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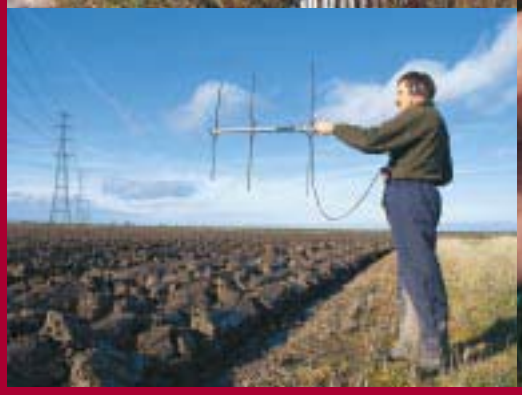

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Thanet intertidal survey: Assessment of favourable condition of reef and sea-cave features in the Thanet Coast cSAC

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Executive summary

- The results of monitoring ‘reef’ and ‘sea-cave’ features in the Thanet coast cSAC are reported.

- Study areas monitored in 1997 were re-assessed and new study areas established (North Foreland, between Dumpton Gap and Ramsgate, Pegwell).

- Chalk cliff and cave biotopes at the study areas were as previously reported; cliff and cave biotopes of the new study areas were similar to those at other study locations.

- Foreshore reef biotopes at the study areas were as previously reported apart from the absence of a bloom of green algae.

- Of the 35 biotopes recorded in 1997, the 12 most common were re-assessed (the remainder fell outside the study locations).

- The important biotope ‘Kelp-dominated communities on animal-bored rock’ was present in most study locations and remained widespread in the Thanet coast cSAC; constituent species were largely as recorded in 1997.

- Of the 7 important biotopes encompassing ‘red-algal turf communities’, 3 were missed in the present study, and 2 were re-assessed at single study areas only.

- The targets for ‘favourable condition’ status have been met.

- A re-classification of ‘littoral cave and overhang’ biotopes is reviewed using results from this monitoring survey.

- Recommendations for future monitoring are made.

Contents

1. Introduction

1.1 Background

The Isle of Thanet, a small peninsula and outcrop of chalk rock at the extreme east of Kent (Figure 1), has a coastline characterised by a geomorphological structure in which subaerial and marine erosion creates a vertical rocky cliff face that abuts a horizontal wave-eroded platform. The coast of Thanet holds Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and Ramsar Site status. In 1996 the Thanet coast was also put forward to the European Commission as a candidate Special Area of Conservation (cSAC). The qualifying features of interest are the submerged or partly submerged chalk sea-caves and reefs (Brown *et al*, 1997). Reefs include 'submarine, or exposed at low tide, rocky substrates and biogenic concretions, which arise from the sea floor in the sublittoral zone but may extend into the littoral zone where there is an uninterrupted zonation of plant and animal communities'. In the present case the reef is a chalk wave-cut platform. A 'Habitat Action Plan' for chalk shores has been prepared recently (Anon, 2000) as part of the United Kingdom 'Biodiversity Action Plan' (BAP).

A comprehensive survey of chalk cave, cliff, intertidal and subtidal reef biotopes of the Thanet coast cSAC was undertaken in 1997 (Tittley *et al*, 1998). This study has provided much of the baseline information for monitoring the marine biotopes and associated fauna and flora at sites along the 23km stretch of coast. Fowler & Tittley (1993) reviewed the importance of coastal chalk cave and cliff habitats in Britain. Their extent in Thanet was described and mapped by Tittley (1985) and this provides an important baseline for comaprison. The structure and composition of the associated algal communities was analysed by Tittley & Shaw (1980). Since 1997 additional coastal biotope mapping has been undertaken in the Thanet coast cSAC between Walpole Bay and Foreness Point (Anon., 1998).

English Nature has a duty to monitor and assess the condition of the reef and cave features in order to report their conservation status. *English Nature*'s advice as to the conservation objectives, and objectives which may cause deterioration of natural habitats or the habitats of species, or disturbance of species for the North East Kent European marine sites (which includes the Thanet coast cSAC) has been prepared (Anon. 1999). This fulfils its obligations under Regulation 33(2) of the Conservation (Natural Habitats, &c) Regulations 1994. A management scheme for the North East Kent European marine sites has also been prepared (Anon. 2001).

The conservation objectives for the reefs and caves of the Thanet coast cSAC are:

- subject to natural change, maintain the reefs in favourable condition, in particular, intertidal chalk cliff algal communities and lichen communties, intertidal red algal turf communities, kelp dominated communities on animal bored rock;
- subject to natural change, maintain the submerged or partially submerged sea caves in favourable condition, in particular, intertidal chalk cliff algal and lichen communities.

1.2 Aims and Objectives

The aim of this study is to monitor and assess the condition of the reefs and caves in the Thanet coast cSAC, with the specific objectives:

- ∉ to survey littoral monitoring sites that encompass the range of important biotopes present at Thanet, using the information defined in the conservation objectives;
- ∉ to survey these sites (including a full species inventory and assessment of abundance) suitable for repeat surveys over a time series;
- ∉ to compare survey results with data collected in 1997 (Tittley *et al*, 1998) and identify any differences.

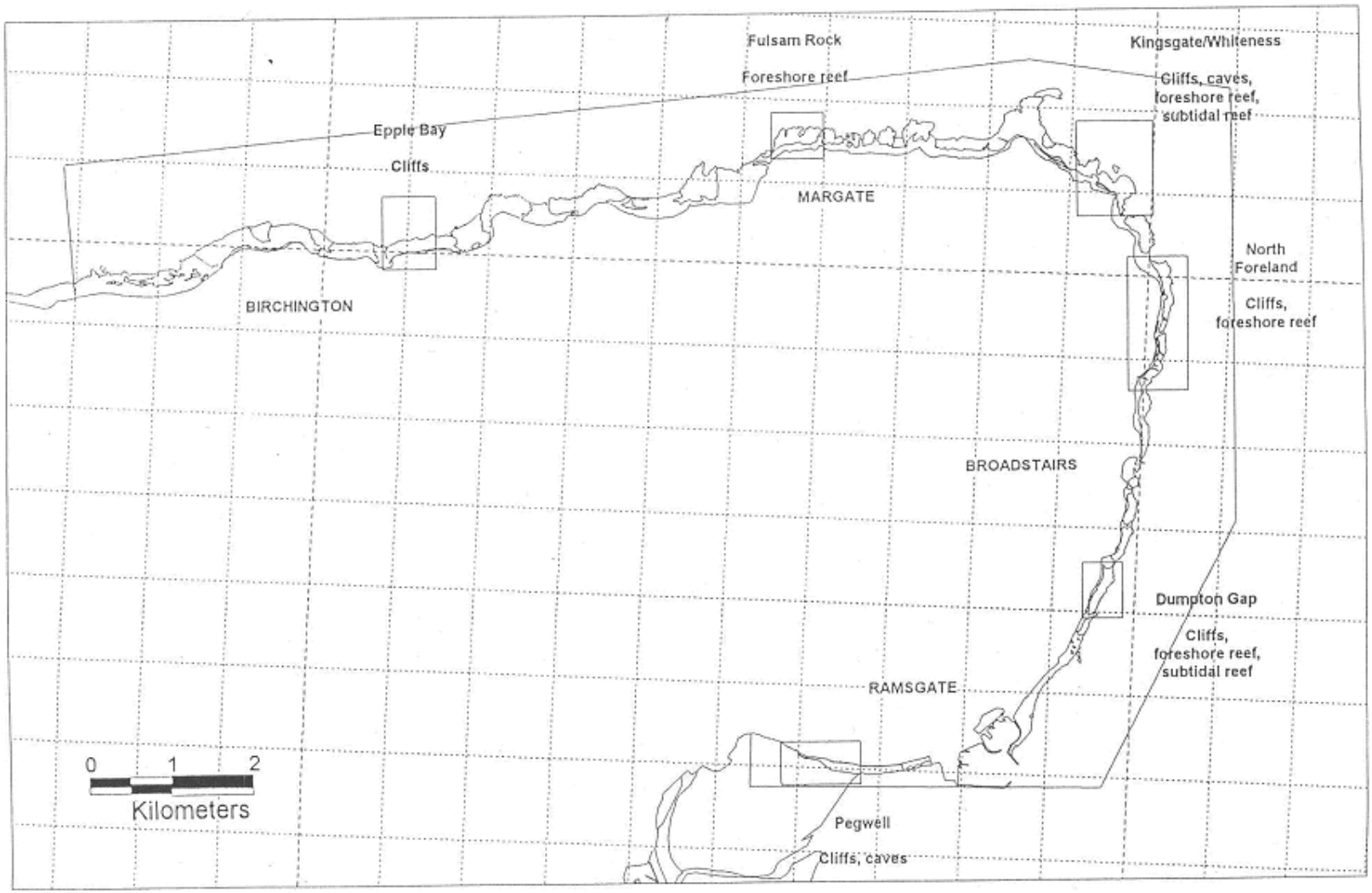

Figure 1. Map of the Thanet coast cSAC showing sites of particular interest.

2. Methods

Six 'sites (locations) of particular interest' around the Thanet coast cSAC were identified by Tittley *et al* (1998, Figure 1) from the 1997 biotope survey. These and their features of interest were:

Location	Feature Caves/cliff	Feature Foreshore reef	Survey 1997	Survey 2001
Epple Bay (EB)	+		+	+
Fulsam Rock (FR)		+	+	+
White Ness (WN)	+	+	+	+
North Foreland (NF)	+	+		+
Dumpton Gap (DG)	+	+		+
Pegwell (PB)	+			+

More detailed field-survey (to Phase 2/3 level) was undertaken in 1997 at three of these locations (see above) all of which were located on the northeast and north coast of Thanet. The present (2001) survey re-assesses previously studied areas, and establishes new study locations and areas on the east, southeast and southwest coasts of Thanet (see above). The biotope distribution maps created in 1997 were used to position the new study areas in order that the range of biotopes that characterise the cliff and foreshore reef of the Thanet cSAC was adequately represented. The positions of the study areas are shown in figures 2 – 7.

Surveys at all survey areas were based on the ACE methodology (Hiscock, 1998) but with a different approach for cliff /cave habitats. The method serves to identify or confirm the species present in biotopes at a particular area.

Fieldwork was undertaken as follows:

15 September 2001 pm	White Ness/Botany Bay
16 September 2001 pm	White Ness
	North Foreland
17 September 2001 pm	Pegwell
	Dumpton
21 September 2001 am	Fulsam Rock
22 September 2001 am	Epple Bay
	Dumpton/Ramsgate

Caves and cliffs

Phase 2 studies in chalk caves and on cliff faces involved recording along a transect line at 0.5m intervals from beach level to as high as could be reached safely. A photographic record (still and video film) was made at each study transect. For ease of future monitoring by non-specialists, the principal algal zones or communities were also given simple descriptive names (*eg* brown gelatinous zone; red algal felt etc.). The biotope classification for cliffs and caves (Connor *et al*, 1997) has recently been revised (Bull, 2001, unpublished). Data gathered from the transect studies of Thanet caves and cliffs were used to review a proposed reclassification of cave biotopes (see below, section 4.4).

Reefs

At each of the overall study locations the characterising biotopes were identified and checked against those recorded in the 1997 biotope maps. Detailed study areas were located in the main habitats (midlittoral rocky reef (MLR), rockpools (Rkp), lower littoral and sublittoral fringe (MIR) reef). The study areas were positioned to form a discontinuous transect across the foreshore reef, and were surveyed at Phase 2 level using the ACE methodology. In this survey a $1m^2$ quadrat was established in each of the biotopes studied, the characterising species were identified and their abundances and percentage cover recorded. The SACFOR abundance scale was used (see Connor *et al*, 1997 p. 297). The surrounding area was also checked for additional species. In addition, other associated species were listed and their abundances noted. A photographic record (still and video) was kept of each biotope recorded.

Study areas SS1-9 in Tittley *et al* (1998) have been re-numbered SAC1-9. Note that the positions of SS 6/7 (Now SAC6 and 7) and SS8 (now SAC8) were incorrectly reversed in Figure 3 in Tittley *et al* (1998). Cave study areas SAC6 and 7, on the north and south cave walls respectively, each comprised two transects at 5m and 10m in from the entrance of the cave.

The present survey used the biotope classification system of Connor *et al* (1997) in order to achieve comparable results with the 1997 survey. Plant and animal nomenclature largely follows Howson & Picton (1997).

Location information for most study areas was supported by GPS recordings and in some cases also by measurement from a particular physical feature. The grid reference cited for each study site presents a false accuracy; although each reference point is to 1 m it is suggested that the 5 m grid square within which it falls is more realistic (ie for TR 35483 71448 read square TR 35480 71445). GPS positioning proved especially unreliable in inshore areas due to interference of GPS reception by the cliffs.

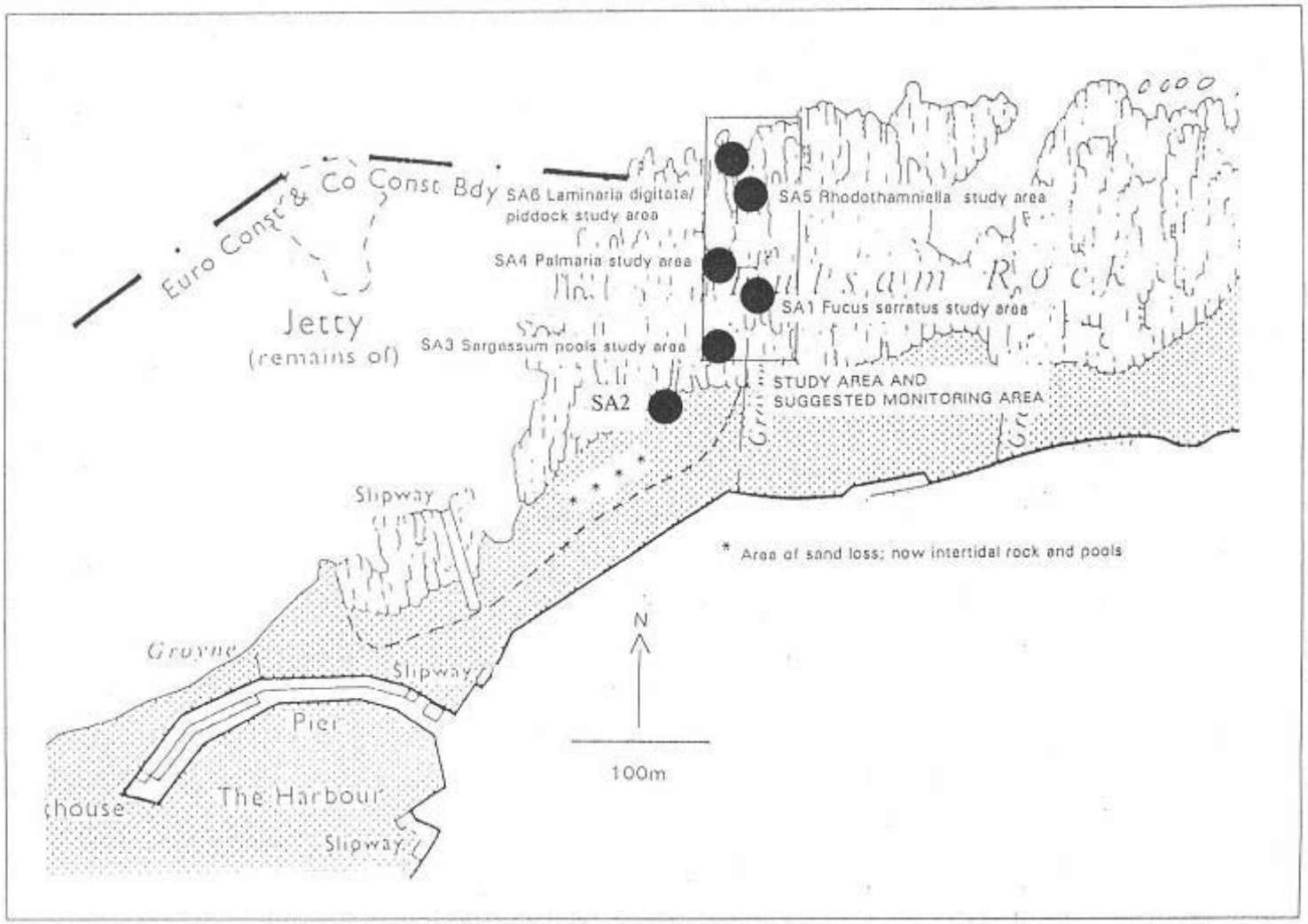

Figure 2. Map showing Fulsam Rock study areas.

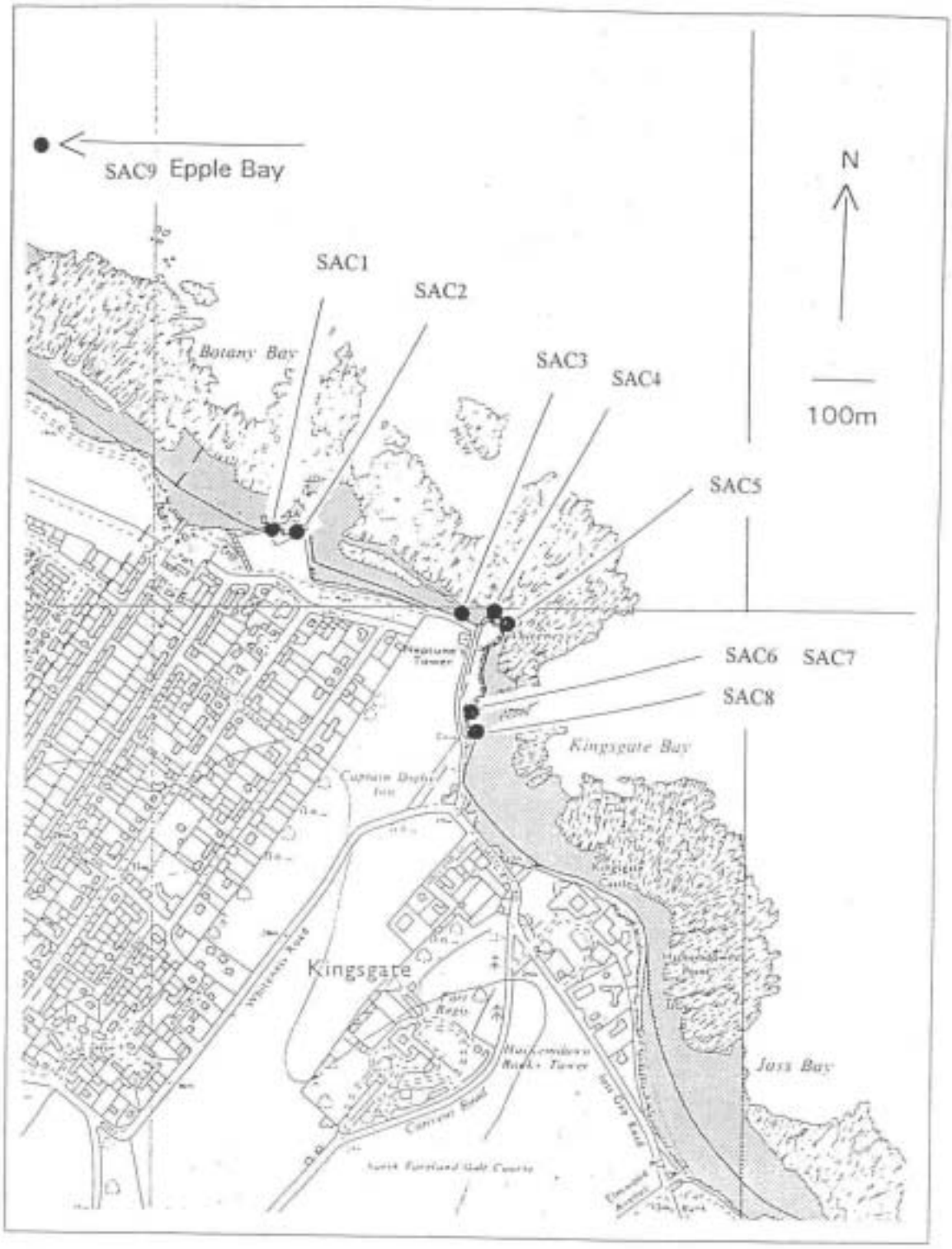

Figure 3. Map showing chalk cave and cliff study areas.

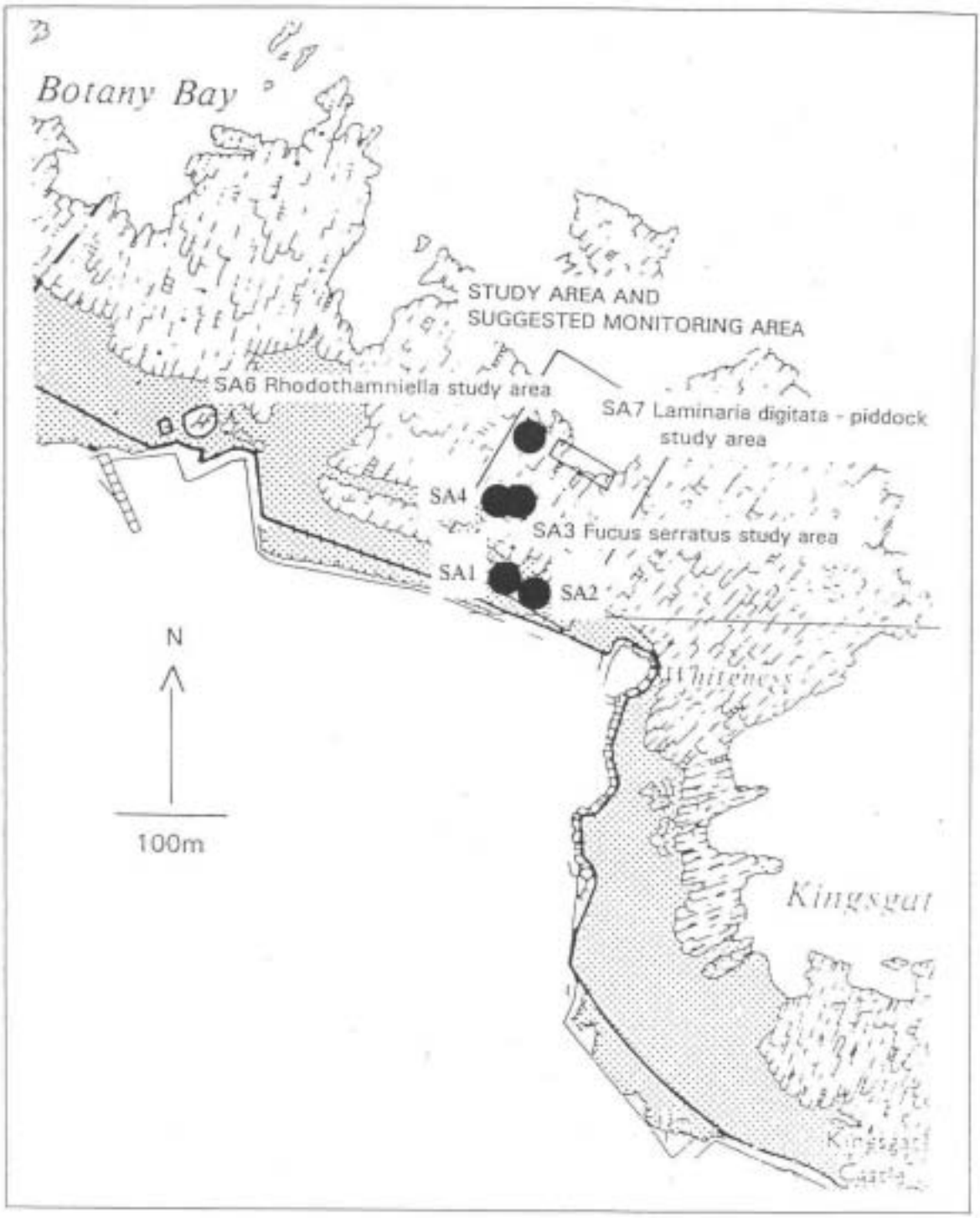

Figure 4. Map showing White Ness study areas.

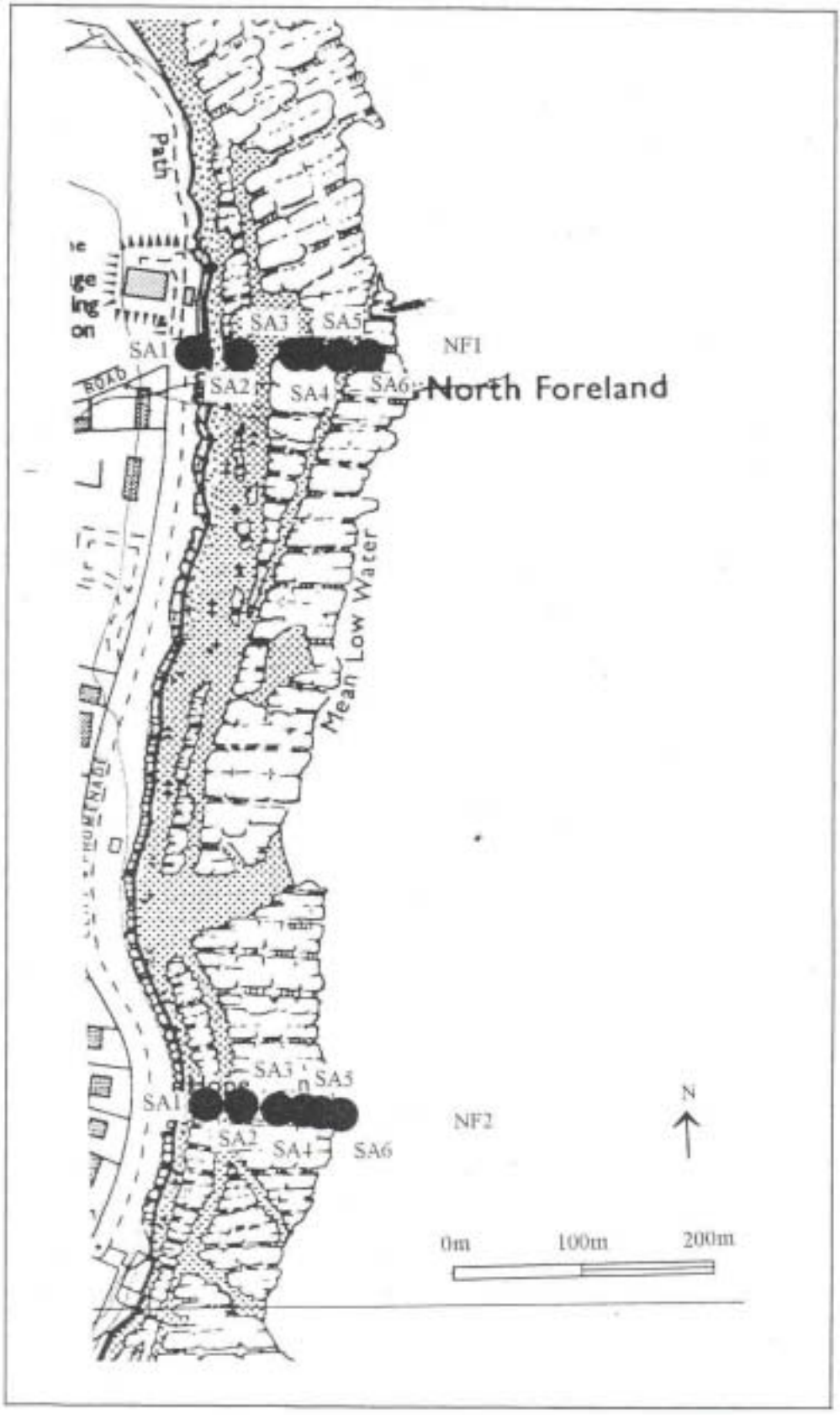

Figure 5. Map showing North Foreland study areas.

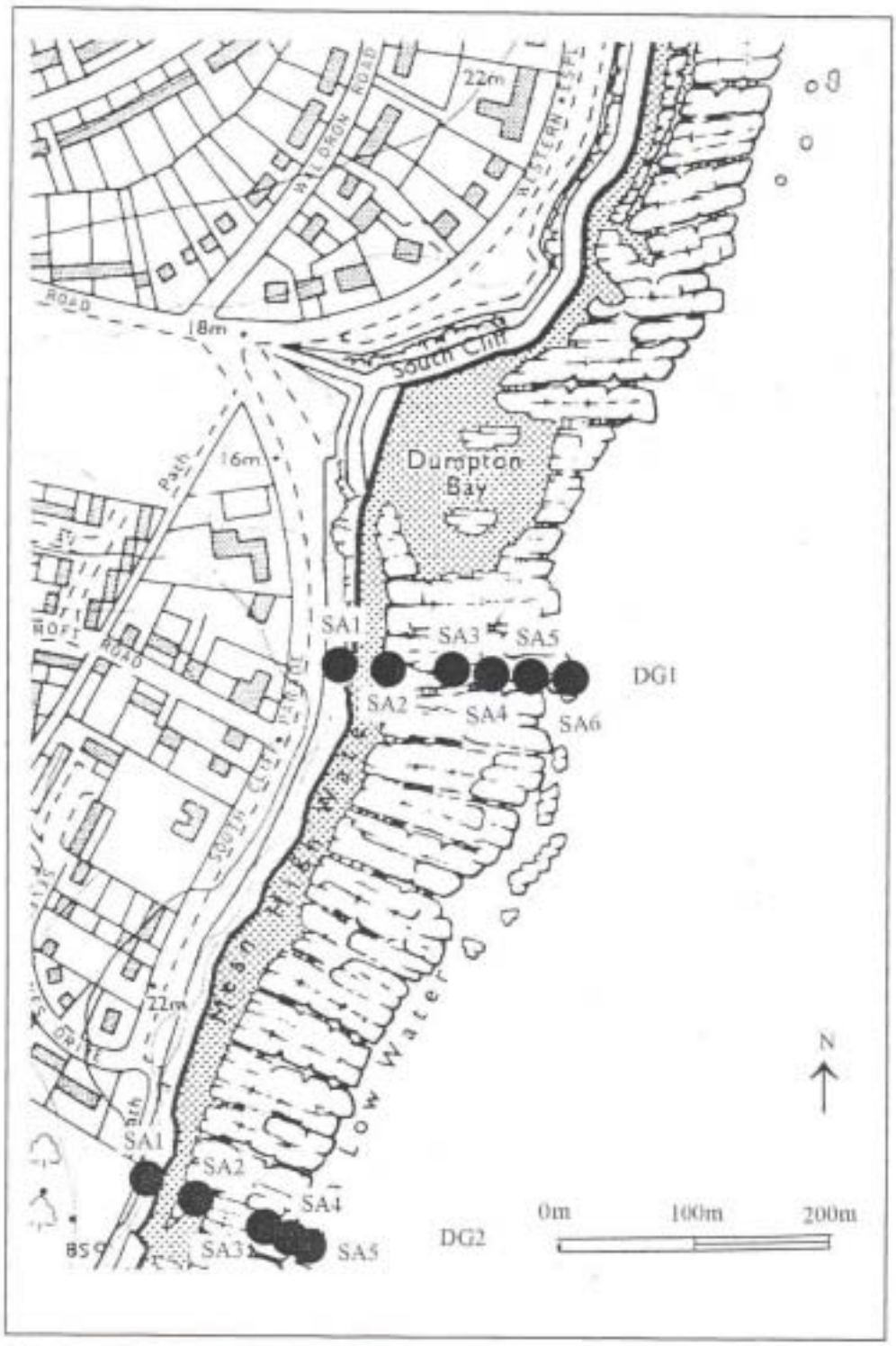

Figure 6. Map showing Dumpton Gap to Ramsgate study areas.

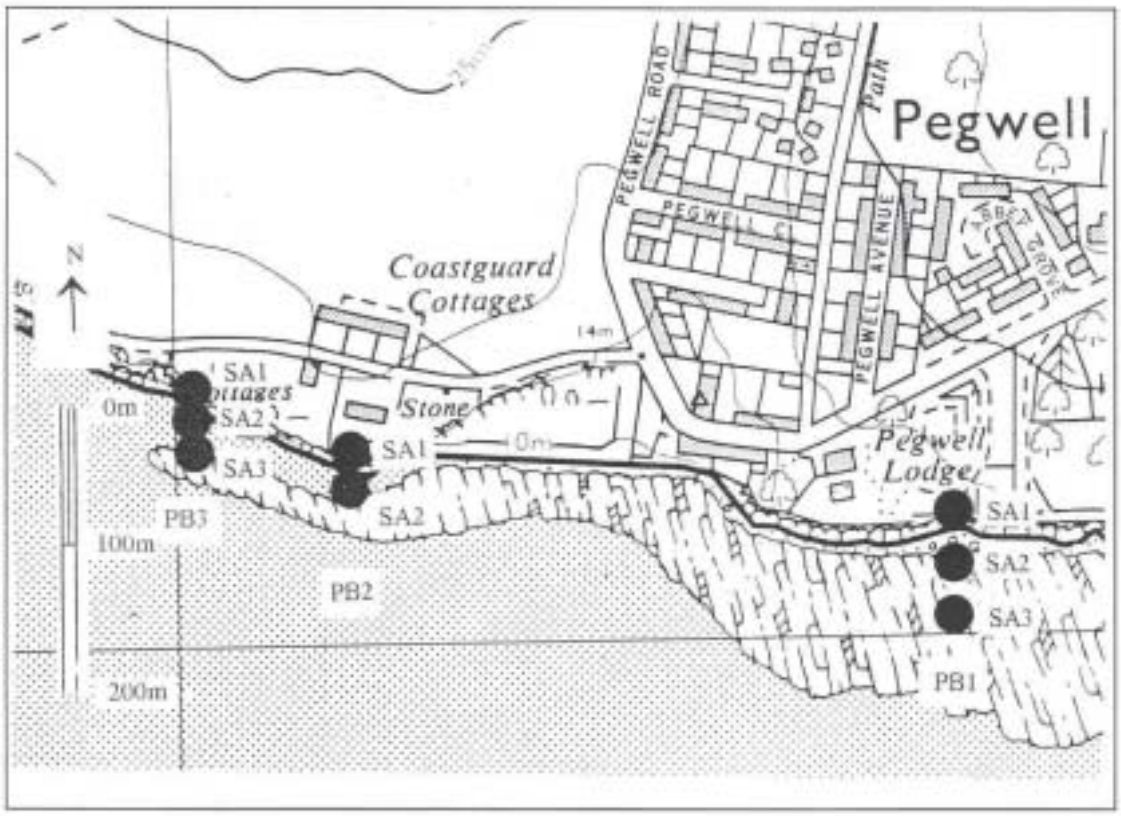

Figure 7. Map showing Pegwell study areas.

3. Results (summary)

The study areas, biotopes monitored, and the results of comparison with 1997 (Tittley *et al*, 1998) data are listed below. Full data (geographical position, shore level, species lists, abundance/cover, notes and observations) for each study area are given in Appendix 1. In general the biotopes mapped in 1997 were successfully relocated in the study areas; the characterising species (*eg Enteromorpha/Porphyra* mat, *Fucus* canopy, *Rhodothamniella* cushions, *Mastocarpus* turf, *Palmaria* cover, *Laminaria digitata* canopy) were visually obvious. The associated species lists compiled for each detailed study area (and also the surrounding area) differed little from those compiled in 1997. No significant change in biota was noted in the study areas reassessed in 2001. Biotopes, and characterising and associated species recorded from study areas in the new study locations (North Foreland, Dumpton, Pegwell) corresponded to those recorded elsewhere in the Thanet coast cSAC.

Study site		Cave/cliff	Foreshore reef biotope monitored	Result of comparison	
				biotope monitored	with 1997 data
EB	SAC9		LR.L Chr		No change
FR	SA1			MLR.BF Fser	No change
FR	SA2			MLR.Rkp Cor	No change
FR	SA3			MLR.Rkp Sar	No change
FR	SA4			MLR.Eph Rho	No change
FR	SA5			MLR.R Pal	No change
FR	SA6			MIR.LdigPid	No change
WN	SAC1		LR.L Chr		No change
WN	SAC2		LR.L Chr		No change
WN	SAC3		LR.L Chr		No change
WN	SAC4		LR.L Chr		No change
WN	SAC5		LR.L Chr		No change
WN	SAC6A		LR.L Chr		No change
WN	SAC6B		LR.L Chr		No change
WN	SAC7A		LR.L Chr		No change
WN	SAC7B		LR.L Chr		No change
WN	SAC8		LR.L Chr		No change
WN	SA1			MLR.BF Fves	No change
WN	SA2			MLR.Eph EntPor	No change
WN	SA3			MLR.BF Fser	No change
WN	SA4			MLR.Rkp Cor	No change
WN	SA5			MLR.Rkp FK	No change
WN	SA6			MLR.Eph Rho	No change
WN	SA7			MIR.LdigPid	Not studied
NF1	SA1		LR.L Chr		
NF1	SA2			MLR.Eph EntPor	
NF1	SA3			MLR.BF Fser	
NF1	SA4			MLR.Rkp Cor	
NF1	SA5			MLR.Eph Rho	
NF1	SA6			MLR.Rkp Cor	
NF2	SA1			MLR.Eph EntPor	
NF2	SA2			MLR.BF Fves	
NF2	SA3			MLR.BF Fser	
NF2	SA4			MLR.Eph Rho	
NF2	SA4A			MLR.Eph Rho/ MLR.R Osm	
NF2	SA5			MIR.LdigPid	

DG1	SA1	LR.L Chr	
DG1	SA2		MLR.Eph EntPor
DG1	SA3		MLR.BF Fser
DG1	SA4		MLR.Rkp Cor
DG1	SA5		MLR.Eph Rho
DG1	SA6		MIR. LdigPid
DG2	SA1	LR.L Chr	
DG2	SA2		MLR.Eph EntPor
DG2	SA3		MLR.BF Fser
DG2	SA4		MLR.R Mas
DG2	SA5		MIR.LdigPid
PB1	SA1	LR.L Chr	
PB1	SA2		MLR. BLitt
PB1	SA3		SLR.Myt X
PB2	SA1	LR.L Chr	
PB2	SA2		SLR.Myt X
PB3	SA1	LR.L Chr	
PB3	SA2		SLR Myt X
PB3	SA3		MLR.Eph EntPor

Of the 35 different biotopes recorded in the 1997 survey (most of which were characterised by algae) the 12 most common were reassessed in the present survey. The mixed biotopes characterised by summer flushes of green algae were not recorded on this occasion. Six of the 35 biotopes noted as rare in Britain by Tittley *et al*, (1998) were reassessed; others fell outside of the main study locations. At White Ness the deep rockpool was not relocated, and the sublittoral fringe '*Laminaria digitata* over piddock bored chalk' biotope was not examined due to a high (neap) tide.

4. Discussion

4.1 Cave and cliff biotopes

The overall distribution of chalk cave and cliff algal biotopes in the Thanet coast cSAC remained as described in Tittley (1985). Only small (natural) differences were noted on comparing 1997 and 2001 data, and these differences were probably due to seasonal change. Three of the four study areas at the North Foreland and Dumpton Gap sites included small lengths of cliff with typical cliff algal communties; in general the communities are poorly developed between Joss Bay and Ramsgate (see Tittley, 1985). Cave and cliff communties were well-developed between Ramsgate and Pegwell Bay (see Tittley, 1985).

4.2 Foreshore reef biotopes

The overall distribution of foreshore biotopes and characterising species in the sites studied remained as described in Tittley *et al*, (1998). Although more comprehensive lists of animal species were prepared on this occasion for each study area, differences between 1997 and 2001 data were minor and probably reflected natural variation. The principal difference, observed particularly at Fulsam Rock, was the absence of an overgrowth of summer ephemeral green algae. A dense summer bloom of *Enteromorpha* and *Ulva* was recorded in 1997 and also its removal from the foreshore reefs (in September 1997) following autumn storms. Its absence on this occasion may have been due to the later timing of the survey (mid-September).

4.3 Important biotopes

Chalk cliff algal and lichen communities are subfeatures of the main 'Interest features' "Reefs", and "Sea caves" in the Thanet coast cSAC. Fifteen transect study sites have been recorded in detail in the present survey (see Appendix), sufficient to report 'favourable condition' of the two features.

Red algal turf communities and Kelp-dominated communities on animal-bored rock are also important sub-features of the 'Interest feature' "Reefs". The important biotopes of these sub-features studied in the present survey and study areas at which they were monitored are presented in Table 1 below.

Table 1. Important biotopes of 'intertidal red algal turf communities' and 'kelp dominated communities on animal bored rock' sub-features.

Site/ Biotope	MLR.R Mas	MLR.R Osm	MLR.R Pal	MLR.R XR	MLR.R Pid	MLR. Eph Rho	MLR.BF FserR	MIR.KR LdigPid
FRSA1								
FRSA2								
FRSA3								
FRSA4						+		
FRSA5			+					
FRSA6								+
WNSA1								
WNSA2								
WNSA3								
WNSA4								
WNSA5								
WNSA6						+		
WNSA7								+
NF1SA2								
NF1SA3								
NF1SA4								
NF1SA4A								
NF1SA5						+		
NF1SA6								
NF2SA1								
NF2SA2								
NF2SA3								
NF2SA4						+		
NF2SA4A		?				+		
NF2SA5								+
DG1SA2								
DG1SA3								
DG1SA4								
DG1SA5						+		
DG1SA6								+
DG2SA2								

Site/ Biotope	MLR.R Mas	MLR.R Osm	MLR.R Pal	MLR.R XR	MLR.R Pid	MLR. Eph Rho	MLR.BF FserR	MIR.KR LdigPid
DG2SA3								
DG2SA4	+							
DG2SA5								+
PB1SA2								
PB1SA3								
PB2SA2								
PB3SA2								
PB3SA3								
Totals	**1**	**?1**	**1**	**0**	**0**	**6**	**0**	**5**

The table shows that 5 study areas have been located in the sub-feature 'Kelp-dominated communities on animal bored rock' (MIR.KR.Ldig.Pid biotope), a sufficient number to achieve adequate monitoring and to report favourably maintained status. The latter biotope is widespread in the Thanet coast cSAC except at the western fringes (Pegwell Bay, Minnis Bay). Of the 'red algal turf communities' sub-feature, the biotope '*Rhodothamniella floridula* on sand-scoured lower eulittoral rock' was monitored in 6 study areas, sufficient to report favourably maintained status. This biotope also occurs widely in the Thanet cSAC. The biotopes characterised by *Mastocarpus* (MLR R Mas) and *Palmaria* (MLR.R Pal) were each reassessed in only a single study area, probably insufficient to adequately monitor the status of these biotopes. *P. palmata* is common in Thanet and the establishment of additional study areas to ensure adequate monitoring study areas should be straightforward. Components of the biotope characterised by *Osmundea* and *Gelidium* were observed among a *Rhodothamniella* turf at Hope Point (NF2) but otherwise missed in this survey. The *Gelidium* dominated vegetation recorded at Pegwell may represent a variant of the biotope (a sub-biotope?) without *Osmundea*. However, the extensive *Mytilus* bed was the principal feature at Pegwell and provided substrate for *Gelidium* overgrowth. The *Osmundea* turf biotope occurs commonly on the moderately wave-exposed headlands and establishment of additional study areas to ensure adequate monitoring should be straightforward. Although the MLR.R XR (mixed red algae) biotope was missed in the present survey, it is not uncommon and again establishment of additional study areas should be straightforward. The other important red algal turf biotopes (MLR.R Pid, MLR.BF FserR) also missed in the present monitoring exercise occur infrequently in the cSAC. The *Mastocarpus* characterised biotope (MLR.R Mas) occurs only at a single location in the cSAC (see biotope map in Tittley *et al*, 1998) but was monitored as one of the new study areas (DG2 SA4). Suggested site locations to monitor these uncommon or missed 'red algal turf communities' are given in Table 2 below.

Table 2. Suggested locations of study sites for 'red algal turf' biotopes.

Biotope	Locations for study areas
MLR.R.Osm	North of Broadstairs Hackemdown Point White Ness headland Botany Bay headland Botany Bay west side Foreness Point east side Westgate
MLR.R XR	Ramsgate to Dumpton Gap Dumpton Gap Bay North side of Hackemdown Point Botany Bay headland Foreness Point to Palm Bay
MLR.R Pal	Dumpton Gap to Broadstairs White Ness headland
MLR.BF FserR	Botany Bay west side Foreness Point east side
MLR.R Pid	Birchington

4.4 Re-classification of littoral cave biotopes

As part of the development of the marine biotopes classification, a provisional re-classification of littoral cave biotopes has been proposed (Bull, 2001, unpublished). Within the biotope complex (Connor *et al*, 1997) 'Overhangs and caves' [LR.Ov] it is proposed that the three biotopes listed be replaced by ten newly defined biotopes. Their possible status and occurrence in the Thanet coast cSAC is considered below.

LR.CvOv: 'Littoral caves and overhangs' [Biotope complex]
Athough present in the Thanet coast cSAC, cave habitats are now less common (see Fowler & Tittley, 1993). Overhang biotopes occur sporadically on the north and east coasts of Thanet but are restricted in area and thus not mapped.

LR.CvOv BarCv: 'Barren/boulder-scoured littoral cave walls and floors'.
Wave and sand scoured bare zones were observed in the present survey at most cliff and cave study sites in the Thanet coast cSAC. Certain sites, usually at the entrances to caves and tunnels where there is wave-wash, are characterised by barnacles although crustose Corallinaceae are occasionally present.

LR.CvOv ScrFa: 'Sand/pebble-scoured rock in upper to lower shore caves with sparse fauna (barnacles and spirorbids)'.
This biotope may also be present in the Thanet coast cSAC; see comment to LR.CvOv BarCv above. Further field-work is required to confirm its presence.

LR.CvOv FaC: 'Wave-surged, littoral cave walls with faunal crust'.
This biotope may also be present in the Thanet coast cSAC (see comment to LR.CvOv BarCv above). The diversity of species listed by Bull (2001) has not been observed in Thanet caves.

LR.CvOv mucHil: '*Verrucaria mucosa* and/or *Hildenbrandia rubra* on upper to mid shore cave walls'.

This biotope is not present on the soft chalk of the Thanet coast cSAC despite the occurrence of *Verrucaria* and *Hildenbrandia* in caves on the harder chalk of Flamborough Head, Yorkshire (Tittley, 1988).

LR.CvOv AudCla: '*Audouinella purpurea* and *Cladophora rupestris* on upper to mid-shore cave walls'.

The biotope is probably present in Thanet coast cSAC caves. Bull (2001) described it as occurring on "…vertical and steeply sloping upper walls at the entrances and inner reaches of upper to mid-shore caves that are partially sheltered from direct wave action, [and] are characterised by a turf of the 'velvety' red alga *Audouinella purpurea* and patches of green filamentous algae *Cladophora rupestris*….". Velvety growths of *A. purpurea* were commonly recorded in the present survey in caves on Thanet but *C. rupestris* was absent. The shade tolerant red algae *Catenella caespitosa*, *Lomentaria articulata* and *Hildenbrandia rubra* noted by Bull (2001) also have not been recorded in Thanet caves, although *C. caespitosa* has been sporadically recorded in other Thanet habitats. It is not clear whether the occurrence of *A. purpurea* alone confirms the presence of this biotope in Thanet.

LR.CvOv GCv: 'Green algal films on upper and mid-shore cave walls and ceilings'.

Bull (2001) noted that "…The upper walls and ceilings of upper and mid-shore hard and soft rock (chalk) caves exposed to moderate wave action may be dominated by a band of green algal films (or 'stains')….". This was observed in the present survey in Thanet caves where *Pseudendoclonium submarinum* is the characterising species of green films on ceilings. However, this green algal film biotope usually occurred above growths of *Pilinia rimosa (Waerniella lucifuga)*, only occasionally overlapping. Our observations suggested that *P. rimosa* characterised a distinct biotope (see below), and was not a co-characterising species of the green film biotope as suggested by Bull (2001). In caves on Thanet, as elsewhere, fauna is sparse in this biotope.

LR.CvOv Br: 'Brown algal crusts on upper and mid-shore cave walls and ceilings'.

The present re-assessment of Thanet sea-cave algal communities suggests that Bull's (2001) definition of this biotope covers two biotopes. We suggest changing 'brown algal crusts' to read "gelatinous brown algal (non Phaeophyceae) growths on upper and mid-shore cave walls and ceilings". *Pilinia rimosa (Waerniella lucifuga)* is a filamentous (non-crustose) species of Phaeophyta that formed 'golden velvety growths on cave walls' in the Thanet coast cSAC (Tittley *et al*, 1998) and probably characterises a separate biotope (suggested code - LR.CvOv Pilrim; see also comments above). It was not a co-characterising species of the "gelatinous brown algal growths" biotope, although the two occasionally overlap. *P. rimosa* usually occurred at lower levels on cave walls below the former. Although the Haptophyceae *Apistonema carterae* forms gelatinous brown zones on open cliff faces and in caves, other genera and species of Chrysophyceae, Haptophyceae, and Prasinophyceae are involved (see Tittley, 1985; Fowler & Tittley, 1993).

From the 1997 survey results, Tittley *et al*, (1998) proposed a cave biotope (LR.L AudpPilmar (*sic*)) characterised by *Audouinella purpurea* and *Pilinia rimosa*. This suggestion should be re-examined to investigate whether or not these species, which both form velvety growths on cliff faces usually just above high water mark, constitute a single, or a mixture of two biotopes, or (more likely) two distinct biotopes (LR.CvOv AudCla, LR.CvOv Pilrim).

Distinct bright orange growths of the Haptophyceae *Chrysotila lamellosa* have been recorded commonly in the present survey at supralittoral (spray zone) level on cliff faces and above the entrances to sea-caves. This distinct zone suggests a biotope ['Orange gelatinous *Chrysotila lamellosa* on supralittoral chalk' LR.CvOv Chrysot]; the community was best- developed on shaded north-facing cliffs.

LR.CvOv SR: 'Sponges and shade-tolerant red seaweeds on overhanging lower eulittoral bedrock and caves'.
The assemblage of shade-tolerant red algae characterised by *Lomentaria articulata*, *Plumaria plumosa*, *Osmundea pinnatifida* and sponges (*Grantia compressa*, *Halichondria panicea* and *Hymeniacidon perleve*) described by Bull (2001) was observed in the present survey sporadically on overhanging chalk bedrock on the open lower shore in the Thanet coast cSAC. The biotope was not extensive enough to be mapped as a distinct item; further field-work is required confirm its presence.

LR.CvOv SR.Den: 'Sponges, shade-tolerant red seaweeds and *Dendrodoa grosssularia* on wave-surged overhanging lower eulittoral bedrock and caves'.
The characterising species of this sub-biotope were observed in the Thanet coast cSAC on overhanging rocks associated with deep channels on the foreshore reef; further fieldwork is required to confirm its presence as a distinct unit. The sub-biotope is probably not extensive enough to be mapped as a distinct item.

LR.CvOv SbyAs: 'Sponges, bryozoans and ascidians on deeply overhanging lower shore bedrock or caves'.
Many of the associated species were recorded in the Thanet coast cSAC in the present survey; further field-work is required to confirm the presence of a distinct biotope but likely to be restricted in extent.

5. Conclusion

5.1 Favourable Condition

The results of present monitoring survey of biotopes in the Thanet Coast cSAC, compared with data gathered in 1997 (Tittley *et al*, 1998), has revealed no decrease in extent and distribution of key biotopes and the characterising species in the study areas. As mentioned, some important red algal turf biotopes still require study. In our opinion the targets set for 'favourable condition' have been achieved (see Table 3 below).

Table 3. Favourable condition: targets and results

Interest feature	**Subfeature**	**Attribute**	**Measure**	**Target**	**Result**
Reefs	Intertidal chalk cliff algal and lichen communities	Extent and distribution of characteristic biotopes	Extent and distribution of chalk cliff and lichen communities. Measured once during reporting cycle	No decrease in extent and distribution of intertidal chalk cliff algal communities from an established baseline, subject to natural change.	**Target achieved**, no decrease in extent in algal and lichen communities and cliff habitat; monitoring revealed all in good condition. Natural variation in extents recorded.
		Species composition of characterisitic biotope	Presence and abundance of composite species of characteristic biotope	Presence and abundance of composite species should not deviate from an established baseline, subject to natural change.	**Target achieved,** key species (*Apistonema carterae*, *Audouinella purpurea*, *Chrysotila* spp., *Pilinia rimosa*, *Pseudendoclonium submarinum*) remain present.
	Intertidal red algal turf communities	Extent and distribution of characterisitic biotopes	Extent and distribution of important biotopes. Measured during summer once during reporting cycle.	Extent and deviation of the biotopes should not deviate from an established baseline, subject to natural change.	**Target achieved** for biotopes studied; six biotopes require further survey (three missed).
		Species composition of characteristic biotopes	Presence and abundance of composite species of each biotope, measured during summer, once during reporting cycle.	Presence and abundance of composites species should not deviate significantly from an established baseline, subject to natural change.	**Target achieved** for biotopes studied; all characterising species present (*Mastocarpus stellatus*, *Osmundea* spp., *Palmaria palmata*, *Rhodothamniella floridula*); associated faunal records improved. Six biotopes require further survey (three missed).

Interest feature	Subfeature	Attribute	Measure	Target	Result
	Kelp dominated communities on animal bored rock	Extent and distribution of characteristic biotopes.	Extent and distribution of important [sublittoral fringe] biotopes. Measured during summer once during reporting cycle.	Extent and deviation of the biotopes should not deviate from an established baseline, subject to natural change.	**Target achieved,** MIR.KR.LdigPid remains widespread at sublittoral fringe shore level in the Thanet cSAC, as mapped in 1997.
		Species composition of characteristic biotope.	Presence and abundance of composite species of biotope.	Presence and abundance of composites species should not deviate significantly from an established baseline, subject to natural change.	**Target achieved,** *Laminaria digitata* and piddock species remain abundantly present; associated algae and invertebrates were as recorded in 1997.
Sea caves	Intertidal chalk cliff algal and lichen communities	Extent and distribution of characterisitic biotopes.	Extent and distribution of chalk cliff and lichen communities. Measured once during reporting cycle	No decrease in extent and distribution of intertidal chalk cliff algal communities from an established baseline, subject to natural change	**Target achieved**, no decrease in number of caves, extent in algal and lichen communities and cliff habitat; monitoring revealed all in good condition
		Species composition of characteristic biotope.	Present and abundance of composite species of characteristic biotope	Presence and abundance of composite species should not deviate from an established baseline, subject to natural change.	**Target achieved,** key species remain present (see above).

5.2 Future monitoring

The present study presents a comprehensive assessment of the Thanet Coast cSAC for the 'sea-cave' feature, and 'chalk cliff' sub-feature. Further field-work is required to assist refinement and application of the new classification of cave and overhang biotopes proposed by Bull (2001).

To achieve a comprehensive assessment of the foreshore reefs additional study areas are required to monitor the full range of 'important' reef biotopes identified by *English Nature*. We suggest also a re-evaluation of reefs at Epple Bay; an additional transect study there would ensure adequate monitoring of the northwest section of the Thanet coast c SAC.

English Nature proposes that the field method for future monitoring should be 'skilled-eye-appraisal'. For the chalk caves cliffs we have described the principal 'colour features' of the algal communities that can be recognised by eye. Many of the characterising species of the foreshore reef biotopes also allow 'skilled-eye' recognition. Loss of such species within a reporting cycle would indicate major environmental disturbance. Change in the visually less obvious associated species may be important in indicating gradual, slower, change and should not be overlooked (see below).

The foreshore reef in the Thanet Coast cSAC is noted by *English Nature* (Anon., 1995) "…for the exceptional continuity of marine research undertaken there…". This allows the creation of a historical profile, which for Thanet extends back to the early 17th century when the species that form the principal vegetational features at Margate were first recorded (Tittley *et al*, 1999). We strongly recommend maintaining the continuity of marine research with periodic reappraisals using the method of the present study in which the species assemblages of biotopes are recorded. We also suggest that GIS mapping of the biotopes within a 250 m x 250 m square at each of the six sites of particular interest in the cSAC would provide a more precise indication of change in extent of biotopes, and also complement the transect and quadrat (ACE) recording.

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Appendix 1 - Study area data

Epple Bay (EB)

Site SAC9: cliff communities

A north-facing site 8.5 m west of a large cave/inlet, and 12.5 m east of a short length of sea-wall to the west. At the foot of the cliff is a narrow platform 2-3 m wide. The study site forms part of a short length of cliff that remains in a natural state. Grid ref. TR 30930 69977.

Height	**1997**	**2001**	**Colour zone 2001**
3.5 m+		Black powdery zone	Black powdery zone
3.0 m+	*Apistonema carterae*	*Apistonema carterae*	Gelatinous brown zone
2.5 m+	*Apistonema carterae* *Rhizoclonium riparium*	*Rhizoclonium riparium*	Filamentous green zone
2.0 m+	*Apistonema carterae* *Rhizoclonium riparium*	Enteromorpha *spp.*	Filamentous green zone
1.5 m+	*Enteromorpha* spp.	*Enteromorpha* spp.	Filamentous green zone
1.0 m+	*Enteromorpha* spp. Red algae	*Enteromorpha* spp. Red algae (*Gelidium*) mosaic	Mixed green red algal zone
0.5 m+	*Enteromorpha* spp. Red algae	Red algae (*Gelidium)* mosaic *Semibalanus balanoides*	Red algal zone
0.0 m+	*Fucus* spp.	*Gelidium pusillum* *Fucus* spp. *Littorina* spp. *Patella vulgata* *Semibalanus balanoides*	Red algal – barnacle mosaic

Photographs

Nos. T1, T2, T3, T4, T5

Observations

Other species recorded at the base of the cliff between 0m and 1m included the marine lichen *Arthropyrenia halodites*, the algae *Aglaothamnion hookeri, Osmundea* sp., *Ralfsia* sp., and the animals *Actinia equina, Elminius modestus, Mytilus edulis.* Occasional *Polydora* sp. borings were noted in the chalk rock.

The algal zonation remains well developed with a pattern of zonation largely as recorded in 1997. Differences reflect natural fluctuations in extents of zones and populations. Height of zonation varied according to shading and wave-action.

Fulsam Rock (FR)

FR SA1: *Fucus serratus* canopy (MLR.BF Fser biotope)

The quadrat was located 15 m north (seawards) of the concrete groyne and navigation marker at approximately lower midlittoral shore level. Grid ref. TR 35550 71532

Species recorded	**1997**	**2001**	**Notes**
Ceramium deslongchampii	+	o	
Ceramium gaditanum	+	o	
Ceramium nodulosum	+		
Chondrus crispus	+	c	
Cladostephus spongiosus	+		
Cladophora rupestris	+	c	
Corallina officinalis	+	o	
Dictyota dichotoma	+		
Fucus serratus	**+**	**a**	**Dominant species 75% cover**
Gelidium pusillum		c	
Halurus flosculosus	+		
Hildenbrandia rubra	+		On flints
Osmundea pinnatifida	+		Near quadrat
Palmaria palmata	+	c	
Phymatolithon lenormandii	+	c	
Pilayella littoralis	+		
Polysiphonia fucoides	+		
Rhodothamniella flordiula	+	c	
Ulva lactuca	+	r	
Carcinus maenas		o	
Cryptosula pallasiana		o	
Dynamena pumila	+	c	Epiphyte
Electra pilosa	+		
Elminius modestus	+		
Flustrellidra hispida		o	
Halichondria panicea	+		
Lanice conchilega	+		
Lepidochitona cinerea	+		
Littorina fabalis	+	o	
Littorina littorea	+		
Littorina obtusata	+		
Patella vulgata	+		
Polydora spp.	+	o	
Pomatoceros lamarckii	+		
Pomatoceros triqeter	+		
Sabellaria spinulosa		a	
Semibalanus balanoides	+		
Spirorbis corallinae	+		
Spirorbis spirorbis	+		

Photographs

No. T6

Observations

The *Fucus serratus* canopy covers large areas of reef at Fulsam Rock as described previously. The associated under- and epi- flora was much as listed previously, differences were due to natural ephemerality and variability of species. The crustose coralline alga *Phymatolithon lenormandii* remained the principal underflora component and the sand-binding polychaete *Sabellaria spinulosa* was also re-found. Patchy turfs of underflora algae were much as previously described. Cushions of *Rhodothamniella floridula* and tufts of other red algae occupied open areas in the fucoid canopy. The chalk rock continued to show occasional *Polydora* holes. Although fewer animal species were recorded on this occasion, the main features of this chalk reef biotope were as described in 1997.

Fulsam Rock

FR SA2: *Corallina* pools (LR.Rkp Cor biotope)

Foreshore reefs at Fulsam Rock bear pools of differing shapes, sizes and depths and characterised by growths of the coralline red alga *Corallina officinalis*. Many of the pools adjacent to SA1 contained *Sargassum muticum* and were therefore assigned to that biotope. The pool investigated was located to the west of the groyne. Grid ref. TR 35483 71448.

Species recorded	**1997**	**2001**	**Notes**
Ceramium nodulosum		o	
Chondrus crispus	+	o	
Cladophora rupestris		o	
Corallina officinalis	**+**	**a**	**Dominant species**
Cystoclonium purpureum	+		
Dictyota dichotoma	+		
Fucus serratus	+	f	
Phymatilothon lenormandii	+		
Sargassum muticum	+		Abundant nearby
Ulva lactuca	+	o	
Polydora sp.		o	
Anemonies	+		
Hydroids	+		
Gastropods	+		
Amphipods	+		
Isopods	+		
Decapods	+		

Observations

The rock-pool biotope characterised by *Corallina officinalis* remained much as described in 1997; algal species-richness differed from pool to pool, and the pool investigated in this survey was species-poor.

Fulsam Rock

FR SA3: *Sargassum* pools (LR.Rkp FK.Sar biotope)

Shallow pools on the chalk reef approximately 15-20 m south and west of the concrete groyne. Grid ref. TR 35521 71495.

Species present	**1997**	**2001**	**Notes**
Ceramium nodulosum		o	
Chaetomorpha melagonium	+		
Cladophora rupestris		o	
Cladostephus spongiosus		o	
Corallina officinalis	+	c	
Cystoclonium purpureum		o	
Dictyota dichotoma		o	
Fucus serratus	+	c	
Halidrys siliquosa	+	c	
Halurus flosculosus		o	
Laminaria digitata	+		
Palmaria palmata	+	c	
Polyides rotundus	+	o	
Polysiphonia fucoides		o	
Sargassum muticum	**+**	**s**	**Dominant species 65%-90% cover**
Ulva lactuca	+	o	
Alcyonidium hirsutum		?	epiphytic
Bicellariella ciliata		?	
Botrylloides leachii		?	
Carcinus maenas		?	
Dynamena pumila		?	
Electra pilosa		?	
Flustrellidra hispida		?	
Halichondria panicea		?	
Molgula manhattensis		?	
Lucernariopsis cruxmelitensis		?	Western species
Piddock holes		?	
Polydora holes		?	
Sabellaria spinulosa		?	
Sertularella gaudichaudi		?	
Sponge yellow-orange		?	
Sponge red		?	

Photographs

Nos. T7, T8, T9.

Observations

Many pools on the inshore reef of Fulsam Rock were characterised by dense, blanketing growths of the invasive brown alga *Sargassum muticum*. As stated previously *S. muticum* growths formed commonly 70-80% cover and sometimes as much as 100% cover; plants were commonly 1-2m in length. *S. muticum* continued to occupy pools formerly characterised by bushy growths of *Halidrys siliquosa*. *Sargassum* pools remained generally rich both in algal and animal species and in general the biotope has changed little since 1997.

Fulsam Rock

FR SA4: *Palmaria* dominated reef and lagoon area (MLR.R Pal biotope)

The study area was located at the inshore end of a large inlet with standing water in an area of lower littoral reef, directly north of the groyne. Grid ref. TR 35521 71556.

Species list	**1997**	**2001**	**Notes**
Ceramium nodulosum	+	o	
Chondrus crispus	+	c	
Cladophora rupestris		r	
Cladostephus spongiosus		o	
Corallina officinalis	+	o	
Cryptopleura ramosa	+		
Dictyota dichotoma	+		Nearby
Fucus serratus	**+**	**a**	**Co-dominant species 35% cover**
Gelidium pusillum		r	
Halurus flosculosus	+		Nearby
Hildenbrandia rubra		o	On flint
Laminaria digitata	+		
Osmundea pinnatifida		o	
Palmaria palmata	**+**	**c**	**Dominant species 35% cover**
Phymatolithon lenormandii		c	
Polysiphonia fucoides	+		Nearby
Rhodothamniella floridula		c	
Stragularia clavata		o	On flint
Sargassum muticum	+		Nearby
Ulva lactuca	+	o	
Alcyonidium hirsutum		r	
Amphiblestrum auritum			
Bugula fulva		r	
Callopora aurita		r	
Conopium reticulum			
Crepidula fornicata		r	
Dynamena pumila		o	

Species list	1997	2001	Notes
Electra pilosa		?	
Elminius modestus		r	
Flustrellidra hispida		o	1% cover
Halichondria panicea		o	
Littorina fabalis		r	
Pagurus sp.		r	
Piddock-bored chalk reef	+		
Pisidia longicornis		o	
Plumularid hydroids		o	
Polydora holes		f	
Pomatoceros sp		o	
Sabellaria spinulosa		f	
Schizomavella linearis		r	
Scrupocellaria scruposa		r	

Photographs

Nos. T10, T11

Observations

The red alga *Palmaria palmata* was visually obvious on this part of Fulsam Rock and formed almost pure stands. *Fucus serratus* was locally co-dominant, reflecting an autumnal decrease in extent and biomass of *P. palmata*. The area was generally species rich although the associated algal species differed from those previously recorded due to natural ephemerality of occurrence. The area was also species-rich in animals and a more comprehensive list was collated in this survey. In general the biotope in this study area had changed little since 1997.

Fulsam Rock

FR SA5: *Rhodothamniella* turf/hummocks (MLR.Eph Rho biotope)

The *Rhodothamniella* biotope study site was located directly north of the concrete groyne and in the chalk reef to the east of the inlet with standing water; a metal stake hammered into the chalk provides a permanent marker. Grid ref. TR 35542 71612.

Species list	1997	2001	Notes
Ceramium nodulosum	+	o	
Chondrus crispus	+	o	
Cladostephus spongiosus			Nearby
Corallina officinalis		o	
Dictyota dichotoma	+	f	
Fucus serratus		r	
Gelidium pusillum		c	15% cover
Halurus flosculosus	+	o	
Osmundea pinnatifida	+	o	
Palmaria palmata	+	o	
Polysiphonia fucoides	+	o	
Rhodothamniella floridula	**+**	**a**	**Dominant species 65% cover**

Species list	1997	2001	Notes
Ulva lactuca	+	o	
Amphipholis squamata	+		
Bryozoan crust			Nearby
Golfingia minuta	+		
Helcion pellucidum		r	
Halichondria panicea		?	
Lanice conchilega		?	
Molgula manhattensis		f	
Mytilus edulis	+	o	3% cover
Perinereis cultrifera	+		
Piddock holes	+	a	
Plumulariid hydroids		?	
Polydora holes	+	c	
Ruditapes saxatilis		?	
Sabellaria spinulosa		f	
Sagartia troglodites	+		
Sertularella gaudichaudi		?	
Sponge encrusting indet.		?	

Photographs

No. T12

Observations

A *Rhodothamniella floridula* turf continued to cover large areas of Fulsam Rock at lower midlittoral shore level. In this study area other red algae were associated with the turf, and much of the sediment bound by the filaments of *R. floridula* had been washed out. Associated algal species were as recorded in 1997. Many invertebrate species were associated, and the assembalge grew over Piddock and *Polydora* bored chalk. Both piddock and *Polydora* formed tubes through the *Rhodothamniella* turf. The extensive summer bloom of *Enteromorpha* spp. and *Ulva lactuca* reported in 1997 was not recorded on this occasion.

Fulsam Rock

FR SA6: *Laminaria digitata* over piddock-bored reef (MIR.KR Ldig.Pid)

The study area was located 5-6 m seaward (north) of FR SA5 (in line with the metal stake and concrete groyne). Deep gullies with vertical and overhanging walls cut into the chalk reef were not investigated on this occasion due to a higher tide level and heavy surf. Grid ref. TR 35529 71640.

Species list	1997	2001	Notes
Ceramium nodulosum	+		
Chondrus crispus		c	
Corallina officinalis		c	
Cryptopleura ramosa	+		
Crustose Corallinaceae		c	
Cystoclonium purpureum	+	c	

Species list	**1997**	**2001**	**Notes**
Fucus serratus		o	
Halurus flosculosus	+		
Laminaria digitata	**+**	**a**	**Dominant species Cover variable**
Membranoptera alata	+	o	
Palmaria palmata		c	
Polysiphonia elongata	+		
Polysiphonia fucoides	+	o	
Plocamium cartilagineum	+		
Rhodomela confervoides	+		
Rhodymenia holmesii	+		
Ulva lactuca		o	
Alcyonidium mytili		?	
Amphipholis squamata	+		
Asterias rubens	+		
Balanus crenatus		f	
Barnea candida (piddock)	+		
Barnea parva (piddock)	+		
Botrylloides schlosseri	+		
Botryllus leachii	+		
Bryozoan crusts		f	
Bryozoan foliose		r	
Bugula sp.	+		
Cancer pagurus	+		
Carcinus maenas		o	Juvenile
Dynamena pumila	+	?	
Electra pilosa		f	
Eudendrum capillare	+		
Halichondria panicea	+	?	Nearby
Hiatella arctica (piddock)	+		
Microciona atrasanguinea	+		
Molgula manhattensis	+		
Mytilus edulis		o	
Nereis pelagica	+		
Nereid		o	
Ophiothrix fragilis	+		
Perinereis cultrifera	+		
Pholas dactylus (piddock)	+		
Pilumnus hirtellus	+		
Plumularia setacea	+		
Plumulariid hydroids		o	
Polydora sp.	+		
Pomatoceros sp.			Nearby
Porcellana platycheles	+		
Ruditapes saxatilis	+		
Sabellaria spinulosa		o	
Sagartia troglodytes	+		
Scypha ciliata	+		
Ventromma halecioides	+		
Verruca stroemia		r	

Photographs

Nos. T13, T14

Observations

A distinct biotope characterised by small *Laminaria digitata* plants over piddock-bored chalk reef was, as previously, widespread at low water level on Fulsam Rock. Fewer algae and invertebrates were recorded as deep gullies, clefts and vertical and overhanging walls were not investigated on this occasion. The study area was horizontal chalk reef with a canopy of *L. digitata;* beneath the canopy was an underflora of red algae and a variety of animal species. The biota here is probably dynamic due to the friable nature of the bored chalk and the ease with which kelp plants break away.

White Ness area (WN)

Cliffs and caves

SAC1: Botany Bay cliffs

The study transect was situated on a north-facing cliff face behind (south of) the two stacks (indicated by two nails in cliff face at 1.65 m above sand level and below the graffiti "Gracie"). Grid ref. TR 39197 71128.

Height	1997	Height	2001	Colour zone
3.0 m+	Black fungus			
2.5 m+	*Apistonema carterae*	2.0 m+	Black fungus	Powdery black zone
2.0 m+	*Apistonema carterae*	1.5 m+	*Apistonema carterae*	Gelatinous brown zone
1.5 m+	*Rhizoclonium tortuosum*	1.0 m+	*Rhizoclonium tortuosum*	Filamentous green zone
1.0 m+	*Enteromorpha prolifera*	0.5 m+	*Enteromorpha* spp.	Filamentous green zone
0.5 m+	*Fucus spiralis*	0.0 m+	*Enteromorpha* spp. Sand level	Fucoid zone
0.0 m+	Bare abrasion zone		Sand covered	White zone
	Other species recorded *Audouinella purpurea* *Blidingia minima* *Phymatolithon lenormandii* *Pleurocapsa* sp. *Schizothrix mexicana*		Other species recorded: *Aglaothamnion hookeri* *Audouinella purpurea* *Gelidium pusillum*	All at foot of cliff

Photographs

Nos. T15, T16

Observations

The overall zonation was as described in 1997; differences in widths of algal zones reflected natural variation in populations.

White Ness area

SAC2: Botany Bay cliffs

The study site was located to the east of the stacks and deep incut, and by a nail in the cliff face directly below a painted red arrow. Grid ref. TR 39237 71125.

	1997		**2001**	**Colour zone**
4.0 m+	Black fungus	4.0 m+	Black fungus	Powdery black zone
3.5 m+	*Apistonema carterae*	3.5 m+	Apistonema carterae	Gelatinous brown zone
3.0 m+	*Apistonema carterae*	3.0 m+	*Apistonema carterae*	Gelatinous brown zone
2.5 m+	*Rhizoclonium tortuosum*	2.5 m+	*Apistonema carterae*	Gelatinous brown zone
2.0 m+	*Rhizoclonium tortuosum*	2.0 m+	*Rhizoclonium riparium* Enteromorpha	Filamentous green zone
1.5 m+	*Gelidium pusillum Enteromorpha*	1.5 m+	*Rhizoclonium riparium Enteromorpha*	Filamentous green zone
1.0 m+	*Gelidium pusillum Enteromorpha*	1.0 m+	*Gelidium pusillum Enteromorpha*	Dark red/green zone
0.5 m+		0.5 m+	*Gelidium pusillum Enteromorpha*	Dark red/green zone
0.0 m+	*Fucus spiralis Enteromorpha*	0.0 m+	Fucus zone	Fucoid/green zone
			Other species: *Arthropyrenia halodites* *Littorina* sp. *Semibalanus balanoides*	 In red/green zone In red/green zone In red/green zone

Photographs

Nos. T17, T18, T19

Observations

The overall zonation was as described in 1997; differences in widths of algal zones reflect natural changes in populations.

White Ness area

SAC3: Cave near White Ness

North east facing large cave. Grid ref. TR 39515 70992.

1997	**2001**	**Colour zone**
Inner cave supralittoral level		
Pseudendoclonium submarinum	*Pseudendoclonium submarinum*	Green stain zone
Chrysonema litorale *Epicladia perforans*	*Chrysonema litorale* *Epicladia perforans*	Gelatinous brown zone
Middle cave upper littoral level		
	Pseudendoclonium submarinum	Green stain zone
	Pilinia maritima (Waerniella)	Golden brown zone to 2.5m high

1997	2001	Colour zone
Outer cave supralittoral level		
Apistonema carterae *Chrysotila lamellosa* *Entodesmis litoralis* *Epicladia perforans*	*Apistonema carterae* *Chrysotila lamellosa* *Entodesmis litoralis* *Epicladia perforans*	Gelatinous brown zone
Enteromorpha prolifera	*Enteromorpha prolifera*	Filamentous green zone
Outer cave upper midlittoral levels		
Aglaothamnion hookeri *Audouinella purpurea* *Enteromorpha intestinalis* *Enteromorpha prolifera* *Rhizoclonium riparium*	*Aglaothamnion hookeri* *Audouinella purpurea* *Enteromorpha intestinalis* *Enteromorpha prolifera* *Rhizoclonium riparium*	Mixed red-green zone

Photographs

Nos. T20, T21, T22, T23, T24, T25

Observations

The cave communities remained well-developed and in species content and extent as described in 1997.

White Ness area

SAC4: Cliff at White Ness

The study transect was a northeast facing cliff situated to the west of the arch/tunnel. Grid ref. TR 39571 70993.

1997	2001	Colour zone
High supralittoral level		
	Chrysotila lamellosa	Orange zone above tunnel
Supralittoral level		
Apistonema carterae *Calothrix* sp. *Epicladia perforans*	*Apistonema carterae* *Calothrix* sp. *Epicladia perforans*	Gelatinous brown zone
High water spring tide level		
Apistonema carterae	*Apistonema carterae*	Gelatinous brown zone
Enteromorpha compressa *Enteromorpha intestinalis* *Enteromorpha prolifera*	*Enteromorpha* spp.	Filamentous green zone
Upper littoral level		
	Arthropyrenia halodites *Enteromorpha* sp. *Fucus* spp. *Gelidium pusillum* *Rhodothamniella floridula*	Red-green zone

Photographs

Nos. T26, T27, T28

Observations

The cave communities remained well-developed and in extent and species content as described in 1997.

White Ness area

SAC5: White Ness arch

The study transect was a cliff face on the west side of the arch. Grid ref . TR 39593 70974.

Height	1997	Height	2001	Colour zone
2.5 m+	*Pseudendoclonium submarinum*	2.5 m+	*Pseudendoclonium submarinum*	Green stain
	Apistonema carterae	2.0 m+	*Apistonema carterae*	Gelatinous brown zone
2.0 m+	*Rhizoclonium riparium*			Filamentous green zone
1.5 m+	*Rhizoclonium riparium*	1.5 m+	*Rhizoclonium riparium*	Filamentous green zone
1.0 m+	*Enteromorpha* spp.	1.0 m+	*Enteromorpha* spp.	Filamentous green zone
0.5 m+	*Fucus* spp.	0.5 m+	*Elminius modestus* *Semibalanus balanoides* *Fucus* spp. *Aglaothamnion hookeri* *Audouinella purpurea* *Gelidium pusillum*	Barnacle zone
0.5 m+	Abrasion zone with barnacles and limpets		*Elminius modestus* *Semibalanus balanoides*	Barnacle zone

Photographs

Nos. T29, T30, T31

Observations

The cave communities remained well-developed and in extent and species content as described in 1997; differences in widths of algal zones reflected natural variation.

White Ness area

SAC6: Kingsgate Bay cave

The study transect was the north wall of an east-facing, narrow cave extending 40-50 m into the chalk cliff; two transects were recorded, at 5 m and 10 m in from the mouth. Grid ref. TR 39531 70828.

Height	1997	2001 - 5m in	2001 –10m in	Colour zone
4.0 m+		Black fungus	Black fungus	Black zone
3.5 m+		*Pseudendoclonium submarinum* *Apistonema carterae* Cyanophyta spp.	*Pseudendoclonium submarinum* *Apistonema carterae* Cyanophyta spp.	Green-brown zone
3.0 m+		*Pseudendoclonium submarinum* *Apistonema carterae* Cyanophyta spp.	*Pseudendoclonium submarinum* *Apistonema carterae* Cyanophyta spp.	Green-brown zone
2.5 m+	*Pseudendoclonium submarinum*	*Pseudendoclonium submarinum* *Apistonema carterae* Cyanophyta spp.	*Pseudendoclonium submarinum* *Apistonema carterae* Cyanophyta spp.	Green-brown zone
2.0 m+	*Pseudendoclonium submarinum*	*Pseudendoclonium submarinum* *Apistonema carterae* Cyanophyta spp.	*Pseudendoclonium submarinum* *Apistonema carterae* Cyanophyta spp.	Green-brown zone
1.5 m+	*Apistonema carterae* Epicladia perforans	*Apistonema carterae*	*Apistonema carterae*	Gelatinous brown zone
1.0 m+	*Apistonema carterae* *Epicladia perforans* *Enteromorpha prolifera*	*Apistonema carterae*	*Apistonema carterae*	Gelatinous brown zone
0.5 m+	*Apistonema carterae* *Epicladia perforans* *Enteromorpha* spp.	*Apistonema carterae*	*Apistonema carterae*	Gelatinous brown zone
0.0 m+	*Audouinella purpurea* *Gelidium pusillum*	*Audouinella purpurea*	*Audouinella purpurea*	Red zone
	Other species recorded: *Rhizoclonium riparium* *Chrysotila lamellosa* *Entodesmis litoralis* *Schizothrix mexicana* *Sphacelaria ? nana*			

Photographs

Nos. T32, T33, T34

Observations

The cave communities remained well-developed and in extent and species content as described in 1997; differences in widths of algal zones reflected natural variation.

White Ness area

SAC7: Kingsgate Bay cave

The study transect was the south wall of an east-facing, narrow cave extending 40-50m into the chalk cliff; two transects were recorded, at 5 m and 10 m in from the mouth. Grid ref. TR 39531 70828.

Height	1997	2001 – 5m in	2001 – 10m in	Colour zone
4.0 m+	*Pseudendoclonium submarinum*			
3.5 m+	*Pseudendoclonium submarinum*		Brown zone	
3.0 m+	*Audouinella purpurea* *Pilinia maritima*		Brown zone	
2.5 m+	*Audouinella purpurea* *Pilinia maritima*	*Pseudendoclonium submarinum*	*Pseudendoclonium submarinum*	Green stain
2.0 m+	*Audouinella purpurea* *Pilinia maritima*	*Apistonema carterae*	*Pseudendoclonium submarinum*	Green stain/ Gelatinous brown zone
1.5 m+	*Audouinella purpurea* *Pilinia maritima*	*Apistonema carterae*	Gelatinous dark brown alga/*Pseudendoclonium submarinum*	Gelatinous brown zone with green stain
1.0 m+	*Audouinella purpurea* *Pilinia maritima*	*?Pilinia rimosa*	*?Pilinia rimosa*	Brown felt zone
0.5 m+	*Audouinella purpurea*	*Audouinella purpurea*	*?Pilinia rimosa*	Red felt zone
0.0 m+	*Audouinella purpurea*	*Audouinella purpurea*	*Audouinella purpurea*	Red felt zone
	Other species recorded: *Enteromorpha prolifera* *Rhizoclonium riparium*			

Photographs

Nos. T35, T36

Observations

The cave communities remained well-developed and in extent and species content largely as described in 1997; differences in widths of algal zones reflected natural variation.

White Ness area

SAC8: Kingsgate Bay cave

The study transect was situated on the north wall of an east-facing cave near the mouth. Although sand accumulation prevented tidal access to the cave, it allowed our access to the supralittoral level at which these communities occurred. Grid ref. TR 39543 70798.

Height	1997	Height	2001	Colour zone
4.0 m+	*Chrysotila lamellosa*	4.0 m+	*Chrysotila lamellosa*	Gelatinous orange zone
3.5 m+	*Chrysotila lamellosa*	3.5 m+	*Chrysotila lamellosa*	Gelatinous orange zone
3.0 m+	*Chrysotila lamellosa*	3.0 m+	*Chrysotila lamellosa*	Gelatinous orange zone
2.5 m+	*Chrysotila lamellosa*	2.5 m+	*Chrysotila lamellosa*	Gelatinous orange zone
2.0 m+	*Chrysotila lamellosa*	2.0 m+	*Chrysotila lamellosa*	Gelatinous orange zone
1.5 m+	*Chrysotila lamellosa*	1.5 m+	*Chrysotila lamellosa*	Gelatinous orange zone
1.0 m+	*Chrysotila lamellosa*	1.0 m+	*Chrysotila lamellosa*	Gelatinous orange zone
0.5 m+	*Chrysotila lamellosa*	0.5 m+	*Chrysotila lamellosa*	Gelatinous orange zone
0.0 m+	*Pseudendoclonium submarinum*	0.0 m+	*Pseudendoclonium submarinum*	Green stain

Photographs

No. T37

Observations

The cave communities remained well-developed and in extent and species content as described in 1997.

White Ness

Foreshore reef

WN SA1: *Fucus vesiculosus* canopy (MLR.BF FvesB biotope)

The study area was located 25 m north of cave SAC3 on the first ridge of the chalk reef at midlittoral shore level. Grid ref. TR 39458 71032.

Species	1997	2001	Notes
Cyanophyta chalk boring	+	o	
Enteromorpha spp.	+	o	
Fucus serratus		o	5-10% cover
Fucus vesiculosus	**+**	**a**	**Dominant species 65% cover**
Gelidium pusillum	+	o	
Phymatolithon lenormandii	+	c	
Ralfsia spp.	+	o	
Actina equina	+		Nearby o
Arenicola marina	+		Nearby o
Bryozoan crusts			Nearby r
Carcinus maenas	+	c	
Clitellio arenarius	+		

Species	1997	2001	Notes
Elminius modestus	+		Nearby r
Eulalia viridis	+		
Eulimnogammarus obtusatus	+		
Grania sp.	+		
Idotea granulosa	+		
Jaera albifrons	+		
Lepidochitona cinerea	+		Nearby o
Lineus ruber	+		
Lineus viridis	+		
Littorina fabalis	+	}	*Littorina* spp f
Littorina littorea	+	}	
Littorina obtusata	+	}	
Littorina saxatilis	+	}	
Mytilus edulis	+		Nearby r
Nucella lapillus	+		
Patella vulgata	+		Nearby r
Perinereis cultrifera	+		
Pomatoceros lamarckii	+		Nearby r
Semibalanus balanoides	+		Nearby r
Tubificoides benedii	+		

Photographs

No. T38

Observations

Inshore reef adjacent to the sandy beach continued (as described in 1997) to support a canopy of the large brown alga *Fucus vesiculosus* that formed a distinct biotope. It continued to show a limited linear extent and covered an underflora and fauna of medium species richness.

White Ness

WN SA2: *Enteromorpha-Porphyra* cover (MLR.Eph EntPor biotope)

The study area was located on the inshore fringe of the foreshore reef adjacent to the sandy beach, 9-10 m west of SA1. Midlittoral shore level. Grid ref. TR 39482 71020.

	1997	2001	Notes
Chalk boring cyanophyta		c	
***Enteromorpha* sp.**	**+**	**s**	**Dominant species 60-100% cover**
Fucus vesiculosus	+		Nearby
Gelidium pusillum		o	
Porphyra sp.	+	o	
Rhodothamniella floridula	+		Nearby
Actinia equina	+		Nearby o
Elminius modestus			
Littorina littorea	+		Nearby o
Littorina fabalis		o	

Observations

This sand scoured biotope occurred widely on the landward fringe of chalk reef adjacent to the sandy beach, and was low in species diversity. It remained as described in 1997, and is a common biotope on the inshore fringes of the reef on Thanet.

White Ness

WN SA3: *Fucus serratus* canopy (MLR.BF Fser biotope)

The study area was located at lower midlittoral level near the seaward edge of the chalk reef (in line with the mouth of cave SAC3). Grid ref. TR 39469 71095.

Species	1997	2001	Notes
Arthropyrenia halodites	+		
Chalk-boring cyanophyta		c	
Cladophora rupestris		a	Common underflora species 25% cover
Cladostephus spongiosus	+		Nearby
Corallina officinalis		o	
Fucus serratus	**+**	**s**	**Dominant species 80% cover**
Gelidium pusillum	+	o	
Lomentaria articulata	+		
Membranoptera alata	+		
Palmaria palmata		o	
Phymatolithon lenormandii	**+**	**a**	**Dominant underflora species 75% cover**

Species	1997	2001	Notes
Ralfsia clavata	+		
Rhodothamniella floridula	+		
Ulva lactuca	+	o	
Carcinus maenas		o	
Conopeum reticulatum			
Cryptosula pallasiana		o	
Dynamena pumila		o	
Electra pilosa		o	
Elminius modestus	+		
Halichondria panicea	+	r	
Littorina fabalis		?	
Littorina littorea		o	
Patella vulgata	+	f	
Piddock holes	+	f	
Plumulariid hydroid		r	
Polydora sp.	+	f	
Pomatoceros spp.	+	o	
Sabellaria spinulosa	+	c	10% cover
Semibalanus balanoides	+	o	

Photographs

Nos. T39, T40

Observations

The *Fucus serratus* canopy still covered large areas of foreshore reef from the landward fringe to lower littoral shore level. As noted in 1997 it covered an understorey of algae and animals comprising many encrusting or crustose species. The crustose coralline alga *Phymatolithon lenormandii* was the most noticeable underflora species but the encrusting polychaete *Sabellaria spinulosa* was also commonly present.

White Ness

WN SA4: *Corallina* pools (LR.Rkp Cor biotope)

The study area was shallow standing water 2 m west of WN SA3 at lower littoral shore level. Grid ref. TR 39450 71096.

Species list	1997	2001	Notes
Ahnfeltia plicata	+		
Chondrus crispus	+	o	
Cladophora rupestris		o	
Cladostephus spongiosus		o	
Corallina officinalis	**+**	**s**	**Dominant species 50% cover**
Cystoclonium purpureum	+		
Dictyota dichotoma	+	o	
Enteromorpha spp.	+	o	
Fucus serratus		c	20% cover
Gelidium pusillum	+	o	
Halurus equisetifolius	+	o	
Hildenbrandia rubra	+		
Laminaria digitata		r	
Palmaria palmata	+		
Phymatolithon lenormandii	+		
Polysiphonia fucoides		o	
Ralfsia sp.	+	o	
Rhodomela confervoides	+	o	
Ulva lactuca	+	c	20% cover
Alcyonidium mytili		r	epiphytic
Cryptosula pallasiana			
Dynamena pumila		o	
Flustrellidra hispida		f	epiphytic
Gobiusculus flavescens		o	
Halichondria panicea		o	
Piddock holes		o	
Plumulariid hydroids		r	
Polydora holes		o	
Sponge thin encrusting		r	

Photographs

Nos. T41, T42, T43

Observations

As noted in 1997, *Corallina* pools occurred sporadically on the foreshore reef at White Ness and contained a species-rich assemblage of algae and invertebrates. The species list of this assemblage was similar to that recorded in 1997.

White Ness

WN SA5: Deep rock pools (LR.Rkp FK biotope)

Not relocated in September 2001.

Species list	1997	2001	Notes
Chondrus crispus	+		
Corallina officinalis	+		
Fucus serratus	+		
Laminaria digitata	+		
Palmaria palmata	+		
Rhodomela confervoides	+		
Ulva lactuca	+		

White Ness

WN SA6: *Rhodothamniella floridula* turf (MLR.Eph Rho biotope)

The study area was located north of the cliff between Botany Bay and Whiteness (in line with a recent cliff-fall) at the seaward fringe of the chalk reef near low water level. Grid ref. TR 39475 71148.

Species list	1997	2001	Notes
Ceramium deslongchampii	+	o	
Ceramium gaditanum	+	o	
Ceramium nodulosum	+		
Chondrus crispus	+	o	
Cladostephus spongiosus	+	o	
Cladophora rupestris	+	o	
Corallina officinalis		o	
Cystoclonium purpureum	+		Nearby
Dictyota dichotoma	+		
Enteromorpha sp.		o	
Fucus serratus	+	o	
Gelidium pusillum	+	o	
Halurus flosculosus	+		
Lomentaria articulata	+		Nearby
Osmundea pinnatifida	+	o	
Palmaria palmata	+	o	
Phymatolithon sp.		o	
Rhodothamniella floridula	**+**	**s**	**Dominant species 90% cover**
Ulva lactuca		o	
Achelia longipes	+		
Cryptosula pallasiana		o	
Dynamena pumila		o	
Lanice conchilega		f	
Mycale aff. *macilenta*	+		
Mytilus edulis		o	
Patella vulgata		f	
Petricola pholadiformis	+	o	
Piddock holes		o	

Species list	1997	2001	Notes
Polydora tubes		s	90% cover
Pomatoceros sp.		o	
Ruditapes saxatilis	+		
Sabellaria spinulosa		o	
Sagartia troglodytes	+		

Photographs

Nos. T46, T47

Observations

The *Rhodothamniella* turf continued to form an extensive band at lower littoral shore levels between the *Fucus serratus* and *Laminaria digitata* biotopes. The biotope was rich in associated algae and invertebrates with *Polydora* forming extensive tubes through the cushions of *Rhodothamniella.* This biotope at White Ness had not changed since 1997.

White Ness

WN SA7: *Laminaria digitata* over piddock-bored chalk reef (MIR.KR LdigPid)

Not examined in September 2001 due to high tide level.

Species list	1997	2001	Notes
Cystoclonium purpureum	+		
Laminaria digitata	+		
Palmaria palmata	+		
Phymatolithon lenormandii	+		
Polysiphonia fucoides	+		
Asterias rubens	+		
Lanice conchilega	+		
Piddocks	+		
Polydora	+		
Ruditapes saxatilis	+		
Sabellaria spinulosa	+		
Sagartia troglodytes	+		

North Foreland (NF)

North Foreland: North Foreland Point (NF1)

NF1 SA 1: East-facing cliff communities

The study transect was situated adjacent to a small projecting headland. Grid ref. TR 40154 69735.

Height	Species (2001)	Colour zone
3.5m+	*Chrysotila lamellosa* (not on transect line but nearby)	Orange gelatinous zone
3.0m+	Black fungus	Powdery black zone
2.5m+	*Apistonema carterae*	Brown gelatinous zone
2.0m+	*Apistonema carterae*	Brown gelatinous zone
1.5m+	*Enteromorpha* spp.	Filamentous green zone
1.0m+	*Fucus spiralis* *Enteromorpha*	Fucoid zone
0.5m+	*Fucus spiralis* *Enteromorpha* Other species recorded: *Arthropyrenia halodites* *Gelidium pusillum* *Littorina* spp.	Fucoid zone
0m+	Abrasion zone	White chalk

Photographs

Nos. T48, T49

Observations

The study transect traversed four algal zones; a yellow-orange *Chrysotila lamellosa* zone at high spray zone level was observed nearby. The algal communities were not as extensive here compared with White Ness and Botany Bay.

North Foreland: North Foreland Point (NF1)

NF1 SA 2: *Enteromorpha-Porphyra* (MLR.Eph EntPor biotope)

The study area comprised cobble substratum adjacent to a sandy beach 30 m east (seaward) of the chalk cliff at upper mid littoral shore level. Grid ref. TR 40194 69734.

Species list	1997	2001	Notes
***Enteromorpha* sp.**		**a**	**Co-dominant species 40% cover**
Fucus vesiculosus		o	
Phymatolithon lenormandii		o	
Porphyra purpurea		**a**	**Co-dominant species 35% cover**
Elminius modestus		o	
Littorina littorea		o	
Littorina fabalis		r	
Mytilus edulis		c	
Patella vulgata			Nearby
Semibalanus balanoides		o	
Plumulariid hydroid		r	

Photographs

No. T50

Observations

The sand-scoured *Enteromorpha-Porphyra* assemblage formed a distinct band at the interface between the chalk wave-cut platform and the sandy beach adjacent to the chalk cliffs. The biotope was, as elsewhere on Thanet, poor in species.

North Foreland: North Foreland Point (NF1)

NF1 SA 3: *Fucus serratus* canopy (MLR.BF Fser biotope)

The study area was located 80 m east (seaward) of the chalk cliffs on the wave cut platform at midlittoral shore level. Grid ref. TR 40237 69734.

Species list	1997	2001	Notes
Fucus serratus		**a**	**Dominant species 65% cover**
Fucus vesiculosus		o	
Enteromorpha spp.		a	25% cover
Gelidium pusillum		f	5% cover
Osmundea pinnatifida		o	
Phymatolithon lenormandii		o	
Ralfsia verrucosa		o	
Chalk-boring Cyanophyta		c	25% cover
Blenny/Shanny		r	
Carcinus maenas		o	

Species list	1997	2001	Notes
Elminius modestus		r	
Littorina littorea		f	
Littorina fabalis		f	
Patella vulgata		c	
Polydora holes		f	
Semibalanus balanoides		o	

Photographs

Nos. T51, T52

Observations

Fucus serratus formed a distinct canopy and biotope over much of the foreshore reef of the North Foreland. Beneath the fucoid cover was an understorey of smaller brown, green and red algae and invertebrates; species diversity increased at low shore levels. The biotope here was in structure and content as elsewhere on Thanet.

North Foreland: North Foreland Point (NF1)

NF1 SA 4: *Corallina* pools (LR.Rkp Cor biotope)

The study area was a shallow *Corallina* pool located on the chalk wave cut platform (reef) 90 m east (seaward) of the cliff face. Grid ref. TR 40251 69735.

Species present	1997	2001	Notes
Chondrus crispus		o	
Corallina officinalis		**a**	**Dominant species 30% cover**
Enteromorpha sp.		o	
Fucus serratus		o	
Gelidium pusillum		o	
Osmundea ? pinnatifida		o	
Phymatolithon lenormandii		a	Dominant understorey species 40% cover
Ulva lactuca		o	
Actinia equina		?	
Plumulariid hydroids		?	
Lanice conchilega		?	
Littorina littorea		f	
Littorina fabalis		o	
Mytilus edulis		?	
Patella vulgata		o	

Photographs

Nos. T53, T54

Observations

The assemblage of species recorded in this biotope was typical of shallow rock pools on the chalk reef around Thanet.

North Foreland: North Foreland Point (NF1)

NF1 SA 5: *Rhodothamniella* cushions (MLR.Eph Rho biotope)

The study area was located on the wave-cut platform (reef) 125 m east (seaward) of the cliff face, at lower midlittoral shore level (immediately above the *Laminaria* zone), in moderately wave-exposed conditions. Grid ref. TR 40274 69734.

Species present	**1997**	**2001**	**Notes**
Chondrus crispus		o	
Corallina officinalis		o	
Fucus serratus		o	
Enteromorpha sp.		o	
Gelidium pusillum		c	10% cover
Lomentaria articulata		o	
Osmundea ? pinnatifida		o	
Palmaria palmata		o	
Polysiphonia fucoides		o	
Rhodothamniella floridula		**s**	**Dominant species 60% cover**
Ulva lactuca		o	
Mytilus edulis		a	30% cover
Polydora holes		c	10% cover
Sertularella gaudichaudi		r	

Photographs

Nos. T55, T56, T57

Observations

The *Rhodothamniella* assembalge recorded here was typical of the biotope at lower littoral level on the foreshore reef around Thanet, and formed a zone between lower *Laminaria* and higher *Fucus serratus* biotopes (zones).

North Foreland: North Foreland Point (NF1)

NF1 SA 6 Deep *Laminaria* rock-pool (LR.Rkp FK biotope)

The deep rock-pool study area was located on the wave-cut platform (reef) 160 m east (seaward) of the cliff face at lower littoral shore level. Grid ref. TR 40296 69734.

Species present	**1997**	**2001**	**Notes**
Chondrus crispus		o	
Corallina officinalis		**a**	**Dominant understorey species**
Dictyota dichotoma		o	
Fucus serratus		**c**	**Sub-dominant species**
Halurus flosculosus		o	
Laminaria digitata		**a**	**Dominant species**
Lomentaria articulata		o	
Palmaria palmata		o	
Polysiphonia fucoides		o	
Ulva lactuca		f	
Amphipholis squamata		?	
Halichondria panicea		?	
Molgula manhattensis		o	
Mytilus edulis		o	
?*Hiatella arctica*		?	
Sabellaria spinulosa		?	
Sagartia sp.		?	

Photographs

No. T58

Observations

This biotope occurred only sporadically in the area and was less rich in species than elsewhere on Thanet.

North Foreland: Hope Point (NF2)

The chalk cliff at this study location was bare of algae.

NF2 SA 1: *Enteromorpha* mat (MLR.Eph EntPor)

The study area was of sand, flint, cobble and chalk boulder, situated 24 m east (seaward) of the cliff face (17 m east of a large boulder on the foreshore) at upper midlittoral shore level. Grid ref. TR 40162 69148.

Species present	1997	2001	Notes
***Enteromorpha* spp.**		**s**	**Dominant species 80% cover**
Fucus vesiculosus		o	
Gelidium pusillum		f	5% cover
Littorina littorea		o	
Polydora holes		o	

Photographs

Nos. T59, T60

Observations

This sand-scoured *Enteromorpha* assemblage lacked *Porphyra purpurea* but, as elsewhere on Thanet, formed a distinct band at the interface between the chalk wave-cut platform and the sandy beach adjacent to the chalk cliffs. The biotope was poor in species.

North Foreland: North Foreland Point (NF2)

NF2 SA 2: *Fucus vesiculosus* canopy (MLR.BF FvesB biotope)

This study area was situated 45 m east (seaward) of the cliff face on the landward fringe of the chalk wave- cut platform (reef) at upper midlittoral shore level. Grid ref. TR 40190 69148.

Species present	1997	2001	Notes
Enteromorpha spp.		f	5% cover
Fucus serratus		f	5% cover
Fucus vesiculosus		**s**	**Dominant species 80% cover**
Gelidium pusillum		c	15% cover
Phymatolithon lenormandii		f	10% cover
Ralfsia verrucosa		o	
Chalk boring Cyanophyta		a	60% cover
Actinia equina		c	
Alcyonidium gelatinosum		r	
Dynamena pumila		o	

Species present	1997	2001	Notes
Elminius modestus		r	
Idotea sp.		r	
Littorina littorea		o	
Littorina fabalis		?	
Littorina obtusata		?	
Semibalanus balanoides		f	

Photographs

No. T61

Observations

The *Fucus vesiculosus* biotope was present in patches within the *Enteromorpha* area at the landward fringe of the wave-cut platform. Elsewhere these species form a mixed biotope of *Fucus* and *Enteromorpha*. An underflora of filiform and crustose algal species occurred under *Fucus* together with invertebrate species.

North Foreland: North Foreland Point (NF2)

NF2 SA 3: *Fucus serratus* canopy (MLR.BF Fser biotope)

The study area was situated on the wave-cut platform (reef) at lower midlittoral shore level (10 m inshore of NF2 SA4). Grid ref. TR 40220 69145.

Species present	1997	2001	Notes
Cladophora rupestris		o	
Enteromorpha spp.		o	
Fucus serratus		**s**	**Dominant species 100% cover**
Gelidium pusillum		o	
Palmaria palmata		o	
Phymatolithon lenormandii		**s**	**Dominant understorey species 90% cover**
Ulva lactuca		o	
Actinia equina		f	
Carcinus maenas		f	
Dynamena pumila		o	
Littorina littorea		c	
Littorina fabalis		f	
Patella vulgata		c	
Polydora holes		o	
Sabellaria spinulosa		r	

Photographs

No. T62

Observations

A *Fucus serratus* canopy occurred widely over much of the wave-cut platform at Hope Point at mid- and lower littoral shore levels. As elsewhere on Thanet an understorey of smaller algal species and invertebrates occurred beneath *F. serratus*. The crustose coralline red alga *Phymatolithon lenormandii* was the dominant understorey species forming an adherent layer covering approximately 90% of the rock surface. The biotope was richer in species at low shore levels.

North Foreland: North Foreland Point (NF2)

NF2 SA 4: Mixed *Osmundea –Rhodothamniella* turf (MLR.Eph Rho/MLR.R Osm)

The study area was situated on the wave cut platform at lower midlittoral level in an area where the surface was uneven with vertical and often overhanging faces commonly present. Grid ref. TR 40240 69144.

Species present	1997	2001	Notes
Ceramium gaditanum		o	
Chondrus crispus		o	
Cladostephus spongiosus		o	
Enteromorpha sp.		o	
Fucus serratus		o	
Gelidium pusillum		o	
Lomentaria articulata		c	20% cover
Phymatolithon lenornmandii		o	
Osmundea ? pinnatifida		**a**	**Subdominant species 40% cover**
Rhodothamniella floridula		**s**	**Dominant species 60% cover**
Cryptosula pallasiana		r	1% cover
Dynamena pumila		?	
Elminius modestus		r	
Littorina fabalis/obtusata		r	
Nucella lapillus		o	
Patella vulgata		f	
Polydora holes		f	
Pomatoceros sp.		r	
Semibalanus balanoides		o	

Photographs

Nos. T63, T64

Observations

A species rich assemblage was sampled that comprised a mixture of two biotopes (a turf of *Osmundea* spp., and cushions of *Rhodothamniella floridula*). The assemblage was located a few metres inshore of a more typical *Rhodothamniella*-cushion biotope between the *Fucus serratus* and the *Laminaria digitata* biotopes. Vertical rock faces were often covered with a

close turf of *Lomentaria articulata.* Invertebrate species occurred amongst the algae. This assemblage resembled the mixed red algal biotope (MLR. R XR).

North Foreland: North Foreland Point (NF2)

NF2 SA 5: *Rhodothamniella* cushions (MLR.Eph Rho biotope)

The study area was situated on the wave cut platform (reef) at lower littoral shore level, inshore of the *Laminaria* zone, in a wave-exposed situation. Grid ref. TR 40254 69142.

Species present	**1997**	**2001**	**Notes**
Chondrus crispus			Nearby
Cladostephus spongiosus			Nearby
Fucus serratus		o	
Halurus flosculosus			Nearby
Osmundea ? pinnatifida			Nearby
Palmaria palmata		o	
Polysiphonia fibrata		o	
Polysiphonia fucoides		o	
Rhodothamniella floridula		**s**	**Dominant species 70% cover**
Ulva lactuca		c	20% cover
Carcinus maenas		o	
Lanice conchilega		a	
Molgula manhattensis		r	
Mytilis edulis		s	40% cover
Polydora holes		c	
Sagartia sp.		r	
Tapes (Venerupis) pullastra		r	

Photographs

No. T65

Observations

Rhodothamniella at this study area was not cushion forming but formed a purer stand than at the previous study site (NF2 SA4). The biotope was otherwise as described elsewhere on Thanet.

North Foreland: North Foreland Point (NF2)

NF2 SA 6 *Laminaria digitata* fringe (MIR.KR LdigPid biotope)

The study area was situated on the foreshore reef at sublittoral fringe shore level. Grid ref. TR 40272 69142.

Species present	1997	2001	Notes
Chondrus crispus		o	
Cladophora rupestris		o	
Halurus flosculosus		o	
Laminaria digitata		**s**	**Dominant species**
Palmaria palmata		o	
Polysiphonia fucoides		o	
Ulva lactuca		o	
Crustose Corallinaceae		o	
Mytilus edulis		s	
Piddock holes		?	

Photographs

No. T66

Observations

The kelp *Laminaria digitata* formed a more-or-less continuous zone along the coast at sublittoral fringe shore level and below. Piddock holes were common, and the species assemblage was typical of the '*Laminaria digitata* over Piddock bored chalk' biotope widely recorded around Thanet.

Dumpton and Ramsgate (DG)

Dumpton Gap - East Ramsgate: Dumpton Gap (DG1)

DG1 SA1: East-facing chalk cliff

The study transect was the third small projecting headland on the cliffs to the south of Dumpton Gap bay; the remains of former coastal protection lay to either side of the headland. Grid ref. TR 39578 64453.

Height	Species present (2001)	Colour zone
3.0m+	Black fungus	Powdery black zone
2.5m+	*Apistonema carterae*	Brown gelatinous zone (patchy)
2.0m+	*Enteromorpha* spp.	Filamentous green zone
1.5m+	*Enteromorpha* spp. Also present: *Littorina saxatilis*	Filamentous green zone
1.0m+	Arthropyrenia halodites Also present: *Littorina saxatilis*	Crustose lichen zone
0.5m	*Enteromorpha* spp.	Filamentous green zone with red patches

Height	Species present (2001)	Colour zone
	Gelidium pusillum Also present: *Littorina saxatilis*	
0.0m	*Enteromorpha* spp. *Gelidium pusillum* Also present: *Littorina saxatilis* *Patella vulgata*	Filamentous green zone with red patches

Photographs

Nos. T67, T68, T69

Observations

The zonation of algae and other organisms on the cliff was typical of cliffs elsewhere on Thanet, although poorly developed and restricted in extent on this section of coast. A cave located to the north of this study transect contained additionally *Pseudendoclonium submarinum* (green stains).

Dumpton Gap - East Ramsgate: Dumpton Gap (DG1)

DG1 SA2: *Enteromorpha-Porphyra* cover (MLR.Eph EntPor biotope)

The study site was situated 39 m east (seaward) of the chalk cliff, below a sandy beach that separated the rocky foreshore from the cliff. In the study area a thin layer of sand covered chalk rock and there were deposits of flint cobble. Grid ref. TR 39612 66449.

Species present	1997	2001	Notes
***Enteromorpha* spp.**		**s**	**Dominant species 90% cover**
Gelidium pusillum		r	
Porphyra purpurea			Nearby
Littorina ? fabalis (juvenile)			Nearby r
Patella vulgata			Nearby o
Polydora holes		o	

Photographs

Nos. T70, T71

Observations

The study area was located in a distinct green zone 20-30m wide at upper midlittoral shore level, and, as elsewhere on Thanet, was sand abraded. *Porphyra purpurea* was detected in only small amounts and the biotope was species-poor.

Dumpton Gap - East Ramsgate: Dumpton Gap (DG1)

DG1 SA3 *Fucus serratus* canopy (MLR.BF Fser biotope)

The study area was situated on the foreshore reef 69-70 m ESE (285°) seaward of the cliff and a few metres seaward of the *Enteromorpha-Porphyra* zone. Grid ref. TR 39658 66449.

Species present	**1997**	**2001**	**Notes**
Arthropyrenia halodites		o	
Enteromorpha spp.		c	10% cover
Fucus serratus		**s**	**Dominant species 80% cover**
Fucus vesiculosus		o	
Gelidium pusillum		a	25% cover
Osmundea ? pinnatifida		o	
Phymatolithon lenormandii		f	10% cover
Ralfsia verrucosa		o	
Rhodothamniella floridula		o	
Ulva lactuca		o	
Chalk boring Cyanophyta		f	10% cover
Alcyonidium mytili		?	
Cryptosula pallasiana		<1	
Dynamena pumila		f	
Elminius modestus		?	
Littorina fabalis		o	
Littorina littorea		f	
Mytilus edulis		r	
Patella vulgata		a	
Polydora holes		f	10% cover
Semibalanus balanoides		?	

Photographs

No. T72

Observations

In keeping with other sites on Thanet, the *Fucus serratus* canopy covered large area of the wave cut platform at Dumpton Gap; beneath the canopy layer was an understorey of smaller algae and invertebrates. The species content of the biotope was similar to that in the biotope elsewhere on Thanet.

Dumpton Gap - East Ramsgate: Dumpton Gap (DG1)

DG1 SA4: *Corallina* pool (LR.Rkp Cor biotope)

The study area was located centrally on the wave-cut platform at mid littoral shore level. Grid ref. TR 39686 66446.

Species present	**1997**	**2001**	**Notes**
Ceramium nodulosum		r	
Chondrus crispus		f	5% cover
Cladophora rupestris			Nearby
Corallina officinalis		**a**	**Dominant species 40% cover**
Cystoclonium purpureum		o	
Enteromorpha spp.		o	
Fucus serratus		f	15% cover
Osmundea pinnatifida		r	
Palmaria palmata		o	
Ulva lactuca		c	15% cover
Actinia equina			
Alcyonidium mytili		o	
Amphipholis squamata			Nearby on flint
Barnea parva (piddock)			Nearby
Conopeum reticulatum			Nearby
Dynamena pumila		o	
Electra pilosa		o	
Elminius modestus			Nearby
Gibbula cineraria			Nearby on flint
Lanice conchilega		o	
Lepidochitona cinereus			Nearby on flint
Littorina fabalis		?	
Littorina littorea		o	
Mytilus edulis			Nearby
Polydora holes		?	
Pomatoceros sp.			Nearby
Sabellaria spinulosa		o	
Sagartia elegans			Nearby

Photographs

No. T73

Observations

Rock-pools characterised by mats of *Corallina officinalis* were common at midlittoral levels on the foreshore reef. The biotope was moderately species-rich with invertebrates among the algal turf or on flint cobbles; species richness varied according to depth of pool and position on the shore (those at higher levels and those shallower are generally less rich). The biotope occurred widely around Thanet.

Dumpton Gap - East Ramsgate: Dumpton Gap (DG1)

DG1 SA5 *Rhodothamniella* cushions (MLR.Eph Rho biotope)

The study area was situated on the wave-cut platform at lower midlittoral levels. Grid ref. TR 39715 66444.

Species present	**1997**	**2001**	**Notes**
Ceramium deslongchampii		o	
Ceramium gaditanum		o	
Chondrus crispus		f	5% cover
Cladostephus spongiosus		f	5% cover
Corallina officinalis		r	
Enteromorpha sp.			Nearby
Fucus serratus		o	5% cover
Gelidium pusillum		a	20% cover
Halurus flosculosus			Nearby
Lomentaria articulata		r	
Osmundea ? pinnatifida		f	5% cover
Palmaria palmata		r	
Phymatolithon lenormandii		t	
Polysiphonia fucoides		r	
Rhodothamniella floridula		**s**	**Dominant species 80% cover**
Ulva lactuca		o	
Alcyonidium mytili		r	
Cryptosula pallasiana		?	
Conopium reticulatum		<1	
Elminius modestus		?	
Lanice conchilega		o	
Littorina fabalis		r	
Patella vulgata		r	
Polydora tubes		a	50% cover
Pomatoceros sp.		o	
Sabellaria spinulosa		?	
Piddock holes		o	

Photographs

No. T74

Observations

Rhodothamniella cushions (turf) formed a patchy but distinct biotope at lower midlittoral shore level between the *Fucus serratus* and *Laminaria digitata* zones, a pattern of zonation that occurred commonly on other Thanet shores. The biotope was moderately species-rich with invertebrates occurring in and among the algae; *Polydora* commonly formed tubes through the algal turf.

Dumpton Gap - East Ramsgate: Dumpton Gap (DG1)

DG1 SA6 *Laminaria digitata* forest over Piddock bored chalk (MIR.KR LdigPid biotope)

The study area was situated on the chalk wave-cut platform at low water neap tide level in moderately washed conditions. Grid ref. TR 39744 66443.

Species present		**2001**	**Notes**
Chondrus crispus		c	
Cladophora rupestris		o	
Cladostephus spongiosus		r	
Corallina officinalis			Nearby o
Cystoclonium purpureum		f	
Fucus serratus		o	
Halurus flosculosus		r	
Laminaria digitata		**s**	**Dominant species**
Mastocarpus stellatus		o	On flint only
Membranoptera alata		r	
Palmaria palmata		a	Subdominant species
Phymatolithon spp./ Crustose Corallinaceae		f	
Polysiphonia fucoides		f	
Porphyra sp.		o	
Ulva lactuca		o	
Alcyonidium mytili		?	
Asterias rubens			Nearby
Barnea parva (piddock)		?	
Bugula fulva		?	
Carcinus maenas		?	
Dynamena pumila		?	
Electra pilosa		?	
Gibbula cineraria		?	
Halichondria panicea			Nearby
Lanice conchilega		?	
Mytilus edulis		?	
Nereid aff. Nereis pelagica		?	In *Laminaria* holdfast
Nucella lapillus		?	
Sabellaria spinulosa		?	
Schizomavella linearis		?	
Sertularella gaudichaudi		?	

Photographs

No. T75

Observations

This study area was part of the dense stand of *Laminaria digitata* (often over piddock-bored chalk reef) that surrounded much of the Thanet coast. The study area was moderately species-rich with a well-developed understorey of fauna and flora beneath the *Laminaria* canopy.

Dumpton Gap - East Ramsgate: East Ramsgate (DG2)

DG2 SA1: Chalk cliff algal communities

The study transect was located on the second small headland north of Ramsgate esplanade. Grid ref. TR 39438 66075.

Height	Species present (2001)	Colour zone
3.0m+	Black fungus	Powdery black zone
2.5m+	*Apistonema carterae*	Gelatinous brown zone
2.0m+	*Apistonema carterae*	Gelatinous brown zone
1.5m+	*Apistonema carterae* / *Enteromorpha* spp. boundary	
1.0m+	*Enteromorpha* spp.	Filamentous green zone
0.5m+	*Enteromorpha* spp.	Filamentous green zone
0m+	*Arthopyrenia halodites* Also present: *Enteromorpha* spp. *Gelidium pusillum* *Littorina saxatilis* *Patella vulgata*	Crustose lichen zone

Photographs

No. T76

Observations

The study transect was on a headland with a limited extent of chalk cliff algal communities. The transect traversed four zones from a powdery black fungal zone at high spray zone level (supralittoral) to a zone characterised by the crustose lichen *Arthropyrenia halodites* at the base of the cliffs, and was geneerally typical of the zoantion of algal communities on open cliff-faces in Thanet.

Dumpton Gap - East Ramsgate: East Ramsgate (DG2)

DG2 SA2: *Enteromorpha-Porphyra* zone (MLR.Eph EntPor biotope)

The study area was located 40 m E (seaward) of the cliff in an area of sand-covered chalk platform at upper midlittoral shore level. Grid ref. TR 39473 66059.

Species present	1997	2001	Notes
***Enteromorpha* spp.**		**s**	**Dominant species 80% cover**
Fucus spp. (juvenile)		o	
Fucus vesiculosus			Nearby
Gelidium pusillum		o	
Patella vulgata			Nearby o
Polydora holes		o	
Semibalanus balanoides			Nearby o

Photographs

No. T77

Observations

The biotope, widespread on Thanet, formed a zone approximately 40m wide over the inner (landward) fringe of the wave-cut platform. *Porphyra purpurea* was not detected, and as elsewhere on Thanet the biotope was poor in species.

Dumpton Gap - East Ramsgate: East Ramsgate (DG2)

DG2 SA3: *Fucus serratus* canopy (MLR.BF Fser biotope)

The study area was located at midlittoral level on the wave-cut platform 105 m east (seaward) of the cliff face in an area where there is much flint and broken chalk. Grid ref. TR 39524 66039.

Species recorded	1997	2001	Notes
Arthropyrenia halodites		o	
Chondrus crispus		o	
Cladophora rupestris		a	30% cover
Corallina officinalis		o	
Enteromorpha spp.			Nearby o
Fucus serratus		**s**	**Dominant species 80% cover**
Gelidium pusillum		o	
Lomentaria articulata		o	
Mastocarpus stellatus			Nearby o
Osmundea pinnatifida			Nearby o
Palmaria palmata		f	5% cover
Phymatolithon lenormandii		c	30% cover
Porphyra purpurea			Nearby o
Alcyonidium mytili			Nearby

Species recorded	1997	2001	Notes
Carcinus maenas			Nearby
Dynamena pumila		o	
Electra pilosa		o	
Elminius modestus		o	
Gibbula cineraria			Nearby
Lanice conchilega		o	
Littorina fabalis			Nearby
Littorina littorea		?	
Mytilus edulis		o	
Nucella lapillus			Nearby
Patella vulgata		f	
Pomatoceros sp.		r	
Sagartia sp.			Nearby
Sabellaria spinulosa		f	
Crustose Bryozoa			Nearby

Photographs

No. T78

Observations

As elsewhere on Thanet, a canopy of *Fucus serratus* was widespread over much of the wave-cut platform. Beneath the canopy was an understorey assemblage of small algae and invertebrates, similar in species content to the biotope elsewherein the SAC.

Dumpton Gap - East Ramsgate: East Ramsgate (DG2)

DG2 SA4: *Chondrus* and *Mastocarpus* on flint and chalk cobbles (MLR.R XR biotope)

The study area was situated at lower littoral shore level where the foreshore reef bore a deposit of flint and chalk cobble. Grid ref. TR 39543 66031.

Species recorded	1997	2001	Notes
Ceramium nodulosum		o	
Chondrus crispus		**a**	**Co-dominant species 30% cover**
Enteromorpha spp.		o	5% cover
Halurus flosculosus		o	
Mastocarpus stellatus		**a**	**Co-dominant species 20% cover**
Palmaria palmata		o	
Plocamium cartilagineum		r	
Polysiphonia fucoides		o	
Porphyra purpurea		o	
Ralfsia verrucosa		r	
Ulva lactuca		o	
Crustose Corallinaceae		c	On flint only
Amphipholis squamata		o	
Conopeum reticulum		?	
Electra pilosa		o	

Gibbula cineraria			Nearby o
Lanice conchilega		**s**	**Dominant understorey species**
Lepidochitona cinereus			Nearby o
Littorina littorea			Nearby o
Pomatoceros sp.			Nearby
Sabellaria spinulosa		o	
Sagartia sp.		f	

Photographs

Nos. T79, T80

Observations

Chondrus crispus and *Mastocarpus stellatus* together covered 50% of the study quadrat. The sandmason worm *Lanice conchilega* was the dominant understorey species occupying the sediment filled crevices between cobbles. On Thanet *M. stellatus* grows only on flint, and thus the biotope is only sporadically present; this is the only location in the Thanet coast cSAC where flint cobble deposits occur sufficiently extensively for the biotope to be mapped (cf Tittley *et al*, 1998).

Dumpton Gap - East Ramsgate: East Ramsgate (DG2)

DG2 SA5: *Laminaria digitata* on piddock-bored chalk (MIR.KR LdigPid biotope)

The study area was situated on the wave-cut platform at sublittoral fringe shore level; deposits of flint cobble were common. Grid ref. TR 39956 66025.

The investigation in this study area was limited due to difficult working conditions (low evening light, incoming tide) and animal abundances were not noted.

Species present	**1997**	**2001**	**Notes**
Cladophora rupestris		c	
Cladostephus spongiosus		o	
Chondrus crispus		c	
Cystoclonium purpureum		a	
Enteromorpha spp.		o	
Halurus flosculosus		o	
Laminaria digitata		**s**	**Dominant species**
Mastocarpus stellatus		f	On flint only
Plocamium cartilagineum		o	
Ulva lactuca		r	
Crustose Corallinaceae		a	
Achelia echinata			
Alcyonidium mytili		?	
Amphipholis squamata		?	
Balanus crenatus		?	
Barnea parva (piddock)		?	
Bugula fulva		?	

Species present	1997	2001	Notes
Bugula plumosa		?	
Calcareous sponges		?	
Crustose Bryozoan		?	
Electra pilosa		?	
Elminius modestus		?	
Gibbula cineraria		?	
Halichondria panicea		?	
Lacuna pallidula		?	
Lanice conchilega		?	
Lepidochitona cinereus		?	
Nucella lapillus		?	
Nymphon gracile		?	Western species
Patella vulgata		?	
Pomatoceros sp.		?	
Porcellana platycheles		?	
Sertularella gaudichaudi		?	

Observations

The study area was located in the '*Laminaria digitata* over piddock-bored chalk' biotope that occurred widely around Thanet at sublittoral fringe levels and below. The biotope was rich in species and similar to that at locations elsewhere in the Thanet coast cSAC.

Pegwell (PB)

Pegwell: below Pegwell Lodge (PB1)

PB1 SA1: Chalk cliff algal communities

The study transect was a south-facing cliff approximately 200 m west of the undercliff road. Grid ref. TR 36528 64091.

Height	Species present (2001)	Colour zone
2.5m+	*Apistonema carterae*	Gelatinous brown zone
2.0m+	*Rhizoclonium riparium*	Filamentous green zone
1.5m+	*Enteromorpha* spp.	Filamentous green zone
1.0m+	*Enteromorpha* spp.	Filamentous green zone
0.5m+	*Enteromorpha* spp. Also present: *Arthropyrenia halodites* *Fucus spiralis* *Littorina ? saxatilis* *Patella vulgata*	Filamentous green zone
0.0m+	*Enteromorpha* spp. Also present: *Arthropyrenia halodites* *Fucus spiralis* *Littorina ? saxatilis* *Patella vulgata*	Filamentous green zone

Photographs

Nos. T81, T82

Observations

The transect traversed three main zones of algae with the gelatinous brown *Apistonema carterae* at spray zone levels. Gelatinous orange growths of *Chrysotila lamellosa* occurred at high spray zone levels in an adjacent inlet. The cliff algal zonation closely resembled that at locations elsewhere on Thanet.

Pegwell: below Pegwell Lodge (PB1)

PB1 SA2: *Polydora*-bored, *Littorina*-grazed chalk rock (MLR LitPat biotope)

The study area was situated on the foreshore reef 24 m south (seaward) of the cliff face at PB1 SA1. Grid ref. TR 36529 64048.

Species present	1997	2001	Notes
Littorina littorea		a	Dominant species
Mytilus edulis		f	5-10% coveer
Patella vulgata			Nearby
Polydora holes		a	60% cover
Chalk-boring Cyanophyta		c	

Photographs

No. T83

Observations

The study area was typical of the inshore part of the chalk foreshore reef at this location and was largely bare of macroalgae. The chalk was noticeably bored by *Polydora,* grazed by *Littorina* spp. and *Patella vulgata*, and covered by occasional patches of *Mytilus edulis*.

Pegwell: below Pegwell Lodge (PB1)

PB1 SA3: *Mytilus edulis* covered chalk rock (SLR.MX MytX biotope)

The study area was situated on the wave-cut platform 60 m south (seaward) of the cliff face at PB1 SA1. Grid ref. TR 36528 64004.

Species present	1997	2001	Notes
Gelidium pusillum		s	Dominant alga 40% cover (over Mytilus)
Porphyra purpurea		o	
Chalk boring Cyanophyta		o	
Elminius modestus		o	5% cover
Littorina littorea		s	
Mytilus edulis		s	Dominant species 95% cover
Patella vulgata		o	
Polydora holes		o	5% cover
Semibalanus balanoides		o	5% cover

Photographs

Nos. T84, T85

Observations

The species assemblage in this study area resembled more the biotope SLR.MX MytX defined as *Mytilus edulis* beds on eulittoral mixed substrata (MLR.MF MytFves was discounted due to the absence of *Fucus*). The principal alga was *Gelidium pusillum* that formed a layer over Mytilus. It also formed a mosaic over large areas of the chalk foreshore reef at midlittoral shore level.

Pegwell: below Coastguard cottages (PB2)

PB2 SA1: Chalk cliff algal communities

The study transect was situated on a south-west facing chalk stack adjacent to an arch. Grid ref. TR 36120 64149.

Height	Species present (2001)	Colour zone
2.5m+	*Apistonema carterae*	Gelatinous brown zone
2.0m+	*Rhizoclonium riparium*	Filamentous green zone
1.5m+	*Rhizoclonium riparium*	Filamentous green zone
1.0m+	*Enteromorpha* spp.	Filamentous green zone
0.5m+	*Enteromorpha* spp.	Filamentous green zone
0m+	Small amounts of *Arthropyrenia halodites* *Gelidium pusillum* Chalk boring Cyanophyta Elminius modestus *Littorina* spp. Mytilus edulis *Patella vulgata* *Semibalanus balanoides*	Bare (grazed/ wave-washed) zone

Photographs

Nos. T86, T87, T88

Observations

The transect traversed three main zones of algae from a gelatinous brown *Apistonema carterae* zone at supralittoral shore level to a bare wave-washed zone at beach level. The cliff algal zonation closely resembled that at locations elsewhere on Thanet.

Pegwell: below Coastguard cottages (PB2)

PB2B SA2 *Gelidium pusillum* turf over *Mytilus edulis* (?SLR.MX MytX biotope)

The study area was located on the inshore part of the wave-cut platform 16 m south west (210° to Pegwell Bay) of the cliff study area PB2 SA1. Grid ref. TR 636119 64114.

Species present	1997	2001	Notes
Arthropyrenia halodites		r	
Gelidium pusillum		**a**	**Co-dominant species 25% cover**
Phymatolithon lenormandii		o	
Ralfsia verrucosa		r	
Chalk boring Cyanophyta		o	
Elminius modestus		o	5% cover
Littorina littorea		a	

Species present	1997	2001	Notes
Mytilus edulis		**a**	**Co-dominant species 25% cover**
Polydora holes		a	
Semibalanus balanoides		o	5% cover

Photographs

No. T89

Observations

The species assemblage of this biotope comprised a turf of *Gelidium pusillum* over rock and *Mytilus edulis*; both species formed mosaics of growth over large areas of the wave-cut platform. The biotope was provisionally classified as SLR.MX MytX, although there is a resemblance to MLR.R Osm (*Osmundrea pinnatifida* and *Gelidium pusillum* on moderately exposed mid eulittoral rock) without *Osmundea*. *Gelidium pusillum* commonly formed turfs over chalk reef around Thanet.

Pegwell: below Cliff cottage (PB3)

PB3 SA1: Chalk cliff communities

The study transect was a small headland with caves either side (a large inlet is situated on the NE side). Grid ref. TR 36013 64202.

Height	Species present	Colour zone
2.0m+	Black fungus	Powdery black zone
1.5m±	*Apistonema carterae* Additionally present: *Audouinella purpurea*	Gelatinous brown zone
1.0m+	*Arthropyrenia halodites*	Crustose lichen zone (discontinuous)
0.5m+	*Enteromorpha* spp. Additionally present: *Fucus* spp. *Gelidium pusillum*	Filamentous green zone
0m+	*Enteromorpha* spp. Additionally present: *Fucus* spp. *Gelidium pusillum*	Filamentous green zone

Photographs

Nos. T90, T91

Observations

The transect traversed three main zones of algae with the gelatinous brown *Apistonema carterae* at spray zone levels below a powdery black fungal zone at high spray zone (supralittoral) level; a narrow wave-washed abrasion zone was present at beach level. The chalk cliff algal zonation closely resembled that at locations elsewhere on Thanet.

Pegwell: below Coastguard cottages (PB3)

PB3 SA2: *Mytilus* over chalk (SLR.MX MytX biotope)

The study area was located on the inner wave-cut platform 5 m out (west) from the cliff-face. Grid ref. TR 36011 64174.

Species present	1997	2001	Notes
Arthropyrenia halodites		o	
Enteromorpha spp.		o	
Fucus vesiculosus		o	
Gelidium pusillum		o	
Porphyra purpurea		o	
Elminius modestus		o	5% cover
Lanice conchilega		?	
Littorina saxatilis		o	
Mytilus edulis		s	Dominant species 60% cover
Patella vulgata		f	
Semibalanus balanoides		o	5% cover

Photographs

No. T92

Observations

The study contained *Mytilus* dominated biotope typical of the wave cut platform on the north east side of Pegwell Bay, and comparable with a mussel characterised biotope on the northwest coast of Thanet where inshore waters are also sediment-laden.

Pegwell: below Coastguard cottages (PB3)

PB3 SA3: *Enteromorpha-Porphyra* mat (MLR.Eph EntPor biotope)

The study area was situated on the wave-cut platform at midlittoral level 22 m west (towards Pegwell Bay) of the cliff face. Grid ref. TR 36013 64147.

Species present	1997	2001	Notes
Aglaothamnion hookeri		o	
***Enteromorpha* spp.**		**s**	**Dominant species 65% cover**
Fucus sp. (juvenile)		o	
Fucus spiralis			Nearby
Gelidium pusillum		o	
Porphyra purpurea		o	
Ulva lactuca		r	
Cerastoderma edule		f	
Elminius modestus		?	

Species present	1997	2001	Notes
Lanice conchilega		o	
Littorina littorea		o	
Macoma balthica		?	
Mytilus edulis		**a**	**Dominant species 20% cover**
Semibalanus balanoides		o	

Photographs

Nos. T93, T94

Observations

This *Enteromorpha* mat (with occasional *Porphyra purpurea*) present here was typical of of that on inshore reefs around Thanet.

Appendix 2 - List of photographs

Thanet No	Film	Loc	Habitat/Species	Date
T01	D1	EB SAC9	Cliff transect	22.9
T02	D3	EB SAC9	Cliff transect Chrysophyceae zone/biotope	22.9
T03	D4	EB SAC9	Cliff transect green algal zone/biotope	22.9
T04	D5	EB SAC9	Cliff transect red algal zone/biotope	22.9
T05	D9	EB SAC9	Cliffs + transect	22.9
T06	B37	FR SA1	*F serratus* biotope quadrat	21.9
T07	B29	FR SA3	*Sargassum mutucum* pool biotope quadrat	21.9
T08	B32	FR SA3	Halidrys pool biotope	21.9
T09	B35	FR SA3	*Sargassum muticum* + Corallina pool subbiotope	21.9
T10	B24	FR SA4	Palmaria biotope area + quadrat	21.9
T11	B25	FR SA4	Palmaria biotope quadrat	21.9
T12	B12	FR SA5	Rhodothamniella biotope quadrat	21.9
T13	B15	FR SA6	*L digitata* biotope zone	21.9
T14	B19	FR SA6	*L digitata* + piddocks biotope	21.9
T15	CS1/2	WN SAC1	Cliff zonation	15.9
T16	CS1/3	WN SAC1	Cliff transect location	15.9
T17	CS1/11	WN SAC2	Cliff zonation - upper zones	15.9
T18	CS1/10	WN SAC2	Cliff zonation	15.9
T19	CS1/9	WN/SAC2	Cliff transect location	15.9
T20	C1	WN SAC3	Cave	15.9
T21	C26	WN SAC3	Cave wall zonation	15.9
T22	C30	WN SAC3	Cave wall zonation *Aud purpurea* biotope	15.9
T23	C31	WN SAC3	Cave wall zonation brown algae + Chrysophyceae biotope	15.9
T24	C33	WN SAC3	Cave wall green stains Pseundendoclonium biotope	15.9
T25	C35	WN SAC3	Cave wall with Chrysophyceae biotope	15.9
T26	E1	WN SAC4	Cliff zonation	15.9
T27	E2	WN SAC4	Cliff zonation Chrysophyceae-Apistonema biotope	15.9
T28	E5	WN SAC4	Cliff zonation green + red algal zones	15.9
T29	E7	WN SAC5	Cliff zonation	15.9
T30	E8	WN SAC5	Cliff zonation red algal zone	15.9
T31	E10	WN SAC5	Cliff zonation Chrysophyceae biotope zone	15.9
T32	E15	WN SAC6	Cave zonation	16.9
T33	E16	WN SAC6	Cave zonation *Audouinella purpurea* biotope	16.9
T34	E17	WN SAC6	Cave zonation Chrysophyceae biotope	16.9
T35	E20	WN SAC7	Cave zonation	16.9
T36	E21	WN SAC7	Cave zonation-Pseudend-Chrysoph-Aud purp biotopes	16.9
T37	E11	WN SAC8	Cliff zonation Chrysophyceae-Chrysotila biotope	15.9
T38	C3	WN SA1	F vesiculosus biotope area	15.9
T39	C4	WN SA2	Enteromorpha-Porphyra biotope area	15.9
T40	C5	WN SA2	Enteromorpha-Porphyra Biotope quadrat	15.9
T41	C8	WN SA3	*F serratus* biotope quadrat	15.9
T42	C10	WN SA3	*F serratus* biotope quadrat + Cladophora underflora	15.9
T43	C13	WN SA3	*F serratus* biotope area to cave	15.9
T44	C14	WN SA4	Corallina pool biotope	15.9
T45	C16	WN SA4	Corallina pool biotope	15.9
T46	C19	WN SA6	Rhodothamniella biotope quadrat	15.9
T47	C22	WN SA6	Rhodothamniella biotope zone	15.9
T48	E23	NF1 SA1	Cliff zonation	16.9
T49	E25	NF1 SA1	Cliff zonation-Apistonema biotope	16.9
T50	E27	NF1 SA2	Enteromorpha-Porphyra biotope quadrat	16.9

Thanet No	Film	Loc	Habitat/Species	Date
T51	E29	NF1 SA3	*F serratus* biotope	16.9
T52	E30	NF1 SA3	*F serratus* biotope-Polydora borings	16.9
T53	E32	NF1 SA4	Corallina pool biotope	16.9
T54	E34	NF1 SA4	Corallina pool biotope	16.9
T55	A3	NF1 SA5	Rhodothamniella biotope	16.9
T56	A5	NF1 SA5	Rhodothamniella biotope-Lomentaria	16.9
T57	A7	NF1 SA5	Rhodothamniella biotope quadrat	16.9
T58	A8	NF1 SA6	*L digitata* pool	16.9
T59	A22	NF2 SA1	Enteromorpha-Porphyra biotope	16.9
T60	A24	NF2	Inshore area + cliffs	16.9
T61	A20	NF2 SA2	*F vesiculosus* biotope	16.9
T62	A17	NF2 SA3	*F serratus* biotope	16.9
T63	A14	NF2 SA4	Rhodothamniella+ red algae biotope	16.9
T64	A15	NF2 SA4	Rhodothamniella+Lomentaria + red algae biotope	16.9
T65	A10	NF2 SA5	Rhodothamniella biotope quadrat	16.9
T66	A11	NF2 SA6	*L digitata* biotope zone	16.9
T67	D32	DG1 SA1	Cliff zonation	22.9
T68	D33	DG1 SA1	Cliff zonation Arthropyrenia	22.9
T69	D34	DG1 SA1	Cliff zonation Chrysophyceae-Apistonema biotope	22.9
T70	D30	DG1 SA2	Enteromorpha-Porphyra biotope zone	22.9
T71	D31	DG1 SA2	Enteromorpha + Fucus biotopes	22.9
T72	D10	DG1 SA3	*F serratus* biotope	22.9
T73	D13	DG1 SA4	Corallina pool biotope	22.9
T74	D16	DG1 SA5	Rhodothamniella biotope	22.9
T75	B8	DG1 SA5	*L digitata* biotope zone	17.9
T76	D27	DG2 SA1	Cliff zonation	22.9
T77	D25	DG2 SA2	Enteromorpha-Porphyra biotope quadrat	22.9
T78	D23	DG2 SA3	*F serratus* biotope quadrat	22.9
T79	D19	DG2 SA4	Mastocarpus biotope	22.9
T80	D22	DG2 SA4	Mastocarpus biotope	22.9
T81	B1	PB1 SA1	Cliff zonation	17.9
T82	B3	PB1	Cave +Chrysotila +Pseudendoclonium biotopes	17.9
T83	B4	PB1 SA2	Cliffs + foreshore + Littorina biotope area	17.9
T84	B6	PB1 SA3	Mytilus biotope	17.9
T85	B7	PB1 SA3	Mytilus biotope quadrat	17.9
T86	A32	PB2 SA1	Cliff zonation	17.9
T87	A33	PB2 SA1	Cliff + cave zonation	17.9
T88	A35	PB2 SA1	Arch + cliff + cave zonation	17.9
T89	A36	PB2 SA2	Mytilus biotope + Gelidium	17.9
T90	A25	PB3 SA1	Enteromorpha biotope + cliff zonation	17.9
T91	A27	PB3 SA1	Enteromorpha biotope +Arthropyrenia on cliff	17.9
T92	A28	PB3 SA2	Mussel biotope	17.9
T93	A30	PB3 SA3	Enteromorpha-Porphyra biotope foreshore	17.9
T94	A31	PB3 SA3	Enteromorpha-Porphyra biotope zone + Pegwell Bay cliffs	17.9

Appendix 3 - Algal species recorded at Fulsam Rock

Fulsam Rock

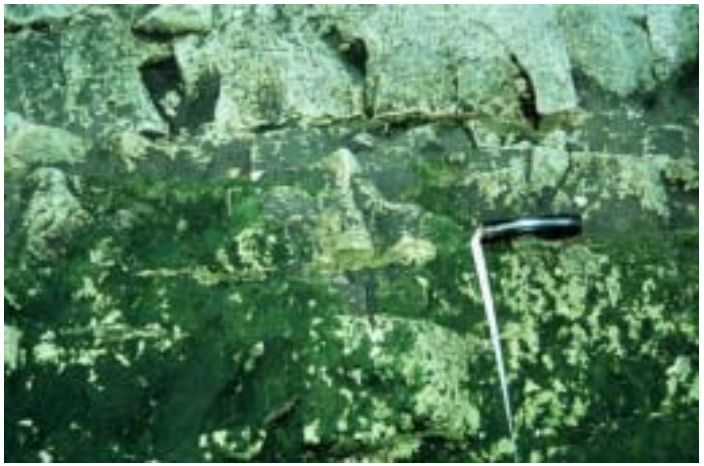
	1966/9 [1]	1986[2]	1993[3]	1997[4]	2001[5]
Green algae (Chlorophyta)					
Blidingia minima		+			
Bryopsis plumosa	+	+			
Chaetomorpha mediterranea	+				
Chaetomorpha melagonium	+	+			
Cladophora rupestris	+	+	+	+	+
Cladophora sericea	+	+			
Enteromorpha compressa	+				
Enteromorpha intestinalis		+		+	
Enteromorpha linza		+			
Enteromorpha prolifera		+		+	
Enteromorpha torta		+			
Ulva lactuca	+		+	+	+
Brown algae (Phaeophyta)					
Cladostephus spongiosus	+	+	+	+	+
Dictyota dichotoma	+		+	+	+
Elachista fucicola		+			
Fucus serratus	+	+	+	+	+
Fucus spiralis			+	+	
Fucus vesiculosus	+	+			
Halidrys siliquosa	+	+	+	+	+
Halopteris scoparia	+	+			
Laminaria digitata	+	+	+	+	+
Laminaria saccharina	+	+		+	
Petalonia fascia		+			
Pilayella littoralis	+	+		+	
Sargassum muticum	-	-	+	+	+
Spongonema tomentosum		+			
Stragularia (Ralfsia) clavata		+			+
Red algae (Rhodophyta)					
Aglaothamnion hookeri		+			
Ahnfeltia plicata	+	+			
Audouinella purpurea		+			
Ceramium deslongchampii	+	+		+	+
Ceramium gaditanum	+		+	+	+
Ceramium nodulosum	+	+	+	+	+
Chondria dasyphylla		80s			
Chondrus crispus	+	+	+	+	+
Corallina officinalis	+	+		+	+
Cryptopleura ramosa	+		+	+	

	1966/9 [1]	1986[2]	1993[3]	1997[4]	2001[5]
Cystoclonium purpureum	+	+	+	+	+
Dumontia contorta	+				
Furcellarialumbricalis	+				
Gelidium pusillum	+	+	+		+
Halurus flosculosus	+		+	+	+
Heterosiphonia plumosa		+			
Hildenbrandia rubra		+			+
Lomentaria articulata		+			
Mastocarpus stellatus	+				
Membranoptera alata	+		+	+	+
Osmundea hybrida	+				
Osmundea pinnatifida	+		+	+	+
Palmaria palmata	+	+	+	+	+
Phymatolithon lenormandii	+	+		+	
Phymatolithon purpureum			+		
Plocamium cartilagineum			+	+	
Polyides rotundus	+				+
Polysiphonia elongata				+	
Polysiphonia fucoides	+	+	+	+	+
Porphyra purpurea	+	+			
Rhodomela confervoides				+	
Rhodothamniella floridula	+	+	+	+	+
Rhodymenia holmesii				+	

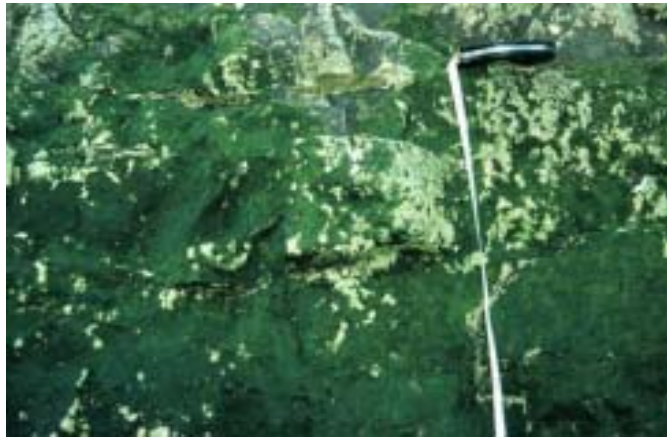
Data sources

1 = NHM 1960s data
2 = Tittley *et al* (1986)
3 = MNCR survey (Tittley & George, unpublished)
4 = Tittley *et al* (1998)
5= Present survey

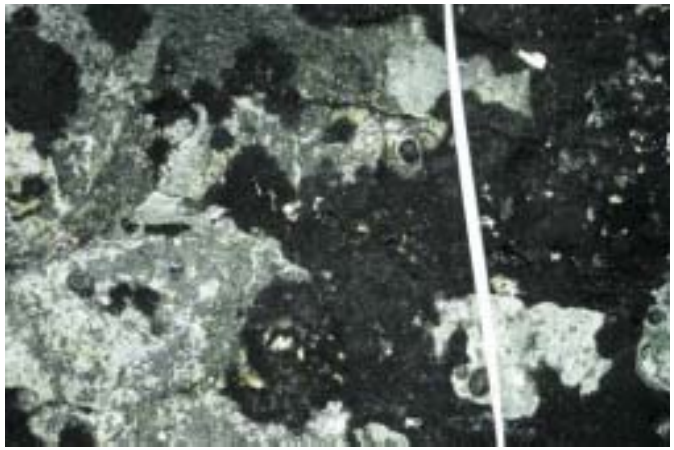
T01 – Cliff transect



T02 – Cliff transect Chrysophyceae zone/biotope



T03 – Cliff transect green algal zone/biotope

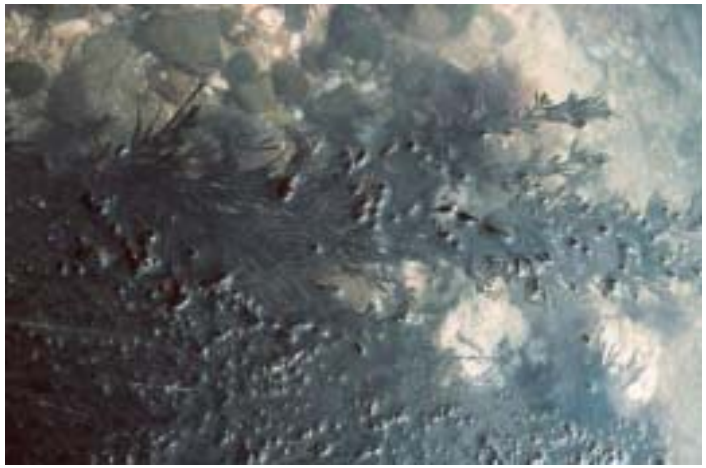


T04 – Cliff transect red algal zone/biotope

T05 – Cliffs + transect

T06 – *F serratus* biotope quadrat

T07 – *Sargassum mutucum* pool biotope quadrat



T08 – Halidrys pool biotope

T09 – *Sargassum muticum* + Corallina pool subbiotope

T10 – Palmaria biotope area + quadrat

T11 – Palmaria biotope quadrat

T12 – Rhodothamniella biotope quadrat

T13 – *L digitata* biotope zone

T14 – *L digitata* + paddocks biotope

T15 – Cliff zonation

T16 – Cliff transect location

T17 – Cliff zonation – upper zones

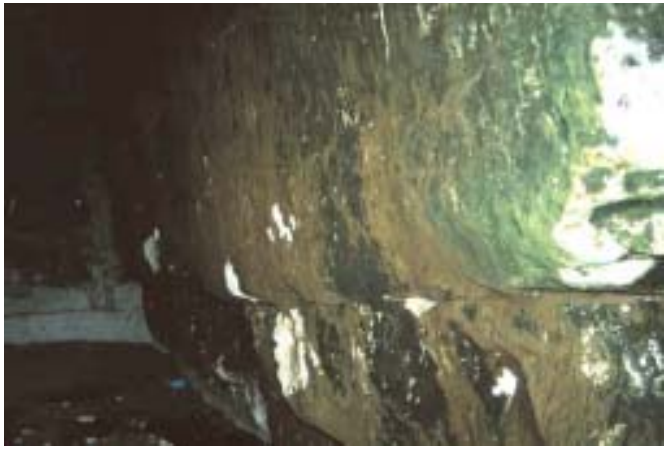
T18 – Cliff zonation

T19 – Cliff transect location

T20 - Cave

T21 – Cave wall zonation

T22 – Cave wall zonation *Aud purpurea* biotope



T23 – Cave wall zonation brown algae + Chrysophyceae biotope

T24 – Cave wall green stains Pseundendoclonium biotope

T25 – Cave wall with Chrysophyceae biotope

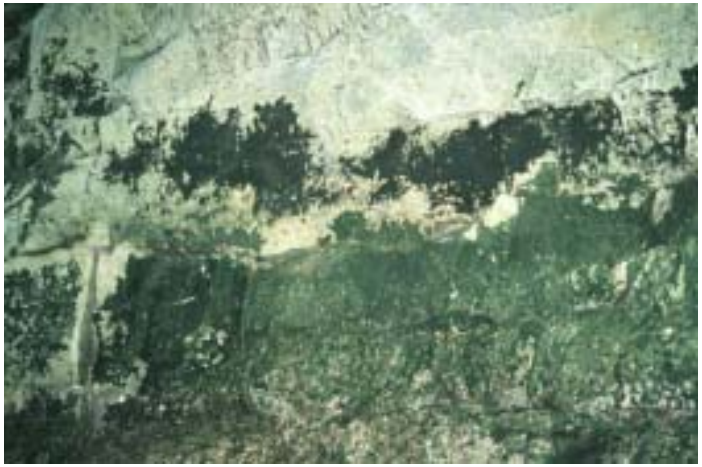
T26 – Cliff zonation

T27 – Cliff zonation Chrysophyceae-Apistonema biotope

T28 – Cliff zonation green + red algal zones

T29 – Cliff zonation

T30 – Cliff zonation red algal zone



T31 – Cliff zonation Chrysophyceae biotope zone

T32 – Cave zonation

T33 – Cave zonation *Audouinella purpurea* biotope

T34 – Cave zonation Chrysophyceae biotope

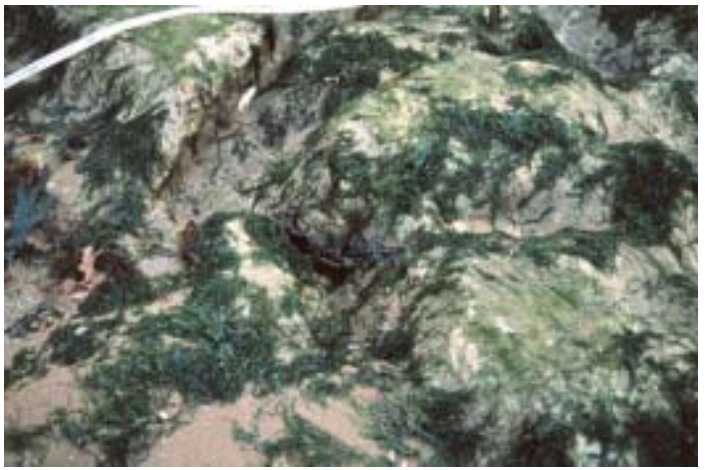
T35 – Cave zonation

T36 – Cave zonation – Pseudend-Chrysoph-Aud purp biotopes

T37 – Cliff zonation Chrysophyceae-Chrysotila biotope

T38 – *F vesiculosus* biotope area

T39 – Enteromorpha-Porphyra biotope area



T40 – Enteromorpha-Porphyra Biotope quadrat

T41 – *F serratus* biotope quadrat

T42 – *F serratus* biotope quadrat + Cladophora underflora

T43 – *F serratus* biotope area to cave

T44 – Corallina pool biotope

T45 – Corallina pool biotope

T46 – Rhodothamniella biotope quadrat

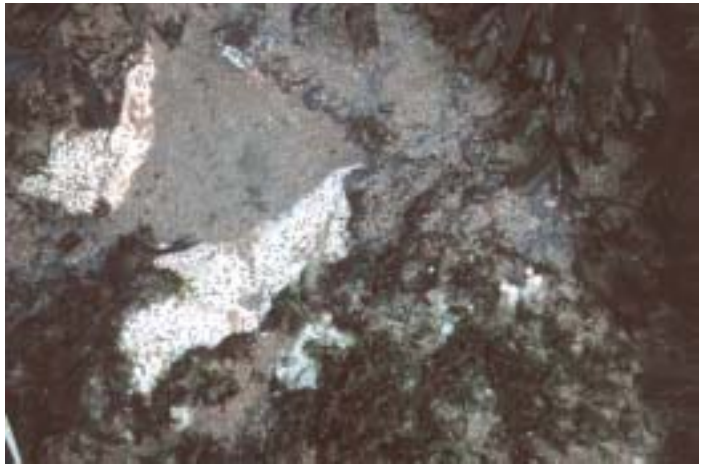
T47 – Rhodothamniella biotope zone

T48 – Cliff zonation

T49 – Cliff zonation–Apistonema biotope

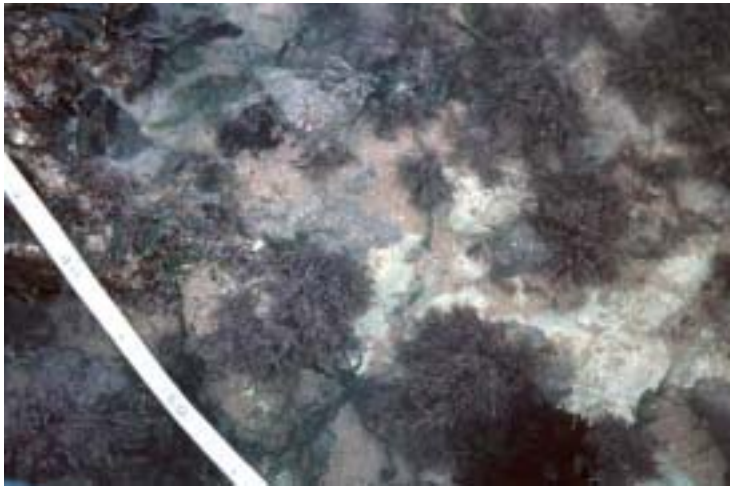
T50 – Enteromorpha-Porphyra biotope quadrat

T51 – *F serratus* biotope



T52 – *F serratus* biotope-Polydora borings

T53 – Corallina pool biotope



T54 – Corallina pool biotope

T55 – Rhodothamniella biotope

T56 – Rhodothamniella biotope-Lomentaria

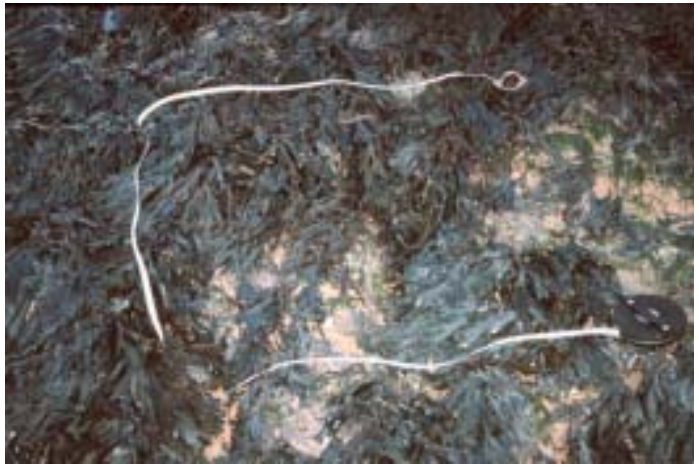
T57 – Rhodothamniella biotope quadrat

T58 – *L digitata* pool

T59 – Enteromorpha-Porphyra biotope

T60 – Inshore area + cliffs

T61 – *F vesiculosus* biotope

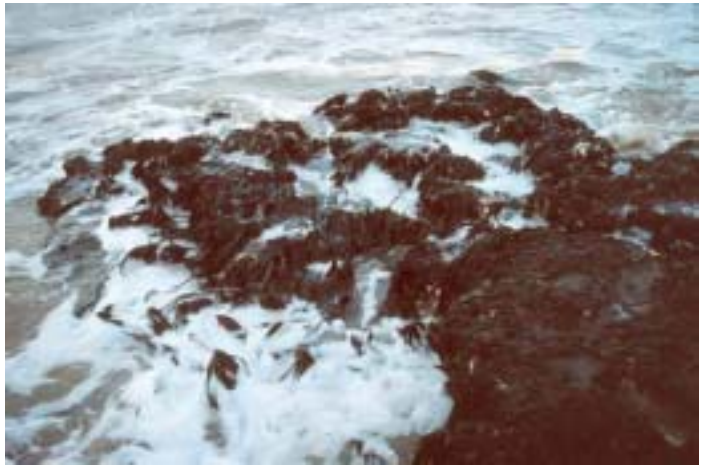


T62 – *F serratus* biotope

T63 – Rhodothamniella + red algae biotope

T64 – Rhodothamniella+Lomentaria + red algae biotope

T65 – Rhodothamniella biotope quadrat



T66 – *L digitata* biotope zone

T67 – Cliff zonation

T68 – Cliff zonation Arthropyrenia

T69 – Cliff zonation Chrysophyceae-Apistonema biotope

T70 – Enteromorpha-Porphyra biotope zone

T71 – Enteromorpha + Fucus biotopes

T72 – *F serratus* biotope

T73 – Corallina pool biotope

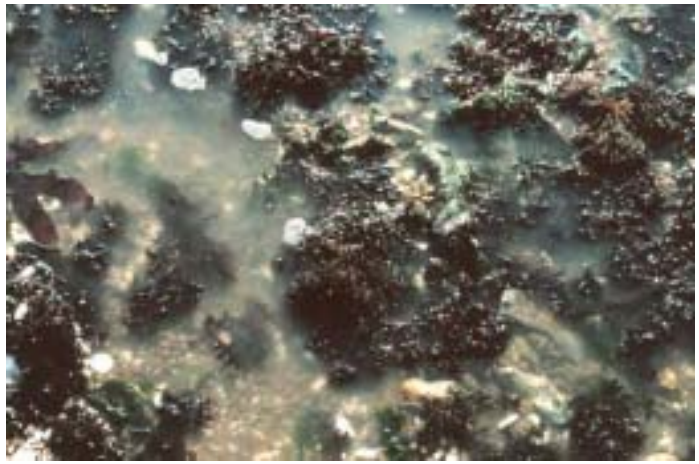
T74 – Rhodothamniella biotope

T75 – *L digitata* biotope zone

T76 – Cliff zonation

T77 – Enteromorpha-Porphyra biotope quadrat

T78 – *F serratus* biotope quadrat



T79 – Mastocarpus biotope

T80 – Mastocarpus biotope

T81 – Cliff zonation

T82 – Cave + Chrysotila + Pseudendoclonium biotopes

T83 – Cliffs + foreshore + Littorina biotope area

T84 – Mytilus biotope

T85 – Mytilus biotope quadrat

T86 – Cliff zonation

T87 – Cliff + cave zonation

T88 – Arch + cliff + cave zonation

T89 – Mytilus biotope + Gelidium

T90 – Enteromorpha biotope – cliff zonation

T91 – Enteromorpha biotope + Arthropyrenia on cliff

T92 – Mussel biotope

T93 – Enteromorpha-Porphyra biotope foreshore

T94 – Enteromorpha-Porphyra biotope zone + Pegwell Bay cliffs

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Top left: Using a home-made moth trap.
Peter Wakely/English Nature 17,396
Middle left: Co_2 experiment at Roudsea Wood and Mosses NNR, Lancashire.
Peter Wakely/English Nature 21,792
Bottom left: Radio tracking a hare on Pawlett Hams, Somerset.
Paul Glendell/English Nature 23,020
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