A report to the
Nature Conservancy Council
from the
Field Studies Council Oil Pollution Research Unit
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SURVEYS OF HARBOURS, RIAS AND ESTUARIES IN SOUTHERN BRITAIN

PLYMOUTH AREA INCLUDING THE YEALM

Volume 1

Report

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December 1986

FSC/OPRU/36/86

SURVEYS OF HARBOURS, RIAS AND ESTUARIES IN SOUTHERN BRITAIN
PLYMOUTH AREA INCLUDING THE YEALM

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SURVEYS OF HARBOURS, RIAS AND ESTUARIES IN SOUTHERN BRITAIN

PREFACE TO REPORTS

The marine inlets of southern Britain are almost all formed from drowned valleys. They vary in shape, size, depth and salinity according to their historic and present hydrographic influences. All are more-or-less sheltered from wave action and have therefore been the focus of many urban and port developments. Some support or have supported important fisheries and several are currently being developed for shellfish and fin fish farming. Many of these inlets are known to include marine or estuarine habitats and communities which are rarely encountered in the British Isles. Some are already known as rich areas for marine life. However, little is known of the ecosystems present within many of these areas and new and potential developments make description and comparison urgent if scientific interests are to be taken into account during planning. Therefore the Nature Conservancy Council has commissioned the Field Studies Council to undertake studies of the area over an initial three year period from 1985 to 1988.

There are 24 inlets included in the study. Some are already well documented and may need little survey work. Others require a considerable amount of field work and analysis of data.

Our work consists of both a review of available information and field work.

The aims of the information review are:

1. To describe the areas in terms of their physical attributes.

2. To review the results of previous marine biological and related studies both published and unpublished.

3. To review fisheries, boating activities, port operations, diving activities, educational activities, research studies and other marine resource usage.

4. To catalogue available information.

Items of published and unpublished information are entered onto computer files and can be retrieved by area or subject. A paper copy of each entry is maintained in a loose-leaf file ordered by area.

Where field work is carried out, it aims to:

1. Collect information on the habitats present and the abundance of species in those habitats at sites selected to include a wide range of different shore and seabed types, areas of known conservation importance, or where rare species are or might be present.

2. Collect photographs of the habitats, communities and species present.

For each area where surveys are undertaken, the following reports are produced:

Volume 1 - Report of field surveys
Volume 2 - Species distribution records
Volume 3 - Field data
Volume 4 - Catalogue of photographs

Keith Hiscock
October 1985

SURVEYS OF HARBOURS, RIAS AND ESTUARIES IN SOUTHERN BRITAIN

PLYMOUTH AREA INCLUDING THE YEALM

Synopsis

Plymouth and the Yealm Estuary are situated on the south coast of Devon. The Plymouth area includes a complex of marine inlets, the largest of which is the Tamar which is tidal for about 30km and is joined by the Rivers Tavy and Lynher. The Tamar empties into Plymouth Sound which is an open bay with an artificial breakwater at its entrance and Drake's Island to the northwest. The River Plym empties into the northeast of Plymouth Sound. The Yealm Estuary is situated to the east of Plymouth Sound and is tidal for 6.5 km.

Plymouth Sound is an important commercial harbour, and the Devonport Royal Naval Dockyard is situated in the lower Tamar estuary. The area has a long history of marine biological study, both for research and education. Staff from the Marine Biological Association at Plymouth have carried out research in the area since 1884. Research is also carried out by staff at the Institute for Marine Environmental Research, and Plymouth Polytechnic uses the area for student projects and practicals.

The coastline of Plymouth Sound is steeply sloping and almost entirely rocky. The coastlines of its associated estuaries are generally more gently sloping, and contain large expanses of mud flats. Rocky outcrops are also present and steep rock slopes occur on some river bends. The Yealm estuary is a narrow steep sided inlet with some branches. Underwater a steep sided channel winds a course through Plymouth Sound from the entrance to the Tamar and out past the Breakwater. Depths of up to 40m are present in this channel. The Tamar is the main receiver of freshwater inputs and salinity does not normally reach fully marine conditions until it enters Plymouth Sound. The northern area of Plymouth Sound is influenced by this freshwater input. Freshwater input to the Plym and the Yealm is low. Areas of strong tidal streams are present at the narrow rocky entrance to the Tamar and across the 'Bridge' between Drake's Island and the western side of the Sound. The inner area of the Sound is sheltered by the Breakwater at its entrance, but the outer Sound, particularly on the eastern coast, is subject to strong wave action from prevailing south-westerly winds. The Yealm is sheltered by a sandbar at its entrance.

The present survey aimed to collect further information on the marine habitats and communities which had not previously been described or had not been sampled since the early 1900's. The abundance of species living on hard surfaces and visible on the surface of sediments was recorded *in situ*. Intertidal sediment fauna was collected in 0.01 and 0.1 m^2 cores and by digging, and samples were sieved over 0.5 mm, 1 mm and 5 mm mesh sieves. Subtidal sediments were sampled using a pipe dredge and, outside the Breakwater, with a suction sampler. The samples were sieved over a 1 mm mesh. Animals were picked out of the sediments, identified and counted. Photographs were taken to illustrate habitats, communities and species. A series of aerial photographs was taken during low water spring tide level in April.

Habitats and communities present were classified into 29 intertidal types (22 in the Plymouth area and 7 in the Yealm) and 28 subtidal types (22 in the Plymouth area and 6 in the Yealm). Descriptions are given of each of these and the abundance of species is shown in tables. The distribution of habitats is discussed and the subtidal substratum types are listed. Nine major ecological zones are suggested, and described, for the Tamar and Plymouth Sound, on the basis of salinity, wave exposure and the communities and species found in them. These zones are termed - Open Sea, Open Coast, Sheltered Bay, Outer Estuarine, Lower Estuarine, Central Estuarine, Upper Estuarine, Riverine - Estuarine Transition and Riverine. The habitats and communities surveyed are compared with those in other marine inlets and with previous marine biological studies in the area. The area of Plymouth Sound and the Tamar is much more extensive than most other marine inlets studied although it includes many similar habitats, communities and species. The Yealm is small but compares very well with other inlets. The main characteristics of the Plymouth area and Yealm estuary are much as previously described in the Plymouth Marine Fauna (1957) and published work from the first half of this century (and late nineteenth century). For some areas our assessments rely in some part on this previous work. However, this survey has found a number of changes, and communities on rocky sublittoral habitats have been adequately described for the first time. There have also been a number of species that have been recorded for the first time. These include species of the red algae Schmitzia, and a variety of polychaete worms, including Pisione remota, Ampharete lindstroemi, and Protodorvillea kefersteini. The seapen Virgularia mirabilis was also recorded from north of the Breakwater, where it has not previously been seen. Apoglossum ruscifolium was commonly recorded in the Hamoaze on this survey but not by Johnson in 1890. The distribution of Fucus vesiculosus in the Tamar appears to have extended northwards since the records of Percival (1929), while that of Cordylophora lacustris appears to have extended downriver. The former suggesting a reduced freshwater input, but the latter an increase. A number of minor changes were also noted in Kitching's gulley outside the entrance to the Yealm.

The scientific interest and nature conservation importance of the area has been assessed using standard criteria and the conservation importance of the habitats and communities in the area have been provisionally graded as of Local, Regional, National or International importance. Species of particular scientific interest identified during the survey have been noted and their conservation importance provisionally graded as of Regional, National or International importance. For the general assessment of scientific interest and nature conservation importance the area has been considered in six separate parts :- The Open Sea and Open Coast which is most notable for the Mediterranean - Atlantic species found in deep water offshore; Outer Plymouth Sound which has some interesting rocky shore habitats, particularly the rockpools, and large areas of very rich and interesting subtidal sediment communities; Inner Plymouth Sound which has some very unusual limestone bedrock communities characteristic of rias and with interesting boring species; the Cattewater and Plym Estuary which have some rich mudflats but are generally of lesser importance; the Tamar and Lynher Estuaries which are most notable for the presence of rocky substrata extending along the estuarine gradient and the rich current swept cobbles and pebbles in the lower estuary; and the Yealm Estuary which is of outstanding interest due mainly to the high diversity of habitats and communities which are almost entirely natural. Much of Plymouth Sound and its associated estuaries are affected by human activity, but in the Yealm Estuary current levels of recreational activity do not appear to be damaging its naturalness, except for the presumably high levels of organotin from antifouling paints.

1. INTRODUCTION AND HISTORICAL PERSPECTIVE

The areas studied during this part of the Surveys of Harbours, Rias and Estuaries are sited around the City of Plymouth (50°22'N, 4°9'W) and the Yealm Estuary (50°19'N, 4°3'W). The location of these areas and of the main coastal features mentioned in the text are shown in Fig. 1 which folds out of the back of the report.

The area of Plymouth includes a complex of marine inlets, the largest of which is the Tamar. The River Tamar extends about 66 km from its source near Morwenston in Cornwall to Weir Head below which it is tidal for about 30 km to its lower limit at the narrows between Wilderness Point and Devils Point. The River Tavy rises on Dartmoor and joins the Tamar about 10 km from its mouth. The tidal section of the Tavy is about 6.5 km long with its head at Lopwell Dam. On the west side of the estuary below the road and rail bridges, the Tamar is joined by the River Lynher which rises on Bodmin Moor and is tidal for about 13.5 km. from Notter Weir. The River Tiddy is a tributary of the Lynher. The Tamar empties into 'Plymouth Sound' which is an open bay but with Drakes Island and the artificial breakwater at its entrance providing considerable shelter. On the north-east of Plymouth Sound, the estuary of the River Plym extends from Longbridge (the east part of the City of Plymouth) to the Laira Bridge and on, as The Cattewater, to its entrance into Plymouth Sound off Mount Batten Point, a distance of 5.5 km.

Plymouth and the River Tamar are places with considerable historical importance. Plympton was the main centre of population until the middle of the 14th century because of its importance in exporting Dartmoor tin. However, it was the silting-up caused by tin-streaming waste which largely resulted in the movement of trade to Sutton. The 16th century was a time of considerable maritime activity resulting from the numerous voyages of exploration departing and returning from the port. Many of these departed from Sutton as evidenced by the numerous commemorative plaques there. The Tamar has been a highway for many centuries providing an outlet for the two main occupations of the area, mining and farming. Market gardening, salmon fishing and quarrying for granite were the main occupations of the inhabitants of the area until the middle of the 19th century. For fifty years from that time, the valley was the richest copper and arsenic producing region in Europe. This importance is reflected in the many quays which remain in existance along its course. Cotehele Quay, just below Calstock, is a particularly well-preserved example. However, commercial freight traffic has ceased over the last 50 years and the Tamar above the bridges is used almost only by pleasure craft. Below the bridges, in the stretch known as 'The Hamoaze', the Cornish side of the estuary remains in a fairly undisturbed state when compared to the extensive jetties, walls, dockyards and areas of development on the Devonshire shore. Many creeks which existed there at one time have been infilled or dredged and walled. The greatest development is in the Royal Dockyard of Devonport. This area of the Tamar has been important for naval purposes since as long ago as 1287 when a fleet was assembled for an expedition against Guienne. The naval dockyard was formally established in the 1690's. Further major extensions were carried out in the years 1718 to 1725, 1853 and 1896 to 1907 with changes in the 1970's to provide further facilities for submarines and frigates in particular. During the period of our survey, extensive dredging was underway in the northern region of the dockyard (Weston Mill Lake) to provide further submarine facilities. The length of shore occupied by the Dockyard is about 4 km. On the opposite shore, Torpoint also includes dockyard facilities and the slipways for the

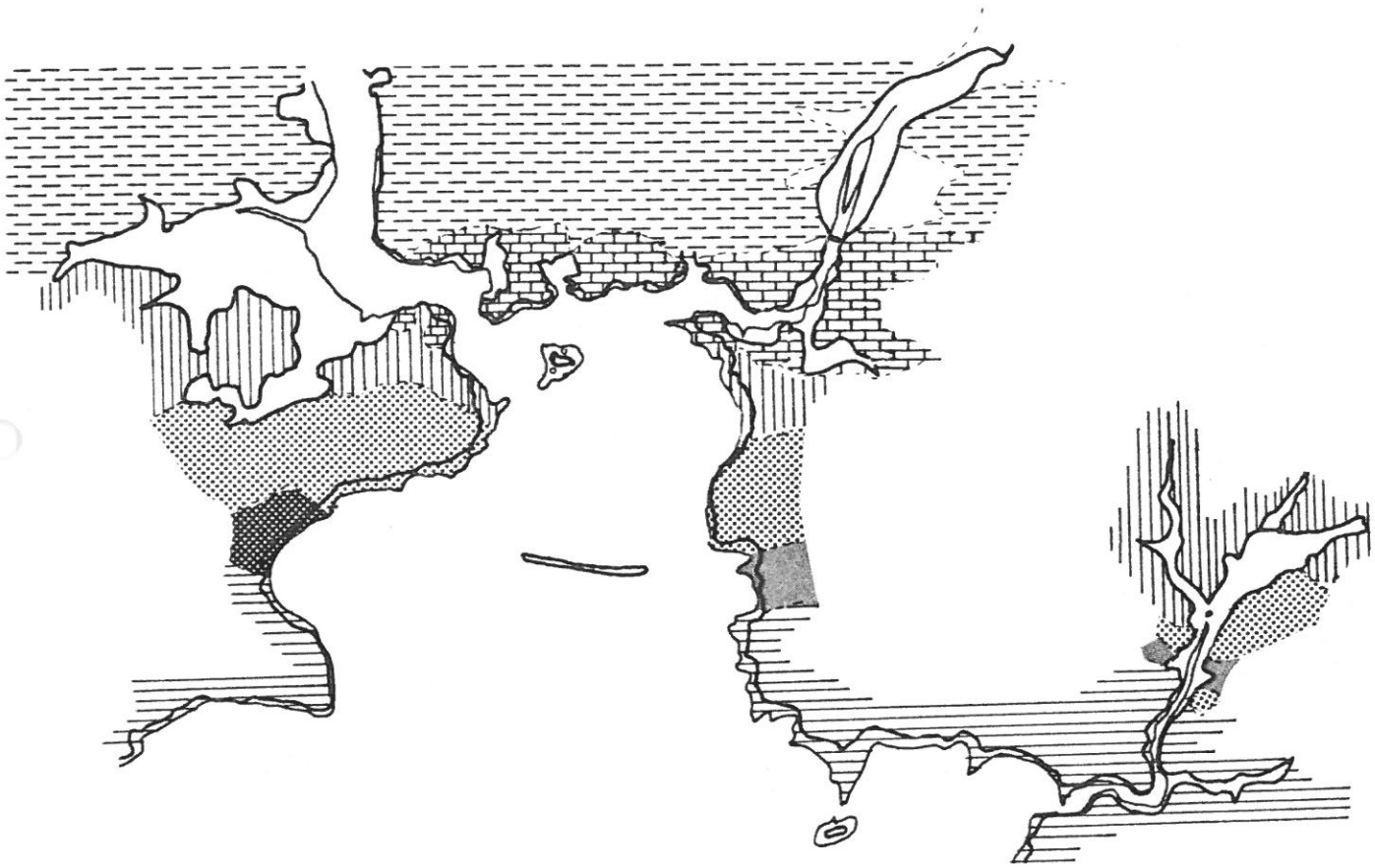
Torpoint Ferry. A square-shaped harbour in the middle of the shore south of Torpoint was used to hold barges containing ballast and is known as the 'Ballast Pound.' Other structures exist in the Hamoaze including the jetty at Yonderberry, the walls across creeks at Millbrook, the bridge piles and the large marina pontoons at Mutton Cove. To the east of The Narrows, Millbay is now entirely bordered by dock walls and is the terminal for ferries to Brittany and Spain. Plymouth Hoe on the north side of the Sound is a recreational area along which much of the shore is natural but with occasional structures such as the West Hoe Pier below the Royal Western Yacht Club and the Tinside swimming pool (east Hoe). Sutton Harbour at the entrance to the Plym is an area of considerable historic interest including quays, wharves and warehouses originally an important part of commercial Plymouth. The fish market remains a very busy base for the fishing boats based at Plymouth and the visitor cannot fail to notice that this was the place where the Mayflower set sail for the New World in 1620. The new marina at the entrance to Sutton Harbour was completed in 1986. The Cattewater at the entrance to the Plym now provides the main commercial wharfage in the area as well as mooring for yachts and extends to the Laira Bridge, the limit of deep water along the Plym. Above the Laira Bridge, the borders of the River Plym are largely of embankments extending to mudflats although with natural shore line along the National Trust property at Saltram Park. The coastline of Plymouth Sound is otherwise little developed with the forts at Picklecombe, Wilderness Point, Drakes Island and Bovisand providing some of the most imposing coastal structures. Plymouth Breakwater, constructed across the centre of the Sound and extending for about 1.7 km., was completed in 1841. It is constructed of limestone blocks faced in places by granite. The fort off the centre of the Breakwater was built in 1860.

The Yealm Estuary extends from The Bar at its entrance for 6.5 km. to its maximum tidal extent at Puslinch. Newton Creek is an arm of the Yealm which is 1.5 km. long and is bordered by the villages of Newton Ferrers and Noss Mayo. To the north, Cofflete Creek extends for 2 km. as a tributary of the main estuary. There have been settlements on the Yealm for a long period and Newton Ferrers is mentioned in the Domesday Book. There are no industries or docks which border the Yealm and the shores are mainly unaltered by the activities of man except for the walls built at Thorn and at Mudbank Creek to make ponds. Some walls bordering Newton Ferrers, particularly in Newton Creek, extend into the Yealm. Extensive yacht moorings are present north to about Madge Point but the river bed above this is privately owned and only a few moorings are established at Steer Point.

2. PHYSICAL CONDITIONS

2.1. Geology and topography

The coastline of Plymouth Sound and the River Yealm include several rock types which can be broadly separated into slates, grits, limestone and volcanic (Fig. 2). From the centre of Plymouth northwards, Upper Devonian slates (locally known as shillet) extend to the edge of the Dartmoor Granite. The coastline of Plymouth Sound is steeply sloping from heights of about 100 m on the west and east sides but the remaining coastline has a more gentle slope in the populated areas and along the river estuaries which empty into the Sound. Large expanses of these estuaries are of mud covering-over the bedrock at least below mid-tide level. However, in the narrow winding sections of the Tamar, steep slopes fringed by rock extending into the subtidal are present. The Yealm below Steer Point is a narrow steep sided inlet cut into the 100 m plateau but fringed by more gradually sloping land in the eastern arm.



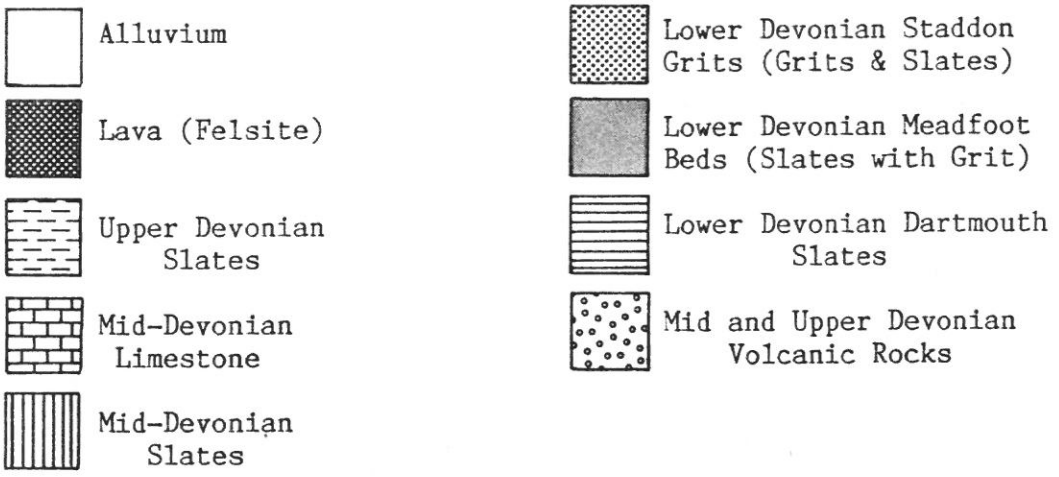


Fig. 2. Simplified map of the geology of the area of Plymouth and the Yealm. Taken mainly from Curry (1977) and also from the Geological Survey of Great Britain Sheet 349 (eastern areas including the Yealm).

2.2. Hydrography

2.2.1. Bathymetry and tidal heights. Fig. 3 shows the main features of the bathymetry and heights of mud flats in Plymouth Sound and the estuaries which discharge into it. Fig. 4 shows the same information for the Yealm. The most remarkable feature of the bathymetry of the area studied is the presence of the deep steep-sided channel which extends from about Torpoint in a winding course to south of Mallard Shoal (just west of Mount Batten Point) with depths of up to 40 m present. Tidal range at Plymouth is between 0.8 and 5.5 m relative to chart datum at Mean Spring Tides and 2.2 to 4.4 m at Mean Neap Tides. These ranges are almost the same on the Yealm, at St. Germans and northwards to Cargreen on the Tamar but are between 0.4 and 4.6 m at spring tides and 1.4 and 3.5 m at neap tides at Cotehele Quay further north (Admiralty, 1985).

2.2.2. Temperature. Records of seawater temperature have been maintained by Plymouth City Council and by the Marine Biological Association for the Plymouth Sound area and from paint test rafts by the International Paints Laboratory in the Yealm. Offshore of Plymouth, temperatures range from 8.5°C in winter to 16°C in summer (Lee and Ramster, 1981) although these are depressed in winter and elevated in summer in the Sound. In the Yealm, data analysed for the years 1956 to 1960 showed temperature maximum and minimum to be 20.4°C in July and 5.2°C in February. However, during the extremely cold winter of 1962-63, temperature at 0.9 m depth fell to -1.5°C (B. Sparrow, pers. comm.).

2.2.3. Freshwater input and salinity. Salinity of surface and subsurface waters of marine inlets is highly variable in relation to freshwater input and tidal movement. The Southwest Water Authority (1979) record river flows from the lowest gauging stations on the main sources as follows:

			TAMAR		PLYM	YEALM
Gauging Station	Tiddeford	Pillaton	Gunnislake	Copwell	Cornwood	Puslinch
River	(Tiddy)	(Lynher)	(Tamar)	(Tavy)	(Plym)	(Yealm)
OS Grid Reference	5x343595	-	5x46725	-	5x521613	5x574511
Catchment area	37.2 km^2	135.5 km^2	916.9 km^2	205.9 km^2	192 km^2	54.9 km^2
Records from	Jan. 1970	-	Jan. 1957	-	-	Jan. 1963
Average Gauged Flow	0.85 $m^{3/s}$	4.25 $m^{3/s}$ (estimate)	22.42 $m^{3/s}$	6.65 $m^{3/s}$	2.18 $m^{3/s}$	1.62 $m^{3/s}$
Max. Daily Gauged Flow	6.40 $m^{3/s}$	-	321.56 $m^{3/s}$	-	31.01 $m^{3/s}$	15.57 $m^{3/s}$
Min. Daily Gauged Flow	0.06 $m^{3/s}$	-	0.580 $m^{3/s}$	-	0.12 $m^{3/s}$	0.03 $m^{3/s}$

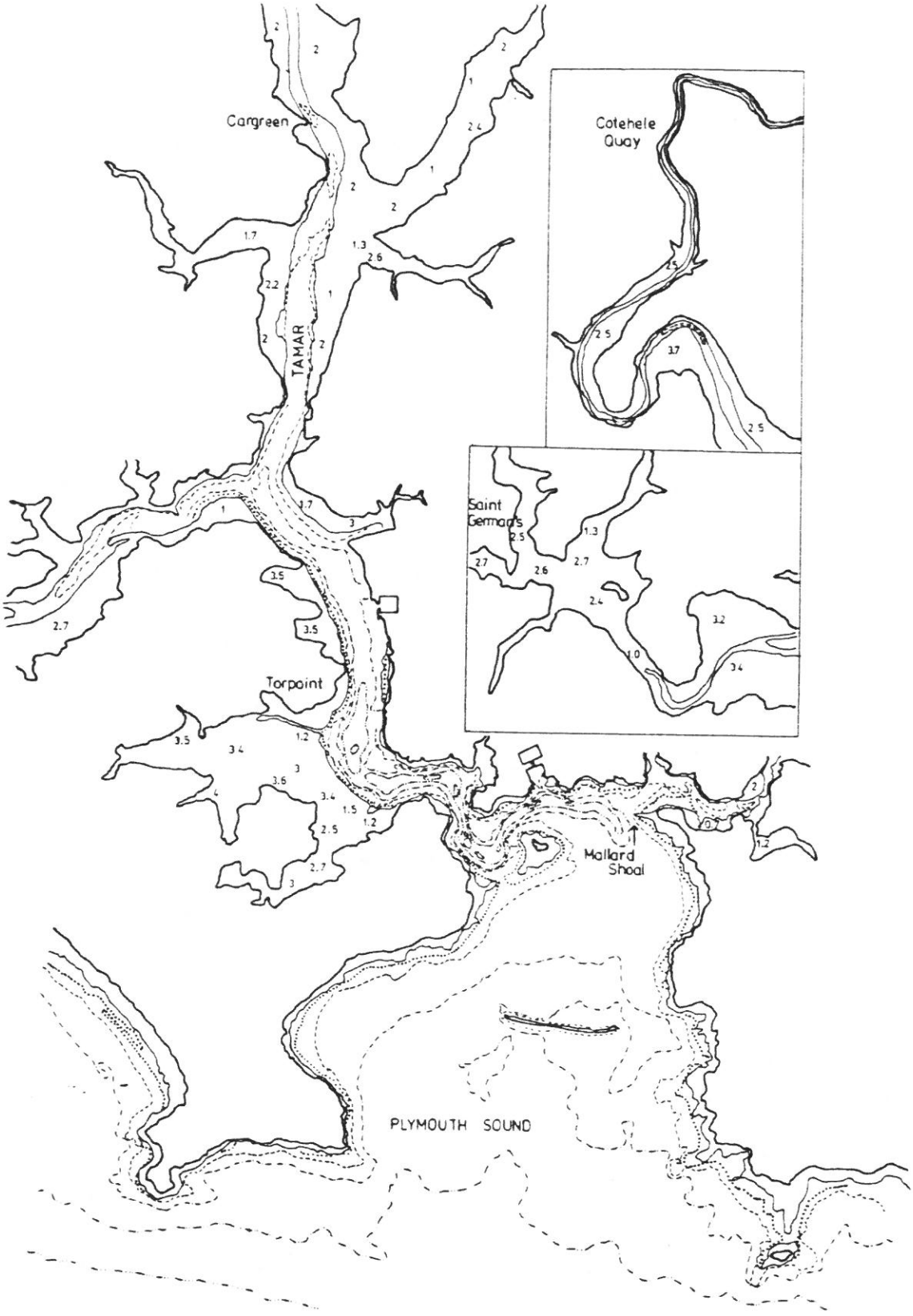


Fig. 3. Main features of the bathymetry and heights of mud flats in the region of Plymouth and the Tamar Estuary. The heights of mud flats above chart datum are given. Based on Admiralty Charts, 871, 1900, 1902 and 1967.

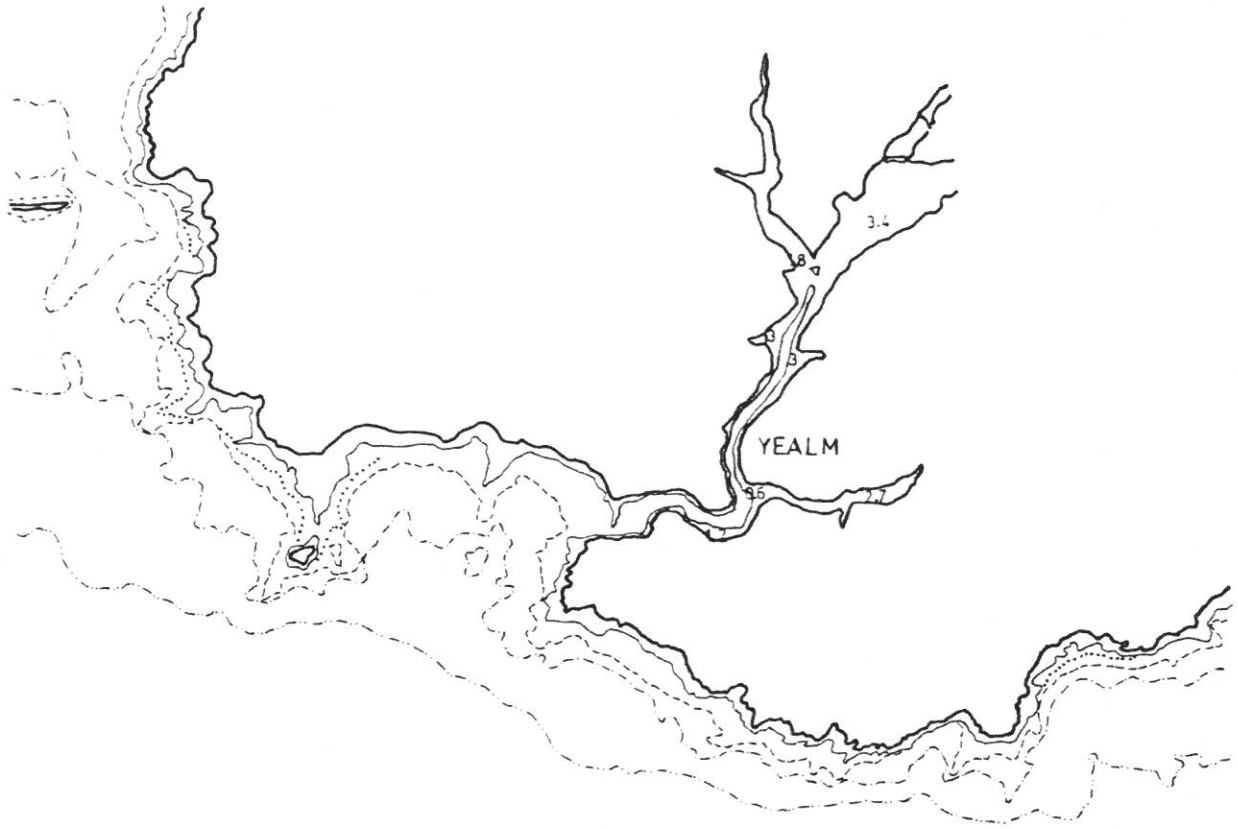


Fig. 4. Main features of the bathymetry and heights of mud flats in the River Yealm. The heights of mud flats are given above chart datum. Based on Admiralty Chart 95.

The Tamar is clearly the main receiver of freshwater inputs but effects on salinity are affected by the volume of the inlet. For the Tamar, Mommaerts (1969) quotes a volume of 50 million m^3 with a maximum freshwater input of 8.5 million m^3 in 6h and minimum 115,000 m^3 in 6h for 1967-68. Salinity readings have been taken by various workers for the Tamar and by the International Paints Laboratory for the Yealm. Milne (1938) was the first to produce a description of salinity in the Tamar which covered different freshwater flow conditions. The salinity profiles across the estuary midway between Saltash and Neal Point demonstrate a salt wedge which, at low water, resulted in a gradient from 15 °/oo at the surface to 24 °/oo near the bottom and 27 °/oo to 31 °/oo at high water. The records taken over one year showed a generally steady near-surface salinity of 34 °/oo at the Breakwater and Drakes Island but with an extreme low of 27 °/oo at both following heavy rain in March. At Saltash, salinity was very low (less than 20 °/oo) at times in winter and spring rising to about 30 °/oo during summer. More recently, Uncles et al (1983) computed high water salinity values for the Tamar from run-off data between October 1981 and October 1982 (see Fig. 2 of Warwick and Gee, 1984, reproduced in Fig. 5). These indicated a period of relatively low and strongly fluctuating values from October to March and a period of higher more stable salinities from April to September. Cooper and Milne (1938) give an example of the extent to which salinity at a certain location can vary in relation to rainfall. Very high rainfall during the winter of 1936-37

resulted in a surface salinity at low water at Neal Point of only 7.8 °/oo compared to 25.1 °/oo in June during a very dry spell. During regular sampling of the Tamar, Plymouth Polytechnic recorded an all-time low of 5 °/oo in the water column at the Tamar Bridge in late November 1986 (G.E. Millward, pers. comm.).

Records taken on the Yealm indicate salinity to the northern limit of Yealm Pool just north of Madge Point as varying between 26.5 to 33 °/oo at high water and 8.0 to 32.9 °/oo (but very rarely below 15 °/oo) at low water 0.9 m below the surface in the years 1959 to 1969.

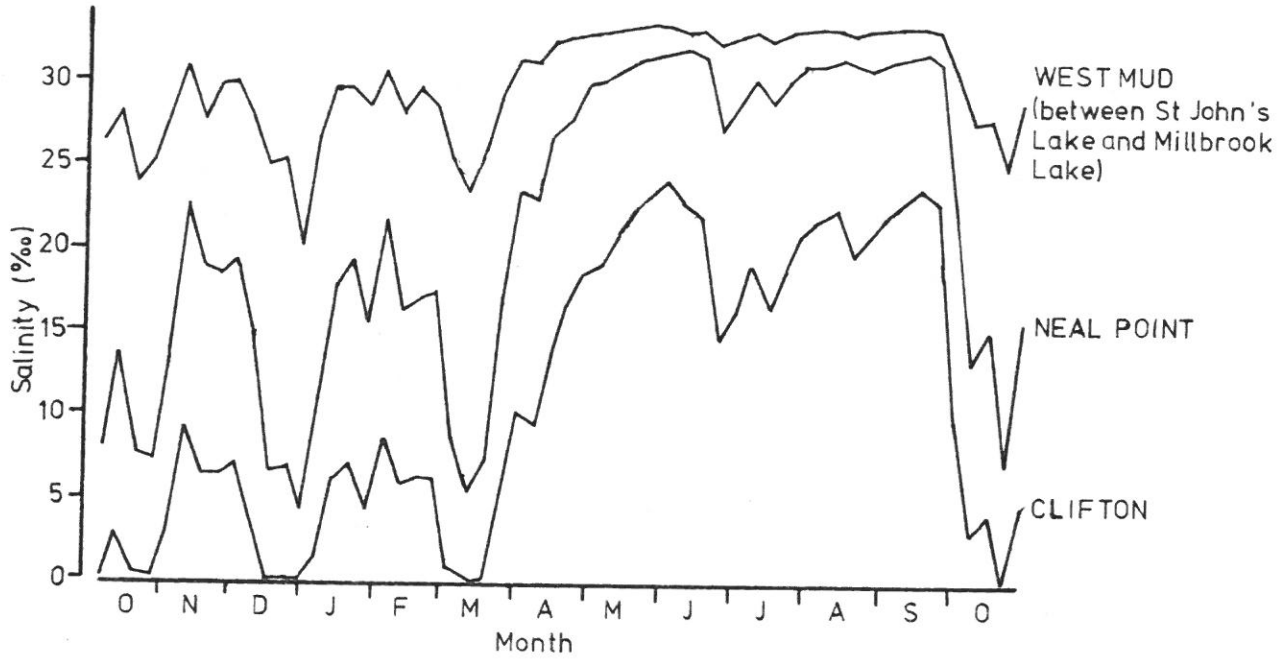


Fig. 5. High water salinity values for the Tamar. (Re-drawn from Warwick and Gee, 1984.)

2.2.4. Water turbidity and the penetration of light. Some of the earliest studies of the attenuation of light of different wavebands in seawater were undertaken in Plymouth Sound and the Tamar Estuary by Copper and Milne (1938, 1939). Their studies provided information on the penetration of light in winter and summer and at high and low water. The greatest depth to which 1% of surface illumination (green light) penetrated was 5.62 m in June at the Breakwater buoy and the least at this site in February was 1.72 m. At Neal Point, the greatest penetration was 2.81 m and the least was 0.30 m.

2.2.5. Tidal streams. Detailed records of surface tidal flow are given on Admiralty charts 871, 1900 and 1902 for areas of Plymouth Sound and the Tamar (Fig. 6) and a summary of tides and tidal streams is given in George (1982). Tidal streams set in the direction of the channels and are generally in the region of a maximum of 1.2 knots (0.6 m s^{-1}). The strongest tidal streams are recorded in the Narrows between Wilderness Point and Devil's Point and across The Bridge between the mainland and Drakes Island where velocities of up to 2.8 knots (1.5 m s^{-1}) have been recorded. Strong tidal flows also occur at the entrance to the Lynher and in the narrow channels in the northern part of the Tamar. However, charts do not record tidal stream or river current velocity in the upper part of the Tamar particularly in the narrow

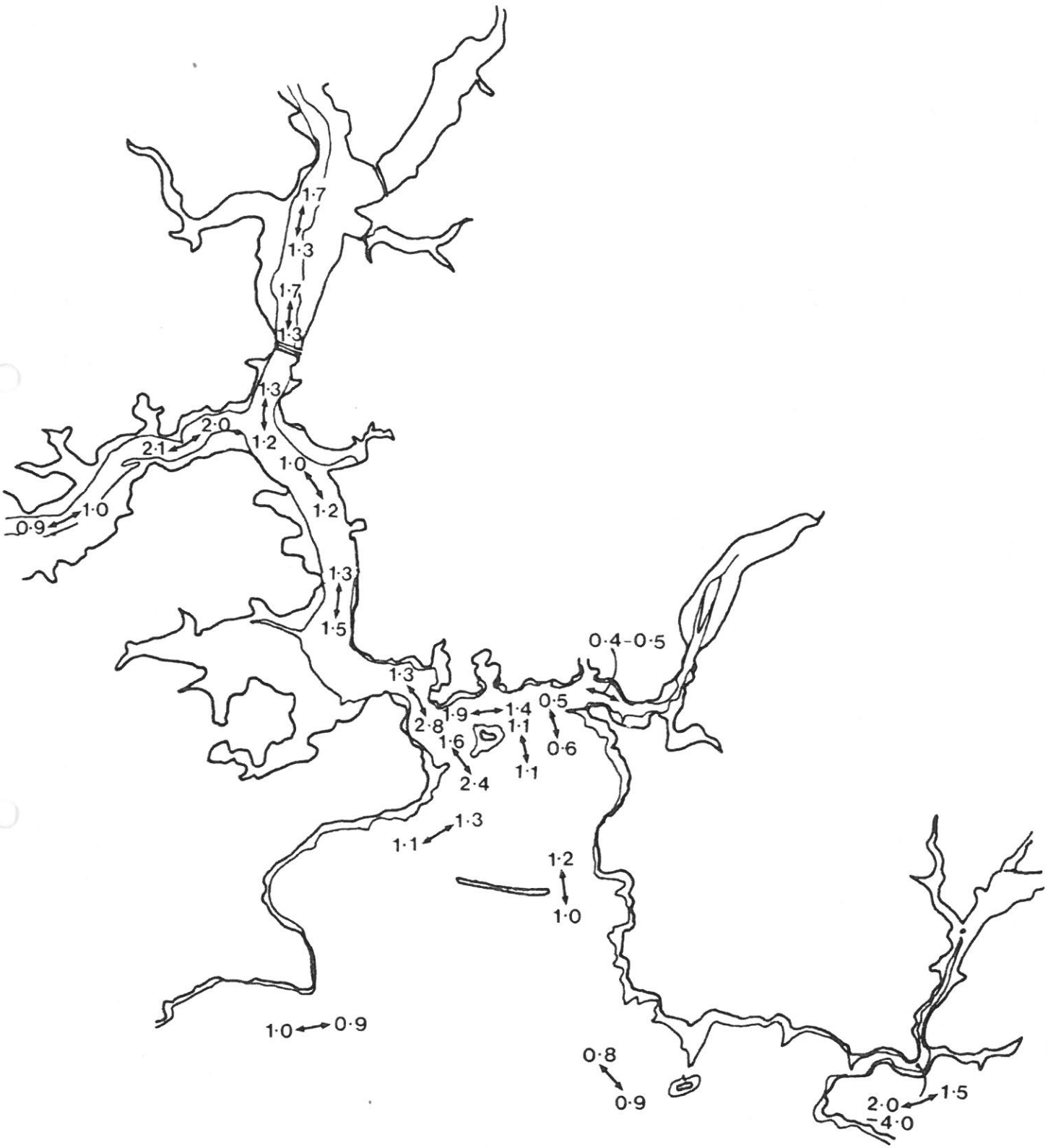


Fig. 6. Maximum velocity (in knots) of surface tidal streams. From Admiralty Charts 871, 1900, 1902 and 1967 and, for the Yealm, from the Channel Pilot (Admiralty, 1977). Fig. 1 gives the names of coastal features.

section near Hooe where flow can be expected to be very strong. George (1982) states that 'further up-estuary the rate of the flood stream at springs can reach 1.3 m s^{-1} (2.5k) and the ebb 1.1 m s^{-1} (2.1k) under low runoff conditions'. Tidal stream velocity in the Plym is weak. Detailed records are not available for th Yealm although the Channel Pilot (Admiralty, 1977) notes maximum flow of 2 knots on the ebb but increasing to 4 knots during periods of strong freshwater flow.

2.2.6. Exposure to wave action. The eastern side of Plymouth Sound from Bovisand to the entrance to the Yealm including south faces of the Breakwater are exposed to very strong wave action from prevailing south-westerly winds and some swell. Western shores are sheltered by their aspect from prevailing winds. North of the Breakwater, shores obtain considerable shelter from the presence of the Breakwater and the shallow nature of the seabed although wave action can doubtless be fairly severe on the shore below the Hooe and between Mount Batten Breakwater and in Jennycliff Bay where fetch can be as much as 6 km and winds of gale force 8 would generate waves of about 1.2 m height with a seabed oscillatory velocity at 5 m depth of about 55 cm/s (Darbyshire and Draper, 1962; Hiscock, 1976). Similarly, long fetches occur in the Tamar and Lynher although the shallow depth to the seabed would buffer wave action and wind direction would have to be along the direction of the channel to cause very strong wave action. The sand bar at the entrance to the Yealm, absorbs wave action from prevailing winds although, particularly at high tide, shores at the entrance to the Yealm doubtless receive strong wave action. However, east and north of Misery Point (east of Cellar Beach), it is unlikely that wave action from the open coast penetrates and there is considerable shelter from local wind induced waves due to the high steep-sided valley and wave action is most likely slight.

2.3. Substratum types

2.3.1. Intertidal areas. The following description is derived from inspection of maps and charts, reference to the Plymouth Marine Fauna (Marine Biological Association, 1957) and experience during survey.

Shores in Plymouth Sound are almost entirely of bedrock. Exceptions include the sandy beaches at Bovisand Bay and Crownhill Bay, a little further south, and small shingle (mainly gravel and stones) beaches at Cawsand, Barn Pool (south of Wilderness Point), Cremyll, N. Drakes Island, Jennycliff Bay and at a few other locations, but occupying very small areas. The shore formed by the Plymouth Breakwater is unusual in being comprised of irregular limestone blocks below low water of neap tides level and cemented limestone blocks faced with granite in places on the south side. A few harbour walls are present in Plymouth Sound but these form a major and extensive intertidal substratum type in the Hamoaze, Millbay Docks and the Cattewater. Bedrock type (Fig. 2) is important in the provision of habitats for marine species. Limestone rock is generally pitted and with shallow pools. Deep fissures and caves occur below the Hoe. Shale rock has crevices and, in the area described as Rum Bay (between Mount Batten Breakwater and Jennycliff Bay) is clearly soft and friable (Marine Biological Association, 1957).

On the western shores of the Hamoaze, in the Lynher estuary and northward along the Tamar, extensive mudflats are present backed by shale or saltmarsh on the upper shore. Small areas of shingle shore are present and this type of substratum is particularly well-developed in the area of Torpoint. At a few places, bedrock extends throughout the intertidal region. Along the bend between Hooe and Halton Quay and bordering the river north of Cothele Quay,

extensive steeply sloping rocky shores with a deposit of semi-liquid mud occur.

The Cattewater is fringed by wharfs and in places by muddy shores generally backed by walls. A few areas of muddy shingle occur here. Hooe Lake is of mud. Above Laira Bridge, there is a broad expanse of intertidal mud derived in part from china clay waste washed down the River Plym and bordered mainly by stone embankments.

The Yealm Estuary is predominantly bordered by shale rock which gives way to muddy shingle below about lower midshore level except at a few steeply sloping locations and in the entrance. Mudflats occur in creeks and bays in the upper estury and Newton Creek is of mud bordered by muddy shingle.

2.3.2. Subtidal areas. Admiralty charts provide some information on substratum types present although data would be much more detailed on orginal surveys which were not consulted. The introduction to the Plymouth Marine Fauna also records notes on seabed types.

The following information has been obtained from Admiralty Charts 1967, 871, 1900 and 95 supplemented by notes in Marine Biological Association (1957) given in parenthesis.

Area of Cawsand Bay ..... Fine Sand. (Mud, muddy sand and fairly clean sand).

Near area south of Plymouth Breakwater ..... Coarse sand, gravel and shell with areas of rock (shoals shallower than 10 m).

Distant area south of Plymouth Breakwater ..... Rock. Fine sand.

Off west shore of Plymouth Sound to centre ..... Coarse sand or gravel with broken shells. (Coarse shell gravel, whole shells and flat stones).

North of Plymouth Breakwater ..... Mud.

Winter Shoal (N.E. Drakes Is.) ..... (Bank of stones overlying mud to thin layer of gravel over mud in the South).

Jennycliff Bay ..... Mud and muddy shells. (Sandy mud).

South of Mount Batten Breakwater .... (Black mud).

Off Tinside (east Hoe) ..... (Muddy).

Deep water channel from St. John's Lake to Mallard Shoal ..... Gravel, shells, shingle and stones.

N. of Drakes Island (shallow) ..... (Sandy at 2 to 6 m. Muddy stones and clinker at 6 to 15 m).

Barn Pool (S. of Wilderness Pt.) .... (Stones at 6 to 9 m, soft mud at 11 to 17 m).

Tamar north of Torpoint to Weir Quay ..... Mud.

Weir Quay to Calstock ..... Fine sand and mud or coarse sand.

River Yealm - Yealm Pool ..... Fine sand and small stones. (Stones and shells).

Neither Admiralty charts or the Plymouth Marine Fauna give an accurate picture of the extent of bedrock and its nature in the subtidal. However, a guide to dive sites in and around Plymouth Sound (Dart, 1985) shows sketches of seabed profiles at 20 locations all with bedrock present. Several of these locations were studied during the present survey and observations on the distribution of bedrock are included in the discussion. Available information indicates the presence of subtidal bedrock bordering the deep channel from The Narrows to Mallard Shoal, fringing the open coast to shallow depths and present on shoals as well as in deep water at some locations offshore.

3. HUMAN INFLUENCES

3.1. Sewerage and storm drains

Fig. 7 shows the location of sewage outfalls in the region of Plymouth and the Tamar and provides a guide to the volume discharged based on population served and whether the sewage is untreated, partially treated (settlement or septic tank) or fully treated. Discharges into the River Tamar (including the Lynher and St. John's Lake) are mostly treated. Discharges of untreated sewage from Plymouth are substantial and are noted below for different water bodies as number of population served.

Hamoaze (east shore off dockyard to Devil's Point)	15,860
Millbay area	60,750
Cattewater area	5,730

In the Yealm there is a substantial discharge of 130 m^3 / day (dry weather flow) in the upper estuary, which is fully treated. This discharge is not, however, subject to quality control. The effluent deriving from Newton Ferrers and Noss Mayo is transferred to a new treatment works that discharges 720 m^3 / day (dry weather flow) of fully treated effluent at Royal Commision Standard quality to a freshwater tributary of the estuary.

3.2. Industrial effluents and pollution

There are no known major sources of industrial effluents in the region of Plymouth. However, the River Plym carries waste from china clay extraction and the muddy shores of the River Plym north of Laira Bridge are composed in part of this waste. The Royal Naval Dockyard at Devonport doubtless discharges waste into the Hamoaze although the nature of those wastes can only be speculated. Other trade wastes are small and are discharged through sewers. There is an oil terminal at the entrance to the Cattewater.

Concentration of Polycyclic Aromatic Hydrocarbons (which are derived from combustion of fossil fuels, erosion of coal, domestic sewage, oil, etc.) in sediments of the Tamar have been described most recently by Readman et al (1984). Levels were generally low. Elevated levels occurred at the head of

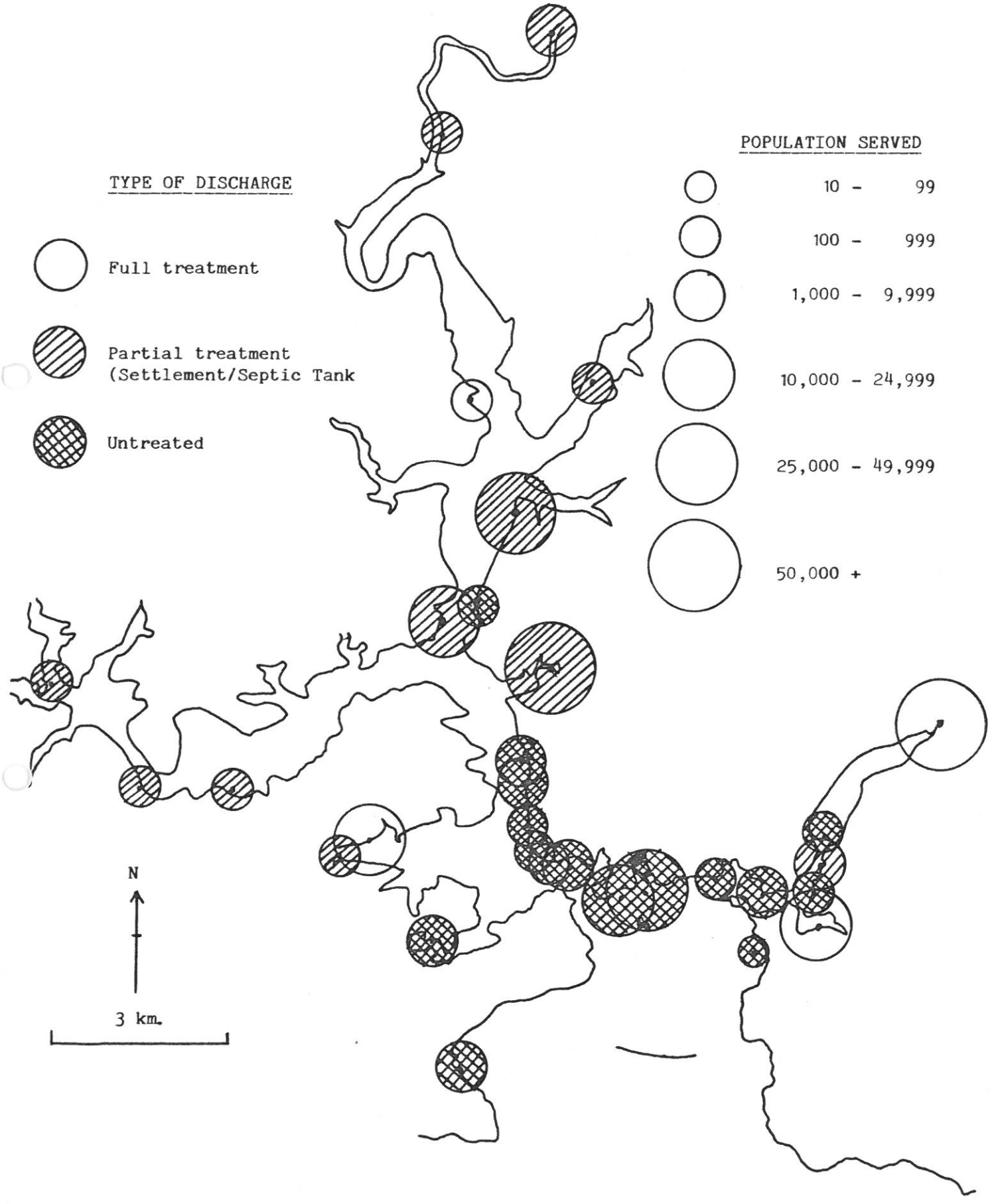


Fig. 7. Sewage outfalls in the region of Plymouth and the Tamar. Outfalls close together have been combined in the proportional circles. Information obtained from detailed records supplied by Southwest Water.

the estuary due to sedimentation/flocculation and in the urbanised area originating from anthropogenic sources, especially road runoff.

Concentrations of metals in sediments have been recorded for the Lynher by Bland et al (1982). They found that sediments contained high levels of Cn, Fe, Pb and Zn probably associated with runoff from metaliferous catchment areas and high Mg from local sewage input. Oysters contained some Cn and Zn and high coliform bacteria. China clay wastes enter the Yealm from the River Pile but amounts are now believed to be small.

As a busy port and centre for yachting, the waters in the area of Plymouth have been exposed to antifouling paints containing tributyltin (TBT) compounds. Similarly, the Yealm is crowded with yachts and other pleasure craft and can be expected to be subject to concentrations of TBT. TBT has been shown to have significant lethal and sublethal effects at very low concentrations (for example, Thain, 1983). In their study of concentrations of organotin and total tin in coastal waters of southwest England, Cleary and Stebbing (1985) sampled at sixteen locations in the Plymouth area from Hole's Hole in the north of the Tamar to Plymouth Sound and at five sites in the Yealm. All of the concentrations of tributyltin oxide recorded were lower than 0.10 $\mu g\ l^{-1}$ (not detectable) except in the Sutton Harbour Marina where the highest level was 0.88 $\mu g\ l^{-1}$. Thus, within the general water body, concentrations of tributyl compound appeared to be lower than that found to have significant effects on marine organisms except at Sutton Marina. However, recent work by Bryan et al (1986) links the development of imposex in dogwhelks unequivocably to extremely low (readily by concentrations of 0.02 $\mu g\ l^{-1}$ and probably by as low as 1 ng l^{-1}) concentrations of TBT. In the Plymouth Sound area, 48 to 67% of dogwhelks had developed imposex. In the entrance to the Yealm, 70% had developed imposex.

3.3. Port/harbour facilities and users

Plymouth is a major centre for a wide range of shipping and this is reflected in the facilities available there. The Royal Naval Dockyard at Devonport occupies 4 km of shoreline with numerous wharfs, jetties and docks. There are extensive pontoon and marina facilities at Mutton Cove and at the entrance to Sutton Harbour which is the base for approximately 40 fishing vessels. Moorings are a major feature of the Cattewater and of parts of the Tamar and Lynher and many yachts are on moorings which dry at low water. Millbay Docks is a commercial harbour which includes the Brittany Ferries terminal. Jetties and wharves in the Cattedown are used by commercial traffic including small coasters and oil product tankers. There are many other jetties, slipways and small harbours or quays in the area. Dredging is carried out to maintain channels and to provide new facilities for both pleasure craft and commercial or naval traffic.

Yealm Pool from just above Misery Point (east of Cellar Beach) to Madge Point provides moorings for a large number of small craft. A few yachts are moored off Steer Point. Otherwise, there are very few harbour facilities in the Yealm.

3.4. Educational and research usage

The wide range of shore and seabed types available for study in the region of Plymouth has made the area a centre for marine research. However, studies of marine ecology which involve observation and sampling in the field are now few and the collecting grounds described in the Plymouth Marine Fauna

are rarely visited. Field studies are now directed mainly at aspects of water quality and obtaining data to program mathematical models of the Tamar estuarine system. Some sampling continues for the specimen supply service provided commercially by the Marine Biological Association. Local student groups doubtless undertake some work on shores but there is no field centre in the area from which regular excursions take place. Educational use is made of the reefs at Wembury as a part of the Wembury marine conservation area. Fort Bovisand Underwater Centre provides training for divers including the use of underwater explosives and, in the past, marine biology. Research in the Yealm is directed at the study of fouling on panels submerged on rafts at three locations and student groups from Manchester University have undertaken studies there in the past two years. Several honours degree projects carried out by students at Plymouth Polytechnic include studies of the behaviour of particular species or involve sampling to describe marine communities.

3.5. Commercial utilization of fish stocks

Very little commercial fishing is undertaken in the area of Plymouth or in the Yealm. This is, at least in part, because of the prohibition of fishing over a large area of Plymouth Sound and the Hamoaze for navigational and naval reasons. Set nets and seine nets are used for the catching of salmon in the Tamar and Yealm. The seabed of the Yealm from Madge Point to Steer Point is the site of a now defunct oyster fishery. Shore-based oyster-rearing in trays has been undertaken at Steer Point but, in 1986, the trays were not in use although there were plans to revive the activity.

3.6. Established Nature Conservation Importance

In their description and assessment of nature conservation importance of the shores of Devon and Cornwall, Powell et al (1978), do not provide any details of Plymouth Sound or its branches but identify Wembury Bay and the Yealm Estuary as of Primary Importance. Later, Bishop and Holme (1980) included Wembury Bay and the Yealm estuary in their list of sediment shores of National Importance. Wembury was considered important for its extensive broken rocky areas which provide a wide range of intertidal and subtidal rocky habitats supporting rich communities of plants and animals. For the Yealm Estuary, Powell et al (1978) identify the main areas of interest as the south bank of the estuary below its junction with Newton Creek and the Yealm Sand Bank. These areas are predominantly of sediment.

Sites of established nature conservation importance are mainly identified for their saltmarsh or ornithological interest. Sites of Special Scientific Interest which border the area include:

The Lynher Estuary. This area supports a rich variety of estuarine habitats ranging through the full sequence from fresh to salt water. It has considerable ornithological interest. Includes all of the intertidal areas above mean low water and some woodland east to Black Rock.

St. John's Lake. The site notification draws attention to the extensive mud flats which provide important feeding grounds for large populations of wintering wildfowl and waders (for which it is of National Importance), the species-rich saltmarsh and the considerable areas of mudflat covered with Enteromorpha sp., Zostera angustifolia and Z. noltii. The site includes all of the intertidal areas to MLW eastwards to the Hamoaze and south to Southdown but excluding shores at Torpoint.

Warleigh Point. One of the best coastal examples of ancient Sessile Oak woodland in Devon. Boundary extends to Mean High water.

Wembury Point. Extends from Andurn Point in Plymouth Sound to west of Warren Point in the entrance to the Yealm and includes the Great Mewstone. The site includes all of the intertidal to Mean Low Water and some inland areas. Marine biological features mentioned in the site notification include: 'This site comprises extensive reefs of interest for their intertidal plant and animal communities together with coastal sand, shingle and steep slopes of sea-cliff grassland and mixed scrub. The slatey Blackstone Rocks dip in a south-easterly direction, providing crevices and gullies which shelter delicate organisms. To seaward, there is an extensive wave-cut platform with numerous rock pools; some of the earliest intertidal rock transects can still be followed here. Wembury Point itself is sheltered from extreme wave action by the Mewstone and outlying reefs, whereas Renney Rocks are of quartzite and are fully exposed to wave action from south and west. This combination has allowed a wide variety of plant and animal species and communities to develop; for instance there are southern species of seaweeds, with several Gigartina and Gracilaria species on this one shore. Some of the earliest SCUBA studies of marine species underwater, which complement those of the foreshore, were carried out nearby. The sea and seabed in this vicinity is now a voluntary marine conservation area, where study is continuing'.

The Cornwall Trust for Nature Conservation manage areas at Lanolph (Kingsmill Lake) and Carrgreen which include mudflats.

The description of the Plymouth area in 'Devon Wetlands' (Devon County Council, 1977) notes that the area is one of the best examples of a relatively unpolluted estuary and the whole area represents an outstandingly important complex of wetland habitats with extensive areas of saltmarshes, mudflats, reed beds and open water. In the same publication, the rich and varied fauna of the Yealm is mentioned although a reduction in the abundance and variety of fish and invertebrates over recent years is noted.

The region of Plymouth is historically important because of the long period of study mainly by biologists from the Marine Biological Association of the United Kingdom. The Plymouth Laboratory was established in 1884 and lists of the marine flora and fauna of the area were first published by Heape (1888). Subsequently, the region has been greatly used for collecting and the efforts of many naturalists are recorded in the Plymouth Marine Fauna (1904, 1931 and 1957) and in the Flora of Devon (Anon, 1950). No particular areas are identified as of conservation importance in the various published studies.

4. PREVIOUS MARINE BIOLOGICAL AND RELATED STUDIES

Some of the earliest marine biological studies undertaken at Plymouth are those of the algologist John Boswarva who published a 'Catalogue of the Marine Algae of Plymouth' in 1862. In 1884, the Marine Biological Association of the United Kingdom was established and the Journal of the Marine Biological Association was first published in 1887. A great deal of the material published in that Journal has been concerned with the marine biology of the Plymouth region so that a considerable amount of literature exists on the area. In 1888, W. Heape published a list of the algae and animals known from Plymouth Sound. These lists included ecological notes and the records of algae are particularly useful in view of the sparse information given in recent lists (Anon, 1950; Parke, 1950). Johnson (1890) pursued some of the records of algae in Heape by dredging and shore collecting and gives a useful

assessment of the richness of various sites. The Plymouth Marine Fauna was first published in 1904 with the latest edition in 1957 providing species lists with notes on location, abundance and habitats obtained from the large amount of collecting which had by then been carried out in the area. The introduction to the Fauna gives a description of the main collecting grounds and the species found there. However, other published descriptions of the communities present in different habitats or areas are very sparse. A considerable amount of work was undertaken in the late 1920's and in the 1930's. Percival (1929) describes the distribution of mainly planktonic species in relation to distance from the sea in the Tamar and notes those which are predominantly open coast or predominantly estuarine and the boundaries of their distribution. A series of six papers on the 'Ecology of the Tamar Estuary' was also published between 1938 and 1940 with a further paper in 1956. One of those papers, by Spooner and Moore (1940) includes quantitative descriptions of the fauna of mudflats at six locations in the Tamar thus providing data capable of comparison with more recent results.

Ford (1923) undertook an extensive and detailed programme of sampling seabed sediments in the region of Plymouth. Nineteen sites were sampled in the area currently under consideration and the communities classified and described. The results of Ford's work were presented as community types following the system established by C. G. Joh. Peterson. This system of classification suffers from the fact that the spatangoids used in naming the communities were not generally present in the Plymouth samples. Two main communities were described. The Spatangus purpureus - Venus fasciata (Sp.Vf) community occurred on the coarser grounds at the western entrance to Plymouth Sound and most typically on Queen's Ground with a reduced community off Bovisand Pier. The Echinocardium cordatum - Venus gallina (= V.striatula) (EcVg) community occurred in the muddier grounds inside of the Breakwater and included two main sub-communities. The EcVg mud sub-community was most commonly encountered whilst the EcVgb sub-community was found in sandier areas, especially near anchorage bouys. The mud in Millbay Docks included typical mud forms and in addition, an enormous abundance of the cirratulid Tharyx sp. (as ?Heterocirrus sp.). Sediment communities have also been sampled by Gibbs (1969) off Cawsand Bay, north of Drakes Island and in Stonehouse Pool east of Millbay Docks to describe the polychaete populations present. Major studies of sediment seabed communities in the area by Allen (1899) and Holme (1953) are not relevant to the present study as they were undertaken offshore.

The studies of H. B. Moore (Moore, 1939; Moore and Sproston, 1940) of colonisation of a new shore provided a description of rocky shore ecology in an area below the marine laboratory. More general descriptions of intertidal zonation were made along transects at Wembury by Colman (1933) and at several locations in the Plymouth Sound area by Evans (1947). Southward and Orton (1954) described the commoner intertidal plants and animals living on the Plymouth Breakwater. The Colman transects were re-surveyed in 1973 (Boalch et al., 1974; Boalch and Jephson, 1981) although detailed results have not been published. The most remarkable study carried out during the 1930's was the survey and sampling of sublittoral communities in a gulley at Wembury in 1931 and 1932 by Kitching, Macan, and Gilson (1934). Their sampling has been repeated during the period 1973 to 1978 by G. W. Potts. Sampling to investigate fauna inhabiting intertidal algae was carried out by Colman (1940) and of intertidal and shallow subtidal algae by Weiser (1952). The study by Weiser below the MBA laboratory provides a useful summary of Colman's and Kitchings work as well as his own particularly in relation to the changes which occur across the littoral-sublittoral boundary.

The International Paint Company established a marine laboratory at Newton Ferrers on the Yealm in 1926 to provide a base to test effectiveness of antifouling paints. Records of temperature, salinity and some information on fouling organisms is maintained in archives there but also in the memories of past workers at the laboratory. The laboratory has also supported several fellows based at the Marine Biological Association and funded some short-term studies of rocky shore communities (Cunningham et al, 1984; Cunningham and Hawkins, 1985).

Plymouth Polytechnic staff and students have undertaken a variety of studies in the area. Much useful information on hydrography, biology of particular species and lists of species in different habitats is held as project reports.

The Institute for Marine Environmental Research was established at Plymouth in 1970. Much of their original work was undertaken in the Bristol Channel but the Tamar Estuary is the current focus of many of the studies being carried out there. These studies have included work aimed at quantifying the production dynamics of the benthic communities of intertidal mudflats and have been undertaken mainly in the River Lynher estuary by R. M. Warwick and co-workers. Warwick and Price (1975) sampled macrofauna species present near Clift Quay and provided a description of biomass and production by sampling at monthly intervals for one year. Warwick et al., (1979) prepared a preliminary model describing carbon flow through both the macrofauna and meiofauna. Warwick and Price (1979) sampled the meiofauna and described the communities present, changes in total abundance through the year and respiration rates of sixteen species. Gee et al., 1982 described the role of epibenthic predators in determining prey densities in the mudflats and, as a part of this study, listed macrofauna species present. Warwick and Gee (1984) described the community structure of meiobenthos at West Mud (off Southdown), Neal Point and Clifton in the Tamar estuary to investigate distributional trends in relation to decreasing salinity. Macrofauna samples were also collected and described. Work on physical and chemical aspects of the Tamar with associated mathematical modelling of the system are a particularly important part of the IMER work and many of the results of those studies have been summarised in the abstracts of symposia of the Estuarine and Brackish-Water Sciences Association held in 1982 and 1986 at Plymouth. Specific reference to those studies is made in Section 2 of this report.

Published studies of fish and fisheries within the area of Plymouth have been undertaken predominantly at the Marine Biological Association starting with a comprehensive review in the first issue of the Journal (Heape, 1887).

Despite the long history of study in the region of Plymouth and the extensive lists of species in the Plymouth Marine Fauna, there are few descriptions of the communities present in the area with the exception of the summaries referring to particular collecting grounds in the Plymouth Marine Fauna and the detailed lists for intertidal mudflat habitats and some subtidal sediments in Plymouth Sound. Also, a great deal of information is held in the personal records of staff at the Marine Biological Association on the changes which have occurred in the marine fauna and flora in the years since the publication of the last Plymouth Marine Fauna almost thirty years ago. A little of that information is published. For instance, the loss of Alaria esculenta from the Breakwater at Plymouth is noted in Widdowson (1971). Warwick and Price (1975) record the arrival of Mya arenaria in the Plymouth region and all along the south coast about ten years previously. Immigrant species have also been noted. The spread of Laminaria ochroleuca, apparently

by natural means from the coast France, was first recorded from Plymouth in 1948 (Parke, 1948) whilst Sargassum muticum is an alien species first recorded in the Yealm in 1976 (Boalch and Potts, 1977).

Only a summary of the information available is included here, but abstracts of all information obtained is given in the information review file for the Harbours, Rias and Estuaries study.

5. SURVEY AIMS AND METHODS

5.1. Introduction

The aims of the field survey were:

1. To collect information on the habitats present and on the abundance of species in those habitats at sites selected to include a wide range of different shore and seabed types, areas of known or likely nature conservation importance, or where rare or unusual species might be present.

2. To collect photographs of the habitats, communities and species present.

Reviews of available literature and discussions with staff at the Marine Biological Association and Institute of Marine Environmental Research revealed aspects of the ecology of the area which might most usefully be investigated because (1) they had not been studied previously, or (2) they had been studied and provided a basis for comparison with work done over 40 years ago, or (3) they were in habitats not encountered or rarely encountered in other inlets.

In the Plymouth area it was surprising to find that several habitats had not been thoroughly surveyed and sampled to describe communities (rather than add to species lists) and the results published. These areas included (1) the sublittoral sediment seabed in the Tamar and Plym, and (2) bedrock or boulder surfaces on the shore and underwater.

Previous studies worth comparison included those of Johnson (1890) on marine algae and Percival (1929) who plotted distribution of species, including some shore species, along the Tamar Estuary. The Tamar provided an opportunity to study the distribution of species along a strong and well-described salinity gradient and this was undertaken for intertidal and subtidal areas.

Several of the locations we planned to study were within areas controlled by the navy. We did not include any areas bordered by naval dockyard facilities and were unable to obtain permission to dive in the region of Yonderberry as we had hoped to. However, the port authorities were very helpful in providing advice and in giving permission to dive or dredge sample in areas where those activities are normally prohibited for navigational reasons.

Survey methods for both intertidal rocky shores and subtidal hard substrata were based on techniques already developed for use in NCC surveys. Check lists were used throughout to ensure recording to a consistent style and, for species abundance data, in a form ready for recording on computer files. Examples of recording sheets are not included in this volume of the report but are held in Volume 3.

5.2. Rocky shores.

At each site selected for survey, the team determined the sort of work which would be carried out. On most shores this was a systematic description of the abundance of species in the main habitats/communities present at different heights on the open shore. Records were also made from habitats such as overhangs, gullies, rockpools and under boulders. Recording from unusual habitats would take precedence over recording on the open shore if time was limited. On some shores time permitted only a brief survey, or it was appropriate to note that the shore was very similar to one previously surveyed and detailed records were not taken. Using tidal height predictions made for half hour intervals through the day, the height of sea level above chart datum was established and a cross staff used to level the shore at each 0.5 m interval so that a record could be made of the height of the main zones. The botanist and zoologist decided on the location of each of the distinctly different habitats to be surveyed, which normally included the lower shore (LS), lower midshore (LMS), midshore (MS), upper midshore (UMS), upper shore (US) and splash zone (Spl) as well as the other habitats. The quantity of each species was recorded according to the appropriate abundance scale (Appendix 1). Specimens were collected where necessary for identification and included limestone rock from the lower shore to sample boring species. Sketches of the site location and site profile, or of any other important features, were prepared and photographs of the shore and of species present were taken from various angles. Data was later transferred to the Intertidal Habitat Recording Sheet and plant and animal recording sheets.

5.3. Sediment shores.

At each site selected, the shore habitats present were recorded for the Intertidal Habitat Recording Sheet. Samples were taken at LS, LMS, MS and UMS as far as conditions (access to soft mud in particular) and time allowed. These levels were at approximately 0.7, 1.8, 3.0 and 4.5 m above chart datum. On coarse sediments which could be walked on, these were determined by levelling with the cross staff. On soft sediments, the team planned to float up with the tide in the boat using the tidal height predictions to take samples at appropriate levels just ahead of the water level and a short walking distance from the boat. In practice, this was too time-consuming and samples on soft muddy shores were generally taken at whatever level the tide was. It was planned to take the following samples at each station:

1 x 0.01 m^2 core seived over 0.5 mm mesh
1 x 0.1 m^2 core seived over 1 mm mesh
0.5 m^2 dug and seived over 5 mm mesh

In the event, practical difficulties reduced the amount of sampling and a different suite of samples was taken depending on circumstances. The actual samples taken are noted below in Table 2.

Samples were seived on the shore by 'puddling' at the water's edge where possible. Samples were transferred to kilner jars and formalin together with eosin stain added on return to the accommodation.

5.4. Epibiota on subtidal rock and sediments

Subtidal areas were surveyed by diving. Usually, sites were surveyed by a botanist and a zoologist diving as a pair from deep to shallow water or offshore to onshore with some spot dives. The pair leader determined the separate habitats from which records were to be made as they were encountered

on the seabed. At each survey station, the habitat type was described and abundance of conspicuous species was recorded according to the scales given in Appendix 2. Photographs were taken to illustrate habitats, communities and species using Nikonos underwater cameras equipped with wide angle, close-up or standard lenses and with high or low power flash guns as appropriate. Specimens were collected where necessary for species identification. At some sites where limestone was present, rock samples with boring organisms were sampled using a hammer and chisel. Site location information, substratum type, topographical features and other habitat details were recorded on the Sublittoral Habitat Recording Sheet. Species data was recorded on the plant and animal checklists.

5.5. Sampling from subtidal sediments

5.5.1. Suction samples. A diver operated suction sampler was used to collect sediments from between slate rock outcrops at site 71, south of the Breakwater. The sampler is the same as that used in the Isles of Scilly (Rostron, 1983) and is described in that report. The area and volume of sediment sampled was not measured, but was in excess of 0.1 m^2 and to a depth of 10-20 cm. The sample was sieved over a 1 mm mesh and preserved in formalin.

5.5.2. Dredging. In order to sample the sublittoral sediments in the area a 30' fishing boat, the "Westward" (skipper Jack Alexander), was hired to do some dredging in the Tamar, Lynher, Plym, Sound and Yealm on the 16th and 17th July.

Sampling gear consisted of a pipe dredge (1 m in length by 25 cm diameter made of 5 mm steel) which was towed behind the boat on the ships wire warp winch. The dredge contents were tipped into a 30 litre skip to measure the volume, and then into a wash box and washed through a 1 mm sieve. Contents of the sieve were then placed in Kilner jars or buckets with lids and preserved with formalin containing the vital stain eosin. Notes of time of deployment, depth of water (later corrected to chart datum), latitude/longitude (from the satellite position fixer, later corrected to OS grid reference), volume of sediment and notes on sediment type and animals seen were made. Where the volume of the sieved sediment was greater than about 4 Kilner jars the remainder was picked over for large macrofauna species, a note was taken of the proportion of the whole that was kept and the remainder was thrown out.

Nine sites in the Tamar, Lynher and Sound were sampled on the first day and twelve sites in the Plym, Sound and Yealm were sampled on the second day.

KH dived to watch the dredge working at Madge Point (D18) and found that it did not dig in very well, but took snatches at the sediment. Nonetheless, at all sites a sufficient volume of sediment (at least 10 litres) was taken for analysis, although it was occasionally necessary to redeploy the dredge.

5.6. Aerial photography

Aerial photography was undertaken on April 24th when low tide was a predicted 0.5 m above chart datum at 1240 h. The aircraft used was a Cesna 172 piloted by Mr. R. Dougan of Exeter Flying Club. Fig. 8 shows the general flight path over the Plymouth area and times of start and finish. A continuous series of oblique photographs of the shore line with gaps along some very similar lengths of the Tamar was taken from a height of between about 400 and 600' using two cameras to enable film changes to be made by one of the team allowing the photographer to continue the sequential photographs uninterrupted. Filmstock used was Kodochrome 64. Distant views and

supplementary photographs were taken with a separate camera using Fujichrome 100 film which was processed later in the day. Observations and notes were made of any features of particular interest which could be visited during field surveys or which helped in describing aspects of habitat or species distributions.

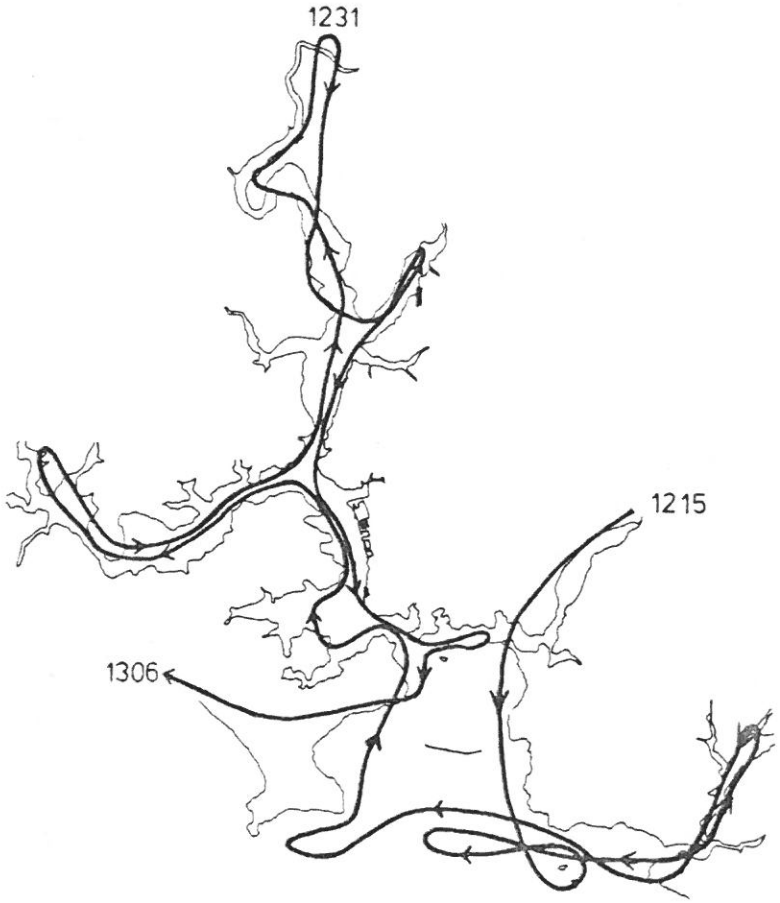


Fig. 8. Flight path and times for aerial photographs.

5.7. Data analysis and presentation

5.7.1. Abundance of conspicuous species. Records of the abundance of conspicuous species in separate habitats at each site were entered into the data management program described by Hobbs (1985). Print-out from these files has enabled a clear view of the distribution and habitat preferences of each species. In addition, distribution of all but rarely occurring species were rough-plotted onto outline site maps to give a clearer picture of distribution. Inspection of site records has been used to identify the different habitats and communities encountered during survey and to classify them. The abundance of species in examples of those habitats has been tabulated directly from field records with addition of any laboratory identifications.

5.7.2. Sediment samples. Preserved sediment samples were further washed over a 1 mm mesh seive to remove formalin and remaining fine sediment. The samples were each spread out in a white tray, covered with water, and biological material extracted. The fauna was identified and numbers of individuals of each species noted.

6. RESULTS

6.1. Introduction

The location of sites surveyed is listed in Table 1 (Tables are inserted at the end of the text) and illustrated in Figs. 9 to 11. Sixty-four intertidal, 50 subtidal diving and 21 subtidal dredge sites were surveyed and sampled.

The following end-products have been produced:

Volume 1 : This report.
Volume 2a : Species distribution records from intertidal surveys (print-out from data-base).
Volume 2b : Species distribution records from subtidal surveys.
Volume 3a : Field data for intertidal surveys.
Volume 3b : Field data for subtidal surveys.
Volume 4 : Catalogue of photographs.

Colour transparency slides illustrating habitats, communities and species on the shore and underwater

The communities of conspicuous species present are described below and in Tables 2 to 8 and 10 to 19. A list of all species recorded and entered into the data-base is given in Table 20 (intertidal sites) and Table 21 (subtidal diving sites). Tables 2 and 9 are lists of species sampled from intertidal and subtidal sediments. Aerial photographs (one set) and photographs from the shore and underwater (three sets) are held by the Nature Conservancy Council. Specimens of algae and animals are held at the Oil Pollution Research Unit.

Habitats and communities are separated on the basis of wave exposure, tidal stream exposure, substratum type, infralittoral or circalittoral (for some sublittoral sites), the marine inlet in which they were found (the Yealm, Plymouth Sound, the River Plym, the River Tamar, including the Hamoaze, and the River Lynher). As far as possible, similar descriptions of habitat/community types have been given for comparable situations to those recorded in reports of the Fal and Salcombe/Kingsbridge Surveys.

6.2. Description of intertidal habitats and communities

6.2.1. Introduction. Intertidal habitats and associated communities could generally be separated into distinctive types. Changes in the species present in similar habitats at different sites along the Tamar occurred over short distances. However, several sites have been included in a single section and a description of the species lost or gained with increasing distance from the open sea is made.

Table 2 includes records from samples of intertidal sediments. Most other tables are structured to show the species present in each abundance category. Where the communities present in similar habitats at different sites are tabulated, the abundance of each species is given on the same line for comparative purposes.

6.2.2. Wave exposed bedrock at the entrance to Plymouth Sound. (Site 9). Open coast areas were not investigated in any detail but brief observations were made at Penlee Point where typical exposed open coast communities dominated by limpets and barnacles with dense red algae on the lower shore were present. Rocks here were very broken with gullies and overhangs which

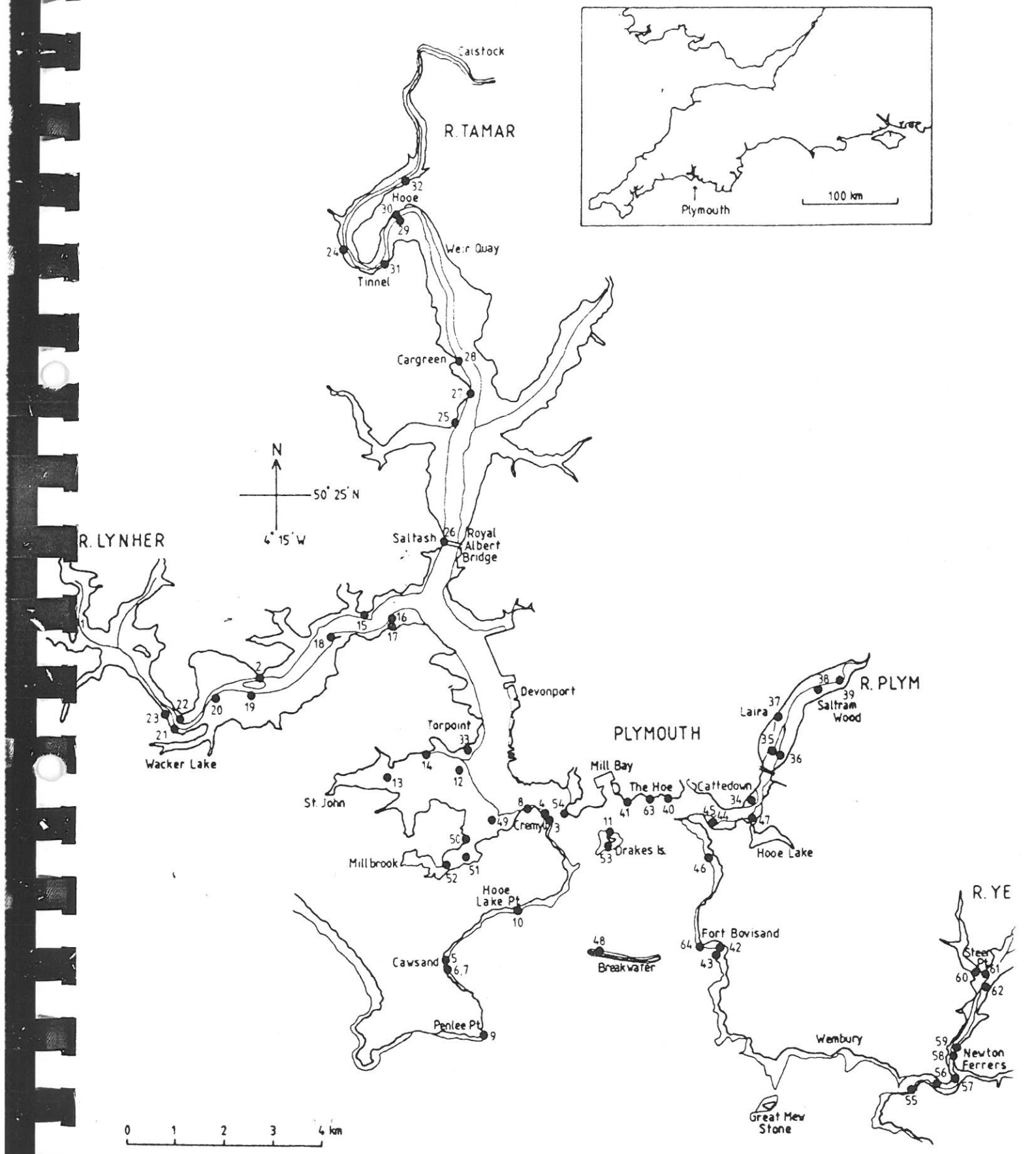


Fig. 9. Location of intertidal sites surveyed

held several animal species not encountered on open surfaces but which were outliers of the sublittoral communities described in the next section.

6.2.3. Rockpools. (Sites 6, 9. 10, 40, 41, 43, 46, 53, 64). (Table 3). These were studied at exposed to very sheltered sites and on slate, quartzitic sandstone/grit and limestone rock. However, the communities present were broadly similar at each of the sites studied. The differences which occurred were mainly due to factors other than wave exposure including rock type and the presence of sand or boulders in pools. Pools in the splash zone and upper shore were dominated by green algae (Cladophora sp. and Enteromorpha sp.) with scattered spirorbinid polychaetes at Site 9 and in some places a high abundance of Patella vulgata. Pools on the upper midshore had a much wider variety of species being encrusted with calcified algae with dense Corallina officinalis particularly in the uppermost fringe of the pool and a high abundance of Ceramium rubrum. Upper midshore pools often held a high abundance of Gibbula umbilicalis and, at Site 10 (Hooe Lake Point) and Site 46 (Jennycliff Bay), large shallow pools were colonised by very large numbers of Littorina littorea with a dense population of Monodonta lineata at the fringe of the pools. The same species occurred in pools at West Hoe (Site 41) but in less numbers. The richest variety of species were recorded in lower midshore pools where no one species was recorded as dominant although Corallina officinalis, Chondrus crispus, Ulva sp., Halidrys siliquosa and Sargassum muticum were often present in large amounts. Some typical rock pool algae recorded here were Gastroclonium ovatum, Bifurcaria bifurcata (Sites 10 and 64 only) and Mesophyllum lichenoides. Mastocarpus stellatus was present in several pools although not those included in Table 3. Animals recorded in this area and usually associated with rockpools included Anemonia viridis, Runcina coronata, Asterina gibbosa (under stones), Amphipholis squamata and juvenile Ophiothrix fragilis. Little sampling was undertaken on amphipods and small prosobranchs were generally missed. Runcina coronata was particularly abundant in pools at Bovisand Bay (Site 43) and Drakes Island (Site 53). Very few fish or prawns were found so early in the year but Cottus scorpius, Blennius pholis and Palaemon serratus were recorded. Lower shore pools contained several sublittoral fringe and predominantly sublittoral species including species of Laminaria, Dilsea carnosa, Urticina felina, Nassarius incrassatus and Gibbula cineraria.

The lower shore pool at Penlee Point was sandy and included species characteristic of areas where sand is present (Audouinella sp. with Ahnfeltia plicata, Cystoclonium purpureum and Polyides rotundus). Swarms of mysids, Siriella jaltensis, were also present in this pool. Limestone pools at Tinside were quite rich in species although Polydora sp. and boring Cliona celata seemed the only species whose presence depended on the limestone. Enteromorpha sp. was recorded in these pools but as a result of abrasion by boulders. Several species occurred here which were characteristic of shores further up the estuary including Callithamnion sp., Plumaria elegans, Dendrodoa grossularia and Botrylloides leachii. At Wilderness Point (Site 3), the communities were distinctly estuarine in character with Ciona intestinalis, Elminius modestus, Crepidula fornicata, Clava squamata present.

The largest and deepest pools encountered in the areas surveyed were those at Staddon Point (Site 64). Only algae were surveyed here but included Common Bifurcaria bifurcata and some species not recorded in other pools: Chorda filum and Codium sp.

6.2.4. Gently sloping broken rock slopes semi-exposed to wave action within Plymouth Sound. (Sites 6, 10, 43, 46, 48, 53). (Table 4). These shores were of slate bedrock except at the breakwater (Site 48) where

limestone and some concrete blocks were present. Rock in the splash zone generally held fairly rich lichen communities. Ligia oceanica were generally present on crevices at the lower part of this zone (Littorina 'saxatilis', L. neritoides). Gently sloping rocks on the upper shore were largely of bare rock encrusted by Verrucaria maura with scattered limpets and barnacles (mainly Chthamalus montagui with some C. stellatus) and patches of algae (Fucus spiralis, Pelvetia canaliculata). There were large numbers of Littorina littorea, Gibbula umbilicalis and Monodonta lineata particularly near to pools on some shores. The sphaeromid isopod Campecopea hirsuta was Frequent on the upper shore at Site 53 (Drakes Island). Further down the shore, limpets and barnacles (mainly C. stellatus with C. montagui, Semibalanus balanoides and Elminius modestus) were dominant with some patches of Fucus vesiculosus and Ascophyllum nodosum. Lichina pygmaea formed extensive patches here at Site 10 (Hooe Lake Point). At about midshore level on gently sloping rock, algae were dominant with a high abundance of F. vesiculosus, A. nodosum, Gelidium pusillum, Mastocarpus stellatus and Laurencia pinnatifida growing on rocks with a patchy cover of encrusting pink Rhodophyta. Gibbula umbilicalis were Abundant on rocks here and algae were colonised by large numbers of Littorina mariae and L. obtusata and by Hyale nilssoni. On the lower midshore, dense Fucus serratus was usually present. Limpets were abundant but barnacles were generally recorded very sparse. Many species noted below as characteristic of the lower shore were present. On the lower shore, rocks were covered by encrusting algae overgrown by Corallina officinalis, Palmaria palmata, Chondrus crispus, Himanthalia elongata and Laminaria digitata. Bifurcaria bifurcata was present at Hooe Lake Point (Site 10). Animals were generally very sparse and limpets and barnacles often absent. The hydroids Campanularia flexuosa and Dyamena pumila were characteristic of algae here but in small amounts. The extensive broken rock platform south of Drakes Island provided the opportunity to study sublittoral fringe communities. Rocks here were covered by encrusting algae colonised by foliose red algae, encrusting sponges, Umbonula littoralis and ascidians.

Overhang and underboulder communities are described separately.

6.2.5. Overhangs on the lower shore in Plymouth Sound and at Wilderness Point. (Sites 3, 10, 11, 41, 43, 46, 53, 63). (Table 5). Overhangs and other shaded surfaces held a characteristic fauna. In open parts of Plymouth Sound/areas of hard rock, these were characterised by encrusting sponges, some actinians, encrusting and erect Bryozoa, Balanus perforatus and a fairly wide variety of molluscs and ascidians. Algae were also present and were species also found an open on the lower shore and in pools. However, overhangs and small caves at some locations along the north side of Plymouth Sound were distinctly different in character and are described separately (Section 6.2.11). D. grossularia appeared to be characteristic of the greater degree of shelter/more stressful conditions of sites near to the Tamar whilst Polydora ciliata was boring into the rock. D. grossularia was Common at Jennycliff Bay and Occasional at Drakes Island and some of the richer elements of more open coast overhangs were not recorded here so that this area appears intermediate in character between open and enclosed areas. Goniodoris nodosa was found with Dendrodoa grossularia on which it feeds at Sites 4, 6 and 46. Asterina gibbosa was Frequent at Site 46. Cerus pedunculatus was Frequent at Sites 11 and 41. A cave at midshore level on the south side of Cawsand Bay (Site 7) was colonised by similar communities to those under overhangs on the lower shore although Clathrina coriacea was recorded as Frequent, Pomatoceros as Common and Phyllophora traillii was Frequent.

6.2.6. Lower midshore underboulder communities in Plymouth Sound. (Site 46). These were only recorded incidently at Jennycliff Bay but the

communities present were distinctive being dominated by encrusting Bryozoa, Verruca stroemia and Heteranomia squamula with a high abundance of amphipods.

6.2.7. Lower shore underboulder communities at Wilderness Point and Devil's Point. (Sites 3, 54). Boulders on the lower shore at about +1 m were of limestone and, at Wilderness Point (Site 3) sandstone as well. Communities under the boulders were rich but were very different for the two rock types. Limestone boulders were dominated by boring species with Abundant Hiatella arctica and Common Polydora sp.. Gastropods, other than Nassarius incrassatus and Ocenebra erinacea, were restricted to the smooth sandstone boulders.

The following species were recorded at both sites and the abundance is for Wilderness Point (* = At Devil's Point only):

Abundant species

Hiatella arctica

Common species

Halichondria panicea*, Polydora sp., Spirorbis tridentatus*, , Botrylloides leachii

Frequent species

Cliona sp.*, Hymeniacidon perleve, Tubularia indivisa*, Spiorbinidae indet. (on rock), Verruca stroemia*, Heteranomia squamula, Dendrodoa grossularia*

Occasional species

Scypha ciliata*, Porifera indet. (slimy brown), Campanularia flexuosa*, Nereis sp.*, Balanus crenatus*, Carcinus maenas, Pisidia longicornis, Porcellana platycheles, Gibbula cineraria, Nassarius incrassatus, Ocenebra erinacea, Botryllus schlosseri*

Rare species

Leucosolenia botryoides, ?Haliclona sp.*, Actinia fragacea*, Halosydna gelatinosa, Cancer pagarus*, Amphipholis squamata.

6.2.8. Clean sand at Bovisand Beach. (Site 42). (Table 2). This was the only truly sand beach in the survey area. Samples taken from the midshore, lower midshore and lower shore revealed a very sparse fauna, with only eleven species recorded and in low numbers. The polychaete, Scolelepis tridentata, was found in reasonable numbers in one LMS sample (13 per 0.1 m^2), but not elsewhere. Other species included Notomastus latericeus, Scolelepis squamata, Urothoe brevicornis and one ?Thalassema thalassemum.

6.2.9. Coarse sand and gravel with pebbles in small bays in the area of Plymouth Sound. (Sites 5 and 11). (Table 2). Sites investigated were at Cawsands Bay and on the northeast side of Drakes Island. Communities living in the sediments were very impoverished and dominated by oligochaetes, nemerteans and Capitella capitata. The archiannelid, Saccocirrus papillocereus was found at both sites, being particularly abundant on the lower shore in Cawsands Bay (Site 5). At Drakes Island (Site 11) two juvenile Ophelia sp. were found. Ophelia has not been previously recorded from the Sound.

6.2.10. Steeply sloping broken limestone bedrock on the north side of Plymouth Sound. (Sites 40, 41 and 63). (Table 6). Shores from Western King Point to the entrance to Sutton Harbour were very similar and included steeply sloping broken and pitted limestone bedrock with some vertical surfaces,

platforms, pools and overhangs. The communities present were broadly similar to those recorded on slate bedrock in Plymouth Sound (Section 6.2.4). Barnacles and small littorinids were more abundant on the upper shore than at sites described in Section 6.2.4 and the small bivalve Lasaea rubra was present at least at Site 41. Lichen populations were not particularly rich although Lichina pygmaea was Common in places. The shores were obviously exposed to fairly strong wave action as well as sunshine and Pelvetia canaliculata was only recorded west of Site 41 at a position below the 'Drake's View Hotel' whilst Ascophyllum nodosum was not recorded. The most notable feature of the lower shore was the very high abundance of Polydora sp. below the canopy of Himanthalia elongata. This did not appear to prevent the establishment of a wide variety of foliose algae on the lower shore although encrusting algae, which dominated rock on slate surfaces, were only Occasional.

6.2.11. Lower shore gulleys, overhangs and caves in limestone bedrock on the north side of Plymouth Sound. (Site 40). These were remarkable for the domination of rock by Dendrodoa grossularia and the presence of Abundant Scypha compressa and are therefore separated from similar habitats described in Section 6.2.5 and from overhanging surfaces included in Section 6.2.10. The dense cover of D. grossularia probably prevented the establishment of many species and the community was impoverished. Other species recorded were Frequent Scypha ciliata, Halichondria panicea, Hymeniacidon perleve and Botrylloides leachii, Occasional Morchellium argus and Rare Metridium senile and ?Oscarella lobularis. The rock under the dense cover of Dendrodoa was bored by Hiatella artica and by worms not identified from this site. The community was best developed in an area below the Men's Changing Area at Tinside.

6.2.12. Wave-sheltered limestone bedrock and boulder shores in the area of The Narrows. (Sites 3 and 54). Bedrock on these shores extended to low water level. Communities were those of very sheltered shores being dominated by fucoid algae with limpets and barnacles sparse below the upper shore. However, lichen populations were very sparse. Only a thin covering of Verrucaria maura was recorded on the granite walls of the fort at Wilderness Point whilst at Devil's Point, V. maura and Lichina pygmaea were present in small amounts. Catenella caespitosa was Rare at Devil's Point. Pelvetia canaliculata was recorded as Rare at Wilderness Point only. Littorina saxatilis and L. neglecta were Common on the upper shore together with Abundant Patella vulgata and Chthamalus montagui, Frequent Elminius modestus and Semibalanus balanoides and Occasional Chthamalus stellatus. The sphaeromid isopod, Campecopea hirsuta was Occasional on the upper midshore at Devil's Point. A fairly wide variety of species were present on the mid and lower shores with Mastocarpus stellatus and Palmaria palmata present in large quantities at both levels and Laurencia pinnatifida, Lomentaria articulata and Plumaria elegans Common on the lower shore. Audouinella sp. was locally Extremely Abundant here. Himanthalia elongata and Laminaria digitata were also present in large amounts with some L. saccharina on the lowest shore and Laminaria hyperborea was recorded at Devil's Point. Littorina obtusata and L. mariae were very sparse amongst the fucoids. Rocks on the lower midshore and lower shore were pitted with the borings of Polydora sp. and some Hiatella arctica. Animals here included a small variety of species with Common Dynemena, Frequent Halichondria panicea, Botrylloides leachii and Dendrodoa grossularia and Occasional Hymeniacidon perleve, Botryllus schlosseri, Gibbula cineraria and Goniodoris nodosa. Electra pilosa and Flustrellidra hispida were present in large amounts on algae.

6.2.13. Wave sheltered hard substrata extending to mud on the lower shore in the Cattewater. (Sites 34, 44, 45 and 47). These sites included upper shore areas of concrete blocks and jetty walls with scattered boulders, bedrock and debris extending to small boulders and cobbles on the lower shore. Communities present were similar, though with less species, than those described in Section 6.2.14. However, Carcinus maenas and amphipods (most likely Chaetogammarus marinus) were particularly abundant at these sites compared to other areas studied. Alcyonidium gelatinosum (=A.polyoum), Campanularia flexuosa and Bowerbankia imbricata were Frequent at Oreston Spit (Site 47) reflecting the greater shelter/variable salinity at this site. In areas of cobbles amongst mud, Cirratulus cirratus was Common and digging revealed a high density of Nereis virens at Oreston Spit.

6.2.14. Wave-sheltered limestone bedrock generally extending to mud on the lower shore in the lower Tamar Estuary and River Lynher. (Sites 1, 2, 8, 15, 26, 27, 28, 33,and 50). (Table 7). These sites were on shale bedrock (quay walls at St.German's, Site 1; limestone blocks on the lower shore at Southdown Quay, Site 50) and included locations subject to variable salinity where fairly rich intertidal communities were present but including some species typical of very sheltered / estuarine conditions. Rock extended to about +1m near the lower Tamar / Lynher but only to about mid-tide level at most other sites. The shores were generally dominated by fucoids. In the narrow splash zone, lichens were abundant with Calloplaca thallincola, Calloplaca marina, grey lichens, Verrucaria maura and Xanthoria parietina the main taxa with Ramalina sp. at some sites. Fucus spiralis and Pelvetia canaliculata dominated the upper shore (not at St. German's Quay or Cargreen) with Catenella caespitosa and Bostrychia scorpioides Frequent lower down the shore. Fucus spiralis was not present at St. German's Quay, Ascophylum nodosum (colonised by Polysiphonia lanosa) was dominant leaving little room for Fucus vesiculosus and Fucus serratus which were present in small amounts. Elminius modestus was the main barnacle species present under the fucoids with some Semibalanus balanoides (not recorded west of Passage Point (Site 15) in the Lynher or north of the Tamar Bridge). Littorina saxatilis, Littorina obtusata and Littorina littorea were all Frequent. Patella vulgata was present under the fucoids but not west of Passage Point (Site 15) in the Lynher or at the Tamar Bridge and northwards in the Tamar. There were large numbers of Hyale nilssoni on the upper shore at Black Rock (Site 2) and Chaetogammarus marinus present on the lower shore at most sites. Dynamena pumila was generally common on the lower shore, Audouinella sp. was often abundant with filamentous brown algae and frequent Callithamnion sp. and Ceramium sp(p). Foliose algae present in fairly large amounts were Mastocarpus stellatus, Palmaria palmata and Polysiphonia macrocarpa (Site 8). Balanus crenatus was often present in large amounts. Balanus improvisus was searched for but not found. Clumps of large Mytilus edulis occurred on some shores. Estuarine animal species present on these shores included Bowerbankia imbricata and Clava squamata. Southdown Quay (Site 50) was of limestone and was heavily bored by Polydora sp. with occasional Hiatella arctica.

Below the Ballast Pound at Torpoint (Site 33), ridges of shale rock dominated by Fucus serratus were present at +0.8 to +1m. These were the lowest bedrock areas studied on this type of shore and the species present are noted below.

Superabundant species

Fucus serratus

Common species

Dynamena pumila, Pomatoceros sp., Spirorbinidae indet. (on fucoids), Elminius modestus

Frequent species

Callithamnion sp., Ceramium rubrum, Rhodophyta indet. (pink encrusting), Chrysophyta indet. (colonial diatoms), Ectocarpoidea indet., Ulva sp., Hymeniacidon perleve, Clava squamata, Alcyonidium gelatinosum, Flustrellidra hispida, Bryozoa indet. (brown encrusting)

Occasional species

Mastocarpus stellatus, Polysiphonia urceolata, Porifera indet. (slimy yellow), Polydora sp., Balanus crenatus, Chaetogammarus marinus

Rare species

Dumontia incrassata, Hypoglossum woodwardii, Palmaria palmata, Halichondria panicea, Actiniae indet., Littorina mariae, Patella vulgata

6.2.15. Lower shore shale cobbles and boulders below the Ballast Pound (Site 33). This was a distinctive habitat notable for the high abundance of finely branching red algae and the presence of a fairly rich animal community on and under boulders. The area was clearly subject to disturbances as many boulders were turned upside down. This site is also described in Section 6.3. Species recorded are listed below (animal abundances include records from under boulders).

Superabundant species

Chrysophyta indet. (colonial diatoms)

Common species

Callithamnion sp., Callithamnion/Antithamnion sp., Leucosolenia botryoides, Balanus crenatus, Gibbula cineraria

Frequent species

Antithamnion plumula, Lomentaria clavellosa, Ulva sp., Halichondria panicea, Hymeniacidon perleve, Pomatoceros sp.

Occasional species

Hypoglossum woodwardi, Polysiphonia sp., Scypha ciliata, Crepidula fornicata, Heteranomia squamula, Ascidiella aspersa, ?Styela clava

Rare species

Ceramium rubrum, Nitophyllum punctatum, Myxilla sp. (channeled, cream), Cliona sp., Cereus pedunculatus, Aphroditidae indet., Carcinus maenas, Ciona intestinalis, Pholis gunnellus

Present, no records of abundance

Halichondria bowerbankii

6.2.16. Underside of a concrete slipway at Black Rock (Site 2). This was an unusual intertidal habitat which included a small variety of species. Campanularia flexuosa was Abundant but the most conspicuous species were Metridium senile and Mytilus edulis which were Common. Clava squamata was Common and Bowerbankia imbricata Frequent. The only sponge observed was one Halichondria ?bowerbankii.

6.2.17. Mussel beds on intertidal sediment flats in the Lynher and Hamoaze (Sites 12, 15, 16, 18). Mussel beds occurred at a few locations within the area of study including in the Tamar. The ones surveyed were colonised by Elminius modestus with generally Frequent Littorina saxatilis and Littorina littorea. Cerastoderma edule were present in the sediment between. Attached algae or algae living on stones amongst the mussels included Fucus vesiculosus and Ascophyllum nodosum. On the lower shore at Jupiter Point (Site 18), mussels were colonised by filamentous red algae and by Abundant Halichondria ?bowerbankii and Bowerbankia imbricata as well as Occasional Crepidula fornicata and Myxilla incrustans. Interstitial fauna sampled at Passage Point (Site 15) contained abundant Cirriformia tentaculata and a few other worms and amphipods. At St. Johns Lake mussel bed (Site 12) it was dominated by Cirratulus cirratus.

6.2.18. Muddy sediments in the Tamar, Lynher and Hamoaze (Sites 1, 12, 15, 17, 19, 20, 21, 23, 24, 25, 26, 29 and 49) (Table 2). In general these sediments were found to be species poor and usually very impoverished, except at certain sites where the polychaete Tharyx sp. was very abundant (e.g. Tamar Bridge (Site 26) and Wacker Lake Buoy (Site 20)). Other species include Streblospio shrubsoli, Nereis diversicolor, Nephtys hombergi and Oligochaeta indet. with Cirratulus cirratus and Cirriformia tentaculata in stoney ground. Nereis diversicolor and Oligochaeta indet. were found right to the furthest limit of sampling up the Tamar and Lynher (Sites 24 and 1), but Tharyx sp., Streblospio shrubsoli and Nephtys hombergi dropped out just before these sites and were most abundant near the mouths of the estuaries and in the Hamoaze.

6.2.19. Mud in the upper reaches of St. Johns Lake and Millbrook Lake (Sites 13, 51 and 53) (Table 2). Although seemingly further from marine influence than the Hamoaze sites these sites were relatively rich in both species and biomass. The polychaetes Streblospio shrubsoli, Nephtys hombergi, Nereis diversicolor, Ampharete acutifrons and Tubificoides ?benedeni were all present in reasonable numbers, and in the northern inlet they were joined by the bivalves Abra tenuis, Scrobicularia plana and Macoma balthica and a high density of Hydrobia ulvae.

6.2.20. Mud with high China Clay content in the upper Plym (Sites 35, 36, 37, 38 and 39) (Table 2). These sediments were characterised by the high China clay content which at Site 39 made it almost white. Nereis diversicolor was ubiquitously abundant and Scrobicularia plana was abundant, particularly on the mud flats at N. Saltram Wood. Other species included Streblospio shrubsoli, Tubificoides ?benedeni and Pygospio elegans. One specimen of the echiuran ?Thalassema thalassemum was taken at Site 35, and siphons of ?Mya sp. were also seen at this site.

6.2.21. Muddy sediments in the lower Plym (Sites 34 and 44) (Table 2). Both these sites contained very large numbers of various polychaetes that either tolerate variable salinity or opportunistically take over such sediments. Again Nereis diversicolor was ubiquitously

abundant, as were Tharyx sp. and Nephtys hombergi. Tubificoides ?benedeni was very abundant on the midshore and Pygospio elegans, Streblospio shrubsoli and Capitella capitata were also abundant there. Various other polychaetes were recorded in relatively lower numbers, including Ophryotrocha hartmanni which was first described from Plymouth and was only found at these sites on this survey. Cerastoderma edule was found occasionally.

6.2.22. Rock extending to the lower midshore in the upper Tamar (Sites 24, 30, 31, 32). Sloping rock at these sites was covered by semi-liquid mud and only pinnacles and vertical surfaces were colonised. The range of species present was very restricted and decreased rapidly with increasing distance up the estuary. At South Hooe (Site 30), the following species were present over the intertidal to the lower midshore.

Superabundant species
Ascophyllum nodosum, Fucus spiralis, Fucus vesiculosus

Abundant species
Pelvetia canaliculata, Fucus sp. (sporlings)

Common species
?Phaeophyta indet. (encr.), Verrucaria maura, Elminius modestus, Chaetogammarus marinus

Frequent species
Bostrychia scorpioides, Enteromorpha sp., Caloplaca marina, Balanus crenatus, Hyale nilsonni

Occasional species
Audouinella sp.

Approximately 1 km further up the estuary at the site below Tinnel (Site 31), Pelvetia canaliculata, Fucus spiralis, Bostrichia scorpioides, Hyale nilsonni and Chaetogammarus marinus could not be found. However, the hydroid Cordylophora lacustris was Common under overhangs on the lower midshore. Nereis diversicolor was Abundant in the mud between rocks here. Littorina 'saxatilis' was recorded as Occasional between the slates at Pentille Quay (Site 24). Ascophyllum nodosum was not recorded off Pentille Quay or at North Hooe (Site 32). Elminius modestus and Balanus crenatus were not recorded at North Hooe. Here upper shore rocks were colonised by blue-green algae and Enteromorpha sp. and Sphaeroma rugicorda was recorded under stones. Fucus vesiculosus persisted in a stunted form at Cotehele Quay and was present at the southern end of the rocky bend leading to Calstock but not at the northern end. Here, rock above mid-tide level was colonised by Blue-green algae and diatoms.

YEALM

6.2.23. Wave-sheltered bedrock at the entrance to the Yealm (Site 55) (Table 8). The area of Cellar Beach included a wide range of rocky and sediment shore habitats. Studies of rocky areas were undertaken to the west of the main sediment shore and were concentrated on vertical and overhanging surfaces. Open bedrock and boulder communities were colonised by patchy Pelvetia canaliculata on the upper shore with a high abundance of Chthamalus montagui, Littorina 'saxatilis' and L. littorea. Limpets, barnacles, Fucus vesiculosus and Enteromorpha sp. provided patchy cover to most of the upper midshore. Monodonta lineata were Occasional. Nucella

lapillus was not found. Below midshore level, the broken bedrock platform was covered by Fucus serratus with Mastocarpus stellatus and Laurencia spp. Rocks protruding from the platform were dominated by limpets and barnacles. Vertical rock with some platforms above midshore level were colonised by patchy Fucus spiralis with Ascophyllum nodosum together with a wide variety of foliose and filamentous red, brown and green algae on shaded rock. Below midshore level, broken vertical rock was generally dominated by Fucus serratus and foliose red algae with patches dominated by barnacles. Sponges, Halichondria panicea and Hymeniacidon perleve, were Occasional or Frequent on lower midshore rocks. Fucus serratus was densely colonised by hydroids, Spirobinidae and bryozoans. Rocks on the lower shore were colonised by some species typical of the sublittoral fringe or of damp areas of shore including Laminaria saccharina, Palmaria palmata and Sargassum muticum. The variety and abundance of red algae and of some animal species which are predominantly lower shore and sublittoral was higher on vertical surfaces on the lower shore.

6.2.24. Overhangs and small caves on the lower shore at the entrance to the Yealm (Site 55) (Table 5). These were colonised by a rich and characteristic fauna incluing several species not generally encountered on the open shore such as Metridium senile, Sagartiogeton undatus, Morchellium argus and Sidnyum turbinatum. Algae were present in the less shaded areas and the communities recorded were very similar to those described in the previous section for vertical rock except that Antithamnion sp., Audouinella sp. and Bryopsis plumosa were only recorded in this habitat on the lower shore and Fucus serratus was absent. The species recorded in this habitat are included in Table 9.

6.2.25. Sand with gravel and pebbles at the entrance to the Yealm (Site 55) (Table 2). Cellar Beach extended down to a wide area of sand which was sampled at the lower midshore and lower shore. The communities present were similar and were dominated visibly at the surface and in samples by Lanice conchilega. Pygospio elegans, Spio martinensis and Corophium crassicorne were also present in large numbers. Large specimens of Ensis ensis and Glycera sp. were Occasional. Arenicola marina was present. A total of 24 species of mostly polychaetes were sampled in 0.1 and 0.01 m^2. (The area sampled did not extend into areas colonised by Zostera marina which was present in shallow depths offshore.)

6.2.26. Hard substrata on muddy sand on the lower shore at Warren Point, Yealm (Site 57). The spit at Warren Point opposite Newton Creek appeared to act as a trap for rubbish including rags, bottles and tyres in particular on the lower shore. Further up the shore, algal debris and large quantities of tree debris were piled up. The main substratum present was of shingle or muddy sand colonised by patchy fucoid cover and with a high density of Littorina littorea. The lower shore hard substrata provided a point of attachment for Frequent Calyptera chinensis, Crepidula fornicata and Sargassum muticum. Gracilaria foliifera, G. verrucosa and Cystoseira nodicaulis were other notable species of algae present whilst several Aplysia punctata and Anemonia viridis and a few specimens of Suberites ficus and Calliostoma zizyphinum were notable animal species.

6.2.27. Bedrock and boulders extending to shingle and boulders on the lower shore in the Yealm (Sites 56, 59, 60, 61, 62). Areas of rock and other hard substrata apparently extended to the lower shore for much of the narrow part of the Yealm up to about Thorn Quay. The upper shore was dominated by dense fucoid algae including a band of Pelvetia canaliculata

on the uppermost shore followed by a dense cover of Ascophyllum nodosum with Fucus spiralis. Also on the uppermost shore were dense filamentous green algae and Catenella caespitosa with Frequent Bostrychia scorpioides. Ligia oceanica were Frequent here. Rock under the dense algal cover was mostly bare. Lower down, on the upper midshore, rock was dominated by limpets (Patella vulgata) and barnacles (Semibalanus balanoides and Eliminius modestus but with Occasional Chthamalus montagui at Site 59). Monodonta lineata was also Common at Site 59. Littorina mariae and Littorina littorea were present in quite large numbers mainly amongst algae. Midshore and lower midshore areas were colonised by patchy fucoid algae and a fairly small variety of other species but including Frequent Carcinus maenas and Occasional Bowerbankia imbricata at Site 59. Overhanging surfaces did not have a very distinctive fauna except that Hymeniacidon perleve was Common and they were the only location for Occasional Pomatoceros sp., Spirobinidae and Gibbula cineraria at Site 59. Lower shore shingle was colonised by encrusting algae with some filamentous red algae and patchy Fucus serratus and Sargassum muticum in particular. Several species of foliose red algae also occurred here but only at Site 59. Growing on fucoid algae were Clava squamata, Campanularia flexuosa and Alcyonidium gelatinosum (Dynamena pumila at Site 62). Littorina littorea were Abundant here and eels, Anguilla anguilla, were present under stones.

Further north along the Yealm and east along Newton Creek, bedrock was restricted to above about midtide level although scattered boulders, shingle and other hard substrata often extended further down the shore. Similar species were present although with increasing distance northwards from Madge Point (Site 59) the following changes occurred:

- The variety of foliose red algae decreased (Gelidium pusillum, Chylocladia verticillata, Cystoclonium purpureum, Dumontia incrassata, Hypoglossum woodwardii, Lomentaria clavellosa not recorded at Sites 61 and 62 where detailed recording undertaken).
- Chthamalus montagui ceased to occur
- The abundance of Bowerbankia imbricata increased (particularly on shingle shores)
- Monodonta lineata ceased to occur.

However, it is notable that, for as far north as was surveyed and into Newton Creek, the main rocky shore species including limpets continued to be present.

6.2.28. Coarse shelly gravel and sand with tree debris below the surface in the middle section of the Yealm (Site 58) (Table 2). The sediments were colonised by occasional Ensis sp. together with Nepthys hombergi, Lanice conchilega, Glycera sp., Arenicola marina and Venerupis pullastra.

6.2.29. Mud and muddy sand in the upper Yealm (Sites 60 and 62) (Table 2). The slipway at Steer Point provided an opportunity to sample down the mudflats from a firm base. Adjacent to the slip, the sediment was of mud with some shale mixed in whilst on the opposite bank, the mud was very soft. Samples included a wide variety of Polychaetes with

particularly high abundances of Ampharete acutifrons, Cirratulidae indet., Pygospio elegans, Streblospio shrubsoli and Tubificoides indet. Larger species present in smaller numbers included Nepthys hombergi, Nereis diversicolor and Abra tenuis (and Scrobicularia plana at Site 62) with Lanice conchilega and Cerastoderma edule occurring in sandier sediments.

6.3. Description of subtidal habitats and communities

6.3.1. Introduction. Subtidal habitats and communities are separated here mainly in terms of the substrata present and exposure to wave action and tidal streams. Areas of limestone and shale rock are also separated for the area of Plymouth Sound; although often the only substantial differences were in the presence of boring species in the limestone. At those rocky sites described as sheltered from wave action within Plymouth Sound, shallow communities were different at each site surveyed (much more so than for wave exposed sites) but have not been separated. Habitats and communities present in the Yealm are described separately to facilitate assessment of that inlet separately from those in the immediate area of Plymouth. Table 9 includes records from dredge samples of subtidal sediments. Other tables are structured as for intertidal areas.

6.3.2. Bedrock adjacent to the coast exposed to strong wave action in the region of Plymouth Sound. (Sites 67, 70, 89A). Bedrock adjacent to the shore was often very broken with gullies, overhangs and, at one location, a tunnel. Rock surfaces together with boulders generally extended to about 3 to 5 m where there was a sediment plain. Communities associated with different topographical features are described separately below. 'Kitchings Gulley' (Site 93) is described later in the sections on the Yealm.

Open rock surfaces (Sites 67 and 89A). Rock surfaces away from the gulley or tunnel systems were studied outside of the Penlee Point Tunnel (Site 67) and at Penlee Point (Site 89A). At the latter site, sublittoral fringe communities were dominated by Corallina officinalis with Ceramium rubrum (agg.) and a mixture of Laminaria hyperborea, Laminaria saccharina and Saccorhiza polyschides with Himanthalia elongata and Cystoseira foeniculacea present. Animals in the fringe included Frequent Umbonula littoralis, Balanus crenatus and Obelia dichotoma with Electra pilosa Common in algae. In the kelp forest below the fringe, Cryptopleura ramosa was particularly abundant at Site 89A and Brongniartella byssoides at Site 67. Corallina covered rocks in shallow depths but encrusting calcareous algae were dominant at 7.5 m at Site 67. Some large patches of Distomus variolosus occurred. Algae and animals were similar to those on open rock surfaces on the breakwater (Site 65) and so are not tabulated here.

Shallow tunnel and steeply sloping bedrock exposed to very strong wave action at Penlee Point (Site 67). (Table 10). These were very unusual habitats consisting of a flask-section tunnel open at the top and leading from the open coast to an apparent rock pool which was bowl-shaped. The maximum depth of 8.5 m was in the tunnel and was a floor of cobbles. The cobbles obviously caused abrasion during storms and there was a clear zonation within the tunnel from bare rock with widely separated Spirobis tridentatus, near the bottom, to rock dominated by S. tridentatus and tubiculous amphipods or colonised by small Pomatoceros sp., Balanus crenatus, Diplosoma listerianum and Morchellium argus, to rock dominated by encrusting and erect Bryozoa and Hydrozoa and some sponges and Diplosoma listerianum furthest from the base. The predominant hydroid was Coryne van-benedini with Aglaophenia pluma, Obelia geniculata and Tubularia indivisa Frequent. The presence of O. geniculata on rock was peculiar but confirmed by specimens. Bryozoans were mainly Crisia

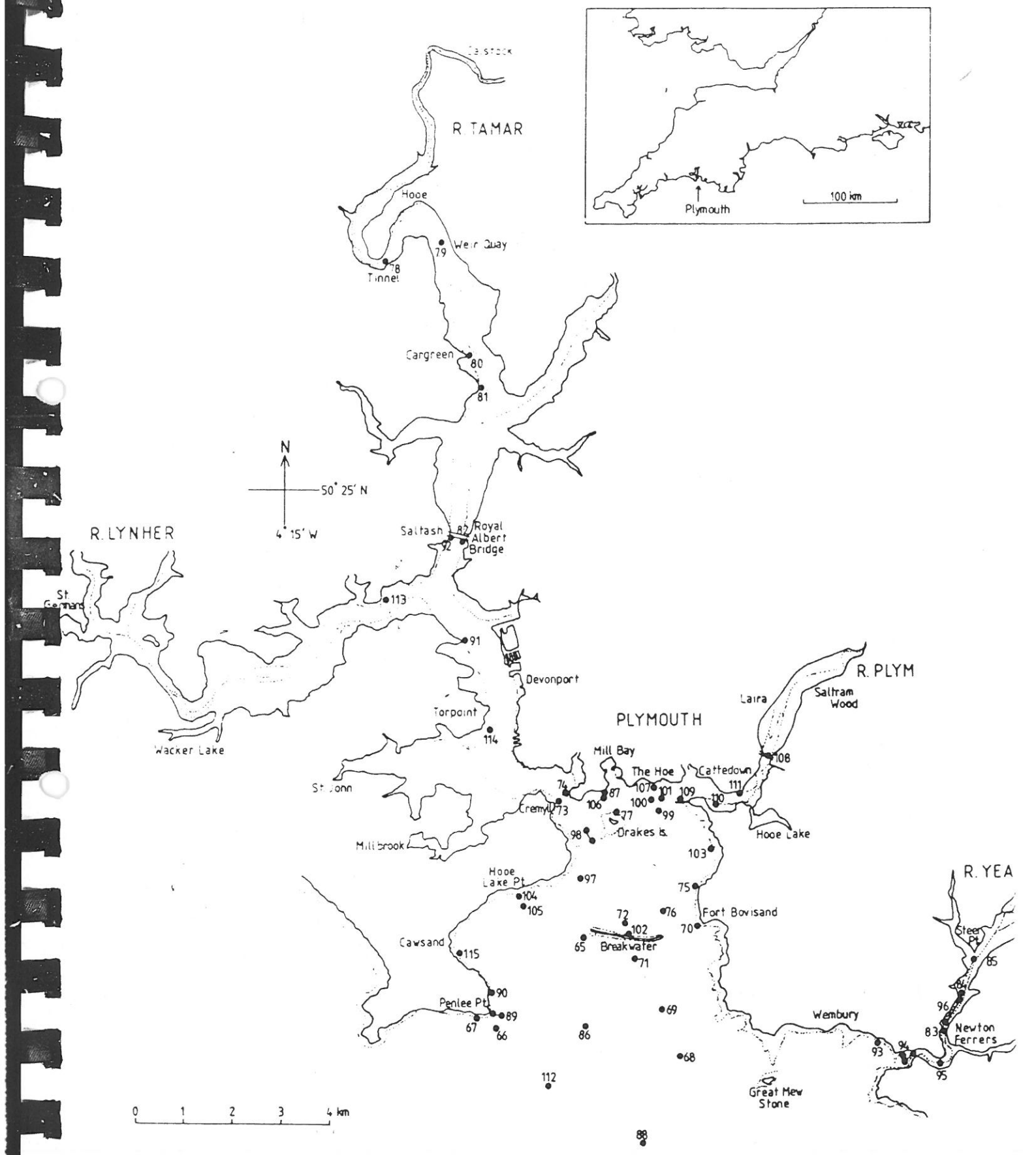


Fig. 10. Location of subtidal (diving) sites surveyed

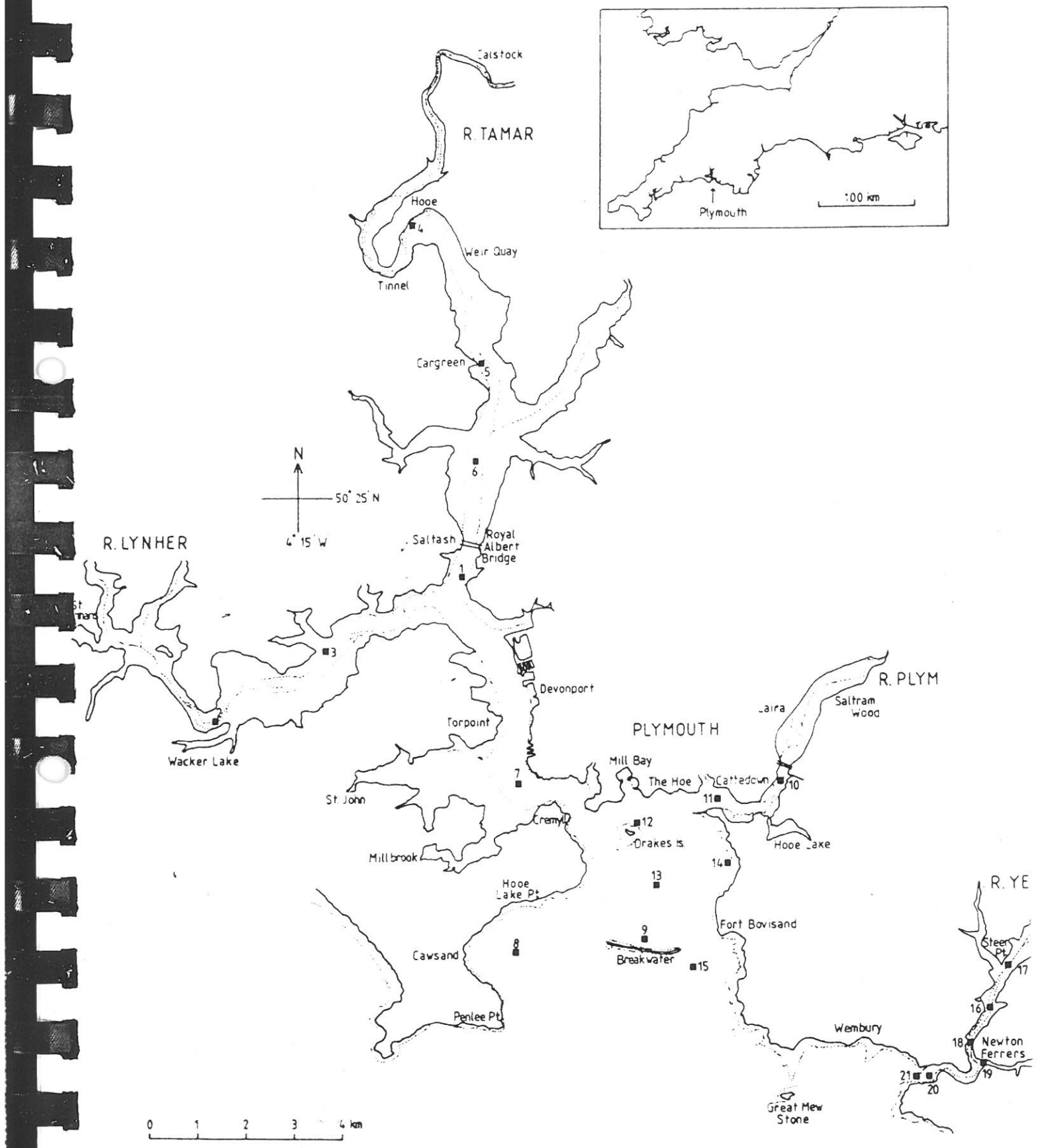


Fig. 11. Location of subtidal (dredge) sample sites

denticulata, Scrupocellaria reptans and Escharoides coccinea, Cellepora pumicosa together with Palaemon serratus, Galathea strigosa and Psammechinus miliaris were present in crevices. Very large numbers of Centrolabrus exoletus were present at the entrance to the tunnel over kelp debris and Trisopterus luscus were Common in the tunnel. The walls of the inner gulley (pool) were dominated by algae especially Corallina officinalis, Cryptopleura ramosa, Polyneura gmelinii and ?Audouinella sp. Animals included Common Tubularia indivisa, Escharoides coccinea and Scrupocellaria reptans with a variety of other erect Hydrozoa and Bryozoa, several ascidians and a few sponges and anthozoans. The presence of quite large numbers of Balanophyllia regia in one part of the pool was notable.

Shallow wave exposed gulley system at Staddon Point (Fort Bovisand) (Site 70). These were very broken gullies with large boulders in places. The communities present were very similar to those recorded for Kitching's Gulley and described later.

6.3.3. Wave exposed broken shale reefs in the infralittoral at the entrance to Plymouth Sound. (Sites 66, 68, 69, 71, 86, 89B, 112). (Table 11). At Sites 66, 68, 69, 71 and 89B there were low shale reefs with slightly inclined strata so that there were extensive upward facing surfaces terminating in vertical or overhanging surfaces up to 1.5 m high. They occurred in several areas at depths of 10 to 14 m. Between the reefs were extensive areas of broken shale and coarse sand with muddy sand patches. At Site 112, rock was more extensive and surveys extended from 18 m to 28 m. Bedrock surfaces in the upper infralittoral were colonised by Laminaria hyperborea over rock covered by crustose algae with sparse foliose algae on the higher parts of the reefs, but by communities typical of disturbed areas lower on the reefs including Saccorhiza polyschides, Laminaria saccharina, Desmarestia viridis, Halidrys siliquosa and a wide variety of foliose algae. The most abundant foliose algae included Bonnemaisonia asparagoides, Brongniartella byssoides, Delesseria sanguinea, Plocamium cartilagineum, Phyllophora pseudoceranoides, Phyllophora crispa and Callophyllis lacineata. Animals were generally sparse on these upward facing surfaces although a dense settlement of Verruca stroemia was evident on crustose algae and Electra pilosa covered many red algae. Echinus esculentus was Frequent but was not recorded at Site 89B. A notable occurence was Asterina gibbosa at Site 71. Vertical and overhanging surfaces were creviced and colonised by encrusting algae, sponges, hydroids and encrusting Bryozoa in particular. Sponges included Hemimycale columella, Dysidea fragilis and Halichondria panicea. Hydroids were sparse but mainly Obelia dichotoma. Alcyonium digitatum and Corynactis viridis were Frequent. Bryozoa included Bugula flabellata and enrusting species. The most conspicuous species were scattered Botryllus schlosseri, Morchellium argus, Diplosoma spp., Clavelina lepadiformis and sometimes Stolonica socialis. The large serpulid Protula tubularia was generally Occasional. Distomus variolosus was common at Site 89B. Pycnoclavella aurilucens occured at some sites. Crevices were colonised by ?Hiatella arctica (siphons observed), Aslia lefevrei and by Ophiopsila aranea with Galathea strigosa at some sites. Algae were widely scattered on vertical surfaces and the only ones which were present in any numbers were Schottera nicaeensis and Phyllophora traillii. Fish were fairly sparse over the rock but included Labrus bergylta and Ctenolabrus rupestris.

Large and small slates between the reefs were colonised by a distinctive community of a wide variety of algae, particularly finely branched brown and green species and by sparse encrusting Bryozoa, barnacles and Pomatoceros sp. Algae present and characteristic of this sort of habitat included Halarachnion ligulatum, Scinaia turgida, Schmitzia neapolitana, ?Naccaria wiggii,

Asperococcus sp. and, Cutleria multifida. Underneath the stones, the fauna was generally sparse and included encrusting Bryozoa, Verruca stroemia, Pomatoceros sp., Pisidia longicornis and Ophiothrix fragilis. Chorda filum occurred in sediment between stones.

The coarse shell sand with patches of muddy sand was colonised most conspicuously by Cerianthus lloydii with some ophiuroid arms in places, worm tubes and, rarely, Neopentadactyla mixta. Samples taken in this sediment revealed a number of species of small bivalves including Venus ovata, Dosinia exoleta, Tellina donacina, Abra prismatica and Venerupis rhomboides, a few polychaetes, including Glycera tridactyla, Laonice cirrata and many small Pectinaria koreni, a few Cerianthus lloydi and amphipods like Ampelisca brevicornis and the ophiuroid Ophiura albida.

At Site 86, the seabed was of bedrock fringed by boulders and extending to a sand plain at 16 to 18 m. At Site 112, the seabed was of broken upward facing bedrock at about 18 m extending to vertical and broken bedrock at 18 to 22 m. Rocks were dominated by foliose algae with similar species to those recorded on shallower reefs described previously but kelps were absent. In addition, Dictyopteris membranacea, Dictyota dichotoma and Carpomitra costata were present. Animal communities on vertical and broken bedrock were richer than in shallow depths with elements of the communities described in Section 6.3.2. present. The rarely recorded anthozoans Parerythropodium coralloides and Hoplangia durotrix were present under overhangs at Site 86. Silty boulders adjacent to the muddy sand plain at Site 86 were dominated by Balanus crenatus. Fish were generally more abundant than on the shallower reefs with Frequent Centrolabrus exoletus, Ctenolabrus rupestris and Labrus mixtus.

6.3.4. Wave and tidal stream exposed limestone blocks in the infralittoral on the seaward side of Plymouth Breakwater. (Site 65). (Table 12). The tumble of large irregularly shaped limestone blocks which composed the seaward side of the breakwater extended to 13 m. Horizontal and upward facing surfaces in the sublittoral fringe were dominated by Corallina officinalis and Chondrus crispus with Cladostephus spongiosus, Ulva sp., Cladophora sp. and Himanthalia elongata also characteristic of very shallow depths. Laminaria hyperborea was Abundant but other large brown algae included Saccorhiza polyschides and species of Desmarestia. Plumularia setacea was Common on these algae dominated surfaces and Corallina was heavily colonised by Celleporella hyalina. Few other animal species were present and were outliers of more abundant populations on adjacent vertical surfaces. Here Plumularia setacea was again Common and anthozoans (Actinothoe sphyrodeta, Sagartia elegans var. rosea and Corynactis viridis) covered a substantial proportion of rock surfaces together with encrusting bryozoans (mainly Umbonula littoralis with some Schizomavella linearis) and Scrupocellaria reptans. Diplosoma listerianum was also Frequent. Amphilectus fucorum and Aglaophenia pluma, species characteristic of the sublittoral fringe, were also present, Deeper than the sublittoral fringe, rocks were very intensively bored, most likely by Hiatella arctica, with surfaces dominated by a forest of Saccorhiza polyschides and foliose algae similar to those listed in Section 6.3.3. for reefs at the entrance to Plymouth Sound. Few animal species were recorded although Gibbula cineraria was notable here. Neither Distomus variolosus nor Dendrodoa grossularia were recorded here. Wrasse were Frequent and included Crenilabrus melops, Ctenolabrus rupestris and Labrus bergylta. Caves formed by the boulders held similar communities to those present on the sides of deeper rocks except that they were the only habitat where Echinus esculentus and Trisopterus luscus were recorded at this site. At the base of the boulder tumble, upward facing sandy rock surfaces

remained dominated by foliose red algae although Saccorhiza polyschides was sparse. Under the red algae, Verruca stroemia and the tubes of amphipods dominated the heavily bored rock together with scattered other animal species. Vertical and overhanging surfaces were covered by Verruca stroemia and overgrown by erect Bryozoa (Scrupocellaria scruposa, Crisia denticulata, Bugula turbinata) with Obelia dichotoma, Alcyonium digitatum and Eudendrium ?capillare. Cliona sp. and Phoronis hippocrepia were additional boring species here.

6.3.5. Wave exposed broken bedrock in the circalittoral offshore of Plymouth Sound. (Sites 88 and 112). (Table 13). These were areas of bedrock at around 30 m and at locations where a steep slope to deep water was indicated on the chart. Both broken upward facing rock surfaces and cliffs and overhangs were present. Upward facing surfaces including shelves under cliffs were colonised most conspicuously by Common or Frequent Eunicella verrucosa, Alcyonium digitatum, Pentapora foliacea, Holothuria forskali, Echinus esculentus and Alcyonidium diaphanum. At Site 88, E. verrucosa became Abundant near to the edge of the cliff and probably was colonised by the anemone Amphianthus dorhni although a casual observation is unconfirmed. Rock surfaces were colonised by patchy encrusting algae and had sparse erect Bryozoa and Hydrozoa with Occasional Myriogramme bonnemaisonii, Polyneura gmelinii and Rhodymenia pseudopalmata (spiky) at 27 m at Site 88. Broken vertical and overhanging surfaces were colonised by dense Verruca stroemia, encrusting Bryozoa (mainly Parasmittina trispinosa, Schizomavella linearis and Cellepora pumicosa) with scattered Bugula flabellata, hydroids and anthozoans. Alcyonium glomeratum was Frequent at Site 88 but only Rare at Site 112. Other anthozoans of interest but present in small amounts were Parazoanthus axinellae (both sites) and Leptopsammia pruvoti (Site 88). The sponge Thymosia guernii was recorded at Site 112.

6.3.6. Sandy sediments offshore of the Plymouth Sound Breakwater. (Sites 65, 86, Dredge Site 15) (Table 9). Coarse sand off the south-west corner of the breakwater held few visible species. Further offshore at Site 86, muddy sand was colonised visibly by Frequent Asterias rubens and casts of Arenicola marina. Ophiuroid arms and bivalve siphons could be seen together with some Lanice conchilega. Callionymus lyra was the only fish species observed. At Dredge Site 15, coarse shell sand was collected and held a fairly diverse community (39 taxea) of small bivalves and polychaetes, plus a few small crustacea, but low in numbers and biomass. It was dominated by Spisula elliptica (mostly juveniles) with Dosinia lupinus , Gari tellinella, Glycera lapidum and small numbers of many species found in the sheltered muddy sediments inside the breakwater. The polychaete Pisione remota (not recorded in PMF) and the archiannelid Polygordius lacteus were also here in reasonable numbers, but not elsewhere.

6.3.7. Bedrock adjacent to the coast sheltered from strong wave action. (Sites 75, 90, 103, 104, 105, 115). These sites are distinguished from those described in Sections 6.3.2. and 6.3.4. by their apparent shelter, the absence or low abundance of Distomus variolosus and sometimes its replacement by Dendrodoa grossularia in the infralittoral and the well developed kelp forest often with Laminaria ochroleuca present. However, communities at Site 90 (Inner Broady Cove) were intermediate between those described in Section 6.3.2. and in this section. All of the sites included here were present on shale or metamorphic rock. Sites 103, 104 and 115 were gradually sloping bedrock or outcrops dominated by kelp including Laminaria ochroleuca and extending to sediments at shallow depths. Hooe Lake Point (Site 104) appeared more exposed to wave action and less affected by likely scour from sediments although rocks were sandy. Here Laminaria hyperborea was dominant and there

was a sparse cover of foliose red algae particularly Cryptopleura ramosa, Kallymenia reniformis, Callophyllis lacineata and Phyllophora traillii with Drachiella spectabilis Frequent towards the lower part of the rocky areas. Animals were sparse on upward facing bedrock with Asterias rubens and Morchellium argus particularly conspicuous and patches of sand-covered barcacles present. Sides of rock here bordered the shell gravel fringe and were densely covered by barnacles and Polydora overgrown by dense foliose algae including Polyneura hilliae, Rhodymenia holmesii, Rhodymenia pseudopalmata and Kallymenia reniformis. There were several ascidian species present with Frequent Botryllus schlosseri, Clavelina lepadiformis, Didemnidae indet. and Morchellium argus. Distomus variolosus was recorded as Occasional and was present mainly on kelp holdfasts and stipes. At Jennycliff Bay (Site 103), very different algal communities occured. Laminaria ochroleuca was dominant on the shallow bedrock with Saccorhiza polyschides and Laminaria saccharina Common and Frequent respectively. The most abundant foliose algae were encrusting pink and dark red algae, Corallina officinalis and Polyneura gmelinii. Foliose algae were generally sparse and both rock surfaces and kelp fronds were heavily silted. The dominant barnacle was Verruca stroemia which was Common. Animals which were recorded as Frequent in this habitat included Amphilectus fucorum, Dendrodoa grossularia and Polycarpa rustica. South Cawsand Bay (Site 115) was most similar to Jennycliff Bay although both foliose algae and animals were sparse and with few species present.

6.3.8. Wave sheltered offshore reefs and boulders in Plymouth Sound. (Sites 76, 97, 105). These reefs or boulders at around 8 to 11 m were colonised by broadly similar communities of algae although with some differences in the fauna. Algae were most thoroughly recorded at Duke Rock Buoy (Site 76) where Calliblepharis ciliata was Common with Frequent Delesseria sanguinea, Heterosiphonia plumosa, Rhodymenia pseudopalmata and Stenogramme interrupta. Animal species were generally sparse on upward facing surfaces but included Common Nemertesia ramosa and Frequent N. antennina. On vertical surfaces of boulders the same species were present plus Stolonica socialis, Halecium halecinum, Epizoanthus couchii, Bugula flabellata and Rare Raspailia ramosa, Caryophyllia smithii and Bowerbanki pustulosa. Off Hooe Lake Point, Nemertsia spp. were not recorded but Sagartiogeton undatus, Urticina felina, Bugula plumosa, Didemnum maculosum, Morchellium argus and Stolonica socialis were all recorded as Frequent. Alcyonium digitatum was only recorded at Site 97 (offshore of Picklecombe Point) where it was present in large amounts on boulders.

6.3.9. Infralittoral pebbles and cobbles in sand and gravel at sites sheltered from strong wave action, exposed to moderate tidal streams in Plymouth Sound. (Sites 76, 97, 98). This type of habitat was recorded at 8 to 11 m and was colonised by a community of algae characteristic of such situations. These included Dudresnaya verticillata, Gracilaria foliifera, Naccaria wiggii, Schmitzia hiscockiana, Schmitzia neopolitana and Cutleria multifida. Animals were generally sparse although Alcyonidium diaphanum was Common at Site 76 (Duke Rock Buoy). Communities were sufficiently similar to include them in one list given below. Only collections of algae were made at Site 98 (N. of The Bridge) so detailed records are not available. Abundance notations are for Site 76 except where a species was only recorded at Site 97 (offshore of Picklecombe Point). (* = only recorded at Site 76. + = only recorded at Site 97.) In general, the species present in this habitat at Site 76 appeared richer and had more similarities with stable hard substrata communities than did those at Site 97.

Common species

Antithamnion plumula, Stenogramme interrupta, Alcyonidium diaphanum.

Frequent species

Dudresnaya verticillata, Halarachnion ligulatum, Radicilingua thysanorhizans, Rhodomela confervoides, Pomatoschistus minutus, Pomatoceros sp., Ophiothrix fragilis.

Occasional species

Acrosorium uncinatum *, Antithamnion cruciatum *, Antithamnion spirographidis +, Bonnemaisonia asparagoides, Brongniartella byssoides, Cryptopleura ramosa, Heterosiphonia plumosa, Naccaria wiggii, Phymatolithon polymorphum *, Polyneura gmelinii, Polyneura hilliae, Polysiphonia spp., Schmitzia neopolitana, Scinaia forcellata, Scinaia turgida (Scinaia sp. recorded at Site 97), Arthrocladia villosa, Desmarestia ligulata *, Laminaria sp. (sporelings) *, Enteromorpha sp., Suberites domuncula *, Nemertesia antennina *, Nemertesia ramosa, Pecten maximus *, Cellepora pumicosa +, Escharoides coccinea, Asterias rubens, Morchellium argus *, Polyclinidae indet. *

Rare species

?Atractophora hypnoides +, Gracilaria foliifera +, Lomentaria clavellosa +, Lomentaria orcadensis +, Myriogramme heterocarpum *, Phycodrys rubens *, Phyllophora crispa, Plocamium cartilagineum, Schottera nicaeensis, Schmitzia hiscockiana, Desmarestia aculeata +, Desmarestia viridis, Cutleria multifida +, Bryopsis plumosa, ?Cladophora sp., Cliona sp. (boring) +, Sagartia troglodytes +, Bispira volutacornis *, Terebellidae indet., Prostheceraeus vittatus *, Pagurus bernhardus, Crepidula fornicata *, Gibbula cineraria +, Chlamys varia *, Marthasterias glacialis, Asterina gibbosa *, Botryllus schlosseri *, Clavelina lepadiformis, Lissoclinum perforatum *, Gobius niger *.

6.3.10. Clean and Muddy shell gravel with shale pebbles in Plymouth Sound. (Site 103). At Jennycliff Bay (Site 103), there was a fringe of clean gravel composed mainly of barnacle shells with shale pebble adjacent to rock at 1.5 to 3 m. This extended as muddy gravel with pebbles to the mud plain at 4.2 m. Communities present included similar species on both clean and muddy gravel although a richer variety of species was present on the muddy shell gravel and pebbles. Species present on muddy gravel and shale pebbles are listed below. (* = recorded on clean gravel and pebbles only.)

Frequent species

Ceramium rubrum, Nitophyllum punctatum, Polyneura hilliae, Rhodomela confervoides *, Rhodophyllis divaricata, Gracilaria verrucosa, Chrysophyta indet. (diatoms), Chorda filum, Dictyota dichotoma, Laminaria saccharina, Ulva sp., Verruca stroemia, Electra pilosa (on algae).

Occasional species

Antithamnion plumula, Callophyllis lacineata, Corallinacea indet. (pink encr.), Phaeophyta indet. (encr.), Saccorhiza polyschides, Enteromorpha sp., Hydractinia echinata (on Pagurus bernhardus) *, Obelia geniculata (on Laminaria), Pomatoceros sp., Terebellidae indet. (?Loimea medusa), Spirorbinidae indet., Balanus crenatus, Pagurus bernhardus *, Nassarius incrassatus, Membranipora membranacea (on Laminaria), Morchellium argus *, Pomatoschistus pictus *.

Rare species

Gracilaria foliifera, Griffithsia corallinoides, Polysiphonia nigrescens, Bryopsis plumosa, Amphilectus fucorum, Nassarius reticulatus *.

The presence of Gracilaria foliifera and of the large terebellid (?Loimea medusa) in this habitat is notable as both are rarely recorded.

6.3.11. Muddy sand colonised by Zostera marina in Plymouth Sound. (Sites 77 and 115). (Table 14). Areas of Zostera marina were studied in a dense bed at 0.5 to 2 m north of Drakes Island (Site 77) and in a patchy bed in 3 to 4 m on the south side of Cawsand Bay (Site 115). At both sites, Z. marina occurred with Laminaria saccharina and a small variety of foliose red algae on pebbles in the sand. The greatest variety of algae and animals amongst the Zostera was recorded at South Cawsand Bay (Site 115). Animal species living on and in the sediment here were especially rich although the records do not differentiate between the seabed amongst Zostera and adjacent to the bed (sediment here is also referred to in Section 6.3.14). The greatest variety of algae and animals on leaves was recorded at N. of Drakes Island. Here plants were observed to have seeds. Ectocarpoid algae were particularly abundant on leaves at N. of Drakes Island. The Zostera bed off Drakes Island was obviously a recipient of sewage effluent.

A dredge sample (D12) from the vicinity of the Drakes Island bed contained a muddy coarse gravel and sand with small stones and shells. It was quite rich in species but not high in numbers or biomass. No species dominated but most abundant were Venus striatula, juvenile Mya truncata, Lucinoma borealis, Amphicteis gunneri and Melinna palmata.

6.3.12. Limestone blocks sheltered from strong wave action and tidal streams in the infralittoral on the north side of the Plymouth Breakwater. (Site 102). The tumble of large boulders extended to a mud slope at 5 m. Boulders formed caves and overhangs. In depths shallower than 2 m, boulders were dominated by a forest of Saccorhiza polyschides with a sparse small variety of algae. Rock in the upper and lower infralittoral was dominated by Phoronis hippocrepia with Common Hiatella arctica. Other animal species were few and sparse but included Frequent Halichondria panicea and Morchellium argus.

6.3.13. Steeply sloping broken limestone bedrock and boulders in the infralittoral and circalittoral very sheltered from wave action, exposed to strong tidal streams. (Sites 99, 100, 101, 106, 107, 109). (Table 15). These sites are separated from those in Section 6.3.17 because of the absence of Dendrodoa grossularia in the circalittoral and the presence of a wider variety of animal species including Corynactis viridis, Antedon bifida and Morchellium argus not recorded in The Narrows which appeared characteristic of open coast and enclosed but high salinity conditions. Also, Laminaria ochroleuca and L. hyperborea occurred where shallow rock was present at these sites but not in The Narrows.

Shallow water communities were dominated by dense kelp. Off the swimming pool at Tinside (Site 107), there was a forest of Laminaria ochroleuca with L. hyperborea, L. saccharina and Saccorhiza polyschides mixed in. At Site 109 (Mount Batten Breakwater), L. saccharina was dominant and L. hyperborea was not recorded. Foliose algae included few species, mainly Callophyllis laciniata, Cryptopleura ramosa, Polyneura gmelinii, P. hilliae and Kallymenia reniformis. Dendrodoa grossularia was Common in shallow depths at Site 107. All of the algae were heavily silted at the two sites where shallow water communities were studied and which were exposed to more moderate tidal streams

than deeper areas. Kelps extended to a depth of 2 to 3 m and foliose red algae were Frequent to about 4 m. The upper infralittoral community present off Tinside is listed below.

Abundant species
Laminaria ochroleuca

Common species
Callophyllis lacineata, Kallymenia reniformis, Polyneura hilliae, Cirripedia indet., Dendrodoa grossularia.

Frequent species
Phyllophora traillii, Laminaria hyperborea, Laminaria saccharina, Polydora sp., Hiatella arctica (siphons).

Occasional species
Hypoglossum woodwardii, Palmaria palmata, Saccorhiza polyschides, Halichondria panicea, Hymeniacidon perleve, Myxicola aesthetica, Morchellium argus, Polycarpa rustica.

Rare species
Pagurus bernhardus.

Circalittoral animal communities were similar at the sites included in this section. Rocks were dominated by Polydora sp. with many holes and siphons of Hiatella arctica conspicuous. In shallower depths, Myxicola aesthetica was the most abundant boring organism. Antedon bifida occurred only in deeper water. Nemertesia spp. were most abundant at sites exposed to strongest tidal streams, especially N. ramosa whilst Alcyonium digitatum had a patchy distribution, not being found off Tinside (Site 107) or Eastern King Point (Site 87). The presence of the rarely encountered anemone Aiptasia mutabilis, which was Frequent in the lower infralittoral/upper circalittoral off Tinside was particularly notable.

Limestone rock was obviously extensively bored but only a few species were conspicuous. Samples of rock were removed with hammer and chisel from a depth of 12 m near to the top of the cliff at Eastern King Point (Site 87) and from 4m off Tinside (Site 107). The most conspicuous boring species was Hiatella arctica which appeared ubiquitous together with Polydora sp(p) and Sabella flabellata which occured in most samples and Pseudopotamilla reniformis in some samples. Myxicola aesthetica occured in very large numbers at depths between about 10 and 20 m at several sites. Small numbers of Thalassema thalassemum also occured in many samples although it was not clear if the holes were bored by the Thalassema Many other species used holes in the limestone for refuges including Harmothoe impar, H. spinifera, Nicolea zostericola, Cirriformia tentaculata and Nereis pelagica.

A sample of mud tubes was taken from the steep limestone bedrock surface west of Mallard Shoal (Site 100) at a depth of ca. 18 m. It contained a rich community of small crustaceans, including Apseudes talpa, Tritaeta gibbosa, Lysianassa ceratina, Corophium sextonae, Ericthonius punctatus and Janira maculosa with the polychaetes Typosyllis ?cirropunctata and Harmothoe impar, the bivalve Kellia suborbicularis and the ophiuroids Amphipholis squamata and Ophiothrix fragilis.

6.3.14. Muddy fine sediments in Plymouth Sound and the Catttewater. (Sites 72, 90, 103, 105, 107, 109, 110, 115, Dredge sites 8, 9, 10, 11, 13, 14). (Table 9). Shallow sandy mud in Plymouth Sound and the Cattewater was investigated both in situ and by dredge. These were generally very rich in both species and biomass, including many conspicuous species. The mud in

Jennycliff Bay (D14) and north of the Breakwater (D9) had a particularly high biomass, mostly due to the very high numbers of the Ampharetid polychaete Melinna palmata. Numbers of species were 41 and 34 respectively. In Jennycliff Bay other characteristic species included three species of Maldanid polychaetes (Euclymene oerstedi, Clymeneura clypeata and another species of Euclymeninae not yet identified), the polychaetes Caulleriella caput-esocis and Lumbrineries latreilli and the bivalves Abra alba, Venus striatula, Nucula turgida, Cultellus pellucidus and Thyasira flexuosa. Conspicuous species at the surface included Frequent Cerianthus lloydi, Philine aperta, Amphiura chiajei and Pomatoschistus pictus with Occasional Sagartiogeton undatus and Myxicola indundibulum The presence of the rarely recorded Opisthobranch Calliopoea bellulus feeding on the eggs of P. aperta is particularly notable (also recorded in Cawsand Bay). North of the Breakwater the composition was somewhat different, lacking most of the bivalves and containing large numbers of Scalibregma inflatum, Magelona alleni, Nephtys hombergi, ?Cerebratulus sp. and Caulleriella caput-esocis. The burrowing anemone Edwardsia claparedii was conspicuous, burrows of Goneplax rhomboides were Common and Philine quadripartita was Occasional. One specimen of the sea pen Virgularia mirabilis was taken in the dredge, but none were recorded in situ.

At the mid-Sound dredge site (D13) the sediment was coarser and contained some gravel. Melinna palmata was still dominant, but the biomass was lower and the number of species higher than in D9 and D14 (Site 55). The polychaetes Notomastus latericeus and Lumbrinereis latreilli and the bivalves Dosinia lupinus and Venus striatula were quite common.

In Cawsands Bay (D8) the sediment was sandier and contained a very diverse community of small polychaetes, bivalves and crustaceans. Biomass was quite low, but the longest list of species for any site was recorded here (71 taxa). Scoloplos armiger and Chaetozone setosa dominated the polychaetes with Magelona filiformis, Sthenelais limicola and Scalibregma inflatum frequent. Venus striatula, Nucula turgida and Cultellus pellucidus were the most abundant bivalves. Ampelisia brevicornis (all small), Synchelidium maculatum, Perioculodes longimanus, Tanaopsis graciloides and Eudorella truncatula were the most abundant crustaceans.

The mud plain off Tinside Swimming Pool appeared less sandy than at Jennycliff Bay and the species visible at the surface (there were no dredge samples here) were different. Edwardsia claparedii was Abundant and there were burrows of Goneplax rhomboides present. Some groups of Apphorais pes-pelecani were observed. S. undatus was again Frequent although Myxicola infundibulum and Amphiura chiajei were not recorded whilst only one Philine aperta was seen.

In the Cattewater (Sites 109 and 110, Dredge Sites 10 and 11), communities were similar in surface appearance to those off Tinside. Gobius niger was present here and it was the only site where the anemone Halcampa chrysanthellum was recorded. Site 110 at Clovelly Bay was notable for the very high abundance of anemones in shallow (intertidal) sediments.

The dredge sample from the east Cattewater (D10) contained very sulphurous soft black mud with some white china clay and vegetable matter. The fauna was sparse but was dominated by a few large Cirratulus cirratus and Nephtys hombergi. The most abundant species, however, were Capitella capitata and Tharyx sp.. A few other polychaete and oligochaete species were found in low numbers. In the west Cattewater (D11), however, the black mud was glutinous and not sulphurous and contained a richer fauna. It was dominated by vast numers of Tharyx sp. and Caulleriella ?caput-esocis with C. cirratus, Nephtys hombergi and Tubificoides ?benedeni prominent, and a number of the

species found in the muddy sediments in the Sound. Interestingly, the juvenile Mya truncata found in most of the dredge samples taken in the Plymouth area were distinctly larger in this sample. The caprellid amphipod Parambius typicus was also taken here although it was not obvious on what they would have been attached to.

6.3.15. Wharf and bridge piles in the Cattedown. (Sites 108 and 111). The seabed in the Cattedown was of mud except for the quite considerable amounts of rubbish there. Jetty pilings (Cattedown Wharf) and bridge pilings (Laira Bridge) provided examples of hard substrata. The concrete piles of the wharf (Site 111) extended to 4 m where there was a steep mud slope. Communities here were richer than those at Laira Bridge and included the following species. (* = also present in Laira Bridge piles).

Abundant species

Styela clava.

Frequent species

Halichondria bowerbankii, Obelia sp. *, Metridium senile *, Carcinus maenas *, Unbonula littoralis, Clavelina lepadiformis, Didemnidae indet. (yellow-brown), Diplosoma listerianum, Morchellium argus.

Occasional species

Hymeniacidon perleve *, Kirchenpauria pinnata, Alcyonium digitatum, Balanus crenatus *, Ascidia mentula, Ciona intestinalis.

Rare species

Iophon nordmani, Ophiothrix fragilis.

Mytilus edulis and Elminius modestus were present on the Laira Bridge piles. No algae were recorded.

6.3.16. Circalittoral cobbles with with some small boulders amongst muddy shell gravel very sheltered from wave action, exposed to strong tidal streams. (Sites 98, 106). These cobbles were dominated by barnacles and Pomatoceros sp. At the Bridge, there were many species of hydroids, Bryozoa and ascidians generally Occasional. The community present from 10 to 20 m north of the Bridge is listed below.

Common species

Pomatoceros sp., Balanus crenatus, Verruca stroemia (spat).

Frequent species

Actinothoe sphyrodeta, Anomia ephippium, Didemnidae indet., Morchellium argus.

Occasional species

Halichondria panicea, Porifera indet. (encr.), Halecium halecinum, Plumularia setacea, Kirchenpaueria pinnata, Terebellidae indet. (?Loimea medusa), Alcyonidium diaphanum, Bryozoa indet. (encr.).

Rare species

Aglaophenia pluma, Cereus pedunculatus, Sagartiogeton undatus, Urticina felina, Chaetopterus variopedatus, Bicellariella ciliata, Asterias rubens, Ascidiella aspersa, Dendrodoa grossularia, Didemnum maculosum.

Present, no record of abundance

Cellepora pumicosa, ?Diplosoma spongiforme.

Communities on cobbles in Millbay Pit were much poorer in species of Hydrozoa and ascidians but with a wider variety of polychaetes and decapods recorded.

6.3.17. Steeply sloping broken limestone bedrock and boulders in the infralittoral and circalittoral very sheltered from wave action, exposed to strong tidal streams in the Narrows. (Sites 73, 74). (Table 16). The communities present at these sites were distinctly different to those described in Section 6.3.13 because of the domination of rock surfaces by Dendrodoa grossularia together with the absence of many of the species characteristic of sites further down the channel. Apart from species mentioned in Section 6.3.13 as characteristic of open coast/high salinity conditions, Metridium senile, Clavelina lepadiformis and Cereus pedunculatus were not recorded here though present further upriver. Although Laminaria ochroleuca and L. hyperborea were not recorded, the variety of algae was high with some species absent at less tide-exposed sites occurring again (Delesseria sanguinea, Dilsea carnosa, Corallina officinalis and encrusting Rhodophyta). Laminaria digitata was possibly present but identification was difficult. Filamentous red algae, especially Callithamnion spp. and Antithamnion spp., were present in large amounts at these sites and upriver from them. Apoglossum ruscifolium was also noted here and at upriver sites. However, this narrow rocky stretch of the estuary marked the last recorded location for a large number of both algae and animals mentioned in the Discussion.

Shallow communities to about 15 m were dominated by Laminaria saccharina, often heavily encrusted with Membranipora membranacea and Obelia geniculata. Dendrodoa grossularia was dominant on rock surfaces together with patches of Polydora sp. and the variety of foliose algae was not as high as in the lower infralittoral. Here, D. grossularia continued to dominate rock surfaces but was itself overgrown by foliose algae and outliers of the animal communities below. Particularly abundant algae were Callophyllis laciniata and Cryptopleura ramosa. These communities were dominated by D. grossularia with Frequent Polycarpa rustica. Nemertesia antennina was Common and Plumularia setacea Frequent together with Hymeniacidon perleve, Amphilectus fucorum, Halichondria panicea, Pomatoceros sp. and Diplosoma listerianum which often covered the Dendrodoa. Actinothoe sphyrodeta and Alcyonium digitatum were recorded only from the deeper part of the circalittoral below 20 m. Ctenolabrus rupestris were generally Frequent. The area north of Devils Point showed few differences to the opposite shore. Here, Haliclona oculata was Frequent though not recorded opposite and Nemertesia ramosa was recorded as Common against Occasional on the opposite shore. Halichondria panicea and Salmacina dysteri both grew in forms typical of wave sheltered, tide-exposed situations.

6.3.18. Steeply sloping bedrock, Boulders and other hard substrata in the infralittoral and circalittoral at sites in the lower Tamar. (Sites 91, 92). (Table 17). The communities present in these habitats were greatly impoverished compared with those at sites further south. Rocks were dominated by Halichondria panicea with patches of Mytilus edulis and Balanus crenatus in shallow depths at Site 92. Laminaria saccharina was only recorded at Site 91 where it was Rare. Foliose red algae included Frequent Polyneura gmelinii, Polyneura hilliae (not Site 92) and Hypoglossum woodwardii together with filamentous species Antithamnion plumula and Callithamnion sp. Algae extended to 1.5 m at Site 91 and 1 m at Site 92. Hymeniacidon perleve was conspicuous at both sites and an unidentified soft grey sponge at Site 92. Hydroids were sparse on the rock but included several species with Hartlaubella gelatinosa, a species only recorded in the Tamar, Occcasional at Site 92. Hydrallmania

falcata was Common on an old car tyre at Site 91. Carcinus maenas was present in fairly large numbers. Bryozoans included Bowerbankia pustulosa and Bugula plumosa with B. turbinata at Site 91. Clavelina lepadiformis was Frequent at Site 91 but not at Site 92 with Botrylloides leachii and Styela clava at both sites.

6.3.19. Cobbles and shells on muddy sediments in the infralittoral and circalittoral at sites in the lower Tamar and River Lynher. (Sites 113, 114, 91, 82, 92, Dredge Sites D3, D7). (Table 9 and 18). Infralittoral communities on this type of substrata were recorded at the Ballast Pound (Site 114) and the Ferry Slip at St. Budeaux (Site 82) in the Tamar. Off the Ballast Pound, fairly rich algal communities were recorded (26 species). Filamentous red algae were Abundant and filamentous brown algae Common with many foliose red and green algae noted as Frequent. Algae were present to a depth of between 3.0 m and 3.5 m with the rarely recorded Griffithsia devoniensis present at 3.0 m. Cobbles were dominated by Balanus crenatus and Pomatoceros sp. with Frequent Halichondria panicea and Cryptosula pallasiana and, off the Ballast Pound, Hymeniacidon perleve. The variety of animals was quite high especially at the Ballast Pound. Several hydroid and anthozoan species occurred but differences most likely associated with difference in water quality were noted. These included the presence of Actinothoe sphyrodeta, Anemonia viridis, Cereus pedunculatus and Dendrodoa grossularia only at the lower site and of Sertularia cupressina and Hartlaubella gelatinosa at the upper site only. Calyptraea chinensis was recorded at the Ballast Pound but was rarely seen elsewhere in the Plymouth area. Styela clava was Frequent at the Ferry Slip but only recorded as Rare off the Ballast Pound. The most remarkable difference was in the abundance and variety of algae with only Hypoglossum woodwardii and filamentous species being recorded at the Ferry Slip and only to a depth of 0 m.

The area surveyed off Sand Acre Point in the River Lynher (Site 113) had characteristics of both the assemblage of species off the Ballast Pound and those at the Ferry Slip together with species only recorded here in this habitat. Seven species of algae were recorded from the upper infralittoral with Apoglossum ruscifolium and Polysiphonia sp. Frequent. Crepidula fornicata, Mytilus edulis and Ostrea edulis were recorded here but not at the other sites.

Pebbles and cobbles on the level seabed under the Royal Albert Bridge (Site 92) were colonised by Balanus crenatus with Frequent Pagurus bernhardus and Urticina felini/eques. Crangon crangon was generally Common and Bowerbankia pustulosa Common in some areas. Sagartiogeton undatus was Frequent.

Two dredge sites, off Devonport (D7) and off Ince Point in the Lynher (D3), contained cobbles and shell material and many epifaunal species. Off Devonport the sediment was rubble and shell gravel with abundant Pomatoceros sp., Heteranomia squamula and Calyptraea chinensis. A large number of small infaunal and epifaunal polychaetes were found in low numbers, including Jasmineira elegans, Nematonereis unicornis, Amphicteis gunneri and Lumbrinereis latreilli. The amphipods Unciola crenatipalma and Corophium crassicorne were frequent, and two Pisidia longicornis were taken. Off Ince Point the sediment was muddy with shell gravel and many whole Mytilus edulis shells. A few live Mytilus edulis were present, and Elminius modestus, Ascidiella aspersa, many Sagartia troglodytes and clumps of Bowerbankia gracilis were conspicuous. Infauna consisted of very abundant Tharyx sp. with a few other polychaetes and amphipods in low numbers.

6.3.20. Hard substrata on mud in the upper reaches of the Tamar Estuary. (Sites 79, 80, 81). Subtidal hard substrata at the few sites surveyed above the bridge in the River Tamar were mainly shells, tree remains or rubbish such as car tyres. At Cargreen (Site 80) some small areas of bedrock and stones bound together by Mytilus were present. The greatest variety of species was encountered on a tree branch and tree stump at Weir Point (Site 81) at 3 m. Here the following species were recorded.

Abundant species

Conopeum reticulum.

Common species

Obelia flabellata, Hartlaubella gelatinosa, Electra crustulenta.

Frequent species

Obelia dichotoma (on shells), Clava multicornis, Lanice conchilega (in sediment), Arenicola marina (in sediments), Balanus crenatus, Palaemon serratus (in 'cave' formed by stump), Bowerbankia imbricata, Alcyonidium mytili.

Occasional species

Carcinus maenas.

Rare species

Actinia equina (on shells at 3 m), Pomatoceros sp., Mytilus edulis.

Obelia dichotoma was present at Cargreen.

6.3.21. Bedrock and boulders in river conditions of the upper Tamar estuary. (Site 7). This site was investigated adjacent to steeply sloping bedrock shore below Tinnel on the bend at Hooe. Steeply sloping broken shale bedrock at +1 to 3 m was dominated by a thick 100% cover of the hydroid Cordylophora lacustris. Deeper, sloping or horizontal, bedrock and small boulders at 3 to 4 m was almost entirely bare except for a few scattered C. lacustris in shallow areas, Frequent Electra crustulenta and Rare Balanus sp.

6.3.22. Muddy sediments in the Tamar and Lynher (Dredge sites D1, D2, D4, D5, D6) (Table 9). These samples were characterised by a very poor fauna, particularly in the upper estuaries and where the sediment contained large quantities of twig and leaf debris (D2, D4, D5). Thary sp., Oligochaeta indet., Nephtys hombergi, Nereis diversicolor and Melita palmata were the most ubiquitous species with Tubificoides sp., Pectinaria koreni, Crangon crangon and small numbers of other polychaetes and amphipods found in the more marine sites.

YEALM

6.3.23. Shallow wave-exposed gulley including steeply sloping and overhanging rock and rocks adjacent to sand near Tomb Rock at the entrance to the Yealm ('Kitching's Gulley'). (Site 93). (Table 19). This was the gulley described in great detail by Kitching et al (1934). The gulley included a steeply sloping north-west wall and an overhanging south-east wall broken by shelves extending from +1 m to 2.5 m. Small boulders were present in the bottom of the gulley with bedrock and large boulders at the entrance terminating at an extensive plain of rippled coarse sand outside of the entrance. Algal communities present on the north-west wall and on

upward-facing shelves on the south-east wall were very similar to those recorded from the pool in Penlee Point tunnel although several additiional species were noted at this site including Mesophyllum lichenoides. Also, the 'Falkenbergia' phase of Asparagopsis armata was recorded as Common on the sloping face but was not recorded at Penlee Point (although it might be the ?Audouinella sp. recorded there). Animal communities on overhanging surfaces of the gulley were rich and were dominated by a patchy cover of Distomus variolosus and Scrupocellaria reptans with some anastomosing Halichondria panicea and scattered hydroids, Corynactis viridis and other tunicates. Tubiculous amphipods were Freqent on the overhangs but Abundant on shelves below the overhangs. The community present on the south-east wall is listed in Table 19. Algae were recorded only from vertical surfaces although some occurred on the overhangs particularly Rhodymenia pseudopalmata and Cryptopleura ramosa.

At the entrance to the gulley at 2 m, bedrock and boulders near to coarse sand were colonised by encrusting and foliose algae, Laminaria hyperborea, L. saccharina, Saccorhiza polyschides and Cystoseira foeniculacea. Cladostephus spongiosus and Gigartina acicularis were notable records although most of the foliose algae were those present in similar abundance on the north-west wall. Animal species were generally sparse although Freqent Pomatoceros sp., Balanus crenatus, Gibbula cineraria and Diplosoma listerianum occurred with a few Anemonia viridis.

6.3.24. Clean coarse sand off the entrance to the Yealm. (Site 93). This habitat was not thoroughly surveyed but it appeared quite extensive. Adjacent to rock at Site 93, clean rippled sand at 3 m was colonised by dense Arenicola marina (casts) and Frequent Nassarius reticulatus. Ammodytes sp. were also present.

6.3.25. Fine clean sand colonised in places by dense **Zostera marina** at the entrance to the Yealm. (Site 94, Dredge Sites 20, 21). (Table 14 and 9). Areas of dense Zostera marina were surveyed at 1.7 m off Cellar Beach and were dredged at the same site and off The Bar. A small variety of algae and animals were present amongst and on the Zostera. Dominant algae were colonial diatoms and filamentous brown algae with Ceramium sp. Frequent and encrusting calcareous algae on the edges of old leaves. The only animal species recorded on the leaves were Occasional Anemonia sulcata and Rare Polycera quadrilineata with Rare Syngnathus acus and ?Entelurus aequoreus amongst the leaves.

Areas of sand at 1.3 m which were not colonised by Zostera marina were obviously very rich in burrowing species. Those visible at the surface included Abundant Echinocardium cordatum (craters in the sand), Common Ensis ensis (siphons) and Frequent Lanice conchilega, Nassarius reticulatus and Pomatoschistus sp. Dredge samples off Cellar Beach (D20) and on the Yealm sand bar (D21) showed that the sediment was muddier than the surface sand appeared. They contained large numbers of bivalves, particularly Venus striatula with Abra nitida, Lucinoma borealis and Spisula elliptica (mostly juveniles) also common. They were also characterised by a great variety of amphipods, many of which were obviously epifaunal from Zostera and erect algae. Dexamine spinosa, Aora gracilis, Gammarus locusta, Erichthonius difformis and Ampelisca brevicornis were most abundant, but a total of 24 species of gammaridean and caprellid amphipods were recorded. The tanaid Apseudes latreillii was also very abundant. Polychaetes were distinctly lacking, but Platynereis dumerilli, Nereis irrorata and Spio martinensis were found in reasonable numbers.

6.3.26. Cobbles and pebbles on sediment in the upper infralittoral sheltered from wave action and exposed to moderate tidal streams in the Yealm. (Sites 83, 94, 95, 96 and Dredge Site 18). (Table 19). Cobbles, including shale and oyster shells in the upper river occurred on the bed of the Yealm from near the entrance opposite Cellar Beach up to Madge Point where muddy sediments become predominant. These hard substrata were colonised by very similar communities at each of the sites surveyed although were easily divided into the shallow infralittoral/sublittoral fringe communities dominated by large brown algae, and those deeper where foliose red algae predominated on cobbles encrusted with barnacles and/or Bryozoa.

In shallow depths around chart datum level at the entrance to the Yealm, hard substrata were dominated by Laminaria saccharina, Ulva sp. and Enteromorpha sp. Other species conspicuous here were Saccorhiza polyschides (which was not recorded at sites further into the river), Chorda filum, Sargassum muticum, Gracilaria verrucosa and Ceramium rubrum. Pebble communities in slightly deeper water were richest at 2.2 to 3.2 m off Misery Point where, amongst other species, Gracilaria foliifera and Gastroclonium reflexum were Frequent amongst the rich variety of algae. The animal component of this community was also rich with high abundances of Sertularia cupressina, Plumularia setacea, Obelia sp., Urticina felina, Pomatoceros sp. and Morchellium argus. Calyptraea chinensis was recorded in shallower depths and at all of the upriver sites. With increasing distance from the open sea, some changes occurred in the communities present and are noted below.

- The variety of algae decreased.
- The abundance and variety of fine filamentous red algae, particularly species of Antithamnion, Ceramium and Griffithsia corallinoides, increased.
- Some additional foliose species were recorded, notably Cryptopleura ramosa, Nitophyllum punctatum, Phycodrys rubens and Stenogramme interrupta.
- Sargassum muticum became present on deeper hard substrata than at the entrance.
- The variety of species recorded on cobbles increased markedly within the river. Species not recorded at the entrance included Halichondria panicea, Hymeniacidon perleve, Suberites ficus, Hartlaubella gelatinosa, Hydractinia echinata, Hydrallmania falcata (innermost areas only), Metridium senile, Calliostoma zizyphinum, Crepidula fornicata, Ocenebra erinacea, Bugula turbinata, Cryptosula pallasiana, and Gobius niger.
- The numbers of opisthobranchs recorded decreased.

Some species only recorded at one location within the river were notable and included Occasional Branchiomma vesiculosum at Site 83, two Prostheceraeus vittatus at Site 95 and Occasional Hydrallmania falcata at Site 96.

The growth forms of Halichondria panicea and Hymeniacidon perleve were also typical of enclosed areas; the former growing as elongated tassels and the latter as rounded cushions.

Mooring blocks in the river were colonised by the same species as occurred on cobbles except that some (erect Bryozoa, ascidians) were more abundant and the concrete blocks were colonised by dense Polydora sp.

A dredge sample (Dredge Site 18) was taken at Site 83 and found to contain a muddy shell gravel with some stones and shells with encrusting species. The infauna was dominated by the spionid polychaete Aonides oxycephala with Notomastus latericeus also common. The bivalves Cerastoderma edule, Venus striatula and Venerupis pullastra were present and quite sizeable. The tanaids Apseudes talpa and A. latreilli were both common.

6.3.27. Slope of large boulders in the sublittoral fringe/upper infralittoral in the shelter of the River Yealm. (Site 83). This boulder tumble adjacent to the rocky shore at Clitters Wood was dominated by large plants of Laminaria saccharina with Ulva sp. and Cystoclonium purpureum and with widely separated but large Sargassum muticum. Rocks below this canopy were dominated by a turf of filamentous brown algae. There were few animals present although Balanus crenatus, Gibbula cineraria, Bowerbankia imbricata and Dendrodoa grossularia were all Frequent. Overhanging or vertical surfaces held Occasional Leucosolenia botryoides, Hymeniacidon perleve, encrusting Bryozoa (including some Schizomavella linearis), Bugula turbinata, Clavelina lepadiformis and Morchellium argus. A few Ctenolabrus rupestris were present amongst boulders.

6.3.28. Muddy sand with scattered hard substrata in the River Yealm. (Sites 95, 96, 84, 85 and Dredge Sites 16, 17, 19). (Table 19). Areas of muddy sediment were fairly bare with a few algae attached to shells and small pebbles. At Site 95, there were Occasional Lanice conchilega and Cereus pedunculatus with a single Sabella pavonina in the sediment. Pagurid crabs, Carcinus maenas, Nassarias reticulatus, Gobius niger, Callionymus lyra and Pomatoschistus pictus occurred over the mud. Above Madge Point, woodland debris was incorporated into the sediments and together with scattered oyster shells provided substrata for attachment of species listed in Section 6.3.26. Dense carpets of Gracilaria verrucosa occurred here. Off Shortaflete Creek (Site 84), sediments were finer and only Occasional Sagartiogeton undatus and Rare Cereus pedunculatus, Sabella pavonina, Terrebellidae indet., Nassarius reticulatus, Venerupis pullastra and Venus striatula were recorded as infaunal species. The species living on hard substrata at these sites were a part of the cobble community but were much impoverished and included Occasional Hymeniacidon perleve, Suberites ficus, Sertularia cupressina, Balanus crenatus and Rare Morchellium argus. Bowerbankia imbricata was also recorded here and together with B. pustulosa at Site 85. Similarly, a much impoverished algal flora was present and most were red filamentous species. One live Ostrea edulis was recorded here. Off Steer Point, communities were similar but firm muddy sand was present colonised by dense patches of Arenicola marina and Lanice conchilega. A power cable crossing the river in the area surveyed at Site 85 was colonised by Frequent encrusting Bryozoa with Metridium senile Common.

Dredge 19 from the black mud in the entrance to the Newton Ferrers Creek was distinctly lacking in fauna. Low numbers of 16 species were found with a few large Nephtys hombergi dominating and the polychaetes Aonides oxycephala and Capitella capitata being most abundant. Likewise the dredge sample from the Steer Point (D17) contained a sparse fauna dominated by Nereis diversicolor; with Tharyx sp., Notomastus latericeus and the isopod Cyathura carinata also present in reasonable numbers. However, the sample from the west of Shortaflete Creek (D16) contained large numbers of Tharyx sp. and a few other species of polychaetes and bivalves including Melinna palmata, Lanice conchilega, Polycirrus sp. and Corophium volutator.

7. DISCUSSION

7.1. Distribution of habitats and communities

7.1.1. Substrata and habitats. The substratum types present in intertidal areas have been adequately described in Section 2. The habitats present are varied for intertidal rock and include locations where overhanging, creviced, underboulder and rockpool habitats are present as well as open rock slopes. The range of sediment shore types is restricted to a few coarse sand and gravel beaches in the area of Plymouth Sound with extensive mud flats in the Tamar and Plym. In the Yealm, some sandy areas are present at the entrance and mixed sediment and shingle in the area of Yealm Pool provide a stable coarse sediment habitat. Further up the inlet, extensive mud flats are again present.

Descriptions of substrata and habitats in the subtidal are inadequate for hard substrata in published literature and a summary of our findings which includes available information is given below.

PLYMOUTH AREA

- Offshore of Plymouth Sound, there are extensive areas of deep bedrock including plateaus, gullies and overhangs in places but particularly around the 30 m depth contour.

- Offshore of Plymouth Sound but in the area of 15 to 20 m depth, much of the seabed is of coarse sediment but with low shale reefs including broken rock surfaces with overhangs and extensive upward facing surfaces. Broken shale is present on the level seabed amongst the reefs.

- Rock adjacent to the coast at the entrance to Plymouth Sound is broken with overhangs, gullies and tunnels. Rock generally extends to only shallow depths (5 to 10 m) and is fringed by sediment.

- Plymouth Sound is predominantly of muddy sediments with fine mud on the north side of the breakwater off Tinside and north of Mount Batten Breakwater. However, there are areas where coarse sediment and pebbles/cobbles are present in shallow or tide-swept areas.

- Rock surfaces fringing the coast in Plymouth Sound generally extend to about 2 to 5 m bcd and are broken by gullies and overhangs.

- There are deep and often steeply sloping, vertical and overhanging bedrock or boulder and stable cobble surfaces bordering the channel from east of Drakes Island to the Hamoaze. These rocks are limestone and extend to depths in excess of 30 m in places.

- The level or near-level seabed in the main channel from east of Drakes Island to the Hamoaze is of pebbles and cobbles with shell.

- The seabed of the Hamoaze from Torpoint to the bridges is of cobbles and pebbles with a coastal fringe of bedrock and boulders. There are extensive artificial surfaces on the eastern side.

- The natural seabed in the Tamar, Lynher and Plym is of mud with occasional shell fragments and hard substrata provided by submerged tree debris and rubbish such as old tyres.

- In the upper reaches of the Tamar along the river bend at Hooe, bedrock extends into the subtidal and parts of the river bed are of boulders.

YEALM

- Outside of the entrance to the Yealm there is extensive sand, and bedrock extends to only shallow depths though with gullies and overhanging surfaces. Upward facing rocks are sandy.

- The entrance to the Yealm includes areas of muddy sand with shell. Rocks extend only into very shallow depths.

- The main channel in Yealm Pool is of cobbles and pebbles with some boulders. Steeply sloping rocky shores extend as boulder slopes with some bedrock into the subtidal.

- The channel becomes increasingly muddy with increasing distance north and is eventually of mud. Electricity cables crossing the channel form a limited area of hard substratum.

7.1.2. Communities and species. Section 6 includes a classification of the different community types encountered during the present survey. The main community types which can be recognised from published information correspond to some of the habitat/community types described here. However, we did not survey open coast sites in detail, especially on the shore, and failed to investigate the apparently rich shores between Mount Batten Point and Jennycliff Bay (Rum Bay) described in the Plymouth Marine Fauna. We did not investigate some previously described shores in detail and rely in part on published descriptions of sediment communities in the Tamar and Lynher for discussion here. We failed to sample apparently rich shores on the south side of Yealm Pool for which descriptions of communities present are not available. However, the surprising sparcity of published information on intertidal hard substratum communities in the Plymouth area has been rectified to some extent by the work carried out here. The surveys undertaken by diving add greatly to the knowledge of communities on hard substrata. The descriptions of communities and the data analyses provide a considerable amount of information on the distribution of species along the gradient of increasing shelter and change in water quality which occurs in the inlets studied and provides a basis for identifying ecological zones in the Tamar at least.

Six major ecological zones are suggested for the Tamar (Fig. 12). Boundaries are proposed at locations where marked changes occur in the presence or absence of species or where habitats change. However, many species reach the limits of their distribution between boundaries. The results of previous studies have been taken into account in determining these zones.

Zone 1. Open Sea. This is the area where sediment communities typical of the open coast occur and where communities on rock include many Mediterranean-Atlantic species with a particularly high abundance of Eunicella verrucosa and with Alcyonium glomeratum, Parerythropodium coralloides, Parazoanthus axinellae, Hoplangia durotrix and Leptopsammia pruvoti also observed. Water quality is most likely unaffected by estuarine influence.

Zone 2. Open Coast (Southern Sound). These areas are subject to strong wave action. Rocky shores hold typical open coast communities dominated by limpets (all three species of Patella) and barnacles (especially Chthamalus

spp.). In the subtidal, shallow algal and animal communities typical of the open coast are present. Distomus variolosus is present in abundance on shallow rocks at some sites. The variety of animal species is restricted by the shallow extent of rocks but includes Echinus esculentus and other species expected on the open coast.

Zone 3. Sheltered Bay (Central Sound). The outer part of Plymouth Sound is considered a sheltered Bay affected by increased turbidity and occasionally reduced salinity as a result of the estuarine conditions further inshore. Elements of the estuarine community occur particularly in Jennycliff Bay. Sediments are muddy and communities rich. Rocky shores and subtidal hard substrata show some reduction in species present compared to the open coast and Echinus esculentus was not found.

Zone 4. Outer Estuarine (Northern Sound). Waters here can be very turbid and salinity at the surface occasionally falls below 30 $^{0}/_{oo}$. Intertidal and shallow subtidal areas are colonised by a high proportion of species found on the open coast including Laminaria hyperborea and L. digitata together with L. ochroleuca which is restricted to this zone. Shores are dominated by limpets and barnacles but only P. vulgata is present and the abundance of Chthamalus montagui is reduced compared to the open coast. Communities present include a large variety of species. The limestone rock in this zone encourages the occurrance of communities of boring bivalves and worms characteristically including Myxicola aesthetica and Hiatella arctica with Antedon bifida, Suberites ficus and Haliclona oculata also characteristic. Dendrodoa grossularia dominates shallow rocks but extended throughout the subtidal only at the western/northern limit near Devil's Point. This limit is also the greatest area of change recorded in the communities present on buoys by Milne (1940).

Zone 5. Lower Estuarine. The variety of algae and animals is greatly reduced. Patella vulgata still occurs on shores together with S. balanoides and a high abundance of Elminius modestus. C. stellatus is still present in low abundance. Shores are generally dominated by fucoid algae. A few typically estuarine intertidal species occur, notably Clava squamata and Bowerbankia imbricata. Sediment shores are colonised by a fairly rich variety of species with small numbers of the estuarine worm Nereis diversicolor (Spooner and Moore, 1940). There are few foliose red algae but the abundance of filamentous algae is greatly increased in this zone. Communities on the few areas of subtidal rock investigated are typical of sheltered estuarine areas with kelp plants absent and algae extending no deeper than about 1 m below chart datum and then predominantly of filamentous species with some Polyneura gmelinii and Hypoglossum woodwardii present. Animal communities are dominated by Halichondria panicea and with a high abundance of Balanus crenatus. Salinity in this part of the estuary is usually below 30 $^{0}/_{oo}$ and often much lower but not generally less than 20 $^{0}/_{oo}$. This zone extends northward to the confluence of the River Lynher, the upper limit of Euryhaline conditions according to Mommaerts (1969).

Zone 6. Central Estuarine. In this area, shores continue to be dominated by fucoids but Patella is absent and barnacle populations are dominated by Elminius modestus on the upper shore and Balanus crenatus on the lower shore with some Semibalanus balanoides. Chthamalus stellatus occurs as far north as Saltash Bridges (Southward, 1976). The northern limit of this zone at Cargreen marks the furthest north at which Fucus serratus, Polysiphonia lanosa, Dynamena pumila and species of Littorina were recorded (L. 'saxatilis' was noted at Pentille Quay, but the observation requires

checking). Percival (1929) notes Clava multicornis, C. squamata, Cryptosula pallasiana and Alcyonidium mytili as disappearing past Cargreen. On the mudflats, Scrobicularia plana, Nepthys hombergii and Nereis diversicolor, all typically estuarine species, are common. Subtidal rocks are dominated by Halichondria panicea and Balanus crenatus with an unidentified sponge of the family Gellidae at Saltash. Carcinus maenas are abundant. Below about 5 m, the most conspicuous species are Bowerbankia pustulosa, Sagartiogeton undatus, Metridium senile and Urticina sp(p). Stones in tide-swept channels are colonised by typically estuarine species: Conopeum reticulum and Hartlaubella gelatinosa together with large numbers of Crangon crangon.

Subtidal sediments are dominated by the same species found on the mud flats, i.e. Tharyx sp., Nephtys hombergi, Streblospio shrubsoli and Tubificoides ?benedeni with the addition of a few species found more typically in the central and northern Sound.

Zone 7. Upper Estuarine. This zone extends northwards from Cargreen to South Hooe. Shore communities are impoverished and liquid mud occurs amongst the dense Ascophyllum nodosum and Fucus vesiculosus. Balanus improvisus occurred in this zone in the past but none could be found in 1986. This is the furthest up the estuary that intertidal mudflats occur. The fauna of mudflats is sparse with Nepthys hombergi, Nereis diversicolor and Heteromastus sp. present. Cardium edule and Corophium are still present in small numbers. In the subtidal, Hartlaubella gelatinosa and Bowerbankia pustulosa are present together with Balanus crenatus. Percival (1929) notes that H. gelatinosa disappears above Hole's Hole (South Hooe) and Ascidiella aspersa at about this point. Salinity is always less than $30^{0}/00$ in this zone and often as low as $5^{0}/00$.

Zone 8. Riverine - Estuarine Transition. Between South Hooe and Halton Quay the river narrows and there is a region of rapid and obvious change. Shores remain covered by dense fucoids but Ascophyllum nodosum and Pelvetia canaliculata disappear in this zone leaving only Fucus vesiculosus at Pentille Quay. Elminius modestus and Balanus improvisus (in former years) are still present in this zone. The hydroid Cordylophora lacustris occurs on the lower shore and dominates shallow subtidal rocks with a few Balanus crenatus present on rocks in the channel. Scrobicularia plana is still present in mud and Nereis diversicolor is abundant. Phragmites appears fringing the shore at the northern limit of this zone. Percival (1929) notes that in this area (between Pentille Quay and Halton Quay) brackish water species which replace some marine species occur. Mommaerts (1969) puts the lower limit of mesohaline ($5^{0}/00$ to $18^{0}/00$) condition at Pentille Quay. Salinity is always less than $20^{0}/00$ and can drop to $0^{0}/00$ in this area.

Zone 9. Riverine. Fucus vesiculosus persists here as far north as the uppermost boundary just north of Cothele Quay. Balanus improvisus, Elminius modestus and Conopeum reticulum extend northwards to about 1 km above Halton Quay. Percival (1929) notes the continued presence of Nereis diversicolor, Tubifix costatus, Praunus flexuosus, Crangon crangon (as C. vulgaris) and Carcinus maenas north to Calstock. Smith (1956) notes the northern limit of distribution of Nereis diversicolor at Cothele Quay although some healthy individuals were found at Calstock) and observes that F. vesiculosus also stopped here in 1954. The freshwater - brackishwater interphase (Owens et al, 1982) extends as far south as Cotehele in winter (A. Morris, pers. comm.).

7.2. Comparison with other marine inlets

7.2.1. Plymouth. The area of Plymouth Sound and the Tamar is much more extensive than most other marine inlets studied although it includes many similar habitats, change in habitats from the open coast to enclosed areas and characteristic species. Changes related to decreasing salinity, particularly on hard substrata, are much better developed in the Tamar than for any of the other marine inlets yet studied.

Offshore areas are remarkable for the presence of many Mediterranean - Atlantic species although grazing by urchins probably prevents a high abundance of turf-forming animals. Sediments south of the Plymouth Breakwater were coarse and included communities typical of open coast areas. Hard substrata on the shore and shallow subtidal included very similar communities to those encountered further east near Salcombe and are probably typical of open coast areas of South Cornwall and Devon. The scarlet and gold star coral, Balanophyllia regia was present in some areas.

Rocky shores within Plymouth Sound were fairly rich in species and with particularly well-developed populations of topshells. The creviced shores between Mount Batten Point and Jennycliff Bay are noted as especially rich in the Plymouth Marine Fauna. Underboulder and overhang communities occurred but were considered not as rich as those in some other areas including Salcombe, Yealm, Helford and Fal. Rockpools were present at several sites and included a fairly wide variety of typical rockpool species which would be expected on sheltered parts of the open coast. Rockpools are not usually features of marine inlets and so the presence of many rockpools fairly sheltered from wave action is notable. The presence of large amounts of Sargassum muticum in upper midshore pools is notable. Coastal fringing rock in the subtidal included communities typical of wave-sheltered shallow habitats and also found near the entrance to other marine inlets. Offshore hard substrata in the southern part of Plymouth Sound were typical of open coast areas. The areas of tide-swept pebbles and cobbles in shallow depths in Plymouth Sound (particularly along the western side) were colonised by algae and animals typical of such habitats and encountered elsewhere in similar situations. Some rare or unusual species characteristically encountered in this habitat were present although larger populations are known elsewhere.

The subtidal sediment communities present in areas of Plymouth Sound protectd by the western shore or by the breakwater were very rich and extensive areas of these sediments occur. The communities present in Cawsand Bay, Jennycliff Bay and north of the Breakwater are considered especially rich compared to other marine inlets; and those of muddy sediments not sampled but observed off Tinside and at the entrance to the Cattewater also appeared very rich compared with muds encountered elsewhere. Communities with similar species compositions exist in muddy sands in the Kingsbridge estuary north of Salcombe and in mixed silty sediments in the Fal estuary off the Trefusis cliffs. The sediments at these sites, however, were generally less muddy than those found in Jennycliff Bay and north of the Breakwater, and species like Goneplax rhomboides, Edwardsia claparedii, Philine aperta and Virgularia mirabilis were not recorded. Maerl beds, like those found off St. Mawes in the Fal estuary, were not found in the Plymouth area or the Yealm. Zostera marina beds which colonised muddy sand in Cawsand Bay and north of Drakes Island were not considered rich in species compared with some other areas.

Communities on the lower shore in the northern part of Plymouth Sound were unusual because of colonisation by boring organisms. These shores included caves and overhangs where communities not generally encountered in the intertidal of marine inlets were found dominated by Dendrodoa grossularia

and with calcareous sponges present. Similar communities, although on the open shore, also occur in the Daucleddau. The steep rocky subtidal slopes present from the Hamoaze to east of Drakes Island provided some of the most notable marine communities present in the Plymouth area. Similar extensive rock slopes occur in the Daucleddau and are colonised by similar communities characteristic of this type of habitat. However, the presence of limestone rock creates a habitat for many boring organisms at the Plymouth sites and greatly enhanced the variety of species present. The cobble and shell bed of the channels included similar communities to those found in tide-swept channels elsewhere and communities are not particularly rich. The broken limestone rock in the subtidal off the Tinside swimming pool held very similar communities to those known for the limestone rock at Stackpole Quay in Pembrokeshire including the presence of large numbers of the rarely encountered anemone Aiptasia mutabilis.

The rocky shores of the Hamoaze, Cattewater, River Lynher and River Tamar to Cargreen were colonised by very similar communities to those encountered in other marine inlets. These shores did not generally extend to low water level. Extensive examples of such shores, extending to the lower shore, occur in the Daucleddau. Where subtidal bedrock and boulders were present between the bridges and Devil's Point (for instance, at the Bridges and at Looking Glass Point) communities very similar to those at Tom's Rock near King Harry Ferry in the Fal, the rocks at Bodinnik on the Fowey and Black Tar in the Daucleddau were present. Intertidal mudflats in St. John's Lake included quite a wide variety of species which were typically estuarine. We did not find Zostera although extensive areas at St. John's Lake are reported by Spooner and Moore (1940). The extensive dock walls and the jetty at Yonderberry were not surveyed and no comparison of communities present with, for instance, those in Milford Haven can be carried out. Jetty and bridge piles in the Cattewater were impoverished compared with those in Milford Haven. Muddy shores north of the bridges in the Tamar and of the Laira Bridge on the Plym appeared generally impoverished in comparison to similar areas in the Daucleddau estuary (Milford Haven) with both fewer species and numbers. However, areas of mudflat in the upper reaches of the Plym estuary held quite high densities of large Scrobicularia plana along with many Nereis diversicolor and a greater variety of species than was found in the Tamar. Sites in the upper reaches of the Exe estuary had similar communities dominated by S. plana and N. diversicolor to those in the upper Plym.

The rocky shores which occurred from Weir Quay around the river bend at Hooe and on towards Calstock provide the best examples yet encountered of shore communities subject to low and variable salinity. Rock and other hard substrata were also present at places in the sublittoral providing opportunities to follow the distribution of species along a major gradient of changing salinity. The loss of species with increasing distance upriver was easily followed and the presence of the hydroid Cordylocladia lacustris is particularly notable as it is not recored from any of the other marine inlets studied in southern Britain. The estuarine and northern barnacle Balanus improvisus (which was present in the Daucleddau in 1986) was searched for but not found, although it is recorded in the Plymouth Marine Fauna.

The Plymouth area did not include examples of the rich intertidal sediments which are found in the entrances to many of the marine inlets in southern Britain. Sediment shores in the Sound were too coarse and exposed to wave and current action, while the muddier shores at Cremyl and in the Cattewater were affected by the reduced salinity. In the Cattewater, however, the muddy sediments on Cockle Bank and at Clovelly Bay slip were quite rich in

species and individuals and compare favourably with intertidal communities in the lower estuarine areas of other estuaries. Some conspicuous species usually found in marine inlets were not encountered or were present in very low numbers including Dysidea fragilis (which typically forms cushion-shaped masses in tide-exposed, wave sheltered channels), Amphilectus fucorum, Crepidula fornicata (which is abundant in similar habitats in the Daucleddau), Ascidiella aspersa (abundant in the Fal and Salcombe), and Sabella pavonina (abundant in the Kingsbridge Estuary).

7.2.2 Yealm. The entrance to the Yealm includes rocky shore communities with a range of habitats of which overhangs and small caves held particularly rich communities. The sediment seabed here was also rich in species but the Zostera bed similar to many others encountered. The mixed sandy sediment communities taken in dredge samples from here were similar to those found in the mixed coarse sediments in Salcombe Harbour. The tide-swept bed of the channel which extended from the mouth to north of Madge Point was colonised by communities typical of this sort of habitat and present in many of the marine inlets studied although the high abundance of Gracilaria foliifera was remarkable but not as great as at Salcombe. The inlet was not subject to the large changes in water quality which had such marked effects on the fauna and flora of intertidal areas in the Tamar and, as with most other inlets surveyed, sheltered marine communities extended for most of the distance of the tidal limits.

7.3 Comparison with previous marine biological studies.

The Plymouth area including the Yealm has been the subject of marine biological studies for over one hundred years. Publications which describe the habitats, communities and species present in the area and which provide a useful historical basis for comparison with our records include those of Johnson (1890) on algae, Ford (1923) on sublittoral sediment communities, Percival (1929) on the distribution of species along the Tamar, Kitching et al (1934) on communities in a shallow sublittoral gulley on the open coast, Spooner and Moore (1940) on the fauna of mudflats, and the Plymouth Marine Fauna (Marine Biological Association, 1957) which describes collecting sites and gives detailed records on the fauna of the Plymouth area. More recently, the work of Gibbs (1969) on the polychaete fauna of sediments in Plymouth Sound and the studies of Warwick and co-workers (particularly Warwick and Price, 1975; Warwick et al, 1979; Warwick and Price , 1979; Gee et al, 1982 and Warwick and Gee, 1985) provide data for comparison.

Comparison of our records of algae with those of Johnson (1890) reveals that the main species he collected by dredging were also present in large amounts in 1986. However, Taonia atomaria which he notes from the Duke Rock Bouy area was not recorded in 1986 except outside of the Penlee Point tunnel. We recorded several apparently native species not collected by Johnson including species of Schmitzia and, rarely, Gracilaria foliifera (recorded as G multipartita from the shore by Heape, 1888). Johnson notes the occurence of Carpomitra costata (as C. Cabrerae) found 20 years previousely by Cocks on the Mount Edgecumbe mud-bank but not by him. We recorded Carpomitra from two typical locations in the lower infralittoral off Plymouth Sound and it seems most likely that the record by Cocks was a drift specimen. The algae found on the lower shore and shallow sublittoral in the Hamoaze and towards Saltash by Johnson were similar to those recorded from the present survey including the rarely recorded species Griffithsia devoniensis. Apoglossum ruscifolium was commonly recorded in this area in 1986 but was not noted by Johnson (recorded

from the Sound as Delesseria ruscifolia by Heape, 1888). We did not record Dasya ocellata, apparently a common species in 1889.

Our records of the distribution of species along the Tamar correspond well with those made by Percival (1929). However, he recorded Fucus vesiculosus as extending as far north as North Hooe wheras our records were of sparse growths at Cothele Quay (also noted by Smith, 1956) and a few plants at the southern end of the cliff at Calstock Bend. Also, Percival (1929) records Cordylophora lacustris as extending south to Halton Quay wheras we found it below Tinnel further downriver. These two observations are contradictory since one suggests further penetration of marine conditions than in the late 1920's and the other suggests reduced penetration of marine conditions.

The communities present in the shallow sublittoral gulley (Kitchings's Gulley) on the open coast outside of the Yealm (Site 93) were very similar to those described at the same site by Kitching et al (1934). However, the following differences were recorded.

- Laminaria hyperborea was no longer dominant on the north-west slope.
- The 'Falkenbergia' phase of Asparagopsis armata was present in 1986.
- Myriogramme bonnemaisonii, which was mentioned as important in 1931/32 was not recorded in 1986.
- We did not record Bunodactis verrucosa or Mytilus edulis in 1986 although both were noted in 1931/32.
- Stolonica socialis was not recorded in the gulley in 1986 although it was noted as a large patch near the entrance in 1931/32. However, it was noted in the adjacent gulley in 1986.
- Sabellaria spinulosa, which was recorded as a continuous crust over rock at the foot of the south-east wall in 1931/32 was not observed in 1986.
- Sabella pavonina and Dasychone bombyx were recorded in 1931/32 but not seen in 1986. Pseudopotamilla reniformis was recorded in 1986 but not 1931/32.
- Scrupocellaria reptans appeared to be more abundant in 1986 (recorded as Frequent) than in 1931/32 when only a few small colonies were recorded from samples.

The differences noted above are considered small and probably reflecting normal variability in sublittoral ecosystems. Some are doubtless due to sampling in 1931/32 versus observation in 1986. Asparagopsis armata is an immmigrant species not recorded in the British Isles in the 1930's.

Comparison of intertidal sediments in the Tamar, Lynher and St. Johns Lake with the results of Spooner and Moore (1940) finds the present fauna relatively reduced, particularly in the Tamar. Typically estuarine polychaetes were there in comparable numbers (although surprisingly Spooner and Moore do not record Streblospio shrubsoli), but we did not find any live bivalves (i.e. Macoma balthica, Cerastoderma edule and Scrobicularia plana) or Hydrobia ulvae, although these were searched for. A few empty shells of S. plana were observed at South Hooe and Warwick and Gee (1984) describe the

macrofauna at this site as comprising mainly large S. plana (46 ind. m^{-2}) and large numbers of Nereis diversicolor. Similarly, there were very few small crustaceans observed, and none sampled. Cyathura carinata which was common in Spooner and Moore's samples was only sampled once in the Tamar from a dredge off Cargreen.

In St. John's Lake the most obvious apparent loss was that of Hydrobia ulvae which was only recorded as present at one site where a dense patch of Enteromorpha sp. provided a favourable habitat. The lack of Zostera beds, where once they were abundant, is likely to be a contributory factor. A comparable diversity of polychaetes and bivalves, however, was recorded, although once again Spooner and Moore did not record Streblospio shrubsoli.

Comparison of subtidal sediments in Plymouth Sound with the results of Ford (1923) is difficult considering the inconsistency of his sorting or sieving which appears to have disregarded the bulk of the polychaetes, while retaining some of the smaller crustaceans, and concentrates on the bivalves. However, a comparison with the bivalves sampled in the Sound and in Jennycliff Bay in particular, show similar species complements. Two species recorded by Ford in reasonable numbers, but not by us, were Venerupis pullastra (as Tapes pullastra) and Venus fasciata (used by Ford as a characteristic species of sediments in the Queen's Ground and west channel). Ford also recorded Nucula nitida where we recorded N. turgida.

Another useful comparison is with the polychaete fauna list for areas of Plymouth Sound given by Gibbs (1969); although detailed comparison is not possible due to differences in site position and sediment characteristics. Gibbs also sampled in Cawsand Bay and north of Drakes Island, and, considering the sediment differences, (his were sandier) his species list contains few species not recorded in this study. The fact that there are many species recorded by us but not by him reflects the greater diversity of sediment types sampled during the current study. Species recorded by Gibbs and not by us, but which we might have expected to, are Exogone gemmifera, Nephtys cirrosa, Ophryotrocha puerilis, Aricidea minuta, Cossura longocirrata and Capitellides giardi. Species recorded by us in our Cawsand Bay sample (D8) but not by Gibbs include Amphicteis gunneri, Ophiodromus flexuosus and Sthenelais limicola.

Not surprisingly there are a number of species recorded by us but not recorded in the Plymouth Marine Fauna (Marine Biological Association, 1957). The more interesting of these include Ampharete lindstroemi, found in dredge samples from Cawsand Bay and mid-Sound; Chone filicaudata, found in a dredge sample from east of the Breakwater; Pisione remota, also found in a dredge sample from east of the Breakwater; Protodorvillea kefersteini, found in various dredge samples from the Sound and the entrance to the Yealm; and Schistomeringos caeca, found in a dredge sample from east of the Breakwater. These species are marked in Table 9, as are those species recorded in the Fauna but not in either the Yealm or Plymouth areas. With respect to the latter it is interesting that the seapen Virgularia mirabilis was previously not recorded in the Sound but was taken by us, in what might be considered a typical habitat, in mud just north of the Breakwater. Unfortunately, however, neither Callianassa subterranea or Upogebia spp. (the callianassid shrimps) were recorded there, where once they were taken in large numbers. However, both burrow deeply and our dredge may not have taken a sufficiently penetrating sample. Other species not previously recorded in the Sound (but recorded in the Plymouth Marine Fauna) include Amphicteis gunneri, Sigalion mathildae and Sthenelais limicola.

7.4 Recommendations for future work

We are aware that our survey is of an area well known to marine biologists at institutes in Plymouth and elsewhere. The conclusions of this report regarding the habitats and communities present as well as the nature conservation importance of habitats and species has not been the subject of discussion with anyone from those institutes. It would be appropriate to use this report to act as a basis for further review, bringing in those scientists to agree on a more comprehensive appraisal of the area.

Some areas were not surveyed thoroughly and would benefit from further study. In particular, we did not study sites along the coast from Mount Batten to Jennycliff Bay (Rum Bay) and, since this is known as a rich area, should attempt to survey it in a similar manner for comparative purposes. We did not sample sediment communities on the lower shore on the south side of Yealm Pool. These are said to be very rich in species but no lists are known for these sites so that sampling is appropriate to enable comparison with other areas. The upper Tamar is an area of rapid change in marine communities and particularly communities on the rocky shore, including man-made jetties. Our survey was very rapid and the area would benefit from a study which maps the distribution of species along this marked gradient. The species are few and present no great taxonomic problems so that an undergraduate project may reveal the required information.

8. ASSESSMENT OF SCIENTIFIC INTEREST AND MARINE NATURE CONSERVATION IMPORTANCE OF THE PLYMOUTH AREA AND YEALM ESTUARY

8.1. Introduction

The assessment of scientific interest and nature conservation importance has been undertaken through a general evaluation which follows the criteria outlined by Mitchell (1986) (Section 8.2) and by ranking the conservation importance of the habitats and communities encountered and of species considered of conservation interest (Section 8.3). The conclusion of these exercises is given in Section 8.4. The criteria used here to assess conservation importance are applied in the manner outlined in the NCC 'Handbook for the Preparation of Management Plans' (1st edition, February 1983) but defined in relation to northeast Atlantic marine ecosystems. The definitions were first used in the management plan for the Lundy marine nature reserve and have subsequently been used for the Skomer marine nature reserve management plan and to evaluate marine ecosystems in the Isles of Scilly and the area of Bardsey and the Lleyn Peninsula. They are to be used for each area included in the Surveys of Harbours, Rias and Estuaries but are provisional until comparison of the majority of areas is possible.

The size of area considered here, the different physical and biological characteristics of each of the main zones or areas identified and the different conservation assessments makes it appropriate to consider the following areas separately:

Open sea and open coast (Zones 1 and 2 in the Plymouth area including the coastline near Penlee Point and from Staddon Point around to Season Point at the entrance to the Yealm).

Outer Plymouth Sound (Zone 3).

Inner Plymouth Sound (Zone 4).

Cattewater and Plym Estuary.

Tamar and Lynher Estuaries (Zones 5 - 9).

Yealm Estuary.

The location of each area is shown in Fig. 12.

8.2. General evaluation

8.2.1. Open sea and open coast.

1. Naturalness. Habitats and communities in this area are considered to be natural except for the breakwater which is an artifical structure but colonised by communities similar to those of the open coast.

2. Representativeness. Intertidal habitats and communities are typical of broken shores and include good examples of rich rockpool, overhang and crevice communities. Subtidal habitats and communities adjacent to the coast are typical of the south coast of Devon at least from Rame Head to Start Point. Similarly, sediment communities appear typical of open coast situations. The broken shale rock of the various shoals are particularly rich and the extent of this type of habitat is little known but probably occurs commonly. The rocky reefs and cliffs deeper than about 20 m include good examples of southern communities with several Mediterranean-Atlantic species present often in high abundance. The cliffs and broken surfaces at about 30-40 m may be a relict shoreline which occurs at other locations along the south coast.

3. Rarity. Several species rarely recorded in Britain occur in the area described here (see Section 8.3).

4. Diversity. The diversity of rocky intertidal and subtidal habitats is very high in this area mainly because of the broken nature of rocks which provides rock pools, overhangs, gullies, tunnels and cliffs as well as upward facing surfaces from the upper shore to the lower circalittoral. Species richness is also high. Sediment habitats and communities appear less diverse.

5. Fragility. Sensitivity of habitats and communities to distrubance and environmental change is considered to be generally low. However, some of the rarer and probably very slow-growing species with negligable recruitment including several Anthozoan species would be severely affected by collection for scientific or souvenir purposes.

6. Size. The area included is arbitarily bounded by lines drawn due south from Penlee Point and Gara Point. The zone described as 'Open Sea' between the 20 and 40 m depth contours occupies 1583 ha of seabed. The area described as 'Open Coast' occupies 1813 ha of shore and seabed including 8.6 km of coast measured at HWOST level from Staddon Point to Season Point and the breakwater which is 1.7 km long.

7. Situation. The area considered here includes the Wembury Voluntary Marine Conservation Area which is also an intertidal SSSI.

8. Recorded history. This area has been studied for the past one hundred years by workers from the Marine Biological Association and records of algae and animals collected over that period are given in various publications. Particular attention is drawn to the records published in the Plymouth Marine

Fauna (Marine Biological Association, 1957), the studies of transects at Wembury (Colman, 1933; Boalch et al, 1974), the earliest diving studies by Kitching et al (1934) and the earliest diving studies using SCUBA by Forster (1958).

9. Research and education potential. This area provides a wide range of opportunities for both research and education particularly in relation to its proximity to marine research institutes, to the Polytechnic at Plymouth, to the diving centre at Fort Bovisand and to the conservation area at Wembury. The Wembury conservation area has codes of practice of research and educational parties and a warden who provides guidance and interpretive material for visitors.

10. Restoration potential. Not relevant.

11. Intrinsic appeal. The coastline is attractive and popular for recreation both from the residents of Plymouth and visitors. Underwater areas offshore of Plymouth Sound are attractive to divers for their scenic appeal.

12. Vulnerability. Potential or actual threats to this area are currently considered to be slight except in the intertidal at Wembury where tourist and educational pressure occurs. Trawling is not generally undertaken because of the presence of rocky reefs. Some subtidal marine species would be sensitive to collecting but this is not currently undertaken.

13. Urgency. The voluntary conservation measures at Wembury already provide a degree of protection for this area and there is no urgency at present to institute new conservation measures for the area.

14. Feasibility. The conservation area at Wembury provides an important precedent for active conservation management of the most vulnerable part of this area. The co-operation and understanding which has been achieved from interested parties should be capable of being extended to include an awareness of the need for conservation of areas nearby.

8.2.2. Outer Plymouth Sound

1. Naturalness. Almost all of the coastline is of natural bedrock with the harbour at Fort Bovisand and walls at Picklecombe Fort providing artificial surfaces. The Breakwater and Breakwater Fort are artificial and will also have caused considerable changes to shore communities on the east side of the Sound following construction of the breakwater resulting in the development of communities characteristic of more wave sheltered conditions. Similarly, the shelter afforded by the breakwater has resulted in the presence of more muddy seabed than would previously have been present. Areas of seabed have been subject to dredging and some of the shoals have been blasted for navigation purposes.

2. Representativeness. Shore communities are generally representative of sheltered bay communities and include extensive areas of rock. In the subtidal, the shallow fringe of bedrock includes typically sheltered coast communities although with estuarine elements particularly in Jennycliff Bay. The tide-swept pebbles which occur in areas offshore hold communities of algae and animals typical of this sort of habitat. Bedrock reefs hold predominantly open sheltered coast communities. Sediments include several different types and the muddy sediments north of the breakwater are fairly typical of harbours. Likewise, the boulder tumble on the north side of the breakwater

includes communities similar to those of extensive harbour walls elsewhere although with boring species characteristic of limestone.

3. Rarity. A small number of rarely recorded species occurs in this area.

4. Diversity. The diversity of rocky shore habitats and communities is fairly high but intertidal sediments are rare and impoverished. The diversity of algae is high in the subtidal particularly on tide-swept cobbles. Subtidal sediments contain a number of rich associated animal communities, with those in Cawsands Bay being particularly diverse.

5. Fragility. Shore communities in this area would be sensitive to oil pollution and clean-up because of their shelter and the traps for oil which exist in the gullies, pools and extensive flat or gradually sloping surfaces. There are few habitats which would be particularly sensitive to tourist pressure but collecting by educational groups could result in local depletion of some species. Also, the shale rocks may be damaged during collecting of crevice fauna. Areas already subject to dredging most likely include a resilient flora and fauna.

6. Size. The area of shore and seabed within this zone is 1103 ha in extent and includes a coastline of 9.1 km measured at HWOST and the breakwater which is 1.7 km long.

7. Situation. The area is a busy recreational and naval area with anchoring and fishing prohibited in an area north of the breakwater. Dredging of the navigational channel is a source of disturbance but occurs infrequently and other sources of disturbance are few.

8. Recorded history. This area has been studied for the past 100 years by workers from the Marine Biological Association and records of algae and animals collected over that period are given in various publications. Particular attention is drawn to the records in the Plymouth Marine Fauna (Marine Biological Association, 1957), Johnson (1890) (marine algae) and Ford (1923) (sediment communities).

9. Research and educational potential. The area is used for research including collection of specimens by the marine laboratories at Plymouth and by the Polytechnic. The area provides some fairly rich areas for educational purposes as well as areas where particular rocky shore communities can be studied.

10. Restoration potential. Although areas of seabed are present which have been changed by dredging, explosives or the increased shelter resulting from the building of the breakwater, there is no necessity for restoration.

11. Intrinsic appeal. Areas of coastline are fairly attractive and popular for recreation. Underwater areas are not attractive to divers.

12. Vulnerability. Threats to habitats and communities in this area are mainly the maintenance of navigation channels. Communities are already affected by these activities. It is unlikely that other activities, except major construction projects, ould affect the area.

13. Urgency. There is no urgency for protection.

14. Feasibility. The coastline in this area is generally considered of high scenic appeal and development is not likely to take place. Any proposal for conservation measures on the shore or underwater should therefore be compatable with the maintenance of scenic interest.

8.2.3. Inner Plymouth Sound.

1. Naturalness. The degree of modification by human activity (mainly sewage discharge) is difficult to assess. The shoreline is predominantly natural though with the dock at Mill Bay and the breakwater at Mount Batten major exceptions. Smaller areas of walls extending into the intertidal occur. The seabed including the deep steep-sided channels is entirely natural except for areas of jetty piles and the bases of navigation beacons.

2. Representativeness. The habitats and communities present in this area are very rarely encountered and are not representative of any widely occurring biocoenosis.

3. Rarity. The broken and often steeply sloping limestone rocks in the area are rarely encountered features with unusual communities. There are similarities to communities present in Milford Haven and the Daucleddau and, below Tinside, to Stackpole Quay in Pembrokeshire. However, the well-developed community of boring worms and bivalves is very unusual. Some of the species present are rarely encountered and are noted in Section 8.3.

4. Diversity. Intertidal areas are almost all rocky but with different communities on the south-facing limestone rock below the Hooe compared to areas on the southern border. Species diversity on the shore is high only on the broken rock surfaces in the area of The Narrows. Underwater, broken rock and boulders provide a fairly high diversity of habitats but with a low species richness. Muddy sediments off Tinside appeared rich in species whilst sandy sediments north of Drakes Island were fairly diverse but not as rich in numbers.

5. Fragility. The habitats and communities present are subject to fairly stressful conditions as a result of variable water quality and the large amount of untreated sewage effluent disposed in this area. It therefore seems most likely that they are hardy and resilient.

6. Size. The area of shore and seabed within this zone is 246 ha in extent and included 5.2 km of coastline measured at HWOST (excluding Mill Bay Docks).

7. Situation. This area is important for navigation so that anchoring and fishing are prohibited over a substantial part. The northern shore is extensively developed although much of this is for recreation. The western shore is bordered by the Mount Edgcumbe Country Park.

8. Recorded history. This area has been studied over the past 100 years by workers from the Marine Biological Association and records of algae and animals collected over that period are given in various publications. Particular attention is drawn to the records in the Plymouth Marine Fauna (Marine Biological Association, 1957) and Weiser (1940). However, communities present on the most unusual and rarely encountered habitats on subtidal rocks are not described in historical literature.

9. Research and educational potential. The area is used for the collection of specimens by dredging by the Marine Biological Association.

Shores offer some potential for education and interpretation but with no special features for this purpose.

10. Restoration potential. This exists mainly through the effects of reducing the discharge of untreated sewage into this area. However, the impact of this effluent is not clearly known, does not appear to be highly deleterious, and may even encourage the maintenance of a rich community through the supply of suspended organic matter.

11. Intrinsic appeal. The coastline is popular for recreation because of its proximity to Plymouth and the area of the Mount Edgcumbe County Park is attractive. Underwater areas are considered scenically attractive to divers because of the steep rocky surfaces.

12. Vulnerability. The area under consideration is currently threatened only by slight possibility of the release of poisonous chemicals from the Royal Naval Dockyards or through the sewage system. However, major construction projects could be proposed for this area.

13. Urgency. There is no urgency for protection in relation to current threats.

14. Feasibility. There are many potentially conflicting interests in this area so that the establishment of any conservation measures would be subject to discussion with a wide range of groups.

8.2.4. Cattewater and Plym Estuary.

1. Naturalness. Much of this area is affected by man through the building of embankments, jetties and quays and by the establishment of moorings. Also, there is a considerable amount of refuse on the shore and seabed in the Cattewater. The sediments in the Plym Estuary are in part derived from china clay works.

2. Representativeness. The mudflats of the Plym estuary are colonised by typical estuarine communities. The shores of the Cattwater are most likely typical of rather run-down extremely sheltered harbours.

3. Rarity. The habitats, communities and species are not rarely encountered.

4. Diversity. Several types of hard substratum habitat occur in this area together with mixed and muddy substrata. Species diversity is generally low, although intertidal sediments were richer than those sampled in the Tamar.

5. Fragility. Any plants and animals living in this area are unlikely to be fragile.

6. Size. The area of shore and seabed within the Cattewater east to Laira Bridge is 84 ha in extent and includes 9.5 km of coastline measured at HWOST (excluding Inner Sutton Harbour) (5.3 km at chart datum level which excludes Hooe Lake and Pomphlett Creek). The area of the Plym Estuary north of Laira Bridge is 136 ha and with a coastline of 5.9 km at HWOST.

7. Situation. This area is substantially developed for both commerce and recreation. The National Trust own part of the land to the east of the Plym

Estuary. There is currently a proposal to place a barrage at Laira Bridge to produce an area of standing water for recreational purposes.

8. Recorded history. This area has been occasionally sampled by workers from the Marine Biological Association and records of animals are included in the Plymouth Marine Fauna (Marine Biological Associations, 1957).

9. Research and Educational Potential. This area appears to have little potential for research or education.

10. Restoration potential. Areas of the Cattewater are clearly derelict and this dereliction overflows onto the shore so that there is potential for some restoration of natural communities although possibly by removing artificial habitats which add to diversity. The proposal to build a barrage at Laira Bridge may offer opportunities to develop a saline lagoon environment in the Plym Estuary.

11. Intrinsic appeal. The area of National Trust property on the east side of the Plym is attractive meadow and park. Other shores are unattractive urban and dock developments in various states of dereliction.

12. Vulnerability. Habitats and communities in this area are likely to be subject to construction and development. The communities present in the Plym Estuary would be destroyed by the building of a barrage to hold mainly fresh water.

13. Urgency. This area is the most likely to be affected by man-induced change in the near future. There are opportunities to create new habitats of scientific interest within any new developments and these should be pursued if those developments are not antagonistic to nature conservation interests.

14. Feasibility. The area of the Plym Estuary is of a size which would make management for nature conservation purposes feasible, and the shores are largely undeveloped with few conflicting interests. However, in the Cattewater, there are many different activities which affect the shore and subtidal so that any management would be complex.

8.2.5. Tamar and Lynher Estuaries

1. Naturalness. The east side of the Hamoaze and, to a limited extent, the west side are developed and the original shoreline obliterated. Also, dredging is undertaken to maintain navigation channels. However, the shores of the Lynher and of the Tamar north of the bridges are almost entirely natural with the exception of a few quays and jetties. The seabed in these areas is ot dredged but moorings and pontoons are present in several places.

2. Representativeness. The extensive intertidal mudflats and the subtidal sediments present in this area are colonised by communities typical of estuarine areas. Rocky shores are similarly representative of typically extremely sheltered communities present in many marine inlets. Subtidal hard substrata are not extensive in this area but include communities characteristic of marine inlets. The most outstanding feature of the communities present in this area is the change in composition and the decrease in species richness which occurs with increasingly low and variable salinity conditions along the estuary of the Tamar in particular. This change can be observed on both sediments (which is usual in well-developed estuaries) and on rock (which it is unusual to find so far up an estuary). Also the estuary

above the bridges is subjct to very few polluting influences so that communities are unlikely to be stressed by factors created by man.

3. Rarity. The changes in species composition and decrease in species richness on rocky substrata along the estuarine gradient described above are rarely encountered features. This is mainly due to the low freshwater inputs of most other marine inlets and the absence of hard substrata, particularly bedrock, distant from the sea. Some of the species present are rarely encountered and are noted in Section 8.3.

4. Diversity. Diversity of habitats is high for estuarine situations with both soft and hard substrata present as well as small areas of man-made structures. Species richness is low because of the low and variable salinity and other stressful environmental factors, although mudflat communities in St. Johns Lake are fairly diverse in bivalves and polychaetes.

5. Fragility. The communities and species present in this area are subject to a high degree of natural stress resulting from variation in salinity and turbidity in particular. They are therefore resilient to large changes in conditions. Changes in water flow or freshwater input would be likely to result in a relocation of zonal boundaries but only major construction works or shore reclamation seem likely to cause damage.

6. Size. Lengths and areas of shore and seabed are given for sections of the Tamar, Lynher and Tavy.

	Length of shore at HWOST (km)	Total area to HWOST (ha)	Area intertidal (HWOST to chart datum) (ha)
Tamar Zone 5	21	973	595
Lynher - Erth Point to entrance	16	583	454
Lynher/Tiddy - Upper limits of tidal extent to Erth Point	18	254	254
Tamar Zone 6 excluding the Tavy	19	710	483
Tavy - east of rail bridge	8	178	178
Tamar Zone 7	5.2	227	168
Tamar Zone 8	4.4	95	73
Tamar Zone 9	8.8	100	77

7. Situation. The Tamar and Lynher are already recognised as an 'outstandingly important complex of wetland habitats with extensive areas of saltmarshes, mudflats, reed beds and green water' (Devon County Council, 1977). This is reflected in the SSSI notifications for the Lynher Estuary and St. John's Lake. The historical and scenic interest of the upper Tamar

Estuary is also an important feature of the area with some areas of land bordering the river in National Trust ownership and several schemes underway to restore or maintain the ancient quays.

8. Recorded history. This area has been studied over the past 100 years by workers from the Marine Biological Association and much more recently by staff at the Institute for Marine Environmental Research and Plymouth Polytechnic. Particular attention is drawn to papers on marine biology by Percival (1929) and Spooner and Moore (1940) as well as the Plymouth Marine Fauna (1957). These give good records of animal species and intertidal sediment communities though not of algae and not from subtidal sediments or hard substrata.

9. Research and educational potential. The potential for studies of physical oceanography within an estuarine system has ben realised recently by the Institute for Marine Environmental Research. Also, the area provides a valuable location for experimental studies of estuarine sediment communities evidenced by the papers by R.M. Warwick and co-workers. The educational potential for demonstration of changes in rocky shore communities with increasingly reduced and variable salinity have not been realised. The scenic attraction of the area also provides an opportunity to incorporate information on marine biology as well as ornithology into guided talks and boat trips where the commentary is historical.

10. Restoration potential. Although areas of shore below the bridges have been affected by the activities of man, there is little possibility of, or need for, restoration.

11. Intrinsic appeal. This is very high for terrestrial areas bordering the upper Tamar and for the bird populations attracted to mudflats. However, neither intertidal or subtidal habitats and communities have any intrinsic appeal except as unspoilt parts of the general scenery.

12. Vulnerability. Marine habitats and communities near to the dockyard complex and in the immediate vicinity of Torpoint are doubtless threatened with further developments including construction and dredging. However, communities on the shore and underwater not directly obliterated by such developments are not thought to be vulnerable to their effects.

13. Urgency. For some sites, particularly areas of rich lower shore communities near to Torpoint, there is an urgency to ensure that appropriate consultation procedures are initiated in the case of proposed developments.

14. Feasibility. The areas of the Lynher and Tamar above the bridges are already highly regarded for their scenic, historical and ornithological interests so that further measures to ensure the nature conservation of sites within these areas would doubtless be feasible.

8.2.6. Yealm Estuary

1. Naturalness. Marine habitats and communities in the Yealm and adjoining creeks are considered to be almost entirely natural although with some walls, moorings and pontoons as artifical substrata. Mooring chains also cause considerable damage to the seabed in places. Populations of dogwhelks have been decimated in recent years most likely by the effects of TBT antifouling paints.

2. Representativeness. Several of the habitats and communities present in the Yealm provide good though not extensive examples of those characteristic of marine inlets with little freshwater input. They include the muddy sand supporting Zostera marina at the entrance, the fucoid-dominated bedrock within the inlet, tide-swept cobbles in the main channel, shallow fringing subtidal rock and the mud banks of the upper estuary.

3. Rarity. The shaley sediments of the south shore within the inlet are not encountered in many of the marine inlets studied and include rich animal communities although not as rich or extensive as in Salcombe. Several species present in the tide-swept cobbles are rarely found.

4. Diversity. This inlet has a wide diversity of habitats, communities and species within a small area. Those habitats are almost entirely natural including both rocky and sediment intertidal areas and predominantly sediment or mobile hard substrata in the subtidal. Species richness is particularly high on rocky shores at the entrance, in subtidal sediments near the entrance, on the tide-swept cobbles and in shaley sediments on the south shore.

5. Fragility. The communities and species present in the Yealm are subject to fluctuating salinities and other forms of environmental stress and are likely to be resilient to occasional additional influences.

6. Size. The main body of the Yealm includes 129 ha of shore and seabed measured to HWOST, of which 38.7 ha is below chart datum level. The length of shoreline from the sand bar at the entrance to Steer Point is 7.8 km. Newton Creek, which dries at low water, is 20 ha in extent and with a shore line at HWOST of 1.5 km. The upper Yealm north-east of Steer Point, which dries at low water, is 70 ha in extent, with a shore line of 3.4 km at HWOST, and Coflette Creek to the north-west of Steer Point is 30 ha in extent with a coastline of 3.2 km at HWOST.

7. Situation. The Yealm is widely recognised as a scenically very attractive area although there are no current identified sites of nature conservation importance there. The land adjacent to the inlet and the seabed north of Madge Point is owned by the Kitley Estate and is managed to maintain its scenic character. Dredging is prohibited north of Madge Point to protect the oyster beds there and the Kitley Estate have maintained that area mainly free of moorings.

8. Recorded history. There are many scattered records of species of algae and animals present in the Yealm. Records in the Plymouth Marine Fauna (Marine Biological Association, 1957) show that there has been dredging to collect specimens in the past. However, there are no known descriptions of habitats and communities. There is probably a considerable volume of information in the memories or field notes of staff from the Marine Biological Association. Records from the International Paints Laboratory of seawater temperatures and salinities extend back about 30 years.

9. Research and educational potential. The inlet is already used for research into the effectiveness of antifouling paints and there is a small amount of spin-off research into marine biology. The area is within easy access of Plymouth and there is potential for further research and educational activities but no particular features of the Yealm which make it specially useful for these activities.

10. Restoration potential. Marine habitats are almost entirely natural and there is little scope or need for restoration of the very few man-made influences on the shore. However, the seabed in Yealm Pool is greatly disturbed by heavy mooring chains. In view of the scientific interest of the communities attached to cobbles in this area, it might be appropriate to give some thought to the way in which moorings are constructed and deployed in the area and to the desirability of pontoons rather than moorings.

11. Intrinsic appeal. This is very high for adjacent terrestrial areas. However, there are few features of the shore or seabed or species living there which make it particularly attractive.

12. Vulnerability. The Yealm is fairly well protected from threats particularly while the owners of the Kitley Estate are sensitive to the scenic value of the area. Also, Newton Ferrers is populated by a high population of people keen to ensure the appeal of the area. Marine life in the area is particularly vulnerable to its use for yacht mooring through both the disturbance caused to the seabed and the chemicals released by antifouling paints. The activities of the research laboratory are not seen as a threat to any greater extent than the mooring of yachts providing that research does not include the release of noxious chemicals from experimental tanks or through waste disposal.

13. Urgency. There are no known threats which make it particularly urgent to seek conservation measures although expansion of yacht moorings is a year-to-year possibility.

14. Feasibility. Protection within this area seems highly feasible in view of the recognised scenic appeal of the inlet and the desire to retain the ecological richness there. Measures to protect marine habitats and species would support protection on the land. This is particularly the case for the area north of Madge Point which is privately owned and managed in a way sympathethic to its present character. The whole of the inlet is a fairly small unit which makes management feasible.

8.3. Identification/confirmation of important features.

Features of littoral and sublittoral ecosystems in the Plymouth area and Yealm Estuary are evaluated here in terms of their International, National, Regional or Local importance. Table 22 lists the main habitat/community types encountered, Table 23 lists species which are considered of scientific interest in their presence in the survey area, for Table 22, the separation of habitat type is according to Section 6. The rating of importance is made broadly according to the following definitions.

International. Communities which are outstandingly good examples of their type in the Northeast Atlantic. Communities recorded at only a very few locations in the Northeast Atlantic.

Species which are recorded at only a few locations in the Northeast Atlantic. Species recorded in higher abundance in the area under consideration than anywhere else in the Northeast Atlantic or where the area is one of only a very few locations where large quantities are recorded.

National. Communities which are outstandingly good examples of their type in Britain. Communities recorded in only a very few marine inlets

or estuaries in Britain. Both of these definitions refer to communities which are or are likely to be widely occurring in other inlets and estuaries in the Northeast Atlantic.

Species which are recorded at only a few locations in Britain but are more widespread in other parts of the Northeast Atlantic. Species recorded in higher abundance at the inlet or estuary under consideration than in any other elsewhere in Britain or where the site is one of only a very few locations where large quantities are recorded in Britain.

Regional. Communities which are present in inlets and estuaries elsewhere in Britain but which are outstandingly good examples of their type in the inlet or estuary under consideration or are as good examples as similar communities present elsewhere in Britain. Communities recorded at only a few locations in inlets and estuaries in southwest Britain.

Species which are unrecorded or recorded at only a few locations in inlets and estuaries in southwest Britain but are widespread in other inlets and estuaries or on the open coast in other parts of Britain. Species recorded in higher abundance in the area under consideration than in any other inlet or estuary in southwest Britain or where the site is one of only a very few locations where large quantities are recorded in southwest Britain.

Local. Communities which are widespread in inlets and estuaries in southwest Britain with as good or better examples at several other locations.

The selection only of species which are of higher than Local importance precludes the use of this category in the species lists.

8.4 Conclusion

Plymouth Sound and its associated estuaries, including the Yealm estuary, have a very rich marine fauna and flora with a high diversity of both rocky and soft sediment habitats. Sublittoral habitats and communities inside Plymouth Sound and, in the deeper water just outside, are particularly interesting and are fairly extensive. The Yealm estuary is of outstanding interest due mainly to the high diversity of habitats and communities which are almost entirely natural.

The presence of the naval dockyards in the Hamoaze will doubtless have effects on the nearby habitats and communities, and the commercial and domestic pollution coming from a sizeable city has noticeably damaging effects in the north of Plymouth Sound and the Cattewater. Recreational pressure in the Yealm estuary does not appear to be damaging its naturalness, except for the presumably high levels of organotin from antifouling paints.

9. ACKNOWLEDGEMENTS

Field survey in areas of Plymouth Sound and the Hamoaze was undertaken with permission of the Assistant Queens Harbour Master, Lt. Commander D. Baird, and in the Plym with permission of the Cattewater Harbour Master. We are very grateful for the co-operation and assistance we received. Advice was given by, and useful discussion made with, Drs. Alan Southward, Norman Holme, Gerald Boalch, Geoff Potts and Peter Gibbs at the Marine Biological Association; Drs. Geoff Wigham, John Hinton and G.E. Millward at Plymouth Polytechnic; Dr. Richard Warwick at the Institute of Marine Environmental Research and Dr. R. Daley of the International Paints Laboratory at Newton Ferrers. Colin George and his colleagues at the MAFF office in Plymouth provided information on fisheries and helped us to find a fishing boat to carry out dredge sampling in the area. The Cofflete Boat Club gave permission to use the slip at Steer Point in the Yealm. Mr. Rodney Bastard gave us permission to carry out sampling in areas of the Yealm owned by the Kitley Estate and information on oyster farming. Paul Dart took part in the subtidal survey on 13th-15th July and supplied us with much useful information on dive sites and local knowledge. We are very grateful for his help. Dredging was undertaken on the M.V. Westward on July 16th and 17th. The skipper, Jack Alexander, and his crew are thanked for their assistance. Mr. John Hart of the Bovisand Lodge Estate gave us useful local knowledge. Information on sewage inputs into the Plymouth area and the Yealm was provided by Brian Sinkins of the South West Water Authority. Dr. Peter Garwood of the Dove Marine Laboratory kindly identified the species of syllid polychaetes.

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TABLE 1

Sites surveyed and survey staff.

INTERTIDAL SITES

Site No.	Site Name	OS Grid Ref. SX:	Algae	Animals	Sediment	Habitat	Date surveyed
1	St. Germans Quay	364572	SH	KH	KH	-	23.4.86
2	Black Rock	398561	SH	KH	KH	notes	23.4.86
3	Wilderness Point	456532	SH	KH	KH	-	23.4.86
4	Cremyll Bay	455533	-	-	JM	JM, MH KC	23.4.86
5	Cawsands Bay (North)	434502	-	-	MH	MH, KC	24.4.86
6	Cawsands Bay (South)	435501	SH	SH	MH	MH, KC	24.4.86
7	Cawsands Bay (Cave)	434501	SH	SH	SH	-	24.4.86
8	Cremyll West	451535	SH	MH	KH	MH, KC	24.4.86
9	Penlee Point	444487	SH	KH	KH	-	25.4.86
10	Hooe Lake Point	450513	SH	KH	KH	-	25.4.86
11	Drakes Island North Bay	467529	MH	MH	JM	JM, MH TL	25.4.86
12	St. Johns Lake Mussel Bed	436542	-	-	MH	JM,MH, TL	25.4.86
13	St. Johns Lake Upper Reaches	422541	-	-	JM	JM, MH	25.4.86
14	St. Johns Lake Landing Pier	432545	-	-	JM	-	25.4.86
15	West of Passage Point	418572	MH	MH	MH	JM	26.4.86
16	Mussel bed south of Beggars Island	424571	-	JM	JM	-	26.4.86
17	Mudflat adjacent to Site 16	424571	-	-	JM, MH	MH, JM TL	26.4.86
18	Mussel bed near Jupiter Point	413569	-	JM	JM	-	26.4.86
19	Mudflat opposite Black Rock	395558	-	-	JM, MH	MH, JM, TL	26.4.86
20	Sand bank near Wacker Lake Buoy	392557	-	-	JM, MH,	MH, JM, TL	26.4.86
21	Opposite Redshank Point	385552	-	-	JM, MH	MH, JM, TL	26.4.86
22	Redshank Point	385554	-	-	JM, MH	MH, JM, TL	26.4.86
23	Opposite Erth hill	380556	-	-	JM, MH	MH, JM, TL	26.4.86
24	South of Pentillie Quay	412644	-	-	MH	MH, KC	27.4.86
25	Neil Point West Shore	436613	-	-	JM	JM, MH, KC, TL	27.4.86
26	W. Shore below Tamar Bridges	433588	SH	MH KH	KH MH	MH, KC	27.4.86
27	Weir Point	438618	SH	KH	KH	-	27.4.86
28	Cargreen Quay	436626	SH	KH	KH	-	27.4.86
29	Opposite South Hooe	423652	-	-	JM	JM, MH, KC, TL	27.4.86
30	South Hooe	421643	SH	KH	KH	-	27.4.86

Site No.	Site Name	OS Grid Ref. SX:	Algae	Animals	Sediment	Habitat	Date surveyed
31	North of Tinnel	421643	SH	KH	KH	-	27.4.86
32	North Hooe	425661	SH	KH	KH	-	27.4.86
33	Torpoint	437545-441546	SH	KH	KH	-	27.4.86
34	Cockle Bank	497536	-	-	JM , KC,DR	JM	22.5.86
35	Sandbank opposite Blagdons Boatyard	503545	-	-	JM, KC,DR	JM	22.5.86
36	Sandbank near Blue Circle Sluice	504545	-	-	JM, KC,DR	JM	22.5.86
37	Point Quay	504552	-	-	JM, KC,DR	JM	22.5.86
38	Saltram Wood	511557	-	-	JM, KC,DR	JM	22.5.86
39	N. Saltram Wood	515558	-	-	JM, KC,DR	JM	22.5.86
40	E. Tinside (Mens Bathing area)	479537-480537	AEL	KH	-	KH	22.5.86
41	West Hoe (Millbay Pier to RWYC)	471536-473536	AEL	KH	-	KH	22.5.86
42	Bovisand Bay Beach	492505	-	-	JM,KC	JM	23.5.86
43	Bovisand Bay South	491505	JE	DR	-	DR	23.5.86
44	Clovelly Bay Slip	489532	-	-	JM,KC	JM	23.5.86
45	W. of Clovelly Bay Slip	489533	JE	DR	-	DR	23.5.86
46	Jennycliff Bay	491522-491522	AEL	KH	-	KH	23.5.86
47	Oreston Spit	498533	AEL	KH	-	KH	23.5.86
48	Breakwater N. Side W. end	467505	DR	JM	-	JM, DR	24.5.86
49	Opposite Empacombe Quay	444532	-	-	JM,DR	JM	24.5.86
50	Southdown Quay Wall	438527	DR	DR,JM		JM	24.5.86
51	Millbrook Lake	438524	-	-	DR,JM	JM	24.5.86
52	E. of Foss Point	434521	-	-	DR,JM	JM	24.5.86
53	South Drakes Island	468527	AEL	KH	-	KH	24.5.86
54	Devils Point	460533	AEL	KH	-	KH	24.5.86
55	Cellar Beach	530476-531476	AEL	KH	-	KH	25.5.86
56	Warren Point West	535478	DR	JM,DR	-	JM	25.5.86
57	Warren Point	538478-439478	AEL	KH	JM,DR	JM	25.5.86
58	S. of Madge Point	539482	-	-	DR,KC JM,SK	JM	25.5.86
59	Madge Point	539484	AEL	KH	-	KH	25.5.86
60	Steer Point Slip	544499-545499	DR	DR	JM,KC DR	DR, JM	26.5.86
61	Steer Point East	546499-545497	DR	DR	-	DR	26.5.86
62	Crawl Wood Beacons	546495	AEL	KH	-	KH	26.5.86
63	Tinside Swimming Pool	478536	AEL	KH	-	-	26.5.86
64	Staddon Point	486507	AEL	-	-	-	26.5.86

SUBTIDAL SITES

Site No.	Site Name	OS Grid Ref. SX:	Algae	Animals	Habitat	Date surveyed
65	SW Breakwater	462503-463505	AEL	KH, BB	KH, BB	13.7.86
66	Draystone Ledge	445485	AEL, BB	BB	BB	13.7.86
67	Penlee Tunnel	442487	AEL	KH	KH	13.7.86
68	Tinker Shoal South	483480	AEL, BB	BB	BB	14.7.86
69	East Tinker Buoy	480488	AEL	JM	JM, AEL	14.7.86
70	Staddon Point Gulley	486507	AEL	JM	JM, AEL	14.7.86
71	S of Breakwater	473499	AEL	KH, JM, BB	KH	14.7.86 & 18.7.86
72	N of Breakwater	472507	-	BB	BB	14.7.86
73	Battery Buoy	458533	AEL	JM, BB	BB, JM, AEL	15.7.86 18.7.86
74	N Devil's Point	459534	-	KH	KH	15.7.86
75	Ramscliff Point	487514	-	BB	BB	15.7.86
76	Duke Rock Buoy	480509	AEL	JM	JM, AEL	15.7.86
77	N Drake's Island	470529	AEL	KH	AEL, KH	16.7.86
78	Below Tinnel	420642	-	KH	KH	16.7.86
79	Weir Quay	431649	-	BB	BB	16.7.86
80	Cargreen	437627	-	BB	BB	16.7.86
81	Weir Point	440620-440619	-	KH	KH	16.7.86
82	Ferry Slip, St. Budeaux	436587	AEL	BB	BB, AEL	16.7.86
83	Clitter's Wood	538483	AEL, KH	KH	KH	17.7.86
84	Shortaflete Creek	543492	AEL	BB	BB	17.7.86
85	Steer Point	545497-545495	-	BB	BB	17.7.86
86	S of Knap Shoal	463484-463486	TB	KH	KH	18.7.86
87	Eastern King Point	467534	TB	KH	KH	18.7.86
88	Entrance, Plymouth Sound	477460	AEL	KH, JM	KH, AEL, TB, JM	19.7.86
89	Penlee Point	443487-447487	TB, SH	IMTD,BB	BB,IMTD, TB	20.7.86
90	Inner Broady Cove	443492	SH	JM	SH, JM	20.7.86
91	Looking Glass Point	436566	TB	IMTD,JM	TB, JM	20.7.86
92	Royal Albert Bridge	435588	SH	KH, BB	SH, KH, BB	20.7.86
93	Kitchings Gully, Tomb Rock	526480	TB	KH	KH	21.7.86
94	Off Cellar Bay	530479-530477 -531478	SH	JM	JM, SH	21.7.86
95	Ferry Cottage, Yealm	538475	CH	BB	CH, BB	21.7.86
96	Northern Yealm	540486-543491	CH	IMTD	CH,IMTD	21.7.86
97	Offshore, Picklecombe Point	465514-461512	SH	IMTD	SH,IMTD	22.7.86
98	N of the Bridge	462527-464525	BB, CH, SH	BB	BB	22.7.86
99	S of Mallard Shoal	479531	-	KH	KH	22.7.86

Site No.	Site Name	OS Grid Ref. SX:	Algae	Animals	Habitat	Date surveyed
100	W of Mallard Shoal	476532-479532	SH	JM	SH, JM	22.7.86
101	Mallard Shoal (Beacon)	470532	SH	KH	KH, SH	22.7.86
102	N Breakwater (Fort)	473504	IMTD	BB	BB,IMTD	22.7.86
103	Jennycliff Bay	489521-490521	SH	CH,IMTD	SH,IMTD	23.7.86
104	Hooe Lake Point (Inner)	450512	CH	JM	CH, JM	23.7.86
105	Off Hooe Lake Point	452510	IMTD	IMTD	IMTD	23.7.86
106	Mill Bay Pit	468534	-	KH	KH, BB	23.7.86
107	Off Tinside Swimming Pool	477536	CH	JM	JM/CH	23.7.86
108	Laira Bridge Piling	502542	IMTD	IMTD	IMTD	24.7.86
109	N of Mount Batten Breakwater	483533	CH	BB	BB, CH	24.7.86
110	Clovelly Bay	491531-492532	JM	JM	JM	24.7.86
111	Cattedown Wharf Piles	496535	-	JM	JM	24.7.86
112	Reef near "The Elk"	-	SH, CH	IMTD,BB, JM	CH, JM, IMTD,BB	24.7.86
113	Sand Acre Point	419572-421573	IMTD	IMTD,BB	IMTD,BB	25.7.86
114	Off Ballast Pound	441547-443546	SH	JM	JM, SH	25.7.86
115	Cawsand Bay	437499-438499	SH	IMTD	IMTD,SH	25.7.86

TABLE 2

Species sampled from intertidal samples.

Numbers of each species present are given, but the sample areas and mesh sizes vary according to the descriptions along the top of the table. The following abbreviations are used: UMS = Upper Midshore, MS = Midshore, LMS = Lower Midshore, LS = Lower Shore, P = Present (no record of abundance). Details of sediment types, sample size and mesh size at each station follow the table. Fig. 9 (page 23) shows the site locations.

	1 MS .04	4 LS .01	4 LS .1	4 LS .5	4 LMS .01	4 LMS .1	4 LMS .5	4 MS	4 MS .1	4 MS .5	4 UMS .01	4 UMS .1	4 UMS .5	5 LS .01	5 LMS .01	5 LMS .1	5 MS .01	5 MS .1	5 UMS .01	5 UMS .1	6 LS .01	6 LS .1	6 LMS .01	6 LMS .1	6 MS .01	6 MS .1	6 UMS .01	6 UMS .1
COELENTERATA - ANTHOZOA																												
Actiniaria indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sagartiogeton undatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NEMERTEA																												
Nemertea indet. sp.1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nemertea indet. sp.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NEMATODA																												
Nematoda indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
ECHIURA																												
?Thalassema thalassemum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANNELIDA - POLYCHAETA																												
Ampharete acutifrons	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anaitides maculata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aonides oxychephala	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arenicola marina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aricidia minuta	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	2	2	1	1	-	-	-	-
Capitella capitata	-	-	1	-	1	-	-	4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Capitomastus minimus	-	-	-	-	-	-	-	-	-	-	3	5	-	1	-	-	-	-	-	-	-	49	2	1	3	-	6	135
Chaetozone setosa	-	-	21	-	-	21	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
Caulleriella sp.	-	3	-	-	5	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cirratulus cirratus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-
Cirriformia tentaculata	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eteone longa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eumida sanguinea	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eunereis longissima	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Exogone hebes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Exogone naidina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Glyceridae indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lanice conchilega	-	-	-	-	1	1	7	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magelona alleni	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magelona filiformis	-	-	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magelona mirabilis	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Malacoceros feluginosus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Marphysa belli	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	3	47
Mediomastus fragilis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melinna palmata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys caeca	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys hombergi	-	-	-	2	1	10	-	-	8	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nereis diversicolor	99	-	-	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
Nereis virens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Notomastus latericius	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ophelia sp. (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ophryotrocha hartmanni	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parapionosyllis minuta	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pholoe ?pallida	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phyllodocidae indet.	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Poechilochaetous serpens	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polydora ciliata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polynoidae indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pygospio elegans	-	2	10	-	8	65	-	18	77	-	1	5	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Sabellidae indet.(sp.1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sabellidae indet.(sp.2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Saccocirrus papillocereus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scolelepis squamata	-	-	-	-	-	-	-	-	-	-	-	-	-	131	-	1	-	-	1	-	1	-	-	-	-	-	-	-
Scolelepis tridentata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sphaerodoridium minutum	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	1 MS .04	4 LS .01	4 LS .1	4 LS .5	4 LMS .01	4 LMS .1	4 LMS .5	4 MS .[illegible]	4 MS .1	4 MS .5	4 UMS .01	4 UMS .1	4 UMS .5	5 LS .01	5 LMS .01	5 LMS .1	5 MS .01	5 MS .1	5 UMS .01	5 UMS .1	6 LS .01	6 LS .1	6 LMS .01	6 LMS .1	6 MS .01	6 MS .1	6 UMS .01	6 UMS .1
Sphaerosyllis tetralix	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spio martinensis	-	-	5	-	-	-	-	1	1	-	1	-	-	-	-	-	-	-	-	-	1	2	1	-	2	-	1	-
Spiophanes bombyx	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Streblospio shrubsoli	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Syllidia armata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tharyx marioni	-	-	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANNELIDA - OILGOCHAETA																												
Oligochaeta indet. sp.1	15	-	-	-	-	-	-	-	-	-	-	-	-	29	152	68	69	90	60	47	-	-	1	-	2	-	-	-
Oligochaeta indet. sp.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tubificoides ?benedeni	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	7
CRUSTACEA - COPEPODA																												
Harpacticoidea indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRUSTACEA - MYSIDACEA																												
Siriella jaltensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRUSTACEA - TANAIDACEA																												
Tanaidacea indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRUSTACEA - ISOPODA																												
Cyathura carinata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eurydice pulchra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eurydice spinigera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jaera albifrons	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Porcellio scaber	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRUSTACEA - AMPHIPODA																												
Corophium crassicorne	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corophium volutator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melita palmata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pontocrates arenarius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Urothoe brevicornis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Urothoe poseidonis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	2	5	-	-	-	-	-
CRUSTACEA - DECAPODA																												
Carcinus maenas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crangon crangon	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Decapoda indet. (megalopa)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MOLLUSCA - PROSOBRANCHIA																												
Hydrobia ulvae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nassarius reticulatus	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MOLLUSCA - BIVALVIA																												
Abra alba	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Abra tenuis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cerastoderma edule	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ensis ensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Macoma baltica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mysella bidentata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mytilus edulis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scrobicularia plana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tellina fabula	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Venus striatula	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Venerupis pullastra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ECHINODERMATA - STELLEROIDEA																												
Ophiuroidea indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	8 LS .01	8 LS .1	11 LS .01	11 LS .1	11 LMS .01	11 LMS .1	11 MS .01	11 MS .1	11 UMS .01	11 UMS .1	12 LMS .01	12 LMS .1	12 LMS .1	13 MS .01	13 MS .1	13 MS .5	17 LMS .01	15 SLF .02	15 LS	15 LMS .1	15 UMS .01	19 LS .01	20 LS .01	21 LMS .01	21 LMS .1
COELENTERATA - ANTHOZOA																									
Actiniaria indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sagartiogeton undatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NEMERTEA																									
Nemertea indet. sp.1	1	2	-	-	-	1	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-
Nemertea indet. sp.2	-	-	-	-	13	14	1	280	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NEMATODA																									
Nematoda indet.	1	6	-	12	-	3	2	4	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-
ECHIURA																									
?Thalassema thalassemum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANNELIDA - POLYCHAETA																									
Ampharete acutifrons	-	-	-	-	-	-	-	-	-	-	5	-	32	30	92	22	-	-	-	-	-	-	-	-	-
Anaitides maculata	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Aonides oxychephala	-	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arenicola marina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	P	-	-
Aricidia minuta	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Capitella capitata	38	19	4	19	-	-	-	-	-	-	-	1	-	-	-	5	-	-	-	-	-	-	-	-	-
Capitomastus minimus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-
Chaetozone setosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caulleriella sp.	-	-	-	-	-	-	-	-	-	-	-	-	3	1	-	-	-	1	-	-	-	-	-	-	-
Cirratulus cirratus	-	-	-	-	-	-	-	-	-	-	-	59	-	-	-	-	1	1	1	-	-	-	-	-	-
Cirriformia tentaculata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-
Eteone longa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eumida sanguinea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eunereis longissima	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Exogone hebes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Exogone naidina	1	-	-	-	-	-	-	-	-	-	-	-	-	7	-	-	-	-	-	-	-	1	-	-	-
Glyceridae indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lanice conchilega	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magelona alleni	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magelona filiformis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magelona mirabilis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Malacoceros feluginosus	5	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Marphysa belli	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mediomastus fragilis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melinna palmata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	1	-	-
Nephtys caeca	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys hombergi	-	-	-	-	-	-	-	-	-	-	-	-	3	3	11	8	-	-	-	-	5	1	2	-	-
Nereis diversicolor	-	-	-	-	-	-	-	-	-	-	-	-	5	-	3	-	2	-	1	-	-	-	-	2	35
Nereis virens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-
Notomastus latericius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ophelia sp. (juv.)	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ophryotrocha hartmanni	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parapionosyllis minuta	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pholoe ?pallida	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phyllodocidae indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Poechilochaetous serpens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polydora ciliata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polynoidae indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pygospio elegans	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1	-	-	-	-	-	1	-	-	-
Sabellidae indet.(sp.1)	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Sabellidae indet.(sp.2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Saccocirrus papillocereus	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scolelepis squamata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scolelepis tridentata	-	-	-	-	1	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sphaerodoridium minutum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	8 LS .01	8 LS .1	11 LS .01	11 LS .1	11 LMS .01	11 LMS .1	11 MS .01	11 MS	11 UMS .01	11 UMS .1	12 LMS .01	12 LMS .1	12 LMS .1	13 MS .01	13 MS .1	13 MS .5	17 LMS .01	15 SLF 02	15 LS	15 LMS .1	15 UMS .01	19 LS .01	20 LS .01	21 LMS .01	21 LMS .1
Sphaerosyllis tetralix	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spio martinensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Spiophanes bombyx	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Streblospio shrubsoli	-	-	-	-	-	-	-	-	-	-	-	-	-	141	51	-	-	-	-	-	-	1	1	-	-
Syllidia armata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tharyx marioni	-	-	-	-	-	-	-	-	-	-	14	11	125	-	-	-	15	-	12	-	-	5	149	2	-
ANNELIDA - OILGOCHAETA																									
Oligochaeta indet. sp.1	82	82	33	148	12	38	79	493	57	47	1	-	-	4	-	1	-	-	-	-	1	2	-	37	57
Oligochaeta indet. sp.2	113	117	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tubificoides ?benedeni	-	-	1	-	-	-	-	-	-	-	-	-	-	79	36	15	4	-	11	-	-	-	-	3	19
CRUSTACEA - COPEPODA																									
Harpacticoidea indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRUSTACEA - MYSIDACEA																									
Siriella jaltensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRUSTACEA - TANAIDACEA																									
Tanaidacea indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRUSTACEA - ISOPODA																									
Cyathura carinata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eurydice pulchra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eurydice spinigera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jaera albifrons	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Porcellio scaber	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRUSTACEA - AMPHIPODA																									
Corophium crassicorne	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corophium volutator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
Melita palmata	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	2	-	-	-	-	-	-	-
Pontocrates arenarius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Urothoe brevicornis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Urothoe poseidonis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRUSTACEA - DECAPODA																									
Carcinus maenas	-	-	-	-	-	-	-	-	-	-	1	-	3	-	-	-	-	5	-	-	-	P	-	-	-
Crangon crangon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Decapoda indet. (megalopa)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MOLLUSCA - PROSOBRANCHIA																									
Hydrobia ulvae	-	-	-	-	-	-	-	-	-	-	-	-	-	P	P	P	-	-	-	-	-	-	-	-	-
Nassarius reticulatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MOLLUSCA - BIVALVIA																									
Abra alba	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Abra tenuis	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Cerastoderma edule	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	1	-	-	P	-	-	-
Ensis ensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Macoma baltica	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Mysella bidentata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mytilus edulis	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-
Scrobicularia plana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-
Tellina fabula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Venus striatula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Venerupis pullastra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ECHINODERMATA - STELLEROIDEA																									
Ophiuroidea indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	23 LMS .01	24 LMS .01	25 LS .01	26 LS .01	26 LMS .01	29 LMS .01	29 LMS .1	34 LS .01	34 LS .[illegible]	34 LMS .01	34 LMS .1	34 MS .01	34 MS .1	34 UMS	35 LMS .01	36 LMS .01	37 MS .01	38 MS .01	39 MS .[illegible]	42 LS .01	42 LS .1	42 LMS .01	42 LMS .1	42 MS .01	42 MS .1	44 LS .01	44 LS .1	44 LMS .01	44 MS .01
COELENTERATA - ANTHOZOA																													
Actiniaria indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	1	3	-
Sagartiogeton undatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NEMERTEA																													
Nemertea indet. sp.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nemertea indet. sp.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NEMATODA																													
Nematoda indet.	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	3
ECHIURA																													
?Thalassema thalassemum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-
ANNELIDA - POLYCHAETA																													
Ampharete acutifrons	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anaitides maculata	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aonides oxychephala	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arenicola marina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aricidia minuta	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Capitella capitata	-	-	-	-	-	-	-	-	-	-	3	49	153	-	-	-	-	-	-	-	P	-	3	4	-	-	-	-	9
Capitomastus minimus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chaetozone setosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caulleriella sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cirratulus cirratus	-	-	-	-	-	-	-	-	7	2	5	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
Cirriformia tentaculata	-	-	-	-	-	-	-	-	4	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-
Eteone longa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eumida sanguinea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eunereis longissima	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Exogone hebes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Exogone naidina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Glyceridae indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lanice conchilega	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magelona alleni	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magelona filiformis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magelona mirabilis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Malacoceros feluginosus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
Marphysa belli	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mediomastus fragilis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	4	-
Melinna palmata	-	-	-	-	-	-	-	2	12	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Nephtys caeca	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys hombergi	-	-	-	-	-	-	-	-	23	5	15	1	5	-	1	1	-	-	-	-	-	-	-	-	-	1	12	-	-
Nereis diversicolor	92	-	-	-	-	1	-	1	1	1	5	3	34	3	P	1	16	9	2	-	-	-	-	-	-	1	-	-	1
Nereis virens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Notomastus latericius	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	1	-	2	-	-	-	3	-	-	-	-	-
Ophelia sp. (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ophryotrocha hartmanni	-	-	-	-	-	-	-	-	-	-	-	18	48	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-
Parapionosyllis minuta	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pholoe ?pallida	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Phyllodocidae indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Poechilochaetous serpens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polydora ciliata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polynoidae indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pygospio elegans	-	-	-	-	-	-	-	-	-	3	14	6	27	-	22	18	-	-	-	-	-	-	-	-	-	-	3	-	2
Sabellidae indet.(sp.1)	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sabellidae indet.(sp.2)	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Saccocirrus papillocereus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scolelepis squamata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
Scolelepis tridentata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	-	-	-	-	-	-
Sphaerodoridium minutum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	23 LMS .01	24 LMS .01	25 LS .01	26 LS .01	26 LMS .01	29 LMS .01	29 LMS .1	34 LS .01	34 LS .1	34 LMS .01	34 LMS .1	34 MS .01	34 MS .1	34 UMS	35 LMS .01	36 LMS .01	37 MS .01	38 MS .01	39 MS	42 LS .01	42 LS .1	42 LMS .01	42 LMS .1	42 MS .01	42 MS .1	44 LS .01	44 LS .1	44 LMS .01	44 MS .01
Sphaerosyllis tetralix	-	-	-	4	4	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spio martinensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spiophanes bombyx	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Streblospio shrubsoli	-	-	2	-	-	-	2	-	-	1	1	-	75	-	31	24	-	54	1	-	-	-	-	-	-	-	-	-	-
Syllidia armata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Tharyx marioni	-	-	7	77	87	1	-	40	58	117	355	10	210	-	-	-	-	-	-	-	-	-	-	-	-	38	197	-	16
ANNELIDA - OILGOCHAETA																													
Oligochaeta indet. sp.1	9	2	1	10	17	-	3	1	-	1	-	-	-	-	11	3	5	-	-	2	-	-	-	-	-	-	-	86	1
Oligochaeta indet. sp.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tubificoides ?benedeni	-	-	-	-	7	-	-	-	2	37	23	281	1200	-	6	91	-	1	-	-	-	-	-	-	-	4	-	-	92
CRUSTACEA - COPEPODA																													
Harpacticoidea indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
CRUSTACEA - MYSIDACEA																													
Siriella jaltensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRUSTACEA - TANAIDACEA																													
Tanaidacea indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRUSTACEA - ISOPODA																													
Cyathura carinata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-
Eurydice pulchra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Eurydice spinigera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jaera albifrons	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
Porcellio scaber	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRUSTACEA - AMPHIPODA																													
Corophium crassicorne	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corophium volutator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melita palmata	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	1	1	8
Pontocrates arenarius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
Urothoe brevicornis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
Urothoe poseidonis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRUSTACEA - DECAPODA																													
Carcinus maenas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Crangon crangon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Decapoda indet. (megalopa)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
MOLLUSCA - PROSOBRANCHIA																													
Hydrobia ulvae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nassarius reticulatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MOLLUSCA - BIVALVIA																													
Abra alba	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Abra tenuis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cerastoderma edule	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	1	-	1
Ensis ensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Macoma baltica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mysella bidentata	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mytilus edulis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scrobicularia plana	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	P	-	1	4	-	-	-	-	-	-	-	-	-	-
Tellina fabula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Venus striatula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Venerupis pullastra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ECHINODERMATA - STELLEROIDEA																													
Ophiuroidea indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-

	49 LS .01	51 LMS .01	51 LMS .1	52 MS .01	55 LS .1	55 LS .5	55 LM	58 LS .01	60 LS .1	60 LMS .01	60 LMS .01	60 LMS .1	60 MS .01	60 MS .1	62 MS .01	62 MS .1
COELENTERATA - ANTHOZOA																
Actiniaria indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sagartiogeton undatus	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NEMERTEA																
Nemertea indet. sp.1	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	1
Nemertea indet. sp.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NEMATODA																
Nematoda indet.	-	-	-	-	-	-	-	1	1	2	-	-	1	-	2	-
ECHIURA																
?Thalassema thalassemum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANNELIDA - POLYCHAETA																
Ampharete acutifrons	-	-	2	-	-	-	-	-	-	2	7	11	12	103	-	4
Anaitides maculata	-	-	-	-	1	1	-	-	-	-	-	-	1	-	-	-
Aonides oxychephala	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-
Arenicola marina	-	-	-	-	-	P	-	P	2	-	-	-	-	-	-	-
Aricidia minuta	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Capitella capitata	-	-	-	-	4	4	-	5	3	-	-	1	2	2	-	-
Capitomastus minimus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chaetozone setosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caulleriella sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cirratulus cirratus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cirriformia tentaculata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eteone longa	-	-	-	-	-	-	-	-	-	-	-	2	-	2	-	-
Eumida sanguinea	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Eunereis longissima	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Exogone hebes	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Exogone naidina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Glyceridae indet.	-	-	-	-	1	P	P	P	-	-	-	-	-	-	-	-
Lanice conchilega	-	-	-	-	29	3	-	P	1	-	-	-	-	-	-	-
Magelona alleni	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magelona filiformis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magelona mirabilis	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Malacoceros feluginosus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Marphysa belli	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Mediomastus fragilis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melinna palmata	1	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-
Nephtys caeca	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Nephtys hombergi	-	4	22	-	1	-	-	P	3	2	6	1	-	7	1	3
Nereis diversicolor	-	1	13	2	1	-	-	-	-	-	-	8	-	16	-	2
Nereis virens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Notomastus latericius	-	-	-	-	4	-	-	5	-	-	-	1	5	1	-	-
Ophelia sp. (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ophryotrocha hartmanni	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parapionosyllis minuta	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-
Pholoe ?pallida	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phyllodocidae indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Poechilochaetous serpens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polydora ciliata	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
Polynoidae indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pygospio elegans	-	-	-	-	39	24	-	-	-	4	11	35	6	291	5	8
Sabellidae indet.(sp.1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sabellidae indet.(sp.2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Saccocirrus papillocereus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scolelepis squamata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scolelepis tridentata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sphaerodoridium minutum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	49 LS .01	51 LMS .01	51 LMS .1	52 MS .01	55 LS .1	55 L	55 LMS .01	58 LS .01	60 LS .1	60 LMS .01	60 LMS .01	60 LMS .1	60 MS .01	60 MS .1	62 MS .01	62 MS .1
Sphaerosyllis tetralix	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spio martinensis	-	-	-	-	20	1	-	2	-	-	-	-	-	-	-	-
Spiophanes bombyx	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Streblospio shrubsoli	-	27	59	12	-	-	-	-	2	1	7	38	6	126	18	13
Syllidia armata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tharyx marioni	47	4	-	-	-	-	-	2	6	9	28	4	64	32	20	8
ANNELIDA - OILGOCHAETA																
Oligochaeta indet. sp.1	-	-	-	-	-	-	-	-	5	-	-	16	-	-	-	-
Oligochaeta indet. sp.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tubificoides ?benedeni	2	28	23	17	-	-	-	9	-	1	5	52	-	175	33	26
CRUSTACEA - COPEPODA																
Harpacticoidea indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRUSTACEA - MYSIDACEA																
Siriella jaltensis	-	-	-	-	-	-	-	-	-	-	30	-	-	-	-	1
CRUSTACEA - TANAIDACEA																
Tanaidacea indet.	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CRUSTACEA - ISOPODA																
Cyathura carinata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eurydice pulchra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eurydice spinigera	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Jaera albifrons	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Porcellio scaber	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRUSTACEA - AMPHIPODA																
Corophium crassicorne	-	-	-	-	28	-	-	-	-	-	-	-	-	-	-	-
Corophium volutator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melita palmata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pontocrates arenarius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Urothoe brevicornis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Urothoe poseidonis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRUSTACEA - DECAPODA																
Carcinus maenas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crangon crangon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Decapoda indet. (megalopa)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
MOLLUSCA - PROSOBRANCHIA																
Hydrobia ulvae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nassarius reticulatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MOLLUSCA - BIVALVIA																
Abra alba	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Abra tenuis	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	1
Cerastoderma edule	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ensis ensis	-	-	-	-	-	-	1	P	-	-	-	-	-	-	-	-
Macoma baltica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mysella bidentata	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Mytilus edulis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scrobicularia plana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Tellina fabula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Venus striatula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Venerupis pullastra	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-
ECHINODERMATA - STELLEROIDEA																
Ophiuroidea indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Details of intertidal samples taken

Site and sediment type	Sample size and sieve mesh
St. German's Quay (1)	
Midshore mud and shingle	4 x 0.01 m^2 over 0.5 mm
Cremyl (4)	
Lower shore sandy mud and shingle	1 x 0.01 m^2 over 0.5 mm
Lower shore sandy mud and shingle	1 x 0.1 m^2 over 1 mm
Lower shore sandy mud and shingle	1 x 0.5 m^2 over 5 mm
Lower midshore sandy mud and shingle	1 x 0.01 m^2 over 0.5 mm
Lower midshore sandy mud and shingle	1 x 0.1 m^2 over 1 mm
Lower midshore sandy mud and shingle	1 x 0.5 m^2 over 5 mm
Midshore sandy mud and shingle	1 x 0.01 m^2 over 0.5 mm
Midshore sandy mud and shingle	1 x 0.1 m^2 over 1 mm
Midshore sandy mud and shingle	1 x 0.5 m^2 over 5 mm
Upper midshore sandy mud and shingle	1 x 0.01 m^2 over 0.5 mm
Upper midshore sandy mud and shingle	1 x 0.1 m^2 over 1 mm
Upper midshore sandy mud and shingle	1 x 0.5 m^2 over 5mm
Cawsands Bay (N) (5)	
Lower shore coarse sand and shell gravel	1 x 0.01 m^2 over 0.5 mm
Lower midshore coarse sand and shell gravel	1 x 0.01 m^2 over 0.5 mm
Lower midshore coarse sand and shell gravel	1 x 0.1 m^2 over 1 mm
Midshore coarse sand and shell gravel	1 x 0.01 m^2 over 0.5 mm
Midshore coarse sand and shell gravel	1 x 0.1 m^2 over 1 mm
Upper midshore coarse sand and shell gravel	1 x 0.01 m^2 over 0.5 mm
Upper midshore coarse sand and shell gravel	1 x 0.1 m^2 over 1 mm
Cawsands Bay (S) (6)	
Lower shore coarse sand with gravel	1 x 0.01 m^2 over 0.5 mm
Lower shore coarse sand with gravel	1 x 0.1 m^2 over 1 mm
Lower midshore coarse sand with gravel	1 x 0.01 m^2 over 0.5 mm
Lower midshore coarse sand with gravel	1 x 0.1 m^2 over 1 mm
Midshore coarse sand with gravel	1 x 0.01 m^2 over 0.5 mm
Upper midshore coarse sand with gravel	1 x 0.01 m^2 over 0.5 mm
Upper midshore coarse sand with gravel	1 x 0.1 m^2 over 1 mm
Cremyl West (8)	
Lower shore muddy shell gravel and shingle	1 x 0.01 m^2 over 0.5 mm
Lower shore muddy shell gravel and shingle	1 x 0.1 m^2 over 1 mm
Drakes Island North Bay (11)	
Lower shore clean shell gravel and pebbles	1 x 0.01 m^2 over 0.5 mm
Lower shore clean shell gravel and pebbles	1 x 0.1 m^2 over 1 mm
Lower midshore coarse sand and small pebbles	1 x 0.01 m^2 over 0.5 mm
Lower midshore coarse sand and small pebbles	1 x 0.1 m^2 over 1 mm
Midshore coarse sand and pebbles	1 x 0.01 m^2 over 0.5 mm
Midshore coarse sand and pebbles	1 x 0.1 m^2 over 1 mm
Upper midshore coarse sand and shell gravel	1 x 0.01 m^2 over 0.5 mm
Upper midshore coarse sand and shell gravel	1 x 0.1 m^2 over 1 mm
St. John's Lake Mussel Bed (12)	
Lower midshore mud and cockle shells	1 x 0.01 m^2 over 0.5 mm
Lower midshore mud and cockle shells	1 x 0.1 m^2 over 1 mm
Lower midshore black anoxic mud and mussels	1 x 0.1 m^2 over 1 mm

St. John's Lake Upper Reaches (13)	
Midshore mud	1 x 0.01 m^2 over 0.5 mm
Midshore mud	1 x 0.01 m^2 over 1 mm
Midshore mud	1 x 0.5 m^2 over 5 mm
W. of Passage Point (15)	
Sublittoral fringe mud and mussel bed	2 x 0.01 m^2 over 1 mm
Lower shore mussel bed mud	Unquantitative sample
Lower midshore muddy gravel	1 x 0.1 m^2 over 1 mm
Upper midshore shingle	1 x 0.01 m^2 over 0.5 mm
Muddy Shore adjacent to Beggars Island (17)	
Lower midshore mud	1 x 0.01 m^2 over 0.5 mm
Opposite Black Rock (19)	
Lower shore mud and shingle	1 x 0.01 m^2 over 0.5 mm
Sandbank near Wacker Lake Buoy (20)	
Lower shore muddy sand and twigs	1 x 0.1 m^2 over 1 mm
Opposite Redshank Point (21)	
Lower midshore black anoxic mud and twigs	1 x 0.01 m^2 over 0.5 mm
Lower midshore black anoxic mud and twigs	1 x 0.1 m^2 over 1 mm
Opposite Erth Hill (23)	
Lower midshore mud	1 x 0.01 m^2 over 0.5 mm
S. of Pentillie Quay (24)	
Lower midshore mud	1 x 0.01 m^2 over 0.5 mm
Neil Point West Shore (25)	
Lower shore mud	1 x 0.01 m^2 over 0.5 mm
W. Shore below Tamar Bridge (26)	
Lower shore mud	1 x 0.01 m^2 over 0.5 mm
Lower midshore mud	1 x 0.01 m^2 over 0.5 mm
Opposite South Hooe (29)	
Lower midshore mud	1 x 0.01 m^2 over 0.5 mm
Lower midshore mud	1 x 0.1 m^2 over 1 mm
Cockle Bank (34)	
Lower shore mud and coarse sand	1 x 0.01 m^2 over 0.5 mm
Lower shore mud and coarse sand	1 x 0.1 m^2 over 1 mm
Lower midshore mud and sand	1 x 0.01 m^2 over 0.5 mm
Lower midshore mud and sand	1 x 0.1 m^2 over 1 mm
Midshore mud with sand	1 x 0.01 m^2 over 0.5 mm
Midshore mud with sand	1 x 0.1 m^2 over 1 mm
Upper midshore mud with sand	Unquantitative sample
Sandbank opposite Blagdons Boatyard (35)	
Lower midshore fine muddy sand	1 x 0.01 m^2 over 0.5 mm
Sandbank near Blue Circle Sluice (36)	
Lower midshore fine muddy sand	1 x 0.01 m^2 over 0.5 mm

Point Quay (37)	
Midshore mud	1 x 0.01 m^2 over 0.5 mm
Saltram Wood (38)	
Midshore mud and clay	1 x 0.01 m^2 over 0.5 mm
N. Saltrom Wood (39)	
Midshore china clay and mud	1 x 0.01 m^2 over 0.5 mm
Bovisand Bay Beach (42)	
Lower shore clean medium sand	1 x 0.01 m^2 over 0.5 mm
Lower shore clean medium sand	1 x 0.1 m^2 over 1 mm
Lower midshore clean medium sand	1 x 0.01 m^2 over 0.5 mm
Lower midshore clean medium sand	1 x 0.1 m^2 over 1 mm
Midshore clean medium sand	1 x 0.01 m^2 over 0.5 mm
Midshore clean medium sand	1 x 0.1 m^2 over 1 mm
Clovelly Bay Slip (44)	
Lower shore mud and shingle	1 x 0.01 m^2 over 0.5 mm
Lower shore mud and shingle	1 x 0.1 m^2 over 1 mm
Lower midshore muddy gravel	1 x 0.01 m^2 over 0.5 mm
Midshore mud and gravel	1 x 0.01 m^2 over 0.5 mm
Opposite Empacombe Quay (49)	
Lower shore mud	1 x 0.01 m^2 over 0.5 mm
Millbrook Lake (51)	
Lower midshore mud	1 x 0.01 m^2 over 0.5 mm
Lower midshore mud	1 x 0.1 m^2 over 1 mm
E. of Foss Point (53)	
Midshore mud	1 x 0.01 m^2 over 0.5 mm
Cellar Beach (55)	
Lower shore fine sand and shell gravel	1 x 0.1 m^2 over 1 mm
Lower shore fine sand and shell gravel	1 x 0.5 m^2 over 5 mm
Lower midshore fine sand and gravel	1 x 0.01 m^2 over 0.5 mm
S. of Madge Point (58)	
Lower shore coarse sand with shell gravel	1 x 0.01 m^2 over 0.5 mm
Steer Point Slip (60)	
Lower shore muddy sand and shale gravel	1 x 0.1 m^2 over 1 mm
Lower midshore muddy sand and shale gravel	1 x 0.01 m^2 over 0.5 mm
Lower midshore mud	1 x 0.01 m^2 over 0.5 mm
Lower midshore mud	1 x 0.1 m^2 over 1 mm
Midshore mud	1 x 0.01 m^2 over 5 mm
Midshore mud	1 x 0.1 m^2 over 1 mm
Crawl Wood Beacons (62)	
Midshore mud	1 x 0.01 m^2 over 0.5 mm
Midshore mud	1 x 0.1 m^2 over 1 mm

Table 3

Abundance of conspicuous species in selected rockpools. Sites are ordered from open coast to the most enclosed areas where rockpools were present. Species which were only recorded as Rare in one or more pools or which were Occasional in one pool are listed at the end. * = inconspicuous and not consistently recorded. + = under stones.

	Penlee Point (9a). UMS.	Penlee Point (9b). LMS.	Penlee Point (9c). LS with sand present.	Cawsand Bay South (6a). US. Algae only.	Cawsand Bay South (6b). LMS. Algae only.	Hooe Lake Point (10a). UMS.	Hooe Lake Point (10b). LMS.	Bovisand Bay South (43). LMS. (2 pools).	Jennycliff Bay (46a). UMS.	Jennycliff Bay (46b). MS. Animals only.	Jennycliff Bay (46c). LMS.	E. Tinside (40). MS/LMS.	Wilderness Point (3a). UMS. (Animals mostly under boulders).	Wilderness Point (3b). LMS. (Animals mostly under boulders).
ALGAE														
Ahnfeltia plicata	-	-	C	-	-	-	-	-	-	-	?O	-	-	-
Audouinella sp.	-	-	A	-	-	-	-	-	-	-	-	-	-	-
Calliblepharis jubata	-	R	-	-	-	-	F	C	-	-	-	-	-	-
Callithamnion sp.	-	-	-	-	-	-	-	-	-	-	-	F	-	R
Ceramium rubrum	F	F	F	C	C	O	F	-	F	-	-	F	O	S
Ceramium sp.	-	-	-	-	-	-	-	O	O	-	O	F	-	-
Chondrus crispus	-	O	F	F	O	-	-	-	C	-	-	F	R	R
Corallina officinalis	F	C	F	-	S	F	A	A	C	-	C	C	O	A
Cryptopleura ramosa	-	R	O	-	-	-	F	-	-	-	O	-	-	O
Cystoclonium purpureum	-	-	O	-	-	-	-	-	-	-	O	-	-	-
Dilsea carnosa	-	-	F	-	F	-	R	-	-	-	O	-	-	-
Dumontia incrassata	-	F	F	A	F	-	R	-	C	-	F	-	C	R
Furcellaria lumbricalis	-	-	-	F	-	-	-	-	-	-	O	-	-	-
Gastroclonium ovatum	-	C	-	-	O	-	O	-	-	-	C	-	-	-
Gelidium latifolium	-	-	-	-	R	-	-	-	-	-	-	F	-	-
Gelidium pusillum	-	-	-	-	?R	-	-	-	O	-	-	O	-	-
Gigfordia granulosa	-	F	-	-	-	-	-	-	-	-	-	-	-	-
Hildenbrandia sp.	-	-	-	-	-	-	-	O	-	-	-	-	F	F
Laurencia hybrida	-	-	-	R	-	-	-	-	F	-	O	-	-	-
Lomentaria articulata	-	O	O	-	F	-	-	O	O	-	F	F	-	R
Lomentaria clavellosa	-	O	O	-	-	-	-	-	-	-	O	-	-	-
Mesophyllum lichenoides	-	R	-	-	O	-	F	-	-	-	-	F	-	-
Palmaria palmata	-	R	F	O	-	O	O	F	O	-	-	C	-	F
Plumaria elegans	-	-	-	-	-	-	-	-	-	-	-	F	-	R
Polyides rotundus	-	-	F	-	-	-	-	-	-	-	F	-	-	S
Polysiphonia macrocarpa	-	-	F	-	-	-	-	-	-	-	-	-	-	-
Polysiphonia sp.	-	O	-	O	-	-	-	-	O	-	-	R	-	-
Rhodophyta indet. (dk. red encr.)	-	-	-	-	O	-	F	O	-	-	-	-		F
Rhodophyta indet. (pink encr.)	C	-	O	F	A	S	C	R	A	-	-	-	C	A
Scytosipnon lomentaria	R	-	-	-	-	F	-	O	O	-	-	-	-	-
Porphyra sp.	-	-	-	-	-	-	-	-	O	-	C	O	-	-
Bacillariophyceae indet. (colonial diatoms)	-	C	-	-	-	-	-	-	-	-	-	-	-	-
Asperococcus sp.	-	R	-	-	-	-	-	-	F	-	-	-	-	-
Bifurcaria bifurcata	-	-	-	-	-	-	A	-	-	-	-	-	-	-
Colpomenia peregrina	O	R	-	-	F	-	R	-	O	-	-	-	-	-
Desmarestia viridis	-	O	F	-	-	-	-	-	-	-	-	-	-	-
Ectocarpoidea indet.	-	F	-	-	-	F	F	-	C	-	-	-	-	F
Fucus serratus	-	R	-	O	-	-	-	O	-	-	-	-	-	-
Himanthalia elongata	R	C	-	-	-	-	F	A	O	-	-	F	-	-
Laminaria digitata	-	-	F	-	-	-	F	O	-	-	-	F	-	-
Laminaria hyperborea	-	-	F	-	O	-	F	-	-	-	-	-	-	-
Laminaria saccharina	-	O	F	O	F	-	-	-	-	-	-	-	-	R
Laminaria sp. (sporlings)	-	-	F	-	-	-	-	-	-	-	-	-	-	O
Petalonia sp./fascia	-	-	-	-	R	-	R	-	F	-	-	-	R	-
Phaeophyta indet. (filam.)	C	-	-	-	-	-	-	-	C	-	-	-	-	-
Sargassum muticum	O	C	R	C	-	-	-	-	F	-	-	-	-	-
Cladophora rupestris	-	-	-	-	-	-	-	-	-	-	-	-	-	F
Cladophora ?pellucida	-	-	-	C	-	-	-	-	-	-	-	-	-	-
Cladophora sp.	F	O	F	-	-	-	-	-	-	-	-	F	-	F
Enteromorpha sp.	-	-	-	-	-	-	-	-	-	-	-	F	-	-
Punctaria sp.	O	R	?F	-	-	-	-	-	-	-	-	-	-	-
Ulva sp.	F	A	F	-	-	C	E	-	-	-	-	C	O	-

ANIMALS														
Hymeniacidon perleve	-	-	-	-	-	-	-	-	-	-	-	F	-	R
Porifera indet. (brown, slimy)	-	-	-	-	-	-	-	-	-	-	F	-	-	-
Campanularia flexuosa	-	-	-	-	-	-	-	-	-	-	-	C	-	O
Actinia equina	O	R	-	-	-	R	-	F	-	-	O	O	-	-
Anemonia viridis	-	-	O	-	-	O	-	O	-	-	-	-	-	-
Urticina felina	-	-	F	-	-	-	-	-	-	-	-	-	R	-
Polydora sp.	-	-	-	-	-	-	-	-	-	-	-	A	-	A
Spirorbis tridentatus	-	-	-	-	-	-	-	-	-	-	F	-	-	-
Spirorbinidae indet. (on Corallina)	-	-	-	-	-	-	-	-	F	-	F	-	-	-
Spirorbinidae indet. (on rock)	-	-	-	-	-	-	O	-	-	-	-	-	-	C
Spirorbis pagenstecheri	-	-	-	-	-	-	-	-	-	-	-	-	-	C
Elminius modestus	-	-	-	-	-	-	-	-	O	-	-	-	C	O
Verruca stroemia	-	-	-	-	-	-	F	-	-	-	-	C	-	-
Amphipoda indet. *	F	-	-	-	-	-	-	-	F	F	-	-	-	-
Palaemon serratus	-	-	P	-	-	-	-	-	O	F	-	-	F	-
Gibbula cineraria	-	-	O	-	-	-	F	-	-	-	C	-	R	F
Gibbula umbilicalis	O	-	-	-	-	F	-	O	F	-	-	O	F	O
Littorina littorea	O	-	-	-	-	-	-	-	S	-	C	-	C	R
Monodonta lineata	O	-	-	-	-	-	-	-	A	-	-	-	-	-
Nassarius incrassatus *	-	-	F	-	-	-	O	-	-	-	-	-	-	O
Patella vulgata	O	-	-	-	-	C	-	A	O	-	-	-	-	P
Rissoa sp. *	-	P	P	-	-	O	-	-	C	-	-	-	-	-
Buncina coronata	-	-	-	-	-	-	R	F	-	-	-	-	-	-
Heteranomia squamula	-	-	-	-	-	-	O	-	-	-	-	-	F	F
Amphipnolis squamata	-	O	-	-	-	-	-	-	-	O	P	-	-	-
Asterina gibbosa	-	-	-	-	-	-	-	-	-	-	F	-	-	-
Botrylloides leachii	-	R	-	-	-	-	-	-	-	-	-	O	-	O

Taxa recorded as 'Rare' in one or more pools or which were Occasional in one pool are as follows:

Apoglossum ruscifolium (O, 40; R, 3b), Calliblepharis ciliata (O, 43), Callophyllis lacineata(R, 10b), Ceramium ciliatum (O, 9b), Ceramium echionotum (R, 10b), Chylocladia verticillata (R, 3b; R, 10b), Delesseria sanguinea (O, 9b), Heterosiphonia plumosa (R, 43), Hypoglossum woodwardii (O, 4b), Laurencia pinnatifida (R, 10b), Phyllophora membranifolia (O, 6b), Polyneura sp. (R, 9c; R, 3b), Polysipnonia nigrescens (R, 9b), Polysiphonia urceolata (R, 10b), Polysiphonia ?violacea (R, 40), Rhodomela conferroides (O, 9c; R, 3b), Cladostephus spongiosus (R, 6a; O, 40), Chorda tomentosa (O, 9c), Desmarestia ligulata (R, 9b), Desmarestia aculeata (P, 43), Dictyota dichotoma (O, 46a), Elachista scutulata (R, 9a), Phaeophyta indet. (encr.) (O, 3a), Saccorhiza polyschides (R, 9c), Chaetomorpha melagonium (R, 40; R, 3b), Cliona sp. (boring) (R,40; P, 3b), Scypna compressa (O, 40), Scypha ciliata (O, 10b), Halichondria panicea (O, 40; R, 3b), Leucosolenia botryoides (O, 3b), Clava squamata (R, 3b), Tubularia indivisa (R, 9c), Plumularia setacea (O, 40), Dynamena pumila (O, 3b), Bunodactis verrucosa (R, 9b; O, 9c), Cereus pedunculatus (R, 40), Turbellaria indet. (tiny, orange) (P, 9b), Aphroditidae indet. (R, 10b; R, 46c), Cirratulus cirratus (P, 46b; P, 46c), Eulalia viridis (O, 40), Halosydna gelatinosa (R, 3b),Pomatoceros sp.(R, 46a; R, 40; O, 3b), Apherusa jurenii (P, 9a), ?Gamarellus angulatus (P, 9c), Idotea granulosa (P, 9b), Idotea pelogica (P, 9b), Cancer pagurus+ (R, 10b; R, 46c), Carcinus maenas (R, 43; R, 46a; R, 40; O, 3b), Galathea squamifera+ (R, 10b), Liocarcinus puber (R, 40), Pagurus bernhardus (R, 9b; R, 10b; R, 3a), Pisidia longicornis+ (R, 10b), Porcellana platycheles+ (R, 10b; R, 46c), Siriella jaltensis (P, 9c), Calliostoma zizyphinum (R, 10b), Crepidula fornicata (R, 3b) (R, 10b), Littorina 'saxatilis' (O, 9a; R, 3a), Lepidochitona cinereus (R, 3b), Littorina mariae (P, 46a), Nucella lapillus (R, 10b; R, 46a), Ocenebra erinacea (R, 3b), Archidoris pseudoargus (R, 9b), Hiatella arctica (R, 10a), Modiolus sp. (R, 43), Acanthochitona crinitus (R, 40), Ophiothrix fragilis* (R, 10b), Psammechinus miliaris (R, 46c; R, 3a), Ciona intestinalis (R, 3a; R, 3b), Dendrodoa grossularia (O, 40), Polyclinidae indet. (R, 46c), Blennius pholis (R, 10b; O, 43; R, 3b), Cottus scorpius (R, 9b; R, 10b; R, 46b; R, 3b).

TABLE 4

Communities of conspicuous species on intertidal rock at Jennycliff Bay (Site 46)

Splash zone. Broken steeply sloping shale at 5.5 to 8 m. (Angiosperms only near the top, Littorinids only near the bottom)	Upper shore. Broken shale at 4.5 to 5.5 m.	Upper midshore Broken shale platform at 3.0 to 4.5 m.	Midshore broken shale platform at 2.0 to 3.0m	Lower midshore broken shale bedrock. Platform (height not recorded)	Lower shore broken shale bedrock (height not recorded)
SUPERABUNDANT SPECIES	Littorina 'saxatilis'				
ABUNDANT SPECIES Ochrolechia parella	Fucus spiralis Verrucaria maura	Chthamalus montagui Patella vulgata	Fucus vesiculosus Gibbula umbilicalis	Rhodophyta indet. (encr.) Fucus serratus Patella vulgata	Palmaria palmata Himanthalia elongata Laminaria digitata
COMMON SPECIES Caloplaca marina 'Grey lichens' Xanthoria parietina Festuca rubra Plantago maritima Littorina 'saxatilis'	Chlorophyta indet. (filam.) Chthamalus montagui	Monodonta lineata	Gelidium pusillum Mastocarpus stellatus Laurencia pinnatifida Polysiphonia lanosa Corallinaceae indet. (encr.) Ascophyllum nodosum Chthamalus montagui Elminius modestus Littorina mariae Patella depressa Patella vulgata	Mastocarpus stellatus Laurencia pinnatifida Palmaria palmata Corallinaceae indet. (encr.) Porphyra sp.	Chondrus crispus Lomentaria articulata Rhodophyta indet. (encr.)
FREQUENT SPECIES Lecanora atra Lichina confinis Verrucaria maura Littorina neritoides	Pelvetia canaliculata Enteromorpha sp. Semibalanus balanoides Anurida maritima Littorina neglecta	Fucus vesiculosus Enteromorpha sp. Chthamalus stellatus Elminius modestus Anurida maritima Littorina littorea Littorina neglecta	Chondrus crispus Campanularia flexuosa Balanus perforatus Hyale nilssoni Littorina littorea Nucella lapillus	Chondrus crispus Corallina officinalis Dumontia incrassata Laurencia hybrida Himanthalia elongata Spirorbinidae indet. (on 'lithothamnia') Gibbula cineraria Alcyonidium hirsutum	Corallina officinalis Cystoclonium purpureum Dumontia incrassata Gelidium latifolium Mastocarpus stellatus Porphyra sp. Fucus serratus Phaeophyta indet. (filam.) Spirorbinidae indet. (on 'lithothamnia') Dendrodoa grossularia Electra pilosa
OCCASIONAL SPECIES Ramalina sp. Ligia oceanica	Ligia oceanica Littorina neritoides	Gelidium pusillum Mastocarpus stellatus Laurencia pinnatifida Corallinaceae indet. (encr.) Ascophyllum nodosum Verrucaria mucosa Semibalanus balanoides	Corallina officinalis Dumontia incrassata Laurencia hybrida Rhodophyta indet. (encr.) Cladophora sp. Enteromorpha sp. Ulva sp. Dictyota dichotoma Dynamena pumila Spirorbinidae indet. (on fucoids) Chthamalus stellatus Semibalanus balanoides Littorina 'saxatilis' Littorina obtusata Umbonula littoralis	Cystoclonium purpureum Lomentaria clavellosa Dynamena pumila Pomatoceros sp. Littorina mariae Littorina obtusata Patella depressa Electra pilosa	Apoglossum ruscifolium Calliblepharis jubata Ceramium rubrum Ceramium sp. Dilsea carnosa Gastroclonium ovatum Laurencia pinnatifida Lomentaria clavellosa Laminaria ?hyperborea Laminaria saccharina Cladophora sp. Ulva sp.
RARE SPECIES		Gibbula umbilicalis Littorina 'saxatilis'		Hymeniacidon perleve Nucella lapillus Runcina coronata Liocarcinus puber	

Table 5

Species present under overhangs in the area of Plymouth Sound and the entrance to the Yealm. Ordered from open sea to the most enclosed sites but with the Yealm site last. Algae were not recorded from Sites 10 and 43. Taxa which were Rare or Occasional at only one site are listed at the end of the table.

	Overhangs on the lower shore at Bovisand Bay South (Site 43). (Animals only).	Overhangs on the lower shore at Houe Lake Point (Site 10). (Animals only).	Overhangs on the lower shore at Jennycliff Bay (Site 46).	Midshore to lower midshore overhangs at Drakes Island (Site 53).	Overhangs on the lower shore at the Inside Swimming Pool (Site 65).	Vertical and overhanging limestone rock at 0.8 to 1 m at Wilderness Point (Site 3).	Overhangs and small caves on the lower shore below +2 m at Cellar Beach, Yealm (Site 55).
ALGAE							
Apoglossum ruscifolium	-	-	F	-	-	F	F
Audouinella sp.	-	-	-	O	-	-	-
Ceramium rubrum	-	-	-	F	-	-	-
Ceramium sp.	-	-	-	A	-	-	-
Gelidium latifolium	-	-	F	-	-	-	-
Gelidium pusillum	-	-	O	C	-	-	O
Laurencia pinnatifida	-	-	O	F	-	-	-
Lomentaria articulata	-	-	O	C	-	-	A
Lomentaria clavellosa	-	-	O	C	-	O	O
Mastocarpus stellatus	-	-	-	C	C	-	A
Membranoptera alata	-	-	-	-	-	R	O
Palmaria palmata	-	-	O	-	A	F	O
Plumaria elegans	-	-	O	F	-	F	A
Rhodophyta indet. (dk. red encr.)	-	-	F	O	O	-	-
Rhodophyta indet. (pink encr.)	-	-	C	F	O	F	-
Porphyra sp.	-	-	O	R	-	-	-
Cladostephus spongiosus	-	-	O	O	-	-	-
Ectocarpoidea indet.	-	-	F	-	-	O	-
Himanthalia elongata	-	-	-	-	F	-	-
Laminaria digitata	-	-	-	-	F	-	-
Laminaria sp. (sporlings)	-	-	C	-	-	F	-
Phaeophyta indet. (filam.)	-	-	F	F	-	-	-
Bryopsis plumosa	-	-	-	-	O	R	O
Cladophora rupestris	-	-	-	-	-	F	-
Ulva sp. (p)	-	-	-	O	F	-	O
ANIMALS							
Leucosolenia botryoides	-	-	O	-	O	-	-
Scypha ciliata	-	-	-	-	-	R	R
Scypha compressa	F	R	-	O	-	R	C
Cliona sp. (boring)	-	R	-	-	O	-	-
Halichondria ?bowerbanki	-	-	-	-	F	-	-
Halichondria panicea	C	F	O	C	-	O	C
Hymeniacidon perleve	F	O	-	C	-	O	C
Myxilla sp.	R	-	R	-	-	-	F
Dynamena pumila	R	-	-	O	-	-	-
Campanularia flexuosa	-	-	-	C	-	-	-
Plumularia setacea	-	-	-	-	F	-	-
Actinia equina	-	-	-	F	-	-	-
Corynactis viridis	-	-	-	-	F	-	-
Sagartia elegans	-	-	-	C	-	-	-
Urticina felina	-	F	-	-	-	-	C
Metridium senile	-	-	-	-	-	-	-
Eulalia viridis	-	-	O	O	-	-	-
Polydora sp.	-	-	-	F	-	A	-
Pomatoceros sp. (p)	-	O	O	O	-	-	F
Spirorbinidae - on rock	-	-	C	O	-	-	F
Balanus perforatus	-	C	-	C	-	-	-
Tigriopus fulvus	A	-	-	-	-	-	-
Calliostoma zizyphinum	O	O	R	F	-	-	-
Gibbula cineraria	-	O	C	O	-	-	-
Gibbula umbilicalis	-	-	-	O	-	-	R
Nassarius incrassatus	-	R	-	O	-	-	-
Nucella lapillus	R	-	-	R	-	-	-

Ocenebra erinacea	-	R	O	R	-	-	-
Patella aspera	A	-	-	-	-	-	-
Patella vulgata	O	-	-	-	-	-	-
Patina pellucida	F	-	-	-	-	-	-
Archidoris pseudoargus	R	-	-	-	-	-	R
Goniodoris nodosa	-	-	O	-	-	F	-
Rissoidae indet.	F	-	-	-	-	-	-
Heteranomia squamula	-	O	-	O	-	-	O
Flustrellidra hispida	-	F	-	-	-	-	C
Scrupocellaria reptans	R	F	-	-	-	-	-
Umbonula littoralis	C	C	-	O	-	-	O
Asterina gibbosa	-	-	F	-	-	-	-
Botrylloides leachii	O	-	-	O	C	O	O
Botryllus schlosseri	C	F	-	O	-	-	-
Dendrodoa grossularia	-	-	C	-	-	A	-
Morchellium argus	-	-	-	-	O	-	F
Polyclinidae indet.	F	R	P	-	-	-	-
Sidnyum turbinatum	-	-	-	O	-	-	F

Taxa recorded as 'Rare', 'Occasional' or 'Present' at only one site are as follows: Antithamnion cruciatum (P, 46), Antithamnion sp. (O, 55), ?Callithamnion sp. (P, 46), Callithamnion/Antithamnion sp. (O, 46), Callphyllis lacineata (O, 3), Cryptopleura ramosa (O, 53), Hypoglossum woodwardii (O, 55), Phyllophora pseudoceranoides (O, 55), Polysiphonia ?urceolata (R, 46), Polysiphonia sp. (O, 46), Cladophora sp. (O, 46), Fucus serratus (O, 63), Fucus serratus (sporlings) (O, 53), Laminaria hyperborea (O, 63), Laminaria saccharina (O, 63), Leathesia difformis (O, 53), Cladophora sp. (O, 53), Enteromorpha sp. (R, 3), Clathrina coriacea (R, 55), Leuconia barbata (O, 10), ?Haliclona simulans (R, 10), Myxilla incrustans (O, 10), Microciona astrasanguinea (R, 10), Ophlitaspongia seriata (R, 43), Porifera indet. (yellow, slimy) (O, 10) Microciona atrasanguinea (R, 10), Oscarella lobularis (O, 63), Suberites sp. (R, 55), ?Clava sp. (R, 53), Tubularia indivisa (O, 63), Obelia sp. (O, 43), Cereus pedunculatus (O, 43), Diadumene cincta (O, 53), Sagartiogeton undatus (O, 55), Nereis sp. (R, 53), Liocarcinus puber (R, 55), Acanthochitona crinitus (R, 53), ?Jorunna tomentosa (R, 55), Anomiidae indet. (R, 55), Hiatella arctica (O, 3), Monia squama (R, 55), Bugula plumosa (O, 10), Crisia sp. (O, 10), Didemnidae indet. (O, 10), Sidnyum elegans (O, 43).

TABLE 6

Communities of conspicuous species on intertidal rock at E. Tinside (Mens Bathing Area) Site 40

Splash zone (plants only)	Upper shore pitted limestone with some overhangs. * = in damp places.	Midshore pitted limestone with many vertical surfaces and some damp places	Lower midshore broken limestone bedrock	Lower shore limestone
EXTREMELY ABUNDANT SPECIES				
				Polydora sp.
SUPERABUNDANT SPECIES				
	Chthamalus montagui Littorina 'saxatilis'	Chthamalus montagui		
ABUNDANT SPECIES				
	Patella vulgata	Patella vulgata	Palmaria palmata Fucus serratus Polydora sp.	Himanthalia elongata
COMMON SPECIES				
	Chthamalus stellatus Littorina neglecta	Chthamalus stellatus Semibalanus balanoides	Ceramium sp. Gelidium pusillum Laurencia pinnatifida Lomentaria articulata Rhodophyta indet. (filam.)	Corallina officinalis Gelidium pusillum Mastocarpus stellatus
FREQUENT SPECIES Calloplaca marina Festuca rubra	Anurida maritima Littorina neritoides	Actinia equina	Chondrus crispus Corallina officinalis Mastocarpus stellatus Plumaria elegans Halichondria panicea Littorina obtusata	Chondrus crispus Gastroclonium ovatum Lomentaria articulata Laminaria digitata Laminaria saccharina Ulva sp. Hymeniacidon perleve
OCCASIONAL SPECIES Calloplaca thallincola 'Grey lichens' Verrucaria maura Xanthoria parietina Plantago maritima	'Grey lichens' Verrucaria maura Semibalanus balanoides Mytilus edulis *	Callithamnion sp. Ceramium sp. Laurencia pinnatifida Enteromorpha sp. Ulva sp. Lichina pygmaea Elminius modestus Nucella lapillus	Gelidium latifolium Laurencia hybrida Polysiphonia sp. Corallinaceae indet. (encr. Scytosiphon lomentaria Cladostephus spongiosus Himanthalia elongata Ulva sp. Hymeniacidon perleve Balanus perforatus Littorina mariae Electra pilosa	Laurencia pinnatifida Plumaria elegans Corallinaceae indet. (encr.) Bacillariophyceae indet. Fucus serratus Cladophora sp.
RARE SPECIES				
	Hyale nilssoni	Hymeniacidon perleve Balanus perforatus	Scypha ciliata Pomatoceros sp. Verruca stroemia Heteranomia squamula Hiatella arctica	Scypha ciliata Halichondria panicea Pomatoceros sp. Botrylloides leachii

TABLE 7

Communities of conspicuous species on slate bedrock at Black Rock on the River Lynher (Site 2)

Splash zone at +5.2 m and above (not including saltmarsh and terrestrial angiosperms)	Upper shore steeply sloping rock at +4.4 to 5.0 m. * = under Pelvetia	Upper midshore broken gently sloping rock at +3.3 to 4.4 m.	Lower midshore (lowest rock) at +1.2 m. (Incomplete records for animals).
EXTREMELY ABUNDANT SPECIES			
	Fucus spiralis Pelvetia canaliculata	Ascophyllum nodosum	Ascophyllum nodosum
SUPERABUNDANT SPECIES Xanthoria parietina Verrucaria maura (locally)			
ABUNDANT SPECIES Calloplaca thallincola 'Grey lichens'			
COMMON SPECIES Calloplaca marina	Catenella caespitosa * Fucus sp. (sporlings) * Enteromorpha sp. Hyale nilsonni	Chaetogammarus marinus	Dynamena pumila Elminius modestus
FREQUENT SPECIES			
	Bostrychia scorpioides	Polysiphonia lanosa Ascophyllum nodosum (sporlings) Clava squamata Dynamena pumila Elminius modestus Littorina obtusata Bowerbankia imbricata	Audouinella sp. Rhodophyta indet. Fucus serratus ?Phaeophyta indet. (encr.) Clava squamata
OCCASIONAL SPECIES			
	Elminius modestus Carcinus maenas Anurida maritina Littorina 'saxatilis'	Audouinella sp. Fucus sp. (sporlings) Actinia equina ?Cirratulus cirratus Hyale nilsonni Carcinus maenas Littorina mariae	Fucus vesiculosus Actinia equina
RARE SPECIES			
			Mytilus edulis
PRESENT, NO RECORD OF ABUNDANCE			
		Alcyonidium hirsutum	Jaera albifrons

TABLE 8

Communities of conspicuous species on bedrock and boulders at the entrance to the Yealm, Cellar Beach (Site 55)

Broken rock platform and boulders above midshore level. * = on algae	Broken vertical rock above midshore level * = on algae	Broken rock platform and boulders below midshore level * - on algae	Broken vertical rock surfaces below midshore level. * = on algae.	Vertical and overhanging broken shale bedrock at 11 to 12 m at Site 71.
SUPERBABUNDANT SPECIES				
		Fucus serratus		
ABUNDANT SPECIES				
Fucus vesiculosus	Laurencia pinnatifida Chthamalus montagui Patella vulgata	Laurencia pinnatifida	Mastocarpus stellatus Laurencia pinnatifida Lomentaria articulata	
COMMON SPECIES				
Laurencia pinnatifida Rhodophyta indet. (encr.) Fucus spiralis Semibalanus balanoides Littorina 'saxatilis' Littorina littorea Patella vulgata	Audouinella sp. Catenella caespitosa Ceramium shuttleworthianum Gelidium pusillum Rhodophyta indet. (encr.) Bacillariophyceae indet. Phaeophyta indet. (filam.) Chlorophyta indet. (filam.) Ulva sp. Verrucaria maura Semibalanus balanoides Littorina 'saxatilis'	Ceramium rubrum Corallinaceae indet. (encr.) Ulva sp. Spirorbinidae indet. (on encr. calc. algae) Spirorbinidae indet. (on fucoids) Semibalanus balanoides Patella vulgata	Gelidium pusillum Plumaria elegans Fucus serratus Patella vulgata Electra pilosa *	Phyllophora trailii Obelia dichotoma Cirripedia indet. (juv.)
FREQUENT SPECIES				
Audouinella sp. Gelidium pusillum Mastocarpus stellatus Corallinaceae indet. (encr.) Fucus serratus Phaeophtya indet. (filam.) Enteromorpha sp. Actinia equina Chthamalus montagui Gibbula umbilicalis Littorina mariae Littorina neglecta	Ceramium rubrum Lomentaria articulata Fucus serratus Fucus spiralis Cladophora sp. Gibbula umbilicalis Littorina littorea	Ceramium shuttleworthianum Chondrus crispus Corallina officinalis Dumontia incrassata Mastocarpus stellatus Laurencia hybrida Lomentaria articulata Palmaria plamata Cladostephus spongiosus Laminaria saccharina Phaeophyta indet. (filam.) Sargassum muticum Cladophora sp. Enteromorpha sp. Dynamena pumila * Actinia equina Pomatoceros sp. Littorina mariae Littorina obtusata Patella depressa Alcyonidium gelatinosum * Flustrellidra hispida *	Ceramium shuttleworthianum Corallina officinalis Dumontia incrassata Hypoglossum woodwardii Laurencia hybrida Membranoptera alata Palmaria palmata Halichondria panicea Hymeniacidon perleve Elminius modestus Semibalanus balanoides Flustrellidra hispida *	Rhodophyta indet. (encr., red) Bryozoa indet. (encr.) Asterina gibbosa Morthasterias glacialis Cucumaea indet. Diplosoma listerianum Morchellium argus
OCCASIONAL SPECIES				
Ceramium shuttleworthianum Laurencia hybrida Lomentaria articulata Ulva sp. ?Verrucaria mucosa Campanularia flexuosa * Chthamalus modestus Elminius modestus Anurida maritima Monodonta lineata	Mastocarpus stellatus Laurencia hybrida Fucus vesiculosus Verrucaria mucosa Chthamalus stellatus Elminius modestus Littorina neglecta	Gastroclonium ovatum Plumaria elegans Polyides rotundus Polysiphonia sp. Rhodophyta indet. (encr.) Halichondria panicea Hymeniacidon perleve Clava squamata * Campanularia flexuosa * Actiniae indet. (small) Cirratulus cirratus Balanus perforatus Umbonula littoralis	Ceramium rubrum Chondrus crispus Lomentaria clavellosa Phyllophora pseudoceranoides Polysiphonia urceolata Rhodophyta indet. (encr.) Sargassum muticum Ulva sp. Campanularia flexuosa * Spirorbinidoe indet. (on rock) Balanus perforatus Gibbula umbilicalis Heteranomia squamula	Acrosarium uncinatum Drachiella spectabilis Lomentaria darellosa Meredithia microphylla Phyllophora crispa
RARE SPECIES				
Hymeniacidon perleve Anemonia viridis Eulalia viridis Pomatoceros sp. Carcinus maenas		Calliblepharis jubata Laminaria digitata Fucus ceranoides/vesiculosus Actinia fragacea Blennius pholis Littorina littorea		Apoglossum ruscifolium Laminaria digitata Scypha ciliata Urticina felina
PRESENT, NO RECORD OF ABUNDANCE				
Porphyra sp. * Pelvetia canaliculata	Porphyra sp. * Ascophyllum nodosum			

TABLE 9

Species sampled in dredge hauls and one suction sample from subtidal sediments. Abundances are semi-quantitative according to the following scale:-

Code	Numbers in sample
A	1 - 2
B	3 - 9
C	10 - 49
D	50 - 199
E	200 - 499
F	500 +
P	Present

Characters in the first column mark those species that are either not recorded in the Plymouth Marine Fauna (PMF) or in Gibbs (1969) in the case of the polychaetes (*), recorded in the PMF but not for Plymouth Sound or its associated estuaries (P) or recorded in the PMF but not for the Yealm estuary (Y). Taxanomic nomenclature is according to the several texts listed in Volume 2 of this report or to references in the notes column. Names given in the notes column are the names under which they are recorded in the PMF. The following table gives details of the samples taken and Fig. 11 shows their location.

S1 South of Breakwater. 12m bcd suction sample.
D15 East end Breakwater. 12m bcd ca. 4 1 coarse shell sand.
D8 Cawsands Bay. 9m bcd ca. 15 1 muddy sand and shell sand.
D9 North of Breakwater. 8m bcd ca. 30 1 soft mud and mud tubes.
D13 Mid. Sound. 8m bcd ca. 30 1 muddy sand and gravel.
D14 Jennycliff Bay. 5m bcd ca. 30 1 sandy mud and tubes.
D12 N.E. Drakes Island. 5m bcd ca. 7 1 muddy gravel and sand.
D7 Off Devonport. 31m bcd ca. 8 1 rubble and shell gravel.
D1 South of Saltash Bridge. 6m bcd ca. 20 1 glutinous mud with stones.
D6 Off Warren Point. 2.5m bcd ca. 30 1 soft mud.
D5 Cargreen. 3.5m bcd ca. 10 1 muddy sand and twigs.
D4 South Hooe. 1.5m bcd ca. 8 1 fine 'gravel' and twigs.
D3 Off Ince Point. 3m bcd ca. 25 1 glutinous mud and shell gravel.
D2 Dandy Hole. 4m bcd ca. 7 1 black mud, leaves and twigs.
D11 West Cattewater. 4.5m bcd ca. 30 1 black glutinous mud.
D10 East Cattewater. 2m bcd ca. 30 1 black mud and white clay.
D21 Yealm sand bar. 0-3m bcd ca. 10 1 silty sand.
D20 Off Cellar Beach. 1m bcd ca. 8 1 silty sand and gravel.
D19 Newton Ferrers entrance. 0.5m acd ca. 10 1 muddy coarse sand.
D18 Off Madge Point. 3.5m bcd ca. 15 1 mud and shell gravel.
D16 West Shortaflete Creek. 2m bcd ca. 30 1 muddy sand with gravel.
D17 East of Steer Point. 0m bcd ca. 15 1 mud, gravel and twigs.

*	Name	S1	015	08	09	013	014	012	07	01	06	05	04	03	02	010	011	017	016	018	019	020	021	Notes (name in PMF)
	PORIFERA																							
	Porifera indet.	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Scypha ciliata	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Sycon ciliatum
	COELENTERATA - HYDROZOA																							
	Hydractinia echinata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	
	COELENTERATA - ANTHOZOA																							
	Actiniaria indet.	-	A	-	-	B	-	B	A	-	-	-	-	B	-	-	-	-	-	-	-	A	A	
	Cerianthus lloydi	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Edwardsia claparedii	-	-	-	B	B	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	E.callimorpha
	Sagartia troglodytes	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-	
	Virgularia mirabilis	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	PLATYHELMINTHES																							
	Turbellaria indet.	-	-	-	A	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	NEMERTEA																							
	?Cerebratulus sp.	-	-	C	B	A	B	B	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	
	Nemertea indet. (sp.1, slimy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	
	Nemertea indet. (sp.2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	
	Nemertea indet. (sp.3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	
	Nemertea indet. (sp.4)	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	
	?Tubulanus spp.	-	-	B	B	B	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	
	NEMATODA																							
	Nematoda indet.	-	A	A	-	-	-	-	-	-	-	-	-	-	-	-	B	-	-	-	-	-	A	
	ECHIURA																							
	?Thalassema thalassemum	-	-	A	A	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	T.neptuni
	ANNELIDA - ARCHIANNELIDA																							
	Polygordius lacteus	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	
	ANNELIDA - POLYCHAETA																							
Y	Amphareta acutifrons	-	-	-	-	-	-	-	-	-	A	-	-	A	-	-	A	A	B	-	-	A	-	
*	Amphareta lindstroemi	-	-	A	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
P	Amphicteis gunneri	-	-	B	-	B	-	C	C	-	-	-	-	A	-	-	-	-	-	-	-	-	-	
Y	Anaitides maculata	-	-	B	A	B	C	A	B	-	-	-	-	A	-	-	A	A	A	A	-	A	-	Phyllodoce maculata
	Aonides oxycephala	-	B	-	-	-	-	B	A	-	-	-	-	-	-	-	-	-	B	D	C	A	-	
	Arenicola marina	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Autolytus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	
A	Capitella capitata	-	-	-	-	-	-	-	-	-	-	B	-	-	-	C	-	B	B	-	C	-	-	
	Chaetozone setosa	-	-	D	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	
	Caulleriella sp.	-	B	D	D	C	F	C	-	-	-	-	-	-	-	-	F	-	-	-	-	-	-	
*	Chone filicaudata	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Cirratulus cirratus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	C	C	-	-	-	-	-	-	
	Clymenura clypeata	-	A	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Leichone leiopygos
	Eteone longa	-	-	A	-	-	B	-	B	A	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y	Euclymene oerstedi	-	A	A	-	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
*	Euclymeninae indet.	-	A	-	A	B	D	B	-	-	-	-	-	-	-	-	-	-	-	-	-	A	A	
	Eumida sanguinea	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	Eulalia sanguinea
	Eunereis longissima	-	-	-	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	B	-	-	-	
	Exogone hebes	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
P	Gattyana cirrosa	-	A	A	-	A	-	B	-	A	-	-	-	A	-	-	A	-	A	A	-	A	-	
	Glycera lapidum	-	B	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	
	Glycera tridactyla	P	-	A	A	A	A	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	G.convoluta
	Goniada maculata	-	-	-	-	B	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Gyptis propinqua	-	-	A	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Oxydromus propinqus
*	Harmothoe ?fragilis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	
PY	Harmothoe glabra	-	-	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	H.longisetis
	Harmothoe impar	-	-	-	A	-	-	-	C	-	-	-	-	A	-	-	-	-	-	-	-	-	-	
	Heteromastus filiformis	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Hydroides norvegica	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Jasmineira elegans	-	-	A	-	-	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y	Kefersteinia cirrata	-	B	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	
Y	Langerhansia cornuta	-	B	A	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	A	-	-	-	Syllis cornuta
Y	Lanice conchilega	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	B	B	-	A	B	B	
	Laonice cirrata	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Lumbrineris latreilli	P	-	A	C	C	D	B	B	-	-	-	-	-	-	-	A	-	-	B	A	-	A	Lumbriconereis latreilli
	Magelona alleni	P	-	C	C	A	C	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M.cincta
	Magelona filiformis	-	-	C	-	C	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	M.sp.
*	Magelona minuta	-	-	A	-	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Magelona mirabilis	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M.papillicornis
	Marphysa belli	P	-	-	-	B	C	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y	Melinna palmata	-	B	B	F	D	F	C	-	A	B	-	-	A	-	A	C	-	C	-	A	B	-	
	Myriochele sp.	-	-	B	B	A	C	-	-	-	-	-	-	-	-	C	-	-	-	-	-	-	-	c.f. Gibbs, 1969
	Nematonereis unicornis	-	-	-	-	A	-	B	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Nephtys caeca	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	
	Nephtys hombergi	-	-	C	B	B	-	-	-	B	C	A	-	B	B	B	C	-	-	-	B	-	-	
p	Nephtys hystricis	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Nephtys sp. (juv.)	-	-	-	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y	Nereis diversicolor	-	-	-	-	-	-	-	-	-	A	A	B	-	-	A	-	C	-	-	A	-	-	
	Nereis irrorata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	B	A	

	Name	S1	D15	D8	D9	D13	D14	D12	D7	D1	D6	D5	D4	D3	D2	D10	D11	D17	D16	D18	D19	D20	D21	Notes (name in PMF)
	Nereis pelagica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	
	Nereis sp. (juv.)	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Nereis virens	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	
	Notomastus latericeus	-	-	B	B	C	C	A	B	A	-	-	-	A	-	-	-	B	B	C	A	A	A	
	Ophelina acuminata	-	-	-	A	A	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	Ammotrypane aulogaster
P	Ophiodromus flexuosus	-	-	A	B	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y	Owenia fusiformis	-	-	A	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	
	Pectinaria auricoma	-	-	A	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y	Pectinaria koreni	P	-	B	-	A	-	-	-	-	B	-	-	-	-	-	-	-	A	-	-	-	-	
	Pholoe minuta	-	-	A	-	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Platynereis dumerili	-	-	-	-	-	B	A	-	-	-	-	-	-	-	-	-	-	-	-	-	B	C	
*	Pisione remota	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
P	Pista cristata	-	A	-	-	A	B	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Poecilochaetus serpens	-	-	-	-	A	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y	Polycirrus sp.	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	C	A	-	A	-	
*	Polydora pulchra	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Polydora sp.	-	-	-	-	-	-	-	-	-	B	-	-	B	A	-	-	-	-	-	-	-	-	
Y	Pomatoceros sp.	-	-	-	-	-	-	C	E	B	-	-	-	A	-	-	-	-	-	P	-	-	-	
*	Prionospio malmgreni	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
*	Prionospio multibranchiata	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Procerea cornuta	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	Autolytus cornutus
*	Protodorvillea kefersteini	-	A	A	-	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	B	-	
	Pygospio elegans	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	
	Scalibregma inflatum	-	-	C	D	B	C	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
*	Schistomeringos caeca	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
*	Scolelepis tridentata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	
	Scoloplos armiger	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	
PY	Sigalion mathildae	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	
	Sphaerosyllis sp.	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	
P	Spio filicornis	-	B	B	-	A	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	A	
*	Spio martinensis	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	B	C	
P	Spiophanes bombyx	-	-	B	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	
	Sthenelais boa	-	-	-	-	A	-	A	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
P	Sthenelais limicola	-	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y	Streblospio shrubsoli	-	-	-	-	-	-	-	-	-	C	A	-	-	B	-	-	-	-	-	-	-	-	
	Syllidia armata	-	-	C	-	-	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Magalia perarmata
Y	Syllis gracilis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	
	Tharyx sp.	-	B	C	C	C	-	-	A	F	B	B	B	F	C	C	F	C	E	-	A	-	-	
P	Trichobranchus roseus	-	-	-	A	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PY	Trypanosyllis coeliaca	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
*	Typosyllis sp.	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Typosyllis sp. (sexual stolon)	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Websterinereis glauca	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Leptonereis glauca
	ANNELIDA - OLIGOCHAETA																							
	Oligochaeta indet.	-	-	A	B	-	C	-	-	-	C	-	A	B	B	A	-	A	-	-	-	-	-	
Y	Tubificoides ?benedeni	-	A	A	-	-	-	-	-	C	A	-	-	B	-	C	D	-	-	-	-	-	-	Peloscolex benedeni
	CRUSTAEA - OSTRACODA																							
	Asterope mariae	-	-	A	-	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	B	A	
	Philomedes ?interpuncta	-	-	-	-	A	B	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	CRUSTACEA - CIRRIPEDIA																							
Y	Balanus crenatus	-	-	-	-	-	-	P	-	B	-	-	-	P	-	-	-	-	P	-	-	-	-	
	Elminius modestus	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	
	CRUSTACEA - MYSIDACEA																							
	Gastrosaccus normani	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	CRUSTACEA - CUMACEA																							
Y	Bodotria scorpioides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	
P	Diastylis rugosa	-	-	-	-	A	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y	Diastylis sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	
	Eudorella truncatula	-	-	B	A	A	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	CRUSTACEA - TANAIDACEA																							
	Apseudes latreillii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	C	B	C	B	
Y	Apseudes talpa	-	-	A	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	C	A	-	-	
*	Tanaopsis graciloides	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	CRUSTACEA - ISOPODA																							
	Conilera cylindracea	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Cyathura carinata	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	C	-	A	-	-	-	
	Eurydice pulchra	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Gnathiidae indet. (praniza)	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Janira maculosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	
	CRUSTACEA - AMPHIPODA																							
	Acidostoma obesum	-	-	-	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y	Ampelisca brevicornis	P	-	C	A	B	B	-	-	-	-	-	-	A	-	A	-	-	-	-	C	A		
Y	Ampelisca diadema	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	B	-		
	Ampelisca tenuicornis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-		
	Ampelisca typica	P	-	-	-	A	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
P	Amphilochus neapolitanus	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

*	Name	S1	015	08	09	013	014	012	07	01	06	05	04	03	02	010	011	017	016	018	019	020	021	Notes (name in PMF)
	Ampithoe ramondi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	A.vaillanti
	Aora gracilis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	C	-	A.typica
	Apherusa ovalipes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	B	-	
	Argissa hamatipes	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A.stebbingi
	Atylus vedlomensis	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Nototropis vedlomensis
P	Bathyporeia sarsi	P	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Caprella acanthifera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Corophium crassicorne	-	-	B	-	-	-	-	C	-	-	-	-	-	-	-	-	-	-	-	-	B	A	
	Corophium volutator	-	-	-	-	-	-	-	-	B	A	-	-	A	-	-	-	-	C	A	-	-	-	
	Corophium sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	C	C	
	Dexamine spinosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	C	A	
Y	Ericthonius difformis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Gammarella fucicola	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	A	Pherusa fucicola
	Gammarus locusta	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	B	B	
	Harpinia antennaria	-	-	B	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
*	Harpinia laevis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	
	Harpinia sp. (juv.)	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y	Jassa falcata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	A	
Y	Leptocheirus hirsutimanus	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	
	Leptocheirus pectinatus	-	-	-	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PY	Leucothoe lilljeborgi	-	-	A	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	
	Lysianassa ceratina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	
	Maera grossimana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	
	Maera othonis	-	-	-	-	A	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Melita gladiosa	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Melita obtusata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	B	A	
	Melita palmata	-	-	-	-	-	-	-	-	A	-	A	A	A	-	-	B	-	-	-	A	-	-	
Y	Metaphoxus pectinatus	-	A	-	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	B	
*	Microdeutopus stationis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y	Orcomene humilis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	
Y	Orcomene nana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	Orchomenella nana
	Parambius typicus	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	B	-	-	-	-	-	-	
	Perioculodes longimanus	-	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Perrierella audouiniana	-	-	-	-	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Phtisica marina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
P	Pontocrates altamarinus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	B	-	
Y	Socarnes erythrophthalmus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	
	Stenothoe marina	-	-	A	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	
*	Synchelidium maculatum	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Unciola crenatipalma	-	-	B	-	-	-	B	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y	Urothoe elegans	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Urothoe marina	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	B	-	
Y	Urothoe poseidonis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	U.grimaldi var. poseidonis
	CRUSTACEA - DECAPODA																							
	Carcinus maenas (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	B	-		
	Crangon crangon	-	-	-	-	-	-	-	-	B	-	-	B	-	-	-	A	-	-	-	-	-		C.vulgaris
	Hippolyte varians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	B	B		
	Liocarcinus pusillus	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		Portunus pusillus
	Pagurus bernhardus	-	A	-	-	-	A	-	-	-	-	-	-	-	-	-	-	B	B	A	A	B		Eupagurus bernhardus
	Pisidia longicornis	-	-	A	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-		Porcellana longicornis
	MOLLUSCA - POLYPLACOPHORA																							
Y	Tonicella rubra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-		
	MOLLUSCA - PROSOBRANCHIA																							
	Calliostoma zizyphinum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-		
	Calyptraea chinensis	-	-	-	-	-	B	C	-	-	-	-	-	-	-	-	-	A	B	-	-	-		
	Natica alderi	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	MOLLUSCA - OPHISTHOBRANCHIA																							
	Philina aperta	-	-	A	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		P.quadripartita
	MOLLUSCA - BIVALVIA																							
	Abra alba	-	-	C	-	A	C	A	-	-	-	-	-	-	A	-	-	-	-	-	-	-		
	Abra nitida	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	B	C		
	Abra prismatica	P	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	Acanthocardia echinata	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		Cardium echinata
	Cerastoderma edule	-	A	-	-	-	A	-	-	-	-	-	A	-	-	A	A	A	B	-	-	A		Cardium edule
Y	Corbulla gibba	P	-	C	B	-	B	A	-	-	-	-	-	-	-	B	-	-	-	-	-	A		
Y	Cultellus pellucidus	-	-	C	-	B	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		Phaxas pellucidus
	Dosinia exoleta	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A		
	Dosinia lupinus	-	A	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	Ensis ensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Y	Gari tellinella	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-		
	Heteranomia squamula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-		
Y	Hiatella arctica	-	-	-	-	-	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	Lucinoma borealis	-	-	-	-	-	A	B	-	-	-	-	-	-	-	-	-	-	A	-	-	-		
	Montacuta ferruginosa	-	-	-	B	-	B	-	-	-	-	-	-	-	-	-	-	-	B	-	A	B		
	Musculus marmoratus	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	Mya truncata (juv.)	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	Mysella bidentata	-	-	A	-	B	B	C	-	-	A	-	-	-	-	C	-	-	C	A	C	B		
	Mytilus edulis	-	-	-	-	A	B	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-		
Y	Nucula nucleus	P	-	-	-	-	-	A	A	-	-	-	-	-	-	-	-	-	A	-	A	-		

*	Name	S1	015	08	09	013	014	012	07	01	06	05	04	03	02	010	011	017	016	018	019	020	021	Notes (name in PMF)
Y	Nucula turgida	-	-	C	A	A	C	-	-	-	-	-	-	-	-	-	-	-	A	-	-	A	A	
	Parvicardium ovale	P	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Cardium ovale
Y	Spisula elliptica	-	D	A	-	A	-	A	-	-	A	-	-	-	-	-	A	-	B	-	-	C	B	
	Tellina donacina	P	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Tellina fabula	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Tellina pygmaea	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Thyasira flexuosa	-	-	-	A	B	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Venerupis pullastra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	
	Venerupis rhomboides	P	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Venus ovata	P	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Venus striatula	-	-	C	-	B	C	B	-	-	-	-	-	-	-	-	-	-	A	A	-	C	C	
	BRYOZOA																							
*	Bowerbankia ?gracilis	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-	
	Cryptosula pallasiana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P	P	-	-	-	
	PHORONIDA																							
	Phoronis sp.	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	ECHINODERMATA - STELLEROIDEA																							
Y	Amphiura filiformis (juv.)	-	-	B	A	B	-	-	-	-	-	-	-	-	-	-	-	-	-	B	A	A	B	
	Ophiothrix fragilis (juv.)	-	-	-	-	A	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	A	
	Ophiura albida	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Ophiura sp.	-	-	-	-	-	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	ECHINODERMATA - ECHINOIDEA																							
	Echinus esculentus (juv.)	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	CHORDATA - ASCIDIACEA																							
	Ascidiella aspersa	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-	
	Dendrodoa grossularia	-	-	-	-	-	-	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Morchellium argus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P	-	P	-	
Y	Pyura tessellata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	
	CHORDATA - PISCES																							
	Ammodytes tobianus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	
	Cyclopterus lumpus (juv.)	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Fish eggs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P	-	

19 16 17 14

TABLE 10

Communities of conspicuous species present in a shallow tunnel and on steeply sloping bedrock at Penlee Point (Site 67).

Vertical or steeply sloping walls of inner gulley (pool) at 0.5 to 5.5 m. (Abundance of algae is at 3.5 m or as noted below). * = only recorded at 0.5 to 1.5 m. + = only recorded at 4.5 to 5.5 m.	Vertical or overhanging rock including crevices in the tunnel at 0.5 to 4 m. * = in crevices	Vertical and overhanging rock at 4 to 6 m in the tunnel. (Including fish in the tunnel.) * = at entrance.
ABUNDANT SPECIES		
		Centrolabrus exoletus *
COMMON SPECIES		
?Audouinella sp. *	Coryne van-benedini	Spirorbis tridentatus
Corallina officinalis		Amphipoda indet. (tubes)
Cryptopleura ramosa		Trisopterus luscus
Rhodophyta indet. (encr. red)		
Tubularia indivisa		
Escharoides coccinea		
Scrupocellaria reptans		
FREQUENT SPECIES		
Brongniatella byssoides	?Hymedesmia sp.	Pomatoceros sp.
Chondrus crispus	Aglaophenia pluma	Balanus crenatus
Hypoglossum woodwardii	Obelia geniculata	Diplosoma listerianum
Phyllophora traillii *	Tubularia indivisa	Morchellium argus
Phyllophora gmelinii	Palaemon serratus *	
Pterosiphonia parasitica	Cellepora pumicosa *	
Rhodophyta indet. (encr. pink)	Crisia denticulata	
Plumularia setacea	Escharoides coccinea	
Corynactis viridis	Scrupocellaria reptans	
Sagartia elegans	Diplosoma listerianum	
Crisia denticulata		
Botryllus schlosseri		
Clavelina lepadiformis		
Diplosoma listerianum		
Didemnidae indet. (yellow)		
OCCASIONAL SPECIES		
Dilsea carnosa	Clathrina coriacea	Leucosolenia botryoides
Drachiella spectabilis	Leuconia barbata	Polycarpa rustica
Grateloupia filicina *	Leucosolenia botryoides	
Palmaria palmata *	Hymeniacidon perleve	
Phyllophora crispa	Cancer pagurus	
Rhodomela confervoides *	Galathea strigosa *	
Sphondylothamnion multifidum		
Porphyra sp.		
Dictyota dichotoma		
Laminaria hyperborea		
Leuconia barbata		
Dysidea fragilis		
Aglaophenia pluma		
Balanophyllia regia		
Caryophyllia smithii		
Urticina felina		
Pomatoceros sp.		
Schizomavella linearis		
RARE SPECIES		
Bryopsis plumosa +	Liocarcinus puber	Cancer pagurus
Cladophora sp. +	Psammechinus miliaris *	Cottus scorpios
Ulva sp.		
Scypha ciliata		
Porifera indet. (encr. citrus yellow)		
Maja squinado		
Acmaea virginea		
Marthasterias glacialis		
Polycarpa rustica		
Cottus scorpius		

TABLE 11

Communities of conspicuous species present on broken shale reefs and on large and small slates south of the Breakwater (Site 71)

Upward facing surfaces of reefs at 11 to 12 m at Site 71.	Vertical and overhanging broken shale bedrock at 11 to 12 m at Site 71.	Large and small slates between reefs at 11 to 12 m. * = only recorded under slates.
ABUNDANT SPECIES		
Delesseria sanguinea		
Cirripedia indet. (spat)		
COMMON SPECIES		
Plocamium cartilagineum	Phyllophora traillii	Phaeophyta indet. (filam.)
Rhodophyta indet. (encr.)	Obelia dichotoma	
Laminaria hyperborea	Cirripedia indet. (juv.)	
FREQUENT SPECIES		
Bonnemaisonia asparagoides	Rhodophyta indet. (encr., red)	Dudresnaya verticillata
Brongniartella byssoides	Bryozoa indet. (encr.)	Halarachnian ligulatum
Cryptopleura ramosa	Asterina gibbosa	?Naccaria wiggii
Dilsea carnosa	Marthasterias glacialis	'Traillielia intricata'
Heterosiphonia plumosa	Cucumaea indet.	Bacillariophycaea indet.
Phyllophora crispa	Diplosoma listerianum	Enteromorpha sp.
Phyllophora traillii	Morchellium argus	Asperococcus sp.
Polyneura gmelinii		Pomatoceros sp. *
?Polyneura hilliae		Verruca stroemia *
Rhodophyta indet. (pink)		Pisidia longicornis *
Rhodymenia holmesii		Cellepora pumicosa *
Rhodymenia pseudopalmata		Escharoides coccinea *
Desmarestia viridis		Ophiothrix fragilis *
Morchellium argus		
OCCASIONAL SPECIES		
Acrosorium uncinatum	Acrosarium uncinatum	Brongniartella byssoides
Compsothamnion thuyoides	Drachiella spectabilis	Calliblepharis ciliata
Drachiella spectabilis	Lomentaria jarellosa	Callophyllis laciniata
Halarachnion ligulatum	Meredithia microphylla	Phyllophora crispa
Kallymenia reniformis	Phyllophora crispa	Polysiphonia elongata
Lomentaria clavellosa	Polyneura gmelinii	Polysiphonia sp.
Phyllophora pseudoceranoides	Polyneura hilliae	Rhodomela confervoides
Phymatolithon polymorphum	Rhodophyllis sp.	Rhodophyta indet. (encr. pink)
Sphondylothamnion multifidum	Rhodophyta indet. (encr. pink)	Scinaia turgida
Halidrys siliquosa	Rhodymenia holmesii	?Spyridia filamentosa
Laminaria saccharina	Rhodymenia pseudopalmata	Schmitzia neopolitana
Chaetomorpha sp.	Rhody. pseudo. (spikey)	Chorda filum
Asterina gibbosa	Schottera nicaeensis	Cutleria multifida
Labrus bergylta	Phaeophyta indet. (filam.)	Mesogloia lanosa
	Chaetomorpha sp.	Sporochnus pedunculatus
	Dysidea fragilis	?Striaria attenuata
	Alcyonium digitatum	?Tilopteris mertensii
	Caryophyllia smithii	Desmarestia aculeata
	Pomatoceros sp.	Chlorophyta indet. (filam.)
	?Schizomavella linearis	Terebellidae indet. *
	Ophiuroidea indet. (arms)	Polyplacophora indet. *
	Echinus esculentus	Marthasterias glacilis
	Clavelina lepadiformis	Asterina gibbosa
	Didemnidae indet. (cream)	Diplosoma listerianum
	Stolonica socialis	Morchellium argus
	Ctenolabrus rupestris	
RARE SPECIES		
Cordylecladia erecta	Halarachnion ligulatum	Laurencia sp.
Gelidium latifolum	Scypha ciliata	Anemonia viridis
Labrus mixtus	Cliona celata	?Polymnia nebulosa *
	Dercitus bucklandi	?Gibbula tumida *
	Hemimycale columella	Coryphella sp.
	Pachymatisma johnstoni	Ophiuroidea indet. (arms)
	Plumularia setacea	Holothuria forskali
	Cornactis viridis	
	Aiptasia mutabilis	
	Chaetopterus variopedatus	
	Protula tubularia	
	Prostheceraeus vittatus	
	Galathea strigosa	
	Liocarcinus puber	
	Trivia arctica	
	Parasmittina trispinosa	
	Henricea oculata	
	Corella parallelogramma (var. lavaeformis)	
	Lissoclinum perforatum	
	Polycarpa rustica	
	Sidnyum elegans	
	Pyura tessulata	
	Cottus scorpius	
	Thorogobius ephippiatus	
PRESENT, NO RECORD OF ABUNDANCE		
Coryne cf. vermicularis	Pyrgoma anglicum	Callopora rylandi
		Chorizopora brongniartii
		Escharella sp.
		Tubipora flabellaris
		Distaplia rosea
		Ascidiella sp. (juv.)

TABLE 12

Communities of conspicuous species present in limestone blocks on the southwest of the Breakwater, Plymouth Sound (Site 65)

Infralittoral fringe. Horizontal or upward facing surfaces at 0 to 0.5 m bcd * = on Corallina	Infralittoral fringe. Vertical surface at 0 to 0.5 m bcd	Upper infralittoral. Upward facing surfaces at 6 m bcd	Lower infralittoral. Vertical and overhanging surface at the base of the breakwater at 12 m bcd * = additional records from caves at 10.5 m	Lower infralittoral. Upward facing sandy surfaces at 12.5 m
ABUNDANT SPECIES				
Laminaria hyperborea		Delesseria sanguinea	Verruca stroemia	Verruca stroemia
COMMON SPECIES				
Chondrus crispus	Umbonula littoralis	Callophyllis lacineata	Alcyonium digitatum	Callophyllis lacineata
Corallina officinalis	Plumularia setacea	Plocamium cartilagineum	Scrupocellaria scruposa	Amphipoda indet. (tubes)
Celleporella sp. *		Saccorhiza polyschides	Trisopterus luscus *	Morchellium argus
Plumularia setacea		Bivalvia indet. (boring)		
FREQUENT SPECIES				
Brongniartella byssoides	Actinothoe sphyrodeta	Brongniartella byssoides	Cliona sp. (boring)	Delesseria sanguinea
Cryptopleura ramosa	Corynactis viridis	Heterosiphonia plumosa	Eudendrium ?capillare	Plocamium cartilagineum
Delesseria sanguinea	Sagartia elegans rosea	Kallymenia reniformis	Obelia dichotoma	Cliona sp. (boring)
Kallymenia reniformis	Pomatoceros sp.	Pterosiphonia parasitica	Crisia denticulata	Nemertesia antennina
Rhodophyllus divaricata	Scrupocellaria reptans	Obelia dichotoma	Echinus esculentus *	Actinothoe sphyrodeta
Rhodophyta indet. (pink en	Diplosoma listerianum	Gibbula cineraria	Diplosoma listerianum	Alcyonium digitatum
Pterosiphonia complanata		Electra pilosa	Didemnidae indet. (yellow)	Caryophyllia smithii
Cladostephus spongiosus		Crenilabrus melops	Centrolabrus exoletus	Ctenolabrus rupestris
Desmarestia aculeata		Ctenolabrus rupestrus		
Himanthalia elongata				
Cladophora sp.				
Umbonula littoralis				
OCCASIONAL SPECIES				
Callophyllis laciniata	Apoglossum ruscifolium	Apoglossum ruscifolium	Hypoglossum woodwardii	Brongniatella byssoides
Lomentaria clavellosa	Cryptopleura ramosa	Dilsea camosa	Kallymenia reniformis	Dilsea carnosa
Lomentaria orcadensis	Hypoglossum woodwardii	?Gloiosiphonia sp.	Halecium beanii	Heterosiphonia plumosa
Phycodrys rubens	Kallymenia reniformis	Lomentaria clavellosa	Nemertesia antennina	Kallymenia reniformis
Rhodophyta indet. (dk. red	Lomentaria orcadensis	Desmarestia viridis	Plumularia setacea	Polyneura gmelinii
'Aglaozonia parvula'	Clathrina coriacea	Laminaria hyperborea	Caryophyllia smithii	Lomentaria orcadensis
Desmarestia ligulata	Leucosolenia botryoides	Amphilectus fucorum	Corynactis viridis	Pterosiphonia parasitica
Desmarestia viridis	Amphilectus fucorum	Escharoides coccinea	Sagartia troglodytes	Schottera nicaeensis
Saccorhiza polyschides	Halichondria panicea	Schizomarella linearis	Phoronis hippocrepia	Desmarestia viridis
Ulva sp.	Aglophenia pluma	Labrus bergylta	Pyrgoma anglicum	Dictyota dichotoma
Actinothoe sphyrodeta	Sertularella polyzonias		Alcyonidium diaphanum	Saccorhiza polyschides
Pomatoceros sp.	Balanus ?perforatus		Bugula turbinata	Cliona celata
Diplosoma listerianum	Didemnidae indet. (pink)		Escharoides coccinea	Tubularia indivisa
			Schizomavella linearis	Alcyonidium diaphanum
			Marthasterias glacialis	Bugula plumosa
			Clavelina lepadiformis	Bugula turbinata
				Marthasterias glacialis
				Diplosoma listerianum
				Lissoclinum perforatum
				Crenilabrus melops
				Labrus bergylta
RARE SPECIES				
Lomentaria articulata	Dictyota dichotoma	?Rhodymenia delicatula	Dysidea fragilis	Bonnemaisonia asparagoides
Pilumnus hirtellus	Hymeniacidon perleve	Henricea oculata	Haliclona sp.	Cordelecladia erecta
	Alcyonium digitatum		Myxilla sp.	Drachiella spectabilis
	Calliostoma zizyphinum		Chaetopterus variopedatus	?Radicilingua thysanorhizans
			Asterias rubens	Scinaia turgida
			Henricea oculata	Callithamnion ?hookeri
				Desmarestia ligulata
				Dictyopteris membranacea
				Halopteris filicina
				Bryopsis plumosa
				Sertularella polyzonias
				Holothuria forskali
				Labrus mixtus

TABLE 13

Communities of conspicuous species present on broken circalittoral bedrock offshore of Plymouth Sound (Sites 88 and 112)

Lower infralittoral horizontal bedrock at 18 m bcd at the southwest entrance (Site 112)	Upper circalittoral. Broken and vertical bedrock at 18 to 22 m bcd at the southwest entrance (Site 112)	Upper circalittoral. Sloping sides of open gullies at ca. 24 to 28 m bcd at the southwest entrance (Site 112)	Upper circalittoral. Upward facing broken bedrock at 27 to 30 m bcd (Site 88)	Lower circalittoral. Vertical and overhanging bedrock at 30 to 34 m
ABUNDANT SPECIES				
	Alcyonium digitatum	Eunicella verrucosa	Eunicella verrucosa	Caryophyllia smithii Verruca stroemia
COMMON SPECIES				
Bonnemaisonia asparagoides Brongniatella byssoides	Polyneura gmelinii Verruca stroemia Parasmittina trispinosa Schizomavella linearis Cucumaria lefevrei	Bonnemaisonia asparagoides Brongniartella byssoides Rhodophyllis sp. (big) Alcyonium digitatum	Caryophyllia smithii Pentapora foliacea Echinus esculentus Holothuria forskali	Asterias rubens
FREQUENT SPECIES				
Delesseria sanguinea Polyneura gmelinii Rhodophyllis sp. (big) Dictyopteris membranacea Verruca stroemia Cellepora pumicosa Electra pilosa Asterias rubens Centrolabrus exoletus	Corallinacea indet. (pink Myriogramme heterocarpum Schottera nicaeensis Dictopteris membranacea Abietinaria abietina Halecium halecinum Sertularia gayi Actinothoe sphyodeta Caryophyllia smithii Eunicella verrucosa Alcyonidium diaphanum Bugula flabellata Asterias rubens Marthasterias glacialis Echinus esculentus Holothuria forskali Centrolabrus exoletus Ctenolabrus rupestris Labrus mixtus	Drachiella spectabilis Polyneura gmelinii Aglaophenia tubulifera Nemertesia antennina Nemertesia ramosa Sertularia gayi Parasmittina trispinosa Pentapora foliacea Asterias rubens Marthasterias glacialis Centrolabrus exoletus	Corallinacea indet. (encr Nemertesia antennina Nemertesia ramosa Alcyonium digitatum Parazoanthus axinellae Alcyonidium diaphanum Clavelina lepadiformis	Alcyonium digitatum Alcyonium glomeratum Corynactis viridis Parazoanthus axinellae Cucumaria lefevrei Ascidia mentula Trisopterus luscus
OCCASIONAL SPECIES				
Antithamnion plumula Drachiella spectabilis Polyneura hilliae Rhodymenia pseudopalmata Schottera nicaeensis Dictyota dichotoma Carpomitra costata Nemertesia antennina Nemertesia ramosa Actinothoe sphyrodeta Pomatoceros sp. Schizomavella linearis Echinus esculentus Holothuria forskali Clavelina lepadiformis Labrus mixtus Trisopterus luscus	Brongniatella byssoides Delesseria sanguinea Halarachnion ligulatum Kallymenia reniformis Phyllophora crispa Polyneura hilliae Carpomitra costata Cliona celata Hemimycale columella Aglaophenia tubulifera Nemertesia antennina Nemertesia ramosa Sagartia troglodytes Chaetopterus variopedatus Pomatoceros sp. Chartella papyracea Electra pilosa Omalosecosa ramulosa Ophiopsila aranea Ascidia mentula Botryllus schlosseri Clavelina lepadiformis Labrus bergylta Trisopterus luscus	Delessaria sanguinea Kallymenia reniformis Schottera nicaeensis Dictyopteris membranacea Dictyota dichotoma Cliona celata Hemimycale columella Abietinaria abietina Caryophyllia smithii Alcyonium diaphanum Bugula flabellata Cellepora pumicosa Electra pilosa Echinus esculentus Holothuria forskali Botryllus schlosseri Clavelina lepadiformis	?Myriogramme bonnemaisonii Polyneura gmelinii Rhodophyta indet. (encr. re Rhodymenia pseudopalmata Cliona celata Halichondria cfbowerbankii Raspailia ramosa Plumularia setacea Alcyonium glomeratum Leptopsammia pruvoti Salmacina dysteri Omalosecosa ramulosa Asterias rubens Marthasterias glacialis Labrus bergylta	Leucosolenia botryoides Cliona celata Axinella damicornis Axinella infundibuliformis Nemertesia antennina Plumularia setacea Eunicella verrucosa Cellepora pumicosa Parasmittina trispinosa Marthasterias glacialis Clavelina lepadiformis Ctenolabrus rupestris
RARE SPECIES				
Pterosiphonia parasitica Desmarestia aculeata Cliona celata Halecium halecinum Caryophyllia smithii Cucumaria lefevrei Botryllus schlosseri	Heterosiphonia plumosa Scypha ciliata Pachymatisma johnstonia Thymosia guernii Sertularella polyzonias Tubularia indivisa Epizoanthus couchii Parazoanthus axinellae Alcyonium glomeratum Bispira volutacornis Hydroides norvegica Salmacina dysteri ?Serpula vermicularis Cancer pagurus Liocarcinus depurator Pentapora foliacea Zeus faber	Halarachnion ligulatum Hypoglossum woodwardii Phyllophora crispa Desmarestia ligulata	Hemimycale columella Axinella polypoides Aglaophenia tubulifera Doridae indet. Labrus mixtus	Sertularella polyzonias Protula tubularia Calliostoma zizyphinum Bugula flabellata Diazona violacea Stolonica socialis

TABLE 14

Communities of conspicuous species present in Zostera beds in Plymouth Sound and the Yealm

SPECIES	South Cawsand Bay (Site 115)		North Drake Island (Site 77)		Off Cellar Beach (Site 94)	
	On or over seabed (not necessarily in bed)	On leaves	On or over seabed	On leaves	On or over seabed (not necessarily in bed)	On leaves
ALGAE						
Audouinella sp.	-	-	-	F	-	-
Ceramium rubrum	-	-	F	F	F	O
Chylocladia verticillata	R	-	R	-	-	-
Cryptopleura ramosa	O	-	-	-	-	-
?Fosiella limitata	-	-	-	R	-	-
Gracilaria verrucosa	O	-	O	-	O	-
Nitophyllum punctatum	O	-	R	-	-	-
Polyneura hilliae	O	-	-	-	-	-
Polysiphonia sp.	-	-	-	O	-	-
Radicilingua thysanorhizans	R	-	-	-	-	-
?Rhodophysema sp.	-	-	-	R	-	-
Rhodomela confervoides	O	-	-	-	-	-
Rhodophyllis divaricata	-	-	-	-	O	-
Rhodophyta indet. (encr. pink)	-	-	-	R	-	-
Rhodophyta indet. (encr. red)	-	-	-	F	-	-
Rhodymenia pseudopalmata	-	-	-	R	-	-
Stenogramme interrupta	-	-	O	-	-	-
Chrysophyta indet. (diatoms)	F	F	F	C	-	A
Ectocarpoidea indet.	F	F	C	C	-	A
Laminaria saccharina	O	-	O	-	O	-
Punctaria latifolia	-	-	-	R	-	-
Saccorhiza polyschides	-	-	R	-	O	-
Sargassum muticum	-	-	-	-	O	-
Cladophora sp.	-	-	-	-	O	-
?Derbesia sp.	O	-	-	-	-	-
Enteromorpha sp.	-	-	O	R	-	-
Ulva sp.	-	-	F	-	-	-
ANIMALS						
Obelia geniculata	-	-	-	F	-	-
Anemonia viridis	-	-	-	-	O	O
Cerianthus lloydii	O	-	-	-	-	-
Sagartiogeton undatus	C	-	-	-	-	-
Arenicola marina	O	-	O	-	-	-
Lanice conchilega	O	-	R	-	F	-
Myxicola infundibulum	O	-	-	-	-	-
Amphipoda indet. (tubes)	-	-	-	R	-	-
Caprellidae indet.	-	-	-	P	-	-
Maja squinado	-	-	R	-	-	-
Pagurus bernhardus	-	-	R	-	-	-
Gibbula cineraria	-	-	-	O	-	-
Lacuna vincta	-	-	-	R	-	-
Nassarius incrassatus	O	-	-	-	-	-
Nassarius reticulatus	O	-	O	-	F	-
Calliopoea bellula	O	-	-	-	-	-
Philine aperta	F	-	-	-	-	-
Polycera quadrilineata	-	-	-	-	-	R
Bivalvia indet. (siphons)	C	-	R	-	O	-
Ensis sp. (siphons)	-	-	-	-	C	-
Acrocnida brachiata	F	-	-	-	-	-
Echinocardium cordatum (pits)	O	-	-	-	A	-
Labidoplax digitata	O	-	-	-	-	-
?Entelurus aequoris	-	-	-	-	R	-
Pleuronectidae indet. (juv.)	-	-	R	-	R	-
Pomatoschistus pictus	O	-	-	-	-	-
Pomatoschistus sp.	F	-	R	-	F	-
Syngnathus sp.	R	-	-	-	-	-
Zeus faber	R	-	-	-	R	-

TABLE 15

Communities of conspicuous species present in the area of Mallard Shoal

Lower infralittoral. Horizontal or gently sloping bedrock at 4 to 5 m bcd. Mallard Shoal Beacon (Site 101) * = Sporlings	Lower circalittoral. Slope of bedrock at 15 to 21 m bcd * = additional records or different abundance at 8 to 13 m bcd	Lower circalittoral. Vertical bedrock at 16 to 18 m bcd	Lower circalittoral. Cobbles on clean shell gravel at 1 to 19 m bcd
DOMINANT SPECIES Polydora sp.		Antedon bifida	Polydora sp.
ABUNDANT SPECIES	Sagartia elegans Polydora sp.	Hiatella arctica	
COMMON SPECIES Nemertesia antennina	Cereus pedunculatus * Metridium senile * Urticina felina Myxicola aesthetica * Antedon bifida	Polydora sp.	
FREQUENT SPECIES Hypoglossum woodwardii Polyneura gmelinii Polyneura hilliae Laminaria saccharina * Metridium senile Morchellium argus	Suberites domuncula Nemertesia antennina Obelia dichotoma Alcyonium digitatum Sagartia elegans mineata Sagartiogeton undatus Amphipoda indet. (tubes) Clavelina lepadiformis Morchellium argus Gadoidea indet.	Clavelina lepadiformis	Sagartia elegans nivea ?Loimea medusa
OCCASIONAL SPECIES Antithamnion plumula Kallymenia reniformis Cliona sp. (boring) Hymeniacidon perleve Subsertes domuncula Obelia dichotoma Plumularia setacea Alcyonium digitatum Cereus pedunculatus Urticina felina Hiatella artica Diplosoma listerianum Distomus variolosus	Cliona sp. (boring) Halichondria panicea Halecium halecinum Plumularia setacea Cereus pedunculatus Metridium senile Hiatella arctica Bowerbankia pustulosa Distomus variolosus * Polycarpa rustica	Hymeniacidan perleve Alcyonium digitatum Corynactis viridis Sagartia elegans Sagartia mineata Distomus variolosus Morchellium argus	Obelia dichotoma Plumularia setacea Actinothoe sphyrodeta Cereus pedunculatus Cerianthus lloydii Sagartiogeton undatus Cellepora pumicosa Antedon bifida Marthasterias glacialis
RARE SPECIES Chylocladia verticillata Halichondria ponicea Myxicola aesthetica Salmacina dysteri Doto fragilis Polycera faervensis Marthosterias glacialis Diplosoma sp. (soft) Ctenolabnus rupertis Pomataschistus minutus Gadoidea indet.	Polymastia mamillaris Raspailia ramosa Hydrallmania falcata Nemertesia ramosa Corynactis viridis Salmacina dysteri Liocarcinus puber Pagurus berhardus * Bugula flabellata Scrupocellaria scruposa Marthasterias glacialis Botrylloides leachii Distaplia rosea Styela clava Diplosoma listerianum Ctenolabrus rupestris	Suberites domnula Nemertesia antennina Epizoanthus couchii Sagartiogetan undatus Salmacina dysteri Polycene frenoensis Labrus bergylta Thorogobius eplippiatus	Hymeniacidon purleve Aeolidea papillosa Ciona intestinalis Lissoclinum perforatum Callionymus lyra
PRESENT, NO RECORD OF ABUNDANCE Kirchenpauria pinnata	Pomatoceros sp. Balanus crenatus Nassarius incrassatus Ophiothrix fragilis		

TABLE 16

Communities of conspicuous species present below Royal Albert Bridge on the west side of the River Tamar (Site 92)

Moderate slope of boulders and broken bedrock at 0.5 m bcd (animal records at +0.5 to 1 m bcd)	Steep slope of large muddy boulders and broken bedrock at 2 to 5 m bcd	Moderate slope of muddy boulders, cobbles and debris at 5 to 10 m bcd	Level seabed of pebbles and cobbles on muddy sediment at 10 to 12.5 m bcd
COMMON SPECIES			
Balanus crenatus	Sagartiogeton undatus		Crangon crangon
FREQUENT SPECIES			
Hypoglossum woodwardii	Halichondria panicea	Halichondria panicea	Urticina sp.
Polyneura gmelinii	Carcinus maenas	Metridium senile	Balanus crenatus
Carcinus maenas	Bowerbankia pustulosa	Urticina sp.	Pagurus bernhardus
		Balanus crenatus	Bowerbankia pustulosa
		Carcinus maenas	
		Bowerbankia pustulosa	
		Styela clava	
OCCASIONAL SPECIES			
Antithamnion plumula	Hymeniacidon perleve	Gellidae indet.	Hartlaubella gelatinosa
Apoglossum ruscifolium	?Gellidae indet.	Pagurus bernhardus	Metridium senile
Rhodophyta indet. (filam.)	Metridium senile	Styela clava	Sagartiogeton undatus
Halichondria panicea	Sagartiogeton undatus		Conopeum reticulum
Mytilus edulis	Urticina sp.		
	Balanus crenatus		
	Archidoris pseudoargus		
RARE SPECIES			
Polyneura hilliae	Plumularia setacea	Cliona sp. (boring)	Cliona sp. (boring)
Obelia geniculata	Liocarcinus puber	Suberites sp.	Hydrallmania falcata
Terebellidae indet.	Mytilus edulis	Plumularia setacea	Sertularia cupressina
	Bugula plumosa	Sagartia elegans rosea	Carcinus maenas
	Ascidiella aspersa	Crepidula fornicata	Macropodia rostrata
	Ciona intestinalis	Aeolidea papillosa	Crepidula fornicata
		Mytilus edulis	Aeolidea papillosa
		Bugula plumosa	Bryozoa indet. (encr.)
		Botrylloides leachii	Botrylloides leachii
			Styela clava
			Pleuronectes platessa
			Pleuronectidae indet. (juv.)
PRESENT - NO RECORD OF ABUNDANCE			
	Sertularia argentea	Lafoea pocillum	
	Crepidula fornicata		
	Conopeum sp.		
	Scruparia chelata		

TABLE 17

Communities of conspicuous species in the infralittoral and circalittoral at Wilderness Point to Battery Buoy

Bedrock and boulders in the sublittoral fringe at +1 to 0 m.	Bedrock and boulders in the infralittoral. Abundance Records are from the Lower Infralittoral at 2.5 to 3.5 m except where * = at 0.5 to 1.5 m only (the zone dominated by L. saccharina)	Bedrock, boulders and cobbles in the circalittoral. Abundance records are for 23 to 25 m except where * = 11 to 16 m only.
ABUNDANT SPECIES		
Laminaria saccharina	Dendrodoa grossularia	Dendrodoa grossularia
Dendrodoa grossularia		
COMMON SPECIES		
Polydora sp.	Callophyllis lacineata	Halichondria panicea
	Cryptopleura ramosa	Nemertesia antennina
		Alcyonium digitatum
FREQUENT SPECIES		
Callophyllis lacineata	Callithamnion sp.	Amphilectus fucorum
Balanus crenatus	Kallymenia reniformis	Hymeniacidon perleve
	Rhodophyllis divaricata	Plumularia setacea
	Rhodophyllis sp.	Actinothoe sphyrodeta
	Myriogramme bonnemaisonii/ Polyneura hilliae	Scrupocellaria sp.
	Compsothanmion thyoides	
	Laminaria saccharina (juv.)	
	Hymeniacidon perleve	
	Nemertesia antennina	
	Pomatoceros sp.	
	Diplosoma listerianum	
	Polycarpa rustica	
OCCASIONAL SPECIES		
Corallina officinalis	Apoglossum ruscifolium	Cliona sp. (boring)
Dilsea carnosa	Bonnemaisonia asparagoides	Suberites ficus
Kallymenia reniformis	Brongniartella byssoides	Hydrallmania falcata
Palmaria palmata	Hypoglossum woodwardii	Nemertesia ramosa
	Lomentaria orcadensis	Salmacina dysteri
	Nitophyllum punctatum	Verruca stroemia *
	Palmaria palmata *	Cancer pagurus
	Polyneura hilliae *	Doto fragilis
	Polysiphonia sp.	Coryphella lineata
	Rhodophyta indet. (encr. pink)	Bicellariella ciliata
	Phymatolithon polymorphum *	Bryozoa indet. (encr.)
	Desmarestia ligulata	Bugula flabellata *
	Laminaria ?digitata *	Botryllus schlosseri
	Cladophora sp.	Distomus variolosus *
	Ulva sp.	
	Cliona sp. (boring)	
	Halichondria panicea	
	Halecium halecinum	
	Polydora sp. *	
	Balanus crenatus	
	Gibbula cineraria	
	Botryllus schlosseri	
RARE SPECIES	Laminaria saccharina	Leucosolenia botryoides *
Delesseria sanguinea	Suberites ficus*	Scypha ciliata *
?Plumaria elegans	Hydrallmania falcata	?Pachymatisma johnstonia
Cladophora sp.	Nemertesia ramosa	Tubularia larynx
Chaetomorpha sp.	Kirchenpauria pinnata	Ocenebra erinacea *
Ulva sp.	Terebellidae indet.	Trivia arctica *
Halichondria panicea	Liocarcinus puber	Phoronis hippocrepia
Hymeniacidon perleve	Bicellariella ciliata	Diplosoma listerianum
Pomatoceros sp.	Botrylloides leachii	
Paguridae indet.		
PRESENT, NO RECORD OF ABUNDANCE		
		Inachus dorsettensis
		Archidoris pseudoargus
		Ctenolabrus rupestris

TABLE 18

Abundance of conspicuous species on two areas of Shallow cobbles and shells in the lower Tamar and River Lynher

Small boulders, cobbles and pebbles in muddy gravel at +0.5 to 1 m at Site 114. * = Additional record of species only recorded on stones and shells at +1 to +0.5 m. + = Additional record of species only recorded on small boulders, cobbles and pebbles at 1.5 to 3.5 m.	Shells and shale pebbles on muddy sand at 0 to 4.3 m at Site 113.
ABUNDANT SPECIES	
Rhodophyta indet. (filam.)	
COMMON SPECIES	
Ectocarpoidea indet. *	
Pomatoceros sp.	
Balanus crenatus	
FREQUENT SPECIES	
Antithamnion plumula	Apoglossum ruscifolium
Antithamnion spirographidis	Polysiphonia sp.
Callithamnion sp.	Hydractinia echinata
Ceramium rubrum	Hydrozoa indet.
Nitophyllum punctatum	Polydora sp.
Polyneura gmelinii	Pomatoceros sp.
Polyneura hilliae	Balanus crenatus
Gracilaria verrucosa *	Crangon crangon
Chrysophyta indet. (colonial diatoms)	Pagurus bernhardus
Bryopsis plumosa	Jorunna tomentosa
Enteromorpha sp.	Mytilus edulis
Ulva sp.	Bryozoa indet. (encr.)
Halichondria panicea	
Hymeniacidon perleve	
Anemonia viridis	
Cereus pedunculatus	
Cryptosula pallasiana	
Dendrodoa grossularia	
OCCASIONAL SPECIES	
Corallinacea indet. (pink encr.)	Antithamnian plumula
Cryptopleura ramosa	Callithamnion sp.
Griffithsia devoniensis	Ceramium sp.
Chorda filum *	Gracilaria verrucosa
Cladophora sp.	Halichondria panicea
Obelia dichotoma +	Hymeniacidon perleve
Kirchenpauria pinnata +	Suberites ficus
Serpulidae indet. +	Kirchenpauria pinnata
Carcinus maenas	Sertularia cupressina
Crangon crangon	Sagartia troglodytes
Macropodia rostrata	Sagartiogeton undatus
Venerupis pullastra	Carcinus maenas
Gobius niger	Crepidula fornicata
	Gibbula cineraria
	Ostrea edulis
	Ascidiella scabra
	Botrylloides leachii
RARE SPECIES	
Apoglossum ruscifolium +	Polyneura gmelinii
Chylocladia verticillata	Cliona sp. (boring)
Griffithsia corallinoides	Hymeniacidon perleve
Hypoglossum woodwardii +	Cereus pedunculatus
Chondria dasyphylla	Metridium senile
Scypha ciliata * +	Inachus phalangium
Cliona spp. (boring)	Buccinum undatum
Suberites ficus +	Cerastoderma edule
Obelia geniculata	Styela clava
Halecium beanii +	Callionymus lyra
Cancer pagurus +	Pholis gunnellus
Polyplacophora indet.	Pomataschistus sp.
Gibbula cineraria	Syngnathus acus
Nassarius reticulatus	
Botrylloides leachii	
Diplosoma listerianum	
Styela clava	
PRESENT, NO RECORD OF ABUNDANCE	
Polysiphonia sp.	
Antithamnion sp.	
Littarina littorea *	
Calyptera chinensis	

TABLE 19

Communities of conspicuous species present in the area of the Yealm

Vertical and overhanging rock in a gully on the open coast outside of the entrance to the Yealm (Site 93). (Algae were generally recorded from vertical rock, animals from overhangs.) * = an algae.	Pebbles scattered in sand at 0 to 0.5 m (Sublittoral fringe). North shore opposite Cellar Beach (Site 94).	Pebbles and gravel at 2.2 to 3.2 m off Misery Point (Site 94)	Sandy mud with shells and woodland debris in the upper part of the River Yealm (Sites 84 and 85). (Species living on/in the mud or attached to hard substrata have not been separated but the electricity cable is not included.) (Algae were sampled and are only recorded as present. Some may have been drift.) * = Site 84 only. + = Site 85 only.
ABUNDANT SPECIES			
Rhodymenia pseudopalmata	Chrysophyta indet. (epiphytic diatoms)	Sertularia cupressina	
	Laminaria saccharina		
	Ulva sp.		
COMMON SPECIES			LOCALLY COMMON AT SITE 85
Cryptopleura ramosa	Enteromorpha sp.	Obelia sp.	Arenicola marina
Electra pilosa *			Lanice conchilega
Distomus variolosus			
FREQUENT SPECIES			
Delesseria sanguinea	Ceramium rubrum	Gastroclonium reflexum	Carcinus maenas
Phyllophora pseudoceranoides	Gracilaria verrucosa	Gracilaria foliifera	Paguridae indet.
Plocamium cartilagineum	Phymatolithon lenormandii	Gracilaria verrucosa	Mysidacea indet.
Schottera nicaeensis	Rhodophyta indet. (encr.)	Radicilingua thysanorhizans	Pomataschistus sp.
Haliphysema tumanowiczi	Asperococcus sp.	Rhodophyta indet. (encr.)	
Scypha compressa	Chorda filum	Asperococcus sp.	
Halichondria panicea	Saccorhiza polyschides	Ectocarpoidea indet.	
Obelia geniculata	Sargassum muticum	Phaeophyta indet. (encr.)	
Corynactis viridis	Punctaria sp.	Plumularia setacea	
Amphipoda indet. (tubes)	Cladophora sp.	Urticina felina	
Scrupocellaria reptans		Pomatoceros sp.	
Diplosoma listerianum		Paguridae indet.	
		Morchellium argus	
OCCASIONAL SPECIES			
Acrosorium uncinatum	Antithamnion plumula	Apoglossum ruscifolium	Hymeniacidon perleve
Callithamnian tetragonum	Chondrus crispus	Brongniartella byssoides	Suberites ficus
Callophyllis laciniata	'Falkenbergia rufolanosa'	Ceramium sp.	Hydractinia echinata
Dilsea carnosa	Chrysophyta indet. (colonial diatoms)	Chondria dasyphylla	Sertularia cupressina
Kallymenia reniformis	Cladostephus spongiosus	Chondrus crispus	Sagartiogeton undatus *
Polyneura gmelinii	Lanice conchilega	Grateloupia filicina	Pleuronectidae indet. +
Cladophora sp.	Carcinus maenas	Gymnogongrus crenulatus	Crangon sp. +
Clathrina coriacea	Nassarius reticulatus	Halarachnion ligulatum	
Leuconia barbata	Aplysia punctata	Hypoglossum woodwardii	
Scypha ciliata		Peyssonelia sp.	
Dysidea fragilis		Polyneura gmelinii	
Aglaophenia pluma		Polysiphonia ?urceolata	
Plumularia setacea		Rhodomela confervoides	
Sertularella polyzonias		Rhodophyllis divaricata	
Actinothoe sphyrodeta		Scinaia ?forcellata	
Pomatoceros sp.		Anemonia viridis	
Pseudopotamilla reniformis		Nassarius reticulatus	
Mysidacea indet.		Dentronotus frondosus	
Bugula turbinata		Dendrodoa grossularia	
Schizomavella linearis			
Ophiothrix fragilis (juv.)			
Cucumacea indet.			
Aplidium punctum			
Polycarpa rustica			
RARE SPECIES			
Amphilectus fucorum	Phycodrys rubens	Antithamnion plumula	Cereus pedunculatus +
Sagartia elegans venusta	Laurencia ?pinnatifida	Antithamnion spirographidis	Metridium senile +
Chaetopterus variopedatus	Cystoseira sp.	Callophyllis laciniata	Sagartia troglodytes *
Terebellidae indet.	Cereus pedunculatus	Chylocladia verticillata	Sabella pavonina *
Balanus crenatus	Lucernariopsis campanulata	Dilsea carnosa	Ostrea edulis *
Gibbula cineraria	Pomatoceros sp.	Drachiella spectabilis	Venerupis pullastra *
Jorunna tomentosa		Gastroclonium ovatum	Venus striatula *
Asterias rubens		?Gracilaria bursa-pastoris	Morchellium argus
Echinus esculentus		Phyllophora pseudoceranoides	Syngnathus acus
Botryllus schlosseri		Desmarestia ligulata	
Lissoclinum perforatum		Bryopsis plumosa	PRESENT, NO RECORD OF ABUNDANCE
Morchellium argus		Cladophora sp.	Antithamnion plumula
Didemnidae indet. (yellow)		Aplysia punctata	Antithamnion spirographidis *
?Diplosoma sp.		Facelina bostoniensis	Callithamnion sp.
		?Echinus esculentus (juv.)	Ceramium rubrum
		Clavelina lepadiformis	Cryptopleura ramosa *
			Gracilaria verrucosa
			Griffithsia corallinoides * +
PRESENT, NO RECORD OF ABUNDANCE			Hypoglossum woodwardii
Aplidium iensum/punctum			Polysiphonia sp.
			Polysiphonia ?macrocarpa +
			Polysiphonia ?nigra
			Polysiphonia nigrescens *
			Rhodophyta indet. (encr. red) +
			Rhodophyta indet. (encr. pink) +
			Bacillariophycea indet.
			Chorda filum +
			Fucus sp. +
			Bryopsis plumosa *
			Cladophora sp. *
			Chaetomorpha sp. * +
			Enteromorpha sp. +
			Ulva sp. +
			Hartlaubella gelatinosa +
			Terebellidae indet. *
			Balanus crenatus
			Nassarius reticulatus *
			Bowerbankia intricata * +
			Bowerbankia pustulosa +
			Bryozoa indet. (encr.)
			Conopeum ?reticulatum

TABLE 20

Complete list of conspicuous intertidal species found from survey work in the Plymouth Area including the Yealm.

CYANOPHYTA
Cyanophyta indet.

RHODOPHYTA
Ahnfeltia plicata
Antithamnion cruciatum
Antithamnion plumula
Antithamnion sp.
Antithamnion spirographidis
Apoglossum ruscifolium
Audouinella sp.
Bangia sp.
Bostrychia scorpioides
Brongniatella byssoides
Calliblepharis ciliata
Calliblepharis jubata
Callithamnion granulatum
Callithamnion sp.
Callithamnion tetragonum
Callithamnion tetricum
Callithamnion/Antithamnion sp.
Callithamnion/Compsothamnion sp.
Callophyllis laciniata
Catenella caespitosa
Ceramium ciliatum
Ceramium echionotum
Ceramium flabelligerum
Ceramium rubrum
Ceramium shuttleworthianum
Ceramium sp.
Chondrus crispus
Chylocladia verticillata
Compsothamnion thuyoides
Corallinacea indet. (encr.)
Corallina officinalis
Cryptopleura ramosa
Cystoclonium purpureum
Delesseria sanguinea
Dilsea carnosa
Dumontia incrassata
Furcellaria lumbricalis
Gastroclonium ovatum
Gelidium latifolium
Gelidium pusillum
Gigartina pisillata
Gracilaria foliifera
Gracilaria verrucosa
Griffithsia flosculosa
Gymnogongrus devoniensis
Gymnogongrus griffithsiae
Gymnogonrus crenulatus
Heterosiphonia plumosa
Hildenbrandia sp.
Hypoglossum woodwardii
Laurencia hybrida
Laurencia pinnatifida
Lomentaria articulata
Lomentaria clavellosa
Mastocarpus stellatus
Membranoptera alata
Mesophyllum lichenoides
Myriogramma heterocarpum
Myriogramme bonnemaisonia
Nitophyllum punctatum
Palmaria palmata
Phyllophora membranifolia
Phyllophora pseudoceranoides
Phyllophora traillii
Phymatalithon lenormandii
Plocamium cartilagineum
Plumaria elegans
Polyides rotundus
Polyneura hilliae
Polyneura sp.
Polysiphonia fibrata
Polysiphonia lanosa
Polysiphonia macrocarpa
Polysiphonia nigra
Polysiphonia nigrescens
Polysiphonia sp.
Polysiphonia urceolata
Polysiphonia violaceae
Porphyra leucosticta
Porphyra sp.
Pterosiphonia parasitica
Rhodomela confervoides
Rhodophyta indet (filamentous)
Rhodophyta indet. (dark red encr.)
Rhodophyta indet. (sporelings)
Schmitziella endophloea

CHRYSOPHYTA
Bacillariophyceae indet. (diatoms)

PHAEOPHYTA
Ascophyllum nodosum
Ascophyllum nodosum (sporelings)
Asperococcus sp.
Bifurcaria bifurcata
Chorda filum
Chorda tomentosa
Cladostephus spongiosus
Colopmenia peregrina
Cystosiera nodicaulis
Desmarestia aculeata
Desmarestia ligulata
Desmarestia viridis
Dictyota dichotoma
Ectocarpoidea indet.
Elachista fucicola
Elachista sp.

PORIFERA - CALCAREA
Calcarea indet.
Clathrina coriacea
Leuconia barbata
Leucosolenia botryoides
Myxilla sp. (brick red)
Scypha ciliata
Scypha compressa

PORIFERA - DEMOSPONGIAE
Amphilectus fucorum
Cliona celata
Cliona sp. (boring)
Halichondria bowerbanki
Halichondria panicea
Haliclona simulans
Haliclona sp.
Hymeniacidon perleve
Microciona atrasanguinea
Myxilla incrustans
Myxilla sp.
Ophlitaspongia seriata
Oscarella lobularis
Porifera indet.
Porifera indet. (brown slimy)
Porifera indet. (orange)
Porifera indet.(yellow slimy)
Suberites ficus
Suberites sp.

COELENTERATA - HYDROZOA
Campanularia flexuosa
Clava sp.
Clava squamata
Cordylophora lacustris
Dynamena pumila
Hydractinia echinata
Hydroidea indet.
Obelia sp.
Plumularia setacea
Sertularia cupressina
Syncoryne sp.
Tubularia indivisa

COELENTERATA - ANTHOZOA
Actinia equina
Actinia fragacea
Actiniaria indet.
Actinothoe sphyrodeta
Anemonia viridis
Bunodactis verrucosa
Caryophyllia smithii
Cereus pedunculatus
Corynactis viridis
Diadumene cincta
Metridium senile
Sagartia elegans
Sagartiogeton undatus
Urticina felina

PLATYHELMINTHES
Procerodes ulvae
Turbellaria indet.

ANNELIDA - POLYCHAETA
Aphroditidae indet.
Arenicola marina
Cirratulus cirratus
Eulalia viridis
Halosydra gelatinosa
Harmothoe impar
Lanice conchilega
Nereidae indet.
Nereis diversicolor
Nereis virens
Polydora sp.
Polynoidae indet.
Pomatoceros sp.
Spirorbinidae - on 'lithothamnia'
Spirorbinidae - on Corallinaceae
Spirorbinidae - on fucoids
Spirorbinidae - on rock
Spirorbinidae- on Gigartina/Chondrus
Spirorbis pagenstecheri
Spirorbis tridentatus
Terebellidae indet.

CRUSTACEA - COPEPODA
Tigriopus fulvus
Tigriopus sp.

CRUSTACEA - CIRRIPEDIA
Balanus crenatus
Balanus perforatus
Chthamalus montagui
Chthamalus sp.
Chthamalus stellatus
Cirripedia indet.
Elminius modestus
Semibalanus balanoides
Verruca stroemia

CRUSTACEA - MYSIDACEA
Siriella jaltensis

CRUSTACEA - ISOPODA
Campecopea hirsuta
Dynamene bidentata
Idotea granulosa
Idotea pelagica
Idotea sp(p)

Fucus ceranoides/vesiculosus hybrid
Fucus serratus
Fucus sp. (sporelings)
Fucus spiralis
Fucus vesiculosus.
Giffordia granulosa
Himanthalia elongata
Laminaria digitata
Laminaria hyperborea
Laminaria ochroleuca
Laminaria saccharina
Laminaria sp. (sporelings)
Leathesia difformis
Pelvetia canaliculata
Petalonia fascia
Petalonia sp.
Phaeophyta indet. (encrusting)
Phaeophyta indet. (filamentous)
Punctaria sp.
Saccorhiza polyschides
Sargassum muticum
Scytosiphon lomentaria
Spongonema tomentosum
Striaria attenuata

CHLOROPHYTA
Bryopsis plumosa
Chaetomorpha melagonium
Chaetomorpha sp.
Chlorophyta indet.('green fuzz')
Chlorophyta indet.(filam.)
Cladophora pellucida
Cladophora rupestris
Cladophora sp.(p)
Codium sp.
Codium tomentosum
Enteromorpha sp.(p)
Monostroma sp.
Ulva sp.(p)

LICHENS
Anaptychia fusca
Caloplaca marina
Caloplaca thallincola
Grey lichens
Lecanora atra
Lichina confinis
Lichina pygmaea
Ochrolechia parella
Physcia sp.
Ramalina sp.
Verrucaria maura
Verrucaria mucosa
Xanthoria parietina

ANGIOSPERMAE
Armeria maritima
Chrithmen maritimum
Festuca rubra
Plantago maritima
Zostera marina

Jaera albifrons
Ligia oceanica
Sphaeroma rugicauda
Sphaeroma sp.

CRUSTACEA - AMPHIPODA
Apherusa jurinei
Chaetogammarus marinus
Gammarellus angulosus
Gammaridae indet.
Hyale nilssoni
Melita palmata
Orchestia mediterranea

CRUSTACEA - DECAPODA
Cancer pagurus
Carcinus maenas
Galathea squamifera
Liocarcinus puber
Liocarcinus sp.
Pagurus bernhardus
Pagurus cuanensis
Palaemon serratus
Pisidia longicornis
Porcellana platycheles

CHELICERATA - ARACHNIDA
Arachnida indet.

INSECTA
Anurida maritima
Petrobius maritimus

MOLLUSCA - POLYPLACOPHORA
Acanthochitona crinatus
Lepidochitona cinereus

MOLLUSCA - PROSOBRANCHIA
Acmaea virginea
Buccinum undatum
Calliostoma zizyphinum
Calyptera chinensis
Crepidula fornicata
Gibbula cineraria
Gibbula umbilicalis
Lacuna pallidula
Lasaea rubra
Littorina 'saxatilis'
Littorina littorea
Littorina mariae
Littorina neglecta
Littorina neritoides
Littorina obtusata
Littorina obtusata/mariae
Littorina obtusata/mariae (eggs)
Littorina obtusata/mariae (juvs)
Monodonta lineata
Nassarius incrassatus
Nassarius reticulatus
Nucella lapillus
Ocenebra erinacea
Patella aspera
Patella depressa
Patella sp.
Patella vulgata
Patina pellucida
Rissoa parva
Rissoidae indet.

MOLLUSCA - OPHISTHOBRANCHIA
Aplysia punctata
Archidoris pseudoargus
Eubranchus sp.
Goniodoris nodosa
Jorunna tomentosa
Runcina coronata

MOLLUSCA - BIVALVIA
Anomiidae indet.
Cerastoderma edule
Cyprina islandica
Ensis sp.
Heteranomia squamula
Hiatella arctica
Modiolus phaseolius
Modiolus sp.
Monia squama
Mytilus edulis
Pholas sp.

BRYOZOA
Alcyonidium gelatinosum
Alcyonidium hirsutum
Bowerbankia imbricata
Bryozoa indet. (encrusting)
Bugula plumosa
Cellepora sp.
Crisia sp.
Cryptosula pallasiana
Electra pilosa
Flustrellidra hispida
Ostrea edulis
Scrupocellaria reptans
Scrupocellaria sp.
Umbonula littoralis

ECHINODERMATA - STELLEROIDEA
Amphipholis squamata
Asterias rubens
Asterina gibbosa
Marthasterias glacialis
Ophiothrix fragilis

Ophiuroidea indet

ECHINODERMATA - ECHINOIDEA
Psammechinus miliaris

CHORDATA - ASCIDIACEA
Ascidiella aspersa
Botrylloides leachi
Botryllus schlosseri
Ciona intestinalis
Dendrodoa grossularia
Didemnum candidum
Didemnum maculosum
Diplosoma listerianum
Molgula manhattensis
Morchellium argus
Polyclindae indet.
Sidnyum elegans
Sidnyum turbinatum
Styela clava

CHORDATA - PISCES
Anguilla anguilla
Blennius pholis
Cottus scorpius
Myoxocephalus scorpius
Pholis gunnellus

TABLE 21

Complete list of conspicuous subtidal species found from survey work in the Plymouth Area including the Yealm.

CYANOPHYTA
Cyanophyta indet (red)
Cyanophyta indet. (blue/greens)

RHODOPHYTA
Acrosorium uncinatum
Ahnfeltia plicata
Antithamnion cruciatum
Antithamnion plumula
Antithamnion sp.
Antithamnion spirographidis
Apoglossum ruscifolium
Atractophora hypnoides
Audouinella sp(p)
Bonnemaisonia asparagoides
Brongniartella byssoides
Calliblepharis ciliata
Calliblepharis jubata
Callithamnion hookeri
Callithamnion sp.
Callithamnion tetragonum
Callophyllis laciniata
Ceramium ciliatum
Ceramium diaphanum/strictum
Ceramium echionotum
Ceramium rubrum (agg.)
Ceramium sp.
Chondria dasyphylla
Chondrus crispus
Chylocladia verticillata
Compsothamnion thuyoides
Corallina officinalis
Corallinaceae indet. (encrusting)
Cordylecladia erecta
Crouania attenuata
Cryptopleura ramosa
Cystoclonium purpureum
Delesseria sanguinia
Dilsea carnosa
Drachiella spectabilis
Dudresnaya verticillata
Falkenbergia rufolanosa *
Furcellaria lumbricalis
Gastroclonium ovatum
Gastroclonium reflexum
Gelidium latifolium
Gigartina acicularis
Gloiosiphonia capillaris
Gracilaria bursa-pastoris
Gracilaria foliifera
Gracilaria verrucosa
Grateloupia filicina
Griffithsia corallinoides
Griffithsia devoniensis
Gymnogongrus crenulatus
Gymnogongrus devoniensis
Halarachnion ligulatum
Heterosiphonia plumosa
Hypoglossum woodwardii
Kallymenia reniformis
Laurencia pinnatifida
Laurencia sp.
Lomentaria articulata
Lomentaria clavellosa
Lomentaria orcadensis
Membranoptera alata
Meredithia microphylla
Mesophyllum lichenoides
Myriogramme bonnemaisonii
Myriogramme heterocarpum
Myriogramme sp.
Naccaria wiggii
Nitophyllum punctatum
Palmaria palmata
Peyssonnelia sp.
Phycodrys rubens
Phyllophora crispa
Phyllophora pseudoceranoides
Phyllophora sicula
Phyllophora traillii
Phymatolithon lenormandii
Phymatolithon polymorphum
Plocamium cartilagineum
Plumaria elegans
Polyides rotundus
Polyneura gmelinii
Polyneura hilliae
Polysiphonia brodiaei
Polysiphonia elongata
Polysiphonia macrocarpa
Polysiphonia nigra
Polysiphonia nigrescens
Polysiphonia sp.
Polysiphonia urceolata
Porphyra sp(p).
Porphyropsis coccinea
Pterosiphonia complanata
Pterosiphonia parasitica
Ptilota plumosa
Ptilothamnion pluma
Radicilingua thysanorhizans
Rhodomela confervoides
Rhodophyllis divaricata
Rhodophyllis sp.
Rhodophysema sp.
Rhodophyta indet. (encrusting)
Rhodophyta indet. (filamentous)
Rhodophyta indet. (foliose)
Rhodymenia delicatula
Rhodymenia holmesii
Rhodymenia pseudopalmata

Rhodymenia pseudopalmata (spiky)
Schmitzia hiscockiana
Schmitzia neopolitana
Schottera nicaeensis
Scinaia forcellata
Scinaia turgida
Sphondylothamnium multifidum
Spyridia filamentosa
Stenogramme interrupta
Trailliella imbricata *

CHRYSOPHYTA
Bacillariophyta indet. (diatoms)

PHAEOPHYTA
Aglaozonia parvula *
Arthrocladia villosa
Ascophyllum nodosum
Asperococcus compressus
Asperococcus sp.
Carpomitra costata
Chorda filum
Cladostephus spongiosus
Cutleria multifida
Cystoseira foeniculacea
Cystoseira sp.
Desmarestia aculeata
Desmarestia ligulata
Desmarestia viridis
Dictyopteris membranacea
Dictyota dichotoma
Ectocarpoidea indet.
Fosliella limitata
Fucus serratus
Fucus sp.
Fucus vesiculosus
Halidrys siliquosa
Halopteris filicina
Halopteris scoparia
Himanthalia elongata
Laminaria digitata
Laminaria hyperborea
Laminaria ochroleuca
Laminaria saccharina
Laminaria saccharina (juv.)
Laminaria sacchorina (sporelings)
Laminaria sp. (sporelings)
Mesogloia lanosa
Phaeophyta indet. (encrusting)
Phaeophyta indet. (filamentous)
Punctaria latifolia
Punctaria sp.
Ralfsia sp.
Saccorhiza polyschides
Sargassum muticum
Sporochnus pedunculatus
Striaria attenuata
Taonia atomaria
Tilopteris mertensii

CHLOROPHYTA
Bryopsis plumosa
Chaetomorpha melagonium
Chaetomorpha sp.
Chlorophyta indet. (fil.)
Cladophora pellucida
Cladophora sp.
Derbesia sp.
Enteromorpha sp.
Ulva sp.

ANGIOSPERMAE
Zostera marina

PROTOZOA
Haliphysema tumanowiczi

PORIFERA - CALCAREA
Clathrina coriacea
Grantia compressa
Leuconia barbata
Leuconia nivea
Leucosolenia botryoides
Scypha ciliata

PORIFERA - DEMOSPONGIAE
Amphilectus fucorum
Axinella damicornis
Axinella infundibuliformis
Axinella polypoides
Ciocalypta penicillus
Cliona celata
Cliona sp. (boring)
Dercitus bucklandi
Dysidea fragilis
Gellidae indet.
Halichondria bowerbankii
Halichondria panicea
Haliclona oculata
Haliclona sp.
Haliclona viscosa
Hemimycale columella
Hymedesmia sp.
Hymeniacidon perleve
Iophon hyndmani
Myxilla incrustans
Myxilla sp.
Pachymatisma johnstonia
Polymastia mamillaris
Porifera indet.
Porifera indet. (blue / grey encrusting)
Porifera indet. (citrus yellow encr.)
Porifera indet. (encrusting)
Porifera indet. (orange encrusting)
Porifera indet. (yellow encrusting)
Raspailia hispida
Raspaillia ramosa
Stelligera rigida
Suberites carnosus
Suberites ficus
Suberites sp.
Terpios fugax
Thymosia guernei

COELENTERATA - HYDROZOA
Abietinaria abietina
Aglaophenia pluma
Aglaophenia tubulifera
Bougainvillia ramosa
Calycella syringa
Clava multicornis
Clytia hemisphaerica
Cordylophora lacustris
Coryne van-benedeni
Coryne vermicularis
Dynamena pumila
Eudendrium capillare
Gonothyraea gracilis
Gonothyraea loveni
Halecium beanii
Halecium halecinum
Hartlaubella gelatinosa
Hydractinia echinata
Hydrallmania falcata
Kirchenpaueria pinnata
Lafoea pocillum
Nemertesia antennina
Nemertesia ramosa
Obelia dichotoma
Obelia geniculata
Obelia sp.
Plumularia cathrina
Plumularia halecioides
Plumularia setacea
Plumularia similis
Plumularia sp.
Sertularella gayi
Sertularella polyzonias
Sertularia argentea
Sertularia cupressina
Tubularia indivisa
Tubularia larynx

COELENTERATA - SCYPHOZOA
Lucernariopsis campanulata
Scyphyzoa indet. (scyphistomae)

COELENTERATA - ANTHOZOA
Actinia equina
Actinothoe sphyrodeta
Adamsia carciniopados
Aiptasia mutabilis
Alcyonium digitatum
Alcyonium glomeratum
Amphianthus dorhnii
Anemonia viridis
Balanophyllia regia
Bunodactis verrucosa
Caryophyllia smithii
Cereus pedunculatus
Cerianthus lloydii
Corynactis viridis
Edwardsia claparedii
Epizoanthus couchii
Eunicella verrucosa

Halcampa crysanthellum
Hoplangia durotrix
Metridium senile
Parazoanthus axinellae
Parerythropodium coralloides
Sagartia elegans
Sagartia elegans mineata
Sagartia elegans nivea
Sagartia elegans rosea
Sagartia troglodytes
Sagartiogeton undatus
Urticina eques
Urticina felina
Urticina felina/eques

PLATYHELMINTHES
Prosthecereaus vittatus

ENTOPROCTA
Pedicellina sp.

ECHIURA
Thalassema thalassemum

ANNELIDA - POLYCHAETA
Aphroditacea indet.
Arenicola marina (casts)
Bispira volutacornis
Branchiomma vesiculosum
Chaetopterus variopedatus
Chaetozone setosa
Cirriformia tentaculata
Filograna implexa
Gattyana cirrosa
Harmothoe castanea
Harmothoe impar
Harmothoe spinifera
Hydroides norvegica
Laeonereis glauca
Lanice conchilega
Loimia medusa
Lysidice ninetta
Melinna palmata
Myxicola aesthetica
Myxicola infundibulum
Neoamphrite figulus
Nereis pelagica
Nicolea zostericola
Ophiodromus flexuosa
Polychaeta indet. (tubes)
Polydora flava
Polydora sp.
Polymnia nebulosa
Pomatoceros sp.(p)
Protula tubularia
Pseudopotamilla reniformis
Sabella flabellata
Sabella pavonina
Sabellaria spinulosa
Salmacina dysteri
Serpula sp.
Serpulidae indet.
Spirorbinidae indet.
Spirorbis corallinae
Spirorbis tridentatus
Terebellidae indet.
Typosyllis cirropunctata

CRUSTACEA - CIRRIPEDIA
Balanus crenatus
Balanus crenatus (spat)
Balanus perforatus
Balanus sp.
Cirripedia indet. (juv.)
Cirripedia indet..
Elminius modestus
Pyrgoma anglicum
Verruca stroemia

CRUSTACEA - MYSIDACEA
Mysidacea indet.

CRUSTACEA - TANAIDACEA
Apseudes talpa
Gnathia sp.(Pranza)

CRUSTACEA - ISOPODA
Janira maculosa

CRUSTACEA - AMPHIPODA
Amphipoda indet. (tubes)
Caprella acanthifera
Caprellidae indet.
Corophium bonellii
Corophium sextonae
Corophium sp.
Ericthonius punctatus
Lysianassa ceratina
Maera othonis
Pseudoprotella phasma
Tritaeta gibbosa

CRUSTACEA - DECAPODA
Cancer pagurus
Carcinus maenas
Corystes cassivelaunus
Crangon crangon
Crangon sp.
Galathea sp.
Galathea squamifera
Galathea strigosa
Goneplax rhomboides

Goneplax rhomboides (burrows)
Homarus gammarus
Inachus dorsettensis
Inachus phalangium
Inachus sp.
Liocarcinus depurator
Liocarcinus puber
Macropodia rostrata
Maja squinado
Paguridae indet.
Pagurus bernhardus
Pagurus prideuxi
Palaemon serratus
Pilumnus hirtellus
Pisidia longicornis
Porcellana platycheles

CHELICERATA - PYCNOGONIDA
Endeis spinosa
Nymphon gracile

MOLLUSCA - POLYPLACOPHORA
Polyplacophora indet.
Tonicella rubra

MOLLUSCA - PROSOBRANCHIA
Acmaea virginea
Apphorhais pespelecani
Buccinium undatum
Calliostoma zizyphinum
Calyptraea chinensis
Crepidula fornicata
Gibbula cineraria
Gibbula tumida
Lacuna vincta
Littorina littorea
Littorina obtusata/mariae
Monodonta lineata
Nassarius incrassatus
Nassarius reticulatus
Nassarius reticulatus (eggs)
Nassarius sp.
Ocenebra erinacea
Patella sp.
Patina pellucida
Rissoa parva
Trivia arctica
Trivia monacha

MOLLUSCA - OPHISTHOBRANCHIA
Acanthodoris pilosa
Aeolidia papillosa
Aplysia punctata
Archidoris pseudoargus
Calliopoea bellulus
Coryphella lineata
Coryphella pedata
Coryphella sp.
Crimora papillata
Dendronotus frondosus
Doridacea indet.
Doto coronata
Doto fragilis
Elysia viridis
Eubranchus farrani
Eubranchus sp.
Facelina bostoniensis
Goniodoris nodosa
Jorunna tomentosa
Limacia clavigera
Ophisthobranchia indet.
Philine aperta
Philine quadripartita
Polycera faeroensis
Polycera quadrilineata
Rostanga rubra
Tergipes tergipes

MOLLUSCA - BIVALVIA
Abra alba
Abra sp.
Anomia ephipium
Anomia sp.
Bivalvia indet. (boring)
Bivalvia indet. (siphons)
Cerastoderma edule
Chlamys varia
Corbula gibba
Dosinia exoleta
Ensis ensis
Heteranomia squamula
Hiatella arctica
Hiatella sp. (siphons)
Kellia suborbicularis
Musculus marmoratus
Mya sp. (siphon)
Mytilus edulis
Nucula turgida
Ostrea edulis
Pecten maximus
Sphenia binghami
Venerupis pullastra
Venus striatula

MOLLUSCA - CEPHALOPODA
Cephalopoda indet. (eggs)

BRYOZOA
Alcyonidium diaphanum
Alcyonidium mytili
Bicellariella ciliata
Bowerbankia imbricata

Bowerbankia pustulosa
Bryozoa indet. (encrusting)
Bugula flabellata
Bugula plumosa
Bugula turbinata
Callopora rylandi
Cellaria salicornioides
Cellepora pumicosa
Cellepora sp.
Celleporina hassalli
Chartella papyracea
Chorizopora brongniarti
Conopeum reticulum
Conopeum sp.
Crisia denticulata
Crisiidae indet.
Cryptosula pallasiana
Electra crustulenta
Electra pilosa
Escharella sp.
Escharoides coccinea
Membranipora membranacea
Nolella sp.
Omalosecosa ramulosa
Parasmittina trispinosa
Pentapora foliacea
Schizomavella linearis
Scruparia chelata
Scrupocellaria reptans
Scrupocellaria scrupea
Scrupocellaria scruposa
Scrupocellaria sp.
Tubulipora flabellaris
Umbonula littoralis

PHORONIDA
Phoronis hippocrepia
Phoronis sp.

ECHINODERMATA - CRINOIDEA
Antedon bifida

ECHINODERMATA - STELLEROIDEA
Acrocnida brachiata
Amphipholis squamata
Amphiura chiajei
Amphiura sp.
Asterias rubens
Asterina gibbosa
Henricia oculata
Marthasterias glacialis
Ophiopsila aranea
Ophiothrix fragilis
Ophiura texturata
Ophiuroidea indet. (arms)

ECHINODERMATA - ECHINOIDEA
Echinocardium cordatum
Echinus esculentus
Psammechinus miliaris

ECHINODERMATA - HOLOTHUROIDEA
Aslia (=Cucumaria) lefevrei
Holothuria forskali
Labidoplax digitata
Neopentadactyla mixta

CHORDATA - ASCIDIACEA
Aplidium densum/punctum
Aplidium glabrum
Aplidium punctum
Ascidia mentula
Ascidiella aspersa
Ascidiella scabra
Ascidiella sp. (juv)
Botrylloides leachi
Botryllus schlosseri
Ciona intestinalis
Clavelina lepadiformis
Corella parallellograma
Dendrodoa grossularia
Diazona violacea
Didemnidae indet.
Didemnidae indet. (yellow)
Didemnum latrillei
Didemnum maculosum
Didemnum sp.
Didemnum trididemnum
Diplosoma listerianum
Diplosoma sp.
Diplosoma spongiforme
Distaplia rosea
Distomus variolosus
Lissoclinum perforatum
Molgula complentata
Molgula manhattensis
Morchellium argus
Polycarpa pomaria
Polycarpa rustica
Polyclinum aurantium
Pycnoclavella aurilucens
Pyura tessulata
Sidnyum elegans
Stolonica socialis
Styela clava
Trididemneum cereum
Trididemnum sp.

CHORDATA - PISCES
Ammodytes sp.
Blennius ocellaris
Callionymus lyra
Centrolabrus exoletus
Conger conger

Cottus scorpius
Crenilabrus melops
Ctenolabrus rupestris
Entelurus aequoreus
Gadidae indet.
Gobiidae indet.
Gobius niger
Gobiusculus flavescens
Labrus bergylta
Labrus mixtus
Molva molva
Parablennius gattorugine
Pholis gunnellus
Pleuronectes platessa
Pleuronectidae indet. (juv.)
Pollachius pollachius
Pomataschistus minutus
Pomatoschistus pictus
Pomatoschistus sp.
Raja clavata
Sygnathus acus
Taurulus bubalis
Thorogobius ephippiatus
Trisopterus luscus
Trisopterus minutus
Zeus faber

TABLE 22

Classification, description and evaluation of the conservation importance of habitats / community types present in the Plymouth Area and the Yealm.

Classification (based on sections 6.2 and 6.3)	Description	Provisional suggested importance
INTERTIDAL		
1. Wave exposed bedrock at the entrance to Plymouth Sound (described in section 6.2.2)	Open coast habitats at Penlee Point are typical of those of the exposed coast of South Devon. The rock is very broken with gullies and overhangs. The open surfaces are dominated by limpets and barnacles with dense red algae on the lower shore. Shores at Wembury are not included here.	Local
2. Rockpools in Plymouth Sound (described in section 6.2.3)	Rockpool communities are similar at many sites in Plymouth Sound and are fairly rich in species, particularly those on the lower midshore and the large deep pools at Staddon Point. Included here are most rocky shores in the Sound and in the shelter of Penlee Point. The sheltered location of pools and fairly rich communities make them of some importance.	Regional
3. Gently sloping broken rock slopes semi-exposed to wave action within Plymouth Sound (described in section 6.2.4)	These communities are typical of sheltered bay rocky shores, with a fairly high diversity of species over the whole shore. Although not surveyed, the shores between Mount Batten and Jennycliff Bay are included here and have previously been described as very rich in species.	Regional
4. Overhangs on the lower shore in Plymouth Sound and at Wilderness Point (described in section 6.2.5)	Overhangs are colonised by a wide variety of species that are characteristic of such situations, with additional boring species in limestone. They are not as rich as similar habitats in other inlets. They include most rocky shores in Plymouth Sound, except that certain locations on the north coast are not assessed here (see 10).	Local

5. Lower midshore underboulder communities in Plymouth Sound (described in section 6.2.6)	These communities are dominated by a few encrusting species and large numbers of amphipods. They are not as rich as similar habitats in other inlets. They were only recorded at Jennycliff Bay during the present survey.	Local
6. Lower shore underboulder communities at Wilderness Point and Devil's Point. (described in section 6.2.7)	Rich communities of typical underboulder species are present. Limestone boulders are dominated by boring species and sandstone boulders by gastropods.	Regional
7. Clean sand at Bovisand Beach (described in section 6.2.8)	This beach is exposed to wave action and the fauna is sparse.	Local
8. Coarse sand and gravel with pebbles in small bays in the area of Plymouth Sound (described in section 6.2.9)	These sediments contain species characteristic of stressfull conditions, including many oligochaete and capitellid worms. Species diversity is not high. They include beaches at Cawsand and on the north side of Drakes Island.	Local
9. Steeply sloping broken limestone bedrock on the north side of Plymouth Sound (described in section 6.2.10)	The communities found here are not particularly rich and are generally reduced examples of those found elsewhere in the Sound.	Local
10. Lower shore gulleys, overhangs and caves in limestone bedrock on the north side of Plymouth Sound. (described in section 6.2.11)	These habitats are dominated by <u>Dendrodoa grossularia</u>, but are otherwise low in species diversity. Such communities are rarely recorded. The limestone rock is also extensively bored by species of worms and boring bivalves. They are best developed below the mens bathing area at Tinside. Also, there is a history of study of these communities.	Regional / National
11. Wave-sheltered limestone bedrock and boulder shores in the area of The Narrows (described in section 6.2.12)	A wide variety of species, typical of very sheltered shores, are found here on rock that extends down to the low water level.	Regional

12. Wave sheltered hard substrata extending to mud on the lower shore in the Cattewater (described in section 6.2.13)	The communities here are typical of sheltered variable salinity areas, but the shores are spoilt by large quantities of man-made debris.	Local
13. Wave-sheltered bedrock generally extending to mud on the lower shore in the lower Tamar Estuary and River Lynher (described in section 6.2.14)	These are typically estuarine communities with the addition of species characteristic of sheltered fully marine conditions. They are generally quite rich, particularly where they extend to the lower shore. They include shores in the Lynher as far west as St. Germans, in the Tamar as far north as Cargreen, at Torpoint, Southdown and north of Cremyl.	Regional
14. Lower shore shale cobbles and boulders below the Ballast Pound (described in section 6.2.15)	This habitat is characterised by a rich flora of finely branching algae, including some rare species, and a typical but fairly rich boulder fauna. It covers a fairly extensive area and increases in richness into the subtidal.	Regional / National
15. Underside of a concrete slipway at Black Rock (described in section 6.2.16)	An unusual habitat which is effectively a large intertidal overhang in estuarine conditions. It is dominated by large numbers of Metridium senile and Mytilus edulis with the addition of a few more typically intertidal species. This habitat is not often encountered.	Regional
16. Mussel beds on intertidal sediment flats in the Lynher and Hamoaze (described in section 6.2.17)	Communities of conspicuous species on these beds are quite rich, particularly at Jupiter Point where an extensive bed forms a spit at low water. Associated fauna is typical of such habitats	Local
17. Muddy sediments in the Tamar, Lynher and Hamoaze (described in section 6.2.18)	Our sampling did not find the rich communities described by previous workers. Communities are typical of estuarine mud, but generally impoverished and never rich.	Local
18. Mud in the upper reaches of St. Johns Lake and Millbrook Lake (described in section 6.2.19	Rich communities of mudflat animals, including a high diversity of bivalves and polychaetes exist here. The area has an established nature conservation importance as a feeding ground for birds	Regional

19. Mud with high China Clay content in the upper Plym (described in section 6.2.20)	The high China Clay content did not appear to affect the quite diverse polychaete fauna found here. The highest densities of Scrobicularia plana found in the survey were recorded here. Communities were typical of estuarine mudflats.	Local / Regional
20. Muddy sediments in the lower Plym (described in section 6.2.21)	A large number of polychaete species, some in large numbers are found here. An apparently high input of organic material is not having an overly damaging effect on the communities.	Regional
21. Rock extending to the lower midshore in the upper Tamar (described in section 6.2.22)	This habitat is interesting because it is unusual to find rock at such a low level on the shore this far up an estuary. The communities, though fairly low in diversity, are unusual and provide the only example known in south-west Britain of the change in rocky shore communities from polyhaline to mesohaline conditions.	National
YEALM		
22. Wave-sheltered bedrock at the entrance to the Yealm (described in section 6.2.23)	The communities here contain a wide variety of species, particularly on the lower shore where damp areas are colonised by many typically subtidal species. The area studied was at Cellar Beach.	Regional
23. Overhangs and small caves on the lower shore at the entrance to the Yealm (described in section 6.2.24)	A high diversity of animal species, which are characteristic of this habitat, are present here. Many of these species are not generally found on open coast shores. The area studied was that to the west of Cellar Beach.	Regional
24. Sand with shale gravel and pebbles at the entrance to the Yealm (described in section 6.2.25)	These sediments contain a high diversity of macrofauna, especially of polychaete species. Ensis ensis is fairly abundant, and the presence of many large polychaete species indicates that the community is well established. The area studied was at Cellar Beach, but the assessment of importance takes account of reports from the south shore of the Yealm.	Regional / National
25. Hard substrata on muddy sand on the lower shore at Warren Point, Yealm (described in section 6.2.26)	An unusual shore due to the presence of much man-made and biological material washed on to it. The fauna and flora present is not rich but contains a number of notable species.	Regional

26. Bedrock and boulders extending to shingle and boulders on the lower shore in the Yealm (described in section 6.2.27)	The communities found here are good examples of very sheltered rocky shores. Species richness decreases as one moves up the inlet, and lower shore habitats were not found north of Thorn Quay. Included here are shores between Warren Point and Steer Point.	Regional
27. Coarse shelly gravel and sand with tree debris below the surface in the middle section of the Yealm (described in section 6.2.28)	This habitat is colonised by a reduced community of macrofauna to that found at Cellar Beach, but still with many large polychaetes and bivalves. The area studied was at Madge Point.	Regional
28. Mud and muddy sand in the upper Yealm (described in section 6.2.29)	Fairly rich communities of polychaete species exist here, with large numbers of cockles in the sandier areas. They include shores around the area of Steer Point.	Local
SUBTIDAL		
29. Bedrock adjacent to the coast exposed to strong wave action in the region of Plymouth Sound (described in section 6.3.2)	These habitats are typical of the region, but include some very good examples of gullies and other rock features with rich communities of animals. The tunnel at Penlee Point is unusual and of particular interest. Areas included in the survey are at Penlee Point and Staddon Point.	Regional
30. Wave exposed broken shale reefs in the infralittoral at the entrance to Plymouth Sound (described in section 6.3.3)	Communities here are very rich in both algae and animals, with several species rarely recorded in Britain, being mostly at their northern limits. Sediment communities are also of interest, but are not well well described. Although not well described from other areas these habitats are likely to be typical of the region.	Regional / National
31. Wave and tidal stream exposed limestone blocks in the infralittoral on the seaward side of Plymouth Breakwater (described in section 6.3.4)	Similar, but less diverse, communities to those found on open bedrock surfaces on the open coast are found here, with the addition of boring species in the limestone.	Local

32. Wave exposed broken bedrock in the circalittoral offshore of Plymouth Sound (described in section 6.3.5)	Communities here are remarkable for the high abundance of Eunicella verrucosa and the southern characteristics of the fauna and flora. Many species are rarely recorded in Britain. Species of particular interest include Carpomitra costata, Leptopsammia pruvoti, Thymosia guernii and Amphianthus dorhnii.	Regional / National
33. Sandy sediments offshore of the Plymouth Sound Breakwater (described in section 6.3.6)	Communities in these sediments are fairly diverse, with many small bivalves and polychaetes. The rarely recorded polychaete Pisione remota was recorded here.	Regional
34. Bedrock adjacent to the coast sheltered from strong wave action (described in section 6.3.7)	Similar communities of typical sheltered bay species are found on the west coast of Plymouth Sound around Cawsand Bay and the east coast around Jennycliff Bay.	Local
35. Wave sheltered offshore reefs and boulders in Plymouth Sound (described in section 6.3.8)	A number of these rocky outcrops occur in Plymouth Sound and are effectively the deeper water extensions of the shallow coastal communities (see 34). Species are characteristic of sheltered bay conditions, including rich algal communities with good historical records.	Regional
36. Infralittoral pebbles and cobbles in sand and gravel at sites sheltered from strong wave action, exposed to moderate tidal streams in Plymouth Sound (described in section 6.3.9)	Diverse communities of algae, characteristic of tidal swept areas, and including some unusual species, are found here. Animals are fairly sparse. They include areas north of 'The Bridge', east of Picklecombe Fort and at Duke Rock Buoy. There is a good historical record for this habitat.	Regional
37. Clean and Muddy shell gravel with shale pebbles in Plymouth Sound (described in section 6.3.10)	This habitat is notable for the presence of Gracilaria foliifera and possibly the worm Loimea medusa, which are both rarely recorded. A small variety of other algae and animals are also present.	Regional
38. Muddy sand colonised by Zostera marina in Plymouth Sound (described in section 6.3.11)	Fairly rich communities of associated algae and animals are found in these beds; and infauna, though not sampled in exactly the same areas, also consists of a wide variety of species. Areas included are Cawsand Bay, which is especially rich, and north of Drakes Island.	Regional

39. Limestone blocks sheltered from strong wave action and tidal streams in the infralittoral on the north side of the Plymouth Breakwater (described in section 6.3.12)	A low diversity of species is found here, although cave and overhang habitats exist where a greater variety of animals might be expected. Rock surfaces are dominated by Phoronis hippocrepia, with dense Saccorhiza polyschides in shallow depths.	Local
40. Steeply sloping broken limestone bedrock and boulders in the infralittoral and circalittoral very sheltered from wave action, exposed to strong tidal streams (described in section 6.3.13)	The tide scoured channel includes habitats, communities and species rarely encountered in other marine inlets. Rich animal communities are present on the pitted limestone surface and those boring into the rock provide a further feature of interest. Notable is the presence of the rarely encountered anemone Aiptasia mutabilis and the high abundance of the worm Myxicola aesthetica. Included are areas in the main channel off the Hoe, Eastern King Point, Mallard Shoal and north of the Mount Batten Breakwater	National
41. Muddy fine sediments in Plymouth Sound and the Catttewater (described in section 6.3.14)	Sediment communities of high biomass and diversity are found in many areas of Plymouth Sound. They are similar to communities found in other harbours but are more extensive and the wider range of muddy sediment types allows a greater diversity of species. Included are sediments in Cawsand Bay, Jennycliff Bay, north of the Breakwater, mid-Sound and the Cattewater.	National
42. Wharf and bridge piles in the Cattedown (described in section 6.3.15)	Fairly rich communities of animals, characteristic of harbour pilings and dock walls are found at the Cattedown Wharf. Bridge pilings at the Laira Bridge are not as rich.	Local
43. Circalittoral cobbles with with some small boulders amongst muddy shell gravel very sheltered from wave action, exposed to strong tidal streams (described in section 6.3.16)	Though not extensive this habitat is found at 'The Bridge' and in Millbay Pit, and contains a reasonable variety of animals that are characteristic of current stressed areas.	Local

44. Steeply sloping broken limestone bedrock and boulders in the infralittoral and circalittoral very sheltered from wave action, exposed to strong tidal streams in the Narrows (described in section 6.3.17)	Most surfaces here are domianted by the ascidian Dendrodoa grossularia. A wide range of other species of animals and algae are also present on both sides of the Narrows. This habitat is not often encountered, and very rarely to such depths.	Regional / National
45. Steeply sloping bedrock, boulders and other hard substrata in the infralittoral and circalittoral at sites in the lower Tamar (described in section 6.3.18)	Species diversity is low and communities fairly impoverished, due to the freshwater influence. However, bedrock habitats in estuarine conditions are not generally encountered.	Regional
46. Cobbles and shells on muddy sediments in the infralittoral and circalittoral at sites in the lower Tamar and River Lynher (described in section 6.3.19)	Shallow water areas contained fairly rich communities of both algae and animals, particularly off the Ballast Pound. Deeper areas held a wide variety of both epifauna and infauna. Numbers of species reduces with increasing distance upstream. Areas included are at St.Budeaux, Sand Acre Point, Royal Albert Bridge, Ince Point and off Devonport.	National / Regional
47. Hard substrata on mud in the upper reaches of the Tamar Estuary (described in section 6.3.20)	A small variety of mostly bryozoan and hydroid species are found on shells, tree branches and man-made debris. The communities are typical of polyhaline conditions.	Regional
48. Bedrock and boulders in river conditions of the upper Tamar estuary (described in section 6.3.21)	This habitat is of interest due to the very high density of the rarely encountered hydroid Cordylophora lacustris, with very little else present.	Regional / National
49. Muddy sediments in the Tamar and Lynher (described in section 6.3.22)	These sediments contained typically estuarine communities. Macrofaunal diversity was low and most areas appeared rather impoverished	Local

YEALM

50. Shallow wave-exposed gulley including steeply sloping and overhanging rock and rocks adjacent to sand near Toms Rock at the entrance to the Yealm ('Kitching's Gulley') (described in section 6.3.23)	This gulley is of particular interest for its history of study. Communities are rich, but generally characteristic of open coast habitats in this region.	Regional
51. Clean coarse sand off the entrance to the Yealm (described in section 6.3.24)	Though not thoroughly surveyed this habitat appeared to hold a rich community of species characteristic of exposed sand and gravel.	Regional
52. Fine clean sand colonised in places by dense Zostera marina at the entrance to the Yealm (described in section 6.3.25)	This habitat is of particular interest for the high diversity of small crustaceans, mostly amphipods, recorded here. Zostera and erect algae increase the habitat diversity for tube dwelling amphipods. Conspicuous species on Zostera and on the seabed are not diverse but a large population of Echinocardium cordatum is present.	Regional / National
53. Cobbles and pebbles on sediment in the upper infralittoral sheltered from wave action and exposed to moderate tidal streams in the Yealm (described in section 6.3.26)	A high diversity of algae, in particular, and animals are present in the main channel between Cellar Beach and Madge Point. Numbers of species decrease with increasing distance from the entrance, but remain high until fine sediments obscure the cobbles. Some rare species are present.	National
54. Slope of large boulders in the sublittoral fringe/upper infralittoral in the shelter of the River Yealm (described in section 6.3.27)	A restricted habitat with a small variety of species that are commonly found in the area and which are typical of sheltered inlets.	Local / Regional
55. Muddy sand with scattered hard substrata in the River Yealm (described in section 6.3.28)	Conspicuous fauna on these sediments is generally fairly sparse, although a wide variety of species characteristic of muddy channels are present. Infauna was not particularly diverse or rich.	Local / Regional

TABLE 23

Species of conservation interest in the are of Plymouth and the Yealm.

Species	Notes	Provisional suggested importance
ALGAE		
Gracilaria foliifera	This southern algae was recorded in large quantities in the Yealm and in very small amounts in Plymouth Sound on tide-swept cobbles. It is a southern species rarely encountered in Britain but more abundant in Salcombe Harbour. Importance refers to the Yealm.	Regional/ National
?Crouania attenuata	A rare species restricted to the South coast. Recorded as abundant on steeply sloping bedrock in Kitchings Gulley.	National
Griffithsia devoniensis	This filamentous algae is found only in sheltered marine inlets and is known from only a few locations in Britain. It occurred in the Hamoaze and was particularly abundant at Torpoint.	Regional/ National
Schmitzia hiscockiana	S. hiscockiana was first described in 1986 and is known from a few locations occurring on tide-swept or wave exposed cobbles. In the area considered here it occurred on cobbles and pebbles at two sites in Plymouth Sound.	Regional
Schmitzia neopolitana	This has a similar distribution to the above species and is rarely recorded in Britain.	Regional
Carpomitra costata	C. costata is a southern alga with a restricted distribution in Britain. In the Plymouth area, it was recorded in the lower infra-littoral/upper circalittoral at open coast sites.	Regional

Laminaria ochroleuca	The occurrence of L. ochroleuca was first described for British waters in the region of Plymouth in 1948. The species occurs in areas of local shelter on the open coast or at the entrance to marine inlets in the south-west area. Populations in Plymouth Sound are particularly well-developed and dominate the kelp forest in places.	Regional
ANIMALS		
Cordylophora lacustris	This hydroid occurs only in oligohaline conditions where hard substrata are available. Populations are rarely encountered and those in the Tamar are well developed.	Regional/ National
Hartlaubella gelatinosa	This hydroid occurs in oligohaline conditions on hard substrata and was recorded at a number of sites in the Tamar and Yealm.	Regional
Aiptasia mutabilis	This sea anemone has a sporadic occurrence in south-west England and Wales and is a rarely encountered species. A large population is present in places in the lower infralittoral off Tinside.	Regional
Eunicella verrucosa	The sea fan E. verrucosa is fairly widely distributed in south-west Britain but populations on the broken circalittoral rock at the entrance to Plymouth Sound were very dense, included many of the white variety and provided a host for the anemone Amphianthus dorhnii.	National
Amphianthus dorhnii	This anemone is recorded as occurring on E. verrucosa from the entrance to Plymouth Sound and is believed to have been observed during the survey. This is the only location recorded for this species in Britain.	National
Parerythropodium corallinoides	This conspicuous alcyonacean is recorded at only a few locations in Britain and was present under overhangs on offshore reefs at the entrance to Plymouth Sound.	Regional/ National

Parazoanthus axinellae	Colonies of this zoanthid anemone were encountered offshore of Plymouth Sound. The species is not recorded in large amounts from anywhere along the south coast of England although it is abundant at some locations around Lundy and West Wales.	Regional
Hoplangia durotrix	This coral is rarely recorded in Great Britain and is restricted to South-west England and Wales. Specimens have previously been recorded on the shore at Wembury. During the work described here it was recorded at one site.	National
Balanophyllia regia	The scarlet and gold star coral has a scattered distribution in South-west England and Wales and some dense populations are present in the Plymouth area. The importance of this species is enhanced by its intrinsic appeal.	Regional
Leptopsammia pruvoti	This cup coral is known from three other localities in Great Britain and, although only recorded once during the study described here, its presence, possibly in large numbers at some locations, is important.	National
Myxicola aesthetica	A small sabellid with a particularly mucilaginous tube that lives in crevices, mostly in Southwest Britain. Found to be very abundant in the sublittoral limestone in Plymouth Sound.	Regional/ National
Calliopea bellulus	A small saccoglosson ophisthobranch very infrequently recorded. It was recorded from Jennycliff Bay feeding on the eggs of Philine aperta.	National

Appendix 1

Abundance scales for rocky shore species

1. Live barnacles (except B. perforatus) (record adults, spat, cyprids separately); Littorina neritoides Littorina neglecta

7 Ex 500 or more per 0.01 m², 5+ per cm²
6 S 300–499 per 0.01 m², 3–4 per cm²
5 A 100–299 per 0.01 m², 1–2 per cm²
4 C 10–99 per 0.01 m²
3 F 1–9 per 0.01 m²
2 O 1–99 per m²
1 R Less than 1 per m²

2. Balanus perforatus

7 Ex 300 or more per 0.01 m²
6 S 100–299 per 0.01 m²
5 A 10–99 per 0.01 m²
4 C 1–9 per 0.01 m²
3 F 1–9 per 0.1 m²
2 O 1–9 per m²
1 R Less than 1 per m²

3. Patella spp. 10 mm+, Littorina Littorea (juv. & adults), Littorina mariae/obtusata (adults), Nucella lapillus (juv., < 3 mm)

7 Ex 20 or more per 0.1 m²
6 S 10–19 per 0.1 m²
5 A 5–9 per 0.1 m²
4 C 1–4 per 0.1 m²
3 F 5–9 per m²
2 O 1–4 per m²
1 R Less than 1 per m²

4. Littorina 'saxatilis', Patella < 10 mm, Anurida maritima, Hyale nilssoni and other amphipods, Littorina mariae/obtusata juv.

7 Ex 50 or more per 0.1 m²
6 S 20–49 per 0.1 m²
5 A 10–19 per 0.1 m²
4 C 5–9 per 0.1 m²
3 F 1–4 per 0.1 m²
2 O 1–9 per m²
1 R Less than 1 per m²

5. Nucella lapillus (> 3 mm), Gibbula sp. Monodonta lineata, Actinea equina, Idotea granulosa, Carcinus (juv. & recent settlement), Ligia oceanica

7 Ex 10 or more per 0.1 m²
6 S 5–9 per 0.1 m²
5 A 1–4 per 0.1 m²
4 C 5–9 per m², sometimes more
3 F 1–4 per m², locally sometimes more
2 O Less than 1 per m², locally sometimes more
1 R Always less than 1 per m²

6. Mytilus edulis, Dendrodoa grossularia

7 Ex 80% or more cover
6 S 50–79% cover
5 A 20–49% cover
4 C 5–19% cover
3 F Small patches, 5%, 10+ small individuals per 0.1 m², 1 or more large per 0.1 m²
2 O 1–9 small per 0.1 m², 1–9 large per m²; no patches except small in crevices
1 R Less than 1 per m²

7. Pomatoceros sp.

5 A 50 or more tubes per 0.01 m²
4 C 1–49 tubes per 0.1 m²
3 F 1–9 tubes per 0.1m²
2 O 1–9 tubes per m²
1 R Less than 1 tube per m²

8. Spirorbinidae

5 A 5 or more per cm² on appropriate substrata; more than 100 per 0.01 m² generally
4 C Patches of 5 or more per cm²; 1–100 per 0.1 m² generally
3 F Widely scattered small groups; 1–9 per 0.1 m² generally
2 O Widely scattered small groups; less than 1 per 0.1 m² generally
1 R Less than 1 per m²

9. Sponges, hydroids, Bryozoa

5 A Present on 20% or more of suitable surfaces
4 C Present on 5–19% of suitable surfaces
3 F Scattered patches; < 5% cover
2 O Small patch or single sprig in 0.1 m²
1 R Less than 1 patch over strip; 1 small patch or sprig per 0.1 m²

10. Flowering plants, lichens, lithothamnia

7 Ex More than 80% cover
6 S 50–79% cover
5 A 20–49% cover
4 C 1–19% cover
3 F Large scattered patches
2 O Widely scattered patches all small
1 R Only 1 or 2 patches

11. Algae

7 Ex More than 90% cover
6 S 60–89% cover
5 A 30–59% cover
4 C 5–29% cover
3 F Less than 5% cover, zone still apparent
2 O Scattered plants, zone indistinct
1 R Only 1 or 2 plants

Other animal species: record as percentage cover or approx. numbers within 0.01, 0.1 or 1 m²

Appendix 2

Abundance scales used for surveys of nearshore sublittoral areas in south-west Britain

ANIMALS

1. Large solitary species and colonies. For instance, solitary sponges, Alcyonium digitatum, hydroid clumps, large anemones, Pentapora foliacea, Cellepora pumicosa, echinoderms, large solitary tunicates.

ABUNDANT	One or more per 0.1 m^2.
COMMON	One or more per 1 m^2.
FREQUENT	Less than 1 per m^2 but more than about 20 individuals observed.
OCCASIONAL	About 3–20 observed.
RARE	One or two observed.

2. Small solitary species. For instance, Grantia compressa, small anemones, Caryophyllia smithii, Antdeon bifida, small solitary tunicates.

ABUNDANT	One or more per 0.01 m^2.
COMMON	One or more per 0.1 m^2.
FREQUENT	One or more per m^2, scattered patches.
OCCASIONAL	Less than one per m^2, scattered small patches.
RARE	Widely scattered individuals, one or two small patches.

3. Small colonial species and crustose species. For instance, encrusting sponges, Corynactis viridis, small hydroids, Polydora ciliata, beds of Mytilus edulis, barnacles, bryozoa, encrusting tunicates.

ABUNDANT	Large confluent colonies with more than 50% cover. More than 100 per 0.01 m^2.
COMMON	Many small or a few large patches with 10% to 50% cover. One or more per 0.01 m^2.
FREQUENT	Scattered patches less than 10% cover overall. One or more per 0.1 m^2.
OCCCASIONAL	Scattered small patches less than 1% cover overall. One or more per m^2.
RARE	Widely scattered very small patches or individuals. Less than one per m^2.

ALGAE

Kelps.

ABUNDANT	Plants mostly less than 50 cm apart. Difficult to swim between.
COMMON	Plants 50 cm to 1 m apart.
FREQUENT	Plants 1 to 2 m apart. Easy to swim between.
OCCASIONAL	Plants more than 2 m apart, zone still apparent.
RARE	Few plants present.

Foliose or filamentous undergrowth species.

ABUNDANT	More than 20% cover over most of area.
COMMON	Less than 20% cover but many plants present throughout zone.
FREQUENT	Less than 20% cover and distribution patchy or scattered plants present throughout zone.
OCCASIONAL	Scattered plants present.
RARE	Few plants seen in dive.

Kelp stipe flora.

ABUNDANT	Plants dense on most stipes.
COMMON	Plants present on most stipes but not dense.
FREQUENT	Distribution patchy, plants may be dense on some stipes, absent on others.
OCCASIONAL	Few plants on many stipes.
RARE	Few plants seen during dive.

Crustose species.

ABUNDANT	More than 50% cover.
COMMON	More than 20% cover.
FREQUENT	More than 5% cover.
OCCASIONAL	Less than 5% cover. Few scattered large patches or many small patches.
RARE	Few patches seen.

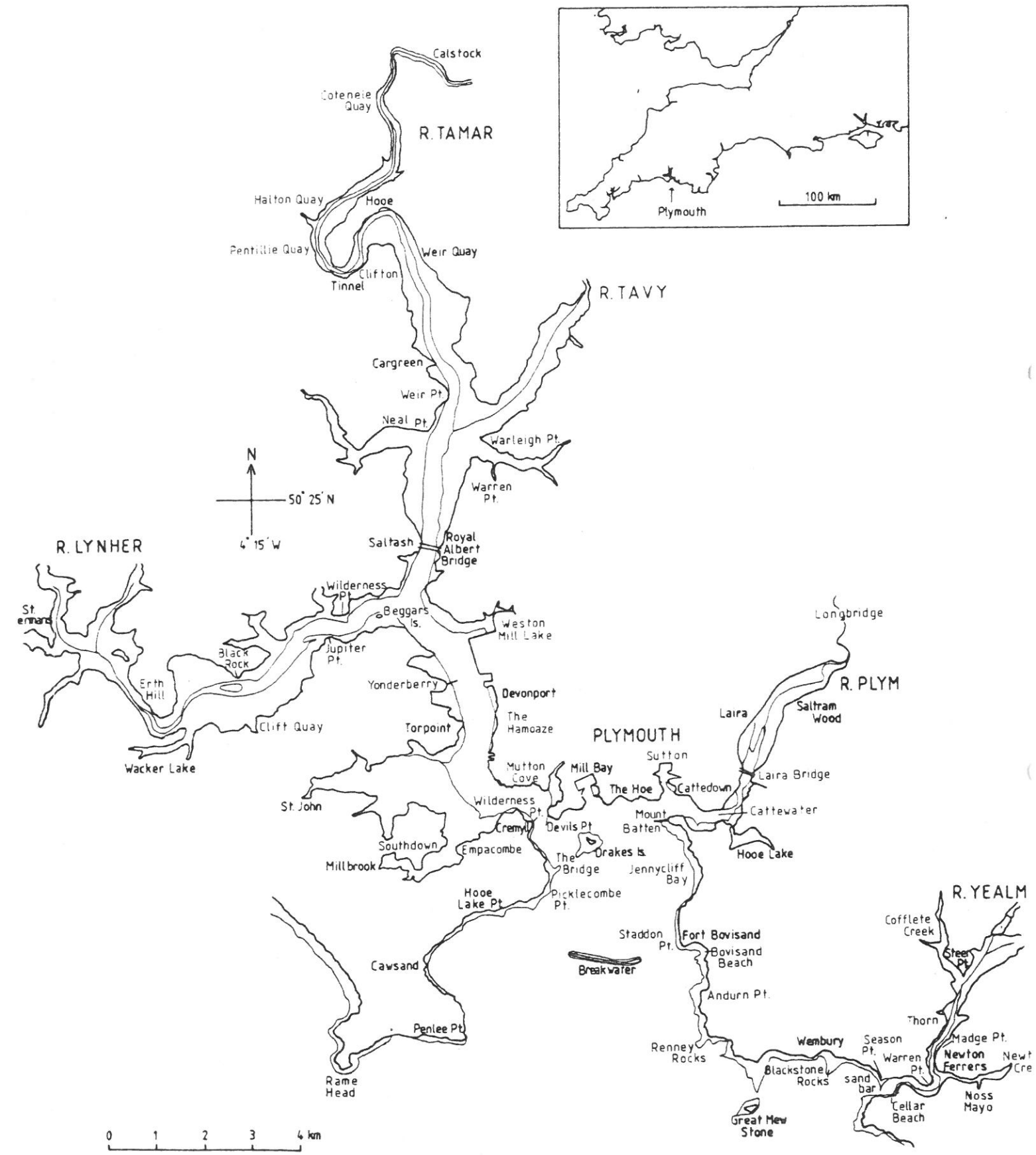

Fig. 1. Location of places mentioned in the text.