A report to the Nature Conservancy Council
from the Field Studies Council
Oil Pollution Research Unit,
Orielton Field Centre, Pembroke, Dyfed, U.K.

SURVEYS OF HARBOURS, RIAS AND ESTUARIES IN SOUTHERN BRITAIN
SALCOMBE HARBOUR AND THE KINGSBRIDGE ESTUARY

Volume 1

Report

Keith Hiscock

Survey teams:

Intertidal

Dr. Keith Hiscock, Field Studies Council
Graham Hobbs, Field Studies Council
Christopher Lumb, Nature Conservancy Council
Simon Walsh, Field Studies Council
Teresa Bennett, ex Field Studies Council
Timothy Russell, Field Studies Council

Subtidal

Dr. Keith Hiscock, Field Studies Council
Dale Rostron, Field Studies Council
Sarah Fowler, Nature Conservancy Council
Dr. Christine Maggs, Queens University, Belfast
Heather Hughes, Field Studies Council

Identification of Sediment samples

Dale Rostron, Field Studies Council
Jon Moore, Field Studies Council

Laboratory assistance

Heather Hughes, Field Studies Council

Secretarial: Margaret-Anne Codd, Field Studies Council
Tracey Lyons, Field Studies Council

March 1986

FSC/OPRU/40/85

SURVEYS OF HARBOURS, RIAS AND ESTUARIES IN SOUTHERN BRITAIN
SALCOMBE HARBOUR AND THE KINGSBRIDGE ESTUARY

Contents

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 surveys over an initial three year period from 1985 to 1988.

Some of the inlets included in the study 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 to:

1. Describe the areas in terms of their physical attributes.
2. Review the results of previous marine biological and related studies both published and unpublished.
4. Review fisheries, boating activities, port operations, diving activities, educational activities, research studies and other marine resource usage.
3. 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 will aim 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

SALCOMBE HARBOUR AND THE KINGSBRIDGE ESTUARY

Synopsis

Salcombe Harbour and the Kingsbridge Estuary are situated on the south coast of Devon and are constituted by a steep-sided main channel with branches. The length of the main channel is 8 km from the entrance to Kingsbridge in the north. The area covered by water at high tide is about 4 km^2. There are extensive areas of intertidal sediments in the estuary which are sandy in Salcombe Harbour but of mud futher north and in the creeks. Some sediments have coarse shale and shells mixed-in. Rocky shores extending into the subtidal occur at the entrance and at promentories within the inlet. There is very little freshwater inflow and conditions are almost fully marine along most of the main channel. The area is used mainly for recreational sailing and there are extensive moorings and pontoons. There is little fishing activity and only a few oyster cultivation trays. The area is used by field courses and collecting occurs especially at two particularly rich sites. The scientific importance of the shores from a marine biological point-of-view is well established and the whole inlet including the seabed is to be notified as an SSSI. The area was first surveyed and sampled thoroughly in 1900 and since then, staff at the Marine Biological Association at Plymouth have made collections and observations in the area particularly of burrowing species and their commensials and the decline of Zostera marina at Mill Bay.

The present survey aimed to collect further information on the marine habitats and communities, particularly those in the subtidal, which had not been sampled since 1900, and from intertidal and subtidal rocky areas which had never been thoroughly surveyed. Also, survey and sample sites were planned to cover the areas sampled by Allen and Todd in 1900 so that comparisons could be made. The abundance of species living on hard surfaces and visible on the surface of sediments was recorded in situ. Burrowing fauna were collected in cores and by digging in intertidal areas and samples were sieved over 0.5 mm, 1 mm and 5 mm mesh sieves. Subtidal sediments were sampled using a pipe dredge and, at the entrance, a suction sampler. The samples were sieved over a 1 mm mesh. Animals were picked out of the sediments, identified and individuals of each species counted. Photographs were taken to illustrate habitats, communities and species and a series of aerial photographs was taken during extreme low water level in April.

Habitats and communities present were classified into nine intertidal and twelve subtidal types. Descriptions are given of each of these and the abundance of species is shown in tables. The distribution of habitats and communities is discussed and the changes on moving from the open coast to the most sheltered parts of the estuary are listed. The main characteristics of marine communities in Salcombe Harbour and the Kingsbridge Estuary are the same as in 1900 except that a few well-recorded species have disappeared or been reduced in abundance. These losses have in part, been linked to the loss of Zostera marina due to disease in the 1930's and to accumulation of sand in some areas. Recently, the abundance of dog whelks, Nucella lapillus appears to have declined dramatically and the antifouling coating Tributyltin is suspected as the cause. Incoming species include Mya arenaria, a native species which invaded the south coast about twenty years ago, and Laminaria ochrolenca, a southern species which was first observed in Britain

in 1948 and at Salcombe in 1949. Alien species are also present and, most recently, Sargassum muticum has colonised the estuary and is now abundant. Our surveys added substantially to the amphipods and polychaetes known from sediments, doubtless because of the smaller mesh size we used to screen samples compared to previous studies, and to the flora and fauna recorded from hard substrata which had not previously been surveyed in any detail.

The scientific interest and nature conservation importance of the area has been assessed using standard criteria and the conservation importance of the habitat and communities in the area have been provisionally graded as of Local, Regional, National or International importance. Species of particular scientific interest identified during surveys of conspicuous species have been noted and their conservation importance provisionally graded as of Regional, National or International importance. The assessment of importance of sediment-dwelling species requires further consideration. Salcombe Harbour and the Kingsbridge Estuary are of outstanding scientific interest mainly for the burrowing fauna present in both intertidal and subtidal sediments and because of the presence of many rare or unusual species in both intertidal and subtidal areas. Current levels of recreational usage do not appear to pose a significant threat to the scientific interest of the area but digging for specimens and bait at extreme low water level, the effects of Tributyltin anti-fouling paints and the possible impact of Sargassum muticum on the rich sediment-dwelling fauna are all cause for concern.

1. INTRODUCTION AND HISTORICAL PERSPECTIVE

Salcombe Harbour and the Kingsbridge Estuary are situated on the South coast of Devon around longitude 3°46' W, latitude 50°15' N. The location of the area and of the main coastal features mentioned in the text are shown in Fig. 1 (which folds out of the back of the repart in bound copies). The area covered by water at high tide is about 4 km^2 and half that at low water of spring tides. The inlet has been an important area for trading, fishing and recreation for many years with centres of population at Salcombe (pop. 2,374 in 1981) and Kingsbridge (pop. 4,142 in 1981) (South Hams District Council Plan, 1984).

In 1822 Salcombe was described as "a fishing town with three shipwrights' yards and a whitsuntide fair for trinkets, sweetmeats etc". It began to grow rapidly in the 1840's and especially after the opening of the railway at Kingsbridge in 1893. Salcombe Castle (Fort Charles) was erected by Henry VIII and is now in ruins (Hoskins, 1954). During the last war, the area was used by troops training for landings on the coast of France. A slipway was built in Mill Bay and there are many anecdotal stories of ammunition and vehicles being dumped or lost in the harbour. The harbour is now occupied by extensive systems of moorings with harbour facilities occupying about 1 km of coastline adjacent to the town and large pontoons moored in the northern part of the harbour. The harbour accepts vessels up to 100 m in length and 5.5 m draught. Salcombe has considerable character and is an attractive location to visitors who saturate the town during the summer and provide its main income. However, the town has declined in population over the past 20 years.

Kingsbridge, at the head of the estuary is a long-established settlement being a borough by 1238. In the 1880's Kingsbridge had an active coasting trade, a ship building yard, a tannery, two breweries, an agricultural implement works and a great cattlemarket every month (Hoskins, 1954). At Kingsbridge, the population fell after the arrival of the railway in 1893 but has since risen, due in particular to its importance as a holiday centre. The economy of Kingsbridge remains focussed on the tourist trade and as a regional centre for services. Small vessels are moored in the region of Kingsbridge but the long period over which the majority of the inlet is dry doubtless makes it unattractive as a major centre for boating. The population of Kingsbridge has increased by over one quarter in the past 20 years and is one of the fastest growing market towns in Devon (South Hams District Council Plan, 1984).

There are several smaller settlements on the shores of the estuary some of which have grown considerably in recent years by the influx of retired people and the purchase of second homes.

2. PHYSICAL CONDITIONS

2.1. Geology and topography

Salcombe Harbour and the Kingsbridge Estuary constitute a system of steep-sided inlets cut into the land-mass with a plateau of about 120 to 130 m height (Fig. 2). Originally an unglaciated river valley, the deep-cut inlets are not the result of any recent river; the River Avon which formely flowed into the system runs within 3 km of Kingsbridge but now flows into a rather small estuary to the west. The harbour and estuary are a ria - a drowned river valley resulting from the post glacial rise in sea level.

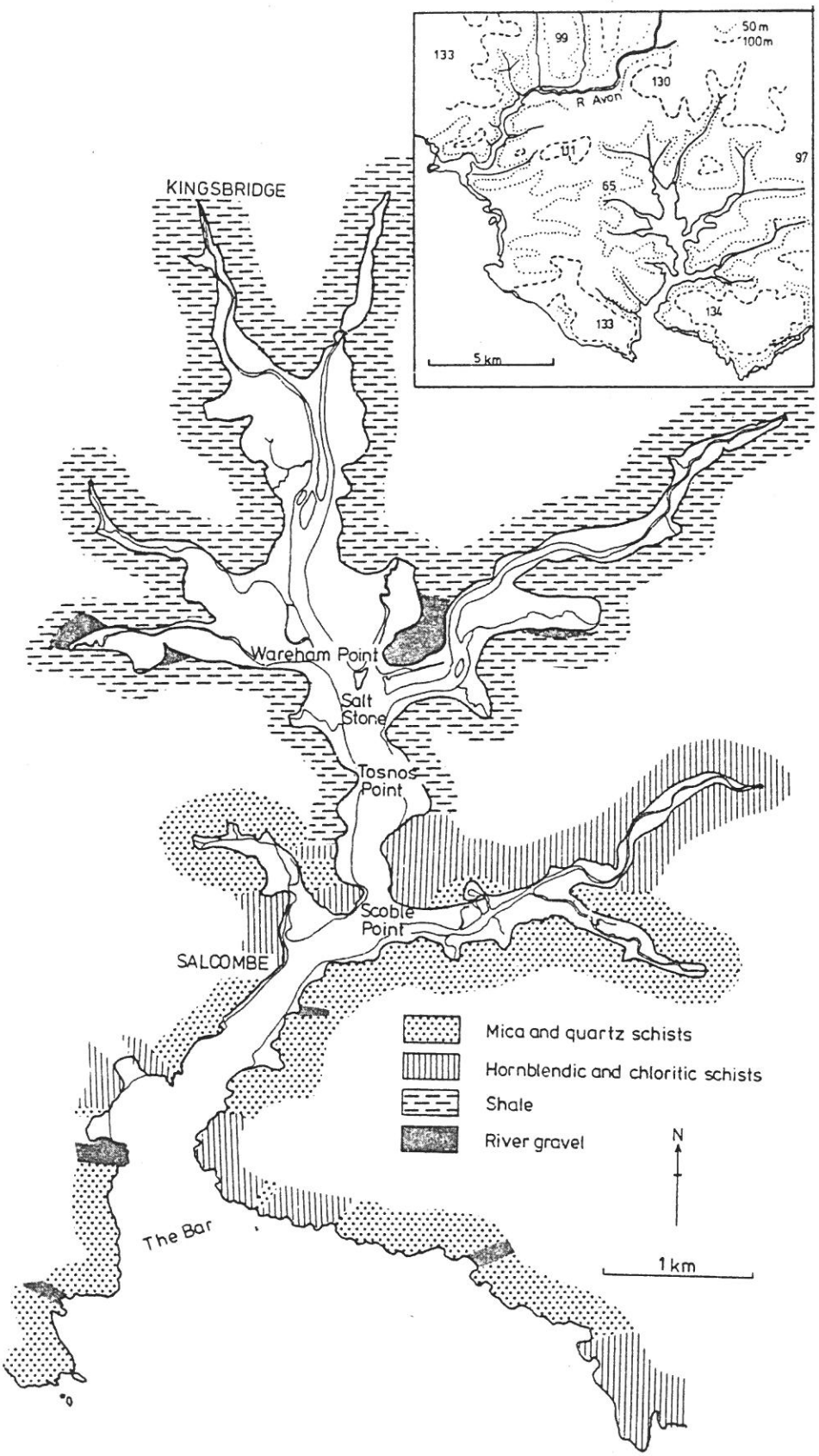

Fig. 2. Coastal geology, topography and catchment area of the area of Salcombe Harbour and the Kingsbridge Estuary. Geology re-drawn from the Geological Survey of Great Britain Sheets 355 and 356. Topographical features and catchment area (box) re-drawn from Admiralty Chart 28 and the Ordnance Survey Map.

To the north of a position between Scoble Point and Tosnos Point (Fig. 2) shale rock is present throughout most of the coast with some strips of river gravel. The headland which terminates at Wareham Point is of river gravels although the Salt Stone off these is of shale. South of the shales, rocks are of mica and quartz schist or hornblendic and chloritic schists. North of Scoble Point, at least below Mean High water of Neap Tides level, bedrock is overlain by sediments. In the intertidal and middle of the channels these are fine muds. Coarser sediments are present on the subtidal seabed where currents cause scour. Where sediments are present on the shores of Salcombe Harbour, they are generally of sand. The seabed here is of coarse material including extensive areas of cobbles and pebbles. The estuary is separated from the open sea by a shallow sand bar at its entrance.

2.2. Hydrography

2.2.1. Bathymetry and tidal heights. Fig. 3 shows the main features of the bathymetry and the heights of mud flats in the region of Salcombe Harbour, the Kingsbridge Estuary and off the nearby open coast. Tidal range at Salcombe is between 0.7 and 5.3 m relative to chart datum (cd) at Mean Spring Tides and 2.1 and 4.1 m at Mean Neap Tides. Maximum tidal range is about 6 m. The main bathymetric feature is the navigation channel which extends to between 6 and 8 m below cd (bcd) from the entrance to Salcombe Harbour to Tosnos Point with one area over 12 m deep north of Snapes Point. At Snapes Point and Scoble Point deep water occurs close to the shore suggesting steep rocky slopes. Further north and extending a short distance into Southpool and Frogmore Creeks, the channel is shallower than 2.5 m bcd. There is an extensive shallow area across the entrance to the harbour where depths are less than 2.5 m bcd and parts of the bar at the entrance are less than 1 m bcd. There are small areas of shallow banks off Snapes Point, in the centre of the channel south of Tosnos Point and adjacent to the western shore north of Tosnos Point. Bays in the harbour are generally shelving sand above cd but rock surfaces backing them are generally steeply sloping. The very extensive areas of mud flats occupying the creeks and most of the northern part of the estuary are fairly level and at a height of 3 to 4 m above cd. Navigation channels in the creeks and near to Kingsbridge dry during spring tides.

2.2.2. Temperature. There is no known published information on seawater temperatures within the shelter of the inlet. These are more likely elevated during summer months and depressed during cold winter weather compared to temperatures on the open coast. Here, surface temperatures range from 8.5°C in winter to 16°C in summer (Lee and Ramster, 1981).

2.2.3. Freshwater input and salinity. South West Water have supplied information on theoretical average daily flow of freshwater to the estuary. The total channel flow and direct run-off is estimated at 1.59 $m^3 s^{-1}$. For comparison, the theoretical average daily flow on the River Dart at Totnes Weir is 10.5 $m^3 s^{-1}$. There are numberous small channels on the Salcombe/Kingsbridge estuary none of which are measured.

2.2.4. Tidal streams. Tidal streams set in the direction of the channels and are recorded as a maximum of 1.9 knots surface velocity off Salcombe during spring tides. However, the supplement to the Channel Pilot (Admiralty, 1971) records an ebb tidal stream of up to 3 knots in the same area during spring tides. Notations on Admiral Chart 28 show maximum tidal stream velocity as 1 knot outflowing opposite Fort Charles, 2.5 knots inflowing off Ditch End and up to 1.5 knots on inflow and outflow at locations between Snapes Point and the Salt Stone. No other information is known to be available on tidal stream velocity in the area although it is known that streams are weak in the creeks.

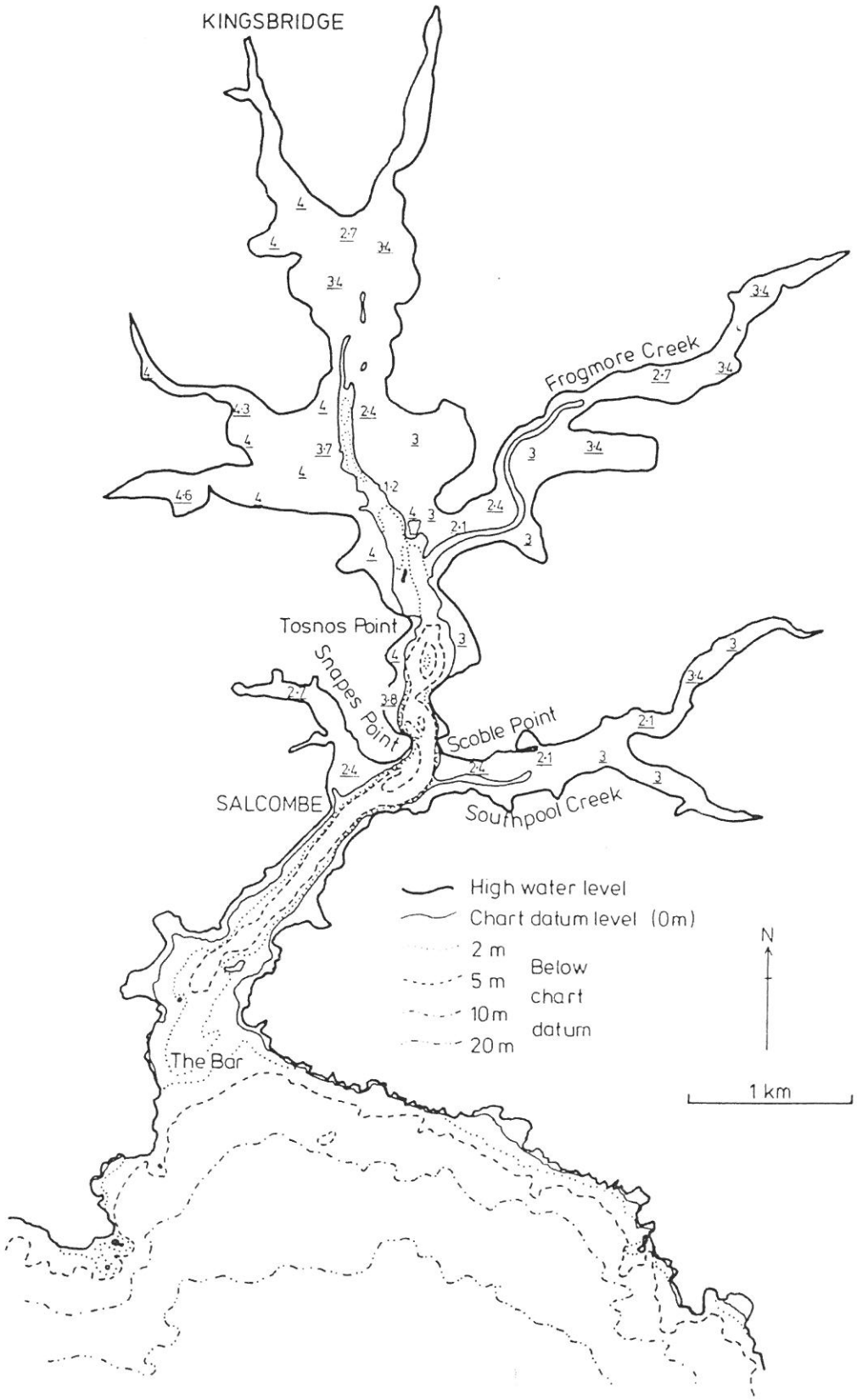

Fig. 3. Main features of the bathymetry and heights of muds flats in Salcombe Harbour, the Kingsbridge Estuary and off the nearby open coast. The heights of mud flats above chart datum are given. Based on Admiralty Chart 28.

2.2.5. Exposure to wave action. Open coast areas to the east of the inlet are exposed to prevailing winds and therefore strong wave action. However, shelter is offered by Bolt Head and by the gradually sloping nature of the seabed so that the shore and shallow seabed are not extremely exposed. The east facing coast near Starehole Bay and northwards into the inlet is very sheltered from prevailing winds but subject to occasional very strong winds over a long fetch from open coast waves and swell, so that the wave action within the inlet is almost entirely generated by wind fetch over open water. However, some swell does enter the harbour. Fetch can be as much as about 2 km and during a strong gale winds of an appropriate direction would generate waves of up to about 80 cm in height within the inlet (derived from graphs in Darbyshire and Draper, 1962). Such waves would be of short lengths (about 16 m) and period (about 3 seconds) and would create oscillatory velocities at the seabed of about 30 cm/sec at 5 m depth and 5 cm/sec at 10 m depth (Hiscock, 1976). Because this is less than the strength of tidal streams at the seabed, effects are probably negligiable. At the surface, they would be sufficient to create some re-suspension of mud. In some areas, particularly in Batson Creek, Southpool Creek and Frogmore Creek and at the heads of all the creeks much more sheltered conditions exist. Also, areas immediately to the north of Snapes Point are very sheltered because of the protection afforded as the channel changes direction.

2.3. Substratum types

2.3.1. Intertidal areas. Ordnance Survey maps provide the greatest amount of useful information about the distribution of bedrock, boulder, shingle, sand and mud surfaces in the intertidal. Descriptions of the marine biology of the area by Allen and Todd (1900), Wilson (1948) and in the Plymouth Marine Fauna (Marine Biological Association, 1957) also provide information. This and descriptions collected during the survey decribed here will be included in the Discussion section of this report.

2.3.2. Subtidal areas. The published Admiralty Chart (No. 28) provides very little information although it would be expected that original surveys recorded seabed type. These have not been consulted. Allen and Todd (1900) and Marine Biological Association (1957) provide a description of substratum types at dredged locations. Observations collected during the current survey provide the most useful information and all available data will be brought together in the Discussions section of this report.

3. HUMAN INFLUENCES

3.1. Sewerage and storm drains

Information on sewage discharge into the estuary has been supplied by South West Water.

Several small sewage treatment works discharge treated effluent to streams prior to the estuary. There are four direct discharges for which treatment varies. The Kingsbridge sewage treatment works (Park Bay) (Ordnance Survey Grid Reference 738 424) has a design discharge of 260,000 gallons per day. It is a single biological filter with a consent condition of 20 mg/l BOD and 30 mg/l suspended solids on the effluent. The sewer at Salcombe (Ordnance Survey Grid Reference 735 375) has a design discharge of 270,000 gallons per day and Macerated crude is discharged on the ebb tide. East Portlemouth has a design discharge of 1,100 gallons per day of crude at Ordnance Survey Grid Reference 740 383. Southpool sewage treatment works (Ordnance Survey Grid

Reference 735 375) has a design discharge of 270,000 gallons per day and Macerated crude is discharged on the ebb tide. East Portlemouth has a design discharge of 1,100 gallons per day of crude at Ordnance Survey Grid Reference 740 383. Southpool sewage treatment works (Ordnance Survey Grid Reference 771 401) has a design discharge of 7,000 gallons per day. It is a single biological filter with a consent condition of 30 mg/l BOD and 40 mg/l suspended solids. It is unlikely that any of these works are discharging as much as the design quantites and, since flows are not measured, these figures should be used as a guide to the relative volumes of the four discharges.

3.2. Industrial effluents and pollution

There are no industrial activities bordering the inlet or within its catchment area known to be producing aqueous effluents. Also, there is no history of metal extraction in the region which may have resulted in leaching of heavy metals into the inlet.

In the past few years, there has been concern about the effects of organo-tin anti-fouling paints and research suggests significant effects at low concentrations. For instance, 48 h LC_{50} values of 1.6 $\mu g\ l^{-1}$ for Crassostrea gigas, 2.3 $\mu g\ l^{-1}$ for Solea solea and 1.5 $\mu g\ l^{-1}$ for Crangon crangon larvae (Thain, 1983). Over longer periods, LC_{50} values for larvae occur at much lower levels and Waldock and Thain (1983) found that concentrations of tributyltin oxide as low as 0.15 $\mu g\ l^{-1}$ produced shell thickening and reduced growth in spat of C. gigas over an 8 week period. 0.35 $\mu g\ l^{-1}$ of tributyltin flouride was the threshold of inhibition of growth of Campanularia flexuosa (Stebbing, 1981). As a very busy centre for yachting, Salcombe Harbour has come under some scrutiny. Cleary and Stebbing (1985) studied the concentration of total tin and organotin in coastal waters of Southern England. Two samples were taken in July and September in 1984 in Salcombe Harbour. Levels of organotin as tributyltin oxide were less than 0.10 $\mu g\ l^{-1}$ (not detectable) on both occasions. Thus, within the general water body, concentrations of tributyltin compound were lower than that found to have significant effects on marine organisms. However, recent studies by Drs G. Bryan and P. Gibbs have demonstrated very high sensitivity of the dogwhelk Nucella lapillus to tributyltin compounds with reduction in abundance at many sites (P. Gibbs, pers. comm.).

3.3. Port/harbour facilities and users.

Salcombe Harbour and the Kingsbridge Estuary is primarily an area of recreation but includes facilities for a small fishing fleet of about 25 vessels. The whole area is administered by the Salcombe Harbour Sub Committee which reports to the South Hams District Council and the area is administered in accordance with the Salcombe Harbour Order, 1954. Detailed information on the number and location of moorings, access points and uses of areas within the inlet are included in a document produced by the Salcombe Harbour Office in January 1981. At that time, there were 1,708 moorings throughout the area from the Bar to Kingsbridge including all the creeks. This number had increased slightly in some areas and decreased in others up to 1985 but was about 10% up on 1981 figures (Capt. J. Blazeby, pers. comm.). Channels and some areas of mud flats are kept clear of moorings for navigation purposes. There are pontoons at Salcombe at the entrance to Batson Creek, north of Snapes Point and south and north of Tosnos Point. The harbour authority is following a strategy of establishing pontoons for high density berthing and clearing some areas of moorings for amenity. Fishing vessels and moorings for keep pots are maintained off the entrance to Batson Creek and there is a fish

quay in Batson Creek. Some dredging is undertaken to maintain the channel leading to the Whitesand (Salcombe) pontoon and up to the Fisheries quay in Batson Creek. Anchoring is permitted in specified areas. The eastern part of Salcombe has seawalls and other structures extending into the intertidal as do areas around Kingsbridge. The Boat Pool in Southpool Creek has been formed by the construction of a dyke. There are various slipways adjacent to settlements but the majority of the coast is unaffected by developments.

Most recreation is sailing and the large number of craft using the area have necessitated the banning of diving within the inlet although some diving on a wreck north of the Black Stone is undertaken with the permission of the harbourmaster. Water skiing has been prohibited in the past but is to be allowed in the area south of Charleton Point for a trial period in 1986 or 1987. North Sands, South Sands and the area from Mill Bay to Ditch End are popular beaches for family recreation and there is some swimming.

3.4. Sand extraction

Wilson (1948) notes that Salcombe was formally much visited by sailing vessels who took sand from Mill Bay for ballast. Large amounts of sand for building purposes were also removed to Kingsbridge. This excavation stopped soon after the 1914-18 war. Sand was also extracted in barges from The Bar though not, as far as is known, in this century. The Harbour Authority policy document notes the accretion of sand in the harbour as increasing each year and proposed that controlled sand extraction from the Bar should be investigated. Wilson (1948) also suggests that cessation of sand extraction has led to a considerable increase in the level of sand particularly on the east side of the Harbour.

3.5. Educational and research usage.

The known richness of marine communities within Salcombe Harbour and the Kingsbridge Estuary, the published description of locations for collecting and the proximity of Slapton Ley and Courtlands Field Centres and of the Marine Biological Association Laboratory have all led to the use of the area over many years for student training and for the collection of biological material for research and specimen supply. Mill Bay, the area below the Marine Hotel at Salcombe and the Salt Stone are all favoured areas with some work also at New Bridge in Bowcombe Creek to High House Point. During our field survey in April, groups of students from Cambridge and Manchester were using the area. The areas of greatest interest are limited in extent and some damage is doubtless caused by digging in particular.

3.6. Commercial utilization of fish stocks.

Although several fishing vessels use Salcombe as a base, their activities are almost entirely outside of the inlet. There is rare dredging for scallops (stocks of which are now greatly depleated) and no known dredging for oysters. Nets are set for short periods within the inlet.

There are no licenses issued by the South West Water for salmon and sea trout netting but there is one for eel fishing. Migratory species do use the estuary but eels are most numerous, sea trout less so and salmon only occasional.

A thriving white fishery exists with many single operators working small boats and using drift nets for bass and mullet. Anglers are also numerous, taking mainly demersal species such as blonde and thornback rays, plaice, flounder and dab, as well as bass and mullet.

Shellfish are important with winkles, oysters and crabs being taken commercially and there is limited picking of mussels and cockles.

Some oyster cultivation occurs on trays in channels at Collapit Creek, South of Gerston Point, South of Charleton Point and near the entrance to Frogmore Creek.

3.7. Established nature conservation importance.

The whole area of Salcombe Harbour and the Kingsbridge Estuary is to be notified as a Site of Special Scientific Interest extending from High Water Ordinary Spring Tide level across the inlet including the seabed. The SSSI designation is northwards from The Bar. The citation related to the notification includes the following key points.

> "The Salcombe-Kingsbridge Estuary possesses an outstanding intertidal and marine flora and invertebrate fauna. It is also important as a feeding ground for wildfowl and waders.
>
> At the heads of the tributary creeks occur small areas of saltmarsh, an uncommon habitat in Devon. This saltmarsh is in the earlier stages of development and the flora is dominated by Sea Aster (Aster tripolium), common Saltmarsh-grass (Puccinellia maritima) and Sea Plantain (Plantago maritima).
>
> The majority of the intertidal area in the upper estuary comprises soft sediments, in parts colonised on the surface by common green algae (Enteromorpha and Ulva spp.) and on the edges of the mud by brown algae. The sediments are generally exposed to underwater currents but are sheltered from wave action and some, particularly around the Salstone, contain exceptionally rich invertebrate faunas. These include large populations of tube-living and burrowing worms, burrowing bivalves and beds of the Daisy Anemone (Cereus pedunculatus). Invertebrate communities are influenced by the nature of the substrate. On muds and muddy gravels extensive growths of sponges such as Hymeniacidon perleve and Halichondria bowerbanki have developed and these have been colonised by a wide range of species including the sea squirts.
>
> At and below LWM, silty hard sand harbours populations of the probiscis worm Golfingia elongata, the burrowing crustaceans Upogebia deltaura and Callianassa are found in the silty sand and the Angular Crab Goneplax angulata in sandy mud. Small stones are frequently colonised by sea squirts.

Sediment shores of the lower estuary around Mill Bay and Salcombe are important for their beds of Eel-grass (Zostera marina) which support a varied burrowing fauna including the Sea Potato (Echinocardium cordatum), with its commensal bivalves, and the Brittlestar (Acrocnida brachiata). Above low water mark a fauna characteristic of sheltered sand shores is present, including the Lugworm (Arenicola marina) and the Sand Mason Worm (Lanice conchilega).

The rocky shores support a variety of marine algae including many uncommon species. The Salstone is one of the few British localities for the red alga Chondria coerulescens, and Castle Rocks on the west side of Salcombe Harbour possesss an exceptional flora which includes all four British species of the red alga Gigartina and also Gracilaria foliifera and the kelp Laminaria ochroleuca. The overhangs and gullies of the Castle Rocks support a rich fauna including the Cowrie (Trivia arctica) which is usually common here, the Sea Gherkin (Cucumaria saxicola), and many sponges and crustacea.

The estuary is used as an overwintering ground by large numbers of wildfowl such as wigeon (Anas penelope), Teal (A. crecca) and Shelduck (Tadorna tadorna), and the intertidal mudflats are important feeding grounds for passage waders in autumn.

West Charleton Marsh, separated from the estuary by a bank, is used by a variety of wildfowl and waders in winter, including Pintail (Anas acuta), Curlew (Numenius arquata) and Black-tailed Godwit (Limosa limosa), and also by the uncommon Water Pipit (Anthus spinoletta spinoletta). The peripheral scrub supports a range of breeding birds including Cirl Bunting (Emberiza cirlus)."

Powell et al (1978) considered that Castle Rocks were of high interest mainly because of the rich algal communities including all four British Gigartina species. Mill Bay was noted as historically interesting because of the documentation of species and changes in the Zostera beds by staff at the MBA. Communities at the Salt Stone were described as rich in tube-dwelling and burrowing polychaetes in particular. The whole inlet was considered of high interest because of the near-marine conditions which prevail throughout and also as the type locality of a number of invertebrates first described by George Montagu and as the subject of an early survey by Allen and Todd in 1900. Bishop and Holme (1980) listed the area as of 'National Importance' for sediment communities and proposed that Salcombe Estuary and the coast to Start Point should be considered of International Importance for the sediment shores. However, the reason for inclusion of the open coast areas to Start Point is not made clear.

Various letters and brief reports have been made relating to proposed marina developments at West Charleton. These and the above citations emphasise the importance of the whole inlet and, in particular, the area of the Salt Stone, Mill Bay, Castle Rocks and the shore below the Marine Hotel for their marine biological interest.

4. PREVIOUS MARINE BIOLOGICAL STUDIES

The area of Salcombe and the Kingsbridge Estuary has been studied since the early 19th century when George Montagu was resident at Kingsbridge from 1798 to 1815, describing many species new to science from the area. Later the proximity of Salcombe to the Plymouth laboratory of the Marine Biological Association together with early recognition of its richness for burrowing fauna led to a long history of collecting. This activity started as early as the late 19th century when, in the introduction to their description of the area, Allen and Todd (1900) noted "In connection with the work of the Plymouth laboratory it has been the custom of the Marine Biological Association for several years past to extend its operations during the summer months to the various harbours on the coast of Devon and Cornwall, with a view to making a comparative study of the faunas found in different localities and of correlating, so far as that may be possible, differences in the character of the fauna with differences in the physical conditions prevailing in each." Salcombe was the first area investigated thoroughly and the only other area apparently surveyed and described as a part of this study was the Exe. Allen and Todd and their co-workers made collections on the shore and by trawling and dredging from intertidal and subtidal areas. They provided an assessment of physical conditions and descriptions of the intertidal fauna at the Salstone (now Salt Stone), the mud flats between Gerston Point and the Salt Stone and the western shore, Halwell Point to Pilworthy Point (now Scoble Point), Zostera beds at the northeastern end of Salcombe Harbour, Southpool Lake (Creek), the east side of Salcombe Harbour (Ditch End to Ferry House), sand banks and Zostera beds near the mouth of Salcombe Harbour (on the east and west sides) and bays southwest of the harbour. They compared the fauna of shores in the south of the inlet with those of the north. Dredge tows were made in the channel west of Salt Stone, in the channel between the Salt Stone and Snapes Point, around Snapes Point and in The Bag, and along the channel between Snapes Point and the mouth of the harbour. Species were listed for each separate area sampled and for the whole survey area.

The area continued to be an important collecting area for botanists and zoologists from the MBA laboratories particularly during the annual Easter field course. Intertidal areas at the Salt Stone, below the Marine Hotel on the west side of the harbour and in Mill Bay were especially favoured. The detailed records maintained for the area and its importance to MBA staff is reflected in the Plymouth Marine Fauna (Marine Biological Association, 1957) where Salcombe is described separately in the introduction. A brief description is given of the fauna at Castle Rocks (Fort Charles), the shore of Salcombe Harbour, Ox Point and Tosnos Point, The Salt Stone, Dentridge and Kingsbridge Flats. Species records for Salcombe are given a separate paragraph in each relevant entry of the fauna. The introduction notes that "Salcombe records are given in some detail as this locality has always been one of the chief collecting grounds for an intertidal fauna of unusual richness and interest". Another aspect of the studies undertaken by staff of the MBA has been the observations made on the commensal polychaetes and bivalves associated with various burrowing species. These are listed in the Plymouth Marine Fauna and there have been subsequent records chiefly made by Dr. P. Gibbs.

The 'wasting disease' of Zostera marina which occurred throughout northwest Europe around 1931 led to changes in the structure of shore and the composition of shore communities in Salcombe. These changes are documented by Wilson (1948) with further notes in the Plymouth Marine Fauna. The dramatic decline in Zostera marina on the west and east sides of Salcombe Harbour resulted in loss of sand with consequent reduction of sediment level and the uncovering of pebbles and stones. The richness of the burrowing fauna

declined at some locations so that it became impossible to find Cerianthus lloydii, Edwardsia callimorpha (now E. claparedii), Halcampa chrysanthellum and Lutraria lutraria and there were reduced abundances of Amphitrite johnstoni and its commensal Gattyana cirrosa, Golfingia elongata and Ensis siliqua. However, other causes were suspected for the decline of G. elongata and E. siliqua. Pinna fragilis was noted as 'occasional' up to 1931. The study by Wilson (1948) also noted a progressive accumulation of sand on some shores of the harbour from well before the decline of Zostera and consequent erosion of sediments. The accumulation of sediments was attributed to cessation of sand removal from Mill Bay and, in earlier times, The Bar. Sand accumulation near Ditch End over a previously muddy shore may have resulted in the loss of Zostera (probably Z. hornemanniana now Z. angustifolia) from there.

Field courses run by the MBA ceased after 1973 although shores in the area continue to be used for teaching, notably from Slapton Ley Field Centre, and for specimen collecting. Some of these shores are described in a paper by McCarter and Thomas (1980) which illustrates and discusses the zonation and abundance of rocky shore species at sites near the entrance to Salcombe Harbour, at the Salt Stone, and provides some observations on communities near Kingsbridge and at New Bridge, Bowcombe Creek. Lists of species collected during such courses are available and records supplied by Dr. C. B. Goodhart (University Museum of Zoology, Cambridge) and Drs. P. Cunningham and S. Hawkins (Dept. of Zoology University of Manchester) have been provided as a background to the present work.

Collections of algae have also been made from Salcombe and records are mostly published in a paper by M. Parke (Anon, 1952). These records revealed the presence of species of scientific interest including Gracilaria foliifera and the presence of all four species of Gigartina known from the British Isles. Studies of algae were encouraged with the arrival of Sargassum muticum in the area in 1981 (Critchley et al, 1983). Sargassum is now well established although resultant change in the native flora and fauna appears minimal up to now. Collections, including dredged samples, continue to be made by G. Boalch of the MBA.

The Scottish Marine Biological Association/MBA Intertidal Survey Unit visited the area and surveyed sites at Castle Rocks (Fort Charles), Mill Bay, the Marine Hotel and Salt Stone during the NCC-commissioned intertidal survey of Great Britain (Powell et al, 1978).

Studies of fisheries and fish stocks in the area have been undertaken by Ministry of Agriculture, Fisheries and Food scientists. Particular attention has been given to scallop stocks which have declined in recent years. Work was undertaken in the late 1970's and early 1980's to study growth, mortality and mobility of scallops whilst at the same time testing the viability of scallops culture. The work was undertaken by G. Pickett.

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.

During the Salcombe survey we also planned to sample areas which were included in the studies undertaken by Allen and Todd (1900) with the intention of comparing communities present then and now.

Survey methods for both intertidal rocky shores and subtidal hard substrata were based on techniques already developed for use in NCC surveys. Techniques new to surveys being undertaken for NCC by FSC had to be developed for intertidal and subtidal sediment sampling. 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 predictictions 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. 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 NCC Rocky Shore Recording Sheet, a habitat description sheet and plant and animal recording sheets.

5.3. Sediment shores.

At each site selected, the shore habitats present were recorded on the NCC Sediment Shore Recording Sheet. The abundance of species visible at the surface was noted. Since the majority of species present were infaunal, sampling was necessary. The Salcombe survey was the first to be undertaken in this programme and there was considerable experimentation with techniques. Initially, it was planned to take samples from distinctly different habitats and/or the following levels on the shore: lower shore, lower midshore, midshore, upper midshore, upper shore. At each station it was planned to take one 0.1 m^2 core to a depth of 20 cm for seiving over a 0.5 mm mesh to obtain small macrofauna species and a further 0.5 m^2 seived over a 2 mm or larger mesh to obtain large widely dispersed species. Samples seived over a 0.5 mm mesh were particularly important for finer sediments. It was planned to use a small inflatable dingy pulled over the mud to transport equipment, samples and a knapsack sprayer for washing samples over the seive.

Tests were undertaken on the firm muddy sand at North Sands (Site 1). The difficulties experienced in washing a large volume of samples over a 0.5 mm mesh and the practicality of other sample size - sieve combinations, led to the use of the following basic approach at each station:

Several 0.01 m^2 cores to be taken at muddy sites for seiving over a 0.5 mm mesh.

A 0.1 m^2 core to be taken on sandy sites at least for seiving over a 1 mm mesh.

An area of sediment to be dug over and seived (riddled) over a 5 mm mesh.

On the third day, the mudflats at Blanksmill Creek were sampled with difficulty because of the intractibility of the mud which made progress over it extremely difficult. Also, although the inflatable dingy could be pulled as a sled, the force required to do so embedded the field staff yet further into the mud. Mud was also found to be extremely time consuming to seive and large quantities had to be returned to the field centre. It was concluded that sampling mud would have to be undertaken on the rising tide based on the large inflatable so that walking over the mudflats would be unnecessary. At several sites, sediments were only present on the lower shores and, at the heads of creeks, on the upper shore so that a varied sampling programme was necessary. The samples taken and a note of methods used is given below for each site. Sediment type was described at each site but no samples were collected for analysis.

North Sands (1)

Coarse sand at upper midshore.	1 x 0.1 m^2 core over 5 mm
Coarse sand at lower midshore.	1 x 0.1 m^2 core over 2 mm
Coarse sand at lower midshore.	1 x 0.1 m^2 core over 0.5 mm

N. Tosnos Point (5)

Muddy gravel at c. +0.5 m.	0.5 m^2 dug and seived over 5 mm.

N. Blanksmill Creek (6)

Mudflat at +3.7 m.	4 x 0.01 m^2 cores over 0.5 mm
	1 x 0.01 m^2 core over 1 mm
	0.25 m^2 dug and picked over for large animals
Mud at low water level.	4 x 0.01 m^2 cores over 0.5 mm

Salt Stone (7)

Muddy gravel at lower midshore.	Single spadefull seived over 5 mm
Sand at lower midshore .	Single spadefull seived over 5 mm
Muddy gravel at low water level.	0.25 m^2 dug and seived over 5 mm

Mill Bay (8)

Coarse sand at upper midshore (c. +3.7 m).	1 x 0.01 m^2 core seived over 0.5 mm
	1 x 0.01 m^2 core seived over 1 mm

Coarse sand at midshore (c.+2.2 m).	1 x 0.01 m^2 core seived over 0.5 mm 1 x 0.1 m^2 core seived over 1 mm
Coarse sand at low water level (c.+0.4 m).	1 x 0.01 m^2 core seived over 0.5mm 1 x 0.1 m^2 core seived over 1 mm 0.5 m^2 dug and seived over 5 mm

N. of Horespool Cove (11)

Mud below rocky shore at c.+2.4 m.	4 x 0.01 m^2 cores seived over 0.5 mm
Mudflat at c.+1.8 m.	4 x 0.01 m^2 cores seived over 0.5 mm
Mud at low water level (c.+0.5 m).	4 x 0.01 m^2 cores seived over 0.5 mm

Ditchend Cove (12)

Muddy sand at lower midshore c.+2.5 m	4 x 0.01 m^2 cores seived over 0.5 mm
Sand at low water level.	4 x 0.01 m^2 cores seived over 0.5 mm
Sandy mud at low water level.	4 x 0.01 m^2 cores seived over 0.5 mm

Park Bay (15)

Soft mud at upper midshore.	4 x 0.01 m^2 cores seived over 0.5 mm c.0.5 m^2 dug and picked over for large animals
Mud with stones and gravel at midshore level.	4 x 0.01 m^2 cores seived over 0.5 mm c.0.5 m^2 dug and picked over for large animals
Mud at low water level.	4 x 0.01 m^2 cores seived over 0.5 mm c.0.5 m^2 dug and picked over for large animals

High House Point (16)

Mud on lower shore.	2 x 0.5 m^2 dug and picked over for large animals.
Muddy gravel on lower shore.	0.5 m^2 dug and picked over for large animals.

Frogmore (18)

Mud over bedrock between channel and wall (c.+3.5 m).	c.0.25 m^2 dug to 5-10 cm and seived over 1 mm.
Mud near to channel (c.+3 m)	4 x 0.01 m^2 cores over 0.5 mm

5.4. Epibiota on subtidal rock and sediments

Subtidal areas were surveyed by diving. Usually, sites were surveyed from deep to shallow water or offshore to onshore with some spot dives. A drift dive was undertaken at one location. The team 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. Site location information, substratum type, topographicical 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 three sites in the south of the survey area. The sampler is the same as that used in the Isles of Scilly (Rostron, 1983) and is described in that report. Two samples of 0.1 m^2 area and to a depth of 20 cm were taken at each site. The samples were seived over a 1 mm mesh and preserved in 4% formalin with eosin added to stain biological material.

5.5.2. Dredging. Dredging was undertaken from an 8 m fishing vessel, the MV 'Crustacean', which was equipped with two winches, a davit, seawater pump and Decca position-fixing equipment. A pipe dredge, 1 m long and 25 cm diameter constructed of 5 mm steel, was used to collect sediment from each sample site. Sample position was recorded on the chart and the latitude and longitude noted from the Decca equipment.

The pipe dredge collected variable amounts of sediment but the minimum accepted as a reasonable sample was 8 litres. The largest sample was about 45 litres. Samples were emptied into a skip and transferred to a washing box. Here, seawater from the hose was used to break-up the mud and the outflow from the box flowed over a 1 mm mesh seive. Once the sample had been washed out of the box, resilient lumps of sediment or accumulations of sediment were washed through the seive by rotation or shaking of the seive in seawater held in the washing box. Seived samples were transferred to kilner jars and preserved in 8% formalin to which eosin had been added to stain biological material. Large ascidians and some other large and readily identified species were counted, a note made of their presence and they were returned to the sea.

5.6. Aerial photography

Aerial photography was undertaken on April 5th using a Cesna 172 aircraft piloted by Mr R. Dougan from the Exeter Flying Club. The flight was to primarily survey the Salcombe inlet but photographs were also taken of the Exe, Dart and Teign. Fig. 4. shows the general flight path and the flight paths over Salcombe Harbour and the Kingsbridge estuary. A contiguous series of oblique photographs was taken using Olympus OM2 and OM10 cameras equipped with 50 mm lenses and a haze (ultra-violet) filter. Shutter speed was as fast as light conditions allowed but was never less than 1/250 s. Filmstock was Kodachrome 64. General views and features of particularly high interest were photographed using a Canon AV 1 equipped with a zoom lens set for most photographs at 28 mm but extended to 80 mm for some photographs. Shutter speed was 1/500 or 1/1000 s. Filmstock used was Fujichrome 100 which enabled processing that evening. A record of the flight path over the main areas surveyed was made during the flight. Annotations were also made on maps to indicate where features of particular interest were present in the Salcombe and Kingsbridge area. The following notes were made of flight times and heights (low water was at 1250 BST at Salcombe):

1203 BST:	Take off from Exeter airport.
1208-1225:	Photography of Exe Estuary at 600' height (at this time the tide was still over the mudflats in the upper estuary).
1225-1255:	Flying along the coast to Salcombe.
1255-1325:	Photography of Salcombe area at 500-600' height.
1325-c.1330:	Flying overland to the Dart.
c.1330-c.1337:	Photography of Dart Estuary.
c.1337-c.1342:	Flying overland to the Teign.
c.1342-1345:	Photography of the Teign Estuary. (Forecast of bad weather at this time so headed straight back to airport)
1358:	Landed at Exeter airport.

Strong wind and the nature of the coastline at Dartmouth which caused turbulence made it unwise to proceed through the entrance to the Dart. The forecast of imminent bad weather prevented further photography although on return to the airport it could be seen that the mudflats in the upper Exe were uncovered.

Photographs were labelled and filed in two sets: the contiguous series and the general views. Photographs were filed in the order they were taken. The OM10 camera had malfunctioned throughout its use leading to all of the photographs taken with that camera being over-exposed. However, the slides were filed where they included subjects not included in photographs taken with the OM2. Sequences of Batson Creek, the north side of Frogmore Creek and the east side of the area south of Frogmore Creek were only covered by over-exposed sequential photographs or by good quality general views.

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.

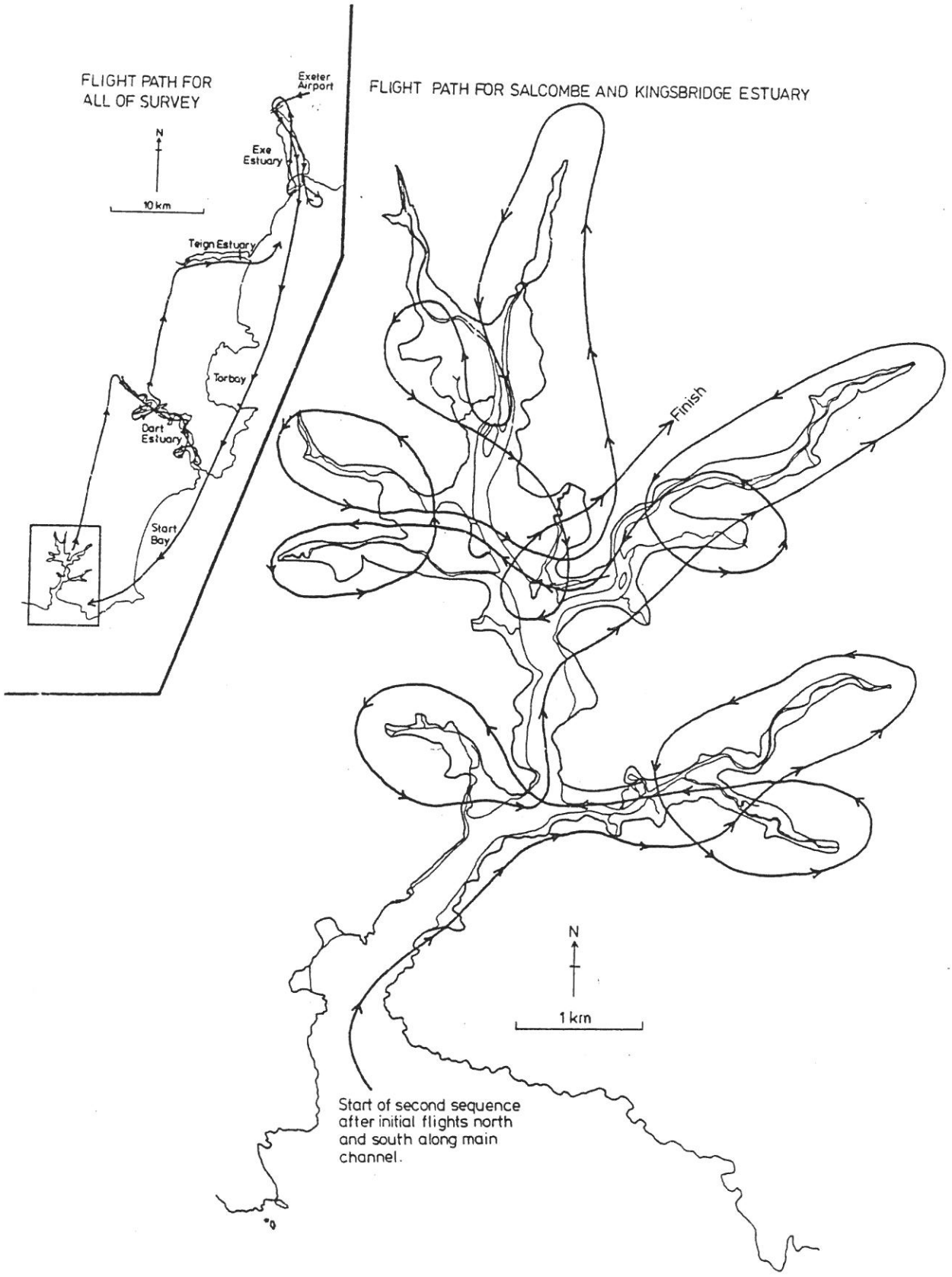

Fig. 4 . Flight path for aerial photography.

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. 1 and 5. Twenty-one intertidal sites and twenty-five subtidal sites were surveyed and sampled. Dredge samples were taken at ten sites.

Classification and description of the communities present in the area are restricted to those which were surveyed.

The communities present are described below and in Tables 2 to 14. Tables 15 and 16 are lists of species sampled from intertidal and subtidal sediments. Photographs are held by the Nature Conservancy Council. Specimens of algae and animals are held at the Oil Pollution Reseach Unit.

6.2. Description of intertidal habitats and communities.

6.2.1. Introduction. The intertidal areas of Salcombe Harbour and the Kingsbridge Estuary were found to include several readily recognised habitat/community types. However, there were also areas of change where one type graded into another and other areas where patches of unusual habitats/communities were present. The sections below include notes on unusual features in certain areas. Also, it is inevitable that some habitat/community types have not been sampled. Sections are ordered from open coast to sheltered habitats.

6.2.2. Wave exposed bedrock at the entrance to or just outside of Salcombe Harbour (Sites 2, 3 and 9). (Tables 2 and 3). This category includes shores which were basically broken rock slopes sufficiently exposed that fucoids were not abundant. However, a wide variety of communities were present with change from wave exposed to wave sheltered conditions. A separation of Sites 2 and 3 from Site 9 might be appropriate.

On the wave exposed coast near to or outside of The Bar, shores were broken and dominated by limpets and barnacles. Ramalina siliquosa was abundant in the splash zone together with a high cover of Xanthoria parietina, Verrucaria maura and grey lichens. Caloplaca marina and Verrucaria maura occurred lower down. Lichina pygmaea and Porphyra sp. were conspicuous on the upper shore together with Littoria neritoides. Barnacles on the midshore were Chthamalus montagui and C. stellatus with Semibalanus balanoides and Balanus perforatus on the lower midshore. Littorina 'saxatilis' were Frequent as was the anemone Actinia equina. Patella aspera and Mytilus edulis were generally common on the lower shore and M. edulis was present in very large amounts adjacent to the sand at Limebury Point (Site 3). The lowest part of the shore was dominated by algae - mainly Corallina officinalis, Gigartina stellata, Chondrus crispus, Palmaria palmata, Laurencia pinnatifida, Himanthalia elongata and Laminaria digitata growing on rock encrusted with calcareous algae. Rock pools and deep crevices were present. Rock pools were dominated by encrusting calcareous algae and Corallina officinalis with other red foliose algae present. One pool at +1.75 m at Limebury Point (Site 3) held a very rich community of algae. Pools higher up on the shore held a similar fauna to that noted for other locations (Table 3) except that Audouinella sp. was present in large amounts. A large pool at +4.75 m at Site 2 was rich in algae and held large numbers of Anemonia viridis. Some pools at Limebury

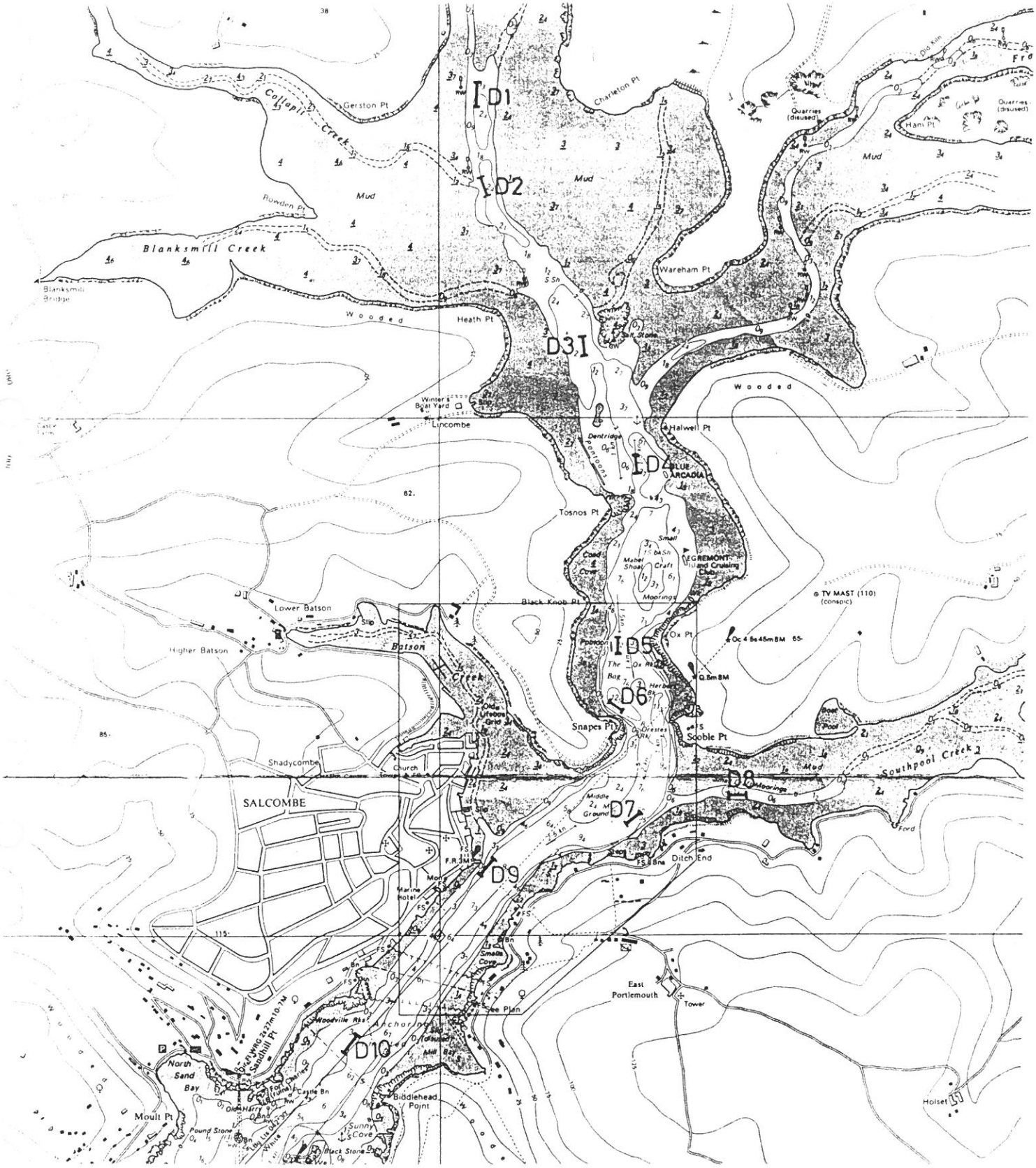

Fig. 5. Location of dredge sites. Drawn onto a portion of British Admiralty Chart 28 with the sanction of the Controller, HM Stationary Office and of the Hydrographer of the Navy.

Point (Site 3) and Fort Charles (Site 9) were dominated by Bifurcaria bifurcata. Gullies were also very rich in algae and provided shelter where Fucus serratus could thrive on the open coast and where the only Nucella lapillus were recorded at this exposed site. The sponges Halichondria panicea and Myxilla sp. together with Pomatoceros sp(p). and Spirorbinidae were also present here.

With increase in shelter towards the harbour and in the lee of seaward rocks, open shores changed in character with a lower abundance of lichens and fucoids present on the open shore including Pelvetia canaliculata, Fucus spiralis, F. vesiculosus and F. serratus. Polyides rotundus occurred where sand was present on the lowest shore towards the harbour. The extensive system of gullies and overhangs at Fort Charles (Site 9) provided a habitat for a very rich variety of animal species including sponges, anemones and ascidians in particular. Laminaria ochroleuca was observed just offshore of Fort Charles. The following species were recorded from overhangs and under boulders in the gullies:

ABUNDANT SPECIES: Bryozoa indet (encr.)

COMMON SPECIES: Scypha compressa, Hymeniacidon perleve, Balanus perforatus, Flustrellida sp., Morchellium argus.

FREQUENT SPECIES: Plumaria elegans, Halichondria panicea, Hemimycale columella, Corynactis viridis, Pomatoceros sp(p)., Spirorbinidae indet. (on rock), Didemnum maculosum, Dendrodoa grossularia.

OCCASIONAL SPECIES: Chondrus crispus, Corallina officinalis, Lomentaria articulata, Laurencia pinnatifida, Dysidea fragilis, ?Syncoryne sp., Dynamena pumila, Actinothoe sphyrodeta, Urticina felina, Caryophyllia smithii, Balanus crenatus, Cancer pagurus, Carcinus maenas, Trivia monacha, Archiodoris pseudoargus (eggs), Gibbula umbilicalis, Gibbula cineraria, Helcion pellucida, Scrupocellaria reptans

RARE SPECIES: Clathrina coriacea, Myxilla sp. (cream-coloured), Tubularia indivisa, Littorina littorea.

6.2.3. Sandy beaches backed by bedrock at the entrance to and on the east side of Salcombe Harbour (Sites 1, 8 and 12). (Table 15). North Sands and Mill Bay were extensive sandy beaches bordered by rock but with sand to near high water level. Sand at North Sands (Site 1) was mainly featureless except on the upper shore where casts of Arenicola marina (density 8-9/m^2) were present. The lower shore at Mill Bay (Site 8) was colonised conspicuously by a dense bed of Lanice conchilega with Zostera marina present. At Ditch End Cove (Site 12), areas of sandy mud were present.

Although broadly of the same character, the communities present in the sediments at the three sites were very different. At North Sands, an impoverished fauna was present but with large numbers of Scolelepis squamata and a few Arenicola marina and Nephtys hombergii in samples. The burrowing fauna was found to be richer at Mill Bay where Nephtys caeca, Magelona rosea, Clymene sp., Lanice conchilega, Urothoe poseidonius and Abra tenuis were the most abundant species. However, the muddy substrata at Ditch End Cove were the richest with high numbers of Golfingia sp., Nereis diversicolor, Pygospio elegans, Streblospio shrubsolii, Tharyx sp. (with other similar species) Oligochaeta and Corophium volutatar making this site more similar to the more obviously estuarine beaches.

6.2.4. Steeply sloping semi-exposed rocky shores within the harbour (Sites 10 and 14) (Table 4). These shores were the furthest north in the inlet that bedrock or stable boulders extended to extreme low water level. A band of lichens (mainly Verrucaria maura, Xanthoria parietina, grey lichens and some Ramalina siliquosa and Caloplaca marina) were present in the splash zone. Zones of Pelvetia canaliculata and Fucus spiralis were present on the upper shore and the upper midshore to lower midshore was dominated by Patella vulgata and Semibalanus balanoides (Scoble Point) or Elminius modestus (Snapes Point) with some Fucus vesiculosus and Ascophyllum nodosum. Attached to the fucoid algae at this level were populations of Polysiphonia lanosa (on A. nodosum) , Dynamena pumila and Clava squamata. Littorina saxatilis and L. obtusata were generally Frequent. Enteromorpha sp. was Frequent over much of the shore. The lower midshore was dominated by Fucus serratus and the lower shore had a thick cover of brown and red algae characterised by Cladostephus spongiosus, Cladophora sp., Audouinella sp., Ceramium spp., Callithamnion spp. and Chondrus crispus with Sargassum muticum and Gigartina acicularis also present. Spirorbinidae and Pomatoceros sp(p). were Frequent. The sponge Hymeniacidon perleve was present in large amounts over much of the lower shore together with Halichondria panicea, Myxilla sp., Ascidiella aspersa, Sidnyum elegans, Morchellium argus and with erect bryozoans especially Scrupocellaria reptans and Bugula spp. present. Balanus perforatus was also present and Balanus crenatus was common on the lower shore.

6.2.5. Gradually sloping broken bedrock above lower midshore level in the shelter of Salcombe Harbour, the Kingsbridge Estuary and entrance to Creeks. (Sites 4, 5, 7, 11, 12). (Table 5). These were sites sheltered from wave action and rock did not extend to extreme low water (although at N. Tosnos Point - Site 5 - rock extended to +1 m). Apart from these sites, similar features and communities occurred in the region of Scoble Point (Site 10) and Snapes Point (Site 14) and on shores bordering the channel from there to the Salt Stone. Shore communities were very similar to each other although at Ditch End (Site 12) the communities had many similarities to those described in Section 6.2.4. North of Horsepool Cove (Site 11), communities included large numbers of Gammarus locusta, a feature of shores futher up the estuary and in creeks (Section 6.2.8.) but Patella vulgata was present and Hydrobia ulvae not recorded making the communities more similar to those of the middle estuary. All of the shores except at Ditch End were heavily silted in places. At Ditch End, rock in the splash zone was covered mainly by Verrucaria maura together with grey lichens, Xanthoria parietina, Ramalina siliquosa and some Lichina confinis. X. parietina and R. siliquosa were not recorded at Tosnos Point but Catenella caespitosa was common there. At S. Tosnos Point (Site 4) the upper part of the shore was of pebbles. The Salt Stone (Site 7) is a rock pinnacle extending only up to high water of neap tides level so that a lichen community was not present there. At High House Point, the only lichens recorded were V. maura and L. confinis. Pelvetia canaliculata dominated the uppermost shore often with Catenella caespitosa also present and with patches of V. maura on the rock below. At Tosnos Point, rocks were very silty and Enteromorpha sp. was present in large amounts. The zone of Fucus spiralis below P. canaliculata was also well developed with a dense turf of C. caespitosa and patches of dark red encrusting algae below. Littorina 'saxatilis' were present on the upper shore. From the upper mid-shore often to the furthest downward extent of rock, the shore was dominated by Ascophyllum nodosum with Fucus vesiculosus present. Sargassum muticum was present on this part of the shore and below at N. Tosnos Point. At Ditch End, F. vesiculosus was more abundant than A. nodosum. Fucoids were colonised by Polysiphonia lanosa (on A. nodosum), Clava squamata, Dynamena pumila and Bowerbankia imbricata with a high abundance of Littorina obtusata with some

Littorina mariae and some Littorina littorea. Gibbula cineraria and Calliostoma zizyphinum were recorded amongst the fucoids at the Salt Stone (Site 7). The rock below the fucoid canopy was colonised by patchy thin pink encrusting algae and by scattered Patella vulgata, Elminius modestus, small numbers of Semibalanus balanoides and by Actinia equina. Silt-filled depressions at Tosnos Point were colonised by Terebellidae (Cirratulus cirratus identified from Site 16). Fucus serratus dominated the lower shore where rock extended far enough and was encrusted with Alcyonidium gelatinosum (= A. polyoum) and colonised by species noted for the A. nodosum/F. vesiculosus community. Rock under the F. serratus was colonised by Balanus crenatus and Verruca stroemia and Pomatoceros sp(p). Vertical and overhanging surfaces on the lower shore at Tosnos Point were particularly rich and colonised especially by Halichondria panicea, Hymeniacidon perleve, Myxilla incrustans, Scypha ciliata, Balanus perforatus, Morchellium argus and Ascidiella aspersa.

6.2.6. Muddy shale gravel with stones and stable hard substrata on the lower shore in the shelter of the Kingsbridge Estuary (Sites 5, 7, 10). (Tables 6 and 15). This type of substratum occurred on the north side of headlands (Scoble Point - Site 10 and Tosnos Point - Site 5) and around the Salt Stone (Site 7). Communities were especially rich because of the mixture of hard and soft substrata. Samples of burrowing fauna were collected from Tosnos Point and the Salt Stone.

Much of the lower shore at both sites was covered by Ulva lactuca and by Laminaria saccharina with Common Sargassum muticum at the Salt Stone. Filamentous algae including Antithamnion plumula, Callithamnion sp. and Audouinella sp. were abundant.

The most conspicuous and abundant elements of the surface fauna were Ascidiella aspersa, Halichondria bowerbankii and Hymeniacidon perleve. Calliostoma zizyphinum and Gibbula cineraria were present in fairly large numbers. Stones were colonised by encrusting bryozoa and Pomatoceros sp(p). with Pisidia longicornis, Galathea spp., Harmothoe ?spinifera, Lepidopleurus asellus and Ophiothrix fragilis particluarly abundant underneath. Pholis gunnellus was also present. A small sabellid, probably Sabella flabellata, was also present. Tubes of terebellid worms (later identified as Neoamphitrite figulus) and of Sabella pavonina and burrows of a callianassid decapod were surface evidence of burrowing species and Cereus pedunculatus was another burrowing species conspicuous at the surface. Samples of sediment from the lower shore at North Tosnos Point and southwest of the Salt Stone seived over a 5 mm mesh provided only a small number of species with which to characterise the fauna and, disappointingly, did not collect any callianassid decapods. Clymene sp., Melinna palmata and Neoamphitrite figulus were the most abundant species.

Some large debris were present on the lower shore (a barrel at Tosnos Point and wreckage at the Salt Stone) and included high populations of Ascidiella aspersa, Scypha ciliata and some Tubularia larynx together with large amounts of Styela clava and Morchellium argus at the Salt Stone.

6.2.7. Mud flats in the upper estuary (Sites 6, 11, 15). (Table 15). These were extensive mud flats about 2 to 4 m above chart datum level extending to the tidal channels via a fairly steep bank. Conspicuous species on the surface of the mud flats were dense Hydrobia ulvae and patches of Littorina littorea with large numbers of Littorina 'saxatilis' and Cerastoderma edule evident in places at North Blanksmill Creek (Site 6). North Horsepool

Cove (Site 11) appeared more bare. At Park Bay (Site 15), aggregations of Littorina littorea were recorded together with abundant worm holes and bivalve siphon holes. The upper shore here was colonised by Zostera noltii and by Enteromorpha sp. with some Ulva sp. giving the shore an appearance close to that encountered at the head of West Blanksmill Creek (Site 19). Burrows ca. 5 cm in diameter in the mud banks at the edges of the water courses in West Blanksmill Creek were found to be colonised by Carcinus maenas.

Animal communities living in the sediments were rich in species with Nematoda, Pygospio elegans, Ampharete baltica, Tharyx sp. (and others), Oligochaetes and Golfingia sp. consistent features of this habitat. Other species, such as Melinna palmata, were part of the widespread fauna in sediments. Each site had its own features. At Park Bay (Site 15), there were particularly large numbers of Nereis diversicolor and of insect pupae; both species to be expected where fresh water influence is present. The unusually large numbers of Scoloplos armiger at UMS level at this site are less easy to explain. There were high numbers of Abra tenuis at Sites 6 and 15 but not at Site 11. Here, Corophium volutatar was abundant but not at the other two sites. The absence of records of Hydrobia ulvae in Table 15 may result from the lack of staining by the eosin incorporated in the formalin so that, if present, they were not picked out during sorting.

6.2.8. Rock on the upper shore within creeks and in the upper estuary (Sites 16, 18, 19, 20). (Table 7). Communities present here were a reduced open coast community (described in Section 6.2.5.) with some additional species. Very few or no Semibalanus balanoides were recorded. Patella vulgata, Actinia equina and Clava squamata were not found. Variable numbers of Littorina saxatilis and Littorina littorea were recorded. Hydrobia ulvae and Gammarus locusta together with, at some sites, Carcinus maenas were present in large numbers. Elminius modestus was common in places. At West Blanksmill Creek (Site 19), Pelvetia canaliculata and the saltmarsh plant Salicornia grew together on broken shale on the upper shore. At Southpool (Site 20) ?Audouinella sp. was a conspicuously abundant coloniser of bare rock below the Ascophyllum canopy.

6.2.9. Mud with shale and gravel on the upper midshore at the heads of creeks (Sites 16, 18, 19, 20). (Table 15). Hard substrata embedded in the mud were colonised by Fucus spiralis and Fucus vesiculosus with dense patches of Ascophyllum nodosum in places where larger substrata were present. Carcinus maenas and Littorina littorea were common with dense populations of amphipods (most likely mainly Gammaris locusta) and large numbers of Carcinus maenas present under fucoids. Hyale nilssonii was also most likely present on the upper shore but specimens of this small amphipod were not collected. High densities of Littorina 'saxatilis' and Littorina obtusata/mariae were recorded at High House Point (Site 16) and West Blanksmill Creek (Site 19) but only small numbers elsewhere. Burrowing fauna encountered at Frogmore (Site 18) included very high numbers of Nereis diversicolor, Golfingia sp., Oligochaeta and Corophium volutator, particularly on the upper midshore. Streblospio shrubsolii was very abundant at the midshore station only. Very few other species were recorded. At High House Point (Site 16), the sediment fauna on the lower midshore was rich in species but with only Nereis diversicolor and Scrobicularia plana recorded in large numbers. A patch of muddy gravel near to the Southville Landing jetty had a high abundance of Lanice conchilega, Corophium volutator and Cerastoderma edule.

6.2.10. Tidal rapids at the Boat Pool (Site 13). The Boat Pool on the north side side of Southpool Creek is a large artificially enclosed lagoon with an entrance about 8 m wide and with a sill at ca. 3 m above chart datum level. The outflow from the channel provided an unusual habitat for such a sheltered area - similar to a tidal rapid. The biota on stones in the channel was particluarly rich in sponges, hydroids and ascidians with large numbers of Ophiothrix fragilis present. Only animal species were recorded in detail from the rapids and are as follows:

Abundant species: Ophiothrix fragilis

Common species: Halichondria panicea, Dynamena pumila, Pomatoceros sp(p), Spirorbinidae indet. (on fucoids), Anomiidae indet., Umbonula littoralis, Bryozoa indet. (encr.), Ascidiella aspersa, Ciona intestinalis, Styela clava.

Frequent species: Scypha compressa, Leucosolenia botryoides, Myxilla sp., Tubularia larynx (but see list of species identified from samples below), Balanus crenatus, Balanus perforatus, Gibbula cineraria, Amphipholis squamata, Ascidia conchilega.

Occasional species: Scypha ciliata, Hymeniacidon perleve, Dysidea fragilis, ?Haliclona sp., ?Myxilla sp. (orange), Terebellidae indet., Spirorbinidae indet. (on rock), Carcinus maenas, Calliostoma zizyphium, Gibbula umbilicalis, Electra pilosa, Dendrodoa grossularia.

Rare species: Archidoris pseudoargus, Hiatella arctica.

Species recorded from samples: Campanularia flexuosa, Bougainvillia ramosa, Tubularia ?humilis, Operculariella lacerta, Harmothoe ?spinifera, Hiatella arctica.

6.2.11. Stone walls in the upper estuary (Sites 17 and 46). Man-made walls provide the only extensive hard substrata in the upper estuary and although dissimilar as a habitat to natural bedrock shores, provide a basis for mapping species distribution. Species present were similar to those described in Section 6.2.8. except that Hydrobia ulvae was not recorded. Southville Landing Jetty (Site 17) extended from about 1.5 to 4 m above chart datum level. The walls were dominated by Fucus vesiculosus and, lower down, Fucus serratus with only Occasional Ascophyllum nodosum. Ulva and Enteromorpha were present under the fucoids, Callithamnion ?roseum, Gelidium pusillum, Audouinella sp., Ceramium rubrum and Cladophora sp. were the main algae present. At the end of the jetty, walls were dominated by encrusting sponges including Halichondria panicea, Myxilla sp. and Hymeniacidon perleve with abundant Laomedea flexuosa. Elminius modestus and Balanus perforatus were the main barnacles present. The record of Scrupocellaria reptans is remarkable. Records were taken from each of the vertical walls on Southville Landing Jetty but were very similar and are combined below:

Abundant species: Fucus serratus, Fucus vesiculosus, Myxilla sp., Laomedea flexuosa, Elminius modestus, Amphipoda indet (tubes)., Scrupocellaria reptans.

Common species: Cladophora sp., Halichondria panicea, Carcinus maenas, Littorina littorea, Alcyonidium sp. (on F. serratus), Alcyonidium sp. (on rock), (Alcyonidium gelatinosum (=A. polyoum) was identified from samples).

Frequent species: Audouinella sp., Callithamnion ?roseum, Gelidium pusillum, Ceramium rubrum, Ulva sp., Dynamena pumila, Pomatoceros sp(p)., Spirorbinidae indet. (on fucoids), Littorina obtusata.

Occasional species: Rhodophyta indet (encr. dark red), Polysiphonia lanosa, Ascophyllum nodosum, Enteromorpha sp., Hymeniacidon perleve, Spirobinidae indet. (on rock), Balanus perforatus, Hyale nilssoni, Bryozoa indet. (encr.).

Rare species: Haliclona sp., Balanus crenatus, Mytilus edulis, Styela clava.

Species identified from samples: Bowerbankia imbricata.

Only a brief description of communties on New Bridge at Bowcombe Creek (46) was made. It is notable that the abundance of Balanus perforatus was very high and a species of Clava was commmon on the barnacles.

6.3. Description of subtidal habitats and communities.

6.3.1. Introduction. Subtidal habitats and communities were surveyed at a greater number of sites than for the intertidal particularly on the open coast near the entrance to Salcombe Harbour. At many of the sites, subtidal transects were surveyed as a continuation of intertidal survey sites. The range of natural habitats was high for the size of area surveyed and was increased by the presence of man-made habitats including wrecks, mooring chains and pontoons. It was easier to separate distinctive habitats and communities for subtidal rock than for intertidal rock within the inlet. However, sediments were generally mixed and graded from one type to another making division difficult. Bedrock on the open coast is described here as one habitat although several distinctive community types occurred in different topographical features.

6.3.2. Broken rock slopes on the open coast and entrance to Salcombe Harbour (Sites 22, 23, 24, 29, 32, 44). (Table 8). The communities colonising open rock surfaces clear of sand were very similar from site-to-site but topographical features including tunnels and surge gullies and the effects of sand cover on rocks adjacent to the sand plain led to the presence of distinctive communities in those habitats. Since such habitats appeared to occur in places all around the open coast, they are included in this section but described separately. The broken rock surfaces at Fort Charles (Site 32) and the Black Stone (Site 44) at the entrance to Salcombe Harbour have been included here because the communities are very similar to those on open coast rocks.

Open rock surfaces clear of sand (Sites 22, 23, 23, 29) (Table 8). These rock surfaces were broken and extended to a sand plain at a maximum depth of 6.5 m bcd. The sublittoral fringe was surveyed only at Site 22. Here, rocks were dominated by crustose algae with large patches of Mytilus edulis and small Laminaria digitata and a low variety of foliose algae and animals. Acmaea virginea was abundant in the fringe at Site 29. Corallina officinalis formed a dense cover just deeper than the fringe on exposed shores. Rock surfaces below the fringe were colonised by a dense forest of Laminaria hyperborea and Saccorhiza polyschides with a mixture of a small variety of foliose algae and animals on the rock underneath. The presence of the southern ascidian Distomus variolosus, usually on kelp holdfasts, in this habitat is notable. Fish present included Labrus bergylta, Crenilabrus melops and Gobiusculus flavescens. Where crevices occurred, they were colonised by sponges, anemones and erect Bryozoa mainly. At Gammon Head (Site 23), rock surfaces at 5.5 m were colonised by a rich variety of animals, especially sponges mixed with foloise alagae. Vertical surfaces here included a similar

fauna but with abundant Haliphysema tumanowiczi and a large variety of erect and encrusting Bryozoa. Vertical surfaces in Starehole Bay (Site 24) were simlarly rich. Stipes of Laminaria hyperborea at the sites were colonised by a typical kelp stipe community including Palmaria palmata, Membranoptera alata and Phycodrys rubens. Algae on rock and kelp stipes were heavily colonised by Electra pilosa. At the more wave sheltered sites (Sites 32 and 44) at the entrance to Salcombe Harbour, Laminaria ochroleuca was Frequent and the ascidian Stolonica socialis was recorded. A notable feature of the Black Stone was the large number of Conger conger present. Crepidula fornicata was also recorded as Frequent on rock at Fort Charles (Site 32) and vertical surfaces were colonised by dense tubicolous Amphipoda at the Black Stone, both features of the inner estuary communities.

Tunnels and surge gullies (Sites 23, 26, 29, 32). The broken nature of subtidal rock surfaces on the open coast and at the outermost part of Salcombe Harbour was characterised by steep sided often narrow gullies and by tunnels, often with a narrow crevice to open water in the roof above and terminating in a dead-end sometimes with a wider exit to open water. These small tunnels were colonised especially by Crisiidae, Scrupocellaria sp(p) and Corynactis viridis with Leuconia barbata a particular feature. Antedon bifida, not otherwise recorded on the open coast, was present in gullies. The community present on overhanging walls of the tunnel at 0 to 1 m at Bellhouse rock in Starehole Bay (Site 26) is listed below:

* = only present near to the entrance.

Abundant species: Scrupocellaria sp(p).

Common species: Corynactis viridis, Labrus bergylta.

Frequent species: Plocamium cartilagineum*, Meredithia microphylla*, Rhodymenia pseudopalmata*, Dictyota dichotoma*, Leuconia barbata, Dysidea fragilis, Tubularia indivisa, Alcyonium digitatum, Verruca stroemia, Jassidae indet. (tubes), Crisiidae indet., Polycarpa rustica.

Occasional species: Kallymenia reniformis*, Delesseria sanguinea*, Polyneura gmelinii, Urticina felina, Pomatoceros sp(p)., Bryozoa indet. (encr)., Antedon bifida, Dendrodoa grossularia, Distomus variolosus*, Diplosoma listerianum.

Rare species: Rhodophyllis sp.*, Aglaozonia parvula*, Clathrina coriacea, Sertularella polyzonias, Cancer pagurus, Archidoris pseudoargus, Taurulus bubalis.

In the most exposed tunnels and gullies, particularly at their narrow ends, Tubularia indivisa and Dendrodoa grossularia were present in large amounts. Where tunnels where not obviousely exposed to wave surge, Caryophyllia smithii was abundant in the darker sections. In some nearshore gullies (particularly at SE. Leek Cove, Site 29), abrasion from cobbles and boulders obviousely occurred and areas near to these mobile substrate were dominated by encrusting calcareous algae in open gullies and, in one closed gulley, by a mosaic of encrusting Bryozoa with scattered Pomatoceros sp(p). and patches of Diplosoma listerianum. An unusually encountered sponge, Haliclona simulans was present in a side gulley of the tunnel at SE. Leek Cove. At Gammon Head (Site 23), a very large surge gulley with extensive areas dominated by a Dendrodoa grossularia - Clathrina coriacea community with Pachymatisma johnstonia, Stellata grubii and Haliphysema tumanowiczi also Common but with the community assessed to be a somewhat impoverished example of its type.

Rock partly covered by sand (Sites 22, 29). Adjacent to the sand plain, rock outcrops and the edge of the nearshore rock slope were partly covered in obviously mobile sand. At Great Eelstone (Site 22), the stipes and fronds of attached algae protruded through sand in places whilst, in others, rocks were exposed and covered by a variety of encrusting algae. Polyides rotundus, Taonia atomaria, Desmarestia aculeata and Laminaria saccharina were typical of this type of habitat and, in addition, the rarely encountered alga Gracilaria foliifera was present. Crustose species included Hildenbrandia sp., Peyssonnelia atropurpurea, P. immersa and P. dubyi. Ulva sp. was also Frequent. Animal species were very sparse on rock although Urticina felina, Balanus crenatus, Patina pellucida and Distomus variolosus were Frequent. Large shoals of Gobiusculus flavescens were present over the algae. On rock slopes adjacent to the sand at southwest of Leek Cover (Site 29), small Mytilus edulis dominated the rock but there was a similar sparser community of algae and animals to that encountered at Great Eelstone. One plant of Asparagopsis armata attached by barbs and forming a new plant was found here. The community present on sandy rocky at the Great Eelstone (Site 22) is described below:

Abundant species: Rhodophyta indet (encr. pink.).

Common species: Hildenbrandia sp., Gobiusculus flavescens.

Frequent species: Polyides rotundus, Gracilaria foliifera, Ahnfeltia plicata, Gymnogongrus crenulatus, Phyllophora crispa, Peyssonnelia atropurpurea, Peyssonnelia immersa, Peyssonnelia dubyi, Cordylecladia erecta, Antithamnion spirographidis, Ceramium rubrum, Cryptopleura ramosa, Desmarestia aculeata, Laminaria saccharina, Saccorhiza polyschides, Ulva sp., Sagartiogeton undatus, Bunodactis verrucosa, Pomatoceros sp(p)., Gibbula cineraria, Membranipora membranacea, Bryozoa indet. (encr), Asterias rubens.

Rare species: Scinaia turgida, Myriogramme bonnemaisonii, Ceramium echionotum, Amphilectus fucorum, Anemonia viridis, Lanice conchilega, Bicellariella ciliata, Labrus bergylta.

Present, no record of abundance: Spermothamnion repens.

6.3.3. Wreck in Starehole Bay (25). (Table 9). The wreckage of a large vessel lay scattered over the centre of Starehole Bay with some substantial sized erect plates, the forward section still in compartments forming enclosed 'caves', and a large number of metal plates and girders lying on the sandy seabed. Outer surfaces of the wreck at 3 to 5 m were dominated by a wide variety (56 species recorded) of foliose algae with Occasional Laminaria hyperborea and Frequent Laminaria saccharina. Gracilaria foliifera was also Frequent. There were few animal species here although Actinothoe sphyrodeta, Verrucaria stroemia, tubicolous amphipods and Scrupocellaria sp(p)., were Frequent, Gibbula cineraria and Asterias rubens were Common. Horizontal sandy plates at 4 m were colonised by a low variety of algae (compared to nearby sandy rock described earlier) but with Abundant Gracilaria foliifera and Common Rhodochorton floridulum particularly notable because of their much lower abundance elsewhere. The especially high abundance of G. foliifera on wreck surfaces was also noted at the Black Stone (Site 44). The presence of usually intertidal species on the wreck surfaces is also notable: Laurencia pinnatifida, Palmaria palmata (on rock) and Ulva sp. Very few animal species were recorded although Urticina felina was Frequent and Asterias rubens Occasional. Overhanging surfaces within the wreck were colonised by dense Caryophyllia smithii, erect Bryozoa, scattered Corynactis viridis and in several areas by a cover of Verrucaria stroemia and tubicolous amphipods. The

edges of openings in the plates were lined by Tubularia indivisa. Shoals of Trisopterus luscus were present. Patches of muddy sand inside the wreck were colonised by Cerianthus lloydii with a few casts of Arenicola marina also visible.

6.3.4. Sand in the region of The Bar and in Starehole Bay (Sites 21, 22, 24 and 28). (Table 16). Sites were surveyed south and north of The Bar and in Starehole Bay. Suction samples (2 x 0.1 m^2 area) were taken south of The Bar and on the south side of Starehole Bay. In the region of The Bar (Sites 21 and 28) the bottom was of coarse rippled sand. Conspicuous species present included Frequent Paguridae, Crangonidae, Nassarius reticulatus and bivalve siphons. Characteristic depressions in the sediment indicated the presence of Echinocardium cordatum. Starehole Bay was investigated by snorkel diving over much of its area. Here, the seabed was of rippled sand with sparsely distributed algal detritus . The sand was otherwise mainly bare except that it was 'pock-marked' by Echinocardium cordatum burrows. There were large numbers of a bivalve visible only by its siphons and some groups of Arenicola marina casts were present near to the shore. Lanice conchilega, Natica alderi (egg cases), Nassarius reticulatus, Crangon crangon, Pleuronectys platessa and Callionymus lyra were Occasional. Several shoals of sand eels, Ammodytes sp., were seen.

Sediment samples collected at Sites 21 and 24 revealed a fairly sparse fauna with a high abundance of Nephthys caeca and Chaetozone sp. (which were widespread elsewhere) and a very high abundance of Magelona mirabilis at Site 24 with a few at Site 21 and rarely recorded elsewhere. There were few amphipods in the samples except at Site 21 which was the only location for Bathyporeia pelagica and Atylus swannerdami. There were many Pontophilus trispinosa at both Sites 21 and 24. The bivalve fauna was fairly diverse with Venus fasciata, Tellina fabula and Montacuta ferruginosa the main species recorded. Echinocardium cordatum was collected only at these two sites. However, the sediment fauna of the two sites was distinctly different.

6.3.5. Rock outcrops and stable hard substrata and sand off South Sands and Mill Bay (Sites 27, 45). (Table 10). Rock surfaces and mooring blocks in shallow depths at these two sites were colonised by a very similar community and the two sites are therefore described together. However, rock surfaces were much more extensive at Mill Bay (Site 45) and extended, adjacent to a sand slope, into the deep channel leading into Salcombe Harbour.

The area colonised by Zostera marina at 1.5 m bcd at Mill Bay included widely scattered rock outcrops with a patchy cover of foliose algae and Frequent Sargassum muticum and Laminaria saccharina. Cereus pedunculatus, Gibbula cineraria and Nassarius reticulatus were Frequent here.

Sand-covered rocks at 1.8 m bcd were colonised by foliose algae and Laminaria saccharina with some Sargassum muticum, Cereus pedunculatus, Nassarius reticulatus, Distomus variolosus and Ascidiella aspersa present. Gracilaria foliifera was Abundant and Polyides rotundus Common here. Similar though less rich algae communities were present on the hard substrata on the south side of South Sands Bay although Ulva sp. and Enteromorpha sp. were also Occasional and Frequent respectivley here. Sandy outcrops near to the base of the sand slope at 4.5 m bcd were capped by Laminaria saccharina with scattered foliose algae present. Anemones were a particular feature of these rock outcrops and included large numbers of Metridium senile, Cereus pedunculatus and several varieties of Sagartia elegans. Sponges, Plumularia similis, Distomus variolosus and Stolonica socialis were also Frequent. Tubicolous amphipods were abundant and identified species are listed in Table 16. Most were Corophium sextonae.

6.3.6. Sand off South Sands and at Mill Bay colonised by Zostera marina (Sites 27, 45). (Table 15). Areas of level coarse sand colonised by Zostera marina were present in shallow depths at these two sites. The sand at Mill Bay (45) at 0.5 m bcd was colonised by 'streamers' of Ulva sp. and by Lanice conchilega with Frequent Pomatoschistus sp., and small Pleuronectidae present. A few ophiuroid arms were seen protruding from the sediment. More species were recorded on the sand at South Sands with Pagurus sp., Nassarius reticulatus, Crangon crangon, Callionymus lyra and Ammodytes sp. particularly notable Zostera plants at South Sands were colonised by small algae, particularly Ceramium rubrum and Antithamnion spirographides with Common Rissoidae on the leaves. Zostera plants at Mill Bay were very clean of epibiota although no records were taken of algae present on the leaves here. Lacuna vincta was Frequent on the leaves and one Anemonia viridis was attached to the Zostera. No other animal species were recorded on the leaves and the Zostera as a habitat was considered impoverished. (Another area of Zostera marina was investigated at Site 31 and is described separately because of the different substrata present there).

Sediment samples were taken at South Sands (Site 27). Here, the fauna was quite rich compared to the other two sites where suction samples were taken (Sites 21 and 24). However, few were specific to this site and most were present in small numbers. Pectinaria koreni occurred here and there was a high abundance of Ericthonius punctatus (=E. brasiliensis) only recorded at this site.

6.3.7. Mixed coarse tide-swept mobile substrate in Salcombe Harbour (Sites 30, 31, 32, 44). (Tables 11 and 15). A very extensive area of tide-swept pebbles, gravel and muddy sand occurs across almost the whole inlet from between Fort Charles and the Black Stone to near the ferry crossing at the south of Batson Creek. The main habitat and community types encountered were:

- Muddy sand with pebbles and some shells at 0.5 m bcd. Visually dominated by Laminaria saccharina and Sargassum muticum with Frequent Cystoseira baccata, Gracilaria verrucosa, G. foliifera, Chondrus crispus, Enteromorpha sp. and Ulva sp. especially notable. Animals were not recorded in this habitat.

- Muddy sand colonised by dense patches of Zostera marina at 1 to 2.5 m. the plant community here was a reduced shallow water community with Zostera marina and Sargassum muticum visually dominant. Cereus pedunculatus, Cerianthus lloydii, Gibbula cineraria, Aplidium pallidum and Ascidiella aspersa were conspicuous animal species whilst swimming amongst the algae were Labrus bergylta, Pollachius pollachius and Gobiusculus flavescens.

  There were very few epiphytic algae on the Zostera and animal species were also sparse with some Campanularia angulata and Anemonia sulcata attached.

- Steeply sloping muddy sand with some pebbles at 2.5 to 5.5 m. Gracilaria verrucosa and G. foliifera were respectively Abundant and Common here but with large Laminaria saccharina plants covering much of the seabed. Chorda filum was also present and several encrusting algae were recorded on stones. There were Common Aplysia punctata, Frequent Cerianthus lloydii and Gibbula cineraria and Occasional Myxicola infundibulum, Gibbula magus and Psammechinus miliaris particularly notable here amongst the animals. The variety of animal species recorded was high.

- Pebbles and gravel on silty sand at 6.5 m. Algae were much more abundant here. The above species plus Frequent Stenogramme interrupta and Scinaia turgida and Occasional Scinaia forcellata, Desmarestia aculeata, D. ligulata, Cystoseira baccata and Sargassum muticum particularly notable. A wide variety of animal species were also recorded from this habitat with Common Gibbula cineraria and Frequent Anemonia viridis, Urticina felina, Calliostoma zizyphinum, Crepidula fornicata and Ascidiella aspersa some of the main species. To the north, this substratum became more silty and A. aspersa more abundant.

- Coarse sand waves with shell debris in troughs at 6.5 m. Shells were colonised mainly by Gracilaria verrucosa and G. foliifera which were Common and Frequent respectively. Three other species of attached algae were recorded. Paguridae, Buccinum undatum and Asterias rubens were present.

- Dunes of clean sand at 6.5 m with Gracilaria verrucosa protruding through in places and very sparse fauna - Occasional Paguriidae, Pleuronectys platessa and Callionymus lyra.

Similar communities to those present on the steeply sloping seabed occurred on pebbles and boulders on a gravel plain at 6.5 m bcd at Fort Charles (Site 32). Here, Common Stenogramme interrupta, Occasional Ciocalypta penicillus and Frequent Sertularia argentea were notable records. Off the Black Stone (Site 44), the level seabed of stones, shell fragments and small boulders on coarse sand at 7 m was mainly characterised by the crustose algae present on the stones with a high abundance of Pomatoceros sp(p). algae were present.

Sediment samples were collected from this area at Salcombe Ferry (D9) and off Mill Bay (D10). The samples were very rich in species. There were large numbers of nemerteans present and a wide diversity of Polychaeta of which the following taxa were particularly abundant at these sites: Polynoidae indet., Phloe minuta, Eumida sanguinea, Perinereis cultrifera, Glycera sp., Lumbriconereis sp., Aonides spp., Scalibregma inflatum, Mediomastus fragilis and Polycirrus sp. Amongst the tanaids, Apseudes latreillei was present in very large numbers and, amongst the isopods, Janira maculosa was present in high numbers at D9. A wide variety of amphipods were present but none especially found or particularly Abundant at these sites. Amongst the bivalves, Nucula nucleus, Lucinoma borealis, Mysella bidentata and Mya arenaria were particularly common here. Amphipholis squamata was present in quite large numbers. There were several species associated with stones including Pomatoceros sp(p)., Porcellana longicornis and Corophium sextonae.

6.3.8. Steeply sloping bedrock and boulder slopes in Salcombe Harbour (Sites 33, 34). (Table 12). At both these sites the 10 m depth contour occurs close to the shore and steeply sloping surfaces predominantly of hard substrate were present including the furthest north in the estuary where circalittoral bedrock was found. Off the northeast-facing shore of Snapes Point (Site 33), bedrock was present from the intertidal to about 4 m bcd with large angular boulders on a steep slope of muddy sand extending to 11.5 m bcd. West of Scoble Point, a gently sloping spur of bedrock and boulders extended from the intertidal to a depth of 4 m about 30 m offshore. At 4 m, the slope increased greatly and from 7 m to 10 m bcd a very steep broken rock slope with extensive overhanging and vertical surfaces was present. At the base of the steep slope, boulders and cobbles extended to the level seabed at 12 m. Here, cobbles and pebbles on muddy gravel were present with some boulders and metal debris including chains and a large ship's funnel.

Communities on shallow rock at both sites were dominated by algae including several finely branching Rhodophyta, foliose Rhodophyta, large Laminaria saccharina, Sargassum muticum, species of Cladophora and Bryopsis, Codium sp. and, at Site 34, Gigartina acicularis. Anemonia viridis, Morchellium argus, Didemnidae and Diplosoma listerianum were also Frequent. Many Gobius niger were present particularly at Snapes Point. Verruca stroemia was dominant on cobbles and tubicolous amphipods (Corophium sextonae and Jassa falcata in samples) were present in large amounts.

Rocks below about 2 m were more sparsely colonised by algae but with a wide variety of foloise species present and with hard surfaces dominated by tubicolous amphipods. Sponges were Freqent here including Hymeniacidon perleve, Amphilectus fucorum and Dysidea fragilis. Ascidiella aspersa was Frequent. A small white didemnid was Common on algae and rock. The undersides of cobbles and boulders were richly encrusted with sponges, bryozoans and ascidians.

The community present under stones was not thoroughly investigated but species noted are listed below:

Common species: Didemnidae indet. (small, white, spikey colonies), Didemnum maculosum.

Frequent species: Pomatoceros sp(p)., Verruca stroemia, Bryozoa indet (encr.), Botrylloides leachii.

Occasional species: Halichondria panicea, Dysidea fragilis, Anemonia viridis, Clavelina lepadiformis, Morchellium argus.

Rare species: Caryophyllia smithii, Polycarpa rustica.

Present no record of abundance: Trivia monacha.

Circalittoral rock deeper than about 4 m was characterised by the presence of extensive patches of Schizomavella auriculata on overhanging and vertical rock and by dense Cellepora fistulosa and tubicolous amphipods on upward-facing surfaces. Nemertesia antennina, Halecium beanii and Caryophyllia smithii were also conspicuous. Ctenolabrus rupestris were also particluarly abundant here. At the top of this area, foliose algae were still present but very sparse although Bryopsis plumosa was recorded as Frequent.

On the level seabed at 12 m at Site 34, cobbles were dominated by Verruca stroemia with Hymeniacidon perleve, Abietinaria abietina, Plumularia setacea, Aglaophenia sp., Nemertesia antennina, Epizoanthus couchii, Gibbula cineraria and Bugula plumosa particularly conspicuous. Several Marthasterias glacialis were also observed here. There were no erect algae present at this depth but encrusting species were occasional. A large ship's funnel lying on the seabed provided a refuge for a shoal of Trisopterus sp. and a hard substratum for dense Nemertesia antennina and Aglaophenia pluma.

6.3.9. Muddy sand with shell gravel and pebbles in Salcombe Harbour and the Kingsbridge Estuary (Sites 33, 35, 36, 37, 38, 40, 41). (Table 13). This habitat extended throughout the main channel from Salcombe to the Salt Stone. The substratum type appeared to vary in relation to tidal scour with pebbles and shells mainly present in the central channel and silty sand with little coarse material on the slopes bordering the channel. At Site 37 off Ditch End, clay with piddock-like holes was present.

The communities were broadly similar at similar depths from site to site although there were apparent changes along the length of the estuary with Branchiomma vesiculosum, Sabella pavonina and Bowerbankia pustulosa particularly abundant to the north. However, species richness did not appear to change and the sites near to the Salt Stone (Sites 40 and 41) were the richest surveyed. The communities were also similar to those described off the Marine Hotel and separation of this section from Section 6.3.7. may be artificial.

Sediments were colonised conspicously by burrowing species including Cerianthus lloydii, Cereus pedunculatus, Sagartiogeton undatus, Myxicola infundibulum and, at the Salt Stone, Branchiomma vesiculosum and Sabella pavonina. The tubes of a small polychaete were abundant at Site 33. The main fish species recorded were Pleuronectes platessa, Callionymus lyra and Pomatoschistus minutus with juvenile flat fish in places. Carcinus maenas, Liocarcinus depurator and Pagurid crabs with Hydractinia echinata on their shells were all widely recorded though not at every site. Sediments were covered by diatoms shallower than 6 m at Site 35. Analysis of dredge samples from these sites revealed a very rich polychaete and amphipod fauna with differing abundant species but including Chaetozone setosa, Cirratulidae, Notomastus latericeus, Clymene sp., Melinna palmata, Apseudes talpa, Maera grossimana, Melita gladiosa, Aora gracilis, Nucula spp., Thyasira flexuosa and Abra spp.

Stable hard substrata amongst the sediment were colonsied by very large numbers of Ascidiella aspersa. Algae included Stenogramme interrupta, Gracilaria verrucosa and Gracilaria foliifera in deeper water joined by Chorda filum, Sargassum muticum and Ulva sp(p) in shallower depths. Scinaia forcellata and S. turgida were present on shells at the Salt Stone. On the very shallow bank at Middle Ground (Site 38), there was a dense covering of algae with a rich fauna of sponges, ascidians and brittle stars. This was the furthest north at which Antedon bifida was recorded in the estuary. There were many small and unusual filamentous algae including Chondria caerulescens and Griffithsia barbata. Some Suberites domuncula were present but the most conspicuous annual species on stones and shells were coelenterates with Anemonia viridis, Urticina felina, Sagartia elegans, Metridium senile and Nemertesia antennina often present. The variety of decapods was particluarly high at the Salt Stone (Site 40). Gobius niger appeared to be associated with areas colonised by epibiota in this habitat.

6.3.10. Infralittoral stable hard substrata on sediment in the Kingsbridge Estuary (Sites 35 and 41). These substrata included a mooring block at Site 35 and a long-abandoned lobster pot and shallow boulders at the Salt Stone (Site 41). The mooring block was colonised mainly by Bowerbankia pustulosa and Ascidiella aspersa together with Halichondria panicea, Nemertesia antennina, Ophiothrix fragilis and sparse foliose algae. One Homarus gammarus and several other small decapod species were recorded here. The slope of large and small boulders at 0 to 2 m to the south of the Salt Stone (Site 41) was very silty and colonised by silt-tolerant algae such as Gigartina acicularis. Gracilaria foliifera was Common here. Species present on the boulders but not recorded on the mobile substrata usually found in this area were Phyllophora crispa (O), Phyllophora traillii (F), Lithophyllum incrustans (F), Gigartina acicularis (F), Gigartina teedii (R), Rhodochortan floridulum (O) and Seirospora seirosperma (O). However, the only kelp present was Laminaria saccharina. A lobster pot nearby at 3.5 m was colonised by Occasional Laminaria ochroleuca and by a small variety of other species including several not recorded on other substrata in this area: Dilsea carnosa (O), Callophyllis lacineata (F), Cryptopleura ramosa (C), Hypoglossum woodwardii (F) and Delesseria sanguinea (A). Animals were not recorded at Site 41.

6.3.11. Shallow mud with terrestrial debris in creeks and north of the Salt Stone in the main channel (Sites 39, 42, 43, D1, D2, D8). (Tables 14 and 16). These sites are included together because of the similar sediment substrata and the impoverishment of sediment at D1, D2 and D8 near Sites 39 and 43 compared with other sites where dredge samples were collected. However, Site 39/D8 in Southpool Creek was richer in both epifauna and infauna than the site near Gerston Point (Site 43, D1 and D2).

Sediments in Southpool Creek were of sandy mud compared to mud and there was more scattered hard substratum than at the other sites. In the middle of the creek at 2 m bcd, there were large clumps of Ascidiella aspersa colonised by a small variety of attached sponges, anemones and Bowerbankia pustulosa. Cereus pedunculatus and Sagartiogeton undatus were present on the sediment. Conspicuous burrowing species included an unidentified terebellid with an extensive network of tentacles and Myxicola infundibulum. Several fish were present including Frequent Pomatoschistus minutus and Gobius niger and Occasional Callionymus lyra and young Pleuronectidae. At the edge of the channel at around 1 m bcd, dense algae were present in patches. The algae were mainly Cystoclonium purpureum, Gracilaria foliifera, Polyneura hilliae, Ulva sp., and Cladophora rupestrus. Common animal species recorded here were Ophiothrix fragilis and Ascidiella aspersa. One particularly notable record was of Sabella flabellata, a small fan worm attached to the algae and probably recorded as Sabella sp. elsewhere. Sabella pavonina was also present here. At 0.5 m, there was a sparse low cover of algae with conspicuous Chorda filum, Sargassum muticum and Laminaria saccharina and similar animal species to those found in the centre of the channel.

At sites 42 and 43, there was very little hard substratum and the bottom was of smooth diatom-filmed mud. The most conspicuous feature of the visible fauna here was the presence of groves of Sabella pavonina. Other species living in the sediment included Myxicola infundibulum and Cereus pedunculatus. Ascidiella aspersa with Bowerbankia pustulosa attached were also present. Carcinus maenas and Paguridae with Hydractinia echinata attached to their shells were Frequent. Pomatoschistus sp. and notably, Gobiusculus flavescens, were present. Remarkably, one Asterina gibbosa was found here.

Dredge samples (D8, D1 and D2) taken near to Sites 39 and 43 revealed an impoverished fauna numerically dominated by cirratulid polychaetes which wer not present at mid-channel sites. Nepthys hombergii and Chaetozone setosa were also present in high numbers. The greater richness of fauna from near Site 39 (D8) included a high abundance of Melinna cristata and Ampelisca brevicornis as well as greater numbers of bivalves particularly Thysaria flexuosa, Abra spp. and Mya arenaria. Conspicuous species collected in the suction sampler at Site 39 whilst trying to obtain a specimen of the large terebellid included Pectinaria anguicoma, Notomastus latericeus, Melinna palmata, Nephthys ?hombergii and ?Clymene sp.

6.3.12. Mooring chains (Site 33). A heavy-duty mooring chain was studied off Snapes Point. Shallow parts of the chain were colonised by dense Laminaria saccharina to 4.5 m with sparse foliose algae extending down to 8 m. Mytilus edulis and tubes of Jassa falcata and Parajassa pelagica smothered much of the chain with Frequent Didemnum gelatinosum, Occasional Scypha ciliata, Tubularia larynx and Ciona intestinalis the only other sessile animal species recorded. From 4.5 to 11.5 m, the chain remained smothered by Jasiid tubes but with only Frequent Mytilus edulis. Tubularia larynx was Frequent on this lower part of the chain and a stalked barnacle, Scalpellum scalpellum, was recorded. A few anemones occurred on the chain.

6.3.13. Pontoon floats, The Bag (Site 35). This pontoon was installed between 1978 and 1979. The large fibreglass floats provided a habitat for a community not encountered elsewhere. Algae extended down the vertical sides of the floats to about 15 cm below sea level. Species were mostly those recorded from other habitats in the estuary but Corallina officinalis and Palmaria palmata were both unusual records. Dense animal communities were present below this belt of algae including many anemones and Common Tubularia larynx, Jasiidae and Mytilus edulis. The undersides of the floats were covered by very dense ascidians with large numbers of Ascidia mentula, Botryllus schlosseri and Styela clava particularly notable because of their sparse occurrence elsewhere. A remarkable feature of the pontoons was the presence of large numbers of Corynactis viridis which was not recorded on rock surfaces in the estuary.

The community present is listed below. No separation was made between communities on the side and underneath the floats.

Abundant species: Obelia geniculata (on kelp fronds), Styela clava.

Common species: Tubularia larynx, Metridium senile, Jasiidae indet. (tubes), Mytilus edulis, Ascidia mentula, Ascidiella aspersa, Didemnum maculosum, Didemnidae indet.

Frequent species: Rhodophyllis divaricata, Chondrus crispus, Palmaria palmata, Ceramium rubrum, Polysiphonia brodiaei, Laminaria saccharina, Cladostephus spongiosus, Enteromorpha sp., Halichondria panicea, Urticina felina, Sagartia elegans, Corynactis viridis, Balanus perforatus, Caprellidae indet., Bryozoa indet (encr.), Ophiothrix fragilis, Botryllus schlosseri, Didemnidae indet. (white), Ciona intestinalis.

Occasional species: Calliblepharis ciliata, Gracilaria verrucosa, Gymnogongrus crenulatus, Corallina officinalis, Callophyllis lacineata, Kallymenia reniformis, Gastroclonium ovatum, Antithamnion plumula, Callithamnion tetragonum, Cryptopleura ramosa, Hypoglossum woodwardii, Myriogramme bonnemaisonii, Polyneura gmelinii, Chondria caerulescens, Laurencia pinnatifida, Polysiphonia brodiaei, Saccorhiza polyschides, Sargassum muticum, Codium sp., Ulva sp., Bryopsis plumosa, Bryopsis hypnoides, Sagartiogeton undatus, Serpula sp., Liocarcinus depurator.

Rare species: ?Syncoryne sp., Alcyonium digitatum, Sabella sp., Cancer pagurus, Phallusia mammillata.

7. DISCUSSION.

7.1. Distribution of habitats and communities.

7.1.1. Intertidal

Substrata and habitats. Various publications provide information on shore types and the substrata present within Salcombe Harbour and the Kingsbridge Estuary. Ordnance Survey maps indicate areas of rock, sand, shingle and mud, Allen and Todd (1900) described shores and the Plymouth Marine Fauna (Marine Biological Association, 1957) describes shore types. Our surveys provide descriptions of topographical and sediment features of the shores we sampled. Also, the aerial photographs taken during our field work provide useful data although they had been lodged with NCC by the time this section was written so were not referred to. Physiographic and sedimentological features change with increasing distance northwards and in relation to increasing shelter and the main features of intertidal substrata and habitats are noted below.

- Open coast areas are of bedrock which in places is very broken with fissures, overhangs and pools.

- At the entrance to Salcombe Harbour, bays are filled with fine to coarse sand with the headlands between of broken rock. At Fort Charles, the rock surfaces are particularly broken providing a wide range of habitats.

- Salcombe Harbour between Mill Bay and Ditch End Cove is fringed by rock on the upper shore and sandy sediment on the lower shore. On the southeast side, this sand is extensive but becomes muddy near to Ditch End. On the north shore, stones, stony gravel and patches of silty sand occur with the most extensive area of silty sand just north of Woodville Rocks.

- To the north of Salcombe Harbour, bedrock surfaces extending to near low water level occur at headlands only and most of the shores are of muddy sediment backed by rock above about upper midshore level. Muddy sediments include muddy gravel with shale and shells in small areas north of the points and at the Salt Stone.

- Extensive mudflats occur in the Creeks and north of the Salt Stone These are backed by rock above upper midshore level near the entrance to creeks but extend to patchy saltmarsh at the head of creeks.

- At the heads of some creeks, and at High House Point, shaley sediments and muddy gravel occur.

Communities and species. The presence of hard substrata to low water level from the open coast to within the shelter of Salcombe Harbour and to the lower midshore as far north as High House Point, enables the comparison of communities present in some detail. No attempt has been made to tabulate all species distributions and notes here are based on the major most obvious changes from open coast to the most enclosed parts of the estuary where shelter from wave action as well as turbid water, silty surfaces and variable salinity create very different conditions to those of the open coast. Although the following trends are based on observations made during the survey described here, distributional notes for animal species have been checked and expanded with the aid of the Plymouth Marine Fauna (Marine Biological

Association, 1957). Species noted below are predominantly intertidal and records of predominantly subtidal species are incorporated into that section.

On moving from the open coast northwards:

- Algae typical of the open coast no longer occur. For instance, Corallina officinalis, Porphyra sp(p) and Bifurcaria bifurcata. Or, they decrease markedly in abundance. For instance, Chondrus crispus, encrusting pink calcareous algae.

- Some algae extend into the inlet only as far as Snapes-Scoble Point: Laurencia hybrida, L. pinnatifida, Lomentaria articulata, Palmaria palmata, Plumaria elegans.

- Algae typical of sheltered conditions appear or increase in abundance. For instance, Ascophyllum nodosum, Fucus spiralis, Fucus vesiculosus, Fucus spiralis, Pelvetia canaliculata, Catenella caespitosa, Polysiphonia lanosa (associated with Ascophyllum).

- The variety, abundance and vertical extent of maritime lichens decreases except that sites at High House Point and the Boat Pool in Frogmore Creek were fairly rich in lichen species.

- Animals typical of the open coast no longer occur or are present in much reduced abundance. For instance, Nucella lapillus, Littorina neritoides, Littorina neglecta, Chthamalus stellatus, Chthamalus montagui, Patella aspera.

- Semibalanus balanoides is greatly reduced in abundance with increasing distance from the open coast but is still present at the heads of creeks. Mytilus edulis is also greatly reduced in abundance. However, Snapes Point and Scoble Point appear to be 'oases' for several of these species.

- Animals typical of sheltered/enclosed coasts or those associated with dense fucoid algae appear or are present in high abundance: Hymeniacidon perleve, Spirobinidae, Littorina obtusata, Littorina mariae, Littorina littorea, Psammechinus miliaris, Polyclinidae. The abundance of Balanus perforatus increases in abundance northwards and Verruca stroemia was found on the shore only north of Salcombe.

- Animals typical of enclosed inlets where low salinity/high turbidity conditions occur appear and increase in abundance with increasing distance from the open coast. Halichondria bowerbankii, Clava squamata, Laomedea flexuosa, Gammarus locusta, Elminius modestus, Carcinus maenas, Bowerbankia imbricata and Ascidiella aspersa. Hydrobia ulvae was only found at the most distant sites from the open coast.

- On the few areas of hard substrata near to the heads of creeks and at High House Point and Southville Landing Jetty, the following species, some typical of sheltered conditions, were not recorded: Clava squamata, Actinia equina, Patella vulgata, Polyclinidae. Hymeniacidon perleve was also present in much lower abundance at these northern sites.

Many of these changes are typical of the differences between open and enclosed or wave sheltered coastlines and are well-documented. There are exceptions to the general trends. Corallina officinalis occurred on pontoon floats at Site 35 and was recorded during the sublittoral survey at Mill Bay, whilst Snapes Point and Scoble Point were 'oases' for some open coast species. Their presence here gives a clue to at least one of the reasons for loss of open coast species and that is the heavy siltation which occurs where water-movement is reduced. Projecting headlands and pontoons in the main channel will be subject to strong water movement. Anemonia viridis was only found at the Salt Stone on the shore within the estuary but its absence from much of the area may be due to the absence of large rockpools. Some species which live predominantly in the lower shore would not be expected to penetrate far into an area where stable hard substrata did not extend far down the shore and this was clearly important for many species. However, the variety of species remained high throughout the sites bordering the main channel and communities on hard substrata at the Salt Stone were remarkably rich seeming to benefit both from the almost fully marine conditions there and the lack of disturbance from storms as well, doubtless, as other factors unclear at present. However, communities on the few open areas of hard substrata in the far north of the estuary and at the heads of creeks were clearly affected by estuarine conditions as evidenced by the loss of some species tolerant of shelter alone and by the presence of species characteristic of low/variable salinity.

The species present in sediments were those which would be typically expected in the types represented but were particularly rich except at the sheltered muddy sites. We did not sample the area considered to be especially rich below the Marine Hotel and, with regard to effects of digging, took minimal samples at the Salt Stone. Introductory notes in the Plymouth Marine Fauna and unpublished lists made available to us have therefore been used to reach the following conclusions regarding the communities present in intertidal sediments.

- The richness of intertidal sediment communities is poor on wave exposed sandy beaches at the entrance to Salcombe Harbour, increases as sediments become more sheltered/consolidated/muddy with increasing distance along the main channel but is poorer in creeks and at the top of the estuary.

- Mixed sediments including muddy sand, shells and shale are particularly rich and, in Salcombe Harbour, contain many well-documented commensal relationships between species.

- At Park Bay, adjacent to the sewage works, species typical of freshwater runoff were abundant but the communities were rich in species with no indication of major pollution effects.

7.1.2. Subtidal.

Substratum and habitats. Information on seabed types is available from Allen and Todd (1900) and from Admiralty surveys although only the current chart has been consulted. Our surveys provide a description of the seabed types at the sites we dived or took dredge samples and these can be extrapolated to the rest of the area except that local patches of bedrock, clay, boulders or other sporadically occuring substrata will have been missed. The main features we encountered are listed below.

- On the open coast, there is a fringe of broken bedrock extending to a depth of about 6 m bcd. The rock is very broken with networks of gullies and tunnels in places. Some of the rock is sand covered.

- The seabed beyond fringing rock is of muddy sand except near to the Bar where coarse sand is present.

- At the entrance to the harbour, only the rocks at Fort Charles and the Black Stone extend into the shallow sublittoral and these terminate at a plain of rippled coarse sand at about 6 m bcd.

- The centre of the channel in Salcombe Harbour from north of the Bar to Salcombe Ferry is a mixture of coarse sand with shells, pebbles and muddy gravel. At the edges of the channel a slope of coarse sand leads to shallow depths except at Fort Charles and the Black Stone and at Mill Bay where rock outcrops partly covered by sand are present to 5.5 m bsl. These rock outcrops in the steep slope bordering the channel possibly occur elsewhere especially off the south-east shore.

- From Salcombe Ferry to the Salt Stone in the main channel, most areas of seabed are of muddy sand with shells and pebbles present especially in mid-channel. Where the deep channel is constricted by shallow bathymetry, cobbles and pebbles occur and, at Snapes and Scoble Point, dominate the seabed at 10 m bcd. Patches of clay occur in this region.

- At Snapes Point and Scoble Point bedrock and boulders extend into deep water providing sloping, vertical and overhanging surfaces.

- North of the Salt Stone and at the entrances to Creeks, the seabed is of mud (sandy mud at Southpool Creek) with terrestrial debris such as twigs and leaves.

Species and communities. Many of the algae recorded were present on the open coast and in the main channel of the sheltered inlet up to and including the Salt Stone. However, several species were present only or in greatest abundance in exposed or sheltered conditions. Changes which occurred on moving northwards from the open coast included:

- Several algae were only found on the open coast or extended only a short distance into the inlet. For instance, Cruoria sp., Delesseria sanguinea, Dilsea carnosa, Gastroclonium ovatum, Corallina officinalis, Meredithea microphylla, encrusting calcareous pink algae, Rhodymenia pseudopalmata, Membranoptera alata, Phycodrys rubens, Polyides rotundus, Furcellaria lumbricalis, Dictyopteris membrancea, Laminaria digitata, L. hyperborea and L. ochroleuca.

- A few algae appeared to extend up to The Bag, especially on the pontoon floats including Laurencia pinnatifida, Palmaria palmata, Rhodymenia delicatula and Rhodymenia holmesii.

- Several species were found only within the shelter of the inlet including: Chorda filum, Sargassum muticum, Cystoseira baccata, C. nodicaulis, Griffithsia corallinoides, Polyneura hilliae, Bryopsis hypnoides, Cladophora rupestris, Codium sp. and Enteromorpha sp.

Exceptions to these notes occur. For instance, G. ovatum and C. officinalis which appeared restricted to the open coast occurred on the pontoon floats at The Bag. D. sanguinea, D. carnosa and L. ochroleuca also apparently restricted to the open coast, occurred on an abandoned lobster pot at the Salt Stone. The presence of these species further into the estuary than expected might be the result of reduction of silt cover where surfaces are exposed to strong tidal flow. In the case of the lobster pot, it might be that sporelings were present on the pot from its previous use in a different ocation.

Some of the species which are apparently only able to survive on the open coast were infact associated with particular substrata which only occurred there. P. rotundus and F. lumbricalis were on sand-covered rocky whilst M. alata and P. rubens were found mainly on kelp stipes or abraded rock.

Animal species showed a much more segregated distribution from open coast to enclosed habitats and the main features are listed below:

- Animals recorded only from the open coast as far into the estuary as Fort Charles and the Black Stone included Haliphysema tumanowiczi, Stelleta grubii, Pachymatisma johnstonia, Dercitus bucklandii, Myxilla incrustans, Cliona celata, Hemimycale columella, Phorbas fictitius, Tethya aurantium, Tubularia indivisa (also recorded at Mill Bay), Actinothoe sphyrodeta, Corynactis viridis (but on the pontoon in The Bag), Isozoanthus sulcatus, Alcyonium digitatum (but on the pontoon in The Bag), Galathea strigosa, Helcion pellucida, Crisiidae indet., Escharoides coccinea, Asterias rubens (but on pebbles at Site 30), Distomus variolosus (also at Mill Bay), Stolonica socialis (recorded at Mill Bay), Polyclinum aurantium, Crenilabrus melops. Asterias rubens was present in large amounts on the open coast but in very small numbers within the estuary.

- Animals recorded only or almost only inside the estuary but not extending into the creeks or uppermost main channel included Scypha ciliata (but on vertical rock at 6 m at Site 23), Suberites ficus, Raspailia ramosa, Halichondria bowerbankii, Tubularia larynx, Halecium sp(p), Sertularia argentea, Nemertesia antennina, Aglaophenia pluma, Terebellidae, Branchioma vesiculosum, tubicolous amphipods on rocks, Galathea squamifera, Liocarcinus depurator, Macropodia rostrata, Buccinum undatum, Crepidula fornicata, Chlamys opercularis, Alcyonidium diaphanum, Bugula plumosa, Cellaria fistulosa (but known to occur on the open coast, Rubin, 1980), Ophiothrix fragilis (but also in Southpool Creek, Site 39), Ciona intestinalis, Didemnum gelatinosum, Phallusia mammillata, Sygnathus acus (also south of The Bar, Site 21).

- Animals recorded only within the estuary including the creeks and upper estuary included Hydractinia echinata (on Pagurid crabs), Metridium senile, Sagartiogeton undatus, Cereus pedunculatus, Sabella pavonina (also on the inside of the wreck in Starhole Bay), Myxicola infundibulum, Carcinus maenas (not near the entrance as large individuals), Crangon crangon (also on the open coast), Paguridae (also on the open coast), Bowerbankia pustulosa (also in the wreck in Starehole Bay), Ascidiella aspersa, Styela clava, Pomatoschistus spp. (Rare at Site 23) and Gobius niger.

- Animals recorded on the open coast and as far north in the estuary as Snapes-Scoble Point incuded Dysidea fragilis, Amphilectus fucorum, Sertularella polyzonias, Cerianthus lloydii, Caryophyllia smithii, Urticina felina (also on the pontoon at The Bag and Rare in Southpool Creek), Bispira volutacornis, Chaetopterus variopedatus, Palaemon serratus, Macropipus puber (recorded to Tosnos Point), Bicellariella ciliata, Scrupocellaria spp, Cellepora pumicosa, Schizomavella auriculata, Antedon bifida (only to Middle Ground, Site 38), Thorogobius ephippiatus.

- Animals recorded on the open coast up to the Salt Stone but not in the creeks included Lanice conchilega, Pomatoceros sp(p)., Verruca stroemia (on the shore only at the Salt Stone), Cancer pagurus, Maja squinado, Pisidia longicornis, Calliostoma zizyphinum, Nassarius reticulatus (to Tosnos Point), Marthasterias glacialis, Aplidium punctum, Diplosoma listerianum, Polycarpa rustica, Ctenolabrus rupestris, Labrus bergylta, Pollachius pollachius (only to the Marine Hotel, Site 31).

Many of the open coast species not recorded within the estuary are bedrock species some of them typical of wave exposed coasts. However, the presence of bedrock or large boulders at Snapes Point and Scoble Point colonised by a very different animal community to that present on the open coast points to other factors within the inlet being important. Conversely, some of the species recorded only within the inlet live in sediments or on coarse mobile substrata so that feature may be most important.

Species which appear to be characteristic of the enclosed part of the survey area and in particular of those locations where water quality conditions will most likely be distinctly different to the open coast include: Halichondria bowerbankii, Tubularia larynx, Metridium senile, Sagartiogeton undatus, Sabella pavonina, Myxicola infundibulum, Carcinus maenas, Liocarcinus depurator, Crepidula fornicata, Ascidiella aspersa, Styela clava and Gobius niger.

7.2. Comparison with previous marine biological studies

During our survey, we aimed to re-sample the areas from which collections were made by Allen and Todd in 1900 and to compare our records with their's and with additional ones published in the Plymouth Marine Fauna (Marine Biological Association, 1957) as well as lists provided by later field workers. The details of sampling methods and location of sites in Allen and Todd (1900) were very sparse and a repeat survey using the same techniques and sites was not possible. Also it was clear from the numbers and the species of polychaetes and amphipods that Allen and Todd sampled from sediments that they must have used a very coarse mesh dredge for most of their work. Inevitably, our records include a greater number of small species. However, later sampling by taxonomic specialists from the Marine Biological Association Laboratories at Plymouth added many species of amphipods collected from intertidal algae which we did not sample and of polychaetes from intertidal sediments at the entrance to Salcombe Harbour which we could not have sampled so thoroughly. Additional species to the previously recorded fauna and apparently greatly increased abundance of particular species in our study must also reflect the surveys of both intertidal and subtidal rocky surfaces which did not, as far as we know, form an important part of any other surveys except that carried out by Powell et al. (1978). Animal species are the previously

most thoroughly surveyed and sampled group and the comparison is predominantly of animal species.

The following observation of changes have been made by a rapid review of previous publications and lists. They are by no means comprehensive and comments have ignored rarely recorded species or ones most likely resulting from particularly intensive collections or the attentions of specialists in particular groups. Comments on the species collected from sediments are included in Tables 15 and 16 and are not generally repeated here.

The main characteristics of the fauna of Salcombe Harbour and the Kingsbridge Estuary appear largely unchanged since the surveys carried out by Allen and Todd (1900). However, some changes were noted by Wilson (1948) as a result of the decline in Zostera marina and changes in sediment type on the east side of Salcombe Harbour. Our studies were not sufficiently detailed to discover whether further change had occurred there. However, the loss of talked jellyfish (Haliclystus auricula and Lucernariopsis campanulata) from Zostera beds was noted in the Plymouth Marine Fauna and we searched for but did not find any. The abundance of commercial shellfish including Chlamys operecularis, Peten maximus and Ostrea edulis have been given particular prominence in previous reports. Dredging for scallops, P. maximus, appears to have been a profitable activity in the estuary but numbers are now very small and we only found scallops at two sites. Similarly, the abundance of Chlamys operecularis appears to have declined since Allen and Todd described it as "common - dredge material". Ostrea edulis was not mentioned by Allen and Todd and, although the introduction to the Plymouth Marine Fauna refers to the "present oyster bed" covering part of Dentridge Bank, the list refers only to relaying in 1954 so it might be that Salcombe was never an important site for oysters. Cockles (Cerastoderma edule) appear to be as plentiful as in previous years. The abundance of Gibbula magus appears to be much lower than in previous years. It was recorded by Allen and Todd as "common in dredgings from between Salstone and the mouth of the harbour". We recorded it as Occasional at one site. We did not record any Pinna fragilis which was noted by Allen and Todd and in the Plymouth Marine Fauna as "occasionally found" and, in view of the conspicuous appearance of this shell, it appears certain that numbers have substantially declined. The list of burrowing species in the Plymouth Marine Fauna notes that it was occasional up to 1931. Neither did we record any Calliactis parasitica, another conspicuous species recorded by Allen and Todd. We did not record the burrowing anemones Edwardsia claparedii, Halcampa chrysanthellum or Peachia cylindrica noted in the Plymouth Marine Fauna. Sertularia argentea was recorded as Common in dredgings from the channel west of the Salstone to the mouth of Salcombe Harbour by Allen and Todd although we only recorded it from a few locations in small amounts and this may reflect a significant difference. Similarly, we recorded a much lower abundance of spider crabs (Inachus dorsettensis and Macropodia rostrata), Eurynome aspersa and Diodora apertura than would have been expected from the records in Allen and Todd. We did not record Philine quadripartita, a species typical of muddy substrata in enclosed areas and recorded by Allen and Todd. In the sediments, we did not record several species noted as present in large amounts by previous workers: Lepidonotus squamatus, several species of Harmothoe, Eulalia viridis, Melinna palmata and Audouinia (now Cirriforme) tentaculata.

We recorded many species not noted in the Plymouth Marine Fauna. These include many polychaetes and amphipods from sediments and doubtless reflect the use of small-mesh sieves for extracting fauna. These species are noted in Tables 15 and 16. Mya arenaria, which we recorded in large numbers, was not

noted in previous publications. However, Warwick and Price (1975) observed that the species had invaded south-west England in the previous ten years and our records clearly reflect that invasion. Our records of species living on subtidal stable hard substrata include many new records which are not fully listed here. They include species present in large amounts such as Nemertesia antennina, Metridium senile, Tubularia larynx, Jassa falcata, Parajassa pelagica and Cellaria fistulosa, but also ones such as Macropipus puber which we night have expected to have been recorded previously. The record of Corophium sextonae present in large amounts on hard substrata, including in dredges, is particularly notable since this was not recorded by Allen and Todd in 1900 or in Plymouth Sound during extensive dredgings from 1895 to 1911. Subsequently (1941-1954) the species was found in Plymouth Sound (Marine Biological Association, 1957) and there appears to be a real change in the abundance of this species. The absence of records of Sagartiogeton undatus from the work of Allen and Todd is also remarkable since the species was widespread in 1985. It was recorded by T. A. Stephenson, presumably in the 1920's or 1930's and noted in the Plymouth Marine Fauna.

Some changes have resulted from colonisation by immigrant species. The slipper limpet, Crepidula fornicata, was recorded in small numbers in in situ observations and in dredge samples. C. fornicata was first recorded in the Plymouth area in 1950 at Salcombe but the low abundance of large shells on which to settle may have helped prevent it becoming a dominant member of the epifauna. Another immigrant species, Elminius modestus was a common inhabitant of many intertidal locations. E. modestus was first recorded in the British Isles in 1947 and was found at Salcombe in 1949. More recently, the invasive weed Sargassum muticum has colonised extensive areas of the shore and shallow subtidal within the estuary particularly at the Salt Stone and along the western shore of Salcombe Harbour. S. muticum was first observed in Salcombe in 1981 (Critchley et al., 1983). Another alga, Asparagopsis armata was present at two sites but nowhere formed a significant part of the biota. A. armata was first recorded in the British Isles in 1939 and is now widely distributed although the gametangial phase is restricted to southern coasts.

7.3. Evidence of pollution/disturbance effects

The use of Salcombe Harbour and the Kingsbridge Estuary for recreation in particular has expanded greatly in the past twenty years. The main sources of potential pollution and disturbance have been outlined in Section 3. During the present survey we specifically investigated the sediment communities at Park Bay adjacent to the sewage treatment plant and made more general observations at sites used for collecting by educational parties and in the region of moorings and pontoons. Although much more sewage, detergent and other waste now finds its way directly into the estuary compared with the beginning of this century, comparison with the observations of previous workers suggests little overall change and the continued presence of rich communities. However, for native species, changes which have occured since 1900 have been mainly losses or reductions in abundance rather than gains.

Communities in sediments at Park Bay were typical of estuarine mud flats with high numbers of species characteristic of areas of freshwater runoff which is most likely the main effect of the effluent from the sewage treatment plant. During the aerial survey in April, Park Bay appeared to have a particularly high cover of green algae, probably another effect of freshwater although many of the upper shore mud flat areas were colonised in a similar way later in the summer. Sewage debris was visible in the water column at the

harbour sites near the Marine Hotel although communities there were rich and it seems unlikely that any significant effect occurs.

The communities living in sediments below moorings and those on the pontoons were rich and varied. There was very little visible rubbish on the seabed. However, the apparent recent decline in abundance of the dogwhelk Nucella lapillus within the estuary and the adjacent open coast is notable. In the early 1970's, Bantock and Cockayne (1975) collected samples of 30 to 100 Nucella from each of nine sites in Salcombe Harbour and at the Salt Stone for studies of chromosomes. Nucella were not easy to find in 1985 although in 1984, students of Manchester University recorded it at the Salt Stone. Nucella appears particularly sensitive to TBT (unpublished studies undertaken by Dr G. Bryan and Dr P. Gibbs) and its decline has been noticed because of its conspicuous and widespread occurence. Other less conspicuous but sensitive species may have been affected by anti-fouling coatings. Also, dissolved pollutants such as TBT are more likely to affect larvae than established populations so that noticable effects may only occur when those established populations disappear due to natural mortality.

The influx of alien species, particularly Sargassum muticum and the changes brought about by decline in Zostera marina and cessation of sand removal (Wilson, 1948) are also notable.

The conclusion that the estuary retains its status as a rich site for a wide range of marine communities emphasises the importance of maintaining and improving this situation. Careful consideration of proposed new developments from a marine biological point-of-view and continued efforts to minimise all forms of pollution in the estuary are important.

8. ASSESSMENT OF SCIENTIFIC INTEREST AND NATURE CONSERVATION IMPORTANCE OF SALCOMBE HARBOUR AND THE KINGSBRIDGE 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 Ratcliffe (1971) (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. Where comparisons are made on a 'Regional' basis, the region is southwest Britain from north Pembrokeshire around to Portland Bill. For Salcombe and the Kingsbridge Estuary, the area included in this assessment is the coastline north of The Bar.

8.2. General evaluation

Size. Salcombe Harbour and the Kingsbridge Estuary extends 8 km from The Bar at its entrance to Kingsbridge in the north. The area covered by water at high tide is about 4 km^2 and half that at low water of spring tides. The southern half of the inlet and all of the branches are less than 500 m wide but, in the northern half, extensive mud flats occupy a width up to 1.5 km. These mud flats are often backed by rock on the upper shore. Near to the entrance, the intertidal sediments become coarser and fairly large sandy bays are present. Bedrock extending to low water is very restricted in area and, except at the entrance, is only found at a few promentaries. The Salt Stone is an isolated rock outcrop in the upper estuary. A deep channel about 200 m wide extends northwards for about 4 km. This is mainly of muddy sediments but with shell fragments and stones and isolated areas where bedrock occurs. Other channels are of mud. The areas where bedrock is present, at Mill Bay, Snapes Point and Tosnos Point, occupy only a small length of coastline. Another habitat is provided by the extensive system of pontoons in the area.

Diversity. Diversity of sediment habitats and associated communities is high with types ranging from thick mud through muddy sediments with coarser material to coarse sand. Muddy substrata with shale and shells provides a particularly rich habitat. The range of artificial substrata is also high including pontoon floats, mooring chains and mooring blocks. Rock surfaces and associated communities occur in both wave exposed and wave sheltered habitats including on the upper shore at the heads of creeks and into deep subtidal areas at some locations in the main channel. Hard substrata and associated communities are also present in the form of cobbles, pebbles or shells associated with the sediments. Species diversity particularly on and in the mixed substrata and bordering the main channel is very high for both algae and animals. Also, the broken rocks near to the entrance of the harbour are rich in a wide variety of algae and animals.

The high diversity of species is maintained well into the estuary.

Naturalness. The seabed habitats are mainly natural substrata and the communities are similar to those present in 1900 before extensive development of the inlet for recreational sailing. There has been very little dredging. Artificial substrata are mainly pontoons and mooring chains and blocks with a few walls and jetties extending into the intertidal.

Rarity. Tables 17 and 18 (Tables are included at the end of the text) point to rarely encountered communities and species. These include the sheltered mixed sediments in intertidal and subtidal areas and the subtidal bedrock at Snapes Point and Scoble Point. Many rarely encountered algae and animals have been recorded from the area and in particular from the mixed substrata present in the main channel.

Fragility (vulnerability). The main reasons for the richness of the communities present in Salcombe Harbour and the Kingsbridge Estuary appear to be the penetration of almost fully saline water a considerable distance northwards, the strong tidal flow in the main channel which prevents deposition of silt and maintains a coarse mixed substratum, and the shelter from wave action. These features would only be changed by major construction works which altered water flow patterns. There appears to be no major problem associated with sewage disposal or of other inputs into the marine environment

within the inlet. However, the water body is a very restricted area and an oil spill or accidental discharge could cause major effects. The rich sediment communities are subject to collecting by field parties and, since many of them occur in very restricted areas, caution in digging especially needs to be exercised.

Typicalness. Many features of the marine communities are typical of sheltered marine inlets and, at the heads of creeks and the northernmost part of the main channel, are typical of estuarine conditions. However, communities on mixed substrata are perhaps untypical in their richness. On the other hand, communities on rock within the inlet include elements typical of sheltered ria communities but were not as rich as some other areas known.

Recorded history. Salcombe Harbour and the Kingsbridge Estuary are one of the best recorded marine sites in Britain. Studies of animals were being carried out there in the early part of the 19th century by George Montagu and many species new to science were recorded from the area. Later, a detailed survey was undertaken by Allen and Todd in 1900 and rich areas discovered by them continued to be sampled by staff from the Marine Biological Laboratories at Plymouth. The decline of Zostera marina and changes in fauna associated with loss of Zostera and sediment accumulation are well documented. The history of algal recording is much more recent.

Position in an ecological/geographical unit. Powell et al., (1978) and Bishop and Holme (1980) include the coast from the entrance to the inlet to Start Point as of high nature conservation importance although clarification for including open coast areas is needed. Most of the land adjacent to the inlet is intensively farmed or is developed for housing. The saltmarsh communities are of some interest but are not particularly rich or extensive. The area is important as a feeding ground for wildfowl and waders. No adjacent terrestrial areas of high nature conservation importance are known.

Potential value. There are no areas where rehabilitation is required. However, it has been suggested by Wilson (1948) that the cessation of sand extraction at Mill Bay has resulted in sediment accumulation further up the estuary with associated changes in the fauna including losses of some unusual species. Re-introduction of extraction might be desirable. The area of the Salt Stone might be less rich than previously due to collecting and the presence of Sargassum muticum since 1981 now poses a threat to this rich site so that management might be appropriate.

Intrinsic appeal. The estuary is attractive scenically although not to the extent of similar areas such as the Dart and the Fal. Its appeal is mainly to those interested in recreation on the water, particularly yachting.

Research and educational value. The recorded history and rich communities present make the intertidal sediment area of the inlet particularly attractive for research and education. Also, as an intensively developed centre for pleasure boating, there are opportunities to study the impact of this activity on marine communities. The effects of the invasive Sargassum muticum could also be studied here.

8.3. Identification/confirmation of important features.

Features of littoral and sublittoral ecosystems in the area of the Salcombe Harbour and Kingsbridge Estuary are evaluated here in terms of their International, National, Regional or Local importance. Table 17 lists the

main habitat/community types encountered, Table 18 lists species which are considered of scientific interest in their presence in the survey area, for Table 17, 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

Salcombe Harbour and the Kingsbridge Estuary are clearly of outstanding importance and interest for the marine habitats, communities and species present there. Those habitats and communities appear to have remained largely unchanged since detailed studies were first undertaken in 1900 although there are locations where losses of certain species have been recorded partly as a result of natural sediment accumulation. The SSSI draft designation outlines

the main features of intertidal communities which we have confirmed but the interest of subtidal communities including algae and animals should also be mentioned. The following note is suggested: 'The bed of the main channel from the entrance to Salcombe Harbour to the Salt Stone is of mixed sediments with stones and shells. The communities present are very rich in algae and animals including several rare or unusual species. At Snapes Point and Scoble Point, broken rock surfaces extend into deep water and are colonised by typical ria communities. Subtidal communities were described in detail in 1900 and appear much the same today'.

Although current levels of recreational use do not appear to pose a threat to most habitats and communities, care should be taken to avoid developments on the shore and to exclude both onshore and offshore developments from the region of the Salt Stone where some of the richest communities occur in a small area. Digging on the lower shore for biological specimens or for fishing bait disturbes the richest elements of the communities present and a code of practice for educational or research groups is needed together with a ban on digging for bait below low water of neap tides level. The effects of Tributyltin compounds are a cause for concern and government legislation, voluntary codes of practice etc should be enforced. The presence of Sargassum muticum since 1981 and its high abundance gives some cause for concern about its possible effects on the natural communities present and annual removal of plants together with monitoring on Sargassum-cleared and dominated areas of shore may be a part of management of the area for nature conservation purposes.

9. ACKNOWLEDGEMENTS.

Field survey was undertaken with the permission of the Harbour Master, Captain J. Blazeby, and we are very grateful for the co-operation we received from Salcombe Harbour staff throughout planning and undertaking the survey. Data on freshwater input, sewage discharges and regulated fisheries were supplied by South West Water and Roger Hamilton is thanked for obtaining them. Very useful discussions have been held with Drs. Alan Southward, Norman Holme, Gerald Boalch and Peter Gibbs at the Marine Biologcial Association Laboratory at Plymouth and Graham Pickett at the MAFF Laboratory at Lowestoft. Dr. Charles Goodhart of Cambridge University and Drs. Steve Hawkins and P. Cunningham have supplied unpublished species lists. Paul Dart took part in field survey on September 8th and Dr. Bill Farnham on September 10th and 11th and we are grateful for their help. Dredging was undertaken from the M.V. 'Crustacean' on September 9th and Geoff Foale is thanked for his assistance as skipper and for the fact that everything on the boat worked. We were based at Slapton Ley Field Centre where staff made us most welcome and provided excellent facilities.

10. REFERENCES

Admiralty (1977). Channel Pilot. Taunton: Hyrographer of the Navy. 382 pp.

Allen, E. J. and Todd, R. A. (1900). The fauna of Salcombe Estuary. J. mar. biol. Ass. U.K.. 6, 151-217.

Anon (1952). Flora of Devon. Vol. II. Part I. The Marine Algae. Devonshire Association, Exeter. 77 pp.

Bantock, C. R. and Cockayne, W. C. (1975). Chromosomal polymorphism in Nucella lapillus. Heredity **34**, 321-245.

Bishop, G. M. and Holme, N. A. (1980). The sediment shores of Great Britain. Report to the NCC from the Marine Biological Association, Plymouth. 77 pp.

Cleary, J. J. and Stebbing, A. R. D. (1985). Organotin and total tin in coastal waters of southwest England. Mar. Pollut. Bull. **16**, 350-355.

Critchley, A. T., Farnham, W. F. and Morrell, S. L. (1983). A chronology of new European sites of attachment for the invasive brown alga, Sargassum muticum, 1973-1981. J. mar. biol. Ass. U.K.. **63**, 799-811.

Darbyshire, M. and Draper, L. (1962). Forcasting wind-generated sea waves. Engineering Lond. **195**, 482-487.

Day, J. H. (1967). A monograph of the Polychaeta of Southern Africa. Part 1. Errantia. London: British Museum (National History), 458 and XXIX pp.

Hartley, J. P. (1981). The Family Paraonidae (Polychaeta) in British waters: a new series and new records with a key to species. J. mar. biol. Ass. U.K., **61**, 133-149.

Hartmann-Schroder, G. (1971). Annelida, Borsten wurmer, Polychaeta. Tierwelt Dtl. 58, 1-594.

Hiscock, K. (1976). The influence of water movement on the ecology of sublittoral rocky areas PhD Thesis, University of Wales. 235 pp.

Hobbs, G. (1985). Surveys of Harbours, Rias and Estuaries in Southern Britain. Field Survey Data Base Operating Instructions. Report to the Nature Conservancy Council from the Field Studies Council Oil Pollution Research Unit. 25 pp.

Hoskins, W. G. (1954). A New Survey of England: Devon. Collins, London.

Ingle, R. W. (1980). British Crabs. London: British Museum (Natural History)/Oxford University Press. 222 pp.

Lee, A. J. and Ramster, J. W. (eds). (1981). Atlas of the seas around the British Isles. Lowestoft: Ministry of Agriculture, Fisheries and Food.

Marine Biological Association (1957). Plymouth Marine Fauna. Marine Biological Association of the United Kingdom, Plymouth. 457 pp.

McCarter, N. H. and Thomas, A. D. (1980). Patterns of animal and plant distributions on rocky shores of the South Hams (South Devon). Fld. Stud. 5, 229-258.

Myers, A. A. and McGrath, D. (1982). Taxonomic studies on British and Irish Amphipoda. Re-establishment of Leucothoe procera. J. mar. biol. Ass. U.K. 62, 693-698.

Powell, H. T., Holme, N. A., Knight, S. J. and Harvey, R. (1978). Survey of the Littoral Zone of the Coast of Great Britain. 2. Report on the Shores

of Devon and Cornwall. Report to the NCC by the SMBA/MBA Intertidal Survey Unit. 126 pp, maps and appendices.

Rubin, J. A. (1980). Spatial interaction in a sublittoral benthic community. Prog. Underwater Sci. 5, 137-146.

Stebbing, A. R. D. (1981). Hormesis-stimulation of colony growth in Campanularia flexuosa (Hydrozoa) by copper, cadmium and other toxicants. Aquat. Toxic. 1, 227-238.

Thain, J. E. (1983). The acute toxicity of bis (tributyltin) oxide to the adults and larvae of some marine organisms. ICES Paper CM 1983/E:13 (mimeograph). International Council for the Exploration of the Sea, Copenhagen.

Waldock, M. J. and Thain, J. E. (1983). Shell thickening in Crassostrea gigas: organotin antifouling or sediment induced. Mar. Pollut. Bull. 14, 411-415.

Warwick, R. M. and Price, R. (1975). Macrofauna production in an estuarine mudflat. J. Mar. Biol. Ass. U.K. 55, 1-18.

Wilson, D. P. (1948). The decline of Zostera marina L. at Salcombe and its effects on the shore. J. mar. biol. Ass. U.K. 28, 395-412.

Wilson, D. P. (1982). The larval development of three species of Magelona (Polychaeta) from localities near Plymouth. J. mar. biol. Ass. U.K. 62, 385-401.

TABLE 1

Sites surveyed and survey staff.

Site No.	Site Name	Date Surveyed	Ordnance Survey Grid Ref. SX:	Initials of Survey Staff
		INTERTIDAL SURVEY		
1	North Sands	4.4.85	731381	KH,CL,GH,TB
2	East of Leek Cove	5.4.85	737373	TB, TR
3	Limebury Point	5.4.85	736375	TB, TR
4	S. Tosnos Point	6.4.85	746401	CL, TB
5	N. Tosnos Point	6+7.4.85	747402	CL,TB,KH
6	N. Blanksmill Creek	6.4.85	740410	GH, SW
7	Salt Stone	6.4.85	746407	CL,TB,KH,GH, SW.
8	Mill Bay	7.4.85	740382	GH, SW
9	Salcombe Castle (Fort Charles)	7.4.85	734381	CL,TB,KH
10	Scoble Point	7.4.85	748394	CL, TB
11	N. of Horsepool Cove	7.4.85	753391-753392	GH,SW,KH
12	Ditchend Cove	8.4.85	747389	GH, TB
13	Boat Pool	8.4.85	755394	CL, SW
14	Snapes Point	8.4.85	746394	CL, SW
15	Park Bay	8.4.85	739428-736426	GH,TB,CL,SW
16	High House Point	9.4.85	743428	CL,TB,GH,SW
17	Southville Landing Jetty	9.4.85	742428	CL, TB
18	Frogmore	9.4.85	774425	CL,TB,GH,SW
		29.6.85	775426-771424	KH
19	W. Blanksmill Creek	28.6.85 11.9.85	726410- 733410	KH, WF
20	Southpool	29.6.85	774401-771401	KH
46	New Bridge, Bowcombe Creek	9.4.85	745432	CL
		SUBTIDAL SURVEY		
21	S. of The Bar	7.9.85	735370	DR, SF
22	Great Eelstone	7.9.85	731366	KH, CM
23	W. Gammon Head	7.9.85	764355	DR,SF,KH,CM
24	S. Starehole Bay	8.9.95	727362	DR, SF
25	Wreck, Starehole Bay	8.9.85	729365	KH, CM
26	Bellhouse Rock, Starehole Bay	8.9.85	727364	KH, CM
27	S. Southsands	8.9.85	731376	DR, SF
28	N. of The Bar	8.9.85	734374-734373	DR, SF
29	SE of Leek Cove	8.9.85	738372	KH, CM
30	Salcombe Drift	9.9.85	739386-742387	SF
31	Marine Hotel	9.9.85	739387-743385	CM, DR

SUBTIDAL SURVEY (Continued)

32	Fort Charles	9.9.85	735381-736379	CM,SF,DR
33	Snapes Point	10.9.85	746393	DR, SF
34	Scoble Point	10.9.85	748393	KH, CM
35	Pontoon, The Bag	10.9.85	746396	DR, SF
36	N. Tosnos Point	10.9.85	747402	KH, CM
37	Ditch End	11.9.85	746390-746388	DR, SF
38	Middle Ground	11.9.85	747392-747393	CM, WF
39	Southpool Creek	11.9.85	751391	KH
40	W. of Salt Stone	11.9.85	745408-746408	DR, SF
41	S. of Salt Stone	11.9.85	747406-747407	CM, WF
42	Frogmore Creek	11.9.85	753407	KH
43	Gerston Point	11.9.85	742416-742415	KH
44	Black Stone	12.9.85	736378	DR,SF,WF
45	Mill Bay	12.9.85	739382-740382	KH, CM

DREDGE SAMPLES

Site No.	Location	Date Sampled	Latitude and Longitude North	West	Approximate Volume of Samples
D1	Gerston Point (deep)	9.9.85	50°15.66'	3°46.04'	15 1.
D2	Gerston Point (shallow)	9.9.85	50°15.59'	3°46.03'	10 1.
D3	Salt Stone	9.9.85	50°15.14'	3°45.68'	45 1.
D4	Tosnos-Halwell Point	9.9.85	50°14.92'	3°45.55'	8 1.
D5	Ox Point	9.9.85	50°14.59'	3°45.60'	7 1.
D6	The Bag (deep pit)	9.9.85	50°14.50'	3°45.61'	25 1.
D7	Ditch End	9.9.85	50°14.25'	3°45.57'	30 1.
D8	Southpool Creek	9.9.85	50°14.33'	3°45.30'	8 1.
D9	Salcombe Ferry	9.9.85	50°14.11'	3°45.99'	20 1.
D10	Mill Bay	9.9.85	50°13.78'	3°46.36'	25 1.

TABLE 2.

Abundance of conspicuous species on intertidal rock surfaces at the entrance to Salcombe Harbour, East of Leek Cove (Site 2) and, on the lower shore, at Limebury Point (Site 3).

Splash (lichen) at +8.5 to 10.5m	Splash (black lichen) at +6.5 to 8.5m	Upper shore (Lichina pygmaea and Porphyra) at +5.0 to 6.5m	Mid to Upper Midshore (Limpet Barnacle) at +1.5 to 2.5m	Lower Midshore (Limpet/ Barnacle) at +1.5 to 2.5m	Lower shore at Limebury Point (3) at +0.5
		SUPERABUNDANT SPECIES			
	Verrucaria maura		Chthamalus stellatus Chthamalus montagui Patella vulgata		Rhodophyta indet. (encr. pink) Mytilus edulis
		ABUNDANT SPECIES			
Xanthoria parietina Grey lichens Ramalina siliquosa				Rhodophyta indet. (encr. pink) Chthamalus stellatus Semibalanus balanoides	Laminaria digitata Himanthalia elonga
		COMMON SPECIES			
Verrucaria maura		Lichina pygmaea Porphyra sp. Chthamalus montagui Patella vulgata Littorina 'saxatilis' Littorina neglecta	Actinia equina Littorina neglecta	?Patella aspersa ?Patella depressa	Chondrus crispus Gigartina stellata Corallina officinalis Semibalanus balanoides Patella vulgata Patella ?aspersa Patella ?depressa
		FREQUENT SPECIES			
	Caloplaca marina Littorina neritoides	Fucus spiralis Enteromorpha sp.	Littorina 'saxatilis'	Chthamalus montagui Balanus perforatus Patella vulgata	Palmaria palmata Gastroclonium ovatum Lomentaria articulata Laurencia hybrida Laurencia pinnatifida Laminaria saccharina Fucus serratus Balanus perforatus Polyclinidae indet.
		OCCASIONAL SPECIES			
	Lichina confinis Porphyra sp, Littorina 'saxatilis'	Pelvetia canaliculata Actinia equina Mytilus edulis	Corallina officinalis Rhodophyta indet. (encr. pink) Laurencia hybrida Lichina pygmaea Mytilus edulis	Laurencia pinnatifida Halichondria panicea Mytilus edulis	Callithamnion tetragonum Plumaria elegans Cryptopleura ramosa Heterosiphonia plumosa Enteromorpha sp. Ulva sp. Codium sp. Polyides rotundus Myxilla sp. Halichondria panicea Chthamalus stellatus Bryozoa indet. (encr.)

TABLE 3.

Abundance of conspicuous species in rock pools and on overhanging rocks in gullies at the entrance to Salcombe Harbour.

Pools at +5 to 6.5m E. of Leek Cove (2)	Pools at +4.75m E. of Leek Cove (2)	Upper shore (Pelvetia) pool at Fort Charles (9)	Midshore (Barnacle/ L.pinnatifida) pool at Fort Charles (9)	Lower shore (algal dominated) pool at Fort Charles (9)	Pool at + 1.75m at Limebury Point (3)
SUPERABUNDANT SPECIES					
			Rhodophyta indet.(encr. pink)	Rhodophyta indet.(encr. pink)	Rhodophyta indet.(encr. pink) Mytilus edulis
ABUNDANT SPECIES					
	Corallina officinalis Rhodophyta indet.(encr. pink) Anemonia viridis			Corallina officinalis Laminaria digitata	
COMMON SPECIES					
	Enteromorpha sp	Corallina officinalis	Corallina officinalis Laminaria digitata Bifurcaria bifurcata	Calliblepharis jubata	Corallina officinalis Laminaria digitata Laminaria saccharina Bifurcaria bifurcata
FREQUENT SPECIES					
Rhodophyta indet.(encr. pink)	Gelidium pusillum Ceramium rubrum	Gelidium pusillum Ceramium rubrum Phaeophyta indet.(filam.)		Chondrus crispus Palmaria palmata Rhodymenia pseudopalmata Cryptopleura ramosa Himanthalia elongata Hymeniacidon perleve Corynactis viridis Spirorbinidae indet.(on Chondrus) Patella aspersa Balanus crenatus	Gastroclonium ovatum Plumaria elegans Delesseria sanguinea Phyllophora pseudoceranoides Schottera nicaeensis Codium tomentosum Anemonia viridis
OCCASIONAL SPECIES					
Corallina officinalis Ceramium rubrum Enteromorpha sp. Cladophora sp.	Calliblepharis jubata Pterocladia capillacea Laurencia pinnatifida Polysiphonia urceolata Scytosiphon lomentaria Halopteris scoparia Phaeophyta indet.(filam.) Ulva sp.	Mesophyllum lichenoides Palmaria palmata Scytosiphon lomentaria Sphacelaria sp. Enteromorpha sp. Cladophora pellucida Littorina littorea	Gelidium pusillum Calliblepharis jubata Chondrus crispus Palmaria palmata Delesseria sanguinea Gastroclonium ovatum Lomentaria articulata Ceramium rubrum Laurencia hybrida Himanthalia elongata Cladophora pellucida Actinia equina Urticina felina Corynactis viridis Littorina littorea Amphipholis squamata	Gelidium latifolium Lomentaria articulata Dilsea carnosa Plumaria elegans Phaeophyta indet.(filam.) Chaetomorpha melagonium Cladophora pellucida Myxilla sp. Actinia equina Urticina felina Pomatoceros sp(p). Spirorbinidae indet.(on rock) Idotea sp. Mytilus edulis	Calliblepharis ciliata Mesophyllum lichenoides Ceramium ciliatum Palmaria palmata Lomentaria articulata Lomentaria clavellosa Griffithsia ?flosculosa Laurencia pinnatifida Polysiphonia brodiaei Furcellaria lumbricalis Ulva sp. Scypha compressa ?Myxilla sp. Halichondria panicea Nucella lapillus

TABLE 4.

Abundance of conspicuous species on intertidal rock at Scoble Point (Site 10). (Heights of survey stations not recorded).

	Splash (Verrucaria maura)	Upper shore (Pelvetia canaliculata)	Upper midshore (Fucus spiralis)	Midshore (Fucus vesiculosus)	Midshore (Limpet/barnacle)	Lower midshore (Fucus serratus)	Lower shore (Algal/sponge turf)
SUPERABUNDANT SPECIES					Patella vulgata	Fucus serratus	
ABUNDANT SPECIES	Grey lichens Verrucaria maura	Pelvetia canaliculata	Fucus spiralis	Patella vulgata	Semibalanus balanoides		
COMMON SPECIES	Xanthoria parietina		Pelvetia canaliculata	Fucus vesiculosus Semibalanus balanoides	Littorina neglecta	Audouinella sp. Clava squamata Dynamena pumila Spirorbinidae indet. (on rock and fucoids) Semibalanus balanoides Balanus perforatus	Hymeniacidon perleve Spirorbinidae indet. (on fucoids) Balanus crenatus
FREQUENT SPECIES	Ramalina siliquosa	Enteromorpha sp. Verrucaria maura	Enteromorpha sp. Littorina 'saxatilis'	Rhodophyta indet. (pink encr.) Ascophyllum nodosum Enteromorpha sp. Ulva sp. Littorina 'saxatilis' Littorina obtusata	Laurencia pinnatifida Fucus vesiculosus Enteromorpha sp. Spirorbinidae indet. (on rock) Carcinus maenas Littorina 'saxatilis'	Gelidium pusillum Chondrus crispus Rhodophyta indet. (pink encr.) Polysiphonia lanosa Ascophyllum nodosum Enteromorpha sp. Ulva sp. Hymeniacidon perleve Balanus crenatus	Audouinella sp. Gigartina acicularis Ceramium rubrum Sargassum muticum Cladostephus spongiosus Fucus serratus Ulva sp. ?Pilayella littoralis Pomatoceros sp(p). Liocarcinus puber Pisidia longicornis Nassarius incrassatus Electra pilosa Membranipora membranacea
OCCASIONAL SPECIES		Catenella caespitosa Fucus spiralis Caloplaca marina ?Hyale nilssoni Anurida maritima Littorina 'saxatilis'	Audouinella sp. Rhodophyta indet. (encr. dk. red) ?Hyale nilssoni	Audouinella sp. Gelidium pusillum Chondrus crispus Elminius modestus Littorina neglecta	Rhodophyta indet. (encr. pink) Cladostephus spongiosus Fucus vesiculosus Cladophora sp. Actinia equina Terebellidae indet. Balanus perforatus Elminius modestus Anomiidae indet. Gammaridae indet. Bryozoa indet.(encr.)	Callithamnion tetricum Antithamnion plumula Gigartina stellata Rhodophyta indet. (encr. dk. red) Palmaria palmata Lomentaria articulata Ceramium rubrum Ceramium shuttleworthianum Laurencia hybrida Cladostephus spongiosus Fucus vesiculosus Cladophora sp. Pomatoceros sp(p). Patella vulgata Crepidula fornicata	Chondrus crispus Chylocladia verticillata Lomentaria articulata Lomentaria clavellosa Ceramium ciliatum Cryptopleura ramosa Laurencia pinnatifida Polysiphonia urceolata Rhodophyta indet.(filam) Colpomenia peregrina Desmarestia viridis Halichondria panicea Myxilla sp. Porifera indet. (encr. red) Spirorbinidae indet. (on rock) Verruca stroemia Balanus perforatus Gibbula umbilicalis Ciona intestinalis Sidnyum elegans
RARE SPECIES					Littorina obtusata		Polymastia mamillaris

TABLE 5.

Abundance of conspicuous species on intertidal rock at North Tosnos Point (Site 5).

Splash (Verrucaria maura) at +5.5 to 5.7m	Upper shore (Pelvetia canaliculata) at +4.9 to 5.5m	Upper midshore (Fucus spiralis) at +4.7 to 4.9m	Midshore-Lower Midshore (Ascophyllum nodosum) at +2.7 to 4.7m	Lower midshore bedrock and boulders including overhanging surfaces (Fucus serratus) below 2.7m	
		EXTREMELY ABUNDANT SPECIES			
			Ascophyllum nodosum		
		SUPER ABUNDANT SPECIES			
		ABUNDANT SPECIES			
Verrucaria maura	Pelvetia canaliculata		Fucus vesiculosus Patella vulgata	Fucus serratus	
		COMMON SPECIES			
Catenella caespitosa	Fucus spiralis Enteromorpha sp.	Fucus sprialis Enteromorpha sp.	Clava squamata Terebellidae indet. Littorina obtusata	Hymeniacidon perleve Pomatoceros sp(p). Bryozoa indet.(encr.)	Ascidiella aspersa Morchellium argus
		FREQUENT SPECIES			
	Catenella caespitosa	Polysiphonia lanosa Ascophyllum nodosum	Polysiphonia lanosa Fucus serratus Sargassum muticum Cladophora sp. Hymeniacidon perleve Semibalanus balanoides Elminius modestus Anurida maritima Bryozoa indet.(encr.)	Antithamnion plumula Callithamnion sp. Ceramium rubrum Sargassum muticum Ulva sp. Leucosolenia botryoides Clava squamata Dynamena pumila Spirorbinidae indet. (on fucoids)	Verruca stroemia Semibalanus balanoides Balanus perforatus Balanus crenatus Littorina obtusata Umbonula littoralis Didemnidae indet. (on F.serratus)
		OCCASIONAL SPECIES			
Enteromorpha sp. Caloplaca marina Grey lichens Lichina confinis	Anurida maritima Littorina 'saxatilis'	Elminius modestus ?Hyale nilssoni Anurida maritima Littorina 'saxatilis' Littorina obtusata	Rhodophyta indet. (dk. red encr.) Halichondria panicea Pomatoceros sp(p). Spirorbinidae indet. (on rock and fucoids) Balanus perforatus Carcinus maenas Littorina nigrolineata	Chondrus crispus Gracilaria verrucosa Rhodophyta indet. (dk. red encr.) Lomentaria clavellosa Polysiphonia urceolata Ascophyllum nodosum Bryopsis hypnoides Grantia compressa Myxilla sp. Halichondria panicea	Terebellidae indet. Spirorbinidae indet. (on rock) Liocarcinus puber Carcinus maenas Anomiidae indet. Crepidula fornicata Ciona intestinalis
		RARE SPECIES			
			Myxilla sp.	Cereus pedunculatus Calliostoma zizyphinum Sidnyum elegans	
		PRESENT - NO RECORD OF ABUNDANCE			
			Scypha ciliata Gonothyrea loveni Littorina rudis Nymphon gracile Bowerbankia imbricata Alcyonidium gelatinosum (=A.polyoum) Sidnyum elegans	Pleonosporium borreri Pilayella littoralis Cladostephus spongiosus	

TABLE 6.

Abundance of conspicuous species on the lower shore southwest of the Salt Stone (Site 7) (algae and animals), southeast of the Salt Stone (Site 7) and at North Tosnos Point (Site 5) (animals only).

South-west of the Salt Stone (7) (algae and animals	South-east of the Salt Stone (7) (animals only)	Rocks and wreckage South-east of the Salt Stone (7) (animals only)	North of Tosnos Point (5) (animals only)
ABUNDANT SPECIES			
Ulva sp. Hymeniacidon perleve Halichondria bowerbankii		Morchellium argus	
COMMON SPECIES			
Antithamnion plumula Laminaria saccharina Sargassum muticum Hydractinia echinata Pomatoceros sp(p). Terebellidae indet. (tubes) Harmothoe ?spinifera Gibbula cineraria Lepidopleurus asellus Anomiidae indet. Pisidia longicornis Paguridae indet. Umbonula littoralis Bryozoa indet. Ascidiella aspersa Morchellium argus	Halichondria bowerbankii Pomatoceros sp(p). Bryozoa indet.(encr.)	Scypha ciliata Bryozoa indet. Styela clava Ascidiella aspersa	Terebellidae indet. (tubes) Bryozoa indet.(encr.)
FREQUENT SPECIES			
Audouinella sp. Ceramium rubrum Gracilaria verrucosa Phaeophyta indet.(filam.) Leuconia barbata Scypha ciliata Sabella pavonina Lineus longissimus Doriidae indet. Calliostoma zizyphinum Ophiothrix fragilis Botryllus schlosseri	Hymeniacidon perleve Hydractinia ecninata Harmothoe ?spinifera Paguridae indet. Pisidia longicornis Umbonula littoralis Ophiothrix fragilis Morchellium argus	Hymeniacidon perleve Dynamena pumila Calliostoma zizyphinum Umbonula littoralis Didemnum maculosum	Halichondria bowerbankii Halichondria panicea Terebellidae indet.(tubes) Anomiidae indet. Ophiothrix fragilis Ascidiella aspersa
OCCASIONAL SPECIES			
Gigartina teedii Chondrus crispus Chylocladia verticillata ?Polyneura hilliae Griffithsia corallinoides Calliblepharis ciliata Lomentaria clavellosa Polysiphonia sp. Cladostephus spongiosus ?Cystoseira sp. Desmarestia viridis Bryopsis plumosa Bryopsis hypnoides Myxilla sp. Halichondria panicea Obelia sp. Cereus pedunculatus Branchioma vesiculosum Balanus crenatus Balanus perforatus Verruca stroemia Galathea dispersa Galathea squamifera Cancer pagurus Doriidae indet. Littorina littorea Nassarius incrassatus Psammechinus miliaris Didemnum maculosum Ascidia conchilega Sidnyum elegans ?Aplidium sp. Pholis gunnellus	Scypha ciliata Myxilla sp. Halichondria panicea Branchiomma vesiculosum Sabella pavonina Terebellidae indet. Lineus longissimus Galathea dispersa Galathea squamifera Cancer pagurus Calliostoma zizyphinum Doriidae indet. Psammechinus miliaris Didemnum maculosum Sidnyum elegans Pholis gunnellus	Leucosolenia botryoides Halichondria bowerbankii Pomatoceros sp(p). Balanus crenatus Balanus perforatus Sidnyum elegans	Leucosolenia botryoides ?Sabella flabellata Pomatoceros sp(p). Lineus longissimus Balanus perforatus Pisidia longicornis Carcinus maenas Calliostoma zizyphinum Gibbula umbilicalis Psammechinus miliaris Styelinae indet. Pholis gunnellus
RARE SPECIES			
Anemonia sulcata Callianassidae indet. Crepidula fornicata Trivia monacha Styela clava Phallusia mammillata			Cereus pedunculatus Galathea dispersa Trivia monacha Sidnyum elegans Phallusia mammillata
PRESENT- NO RECORD OF ABUNDANCE			
Callithamnion sp. Amphitrite johnstoni			

TABLE 7.

Abundance of conspicuous species on the shore at High House Point (Site 16).

	Splash (Verrucaria maura) Muddy bedrock and pebble/ gravel	Upper shore (Pelvetia canaliculata) Muddy bedrock and muddy gravel	Upper midshore (Fucus spiralis) Muddy bedrock and muddy gravel	Midshore (Ascophyllum nodosum/ Fucus vesiculosus) Muddy bedrock and muddy gravel	Lower midshore (Fucus serratus) Low muddy rock outcrops on gravelly mud
SUPERABUNDANT SPECIES	Verrucaria maura			Ascophyllum nodosum	
ABUNDANT SPECIES		Enteromorpha sp. Verrucaria maura	Fucus spiralis Enteromorpha sp.	Fucus vesiculosus Littorina obtusata Gammaridae indet. (mainly in Gammarus locusta in samples)	Littorina littorea Littorina obtusata
COMMON SPECIES	Gammaridae indet. Acarina indet.(mites)	Gammaridae indet.	Catenella caespitosa Gammaridae indet, (mainly Gammarus locusta in sample) Littorina 'saxatilis' Littorina obtusata	Enteromorpha sp. Carcinus maenas	Ascophyllum nodosum Fucus serratus Fucus vesiculosus Myxilla sp. Elminius modestus Gammaridae indet. (mainly Gammarus locusta in samples) Carcinus maenas
FREQUENT SPECIES	Enteromorpha sp.	Catenella caespitosa Pelvetia canaliculata Littorina obtusata	?Audouinella sp. Anurida maritima Hydrobia ulvae	?Audouinella sp. Gelidium pusillum Polysiphonia lanosa Phaeophyta indet.(filam.) Ulva sp. Cladophora sp. Myxilla sp. Sagartia sp. Pomatoceros sp(p). Cirratulus cirratus Spirorbinidae indet.(on rock) Littorina 'saxatilis' Hydrobia ulvae	Gelidium pusillum Chondrus crispus Polysiphonia lanosa Ulva sp. Cladophora sp. Spirorbinidae indet.(on rock) Spirorbinidae indet.(on fucoids) Littorina 'saxatilis' Hydrobia ulvae
OCCASIONAL SPECIES	Littorina 'saxatilis' Hydrobia ulvae	Fucus spiralis Carcinus maenas Acarina indet.(mites) Littorina 'saxatilis' Hydrobia ulvae	?Callithamnion roseum Ascophyllum nodosum Pelvetia canaliculata Ulva sp. Cladophora sp. Cirratulus cirratus Carcinus maenas	Chondrus crispus Rhodophyta indet.(dk red encr.) Semibalanus balanoides Elminius modestus Littorina littorea	Gigartina stellata Ceramium rubrum ?Callithamnion roseum Halichondria panicea Pomatoceros sp(p). Cirratulus cirratus Balanus crenatus Balanus perforatus Semibalanus balanoides Cardium edule Bryozoa indet.(encr.)

TABLE 8.

Abundance of conspicuous species on broken subtidal bedrock on the open coast near to Salcombe Harbour.

Sublittoral fringe at 0 to 0.5m bed at Site 22	Broken bedrock in the Upper infralittoral at 5.5m bed at Site 23 *= on algae	Vertical rock in the Upper infralittoral at 6m bed at Site 23	Algae on kelp stipes in the Upper infralittoral at Site 23 (with additional records for Sites 24 and 29). *:Site 24 +:Site 29
ABUNDANT SPECIES			
Rhodophyta indet. (encr. pink) Laminaria digitata Mytilus edulis	Laminaria hyperborea Electra pilosa*	Haliphysema tumanowiczi	Palmaria palmata
COMMON SPECIES			
Chondrus crispus Patella sp(p) Asterias rubens	Cruoria pellita Rhodophyta indet. (encr. pink) Patina pellucida*	Meredithia microphylla	Phycodrys rubens
FREQUENT SPECIES			
Cruoria pellita Peyssonelia immersa Dilsea carnosa Callithamnion tetragonum Laminaria saccharina	Dilsea carnosa Callophyllis laciniata Kallymenia reniformis Rhodymenia pseudopalmata Acrosorium uncinatum Cryptopleura ramosa Delesseria sanguinea Myriogramme bonnemaisonii Saccorhiza polyschides Dercitus bucklandi Haliclona 'rosea' Oscarella lobularis Corynactis viridis Gibbula cineraria Bryozoa indet.(encr.) Asterias rubens Distomus variolosus Crenilabrus melops	Rhodophyta indet. (encr. pink) Plocamium cartilagineum Callophyllis laciniata Kallymenia reniformis Meredithia microphylla Acrosorium uncinatum Heterosiphonia plumosa Dictyota dichotoma Scypha compressa Dysidea fragilis Sertularella polyzonias Corynactis viridis Caryophyllia smithii Pyrgoma anglicum Crisidia cornuta Schizomaella auriculata Escharoides coccinea Didemnidae indet.	Callophyllis laciniata Cryptopleura ramosa Membranoptera alata Ceramium rubrum* Apoglossum ruscifolium*
OCCASIONAL SPECIES			
Rhodochorton floridulum Callophyllis lacineata Lomentaria clavellosa Halurus equisetifolius Laurencia pinnatifida Desmarestia aculeata Cladophora sp. Amphilectus fucorum Sagartia elegans	Peyssonnelia ?harveyana Sphaerococcus coronopifolius Plocamium cartilagineum Gymnogongrus crenulatus Phyllophora crispa Chondrus crispus Corallina officinalis Meredithia microphylla ?Petrocelis hennedyi Peyssonelia dubyi Spondylothamnium multifidum Membranoptera alata Polyneura gmelinii Phycodrys rubens Heterosiphonia plumosa Brongniartella byssoides Polysiphonia plumosa Polysiphonia sp. Halopteris filicina Cladostephus spongiosus Dictyota dichotoma Cladophora pellucida Haliphysema tumanowiczi Pachymatisma johnstonia Stelligera rigida Amphilectus fucorum Phorbas fictitius Dysidea fragilis Sertularella polyzonias Urticina felina Caryophyllia smithii Pomatoceros sp(p). Balanus crenatus Crisiidae indet. Scrupocellaria reptans Escharoides coccinea Marthasterias glacialis Polyclinum aurantium Botryllus schlosseri Didemnidae indet. Lissoclinum perforatum Diplosoma spongiforme Labrus bergylta	Sphaerococcus cornopifolius Schottera nicaeensis Corallina officinalis Dilsea carnosa Cordylecladia erecta Rhodymenia delicatula Hypoglossum woodwardii Delesseria sanguinea Brongniartella byssoides Pterosiphonia parasitica Polysiphonia sp. Halopteris filicina Cladostephus spongiosus Cladophora pellucida Pachymatisma johnstonia Hemimycale columella Oscarella lobularis Actinothoe sphyrodeta Pomatoceros sp(p). Calliostoma zizypninum Scrupocellaria reptans Marthasterias glacialis Lissoclinum perforatum	Rhodymenia pseudopalmata Laminaria digitata Saccorhiza polyschides Cladophora pellucida*

TABLE 8 (CONTINUED).

RARE SPECIES

Lomentaria articulata
Polysiphonia elongata
Pterosiphonia parasitica
Gastroclonium ovatum
Pomatoceros sp(p).
Balanus crenatus
Balanus perforatus

Lomentaria orcadensis
Callocolax neglectus
Tethya aurantium
Oscarella lobularis
Haliclona viscosa
Halichondria panicea
Hymeniacidon perleve
Myxilla incrustans
Hemimycale columella
Actinothoe sphyrodeta
Cancer pagurus
Homarus gammarus
Maja squinado
Acnaea virginea
Calliostoma zizyphinum
Amphipholis squamata
Pycnoclavella aurilucens
Dendrodoa grossularia
Ascidiacea indet.
(encr.white flecked)
Pomatoschistus sp.

Schizymenia dubyi
Rhodophyllis divaricata
Sphaerococcus coronopifolius
Lomentaria orcadensis
Rhodymenia holmesii
Laminaria hyperborea
Dictyopteris membranacea
Bryopsis plumosa
Clathrina coriacea
Leuconia barbata
Cliona celata
Stelligera rigida
Amphilectus fucorum
Phorbas fictitius
Plumularia sp.
Potamilla reniformis
Asterias rubens
Morchellium argus
Diplosoma spongiforme
Didemnum maculosum
Taurulus bubalis

Laminaria hyperborea

PRESENT, NO RECORD OF ABUNDANCE

Phyllophora traillii
Pseudolithoderma extensum

Cruoria pellita
Peyssonelia dubyi
Rhodophyta/Phaeophyta
indet.(encr.)
Microporella ciliata

Lomentaria articulata +
Myriogramme bonnemaisonii
Brongniartella byssoides
Polysiphonia sp.
Antithamnion spirographidis*
Laminaria hyperborea

TABLE 9.

Abundance of conspicuous species on subtidal wreck surfaces in Starehole Bay (Site 25).

Steeply sloping and vertical surface at 3 to 5m	Overhanging surface at 2 to 5m (Animals only recorded, very few or no algae present)	Horizontal sandy plate at 4m
	ABUNDANT SPECIES	
	Caryophyllia smithii Verruca stroemia Jassidae (tubes)	Gracilaria foliifera
	COMMON SPECIES	
Gibbula cineraria Asterias rubens	Coryractis viridis Pollachius pollachius	Rhodochorton floridulum Gymnogongrus crenulatus Cryptopleura ramosa
	FREQUENT SPECIES	
Plocamium cartilagineum Gracilaria foliifera Gymnogongrus crenulatus Phyllophora crispa Chondrus crispus Lithophyllum incrustans Dilsea carnosa Callophyllis laciniata Kallymenia reniformis Acrosorium uncinatum Cryptopleura ramosa Polyneura hilliae Heterosiphonia plumosa Dermatolithon pustulosum Laminaria saccharina Saccorhiza polyschides Halopteris filicina Chaetomorpha melagonium	Leuconia barbata Dysidea fragilis Actinothoe sphyrodeta Asterias rubens Trisopterus sp.	Phyllophora crispa Callophyllis laciniata Hypoglossum woodwardii Dermatolithon pustulosum Urticina felina Pollachius pollachius
	OCCASIONAL SPECIES	
Rhodochorton floridulum Calliblepharis ciliata Calliblepharis jubata Gigartina acicularis Corallina officinalis Rhodymenia pseudopalmata Antithamnion spirographidis Halurus equisetifolius Spondylothamnion multifidum Hypoglossum woodwardii Polyneura gmelinii Laurencia pinnatifida Pterosiphonia parasitica Pterosiphonia pennata Desmarestia ligulata Desmarestia viridis Laminaria hyperborea Cladostephus spongiosus Dictyota dichotoma Ulva sp. Cladophora pellucida Cladophora sp. Urticina felina Caryophyllia smithii Pomatoceros sp(p). Bryozoa indet.(encr.) Gobiusculus flavescens	Tubularia indivisa Alcyonium digitatum Pomatoceros lamarkii Maja squinado Crisiidae indet. Scrupocellaria sp(p). Cellepora pumicosa Bowerbankia pustulosa ?Polycarpa sp.	Polyides rotundus Phyllophora sicula Dilsea carnosa Kallymenia reniformis Palmaria palmata Cordylecladia erecta Antithamnion plumula Spondylothamnion multifidum Gibbula cineraria Asterias rubens
	RARE SPECIES	
Scinaia forcellata Scinaia turgida Schizymenia dubyi Rhodophyllis divaricata Chylocladia verticillata Callocolax neglectus Gastroclonium ovatum Lomentaria orcadensis Rhodymenia holmesii Antithamnion plumula Drachiella spectabilis Nitophyllum punctatum Phycodrys rubens Pterosipnonia complanata Dictyopteris membranacea Bryopsis plumosa Sertularella polyzonias Alcyonium digitatum Lissoclinum perforatum ?Polycarpa sp. Taurulus bubalis	Halichondria panicea Amphilectus fucorum Porifera indet.(white encr.) Sabella pavonina Pagurus sp. Botrylloides leachii Thorogobius ephippiatus	Lomentaria clavellosa Delesseria sanguinea Halidrys siliquosa
	PRESENT - NO RECORD OF ABUNDANCE	
	Phthisica marina Scrupocellaria scruposa Scrupocellaria scrupea	

TABLE 10.

Abundance of conspicuous species on subtidal rock surfaces and sand at Mill Bay (Site 45).

Rock outcrops amongst *Zostera marina* bed and coarse sand at 1.5m bed	Sand covered rocks at 1.8m bcd	Rock outcrops in sand at 4.5m bcd *= in *Cladophora pellucida*
	ABUNDANT SPECIES	
	Gracilaria foliifera	
	COMMON SPECIES	
	Polyides rotundus	*Sagartia elegans mineata* *Metridium senile* Amphipoda indet.(tubes)
	FREQUENT SPECIES	
Antithamnion spirographidis *Nitophyllum punctatum* *Chylocladia verticillata* *Sargassum muticum* *Laminaria saccharina* *Cereus pedunculatus* *Gibbula cineraria* *Nassarius reticulatus*	*Rhodochorton floridulum* *Gracilaria verrucosa* *Gymnogongrus crenulatus* *Cordylecladia erecta* *Laminaria saccharina* *Nassarius reticulatus*	*Phyllophora traillii* *Schmitziella endophloea** *Corallina officinalis* Rhodophyta indet.(encr.pink) *Kallymenia reniformis* *Rhodymenia holmesii* *Laminaria saccharina* *Cladophora pellucida* *Halichondria panicea* *Hymeniacidon perleve* *Plumularia similis* *Cereus pedunculatus* *Schizomavella linearis* *Distomus variolosus* *Stolonica socialis*
	OCCASIONAL SPECIES	
Rhodophyllis sp. *Polysiphonia elongata* *Dictyota dichotoma* *Cystoseira nodicaulis* *Bryopsis plumosa* *Lanice conchilega* *Ascidiella aspersa* *Gobiusculus flavescens* *Callionymus lyra*	*Plocamium cartilagineum* *Ceramium rubrum* *Polysiphonia elongata* *Sargassum muticum* *Cereus pedunculatus* *Lanice conchilega* *Ascidiella aspersa* *Gobiusculus flavescens*	*Rhodophyllis divaricata* *Gracilaria foliifera* *Phyllophora crispa* *Phyllophora pseudoceranoides* *Callophyllis laciniata* *Rhodymenia pseudopalmata* *Sphondylothamnion multifidum* *Bryopsis plumosa* *Dysidea fragilis* *Tubularia indivisa* *Sertularia argentea* *Aglaophenia pluma* *Sagartia elegans nivea* *Corynactis viridis* Caprellidae indet. *Scrupocellaria scruposa* Didemnidae indet. *Diplosoma listerianum*
	RARE SPECIES	
Asparagopsis armata *Griffithsia flosculosa* *Brongniartella byssoides* *Cerianthus lloydii* Ophiuroidea indet.(arms)	*Cliona celata* *Anemonia viridis* *Urticina felina* *Metridium senile* *Bunodactis verrucosa* *Botryllus schlosseri*	*Plocamium cartilagineum* *Lomentaria clavellosa* *Rhodymenia delicatula* *Desmarestia ligulata* *Polymastia mammillaris* *Anemonia viridis* *Urticina felina* *Sagartia elegans venusta* *Sagartiogeton undatus* *Bunodactis verrucosa* *Trivia monacha* *Bugula plumosa* *Cellaria fistulosa* *Cucumaria* sp. *Lissoclinum perforatum* *Ascidiella aspersa* *Morchellium argus* *Taurulus bubalis*
	PRESENT - NO RECORD OF ABUNDANCE	
Polysiphonia violacea	*Gammaropsis*(=*Eurystheus*) *maculata* *Corophium sextonae*	*Amphithoe ramondi* *Lysianassa ceratina* *Pseudoprotella phasma*

TABLE 11.

Abundance of conspicuous species on subtidal mixed substrata at Sites 30 and 31 off the Marine Hotel in Salcombe Harbour. Based mainly on records from Site 31.

Muddy sand with pebbles and some shells at 0.5m bed (algae only)(Site 31)	Muddy sand colonised be Zostera marina at 1 to 2.5m bed (Site 31) *= on Z.marina	Steeply sloping muddy sand with some pebbles at 2.5 to 5.5m bed (Site 31) *= on Pagurid crabs	Pebbles and gravel on silty sand at 6.5m bed (Records mainly from Site 30)
ABUNDANT SPECIES			
Laminaria saccharina	Zostera marina	Gracilaria verrucosa	
COMMON SPECIES			
Sargassum muticum		Gracilaria foliifera Aplysia punctata Callionymus lyra	Gracilaria foliifera Gracilaria verrucosa Gibbula cineraria Aplysia punctata
FREQUENT SPECIES			
Gracilaria foliifera Gracilaria verrucosa Chondrus crispus Antithamnion spirographidis Ceramium rubrum Cladostephus spongiosus Dictyota dichotoma Cystoseira baccata Enteromorpha sp. Ulva sp.	Stenogramme interrupta Chylocladia verticillata Laminaria saccharina Sargassum muticum Ulva sp. Cereus pedunculatus Gibbula cineraria Aplidium pallidum Callionymus lyra	Calliblepharis ciliata Rhodophysema elegans Lithothamnion lenormandii Peyssonnelia dubyi Chorda filum Laminaria saccharina Ulva sp. Cerianthus lloydii Pomatoceros sp(p). Gibbula cineraria	Scinaia turgida Rhodophyllis divaricata Plocamium cartilagineum Gymnogongrus crenulatus Stenogramme interrupta Rhodomela confervoides Ulva sp. Anemonia viridis Urticina felina Pomatoceros sp(p). Calliostoma zizyphinum Crepidula fornicata Ascidiella aspersa
OCCASIONAL SPECIES			
Rhodophyllis divaricata Chylocladia verticillata Polyneura hilliae Rhodomela confervoides Asperococcus fistulosus Cladophora sp. Bryopsis plumosa	Calliblepharis ciliata Antithamnion plumula Nitophyllum punctatum Halidrys siliquosa Enteromorpha sp. Cladophora sp. Bryopsis plumosa Campanularia angulata* Cerianthus lloydii Pagurus cuanensis Ascidiella aspersa Pollachius pollachius Labrus bergylta Gobiusculus flavescens	Peyssonnelia atropurpurea Peyssonnelia immersa Dermocorynus montagnei Cladophora rupestris Anemonia viridis Sagartia troglodytes Cereus pedunculatus Lanice conchilega Myxicola infundibulum Sabella sp. Pomatoceros sp(p). Pagurus bernhardus Galathea strigosa Gibbula magus Crepidula fornicata Nassarius reticulatus Pecten maximus Psammechinus miliaris Ascidiella aspersa Pomataschistus minutus	Scinaia forcellata Calliblepharis ciliata Phyllophora sicula Callophyllis laciniata Kallymenia reniformis Rhodymenia pseudopalmata Antithamnion plumula Antithamnion spirographides Acrosorium uncinatum Cryptopleura ramosa Myriogramme bonnemaisonii Polyneura hilliae Heterosiphonia plumosa Desmarestia aculeata Desmarestia ligulata Laminaria saccharina Sargassum muticum Dictyota dichotoma Cystoseira baccata Cladophora pellucida Suberites domuncula Obelia dichotoma Plumularia setacea Cerianthus lloydii Sagartiogeton undatus Cereus pedunculatus Chaetopterus variopedatus Terebellidae indet. Myxicola infundibulum Maja squinado Palaemon serratus Buccinum undatum Nassarius reticulatus Aplysia punctata Asterias rubens Marthasterias glacialis Polycarpa sp. Botryllus schlosseri
RARE SPECIES			
Calliblepharis jubata	Bonnemaisonia hamifera Suberites sp. Anemonia viridis Nassarius reticulatus Eubranchus ?vittatus Sygnathus sp.	Scinaia turgida Halarachnion ligulatum Plocamium cartilagineum Stenogramme interrupta Desmarestia ligulata Porifera indet.(encr.) Hydractinia echinata* Urticina felina Adamsia carcinopados* Sagartiogeton undatus Tubularius annulatus Chaetopterus variopedatus Arenicola marina (casts) Branchiomma vesiculosum Pagurus prideuxi Littorina littorea Littorina obtusata/mariae Parasmittina trispinosa Marthasterias glacialis Morchellium argus Sygnathus sp. ?Taurulus bubalis	**RARE SPECIES** Polyides rotundus Chorda filum Bryopsis plumosa Lanice conchilega Hippolyte variens Cancer pagurus Liocarcinus puber Arcmaea virginea Antedon bifida Marthasterias glacialis
PRESENT - NO RECORD OF ABUNDANCE			
		Grateloupia filicina Cruoria rosea Spermothamnion repens Hildenbrandia sp. Polymnia nebulosa Pisidia longicornis	Pisidia longicornis

TABLE 12.

Abundance of conspicuous species on subtidal hard substrata at Scoble Point (Site 34).

Gradual slope of bedrock and boulders at 0 to 2m bcd.	Gradual slope of boulders and bedrock at 2 to 4m bcd. *= a small white spikey sp.	Very steep broken rock at 5 to 10m bcd. (Algae recorded at 5 to 6m) *= under overhangs and on verticals += on up facing surfaces	Level seabed of cobbles and pebbles on muddy gravel at 12m bcd.
ABUNDANT SPECIES			
Verruca stroemia	Amphipoda indet (tubes)*	Amphipoda indet. (tubes)* Cellaria fistulosa	Verruca stroemia
COMMON SPECIES			
Codium sp. Anemonia viridis Amphipoda indet.(tubes)*	Hymeniacidon perleve Dysidea fragilis Didemnidae indet.*	Nemertesia antennina Schizopurella auriculata*	Aglaophenia sp. Epizoanthus couchii
FREQUENT SPECIES			
Rhodophyllis sp. Gracilaria foliifera Gigartina acicularis Ceramium rubrum Chondria caerulescens Laminaria saccharina Sargassum muticum Bryopsis plumosa Amphilectus fucorum Laomedea flexuosa Bugula plumosa Bryozoa indet.(encr.) Morchellium argus	Rhodochorton floridulum Calliblepharis ciliata Rhodophyllis divaricata Rhodophyllis sp. Gracilaria foliifera Chylocladia verticillata Cordylecladia erecta Ulva sp. Cladophora pellucida Bryopsis plumosa Amphilectus fucorum Nemertesia antennina Cellaria fistulosa Ascidiella aspersa Morchellium argus	Bryopsis plumosa Hymeniacidon perleve Dysidea fragilis Halecium sp. Epizoanthus couchii Caryophyllia smithii Ctenolabrus rupestris	Hymeniacidon perleve Abietinaria abietina Plumularia setacea Nemertesia antennina Gibbula cineraria Bugula plumosa Bryozoa indet.(encr.) Marthasterias glacialis
OCCASIONAL SPECIES			
Antithamnion plumula Antithamnion spirographidis Callithamnion sp. Crouania attenuata Cystoseira baccata Cladophora sp. Bryopsis hypnoides Dysidea fragilis Pomatoceros sp(p). Bryozoa indet.(encr.) Clavelina lepadiformis Ctenolabrus rupestris Gobiusculus flavescens	Plocamium cartilagineum Gracilaria verrucosa Gymnogongrus crenulatus Schmitziella enophloea Rhodymenia holmesii Griffithsia corallinoides Nitophyllum punctatum Polysiphonia elongata Laminaria saccharina Halopteris filicina Cladophora sp. Anemonia viridis Coryophyllia smithii Paguridae indet. Liocarcinus puber Gibbula cineraria Bugula plumosa Bryozoa indet.(encr.) Clavelina lepadiformis Ctenolabrus rupestris Gobius niger	Calliblepharis ciliata Rhodophyllis sp. Lithothamnion incrustans Peyssonnelia dubyi Rhodomenia delicatula Polyneura gmelinii Pseudolithoderma sp. Amphilectus fucorum Chaetopterus variopedatus Bispira volutacornis Liocarcinus puber Gibbula cineraria Scrupocellaria scruposa Schizomavella auriculata Morchellium argus Didemnidae indet.* Trisopterus sp.	Peyssonnelia dubyi Pseudolithoderma sp. Raspailia ramosa Chaetopterus variopedatus Pomatoceros sp(p). Paguridae indet. Scrupocellaria scruposa Cellaria fistulosa Botryllus schlosseri Callionymus lyra
RARE SPECIES			
Porifera indet. (encr. yellow) Porifera indet. (encr. red) Porifera indet. (encr. grey) Nemertesia antenina Bispira volutacornis Acmaea virginea Crepidula fornicata Bugula turbinata Bowerbankia pustulosa Botryllus schlosseri Didemnidae indet. Didemnum maculosum Berthella plumosa Distaplia rosea Taurulus bubalis	Gelidium latifolium Phyllophora traillii Sphondylothamnion multifidum Phycodrys rubens Suberites domuncula Plumularia setacea Cancer pagurus Inachus phalangium Chartella papyracea Botryllus schlosseri Taurulus bubalis Callionymus lyra	Gracilaria foliifera Gracilaria verrucosa Phyllophora sicula Stenogramme interrupta Chylocladia verticillata Lomentaria clavellosa Heterosiphonia plumosa Porifera indet. (encr. yellow) Polymastia mamillaris Raspailia hispida Halichondria bowerbankii Maja squinado Bicellariella ciliata Chartella papyracea Alcyonidium gelatinosum Clavelina lepadiformis Polycarpa rustica Ascidiella aspersa Styela clava Botryllus schlosseri	Rhodophyta indet. (encr. pink) Hildenbrandia sp. Suberites domuncula Dysidea fragilis Polyplacophora indet. Homarus gammarus Calliostoma zizyphinum Crepidula fornicata Cellepora pumicosa Ascidiella aspersa
PRESENT - NO RECORD OF ABUNDANCE			
Hermaea dendritica Hermaea bifida		Lysianassa ceratina * Leucothoe spinicarpa Panoplea minuta Aora gracilis Amphithoe rubricata Corophium sextonae	Scrupocellaria scruposa Schizomavella auriculata Gadoidea indet.(shoal)

TABLE 13.

Abundance of conspicuous species on subtidal muddy sand, stones and shells in Salcombe Harbour and the Kingsbridge Estuary.

Muddy sand with stones and shells at 3.5m at Site 36.	Muddy sand at 2m at Site 36.	Muddy sand with stones at 5.4m at Site 40. *= on shells and clean sand at Site 41.	Muddy sand with stones at 0 - 4m at Site 40 combined with records of algae on shells and pebbles on sand at 3.5m at Site 41. += algae at Site 40 only *= algae at Site 41 only
		ABUNDANT SPECIES	
		Gracilaria verrucosa*	Laminaria saccharina*
		COMMON SPECIES	
Pomatoschistus sp.	Bowerbankia pustulosa Ascidiella aspersa	Myxicola infundibulum Paguridae indet. Inachus sp. Macropodia rostrata Gobiidae indet.	Gracilaria verrucosa Ulva sp.* Carcinus maenas
		FREQUENT SPECIES	
Gracilaria foliifera Gracilaria verrucosa Lithothamnion lenormandi Laminaria saccharina Ulva sp. Hydractinia echinata Lanice conchilega Paguridae indet. Carcinus maenas Gibbula cineraria Ascidiella aspersa	Gracilaria verrucosa Laminaria saccharina Ulva sp. Cereus pedunculatus Sagartiogeton undatus Paguridae indet. Macropodia sp. Pomatoschistus sp.	Gracilaria verrucosa Peyssonnelia dubyi* Laminaria saccharina* Obelia dichotoma Terebellidae indet. Sabella pavonina Branchiomma vesiculosum Galathea squamifera Crangon crangon	Gracilaria foliifera* Lithothamnion lenormandii* Griffithsia corallinoides+ Griffithsia barbata+ Polyneura hilliae* Polysiphonia elongata+ Rhodomela confervoides* Pseudolithoderma sp.* Desmarestia aculeata* Chorda filum* Sargassum muticum Obelia dichotoma Cereus pedunculatus Branchiomma vesiculosum Macropodia rostrata Crangon crangon
		OCCASIONAL SPECIES	
Rhodophyllis divaricata Antithamnion plumula Pseudolithoderma sp. Chorda filum Dictyota dichotoma Cladophora sp. Bryopsis plumosa Metridium senile Cereus pedunculatus Bowerbankia pustulosa Pleuronectidae indet. (small)	Rhodophyllis divaricata Antithamnion plumula Scypha ciliata Anemonia viridis Metridium senile Sagartia elegans mineata Sagartia sp(p). Nassarius reticulatus Gobius niger	Scinaia forcellata* Scinaia turgida* Gracilaria foliifera Calliblepharis ciliata Rhodophyllis divaricata Stenogramme interrupta* Kallymenia reniformis Myriogramme bonnemaisonii Nitophyllum punctatum Polyneura hilliae Polysiphonia elongata Ulva sp. Suberites domuncula Sagartiogeton undatus Lanice conchilega Sabella sp. Galathea strigosa Carcinus maenas Liocarcinus depurator Crepidula fornicata Buccinum undatum Styela clava Pomatoschistus pictus Solea solea	Calliblepharis ciliata Cystoclonium purpureum Rhodophyllis divaricata Plocamium cartilagineum* Chylocladia verticillata* Lomentaria clavellosa* Cordylecladia erecta* Antithamnion plumula+ Antithamnion spirographides* Nitophyllum punctatum* Cutleria multifida+ Saccorhiza polyschides Cladostephus spongiosus* Dictyota dichotoma Cladophora sp.+ Bryopsis plumosa* Bryopsis hypnoides+ Suberites domuncula Halichondria bowerbankii Anemonia viridis Sabella pavonina Myxicola infundibulum Morchellium argus Styela clava Didemnum gelatinosum Sygnathus acus Gobius niger
		RARE SPECIES	
Stenogramme interrupta Peyssonelia dubyi Antithamnion spirographidis Callithamnion sp. Sargassum muticum Cladophora rupestris Anemonia viridis Sagartia elegans venusta Pomatoceros sp(p). Liocarcinus puber Macropodia sp. Calyptera chinensis Calliostoma zizyphinum Crepidula fornicata Antiopella cristata Morchellium argus	Hymeniacidon perleve Myxicola infundibulum Branchiomma vesiculosum Sabellidae indet. Antiopella cristata Polycarpa sp. Styela clava Ciona intestinalis Botryllus schlosseri Diplosoma sp.(yellow)	Heterosiphonia plumosa* Laminaria saccharina Dictyota dichotoma Enteromorpha sp. Halichondria bowerbankii Hymeniacidon perleve Tubularia larynx Anemonia viridis Metridium senile Sagartia troglodytes Cereus pedunculatus Maja squinado Chlamys opercularis Sepia officinalis (eggs)	Kallymenia reniformis+ Stenogramme interrupta* Cystoseira nodicaulis* Chorda filum+ Serpula vermicularis Galathea strigosa Ophiothrix fragilis Phallusia mammillata Didemnidae indet.

TABLE 14.

Abundance of conspicuous species on subtidal sand mud and attached to debris in Southpool Creek (Site 39). Algae are incompletely recorded.

Sandy mud at 2m bcd * Species with extensive network of tentacles.	Sandy mud with dense patches of algae at 1m bcd.	Sandy mud with low algal cover at +0.5m.
	COMMON SPECIES	
Ascidiella aspersa	Ascidiella aspersa	Bowerbankia pustulosa
	FREQUENT SPECIES	
Sagartiogeton undatus	Gracilaria foliifera	Myxicola infundibulum
Myxicola infundibulum	Polyneura hilliae	Ascidiella aspersa
Terebellidae indet.*	Chorda filum	Pomatoschistus sp.
Macropodia sp.	Ulva sp.	
Bowerbankia pustulosa	Cladophora rupestris	
Pomatoschistus sp.	Sagartiogeton undatus	
Gobius niger	Bowerbankia pustulosa	
	OCCASIONAL SPECIES	
Metridium senile	Ceramium sp.	Laminaria saccharina
Cereus pedunculatus	Cereus pedunculatus	Carcinus maenas
Terebellidae indet.	Myxicola infundibulum	
Arenicola marina (casts)	Sabella pavonina	
Paguridae indet.	Sabella flabellata	
Carcinus maenas	Carcinus maenas	
Pleuronectidae indet.(small)	Crepidula fornicata	
Callionymus lyra	Callionymus lyra	
	RARE SPECIES	
Laminaria digitata	Griffithsia barbata	Sargassum muticum
Laminaria saccharina	Sargassum muticum	Chorda filum
Suberites domuncula	Suberites domuncula	Sagartiogeton undatus
Halichondria panicea	Sagartiogeton undatus	Gobius niger
Urticina felina	Clavelina lepadiformis	
Buccinum undatum	Morchellium argus	
Nassarius reticulatus		
Ophiothrix fragilis		
?Ophiura texturata		
Polycarpa sp.		
Styela clava		
Pleuronectes platessa		
	PRESENT - NO RECORD OF ABUNDANCE	
Cystoseira sp.	Cystoclonium purpureum	
Ulva sp.	Griffithsia corallinoides	
	Dictyota dichotoma	

TABLE 15.

Species sampled from intertidal sediments. Sites have been ordered from the uppermost estuary to the entrance and sample stations from upper shore to lower shore. Numbers of each species present are given but are per different sample areas seived over different sized meshes noted in the heading. The following abbreviations are used: UMS = Upper Mid Shore, MS = Mid Shore, LMS = Lower Mid Shore, LS = Lower Shore, P = Present no record of abundance. Reference to the Plymouth Marine Fauna (PMF) includes those made by Allen and Todd (1900). The note 'not in PMF' refers only to records for Salcombe. Nomenclature is according to the several texts listed in Volume 2 of this report or to references in the notes column.

TABLE 15

SPECIES	High House Point (16)			Park Bay (15)					Frogmore (18)		N. Blanksmill Creek (6)			Salt Stone (7)			N. Tosno Point (5)
	LMS mud. 1 x 0.5 m^2 dug and 'picked over'.	LMS mud. 1 x 0.5 m^2 dug and 'picked over'.	LS muddy gravel. 1 x 0.5 m^2 dug and 'picked over'.	UMS soft mud. 4 x 0.01 m^2. 0.5 mm mesh.	UMS soft mud. MS mud with stones and gravel, ca. 0.5 m^2 x2 dug and 'picked over' (2 samples mixed).	MS mud with stones and gravel. 4 x 0.01 m^2. 0.5 mm mesh.	LS mud. 4 x 0.01 m^2. 0.5 mm mesh.	LS mud. ca. 0.5 m^2 dug and 'picked over'.	UMS (ca. +3.5 m) mud over bedrock. ca. 0.25 m^2 dug. 1 mm mesh.	MS (ca. +3 m) mud. 4 x 0.01 m^2. 0.5 mm mesh.	UMS (ca. +3.7 m) mud. 1 x 0.01 m^2. 4 x 0.01 m^2. 0.5 mm mesh.	UMS (ca. +3.7 m) mud. 1 x 0.01 m^2. 1 mm mesh.	UMS (ca. +3.7 m) mud. ca. 0.25 m^2 dug and 'picked over'.	LS mud. 4 x 0.01 m^2. 0.5 mm mesh.	LMS muddy gravel. Spadeful. 5 mm mesh.	LMS sand. Spadeful. 5 mm mesh.	LS muddy gravel. ca. 0.25 m^2 dug. 5 mm mesh.	LS (+0.5 m) muddy gravel. ca. 0.5 m^2 dug. 5 mm mesh.
COELENTERATA:HYDROZOA																	
Obelia dichotomoa	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
NEMERTEA																	
Nemertea indet.	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
NEMATODA																	
Nematoda indet.	-	-	-	2	4	-	-	-	6	-	1	-	-	2	-	-	-
SIPUNCULA																	
Golfingia procera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Golfingia sp(p)	-	-	-	7	137	-	-	2	260	44	23	-	-	1	1	2	-
ANNELIDA:POLYCHAETA																	
Gattyana cirrosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Harmothoe lunulata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Anaitides mucosa	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
Phyllodoce laminosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phyllodoce sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kefersteinia cirrata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Exogene naidina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Typosyllis sp.	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nereis diversicolor	69	9	5	1	29	74	5	4	545	73	-	-	-	3	-	-	-
Nereis longissima	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	-	-
Platynereis dumerillii	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Nephyts caeca	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys hombergi	1	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Glycera sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Goniada maculata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scoloplos armiger	-	-	-	111	2	-	-	-	-	-	1	1	-	-	-	1	-
Scoielepis squamata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polydora pulchra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polydora sp.	-	2	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-
Priomospio malmgreni	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pygospio elegans	-	1	-	-	35	-	-	-	-	-	11	-	-	-	-	-	-
Spiophanes bombyx	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Streblospio shrubsolii	-	3	-	3	7	-	-	2	-	150	-	-	-	-	-	-	-
Magelona alleni	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magelona rosea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chaetozone setosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cirratulus cirratus	-	6	-	-	13	-	-	-	-	-	-	-	-	-	-	-	1
Cirratulidae indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
?Tharyx sp. (+ others)	-	-	-	-	26	-	-	-	-	-	3	-	-	175	1	-	-
Capitella capitata	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Heteromastus filiformis	-	-	-	-	12	-	-	-	-	-	8	2	-	9	-	-	-
Notomastus latericeus	-	-	5	-	-	-	-	-	-	-	-	-	-	9	-	3	-
Arenicola marina	-	4	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Clymene sp.	-	-	-	-	-	-	-	-	-	-	-	2	-	-	1	12	-
Pectinaria auricoma	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ampharete baltica	-	3	-	-	65	-	-	-	-	1	144	41	-	8	-	2	4
Melinna palmata	-	2	1	-	4	1	-	-	-	-	3	-	-	16	2	1	3
Lanice conchilega	-	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Neoampnitrite figulus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
Polycirrus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Branchiomma vesiculosum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
ANNELIDA:OLIGOCHAETA																	
Tubificoides (=Peloscolex) benedeni	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oligochaeta indet.	-	2	-	264	175	4	-	-	260	74	383	12	4	-	-	-	-

Continued .... /

ıe	N. Tosnos Point (5)	N. of Horsepool Cove (11)		Ditchend Cove (12)			Mill Bay (8)								North Sands (1)			NOTES
LS muddy gravel. ca. 0.25 m^2 dug. 5 mm mesh.	LS (+0.5 m) muddy gravel. ca. 0.5 m^2 dug. 5 mm mesh.	MS (+2.7 m) mud below rock. 4 x 0.01 m^2. 0.5 mm mesh.	LMS (+1.8 m) mud. 4 x 0.01 m^2. 0.5 mm mesh.	LS (+0.5 m) mud. 4 x 0.01 m^2. 0.5 mm mesh.	LMS (ca. +2.5 m) sandy mud. 4 x 0.01 m^2. 0.5 mm mesh.	LS sand. 4 x 0.01 m^2. 0.5 mm mesh.	LS sandy mud. 4 x 0.01 m^2. 0.5 mm mesh.	UMS (ca. +3.7 m) coarse sand. 1 x 0.01 m^2. 0.5 mm mesh.	UMS (ca. +3.7 m) coarse sand. 1 x 0.1 m^2. 1 mm mesh.	MS (ca. +2.2 m) coarse sand. 1 x 0.01 m^2. 0.5 mm mesh.	MS (ca. +2.2 m) coarse sand. 1 x 0.1 m^2. 1 mm mesh.	LS (ca. +0.4 m) coarse sand. 1 x 0.01 m^2. 0.5 mm mesh.	LS (ca. +0.4 m) coarse sand. 1 x 0.1 m^2. 1 mm mesh.	LS (ca. +0.4 m) coarse sand. ca. 5 m^2 dug. 5 mm mesh.	UMS coarse sand. 1 x 0.1 m^2. 5 mm mesh.	LMS coarse sand. 1 x 0.1 m^2. 2 mm mesh.	LMS coarse sand. 1 x 0.1 m^2. 0.5 mm mesh.	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
-	1	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	4	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1	-	2	17	-	-	2	36	-	-	-	1	-	3	-	-	-	-	Not recorded in PMF. Similar to PMF although high numbers at creek sites not noted there.
-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	1	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	Less extensive than expected from PMF.
-	-	5	8	-	-	-	3	-	-	-	-	-	1	-	-	-	-	Similar to PMF.
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
-	-	-	1	-	-	2	-	-	-	-	-	-	-	1	-	-	-	Not recorded in PMF. -
-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	Similar to PMF.
-	-	2	2	1	10	-	2	-	-	-	-	-	3	2	-	-	-	Not recorded in PMF. Sev. sp. recorded in PMF but not from Salcombe.
-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	More widesprd. & abund. than would have been expected from PM
-	-	-	-	-	2	-	1	-	-	-	-	2	6	-	-	1	-	Much less " " " " " "
-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	4	-	-	Not recorded in PMF. Similar to PMF.
-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	Less abundant than expected from PMF.
-	-	-	-	-	-	1	1	-	-	-	-	-	1	1	-	-	-	Similar to PMF. -
-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	51	14	3	Sensu Hartman-Shroeder (1971). Not rec. in PMF.
-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
-	-	1	-	-	145	-	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF. Not recorded in PMF.
-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	Similar to PMF.
-	-	3	-	-	38	1	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
-	-	3	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF. Not recorded in PMF.
-	-	-	2	-	-	1	2	-	-	-	-	1	20	3	-	-	-	Not rec. in PMF although sim. dist. to M. papillosum.
-	1	-	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
-	-	-	-	-	4	-	-	-	-	-	-	-	4	-	-	-	-	Not recorded in PMF. -
-	-	218	216	107	21	130	156	-	-	-	-	1	-	-	-	-	-	Not recorded in PMF.
-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
3	-	6	5	-	-	2	3	-	-	-	3	-	-	-	-	-	-	Not recorded in PMF.
12	-	1	-	2	-	-	-	-	-	-	-	-	7	9	1	-	-	Similar to PMF. Not recorded in PMF.
2	-	48	30	-	-	-	-	-	-	-	-	-	-	2	-	-	-	Less abundant than expected from PMF.
2	4	3	15	46	2	6	13	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
-	3	-	-	-	-	3	-	-	-	-	-	-	17	12	-	-	-	Sim. to PMF except m. abund. in mid. riches. than expected.
-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Similar to PMF.
-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	As Amphitrite johnstoni in PMF. Similar to PMF.
-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P. caliendrum recorded in PMF.
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Less abundant than expected from PMF.
-	-	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
-	-	5	60	35	43	-	-	-	-	-	2	-	-	-	-	-	1	-

TABLE 15 (CONTINUED).

	High House Point (16)			Park Bay (15)					Frogmore (18)		N. Blanksmill Creek (6)				Salt Stone (7)			N Tosr Poi (5 L:
	LMS	LMS	LS	UMS	UMS/ MS	MS	LS	LS	UMS	MS	UMS	UMS	UMS	LS	LMS	LMS	LS	
CRUSTACEA:MYSIDACEA																		
Leptomysis lingvura	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	
Paramysis nouveli	-	-	-	-	-	-	-	-	-	-	2	1	2	-	-	-	-	
CRUSTACEA:CUMACEA																		
Bodotria scorpioides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Cumopsis goodsiri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
CRUSTACEA:ISOPODA																		
Cyathura carinata	-	-	-	-	-	-	-	-	-	-	16	2	-	-	-	-	-	
Eurydice pulchra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
CRUSTACEA:AMPHIPODA																		
Ampelisca brevicornis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chaetogammarus stoerensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Bathyporeia sarsi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Urothoe poseidonius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Corophium volutator	1	-	19	-	1	-	-	-	381	142	-	-	-	-	-	-	-	
CRUSTACEA:DECAPODA																		
Crangon crangon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Carcinus maenas	-	-	-	-	3	-	-	-	1	-	-	-	-	-	1	-	-	
INSECTA																		
Insecta indet. (pupae)	-	-	-	62	-	-	-	-	2	-	3	1	-	-	-	-	-	
MOLLUSCA:BIVALVIA																		
Modiolus sp. (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Thyasira flexuosa	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	
Lucinoma borealis	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	
Cerastoderma edule	-	1	5	-	4	4	-	-	-	-	-	-	-	-	-	-	-	
Parvicardium scabrum	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	
Mysella bidentata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Abra alba	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Abra tenuis	-	-	-	5	19	-	-	-	-	-	17	3	-	-	-	1	-	
Scrobicularia plana	25	3	1	-	3	6	1	-	-	1	-	-	-	-	-	-	-	
Tellina tenuis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Macoma balthica	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	
BRYOZOA																		
Cryptosula pallasiana	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-	
Celleporella hyalina	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	
PISCES																		
Pomatoschistus microps	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

ie LS	N. Tosnos Point (5) LS	N. of Horsepool Cove (11) MS	LMS	LS	Ditchend Cove (12) LMS	LS	LS	Mill Bay (8) UMS	UMS	MS	MS	LS	LS	LS	North Sands (1) UMS	LMS	LMS	NOTES
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	From algae at Fort Charles in PMF.
-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	Not recorded in PMF.
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	Not recorded in PMF.
-	-	1	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	Similar to PMF.
-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
-	-	-	-	-	13	1	-	-	-	-	-	-	1	-	-	3	1	Not recorded in PMF.
-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	Similar to PMF.
-	-	66	52	-	-	2	65	-	-	-	1	-	-	-	-	-	-	Not recorded in PMF but as C. grossipes in A & T - similar to A & T.
-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	Not as widesprd. or abund. as expctd. from PMF - time of year.
-	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Similar to PMF taking account of sample size.
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Less abundant than expected from PMF.
-	2	1	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	(As above) but occurs deep in sediment. See Table 16.
-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	Similar to PMF.
-	-	1	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	Not in PMF.
-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	Similar to PMF.
-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	Subtidal species - see Table 16.
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	Sim. to PMF though further up estuary than expected.
-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	Similar to PMF.
-	-	1	1	-	-	-	2	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.

TABLE 16.

Species sampled in dredge hauls and suction samples from subtidal sediments. Numbers of each species present are given but are per a variable sample size noted in the heading. Depths are taken from the echo sounder and corrected for depth of the transducer and tidal height but are approximate. References to records in the Plymouth Marine Fauna (PMF) include those made by Allen and Todd (1900). The note 'not in PMF' refers to records for Salcombe. Nomenclature is according to the several texts listed in Volume 2 of this report or to references in the notes column. P = Present, no record of abundance.

TABLE 16

SPECIES	DREDGE SITES										SUCTION SAMPLE SITES			NOTES
	D1. Gerston Point. 2 m bcd, ca. 15 l black mud.	D2. Gerston Point. 1 m bcd, ca. 10 l brown-black mud.	D3. Salt Stone. 2 m bcd, ca. 45 l sandy mud with shells and shale.	D4. Tosnos - Halwell Point. 2-3 m bcd, ca. 8 l sandy mud with lots of shells.	D5. Ox Point. ca. 5-6 m bcd, ca. 7 l sandy gravel and stones.	D6. The Bag (deep pit). 11 m bcd, ca. 25 l sandy mud.	D7. Ditch End. 7 m bcd, ca. 30 l sandy mud with gravel.	D8. Southpool Creek. 1.5 m bcd, ca. 20 l black mud.	D9. Salcombe Ferry. 7 m bcd, ca. 20 l muddy sand with gravel, stones and shells.	D10. Mill Bay. 4-5 m bcd, ca. 25 l muddy sand with gravel and stones	SS1 (Site 21) South of The Bar. 3.5 m bcd, 2 x 0.1 m^2 excavated to 20 cm. Coarse rippled sand.	SS2 (Site 24) South Storehole Bay. 4.4 m bcd, 2 x 0.1 m^2 excavated to 20 cm. Coarse rippled sand.	SS3 (Site 27) Southsands Bay. 0 m bcd, 2 x 0.1 m^2 excavated to 20 cm. Fine clean sand.	
PORIFERA														
Scypha ciliata	-	-	-	-	1	4	-	-	-	-	-	-	-	Similar to PMF.
Porifera indet.	-	-	P	-	P	-	-	-	P	-	-	-	-	-
COELENTERATA:HYDROZOA														
Obelia dichotoma	-	-	P	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
COELENTERATA:ANTHOZOA														
Epizoanthus couchi	-	-	-	-	P	-	-	-	-	-	-	-	-	Not recorded in PMF.
Anthozoa indet.	4	1	5	3	2	2	6	-	5	30	-	-	-	-
NEMERTEA														
Nemertea indet.	-	-	7	1	1	4	-	7	19	52	-	2	2	-
NEMATODA														
Nematoda indet.	-	1	-	-	-	-	-	-	-	-	-	-	-	-
ANNELIDA:POLYCHAETA														
Harmothoe lunulata	-	-	8	1	6	4	2	1	-	-	-	-	-	Similar to PMF.
Gattyana cirrosa	-	-	-	-	-	-	3	-	-	-	-	-	-	Similar to PMF.
Polynoidae indet.	-	-	17	2	9	3	4	-	30	12	1	-	-	-
Phloe minuta	-	-	7	3	9	9	2	1	40	23	2	-	-	-
Sigalion mathildae	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sthenelais boa	-	-	3	3	1	1	4	-	4	-	-	1	-	Not in PMF.
Sthenelais limicola	-	-	1	-	-	-	-	-	-	-	-	-	-	Similar to PMF.
Anaitides mucosa	-	-	2	1	-	6	-	1	1	7	-	1	-	Not in PMF.
[illegible]ne longa	-	-	-	-	-	-	-	-	-	5	-	-	2	Not in PMF.
[illegible]da sanguinea	-	-	9	3	7	5	-	4	21	3	-	-	-	Not in PMF.
Mysta (=Eteone) picta	-	-	-	-	-	1	-	-	1	1	-	-	-	Not in PMF.
Phyllodoce laminosa	-	-	-	-	-	-	-	-	2	3	-	-	1	Not in PMF.
Gyptis capensis	-	-	7	1	-	1	-	-	-	4	-	4	-	Sensu Day (1963). Would have been included as Oxydromus propinqua in PMF. Not in PMF.
Kefersteinia cirrata	-	-	-	-	-	-	-	-	-	2	-	-	-	Recorded in PMF from Salt Stone.
Nereimyra punctata	-	-	-	-	3	2	-	-	7	-	-	-	-	Not in PMF.
Typosyllis sp.	1	-	14	-	1	3	-	-	1	1	5	-	-	-
Syllidae indet.	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Lagoneris (=Leptonereis) glauca	-	-	-	-	1	-	-	-	-	-	-	-	-	Sensu Hartmann-Shroeder (1971). Not recorded in PMF.
Nereis diversicolor	-	-	-	1	-	-	-	-	-	-	-	-	-	Similar to PMF.
Nereis longissima	-	-	3	-	-	-	1	1	2	-	-	-	-	Similar to PMF.
Perinereis cultrifera	-	-	-	-	1	-	-	-	35	1	-	-	-	Less widespread than expected from PMF records.
Platynereis coccinea	-	-	-	-	17	-	-	-	-	-	-	-	-	Not recorded in PMF.
Platynereis dumerillii	-	-	8	3	-	63	30	-	6	34	1	-	2	Not recorded in PMF.
Nereidae indet.	-	-	-	-	-	-	4	-	-	-	-	-	-	-
Nephtys caeca	-	-	-	7	6	-	-	-	8	11	13	6	4	Not recorded in PMF.
Nephtys hombergii	15	5	44	-	-	40	8	4	5	-	-	-	-	Similar to PMF.
Sphaerodorum flavum	-	-	-	-	-	-	-	-	1	-	-	-	-	Not recorded in PMF.
Glycera sp.	-	-	1	-	-	1	-	-	14	8	-	1	-	Similar to records of several species in PMF.
Goniada maculata	-	-	-	-	-	1	4	3	1	3	-	-	-	Similar to PMF.
Marphysa sanguinea	-	-	-	-	-	-	-	-	-	1	-	-	-	Lower abundance than expected from PMF records.

Continued .... /

TABLE 16 (CONTINUED).

SPECIES	DREDGE SITES D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	SUCTION SAMPLE SITES SS1	SS2	SS3	NOTES
ANNELIDA:POLYCHAETA														
Nematonereis unicornis	-	-	1	-	-	-	?Zo (?20)	-	-	2	-	-	-	Not recorded in PMF.
Lumbrinereis sp.	-	-	8	1	4	4	-	4	20	16	-	-	-	L. latreilli recorded in PMF.
Protodorvillia (=Staurocephalus) kefersteini	-	-	-	-	-	-	-	-	1	1	-	-	-	Sensu Hartmann-Shroeder (1971). Not recorded in PMF.
Orbinia cuvierii	-	-	-	-	-	-	-	-	-	3	-	-	-	Not recorded in PMF.
Scoloplos armiger	-	1	-	-	-	-	-	2	2	-	-	-	-	Similar to PMF.
Aricidea albatrossae/wassi*	-	-	-	-	-	-	-	-	-	-	-	1	-	*Sensu Hartley (1981). Not recorded in PMF.
Aonides oxycephala	-	-	3	2	-	-	-	-	20	37	-	-	-	Not recorded in PMF.
Aonides paucibranchiata	-	-	1	-	-	-	-	-	-	11	-	-	-	Not recorded in PMF.
Malacoceros (=Scolelepis) fuliginosa	-	-	-	-	1	-	-	1	5	9	-	-	-	Sensu Similar to PMF.
Scolelepis squamata	-	-	-	-	-	-	-	-	-	-	-	1	-	Sensu Hartmann-Shroeder (1971). Not recorded in PMF.
Polydora pulchra	-	-	7	-	-	2	-	-	2	-	-	-	-	Sensu Hartmann-Shroeder (1971). Not recorded in PMF.
Polydora sp.	-	-	2	1	-	1	-	-	-	1	-	-	-	-
Prionospio malmgreni	-	-	-	-	-	3	-	-	-	-	-	-	-	Not recorded in PMF.
Pygospio elegans	-	-	5	-	-	3	-	3	4	1	-	-	-	Less abundant than expected from PMF records.
Spio filicornis	-	-	1	5	-	12	-	-	7	4	1	8	4	Not recorded in PMF.
Spiophanes bombyx	-	-	2	-	-	-	-	-	6	-	-	-	-	Not recorded in PMF.
Magelona mirabilis	1	-	2	-	-	-	-	2	-	-	4	107	-	Sensu Wilson (1982). Recorded as M. papilliocornis in PMF. Similar to PMF.
Magelona alleni	-	-	12	-	-	10	-	3	1	1	1	-	-	Not recorded in PMF.
Poecilochaetus serpens	-	-	-	-	-	-	-	-	1	1	-	2	-	Not recorded in PMF.
Chaetozone setosa	19	38	63	10	3	58	-	131	18	15	27	7	12	Not recorded in PMF.
Cirratulus cirratus	-	-	5	-	1	1	-	-	1	6	-	-	-	Not recorded in PMF.
Cirratulidae indet. 1	-	745	-	-	-	-	-	1038	-	-	-	-	-	Species with eyes.
Cirratulidae indet. 2	-	-	-	1	-	1	-	-	-	-	-	-	-	-
Cirriformia tentaculata	-	-	-	-	-	-	-	-	-	5	-	-	6	Not recorded in PMF.
?Tharyx sp. (+ others)	12	-	-	1	-	2	-	-	-	-	-	-	-	Not recorded in PMF.
Diplocirrus glaucus	-	-	-	-		2	-	-	-	-	-	-	-	Not recorded in PMF.
Scalibregma inflatum	-	-	2	-	-	-	-	-	6	8	-	-	-	Not recorded in PMF.
Capitella capitata	-	-	13	3	-	-	-	-	-	9	-	-	4	Not recorded in PMF.
Capitomastus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
Mediomastus fragilis	-	-	-	-	-	1	-	-	7	20	-	-	-	Not recorded in PMF.
Heteromastus filiformis	-	-	1	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
Notomastus latericeus	-	-	43	36	6	20	-	14	89	62	-	-	4	Similar to PMF.
Arenicola marina	-	-	-	-	-	-	-	-	-	1	-	-	-	Mainly intertidal (see Table 15).
Clymene sp.	-	-	273	5	4	181	-	65	31	64	-	-	-	Not recorded in PMF.
Myriochele oculata	-	1	2	-	-	1	-	10	-	-	-	-	-	Not recorded in PMF.
Owenia fusiformis	-	-	-	-	-	6	2	-	-	3	-	-	-	Similar to PMF.
Sabellaria spinulosa	-	-	-	-	1	-	-	-	-	-	-	-	-	Not recorded in PMF.
Pectinaria auricoma	-	-	1	-	-	1	-	-	2	6	-	-	-	Similar to PMF.
Pectinaria koreni	-	-	1	-	-	5	-	1	-	1	-	-	3	Similar to PMF.
Ampharete grubei	1	3	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
Ampharete lindstroemi	-	-	9	-	1	8	-	5	5	25	-	-	-	Not recorded in PMF.
Melinna cristata	-	7	-	-	-	-	-	177	1	1	-	-	-	More abundant than expected from PMF.
Melinna palmata	16	-	260	2	-	113	370	-	1	-	-	-	-	Similar to PMF.
Ampharetidae indet.	-	-	-	-	-	-	20	-	-	-	-	-	-	-
Eupolymnia (=Polymnia) nebulosa	-	-	-	-	-	-	-	-	-	2	-	-	-	Recorded in PMF but from the Salt Stone.
Lanice conchilega	-	-	8	5	1	6	-	-	3	8	-	-	-	Recorded in PMF but mainly intertidally (see Table 15).
Neoamphitrite figulus (=Amphitrite johnstoni)	-	-	-	-	1	-	-	-	-	-	-	-	-	Mainly intertidal (Table 16).
Pista cristata	-	-	-	-	-	2	-	-	2	1	-	-	-	Not recorded in PMF.
Polycirrus sp.	-	-	1	7	-	-	-		26	15	-	-	-	P. caliendrum recorded in PMF.
Terrebelidae indet.	-	-	-	-	-	-	8	-	-	-	-	-	-	-
Amphiglena mediterranea	-	-	-	-	-	-	-	-	1	-	-	-	-	Not recorded in PMF.
Branchiomma vesiculosum	-	-	1	2	-	-	-	-	3	-	-	-	-	Less abundant than expected from PMF.
Sabella pavonina	5	-	-	-	-	-	-	-	-	-	-	-	-	Similar to PMF.
Sabella sp.	-	-	1	1	-	1	-	-	2	1	-	-	-	-
Pomatoceros sp.(p)	-	-	8	4	100	2	10	-	348	92	-	-	-	Similar to PMF.
Serpula vermicularis	-	-	-	-	-	-	5		-	-	-	-	-	Not recorded in PMF.

Continued .... /

TABLE 16 (CONTINUED).

SPECIES	DREDGE SITES D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	SUCTION SAMPLE SITES SS1	SS2	SS3	NOTES
ANNELIDA:OLIGOCHAETA														
Tubificoides (=Peloscolex) benedeni	2	10	-	-	-	-	-	2	-	-	-	-	7	Not recorded in PMF.
Oligochaeta indet.	-	-	2	-	-	4	-	4	-	-	-	-	3	-
ANNELIDA:HIRUDINEA														
Pisicola sp.	-	-	-	-	1	-	-	-	-	-	-	-	-	Not recorded in PMF.
?Hirudinea indet.	-	-	-	-	-	-	-	-	1	3	-	-	-	-
SIPUNCULA														
Golfingia sp. (P)	-	-	4	1	-	1	-	-	-	3	-	-	-	Records in PMF suggest a greater abundance.
Phascolion strombi	-	-	1	-	-	-	-	-	-	-	-	-	-	Similar to PMF.
Sipuncula indet.	-	-	-	-	-	-	1	-	-	-	-	-	-	-
CRUSTACEA:OSTRACODA														
Asterope mariae	-	-	-	-	-	-	13	-	-	-	-	-	-	Not recorded in PMF.
Ostracoda indet.	-	-	8	10	15	44	-	-	36	38	-	-	-	
CRUSTACEA:CIRRIPEDIA														
Verruca stroemia	-	-	-	-	P	-	-	-	-	-	-	-	-	Not recorded in PMF.
Balanus crenatus	-	-	-	-	-	-	1	-	P	-	-	-	-	Not recorded in PMF.
CRUSTACEA:MYSIDACEA														
Leptomysis lingvura	-	-	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
Paramysis nouveli	-	-	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF although other species of Paramysis noted.
CRUSTACEA:CUMACEA														
Eudorella truncatula	-	-	3	-	1	1	-	-	1	-	-	-	-	Not recorded in PMF.
Bodotria scorpioides	-	-	-	-	-	-	1	-	-	1	-	-	-	Recorded in PMF.
Diastylis bradyi	-	-	-	-	-	-	-	-	-	-	1	-	-	Recorded at Salcombe in PMF.
CRUSTACEA:TANAIDACEA														
Apseudes latreillei	-	-	35	153	81	39	21	-	578	208	-	-	9	Much more abundance than suggested in PMF.
Apseudes talpa	-	-	2	-	18	2	-	-	-	7	-	-	-	Not recorded by A & T.
Tanais sp.	-	-	20	-	7	2	-	-	4	2	-	-	1	Similar to PMF. T. cavolini recorded in PMF.
CRUSTACEA:ISOPODA														
Anthura gracilis	-	-	-	-	-	-	-	-	1	-	-	-	-	Similar to PMF.
Cythia oxyura	-	-	-	-	-	-	-	-	3	-	-	-	-	Almost certainly recorded as G. maxillaris by A & T. If so, less abundant than suggested by PMF.
Idotea baltica	-	-	-	-	-	-	-	-	-	-	-	-	1	Less abundant than expected from PMF.
Zenobiana prismatica	-	-	-	-	-	-	-	-	-	-	-	-	2	Similar to PMF.
Astacilla longicornis	-	-	-	3	3	-	-	-	1	-	-	-	-	Similar to PMF.
Janira maculosa	-	-	2	1	3	-	-	-	13	1	-	-	-	Similar to PMF.
Munna minuta	-	-	1	-	1	-	-	-	-	-	-	-	-	Not recorded in PMF.
CRUSTACEA:AMPHIPODA														
Orchomene nana	-	-	3	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
Lysianassidae indet.	-	-	-	-	2	2	-	-	-	-	-	-	-	-
Ampelisca brevicornis	-	-	9	1	-	8	1	37	-	-	-	-	-	More extensive distribution and higher abundance than suggested in PMF.
Ampelisca spinipes	-	-	-	-	1	-	1	-	-	-	-	-	-	Similar to PMF.
Ampelisca tenuicornis	-	-	-	-	-	40	6	-	2	-	-	-	-	Higher abundance at D6 than expected from PMF.
Ampelisca sp.	-	-	-	-	-	-	4	-	-	-	-	-	-	-
Panoploea minuta	-	-	1	-	1	1	-	-	3	2	-	-	-	Not recorded in PMF.
Pereionotus testudo	-	-	-	-	-	-	-	-	-	1	-	-	-	Similar to PMF.
Leucothoe procera (=L. richiardii)	-	-	-	-	-	-	-	1	-	-	-	-	-	See Myers & McGrath (1982) for correct taxonomy. Not in PMF.
Leucothoe spinicarpa	-	-	1	-	-	-	-	-	-	-	-	-	-	Similar to PMF.
Metopa sp.	-	-	1	-	4	1	-	-	-	1	-	-	-	Not recorded in PMF.
Hyale sp.	-	-	-	-	-	5	-	-	-	-	-	-	-	-
Gammarus locusta	-	-	8	-	-	1	3	-	1	-	-	-	-	Similar to PMF although no A & T subtidal records mentioned.

Continued .... /

TABLE 16 (CONTINUED).

SPECIES	DREDGE SITES										SUCTION SAMPLE SITES			NOTES
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	SS1	SS2	SS3	
CRUSTACEA:AMPHIPODA														
Maera grossimaria	1	1	30	8	8	16	-	-	33	-	1	-	-	More abundant and widespread than would have been expected from PMF.
Gammarella fucicola	-	-	-	-	-	-	-	-	-	1	-	-	-	Not recorded in PMF.
Melita gladiosa	-	-	8	12	2	16	-	-	10	-	-	-	-	Similar to PMF.
Melita palmata	-	-	-	-	1	12	-	-	1	4	-	-	-	More extensive in the lower estuary than might have been expected from PMF. Not recorded by A & T.
Cheirocratus sundevalli	-	-	-	2	3	-	-	-	5	-	-	-	-	Recorded in PMF. Not recorded by A & T.
Bathyporeia pelagica	-	-	-	-	-	-	-	-	-	-	3	-	-	Not recorded in PMF.
Urothoe elegans	-	-	-	-	-	-	-	-	-	-	-	-	1	Not recorded in PMF.
Urothoe poseidonis	-	-	-	-	-	-	-	-	-	-	3	-	-	Similar to PMF.
Harpinioculodes longimanus	-	-	1	1	-	27	-	-	-	-	-	-	-	More abundant and in more enclosed areas compared to PMF record.
Pontocrates arenarius	-	-	-	-	-	-	-	-	-	-	1	-	-	Not recorded in PMF.
Harpinia crenulata	-	-	-	-	-	-	-	-	3	-	-	-	-	Not recorded in PMF.
Harpinia sp.	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Apherusa jurinei	-	-	1	-	-	-	-	-	-	-	-	-	-	Recorded in PMF as a species amongst algae and stones.
Apherusa ovalipes	-	-	-	-	1	-	-	-	-	-	-	-	-	Not recorded in PMF.
Atylus (=Nototropis) swammerdami	-	-	-	-	-	-	-	-	-	-	9	-	-	Not recorded in PMF.
Dexamine spinosa	-	-	-	-	-	4	-	-	4	3	1	-	5	Similar to PMF.
Ampithoe (Ampithoe) rubricata	-	-	10	-	-	13	2	-	-	-	-	-	3	Similar to PMF.
Ampithoe (Pleonexes) neglecta	-	-	-	-	-	-	-	-	-	-	-	-	1	Not recorded in PMF.
Aora gracilis (=A. typica)	-	-	56	7	12	229	3	3	6	8	-	-	15	More abundant and widespread than suggested by PMF.
Microdeutopus anomalus	-	-	8	1	1	-	-	-	-	1	-	-	-	Not recorded in PMF for subtidal.
Photis longicaudata	-	-	-	-	-	-	-	-	8	17	-	-	-	Not recorded in PMF for subtidal.
Corophium sextonae	-	-	19	5	84	26	8	2	167	1	-	-	-	Much more abundant than indicated in PMF where it is noted that it was missing from rich collections made in Plymouth Sound from 1895-1911 but very abundant in dredgings made 1941-54.
Unciola crenatipalma	-	-	-	-	7	-	-	-	7	2	-	-	-	-
Jassa falcata	-	-	-	-	-	-	-	-	-	-	1	-	6	Not recorded in PMF.
Erichthonius punctatus (=E. brasiliensis)	-	-	-	-	-	-	-	-	-	-	-	-	59	See Myers & McGrath (1982) for correct taxonomy. Recorded in PMF but no distribution record.
Phthisica marina	-	-	28	4	15	96	-	1	8	6	-	-	-	More abundant and widespread than suggested in PMF.
Pseudoprotella phasma	-	-	-	1	2	-	-	-	-	-	-	-	-	Less abundant than might have been expected from PMF.
Caprella acanthifera	-	-	1	-	-	-	-	-	-	5	-	-	-	Not recorded in PMF.
Caprella fretensis	-	-	1	-	-	2	-	-	-	-	-	-	-	Recorded in PMF but no record of distribution.
Caprella linearis	-	-	-	-	1	2	-	-	-	-	-	-	-	Not recorded in PMF.
Caprella spp.	-	-	-	-	-	-	3	-	-	-	-	-	-	-
Amphipoda indet.	-	-	3	-	-	-	2	-	-	-	-	-	-	-
CRUSTACEA:DECAPODA														
Hippolyte varians	-	-	2	-	-	-	-	-	-	2	-	-	-	Similar to PMF.
Spirontocaris (=Thoralus) cranchii	-	-	2	1	3	-	-	-	3	-	-	-	-	Salcombe is the type locality. More abundant than expected from A & T.
Crangon crangon	-	1	-	1	-	-	-	-	-	-	-	-	1	Similar to PMF.
Pontophilus trispinosus	-	-	-	-	-	-	-	-	-	-	3	3	1	Similar to PMF.

Continued .... /

SPECIES	DREDGE SITES D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	SUCTION SAMPLE SITES SS1	SS2	SS3	NOTES
CRUSTACEA:DECAPODA														
Galathea sp.	-	-	3	1	-	-	-	-	14	2	-	-	-	Most were G. intermedia with some G. strigosa.
Thia scutellata	-	-	-	-	-	-	1	-	-	-	-	-	-	Not recorded in PMF.
Pisidia longicornis	-	-	-	3	9	-	-	-	18	2	-	-	-	Similar to PMF.
Pagurus bernhardus	-	-	3	-	-	5	4	-	-	6	-	-	-	Less abundant than expected from PMF.
Anapagurus hyndmanni	-	-	-	1	1	-	-	-	-	5	-	-	-	Recorded as 'Present' in PMF.
Paguridae indet.	-	-	-	1	1	5	2	1	8	16	-	-	-	-
Ebalia granulosa	-	-	-	-	-	-	1	-	2	1	-	-	-	Not in PMF. Recorded only from Clyde and Argyll, Galway and Porcupine Back in Ingle (1980).
Liocarcinus depurator	-	-	-	-	-	1	2	-	-	-	-	-	-	Similar to PMF.
Carcinus maenas	-	-	7	-	1	3	-	-	-	1	-	-	-	Simila to PMF.
Cancer pagurus	-	-	-	-	-	4	-	-	-	-	-	-	-	Not recorded in PMF.
Eurynome spinosa	-	-	-	-	-	-	-	-	1	-	-	-	-	Not recorded in PMF.
Pisimela denticulata	-	-	-	-	-	-	-	-	-	1	-	-	-	Not recorded in PMF.
PYCNOGONIDA														
Nymphon gracile	-	-	-	1	-	9	1	-	1	-	-	-	-	Similar to PMF.
Achelia (+Ammothea) echinata	1	-	9	2	13	16	4	-	4	2	-	-	-	Similar to PMF.
Anoplodactylus petiolatus	-	-	6	1	-	34	7	-	-	-	-	-	-	Not recorded in PMF.
Endeis chorybdaea	-	-	-	-	-	-	1	-	-	1	-	-	-	Identified by Dr. R. Bamber. Not recorded in PMF.
Callipallene (=Pallene) brevirostris	-	-	-	1	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
MOLLUSCA:POLYPLACHOPHORA														
Polyplachophora indet.	-	-	-	-	-	-	-	-	-	7	-	-	-	-
MOLLUSCA:GASTROPODA														
Acmaea virginea	-	-	-	-	1	-	3	-	-	5	-	-	-	Similar to PMF.
Gibbula umbilicalis	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Calyptraea chinensis	-	-	-	1	-	-	-	-	-	-	-	-	-	Not as common as suggested in PMF (probably lack of stones).
Crepidula fornicata	-	-	2	1	-	-	-	-	2	-	-	-	-	First recorded in the Plymouth area at Salcombe in 1950 (PMF).
Trivia arctica	-	-	-	-	-	-	-	-	-	1	-	-	-	Not previously in dredge material (PMF).
Buccinum undatum	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Nassarius reticulatus	-	-	-	-	-	-	12	-	-	-	-	-	-	-
Nudibranchia indet.	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Philine catena	-	-	-	-	-	-	-	-	-	1	-	-	-	Not recorded in PMF.
Berthella plumula	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Goniodoris nodosa	-	-	-	-	-	-	-	-	1	-	-	-	-	Similar to PMF.
Doridae indet.	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Coryphella sp.	-	-	-	-	-	-	-	-	1	-	-	-	-	Not recorded in PMF.
Coryphella/Eubranchus sp.	-	-	-	-	1	-	-	-	-	-	-	-	-	Not recorded in PMF.
MOLLUSCA:BIVALVIA														
Nucula turgida	-	-	4	-	-	21	11	2	-	-	-	-	-	Not recorded in PMF.
Nucula nucleus	-	-	-	1	23	6	14	-	48	10	-	-	-	More extensive (at the entrance to Salcombe Harbour) than suggested in PMF.
Modiolus sp.	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Musculus marmoratus	-	-	-	P	-	-	-	-	-	-	-	-	-	? Similar to PMF.
Anomia ephippium	-	-	-	-	-	-	1	-	2	-	-	-	-	Not as abundant as in PMF, but occurs on stones (not sampled).
Chalmys varia	-	-	-	-	-	-	1	-	-	-	-	-	-	Similar to PMF.
Lima [sulcata]	-	-	-	-	-	-	-	-	-	1	-	-	-	Not recorded in PMF but L. sulcata is a northern species.
Thyasira flexuosa	-	2	21	-	-	26	6	30	-	1	-	-	-	In different areas to that expected from PMF.
Lucinoma borealis	-	-	3	2	1	12	14	-	20	8	-	-	2	More extensive than suggested in PMF.

Continued .... /

TABLE 16 (CONTINUED).

SPECIES	DREDGE SITES D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	SUCTION SAMPLE SITES SS1	SS2	SS3	NOTES
MOLLUSCA:BIVALVIA														
Acanthocardia aculeata	-	-	-	-	-	1	-	-	-	-	-	-	-	Not recorded in PMF.
Parvicardium (=Cardium) ovale	-	-	-	-	-	-	-	1	2	1	-	-	-	Not recorded in PMF.
Mysella bidentata	-	-	2	2	6	15	23	-	72	69	-	-	-	More widespread and abundant than suggested in PMF.
Montacuta ferruginosa	-	-	-	-	-	-	-	-	-	-	8	17	-	Similar to PMF.
Parvicardium (=Cardium) exiguum	-	-	1	-	-	-	1	-	-	1	-	-	-	Similar to PMF.
Venus fasciata	-	-	-	-	-	-	-	-	-	2	2	1	-	Similar to PMF.
Venus ovata	-	-	-	-	-	1	-	-	6	-	-	-	-	Similar to PMF.
Venus striatula	-	-	10	1	-	7	15	-	2	-	1	3	-	Not recorded so far upstream in PMF.
Venus sp.	-	-	1	-	-	-	1	-	-	-	-	-	-	-
Venerupis pullastra	-	-	2	1	-	-	1	-	-	7	-	-	-	Similar to PMF (for subtidal)
Venerupis sp.	-	-	-	-	4	-	-	-	3	-	-	-	-	-
Spisula elliptica	-	-	-	-	-	-	-	-	-	-	3	-	-	S. solida recorded in PMF but not S. elliptica.
Abra alba	1	-	6	4	7	1	79	3	20	11	-	3	4	More widespread than suggested in PMF.
Abra tenuis	-	1	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
Abra nitida	-	-	5	-	-	69	-	5	-	-	-	-	-	Not recorded in PMF.
Corbula gibba	-	-	4	-	2	10	29	1	10	5	-	-	5	Not recorded in PMF.
Cultellus (=Phaxas) pellucidus	-	-	6	-	-	5	4	-	-	-	-	15	5	Similar to PMF.
Tellina fabula	-	-	-	-	-	-	-	-	-	-	-	28	1	One recorded in PMF.
Tellina pygmaea	-	-	-	1	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
Ensis ensis	-	-	-	3	-	-	-	-	-	7	-	2	1	Similar to PMF.
Hiatella arctica	-	-	-	-	1	-	-	-	1	-	-	-	-	Similar to PMF.
Mya arenaria	-	-	2	1	3	9	-	2	46	10	-	-	-	Not recorded in PMF.
Thracia phaseolina	-	-	-	-	-	-	10	-	-	-	-	1	-	-
BRYOZOA														
Stomatopora sp.	-	-	-	P	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
Cryptosula pallasiana	-	-	P	P	-	-	-	-	P	-	-	-	-	Not recorded in PMF.
Celleporella hyalina	-	-	P	-	P	-	-	-	-	-	-	-	-	Not recorded in PMF.
Alcyonidium sp.	-	-	-	P	P	P	-	-	-	-	-	-	-	-
Bowerbankia pustulosa	-	-	-	-	-	P	-	-	-	-	-	-	-	Less abundant and widespread than expected from PMF but see in situ records.
Aegula sp.	-	-	-	-	-	-	P	-	-	-	-	-	-	Attached to Ascidiella aspersa, B. flabellata B. turbinata recorded in PMF.
ECHINODERMATA														
Asterias rubens	-	-	-	-	-	-	-	-	-	1	-	-	-	Similar to PMF.
Ophiothrix fragilis	-	-	-	-	1	-	-	-	-	-	-	-	-	Similar to PMF.
Amphipholis squamata	-	-	9	-	15	2	-	-	35	42	-	-	-	Not recorded in PMF.
Acrocnida branchiata	-	-	-	-	-	2	5	1	-	-	-	-	-	Similar to PMF.
Ophiura affinis	-	-	-	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
Ophiura albida	-	-	-	-	-	-	-	-	-	1	-	-	-	Not recorded in PMF.
Psammechinus miliaris	-	-	-	-	-	-	-	-	-	4	-	-	-	Less than expected from PMF.
Echinocardium cordatum	-	-	-	-	-	-	-	-	-	-	1	5	-	Recorded in PMF from areas not sampled.
Leptosynapta inhaerens	-	-	-	-	-	-	-	-	-	2	-	-	-	Similar to PMF.
CHORDATA:ASCIDIACEA														
Polyclinidae indet.	-	-	-	-	-	-	-	-	P	-	-	-	-	-
Didemnidae indet.	-	-	-	-	-	P	-	-	-	-	-	-	-	-
Ascidiella aspersa	2	-	99	5	9	31	4	-	18	-	-	3	-	Similar to PMF.
Styela clava	-	-	2	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
Polycarpa rustica	-	-	?13	-	1	-	-	-	1	-	-	-	-	Similar to PMF.
Dendrodoa grossularia	-	-	-	1	4	P	-	-	P	-	-	-	-	Similar to PMF.
Molgula manhattensis	-	-	-	-	-	1	-	-	1	-	-	-	-	Recorded for the Salt Stone in PMF.
CHORDATA:PISCES														
Solea solea	-	-	-	-	-	-	1	-	-	-	-	-	-	Not recorded in PMF.
Limanda limanda	-	-	1	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.
Callionymus lyra	-	-	1	-	-	-	-	-	-	-	-	-	-	Not recorded in PMF.

TABLE 17.

Classification, description and evaluation of the conservation importance of habitats/community types present in the Salcombe Harbour and Kingsbridge Estuary and encountered during the survey.

Classification (based on Section 6.2 and 6.3).	Description	Provisional suggested importance
INTERTIDAL		
1. Wave exposed bedrock at entrance to or just outside of Salcombe Harbour (described in Section 6.2.2).	Open coast habitats are similar to those at many other locations. However, at the entrance to the Harbour, sites were of broken rock leading to the presence of a wide range of habitats including overhangs, gullies and rockpools. Also, these areas were colonised by species typical of the open coast and of the enclosed inlet so that communities were very rich. At Fort Charles, all four species of Gigartina known from the British Isles are present. This area is the eastern-most recorded location of the southern species Laminaria ochroleuca. The suggested importance relates to rocks at the entrance to Salcombe Harbour and includes Fort Charles, the Black Stone, Biddlehead Point and Woodville Rocks.	Regional/ National
2. Sandy beaches backed by bedrock at the entrance to and along the sides of Salcombe Harbour. (Described in Section 6.2.3)	Communities on the lower shore along both sides of Salcombe Harbour are extremely rich in burrowing fauna with associated commensial species and a long history of study. The suggested importance relates to sediments in Salcombe Harbour. Sandy beaches at the entrance to Salcombe Harbour do not have a very high faunal diversity.	National/ International
3. Steeply sloping semi-exposed rocky shores within the harbour (described in Section 6.2.4).	These shores include communities typical of steeply sloping rocks on enclosed coasts dominated by a limpet-barnacle community with scattered fucoids. Lower shore communities were very rich in algae and animals several of which are not generally encountered on the open coast. They include Snapes Point, Scoble Point and Ox Point.	Regional

4. Gradually sloping broken bedrock fringed by muddy shale gravel or mud with shells and stones in the shelter of Salcombe Harbour, the Kingsbridge Estuary and entrance to creeks (described in 6.2.5 and 6.2.6).	Rocky shores here include communities typical of sheltered mouth-of-estuary conditions but are very rich where overhangs or steeply sloping rock occur towards the lower shore. Sediments on the lower shore are very rich in burrowing species and have a long history of study. This category includes the Salt Stone and areas immediately to the north of Tosnos Point, Ox Point, Snapes Point and Scoble Point.	National/ International
5. Mud flats in the upper estuary (described in Section 6.2.7).	Communities on and below the surface of these sediments are rich in species and include areas of Zostera noltii. They are typical of mud flat areas although associated bird populations do not appear to be as rich as on similar habitats in some other estuaries.	Regional
6. Upper shore rock extending to mud with shale and gravel above mud flats within creeks (described in Sections 6.2.8 and 6.2.9).	These are typically estuarine communities with several widely distributed species found in fully saline conditions absent and with species characteristic of area of reduced salinity occurring. This habitat fringes most of the creeks and uppper estuary.	Regional/ Local
7. Tidal rapids at the the Boat Pool (described in Section 6.2.10).	A rich community of animal species is present on and under stones here.	Local
8. Stone walls in the upper estuary (described in Section 6.2.11).	These surfaces are interesting because of the lack of other hard substrata extending towards the lower shore in the upper part of the estuary. Animal communities are especially interesting though the number of species present is not high.	Regional/ Local
SUBTIDAL		
9. Broken rock slopes on the open coast and entrance to Salcombe Harbour (described in Section 6.3.2).	These areas are quite rich in species and are particularly interesting because of the broken nature of the rock which leads to the presence of tunnels and surge gullies. It is the presence of these features of a mixture of open coast and sheltered inlet species and some unusual algae at the	Regional

9 (Cont.)	sites at the entrance of Salcombe Harbour which are most important in the assessment. Areas of greatest importance are off Fort Charles and the Black Stone.	
10. Sand near the entrance to Salcombe Harbour (described in Section 6.3.4).	These sediments have a fairly sparse fauna but are colonised by very high numbers of Echinocardium cordatum and its commensial bivalve Montacuta ferruginosa. The area included extends south from the inner Bar and includes Starehole Bay.	Local
11. Rock outcrops and stable hard substrata and sand at the entrance to Salcombe Harbour (described in Sections 6.3.5 and 6.3.6).	Sand is colonised by Zostera marina with a fairly impoverished associated epifauna and flora but with a rich burrowing fauna which, near to chart datum level, has been studied over many years at Mill Bay. Rock communities are rich in algae in shallow depths and especially in anemones near to the deep channel. The area included is from south Sands northwards to Mill Bay. The rich infauna and history of study at Mill Bay makes this site of especially high interest.	Regional/ National
12. Tide swept sand with pebbles and shells in the main channel of Salcombe Harbour and the Kingsbridge Estuary (described in Sections 6.3.7 and 6.3.9).	This habitat extends from the entrance to Salcombe Harbour north to the Salt Stone. In Salcombe Harbour, coarse sand is present whilst from the area off Ditch End northwards, muddy sand predominates. Mixed with and on the surface of this sand are pebbles and shells. Communities present are very rich in algae, epifaunal animals and infaunal species with some rarely encountered species present. These communities were first described in 1900.	National
13. Steeply sloping bedrock and boulders in Salcombe Harbour (described in Section 6.3.8).	This is a very restricted habitat within the inlet but includes communities typical of sheltered rias and very different to those of rock on the open coast. Richer communities on more extensive areas of this type of habitat are known to occur in Plymouth Sound. Recorded at Snapes Point and Scoble Point.	Regional/ Local

14. Infralittoral stable hard substrata on sediment in the Kingsbridge Estuary (described in Section 6.3.10).	The boulder slope at the Salt Stone together with various artificial surfaces such as mooring blocks provide areas of subtidal hard substrata near the northern-most limit of marine conditions and therefore the opportunity to study communities present in extreme shelter on silted surfaces.	Regional
15. Shallow mud with terrestrial debris in creeks and north of the Salt Stone in the main channel (described in Section 6.3.11).	This habitat holds a distinctive community of a small variety of infaunal and of conspicuous epi-faunal species typical of enclosed outer-estuary conditions. The communities occur in the main channel north of the Salt Stone and near the entrances to Frogmore Creek and Southpool Creek at least.	Regional
16. Mooring chains and pontoon floats (described in Sections 6.3.12 and 6.3.13).	The communities present on these substrata are distinctive from those of rock and very rich on pontoon floats where many open coast species occur. Similar communities are found in other harbours.	Local

TABLE 18.

Species of high conservation interest recorded during survey work in Salcombe Harbour and the Kingsbridge Estuary. Notes of algae are mainly from information supplied by Dr. C. A. Maggs.

	Notes	Suggested importance
ALGAE		
Gracilaria foliifera	Recorded at a few locations from Cornwall, South Devon and Dorset. Present in very large amounts at Salcombe and particularly colonising disturbed surfaces.	National
Gigartina teedii	A few plants of this extremely rare species were recorded at two sites near to chart datum level. Previously recorded from Cornwall and South Devon.	National
Bornetia secundiflora	A rare species restricted to the south coast. One plant found.	Regional
Crouania attenuata	A rare species restricted to the south coast. Recorded at one site.	Regional
Griffithsia barbata	A rare species restricted to the south coast. Present in fairly high abundance at very sheltered sites.	Regional
Drachiella spectabilis	Possibly the most easterly record in the British Isles of this species which has only been extensively recorded in recent years.	Regional
Chondria coerulescens	Recorded from Suffolk, Sussex and Hampshire and, in 1889, at Torquay. Found in quite large amounts at very sheltered sites.	Regional
Laminaria ochroleuca	A widespread species on the south coast with a northern recorded limit at Lundy. Reaches its eastern limit at Salcombe.	Regional
ANIMALS		
Halichondria bowerbanki	This sponge is a typical ria or harbour species which occurred in particularly high abundance at the Salt Stone.	Regional

Sabella ?flabellata	Several records of a small sabellid attached to various substrata on the lowest shore and in the shallow sub-tidal were made at very sheltered sites. There is still some doubt over its identity by Dr. P. Knight-Jones provisionally considers it nearest to S. flabellata Savigny (1820). Specimens were collected at Site 39.	Regional/ National
Sabella pavonina	This fan worm is typical of sheltered harbours and inlets. It was present in large numbers in the north of the inlet and in Frogmore Creek and the populations are considered especially rich.	Regional
?Sabella spallanzani	There were several records of ?Sabella sp. but without specimens or photographs so that no specific identification could be made. However, a large sabellid was noticed on part of a film made in Salcombe Harbour ('Beneath the Keel' - BBC). A video of the film was viewed and the large solitary sabellid with spiral branchiols attached to a pontoon was considered most likely to be this species. S. spallanzani is unrecorded from the British Isles though found in sheltered inlets of the coast of Brittany.	National (if in fact) present)
Terebellidae indet.	A dense mat of tentacles of this obviously very large species was visible in the sandy mud of Southpool Creek. It might be Loimea medusa (Dr. P. Gibbs, pers. comm.). Similar worms have been seen in Falmouth and off Skomer but not yet captured.	Regional

(The several burrowing species listed in the Plymouth Marine Fauna and/ or recorded during this survey are not included separately here but are a rich part of the communities present and several unusual species occur or are present in high abundance.)

APPENDIX 1

Abundance scales for rocky shore species.

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

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

2. Balanus perforatus

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

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 m^2
6 S	10-19 per 0.1 m^2
5 A	5-9 per 0.1 m^2
4 C	1-4 per 0.1 m^2
3 F	5-9 per m^2
2 O	1-4 per m^2
1 R	Less than 1 per m^2

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 m^2
6 S	20-49 per 0.1 m^2
5 A	10-19 per 0.1 m^2
4 C	5-9 per 0.1 m^2
3 F	1-4 per 0.1 m^2
2 O	1-9 per m^2
1 R	Less than 1 per m^2

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

7 Ex	10 or more per 0.1 m^2
6 S	5-9 per 0.1 m^2
5 A	1-4 per 0.1 m^2
4 C	5-9 per m^2, sometimes more
3 F	1-4 per m^2, loc. sometimes more
2 O	Less than 1 per m^2. locally sometimes more
1 R	Always less than 1 per m^2

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 m^2, 1 or more large per 0.1 m^2
2 O	1-9 small per 0.1 m^2, 1-9 large per m^2; no patches except small in crevices
1 R	Less than 1 per m^2

7. Pomatoceros lamarkii

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

8. Spirorbinidae

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

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 m^2
1 R	Less than 1 patch over strip; 1 small patch or sprig per 0.1 m^2

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 m^2.

APPENDIX 2

Abundance scale 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 smithi, Antedon 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.
OCCASIONAL	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

4. 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.

5. Foliaceous 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.

6. 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	Only few plants seen during dive.

7. 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.

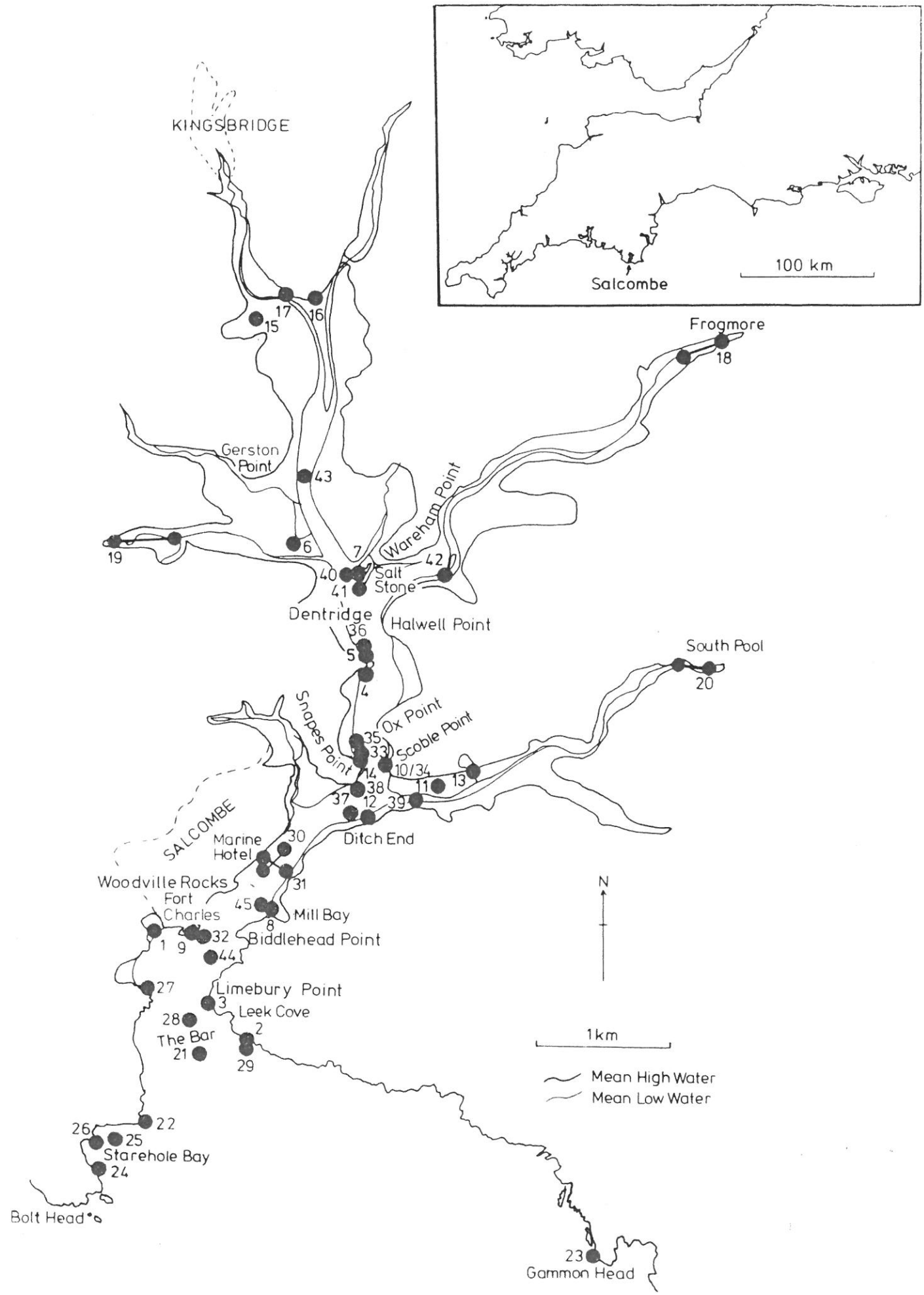

Fig. 1. Location of sites surveyed and of places mentioned in the text.