SCOTTISH NATURAL HERITAGE

COMMISSIONED REPORT

Commissioned Report No. 076

North-west Scotland subtidal seagrass bed survey 2004

(ROAME No. F04LB05)

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COMMISSIONED REPORT

Summary

North-west Scotland subtidal seagrass bed survey 2004

Commissioned Report No. 076 (ROAME No. F04LB05)
Contractor: Ben James, Maris Ecologists

Background

Maris Ecologists were contracted by Scottish Natural Heritage (SNH) to participate in and subsequently report on a survey of nearshore marine habitats on the north-west coast of Scotland between Greenstone Point in Gruinard Bay and Sheigra at Kinlochbervie. The primary aim of the survey work was to map the distribution, size and extent of *Zostera marina* seagrass beds in the West Sutherland and North West Ross areas. The study was commissioned to determine the scale of potential 'under-recording' of the seagrass resource in the SNH North Highland area, to subsequently inform local implementation of the UK '*Seagrass Beds*' priority Habitat Action Plan (HAP) and to support the continued delivery of SNH's statutory marine nature conservation advice.

SNH identified a series of 'areas of search' for subsequent field investigation on the basis of historical survey information, anecdotal evidence of seagrass presence (eg records of washed-up plants from Clashnessie, Achmelvich and others) and responses to press and biodiversity newsletter articles asking divers, inshore fishermen and local people to report sightings of 'common eelgrass'. The survey took place over the period 11–15th August 2004 using the SNH drop-down video camera equipment, a 'glass-bottomed bucket' and snorkelling sampling methodologies deployed from the SNH 6.5m RHIB *Aphrodite*.

Main findings

- Approximately 280km of coastline was covered during the five-day survey period. Suitable shallow water habitat (0–10m) was assessed within 15 of the 28 originally identified 'areas of search'. The survey work concentrated on the validation of historical seagrass records and then anecdotal observations within a reasonable proximity to these 'confirmed' sites. Sublittoral video records were obtained from 56 sampling locations.
- The range of biotopes and species recorded was confined by the targeted nature of the sampling programme to characteristic sublittoral fringe and infralittoral muddy sand communities between 0.7m ACD and 14.4m BCD, fringed by kelp dominated boulder and bedrock shores.
- Sublittoral *Zostera marina* seagrass presence (SS.SMP.SSgr.Zmar) was confirmed at seven sites in medium-fine to fine-silty sand between 0.7m ACD–4m BCD. The seven confirmed records comprise four distinct stands of seagrass; a bed off Second Coast (~22m^2) and a shallower bed further east within Gruinard Bay at Fraoch Eilean Mòr (~80m^2 or 0.6ha), and two small stands (approx. 3m^2 and 10m^2) within Loch Dhrombaig. Extent of cover was estimated *in-situ* for the Loch Dhrombaig 'beds' and from the drop-down video footage for the single point sample off Second Coast. The boundaries of the fourth

bed at Fraoch Eilean Mòr were mapped by a series of drop-down video deployments and subsequent GIS mapping techniques. Eelgrass coverage was patchy within and between sites (5–65% cover).

- The identification of the two 'new' small *Z. marina* beds in Gruinard Bay is offset by an apparent loss of two beds from Poll Loisgann and Cùil Lochain within Enard Bay (0.5ha and 10m x 30m respectively).

Note: The material in the Annex has not been included in this report but may be consulted, by prior arrangement at: Scottish Natural Heritage, 17 Pulteney Street, Ullapool, Wester Ross IV26 2UP or Scottish Natural Heritage Headquarters Library.

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Contents

List of figures

List of tables

1 INTRODUCTION

1.1 Seagrasses in the UK

Seagrasses are marine flowering plants found in intertidal and shallow subtidal coastal areas around the world, typically on sands and muds to a maximum depth of about 10m. In the British Isles, three species of seagrass of the genus *Zostera* occur, dwarf eelgrass *Z. noltii* is found highest on the shore, often adjacent to lower saltmarsh communities, narrow-leaved eelgrass *Z. angustifolia* on the mid to lower shore and eelgrass *Z. marina* predominantly in the sublittoral (Anon., 1999). In the UK literature *Z. marina* is distinguished from *Z. angustifolia* on the basis of morphology. However, outside the UK most authors consider *Z. angustifolia* to be a phenotypic variant of *Z. marina* (Tyler-Walters, 2000).

Seagrasses often grow in dense, extensive beds or meadows, which can occur in marine inlets, bays or lagoons that are sheltered from significant wave action. The plants stabilise the mobile substratum (acting to reduce coastal erosion), provide food for wildfowl, shelter for the juveniles of commercially important fish species and are productive and biologically diverse habitats (Davison and Hughes, 1998).

All three seagrass species were once abundant and widespread around the British coasts but in the 1930s were severely reduced by an outbreak of 'wasting disease' (*Labyrinthula macrocystis* slime mould), which appears to most significantly affect sublittoral *Z. marina*. To date, recovery has been poor or slow and all three *Zostera* species are now considered nationally scarce in the UK (Tyler-Walters, 2000). The biological diversity, scarcity and ecological sensitivity of seagrass habitats to anthropogenic activities, make them a high priority for conservation effort within the UK.

1.2 *Zostera* spp. status in Scotland

Cleator (1993) reviewed the status of the genus *Zostera* in Scottish coastal waters and described two principal seagrass communities: mixed intertidal *Z. angustifolia* and *Z. noltii*, predominantly found in the east coast firths, and a sublittoral *Z. marina* community occurring on the west coast, the Hebrides, the Shetland Isles and to a lesser degree, Orkney. The report presented the distribution of the three *Zostera* species in tabular and map form (maps reproduced here as Figure 1).

The most significant populations of *Z. angustifolia* and *Z. noltii* are found along the southern shore of the Firth of Forth, near Dunbar, Aberlady and east of Bo'ness: north east Fife in the Eden estuary and at Tayport; in the Inverness, Beauly, Cromarty and Dornoch Firths. *Z. noltii* is also found on the west coast from Argyll southwards whilst *Z. angustifolia* is mainly restricted to Loch Sween, the Solway Firth and Loch Don, Mull. There are no significant *Zostera* populations between Berwick and Dunbar and between the Montrose Basin and the Moray Firth. This is assumed to be mainly due to a lack of suitable habitat (Cleator, 1993).

Cleator questioned the reliability of the *Z. angustifolia* and intertidal *Z. marina* records before the original description of *Z. angustifolia* in 1936 and considers that the records from the east coast may be *Z. angustifolia* due to their small size and intertidal habitat.

Figure 1 The distribution of *Z. marina*, *Z. angustifolia* and *Z. noltii* in Scottish coastal waters. On each figure the blue 'squares' represent pre-1940 records and the orange/ yellow 'triangles' post-1940's records (from Cleator, 1993)

1.3 *Zostera marina* status and conservation in Scotland

Z. marina is the largest of the three British eelgrasses and typically occurs in the shallow sublittoral to about 4m (although it has been recorded as deep as 13m in water of exceptional clarity), in fully marine conditions and on relatively coarse sandy sediments. It is a perennial plant that maintains its populations largely by a vegetative process, where detached shoots or rhizome fragments are dispersed by currents and re-establish themselves (Davidson and Hughes, 1998).

Cleator (1993) suspected that *Z. marina* might have been under-recorded on the west coast of Scotland due to its generally subtidal habitat and the remoteness of many coastal locations. The potential scale of 'under-recording' along the north-west coast is highlighted when the *Z. marina* distribution in Figure 1 is compared to a map of recorded and expected distribution of *Z. marina* around Britain and Ireland (see Figure 2 below).

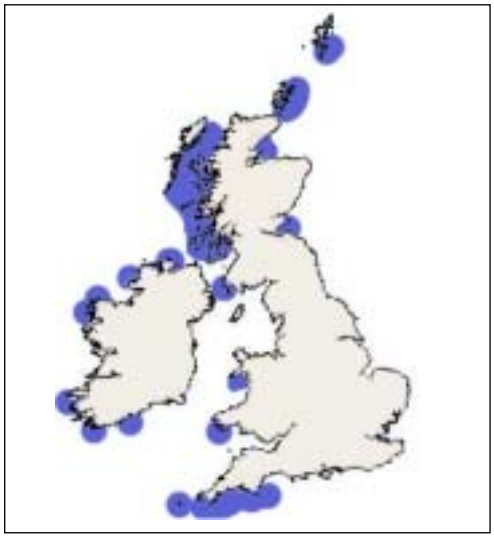


Figure 2 A map showing the recorded and expected distribution of *Zostera marina* around Britain and Ireland (Tyler-Walters, 2000)

Zostera marina is afforded enhanced nature conservation status within the UK under a range of national and international initiatives. The Convention on Biological Diversity (Biodiversity Convention or CBD) adopted at the Earth Summit in Rio de Janeiro, Brazil in June 1992 was ratified by the UK in 1994 with the launch of the UK Biodiversity Action Plan (UK BAP) (Anon., 1994). This UK strategy identified broad activities for conservation work over the next 20 years and established fundamental principles for future biodiversity conservation. A series of costed Habitat and Species Action Plans (HAPs and SAPs) were subsequently produced to guide the delivery of targeted conservation action on 391 species and 45 habitats. *Z. marina* is encompassed within the '*Seagrass beds*' priority HAP (Anon., 1999) which outlines a series of key actions to be delivered by government departments, respective agencies and research institutes with the objective of maintaining the distribution and extent of seagrass beds in UK waters.

To compliment the UK BAP and to address biodiversity issues at the devolved country level, Scotland published its landmark strategy '*Scotland's Biodiversity: It's In Your Hands*' in May 2004 (Scottish Executive, 2004). The strategy maps out a 25-year framework for action to conserve and enhance biodiversity for the health, enjoyment and well being of all the people of Scotland. It is envisaged that alongside the new Nature Conservation (Scotland) Act 2004 (which places a duty on all public bodies in Scotland to conserve and further biodiversity as they carry out their functions) the strategy will give Scotland a new and integrated system of nature conservation.

The maintenance of biodiversity is also the primary aim of European Community Directive 92/43/EEC on the *Conservation of Natural Habitats and of Wild Fauna and Flora* (the EC Habitats Directive). The provisions of the Directive require Member States to introduce a range of measures including the protection of the species and habitats listed in the annexes by means of a network of sites. The Directive is the means by which the EC meets its obligations as a signatory of the Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention – under which *Z. marina* is strictly protected).

Z. marina communities are therefore explicitly included within several of the listed 'marine' Annex I habitats (refer to Jackson and McLeod, 2002 and European Commission, 2003) and under implementing national legislation subtidal seagrass beds are now encompassed within a series of well managed and monitored protected areas around Scotland (eg Sound of Arisaig and Loch nam Madadh candidate Special Areas of Conservation (cSAC) and the Sound of Barra possible SAC). The introduction of SACs has resulted in statutory site-based conservation extending across both the littoral and sublittoral zones for the first time in Scotland (Saunders, 2004).

Recent work to implement Annex V of the OSPAR Convention ('*the Protection and Conservation of the Ecosystems and Biological Diversity of the* [OSPAR] *Maritime Area*' has seen *Zostera* beds included on the '*Initial list of threatened and/or declining species and habitats*' (OSPAR, 2004a) for the whole OSPAR maritime area. The UK Joint Nature Conservation Committee (JNCC) interpretation of the *Zostera* beds listing (see Table 1), encompassing both intertidal and subtidal habitats, was endorsed by Contracting Parties in 2004 (OSPAR, 2004b).

The UK is actively engaged in taking forward this important area of work and assessments of the species and habitats identified in the OSPAR List will be carried out by Contracting Parties under the Joint Assessment and Monitoring Programme (OSPAR, 2004c). On the basis of these assessments appropriate measures within the sphere of competence of OSPAR will be developed to ensure their protection.

Table 1 OSPAR definition of '*Zostera* beds' habitat as included on the 'Initial list of threatened and/or declining species and habitats'

***Zostera* beds**

Eunis Code: A2.71 and A4.53

National Marine Habitat Classification for UK & Ireland code: LS.LMP.LSgr/SS.SMP.SSgr

Two sub-types: – *Zostera marina* beds
– *Zostera noltii* beds

a) ***Zostera marina***

Zostera marina forms dense beds, with trailing leaves up to 1m long, in sheltered bays and lagoons from the lower shore to about 4m depth, typically on sand and sandy mud (occasionally with an admixture of gravel). Where their geographical range overlaps, such as the Solent in the UK, *Z. marina* passes upshore to *Z. noltii*.

b) ***Zostera noltii***

Zostera noltii forms dense beds, with leaves up to 20cm long, typically in the intertidal region (although it can occur in the very shallow subtidal), on mud/sand mixtures of varying consistency.

To qualify as a *Zostera* 'bed', plant densities should provide at least 5% cover (although when *Zostera* densities are this low, expert judgement should be sought to define the bed). More typically, however, *Zostera* plant densities provide greater than 40% cover. Seagrass beds stabilise the substratum as well as providing a habitat for many other species. As well as an important source of organic matter, seagrass beds may also provide an important nursery habitat for juvenile fish (ICES, 2003).

1.4 Project aims

The current study was commissioned to determine the scale of potential 'under-recording' of the subtidal seagrass resource present along the north-west coast of Scotland (within the SNH North Highland area) to subsequently inform both the development and local delivery of a range marine biodiversity commitments. The results of work will support the on-going delivery of SNH's statutory marine nature conservation remit.

Maris Ecologists were contracted by SNH to participate in and subsequently report on a survey of nearshore marine habitats between Greenstone Point in Gruinard Bay and Sheigra at Kinlochbervie. The primary objective of the survey work was to map the distribution, size and extent of *Z. marina* seagrass beds in the West Sutherland and North West Ross areas.

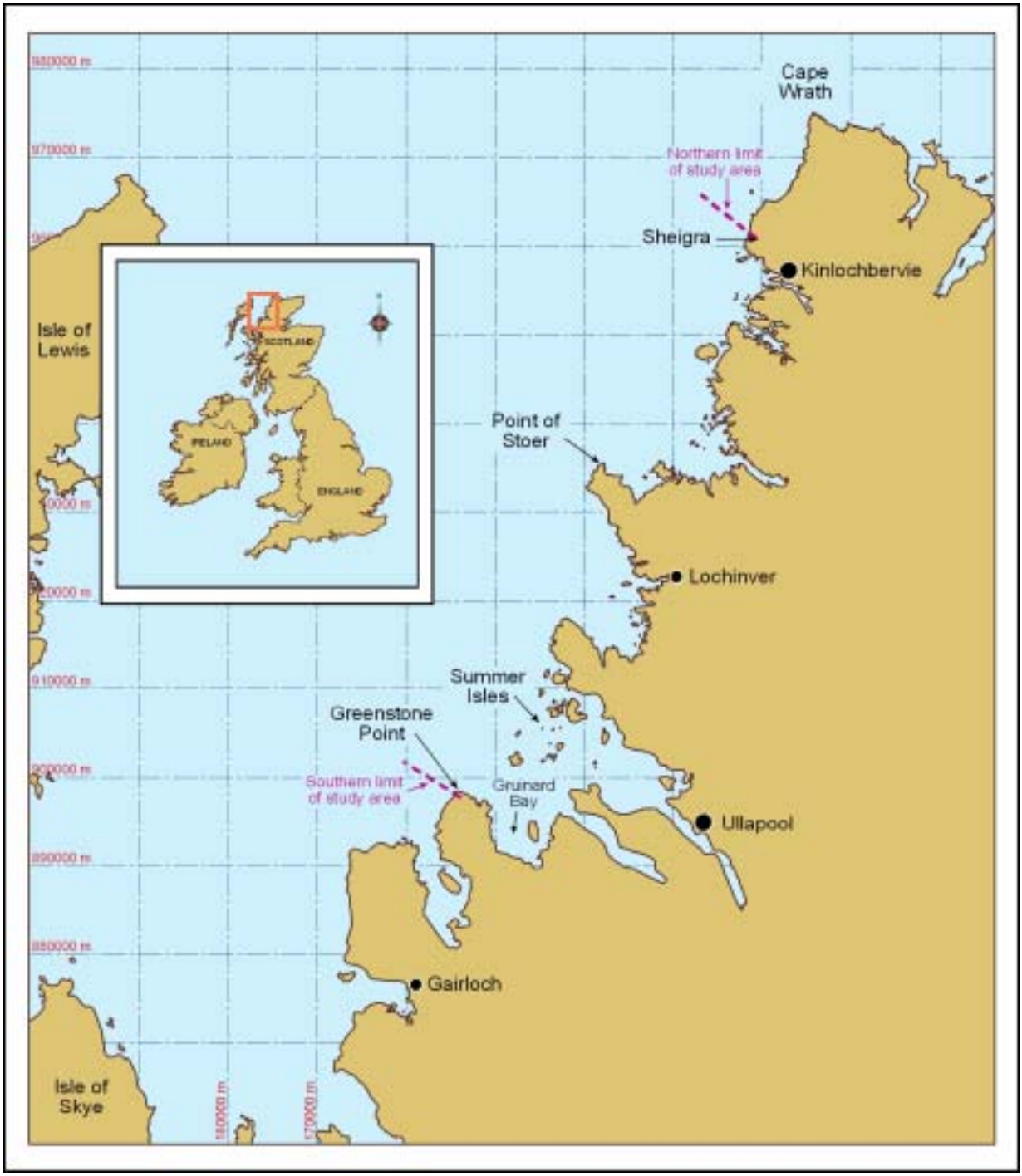
The key elements of the project comprised:

- A pre-survey publicity/public awareness raising and engagement stage seeking observations of subtidal seagrass habitats within the survey area;
- The identification of areas of known or potentially suitable habitat – 'Areas of Search' – for subsequent field survey;
- Field validation of the pre-defined areas of search using a range of rapid sampling techniques; and
- Subsequent interpretation and reporting of the results of the survey including the provision of GIS 'mapping' deliverables illustrating the composition and distribution of the marine communities encountered.

2 STUDY AREA

The study area extends from Greenstone Point in Gruinard Bay to Sheigra near Kinlochbervie (see Figure 3 below). The predominantly rocky, rugged coastline is interspersed with large embayments, sealochs and scattered small islands. Whilst much of the open outer coast is exposed to considerable wave action, many of the sealochs, by contrast, are protected by sills or narrows and are very sheltered. This varied maritime influence results in a wide range of intertidal and subtidal habitats (Barne *et al.*, 1997).

Figure 3 A map of the British Isles with an enlarged section of the study area on the north-west coast of Scotland



2.1 Historical survey effort within the study area

Numerous marine biological surveys have been undertaken within the extensive study area. The Marine Nature Conservation Review (MNCR) surveyed all of the major sealochs between 1988 and 1992, the results of these studies are summarised in Howson *et al.* (1994). The MNCR, which commenced in 1987, was a major resource survey initiated by Britain's nature conservation agencies to extend the knowledge of benthic marine habitats, communities and species around Great Britain and to identify sites and species of nature conservation importance (Hiscock, 1996).

The Scottish Association for Marine Science (SAMS – formerly the Scottish Marine Biological Association), based at Dunstaffnage near Oban, in conjunction with the Marine Biological Association (MBA) in Plymouth, undertook a major survey of the shores of Great Britain for the then Nature Conservancy Council (NCC) in the late 1970s (Bishop and Holme, 1980; Harvey *et al.*, 1980; Powell *et al.*, 1980). Smith (1978, 1981 and 1985) undertook a number of surveys of shores (with particular emphasis on the molluscan fauna) for the NCC, throughout the west of Scotland (Barne *et al.*, 1997).

The shores of the Summer Isles were surveyed by Heriot-Watt University expeditions in 1978 and 1979 (Anon., 1978–79), providing extensive species lists, and Jones (1980) and Dipper (1981) investigated sublittoral habitats around the islands. Phase 1 Seasearch surveys have been completed within Gruinard Bay (Gubbay, 1990), around the Summer Isles (Howson and Bradshaw, 1997) and within Lochs Broom and Little Loch Broom (Gubbay and Nunn, 1988). SNH also collected Remotely Operated Vehicle (ROV) video footage whilst ground-truthing acoustic mapping of sublittoral habitats around the Summer Isles in 1996. Surveys of saline lagoons within this sector of the coast were undertaken by the MNCR in 1994 (Covey *et al.*, 1998).

The distribution of individual sampling records held within the MNCR database (pre-1998) can be seen in Figure 4. A number of more recent studies have been undertaken in the survey area, either in connection with discrete development proposals (eg Scottish Water sewage outfall within Loch Broom) or within sites previously recognised for their marine nature conservation value (eg the broadscale mapping of Loch Laxford cSAC reported in Bates *et al.*, 2002), but these studies have not substantially 'broadened' the survey coverage depicted in Figure 4 and a number of data 'gaps' remain.

2.2 Previous information on the biology of the area

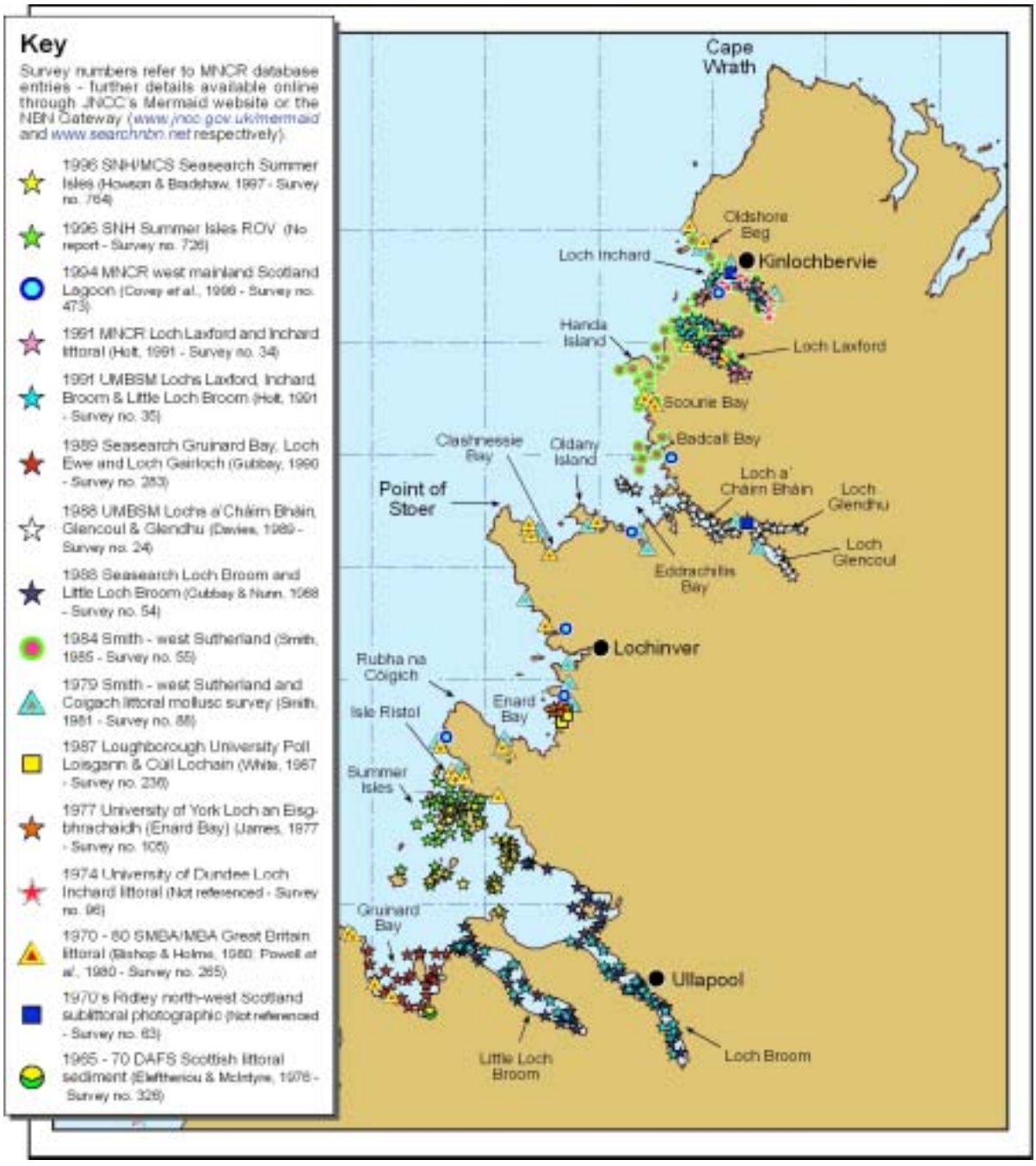
2.2.1 Gruinard Bay

In the western part of Gruinard Bay the sublittoral habitats show a gradual transition from kelp *Laminaria hyperborea* dominated boulders to a gently sloping, predominantly sandy seabed below 12m (Gubbay, 1990). The southern margin of the bay whilst also fringed by kelp dominated boulders gives way to more mixed substrata with boulders, pebbles and cobbles on coarse shelly sand supporting foliose red algae. Further east where the Little Gruinard and Inverianvie rivers enter the most sheltered part of the bay, the sediments are mostly sandy mud with balls of fluffy '*Trailliella*' red algae scattered on the surface. The deepest parts of the bay support beds of phosphorescent sea pen *Pennatula phosphorea* in circalittoral sandy mud. Gullied bedrock fringes Gruinard Island, giving way to a sandy seabed in the west and extensive maerl deposits to the north (Gubbay, 1990).

2.2.2 Little Loch Broom and Loch Broom

The marine communities of Loch Broom and Little Loch Broom show many similarities (see Holt, 1991 and Gubbay and Nunn, 1988). The gaping file shell *Limaria hians* has been recorded at the entrance to Little Loch Broom, where it was associated with maerl, and also from the narrows within Loch Broom.

Figure 4 The distribution of pre-1998 marine survey sites within the study area



Forests of the kelp *L. saccharina*, typical of sheltered conditions, dominate the sublittoral fringe with *Echinus esculentus* urchins or *Ophiothrix fragilis* and *Ophiocomina nigra* brittlestars. Below this, mixed sandy, shelly mud features the sea pen *Virgularia mirabilis*, with deeper parts having soft burrowed mud (Barne *et al.*, 1997). Gubbay and Nunn (1988) recorded small patches of *Zostera* sp. amongst maerl and sand at Badluachrach Jetty in Little Loch Broom.

2.2.3 Summer Isles

The Summer Isles as a whole do not exhibit as wide a diversity of sublittoral habitats and communities as other islands or island groups in the Hebrides (Dipper, 1981). The richest habitats within the Summer Isles appear to be sea caves and shallow sand and maerl areas rich in bivalves, burrowing anemones, holothurians and algae. Howson and Bradshaw (1997) recorded beds of the gaping file shell *Limaria hians* at two sites on the Carn Skerries. Off the south-west of Tanera Beg, a sea cave at 9m depth, approximately 100m long has a typical surge gully fauna with patches of the ascidian *Dendrodoa grossularia* and the sponges *Clathrina coriacea* and *Myxilla incrustans*, together with jewel anemones *Corynactis viridis*, *Sagartia elegans* anemones and plumose anemones *Metridium senile*. A thick live maerl bed occurs in the small bay of Mol Mor on Tanera Mhor, the maerl lying on the crests of sandy ridges and extending to about 20m (Dipper, 1981 in Barne *et al.*, 1997).

Figure 5 A *Limaria hians* 'gaping' file shell from the sill of inner Loch Broom, tideswept stoney cobbles with brown algae just behind the rapids entrance to Lochan nam Meallan at Oldshore and a common starfish *Asterias rubens* on live maerl with the bootlace weed *Chorda filum* between Eilean Fada Mor and Tanera Beg, Summer Isles

Around Isle Ristol and within Achnahaird Bay, Bishop and Holme (1980) described a variety of intertidal sediment communities characterised by a range of species including the thin tellin *Angulus tenuis*, lugworms *Arenicola marina*, sandmason worms *Lanice conchilega*, the carpet shell *Venerupis pullastra* and a community characterised by heart urchins *Echinocardium cordatum* and razor shells *Ensis siliqua*. The range of communities present within such a small area led Bishop and Holme to grade these sites as nationally important although they are now known to be more widespread.

2.2.4 Rubha na Còigich to Point of Stoer

Relatively fewer data have been collected from coastal sites around the steep exposed rocky headland of Rubha na Còigich, within Enard Bay and northwards to the Point of Stoer. The University of York surveyed eight sublittoral sites within Loch an Eisg-bhrachaidh in 1977 (James, 1977) and Loughborough University undertook a general snorkelling survey of Poll Loisgann and Cùil Lochain in 1987 (White, 1987). Both studies reported high species diversity in the small areas surveyed. The 1987 study undertaken in connection with the adjacent Inverpolly National Nature Reserve (NNR), recorded *Zostera marina* beds on shelly sand in the shallow waters of Poll Loisgann and Cùil Lochain (seagrass area of 0.5ha and 10m x 30m respectively) (White, 1987). The survey report recommended that the then impending salmon farming applications within Poll Loisgann be opposed.

2.2.5 Point of Stoer to Eddrachillis Bay

Further to the north, Powell *et al.* (1980 – SMBA/MBA Great Britain littoral survey) noted good examples of exposed rocky and boulder shores around the Stoer Peninsula and sheltered shores on the east side of Oldany Island. The latter shores have a sufficiently wide range of habitats within a small area to merit national importance (Barne *et al.*, 1997).

Smith (1981) investigated the steep rocky and boulder shore to the east of Culkein Bay and within the channel separating Oldany Island from the mainland. Contrary to Powell's description (1980), Smith observed this 700m long channel to dry out completely at the *Fucus serratus* zone. The bedrock walled channel had a mixed coarse sediment base (boulders and gravel) that sheltered a very rich fauna (an extensive list of Mollusca) and the channel, as the only one of its kind seen by Smith in West Sutherland, was considered of regional importance.

Six sandy beaches around the Stoer Peninsula, including Culkein Stoer and Clashnessie, are noted within the '*The Flora of Assynt*' (Evans and Rothero, 2002) as sites where washed-up *Z. marina* plant material has previously been recorded. The brief *Z. marina* section in this publication also highlights the presence of a bed of the growing plant, recorded in Port Dhrombaig by T. Lockie in 2001. Unfortunately, specific details regarding the first record from the region, on Oldany Island in the 1950's, are not provided.

2.2.6 Eddrachillis Bay

Smith (1981) noted the importance of the molluscan fauna in the brackish Duart Lochan and the intertidal and subtidal elements of this site were assessed again by the MNCR lagoons survey in 1994. The Loch a' Chàirn Bhàin complex, which includes Lochs Glencoul and Glendhu, supports communities reflecting the wide range of exposure to both wave action and tidal streams (Davies, 1989). In the outer part of Loch a' Chàirn Bhàin, coarse sediments have populations of heart urchin *Spatangus purpureus* and the brittlestar *Amphiura securigera*; within the loch, increasing shelter produces finer sediments supporting populations of the echiuran worm *Amalosoma eddystonense* and the large bivalve *Arctica islandica* together with more typical and widespread sheltered loch species. Upward facing rocky areas are dominated by ascidians, particularly *Ciona intestinalis*, while boulders on sediment in the sheltered parts of the loch support ascidians and brittlestars (Howson *et al.*, 1994). The sills in Loch Glencoul feature nests of the gaping file shell *Limaria hians* in areas of muddy gravel. In deeper waters, areas of mixed sandy mud occur, with the seapen *Virgularia mirabilis* and the scallop *Pecten maximus*. At Kylesku Narrows, there are excellent examples of species rich, tide-swept biotopes with the bedrock dominated by hydroids and dead-man's fingers *Alcyonium digitatum* (Davies, 1989 in Barne *et al.*, 1997).

2.2.7 Badcall Bay to Laxford

Smith (1985) investigated the intertidal and shallow sublittoral communities present along this stretch of coastline in July 1984 (11 shore and 58 dive sites). Whilst the rocky sublittoral areas were considered to support a low diversity of species with much of rock surface grazed down to encrusting calcareous algae by *E. esculentus* urchins, the sublittoral muddy habitats encountered were of considerable interest. Sites considered worthy of further investigation included Loch Inchard and Loch Laxford, especially Loch a' Chadh-Fi, and all the waters around Handa Island.

Scourie Bay, to the south of Handa Island, is the only clean, moderately sheltered sediment shore on the west coast of Sutherland (Powell *et al.*, 1980). It supports a tellin *Angulus tenuis* community, and though the invertebrate density is not high, it is still considered a site of marine biological importance. Close by, at Rubha Shios, there are numerous small rockpools colonised by the anemones *Metridium senile* and *Sagartia elegans*, both species more commonly found in the subtidal (Smith, 1985 in Barne *et al.*, 1997).

2.2.8 Loch Laxford

Loch Laxford is an example of a fjardic sealoch (others such as Lochs Broom and Inchard are fjoridic in nature). The loch also represents an excellent example of a 'large shallow inlet and bay' (as listed on Annex I of the Habitats Directive) and has been proposed as a candidate SAC on the basis of the diverse and highly characteristic marine communities present.

The seabed of the more exposed outer reaches of the Loch Laxford system is composed predominantly of extensive areas of coarse, rippled, shell gravel and barren, grazed bedrock and boulder fields. Increasing shelter in Loch Dùghaill and the central region of Loch Laxford sees a transition to predominantly muddy sands and mud with seapens and megafaunal burrows. In the extremely sheltered shallow bays and Loch a' Chadh-Fi, soft muds are characterised by high densities of the seaslug, *Philine aperta*. Rocky reefs fringe most of the coastline with kelp *Laminaria hyperborea* forests dominating the outer infralittoral region and *L. saccharina* forests the more sheltered areas. Circalittoral fringing reefs are primarily confined to the outer and central regions of the cSAC, with impoverished, urchin *Echinus esculentus*-grazed faunal and algal crust biotopes dominating the mouths of Loch Laxford and Loch Dùghaill and richer, ascidian-dominated communities populating the steep rock faces in the central reaches (Bates *et al.*, 2002).

2.2.9 Loch Inchard

Howson *et al.* (1994) considered Loch Inchard to have a greater range of biotopes than any other loch within this sector of the coast. At the head of the loch are beds of free-living alga *Ascophyllum nodosum* ecad *mackaii*. Sheltered subtidal bedrock walls feature the sealoch anemone *Protanthea simplex* and the brachiopod *Neocrania anomola*. Sediment areas are similar to those in Loch Laxford, with mixed sandy, shelly mud and deep soft burrowed mud (Holt, 1991).

To the north of Loch Inchard, the tidal inlet Lochan nam Meallan at Oldshore has an extremely rich molluscan fauna (Smith, 1981). The shore at Sheigra is a good example of a fully exposed rocky site, with a zone of dabberlocks kelp *Alaria esculenta* on the lower shore and the red alga *Porphyra umbilicalis* with littorinids on the upper shore (Powell *et al.*, 1980). The brown algae *Fucus vesiculosus* in its *linearis* form is also found here (Barne *et al.*, 1997).

3 METHODS

3.1 Defining 'Areas of Search' for subsequent targeted survey

SNH identified a series of areas for targeted field investigation on the basis of feedback from local press and biodiversity newsletter articles seeking information on sightings of 'common eelgrass' (see example in Table 2 below), historical survey records and anecdotal evidence of seagrass presence (eg records of washed-up plants or capture within fishing nets).

Table 2 Example of a press article run in a local paper seeking information on occurrences of subtidal seagrass beds within the study area

Divers, fishermen and local people asked to look out for rare underwater plant
Caithness News – 21 January, 2004

Common Eelgrass *Zostera marina* and diver Sue Scott (SNH)

Divers, inshore fishermen and local people from West Sutherland and North West Ross are being asked to report sightings of a rare underwater plant. Common eelgrass, (*Zostera marina*) is a species of seagrass with leaves that are said to look like green eels when they move with the current of the sea. It is the subject of a survey being carried out this year by Scottish Natural Heritage (SNH) to find out where it occurs around the north coast. Common eelgrass likes a sheltered sand or mud substrate to grow in and does not like to grow deeper than 10m. There are three different species of eelgrass in the UK and all are considered scarce. It is an important species for the biodiversity of Scotland's marine environment by providing shelter for flatfish and, in some areas, for cephalopods such as squid and octopus.

Rachel Horsburgh, an SNH area officer in the north-west, said local divers and fishermen could hold the key to recording the plant's distribution. She added: "In North Highland we have important and extensive beds of dwarf and narrow-leaved eelgrass in the Dornoch Firth. However, common eelgrass, the completely sub-tidal species, is under-recorded in North Highland, with only two confirmed beds in North West Ross. But we believe it is likely that there is more of it around than originally thought. Divers, fishermen and local people could be instrumental in helping to fill in the knowledge gaps we have of this species' distribution in the north." Small eelgrass beds of approximate size 0.5ha and 0.03ha are known to occur in Enard Bay, in North West Ross. These are the only two common eelgrass sites in the North Highland area that have been recorded by the Marine Nature Conservation Review. A further site was noted in 2001 in Port Dhrombaig, Eddrachillis Bay, West Sutherland, by a local biological recorder. Wash-ups of the species have also been recorded on beaches at Clashnessie, Achmelvich, Clachtoll, Culkein Stoer and Balcladich Bay, West Sutherland. Starting this year, SNH will carry out survey work to find more of these hidden beds, to help find out more about this important and fragile habitat. Using underwater cameras, the aim is to map the full distribution and extent of common eelgrass beds in West Sutherland and North West Ross. Meanwhile anyone who is aware of any sub-tidal eelgrass beds anywhere in the wider area of coast between Gruinard Bay on the west around the north to the Dornoch Firth in the east is asked to contact Rachel Horsburgh at the SNH Ullapool office.

A review of recent and archive aerial photographs available on the SNH geographic information system (GIS) was also undertaken in conjunction with a consideration of nearshore bathymetric, geological and physiographic conditions to validate initial proposals and to determine additional opportunistic 'search locations' for assessment.

The list of identified search locations (Table 3 and illustrated in Figure 6) was used to guide the development of the field-sampling programme.

Table 3 'Areas of Search' for the 2004 NW Scotland *Zostera marina* subtidal seagrass bed survey

No.	Site name	Nature of sighting	Grid reference (NGR)
1.	Between Udrigle and Laide	Confirmed	NG 898 931
2.	Second Coast	Caught in nets	NG 931 907
3.	Priest Island	Confirmed	NG 931 019
4.	Poll Loisgann	Confirmed	NC 069 161
5.	Cùil Lochain	Possible	NC 068 164
	Cùil Lochain	Confirmed	NC 072 170
6.	Loch an Eisg-brachaidh	Possible	NC 071 173
7.	Achmelvich Bay	Possible	NC 055 249
8.	Bay of Clachtoll	Wash-up	NC 039 269
9.	Bay of Stoer	Wash-up	NC 036 280
10.	Balchladich Bay	Wash-up	NC 025 302
11.	Bay of Culkein	Wash-up	NC 040 331
12.	Clashnessie Bay	Wash-up	NC 059 312
13.	Oldany Island	Confirmed	NC 099 348
14.	Port Dhrombaig	Confirmed	NC 121 331
15.	Loch Nedd	Possible	NC 138 326
16.	Loch Ardbhair	Possible	NC 168 338
17.	Duartmore Bay	Possible	NC 181 359
18.	Shark Bay	Possible	NC 180 362
19.	Badcall Bay	Possible	NC 159 416
20.	Farhead Point	Possible	NC 150 411
21.	East Eilean a' Bhuic	Possible	NC 138 448
22.	Port of Tarbet	Possible	NC 159 488
23.	Eilean Dubh na Foinndalach Bige, Loch Laxford	Possible	NC 204 487
24.	South Eilean Port a' Choit, Loch Laxford	Possible	NC 214 479
25.	North Eilean an Eieannaich, Loch Laxford	Possible	NC 202 504
26.	Loch an Roin	Possible	NC 197 540
27.	Loch Ceann na Saile	Possible	NC 208 550
28.	Lochan nam Meallan	Possible	NC 201 580

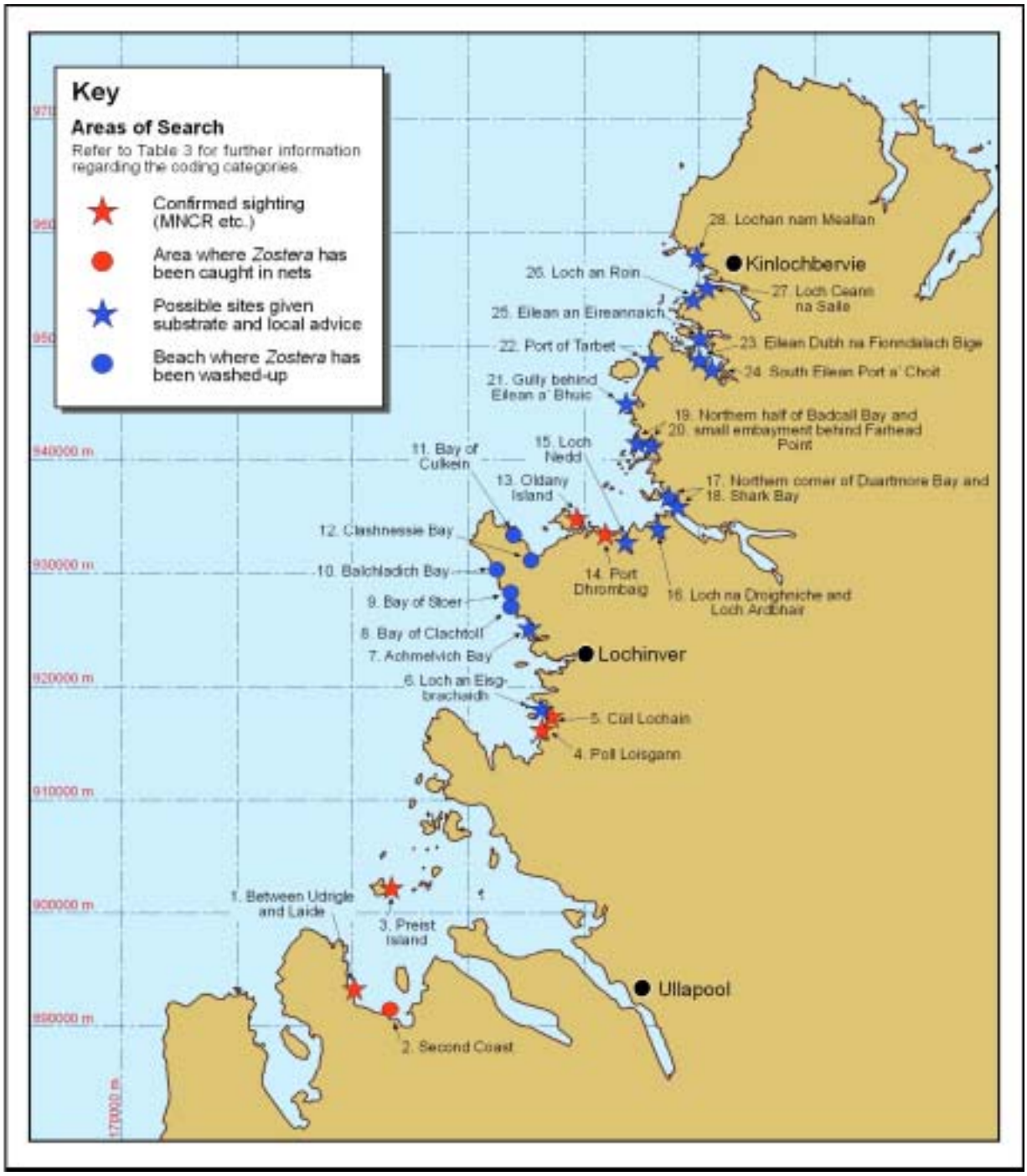
Confirmed sightings relate to MNCR database entries, local fishermen, diver and County Biological Recorder sightings

Caught in nets as described

Possible relates to areas where no sighting has been confirmed but seen to be possible through discussions with local fishermen and divers and an examination of existing aerial photography/mapping to determine suitable substrate

Wash-up relates to beaches where leaves of *Zostera marina* have been washed-up and recorded by the County Local Recorder

Figure 6 'Areas of Search' within the NW Scotland study area. Locations identified by SNH prior to the fieldwork element



3.2 Fieldwork

The fieldwork took place over the period 11–15th August 2004 using the SNH drop-down video camera equipment, a 'glass bottomed bucket' and snorkelling sampling methodologies deployed from the SNH 6.5m RHIB *Aphrodite*. The survey team comprised Rachel Horsburgh, Matt Dalkin, Ben James, Mark Stewart (11–13th) and Angus McHattie (14th and 15th). The weather was mostly fine although occasional breezy spells made the Rigid Hull Inflatable Boat (RHIB) passage a little uncomfortable and led to a number of rather 'rapid' video deployments. No weather downtime was incurred.

Due to the extensive length of coastline under investigation it was necessary to work from a series of accommodation 'bases' progressing up the coast between Aultbea and Scourie. The RHIB was launched and recovered on a daily basis. Further details of the survey logistics and a graphical representation of the daily RHIB routes are given in Appendix 1 (daily field log) and on Figure 8.

3.2.1 Drop-down video, 'glass-bottomed' bucket and snorkel sampling

The drop-down video methods broadly followed those outlined in Procedural Guideline 3–5 of the Marine Monitoring Handbook (Davies *et al.*, 2001). Positional information was derived from the boat's differentially corrected Global Positioning System (dGPS). The coordinates for each sampling site were recorded in the field in British National Grid format (OSGB 36 datum) and subsequently validated against the downloaded dGPS records in the Latitude and Longitude format (WGS 84 datum) of original data capture.

Ordnance Survey (OS) 1:50,000 Landranger maps annotated with the identified '*Areas of Search*' were used in conjunction with the waypoint functions of the RHIB dGPS to locate the initial broad areas of search. Within these areas, and at opportunistic locations encountered en-route, sampling was undertaken to determine the presence of subtidal seagrass. In very clear shallow waters (~4–5m max.) visibility was normally such that a rapid assessment of benthic habitats could be made using the glass-bottomed bucket over the side of the RHIB. The general RHIB route and any seabed habitat observations made en-route using the glass-bottomed bucket were noted and are outlined in Appendix 1.

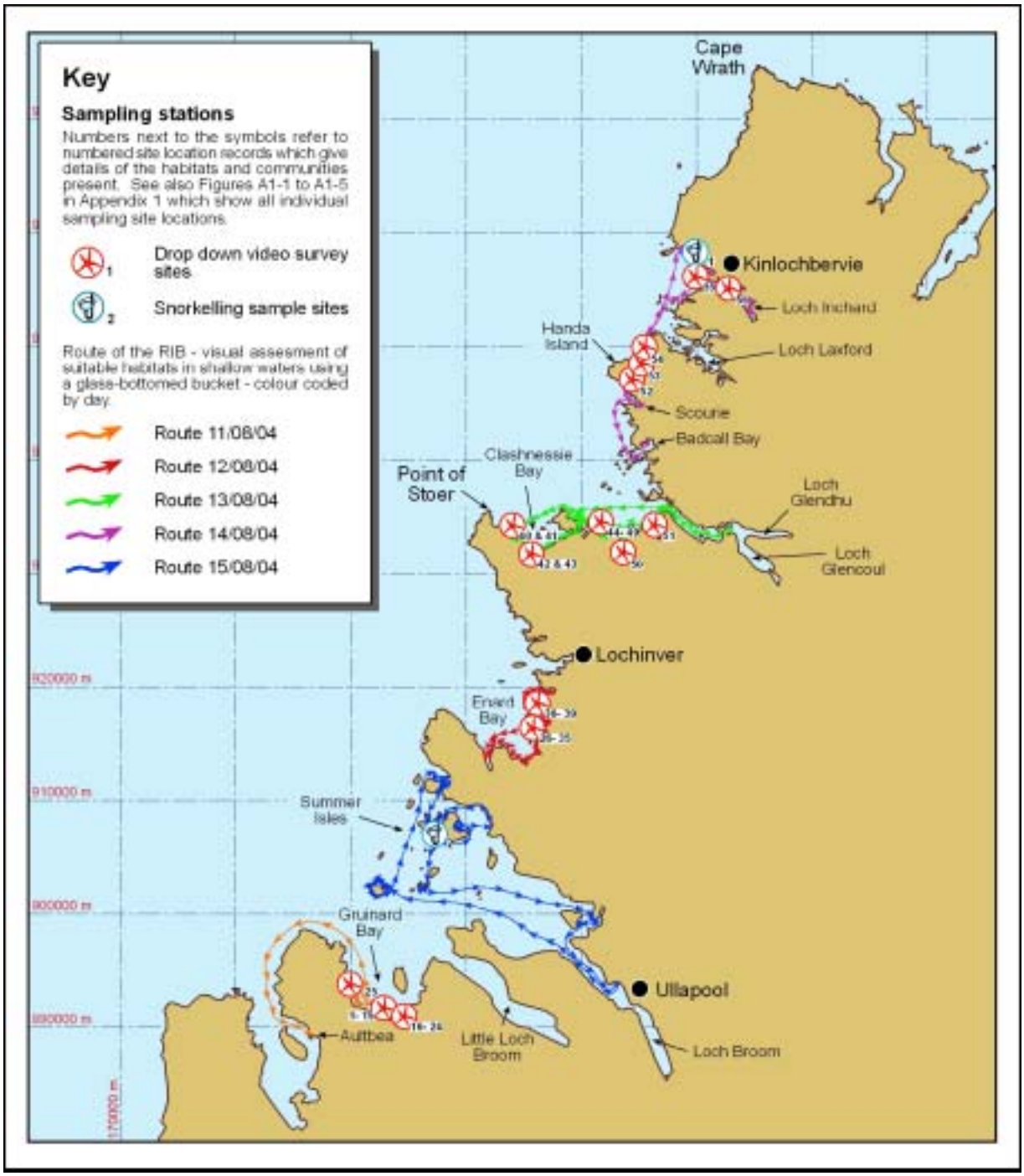
Figure 7 A sequence of photographs showing the drop-down video equipment on the RHIB, surveyors using the glass-bottomed bucket and the surface video recorder/viewer. Field observations were written onto standardised recording sheets contained within a splash-proof 'weather writer'

In water depths of greater than 5m or where sea conditions precluded the use of the glass-bottomed bucket the drop-down video equipment was deployed and a permanent visual record of seabed communities collected. A total of 56 separate drop-down video drops/short tows were taken of between 1–3 minutes duration.

The caged digital video camera (a 3-CCD Sony DCR-TRV900 within an Amphibico Navigator 900 housing), lowered to the seabed by hand, was controlled from the surface and the relayed footage recorded onto mini-DV tapes within the surface video display/recorder unit (Sony mini digital VCR – GV-D900). Field notes detailing site number, position, depth, time and conspicuous habitat features were taken for all drop-video sampling sites on standardised recording forms. The ground-truthing locations are illustrated on Figure 8 and the detailed video sampling records are presented in Appendices 2 and 3.

Photography was an integral part of the survey and 'scenic' surface digital photographs were taken throughout using a Canon digital IXUS 500. A small number of sublittoral habitat shots were taken using the same camera within a Canon WP-DC800 waterproof casing whilst snorkelling. Digital photographs were downloaded onto a laptop computer at the end of each day. A digital photograph log is provided in Appendix 4.

Figure 8 Drop-down video and snorkel sampling sites within the NW Scotland study area



Snorkelling was undertaken to determine seagrass presence or absence within Lochan nam Meallan at Oldshore, where RHIB access was restricted by narrow tidal rapids, and also on a shallow maerl bed between the islands of Eilean Fada Mor and Tanera Beg in the Summer Isles.

3.3 Data processing

3.3.1 Video analysis

The videotapes were processed in accordance with the methods outlined in Procedural Guideline 3–5 (Davies *et al.*, 2001). Tapes were viewed using freeze-frame; slow motion and standard play speed as necessary to enable the identification of as many conspicuous species as possible and a determination of broad substrate type. Notes were entered into an excel spreadsheet in a systematic way, recording main habitat features, conspicuous species or, where this detail was not discernible, higher taxonomic categories. Where practicable, species abundance (using MNCR SACFOR scales – Hiscock, 1996) or percentage cover estimates were also recorded. Species recording followed Howson and Picton (1997).

A minimum of two still images were 'captured' from the digital video footage taken at each sampling site (examples given in Figure 9 below) and these were 'hot-linked' to the sampling data spreadsheets for future reference. The final stage in the analyses consisted of reviewing the excel records, the captured images and where necessary the original video footage in order to tag the records with biotope[1] codes from the latest version of the national classification. The subtidal sediments and infralittoral rock sections of version 05.04 (Connor *et al.*, 2004) were published prior to undertaking the video processing and were therefore used in this study in conjunction with the earlier 97.06 version (Connor *et al.*, 1997).

Figure 9 Examples of still images captured using the drop-down video equipment (kelp, seagrass and maerl biotopes)

The mini-DV digital video footage collected from the 56 sampling sites was converted into an electronic format (separate '*.mpeg*' or '*.avi*' files and a 'DVD movie') and delivered as an Annex to this report.

3.3.2 GIS analysis

ESRI shapefiles were created from the finalised drop-down video and digital photography point sampling data. A subset of the video data table containing only confirmed and potential records of subtidal *Zostera marina* was converted into a further discrete point sample shapefile. It was possible to accurately map the boundaries of only one seagrass bed on the basis of multiple 'positive' drop-down video records. The seagrass bed boundaries were plotted at a scale of 1:3,000 using straight line joins between discrete point sample data. For another three confirmed seagrass records an estimated 'bed' size (derived from the video footage) was mapped using the buffer tool(s) within ArcGIS. The buffered and mapped seagrass bed polygons were then merged to form a fourth 'seagrass beds' polygon shapefile. An overview of the GIS files provided within an Arcview 3.2 project, as an annex to this report, is provided in Appendix 5.

[1] A 'biotope' is defined as the habitat together with its commonly associated communities of species. The habitat encompasses all physical factors that shape the nature of the location, including the substratum, patterns of wave exposure, water salinity and tidal influence (Connor *et al.*, 1997).

4 RESULTS

Original field notes and maps completed during the survey, together with electronic data files, videotapes and digital photographs, have been supplied to SNH.

A total of 56 separate video drops/short tows of between 1–3 minutes duration were completed. The positions of the sublittoral sampling sites are summarised in Figure 8 and on Figures A1 – 1 to A1 – 5 in Appendix 1. Snorkelling methodologies were employed at a further two locations and a glass-bottomed bucket was used as a rapid assessment tool in shallow clear waters between the drop-down video sites, either on an opportunistic basis or to confirm the absence of seagrass in a predefined area of search. Where the viewing bucket was used in this 'negative assessment' way only generalised observations were recorded so precise grid references at specified times are not available. However, the RHIB routes taken are shown on Figure 8 and in more detail within Appendix 1 where a description of the general observations is also provided. A summary of those areas of search discounted through the use of the viewing bucket is also provided at the end of this section (see Section 4.3).

A total of 18 different biotopes were identified from the video records under ten biotope complex headings. The range of biotopes and species recorded was confined by the targeted nature of the sampling programme, to sublittoral fringe and infralittoral muddy sand communities between 0.7m ACD and 14.4m BCD, fringed by kelp dominated boulder and bedrock shores in varying conditions of exposure. A summary description of the communities encountered is given in the following sections at a biotope complex resolution, split initially under the broad EUNIS Level 2 habitats. Further details of individual sampling records are provided in Appendices 2 and 3.

4.1 IR – Infralittoral rock (and other hard substrata) communities

4.1.1 IR.HIR.KSed – Sediment-affected or disturbed kelp and seaweed communities

The seabed at Site 3 within Gruinard Bay comprised a gently undulating plain of pebbles and stone gravel. The 'peaks' of the shallow sediment waves (1.5–2m across) had a sparse scattering of filamentous algae but were otherwise free of conspicuous fauna. The coarse sediment 'troughs' supported dense banks of algae including *?Desmarestia* sp. but the only conspicuous fauna was a single large starfish *?Luidia sarsi*. This community was assigned to the HIR.Ksed.DesFilR biotope but consideration was also given to the new coarse sediment biotope SS.SCS.ICS.SSh (sparse fauna on highly mobile sublittoral shingle).

4.1.2 IR.LIR.K – Silted kelp communities (sheltered infralittoral rock)

This biotope complex encompasses two *Laminaria saccharina* dominated kelp biotopes recorded in the upper infralittoral at Sites 29, 34 and 35. Silted kelp forest (LIR.K.Lsac.Ft) was found on bedrock and large boulders at Sites 29 and 35 between 5.2–7.9m BCD. The substrate was more complex at Site 34 comprising mixed coarse sand with stone gravel, pebbles and cobbles and the kelp canopy was much reduced (LIR.K.Lsac.Pk), probably limited by available hard substrata. A '*kelp and seaweed communities on sublittoral sediment*' biotope (SS.SMp.KSwSS) was also considered for this record. *Echinus esculentus* urchins were present at all sites with foliose red algae including *?Delessaria sanguinea* (Site 34) and varied filamentous red algal species under the kelp canopy. At Site 35 this biotope was present on the lower section of a bedrock and boulder slope that gave way to a silty mixed sediment plain with scattered algae.

4.1.3 IR.MIR.KR – Kelp and red seaweeds (moderate energy infralittoral rock)

Laminaria hyperborea forests and parks subject to indeterminate levels of *E. esculentus* urchin grazing pressure on mid to upper infralittoral (2.2–11.7m BCD) bedrock and boulders, and cobbles on more mixed coarse sediments. This biotope complex encompassed seven sites (1, 2, 15, 25, 41, 49 and 55) and three biotopes, differentiated by kelp canopy cover with depth and perceived grazing pressure. Kelp stipes exhibited varying densities of epiphytic red algal growth, with filamentous red and encrusting pink coralline algae, keelworms and barnacles recorded on rocky substrates below the kelp canopy at some sites. A single crab was observed at Site 55.

4.2 SS – Sublittoral sediment communities

4.2.1 SS.SMp.KSwSS – Kelp and seaweed communities on sublittoral sediment

This biotope complex accounted for the largest proportion of the sampling records (19 of 56) of which 18 were assigned to a single biotope SMp.KSwSS.LsacR (*Laminaria saccharina* and red seaweeds on infralittoral sediments). A further, albeit tentative, subdivision of these records assigned them into one of the four 'new' sub-biotope categories on the basis of algal community composition and density of coverage, seabed substrata and perceived exposure.

The sub-biotope assignations are all labelled to emphasise the uncertainty of the level 6 EUNIS code descriptor eg Site 13 – SMP.KSwSS.LsacR?.Gv, and this differentiation was only undertaken to highlight observed groupings in the video records. At Sites 13, 14, 53 and 54 an infralittoral fine sand biotope was also considered appropriate but for the presence of the conspicuous algal component (unidentified short 'wiry' algal species together with *Asperococcus* sp., *Chorda filum* and very sparse *L. saccharina*) and a lack of information on the infaunal community composition.

Figure 10 Examples of 'kelp and seaweed communities on sublittoral sediment' biotopes. From the left – images from Sites 11, 13 and 28 tentatively assigned with the short codes LsacR?.Sa; LsacR?.Gv and LsacCho respectively

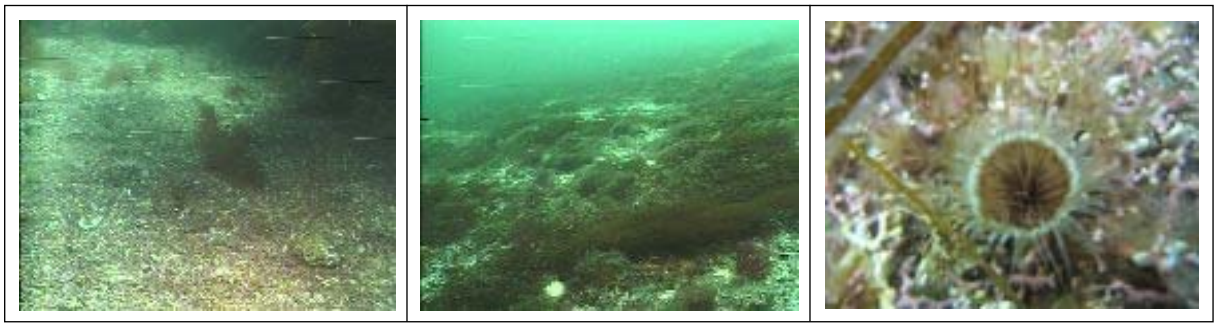
In-situ field observations of the video footage from Sites 8, 9 and 10 tentatively ascribed these sites to the *Zostera marina* seagrass biotope because of the presence of a short, patchy algal component on medium sand and partly because the sites were selected in the hope that they would define the outer boundaries of the seagrass bed present in the shallow waters off Second Coast. The lack of seagrass was apparent only upon more detailed review of the video records and Site 6 remained the only positive sample point from this seagrass bed. Site 28 (refer to image above), the '19th' sample under this biotope complex grouping, was assigned to the distinct SMp.KSwSS.LsacCho biotope on the basis of the increased abundance of bootlace weed *Chorda filum*.

4.2.2 SS.SMp.Mrl – Maerl beds

Maerl beds were recorded at three locations within the study area. Sites 51 and 52 were sampled using the drop-down video and a third bed lying in very shallow waters between the islands of Eilean Fada Mor and Tanera Beg in the Summer Isles was briefly 'snorkelled' to confirm maerl presence and to take some photographs. Site 51 was situated adjacent to the narrow constriction between Loch na Droighniche and Loch Ardbhair – an area of physiographically created accelerated tidal streams. Live maerl and a raised bank of maerl gravel at ~2.2m BCD supported *?Dictoyota dichotoma*, *Ulva* sp., *Ectocarpacae* indet., *Asterias rubens*, *Luidia ciliaris*, *?Marthasterias glacialis*, *Halidrys siliquosa*, *?Cerianthus lloydii* and a range of filamentous and foliose red algae below kelp dominated bedrock loch edges.

The deeper infralittoral maerl bed at Site 52 (12m BCD) was an extensive (10's of m^2) 'trough and ridge' tideswept community. As can be seen from the central image given below, this bed within the Sound of Handa supported dense stands of a range of algal species including *Desmarestia* spp., *Scinaia ?turgida*, *Laminaria saccharina*, and the ubiquitous *Ulva* sp. This community was tentatively assigned the SMP.Mrl(?.Pcal.R) sub-biotope coding on the basis of the dense algal communities observed.

Figure 11 Images from the maerl beds recorded at Sites 51, 52 and the snorkelling site between Eilean Fada Mor and Tanera Beg in the Summer Isles

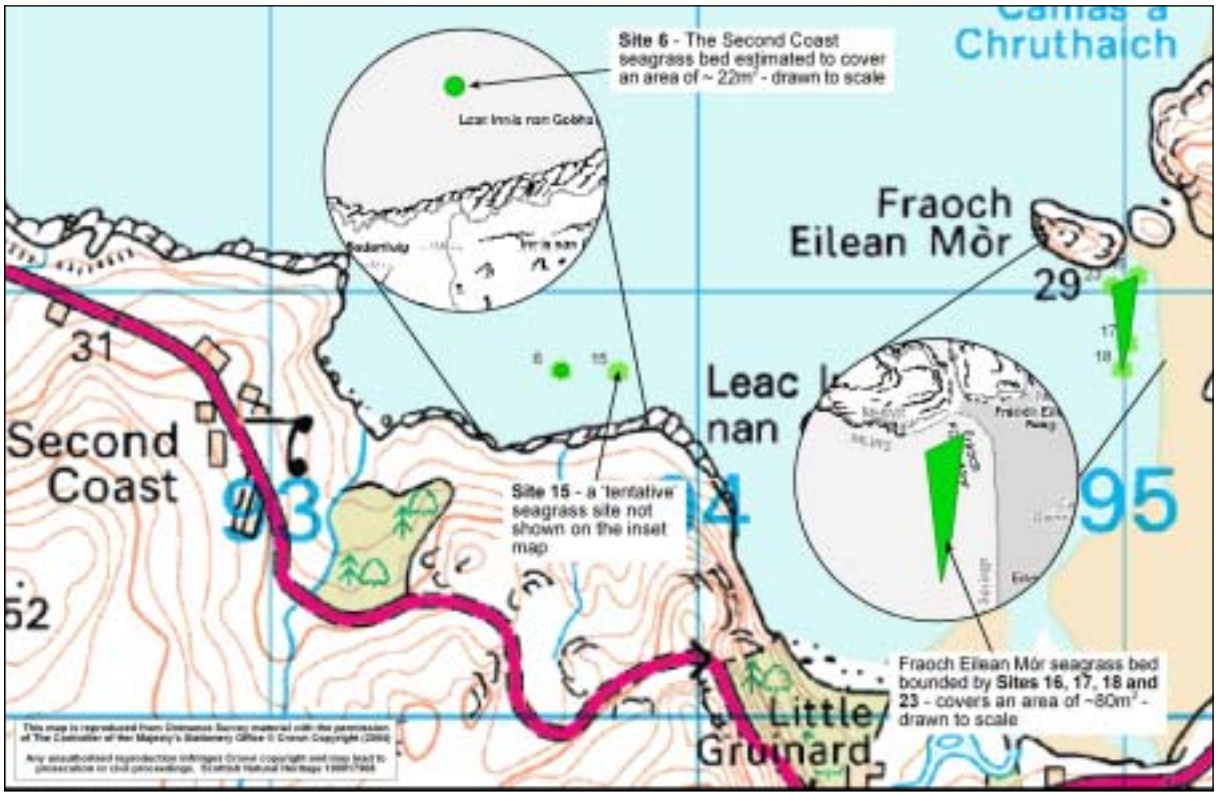


4.2.3 SS.SMp.SSgr – Sublittoral seagrass beds

Sublittoral *Zostera marina* seagrass presence (SMP.SSgr.Zmar biotope in all cases) was confirmed at seven sites (Sites 6, 16, 17, 18, 23, 44 and 45) and was potentially present at Site 15. The seagrass was predominantly found on fine slightly silty sand in the sublittoral fringe and shallow infralittoral (between 0.7m ACD at Site 16 to 4m BCD at Site 6). The seven confirmed records comprise four distinct stands of seagrass, a bed off Second Coast (Site 6 and the tentative record at Site 15) and a shallower bed further east within Gruinard Bay at Fraoch Eilean Mòr (Sites 16, 17, 18, and 23) and two small stands within Loch Dhrombaig (Sites 44 and 45). Eelgrass coverage was patchy within and between sites (5–65% cover).

The boundaries of the shallower Gruinard Bay bed were mapped using video sampling at specific locations (guided by the glass-bottomed bucket). The four point sample video records were taken as the outer most boundaries of the bed and joined (using straight lines plotted at a scale of 1:3,000) to create a seagrass polygon within the GIS project. As discussed previously (Section 4.2.1) the boundaries of the bed located off Second Coast were not accurately defined using the drop-down video deployments so a circular bed of 25m diameter (approximate size estimated from the video footage) was created using GIS buffering tools (see Figure 12).

Figure 12 The locations of the subtidal *Zostera marina* beds recorded within Gruinard Bay

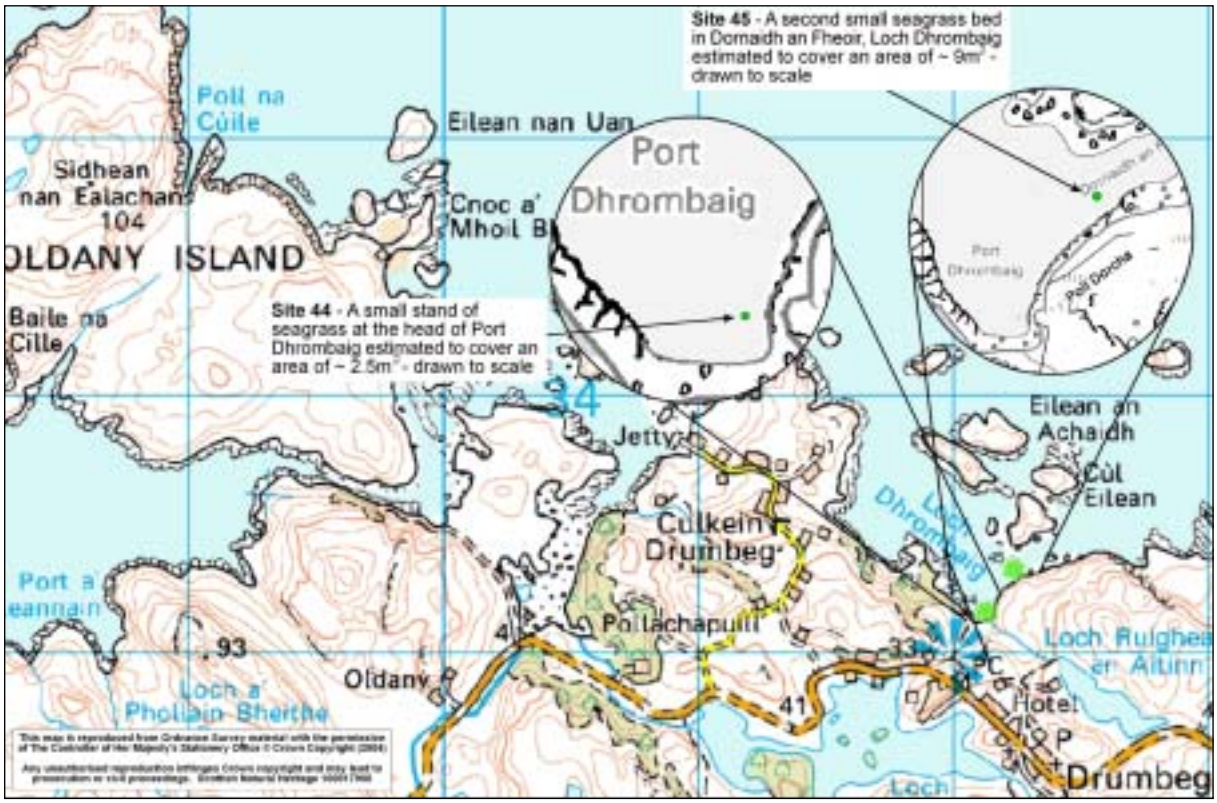


The extents of the seagrass 'stands' within Loch Dhrombaig were estimated *in-situ* using the glass-bottomed bucket. *Z. marina* was found in an area of ~3 x 2m at Site 44. Seagrass coverage within this small area was between 60–85%. The *Zostera* blades were adorned by a dense epiphytic ectocarpacae indet./diatom film and clumped aggregations of both filamentous and foliose algae, including the sea oak *Halidrys siliquosa*, were present within the bed. A single stalked jellyfish attached to a *Zostera* blade was visible on the video footage. In the shallower waters to the south, the fine silty sand supported patches of fine filamentous and foliose algae with *Chorda filum* and *?Trailliella* sp. A single flatfish *?Platichthys flesus* was observed on the surface of the sandy substrate. In the deeper waters to the north of the seagrass the seabed was covered in silted kelps possibly on more mixed substrata.

Figure 13 Images captured using the drop-down video equipment within *Zostera marina* beds at Sites 6, 44 and 45 respectively

Less dense *Z. marina* (variable cover ~5–35%) on clean medium-fine sand covered an area of ~10m^2 at Site 45. Dense aggregations of filamentous and foliose red algae were observed within the bed but the blades of the individual *Zostera* plants appeared to have a reduced epiphyte loading. Circular boundaries of radius 1.5m and 5m respectively were created using the GIS to represent the seagrass presence at Sites 44 and 45 (see Figure 14 below).

Figure 14 The locations of the subtidal *Zostera marina* beds recorded within Loch Dhrombaig



4.2.4 SS.SMu.IsaMu – Infralittoral sandy mud

Sites 26 and 30 situated on either side of the salmon farm cages within Poll Loisgann were tentatively assigned to the SMU.ISaMu(?.Cap) biotope. At both sites the muddy sand/sandy mud substrate was covered in a brown diatom film (potential organic enrichment from the adjacent fish farm) and sparse fauna were observed. At Site 26 the video cage landed just behind a *L. saccharina* festooned mooring line approximately 1m off the seabed and a single *?Asterias rubens* starfish and scattered algal debris were observed before the video equipment disturbed a large plume of fine silty sediment.

The mixed infralittoral sediment plain with algal detritus, filamentous algae and *L. saccharina* recorded at Site 56 within Loch Inchard was assigned to the generic SMU.IsaMu biotope complex. The sediment comprised poorly sorted silty muddy sand with a stone and shell gravel fraction and sparse pebbles. The muddy sub-biotope of the '*kelp and seaweed communities on sublittoral sediment*' (SMP.KSwSS.LsacR?.Mu) was also considered for this record.

4.2.5 SS.SMu.IFiMu – Infralittoral fine mud

The seabed at Site 50, within Loch Nedd, appeared to be fine silty mud/muddy sand. The sediment surface was covered in dense filamentous algal turf possibly with scattered foliose algae. The drop-down equipment disturbed the soft sediment that plumed and partially obscured the initial footage.

The SMP.KSwSS.Tra biotope '*mats of Trailliella on infralittoral muddy gravel*' was also considered for this record but the highly silty nature of the sediment and an extremely tentative potential presence of *?Philine aperta* towards the end of the video sequence (quite literally blurred small white blobs) resulted in the assigned, more generic, coding.

The '*Philine aperta and Virgularia mirabilis in soft stable infralittoral mud*' biotope (SMU.IFiMu.PhiVir) has been ascribed to the Site 39 record. *Philine aperta* and 'their' opisthobranch mollusc egg masses were tentatively recorded with clumps of heavily silted (possibly drift) algae and a diatom film on the surface of the fine silty sediment plain. No *V. mirabilis* seapens were observed from this upper infralittoral (6.2m BCD) muddy community.

4.2.6 SS.SSa.IFiSa – Infralittoral fine sand

Clean infralittoral medium-fine sand was recorded at sites within the Bay of Culkein (Site 40), Clashnessie Bay (Sites 42 and 43) and off Second Coast in Gruinard Bay (Sites 4, 5 and 7). In shallow water (less that 3.5m BCD) the substrate appeared highly mobile and well rippled with no conspicuous fauna (Sites 7, 40 and 42). In slightly deeper water (3.5–6.5m BCD) the substrate appeared less mobile with a diatom film on the sediment surface at Site 43, drift algae at Sites 4 and 5 and a sparse filamentous algal component possibly attached to pebbles and shells within the firm sediment at Site 4. A single small starfish *?Asteropecten irregularis* was observed at Site 4. The perceived degree of mobility is reflected in the biotopes assigned to these records.

4.2.7 SS.SSa.IMuSa – Infralittoral muddy sand

The SSa.IMuSa.AreISa '*Arenicola marina polychaetes in infralittoral fine or muddy sand*' biotope was assigned to six sites. The substrate at Sites 19, 20, 22 and 24 was characteristically 'hummocked' fine silty sand with 'mounded' *A. marina* casts, other conspicuous infaunal 'holes' and scattered shell debris. The sediment surface at these sites was covered in a patchy brown diatom layer with scattered small starfish *?Asteropecten irregularis*. The sediment at Site 21 appeared siltier than the previous records (all located in the vicinity of the seagrass bed below Fraoch Eilean Mòr in Gruinard Bay) with a single *Cerianthus lloydii* burrowing anemone and a *Philine aperta* opistobranch mollusc recorded. However, the community was certainly not sufficiently different nor the substrate sufficiently muddy to assign the SMU.IFiMu.Are biotope coding.

At Site 48 (near the fish farm in Loch Dhrombaig) the clean medium-fine upper infralittoral sand surface was covered with patchy *Ectocarpacae* indet. (~20–80% cover with dense banks in places) with scattered *Cerianthus lloydii* burrowing anemones and less numerous *Arenicola marina* worm casts.

4.3 Assessment of the pre-defined search areas

Of the 28 'Areas of Search' identified by SNH, six were classed as 'confirmed', one as 'caught in nets', 16 as 'possible' (the second 'possible' area within Cùil Lochain is considered to be encompassed within the confirmed record at that location and is not included again here) and five as 'wash-up' locations (refer to Table 3 for more details of these classes).

All but one of the 'confirmed' search areas was sampled in the 2004 study. Only the lower portion of the Oldany Island area (whole of the eastern side of the island) from the sandy beach at Mol Ban and through the channel separating the island from the mainland in the south was assessed using the glass-bottomed bucket from the RHIB. The more northerly section to the top of the island could not be sampled in the onshore winds but was considered as unsuitably deep, rocky habitat.

Within Gruinard Bay similar onshore winds also hampered sampling off the coast at Udrigle and the single 'rapid' video deployment recorded *Laminaria hyperborea* kelp forest on bedrock or boulders. Areas of sediment were apparent amongst the kelp but conditions were unsuitable for further sampling in this 'confirmed' location. The video equipment was used to successfully locate seagrass communities present in choppy waters ~4m BCD off Second Coast (Site 6) thus validating the 'caught in nets' sighting within this area of search. The other seagrass bed recorded within Gruinard Bay at Fraoch Eilean Mòr was 'picked-up' through opportunistic use of the glass-bottomed bucket, with the drop-video (and boat based video) subsequently deployed to map the bed boundaries.

Multiple video drops and the use of the glass-bottomed bucket failed to relocate seagrass beds previously recorded within Cùil Lochain and Poll Loisgann. The boulder and cobble substrate present within the Priest Island 'confirmed' search area was assessed using the glass-bottomed bucket but considered unsuitable (discussed in more detail in Section 5.5). The 2001 record from Port Dhrombaig (Evans and Rothero, 2002) and a further seagrass stand in the Dornaidh an Fheoir channel within Loch Dhrombaig were located using the viewing bucket. The area covered by the beds was estimated from the RHIB and the video equipment was then deployed to capture a permanent visual record.

Of the sixteen 'possible' search areas the following ten were not assessed; Achmelvich Bay, Duartmore Bay, Shark Bay, Badcall Bay, Farhead Point, East Eilean a' Bhuic, the three areas within Loch Laxford and Loch an Roin. The absence of subtidal seagrass within the six areas visited was determined using a combination of drop-video and viewing bucket techniques.

Of the five 'wash-up' locations, Balchladich Bay, Bay of Stoer and the Bay of Clachtoll were not sampled.

5 DISCUSSION

5.1 Biology of subtidal seagrass beds

5.1.1 Vegetative growth

Z. marina growth is seasonal (generally occurring during the spring and summer, from April to September) and closely related to environmental temperature. *Zostera* invests a large proportion of its resources in the maintenance of rhizomes and roots which branch during growth, producing vertical leaf shoots, which are responsible for the lateral expansion of patches. Short pieces of rhizome that break off the parent plant and are carried away by currents may generate new plants if deposited on a suitable substratum (Davison and Hughes, 1998). Dispersal by detached or drifting rhizome fragments was considered to be rare, but new evidence suggests that the importance of this mechanism may have been underestimated (Borum *et al.*, 2004).

Due to the relatively high temperatures (above 15°C) required for flowering and seed germination, sexual reproduction does not play a major role in the life history of *Z. marina* in northern latitudes and subtidal seagrass beds in the UK generally, and certainly within Scottish waters, are believed to persist almost completely as a result of vegetative growth rather than by seed production (Davison and Hughes, 1998).

5.1.2 Population structure

Zostera patches resulting from vegetative growth will be composed of plants with an identical genetic composition. Beds formed largely by this process will as a result be less genetically diverse than those arising from sexual reproduction. This may have implications for the resilience of a bed to anthropogenic impacts (Davison and Hughes, 1998).

5.2 Environmental factors that affect the distribution and extent of *Z. marina*

5.2.1 Physical and biotic environment

The distribution and growth of seagrasses is regulated by a variety of water quality factors such as temperature, salinity, nutrient availability, substratum characteristics, turbidity and submarine irradiance (Short and Wyllie-Echeverria, 1996 in Devlin, 1999).

As outlined in Section 1.3, *Z. marina* is considered a perennial subtidal species occurring on relatively coarse sediments within sheltered fully marine conditions where there is a close balance between the rates of sediment erosion and accretion. Survival and growth of subtidal *Z. marina* is affected by water turbidity, with plants growing deeper where the water is clearest. The lower depth limit is typically about 4m, reflected well within this study, but may exceed 10m in exceptional circumstances. Whilst *Zostera* growth can be stimulated by modest nutrient enrichment excessive input of nutrients can have deleterious effects (Davison and Hughes, 1998).

5.2.2 Sensitivity to natural events

Like all marine biotopes, seagrass beds are subject to natural change and *Zostera* beds are known to be spatially dynamic, with advancing and receding leading edges, causing changes in coverage. Naturally occurring changes can take place at a range of scales, with effects ranging from small alterations in *Zostera* coverage or density, to destruction of entire beds over large geographic areas (Davison and Hughes, 1998).

Extreme weather conditions such as violent storms or heavy floods can denude eelgrass beds over wide areas through the mechanical removal of plants or as a result of adverse changes to the physical environment (water clarity and/or sediment characteristics). The 'wasting disease' is by far the most significant biological factor, responsible for the observed long-lasting declines in the number and extent of subtidal *Zostera* beds around the UK. As stated previously (Section 1.1) the most severe outbreak of this disease took place in the early 1930s, and recovery from this is still incomplete. The disease-causing agent *Labyrinthula macrocystis* is probably continually present at low levels within seagrass communities and undergoes occasional epidemic outbreaks for reasons that are still not fully understood. Declines in the natural populations of epiphyte grazers can also indirectly affect the health of *Zostera* beds by allowing increased growth of fouling algae, although nutrient enrichment or other forms of anthropogenic pollution are the factors most likely to bring about such changes (Davison and Hughes, 1998).

5.2.3 Human activities

Although natural events have been responsible for both large-scale and local losses of seagrass habitat, recent evidence suggests that human population expansion and the increasing input of anthropogenic materials into our coastal waters are primarily responsible for the observed worldwide decline in seagrasses (Short and Wyllie-Echeverria, 1996 in Devlin, 1999).

The *World Atlas of Seagrasses* (Green and Short, 2003 in Borum *et al.*, 2004) estimated that the global loss of seagrasses between the mid-1980s and the mid-1990s was close to 12,000km^2. Recent studies undertaken along a 200km stretch of the Swedish Skagerrak coast (Baden *et al.*, 2003) reported a decrease in areal extent of *Z. marina* of 58% over the last 10–15 years. A more extended analysis of the worldwide loss of seagrasses, based on an extrapolation of known losses over the last two decades, concludes that the global seagrass loss due to human impact amounts to 33,000km^2 (Duarte *et al.*, 2004 in Borum *et al.*, 2004).

Coastal development can have adverse effects on *Zostera* beds by causing increased sediment erosion or accretion (depending on the nature of development), and by causing increases in water turbidity. Excessive nutrient enrichment can cause damage to eelgrass beds by a variety of mechanisms, the most important of which are metabolic imbalance, proliferation of phytoplankton, epiphytic or blanketing algae, and increased susceptibility to wasting disease. Human-induced climate change may have significant longer-term effects on the distribution and extent of *Zostera* beds as a result of higher water temperatures, surface water acidification and increased frequency and severity of storms (Davison and Hughes, 1998).

5.3 Subtidal seagrass resource in shallow coastal waters off north-west Scotland

5.3.1 Seagrass beds recorded in the 2004 survey

Four distinct stands of sublittoral *Zostera marina* seagrass (SMP.SSgr.Zmar) were recorded within Gruinard Bay and Loch Dhrombaig. The beds recorded off Second Coast and Fraoch Eilean Mòr in Gruinard Bay were previously unrecorded (although the Second Coast site was clearly known about by the local fisherman who advised SNH of its whereabouts). The 2004 records from Loch Dhrombaig confirm the continued existence of the smallest seagrass stand (Site 44) first recorded at by T. Lockie in 2001 (Evans and Rothero, 2002) and 'extend' the known distribution of this habitat within the loch to the adjacent Site 45.

5.3.2 Seagrass losses from Poll Loisgann and Cùil Lochain

The identification of the two 'new' small *Z. marina* beds in Gruinard Bay is offset by an apparent loss of two beds from Poll Loisgann and Cùil Lochain within Enard Bay (estimated areas of 0.5ha and 10m x 30m respectively) (White, 1987).

Whilst the loss of *Z. marina* from these two locations may have been the outcome of entirely natural events (see Section 5.2.2 above), it is possible that the salmon farming operations that commenced within Poll Loisgann, a small sheltered sealoch, in 1992, played some role in the observed decline at this location (no similar activities within Cùil Lochain however).

Figure 15 View of the fishfarm cages situated within Poll Loisgann, Enard Bay

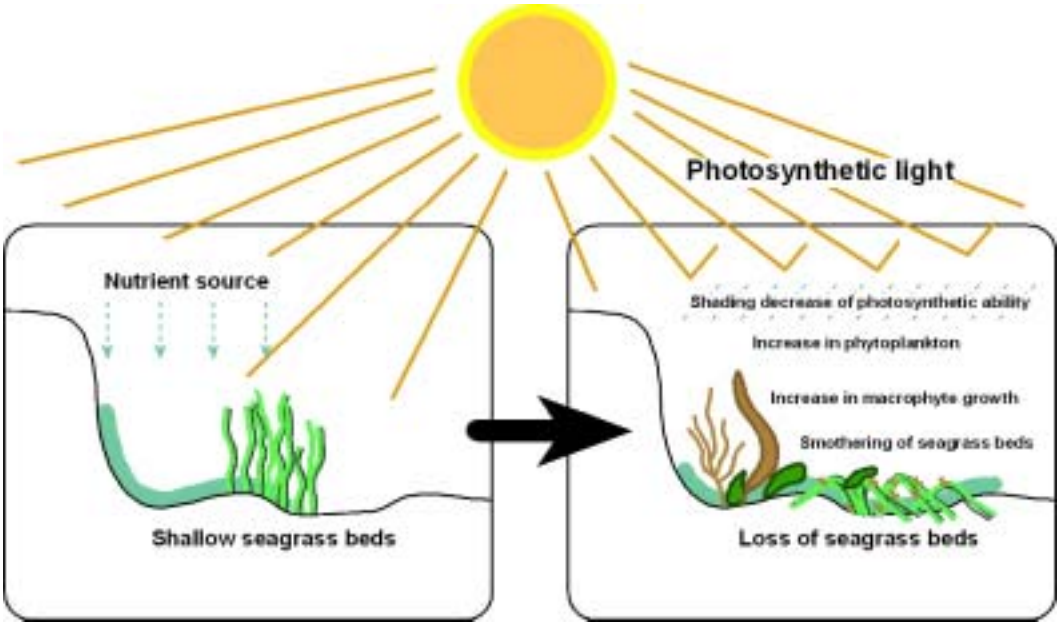
The initial Atlantic salmon stocking biomass of 75 tonnes within Poll Loisgann was expanded to 275 tonnes in 1995 and this remains the current consented maximum biomass. The site has not been stocked on a continuous basis and is believed to have lain fallow for a number of years (SNH *pers. comm.*). The cages were in place during the 2004 survey (situated ~100m from the edge of the historical seagrass bed record) but did not appear to be stocked, with the cage netting heavily 'fouled' by filamentous brown algae.

5.3.2.1 Aquaculture activities and subtidal seagrass beds

Coastal aquaculture activities have been shown to give rise to potentially significant impacts on seagrass beds due to shading, increased nutrient input (inefficient utilisation of fish feeds and faecal by-products) and a subsequent deterioration in sediment quality. Although seagrass meadows are often nutrient limited, increased nutrient inputs can only be expected to enhance seagrass primary production at moderate levels. Increased nutrient levels promote phytoplankton biomass, which deteriorates the underwater light climate (resulting in seagrass loss, particularly in the deeper portions of the beds), and the stimulation of the growth of epiphytes and opportunistic macroalgae, which further shade and suffocate seagrasses (Borum *et al.*, 2004).

High sediment nitrate and ammonium concentrations may also be toxic to seagrasses and such deteriorations in sediment quality may play a critical role in enhancing initial seagrass loss. Burkholder *et al.* (1992) found that nitrate enrichment could cause death or decline in seagrasses, including *Z. marina* in poorly-flushed areas (high internal nitrogen concentrations cause a metabolic imbalance), an effect exacerbated by heavy epiphyte growth.

Figure 16 Summary of the effects of nutrients on shallow seagrass beds (adapted from Devlin, 1999)



Physiological stresses imposed by nutrient supply imbalances may also affect weakened plants by enhancing susceptibility to opportunistic pathogens (eg 'wasting' disease) (Den Hartog, 1996 in Devlin, 1999).

5.3.3 Recommendations for future work

The survey work confirmed the absence of seagrass from large areas of potentially suitable substrates (although more detailed studies would need to be undertaken to ascertain the suitability of other physical and biological parameters) in shallow coastal waters (the RHIB covered an estimated 280km of coastline) with 15 of the originally identified 28 'areas of search' assessed using a combination of sampling techniques. Time constraints were really all that prevented an assessment of the other identified search areas, with the work sensibly prioritised to focus initially on 'confirmed' records and then 'other' potential locations in close proximity to these sites.

One historical *Z. marina* record '*amongst maerl and sand*' in the shallow subtidal near Badluarach jetty in Little Loch Broom (Gubbay and Nunn, 1988) was only identified after completion of the 2004 fieldwork. This location and a number of the 'missed' search areas may support *Z. marina* (eg the fisherman's record between Udrigle and Laide where sampling had to be curtailed due to poor weather) and a number of further areas are also considered worthy of investigation should suitable opportunities arise eg Camas a' Chruthaich to the north of Fraoch Eilean Mor, the sandy beach at Mungasdale and Camas a' Charraig at

Mellon Udrigle. As stated in Evans and Rothero (2002) whilst the beaches at Clashnessie and Culkein Stoer could conceivably have received 'washed-up' plants from Port Dhrombaig or from Oldany (the site of the first record in this area but not relocated in 2004) it seems unlikely that this could be the case at Achmelvich, Balchladich and Clachtoll so there must still be other beds out there waiting to be discovered.

The validation of *Zostera* presence or absence at these sites and an assessment of the extent of the seagrass bed off Second Coast should be undertaken on an opportunistic basis or as part of a programme of future SNH area office marine BAP delivery.

5.4 Implications for conservation management

The results of this study indicate that *Z. marina* is perhaps not as 'under-recorded' on the north-west coast of Scotland as previously believed. In relation to the apparent loss of seagrass beds from two sites within Enard Bay it is estimated that seagrass meadow recolonisation can take in the order of a decade in favourable environmental conditions (Borum *et al.*, 2004). If increased nutrient input from aquaculture activities has in any way been instrumental in the decline within Poll Loisgann however, additional time would also be required to break-down excess organic matter remaining in the sediment. Declines in the seagrass *Posidonia oceanica* were apparent three years after cessation of fish culture in some studies undertaken in the Mediterranean (Delgado *et al.*, 1999).

Once impacted, by natural or anthropogenic factors, seagrass colonisation and regrowth can be extremely slow, or nonexistent, because of possible ongoing impacts and the poor dispersal capabilities of most seagrass species (Dennison and Kirkman 1996 in Devlin, 1999). This is particularly pertinent in Scotland's cool coastal waters (<15°C required for flowering and seed germination) and helps to explain the limited recovery of subtidal *Z. marina* around the UK since the widespread losses recorded in the 1930's (and the observed absence of seagrass from a number of shallow coastal areas that appear, at least superficially, to represent potentially suitable habitat). These factors also suggest that recovery of the Enard Bay losses are unlikely, certainly in the short to medium-term, and have considerable implications for the continuing survival (population viability) of the four small stands recorded in 2004.

5.4.1 Conservation management – seagrass transplants

Due to the general lack of natural recovery of seagrass beds from wasting disease, numerous workers in North America and Australia, and to a lesser extent in Europe, have put a great deal of effort into researching methods to transplant seagrass plants (using mature plants and/or seeds) into suitable areas. A concise summary of a number of the trials undertaken in the UK (mainly in the south-east and south-west of England) is provided in Davison (1997) including a review of an unsuccessful pilot scheme to transplant healthy *Z. marina* in the Helford Passage in Cornwall in 1992.

A compilation of data on whole plant transplant success, from 53 reports published in the USA, showed a mean percentage survival of 42% after one year. The survival rates vary considerably with the planting methods applied, but in general many of the planting units are lost. Transplantation attempts using *Z. marina* seeds have been even less successful with several experiments carried out in the USA reporting germination successes of less than 10%. Density of 'seeding' did not influence the results of these studies and subsequent survival of 'new' seedlings was also very low (Borum *et al.*, 2004).

Transplantation of seagrasses is a laborious and expensive activity (especially so in the subtidal environment). The costs of transplanting are, of course, species, site and method specific and may vary dramatically. The UKBAP seagrass Habitat Action Plan includes an objective to '*assess the feasibility of restoration of damaged or degraded seagrass*' in the UK with an interim target of 1,000ha of restoration proposed (species not specified and it is recognised that such restoration could include wider site enhancement measures other than just transplantation). The costs put forward in the HAP speculated an average cost of £5,000 per hectare at 1999 prices for restorative works which is significantly lower than the actual costs for seagrass transplanting reported in Borum *et al.* (2004). Here the price for a transplantation project in New Hampshire, USA, (species and project specifics unknown) was approximately 250,000 Euros (£175K) per hectare (2002 prices).

Van Katwijk (2003) provides an interesting review of research into the possibilities of reintroduction of *Z. marina* in the Dutch Wadden Sea area including a summary of seagrass restoration projects worldwide. Within this review the ambitious interim UK HAP target of 1,000ha of restoration is put into some perspective when the scale of successful transplantation in other countries is considered. A total of 78ha of *Z. marina* has been transplanted in the USA, according to a review by Fonseca *et al.* (1998), with figures of 2ha in Australia and 'several tens of hectares' in Japan provided for a similar time period.

5.4.2 Conclusions

The conclusions of this work will feed into the UKBAP process (including the 2005 review of HAP targets – UK BRIG, 2004) with the seagrass species records registered on the National Biodiversity Network (NBN), subsequently advising delivery of SNH's nature conservation advice and other initiatives including the JNCC led compilation of distribution maps of the habitats and species on the OSPAR 'initial list' (SNH *pers. comm.*).

No progress against the original seagrass HAP targets was registered in the 2002 UKBAP reporting round and the use of transplantation as a restoration technique may need to be reviewed in light of worldwide achievements to date and the significant costs of such work. The results of recent country level survey and assessment work will be fed into the 2005 BAP reporting to help determine whether, and at what scale, restorative measures may be appropriate in Scottish coastal waters.

In addition to the cost implications, consideration would also have to be given to the requirement to collect source material (could only be full plant transplants if Scottish in origin – admittedly with the potential for subsequent seed/seedling production in a research facility) which may adversely affect the existing 'donor' seagrass beds, especially when harvesting approaches leave bare patches which are then susceptible to erosion (Borum *et al.*, 2004).

5.5 The 2004 seagrass mapping approach

5.5.1 Seabed sampling

In light of the aims of the study (is subtidal seagrass present or not) and the considerable logistical issues associated with covering as many of the search areas as practicable within the allocated survey timetable (large area, RHIB launch and recovery each day and travel between accommodation bases), a rapid video sampling strategy was adopted. If seagrass was clearly not present the video system was recovered and the RHIB moved on to the next sampling location.

This pragmatic approach maximised the area covered and provided sufficient 'biological resolution' to meet the aims of the study although the brevity of the video sampling did reduce the confidence with which biotope categories could subsequently be assigned to the records (average sample time of between 40 seconds–one minute; with the 'briefest' drop of just nine seconds completed at Site 25) and it is possible that very small stands of seagrass were overlooked.

The squally weather conditions led to an initial misidentification of the communities present at a number of sampling locations off Second Coast in Gruinard Bay resulting in a failure to map the seagrass bed boundaries in that location. The 25m-diameter bed size assigned to this record is considered a conservative estimate and it is possible that patchy sparse seagrass coverage continues for a further 100m to the east, to the tentative record below the kelp-dominated bedrock at Site 15.

5.5.2 Methodological recommendations

The initial prioritisation of survey effort within the extensive study area, using local knowledge and an understanding of the key habitat requirements of subtidal *Zostera* resulted in a cost-effective targeted sampling programme. The survey work collected information, albeit at a coarse resolution, on a number of other habitats of nature conservation interest (eg maerl beds and tidal rapids) and such an approach could be adapted to meet the future information needs of these broad habitats.

Figure 17 Shallow sublittoral cobbles and boulders with a luxuriant 'grassy' growth of *Enteromorpha* sp. in the small embayment below Acairseid Eilean a' Chlèirich bay on the south-eastern side of Priest Island, Summer Isles. It is believed that this habitat was misidentified as a sublittoral seagrass bed

Press releases and adverts seeking observations on specific habitats and species from local marine user groups could make even greater use of photographs and illustrations to clarify the exact features under investigation. The 'confirmed' record of seagrass from Priest Island actually turned out to be dense *Enteromorpha* sp. on boulders, although the 'grassy' nature of this algal community was apparent from the RHIB (see Figure 17).

Whilst the pragmatic 'rapid assessment' technique provided sufficient information to meet the aims of the study, additional (longer) and varied (including close-up) footage would have aided species recognition and subsequent biotope assignation at some locations. The drop-down video surface unit is showing signs of 'wear and tear' (keypad is de-laminating) with a loss of some of the original functionality. The picture 'capture' quality has also deteriorated and some maintenance/upgrading to worn elements of the equipment may be appropriate.

The Countryside Council for Wales (CCW), in conjunction with contractors Envision Mapping and C-Technics have recently developed a drop-down system for monitoring work in CCW. A consideration of their potentially more robust surface video unit (within a sealable 'peli-case' type box) and VDU viewing goggles (to aid screen viewing in daylight conditions) may prove beneficial. The report produced as part of their equipment development process (Sotheran and Foster-Smith, 2004) also includes a guidance manual that updates the procedural guideline for drop-down video (in Davies *et al.*, 2001) with equipment-specific instructions, safety and technical briefings for the whole survey team and techniques to maximise data quality.

The survey adopted a 'negative assessment approach' ie if seagrass was clearly not present using the glass-bottomed bucket in clear shallow water then no detailed sampling records were taken and the RHIB moved on to the next area of search. Whilst this was a valid sampling strategy in relation to the 'seagrass' assessment scope of this project it potentially 'missed' the opportunity to capture at least some basic information and a permanent 'visual' record (video or still image) of conditions at each of these rapid assessment locations. Future studies could perhaps take on a more general remit (or at least consider a broader range of BAP and/or other habitats of conservation interest at the planning stage) and seek to capture an agreed minimum level of data even when only deploying the viewing bucket in very shallow clear waters. A balance will always need to be struck between what can realistically be achieved with limited resources and survey time whilst maximising the 'data return' for that investment.

When planning surveys of this nature it is essential that previous locational information be collected at as detailed a resolution as possible to guide the subsequent *in-situ* sampling programme. The Poll Loisgann 'Area of Search' coordinates provided by SNH were derived from the original survey report (White, 1987) and probably represented a notional centre point of the loch for reporting purposes at that time. Whilst these coordinates were appropriate to guide the initial RHIB positioning (in the right loch), detailed OS base mapping and GIS tools could have been used to determine centre points and lateral extent positions for the indicative seagrass bed illustrated on a 1:10,000 paper map in the 1987 report. This would have giving greater confidence when subsequently reporting habitat losses and is particularly relevant when considering 'older' survey records and possible changes in habitats of conservation concern. This would also be an essential planning consideration were this sampling approach to be applied to an assessment of 'deeper' habitats or those in more turbid waters.

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APPENDICES

APPENDIX 1 – Field log

NW Scotland Seagrass Survey, 10–16th August 2004 – Field log

Survey team: Rachel Horsburgh (RH), Matt Dalkin (MD), Ben James (BJ), Mark Stewart (MS) and Angus McHattie (AM)

Tues 10th August

Weather:	Very wet and mild in Edinburgh but the rain cleared as travelled north with a fine evening in Aultbea.

09:40 MD & BJ meet at SNH Edinburgh to load survey equipment. The single SNH pool vehicle was a little overloaded to also tow the RHIB and a hire car was required. BJ returned home to pick up driving licence.

11:00 MD & BJ pick up hire car from Arnold Clark (Edinburgh), re-pack vehicles and drive to Port Edgar to pick up SNH RHIB *Aphrodite* via a brief Tesco's stop for food and fuel.

13:15 MD & BJ leave Edinburgh and travel in convoy to Aultbea with rest and fuel stops en-route (filled RHIB at Torre services @ 16:45).

19:20 MD & BJ arrive at Cartmel B&B in Aultbea and meet MS who has travelled up from Fort William.

20:40 RH meets MD, BJ and MS at the Aultbea Hotel to plan Wednesday survey programme. Supper at the hotel.

22:30 Return to B&B and retire for the evening.

Weds 11th August

Weather:	Overcast with brighter spells and warm NE winds force 4–5. Sea-state moderate.
Tides:	3.7m @ 04:44 Port: Mellon Charles 2.2m @ 10:47

06:30 Launch RHIB at Laide jetty and 'tie-off' to local mooring (NG 9020 9255).

07:35 Return to Cartmel B&B for breakfast.

09:10 Leave B&B and investigate alternative slip option in Aultbea (NG 8659 8892) for subsequent boat recovery. Leave two vehicles in Aultbea and then drive to Laide jetty.

09:35 Prepare equipment for survey, load RHIB at Laide jetty and enter potential sampling locations into the boat GPS.

10:15 Commence survey work. Initially intended to start off the coast at Udrigle (a 'confirmed' seagrass sighting) but conditions were unsuitable (NE onshore winds with moderate sea-state) so crossed to a potential site off Second Coast ('caught in nets' sighting) and completed Sites 1–15. A number of video drops were very brief due to the adverse weather conditions and close proximity of the rocky shore.

11:30 Investigate sandy beach at Camas Gaineamhaich, observe the presence of *Zostera marina* in the clear shallow waters in the lee of the outcrop Fraoch Eilean Mor and complete a single video drop at Site 16.

12:00 Lunch

Appendix 1 *(continued)*

12:45 Continue sampling and complete Sites 17–24 in shallow waters to the south of Fraoch Eilean Mor in an attempt to delineate the narrow band of seagrass present. The remainder of the shallow embayment down to the confluence of the Little Gruinard and Inverianvie rivers (and beyond) was assessed using the glass-bottomed bucket from the RHIB – no seagrass was observed.

13:40 Return to Udrigle coast area but the sea-state was still uncomfortable in the 'reefy' shallows so after one quick drop-down video attempt (Site 25) further sampling in this area was abandoned.

14:20 Drop RH and MS at Laide jetty to drive vehicles back to Aultbea. BJ and MD drive boat around Greenstone Point to the slipway at Aultbea. Unload and remove the RHIB from the water.

16:15 Depart Aultbea slipway and drive to Lochinver.

18:30 Arrive Lochinver and park RHIB on hard standing within the harbour area. Survey team drive to the Ard Glas B&B.

19:15 Supper at the Caberfeidh restaurant in Lochinver.

20:50 Return to the B&B, put video camera batteries on to charge, write-up field notes and prepare for following day's survey.

22:00 Retire for the evening.

Thurs 12th August

Weather:	Fine day with scattered clouds some rain early on and then bright sunny spells. Wind NE force 3–4 and sea-state calm for most of the day in the shelter of the shore and a slight swell returning to the slip against the wind in the afternoon.
Tides:	3.9m @ 05:48 Port: Loch Inver 2.1m @ 11:55

07:30 Breakfast at the Ard Glas B&B.

09:00 Pick up lunch at the local shop and then visit the Lochinver harbourmaster to discuss launching facilities in the area and possible mooring options for the evening. Insufficient water to launch at Lochinver harbour slip so contact FinFish fishfarm to see if it is possible to launch at their slip.

09:10 Drive to the FinFish slipway at Rubha Phollaidh (the back road from Lochinver is quite narrow and twisting and proved a 'tight squeeze' for the RHIB in places).

10:40 Launch the RHIB, load equipment and commence survey work in Poll Loisgann a small inlet just to north of the launch site. Seagrass had been recorded here historically but was not observed on the video drops made at Sites 26–30 or within the shallow waters at the head of the inlet assessed using the glass bottomed bucket (from ~5.5–1m BSL). There is a small fishfarm located within the inlet and areas in the vicinity of the cage and its mooring chains could not be surveyed.

12:15 Sites 31–35 completed – encompassed a very brief snorkel at the head of Cuil Lochain (Site 31) and an assessment of an historical seagrass record on the eastern edge of Cuil Lochain (no seagrass observed using the drop video at Sites 32 and 33).

13:05 Lunch whilst motoring up the coast to Loch Kirkaig. The clear shallow waters of Loch Kirkaig and the small inlet to the north of Cais-bhaigh were assessed using the glass-bottomed bucket and no seagrass was observed.

14:10 Sites 36–39 completed within Cais-bhaigh and Loch an Eisg-brachaidh.

Appendix 1 *(continued)*

Figure A1 – 1 A map showing the approximate RHIB route and the drop-down video sampling locations completed within Gruinard Bay on 11/08/04. A glass bottomed 'viewing' bucket was used in other clear shallow water areas to determine the presence of seagrass. The RHIB was recovered from the slip at Aultbea (not on map)

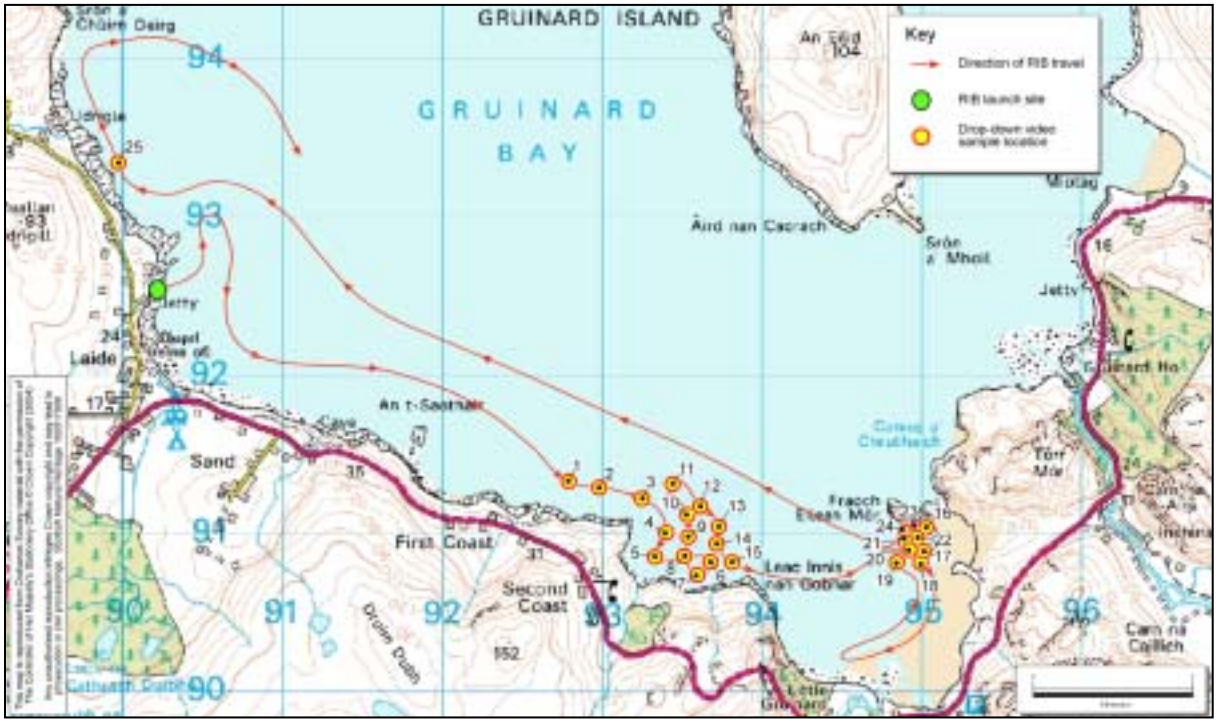
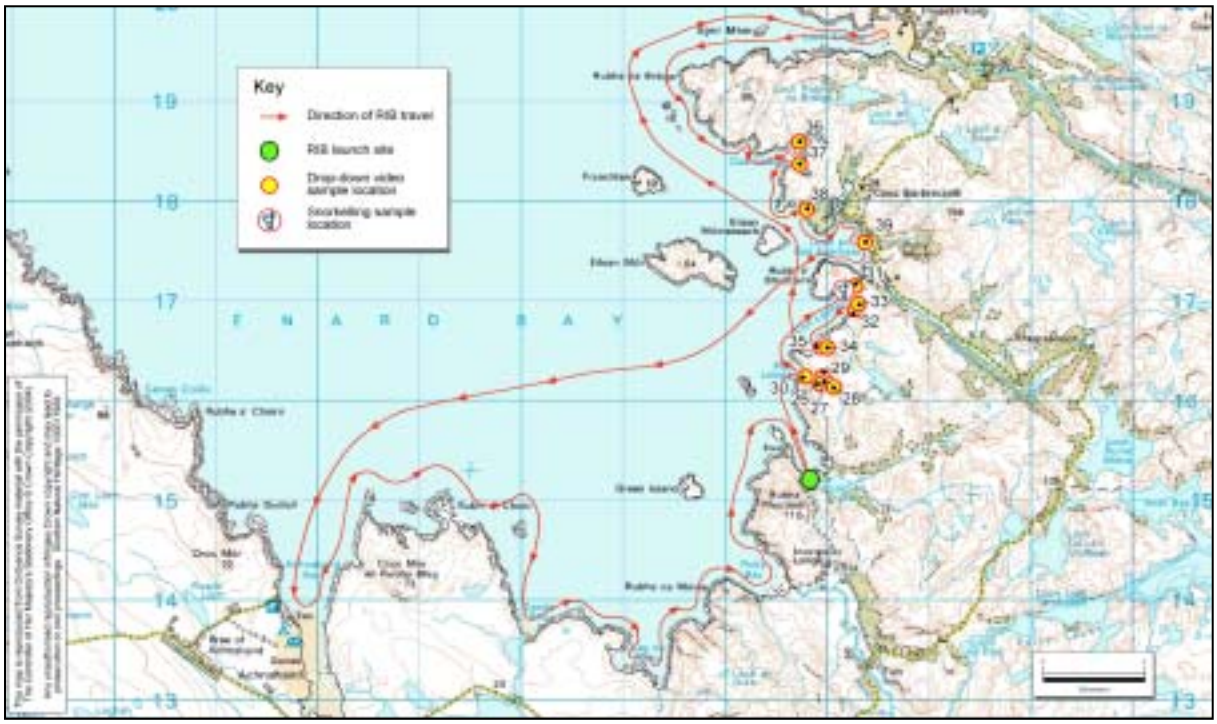


Figure A1 – 2 A map showing the approximate RHIB route and the drop-down video sampling locations completed within Enard Bay on 12/08/04. A glass bottomed 'viewing' bucket was used in other clear shallow water areas to determine the presence of seagrass



Appendix 1 – Thurs 12th August *(continued)*

15:00 Headed across Enard Bay to investigate the sediment areas along the southern coast starting at Achnahaird Bay (fine hard rippled sand leading out from the intertidal with cobble areas with kelp, *Ulva* sp. and filamentous algae starting at ~3.5m BSL). The glass-bottomed bucket was also sufficient to determine the absence of seagrass within the other embayments along this part of the coast – Garvie Bay (kelp and cobbles), Lag na Saille (kelp on cobbles and rock with patches of hard packed sand) and Polly Bay (sand with filamentous algae).

17:10 Return to FinFish slipway at Rubha Phollaidh and recover the RHIB from the water. Unpack survey equipment and drive back to Lochinver (alternative route past Loch Bad a' Ghaill and Loch Lurgainn which whilst longer proved more suitable for trailer towing).

19:20 Drop the RHIB off at the harbour and then head to the Loch Inver Larder restaurant for supper.

20:50 Return to the Ard Glas B&B put equipment on to charge, copy up records and retire.

Fri 13th August

Weather:	A bright sunny day with patchy cloud cover in the morning. Gentle winds freshened to create a moderate swell in the afternoon.
Tides:	4.1m @ 06:33 Port: Loch Inver 1.9m @ 12:41

07:30 Breakfast at the Ard Glas B&B.

09:15 Pick up the RHIB from Lochinver harbour carpark and stop to get lunch from the local shops. Re-fuel the boat and vehicles and drive to Kylesku.

09:45 Launch the RHIB at the Kylesku slip, prepare equipment for survey and load onto the RHIB.

10:40 Depart Kylesku slip, drive the RHIB under the road bridge and up Loch a' Chàirn Bhàin and into Eddrachillis Bay. The swell picked up as we crossed the bay towards Oldany Island and this proved uncomfortable and unworkable for RH. Conditions were unsuitable for attempting to sample the historical seagrass area identified as lying along the northeastern edge of Oldany Island.

11:30 Drop RH on the shore to the east of Oldany Island on very picturesque sandy beach (NC 09800 34500). MD, MS and BJ continue around Oldany Island to the sandy beach at Culkein Bay. The onshore swell prevented sampling too close to the shore but a couple of video drops were completed (Sites 40 and 41).

12:20 Sites 42 and 43 completed in Clashnessie Bay and then return to pick up RH via the narrow channel to the south of Oldany Island (channel splits the island from the mainland). The tide was quite low and the RHIB just managed to pass through the channel (~70cm water depth). No seagrass was observed in the channel area or in the clear shallow waters of the secluded inlet beyond (checked using the glass-bottomed bucket from the RHIB).

13:00 Pick up RH from sandy beach area and finish lunch.

13:20 Move eastwards along the southern shore of Eddrachillis Bay and assess known previous record (T. Lockie, 2001) within Loch Dhrombaig. Sites 44–49 (plus visual assessment of other areas) highlights two small areas (3m^2 and 10m^2) of seagrass.

Appendix 1 *(continued)*

15:00 A single drop video sample was taken in Loch Nedd (Site 50) after completing a visual assessment of the head of the loch (muddy sand with worm casts, *Chorda filum* and fucoids). The shallow head areas of Loch Ardbhair were also assessed using the glass-bottomed bucket. A single drop video sample (Site 51) was taken from suitable habitat in an area of accelerated current in the narrows area coming out of Loch na Droghniche (coarse sand and gravel with maerl).

16:00 A brief visual assessment of the shallow sublittoral area within Loch na Mola was made on the way back to the slip at Kylesku (no seagrass observed).

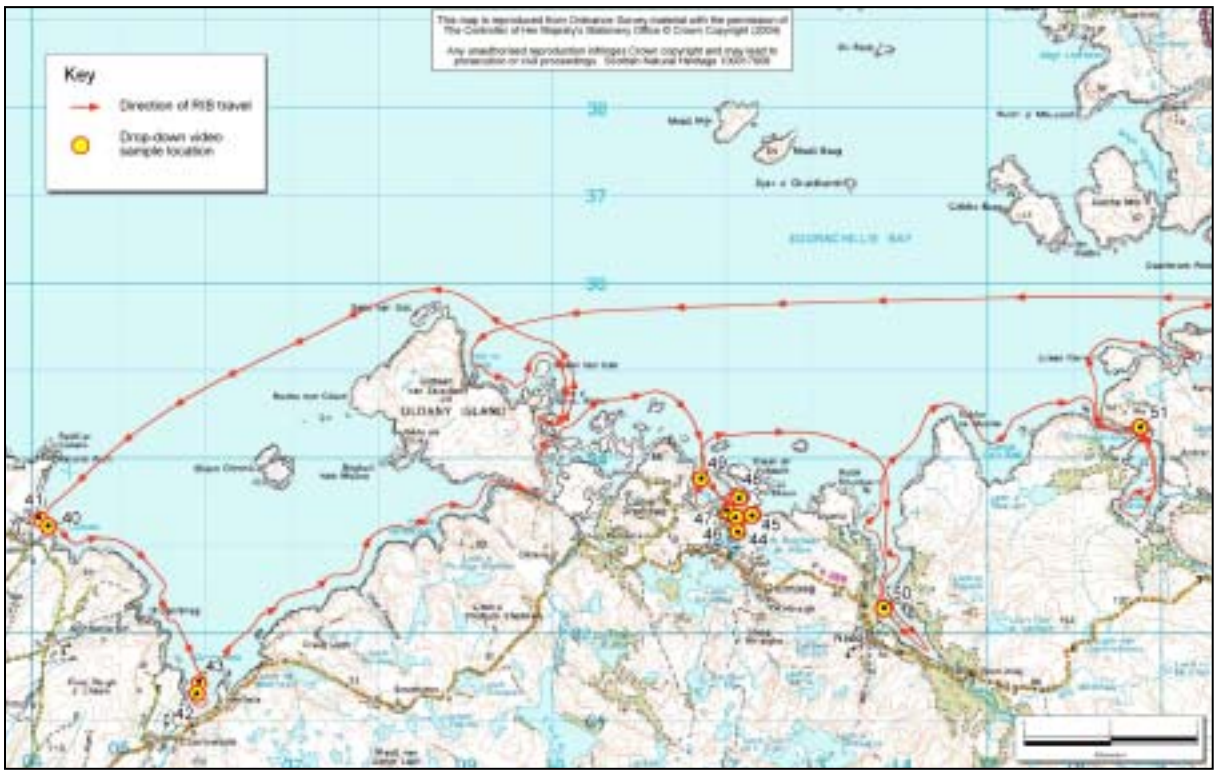
17:00 Arrive at Kylesku slipway, unpack survey equipment and recover the RHIB from the water. Mark Stewart leaves for Fort William. Others drive to accommodation in Scourie.

17:45 Arrive Scourie and check-in to the Minch View B&B.

18:30 Supper at the Scourie Hotel.

19:50 Return to Minch View B&B and put batteries on to charge, write-up field notes and retire for the evening.

Figure A1 – 3 A map showing the approximate RHIB route and the drop-down video sampling locations completed within Eddrachillis Bay on 13/08/04. A glass bottomed 'viewing' bucket was used in other clear shallow water areas to determine the presence of seagrass. The RHIB was launched and recovered from the slip at Kylesku (not on map)



Appendix 1 *(continued)*

Sat 14th August

Weather:	A bright clear sunny day – calm seas and gentle NE wind.
Tides:	3.8m @ 07:21 Port: Badcall Bay 1.4m @ 13:29

08:00 Breakfast at the Minch View B&B.

09:05 AM arrives from Skye. All go and launch the RHIB at Scourie slipway. The slipway is steep and the trailer and ropes used in launching 'scrape' quite heavily so an alternative recovery slip is investigated. RH tries to contact Loch Duart fishfarms to discuss the use of either of their slips at Fanagmore and Badcall Bay but cannot confirm availability. The RHIB is left at anchor in Scourie Bay.

09:30 Drive to Fanagmore with the RHIB trailer and a 'spare' vehicle but the entrance to the site is blocked. Drive to Badcall Bay to try alternative Loch Duart fishfarm slip but this was not possible due to ongoing operations. RH leaves several telephone messages in an attempt to secure a slip for later in the day.

11:30 Return to Scourie and park the RHIB trailer near the slip. Load the survey equipment into the RHIB and commence survey work by 'visually' assessing the shallow waters in Scourie Bay and the small sandy bay on the southeastern corner of Handa Island using the glass-bottomed bucket.

12:40 Sites 52–54 completed within the central and northern areas of the Sound of Handa (Site 52 – extensive maerl bed) together with a general visual reconnaissance of shallower water areas. Due to the late start it was decided to drive the RHIB to the most northerly boundary of the survey area (Bàgh a' Phollain at Oldshore Beg) and to work back down the coast encompassing as many of the predetermined areas of search as possible.

14:10 Assess the shallows off the beautiful sandy bays at Oldshore Beg and Oldshoremore using the glass-bottomed bucket (clean fine sand with kelp on rocky areas but no seagrass observed).

14:45 Investigate Lochan nam Meallan inlet located to the east of Oldshoremore by snorkelling (not clearly discernible on Figure A4 at the 1:50,000 scale). Entry via the shallow tidal rapids inaccessible to the RHIB the inlet ranged in depth from ~0.5–6m BSL and had a number of small rowing boats moored up in the deeper areas (no seagrass present).

15:25 Sampling within Lochs Clash and Inchard (Sites 55 and 56). The shallow sediment areas within Loch Clash were assessed using the glass-bottomed bucket but no seagrass was recorded. Only one drop-video site was sampled in Loch Inchard (Site 56) but the shallow subtidal areas in Loch Sheigra ('grassy' looking short turf of algae present on shelly muddy sand in places), Achriesgill Bay (muddy with shell debris and filamentous algae) and the head of the loch (pebbles on muddy sand with cobbles and kelp) were all visually assessed. On the way out of Loch Inchard the embayment at Mol Ban was also investigated using the viewing bucket.

17:00 Potentially suitable habitat was present within Loch Ceann na Saile (muddier at the head) but no seagrass was observed in this tranquil inlet (~5–6m max. depth), and the drop-down video equipment was not deployed. The narrow shallow tidal rapids entrance to Loch an Ròin prevented RHIB access to this inlet. There was insufficient time to undertake any sampling within Loch Laxford.

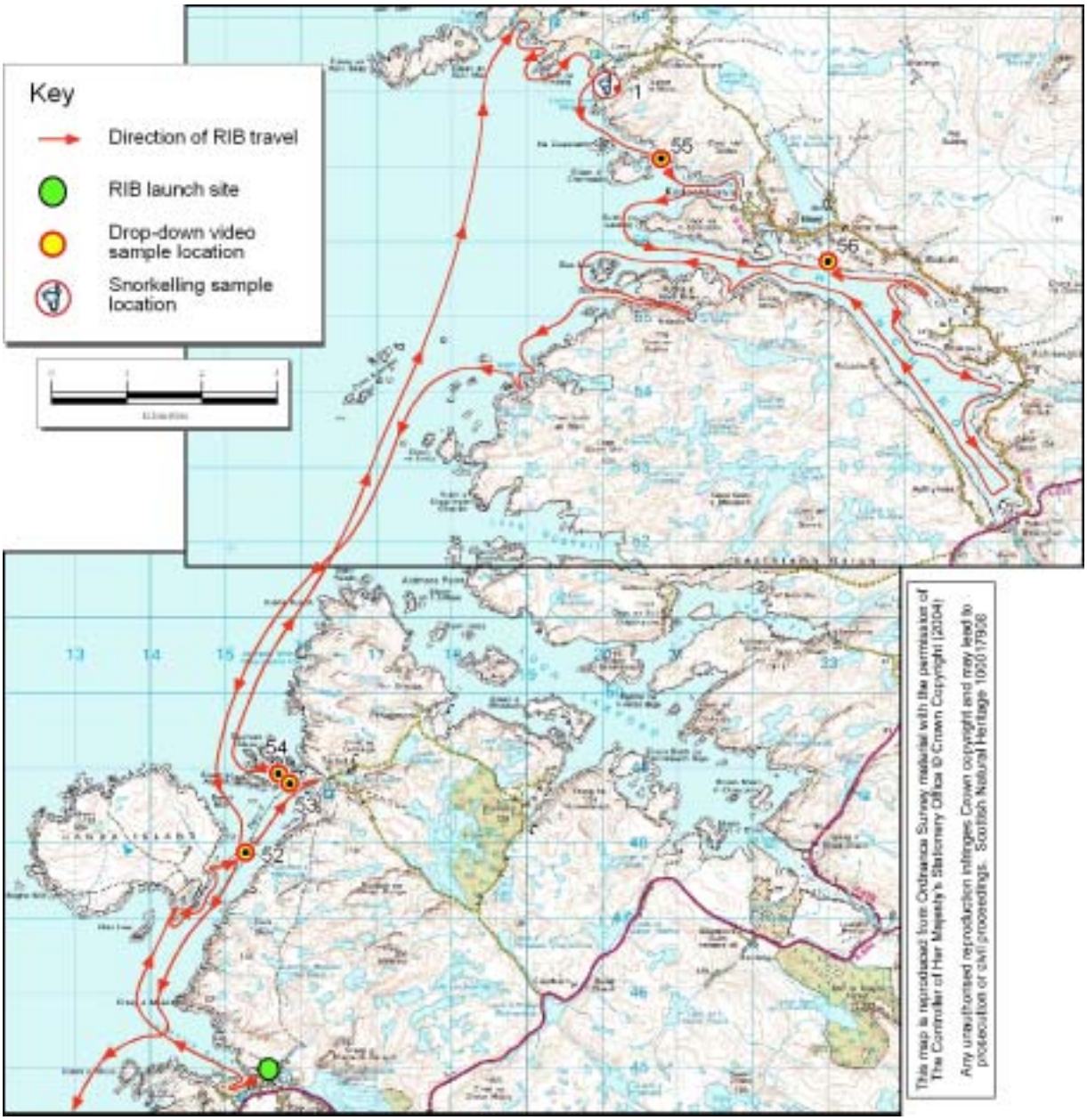
18:00 Refuel the RHIB (jerry cans on board) whilst in Bàgh Loch an Ròin and then return to Scourie slip. Drop-off RH and AM who drive the vehicles with boat trailer to the Badcall Bay fishfarm slip (access agreed during the day). MD and BJ drive the RHIB to Badcall.

Appendix 1 *(continued)*

18:50 Unload survey equipment and recover the RHIB from the water. Return to Scourie, drop RHIB off in the carpark at the back of Scourie Bay (on the road to the cemetery) and go to the Scourie Hotel for supper.

20:30 Return to Minch View B&B and put batteries on to charge, write-up field notes and retire for the evening.

Figure A1 – 4 A map showing the approximate RHIB route and the drop-down video sampling locations completed on 14/08/04. A glass bottomed 'viewing' bucket was used in other clear shallow water areas to determine the presence of seagrass. The small tidal inlet, Lochan nam Meallan, was inaccessible to the RHIB and was explored by snorkelling. The RHIB was recovered from the fishfarm slip at Lower Badcall (not on map)



Appendix 1 *(continued)*

Sun 15th August

Weather:	Light rain in Scourie before breakfast and overcast in Ullapool but the weather cleared and a bright day amongst the Summer Isles with light winds and flat calm waters. Light showers and a slight swell developed in the afternoon en-route back to Ullapool.
Tides:	4.6m @ 07:48 Port: Ullapool 1.4m @ 13:58

07:30 Breakfast at Minch View B&B.

08:15 Load vehicles, pick-up the RHIB and drive to Ullapool.

10:15 Refuel and then launch the boat at Ullapool sailing club slipway (a gently sloping narrow slip – rope launch). Prepare equipment for survey and load onto the RHIB, drive RHIB trailer and vehicles to the lorry carpark and return to the boat.

11:15 Drive RHIB out of Loch Broom and straight to the south-eastern corner of Priest Island to commence survey work. The 'area of search' turned out to be a rocky cliffed surge gully with *Alaria esculenta*, *Himanthalia elongata*, *Desmarestia* sp. and *Enteromorpha* sp. on boulders and cobbles. The shallow cobble and boulder seabed in the small bay to the south of the gully (which corresponds more accurately with SNH's tabulated search area grid reference) was carpeted in a luxuriant growth of *Enteromorpha* sp., potentially explaining the seagrass record in this location.

12:00 Lunch whilst circumnavigating Priest Island in an anti-clockwise direction and prior to heading northwards to the sandy embayment on the northeast side of Isle Ristol. The clean fine sandy substrate at this location had scattered *Arenicola marina* casts on the surface and scattered filamentous and bootlace algae *Chorda filum* with sand eels in the water column. The bay on the opposite side of Loch an Alltain Duibh (below the smokehouse at Altandhu) similarly had a clean sandy substrate with shell debris but again no seagrass was observed and the drop-down video was not deployed. The rocky flanking margins on both sides of the bay were covered in kelp.

13:00 The glass-bottomed bucket was used throughout the shallow approaches to the 'Anchorage' area and inlet at Dornie. The seabed in the inlet comprised soft muddy sand with *A. marina* casts, *Chorda filum*, filamentous algae and fucoids. The seabed in the hooked area on the western side of the Caolas Eilean Ristol channel was covered in drift weed, kelp and ephemeral green algae. From Isle Ristol the RHIB travelled in SW direction into the small group of islands around Tanera Beg.

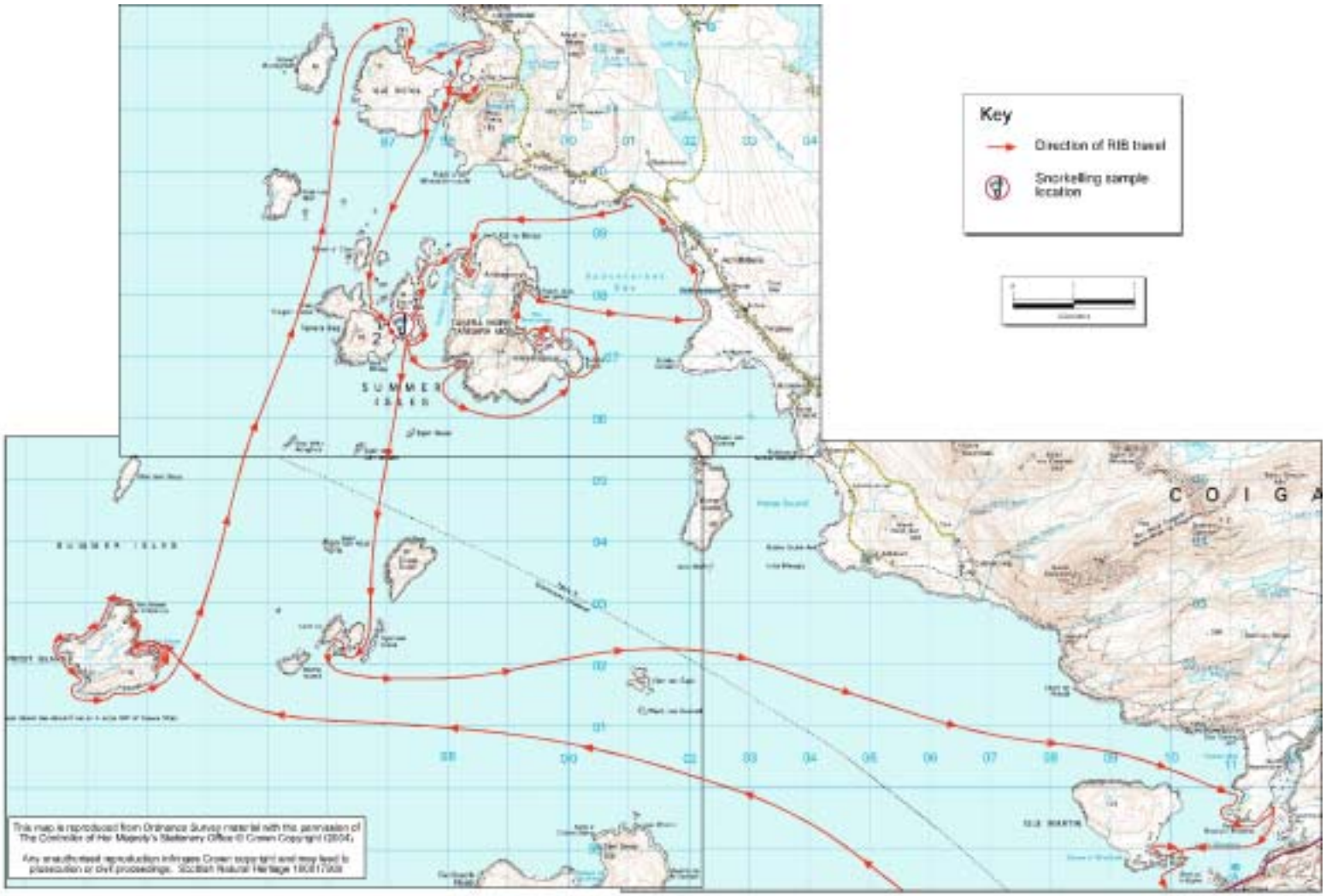
14:00 A shallow maerl bed was noted whilst passing through the shallow channel between Eilean Fada and Tanera Beg. The RHIB then travelled around the bottom of Tanera More via Mol Mòr (clean fine sand below a boulder shore with kelp on the boulders around the edges and some coarser sediment patches) and Rubha Dubh on the SE corner (coarse shelly sand with filamentous algae and lots of *Chorda filum*).

14:25 Within the Anchorage on the eastern side of the Tanera More the seabed comprised coarse shelly gravel and sand with filamentous algae in both the 'pier' and 'Ardnagoine' corners – the drop video was not deployed. The RHIB then crossed Badentarbat Bay to the mixed sediment bay situated just below the hotel/hydroponicum (c.f. Figure A5) and using the glass-bottomed bucket worked northwards to the pier at Badentarbat. The 'browner' sediment along this stretch of the coast supported *Cerianthus lloydii* anemones and no seagrass was observed.

15:15 Visual assessment of the seabed in the small inlet on the northwestern tip of Tanera More (coarse sediment with shell debris supporting *Chorda filum*, kelp with *E. esculentus* urchins and filamentous algae).

Appendix 1 *(continued)*

Figure A1 – 5 **A map showing the approximate RHIB route taken on the 15/08/04 around the Summer Isles, Isle Ristol, Badentarbat Bay and Isle Martin. A glass bottomed 'viewing' bucket was used in the clear shallow water areas to determine the presence of seagrass. A shallow maerl bed between Tanera Beg and Eilean Fada Mor was explored by snorkelling. The RHIB was launched and recovered from the sailing club slip in Ullapool (to the south of the map – not shown)**



Appendix 1 – Sun 15th August *(continued)*

15:40 A brief snorkel on the shallow maerl bed situated between Eilean Fada and Tanera Beg before heading back down the coast towards Ullapool via 'stop-offs' at the Sgeirean Glasa and Carn Deas islands (gully floor looked to be a 'maerl' possibility but too deep to confirm and the embayment between Carn Iar and Carn Deas had kelp with patches of clean sand). The shallow inlet at Keanchulish was tentatively examined using the viewing bucket as was the embayment on the south-east of Isle Martin but no seagrass was observed.

17:10 Return to Ullapool slipway, unload survey equipment and recover the RHIB from the water. Drop RHIB off in lorry carpark (near Safeway's) and drive to the Riverside Hotel.

19:00 Meet up with AM and drive to RH house for supper.

22:40 Return to respective accommodation in Ullapool, write-up the days survey activities and retire for the evening.

Mon 16th August

Weather:	Foggy start in Ullapool. Some heavy rain showers on the drive back to Edinburgh.

08:00 Breakfast at the Riverside Hotel.

09:00 Load cars, pick up the RHIB and start drive back to Edinburgh.

11:40 Stop in Aviemore for a break and some lunch.

12:20 Depart Aviemore and continue drive back to Edinburgh – brief delays experienced on the A9 due to a recent landslip.

15:30 Drop the RHIB off at Port Edgar marina.

15:50 Arrive at SNH Edinburgh, unload the vehicles and return the hire car.

16:30 Return home – end of survey.

Ben James
16th August, 2004

APPENDIX 2 – Drop-down video data

Site No.: **1**
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	Northings	Depth (mBCD)	Time
In:	192795	891325	8.2	10:50
Out:	–	–		10:51

Video IN: 00:00:00:00
Video OUT: 00:00:31:00

Habitat Description

Substrate: Level coarse sediment plain of cobbles, boulders and a pebble gravel.

Characterising species: Laminaria hyperborea park (~1 plant per m^2) with *Echinus esculentus* urchins (~1–2/m^2 but patchy) and scattered filamentous algae. Keelworms and barnacles possibly present on the rocky substrate together with encrusting coralline algae.

	Code – Ver. 04.05
1° Biotope	IR.MIR.KR.Lhyp.GzPk
2° Biotope	–

Comments –
Very brief footage – indeterminate grazing pressure.

Site No.: **2**
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	Northings	Depth (mBCD)	Time
In:	192987	891286	11.7	10:55
Out:	–	–		10:56

Video IN: 00:00:31:01
Video OUT: 00:01:01:13

Habitat Description

Substrate: Plain of boulders and cobbles with kelp. Kelp canopy patchy with cobble and pebble 'clearings'.

Characterising species: L. hyperborea (~4+ plants per m^2) sparse *L. saccharina* (~1 per 10m^2). Enc. coralline algae, barnacles and *E. esculentus* on boulders with scattered fil. algae inc. ?*Desmarestia* sp. Limited epiphytic red algal growth on kelp stipes.

	Code – Ver. 04.05
1° Biotope	IR.MIR.KR.Lhyp.Pk
2° Biotope	–

Comments –
Very brief footage. Indeterminate grazing pressure – lower numbers of *Echinus esculentus* than Site 1. Appears to be slightly more sheltered than Site 1 but could be due to increase in depth.

Appendix 2 *(continued)*

Site No.: ***3***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	Northings	Depth (mBCD)	Time
In:	*193253*	*891220*	*10.2*	*11:00*
Out:	–	–		*11:01*

Video IN: 00:01:01:14
Video OUT: 00:01:41:09

Habitat Description

Substrate: Undulating plain of pebbles/stone gravel. 'Peaks' free of conspicuous flora and fauna and 'troughs' with dense coverage of fil. algae.

Characterising species: Dense cover (~20–35%) of *?Desmarestia* sp. with filamentous and foliose red and brown algae in clearly defined gravel troughs. Only conspicuous fauna observed was a single large starfish *?Luidia sarsi*.

	Code – Ver. 04.05
1° Biotope	?IR.HIR.Ksed.DesFilR/ (SS.SCS.ICS.SSh)
2° Biotope	–

Comments –
Brief footage.

Site No.: ***4***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	Northings	Depth (mBCD)	Time
In:	*193401*	*891006*	*6.2*	*11:04*
Out:	–	–		*11:06*

Video IN: 00:01:41:10
Video OUT: 00:02:29:14

Habitat Description

Substrate: Level plain of firm clean medium sand.

Characterising species: Sparse small filamentous algae that look to be attached to pebble/shells in the substrate together with drift algal detritus (kelp and *Chorda filum*). A single *?Asteropecten irregularis* starfish seen.

	Code – Ver. 04.05
1° Biotope	SS.SSA.IFiSa
2° Biotope	–

Comments –
Possibly '*SS.SSA.IFiSa.IMoSa*' – the 'mobile' version of this biotope. However, whilst the faunal component was sparse the sediment was not particularly rippled and some uncertainty as to degree of mobility.

Appendix 2 *(continued)*

Site No.: **5**
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	Northings	Depth (mBCD)	Time
In:	19336	890843	4.2	11:09
Out:	–	–		11:09

Video IN: 00:02:29:15
Video OUT: 00:02:54:09

Habitat Description

Substrate: Level plain of firm clean medium-fine sand with some shell content.

Characterising species: Drift algal debris – no conspicuous fauna seen.

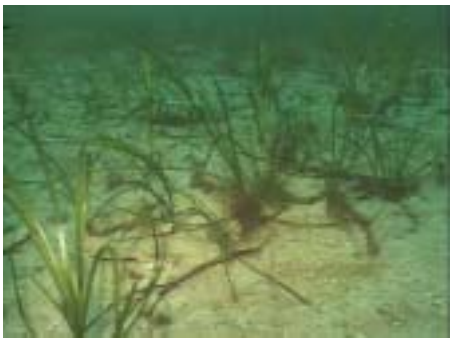
	Code – Ver. 04.05
1° Biotope	SS.SSA.IFiSa?.IMoSa
2° Biotope	–

Comments –

Site No.: **6**
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	Northings	Depth (mBCD)	Time
In:	193682	890813	4.0	11:13
Out:	–	–		11:14

Video IN: 00:02:54:10
Video OUT: 00:03:39:22



Habitat Description

Substrate: Fine (slightly silty) sand with shell debris and larger shells inc. *Ensis* sp. on the surface.

Characterising species: Eelgrass *Zostera marina* (variable coverage from 5–35%) with filamentous red algae (inc. 'fluffy' balls of ?*Trailliella*), sparse *Ulva* sp. and *Asperococcus* sp. Brown diatom film on the sediment surface in places.

	Code – Ver. 04.05
1° Biotope	SS.SMP.SSgr.Zmar
2° Biotope	–

Comments –
From the limited 'overview' footage (drop-video 'flying' above the seabed) the seagrass bed looked to cover a minimum of 25m^2.

Appendix 2 *(continued)*

Site No.: ***7***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	Northings	Depth (mBCD)	Time
In:	*193597*	*890729*	*1.5*	*11:18*
Out:	–	–		*11:18*

Video IN: 00:03:39:23
Video OUT: 00:03:56:07

Habitat Description

Substrate: Rippled level plain of medium-fine sand.

Characterising species: Scattered algal debris (believed to be drift) and no conspicuous fauna seen.

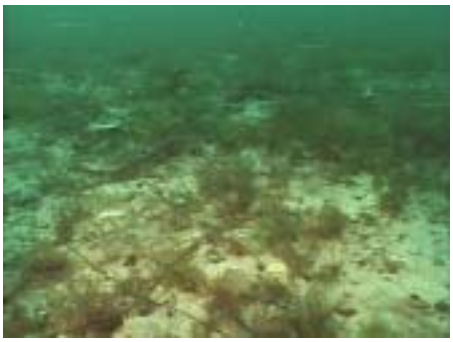
	Code – Ver. 04.05
1° Biotope	SS.SSA.IFiSa.IMoSa
2° Biotope	–

Comments –

Site No.: ***8***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	Northings	Depth (mBCD)	Time
In:	*193516*	*890852*	*5.2*	*11:21*
Out:	–	–		*11:21*

Video IN: 00:03:56:08
Video OUT: 00:04:31:04



Habitat Description

Substrate: Poorly sorted medium sand with shell and stone gravel.

Characterising species: Patchy (~30–70%) algal cover of a range of fil. and foliose red algae inc. short 'wiry' indet. species (of *Ahnfeltia plicata/ Gracilaria* sp. type) with *C. filum*, *?Trailliella*, *Asperococcus* sp., *?Desmarestia* sp., *Ulva* sp. with aggregations of bivalve shells inc. *Ensis* sp.

	Code – Ver. 04.05
1° Biotope	SS.SMP.KSwSS.LsacR?.Gv/(CbPb)
2° Biotope	–

Comments –
Site considered as 'outer' edge of *Zostera* bed whilst *in-situ* but this was due to poor video recorder resolution in the field and this 'drop' should not be considered to represent any such easterly boundary. Potentially a 'blade or a plant' of *Zostera marina* observed during the sequence but not clear.

Appendix 2 *(continued)*

Site No.: **9**
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	Northings	Depth (mBCD)	Time
In:	193545	890977	6.2	11:26
Out:	–	–		11:28

Video IN: 00:04:31:05
Video OUT: 00:04:48:18

Habitat Description

Substrate: Plain of medium sand with sparse proportion of scattered stone gravel.

Characterising species: Patchy algal cover (~20–45%). Range of species present but most could not be identified beyond 'short wiry component' – conspicuous species included *Asperococcus* sp., ?*Desmarestia* sp., and ?*Trailliella*.

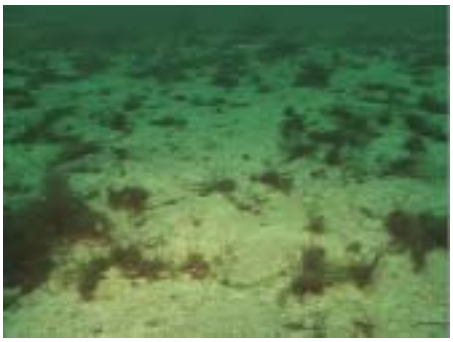
	Code – Ver. 04.05
1° Biotope	SS.SMP.KSwSS.LsacR?.Gv/(CbPb)
2° Biotope	–

Comments –
Site considered to be part of the *Zostera* bed whilst *in-situ* but this was due to poor video recorder resolution in the field. Potentially a 'blade or a plant' of *Zostera marina* observed during the sequence but no clear image and extremely low abundance if present at all.

Site No.: **10**
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	Northings	Depth (mBCD)	Time
In:	193545	891116	7.5	11:31
Out:	–	–		11:33

Video IN: 00:04:48:19
Video OUT: 00:05:24:19



Habitat Description

Substrate: Plain of firm medium sand with shell debris.

Characterising species: Patchy scattered clumps of fil. algal cover (~15–30%). Range of species present but many could not be identified from the video footage. ?*Desmarestia* sp., *Ulva* sp., *Laminaria saccharina* (possibly drift), ?*Trailliella* and sparse *Asperococcus* sp. observed.

	Code – Ver. 04.05
1° Biotope	SS.SMP.KSwSS.LsacR?.Gv/(CbPb)
2° Biotope	–

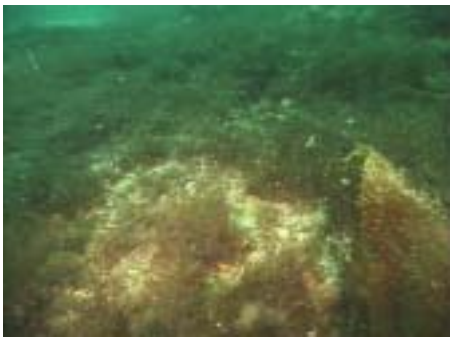
Comments –
Site considered as the 'outer' edge of the *Zostera* bed whilst *in-situ* but this was due to poor video recorder resolution in the field and this 'drop' should not be considered to represent any northerly boundary. As for Sites 8 & 9 potentially a 'blade' of *Zostera marina* visible at the very start of the sequence but no clear image.

Appendix 2 *(continued)*

Site No.: ***11***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	Northings	Depth (mBCD)	Time
In:	*193439*	*891316*	*10.2*	*11:36*
Out:	–	–		*11:38*

Video IN: 00:05:24:20
Video OUT: 00:06:24:00



Habitat Description

Substrate: Coarse mixed sediment plain – ?coarse sand with gravel, pebbles and scattered cobbles.

Characterising species: L. hyperborea (scattered plants on available cobbles and boulders) and *L. saccharina* with a dense cover of fil. and foliose algae (70%) (inc. ?*Bonnemaisonia hamifera* and ?*Trailliella*) on the mixed sediment surface. Kelp cover <15% – patches of open substrate ~5–10%.

	Code – Ver. 04.05
1° Biotope	SS.SMP.KSwSS.LsacR?.Sa
2° Biotope	–

Comments –

Site No.: ***12***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	Northings	Depth (mBCD)	Time
In:	*193621*	*891169*	*8.2*	*11:42*
Out:	–	–		*11:43*

Video IN: 00:06:24:01
Video OUT: 00:06:58:17

Habitat Description

Substrate: Hard, coarse-medium sand with a coarser gravel, pebble and cobble fraction.

Characterising species: L. saccharina (~1 plant per 5m^2) and *L. hyperborea* (1 plant per 20m^2) with ?*Desmarestia* sp., bushy filamentous red algal turf (inc. ?*Bonnemaisonia hamifera*), ?*Trailliella*, *Ulva* sp., and ?*Dictyota dichotoma*. Algal cover of ~85–90%.

	Code – Ver. 04.05
1° Biotope	SS.SMP.KSwSS.LsacR?.Sa
2° Biotope	–

Comments –
Difficult to define substrate type.

Appendix 2 *(continued)*

Site No.: ***13***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	Northings	Depth (mBCD)	Time
In:	*193730*	*891034*	*6.6*	*11:45*
Out:	–	–		*11:47*

Video IN: 00:06:58:18
Video OUT: 00:07:27:14

Habitat Description

Substrate: Plain of medium sand with shell debris (including *Ensis* sp.).

Characterising species: A range of indet. small 'wiry' filamentous algae providing a cover of ~10–30% on the sediment surface. Other algae included *Ulva* sp., *Asperococcus* sp. and *Chorda filum*. A single *?Asteropecten irregularis* starfish was observed.

	Code – Ver. 04.05
1° Biotope	SS.SMP.KSwSS.LsacR?.Gv/ (SS.SSA.IFiSa)
2° Biotope	–

Comments –

Site No.: ***14***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	Northings	Depth (mBCD)	Time
In:	*193719*	*890927*	*6.1*	*11:54*
Out:	–	–		*11:55*

Video IN: 00:07:27:15
Video OUT: 00:08:01:06

Habitat Description

Substrate: Medium-fine sand plain with noticeable shell and gravel fraction.

Characterising species: Cancer pagurus in a 'sand hole', *Chorda filum*, *Asperococcus* sp., and a range of filamentous algae including scattered short 'wiry' indet. red algae. Overall algal cover ~10–35%.

	Code – Ver. 04.05
1° Biotope	SS.SMP.KSwSS.LsacR?.Gv/ (SS.SSA.IFiSa)
2° Biotope	–

Comments –

Appendix 2 *(continued)*

Site No.: ***15***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	Northings	Depth (mBCD)	Time
In:	*193816*	*890812*	*3.8*	*12:00*
Out:	–	–		*12:01*

Video IN: 00:08:01:07
Video OUT: 00:08:25:13

Habitat Description

Substrate: Kelp forest on bedrock and a sand plain beyond with shell debris.

Characterising species: L. hyperborea forest with epiphytic red algae (?*Cryptopleura ramosa*) on stipes and *Echinus esculentus* urchins on the kelp and bedrock below. At the base of the bedrock is a sandy plateau, which appears to potentially support *Zostera marina* although this could also be algae.

	Code – Ver. 04.05
1° Biotope	IR.MIR.KR.Lhyp.Ft
2° Biotope	?SS.SMP.SSgr.Zmar

Comments –
The consolidated areas visible very briefly on the sandy substrate at the end of the sequence have the appearance of thin seagrass.

Site No.: ***16***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-2

	Eastings	Northings	Depth (mBCD)	Time
In:	*195031*	*891036*	*–0.7*	*11:52*
Out:	–	–		*11:52*

Video IN: 00:00:00:00
Video OUT: 00:00:37:01

Habitat Description

Substrate: Fine silty sand with seagrass (north-eastern/inshore edge of the seagrass bed). Scattered shell debris.

Characterising species: Zostera marina seagrass (25–60% patchy cover) bed on upper infralittoral silty sand with clumped aggregations of filamentous algae.

	Code – Ver. 04.05
1° Biotope	SS.SMP.SSgr.Zmar
2° Biotope	–

Comments –
The image provided here was taken using a stills camera over the side of the RHIB rather than being a 'captured' image from the video footage. The video footage was also taken from over the side of the RHIB using an Aquapac bag and a handycam and the resultant footage was of low quality.

Appendix 2 *(continued)*

Site No.: ***17***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-2

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*195010*	*890877*	*0.5*	*13:00*
Out:	–	–		*13:02*

Video IN: *00:00:37:02*
Video OUT: *00:01:35:13*

Habitat Description

Substrate: Hummocked fine silty sand with seagrass. Scattered shell debris including *Ensis* sp.

Characterising species: Zostera marina seagrass (5–25% very patchy cover) bed on upper infralittoral silty sand with clumped aggregations of filamentous algae.

	Code – Ver. 04.05
1° Biotope	SS.SMP.SSgr.Zmar
2° Biotope	–

Comments –
As for Site 16 the image provided here was taken using a stills camera over the side of the RHIB rather than being a 'captured' image from the video footage. The video footage was also taken from over the side of the RHIB using an Aquapac bag and a handycam and the resultant footage was of low quality.

Site No.: ***18***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-2

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*194997*	*890817*	*0.4*	*13:20*
Out:	–	–		*13:21*

Video IN: *00:01:35:14*
Video OUT: *00:02:41:24*

Habitat Description

Substrate: Fine silty sand with seagrass (southern edge of bed). Scattered shell debris inc. *Ensis* sp.

Characterising species: Zostera marina seagrass (5–10% sparse and very patchy cover) bed on upper infralittoral silty sand. Shoals of sand eels ?*Ammodytes tobianus* present.

	Code – Ver. 04.05
1° Biotope	SS.SMP.SSgr.Zmar
2° Biotope	–

Comments –
As for Site 16 the image provided here was taken using a stills camera over the side of the RHIB rather than being a 'captured' image from the video footage. The video footage was also taken from over the side of the RHIB using an Aquapac bag and a handycam and the resultant footage was of low quality.

Appendix 2 *(continued)*

Site No.: ***19***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*194848*	*890817*	*6.8*	*13:25*
Out:	–	–		*13:26*

Video IN: 00:08:25:14
Video OUT: 00:09:07:14

Habitat Description

Substrate: Hummocked fine silty sand with 'mounded' *Arenciola marina* casts and some scattered shell debris (inc. *Ensis* sp.).

Characterising species: Arenicola marina casts on the infralittoral fine silty sediment surface with a brown ?diatom layer in places and sparse filamentous algae.

	Code – Ver. 04.05
1° Biotope	SS.SSA.IMuSa.ArelSa
2° Biotope	–

Comments –

Site No.: ***20***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*194923*	*890891*	*3.4*	*13:29*
Out:	–	–		*13:30*

Video IN: 00:09:07:15
Video OUT: 00:09:24:20

Habitat Description

Substrate: Hummocked fine silty sand with 'mounded' *Arenciola marina* casts and some scattered shell debris (inc. *Ensis* sp.).

Characterising species: Arenicola marina casts on the sediment surface with other conspicuous infaunal 'holes'. A brown ?diatom layer covered the fine sand in places. Scattered small starfish ?*Asteropecten irregularis* and sparse algae (drift?).

	Code – Ver. 04.05
1° Biotope	SS.SSA.IMuSa.ArelSa
2° Biotope	–

Comments –

Appendix 2 *(continued)*

Site No.: ***21***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*194929*	*890963*	*4.2*	*13:32*
Out:	–	–		*13:33*

Video IN: 00:09:24:21
Video OUT: 00:09:46:01

Habitat Description

Substrate: Hummocked very fine muddy sand/sandy mud with 'mounded' *Arenciola marina* casts.

Characterising species: Arenicola marina casts, possibly a single *Cerianthus lloydii* anemone and a *Philine aperta* opistobranch mollusc. A sparse brown diatom film on the sediment surface.

	Code – Ver. 04.05
1° Biotope	SS.SSA.IMuSa.ArelSa/ **(SS.SMU.IFiMu.Are)**
2° Biotope	–

Comments –
A slightly muddier sediment but not sufficient to encompass the SS.SMU.IfiMu.Are biotope.

Site No.: ***22***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*194977*	*890978*	*1.1*	*13:34*
Out:	–	–		*13:35*

Video IN: 00:09:46:01
Video OUT: 00:09:59:13

Habitat Description

Substrate: Plain of hummocked very fine silty sand with 'mounded' *Arenciola marina* casts.

Characterising species: Arenicola marina casts on the surface of the infralittoral fine silty sand with other conspicuous infaunal 'holes'.

	Code – Ver. 04.05
1° Biotope	SS.SSA.IMuSa.ArelSa
2° Biotope	–

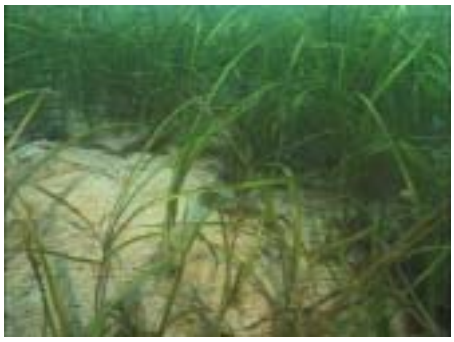
Comments –

Appendix 2 *(continued)*

Site No.: ***23***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	Northings	Depth (mBCD)	Time
In:	*194974*	*891012*	*0.7*	*13:37*
Out:	–	–		*13:38*

Video IN: 00:09:59:14
Video OUT: 00:10:56:00



Habitat Description

Substrate: Fine silty sand with *Arenicola marina* mounds and seagrass.

Characterising species: Zostera marina seagrass (30–65% patchy cover) with *A. marina* casts and small clumped aggregations of fil. algae. Outwith the *Zostera* bed boundaries the fine silty sand was hummocked with *A. marina* casts and had similar aggregations of drift fil. algae (~5% cover).

	Code – Ver. 04.05
1° Biotope	SS.SMP.SSgr.Zmar
2° Biotope	SS.SSA.IMuSa.ArelSa

Comments –
A slightly muddier sediment but not sufficient to encompass the SS.SMU.IfiMu.Are biotope.

Site No.: ***24***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	Northings	Depth (mBCD)	Time
In:	*194918*	*891014*	*2.4*	*13:40*
Out:	–	–		*13:41*

Video IN: 00:10:56:01
Video OUT: 00:11:25:16

Habitat Description

Substrate: Hummocked fine silty sand with 'mounded' *Arenciola marina* casts.

Characterising species: Arenicola marina casts on the sediment surface with other conspicuous infaunal 'holes'. A brown ?diatom layer covered the fine sand in places. Scattered small starfish ?*Asteropecten irregularis* observed.

	Code – Ver. 04.05
1° Biotope	SS.SSA.IMuSa.ArelSa
2° Biotope	–

Comments –

Appendix 2 *(continued)*

Site No.: ***25***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 11/08/04
Video No.: D-NWS-0804-1

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*189974*	*893343*	*2.5*	*14:02*
Out:	–	–		*14:03*

Video IN: *00:11:25:17*
Video OUT: *00:11:34:00*

Habitat Description

Substrate: ?Bedrock or boulders.

Characterising species: Laminaria hyperborea forest with a suggestion of foliose red seaweeds on the kelp stipes.

	Code – Ver. 04.05
1° Biotope	IR.MIR.KR.Lhyp.Ft
2° Biotope	–

Comments –
Extremely brief video drop due to onshore winds and close proximity of shallow reef areas. Substrate not seen but dense kelp canopy would indicate bedrock or large boulders.

Site No.: ***26***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 12/08/04
Video No.: D-NWS-0804-3

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*206972*	*916172*	*7.8*	*11:37*
Out:	–	–		*11:38*

Video IN: *00:00:00:00*
Video OUT: *00:00:50:02*

Habitat Description

Substrate: Fine muddy sand/sandy mud with limited 'floaty' shelly gravel fraction.

Characterising species: L. saccharina covered anchor/mooring line approx. 1m off the seabed. Predominantly fine silty sand with thick brown diatom film on the surface and sparse scattered drift algae (decaying). A single starfish ?*Asterias rubens* observed.

	Code – Ver. 04.05
1° Biotope	SS.SMU.ISaMu(?.Cap)
2° Biotope	–

Comments –
Very brief video drop due to the presence of the fish farm mooring line and risk of entanglement.
A muddier substrate than at Site 27. Possible organic enrichment from the fishfarm hence the (?.Cap).

Appendix 2 *(continued)*

Site No.: ***27***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 12/08/04
Video No.: D-NWS-0804-3

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*207042*	*916155*	*3.7*	*11:40*
Out:	–	–		*11:41*

Video IN: 00:00:50:03
Video OUT: 00:01:45:10

Habitat Description

Substrate: Poorly sorted fine muddy sand with a coarser 'floaty' shelly gravel fraction.

Characterising species: Filamentous algae (10–15%) with *Laminaria saccharina*, *Asperococcus* sp. (5%), *Chorda filum* (scattered), *Ulva* sp. (5–10%) and a turf of *?Trailliella* (30%). A single *Asterias rubens* starfish – overall algal cover ~60–70%.

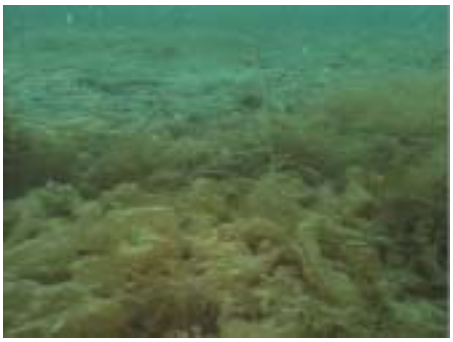
	Code – Ver. 04.05
1° Biotope	SS.SMP.KSwSS.LsacR?.Mu
2° Biotope	–

Comments –

Site No.: ***28***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 12/08/04
Video No.: D-NWS-0804-3

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*207061*	*916136*	*1.9*	*11:43*
Out:	–	–		*11:44*

Video IN: 00:01:45:11
Video OUT: 00:02:55:15



Habitat Description

Substrate: Mixed silty medium sand with coarser 'floaty' gravel fraction.

Characterising species: Clumps of filamentous algae *?Bonnemaisonia hamifera* (15–35%) with *Asperococcus* sp. (15–25%), *Chorda filum* (scattered <5%), *Ulva* sp. (<5–%) and *?Trailliella* (5–10%).

	Code – Ver. 04.05
1° Biotope	SS.SMP.KSwSS.LsacCho/ **(SS.SMP.KSwSS.LsacR?.Mu)**
2° Biotope	–

Comments –
A reduced *?Trailliella* low filamentous algal turf than at Site 27 – as move towards the head of the loch.

Appendix 2 *(continued)*

Site No.: ***29***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 12/08/04
Video No.: D-NWS-0804-3

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*206973*	*916220*	*5.2*	*11:58*
Out:	–	–		*11:59*

Video IN: *00:02:55:16*
Video OUT: *00:03:16:02*

Habitat Description

Substrate: ?Bedrock and boulders.

Characterising species: Heavily silted *Laminaria saccharina* forest with *Echinus esculentus* urchins and encrusting pink coralline algae on the boulders below.

	Code – Ver. 04.05
1° Biotope	IR.LIR.K.Lsac.Ft
2° Biotope	–

Comments –
Brief footage and no clear view of the substrate other than 'rocky'.

Site No.: ***30***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 12/08/04
Video No.: D-NWS-0804-3

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*206802*	*916238*	*14.4*	*12:11*
Out:	–	–		*12:12*

Video IN: *00:03:16:03*
Video OUT: *00:03:50:11*

Habitat Description

Substrate: Plain of firm fine muddy sand/sandy mud with sparse 'floaty' shelly fraction.

Characterising species: Seabed of fine silty sand covered by a brown diatom film on the surface.

	Code – Ver. 04.05
1° Biotope	SS.SMU.ISaMu(?.Cap)
2° Biotope	–

Comments –
Brief footage because considered too deep for *Zostera marina* biotope but as close to the outer (western) edge of the fishfarm as could be sampled. As for Site 26 – possible organic enrichment from the fishfarm hence the (?.Cap).

Appendix 2 *(continued)*

Site No.: ***31***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 12/08/04
Video No.: D-NWS-0804-3

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*207270*	*917151*	*3.3*	*12:32*
Out:	–	–		*12:33*

Video IN: 00:03:50:12
Video OUT: 00:04:54:05

Habitat Description

Substrate: Undulating plain of fine silty sand with a 'floaty' shelly fraction.

Characterising species: Seabed with patches of algal cover (~20–35% total) comprising filamentous algae indet., *Chorda filum*, *Asperococcus* sp., *Ulva* sp., *Asterias rubens* (x1), ?*Desmarestia* sp., and ?*Trailliella*.

	Code – Ver. 04.05
1° Biotope	SS.SMP.KSwSS.LsacR?.Mu/ **(SS.SMP.KSwSS.LsacCho)**
2° Biotope	–

Comments –

Site No.: ***32***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 12/08/04
Video No.: D-NWS-0804-3

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*207276*	*916899*	*3.6*	*12:43*
Out:	–	–		*12:45*

Video IN: 00:04:54:06
Video OUT: 00:07:16:14

Habitat Description

Substrate: Undulating plain of firm mixed silty medium sand with coarser 'floaty' gravel fraction. Scattered sparse boulders/cobbles with kelp then 'stepped' bedrock and boulders.

Characterising species: Patchy algal cover (~40–70%) comprising filamentous algae indet., *C. filum*, *Asperococcus* sp., *Ulva* sp., and a ?*Trailliella* turf. Bedrock edge with silted 'cape' *L. hyp.* and *L. sacc.*

	Code – Ver. 04.05
1° Biotope	SS.SMP.KSwSS.LsacR?.Mu/ **(SS.SMP.KSwSS.Tra)**
2° Biotope	IR.LIR.K.LhypLsac.Ft

Comments –

Appendix 2 *(continued)*

Site No.: ***33***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 12/08/04
Video No.: D-NWS-0804-3

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*207292*	*916921*	*4.8*	*12:48*
Out:	–	–		*12:50*

Video IN: 00:07:16:15
Video OUT: 00:08:09:15

Habitat Description

Substrate: Firm mixed silty medium sand with coarser 'floaty' gravel fraction.

Characterising species: Filamentous algal cover (~85%) including algae indet. (?*B. hamifera*), *Chorda filum*, *Asperococcus* sp., *Ulva* sp., *L. saccharina* and ?*Trailliella*. A single *Asterias rubens*.

	Code – Ver. 04.05
1° Biotope	SS.SMP.KSwSS.LsacR?.Mu/ **(SS.SMP.KSwSS.Tra)**
2° Biotope	–

Comments –

Site No.: ***34***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 12/08/04
Video No.: D-NWS-0804-3

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*207001*	*916519*	*7.1*	*12:58*
Out:	–	–		*13:00*

Video IN: 00:08:09:16
Video OUT: 00:09:03:08

Habitat Description

Substrate: Mixed coarse sandy sediment plain with ?stone gravel and pebbles/cobbles.

Characterising species: Silted *Laminaria saccharina* park with *Echinus esculentus* urchins, foliose red algae including ?*Delessaria sanguinea* and filamentous red algae under the kelp canopy.

	Code – Ver. 04.05
1° Biotope	IR.LIR.K.Lsac.Pk/ **(SS.SMP.KSwSS.LsacR?.Sa/(Mu))**
2° Biotope	–

Comments –
Poor video contrast – difficult to determine substrate type.

Appendix 2 *(continued)*

Site No.: ***35***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 12/08/04
Video No.: D-NWS-0804-3

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*206966*	*916519*	*7.9*	*13:02*
Out:	–	–		*13:03*

Video IN: *00:09:03:09*
Video OUT: *00:10:06:11*

Habitat Description

Substrate: Bedrock and large boulder slope giving way to coarse mixed silty sediment plain with a gravel fraction and shell debris.
Characterising species: Silted *L. saccharina* with *E. esculentus* urchins and filamentous red algae. Barnacles and keelworms on the boulders. Gadoids swimming amongst the kelp. Mixed coarse sediment plain with scattered clumps of unidentified filamentous and foliose algae.

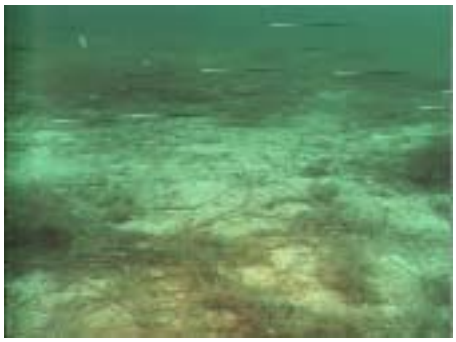
	Code – Ver. 04.05
1° Biotope	IR.LIR.K.Lsac.Ft
2° Biotope	SS.SMP.KSwSS.LsacR?.Mu

Comments –

Site No.: ***36***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 12/08/04
Video No.: D-NWS-0804-3

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*206730*	*918591*	*5.3*	*14:15*
Out:	–	–		*14:17*

Video IN: *00:10:06:12*
Video OUT: *00:11:00:13*



Habitat Description

Substrate: Undulating plain of silty medium sand leading up to an algal turf covered bedrock 'step'.
Characterising species: Filamentous algal cover (*~75%*). *Chorda filum*, *Asperococcus* sp., filamentous algae indet. including *?Trailliella*. *Echinus esculentus* urchins on vertical faces of filamentous algal turf covered bedrock step.

	Code – Ver. 04.05
1° Biotope	SS.SMP.KSwSS.LsacR?.Mu/ (SS.SMP.KSwSS.LsacCho)
2° Biotope	–

Comments –

Appendix 2 *(continued)*

Site No.: ***37***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 12/08/04
Video No.: D-NWS-0804-3

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*206744*	*918370*	*4.3*	*14:22*
Out:	–	–		*14:23*

Video IN: *00:11:00:14*
Video OUT: *00:11:30:21*

Habitat Description

Substrate: Mixed silty medium sand with coarser 'floaty' gravel fraction.

Characterising species: Filamentous algal cover (25–35%) with *Chorda filum*, fucoids (*F. serratus* clumps) and ?*Desmarestia* sp./filamentous algae indet.

	Code – Ver. 04.05
1° Biotope	SS.SMP.KSwSS.LsacR?.Mu/ **(SS.SMP.KSwSS.LsacCho)**
2° Biotope	–

Comments –

Site No.: ***38***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 12/08/04
Video No.: D-NWS-0804-3

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*206798*	*917927*	*5.1*	*14:32*
Out:	–	–		*14:33*

Video IN: *00:11:30:22*
Video OUT: *00:12:29:20*

Habitat Description

Substrate: Plain of mixed silty medium sand with coarser 'floaty' gravel fraction and sparse shell debris (inc. *Ensis* sp. razorshells).

Characterising species: Seabed with high coverage of filamentous algae (~50–80%) comprising algae indet. (?*Bonnemaisonia hamifera*), *Chorda filum*, *Asperococcus* sp., and *Ulva* sp. A single ?*A. rubens* observed.

	Code – Ver. 04.05
1° Biotope	SS.SMP.KSwSS.LsacR?.Mu/ **(SS.SMP.KSwSS.Tra)**
2° Biotope	–

Comments –

Appendix 2 *(continued)*

Site No.: ***39***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 12/08/04
Video No.: D-NWS-0804-3

	Eastings	Northings	Depth (mBCD)	Time
In:	*207379*	*917581*	*6.2*	*14:49*
Out:	–	–		*14:51*

Video IN: 00:12:29:21
Video OUT: 00:13:30:03

Habitat Description

Substrate: Plain of very silty fine sediment (mud – muddy sand).

Characterising species: Philine aperta (?a couple observed) and 'their' opisthobranch mollusc egg masses together with a diatom film on the sediment surface. Clumps of heavily silted (possibly drift) algae present.

	Code – Ver. 04.05
1° Biotope	SS.SMU.IFiMu.PhiVir
2° Biotope	–

Comments –
No *Virgularia mirabilis* seapens present and individual *Philine aperta* presence not categorically established.

Site No.: ***40***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 13/08/04
Video No.: D-NWS-0804-4

	Eastings	Northings	Depth (mBCD)	Time
In:	*204127*	*933251*	*2.4*	*12:11*
Out:	–	–		*12:12*

Video IN: 00:00:00:00
Video OUT: 00:00:52:08

Habitat Description

Substrate: Clean, medium-fine rippled sand.

Characterising species: No conspicuous fauna observed.

	Code – Ver. 04.05
1° Biotope	SS.SSA.IFiSa.IMoSa
2° Biotope	–

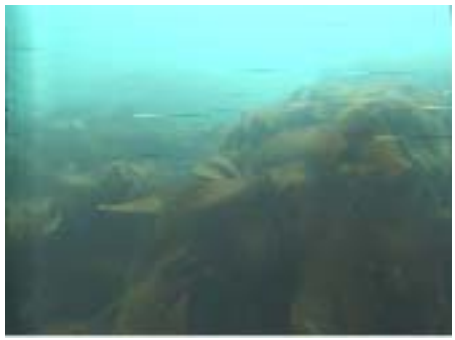
Comments –

Appendix 2 *(continued)*

Site No.: ***41***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 13/08/04
Video No.: D-NWS-0804-4

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*204102*	*933278*	*2.2*	*12:14*
Out:	–	–		*12:15*

Video IN: *00:00:52:09*
Video OUT: *00:01:43:22*



Habitat Description

Substrate: Bedrock and ?large boulders (no clear footage of substrate).

Characterising species: Laminaria hyperborea forest in the shallow sublittoral. Foliose and filamentous red algae on the kelp stipes.

	Code – Ver. 04.05
1° Biotope	IR.MIR.KR.Lhyp.Ft
2° Biotope	–

Comments –

Site No.: ***42***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 13/08/04
Video No.: D-NWS-0804-4

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*205888*	*931312*	*3.3*	*12:32*
Out:	–	–		*12:33*

Video IN: *00:01:43:23*
Video OUT: *00:02:32:13*

Habitat Description

Substrate: Clean, medium-fine rippled sand.

Characterising species: No conspicuous fauna observed.

	Code – Ver. 04.05
1° Biotope	SS.SSA.IFiSa.IMoSa
2° Biotope	–

Comments –

Appendix 2 *(continued)*

Site No.: ***43***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 13/08/04
Video No.: D-NWS-0804-4

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*205911*	*931414*	*6.5*	*12:35*
Out:	–	–		*12:36*

Video IN: *00:02:32:14*
Video OUT: *00:03:29:18*

Habitat Description

Substrate: Undulating plain of medium sand.

Characterising species: A brown diatom/filamentous algal film on sediment surface in places (~15% cover). No conspicuous fauna observed.

	Code – Ver. 04.05
1° Biotope	SS.SSA.IfiSa?.ImoSa
2° Biotope	–

Comments –

Site No.: ***44***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 13/08/04
Video No.: D-NWS-0804-4

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*212134*	*933160*	*–0.3*	*13:44*
Out:	–	–		*13:47*

Video IN: *00:03:29:19*
Video OUT: *00:05:58:02*

Habitat Description

Substrate: Fine silty 'grey' sand with a shell fraction.

Characterising species: ~3 x 2m stand of *Zostera marina* seagrass (60–85% cover within patch) with epiphytic fine filamentous algae/diatom film on seagrass blades and filamentous algae. In shallower waters to the south the fine silty sand supported patches of very fine filamentous and foliose algae. Silted kelps possibly on more mixed substrata to the north.

	Code – Ver. 04.05
1° Biotope	SS.SMP.SSgr.Zmar
2° Biotope	SS.SSA.IMuSa (to south) and IR.LIR.K (to north)

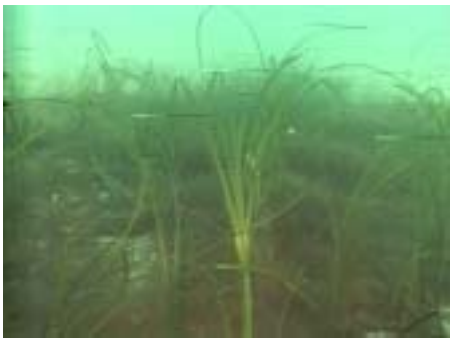
Comments –

Appendix 2 *(continued)*

Site No.: ***45***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 13/08/04
Video No.: D-NWS-0804-4

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*212242*	*933325*	*1.8*	*14:05*
Out:	–	–		*14:08*

Video IN: *00:05:58:03*
Video OUT: *00:08:58:13*



Habitat Description

Substrate: Clean medium-fine sand in upper infralittoral with coarser shelly fraction.

Characterising species: ~10 x 10m bed of less dense seagrass *Zostera marina* (~variable cover 5–35% – blades with very little epiphytic algae). Dense aggregations of filamentous and foliose red algae within the bed/amongst the seagrass plants.

	Code – Ver. 04.05
1° Biotope	SS.SMP.SSgr.Zmar
2° Biotope	–

Comments –
The video cage towed backwards limiting the seabed view for a proportion of the 'drop'.

Site No.: ***46***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 13/08/04
Video No.: D-NWS-0804-4

	Eastings	*Northings*	*Depth (mBCD)*	*Time*
In:	*212098*	*933314*	*6.5*	*14:07*
Out:	–	–		*14:08*

Video IN: *00:08:51:14*
Video OUT: *00:09:42:22*

Habitat Description

Substrate: Appeared to be clean medium-coarse sand possibly with a stone gravel fraction and some pebbles/cobbles.

Characterising species: High cover (~65–90%) of mixed foliose and filamentous algae comprising silted *L. saccharina* (30%) with *Ulva* sp. (30%) and bushy filamentous red algae indet (20%). Sparse silty *L. hyperborea* on available pebble/cobble substrata.

	Code – Ver. 04.05
1° Biotope	SS.SMP.KSwSS.LsacR?.Mu/ **(IR.LIR.K.Lsac.Pk)**
2° Biotope	–

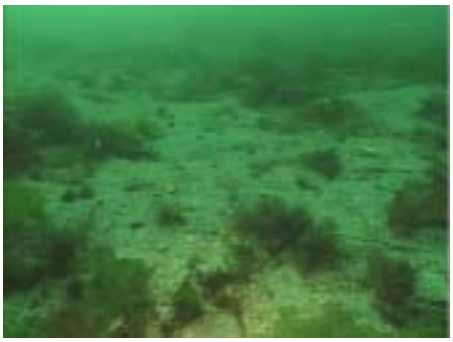
Comments –
No clear footage of the substrate.

Appendix 2 *(continued)*

Site No.: ***47***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 13/08/04
Video No.: D-NWS-0804-4

	Eastings	Northings	Depth (mBCD)	Time
In:	*212018*	*933353*	*8.1*	*14:20*
Out:	–	–		*14:21*

Video IN: 00:09:42:23
Video OUT: 00:10:19:12



Habitat Description

Substrate: Mixed coarse sand with shelly gravel.

Characterising species: Filamentous and foliose algal cover (~25–40%) on mixed sediment plain – *Asperococcus* sp., *Laminaria saccharina*, *Ulva* sp., *Chorda filum* and bushy filamentous red algae indet.

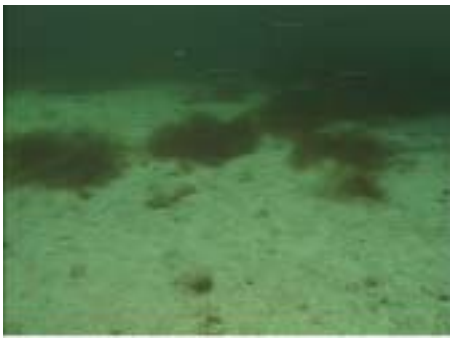
	Code – Ver. 04.05
1° Biotope	SS.SMP.KSwSS.LsacR?.Sa/(Gv)
2° Biotope	–

Comments –

Site No.: ***48***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 13/08/04
Video No.: D-NWS-0804-4

	Eastings	Northings	Depth (mBCD)	Time
In:	*212151*	*933562*	*2.9*	*14:26*
Out:	–	–		*14:27*

Video IN: 00:10:19:13
Video OUT: 00:11:44:16



Habitat Description

Substrate: Clean medium-fine sand in upper infralittoral.

Characterising species: Ectocarpacae indet. on a thin rope. Patchy cover of Ectocarpacae on sediment surface (~20–80% cover – with dense banks in places), *Cerianthus lloydii* burrowing anemones and *Arenicola marina* casts.

	Code – Ver. 04.05
1° Biotope	SS.SSA.IMuSa.ArelSa
2° Biotope	–

Comments –

Appendix 2 *(continued)*

Site No.: ***49***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 13/08/04
Video No.: D-NWS-0804-4

	Eastings	Northings	Depth (mBCD)	Time
In:	*211694*	*933762*	*10.7*	*14:38*
Out:	–	–		*14:39*

Video IN: *00:11:44:17*
Video OUT: *00:12:26:23*

Habitat Description

Substrate: Boulders, cobbles and pebbles on coarse sandy gravel.

Characterising species: Laminaria hyperborea kelp park in relatively sheltered lower infralittoral with *Echinus esculentus* urchins and sparse filamentous and foliose red algae on the rocky substrate below the kelp. Keelworms on the cobbles and pebbles.

	Code – Ver. 04.05
1° Biotope	IR.MIR.KR.Lhyp.Pk
2° Biotope	–

Comments –

Site No.: ***50***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 13/08/04
Video No.: D-NWS-0804-4

	Eastings	Northings	Depth (mBCD)	Time
In:	*213821*	*932281*	*5.8*	*15:13*
Out:	–	–		*15:15*

Video IN: *00:12:27:00*
Video OUT: *00:13:30:18*

Habitat Description

Substrate: Silty fine mud/muddy sand with sparse bivalve shells visible on algal mat surface.

Characterising species: Dense coverage (~95%) of low turf filamentous algae with sparse foliose algae – possibly a single *Echinus esculentus* urchin seen.

	Code – Ver. 04.05
1° Biotope	SS.SMU.IFiMu
2° Biotope	–

Comments –

Appendix 2 *(continued)*

Site No.: ***51***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 13/08/04
Video No.: D-NWS-0804-4

	Eastings	Northings	Depth (mBCD)	Time
In:	*216758*	*934331*	*2.2*	*15:56*
Out:	–	–		*15:58*

Video IN: 00:13:30:19
Video OUT: 00:15:08:06

Habitat Description

Substrate: Live maerl and a raised bank of maerl gravel. Bedrock loch edges and bedrock outcrops/ boulders within the maerl bed.

Characterising species: Live maerl and maerl gravel with ?*D. dichotoma*, *Ulva* sp., *A. rubens*, *L. ciliaris*, *M. glacialis*, *H. siliquosa*, ?*C. lloydii*, filamentous and foliose red algae. *L. saccharina* and *L. hyperborea* on bedrock outcrops/loch flanks.

	Code – Ver. 04.05
1° Biotope	SS.SMP.Mrl
2° Biotope	IR.MIR.KR.Lhyp.Ft

Comments –

Site No.: ***52***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 14/08/04
Video No.: D-NWS-0804-5

	Eastings	Northings	Depth (mBCD)	Time
In:	*215265*	*947863*	*12.0*	*12:48*
Out:	–	–		*12:51*

Video IN: 00:00:00:00
Video OUT: 00:01:55:18

Habitat Description

Substrate: Live maerl and maerl gravel with scattered bivalve shells.

Characterising species: An extensive tideswept infralittoral maerl bed in the Sound of Handa. Significant algal cover (~30–65%) including dense *Desmarestia* spp., *Scinaia* ?*turgida*, *L. saccharina*, *Ulva* sp., filamentous and foliose red and brown algae indet. with *E. esculentus* and *A. rubens*.

	Code – Ver. 04.05
1° Biotope	SS.SMP.Mrl(?.Pcal.R)
2° Biotope	–

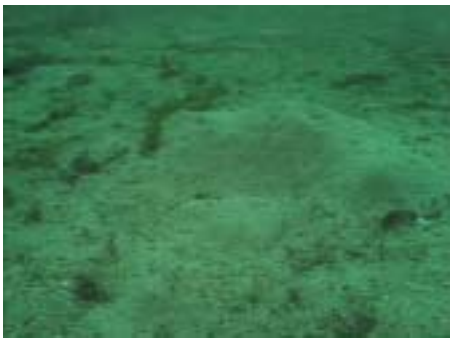
Comments –

Appendix 2 *(continued)*

Site No.: ***53***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 14/08/04
Video No.: D-NWS-0804-5

	Eastings	Northings	Depth (mBCD)	Time
In:	*215826*	*948813*	*8.3*	*13:09*
Out:	–	–		*13:10*

Video IN: 00:01:55:19
Video OUT: 00:02:55:12



Habitat Description

Substrate: Mixed medium-fine sand and shelly gravel.

Characterising species: Patchy (~5–20%) algal cover of a range of filamentous and foliose red algae including short 'wiry' indet. component with *Ulva* sp., *L. saccharina*, *C. filum* and burrowing anemones *C. lloydii*. Bivalve shells including *Ensis* sp. on the sediment surface.

	Code – Ver. 04.05
1° Biotope	SS.SMP.KSwSS.LsacR?.Gv/ **(SS.SSA.IFiSa)**
2° Biotope	–

Comments –

Site No.: ***54***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 14/08/04
Video No.: D-NWS-0804-5

	Eastings	Northings	Depth (mBCD)	Time
In:	*215730*	*948910*	*6.8*	*13:14*
Out:	–	–		*13:15*

Video IN: 00:02:55:13
Video OUT: 00:04:07:06

Habitat Description

Substrate: Hard packed, tideswept mixed medium-fine sand with a shelly fraction.

Characterising species: Patchy (~5–10%) algal cover of a range of filamentous algae including short 'wiry' indet. species plus *Ulva* sp., *L. saccharina*, *C. filum* and ?*Desmarestia* sp. Patchy diatom film on sediment surface and shoals of sand eels ?*Ammodytes tobianus* present.

	Code – Ver. 04.05
1° Biotope	SS.SMP.KSwSS.LsacR?Gv/ **(SS.SSA.IFiSa)**
2° Biotope	–

Comments –

Appendix 2 *(continued)*

Site No.: ***55***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 14/08/04
Video No.: D-NWS-0804-5

	Eastings	Northings	Depth (mBCD)	Time
In:	*220772*	*957103*	*7.5*	*15:26*
Out:	–	–		*15:28*

Video IN: *00:04:07:07*
Video OUT: *00:05:03:03*

Habitat Description

Substrate: Boulders, cobbles and pebbles on coarse sandy gravel.

Characterising species: Laminaria hyperborea park with *Echinus esculentus* urchins. A single crab ?*Carcinus maenas* disturbed from a kelp plant and some red algal growth on the kelp stipes.

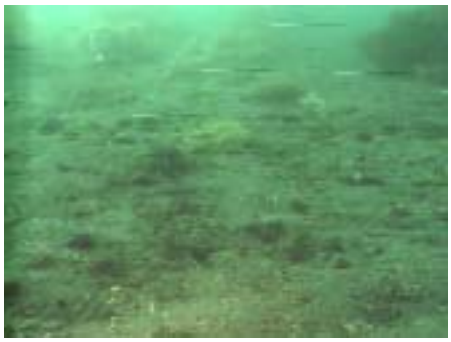
	Code – Ver. 04.05
1° Biotope	IR.MIR.KR.Lhyp.Pk
2° Biotope	–

Comments –

Site No.: ***56***
Survey: NW Scotland Seagrass '04
Operators: BJ & MS
Date: 14/08/04
Video No.: D-NWS-0804-5

	Eastings	Northings	Depth (mBCD)	Time
In:	*222983*	*955736*	*5.3*	*16:05*
Out:	–	–		*16:06*

Video IN: *00:05:03:04*
Video OUT: *00:06:01:06*



Habitat Description

Substrate: Poorly sorted silty muddy sand with stone and shell gravel and sparse pebbles/cobbles.

Characterising species: Algal detritus with *Ulva* sp., filamentous algae indet., *Asperococcus* sp. and *Laminaria saccharina*. ?Serpulid tubes on cobbles. Algal cover ~10–25%.

	Code – Ver. 04.05
1° Biotope	SS.SMU.IsaMu/ (SS.SMP.KSwSS.LsacR?.Mu)
2° Biotope	–

Comments –

APPENDIX 3 – Drop-down video data 'summary table'

Site	WGS84 Latitude	WGS84 Longitude	Position OSGB36			Depth (BCD)	Date	Substrate	Characterising species	Biotope code Ver. 04.05	2° Biotope(s) Ver. 04.05
1	57.86320	–5.49470	NG	92795	91325	8.2m	11-Aug-04	Level coarse sediment plain of cobbles, boulders and a pebble gravel	*Laminaria hyperborea* with *Echinus esculentus* urchins (~1–2/m^2 but patchy) and scattered filamentous algae	IR.MIR.KR.Lhyp.GzPk	
2	57.86294	–5.49143	NG	92987	91286	11.7m	11-Aug-04	Plain of boulders and cobbles with kelp. Kelp canopy patchy with cobbles and pebble clearings	*L. hyperborea* with sparse *L. saccharina*. Some scattered filamentous algae but as at Site 1 **not** a high coverage of foliose reds. *Echinus esculentus* present but not as conspicuous as at Site 1	IR.MIR.KR.Lhyp.Pk	
3	57.86247	–5.48691	NG	93253	91220	10.2m	11-Aug-04	Gently undulating level plain of pebbles/stone gravel. 'Peaks' free of conspicuous flora and fauna and 'troughs' with dense filamentous algae	Dense cover (35%) of ?*Desmarestia* sp. with filamentous and foliose red and brown algae in clearly defined gravel troughs. Only conspicuous fauna observed was a single large starfish ?*Luidia sarsi*	IR.HIR.Ksed.DesFilR/ (SS.SCS.ICS.SSh)	
4	57.86062	–5.48424	NG	93401	91006	6.2m	11-Aug-04	Level plain of firm clean medium sand	Sparse small filamentous algae that look to be attached to pebble/shells in the substrate together with drift algal detritus (kelp and *Chorda filum*). A single ?*Asteropecten irregularis* starfish seen	SS.SSA.IFiSa	
5	57.85913	–5.48518	NG	93336	90843	4.2m	11-Aug-04	Level plain of firm clean medium-fine sand with some shell content	Drift algal debris – no conspicuous fauna seen	SS.SSA.IFiSa?.IMoSa	
6	57.85902	–5.47935	NG	93682	90813	4.0m	11-Aug-04	Fine (slightly silty) sand with shell debris and larger shells inc. *Ensis* sp. shells on the surface	Eelgrass *Zostera marina* (variable coverage from 5–35%) with filamentous red algae (inc. 'fluffy' balls of ?*Trailliella*), sparse *Ulva* sp. and *Asperococcus* sp. Brown diatom film on the sediment surface in places	SS.SMP.SSgr.Zmar	
7	57.85823	–5.48070	NG	93597	90729	1.5m	11-Aug-04	Rippled level plain of medium-fine sand	Scattered algal debris (believed to be drift) and no conspicuous fauna seen	SS.SSA.IFiSa.IMoSa	
8	57.85929	–5.48217	NG	93516	90852	5.2m	11-Aug-04	Poorly sorted medium sand with shell and stone gravel	A mixed sediment plain (predominantly sandy but with stone gravel) in the upper infralittoral with patchy (~30–70%) algal cover of a range of filamentous and foliose red algae. Noticeable aggregations of bivalve shells including *Ensis* sp. Potentially a 'blade or a plant' of *Zostera marina* during the sequence but not clear	SS.SMP.KSwSS.LsacR?. Gv/(CbPb)	

Appendix 3 *(continued)*

Site	WGS84 Latitude	WGS84 Longitude	Position OSGB36			Depth (BCD)	Date	Substrate	Characterising species	Biotope code Ver. 04.05	2° Biotope(s) Ver. 04.05
9	57.86043	–5.48178	NG	93545	90977	6.2m	11-Aug-04	Plain of medium sand with sparse proportion of scattered stone gravel	Medium-coarse sand plain (with lesser fraction of stone gravel than Site 8) in the upper infralittoral with patchy algal cover (~20–45%). Range of algal species present but most could not be identified beyond the short 'wiry' component. Conspicuous species included *Asperococcus* sp., *?Desmarestia* sp., and *?Trailliella*	SS.SMP.KSwSS.LsacR?.Gv/(CbPb)	
10	57.86168	–5.48191	NG	93545	91116	7.5m	11-Aug-04	Plain of firm medium sand with shell debris	Level plain of firm medium sand with a little stone gravel in the infralittoral with patchy scattered clumps of filamentous algal cover (~15–30%). Range of species present but many could not be identified from the video footage. *?Desmarestia* sp., *Ulva* sp., *Laminaria saccharina* (possibly drift), *?Trailliella* and sparse *Asperococcus* sp. present	SS.SMP.KSwSS.LsacR?.Gv/(CbPb)	
11	57.86341	–5.48386	NG	93439	91316	10.2m	11-Aug-04	Coarse mixed sediment plain – ?coarse sand with stone gravel, pebbles and scattered cobbles	Sparse *Laminaria hyperborea* and *L. saccharina* with a dense cover of filamentous and foliose algae (70%) (inc. *?Bonnemaisonia hamifera* and *?Trailliella*) on the mixed sediment surface. Kelp cover less than 15% – some patches of open substrate ~5–10%	SS.SMP.KSwSS.LsacR?.Sa	
12	57.86218	–5.48068	NG	93621	91169	8.2m	11-Aug-04	Hard, coarse-medium sand with a coarser gravel, pebble and cobble fraction	*L. saccharina* and sparse *L. hyperborea* with *?Desmarestia* sp., bushy filamentous red algal turf (inc. *?Bonnemaisonia hamifera*), *?Trailliella*, *Ulva* sp., and *?Dictyota dichotoma*. Algal cover of ~85–90%	SS.SMP.KSwSS.LsacR?.Sa	
13	57.86110	–5.47872	NG	93730	91043	6.6m	11-Aug-04	Plain of medium sand with shell debris (including *Ensis* sp.)	A range of unidentified small 'wiry' filamentous algae (of *Cordylecladia erecta/Gracilaria* sp. type) providing a cover of ~10–30% on the sediment surface. Other algae included *Asperococcus* sp., *Ulva* sp. *?Chorda filum* and a single *?Asteropecten irregularis* starfish	SS.SMP.KSwSS.LsacR?.Gv/ (SS.SSA.IFiSa)	

Appendix 3 *(continued)*

Site	WGS84 Latitude	WGS84 Longitude	Position OSGB36			Depth (BCD)	Date	Substrate	Characterising species	Biotope code Ver. 04.05	2° Biotope(s) Ver. 04.05
14	57.86006	–5.47882	NG	93719	90927	6.1m	11-Aug-04	Medium-fine sand plain with noticeable shell and gravel fraction	*Cancer pagurus* in a 'sand hole', *Chorda filum*, *Asperococcus* sp., and a range of filamentous algae including scattered low 'wiry' red algae. Overall algal cover ~10–35%	SS.SMP.KSwSS.LsacR?.Gv/ (SS.SSA.IFiSa)	
15	57.85907	–5.47708	NG	93816	90812	3.8m	11-Aug-04	Kelp forest on bedrock and a sand plain beyond with shell debris	*L. hyperborea* forest with epiphytic red algae (?*Cryptopleura ramosa*) on stipes and *Echinus esculentus* urchins on the kelp and bedrock below. At the base of the bedrock is a sandy plateau which appears to potentially support *Zostera marina* although this could also be algae	IR.MIR.KR.Lhyp.Ft	?SS.SMP.SSgr.Zmar
16	57.86164	–5.45684	NG	95031	91036	–0.7m	11-Aug-04	Fine silty sand with seagrass (north-eastern/ inshore edge of the seagrass bed). Scattered shell debris	*Zostera marina* seagrass (25–60% patchy cover) with clumped aggregations of filamentous algae	SS.SMP.SSgr.Zmar	
17	57.86020	–5.45706	NG	95010	90877	0.5m	11-Aug-04	Hummocked fine silty sand with seagrass. Scattered shell debris including *Ensis* sp.	*Zostera marina* seagrass (5–25% very patchy cover) with clumped aggregations of filamentous algae	SS.SMP.SSgr.Zmar	
18	57.85966	–5.45723	NG	94997	90817	0.4m	11-Aug-04	Fine silty sand with seagrass (southern edge of the seagrass bed). Scattered shell debris	*Zostera marina* seagrass (5–10% sparse and very patchy cover). Groups of sand eels ?*Ammodytes tobianus* present	SS.SMP.SSgr.Zmar	
19	57.85959	–5.45973	NG	94848	90817	6.8m	11-Aug-04	Hummocked fine silty sand with 'mounded' *Arenciola marina* casts and shell debris	*Arenicola marina* casts on the sediment surface with a brown ?diatom layer in places and sparse filamentous algae	SS.SSA.IMuSa.ArelSa	
20	57.86029	–5.45853	NG	94923	90891	3.4m	11-Aug-04	Hummocked fine silty sand with 'mounded' *Arenciola marina* casts and some scattered shell debris	*Arenicola marina* casts on the sediment surface with other conspicuous 'holes'. A brown ?diatom layer covered the fine sand in places. Scattered small starfish ?*Asteropecten irregularis* and sparse algae (drift?)	SS.SSA.IMuSa.ArelSa	

Appendix 3 *(continued)*

Site	WGS84 Latitude	WGS84 Longitude	Position OSGB36			Depth (BCD)	Date	Substrate	Characterising species	Biotope code Ver. 04.05	2° Biotope(s) Ver. 04.05
21	57.86094	–5.45850	NG	94929	90963	4.2m	11-Aug-04	Hummocked very fine muddy sand/sandy mud with 'mounded' *Arenciola marina* casts	*Arenicola marina* casts, possibly a single *Cerianthus lloydii* anemone and a *Philine aperta* mollusc. A sparse brown diatom film on the sediment surface	SS.SSA.IMuSa.ArelSa/ (SS.SMU.IFiMu.Are)	
22	57.86109	–5.45771	NG	94977	90978	1.1m	11-Aug-04	Plain of hummocked very fine silty sand with 'mounded' *Arenciola marina* casts	*Arenicola marina* casts on the sediment surface with other conspicuous infaunal 'holes'	SS.SSA.IMuSa.ArelSa	
23	57.86140	–5.45778	NG	94974	91012	0.7m	11-Aug-04	Fine silty sand with *Arenicola marina* mounds and seagrass	*Z. marina* seagrass (30–65% patchy cover) with *Arenicola marina* casts and small clumped aggregations of filamentous algae. Outwith the *Zostera* the fine silty sand was hummocked with *A. marina* casts and drift filamentous algae	SS.SMP.SSgr.Zmar	SS.SSA.IMuSa.ArelSa
24	57.86139	–5.45872	NG	94918	91014	2.4m	11-Aug-04	Hummocked fine silty sand with 'mounded' Arenicola marina casts	*Arenicola marina* casts on the sediment surface with other conspicuous 'holes'. A brown ?diatom layer covered the fine sand in places. Scattered small starfish ?*Asteropecten irregularis*	SS.SSA.IMuSa.ArelSa	
25	57.87997	–5.54395	NG	89974	93343	2.5m	11-Aug-04	?Bedrock or boulders	*Laminaria hyperborea* forest with a suggestion of foliose red seaweeds on the kelp stipes	IR.MIR.KR.Lhyp.Ft	
26	58.09236	–5.27646	NC	6972	16172	7.8m	12-Aug-04	Fine muddy sand/sandy mud with limited 'floaty' shelly gravel fraction	Seabed predominantly of fine silty sand with thick brown diatom film on the surface and sparse scattered drift algae (decaying). A single starfish ?*Asterias rubens* observed before the cage disturbs a plume of sediment	SS.SMU.ISaMu(?.Cap)	
27	58.09224	–5.27526	NC	7042	16155	3.7m	12-Aug-04	Poorly sorted fine muddy sand with a coarser 'floaty' shelly gravel fraction	Filamentous algae (10–15%) with *L. saccharina*, *Asperococcus* sp. (5%), *Chorda filum* (scattered), *Ulva* sp. (5–10%) and a turf of ?*Trailliella* (30%). A single *Asterias rubens* starfish – overall algal cover ~60–70%	SS.SMP.KSwSS.LsacR?.Mu	
28	58.09207	–5.27492	NC	7061	16136	1.9m	12-Aug-04	Mixed silty medium sand with coarser 'floaty' gravel fraction	Clumps of filamentous algae ?*Bonnemaisonia hamifera* (15–35%) with *Asperococcus* sp. (15–25%), *Chorda filum* (scattered <5%), *Ulva* sp. (<5–%) and ?*Trailliella* (5–10%)	SS.SMP.KSwSS.LsacCho/ (SS.SMP.KSwSS.LsacR?.Mu)	

Appendix 3 *(continued)*

Site	WGS84 Latitude	WGS84 Longitude	Position OSGB36			Depth (BCD)	Date	Substrate	Characterising species	Biotope code Ver. 04.05	2° Biotope(s) Ver. 04.05
29	58.09279	–5.27648	NC	6973	16220	5.2m	12-Aug-04	?Bedrock and boulders	Heavily silted *Laminaria saccharina* forest with *Echinus esculentus* urchins and encrusting pink coralline algae on the boulders below	IR.LIR.K.Lsac.Ft	
30	58.09288	–5.27940	NC	6802	16238	14.4m	12-Aug-04	Plain of firm fine muddy sand/sandy mud with 'floaty' shelly fraction	Seabed of fine silty sand covered by a brown diatom film on the surface	SS.SMU.ISaMu(?.Cap)	
31	58.10127	–5.27222	NC	7270	17151	3.3m	12-Aug-04	Undulating plain of fine silty sand with a 'floaty' shelly fraction	Patchy algal cover (~20–35% total) comprising filamentous algae indet., *Chorda filum*, *Asperococcus* sp., *Ulva* sp., *Asterias rubens* (x1), ?*Desmarestia* sp., and ?*Trailliella*	SS.SMP.KSwSS.LsacR?.Mu/ (SS.SMP.KSwSS.LsacCho)	
32	58.09901	–5.27191	NC	7276	16899	3.6m	12-Aug-04	Undulating plain of firm mixed silty medium sand with coarser 'floaty' gravel fraction. Scattered boulders/cobbles with kelp then 'stepped' bedrock and boulder margin	Patchy algal cover (~40–70%) comprising filamentous algae indet. (?*Bonnemaisonia hamifera*), *Chorda filum*, *Asperococcus* sp., *Ulva* sp., and a ?*Trailliella* turf (~?35%). Stepped bedrock edge with boulders and cobbles around the sediment supported silted 'cape' *L. hyperborea*, scattered *L. saccharina* with *E. esculentus*, filamentous algae and barnacles	SS.SMP.KSwSS.LsacR?.Mu/ (SS.SMP.KSwSS.Tra)	IR.LIR.K.LhypLsac.Ft
33	58.09922	–5.27166	NC	7292	16921	4.8m	12-Aug-04	Firm mixed silty medium sand with coarser 'floaty' gravel fraction	Filamentous algal cover (~85%). Filamentous algae indet. (?*Bonnemaisonia hamifera*), *Chorda filum*, *Asperococcus* sp., *Ulva* sp., *Laminaria saccharina* and ?*Trailliella*. A single *A. rubens*	SS.SMP.KSwSS.LsacR?.Mu/ (SS.SMP.KSwSS.Tra)	
34	58.09548	–5.27626	NC	7001	16519	7.1m	12-Aug-04	Mixed coarse sandy sediment with ?stone gravel, pebbles/cobbles	Silted *L. saccharina* park with *E. esculentus* urchins, foliose red algae including ?*Delessaria sanguinea* and filamentous red algae under the kelp	IR.LIR.K.Lsac.Pk/ (SS.SMP.KSwSS.LsacR?.Sa/(Mu))	
35	58.09547	–5.27684	NC	6966	16519	7.9m	12-Aug-04	Bedrock and large boulder slope giving way to coarse mixed silty sediment plain with a gravel fraction and shell debris	Silted *L. saccharina* with *E. esculentus* urchins and filamentous red algae. Barnacles and keelworms on the boulders below algal canopy. Gadoids swimming amongst the kelp. Mixed coarse sediment plain with scattered clumps of unidentified filamentous and foliose algae	IR.LIR.K.Lsac.Ft	SS.SMP.KSwSS.LsacR?.Mu

Appendix 3 *(continued)*

Site	WGS84 Latitude	WGS84 Longitude	Position OSGB36			Depth (BCD)	Date	Substrate	Characterising species	Biotope code Ver. 04.05	2° Biotope(s) Ver. 04.05
36	58.11395	–5.28255	NC	6730	18591	5.3m	12-Aug-04	Undulating plain of silty medium sand leading up to an algal turf covered bedrock 'step'	Filamentous algal cover (~75%). *Chorda filum*, *Asperococcus* sp., filamentous algae indet. inc. ?*Trailliella*. *E. esculentus* urchins on vertical faces of filamentous algal turf covered bedrock step	SS.SMP.KSwSS.LsacR?.Mu/ (SS.SMP.KSwSS.LsacCho)	
37	58.11197	–5.28214	NC	6744	18370	4.3m	12-Aug-04	Mixed silty medium sand with coarser 'floaty' gravel fraction	Filamentous algal cover (25–35%) with *Chorda filum*, fucoids (*F. serratus* clumps) and ?*Desmarestia* sp./filamentous algae indet.	SS.SMP.KSwSS.LsacR?.Mu/ (SS.SMP.KSwSS.LsacCho)	
38	58.10802	–5.28086	NC	6798	17927	5.1m	12-Aug-04	Plain of mixed silty medium sand with coarser 'floaty' gravel fraction and shell debris	Seabed with high coverage of filamentous algae (~50–80%) comprising algae indet. (?*Bonnemaisonia hamifera*), *Chorda filum*, *Asperococcus* sp., and *Ulva* sp. A single ?*Asterias rubens* observed	SS.SMP.KSwSS.LsacR?.Mu/ (SS.SMP.KSwSS.Tra)	
39	58.10517	–5.27073	NC	7379	17581	6.2m	12-Aug-04	Plain of very silty fine sediment (mud – muddy sand)	*Philine aperta* (?a couple observed) and 'their' opisthobranch mollusc egg masses together with a diatom film on the sediment surface. Clumps of heavily silted (possibly drift) algae present	SS.SMU.IFiMu.PhiVir	
40	58.24425	–5.33897	NC	4127	33251	2.3m	13-Aug-04	Clean, medium-fine rippled sand	No conspicuous fauna observed	SS.SSA.IFiSa.IMoSa	
41	58.24448	–5.33941	NC	4102	33278	2.2m	13-Aug-04	Bedrock and ?large boulders (no clear footage of substrate)	*Laminaria hyperborea* forest in the shallow sublittoral. Foliose and filamentous red algae on the kelp stipes	IR.MIR.KR.Lhyp.Ft	
42	58.22764	–5.30740	NC	5888	31312	3.3m	13-Aug-04	Clean, medium-fine rippled sand	No conspicuous fauna observed	SS.SSA.IFiSa.IMoSa	
43	58.22857	–5.30709	NC	5911	31414	6.5m	13-Aug-04	Undulating plain of medium sand	A brown diatom/filamentous algal film on sediment surface in places (~15% cover). No conspicuous fauna observed	SS.SSA.IFiSa?.IMoSa	

Appendix 3 *(continued)*

Site	WGS84 Latitude	WGS84 Longitude	Position OSGB36			Depth (BCD)	Date	Substrate	Characterising species	Biotope code Ver. 04.05	2° Biotope(s) Ver. 04.05
44	58.24692	–5.20272	NC	12134	33160	–0.3m	13-Aug-04	Fine silty 'grey' sand with a shell fraction	~3 x 2m stand of *Z. marina* seagrass (60–85% cover within patch) with epiphytic fine filamentous algae/diatom film on seagrass blades and filamentous algae within the bed. To the south the fine silty sand supported patches of very fine filamentous and foliose algae with *Chorda filum* and ?*Trailliella*. North of the seagrass the seabed was covered in silted kelps possibly on more mixed substrata	SS.SMP.SSgr.Zmar	SS.SSA.IMuSa & IR.LIR.K
45	58.24845	–5.20102	NC	12242	33325	1.8m	13-Aug-04	Clean medium-fine sand in upper infralittoral with coarser shelly fraction	~10 x 10m bed of less dense *Z. marina* seagrass (~variable cover 5–35% – blades with very little epiphytic algae). Dense filament and foliose red algae within the bed	SS.SMP.SSgr.Zmar	
46	58.24829	–5.20347	NC	12098	33314	6.5m	13-Aug-04	Appeared to be clean medium-coarse sand possibly with a stone gravel fraction and some pebbles/cobbles	Mixed sediment plain with high cover (~65–90%) of mixed foliose and filamentous algae comprising silted *L. saccharina* (30%) with *Ulva* sp. (30%) and bushy filamentous red algae indet (20%). Sparse silty *L. hyperborea* (<2% – x1 plant seen) on pebble/cobble substrate	SS.SMP.KSwSS.LsacR?.Mu/(IR.LIR.K.Lsac.Pk)	
47	58.24861	–5.20485	NC	12018	33353	8.1m	13-Aug-04	Mixed coarse sand with shelly gravel	Filamentous and foliose algal cover (~25–40%) on mixed sediment plain – *Asperococcus* sp., *Laminaria saccharina*, *Ulva* sp., *Chorda filum* and bushy filamentous red algae indet.	SS.SMP.KSwSS.LsacR?.Sa/ (Gv)	
48	58.25054	–5.20275	NC	12151	33562	2.9m	13-Aug-04	Clean medium-fine sand in upper infralittoral	Sequence starts with Ectocarpacae indet. on a thin rope. Patchy cover of Ectocarpacae on sediment plain surface (~20–80% cover – with dense banks in places), *C. lloydii* burrowing anemones and *A. marina* casts on the sediment	SS.SSA.IMuSa.AreISa	
49	58.25213	–5.21069	NC	11694	33762	10.7m	13-Aug-04	Boulders, cobbles and pebbles on a coarse sandy gravel	*L. hyperborea* kelp park in relatively sheltered lower infralittoral with *E. esculentus* urchins and sparse filamentous and foliose red algae on the rocky substrate below the kelp. Keelworms on the cobbles and pebbles	IR.MIR.KR.Lhyp.Pk	

Appendix 3 *(continued)*

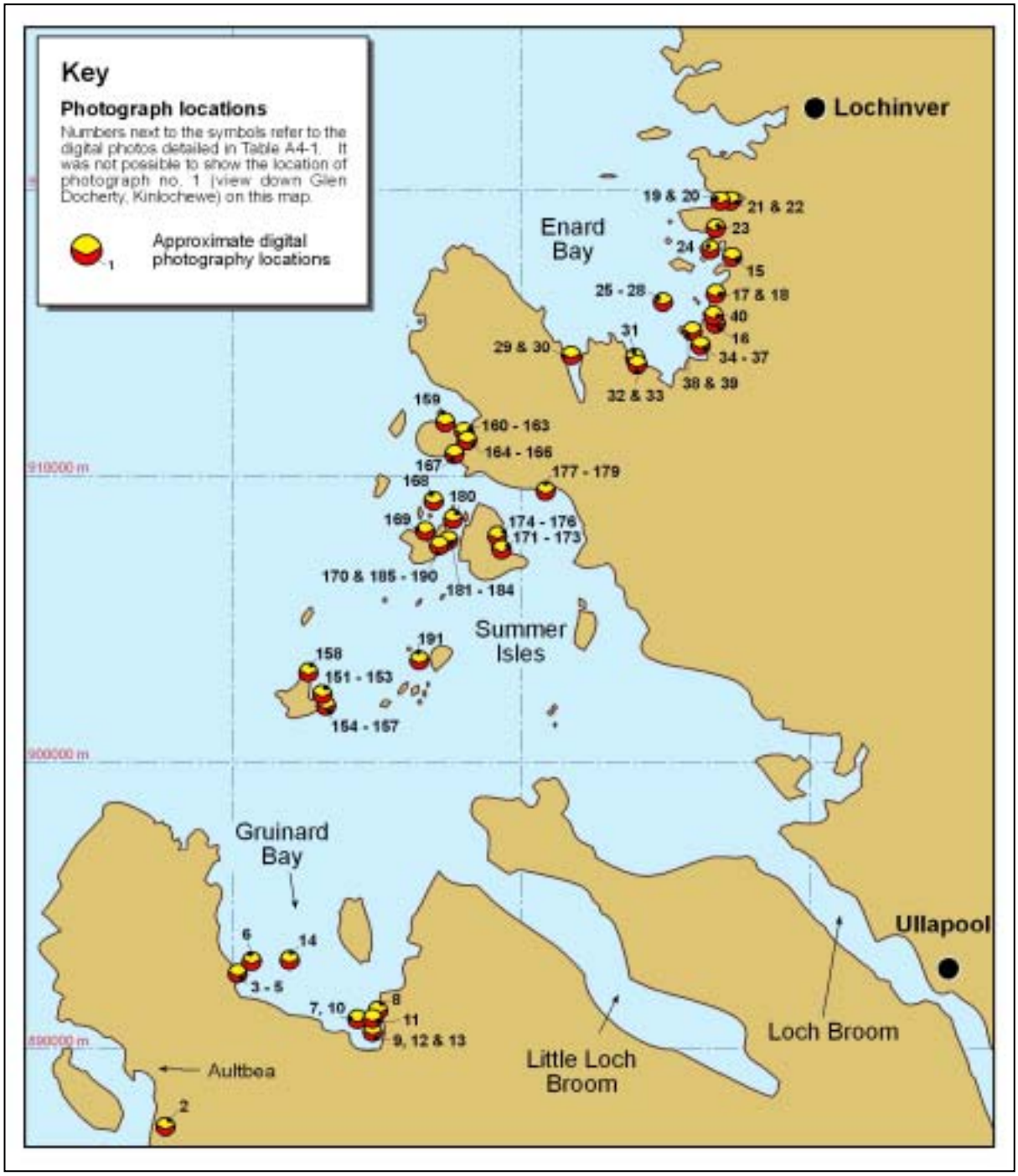
Site	WGS84 Latitude	WGS84 Longitude	Position OSGB36			Depth (BCD)	Date	Substrate	Characterising species	Biotope code Ver. 04.05	2° Biotope(s) Ver. 04.05
50	58.23976	–5.17332	NC	13821	32281	5.8m	13-Aug-04	Silty fine mud/muddy sand with sparse bivalve shells	Dense coverage (~95%) of low turf filamentous algae with sparse foliose algae – possibly a single *E. esculentus* urchin seen	SS.SMU.IFiMu	
51	58.25938	–5.12500	NC	16758	34331	2.2m	13-Aug-04	Maerl bed with live maerl and a raised bank of maerl gravel. Bedrock loch edges and bedrock outcrops/boulders within maerl bed	Live maerl with foliose brown algae *?Dictyota dichotoma*, *Ulva* sp., Ectocarpacae indet., maerl gravel, *A. rubens*, *L. ciliaris*, *?M. glacialis*, *Halidrys siliquosa*, *?C. lloydii*, filamentous and foliose red algae. *L. saccharina* and *Laminaria hyperborea* on bedrock outcrops/loch flanks with enc. coralline algae on rocky substrate and filamentous and foliose red algae on kelp stipes and rock	SS.SMP.Mrl	IR.MIR.KR.Lhyp.Ft
52	58.38002	–5.16121	NC	15265	47853	12.0m	14-Aug-04	Live maerl and maerl gravel with scattered bivalve shells	An extensive tideswept infralittoral maerl bed in the Sound of Handa. Significant algal cover (~30–65%) of a range of species including dense *Desmarestia* spp., *Scinaia ?turgida*, *L. saccharina*, *Ulva* sp., filamentous and foliose red and brown algae indet. with *Echinus esculentus* and *Asterias rubens*	SS.SMP.Mrl(?.Pcal.R)	
53	58.38886	–5.15240	NC	15826	48813	8.3m	14-Aug-04	Mixed medium-fine sand and shelly gravel	A predominantly sandy sediment plain with patchy (~5–20%) algal cover of a range of filamentous and foliose red algae including short 'wiry' unidentified species with *Ulva* sp., *L. saccharina*, *C. filum* and burrowing anemones *C. lloydii*. Bivalve shells including *Ensis* sp. on the sediment surface	SS.SMP.KSwSS.LsacR?.Gv/ (SS.SSA.IFiSa)	
54	58.38969	–5.15413	NC	15730	48910	6.8m	14-Aug-04	Hard packed, tideswept mixed medium-fine sand with a shelly fraction	Medium-fine sand plain with patchy (~5–10%) algal cover of a range of filamentous algae including short 'wiry' unidentified species with *Ulva* sp., *L. saccharina*, *C. filum* and *Desmarestia* sp. Patchy diatom film on sediment surface and shoals of sand eels *?Ammodytes tobianus* present	SS.SMP.KSwSS.LsacR?.Gv/ (SS.SSA.IFiSa)	

Appendix 3 *(continued)*

Site	WGS84 Latitude	WGS84 Longitude	Position OSGB36			Depth (BCD)	Date	Substrate	Characterising species	Biotope code Ver. 04.05	2° Biotope(s) Ver. 04.05
55	58.46526	–5.07441	NC	20772	57103	7.5m	14-Aug-04	Boulders, cobbles and pebbles on a coarse sandy gravel	*Laminaria hyperborea* park with *Echinus esculentus* urchins. A single ?shore crab *Carcinus maenas* disturbed from a kelp plant and some red algal growth on the kelp stipes	IR.MIR.KR.Lhyp.Pk	
56	58.45390	–5.03551	NC	22983	55736	5.3m	14-Aug-04	Poorly sorted silty muddy sand with stone and shell gravel and sparse pebbles/cobbles	Algal detritus with *Ulva* sp., filamentous algae indet., *Asperococcus* sp. and *Laminaria saccharina*. ?Serpulid tubes on cobbles. Algal cover ~10–25%	SS.SMU.IsaMu/ (SS.SMP.KSwSS.LsacR?.Mu)	

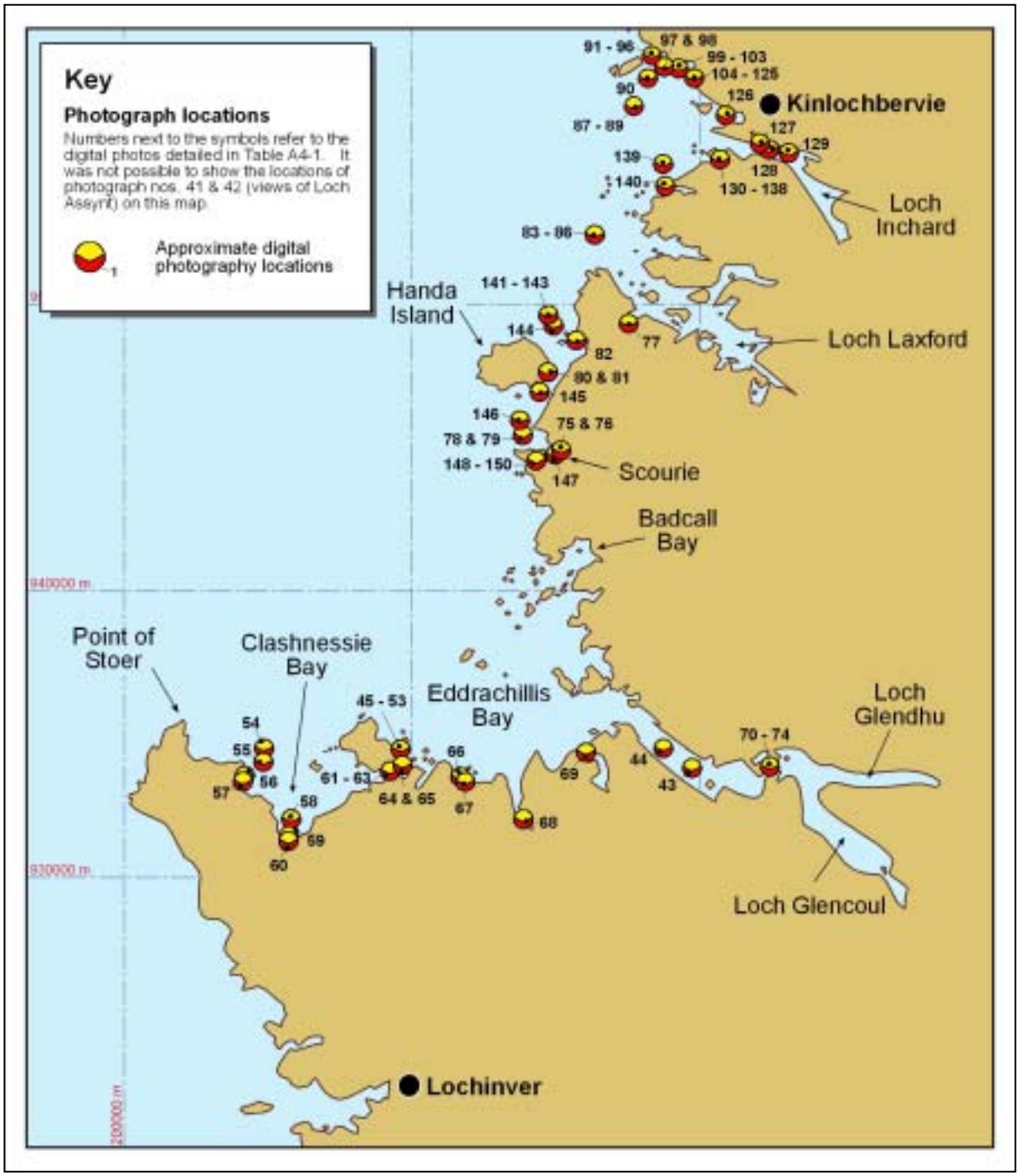
APPENDIX 4 – Mapped photograph locations and log

Figure A4–1 A map showing the distribution of approximate digital photography locations in the southern half of the study area (Gruinard Bay to Lochinver)



Appendix 4 *(continued)*

Figure A4–2 A map showing the distribution of approximate digital photography locations in the northern half of the study area (Lochinver to Kinlochbervie)



Appendix 4 *(continued)*

Table A4–1 Digital photography log

Photo ID	Approx. dir (°)	Wpt.	Position NGR		General location	Title	Date	Taken by
img01	330	n/a	206750	859160	Kinlochewe	View down Glen Docherty	10-Aug-04	BJ
img02	330	n/a	187660	887200	Loch Ewe	View across to the Isle of Ewe	10-Aug-04	BJ
img03	30	n/a	190170	892540	Laide	Matt Dalkin, Rachel Horsburgh and Mark Stewart preparing drop video kit	11-Aug-04	BJ
img04	30	n/a	190170	892540	Laide	Matt Dalkin, Rachel Horsburgh and Mark Stewart preparing drop video kit near the slip at Laide	11-Aug-04	BJ
img05	90	n/a	190170	892540	Laide	The view down the slip at Laide	11-Aug-04	BJ
img06	n/a	n/a	190700	892900	Gruinard Bay	Matt, Rachel and Mark on the RHIB – inputting GPS waypoints – a little 'choppy'	11-Aug-04	BJ
img07	115	n/a	194700	890900	Little Gruinard, Gruinard Bay	The sandy beach at Little Gruinard	11-Aug-04	BJ
img08	n/a	16	195031	891036	South of Fraoch Eilean Mor, Little Gruinard, Gruinard Bay	*Zostera marina* in shallow water at Site 16 – image taken of seabed from drifting RHIB	11-Aug-04	BJ
img09	n/a	17	195010	890877	South of Fraoch Eilean Mor, Little Gruinard, Gruinard Bay	*Zostera marina* in shallow water at Site 17 – image taken of seabed from drifting RHIB	11-Aug-04	BJ
img10	170	n/a	194700	890960	South of Fraoch Eilean Mor, Little Gruinard, Gruinard Bay	Marks neck seal was a little tight	11-Aug-04	BJ
img11	n/a	n/a	194960	890950	Sandy Bay north of Little Gruinard	Mark and Rachel using the glass bottomed bucket to view the shallow seabed	11-Aug-04	BJ
img12	n/a	18	194997	890817	South of Fraoch Eilean Mor, Little Gruinard, Gruinard Bay	*Zostera marina* in shallow water at Site 18 – image taken of seabed from drifting RHIB	11-Aug-04	BJ
img13	n/a	18	194997	890817	South of Fraoch Eilean Mor, Little Gruinard, Gruinard Bay	*Zostera marina* in shallow water at Site 18 – image taken of seabed from drifting RHIB (2)	11-Aug-04	BJ
img14	100	n/a	192000	893000	Gruinard Bay	Scenic shot with sea and 'layered' hills in the distance	11-Aug-04	BJ
img15	n/a	n/a	207460	917630	Coast road from Lochinver to Inverpolly	Matt negotiating the very narrow, tight turns driving the RHIB down the minor road from Lochinver to the fishfarm slip at Inverpolly	12-Aug-04	BJ

Appendix 4 – Table A4–1 *(continued)*

Photo ID	Approx. dir (°)	Wpt.	Position NGR		General location	Title	Date	Taken by
img16	145	n/a	206820	915260	Fishfarm slip north of Inverpolly Lodge, Enard Bay	Mark and Rachel and the front of the RHIB – the fishfarm slipway (just about all tide access but a difficult bendy slip)	12-Aug-04	BJ
img17	n/a	n/a	206895	916210	Poll Loisgann, Enard Bay	Mussels, anemones and red algae on a fishfarm float within Poll Loisgann	12-Aug-04	BJ
img18	100	30	206800	916230	Poll Loisgann, Enard Bay	View of small fishfarm in Poll Loisgann	12-Aug-04	BJ
img19	85	n/a	207300	919590	Loch Kirkaig, Enard Bay	Sandy bay at Inverkirkaig	12-Aug-04	BJ
img20	105	n/a	207330	919630	Loch Kirkaig, Enard Bay	The head of Loch Kirkaig and hills beyond	12-Aug-04	BJ
img21	45	n/a	207450	919650	Loch Kirkaig, Enard Bay	Chalets on the northern shore-line at head of Loch Kirkaig	12-Aug-04	BJ
img22	5	n/a	207450	919650	Loch Kirkaig, Enard Bay	Matt Dalkin and Mark Stewart in the sunshine at the head of Loch Kirkaig	12-Aug-04	BJ
img23	n/a	n/a	206880	918620	Cais-bhaigh, Enard Bay	*Actinia equina* and *Nucella lapillus* on submerged barnacle covered intertidal bedrock	12-Aug-04	BJ
img24	10	38	206700	917900	North of Loch an Eisg-brachaidh, Enard Bay	Diving ducks on the waters surface	12-Aug-04	BJ
img25	280	n/a	205000	916000	Enard Bay	View across Enard Bay to headland at Rubha Coigeach	12-Aug-04	BJ
img26	n/a	n/a	205000	916000	Enard Bay	Mark Stewart on the phone to Angus McHattie whilst on the RHIB	12-Aug-04	BJ
img27	n/a	n/a	205000	916000	Enard Bay	Matt Dalkin on the RHIB	12-Aug-04	BJ
img28	n/a	n/a	205000	916000	Enard Bay	Rachel Horsburgh and Matt Dalkin on the RHIB	12-Aug-04	BJ
img29	205	n/a	201800	914100	Achnahaird Bay	People enjoying the sandy beach at Achnahaird	12-Aug-04	BJ
img30	160	n/a	201800	914100	Achnahaird Bay	South east corner of the sandy shore at Achnahaird	12-Aug-04	BJ
img31	140	n/a	204000	914000	Garvie Bay	Garvie Bay	12-Aug-04	BJ
img32	140	n/a	204100	913800	Garvie Bay	Rod fisherman in the south-east corner of Garvie Bay	12-Aug-04	BJ
img33	100	n/a	204100	913800	Garvie Bay	Rocky plateau along the edge of Garvie Bay	12-Aug-04	BJ
img34	45	n/a	206300	914500	Polly Bay within Enard Bay	Cave entrance in rocky cliffs along the northern coastline of Polly Bay	12-Aug-04	BJ

Appendix 4 – Table A4–1 *(continued)*

Photo ID	Approx. dir (°)	Wpt.	Position NGR		General location	Title	Date	Taken by
img35	n/a	n/a	206300	914500	Polly Bay within Enard Bay	Close up of shag on rocky ledge in entrance to sea cave	12-Aug-04	BJ
img36	n/a	n/a	206300	914500	Polly Bay within Enard Bay	Close up of inquisitive shag on rocky ledge nest site in entrance to sea cave	12-Aug-04	BJ
img37	255	n/a	206300	914500	Polly Bay within Enard Bay	Collection of shags on low sea cliffs along edge of Polly Bay	12-Aug-04	BJ
img38	n/a	n/a	206000	915000	Enard Bay	The drop-down video equipment on the deck of the RHIB	12-Aug-04	BJ
img39	n/a	n/a	206000	915000	Enard Bay	The drop-down video equipment on the deck of the RHIB	12-Aug-04	BJ
img40	145	n/a	206740	915530	Fishfarm and slip in inlet north of Inverpolly Lodge, Enard Bay	The fishfarm and slipway launch/RHIB recovery site beyond	12-Aug-04	BJ
img41	250	n/a	221480	925140	Loch Assynt	Trees on small islets within Loch Assynt (silhouette)	12-Aug-04	BJ
img42	185	n/a	220200	926000	Loch Assynt	Trees on small bouldery islet in Loch Assynt	12-Aug-04	BJ
img43	180	n/a	220000	933800	Loch a Chairn Bhain	Ardvar and Loch a' Mhuilinn Woodlands cSAC viewed from Loch a Chairn Bhain	13-Aug-04	BJ
img44	150	n/a	219000	934500	Loch a Chairn Bhain	Looking back along south coast of Loch a Chairn Bhain towards Kylesku – Quinag hills in the distance	13-Aug-04	BJ
img45	355	n/a	209870	934440	Oldany Island, Eddrachillis Bay	Small sandy bay on NE of Oldany Island at Cnoc a' Mhoil Bhain	13-Aug-04	BJ
img46	350	n/a	209846	934474	Oldany Island, Eddrachillis Bay	House at the top of the small sandy bay on NE of Oldany Island at Cnoc a' Mhoil Bhain	13-Aug-04	BJ
img47	25	n/a	209846	934474	Oldany Island, Eddrachillis Bay	Small sandy bay on NE of Oldany Island at Cnoc a' Mhoil Bhain	13-Aug-04	BJ
img48	25	n/a	209846	934474	Oldany Island, Eddrachillis Bay	Clear shallow waters in small sandy bay on NE of Oldany Island at Cnoc a' Mhoil Bhain	13-Aug-04	BJ
img49	n/a	n/a	209846	934474	Oldany Island, Eddrachillis Bay	Matt Dalkin and Mark Stewart next to the RHIB	13-Aug-04	BJ
img50	n/a	n/a	209846	934474	Oldany Island, Eddrachillis Bay	Matt Dalkin, Mark Stewart and Rachel Horsburgh next to the RHIB	13-Aug-04	BJ
img51	85	n/a	209846	934474	Oldany Island, Eddrachillis Bay	Clear shallow waters in small sandy bay on NE of Oldany Island at Cnoc a' Mhoil Bhain	13-Aug-04	BJ

Appendix 4 – Table A4–1 *(continued)*

Photo ID	Approx. dir (°)	Wpt.	Position NGR		General location	Title	Date	Taken by
img52	120	n/a	209820	934500	Oldany Island, Eddrachillis Bay	The RHIB in the clear shallow waters at Cnoc a' Mhoil Bhain	13-Aug-04	BJ
img53	120	n/a	209820	934500	Oldany Island, Eddrachillis Bay	Close-up of the RHIB and survey team in the clear shallow waters at Cnoc a' Mhoil Bhain	13-Aug-04	BJ
img54	270	n/a	205000	934500	Point of Stoer	Cliffs along the Point of Stoer – Geodha an Lath-roinn	13-Aug-04	BJ
img55	310	n/a	205000	934000	Point of Stoer	View to the Point of Stoer	13-Aug-04	BJ
img56	220	n/a	204360	933500	Bay of Culkein	View to the Bay of Culkein	13-Aug-04	BJ
img57	245	n/a	204300	933300	Bay of Culkein	View to the Bay of Culkein after finishing sampling Sites 40 and 41	13-Aug-04	BJ
img58	185	n/a	206000	932000	Clashnessie Bay	View of Clashnessie Bay	13-Aug-04	BJ
img59	225	42	205890	931310	Clashnessie Bay	The sandy beach at Clashnessie	13-Aug-04	BJ
img60	230	n/a	205900	931200	Clashnessie Bay	People on the sandy beach at Clashnessie	13-Aug-04	BJ
img61	n/a	n/a	209460	933710	Oldany Island, Eddrachillis Bay	*Chorda filum* on waters surface in narrow channel splitting Oldany Island from the mainland	13-Aug-04	BJ
img62	115	n/a	209490	933700	Oldany Island, Eddrachillis Bay	Narrow channel between Oldany Island and the mainland just navigable in the RHIB at low tide	13-Aug-04	BJ
img63	n/a	n/a	209720	933630	Oldany Island, Eddrachillis Bay	*Laminaria saccharina* in clear shallow waters of narrow channel	13-Aug-04	BJ
img64	60	n/a	209900	933850	Oldany Island, Eddrachillis Bay	Seals lounging on intertidal algal covered rock	13-Aug-04	BJ
img65	110	n/a	209880	933900	Oldany Island, Eddrachillis Bay	Seals lounging on intertidal algal covered rock	13-Aug-04	BJ
img66	175	46	212100	933300	Loch Dhrombaig	Head of Loch Dhrombaig, small boat near Site 44	13-Aug-04	BJ
img67	70	n/a	211900	933500	Loch Dhrombaig	Mark Stewart with the drop-down video viewer on the RHIB	13-Aug-04	BJ
img68	135	n/a	214100	932000	Loch Nedd	The head of Loch Nedd	13-Aug-04	BJ
img69	135	n/a	216300	934350	Loch na Droighniche	Sonic seal scarer warning notice on fishfarm within Loch na Droighniche	13-Aug-04	BJ
img70	45	n/a	222450	933650	Loch a Chairn Bhain	Approaches to the Bridge at Kylesku	13-Aug-04	BJ
img71	90	n/a	222640	933770	Loch a Chairn Bhain	Looking up at the southern legs of the bridge at Kylesku from the water	13-Aug-04	BJ

Appendix 4 – Table A4–1 *(continued)*

Photo ID	Approx. dir (°)	Wpt.	Position NGR		General location	Title	Date	Taken by
img72	185	n/a	222760	933870	Kylesku	The southern legs of the bridge at Kylesku	13-Aug-04	BJ
img73	220	n/a	222830	933930	Kylesku	The bridge at Kylesku	13-Aug-04	BJ
img74	135	n/a	222960	933940	Kylesku	The slip at Kylesku	13-Aug-04	BJ
img75	225	n/a	215470	944980	Scourie	Scourie slip with the SNH RHIB Aphrodite in the water	14-Aug-04	BJ
img76	180	n/a	215470	944980	Scourie	Scourie slip with the SNH RHIB and the campsite beyond	14-Aug-04	BJ
img77	40	n/a	217800	949400	Fanagmore	Blocked entrance to Duart fish farm at Fanagmore	14-Aug-04	BJ
img78	180	n/a	214100	945500	Scourie Bay	Matt and Angus applying much needed suncream	14-Aug-04	BJ
img79	270	n/a	214100	945500	Scourie Bay	Rachel Horsburgh on the RHIB	14-Aug-04	BJ
img80	240	n/a	215000	947700	Handa Island	Small sandy bay on NE edge of Handa Island where the ferry drops people off	14-Aug-04	BJ
img81	210	n/a	215000	947700	Handa Island	View down the Sound of Handa with small sandy bay on the right edge of the image (as per img80)	14-Aug-04	BJ
img82	85	n/a	216000	948800	Sound of Handa	The jetty and carpark at Tarbet	14-Aug-04	BJ
img83	135	n/a	216600	952500	Mouth of Loch Laxford	View of the mouth of Loch Laxford with Ben Stack in the distance	14-Aug-04	BJ
img84	115	n/a	216600	952500	Mouth of Loch Laxford	View of the mouth of Loch Laxford with Ben Stack in the distance and Foinaven to the left	14-Aug-04	BJ
img85	110	n/a	216600	952500	Mouth of Loch Laxford	View of the mouth of Loch Dughaill with Foinaven in the distance	14-Aug-04	BJ
img86	140	n/a	216600	952500	Mouth of Loch Laxford	Ben Stack viewed from the mouth of Loch Laxford	14-Aug-04	BJ
img87	40	n/a	218000	957000	Oldshoremore	The sandy beaches at Oldshore Beg and Oldshoremore	14-Aug-04	BJ
img88	35	n/a	218000	957000	Oldshoremore	Matt, Rachel and Angus on the RHIB with Oldshore Beg and Oldshoremore in the background	14-Aug-04	BJ
img89	35	n/a	218000	957000	Oldshoremore	Matt, Rachel and Angus on the RHIB (close-up) with Oldshore Beg and Oldshoremore in the background	14-Aug-04	BJ

Appendix 4 – Table A4–1 *(continued)*

Photo ID	Approx. dir (°)	Wpt.	Position NGR		General location	Title	Date	Taken by
img90	180	n/a	218500	958000	Oldshoremore	Matt, Rachel and Angus on the RHIB	14-Aug-04	BJ
img91	25	n/a	218700	958500	Oldshoremore	Bagh a' Phollain – the sandy beach at Oldshore Beg	14-Aug-04	BJ
img92	305	n/a	218650	958760	Oldshoremore	Cave in rocks along the western edge of Bagh a' Phollain	14-Aug-04	BJ
img93	40	n/a	218770	958710	Oldshoremore	Bagh a' Phollain – the sandy beach at Oldshore Beg and the nose of the RHIB	14-Aug-04	BJ
img94	315	n/a	218870	958860	Oldshoremore	The clear turquoise waters and sandy seabed at the base of the low cliffs along the western edge of Bagh a' Phollain	14-Aug-04	BJ
img95	50	n/a	218920	958800	Oldshoremore	The eastern edge of Oldshore Beg sandy beach	14-Aug-04	BJ
img96	40	n/a	218800	958800	Oldshoremore	Angus checking the water depth from the nose of the RHIB approaching Oldshore Beg	14-Aug-04	BJ
img97	135	n/a	219050	958430	Oldshoremore	Gulls on lower eulittoral algal dominated rocky outcrop Eilean na h-Aiteig	14-Aug-04	BJ
img98	110	n/a	219050	958400	Oldshoremore	Gulls on intertidal rocky outcrop Eilean na h-Aiteig (close-up)	14-Aug-04	BJ
img99	325	n/a	219600	958300	Oldshoremore	Part 1 of sandy beach at Oldshoremore	14-Aug-04	BJ
img100	15	n/a	219600	958300	Oldshoremore	Part 2 of sandy beach at Oldshoremore	14-Aug-04	BJ
img101	45	n/a	219600	958300	Oldshoremore	Part 3 of sandy beach at Oldshoremore	14-Aug-04	BJ
img102	65	n/a	219600	958300	Oldshoremore	Part 4 of sandy beach at Oldshoremore	14-Aug-04	BJ
img103	355	n/a	219900	958200	Oldshoremore	Oldshoremore beach from far eastern side near rocky promontory	14-Aug-04	BJ
img104	n/a	n/a	220025	958130	Oldshoremore	Encrusting sponge with algae on boulder within the tidal rapids entrance to the shallow inlet to the east of Oldshoremore (Lochan nam Meallan)	14-Aug-04	BJ
img105	n/a	n/a	220025	958130	Oldshoremore	*Henricia oculata* on pebbles within the rapids	14-Aug-04	BJ
img106	n/a	n/a	220025	958130	Oldshoremore	*Asterias rubens* on barnacle adorned pebbles within the rapids	14-Aug-04	BJ
img107	n/a	n/a	220025	958130	Oldshoremore	*Solaster endeca* on a boulder within the rapids with kelp *Laminaria digitata* stipes, hydroids and coralline algae	14-Aug-04	BJ

Appendix 4 – Table A4–1 *(continued)*

Photo ID	Approx. dir (°)	Wpt.	Position NGR		General location	Title	Date	Taken by
img108	n/a	n/a	220025	958130	Oldshoremore	Worm cast of coarse sand amongst shells with keelworms and shelly gravel in the rapids	14-Aug-04	BJ
img109	n/a	n/a	220040	958110	Oldshoremore	*Laminaria saccharina* in clear shallow waters of Lochan nam Meallan	14-Aug-04	BJ
img110	n/a	n/a	220050	958110	Oldshoremore	A 'hedgehog' stone with an algal coating within Lochan nam Meallan	14-Aug-04	BJ
img111	n/a	n/a	220050	958110	Oldshoremore	A 'hedgehog' stone on shelly gravel within Lochan nam Meallan	14-Aug-04	BJ
img112	n/a	n/a	220050	958120	Oldshoremore	Prawns on underside of boulder within Lochan nam Meallan	14-Aug-04	BJ
img113	n/a	n/a	220060	958120	Oldshoremore	'Hedgehog' stones, shells and cobbles with red algae within Lochan nam Meallan	14-Aug-04	BJ
img114	n/a	n/a	220070	958110	Oldshoremore	*Asperococcus* sp. algae on shallow sediment covered bedrock and boulders with filamentous algae on the waters surface	14-Aug-04	BJ
img115	n/a	n/a	220070	958110	Oldshoremore	*Asperococcus* sp. algae on shallow sediment and boulders within Lochan nam Meallan	14-Aug-04	BJ
img116	n/a	n/a	220070	958110	Oldshoremore	*Asperococcus* sp. algae on shallow sediment within Lochan nam Meallan	14-Aug-04	BJ
img117	n/a	n/a	220040	958090	Oldshoremore	Dense algae in the clear shallow waters of the inlet	14-Aug-04	BJ
img118	n/a	n/a	220035	958100	Oldshoremore	Dense algae overlying cobbles in the clear shallow tide-swept waters of Lochan nam Meallan just behind the rapids entrance	14-Aug-04	BJ
img119	n/a	n/a	220035	958100	Oldshoremore	A 'hedgehog' stone on shells and cobbles below the *Chorda filum* within Lochan nam Meallan	14-Aug-04	BJ
img120	n/a	n/a	220035	958100	Oldshoremore	*Chorda filum* in clear shallow water with cobbles and pebbles covered with keelworms	14-Aug-04	BJ
img121	n/a	n/a	220035	958110	Oldshoremore	Kelp in the tidal rapids	14-Aug-04	BJ
img122	175	n/a	220010	958160	Oldshoremore	The rapids viewed from the shore	14-Aug-04	BJ
img123	160	n/a	220010	958170	Oldshoremore	The rapids area with Lochan nam Meallan beyond	14-Aug-04	BJ

Appendix 4 – Table A4–1 *(continued)*

Photo ID	Approx. dir (°)	Wpt.	Position NGR		General location	Title	Date	Taken by
img124	n/a	n/a	219900	958200	Oldshoremore	Two 'hedgehog' stones	14-Aug-04	BJ
img125	n/a	n/a	219900	958200	Oldshoremore	A close-up of a 'hedgehog' stone	14-Aug-04	BJ
img126	95	n/a	221200	956700	Loch Clash	Sediment shores at the head of Loch Clash	14-Aug-04	BJ
img127	330	n/a	222400	955700	Kinlochbervie	The entrance to Loch Bervie harbour area	14-Aug-04	BJ
img128	120	n/a	222700	955500	Loch Inchard	The view down Loch Inchard over Angus's shoulder	14-Aug-04	BJ
img129	25	n/a	223400	955400	Loch Inchard	Mussel farm buoys along the north shore of Loch Inchard	14-Aug-04	BJ
img130	105	n/a	220850	955150	Kinsalle inlet, Loch Inchard	Loch Ceann na Saile	14-Aug-04	BJ
img131	175	n/a	220850	955150	Kinsalle inlet, Loch Inchard	The clear shallow waters and southern boulder shoreline within Loch Ceann na Saile	14-Aug-04	BJ
img132	175	n/a	221150	955030	Kinsalle inlet, Loch Inchard	The dwelling in the south-east corner of Loch Ceann na Saile	14-Aug-04	BJ
img133	270	n/a	221020	955130	Kinsalle inlet, Loch Inchard	The view out of the Loch Ceann na Saile through the shallow narrows	14-Aug-04	BJ
img134	345	n/a	221150	955030	Kinsalle inlet, Loch Inchard	The northern shoreline and heather vegetation at the head of the Loch Ceann na Saile	14-Aug-04	BJ
img135	n/a	n/a	220850	955150	Kinsalle inlet, Loch Inchard	Kelp in the inner part of the narrows of Loch Ceann na Saile	14-Aug-04	BJ
img136	180	n/a	220790	955150	Kinsalle inlet, Loch Inchard	*Himanthalia elongata* on the waters surface within the tidal narrows area of Loch Ceann na Saile	14-Aug-04	BJ
img137	170	n/a	220790	955150	Kinsalle inlet, Loch Inchard	*Himanthalia elongata* on the waters surface within the tidal narrows area of Loch Ceann na Saile	14-Aug-04	BJ
img138	180	n/a	220790	955150	Kinsalle inlet, Loch Inchard	*Himanthalia elongata* on the waters surface within the tidal narrows area of Loch Ceann na Saile and the boulder shoreline	14-Aug-04	BJ
img139	230	n/a	219000	955000	Coastline south of Loch Inchard	Rocky skerries (inside Dubh Sgeirean) with the Point of Stoer in the distance	14-Aug-04	BJ
img140	75	n/a	219100	954200	Loch an Roin, coastline south of Loch Inchard	The entrance of Loch an Roin inlet which was too shallow to enter	14-Aug-04	BJ

Appendix 4 – Table A4–1 *(continued)*

Photo ID	Approx. dir (°)	Wpt.	Position NGR		General location	Title	Date	Taken by
img141	245	n/a	215000	949700	Handa Island	The northern cliffs of Handa Island	14-Aug-04	BJ
img142	30	n/a	215000	949500	Nr. Handa Island	Matt and Rachel on the RHIB	14-Aug-04	BJ
img143	85	n/a	215000	949500	Nr. Handa Island	Angus with hat and shades on	14-Aug-04	BJ
img144	100	n/a	215180	949360	Sgeirean Glasa nr. Handa Island	Some trawl ropes and netting snagged on the rocks east of the north of Handa Island (Sgeirean Glasa)	14-Aug-04	BJ
img145	215	n/a	214700	947000	Sound of Handa	Large number of shags in the waters of the Sound of Handa	14-Aug-04	BJ
img146	235	n/a	214000	946000	Sound of Handa/ mouth of Scourie Bay	View across outer Eddrachillis Bay to the Old Man and Point of Stoer	14-Aug-04	BJ
img147	180	n/a	215330	944870	Scourie Bay	The campsite on the southern shore of Scourie Bay	14-Aug-04	BJ
img148	310	n/a	214600	944600	Scourie More	Sunset from behind the Minchview B&B	14-Aug-04	BJ
img149	310	n/a	214600	944600	Scourie More	Sunset from behind the Minchview B&B (2)	14-Aug-04	BJ
img150	310	n/a	214600	944600	Scourie More	Sunset from behind the Minchview B&B (3 close-up)	14-Aug-04	BJ
img151	180	n/a	193050	902200	Priest Island, Summer Isles	Gully indicated on SNH annotated map	15-Aug-04	BJ
img152	180	n/a	193050	902160	Priest Island, Summer Isles	Head of the rocky gully	15-Aug-04	BJ
img153	355	n/a	193050	902160	Priest Island, Summer Isles	Matt and Angus in the RHIB looking down the gully	15-Aug-04	BJ
img154	n/a	n/a	193140	901950	Priest Island, Summer Isles	Shallow boulders with 'grassy' *Enteromorpha* algae (1) in small embayment to the south of the initial map highlighted gully area at grid reference of 'confirmed' sighting	15-Aug-04	BJ
img155	n/a	n/a	193140	901950	Priest Island, Summer Isles	Shallow boulders with 'grassy' *Enteromorpha* algae (2) in small embayment to the south of the gully area at grid reference of 'confirmed' sighting	15-Aug-04	BJ
img156	n/a	n/a	193140	901950	Priest Island, Summer Isles	Shallow boulders with 'grassy' *Enteromorpha* algae (3) in small embayment to the south of the gully area at grid reference of 'confirmed' sighting	15-Aug-04	BJ
img157	270	n/a	193140	901950	Priest Island, Summer Isles	Boulder shore above the green algal area in the shallow sublittoral in small embayment to the south of the gully area at grid reference of 'confirmed' sighting	15-Aug-04	BJ

Appendix 4 – Table A4–1 *(continued)*

Photo ID	Approx. dir (°)	Wpt.	Position NGR		General location	Title	Date	Taken by
img158	260	n/a	192607	902997	Priest Island, Summer Isles	Natural arch on northern tip of Priest Island	15-Aug-04	BJ
img159	260	n/a	197400	911800	Isle Ristol, Summer Isles	Sandy beach on north east of Isle Ristol	15-Aug-04	BJ
img160	n/a	n/a	198060	911440	Isle Ristol, Summer Isles	*Himanthalia elongata* in shallow waters approaching the anchorage at Old Dornie	15-Aug-04	BJ
img161	n/a	n/a	198060	911440	Isle Ristol, Summer Isles	Angus McHattie looking at *Himanthalia elongata* in shallow waters approaching the anchorage at Old Dornie	15-Aug-04	BJ
img162	n/a	n/a	198060	911440	Isle Ristol, Summer Isles	Shallow waters approaching the anchorage at Old Dornie from Loch an Alltain Duibh	15-Aug-04	BJ
img163	n/a	n/a	198060	911440	Isle Ristol, Summer Isles	*Himanthlia elongata* on waters surface	15-Aug-04	BJ
img164	80	n/a	198260	911220	Old Dornie, Rubha Mor	The Anchorage at Old Dornie	15-Aug-04	B
img165	30	n/a	198400	911250	Old Dornie, Rubha Mor	A wooden boat at anchor in the Anchorage at Old Dornie	15-Aug-04	BJ
img166	135	n/a	198050	911180	Caolas Eilean Ristol	An otter in the shallows near the Anchorage at Old Dornie	15-Aug-04	BJ
img167	10	n/a	197700	910700	Caolas Eilean Ristol	Matt and Angus on the RHIB	15-Aug-04	BJ
img168	n/a	n/a	197000	909000	Summer Isles	Calm waters reflecting the clouds	15-Aug-04	BJ
img169	40	n/a	196700	908000	Summer Isles	Low lying islands around Eilean Fada Mor	15-Aug-04	BJ
img170	260	n/a	197200	907540	Tanera Beg, Summer Isles	Small sandy area on eastern coast of Tanera Beg – RHIB above shallow maerl bed	15-Aug-04	BJ
img171	225	n/a	199300	907400	Tanera More, Summer Isles	Southern end of The Anchorage on eastern side of Tanera More	15-Aug-04	BJ
img172	315	n/a	199300	907500	Tanera More, Summer Isles	Fishfarm within The Anchorage on eastern side of Tanera More (1)	15-Aug-04	BJ
img173	70	n/a	199150	907600	Tanera More, Summer Isles	Fishfarm boat within The Anchorage on eastern side of Tanera More	15-Aug-04	BJ
img174	80	n/a	199170	907700	Tanera More, Summer Isles	Fishfarm barge within The Anchorage on eastern side of Tanera More	15-Aug-04	BJ
img175	40	n/a	199200	907800	Tanera More, Summer Isles	Fishfarm within The Anchorage on eastern side of Tanera More (2)	15-Aug-04	BJ
img176	60	n/a	199200	907800	Tanera More, Summer Isles	Fishfarm cages within The Anchorage on eastern side of Tanera More	15-Aug-04	BJ

Appendix 4 – Table A4–1 *(continued)*

Photo ID	Approx. dir (°)	Wpt.	Position NGR		General location	Title	Date	Taken by
img177	325	n/a	200900	909400	Badentarbat Bay	House on the northern shore of Badentarbat Bay	15-Aug-04	BJ
img178	325	n/a	200900	909400	Badentarbat Bay	House on the northern shore of Badentarbat Bay (close-up)	15-Aug-04	BJ
img179	35	n/a	200900	909400	Badentarbat Bay	View over rear of RHIB to sandy shore situated to the east of the pier at Badentarbat	15-Aug-04	BJ
img180	280	n/a	197650	908400	Eilean Fada Mor, Summer Isles	Seals lounging on intertidal algal covered rock	15-Aug-04	BJ
img181	160	n/a	197500	907700	Eilean Fada Mor, Summer Isles	Scottish Sea Farms fishfarm on east side of Eilean Fada Mor (1)	15-Aug-04	BJ
img182	85	n/a	197500	907700	Eilean Fada Mor, Summer Isles	Scottish Sea Farms fishfarm on east side of Eilean Fada Mor (2)	15-Aug-04	BJ
img183	180	n/a	197500	907700	Eilean Fada Mor, Summer Isles	Scottish Sea Farms fishfarm on east side of Eilean Fada Mor (3)	15-Aug-04	BJ
img184	165	n/a	197500	907700	Eilean Fada Mor, Summer Isles	Scottish Sea Farms fishfarm on east side of Eilean Fada Mor (4)	15-Aug-04	BJ
img185	n/a	n/a	197161	907488	Eilean Fada Mor, Summer Isles	Maerl in shallow water between Eilean Fada Mor and Tanera Beg	15-Aug-04	BJ
img186	n/a	n/a	197161	907488	Eilean Fada Mor, Summer Isles	Maerl bed below *Chorda filum* in shallow waters between Eilean Fada Mor and Tanera Beg	15-Aug-04	BJ
img187	n/a	n/a	197161	907488	Eilean Fada Mor, Summer Isles	Lions Mane jellyfish above maerl bed in shallow waters between Eilean Fada Mor and Tanera Beg	15-Aug-04	BJ
img188	n/a	n/a	197161	907488	Eilean Fada Mor, Summer Isles	*Asterias rubens* on maerl with *Chorda filum*	15-Aug-04	BJ
img189	n/a	n/a	197161	907488	Eilean Fada Mor, Summer Isles	A dark colouration *Cerianthus lloydii* in maerl gravel	15-Aug-04	BJ
img190	n/a	n/a	197161	907488	Eilean Fada Mor, Summer Isles	A pale colouration *Cerianthus lloydii* with *Corda filum* in live maerl and maerl gravel	15-Aug-04	BJ
img191	190	n/a	196500	903500	Summer Isles	View of small islands (Sgeirean Glasa, Carn Deas and Carn Iar) over bow of RHIB	15-Aug-04	BJ

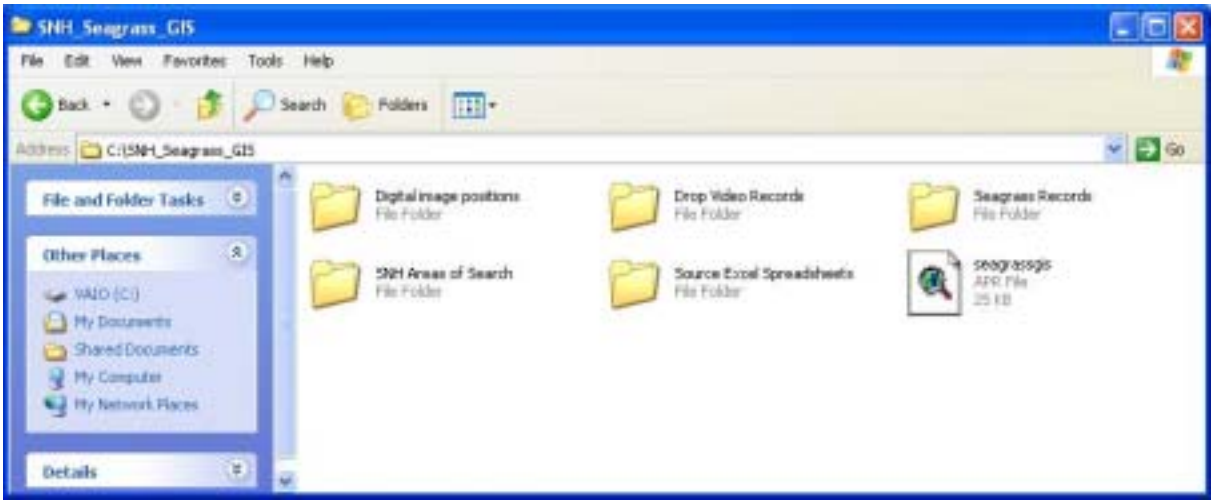
APPENDIX 5 – GIS project overview

A5 – 1 NW Scotland SNH Seagrass Survey 2004 – GIS Project Overview

Folder structure of GIS project supplied separately on CD.

A5 – 1.1 Main Folder: SNH_Seagrass_GIS

Contains five sub-folders and the main Arcview project file – 'seagrassgis.apr'. All files are projected in OSGB36 datum, in units of metres.



A5 – 1.1.1 Subfolder 1: Digital image positions

Contains the '***Digital_images.shp***' shapefile (and associated files – .dbf, .shx, .sbx, .sbn, .prj), a legend file *'images.avl'* (ascribes colours and fills to the shapefile) and the original source text file – '*NWS_Seagrass_Photos.txt*'. Point sample data for the 191 digital (mainly scenic surface) images taken during the survey. Information fields are described in more detail in Section A5 – 1.1.5 below (Source Excel Spreadsheets).

A5 – 1.1.2 Subfolder 2: Drop video records

Contains the '***Drop-video-sites.shp***' shapefile (and associated files – .dbf, .shx, .sbx, .sbn, .prj), a legend file '*drop video.avl*' (ascribes colours and fills to the shapefile) and the original source text file – '*DropVideo.txt*'. 56 drop-down video sites point sampling data. Information fields are described in more detail in Section A5 – 1.1.5 below (Source Excel Spreadsheets).

A5 – 1.1.3 Subfolder 3: Seagrass records

Contains the '***Seagrass_records.shp***' and '***Seagrass_beds_small_buffers.shp***' shapefiles (and associated files – .dbf, .shx, .sbx, .sbn, .prj as appropriate) and respective legend files *'seagrass sites.avl'* and *'seagrass_beds_small_buff.avl'* (ascribe colours and fills to the shapefiles).

Appendix 5 *(continued)*

The first of the two shapefiles '***Seagrass_records.shp***' is a point data subset of the drop-down video file – all sites where *Z. marina* seagrass was recorded (including the tentative record from Site 15). Associated information fields are as per the source '*Drop Video Data – GIS*' excel spreadsheet described in more detail in Section A5 – 1.1.5.

The '**Seagrass_beds_small_buffers.shp**' file is a manipulated sub-sample of this data (excluding Site 15) comprising polygon data for the four discrete seagrass 'beds' identified during the survey. Video footage and/or *in-situ* observations from three of the beds (each just a single point sample) enabled circular buffers of a known radius to be created around the sampling location (buffers of 12.5m, 1.5m and 5m for Sites 6, 44 and 45 respectively).

The boundary of the fourth bed (below Fraoch Eilean Mòr within Gruinard Bay) was mapped in shallow water using the drop-down video and the four individual point samples (Sites 16, 17, 18 and 23) joined using straight lines at a scale of 1:3,000.

The three 'buffered' polygons and the mapped boundary of the fourth seagrass bed were merged into a single shapefile with the following attributes:

Table A5 – 1 Attributes and their descriptions for the 'Seagrass_beds_small_buffers.shp' shapefile

Column	Description
FID	Unique data identifier – numbered 1 to 4 for the discrete seagrass 'beds'
Shape	Type of data – 'polygons'
BufferDist	Buffer distance – applicable to 3 of the 4 polygons. Radius in metres
Sites	Drop-down video sampling 'Sites' comprising each seagrass bed
Date_	Date
Bioto_0405	Biotope code as per Version 04.05 – all '*SS.SMP.SSgr.Zmar*'
Comments	Comments such as how area defined (from video, *in-situ* etc)
Area	Area of seagrass coverage in metres – polygon field calculation
Area_hecta	Area of seagrass coverage in hectares (*Area* field/10,000)
Area_m^2_	Area of seagrass coverage in square metres (square root of *Area* field)

A5 – 1.1.4 Subfolder 4: SNH Areas of Search

Contains the '***SNH_Areas_of_Search.shp***' shapefile (and associated files – .dbf, .shx, .sbx, .sbn, .prj), a legend file '*aos.avl*' (ascribes colours and fills to the shapefile) and the original source text file – '*SNH_Areas_of_Search.txt*'. Point sample data for the 26 areas of search identified by SNH prior to the commencement of the fieldwork element. Information fields are described in more detail in Section A5 – 1.1.5 below (Source Excel Spreadsheets).

Appendix 5 *(continued)*

A5 – 1.1.5 Subfolder 5: Source Excel Spreadsheet

Contains a single 'source' excel worksheet '***NW Scot Seagrass – GIS source data spreadsheets 121004.xls***' comprising three distinct sheets:

The three component spreadsheets contain the original source data used in the creation of the '***Drop-video-sites.shp***', '***Digital_images.shp***' and '***SNH_Areas_of_Search.shp***' shapefiles (the source for the imported '.txt' files).

The first two sheets are derived from the main sampling data spreadsheet (supplied on CD as an Annex to this report) and have been 'simplified' (removal of formatting and truncation of text) to facilitate import into the GIS.

The spreadsheet attributes are outlined on the following pages:

Table A5 – 2 Attributes and descriptions for the 'Drop Video Data – GIS' worksheet (within 'NW Scot Seagrass – GIS source data spreadsheets 121004.xls')

Column	Description
Wpt	Waypoint number from the RHIB dGPS
Site	Field Site number – corresponds to waypoint number
WGS84_Lat	Decimal degrees latitude in WGS84
WGS84_Long	Decimal degrees longitude in WGS84
OS_Code	National Grid two letter unique reference
Easting	Five figure grid reference to accompany the OS code in OSGB36
Northing	Five figure grid reference to accompany the OS code in OSGB36
X_Coord	Six figure grid reference in OSGB36
Y_Coord	Six figure grid reference in OSGB36
System	Sampling equipment eg drop-down video or other
Depth_BSL	Depth below sea level (in metres) at time of survey
Tidal_Corr	Tidal correction data in metres above Chart Datum – taken from port of Ullapool at 10 minute intervals – supplied by SNH and produced by TotalTide software
Depth_BCD	Corrected depth 'below chart datum' as positive numbers
Operators	Initials of staff member operating the drop-down video equipment. MS = Mark Stewart and BJ = Ben James
Date	Date (month, day, year)
Time_In	24-hour time at start of sampling in the field
Time_Out	24-hour time at end of sampling in the field
Video_no	SNH unique video coding for mini-DV videotapes
Vid_IN	Time code on videotape for start of sampling sequence
Vid_OUT	Time code on videotape at end of sampling sequence
Substrate	Broad categories of seabed substratum
Species	Conspicuous species visible on the video footage
Bio_complex	Generalised description of biotope complex
Bio_9706	MNCR biotope code (and alternatives considered) for main biotope. Version 97.06
Bio2_9706	MNCR biotope code (and alternatives considered) for any secondary biotope(s). Version 97.06
Bio_0405	MNCR biotope code (and alternatives considered) for main biotope. Version 04.05
Bio2_0405	MNCR biotope code (and alternatives considered) for any secondary biotope(s). Version 04.05
Comments	Any comments made whilst analysing the video footage or assigning biotope codes
Seagrass	Simple field to indicate the presence of seagrass (Y = Yes, N = No)

Appendix 5 *(continued)*

Table A5 – 3 Attributes and descriptions for the 'Still Image Catalogue – GIS' worksheet (within 'NW Scot Seagrass – GIS source data spreadsheets 121004.xls')

Column	Description
Image	Unique image reference number for 191 digital photographs (img01 – img191 supplied on CD accompanying this report)
Bearing	Approximate bearing of the image (estimated only and not recorded in the field). Does not apply to any vertical or sublittoral images
Wpt	Field sampling 'Site' waypoint – only applicable to those images taken from a video sampling location
Eastings	Six figure grid reference in OSGB36
Northings	Six figure grid reference in OSGB36
Spec_Gen	*S = Specific* – if the photograph location was recorded in the field using the RHIB dGPS **OR** *G = Generated* – applies to the majority of the images – general area noted in the field but the grid reference subsequently generated using the GIS
Location	General geographic location of photograph
Subject	Standardised SNH maritime group categories for photographs eg View
Title	Description of the photograph
Date	Date (month, day, year)
Taken_by	Initials of the photographer

Table A5 – 4 Attributes and descriptions for the 'SNH Areas of Search' worksheet (within 'NW Scot Seagrass – GIS source data spreadsheets 121004.xls')

Column	Description
Number	Unique identifier for 28 areas of search
Area_Search	Name/general location of the area of search
Sighting	One of four categories as assigned by SNH prior to commencement of the fieldwork – Confirmed, Caught in nets, Possible or Wash-up (refer to Table 3 of the main report)
Grid_reference	Six figure grid reference provided by SNH in OSGB36
OS_Code	National Grid two letter unique reference
X_Coord	Six figure grid reference in OSGB36
Y_Coord	Six figure grid reference in OSGB36

ANNEX

The material in this Annex has not been included in this report but may be consulted, by prior arrangement at:

Scottish Natural Heritage, 17 Pulteney Street, Ullapool, Wester Ross IV26 2U, or Scottish Natural Heritage Headquarters Library.