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THE DISTRIBUTION OF *Alcyonidium* SPECIES (BRYOZOA) IN ORKNEY AND SHETLAND, WITH FAUNISTIC NOTES ON SOME LOCATIONS

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SUMMARY

Nine major intertidal sites in Orkney and nine in Shetland were visited to determine the presence of *Alcyonidium* spp., together with other bryozoans, ascidians, hydroids and sponges, and salient ecological characteristics. *Alcyonidium gelatinosum* and *A. hirsutum* were widespread and abundant on fucoid and other algae; *A. diaphanum* (mainly subtidal) was found occasionally; *A. polyomm* was not found and is presumed absent. The distributions are discussed. The associated sessile fauna from the shores is listed. Certain sites were faunistically very rich: the rocky spit in the Bay of Ham, Rousay and St. Peter's Bay on the mainland, in Orkney, and the narrow channel between Muckle Roe and the mainland and the narrow passage of Bridge End between East and West Burra, in Shetland, were outstanding and should be conserved.

INTRODUCTION

Species of the bryozoan genus *Alcyonidium*, with their pale brown gelatinous colonies, are abundant and well-known members of the intertidal and sublittoral fauna. The identification of species, however, can be difficult. This, together with an extraordinary degree of nomenclatural confusion, led to doubt over the number of species involved and their geographical distribution. Species accounts in the standard reference works (Hayward 1985; Hayward and Ryland 1990, 1995) are deficient and misleading. Following the recognition of the true identity of *A. mytili* (Dalyell 1848; Cadman and Ryland 1996a, b), the present authors embarked on a comprehensive study of the Western European species, using a combination of characters based on morphology, reproductive biology and molecular genetics. As part of the investigation, the authors visited sites all around the coasts of Britain and Ireland,

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including the archipelagos of Orkney and Shetland, and elsewhere in Europe, to determine the geographical distribution and breeding seasons of the intertidal species. These studies led slowly to the full recognition and redescription of the species involved (de Putron and Ryland 1998; Porter *et al.* 2000, 2001; Ryland and Porter 2000, 2003; Porter 2004), culminating with a review – including descriptions and a key – of all the species involved in the confusion (Ryland and Porter 2006).

Five species of *Alycionidium* occur on British rocky shores: *A. diaphanum* (Hudson), *A. gelatinosum* (Linnaeus), *A. hirsutum* (Fleming), *A. mytili* Dalyell, and *A. polyoum* (Hassall). *A. diaphanum* (known as *A. gelatinosum* until the 1980s) is unmistakable, having smooth erect colonies, initially attached but later breaking free; quantities of large colonies from the sublittoral can be washed ashore following late Summer and Autumn gales. *A. hirsutum* is also easily recognized: generally encrusting fucoids or red algae, its surface is finely papillate, giving it a matte appearance out of water; rarely it grows erect. During Winter the zooids contain conspicuous rings of whitish embryos. The remaining three species are difficult to separate, all being encrusting and smooth surfaced; the substratum may help. *A. mytili* is oviparous, and never contains visible clusters of embryos; it occurs on mussels (*Mytilus* spp.) and other mollusc shells and on the stipes of *Laminaria hyperborea* (Gunn.) Fosl. Polyps have about 15 tentacles. The other two species are larviparous. *A. gelatinosum* (formerly known first as *A. mytili* and then as *A. reticulum* Ryland & Porter (Ryland and Porter 2000)) has 18-19 tentacles and zooids contain clusters of 3-5 white, pink or red embryos mainly during Winter months. It reaches its best development on fucoids but occurs also on stones and shells (including *Mytilus*). *A. polyoum* (known from the 1980s until recently as *A. gelatinosum*) has 20-21 tentacles and zooids contain clusters of 8-9 pale brown embryos mainly during Summer and Autumn (through December); it occurs especially on fucoids but one Scottish population (Great Cumbrae island) lives on *Littorina obtusata* (L.).

Our visits to Orkney and Shetland each covered one full set of spring tides, enabling us to visit several shores. Some Orkney shores were later revisited by JSR alone. Some of the sites visited were revealed as faunistically very rich, particularly for active and passive suspension feeders such as bryozoans, ascidians, hydroids and sponges. During our surveys of the Scottish mainland, the descriptive papers of Lewis (1957) and Lewis and Powell (1960) provided an invaluable guide to suitable shores: there is nothing comparable for the Northern Isles, although Hiscock (1981) has provided a general account of the shores of Sullom Voe. The aim of this paper, therefore, besides elucidating the occurrence of *Alcyonidium*, is to draw attention to some important sites, since shores are in danger of being overlooked in the current enthusiasm for scuba diving. Finally, we shall review the occurrences of *Alcyonidium* in the Northern Isles in the context of its wider geographical distribution.

MATERIAL AND METHODS

We visited Orkney from the 25th. of September to the 2nd. of October 2000, using the facilities of Heriot-Watt University's International Centre for Island Technology in Stromness. A few shores were revisited by JSR alone in August 2001, during and following an Orkney Biodiversity Records Centre workshop on sessile animals of the lower shore. The timing of low water springs varies considerably through the islands, being earlier at Westerly sites than Easterly ones, such that it was sometimes possible to work two tides in a day. Predictions of ~0.5 m. low water provide adequate working conditions and anything <0.3 m. will be excellent (subject to the effects of wind and barometric pressure). We were in Shetland from the 31st. of May to the 5th. of June 2001, using facilities provided by the North Atlantic Fisheries College in Scalloway. Low water springs always fall during the middle day. Sites were selected from maps and charts on the basis of estimates of likely tidal flow (the prevalence of suspension feeders being related to mass tidal transport) and degree of shelter (*Alcyonidium* is

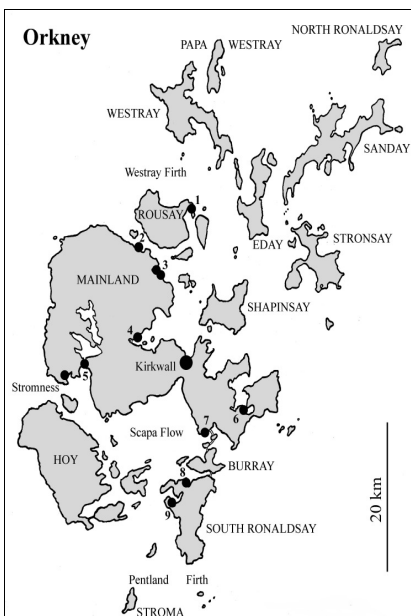


Figure 1. Sites visited September-October 2000 and August 2001, numbered as in Table 1.

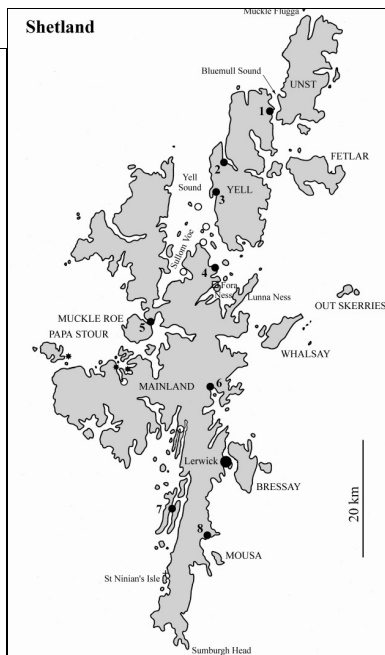


Figure 2. Sites visited June 2001, numbered as in Table 3. Additional recent records of *Alcyonidium* (J.N.C.C.-M.N.C.R.): +, *A. albidum*; ○, *A. gelatinosum*; ★, *A. mytili*; □, *A. parasiticum*.

uncommon on exposed coasts). The objective, within the constraint of ease of access (the timing of ferries and the existence of roads and rights of way), was the widest geographical coverage possible. Up to about three hours could be spent on a shore unless more than one site was to be visited on a given tide.

Site notes were made and photographs taken. A thorough search was made for *Alcyonidium*, with specimens collected where identity was in doubt. Other sessile fauna was recorded when identification could be made *in situ* or from small samples taken back to the laboratory. Limitations imposed by available works of reference and time meant that faunistic studies were confined to specific major taxa, concentrating on sessile suspension feeders under boulders or on weed rather than the fauna of exposed rocky faces.

RESULTS

Nine sites were visited in Orkney (Figure 1, Table 1) and a further nine in Shetland (Figure 2, Table 3).

Orkney

	Locality	Grid reference	Date	Tide (m.)	<i>Ad</i>	<i>Ag</i>	<i>Ah</i>
1	Rousay: Bay of Ham, Sound of Langataing	HY453320	28-09-00 22-08-01	0.64	A	A	X
2	Mainland: Evie, by Aikerness	HY370266	18-08-01	0.45		X	
3	Mainland: Tingwall and Woodwick	HY404228 HY397237	27-09-00	0.78		X	
4	Mainland: the Ouse outflow	HY362143	18-08-01				A
5	Mainland: the Bush, Loch of Stenness	HY283110	26-19-00 18-08-01	0.83 0.83		A O	
6	Mainland: St. Peter's Bay, Deer Sound	HY541043	01-10-00 19-08-01	0.29 0.21		A	A
7	Mainland: St. Mary's, Bay of Ayre	HY475013	29-09-00	0.53		O	O
8	S. Ronaldsay: St. Margaret's Hope	ND445939	29-09-00				
9	S. Ronaldsay: Oyce of Herston	ND425914	30-09-00 23-08-01	0.61 0.16		O	

Table 1. Localities visited in Orkney, with Ordnance Survey grid references. Three species of *Alcyonidium* were recorded: *A. diaphanum* (*Ad*), *A. gelatinosum* (*Ag*) and *A. hirsutum* (*Ah*). A = abundant, O = occasional, X = present (abundance not recorded). Predicted low water (from tables) is for the most appropriate locality; morning tides were lower than evening tides.

1. Rousay, Bay of Ham. Past the lochan a spit projects towards the turbulent tide race in the Sound of Langataing. The spit has longitudinal ridges of barnacle-covered bedrock, with the strata dipping to the West. The steep scarp faces are undercut and overhung with *Fucus serratus* L.; much *Tubularia larynx*, some orange *Alcyonium digitatum* L., *Polyclinum aurantium* and *Aplidium proliferum* (authorities for ascidian, bryozoan, hydroid and sponge species are given in Table 4). Shore mostly with *Ascophyllum nodosum* (L.) le Jol. giving way to *F. serratus* lower down, but the pool toward the end of the spit has *Himanthalia elongata* (L.) S. F. Gray. The bedrock

weathers into flat slabs which, with smaller stones, accumulate in the gullies; bryozoans encrust both surfaces, even on small stones when clear of the sediment. Such slabs and overhangs had pendent *Alcyonidium diaphanum* in fair abundance. *A. gelatinosum* was both under the slabs and on the *F. serratus* toward the end of the spit; some long, flat, lobate colonies were found among *Laminaria* holdfasts at Low Water Spring Tide level. *A. hirsutum* was abundant mainly as small colonies on *Cladophora* and other filamentous algae. Twenty-five flat stones or splits, in size less than ~30 cm. in the longer axis, were examined for all *Bryozoa*, in addition to typical rock dwellers such as *Verruca stroemia* and spirorbids (at least three spp.). Twenty-five bryozoan species were recorded (Table 2). Numerous sponges were present on the slabs (Table 4).

<i>Phaeostachys spinifera</i>	24	<i>Crisidia cornuta</i>	7
<i>Celleporina hassallii</i>	23	<i>Callopora dumerilii</i>	3
<i>Escharoides coccinea</i>	23	<i>Cribrilina cryptoecium</i>	3
<i>Callopora lineata</i>	22	<i>Scruparia chelata</i>	3
<i>Microporella ciliata</i>	22	<i>Umbonula littoralis</i>	3
<i>Callopora rylandi</i>	20	<i>Alcyonidium gelatinosum*</i>	2
<i>Celleporella hyalina</i>	19	<i>Electra pilosa</i>	2
<i>Membraniporella nitida</i>	17	<i>Scrupocellaria scruposa</i>	2
<i>Cauloramphus spinifer</i>	16	<i>Diplosolen obelia</i>	1
<i>Schizoporella linearis</i>	13	<i>Flustrellidra hispida</i>	1
<i>Crisia aculeata</i>	12	<i>Hippothoa divaricata</i>	1
<i>Haplopoma graniferum</i>	12	<i>Scrupocellaria reptans</i>	1
<i>Escharella immersa</i>	8		

Table 2. Rock encrusting bryozoans on the spit, Bay of Ham, Rousay. The numeral is the number of stones or rock splits, out of the total sample of 25, supporting the bryozoan. (*The number for *A. gelatinosum* is possibly an underestimate, as small colonies may have been dissolved by the bleach used to clean the calcified species.)

2. Evie. With some shelter from the East, this is a better site than nearby Tingwall Pier. Very clear algal zones, with midshore *Ascophyllum*, then *Fucus serratus* and *Laminaria digitata* (Huds.) Lamour.. There were large, but slippery, flattish boulders in the *Laminaria* zone. *Schizoporella unicornis* and *Umbonula littoralis* were abundant on the underside of boulders.

3. Tingwall Pier and Woodwick. We visited the rather exposed shore just S.E. of the pier; *Fucus serratus* was not well uncovered and continued well below the day's low water (L.W.), but *Laminaria hyperborea* holdfasts were collected by snorkelling. *Alcyonidium gelatinosum* was observed on subtidal *Gibbula cineraria* (L.). Woodwick was more sheltered with plenty of *Ascophyllum* (bearing small clumps of *Bowerbankia imbricata*). *Laminaria* at L.W. and the low level *F. serratus* had *Alcyonidium hirsutum*. Worth a longer visit.

4. The Ouse outflow, Finstown. A brief visit made on late ebb. *Fucus serratus* clumps in the flow had *Alcyonidium hirsutum* in great abundance. There were many ascidians including *Dendrodoa grossularia*, *Ciona intestinalis*, and *Ascidella scabra*.

5. The Loch of Stenness communicates with the Bush via a three-arch bridge through which the tidal flow can be very strong. The channel winds through the Bush with *Ascophyllum* – *Fucus* flats to each side. Not a rich fauna but *Clava multicornis* was abundant and conspicuous on both sides of the bridge; seaward of the bridge *Electra crustulenta* was plentiful on *F. serratus*, together with *Spirorbis spirorbis* (L.). *Alcyonidium* was more abundant in 2000.

6. St. Peter's Bay, Deer Sound. Off Comely Farm is a reef (exposed at L.W.S.T.) populated with *Laminaria digitata* (bearing bryozoans, spirorbids and ascidians) and some *Saccorhiza polyschides* (Lightf.) Batt.. In the gully before the island is a *Zostera* bed with *Chorda filum* (L.) Stackh., the tangles supporting ascidians, and a little *Halidrys siliquosa* (L.) Lyngb. with *Scrupocellaria reptans* and *Aplidium pallidum*. *Celleporella hyalina* was abundant on kelp blades, and some *Callopora lineata* on both blades and *Halidrys*. At a slightly higher level we found *Fucus serratus* and *Ascophyllum* with more ascidians. There was also floating *F. serratus*, very richly encrusted, with *Alcyonidium gelatinosum* and *A. hirsutum*. The ascidians were spectacular. On the larger boulders were *Ascidia mentula* (together with white and orange *Alcyonium digitatum*). On *Laminaria* fronds and stipes, and on the rare clumps of *F. serratus*, were *Ascidella aspersa*, *A. scabra*, a little *Ciona* and numerous examples of *Corella parallelogramma*, *Botryllus schlosseri* and *Botrylloides leachi*.

7. St. Mary's, Bay of Ayre. Partially sheltered, with abundant *Ascophyllum*. Some *Alcyonidium hirsutum* and *Bowerbankia imbricata* on this.

8. St. Margaret's Hope. Only seen about 1.5 hours after L.W.. Some *Ascophyllum* was well covered with ascidians (*Asciella aspersa*, *A. scabra*, *Botryllus schlosseri* and *Ciona intestinalis*).

9. Oyce of Herston. We worked towards the spit which separates Widewall Bay from the Oyce of Herston. A very sheltered fucoid shore, with *Bowerbankia imbricata* on *Ascophyllum* and *Fucus vesiculosus* L.. The spit, which lacked macroalgae other than a finely filamentous red forming clumps 3-5 cm. across, was surrounded by dense *Zostera marina* L. and clumps of *Halidrys siliquosa* in the water at L.W.. The *Halidrys* also had this red alga, together with huge clumps of *Walkeria uva*, large clumps of *Plumularia setacea*, a firm speckled grey form of *Diplosoma listerianum*, *Aplidium pallidum* and some sponges. *Saccharina latissima* (L.) Lane, Mayes, Druehl & Saunders (= *Laminaria saccharina* (L.) Lamour.) bore *Celleporella hyalina*, *Callopora lineata* and *Tubulipora* sp..

Shetland

1. Cullivoe, Bluemull Sound, Yell. South shore was very sheltered with *Fucus spiralis* L. and extensive long *Ascophyllum*; very little *F. serratus*. On the *Ascophyllum*, very abundant small colonies of *Alcyonidium hirsutum*, together with *Bowerbankia*, *Umbonula littoralis*, *Cribrilina cryptoecium*, *Leucosolenia botryoides*, *Coryne muscoides* and *Clava multicornis*. Species on *F. serratus* included *Walkeria uva* and *Trididemnum cereum* (with some *Lamellaria* egg masses – see 5 below).

2. Gremister, the Herra, Whalfirth, Yell. The voe is about six km. long, North facing and narrow; Gremister is over three km. from mouth, where the voe does a dog's leg. A North facing sandy beach, crossed by a stream. Rocky to the West of the beach; mid-shore with fairly bushy *Ascophyllum*, and a low tide zone of *Fucus serratus*. Abundant *Mytilus*, *Alcyonidium hirsutum*, *A. gelatinosum* and *Flustrellidra*.

	Locality	Grid reference	Date	Tide (m.)	Ag	Ah
1	Yell: Cullivoe	HP545023	05-06-01	0.75	?	A
2	Yell: Gremister, the Herra	HU465935	05-06-01	0.49	A	A
3	Yell: Southladie Voe, West Sandwick	HU448879	05-06-01	0.49	A	F
4	Mainland: Mossbank, Yell Sound	HU449754	01-06-01	0.38	A	A
5a	Muckle Roe Bridge	HU343659	02-06-01	0.58	F	A
5b	Muckle Roe Marina	HU337663/4	02-06-01	0.58	?	?
6	Mainland: Catfirth	HU443540	02-06-01	0.38	F	A
7	Burra: Bridge End	HU374333	03-06-01	0.57	F	A
8	Mainland: Voxter Pier, Aith Voe.	HU438283	04-06-01	0.37	F	O

Table 3. Localities visited in Shetland, with Ordnance Survey grid references. Two species of *Alcyonidium* were recorded: *A. gelatinosum* (Ag) and *A. hirsutum* (Ah), A = abundant, F = frequent, O = occasional, ? = not on our lists, possibly an error of omission. Tidal predictions (from tables) are from the most appropriate locality (Foula for West coast sites).

3. Southladie Voe, West Sandwick, Yell Sound. Very sheltered shore in a South facing voe, behind a long breakwater. The water was very peaty. Very long (nearly 2 m.) *Ascophyllum* on the lower shore, with *Alcyonidium gelatinosum*, which contained some embryos, particularly prevalent at the base of the plants, and *A. hirsutum*.

4. Mossbank. Facing Northeast. Fetch approximately 4 km. to island of Yell. A boulder shore, backed by a sea wall. *Fucus spiralis*, *F. vesiculosus*, a little *Ascophyllum nodosum* and *F. serratus*, with *Mastocarpus stellatus* (Stackh.) Guiry, *Laminaria digitata* and *Alaria esculenta* (L.) Grev.. *Alcyonidium hirsutum* was abundant, especially on *Mastocarpus*, but also on *F. serratus* and *Chondrus crispus* Stackh.. *Alcyonidium gelatinosum* was found on *F. serratus* and the undersides of stones, and there was recent *Alcyonidium* settlement (small colonies) on the ends of *F. serratus* fronds. *Flustrellidra hispida*, *Dynamena pumila*, *Clava multicornis* and *Gonothyrea loveni* were abundant on the lower shore fucoids.

5a. Muckle Roe, East of the bridge. A gravelly substratum, partially drying out at low tide to an island. Clumps of *Ascophyllum* and *Fucus serratus*, *Laminaria digitata*, some *Saccharina latissima*, *Chorda filum*

and *Himanthalia* (as buttons). Abundant *Dynamena*, *Clava*, *Laomedea flexuosa* and *Bowerbankia* sp.. Some *Alcyonidium gelatinosum* present on *F. serratus* and *Ascophyllum*; colonies moderately sized – some of these had quite thick white walls and other colonies were very thin. Abundant *Alcyonidium hirsutum*, mainly on *Ascophyllum*, but also on *F. serratus*, *F. vesiculosus* and *Chondrus crispus*, mainly as small colonies – indicative of settlement earlier in the year. Furoid algae supported a rich sessile fauna including *Sidnyum turbinatum*, with *Lamellaria perspicua* (L.) egg masses neatly placed below the common cloacal openings, and scyphistomae of *Aurelia aurita* (L.).

5b. Muckle Roe Marina, where the marina channel meets the main channel. Abundant *Pelvetia*, *Fucus spiralis*, *F. vesiculosus*, *Ascophyllum*, *Halidrys*, *Himanthalia*, *Laminaria digitata*, *Furcellaria lumbricalis* (Huds.) Lamour. (= *F. fastigiata* Turner (Lamour.)), with some *Fucus serratus*. Superabundance of large *Ascidiella aspersa* with pink siphons, some *Ascidiella scabra*, *Lissoclinum perforatum*, polyclinids, abundant *Diplosoma* on *Halidrys*, *Botryllus* and *Botrylloides*. *Laomedea flexuosa*, *Clava*, abundant *Bowerbankia imbricata* (more so than at bridge site). Filamentous alga, ?*Ectocarpus*, wrapped around *Halidrys* and other algae; numerous nudibranchs; scyphistomae on underside of stones. This double site (5a and b) is extremely rich by any standards.

6. Catfirth. Southerly aspect, very sheltered by Little Holm in the mouth of the voe. Black peaty shore. Mussels near low water. *Fucus vesiculosus*, *F. serratus*, *Ascophyllum*, *Laminaria digitata* and *Chorda filum*, all attached to mussel substratum. Abundant *Alcyonidium hirsutum*, with very large numbers of small colonies, and a moderate amount of *A. gelatinosum*. Many examples of *Aurelia* washed up on the shore.

7. Bridge End, West side of channel. Appears to be a dredged small-boat channel, through which there is a very strong flow. The channel was filled with *Laminaria digitata*, covered with large colonies of *Membranipora membranacea* (with clear excurrent chimneys), and small spots of *Celleporella hyalina*. The shore is tucked in behind the bridge and the sediment very soft in places. The middle shore was *Ascophyllum*, the lower shore had broad *Fucus serratus* with (unusually) elongated air bladders in the thallus tips.

The abundance of the ascidians was amazing, especially *Ascidiella scabra* and a bright yellow ascidian, probably *Ascidia conchilega*; superabundant *Dynamena pumila*. Very profuse *Alcyonidium hirsutum* and moderately abundant *A. gelatinosum* with visible white walls. This is another important site extremely rich in ascidians, bryozoans, hydroids and sponges.

8. Voxter Pier, Aith Voe. East facing, but the voe opens to the South 200 m. downstream. A gently sloping boulder shore quite heavily coated with green and brown filamentous algae. *Pelvetia* at top, *Fucus spiralis*, *F. vesiculosus*, *Ascophyllum nodosum*, a little *F. serratus*, *Laminaria digitata* and *Halidrys* further down. The algae were for the main part clean, apart from moderate amounts of *Bowerbankia imbricata* present on *Ascophyllum*. Small amounts of *Alcyonidium hirsutum* and *A. gelatinosum* (commoner of the two), but not observed on *F. serratus*.

At least one species of *Alcyonidium* was recorded from every shore visited, except for St. Margaret's Hope, Orkney, (Table 1, 8), at which the tide was too high. *A. hirsutum* tended to be the commonest species, almost universally present, but *A. gelatinosum* was abundant at several locations. Neither *A. mytili* nor *A. polyoum* was found. Small cylindrical colonies of *A. diaphanum* were found under rock slabs on the spit at the Bay of Ham, Orkney (Table 1, 1). In searching for *Alcyonidium* we observed and identified many other bryozoans, together with sponges, hydroids and ascidians (Table 4).

DISCUSSION

Searching for *Alcyonidium* we visited nine shores in Orkney and nine in Shetland. In the absence of published information about suitable shores (*cf.* mainland Scotland), we selected accessible sites that seemed likely to combine shelter from wave action with high tidal flow, using maps and nautical charts showing tidal currents. Such sites, from our experience and from the literature (*e.g.* Lewis 1957, 1964), support large and varied populations of passive and active suspension feeders (hydroids, ascidians, bryozoans and sponges). Such shores are of high scientific interest and importance, their fauna including many primarily subtidal species.

<i>Schizoporella unicornis</i> (Johnston in Wood)	P	A	P						
<i>Scruparia chelata</i> (L.)	O								
<i>Scrupocellaria reptans</i> (L.)	R		P	P			P	P	
<i>S. scruposa</i> (L.)	O								
<i>Tubulipora</i> sp.						P			
<i>Umbonula littoralis</i> Hastings	O	A	P			P	P	P	
<i>Walkeria uva</i> (L.)						P	P		
ASCIDIACEA									
<i>Aplidium pallidum</i> (Verrill)	P		P			P			
<i>A. proliferum</i> (Milne Edwards)	P								
<i>Ascidia conchilega</i> (Müller)								A	
<i>A. mentula</i> (Müller)						P			
<i>Ascidiella aspersa</i> (Müller)	P					P	P	A	
<i>A. scabra</i> (Müller)	P		P			P	P	O A	
<i>Botrylloides leachi</i> (Savigny)						P	P	P	
<i>Botryllus schlosseri</i> (Pallas)	P		P			P	P	P	
<i>Ciona intestinalis</i> (L.)						P			
<i>Corella parallelogramma</i> (Müller)						P			
<i>Dendrodoa grossularia</i> (van Beneden)						P			
<i>Didemnum maculosum</i> (Milne Edwards)	P	P				P			
<i>Diplosoma listerianum</i> (Milne Edwards)						P		P	
<i>Lissoclinum perforatum</i> (Giard)								P	
<i>Polyclinum aurantium</i> Milne Edwards	P					P			
<i>Sidnyum turbinatum</i> Fleming								P	
<i>Trididemnum cereum</i> (Giard)			P			P	P	P	

Table 4. Faunistic records (*Porifera*, *Hydroida*, *Bryozoa* (excluding *Alcyonidium*) and *Ascidacea*) from Orkney and Shetland shores. Location numbers correspond to Tables 1 (Orkney) and 3 (Shetland). A = abundant, F = frequent, O = occasional, R = rare, P = present but abundance not recorded, ? = species identification uncertain.

Moreover, they may be considered as ecologically vulnerable to catastrophes in that almost all such species reproduce by means of brooded embryos and short-lived larvae, which are unlikely to colonize (or re-colonize) beyond short distances (Ryland and de Putron 1998). Algal dwellers may occasionally be spread by rafting (Ingólfsson 1998).

Several shores we visited were of considerable interest and some we consider of great importance. In Orkney we highlight the following. The rocky spit in the Bay of Ham, Rousay, that projects into the current swept Sound of Langataing (site 1); here the weathering of the bedrock has produced both overhangs and flat

boulders which support a diverse fauna of bryozoans (30 species, Tables 1, 2 and 4) and sponges, with some ascidians and orange coloured *Alcyonium digitatum*. The Bush, on the mainland, (site 5), carrying the brackish outflow from the Loch of Stenness; *Electra crustulenta*, which is of very local occurrence around the British Isles, was abundant here. St. Peter's Bay, Deer Sound, on the mainland (site 6) supports a spectacular abundance and diversity of ascidians including *Ascidia mentula* and *Corella parallelogramma* which are rarely found between tidemarks; *Alcyonium digitatum* was also seen here. Finally, the Oyce of Herston (site 9) shared some of the features of St. Peter's Bay, with ascidians conspicuous, while the *Halidrys* supported tufts of *Walkeria uva*. We did not visit the Northernmost islands.

In Shetland the two localities that stand out as being of great ecological significance are both narrow channels between islands: that between Muckle Roe and the mainland, where we collected at two sites (5a and b) and Bridge End (site 7) in the narrow passage between East and West Burra. Both channels are rich in hydroids and ascidians, the latter being particularly colourful in the clean water. This was particularly true for *Ascidia conchilega* at Bridge End, often greyish but here bright yellow (a trait more often observed in *Ciona intestinalis*), while we also noted – but did not record – other abundant animals such as nudibranchs. The alga *Halidrys siliquosa* was observed at several sites in both island groups, but never with the hydroid *Aglaophenia pluma* (L.), so often associated with it further South. Though there is one recent record from Rousay Sound (National Biodiversity Network Gateway web site, as of the 8th. of October, 2007) and an early one from Westray, Orkney (Hincks 1868) we have not seen it North of the Uists.

Alcyonidium diaphanum, if found growing on the shore at all, occurs only at extreme low water springs. We saw it only once but expect it to be widespread subtidally (and to get washed ashore during Autumn storms). It was recorded at numerous sites in the 1995-1997 Joint Nature Conservation Committee - Marine Nature Conservation Review surveys of Orkney (Side and Unsworth 2000),

mainly around Scapa Flow but also at Wide Firth and off Sanday and Papa Westray. In Shetland, Norman (1869) found it by dredging at $\sim 60^{\circ}45'N.$, $0^{\circ}35'W.$ and $\sim 60^{\circ}27'N.$, $1^{\circ}W.$; it was not recorded during a recent survey of Sullom Voe (Spurrier and Wood 1997) but has been recorded from numerous sites at 5-47 m. depth during J.N.C.C.-M.N.C.R. surveys (N.B.N. Gateway). Unlike the other species discussed here it is easily recognized (though a look-alike species that differs by having oviparous reproduction has recently been described (Porter 2004); its geographical limits are not precisely known). *A. hirsutum*, common in both island groups, is a very widely distributed species. It occurs on both sides of the North Atlantic, extending into Arctic waters. In Europe it is found in the Skaggerak and Southwards to Brittany. Turning to the smooth-surface encrusting species, *A. polyoum* was not found in either island group. Our surveys have established it to be an essentially Southern species, extending Northwards from the rias of Galicia, through the Bay of Biscay, around the coasts of Ireland and England, to the Mull of Kintyre and the Clyde on the West. We have no West coast records North of the Firth of Clyde, but many of our visits were made before all the differences from *A. gelatinosum* were understood. On the East coast it reaches North to Meikle Ferry, Dornoch Firth (Ryland and Porter 2005, 2006), where it is abundant. This outlier seems surprising, but possibly the shallow waters become warm during Summer (permitting breeding). *A. mytili*, on the other hand, though not observed, was expected and probably occurs (it has been recorded in both Orkney and Shetland (Figure 2) by J.N.C.C.-M.N.C.R. teams). It tends to be found intertidally only on exceptionally low ebbs, often on mussels, *Mytilus edulis* L., (as in the Firth of Forth) (Cadman and Ryland 1996b), or the stipes of *Laminaria hyperborea*. Its Southern extension is not known, but it occurs from Pembrokeshire and the West of Ireland up the West coast of Scotland (*e.g.* Falls of Lora (Loch Etive), at Ballachulish, Loch Eil, in the channel below Kylesku Bridge (Sutherland) and at Lochmaddy (North Uist)), and has been seen recently in Southwest Iceland and on the North Sea island of Sylt

(Ryland and Porter 2006); old records indicate its presence in the Southwestern Baltic (see Ryland and Porter 2003).

Alcyonidium gelatinosum, the species at the centre of so much confusion (Ryland and Porter 2003, 2006) was almost as abundant as *A. hirsutum*. It was also widely recorded (though often misidentified) in Orkney by the J.N.C.C.-M.N.C.R. teams in Scapa Flow, Wide Firth and, in 1997, intertidally in Sanday. Its identification within the islands will present no difficulty in the absence of *A. polyoum*. The first record is that of Norman (1869) who recorded “a third species [*i.e.* after *A. diaphanum* and *A. hirsutum*] between tide-marks, West Voe, Out Skerries ... MS name *A. radiatum*” [a *nomen nudum*]. Even after its recognition, confusion over its identity continued because it was thought to be confined to stones (and, more rarely, the shells of some molluscs). In the Menai Strait, for example, *A. polyoum* is abundant on fucoids, *A. gelatinosum* restricted to stones. The realization that, in some localities, it also encrusts fucoids, in the same manner as *A. hirsutum* and *A. polyoum*, means that many – even quite recent – records attributed to the latter are actually of *A. gelatinosum*. The *Alcyonidium* sp. recorded from several sites in Sullom Voe (Hiscock 1981) could be *A. gelatinosum*, *A. hirsutum* or a mixture of the two and there are several recent J.N.C.C.-M.N.C.R. (N.B.N. Gateway)) records (see Figure 2) which must be *A. gelatinosum*. This species extends from Brittany in the South, around Ireland and England to Denmark, the South-western Baltic, and Norway. It is abundant in suitable localities along the Scottish West coast and in the Hebrides. As shown here, it is widespread throughout both Orkney and Shetland. Kramp (1934) gave a number of Faroese localities for “*A. polyoum* syn. *A. mytili*”. Only one, “on algae in the intertidal zone, Vestmanhavn [an inlet subject to considerable freshwater discharge], Strømø” appears referable to *A. gelatinosum*, the other, deeper, records on shells probably being of *A. mytili* (or a different species altogether). We did not find *A. gelatinosum* in Southwest Iceland (visited August 2002). For Norway, Dons (1939) stated that its distribution was virtually identical to that of *A. hirsutum*, with which it occurred on fucoids

(though it was also found on mussel shells), and therefore did not itemize localities. As with Kramp's (1934) Faroese records, some of Dons' evidently refer to *A. mytili*. Thus, while *A. hirsutum* was distributed all the way up to Finnmark (to the Varanger Fjord on the border with Russia), the Northern limit of *A. gelatinosum* remains undetermined.

Two other species, *Alcyonidium albidum* Alder and *A. parasiticum* (Fleming), have been recorded in Shetland once (J.N.C.C.-M.N.C.R.) (Figure 2).

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