



COMMISSIONED REPORT

Commissioned Report No. 209

**Site Condition Monitoring: surveys of
lagoons in The Vadills Lagoon
Special Area of Conservation,
July–August 2003**

(ROAME No. F02AA409c)

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**Site Condition Monitoring: surveys of lagoons in the
Vadills Lagoon Special Area of Conservation: July–August 2003**

Commissioned Report No. 209 (ROAME No. F02AA409c)

Contractor: ERT (Scotland) Ltd

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Summary

ERT (Scotland) Ltd (ERT), was contracted by Scottish Natural Heritage (SNH) to undertake Contract no. AB(AA409)030434, Site Condition Monitoring: surveys of marine rocky environments and lagoons in the Papa Stour cSAC and The Vadills Lagoon cSAC.

The Vadills is a complex of interconnected lagoonal basins on the west coast of Shetland at the head of Brindister Voe, some 10km to the east of Papa Stour (Figure 1.1). The site is a candidate Special Area of Conservation (cSAC) under the EC Habitats Directive (92/43/EEC) on the basis of its Annex 1 habitat 'lagoons' (areas of shallow, coastal salt water, wholly or partially separated from the sea by sandbanks, shingle or rocks). The cSAC also encompasses The Vadills SSSI, notified for its lagoonal shores and tidal rapids.

The present contract was to initiate the monitoring of The Vadills cSAC, with the main emphasis being on establishing re-locatable monitoring stations and gathering field data from each station at a Marine Nature Conservation Review (MNCR) Phase 2 level of recording.

The survey was to include the elements described below.

In situ recording using divers or intertidal surveyors to:

- establish re-locatable transects to cover both lagoonal and tidal narrows features as a basis for survey and monitoring;
- record epibiota to MNCR Phase 2 level within spatially defined biological zones identified along the length of the transect;
- obtain a video and stills photographic record of:
 - a) the extent and distribution of substrata and habitats within each transect site, and
 - b) the extent and distribution of epibiota and biotopes within the same sites.

The methodologies adopted were based on those supplied in Annex A of the invitation to tender for this contract. MNCR protocols for Phase 2 survey were adopted for biological recording (Hiscock, 1996; 1998).

Survey work took place over the period 20 July–16 August 2003, and 11 transects were established and surveyed. Where possible, each transect extended across the littoral zone into the sublittoral, and sheltered

lagoonal transects as well as tidal narrows transects were studied. All transects were easily re-locatable and with evenly sloping terrain, extending for up to 100m from the supralittoral start point to the sublittoral end point.

- Altogether 18 biotopes were identified at the 11 transects surveyed, together with 121 taxa from shore work and 98 taxa from sublittoral recording. The most ubiquitous biotopes recorded were **LR.L.YG**, **SLR.F.Pel**, **SLR.F.Fspi**, **SLR.FX.AscX**, **SLR.FX.FserX** and **IMX.KSwMx.LsacX**, representative of very sheltered intertidal or shallow infralittoral marine environments. Biotopes of note included **SLR.FX.AscX.mac**, **IMS.Sgr.Rup**, **IMU.MarMu.AreSyn**, **CMU.Beg**, and of these only **IMU.MarMu.AreSyn** was found on more than one transect in the survey. Additional occurrences of **SLR.FX.AscX.mac** and **IMS.Sgr.Rup** were, however, recorded during additional exploratory searches made in the vicinity of some of the transects.
- Re-location of the transect start points in the future should be straightforward. The manner in which a transect has been laid out over a topographically varied sea bed can be difficult or impossible to reproduce, although the sea bed type in The Vadills is flat and very shallow which should simplify the task of recreating the transect (in terms of both distance and direction) in the future. Laying transect line across tidal narrows was difficult, so a solution was to suspend the line over the water. This could be difficult to reproduce in future surveys unless both end points of the transect can be relocated accurately.
- The basic format used in fieldwork recording worked well, but needs to be developed into a set of standard recording forms to ensure consistency and completeness in fieldwork recording, to ease the process of locating data subsequently, and to avoid duplication of effort. The use of the MNCR Site Forms and site-specific species checklists to record information is highly recommended.
- Good quality stills photographs from the sublittoral would have been useful in addition to the video footage in the data review, since the resolution of video is often not sufficient to be able to identify species.
- Overall, the benthic marine biological features of The Vadills are now fairly well known in descriptive terms. The semi-enclosed system is also generally held to be fragile and potentially more susceptible to agents of change than habitats on more exposed open coasts. However, little or nothing is known about the physical, hydrographic and chemical aspects of the marine environment and which (if any) are most influential in supporting species or biotopes of interest such as seagrass or holothurian beds. Bathymetry, tidal streams, salinity, oxygen saturation and sediment redox are examples of environmental parameters for which seasonal or one-off data would be useful in interpreting biological data and changes over time. Some of these might be easily or usefully incorporated into surveys or monitoring in the future.
- Similarly, if particular species such as seagrasses or *Ascophyllum nodosum* ecad *mackaii* are to be regarded as important in the cSAC in management terms, then these might usefully have their own monitoring programmes incorporating measures of distribution, density or condition as appropriate.
- The biotopes identified in the present survey are characteristic of the sheltered inner regions of sea lochs and lagoons, and all have been found in the cSAC during previous surveys.

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1 INTRODUCTION

ERT (Scotland) Ltd (ERT), was contracted by Scottish Natural Heritage (SNH) to undertake Contract no. AB(AA409)030434, Site Condition Monitoring: surveys of lagoons in The Vadills Lagoon cSAC. The Vadills is a complex of interconnected lagoonal basins on the west coast of Shetland at the head of Brindister Voe, some 10km to the east of Papa Stour (Figure 1.1). The site is a candidate Special Area of Conservation (cSAC) under the EC Habitats Directive (92/43/EEC) on the basis of its Annex 1 habitat 'lagoons' (areas of shallow, coastal salt water, wholly or partially separated from the sea by sandbanks, shingle or rocks). The cSAC also encompasses The Vadills SSSI, notified for its lagoonal shores and tidal rapids.

Marine biological survey of The Vadills started in 1987 when the Oil Pollution Research Unit undertook both littoral and sublittoral recording at sites in and around the lagoon system as part of a wider study of Shetland (Howson, 1988). Mapping of the shore and seabed habitats was first undertaken in 1993 (Bunker *et al.*, 1994) following which further broad scale survey and mapping of shore biotopes was carried out by Entec (Entec, 2000).

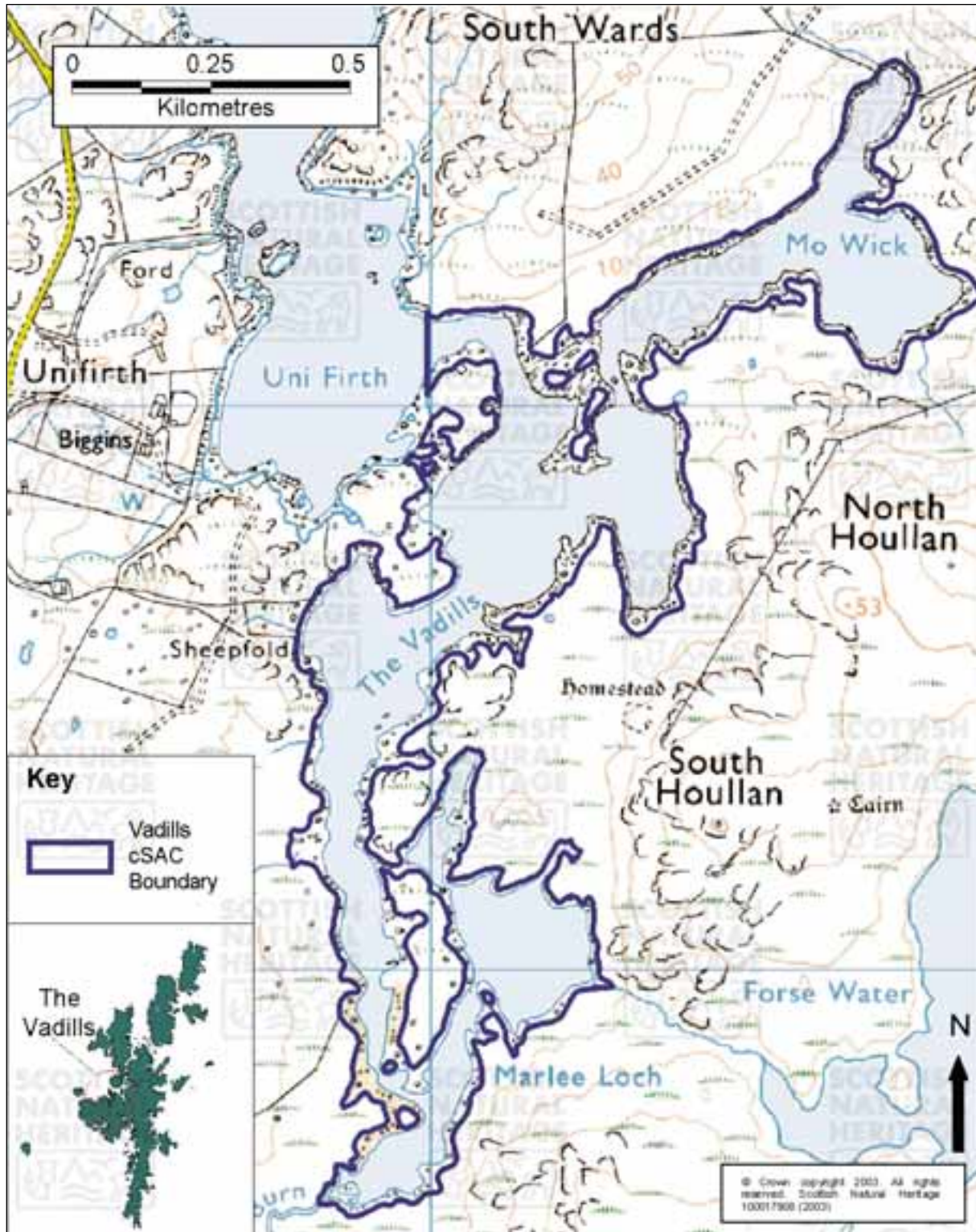
The lagoon system is extremely sheltered and is largely undisturbed by human activities. It consists of a number of shallow basins connected to each other by narrow channels. It encompasses a variety of environmental conditions ranging from brackish to fully marine, from still to fast-flowing water, and from soft, flocculent, peaty mud through coarse sediments (including maerl) to bedrock and boulders. There is a correspondingly wide range of communities, with a high diversity of species. Such diversity is unusual, given its northern location and relatively small size. The site supports several unusual species and communities. These include dense populations of the holothurians *Leptopentacta elongata* and *Leptosynapta inhaerens*, areas of the free-living fucoid alga *Ascophyllum nodosum* ecad *mackaii*, for which this is the only known location in Shetland, and the brittlestar *Ophiura affinis*, which is unusual in such shallow water. There are small areas of extremely sheltered littoral sediment, which support filamentous green and brown algae, and several beds of beaked tasselweed *Ruppia maritima*. Marlee Loch supports a bed of eelgrass *Zostera marina*. Shallow rock habitats here support sugar kelp *Laminaria saccharina*, whilst *L. hyperborea* and sea-oak *Halidrys siliquosa* occur in the channels where tidal streams are faster.

The present contract was to initiate the monitoring of The Vadills cSAC, with the main emphasis being on establishing re-locatable monitoring stations and gathering field data from each station at a Marine Nature Conservation Review (MNCR) Phase 2 level of recording.

The two principal objectives to the survey were as follows:

- establish an appropriate baseline biological dataset that will facilitate the assessment of the 'favourable condition' status of the lagoon interest feature in the cSAC in future monitoring studies;
- gather sufficient data for SNH to form a judgement on the current condition of the interest features of the site.

Figure 1.1 Location of The Vadills cSAC limits, Vadills site condition monitoring survey, July–August 2003



2 METHODS

2.1 Planning

The method devised for this study was developed from an outline plan set out by SNH in Annex A of the invitation to tender for this contract. The intended approach, for both intertidal and subtidal features, was to concentrate monitoring effort on re-locatable transects along which data could be collected at identifiable points. The survey was to include the following elements:

In situ recording using divers or intertidal surveyors to:

- establish re-locatable transects to cover both lagoonal and tidal narrows features as a basis for survey and monitoring;
- record epibiota to MNCR Phase 2 level within spatially defined biological zones identified along the length of the transect;
- obtain a video and stills photographic record of:
 - a) the extent and distribution of substrata and habitats within each transect site, and
 - b) the extent and distribution of epibiota and biotopes within the same sites.

The methodologies adopted were based on those supplied in Annex A of the invitation to tender for this contract. MNCR protocols for Phase 2 survey were adopted for biological recording (Hiscock, 1996; 1998).

Site selection was driven by several factors including the requirements outlined in the interagency common standards monitoring guidance for marine SACs, the desirability of selecting locations for which pre-existing survey data were available, and the need to reflect the environmental diversity of the interest features of the SAC. With the latter factor in mind, 11 areas of potential interest were selected in the cSAC with the outline objective of surveying a transect within each (Figure 2.1). In addition, it was intended that data collection reflect two broad habitat types known to be integral to the nature of The Vadills: the quiescent lagoonal regions, as well as the tidal narrows and rapids that provide links between lagoons and via which the whole system is connected to the marine environment.

Survey work took place over the period 20 July–16 August 2003, and the team was as follows:

Dan Harries	SNH, nominated Project Officer and diving surveyor
Graham Saunders	SNH, diving surveyor
Claire Dalgleish	ERT, diving surveyor
Robert Irving	SeaScope Marine Environmental Consultants, diving surveyor
Jenny Hill	JNCC, diving surveyor (21–27 July)
Louise Lieberknecht	JNCC, littoral surveyor (28 July–3 August)
David Connor	JNCC, diving surveyor (4–10 August)

An SNH 4.5m inflatable Zodiac was the main survey platform, and this was operated from the slip at Brindister Voe near the entrance to The Vadills system each day.

2.1.1 Littoral and sublittoral transect surveys

Altogether 11 transects were established and surveyed (Figure 2.2). Most of these occurred within one of the 11 potential regions of interest selected during planning and shown in Figure 2.1. Where possible, each transect was to extend across the littoral zone into the sublittoral. Actual transect locations were selected once on site. The aim was to select lagoonal transects as well as tidal narrows transects, all of which were easily re-locatable and with evenly sloping terrain, extending for up to 100m from the supralittoral start point to the sublittoral end point.

A fixed re-locatable point was created at the highest point of each transect (in the supralittoral), using a wooden stake hammered into the grass and with a small patch of high-durability oil-based paint on a neighbouring boulder or stone. The paint mark used was a black circle with a white spot in the centre. The co-ordinates of such points were established by GPS, in addition to which re-location photographs were taken of the site marker and any related reference features in the vicinity. A photograph of the whole transect was taken, which included a surveyor pointing to the wooden stake in the background with the buoy marking the end of the sublittoral transect.

2.1.2 Laying the transect lines

Lagoon transects

The start location of the transect was chosen and a measuring tape attached to the wooden stake marking the start point. From here the tape was un-reeled down the shore and a surveyor then snorkelled out into the lagoon, swimming on a bearing and also guided by an onlooker from the shore. A buoy was attached to the tape reel in order to mark the transect end point. This resulted in the transect line being gently laid on the seabed. Snorkellers were used for transect deployment rather than divers, to minimise disturbance to the site prior to survey and video work.

Tidal narrows transects

The start location of the transect was chosen and the measuring tape attached to the wooden stake marking the start point. From here the tape was reeled down the shore, across the tidal narrows using the inflatable, and up the adjacent shore where a second wooden stake (no paint mark) was installed to mark the other end. All the tidal narrows sites chosen were <100m across. The transect datum line at all tidal narrows transects (except for Mo Wick Narrows, TV03TN3) had to be laid high enough and tensioned sufficiently to remain just above sea level. The tidal currents were so strong through the narrows (in some cases there was no slack water) that when the line was laid in the water it was dragged off position by the flow. The water depth at these locations was shallow enough (approximately 2m) to allow the diver to see the distance marks on the line even when it was positioned above the surface.

Littoral survey

Once the transect was laid out, patterns of zonation down the shore were established, and the position of biotope boundaries, changes in substratum type and other shore features were noted by recording distance along the tape and the height above sea level. Height on the shore was measured in relation to sea level at a recorded time using a clinometer. A detailed record was then made of species abundance and substratum type within each zone or biotope, and within 2m either side of the tape. Species abundance

estimates were made in relation to a defined area rather than directly quoting a SACFOR abundance estimate. Where a species abundance record applied only to a specific sub-habitat such as boulder overhangs or crevices, then this was noted.

Photographs were taken as a permanent record of the transect and its biota as a whole, as well as adjacent areas of shore.

Species which could not be readily identified *in situ* were collected and preserved for later examination.

Sublittoral survey

The sublittoral survey was a continuation of the littoral and followed the same transect direction.

In practice, a single diver swam from the sublittoral fringe down towards the end of the sublittoral component of the transect. Occasionally, depending on the site (eg some lagoonal transects), the diver swam out to the end of the transect marked with the buoy and swam back to shore carrying out video work on the swim back. The video was carried out prior to any biological recording to ensure good visibility footage was obtained.

Following this a second pair of divers were deployed to carry out biological recording. Patterns of zonation along the transect were first established, and the position of biotope boundaries, changes in substratum type and other features were then noted by recording distance along the line and depth below sea level. Depth was measured in relation to sea level at a recorded time using the diver's computer. A detailed record was then made of species abundance and substratum type within each zone or biotope, and within 2m either side of the tape as described above for the littoral.

2.1.3 Photography

Recording at littoral transect sites was supplemented by digital stills photography. The stills photographic record was obtained using cameras equipped with flash, and the aim was to obtain images of the littoral sites within their shore context (also useful for re-location purposes), habitat/biotope views, and close-up views of the fauna and flora.

Video was used to record the extent and distribution of biotopes on the sublittoral component of the transects, using a digital video (mini DV format) in an underwater housing equipped with low-power LED lights. Additional footage of the shore or seabed was obtained where time and conditions permitted to illustrate the general character of the sites and any features of interest occurring between stations.

2.1.4 Equipment

Equipment for measuring and recording at littoral sites in The Vadills included:

Measuring tapes (100 and 30m; all-plastic construction); a negatively buoyant graduated line (100m) on a metal reel; a sighting compass; clinometer; recording slates or waterproof paper in a weatherwriter; wooden stakes (50cm); lump hammer; oil-based durable paint; removable plastic ties for securing the tape datum to stakes; digital cameras; digital video with underwater housing and low-power LED lights and two hand-held GPS units.

With the exception of sighting compasses, clinometers, levelling devices and weatherwriters, similar equipment was also used at sublittoral sites. Electronic dive timers or computers were used for depth measurement.

2.2 Analysis and reporting

2.2.1 During fieldwork

The basic characteristics of each transect (site name, position, height/depth, surveyors etc) were recorded on purpose-designed survey forms. In addition to this, neat versions of the physical measurements and the MNCR Phase 2 biological records were completed in a standard format. This included:

- records of the physical measurement data (positions, distances, bearings, heights/depths, time of recordings);
- neat near-scale drawings of the transects, (including the position of the tape datum);
- notes of times and heights/depths relative to sea level and to chart datum;
- a drawing of each lagoon or tidal narrows profile where biological recording was completed, indicating the extent of each zone or biotope with measurements, a brief description of each zone, and a species list for each zone with abundance data;
- a note of any specimens taken.

Specimens taken in the field were identified as far as possible, the record sheets amended accordingly, and any specimens requiring further work preserved and labelled.

The photographs and video taken each day were reviewed, and appropriate logs maintained. Photographs were downloaded each day and stored on laptop computer, to free up camera memory for the following day's work. Hand-held video footage was reviewed by the survey team to check for consistency with data sheets and between team members. All work that was transferred onto laptop computer was backed up onto CD-ROM at the end of each working day.

2.2.2 Post fieldwork

On return from fieldwork, all field data were copied or backed up, and a copy issued to SNH. Video footage taken on miniDV tape in the field, was copied for back-up purposes.

The biological data were reviewed for consistency, and checked against the photographic and video record, and the biotope codes finalised. The transect profiles drawn up during the fieldwork were also reviewed, and then scanned and digitised for subsequent presentation.

Specimens requiring further identification were identified as far as possible, and the record sheets again amended accordingly.

Figure 2.1 Areas of potential interest identified during survey planning, Vadills cSAC site condition monitoring, July–August 2003

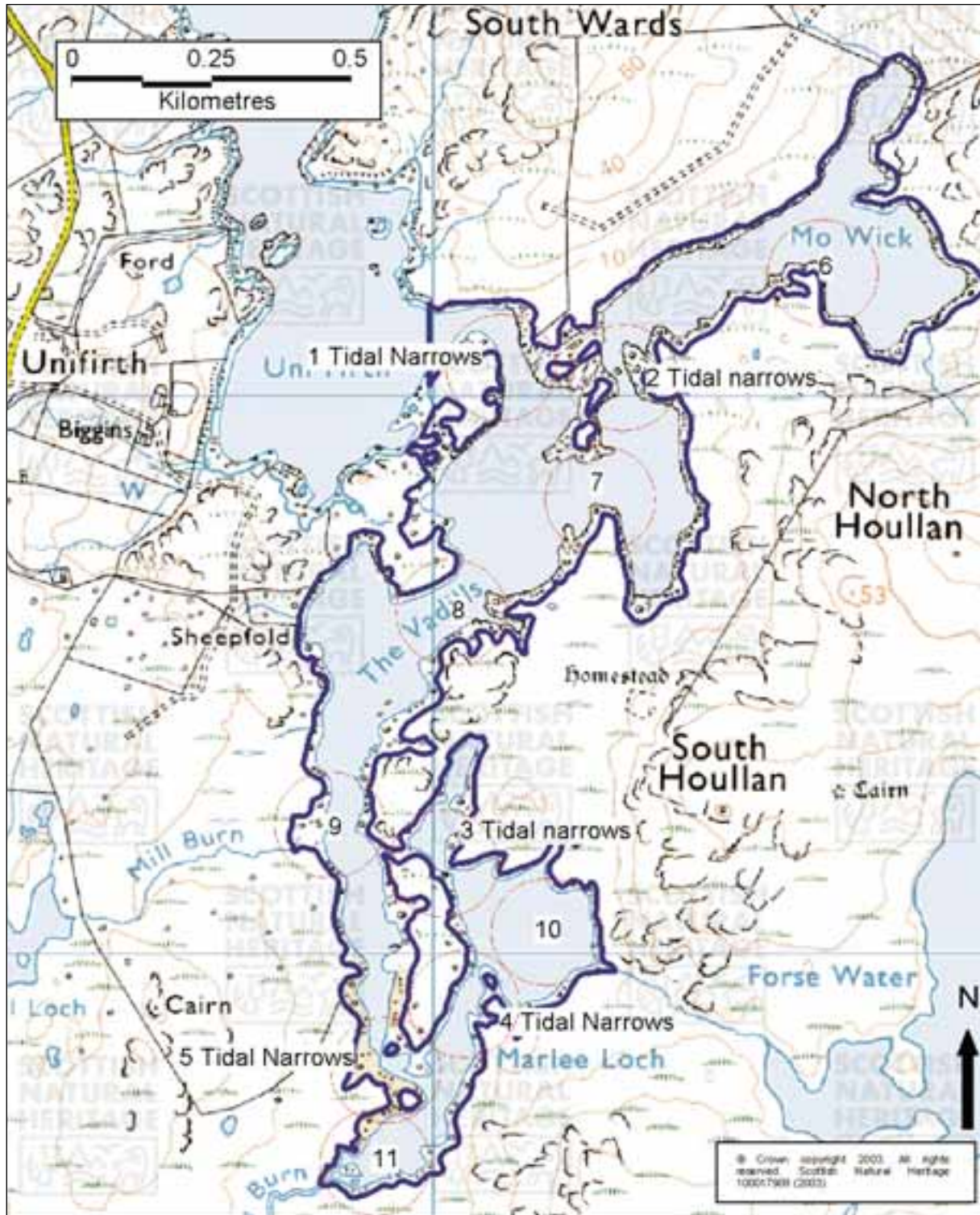
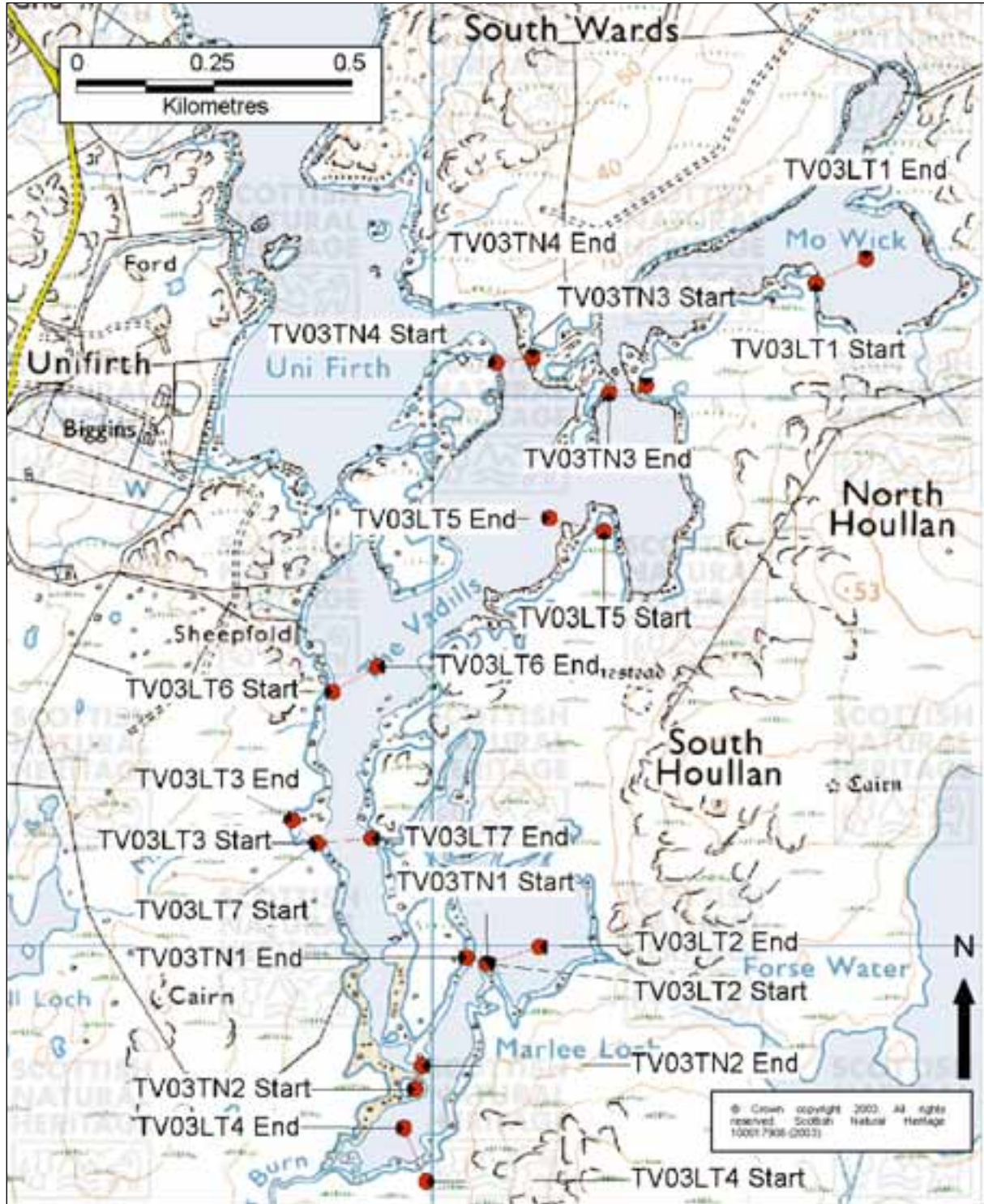


Figure 2.2 Location of site condition monitoring transects within The Vadills cSAC, July–August 2003



3 RESULTS

An inventory of lagoon and tidal narrows sites for The Vadills cSAC is provided in Appendix 1. Transect re-location data in the form of annotated maps, photographs, GPS records and notes, have been prepared in Appendix 2, and the transect profiles including physical measurements, salinity, zonation and biotope summaries are given in Appendix 3. Species abundance data for each station are tabulated in Appendix 4.

An overview of the survey data is presented first in Section 3.1, following which site descriptions (incorporating both physical and biological data) are presented in Section 3.2. Descriptive text for each site is accompanied by supporting tables and figures.

3.1 Data overview

A summary of the data obtained from each transect is shown in Table 3.1. Note that site numbering follows a system developed for SAC monitoring work, in which the survey location, year, and feature being surveyed are readily identifiable. In this case, the letters TV signify The Vadills cSAC, the number 03 stands for the year 2003, the letters LT or TN show that the feature being surveyed is either a lagoonal transect or a tidal narrows transect respectively, and the last number indicates the field site number.

The salinity measurements taken all varied within the very narrow range 34.5–35.5‰. The samples taken from either side (above and below) of a thermocline at TV03LT4 both proved to be 34.5‰. The deepest depth recorded in The Vadills system was 5m BSL. No tidal corrections were applied to depth readings obtained due to lack of data, and the obvious influence of the many rapids and narrow channels on the normal tidal rise and fall seen on the nearest open coast.

Altogether 18 biotopes were identified at the 11 transects surveyed (Table 3.2). Of these, most were readily identifiable using the 97.06 version of the biotope classification. Where difficulties were experienced in assigning a code to the data, this is indicated by a question mark against the code (eg ?SIR.Lag.FChoG). The reasons for any such problems are highlighted in the biotope tables for each transect in Appendix 3, and are also discussed in Section 3.1.1 below.

A complete list of the species or taxa found in the littoral and sublittoral zones from the transects is shown in Tables 3.3 and 3.4 respectively (abbreviated from the species-abundance matrix shown in Appendix 4). Overall, 121 taxa were identified from the littoral, whilst 98 taxa were recognised from sublittoral zones. Specimens of certain taxa were collected during fieldwork, most of which were readily identified using microscopes and keys at the survey accommodation. Certain species that were difficult to identify were preserved in a small collection for laboratory identification.

Good photographic and video coverage of the transects was obtained for the purpose of re-location in future surveys. Stills photography was only used above water, and video was used to obtain a sublittoral photographic record. The video footage was reviewed against the field record sheets and no discrepancies were noted.

3.1.1 Littoral data

The most ubiquitous biotopes found during the survey were **LR.L.YG**, **SLR.F.Pel**, **SLR.F.Fspi**, **SLR.FX.AscX** and **SLR.FX.FserX**, and this is a reflection of the consistently very sheltered conditions and uniform intertidal habitat types to be found throughout The Vadills system.

Shore zones were generally fucoid-dominated, and species of note recorded during this survey included *Ascophyllum nodosum* ead *mackaii* and *Fucus ceranoides*. Both species were found on the shore at Mill Burn (TV03LT3), and both were also recorded at one or two other locations close to other surveyed transects. These additional off-transect records, consisting of sketches and accompanying notes, are reproduced in Appendix 1.

3.1.2 Sublittoral data

Sublittorally, there was relatively little consistency in the biotopes being identified; the most ubiquitous was **IMX.KSwMx.LsacX**, found at six of the 11 transects studied. The Vadills shallows were thus characterised by algal-dominated biotopes, but one of the most interesting and unusual encountered was **IMU.MarMu.AreSyn** (found at TV03LT1 and TV03LT6). This was due to the prominence of holothurians, and the fact that *Leptosynapta inhaerens*, *Paracucumaria hyndmani* and *Leptopentacta elongata* were out on the sediment surface rather than concealed beneath it.

The seagrass *Ruppia maritima* was found at TV03LT4 (**IMS.Sgr.Rup**), whilst a *Beggiatoa*-dominated biotope (**CMU.Beg**) was identified at TV03LT7.

Table 3.1 Sites surveyed and summary of data collected, Vadills site condition monitoring survey, July–August 2003

Site no	Transect name	Transect type ¹	Littoral profile	Sublittoral profile	Number of biological zones	Littoral photo record	Sublittoral photo record
TV03LT1	Mo Wick	Littoral and sublittoral	Yes	Yes	7	Digital stills	Digital video
TV03LT2	Marlee Loch Basin	Littoral and sublittoral	Yes	Yes	5	Digital stills	Digital video
TV03LT3	Mill Burn	Littoral	Plan	n/a	12	Digital stills	n/a
TV03LT4	Head of The Vadills	Littoral and sublittoral	No	No	7	Digital stills	Digital video
TV03LT5	Outer Basin	Littoral and sublittoral	Yes	No	14	Digital stills	Digital video
TV03LT6	Vadills Middle Basin	Littoral and sublittoral	Yes	No	7	Digital stills	Digital video
TV03LT7	Vadills Inner Basin	Littoral and sublittoral	Yes	Yes	12	Digital stills	Digital video
TV03LTN1	Marlee Loch Narrows	Littoral and sublittoral	Yes	Yes	5	Digital stills	Digital video
TV03LTN2	Head of The Vadills Narrows	Littoral and sublittoral	Yes	Yes	7	Digital stills	Digital video
TV03LTN3	Mo Wick Narrows	Littoral and sublittoral	Yes	Yes	8	Digital stills	Digital video
TV03LTN4	Vadills Entrance Narrows	Littoral and sublittoral	Yes	Yes	14	Digital stills	Digital video

¹ At many transects, surveys of the lower littoral zones took place at times other than Low Water and were therefore surveyed by divers or snorkellers.

Table 3.2 List of biotopes identified and their distribution amongst the 11 littoral sites surveyed, Vadills site condition monitoring survey, July–August 2003

Number	Biotope	Transect ¹										
		TV03LT1	TV03LT2	TV03LT3	TV03LT4	TV03LT5	TV03LT6	TV03LT7	TV03LTN1	TV03LTN2	TV03LTN3	TV03LTN4
1	LR.L.YG	P	P	P	P	P	P	P	P	P	P	P
2	SLR.F.Pel	P	P	P	P	P	P	P	P	P	P	P
3	SLR.F.Fspi	P		P		P	P	P			P	
4	SLR.F.Asc											P
5	SLR.F.Asc.Asc						P					
6	SLR.F.Fserr											P
7	SLR.FX.AscX	P	P	P		P		P	P	P	P	
8	SLR.FX.AscX.mac			P								
9	SLR.FX.FserX	P	P			P	P	P	P	P	P	
10	SLR.FX.EphX				P	P						
11	MIR.KR.Lhyp.Tft											P
12	SIR.K.Lsac.T											P
13	¿SIR.Lag.FChoG										P	
14	IMS.Sgr.Rup				P							
15	IMU.MarMu.AreSyn	P					P					
16	CMU.Beg							P				
17	IMX.KSwMx.LsacX	P				P	P	¿			P	P
18	IMX.KSwMx.FiG		P						P			

¹ Site names as in Table 3.1.

Table 3.3 List of species/other categories identified and their distribution and maximum abundance (SACFOR scale) at the 11 littoral sites surveyed, Vadills site condition monitoring survey, July–August 2003

		TV03LT1	TV03LT2	TV03LT3	TV03LT4	TV03LT5	TV03LT6	TV03LT7	TV03LTN1	TV03LTN2	TV03LTN3	TV03LTN4
1	<i>Beggiatoa</i> sp.						P					
2	<i>Caloplaca marina</i>			○		○					F	
3	<i>Caloplaca</i> sp.			○	F							R
4	Yellow lichen	○	P						P*			
5	<i>Tephromela atra</i>						○					
6	<i>Lecanora gangaleoides</i>			F	P*	C		C			A	○
7	<i>Lecanora sulphurea</i>					R						○
8	<i>Lecanora</i> sp.									○		R
9	<i>Ramalina siliquosa</i>						R					○
10	<i>Ochrolechia parella</i>			F	P*		A			R		
11	Grey lichen	○	P						P*			
12	<i>Verrucaria maura</i>	F	C	A	A	A	A	A	P*	A	F	A
13	<i>Verrucaria mucosa</i>			○		R	F			F		P
14	<i>Lichina pygmaea</i>									R		
15	<i>Xanthoria parietina</i>						○					
16	Moss patches						○					
17	Grassy turf						F					
18	<i>Audouinella</i> sp.	P		S					P	R		
19	<i>Hildenbrandia rubra</i>					A				○	R	
20	Encrusting coralline alga					F					P	S
21	<i>Cystoclonium purpureum</i>									C		
22	<i>Furcellaria lumbricalis</i>	F	○				C			R		
23	<i>Chondrus crispus</i>	○				R	P				P	
24	<i>Mastocarpus stellatus</i>								P			
25	<i>Phyllophora pseudoceranoides</i>									○		
26	<i>Polyides rotundus</i>										P	
27	<i>Chylocladia verticillata</i>						P					
28	<i>Ceramium pallidum</i>									F		
29	<i>Ceramium</i> sp.										P	
30	<i>Polysiphonia lanosa</i>	C				○						
31	<i>Polysiphonia</i> sp.						P				P	
32	‡Red coralline crusts						P					C
33	Filamentous red alga indet.											S
34	<i>Ectocarpaceae</i> sp.								P		P	
35	‡Brown filamentous algae indet.										P	

Table 3.3 (continued)

	TV03LT1	TV03LT2	TV03LT3	TV03LT4	TV03LT5	TV03LT6	TV03LT7	TV03LTN1	TV03LTN2	TV03LTN3	TV03LTN4
36	?	Brown filamentous algae 2 indet.			○						
37		<i>Desmarestia aculeata</i>								P	
38	A	<i>Chorda filum</i>	C					A	A	S	
39		<i>Laminaria digitata</i>							P		
40		<i>Laminaria hyperborea</i>							P		
41		<i>Halidrys siliquosa</i>				P					
42	S	<i>Ascophyllum nodosum</i>	A	C	R	S	S	S	A	S	S
43		<i>Ascophyllum nodosum</i> ecad <i>mackaii</i>		S							
44		<i>Fucus ceranoides</i>		A							
45		<i>Fucus cottonii</i> *		○							
46	A	<i>Fucus serratus</i>	S		A	S	A	S	A	F	F
47		<i>Fucus spiralis</i>		C	R	A	A	A	F	F	A
48	F	<i>Fucus vesiculosus</i>	C	C	R	F	F		F		F
49		<i>Fucus</i> sp.					P				
50	C	<i>Pelvetia canaliculata</i>	C	C	R	A	A	S	F	C	A
51		<i>Enteromorpha</i> sp.			C					P	
52		<i>Ulva</i> sp.								○	
53	○	<i>Chaetomorpha</i> sp.									
54		<i>Cladophora rupestris</i>							C		
55	P	<i>Cladophora</i> sp.			A	A			R	P	P
56		Green filamentous algae	C		S	R	P	P	○	A	S
57		Green algal mat indet			P						
58		<i>Leucosolenia botryoides</i>			R						
59		<i>Leucosolenia</i> sp.						P	○	P	
60		<i>Halichondria panicea</i>			○				C	P	
61		<i>Halichondria</i> sp.	P					P		P	
62		<i>Dynamena pumila</i>						P	○		
63		<i>Obelia geniculata</i>							P		
64		Hydroids						P			
65		<i>Haliplanella lineata</i>							P		
66		<i>Arenicola marina</i>			P						
67	○	<i>Cirratulus cirratus</i>								A	
68		<i>Spirorbidae</i>	P		A	P				P	P
69	P	<i>Oligochaeta</i>									
70		<i>Verruca stroemia</i>			R						
71		<i>Balanus</i> sp.				P				P	P
72	F	Amphipods			R					A	

Table 3.3 (continued)

		TV03LT1	TV03LT2	TV03LT3	TV03LT4	TV03LT5	TV03LT6	TV03LT7	TV03LTN1	TV03LTN2	TV03LTN3	TV03LTN4
73	<i>Idotea granulosa</i>										P	
74	<i>Idotea</i> sp.										P	
75	<i>Ligia oceanica</i>	R				R				P	P	
76	Isopods	R										
77	Mysid shrimps	R	P		P							
78	<i>Crangon crangon</i>		P									
79	<i>Carcinus maenas</i>	F	C		O	O	F		P	A	C	
80	<i>Patella vulgata</i>					O					P	
81	<i>Patella</i> sp.						P					
82	<i>Littorina littorea</i>				P	R						
83	<i>Littorina mariae</i>	P				O						
84	<i>Littorina obtusata</i>	F	C			F	F				P	
85	<i>Littorina saxatilis</i>	C	A			A	P				C	P
86	<i>Melarhaphe neritoides</i>									P		
87	Rissoid indet.					P						
88	<i>Cingula trifasciata</i>					P					F	
89	<i>Cingula trifasciata</i> var <i>rupensis</i>										P	
90	<i>Nucella lapillus</i>	R				O			P	P	P	
91	<i>Mytilus edulis</i>					O	F				P	P
92	Anomiacea indet.					R						
93	<i>Filicrisia geniculata</i>										P	
94	<i>Alcyonidium gelatinosum</i>										P	
95	<i>Alcyonidium hirsutum</i>	P					P		P		P	
96	<i>Alcyonidium</i> sp.						P			S	P	
97	<i>Membranipora membranacea</i>									R		
98	<i>Flustrellidra hispida</i>	F				P					P	
99	<i>Bowerbankia gracillima</i>					P						
100	<i>Umbonula littoralis</i>										P	
101	<i>Cellepora pumicosa</i>										P	
102	<i>Antedon bifida</i>						P				P	
103	<i>Asterias rubens</i>	P					P				P	
104	<i>Henricia</i> sp.						P					
105	<i>Corella parallelogramma</i>		F									
106	<i>Asciidiella aspersa</i>	S	A				A		A			
107	<i>Asciidiella scabra</i>						C			F	P	C
108	<i>Asciidiella</i> sp. (strawberry squirts)		C						A			
109	<i>Botryllus schlosseri</i>	R					P		P		P	

Table 3.3 (continued)

		TV03LT1	TV03LT2	TV03LT3	TV03LT4	TV03LT5	TV03LT6	TV03LT7	TV03LTN1	TV03LTN2	TV03LTN3	TV03LTN4
110	<i>Botrylloides leachii</i>										P	
111	<i>Dendrodoa/Styella</i>										A	
112	<i>Anurida maritima</i>					S	C				S	
113	Red halocarid mites	F				R	P					P
114	Millipedes	C								P	P	
115	Spider					R						
116	Thysanura indet.						P					
117	<i>Taurulus bubalis</i>										P	
118	<i>Gasterosteus aculeatus</i>									P		
119	<i>Gobiusculus flavescens</i>	F										
120	<i>Pomatoschistus</i> sp.	C									P	
121	Pleuronectiformes (Juv)				P							

Table 3.4 List of species/other categories identified and their distribution and maximum abundance (SACFOR scale) at the ten sublittoral sites surveyed, Vadills site condition monitoring survey, July–August 2003

		TV03LT1	TV03LT2	TV03LT4	TV03LT5	TV03LT6	TV03LT7	TV03TN1	TV03TN3	TV03TN4
1	<i>Beggiatoa</i> sp.				C	F	R			
2	Encrusting coralline alga				C			C	R	S
3	<i>Cystoclonium purpureum</i>							P		
4	<i>Dilsea carnosa</i>									P
5	<i>Furcellaria lumbricalis</i>	C	P		O	A	A		R	
6	<i>Chondrus crispus</i>								R	
7	<i>Phyllophora</i> sp.	P								
8	<i>Polyides rotundus</i>	P			P				R	
9	<i>Gracilaria gracilis</i>	P								
10	? <i>Gracilaria</i> sp.				A					
11	<i>Lomentaria clavellosa</i>									P
12	Foliose red algae	P*								P
13	<i>Ectocarpaceae</i> sp.					P		P*		S
14	<i>Desmarestia aculeata</i>									P
15	<i>Asperococcus</i> sp.				P	P				
16	?Brown filamentous weed				S	P	A			F
17	?Brown filamentous algae 3 indet.				S					
18	<i>Sphacelaria plumosa</i>									P
19	<i>Chorda filum</i>	F	P		A	A	A		S	A
20	<i>Laminaria digitata</i>					P		A		
21	<i>Laminaria hyperborea</i>									A
22	<i>Laminaria saccharina</i>	A**			S	P			S	S
23	<i>Halidrys siliquosa</i>					C	P		O	F
24	<i>Ascophyllum nodosum</i>	R	O	O	A	P	P			
25	<i>Fucus serratus</i>	R	O	R	S	C	P	C	O	
26	<i>Fucus vesiculosus</i>		O	O						
27	<i>Furoid sporelings</i>								R	
28	<i>Enteromorpha</i> sp.			P	F				P	S
29	<i>Ulva</i> sp.					P				F
30	<i>Chaetomorpha</i> sp.	P							?C	
31	Green filamentous algae		S	S	P	P	S	P*		
32	Green algal mat indet		P	A			S			
33	<i>Ruppia maritima</i>			A						
34	<i>Leucosolenia</i> sp.						P			
35	<i>Cliona celata</i>									P

Table 3.4 (continued)

		TV03LT1	TV03LT2	TV03LT4	TV03LT5	TV03LT6	TV03LT7	TV03TN1	TV03TN3	TV03TN4
36	<i>Halichondria panicea</i>				C		P			
37	<i>Halichondria</i> sp.							A		P
38	<i>Hydractinia echinata</i>	P			F					
39	<i>Obelia geniculata</i>									P
40	<i>Priapulus caudatus</i>	P								
41	<i>Arenicola marina</i>	O		C	A	C	C	P	R	
42	Terebellidae				P					
43	<i>Pomatoceros triqueter</i>								P	A
44	Serpulidae sp.								P	
45	Spirobidae sp.				P					
46	<i>Balanus crenatus</i>				P					
47	Mysid shrimps	R	P	P			P			
48	<i>Crangon crangon</i>	O	P	P	P	∅P	P			
49	<i>Pagurus bernhardus</i>	O			S	P	P			P
50	<i>Hyas</i> sp.									P
51	<i>Macropodia rostrata</i>				P					
52	<i>Macropodia</i> sp.	P			F	P	P			P
53	<i>Cancer pagurus</i>									P
54	<i>Liocarcinus depurator</i>				P					
55	<i>Carcinus maenas</i>	C	O	F	C	C	C	C		F
56	<i>Gibbula cineraria</i>									P
57	<i>Tectura testudinalis</i>									P
58	<i>Littorina littorea</i>		P							
59	<i>Littorina obtusata</i>			A						
60	<i>Buccinum undatum</i>						P			P
61	<i>Acanthodoris pilosa</i>				R					
62	<i>Mytilus edulis</i>			P				A		
63	<i>Modiolus modiolus</i>								A	A
64	<i>Cerastoderma edule</i>			P						
65	<i>Macoma balthica</i>			P						
66	<i>Mya truncata</i>			P						P
67	<i>Alcyonidium hirsutum</i>							P		P
68	<i>Membranipora membranacea</i>									P
69	<i>Scrupocellaria reptans</i>				P					
70	Bryozoan crusts								P	
71	<i>Antedon bifida</i>				A	P	P			A
72	<i>Solaster endeca</i>				P					

Table 3.4 (continued)

		TV03LT1	TV03LT2	TV03LT4	TV03LT5	TV03LT6	TV03LT7	TV03TN1	TV03TN3	TV03TN4
73	<i>Crossaster papposus</i>									P
74	<i>Henricia sanguinolenta</i>								P	
75	<i>Henricia</i> sp.					P				P
76	<i>Asterias rubens</i>	P			O	P	P		P	P
77	<i>Ophiothrix fragilis</i>				C	P			P	A
78	<i>Paracucumaria hyndmani</i>					A				
79	<i>Leptopentacta elongata</i>	P								
80	<i>Leptosynapta inhaerens</i>	F				C				
81	<i>Clavelina lepadiformis</i>	O			P				P	P
82	<i>Lissoclinum perforatum</i>									P
83	<i>Ciona intestinalis</i>			P						
84	<i>Corella parallelogramma</i>	P	P		P		A		P	P
85	<i>Ascidia aspersa</i>	A	A		A	A		A	P	A
86	<i>Ascidia scabra</i>	P		C	C	P	S		P	C
87	<i>Ascidia</i> sp. (strawberry squirts)		A					A		
88	<i>Ascidia virginea</i>	P								
89	<i>Botryllus schlosseri</i>						P		P	P
90	<i>Botrylloides leachii</i>								P	P
91	<i>Gasterosteus aculeatus</i>				P					
92	Pipefish indet.		P			P	P			
93	<i>Centrolabrus exoletus</i>								P	
94	<i>Pholis gunnellus</i>								P	
95	Gobiidae indet		P							
96	<i>Gobiusculus flavescens</i>				P				P	
97	<i>Pomatoschistus</i> sp.			F	C	A	P			
98	Pleuronectiformes (Juv)				P					

3.2 Site descriptions

3.2.1 Mo Wick, TV03LT1

The location of the Mo Wick transect, TV03LT1 is indicated in Figure 3.1, and a photograph of the transect is shown in Figure 3.2. Diagrams illustrating the transect profile are shown in Figure 3.3. Transect statistics are summarised in Table 3.5 and biotope information is detailed in Table 3.6 and Figure 3.3.

Physical description

Mo Wick is the northernmost of the lagoonal basins making up The Vadills system, and TV03LT1 projects from the southern shore north-east towards the centre of the basin. The shore aspect is north-east, and the transect extended from the supralittoral approximately half way across the very sheltered lagoon. From the low-lying cropped grassland surrounding Mo Wick, the shore sloped gently towards the water with an intertidal zone approximately 12m wide. In the sublittoral the sea bed was almost flat, eventually reaching a depth of 2.6m BSL at 100m distance near the centre of the basin. The substratum for the most part consisted of angular small boulders, cobbles and pebbles with areas of gravel in the eulittoral. Subtidally, there was a layer of silt over the stones which became thicker with distance offshore. Over the outer 50m or so of the transect, the sea bed was a soft, flocculent and anoxic mud that was noticeably warmer than the overlying water.

Habitats and communities

In the intertidal zone the biological zonation was typical of sheltered conditions, progressing from yellow, grey and black lichens in the supralittoral through narrow bands of *Pelvetia canaliculata* and *Fucus spiralis* in the upper eulittoral to a wider zone of the furoid *Ascophyllum nodosum* in the mid and lower eulittoral between 5.7m and 16m on the tape. The coarse sand and gravelly sediment beneath furoid-covered boulders and cobbles supported oligochaetes and the cirratulid polychaete *Cirratulus cirratus*.

In the lower eulittoral, the muddy pebble and gravel substratum was dominated by a belt of *Fucus serratus* in which *Chorda filum* and *Furcellaria lumbricalis* were also prominent. The ascidians *Ascidella aspersa* and *Botryllus schlosseri* were the most abundant animals present, these growing on or encrusting much of the algae. From 20–43m on the tape there was a wide and shallow sublittoral fringe of pebbles overlain by thick silt that was overgrown by a mixture of cape form *Laminaria saccharina*, *C. filum* and *F. lumbricalis*. An understory of red algae included *Gracilaria gracilis*, *Polyides rotundus* and *?Phyllophora* sp., and the algae provided a substratum for locally dense populations of *A. aspersa*. Beyond 43m on the tape and out towards the centre of the shallow basin, the sea bed of soft flocculent mud supported few algae and was instead characterised by burrowing holothurians such as *Leptopentacta elongata* and *Leptosynapta inhaerens*. Many of these animals were lying on the open surface of the mud. A core sample taken within this zone yielded one specimen of the priapulid *Priapulid caudatus*.

Figure 3.1 Map showing location of Mo Wick transect (TV03LT1), Vadills site condition monitoring survey, July–August 2003



Figure 3.2 Photograph showing location of Mo Wick transect (TV03LT1), Vadills site condition monitoring survey, July–August 2003



Figure 3.3 Diagram of transect and biotope distribution in Mo Wick transect (TV03LT1), Vadills site condition monitoring survey, July–August 2003

Upper diagram – littoral transect
 Lower diagram – complete transect

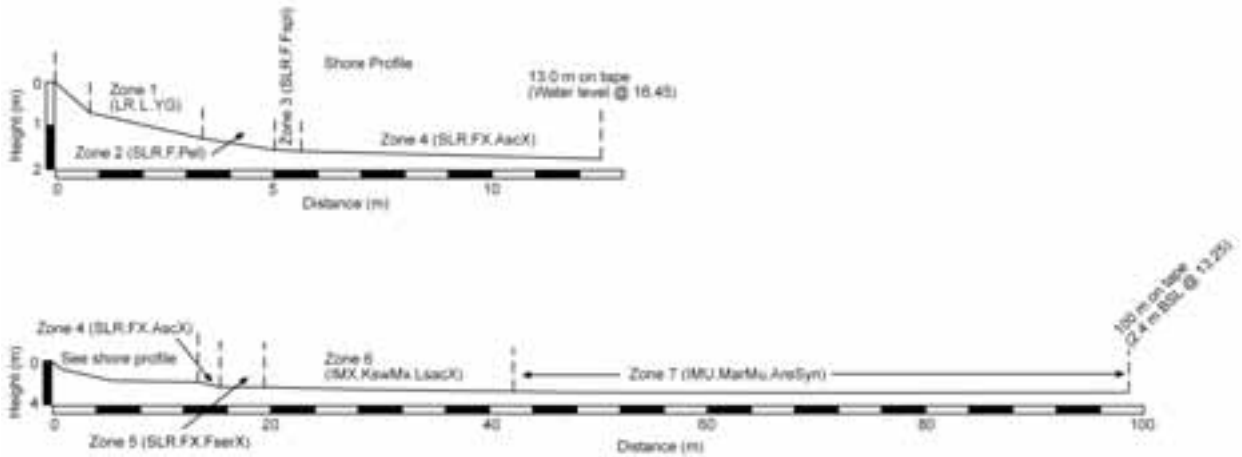


Table 3.5 Summary statistics for Mo Wick transect (TV03LT1), Vadills site condition monitoring survey, July–August 2003

Lagoon transect name	Mo Wick
Transect number	TV03LT1
Type/name of transect	Littoral and sublittoral
Position of transect start point on shore	HU 29696, 56206
Position of transect end point	HU 29787, 56251
Aspect and exposure	North-east (065° magnetic); very sheltered
Transect length	100m
Biotopes	Littoral – 4 zones/4 biotopes; sublittoral – 3 zones/3 biotopes

Table 3.6 Biotope data for Mo Wick transect (TV03LT1), Vadills site condition monitoring survey, July–August 2003

Zone	Biotopes	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 1.1–3.7m on tape (0.5–1.0m ASL, 1645 BST 01/08/03)	Very sheltered cobbles, small boulders and pebbles	Patchy cover of yellow and grey lichens with <i>Verrucaria maura</i> on the larger boulders and cobbles
2	SLR.F.Pel	Littoral fringe; 3.7–5.4m on tape (0.3–0.5m ASL, 1645 BST 01/08/03)	Very sheltered angular pebbles and gravel with occasional cobbles	Dominated by <i>Pelvetia canaliculata</i> , with lesser cover of <i>Verrucaria maura</i> and subsidiary mobile fauna.
3	SLR.F.Fspi	Upper eulittoral; 5.4–6.0m on tape (0.2–0.3m ASL, 1645 BST 01/08/03)	Very sheltered pebbles and gravel	Dominated by <i>Fucus spiralis</i> , with lesser cover of <i>Pelvetia canaliculata</i>
4	SLR.FX.AscX	Mid eulittoral; 6.0–16m on tape (0.2m ASL – 1.5m BSL, 1645 BST 01/08/03)	Very sheltered coarse sand, pebbles and gravel, with occasional cobbles and small boulders	Dominated by <i>Ascophyllum nodosum</i> and <i>Fucus vesiculosus</i> , with understorey of red algae
5	SLR.FX.FserX	Lower eulittoral; 16–20m on tape (~1.5m BSL, 1400 BST 01/08/03)	Very sheltered pebbles and gravel with silty mud	Main cover of <i>Fucus serratus</i> , with <i>Ascophyllum nodosum</i> , <i>Chorda filum</i> and <i>Furcellaria lumbricalis</i> . Epiphytic fauna of solitary and colonial ascidians
6	IMX.KSwMx.LsacX	Infralittoral mixed sediments; 20–43m on tape (1.5–2.0m BSL, 1350 BST 01/08/03)	Very sheltered pebbles thickly overlain by mud and silt	Characterised by <i>Chorda filum</i> , but with patches of dense <i>Furcellaria lumbricalis</i> and <i>Laminaria saccharina</i> (cape form)
7	IMU.MarMu.AreSyn	Infralittoral mud; 43–100m on tape (2.0–2.6m BSL, 1335 BST 01/08/03)	Very sheltered soft flocculent mud, anoxic below surface	Occasional clumps of ?free-living <i>Furcellaria lumbricalis</i> (with ascidians), <i>Fucus serratus</i> and <i>Laminaria saccharina</i> . Mobile crustaceans on sediment surface. Infauna included <i>Leptosynapta inhaerens</i> , <i>Leptopentacta elongata</i> and <i>Priapulid caudatus</i>

3.2.2 Marlee Loch Basin, TV03LT2

The location of the Marlee Loch Basin transect, TV03LT2 is indicated in Figure 3.4, and a photograph of the transect is shown in Figure 3.5. Diagrams illustrating the transect profile are shown in Figure 3.6. Transect statistics are summarised in Table 3.7 and biotope information is detailed in Table 3.8 and Figure 3.6.

Physical description

Marlee Loch is the southernmost of the lagoonal basins making up The Vadills system, and is itself split into three sections; a southern section which connects to the rest of The Vadills, a middle section and a small northern pool. TV03LT2 is located on the southern shore of the central basin. The shore aspect is north-east, and the transect extends from the supralittoral approximately half way across the very sheltered lagoon. From the grassland backing the transect, there is a small steep drop to the top of the shore beyond which the profile slopes gently towards the lower eulittoral in which there is another short steep drop into the sublittoral fringe. Overall, the intertidal zone is approximately 12m wide, and consists predominantly of small angular cobbles, pebbles and gravel. In the sublittoral the sea bed was almost flat, eventually reaching a depth of 1.3m BSL at 100m distance near the centre of the basin. The substratum offshore for the most part consisted of soft flocculent mud. The salinity in the centre of the basin was measured at 35‰.

Habitats and communities

In the intertidal zone the biological zonation progressed from yellow, grey and black lichens in the supralittoral (2–4.5m on tape) through a narrow band of *Pelvetia canaliculata* with a small amount of *Fucus spiralis* in the upper eulittoral (4.5–7m on tape) to a wider zone of *Ascophyllum nodosum* on mixed substrata in the mid and lower eulittoral between 7m and 13m on the tape. As in Mo Wick, the algae provided a substratum for several ascidian species including *Asciidiella aspersa*, *Asciidiella* sp. ('strawberry squirts') and *Corella parallelogramma*. The lower eulittoral zone was narrow (approximately 2.5m wide) and included a steep muddy slope of boulders and silty gravel, supporting a dense growth of *Fucus serratus*, together with *Chorda filum* and a mat of filamentous green algae.

From 15.5m on the tape and out towards the centre of the shallow basin at 100m, the sea bed of soft flocculent mud in the sublittoral fringe supported a dense growth of filamentous green algae. The only other algae within this part of the transect were drift specimens of *F. serratus*, *F. vesiculosus*, *A. nodosum*, *C. filum* and *Furcellaria lumbricalis*. Whether these unattached algae were dead or dying, or were loose-lying and living and a feature of such sheltered conditions is unknown. A core sample taken within this zone yielded no macrofauna, but contained many fragments of grass. Whether the grass fragments represented the remnants of a former seagrass bed in the basin, or whether they are accumulated debris from elsewhere is not known.

Snorkel swims across the full width of this lagoonal basin revealed no extant seagrass beds, and indicated that the much of the basin is likely to be similar to the outer half of the transect sampled (sketch plan and notes reproduced in Appendix 1 Figure 2).

Figure 3.4 Map showing location of Marlee Loch Basin transect (TV03LT2), Vadills site condition monitoring survey, July–August 2003

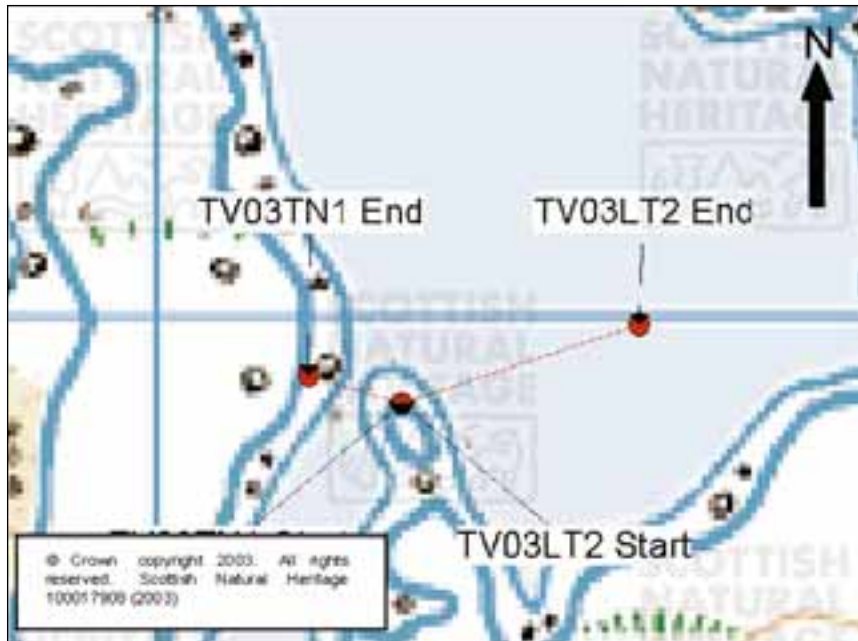


Figure 3.5 Photograph showing location of Marlee Loch Basin transect (TV03LT2), Vadills site condition monitoring survey, July–August 2003



Figure 3.6 Diagram of transect and biotope distribution in Marlee Loch Basin transect (TV03LT2), Vadills site condition monitoring survey, July–August 2003

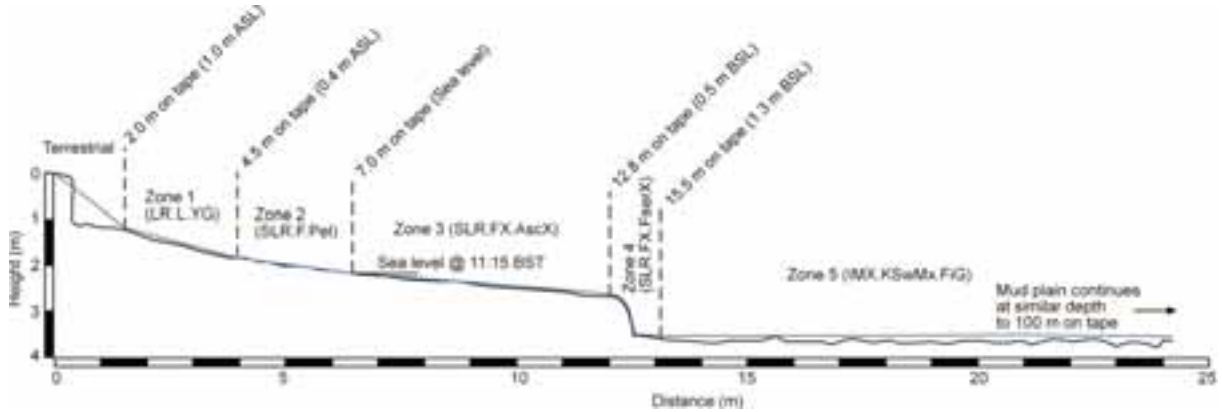


Table 3.7 Summary statistics for Marlee Loch Basin transect (TV03LT2), Vadills site condition monitoring survey, July–August 2003

Lagoon transect name	Marlee Loch Basin
Transect number	TV03LT2
Type/name of transect	Littoral and sublittoral
Position of transect start point on shore	HU 29112, 54942
Position of transect end point	HU 29193, 54998
Aspect and exposure	North-east (067° magnetic); very sheltered
Transect length	100m
Biotopes	Littoral – 4 zones/4 biotopes; Sublittoral – 1 zones/1 biotope

Table 3.8 Biotope data for Marlee Loch Basin transect (TV03LT2), Vadills site condition monitoring survey, July–August 2003

Zone	Biotopes	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 2–4.5m on tape (0.4–1.0m ASL, 1115 BST 02/08/03)	Sheltered angular pebbles and cobbles	Sparse cover of yellow and grey lichens and <i>Verrucaria maura</i>
2	SLR.F.Pel	Mid to upper eulittoral; 4.5–7.0m on tape (0.0–0.4m ASL, 1115 BST 02/08/03)	Sheltered angular cobbles, pebbles and gravel	Mostly bare, but main cover of <i>Pelvetia canaliculata</i> , <i>Verrucaria maura</i> and some <i>Fucus spiralis</i>
3	SLR.FX.AscX	Mid to lower eulittoral; 7.0–12.8m on tape (0.0–0.5m BSL, 1115 BST 02/08/03)	Very sheltered muddy angular pebbles, with some cobbles and small boulders	Algal-dominated, mainly by <i>Ascophyllum nodosum</i> ; also with <i>Fucus vesiculosus</i> and <i>F. serratus</i>
4	SLR.FX.FserX	Lower eulittoral and sublittoral fringe; 12.8–15.5m on tape (0.5–1.3m BSL, 1115 BST 02/08/03)	Very sheltered steep slope of boulders and silty gravel	Dominated by <i>Fucus serratus</i> . Dense fauna mainly of solitary ascidians and <i>Carcinus maenas</i>
5	IMX.KSwMx.FiG	Infralittoral mud; 15.5–100m on tape (1.1–1.4m BSL, 1115 BST 02/08/03)	Very sheltered and very soft flocculent mud	Almost total cover of filamentous green alga, with occasional patches of drift algae. Main fauna of solitary ascidians. No infauna seen in core samples

3.2.3 Mill Burn, TV03LT3

The location of the Mill Burn transect, TV03LT3 is indicated in Figure 3.7, and a photograph of the transect is shown in Figure 3.8. Diagrams illustrating the plan view of the transect are shown in Figure 3.9. Transect statistics are summarised in Table 3.9 and biotope information is detailed in Table 3.10 and Figure 3.9.

Physical description

Mill Burn is a stream entering the main Vadills basin from the west, which has created a relatively wide and expansive intertidal bay. Although the shore aspect is easterly, the transect TV03LT3 is entirely littoral and takes a north-westerly heading across the beach and the entry point of the Mill Burn. From a low-lying cropped grass and moorland backing, the shore slopes gently towards a flat eulittoral area. The bay is fringed in the supralittoral with boulders, cobbles, pebbles and some bedrock, but the substratum for the most part consists of angular cobbles and pebbles becoming more gravelly and muddy in the eulittoral.

Habitats and communities

The first 13m of TV03LT3 crossed supralittoral yellow and grey lichens, a band of *Pelvetia canaliculata* and *Verrucaria maura*, and then a 4m-wide zone of *Fucus spiralis* and *P. canaliculata*. Between 13m and 55.5m on the survey tape, ie the central area of the bay, the mixed substrata were covered in *Ascophyllum nodosum* and *A. nodosum* ecad *mackaii*. Also prominent were the wracks *Fucus vesiculosus* and *F. ceranoides*. The latter species was particularly abundant in zones 6 and 7 on the transect, between 34.5–41.5m, and wider inspection showed that the occurrence of *F. ceranoides* coincided closely with the path taken across the shore by the Mill Burn. From approximately 53m on the tape, the substratum was starting to slope gently upwards towards the opposite edge of the bay, and both *F. spiralis* and then *Pelvetia canaliculata* became more noticeable amongst the *Ascophyllum*. The upper shore zone characterised by *P. canaliculata* and the supralittoral yellow and grey lichen zone occurred between 55.5m and the end of the transect at 59m.

A further bed of *A. nodosum* ecad *mackaii* was found near Mill Burn, and its perimeter was recorded with GPS waypoints (Appendix 1 Figure 3). An additional overview sketch plan and species notes for Mill Burn bay is shown in Appendix 1 Figure 4.

Figure 3.7 Map showing location of Mill Burn transect (TV03LT3), Vadills site condition monitoring survey, July–August 2003

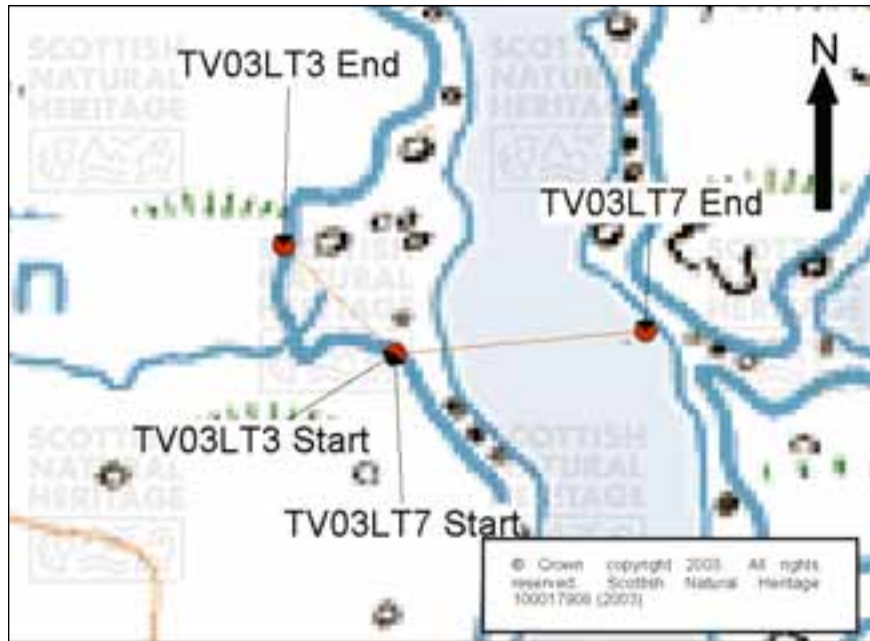


Figure 3.8 Photograph showing location of Mill Burn transect (TV03LT3), Vadills site condition monitoring survey, July–August 2003



Figure 3.9 Diagram of transect and biotope distribution in Mill Burn transect (TV03LT3), Vadills site condition monitoring survey, July–August 2003

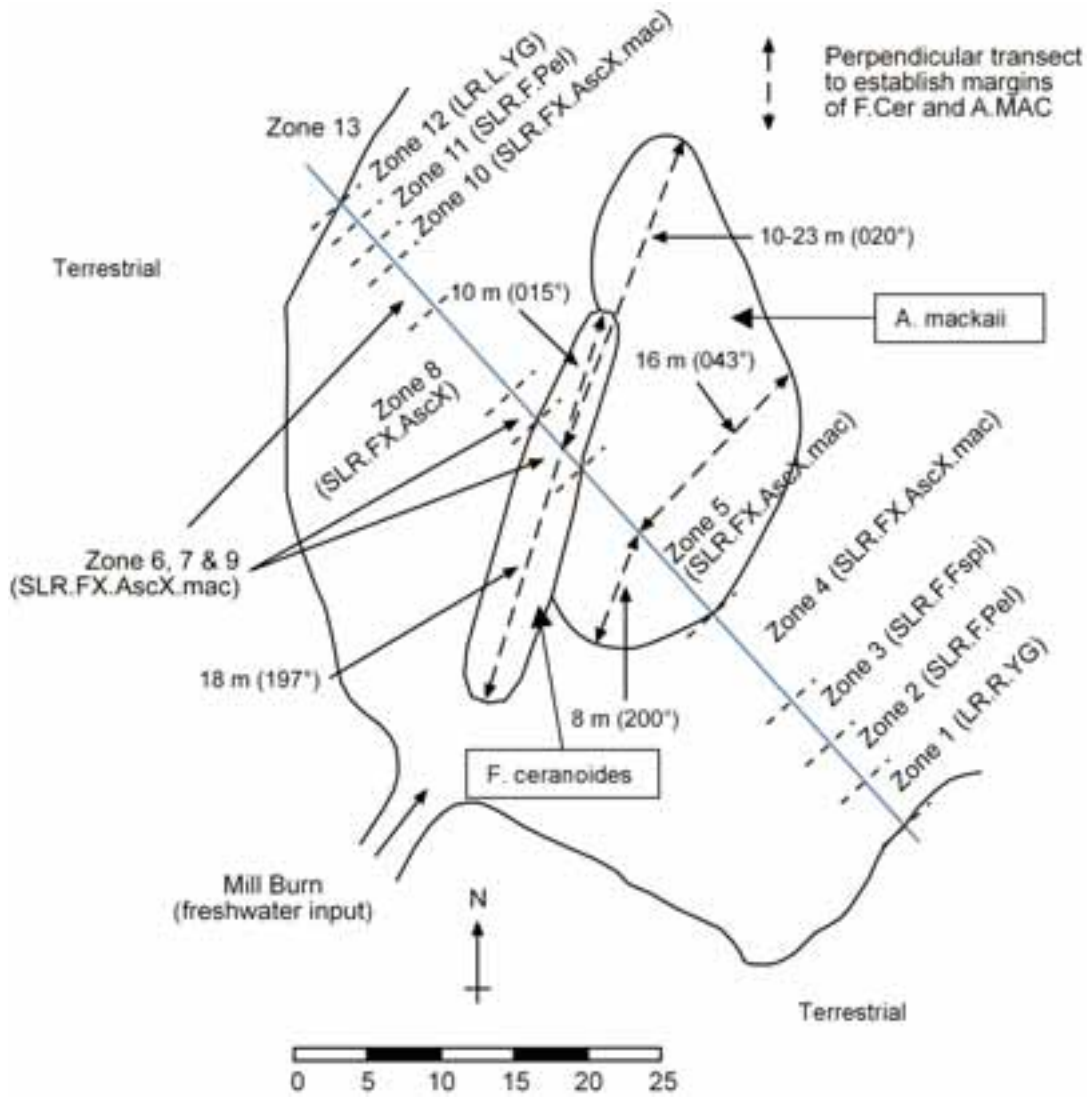


Table 3.9 Summary statistics for Mill Burn transect (TV03LT3), Vadills site condition monitoring survey, July–August 2003

Lagoon transect name	Mill Burn
Transect number	TV03LT3
Type/name of transect	Littoral
Position of transect start point on shore	HU 28788, 55167
Position of transect end point	HU 28743, 55214
Aspect and exposure	North-west (319° magnetic); very sheltered
Transect length	100m
Biotopes	Littoral – 12 zones/4 biotopes

Table 3.10 Biotope data for Mill Burn transect (TV03LT3), Vadills site condition monitoring survey, July–August 2003

Zone	Biotopes	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 1.5–5.5m on tape	Sheltered angular pebbles, cobbles and boulders with some bedrock.	Mainly <i>Verrucaria maura</i> , with additional cover of <i>Caloplaca</i> sp., <i>Ochrolechia parella</i> and <i>Lecanora ?gangaleoides</i>
2	SLR.F.Pel	Mid to upper eulittoral; 5.5–9.0m on tape	Sheltered angular cobbles and pebbles.	Main cover of <i>Verrucaria maura</i> with <i>Pelvetia canaliculata</i> , and some <i>Fucus cottonii</i> (= <i>F. muscooides</i>)
3	SLR.F.Fspi	Upper eulittoral; 9.0–13.0m on tape	Sheltered angular cobbles and pebbles.	Dominated by <i>Fucus spiralis</i> , with lesser cover of <i>Pelvetia canaliculata</i>
4	SLR.FX.AscX.mac	Mid to lower eulittoral; 13.0–21.0m on tape	Sheltered angular cobbles and pebbles	Algal-dominated (~60%), mainly by <i>Ascophyllum nodosum</i> and <i>A. nodosum</i> ecad <i>mackaii</i> . Other main cover from <i>Fucus vesiculosus</i>
5	SLR.FX.AscX.mac	Mid to lower eulittoral; 21.0–34.5m on tape	Sheltered angular cobbles and pebbles.	Algal-dominated (~100%), mainly by <i>Ascophyllum nodosum</i> ecad <i>mackaii</i> . Cover also from <i>A. nodosum</i> and <i>Fucus vesiculosus</i>
6	SLR.FX.AscX.mac	Mid to lower eulittoral; 34.5–39.0m on tape	Sheltered angular cobbles and pebbles.	Algal-dominated, mainly by <i>Ascophyllum nodosum</i> ecad <i>mackaii</i> (~30%) and <i>Fucus ceranoides</i> (~50%). Cover also from <i>A. nodosum</i>
7	SLR.FX.AscX.mac	Mid to lower eulittoral; 39.0–41.5m on tape	Sheltered gravel and pebbles	Substratum mostly bare, with sparse cover of <i>Ascophyllum nodosum</i> ecad <i>mackaii</i> and <i>Fucus ceranoides</i>
8	SLR.FX.AscX	Mid to lower eulittoral; 41.5–49.5m on tape	Sheltered gravel and pebbles with large boulders	Algal-dominated, mainly by <i>Ascophyllum nodosum</i> , <i>Pelvetia canaliculata</i> and <i>Fucus spiralis</i>
9	SLR.FX.AscX.mac	Mid to lower eulittoral; 49.5–53.5m on tape	Sheltered muddy gravel and pebbles	Dominated by a turf of <i>Audouinella</i> sp. Also with <i>Ascophyllum nodosum</i> ecad <i>mackaii</i> , <i>Fucus vesiculosus</i> and <i>A. nodosum</i>
10	SLR.FX.AscX.mac	Mid eulittoral; 53.5–55.5m on tape	Sheltered small cobbles and pebbles	Characterised by mixed fucoids with <i>Ascophyllum nodosum</i> ecad <i>mackaii</i> , <i>Fucus vesiculosus</i> and <i>F. spiralis</i>
11	SLR.F.Pel	Mid to upper eulittoral; 55.5–57.5m on tape	Sheltered angular cobbles and boulders.	Main cover of <i>Verrucaria maura</i> with <i>Pelvetia canaliculata</i> , and some <i>V. mucosa</i>
12	LR.L.YG	Supralittoral; 57.5–59.m on tape	Sheltered boulders and bedrock	Sparse <i>Lecanora ?gangaleoides</i> and <i>Caloplaca</i> sp.

3.2.4 Head of The Vadills, TV03LT4

The location of the Head of The Vadills transect, TV03LT4 is indicated in Figure 3.10, and a photograph of the transect is shown in Figure 3.11. Biotope information is detailed in Table 3.12.

Physical description

TV03LT4 is located in the southernmost basin of Marlee Loch on the south shore. The shore aspect here is north-west, and the transect extends from the supralittoral to just over half way across the very sheltered lagoon (100m total length). In addition, the transect is gently sloping with the transition between the eulittoral and sublittoral occurring at approximately 18.5m on the tape. The substratum in the supralittoral and upper eulittoral consists of angular small boulders, cobbles and pebbles, but below the upper eulittoral zone (from 11m on the tape) includes more muddy sand and gravel. Over the last 50m towards the centre of the basin, the sea bed consists of soft mud with inclusions of muddy sand.

In the shallow water at the centre of the basin, there was a noticeable thermocline at approximately 30–40cm depth. Measurements showed both the warm upper and cold lower water layers to have the same salinity of 34.5‰.

Habitats and communities

TV03LT4 had a wide zone of yellow and grey lichens in the supralittoral, extending for 10m from the origin of the tape. This was succeeded by a narrow (1m wide) zone in the littoral fringe with very sparse *Pelvetia canaliculata* and *Fucus spiralis*, followed by a wider eulittoral zone (11–18.5m) with silty pebbles covered predominantly by *Enteromorpha* sp. *F. vesiculosus*, *F. spiralis* and *Ascophyllum nodosum* were rare in this latter zone. Between 18.5 and 35m, there was a dense sward of the grass *Ruppia maritima* accompanied by a few *F. vesiculosus* and *A. nodosum* plants. Between 35m and 50m, *Ruppia* declined in density whilst the abundance of *F. vesiculosus* and *A. nodosum* increased. *Arenicola marina* was also a characterising component of this zone, together with unattached filamentous green algae. Between 50m and the end of the transect, *Ruppia* continued to decline in abundance, while the other main characterising taxa included the unattached filamentous green algae, rare fucoids (including *F. serratus*) and *Carcinus maenas*.

A snorkel swim was carried out around the head of this basin, to the west of TV03LT4, during which it was observed that the *Ruppia* bed was patchy and restricted to the area of the transect itself. In addition, a zone dominated by *Fucus ceranoides* was present intertidally at the head of the basin where it is entered by The Vadills Burn (Appendix 1 Figure 5).

Figure 3.10 Map showing location of Head of The Vadills transect (TV03LT4), Vadills site condition monitoring survey, July–August 2003

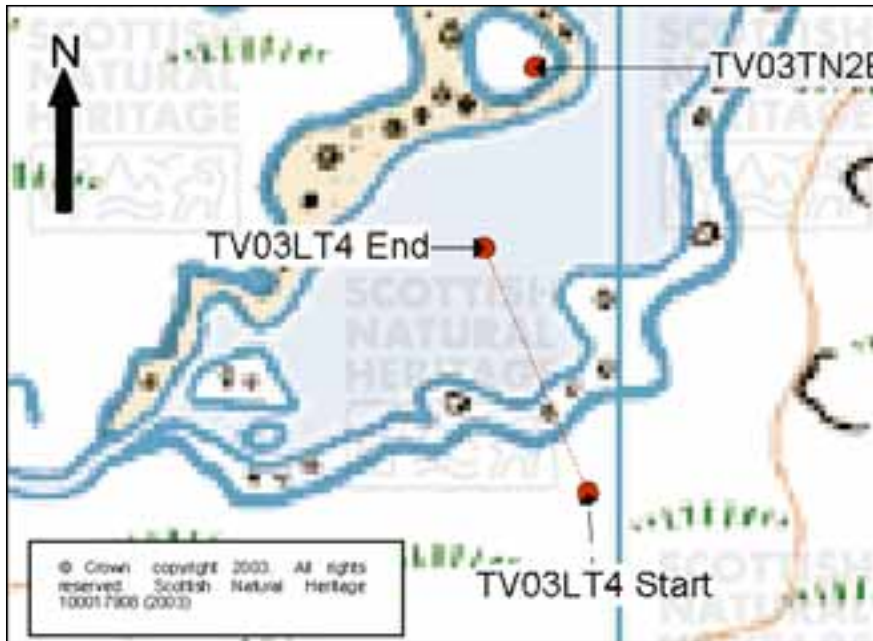


Figure 3.11 Photograph showing location of Head of The Vadills transect (TV03LT4), Vadills site condition monitoring survey, July–August 2003



Table 3.11 Summary statistics for Head of The Vadills transect (TV03LT4), Vadills site condition monitoring survey, July–August 2003

Lagoon transect name	Head of The Vadills
Transect number	TV03LT4
Type/name of transect	Littoral and sublittoral
Position of transect start point on shore	HU 28988, 54570
Position of transect end point	HU 28947, 54667
Aspect and exposure	North-north-west (331° magnetic); very sheltered
Transect length	100m
Biotopes	Littoral – 4 zones/4 biotopes; Sublittoral – 4 zones/4 biotopes

Table 3.12 Biotope data for Head of The Vadills transect (TV03LT4), Vadills site condition monitoring survey, July–August 2003

Zone	Biotopes	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 0.0–5.6m on tape	Sheltered boulders amongst terrestrial grasses	Lichen-dominated, mainly <i>Verrucaria maura</i> , with <i>Lecanora ?gangaleoides</i> , <i>Ochrolechia parella</i> and <i>Caloplaca</i> sp.
2	LR.L.YG	Supralittoral; 5.6–10.0m on tape; (waterline at 10.0m on tape, 1430 BST 04/08/03)	Sheltered cobbles and large boulders	Lichen-dominated, mainly <i>Verrucaria maura</i> , with <i>Lecanora ?gangaleoides</i> , <i>Ochrolechia parella</i> and <i>Caloplaca</i> sp.
3	SLR.F.Pel	Upper eulittoral; 10.0–11.0m on tape (0–0.05m BSL, 1430 BST 04/08/03)	Sheltered angular cobbles and pebbles	Very sparse <i>Pelvetia canaliculata</i> and <i>Fucus spiralis</i>
4	SLR.FX.EphX	Mid to lower eulittoral; 11.0–18.5m on tape (0.05–0.4m BSL, 1430 BST 04/08/03)	Sheltered angular pebbles and silty sand	Characterised by <i>Enteromorpha</i> sp and sparse <i>Ascophyllum nodosum</i> , <i>Fucus vesiculosus</i> and <i>F. spiralis</i>
5	IMS.Sgr.Rup	Sublittoral fringe; 18.5–35m on tape (0.4m–0.5m BSL, 1430 BST 04/08/03)	Sheltered muddy sand and gravel	Characterised by <i>Ruppia</i> sp, a filamentous green algal mat and <i>Arenicola marina</i> casts. Also with small amounts of <i>Ascophyllum nodosum</i> and <i>Fucus vesiculosus</i>
6	IMS.Sgr.Rup	Sublittoral; 35–50m on tape (0.5m–0.8m BSL, 1430 BST 04/08/03)	Sheltered muddy sand and gravel	Sediment dominated by <i>Arenicola marina</i> casts, unattached green filamentous algae, and scattered fucoids and <i>Ruppia</i> sp.
7	IMS.Sgr.Rup	Sublittoral; 50–100m on tape (0.8m–0.9m BSL, 1430 BST 04/08/03)	Sheltered muddy sand and soft mud	Sediment covered primarily by unattached green filamentous alga, with scattered fucoids and <i>Ruppia</i> sp.

3.2.5 Vadills Outer Basin, TV03LT5

The location of The Vadills Outer Basin transect, TV03LT5 is indicated in Figure 3.12, and a photograph of the transect is shown in Figure 3.13. Diagrams illustrating the transect profile are shown in Figure 3.14. Transect statistics are summarised in Table 3.13 and biotope information is detailed in Table 3.14 and Figure 3.14.

Physical description

Vadills Outer Basin is the outermost of the lagoonal basins in The Vadills system, and TV03LT5 is on the eastern shore to the south-east of the tidal narrows separating The Vadills from Brindister Voe. The shore aspect is west-north-west, and the transect extends from the supralittoral for 100m across the very sheltered lagoon. From the low-lying grassland backing the transect, the shore slopes evenly towards the water with an intertidal zone approximately 20m wide. In the sublittoral the sea bed slopes more gently, eventually reaching a depth of 5.0m BSL at 100m distance near the centre of the basin. The littoral substratum consists of small boulders, cobbles and pebbles with areas of gravel. Subtidally, gravel is present to the end of the transect, though an overlying layer of silt becomes thicker with distance offshore. Over the outermost 25m, the sea bed consists of soft flocculent mud overlying gravel.

Habitats and communities

The supralittoral boulders and cobbles (0–2m on the transect tape) had a 20% cover of grey and yellow lichens, whilst the accumulated algal debris along the strandline encouraged the growth of dense populations of talitrid amphipods. The littoral fringe and upper shore supported successive 2m-wide bands dominated by *Pelvetia canaliculata* and *Fucus spiralis* respectively, whilst the eulittoral pebbles between 8–14m were densely covered in *Ascophyllum nodosum*. The lower eulittoral and sublittoral fringe extended from 14m–35m, and was characterised by *F. serratus* and green filamentous algae, with *A. nodosum*. This large zone was interrupted by a band free of *F. serratus* at 20–26m, and dominated instead by *Enteromorpha* sp. and green filamentous algae together with *Arenicola marina*. From 35m out to 100m in the sublittoral fringe at the end of the transect, the kelp *Laminaria saccharina* tended to dominate along with *Halidrys siliquosa* and a taxon tentatively named ?*Gracilaria* sp. This is based on previous knowledge of The Vadills and inspection of the video footage; unfortunately no specimens are available to confirm the identification.

Figure 3.12 Map showing location of Vadills Outer Basin transect (TV03LT5), Vadills site condition monitoring survey, July–August 2003

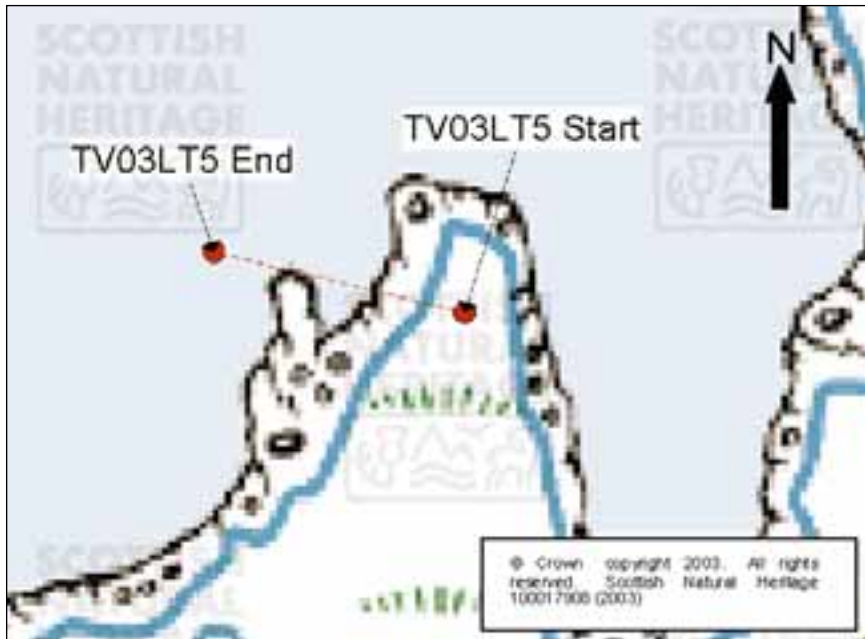


Figure 3.13 Photograph showing location of Vadills Outer Basin transect (TV03LT5), Vadills site condition monitoring survey, July–August 2003



Figure 3.14 Diagram of transect and biotope distribution in Vadills Outer Basin transect (TV03LT5), Vadills site condition monitoring survey, July–August 2003

Littoral zone shown (0–8m); no profile for sublittoral part of the transect (8–100m)

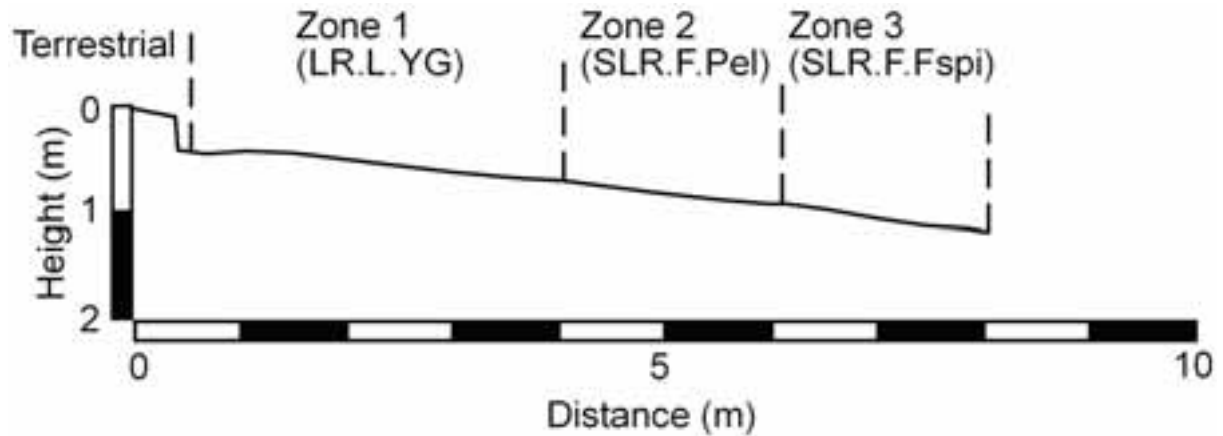


Table 3.13 Summary statistics for Vadills Outer Basin transect (TV03LT5), Vadills site condition monitoring survey, July–August 2003

Lagoon transect name	Vadills outer basin
Transect number	TV03LT5
Type/name of transect	Littoral and sublittoral
Position of transect start point on shore	HU 29311, 55754
Position of transect end point	HU 29212, 55778
Aspect and exposure	West-north-west (288° magnetic); very sheltered
Transect length	100m
Biotopes	Littoral – 5 zones/5 biotopes; Sublittoral – 8 zones/3 biotopes

Table 3.14 Biotope data for Vadills Outer Basin transect (TV03LT5), Vadills site condition monitoring survey, July–August 2003

Zone	Biotopes	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 0.0–4.0m on tape (0.5–1.0m ASL, 1315 BST 05/08/03)	Very sheltered boulders	Lichen-dominated, mainly <i>Verrucaria maura</i> , <i>Lecanora</i> spp. and <i>Caloplaca marina</i>
2	SLR.F.Pel	Upper eulittoral; 4.0–6.0m on tape (0.3–0.5m ASL, 1315 BST 05/08/03)	Very sheltered angular boulders, cobbles, pebbles and gravel with peaty sediment	Dominated by <i>Pelvetia canaliculata</i> and <i>Verrucaria maura</i>
3	SLR.F.Fspi	Upper eulittoral; 6.0–8.0m on tape (0.1–0.3m ASL, 1315 BST 05/08/03)	Very sheltered small boulders, cobbles, pebbles and gravel	Dominated by <i>Fucus spiralis</i> , with lesser cover of <i>Pelvetia canaliculata</i> and green filamentous algae
4	SLR.FX.AscX	Mid to lower eulittoral; 8.0–14.0m on tape (0–0.8m BSL, 1440 BST 05/08/03)	Very sheltered gravel and pebbles with large boulders	Dominated by <i>Ascophyllum nodosum</i> , with understorey of <i>Cladophora rupestris</i> , and a diverse flora and fauna
5	SLR.FX.FserX	Lower eulittoral; 14.0–20.0m on tape (0.8–1.3m BSL, 1440 BST 05/08/03)	Very sheltered pebbles and gravel	Main cover of <i>Fucus serratus</i> , together with <i>Ascophyllum nodosum</i> and green filamentous algae. Fauna included <i>Arenicola marina</i>
6	SLR.FX.EphX	Sublittoral fringe; 20.0–26.0m on tape (1.3–1.4m BSL, 1440 BST 05/08/03)	Very sheltered pebbles and gravel	Main cover of <i>Enteromorpha</i> sp or green filamentous algae, together with brown ‘filamentous algae and <i>Arenicola marina</i>
7	SLR.FX.FserX	Sublittoral fringe; 26.0–29.0m on tape (1.4–1.6m BSL, 1435 BST 05/08/03)	Very sheltered silty pebbles and gravel	Main cover of <i>Fucus serratus</i> , together with <i>Ascophyllum nodosum</i> and ? <i>Gracilaria</i> sp.
8	SLR.FX.FserX	Sublittoral fringe; 29.0–35.0m on tape (1.6–1.8m BSL, 1435 BST 05/08/03)	Very sheltered silty pebbles and gravel	Main cover of <i>Fucus serratus</i> , with <i>Laminaria saccharina</i> , <i>Ascophyllum nodosum</i> , <i>Enteromorpha</i> sp. and <i>Chorda filum</i>
9	IMX.KSwMx.LsacX	Sublittoral fringe; 35.0–40.0m on tape (1.8–2.4m BSL, 1430 BST 05/08/03)	Very sheltered mud with angular cobbles and gravel	Dominated by silted cape form <i>Laminaria saccharina</i> , <i>Fucus serratus</i> and <i>Chorda filum</i> . Also with <i>Furcellaria lumbricalis</i> , ? <i>Gracilaria</i> sp. and <i>Beggiatoa</i>
10	IMX.KSwMx.LsacX	Sublittoral fringe; 40.0–55.0m on tape (2.2–2.6m BSL, 1430 BST 05/08/03)	Very sheltered silty gravel with reduced algal cover	Silty sediment plain with <i>Arenicola marina</i> . With cape form <i>Laminaria saccharina</i> , ? <i>Gracilaria</i> sp., <i>Halidrys siliquosa</i> and Ectocarpaceae indet.

Table 3.14 (continued)

Zone	Biotopes	Location	Substratum notes	Biological notes
11	IMX.KSwMx.LsacX	Sublittoral fringe; 55.0– 5.0m on tape (2.2–3.0m BSL, 1425 BST 05/08/03)	Very sheltered soft mud with gravel, and occasional boulders	Heavy algal cover dominated by <i>Laminaria saccharina</i> and <i>Halidrys siliquosa</i> . <i>Asciidiella scabra</i> and <i>A. aspersa</i> numerous
12	IMX.KSwMx.LsacX	Shallow infralittoral; 75.0–89.0m on tape (3.0–4.9m BSL, 1425 BST 05/08/03)	Very sheltered soft mud with gravel, coarse sand and shell debris	<i>Asperococcus</i> sp and ? <i>Gracilaria</i> sp. superabundant. Other algae include <i>Laminaria saccharina</i> , Ectocarpaceae and <i>Chorda filum</i> . Diverse fauna.
13	?IMX.KSwMx.LsacX	Shallow infralittoral; 89.0–97.0m on tape (4.0–4.8m BSL, 1420 BST 05/08/03)	Very sheltered soft mud overlying gravel	Ectocarpaceae abundant over otherwise bare soft mud, with abundant <i>Arenicola marina</i> casts
14	IMX.KSwMx.LsacX	Shallow infralittoral; 97.0–100m on tape (4.8–5.0m BSL, 1420 BST 05/08/03)	Very sheltered soft mud	Soft mud plain with patches of <i>Laminaria saccharina</i> (cape form), Ectocarpaceae, <i>Chorda filum</i> and <i>Beggiatoa</i> . <i>Antedon bifida</i> , <i>Ophiothrix fragilis</i> , mobile crustacea and <i>Asciidiella scabra</i> also characteristic

3.2.6 Middle Basin, TV03LT6

The location of the Middle Basin transect, TV03LT6 is indicated in Figure 3.15, and a photograph of the transect is shown in Figure 3.16. Diagrams illustrating the transect profile are shown in Figure 3.17. Transect statistics are summarised in Table 3.15 and biotope information is detailed in Table 3.16 and Figure 3.17.

Physical description

Middle Basin is the central basin of The Vadills system, and TV03LT6 originates on its western shore. The transect extends for 100m across the very sheltered lagoon. From the low-lying grassland backing the transect, the shore slopes unevenly towards the water with an intertidal zone approximately 21m wide. In the sublittoral the sea bed slopes more gradually, reaching a depth of 1.9m BSL. In the littoral the substratum consists predominantly of broken bedrock, although bedrock in the eulittoral is overlain with small boulders, cobbles and pebbles with areas of gravel. Subtidally, and also in the lower eulittoral, the transect is characterised by very soft (and wobbly) flocculent mud.

Habitats and communities

Between 1.5–4m, the supralittoral consisted mostly of terraced bedrock and was dominated by a mixture of black, grey and yellow lichens amongst patches of grassy turf. The *Pelvetia canaliculata* and *Fucus spiralis* zones together occupied vertical or steep bedrock in the upper shore from 4–5m on the survey tape. The eulittoral zone, between 5m and the top of the lower eulittoral zone at 20m, was densely covered in *Ascophyllum nodosum* together with *Cladophora* sp. and small amounts of *F. vesiculosus*. The lower eulittoral zone was a narrow band extending from 20–21m, and was characterised by *F. serratus* and *Asciidiella* spp. with *Furcellaria lumbricalis*. Small patches of *Beggiatoa* sp also occurred on the flocculent mud here. Below this, from 21–25m on the transect line, sublittoral fringe cobbles and shells on soft flocculent mud were covered mainly by *F. lumbricalis*, *Halidrys siliquosa*, and *Chorda filum*, with some *Fucus serratus* and *Laminaria saccharina*. The fauna here was characterised by *Arenicola marina* casts in addition to dense *Asciidiella aspersa*. The final and most extensive zone extended from 25–100m, and was characterised by large numbers of the burrowing sea cucumbers *Paracucumaria hyndmani* and *Leptosynapta inhaerens*, together with scattered patches of the white fungal mat *Beggiatoa* sp. and brown and green filamentous algal mats. Most *P. hyndmani* individuals were lying fully exposed and inactive on the sediment surface, in addition to which *Carcinus maenas* in this zone were covered in *Beggiatoa* sp. Casts of the polychaete *Arenicola marina* were also present towards the outer end of the transect, and drift sea weed in this zone was also a substratum for many *Asciidiella aspersa*.

Figure 3.15 Map showing location of Middle Basin transect (TV03LT6), Vadills site condition monitoring survey, July–August 2003



Figure 3.16 Photograph showing location of Middle Basin transect (TV03LT6), Vadills site condition monitoring survey, July–August 2003

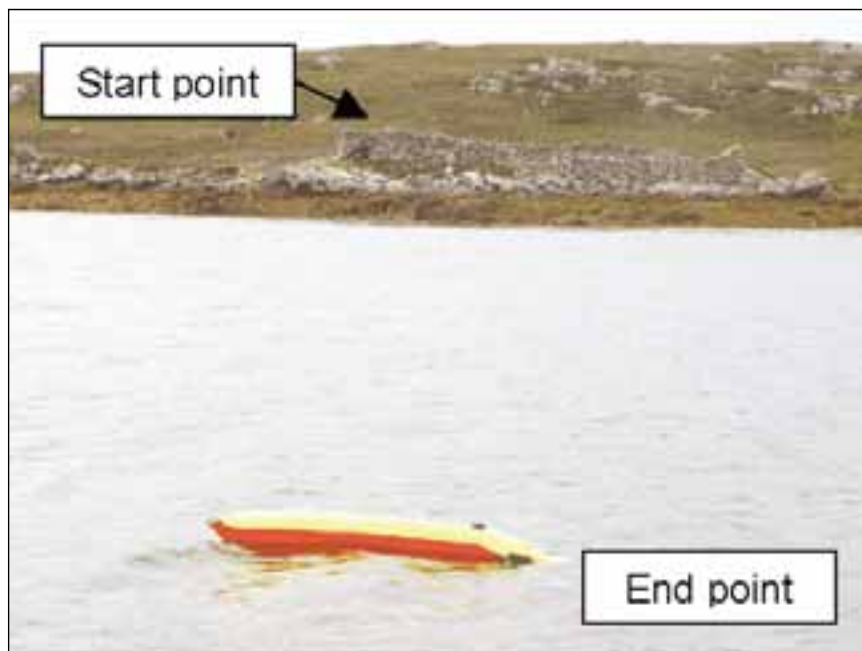


Figure 3.17 Diagram of transect and biotope distribution in Middle Basin transect (TV03LT6), Vadills site condition monitoring survey, July–August 2003

Littoral zone shown; no profile for sublittoral part of the transect

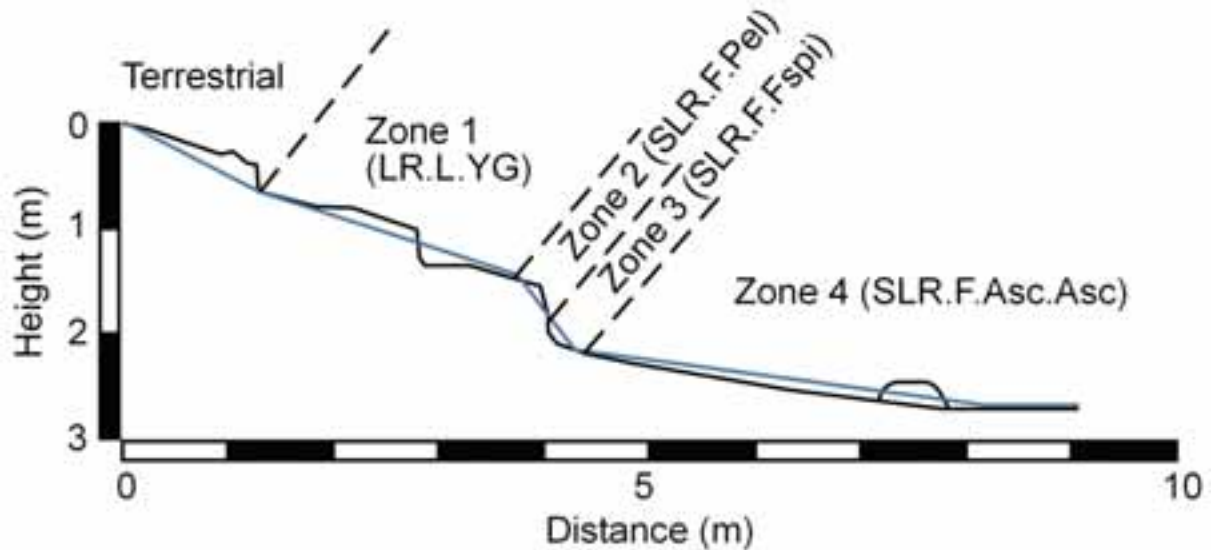


Table 3.15 Summary statistics for Middle Basin transect (TV03LT6), Vadills site condition monitoring survey, July–August 2003

Lagoon transect name	Middle Basin
Transect Number	TV03LT6
Type/name of transect	Littoral and sublittoral
Position of transect start point on shore	HU 28817, 55463
Position of transect end point	HU 28898, 55509
Aspect and exposure	North-east (070° magnetic); very sheltered
Transect length	100m
Biotopes	Littoral – 5 zones/5 biotopes; Sublittoral – 2 zones/2 biotopes

Table 3.16 Biotope data for Middle Basin transect (TV03LT6), Vadills site condition monitoring survey, July–August 2003

Zone	Biotopes	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 1.5–4.0m on tape (2.0–1.2m ASL, 1245 BST 10/08/03)	Very sheltered terraced bedrock slope with patches of grassy turf	Dominated by grey and black lichens, mainly <i>Verrucaria maura</i> and <i>Ochrolechia parella</i>
2	SLR.F.Pel	Upper eulittoral; 4.0–4.5m on tape. (1.2–0.8m ASL, 1245 BST 10/08/03)	Very sheltered and near- vertical broken bedrock	Dominated by <i>Pelvetia canaliculata</i> and <i>Verrucaria maura</i> . <i>Littorina saxatilis</i> and encrusting coralline alga in crevices
3	SLR.F.Fspi	Upper eulittoral; 4.5–5.0m on tape. (0.8–0.5m ASL, 1245 BST 10/08/03)	Very sheltered steep slope of broken bedrock	Dominated by <i>Fucus spiralis</i> and <i>Verrucaria maura</i>
4	SLR.F.Asc.Asc	Mid eulittoral; 5.0–20.0m on tape (0–0.5m ASL, 1245 BST, 10/08/03)	Pebbles, cobbles and small boulders on bedrock slope	Dense <i>Ascophyllum nodosum</i> , with understorey of <i>Cladophora rupestris</i> , littorinids, juvenile <i>Carcinus maenas</i> and <i>Mytilus edulis</i>
5	SLR.FX.FserX	Sublittoral fringe; 20.0–21.0m on tape (0.8m BSL, 1315 BST 10/08/03)	Very sheltered flocculent mud with cobbles, pebbles and empty littorinid shells	Heavily algal dominated, mainly by <i>Fucus serratus</i> . Patches of a green filamentous mat-forming alga and <i>Beggiatoa</i> also present. <i>Asciidiella aspersa</i> and <i>A. scabra</i> abundant
6	IMX.KSwMx.LsacX	Sublittoral fringe; 21.0–25.0m on tape (0.8–1.4m BSL, 1300 BST 10/08/03)	Very sheltered flocculent mud with cobbles, pebbles and empty littorinid and bivalve mollusc shells	Cover mainly of <i>Furcellaria lumbricalis</i> , <i>Halidrys siliquosa</i> , <i>Chorda filum</i> , with some <i>Fucus serratus</i> and <i>Laminaria saccharina</i> . Fauna characterised by <i>Arenicola marina</i> casts in addition to dense <i>Asciidiella aspersa</i>
7	IMU.MarMu.AreSyn	Shallow infralittoral; 25.0–100m on tape (1.4–1.9m BSL, 1250 BST 10/08/03)	Very sheltered wobbly flocculent mud	Mud covered with brown and green filamentous algal mats, and patches of <i>Beggiatoa</i> sp. Fauna dominated by <i>Paracucumaria hyndmani</i> ; <i>Arenicola marina</i> also present, together with <i>Leptosynapta inhaerens</i>

3.2.7 Inner Basin, TV03LT7

The location of the Inner Basin transect, TV03LT7 is indicated in Figure 3.18, and a photograph of the transect is shown in Figure 3.19. Diagrams illustrating the transect profile are shown in Figure 3.20. Transect statistics are summarised in Table 3.17 and biotope information is detailed in Table 3.18 and Figure 3.20.

Physical description

The Inner Basin transect, TV03LT7, shares its origin on the shore with that of TV03LT3 Mill Burn in the main Vadills Basin. It is aligned almost east to west across the inner basin of The Vadills, and extends 100m to straddle the channel completely. From the grass that backs the transect, the shore slopes gently towards the water's edge with an intertidal zone 15.5m wide. In the sublittoral the sea bed is very shallow and almost flat, reaching a depth of 1.5m BSL in the centre of the basin. The substratum in the littoral consisted mainly of angular small boulders, cobbles and pebbles. Subtidally, there was a layer of silt over the stones which became thicker with distance offshore. In the centre of the inner basin channel, the sea bed was a soft, flocculent mud.

Habitats and communities

The upper shore profile and zonation here was very similar to that recorded at TV03LT3, if slightly compressed due to the narrower shoreline available in the inner basin compared to that where the Mill Burn joins the inner basin. On the western shore, the first 9.1m of TV03LT3 crossed supralittoral yellow and grey lichens, a band of *Pelvetia canaliculata* and *Verrucaria maura*, and then a 2m-wide zone of *Fucus spiralis* and *P. canaliculata*. Between 9.1m and 23m on the survey tape, ie the eulittoral zone, the mixed substrata were covered in *Ascophyllum nodosum* (although these eulittoral zones were not thoroughly surveyed). At the edge of the channel, there was just a very narrow (1m wide) band of dense *Fucus serratus* before the commencement of shallow and extensive sublittoral fringe communities characterised by *Chorda filum*, *Furcellaria lumbricalis*, and green and brown filamentous algae. These characterised the entire channel apart from a central region from 40–63m where the soft muddy sea bed was covered with a green algal mat, fauna was sparse (mainly *Carcinus maenas* and *Arenicola marina*), and there were scattered spots of *Beggiatoa* on the mud surface. From approximately 63m onwards, the sea bed was starting to slope gently upwards towards the opposite edge of the channel where, at 100m the *Ascophyllum*-dominated eulittoral on the east side started.

Figure 3.18 Map showing location of Inner Basin transect (TV03LT7), Vadills site condition monitoring survey, July–August 2003

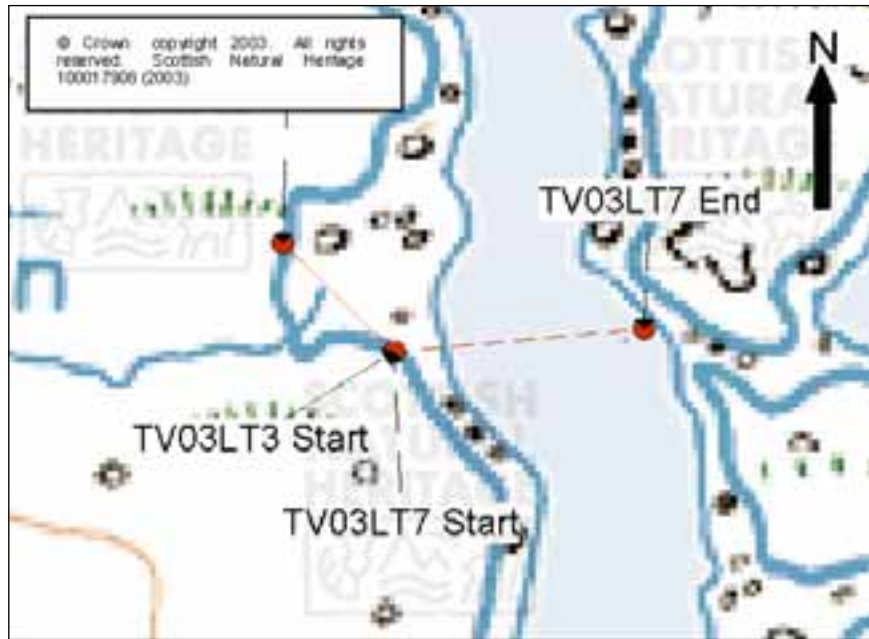


Figure 3.19 Photograph showing location of Inner Basin transect (TV03LT7), Vadills site condition monitoring survey, July–August 2003



Figure 3.20 Diagram of transect and biotope distribution in Inner Basin transect (TV03LT7), Vadills site condition monitoring survey, July–August 2003

Upper diagram – littoral zone, western end
 Lower diagram – sublittoral zone

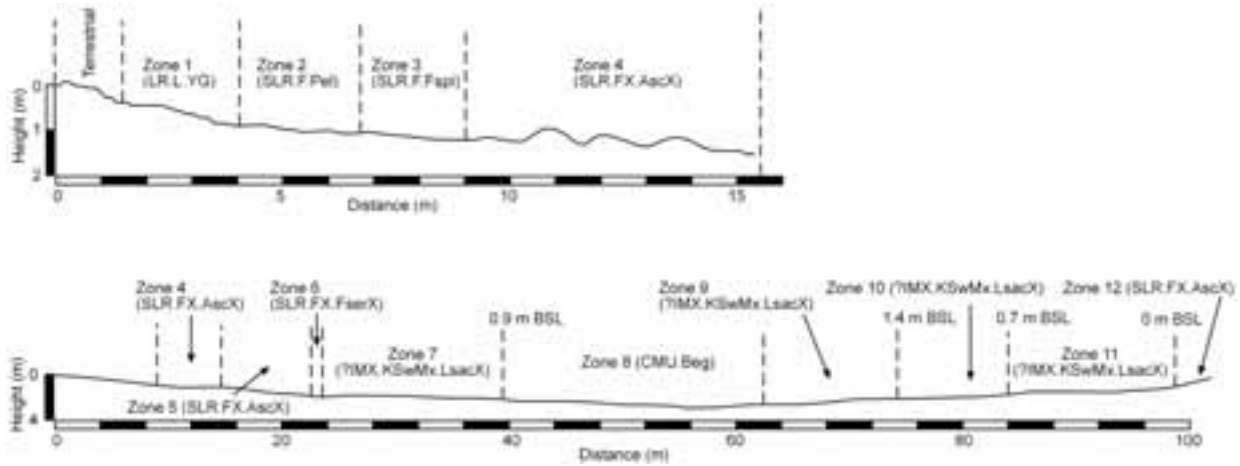


Table 3.17 Summary statistics for Inner Basin transect (TV03LT7), Vadills site condition monitoring survey, July–August 2003

Lagoon Transect Name	Inner Basin
Transect Number	TV03LT7
Type/name of transect	Littoral and sublittoral
Position of transect start point on shore	HU 28788, 55167
Position of transect end point	HU 28887, 55195
Aspect and exposure	East-north-east (080° magnetic); very sheltered
Transect length	100m
Biotopes	Littoral – 7 zones/5 biotopes; Sublittoral – 5 zones/2 biotopes

Table 3.18 Biotope data for Inner Basin transect (TV03LT7), Vadills site condition monitoring survey, July–August 2003

Zone	Biotopes	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 1.5–4.1m on tape. (1.2–0.7m ASL, 1531 BST 14/08/03)	Very sheltered bedrock with angular cobbles, pebbles and gravel	Dominated by <i>Verrucaria maura</i> and <i>Lecanora gangaleoides</i> . Fauna similar to LR.L.YG on TV03LT3 nearby
2	SLR.F.Pel	Upper eulittoral; 4.1–6.8m on tape. (0.7–0.5m ASL, 1531 BST 14/08/03)	Very sheltered angular cobbles, pebbles and gravel	Dominated by <i>Pelvetia canaliculata</i> and <i>Verrucaria maura</i>
3	SLR.F.Fspi	Upper eulittoral; 6.8–9.1m on tape. (0.5–0.3m ASL, 1531 BST 14/08/03)	Very sheltered angular cobbles, pebbles and gravel	Dominated by <i>Fucus spiralis</i> and <i>Verrucaria maura</i>
4	SLR.FX.AscX	Mid eulittoral; 9.1–15.5m on tape. (0.3–0m ASL, 1531 BST 14/08/03)	Very sheltered boulders, pebbles and gravel	Dense <i>Ascophyllum nodosum</i>
5	SLR.FX.AscX	Mid eulittoral; 15.5–23.0m on tape (0–0.3m BSL, 1715 BST 14/08/03)	Very sheltered boulders, pebbles and gravel	Dense <i>Ascophyllum nodosum</i> . Not fully surveyed
6	SLR.FX.FserX	Lower eulittoral; 23.0–24.0m on tape (0.4m BSL, 1710 BST 14/08/03)	Very sheltered cobbles and pebbles	Dense <i>Fucus serratus</i> , with some <i>Ascophyllum nodosum</i> . Not fully surveyed
7	?IMX.KSwMx.LsacX	Sublittoral fringe; 24.0–40.0m on tape (0.4–0.9m BSL, 1710 BST 14/08/03)	Very sheltered pebbles overlain by thin layer of mud	Seabed surface with both green and brown filamentous algae. <i>Chorda filum</i> , <i>Furcellaria lumbricalis</i> and <i>Arenicola marina</i> common. [NB no <i>Laminaria saccharina</i> recorded]
8	CMU.Beg	Sublittoral fringe; 40.0–63.0m on tape (0.9–1.5m BSL, 1700 BST 14/08/03)	Very sheltered soft mud	Seabed with green filamentous algal mat. Otherwise characterised by <i>Arenicola marina</i> casts and <i>Carcinus maenas</i>
9	?IMX.KSwMx.LsacX	Sublittoral fringe; 63.0–75.0m on tape (1.1–1.4m BSL, 1700 BST 14/08/03)	Very sheltered pebbles overlain by 20cm layer of soft mud	Main seabed cover of <i>Furcellaria lumbricalis</i> and filamentous green algae. <i>Asciidiella scabra</i> and <i>Corella parallelogramma</i> very numerous on drift algae. [NB no <i>Laminaria saccharina</i> recorded]

Table 3.18 (continued)

Zone	Biotopes	Location	Substratum notes	Biological notes
10	‡IMX.KSwMx.LsacX	Sublittoral fringe; 75.0–85.0m on tape (1.1–0.7m BSL, 1700 BST 14/08/03)	Very sheltered pebbles overlain by thin layer of mud	Dominated by <i>Chorda filum</i> , <i>Furcellaria lumbricalis</i> and filamentous green algae. <i>Arenicola marina</i> , <i>Asciella</i> <i>scabra</i> and <i>Corella</i> <i>parallelogramma</i> common. [NB no <i>Laminaria saccharina</i> recorded]
11	‡IMX.KSwMx.LsacX	Sublittoral fringe; 85.0–100.0m on tape (0.7–0m BSL, 1650 BST 14/08/03)	Very sheltered fine muddy sand and gravel	Dominated by <i>Chorda filum</i> , <i>Furcellaria lumbricalis</i> and filamentous green algae. <i>Arenicola marina</i> , <i>Asciella</i> <i>scabra</i> and <i>Corella</i> <i>parallelogramma</i> common. [NB no <i>Laminaria saccharina</i> recorded]
12	SLR.FX.AscX	Mid eulittoral; >100m on tape (0m BSL, 1640 BST 14/08/03)	Very sheltered silty cobbles	Dense <i>Ascophyllum nodosum</i> on shore above waterline. Some <i>Fucus serratus</i> present at lower edge of zone. Not fully surveyed

3.2.8 Marlee Loch Tidal Narrows, TV03TN1

The location of the Marlee Loch Tidal Narrows transect, TV03TN1 is indicated in Figure 3.21, and a photograph of the transect is shown in Figure 3.22. Diagrams illustrating the transect profile are shown in Figure 3.23. Transect statistics are summarised in Table 3.19 and biotope information is detailed in Table 3.20 and Figure 3.23.

Physical description

The Marlee Loch Tidal Narrows transect, TV03TN1, shares its origin on the shore with that of TV03LT2 in the Marlee Loch Basin. TV03TN1 straddles the narrowest part of Marlee Loch, heading approximately south-south-west across the channel for a distance of just over 38m. From the grassland backing the transect, there is a small steep drop to the top of the shore beyond which the profile slopes gently towards the lower eulittoral in which there is another short steep drop into the sublittoral fringe. Overall, the intertidal zone is approximately 20m wide, and consists predominantly of small angular cobbles, pebbles and gravel. In the sublittoral the sea bed was almost flat, eventually reaching a depth of 1.1m BSL in the centre of the channel. The substratum in the channel consisted of boulders, cobbles and pebbles.

Habitats and communities

In the intertidal zone the biological zonation progressed from yellow, grey and black lichens in the supralittoral (3.5–6m on tape) through a narrow band of *Pelvetia canaliculata* with a small amount of *Fucus spiralis* in the upper eulittoral (6–9m on tape) to a wider zone of *Ascophyllum nodosum* on mixed substrata in the mid and lower eulittoral between 9m and 15m on the tape. The lower eulittoral zone was approximately 5m wide and extended to the edge of the central channel, supporting a dense growth of *Fucus serratus*, together with *Chorda filum* and a mat of filamentous green algae.

From 20m on the tape across the width of the tidal channel, the boulder and cobble sea bed in the upper infralittoral supported a dense growth of *Laminaria digitata*, *Fucus serratus*, and filamentous green and brown algae. There was also an understorey of red algae including encrusting coralline algae and *Cystoclonium purpureum*, together with animals such as *Halichondria panicea*, very large *Mytilus edulis*, *Alcyonidium hirsutum* and several ascidian taxa.

The lower eulittoral and eulittoral zones on the north side of the channel were similar to those on the south side.

Figure 3.21 Map showing location of Marlee Loch Tidal Narrows transect (TV03TN1), Vadills site condition monitoring survey, July–August 2003

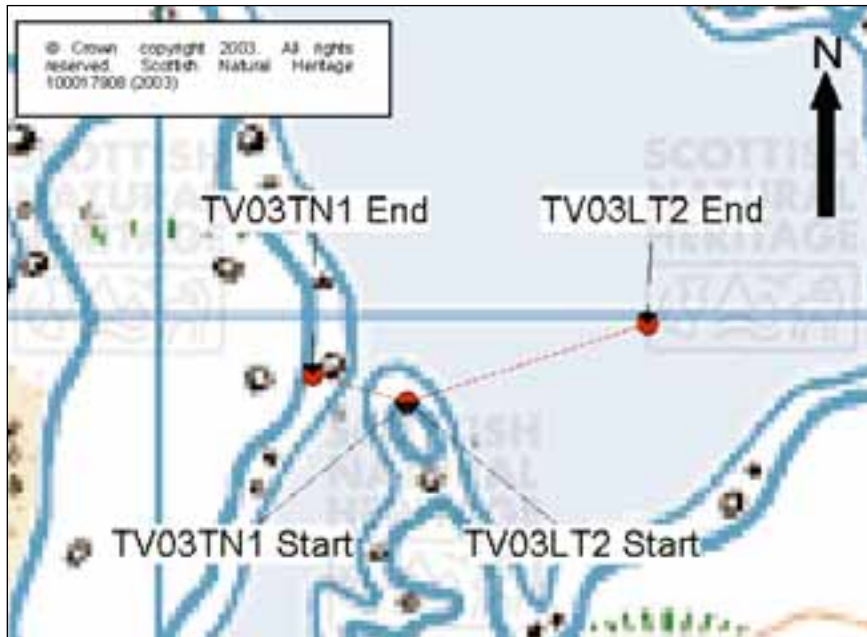


Figure 3.22 Photograph showing location of Marlee Loch Tidal Narrows transect (TV03TN1), Vadills site condition monitoring survey, July–August 2003



Figure 3.23 Diagram of transect and biotope distribution in Marlee Loch Tidal Narrows transect (TV03TN1), Vadills site condition monitoring survey, July–August 2003

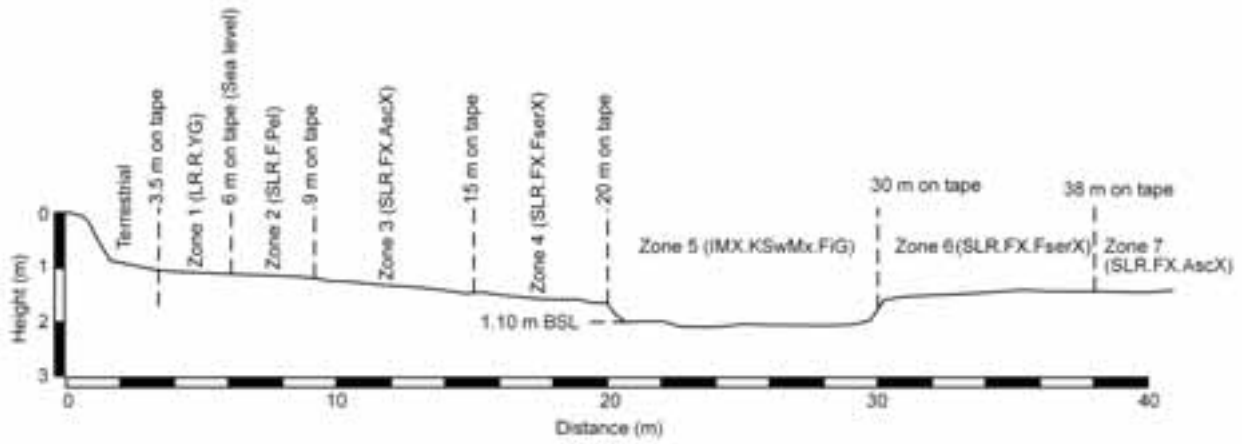


Table 3.19 Summary statistics for Marlee Loch Tidal Narrows transect (TV03TN1), Vadills site condition monitoring survey, July–August 2003

Lagoon Transect Name	Marlee Loch Tidal Narrows
Transect Number	TV03TN1
Type/name of transect	Littoral and sublittoral
Position of transect start point on shore	HU 29112, 54942
Position of transect end point	HU 29064, 54964
Aspect and exposure	North-west (300° magnetic); very sheltered
Transect length	40m
Biotopes	Littoral – 4 zones/4 biotopes; Sublittoral – 3 zones/3 biotopes

Table 3.20 Biotope data for Marlee Loch Tidal Narrows transect (TV03TN1), Vadills site condition monitoring survey, July–August 2003

Zone	Biotopes	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 3.5–6.0m on tape (lower limit at sea level, 1245 BST 02/08/03)	Sheltered angular boulders and cobbles	Sparse cover of yellow and grey lichens and <i>Verrucaria maura</i>
2	SLR.F.Pel	Upper eulittoral; 6.0–9.0m on tape (0.0–0.2m BSL estimated, 1245 BST 02/08/03)	Sheltered angular cobbles, pebbles and gravel	Mostly bare, but main cover of <i>Pelvetia canaliculata</i> , and some <i>Fucus spiralis</i> in lower part of zone
3	SLR.FX.AscX	Mid eulittoral; 9.0–15.0m on tape (0.2–0.5m BSL estimated, 1245 BST 02/08/03)	Very sheltered small boulders, cobbles and pebbles	Algal-dominated, mainly by <i>Ascophyllum nodosum</i> ; also with <i>Fucus vesiculosus</i>
4	SLR.FX.FserX	Lower eulittoral & sublittoral fringe; 15–20.0m on tape (0.5–0.8m BSL estimated, 1245 BST 02/08/03)	Very sheltered small boulders, cobbles and pebbles	Dominated by <i>Fucus serratus</i> , with additional algal cover from <i>Ascophyllum nodosum</i> , <i>Chorda filum</i> , filamentous green alga and Ectocarpaceae indet. Fauna included solitary ascidians, <i>Halichondria</i> sp., and <i>Alcyonidium</i> sp.
5	IMX.KSwMx.FiG	Infralittoral mud; 20.0–30.0m on tape (1.1m BSL, 1255 BST 02/08/03)	Very sheltered boulders, cobbles and pebbles	Dense algal cover with main cover from <i>Laminaria digitata</i> , <i>Fucus serratus</i> , filamentous green alga and Ectocarpaceae indet. Fauna characterised by <i>Halichondria</i> sp., large <i>Mytilus edulis</i> , ascidians and <i>Arenicola marina</i> casts present
6	SLR.FX.FserX	Lower eulittoral & sublittoral fringe; 30– 38.0m on tape (0.5–0.8mBSL, 1300 BST 02/08/03)	Very sheltered small boulders, cobbles and pebbles	See zone 4 above
7	SLR.FX.AscX	Mid eulittoral; 38.0m plus on tape (0–0.5mBSL, 1300 BST 02/08/03)	Very sheltered small boulders, cobbles and pebbles	See zone 3 above

3.2.9 Head of The Vadills Narrows, TV03TN2

The location of The Vadills Narrows transect, TV03TN2 is indicated in Figure 3.24, and a photograph of the transect is shown in Figure 3.25. Diagrams illustrating the transect profile are shown in Figure 3.26. Transect statistics are summarised in Table 3.21 and biotope information is detailed in Table 3.22 and Figure 3.26.

Physical description

The Head of The Vadills Narrows transect, TV03TN2, straddles the narrowest part of The Vadills basin where it enters Marlee Loch. From its origin on the south side of the tidal narrows, the transect heads approximately north-north-west across the channel for a distance of 47m. From the grassland behind the transect, there is a short very steep drop to the top of the shore beyond which the profile slopes steeply towards the sublittoral fringe in the channel. Overall, the intertidal zone on the south side is approximately 20m wide, and consists predominantly of small angular cobbles, pebbles and gravel. In the sublittoral the sea bed reached a maximum depth of 1.1m BSL in the centre of the channel. The substratum in the channel consisted of boulders, cobbles and pebbles. The north side of the channel was not surveyed, but appeared to show similar characteristics of slope and substratum type as the south side.

During the survey, the direction of flow in the channel changed before the expected time of high water in addition to which the slack period lasted less than ten minutes.

Habitats and communities

From the tape origin on the south side of the channel, all zones on the shore appeared relatively narrow due to the slope. There was a 2m-wide yellow and grey lichen zone in the supralittoral at the top of the slope, followed by a 3m-wide band of *Pelvetia canaliculata* with *Fucus spiralis* and *Verrucaria maura*. The eulittoral was dominated by *Ascophyllum nodosum* (which was colonised by *Obelia* sp.) in a band extending from 7–19m on the transect tape. *F. spiralis* was also prominent at the top of the zone, whilst *F. serratus* was common in the lower half. The only fauna noted were *Carcinus maenas*, *Nucella lapillus* and a 3-spined stickleback. In the channel, the boulders were colonised by *F. serratus*, though *Chorda filum*, *Cystoclonium purpureum*, *Phyllophora pseudoceranooides*, *Ceramium pallidum* and *Furcellaria lumbricalis* and small amounts of *Laminaria digitata* were also present. The fauna was dominated by *Halichondria panicea*, *Alcyonidium hirsutum* and *Carcinus maenas*, whilst *Asciidiella scabra* and the anemone *Haliplanella lineata* were also present.

Figure 3.24 Map showing location of Head of The Vadills Narrows transect (TV03TN2), Vadills site condition monitoring survey, July–August 2003

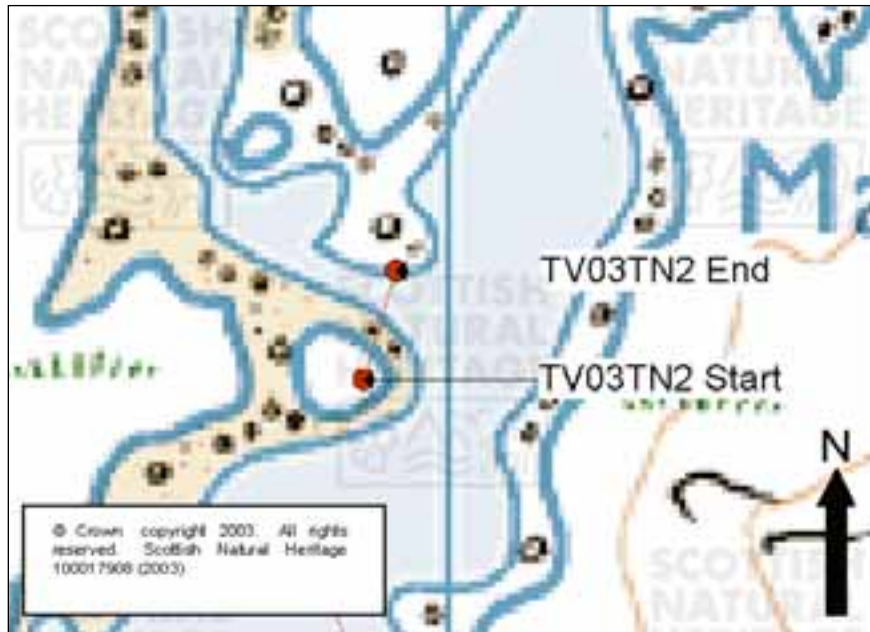


Figure 3.25 Photograph showing location of Head of The Vadills Narrows transect (TV03TN2), Vadills site condition monitoring survey, July–August 2003



Figure 3.26 Diagram of transect and biotope distribution in Head of The Vadills Narrows transect (TV03TN2), Vadills site condition monitoring survey, July–August 2003

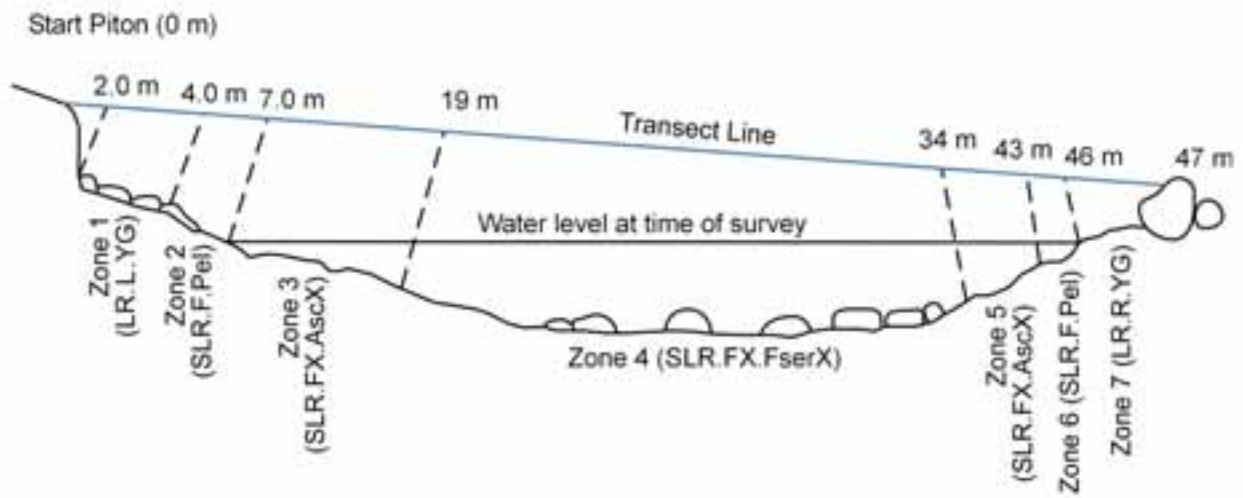


Table 3.21 Summary statistics for Head of The Vadills Narrows transect (TV03TN2), Vadills site condition monitoring survey, July–August 2003

Lagoon Transect Name	Head of The Vadills Narrows
Transect Number	TV03TN2
Type/name of transect	Littoral and sublittoral
Position of transect start point on shore	HU 28967, 54738
Position of transect end point	HU 28980, 54781
Aspect and exposure	South-south-west (028° magnetic); very sheltered
Transect length	47m
Biotopes	Littoral – 7 zones/4 biotopes

Table 3.22 Biotope data for Head of The Vadills Narrows transect (TV03TN2), Vadills site condition monitoring survey, July–August 2003

Zone	Biotopes	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 2.0–4.0m on tape	Very sheltered angular cobbles and pebbles	Black and grey lichens dominated by <i>Verrucaria maura</i> . <i>Lecanora</i> sp., <i>Ochrolechia parella</i> , <i>Lichina pygmaea</i> and <i>V. mucosa</i> also present
2	SLR.F.Pel	Upper eulittoral; 4.0–7.0m on tape	Very sheltered angular cobbles, pebbles and gravel	Main cover of <i>Verrucaria maura</i> and <i>Pelvetia canaliculata</i> , and some <i>Fucus spiralis</i> in lower part of zone
3	SLR.FX.AscX	Mid eulittoral; 7.0–19.0m on tape	Very sheltered angular pebbles, gravel and coarse sand	Algal-dominated, mainly by <i>Ascophyllum nodosum</i> ; also with <i>Fucus serratus</i> in lower half of zone
4	SLR.FX.FserX	Lower eulittoral & sublittoral fringe; 19.0–34.0m on tape (max depth 1.1m BSL, 1450 BST 04/08/03)	Very sheltered small and large boulders, cobbles, pebbles and gravel	Dominated by <i>Fucus serratus</i> , with additional algal cover from <i>Cladophora rupestris</i> , <i>Cystoclonium purpureum</i> , <i>Chorda filum</i> , and <i>Laminaria digitata</i> . Fauna characterised by <i>Halichondria panicea</i> , <i>Alcyonidium hirsutum</i> , and <i>Asciella scabra</i>
5	SLR.FX.AscX	Mid eulittoral; 34.0–43.0m on tape	Very sheltered angular pebbles, gravel and coarse sand	Not fully surveyed, but appeared similar to zone 3
6	SLR.F.Pel	Upper eulittoral; 43.0–46.0m on tape	Very sheltered angular cobbles, pebbles and gravel	Not fully surveyed, but appeared similar to zone 2
7	LR.L.YG	Supralittoral; 46.0–47.0m on tape	Very sheltered angular cobbles and pebbles	Not fully surveyed, but appeared similar to zone 1

3.2.10 Mo Wick Narrows, TV03TN3

The location of the Mo Wick Narrows transect, TV03TN3 is indicated in Figure 3.27, and a photograph of the transect is shown in Figure 3.38. Diagrams illustrating the transect profile are shown in Figure 3.29. Transect statistics are summarised in Table 3.23 and biotope information is detailed in Table 3.24 and Figure 3.29.

Physical description

The Mo Wick Tidal Narrows transect, TV03TN3, crosses the narrows between The Vadills basin and Mo Wick. From its origin on the east side of the tidal narrows, the transect heads approximately west across the channel for a distance of 57m. From the grassland behind the transect, the shore profile slopes gently towards the channel. Overall, the intertidal zone on the east side (the only side fully surveyed) is approximately 28m wide, and consists predominantly of small angular cobbles, pebbles and gravel. The substratum includes sand or mud from the upper shore downwards. In the sublittoral the maximum depth in the centre of the channel was 1.5m BSL. The substratum in the channel consisted of boulders, cobbles and pebbles. The west shore of the channel was not surveyed.

As noted in the Head of The Vadills Narrows, TV03TN2, the period of slack water in the Mo Wick Narrows was just 10 minutes or less, and the turns happened very quickly.

Habitats and communities

There was a 4.5m-wide yellow and grey lichen zone in the supralittoral at the top of the slope, followed by a 2m-wide band of *Pelvetia canaliculata* with *Fucus spiralis* and *Verrucaria maura*. Over the next metre, the dominance between *Pelvetia* and *F. spiralis* swapped and other furoids started appearing, including *F. vesiculosus* and *Ascophyllum nodosum*. The eulittoral from 10.5–16.5m was dominated by *Ascophyllum nodosum*, but a green filamentous mat was also abundant on the *Ascophyllum* and characteristic of the zone. The fauna recorded was mainly hidden under the algal canopy, but main species included *Dendrodoa/Styela* sp., *Littorina obtusata* and *Anurida maritima*. The polychaete *Cirratulus cirratus* was present in sediment beneath the boulders. In the lower eulittoral zone fringing the channel (16.5–28m on tape), the small and large boulders were characterised by *F. serratus*, *A. nodosum*, *Chorda filum*, and *Cladophora* sp. The fauna was relatively inconspicuous, but characterised by species growing on *F. serratus* fronds including *Halichondria panicea*, *Alcyonidium gelatinosum*, *Asciidiella scabra*, *Botryllus schlosseri*, *Botrylloides leachii*, and the bryozoans *Umbonula littoralis* and *Celleporella hyalina*.

The infralittoral fringe zone taking up most of the channel (28–54m on the survey tape) was heavily dominated by *Laminaria saccharina*, though other abundant algae included *Chorda filum* and *Chaetomorpha* sp. Again, the fauna was subsidiary to the algal cover, but the main species present was *Modiolus modiolus* together with *Arenicola marina* in sediment. Other species present or of note included the encrusting coralline algae, some of which had developed ‘hedgehog’ stone-like growth forms (*Lithothamnion glaciale*). In addition, the kelp fronds were heavily encrusted with colonial and solitary ascidians (*B. schlosseri*, *B. botryoides*, *A. scabra*, *A. aspersa*) as well as bryozoan crusts.

One other shallow sublittoral fringe zone habitat was noted at 54–57m on the tape, dominated by *Chaetomorpha/Enteromorpha* sp., and with a variety of other species present including *F. serratus*, *Chondrus crispus*, encrusting coralline algae and *Polyides/Furcellaria* sp.

Figure 3.27 Map showing location of Mo Wick Narrows transect (TV03TN3), Vadills site condition monitoring survey, July–August 2003

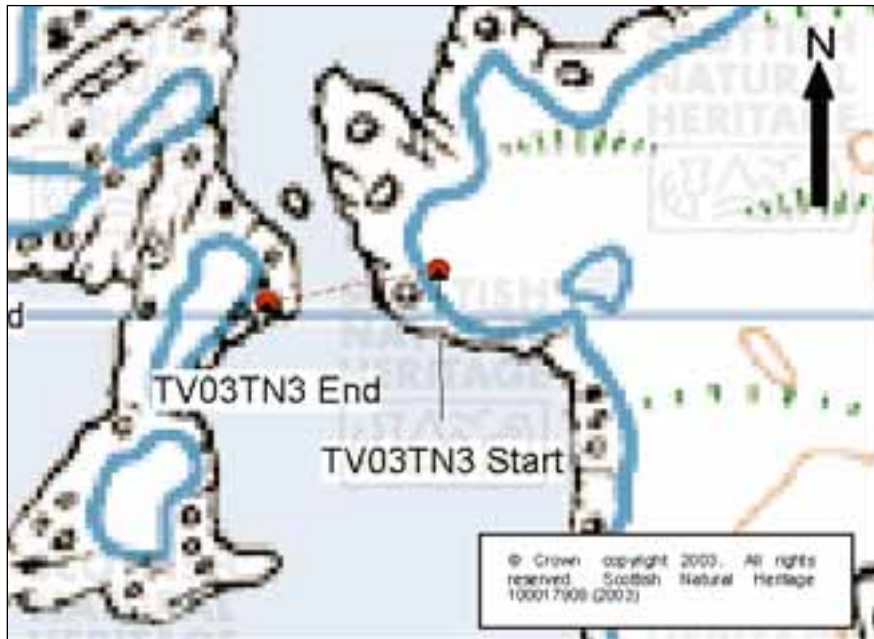


Figure 3.28 Photograph showing location of Mo Wick Narrows transect (TV03TN3), Vadills site condition monitoring survey, July–August 2003



Figure 3.29 Diagram of transect and biotope distribution in Mo Wick Narrows transect (TV03TN3), Vadills site condition monitoring survey, July–August 2003

Upper diagram – littoral zone, eastern end
 Lower diagram – sublittoral zone

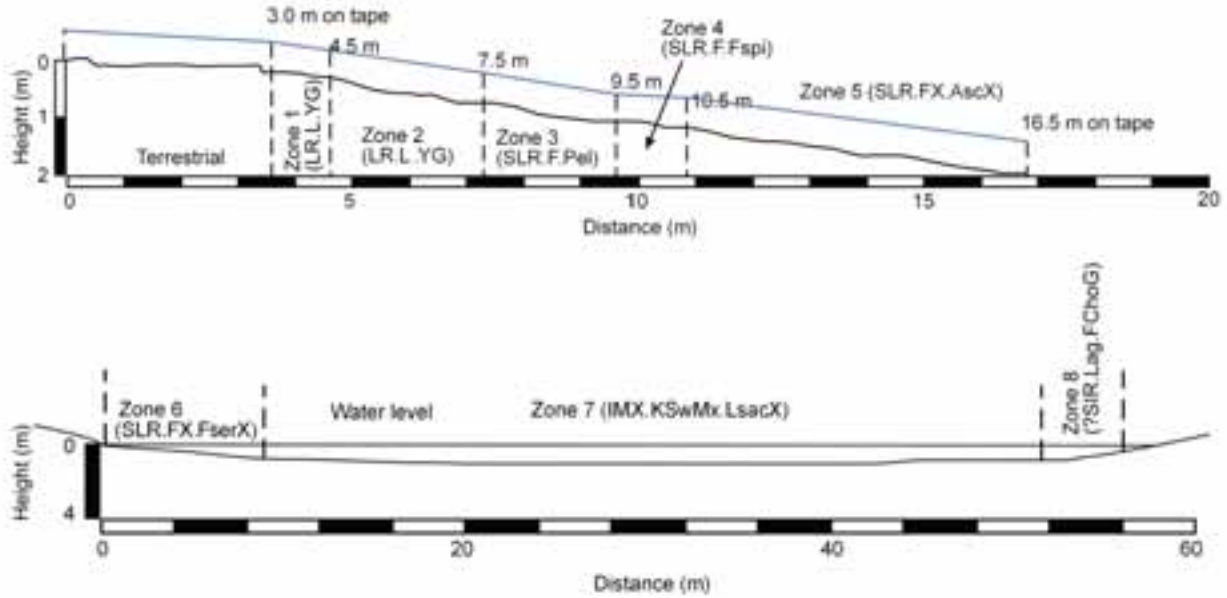


Table 3.23 Summary statistics for Mo Wick Narrows transect (TV03TN3), Vadills site condition monitoring survey, July–August 2003

Lagoon Transect Name	Mo Wick Narrows
Transect Number	TV03TN3
Type / name of transect	Littoral and sublittoral
Position of transect start point on shore	HU 29387, 56019
Position of transect end point	HU 29319, 56006
Aspect and exposure	West-south-west (265° magnetic); very sheltered
Transect length	40m
Biotopes	Littoral – 4 zones/4 biotopes; Sublittoral – 3 zones/3 biotopes

Table 3.24 Biotope data for Mo Wick Narrows transect (TV03TN3), Vadills site condition monitoring survey, July–August 2003

Zone	Biotopes	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 3.0–4.5m on tape. (1.8–1.7m ASL, 1606 BST 10/08/03)	Very sheltered cobbles on strandline	Black and grey lichens, dominated by <i>Lecanora gangaleoides</i> . <i>Verrucaria maura</i> frequent
2	LR.L.YG	Supralittoral; 4.5–7.5m on tape. (1.7–1.3m ASL, 1606 BST 10/08/03)	Very sheltered angular cobbles and pebbles	Yellow, black and grey lichens dominated by <i>Verrucaria maura</i> and <i>Lecanora gangaleoides</i> . <i>Caloplaca marina</i> also present
3	SLR.F.Pel	Upper eulittoral; 7.5–9.0m on tape. (1.3–1.0m ASL, 1606 BST 10/08/03)	Very sheltered angular cobbles, pebbles and gravel	Main cover of <i>Pelvetia canaliculata</i> and <i>Verrucaria maura</i> , with some <i>Fucus spiralis</i> in lower part of zone
4	SLR.F.Fspi	Upper eulittoral; 9.5–10.5m on tape. (1.0–0.9m ASL, 1606 BST 10/08/03)	Very sheltered cobbles, pebbles and gravel on mud	Dominated by <i>Fucus spiralis</i> and <i>Pelvetia canaliculata</i> , with a diverse under-stone fauna of small gastropods, crustaceans and insects
5	SLR.FX.AscX	Mid eulittoral; 10.5–16.5m on tape. (0.9–0m ASL, 1606 BST 10/08/03)	Very sheltered angular pebbles, gravel and coarse sand	Heavily dominated by <i>Ascophyllum nodosum</i> , in turn covered by a green algal mat; also with some <i>Fucus vesiculosus</i> . Diverse algal and faunal understory, and an infauna including <i>Cirratulus cirratus</i>
6	SLR.FX.FserX	Lower eulittoral & sublittoral fringe; 16.5–28.0m on tape (max depth 0.5m BSL, 1530 BST 10/08/03)	Very sheltered silty gravel with occasional cobbles	Dominated by <i>Fucus serratus</i> , with additional algal cover from <i>Ascophyllum nodosum</i> , <i>Chorda filum</i> and <i>Cladophora rupestris</i>
7	IMX.KSwMx.LsacX	Sublittoral fringe; 28.0–54.0m on tape (1.0–1.5m BSL, 1515 BST 10/08/03)	Very sheltered silty cobbles, pebbles and gravel	Dominated by <i>Laminaria saccharina</i> and <i>Chorda filum</i> . Additional cover from <i>Furcellaria lumbricalis</i> , <i>Halidrys siliquosa</i> , <i>Fucus serratus</i> and 'hedgehog' growths on cobbles
8	?SIR.Lag.FChoG	Sublittoral fringe; 54.0–57.0m on tape (0.5m BSL, 1500 BST 10/08/03)	Very sheltered gravel with empty littorinid shells	Main cover of <i>Chaetomorpha</i> and/or <i>Enteromorpha</i> sp., with <i>Fucus serratus</i> . [NB no <i>Chorda filum</i> recorded]

3.2.11 The Vadills Entrance Narrows, TV03TN4

The location of The Vadills Entrance Narrows transect, TV03TN4 is indicated in Figure 3.30, and a photograph of the transect is shown in Figure 3.31. Diagrams illustrating the transect profile are shown in Figure 3.32. Transect statistics are summarised in Table 3.25 and biotope information is detailed in Table 3.26 and Figure 3.32.

Physical description

The Vadills Entrance Tidal Narrows transect, TV03TN4, crosses the narrows at the entrance to The Vadills system, Brindister Voe and The Vadills basin. From its origin on the west side of the entrance, the transect heads approximately east across the channel for a distance of 62m. The shore profile is steep and stepped. Overall, the intertidal zone on the west side (the only side fully surveyed) is approximately 5m wide, and consists predominantly of bedrock with ledges and terraces or steps and varying topography. In the sublittoral the maximum depth in the centre of the channel was 3.5m BSL, but the channel was shallower on the eastern side and the current was faster there also. The substratum in the channel consisted of boulders, cobbles and pebbles with coarse sand and shell gravel. The west shore of the channel was surveyed by divers into the mid-eulittoral zone.

Habitats and communities

There was a 1m-wide yellow and grey lichen zone in the supralittoral at the top of the slope, in which *Verrucaria maura* was dominant. This was followed by a vertical face (2.3–2.7m on tape) characterised by *Pelvetia canaliculata* with *Fucus spiralis*, *Verrucaria maura* and a green filamentous mat indet. The eulittoral from 2.7–4.8m was dominated by *Ascophyllum nodosum*, but a red filamentous alga (filamentous red alga indet.; possibly *Audouinella* sp.) was also abundant and characteristic of the zone, whilst encrusting coralline alga was superabundant on vertical faces lower in the zone. The fauna recorded was limited to sparse spirorbidae and *Mytilus edulis*, although *Ascidiella scabra* was common in the lowest part of this zone. In the sublittoral fringe, (5–9m on tape), a boulder slope was dominated by *Laminaria saccharina*, but this zone was also characterised by high numbers of *Ascidiella* spp. and *Ophiothrix fragilis*. Other fauna included *Halichondria panicea*, *Antedon bifida*, *Corella parallelogramma*, *Clavelina lepadiformis*, and the starfish *Henricia* sp.

The mixed (and more unstable or mobile) substrata of the infralittoral fringe taking up most of the channel (9–33m on the survey tape) was heavily dominated by *Laminaria saccharina*, though other abundant algae included *Chorda filum* and *Halidrys siliquosa*. Again, the fauna was characterised by *Ascidiella* spp., *O. fragilis* and *A. bifida*, in addition to which a relatively high diversity of other species were also present. The deepest part of the channel, 3–3.5m BSL, at 33–40m on the tape, supported a similar biotope with *L. saccharina* replaced by *L. hyperborea*, and in addition *Modiolus modiolus* and encrusting coralline alga featured heavily (the latter on vertical faces of boulders in particular). Whilst present in the centre of the channel, *Modiolus* was more abundant in the shallower areas closer to the east shore where currents were accelerated. These kelp-dominated biotopes characterised the remaining infralittoral fringe along the transect, between 40m and 59m on the tape.

As the transect then rose up through the lower eulittoral and mid eulittoral on the west shore of the entrance narrows, there were recurrences of the *F. serratus*-dominated biotope (59–62m) and of the *Ascophyllum* zone (>62m; the transect terminated at 63m).

Figure 3.30 Map showing location of The Vadills Entrance Narrows transect (TV03TN4), Vadills site condition monitoring survey, July–August 2003

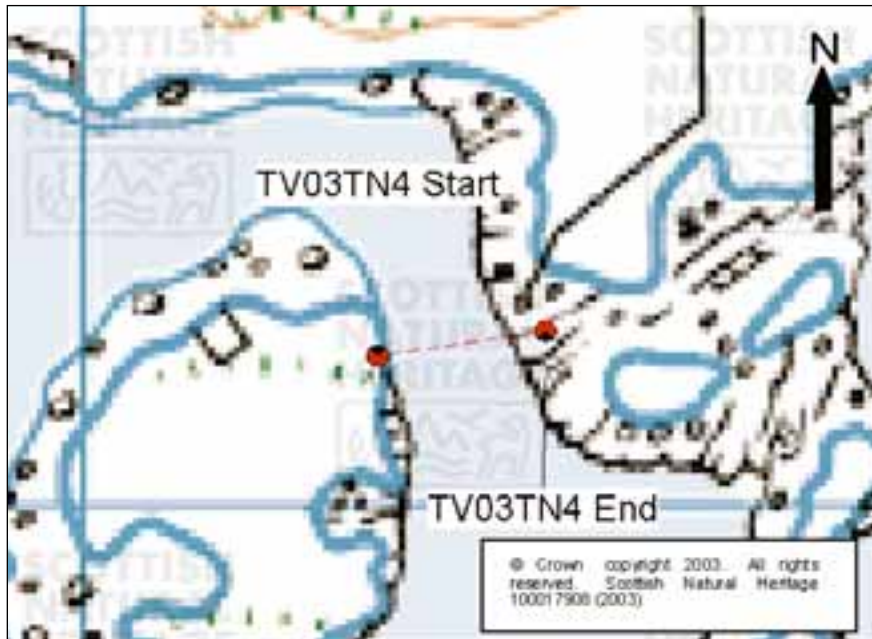


Figure 3.31 Photograph showing location of The Vadills Entrance Narrows transect (TV03TN4), Vadills site condition monitoring survey, July–August 2003



Figure 3.32 Diagram of transect and biotope distribution in The Vadills Entrance Narrows transect (TV03TN4), Vadills site condition monitoring survey, July–August 2003

Upper diagram – littoral zone, eastern end of transect
 Lower diagram – complete transect

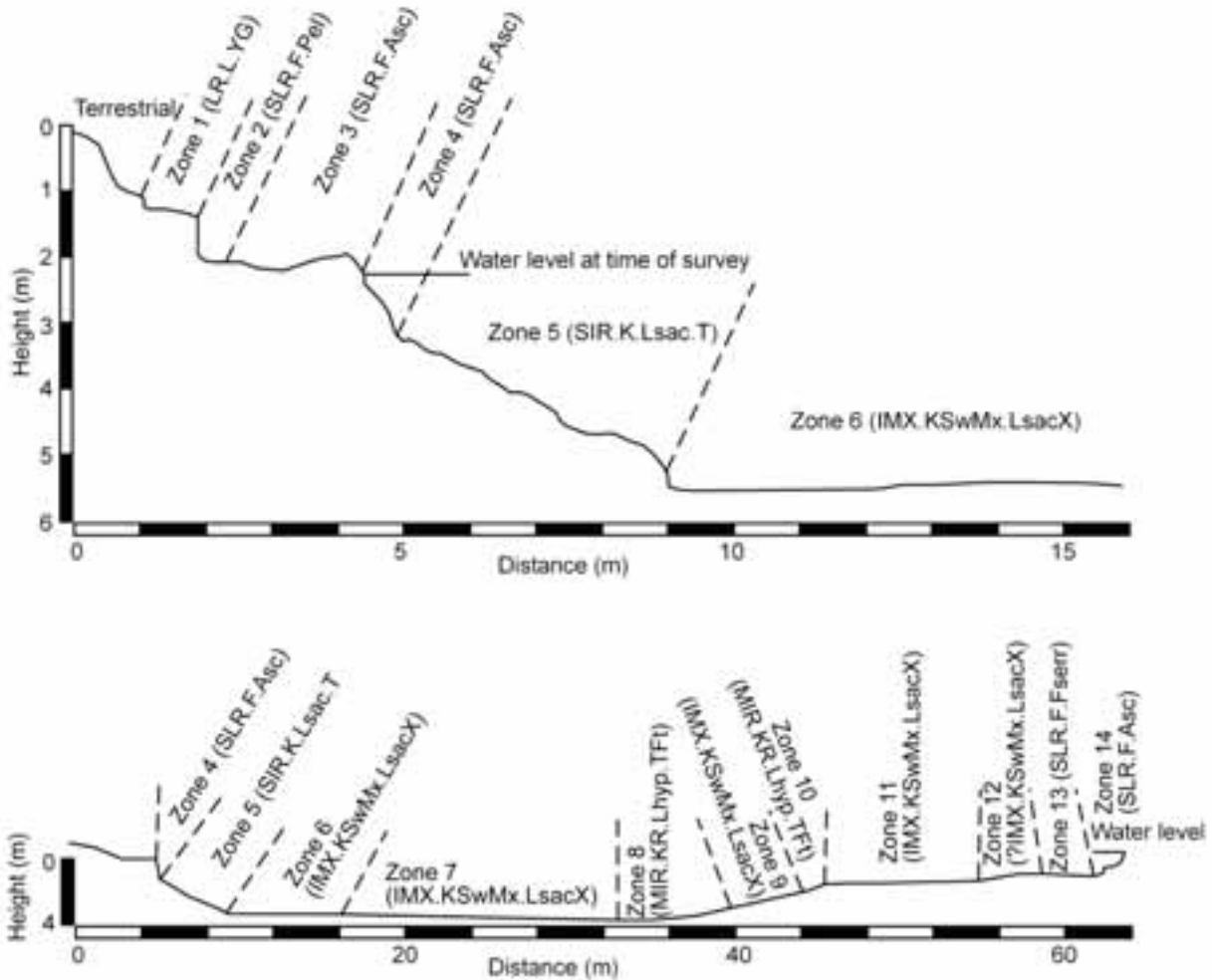


Table 3.25 Summary statistics for The Vadills Entrance Narrows transect (TV03TN4), Vadills site condition monitoring survey, July–August 2003

Lagoon Transect Name	The Vadills Entrance Narrows
Transect Number	TV03TN4
Type/name of transect	Littoral and sublittoral
Position of transect start point on shore	HU 29115, 56061
Position of transect end point	HU 29181, 56071
Aspect and exposure	East-north-east (088° magnetic); very sheltered
Transect length	100m
Biotores	Littoral – 6 zones/4 biotopes; Sublittoral – 6 zones/2 biotopes

Table 3.26 Biotope data for The Vadills Entrance Narrows transect (TV03TN4), Vadills site condition monitoring survey, July–August 2003

Zone	Biotopes	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 1.5–2.3m on tape. (1.2–0.8m ASL, 1750 BST 10/08/03)	Very sheltered stepped bedrock	Black and grey lichens, dominant species <i>Verrucaria maura</i> , with small amounts of <i>Lecanora gangaleoides</i> , <i>L. sulphurea</i> , <i>Ramalina</i> sp. and ? <i>Buellia</i> sp.
2	SLR.F.Pel	Upper eulittoral; 2.3–2.7m on tape. (0.8–0.2m ASL, 1750 BST 10/08/03)	Very sheltered sloping or near-vertical bedrock, with cobbles and pebbles	Main cover of <i>Pelvetia canaliculata</i> , <i>Verrucaria maura</i> , and green filamentous algal mat. Some <i>Fucus spiralis</i> and <i>Ascophyllum nodosum</i> also
3	SLR.F.Asc	Mid eulittoral; 2.7–4.3m on tape. (0.2–0.0m BSL, 1830 BST 10/08/03)	Very sheltered bedrock with patches of angular cobbles and pebbles	Heavily dominated by <i>Ascophyllum nodosum</i> , though beneath this canopy the rock surface was almost fully covered by a turf of red filamentous alga
4	SLR.F.Asc	Mid eulittoral; 4.3–4.8m on tape. (0.0–1.0m ASL, 1750 BST 10/08/03)	Very sheltered steep bedrock slope	Heavily dominated by <i>Ascophyllum nodosum</i> , but with <i>Fucus serratus</i> at lower edge of zone. Encrusting coralline alga superabundant on rock surfaces
5	SIR.K.Lsac.T	Sublittoral fringe; 4.8–9.0m on tape (1.0–3.2m BSL, 1830 BST 10/08/03)	Boulder slope	Dense <i>Laminaria saccharina</i> with colonial and solitary ascidians, <i>Ophiothrix fragilis</i> , <i>Halichondria</i> sp. and <i>Antedon bifida</i>
6	IMX.KSwMx.LsacX	Upper infralittoral; 9.0–16.0m on tape (3.2–3.3m BSL, 1830 BST 10/08/03)	Black muddy coarse sand, with pebbles, cobbles, small boulders and shell debris	Dense <i>Laminaria saccharina</i> with <i>Chorda filum</i> and <i>Halidrys siliquosa</i> . <i>Asciella aspersa</i> and <i>A. scabra</i> both abundant
7	IMX.KSwMx.LsacX	Upper infralittoral; 16.0–33.0m on tape (3.3–3.5m BSL, 1830 BST 10/08/03)	Coarse sand, with pebbles and shell debris	Sparse <i>Laminaria saccharina</i> with <i>Chorda filum</i> , <i>Asciella aspersa</i> and <i>A. scabra</i> . <i>Pomatoceros triqueter</i> abundant on the larger pebbles
8	MIR.KR.Lhyp.TFt	Upper infralittoral; 33.0–40.0m on tape (3.3–3.5m BSL, 1830 BST 10/08/03)	Coarse sand, with pebbles, and boulders	Dense <i>Laminaria hyperborea</i> with ascidians, ophiuroids and <i>Modiolus modiolus</i> . Encrusting coralline alga superabundant

Table 3.26 (continued)

Zone	Biotopes	Location	Substratum notes	Biological notes
9	IMX.KSwMx.LsacX	Upper infralittoral; 40.0–44.0m on tape (2.0–3.0m BSL, 1830 BST 10/08/03)	Coarse sand and gravel, with pebbles, cobbles, and sparse boulders	Dense <i>Laminaria saccharina</i> , <i>Asciella aspersa</i> and <i>A. scabra</i> , together with <i>Ophiolithrix fragilis</i> and <i>Modiolus modiolus</i> . <i>Mya truncata</i> in sediment
10	MIR.KR.Lhyp.TFt	Upper infralittoral; 44.0–46.0m on tape (~2m BSL, 1830 BST 10/08/03)	Small patch of boulders	Dense <i>Laminaria hyperborea</i> with ascidians, ophiuroids and <i>Modiolus modiolus</i> . Encrusting coralline alga superabundant
11	IMX.KSwMx.LsacX	Upper infralittoral; 46.0–55.0m on tape (2.0–1.5m BSL, 1830 BST 10/08/03)	Coarse sand and gravel, with pebbles, sparse cobbles, and small boulders	Dense <i>Laminaria saccharina</i> , <i>Asciella aspersa</i> and <i>A. scabra</i> , together with <i>Ophiolithrix fragilis</i> and <i>Modiolus modiolus</i> . <i>Mya truncata</i> in sediment
12	IMX.KSwMx.LsacX	Upper infralittoral; 55.0–59.0m on tape (1.5–1.0m BSL, 1830 BST 10/08/03)	Pebbles and small cobbles	Dense <i>Enteromorpha</i> sp. and Ectocarpaceae with <i>Modiolus</i> <i>modiolus</i> . Some <i>Laminaria</i> <i>saccharina</i>
13	SLR.F.Fserr	Lower eulittoral; 59.0–62.0m on tape (~1.0m BSL, 1830 BST 10/08/03)	Boulders	Dense <i>Fucus serratus</i> , with some <i>Ascophyllum nodosum</i>
14	SLR.F.Asc	Mid eulittoral; 62.0–63.0m on tape (~1.0–0m BSL, 1830 BST 10/08/03)	Large boulders	Very dense <i>Ascophyllum</i> <i>nodosum</i> ; <i>Fucus serratus</i> present

4 DISCUSSION

4.1 Recording methodology

The method used for establishing the transect line, ensuring future re-location, and the use of MNCR phase 2 recording methods was similar to that used for the cave and reef transects surveyed in Papa Stour (ERT, 2004). Points arising from this are as follows:

- With the way in which the transect start points have been marked, together with the transect photography and the position fixing, re-location of the transect start points in the future should be straightforward. Transect re-location will be easiest for those sites such as tidal narrows which have land markers for both the start and finish points. It is true that reproducing the manner in which a transect has been laid out over a topographically varied sea bed can be difficult or impossible. However, almost without exception, the sea bed type encountered in the present Vadills survey has been flat and very shallow, which simplifies the task of recreating the transect (in terms of both distance and direction) in the future.
- Laying transect line across tidal narrows was problematic, in that the water flow typical of these locations dragged the line causing it to bow and making accurate measurements difficult. A solution tried at three transects (TV03TN1, TV03TN2 and TV03TN4) was to suspend the line over the water. This could be difficult to reproduce in future surveys unless both end points of the transect can be relocated accurately.
- The basic format used in fieldwork recording worked well, but needs to be developed into a set of standard recording forms. This is to ensure consistency and completeness in fieldwork recording, to ease the process of locating data subsequently, and to avoid duplication of effort. The use of the MNCR Site Form to record general site information, for example, is highly recommended. It should be an objective in future monitoring to record species data on locality-specific checklists, which would circumvent the problems of lack of consistency in taxonomic nomenclature between surveyors.
- Good quality stills from the sublittoral would have been useful in addition to the video footage in the data review, since the resolution of video is often not sufficient to be able to identify species.

4.2 Physical data

Salinity readings throughout The Vadills fell within a narrow range approximating to full seawater values (34.5–35.5‰). A larger range in salinity, or a range including lower values might have been expected in such a relatively enclosed system that is fed by burns at several points. However, the intertidal biotopes present were generally consistent with very sheltered or extremely sheltered marine conditions rather than of low salinity. Obvious fresh water influences were restricted to those points where burns entered the system, such as Mill Burn or The Vadills Burn where areas of *Fucus ceranoides* existed.

4.3 Biotope data

Altogether 18 biotopes were identified at the 11 transects surveyed, together with 121 taxa from shore work and 98 taxa from sublittoral recording.

Within The Vadills system, the most ubiquitous biotopes recorded were **LR.L.YG**, **SLR.FPel**, **SLR.FFspi**, **SLR.FX.AscX**, **SLR.FX.FserX** and **IMX.KSwMx.LsacX**, mostly representative of very sheltered intertidal or shallow infralittoral marine environments.

Biotopes of interest or note include **SLR.FX.AscX.mac**, **IMS.Sgr.Rup**, **IMU.MarMu.AreSyn**, **CMU.Beg**, and of these only **IMU.MarMu.AreSyn** was found on more than one transect in the survey. Additional occurrences of **SLR.FX.AscX.mac** and **IMS.Sgr.Rup** were, however, recorded during additional exploratory searches made in the vicinity of some of the transects. The interest stems either from known rarity value for key species or for the rarity of the biotope itself. In both **SLR.FX.AscX.mac** and **IMS.Sgr.Rup**, the biotope is effectively defined by the presence of a single species, *Ascophyllum nodosum* ecad *mackaii* and *Ruppia maritima* or *R. spiralis* respectively. The former is scarce in Britain and associated with the heads of sheltered sea lochs, whilst the *Ruppia* biotope is characteristic of lagoonal habitats and is regarded as uncommon (Connor *et al.*, 1997a, b).

IMU.MarMu.AreSyn, or *Arenicola marina* and synaptid holothurians in extremely shallow soft mud, is characteristic of shallow and extremely sheltered sea loch basins or lagoons (Connor *et al.*, 1997b). *Beggiatoa*-dominated sublittoral mud (**CMU.Beg**) is associated with very sheltered habitats, often with poor water exchange, and may be a seasonal phenomenon although not necessarily annual. It may therefore be the case that the biotope identity of certain mud habitats could fluctuate between **IMU.MarMu.AreSyn** (for example) and **CMU.Beg** depending on the time of year of the survey and prevailing conditions such as temperature, nutrient inputs (whether natural or anthropogenic) and productivity.

4.4 Comparison with previous data

The Oil Pollution Research Unit (OPRU) undertook sublittoral recording at a few sites within The Vadills system in the 1980s as part of a wider study of Shetland (Howson, 1988). In addition, mapping of the littoral and sublittoral biotopes in The Vadills was undertaken by Entec (1999, 2000) and by Bunker *et al.* (1994) respectively. Much of this information was reviewed and amalgamated into an area summary for lagoons in Shetland and Orkney (Thorpe, 1998).

This body of survey work was undertaken to achieve different objectives and using different methods to those of the present survey. Comparison of maps of sample site locations will show that many sites previously sampled are close to the transects sampled here. In fact, subjective comparison of species lists and biotope lists does indicate great similarities between the data sets. However, owing to the differences in objectives and methods, it is likely to be more useful to simply compare the lists of biotopes identified from all Vadills sites than to attempt detailed comparison on a site by site basis. This has been done in Table 4.1.

Most of the discrepancies between the three sets of data compared relate to previous surveys being either intertidal or subtidal, rather than both as in the present survey. All of the most ubiquitous biotopes in the present survey have been recorded previously from The Vadills. At the other end of the scale, some of the more noteworthy biotopes from previous surveys such as **AscX.mac**, **Sgr.Rup** and **AreSyn**, have also been recorded in 2003 because sites were chosen specifically to locate and include them.

Table 4.1 Comparison of biotope records from 2003 survey with those from previous surveys

		ERT and SNH (present survey)	MNCR subtidal data	Entec (2000)
1	LR.L.YG	P		P
2	LR.R.Ver.Ver			P
3	SLR.FPel	P		P
4	SLR.FFspi	P		P
5	SLR.FAsc	P		P
6	SLR.FAsc.Asc	P		P
7	SLR.FFserr	P		P
8	SLR.FFserr.T		P	P
9	SLR.FFserr.VS		P	
10	SLR.FX.FvesX			P
11	SLR.FX.AscX	P		P
12	SLR.FX.AscX.mac	P		P
13	SLR.FX.FserX	P	P	P
14	SLR.FX.EphX	P		P
15	MIR.KR.Lhyp.TFt	P		
16	MIR.SedK.XKScrR		P	
17	MIR.SedK.HalXK		P	
18	SIR.K.LhypLsac		P	
19	SIR.K.Lsac.Ft		P	
20	SIR.K.Lsac.T	P		P
21	?SIR.Lag.FChoG	P	P	
22	SIR.Lag.PolFur		P	
23	IGS.Mrl.Lgla		P	
24	IGS.Sgr.Zmar		P	
25	IMS			P
26	IMS.Sgr.Rup	P	P	P
27	IMS.FaMS		P	
28	IMU			P
29	IMU.MarMu		P	
30	IMU.MarMu.AreSyn	P	P	
31	CMU.Beg	P	P	
32	IMX			P
33	IMX.KSwMx.LsacX	P	P	P
34	IMX.KSwMx.FiG	P	P	P
35	IMX.FaMx		P	

One such biotope not recorded in the present survey was **IGS.Mrl.Lgla**, based on the hedgehog stones or *Lithothamnion glaciale* that have previously been found to be a feature of interest between Mo Wick and Smisslings Wick. This species was recorded in the area during the present survey, but only in small numbers. It is possible that changes may have occurred to reduce numbers of hedgehog stones in the area, or that the main concentrations previously found ('common', or 20–40% cover) were simply missed by the transect. The latter is unlikely, since the entire length of the rapids here was searched specifically for this feature prior to siting the transect. The original habitat description was:

"Shallow tide-swept channel floored with small pebbles and gravel. Many of these pebbles had coralline algal crusts including *Lithothamnion glaciale*, forming hedgehog stones".

The description of the biotope which included hedgehog stones in the present survey (**IMX.LsacX**) was:

"Cobbles and pebbles with encrusting pink corallines – some developed into hedgehog growths".

These two descriptions could be interpreted as being very similar, and it is possible that the original estimate of hedgehog stone cover was inflated by including stones simply covered with pink coralline algal crusts. However, in the absence of definitive quantitative data from either survey, it is also possible that changes may have occurred to reduce numbers of hedgehog stones in the area over the intervening period.

One other feature of interest in The Vadills was the reported occurrence in Marlee Loch of *Zostera marina* in the 1930s. This was not seen during the present survey, either on transect TV03LT2 or during other snorkel swim searches, yet core samples from the vicinity contained what looked like the remains of seagrass buried in the mud. Survey work in 1993 also reported on the apparent absence of *Zostera* from Marlee Loch (Bunker *et al.*, 1994).

Beds of the angiosperm *Ruppia maritima* were recorded by Bunker *et al.* (1994) from Mo Wick, Marlee Loch and in the south-west arm at the Head of The Vadills. In the present survey, *Ruppia* was recorded in the same south-west arm at the Head of The Vadills on transect TV03LT4, although wider exploration in the close vicinity showed the beds here to be small and patchy and typically overgrown by green filamentous algae. Additional exploration in Mo Wick revealed the existence of *Ruppia* beds in the small northernmost basin of The Vadills system (Appendix 1, Figure 1). There are no data on the distribution, condition and density of *Ruppia* from any survey in The Vadills that would permit an assessment of change over time.

Thin mats of filamentous green algae blanketing the sea bed were a common feature of the site in the present survey. Bunker *et al.*, (1994) reported algal mats from soft mud habitats with burrowing holothurians in Smisslings Wick, but did not report on the colour of the algae. However, an unusual alga identified as 'Gracilarioid' was recorded commonly from sheltered muddy areas, and may have been a sheltered growth form of *Gracilaria verrucosa* or a species of *Gracilariopsis*. This could well be the alga provisionally identified in the present survey as ?*Gracilaria* sp. in The Vadills Outer Basin (TV03LT5) on the basis of video footage.

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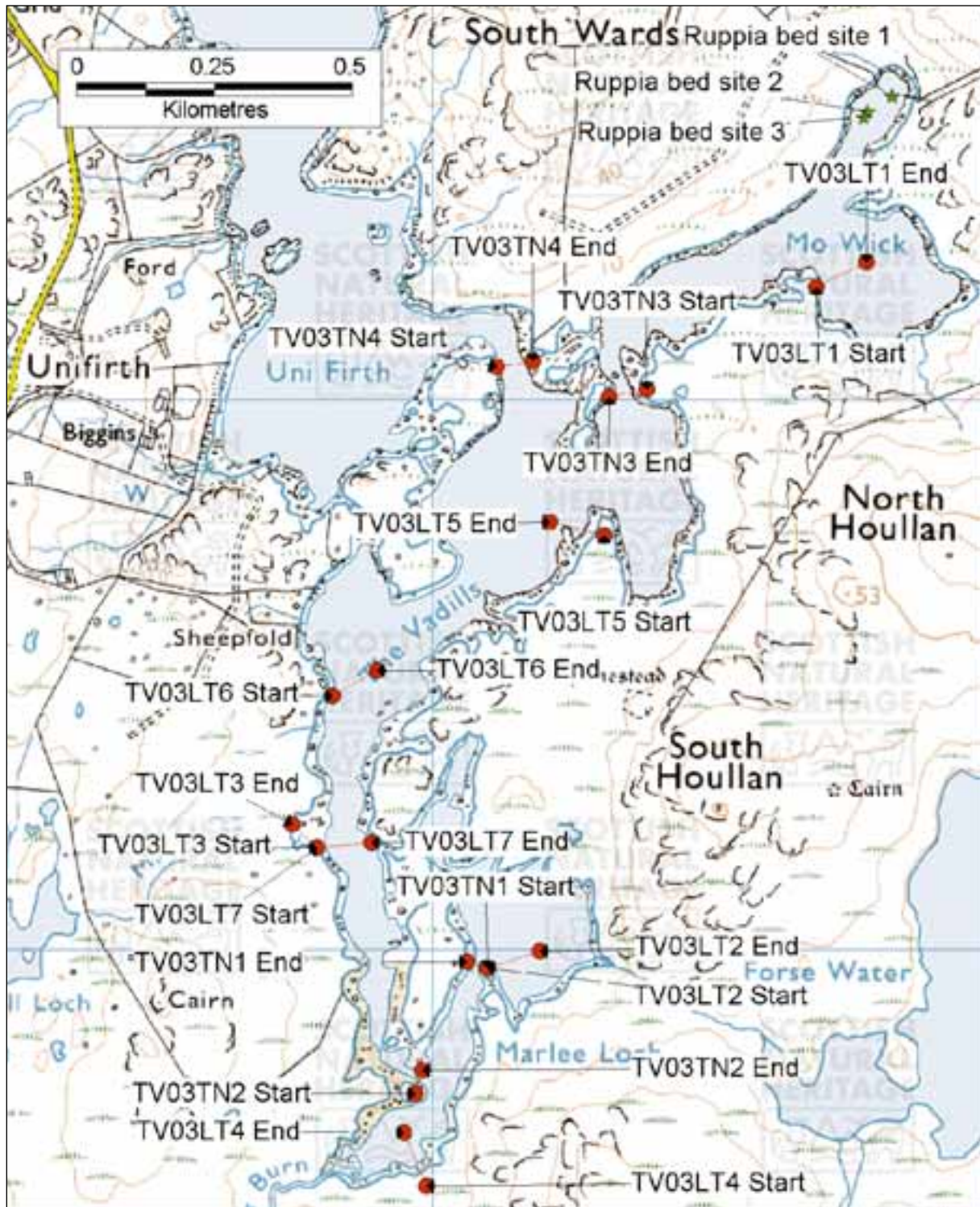
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Appendix 1 Inventory of survey locations

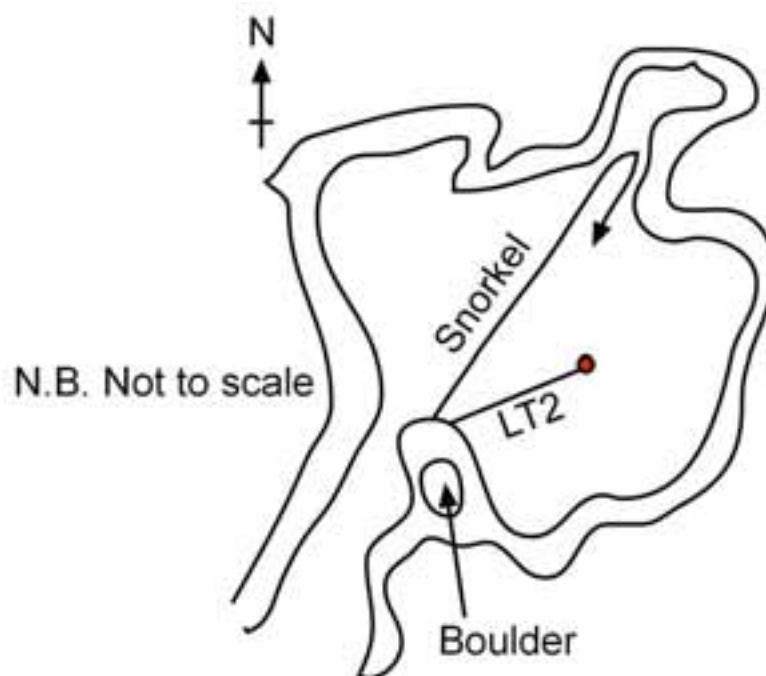
SNH Site code	Site name (or, if un-surveyed, site location description)	Survey information	Type of transect	Position of start point	Position of end point
TV03LT1	Mo Wick	MNCR 443.13	Littoral and sublittoral	HU 29696, 56206	HU 29787, 56251
TV03LT2	Marlee Loch Basin	MNCR 443.23 MNCR 1.208	Littoral and sublittoral	HU 29112, 54942	HU 29193, 54998
TV03LT3	Mill Burn	–	Littoral	HU 28788, 55167	HU 28743, 55214
TV03LT4	Head of The Vadills	MNCR 443.25 MNCR 1.208	Littoral and sublittoral	HU 28988, 54570	HU 28947, 54667
TV03LT5	Vadills Outer Basin	MNCR 443.20	Littoral and sublittoral	HU 29311, 55754	HU 29212, 55778
TV03LT6	Vadills Mid Basin	MNCR 443.22	Littoral and sublittoral	HU 28817, 55463	HU 28898, 55509
TV03LT7	Inner Basin	MNCR 261.57	Littoral and sublittoral	HU 28788, 55167	HU 28887, 55195
TV03TN1	Marlee Loch tidal narrows	MNCR 1.208	Littoral and sublittoral	HU 29112, 54942	HU 29064, 54964
TV03TN2	Head of The Vadills narrows	–	Littoral and sublittoral	HU 28967, 54738	HU 28980, 54781
TV03TN3	Mo Wick Tidal narrows	MNCR 443.19	Littoral and sublittoral	HU 29387, 56019	HU 29319, 56006
TV03TN4	Outer Basin narrows	MNCR 443.18 MNCR 261.58 MNCR 443.12	Littoral and sublittoral	HU 29115, 56061	HU 29181, 56071
N/A	Mo Wick	–	A snorkel was carried out within Mo Wick to assess the presence of previously reported dense <i>Ruppia</i> beds. Several beds were found. See Appendix 1 Figure 1	<i>Ruppia</i> beds 1 – HU 29834, 56554 2 – HU 29789, 56526 3 – HU 29782, 56516	N/A
N/A	Marlee Loch basin (near TV03LT2)	–	A snorkel was carried out within Marlee Loch Basin to generally assess the substratum type and dominant species cover. See Appendix 1 Figure 2	HU 29098, 54967	HU 29196, 55164
N/A	<i>Ascophyllum nodosum</i> ecad <i>mackaii</i> bed in the vicinity of Mill Burn (near TV03LT3)	–	Boundary of <i>A. mackaii</i> bed walked and waypoints taken to roughly map its position and outline. See Appendix 1 Figure 3. An overview plan of Mill Burn bay is shown in Appendix 1 Figure 4	N/A	N/A
N/A	Head of The Vadills (near TV03LT4)	–	A snorkel was carried out within the Head of the Vadills to generally assess the substratum type and dominant species cover. See Appendix 1 Figure 5	N/A	N/A
N/A	Smisslings Wick	–	A snorkel was carried out within Smisslings Wick to assess the substratum type and dominant species cover. See Appendix 1 Figure 6	N/A	N/A

Appendix 1 Figure 2 Locations of transects in The Vadills, Vadills cSAC site condition monitoring, July–August 2003



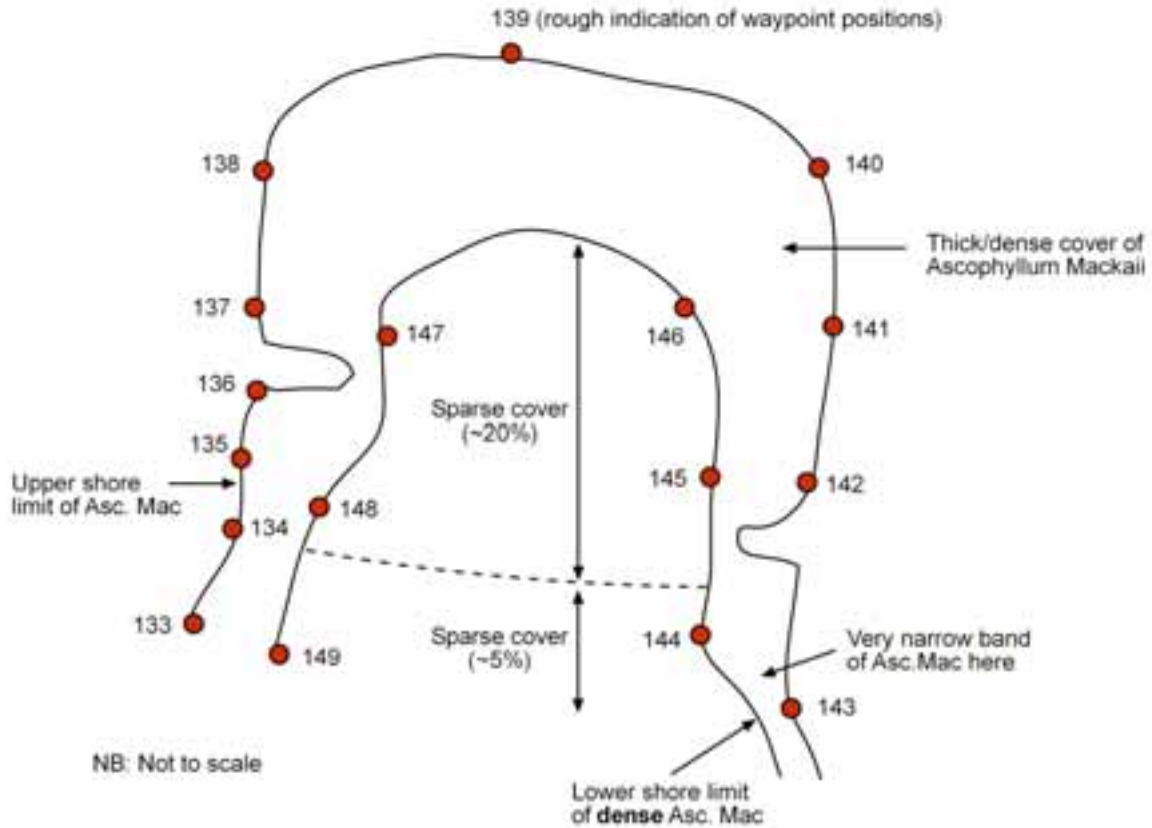
Appendix 1 Figure 2 Marlee Loch

Diagram and notes from additional snorkel swim in Marlee Loch Basin transect (near TV03LT2).



Snorkel swim from transect TV03LT2 (from the start of the transect) to small inlet on the north-northeast side of Marlee Loch. Even depth of 1.5–2m BSL across the basin, with sea bed of soft mud with occasional clumps of algae (*Furcellaria* and ?*Cladophora*), many *Carcinus maenas*, and a few solitary ?*Ascidella* sp. The small inlet on the north-northeast side of the loch did not support *Ruppia*. Lower shore zones (observed when submerged) included *Fucus serratus*, *F. vesiculosus* and stands of *Ascophyllum nodosum*. Many *Carcinus* in amongst the algae, together with *Littorina littorea*. Very few other conspicuous species apparent.

Appendix 1 Figure 3 *Ascophyllum nodosum* ecad *mackaii* bed in the vicinity of Mill Burn (near TV03LT3)

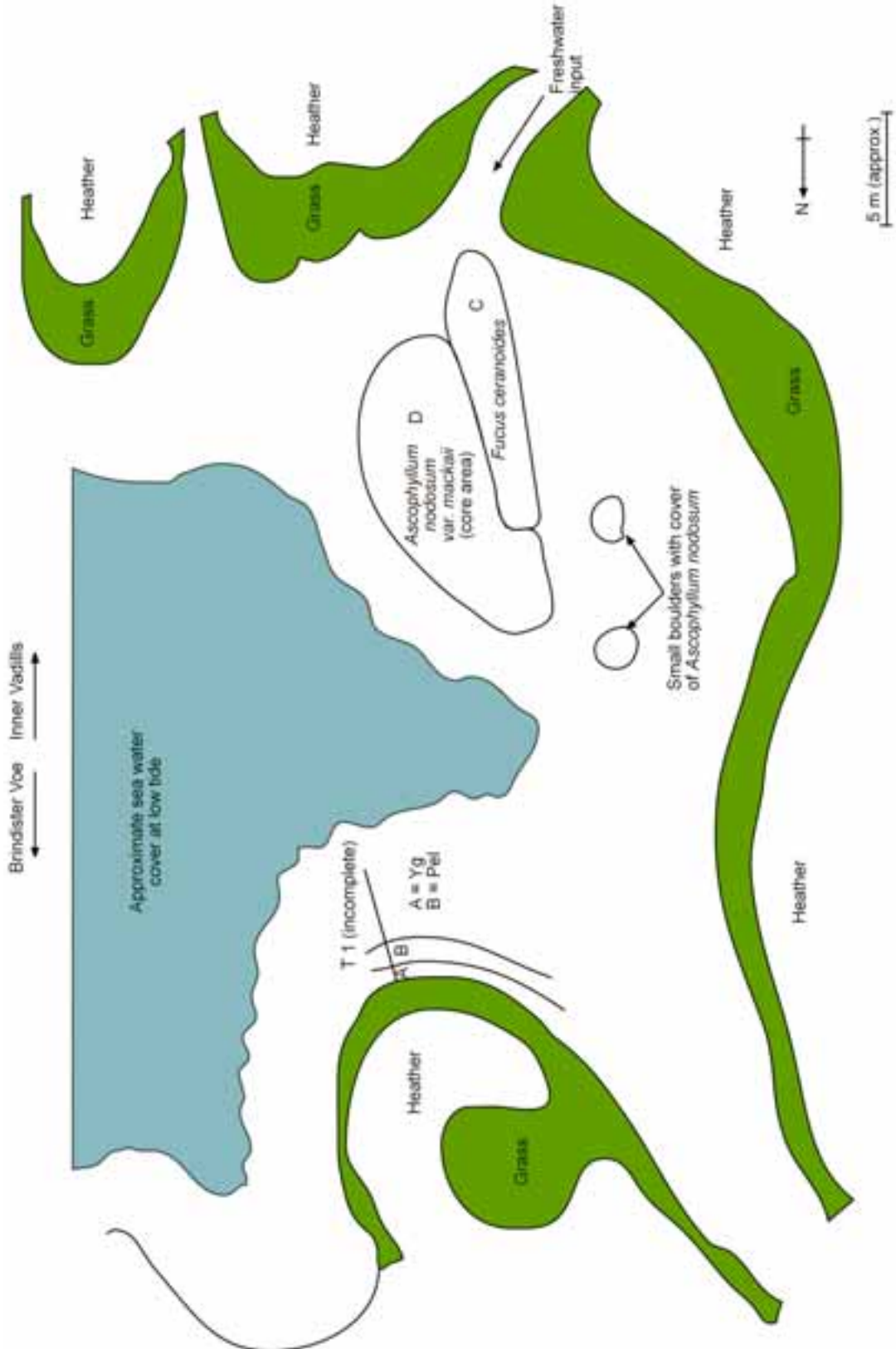


Waypoint data (WGS84 datum)

Waypoint no	Latitude (degrees N)	Longitude (degrees W)
133	60.27636	1.47962
134	60.27631	1.47971
135	60.27627	1.47967
136	60.27620	1.47967
137	60.27613	1.47978
138	60.27606	1.47994
139	60.27606	1.48007
140	60.27616	1.48010
141	60.27625	1.48010
142	60.27634	1.47998
143	60.27658	1.47994
144	60.27642	1.47984
145	60.27635	1.47986
146	60.27628	1.47994
147	60.27619	1.47994
148	60.27624	1.47979
149	60.27633	1.47966

Appendix 1 Figure 4 Mill Burn, TV03LT3

Sketch to indicate boundaries of embayment and location of *Ascophyllum nodosum* ecad *mackaii* and *Fucus ceranoides* beds.



Appendix 1 Figure 4 notes

Biological records for zones A and B and the *A. nodosum* ecad *mackaii* and *F. ceranoides* beds:

Zone A Strandline and lichens ~1.5m wide (angular small boulders and cobbles)

?*Lichenora* sp. (grey) 70%; *Ramalina* sp. P; Grey lichen with black fruiting bodies 20%; *Caloplaca* sp. P; *Verrucaria maura* 10%; loose/dead *Ascophyllum nodosum* ecad *mackaii* and *F. spiralis*.

Zone B Pelvetia zone (angular cobbles, pebbles and gravel)

Verrucaria maura 70%; *Pelvetia canaliculata* (50% locally, less in other places); *Littorina saxatilis* 1–9/30x30cm; red mites P; *Anurida maritima* P; Amphipoda 1–9/10x10cm; *Verrucaria mucosa* <5%; *Semibalanus balanoides* 1–9/10x10cm; Millipedes 1–9/m²; *Fucus spiralis* 10%; *Littorina obtusata* 1–9/m²; *Carcinus maenas* 1–9/10x10m.

Zone C *Fucus ceranoides* bed (gravel and angular pebbles with fresh water influence)

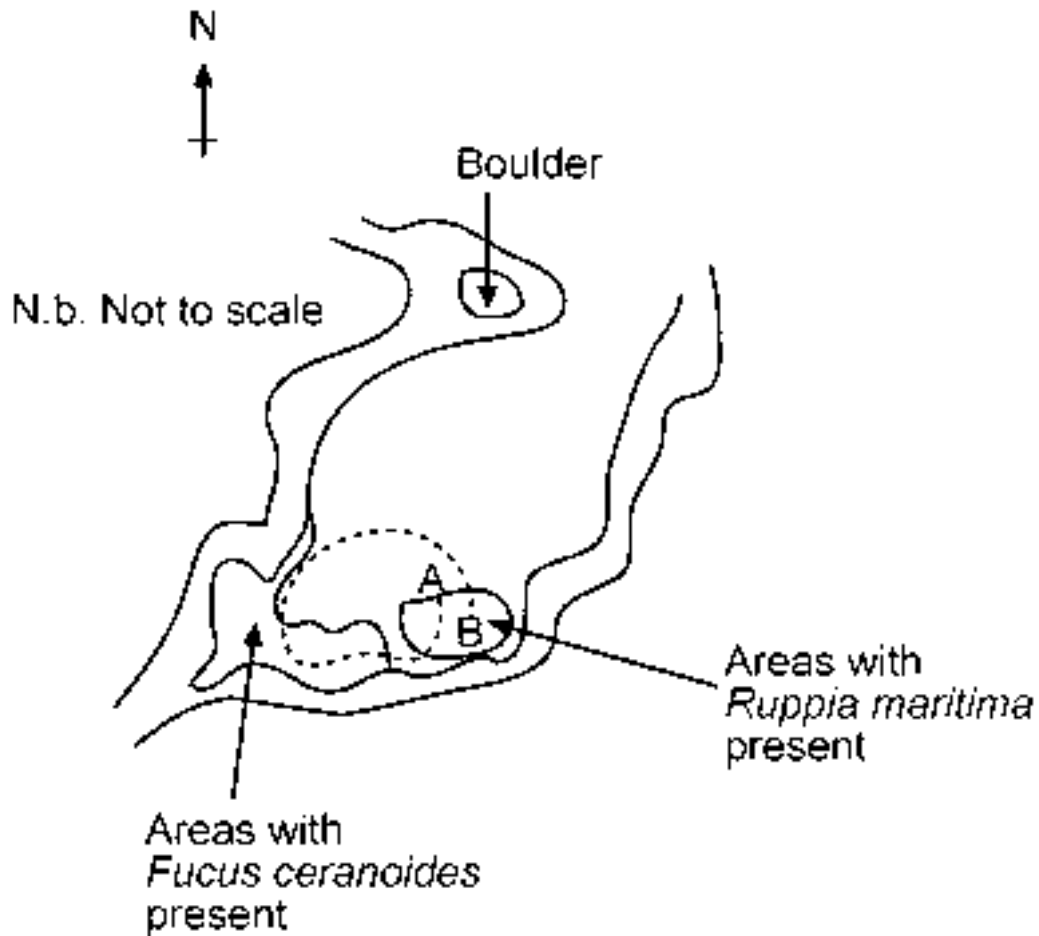
Fucus ceranoides 100%; Gammaridae 1–9/10x10cm; *Littorina obtusata* P; *Ascophyllum nodosum* ecad *mackaii* 5%; *A. nodosum* 5%; *Hildenbrandia rubra* 70%; *Carcinus maenas* 1–9/m²; *Verrucaria mucosa* 10%.

Zone D *Ascophyllum nodosum* ecad *mackaii* bed (coarse gravel with silt)

Ascophyllum nodosum ecad *mackaii* 100%; Gammaridae 1–9/10x10cm; *Carcinus maenas* 1–9/m²; *Littorina obtusata* 1–9/3x3m; *Hildenbrandia rubra* 30%; *Fucus spiralis* 5%; *A. nodosum* 5%; *Littorina saxatilis* 1–9/m².

Appendix 1 Figure 5 'Head of the Inlet'

Diagram and notes from additional snorkel swim around southern tip of Marlee Loch (near TV03LT4).

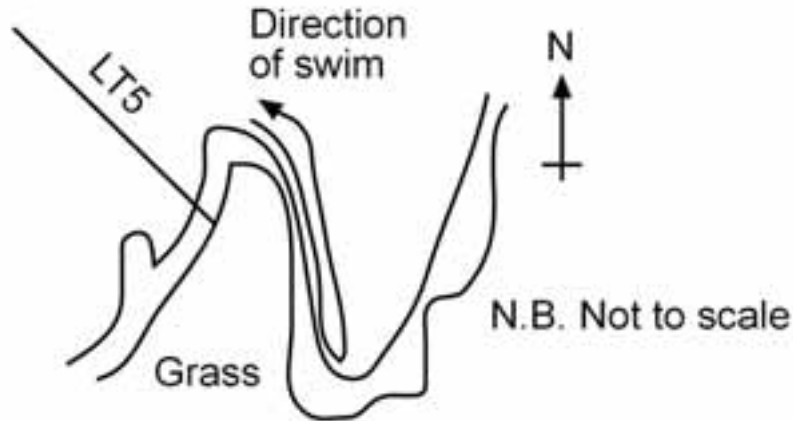


Snorkel swim from A to B as marked.

Many clumps of *Ascophyllum nodosum*, with fore-shortened fronds which were golden-coloured. Similarly coloured *Fucus vesiculosus* with high density of bladders. A zone of *F. ceranoides* was present in the southwest tip of the inlet, at the mouth of The Vadills Burn. Patches of *Ruppia maritima* noted at TV03LT4 were restricted to the area of the transect. The *Ruppia* plants were about 15–20cm tall and covered with a layer of silt.

Appendix 1 Figure 6 Smisslings Wick

Brief snorkel survey of southwest shore of Smisslings Wick, close to start point of TV03LT5



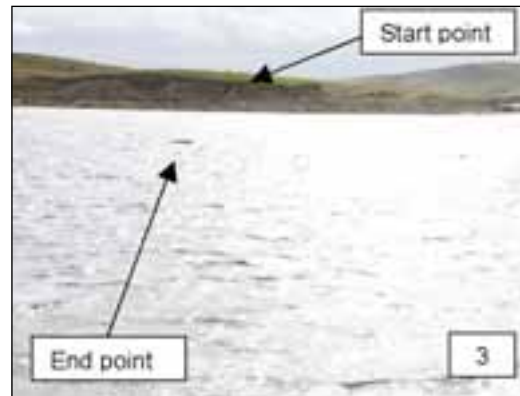
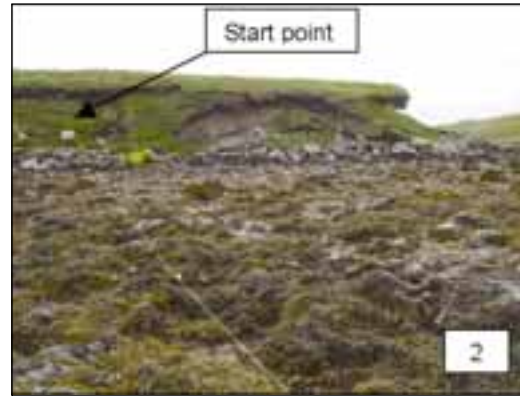
Area within 5–6m of shore was mostly rocky and dominated by abundant *Laminaria saccharina*, although *Fucus serratus* was sometimes the dominant alga in places. *Chorda filum* and *Halidrys siliquosa* were common throughout, whilst *Furcellaria lumbricalis* was locally frequent. Solitary ascidians (*Ascidella scabra* and *Corella parallelogramma*) were typically attached to algal fronds.

Further from the shore, water depths reached 3–4m (15:00 BST) and the sea bed was anoxic-looking soft mud. The mud surface had a thin layer of green filamentous algae and small scattered patches of *Beggiatoa*. Mud mostly bare otherwise, with *Carcinus* tracks, *Arenicola marina*, and rare occurrences of *Antedon bifida* and pipefish, together with occasional patches of *F. lumbricalis* in the southernmost part of the bay.

At the tip of the headland, the mud appeared less anoxic and the algal mat and *Beggiatoa* became sparse. At the same time, macroalgal coverage increased, especially by *Furcellaria*, along with the density of *Arenicola marina*. Other fauna noted included *Ascidella aspersa*, *Buccinum undatum*, *Pagurus bernhardus*, and the empty shells of *Venerupis pullastra* and *Mya truncata*.

Appendix 2 Site relocation data

Site name	Mo Wick
Site code	TV03LT1
Type/name of transect	Littoral and sublittoral
Position of transect start point on shore	HU 29696, 56206
Position of transect end point	HU 29787, 56251
Transect bearing (start point to end point)	065° magnetic
How fixed points are marked	Wooden stake placed into the grass just above the upper limit of the cobble shore and strand line. The wooden stake sticks up out of the grass about 6cm. In front of the wooden stake a white boulder was placed on the grass, and a black circle with a white dot in the middle was painted on to further highlight the start point.
Notes on relocation	Refer to map and photographs
Notes on access	Boat access requires passing very shallow tidal rapids. Small inflatable boat (with shallow draft <0.5m) that can be carried if necessary.

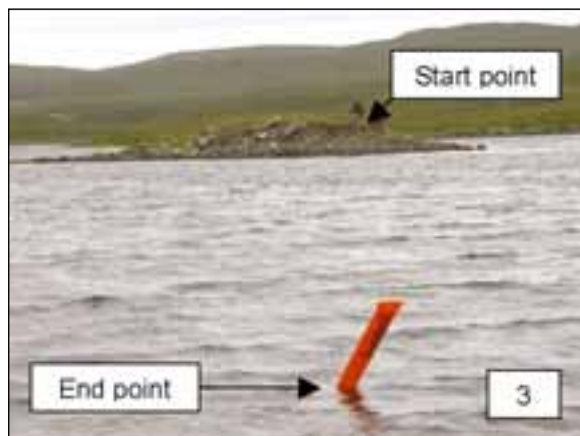


1: View from shore to surface marker buoy (SMB).

2: Photo showing start point and marker stone.

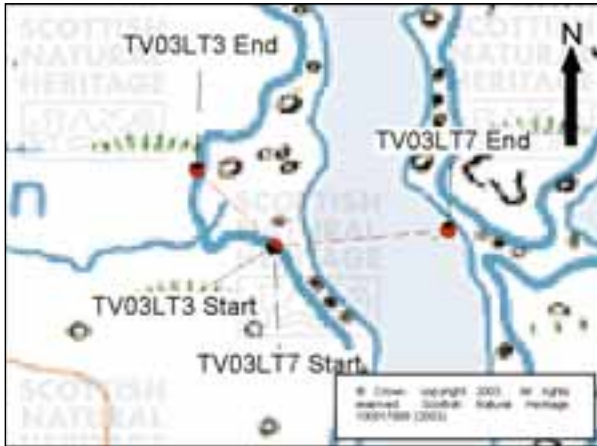
3: View from SMB to start point.

Site name	Marlee Loch Basin
Site code	TV03LT2
Type/name of transect	Littoral and sublittoral
Position of transect start point on shore	HU 29112, 54942
Position of transect end point	HU 29193, 54998
Transect bearing (start point to end point)	067° magnetic
How fixed points are marked	Wooden stake placed into the grass just above the upper limit of the cobble shore and strand line. The wooden stake sticks up out of the grass about 6cm. In front of the wooden stake a boulder was placed on the grass, and a black circle with a white dot in the middle was painted on to further highlight the start point.
Notes on relocation	Refer to map and photographs
Notes on access	Boat access requires passing very shallow tidal rapids. Small inflatable boat (with shallow draft <0.5m) that can be carried if necessary.



- 1: Start piton and tape for TV03LT2.
- 2: View from start point to SMB (in distance).
- 3: View from SMB to start of transect (photo taken at high tide).

Site name	Mill Burn
Site code	TV03LT3
Type/name of transect	Littoral
Position of transect start point on shore	HU 28788, 55167
Position of transect end point	HU 28743, 55214
Transect bearing (start point to end point)	319° magnetic
How fixed points are marked	Start point and end point marked with wooden stake placed into the grass just above the upper limit of the cobble shore and strand line. The wooden stake sticks up out of the grass about 6cm. In front of the wooden stake marking the start point, a boulder was placed on the grass and a black circle with a white dot in the middle was painted on to further highlight the start point.
Notes on relocation	Refer to map and photographs
Notes on access	Boat access requires passing some shallow sections, approach with caution with boat of draft <0.5m.



Site name	Head of The Vadills
Site code	TV03LT4
Type/name of transect	Littoral and sublittoral
Position of transect start point on shore	HU 28988, 54570
Position of transect end point	HU 28947, 54667
Transect bearing (start point to end point)	331° magnetic
How fixed points are marked	Start point marked with wooden stake placed into the grass just above the upper limit of the cobble shore and strand line. The wooden stake sticks up out of the grass about 6cm. In front of the wooden stake marking the start point a boulder was placed on the grass, and a black circle with a white dot in the middle was painted on to further highlight the start point.
Notes on relocation	Refer to map and photographs
Notes on access	Boat access requires passing very shallow tidal rapids. Small inflatable boat (with shallow draft <0.5m) that can be carried if necessary.



Site name	Vadills Outer Basin
Site code	TV03LT5
Type/name of transect	Littoral and sublittoral
Position of transect start point on shore	HU 29311, 55754
Position of transect end point	HU 29212, 55778
Transect bearing (start point to end point)	288° magnetic
How fixed points are marked	Start point marked with wooden stake placed into the grass just above the upper limit of the cobble shore and strand line. The wooden stake sticks up out of the grass about 6cm. In front of the wooden stake a black circle with a white dot in the middle was painted on to a boulder to further highlight the start point.
Notes on relocation	Refer to map and photographs
Notes on access	Boat access straightforward.



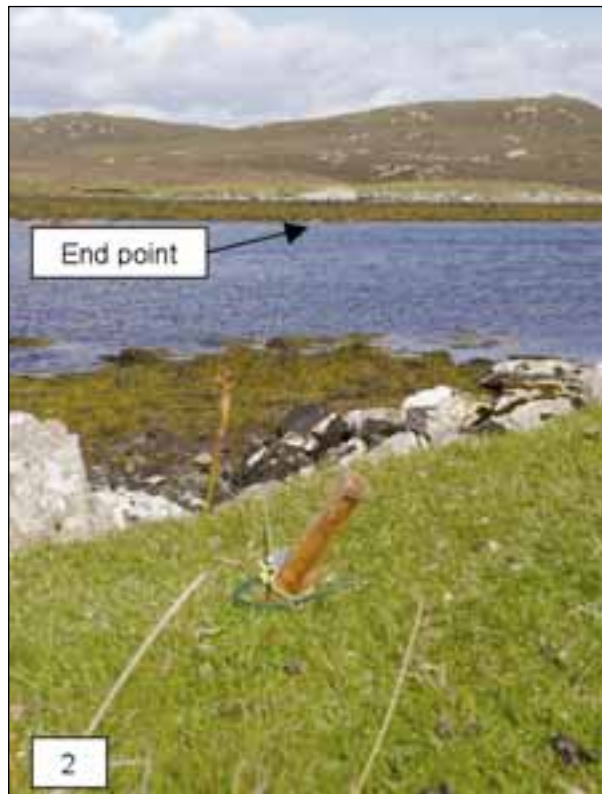
1: Start point of transect TV03LT5.

2: View from SMB to start of transect.

Site name	Middle Basin
Site code	TV03LT6
Type/name of transect	Littoral and sublittoral
Position of transect start point on shore	HU 28817, 55463
Position of transect end point	HU 28898, 55509
Transect bearing (start point to end point)	070° magnetic
How fixed points are marked	Start point marked with wooden stake placed into the grass just above the upper limit of the cobble shore and strand line. The wooden stake sticks up out of the grass about 6cm. In front of the wooden stake a black circle with a white dot in the middle was painted on to a boulder to further highlight the start point.
Notes on relocation	Refer to map and photographs
Notes on access	Boat access requires passing some shallow sections, approach with caution with boat of draft <0.5m.



Site name	Inner Basin
Site code	TV03LT7
Type/name of transect	Littoral and sublittoral
Position of transect start point on shore	HU 28788, 55167
Position of transect end point	HU 28887, 55195
Transect bearing (start point to end point)	080° magnetic
How fixed points are marked	Start point marked with wooden stake placed into the grass just above the upper limit of the cobble shore and strand line. The wooden stake sticks up out of the grass about 6cm. In front of the wooden stake a black circle with a white dot in the middle was painted on to a boulder to further highlight the start point.
Notes on relocation	Refer to map and photographs
Notes on access	Boat access requires passing some shallow sections, approach with caution with boat of draft <0.5m.



1: View of start point.
2: View from start point in direction of transect.

Site name	Marlee Loch Tidal Narrows
Site code	TV03TN1
Type/name of transect	Littoral and sublittoral
Position of transect start point on shore	HU 29112, 54942
Position of transect end point	HU 29064, 54964
Transect bearing (start point to end point)	300° magnetic
How fixed points are marked	Wooden stake placed into the grass just above the upper limit of the cobble shore and strand line. The wooden stake sticks up out of the grass about 6cm. In front of the wooden stake a boulder was placed on the grass, and a black circle with a white dot in the middle was painted on to further highlight the start point.
Notes on relocation	Refer to map and photographs
Notes on access	Boat access requires passing very shallow tidal rapids. Small inflatable boat (with shallow draft <0.5m) that can be carried if necessary.



View across narrows



View of start point



View from start point

Site name	Head of The Vadills narrows
Site code	TV03TN2
Type/name of transect	Littoral and sublittoral
Position of transect start point on shore	HU 28967, 54738
Position of transect end point	HU 28980, 54781
Transect bearing (start point to end point)	028° magnetic
How fixed points are marked	Start point marked with wooden stake placed into the grass just above the upper limit of the cobble shore and strand line. The wooden stake sticks up out of the grass about 6cm. In front of the wooden stake marking the start point a boulder was placed on the grass, and a black circle with a white dot in the middle was painted on to further highlight the start point. The end point was positioned on top of a large boulder in the intertidal area of the opposite shore.
Notes on relocation	Refer to map and photographs
Notes on access	Boat access requires passing very shallow tidal rapids. Small inflatable boat (with shallow draft <0.5m) that can be carried if necessary.



Site name	Mo Wick narrows
Site code	TV03TN3
Type/name of transect	Littoral and sublittoral
Position of transect start point on shore	HU 29387, 56019
Position of transect end point	HU 29319, 56006
Transect bearing (start point to end point)	265° magnetic
How fixed points are marked	Start point marked with wooden stake placed into the grass just above the upper limit of the cobble shore and strand line. The wooden stake sticks up out of the grass about 6cm. In front of the wooden stake a black circle with a white dot in the middle was painted on to a boulder to further highlight the start point. The end point is marked by a wooden stake on the opposite shore.
Notes on relocation	Refer to map and photographs
Notes on access	Boat access requires passing very shallow tidal rapids. Small inflatable boat (with shallow draft <0.5m) that can be carried if necessary.



Site name	The Vadills entrance narrows
Site code	TV03TN4
Type/name of transect	Littoral and sublittoral
Position of transect start point on shore	HU 29115, 56061
Position of transect end point	HU 29181, 56071
Transect bearing (start point to end point)	088° magnetic
How fixed points are marked	Start point marked with wooden stake placed into the grass just above the upper limit of the cobble shore and strand line. The wooden stake sticks up out of the grass about 6cm. In front of the wooden stake a black circle with a white dot in the middle was painted on to a boulder to further highlight the start point. The end point is located on a wall of large boulders and a wire fence on the opposite shore.
Notes on relocation	Refer to map and photographs
Notes on access	Boat access straightforward.

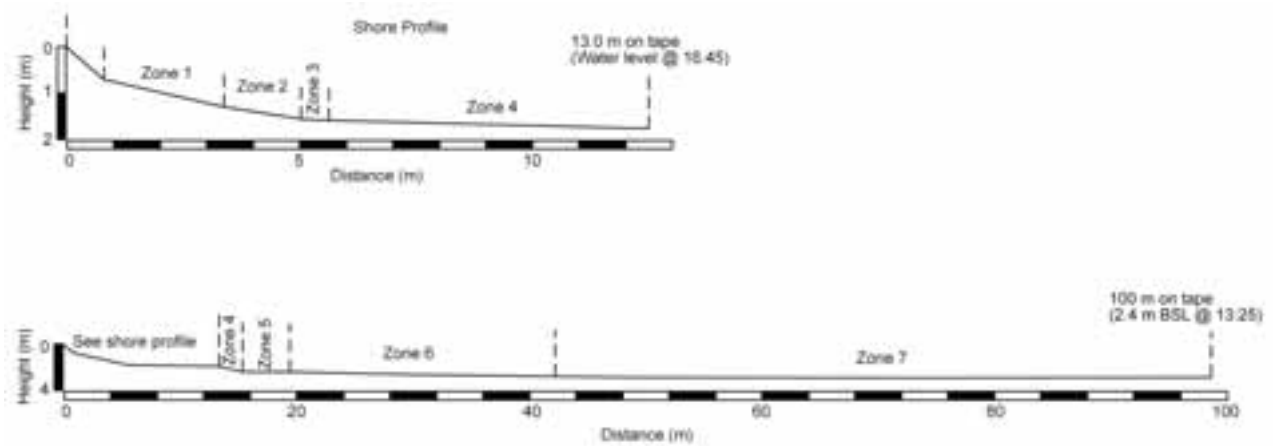


1: Looking towards start point of transect near to base of telegraph pole.
 2: View of transect line across narrows.
 3: Close up of transect end point on opposite shore of narrows beside fence.

Appendix 3 Transect profiles and biotope data

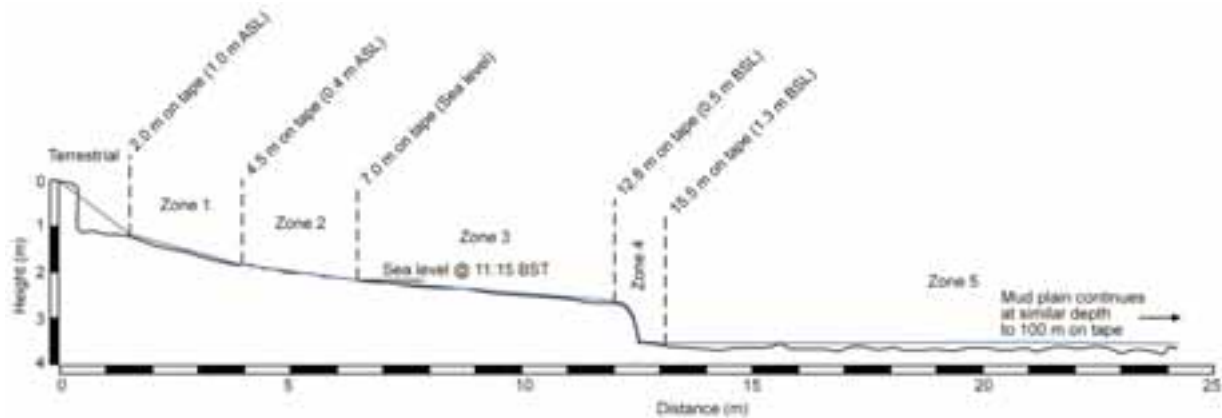
Mo Wick, TV03LT1

Littoral transect profile shown in upper diagram; complete profile shown in lower diagram.



Zone	Biotopes	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 1.1–3.7m on tape (0.5–1.0m ASL, 1645 BST 01/08/03)	Very sheltered cobbles, small boulders and pebbles	Patchy cover of yellow and grey lichens with <i>Verrucaria maura</i> on the larger boulders and cobbles
2	SLR.F.Pel	Littoral fringe; 3.7–5.4m on tape (0.3 – 0.5m ASL, 1645 BST 01/08/03)	Very sheltered angular pebbles and gravel with occasional cobbles	Dominated by <i>Pelvetia canaliculata</i> , with lesser cover of <i>Verrucaria maura</i> and subsidiary mobile fauna including <i>Littorina saxatilis</i> , amphipods, isopods, millipedes and red mites
3	SLR.F.Fspi	Upper eulittoral; 5.4–6.0m on tape (0.2–0.3m ASL, 1645 BST 01/08/03)	Very sheltered pebbles and gravel	Dominated by <i>Fucus spiralis</i> , with lesser cover of <i>Pelvetia canaliculata</i> , millipedes and <i>Littorina obtusata</i> and <i>L. saxatilis</i>
4	SLR.FX.AscX	Mid eulittoral; 6.0–16m on tape (0.2m ASL–1.5m BSL, 1645 BST 01/08/03)	Very sheltered coarse sand, pebbles and gravel, with occasional cobbles and small boulders	Dominated by <i>Ascophyllum nodosum</i> and <i>Fucus vesiculosus</i> , with understorey of <i>Chondrus crispus</i> , ? <i>Cladophora</i> sp., ? <i>Audouinella</i> sp. plus littorinids, <i>Nucella lapillus</i> , <i>Carcinus maenas</i> and infaunal polychaetes
5	SLR.FX.FserX	Lower eulittoral; 16–20m on tape (~1.5m BSL, 1400 BST 01/08/03)	Very sheltered pebbles and gravel with silty mud	Main cover of <i>Fucus serratus</i> , also with <i>Ascophyllum nodosum</i> , <i>Chorda filum</i> and <i>Furcellaria lumbricalis</i> . Epiphytic fauna of solitary and colonial ascidians
6	IMX.KSwMx.LsacX	Infralittoral mixed sediments; 20–43m on tape (1.5–2.0m BSL, 1350 BST 01/08/03)	Very sheltered pebbles thickly overlain by mud and silt	Characterised by <i>Chorda filum</i> , but with patches of dense <i>Furcellaria lumbricalis</i> and <i>Laminaria saccharina</i> (cape form). Fauna mainly ? <i>Asciella scabra</i> , with <i>Arenicola marina</i> casts, <i>Crangon crangon</i> and <i>Macropodia</i> sp.
7	IMU.MarMu.AreSyn	Infralittoral mud; 43–100m on tape (2.0–2.6m BSL, 1335 BST 01/08/03)	Very sheltered soft flocculent mud, anoxic below surface	Occasional clumps of ?free-living <i>Furcellaria lumbricalis</i> (with ascidians), <i>Fucus serratus</i> and <i>Laminaria saccharina</i> . Mobile crustaceans on sediment surface. Infauna included <i>Leptosynapta inhaerens</i> , <i>Leptopentacta elongata</i> and <i>Priapulid caudatus</i> .
Salinity measurement		Water sample at approximately 50m on tape, at a depth of 0.5m BSL, 14/08/03		35.5 ppt

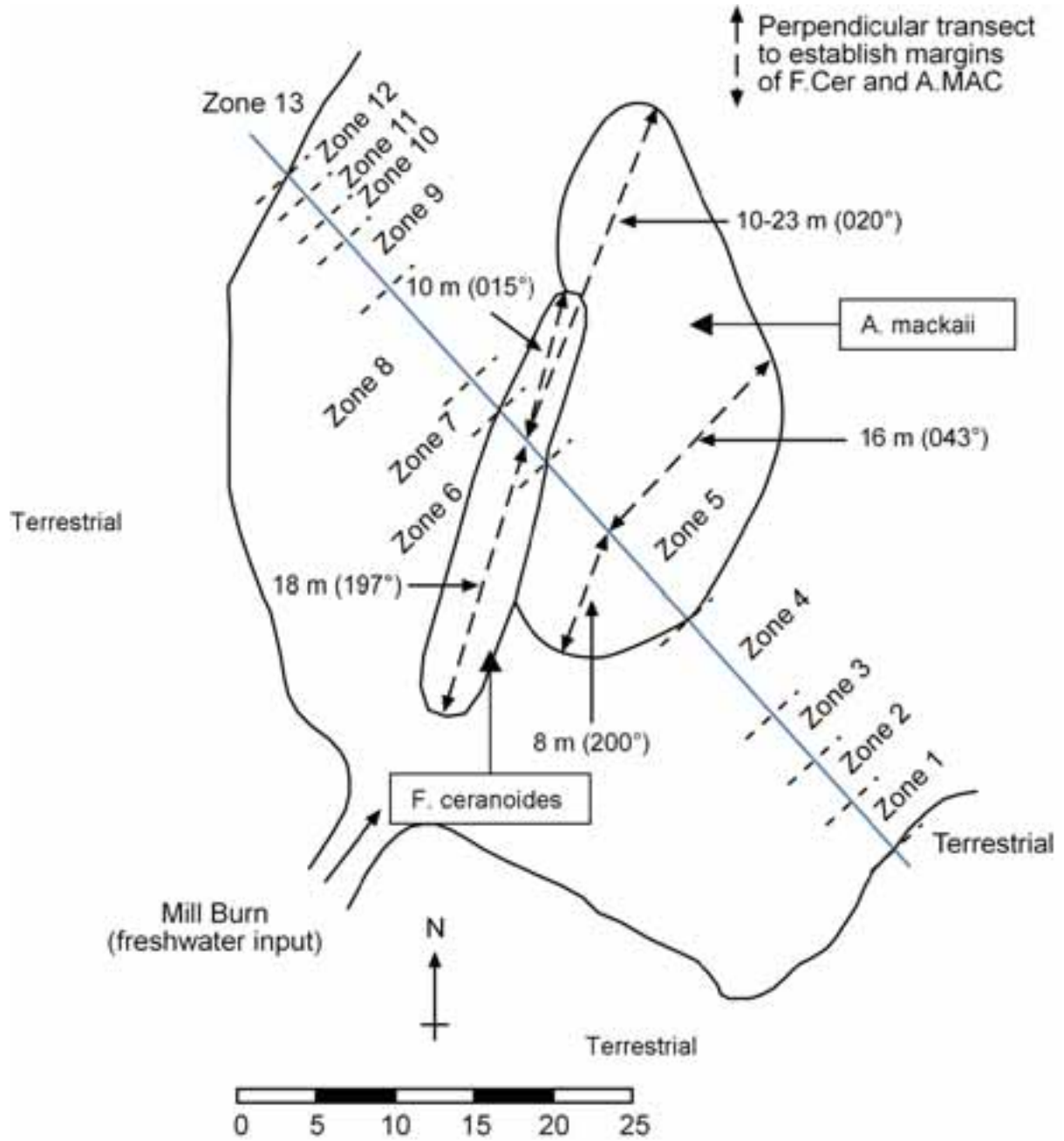
Marlee Loch Basin, TV03LT2



Zone	Biotopes	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 2–4.5m on tape (0.4–1.0m ASL, 11 15 BST 02/08/03)	Sheltered angular pebbles and cobbles	Sparse cover of yellow and grey lichens and <i>Verrucaria maura</i>
2	SLR.F.Pel	Mid to upper eulittoral; 4.5–7.0m on tape (0.0–0.4m ASL, 11 15 BST 02/08/03)	Sheltered angular cobbles, pebbles and gravel	Mostly bare, but main cover of <i>Pelvetia canaliculata</i> , <i>Verrucaria maura</i> and some <i>Fucus spiralis</i> . <i>Littorinid molluscs</i> beneath cobbles
3	SLR.FX.AscX	Mid to lower eulittoral; 7.0–12.8m on tape (0.0–0.5m BSL, 11 15 BST 02/08/03)	Very sheltered muddy angular pebbles, with some cobbles and small boulders	Algal-dominated, mainly by <i>Ascophyllum nodosum</i> ; also with <i>Fucus vesiculosus</i> and <i>F. serratus</i> . Subsidiary fauna of solitary ascidians and <i>Littorina obtusata</i>
4	SLR.FX.FserX	Lower eulittoral & sublittoral fringe; 12.8–15.5m on tape (0.5–1.3m BSL, 11 15 BST 02/08/03)	Very sheltered steep slope of boulders and silty gravel	Dominated by <i>Fucus serratus</i> , with additional algal cover from <i>Chorda filum</i> , filamentous green alga and <i>Furcellaria lumbricalis</i> . Dense fauna mainly of solitary ascidians and <i>Carcinus maenas</i>
5	IMX.KSwMx.FiG	Infralittoral mud; 15.5–100m on tape (1.1–1.4m BSL, 11 15 BST 02/08/03)	Very sheltered and very soft flocculent mud	Almost total cover of filamentous green alga, with occasional patches of drift <i>Ascophyllum nodosum</i> , <i>Fucus serratus</i> and <i>F. vesiculosus</i> . Main fauna of solitary ascidians (<i>Asciella aspersa</i> , <i>Asciella</i> sp. and <i>Corella parallelogramma</i>). No infauna seen in core samples.
Salinity measurement		Water sample at 50m on tape, at a depth of 0.5m BSL, 02/08/03		35.0 ppt

Mill Burn, TV03LT3 (also see Appendix 1, Figure 3)

Plan only; no transect profile.



Zone	Biotopes	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 1.5–5.5m on tape	Sheltered angular pebbles, cobbles and boulders with some bedrock	Mainly <i>Verrucaria maura</i> , with additional cover of <i>Caloplaca</i> sp., <i>Ochrolechia</i> <i>parella</i> and <i>Lecanora</i> <i>?gangaleoides</i> .
2	SLR.F.Pel	Mid to upper eulittoral; 5.5–9.0m on tape	Sheltered angular cobbles and pebbles	Main cover of <i>Verrucaria</i> <i>maura</i> with <i>Pelvetia</i> <i>canaliculata</i> , and some <i>Fucus</i> <i>cottonii</i> (= <i>F. muscooides</i>)
3	SLR.F.Fspi	Upper eulittoral; 9.0–13.0m on tape	Sheltered angular cobbles and pebbles	Dominated by <i>Fucus spiralis</i> , with lesser cover of <i>Pelvetia</i> <i>canaliculata</i>
4	SLR.FX.AscX.mac	Mid to lower eulittoral; 13.0–21.0m on tape	Sheltered angular cobbles and pebbles	Algal-dominated (~60% cover), mainly by <i>Ascophyllum</i> <i>nodosum</i> and <i>A. nodosum</i> <i>ecad mackaii</i> . Other main cover from <i>Fucus vesiculosus</i>
5	SLR.FX.AscX.mac	Mid to lower eulittoral; 21.0–34.5m on tape	Sheltered angular cobbles and pebbles	Algal-dominated (100% cover), mainly by <i>Ascophyllum</i> <i>nodosum</i> <i>ecad mackaii</i> . Cover also from <i>A. nodosum</i> and <i>Fucus vesiculosus</i>
6	SLR.FX.AscX.mac	Mid to lower eulittoral; 34.5–39.0m on tape	Sheltered angular cobbles and pebbles	Algal-dominated, mainly by <i>Ascophyllum nodosum</i> <i>ecad</i> <i>mackaii</i> (~30%) and <i>Fucus</i> <i>ceranoides</i> (~50%). Cover also from <i>A. nodosum</i>
7	SLR.FX.AscX.mac	Mid to lower eulittoral; 39.0–41.5m on tape	Sheltered gravel and pebbles	Substratum mostly bare, with sparse cover of <i>Ascophyllum</i> <i>nodosum</i> <i>ecad mackaii</i> and <i>Fucus ceranoides</i>
8	SLR.FX.AscX	Mid to lower eulittoral; 41.5–49.5m on tape	Sheltered gravel and pebbles with large boulders	Algal-dominated, mainly by <i>Ascophyllum nodosum</i> , <i>Pelvetia canaliculata</i> and <i>Fucus spiralis</i> on boulders and by a turf of <i>?Audouinella</i> sp. on the gravel and pebbles
9	SLR.FX.AscX.mac	Mid to lower eulittoral; 49.5 – 53.5m on tape	Sheltered muddy gravel and pebbles	Dominated by a turf of <i>?Audouinella</i> sp. Also with <i>Ascophyllum nodosum</i> <i>ecad</i> <i>mackaii</i> , <i>Fucus vesiculosus</i> and <i>A. nodosum</i> .
10	SLR.FX.AscX.mac	Mid eulittoral; 53.5–55.5m on tape	Sheltered small cobbles and pebbles	Characterised by mixed fucoids with <i>Ascophyllum</i> <i>nodosum</i> <i>ecad mackaii</i> , <i>Fucus vesiculosus</i> and <i>F. spiralis</i>
11	SLR.F.Pel	Mid to upper eulittoral; 57.5–59.0m on tape	Sheltered angular cobbles and boulders	Main cover of <i>Verrucaria</i> <i>maura</i> with <i>Pelvetia</i> <i>canaliculata</i> , and some <i>V. mucosa</i>
12	LR.L.YG	Supralittoral; 57.5–59.m on tape	Sheltered boulders and bedrock	Sparse <i>Lecanora</i> <i>?gangaleoides</i> and <i>Caloplaca</i> sp.
13	-	Supralittoral; 59.0–62.5.m on tape	Sheltered boulders and bedrock	Terrestrial vegetation only
Salinity measurement		No water sample		–

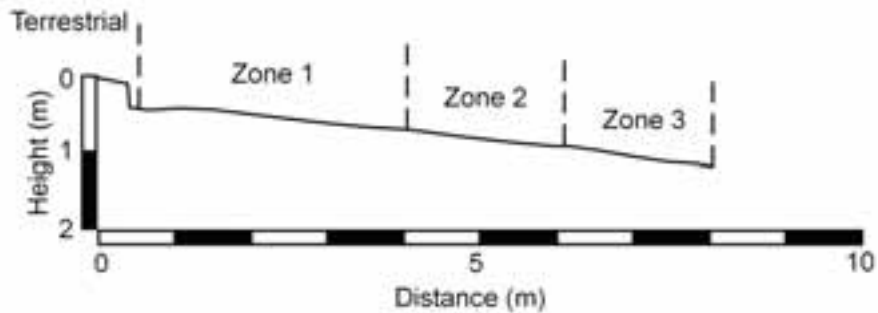
Head of The Vadills, TV03LT4

No transect profile.

Zone	Biotopes	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 0.0–5.6m on tape	Sheltered boulders amongst terrestrial grasses	Lichen-dominated, mainly <i>Verrucaria maura</i> , with <i>Lecanora ?gangaleoides</i> , <i>Ochrolechia parella</i> and <i>Caloplaca</i> sp.
2	LR.L.YG	Supralittoral; 5.6–10.0m on tape; (waterline at 10.0m on tape, 1430 BST 04/08/03)	Sheltered cobbles and large boulders	Lichen-dominated, mainly <i>Verrucaria maura</i> , with <i>Lecanora ?gangaleoides</i> , <i>Ochrolechia parella</i> and <i>Caloplaca</i> sp.
3	SLR.F.Pel	Upper eulittoral; 10.0–11.0m on tape (0–0.05m BSL, 1430 BST 04/08/03)	Sheltered angular cobbles and pebbles	Very sparse <i>Pelvetia canaliculata</i> and <i>Fucus spiralis</i>
4	SLR.FX.EphX	Mid to lower eulittoral; 11.0–18.5m on tape (0.05–0.4m BSL, 1430 BST 04/08/03)	Sheltered angular pebbles and silty sand	Characterised by <i>Enteromorpha</i> sp. and sparse <i>Ascophyllum nodosum</i> , <i>Fucus vesiculosus</i> and <i>F. spiralis</i> .
5	IMS.Sgr.Rup	Sublittoral fringe; 18.5–35m on tape (0.4–0.5m BSL, 1430 BST 04/08/03)	Sheltered muddy sand and gravel	Characterised by <i>Ruppia</i> sp., a filamentous green algal mat and <i>Arenicola marina</i> casts. Also with small amounts of <i>Ascophyllum nodosum</i> and <i>Fucus vesiculosus</i>
6	IMS.Sgr.Rup	Sublittoral; 35–50m on tape (0.5–0.8m BSL, 1430 BST 04/08/03)	Sheltered muddy sand and gravel	Sediment dominated by <i>Arenicola marina</i> casts, unattached green filamentous algae, and scattered fucoids and <i>Ruppia</i> sp.
7	IMS.Sgr.Rup	Sublittoral; 50–100m on tape (0.8–0.9m BSL, 1430 BST 04/08/03)	Sheltered muddy sand and soft mud	Sediment covered primarily by unattached green filamentous alga, with scattered fucoids and <i>Ruppia</i> sp.
Salinity measurement		Water sample at 50m on tape, at a depth of 0.1m BSL (above thermocline), 04/08/03		34.5 ppt
		Water sample at 50m on tape, at a depth of 0.6m BSL (below thermocline), 04/08/03		34.5 ppt

Outer Basin, TV03LT5

Littoral transect profile only.

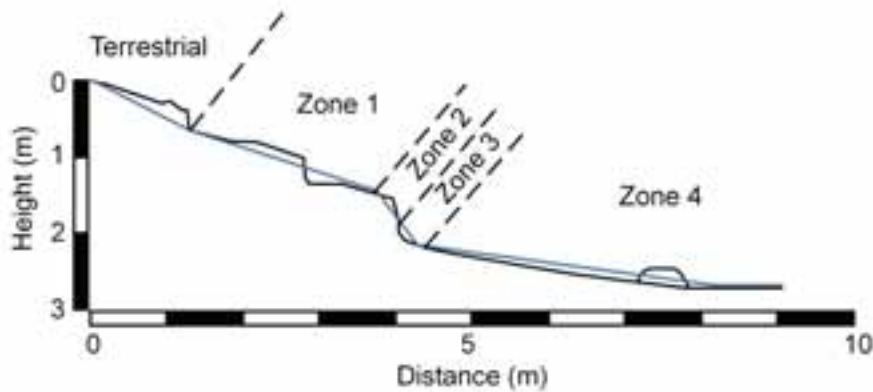


Zone	Biotores	Location	Substratum notes	Biological notes
1	LR.R.YG	Supralittoral; 0.0–4.0m on tape (0.5–1.0m ASL, 1315 BST 05/08/03)	Very sheltered boulders	Lichen-dominated, mainly <i>Verrucaria maura</i> , <i>Lecanora</i> spp. and <i>Caloplaca marina</i> . Decomposing strandline algae with dense talitrid amphipods
2	SLR.F.Pel	Upper eulittoral; 4.0–6.0m on tape (0.3–0.5m ASL, 1315 BST 05/08/03)	Very sheltered angular boulders, cobbles, pebbles and gravel with peaty sediment	Dominated by <i>Pelvetia canaliculata</i> and <i>Verrucaria maura</i> . <i>Littorina saxatilis</i> also characteristic. White nematodes present in sediment
3	SLR.F.Fspi	Upper eulittoral; 6.0–8.0m on tape (0.1–0.3m ASL, 1315 BST 05/08/03)	Very sheltered small boulders, cobbles, pebbles and gravel	Dominated by <i>Fucus spiralis</i> , with lesser cover of <i>Pelvetia canaliculata</i> and green filamentous algae
4	SLR.FX.AscX	Mid to lower eulittoral; 8.0–14.0m on tape (0–0.8m BSL, 1440 BST 05/08/03)	Very sheltered gravel and pebbles with large boulders	Dominated by <i>Ascophyllum nodosum</i> , with understory of <i>Cladophora rupestris</i> , and a diverse flora and fauna
5	SLR.FX.FserX	Lower eulittoral; 14.0–20.0m on tape (0.8–1.3m BSL, 1440 BST 05/08/03)	Very sheltered pebbles and gravel	Main cover of <i>Fucus serratus</i> , together with <i>Ascophyllum nodosum</i> and green filamentous algae. Fauna subsidiary and included <i>Arenicola marina</i> , <i>Littorina littorea</i> and <i>Carcinus maenas</i>
6	SLR.FX.EphX	Sublittoral fringe; 20.0–26.0m on tape (1.3–1.4m BSL, 1440 BST 05/08/03)	Very sheltered pebbles and gravel	Main cover of <i>Enteromorpha</i> sp. or green filamentous algae, together with brown filamentous algae and <i>Arenicola marina</i>
7	SLR.FX.FserX	Sublittoral fringe; 26.0–29.0m on tape (1.4–1.6m BSL, 1435 BST 05/08/03)	Very sheltered silty pebbles and gravel	Main cover of <i>Fucus serratus</i> , together with <i>Ascophyllum nodosum</i> and ? <i>Gracilaria</i> sp.

Zone	Biotopes	Location	Substratum notes	Biological notes
8	SLR.FX.FserX	Sublittoral fringe; 29.0–35.0m on tape (1.6–1.8m BSL, 1435 BST 05/08/03)	Very sheltered silty pebbles and gravel	Main cover of <i>Fucus serratus</i> , together with <i>Laminaria saccharina</i> , <i>Ascophyllum nodosum</i> , <i>Enteromorpha</i> sp. and <i>Chorda filum</i> . <i>Asciidiella aspersa</i> numerous
9	IMX.KSwMx.LsacX	Sublittoral fringe; 35.0–40.0m on tape (1.8–2.4m BSL, 1430 BST 05/08/03)	Very sheltered mud with angular cobbles and gravel	Dominated by silted cape form <i>Laminaria saccharina</i> , <i>Fucus serratus</i> and <i>Chorda filum</i> . Also with <i>Furcellaria lumbricalis</i> , ? <i>Gracilaria</i> sp. and small patches of <i>Beggiatoa</i> on sediment surface
10	IMX.KSwMx.LsacX	Sublittoral fringe; 40.0–55.0m on tape (2.2–2.6m BSL, 1430 BST 05/08/03)	Very sheltered silty gravel with reduced algal cover	Silty sediment plain with <i>Arenicola marina</i> casts and mounds. Patchily abundant algal cover by cape form <i>Laminaria saccharina</i> , ? <i>Gracilaria</i> sp., <i>Halidrys siliquosa</i> and Ectocarpaceae indet
11	IMX.KSwMx.LsacX	Sublittoral fringe; 55.0–75.0m on tape (2.2–3.0m BSL, 1425 BST 05/08/03)	Very sheltered soft mud with gravel, and occasional boulders	Heavy algal cover dominated by <i>Laminaria saccharina</i> and <i>Halidrys siliquosa</i> . <i>Asciidiella scabra</i> and <i>A. aspersa</i> numerous, together with 3-spined stickleback and 2-spot gobies
12	IMX.KSwMx.LsacX	Shallow infralittoral; 75.0–89.0m on tape (3.0–4.9m BSL, 1425 BST 05/08/03)	Very sheltered soft mud with gravel, coarse sand and shell debris	<i>Asperococcus</i> sp. and ? <i>Gracilaria</i> sp. superabundant. Other algae in small amounts including <i>Laminaria saccharina</i> , Ectocarpaceae and <i>Chorda filum</i> . Diverse fauna, especially of ascidians and crustaceans
13	?IMX.KSwMx.LsacX	Shallow infralittoral; 89.0–97.0m on tape (4.0–4.8m BSL, 1420 BST 05/08/03)	Very sheltered soft mud overlying gravel	Brown filamentous weed (Ectocarpaceae) abundant over otherwise bare soft mud. Characterised also by abundant <i>Arenicola marina</i> casts, <i>Carcinus maenas</i> , <i>Asciidiella aspersa</i> and <i>Pagurus bernhardus</i>
14	IMX.KSwMx.LsacX	Shallow infralittoral; 97.0–100m on tape (4.8–5.0m BSL, 1420 BST 05/08/03)	Very sheltered soft mud	Soft mud plain with patches of <i>Laminaria saccharina</i> (cape form), Ectocarpaceae, <i>Chorda filum</i> and <i>Beggiatoa</i> . <i>Antedon bifida</i> , <i>Ophiothrix fragilis</i> , mobile crustacea and <i>Asciidiella scabra</i> also characteristic
Salinity measurement		Water sample at 50m on tape, at a depth of 0.5m BSL, 05/08/03		35.5 ppt

Vadills Middle Basin, TV03LT6

Littoral transect profile only.

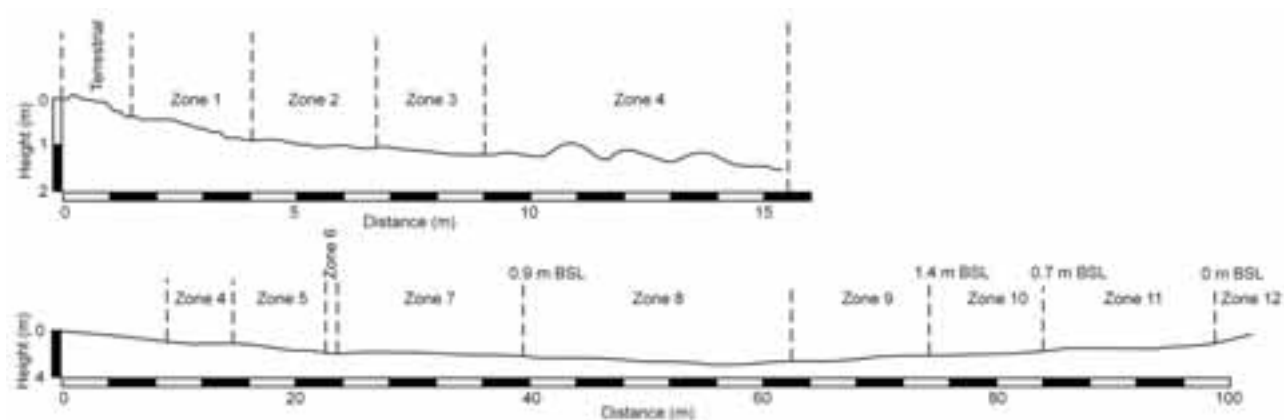


Zone	Biotopes	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 1.5–4.0m on tape. (2.0–1.2m ASL, 1245 BST 10/08/03)	Very sheltered terraced bedrock slope with patches of grassy turf	Dominated by grey and black lichens, mainly <i>Verrucaria maura</i> and <i>Ochrolechia parella</i> . Also with <i>Tephromela atra</i> , <i>Xanthoria parietina</i> and red mites and <i>Thysanura indet</i> (silverfish)
2	SLR.F.Pel	Upper eulittoral; 4.0–4.5m on tape. (1.2–0.8m ASL, 1245 BST 10/08/03)	Very sheltered and near- vertical broken bedrock	Dominated by <i>Pelvetia canaliculata</i> and <i>Verrucaria maura</i> . <i>Littorina saxatilis</i> and encrusting coralline alga in crevices
3	SLR.F.Fspi	Upper eulittoral; 4.5–5.0m on tape. (0.8–0.5m ASL, 1245 BST 10/08/03)	Very sheltered steep slope of broken bedrock	Dominated by <i>Fucus spiralis</i> and <i>Verrucaria maura</i>
4	SLR.F.Asc.Asc	Mid eulittoral; 5.0–20.0m on tape (0–0.5m ASL, 1245 BST 10/08/03)	Pebbles, cobbles and small boulders on bedrock slope	Dense <i>Ascophyllum nodosum</i> , with understory of <i>Cladophora rupestris</i> , littorinids, juvenile <i>Carcinus maenas</i> and <i>Mytilus edulis</i> .
5	SLR.FX.FserX	Sublittoral fringe; 20.0–21.0m on tape (0.8m BSL, 1315 BST 10/08/03)	Very sheltered flocculent mud with cobbles, pebbles and empty littorinid shells	Heavily algal dominated, mainly by <i>Fucus serratus</i> . Patches of a green filamentous mat-forming alga and <i>Beggiatoa</i> also present. Fauna characterised by dense <i>Asciidiella aspersa</i> and <i>A. scabra</i>

Zone	Biotopes	Location	Substratum notes	Biological notes
6	IMX.KSwMx.LsacX	Sublittoral fringe; 21.0–25.0m on tape (0.8m–1.4m BSL, 1300 BST 10/08/03)	Very sheltered flocculent mud with cobbles, pebbles and empty littorinid and bivalve mollusc shells	Seabed with 50% algal cover, mainly <i>Furcellaria lumbricalis</i> , <i>Halidrys siliquosa</i> , <i>Chorda filum</i> , with some <i>Fucus serratus</i> and <i>Laminaria saccharina</i> . Fauna characterised by <i>Arenicola marina</i> casts in addition to dense <i>Asciadiella aspersa</i>
7	IMU.MarMu.AreSyn	Shallow infralittoral; 25.0–100m on tape (1.4m–1.9m BSL, 1250 BST 10/08/03)	Very sheltered wobbly flocculent mud	Mud covered almost completely with brown and green filamentous algal mats, and patches of <i>Beggiatoa</i> sp. Other algae mostly un- attached. Fauna dominated by <i>Paracucumaria hyndmani</i> (on mud surface); <i>Arenicola marina</i> casts also present, together with <i>Leptosynapta inhaerens</i>
Salinity measurement		Water sample at 50m on tape, at a depth of 0.5m BSL, 10/08/03		35.0 ppt

Vadills Inner Basin, TV03LT7

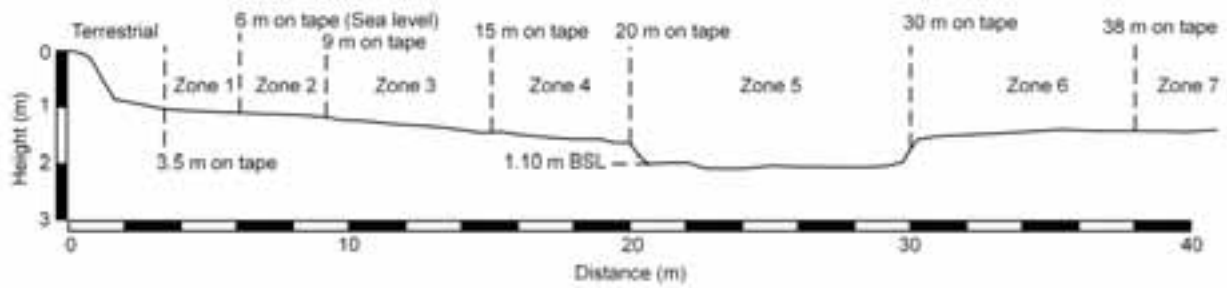
Littoral transect profile shown in upper diagram; complete profile shown in lower diagram.



Zone	Biotores	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 1.5–4.1 m on tape. (1.2–0.7 m ASL, 1531 BST 14/08/03)	Very sheltered bedrock with angular cobbles, pebbles and gravel	Dominated by <i>Verrucaria maura</i> and <i>Lecanora gangaleoides</i> . Fauna similar to LR.L.YG on TV03LT3 nearby
2	SLR.F.Pel	Upper eulittoral; 4.1–6.8 m on tape. (0.7–0.5 m ASL, 1531 BST 14/08/03)	Very sheltered angular cobbles, pebbles and gravel	Dominated by <i>Pelvetia canaliculata</i> and <i>Verrucaria maura</i> . Fauna similar to SLR.F.Pel on TV03LT3 nearby
3	SLR.F.Fspi	Upper eulittoral; 6.8–9.1 m on tape. (0.5–0.3 m ASL, 1531 BST 14/08/03)	Very sheltered angular cobbles, pebbles and gravel	Dominated by <i>Fucus spiralis</i> and <i>Verrucaria maura</i> . Fauna similar to SLR.F.Fspi on TV03LT3 nearby
4	SLR.FX.AscX	Mid eulittoral; 9.1–15.5 m on tape. (0.3–0 m ASL, 1531 BST 14/08/03)	Very sheltered boulders, pebbles and gravel	Dense <i>Ascophyllum nodosum</i> . Fauna similar to SLR.FX.AscX on TV03LT3 nearby
5	SLR.FX.AscX	Mid eulittoral; 15.5–23.0 m on tape (0–0.3 m BSL, 1715 BST 14/08/03)	Very sheltered boulders, pebbles and gravel	Dense <i>Ascophyllum nodosum</i> . Not fully surveyed
6	SLR.FX.FserX	Lower eulittoral; 23.0–24.0 m on tape (0.4 m BSL, 1710 BST 14/08/03)	Very sheltered cobbles and pebbles	Dense <i>Fucus serratus</i> , with some <i>Ascophyllum nodosum</i> . Not fully surveyed
7	?IMX.KSwMx.LsacX	Sublittoral fringe; 24.0–40.0 m on tape (0.4–0.9 m BSL, 1710 BST 14/08/03)	Very sheltered pebbles overlain by thin layer of mud	Seabed surface covered with both green and brown filamentous algae. <i>Chorda filum</i> , <i>Furcellaria lumbricalis</i> and <i>Arenicola marina</i> common. [NB no <i>Laminaria saccharina</i> recorded]

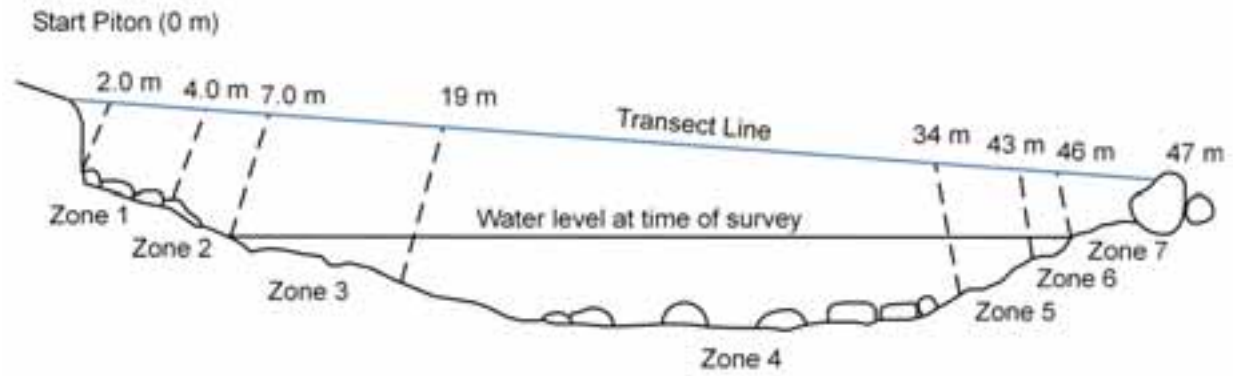
Zone	Biotopes	Location	Substratum notes	Biological notes
8	CMU.Beg	Sublittoral fringe; 40.0–63.0m on tape (0.9–1.5m BSL, 1700 BST 14/08/03)	Very sheltered soft mud	Seabed surface covered with green filamentous algal mat. Otherwise characterised by <i>Arenicola marina</i> casts and <i>Carcinus maenas</i> . Spots of <i>Beggiatoa</i> throughout and sparse <i>Furcellaria lumbricalis</i>
9	?IMX.KSwMx.LsacX	Sublittoral fringe; 63.0–75.0m on tape (1.1–1.4m BSL, 1700 BST 14/08/03)	Very sheltered pebbles overlain by 20cm layer of soft mud	Main seabed cover of <i>Furcellaria lumbricalis</i> and filamentous green algae. <i>Asciidiella scabra</i> and <i>Corella parallelogramma</i> superabundant and abundant respectively (on drift algae). <i>Beggiatoa</i> and mobile crab and starfish scavengers present. [NB biotope designation uncertain; no <i>Laminaria saccharina</i> recorded]
10	?IMX.KSwMx.LsacX	Sublittoral fringe; 75.0–85.0m on tape (1.1–0.7m BSL, 1700 BST 14/08/03)	Very sheltered pebbles overlain by thin layer of mud	Dominated by <i>Chorda filum</i> , <i>Furcellaria lumbricalis</i> and filamentous green algae. <i>Arenicola marina</i> , <i>Asciidiella scabra</i> and <i>Corella parallelogramma</i> common. Mobile crab scavengers present. [NB biotope designation uncertain; no <i>Laminaria saccharina</i> recorded]
11	?IMX.KSwMx.LsacX	Sublittoral fringe; 85.0–100.0m on tape (0.7–0m BSL, 1650 BST 14/08/03)	Very sheltered fine muddy sand and gravel	Dominated by <i>Chorda filum</i> , <i>Furcellaria lumbricalis</i> and filamentous green algae. <i>Arenicola marina</i> , <i>Asciidiella scabra</i> and <i>Corella parallelogramma</i> common. Mobile crab scavengers present. [NB biotope designation uncertain; no <i>Laminaria saccharina</i> recorded]
12	SLR.FX.AscX	Mid eulittoral; >100m on tape (0m BSL, 1640 BST 14/08/03)	Very sheltered silty cobbles	Dense <i>Ascophyllum nodosum</i> on shore above waterline. Some <i>Fucus serratus</i> present at lower edge of zone. Not fully surveyed
Salinity measurement		No water sample		–

Marlee Loch Narrows, TV03TN1



Zone	Biotores	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 3.5–6.0m on tape (lower limit at sea level, 1245 BST 02/08/03)	Sheltered angular boulders and cobbles	Sparse cover of yellow and grey lichens and <i>Verrucaria maura</i>
2	SLR.F.PeI	Upper eulittoral; 6.0–9.0m on tape (0.0–0.2m BSL estimated, 1245 BST 02/08/03)	Sheltered angular cobbles, pebbles and gravel	Mostly bare, but main cover of <i>Pelvetia canaliculata</i> , and some <i>Fucus spiralis</i> in lower part of zone
3	SLR.FX.AscX	Mid eulittoral; 9.0–15.0m on tape (0.2–0.5m BSL estimated, 1245 BST 02/08/03)	Very sheltered small boulders, cobbles and pebbles	Algal-dominated, mainly by <i>Ascophyllum nodosum</i> ; also with <i>Fucus vesiculosus</i> . A variety of other taxa recorded including red and green filamentous algae, <i>Mastocarpus stellatus</i> , <i>Halichondria</i> sp., <i>Botryllus schlosseri</i> and hydroids
4	SLR.FX.FserX	Lower eulittoral & sublittoral fringe; 15–20.0m on tape (0.5–0.8m BSL estimated, 1245 BST 02/08/03)	Very sheltered small boulders, cobbles and pebbles	Dominated by <i>Fucus serratus</i> , with additional algal cover from <i>Ascophyllum nodosum</i> , <i>Chorda filum</i> , filamentous green alga and Ectocarpaceae indet. Fauna characterised by solitary ascidians, <i>Halichondria</i> sp., and <i>Alcyonidium</i> sp., and <i>Leucosolenia</i> sp. on algae.
5	IMX.KSwMx.FiG	Infralittoral mud; 20.0–30.0m on tape (1.1m BSL, 1255 BST 02/08/03)	Very sheltered boulders, cobbles and pebbles	Dense algal cover with main cover from <i>Laminaria digitata</i> , <i>Fucus serratus</i> , filamentous green alga and Ectocarpaceae indet. Fauna characterised by <i>Halichondria</i> sp., large <i>Mytilus edulis</i> , <i>Asciella aspersa</i> and <i>Asciella</i> sp. <i>Arenicola marina</i> casts present
6	SLR.FX.FserX	Lower eulittoral & sublittoral fringe; 30–38.0m on tape (0.5–0.8mBSL, 1300 BST 02/08/03)	Very sheltered small boulders, cobbles and pebbles	See zone 4 above
7	SLR.FX.AscX	Mid eulittoral; 38.0m plus on tape (0-0.5mBSL, 1300 BST 02/08/03)	Very sheltered small boulders, cobbles and pebbles	See zone 3 above
Salinity measurement		Water sample taken at centre of channel at a depth of 0.5m BSL on flood tide, 02/08/03		35.0 ppt

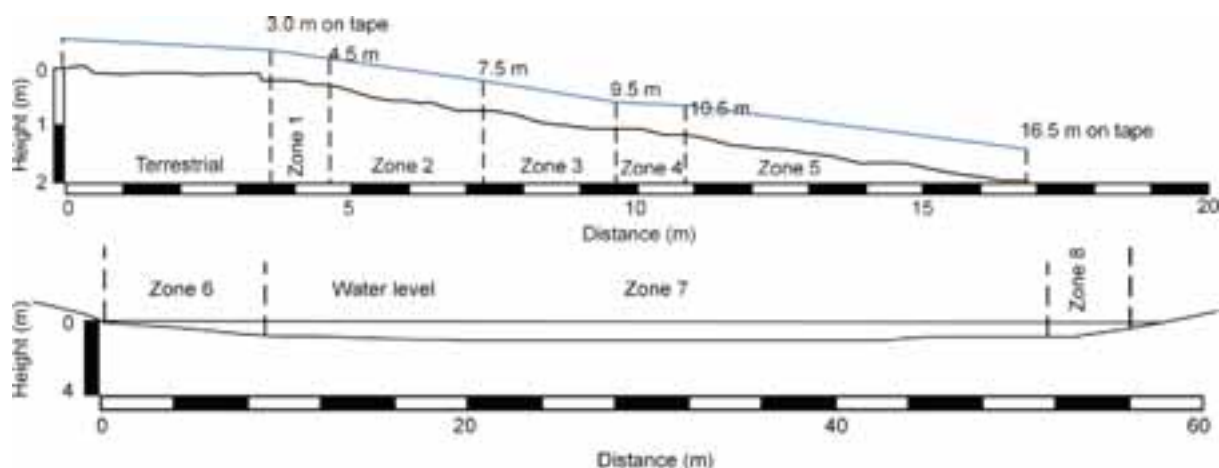
Head of The Vadills Narrows, TV03TN2



Zone	Biotopes	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 2.0–4.0m on tape.	Very sheltered angular cobbles and pebbles	Black and grey lichens dominated by <i>Verrucaria maura</i> . <i>Lecanora</i> sp., <i>Ochrolechia parella</i> , <i>Lichina pygmaea</i> and <i>V. mucosa</i> also present. <i>Littorina neritoides</i> and <i>Ligia oceanica</i> present in crevices
2	SLR.F.Pel	Upper eulittoral; 4.0–7.0m on tape.	Very sheltered angular cobbles, pebbles and gravel	Main cover of <i>Verrucaria maura</i> and <i>Pelvetia canaliculata</i> , and some <i>Fucus spiralis</i> in lower part of zone
3	SLR.FX.AscX	Mid eulittoral; 7.0–19.0m on tape.	Very sheltered angular pebbles, gravel and coarse sand	Algal-dominated, mainly by <i>Ascophyllum nodosum</i> ; also with <i>Fucus serratus</i> in lower half of zone
4	SLR.FX.FserX	Lower eulittoral & sublittoral fringe; 19.0–34.0m on tape (max depth 1.1m BSL, 1450 BST 04/08/03)	Very sheltered small and large boulders, cobbles, pebbles and gravel	Dominated by <i>Fucus serratus</i> , with additional algal cover from <i>Cladophora rupestris</i> , <i>Cystoclonium purpureum</i> , <i>Chorda filum</i> , and <i>Laminaria digitata</i> . Fauna characterised by <i>Halichondria panicea</i> , <i>Alcyonidium hirsutum</i> , and <i>Asciidiella scabra</i>
5	SLR.FX.AscX	Mid eulittoral; 34.0–43.0m on tape.	Very sheltered angular pebbles, gravel and coarse sand	Not fully surveyed, but appeared similar to zone 3
6	SLR.F.Pel	Upper eulittoral; 43.0–46.0m on tape.	Very sheltered angular cobbles, pebbles and gravel	Not fully surveyed, but appeared similar to zone 2
7	LR.L.YG	Supralittoral; 46.0–47.0m on tape.	Very sheltered angular cobbles and pebbles	Very sheltered angular appeared similar to zone 1
Salinity measurement		Water sample at centre of channel, 24m on tape, at a depth of 0.5m BSL, 04/08/03		35.0 ppt

Mo Wick Narrows, TV03TN3

Littoral transect profile shown in upper diagram; complete profile shown in lower diagram.

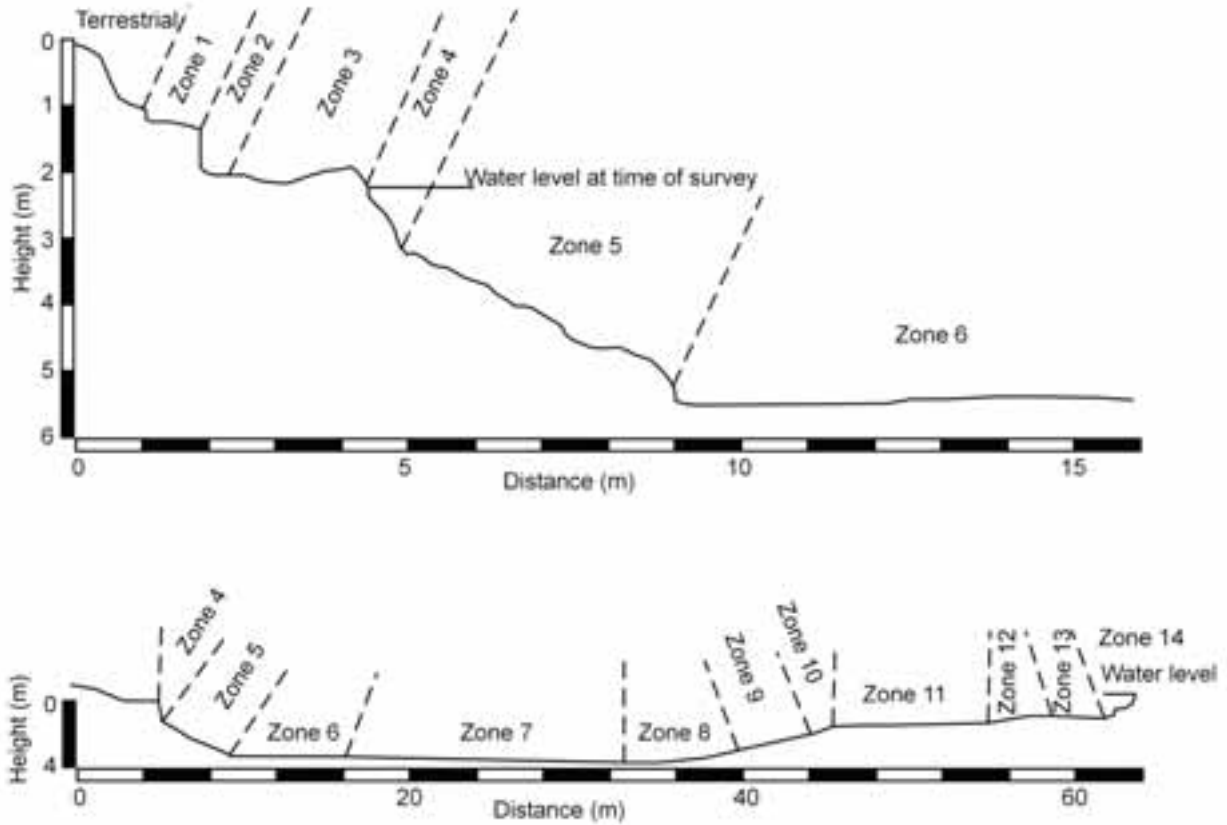


Zone	Biotopes	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 3.0–4.5m on tape. (1.8–1.7m ASL, 1606 BST 10/08/03)	Very sheltered cobbles on strandline	Black and grey lichens, dominated by <i>Lecanora gangaleoides</i> . <i>Verrucaria maura</i> frequent
2	LR.L.YG	Supralittoral; 4.5–7.5m on tape. (1.7–1.3m ASL, 1606 BST 10/08/03)	Very sheltered angular cobbles and pebbles	Yellow, black and grey lichens dominated by <i>Verrucaria maura</i> and <i>Lecanora gangaleoides</i> . <i>Caloplaca marina</i> also present
3	SLR.F.Pel	Upper eulittoral; 7.5–9.0m on tape. (1.3–1.0m ASL, 1606 BST 10/08/03)	Very sheltered angular cobbles, pebbles and gravel	Main cover of <i>Pelvetia canaliculata</i> and <i>Verrucaria maura</i> , with some <i>Fucus spiralis</i> in lower part of zone. Under-stone fauna included talitrid amphipods, <i>Littorina saxatilis</i> , <i>Ligia oceanica</i> , juvenile <i>Carcinus maenas</i> and millipedes
4	SLR.F.Fspi	Upper eulittoral; 9.5–10.5m on tape. (1.0–0.9m ASL, 1606 BST 10/08/03)	Very sheltered cobbles, pebbles and gravel on mud	Dominated by <i>Fucus spiralis</i> and <i>Pelvetia canaliculata</i> , with a diverse under-stone fauna of small gastropods, crustaceans and insects
5	SLR.FX.AscX	Mid eulittoral; 10.5–16.5m on tape. (0.9–0m ASL, 1606 BST 10/08/03)	Very sheltered angular pebbles, gravel and coarse sand	Heavily dominated by <i>Ascophyllum nodosum</i> , in turn covered by a green algal mat; also with some <i>Fucus vesiculosus</i> . Diverse algal and faunal understorey, and an infauna including <i>Cirratulus cirratus</i> .

Zone	Biotores	Location	Substratum notes	Biological notes
6	SLR.FX.FserX	Lower eulittoral & sublittoral fringe; 16.5–28.0m on tape (max depth 0.5m BSL, 1530 BST 10/08/03)	Very sheltered silty gravel with occasional cobbles	Dominated by <i>Fucus serratus</i> , with additional algal cover from <i>Ascophyllum nodosum</i> , <i>Chorda filum</i> and <i>Cladophora rupestris</i> . Epiphytic fauna included <i>Halichondria panicea</i> , ascidians and bryozoans
7	IMX.KSwMx.LsacX	Sublittoral fringe; 28.0–54.0m on tape (1.0m–1.5m BSL, 1515 BST 10/08/03)	Very sheltered silty cobbles, pebbles and gravel	Dominated by <i>Laminaria saccharina</i> and <i>Chorda filum</i> . Additional algal cover from <i>Furcellaria lumbricalis</i> , <i>Halidrys siliquosa</i> , <i>Fucus serratus</i> and ? <i>Chaetomorpha</i> sp. Fauna characterised by bryozoans and ascidians epiphytic on algae. Encrusting coralline alga (some developed into 'hedgehog' growths) on cobbles. <i>Arenicola marina</i> casts also present in sediment
8	?SIR.Lag.FChoG	Sublittoral fringe; 54.0–57.0m on tape (0.5m BSL, 1500 BST 10/08/03)	Very sheltered gravel with empty littorinid shells	Main cover of <i>Chaetomorpha</i> and/or <i>Enteromorpha</i> sp., with small amounts of <i>Fucus serratus</i> and fucoid sporelings. Encrusting coralline alga and <i>Chondrus crispus</i> also present. Fauna very sparse; just a few <i>Pomatoceros triqueter</i> and <i>Serpulidae</i> indet. [NB–biotope designation uncertain; no <i>Chorda filum</i> recorded]
Salinity measurement		Water sample at centre of channel, at a depth of 0.5m BSL, 10/08/03		35.0 ppt

Vadills Entrance Narrows, TV03TN4

Littoral transect profile shown in upper diagram; sublittoral profile shown in lower diagram.



Zone	Biotopes	Location	Substratum notes	Biological notes
1	LR.L.YG	Supralittoral; 1.5–2.3m on tape. (1.2–0.8m ASL, 1750 BST 10/08/03)	Very sheltered stepped bedrock	Black and grey lichens, dominant species <i>Verrucaria maura</i> , with small amounts of <i>Lecanora gangaleoides</i> , <i>L. sulphurea</i> , <i>Ramalina</i> sp. and ? <i>Buellia</i> sp.
2	SLR.F.Pel	Upper eulittoral; 2.3–2.7m on tape. (0.8–0.2m ASL, 1750 BST 10/08/03)	Very sheltered sloping or near-vertical bedrock, with cobbles and pebbles	Main cover of <i>Pelvetia canaliculata</i> , <i>Verrucaria maura</i> , and green filamentous algal mat. Some <i>Fucus spiralis</i> and <i>Ascophyllum nodosum</i> also [NB Overhanging face with yellow, black and grey lichens; dominated by <i>Verrucaria maura</i> - = LR.L.YG]

Zone	Biotopes	Location	Substratum notes	Biological notes
3	SLR.F.Asc	Mid eulittoral; 2.7–4.3m on tape. (0.2–0.0m BSL, 1830 BST 10/08/03)	Very sheltered bedrock with patches of angular cobbles and pebbles	Heavily dominated by <i>Ascophyllum nodosum</i> , though beneath this canopy the rock surface was almost fully covered by a turf of red filamentous alga. Other biota present on the rock surface included <i>Balanus</i> sp., spirorbidae, <i>Cladophora</i> sp., <i>Verrucaria mucosa</i> and <i>Mytilus edulis</i>
4	SLR.F.Asc	Mid eulittoral; 4.3–4.8m on tape. (0.0–1.0m ASL, 1750 BST 10/08/03)	Very sheltered steep bedrock slope	Heavily dominated by <i>Ascophyllum nodosum</i> , but with <i>Fucus serratus</i> at lower edge of zone. Encrusting coralline alga superabundant on rock surfaces. <i>Asciidiella scabra</i> common on both algae and on rock. <i>Cladophora</i> sp. also present
5	SIR.K.Lsac.T	Sublittoral fringe; 4.8–9.0m on tape (1.0–3.2m BSL, 1830 BST 10/08/03)	Boulder slope	Dense <i>Laminaria saccharina</i> with colonial and solitary ascidians, <i>Ophiothrix fragilis</i> , <i>Halichondria</i> sp. and <i>Antedon bifida</i>
6	IMX.KSwMx.LsacX	Upper infralittoral; 9.0–16.0m on tape (3.2–3.3m BSL, 1830 BST 10/08/03)	Black muddy coarse sand, with pebbles, cobbles, small boulders and shell debris	Dense <i>Laminaria saccharina</i> with <i>Chorda filum</i> and <i>Halidrys siliquosa</i> . <i>Asciidiella aspersa</i> and <i>A. scabra</i> both abundant, together with <i>Ophiothrix fragilis</i> and <i>Antedon bifida</i> . Some <i>Botryllus schlosseri</i> and <i>Botrylloides leachi</i> also present
7	IMX.KSwMx.LsacX	Upper infralittoral; 16.0–33.0m on tape (3.3–3.5m BSL, 1830 BST 10/08/03)	Coarse sand, with pebbles and shell debris	Sparse <i>Laminaria saccharina</i> with <i>Chorda filum</i> , <i>Asciidiella aspersa</i> and <i>A. scabra</i> . <i>Pomatoceros triqueter</i> abundant on the larger pebbles. Other frequently recorded species included <i>Ulva</i> sp., <i>Lomentaria clavellosa</i> and <i>Carcinus maenas</i> . Other ascidians, crustaceans and echinoderms also present
8	MIR.KR.Lhyp.TFt	Upper infralittoral; 33.0–40.0m on tape (3.3–3.5m BSL, 1830 BST 10/08/03)	Coarse sand, with pebbles, and boulders	Dense <i>Laminaria hyperborea</i> with ascidians, ophiuroids and <i>Modiolus modiolus</i> . Encrusting coralline alga superabundant

Zone	Biotores	Location	Substratum notes	Biological notes
9	IMX.KSwMx.LsacX	Upper infralittoral; 40.0–44.0m on tape (2.0–3.0m BSL, 1830 BST 10/08/03)	Coarse sand and gravel, with pebbles, cobbles, and sparse boulders	Dense <i>Laminaria saccharina</i> , <i>Asciidiella aspersa</i> and <i>A. scabra</i> , together with <i>Ophiothrix fragilis</i> and <i>Modiolus modiolus</i> . <i>Mya</i> <i>truncata</i> siphons observed in sediment
10	MIR.KR.Lhyp.TFt	Upper infralittoral; 44.0–46.0m on tape (~2m BSL, 1830 BST 10/08/03)	Small patch of boulders	Dense <i>Laminaria hyperborea</i> with ascidians, ophiuroids and <i>Modiolus modiolus</i> . Encrusting coralline alga superabundant
11	IMX.KSwMx.LsacX	Upper infralittoral; 46.0–55.0m on tape (2.0–1.5m BSL, 1830 BST 10/08/03)	Coarse sand and gravel, with pebbles, sparse cobbles, and small boulders	Dense <i>Laminaria saccharina</i> , <i>Asciidiella aspersa</i> and <i>A. scabra</i> , together with <i>Ophiothrix fragilis</i> and <i>Modiolus modiolus</i> . <i>Mya</i> <i>truncata</i> siphons observed in sediment
12	?IMX.KSwMx.LsacX	Upper infralittoral; 55.0– 9.0m on tape (1.5–1.0m BSL, 1830 BST 10/08/03)	Pebbles and small cobbles	Dense <i>Enteromorpha</i> sp. and Ectocarpaceae with <i>Modiolus</i> <i>modiolus</i> . Some <i>Laminaria</i> <i>saccharina</i> present
13	SLR.F.Fserr	Lower eulittoral; 59.0–62.0m on tape (~1.0m BSL, 1830 BST 10/08/03)	Boulders	Dense <i>Fucus serratus</i> , with some <i>Ascophyllum nodosum</i>
14	SLR.F.Asc	Mid eulittoral; 62.0–63.0m on tape (~1.0–m BSL, 1830 BST 10/08/03)	Large boulders	Very dense <i>Ascophyllum</i> <i>nodosum</i> ; <i>Fucus serratus</i> present
Salinity measurement		Water sample at centre of channel, at a depth of 0.5m BSL, 10/08/03		35.0 ppt

Sublittoral data

Zone	TV03LT1		TV03LT2	TV03LT4			TV03LT5							TV03LT6			TV03LT7				TV03TN1	TV03TN3			TV03N4											
	6	7	5	5	6	7	7	8	9	10	11	11a	12	13	14	6	7	7	8	9	10	11	5	7	8	5	6	7	8	9	10	11	12			
1 <i>Beggiatoa</i> sp.									C	P	R					F		R	P																	
2 Encrusting coralline alga												C											C	P	R					S		S				
3 <i>Cystoclonium purpureum</i>																							P													
4 <i>Dilsea carnosa</i>																														P		P				
5 <i>Furcellaria lumbricalis</i>	C	F ²	P						P	P		O			A	F ²	C	R	A	C	F		P	R ³												
6 <i>Chondrus crispus</i>																								R												
7 <i>Phyllophora</i> sp.	P																																			
8 <i>Polyides rotundus</i>	P												P											P												
9 <i>Gracilaria gracilis</i>	P																																			
10 ? <i>Gracilaria</i> sp.							A		O	A	F		P																							
11 <i>Lomentaria clavellosa</i>																												P								
12 Foliose red algae	P																												P ⁴		P ⁴					
13 Ectocarpaceae sp.																P							P ²											S		
14 <i>Desmarestia aculeata</i>																											P	P		P						
15 <i>Asperococcus</i> sp.												P ²	P		P																					
16 ?Brown filamentous weed									P		F	S			P	A			O	O							F									
17 ?Brown filamentous algae 3 indet.													S																							
18 <i>Sphacelaria plumosa</i>																												P								
19 <i>Chorda filum</i>	F		P				A	A							A	A	P	C	P		A	C		S			F	A								
20 <i>Laminaria digitata</i>																							A													
21 <i>Laminaria hyperborea</i>																													A		A					
22 <i>Laminaria saccharina</i>	A ¹	R					F	S	S	S	S	F		S	P	P ²						S		S	S	C	S	S	P							
23 <i>Halidrys siliquosa</i>									C	A	A	P		O	C	P		P ²				O			F											
24 <i>Ascophyllum nodosum</i>	R	O	R	O	R	A	C								P							P														
25 <i>Fucus serratus</i>	R ²	O		R	R	A	S	A			O				C	P ²						P ²	C	O	O											
26 <i>Fucus vesiculosus</i>			O	R	O	R																														
27 Fucoid sporelings																										R										
28 <i>Enteromorpha</i> sp.				P			F							F																				S		
29 <i>Ulva</i> sp.															P													F								
30 <i>Chaetomorpha</i> sp.	P																																			
31 Green filamentous algae			S	A ²	S ²	P									P	P	A		A	C ²	S ²	P ²		S												
32 Green algal mat indet			P	A															S																	
33 <i>Ruppia maritima</i>				A	O	R																														
34 <i>Leucosolenia</i> sp.																		P ²																		
35 <i>Cliona celata</i>																												P	P		P					
36 <i>Halichondria panicea</i>											C	R											P													
37 <i>Halichondria</i> sp.																							A		P				P		P					
38 <i>Hydractinia echinata</i>	P									P		P	F																							
39 <i>Obelia geniculata</i>																													P		P					
40 <i>Priapulus caudatus</i>			P																																	
41 <i>Arenicola marina</i>	O			C	C				C		F	A		C	P	C	F		C	C	P	R														
42 Terebellidae										P																										

Zone	TV03LT1		TV03LT2		TV03LT4			TV03LT5							TV03LT6			TV03LT7				TV03TN1			TV03TN3			TV03N4											
	6	7	5	5	6	7	7	8	9	10	11	11d	12	13	14	6	7	7	8	9	10	11	5	7	8	5	6	7	8	9	10	11	12						
43 Pomatoceros triqueter																							P	P				A											
44 Serpulidae sp.																								P															
45 Spirorbidae sp.															P																								
46 Balanus crenatus												P																											
47 Mysid shrimps		R	P	P																		P																	
48 Crangon crangon	O	C	P	P		P						P			∅P		P		P		P																		
49 Pagurus bernhardus		O									C	C	S		P							P						P											
50 Hyas sp.																													P		P								
51 Macropodia rostrata											P																												
52 Macropodia sp.	P	P										P		F	P							P						P											
53 Cancer pagurus																											P		P		P								
54 Liocarcinus depurator												P		P																									
55 Carcinus maenas		C	O	F	F	F			C		P		P	C	C	C	C	P	F	P	C	C	C					F											
56 Gibbula cineraria																												P	P		P								
57 Tectura testudinalis																												P											
58 Littorina littorea			P																																				
59 Littorina obtusata						A																																	
60 Buccinum undatum																			P										P		P								
61 Acanthodoris pilosa								R																															
62 Mytilus edulis					P																		A																
63 Modiolus modiolus																							A						C	C	C	C	A						
64 Cerastoderma edule				P																																			
65 Macoma balthica				P																																			
66 Mya truncata				P																										P		P							
67 Alcyonidium hirsutum																						P							P		P								
68 Membranipora membranacea																													P		P								
69 Scrupocellaria reptans												P																											
70 Bryozoan crusts																							P																
71 Antedon bifida															A	P	P									P	A	P	P		P								
72 Solaster endeca															P																								
73 Crossaster papposus																												P											
74 Henricia sanguinolenta																							P																
75 Henricia sp.																P											P												
76 Asterias rubens	P											O			P	P		P	P		P						P	P		P									
77 Ophiothrix fragilis												P	C		P								P		C	A		A	A	A	A	A							
78 Paracucumaria hyndmani																A																							
79 Leptopentacta elongata		P																																					
80 Leptosynapta inhaerens		F														C																							
81 Clavelina lepadiformis	O										P	P											P		P		P	P		P									
82 Lissoclinum perforatum																													P		P								
83 Ciona intestinalis						P																																	
84 Corella parallelogramma	P	P	P									P	P							A ²	C	C		P		P		P											
85 Ascidiella aspersa	A		A					A	A	A	F	P	C		A	A						A	P		C	A	A	A	A	A	A	A							
86 Ascidiella scabra		∅P				C		F	P	C	C	C	P		F	P				P ²	S ²	C	C		P		C	C	C	C	C	C							

Zone	TV03LT1		TV03LT2	TV03LT4			TV03LT5							TV03LT6			TV03LT7				TV03TN1	TV03TN3			TV03N4										
	6	7	5	5	6	7	7	8	9	10	11	11a	12	13	14	6	7	7	8	9	10	11	5	7	8	5	6	7	8	9	10	11	12		
87 <i>Ascidella</i> sp. (strawberry squirts)			A																				A												
88 <i>Ascidia virginea</i>		?	P																																
89 <i>Botryllus schlosseri</i>																								P			P	P							
90 <i>Botrylloides leachii</i>																								P			P		P		P				
91 <i>Gasterosteus aculeatus</i>											P																								
92 Pipefish indet.			P													P	P																		
93 <i>Centrolabrus exoletus</i>																								P											
94 <i>Pholis gunnellus</i>																								P											
95 Gobiidae indet.			P																																
96 <i>Gobiusculus flavescens</i>											P													P											
97 <i>Pomatoschistus</i> sp.				F						C			O	C	P	P	A	P	P				P	P											
98 Pleuronectiformes (Juv)													P																						

1 Cape form kelp

2 Unattached, or on unattached algae

3 Recorded as *Polyides*/*Furcellaria*?

4 Foliose red algae subsequently found to include *Membranoptera alata*, *Phyllophora pseudoceranioides*, *Phycodrys rubens*, *Plumaria plumosa*

Appendix 5 Draft site attribute table

Attribute	Target	Prescription (Every 6 years)
Extent of basin	No reduction in the extent of saline lagoon area (~62ha).	<p>Review activities with the potential to alter extent (through consultation with area office & relevant authorities), eg construction work, modification of drainage, isolating barriers etc. Surveyors to visually inspect site for damaging activities during monitoring survey.</p> <p>Geo-rectified Aerial images (LWS) to be compared with baseline every 12 years unless alerted to potential problem by area office or during site visit.</p> <p>Assess change in transect profile, position of waterline and vertical distribution of biotopes at minimum of 5 of the 7 fixed lagoon transects. These transects should each be from different basins within the lagoon system.</p>
Isolating barrier – presence, nature & integrity	No change in width and height (in relation to tidal range) of the barriers.	<p>Review activities with the potential to effect the function of the barriers (through consultation with area office & relevant authorities), eg construction work, dredging etc. Surveyors to visually inspect site for damaging activities during monitoring survey.</p> <p>Geo-rectified Aerial images (LWS) to be compared with baseline every 12 years unless alerted to potential problem by area office or during site visit. Width of isolating barriers to be measured.</p> <p>Assess change to the tidal height/depth profile at the 4 fixed tidal narrows transects.</p>
Salinity regime	Salinity levels should not deviate significantly from an established baseline.	<p>Review activities with the potential to effect the salinity regime (through consultation with area office & relevant authorities), eg changes to the isolating barriers, changes to drainage patterns etc. Surveyors to visually inspect site for new drainage ditches or water extraction pipework during monitoring survey.</p> <p>Salinity readings to be taken from a specified point and depth at 5 of the 7 fixed lagoon transects. These transects should each be from different basins within the lagoon system.</p> <p>Assess the presence & abundance of lagoonal species/ biotopes as a proxy measure of salinity. Changes in the biota that indicate sustained change in the salinity regime should act as a trigger for more intensive salinity surveillance surveys.</p>
Biotope composition of the lagoon	No reduction in the variety of biotopes present at known transects.	<p>Conduct biological surveys at the 4 fixed tidal narrows transects and at 5 of the 7 fixed lagoon transects. These transects should each be from different basins within the lagoon system.</p> <p>Confirm that the variety of biotopes recorded at each transect is similar to previous records allowing for natural change and surveyor variability</p>

Attribute	Target	Prescription (Every 6 years)
Extent of sub-feature or representative/notable biotopes	Maintain the extent of sub-feature or representative/notable biotopes identified for the site.	Discretionary attribute. Assess changes in the extent of <i>Ascophyllum mackaii</i> (SLR.AscX.mac) at Mill Burn (TV03LT3) and at the site south of Mill Burn (Appendix 1 Figure 3).
Extent of water	At least 60% of the water of the lagoon persisting at all times of the year and states of tide.	Discretionary attribute. Inappropriate for this site so will not be assessed separately from the assessment of the "Extent of basin" attribute.
Distribution of biotopes	Maintain the distribution and/or spatial arrangement of biotopes.	Discretionary attribute. Confirm presence of IMS.Rup at sites where previously recorded in Mo Wick and at the Head of The Vadills (Southern end).
Species composition of representative or notable biotopes	No decline in biotope quality due to changes in species composition or loss of notable species.	Discretionary attribute. A subjective assessment of changes in species composition of the IMS.Rup & IMU.AreSyn biotopes will be made when comparing species data in order to assess the "Biotope composition of the lagoon" attribute.
Species population measures – Population structure of a species – presence or abundance of specified species	Maintain age/size class structure of a (named) species. Maintain presence and/or abundance of the specified species.	Discretionary attribute. Confirm presence of <i>Paracucumaria hyndmani</i> , <i>Leptopentacta elongata</i> , and <i>Leptosynapta inhaerens</i> within the IMU.AreSyn biotope. Assess any increase in cover of <i>Beggiatoa</i> on survey transects.
Water depth	Water depth should not deviate significantly from an established baseline.	Discretionary attribute. Assess changes in transect depth profiles

Appendix 6 Survey log

Site Condition Monitoring: Surveys of Marine Rocky Environments and Lagoons in Papa Stour cSAC and The Vadills Lagoon cSAC, July–August 2003

Field Log ERTSL 997

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This document has been prepared in accordance with ERT (Scotland) Ltd's quality procedures and has been authorised for issue by the following signatory.



Iain Dixon, Project Manager
Proposal approval/authorisation for issue

11 September 2003

Date of issue

Survey report – overview

Client	SNH
Survey	Site condition monitoring: Papa Stour and The Vadills cSACs
Vessel	RIB Aphrodite and SNH zodiac
Mobilisation date	20/07/2003
Demobilisation date	17/08/2003
Project number	997

Survey personnel	Dan Harries – SNH
	Graham Saunders – SNH
	Claire Dagleish – ERT
	Robert Irving – Seascope (subcontracted to ERT)
	David Connor – JNCC
	Jenny Hill – JNCC
	Louise Lieberknecht – JNCC
Client representative	Dan Harries (SNH)

Survey report (997) – Summary

Date	Time	Details
20/07/2003		Mobilisation of ERT and SNH to Shetland by ferry from Aberdeen.
21/7/2003	0730	Arrive in Shetland. Meet with Jenny Hill (JNCC) in Lerwick. Food shop for self-catering. Liase with SNH Lerwick with regards to launching RIB Aphrodite.
	0930	Travel to Melby to launch RIB.
	1045	Arrive at Melby. Launch site too narrow.
	1200	Depart Melby for Bousta after advice from locals wrt to suitable launch alternative.
	1230–1300	Arrive at Bousta and launch.
	1300–1400	Setting up kit and lunch.
	1400	Depart mooring for Papa Stour.
		Remainder of day spent checking site locations on Papa Stour of areas previously surveyed by MNCR, those proposed by SNH and other potential sites for reef and caves survey around the island, gaining waypoints for each. No diving operations.
	2000	Check into accommodation at Sand Sound (self catering) and Snarraness (B&B).
22/07/2003	0830–2300	PS03CV1 – Gutters Cave.
23/07/2003	0830–2400	PS03CV2 – Tunnel in Headland west of Geo of Bordie.
24/07/2003	0800–2230	No sites surveyed. Weather not suitable for working around Papa Stour. SNH compressor broken down therefore not enough air fills available to carry out a subtidal site on Papa Stour. Replacement compressor sourced from C&R Diving Ltd. SNH compressor to Scalloway to get repaired. SNH inflatable picked up from Lerwick. CD and RI trip to Vadills to assess suitable launch site(s) for inflatable. Site located at Brindister Pier. Field methods and logistics of first 2 days survey reviewed. Data collected over first 2 days reviewed by team.
25/08/2003	0830–0030	PS03CV3 – Tunnel through Lamba Ness. General Papa Stour sites reconnaissance.
26/07/2003	0830–0100	PS03CV4 – Cave at Brei Holm. Reconnaissance of adjacent caves.
27/07/2003	0830–0000	PS03SR&LR1 – Jerome Coutts Head. SW cave site reconnaissance. Jenny Hill departs. Louise Lieberknecht arrives.
28/07/2003		Rest day. No diving operations. DH and GS move out of B&B and into self-catering at Twatt.
29/07/2003	0830–0130	PS03SR&LR2, PS03LR3 – Lamba Ness headland and West Voe.
30/07/2003	0830–0000	PS03SR&LR4, PS03SR&LR5 – Maiden Stack and Ness of Melby. General site reconnaissance at Neap of Norby (mainland).
31/07/2003	0830–2100	Weather too rough for diving or drop-down around Papa Stour. Write up of previous days data completed and all office and lab kit transferred to self-catering at Twatt. No diving operations.
01/08/2003	0830–0030	TV03LT1 – Mo Wick. CD, RI and LL move from self-catering at Sand Sound to B&B at Gruting.
02/08/2003	0830–2300	TV03LT2 & TV03TN1 – Marlee Loch Basin and Marlee Loch Narrows. LL departs for Lerwick.
03/08/2003		Rest day. David Connor arrives from Lerwick. RI and CD move from B&B Gruting to B&B Snarraness. No diving operations.
04/08/2003	0830–0000	TV03LT3, TV03LT4 & TV03TN2 – Mill Burn, Head of Vadills and Head of Vadills narrows.
05/08/2003	0830–1900	TV03LT5 – Vadills outer basin. Lerwick to do food shop and meet John Baxter.
06/08/2003	0845–2330	PS03SR & LR6 – West of Doo Hole.

Date	Time	Details
07.08.2003	0830–2345	PS03CV5 – West Bay Cave, Fogla Skerry.
08/08/2003	0845–2130	No diving operations. RI and DC move from Snarraness B&B to Gruting B&G. SW Papa Stour caves site assessment.
09/08/2003	0830–2100	PS03SR & LR7 – Reef at Headland of Bordie. Time in field cut short due to rough weather.
10/08/2003	0830–2300	TV03LT6, TV03TN3 & TV03TN4 – Mid Vadills, Mo wick Narrows, Outer Basin narrows. Mo Wick area assessed by snorkelling for Ruppia sp. DC departs for Lerwick.
11/08/2003		Rest Day. No diving operations. Completing previous days write up, repairing dive kit, food shopping in Lerwick.
12/08/2003	0900–2345	PS03SR & LR8, PS03SR & LR9 – Swarta Skerry and Hamna Voe.
13/08/2003	0900–2300	PS03SR & LR10 – Holm of Melby. Attempt to carry out spot dive in Sound of Papa. Not possible due to strong currents. CD moves from Snarraness B&B to Gruting B&B.
14/08/2003	0900–2300	TV03LT7 – Vadills Inner Basin.
15/08/2003	0900–0000	Drop down video at Maiden Stack (PS03SR4), Jerome Couatts Head (PS03SR1), Lamba Ness (PS03SR2) and Headland of Bordie (PS03SR7). 1 diving operation to free DD video. Packing office and lab facilities. CD reviewing video log. Compressor returned to C&R Diving, Inflatable returned to SNH Lerwick. RIB removed from mooring at Bousta.
16/08/2003		Depart accommodations for Lerwick. Ferry from Lerwick to Aberdeen 1700–0730 (17/08/2003).
17/08/2003	0730–1100	Travel from Aberdeen to ERT, Edinburgh
	1100–1300	Unpacking selected kit.

Daily report sheet									
Client SNH		Date 20/07/2003 and 21/07/2003							
Survey Papa Stour and The Vadills		Day no: Mob day + day 1							
Project no 997		Samples/measurements obtained							
Time	Diary of operations	GPS pos'n	Height data	Cave plan	Cross-sections	Physical data	Phase II data	Video	Stills
1130	Arrive ERT to check kit and meet Robert.								
1200	Depart ERT for Aberdeen.								
1430	Arrive Aberdeen – check in to ferry.								
1445	Meet Dan and Graham.								
1500	Awaiting vehicle boarding.								
1630	Board ferry.								
1700	Depart Aberdeen for Lerwick.								
1900	Discuss plan for survey with GS, DH, CD and RI – primarily methodology for surveying reef transects.								
21/07/2003									
0700	Arrive Lerwick – depart ferry for supermarket (opens at 0800) and meet Jenny.								
0800	Food shop.								
0900	DH phone call to Karen Hall to get directions to moorings. Fill boat fuel jerry cans.								
0930	Depart Lerwick to mooring at Melby.								
1045	Arrive at launch site. Launch site (slip) too narrow for boat trailer. Phone call to Karen Hall re alternative launch sites. Discussions with locals re alternative launch site. Attempt to launch at Melby – unsuccessful. Bousta (ca 8 miles away) suggested.								
1200	Depart from Melby for Bousta.								
1230	Arrive at Bousta and launch.								
1300	RIB moored on pontoon.								
1300– 1400	Setting up drop down video (for possible deployment) and loading boat. Lunch.								

Daily report sheet									
Client SNH		Date 20/07/2003 and 21/07/2003							
Survey Papa Stour and The Vadills		Day no: Mob day + day 1							
Project no 997		Samples/measurements obtained							
Time	Diary of operations	GPS pos'n	Height data	Cave plan	Cross-sections	Physical data	Phase II data	Video	Stills
21/07/2003									
1400	Depart mooring for Brei Holm, Papa Stour, 'Area 3'. Purpose – to locate sites chosen and assess suitability (this includes sites not previously surveyed and those previously surveyed by Entec/MNCR). Starting at area 3 and working northwards around the island. This was done by swimming into the caves on the surface ie not diving.								
	Waypoints coded as follows – 3C or 3R = 'original' cave site or reef site within area 3 proposed in method statement. 3Ca or 3Ra – 1st alternative cave or reef site within area 3, 3Cb – 2nd alternative cave site within area 3 etc. See Appendix 7 also, for data.								
1400	Area 3 WP 3Ra – Marks eastern corner of Maiden stack. Starts at 13m BSL – at a distance of 100m east of this point a depth of ca 25m BSL. This is thought to be a more suitable reef site (more gradual gradient) than that previously surveyed (677.3) as this seems to have a complex gradient ie a series of gullies and pinnacles.								
	Area 4 WP 4C (MNCR677.1) – large rock overhang rather than cave, not thought to be best site to survey. Alternative sites = WP4Ca (HU18585 61083) between north Ness and natural arch on map. Cave about 30m long, mostly subtidal (only small intertidal component). WP4Cb – cave within 'gutters cave' facing west, ca 60m long, sublittoral component all way to back, free surface all the way through. Additional cave to the south of this – no waypoint, mainly intertidal component.								

Daily report sheet									
Client SNH		Date 20/07/2003 and 21/07/2003							
Survey Papa Stour and The Vadills		Day no: Mob day + day 1							
Project no 997		Samples/measurements obtained							
Time	Diary of operations	GPS pos'n	Height data	Cave plan	Cross-sections	Physical data	Phase II data	Video	Stills
21/07/2003									
	Area 5 no previous cave data WP5Ca – 2 caves on west of west Voe. Largest = ~1.5m long, 4m wide and ~2m ASL, subtidal component all the way back. Smaller cave ~10m long, intertidal boulder beach at back. WP5Cb – Cave on east of west Voe with very large boulder (obstructs entire cave passage) ~20m in. Cave continues on behind boulder for about 5m although surveyor could not get past it. Thought to be intertidal towards back. WP 5Cc – Very narrow ~50cm wide, 2–3m ASL, 10m long leading up to a cobble beach at the back.								
1400	Area 6 no previous survey data WP6Ca – cave to the south east of Stevies Stack on Papa Stour mainland (note: multiple entrances next to each other). 30m long. WP6Cc cave 'next door' to WP6Ca, smaller of the 2, only 15m long. WP6Cb – 2 cave entrances separated by pillars. Probably only really one network as these both seemed to interlink through multiple passages, extensive network of pillars. Both caves +50m long. Not sure if these are on the wholly on mainland. Most southerly one appears to open out onto the main boulder shore on the mainland suggesting partially separated from main island. Other cave appears to be wholly sublittoral. WP6Cd – mainly intertidal.								
1700	Area 7 – attempt location of tunnel in headland west of geo Bordie. Multiple cave entrances at location, unclear which is one that extends through headland.								
1745	Depart Papa Stour to travel back to Bousta mooring from northwest corner (Area 7) round Fogla Skerry.								
1830	Arrive back at mooring, unpack RIB.								
1920	Depart Bousta for accommodation (~20 miles).								
2000	Arrive accommodation.								
Comments:									

Daily report sheet											
Client SNH			Date 22/07/2003								
Survey Papa Stour and The Vadills			Day no: 2								
Project no 997			Site surveyed PS03CV1 'Gutters cave', Papa Stour, Shetland – WP4Cb								
			Samples/measurements obtained								
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
0830	Depart accommodation.										
0900	Arrive at bousta mooring.										
0900–1000	Loading RIB.										
1000	GPS and engine problems.										
1030	Depart Bousta for Papa Stour. Plan to head for West Bay cave (MNCR 261.106) on Fogla Skerry to assess site and suitability of site and weather conditions for survey. First cave surveyed will be used to standardise methods within team.										
1050	Arrive West Bay cave (40 min after low water) – creel buoy sitting ca 1km NW of site getting pulled under by current running north. Estimated at 2kn.										
1100	On site – 0.5m surge. Waypoint taken – 8C. DH surface assessment. Snorkelled in ca 100m. Cave >100m long, consistently 4m wide, 12–15m deep, subtidal up to 100m. Didn't go slight current running through it (tunnel through headland) west to east. Extensive network of passages. Too extensive and surgey for first cave to survey.										
1110	Depart and travel to Gutters cave.										
1134	Arrive at Gutters cave.	Y									
1149	Reference piton placed above water. 1.9m above sea level at this time.		N/	N/A		4					
	DH and CD physical survey.				Y		Y				
	RI and JH biological survey.							Y			
	GS (CD standby) UW video.								Y		
	DH (CD standby) tape retrieval.										
	GS relocation photos.									Y	

Daily report sheet												
Client SNH				Date 22/07/2003								
Survey Papa Stour and The Vadills				Day no: 2								
Project no 997				Site surveyed PS03CV1 'Gutters cave', Papa Stour, Shetland – WP4Cb								
				Samples/measurements obtained								
Time	Diary of operations			GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills
1727	Depart site – obtain panoramic site relocation photo looking south from 60.34377N 1.67778E.											Y
1735	Depart for Bousta mooring.											
1800	Arrive Bousta, unload RIB.											
1820	Depart Bousta.											
1850	Arrive accommodation.											
1850–2300	Writing up.											
Comments:												
Type of survey: sublittoral cave, detailed recording												
Weather: sea state – calm; sunny, SW2, 0.5m swell												
LW:1010, UW viz: 8–10m												
Surveyors: Claire Dagleish – physical recording; Dan Harries – physical recording; Graham Saunders – boat handling, video and relocation photography, Robert Irving – biological recording; Jenny Hill – biological recording												

Daily report sheet											
Client SNH		Date 23/07/2003									
Survey Papa Stour and The Vadills		Day no: 3									
Project no 997		Site surveyed PS03CV2 Tunnel in headland west of Geo Bordie, Papa Stour, Shetland. HU 153623									
		Samples/measurements obtained									
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
0830	Depart accommodation										
0900	Arrive mooring – left video batteries behind. DH radio interview. Unloading vans.										
0930	GS return to get video batteries.										
1030	GS return to mooring. Loading boat and refuelling.										
1100	Depart mooring for Geo of Bordie.										
1125	Arrive at western entrance to tunnel in headland (HU149623). Surge ca 1.5m in entrance. Entrance 15m wide, 7m above sea level and 14m deep. Too surgy and currents running through headland not known. Not possible to take RIB in to have a look or put a snorkeller in as conditions too rough. Moving to eastern entrance of tunnel around headland to check conditions.										
1137	Arrive eastern entrance (HU153623). 6 cave entrances within this area. Unclear as to which one is the tunnel through headland. DH and CD snorkel to assess caves. Facing west, the left-hand side cave = 60.34332N, 1.70619W on a bearing of 220deg. DH and CD entered here and swam through a network that joined the 3 left-hand entrances. The most northerly cave of the 6 (on the right) = 60.34372N, 1.70857W. Entered this with snorkellers, no current detected. Entered in the RIB and travelled all way through headland, exiting out of the western entrance. Photo of the eastern entrance of this tunnel (most northerly of the 6) taken at the latter position with direction of view 250deg. See Appendix 7 for descriptions. A rough sketch of the entrances on headland is filed along with the field data for PS03CV2.										
1210											

Daily report sheet											
Client SNH		Date 23/07/2003									
Survey Papa Stour and The Vadills		Day no: 3									
Project no 997		Site surveyed PS03CV2 Tunnel in headland west of Geo Bordie, Papa Stour, Shetland. HU 153623									
		Samples/measurements obtained									
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
1220	Exit passage through tunnel in RIB at western entrance (WP taken – 60.34516N, 1.72971W).										
1225	Re-entering tunnel at western entrance to taken surface video from RIB.										
1229	Exit tunnel at eastern entrance.	Y									
1235	Setting up reference piton at left hand side of eastern entrance.										
1300–1401	CD and DH physical survey (no cross sections above sea level done at this stage).		N/A	N/A	Y	4	Y				
1455–1615	RI and JH biological recording (cross-sections 1(0m) and 2(25m) only). GS UW video.								Y		
1652–1745	DH and CD biological recording (cross-sections 3(50m) and 4(75m)). DH UW video of cross section at 0m. CD tape recovery.							Y			
	Relocation photos taken by GS.									Y	
1800	Physical cross sections done by running the tape on the surface above water from ref. piton out to 100m along left hand wall. Cross-sections done at 0, 25, 50, 75 and 100m.										
1830	Recovering reference tape from ref. Piton.										
1840	Depart PS03CV2.										
1900	Arrive at Bousta mooring, unload RIB.										
1930	Depart mooring from accommodation.										
2000	Arrive back at accommodation.										

Daily report sheet											
Client SNH				Date 23/07/2003							
Survey Papa Stour and The Vadills				Day no: 3							
Project no 997				Site surveyed PS03CV2 Tunnel in headland west of Geo Bordie, Papa Stour, Shetland. HU 153623							
		Samples/measurements obtained									
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
2000–2400	Writing up field notes + dinner. 7 cylinders required for air fills. SNH compressor broken down. Weather for next 24 hrs due to blow 5–6 SE therefore conditions too rough to work S, E and W of island. If force 6 reached then sea too rough to travel over to island in RIB (DH/GS).										
2000–2400	Alternative plan would be to source air fills and complete writing up field notes (am). Littoral transect at neap of Norby or organise induction with SNH local office for inflatable for use in Vadills (pm). Inflatable not available for entire 4-week period, SNH Lerwick have priority over its use. Not possible for them to say when it will and won't be available at this stage therefore its use can't be planned much in advance.										
Comments:											
Type of survey: sublittoral cave, detailed recording											
Weather: SW2, sea state = 1m swell											
LW: 1123, HW: 1720, UW viz: 15–20m											
Surveyors: Claire Dagleish – physical and biological recording; Dan Harries – physical and biological recording; Graham Saunders – UW video and relocation stills, Robert Irving – biological recording; Jenny Hill – biological recording											
Forecast for 1700 today for next 24 hrs: SW veering SE 4 increasing to 5–6											
Current: Creel buoy ca 1km NW of northwestern tip of Fogla Skerry pulled 0.5m under surface with current. Current est. at ca 3knts at 1117 (LW 1123) running south to north.											

Daily report sheet												
Client SNH				Date 24/07/2003								
Survey Papa Stour and The Vadills				Day no: 4								
Project no 997				Site surveyed – N/A								
				Samples/measurements obtained								
Time	Diary of operations			GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills
0800	Breakfast.											
0830	DH arrives at accommodation.											
0830–1200	Lack of air fills and weather resulting in no subtidal field work. Therefore, completing write up and reviewing field methods and logistics of first 2 days of field work. Concern of lack of time to record complex biological cross sections, inaccuracy of holding horizontal position along tape when ascending up 1m band at ie 50m cross section, concern with multiple ascents and descents using current methods.											
	Suggested revised methodology for large caves (such as PS03CV2) as follows: Physical recording - Only set 2 pitons per cave if passage not too complicated ie one at start and one at end of tape. Biological recording – Only cover one wall and floor on side 1 (side tape is on). Agree dive time prior to dive. Agree number of cross sections to be covered in dive. Allocate time to each cross section. Within each dive pair descend to ca half depth of cave at first cross section. Diver 1 record from upper section and diver 2 descend to bottom and record lower section. Both divers move to next cross section when allocated time is up. Time (GMT) must be recorded with each depth noted. This will allow corrections to be made in relation to chart datum at a later date as correct tidal port not known for area. Biological cross sections to be marked on tape by DSMB (entrance) and glow sticks (inner cross sections) for reference mid water.											
	Air fill options: Hire an additional 3 tanks (making total of 14) from C&R to fill and pick up on rotation on a daily basis. Possibility of hiring a compressor from C&R. SNH compressor taken to Scalloway by GS to get fixed.											

Daily report sheet											
Client SNH				Date 24/07/2003							
Survey Papa Stour and The Vadills				Day no: 4							
Project no 997				Site surveyed – N/A							
				Samples/measurements obtained							
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
1230	Lunch.										
1330	Downloading and logging photographs.										
1400	GS returns from C&R with hired compressor and 7 full tanks of air. C&R don't have tanks for hire.										
1430	DH to SNH to collect small inflatable for Vadills and sort out paper work and induction. GS and JH to Scalloway to take SNH compressor to get fixed. CD and RI to Vadills to assess launch sites.										
	Suitable launch site at Biggins farm, Uni Firth and also the slipway/pier at Brindister.										
1730	All return to accommodation.										
1800	Review of PS03CV2 video to confirm phase II record notes.										
1900	Data checklists for caves and reef sites created. Discussion with DH re data management.										
2000	Dinner.										
2030	Discussion for following days work and methodology to be followed.										
2100	Reading through previous Papa Stour caves report (Entec) to ID key species to look out for.										
2230	DH and GS leave for B&B.										
Comments:											
Type of survey:											
Weather: SW 6											
LW, UW viz: N/A											
Surveyors: Claire Dagleish –xx; Dan Harries –xx; Graham Saunders – xx, Robert Irving – xx; Jenny Hill – xx											

Daily report sheet											
Client SNH				Date 25/07/2003							
Survey Papa Stour and The Vadills				Day no: 5							
Project no 997				Site surveyed PS03CV3 Tunnel through Lamba Ness							
				Samples/measurements obtained							
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
0830	Depart accommodation.										
0900	Arrive mooring, load boat.										
1000	Depart mooring for SW Papa Stour, Christies Hole.										
1030	Arrive Christies Hole. SW swell, 1.5m. Caves north of Christies hole assessed. Too much swell.										
1040	Moving to Lamba Ness on North side of Papa Stour.										
1103	Arrive Lamba Ness. Assess caves around headland. A series of caves located near Stevie Skerry. Most were small blind inlets. Suitable cave located. Passage ca 75m long through headland with small exits on left separated by a series of pillars. Bedrock and boulders on floor throughout. Steep side walls, ca 4-8m wide throughout and ca 4m deep.										
1146-1305	CD physical survey. Five cross-sections, 0, 18.4, 47.4, 58.9 and 68m. DH general biological overview.	Y	N/A	N/A	Y	5	Y				
1305-1330	Discussion re biological cross sections and physical dimensions of cave.										
1335-1510	RI and JH biological cross sections.							Y			
1410-1510	GS UW video and tape recovery.								Y		
1510-1530	Divers de-kitting.										
1530-1617	Assessment of other possible cave sites in area and barnacle collection for ID.										
1617-1621	DH recovering tape reel dropped in kelp.										

Daily report sheet											
Client SNH				Date 25/07/2003							
Survey Papa Stour and The Vadills				Day no: 5							
Project no 997				Site surveyed PS03CV3 Tunnel through Lamba Ness							
Samples/measurements obtained											
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
1621-1645	Relocation photographs.									Y	
1645	Depart site for Bousta mooring. Headwind, lots of chop, driving rain. Slow journey back.										
1710	Arrive at mooring.										
1710-1800	Unloading boat.										
1800-1830	Travel back to accommodation.										
1830-0030	Writing up (+dinner).										
Comments:											
Type of survey: sublittoral cave, detailed recording											
Weather: SE3 to 4, increasing 5											
LW: UW viz: 10m											
Surveyors: Claire Dalglish –physical survey; Dan Harries –physical survey/general biological overview; Graham Saunders – video/digital stills, Robert Irving – biological recording; Jenny Hill – biological recording											

Daily report sheet											
Client SNH				Date 26/07/2003							
Survey Papa Stour and The Vadills				Day no: 6							
Project no 997				Site surveyed PS03CV4 Cave at Brei Holm (MNCR Site 261.113)							
		Samples/measurements obtained									
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
0830	Depart accommodation.										
0910	Arrive at mooring. Load RIB.										
1000	Depart mooring for SE Papa Stour and caves at Brei Holm.										
1010	Arrive at caves. Anchor RIB.										
1010-1040	Snorkel to assess site lay out. Extensive cave system.										
1040-1100	Placing reference piton.										
1102-1208	CD physical survey. JH general biological overview.		N/A	N/A	Y	4	Y				
1208-1241	Discussion regarding physical findings and setting biological cross sections and diver change over.										
1241-1415	DH and RI biological cross sections (4).					4		Y			
1415-1438	Diver change over.										
1438-1615	GS and JH UW video and digital stills.								Y & VW stills		
1615-1630	Divers dekit.										
1630-1715	DH and CD snorkel to measure connecting and neighbouring passages to PS03CV4. GS relocation digital photos.	Y								Y	
1715	Retrieving anchor.										
1730	Depart site for mooring.										
1745	Arrive at mooring, unload boat.										

Daily report sheet											
Client SNH				Date 26/07/2003							
Survey Papa Stour and The Vadills				Day no: 6							
Project no 997				Site surveyed PS03CV4 Cave at Brei Holm (MNCR Site 261.113)							
		Samples/measurements obtained									
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
1800	Depart for accommodation.										
1830	Arrive at accommodation, unload.										
1900–0100	Writing up.										
Comments:											
Type of survey: sublittoral cave, detailed recording											
Weather: sunny, N4 easing to 2, sea state – calm											
LW: UW viz: 10m											
Surveyors: Claire Dagleish –physical survey; Dan Harries –biological recording; Graham Saunders – UW video and digital stills, Robert Irving – biological recording; Jenny Hill – biological overview											

Daily report sheet											
Client SNH			Date 27/07/2003								
Survey Papa Stour and The Vadills			Day no: 7								
Project no 997			Sites surveyed PS03SR1 and PS03LR1 Jerome Couit's Head, Papa Stour								
			Samples/measurements obtained								
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
0830	Depart accommodation for mooring. JH depart for Lerwick.										
0900	Arrive mooring, load boat.										
0930	Problems with GPS receiving satellite info.										
0945	GPS working, depart mooring for SW Papa Stour, caves at shepherds stack (MNCR 677.5).										
1000	Arrive at site. Locating cave.										
1015	Snorkel to assess cave.										
1030	Swell too large, departing site for alternative caves within area (area 11).										
1045–1112	Series of caves snorkelled to assess suitability for survey. All too short (ca 10–20m long) and shallow (<3m). Also, very surgey midway along passage in most making the site difficult and unsafe to dive.										
1112	Depart for Jerome Couit's Head to carry out reef survey.										
1130	Arrive site. Assessing site.										
1140	Setting up reference piton.										
1222	CD laying transect line and general biological overview; GS setting transect bearing and general biological overview.										
1259	Divers out.										
1325	RI biological recording and DH biological recording.							3			
1410	Divers out. Lunch, waiting for minimum surface interval (2 hrs) for first pair of divers to pass before next dive. Littoral survey carried out. Relocation photos.	Y	N/A				Y			Y	
1550	CD depth profile, GS UW video.			Y	N/A	3			Y		

Daily report sheet											
Client SNH				Date 27/07/2003							
Survey Papa Stour and The Vadills				Day no: 7							
Project no 997				Sites surveyed PS03SR1 and PS03LR1 Jerome Couit's Head, Papa Stour							
				Samples/measurements obtained							
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
1633	Divers out.										
1640	Recovering transect line.										
1700	Depart site for mooring.										
1710	Arrive mooring.										
1740	RI GS and CD depart mooring for accommodation.										
1800	DH depart mooring to pick up Louise from Lerwick.										
1810	RI GS and CD arrive at accommodation.										
1945	DH and LL arrive at accommodation.										
1945	Writing up and discussing transect survey methodology. Proposal for tomorrow = each sublittoral transect to be done in 2 dives. Dive 1 – lay transect line on way out and mark end with DSMB, on way back diver ID boundaries of zonation on distance line, note substrate and depth profile, diver 2 video. Dive 2 – divers descend DSMB line, diver 1 swim on left of transect line to shore, diver 2 on right. Each diver swims towards shore carrying out general biological overview of each zone. Recover the transect line from the boat. This will allow for 2 reef sites (lit and sublitt) to be completed in one day.										
Comments:											
Type of survey: sublittoral and littoral reef, detailed recording											
Weather: SE 2-3											
LW: 1442, UW viz: 15-20m											
Surveyors: Claire Dalglish – laying transect, physical survey and zone assessment; Dan Harries –biological recording; Graham Saunders – UW video and zone assessment, Robert Irving – biological recording											

Daily report sheet												
Client SNH				Date 28/07/2003								
Survey Papa Stour and The Vadills				Day no: 8								
Project no 997				Site surveyed – None								
				Samples/measurements obtained								
Time	Diary of operations			GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills
	Rest day – Food shop in Lerwick, pick up compressor from Scalloway, locate dive shop for misc spare items.											
Comments: N/A												
Type of survey:												
Weather:												
LW: UW viz.												
Surveyors: Claire Dagleish – xx; Dan Harries – xx; Graham Saunders – xx; Robert Irving – xx; Louise Lieberknecht – xx												

Daily report sheet											
Client SNH			Date 29/07/2003								
Survey Papa Stour and The Vadills			Day no: 9								
Project no 997			Sites surveyed PS03SR2, PS03LR2 and PS03LR3 Transect off Lamba Ness headland (SR2 and LR2) and transect within West Voe (LR3)								
			Samples/measurements obtained								
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
0830	Depart accommodation for mooring.										
0900	Arrive mooring, load boat.										
0954	Depart mooring for maidens stack reef site.										
1009	Arrive maidens stack – southerly 4–5, considerable swell. Diving would be difficult if wind picks up as forecast. Westerly swell (~2m), too heavy to head round to the west. Transit to northwest via eastern side of papa Stour to assess conditions for a reef site there.										
1015	Arrive NW, area 7, headland off geo of Bordie to assess site for suitable sublittoral transect ie depth and topography. Strong current (>3knts) running north. Swell 2m. Heading back round to Lamba Ness headland.										
1029	Arrive at Lamba Ness. Determining transect line (litt and sublitt). Setting up reference piton.	Y									
1123	CD laying sublitt transect line (SR2), depth profile and ID of zone boundaries; GS setting transect bearing, UWV video.		N/A	Y	N/A	7 zones	Y		Y		
1202	Divers out.										
1224	RI and DH depth profile and biological recording.							Y			
1230	CD and LL littoral transect (LR2), GS relocation photos.							Y		Y	
1323	Divers out.										
1345	Completed littoral survey.										
1350	Lunch.										
1410	Recovering transect line and ref. Tape.										
1415	Transit to West Voe.										

Daily report sheet												
Client SNH				Date 29/07/2003								
Survey Papa Stour and The Vadills				Day no: 9								
Project no 997				Sites surveyed PS03SR2, PS03LR2 and PS03LR3 Transect off Lamba Ness headland (SR2 and LR2) and transect within West Voe (LR3)								
				Samples/measurements obtained								
Time	Diary of operations			GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills
1430	Arrive west Voe, locating transect. Sublittoral component not possible as this is all cobbles and boulders, and not rock reef. Setting up start piton for littoral reef (LR3).											
1500	CD, LL, GS, RI and DH biological recording on littoral transect.			Y	N/A	Y	N/A	5 zones	Y	Y	N/A	Y
1615	Recovering tape.											
1620	Depart site to assess conditions and reef sites around Fogla Skerry and West Papa Stour.											
1633	Headland of Geo of Bordie – steeply sloping bedrock reef – current still >3knts although it should be slack water (?).											
1710	Waypoint 80 (lowrance dGPS) marks end of suitable reef site off Swarta Skerry.											
1715	Depart site for mooring.											
1735	Arrive at mooring.											
1800	Depart for accommodation.											
1830–0130	Writing up. Discussion wrt reef surveying – to enable two full (ie SR transect and LR transect for each location eg Lamba Ness) sites to be completed in one day it is suggested by all that biological recording should not be carried out at designated stations within the zones (ie 2x2m area at a point location on the transect tape) but in a 2x2m swathe all the way along the tape towards shore. Divers descend the DSMB line and swim from 100–0m recording the zonation and the species, which characterise each zone and their abundances. It is recognised that carrying out this amount of fieldwork during the day will extend the already long write up time.											

Daily report sheet												
Client SNH				Date 29/07/2003								
Survey Papa Stour and The Vadills				Day no: 9								
Project no 997				Sites surveyed PS03SR2, PS03LR2 and PS03LR3 Transect off Lamba Ness headland (SR2 and LR2) and transect within West Voe (LR3)								
				Samples/measurements obtained								
Time	Diary of operations			GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills
Comments:												
Type of survey: sublittoral and littoral reef, detailed recording												
Weather: S 4-5												
LW: 1615, UW viz: 10m												
Surveyors: Claire Dalglish – sublitt depth profile, zone boundaries, littoral recording; Dan Harries – sublitt biological recording, sublitt depth profile; Graham Saunders – UW video, relocation photos, litt recording; Robert Irving – sublitt biological recording, littoral recording; Louise Lieberknecht – litt recording												

Daily report sheet												
Client SNH				Date 30/07/2003								
Survey Papa Stour and The Vadills				Day no: 10								
Project no 997				Sites surveyed PS03SR47LR4, PS03SR5 & LR5 Maiden Stack and Ness of Melby								
				Samples/measurements obtained								
Time	Diary of operations			GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills
0830	Depart accommodation for mooring.											
0845	Fill up with diesel.											
0910	Arrive at mooring. Aim to survey two full locations (ie SR and LR at each) today.											
0950	Depart mooring for Swarta Skerry on west. Swell too heavy round the south side of Papa Stour, turning back for Maidens Stack.											
1008	Arrive at Maidens Stack (PS03SR4 & LR4). Setting up start piton (0m on the sublittoral transect – SR4), no reference piton here as littoral zone is vertical and inaccessible therefore cannot be fully surveyed. Only ca 2m above sea level was recorded (LR4).											
1030	Relocation photos taken with RI pointing to start piton.											Y
1044	CD laying transect line, carrying out depth profile and identifying boundaries between biological zones and substrate details. GS setting bearing for transect line and carrying out UW video.				N/A	Y	N/A	tbc	Y		Y	
1130	Divers out.											
1152	RI and DH carrying out biological recording (2x2m swathe along transect line to shore). GS obtaining more distant relocation photos.									Y		
1253	Divers out.											
1300	Lunch.											
1320	Recovering transect line from boat.											
1340	Transit to Neap of Norby to survey reef site.											

Daily report sheet												
Client SNH				Date 30/07/2003								
Survey Papa Stour and The Vadills				Day no: 10								
Project no 997				Sites surveyed PS03SR47LR4, PS03SR5 & LR5 Maiden Stack and Ness of Melby								
				Samples/measurements obtained								
Time	Diary of operations			GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills
1350	Arrive at Neap of Norby – area too shallow to allow boat in to assess depth and substrate along any possible transect lines here. Sea too rough to allow snorkellers in. 100m transect out from most points on the shore here wouldn't reach more than ca 4m depth and entire transect would cover kelp. Not possible to assess whether substrate is rock or predominantly sediment with cobbles and boulders. Moving west to Ness of Melby.											
1405	Arrive Ness of Melby. Assessing possible transect sites.											
1430	Suitable transect line located (PS03SR5 & LR5). DH and CD swim ashore to set reference and start piton, reference tape and attach sublitt transect line to start.											
1445	CD and LL carry out littoral recording. DH laying sublitt transect line by snorkelling out on a bearing from shore. SMB deployed (tied to end of line reel and dropped to bottom) to mark end of this.			Y	N/A	Y	N/A	tbc				
1503	DH carrying out sublittoral (2x2m swathe) biological recording and depth profile – RI standby diver.								Y	Y		
1540	Diver out. Too much surge nearer shore therefore 30–0m on tape will have to be surveyed by snorkelling.								Y	Y		
1554	GS carrying out UW video – RI standby diver.										Y	
1626	Diver out.											

Daily report sheet											
Client SNH		Date 30/07/2003									
Survey Papa Stour and The Vadills		Day no: 10									
Project no 997		Sites surveyed PS03SR47LR4, PS03SR5 & LR5 Maiden Stack and Ness of Melby									
		Samples/measurements obtained									
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
1630	DH biological recording 30–0m by snorkelling. GS and CD to shore to take photos of each littoral zone and relocation photos. Recovering reference tape.									Y	
1700	DH recovering transect line to boat.										
1730	Depart site for mooring.										
1745	Arrive at mooring, unload boat.										
1815	Depart mooring for accommodation.										
1845	Arrive at accommodation.										
1900–0000	Writing up. Complete write up of field data not possible within this time therefore tomorrow morning will have to be spent finishing this. In addition, RI, CD and LL have to move accommodation on the morning of 1/8/03 therefore office and lab will have to be packed also. Plan for 31/07/03 = complete 30/07/03 write up, pack, and carrying out drop down video if weather allows in the afternoon and evening.										
Comments:											
Type of survey: sublittoral and littoral transects, detailed recording											
Weather: NW4											
LW: 17: 20, UW viz: 10–12m below the shallow kelp zone (it was assumed that this was exuding something as the viz was very cloudy within the shallows where this was super abundant)											
Surveyors: Claire Dagleish – laying sublitt transect, depth profiling, littoral biological recording; Dan Harries – sublitt biological recording, depth profiling, laying sublitt transect line; Graham Saunders – UW video, relocation and litt zone photos, Robert Irving – sublitt biological recording; LL – littoral biological recording											

Daily report sheet											
Client SNH				Date 31/07/2003							
Survey Papa Stour and The Vadills				Day no: 11							
Project no 997				Site surveyed – None							
				Samples/measurements obtained							
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
0830–1330	Writing up previous days field data and moving lab and office stuff to DH and GS self-catering accommodation.										
1330–1400	Lunch.										
1400–1430	Phonecall to ERT office.										
1430–1500	Setting up drop down video.										
1500	Depart accommodation for mooring.										
1530	Arrive at mooring. Sea too rough. SE 5–6. Advised by DH that it would not be possible to deploy drop down video.										
1600	Depart mooring for accommodation.										
1630	Arrive accommodation.										
1700–2000	Looking at previous days specimens.										
2000–2030	Dinner.										
2030–2100	Reviewing video.										
Comments:											
Type of survey: N/A											
Weather: SE 5 to 6											
LW: UW viz: N/A											
Surveyors: Claire Dalglish – xx; Dan Harries – xx; Graham Saunders – xx, Robert Irving – xx; Louise Lieberknecht – xx											

Daily report sheet												
Client SNH				Date 01/08/2003								
Survey Papa Stour and The Vadills				Day no: 12								
Project no 997				Site surveyed TV03LT1 Mo Wick								
				Samples/measurements obtained								
Time	Diary of operations			GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills
0830–0930	Moving out of Sand Sound self-catering accommodation.											
0930	Depart accommodation for Brindister pier (launch site for Vadills).											
1000	Arrive at Brindister. Confirming pier access, loading small SNH inflatable and launching.											
1115	Depart pier for Mo Wick.											
1145	Arrive on site (TV03LT1).											
1150	Setting up transect line using wooden stake onshore.			Y	N/A							
1210	DH laying line offshore.											
1245	Shore relocation photos and lunch.											Y
1316–1414	DH and RI biological recording from 100–0m on distance line.					Y	N/A	3 sublittoral				
1516–1555	GS UW video, CD collecting specimens.										Y	
1555–1630	DH snorkel to assess the general area.											
1630–1700	Littoral recording.					Y		4 littoral				Y
1700	Distance relocation photos and recovering transect line from boat.											
1715	Depart site for pier.											
1745	Arrive at pier, unload boat.											
1815	Depart pier for Gruting accommodation to check in.											
1900	Arrive at accommodation.											
1915	Depart accommodation to travel to self-catering for dinner and write up.											

Daily report sheet											
Client SNH				Date 01/08/2003							
Survey Papa Stour and The Vadills				Day no: 12							
Project no 997				Site surveyed TV03LT1 Mo Wick							
		Samples/measurements obtained									
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
1930–0000	Writing up.										
0000–0030	Travel back to accommodation.										
Comments:											
Type of survey: littoral and sublittoral transect											
Weather: SE 5											
LW: 17:50, UW viz: 2m											
Surveyors: Claire Dagleish – sublittoral specimen collection; Dan Harries – physical survey, sublittoral and littoral biological recording; Graham Saunders – UW video, relocation photos, Robert Irving – sublittoral and littoral biological recording; Louise Lieberknecht – xx											
Note: dives within The Vadills shallower than 1.7m were generally not logged but treated as 'snorkel-dives'. However, all sublittoral field data collected within The Vadills was done using SCUBA											

Daily report sheet											
Client SNH			Date 02/08/2003								
Survey Papa Stour and The Vadills			Day no: 13								
Project no 997			Sites surveyed TV03LT2 and TV03TN1 Marlee Loch Basin and Marlee Loch Narrows (respectively with code)								
			Samples/measurements obtained								
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
0745	LL to bus stop for Lerwick.										
0830	Depart accommodation for Brindister pier.										
0900	Arrive at pier, load boat.										
0940	Depart pier for Vadills, Marlee Loch.										
1015	Arrive on site. Anchor boat.										
1030	Laying transect lines. One wooden stake was positioned at the corner of the Tidal narrows leading into Marlee Loch. One transect line was attached to the stake and placed directly across the narrows on a bearing of 300 deg to the shore on the other side. An additional transect line was attached to the same wooden stake and run out on a bearing of 067 deg for 100m into the Loch basin.	Y	N/A		N/A						
1108-1134	GS UW video along TV03LT2.								Y		
1152-1220	DH and CD biological recording along TV03LT2.			Y			Y	Y			
1300-1330	DH and CD biological recording along TV03TN1.										
1330-1400	GS UW video along TV03TN1.										
	DH, RI and CD littoral survey along TV03LT2.			Y			Y	Y			
	DH littoral survey along TV03TN1.			Y			Y	Y			
	Relocation photographs of both sites.									Y	
1408	Recording positions of start and end points.	Y									
	Recovering transect lines.										

Daily report sheet											
Client SNH				Date 02/08/2003							
Survey Papa Stour and The Vadills				Day no: 13							
Project no 997				Sites surveyed TV03LT2 and TV03TN1 Marlee Loch Basin and Marlee Loch Narrows (respectively with code)							
Samples/measurements obtained											
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
1415	Depart site for the head of The Vadills.										
1430–1530	Snorkel within the head of The Vadills to assess presence of Ruppia. Some found, although not in dense beds as expected/previously reported.										
1530	Depart Vadills for pier.										
1600	Arrive at pier, unload boat, transit to accommodation.										
1630	Arrive accommodation.										
1700–2300	Writing up.										
Comments:											
Type of survey: sublittoral and littoral transects, detailed recording											
Weather: SW 5											
HW: 1230, UW viz: <2m											
Surveyors: Claire Dalglish – sublitt and litt biological recording; Dan Harries – physical survey, sublitt and litt biological recording; Graham Saunders – UW video, relocation photos, Robert Irving – litt biological recording											

Daily report sheet												
Client SNH				Date 03/08/2003								
Survey Papa Stour and The Vadills				Day no: 14								
Project no 997				Site surveyed – None								
				Samples/measurements obtained								
Time	Diary of operations			GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills
	Rest day.											
	RI & CD move accommodation.											
1800	DC arrives.											
Comments:												
Type of survey:												
Weather:												
LW: UW viz:												
Surveyors: Claire Dagleish – xx; Dan Harries – xx; Graham Saunders – xx, Robert Irving – xx												

Daily report sheet											
Client SNH		Date 04/08/2003									
Survey Papa Stour and The Vadills		Day no: 15									
Project no 997		Sites surveyed TV03LT3 (Mill Burn), TV03LT4 (Head of the Vadills), TV03TN2 (Head of The Vadills narrows) + notes on an additional <i>Ascophyllum mackaii</i> bed (see relocation info for site position)									
		Samples/measurements obtained									
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
0830	Depart accommodation for pier at Brindister.										
0900	Arrive at pier, load boat.										
0940	Depart pier for site.										
1010	Arrive on site (TV03LT3).										
	Transect across <i>Ascophyllum mackaii</i> bed.	Y	N/A	Y	N/A				N/A – shore video obtained	Y	
1200	Lunch.										
1235	Depart TV03LT3 for head of Vadills.										
1245	Arrive on site – TV03LT4. Laying transect line.										
1250–1500	DH sublitt and litt biological recording and GS UW video.	Y	N/A	Y	N/A				Y	Y	
	RI, DC and CD assessing <i>A. mackaii</i> bed north of the head of The Vadills.										
1430	RI, DC and CD laying transect line at TV03LT3. Slack water required for this, estimated at 1500.										
1500	Tide flooding. Current flowing into the head of The Vadills. High water was noted on 02/08/03 to be 0.5hrs after HW at Hillswick.										
1505	Tide appears to have changed to ebb. Current has changed direction however, high water mark (ie top of Pelvetia zone) was not reach by waters edge. This seemed a little odd.										

Daily report sheet											
Client SNH				Date 04/08/2003							
Survey Papa Stour and The Vadills				Day no: 15							
Project no 997				Sites surveyed TV03LT3 (Mill Burn), TV03LT4 (Head of the Vadills), TV03TN2 (Head of The Vadills narrows) + notes on an additional <i>Ascophyllum mackaii</i> bed (see relocation info for site position)							
Samples/measurements obtained											
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
1505–1545	DC and CD Littoral biological recording. Sublitt recording RI (CD standby).	Y	N/A	Y	N/A					Y	
1528–1541	GS UW video (CD standby).										
1545	Recovering tape at TV03LT4 and obtaining end positions.										
1600	Recovering tape at TV 03LT4.										
1630	Depart site.										
1645	Obtaining positions for mussel strings near Brindister pier.										
1700	Arrive at pier, unload.										
1800–0000	Arrive at accommodation, writing up.										
Comments:											
Type of survey: littoral and sublittoral transects, detailed biological recording											
Weather: S 1–2, veering N in the afternoon											
HW: 1500, UW viz: N/A											
Surveyors: Claire Dagleish – littoral recording, sublitt fringe; Dan Harries – litt and sublitt recording; Graham Saunders – UW video and photography, Robert Irving – litt and sublitt recording; David Connor – litt recording											

Daily report sheet											
Client SNH				Date 05/08/2003							
Survey Papa Stour and The Vadills				Day no: 16							
Project no 997				Site surveyed TV03LT5 The Vadills Outer Basin							
				Samples/measurements obtained							
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
0830	Depart accommodation for assessment of weather conditions around Papa Stour.										
0930– 1130	Arrive at self-catering accommodation. Completing previous days write up and specimen processing. Weather too rough to work around Papa Stour. Plan to carry out one site within The Vadills.										
1100	DH phonecall to SNH Lerwick (Karen Hall).										
1130	Depart accommodation for pier at Brindister.										
1200	Arrive pier, load boat.										
1230	Arrive at site, anchor boat.										
1245	Laying transect line.	Y	N/A								
1258– 1339	GS UW video.								Y		
1300– 1400	CD and DC littoral transect – biological recording. DH levelling shore.			Y	N/A	5 zones	Y	Y			
1400– 1420	Lunch.										
1420– 1541	CD and RI sublitt transect – biological recording and depth profiling. GS zone photos.			Y	N/A	tbc	Y	Y			
1545– 1615	Relocation photos.									Y	
1615– 1630	Recovering transect line.										
1630– 1700	Transit back to pier.										
1700– 1730	Unloading boat.										
1730– 1900	Writing up.										

Daily report sheet												
Client SNH				Date 05/08/2003								
Survey Papa Stour and The Vadills				Day no: 16								
Project no 997				Site surveyed TV03LT5 The Vadills Outer Basin								
				Samples/measurements obtained								
Time	Diary of operations			GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills
1900	Depart for Lerwick to do food shop and meet John Baxter.											
Comments:												
Type of survey: Litt and sublitt transect, detailed biological recording												
Weather: SW 4-5												
HW: 1530, UW viz: 2-3m												
Surveyors: Claire Dagleish – litt and sublitt recording; Dan Harries – shore levelling; Graham Saunders – UW video, relocation and biological zone photos, Robert Irving – sublitt recording; David Connor – litt recording												

Daily report sheet											
Client SNH			Date 06/08/2003								
Survey Papa Stour and The Vadills			Day no: 17								
Project no 997			Site surveyed PS03SR & LR6 West of Doo Hole								
			Samples/measurements obtained								
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
0845	Depart accommodation for self-catering to complete previous days write up and specimen processing.										
0915	Arrive at accommodation. DH checking weather at Bousta mooring for Papa Stour fieldwork. Weather appears suitable on south coast therefore, plan to assess cave sites in area 11 and carry out a transect within this area.										
1300	Completed write up, lunch.										
1330	Depart for bousta mooring.										
1430	Arrive at mooring, load RIB.										
1500	Depart mooring for site on south of Papa Stour.										
1510–1545	Arrive at Papa Stour, locating suitable site for a reef transect ie moderate gradient without pinnacles or gullies. No such site appeared to occur within this area however therefore, the transect line chosen run across a gully and plateau. This was unavoidable.										
1545–1610	Setting up ref and start pitons on shore.	Y	N/A								
1620	CD laying transect line and recording depth profile, GS UW video. DH recording end point position.			Y	N/A		Y		Y		
1708	Divers out.										
1729	DH and RI biological recording. GS relocation photos.					Tbc		Y		Y	
1856	Divers out.										
1915	CD, DH and RI littoral transect biological recording, close up relocation photos and zone photos.					4	Not measured	Y			
2000	Recovering transect line.										

Daily report sheet											
Client SNH				Date 06/08/2003							
Survey Papa Stour and The Vadills				Day no: 17							
Project no 997				Site surveyed PS03SR & LR6 West of Doo Hole							
				Samples/measurements obtained							
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
2010	Depart site.										
2020	Arrive at mooring, unload RIB.										
2100	Arrive at accommodation.										
2100–2330	Writing up.										
Comments:											
Type of survey: sublitt and litt transect, detailed recording											
Weather: SW 3–4											
LW: UW viz: 10m											
Surveyors: Claire Dagleish – laying transect line, sublitt depth profile, littoral recording; Dan Harries – sublitt biological recording, zone photos; Graham Saunders – UW video and relocation photos, Robert Irving – sublitt and litt biological recording; David Connor – xx											

Daily report sheet											
Client SNH				Date 07/08/2003							
Survey Papa Stour and The Vadills				Day no: 18							
Project no 997				Site surveyed PS03CV5 West Bay Cave, Fogla Skerry							
Samples/measurements obtained											
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
0830	Depart accommodation for self catering.										
0915	Arrive self catering, completing write up for previous days field work.										
1230	Lunch.										
1245	Depart self catering for bousta mooring.										
1315	Arrive at bousta, load boat.										
1340	Depart bousta for Fogla Skerry.										
1400	Arrive Fogla Skerry, assess site by snorkelling.										
1420	Setting reference piton.	N – no GPS satellite signal within vicinity of cave entrance									
1458–1553	CD physical survey and DC general biological overview.		N	N	Y	3-phys	Y				
1625–1745	DH and RI biological recording.					4-biol		Y			
	GS relocation photos.									Y	
1803–1942	GS UW video (CD standby).								Y		
1850–1942	CD depth profile and recovering tape.										
2000	Depart site.										
2020	Arrive back at mooring, unload boat.										
2100	Arrive back at self catering, writing up.										
2310	Depart self catering for accommodation.										
2345	Arrive at accommodation.										
Comments:											
Type of survey: sublitt cave, detailed recording											
Weather: SW 2											
LW: UW viz: 15m											
Surveyors: Claire Dalgleish – physical survey; Dan Harries – biological recording; Graham Saunders – UW video and relocation photos, Robert Irving – biological recording; David Connor – general biological overview											

Daily report sheet											
Client SNH				Date 08/08/2003							
Survey Papa Stour and The Vadills				Day no: 19							
Project no 997				Site surveyed – N/A SW Cave site assessment							
		Samples/measurements obtained									
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
0845	RI and DC check out of accommodation. RI and DC check into B&B at Gruting.										
0930	Depart Gruting accommodation for self-catering via garage for diesel.										
1000	Arrive self catering, complete write up of previous days field work.										
1300	Write up complete, lunch.										
	Depart self catering for boustia mooring.										
1330	Arrive at mooring, load rib.										
1415	Depart mooring to assess potential cave sites on the south and south west side of Papa Stour via the east and north for general site photos.										
1430	Arrive at Papa Stour, site assessment, two potential cave site located. See appendix 7 and sketches 7.6–7.13 for details.										
1900	Depart site for mooring.										
1920	Arrive at mooring, unload boat.										
1945	Depart mooring for Westings for dinner.										
2045	Arrive.										
2130–2330	Depart westings for self catering to write up.										
Comments:											
Type of survey: sublittoral cave, suitable site reconnaissance											
Weather: SW 1, sunny, sea state – calm											
LW: N/A, UW viz: N/A											
Surveyors: Claire Dalglish – cave snorkel; Dan Harries – cave snorkel; Graham Saunders – cave snorkel, Robert Irving –boat handling; David Connor – boat handling											

Daily report sheet											
Client SNH			Date 09/08/2003								
Survey Papa Stour and The Vadills			Day no: 20								
Project no 997			Sites surveyed PS03SR and LR7 Reef at Headland of Bordie								
			Samples/measurements obtained								
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
0900	Arrive at bousa mooring, load boat.										
0945	Depart mooring for NW Papa Stour to assess sea conditions for a reef site.										
1015	Arrive on site at headland of Bordie. Assessing depth and topography with RIB sounder for suitable transect line.										
1045	DH laying reference and start pitons on headland shore and setting up sublittoral transect start.										
1118	CD laying sublitt transect line and carrying out depth profile. DC general biological zone overview, GS UW video.			Y	N/A		Y		Y		
1200	Divers out.										
1231	RI and DH sublitt biological recording.					5		Y			
1245–1345	DC and CD littoral biological recording.	Y	N/A			4		Y			
1326	Divers out.										
1345	GS relocation and litt zone photos.									Y	
	Swell and wind picked up considerably since start of transect. Now too rough to work on North. Plan to travel to Hamna Voe via West side since wind southeasterly.										
1400	Recovering sublitt transect line.										
1415	Depart site for Hamna Voe.										
1435	Abort transit via west, swell too heavy and waves washing over rib. Heading south to Hamna Voe.										
1500	Sheltering in bay behind Lamba Ness for lunch.										
1530	Depart to travel to south to assess conditions in Sound of Papa for possible spot dive and/or Hamna Voe to find suitable transect site.										

Daily report sheet											
Client SNH				Date 09/08/2003							
Survey Papa Stour and The Vadills				Day no: 20							
Project no 997				Sites surveyed PS03SR and LR7 Reef at Headland of Bordie							
Samples/measurements obtained											
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n	Digital Stills
1545	Sea state too rough. Passage south made difficult. Wind now picked up to SE 6-7. Sound of Papa running with tide and large swell, unlikely to be suitable conditions in Hamna Voe as wind is blowing straight into this. Abort plans due to sea state, heading back to mooring.										
1630	Arrive back at mooring after making slow progress due to heavy sea state.										
1645-2100	Depart mooring for self catering and writing up.										
Comments:											
Type of survey: sublittoral and littoral reef, detailed recording											
Weather: SE 4 increasing to 6 possibly 7. Sea State – rough. 2m short swell											
LW: 0730, UW viz: 15m											
Surveyors: Claire Dagleish – sublitt physical survey, littoral recording; Dan Harries – sublitt biological recording; Graham Saunders –UW video, relocation and litt zone photos, Robert Irving – sublitt biological recording; David Connor – sublitt general biological zone overview and litt recording											

Daily report sheet											
Client SNH			Date 10/08/2003								
Survey Papa Stour and The Vadills			Day no: 21								
Project no 997			Sites surveyed TV03LT6, TV03TN3 & TN4 Mid-Vadills, Mo Wick narrows, Outer basin narrows respectively.								
			Samples/measurements obtained								
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
0830	DC to Lerwick with RI.										
0830	GS to Sandness to assess weather conditions on south Papa Stour.										
0915	CD to self catering.										
0920	GS and RI arrive at self-catering. White water breaking on south Papa Stour, decision to work in The Vadills to complete Vadills programme.										
0940	Depart self catering for Brindister pier.										
1000	Arrive Brindister, refuel and load boat.										
1050	Depart pier for outer basin narrows.										
1110	Attempt to lay transect line across outer basin narrows. Current too strong, abandon transect for time being and move into mid Vadills.										
1130	Arrive mid Vadills – site no TV03LT6 laying out transect line.	Y	N/A		N/A						
	GS UW video.								Y		
	CD sublittoral biological recording, depth profile and salinity sampling.			Y		3	Y	Y			
	RI and DH littoral biological recording and profiling.			Y		5	Y	Y			
	GS relocation photos.									Y	
	Recovering transect line.										
	Transit to Mo Wick narrows.										
	Arrive at site – TV03TN3, assessing line of transect. Maerl was previously reported from this site therefore ideally need to try and cover this with transect line. Snorkel to assess.	Y	N/A		N/A						
GS UW video.								Y			

Daily report sheet											
Client SNH				Date 10/08/2003							
Survey Papa Stour and The Vadills				Day no: 21							
Project no 997				Sites surveyed TV03LT6, TV03TN3 & TN4 Mid-Vadills, Mo Wick narrows, Outer basin narrows respectively.							
				Samples/measurements obtained							
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
1130	RI sublittoral biological recording and salinity sampling.			Y		3	Y	Y			
	DH and CD littoral biological recording and profiling.			Y		6	Y	Y			
	GS relocation photos.									Y	
	Recovering transect line.										
	Transit to outer basin narrows.										
	Arrive at site – TV03TN4.										
	Setting up transect line – although slack water is thought to occur now current still running strong making transect set up difficult. Decision to lay line from boat and keep above water to avoid it being carried by current.	Y	N/A		N/A						
	DH sublittoral biological recording and salinity sampling.			Y		15 litt and sublitt	Y	Y			
	GS UW video.								Y		
	RI and CD littoral biological recording.			Y		15 litt and sublitt	Y	Y			
	GS relocation photos.									Y	
	Recovering transect line.										
	Depart site for Mo Wick to assess area for Ruppia beds. Positions on dense beds noted. Depart Mo Wick for pier.	Y									
	Arrive at pier, unload boat.										
	Depart pier for self catering.										
2130–2300	Arrive at self catering, writing up.										
Comments:											
Type of survey: littoral and sublittoral transect, detailed biological recording											
Weather: NW 2, raining											
HW: 1430 @ Hillswick, UW viz: variable between sites, 2–4m											
Surveyors: Claire Dalgleish – sublitt recording, litt recording, elevation recording; Dan Harries – sublitt and litt recording, elevation recording; Graham Saunders – UW video, relocation photos, Robert Irving – litt and sublitt recording, elevation recording											

Daily report sheet											
Client SNH				Date 11/08/2003							
Survey Papa Stour and The Vadills				Day no: 22							
Project no 997				Site surveyed – N/A Rest day							
		Samples/measurements obtained									
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
0900	Depart accommodation for self catering.										
0930–1300	Completing write up from previous day.										
1300–1400	Dive kit repairs.										
1400–1830	Lerwick, food shopping for self catering.										
1830–1930	Dinner – power cut.										
1930–2130	Completing writing up. Laptop files not completed due to lack of power.										
Comments:											
Type of survey: N/A											
Weather: N/A											
LW: N/A, UW viz: N/A											
Surveyors: Claire Dalglish – xx; Dan Harries – xx; Graham Saunders – xx, Robert Irving – xx											

Daily report sheet											
Client SNH		Date 12/08/2003									
Survey Papa Stour and The Vadills		Day no: 23									
Project no 997		Sites surveyed PS03SR & LR8, PS02SR & LR9 Swarta Skerry and Hamna Voe									
		Samples/measurements obtained									
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
0900	Arrive at bousta mooring, load boat.										
0950	Depart mooring for Swarta Skerry.										
1010	Arrive Swarta Skerry – PS03SR & LR8. Swell considerable on west side of Skerry (transect side). Assessing seabed topography with sounder for suitable transect line/bearing taking into consideration sea conditions.										
	Laying litt transect line on shore and setting up start piton for sublitt transect.										
1059–1135	GS UW video, CD laying sublitt line, depth profiling and general biological overview. Strong current running south to north round Skerry, not possible to maintain position to achieve profile and recording between 30m and start of sublitt line.			Y	N/A				Y		
1150	Depart site for shelter in Hamna Voe to wait for current to ease at Swarta.										
1200	Arrive Hamna Voe – site PS03SR & LR9, lunch.										
1230	Assessing site for suitable transect line.										
	Laying shore and sublitt transect (continuous).										
	DH and CD shore recording and levelling. Zone photos.	Y	N/A	Y	N/A	tbc	Y	Y			
1346–1458	RI sublitt recording and depth profiling. GS relocation photos.		Y		tbc	Y	Y		Y		
	Depart site to assess current and surge round Swarta. Slack is thought to be mid-tide.										
	Current still strong, DSMB deployed at end of 100m transect line disappeared under with current. Too surgey for RIB to put surveyors on shore. Return to Hamna Voe.										

Daily report sheet												
Client SNH				Date 12/08/2003								
Survey Papa Stour and The Vadills				Day no: 23								
Project no 997				Sites surveyed PS03SR & LR8, PS02SR & LR9 Swarta Skerry and Hamna Voe								
				Samples/measurements obtained								
Time	Diary of operations			GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills
1554–1615	GS UW video.										Y	
	Return to Swarta, Littoral recording and levelling. Current eased – slack thought to be 1.5hrs after LW/HW. Relocation photos.			Y	N/A	Y	N/A	tbc	Y	Y		Y
1811–1857	DH sublitt recording.					Y		tbc	Y	Y		
1905–1915	GS in water to retrieve dropped dive kit.											
1930	Depart site for mooring.											
2000	Arrive mooring, unload boat.											
2030	Depart mooring for self catering.											
2100	Arrive self catering.											
2100–2300	Writing up.											
Comments:												
Type of survey: littoral and sublittoral transect, detailed recording												
Weather: SW 3												
HW: 0956 (@Hillswick), UW viz: 5–10m												
Surveyors: Claire Dagleish – depth profiling, shore elevations, litt recording, sublitt general biol overview; Dan Harries – sublitt recording, shore profiling, litt recording; Graham Saunders – UW video, Robert Irving – sublitt recording, depth profiling												

Daily report sheet											
Client SNH		Date 13/08/2003									
Survey Papa Stour and The Vadills		Day no: 24									
Project no 997		Sites surveyed PS03SR & LR10 Holm of Melby									
		Samples/measurements obtained									
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
0900–1345	Writing up previous days field notes. CD move from B&B at Snarraness to B&B at Gruting.										
1345	Depart accommodation for mooring.										
1415	Arrive mooring, load boat and refuel.										
1500	Depart mooring for NW Papa Stour to assess sea conditions and the possibility of reef site on Fogla Skerry or cave site on west.										
1530	Arrive south of Fogla, sea state too rough, large swell. Transit back to Holm of Melby to assess suitable reef site.										
1550	Arrive Holm of Melby – sounding suitable reef location. Otters present on north shore.										
1615	Current appears quite strong. Decision to look at MNCR site in Sound of Papa for possible spot dive.										
1630	MNCR site located, deploying shot line.										
	Shot buoy dragged under by sub surface current. Trying to recover.										
1650	Abandon buoy, travel back to Holm of Melby.										
1700	Setting up start point on shore on north east of Holm – not north location previously assessed as this transect line was limited to 5m depth. Location chosen on north east shore runs deeper – ca 11m.										
1750–1840	DH UW video, CD depth profiling and sublitt recording.										
1800	RI litt recording.										
1900–1930	DH and GS shore levelling and zone photos.										
	Returning to retrieve buoy in sound of Papa. Shot weight caught on bottom.										

Daily report sheet											
Client SNH				Date 13/08/2003							
Survey Papa Stour and The Vadills				Day no: 24							
Project no 997				Sites surveyed PS03SR & LR10 Holm of Melby							
Samples/measurements obtained											
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
1951– 1959	GS in to free shot weight and buoy. Current dropped off as buoy is now back on surface – slack here appears to be 3hrs 20min after LW at Hillswick.										
2015	Depart site for mooring.										
2030	Arrive mooring, unload boat.										
2045	Depart mooring for self catering.										
2115	Arrive self catering.										
2115– 2300	Writing up.										
Comments:											
Type of survey: sublitt and litt transect, detailed recording											
Weather: SW veering W 3, rain											
LW: 1638 at Hillswick, UW viz: 10m											
Surveyors: Claire Dagleish – sublitt recording and depth profiling; Dan Harries – UW video, shore levelling; Graham Saunders – shore levelling, photos, Robert Irving – litt recording											

Daily report sheet											
Client SNH				Date 14/08/2003							
Survey Papa Stour and The Vadills				Day no: 25							
Project no 997				Sites surveyed TV03LT7 Inner Basin							
		Samples/measurements obtained									
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
0900–1330	Completing write up from previous day. DH and GS checking RIB down at Bousta mooring for possible overnight damage in rough weather. Checking sea conditions round Papa Stour.										
	Conditions too rough for working around Papa Stour – decision to carry out additional site monitoring within the Vadills.										
1330–1400	Lunch.										
1400	Depart for Brindister pier.										
1420	Arrive at pier, load boat.										
1445	Depart pier for site.										
1500	Arrive at site at Inner Basin (TV03LT7).										
1515	Setting up transect line (start point for Mill Burn transect used).	Y	N/A								
1544–1601	GS UW video (CD standby).										
1520–1540	RI and CD littoral survey and shore levelling.			Y	N/A	5	Y	Y	Y	Y	
1648–1711	DH sublitt recording and profiling. GS standby.			Y			Y	Y	Y		
1645–1730	CD and RI salinity sampling in Mo Wick (transect site and Ruppia site).										
1800	Depart site for pier.										
1830	Arrive at pier, unload boat and demob from water for return to SNH tomorrow.										
1900	Depart pier for self catering.										
1930	Arrive self catering.										
1930–2300	Writing up.										
Comments:											
Type of survey: littoral and sublittoral transect, detailed recording											
Weather: NW 5–6											
LW: ca 1800, UW viz:											
Surveyors: Claire Dalgleish – litt recording and shore levelling; Dan Harries – sublitt recording and depth profiling; Graham Saunders – UW video and relocation photos, Robert Irving – litt recording and shore levelling											

Daily report sheet											
Client SNH			Date 15/08/2003								
Survey Papa Stour and The Vadills			Day no: 26								
Project no 997			Sites surveyed Maiden stack, Jerome Coutts head, Lamba Ness, Headland of Bordie								
			Samples/measurements obtained								
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
0900	DH returning compressor to C&R.										
	RI and GS returning Zodiac to SNH Lerwick.										
	CD completing video log and reviewing video.										
1230	Lunch.										
1300	Depart self catering for boustia mooring to assess conditions for survey work on Papa Stour.										
1330	Arrive at mooring. Sea conditions too rough for diving work. Setting up drop down system. Load drop down video kit onto boat. Plan to sail out to east side and try to obtain video from sites around here.										
1445	Depart mooring for Papa Stour.										
1502	Arrive at Maiden Stack – 2 x drop down runs. Transit to Jerome Coutts head.										
1547	Arrive Jerome Coutts head – 2 x drop down runs. Transit to Lamba Ness.										
1616	Arrive at Lamba Ness – 2 x drop down runs + 1 x drop down at V29 (previous MNCR site). Transit to Headland of Bordie.										
1713	Arrive at headland of Bordie – 1 x drop down run. Video frame stuck on seabed.										
	Attempting to free video from seabed.										
1747–1758	DH in to free video, CD standby.										
1800–1830	Trying to free umbilical.										
1830	Depart site.										
1845	Arrive at mooring, unload boat.										

Daily report sheet											
Client SNH			Date 15/08/2003								
Survey Papa Stour and The Vadills			Day no: 26								
Project no 997			Sites surveyed Maiden stack, Jerome Coutts head, Lamba Ness, Headland of Bordie								
			Samples/measurements obtained								
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
1915	Depart mooring for self catering.										
1945-0000	Packing kit and writing up.										
Comments:											
Type of survey: drop down video											
Weather: NW6											
LW: UW viz: N/A											
Surveyors: Claire Dalglish – Video logging; Dan Harries – video operator; Graham Saunders – video operator; Robert Irving – video operator											

Daily report sheet											
Client SNH				Date 16/08/2003 and 17/08/2003							
Survey Papa Stour and The Vadills				Day no: 27 and 28 (demob)							
Project no 997				Sites surveyed – N/A Travel from Lerwick to Aberdeen							
		Samples/measurements obtained									
Time	Diary of operations	GPS pos'n	Cave elev'n data (litt only)	Trans plan	Cave plan	No of Cross-sections/transect stations/transect zones	Physical data	Phase II data	UW Video	Reloc'n Digital Stills	
1000	Depart accommodation for Lerwick.										
1100	Arrive Lerwick.										
1500–1630	Calibrating various shore levelling techniques.										
1700	Checking onto Ferry.										
1700–0000	Ferry journey back to Aberdeen.										
17/08/2003											
0000–0730	Ferry journey back to Aberdeen.										
0730–1100	Travel from Aberdeen to Edinburgh.										
1100	Arrive ERT, unpack kit.										
1330	RI depart ERT for Devon, CD depart ERT for home.										
Comments:											
Type of survey:											
Weather:											
LW: UW viz:											
Surveyors: Claire Dagleish – xx; Dan Harries – xx; Graham Saunders – xx, Robert Irving – xx											