



Marine Nature Conservation Review: Rationale and methods

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Appendix 1 Glossary of marine ecological terms, acronyms and abbreviations used in MNCR work

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Introduction

This glossary contains more than 700 terms, and is in two parts:

Marine ecological terms,
Acronyms, abbreviations, initials and projects.

This glossary serves a dual purpose:

1. to explain specialist terms which may occur either in the present volume or in other Marine Nature Conservation Review or JNCC Marine Conservation Branch publications, and which may be unfamiliar to the non-specialist reader;
2. to provide definitions which are applicable in the context of the MNCR for terms which are open to interpretation. In a few cases, it has also been necessary to provide alternative definitions, for example those used in legislation or European Directives.

Where possible, existing published definitions have been used, but in many cases definitions have had to be developed. The following convention has been adopted:

- (Smith & Jones 1990) indicates that the source is quoted verbatim;
- (from Smith & Jones 1990) indicates that there have

been minor changes for the sake of brevity or grammatical correctness;

- (based on Smith & Jones 1990) indicates that a more free adaptation is used, but still intended to be true to the spirit of the original; such changes are usually designed to tailor the definition more precisely to the MNCR's context, or to remove ambiguity.

Where no source is quoted, no single source has been used, and the definition has usually been adapted from several sources. The references contain all sources used, and serve as a pointer for further reading.

The glossary is not intended to:

- provide a full and comprehensive dictionary of ecological or marine and coastal terms or of abbreviations - other books meet this need. The emphasis is on MNCR terminology;
- explain other definitions to those used in MNCR work although, as far as possible, terms are compatible with definitions used by workers in other fields;
- cover taxonomic groups, except where they form a habitat, e.g. 'kelp', as many dictionaries already attempt this;
- explain etymology.

Glossary of marine ecological terms

abiotic Devoid of life.

abundance scale A scale describing the relative abundance of organisms (as numbers of individuals per unit area or as % cover), with groupings in several broad categories. In the case of the MNCR's semi-logarithmic 'SACFOR' scale, the units are Superabundant; Abundant; Common; Frequent; Occasional; Rare (scale from Hiscock 1990).

accretion Build-up or accumulation of sediment.

acoustic mapping A remote survey technique for identifying the 'roughness' and 'hardness' of the seafloor and thus major

substrata types and erect biotic cover using SONAR signals interpreted by the use of video or diver recording of representative sites. The acoustic signal is tracked through the global positioning system and thus mapped. Cf. 'RoxAnn[®]'.

aggregation Organisms (usually of the same species) living closely together, but not physically connected (cf. 'colony').

algal mat A dense mass of green or other algae (e.g. *Enteromorpha* spp., *Ulva* spp.) which blankets the substratum in a littoral or shallow-water environment, often in areas of freshwater influence or where eutrophication occurs.

- alien species** A non-established introduced species (q.v.), which is incapable of establishing self-sustaining or self-propagating populations in the new area without human interference (cf. 'introduced species'; 'non-native').
- alluvium** A silty deposit transported by water (from Lincoln, Boxshall & Clark 1982).
- amphidromic point** The central point of a cyclonic tidal system, at which the vertical astronomical tidal range is nil, or very small, increasing progressively with increasing distance from this central point (from Ministry of Defence 1987.)
- anadromous** (of fish) Upward-running: spending part of their life in the sea and migrating up rivers in order to breed (e.g. salmon) (cf. 'catadromous').
- anaerobic** An environment in which the partial pressure of oxygen is significantly below normal atmospheric levels; deoxygenated (Lincoln, Boxshall & Clark 1982).
- anoxic** Devoid of oxygen.
- anthropogenic** Produced by human activity.
- aquaculture** The cultivation of aquatic organisms by human effort for commercial purposes. For the cultivation of marine organisms in seawater, the term 'mariculture' is also used (based on Baretta-Bekker, Duursma & Kuipers 1992.)
- arborescent** Having the shape or characteristics of a tree.
- arctic** Referring to a biogeographical region centred north of the British Isles and influencing the extreme north of the British Isles.
- area** (conservation assessment) A single stretch of open coast, a marine inlet or a lagoon which forms a unit of comparison within an MNCR coastal sector (q.v.). The same units are used in MNCR area summary reports.
- area** (MNCR survey recording and reporting) A discrete physiographic feature such as an island, estuary or sealoch or a stretch of coast often delimited by a change in aspect, or bounded by the presence of inlets or headlands.
- area of search** The area within which SSSI are assessed, selected and notified in order to ensure that the national range of variation in both habitats and species assemblages is encompassed in the SSSI series.
- aspect** (shore) The direction(s) to which a shore faces open water.
- assemblage** A generic term used chiefly by some British marine ecologists which does not assume interdependence within a community or association, but appears to have the same broad definition as 'community' (based on Hiscock & Connor 1991).
- assessment** 1) The evaluation of marine natural heritage importance through an orderly process of gathering information about biotopes and species in an area and comparing their attributes by a standard protocol (as in 'conservation assessment'). 2) The evaluation of the likely impact of a development on the environment (as in 'Environmental Impact Assessment').
- association** A term used by botanists to refer to an assemblage of plants with a definite floristic composition, considered by many workers to be synonymous or very similar to the zoological concept of 'community' (from Hiscock & Connor 1991).
- astronomical tide** (or lunar tide) The periodic rise and fall of the ocean water masses, produced by gravitational effects of the moon and sun on the earth (from Lincoln & Boxshall 1987).
- autecology** The ecology of individual organisms or species (Lincoln, Boxshall & Clark 1982) (cf. 'synecology').
- ayre** (Shetland) A regional term for a long narrow spit of shingle or sand, usually formed across a shallow bay or a voe (q.v.); a regional term for a tombolo (q.v.) (based on Mykura 1976).
- azoic** Devoid of animal life.
- banded ranked relative richness** A structured method for comparing the species richness of biotopes by ranking each according to its species richness and splitting the dataset into five equally-sized bands.
- bar** (geomorphological) A low, elongated body of sediment, such as sand or shingle, laid down by accumulation in shallow water adjacent to a coastline, and lying more or less parallel to the general coastline and sometimes attached to it (based on Allaby & Allaby 1990 and Stiegeler 1976) (cf. 'spit').
- bathyal** Pertaining to the sea floor between 200 m and 4000 m (Lincoln & Boxshall 1987).
- bathymetry** Measurement of ocean or lake depth and the study of floor topography (Lincoln & Boxshall 1987).
- bay** A fully marine but semi-enclosed area of sea with no entrance sill or pass (based on Earl & Pagett 1984), see 'marine inlet'.
- beach** The strip of land along the margin of a body of water that is washed by waves or tides sufficiently to inhibit all or most terrestrial plant growth (based on Lincoln & Boxshall 1987). The term is taken to include the entire littoral zone, including the supralittoral fringe, or splash zone, and is generally interpreted as referring to sediment (or mobile boulders) rather than bedrock shores.
- benthos** Those organisms attached to, or living on, in or near, the seabed, including that part which is exposed by tides as the littoral zone (based on Lincoln & Boxshall 1987).
- bioaccumulation** The ability of organisms to retain and concentrate substances from their environment. The gradual build-up of substances in living tissue; usually used in referring to toxic substances; may result from direct absorption from the environment or through the food-chain. Cf. 'biomagnification'.
- biocenosis** (biocoenosis) A term used in continental Europe which can be considered roughly equivalent to 'community' as suggested by Cain (1939), i.e. "a term of convenience which is employed to designate sociological units to every degree from the simplest one-layered aggregation to the most complex phytocoenosis" (Hiscock & Connor 1991).
- biodegradation** Breakdown or decomposition by bacteria or other biological means.
- biodiversity** (biological diversity) "The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems." (UN Convention on Biological Diversity 1992).
- biogeography** The branch of biology concerned with the geographical distribution of plants and animals, and the factors influencing that distribution.
- biomagnification, bioconcentration** Increasing concentration of a substance in successive trophic levels of a food chain (cf. 'bioaccumulation').
- biomass** The total quantity of living organisms in a given area, expressed in terms of living or dry weight or energy value per unit area.
- biome** A major ecological community, extending over a large area and usually characterised by a dominant vegetation (from

- Makins 1991).
- biota** The plant and animal life of a particular site, area, or period.
- biotope** 1) The physical 'habitat' with its biological 'community'; a term which refers to the combination of physical environment (habitat) and its distinctive assemblage of conspicuous species. MNCR uses the biotope concept to enable description and comparison. 2) The smallest geographical unit of the biosphere or of a habitat that can be delimited by convenient boundaries and is characterised by its biota (Lincoln, Boxshall & Clark 1982).
- bioturbation** The mixing of a sediment by the burrowing, feeding or other activity of living organisms (Lincoln, Boxshall & Clark 1982).
- Birds Directive** The abbreviated term for *Council Directive 79/409/EEC of 2 April 1979 on the Conservation of Wild Birds* (Council of the European Communities 1979).
- black layer** An anoxic layer present below the surface in stable sediment, apparent as a dark layer produced by sulphide salts.
- bloom** (algal/planktonic) 1) A seasonal increase in the abundance of plankton. 2) A superabundance of one or more species of planktonic organism, often resulting in a discoloration or opacity of the water, or of macroalgae; can be a consequence of eutrophication.
- 'blowing', 'blowing out'** A technique for cockle-collecting, formerly practised particularly in the Wash, using the action of a vessel's propeller in very shallow water to wash cockles out of the sand for later collection at low tide. Now largely replaced by hydraulic dredging (based on Fowler 1989.)
- boreal** (biogeographical) Pertaining to cool or cold temperate regions of the northern hemisphere (Lincoln, Boxshall & Clark 1982). In marine zoogeographical terms, Ekman (1953) states that the centre of the boreal region lies in the North Sea. It is bounded by the subarctic transitional zone to the north between Shetland, the Faroe Islands and Iceland and in the south-west of Britain by a transitional zone with the Mediterranean-Atlantic Lusitanian region.
- bottom current** A current that flows close to the sea floor, or within the lowermost layers of water in deep-sea areas (from Stieglar 1976).
- bottom sampling** Sampling of benthic sediments and organisms.
- boulder** An unattached rock, defined in three categories based on Wentworth (1922): very large (> 1024 mm); large (512-1024 mm); small (256-512 mm) (from Hiscock 1990).
- boulder clay** (See 'till').
- boulder tumble** A slope of boulders below a cliff or slope (cf. 'talus').
- brackish** Referring to mixtures of fresh and seawater. Usually regarded as between 0.5 ‰ and 30 ‰ salinity (q.v.) (based on McLusky 1993).
- 'bubbling reef'** A reef formed by underwater chemical precipitation from gas seepage through a porous seabed (cf. 'pock-mark') (based on Jensen *et al.* 1992).
- calcareous** Containing calcium carbonate; chalky. (Of organisms): a species which accumulates calcium carbonate in its tissues.
- car, carr** (mainly north-east England and south-east Scotland) A regional term for a reef.
- carnivore** A predator which feeds on animals.
- catadromous** (of fish): downward-running: spending most of their life in rivers and migrating downstream to the sea in order to breed (e.g. eels) (cf. 'anadromous').
- cave** A hollow normally eroded in a cliff, with the penetration being greater than the width at the entrance (based on Sunamura 1992). Caves can also be formed by boulders. Not defined for the EC Habitats Directive, 'Submerged or partially submerged sea caves' (European Commission 1995) but the UK interpretation considers them to take the form of tunnels or caverns, with one or more entrances, in which vertical and overhanging rock surfaces form the principal marine habitat.
- Celtic Sea** Seas to the south of Ireland and west of Cornwall (south-west England).
- Celtic Seas** As defined by the Oslo and Paris Commissions 1994 for the preparation of quality status reports. The western boundary follows the 200 m depth contour to the west of 6° W between 62°N to 48° 30'N. The eastern boundary is at 5° W and follows the west coast of Great Britain from 62°N to 48° 30'N.
- chalk** A soft fine-grained sedimentary rock, normally white, consisting almost entirely of calcium carbonate.
- characteristic** (species) Special to or especially abundant in a particular situation or biotope. Characteristic species should be immediately conspicuous and easily identified (based on Hiscock & Connor 1991.)
- chart datum** Set reference point on charts for water depth in relation to tides. On metric charts for which the UK Hydrographic Office is the charting authority, chart datum is a level as close as possible to Lowest Astronomical Tide (LAT), the lowest predictable tide under average meteorological conditions (from Ministry of Defence 1987). This is not the same as Ordnance Datum, the fixed reference point for heights and contours shown on Ordnance Survey maps, which is based on mean sea level (MSL) as recorded at Newlyn (Cornwall) over a seven-year period from 1915 to 1921.
- circalittoral** The subzone of the rocky sublittoral below that dominated by algae (the infralittoral), and dominated by animals. No lower limit is defined, but species composition changes below about 40 m to 80 m depth, depending on depth of the seasonal thermocline. This subzone can be subdivided into the upper circalittoral where foliose algae are present and the lower circalittoral where they are not (see Hiscock 1985). The term is also used by Glémarec (1973) to refer to two étages of the sediment benthos below the infralittoral: a "coastal circalittoral category with a eurythermal environment of weak seasonal amplitude (less than 10°C) varying slowly" and a "circalittoral category of the open sea with a stenothermal environment".
- circalittoral** (lower) The part of the circalittoral subzone on hard substrata below the maximum depth limit of foliose algae (based on Hiscock 1985).
- circalittoral** (upper) The part of the circalittoral subzone on hard substrata distinguished by the presence of scattered foliose algae amongst the dominating animals; its lower limit is the maximum limit of depth for foliose algae (based on Hiscock 1985).
- cladistics** A method of classification employing phylogenetic hypotheses, or evolutionary relationships, as its basis, and using recency of common ancestry as the sole criterion for grouping taxa (based on Lincoln, Boxshall & Clark 1982).
- classification** (taxonomy) The placing of animals and plants in a series of increasingly specialised groups because of similarities in structure, origins etc., that indicate a common relationship (from Making 1991).
- classification** (biotopes) The process of identifying distinctive and recurrent groupings of species with their associated habitat

and describing them within a structured framework.

classification (water quality) A system for describing the water quality of rivers and canals and, using four main classes, estuaries and coastal waters in England and Wales (National Rivers Authority 1991). A comparable system operates in Scotland.

clay 1) Sediment particles less than 0.004 mm in size (Wentworth 1922). 2) A soft very fine-grained sedimentary rock composed primarily of clay-sized particles.

cliff Any slope, usually of bedrock but can be clay, steeper than 45°.

climate The totality of the weather conditions at a certain location over a certain period (conventionally 30 years) (from Baretta-Bekker, Duursma & Kuipers 1992).

cluster analyses Statistical methods that group highly correlated variables within a set of variables, according to their attributes, and which exclude from clusters those that are uncorrelated or negatively correlated (based on Lincoln, Boxshall & Clark 1982).

coastal cell (coastal processes cell) A compartment of coastline, divided from neighbouring sections of coast in terms of longshore drift, current flow, and wave convergence and divergence (based on Motyka & Brampton 1993).

coastal sector (MNCR) One of the 15 biogeographically or physiographically defined regions around Great Britain, as defined by Hiscock (1990). Equivalent to a region as in "Regionally important". Eight comparable sectors around the Irish coast have been defined by BioMar (q.v.).

coastal zone The space in which terrestrial environments influence marine (or lacustrine) environments and vice versa. The coastal zone is of variable width and may also change in time. Delimitation of zonal boundaries is not normally possible; more often such limits are marked by an environmental gradient or transition. At any one locality the coastal zone may be characterised according to physical, biological or cultural criteria, which need not, and rarely do, coincide. (Based on Carter 1988.)

cobble A rock particle defined in two categories based on Wentworth (1922): large (128-256 mm); small (64-128 mm) (from Hiscock 1990).

colonisation The process of establishing populations of one or more species in an area or environment where the species involved were not present before (from Baretta-Bekker, Duursma & Kuipers 1992).

colonist (recent) (See 'recent colonist'.)

colony 1) A group of organisms of the same species living connected together in a common mass (Fitter & Manuel 1986.) (cf. 'aggregation'). 2) A group of organisms connected by behavioural or sociological factors (e.g. seabird colony, seal colony).

commensalism Symbiosis (q.v.) in which one species derives benefit from a common food supply, whilst the other species is not adversely affected (Lincoln, Boxshall & Clark 1982).

Common Fisheries Policy (CFP) A 20-year programme agreed in 1983 by EC Member States for the management and conservation of fish stocks, the maintenance and improvement of the market structure associated with the fishing industry, and international fisheries agreements.

community A group of organisms occurring in a particular environment, presumably interacting with each other and with the environment, and identifiable by means of ecological

survey from other groups (from Mills 1969; see Hiscock & Connor 1991 for discussion.)

consent (pollution or discharge) A statutory document specifying acceptable levels of contamination in wastewater discharges (which have been used and contaminated by an industrial process or sewage, or otherwise contaminated) to controlled waters, issued by the National Rivers Authority in England and Wales or a River Purification Authority in Scotland; being superseded by a system of authorisations for prescribed processes.

conservation (nature) "The regulation of human use of the global ecosystem to sustain its diversity of content indefinitely" (Nature Conservancy Council 1984).

consociation Climax community dominated by one particular species (based on Abercrombie, Hickman & Johnson 1980.)

constancy 1) The frequency of occurrence of a species in samples from the same community (based on Makins 1991). 2) The continued presence of a species or community at a particular location. Cf. 'persistence', 'resilience', 'stability'.

continental shelf The seabed adjacent to a continent to depths of around 200 metres, or where the continental slope drops steeply to the ocean floor. Defined in law as "the sea bed and subsoil of the submarine areas adjacent to the coast...to a depth of 200 metres"; the legal landward limit is set at the outer limit of territorial waters (q.v.) (Geneva Conference on the Law of the Sea, Convention on the Continental Shelf, 1958).

controlled waters In the UK, for the purposes of pollution control and other regulations, all rivers, streams, lakes, groundwaters, estuaries and coastal waters to a distance of three nautical miles (5.5 km) offshore (12 nautical miles (22 km) for migratory fish). The term is also used to refer to the area extending to 200 km from baselines (or to the midline between countries where less than 200 km) where a country has rights in relation to utilisation of resources and control of pollution but where the area is not described as an 'Exclusive Economic Zone' (q.v.).

convention An international agreement through which nations agree to work together co-operatively to implement certain defined policies or take other action. International conventions are voluntarily entered into by countries, but once a country has signed a convention it agrees to implement or be bound by the specified terms or conditions. (From Anon. 1994.)

coralline Relating to, or resembling, coral, especially any calcareous red alga impregnated with calcium carbonate.

corer A bottom-sampling device which is a hollow cylinder (or box) pushed vertically into the sediment.

cove (See 'pocket beach').

creeling (Scotland) The setting of traps (creels) on the seabed to fish for lobsters, crabs, etc (see also 'potting').

crevice A narrow crack in a hard substratum < 10 mm wide at its entrance, with the penetration being greater than the width at the entrance. Crevices often support a distinct community of species. Cf. 'fissure'.

Critical Environmental Capital Those elements of the natural environment whose loss would be serious, or which would be irreplaceable or which would be too difficult or expensive to replace in human timescales (Masters & Gee 1995) (cf. 'irreplaceability').

Critically endangered (IUCN Red List categories) A taxon is Critically endangered when it is facing an extremely high risk of extinction in the wild in the immediate future (IUCN 1994)

- (cf. 'Extinct', 'Endangered', 'Vulnerable').
- cryptic; cryptozoic** 1) An animal which lives in hidden places, such as crevices, caves or beneath stones. 2) An organism whose appearance or coloration makes it difficult to see or recognise.
- culch; culch** A mass of broken stones, shells and gravel which forms the basis of an oyster bed (from Makins 1991).
- current** Horizontal movement of water in response to meteorological, oceanographical and topographical factors (see also 'tidal stream') (from Ministry of Defence 1987); a steady flow in a particular direction. 'Current' refers to residual flow after any tidal element (i.e. tidal streams) has been removed.
- decomposers** Organisms which feed by breaking down dead organic matter (from Lincoln, Boxshall & Clark 1982).
- delta** An accumulation of alluvial sediment, deposited where a current enters an open body of water.
- demersal** Living at or near the bottom of a sea or lake, but having the capacity for active swimming (from Lincoln, Boxshall & Clark 1982).
- dendrogram** A branching diagram in the form of a tree, used to depict degrees of relationship or resemblance (from Lincoln, Boxshall & Clark 1982).
- dependency** (conservation assessment) The reliance (of a species, community or ecological process) on a particular location (for instance, a feeding, breeding, sheltering area or a migration corridor) or structure (for instance, a kelp forest, a sea grass bed, a maerl bed) for survival.
- deposit-feeders** Any organisms which feed on fragmented particulate organic matter in or on the substratum; detritivores (from Lincoln, Boxshall & Clark 1982).
- detritus** Fragmented particulate organic matter, derived from the decomposition of plant and animal remains.
- Directive (European)** An item of legislation produced by the Council of the European Communities, the essence of which must be incorporated into the national legislation of Member States by a set date. The precise method of implementation is left to national governments. (Based on Dooley & Kirkpatrick 1993.) Cf. 'Regulation'.
- diversity** The state or quality of being different or varied (from Makins 1991). In relation to species, the degree to which the total number of individual organisms in a given ecosystem, area, community or trophic level is divided evenly over different species, i.e. measure of heterogeneity. Species diversity can be expressed by diversity indices, most of which take account of both the number of species and number of individuals per species. (Based on Baretta-Bekker, Duursma & Kuipers 1992.) Cf. 'evenness'; 'richness'.
- diversity** (conservation assessment) An assessment of the richness of different types in a location (which can be large or small) including the number of different biotopes and numbers of species. The number of species present in an example of a particular biotope.
- double tide** Tides where a double peak occurs at high water or low water, usually due to complex patterns of water movement (Hawkins & Jones 1992).
- dredge** 1) The action of removing material from the seabed. 2) Bottom sampling equipment towed along the seabed for collecting benthic sediment and organisms. Dredges are also used for the commercial collection of benthic organisms, e.g. scallops, or of sediment and may be a suction or hydraulic device. Cf. 'grab'; 'trawl'.
- dune** 1) Terrestrial dunes are mounds or ridges of unconsolidated windblown granular material, either bare or vegetated; 2) Subtidal and intertidal dunes are large sand or gravel ripples (mega-ripples), transported by traction in a strong current (based on Baretta-Bekker, Duursma & Kuipers 1992). The MNCR habitat classification defines these as > 10 cm in height.
- dune slack** (of sand dunes) An inter-dune hollow with a high water table (from Ritchie, Smith & Rose 1978).
- ebb-tide** Outgoing or falling tide.
- ecad** A plant or animal form produced in response to particular habitat factors, the characteristic adaptations not being heritable; a habitat form (from Lincoln, Boxshall & Clark 1982).
- ecology** The study of the inter-relationships between living organisms and their environment (from Lincoln, Boxshall & Clark 1982).
- ecosystem** A community of organisms and their physical environment interacting as an ecological unit (from Lincoln, Boxshall & Clark 1982). Usage can include reference to large units such as the North Sea down to much smaller units such as kelp holdfasts as "an ecosystem".
- ecotone** The zone of transition between two major ecological communities.
- eddy** Motion of a fluid in directions differing from, and at some points contrary to, the direction of the larger-scale current (from Allaby & Allaby 1990); a circular movement of water, the diameter of which may be anything from several cm to several km, caused by topographical features or sudden changes in tidal or tidal stream characteristics. (Based on Ministry of Defence 1987). Cf. 'gyre'.
- embayment** A type of marine inlet typically where the line of the coast follows a concave sweep between rocky headlands, sometimes with only a narrow entrance to the embayment.
- enclosed coast** A marine inlet or harbour fully enclosed from the open sea except at the entrance, not normally open to the sea at two ends. The connection with the open sea is normally less restricted than is the case with lagoons. (Based on Hiscock 1990.)
- Endangered** (IUCN Red List categories) A taxon is considered Endangered when it is not Critically endangered (q.v.) but is facing a very high risk of extinction in the wild in the near future (IUCN 1994) (cf. 'Extinct', 'Critically endangered', 'Vulnerable').
- English Channel** The arm of the Atlantic Ocean between southern England and northern France, linked with the North Sea by the Strait of Dover, considered part of the North Sea to 5° west as defined by the North Sea Ministerial conferences.
- environment** External surroundings and physical and chemical conditions influencing species (cf. 'habitat').
- Environmental Assessment (EA); Environmental Impact Assessment (EIA)** A process of predicting and evaluating an action's impacts on the environment, from which the conclusions are used as a tool in decision-making. It aims to minimise environmental degradation by giving decision-makers better information about the consequences which development actions could have on the environment, although it cannot, in itself, achieve that protection (based on Pritchard 1993). An Environmental Assessment can be used to produce an Environmental Statement (ES). Cf. 'Strategic Environmental Assessment'.
- epibenthos** All organisms living on the surface of the seabed.

- epifauna** Animals living on the surface of the seabed.
- epilithic** Growing on the surface of rock.
- epiphytic** Growing on the surface of a living plant (but not parasitic upon it).
- epizoic** Growing or living on the exterior of a living animal (but not parasitic upon it).
- estuary** 1) A semi-enclosed coastal body of water which has a free connection with the open sea, and within which sea water is measurably diluted by fresh water derived from land drainage (Pritchard 1967). This is the definition used in the context of the MNCR. 2) An inlet of the sea reaching into a river valley as far as the upper limit of tidal rise (Fairbridge 1980). (This definition includes freshwater tidal areas, excluded by Pritchard (1967).) (See Davidson *et al.* 1991 and McLusky 1993 for discussion of definitions.) Three main types of estuary are recognised.
- a) Coastal plain estuaries, formed by the flooding of pre-existing river valleys. Maximum depth in these inlets is usually less than 30 m, with a large width-to-depth ratio.
- b) Bar-built estuaries: also partially-drowned river valleys, with a characteristic sediment bar across their mouth.
- c) Complex estuaries: river estuaries formed as a result of a range of influences such as geological constraints from hard rock outcrops, glaciation, erosion, and sea-level change. See also 'marine inlet'.
- For the purposes of the EC Habitats Directive, 'estuaries' are defined as: "Downstream part of a river valley, subject to the tide and extending from the limit of brackish waters. River estuaries are coastal inlets where, unlike 'large shallow inlets and bays' there is generally a substantial freshwater influence. The mixing of fresh water and sea water and the reduced current flows in the shelter of estuaries leads to deposition of fine sediments carried in from the sea and down rivers, often forming extensive intertidal sand and mud flats. Where the tidal currents are faster than flood tides, most sediments deposit to form a delta at the mouth of the estuary" (European Commission 1995).
- estuary (inner)** That part of an estuary with mesohaline water between 5 ‰ and 18 ‰ salinity (based on McLusky 1993).
- estuary (lower)** That part of an estuary with polyhaline water between 25 ‰ and 30 ‰ salinity (based on McLusky 1993).
- estuary (middle)** That part of an estuary with polyhaline water between 18 ‰ and 25 ‰ salinity (based on McLusky 1993).
- estuary (upper)** That part of an estuary with oligohaline water between 0.5 ‰ and 5 ‰ salinity (based on McLusky 1993).
- étage** A French term referring to 'tiers', 'zones', 'stages' or 'levels' in the marine environment, but not translating accurately to English in the present context (based on Glémarec 1973).
- euhaline** Fully saline seawater > 30 ‰ salinity.
- eulittoral** The main part of the littoral zone characterised by limpets, barnacles, mussels, furoid algae (other than those characteristic of the littoral fringe), with red algae often abundant on the lower part. It lies above the main population of Laminariales. Zonation within the eulittoral is variable, with two to four (commonly three) belts often clearly discernible. (From Hiscock 1990.)
- eulittoral (lower)** The lower belt of the eulittoral subzone, bordering the sublittoral fringe, and generally dominated by *Fucus serratus* and red algae (based on Hiscock 1990).

- eulittoral (mid)** The broad middle belt of the eulittoral subzone, usually characterised by limpets and barnacles or *Mytilus* and filamentous red algae in exposed situations, or dominated by furoids, often with clumps of large mussels present, in shelter. (From Hiscock 1990.)
- eulittoral (upper)** The narrow upper belt of the eulittoral subzone, often very variable in character (from Hiscock 1990).
- European (marine) site** A special area of conservation under the EC Habitats Directive; a site of Community importance drawn from the Member States list by the Commission of the European Communities under the Habitats Directive or a site not submitted by a Member State but found by the Commission to be hosting a priority habitat type or priority species and subject to consultation; an area classified pursuant of Article 4(1) or (2) of the Wild Birds Directive. (Based on The Conservation (Natural Habitats, &c.) Regulation 1994 and Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora.)
- euryhaline** Of or relating to the capability of an organism to live in environments of variable salinity (from Charton & Tietjen 1989).
- eurythermal** Of or relating to the capacity of some organisms to survive in a wide range of temperatures (from Charton & Tietjen 1989).
- eustasy** Movement of sea level relative to land (from Carter 1988). Pertaining to world-wide changes in sea-level, but excluding relative changes in sea-level resulting from local coastal subsidence or elevation (from Lincoln & Boxshall 1987) (cf. isostasy).
- eutrophication** The over-enrichment of an aquatic environment with inorganic nutrients, especially nitrates and phosphates, often anthropogenic (e.g. sewage, fertiliser run-off), which may result in stimulation of growth of algae and bacteria, and can reduce the oxygen content of the water.
- evenness (equitability)** A measurement of the distribution of abundances amongst the different species in a community, habitat or sample (cf. 'diversity', 'richness').
- Exclusive Economic Zone (EEZ)** A legal concept introduced by the United Nations Conference on the Law of the Sea III (UNCLOS III) (1967-82), giving coastal states certain sovereign rights and jurisdictions for economic purposes over an area of sea and seabed extending up to 200 nautical miles (370 km) from a baseline (normally low-water line) (based on Baretta-Bekker, Duursma & Kuipers 1992). Cf. 'controlled waters'.
- exposed (wave exposure)** 1) Coasts which face the prevailing wind but which have a degree of shelter because of extensive shallow areas offshore, offshore obstructions, or a restricted (less than 90°) window to open water. These sites are not generally exposed to large waves or regular swell. 2) Open coasts facing away from prevailing winds but with a long fetch, and where strong winds are frequent (from Hiscock 1990).
- exposure** The degree of wave action on an open shore, governed by the distance of open sea over which the wind may blow to generate waves (the fetch) and the strength and incidence of the winds (Hawkins & Jones 1992). Expressed as a descriptive scale for MNCR recording. Cf. 'exposed', 'extremely exposed', 'sheltered', 'ultra-sheltered', 'very exposed', 'very sheltered'.
- Extent (conservation assessment)** In identifying sites for protection, preference will be given to sites with larger examples of highly rated or rarer biotopes. It is also necessary to consider the size of site required to ensure that the unit to be managed is 'viable'.

- Extinct** (IUCN Red List categories) A taxon is Extinct when there is no reasonable doubt that the last individual has died (IUCN 1994). The term can be applied on a local or national basis as well as world-wide and is also used to refer to situations where it no longer exists from a particular point of view (for instance: 'functionally extinct'; 'commercially extinct'). Cf. 'Critically endangered', 'Endangered', 'Vulnerable'.
- extremely exposed** (wave exposure) Open coastlines which face into the prevailing wind and receive both wind-driven waves and oceanic swell without any offshore obstructions such as islands or shallows for several thousand kilometres and where deep water is close to the shore (50 m depth contour within about 300 m) (from Hiscock 1990).
- extremely sheltered** (wave exposure) Fully enclosed coasts with a fetch of no more than about 3 km (from Hiscock 1990).
- facies** (biological) A geographical variant of a marine community, or a variant which includes a conspicuous or abundant species not present in the main community (based on Hiscock & Connor 1991, from Cotton 1912).
- fetch** The distance across water over which the wind blows from a particular direction uninterrupted by land.
- filiform, filamentous** Thread-like.
- filter-feeder** (see 'suspension-feeder')
- firth** (Scotland) A lengthy estuary or arm of the sea (from Stiegeler 1976).
- fissure** A crack in a hard substratum > 10 mm wide at its entrance, with the depth being greater than the width at the entrance (cf. 'crevice').
- fjord (fiard)** A series of shallow basins connected to the sea via shallow and often intertidal sills. Fjords are found in areas of low-lying ground which have been subject to glacial roughening. They have a highly irregular outline, no main channel and lack the high relief and U-shaped cross-section of fjordic inlets. (See Earll & Pagett 1984 and Howson, Connor & Holt 1994 for discussion and classification of types.)
- fjord (fiord)** A long, narrow-sided inlet of the sea having a shallow entrance sill. Fjords are glacially over-deepened and may have a series of sills and basins, often having deep water at the head. They are commonly surrounded by high ground and in cross-section, have a deep 'U'-shape. (See Earll & Pagett 1984 and Howson, Connor & Holt 1994 for discussion and classification of types.)
- flood-tide** Incoming or rising tide.
- floor, floors** (East Scotland) A local term for a shore platform (q.v.).
- flora** 1) The plants or plant life of a particular region or geological period. 2) A descriptive catalogue of the above.
- fly ash** Fine particles of ash resulting from the combustion of pulverised solid fuel in power stations; often abbreviated as PFA (pulverised fuel ash).
- foliose** Bearing leaves or leaf-like structures; having the appearance of a leaf.
- foreshore** The part of the intertidal zone that lies between normal high- and low-water marks (from Allaby & Allaby 1990). In English law, the landward limit has been defined as the line of medium high tides between the springs and the neaps, while the seaward limit is assumed to be the low-water line of ordinary tides (from Dowrick 1977).
- formation** (biological) A phytosociological unit based on the naming of plant assemblages by physiognomic or life-form characteristics (for example, a forest, a meadow), also taking into account environmental factors (from Hiscock & Connor 1991, based on Børgesen 1908).
- fouling** (biological) Growth of sessile algae and animals, especially on a ship's bottom or other artificial underwater structures, or in water-intake apparatus (based on Baretta-Bekker, Duursma & Kuipers 1992); also termed 'biofouling'.
- fragility** (conservation assessment) The degree of sensitivity of habitats, communities and species to environmental change (Ratcliffe 1977) (cf. 'sensitivity').
- freshwater-seawater interface** (FSI) The point in an estuary at which freshwater and seawater meet, generally at the border between tidal freshwater and the upper reaches of an estuary, with a salinity < 1‰ (based on McLusky 1993).
- fringing habitat** A maritime terrestrial habitat directly bordering the littoral fringe. Fringing habitats include saltmarsh, sand dunes and sea-cliffs above the supralittoral zone, together with the strandline.
- front, frontal system** An interface between two fluid bodies with different properties (based on Baretta-Bekker, Duursma & Kuipers 1992).
- frontolittoral region** A physiographic term applied to the inshore region of the English Channel off the French coast with irregular topography, extending from the tidal zone (based on Cabioch 1968) (cf. 'prelittoral').
- geo** (Shetland and north Scotland) A steep-sided narrow inlet of a cliffed coastline, which has been eroded along a major near-vertical joint or fault (based on Allaby & Allaby 1990).
- geographic region** With regard to biogeography (q.v.) and species distribution, a region which is separated from adjacent regions by barriers or a change in environmental conditions which limits the movement of species or prevent their establishment outside their natural geographical range.
- geology** The scientific study of the origin, history, structure and composition of the earth and its solid features.
- geomorphology** The branch of geology concerned with the structure, origin and development of topographical features of the earth's crust.
- grab** A mechanical bottom-sampling device which is lowered vertically from a stationary ship, for collection of sublittoral sediment and infauna (hand-grabs can also be used) (based on Holme & McIntyre 1984) (cf. 'dredge', 'trawl').
- gradient** A measure of the degree of change of a variable over distance. The response exhibited by the biota to such change is a 'continuum'. Cf. 'zonation'.
- grain-size** (See particle-size.)
- grain-size distribution** (See particle-size distribution)
- granulometric analysis, granulometry** The quantitative measurement of the physical composition (grain-size) of a sediment (see also 'particle-size'; 'sedimentology').
- gravel** Sediment particles 4-16 mm in diameter, based broadly on Wentworth (1922), which may be formed from rock, shell fragments or maerl (based on Hiscock 1990).
- grazers** Animals which: 1) rasp benthic algae (or sessile animals, such as bryozoan crusts) from the substratum, or 2) ingest phytoplankton from the water column by suspension-feeding (q.v.).
- greensand** A greenish sandstone consisting mainly of quartz and glauconite, deposited during the Cretaceous era.
- ground** An area of seabed, typically offshore sediment.
- groyne** A wall or jetty built out from a riverbank or seashore to

- combat the effects of longshore drift (q.v.) and control erosion.
- Gulf Stream** A relatively warm ocean current flowing north-eastwards off the Atlantic coast of North America from the Gulf of Mexico. It reaches north-eastern Atlantic waters off Europe as the North Atlantic Drift.
- gully** A vertical space between two rock walls at least 0.5 m wide and 0.5 m or more in depth (based on Earll 1992).
- gyre** A circular or spiral motion of fluid.
- habitat** The place in which a plant or animal lives. It is defined for the marine environment according to geographical location, physiographic features and the physical and chemical environment (including salinity, wave exposure, strength of tidal streams, geology, biological zone, substratum, 'features' (e.g. crevices, overhangs, rockpools) and 'modifiers' (e.g. sand-scour, wave-surge, substratum mobility). Cf. 'environment'.
- Habitats Directive** The abbreviated term for *Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora* (Commission of the European Communities 1992). Known until about autumn 1994 informally as the "Habitats and Species Directive".
- haline** Another term for saline (q.v.).
- halocline** A horizontal boundary layer in the water-column, at which salinity changes sharply with depth.
- harbour** A sheltered port, i.e. a place in which a vessel can lie in a position of more or less shelter from the elements with a view to the loading or discharge of cargo.
- heavy metal** A generic term for a range of metals with a moderate to high atomic weight, for example cadmium, mercury, lead. Although many are essential for life in trace quantities, in elevated concentrations most are toxic and bioaccumulate, and so are important pollutants.
- herbivores** Organisms which feed on plants, including phytoplankton.
- Highest Astronomical Tide (HAT)** The highest tidal level which can be predicted to occur under average meteorological conditions and any combination of astronomical conditions (from Ministry of Defence 1987).
- holeuryhaline** A term used for organisms that freely inhabit fresh water, seawater and brackish water, or which establish populations in all these environments (from Lincoln, Boxshall & Clark 1982).
- holism, holistic** The concept that all physical and biological entities form a single unified, interacting system, and that any complete system has a totality that is greater than the sum of the constituent parts (from Lincoln, Boxshall & Clark 1982).
- holoplankton** Plankton with a completely pelagic life cycle (cf. meroplankton) (from Baretta-Bekker, Duursma & Kuipers 1992).
- houb** (Shetland) A small sheltered tidal lagoon (from Scott & Palmer 1987) (cf. 'vadill').
- hydraulic dredge** Bottom sampling equipment for collecting benthic sediment and organisms, towed along the seabed using pumped water to draw material up a tube. Such dredges are also used for the commercial collection of benthic organisms, e.g. cockles.
- hydrocarbons** Organic compounds containing mainly hydrogen and carbon; the basic constituents of fossil fuels.
- hydrodynamic regime** The particular conditions of water movements at one particular site, including wave action, tidal streams and residual currents (based on Earll 1992).
- hydrography** The scientific study of seas, lakes & rivers (cf. 'hydrology').
- hydrology** The study of the distribution, conservation, use etc. of the water of the earth and its atmosphere (from Makins 1991) (cf. 'hydrography').
- hypolimnion** The lower, cooler, non-circulating water in a thermally-stratified body of water, often prone to oxygen depletion (based on Allaby & Allaby 1990).
- imposex** An abnormality of the reproductive system in female gastropod molluscs, by which male characteristics are superimposed onto female individuals (Smith 1980), resulting in sterility or, in extreme cases, death. This may be caused by hormonal change in response to pollution from organotin antifoulants, even at low concentrations. See 'organotin'.
- indicator organisms or species** An organism whose characteristics (e.g. presence or absence, population density, dispersion, reproductive success) are used as an index of attributes too difficult, inconvenient, or expensive to measure for other species, or as an index of environmental conditions of interest (Landres, Verner & Thomas 1988). Such characteristics may be used to indicate the degree of pollution or other environmental conditions at a particular locality. See Rowell (1994) and GESAMP (1995) for a discussion.
- infauna** Benthic animals which live within the seabed.
- infralittoral** A subzone of the sublittoral in which upward-facing rocks are dominated by erect algae, typically kelps; it can be further subdivided into the upper and lower infralittoral (based on Hiscock 1985). The term is also used by Glémarec (1973) to refer to areas (étages) with a eurythermal environment of great seasonal and also daily and tidal amplitude.
- infralittoral (lower)** The part of the infralittoral subzone which, on hard substrata, supports scattered kelp plants (a kelp park) or from which kelps are absent altogether and the seabed is dominated by foliose red and brown algae. It may be difficult to distinguish the lower infralittoral where grazing pressure prevents the establishment of foliose algae. (Based on Hiscock 1985.)
- infralittoral (upper)** The part of the infralittoral subzone which, on hard substrata, is dominated by Laminariales forming a dense canopy, or kelp forest (based on Hiscock 1985).
- inlet** See 'marine inlet'.
- international importance: biotopes or areas** (conservation assessment) Biotopes or areas which are highly rated in a coastal sector (q.v.) are considered of international importance if they are one of the best examples or only examples present in the north-east Atlantic (North Cape, Norway to Gibraltar). This was, until 1995, defined for communities as being: "Communities which are outstandingly good examples of their type in the north-east Atlantic. Communities recorded at only a very few locations in the north-east Atlantic" (Hiscock & Mitchell 1989). Cf. 'international importance: species', 'local importance', 'national importance', 'regional importance' (biotopes or areas and species).
- international importance: species** (conservation assessment) Species which are recorded at only a very few locations in the north-eastern Atlantic. Species recorded in higher abundance in the area under consideration than anywhere else in the north-eastern Atlantic, or where the area is one of only a few locations where large quantities are recorded (Davies *et al.* 1990, based on Hiscock & Mitchell 1989). Cf. 'international importance:

biotopes or areas', 'local importance', 'national importance', 'regional importance' (biotopes or areas and species).

interstitial Relating to the system of cavities and channels formed by the spaces between grains in a sediment (interstitial space).

intertidal The area of the shore between the highest and lowest tides (from Lewis 1964) (cf. 'littoral').

introduced species Any species which has been introduced directly or indirectly by human agency (deliberate or otherwise), to an area where it has not occurred in historical times and which is separate from and lies outside the area where natural range extension could be expected (i.e. outside its natural geographical range (q.v.)). The term includes non-established introductions ('aliens' (q.v.)) and established non-natives (q.v.), but excludes hybrid taxa derived from introductions ('derivatives').

Irish Sea The area of sea between Great Britain and Ireland north of a line across St George's Channel from St Anne's Head to Carnsore Point in the south, and south of a line across the North Channel from Mull of Kintyre to Fair Head in the north, including all estuaries except the Firth of Clyde (Irish Sea Study Group definition, based on Shaw (1990)).

irreplacibility (conservation assessment) Not capable of replacement if destroyed in some way. Applied to habitat features, biotopes and species (cf. 'Critical Environmental Capital').

isobath A line on a map connecting points of equal underwater depth; a submarine contour.

isohaline A line on a map connecting places of equal salinity.

isolated saline water As defined for the MNCR, an enclosed water body, within which water exchange with the sea is limited by shingle bars (allowing percolation of seawater), by shallow inlet channels (resulting in standing water at low tide), or by sluice gates or man-made or managed control systems. Isolated saline waters include obs, vadills and typical percolation lagoons, but exclude freshwater systems (or small areas of marine influence in larger freshwater bodies), larger more estuarine systems with extensive intertidal flats and large input and output of water, and enclosed areas of coast which dry completely at low water. Cf. 'lagoons'.

isostasy Movement of land relative to sea, often as a result of glacial 'rebound' (based on Carter 1988) (cf. 'eustasy').

isotherm A line on a map connecting places of equal temperature.

kelp A group of large brown algae of the Order Laminariales, common in the sublittoral fringe and infralittoral zone (q.v.).

kelp forest A belt of the upper infralittoral (q.v.) subzone on hard substrata, dominated by Laminariales sufficiently dense to form an almost continuous canopy.

kelp park A belt of the lower infralittoral (q.v.) subzone on hard substrata, which has scattered Laminariales whose fronds do not meet to form a dense canopy.

knot A unit of speed used in navigation, being one nautical mile (q.v.) per hour, equating to approximately 0.5 metres per second.

k-strategy A life strategy optimally geared to living in a stable habitat with a high level of interspecific competition. Parental care is facilitated by low fecundity (small litters of large size offspring), by longevity and size. K-strategists are unlikely to be well adapted to recover from population densities significantly below their equilibrium level and may become extinct if depressed to such low levels. (From Baretta-Bekker, Duursma & Kuipers 1992.) Cf. r-strategy.

lagoon (saline) A shallow body of coastal salt water (from brackish to hypersaline) partially separated from an adjacent sea by a barrier of sand or other sediment, or less frequently, by rocks (based on Ardizzone *et al.* 1988). Three features serve to identify a coastal lagoon:

- 1) the presence of an isolating barrier beach, spit or island;
- 2) the retention of all or most of the water mass within the system during periods of low tide in the adjacent sea;
- 3) the persistence of natural water exchange between the lagoon and the parent sea - by percolation through and/or overtopping of the barrier, through inlet/outflow channels, etc. - permitting the lagoonal water to remain saline or brackish.

As defined for the EC Habitats Directive, lagoons are "Expanses of shallow coastal salt water, of varying salinity and water volume, separated from the sea by sand banks or shingle, or, less frequently, by rocks. Salinity may vary from brackish water to hypersalinity depending on rainfall, evaporation and the addition of seawater from storms or from temporary flooding by the sea in winter" (European Commission 1995).

Five lagoon types have been identified in Great Britain for the identification of Sites of Special Scientific Interest (Joint Nature Conservation Committee 1996).

(i) Isolated saline lagoon. These are pools which are completely isolated from the sea by a barrier of rock or sediment. No seawater enters the pool by percolation, the only input of salt water occurs by limited groundwater seepage (such as in some dune pools), by overtopping of the barrier (sill) on extreme high water spring tides, or by salt water inundation during storm events.

(ii) Percolation saline lagoon. These pools are separated from the sea by a permeable barrier of shingle or pebbles and small boulders. Sea water exchange occurs through the barrier to varying degrees dependent on the permeability of the barrier.

(iii) Sluiced saline lagoons. These are lagoons where the ingress and egress of water from the lagoon to the open sea is modified by human mechanical interference.

(iv) Silled saline lagoons. These are in many respects similar to some examples of sluiced lagoons. They are generally rocky basins which have a sill between mean high water of spring tides and mean low water of spring tides.

(v) Saline lagoon inlets. These are saline lagoons where there is a permanent connection with the sea.

Cf. 'pond (coastal)'.

large shallow inlet See 'marine inlet'.

latitude An angular distance measured in degrees north (or south) of the equator (latitude 0°).

life form Structural types of organisms or growth forms that dominate or are most conspicuous in certain environmental conditions. (based on Richards, Bunker & Foster-Smith 1996).

limestone A sedimentary rock consisting mainly of calcium carbonate.

limit of tidal influence (tidal limit) Of an estuary, the furthest upstream reach at which tides have an influence on the water level. This influence is often by the effect of a flood-tide holding back freshwater flow; only in estuaries with a relatively small freshwater inflow does saline water (and therefore the remit of the MNCR) reach this limit. (See Fairbridge 1980 and McLusky 1993 for a discussion.) See also 'tidal freshwater area'.

limnetic Pertaining to freshwater < 0.5 ‰ salinity (based on Carriker 1967, in McLusky 1993).

littoral The area of the shore that is occupied by marine organisms which are adapted to or need alternating exposure to air and wetting by submersion, splash or spray. On rocky shores, the upper limit is marked by the top of the Littorina/Verrucaria belt and the lower limit by the top of the laminarian zone (Lewis 1964). It is divided into separate subzones, particularly marked on hard substrata. Cf. 'intertidal'.

littoral fringe The upper subzone of the littoral zone, bordering the supralittoral. It is characterised by marine lichens, littoral molluscs and algae tolerant of exposure to air for long periods; its lower boundary is characteristically the upper limit of dense barnacles. This subzone can be further subdivided into the upper and lower littoral fringes. (From Hiscock 1990.)

littoral width The distance from High Water Spring Tides to Low Water Spring Tides, measured at right angles to the general direction of coastline.

local importance (Conservation assessment) Biotopes or locations which are among the best examples or the only examples of their kind within a particular physiographic feature or area of coast but occur widely elsewhere in the coastal sector (q.v.). This was, until 1995, defined as being: "communities or areas which are widespread in similar situations but for which the one mentioned is a good example in the coastal sector under consideration." (Based on Hiscock & Mitchell 1989). Cf. 'international importance: species', 'national importance', 'regional importance' (biotopes or areas and species).

loch, lough (Scottish, Irish) A lake. In its widest sense, it is an open, enclosed or partially enclosed body of water. (Based on Earll & Pagett 1984.) See also 'sealoch'.

longitude Distance in degrees east or west of the prime meridian at 0°, which runs through Greenwich, south-east England.

longshore drift 1) A current which acts parallel to the coastline, generated by an oblique wave approach or by differences in wave height along the beach, and responsible for the movement of large quantities of beach material along the shore (based on Hansom 1988)

2) Movement of sand and shingle along the shore (Allaby & Allaby 1990).

lower shore A physical term for the area of shore around low tide level, often applied where it is not possible to determine the biological subzone, for example on sediment shores (cf. 'sublittoral fringe').

Lowest Astronomical Tide The lowest tidal level which can be predicted to occur under average meteorological conditions and any combination of astronomical conditions (from Ministry of Defence 1987).

lunar tide (See 'astronomical tide')

Iusitanian (biogeographical) Referring to a biogeographical region centred to the south of the British Isles and influencing the extreme south-west of the British Isles.

macrobenthos The larger organisms of the benthos, exceeding 1 mm in length (from Lincoln & Boxshall 1987); often applied to organisms > 0.5 mm. Cf. 'meiobenthos', 'microbenthos'.

macrofauna Animals exceeding 1 mm in length (Lincoln & Boxshall 1987) or retained on a 1 mm or 0.5 mm sieve; often applied to organisms > 0.5 mm. Cf. 'meiofauna', 'microfauna'.

macroscopic Large enough to be visible to the naked eye,

typically exceeding 1 mm in length.

maerl Twig-like unattached (free-living) calcareous red algae, often a mixture of species and including species which form a spiky cover on loose small stones - 'hedgehog stones'.

mariculture The cultivation, under appropriate environmental conditions, of marine organisms in seawater by human effort for commercial purposes (based on Baretta-Bekker, Duursma & Kuipers 1992 and Charton & Tietjen 1989). (See also 'aquaculture'.)

marine Pertaining to the sea.

marine inlet 1) As used by the MNCR, this term covers all forms of inlet, including estuaries, enclosed bays and the sounds, straits and narrows between land masses.

2) As defined for the Habitats Directive, 'large shallow inlets and bays' are: "Large indentations of the coast where, in contrast to estuaries, the influence of freshwater is generally limited. These shallow indentations are generally sheltered from wave action and contain a great diversity of sediments and substrates with a well developed zonation of benthic communities." (European Commission 1995.) 'Shallow' may be defined by the depth limit of the photic zone in open coastal waters adjoining the inlet or bay. In the UK this is interpreted for the Habitats Directive as a depth of 30 m below chart datum or shallower across at least 75% of the site."

Marine Nature Conservation Review (MNCR) A project initiated by the Nature Conservancy Council (NCC) in 1987 to consolidate the information already collected on British marine ecosystems, particularly the extensive data collected from marine survey projects commissioned by NCC since 1974, and to complete survey work and interpretation of data. Since 1991, the MNCR has been undertaken within the UK's Joint Nature Conservation Committee. The area included in the MNCR is the coastline of England, Scotland and Wales (excluding the Isle of Man and the Channel Isles) extending from the lower limit of terrestrial flowering plants out to the limit of British territorial seas, and into estuaries and other saline habitats to the limits of saltwater influence. The MNCR concentrates on the benthos, and is based on descriptions of habitats and the recorded abundance of conspicuous species.

marine protected area "Any area of intertidal or subtidal terrain, including geological and geomorphological features, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment." (IUCN definition, as modified by the Marine Protected Area Group, a working group of Wildlife Link's Joint Marine Group).

Marine Nature Reserve (MNR) A statutory marine protected area declared in Great Britain by the Nature Conservancy Council and its successor agencies under the Wildlife and Countryside Act 1981 for the purpose of conserving marine flora or fauna or geological or physiographical features in the area and providing opportunities for study and research (from Anon. 1994). Voluntary MNRs are non-statutory protected areas agreed by local sea-users and other interested parties.

maritime 1) Of or related to navigation, shipping.

2) Situated, living or found close to, and having a special affinity with, the sea. (Based on Makins 1991). Cf. 'marine'.

Mean High Water Springs (MHWS) The average of the heights of two successive high waters during those periods of 24 hours when the range of the tide is greatest (from Ministry of Defence 1987).

- Mean Low Water Springs (MLWS)** The average of the heights of two successive low waters during those periods of 24 hours when the range of the tide is greatest (from Ministry of Defence 1987).
- Mediterranean** (biogeographical) An extension of the Atlantic Ocean between Europe and Africa (Charton & Tietjen 1989) often used to describe a biogeographic region but which, according to Ekman (1953), is not a distinct faunal unit but enters into a greater one which includes the neighbouring parts of the Atlantic.
- Meiobenthos** Small benthic organisms which pass through a 1 mm mesh sieve, but are retained by a 0.1 mm mesh (from Lincoln & Boxshall 1987). Typically, they inhabit interstitial space in sediments. Cf. 'macrobenthos', 'microbenthos'.
- meiofauna** Small interstitial animals which pass through a 1 mm mesh sieve but are retained by a 0.1 mm mesh (from Lincoln & Boxshall 1987). Cf. 'macrofauna', 'microfauna'.
- Member State** A nation which is part of the European Union
- meroplankton** Temporary plankton consisting of pelagic stages of organisms which also have benthic stages. Mainly the larvae of sedentary organisms. (From Baretta-Bekker, Duursma & Kuipers 1992). Cf. holoplankton.
- mesohaline** Pertaining to brackish water between 5 ‰ and 18 ‰ salinity (from McLusky 1993).
- microbenthos** Microscopic benthic organisms less than 0.1 mm in length (Lincoln & Boxshall 1987.) Cf. 'macrobenthos', 'meiobenthos'.
- microfauna** Small animals less than 0.1 mm length, not visible to the naked eye (cf. 'macrofauna', 'meiofauna').
- microhabitat** A small part of the habitat which has distinct physical conditions, e.g. rock crevice.
- microscopic** Any organism which cannot be observed without the use of a microscope.
- mid-littoral, mid-shore, middle shore** General physical terms for the area of the shore midway between the high water and low water marks.
- moderately exposed** (wave exposure) Generally coasts facing away from prevailing winds and without a long fetch, but where strong winds can be frequent (from Hiscock 1990).
- modifier** A physical or biological feature or occurrence affecting a site which changes the characteristics of a habitat, e.g. sand-scour, wave surge, substratum mobility, freshwater run-off, grazing, or pollution.
- monitoring** The process of repetitive observation, for defined purposes, of one or more elements of the environment, according to prearranged schedules in space and time and using comparable methods for environmental sensing and data collection. Monitoring provides factual information concerning the present state and past trends in environmental behaviour (based on UNEP definition). The term is also applied to compliance monitoring against accepted standards to ensure that agreed or required measures are followed. Cf. 'surveillance'.
- mud** 1) Fine particles of silt and/or clay, < 0.0625 mm diameter (from Hiscock 1990, after Wentworth 1922).
2) Sediment consisting of inorganic and/or organic debris with particles in this category.
- mudflat** An expanse of mud or muddy sediment in the intertidal zone. The 1991 CORINE biotopes manual (Commission of the European Communities 1991) defines 'Mud flats and sand flats' as "Sands and muds, submerged for part of the tide, devoid of vascular plants, but usually coated by blue algae and diatoms." The EC Habitats Directive 'mudflats and sandflats not covered by seawater at low tide' uses the same definition (European Commission 1995).
- multivariate analysis** In statistics, a group of techniques for the simultaneous analysis of more than one independent variable (from Lincoln, Boxshall & Clark 1982). See 'cluster analysis'; 'ordination'.
- mutualism** (See 'symbiosis'.)
- narrows** A channel connecting two bodies of water, constricted by any of a range of physiographic features, resulting in increased current speeds (based on Earll & Pagett 1984).
- national importance: biotopes and areas** (conservation assessment) Biotopes or areas which are highly rated in the coastal sector will be described as of national importance if they are one of the best examples or only examples known in Great Britain. This was, until 1995, defined for communities as being, "outstandingly good examples of their type in Britain". National importance can apply to biotopes which are, or are likely to be, widely occurring in other similar physiographic situations in the north-eastern Atlantic. (Based on Hiscock & Mitchell 1989.) Cf. 'national importance: species', 'international importance', 'local importance', 'regional importance' (biotopes or areas and species).
- national importance: species** (conservation assessment) Considered to be those benthic species which are nationally rare or nationally scarce (q.v.). Until 1995, defined as: "Species which are recorded at only a few locations in Britain but are more widespread in other parts of the north-east Atlantic. Species recorded in higher numbers at locations under consideration than elsewhere in Britain or where the site is one of a very few locations where large quantities are recorded in Britain." (Based on Hiscock & Mitchell 1989.) A species may also be nationally important where a high proportion of the world population occurs in Britain, even though the species might be widespread in Britain. A nationally important species could be one whose numbers are declining rapidly. Cf. 'national importance: biotopes and areas', 'international importance', 'local importance', 'regional importance' (biotopes or areas and species).
- nationally rare** (species) For marine conservation purposes, these are regarded as species of limited national occurrence (q.v. rarity). By analogy with the approach adopted in British Red Data Books (for instance, Bratton 1991) but referring to sea areas within the three-mile limit of territorial seas, they are defined as those species known to occur in 0.5% or less (eight or fewer) of the 10 x 10 km squares containing sea within the three-mile limit of territorial seas for Great Britain (Sanderson in press). Cf. 'nationally scarce'.
- nationally scarce** (species) For marine conservation purposes, these are regarded as species of limited national occurrence (q.v. rarity). By analogy with the approach adopted in British Red Data Books (for instance, Bratton 1991) but referring to sea areas within the three-mile limit of territorial seas, they are defined as those species known to occur in 0.5 to 3.5% (nine to 55) of the 10 x 10 km squares containing sea within the three-mile limit of territorial seas for Great Britain (Sanderson in press). Cf. 'nationally rare'.
- Natura 2000** The European Community-wide network of protected sites established under the Birds Directive and the Habitats Directive (q.v.).

natural areas A concept, introduced by English Nature, for defining areas based on their landscape features, geology and biota and resulting in the definition of 92 terrestrial and 24 coastal/maritime Natural Areas in England (English Nature 1994). Maritime Natural Areas are based on coastal cell (q.v.) boundaries.

natural habitat As defined by the Habitats Directive (q.v.) "natural habitats means terrestrial or aquatic areas distinguished by geographic, abiotic and biotic features, whether entirely natural or semi-natural" (Commission of the European Communities 1992).

naturalness (conservation assessment) The extent to which a location and its associated biotopes is unaffected by anthropogenic activities.

natural range The geographical range of a species in recent times (since about 5,000 BP) but excluding any changes to that range as a result of human agency.

nature conservation The regulation of human use of the global ecosystem to sustain its diversity of content indefinitely (Nature Conservancy Council 1984).

nautical mile A unit of distance used in navigation, equivalent to 1° of latitude. The standard, or international, nautical mile is 1852 metres; the true nautical mile changes length with latitude, from 1861.7 metres at the equator to 1842.9 metres at the poles.

neap tide The astronomical tide of minimum range, occurring at the time of the first and third quarters of the moon.

nekton Actively swimming pelagic organisms able to move independently of water currents; typically within the size range 20 mm to 20 m (from Lincoln & Boxshall 1987).

neritic Referring to coastal waters overlying the continental shelf (0 m to 200 m below chart datum) (based on Baretta-Bekker, Duursma & Kuipers 1992).

netting Any of several methods of fishing for pelagic, demersal or epibenthic animals. Gill nets are hung vertically in the water; tangle nets are hung loosely to drag on the seabed. Stake nets are set in the intertidal zone or in shallow water. Set nets are left unattended for a period of time before being retrieved. (Based on Fowler 1989.) Cf. 'trawl'.

neuston 1) Organisms similar to plankton, that inhabit the surface film of open water.
2) The ecosystem of the surface film of open water.

niche The ecological resource occupied by a species in a community or ecosystem.

nomenclature The system of scientific names applied to taxa, or the application of these names (Lincoln & Boxshall 1987).

non-native (species) A species which has been introduced directly or indirectly by human agency (deliberate or otherwise), to an area where it has not occurred in recent times (about 5,000 years BP) and which is separate from and lies outside the area where natural range extension could be expected (i.e. outside its natural geographical range (q.v.)). The species has become established in the wild and has self-maintaining populations; the term also includes hybrid taxa derived from such introductions ('derivatives'). Cf. 'alien species'; 'introduced species'; 'recent colonist'; 'reintroduction'; 'translocation'.

North Atlantic Drift A north-easterly continuation of the warm Gulf Stream current into the eastern North Atlantic.

North Sea 1) As defined for the purposes of the North Sea Conferences it is southwards of 62°N, eastwards of 5°W and

northwards of 48° 30'N and includes the Kattegat defined by lines between coastal features (Oslo and Paris Commissions 1994 where it is described as the "Greater North Sea"). For the British coast, these are the seas to the east of Cape Wrath, and of Falmouth. This is the definition used by the JNCC for the *Directory of the North Sea coastal margin* (Doody, Johnston & Smith 1993) and elsewhere.

2) As defined by ICES: ICES subarea IV, being the sea east of 4° W to the north of Scotland, north of 51° N at the Straits of Dover, and south of 61° N.

north-eastern Atlantic North Cape to the Straits of Gibraltar, excluding the Baltic.

ob (north-west Scotland) A small (generally < 1 km), relatively shallow (generally < 10 m) ice-gouged basin, almost completely enclosed by surrounding land and connected to the sea by a generally intertidal sill and/or pass. The main body does not dry out at low tide. (Based on Earll & Pagett 1984 and Smith 1987.)

ocean 1) The body of salt water that covers more than 70% of the Earth's surface.

2) A very large stretch of sea, especially one of the five oceans of the world, as delineated by definable and independent land contours, bottom topography and wind and water circulation in both horizontal and vertical planes (based on Charton & Tietjen 1989).

oceanography The branch of science dealing with the physical, chemical, geological and biological features of the oceans and ocean basins (from Makins 1991).

oligohaline Pertaining to brackish water between 0.5 ‰ and 5 ‰ salinity (based on Carriker 1967, in McLusky 1993).

oligotrophic Having low primary productivity; used of water bodies or substrata low in nutrients.

omnivores Animals which feed on a mixed diet including plant and animal material (from Lincoln, Boxshall & Clark 1982).

open coast Any part of the coast not within a marine inlet, strait or lagoon, including offshore rocks and small islands (Hiscock 1990).

ordination A method of statistical analysis used for summarising similarities between communities or between taxa, by representing the subjects as points in a multidimensional space in such a way that the inter-point distances are inversely related to the similarities (based on Lincoln, Boxshall & Clark 1982).

organochlorine, chlorinated hydrocarbon A synthetic organic compound containing chlorine, highly toxic and the base for many pesticides. Includes PCBs (polychlorinated biphenyls).

organotin, tributyltin (TBT), triphenyltin A synthetic organic compound containing tin, used as a pesticide particularly to prevent the establishment of fouling organisms, but known to be toxic to certain species even at low concentrations. See 'imposex'.

oxycline A horizontal boundary layer in the water column, at which dissolved oxygen content changes sharply with depth.

paralytic shellfish poisoning (PSP) A serious illness affecting organisms with higher nervous systems (vertebrates) caused by eating shellfish which have themselves consumed toxin-producing micro-organisms (usually certain phytoplankton species) and have bioaccumulated the toxins.

parasite An organism that lives in or on another living organism (the host), from which it obtains food and other requirements.

- The host does not benefit from the association and is usually harmed by it. Cf. 'commensalism', 'symbiosis'.
- particle-size** (Of sediment particles) The main characteristic for classifying rock-derived sediments. By granulometric analysis (q.v.), it is possible to distinguish: clay (< 0.004 mm); silt (0.004-0.0625 mm); sand (0.0625 mm - 1 mm); granules (2-4 mm); pebbles (4 mm - 64 mm); cobbles (64-256 mm), and boulders (> 256 mm) (based on Wentworth 1922). The MNCR habitat classification combines or subdivides these categories to separate substratum types in a biologically meaningful way (see descriptions in this glossary and Hiscock 1990).
- particle-size distribution** Percentage (by weight) of sediment particles of each grain-size fraction.
- Particularly Sensitive Sea Area** An area that needs special protection through action by IMO because of its significance for recognised ecological or socio-economic or scientific reasons and which may be vulnerable to environmental damage by maritime traffic (International Maritime Organisation 1991).
- pass** (see 'narrows').
- peat** A pure organic soil, the result of plant material accumulating in waterlogged conditions (from Fitter & Manuel 1986).
- pebble** Rock particle 16-64 mm in diameter (from Hiscock 1990, based on Wentworth 1922).
- 'peeler' crab** A recently-moulted crab, normally a shore crab *Carcinus maenas*, which is still soft-shelled and suitable for use by anglers as bait.
- pelagic zone** The open sea and ocean, excluding the sea bottom. Pelagic organisms inhabit such open waters.
- percentage (%) cover** (MNCR field survey recording)
- (Of epibiota) The proportion of substratum occupied by epibenthic organisms.
 - (Of habitat) The proportion of different substrata available for colonisation by organisms.
- persistence** The continued presence of species or communities at a location (usually inferring in spite of disturbance or change in conditions) (cf. 'constancy', 'stability', 'resilience').
- peuplement** A French term used to describe polyspecific assemblages of organisms; it does not translate as 'population' (which refers to a single species), but neither does it infer any bond or interdependence between species. Thus, it comes closer to the broad definition of 'community' than to 'biocenosis'. (From Hiscock & Connor 1991.)
- photogrammetry** The process of making measurements from photographs.
- photophilous** Thriving in conditions of strong light (cf. 'sciophilous').
- photosynthesis** The biochemical process that utilises radiant energy from sunlight to synthesise carbohydrates from carbon dioxide and water in the presence of chlorophyll and other photopigments (based on Lincoln, Boxshall & Clark 1982).
- phycology** The scientific study of algae.
- phylum (pl. phyla)** A major taxonomic division containing one or more classes.
- phyto-** (as prefix, e.g. phytobenthos, phytoplankton). Pertaining to plants.
- phytoplankton** Planktonic plant life: typically comprising suspended or motile microscopic algal cells such as diatoms, dinoflagellates and desmids (based on Lincoln & Boxshall 1987).
- phytosociology** The study of vegetation, including the organisation, development, geographical distribution and classification of plant communities (from Lincoln & Boxshall 1987).
- pill** (Cornwall, west Wales) A regional term for an arm of an estuary.
- plankton** Organisms which drift in the water column and have limited powers of locomotion in comparison with the horizontal water movements. Many benthic animals have planktonic larvae which act as a dispersive phase. (See also holoplankton, meroplankton). (Based on Hawkins & Jones 1992.) Cf. 'nekton'.
- pock mark** A relatively small depression in the sea-floor, formed by expulsion of gas and/or liquid through the seabed displacing sediment and leaving a crater (based on Dando *et al.* 1991) (cf. 'bubbling reef').
- pocket beach** A beach contained within bounding headlands; a cove (based on Pethick 1984).
- poikilohaline** A term used of organisms having body fluids that conform to external changes in salinity (from Lincoln, Boxshall & Clark 1982).
- poll** A relatively short, relatively shallow fjord, with a sill at its entrance at a depth less than that of the pycnocline (q.v.) (based on Earll & Pagett 1984).
- pollution** (marine) "The introduction by man, directly or indirectly, of substances or energy into the marine environment (including estuaries) resulting in such deleterious effects as harm to living resources, hazards to human health, hindrance to marine activities including fishing, impairment of quality for use of seawater and reduction of amenities" (Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection - GESAMP - 1995).
- polyhaline** Pertaining to brackish water having a salinity between 18 ‰ and 30 ‰ (from McLusky 1993).
- pond** (coastal) A coastal body of water similar to a lagoon, but lacking one or more of the criteria defining a lagoon according to the definition in Barnes (1980), particularly with reference to restricted water exchange with the adjacent sea. In terms of environmental variables and biota, they are very similar to lagoons. Many coastal ponds are artificial. (Definition based on description in Shearer & Shearer 1989.) Cf. 'lagoon'.
- population** All individuals of one species occupying a defined area and usually isolated to some degree from other similar groups (from Lincoln & Boxshall 1987).
- potting** The setting of traps (pots) on the seabed to fish for lobsters, crabs, etc. (see also 'creeling').
- precautionary principle** A principle underlying the concept of sustainable use of resources, which implies that:
- prudent action be taken in the absence of scientific certainty;
 - the balance of the burden of proof should be to show that no irreversible harm will occur rather than to prove that significant damage will occur;
 - environmental well-being be given legitimate status and best-practice techniques be developed.
- (From WWF *Marine Update* No. 14, April 1994).
- prelittoral region** A physiographic term applied to the offshore regions of the English Channel off the French coast with a very shallow (i.e. low gradient) slope (based on Cabioch 1968) (cf. 'frontolittoral').
- production** (primary) The rate at which energy is stored by photosynthetic (or chemosynthetic) action by producer

organisms (plants and bacteria) in the formation of organic substances.

protists Any organism belonging to the kingdom Protista, including bacteria, protozoans, unicellular algae and fungi, regarded as distinct from plants and animals (from Makins 1991).

pycnocline A horizontal boundary layer in the water column at which water density changes sharply with depth, as a result of either a halocline or a thermocline, or both acting together. See 'stratification'.

quadrat A delimited area for sampling fauna or flora, usually taken randomly within the study area, and typically consisting of a square frame (from Lincoln & Boxshall 1987).

qualitative Descriptive; non-numerical (from Lincoln, Boxshall & Clark 1982) (cf. 'quantitative').

quantitative Numerical; based on counts, measurements, ratios or other values (from Lincoln, Boxshall & Clark 1982) (cf. 'qualitative', 'semi-quantitative').

rapids Strong tidal streams resulting from a constriction in the coastline at the entrance to, or within the length of, an enclosed body of water such as a se Loch. Depth is usually shallower than 5 m (based on Hiscock 1990).

rarity (conservation assessment) Seldom found. 'Rarity' needs to take account of the type of distribution and abundance which would be expected of a particular habitat, community, taxonomic group or species and any historical information about past numbers.

rarity (species) "The current status of an organism which, by any combination of biological or physical factors, is restricted either in numbers or area to a level that is demonstrably less than the majority of other organisms of comparable taxonomic entities" (Gaston 1994). (See also 'nationally rare', 'nationally scarce'.)

recent colonist A species which, without any human intervention, has extended its natural geographical range (q.v.) in recent times and which has established new self-maintaining and self-regenerating populations in the wild (cf. 'non-native'; 'vagrant').

recruitment (population biology) Term used for the arrival of young in a given population per unit of time (based on Baretta-Bekker, Duursma & Kuipers 1992).

Red Data Book species A species listed in catalogues published by the IUCN or by national agencies, listing species which are rare, endangered or vulnerable to extinction globally or nationally.

Red list species A species identified as 'Extinct', 'Extinct in the wild', 'Critically endangered', 'Endangered', 'Vulnerable', 'Lower risk', 'Data deficient' or 'Not evaluated' according to criteria laid down in the *IUCN Red List Categories* (IUCN 1994).

reef 1) A ridge of rock or coarse material, the top of which lies close to the surface of the sea, and may be exposed at low tide.
2) An elevated structure on the seabed built by calcareous or other concretion-forming organisms, or by chemical precipitation.

3) An artificial structure deliberately constructed or placed on the seabed with the intention of influencing the local environment, for example to enhance fisheries or absorb wave energy.

4) As defined for the EC Habitats Directive, 'reefs' are "Submarine, or exposed at low tide, rocky substrates and biogenic concretions which arise from the sea floor in the sublittoral zone but may extend into the littoral zone to where there is an uninterrupted zonation of plant and animal

communities. These reefs generally support a zonation of benthic communities of algae and animal species including concretions, encrustations and corallogenic concretions." (European Commission 1995.)

refugium (pl. refugia) A geographical area which has remained isolated from, or unaltered by, climatic or other changes affecting surrounding regions, and that therefore provides a haven for relict (q.v.) species or populations.

regional importance: biotopes and areas (conservation assessment) Biotopes or areas which are widespread in similar situations but for which this is a good example in the coastal sector (q.v.) under consideration. Regional importance was, until 1995, defined for communities as being "Communities which are present in similar physiographic situations in Britain but which are outstandingly good examples of their type in the location under consideration, or are as good as examples of similar communities present elsewhere in Britain. Communities recorded at only a few locations in the same biogeographic region" (Davies *et al.* 1990, based on Hiscock & Mitchell 1989). Cf. 'regional importance: species', 'international importance', 'local importance', 'national importance' (biotopes or areas and species).

regional importance: species (conservation assessment) Species which are unrecorded or recorded at only a few locations in similar physiographic situations in other parts of Britain. Species recorded in higher abundance in the site under consideration than in any other part of the region. Species which are at the geographical limits of their distribution might be included in this category. (Davies *et al.* 1990, based on Hiscock & Mitchell 1989). Cf. 'regional importance: biotopes or areas', 'international importance', 'local importance', 'national importance' (biotopes or areas and species).

regression 1) Retreat of the sea from land areas by fall of sea-level (eustasy) or uplift of the land mass (isostasy) (based on Baretta-Bekker, Duursma & Kuipers 1992).
2) A statistical description of the relationship between two or more variables.

Regulation (European) European Union legislation that has legal force in all Member States (Anon. 1994) (cf. 'Directive').

reintroduction A species which has been reintroduced by human agency, deliberate or otherwise, to an area within its natural geographical range (q.v.) but where it had become extinct in historical times.

relict (species) A species believed to have been previously more widely distributed but now restricted to a limited number of locations where populations are probably self-sustaining, for example, *Thyasira gouldi*, *Leptopsammia pruvoti*.

remote sensing Obtaining information about the earth, its atmosphere, sea surface and shallow seas from satellite observation or aerial survey. In the context of the marine environment, remote sensing can include acoustic techniques to survey the seafloor and water column as well as photographic surveys by remotely-operated vehicles.

representativeness (conservation assessment) Typical of a feature, habitat or assemblage of species. Representative examples are identified from the range of natural or semi-natural habitats and associated communities (biotopes) within a biogeographically distinct area or the boundaries of a national territory.

resilience The ability of an ecosystem to return to its original state after being disturbed (from Makins 1991). (cf. 'constancy',

- 'persistence', 'stability').
- restocking** (See 'translocation')
- ria** A drowned river valley in an area of high relief; most have resulted from the post-glacial rise in relative sea-level (based on Allaby & Allaby 1990). As defined for the EC Habitats Directive, 'rias and voes' are "drowned river valleys (not of glacial origin) with relatively deep narrow well-defined channels which are predominantly marine throughout".
- richness (species)** The number of species in a community, habitat or sample (cf. 'diversity'; 'evenness').
- ripple** A small ridge < 10 cm high formed on top of a layer of sediment (usually sand) as a result of wave action or water currents (cf. 'dune').
- rockmill** A hollow or pit in a rock surface within which pebbles or boulders are moved by currents or wave action, causing scouring and deepening of the hollow, and forming a smooth surface uncolonised by benthic organisms.
- rockpool** A depression in the littoral zone of a rocky seashore, where, during low tide, seawater is left behind (based on Baretta-Bekker, Duursma & Kuipers 1992).
- RoxAnn[®]** An acoustic ground discrimination system, based on SONAR, which provides information on seabed relief and features (cf. 'acoustic mapping').
- r-strategy** A life strategy which allows a species to deal with the vicissitudes of climate and food supply by responding to suitable conditions with a high rate of reproduction. R-strategists are continually colonising habitats of a temporary nature. (From Baretta-Bekker, Duursma & Kuipers 1992.) Cf. 'k-strategy'.
- sailein** (north-west Scotland) A shallow, sheltered area of sediment, which more or less dries out at low tide and is subject to estuarine influence; usually with a constricted entrance to the sea, but not with a sill (based on Smith 1987) (cf. 'ob').
- saline** Salty.
- salinity** Measure of the concentration of dissolved salts in seawater, normally expressed as parts per thousand (‰). Freshwater is regarded as < 0.5 ‰ (limnetic), seawater as > 30 ‰ (euhaline), and brackish water as intermediate, including oligohaline, mesohaline and polyhaline waters (based on McLusky 1993).
- saltmarsh** Areas of alluvial or peat deposits, colonised by herbaceous and small shrubby terrestrial vascular plants, almost permanently wet and frequently inundated with saline waters (from Long & Mason 1983).
- sampling** The selection of a set of data, or the collection of a quantity of material, or of a set of individuals from a population with the purpose of measuring a given characteristic of that sample (based on Dooley & Kirkpatrick 1993).
- sand** Particles defined in three size categories based on Wentworth (1922): very coarse sand and granules (1-4 mm); medium and coarse sand (0.25-1 mm); very fine and fine sand (0.062-0.25 mm) (from Hiscock 1990).
- sandbank** Sand which rises from a level seabed towards the surface, often levelling-off in shallower depths. As defined for the EC Habitats Directive, 'sandbanks which are slightly covered by seawater all the time' are: "Sublittoral sandbanks, permanently submerged. Water depth is seldom more than 20 m below Chart Datum". They can be non-vegetated or vegetated and can include free-living species of the Corallinacea family. (European Commission 1995.)
- sandflat** An expanse of sand of sandy sediment in the intertidal zone. For definition under the EC Habitats Directive, see 'mudflat'.
- sarn** (west Wales) A boulder or cobble reef derived from glacial moraine, lying at shallow depth (maximum depth approximately 10 m below chart datum), completely covered at low tide, and roughly linear in shape (lit.: causeway) (based on Mills 1991a).
- scalp** (Scotland: scaup) A low bank in the intertidal or shallow subtidal; a mussel-bed.
- scar** (Scotland: scaur) A reef, especially one bordered by sediment.
- scavenger** Any organism that feeds on dead organic material.
- sciophilous** Thriving in shaded situations, or in habitats of low light intensity (from Lincoln, Boxshall & Clark 1982) (cf. 'cryptic', 'photophilous').
- scour** The effect of abrasion, usually by sand or gravel, on the seabed.
- seagrasses** Higher plants (angiosperms) that are adapted to living submerged in seawater. They are not true grasses, but belong to the order Helobiae, and are related to pondweeds. Two genera are present in British coastal waters: *Zostera* (eelgrass), a marine genus, and *Ruppia*, a brackish-water genus.
- seabed** The sea floor.
- sealoch, sea lough** (Scotland, Ireland) A marine inlet (q.v.) which has fjordic or fjardic features, entered by the tide (on each cycle), and with a salinity generally greater than 30 ‰. Brackish conditions may be periodically established, particularly in the surface layers. (Based on Earll & Pagett 1984.) As defined for the EC Habitats Directive, 'open sealochs' are "simple glacial features which are longer than they are wide, have no entrance sill and in which the seabed slopes gradually towards the head". See also 'fjard', 'fjord'.
- sector (MNCR)** See 'coastal sector'.
- sedentary** Attached to a substratum but capable of movement across (or through) it (cf. 'sessile').
- sediment** Particulate solid material accumulated by natural processes (from Baretta-Bekker, Duursma & Kuipers 1992).
- sedimentology** The scientific study of sediments.
- semi-quantitative** Measurement based on estimates or rough counts of relative quantity (density, cover) - e.g. abundance scales (cf. 'quantitative').
- sensitivity (conservation assessment)** The intolerance of a habitat, community or individual (or individual colony) of a species to damage, or death, from an external factor. See 'fragility', 'vulnerability'.
- sessile** Permanently attached to a substratum (cf. 'sedentary').
- sheltered** (wave exposure) Coasts with a restricted fetch and/or open water window. Coasts can face prevailing winds but with a short fetch (< 20 km) or extensive shallow area offshore, or may face away from prevailing winds (from Hiscock 1990).
- shingle** Beach pebbles (q.v.), normally well-rounded as a result of abrasion. In relation to coastal vegetated shingle structures, 'shingle' is considered as any sediment which has a grain size of between 2 and 200 mm (Sneddon & Randall 1993).
- shore** The land along the edge of a body of water.
- shore backing** The terrestrial habitat immediately behind the shore.

- shore platform** A surface eroded by wave action, forming a flat rock platform in the intertidal zone (based on Ritchie, Smith & Rose 1978). The more correct term for 'wave-cut platform' or 'abrasion platform'.
- sill** Lowest point on a submarine ridge or saddle at a relatively shallow depth, separating a basin from an adjacent sea or another basin (from Baretta-Bekker, Duursma & Kuipers 1992). In sealochs, sills are structures commonly formed by glaciation, found at the mouth or elsewhere along the length of the loch. Such a threshold can limit water exchange.
- silt** Fine-grained sediment particles ranging in size from 0.004 mm to 0.0625 mm (based on Wentworth 1922).
- site** 1) As used for MNCR field surveys: the general location surveyed and at which separate stations are sampled (cf. 'station').
2) As used in the EC Habitats Directive: a geographically defined area whose extent is clearly delineated (Commission of the European Communities 1992).
3) A Site of Special Scientific Interest or other designated area.
- site of Community importance (SCI)** (Habitats Directive) A site which, in the biogeographical region to which it belongs, contributes significantly to the maintenance or restoration at a favourable conservation status of a natural habitat type in Annex I or of a species in Annex II of the Habitats Directive and may also contribute significantly to the coherence of Natura 2000 referred to in Article 3, and/or contributes significantly to the maintenance of biological diversity within a biogeographic region or regions concerned (Commission of the European Communities 1992). (The designation is to be applied to sites submitted by the UK government to the European Commission but before they are approved by the EU as special areas of conservation. SCI will be protected under statute).
- Site of Special Scientific Interest (SSSI)** An area of land or water notified by the Nature Conservancy Council or its successor agencies under the Wildlife and Countryside Act 1981 as being of special nature (can include geological) conservation importance.
- skere, skerr** (north-eastern England and south-eastern Scotland) A regional term for a reef.
- skerry** Low-lying rocky island or reef, often without terrestrial vegetation, and frequently swept by the sea (based on Scott & Palmer 1987).
- slack water** Period in a tidal cycle usually between flood- and ebb-tide, when the strength of tidal streams is near zero.
- slate** A rock particle which is flattened and thin and corresponds to the diameter of a cobble (64-256 mm) (based on Hiscock 1990). Also describes the type of rock which constitutes such loose-lying substrata.
- sociation** A term used to describe a sub-unit of an association, being a combination of stratal units (from Hiscock & Connor 1991, based on Cotton 1912).
- sound** Any deep (> 5 m depth) tidal channel between two bodies of open coastal water. Strictly, a sound is a wide expanse of water (from Earll & Pagett 1984).
- Special Area of Conservation (SAC)** A site of [European] Community importance designated by the [EU] Member States through a statutory, administrative and/or contractual act where the necessary conservation measures are applied for the maintenance or restoration, at a favourable conservation status, of the natural habitats and/or the populations of the species for which the site is designated (Commission of the European Communities 1992). (This status is achieved by sites adopted by the European Commission.)
- Special Protection Area (SPA)** A site of European Community importance designated under the Wild Birds Directive (Commission of the European Communities Council Directive 79/409/EEC of 2 April 1979 on the Conservation of Wild Birds).
- spit** (geomorphological) A low, elongated accumulation of sediment such as sand or shingle, projecting from the shore into a water body (based on Allaby & Allaby 1990) (cf. 'bar', 'tombolo').
- splash-zone** An informal term for the upper supralittoral fringe, the lower terrestrial zone.
- spring tide** The astronomical tide of maximum range, occurring at or just after new moon and full moon. The most marked spring tides (equinoctial springs) occur at the spring and autumn equinoxes.
- stability** The ability of an ecosystem to resist change (from Makins 1991) (cf. 'constancy', 'persistence', 'resilience').
- station** The location at which a sample is taken or an observation or record is made. 'Stations' may consist of a series of replicate samples. Cf. 'site'.
- stenohaline** Tolerance of only a narrow range of salinities (from Lincoln & Boxshall 1987).
- stenothermal** Tolerance of a narrow range of temperatures.
- stochastic** (statistics) (Of a random variable) Having a probability of distribution, usually with finite variance.
- strait** Any deep (> 5 m) tidal channel between two bodies of open coastal water. Strictly, a strait is the stretch of water between an island and its mainland (or adjacent islands). (From Earll & Pagett 1984.)
- strandline** A line on the shore comprising debris deposited by a receding tide; commonly used to denote the line of debris at the level of Extreme High Water (from Lincoln & Boxshall 1987).
- Strategic Environmental Assessment (SEA)** The formalised, systematic and comprehensive process of evaluating the environmental impacts of a policy, plan or programme and its alternatives, including the preparation of a report on the evaluation and the use of the findings in publicly-accountable decision-making (Pritchard 1993) (cf. 'Environmental Assessment').
- stratified** (sampling) The selection of sample sites from situations of the same environmental character. 'Stratified random sampling' is the sampling method whereby an area is divided up into a number of blocks (strata) of the same size and samples are taken at random within each block (based on Grieg-Smith 1983). Stratified random sampling is often applied more loosely by selecting sample locations at random from all of the examples of a particular major habitat type (for instance, all of the locations where a 1 km Ordnance Survey grid intersect crosses an exposed sandy beach).
- stratification** (ecological) The structuring of a community or a habitat into superimposed horizontal strata, or layers (from Lincoln & Boxshall 1987).
- stratification** (water column) The presence of a horizontal boundary layer in the water-column, with a distinct change in one or more physico-chemical characteristics. See 'halocline', 'oxycline', 'pycnocline' and 'thermocline'.
- stratum** (pl. *strata*) (ecological) A horizontal layer of vegetation within a stratified plant community (from Lincoln & Boxshall 1987).
- struth, sruth** (north-west Scotland) Tidal rapids (lit.:

- outpouring).
- sublittoral** The zone exposed to air only at its upper limit by the lowest spring tides, although almost continuous wave action on extremely exposed coasts may extend the upper limit high into the intertidal region. The sublittoral extends from the upper limit of the large kelps and includes, for practical purposes in nearshore areas, all depths below the littoral. Various subzones are recognised. (Based on Hiscock 1985.) Cf. 'subtidal'.
- sublittoral fringe** The upper part of the sublittoral zone which is uncovered by the tide. On hard substrata, the zone is characterised by the kelps *Laminaria digitata* and *Alaria esculenta*. The lower limit of this zone is marked by the upper limit of the truly sublittoral kelp *Laminaria hyperborea*. This species assemblage does not occur on all British coasts. (Based on Lewis 1964.) Cf. 'lower shore'.
- substratum (pl. substrata)** Material available for colonisation by plants and animals; a more correct term in this context than 'substrate'.
- subtidal** A physical term for the seabed below the mark of Lowest Astronomical Tide (cf. 'sublittoral').
- subzone** (biological) Sub-divisions of the main zones apparent on hard or stable substrata, namely: the supralittoral; upper and lower littoral fringe; upper, mid- and lower eulittoral; sublittoral fringe; upper and lower infralittoral; upper and lower circalittoral. (See separate entries for these terms).
- succession** Sequential development of plant or animal communities through time.
- suction sampler** A benthic sampling device which uses suction to draw sediment and its fauna or biota scraped from rocks into a tube leading to some form of self-sieving collector (based on Holme & McIntyre 1984.)
- supralittoral** The lower terrestrial zone, characteristically dominated by orange and white-to-grey lichens on hard substrata with scattered salt-tolerant higher plants and mosses (from Hiscock 1990).
- surge gully** A narrow marine inlet on a small scale, usually formed by erosion of a rocky shoreline on exposed coasts. Their aspect, facing into waves, and their funnel effect, means that waves entering them become higher and of shorter wavelength, causing back-and-forth or multi-directional water movements of considerable force.
- surveillance** A procedure by which a series of surveys is conducted in a sufficiently rigorous manner for changes in the attributes of a site (or species) to be detected over a period of time. Surveillance is often conducted to identify normal background variation ('noise') in order that abnormal changes can be identified by a monitoring programme (from Marine Conservation Monitoring Workshop, January 1993.) The term is also applied to compliance surveillance to ensure that agreed or required measures are followed. See also 'survey'. Cf. 'monitoring'.
- survey** An inventory of the attributes of a site, area or region in terms of habitat and associated organisms (or of the distribution and/or autecological characteristics of selected species), usually by means of a standardised procedure (based on Marine Conservation Monitoring Workshop, January 1993.)
- suspension feeders, suspensivores, filter-feeders** Any organisms which feed on particulate organic matter, including plankton, suspended in the water column (from Lincoln, Boxshall & Clark 1982).
- sustainability** (environmental) Maintaining the environment's natural qualities and characteristics and its capacity to fulfil its full range of functions, including maintenance of biodiversity (from English Nature, *Planning for environmental sustainability*, June 1994).
- sustainable development** "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development 1987 (Brundtland Report)).
- swell** Sea waves that have left the area where they were generated by the wind, or that have remained after the generating wind has disappeared (from Baretta-Bekker, Duursma & Kuipers 1992.)
- symbiosis** A close association of two organisms; it can include commensalism, in which one species benefits with no harm to the other, and mutualism, in which both species benefit (cf. 'parasite').
- synecology** The study of the ecology of groupings of organisms, populations, communities or systems; ecological sociology (based on Lincoln, Boxshall & Clark 1982) (cf. 'autecology').
- talus** A sloping mass of coarse rock fragments accumulated at the foot of a cliff or slope, which has originated from erosion of the rock-face above (based on Allaby & Allaby 1990 and Stiegeler 1976) (cf. 'boulder tumble').
- taxon (pl. taxa)** A taxonomic group of any rank, including all its subordinate groups; may be a single species or a group of related species, e.g. genus, class, order, etc., considered to be sufficiently distinct from other such groups to be treated as a separate unit (based on Lincoln & Boxshall 1987 and Fitter & Manuel 1986).
- taxonomy** The branch of biology concerned with the classification of organisms into groups (taxa) based on similarities of structure, origin, etc.
- territorial waters** The seas over which a nation exercises jurisdiction and control, but within which other states have certain rights, notably for innocent passage of vessels. In UK law, the landward limit of UK territorial seas is defined as "the low water line around the coast" (Territorial Waters Order in Council 1964); the seaward limit is 12 nautical miles offshore from the landward limit.
- terrestrial** Living on, or referring to, land.
- thermal pollution** Anthropogenic heat input to natural systems, e.g. the discharge of heated cooling water.
- thermocline** A horizontal boundary layer in the water column in which temperature changes sharply with depth (based on Lincoln & Boxshall 1987.)
- thixotropic** A sediment containing interstitial water, which becomes liquid as a result of agitation or pressure.
- Tidal Freshwater Area (TFA)** The upper part of an estuary, which is subject to tidal influence but to which seawater does not normally penetrate.
- tidal race** An exceptionally strong tidal stream, usually caused by the constriction of water passing round a headland, or where tidal streams from different directions converge (Ministry of Defence 1987).
- tidal range** Generally the difference in water height between Extreme High Water Springs and Extreme Low Water Springs. Daily tidal range is the difference between high tide and the next low tide. Estuarine tidal range is classified in three categories according to average spring tidal range:

- a) macrotidal: tidal range greater than 4 m;
- b) mesotidal: tidal range between 2 m and 4 m;
- c) microtidal: tidal range less than 2 m (Davidson & Buck in prep.).

tidal stream The alternating horizontal movement of water associated with the rise and fall of the tide (from Lincoln & Boxshall 1987) (cf. 'current').

tide The periodic vertical movement of water level with respect to some point on land. See 'astronomical tide'.

till (boulder clay) Collective term for typically unstratified and unsorted sediments deposited by the direct action of glacial ice without the intervention of water. Boulder clay consists of a clay-dominated matrix containing stones and boulders of varying size. (Based on Allaby & Allaby 1990.)

tombolo A spit (q.v.) that links an island to the mainland or to another island, formed by deposition when waves are refracted round the island (from Allaby & Allaby 1990).

toxicology The branch of science concerned with poisons, their nature, effects and antidotes (from Makins 1991). 'Ecotoxicology' is the application of toxicology to the natural environment.

training wall A wall or embankment built within an estuary to direct current flow and stabilise a shifting channel.

transect A defined line or strip across a site, along which observations or experiments are made or stations located.

transgression Spread or extension of the sea over a land area as a result of sea-level rise (eustasy) or, locally, by subsidence of the land (isostasy).

translocation (restocking) The deliberate movement of a species by humans from one location to another within its natural geographical range (q.v.) in order to enhance the size or increase the gene pool of the receiving population.

trawl Equipment towed behind a vessel for commercial fishing or scientific collecting. Bottom trawls collect demersal species; midwater trawls collect pelagic species. Cf. 'dredge', 'netting'.

tributyl tin (TBT) (See 'organotin').

trigging (Cornwall) Cockle-collecting. A local term used in the Helford estuary.

turf The lowest stratum of erect branching or filiform species.

typicalness (conservation assessment) See 'Representativeness'.

ultra-sheltered (wave exposure) Fully enclosed coasts with a fetch measured in tens or at most a few hundred metres (from Hiscock 1990).

understorey, undergrowth layer Organisms occurring under the main canopy of algae, especially of kelps (from Hawkins & Jones 1992).

upper shore An informal physical term for the area of the shore around the high tide level.

vadill (Shetland) A small, sheltered tidal lagoon, generally formed at the head of a voe (q.v.) (from Scott & Palmer 1987) (cf. 'houb').

vagile Clinging; sedentary (from Zibrowius 1991) (cf. 'sessile').

vagrant (species) Individuals of a species which, by natural means, move from one geographical region to another outside their usual range, or away from usual migratory routes, and which do not establish a self-maintaining, self-regenerating population in the new region (cf. 'alien species'; 'recent colonist').

very exposed (wave exposure) 1) Open coasts which face into prevailing winds and which receive wind-driven waves and oceanic swell without any offshore obstructions for several hundred kilometres, but where deep water is not close to the shore (50 m depth contour further than about 300 m).

2) Open coasts adjacent to extremely exposed sites but which face away from prevailing winds.

(From Hiscock 1990.)

very sheltered (wave exposure) Coasts with a fetch less than about 3 km where they face prevailing winds or about 20 km where they face away from prevailing winds, or which have offshore obstructions such as reefs or a narrow (< 30°) open water window (based on Hiscock 1990.)

voe (Shetland) A ria (q.v.).

vulnerability Describes the exposure of a habitat, community or individual (or individual colony) of a species to an external factor to which it is sensitive. See 'Sensitivity'.

Vulnerable (IUCN Red List categories) A taxon which is not 'Critically endangered' (q.v.) or 'Endangered' (q.v.) but is facing a high risk of extinction in the wild in the medium term future (IUCN 994) (cf. 'Extinct', 'Critically endangered', 'Endangered').

water quality 1) The nature of a body of water in terms of its physical (for instance, suspended sediment load) and chemical (for instance, salinity) characteristics.

2) The degree of contamination of water. See 'classification (water quality)'.

Wentworth scale A scale of sediment particle size categories described by Wentworth (1922), based on a doubling above, or halving below, a fixed reference diameter of 1 mm, and with descriptive class terms ranging from boulder (> 256 mm) to clay and colloid (< 0.004 mm). This scale is used as the basis of the MNCR and most other sediment classifications. The Wentworth scale is transformed to the phi (ϕ) scale for statistical analysis of sediments.

zonation The distribution of organisms in distinctive belts on the shore, in the sublittoral, due to gradients in environmental factors (cf. 'gradient').

zooid One of the individual animals connected together in a common mass constituting a colony (based on Fitter & Manuel 1986).

zooplankton The animals of the plankton.

Acknowledgements for glossary of marine ecological terms

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Dictionary of abbreviations, acronyms, initials and projects

Conservation has produced a huge number of terms which lend themselves to abbreviation, and there are a number of dictionaries which explain them (see, for example, Padgham 1992). The current dictionary concentrates on terms which are likely to be found either in the MNCR publications series (including area summaries) or in other publications produced by JNCC's Marine Conservation Branch. For non-statutory sites designated by local authorities and county wildlife trusts, only the abbreviations 'SINC', 'SNIC' and 'RIGS' are given here, as these are in widest use; but there are many alternatives. Terms are briefly explained where they are not referenced in the glossary above and are unclear. The inclusion here of environmental consultants and other commercial organisations merely represents some of the many contractors who have been involved with NCC and JNCC in the past, and whose names are regularly abbreviated in reports: the inclusion or exclusion of any such organisation is not intended as an endorsement or otherwise of their work.

acd above chart datum

ACME Advisory Committee on the Marine Environment (an ICES committee)

AES Analytical and Environmental Services Ltd

AGLV Area of Great Landscape Value

AIDEnvironment Advice and Research for Development and Environment (a Netherlands partner in the BioMar programme)

ANACAT anadromous and catadromous fish (a term used in the EC Habitats Directive)

AONB Area of Outstanding Natural Beauty

AOS Area of Search (in relation to SSSI selection)

AOSP Area of Special Protection (formerly Statutory Bird Sanctuary)

AREV Advanced REVelation (a database management system)

ASCOBANS Agreement on the Conservation of Small Cetaceans in the Baltic and North Sea

ASFC Association of Sea Fisheries Committees

asl above sea level

ASMO ASsessment and MONitoring group (of the Oslo and Paris Conventions)

ASSG Association of Scottish Shellfish Growers

ASSI Area of Special Scientific Interest (Northern Ireland)

ATBA Areas To Be Avoided (by shipping)

bcd below chart datum

BEDMAN Benthic Data MANAGEMENT (A database developed at the Dutch National Institute for Coastal and Marine Management and the Netherlands Institute of Ecology to hold survey data on macro- and meiobenthic fauna from the North Sea.)

BGS British Geological Survey

BIOFAR Investigations of the benthic fauna of the Faroe Islands

BIOICE Investigations of the benthic fauna of Iceland

BioMar (Not an acronym) Marine coastal zone management: Identification, description and mapping of biotopes (an EU LIFE-funded project). (Not to be confused with the USA biodiversity and systematics research programme BioMar: BIOlogical diversity in MARine systems).

BM(NH) British Museum (Natural History) (now the Natural History Museum)

BMLSS British Marine Life Study Society

BOD biochemical oxygen demand

BODC British Oceanographic Data Centre

BoEE Birds of Estuaries Enquiry (a British Trust for Ornithology monitoring project, now incorporated into the Wetland Bird Survey)

BRC Biological Records Centre

BRRR Banded Ranked Relative Richness

BSAC British Sub-Aqua Club

bsl below sea-level

c (as prefix, e.g. cSAC) candidate

CA correspondence analysis

ca country agency - one of the statutory national nature conservation bodies, the Countryside Council for Wales, English Nature or Scottish Natural Heritage

CAMEO Computer-Aided Management of Emergency Operations

CANOCO CANOnical Community Ordination (a multivariate analytical programme)

CASE Computer-Aided Site Evaluation

CBRU Cornish Biological Records Unit

CCB Coastal Conservation Branch (of JNCC)

CCBR Co-ordinating Commission for Biological Recording

CCMS Centre for Coastal and Marine Sciences (of NERC)

CCS Countryside Commission for Scotland (now part of Scottish Natural Heritage)

CCTA The UK Government Centre for Information Systems

- CCW** Countryside Council for Wales
- CEC** 1) Commission of the European Communities; the European Commission;
2) Council of the European Communities;
3) Critical Environmental Capital;
4) Crown Estates Commissioners.
- CERCI** Centre for European Research into Coastal Issues (University College Scarborough)
- CEU** Commission of the European Union; the European Commission
- CFP** Common Fisheries Policy (of the European Union)
- CIRC** Centre for Industrial Research and Consultancy (University of Dundee)
- CIRU** Climate Impact Research Unit
- CITES** Convention on International Trade in Endangered Species
- CNCC** Council for Nature Conservation and the Countryside (Northern Ireland)
- Coastwatch** An NCC and JNCC coastal survey project
- CoCo** Countryside Commission
- COREDATA** Conservation Related Database (NCC)
- CORINE** Co-ORDination of INFORMATION on the Environment (an EU biotopes classification initiative)
- COST** COoperation européenne dans la domaine de la recherché Scientifique et Technique (an EU forum for European scientific research co-operation.)
- CPA** coastal protection area
- CR&MG** Coastal Research and Management Group
- CSD** Chief Scientist Directorate (of the Nature Conservancy Council)
- CSGBI** Conchological Society of Great Britain and Ireland
- CSU** Coastal Surveillance Unit (of UCNW)
- CTOG** Coastal Technical Officers' Group (of the statutory nature conservation agencies)
- CWT** County Wildlife Trust
- CZM** Coastal Zone Management
- DAFS** Department of Agriculture and Fisheries for Scotland (until recently, Scottish Office Agriculture and Fisheries Department, since November 1995 Scottish Office Agriculture, Environment and Fisheries Department)
- DANI** Department of Agriculture for Northern Ireland
- DBMS** DataBase Management Software
- DCA** Detrended Correspondence Analysis (DECORANA)
- DECORANA** DEtrended CORrespondence ANALYSIS (a multivariate analytical programme)
- DFR** Directorate of Fisheries Research (of MAFF)
- DML** 1) Dove Marine Laboratory, Cullercoats
2) Dunstaffnage Marine Laboratory, Oban
- DNSCM** *Directory of the North Sea Coastal Margin* (Doody, Johnston & Smith 1993)
- DoE** Department of the Environment
- DoE(NI)** Department of the Environment for Northern Ireland
- DTI** Department of Trade and Industry
- DUS** Dorset Underwater Survey
- E** east
- EA** 1) Environmental Assessment
2) Environment Agency
- EAU** Environmental Advisory Unit (University of Liverpool) (now SGS Environment Ltd)
- EBSA** Estuarine and Brackish-Water Sciences Association (now Estuarine and Coastal Sciences Association)
- EC** 1) European Commission; the Commission of the European Communities;
2) European Community (now referred to as the European Union)
- ECN** Environmental Change Network
- ECSA** Estuarine and Coastal Sciences Association
- EEA** European Environment Agency
- EEC** European Economic Community (later the European Community, now the European Union)
- EEZ** Exclusive Economic Zone
- EHWS** Extreme High Water Springs (tides)
- EIA** Environmental Impact Assessment or Analysis
- EIR** Environmental Information Regulations
- EIS** Environmental Impact Statement
- ELOIS** European Land-Ocean Interaction Study
- ELWS** Extreme Low-Water Springs (tides)
- EMS** European Marine Site
- EN** English Nature
- ENSIS** English Nature SSSI Information System
- ERL** Environmental Resources Ltd
- ES** Environmental Statement
- ESA** Environmentally Sensitive Area
- ESAD** European Seabirds at Sea Database
- ESGOSS** Ecological Steering Group on the Oil Spill in Shetland
- EQO** Environmental Quality Objective
- EU** European Union
- EUCC** European Union for Coastal Conservation
- FSC** Field Studies Council
- FSCRC** Field Studies Council Research Centre
- FSI** freshwater-seawater interface
- GB** Great Britain
- GBNCRS** Great Britain Nature Conservation Resource Survey (an NCC project, 1990/91)
- GCR** Geological Conservation Review (an NCC and JNCC project)
- GENSTAT** (a statistical program package)
- GESAMP** Joint Group of Experts on the Scientific Aspects of Marine environmental Protection (until about 1991, the Joint Group of Experts on the Scientific Aspects of Marine Pollution) (an advisory body to the Heads of eight organisations of the United Nations System)
- GIS** Geographical Information System
- GOOS** Global Ocean Observing System
- GPS** Global Positioning System
- HAT** Highest Astronomical Tide
- HC** Heritage Coast (England & Wales)
- HELCOM** Baltic Environment Protection Commission
- HIDB** Highlands and Islands Development Board (now Highlands and Islands Enterprise)
- HIE** Highlands and Islands Enterprise
- HMPI** Her Majesty's Pollution Inspectorate (England and Wales)
- HMIPI** Her Majesty's Industrial Pollution Inspectorate (Scotland)
- HMSO** Her Majesty's Stationery Office
- HNDA** High Natural Dispersion Area
- HRE** Harbours Rias and Estuaries in southern Britain (an NCC project carried out by OPRU)
- HSD** EC Habitats Directive (known until autumn 1994 informally as the "Habitats and Species Directive")
- HWH** High Water
- HWM** High Water Mark
- HWMOST** High Water Mark of Ordinary Spring Tides
- IAMW** Important Area for Marine Wildlife

- IBA** Important Bird Area
ICES International Council for the Exploration of the Sea
ICI Imperial Chemical Industries Ltd
ICZM Integrated Coastal Zone Management
IECS Institute of Estuarine and Coastal Studies (University of Hull)
IEEP Institute for European Environmental Policy
IFREMER Institut Français de Recherché pour l'Exploitation de la Mer
IMA Important Marine Area
IMER Institute for Marine Environmental Research (now part of Plymouth Marine Laboratory)
IMO International Maritime Organisation
IOE Institute of Offshore Engineering (Heriot Watt University, Edinburgh)
ISSCG Irish Sea Science Coordination Group
ISF Irish Sea Forum
ISSG Irish Sea Study Group
ISSCG Irish Sea Science Co-ordination Group
ISU Intertidal Survey Unit (the Intertidal Survey of Great Britain was an NCC project carried out by MBA & SMBA)
ITE Institute of Terrestrial Ecology
ITQ Individual Transferable Quota (sea fisheries)
IUCN International Union for the Conservation of Nature and Natural Resources (now IUCN - The Conservation Union)
IWC International Whaling Commission
JAMP Joint Assessment and Monitoring Programme (OSPAR)
JMBA Journal of the Marine Biological Association of the United Kingdom
JNCC Joint Nature Conservation Committee
LAT 1) Local Area Team (English Nature);
 2) Lowest Astronomical Tide
lat. latitude
LIFE L'Instrument Financier pour l'Environment [Financial Instrument for the Environment]
LME Large Marine Ecosystem
LNR Local Nature Reserve
LOIS Land-Ocean Interaction Study
long. longitude
LUMBL Liverpool University Marine Biological Laboratory, Port Erin
LW Low Water
LWM Low Water Mark
LWMOST Low Water Mark of Ordinary Spring Tides
MAFF Ministry of Agriculture, Fisheries and Food
MNA Maritime Natural Area
MARPOL International Convention for the Prevention of Pollution of the Sea from Ships
MARS Network of European Marine Research Stations
MBA Marine Biological Association of the United Kingdom
MCA 1) Marine Consultation Area, or 2) (generally prefixed 'Voluntary') Marine Conservation Area
MCB Marine Conservation Branch (of JNCC)
MCS Marine Conservation Society
MDS multi-dimensional scaling
MEHRA Marine Environmental High-Risk Area
MHWS Mean High Water Springs (tides)
MLWM Mean Low Water Mark
MLWOS Mean Low Water of Ordinary Springs (tides)
MLWS Mean Low Water Springs (tides)
MNCR Marine Nature Conservation Review
MNR Marine Nature Reserve
MoD Ministry of Defence
MPCU Marine Pollution Control Unit
MPA marine protected area (generic term)
MSA Marine Safety Agency
MSB Marine Science Branch (of NCC)
MSL mean sea level
MSWG Marine Specialists' Working Group (of the UK statutory nature conservation organisations)
MTL Mean Tide Level
N north
NCB The Nature Conservation Bureau Ltd., Newbury
NCC Nature Conservancy Council
NCCE Nature Conservancy Council for England (English Nature; NCCE remains the formal legal title)
NCCS Nature Conservancy Council for Scotland (now Scottish Natural Heritage)
NCEAG National Coasts and Estuaries Advisory Group
NCEG National Coasts and Estuaries Group
NCO Nature Conservation Order
NE north-east
NERC Natural Environment Research Council
NGO non-governmental organisation
NHBS Natural History Book Service
NHM The Natural History Museum, London
NISS Northern Ireland Sublittoral Survey
NMMP National Marine Monitoring Plan (UK)
NNR National Nature Reserve
NP National Park (England and Wales)
NPW National Parks and Wildlife service (Republic of Ireland)
NORSPA Northern Seas Action Programme (now absorbed by LIFE)
NRA National Rivers Authority
NRSC National Remote Sensing Centre
NSA National Scenic Area (Scotland)
NSNCB National statutory nature conservation body (includes JNCC and the country agencies: the Countryside Council for Wales, English Nature and Scottish Natural Heritage in Great Britain)
NSQSR North Sea Quality Status Report
NSTF North Sea Task Force
NT National Trust
NTS National Trust for Scotland
NVC National Vegetation Classification (published for JNCC as *British Plant Communities*)
NVZ Nitrate Vulnerable Zone
NW north-west
NWC National Wildfowl Counts, subsequently National Waterfowl Counts (a Wildfowl and Wetlands Trust monitoring project, now incorporated into the Wetland Bird Survey)
OAB Offshore Animals Branch (of JNCC) (now Seabirds and Cetaceans Branch)
OLD operations likely to damage (English Nature term)
OMBU Orkney Marine Biology Unit
OPRU Oil Pollution Research Unit
OPW Office of Public Works (Republic of Ireland)
OS Ordnance Survey
OSIS Oil Spill Information System
OSPAR OSlo/PARis Convention (short title for the 1992 International Convention for the Protection of the

- Marine Environment of the North-East Atlantic)
OSPARCOM OSlo and PARis COMmissions
p (as prefix) Proposed designation, e.g. pMNR, pSSSI; in the case of pSAC, possible Special Area of Conservation
PCA Principal Components Analysis
PCBs poly-chlorinated biphenyls
PCoA Principal Co-ordinates Analysis
PDA potentially damaging activity (generally used in context of marine protected areas)
PDO potentially damaging operation (generally used in context of notified SSSIs)
PFA pulverised fuel ash
pH A measure of the concentration of hydrogen ions (defined as $-\log[H^+]$), and hence acidity or alkalinity, over a range 0 (acid) to 14 (alkaline or basic), with a pH value of 7 being neutral
PML Plymouth Marine Laboratory (of NERC)
PPG Planning Policy Guidance note
ppt parts per thousand (measurement of salinity, normally expressed as ‰)
PRIMER Plymouth Routines In Multi-variate Ecological Research (a multivariate analytical programme)
PSP paralytic shellfish poisoning
PSSA Particularly Sensitive Sea Area
psu practical salinity unit
QSR Quality Status Report
QUASIMEME QUality ASsurance of Information for Marine Environmental Monitoring in Europe
Ramsar site A wetland of international importance, especially as waterfowl habitat, designated under the terms of the 1971 Convention on Wetlands of International Importance (held at Ramsar in Iran), especially as a Waterfowl Habitat (the Ramsar Convention)
RCEP Royal Commission on Environmental Pollution
RDB Red Data Book
redox REDuction-OXidation
RIB rigid-hulled inflatable boat
RIGS Regionally Important Geological or Geomorphological Site
ROV remotely-operated vehicle
RoxAnn Reputedly a derivation from "rocks and sand"; see glossary of terms
RPB (usually as suffix, e.g. FRPB): River Purification Board (Scotland)
RSE Royal Society of Edinburgh
RSNC Royal Society for Nature Conservation (the Wildlife Trusts Partnership)
RSPB Royal Society for the Protection of Birds
S south
SAC Special Area of Conservation
SaCB Seabirds and Cetaceans Branch (of JNCC)
SACFOR scale An abundance scale used by MNCR for recording benthic marine organisms (see Hiscock 1990):
 Superabundant; Abundant; Common; Frequent; Occasional; Rare
SAGB Shellfish Association of Great Britain
SAMS Scottish Association for Marine Science
SAST Seabirds at Sea Team (a project within JNCC's Seabirds and Cetaceans Branch)
SBDP Severn Barrage Development Project
SCANS Small Cetacean Abundance in the North Sea (a EU-funded survey project)
SCI Site of [European] Community Importance
SCL saline coastal lagoon
SCOPAC Standing Conference on Problems Associated with the Coastline
SCR Seabird Colony Register (JNCC)
SCUBA Self-Contained Underwater Breathing Apparatus
SDD Scottish Development Department (now Scottish Office Environment Department)
SDSC Scientific Diving Supervisory Committee
SE south-east
SEA Strategic Environmental Assessment
Seasearch A JNCC & MCS Phase 1 sublittoral habitat survey
SEPA Scottish Environment Protection Agency
SERC Science and Engineering Research Council
SERCON System for Evaluating Rivers for CONservation
SFC (usually as suffix, e.g. SWFSC): Sea Fisheries Committee
SFIA Sea Fish Industry Authority
SIM Site Integrity Monitoring
SINC Site of Importance for Nature Conservation (a non-statutory designation)
SISWIS Survey of Isolated Saline Waters In Scotland (MNCR)
SMA Sensitive Marine Area
SMBA Scottish Marine Biological Association (now Scottish Association for Marine Science)
SMP Seabird Monitoring Programme (a project within JNCC's Seabirds and Cetaceans Branch)
SMRU Sea Mammal Research Unit
SNCB statutory nature conservation body e.g. JNCC, English Nature, SNH, CCW
SNH Scottish Natural Heritage
SNIC Site of Nature Conservation Importance (a non-statutory designation)
SNIFFER Scotland and Northern Ireland Forum for Environmental Research
SOAEFD Scottish Office Agriculture, Environment and Fisheries Department
SOAFD Scottish Office Agriculture and Fisheries Department (since November 1995, Scottish Office Agriculture, Environment and Fisheries Department)
SOEnD Scottish Office Environment Department
SOFAR SOund Fixing And Ranging
SONAR SOund Navigation And Ranging
SOTEAG Shetland Oil Terminal Environmental Advisory

- Group
- sp., spp.** species (singular, plural)
- SPA** Special Protection Area (a site designation under the 1979 EC Directive on the Conservation of Wild Birds)
- SPBC** Society for the Protection of the British Coast
- SQM** Site Quality Monitoring
- SSSI** Site of Special Scientific Interest
- STB** Scottish Tourist Board
- STPG** Severn Tidal Power Group
- STQ** Single Transferable Quota (sea fisheries)
- subsp.** subspecies
- SUM** Sea-Use Management
- SVEAG** Sullom Voe Environmental Advisory Group
- SW** south-west
- SWBSS** South-West Britain Sublittoral Survey (An NCC project carried out by OPRU)
- SWCL** Scottish Wildlife and Countryside Link
- SWQO** Statutory Water Quality Objective
- SWT** Scottish Wildlife Trust
- SYSTAT** (a statistical program package)
- TAC** Total Allowable Catch (sea fisheries)
- TBT** tri-butyl tin (organotin)
- TCD** Trinity College, Dublin
- TFA** tidal freshwater area
- TWINSPAN** Two-Way INDicator SPecies ANalysis (a multivariate analytical programme)
- UCG** University College, Galway
- UCNW** University College of North Wales (now known as University of Wales, Bangor)
- UCS** Underwater Conservation Society (now Marine Conservation Society)
- UK** United Kingdom
- UKDMAP** United Kingdom Digital Marine Atlas Project
- UKOOA** United Kingdom Offshore Operators' Association
- UMBMS** University Marine Biological Station, Millport
- UNCED** United Nations Conference on Environment and Development (the 1992 'Rio' conference)
- UNCLOS** United Nations Convention on the Law of the Sea
- UNEP** United Nations Environment Programme
- UNESCO** United Nations Educational, Scientific and Cultural Organisation
- V** (as prefix) Voluntary (e.g. VMNR; VMCA)
- VCO** voluntary conservation organisation
- VSA** Very Sensitive Area (normally used in context of fish-farming)
- W** west
- WA** (as suffix, e.g. SWWA) Water Authority
- WeBS** Wetland Bird Survey
- WOAD** Welsh Office Agriculture Department
- WRC** Water Research Centre Ltd
- WWF** World-Wide Fund for Nature (formerly World Wildlife Fund)
- WWT** Wildfowl and Wetlands Trust
- ZNIEFF** Zones Naturelles d'Intérêt Écologique, Faunistique et Floristique [Natural Zones of Ecological, Faunistic or Floristic Interest] (A French initiative to identify sites of interest and classify biotopes.)

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Appendix 2 Recommendations of the Nature Conservancy Council and Natural Environment Research Council Joint Working Party on Marine Wildlife Conservation

The Working Party commended the initiative that NCC and other groups had already taken in promoting marine conservation but believed that much more needed to be done. Their recommendations are given below.

1. NCC should have a greater involvement in marine wildlife conservation through the development of a formal marine conservation policy.
2. In addition to establishing and maintaining outside links for expert advice, NCC should also consider adding additional marine expertise to its Council or setting up a marine advisory committee.
3. NCC should seek additional resources to enable it to develop an effective strategy for marine conservation.
4. In order to establish conservation areas representative of particular habitats, relatively large areas should be designated in most cases.
5. In the case of specialised habitats of restricted area, consideration should be given to designation of a series of small sites in addition to the large conservation areas.
6. We recommend further consultation and discussion and, where necessary, provision of support for additional studies related to improving description and classification of the lesser known plant and animal communities; high priority should, in particular, be given to sublittoral rocky communities.
7. NCC should seek clarification of the legal situation and consider obtaining legislation to permit the establishment and management of conservation areas below the present low water limit of its powers.
8. NCC should seek consultation with the appropriate authorities and look into the possibility of obtaining legislative measures to protect threatened marine species.
9. Where a species becomes endangered through commercial exploitation, and its collection is not already controlled, discussion on its conservation should be held with the fisheries departments to determine whether or not regulation of collection is desirable.
10. NCC should investigate the powers of local authorities in conserving species to determine whether it is necessary to suggest to the Government that implementation of bye-laws should be made less difficult.
11. A study of the many factors regulating the natural fluctuations in marine communities should be seen as a basic and continuing contribution to a marine conservation programme, and that NCC and NERC should collaborate closely in using their resources to further conservation-oriented research in the marine environment in the following areas:
 - i. to increase the background of environmental knowledge of regions where proposals for future development can reasonably be expected;
 - ii. to promote accurate quantified observations on disturbance and recovery both in the field and experimentally;
 - iii. to promote detailed studies of the natural dynamics of the major marine communities and, in particular, to make a start in stable mud/sand littoral communities and in rocky sublittoral communities;
 - iv. to encourage studies of the impact of human activities on particular species known, or suspected, to be under pressure.
12. In promoting conservation-oriented research, the present expertise and research capacity within NCC, NERC, the universities, polytechnics and museums should be utilised. New programmes should only be set up if the research capacity does not already exist.
13. NCC should take steps to expand their dialogue with other conservation bodies to cover marine conservation matters.
14. NCC and other organisations should place more emphasis on marine conservation within their educational activities and that NCC should encourage tourist boards, museums and other bodies to promote the objectives of marine conservation, particularly in popular coastal areas.

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Appendix 3 Statutory functions of the country nature conservation agencies and the JNCC

The Environmental Protection Act 1990 and subsequently, the Natural Heritage (Scotland) Act 1991 established nature conservation agencies for England, Scotland and Wales (now English Nature, Scottish Natural Heritage and the Countryside Council for Wales) with a series of 'general' functions including:

1. the establishment, maintenance and management of nature reserves in their area;
2. the provision of advice for the Secretary of State or any other Minister on the development and implementation of policies for or affecting nature conservation in their area;
3. the provision of advice and the dissemination of knowledge to any persons about nature conservation in their area....;
4. the commissioning or supportof research which in their opinion is relevant to any of their functions

Additionally, the agencies have the power to initiate and

carry out research directly related to their functions instead of commissioning or supporting other persons.

The agencies also have 'special' functions to be discharged through the Joint Nature Conservation Committee:

1. the provision of advice for the Secretary of State or any other Minister on the development and implementation of policies for or affecting nature conservation for Great Britain as a whole or nature conservation outside of Great Britain;
2. the provision of advice and the dissemination of knowledge to any persons about nature conservation for Great Britain as a whole or nature conservation outside Great Britain;
3. the establishment of common standards throughout Great Britain for the monitoring of nature conservation and for research into nature conservation and the analysis of the resulting information;
4. the commissioning or support of research which in the opinion of the joint committee is relevant to any matter mentionedabove.

Appendix 4 Key statutes, conventions and directives for marine wildlife conservation in the United Kingdom

1 Introduction

Marine areas are influenced by a wide variety of activities including ones undertaken inland or adjacent to the shore. Consequently, there is a substantial amount of legislation relating to activities affecting the marine environment, much of which has a bearing on marine wildlife

conservation. The measures listed here are those which can be used for, or which are relevant to, the protection of marine wildlife and habitats although some are not primarily intended for that purpose. The measures are listed in chronological order under each heading.

2 Great Britain statutes

2.1 Nature conservation

Whaling Industry (Regulation) Act 1934 (as amended)
Prohibits whaling in the 200 mile limit around the UK coast.

Conservation of Seals Act 1970
Provides for the protection and conservation of seals in England, Scotland, Wales and the adjacent territorial waters. It specifies prohibited methods of killing seals and also the closed seasons. It also details activities for which a licence is required.

Wildlife and Countryside Act 1981 (as amended in 1985)
This Act provides the cornerstone to nature conservation in Great Britain. Major provisions relating to marine conservation are noted below.

Section 1 provides for the protection of wild birds.
Section 3 allows for the establishment of Areas of Special Protection for birds.
Section 9 allows for the protection of specifically listed wild animals, including marine species (listed in Schedule 5 of the Act).
Section 13 allows for the protection of wild plants, including marine species (listed in Schedule 8 of the Act).
Section 14 allows for the prevention of the introduction of alien species (listed in Schedule 9 of the Act).
Sections 36 and 37 allow for the establishment of marine nature reserves.

Schedules 5, 8 and 9 are reviewed every five years and revised.

Environmental Protection Act 1990
This Act separated the Nature Conservancy Council into three country agencies and enabled the establishment of the UK Joint Nature Conservation Committee for the purpose of nature conservation and fostering the understanding thereof in Great Britain as a whole and internationally.

Natural Heritage (Scotland) Act 1991
Enabled the establishment of Scottish Natural Heritage incorporating nature conservation and landscape functions. It also contains provisions for Natural Heritage Areas.

The Conservation (Natural Habitats &c.) Regulations 1994
These Regulations make provision for the purpose of implementing, for Great Britain, Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora ('The Habitats Directive'). They came into force on 30 October 1994. The Regulations include specific provisions for 'European marine sites'. They require that all authorities and public bodies with jurisdiction over the marine environment have a general duty to "have regard to the requirements of the Directive". Similar provisions are being made for Northern Ireland.

Environment Act 1995
Provides for the establishment of the Environment Agency in England and Wales (transferring to it the functions of the National Rivers Authority and the waste regulatory authorities) and the Scottish Environment Protection

Agency (transferring to it the functions of the river purification authorities).

Section 6 of the Act identifies, amongst others, the duty of the [Environment] Agency, to such extent as it considers desirable, generally to promote:

- (a) the conservation and enhancement of the natural beauty and amenity of inland and coastal waters

and of land associated with such waters;

- (b) the conservation of flora and fauna which are dependent on an aquatic environment.

Section 34 of the Act identifies the same duties for SEPA. The Act increases the powers of some fisheries statutes with regard to nature conservation (next section).

2.2 Fisheries

Sea Fisheries Regulation Act 1966

Allows for the establishment of Sea Fisheries Committees within England and Wales and lays down their functions and powers (including provisions for making bye-laws). The Environment Act 1995 makes provisions under this Act enabling the Sea Fisheries Committees to encourage the appointment to the Committees of "persons having knowledge of, or expertise in, marine environment matters" (including conserving flora or fauna).

Sea Fisheries (Shellfish) Act 1967

Provides powers to make Regulating and Several Orders with regard to fisheries for shellfish. It also allowed for prohibition of the deposit of shellfish to prevent the spread of shellfish disease (since overtaken by the Fish Health Directive). A Regulating Order enables more specific control over stated molluscan shellfisheries by means of additional regulations and licensing, for which a fee is payable. A Several Order provides sole rights to fish for the nominated species in a defined area.

Sea Fish (Conservation) Act 1967 and 1992

Enables the setting of size limits of fish for sale or fishing, the regulation of nets and other gear and the restriction of fishing in specified areas. The 1992 Act makes provision for limiting the number of days at sea. The Environment Act 1995 makes provisions under the 1967 Act to enable the makings of orders for "marine environmental purposes" (including conserving flora or fauna).

Fishery Limits Act 1976

Extends UK fishery limits to 200 nautical miles from the

territorial sea baselines and allows for the regulation (by area, method, season, etc.) of fishing within these limits.

Fisheries Act 1981

This Act incorporates amendments to the Sea Fish (Conservation) Act 1967 and the Sea Fisheries Act 1968.

Part I sets up the Sea Fish Industry Authority and defines its powers.

Part III deals with the regulation of sea-fishing with respect to size limits for fish.

Part IV deals with fish farming, with particular reference to assistance and advice for their establishment.

Part V amends the Whaling Industry (Regulation) Act 1934 by widening that legislation to include sperm whales.

Inshore Fishing (Scotland) Act 1984

Gives the Secretary of State powers to:-

- a. regulate fishing in specified inshore waters
- b. prohibit the carriage of specified types of net
- c. prohibit the use of mobile gear near fixed salmon nets.

The Environment Act 1995 makes provisions under this Act to enable the makings of orders for "marine environmental purposes" (including conserving flora or fauna).

Sea Fisheries (Wildlife Conservation) Act 1992

Requires appropriate Ministers and relevant bodies to have regard to the conservation of flora and fauna in the discharge of their functions under the Sea Fisheries Acts.

2.3 Water

Water Act 1989 and Water Resources Act 1991

The National Rivers Authority (NRA) was formed in England and Wales as a result of the Water Act 1989. Those aspects of the 1989 Act which concerned the NRA were later consolidated into the Water Resources Act 1991. The

remit of the NRA extended to 3 nautical miles from the coast with regard to water quality and 6 nautical miles for fisheries.

The functions and duties of the NRA were transferred to the Environment Agency under the Environment Act 1995.

2.4 Pollution

Merchant Shipping (Oil Pollution) Act 1971

The Act makes provision with respect to civil liability for oil pollution from merchant ships. Subject to specified limitations the owner is liable for any damage in the UK by contamination from discharge or escape and for the cost of measures taken to prevent or reduce damage and for any damage caused by those measures.

This Act is amended by the Merchant Shipping Act 1983 which makes provision for the registration of small ships and the Merchant Shipping Act 1984 which deals with ascertaining tonnage.

Prevention of Oil Pollution Act 1971 and 1986

Section 2 of the 1971 Act specifies that no oil may be discharged within UK waters from the land. The 1986 Act amends Section 2 of the 1971 Act, making it an offence for a vessel to discharge oil or an oily mixture into waters navigable by sea-going ships on the landward side of the territorial sea baselines.

Section 3 specifies that oil should not be discharged from pipe-lines, or as a result of the exploration of the sea-bed or subsoil, or the exploitation of natural resources.

Section 10 deals with restrictions on the transfer of oil at night.

Section 12 provides powers for the Secretary of State to intervene following a shipping casualty which causes, or threatens to cause, large scale pollution.

Control of Pollution Act 1974

Under Part II, it is an offence to allow any poisonous, noxious or polluting matter to enter a stream or controlled waters (i.e. the territorial sea). It is also an offence to discharge trade or sewage effluent into streams or coastal waters or through a pipe into the sea outside of controlled waters unless this is done with the consent of the water authority or river purification board. Specifically:

Section 31 controls the pollution of rivers and coastal waters;

Section 32 controls discharges of trade and sewage effluent into rivers and coastal waters;

Section 33 deals with sanitary appliances on vessels;

Sections 34-40 deal with procedures on applications for consents to discharge effluent into rivers, coastal waters, etc.

Merchant Shipping Act 1979

Section 20 empowers the Secretary of State to give effect to MARPOL 73/78 by regulations, and deals with the prevention of pollution from ships.

Section 21 lays down the basis of regulations for the prevention of collisions.

Food and Environment Protection Act 1985 (FEPA)

(This Act replaces the Dumping at Sea Act 1974)

Operations licensed by FEPA divide largely into two groups:

- construction, demolition or repair of pipes and structures resting on or in the sea bed;
- deposit of waste materials, such as dredge spoil and sewage sludge (or for scuttling vessels) at sea.

Licensing deposition of sand for beach replenishment is also covered by this Act. (The Zetland County Council and Orkney County Council Acts provide for the issuing of works licences).

Environmental Protection Act 1990

Part 1 of this Act establishes Integrated Pollution Control, which will apply to any process discharging into the sea. Every process will require an authorisation which has to meet certain standards set by the Secretary of State. Such authorisations will require the use of best available technology not entailing excessive cost to prevent and minimise releases of substances, and to render harmless any which are released.

2.5 Other

Crown Estate Act 1961

Provides for the powers exercisable by the Crown Estate Commissioners for the management of the Crown Estate (which mainly includes the seabed within territorial waters).

Territorial Sea Act 1987

Extends UK territorial limits from 3 to 12 miles, subject to certain specific exclusions, one of which is that marine nature reserves can only be established in the 3-12 mile zone if authorised by a special Order in Council.

3 European Directives, policies and regulations

EC Directive on the Conservation of Wild Birds (The 'Birds Directive')

The European Council of Ministers adopted the Directive on the conservation of wild birds (Directive 79/409/EEC) on 2 April 1979. It was further amended on 6 March 1991. This Directive imposes strict legal obligations on Member States to maintain populations of naturally occurring wild birds at levels corresponding to ecological requirements, to regulate trade in birds, to limit hunting to species able to sustain exploitation and to prohibit certain methods of capture and killing. Article 4 requires Member States to conserve the habitat of certain listed species and regularly occurring migratory species through the designation of Special Protection Areas (SPAs).

Council Regulation to Implement CITES

Council Regulation (EEC) No. 3626/82 implements The Convention on International Trade in Endangered Species of wild fauna and flora in the European Union. Marine species are listed in this regulation through their inclusion in CITES.

Common Fisheries Policy

The CFP was introduced in 1983 as a 20-year programme for the management and conservation of fish stocks and to direct fishing activity by the European Community.

Following the mid-term review of the CFP. Article 2 of Council Regulation 3760/92 indicated a re-emphasis of its general objectives on exploitation "to protect and conserve available and accessible marine living aquatic resources and to provide for rational and responsible exploitation on a sustainable basis ... taking account of the implications to the marine ecosystem."

EC Directive on Environmental Assessment

Council Directive 85/337/EEC came into effect in 1988 and is the formal source of requirements for an Environmental Assessment (EA) in the UK. Projects likely to have significant effects on the environment, by virtue of their size, nature or location, are to be subject to an EA before consent is granted. Annex I lists the major developments for which an EA is mandatory, and Annex II those for which one is discretionary. Where this Directive relates to EAs for salmon farms (on Annex II), it was implemented in the UK through an Order which gives the Crown Estate authority to ensure environmental damage is not caused by salmon farms. Trigger points have been set for the size of farms above which an EA must be undertaken.

EC Urban Waste-Water Treatment Directive

This EC Directive (91/271/EEC) was adopted in December 1990. It requires all sewage effluent discharges to coastal waters from municipalities of more than 5,000 people to receive by 1998 at least primary treatment. Unless the receiving waters are categorised as 'less sensitive' areas,

secondary treatment will be required to meet specified standards which all discharges must meet. Discharges from municipalities of more than 5,000 people to coastal and estuarine waters designated as 'sensitive areas' subject to eutrophication will require more stringent treatment.

EC Nitrates Directive

Council Directive 91/676/EEC came into force in December 1993 and is concerned with the protection of freshwaters, estuaries and coastal waters from eutrophication caused by nitrates from agricultural sources. Member states are required to identify and designate 'nitrate vulnerable zones' and to take measures to reduce the influx of nitrates into these waters.

EC Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (The 'Habitats Directive')

Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora came into force on 21 May 1992. The central aim of the Directive is to conserve biodiversity across the area of the European Union through a coherent network of Special Areas of Conservation (SACs). Seven marine habitat types are listed in the Directive and nine of the species listed are marine or spend part of their life in the sea and have breeding populations in the United Kingdom. SACs together with 'Special Protection Areas' (SPAs) identified under the Birds Directive will create a network of sites described as 'Natura 2000'.

EC Fish Health Directive

The Fish Health Directive details Community measures governing trade in live fish and shellfish. Implementation in 1993 specified new GB arrangements for the control of fish and shellfish disease, and for the deposit and importation of Pacific oysters *Crassostrea gigas* and lobsters in the Community. Regulations on trade with third countries and importation of other molluscan shellfish came into force in 1995.

EC Shellfish (Waters) Directive

The EC Directive on the quality required for shellfish waters (79/923/EEC) requires that Member States must designate coastal waters needing protection or improvement in order to support shellfish life and growth and therefore contribute to the quality of shellfish products intended for human consumption.

The environmental quality objective is established in terms of the values corresponding to environmental parameters set out in the Directive. There are two sets of values, mandatory or imperative values and guide values. Member States must ensure that designated waters achieve the mandatory values and should attempt to achieve the guide values.

4 International conventions

International Convention for the Regulation of Whaling

The Whaling Convention came into force in 1948 and established the International Whaling Commission (IWC), which meets annually to review catch quotas, protected species etc. International co-operation is essential to prevent over-exploitation of whales, as they occur beyond the boundaries of national jurisdiction. Since 1982 all stocks of whales have had zero quotas.

The Convention on Wetlands of International Importance, especially as Waterfowl Habitat (The Ramsar Convention)

The Convention was adopted at a meeting of countries concerned with wetland and waterfowl conservation held at Ramsar, Iran, in 1971. This convention, usually known for convenience as the 'Ramsar Convention', was signed by the UK Government in 1973 and ratified by the UK in 1976.

Convention on International Trade in Endangered Species of International Convention for the Regulation of Whaling

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Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

The Convention was initiated at an IUCN General Assembly in 1963 and concluded at Washington in 1973. It came into force in 1975 and has been ratified by well over 100 countries throughout the world, including the UK in 1976. The objectives of CITES are to protect endangered plant and animal species from illegal trade and over-exploitation by means of a system of import and export permits for the regulation of trade. Commercial trade in endangered species listed in Appendix I is forbidden. Controlled trade is allowed for species which, although not currently threatened with extinction, may become so unless restrictions are applied, listed in Appendix II. Where a Party to the Convention protects one of its native species from over-exploitation and seeks the assistance of other Parties in implementing these controls, it can list such species in Appendix III.

World Heritage Convention

The World Heritage Convention concerns the protection of

the world's cultural and natural heritage and was adopted by UNESCO (the United Nations Education, Scientific and Cultural Organisation) in 1972 with the aim of identifying and protecting sites that are outstanding for either natural or cultural reasons. Sites should be of such unique value that they form part of the heritage of mankind. The UK Government ratified the World Heritage Convention in 1984.

International Convention for the Prevention of Pollution from Shipping (MARPOL)

MARPOL covers all the oceans and seas of the world. It was signed in 1973 in London and revised in 1978 and has gradually entered into force annex by annex.

Currently, MARPOL has five annexes all of which have been ratified by the UK, covering different forms of pollution:

Annex I - oil; Annex II - noxious liquid substances; Annex III - harmful packaged substances; Annex IV - sewage; Annex V - garbage pollution. Parties to the convention are bound by Annexes I and II, with III, IV and V being optional. Annex IV has not yet entered into force. A further Annex on air pollution from ships is proposed and another, on ballast water, is being discussed.

Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)

The Convention on the Conservation of Migratory Species of Wild Animals, or the 'Bonn' Convention, was signed in Bonn in 1979. It provides strict protection for migratory species in danger of extinction throughout their range. Appendix II covers migratory species which have an unfavourable conservation status and which require international agreement for their conservation and management. The Convention also provides the framework for a series of 'Agreements' between Range States for the conservation and management of species listed on its Appendix II. The Convention covers all species of migratory animal, including invertebrates, fish, reptiles, amphibians, mammals and birds. The Agreement can cover all aspects of the species' conservation, including habitat conservation, hunting, research, information exchange and status restoration.

Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)

The Council of Europe 'Convention on the conservation of European wildlife and natural habitats' (the 'Bern Convention') aims to "conserve wild flora and fauna and their natural habitats", to promote co-operation between countries and their conservation efforts, and to give "particular emphasis to endangered and vulnerable species, including endangered and vulnerable migratory species". In order to achieve its objectives, the Convention provides for the conservation of wildlife and wildlife habitats in general and for special protection of species listed in Appendix I (strictly protected plants), Appendix

II (strictly protected animals) and Appendix III (protected animals) of the Convention. The requirements of the Bern Convention are mandatory on its contracting parties. Britain is a party to this Convention and ratified its provisions in May 1982.

United Nations Convention on the Law of the Sea (UNCLOS) 1982

UNCLOS was adopted in December 1982 and entered into force on 16 November 1994. UNCLOS attempts to set out a comprehensive legal regime for the seas defining a balance between the rights of coastal states to control and exploit the resources of the seas adjacent to them and the rights of other maritime states to use the oceans both for passage and resource exploitation. In the marine environment, the Convention provides a framework for action on pollution from land based activities, shipping and offshore installations within which more specific measures can be developed.

Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS)

This Agreement relates to Article IV of the Bonn Convention on the Conservation of Migratory Species of Wild Animals. The UK signed the Agreement on 16 April 1992.

International Convention for the Protection of the Marine Environment of the North East Atlantic (The OSPAR Convention)

This was adopted in September 1992 by countries responsible for the protection of the marine environment in the north-east Atlantic. It replaces the 1972 Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft (the Oslo Convention) and the 1974 Convention for the Prevention of Marine Pollution from Land-Based Sources (the Paris Convention).

Article 2 defines the general obligations as to take "all possible steps to prevent and eliminate pollution and ... take the necessary measures to protect the maritime area against the adverse effects of human activities so as to safeguard human health and to conserve marine ecosystems and, where practicable, restore marine areas which have been adversely affected". The Convention also provides for periodic assessments (quality status reports) of the Convention area and for appropriate scientific research and monitoring.

UN Convention on Biological Diversity

The Convention on Biological Diversity was signed in 1992 in

Rio de Janeiro, Brazil, in connection with the United Nations Conference on Environment and Development (UNCED). The objectives of the Convention are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising from the utilisation of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over these resources and to technologies, by appropriate funding. Each contracting party shall develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity. A UK Biodiversity Action Plan was published in 1994 (Anon. 1994) and is being followed by further measures.

UN Agreement over Straddling and Highly Migratory Fish Stocks

A UN treaty, entitled *The agreement for the implementation of the provisions of the 1982 United Nations Law of the Sea relating to the conservation and management of Straddling Fish Stocks and Highly Migratory Fish Stocks* has now been agreed and will be placed before the UN General Assembly for adoption. The provisions of the treaty will enter into force after it has been ratified by 30 States.

The text of the agreement recognises the need to address the impacts that destructive fishing practices have on the marine environment, and requires States both to protect marine biodiversity and maintain the marine ecosystem. However, it does not specify rules pertaining to fishing gear.

References and further reading

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- Cleator, B., and Irvine, M. 1994. *A review of legislation relating to the coastal and marine environment in Scotland*. Unpublished report prepared by Cleator Associates for Scottish Natural Heritage, Edinburgh.
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- Nature Conservancy Council. 1989. *A review: legislative responsibilities in the marine environment*. Peterborough, Nature Conservancy Council.

Compiled by: Clare Eno and Keith Hiscock

Appendix 5 Example of a completed information review sheet

JOINT NATURE CONSERVATION COMMITTEE
MARINE NATURE CONSERVATION REVIEW
Information Sheet

Reference/Description of material:

Howson, C.M., Connor, D.W., and Holt, R.H.F. 1994. The Scottish sealochs. An account of surveys undertaken for the Marine Nature Conservation Review. (Contractor: University Marine Biological Station, Millport.) *JNCC Report*, No. 164. (Marine Nature Conservation Review Report, No.MNCR/SR/27.)

Location of item

MNCR reprint collection no. :
MNCR report collection no.: 2165
MNCR book no. :
Other :

Position: OS grid references:

MNCR Coastal Sector codes:

R12 R12.3 R13 R13.2 R14 R14.1 R15 R15.2

Keywords:

ASSESSMENT	RESEARCH SUMMARY	SCOTLAND	SURVEY: COMMUNITIES
MARINE INLET	REVIEW	SPECIES LIST	SURVEY: HABITATS

Species/Taxonomic group:

Abstract:

(Reviewed by David Connor)

A four-year study of the Scottish sealochs began in 1988 as part of the Marine Nature Conservation Review. The University Marine Biological Station Millport (UMBSM) was commissioned by the Nature Conservancy Council (NCC), subsequently the Joint Nature Conservation Committee (JNCC), in 1988 to undertake this. The primary aim of the project was to describe and classify the littoral and sublittoral biotopes present in the sealochs. The data collected would be used to assess the nature conservation importance of the sealochs, including the identification of areas of high marine biological interest. Field surveys were carried out using standard MNCR recording methods (Hiscock 1990). Littoral surveys employed direct observation of rocky habitats and core sampling on sediment shores. In the sublittoral diving was the primary method for recording epibenthos, supplemented by a towed video survey of the deeper sections of Loch Fyne. Sublittoral sediments were sampled by diver-operated suction-sampler or coring of shallow sediments and by dredging on deeper sediments. During the four years of the project, 86 sealochs including 1278 sites (comprising 1088 littoral habitat records and 2389 sublittoral habitat records) were surveyed. These were described in a series of 21 Area Reports. An additional report described a comparative study of some Norwegian fjords. For the final data analysis, reported here, the full data set was re-analysed to classify the biotopes in the sealochs as a whole. Two methods of cluster analysis, TWINSpan and the clustering application in the GENSTAT statistical package, were used. As a result of the final analysis, 89 biotopes are described. They are discussed in relation to several environmental factors, particularly substratum, wave exposure, tidal streams and salinity, factors which appear to most strongly influence their structure and composition. The sealochs were grouped into three major types (fjords, fjards, and open sealochs) on the basis of their physiographic structure, and the coast divided into eight geographic areas. Habitats, communities and locations of marine biological interest are identified. A brief comparison is made with other marine inlets in the north-east Atlantic, particularly the Norwegian fjords. The tide-swept biotopes found in the Scottish sealochs and especially those characteristic of the fjards are considered to be of greatest interest as there appear to be few comparable examples elsewhere in the north-east Atlantic.

Appendix 6 List of keywords used for information review

The MNCR database literature module has 177 keywords under eight categories, with no limit to the number which can be attached to an information review, either when created or added subsequently. The list of available keywords was expanded in 1994. The following table is a complete list with explanatory notes. Fuller details and cross-referencing are given in: MacDonald, D.S. 1996. *The MNCR database - users manual*. Peterborough, Joint Nature Conservation Committee.

Note that category headers are not themselves keywords unless they are separately listed as such.

Category (bold type) and keywords

BIOCENOSSES (ecological groups)

BACTERIA (See also Microflora)
 BENTHOS (All levels)
 FAUNA
 FLORA
 FUNGI (See also Microflora)
 MEIOFAUNA
 MICROFLORA (See also Bacteria; Fungi)
 NEKTON
 PLANKTON

Environmental/physical factors

CLIMATE (Includes climate change; see also Temperature)
 FRONTAL SYSTEM
 LIGHT
 OXYGEN (see also Eutrophication)
 SALINITY (See also Lagoon/brackish)
 TEMPERATURE (See also Climate)
 TIDAL CURRENTS (Includes tidal streams and currents; see also Wave action)
 WAVE ACTION (See also Tidal currents)

Exploitation/impact/activity

AGGREGATE EXTRACTION (Sand, gravel; see also Dredging; Maerl extraction; Sand/gravel)
 ALGAL CULTURE
 ALGAL HARVESTING
 ALIEN SPECIES (Non-natives)
 ANGLING (See also Bait-digging)
 BAIT DIGGING (See also Angling)
 BARRAGES (See also Energy, Water supply)
 COASTAL DEFENCE
 CULTIVATION: OTHER (Mariculture other than algae, fin-fish, or shellfish)
 CZM (Coastal Zone Management) (Includes Sea-Use Management; see also Planning)
 DISEASES/PARASITES
 DREDGING (NAVIGATIONAL/MAINTENANCE) (See also Aggregate extraction, Waste disposal)
 ENERGY (Covers power generation; see also Barrages)
 EUTROPHICATION (Covers nitrates, phosphates; see also

Water quality)
 FISH FARMING (Fin-fish; see also Shellfish culture)
 FISHING: DRAG GEAR (See also Fishing: suction dredging)
 FISHING: GENERAL (See also angling/conservation management: species)
 FISHING: POTTING/CREELING (See also Shellfish collecting)
 FISHING: SET GEAR
 FISHING: SUCTION DREDGING (See also Fishing: drag gear; Shellfish collecting)
 FOULING (See also Artificial)
 HEAVY METALS (See also Pollution)
 HYDROCARBONS (Includes impacts, e.g. oil pollution; see also Pollution)
 IMPACT (See also Pollution)
 LAND CLAIM
 MAERL EXTRACTION (See also Maerl)
 ORGANOTIN (See also Pollution)
 PESTICIDES/HERBICIDES (See also Pollution)
 PLANNING
 POLLUTION (See also Heavy metals; Hydrocarbons; Sewage; Waste disposal; Water quality)
 PORT FACILITIES (See also Dredging (navigational maintenance); Land-claim)
 PREDATOR CONTROL (See also Predation)
 RECREATION (See also Angling; Education)
 SAND/GRAVEL (See also Aggregate extraction; Sediment)
 SEWAGE (See also Pollution)
 SHELLFISH COLLECTING (See also Fishing: drag gear; Fishing: suction dredging)
 SHELLFISH CULTURE (See also Fish farming)
 TRADE IN WILDLIFE (Including international wildlife trade)
 WASTE DISPOSAL (Includes disposal of dredge-spoil; see also Pollution)
 WATER SUPPLY (See also Barrages; Hydrology)

Feeding relationships

FEEDING METHODS
 FOOD WEBS
 GRAZING EFFECTS (Not agricultural grazing)
 PREDATION (See also Feeding methods; Predator control)

Geographic

BALTIC
 BELGIUM
 CHANNEL ISLES
 DENMARK
 ENGLAND (See also MNCR sector codes)
 ENGLISH Channel (See also MNCR sector codes)
 EUROPE (Includes European Union)
 FAROES
 FRANCE
 GERMANY
 IRELAND (Includes Northern Ireland and the Republic of Ireland; see also Irish Sea; BioMar Irish sector codes)
 IRISH SEA (See also MNCR sector codes, BioMar Irish sector codes)

ISLE OF MAN
MEDITERRANEAN
NETHERLANDS
NON GB (Intended for countries and regions not otherwise keyworded)
NORTH AMERICA (Includes Atlantic and Pacific coasts)
NORTH SEA (See also MNCR sector codes for GB)
NORTH-EAST ATLANTIC
NORWAY
PORTUGAL
SCOTLAND (See also MNCR sector codes)
SPAIN
SWEDEN
WADDEN SEA (See also Denmark, Germany, Netherlands, North Sea)
WALES (See also MNCR sector codes)

Habitats/biotopes

ARTIFICIAL (Includes offshore structures; see also Fouling)
BATHYAL
BRACKISH (See also Lagoon; Salinity)
CAVE
CHALK
CREVICE
ESTUARY (See also Marine inlet (the keyword 'estuary' was added in 1994))
FRINGING HABITAT (Includes strandline, shore backing, saltmarsh)
KELP (Stipes, holdfasts, fronds)
LAGOON (See also Brackish; Salinity)
LITTORAL
MAERL (See also Maerl extraction)
MARINE INLET (Includes fjords, sealochs and harbours; see also Estuary; Lagoon)
LAGOON
OPEN COAST (Includes offshore reefs)
ROCK/HARD
ROCKPOOL
SEDIMENT
SUBLITTORAL
UNDERBOULDER
WATER COLUMN

Legislation/policy

LEGISLATION
LEGISLATION/POLICY
MARINE CONSULTATION AREA (See also Site designation)
MARINE RESERVES/PARKS (Includes MNRs)
SITE DESIGNATION (See also Marine Consultation Area, Marine reserves/parks)

Type of information

AERIAL SURVEY (See also Photography, Remote sensing)
AMENITY/LANDSCAPE
ASSESSMENT (See also EIA/EA)
ATLAS (See also Mapping)
BIBLIOGRAPHY (See also Literature review)
BIOCHEMISTRY (See also Chemistry, Physiology)
BIODIVERSITY (See also Distributional record)
BIOGEOGRAPHY
CHEMISTRY (See also Biochemistry, Hydrography, Oceanography)
COMMUNITY CLASSIFICATION
COMPUTING (Covers methods; see also Data analysis)

CONSERVATION/MANAGEMENT:
COMMUNITIES/BIOTOPES
CONSERVATION/MANAGEMENT:
GENERAL PRINCIPLES/NON-MARINE
CONSERVATION/MANAGEMENT:HABITATS (Includes habitat creation, for which see also Artificial)
CONSERVATION/MANAGEMENT:SPECIES (Includes fish-stocks; see also Recolonisation)
DATA ANALYSIS (See also Computing)
DICTIONARY/GLOSSARY
DIRECTORY (Of names, addresses, organisations, services, etc.)
DISTRIBUTIONAL RECORD (See also Biogeography)
ECOLOGY (See also Population ecology)
EDITED VOLUME (Includes conference/symposium proceedings)
EDUCATION/INTERPRETATION (See also Recreation, Training)
EIA/EA (Environmental Impact Assessment, Environmental Assessment); includes Strategic Environmental Assessment; (see also Planning)
EXPERIMENTAL STUDY
GEOLOGY
GEOMORPHOLOGY
HISTORICAL
HYDROGRAPHY (Includes bathymetry; see also Hydrology)
HYDROLOGY (See also Hydrography; Water supply)
KEY TO SPECIES (Includes all types of identification guide; see also Taxonomy)
LITERATURE REVIEW (See also Bibliography)
MAPPING (See also Atlas)
MATHEMATICAL MODEL
METHODS
MONITORING (Includes surveillance)
OCEANOGRAPHY (See also Hydrography)
ORNITHOLOGY
PHOTOGRAPHY (See also Video)
PHYSIOLOGY
POPULAR ARTICLE (Covers non-specialist articles in magazines etc.)
POPULATION ECOLOGY (See also Ecology)
PRODUCTION
RADIOACTIVITY
RARITY
RAW DATA
RECOLONISATION (See also Conservation/management: Species)
REMOTE SENSING (See also Aerial survey, Mapping, Photography)
REPRODUCTIVE BIOLOGY
RESEARCH SUMMARY
REVIEW (See also Literature review)
SAFETY (See also Training)
SEDIMENTOLOGY
SPECIES LIST
STRANDING
SURVEY:COMMUNITIES
SURVEY:HABITATS
SURVEY:RESTRICTED DATA
SURVEY:SPECIES
TAXONOMY (See also Key to species)
TEXT BOOK
TOXICOLOGY (See also Pollution; Experimental study)
TRAINING (See also Education)
VIDEO (See also Photography)
WATER QUALITY (See also Pollution)
ZONATION

Appendix 7 Key sources for species identification used in conjunction with MNCR survey

General Texts

- Barrett, J., and Yonge, C.M. 1958. *Collins pocket guide to the sea shore*. London, Collins.
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- Hayward, P.J. 1988. *Animals on seaweed*. London, Richmond Publishing. (Naturalists' Handbooks 9.)
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- Cornelius, P.F.S. 1995. *North-west European thecate hydroids and their medusae. Part 1. Introduction, Laodiceidae to Haleciidae*. Shrewsbury, Field Studies Council, for the Linnean Society of London and Estuarine and the Coastal Sciences Association. (Synopsis of the British Fauna (New Series) No. 50.)
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- Hincks, T. 1868. *A history of the British hydroid zoophytes*. Vol. I. Text. London, John Van Voost.
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- Manuel, R.L. 1983. *The Anthozoa of the British Isles - a colour guide*. 2nd ed. Ross-on-Wye, Underwater Conservation Society.
- Manuel, R.L. 1988. *British Anthozoa (Coelenterata: Octocorallia and Hexacorallia); keys and notes for the identification of the species*. 2nd ed. Leiden, E.J. Brill/Dr W. Blackhuys, for the Linnean Society of London and Estuarine and Brackish-Water Sciences Association. (Synopsis of the British Fauna (New Series) No. 18.)
- Svoboda, A., and Cornelius, P.F.S. 1991. The European and Mediterranean species of *Aglaophenia* (Cnidaria: Hydrozoa). *Zoologischer Verhandlungen* 274.

Porifera

- Ackers, R.G. Moss D., and Picton, B.E. 1992. *Sponges of the British Isles ('Sponge V') - a colour guide and working document*. 5th ed. Ross-on-Wye, Marine Conservation Society.

Cnidaria

- Cornelius, P.F.S. 1975. A revision of the species of Lafoeidae and Haleciidae (Coelenterata: Hydroida) recorded from Britain and nearby seas. *Bulletin of the British Museum (Natural History), Zoological series*, 28: 373-426.
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Nemertinea

- Gibson, R. 1994. *Nemertean. Keys and notes for the identification of the species*. 2nd ed. Shrewsbury, Field Studies Council, for the Linnean Society of London and the Estuarine and Coastal Sciences Association. (Synopsis of the British Fauna (New Series) No. 24.)

Nematoda

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- Platt, H.M., and Warwick, R.M. 1988. *Free-living marine nematodes. Part II- British enoplids. Pictorial key to world genera and notes for the identification of British species.* London, Cambridge University Press, for the Linnean Society of London and Estuarine and Brackish-Water Sciences Association. (Synopsis of the British Fauna (New Series) No. 38.)

Entoprocta

- Nielsen, C. 1989. *Entoprocts. Keys and notes for the identification of the species.* Leiden, E.J. Brill, for the Linnean Society of London and Estuarine and Brackish-Water Sciences Association. (Synopsis of the British Fauna (New Series) No. 41.)

Sipuncularia

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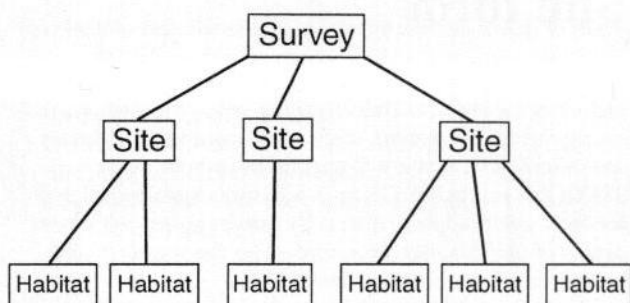
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Appendix 8 Guidance for completion of field recording forms

Introduction

The field recording forms and the MNCR database have a compatible structure, such that data are collected and stored at three levels, namely survey, site and habitat levels with the following inter-relationship:



A series of forms is available which enable recording of data to three levels of detail:

- ❑ **Mapping and inventory** surveys, in which biotopes within given areas of shore or seabed are matched to the MNCR classification, but no habitat or species data

are collected (this type of survey may include a rapid 'on site' survey and/or use of aerial photographs).

- ❑ Surveys of **intermediate** detail, in which habitat details and only the most conspicuous species are recorded, and which may be undertaken by less experienced recorders or include video surveys (which are of coarser detail than *in situ* diver surveys).
- ❑ **Detailed** surveys of each habitat with full species lists (e.g. MNCR Phase 2 surveys including infaunal sediment surveys).

Refer to the table below to ensure the correct forms are used.

Survey form

This form is for the recording of information relevant to the survey as a whole. It includes information (e.g. surveyors, dates and positions) which, when entered onto the database, act as a checking mechanism during data entry of site and habitat records.

Record numbers

Survey number Survey numbers are allocated by the MNCR at Peterborough (contact the Marine Database Manager).

Field survey recording forms to be used for different types of survey								
			Forms to use					
			SURVEY	SITE	HABITAT			
Level of detail	Methods	Littoral/ sublittoral			Littoral habitat (intermediate)	Littoral habitat (detailed)	Sublittoral habitat (intermediate)	Sublittoral habitat (detailed)
Map or list types	Aerial photography/ inventory surveys	L	•	•				
Habitat and main species	Rapid shore surveys	L	•	•	•			
	Video (including with acoustic surveys)	S	•	•			•	
	Seasearch	S	•	•			•	
Habitat and all conspicuous species	MNCR recording & infaunal sampling (cores)	L	•	•		•		
	MNCR recording & infaunal sampling	S	•	•				•

General details

Project / contract title Enter here the title of the major project (e.g. MNCR surveys of isolated saline waters in Scotland) or contract (e.g. UMBSM surveys of Scottish sealochs) to which this survey contributes.

Organisation / contractor Enter the organisation or contractor (e.g. MNCR, Devon Wildlife Trust, University Marine Biological Station, Millport) responsible for undertaking the survey.

Survey title Enter a short title (which is used frequently in database searches) to summarise the year undertaken, organisation, general location and type of survey (e.g. 1989 UMBSM Uist sealochs sublittoral survey; 1993 BioMar Berwickshire RoxAnn and video survey; 1992 FSCRC Solway littoral cockle dredge monitoring study).

Reference Give the reference(s) to the report or paper relevant to this survey. For new surveys a reference is usually not available until after the field data are entered onto the database.

Surveyors

List all the surveyors used during the survey (first and surnames) and give their initials (the latter are used for rapid entry of surveyors on site and habitat forms).

Dates of survey

Enter the first and last day of the survey.

Location

Give two corners of a box (either top left and bottom right or top right and bottom left), using either 6-figure OS grid references or latitude and longitude, that will encompass all sites surveyed during the survey (positions entered for each site are checked by the database to ensure they fall within this given box).

Types of survey undertaken

Tick all the relevant boxes.

Survey Areas

List the area or areas covered by the survey. These should be specified at the start of the survey to ensure names used are consistent with the site-naming guidance given later under 'site form'.

Districts

Give relevant districts (only for surveys in Scotland).

Counties/Regions

List the relevant counties (England and Wales) or regions (Scotland).

MNCR coastal sector

Tick the relevant one. Where the survey covers more than one coastal sector, state which sites are in each sector.

Country nature conservation agency region/team/area

Tick the relevant one. Where the survey covers more than one region (SNH), team (EN) or area (CCW), state which sites are in each.

Synopsis of report/summary of survey

Give a brief text description, outlining relevant details

relating to the aims of the survey, methods (particularly where this differs from standard MNCR methods), level of coverage, areas omitted, etc.

Data processing and validation

This section must be completed as samples and data are worked up and entered to the MNCR database. Refer to separate guidance on each stage of the data processing and validation indicated here. The survey leader / reporter is responsible for ensuring quality control and that the completed survey form is sent to the Head of the MNCR as a record that data validation has been completed to a satisfactory standard.

Site form

This form is for recording features of the site as a whole, including its physical characteristics, site designations, a conservation assessment, known uses and impacts and a site description. A site will encompass one or more STATIONS or HABITATS with a **habitat form** completed for each. For mapping/inventory surveys, only very brief details of each habitat are recorded on the site form and habitat forms are not completed.

A 'site' should be treated as a discrete area of shore or seabed (for instance a rocky shore between sandy bays, a channel between two islands) which can be surveyed during a single visit, although second visits may be required for complex areas. For some extensive sediment flats, whole lagoon sites or for mapping surveys with discrete lengths of coast of similar character, the site may be several kilometres in extent but for detailed recording of rocky habitats the site will be the broad transect down the rock slope or a spot location on a level seabed. Repeat surveys at different times of the year or different years are best considered as different 'surveys' and hence would require separate site records.

Record numbers

Survey number Survey numbers are allocated by the MNCR at Peterborough (contact the Marine Database Manager) and can be entered after the survey if unknown at the time of survey.

Site number This is the report site number assigned at the end of a survey before data entry to the database. Allocation of this number allows renumbering of sites into a more sensible geographical order if required.

Field site number Assigned each day during a survey.

Number of habitat records Number of habitat records completed for this site (note that all habitats present may not have a completed habitat form).

Location

The combination of site name, survey area, district and county/region, should provide a clear indication, without reference to a map, of where the site is located. FOLLOW THE GUIDANCE BELOW - these names are used in reports and to label photographs and must be **clear and informative**.

Site name Use a nearby distinctive feature named on the Admiralty chart or Ordnance Survey map (1:10,000 or 1:25,000 series). The name should be informative and

precise but not verbose:

e.g. SW of Black Head
Slippery Head

Channel between Red Island and North Rocks

Names such as 'Loch Torridon' and '600 m from slip' are at the wrong scale or too vague.

Use capitals for **proper** place names only (i.e. names used on charts and OS maps) and **abbreviate all cardinal points (without full stops) unless they are part of the place name.**

Survey area These should be defined by the survey leader at the start of the survey, for each discrete body of water or stretch of coast (e.g. Loch Sween, Lundy Island, River Stour). Where there is no obvious name it is best to link the site name to the nearest town, so that a combination of town and county gives some idea of where 'SW of Black Rock' actually is, e.g. 'SW of Black Rock, Workington, Cumbria'.

District (Scotland) Applicable only to Scotland (sub-divisions of the Scottish Regions).

County/Region Give the county (or Region/Island Council in Scotland).

Position

(OS grid references or latitude/longitude) - The position of the centre of the site must be given either as an OS grid reference or latitude and longitude. For sites where the area surveyed covers an extensive area (e.g. extensive sediment shores or drift dives) then the limits of the site can be entered as well.

Generally, OS grid references should be used for shore sites where the site position is derived from OS maps, and the latitude and longitude given where positions are derived from Admiralty charts or from Decca or GPS (Global Positioning System). State from which method the position was derived, including the datum for Decca and GPS (usually WGS72 and WGS84 respectively).

Grid references Give a six figure grid reference (e.g. SX 934 192).

Latitude/longitude Give degrees and minutes at least, with decimal fractions of minutes (e.g. 54°31.50'N 4°35.15'W) if possible. Positions entered as degrees, minutes and seconds (e.g. 54°31'30"N 4°35'10"W) are also acceptable.

Survey details

The form allows details for two visits per site to be entered, as for instance when further sampling is required on a second visit or two pairs of surveyors record from the same sublittoral rock site at different depth zones.

Surveyors Give full surnames and all initials of persons undertaking the survey (not just initials).

Date/time/duration Give the date of the survey in the form indicated, time on the 24-hour clock at the beginning of the survey and duration of the survey (hours/minutes). The correct formats for date, time and duration respectively are 27.4.89, 13:45 and 00:22.

Underwater visibility (m) (sublittoral surveys by SCUBA diving only) - An estimate of the horizontal underwater visibility.

Height / depth of survey (m)

Tidal correction (m) Enter the correction used to

convert height or depth limits surveyed relative to sea level to those relative to chart datum. The correction should be calculated from Admiralty tidal predictions for the nearest port or secondary port.

Measured from sea level / Corrected to Chart Datum

Enter the upper and lower height or depth limits covered during the survey of the site. Depths below sea level or chart datum should be preceded by a -, heights by a +.

Type of survey

Tick either littoral or sublittoral (or both) and the types of survey undertaken. **Recording** relates to surveying of epibiota on rocky substrata and on the surface of sediments or the recording of large widely-spaced infaunal species found by digging into the sediment. Ensure the correct core size and the sieve mesh size used for sediment sampling are given; note the number of cores taken on the **habitat** form.

Photography

This section is included to assist in keeping track of the photography carried out in the field and later correlation of photographs with particular sites and photographers (it is often useful to add a note of the subject matter, e.g. '*Metridium*' or 'kelp forest').

Number taken Record the number taken (approximately if necessary) of each type. This should be adjusted if necessary when photographs for the survey are labelled (some may be discarded if poor quality).

Physiographic features

The physiographic feature in which the site is located. There are two main divisions (open and enclosed coast), each of which is further divided. Record the appropriate sub-division, ticking the main category only (i.e. do not tick 'island/rock' for something within a larger marine inlet).

Open coast

Any part of the coast, including offshore rocks and islands, which is not within a marine inlet or lagoon.

Linear coast Areas of open coast including large islands which do not comply with categories below.

Islands / rocks Features separated from the coast of the mainland or large islands.

Offshore seabed Seabed beyond 3 miles (5 km) from the shore.

Semi-enclosed coast An area of coast bounded by headlands which provide some shelter from along-shore winds but which is predominantly open to onshore winds (compare 'embayment').

Strait / sound Channels between the mainland and an island, or between two islands which are open at both ends to the open coast (it does not refer to similar features or narrows within marine inlets).

Barrier beach Coastal features caused by long-shore drift which create sheltered areas (of sediment) behind them.

Enclosed coast

Marine inlets and lagoons which are fully enclosed from the open sea except at the entrance. They include sealochs, voes, estuaries, rias and harbours.

Embayment An enclosed area of coast in which the entrance provides shelter from onshore winds for the major part of the coast inside, but which is not a sealoch, ria, voe, estuary or lagoon.

Sealoch Glacially formed inlets (fjords, fjards) of western Scotland and Ireland; typically elongate and deepened by glacial action with little freshwater influence. Often with narrows and sills dividing the loch into a series of basins.

Ria / voe Drowned river valleys of south-west Britain (ria) and Shetland (voes). Often with a greater presence of rock and more marine in character than estuaries.

Estuary Downstream part of a river where it widens to enter the sea; often with significant freshwater influence and predominantly comprising sediment habitats.

Isolated saline water (lagoon) Enclosed bodies of water, separated or partially separated from the sea by shingle, sand or sometimes rock and with a restricted exchange of water with the sea, yielding varying salinity regimes.

Salinity, wave exposure and tidal streams

For the following categories of **salinity, wave exposure and tidal streams**, record the **predominant category affecting the site as a whole**. Note this may differ between littoral, infralittoral and circalittoral zones in the same location. When there is local variation within the site (for instance, in a major zone) note this on the individual habitat forms.

Salinity

Salinity, particularly in estuaries and lagoons, may be difficult to assess on site, but a review of the literature prior to the survey may assist in categorising each site. The species present on site may also indicate the overall salinity regime to which the site is subject.

The categories are defined as follows (the points of separation approximate to critical tolerance limits for marine species):

Fully marine	30–40‰
Variable	18–40‰
Reduced	18–30‰
Low	<18‰

Give the actual salinity (or salinity range) if measured on site.

Wave exposure

These categories take account of the aspect of the coast (related to direction of prevailing or strong winds), the fetch (distance to nearest land), the degree of open water offshore and the depth of water adjacent to the coast. Estimation of wave exposure will require inspection of charts and maps. In some cases (e.g. Scapa Flow in Orkney) the wave exposure on the shore is greater than in the sublittoral due to enhanced sea chop from persistent strong winds. The wave exposure can often be arrived at by using the guidelines on the form, but fuller descriptions are given below:

Extremely exposed This category is for the few open coastlines which face into prevailing wind and receive oceanic swell without any offshore breaks (such as islands or shallows) for several thousand kilometres and where deep water is close to the shore (50 m depth

contour within about 300 m).

Very exposed These are open coasts which face into prevailing winds and receive oceanic swell without any offshore breaks (such as islands or shallows) for several hundred kilometres but where deep water is not close (> 300 m) to the shore. They can be adjacent to extremely exposed sites but face away from prevailing winds (here swell and wave action will refract towards these shores) or where, although facing away from prevailing winds, strong winds and swell often occur.

Exposed At these sites, prevailing wind is onshore although there is a degree of shelter because of extensive shallow areas offshore, offshore obstructions, a restricted (< 90°) window to open water. These sites will not generally be exposed to strong or regular swell. This can also include open coasts facing away from prevailing winds but where strong winds with a long fetch are frequent.

Moderately exposed These sites generally include open coasts facing away from prevailing winds and without a long fetch but where strong winds can be frequent.

Sheltered At these sites, there is a restricted fetch and/or open water window. Coasts can face prevailing winds but with a short fetch (say < 20 km) or extensive shallow areas offshore or may face away from prevailing winds.

Very sheltered These sites are unlikely to have a fetch greater than 20 km (the exception being through a narrow [< 30°] open water window). They face away from prevailing winds or have obstructions, such as reefs, offshore.

Extremely sheltered These sites are fully enclosed with fetch no greater than about 3 km.

Ultra sheltered Sites with fetch of a few tens or at most 100s of metres.

Tidal streams (maximum at surface)

This is maximum tidal stream strength which affects the actual area surveyed. **Note that for shores and inshore areas this may differ considerably from the tidal streams present offshore.** In some narrows and sounds the top of the shore may only be covered at slack water, but the lower shore is subject to fast-running water. Where tidal streams are significantly different for individual habitats (either enhanced or reduced) compared with the overall strength at the site, this should be noted under 'Modifiers' on the individual habitat record form. The categories are broad and in the circalittoral zone finer divisions, particularly of 'moderately strong' above and below 2 knots, may be significant in structuring community composition.

The categories are defined as follows:

Very strong	>6 knots (>3 m/sec.)
Strong	3–6 knots (1.5–3 m/sec.)
Moderately strong	1–3 knots (0.5–1.5 m/sec.)
Weak	<1 knot (<0.5 m/sec.)
Very weak	negligible

The velocity may be shown on Admiralty charts (either shown directly or as a diamond keyed elsewhere on the chart) or in coastal pilots. However, it is uncommon to have such a direct record for the site being surveyed and you may have to extrapolate considerably.

Geology

Tick at least the major headings (Hard, Moderately hard, Friable, Soft or Very soft) and the secondary headings if possible. Refer to a geological map for the area being surveyed but exercise care in relying on the map, particularly for sublittoral habitats.

Stratification (sublittoral sites only)

A thermocline is a sharp temperature change across a depth profile and will usually be felt by the surveyor descending through the water column. If a thermocline is present, temperature above and below can be noted. A halocline will be indicated by a 'hazy' or shimmering appearance in the water.

Littoral width (littoral sites only)

Distance from High Water Spring Tides to Low Water Spring Tides. Give an estimate of the maximum extent of this for the part of the shore you are working on and for a line at right angles to the top of the shore.

Littoral aspect (littoral sites only)

The direction(s) to which the shore faces open water (may be important in relation to prevailing winds and to desiccation effects due to the sun).

Conservation assessment

The categories here are in 'Mitchell, R. (1987). *Conservation of marine benthic biocenoses in the North Sea and the Baltic*. Strasbourg: Council of Europe' or in the MNCR site assessment protocol. Some of these criteria require experience of similar situations and you should only complete them if you feel confident to do so. Assessment of individual habitats should be noted on the relevant habitat form.

Site designations

This information should be obtained before a survey and noted when the site lies **within the designated site** (include proposed designations if known).

Uses and impacts

These are generally self explanatory. You should tick an activity if you know it occurs even if you do not see the activity while you were at the site. Some impacts will be direct and localised and should only be recorded if on the site. Others may be more diffuse (such as sewage discharge) and should be recorded if it is likely to occur at the site surveyed.

Biotopes present

List the habitats and communities (= biotopes) present at the site, numbering them from the highest or shallowest habitat surveyed to the lowest or deepest. The biotope name should be specific to the site (as on the habitat record form) rather than the general title given in the national classification. Indicate which have records completed on

habitat forms; **when full habitat records are not made, complete the details for classification code and notes.**

Give the source (i.e. version of MNCR classification) of the classification code used.

Sub-habitats At some sites, such as rocky shores, habitats may be further split (e.g. rock pools, overhangs) beyond the main records made in each zone. Link the two records with an arrow from the sub-habitat to the main habitat. The two records can then be linked in the database for some types of analysis.

Mapping/inventory surveys (full details of procedures are given in the *Marine phase 1 handbook*; Richards, Bunker and Foster-Smith, 1996) - When aerial photographs are being ground-truthed, give brief details of each biotope within the defined polygons of the photograph, noting the percentage cover of each biotope (which must add up to 100% for each polygon) and clearly demarcating the biotopes within one polygon from those in the next polygon.

Site description

This is a 'sketch in words' to describe the main characteristics of the site including the type of site, its general physical location, any particular reason for selecting the site and the spatial relationship of the biotopes present. Also include any features which are particularly unusual or of high conservation value. An example is given below:

"A steeply sloping sheltered bedrock shore at the entrance to a large sealoch. Zonation on the shore was distinct with typical zones of yellow and grey lichens, black lichens, *Pelvetia canaliculata*, *Fucus spiralis*, *Fucus vesiculosus* and *Fucus serratus*. The site was representative of shores in the area and had unusually dense numbers of the nudibranch *Onchidoris bilamellata*. The site was about 150 m south of a large fish farm."

Location and sketch/profile/plan of site

Show the location of the site by sticking on a photocopy of a map or chart, and an additional sketch map if necessary to enable re-location of the site. Show the spatial relationship of the different biotopes surveyed in a profile, 3-D drawing or a plan (particularly appropriate for sediment habitats) of the site. Mark clearly the habitats surveyed with height or depth boundaries and where possible indicate the main species present (in words or pictorially). 3-D sketches are particularly useful (but work according to your artistic ability). For mapping/inventory surveys more detailed maps may be made separately and kept with the site form.

Habitat forms

The front page of these forms is for a description of the main characteristics, physical and biological, of each separate habitat investigated. Species present are noted on the remaining pages. The **intermediate** forms allow for up to three habitat records to be made per form.

Because the **littoral** and **sublittoral** versions and the **intermediate** and **detailed** versions are all similar in format and content, details for all versions are given together here. Some categories may not therefore appear on particular forms.

At the top of each set of boxes the type of information required is shown:

- ✓ = tick one only
- ✓✓ = tick as many as apply
- 1-5 = score as appropriate
- % = give estimated percentage of the total encountered
- Abund. = give abundance of taxon on the MNCR SACFOR abundance scale (Superabundant, Abundant, Common, Frequent, Occasional, Rare)

General details

Survey no., Site no., Field site no. As on the associated site form.

Site name As on the associated site form.

Habitat number A sequential number allocated to each habitat within the site. Habitat numbers should run from the highest or shallowest habitat (= 1) to the lowest or deepest.

Position within site For most sites, this section will **not have to be completed** as the position on the site form will be sufficiently accurate. However, it should be completed where the site covers a large area, such as an extensive sediment flat and the location of the habitat or station is significantly different to the central site location on the site form.

Number of cores Give the number of infaunal core samples taken.

Sieved volume Note the volume in litres of sediment left after sieving (to assist later in drawing up contracts for sample sorting).

Replicate number For remotely collected grab and dredge samples several replicates may be taken. The volume, sample numbers and position should be noted for each, although they each have the same habitat number. (Intermediate survey forms only).

Sample volume For remotely collected grab and dredge samples note the volume in litres of sediment collected (i.e. before sieving), rejecting samples with insufficient sediment. (Intermediate survey forms only).

Infaunal sample number Note the number code put on any label/embossed plastic tape with the sample. The following convention is recommended: Survey no. or a letter code for survey/Field Site no./Habitat no., e.g. 346.14.2 or MB14.2 where MB indicates survey area (in this case Morecambe Bay).

Granulometry sample number Note the number code put on any label/embossed plastic tape with the sample. Use the SAME NUMBER as the infaunal sample + GS, e.g. 346.14.2GS.

Surveyors

Enter names of the survey staff (which may be a subset of those surveying the whole site).

Height/depth limits

Enter the upper and lower height or depth limits relative to sea level and relative to chart datum after correction.

Height band/depth band

The appropriate height or depth band should be indicated

(essential for sediment shores and all sublittoral habitats). **Biological zone** These are primarily related to rocky habitats or those where algae grow (e.g. stable shallow sublittoral sediments). **Separate** habitat records should be made for each zone. **Avoid making records which span zones**, especially where they cross the main zones, such as between infralittoral and circalittoral or littoral fringe and eulittoral. Additionally, records may be made for sub-habitats within a zone if appropriate (e.g. rockpools in the mid eulittoral) but note here the zone applicable.

The zones are defined below:

Supralittoral colonised by yellow and grey lichens, above the *Littorina* populations but generally below flowering plants.

Upper littoral fringe this is the splash zone above High Water of Spring Tides with a dense band of the black lichen *Verrucaria maura*. *Littorina saxatilis* and *Littorina neritoides* often present. May include saltmarsh species on shale/pebbles in shelter.

Lower littoral fringe the *Pelvetia* (in shelter) or *Porphyra* (exposed) belt. With patchy *Verrucaria maura*, *Verrucaria mucosa* and *Lichina pygmaea* present above the main barnacle population. May also include saltmarsh species on shale/pebbles in shelter.

Upper eulittoral barnacles and limpets present in quantity or with dense *Fucus spiralis* in sheltered locations.

Mid eulittoral dominated by barnacles (or sometimes by mussels) in more exposed locations, and by *Fucus vesiculosus* and *Ascophyllum nodosum* in more sheltered locations. *Mastocarpus stellatus* and *Palmaria palmata* patchy in lower part. Usually quite a wide belt.

Lower eulittoral *Fucus serratus*, *Mastocarpus stellatus*, *Himantalia elongata* or *Palmaria palmata* variously dominant; barnacles sparse.

Sublittoral fringe dominated by *Alaria esculenta* (very exposed), *Laminaria digitata* (exposed to sheltered) or *Laminaria saccharina* (very sheltered) with encrusting coralline algae; barnacles sparse.

Upper infralittoral dense forest of kelp.

Lower infralittoral sparse kelp park, dominated by foliose algae except where grazed. May lack kelp.

Upper circalittoral dominated by animals, lacking kelp but with sparse foliose algae except where grazed.

Lower circalittoral dominated by animals with no foliose algae but encrusting coralline algae.

Extent of record

Tick zone/height or depth band except where the record is from a restricted feature (such as a rockpool, isolated patch of sediment or rock outcrop) or where several habitats have been recorded together (e.g. where a rapid record is made of a whole shore).

Survey quality

Indicate the quality of records obtained from both fauna and flora.

Thorough suggests that all conspicuous species have been recorded.

Adequate indicates that a high proportion of conspicuous species were recorded (a few more would be found given extra time) or that you feel your expertise is such that some species may have been

overlooked but you were able to record thoroughly within the habitat.

Incomplete implies that insufficient time was spent recording the habitat or that your expertise in fauna or flora was poor.

Do not over-estimate your abilities; inadequately recorded records should be labelled as such and can be screened out of analytical procedures if necessary.

Substratum

Give the percentage of each different substratum present in the habitat as a whole (i.e. from where this particular record is made). For sediments estimate the proportion of each grain size category (which should be backed up by a sample taken for granulometric analysis). The total should add up to 100%.

Where species are recorded as epibiota on fucoid fronds or kelp stipes **do not** record the fucoid or kelp as part of the substratum - the habitat is rock.

Inclination

This category gives an indication of the variation in inclination of the substrata within the record. Record the relative quantity of each category as a proportion of 100%.

Features

Record the particular features of the habitat as a tick (rockmill, ripples, etc.) or on a 1-5 scale as indicated. Where categories are scored, an indication of the extremes of the scale are given below and recorders should interpolate between these for each record.

The categories given here indicate the range of features which should be used to aid description of the habitat, and which in some cases may be better described in words than as a 1-5 score.

Features - Rock

Surface relief overall relief of the habitat from **very even** (unbroken bedrock with uniform inclination) to **very rugged** (highly broken slope with wide range of surfaces, possibly with gullies or rockpools breaking up the overall inclination considerably).

Texture an indication of the smoothness of the rock type from **very smooth** (a hard and well-worn rock such as granite or well rounded cobbles) to **highly pitted** (a highly pitted or bored rock such as some limestone, or very fragmentary and jagged rock such as shale).

Stability an indication of the stability of the rock, and related to wave action, from **very stable** (bedrock or boulders which are never moved by wave action) to **highly mobile** (frequently turned pebbles, cobbles or even boulders, where colonisation is considerably affected because of such movement).

Scour an indication of scour by sand (not abrasion from mobility of rocks - see above), from **none** (no scour present) to **highly scoured** (very highly scoured by sand - rocks likely to be smooth and without colonisation).

Silt the amount of silt settled on the rocks, from **none** (very clean rock surfaces) to **highly silted** (thick layer of silt on all surfaces). Where sand deposits on rocks from wave action note under the tick-boxes of this section.

Fissures - the amount of fissures (over 10 mm wide) present, from **none** to **very many** (accounts for high proportion of habitat).

Crevice the amount of crevices (less than 10 mm wide) present, from **none** to **very many** (accounts for high proportion of habitat).

Rockpools the amount of rockpool present, from **none** to **very many** (accounts for high proportion of habitat).

Boulder, cobble, pebble shape - from **highly rounded** (very rounded boulders, cobbles or pebbles) to **very angular** (highly angular boulders, cobbles or pebbles, e.g. slates).

Features - Sediment

Surface relief overall relief of the habitat, from **very even** (surface completely uniform) to **highly uneven** (surface perhaps with numerous mounds or drainage channels).

Firmness an indication of the degree of softness or compactness of the sediment, on the scale (with littoral and sublittoral guides): 1 **very firm** (no indentation when walked on; difficult to dig with fingers), 2 (make a slight indentation; fingers only in), 3 (sink ankle deep; hand in), 4 (sink knee deep; can penetrate up to elbow) to 5 **very soft** (sink thigh deep; whole arm in).

Stability from **highly stable** (movement of sediment very unlikely) to **highly mobile** (sediment constantly being moved).

Sorting an indication of the uniformity of the particle size, from **very well sorted** (sediment composed of a single grain size) to **very poorly sorted** (sediment with wide range of grain sizes).

Black layer an indication of the depth of the anoxic layer, on the scale: 1 = not visible, 2 > 20 cm below surface, 3 = 5-20 cm below surface, 4 = 1-5 cm below surface, 5 = < 1 cm below surface.

Modifiers

Tick if any of these are affecting the habitat. This category indicates in particular if conditions for this habitat record are different to the overall conditions as noted on the Site form (e.g. salinity, wave exposure or tidal streams).

Freshwater runoff where small streams run over the shore or a freshwater surface layer develops and may affect the species present.

Wave exposure - wave surged gullies which face towards the sea often funnel and enhance wave action; in the sublittoral fringe they often lack *Alaria esculenta* or kelps. Lower shore habitats on steep and vertical rocky shores are often subject to increased wave action compared to the upper shore.

- **sheltered** localised protection from the predominant wave action.

Tidal stream - accelerated from that indicated on the Site Form. Occasionally rock outcrops or wrecks which protrude into the water column experience stronger currents than the surrounding seabed.

- **decelerated** habitats, particularly in the littoral zone and kelp forest probably experience markedly reduced tidal streams compared with those offshore (which are the likely source of tidal stream data from charts and coastal pilots) or on the lower shore of sealoch narrows. If a habitat is specifically subject to slower tidal streams by

way of shelter from headlands, gullies etc., note it here.
Grazing where grazing has eliminated the algae used to characterise the zone, e.g. where *Echinus* completely grazes the foliose algae below kelp forests on North Sea coasts.

Shading shaded surfaces on the shore or in the shallow sublittoral.

Pollution where pollution has or may have a significant modifying effect on the habitat.

Assessment

Give your on-site assessment of the quality of the biotope. This assessment will rely upon the personal experience of the recorder, both within the region being surveyed and of the biotope in question. **Inexperienced recorders may feel unable to complete this section.** The assessment should act as a guide to the survey reporter of the conservation value of the biotope, although a wide variety of other data will also be taken into account in any final evaluation.

Representativeness An assessment of how closely the biotope at the site is representative, both physically and biologically, of the character of the biotope in the MNCR sector as a whole, on the scale:

5 *Very high* Habitat typical. Characteristic species present in average abundance. Significant number of preferential species present or fewer present but in high abundance.

4 *High* Habitat typical. Characteristic species mostly present in average abundance. Preferential species present in moderate abundance.

3 *Moderate* Habitat mostly typical. Characteristic species present but sometimes abundances different to normal. Few preferential species present.

4 *Low* Habitat may show slight variation from the norm. Characteristic species present in slightly different abundances. Very few preferential species present.

5 *Very low* Habitat may show large variation from the norm. Characteristic species present in markedly different abundance to normal. No preferential species present.

Naturalness The degree to which the habitat is affected by man, either through change in the substrata, pollution or disturbance or the introduction of non-native species which affect the natural community composition. Scale:

5 *Highly natural* Substrata wholly natural, likely to be virtually free from pollution or disturbance and no non-native species present.

4 *Natural* Substrata predominantly natural, little evidence of pollution or disturbance (whilst recognising diffuse pollutants and activities such as fishing/potting may have some effect), or non-native species rare to occasional.

3 *Semi-natural* Substrata not fully natural or pollution / disturbance possible or non-native species frequent to common.

2 *Unnatural* Substrata mostly artificial, or significant evidence of pollution or disturbance or non-native species common to abundant.

1 *Highly unnatural* Substrata artificial, or habitat

heavily polluted or disturbed or non-native species abundant to super abundant.

Extent The extent by area of the habitat, based on actual evidence in the field or reasonable judgement from information on charts or maps. Scale:

6 *Very extensive* > 10,000,000 m² (> 3.16 km x 3.16 km)

5 *Extensive* 1,000,000 - 10,000,000 m²
(1 km x 1 km - 3.16 km x 3.16 km)

4 *Moderately extensive* 100,000 - 1,000,000 m²
(316 x 316 m - 1 km x 1 km)

3 *Limited* 10,000 - 100,000 m² (100 x 100 m - 316 x 316 m)

2 *Very limited* 100 - 10,000 m² (10 x 10 m - 100 x 100 m)

1 *Extremely limited* 0 - 100 m² (up to 10 x 10 m)

Species richness An indication of the number of different species present compared with the average for that community in the region (i.e. an exposed sandy beach which would not normally have a rich biota because of the mobile nature of the sediment should not be compared with more stable shores which are usually much richer). Score as follows:

5 *Very high*

4 *High*

3 *Moderate*

2 *Low*

1 *Very low*

Abundance/biomass relates to the quantity or biomass of fauna and flora present. Score as follows:

5 *Very high*

4 *High*

3 *Moderate*

2 *Low*

1 *Very low*

Main cover or characterising species

List the species or higher taxa which best characterised that particular habitat, and note their abundance (abundances are not entered to the database but are important in later interpretation of the record). **Do not list species simply because they were very common**, but only if they are good indicators of the habitat type. Taxa given here (except higher taxa specified individually in the species list) **must not be omitted** from the main species checklist.

Biotope name

This should be a succinct (< 60 character) description of the biotope including the key features of the substrata, the biological zone or height/depth band and the type of community. Modifiers (e.g. tidal stream strengths) should be included in the biotope name if they distinguish this biotope from another. Examples of descriptions are given below.

"Overhanging, infralittoral bedrock with sponges"

"Boulders and cobbles on mud with solitary ascidians at 11-17 m"

"Lower eulittoral *Sabellaria alveolata* reefs"

"Tide-swept cobbles and pebbles with brittlestars at 24-28 m"

Biotope description

This is a 'sketch in words' to describe the main characteristics of the biotope and can include features not included in the checklist, or mentioned in the biotope name. An example is given below:

"A gently sloping plain of sandy mud with patches of empty shells, supporting a diverse community of epifaunal and burrowing species, with *Pecten maximus* and *Virgularia mirabilis* particularly conspicuous."

In your description try to give a clear pen picture of the habitat and the spatial arrangement of the main cover taxa or predominant infaunal groups. Also note any rare or unusual features or species or if the biotope is in any way atypical.

MNCR classification code

Your on-site match of the record to the MNCR classification of biotopes (ensure the version of the classification is noted on the site form).

When assigning field records to a particular biotope the following annotations can be used against the biotope code:

- ? Unsure if record fits defined biotope
- T Record **transitional** between two biotopes (both codes receive a T)
- P Only **part** of record refers to biotope (i.e. record

includes several biotopes) - this is used primarily when matching old data not collected to current MNCR methodology.

- I **Incomplete** record lacking full species list
- ?T Combination of ? and T above
- ?P Combination of ? and P above

Use of these 'flags' is important in data handling to separate adequately correlated records from those for which some uncertainty remains.

Species list

Note ALL the conspicuous species present within the habitat for which this record applies, including any additional species not listed in the checklist. Recording should continue until very few new species are being recorded with additional survey effort. Mark the abundance in the box according to the MNCR abundance scales, but note when a specimen or photograph was taken of the species, or the identification is uncertain (with a '?') to the left of the species code. A specimen **MUST** be kept when identification is uncertain, the species appears to be out of its recorded distributional range or the species is particularly uncommon and its identification might be questioned by others. Species may be recorded as "present" (P) if they are recorded only from samples and abundance is unclear or if field records do not include the information required to identify an abundance grade.

Appendix 9 Abundance scales

Abundance scales used for both littoral and sublittoral taxa from 1990 onwards

Key: S = Superabundant, A = Abundant, C = Common, F = Frequent, O = Occasional, R = Rare

% COVER	Growth form		Size of individuals/colonies				DENSITY	
	CRUST/MEADOW	MASSIVE/TURF	< 1 cm	1-3 cm	3-15 cm	>15 cm		
>80%	S		S				>1/0.001 m ² (1 x 1 cm)	>10,000 / m ²
40-79%	A	S	A	S			1-9 / 0.001 m ²	1000-9999 / m ²
20-39%	C	A	C	A	S		1-9 / 0.01 m ² (10 x 10 cm)	100-999 / m ²
10-19%	F	C	F	C	A	S	1-9 / 0.1 m ²	10-99 / m ²
5-9%	O	F	O	F	C	A	1-9 / m ²	
1-5 % or density	R	O	R	O	F	C	1-9 / 10 m ² (3.16 x 3.16 m)	
<1% or density		R		R	O	F	1-9 / 100 m ² (10 x 10 m)	
					R	O	1-9 / 1000 m ² (31.6 x 31.6 m)	
						R	<1 / 1000 m ²	

PORIFERA	Crusts <i>Halichondria</i>	Massive spp. <i>Pachymatisma</i>		Sml solitary <i>Grantia</i>	Lge solitary <i>Stelligera</i>	
HYDROZOA		Turf species <i>Tabularia</i> <i>Abietinaria</i>		Small clumps <i>Sarsia</i> <i>Aglaophenia</i>	Solitary <i>Corymorpha</i> <i>Nemertesia</i>	
ANTHOZOA	<i>Corynactis</i>	<i>Alcyonium</i>		Sml solitary <i>Epizoanthus</i> <i>Caryophyllia</i>	Med. solitary <i>Virgularia</i> <i>Cerianthus</i> <i>Urticina</i>	Large solitary <i>Eunicella</i> <i>Funiculina</i> <i>Pachycerianthus</i>
ANNELIDA	<i>Sabellaria spinulosa</i>	<i>Sabellaria alveolata</i>	<i>Spirorbis</i>	Scale worms <i>Nephtys</i> <i>Pomatoceros</i>	<i>Chaetopterus</i> <i>Arenicola</i> <i>Sabella</i>	
CRUSTACEA	Barnacles Tube-dwelling amphipods		<i>Semibalanus</i> Amphipods	<i>B. balanus</i> <i>Anapagurus</i> <i>Pisidia</i>	<i>Pagurus</i> <i>Galathea</i> Small crabs	<i>Homarus</i> <i>Nephtys</i> <i>Hyas araneus</i>
MOLLUSCA			Sml gastropod <i>L. neritoides</i>	Chitons Med. gastropods <i>Patella</i> <i>L. littorea</i>	Lge gastropod <i>Buccinum</i> Lge bivalves <i>Mya Pecten</i> <i>Arctica</i>	
	<i>Mytilus</i> <i>Modiolus</i>		Sml bivalves <i>Nacula</i>	Med. bivalves <i>Mytilus</i> <i>Pododesmus</i>		
BRACHIOPODA				<i>Neocrania</i>		
BRYOZOA	Crusts	<i>Pentapora</i> <i>Bugula, Flustra</i>			<i>Alcyonidium</i> <i>Porella</i>	
ECHINODERMATA					<i>Antedon</i> Sml starfish	Large starfish Brittlestars <i>Echinus</i> <i>Holothuria</i>
				<i>Echinocyamus</i> <i>Ocnus</i>	<i>Echinocardium</i> <i>Aslia, Thyone</i>	
ASCIDIACEA	Colonial <i>Dendrodoa</i>			Sml solitary <i>Dendrodoa</i>	Lge solitary <i>Ascidia Clona</i>	<i>Diadema</i>
PISCES					Gobies Blennies	Dogfish Wrasse
PLANTS	Crusts Maerl <i>Audouinella</i> Fucoids/Kelp <i>Desmarestia</i>	Foliose Filamentous			<i>Zostera</i>	Kelp <i>Halidrys</i> Chorda <i>Himantalia</i>

Examples of groups or species for each category

Appendix 10 Examples of completed site and habitat recording forms

Recording forms for full MNCR surveys are illustrated. Additional forms are available for less detailed habitat

surveys. The additional forms include a subset of the information illustrated here.

MARINE NATURE CONSERVATION REVIEW

Survey no. 463

SURVEY



Project / contract title

Organisation / contractor

Survey title

Reference (if known)

MNCR

e.g. 1993 MNCR Colne and Blackwater estuaries littoral survey

1994 MNCR SUBLITTORAL SURVEY OF THE ARDNAMURCHAN PENINSULA

SURVEYORS

Initials	Full name	Initials	Full name
RH	ROHAN HOLT	DC	DOMINIC COUNSELL
PB	PAUL BRAZIER	DD	DAVID DONNAN
ML	MIKE LITTLE	CA	COLIN ADAMS
EM	ELEANOR MURRAY	FB	FRANCIS BUNKER
OP	OWEN PAISLEY		
KN	KATE NORTEN		

DATES OF SURVEY (dd:mm:yy)

From	27 / 06 / 94	To	03 / 07 / 94
------	--------------	----	--------------

LOCATION (limits of survey)(enter Grid Ref. or Latitude / Longitude)(either top left & bottom right OR top right & bottom left)

56° 48.5 'N 07° 10.9 'W	56° 38.0 'N 05° 00.0 'W
-------------------------	-------------------------

TYPES OF SURVEY UNDERTAKEN

<input type="checkbox"/> Zone	<input type="checkbox"/> Sampling	<input type="checkbox"/> Sieve size
<input type="checkbox"/> Littoral	<input type="checkbox"/> Cores (shore: 11 cm diam.)	<input checked="" type="checkbox"/> 0.5 mm mesh
<input checked="" type="checkbox"/> Sublittoral	<input checked="" type="checkbox"/> Cores (diver: 10.3 cm diam.)	<input type="checkbox"/> 1.0 mm mesh
	<input type="checkbox"/> Dredge - anchor	<input type="checkbox"/> Other (state):
	<input type="checkbox"/> Dredge - biological	
<input type="checkbox"/> Recording	<input type="checkbox"/> Grab - Day	<input type="checkbox"/> Images
<input type="checkbox"/> Inventory/map (biotope types only)	<input type="checkbox"/> Grab - Van Veen	<input checked="" type="checkbox"/> Photography
<input type="checkbox"/> Intermediate <i>in situ</i> (habitat / main spp.)	<input type="checkbox"/> Granulometry sample	<input checked="" type="checkbox"/> Video
<input type="checkbox"/> Intermediate remote (habitat / main spp.)	<input type="checkbox"/> Suction sampler	
<input checked="" type="checkbox"/> Detailed (habitat / all spp.)	<input type="checkbox"/> Trawl - Agassiz	<input type="checkbox"/> Sonar
<input type="checkbox"/> Other (state):	<input type="checkbox"/> Other (state):	<input type="checkbox"/> RoxAnn
		<input type="checkbox"/> Sidescan

SURVEY AREAS (list areas defined for site names)

SOUTH OF ARISAIG	SOUND OF MULL
ARDNAMURCHAN POINT	
MULL	

DISTRICTS (Scotland only)

LOCHABER, ARGYLL AND BUTE

COUNTIES / REGIONS

HIGHLAND, STRATHCLYDE

MNCR COASTAL SECTOR

R1 <input type="checkbox"/>	Shetland	R6 <input type="checkbox"/>	Eastern England	R11 <input type="checkbox"/>	Liverpool Bay & Solway
R2 <input type="checkbox"/>	Orkney	R7 <input type="checkbox"/>	Eastern Channel	R12 <input type="checkbox"/>	Clyde Sea
R3 <input type="checkbox"/>	North Scotland	R8 <input type="checkbox"/>	Western Channel	R13 <input checked="" type="checkbox"/>	West Scotland
R4 <input type="checkbox"/>	East Scotland	R9 <input type="checkbox"/>	Bristol Channel & approaches	R14 <input type="checkbox"/>	Outer Hebrides
R5 <input type="checkbox"/>	SE Scotland/NE England	R10 <input type="checkbox"/>	Cardigan Bay & north Wales	R15 <input type="checkbox"/>	North-west Scotland

If survey covers more than one Sector state which sites are in each Sector:

--

COUNTRY AGENCY (EN team/SNH region/CCW area)

- English Nature**
- Northumbria
 - North & East Yorkshire
 - Humber to Pennines
 - East Midlands
 - Norfolk
 - Suffolk
 - Essex, Hertfordshire & London
 - Kent

- Sussex & Surrey
- Hampshire & Isle of Wight
- Dorset
- Devon & Cornwall
- Somerset & Avon
- Three Counties
- West Midlands
- North West
- Cumbria

- Scottish Natural Heritage**
- North East
 - South East
 - South West
 - North West
- Countryside Council for Wales**
- South
 - West
 - North West
 - North East

If survey covers more than one state which sites are in each Region / Team:

SYNOPSIS OF REPORT / SUMMARY OF SURVEY (note methodology particularly if different to standard MNCR methods)

Detailed survey completed by MNCR, SNH staff and contractor, of the Western Approaches of the sand of Mull and the whole of the Ardnamurchan Peninsula. Predominantly rocky substrata surveyed, with a few sediment sites recorded, and diver cores taken. Some dives were accompanied by Remote Operated Vehicle (ROV).

DATA PROCESSING AND VALIDATION

Data	Completed by	Date completed
Specimen (epibiota) identification		
Infaunal sample identification		
Granulometry sample processing		
Labelling of photographs	E. Murray	30/11/94
Pre-data entry check of field survey forms	R. Holt	12/02/94
Data entry - field data	I. Reach	26/02/94
- infauna / granulometry		
Post data entry check of site, habitat & species data	R. Holt	02/09/94
Voucher specimen collection	Lodged:	
Raw data	Stored: CONWY MNCR	

Copy of survey form to be sent to the Head of the MNCR upon completion of data validation. DATE SENT.....

Survey no. 465

Site no.

Field site no. 25

No. of habitat records 1

MARINE NATURE CONSERVATION REVIEW

SITE



LOCATION

Site name MAENLAND ROCK, LOWLAND POINT
 Survey area COVERACK
 District (Scotland only) _____
 County / Region CORNWALL

POSITION (Grid Reference or Latitude / Longitude)

Centre of site (required) 50° 02' 098 N 05° 03' 742 W
 For extensive sites (optional) From _____ To _____

Position derived from: OS map Admiralty chart Decca GPS Differential GPS
 Datum used: WGS72 WGS84 Other (state): _____

SURVEY DETAILS

	Visit 1		Visit 2	
Surveyors	1	<u>C. SPURRIER</u>	1	_____
	2	<u>R. HOLT</u>	2	_____
	3	_____	3	_____
	4	_____	4	_____
Date (dd:mm:yy)	<u>1:8:94</u>		: : _____	
Time at start (h:m)	<u>15:45</u>		: _____	
Duration of survey (h:m)	<u>0:50</u>		: _____	
Underwater visibility (m)	<u>6-10</u>		_____	
Height / depth of survey (m)	_____		_____	
Tidal correction (m)	<u>-3</u>		_____	
Measured from sea level:	Upper	<u>8.0</u>	Lower	<u>14.1</u>
Corrected to Chart Datum:	Upper	<u>5.0</u>	Lower	<u>11.1</u>
	Upper	_____	Lower	_____
	Upper	_____	Lower	_____

TYPE OF SURVEY

<input type="checkbox"/> Littoral	<input type="checkbox"/> Cores (shore: 11 cm diam.)	<input type="checkbox"/> 0.5 mm mesh
<input checked="" type="checkbox"/> Sublittoral	<input type="checkbox"/> Cores (diver: 10.3 cm diam.)	<input type="checkbox"/> 1.0 mm mesh
	<input type="checkbox"/> Dredge - anchor	<input type="checkbox"/> Other (state): _____
Recording	<input type="checkbox"/> Dredge - biological	Images
<input type="checkbox"/> Inventory/map (biotope types only)	<input type="checkbox"/> Grab - Day	<input checked="" type="checkbox"/> Photography
<input type="checkbox"/> Intermediate <i>in situ</i> (habitat / main spp.)	<input type="checkbox"/> Grab - Van Veen	<input type="checkbox"/> Video
<input type="checkbox"/> Intermediate remote (habitat / main spp.)	<input type="checkbox"/> Granulometry sample	
<input checked="" type="checkbox"/> Detailed (habitat / all spp.)	<input type="checkbox"/> Suction sampler	Sonar
<input type="checkbox"/> Other (state): _____	<input type="checkbox"/> Trawl - Agassiz	<input type="checkbox"/> RoxAnn
	<input type="checkbox"/> Other (state): _____	<input type="checkbox"/> Sidescan

PHOTOGRAPHY

	Photographer	No. taken	Equipment used (camera & lens)
Aerial			
Views / landscapes	<u>RH</u>	<u>5</u>	<u>NIKONOS II + 15mm</u>
Habitats	<u>RH</u>	<u>5</u>	<u>" "</u>
Species (close-up)			

PHYSIOGRAPHIC TYPE	
<input type="checkbox"/>	Open coast
<input type="checkbox"/>	- Linear coast
<input type="checkbox"/>	- Islands / rocks
<input type="checkbox"/>	- Offshore seabed
<input type="checkbox"/>	- Semi-enclosed coast
<input checked="" type="checkbox"/>	- Strait / Sound
<input type="checkbox"/>	- Barrier beach
<input type="checkbox"/>	Enclosed coast
<input type="checkbox"/>	- Embayment
<input type="checkbox"/>	- Sealoch
<input type="checkbox"/>	- Ria / Voe
<input type="checkbox"/>	- Estuary
<input type="checkbox"/>	- Isolated saline water (lagoon)

* SALINITY	
<input checked="" type="checkbox"/>	Full (30-40‰)
<input type="checkbox"/>	Variable (18-40‰)
<input type="checkbox"/>	Reduced (18-30‰)
<input type="checkbox"/>	Low (<18‰)
<input type="checkbox"/>	Not known
<input type="checkbox"/>	% ₀₀ Measured

* WAVE EXPOSURE	
<input type="checkbox"/>	Extremely exposed (prevailing wind / swell onshore, deep water)
<input type="checkbox"/>	Very exposed (prevailing wind and swell onshore)
<input type="checkbox"/>	Exposed (prevailing wind onshore, offshore shallows / obstructions)
<input checked="" type="checkbox"/>	Moderately exposed (prevailing wind offshore but onshore wind frequent)
<input type="checkbox"/>	Sheltered (restricted [<20 km] fetch; offshore shallows / obstructions)
<input type="checkbox"/>	Very sheltered (fetch <20 km in any direction and <3 km to prevailing wind)
<input type="checkbox"/>	Extremely sheltered (fully enclosed, fetch <3 km)
<input type="checkbox"/>	Ultra sheltered (fetch of few 10s or at most 100s m)

* TIDAL STREAMS	
(maximum at surface)	
<input type="checkbox"/>	Very strong (>6 kn.)
<input type="checkbox"/>	Strong (3-6 kn.)
<input checked="" type="checkbox"/>	Moderately strong (1-3 kn.)
<input type="checkbox"/>	Weak (<1 kn.)
<input type="checkbox"/>	Very weak (negligible)
<input type="checkbox"/>	Not known

GEOLOGY	
<input type="checkbox"/>	Hard
<input checked="" type="checkbox"/>	- Igneous
<input type="checkbox"/>	- Chert / Flint
<input type="checkbox"/>	- Slate
<input type="checkbox"/>	- Sand / Mudstone
<input type="checkbox"/>	Moderately hard
<input type="checkbox"/>	- Limestone
<input type="checkbox"/>	Friable
<input type="checkbox"/>	- Slate / Shale
<input type="checkbox"/>	Soft
<input type="checkbox"/>	- Sand / Mudstone
<input type="checkbox"/>	- Chalk
<input type="checkbox"/>	Very soft
<input type="checkbox"/>	- Clay
<input type="checkbox"/>	- Peat
<input type="checkbox"/>	Not known

STRATIFICATION	
(sublittoral sites only)	
<input type="checkbox"/>	Thermocline
<input type="checkbox"/>	Halocline
<input checked="" type="checkbox"/>	Not stratified
<input type="checkbox"/>	°C Temperature - surface
<input type="checkbox"/>	°C - bottom

LITTORAL WIDTH	
HWST-LWST (littoral sites only)	
<input type="checkbox"/>	<1 m
<input type="checkbox"/>	1-10 m
<input type="checkbox"/>	10-100 m
<input type="checkbox"/>	100-1000 m
<input type="checkbox"/>	>1000 m

LITTORAL ASPECT	
(littoral sites only)	
<input type="checkbox"/>	North
<input type="checkbox"/>	North-east
<input type="checkbox"/>	East
<input type="checkbox"/>	South-east
<input type="checkbox"/>	South
<input type="checkbox"/>	South-west
<input type="checkbox"/>	West
<input type="checkbox"/>	North-west

CONSERVATION ASSESSMENT	
<input checked="" type="checkbox"/>	Unspoilt / natural
<input checked="" type="checkbox"/>	Representative (for sector)
<input type="checkbox"/>	Rare / unusual biotopes
<input type="checkbox"/>	Rare species
<input type="checkbox"/>	High species richness
<input type="checkbox"/>	High biotope richness
<input type="checkbox"/>	Fragile species present
<input type="checkbox"/>	Fragile biotopes present
<input checked="" type="checkbox"/>	Intrinsic appeal
<input type="checkbox"/>	Ornithological interest
<input type="checkbox"/>	Seal haul out

SITE DESIGNATIONS	
(state 'p' for proposed)	
<input type="checkbox"/>	Area of Outstanding Natural Beauty
<input type="checkbox"/>	Area of Special Protection
<input type="checkbox"/>	Biosphere Reserve
<input type="checkbox"/>	Country Park
<input type="checkbox"/>	County Wildlife Trust Reserve
<input type="checkbox"/>	Environmentally Sensitive Area
<input type="checkbox"/>	Geological Conservation Review site
<input type="checkbox"/>	Heritage Coast
<input type="checkbox"/>	Local Nature Reserve
<input type="checkbox"/>	Marine Consultation Area (Scotland)
<input type="checkbox"/>	Marine Nature Reserve
<input type="checkbox"/>	Ministry of Defence site
<input type="checkbox"/>	National Nature Reserve
<input type="checkbox"/>	National Park
<input type="checkbox"/>	National Scenic Area
<input type="checkbox"/>	National Trust / NT for Scotland
<input type="checkbox"/>	Ramsar site
<input type="checkbox"/>	Royal Soc. Protection of Birds site
<input type="checkbox"/>	Sensitive Marine Area (England)
<input type="checkbox"/>	Site of Special Scientific Interest
<input checked="" type="checkbox"/>	Special Area of Conservation
<input type="checkbox"/>	Special Protection Area
<input type="checkbox"/>	Voluntary Marine Nature Reserve
<input type="checkbox"/>	World Heritage Site
.....	

USES AND IMPACTS	
<input type="checkbox"/>	Fishing - netting
<input type="checkbox"/>	- trawling
<input type="checkbox"/>	- angling
<input checked="" type="checkbox"/>	- potting
<input type="checkbox"/>	Collection - bait digging
<input type="checkbox"/>	- shellfish
<input type="checkbox"/>	- algae
<input type="checkbox"/>	Boulder turning for peelers
<input type="checkbox"/>	Extraction - sand / gravel
<input type="checkbox"/>	- maerl
<input type="checkbox"/>	- oil / gas
<input type="checkbox"/>	Aqua culture - fin-fish
<input type="checkbox"/>	- shellfish
<input type="checkbox"/>	- algae
<input type="checkbox"/>	Coastal defence - sea walls
<input type="checkbox"/>	- dredging
<input type="checkbox"/>	- groynes
<input type="checkbox"/>	Land claim
<input type="checkbox"/>	Military use
<input type="checkbox"/>	Sewage discharge
<input type="checkbox"/>	Waste dumping
<input type="checkbox"/>	Industrial waste discharge
<input type="checkbox"/>	Litter and debris
<input type="checkbox"/>	Oil / tar / chemicals
<input type="checkbox"/>	Educational / scientific study
<input type="checkbox"/>	Recreational - facilities
<input type="checkbox"/>	- resort
<input type="checkbox"/>	- marina
<input type="checkbox"/>	- popular beach
<input type="checkbox"/>	- water sports
<input type="checkbox"/>	- dive site
<input type="checkbox"/>	- wind surfing
<input type="checkbox"/>	Mooring / beaching / launching
<input type="checkbox"/>	Evidence of physical damage
.....	

* Apply to site as a whole; local variations can be noted on individual habitat forms

BIOTOPES PRESENT (link records of sub-habitats, e.g. rockpools and under-boulders, to the main habitat with an arrow)

MNCR classification: version used

Hab. no.	Form	*% cover	Biotope	Classification code	Notes
1		✓	Laminaria hyperborea forest with Saccorhiza polyschides with foliose + filamentous algae	No code assigned	Laminaria hyperborea mixed with Saccorhiza polyschides, Corynactis + bryozoans on verticals.

*For mapping surveys, percentages must add up to 100% within each polygon (area) defined on map / aerial photograph. Clearly demarcate each biotope or group of biotopes which make up a defined polygon.

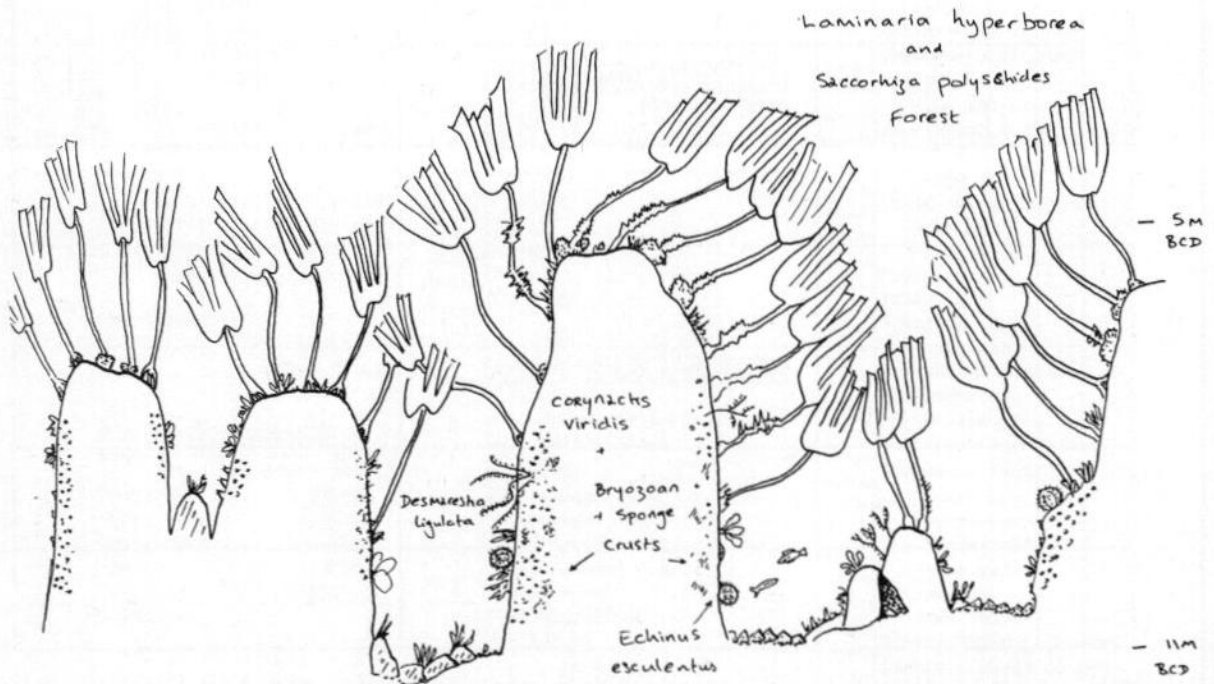
SITE DESCRIPTION

- indicate any specific reason for site selection
- include general location of site
- outline biotopes present, particularly their spatial arrangement
- highlight any unusual or important features of conservation value

Site situated off Lowland Point on the east side of Lizard Peninsula, adjacent to a series of pinnacles and rocks. Site chosen as representative of exposed Kelp forest with some tidal stream effects. Main habitat dominated by dense Kelp forest of Laminaria hyperborea with occasional Saccorhiza polyschides with an understory of foliose red and brown algae. Short vertical walls with Corynactis viridis, sponge and bryozoan crusts and Scrupocellaria reptans and Bugula flabellata

LOCATION AND SKETCH / PROFILE / PLAN OF SITE

- mark site position on a large scale map or chart and general map of survey area
- show clearly heights / depths relative to chart datum, biological zones and biotopes on a 3D sketch or profile OR
- show distribution of biotopes in plan on a sketch, map or chart, giving scale



Survey no. 459
 Site no.
 Field site no. 24

MARINE NATURE CONSERVATION REVIEW
 LITTORAL HABITAT (DETAILED)



Site name: CLEY CHANNEL, S. OF THE MARRAMS

Hab. no.	Position within site (extensive sites only)	No. of cores	Sieved vol. (l)	Infaunal sample no.	Granul. sample no.
2		8		BB 24. 2	BB 24. 2 GS

SURVEYORS		SUBSTRATUM		1-5 FEATURES - ROCK		1-5 FEATURES - SEDIMENT	
T. HILL		Bedrock		Surface relief (even-rugged)		2 Surface relief (even-uneven)	
M. FROST		Boulders		Texture (smooth-pitted)		2 Firmness (firm-soft)	
A. MOFFAT		- very large >1024 mm		Stability (stable-mobile)		1 Stability (stable-mobile)	
		- large 512-1024 mm		Scour (none-scoured)		2 Sorting (well-poor)	
		- small 256-512 mm		Silt (none-silted)		4 Black layer (1=not visible, 2=>20 cm, 3=5-20 cm, 4=1-5 cm, 5=<1 cm)	
m HEIGHT LIMITS		Cobbles 64-256 mm		Fissures >10mm (none-many)			
Upper (from sea level)		Pebbles 16-64 mm		Crevices <10mm (none-many)			
Lower "		Gravel 4-16 mm		Rockpools (none-all)		✓	
Upper (from chart datum)		- stone		Boulder/cobble/pebble shape (rounded-angular)		Mounds / casts	
Lower "		- shell				✓ Burrows / holes	
		- dead maerl				Tubes	
✓ HEIGHT BAND		- live maerl				Algal mat	
Strandline		Sand		Gully		Waves / dunes (>10 cm high)	
✓ Upper shore		- coarse 1-4 mm		Cave		Ripples (<10 cm high)	
Mid shore		- medium 0.25-1 mm		Rockmill		Drainage channels / creeks	
Lower shore		- fine 0.063-0.25 mm		Boulder/cobble - on rock		✓ Standing water	
		80 Mud <0.063 mm		Boulder/cobble - on sediment		Subsurface coarse layer	
		20 Shells (empty)		Boulder holes		Subsurface clay / mud	
		Artificial		Sediment on rock		Surface silt / flocculent	
		- metal		MODIFIERS		ASSESSMENT	
		- concrete		Freshwater runoff		1-5 REPRESENTATIVENESS (atyp/transp)	
		- wood		Wave exposure - wave surged		4	
		Trees / branches		- sheltered		4 Naturalness (unnat.-nat.)	
		Algae		Tidal streams - accelerated		3 Extent A (limit.-exten.)	
		100 Total		- decelerated		4 Species richness (low-high)	
				Grazing		4 Abundance/biomass (low-high)	
✓ Not applicable				Shading			
				Pollution			
EXTENT OF RECORD		INCLINATION		MAIN COVER OR CHARACTERISING SPECIES / TAXA			
Multiple habitats (whole area)		Overhangs		Abund. Species / taxon			
✓ Zone / height band		Vertical faces (80-100°)		A <i>Hydrobia ulvae</i>			
Restricted feature		Very steep faces (40-80°)		C <i>Arenicola marina</i>			
		100 Upper faces (0-40°)		C <i>Enteromorpha</i>			
SURVEY QUALITY		Underboulders		C <i>Zostera noltii</i>			
Flora Fauna		100 Total		A <i>Carcinus maenas</i>			
✓ Thorough				F <i>Hediste diversicolor</i>			
✓ Adequate							
Incomplete							

BIOTOPE NAME (key features of substrata, zone / height & community)

UPPER SHORE MUD WITH *ZOSTERA NOLTII* BEDS, *HYDROBIA* AND *ENTEROMORPHA* SP.

BIOTOPE DESCRIPTION (clearly describe substrata; main cover species / taxa; any unusual or rare features / species)

MNCR classification code:

LMUD. HS. Z

An extensive area of upper shore water logged mud with *Zostera noltii*, *Hydrobia* sp. and *Enteromorpha* sp. Very large numbers of *Carcinus maenas* juveniles were also present.

Survey no. 465
 Site no.
 Field site no. 25

MARINE NATURE CONSERVATION REVIEW
SUBLITTORAL HABITAT (DETAILED)



Site name: MAENLAND ROCK, LOWLAND POINT

Hab. no.	Position within site (extensive sites only)	No. of cores	Sieved vol. (l)	Infaunal sample no.	Granul. sample no.
1					

SURVEYORS		%	SUBSTRATUM		1-5	FEATURES - ROCK	1-5	FEATURES - SEDIMENT
C. SPURRIER		60	Bedrock		4	Surface relief (even-rugged)		Surface relief (even-uneven)
R. HOLT			Boulders		3	Texture (smooth-pitted)		Firmness (firm-soft)
		10	- very large >1024 mm		2	Stability (stable-mobile)		Stability (stable-mobile)
		10	- large 512-1024 mm		1	Scour (none-scoured)		Sorting (well-poor)
		10	- small 256-512 mm		2	Silt (none-silted)		
m	DEPTH LIMITS	4	Cobbles 64-256 mm			Fissures >10mm (none-many)		
3.0	Upper (from sea level)	2	Pebbles 16-64 mm			Crevices <10mm (none-many)	<input checked="" type="checkbox"/>	Mounds / casts
14.1	Lower "		Gravel 4-16 mm		3	Boulder/cobble/pebble shape (rounded-angular)		Burrows / holes
5.0	Upper (from chart datum)	2	- stone					Tubes
11.1	Lower "	2	- shell					Algal mat
			- dead maerl					Waves / dunes (>10 cm high)
			- live maerl					Ripples (<10 cm high)
<input checked="" type="checkbox"/>	DEPTH BAND		Sand					Subsurface black layer
	0-5 m		- coarse 1-4 mm		<input checked="" type="checkbox"/>	Gully		Subsurface coarse layer
<input checked="" type="checkbox"/>	5-10 m		- medium 0.25-1 mm			Cave		Subsurface clay / mud
<input checked="" type="checkbox"/>	10-20 m		- fine 0.063-0.25 mm			Tunnel		Surface silt / flocculent
	20-30 m		Mud <0.063 mm			Rockmill		
	30-50 m		Shells (empty)		<input checked="" type="checkbox"/>	Boulder/cobble - on rock		
	>50 m		Artificial			Boulder/cobble - on sediment		
<input checked="" type="checkbox"/>	ZONE		- metal			Boulder holes		
	Sublittoral fringe		- concrete			Sediment on rock		
	Infralittoral		- wood					
<input checked="" type="checkbox"/>	- upper		Trees / branches		<input checked="" type="checkbox"/>	MODIFIERS	1-5	ASSESSMENT
	- lower		Algae			Freshwater runoff		Representativeness(otyp/tran/typ)
	Circalittoral					Wave exposure - wave surged		Naturalness (unnat.-nat.)
	- upper					- sheltered		Extent (limit-exten.)
	- lower					Tidal streams - accelerated	<input checked="" type="checkbox"/>	3 Species richness (low-high)
	Not applicable					- decelerated	<input checked="" type="checkbox"/>	4 Abundance/biomass(low-high)
		100	Total			Grazing		
						Shading		
						Pollution		
<input checked="" type="checkbox"/>	EXTENT OF RECORD	%	INCLINATION		MAIN COVER OR CHARACTERISING SPECIES / TAXA			
	Multiple habitats (whole area)		Overhangs		Abund.	Species / taxon		
<input checked="" type="checkbox"/>	Zone / depth band	45	Vertical faces (80-100°)		S	Laminaria hyperborea		
	Restricted feature	15	Very steep faces (40-80°)		F	Dictyopterus membranacea		
<input checked="" type="checkbox"/>	SURVEY QUALITY	35	Upper faces (0-40°)		F	Bonnemaisonia asparagodes		
	Flora Fauna	5	Underboulders		C	Corynactis viridis		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> Thorough	100	Total		C	Desmarestia ligulata		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> Adequate					Bryozoan turf		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> Incomplete							

BIOTOPE NAME (key features of substrata, zone / depth & community)

UPPER INFRA LITTORAL BEDROCK AND BOULDERS WITH LAMINARIA HYPERBOREA + DENSE UNDERSTOREY OF RED + BROWN ALGAE

BIOTOPE DESCRIPTION (clearly describe substrata; main cover species / taxa; any unusual or rare features / species)

MNCR classification code:

Rugged bedrock outcrops in upper infralittoral (from 14 - 8 M Btl) with various sized boulders lying at the base of vertical rock faces and smaller more angular cobbles between with shelly stone gravel in patches. Upper surfaces densely covered with red and brown algae beneath a dense canopy of Laminaria hyperborea and occasional Saccorhiza polyschides. Steeper surfaces dominated by encrusting bryozoans and some dense patches of Corynactis viridis.

PISCES

scy can	Scyliorhinus canicula (dogfish)
con con	Conger conger (conger eel)
dip bim	Diplecogaster bimaculata (two-spotted clingfish)
lop pis	Lophius piscatorius (angler)
ZG1500	Gadidae indet.
ZG1960	Molva molva (ling)
ZG2080	Pollachius pollachius (pollack)
pol vir	Pollachius virens (saithe)
tri lus	Trisopterus luscus (bib)
tri min	Trisopterus minutus (poor cod)
gas acu	Gasterosteus aculeatus (three-spined stickleback)
ZG3510	Spinachia spinachia (fifteen-spined stickleback)
ZG3760	Syngnathus acus (greater pipefish)
myo sco	Myoxocephalus scorpius (bull roat)
tau bub	Taurulus bubalis (sea scorpion)
ago cat	Agonus cataphractus (pogge)
cen exo	Centrolabrus exoletus (rock cook)
cre mel	Crenilabrus melops (corkwing)
cte rup	Ctenolabrus rupestris (goldsinny)
lab ber	Labrus bergylta (ballan wrasse)
lab mix	Labrus mixtus (cuckoo wrasse)
par gat	Parablennius gattorugine (tompot blenny)
chi asc	Chirolophis ascanii (Yarell's blenny)
lum lum	Lumpenus lumpretaeformis (snake blenny)
pho gun	Pholis gunnellus (butterfish)
amm tob	Ammodytes tobianus (sand eel)
cal lyr	Callionymus lyra (common dragonet)
cal ret	Callionymus reticulata (reticulated dragonet)
ZG7050	Gobiidae indet.
gob nig	Gobius niger (black goby)
gob fla	Gobiusculus flavescens (two-spotted goby)
les fri	Lesueurigobius friesii (Fries' goby)
ZG7400	Pomatoschistus sp.
pom min	Pomatoschistus minutus (sand goby)
pom pic	Pomatoschistus pictus (painted goby)
tho eph	Thorogobius ephippiatus (leopard-spotted goby)
phr nor	Phrynorhombus norvegicus (Norwegian topknot)
zeu pun	Zeugopterus punctatus (topknot)
ZG8770	Pleuronectidae indet. (juveniles)
ple pla	Pleuronectes platessa (plaice)

CYANOPHYTA

ZL2	Beggiatoa sp.
-----	---------------

RHODOPHYTA :COMPSOPOGONALES to AHNFELTIALES

por coc	Porphyropsis coccinea
ZM830	Porphyra sp.
ZM880	Porphyra miniata
ZM970	Audouinella sp.
sci int	Scinaia interrupta
ZM2040	Asparagopsis armata (Falkenbergia)
bon asp	Bonnemaisonia asparagoides
bon ham	Bonnemaisonia hamifera
ZM2110	Trailiella intricata
gel lat	Gelidium latifolium
pal pal	Palmaria palmata
ahn pli	Ahnfeltia plicata

:CORALLINALES

ZM3840	Corallinaceae indet. (crusts)
cor off	Corallina officinalis
lit cor	Lithothamnion corallioides
lit gla	Lithothamnion glaciale
phy cal	Phymatolithon calcareum

:GIGARTINALES

cru pel	Cruoria pellita
cal cil	Calliblepharis ciliata
cal jub	Calliblepharis jubata
cys pur	Cystoclonium purpureum
ZM6930	Rhodophyllis divaricata
ZM6940	Rhodophyllis divaricata var. wernerii
dil car	Dilsea carnososa
dud ver	Dudresnaya verticillata
dum con	Dumontia contorta
fur lum	Furcellaria lumbricalis
hal lig	Halarachnion ligulatum
cho cri	Chondrus crispus
gra fil	Grateloupia filicina
ZM3220	Callophyllis cristata
cal lac	Callophyllis laciniata
kal ren	Kallymenia reniformis
mer mic	Meredithia microphylla
mas ste	Mastocarpus stellatus
ZM3640	Peyssonnelia sp.
coc tru	Coccotylus truncata
ery tra	Erythrodermis trailii
gym cre	Gymnogongrus crenulatus
phy cri	Phyllophora crispa
phy pse	Phyllophora pseudoceranioides
sch nic	Schottera nicaeensis
ste int	Stenogramme interrupta
plo car	Plocamium cartilagineum
pol rot	Polyides rotundus
sph cor	Sphaerococcus coronopifolius

:GRACILARIALES

gra ver	Gracilaria verrucosa
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:RHODYMENIALES

cor ere	Cordylecladia erecta
rho ard	Rhodymenia ardissonoi
rho del	Rhodymenia delicatula
rho hol	Rhodymenia holmesii
rho pse	Rhodymenia pseudopalmata
chy ver	Chylocladia verticillata
lom art	Lomentaria articulata
lom cla	Lomentaria clavellosa
lom orc	Lomentaria orcadensis

:CERAMIALES

ant cru	Anthamnon cruciatum
ant spi	Anthamnonella spirographidis
ZM7760	Aglaothamnion sp.
ZM8010	Callithamnion tetragonum
ZM8070	Ceramium sp.
cer nod	Ceramium nodulosum
cer str	Ceramium strictum
com thu	Composhamnion thuyoides
gri cor	Griffithsia corallinoides
hal flo	Halurus flosculosus
hal equ	Halurus equisetifolius
plu plu	Plumaria plumosa
pte plu	Pterothamnion plumula
pti gun	Ptilota gunneri
sph mul	Sphondylthamnion multifidum
acr ven	Acrosorium venulosum
apo rus	Apoglossum ruscifolium
cry ram	Cryptopleura ramosa
del san	Delesseria sanguinea
dra het	Drachiella heterocarpa
dra spe	Drachiella spectabilis
ery lac	Erythroglussum laciniatum
har bon	Haraldiophyllum bonnemaisonii
hyp hyp	Hypoglossum hypoglossoides
mem ala	Membranoptera alata
nit pun	Nitophyllum punctatum
phy rub	Phycodrys rubens

pol hil	Polyneura bonnemaisonii
rad thy	Radicalingua thysanorhizans
het plu	Heterosiphonia plumosa
bro bys	Brongiartella byssoides
cho das	Chondria dasyphylla
odo den	Odonthalia dentata
ZM11010	Polysiphonia sp.
ZM11050	Polysiphonia elongata
pol fuc	Polysiphonia fucoides
ZM11160	Polysiphonia nigra
pol str	Polysiphonia stricta
pte par	Pterosiphonia parasitica
rho con	Rhodomela confervoides
rho lyc	Rhodomela lycopodioides
ZM11540	Rhodophyta indet. (non-calc. crusts)

CHRYSTOPHYTA

ZQ1	Diatoms - colonial
ZQ2	Diatoms - film

PHAEOPHYTA

ZR30	Ectocarpaceae indet.
pse ext	Pseudolithoderma extensum
ZR5480	Asperococcus sp.
asp fis	Asperococcus fistulosus
asp tur	Asperococcus turneri
ZR5960	Dictyosiphon sp.
sti rhi	Stilophora rhizodes
cho fla	Chordaria flagelliformis
eud vir	Eudesme virescens
ZR3540	Mesogloia vermiculata
cut mul	Cutleria multifida
ZR3900	Cutleria multifida (Aglaozonia)
ZR4120	Sphaclaria sp.
hal fil	Halopteris filicina
cla spo	Cladostephus spongiosus
die mem	Dictyopteris membranacea
ZR4570	Dictyota dichotoma
tao ato	Taonia atomaria
spo ped	Sporochnus pedunculatus
des acu	Desmarestia aculeata
des lig	Desmarestia ligulata
des vir	Desmarestia viridis
art vil	Arthrocladia villosa
ZR6250	Chorda filum
ZR6310	Laminaria sp. (sporelings)
lam dig	Laminaria digitata
lam hyp	Laminaria hyperborea
lam och	Laminaria ochroleuca
lam sac	Laminaria saccharina
sac pol	Saccorhiza polyschides
ala esc	Alaria esculenta
sar mut	Sargassum muticum
ZR7050	Cystoseira sp.
hal sil	Halidrys siliquosa
ZR7190	Phaeophyta indet. (crusts)

CHLOROPHYTA

ZS2110	Enteromorpha sp.
ZS2400	Ulva sp.
ZS3310	Chaetomorpha linum
cha mel	Chaetomorpha melagonium
ZS3380	Cladophora sp.
bry plu	Bryopsis plumosa
ZS3990	Derbesia sp. (Halicystis)
ZS4140	Codium sp.

ANGIOSPERMAE

zos mar	Zostera marina
ZX7	Ruppia sp.

Appendix 11 Example of an area summary: The River Blackwater, Essex

10

River Blackwater

Location

Position (centre)	51° 44'N 00° 49'E	TL 95 07
County / District	Essex	Maldon & Colchester
Conservation agency / team	English Nature	Essex, Herts. & London

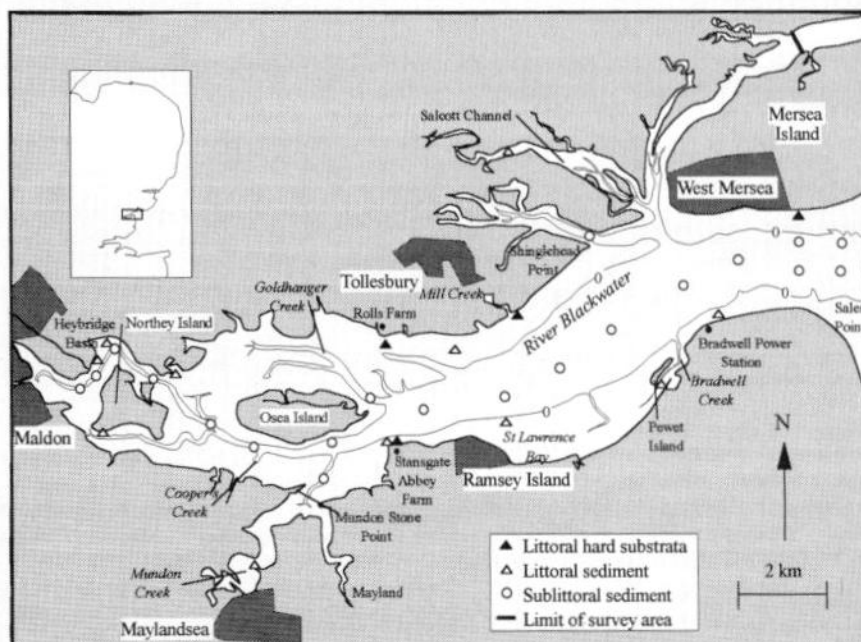


Figure 10.1 Survey area, showing main bathymetric features and location of sites surveyed

Physical features

Physiographic type	Coastal plain estuary
Area of inlet	5,184.0 ha
Intertidal area	3,315.3 ha
Length of inlet	21.2 km
Bathymetry	20 m at deepest
Wave exposure range	Moderately exposed - extremely sheltered
Tidal stream range	Very weak
Tidal range	4.9 m (Osea Island)

Introduction

The River Blackwater extends from its tidal limit at Langford, through Maldon, to its mouth south of Mersea Island, where it meets the River Colne. The upper estuary through Maldon is narrow and bounded by flood protection. Further downstream, the main channel separates into two creeks which pass either side of Northey Island and Osea Island. Downstream from Northey Island are extensive areas of intertidal flats, backed by saltmarsh with coastal protection above. To the south of Osea Island,

Lawling Creek receives water from smaller creeks around Mayland and Maylandsea, and drains into the main channel. Downstream of Osea Island, the main channel of the River Blackwater widens past the extensive embayment of St. Lawrence Bay on the southern shore. On the northern shore at the mouth of the estuary, several small channels drain into Virley Channel which then enters the main channel near West Mersea. A nuclear power station is sited at Bradwell, on the southern shore opposite Virley Channel.

Marine surveys				
	Survey methods	No. of sites	Date(s) of survey	Source
Littoral	recording (epibiota)	13	September 1992	MNCr survey 341
	infaunal sampling (cores)	3	Oct. - Nov. 1990	Dyer, Grist & Smith (1991)
	granulometry sample	10	September 1992	MNCr survey 341
Sublittoral	infaunal sampling (Day grab)	21	July 1991	Johnson (1991)
	granulometry sample	21	July 1991	Johnson (1991)

Marine wildlife features

Marine biotopes present (from Hill & Emblow 1996)														
Littoral rock	R6.1	R6.2	R6.3	R6.4	R6.5	R6.6	R6.7	R6.8	R6.9	R6.10	R6.11	R6.12	R6.13	
Littoral sediment	R6.14	R6.15	R6.16	R6.17	R6.18	R6.19	R6.20	R6.21	R6.22	R6.23	R6.24	R6.25	R6.26	R6.27
Sublittoral	R6.28	R6.29	R6.30	R6.31	R6.32	R6.33	R6.34							

Littoral

As with all the marine inlets in MNCr Sector 6, portions of the shoreline in the River Blackwater are backed by coastal protection and seawalls which extended down into the mid-shore. The seawalls were typically colonised by zones of the ephemeral alga *Enteromorpha* spp. (R6.5) and the fucoid *Fucus spiralis* (R6.6). At sites where salinity was variable, *Fucus ceranoides* was the dominant fucoid algae (R6.8). In sheltered areas, where wave exposure and tidal stream strength were reduced, *Ascophyllum nodosum* dominated the algal canopy (R6.7), although other fucoids were also present. Where the shore was backed by saltmarsh, particularly along the inner estuary, a typical saltmarsh erosion step dominated by *Enteromorpha* spp. was present (R6.5). Two extensive areas of intertidal clay were also found in the estuary - south of Rolls Farm and south of the Cross at West Mersea. This rarely occurring habitat was extensively bored by the piddocks *Barnea candida* and *Petricola pholadiformis* (R6.3).

Throughout the estuary, on areas of mixed substrata, dense beds of mussel *Mytilus edulis* covered by barnacles were found (R6.10). A particularly extensive example was found in St. Lawrence Bay. Some areas of mixed substrata, such as off Bradwell power station and in St. Lawrence Bay, were influenced by freshwater seepage. These areas were covered by a blanket of ephemeral algae, usually *Enteromorpha* spp., *Ulva lactuca* and *Porphyra* spp. (R6.11). Other associated species included the edible wrinkle *Littorina littorea* and the crab *Carcinus maenas*. At a number of sites in the estuary, mixed substrata on the low shore was influenced by enhanced tidal water movement and supported very rich communities of sponges, ascidians and red algae (R6.13). Particularly interesting communities occurred north of Stansgate Abbey Farm and south of Rolls Farm where there were rich communities of sponges, particularly *Halichondria panicea* and *Halisarca dujardini*, with anemones *Sagartia* spp., the peacock worm *Sabella pavonina* and abundant *Griffithsia flosculosa* (a red alga).

Sediment shores in the estuary were typical of the other estuarine systems in the region. The extreme upper estuary at Maldon supported the polychaete *Hediste diversicolor*, *Tubifex costatus* and enchytraeids (R6.27). Muddy substrata dominated the mid- and lower estuary. On the mid-shore, the mud was typically characterised by beds of the bivalves *Scrobicularia plana*, often with *Macoma balthica* and *Cerastoderma edule* (R6.24). Large expanses of low shore mud were characterised by

River Blackwater

polychaetes *Nephtys hombergii* and *Caulleriella killariensis* and *M. balthica* (R6.26). At sites where sandy mud occurred in the mid-estuary, *S. plana* was absent and the area was characterised by *M. balthica* with *C. edule* and polychaetes (R6.22). At one site near Osea Island causeway, where the salinity was reduced by close proximity to a large drainage channel, a modified version of this biotope was recorded which still contained *M. balthica*, but lacked *C. edule* (R6.23). The estuarine polychaete *Manayunkia aestuarina* also occurred in this community.

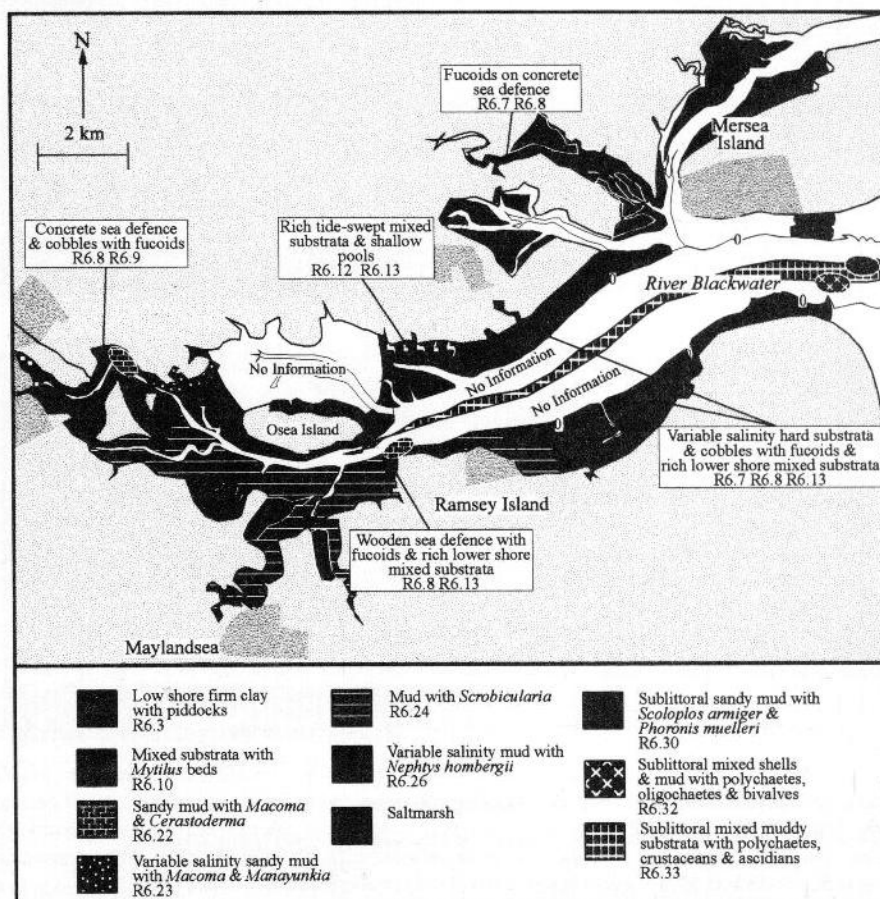


Figure 10.2 Indicative distribution of the biotopes within the River Blackwater (based on data from survey sites shown in Figure 10.1 and additional field observations)

Sublittoral

Most of the sublittoral biotopes described from the marine inlets in MNCR Sector 6 occurred in the Blackwater. Sites in the upper estuary, between Northey Island and Maldon, consisted of poorly sorted mud with dense *Hediste diversicolor*, the amphipod *Corophium volutator* and gastropod *Hydrobia ulvae* (R6.34). Also common in this community were *Cerastoderma edule* and *Macoma balthica*. At a nearby site in Collier's Reach, well sorted mud supported *Nephtys hombergii* with the phoronid *Phoronis mulleri*. Nearer the mouth of the estuary, sandier mud contained the polychaete *Scoloplos armiger* with *Phoronis mulleri* (R6.30). Much of the mid- to low estuary, however, consisted of mixed

Note: The original figure uses colour to identify the different biotopes.

muddy substrata which supported a very rich fauna of polychaetes, crustacea and ascidians (R6.33). The rich assemblage of polychaetes included *Exogone* spp., *Cirriformia tentaculata*, *Mediomastus fragilis* and *Tharyx marioni*. Also common in this biotope was the tube-building Ross worm *Sabellaria spinulosa*. The sediments supported the brittlestars *Amphipholis squamata* and *Ophiura* spp. as well as amphipods and cumaceans. Larger pebbles and stones at these sites supported the ascidians *Asciidiella aspera*, *Asciidiella scabra* and *Dendrodoa grossularia*.

Conservation sites

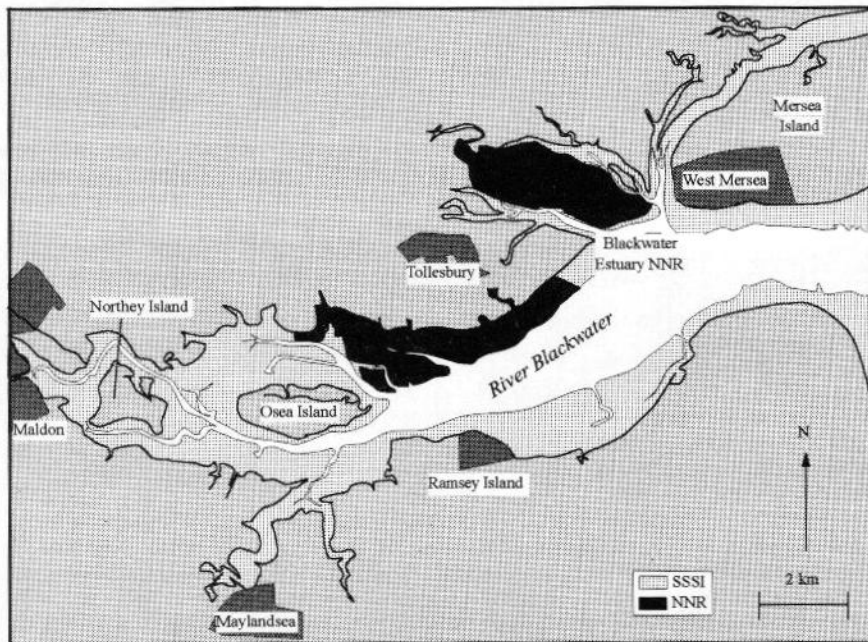


Figure 10.3 Current SSSI and NNR designations in the area.

SSSI boundaries derived from English Nature County SSSI Map Series. © English Nature 1994.

Current designation		
Site name	Designation	Main features
Mid Essex coast	SPA/Ramsar	
Blackwater Estuary	SPA/Ramsar	Ornithological importance
Old Hall Marshes	SPA/Ramsar	Designated as separate site, within the Blackwater Estuary SPA/Ramsar
Essex Estuaries	SAC	Atlantic salt meadows, Estuaries, Mediterranean and thermo-Atlantic halophilous scrubs, Mudflats and sandflats not covered by seawater at low tide, <i>Salicornia</i> and other annuals colonising mud and sand, <i>Spartina</i> swards
Blackwater Estuary	NNR	Intertidal mud
Blackwater Estuary	SSSI	Of biological and geological interest. Saltmarsh, sand dunes and tidal flats; important for seabirds and wildfowl
Old Hall Marshes	SSSI (Pt of Blackwater SSSI)	Biological interest. Saltmarsh and tidal flat; internationally important for wintering wildfowl
Old Hall Marshes	RSPB	Grazing marsh, important for breeding and overwintering birds
Bonner's Salting	CWT	Essex Wildlife Trust
Tollesbury Wick	CWT	Essex Wildlife Trust. Mudflats
Ray Island	NT/CWT	Essex Wildlife Trust. Salting
Northey Island	NT	
Blackwater Flats and Marshes	NCR	

Human influences

Coastal developments and uses

The River Blackwater is one of the largest inlets between the Thames Estuary and The Wash and for its size is possibly the least urbanised. Industry is light, and limited to boat yards and small scale engineering works. The water quality of the inlet has been classified as grade A. The largest installation on the River Blackwater is the nuclear power station at Bradwell. Foreshore recharge sites are operative, designed to protect the coastline. Northey Island is the site of a small scale managed retreat experiment. Another experimental site at Tollesbury is funded by the Ministry of Agriculture Fisheries and Food with support from English Nature. An operational retreat at Orplands, near Bradwell is managed by the National Rivers Authority.

Mariculture, fishing and other uses

During the winter, boats from West Mersea, Bradwell and Maldon, on the River Blackwater, fish for herring *Clupea harengus*, which spawn on the Eagle Bank. In the summer nets are set for bass *Dicentrarchus labrax* and mullet, and fyke-nets are set for eels *Anguilla anguilla*. There is a well documented fishery for the edible winkle *Littorina littorea* in Maldon, and a Several Fishery, for both native oyster *Ostrea edulis* and Pacific oyster *Crassostrea gigas*, which extends from Maldon to a line across the inlet from Gore Saltings to Stansgate Abbey Farm. Bait digging is prohibited within the fishery grounds (Fowler 1992). Further down the inlet, the intertidal flats are extensively dug for bait, at manageable levels. West Mersea is the main sprat trawling area in Essex and Suffolk, and there is another Several Fishery from Thirslet Creek to West Mersea.

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Marine Nature Conservation Review

Appendix 10

Survey sites

Surveys

- 341: MNCR littoral survey of the Blackwater and Colne estuaries, September 1992
 346: NRA intertidal survey of the Essex / Suffolk estuaries, 1990 (Dyer, Grist and Smith 1991)
 347: NRA sublittoral survey of the Blackwater estuary, 1991 (Johnson 1991)

Key to survey types - L, littoral; S, sublittoral; R, recording; P, photography; C, cores (4 x 0.01 m²); G, grab (0.1 m² Day grab); GS, granulometric sample

Littoral sites

Survey Site	Site name	Grid reference	Survey type	Biotopes present	
341	1	Bradwell Power Station	TM 005 093	L/R.P.C.GS	R6.8, R6.10, R6.11, R6.26
341	2	W of Bradwell Marina	TL 992 076	L/R.P.C.GS	R6.7, R6.8, R6.5, R6.13, R6.26
341	3	W of St Lawrence Bay	TL 957 063	L/R.P.C.GS	R6.6, R6.5, R6.10, R6.11, R6.26, R6.24
341	4	N of Stansgate Abbey Farm	TL 932 059	L/R.P	R6.8, R6.10, R6.13
341	5	E of Mundon Creek, Maylandsea	TL 904 027	L/R.C.GS	R6.5, R6.11, R6.24
341	6	SW of Northey Island	TL 875 057	L/R.P.C.GS	R6.24
341	7	Maldon Bridge	TL 850 074	L/R.C.GS.P	R6.27
341	8	Heybridge Basin	TL 875 072	L/R.P.C.GS	R6.9, R6.8, R6.26, R6.24
341	9	Osea Island causeway	TL 893 072	L/R.P.C.GS	R6.23, R6.26
341	10	S of Rolls Farm	TL 944 082	L/R.P	R6.12, R6.6, R6.7, R6.8, R6.10, R6.13, R6.3
341	11	E of Mill Creek	TL 973 089	L/R.C.GS	R6.8, R6.5, R6.10, R6.13, R6.26
341	12	Salcott Creek	TL 968 133	L/R.P.C.GS	R6.7, R6.8, R6.26
341	13	S of the Cross, West Mersea	TM 028 124	L/R.P	R6.10, R6.15, R6.3
346	60	W of Mill Beach	TL 878 075	L/C	R6.26, R6.22
346	61	Stangate Abbey Farm	TL 931 059	L/C	R6.26, R6.22
346	62	W of Mill Point	TL 960 080	L/C	R6.26

Sublittoral sites

Survey Site	Site name	Grid reference	Survey type	Biotopes present	
347	1	N of Sales Point	TM 034 110	S/GS.G	R6.30
347	2	SE of West Mersea	TM 026 109	S/GS.G	R6.33
347	7	W of Bradwell Creek entrance	TL 985 087	S/GS.G	R6.33
347	9	W St. Lawrence Bay	TL 958 067	S/GS.G	R6.33
347	11	Lower Goldhanger Creek	TL 929 070	S/GS.G	R6.33
347	13	E of Mundon Stone Point	TL 917 046	S/GS.G	R6.33
347	15	Between Decoy Point and Northey Island	TL 886 066	S/GS.G	R6.31
347	17	N of Hilly Pool Point, Northey Island	TL 880 073	S/GS.G	R6.34
347	19	Herrings Point	TL 871 061	S/GS.G	R6.34
347	18	Lower Collier's Reach	TL 874 065	S/GS.G	R6.34
347	16	SW of Osea Island	TL 899 059	S/GS.G	R6.32
347	14	N of Cooper's Creek	TL 906 055	S/GS.G	R6.33
347	12	S of Osea Island pier	TL 917 056	S/GS.G	R6.33
347	10	S of Upper Collins Inlet	TL 940 065	S/GS.G	R6.33
347	8	S of Mill Creek	TL 973 075	S/GS.G	R6.33
347	6	S of the Nass	TM 001 099	S/GS.G	R6.33
347	5	S of West Mersea	TM 014 107	S/GS.G	R6.30, R6.32
347	4	S of Mersea Island Caravan Park	TM 035 119	S/GS.G	R6.33
347	3	W Mersea Flat	TM 027 119	S/GS.G	R6.33
347	20	SW of Sunken Island	TL 993 122	S/GS.G	R6.33
347	21	N of Shinglehead Point	TL 990 106	S/GS.G	R6.33