

Marine Nature Conservation Review

Sector 1

Shetland

Area summaries

Christine Howson



1999

Series editor: David Connor

20

Reawick to Quilva Taing

Location

Position (centre)	HU 210 470	60°12.4'N 01°37.2'W
Administrative area	Shetland Islands	
Conservation agency/area	Scottish Natural Heritage	North Areas (Northern Isles)

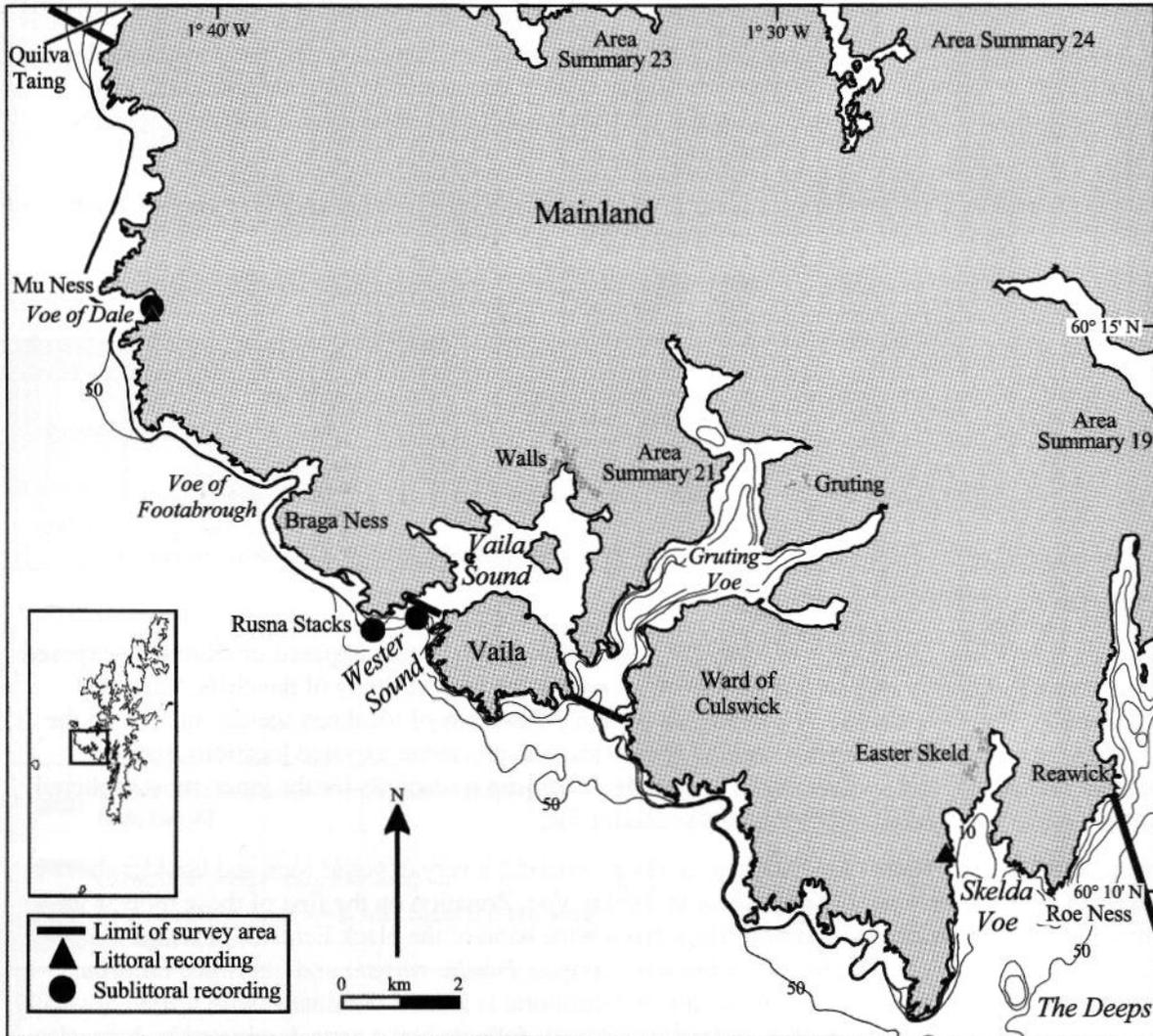


Figure 20.1 Main features of the area, showing sites surveyed.

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Physical features

Physiographic type	Open coast
Length of coast	74.4 km
Bathymetry	50 m contour within 500 m along most of coast
Wave exposure	Very exposed on open coast to very sheltered at head of Skelda Voe; mostly exposed
Tidal streams	Strong to negligible
Tidal range	1.4 m (mean springs); 0.8 m (mean neaps)
Salinity	Fully marine

Introduction

Area 20 comprises the south-west facing coast of the Walls peninsula in the west of Mainland Shetland. This rocky coastline is essentially an open, linear coast and ranks amongst the most exposed stretches of coast in Shetland. There are steep cliffs along much of its length with numerous skerries, stacks, caves and geos, a number of small, exposed embayments and one voe, Skelda Voe. This runs north to south with an exposed, south-facing entrance and is surrounded by lower-lying ground than the rest of the area. A group of sheltered inlets including Vaila Sound and Gruting Voe bisect the area (Area summary 21).

The littoral zone consists largely of steep or vertical rock with some boulder beaches in bays. There is a small mixed sediment flat at the head of Skelda Voe. Rock continues into the sublittoral to a depth of at least 30 m to the west of Vaila and probably continues into deeper water although no data are available. Strong tidal streams run along the coast in Area 20, and are strongest around headlands.

This is a remote rural area with the population concentrated around Skelda Voe and the voes of Gruting and Vaila, and only a sparse population in the north-west of the area. There are few roads. Most of the land is grazed moorland and water quality is excellent.

Marine biology

Marine biological surveys				
	Survey methods	No. of sites	Date(s) of survey	Source
Littoral	Recording	2	1974	Institute of Terrestrial Ecology (1974a)
Sublittoral	Recording	1	1974	Earll (1982); Institute of Terrestrial Ecology (1974b)
	Recording	2	July-August 1987	Moss & Ackers (1987)

Littoral

The littoral zone consists mainly of steep to vertical rock which is very exposed or extremely exposed to wave action. Boulder and cobble beaches are found at the base of many of the cliffs. Sheltered conditions are found in Skelda Voe and it is also likely that areas of localised shelter, such as on the lee side of islands and headlands or behind rocky ridges in otherwise exposed locations, support communities characteristic of sheltered conditions. There are no records for the inner, most sheltered part of Skelda Voe where there is a mixed sediment flat.

There are biological records for only two shores in Area 20, a very exposed rock and boulder shore in Voe of Dale and a sheltered bedrock shore in Skelda Voe. Zonation on the first of these reflects its exposed nature. Bedrock in the littoral fringe has a wide band of the black lichen *Verrucaria maura* with scattered barnacles *Semibalanus balanoides*, limpets *Patella vulgata* and littorinids *Littorina saxatilis* var. *rudis* (Ver.Ver). Below this, the mid-eulittoral is animal-dominated with a zone of small mussels *Mytilus edulis* mixed with *S. balanoides* (MytB) followed by a zone dominated by barnacles and limpets (BPat.Sem). The lower eulittoral is algal-dominated, with thongweed *Himantalia elongata* (Him) and the furoid *Fucus serratus* and a red algal turf of species such as *Osmundea pinnatifida* and *Chondrus crispus* (Fser.R). Kelp *Laminaria digitata* is found in the sublittoral fringe.

A gradually-sloping bedrock shore on the west side of Skelda Voe has a similar littoral fringe community to that of the more exposed shore with a broad band of *V. maura*. The lower edge of this zone supports the furoid alga *Fucus spiralis* (Fspi). In the mid-eulittoral, there is a mosaic of *S. balanoides*, *P. vulgata* and the furoid *Fucus vesiculosus* (FvesB). The lower eulittoral is dominated by *F. serratus* and foliose red algae, particularly the coralline *Corallina officinalis* (Fser.R). This biotope gives way to a sublittoral fringe with a mixture of *L. digitata* and *A. esculenta* (Ala.Ldig). There are numerous shallow pools at all levels on the shore. In the mid-eulittoral, these are dominated by coralline algae (Cor) whilst deeper pools in the lower eulittoral contain a mixture of those species found in the sublittoral fringe, with the additional kelp *Laminaria saccharina* (FK).

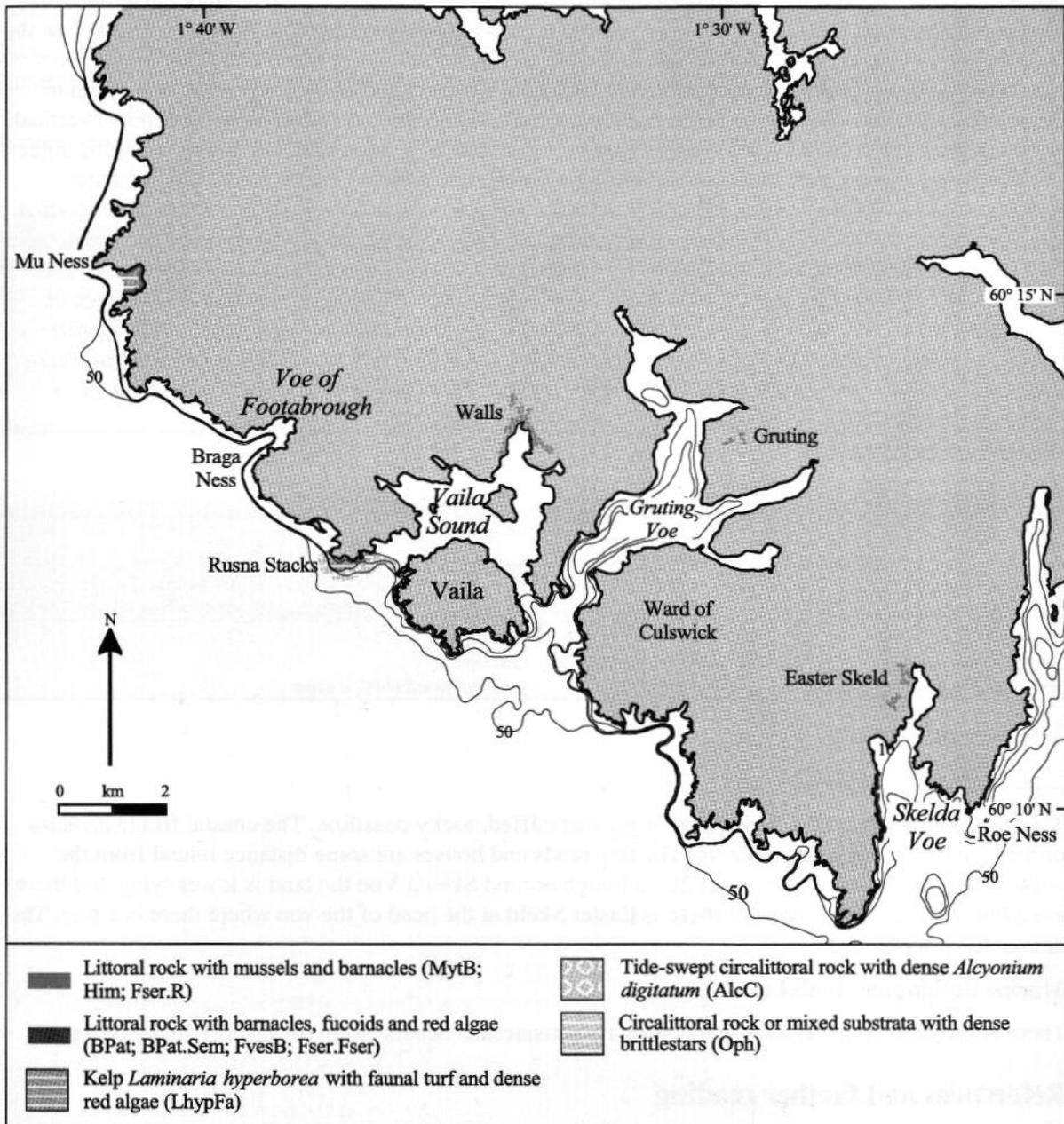


Figure 20.2 Indicative distribution of the main biotopes in the area (based on data from survey sites shown in Figure 20.1, cited literature and additional field observations).

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Sublittoral

Information for the sublittoral zone in Area 20 is also sparse. There is gradually-shelving bedrock in shallow water in Voe of Dale whilst steep rock with numerous ledges and steep-sided gullies reaches at least 30 m depth off Rusna Stacks, to the west of Vaila. In the entrance to Wester Sound, a bedrock wall reaches 25 m, at which depth there is a more level sea bed of bedrock ridges separated by boulder, cobble and sand plains which extend to 31 m depth. These rocky habitats are exposed to strong tides and severe wave action.

Kelp *Laminaria hyperborea* dominates the infralittoral zone, reaching a maximum depth of 17 m at Rusna Stacks where the inclination may prevent it growing deeper (LhypFa). Species found below the kelp canopy and in crevices include the sea urchin *Echinus esculentus*, horse mussel *Modiolus modiolus*, sponges *Leucosolenia complicata*, *Haliclona viscosa* and *Halichondria* sp., the ascidian *Lissoclinum perforatum* and the brittlestar *Ophiura albida*. In the circalittoral zone, steep and vertical rock faces are dominated by dead-man's fingers *Alcyonium digitatum* with encrusting coralline algae common, and species such as the anemone *Sagartia elegans* present (AlcC). Ledges support the dahlia anemone *Urticina felina*, the edible crab *Cancer pagurus* and the hydroid *Abietinaria abietina*. Similar species are found on the rock ridges although grazing by *E. esculentus* is more noticeable here and the encrusting bryozoan *Parasmittina trispinosa* and the keel worm *Pomatoceros triqueter* are more abundant. Boulders and cobbles in the circalittoral, both in Wester Sound and on the floor of gullies off Rusna Stacks, are carpeted with brittlestars *Ophiocoma nigrum* and *Ophiothrix fragilis* (Oph). *U. felina* is abundant between cobbles on the gully floors. Several individuals of the northern species of spider crab *Lithodes maia* have been recorded from the circalittoral cobbles in this area.

Nature conservation

Conservation sites		
Site name	Status	Main features
Shetland: South West Mainland	NSA	Landscape
Culswick Marsh	SSSI	Botanical
Fidlar Geo to Watness	SSSI; GCR	Geological
Sel Ayre	SSSI; GCR	Geological
Skelda Ness	SSSI; GCR	Geological
Shetland Islands	ESA	Agri-environmental scheme

Human influences

Coastal developments and uses

There is little development of any sort along this cliffed, rocky coastline. The coastal fringe consists of moorland used for rough grazing. The few roads and houses are some distance inland from the coast in the north-west part of Area 20, although around Skelda Voe the land is lower-lying and there are a few villages. The largest of these is Easter Skeld at the head of the voe where there is a pier. The houses have septic tanks.

Marine developments and uses

There is no mariculture in Area 20. Potting for crustaceans occurs along the inshore rocky coastline.

References and further reading

- Earll, R.C. 1982. Report on a sublittoral survey of Shetland. (Contractor: Underwater Conservation Society, Ross-on-Wye.) *Nature Conservancy Council, CSD Report*, No. 466.
- Institute of Terrestrial Ecology. 1975a. Report to the Nature Conservancy Council on some aspects of the ecology of Shetland. Part 6.2. Littoral biota of rocky shores. *Nature Conservancy Council, CSD Report*, No. 27.
- Institute of Terrestrial Ecology. 1975b. Report to the Nature Conservancy Council on some aspects of the ecology of Shetland. 6.4: Sublittoral biota. *Nature Conservancy Council, CSD Report*, No. 30.
- Moss, D., & Ackers, G. 1987. *A sublittoral survey of Shetland, 1987*. Unpublished, Marine Conservation Society.

Sites surveyed

Survey 227: 1987 MCS sublittoral survey of Shetland (Moss & Ackers 1987).

Survey 230: 1974 ITE report on sublittoral biota of Shetland (Earll 1982; Institute of Terrestrial Ecology 1975b).

Survey 434: 1974 ITE report on rocky shore ecology of Shetland (Institute of Terrestrial Ecology 1975a).

Littoral sites					
<i>Survey</i>	<i>Site</i>	<i>Site name</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotopes recorded</i>
434	40	Scarvister, Skelda Voe.	HU 305 430	60°10.2'N 01°27.0'W	Ver.Ver; Fspi; BPat; FvesB; Fser.R; Fser.Fser; Cor; FK; Ala.Ldig
434	44	Voe of Dale, Bakka.	HU 174 520	60°15.1'N 01°41.1'W	Ver.Ver; MytB; BPat; BPat.Sem; Him; Fser.R

Sublittoral sites					
<i>Survey</i>	<i>Site</i>	<i>Site name</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotopes recorded</i>
230	6	Bakka.	HU 174 520	60°15.1'N 01°41.1'W	LhypFa
227	41	Tower at Vaila, Wester Sound.	HU 218 469	60°12.3'N 01°36.4'W	AlcC; Oph
227	42	Rusna Stacks, Wester Sound.	HU 210 467	60°12.2'N 01°37.2'W	LhypFa; AlcC; Oph

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Gruting Voe and Vaila Sound

Location

Position (centre)	HU 255 480	60°12.9'N 01°32.3'W
Administrative area	Shetland Islands	
Conservation agency/area	Scottish Natural Heritage	North Areas (Northern Isles)

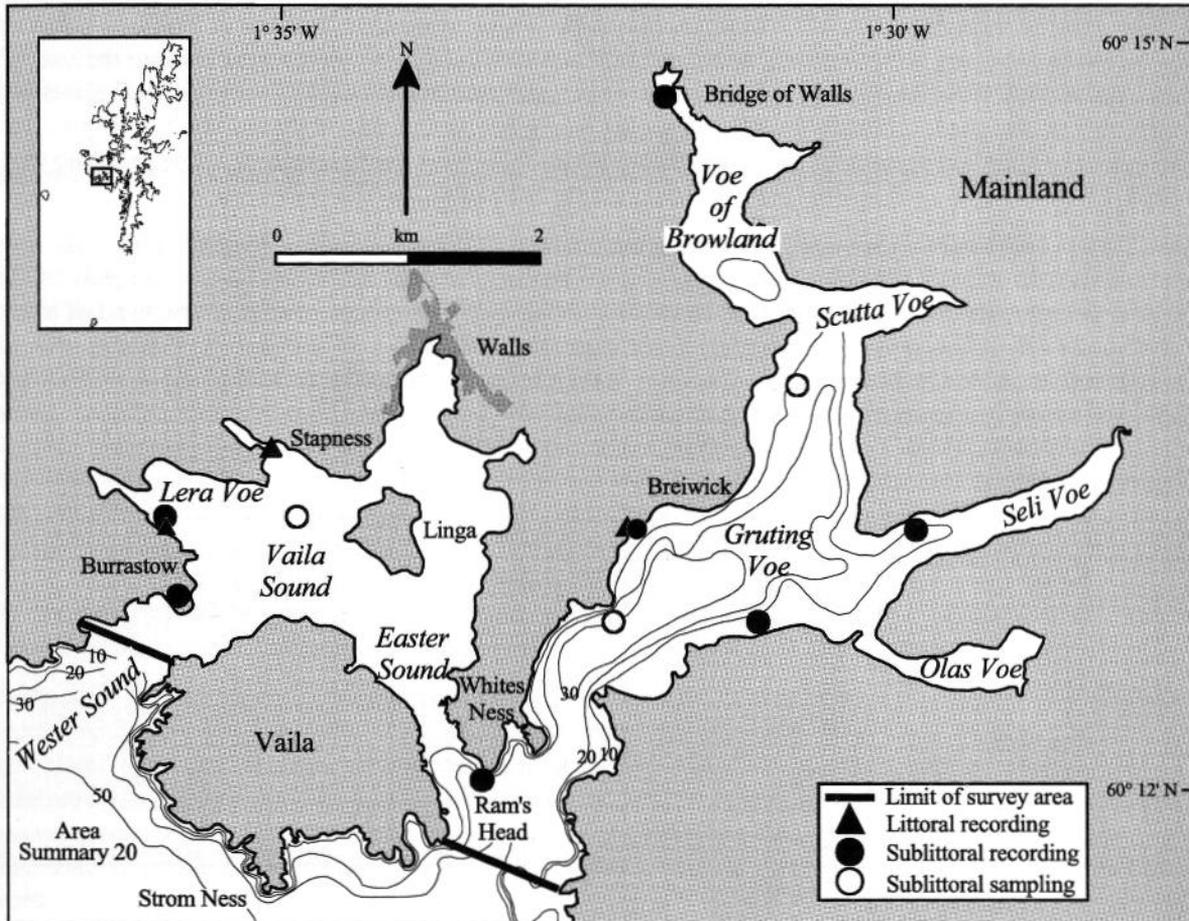


Figure 21.1 Main features of the area, showing sites surveyed.

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Physical features

Physiographic type	Voe
Length of coast	47.8 km
Area of inlet	Gruting Voe: 4.5 km ² ; Voe of Browland: 1.0 km ² ; Seli Voe: 0.7 km ² ; Olas Voe: 0.4 km ² ; Lera Voe: 0.4 km ² ; Vaila Sound: 2.9 km ² ; Wester Sound: 0.75 km ² .
Bathymetry	Vaila Sound: max. depth 26 m; Gruting Voe: max. depth 40 m; Wester Sound: max. depth 18 m, sill 5-7 m; inner arms shallow gradually towards their heads
Wave exposure	Moderately exposed at entrance to ultra sheltered at heads; mostly sheltered
Tidal streams	Moderate to weak through Wester and Easter Sounds; weak or negligible elsewhere
Tidal range	1.4 m (mean springs); 0.8 m (mean neaps)
Salinity	Mostly fully marine; variable or low in heads of inner arms

Introduction

Area 21 comprises the adjoining sheltered inlets of Gruting Voe, amongst the largest of the Shetland voes, and Vaila Sound. Their entrances are sheltered by the island of Vaila, and the channels of

Wester and Easter Sounds form the entrance to Vaile Sound. Both voes have a number of smaller voes leading into them, including Lera Voe on Vaile Sound and Voe of Browland, Scutta, Seli and Olas Voes on Gruting Voe. The system reaches maximum depths of 40 m in the centre of Gruting Voe and 26 m in Vaile Sound, with shallower water in the entrance to Gruting Voe and in Wester and Easter Sounds. Only Wester Sound, however, forms a true sill with a depth of 7 m in the narrows being less than half the depth of the inner basin, an unusual feature in Shetland. Most of the area is sheltered from wave action although more exposed conditions are found at the entrances to Gruting Voe and the sounds and thus there is a transition from exposed to extremely sheltered conditions. Tidal streams within the voes are negligible although moderate tides may run through the sounds and the area is fully marine, with localised areas of variable or low salinity where streams enter, notably the voe heads and a houb at Bridge of Walls.

The entire area is fringed by bedrock, boulders and cobble with bedrock on the headlands at the voe entrances and boulders, shingle and mixed muddy sediment within the voes. The sea bed is floored by poorly-mixed and predominantly muddy sediments which become increasingly muddy with depth. There is only a limited amount of hard substratum in the sublittoral, with a bedrock slope reaching to a depth of 20 m at the entrance to Gruting Voe but only 5-10 m within the voes.

Area 21 is predominantly rural and surrounded by grazed moorland and improved grassland, with roads alongside much of the coastline. Villages at the heads of several of the voes have scattered linear developments of housing along the roads, the largest settlement being Walls, at the head of Vaile Sound. There are several salmon *Salmo salar* and mussel *Mytilus edulis* farms in the area and the voes are occasionally used as yacht anchorages. The ferry to Foula runs from the pier at Walls. The houses have septic tanks and water quality is good.

Marine biology

Marine biological surveys				
	Survey methods	No. of sites	Date(s) of survey	Source
Littoral	Recording	3	1974	Institute of Terrestrial Ecology (1974a)
Sublittoral	Recording	1	1974	Earll (1982); Institute of Terrestrial Ecology (1974b)
	Recording	1	August 1986	Hiscock (1986)
	Recording	1	August 1987	Howson (1988)
	Sampling (diver cores)	3	August 1986	Dixon (1986)
	Sampling (diver cores)	1	August 1986	Hiscock (1986)
	Sampling (Anchor dredge)	3	August 1988	Hiscock (1988)

Littoral

The littoral zone in the outer part of the system and around headlands consists primarily of steep bedrock and boulders. Within the voes, boulder, shingle and mixed muddy sediment shores predominate and these become increasingly muddy towards the heads of voes. There are no extensive sediment flats.

There is limited littoral biological information for Area 21, with records for two sheltered sites in Vaile Sound and one on the north shore of Gruting Voe. Large blocks of rock at the entrance to Lera Voe support yellow and grey lichens in the supralittoral (YG) and the black lichen *Verrucaria maura* in the littoral fringe (Ver.Ver). The remainder of the shore is dominated by furoid algae, with *Pelvetia canaliculata* (Pel), *Fucus spiralis* mixed with sparse *Ascophyllum nodosum* and *Fucus vesiculosus* in the upper eulittoral (Fspi) and dense *F. vesiculosus* across the mid-eulittoral (Fves). There are some barnacles *Semibalanus balanoides*, limpets *Patella vulgata*, mussels *Mytilus edulis* and coralline algae *Corallina officinalis* beneath the furoids. *Fucus serratus* dominates the lower eulittoral with small amounts of other algae including the brown *Halidrys siliquosa* and the red *Mastocarpus stellatus* (Fser.Fser) whilst the sublittoral fringe has kelp *Laminaria digitata* and the brown alga *Chorda filum* (Ldig.Ldig).

Shingle and boulder shores at Stapness and Breiwick support similar biotopes although there are distinct bands of both *P. canaliculata* and *F. spiralis* in the upper eulittoral and *A. nodosum* is more abundant than *F. vesiculosus* in the mid-eulittoral (AscX). The mid-eulittoral at Stapness in particular has a higher proportion of muddy gravel and there is evidence of infauna such as lugworm *Arenicola marina*.

Sublittoral

In the sublittoral, steep bedrock at the southern entrance to Easter Sound gives way to cobble at 20 m which then continues to at least 25 m depth. Further into the system, hard substrata are restricted to rock and boulders in shallow water, reaching a maximum depth of 12 m at the entrance to Lera Voe, 3 m at Breiwick in Gruting Voe and 1 m in the houb at Bridge of Walls. Otherwise, the voes are floored by soft sediments, with muddy sand in shallow water grading to soft, often shelly mud in deeper water.

At the entrance to Gruting Voe and Easter Sound, *Laminaria hyperborea* kelp forest dominates the steep rock to a depth of 10 m with sparser kelp park reaching a depth of 14 m. Both the forest and park are heavily grazed by the urchin *Echinus esculentus*, and the associated flora and fauna are sparse (LhypGz.Ft; LhypGz.Pk). Encrusting coralline algae and the keel worm *Pomatoceros triqueter* cover the rock surface with the featherstar *Antedon bifida* and brittlestar *Ophiocoma nigra* common on kelp holdfasts and around crevices and overhangs. There are scattered *Laminaria saccharina* and *Saccorhiza polyschides* kelp plants present, with some red algae such as *Phycodrys rubens*, found along the edges of crevices. There are few attached species as a result of the grazing pressure by the urchins, but species such as the dahlia anemone *Urticina felina*, edible crab *Cancer pagurus*, the holothurian *Cucumaria frondosa* and horse mussel *Modiolus modiolus* are present. Bedrock continues into the upper circalittoral here as a series of steep faces, ledges and gullies with dead-man's fingers *Alcyonium digitatum* dominating the steep faces and brittlestars common on the ledges (AlcC). The cobble slope at the base of the rock is dominated by brittlestars with moderate numbers of *M. modiolus*, the latter concentrated particularly in sandy patches (Oph). Other species here are similar to those found on the adjacent bedrock.

In the shelter of the voes, *L. saccharina* is the dominant kelp species on silty rock and boulders which reach about 10 m in Lera Voe and 3 m in Gruting Voe (IR). The kelp forest has a variety of other associated algal species, particularly brown algae such as *Asperococcus* sp., *Stilophora tenella* and *Desmarestia viridis* with *Chorda filum* on patches of sediment between boulders. The attached fauna includes bryozoans such as *Scrupocellaria scruposa*, ascidians including *Ascidia mentula* and the anemone *Metridium senile*. There are no records of rock continuing into the circalittoral zone in these voes.

Generally, as in Gruting Voe, rock and boulders are restricted to very shallow water and are replaced by muddy sand with stones and shell debris. This mixed sediment also supports *L. saccharina* attached to the stones and has a range of conspicuous infaunal and mobile epifaunal species (LsacX). At the sandier sites, such as the northern entrance to Wester Sound, there are species such as lugworm *Arenicola marina*, the razor clam *Ensis arcuatus* and the heart urchin *Echinocardium* sp. with epifauna such as the swimming crab *Liocarcinus depurator* and the starfish *Astropecten irregularis* (Cap). At muddier sites, such as the entrance to Seli Voe, there are more loose-lying algae amongst the kelp particularly the red *Phyllophora crispa* and the filamentous *Trilliella*, and there are additional animal species including *M. modiolus*, the burrowing anemone *Cerianthus lloydii* and the ascidian *Ascidella aspersa*. Between depths of about 10-15 m, *P. crispa* and *Trilliella* form a distinct band of loose-lying algal mats with little or no kelp present (Tra). The mud beneath the mats contains a fauna similar to that of the kelp zone with conspicuous *A. marina* and fish burrows and tubes of the worm *Chaetopterus variopedatus*.

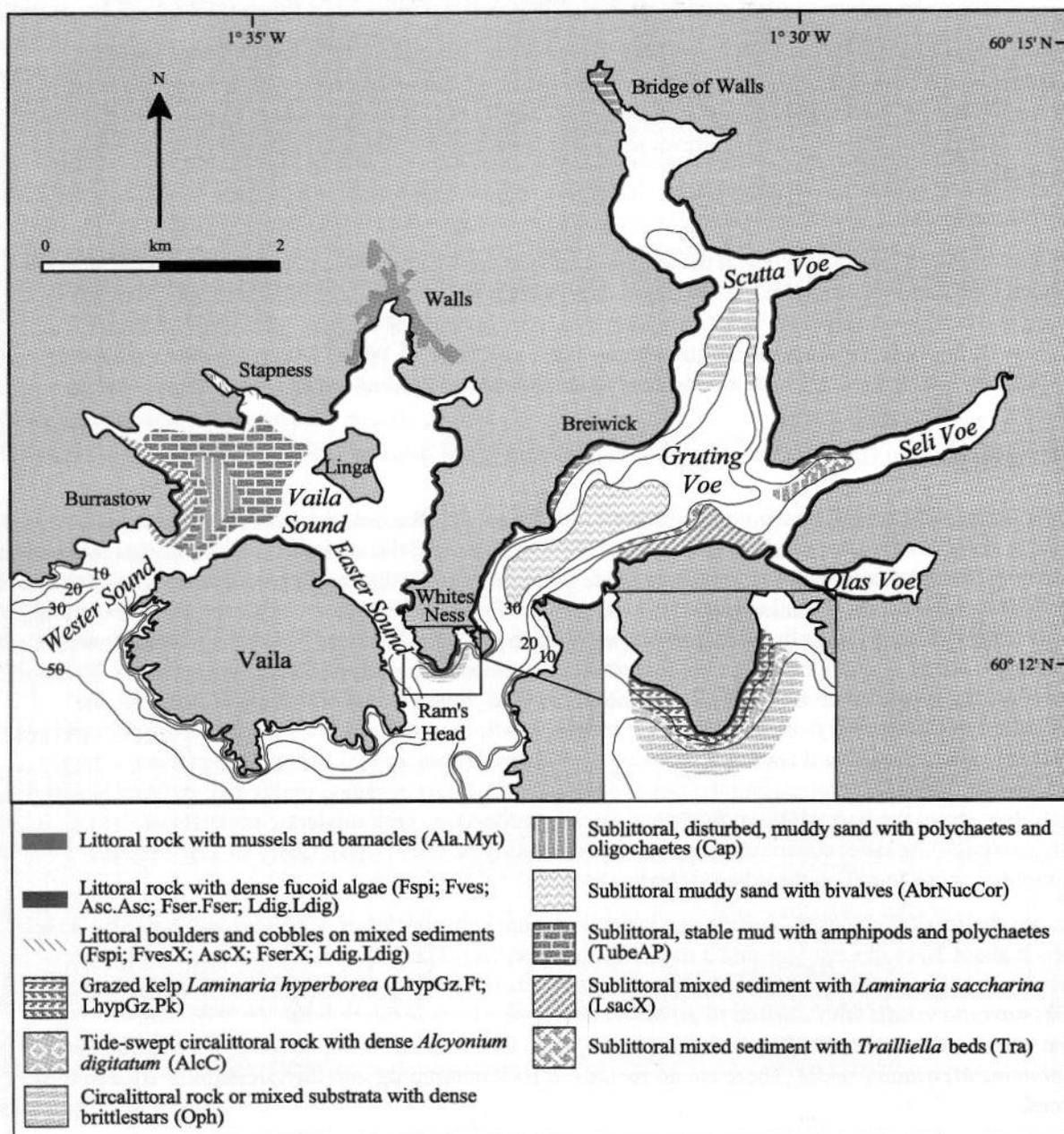


Figure 21.2 Indicative distribution of the main biotopes in the area (based on data from survey sites shown in Figure 21.1, cited literature and additional field observations).

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Much of the area, from a depth of about 12-20 m, consists of muddy sand and gravel, one of the most widespread habitats in the Shetland voes. This contains the polychaete *Myriochele* sp., the bivalve *Clausinella fasciata* and the amphipod *Urothoe elegans* (TubeAP). In deeper water in the basin in Gruting Voe, the soft mud supports a species-rich polychaete/bivalve biotope, including the polychaete *Notomastus* sp. and the bivalve *Abra* sp., with the gastropod *Turritella communis* (AbrNucCor).

A shallow, ultra-sheltered houb at Bridge of Walls at the head of Voe of Browland is connected to the main voe via culverts beneath the bridge. This pool, which is 1 m deep, has a soft peaty mud floor with bedrock outcrops in the centre. The mud supports a bed of the seagrass *Ruppia* sp. with filamentous green and brown algae and rissoid gastropods (Rup) whilst the rock has *Fucus spiralis* at the top, a short turf of filamentous red algae on the sides and the ascidian *Ciona intestinalis* and *M. modiolus* at its base.

Nature conservation

Conservation sites

Site name	Status	Main features
Ward of Culswick	SSSI	Ornithological
Shetland Islands	ESA	Agri-environmental scheme

Human influences

Coastal developments and uses

Area 21 is predominantly rural and surrounded by grazed moorland and improved grassland, with roads alongside much of the coastline. Villages at the heads of several of the voes have scattered linear developments of housing along the roads, with the largest settlement being Walls, at the head of Vaila Sound. Walls has a small harbour and piers; the ferry to Foula runs from here. The houses have septic tanks.

Marine developments and uses

There are salmon *Salmo salar* farms in Vaila Sound and Gruting Voe and mussel *Mytilus edulis* farms in Vaila Sound. Potting for crustaceans is carried out in the rocky inshore parts of the area.

The voes are occasionally used as yacht anchorages.

References and further reading

- Dixon, I. 1986. Fish farm surveys in Shetland. August 1986. (Contractor: Field Studies Council, Oil Pollution Research Unit, Pembroke.) *Nature Conservancy Council, CSD Report*, No. 701.
- Earll, R.C. 1982. Report on a sublittoral survey of Shetland. (Contractor: Underwater Conservation Society, Ross-on-Wye.) *Nature Conservancy Council, CSD Report*, No. 466.
- Hiscock, K. 1986. Marine biological surveys in Shetland. August 1986. (Contractor: Field Studies Council, Oil Pollution Research Unit, Pembroke.) *Nature Conservancy Council, CSD Report*, No. 678.
- Hiscock, K. 1988. *Marine Nature Conservation Review: Marine biological surveys in Shetland, 28th May-5th June 1988. Field Report*. Unpublished, Nature Conservancy Council, Peterborough.
- Howson, C.M. 1988. *Marine Nature Conservation Review: survey of Shetland, Foula and Fair Isle, 1987*. (Contractor: Field Studies Council, Oil Pollution Research Unit, Pembroke.) *Nature Conservancy Council, CSD Report*, No. 816.
- Institute of Terrestrial Ecology. 1975a. Report to the Nature Conservancy Council on some aspects of the ecology of Shetland. Part 6.2. Littoral biota of rocky shores. *Nature Conservancy Council, CSD Report*, No. 27.
- Institute of Terrestrial Ecology. 1975b. Report to the Nature Conservancy Council on some aspects of the ecology of Shetland. 6.4: Sublittoral biota. *Nature Conservancy Council, CSD Report*, No. 30.

Sites surveyed

Survey 1: 1988 MNCr survey of Shetland (Hiscock 1988).

Survey 230: 1974 ITE report on sublittoral biota of Shetland (Earll 1982; Institute of Terrestrial Ecology 1975b).

Survey 232: 1986 OPRU macro-infauna from fish farm sites in Shetland (Dixon 1986).

Survey 261: 1986/87 OPRU/MNCr survey of Shetland, Foula and Fair Isle (Hiscock 1986; Howson 1988).

Survey 434: 1974 ITE report on rocky shore ecology of Shetland (Institute of Terrestrial Ecology 1975a).

Littoral sites					
<i>Survey</i>	<i>Site</i>	<i>Site name</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotores recorded</i>
434	15	Gruting Voe.	HU 257 480	60°12.9'N 01°32.1'W	YG; Ver.Ver; Pel; Fspi; Fves; Asc.Asc; Fser.Fser; Ldig.Ldig
434	29	Burrastow, Lera Voe, Vaila Sound.	HU 222 480	60°12.9'N 01°35.9'W	YG; Ver; Ver.Ver; Pel; Fspi; Fves; Fser.Fser; Ldig.Ldig
434	35	Loch of Vadill, Vaila Sound.	HU 230 486	60°13.3'N 01°35.0'W	Pel; Fspi; Fves; Asc.Asc; Fser.Fser; FvesX; AscX; FserX; Ldig.Ldig

Sublittoral sites					
<i>Survey</i>	<i>Site</i>	<i>Site name</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotores recorded</i>
1	D27	NE Holm of Breibister, Vaila Sound.	HU 232 481	60°13.0'N 01°34.8'W	TubeAP
1	D24	SE of Heock Ness, Gruting Voe.	HU 256 473	60°12.5'N 01°32.2'W	AbrNucCor
1	D23	S of Mara Ness, Gruting Voe.	HU 270 491	60°13.5'N 01°30.7'W	Oph
230	35	Gruting Voe.	HU 257 480	60°12.9'N 01°32.1'W	SIR
232	1	Seli Voe, Hoganess, Shetland.	HU 279 480	60°12.9'N 01°29.7'W	TubeAP; Cap; LsacX
232	2	Lera Voe, Vaila, Shetland.	HU 222 481	60°13.0'N 01°35.9'W	TubeAP; Cap; LsacX
232	3	Vaila Sound, Shetland.	HU 223 475	60°12.7'N 01°35.8'W	Cap; Tra
261	2	Rams Head, Gruting Voe.	HU 246 461	60°11.9'N 01°33.3'W	Ala.Myt; LhypGz.Ft; LhypGz.Pk; AlcC; Oph
261	4	S Gruting Voe.	HU 267 473	60°12.5'N 01°31.0'W	LsacX; Tra
261	132	Bridge of Wells, Gruting Voe.	HU 260 513	60°14.7'N 01°31.8'W	SIR; Rup

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Papa Stour

Location

Position (centre)	HU 150 620	60°20.5'N 01°43.6'W
Administrative area	Shetland Islands	
Conservation agency/area	Scottish Natural Heritage	North Areas (Northern Isles)

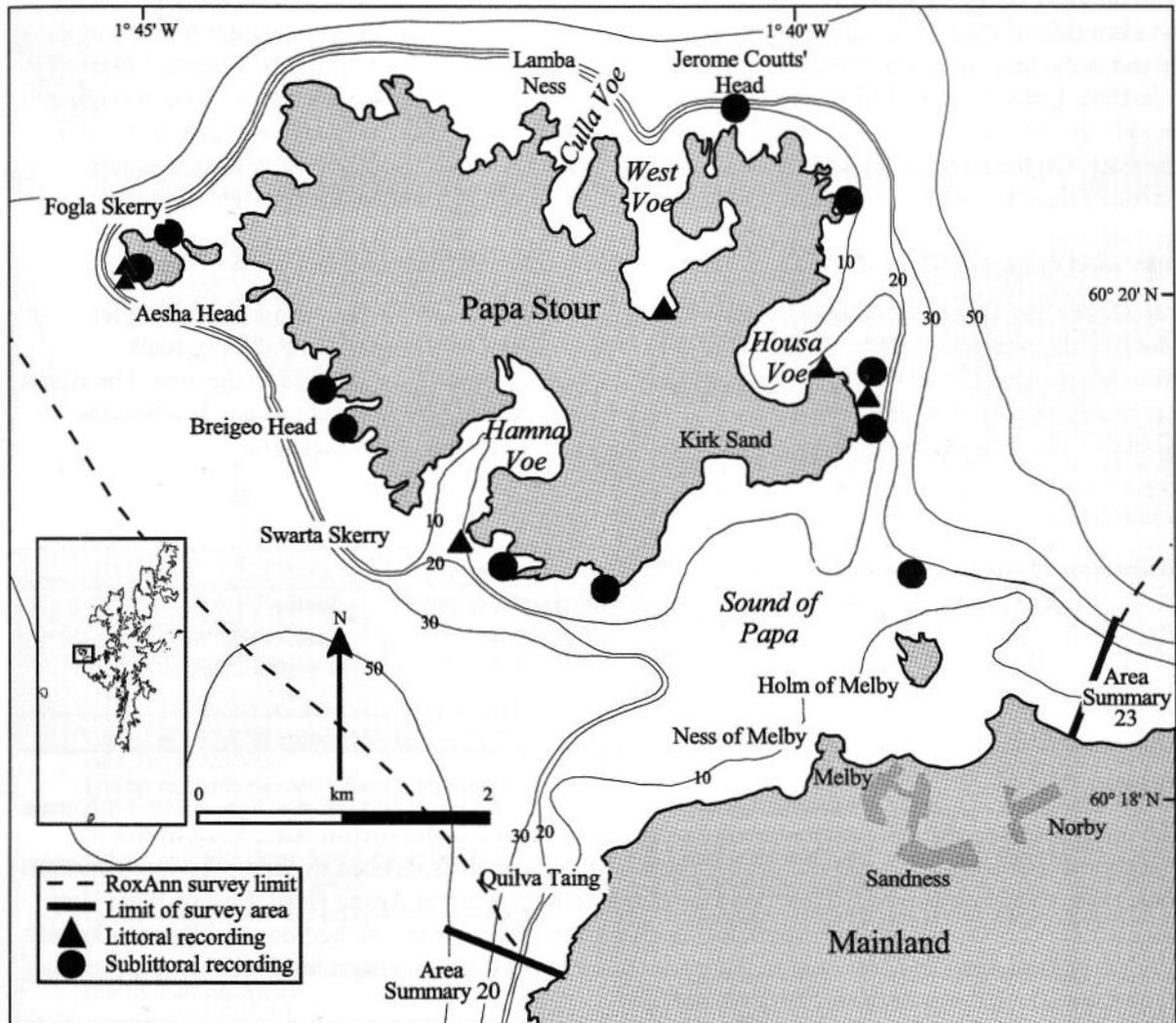


Figure 22.1 Main features of the area, showing sites surveyed.

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Physical features

<i>Physiographic type</i>	Island (open coast with inlets)
<i>Length of coast</i>	Papa Stour: 33.5 km; Mainland: 5.5 km
<i>Bathymetry</i>	30 m contour is about 500 m offshore along most of coast; occasionally within 100 m on west and north. Sound of Papa is shallower than 20 m
<i>Wave exposure</i>	Mostly extremely or very exposed but ultra-sheltered in inner parts of Hamna Voe and West Voe
<i>Tidal streams</i>	Moderate through Sound of Papa and around north-west of island; negligible elsewhere
<i>Tidal range</i>	1.7 m (mean springs); 0.8 m (mean neaps)
<i>Salinity</i>	Fully marine

Introduction

Area 22 on the west coast of Shetland is a rugged stretch of coastline which has some of the most exposed rocky coastline in the British Isles with impressive volcanic cliffs, stacks, arches, sea caves, tunnels and storm beaches. Whilst most of the Papa Stour coast is extremely exposed to wave action, there are four inlets, Housa Voe, Hamna Voe, West Voe and Culla Voe, and the last three of these have a transition from exposed to sheltered conditions, with ultra-sheltered embayments at the head of both Hamna and West Voe. Tidal streams are strong through the Sound of Papa and off the north-west corner of Papa Stour but are weak or negligible elsewhere. The area is fully marine.

The majority of the shoreline consists of steep and vertical bedrock with high cliffs around the western side of Papa Stour and lower-lying ground in the east. One of the outstanding features of the island is the large number of extensive littoral and sublittoral caves and tunnels that dissect this rocky coastline. Littoral sediments are restricted to the inlets and range from sand in Housa Voe through muddy gravel and shingle to mud in the other voes. In the sublittoral, soft sediments are confined to the voes. On the open coast, bedrock and boulders extend to depths of about 30 m with sediment beyond this consisting of coarse, clean shell-gravel and sand. The Sound of Papa, which has an average depth of about 20 m, has a mixture of shell-gravel, rock and boulders on its floor. There is finer sand in bays at Melby on the mainland side of the Sound of Papa.

Papa Stour has a small crofting population concentrated around Housa Voe where there is a pier. Much of the remainder of the island consists of moorland and freshwater lochans. Grey seals *Halichoerus grypus* breed and both grey and common seals *Phoca vitulina* feed in the area. The island has been proposed as a Special Protection Area for its important bird populations and is a Special Area of Conservation for its cave and reef communities. Water quality is excellent.

Marine biology

Marine biological surveys

	Survey methods	No. of sites	Date(s) of survey	Source
Littoral	Phase I mapping/recording	-	1996	Entec (1997, 1999)
	Recording	5	1987	Howson (1988)
Sublittoral	Recording	6	1987	Howson (1988)
	Recording	7	1996	Entec (1997, 1999)

Littoral

The open coasts of Papa Stour rank amongst the most exposed in the British Isles. Most of the shoreline of the western part of the island consists of vertical cliffs, broken by numerous long, narrow geos, with lower-lying rocky ledges and a sand and shingle beach at Aesha Head. East of West Voe and Hamna Voe, the island slopes downwards to broken rocky shores on the Sound of Papa and sandy beaches at Kirk Sand and Housa Voe. There are numerous littoral and supralittoral caves and tunnels along the cliffs and stacks of the open coast.

The four voes provide a transition from wave-exposed conditions at the entrance to wave-sheltered at the head with a corresponding transition in littoral substrata. Steep bedrock at the voe entrances gradually becomes lower-lying with more boulders present with increasing distance into the voe. Hamna Voe, although exposed to the south-west, has a shingle spit on its eastern side which projects about half way across the voe and shelters the inner part; much of the littoral zone in the inner basin consists of narrow shores of shingle and muddy gravel with sandy mud in the most sheltered north-west corner. Similarly, there are shingle shores at the heads of West and Culla Voes and, in the latter, a shingle barrier separates a lochan which may be brackish at times. West Voe has a particularly sheltered eastern arm where there is an expanse of sandy mud and a small tide-swept area of shingle.

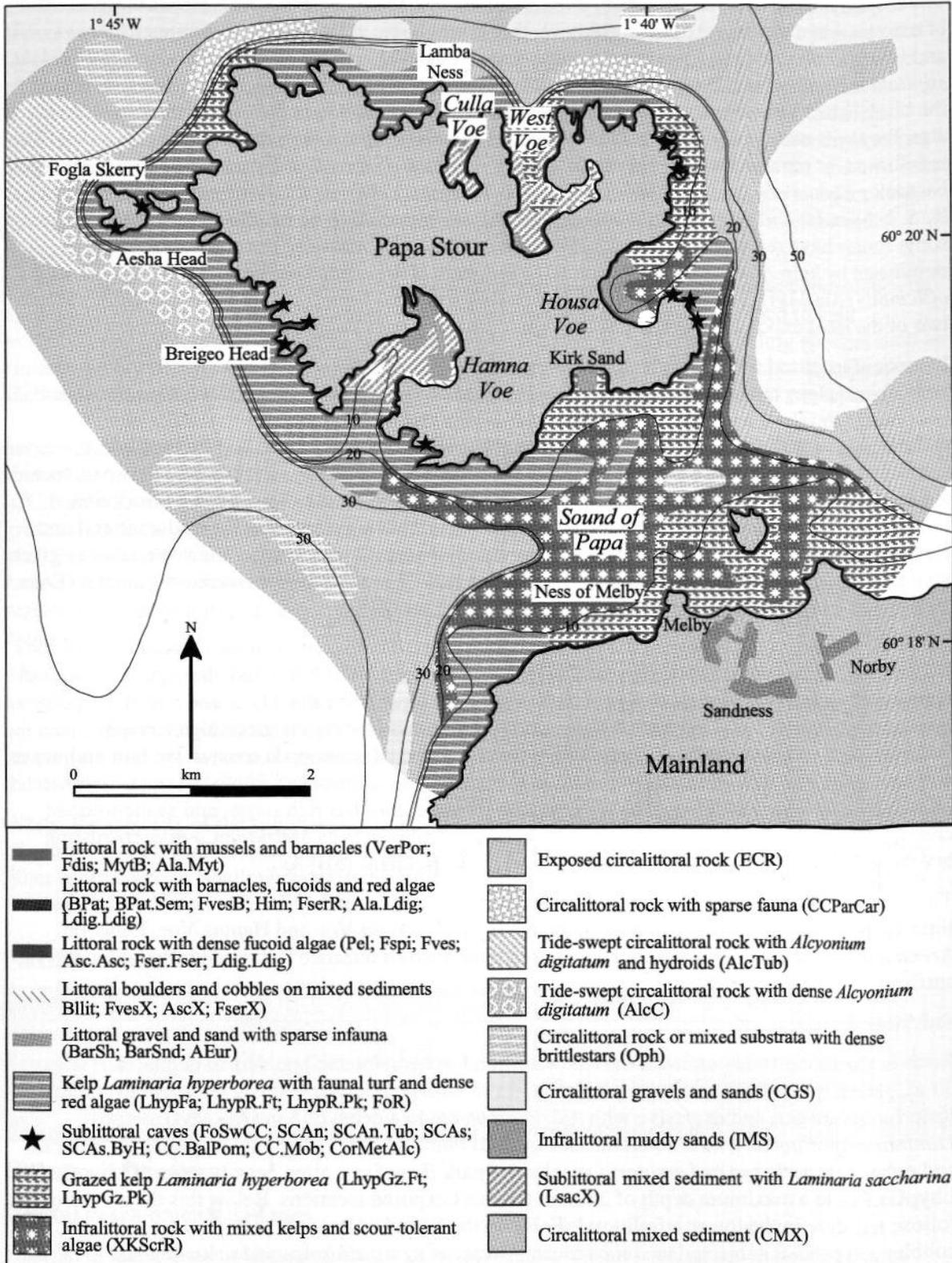


Figure 22.2 Indicative distribution of the main biotopes in the area (based on data from survey sites shown in Figure 22.1, cited literature and additional field observations).

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The majority of the open coast of both Papa Stour and the Mainland supports biotopes characteristic of extreme wave exposure. Even in calm weather these shores are subject to a continuous large swell and littoral zones are raised to a considerable height above high water mark. The green alga *Prasiola stipitata* is common in the supralittoral beneath seabird roosts (Pra) and there is an extensive zone of the black lichen *Verrucaria maura* on all these shores. Lower down, in the upper eulittoral, the red alga *Porphyra umbilicalis* forms a blanket over *V. maura* on all but the vertical shores (Ver.Por). This is followed, or replaced in the case of cliff faces, by a zone of mussels *Mytilus edulis* with scattered barnacles *Chthamalus stellatus* and *Semibalanus balanoides* (MytB). The mid-eulittoral is dominated by *S. balanoides* and limpets *Patella vulgata*; this zone may extend across the lower eulittoral but some shores have red algae such as *Mastocarpus stellatus* and mussels. The sublittoral fringe is dominated by kelp *Alaria esculenta* with large numbers of *M. edulis* and the coralline alga *Corallina officinalis* (Ala.Myt). The northern fucoid *Fucus distichus* has been found in the upper eulittoral on two of the most exposed shores, the south-west corners of both Fogla and Swarta Skerries (Fdis).

In areas of localised shelter, such as the northern side of Swarta Skerry, and in the entrances to the voes, fucoid algae are found with patches of *Fucus spiralis* and *Pelvetia canaliculata* in the upper eulittoral (Fspi; Pel), a mosaic of *Fucus vesiculosus* and barnacles *S. balanoides* in the mid-eulittoral and red algae and thongweed *Himanthalia elongata* in the lower eulittoral. *A. esculenta* dominates the sublittoral fringe, often with the addition of the kelp *Laminaria digitata*. Further into the voes, fucoid algae become increasingly abundant with dense *F. spiralis* and *P. canaliculata* on bedrock and boulders in the upper eulittoral, *F. vesiculosus* and *Ascophyllum nodosum* in the mid-eulittoral and *Fucus serratus* in the lower eulittoral. In the sublittoral fringe, *A. esculenta* at the voe entrances gives way to *L. digitata* and then to *Laminaria saccharina* and *Chorda filum* with increasing shelter (Entec 1997).

There are numerous rockpools on the broken rocky shores. These contain algae characteristic of their height on the shore, with laminarians and coralline algae in the lower and mid-shore pools (Cor) and ephemeral green algae such as *Enteromorpha* spp. in upper shore pools (G). Some mid-shore pools in moderately exposed locations have a particularly rich flora including the green alga *Codium tomentosum*. Littoral caves have communities similar to the adjacent open coast in the mid-and upper eulittoral, with *P. stipitata* often prominent as many auks and cormorants *Phalacrocorax carbo* nest on ledges in the cave entrances. The lower eulittoral sometimes has rich surge- and shade-tolerant communities under overhangs, with dense turfs of anemones such as *Metridium senile*, encrusting bryozoans, sponges such as *Halichondria panicea* and ascidians (SByAs).

The sandy beaches in Housa Voe and Kirk Sands on Papa Stour and at Sandness on Mainland have little visible fauna. In contrast, in mud in the inner parts of West Voe and Hamna Voe, lugworm *Arenicola marina* are common and there are scattered fucoids attached to stones on the sediment surface.

Sublittoral

Rock in the littoral zone continues into the sublittoral as bedrock and boulders to depths of at least 30 m, generally as a cliff inshore to a depth 10-15 m with boulders or bedrock terraces beyond this. Kelp forests are rich and extensive with *Alaria esculenta* to a depth of 5 m (Ala.Myt), dense *Laminaria hyperborea* with a luxuriant subflora and fauna to 21 m (LhypFa; LhypR.Ft; LhypR.Pk) and either *L. hyperborea* or *Laminaria saccharina* park (LsacSac), often heavily grazed (LhypGz.Ft; LhypGz.Pk), to a maximum depth of 28 m in the most exposed locations. Below this there is a zone of foliose red algae in the lower infralittoral (FoR). In the Sound of Papa the substratum is of mixed cobbles and pebbles subjected to some scouring, supporting mixed kelps and scour-tolerant algae (XKScrR). In the shelter of the voes, mixed sediment is covered by a canopy of *L. saccharina* (LsacX).

Communities on circalittoral rock are characteristic of Shetland, with the dominant species including dead-man's fingers *Alcyonium digitatum*, the featherstar *Antedon bifida*, encrusting coralline algae and the keel worm *Pomatoceros triqueter* (AlcC). There are extensive areas of low-lying bedrock outcrops and cobbles supporting this type of community in the deeper water off Papa Stour (Entec

1997). Coarse sand patches are common and the rock is heavily influenced by scour from the sediment and wave action, especially to the north of the island where circalittoral rock is dominated by coralline crusts and a sparse fauna (CCParCar). Further offshore in depths of 40 m to over 60 m, extensive areas of tide-swept compacted cobbles and pebbles support a rich faunal turf of *A. digitatum*, hydroids such as *Tubularia indivisa*, brittlestars, other echinoderms and anemones (AlcTub) (Entec 1997). In the strong tidal streams of the Sound of Papa, boulder and bedrock ridges are dominated by scour-tolerant organisms such as the hydroid *Abietinaria abietina* and the brittlestar *Ophiocomina nigra* (Oph). Rock walls in shallow water, where the inclination is too steep for kelp, have a faunal turf of species such as the anemones *Metridium senile* and *Sagartia elegans* and *A. digitatum* (AlcByH).

The numerous caves and tunnels are highly individual and have particularly diverse communities on their walls, showing a horizontal zonation pattern with distance into the cave related to light availability and the amount of surge. The outer walls have rich faunal turfs including sponges such as *Halichondria panicea*, *Clathrina coriacea*, *Grantia compressa* and *Oscarella lobularis*, anemones such as the dwarf form of *M. senile* and the northern, surge-tolerant species *Phellia gausapata*, various didemnid and polyclinid ascidians and hydroids such as *Dynamena pumila* and *Tubularia larynx* (SCAs.ByH). There is normally a scoured and often undercut zone of encrusting algae and scattered barnacles *Balanus crenatus* and keel worms *P. triqueter* at the base of the wall (CC.BalPom). Further into the caves, diversity decreases and *C. coriacea*, the ascidian *Dendrodoa grossularia* and *T. larynx* often become dominant (SCAs.DenCla). Still further in where there is little available light, the walls become much barer with scattered colonies of the calcareous sponge *Leuconia nivea*, *P. triqueter* and *B. crenatus* (CC.BalPom). Many of the tunnels continue beyond the region of available light, some penetrating stacks and the island itself, but these regions have not been explored.

The caves are often floored by fairly barren boulders, except at the entrances where algae may be luxuriant. Species such as *Odonthalia dentata*, *Plocamium cartilagineum* and *Cryptopleura ramosa* are characteristic and the rare red alga *Schmitzia hiscockiana* has been found here (FoSwCC). Further in, barnacles, *P. triqueter* and encrusting coralline algae dominate the boulders, and species such as the dahlia anemone *Urticina felina* and squat lobsters *Galathea strigosa* are common (CC.Mob).

Whilst the majority of the sublittoral consists of rock or compacted cobble and pebble, there are areas of coarse, mobile sand around the north and east of the island (CGS), most of which lies beyond the 50 m depth contour. Shallow water in the head of Hamna Voe has soft mud with lugworm *Arenicola marina* and there is fine rippled muddy sand in shallow water at the head of Housa Voe (IMS).

Nature conservation

Conservation sites		
Site name	Status	Main features
Papa Stour	SSSI; GCR; pSPA	Botanical; ornithological; coastal geomorphology; geological
Papa Stour	SAC	Reefs; submerged or partially submerged sea caves
Melby	SSSI; GCR	Geological
Shetland Islands	ESA	Agri-environmental scheme

Human influences

Coastal developments and uses

Papa Stour has a small crofting population of about 40 people with housing and cultivated fields concentrated around Housa Voe and the south-eastern corner of the island where there is an air-strip. There is a pier in Housa Voe for the ferry from West Burra Firth (*Area summary 23*). The remainder of the island consists of moorland and lochans. A small number of visitors come to the island for bird watching, walking and occasionally sub-aqua diving.

The crofts have septic tanks and water quality is excellent.

Marine developments and uses

Some potting for crustaceans takes place around the rocky inshore areas and especially offshore in St Magnus Bay (*Area summary 23*); there are also scallop-dredging grounds. Some recreational sub-aqua diving takes place around Papa Stour.

References and further reading

Entec. 1997. *Broad scale survey and mapping of seabed and shore habitats and biota: Papa Stour Shetland*. (Contractor: Entec.) Unpublished report to Scottish Natural Heritage, Edinburgh.

Entec. 1999. *Broad scale survey and mapping of the seabed and shore habitats and biota: Papa Stour cSAC*. (Contractor: Entec.) Unpublished report to Scottish Natural Heritage, Edinburgh (Interim report).

Howson, C.M. 1988. Marine Nature Conservation Review: survey of Shetland, Foula and Fair Isle, 1987. (Contractor: Field Studies Council, Oil Pollution Research Unit, Pembroke.) *Nature Conservancy Council, CSD Report*, No. 816.

Scottish Natural Heritage. [1999]. *Papa Stour. Rocky reefs and sea caves*. Lerwick, Scottish Natural Heritage. (Leaflet).

Sites surveyed

Survey 261: 1987 OPRU/MNCR survey of Shetland, Foula and Fair Isle (Howson 1988).

Survey 677: 1996 Entec sublittoral survey of Papa Stour (Entec 1997, 1999).

Littoral sites					
Survey	Site	Site name	Grid reference	Latitude/longitude	Biotopes recorded
261	107	NE Rib, Fogla Skerry, Papa Stour.	HU 138 612	60°20.1'N 01°45.0'W	Ver.Por; Pra; MytB; BPat; Ala.Myt
261	108	The Rib, Fogla Skerry, Papa Stour.	HU 138 611	60°20.0'N 01°45.0'W	Ver.Por; MytB; Fdis; Cor
261	110	Cave, SW Papa Stour.	HU 161 593	60°19.0'N 01°42.5'W	BPat; SR
261	114	Head of West Voe, Papa Stour.	HU 175 609	60°19.9'N 01°40.9'W	YG; Ver; Fspi; Pel; Asc; Fser
261	115	North House Head, Housa Voe, Papa Stour.	HU 186 605	60°19.7'N 01°39.7'W	MytB; BPat; G; Cor; Ala.Ldig

Sublittoral sites

<i>Survey</i>	<i>Site</i>	<i>Site name</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotopes recorded</i>
261	108	The Rib, Fogla Skerry, Papa Stour.	HU 138 611	60°20.0'N 01°45.0'W	LhypR.Ft; LhypR.Pk; Ant
261	109	Cave S of Breigeo Head, Papa Stour.	HU 153 601	60°19.5'N 01°43.3'W	CC.BalPom
261	111	Jerome Coutts' Head, Papa Stour.	HU 180 623	60°20.6'N 01°40.4'W	Ala.Myt; LhypR.Ft; LhypGz.Pk; AlcByH; CCParCar
261	112	Sound of Papa, Papa Stour.	HU 192 591	60°18.9'N 01°39.1'W	LhypGz.Pk; Oph
261	113	Cave, Brei Holm, Papa Stour.	HU 189 603	60°19.6'N 01°39.4'W	SR; SByAs; FoSwCC; SCAn.Tub; SCAs; SCAs.DenCla; SCAs.ByH; CC.BalPom
261	106	West Bay Cave, Fogla Skerry, Papa Stour.	HU 139 612	60°20.1'N 01°44.8'W	Ala.Myt; FoSwCC; SCAs.DenCla
677	1	Caves N of Geubery Head, Papa Stour.	HU 186 616	60°20.3'N 01°39.7'W	SCAn.Tub; SCAs.DenCla; CC.BalPom; LhypGz.Pk; CorMetAlc
677	2	Between Brei Holm and Turri Geo, Papa Stour.	HU 188 601	60°19.5'N 01°39.5'W	SCAn.Tub; CC.BalPom
677	3	Maiden Stack, Papa Stour.	HU 189 605	60°19.7'N 01°39.4'W	LhypFa; CC.BalPom; LhypGz.Pk; AlcByH
677	4	E end of Clingri Geo, Papa Stour.	HU 171 591	60°18.9'N 01°41.4'W	LhypFa; SCAs.ByH; CC.BalPom; XKScrR
677	5	Shepherd's Stack, Papa Stour.	HU 164 592	60°19.0'N 01°42.1'W	LhypFa; LsacSac; SCAs.DenCla; CC.BalPom
677	6	Caves on E side of Fogla Skerry, Papa Stour.	HU 141 613	60°20.1'N 01°44.6'W	Ala.Myt; SCAn.Tub; CC.BalPom
677	7	Christie's Hole, Papa Stour.	HU 153 604	60°19.6'N 01°43.3'W	LhypFa; FoSwCC; SCAs.DenCla; CC.BalPom

Compiled by: Christine Howson

St Magnus Bay

Location

<i>Position (centre)</i>	HU 300 701	60°24.8'N 01°27.3'W
<i>Administrative area</i>	Shetland Islands	
<i>Conservation agency/area</i>	Scottish Natural Heritage	North Areas (Northern Isles)

Physical features

<i>Physiographic type</i>	Open coast with bays and voes
<i>Length of coast</i>	112.7 km
<i>Bathymetry</i>	Maximum depth of 140 m in St Magnus Bay; 50 m contour follows coastline within about 500 m distance
<i>Wave exposure</i>	Extremely exposed - very sheltered; mostly exposed
<i>Tidal streams</i>	Moderate - strong around headlands; weak or negligible elsewhere
<i>Tidal range</i>	1.7 m (mean springs); 0.8 m (mean neaps)
<i>Salinity</i>	Fully marine

Introduction

St Magnus Bay, on the west coast of Mainland Shetland, has an indented and varied rocky coastline which shelves rapidly into deep water in the centre of the bay, reaching a maximum depth of 140 m. The open coast in Area 23 is extremely exposed and includes the impressive volcanic cliffs of the headland at Esha Ness. Several major voes, notably those of the Swarbacks Minn complex (*Area summary 24*), open onto St Magnus Bay and a number of smaller voes and bays lie within Area 23. These include Ura Firth, Mangaster Voe, West Burra Firth and Voe of Snarraness, and very sheltered conditions can be found at the heads of these voes. There are several narrow channels between islands, such as Roe Sound between Muckle Roe and the mainland, and these have tidal streams of moderate strength flowing through them. Strong tidal streams run around the headlands and through the Sound of Papa, which lies outside the southern boundary of Area 23 (*Area summary 22*). The area is fully marine.

The entire area is fringed by bedrock and boulders with arches, stacks and geos. There are clean sand beaches in several bays and shingle and sediment along the shores of the more sheltered inlets. The sublittoral terrain on the open coast is rugged with numerous cliffs and gullies and bedrock and boulders reach depths of at least 35 m. Clean shell-gravel and sand replaces rock in depths of 25-35 m and grades into slightly muddier, but still coarse, sediments in deep water in St Magnus Bay. In the sheltered inlets, the depth of the rock-sediment transition becomes gradually shallower with increasing shelter and muddier sediments predominate in shallow water, with very little sublittoral hard substratum in the most sheltered voes and sounds.

The small town of Hillswick lies on Ura Firth but this a rural area with roads and scattered houses along only some stretches of the coast. Most of the surrounding land is grazed moorland with a stretch of improved grassland between Esha Ness and Ura Firth. Houses have septic tanks and water quality is good. Other coastal habitats include a houb at the head of Ura Firth, a silled inlet at Minn (Thorpe 1998) and sand dunes and a tombolo in Sand Wick, west of Hillswick. There is a salmon *Salmo salar* farm on Mangaster Voe.

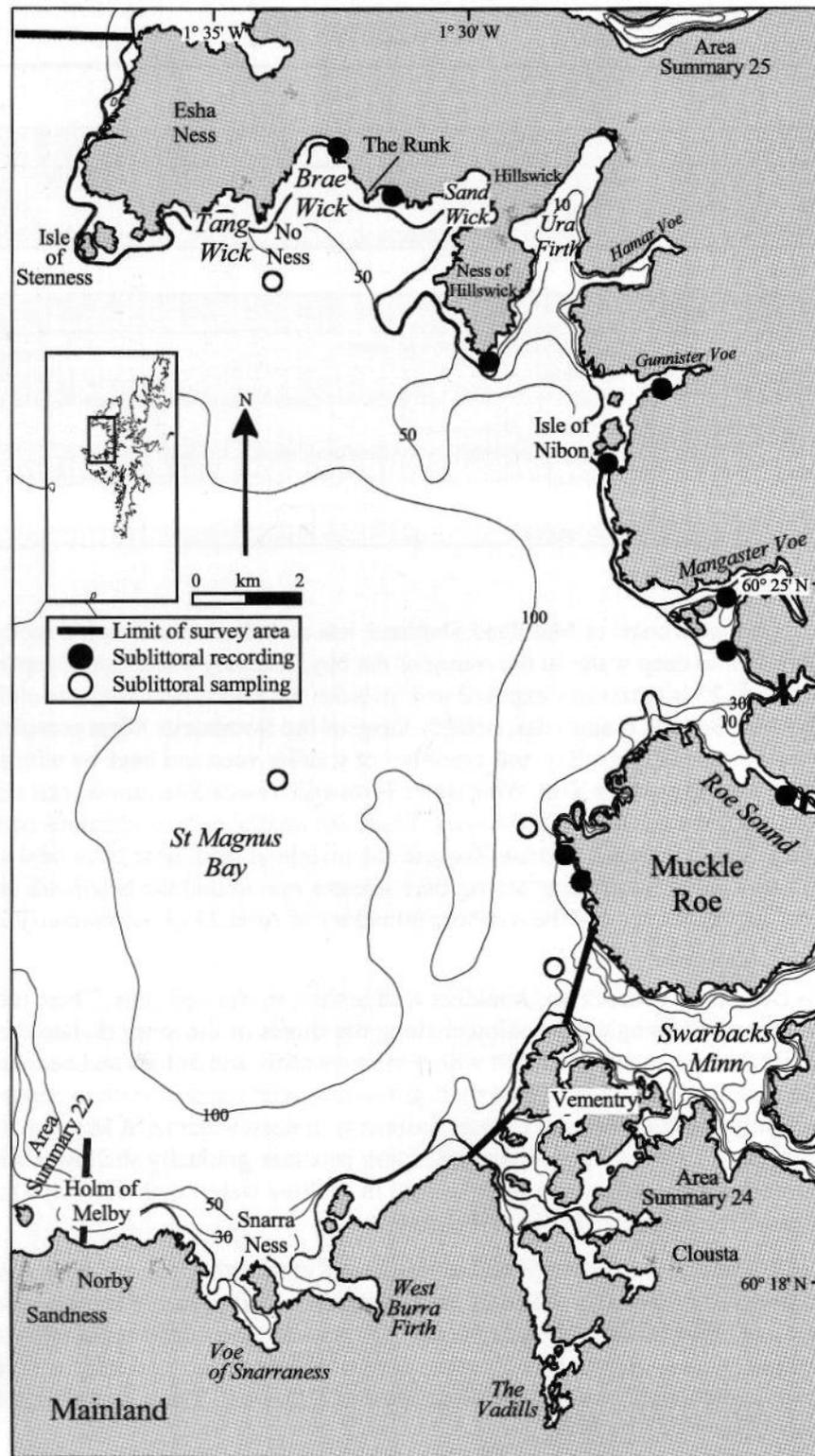


Figure 23.1 Main features of the area, showing sites surveyed.
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Marine biology

Marine biological surveys

Survey methods	No. of sites	Date(s) of survey	Source
Sublittoral Recording	4	July-August 1987	Moss & Ackers (1987)
Recording	1	August 1974	Institute of Terrestrial Ecology (1975), Earll (1982)
Recording	5	July-August 1986	Hiscock (1986)
Infaunal sampling (cores)	1	July-August 1986	Hiscock (1986)
Infaunal sampling (grab)	3	1963	Pearson, Coates & Duncan (1994)
Infaunal sampling (grab)	1	1974 - 1978	Pearson, Coates & Duncan (1994)

Littoral

The littoral zone on the open coast consists of steep bedrock and boulders with high cliffs along several stretches, notably Esha Ness and the west of Muckle Roe. The shores become less steep in the inlets where boulders, shingle and muddy gravel predominate. There are clean sand beaches in several bays, particularly Tang Wick, Brae Wick and Sand Wick along the north coast of St Magnus Bay.

The inaccessible and exposed nature of much of the open coastline has restricted littoral surveys and there is little biological information for Area 23 apart from the author's personal observations. The wave-exposed rocky shore communities of Esha Ness are comparable with those of Muckle Flugga (*Area summary 1*), Foula (*Area summary 31*) and Fair Isle (*Area summary 32*). Even in calm weather these shores are subject to a continuous large swell and littoral zones are raised to a considerable height above the high water mark. The upper and mid-eulittoral are almost entirely covered with the red alga *Porphyra umbilicalis*, barnacles *Semibalanus balanoides* and the green alga *Enteromorpha* sp. Kelp *Alaria esculenta* and the coralline alga *Corallina officinalis* blanket both the sublittoral fringe and the lower eulittoral.

Sublittoral

On the outer coasts, steep or vertical bedrock and boulders in the nearshore sublittoral extend to depths of at least 35 m, where the rock gives way to plains of clean shell-sand. There are numerous steep-sided gullies on the open coast. In more sheltered situations on the lee side of islands and in the inlets, rock and boulder changes to sediment at much shallower depths, and here the sediment has a much higher proportion of mud; this mixed muddy shell-gravel is very characteristic of sheltered sublittoral conditions in Shetland. Moving into the shelter of the voes, the rock-sediment boundary becomes increasingly shallow until, in the inner voes, no sublittoral rock remains.

Sediments on the outer coast grade from the clean shell-gravel and sand of the nearshore sublittoral to muddy shell-gravel, sand and stones in the deep water of St Magnus Bay with mud at the entrance to Swarbacks Minn. In the more sheltered parts of the inlets, muddy shell-gravel and boulders at 0-4 m depth changes to firm muddy sand. This becomes increasingly clean and coarse towards the entrances to the voes with a high proportion of pebbles and shells.

Laminaria hyperborea is the dominant kelp species in the upper infralittoral zone of the wave-exposed sites in this area, with kelp forest reaching a depth of between 12 and 20 m and kelp park reaching 22 m (LhypR.Ft; LhypR.Pk). At most of these sites, there is a dense understorey in the upper infralittoral of both algal and animal species including red algae such as *Odonthalia dentata*, *Plocamium cartilagineum* and *Nitophyllum punctatum*, the brown *Desmarestia ligulata* and *Desmarestia aculeata*, dead-man's fingers *Alcyonium digitatum*, the dahlia anemone *Urticina felina*, the sponge *Halichondria panicea* and featherstar *Antedon bifida*. However, several sites are heavily grazed by the urchin *Echinus esculentus* and at these sites, there is little on the rock surfaces beneath the kelp other than encrusting coralline algae (LhypGz.Ft; LhypGz.Pk). The lower infralittoral, which is also often heavily grazed, varies in its biotope composition with either *L. hyperborea* continuing as the dominant kelp or a park of mixed kelp species with *L. hyperborea*, *Laminaria saccharina* and *Saccorhiza polyschides* present in varying abundances (XKScrR).

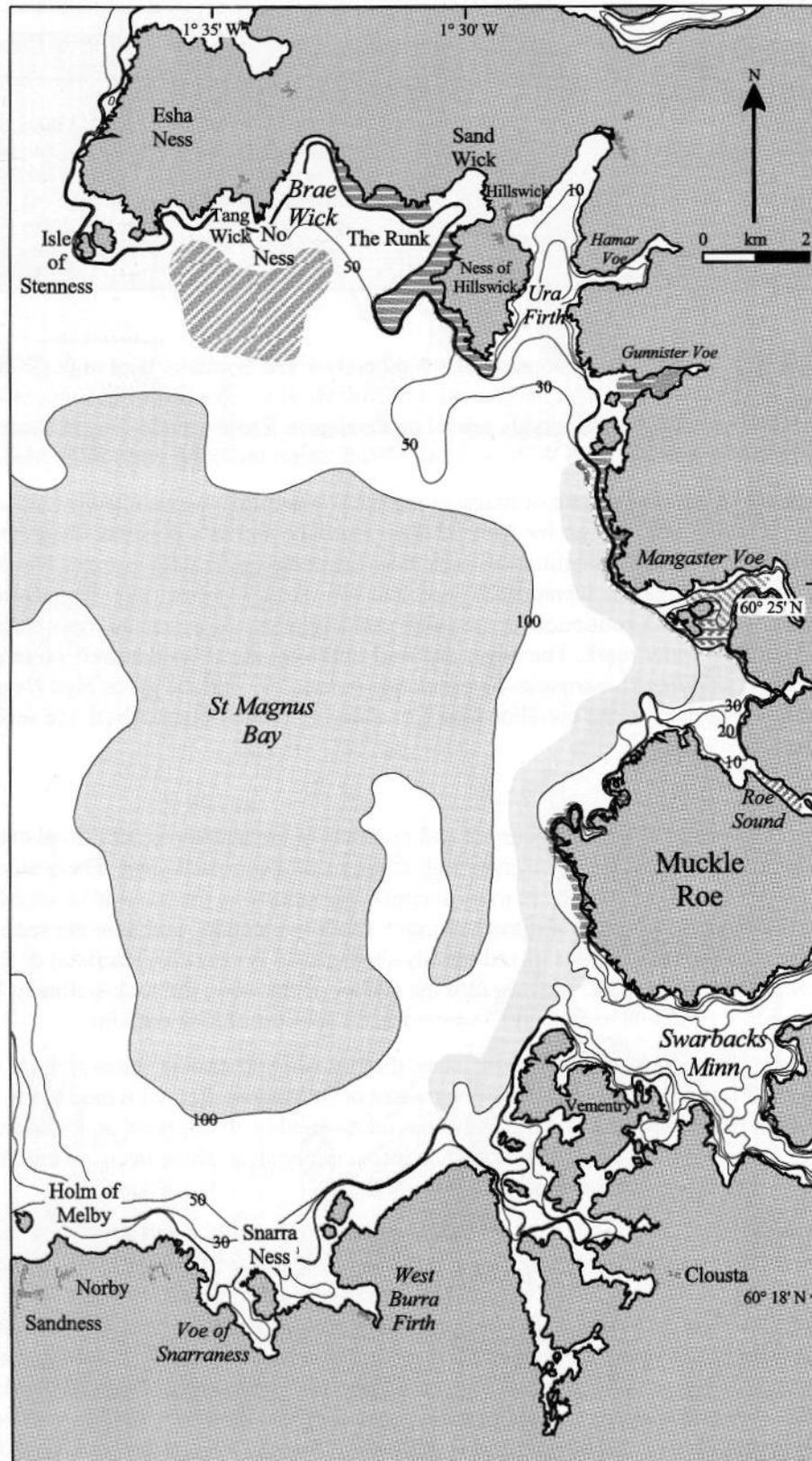


Figure 23.2 Indicative distribution of the main biotopes in the area (based on data from survey sites shown in Figure 23.1, cited literature and additional field observations). (Key to biotopes symbols on next page.)
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 Kelp <i>Laminaria hyperborea</i> with faunal turf and dense red algae (LhypFa; LhypR.Ft; LhypR.Pk)	 Infralittoral muddy sands (IMS)
 Grazed kelp <i>Laminaria hyperborea</i> (LhypGz.Ft; LhypGz.Pk)	 Sublittoral muddy sand with <i>Echinocardium cordatum</i> and bivalves (EcorEns)
 Infralittoral rock mixed kelps and scour-tolerant algae (XKScrR)	 Sublittoral muddy sand with polychaetes (SpiSpi)
 Mixed kelps <i>Laminaria hyperborea</i> and <i>Laminaria saccharina</i> (LhypLsac.Ft)	 Sublittoral, stable mud with dense <i>Arenicola marina</i> (AreSyn)
 Circalittoral rock with sparse fauna (CCParCar)	 Sublittoral mixed sediment with <i>Laminaria saccharina</i> (LsacX)
 Tide-swept circalittoral rock with dense <i>Alcyonium digitatum</i> (AlcC)	 Circalittoral offshore sediment (COS)
 Circalittoral gravels and sands (CGS)	

At a site near the Isle of Nibon, where level sand-scoured rock in a depth of 23-26 m stretches from the base of a cliff, scattered small *L. hyperborea* and *L. saccharina* plants occur on rock which is almost entirely covered by coralline algal crusts.

Surge gullies are common around St Magnus Bay and one at 10 m depth on the south of the Esha Ness peninsula has walls covered by *Dendrodoa grossularia*, *Polyclinum aurantium* and other surge-tolerant ascidians and bryozoans (SCAs). At many sublittoral sites in this area, cliff faces fall from the littoral zone to depths of 20-25 m, often as the walls of large gullies. In these situations, kelp is restricted to ledges or shallow areas of upward-facing or gradually-sloping rock. The rock faces are dominated by *A. digitatum* with a turf of bryozoan and hydroids and species such as the jewel anemone *Corynactis viridis*, clumps of the tubeworm *Filograna implexa* and *U. felina* (CorMetAlc). Numerous crevices have squat lobsters *Galathea strigosa*, brittlestars *Ophiopholis aculeata* and edible crabs *Cancer pagurus*.

At some sites, the influence of grazing is significant in the structure of the circalittoral biotopes. These sites may include the lower part of rock walls that have a rich faunal turf shallower. These are again dominated by *A. digitatum*, but with associated encrusting rather than turf species, particularly the keel worm *Pomatoceros triqueter*, the bryozoan *Parasmittina trispinosa* and coralline algae (AlcC). Species are similar on both upward-facing and steep circalittoral rock. *E. esculentus* is often abundant and grazing-tolerant species such as *A. bifida*, starfish *Asterias rubens* and robust hydroids such as *Abietinaria abietina* and the northern species *Thuiaria thuja* may be present, and groups of *U. felina* occur on ledges and at breaks of slope. A rock and boulder slope south of Mangaster Voe at a depth of 22-35 m is particularly barren, with very large numbers of *E. esculentus*, almost total cover of the rock surfaces by coralline algae and *P. triqueter*, and brittlestars in the boulder interstices (CCParCar).

In the more sheltered conditions on the lee side of islands and inside the inlets, hard substrata are restricted to shallower water, with boulders reaching 10-12 m at the entrances to Mangaster and Gunnister Voes and no sublittoral rock in the bay inside Gunnister Voe and in Roe Sound. Where there is no rock, coarse shell-gravel and pebbles in 0-4 m depth support *L. saccharina* and the brown alga *Chorda filum*, red algae such as *Chondrus crispus* and *Laurencia pinnatifida*, the bivalves *Ensis arcuatus* and *Modiolus modiolus* and the winkle *Littorina littorea* (LsacX). This fairly coarse, shallow sediment grades into muddier sand at depths of about 4-10 m, and lugworm *Arenicola marina* is abundant with species such as the hermit crab *Pagurus bernhardus*, *A. rubens* and the shore crab *Carcinus maenas*. Drift kelp may be abundant in such situations.

This muddy sediment grades in turn into coarser sediments in the outer, slightly more exposed parts of the area, for example towards the entrances to Gunnister and Mangaster Voes where clean sand, shell-gravel and pebbles occur at 10-18 m depth. This moderately exposed coarse sediment supports

scattered *L. saccharina* plants with tufts of small algae such as *Scinaia turgida* and *Codium* sp. on shells and pebbles. The topshell *Gibbula magus* is common and the sand contains a few *A. marina* and bivalves such as *Ensis* sp. (EcorEns). In still more exposed conditions and in deeper water at the base of the outer cliffs, clean, coarse and highly mobile sand in depths of 25-35 m appears relatively barren with scattered *A. marina* and *U. felina*.

At depths of 50-70 m on the eastern side of St Magnus Bay clean sand and gravel supports the polychaete *Prionospio malmgreni* and bivalves *Echinocyamus pusillus*, *Thyasira flexuosa* and *Abra prismatica* (CGS). In the deeper water of the bay, sediments at depths of 70-140 m are coarser in comparison to the sediments of the adjacent deep voes. Muddy shell-gravel, sand and stones predominate, with *Spio* spp. and other robust polychaetes, *A. prismatica* and *E. pusillus* occurring in the north of the bay (SpiSpi), whilst the deeper sediments of the central basin support a sparse fauna dominated by robust polychaetes including *Glycera* spp. and *Pholoe inornata* (COS).

Nature conservation

Conservation sites

Site name	Status	Main features
Shetland: Muckle Roe	NSA	Landscape
Shetland: Esha Ness	NSA	Landscape
Eshaness Coast	SSSI; GCR	Geological
Shetland Islands	ESA	Agri-environmental scheme

Human influences

Coastal developments and uses

The small town of Hillswick lies on Ura Firth but this a rural area with roads and scattered houses, which have septic tanks, along only some stretches of the coast. Most of the surrounding land is grazed moorland with a stretch of improved grassland between Esha Ness and Ura Firth. There is a landfill site for non-hazardous waste near Hillswick.

Marine developments and uses

Much potting for crustaceans, especially crabs, is carried out throughout St Magnus Bay. There are salmon *Salmo salar* farms on Mangaster Voe, Voe of Snarraness, West Burra Firth and Roe Sound.

The ferry to Papa Stour (Area summary 22) runs from a pier in West Burra Firth. The sheltered voes, particularly Ura Firth and Hamar Voe, are used as anchorages.

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Thorpe, K. 1998. *Marine Nature Conservation Review Sectors 1 & 2. Lagoons in Shetland and Orkney: area summaries*. Peterborough, Joint Nature Conservation Committee. (Coasts and seas of the United Kingdom. MNCR series.)

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Survey 227: 1987 MCS sublittoral survey of Shetland (Moss & Ackers 1987).

Survey 230: 1974 ITE report on sublittoral biota of Shetland (Earll 1982; Institute of Terrestrial Ecology 1975)

Survey 261: 1986 OPRU/MNCR survey of Shetland, Foula and Fair Isle (Hiscock 1986).

Survey 377: 1963 DAFS sublittoral survey at Shetland (Pearson, Coates & Duncan 1994).

Survey 382: 1974/76 SOTEAG sublittoral grab sample surveys in Shetland (Pearson, Coates & Duncan 1994).

Sublittoral sites					
Survey	Site	Site name	Grid reference	Latitude/longitude	Biotopes recorded
227	9	Spindle, Swarbacks Minn.	HU 295 647	60°21.9'N 01°27.9'W	LhypR.Pk; AlcByH
227	10	Moo Ness, Swarbacks Minn.	HU 292 652	60°22.2'N 01°28.2'W	LhypR.Ft; AlcByH; AlcC
227	30	The Drongs, St Magnus Bay.	HU 260 775	60°28.8'N 01°31.6'W	LhypR.Ft; SCAs.ByH; AlcByH; AlcC
227	31	Ness of Hillswick, St Magnus Bay.	HU 278 744	60°27.1'N 01°29.6'W	AlcC
230	3	Brae Wick, St Magnus Bay.	HU 250 784	60°29.3'N 01°32.7'W	LhypFa; SCAs
261	9	Gunnister Voe.	HU 310 739	60°26.8'N 01°26.1'W	LhypLsac.Pk; IMS; LsacX
261	10	Entrance to South Sound, Gunnister Voe.	HU 300 725	60°26.1'N 01°27.2'W	LhypR.Ft; XKScrR; CorMetAlc; CCParCar; CGS
261	36	Roe Sound.	HU 333 663	60°22.7'N 01°23.7'W	AreSyn; LsacX
261	50	Egilsay, Mangaster Voe.	HU 322 700	60°24.7'N 01°24.9'W	LhypGz.Ft; LhypLsac.Ft; EcorEns
261	51	South Sound, Mangaster Voe.	HU 322 690	60°24.2'N 01°24.9'W	LhypGz.Ft; LhypGz.Pk; CCParCar; CGS
377	18	W of Strom Ness, Muckle Roe, St Magnus Bay.	HU 285 657	60°22.4'N 01°28.9'W	COS
377	19	Mid St Magnus Bay.	HU 239 666	60°22.9'N 01°33.9'W	COS
377	20	S of Scarf Skerry, St Magnus Bay.	HU 238 759	60°28.0'N 01°34.0'W	SpiSpi
382	12	W of Riding Stack, Swarbacks Minn.	HU 290 631	60°21.1'N 01°28.4'W	CGS

Compiled by: Christine Howson

24

Brindister Voe, Swarbacks Minn, Busta Voe, Olna Firth and Aith Voe

Location

Position (centre)	HU 370 650	60°22.0'N 01°14.7'W
Administrative area	Shetland Islands	
Conservation agency/area	Scottish Natural Heritage	North Areas (Northern Isles)

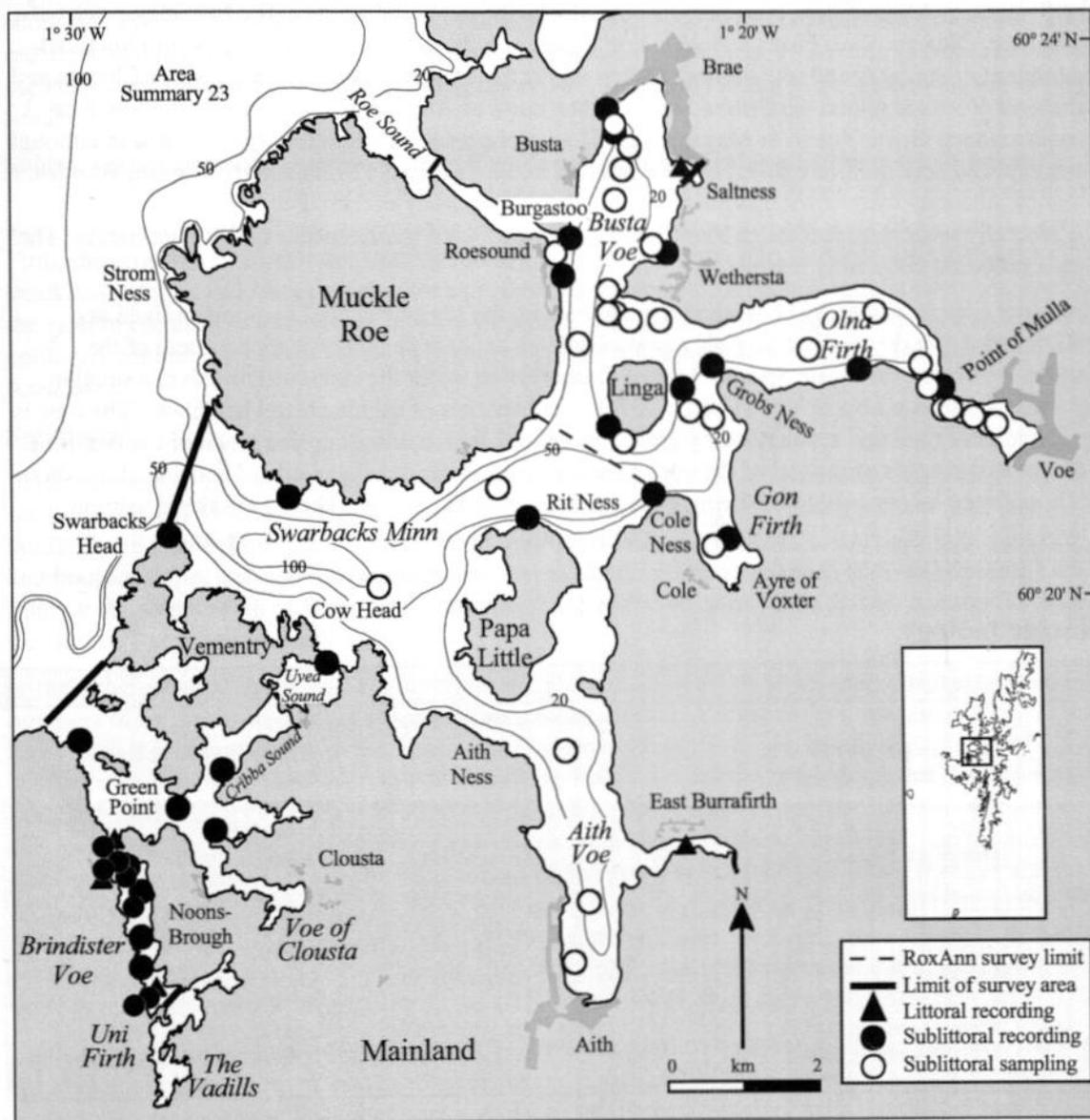


Figure 24.1 Main features of the area, showing sites surveyed.

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Physical features

<i>Physiographic type</i>	Voe/sound
<i>Length of coast</i>	129 km
<i>Bathymetry</i>	Maximum depth >100 m in Swarbacks Minn; Aith Voe is deepest in Shetland, reaching 68 m
<i>Wave exposure</i>	Exposed - Extremely sheltered; majority of area is sheltered
<i>Tidal streams</i>	Negligible except through Roe Sound where speeds reach 2-3 knots
<i>Tidal range</i>	1.7 m (mean springs); 0.8 m (mean neaps)
<i>Salinity</i>	Fully marine throughout most of area; localised areas of low salinity where streams enter enclosed embayments

Introduction

The Swarbacks Minn system is a complex area of islands, inlets and sounds. The four major voes of Busta Voe, Olna and Gon Firths and Aith Voe which, at a depth of 68 m, is the deepest in Shetland, lead directly into the sound of Swarbacks Minn whilst the shallower southern complex of Clousta and Brindister Voes are joined via Cribba Sound. In the north of Area 24, the narrow and shallow Roe Sound connects Busta Voe to St Magnus Bay. Most of the area is sheltered from wave action although more exposed conditions are found at the entrances to the Swarbacks Minn and the Clousta/Brindister complex, and thus there is a transition from exposed to extremely sheltered conditions. Tidal streams are generally weak except through Roe Sound and Uyea Sound where speeds of 2-3 knots occur. The area is predominantly fully marine.

The entire area is fringed by bedrock and boulders with the sea bed floored by poorly-mixed and predominantly muddy sediments. Other coastal habitats include the major lagoon system of the Vadills, which is a candidate Special Area of Conservation under the Habitats Directive, a smaller lagoon at Saltness on Busta Voe (Thorpe 1998), small patches of saltmarsh and heathland. The area is predominantly rural and surrounded by grazed moorland, with roads alongside much of the coastline. Villages at the heads of several of the voes have scattered linear developments of housing along these roads, with the largest settlement being Brae, at the head of Busta Voe. There are several salmon *Salmo salar* and mussel *Mytilus edulis* farms in the area. Water quality is good. Sailing is the main water-based recreational activity.

Marine biology

Marine biological surveys

	<i>Survey methods</i>	<i>No. of sites</i>	<i>Date(s) of survey</i>	<i>Source</i>
<i>Littoral</i>	Phase I mapping/recording	3	August 1993	Bunker, Bunker & Perrins (1994)
	Phase I mapping/recording	254	August 1995	Entec (1996)
	Recording	5	July-August 1974	Institute of Terrestrial Ecology (1975a)
	Infaunal sampling (cores)	1	August 1987	Howson (1988)
<i>Sublittoral</i>	Recording	10	August 1993	Bunker, Bunker & Perrins (1994)
	Recording	3	July-August 1987	Moss & Ackers (1987)
	Recording	15	August 1986 & 1987	Howson (1988)
	Recording	3	August 1974	Earl (1982); Institute of Terrestrial Ecology (1975b)
	Infaunal sampling (grab)	19	November 1995	Entec (1996)
	Infaunal sampling (grab)	10	May 1974 & June 1976	Pearson, Coates & Duncan (1994)

Littoral

Much of the littoral zone consists of steeply-sloping bedrock and boulders with occasional mixed sediment patches between small promontories on linear shores. Littoral sediment is of limited distribution in this area with the exception of a sheltered flat at East Burra Firth at the head of Aith Voe where shingle lies on sand across much of the shore and there is sand with peat fragments on the lower shore. There are also muddy sand shores where streams enter at the heads of other voes and a sand beach at Brae in Busta Voe.

Biological data for the littoral zone are largely restricted to the inner sheltered voes with little or no information for Swarbacks Minn, Papa Little and Aith Voe. The majority of these sheltered rocky shores are dominated by fucoid algae in the mid-shore with an upper shore zonation of yellow and grey lichens in the supralittoral followed lower by zones of the black lichen *Verrucaria maura* (Ver.Ver) and the fucoids *Pelvetia canaliculata* and *Fucus spiralis* (Pel; Fspi). Towards the entrances to the voes, *Fucus vesiculosus* is the dominant mid-shore fucoid (Fves) with *Ascophyllum nodosum* becoming increasingly abundant and then dominant as conditions become more sheltered within the voes (Asc.Asc). This pattern was well-illustrated by a mapping exercise along the shores of Brindister Voe (Bunker, Bunker & Perrins 1994). Steep or vertical rock generally has a band of barnacles *Semibalanus balanoides* and limpets *Patella vulgata* in the mid-shore, as do shores with a moderate fetch such as the headland of Grobs Ness and the south and west shores of Linga. The lower rocky shores are dominated either by the fucoid *Fucus serratus* or by a mixture of this species and various red algae and occasionally including thongweed *Himantalia elongata*. *F. serratus* is characteristic of the inner parts of the voes whereas *H. elongata* is more frequently found in the outer voes and around headlands.

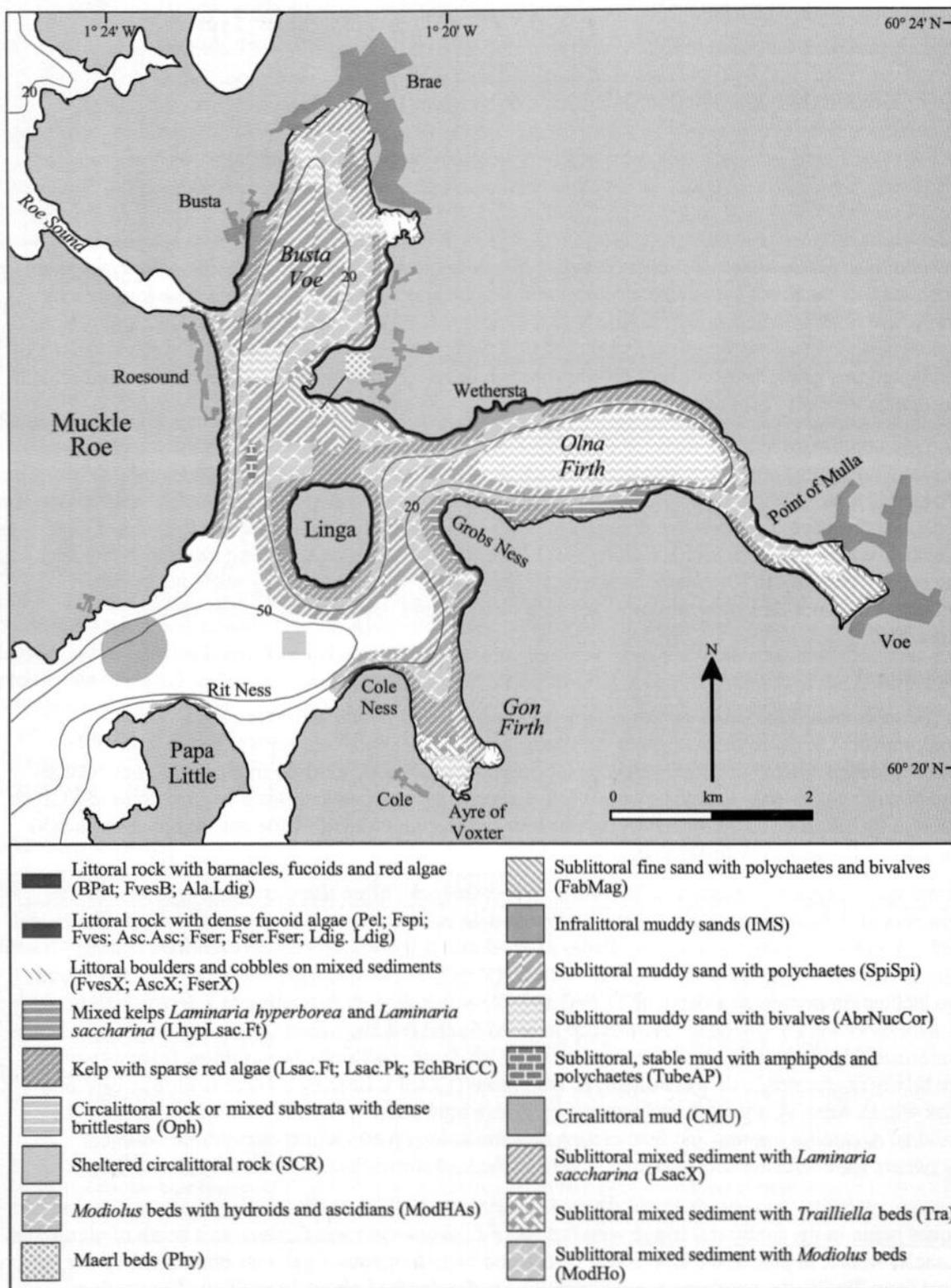
Shingle on mixed sediment shores support fucoids and mussels *Mytilus edulis* with the sediment holding lugworm *Arenicola marina*, bivalves *Mya arenaria* and *Cerastoderma edule* and, in Aith Voe, a polychaete/oligochaete assemblage (PCer). At Voe in Olna Firth and Ayre of Voxter in Gon Firth, the presence of freshwater streams running across the shore results in dense growths of the brackish-water fucoid *Fucus ceranoides* and filamentous green algae including *Enteromorpha* spp. At the eastern entrance to Roe Sound, tide-swept shingle with pools of standing water has richer epifaunal communities of ascidians, bryozoans, sponges and opisthobranchs than elsewhere in Area 24.

Sublittoral

In the sublittoral, hard substrata are relatively infrequent and poorly mixed muddy sediments predominate. On Swarbacks Head, at the entrance to Swarbacks Minn, vertical bedrock and then boulders reach a depth of 27 m before giving way to coarse sand, whereas in the inner voes bedrock and boulder slopes only extend beyond a few metres depth on headlands such as Cole Ness and Green Point at the southern tip of Vementry, in narrows such as the Point of Mulla and on outcrops such as the islet of Burgastoo in Busta Voe.

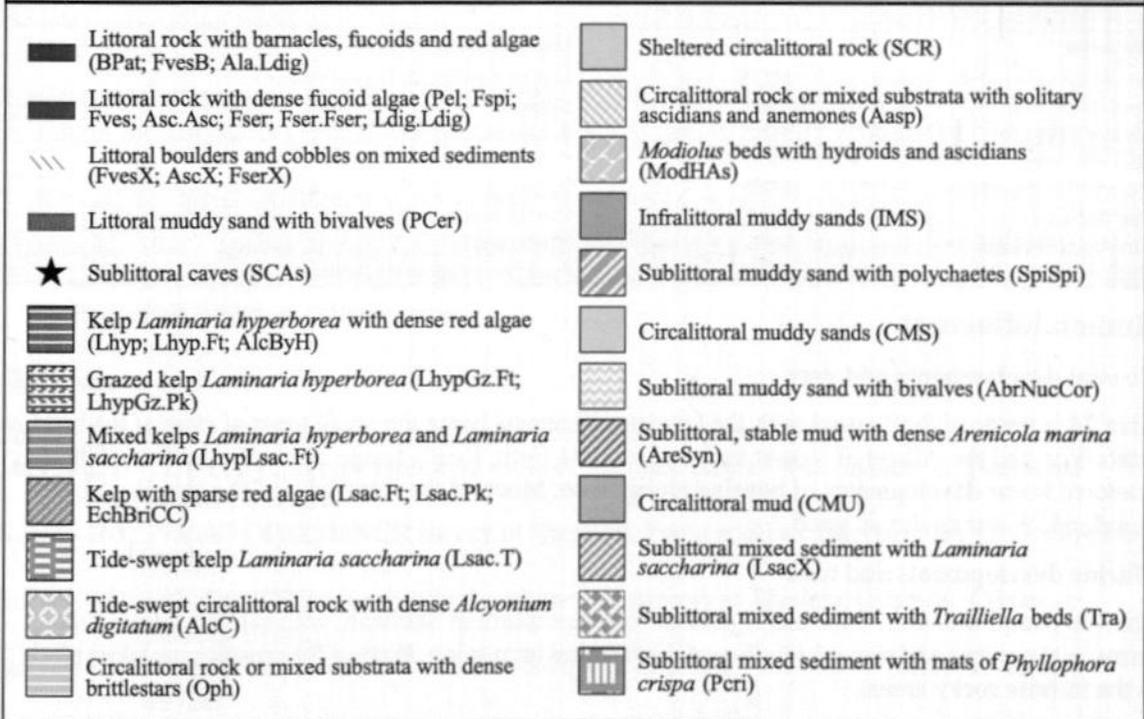
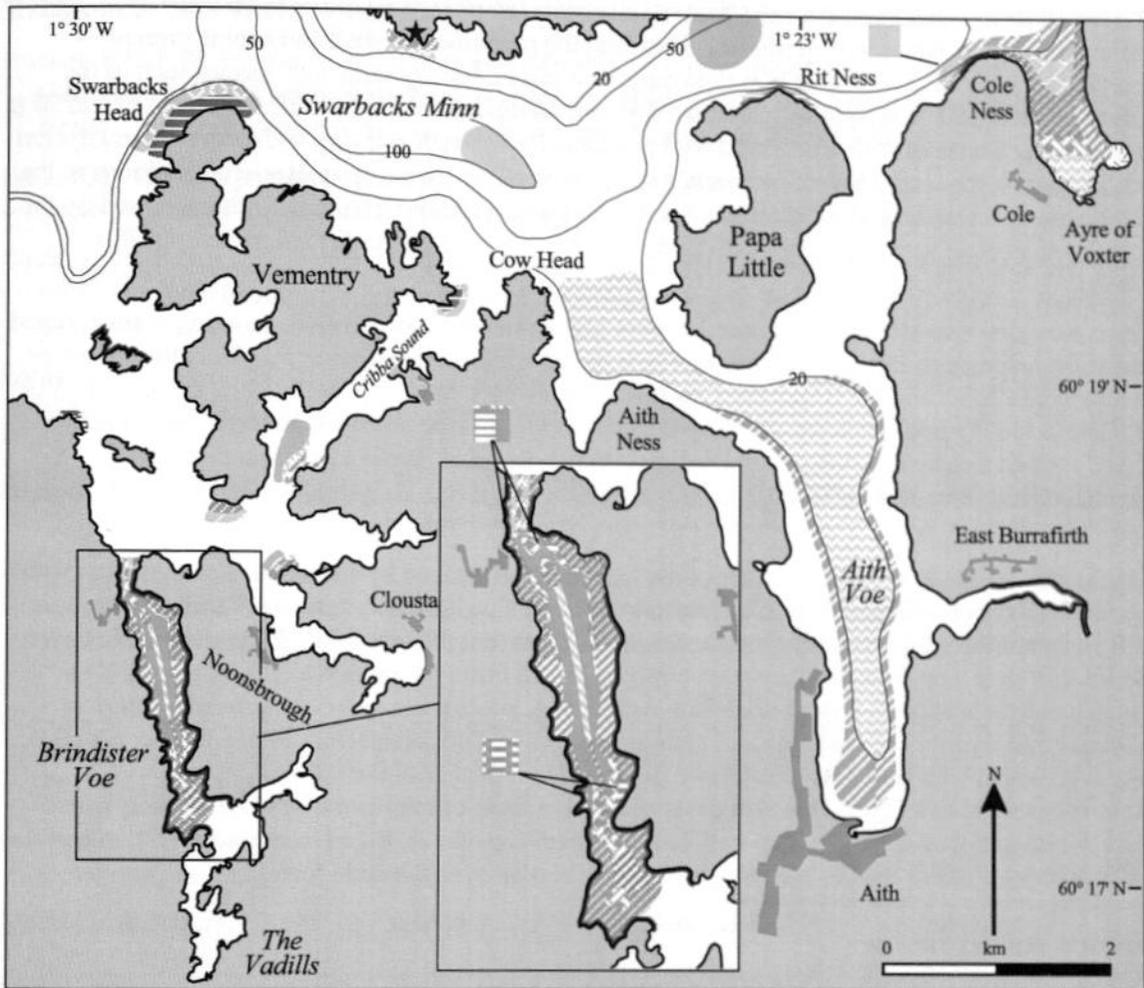
In the wave-exposed conditions at the entrance to Swarbacks Minn there are surge gullies with large numbers of the dahlia anemone *Urticina felina* and the ascidian *Clavelina lepadiformis* whilst vertical bedrock in this area supports large colonies of dead-man's fingers *Alcyonium digitatum* and the calcareous tubeworm *Filograna implexa* (AlcByH). Kelp *Laminaria hyperborea* is abundant where the inclination permits to a depth of 11 m (Lhyp.Ft) with kelp park extending to a depth of 18 m. *L. hyperborea* is also found at the entrance to Uyea Sound but elsewhere *Laminaria saccharina* is the dominant kelp, often in its cape form and mixed with dense stands of *Chorda filum*, features which are highly characteristic of wave-sheltered conditions (Lsac.Ft; Lsac.Pk). There is little circalittoral rock within Area 24, although rocky outcrops from a mud plain in Olna Firth are covered with the ascidian *Asciidiella aspersa* and featherstars *Antedon bifida* (Aasp) whilst circalittoral boulders elsewhere are encrusted with coralline algae and the keel worm *Pomatoceros triqueter* (SCR).

In many places in the voes, there are no hard substrata in shallow water and slopes of muddy sand and stones begin in the sublittoral fringe with forests of *L. saccharina* and *C. filum* to a depth of about 5 m (LsacX) where, in places, the kelp forest is replaced by filamentous algal mats dominated by the red algal form *Trailliella*, overlying the sediment to a water depth of about 14 m (Tra). The shallow sediments contain infaunal species such as lugworm *Arenicola marina*, the razor clam *Ensis arcuatus*, heart urchin *Echinocardium cordatum* and the anemone *Cerianthus lloydii*. However, around the sides of the voes between depths of about 5 and 25 m, beds of the horse mussel *Modiolus modiolus* with associated epifauna such as *A. aspersa* and the queen scallop *Aequipecten opercularis* are the dominant feature of the mixed muddy sediments (ModHAs). In the deeper *Modiolus* beds, silty sediment contains a faunal community characterised by the turret shell *Turritella communis*, the



Figures 24.2, 24.3> Indicative distribution of the main biotopes in the area (based on data from survey sites shown in Figure 24.1, cited literature and additional field observations).

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bivalve *Hiatella arctica* and the polychaete *Notomastus latericeus* (ModHo). In the inner voes, the sediment becomes siltier with increasing depth and the proportion of shell and cobble present decreases. The *Modiolus* beds give way to burrowed mixed, muddy sand with species such as the polychaete worms *Prionospio* sp., *Thyasira* spp. and *Mediomastus* sp. (SpiSpi) and then, beyond 30 m in the deeper basins of Aith Voe, Busta Voe and Olna Firth, to silt and clay with polychaetes *Glycera alba*, *Thyasira* spp. and *Chaetoderma nitidulum* (AbrNucCor). In the more exposed conditions in the outer parts of Swarbacks Minn clean sand and shell-gravel contain a community characterised by the polychaete *Pisione remota*, the bivalve *Abra prismatica* and the urchin *Echinocyamus pusillus* (CMS).

There are a few variations to this general pattern highlighted by Entec (1996), including a small maerl bed at the entrance to Busta Voe (Phy) and beds of the brittlestar *Ophiothrix fragilis* at the entrances to Swarbacks Minn and the Brindister/Clousta system (Oph). Mud with shell debris in the north Voe of Clousta holds a bed of the sea-pen *Virgularia mirabilis* and the anemone *Sagartiogeton undatus* (CMU) whilst nearby in Cribba Sound sediment surveyed below about 17 m is anoxic with no apparent living macrofauna (CMU).

There is a small lagoon at Saltness on the eastern side of Busta Voe, which has beds of tasselweed *Ruppia* spp. on sandy mud on the floor of the lagoon and is fringed by a small area of saltmarsh with the fucoid *Fucus muscoides*. There is a much more extensive lagoon system, the Vadills, at the head of Brindister Voe; both these lagoons are described elsewhere (Thorpe 1998; Entec 1999). However, the Vadills have a profound influence on biotopes in Uni Firth, the inner basin of Brindister Voe, which has a narrows with a weak tidal flow with both *L. saccharina* and *L. hyperborea*, *Halidryx siliquosa* and a variety of red algae and ascidians (Lsac.T). The central floor of the channel contains coarse sediment with bivalves whilst away from the main tidal flow there is muddy sand with a filamentous algal mat (Tra). This also covers extensive areas of mud in the inner basin itself where there are large populations of synaptid holothurians amongst the algae, a biotope which is common in the inner basins of the Vadills but rarely recorded elsewhere in Shetland (AreSyn).

Nature conservation

Conservation sites		
Site name	Status	Main features
Brindister Voe and the Vadills	MCA	Marine biological; lagoon system
Burn of Lunklet	SSSI	Botanical
Loch of Clousta	SSSI	Botanical
Ness of Clousta - The Briggs	SSSI; GCR	Geological
Muckle Roe Meadows	SSSI	Botanical
The Vadills	cSAC	Coastal lagoons
Shetland: Muckle Roe	NSA	Landscape
Shetland Islands	ESA	Agri-environmental scheme

Human influences

Coastal developments and uses

Area 24 is predominantly rural with the largest settlements being the small town of Brae at the head of Busta Voe and the village of Voe at the head of Olna Firth. Roads fringe much of coastline with scattered linear developments of housing along these. Much of the remainder of the area is grazed moorland. Water quality is good.

Marine developments and uses

The voe complex is one of the major centres for mariculture in Shetland, with salmon *Salmo salar* farms in every voe and mussel *Mytilus edulis* farming increasing. Potting for crustaceans takes place in the inshore rocky areas.

There are jetties at Voe and Brae and a slipway at Brae, and all of the sheltered inlets are used as anchorages. Sailing and windsurfing are the main water-based recreational activities with a small amount of diving.

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- Survey 261: 1986/87 OPRU/MNCR survey of Shetland, Foula and Fair Isle (Hiscock 1986; Howson 1988).
- Survey 382: 1974/76 SOTEAG sublittoral grab sample surveys in Shetland (Pearson, Coates & Duncan 1994).
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- Survey 672: 1995 Entec/SNH habitat mapping in Busta Voe and Olna Firth (Entec 1996).

Littoral sites					
<i>Survey</i>	<i>Site</i>	<i>Site name</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotopes recorded</i>
261	123	E Burra Firth, Aith Voe.	HU 360 579	60°18.2'N 01°20.9'W	Pel; FvesX; AscX; PCer
434	3	Gon Firth, Swarbacks Minn.	HU 366 620	60°20.4'N 01°20.2'W	Pel; Fspi; FvesX; FserX; Ldig.Ldig
434	4	Point of Mulla, Olna Firth, Swarbacks Minn.	HU 395 640	60°21.5'N 01°17.0'W	YG; Ver.Ver; Pel; Fspi; Fves; Asc.Asc; FvesX; FserX; Ldig.Ldig
434	5	Busta Voe, Swarbacks Minn.	HU 360 669	60°23.1'N 01°20.8'W	Pel; FvesX; AscX; FserX
434	10	Busta Voe, Swarbacks Minn.	HU 350 677	60°23.5'N 01°21.8'W	YG; Ver; Pel; Fspi; FvesX; FserX; Ldig.Ldig
434	25	Brindister, Swarbacks Minn.	HU 282 580	60°18.3'N 01°29.3'W	Ver.Ver; Pel; Fves; Asc.Asc; Fser.Fser; Ldig.Ldig
443	1	W shore, S of Lower House, Brindister Voe.	HU 282 577	60°18.1'N 01°29.3'W	YG; Ver.Ver; Fves; Fspi; Fser.Fser; Ldig.Ldig
443	2	E shore, rocky promontory in Uni Forth, Brindister Voe.	HU 289 561	60°17.3'N 01°28.6'W	YG; Ver.Ver; Fspi; Fves; Fser.Fser
443	3	West shore, Brindister Voe (beach between Greenhead cottage and Middisfirth).	HU 282 576	60°18.1'N 01°29.3'W	Ver.Ver; Pel; FvesX; AscX
Sublittoral sites					
<i>Survey</i>	<i>Site</i>	<i>Site name</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotopes recorded</i>
227	2	S Muckle Roe, Swarbacks Minn.	HU 307 626	60°20.8'N 01°26.6'W	LsacSac; SCAs; LhypGz.Ft; AlcByH; CCParCar; Oph
227	3	SW Linga, Busta Voe, Swarbacks Minn.	HU 350 635	60°21.2'N 01°21.9'W	LhypLsac.Ft; Lsac.Ft; EcorEns; LsacX; ModHAs;
227	11	Swarbacks Skerry, Swarbacks Minn.	HU 291 621	60°20.5'N 01°28.3'W	Lhyp.Ft; AlcByH; AlcC
230	18	Busta Voe, Swarbacks Minn.	HU 350 677	60°23.5'N 01°21.8'W	LsacX
230	19	Point of Mulla, Olna Firth, Swarbacks Minn.	HU 395 640	60°21.5'N 01°17.0'W	LsacX
230	34	Gon Firth, Swarbacks Minn.	HU 366 620	60°20.4'N 01°20.2'W	Asc.Asc; LsacX
261	1	Shaabers Head, Vementry.	HU 279 594	60°19.1'N 01°29.6'W	LhypGz.Pk
261	3	Point of Ingas Holm, Vementry.	HU 312 604	60°19.6'N 01°26.1'W	Lhyp; ModT; IGS
261	34	Off Wethersta, Busta Voe.	HU 358 658	60°22.5'N 01°21.0'W	Lsac.Pk; ModHo; LsacX; Tra
261	35	Burgastoo, Busta Voe.	HU 345 660	60°22.6'N 01°22.4'W	Lsac.Ft; Lsac.Pk; ModHAs; ModHo; CMU
261	53	East Linga, Olna Firth.	HU 360 640	60°21.5'N 01°20.8'W	Lsac.Ft; Lsac.Pk; Oph.Oacu; ModHo
261	54	NW of Grobs Ness, Olna Firth.	HU 364 643	60°21.7'N 01°20.4'W	Lsac.Pk; ModHAs; CMX
261	55	Green Point, Brindister Voe, Vementry.	HU 292 585	60°18.6'N 01°28.2'W	AntAsH; EchBriCC; ModHAs
261	56	Ness of Clousta, Vementry.	HU 297 582	60°18.4'N 01°27.7'W	Lsac.Ft; Lsac.Pk; CMU; LsacX; Peri; Tra
261	59	Standing Stone, Busta Voe.	HU 351 674	60°23.3'N 01°21.7'W	ModHo
261	60	W of Quilse, Olna Firth.	HU 384 633	60°21.1'N 01°18.2'W	LhypLsac.Ft; ModHAs; ModHo
261	67	Sonso Ness, Cribba Sound, Vementry.	HU 298 590	60°18.8'N 01°27.6'W	Aasp; IMU; LsacX; Tra
261	68	Rit Ness, Swarbacks Minn, Papa Little.	HU 339 623	60°20.6'N 01°23.1'W	LhypLsac.Ft; Oph; IMS; IMX
261	69	Hevden Ness, Busta Voe.	HU 344 655	60°22.3'N 01°22.5'W	Oph.Oacu; ModHo

Sublittoral sites continued					
Survey	Site	Site name	Grid reference	Latitude/longitude	Biotores recorded
261	70	Cole Ness, Cole Deep, Papa Little.	HU 356 626	60°20.7'N 01°21.2'W	Lsac.Ft; Lsac.Pk; SCR; ModHAs; IMS
261	71	S of Point of Mulla, Olna Firth.	HU 395 637	60°21.3'N 01°17.0'W	SCR; CMU
382	1	SE of Garths, Aith Voe, Swarbacks Minn.	HU 345 564	60°17.4'N 01°22.5'W	SpiSpi
382	2	E of Point of Ayres, Aith Voe, Swarbacks Minn.	HU 347 572	60°17.9'N 01°22.2'W	IMX
382	3	E of Point of Sletta, Aith Voe, Swarbacks Minn.	HU 344 592	60°19.0'N 01°22.6'W	AbrNucCor
382	4	Aith Ness, Aith Voe, Swarbacks Minn.	HU 335 627	60°20.8'N 01°23.5'W	CMU
382	5	N of Hoga Pund, Olna Firth, Swarbacks Minn.	HU 401 635	60°21.2'N 01°16.3'W	FabMag
382	6	Point of Mulba, Olna Firth, Swarbacks Minn.	HU 395 637	60°21.3'N 01°17.0'W	SpiSpi; IMX
382	7	NE of Grobs Ness, Swarbacks Minn.	HU 377 645	60°21.8'N 01°18.9'W	AbrNucCor
382	8	W of Burra Voe, Basta Voe, Swarbacks Minn.	HU 352 669	60°23.1'N 01°21.6'W	CMS
382	9	SE of jetty tower, Busta, Busta Voe, Swarbacks Minn.	HU 351 665	60°22.9'N 01°21.7'W	SpiSpi
382	10	E of Greentaing, mouth of Busta Voe, Swarbacks Minn.	HU 346 646	60°21.8'N 01°22.3'W	TubeAP
382	11	NE Holms of Uyea Sound, Swarbacks Minn.	HU 319 614	60°20.2'N 01°25.2'W	CMS
443	4	NW Brindister Island, Brindister Voe.	HU 284 578	60°18.2'N 01°29.1'W	Lsac.Ft; Aasp; IGS; IMS; LsacX; Pcri
443	5	Longa Ness narrows, Brindister Voe.	HU 282 580	60°18.3'N 01°29.3'W	Lsac.Ft; EchBriCC; ModHAs; Tra
443	6	S of Brindister Rock, towards Dutch Island, Brindister Voe.	HU 287 574	60°18.0'N 01°28.8'W	Lsac.Ft; IMS; Tra
443	7	Mid Brindister Voe to N of Broch.	HU 286 572	60°17.9'N 01°28.9'W	For; Lsac.Ft; LsacX; IMS; Beg; Tra
443	8	N of Point of the Hurds, Brindister Voe.	HU 287 568	60°17.6'N 01°28.8'W	Lsac.Ft; Aasp; Ant; IMS
443	9	Head of narrows between Brindister Voe & Uni Firth.	HU 287 564	60°17.4'N 01°28.8'W	Lsac.Ft; Lsac.T; Tra
443	11	NW shore of Uni Firth, Brindister Voe.	HU 288 560	60°17.2'N 01°28.7'W	Lsac.Ft; Aasp; AreSyn
443	10	Uni Firth, Brindister Voe.	HU 286 559	60°17.2'N 01°28.9'W	Lsac.Ft; Tra
443	14	E of mid Brindister Rock, Brindister Voe.	HU 285 577	60°18.1'N 01°29.0'W	Lsac.Ft; Lsac.Pk; Aasp; IMS; Tra
443	17	SE Brindister Island, Brindister Voe.	HU 285 576	60°18.1'N 01°29.0'W	Lsac.Ft; Lsac.Pk; IMS
672	1	S of Skult, Busta Voe.	HU 351 650	60°22.1'N 01°21.7'W	IMS
672	2	SW of Skult, Busta Voe.	HU 353 649	60°22.0'N 01°21.5'W	SpiSpi
672	3	E of Foula Wick, Olna Firth.	HU 386 650	60°22.1'N 01°17.9'W	CMX
672	4	E of Quilse, Olna Firth.	HU 392 643	60°21.7'N 01°17.2'W	SpiSpi
672	5	NW of Point of Mulla, Olna Firth.	HU 393 640	60°21.5'N 01°17.1'W	CMS
672	6	S of Point of Mulla, Olna Firth.	HU 396 637	60°21.3'N 01°16.8'W	IMS
672	7	SW of Point of Mulla, Olna Firth.	HU 399 636	60°21.3'N 01°16.5'W	FabMag
672	8	N of Hoga Pund, Olna Firth.	HU 402 635	60°21.2'N 01°16.2'W	SpiSpi
672	9	E of Linga, Olna Firth.	HU 361 637	60°21.3'N 01°20.7'W	CMS
672	10	W of Grobsness, Olna Firth.	HU 364 636	60°21.3'N 01°20.3'W	IGS
672	11	E of Cole, Gon Firth, Olna Firth.	HU 364 619	60°20.4'N 01°20.3'W	AbrNucCor
672	12	S of Linga, Busta Voe.	HU 352 633	60°21.1'N 01°21.6'W	IMS
672	13	Roesound, Busta Voe.	HU 343 658	60°22.5'N 01°22.5'W	CMX
672	14	NW of Burravoe, Busta Voe.	HU 353 672	60°23.3'N 01°21.5'W	SpiSpi
672	15	SSW of Skult, Busta Voe.	HU 350 650	60°22.1'N 01°21.8'W	SpiSpi
672	16	W of Skult, Busta Voe.	HU 350 653	60°22.2'N 01°21.8'W	FabMag
672	17	NW of Wethersta, Busta Voe.	HU 356 659	60°22.5'N 01°21.2'W	CMX
672	18	N end of Busta Voe.	HU 351 675	60°23.4'N 01°21.7'W	AbrNucCor
672	19	S of Wetherstanes, Olna Firth.	HU 357 649	60°22.0'N 01°21.1'W	IMS

Compiled by: Christine Howson

Location

Position (centre)	HU 300 880	60°34.5'N 01°27.1'W
Administrative area	Shetland Islands	
Conservation agency/area	Scottish Natural Heritage	North Areas (Northern Isles)

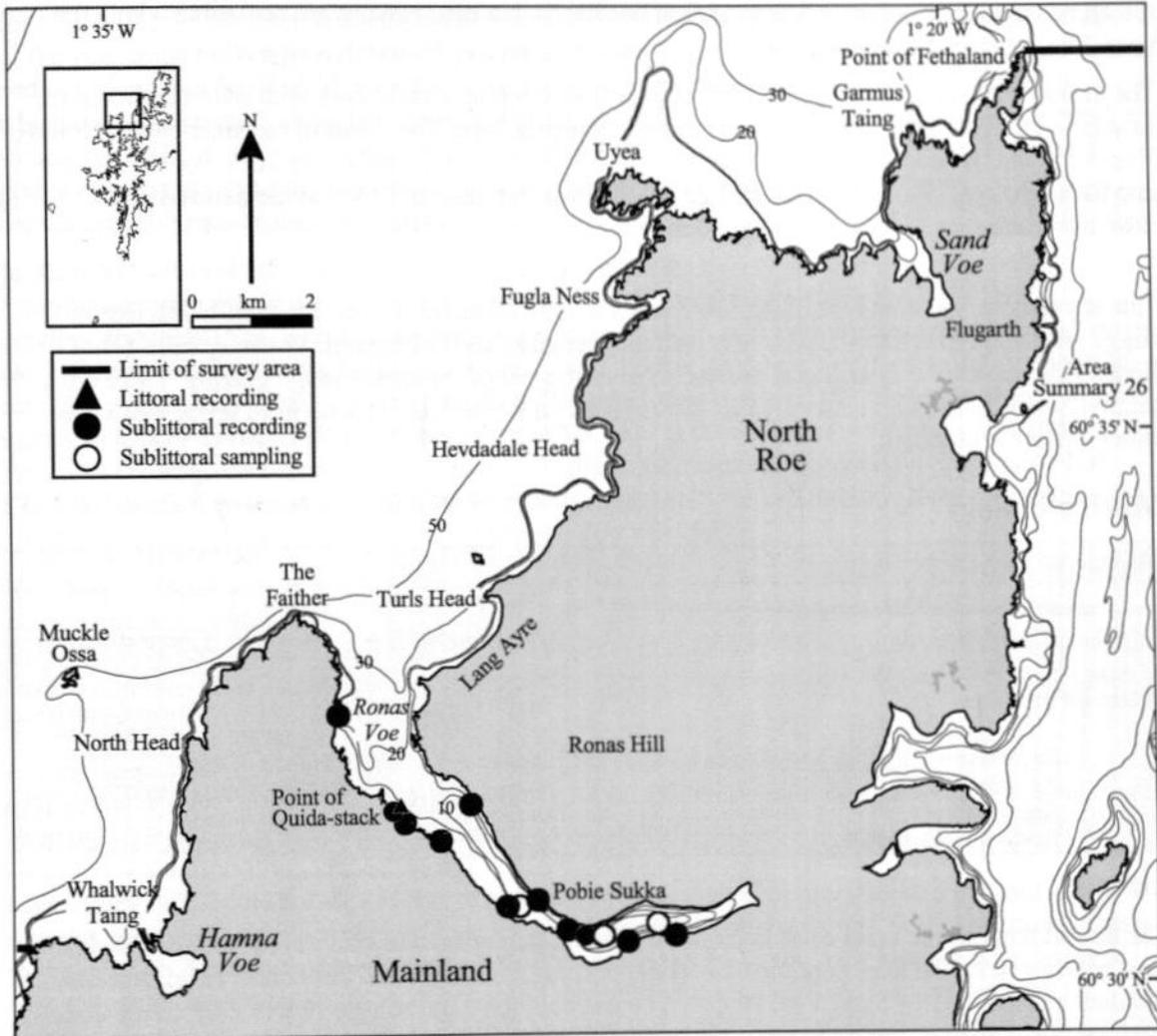


Figure 25.1 Main features of the area, showing sites surveyed.

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Physical features

Physiographic type	Open coast; voes
Length of coast	88.9 km
Area of inlet	Ronas Voe: 6.8 km ²
Bathymetry	50 m depth contour is between 500 m and 5 km off open coast; maximum depth of Ronas Voe: 42 m (inner basin); sill at 15 m
Wave exposure	Extremely exposed on open coast to extremely sheltered in Ronas Voe
Tidal streams	Strong around headlands, negligible in Ronas Voe
Tidal range	1.7 m (mean springs); 0.8 m (mean neaps)
Salinity	Fully marine

Introduction

Area 25, which consists of the north-west coast of Mainland Shetland, is extremely exposed along most of the open coast. This is a very scenic coastline with numerous geos, arches, caves, stacks and offshore islands and much of it comprises high cliffs, particularly around Ronas Hill which is 450 m high. The area includes Ronas Voe, one of the longest voes in Shetland, which has two sills and reaches a maximum depth of 42 m in its inner basin. Ronas Voe has a wave-exposed entrance but is extremely sheltered along most of its length and the deep inner basin is subject to periods of anoxic conditions. Two smaller voes, Hamna Voe and Sand Voe, also lie within the area. Strong tidal streams run along the open coast, particularly around headlands, but tidal streams are negligible within the voes. The area is fully marine.

The littoral zone on the open coast consists largely of steep or vertical rock with sand beaches at the base of some cliffs and in several embayments, including Sand Voe. Most of the inner part of Ronas Voe is fringed by beaches of shingle and muddy gravel. In Ronas Voe, the bedrock slope continues into the sublittoral to a depth of at least 22 m at the voe entrance and 14 m at the narrows with substantial outcrops in depths of up to 26 m in the inner basin. At the base of the rock slope, clean sand at the voe entrance grades to muddy sand and gravel at the head and soft mud in the deep basin.

This is a remote, moorland area with few roads and only scattered houses. Much of North Roe is boggy with numerous lochs and there is lowland wet grassland at Flugarth. The steep hillsides of Ronas Hill are of little agricultural use and most of the rest of the area is rough grazing. There are salmon *Salmo salar* and mussel *Mytilus edulis* farms on Ronas Voe. Houses have septic tanks and water quality is excellent.

Marine biology

Marine biological surveys				
	Survey methods	No. of sites	Date(s) of survey	Source
Littoral	Recording	2	July - August 1974	Institute of Terrestrial Ecology (1975a)
Sublittoral	Recording	2	July - August 1974	Institute of Terrestrial Ecology (1975b), Earll (1982)
	Recording	3	August 1986	Hiscock (1986)
	Recording	2	August 1987	Moss & Ackers (1987)
	Recording	4	August 1987	Howson (1988)
	Infaunal sampling (Grab)	3	1974-78	Pearson, Coates & Duncan (1993)

Littoral

The littoral zone on the open coast consists largely of steep or vertical rock. There are several clean sand beaches, with the longest at the base of the cliffs at Lang Ayre and Hevdadale Head, and a beach and dunes at the head of Sand Voe. Hamna Voe has both sand and shingle beaches. In Ronas Voe, there are steep bedrock shores in the outer part of the voe, grading to boulder and then shingle and gravel shores in the inner part.

There is biological information for two shores in this area, one towards the entrance to Ronas Voe and the second in the sheltered inner basin of the voe. A wave-exposed cliff face at Point of Quida is dominated by animals with barnacles *Semibalanus balanoides* and small mussels *Mytilus edulis* covering most of the shore (MytB). Limpets *Patella vulgata* and dogwhelks *Nucella lapillus* are common. The green algae *Cladophora* sp. and *Enteromorpha* sp. and coralline algal crusts cover the mussels and barnacles in the lower eulittoral and the sublittoral fringe has kelps *Alaria esculenta* and *Laminaria digitata* with *M. edulis* (Ala.Myt).

A very sheltered shore towards the head of Ronas Voe consists mainly of pebbles with occasional boulders, and with a low bedrock cliff at the back of the shore. There is some freshwater seepage. Bedrock in the littoral fringe and upper eulittoral has the black lichen *Verrucaria maura* (Ver.Ver) with bands of the fucoid algae *Pelvetia canaliculata* and *Fucus spiralis* and scattered *S. balanoides*

(Pel; Fspi). Pebbles in the upper part of the mid-eulittoral support an open canopy of the fucoid *Fucus vesiculosus* with barnacles, *P. vulgata* and *M. edulis* (FvesX). Lower in the mid-eulittoral, the *F. vesiculosus* forms a dense canopy with fewer barnacles. The lower eulittoral supports the fucoid *Fucus serratus* with some *F. vesiculosus*, the brown alga *Chorda filum* and *M. edulis* (FserX), whilst *L. digitata* and *C. filum* dominate the sublittoral fringe (Ldig.Ldig).

Sublittoral

In Ronas Voe, the bedrock slope continues into the sublittoral to a depth of at least 22 m at the voe entrance and 15 m at the Point of Quida, just inside the entrance. In places in the outer voe, the rock forms cliff faces with numerous gullies. The rock and boulder slope is not continuous along the sides of the voe, being broken by sediment slopes particularly along the northern shore. However, there is a bedrock slope to a depth of 14 m on the north shore at the narrowest point, where the voe bends, whereas on the southern shore here, there is cobble on mud from the intertidal downwards. There are substantial bedrock outcrops in depths of up to 26 m in the inner basin. The bedrock and boulders give way to clean sand at the voe entrance which then grades to muddy sand and gravel at the head of the voe and soft mud in the deep basin.

In the outer part of Ronas Voe, infralittoral rock is dominated by a kelp forest of *Laminaria hyperborea*, often mixed with *Laminaria saccharina* and *Saccorhiza polyschides* (LsacSac), to a depth of about 10-15 m, with *L. hyperborea* becoming the dominant kelp species from the point where the voe starts to bend eastwards (Lhyp). At this point, there is a kelp park primarily of *L. saccharina*, reaching a maximum depth of 14 m (Lsac.Pk). The kelp forest is grazed to a moderate degree by the urchin *Echinus esculentus* although there are species such as the algae *Odonthalia dentata* and *Phycodrys rubens*, the bryozoan *Alcyonidium* sp., the dahlia anemone *Urticina felina*, the ascidian *Clavelina lepadiformis* and the crab *Cancer pagurus* present in the understory. Kelp stipes support a range of red algal species and the sponge *Halichondria panicea*.

Cliff faces within the kelp forest in this outer part of Ronas Voe are encrusted by animal species such as dwarf plumose anemones *Metridium senile*, dead-man's fingers *Alcyonium digitatum*, the keel worm *Pomatoceros triqueter* and featherstars *Antedon bifida* (AlcByH). Cliffs exposed to wave surge have in addition a turf of ascidian species including *Diplosoma listerianum* and *Sidnyum turbinatum* and particularly large numbers of *A. bifida*.

Laminaria saccharina forests in the inner parts of Ronas Voe are limited in depth largely by the availability of hard substrata, and are restricted to 3-5 m around much of this part of the voe but reach 14 m at Pobie Sukka, where there are deeper rock outcrops (Lsac.Ft). The plants are generally of the sheltered water cape-form, and are mixed with the brown alga *Chorda filum*. Species in the understory include the red alga *Mastocarpus* sp., the shore crab *Carcinus maenas*, the starfish *Asterias rubens*, the ascidian *Asciidiella aspersa* and, beneath rock overhangs, the scyphistoma phase of the jellyfish *Aurelia aurita*. Where the kelp does extend to 14 m, the rock is covered by crusts of dark red algae, large numbers of *A. aspersa* and the hydroid *Bougainvillaea ramosa*, and has the urchin *Psammechinus miliaris*, the crab *Hyas araneus* and small plants of several species of foliose red algae.

More usually, the shallow infralittoral in this extremely sheltered part of Ronas Voe has cobbles lying on mud, beginning either in the sublittoral fringe or below a rocky slope in about 3-5 m, and this habitat supports an open forest of *L. saccharina* and *C. filum* with algae such as *Ceramium* sp. attached to stones and shells, infaunal species such as lugworm *Arenicola marina* and the polychaete *Myxicola infundibulum*, queen scallop *Aequipecten opercularis*, scallop *Pecten maximus* and brittlestar *Ophiura albida* (LsacX).

Circalittoral boulders in 14-22 m depth in the wave-exposed entrance to Ronas Voe are heavily grazed by urchins and brittlestars and are covered by encrusting coralline algae. They support large numbers of brittlestars *Ophiothrix fragilis* and *Ophiocomina nigra* (Oph). In contrast, silty rock outcrops at 17-26 m in the extremely sheltered inner basin support large numbers of the anemone *Sagartiogeton laceratus*, the barnacle *Balanus crenatus* and the ascidian *Asciidiella aspersa* (Aasp). Large *M. senile*

are attached to the tops of rocks, the uncommon polychaete worm *Myxicola aesthetica* is found in crevices and *A. bifida*, *P. triqueter* and the brittlestar *Ophiopholis aculeata* are common (AmenCio.Met).

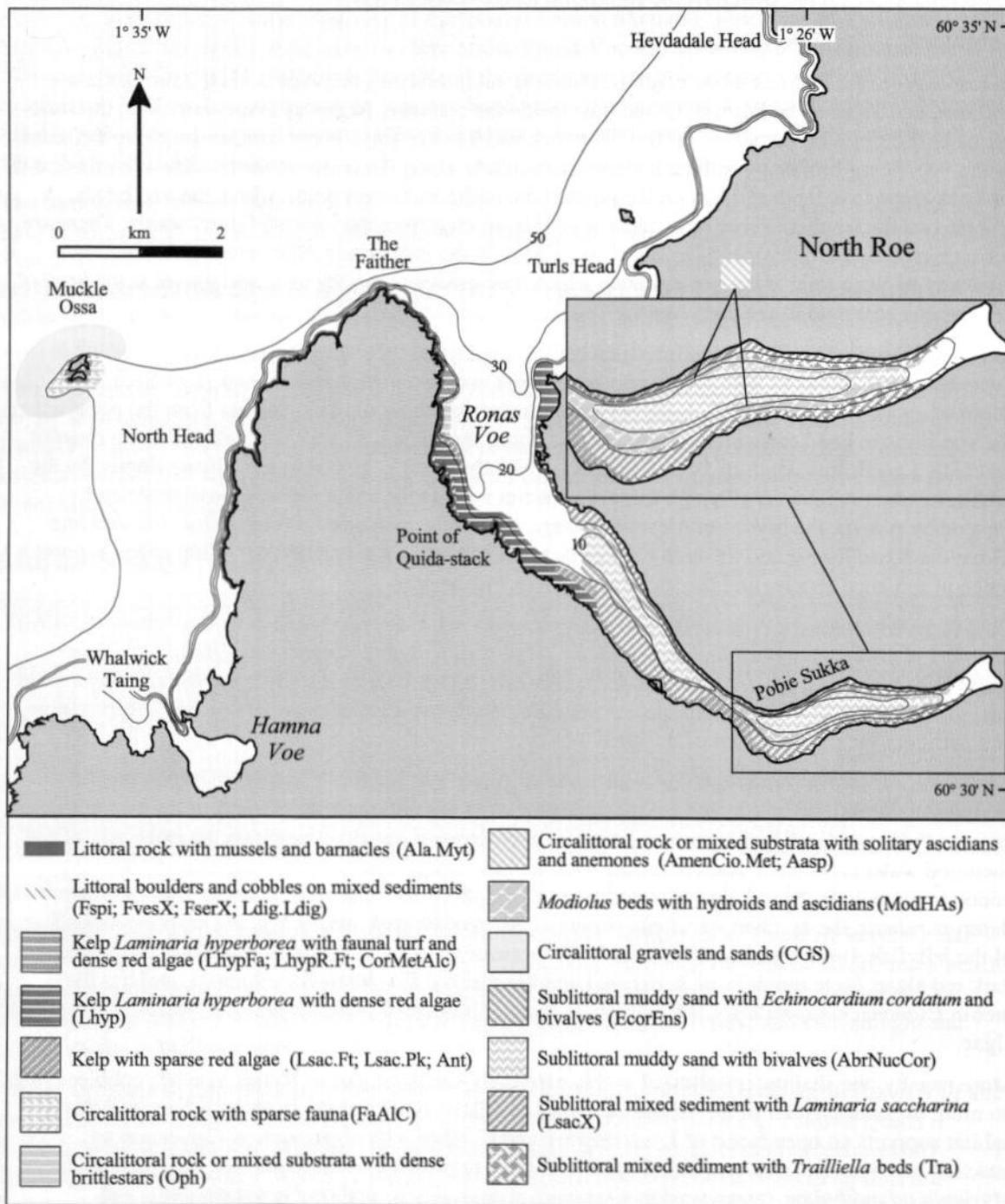


Figure 25.2 Indicative distribution of the main biotopes in the area (based on data from survey sites shown in Figure 25.1, cited literature and additional field observations).

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In the entrance to Ronas Voe, circalittoral boulders give way to a slope of rippled muddy sand with pebbles at a depth of about 22 m. The sediment has numerous excavations and supports large numbers of *O. fragilis* and *O. nigra*, evidence of the bivalves *Ensis* sp. and *Venerupis* sp., *U. felina* and the sand mason worm *Lanice conchilega* (Oph). Further into the voe, there are slopes of muddy sand starting at about 10-15 m. At Point of Quida, this has *A. marina* with the polychaete *Thyasira flexuosa* and the bivalve *Mysella bidentata* whilst on the north side of the voe, there are burrowing echinoderms including *Echinocardium cordatum* and *Amphiura* spp. in shallow water (EcorEns). At one site in the inner voe, there is a mat of unattached filamentous red algae between about 4 and 14 m.

The sand becomes progressively more muddy with increasing depth, and the horse mussel *Modiolus modiolus* is present from about 12 m with brittlestars, including large numbers of *O. albida*, *M. infundibulum*, and in about 25 m, the anemone *Sagartiogeton laceratus* (ModHAs). Similar species are present in the muddier sediments throughout the sheltered parts of the voe, with *M. modiolus* particularly common between about 10 and 25 m. The relative abundances of species associated with the mussels varies from site-to-site. On the inner sill, solitary ascidians are particularly common, notably *Ascidia mentula* and *A. aspersa*, whilst in the inner basin there are large numbers of *M. infundibulum*, *A. opercularis* and *O. fragilis*.

In the soft highly organic mud of the deep inner basin, the polychaetes *Glycera alba*, *Mediomastus fragilis*, *Protodorvillea kefersteini* and *Chaetozone setosa* and the bivalves *Thyasira* spp. and *Abra alba* are found (AbrNucCor). This basin may be periodically anoxic and, at the time of one survey, the bottom sediment between 28 and 37 m depth was covered by a bacterial film with what was assumed to be a mist of bacteria in suspension above the sediment (Beg).

Nature conservation

Conservation sites		
Site name	Status	Main features
Shetland: Esha Ness	NSA	Landscape
Shetland: Fethaland	NSA	Landscape
Fugla Ness	SSSI; GCR	Geological
Ramna Stacks and Gruney	SSSI; RSPB; pSPA	Ornithological
Ronas Hill - North Roe	SSSI	Botanical; ornithological; entomological; geological
Tingon	SSSI	Botanical; ornithological
Uyea - North Roe Coast	SSSI; GCR	Geological
Villians of Hamnavoe	SSSI; GCR	Geological
Shetland Islands	ESA	Agri-environmental scheme

Human influences

Coastal developments and uses

Area 25 is a remote, moorland area with few roads and only scattered houses. Much of North Roe is boggy with numerous lochs and there is lowland wet grassland at Flugarth. Most of the area is rough grazing apart from the steep hillsides of Ronas Hill which are of little agricultural use. Houses have septic tanks and water quality is excellent.

Marine developments and uses

There are two piers on Ronas Voe.

Potting for crustaceans is carried out in the rocky inshore areas and there are salmon *Salmo salar* and mussel *Mytilus edulis* farms on Ronas Voe.

References and further reading

- Earll, R.C. 1982. Report on a sublittoral survey of Shetland. (Contractor: Underwater Conservation Society, Ross-on-Wye.) *Nature Conservancy Council, CSD Report*, No. 466.
- Hiscock, K. 1986. Marine biological surveys in Shetland. August 1986. (Contractor: Field Studies Council, Oil Pollution Research Unit, Pembroke.) *Nature Conservancy Council, CSD Report*, No. 678.
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- Pearson, T.H., Coates, A., & Duncan, J.A.R. 1994. Shetland subtidal sediment community analysis. Report on analysis of subtidal sediment data from Shetland to identify community types present. (Contractor: SEAS Ltd, Oban.) *JNCC Report*, No. 191. (Marine Nature Conservation Review Report, No. MNCR/OR/20.) (SEAS Report, No. SR64.).

Sites surveyed

- Survey 227: 1987 MCS sublittoral survey of Shetland (Moss & Ackers 1987).
- Survey 230: 1974 ITE report on sublittoral biota of Shetland (Earll 1982; Institute of Terrestrial Ecology 1975b).
- Survey 261: 1986/87 OPRU/MNCR survey of Shetland, Foula and Fair Isle (Hiscock 1986; Howson 1988).
- Survey 382: 1974/76 SOTEAG sublittoral grab sample surveys in Shetland (Pearson, Coates & Duncan 1994).
- Survey 434: 1974 ITE report on rocky shore ecology of Shetland (Institute of Terrestrial Ecology 1975a).

Littoral sites						
Survey	Site	Site name	Grid reference	Latitude/longitude	Biotopes recorded	
434	20	Swinster, Ronas Voe.	HU 320 806	60°30.5'N 01°25.0'W	YG; Ver.Ver; Pel; Fspi; FvesX; FserX; Ldig.Ldig	
434	79	S of Point of Quida-Stack, Ronas Voe.	HU 273 827	60°31.6'N 01°30.1'W	MytB, Ala.Myt	

Sublittoral sites					
<i>Survey</i>	<i>Site</i>	<i>Site name</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotopes recorded</i>
227	43A	Ronas Voe A.	HU 292 811	60°30.7'N 01°28.0'W	IMU
227	43B	Ronas Voe B.	HU 297 812	60°30.8'N 01°27.5'W	Lsac.Ft; LsacX
230	2	Ronas Voe.	HU 273 827	60°31.6'N 01°30.1'W	Ala.Myt; Lhyp
230	17	Swinster, Ronas Voe.	HU 320 806	60°30.5'N 01°25.0'W	FvesX; LsacX
261	143	Crying Taing, Ronas Voe.	HU 312 805	60°30.4'N 01°25.9'W	Aasp; ModHAs; LsacX
261	144	Waterfalls, the Brough, Ronas Voe.	HU 286 828	60°31.7'N 01°28.7'W	ModHAs; LsacX; EcorEns
261	145	Natural arch, NW of Scorie Geo, Ronas Voe.	HU 281 822	60°31.3'N 01°29.2'W	Lhyp.Ft; Ant
261	146	Stack of Weinnia - Neap, Ronas Voe.	HU 275 825	60°31.5'N 01°29.9'W	LsacSac; Lhyp.Ft; AlcByH
261	22	Ronas Voe (mouth).	HU 264 843	60°32.5'N 01°31.1'W	LhypR.Ft; Lsac.Pk; Oph
261	23	Ronas Voe (inner sill).	HU 302 807	60°30.5'N 01°27.0'W	Lsac.Ft; Lsac.Pk; ModHAs; Aasp
261	24	Pobie Sukka, Ronas Voe.	HU 305 806	60°30.5'N 01°26.6'W	Lsac.Ft; Lsac.Pk; AmenCio.Met; Aasp; IGS; Beg
382	37	E of Pobie Sukka, Ronas Voe.	HU 317 808	60°30.6'N 01°25.3'W	AbrNucCor
382	38	Skeo Head pier, Ronas Voe.	HU 308 806	60°30.5'N 01°26.3'W	AbrNucCor
382	39	Heylor pier, Ronas Voe.	HU 294 811	60°30.8'N 01°27.7'W	AbrNucCor

Compiled by: Christine Howson

26

Yell Sound (north)

Location

<i>Position (centre)</i>	HU 410 855	60°33.0'N 01°15.1'W
<i>Administrative area</i>	Shetland Islands	
<i>Conservation agency/area</i>	Scottish Natural Heritage	North Areas (Northern Isles)

Physical features

<i>Physiographic type</i>	Sound with voes
<i>Length of coast</i>	77.8 km
<i>Bathymetry</i>	50 m contour follows coast within 1 km of coast; maximum depth 102 m
<i>Wave exposure</i>	Very exposed at entrance to extremely sheltered in heads of inlets; mostly moderately exposed
<i>Tidal streams</i>	Very strong through centre of sound (maximum strength 7 knots); weak or negligible in voes
<i>Tidal range</i>	1.9 m (mean springs); 0.9 m (mean neaps)
<i>Salinity</i>	Fully marine

Introduction

Area 26 includes the northern 14 km of Yell Sound, which divides Mainland Shetland from Yell and is one of the major channels in the Shetland Islands. Yell Sound is about 26 km in length, with a north-east, south-west trend from the rocks of Ramna Stacks (*Area summary 25*) north of Point of Fethaland at its northern entrance to the peninsula of Lunna Ness in the south (see also *Area summary 27*). It has a rocky coastline with numerous small islands and rocks, and there are cliffs along much of the northern part of the area. There are several voes in this area, particularly on the Mainland shore, including Gluss, Burra and Southladi Voes, Quey Firth and Colla Firth. Sullom Voe (*Area summary 29*) opens into the southern boundary of Area 26. Strong tides of up to 7 knots run through the sound which reaches a maximum depth of 102 m, with much of the sea bed deeper than 50 m. The area is moderately exposed to wave action throughout most of its length, with very exposed conditions at its northern end.

Yell Sound is fringed by bedrock and boulder shores, many of which are steep or vertical, but there are sandy beaches in several of the more open bays and shingle overlying muddy sediment in more enclosed areas. In the sublittoral, steep rock on the islands gives way at about 25-30 m to boulder, cobble and pebble plains with coarse sand widespread. There is finer sand in the voes and mud outside the entrance to Sullom Voe.

The area is predominantly rural with roads and villages fringing the coast along both sides of the sound. Tankers approach Sullom Voe from the northern entrance to Yell Sound and so pass directly through Area 26. The treated ballast water discharge site for the Sullom Oil Terminal is located just inside the southern boundary of the area. Other coastal habitats include houbts at Queyfirth and North Haa on Burra Voe (Thorpe 1998), patches of saltmarsh and sand dunes. The area is surrounded by improved grassland and moorland with rough grazing, and some crops are grown. There are salmon *Salmo salar* and mussel *Mytilus edulis* farms in Bay of Ollaberry. The houses in the area have septic tanks with no centralised sewerage, but water quality is good.

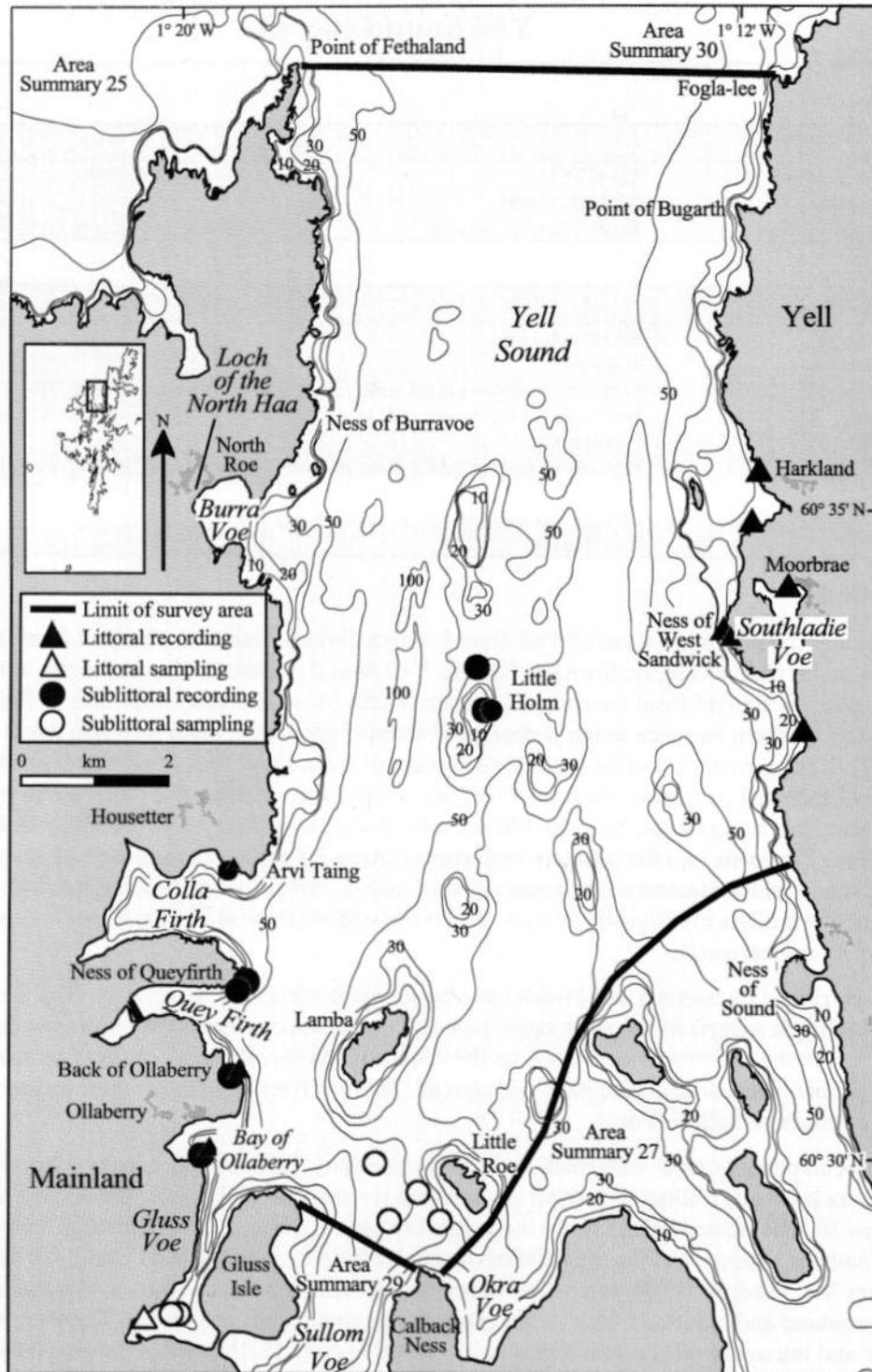


Figure 26.1 Main features of the area, showing sites surveyed.

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Marine biology

Marine biological surveys

	Survey methods	No. of sites	Date(s) of survey	Source
Littoral	Recording	3	1974	Institute of Terrestrial Ecology (1975a)
	Recording	6	1982	Williams, Cohen & Boyce (1983)
	Infaunal sampling (cores)	1	1984	Jones (1984)
Sublittoral	Recording	3	1974	Institute of Terrestrial Ecology (1975b), Earl (1982)
	Recording	5	1987	Moss & Ackers (1987)
	Infaunal sampling (grab)	2	1974-78	Pearson, Coates & Duncan (1994)
	Infaunal sampling (grab)	2	1978-81	Pearson, Coates & Duncan (1994)
	Infaunal sampling (grab)	2	1990	Pearson, Coates & Duncan (1994)

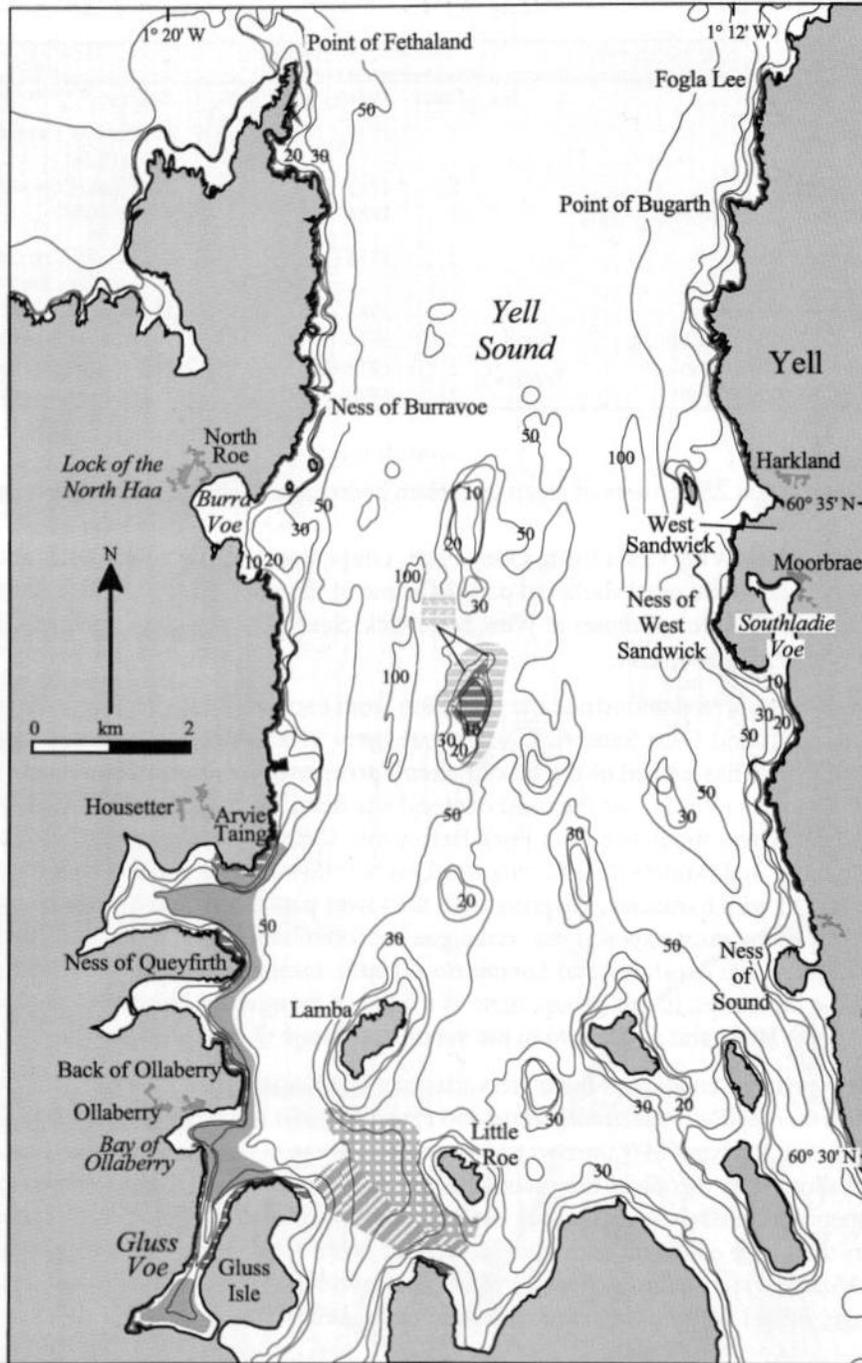
Littoral

The littoral zone in Area 26 consists of steep unbroken bedrock or bedrock and boulder on many of the shores bordering the sound and more gradually-sloping rocky shores inside the voes. There are shingle beaches in Burra Voe, Colla Firth, Quey Firth, Gluss Voe and West Sandwick and shingle overlying muddy sand in the most sheltered parts of some of the voes. There are also a number of clean sand beaches and there are dunes at West Sandwick. Several of the clean sand beaches have rocky outcrops surrounded by sand.

Shores surveyed in this area demonstrate the transition from exposed to sheltered conditions. In wave-exposed conditions around West Sandwick, yellow and grey lichens dominate the supralittoral (YG) whilst the littoral fringe has a band of the black lichen *Verrucaria maura* with scattered barnacles *Semibalanus balanoides* (Ver.B). At the most exposed site here, there is a mat of the red alga *Porphyra umbilicalis* over the lichen (Ver.Por). Below this, the eulittoral is animal-dominated with a zone of *S. balanoides* and limpets *Patella vulgata*. This is followed by a zone of small mussels *Mytilus edulis* mixed with barnacles, covering both the lower part of the mid-eulittoral and the lower eulittoral (MytB). At the most exposed site, red algae are found amongst the mussels in the lower eulittoral and kelps *Alaria esculenta* and *Laminaria digitata* dominate the sublittoral fringe (Ala.Ldig). At the other sites in this group, there is a band of thongweed *Himanthalia elongata* at the bottom of the shore (Him) and *L. digitata* in the sublittoral fringe (Ldig.Ldig).

In slightly more sheltered conditions there are variations on this pattern. At the southern side of Bay of Ollaberry, the fucoids *Pelvetia canaliculata* and *Fucus spiralis* are found in the lower littoral fringe (Pel; Fspi), replacing the band of *V. maura* and barnacles. There is then a pronounced band of limpets and barnacles followed by a zone of the fucoid *Fucus vesiculosus*, which occurs as a mosaic with barnacles, limpets and mussels on open rock between clumps of plants (FvesB). The fucoid *Fucus serratus* covers the lower eulittoral with various red and green algal species including *Cladophora rupestris* and *Mastocarpus stellatus* (Fser.R) whilst *L. digitata* is the main component of the sublittoral fringe, mixed with *Laminaria saccharina* (Lsac.Ldig).

On sheltered rock outcrops at the head of Southladies Voe, fucoid algae are more prominent and the mid-eulittoral is dominated by the fucoid *Ascophyllum nodosum* (Asc.Asc) with *F. serratus* in the lower eulittoral (Fser.Fser). Sand-covered and scoured rocks on the lower shore also have a mat of the filamentous red alga *Audouinella* sp. (Rho). Rock outcrops on a clean sand beach at Back of Ollaberry are dominated by *F. vesiculosus* and *L. digitata* with *Porphyra* sp., mussels, limpets and barnacles (Ldig.Ldig). At Arvie Taing in Colla Firth, there are a few rock outcrops on a shingle and sand beach. These are covered with black lichens in the littoral fringe, mussels and ephemeral algae including *Enteromorpha* sp. and *Porphyra* sp. in the mid-eulittoral and *F. serratus* in the lower eulittoral. The shingle and upper eulittoral rock are dominated by barnacles and limpets with large numbers of littorinids in crevices in the rock and between the stones (BLlit).



	Littoral rock with mussels and barnacles (VerPor; MytB; Ala.Ldig)		Circularittoral rock with sparse fauna (FaAIC)
	Littoral rock with barnacles, fucoids and red algae (MytB; BPat; BPat.Sem; FvesB; Fser.R; Lsac.Ldig)		Circularittoral rock or mixed substrata with dense brittlestars (Oph)
	Littoral rock with dense fucoid algae (Pel; Fspi; Asc.Asc; Fser.Fser)		Infralittoral gravels and sands (IGS)
	Littoral muddy sand with bivalves		Infralittoral muddy sands (IMS)
	Kelp <i>Laminaria hyperborea</i> with dense red algae (Lhyp.Ft; Lhyp.Pk)		Sublittoral muddy sand with polychaetes (SpiSpi)
	Infralittoral rock with mixed kelps and scour-tolerant algae (XKScrR)		Sublittoral soft, stable mud with seapens and crustaceans (SpMeg)

< **Figure 26.2** Indicative distribution of the main biotopes in the area (based on data from survey sites shown in Figure 26.1, cited literature and additional field observations).

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There are records for the infauna of one sediment beach in Area 26, gravelly sand at the head of Gluss Voe. This contains polychaete worms such as *Pygospio elegans* and *Eurydice pulchra* and the cockle *Cerastoderma edule*, with the mud-snail *Hydrobia ulvae* on the surface (PCer).

Sublittoral

Steep bedrock and boulder slopes drop to a cobble, gravel and coarse sand sea bed at about 25-30 m depth around the islands in the centre of Area 26. The depth of the rock-sediment boundary is shallower between Colla Firth and Gluss Isle, with finer sand and shell-gravel beginning in depths of 10-20 m. In deeper water outside the entrance to Sullom Voe, there is shelly mud with finer mud at the head of Gluss Voe. Strong tidal streams have the greatest influence on biotopes in the centre of Yell Sound.

The infralittoral is dominated by kelp forests and then park of *Laminaria hyperborea*, reaching about 27 m depth around the islands in the centre of Yell Sound (Lhyp.Ft; Lhyp.Pk). *Laminaria saccharina* may be co-dominant with *L. hyperborea* in the lower infralittoral and, in the strong tidal streams around Little Holm, scour-tolerant hydroids such as *Sertularia argentea* and *Abietinaria abietina* are frequent (FaAIC). The brittlestar *Antedon bifida*, dead-man's fingers *Alcyonium digitatum*, keel worm *Pomatoceros triqueter* and the ascidian *Ascidia mentula* are common in this tide-swept lower infralittoral and there are numerous urchins *Echinus esculentus* (Ant). In more wave-sheltered and slightly less tide-swept conditions on the mainland coast, the maximum depth of the kelp is shallower, reaching 10-15 m, and in places it is limited by the depth of available hard substrata. At these sites, *L. hyperborea* forest reaches 6-8 m depth with a mixture of kelp species and the brown alga *Desmarestia aculeata* deeper (XKScrR).

There is little information for circalittoral rock in Area 26, as rock and boulders grade into coarse mixed substrata around the islands and headlands influenced by the strong tidal streams. Around Little Holm, bedrock gives way to boulders, cobbles, pebbles and coarse shell-sand at about 25-30 m depth, and at the entrance to Quey Firth, there is a similar mixed substrata slope at 20 m. This circalittoral mixed cobble and sediment is heavily grazed and dominated by the horse mussel *Modiolus modiolus* and the brittlestar *Ophiocomina nigra* with beds of the brittlestar *Ophiothrix fragilis* from about 30 m downwards (Oph). Where brittlestars are absent, species encrusting the rock surfaces include coralline algae, *P. triqueter*, the bryozoan *Parasmittina trispinosa*, the tubeworm *Salmacina dysteri* and *A. digitatum* and frequent hydroids such as *S. argentea* and echinoderms (FaAIC).

On the south side of the headland at the entrance to Quey Firth, which is subject to moderate tidal streams, rock and boulders supporting kelp gives way to a shallow slope of coarse muddy sand and shell debris in 10-20 m depth (XKScrR). This is covered with a meadow of the red alga *Phycodryis rubens* and has scattered plants of both *L. hyperborea* and *L. saccharina* (LsacX). The sediment contains the razor clam *Ensis arcuatus* and occasional *M. modiolus* (IGS). This grades into the coarse mixed sediment with horse mussels and brittlestars described above (Oph).

At Arvi Taing in Colla Firth, rock adjacent to a sand beach reaches about 5 m depth where it gives way to a clean sand slope which drops sharply to 20 m. There is a similar sea bed at Back of Ollaberry, although the rock-sand boundary here is at 14 m (IGS). At both sites, coarse sand supports a diverse fauna with a range of bivalves including *E. arcuatus*, *Lutraria lutraria*, *Mya truncata*, *Venerupis rhomboides* and *Dosinia exoleta*. Lugworm *Arenicola marina*, sand mason worm *Lanice conchilega*, burrowing echinoderms *Amphiura brachiata* and *Echinocardium cordatum* and the anemone *Cerianthus lloydii* are common in the sand. Species such as starfish *Astropecten irregularis* and *Luidia ciliaris*, the crab *Atelecyclus rotundatus* and the topshell *Gibbula magus* are found on the sediment surface.

In deeper water between the entrance to Sullom Voe, Lamba and Little Roe, poorly-sorted mud with a high organic content contains a rich polychaete fauna including species such as *Prionospio malmgreni*, *Myriochele* sp., *Apistobranchus tullbergi*, *Exogone* spp. and *Glycera alba* (SpMeg). Other infauna include bivalves *Thyasira flexuosa* and *Clausinella fasciata* and amphipods *Urothoe elegans* and *Ampelisca tenuicornis*. Shallower muddy sand at the head of Gluss Voe contains bivalves *T. flexuosa*, *Corbula gibba* and *Mysella bidentata* and polychaetes such as *A. tullbergi*, *Scalibregma inflatum* and *Pholoe inornata* (IMS).

Nature conservation

Conservation sites

Site name	Status	Main features
Yell Sound Coast	SSSI; cSAC	Marine interest for otters <i>Lutra lutra</i>
Shetland: Fethaland	NSA	Landscape
Shetland Islands	ESA	Agri-environmental scheme

Human influences

Coastal developments and uses

The area is predominantly rural with roads fringing the coast along both sides of Yell Sound. There are several villages with scattered linear developments of housing along these roads with the major settlements being at North Roe, Housetter and West Sandwick. Houses have septic tanks with no centralised sewerage, but water quality is good. The area is surrounded by improved grassland and moorland with rough grazing, and some crops are grown.

There is a sand and gravel quarry at Quey Firth.

Marine developments and uses

A pier in Colla Firth is used by both fishing and commercial vessels and the voes are used as anchorages. Potting for crustaceans takes place in the inshore rocky areas and there is fishing for queen scallops *Aequipecten opercularis*. There are salmon *Salmo salar* and mussel *Mytilus edulis* farms in Bay of Ollaberry.

Oil tankers using Sullom Voe normally approach from the northern entrance to Yell Sound and so pass directly through Area 26. The treated ballast water discharge site for the Sullom Oil Terminal is located just outside the northern boundary of Area 26, off Calback Ness at the entrance to Orka Voe. This discharge site has a maximum consented daily effluent volume of 60,000 m³.

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- Survey 230 1974 ITE report on sublittoral biota of Shetland (Institute of Terrestrial Ecology 1975b, Earll 1982).
- Survey 376 1982 Leicester Polytechnic littoral survey of the approaches to the Shetland Oil Terminal (Williams, Cohen & Boyce 1983).
- Survey 378 1978-81 BP sublittoral survey of Sullom Voe Oil Terminal effluent discharge site (Pearson, Coates & Duncan 1994).
- Survey 379 1984 OPRU sublittoral monitoring in Sullom Voe (Westwood 1985; Pearson, Coates & Duncan 1994).
- Survey 380 1984 SOTEAG littoral survey in Dales Voe and Gluss Voe, Shetland 1984 (Jones 1984).
- Survey 382 1974/78 SOTEAG sublittoral grab sample surveys in Shetland (Pearson, Coates & Duncan 1994).
- Survey 434 1974 ITE report on rocky shore ecology of Shetland (Institute of Terrestrial Ecology 1975).

Littoral sites					
Survey	Site	Site name	Grid reference	Latitude/longitude	Biotores recorded
376	2	N of West Sand Wick beach, Yell Sound.	HU 443 895	60°35.2'N 01°11.4'W	Ver.Ver; Ver.Por; MytB; BPat; Ala.Ldig
376	7	Taing of Noustigarth, Yell Sound.	HU 442 888	60°34.8'N 01°11.6'W	YG; Ver.Ver; MytB; BPat; BPat.Sem; Him; Ldig.Ldig
376	9	Ness of West Sandwick, Yell Sound.	HU 438 873	60°34.0'N 01°12.0'W	YG; Ver.B; Ver.Ver; BPat; BPat.Sem
376	10	Near Longi Geo, Yell Sound.	HU 439 872	60°33.9'N 01°11.9'W	Ver.B; Ver.Ver; MytB; BPat.Sem; BPat
376	14	S of Markna Geo, Yell Sound.	HU 449 859	60°33.2'N 01°10.8'W	YG; Ver.B; Ver.Ver; BPat.Sem
376	30	NE Southladie Voe, Yell Sound.	HU 447 879	60°34.3'N 01°11.0'W	YG; Ver; Pel; Fspi; Asc.Asc; Rho; Fser.Fser
380	2	W head of Gluss Voe.	HU 358 777	60°28.9'N 01°20.9'W	PCer
434	12	Arvi Taing, Colla Firth, Yell Sound.	HU 370 840	60°32.3'N 01°19.5'W	Ver.Ver; BLlit; EphX; Fser.Fser
434	17	East Ness, Yell Sound.	HU 366 800	60°30.1'N 01°20.0'W	Ver.Ver; Pel; Fspi; PelB; BPat.Sem; FvesB; Fser.R; Lsac.Ldig
434	57	Back of Ollaberry, Yell Sound.	HU 370 811	60°30.7'N 01°19.5'W	Ldig.Ldig

Sublittoral sites					
<i>Survey</i>	<i>Site</i>	<i>Site name</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotores recorded</i>
379	12	W of Little Roe, Yell Sound.	HU 390 799	60°30.1'N 01°17.3'W	SpMeg
379	34	N of Roe Clett, Sullom Voe.	HU 392 791	60°29.6'N 01°17.1'W	SpiSpi
378	1	W of Little Roe, Sullom Voe.	HU 396 795	60°29.8'N 01°16.7'W	SpMeg
378	2	N of Skaw Taing, Sullom Voe.	HU 399 791	60°29.6'N 01°16.4'W	VirOph
382	35	NW of Gluss Ayre, Gluss Voe.	HU 363 778	60°28.9'N 01°20.3'W	IMS
382	36	E of Nissetter, Gluss Voe.	HU 362 778	60°28.9'N 01°20.4'W	IMU
227	24	NE Little Holm, Yell Sound.	HU 405 862	60°33.4'N 01°15.6'W	XKScrR
227	25	E Little Holm, Yell Sound.	HU 406 862	60°33.4'N 01°15.5'W	Lhyp.Pk; Oph
227	26	N Little Holm, Yell Sound.	HU 404 868	60°33.7'N 01°15.7'W	FaAlC; Oph; Ant
227	27A	Ness of Queyfirth A, Yell Sound.	HU 373 825	60°31.5'N 01°19.2'W	XKScrR; Oph
227	27B	Ness of Queyfirth B, Yell Sound.	HU 372 824	60°31.4'N 01°19.3'W	Lhyp.Ft; LhypGz.Ft; XKScrR; IGS; LsacX
230	1	East Ness A, Yell Sound.	HU 366 800	60°30.1'N 01°20.0'W	LsacSac; Lhyp.Ft
230	4	Back of Ollaberry, Yell Sound.	HU 370 811	60°30.7'N 01°19.5'W	Lhyp.Ft; XKScrR
230	5	Arvi Taing, Colla Firth, Yell Sound.	HU 370 840	60°32.3'N 01°19.5'W	Lhyp

Compiled by: Christine Howson

27

Yell Sound (south)

Location

Position (centre)	HU 460 765	60°28.2'N 01°09.8'W
Administrative area	Shetland Islands	
Conservation agency/area	Scottish Natural Heritage	North Areas (Northern Isles)

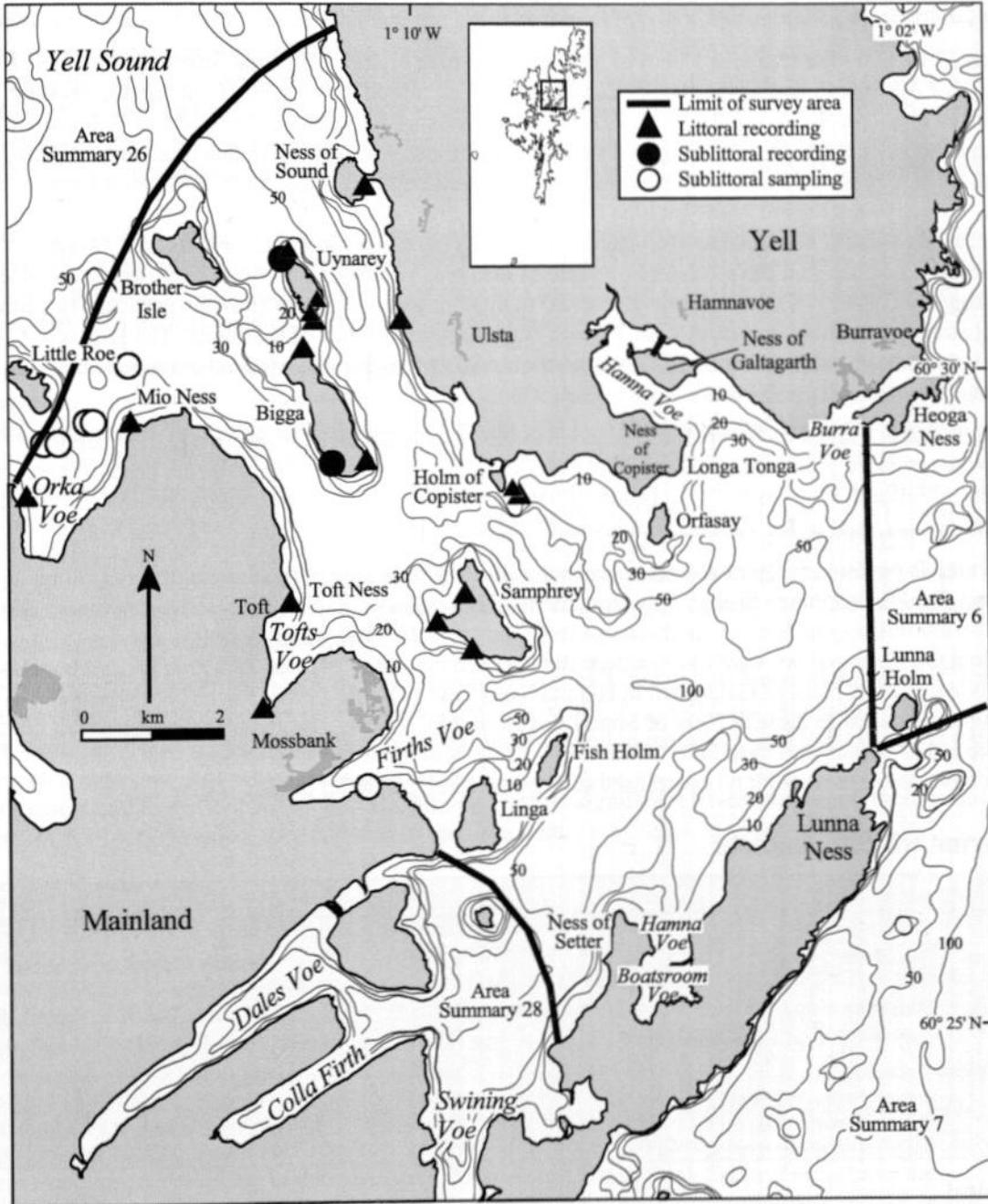


Figure 27.1 Main features of the area, showing sites surveyed.

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Physical features	
<i>Physiographic type</i>	Sound; voes
<i>Length of coast</i>	82 km
<i>Bathymetry</i>	Maximum depth 106 m in eastern part of area; 60 m in northern and western parts
<i>Wave exposure</i>	Very exposed at entrance to extremely sheltered in heads of inlets; mostly moderately exposed
<i>Tidal streams</i>	Very strong through centre of sound (maximum strength 7 knots); weak or negligible in voes
<i>Tidal range</i>	1.9 m (mean springs); 0.9 m (mean neaps)
<i>Salinity</i>	Fully marine

Introduction

Area 27 includes the southern 12 km of Yell Sound, which divides Mainland Shetland from Yell and is one of the major channels in the Shetland Islands. Yell Sound is about 26 km in length, trending more or less north to east from the rocks of Ramna Stacks (*Area summary 25*) north of Point of Fethaland at its northern entrance (*Area summary 26*) to the peninsula of Lunna Ness in the south-east. It has a rocky coastline with numerous small islands and rocks, and there are several voes on both shores of the sound. These include Hamna and Burra Voes on Yell and Orka, Tofts, Firths and Hamna/Boatsroom Voes on the Mainland side. Dales Voe, Colla Firth and Swining Voe (*Area summary 28*) open into the southern boundary of the area. Yell Sound becomes narrower at the island of Bigga and shallows from a depth of over 60 m to 35 m south of Bigga and thus particularly strong tidal streams, reaching speeds of over 7 knots, flow through this part of the sound. The area is moderately exposed to wave action throughout most of its length, with exposed conditions between Lunna Ness and Heoga Ness.

Yell Sound is fringed by bedrock and boulder shores, many of which are steep, and there are long stretches of more gradually-sloping boulder and shingle with muddier shingle at the head of the voes. In the sublittoral, steep rock on the islands gives way at about 25-30 m to boulder, cobble and gravel. There is finer sand in the voes and muddy sand and shell-gravel at the entrance to Orka Voe.

The area is predominantly rural with roads and villages fringing the coast along both sides of the sound. Tankers approach Sullom Voe from the northern entrance to Yell Sound (*Area summary 26*) and so are unlikely to use this southern channel. The treated ballast water discharge site for the Sullom Oil Terminal is located just outside the northern boundary of Area 27. Other coastal habitats include a houb at Ness of Galtagarth in Hamna Voe (Yell) (Thorpe 1998), patches of saltmarsh and shingle spits such as those at Ness of Sound and Holm of Copister. The area is surrounded by improved grassland and moorland with rough grazing, and some crops are grown. The houses in the area have septic tanks with no centralised sewage disposal, but water quality is good.

Marine wildlife features

Marine surveys				
	<i>Survey methods</i>	<i>No. of sites</i>	<i>Date(s) of survey</i>	<i>Source</i>
<i>Littoral</i>	Recording	2	1974	Institute of Terrestrial Ecology (1975)
	Recording	13	1982	Williams, Cohen & Boyce (1983)
	Recording	2	1995	Moore & Little (1995)
<i>Sublittoral</i>	Recording	2	1987	Howson (1988)
	Infaunal sampling (grab)	1	1974-78	Pearson, Coates & Duncan (1994)
	Infaunal sampling (grab)	2	1978-81	Pearson, Coates & Duncan (1994)
	Infaunal sampling (grab)	3	1990	Pearson, Coates & Duncan (1994)

Littoral

The littoral zone in Area 27 is a combination of steep unbroken bedrock or bedrock and boulder shores and long stretches of more gradually-sloping boulder, cobble and shingle shores. These shingle shores may have boulders on the mid-and lower shore. In the greater shelter of the voes there is

shingle overlying muddy sand, and this becomes increasingly prevalent towards the most sheltered parts of the voes and where streams enter.

Bedrock shores around the islands in general support a zonation pattern characteristic of moderately exposed conditions and they demonstrate the transition to sheltered conditions. In wave-exposed conditions around Bigga, yellow and grey lichens dominate the supralittoral (YG) whilst the littoral fringe has a band of the black lichen *Verrucaria maura* (Ver.Ver). At the most exposed site here, on the northern tip of Uynarey, there is a mat of the red alga *Porphyra umbilicalis* over the lichen (Ver.Por). Below this, the eulittoral is animal dominated with a zone of *S. balanoides* and limpets *Patella vulgata* (BPat.Sem). This is followed by a zone of small mussels *Mytilus edulis* which covers both the lower part of the mid-eulittoral and the lower eulittoral (MytB). The composition of this zone varies around the island. On the northern tip, the fucoid *Fucus vesiculosus* is present as scattered clumps in the mid-eulittoral forming a mosaic with barnacles, limpets and mussels on the open rock between the plants, and red algae are found amongst the mussels in the lower eulittoral. On the south-eastern corner there are mussels and barnacles and no *F. vesiculosus* whilst on the south-western corner red algae are abundant. Similar patterns are seen on the north-facing shores of Samphrey and Bigga, on the adjacent coast of Yell and on the east-facing shore of Holm of Copister, in the eastern entrance to the area. Black lichens give way to a zone of barnacles and limpets with the brown algae *Himanthalia elongata* and *Fucus serratus* in the lower eulittoral (Him) and kelp *Laminaria digitata* in the sublittoral fringe (Ldig.Ldig). However, at the more sheltered of these sites, on Samphrey and Bigga, there is a narrow band of the fucoid *Pelvetia canaliculata* in the upper eulittoral (Pel).

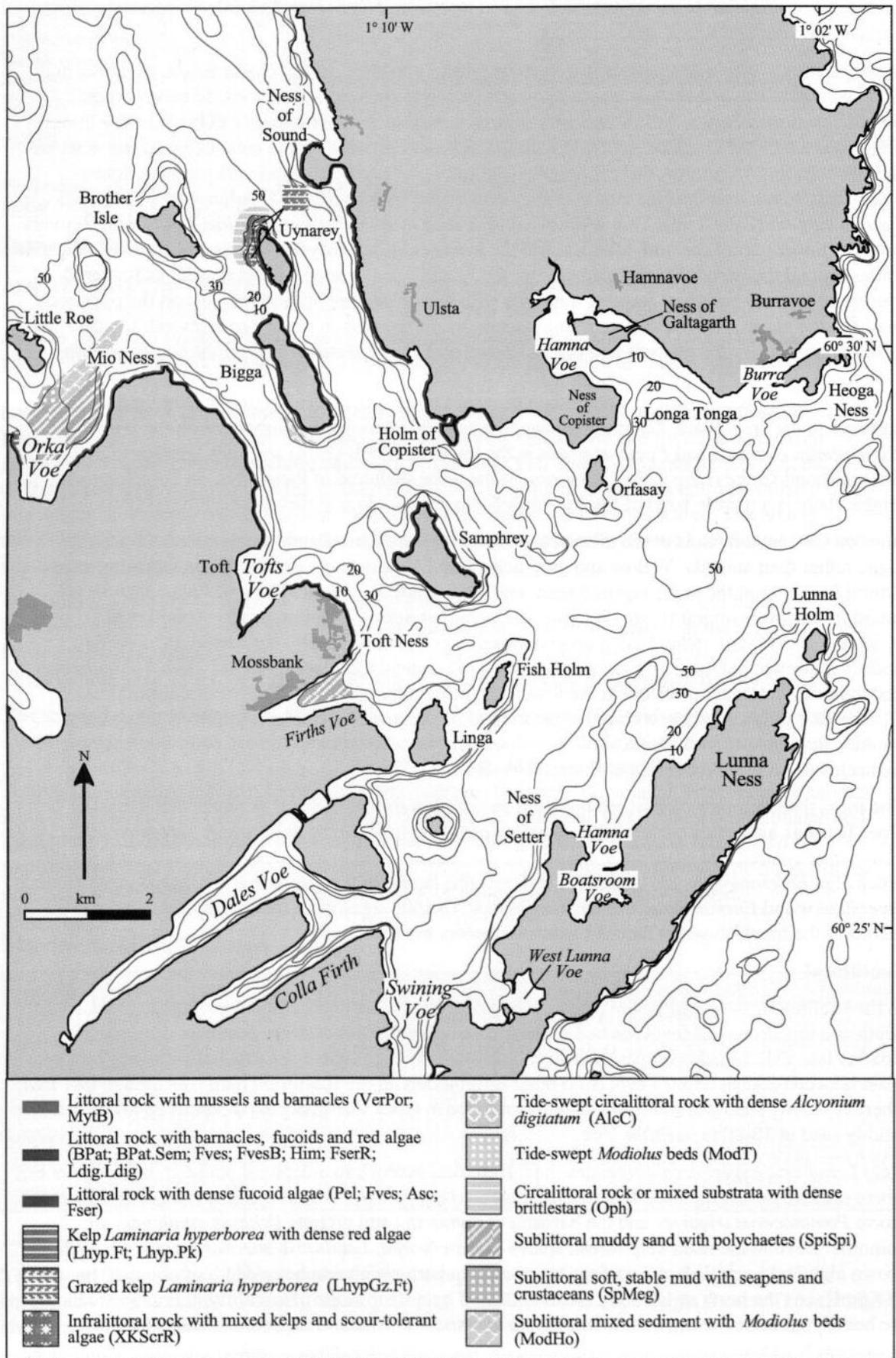
Sites on the southern ends of the islands and sheltered behind headlands are dominated by fucoid algae rather than animals. Yellow and grey lichens and *V. maura* are present in the supralittoral and littoral fringe, as at the more exposed sites, and the fucoids *P. canaliculata* and *Fucus spiralis* are found in the lower littoral fringe (Pel; Fspi). The mid-eulittoral is dominated by a blanket of *F. vesiculosus* (Fves), rather than a broken mosaic, on Uynarey, and by the fucoid *Ascophyllum nodosum* elsewhere (Asc.Asc). On most of these more sheltered shores, there is a band of barnacles and mussels on steeper rock and in the lower part of the mid-eulittoral. The lower eulittoral has *H. elongata* and *F. serratus* with red algae such as *Mastocarpus stellatus* (Fser.R). A shingle and boulder shore at Toft Ness has a similar composition but with an open canopy of *F. vesiculosus* and barnacles on cobbles in the mid-eulittoral (FvesB).

The most sheltered shore for which there are records is a stream bed and its banks at the head of Tofts Voe. This has a zonation pattern of *P. canaliculata*, *F. spiralis*, *F. vesiculosus*, *A. nodosum* and *F. serratus* on rock and boulders at the side of the stream. Sand in the stream bed itself supports the green alga *Enteromorpha* sp. on stones, and contains lugworm *Arenicola marina*, polychaetes *Hediste diversicolor* and *Eurydice pulchra* and amphipods. Despite significant freshwater input, there is no record of the brackish-water fucoid *Fucus ceranoides* here.

Sublittoral

In the sublittoral, steep bedrock at the north end of Uynarey becomes a boulder slope at about 16 m depth and this drops to a level sea bed of cobble and gravel at about 27 m. South of Uynarey and Brother Isle Yell Sound becomes shallower, and south of Bigga there is a gradually-sloping boulder plain between 20 and 25 m. There is no other information on the sublittoral hard substrata in this area. There is muddy sand and shell-gravel at the entrance to Orka Voe in depths of about 20-40 m and muddy sand at 15-20 m in Firths Voe.

Kelp *Laminaria hyperborea* dominates the infralittoral bedrock to a depth of about 16 m (LhypGz.Ft). There are few foliose algae on the rock beneath the kelp canopy, with the rock encrusted by the keel worm *Pomatoceros triquetus* and the barnacle *Balanus* sp., and urchins *Echinus esculentus* are common. Beyond the main kelp forest, sparse *L. hyperborea*, *Laminaria saccharina* and the bushy brown alga *Desmarestia aculeata* form an open kelp park which reaches a depth of about 20 m (XKScrR). At the north of Uynarey this is followed by a steep slope of circalittoral boulders which are heavily grazed by a large number of *E. esculentus*. The boulders support red and brown algal crusts, the bryozoan *Parasmittina trispinosa*, the cup coral *Caryophyllia smithii* and large numbers of



< **Figure 27.2** Indicative distribution of the main biotopes in the area (based on data from survey sites shown in Figure 27.1, cited literature and additional field observations).

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the brittlestar *Ophiocomina nigra*. There are occasional horse mussels *Modiolus modiolus* between the boulders. In a similar depth range south of Bigga, where the angle of slope is less pronounced, boulders support dead-man's fingers *Alcyonium digitatum* and the sponge *Cliona celata* with brittlestars and the edible crab *Cancer pagurus* between boulders (AlcC).

In both cases, as the slope levels out there is more cobble and gravel amongst the boulders, and the brittlestar *Ophiothrix fragilis* forms a dense bed over the cobbles (Oph). South of Bigga, the cobble and gravel plain is shallower, in about 19-20 m, and *M. modiolus* are abundant, becoming scarcer with increasing depth. In this shallower depth the red alga *Phycodrys rubens* grows luxuriantly over the mussels, obscuring the associated community (ModT).

At the entrance to Orka Voe, *M. modiolus* occurs in sand and shell-gravel around the south end of Little Roe (ModHo). The diverse faunal community associated with this is characterised by the bivalve *Gari tellinella*, the polychaete *Glycera lapidum* and *Aonides paucibranchiata*, the amphipods *Leptocheirus hirsutimanus* and *Urothoe elegans* and the brittlestar *Amphipholis squamata*. In slightly deeper water at adjacent sites muddy sand and shell-gravel contains bivalves *Thyasira flexuosa* and *Abra prismatica*, polychaetes *Prionospio malmgreni*, *Pisione remota*, *Exogone hebes* and *Spio armata*, and the echinoderm *Echinocyamus pusillus* (SpiSpi). Muddier sand and gravel in Firths Voe contains bivalves *Clausinella fasciata* and *T. flexuosa*, the polychaete *Myriochele* sp. and the amphipod *Urothoe elegans*.

Nature conservation

Conservation sites		
Site name	Status	Main features
Yell Sound Coast	SSSI; cSAC	Marine interest for otters <i>Lutra lutra</i>
Shetland Islands	ESA	Agri-environmental scheme

Human influences

Coastal developments and uses

Area 27 is predominantly rural with roads and villages fringing the coast along both sides of Yell Sound. The houses in the area have septic tanks with no centralised sewerage, but water quality is good. The area is surrounded by improved grassland and moorland with rough grazing, and some crops are grown.

The head of Orka Voe is claimed land, with a landfill site for inert wastes. There are also two pits licensed for disposal of oily wastes, one of which (now sealed) has been used, for waste from the 1978 *Esso Bernicia* oil-spill.

Marine developments and uses

Tankers approach Sullom Voe from the northern entrance to Yell Sound (*Area summary 26*) and so are very unlikely to use this southern channel. The treated ballast water discharge site for the Sullom Oil Terminal is located just outside the northern boundary of the area, off Calback Ness at the entrance to Orka Voe (*Area summary 26*). This discharge site has a maximum consented daily effluent volume of 60,000 m³. Major oil pipelines make landfall at Firths Ness and Firths Voe.

A ferry runs between Toft on Mainland and Ulsta on Yell and there are additional piers at Burravoe and a jetty at Mossbank. Several of the voes are used as anchorages.

Potting for crustaceans takes place throughout the area and there is fishing for queen scallops *Aequipecten opercularis*. There are salmon *Salmo salar* farms in the south of Area 27.

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Sites surveyed

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- Survey 376: 1982 Leicester Polytechnic littoral survey of the approaches to the Shetland Oil Terminal (Williams, Cohen & Boyce 1983).
- Survey 378: 1978-81 BP sublittoral survey of Sullom Voe Oil Terminal effluent discharge site (Pearson, Coates & Duncan 1994).
- Survey 379: 1984 OPRU sublittoral monitoring in Sullom Voe (Westwood 1985; Pearson, Coates & Duncan 1994).
- Survey 382: 1974/78 SOTEAG sublittoral grab sample surveys in Shetland (Pearson, Coates & Duncan 1994).
- Survey 434: 1974 ITE report on rocky shore ecology of Shetland (Institute of Terrestrial Ecology 1975).
- Survey 736: 1995 OPRU littoral survey of Sullom Voe (Moore & Little 1995).

Littoral sites					
<i>Survey</i>	<i>Site</i>	<i>Site name</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotopes recorded</i>
376	1	Niv of Uynarey Island, Yell Sound.	HU 440 815	60°30.9'N 01°11.9'W	YG; Ver.Ver; Ver.Por; BPat; MytB
376	3	Geo SW of Clothan, Yell Sound.	HU 456 805	60°30.3'N 01°10.1'W	YG; Ver.Ver; BPat; BPat.Sem
376	5	SW Uynarey Island, Yell Sound.	HU 443 805	60°30.3'N 01°11.6'W	YG; Ver.Ver; BPat; BPat.Sem; Mas
376	6	E Uynarey Island, Yell Sound.	HU 444 808	60°30.5'N 01°11.4'W	YG; Ver.Ver; MytB; BPat; BPat.Sem
376	11	E Copister Broch, Yell Sound.	HU 473 780	60°29.0'N 01°08.3'W	YG; Ver.Ver; Ver.B; BPat.Sem; Him; Ldig.Ldig
376	15	Easter Land Taing, Bigga, Yell Sound.	HU 442 801	60°30.1'N 01°11.7'W	YG; Ver.Ver; Pel; BPat.Sem; BPat; Fser.R
376	16	W Helliack, Samphrey Island, Yell Sound.	HU 465 766	60°28.2'N 01°09.2'W	Him; YG; Ver.Ver; Pel; BPat; BPat.Sem
376	18	South Wick of Sound, Yell Sound.	HU 451 824	60°31.3'N 01°10.7'W	YG; Ver.Ver; Pel; PelB; Fspi; BPat; BPat.Sem; Fves; Him
376	20	N Copister Broch, Yell Sound.	HU 472 781	60°29.0'N 01°08.4'W	YG; Ver.Ver; Pel; Fspi; BPat.Sem; Asc.Asc; Him; Fser.R
376	21	SW Samphrey Island, Yell Sound.	HU 466 758	60°27.8'N 01°09.1'W	YG; Ver.Ver; Pel; Fspi; BPat; BPat.Sem; Asc.Asc; Fser.Fser
376	22	SE Uynarey Island, Yell Sound.	HU 443 806	60°30.4'N 01°11.6'W	YG; Ver.Ver; Pel; Fspi; BPat.Sem; Asc.Asc; YG; Ver.Ver; PelB; Pel; Fspi; BPat.Sem; Asc.Asc; Him
376	24	Bunglan, Samphrey Island, Yell Sound.	HU 461 762	60°28.0'N 01°09.6'W	YG; Ver.Ver; PelB; Pel; Fspi; BPat.Sem; Asc.Asc; Him
376	25	SE Bigga Island, Yell Sound.	HU 451 785	60°29.2'N 01°10.7'W	YG; Ver.Ver; Pel; Fspi; BPat.Sem; Asc.Asc
434	8	Grunnavoe, Tofts Voe, Yell Sound.	HU 436 750	60°27.4'N 01°12.4'W	YG; Ver.Ver; Pel; Fves; Asc; Fser; LMS
434	13	Toft Ness, Yell Sound.	HU 440 765	60°28.2'N 01°11.9'W	Ver.Ver; Fspi; FvesB; Fves; Him; Fser.R; Ldig.Ldig
736	1	West of Mio Ness (report site 1.1), Sullom Voe.	HU 418 790	60°29.5'N 01°14.3'W	Ver.Ver; MytB; BPat; Cor
736	3	South of Swarta Taing (OPRU site 3.5), Sullom Voe.	HU 401 779	60°29.0'N 01°16.2'W	YG; Ver.Ver; Pel; MytB; Fser.R

Sublittoral sites					
<i>Survey</i>	<i>Site</i>	<i>Site name</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotopes recorded</i>
261	121	West of Bigga ruins, Yell Sound.	HU 446 785	60°29.3'N 01°11.3'W	AlcC; ModT
261	122	NW Uynarey, Yell Sound.	HU 439 814	60°30.8'N 01°12.0'W	LhypGz.Ft; XKScrR; Oph
379	35	Mouth of Orka Voe.	HU 405 788	60°29.5'N 01°15.7'W	SpiSpi
379	36	E of S Little Roe, Yell Sound.	HU 411 791	60°29.6'N 01°15.0'W	ModHo
379	37	N of W Mio Ness, Yell Sound.	HU 417 799	60°30.0'N 01°14.3'W	ModHo
378	3	N of Orka Voe, Sullom Voe.	HU 407 788	60°29.4'N 01°15.5'W	IMX
378	4	Between Mio Ness and Little Roe, Sullom Voe.	HU 412 791	60°29.6'N 01°15.0'W	SpiSpi
382	40	SW of the mouth of Firths Voe.	HU 451 739	60°26.8'N 01°10.7'W	SpiSpi

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28

Dales Voe, Colla Firth and Swining Voe

Location

Position (centre)	HU 460 705	60°24.9'N 01°09.8'W
Administrative area	Shetland Islands	
Conservation agency/area	Scottish Natural Heritage	North Areas (Northern Isles)

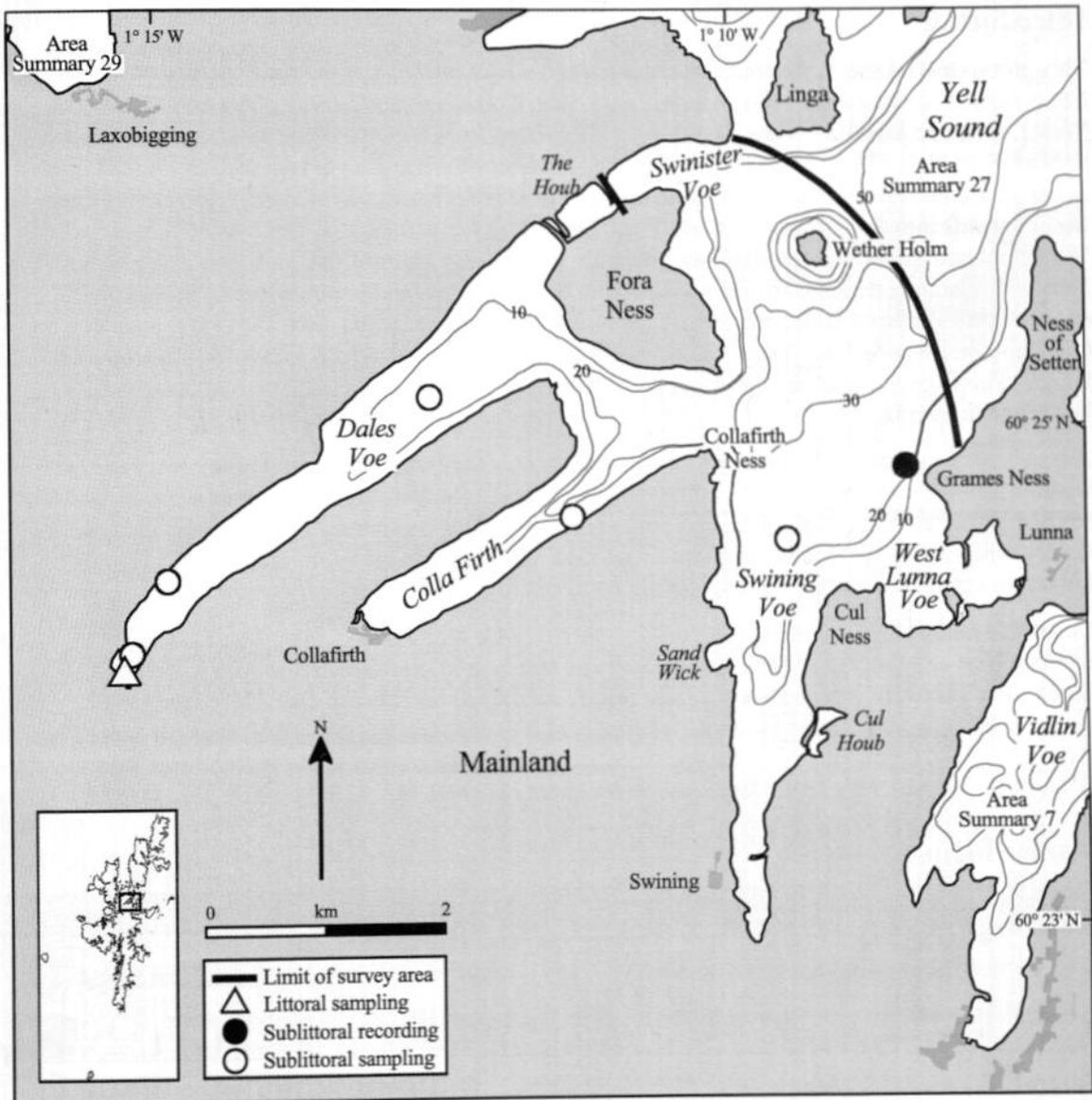


Figure 28.1 Main features of the area, showing sites surveyed.

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Physical features	
<i>Physiographic type</i>	Voes
<i>Length of coast</i>	42.2 km
<i>Area of inlet</i>	Swinister Voe (including houb): 0.32 km ² ; Dales Voe: 2.9 km ² ; Colla Firth: 2.2 km ² ; Swining Voe: 1.6 km ² ; West Lunna Voe: 0.9 km ² .
<i>Bathymetry</i>	Maximum depth in Swinister Voe 17 m; Dales Voe 36 m; Colla Firth 51 m; Swining Voe 35 m; West Lunna Voe 20 m. Depth of over 50 m east of Fora Ness.
<i>Wave exposure</i>	Moderately exposed at entrance to ultra-sheltered; mostly sheltered
<i>Tidal streams</i>	Negligible
<i>Tidal range</i>	1.9 m (mean springs); 0.9 m (mean neaps)
<i>Salinity</i>	Fully marine, with localised areas of variable salinity

Introduction

This group of voes lies at the southern entrance to Yell Sound, west of the rocky peninsula of Lunna Ness. Area 28 includes the major voes of Dales Voe, Colla Firth and Swining Voe and the smaller West Lunna and Swinister Voes. Dales Voe is separated from Swinister Voe by an unusual triple bar houb at Fora Ness (Thorpe 1998) and there are a number of other shingle bars with associated houb in the area. The area reaches a maximum depth of over 50 m to the east of Fora Ness and this deep water extends into the entrance of Colla Firth. Dales Voe has a maximum depth of 36 m and Swining Voe 35 m, and the entire area shallows gradually towards the heads of the voes. The east coast of Fora Ness is moderately exposed to wave action from the north-east but the remainder of the area is enclosed and sheltered with a number of shallow, ultra-sheltered basins such as West Lunna Voe and Cul Houb on Swining Voe. Tidal streams are generally negligible and the area is fully marine, with localised areas of variable or low salinity where streams enter or in enclosed basins, notably the voe heads and the houb.

The entire area is fringed by bedrock, boulders and cobble with bedrock around Fora Ness and on the headlands at the voe entrances and boulders, shingle and mixed muddy sediment within the voes. The sea bed is floored by poorly-mixed and predominantly muddy sediments which become increasingly muddy with depth. There is no information on hard substratum in the sublittoral, but this is probably limited in extent and, within the voes, confined to shallow water.

Dales Voe and Colla Firth are surrounded by steep hillside with lower-lying ground to the east of Swining Voe and there is an area of saltmarsh and wet coastal grassland in the glen at the head of Dales Voe. There are few roads apart from one along the hillside west of Dales Voe, and only scattered housing, and most of the surrounding land is rough grazing. A pier at Collafirth is used by both fishing and commercial vessels and there are salmon *Salmo salar* farms in Swinister Voe and Colla Firth. Houses have septic tanks and water quality is good.

Marine biology

Marine biological surveys

	<i>Survey methods</i>	<i>No. of sites</i>	<i>Date(s) of survey</i>	<i>Source</i>
<i>Littoral</i>	Infaunal sampling (cores)	1	1984	Pearson, Coates & Duncan (1994)
<i>Sublittoral</i>	Recording	1	August 1986	Hiscock (1986)
	Infaunal sampling (grab)	4	1974 & 1976	Pearson, Coates & Duncan (1994)

Littoral

The littoral zone in the outer part of the voes, around headlands and Fora Ness consists primarily of steep bedrock and boulders. Within the voes, boulder, shingle and mixed muddy sediment shores predominate and these become increasingly muddy towards the voe heads. There are extents of muddy sand shores at the head of Dales Voe, Colla Firth and Swining Voe and a sand beach in Sand Wick on Swining Voe.

There is biological information for only one shore in Area 28, the extremely sheltered muddy sand beach at the head of Dales Voe. The mid-shore here is dominated by lugworm *Arenicola marina*, polychaetes *Pygospio elegans*, *Polydora quadrilineata* and *Fabricia sabella* and the tellin *Macoma*

balthica (MacAre). Lower shore sediment contains the cockle *Cerastoderma edule* (PCer), and cobbles on the sediment surface towards the lower part of this zone support mussels *Mytilus edulis* with scattered fucoids and barnacles *Semibalanus balanoides* (MytX).

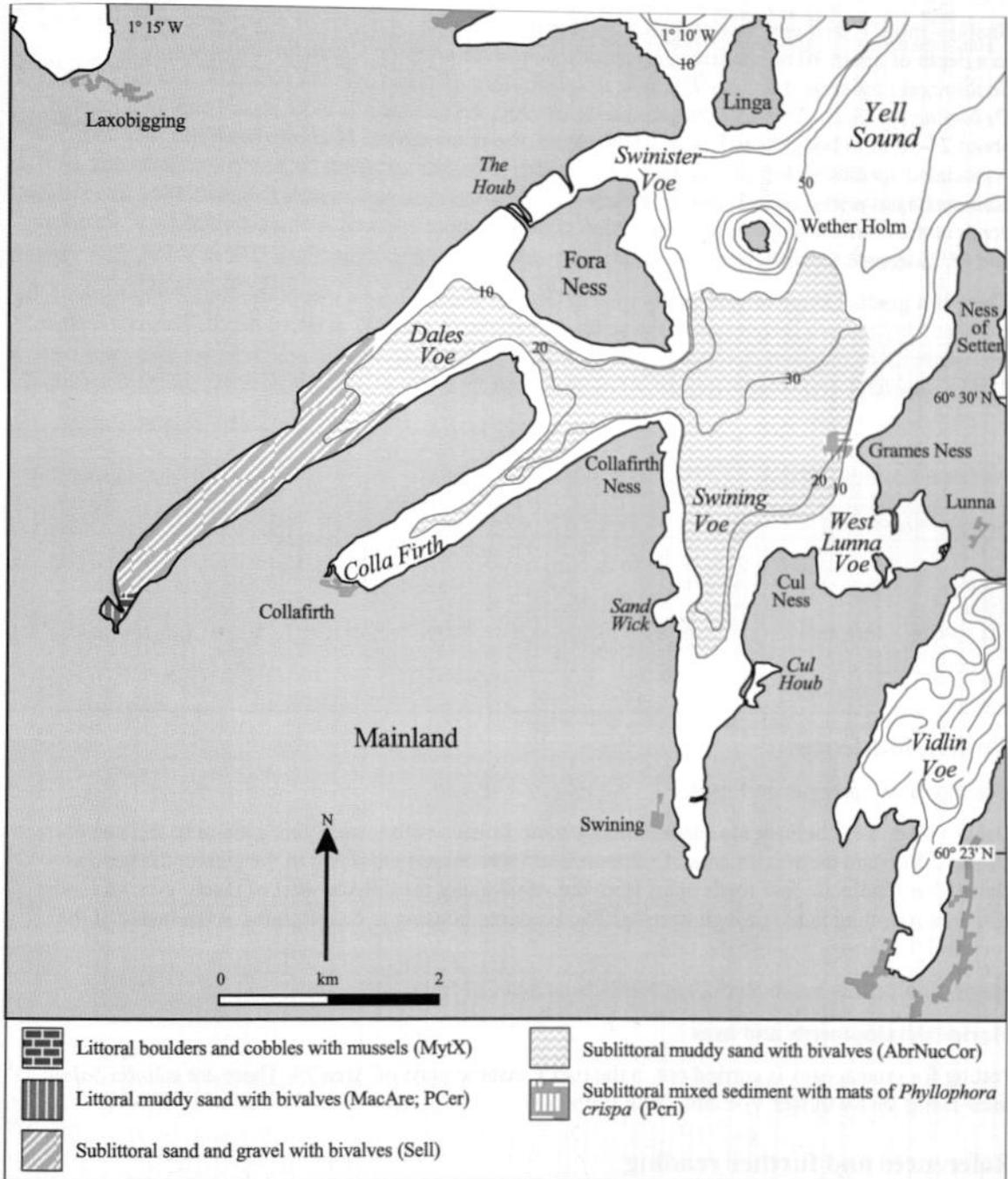


Figure 28.2 Indicative distribution of the main biotopes in the area (based on data from survey sites shown in Figure 28.1, cited literature and additional field observations).

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Sublittoral

The sublittoral consists of poorly-mixed and predominantly muddy sediments which become increasingly muddy with depth. There is no information on hard substratum in the sublittoral, but this is probably limited in extent and, within the voes, confined to shallow water.

Shallow muddy sand enriched with peat fragments in very sheltered water at the head of Dales Voe, in a depth of about 10 m, contains polychaetes *Scoloplos armiger*, *Capitella capitata* and *Scalibregma inflatum*, bivalves *Thyasira flexuosa*, *Abra alba* and *Mysella bidentata* and the amphipod *Dexamine* sp. (Sell). Towards the entrance to the voe, the sediment is more mixed and, in depths of about 25-35 m in both Dales Voe and Colla Firth, the horse mussel *Modiolus modiolus* is found. Associated species include the molluscs *Turritella communis* and *Hiatella arctica*, polychaetes *Notomastus latericeus* and *Prionospio malmgreni* and the bivalve *Thyasira flexuosa*. Mud in a similar depth at the entrance to Swining Voe, which is slightly more exposed is characterised by *T. flexuosa* and *M. bidentata* (AbrNucCor).

There is a gradual slope of soft, sandy mud at Grames Ness, where a mat of the free-living form of the red alga *Phyllophora crispa* covers the sediment between 14 and 27 m (Pcri) depth. This is a feature characteristic of many sheltered sites in the Shetland voes. Sparse kelp *Laminaria saccharina* occurs attached to shells and stones from 14-17 m depth and the bivalves *Mya* sp. & *Ensis* sp. are occasional between 15 and 20 m.

Nature conservation

Conservation sites		
Site name	Status	Main features
Swinister Voe and the Houb of Fora Ness	MCA	Marine biological; voe and lagoon.
The Ayres of Swinister	SSSI; GCR	Geological
Yell Sound Coast	SSSI, cSAC	Marine interest for otters <i>Lutra lutra</i>
Dales Voe	SSSI	Botanical
Shetland	ESA	Agri-environmental scheme

Human influences

Coastal developments and uses

Dales Voe and Colla Firth are surrounded by steep hillside with lower-lying ground to the east of Swining Voe and there is an area of saltmarsh and wet coastal grassland in the glen at the head of Dales Voe. There are few roads apart from the A968 along the hillside west of Dales Voe, and most of the surrounding land is rough grazing. The scattered housing is concentrated at the heads of the voes and the houses have septic tanks.

Major oil pipelines make landfall at Firths Ness and Cul Ness.

Marine developments and uses

Potting for crustaceans is carried out in the rocky inshore parts of Area 28. There are salmon *Salmo salar* farms on Swinister Voe and Colla Firth.

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Thorpe, K. 1998. *Marine Nature Conservation Review Sectors 1 & 2. Lagoons in Shetland and Orkney: area summaries*. Peterborough, Joint Nature Conservation Committee. (Coasts and seas of the United Kingdom. MNCR series.)

Sites surveyed

Survey 261 1986 OPRU/MNCR survey of Shetland, Foula and Fair Isle (Hiscock 1986).

Survey 380 1984 SOTEAG littoral survey in Dales Voe and Gluss Voe, Shetland (Pearson, Coates & Duncan 1993).

Survey 382 1974/76 SOTEAG sublittoral grab sample surveys in Shetland (Pearson, Coates & Duncan 1993).

Littoral sites

Survey	Site	Site name	Grid reference	Latitude/longitude	Biotopes recorded
380	1	Head of Dales Voe.	HU 410 687	60°24.0'N 01°15.3'W	MytX; MacAre; PCer

Sublittoral sites

Survey	Site	Site name	Grid reference	Latitude/longitude	Biotopes recorded
261	19	W Grames Ness, Lunna Ness.	HU 475 702	60°24.8'N 01°08.2'W	Pcri
382	13	E of Moastra, mouth of Swining Voe.	HU 465 696	60°24.5'N 01°09.2'W	AbrNucCor
382	14	Mid Colla Firth.	HU 447 699	60°24.6'N 01°11.2'W	AbrNucCor
382	15	NE Pund of Grutin, Dales Voe.	HU 413 693	60°24.3'N 01°14.9'W	Sell
382	16	Between West Taing and Scarvar Ayre, Dales Voe.	HU 435 708	60°25.2'N 01°12.5'W	AbrNucCor

Compiled by: Christine Howson

Location

<i>Position (centre)</i>	HU 375 740	60°26.9'N 01°19.1'W
<i>Administrative area</i>	Shetland Islands	
<i>Conservation agency/area</i>	Scottish Natural Heritage	North Areas (Northern Isles)

Physical features

<i>Physiographic type</i>	Voe
<i>Length of coast</i>	43.1 km
<i>Area of inlet</i>	19.4 km ²
<i>Bathymetry</i>	Maximum depth of 51 m at entrance, 49 m near head
<i>Wave exposure</i>	Moderately exposed - extremely sheltered; predominantly sheltered
<i>Tidal streams</i>	Moderate at entrance to voe; negligible elsewhere
<i>Tidal range</i>	1.9 m (mean springs); 0.9 m (mean neaps)
<i>Salinity</i>	Fully marine

Introduction

Sullom Voe, lying on the southern shore of Yell Sound in Mainland Shetland, is one of the longest and deepest of the Shetland voes. It reaches a depth of 51 m at its entrance and 49 m at its head with a sill rising to 12 m between Ness of Haggrister and Voxter Ness separating the deep inner basin from the main part of the voe. There are several small subsidiary arms and embayments in the voe, including Voxter and Garths Voes and the Bight of Haggrister. Most of this area is sheltered from wave action although the entrance to the voe is more exposed and thus there is a transition from moderately exposed to extremely sheltered conditions. Tidal streams are generally negligible except at the entrance to the voe where they are moderately strong, the result of the strong flow through Yell Sound. The area is predominantly fully marine.

Sullom Voe is fringed by bedrock, boulders and cobble with shores ranging from steep bedrock to gradually-sloping shingle. The few soft sediment shores are located at the heads of the voes. There is only limited hard substratum in the sublittoral, where poorly-mixed and predominantly muddy sediments predominate. Other coastal habitats include two houbas, at Fugla Ness (Thorpe 1998) and Scatsta, small patches of saltmarsh (Dalby 1981) and heathland.

This is one of the few areas in Shetland with significant industrial activity. The Sullom Voe Oil Terminal, which became operational in 1978, is situated on the southern side of Calback Ness at the entrance to the voe. Depths reach over 30 metres in the jetty area enabling tankers, which approach from the northern entrance to Yell Sound (*Area summary* 26), to come alongside. The arrival of the oil industry stimulated a number of marine biological surveys and monitoring projects, several of which continue under the auspices of the Shetland Oil Terminal Environmental Advisory Group (SOTEAG) (Pearson & Stanley 1981; Dunnet & McIntyre 1995). In addition, a large oil spill in Sullom Voe at the end of 1978 from the *Esso Bernicia*, and the resultant clean-up operations, necessitated work to look at the recovery of habitats in the area (Hiscock & Carlidge 1979).

The terminal and associated developments, including an airfield, are concentrated around the north-east of Sullom Voe whilst the remainder of the area is predominantly rural and surrounded by grazed moorland. The town of Brae lies at the southern end of the voe, and roads alongside much of the coastline have scattered linear villages. There are two small piers at Sullom, on the west side of the voe. The houses have septic tanks and water quality is generally good. Despite the presence of the oil industry, the area has a healthy otter *Lutra lutra* population.

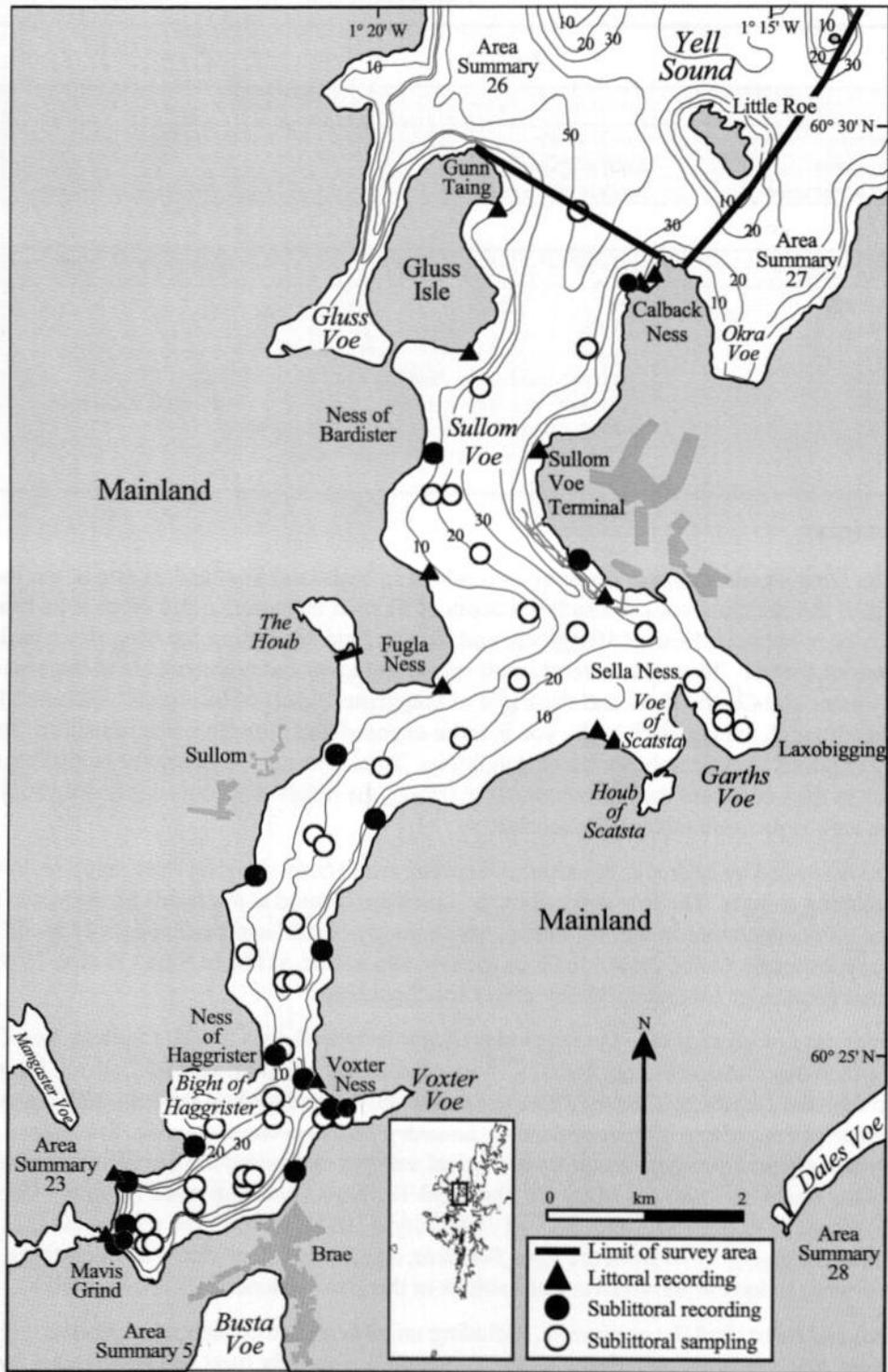


Figure 29.1 Main features of the area, showing sites surveyed.

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Marine biology

Marine biological surveys

	Survey methods	No. of sites	Date(s) of survey	Source
Littoral	Recording	1	July-August 1974	Institute of Terrestrial Ecology (1975a)
	Recording	12	1995	Moore & Little (1995)
Sublittoral	Recording	1	July-August 1974	Institute of Terrestrial Ecology (1975b)
	Recording	1	August 1986	Hiscock (1986)
	Recording	2	July-August 1987	Moss & Ackers (1987)
	Infaunal sampling (suction sample)	1	1963	Pearson, Coates & Duncan (1994)
	Infaunal sampling (grab)	4	1963	Pearson, Coates & Duncan (1994)
	Infaunal sampling (grab)	17	1974-1978	Pearson, Coates & Duncan (1994)
	Infaunal sampling (grab)	14	1984	Westwood (1985); Pearson, Coates & Duncan (1994)

Littoral

Shores in Sullom Voe range from steep moderately exposed bedrock at the entrance to more gradually-sloping and extremely sheltered bedrock, boulders and shingle in the inner parts of the voe with extensive stretches of mixed substrata. However, there are also some very steep bedrock and boulder shores in sheltered conditions, such as Mavis Grind and Voxter Ness. There is little littoral sediment apart from shingle lying on muddy sand at the heads of Garths, Scatsta and Voxter Voes.

Moderately exposed shores at the entrance to Sullom Voe are animal-dominated, with barnacles *Semibalanus balanoides* and limpets *Patella vulgata* across most of the eulittoral zone (BPat.Sem). The dogwhelk *Nucella lapillus* and small mussels *Mytilus edulis* are generally common in this zone and the lichen *Lichina pygmaea* is occasionally present (MytB). There are yellow and grey lichens in the supralittoral (YG) and the black lichen *Verrucaria maura* with *S. balanoides* in the littoral fringe (Ver.B). The lower eulittoral has a rich turf of foliose red algae, including species such as *Mastocarpus stellatus*, *Laurencia pinnatifida*, *Porphyra umbilicalis* and *Corallina officinalis* and the green alga *Cladophora rupestris* and sometimes thongweed *Himanthalia elongata*. Kelps *Alaria esculenta* and *Laminaria digitata* are found in the sublittoral fringe. Furoid algae are generally absent although there are occasionally scattered plants of *Fucus vesiculosus*, and shores just inside the voe, in slightly more sheltered conditions, have *Fucus serratus* in the lower eulittoral (Fser.R). Although steep overall, several of these outer shores have rocky platforms with many small coralline rockpools and overhangs with red algae. The green alga *Prasiola stipitata*, indicative of nitrogen enrichment, is common in the littoral fringe at sites where cormorants *Phalacrocorax carbo* roost.

With increasing shelter, fucoids become more common. Bands of *Pelvetia canaliculata* and *Fucus spiralis* are present on boulders or bedrock in the upper eulittoral on shores around the terminal jetties and further into the voe (Pel; Fspi). Within the voe, where the substratum is stable enough, the furoid *Ascophyllum nodosum* blankets the mid-shore, sometimes mixed with *F. vesiculosus* (Asc.Asc). On less stable shingle shores, *F. vesiculosus* is the dominant species (Fves). These shingle shores often have an upper eulittoral band of gravel and pebble with numerous littorinids *Littorina saxatilis* and amphipods *Ampithoe rubricata* and *Orchestia gammarellus* under stones whilst barnacles and the winkle *Littorina littorea* are often common on mid-shore shingle (BLit). The lower eulittoral at these sheltered sites has a band of *F. serratus* (FserX).

Shore inclination determines the community composition on particular shores. Very steep or vertical bedrock in sheltered conditions, such as at Voxter Ness, supports large *Mytilus edulis*, barnacles and limpets in the mid-eulittoral (MytFR) whereas less-steep rock, such as at Mavis Grind, has a dense blanket of *A. nodosum* (Asc.Asc). There are rich lower eulittoral under-boulder biotopes on some of the mixed substratum shores, such as those around the jetties. The non-native Australasian barnacle *Elminius modestus* is present in small numbers in Sullom Voe (Hiscock 1981).

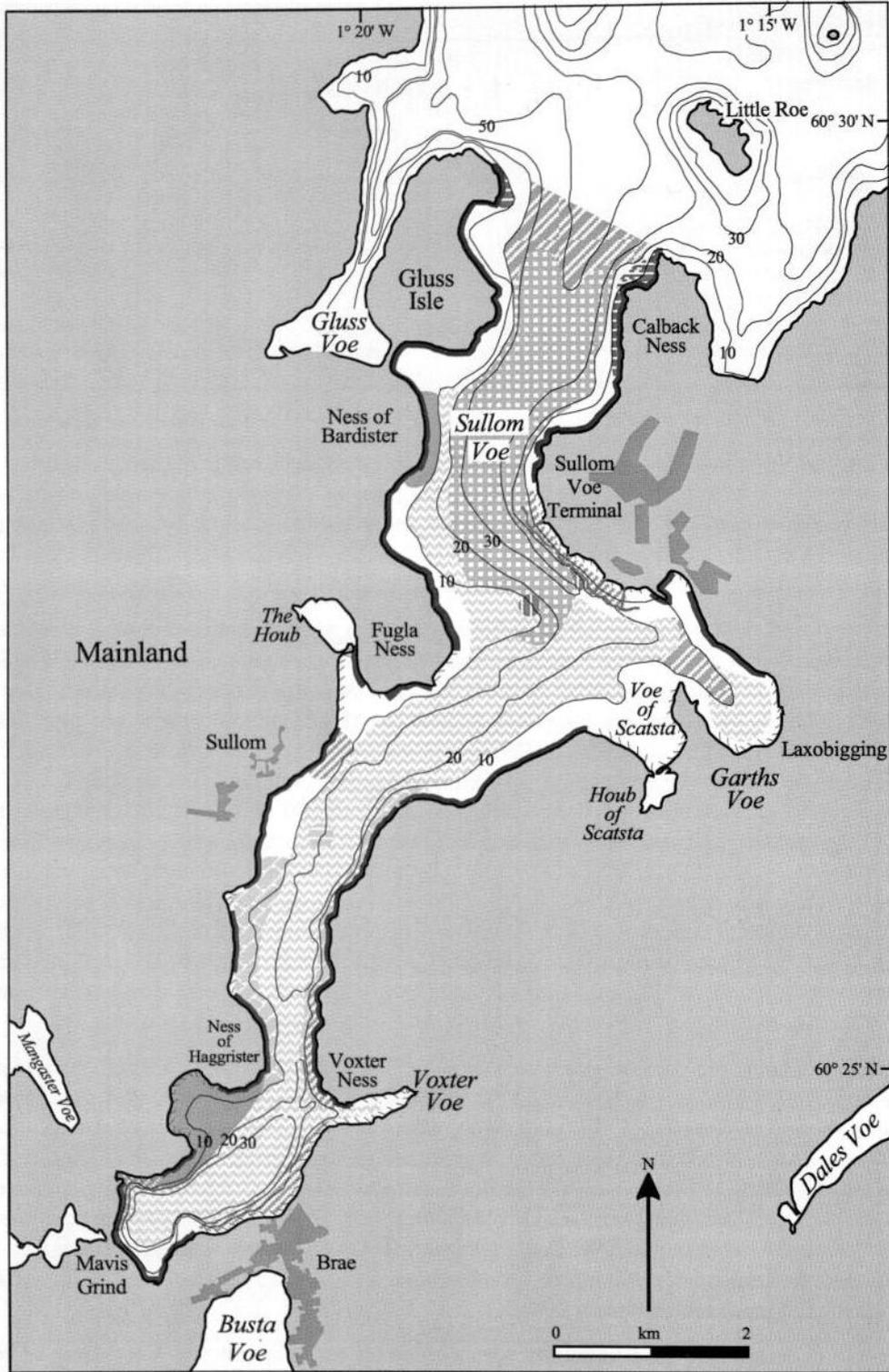


Figure 29.2 Indicative distribution of the main biotopes in the area (based on data from survey sites shown in Figure 29.1, cited literature and additional field observations). (Key to biotopes symbols on next page.)
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 Littoral rock with mussels and barnacles (MytB; Fser.R)	 Infralittoral muddy sands (IMS)
 Littoral rock with barnacles, fucoids and red algae (BPat; BPat.Sem; MytFR; FvesB; Fser.R)	 Sublittoral muddy sand with polychaetes (SpiSpi)
 Littoral rock with dense fucoid algae (Pel; Fspi; Fves; Asc.Asc; Fser.Fser)	 Sublittoral muddy sand with bivalves (AbrNucCor)
 Littoral boulders and cobbles on mixed sediments (BLlit; FvesX; AscX; FserX; EphX)	 Sublittoral soft, stable mud with seapens (PhiVir)
 Kelp <i>Laminaria hyperborea</i> with dense red algae (Lhyp.Ft; Lhyp.Pk)	 Sublittoral soft, stable mud with seapens and crustaceans (SpMeg)
 Grazed kelp <i>Laminaria hyperborea</i> (LhypGz.Ft)	 Infralittoral mixed sediment (IMX)
 Kelp with sparse red algae (Lsac.Ft; Lsac.Pk)	 Sublittoral mixed sediment with <i>Laminaria saccharina</i> (LsacX)
 Circalittoral rock or mixed substrata with dense brittlestars (Oph)	 Sublittoral mixed sediment with <i>Modiolus</i> beds (ModHo)
 Circalittoral rock or mixed substrata with solitary ascidians and anemones (Aasp; AmenCio)	

The few soft sediment shores in Area 29 are situated at the heads of Garths, Voxter and Scatsta Voes. The substratum is variable and poorly-sorted, with a preponderance of coarse sand, gravel, shell debris and peat fragments. At Scatsta Voe, the sediment is relatively sandy and holds bivalves *Angulus tenuis*, *Fabulina fabula*, *Ensis siliqua* and *Ensis arcuatus*, the polychaete *Magelona mirabilis* and the holothurian *Leptosynapta inhaerens* (Jones & Jones 1981).

Sublittoral

In the sublittoral, hard substrata are relatively infrequent and poorly-mixed muddy sediments predominate. Bedrock reaches a depth of 10-12 m at Calback Ness at the entrance to the voe and there is a steep boulder slope at Mavis Grind at the head of the voe, with boulders as deep as 14 m. However, elsewhere in the voe, bedrock and boulder slopes extend to only a few metres depth with hard substrata largely restricted to boulders on sediment in relatively shallow water. Sediments in the outer part of Sullom Voe and around Calback Ness consist of fairly coarse shell-sand and gravel and become increasingly fine with distance into the voe and with depth. Muddy sand and shell-gravel is the dominant sediment type in intermediate depths around the sides of the voe whilst there is mud with a high organic content in the deepest areas. The inner basin is subject to intermittent periods of anoxic conditions.

Around Calback Ness and in the outer parts of Sullom Voe, bedrock to a depth of 10 m is dominated by kelp forests of *Laminaria hyperborea*, with *Saccorhiza polyschides* replacing *L. hyperborea* at the rock-sand boundary and a band of *Laminaria digitata* in the sublittoral fringe. The flora and fauna on the rock surfaces beneath the kelp forest are sparse, a result of grazing by the urchin *Echinus esculentus* although there is a reasonably diverse red algal flora on the kelp stipes, including species such as *Callophyllis cristata*, *Cryptopleura ramosa* and *Haraldiophyllum bonnemaisonii* (Hiscock & Hainsworth 1976; Tittley, Irvine & Jephson 1976). With increasing shelter, *L. hyperborea* is replaced by *L. saccharina* which is the dominant macroalga in the inner voe. In *L. saccharina* forest at Mavis Grind, boulders and coarse sediment support the urchin *Psammechinus miliaris*, the erect bryozoan *Scrupocellaria scruposa*, encrusting bryozoans and the ascidian *Ascidia mentula* (Lsac.Ft). In the more exposed situations, less stable substrata, such as stones, shells and sand, support *L. saccharina* which is mixed with the brown alga *Chorda filum* in the more sheltered parts of the area (LsacX). Red algae including *Palmaria palmata*, *Ahnfeltia plicata* and *Scinaia trigona* are found on the stones in both situations.

Shallow sand and gravel in the outer voe support a fairly rich flora, enhanced by the growth of a range of summer annuals (Hiscock & Hainsworth 1976). A wide variety of algal species, including *Callophyllis cristata*, *Halarachnion ligulatum* and *Ulva* sp. occur as deep as 15 m with a few, such as

the red algae *Polysiphonia elongata*, *Phycodrys rubens*, *Phyllophora crispa* and *Lomentaria clavellosa*, growing as deep as 22 m. In more sheltered conditions inside the voe, muddy sand and shell debris shallower than 10 m supports a blanketing layer of soft vegetation dominated by brown algae such as *Asperococcus compressus* and *Asperococcus bullosus* (Tittley, Irvine & Jephson 1976). In slightly deeper water, the sediment is covered with loose-lying beds of foliose red algae, particularly *P. crispa* and the lingulate form of *P. rubens*. At Scatsta Ness at 15 m depth, beds of *P. crispa* are particularly extensive; at 23 m this species is the only alga found. In slightly deeper water, fine filamentous species, principally the red algae *Audouinella floridula* and *Trailiella* and the blue-green *Oscillatoria rosea*, bind mud and silt (Tittley, Irvine & Jephson 1976).

The horse mussel *Modiolus modiolus* is one of the commonest epifaunal organisms in Sullom Voe, occurring on all substrata at all depths, but it is most abundant on muddy sand and gravel at about 15 m depth, with the central part of the voe, from Voxter Ness to Calback Ness - Gluss Isle, supporting particularly high densities (Pearson & Eleftheriou 1981) although they are also found around the sides of the inner basin (ModHAs). The mussel shells provide a stable hard substratum for a great variety of other epifaunal species, such as brittlestars *Ophiotrix fragilis*, *Ophiocomina nigra* and *Ophiopholis aculeata*, sponges such as *Cliona celata*, ascidians, particularly *Ascidella aspersa*, and various species of hydroid, bryozoan and mollusc, particularly *Aequipecten opercularis*. The sediment beneath the patches of mussels has a higher silt content than the surrounding open sediment which is sandier and more mixed and supports infaunal species such as polychaetes *Notomastus latericeus* and *Thyasira flexuosa* and bivalves *Mysella bidentata* and *Abra alba*. The burrowing holothurian *Thyone fusus* is often associated with the *M. modiolus* beds (ModHo).

North of Calback Ness, organically-enriched shell-sand and gravel has species such as the polychaetes *Capitella capitata* and *Mediomastus fragilis* and the amphipods *Corophium crassicornes* and *Ampelisca typica* (TubeAP). Throughout Sullom Voe, from Little Roe to Voxter Ness, muddy sand at 10-30 m depth supports polychaetes *Scoloplos armiger*, *Apistobrachus tullbergi* and *Tubificoides benedeni*, bivalves *Corbula gibba* and *A. alba* and amphipods *Dexamine* spp. (AbrNucCor). This biotope is also found at 7-8 m depth in Garths Voe. Mud occurring in slightly deeper water, between about 10 and 30 m, between Little Roe and Fugla Ness is characterised by polychaetes *Hydroides norvegica*, *Myriochele* sp. and *S. armiger*, the bivalve *Clausinella fasciata* and the amphipod *Urothoe elegans* (SpMeg).

The high organic content and periodic anoxic conditions in the deep inner basin of Sullom Voe are reflected in the low diversity of the fauna in the deepest parts of this basin. The silty sediment is dominated by polychaetes *Glycera alba*, *Chaetoderma nitidulum*, *Capitella capitata*, *Scalibregma inflatum* and *Pectinaria koreni*, and bivalves *Thyasira* spp., species characteristic of organic enrichment (AbrNucCor).

In general, biotopes within Sullom Voe have been stable over the period of the SOTEAG monitoring programme, which began in 1979, although there have been significant changes in a few areas such as the inner basin, where intermittent eutrophication is a naturally-occurring phenomenon. In Garths Voe, however, there have been significant changes in the faunal composition over the years of sampling with a continued presence and change in distribution patterns of opportunist species. These changes have been attributed to a combination of physical disturbance from shipping and organic enrichment. Communities and hydrocarbon measurements in Orka Voe have also shown some evidence of mild contamination (May & Pearson 1995).

Nature conservation

Conservation sites

Site name	Status	Main features
The Houb, Fugla Ness	MCA	Marine biological; lagoon
Yell Sound Coast	SSSI; cSAC	Marine interest for otters <i>Lutra lutra</i>
Voxter Voe and Valayre Quarry	SSSI; GCR	Geological
Quoys of Garth	SSSI	Geological
Shetland Islands	ESA	Agri-environmental scheme
Scatsa	MoD	Shingle

Human influences

Coastal and marine developments and uses

Sullom Voe is one of the most important ports in the UK and in 1994 it handled 14.3% of the total UK oil traffic in terms of tonnes of oil-related cargo. The Sullom Voe Oil Terminal on the southern side of Calback Ness at the entrance to Sullom Voe occupies about 400 ha. This is Europe's largest oil and liquefied gas terminal, with a throughput of 40,569,604 tonnes of oil in 1992 and over 600,000 tonnes of propane & butane gas in 1991. It has 16 crude oil storage tanks each with a capacity of 600,000 barrels. Oil is delivered from offshore installations via the Brent and Ninian pipelines (Barne *et al.* 1997) and via shuttle tankers from the Schiehallion field. There are four deep-water jetties along the southern side of Calback Ness where water depths of over 30 m enable tankers of up to 250,000 tonnes to come alongside.

The terminal and its associated developments, including an airfield, are concentrated around the north-east of the voe. There are additional piers and jetties for service shipping, including tugs, at Sella Ness in Garths Voe where an industrial site covers about 9 ha. Concrete installations for spur booms used in the control of oil spills are situated at strategic points around Sullom Voe.

The only major licensed trade effluent outfall in Shetland is located off Calback Ness, just outside the north-eastern boundary of Area 29 (*Area summary* 26). This discharges treated ballast water with a maximum consented daily effluent volume of 60,000 m³.

During the construction of the terminal site, a large amount of land-claim was carried out including the infill of a significant part of Orka Voe (*Area summary* 27). Some coastal defence work has been carried out at Sella Ness and along the low-lying approach roads to the terminal, which are affected by onshore wave action during south-westerly storms. There are two small piers at Sullom, on the west side of the voe, where there is a quarry for the igneous rock.

The remainder of Area 29 is predominantly rural and surrounded by grazed moorland. The town of Brae lies at the southern end of Sullom Voe, and roads alongside much of the coastline have scattered linear villages. The houses have septic tanks and water quality is generally good.

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- Survey 696: Natural History Museum sublittoral survey of Sullom Voe, Shetland 1993 (Spurrier & Wood 1997).
- Survey 736: 1995 OPRU littoral survey of Sullom Voe (Moore & Little 1995).

Littoral sites					
<i>Survey</i>	<i>Site</i>	<i>Site name</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotopes recorded</i>
434	7	Skipadock, Sullom Voe.	HU 341 690	60°24.2'N 01°22.8'W	Pel; Fspi; FvesX; AscX; FserX
736	2	Roe Clett (OPRU site 2.3), Sullom Voe.	HU 394 781	60°29.1'N 01°16.9'W	Ver.Ver; MytB; Osm
736	4	Grunn Taing (OPRU site 4.1), Sullom Voe.	HU 379 790	60°29.6'N 01°18.6'W	Ver.Ver; Fspi; BPat.Sem; Fser.R
736	5	The Kames (OPRU site 4.3), Sullom Voe.	HU 384 764	60°28.2'N 01°18.0'W	Ver.Ver; MytB; BPat.Sem; Fser.R
736	6	Voxter Ness (OPRU site 4.6), Sullom Voe.	HU 361 700	60°24.7'N 01°20.6'W	YG; Ver.Ver; Pel; BPat; BPat.Sem; MytFR
736	7	S of Skaw Taing (OPRU site 5.1), Sullom Voe.	HU 396 782	60°29.1'N 01°16.7'W	Ver.Ver; Ver.Por; BPat.Sem; FvesB; Fser.R
736	8	Scatsta Ness (cleared) (OPRU site 6.12), Sullom Voe.	HU 389 735	60°26.6'N 01°17.5'W	Ver.Ver; Fspi; Fves; Fser.Fser.Bo
736	11	Noust of Buraland (OPRU site 3.3), Sullom Voe.	HU 371 752	60°27.5'N 01°19.5'W	Ver.Ver; Ver.B; BPat.Sem; FvesB; Fser.R
736	12	Gluss Island East (OPRU site 3.4), Sullom Voe.	HU 377 775	60°28.8'N 01°18.8'W	Ver.Ver; PelB; MytB; BPat.Sem
736	14	Mavis Grind (OPRU site 5.5), Sullom Voe.	HU 340 684	60°23.9'N 01°22.9'W	Pel; Fspi; Fves; Asc.Asc; Fser.Fser
736	15	Fugla Ayre (OPRU site 6.1), Sullom Voe.	HU 373 741	60°26.9'N 01°19.3'W	YG; Fspi; FvesX; EphX; FserX
736	16	S of Jetty 2 (OPRU site 6.2), Sullom Voe.	HU 391 750	60°27.4'N 01°17.3'W	Pel; Fspi; BLlit; FvesX; FserX
736	17	Scatsta Ness (uncleared) (OPRU site 6.13), Sullom Voe.	HU 389 735	60°26.6'N 01°17.5'W	Ver.Ver; Pel; Fspi; AscX; FvesX; FserX

Sublittoral sites

<i>Survey</i>	<i>Site</i>	<i>Site name</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotores recorded</i>
227	1	Mouth of Voxter Voe, Sullom Voe.	HU 360 700	60°24.7'N 01°20.7'W	ModHAs; LsacX
227	40	Mavis Grind, Sullom Voe.	HU 341 683	60°23.8'N 01°22.8'W	Lsac.Ft; AmenCio; LsacX
230	29	Skipadock, Sullom Voe.	HU 341 690	60°24.2'N 01°22.8'W	LR; SIR
261	45	Mavis Grind, Sullom Voe.	HU 342 685	60°23.9'N 01°22.7'W	Lsac.Ft; Lsac.Pk; Aasp
377	14	Head of Sullom Voe.	HU 344 683	60°23.8'N 01°22.5'W	AbrNucCor; CMU
377	15	S of Sullom Channel, SE Ness of Haggriester, Sullom Voe.	HU 357 698	60°24.6'N 01°21.1'W	AbrNucCor
377	16	Off Voe of Scatsta, Sullom Voe.	HU 382 741	60°26.9'N 01°18.3'W	TubeAP
377	17	Off Dale Voe, Sullom Voe.	HU 375 760	60°27.9'N 01°19.0'W	TubeAP
379	1	Head of Voe, Sullom Voe.	HU 349 689	60°24.1'N 01°21.9'W	AbrNucCor
379	3	E of Lunnister, Sullom Voe.	HU 358 710	60°25.3'N 01°20.9'W	AbrNucCor
379	4	S of Sullom, Sullom Voe.	HU 361 725	60°26.1'N 01°20.6'W	Oph
379	5	SE of Fulga Ness, Sullom Voe.	HU 376 735	60°26.6'N 01°18.9'W	AbrNucCor
379	6	Jetty area in Garths Voe.	HU 403 738	60°26.8'N 01°16.0'W	SpiSpi; AbrNucCor
379	7	N of Voe of Scatsta, Sullom Voe.	HU 395 746	60°27.2'N 01°16.8'W	AbrNucCor
379	8	E of Ungam, Sullom Voe.	HU 388 746	60°27.2'N 01°17.6'W	SpMeg
379	2	Off Dale Voe, Sullom Voe.	HU 378 754	60°27.6'N 01°18.7'W	SpMeg
379	17	NE of Ungam, Sullom Voe.	HU 383 748	60°27.3'N 01°18.1'W	SpMeg; PhiVir
379	9	E of Loch of Scadafleck, Sullom Voe.	HU 373 760	60°28.0'N 01°19.3'W	AbrNucCor
379	10	S of Tivaka Taing, Sullom Voe.	HU 378 771	60°28.6'N 01°18.6'W	SpMeg
379	11	SW of Roe Clett, Sullom Voe.	HU 389 775	60°28.8'N 01°17.5'W	SpMeg
379	32	E of Sella Ness, Garths Voe.	HU 400 741	60°26.9'N 01°16.2'W	SpiSpi
379	33	E of Yarfils Wick, Sullom Voe.	HU 388 789	60°29.5'N 01°17.6'W	SpiSpi
382	17	N Ell Wick, Sullom Voe.	HU 344 683	60°23.8'N 01°22.5'W	AbrNucCor
382	18	E of Mavis Grind, Sullom Voe.	HU 344 685	60°24.0'N 01°22.4'W	AbrNucCor
382	19	NW of North Brae, Sullom Voe.	HU 349 687	60°24.1'N 01°21.9'W	AbrNucCor
382	20	Sullom Voe.	HU 344 704	60°25.0'N 01°22.5'W	AbrNucCor
382	21	N of North Brae, Sullom Voe.	HU 354 689	60°24.1'N 01°21.4'W	TubeAP
382	22	W of Scarva Taing, Sullom Voe.	HU 354 690	60°24.2'N 01°21.4'W	AbrNucCor
382	23	SE of South Ness, Sullom Voe.	HU 354 690	60°24.2'N 01°21.4'W	AbrNucCor
382	24	E of South Ness, Sullom Voe.	HU 351 695	60°24.5'N 01°21.6'W	IMX
382	25	W of Voxter Voe, Sullom Voe.	HU 357 696	60°24.5'N 01°21.0'W	AbrNucCor
382	26	Sullom Voe.	HU 358 703	60°24.9'N 01°20.9'W	CMS
382	27	W of Blo Wick, Sullom Voe.	HU 359 710	60°25.3'N 01°20.8'W	AbrNucCor
382	28	W of Grona Taing, Sullom Voe.	HU 359 716	60°25.6'N 01°20.7'W	AbrNucCor
382	29	NE of Marki Ness, Sullom Voe.	HU 362 724	60°26.0'N 01°20.4'W	AbrNucCor
382	30	NW of Calna Taing, Sullom Voe.	HU 368 732	60°26.5'N 01°19.8'W	AbrNucCor
382	31	Mouth of Voxter Voe.	HU 362 696	60°24.5'N 01°20.5'W	AbrNucCor
382	32	Mid Voxter Voe.	HU 364 696	60°24.6'N 01°20.2'W	AbrNucCor
382	33	Head of Garths Voe.	HU 405 736	60°26.7'N 01°15.8'W	AbrNucCor
382	34	The jetties, Garths Voe.	HU 403 737	60°26.7'N 01°15.9'W	AbrNucCor
696	1	Mavis Grind Reef, Sullom Voe.	HU 341 683	60°23.8'N 01°22.8'W	AmenCio; Aasp
696	2	South Ness Sullom Voe.,	HU 348 693	60°24.4'N 01°22.0'W	ModHAs
696	3	Scarva Taing, Sullom Voe.	HU 359 690	60°24.2'N 01°20.9'W	ModHo; LsacX
696	4	Punds, Sullom Voe.	HU 363 733	60°26.5'N 01°20.4'W	LsacX
696	5	Rattleton, Sullom Voe.	HU 388 754	60°27.6'N 01°17.6'W	PhiVir; LsacX
696	6	Ness of Haggriester, Sullom Voe.	HU 357 702	60°24.8'N 01°21.1'W	ModHAs
696	7	Blo Wick, Sullom Voe.	HU 362 713	60°25.4'N 01°20.5'W	ModHAs; IMU
696	8	Marki Ness, Sullom Voe.	HU 355 721	60°25.9'N 01°21.3'W	ModHAs; Perri
696	9	South of Calna Taing, Sullom Voe.	HU 367 727	60°26.2'N 01°19.9'W	ModHo
696	10	Dale Voe, Sullom Voe.	HU 373 764	60°28.2'N 01°19.2'W	IMS
696	11	Roe Clett, Sullom Voe.	HU 394 781	60°29.1'N 01°16.9'W	LhypGz.Ft
696	12	Voxter Voe, Sullom Voe.	HU 363 697	60°24.6'N 01°20.4'W	SIR
696	13	Jetty piles, Sullom Voe.	HU 363 697	60°24.6'N 01°20.4'W	SIR

Compiled by: Christine Howson