Appendix 17

Marine Habitat Survey

APPENDIX 12.4. RINGASKIDDY INTERTIDAL SURVEY

Introduction

Coastal Protection works in the form of shingle are proposed above the foreshore of Gobby Beach on the eastern boundary of the Indaver site as part of the proposed Ringaskddy Resource Recovery Centre.

On Thursday 18th and Friday 19th June, 2015 the marine flora and fauna of the shore proposed for beach nourishment was examined with survey effort timed to correspond with low water on a Spring tide when as much of the shore as possible was exposed. Survey effort included:

- a general walkover of the shore parallel to the waterline
- the examination of three shore transects perpendicular to the waterline extending to the low tide mark including the collection of six sediment core samples for faunal analysis
- an excursion to a large boulder on the low shore
- the recording of a GPS track of the survey route
- the creation of a photographic record of the shoreline as encountered. Two cameras were used to record details of the shore – both cameras were synchronised (to within a second) with GPS time immediately prior to the start of the survey.

Figure 1 below shows the locations of shore areas walked, stations surveyed on three transects and the location of a large prominent boulder (glacial erratic) examined to the southeast of the beach area. The survey began at the shore exit to the car park bordering the proposed development site, and proceeds south upon exiting the car park to the shore.

Figure 1. GPS track followed at the Ringaskiddy beach site, viewed superimposed on satellite image of the area.

Transect 1

The first of three transects beginning at the south of the car park exit to the shore, this transect ran perpendicular to the shoreline and progressed towards the low tide level. It comprised six stations. At each of these stations, sampling for fauna was attempted using a 15.24cm diameter corer (6 inch diameter). When sampling was possible three replicate samples were taken (sediment conditions determined whether sampling was possible or not). Detailed observations were made at

each of the stations. Continuous observations were made along the entire length of the transect including notes made on the behaviours of other visible fauna (primarily birds and humans). Numerous photographs were taken to document the shore.

Weather conditions on the day were favourable – good visibility, zero precipitation and approximately 1-2 eighths cloud cover. Survey began approximately 1 hour before the time of predicted low water. Humidity was high on this day with temperatures in the range of 19-21 degrees Celsius. A gentle breeze/light air was blowing from the NW. Figure 2 shows a general view of the beach and shore and general conditions on the first day of shore work.

Figure 3 gives a view of the shore backing at the beginning of Transect 1.

Figure 2. View from Transect 1, Station 1 down the shore to low water.

Figure 3. View of shore backing at the beginning of Transect 1.

Transect 1 - Station 1

Figure 4. View of beach sediments in quadrat. Quadrat is 50cm by 50cm. Black marks on quadrat frame are at 10cm intervals.

This station was located on the strandline. The substrate here is primarily a barren shingle (rounded and angular cobble and pebble) with some small and medium boulders as well as some shell hash (less than 5%). Fine-medium sand was present deeper wihin the beach. Stranded material included algal material (primarily *Fucus serratus* and *Ulva* spp.) and litter (mostly plastics and aluminium cans). Evidence of two small camp fires was recorded lose to this station. Shore backing was a low glacial till/soil cliff topped with vegetation. A robin (*Erithacus rubecula*) was noted foraging in the vegetation.

Due to the coarseness of the substrate it was not possible to obtain a sample for faunal analysis. A spade was used to dig to a depth of approximately 15cm. No animals were recorded. A small sample of sediment was retained for reference.

Transect 1 - Station 2

Figure 5. View of beach sediments at Station 2 in quadrat. Quadrat is 50cm by 50cm. Black marks on quadrat frame are at 10cm intervals.

Sediment here was substantially finer-grained than seen at station 1 with a covering of green algae (various species of *Ulva*, notably *Ulva compressa*). The cobble in the lower right-hand corner of the quadrat is largely covered in *Ulva compressa*. These algae are tolerant of large variations in salinity and temperature and are typical of sheltered shores.

Due to the coarseness of the substrate it was not possible to obtain a sample for faunal analysis. A spade was used to dig to a depth of approximately 30cm. No animals were recorded. A small sample of sediment was retained for reference.

The substrate here was composed of mixed sediment with fine sand, coarse sand, very coarse sand, rounded cobbles and small boulders all present. A small boulder covered in *Porphyra umbilicalis* was noted close to this station. The barnacle *Semibalanus balanoides* was also noted.

The next large change in shore characteristics was noted just below this station where a band of decaying algal material was encountered. This was a substantial deposit of decaying green and brown algae and is probably seasonal in nature (occurring here in summer and being partially or wholely swept away in winter). It was accompanied by the presence of *Beggiatoa* spp. (so called 'sewage fungus' - actually filamentous bacteria commonly associated with areas of high concentrations of H_2S). This is visible as a whitish layer coating the sediment surface. The depth of this deposit varied between 0cm (where boulders protruded) and 12cm. It was almost completely natural in composition with very little man made refuse (plastics, aluminium and glass bottles) noted.

Plate 1. The photograph on the following page shows the view down the shore towards the

waterline from Transect 1 Station 2. Green and brown algal cover and the whitish suface covering the band of decaying algal material can be clearly seen. Beyond this, the Polychaete/Bivalve dominated lower shore can be seen.

Transect 1 – Station 3

Figure 6. View of beach sediments at Station 3 in quadrat. Quadrat is 50cm by 50cm. Black marks on quadrat frame are at 10cm intervals.

This station was located at the beginning of the decaying algal belt. The immediated substrate was composed of decaying algal material with molluscan shell valves and shell fragments/hash – the surface was covered in a thin filamentous bacterial mat (*Beggiatoa* spp.). This material was accompanied by a strong smell of methane/H_2S and was quite soft underfoot. Below this 1cm-7cm deep layer the sediment was composed of a mix of fine sand, coarse sand, cobbles and pebbles.

Species noted included the green algae *Ulva lactuca* and *Ulva compressa* (formerly *Enteromorpha compressa*), the brown algae *Fucus serratus* and *Fucus vesiculosus* and, on a nearby medium-sized boulder, limpets *Patella vulgata* and barnacles *Balanus balanoides*. A dead green shore crab (*Carcinus maenas*) was noted as were shells of the common cockle *Cerastoderma edule*, rayed artemis *Dosinia exoleta,* razor clam *Ensis ensis* and periwinkle *Littorina littorea*. No sediment samples or faunal cores were obtained.

Plate 2. The photograph on the following page shows the view down the shore towards the waterline from Transect 1 Station 3. Green and brown algal cover and the whitish suface covering the band of decaying algal material can be clearly seen. Beyond this, the Polychaete/Bivalve dominated lower shore can be seen.

Transect 1 – Station 4

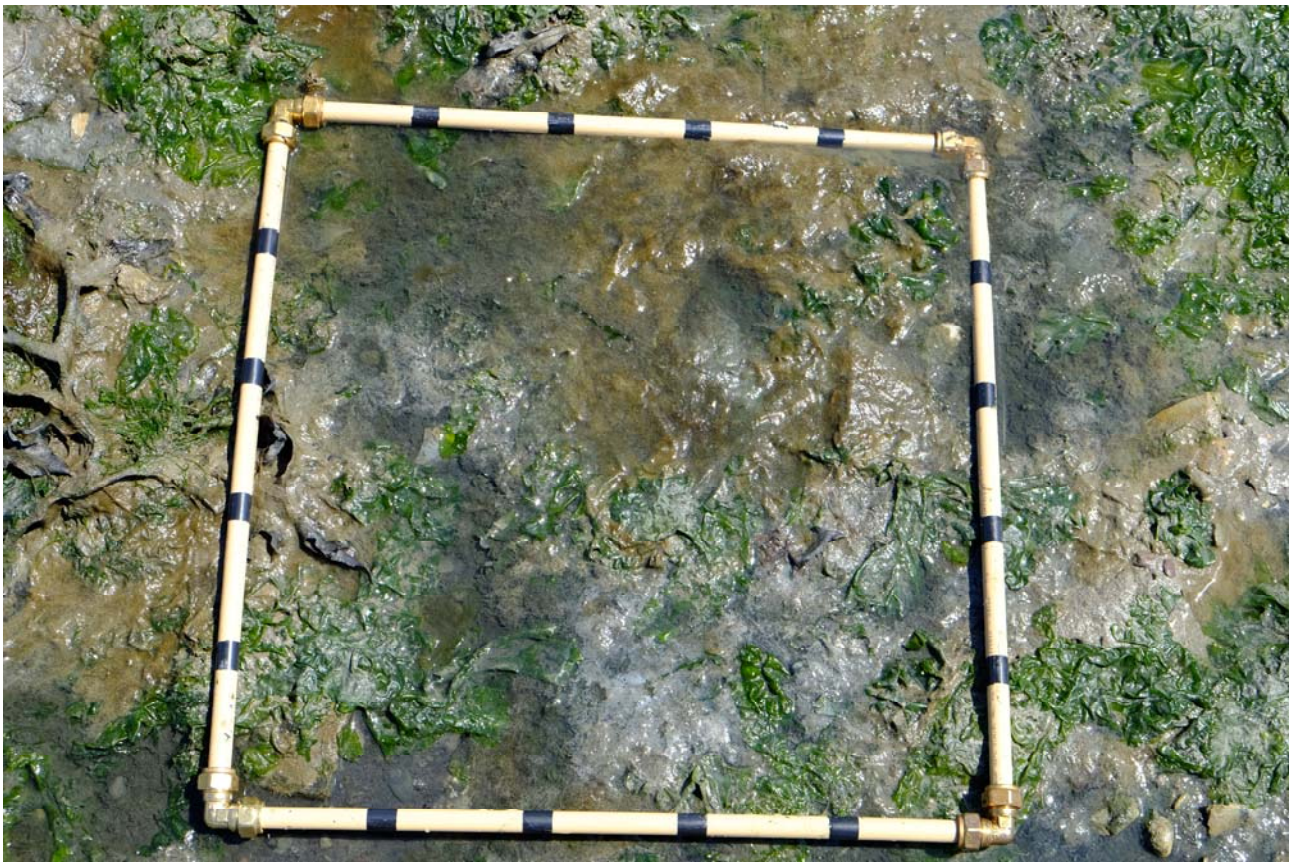


Figure 7. View of beach sediments at Station 4 in quadrat. Quadrat is 50cm by 50cm. Black marks on quadrat frame are at 10cm intervals.

This station was located at the lower end of the decaying algal belt where the shore surface transitioned to clean fine sands with algal cover. Below the top 2cm of sand the substrate was composed of a mix of fine sand, coarse sand, cobbles and pebbles.

Species noted included the green algae *Cladophora rupestris*, *Ulva lactuca* and *Ulva compressa* (formerly *Enteromorpha compressa*), the brown algae *Fucus serratus* and characteristic feeding casts belonnging to the lugworm *Arenicola marina*. The larger nearby boulders were encrusted with limpets (*Patella vulgata*) and barnacles (*Semibalanus balanoides*). Sediment samples were taken for reference. Faunal cores were attempted but not obtained due to the coarseness of the sediment.

This station marked the transition to a Polychaete/bivalve dominated shore. Numerous birds (Grey heron - *Ardea cinerea*, herring gulls – *Larus argentatus*, lesser black-backed gulls – *Larus fuscus*, juvenile greater black-backed gulls – *Larus marinus* and hooded crows – *Corvus corvix*) were noted hunting and scavenging on the shore here.

Plates 3 & 4.The photographs shown on the following page show;

a) the view back up the shore from Station 4 where two children can be seen playing on the beach as four adults enjoy the sunshine from the benches and
b) detail of limpets and barnacles on one of the larger encrusted boulders viewed from Station 4.

Transect 1 – Station 5

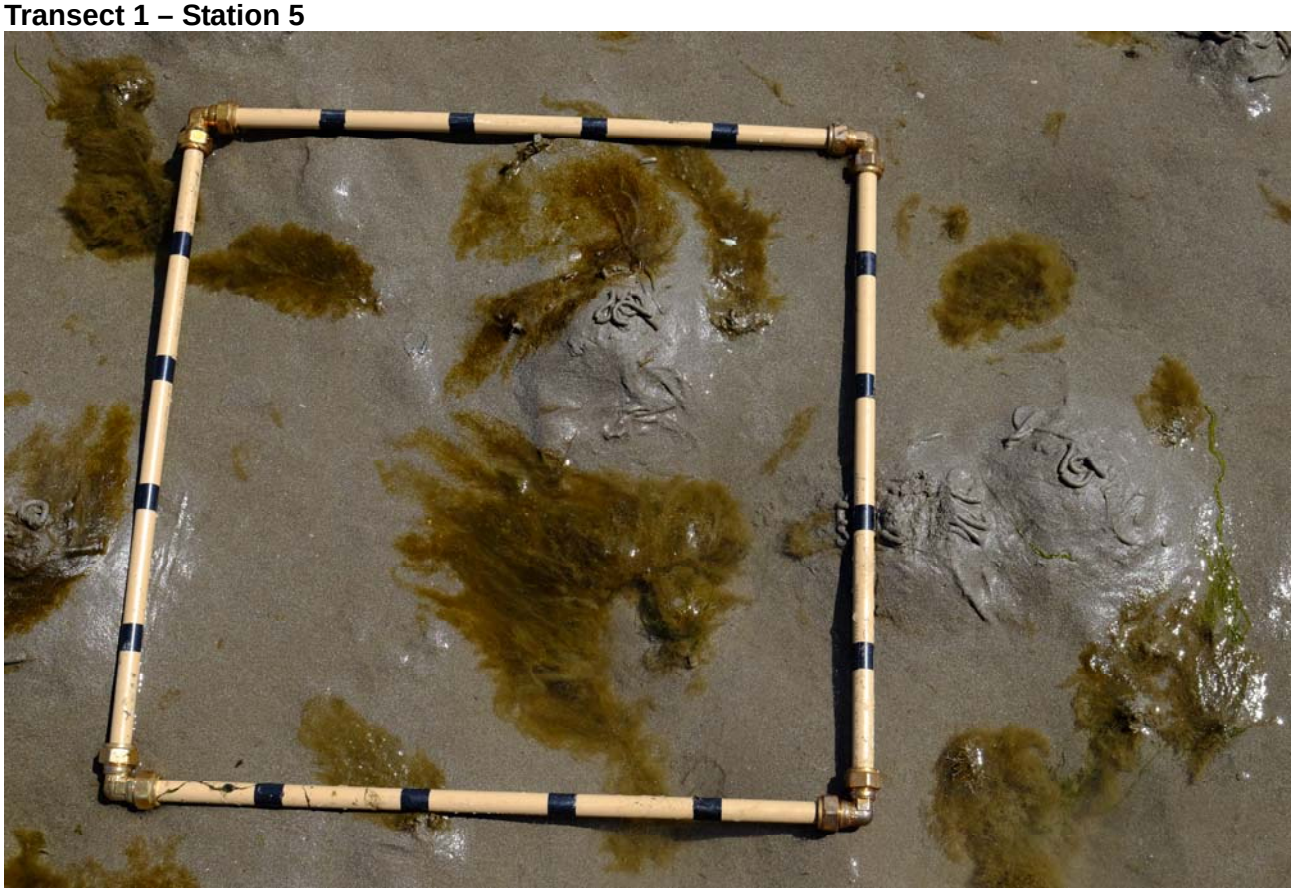


Figure 8. View of beach sediments at Station 5 in quadrat. Quadrat is 50cm by 50cm. Black marks on quadrat frame are at 10cm intervals.

This station was located on firm muddy fine sands and characterised the habitat extending to the low tide mark and beyond, into the shallow subtidal. It was possible to obtain good cores for faunal processing at this station, with approximately 25-35cm of muddy fine sand overlying a deeper layer of coarser cobble and gravel.

Species recorded here included green algae (*Cladophora rupestris*), occasional fronds of *Saccharina latissima* (a brown alga (in this case a kelp) possibly having drifted in from the shallow subtidal) the sand mason, *Lanice conchilega* – a common species of polychaete worm and the lugworm *Arenicola marina* whose very obvious feeding cast were cleary visible.

The tide was continuing to ebb as the survey continued exposing an increasing amount of the lower shore with high atmospheric pressure on the day helping to expose slightly more of the shore than predicted.

Plate 5. The photograph presented on the following page shows the view from Station 5 towards Station 6 and the low tide level.

Transect 1 – Station 6

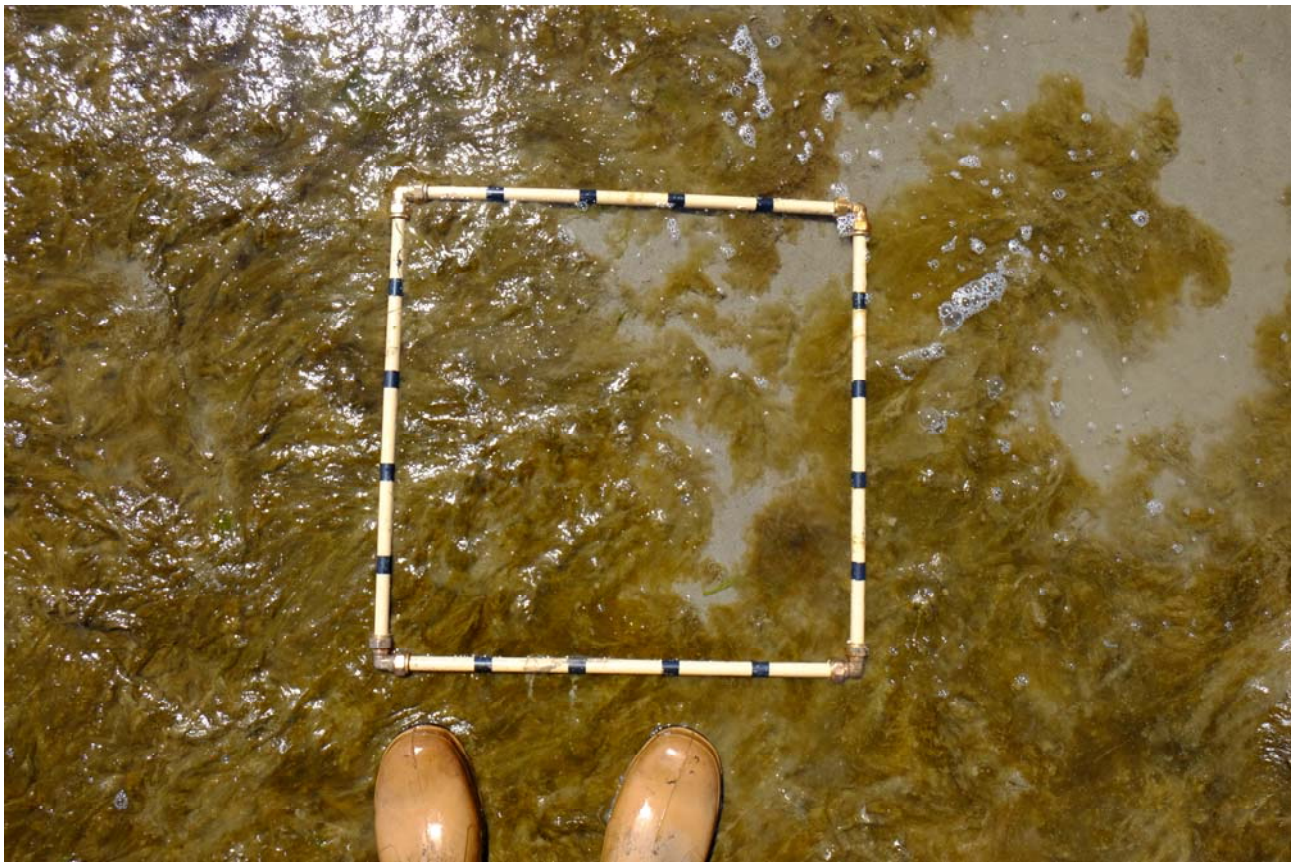


Figure 9. View of beach sediments at Station 6 in quadrat. Quadrat is 50cm by 50cm. Black marks on quadrat frame are at 10cm intervals.

The final station on Transect 1 marking the lowest point on the shore investigated. The station was again characterised by fine muddy sands and a polychaete and bivalve dominated community. The sediment surface was overlain by quite a substantial amount of green algae (*Cladophora rupestris*) and this extended further into the shallow subtidal. This station was characterised by the same sediments and community observed at the previous station with the sand mason and lugworm (*Lanice conchilega* and *Arenicola marina*) again featuring. Empty shells belonging to the common cockle (*Cerastoderma edule*) were also noted close to this station.

At 14:31 the tide abruptly turned and began to inundate the shore once more. Due to the speed of the incoming tide no faunal cores or sediment samples were taken at this station. It was time to begin a second transect, this time running from the lower shore (and the incoming tide) to the upper shore and strandline (results for Transect 2 are presented in the reverse order to that in which they were investigated – Station 1 (upper shore) to Station 6 (lower shore). The low shore station of Transect 2 began approximately 25m south of Station 6 on Transect 1.

Plate 6. The photograph presented on the following page shows:

a) the characteristic feeding mound and cast produced by the lugworm *Arenicola marina* photographed at Station 6

Transect 2 – Station 1

Figure 10. View of beach sediments at Station 1, Transect 2 in quadrat. Quadrat is 50cm by 50cm. Black marks on quadrat frame are at 10cm intervals.

This station was located on the upper shore/strandline. Shore backing at this station was composed of a glacial till/soil cliff partly covered in terrestrial vegetation (notably kidney vetch – *Anthyllis vulneraria* - in flower). Salt crystals and algal growth on the surface of the soil at the base *ca.* 30cm of this cliff indicate that it is subject to inundation by seawater during extremely high tides.

The substrate at the quadrat location was a shinlge beach composed of cobbles, pebbles, small boulders and fine-medium sand deeper within the sediment. The beach here sloped away from the base of the cliff more steeply than further down the shore. Some litter was noted – cigarette butts, plastic and glass bottles. A mix of stranded green and brown algae was recorded along with shell gravel composed of common cockle (*Cerastoderma edule*), razor clam (*Ensis* sp.), blue mussel (*Mytilus edulis*), oyster (*Ostrea edulis*), carpet shell (*Venerupis saxatilis*) and dog whelk (*Nucella lapillus*) shells. No live fauna were noted during the dig at this quadrat location.

Plate 7. The photograph presented on the following page gives a view down the shoreline from Station 1 on Transect 2 towards the low water mark.

Transect 2 – Station 2

Figure 11. View of beach sediments at Station 2, Transect 2 in quadrat. Quadrat is 50cm by 50cm. Black marks on quadrat frame are at 10cm intervals.

This station was located at the upper end of the transition area where the shore became algal dominated. The shore here was composed of cobble, gravel and sand with occasional scattered boulders. The substrate surface was covered with a substantial amount of green and brown algae (primarily *Ulva compressa, Fucus spiralis* and *Fucus serratus*). Limpets (*Patella vulgata*) and barnacles (*Semibalanus balanoides*) were recorded on nearby boulders.

Below the beach surface, sediments were quite hypoxic – no live animals were recorded in sediments at this station. The beach was too coarse to allow faunal cores to be taken. A small sediment sample was retained for reference. Some old oyster shells (*Ostrea edulis*) were noted here.

Plate 8. The photograph presented on the following page shows the view down the shore from Station 2 towards the water line.

Transect 2 – Station 3

Figure 12. View of beach sediments at Station 3, Transect 2 in quadrat. Quadrat is 50cm by 50cm. Black marks on quadrat frame are at 10cm intervals.

This station marked the beginning of a band of decaying algal material on the shore. A substantial deposit of decaying green and brown algae (largely *Ulva* sp. and *Fucus serratus* and *Fucus vesiculosus*) was present. The underlying sediment was composed of cobble, gravel and sand with a number of small boulders scattered along the shore. The substrate was too coarse to allow faunal cores to be taken.

Live animals noted on boulders close to this station included limpets (*Patella vulgata*) and barnacles (*Semibalanus balanoides*) – many dead specimens of each were noted. A dead *Ensis* sp. shell and several dead common green shore crabs were also noted (*Carcinus maenas*). This was most likely due to low oxygen and high decomposition gas levels experienced here due to the large amount of decaying plant matter. The smell of H_2S was quite noticeable here.

Plate 9. The photograph presented on the following page shows the view from Station 3, across the decaying weed deposit, towards the waterline.

Transect 2 – Station 4

Figure 13. View of beach sediments at Station 4, Transect 2 in quadrat. Quadrat is 50cm by 50cm. Black marks on quadrat frame are at 10cm intervals.

This station marked the transition from decaying weed covered shore to live weeds on cleaner muddy sands and a bivalve and polychaete dominated community on the lower shore. The shore surface was covered in a discontinuous layer of *Beggiatoa* spp. with a strong smell of decomposition gases noted. Beneath this layer of decaying organic matter sediment was composed of cobble, gravel and sand. Neither faunal nor sediment sampes were obtained at this station.

A dead harbour crab (*Liocarcinus depurator*) was noted here. Decaying algal material was composed primarily of green algae (*Ulva lactuca* and *Ulva compressa*) and brown algae (*Fucus serratus*). Live *Fucus serratus* was noted on boulders standing proud of the sediment.

Plate 10. The photograph presented on the following page shows the view from Station 4, across the decaying weed deposit, back towards the upper shore.

RINGASKIDDY SHORE TRANSECT 2

Transect 2 - Station 5

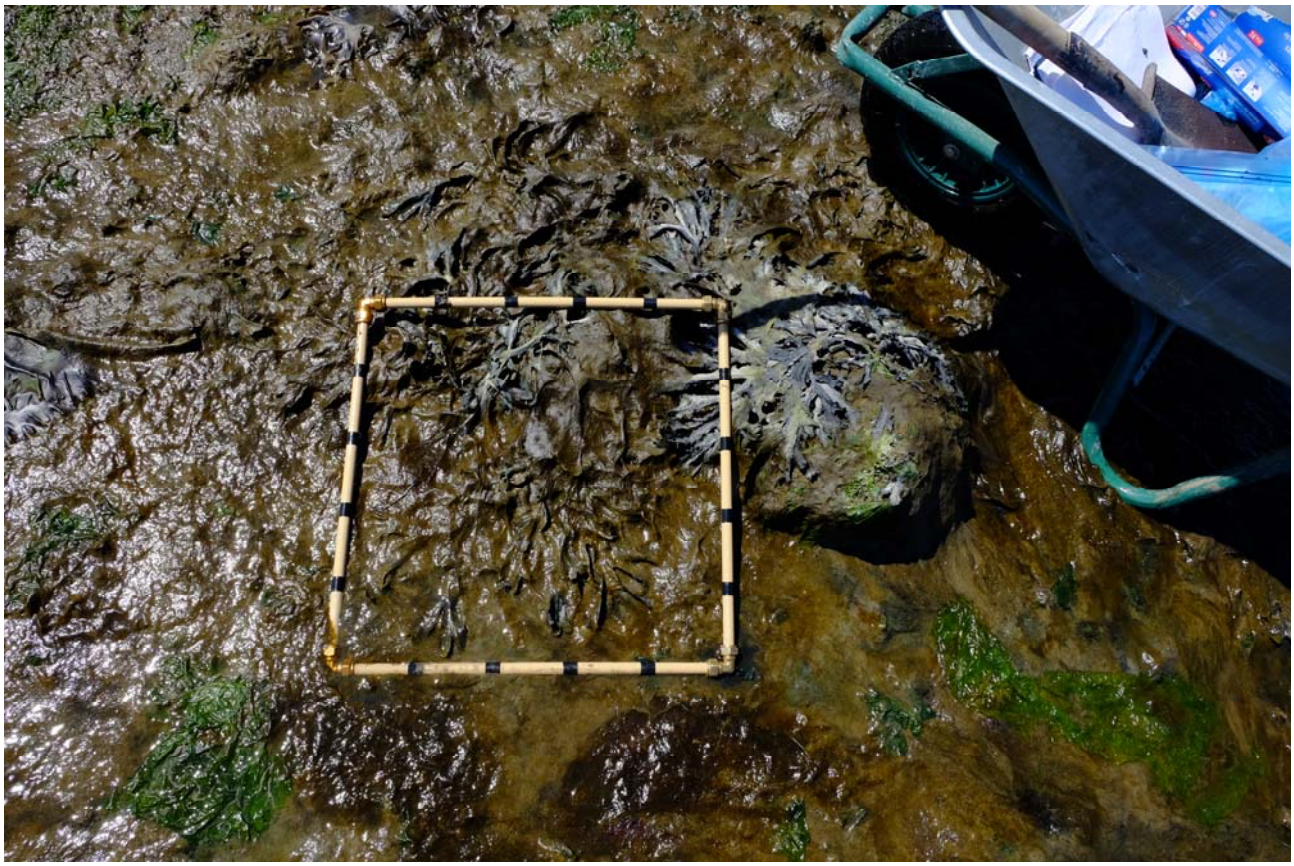


Figure 14. View of beach sediments at Station 5, Transect 2 in quadrat. Quadrat is 50cm by 50cm. Black marks on quadrat frame are at 10cm intervals.

The shore at this station was covered in a layer of live algae – green algae *Cladophora rupestris* and *Ulva* sp. and brown algae *Fucus serratus* and brown (sugar) kelp *Saccharina latissima*. Sediments beneath the plant layer were still quite coarse here with cobble, gravel and sand and occasional boulders. It was not possible to core for fauna here. A single live polychaete (*Lanice conchilega*) and a single live bivalve the smooth Artemis, *Dosina lupinus*, were recorded here when the quadrat sediments were dug over with a spade.

Tubes belonging to a serpulid polychaete (*Pomatoceros* sp.), apparently long dead, were noted on some of the larger cobbles close to this station. Feeding casts belonging to another polychaete, the lugworm *Arenicola marina*, became common from this station onward down the shore.

Transect 2 – Station 6

Figure 15. View of beach sediments at Station 6, Transect 2 in quadrat. Quadrat is 50cm by 50cm. Black marks on quadrat frame are at 10cm intervals.

The final station on Transect 2 was located at the low water mark on mudy fine sands. The sediment surface here was still plant dominated (by *Cladophora rupestris* in this case). Numerous feeding mounds belonging to the lugworm (Arenicola marina) were noted at the sediment surface along with the feeding crowns and tubes of *Lanice conchilega* - the sand mason. This habitat extended into the shallow subtidal.

The incoming tide forced the conclusion of survey effort for the first day. A third transect was investigated during the ebbing tide of the following day.

Plate 11. The photograph presented on the following page gives the view looking shoreward from Station 6 on Transect 2.

RINGASKIDDY SHORE TRANSECT 3

Beginning to the south of the proposed coastal protection works area (the last of three transects) this transect ran perpendicular to the shoreline and progressed towards the low tide level. It was comprised of five stations. At each of these stations sampling for fauna was attempted using a 15.24cm diameter corer (6 inch diameter) and was successful only on the last station where three replicate samples were taken (sediment conditions determined whether sampling was possible or not). Detailed observations were made at each of the stations. Continuous observations were made along the entire length of the transect including notes made on the behaviours of other visible fauna (primarily birds and humans).

Weather conditions on the day were favourable – good visibility, zero precipitation and approximately 5-7 eighths cloud cover. Survey began approximately 1 hour before the time of predicted low water. Humidity was high on this day with temperatures in the range of 18-20 degrees Celsius. A gentle westerly breeze/light air was blowing.

Figure 16. Immature black-backed gull takes flight during scavenging session on rocks, Ringaskiddy.

Transect 3 – Station 1

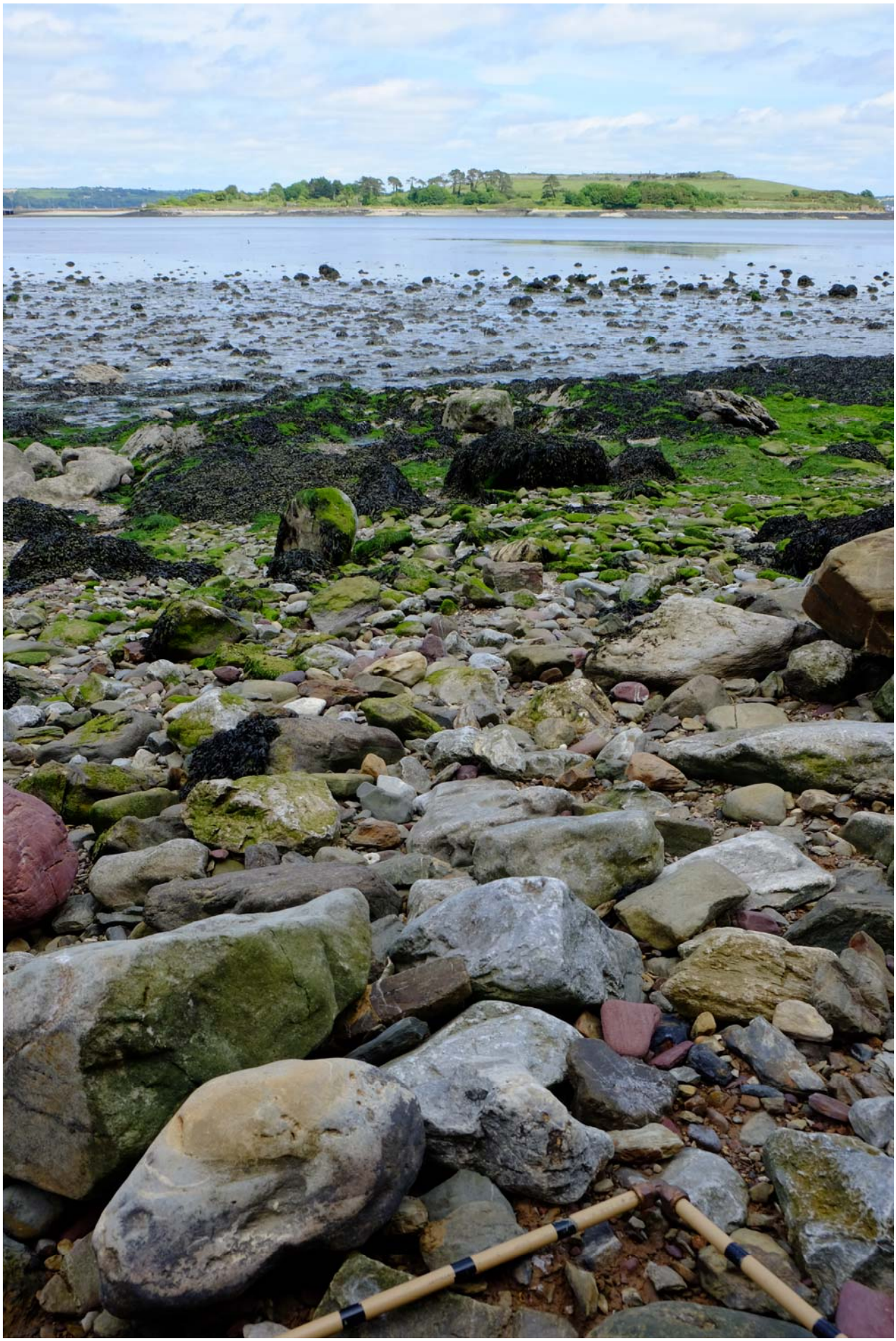
Figure 17. View of beach sediments at Station 1, Transect 3 in quadrat. Quadrat is 50cm by 50cm. Black marks on quadrat frame are at 10cm intervals.

This station was located at the base of the cliff backing the shore and the transect location was chosen to encompass some of the rocky intertidal habitat present on this shore. The cliff face base can be seen in the upper portion of the shot. The presence of salt crystals on the cliff surface indicates that at least 50cm of the cliff base has been covered with seawater in the recent past. Small portions of the cliff (some with grass still growing on them) had recently collapsed onto the shore. At this station the strandline coincided with the cliff base, with small deposits of desiccated green and brown algae present on the shingle shore.

No live fauna were recorded. It was not possible to core for faunal samples due to the coarseness of the shore. The substrate was composed of small boulders, cobble, pebble gravel, sand and some clay/soil. Brown algae (*Fucus vesiculosus*, *Fucus spiralis* and *Ascophyllum nodosum*) were noted on the larger boulders present here.

Plates 12 & 13. The photographs presented on the following pages show:

a) the view from Transect 3, Station 1 up the shore towards the cliff backing
b) the view from Transect 3, Station 1 down the shore towards the waterline



Transect 3 – Station 2

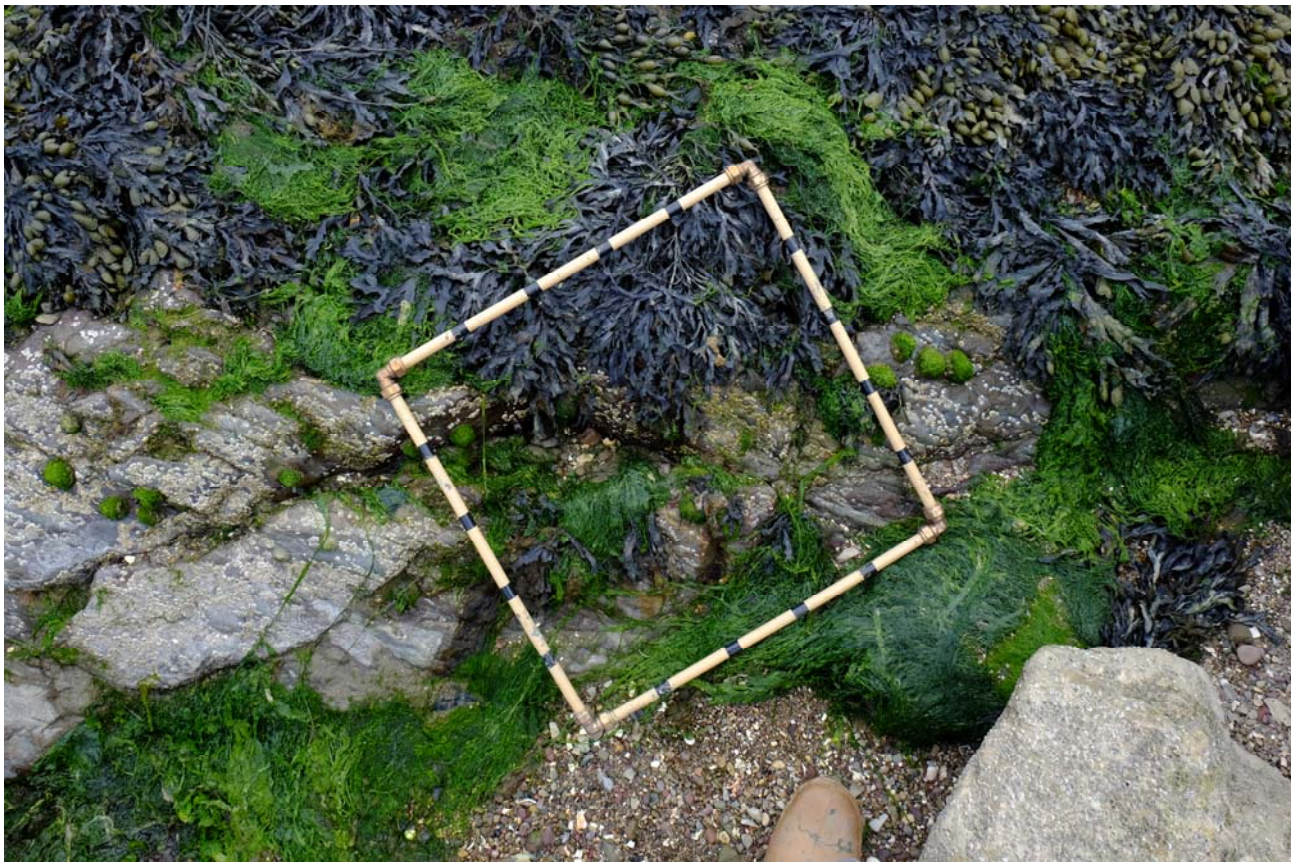


Figure 18. View of beach sediments at Station 2, Transect 3 in quadrat. Quadrat is 50cm by 50cm. Black marks on quadrat frame are at 10cm intervals.

Moving down the shore towards the waterline, this station was located at the start of a small outcrop of bedrock (Carboniferous limestone). The substrate in this case was rock. Species recorded included limpets (*Patella vulgata*), barnacles (*Semibalanus balanoides*), brown algae (*Ascophyllum nodosum*, *Fucus spiralis* and *Fucus serratus*) and green algae (*Ulva compressa*). A dead specimen of the common green shore crab *Carcinus maenas* was noted.

At the base of this outcrop and in the spaces between boulders on the shore here, somewhat finer sediments had accumulated with a mix of pebble and shell gravel and muddy sand. Much of the material on this shore, including the large erratic boulder to the south of the beach, has probably washed out of the nearby glacial till cliff face over time.

The next station investigated was located further down the shore at the end of this bedrock outcrop.

Plate 14. The photograph presented on the next page shows the view down the shore, along the outcropping bedrock encrusted with algae and animals and, beyond this, to a shore characterised by scattered boulders with sediments dominated by polychaetes and bivalves.

Transect 3 – Station 3

Figure 19. View of beach sediments at Station 3, Transect 3 in quadrat. Quadrat is 50cm by 50cm. Black marks on quadrat frame are at 10cm intervals.

This station was located at the end of the bedrock outcrop and at the upper limit of the band of decaying algal matter that was the dominating feature on the mid shore at the time of survey. Substantial growth of brown (primarily fucoids *Fucus serratus*, *F. vesiculosus* and *F. Spiralis*) and green (*Ulva compressa and Prasiola sp.*) and, to a lesser extent, red (*Porphyra umbilicalis*) algae was noted.

The substrate here was quite coarse with cobble and pebble gravel with some muddy sand. A small area of muddy sediment can be seen inside the quadrat – this was limited to a 1-2mm covering overlying coarser sediment. It was not possible to obtain cores for faunal analysis at this station.

Plates 15 & 16. Photographs on the following two pages show;

a) the view from Station 3 back up the shore towards the cliff backing and
b) the view down along the shore and on to the decaying weed as seen from Station 3. Whitish patches of *Beggiatoa* spp. can be seen where this layer has dried in the sun.

Transect 3 – Station 4

Figure 20. View of beach sediments at Station 4, Transect 3 in quadrat. Quadrat is 50cm by 50cm. Black marks on quadrat frame are at 10cm intervals.

Located at the lower end of the band of decaying algal matter, this station marked a transition to cleaner, finer sediment and a change in the dominant algal cover – the shore now being dominated by *Fucus serratus* (dominant on boulders as seen in the picture above), (probably seasonal) *Cladophora rupestris* and *Ulva lactuca* (dominant over sediment) with occasional kelp plants (*Saccharina latissima*) noted. Some decaying algal matter was still present here and there was still a strong smell of H_2S.

Sediments here were still quite coarse with cobble and pebble gravel underlying, and sitting in a matrix of, muddy sand. At this point on the shore, feeding mounds belonging to the lugworm *Arenicola marina* were present, becoming both more frequent and larger as the transect proceeded down the shore. A beached specimen of the common moon jellyfish *Aurelia aurita* was noted as was faecal matter and feathers from birds who had been feeding in this area as the tide ebbed.

Plates 17 & 18. Photographs presented on the following page show:
a) polychaete worm (*Glycera* sp.) - this animal belongs in the sediment and has probably moved out of it to avoid low oxygen levels in the sediment here and
b) the view up the shore towards the cliff shore backing

Transect 3 – Station 5

Figure 21. View of beach sediments at Station 5, Transect 3 in quadrat. Quadrat is 50cm by 50cm. Black marks on quadrat frame are at 10cm intervals.

The location of this station was intentionally relocated to the southeast to allow successful faunal core samples to be obtained. The habitat encountered was identical to that seen at this level on the lower shore on Transects 1 and 2. The substrate here was composed of muddy fine sand with some small shell fragments. This sand overlay a coarser cobble and pebble gravel layer at a depth of approximately 25cm within the sediment profile.

The sediment surface here was overwhelmingly algal dominated. Green algae (*Cladohphora rupestris*) was responsible for the majority of this cover with a very small amount of *Ulva compressa* and one or two kelp plants (*Saccharina latissima*) also present. Sediments were bivalve/polychaete dominated with lugworm (*Arenicola marina*) and sand mason (*Lanice conchilega*) noted at the sediment surface and several empty shells belonging to the common cockle (*Cerastoderma edulis*) and razor clam (*Ensis* sp.) recorded. These animals undoubtedly live in these sediments or in sediments nearby.

Three faunal cores were obtained at this station, immediately refrigerated and were returned to the laboratory for further analysis.

Plate 19. The image presented on the following page shows the view across the shore towards the southwest from Station 5 on Transect 3. This final station on the transect was followed up with an excursion to inspect the large boulder occupying the shore to the southeast.

Prominent boulder inspection

Figure 22. Large boulder to the southeast of Transect 3, Ringaskiddy.

A large boulder to the southeast of Transect 3 was investigated as a likely target for more interesting fauna to be found on this shore. The top of the boulder had a partial covering of algae including, from the top down, *Prasiola* sp. (along with some deposits of bird faeces/uric acid), *Fucus vesiculosus*, *Fucus spiralis*, *Fucus ceranoides*, *Ascophyllum nodosum*, *Fucus serratus, Ulva lactuca* and *Ulva compressa* and around the base of the boulder, kelp (*Saccharina latissima*).

Faunally, this boulder had a substantial covering of three species of barnacle (most numerous – overwhelmingly so - were *Semibalanus balanoides,* followed by *Balanus crenatus* and occasional *Elminius modestus* - a species introduced from New Zealand) with frequent limpets (*Patella vulgata*). Barnacle encrusted blue mussels (*Mytilus edulis*) were noted wedged within deeper clefts on the boulder's sides. The lower flanks of the boulder and the small overhanging surfaces at its base were encrusted in a mix of algae, hydroids (*Dynamena pumila*), bryozoans (*Bugula* sp.), sponges (*Halichondria panicea* and *Mycale rotalis*) and solitary (*Ascidia mentula*) and colonial tunicates (*Clavelina lepadiformis*).

Patches of muddy sand at the base of the boulder supported a small population of fan worms (*Sabella pavonina*) with only a handful of individuals present.

Sediments at the base of the boulder had a substantial amount of shell gravel and showed signs of recent disturbance – this is a likely refuge for a large crustacean (lobster or large crab).

Habitats encountered on the shore - overview

The upper shore here can be classed as Barren Littoral Shingle (EUNIS habitat code A2.111). This substrate typically supports virtually no macrofauna. There is often a temporary cover of the green seaweeds *Enteromorpha* spp. or *Ulva* spp. during periods of stability in the summer - as was observed during the current survey. This area is likely to be influenced by variable salinity. Energy (exposure) for the site is likely to vary considerably with the seasons.

Bedrock and boulders were found scattered throughout the mid and lower shore. Vertical surfaces on these were characterised by a barnacle-limpet community (EUNIS habitat code A1.1131) *Semibalanus balanoides* and *Patella vulgata* dominated community on bedrock. Occasional cracks and crevices in the rock provided a refuge for small individuals of the mussel *Mytilus edulis*, the winkle *Littorina saxatilis* and the dog whelk *Nucella lapillus*. This habitat was found in crevices on the prominent glacial erratic and in crevices found in the limestone bedrock outcrop seen on Transect 3.

Boulder tops, dominated by *Fucus spiralis*, can be classified as *Fucus spiralis* on sheltered upper eulittoral rock (EUNIS habitat code A1.312). In summer, the green alga *Ulva intestinalis* can become very common – as seen on the shore at Ringaskiddy. Vertical surfaces often lack the fucoid cover and are characterised by the barnacle-limpet community (EUNIS habitat code A1.1131) also seen on this beach.

The presence of a substantial deposit of decying algal matter in the mid shore complicates the allocation of a habitat type to this zone though the floral and faunal community encountered closely resembles *Fucus vesiculosus* on variable salinity mid eulittoral boulders and stable mixed substrata (EUNIS habitat code A1.323). The presence of ephemeral seaweeds (green algae here) occupying available space and patches of sediment found between the hard substrata containing the lugworm *Arenicola marina* and the sand mason *Lanice conchilega*, support this classification. The exposure level of this shore probably changes seasonally from sheltered to moderately exposed/exposed during storm events.

The lower shore is characterised by littoral muddy sands with the habitat falling into a Polychaete/Bivalve-dominated muddy sand shore (EUNIS habitat code A2.24). Based on analysis of infaunal samples taken during the transects, this most closely resembles a *Macoma balthica* and *Arenicola marina* in muddy sand shores biotope (EUNIS habitat code A2.241) though with *Abra* present instead of *Macoma*. It also has elements of *Lanice conchilega* in littoral sand (EUNIS habitat code A2.245).

These habitats are all commonly encountered in an Irish context.

Lower shore - Infaunal analysis – results

An attempt was made to obtain faunal samples at all stations visited. This effort was successful at two stations - at Station 5 on Transect 1 and at Station 5 on Transect 3. Using a spade, dig overs to a depth of 30cm were carried out at those stations where coring for fauna was not possible.

Where coring was possible, samples were bagged, labelled and refrigerated immediately after acquisition. Upon return to the lab they were sieved on a 1mm stainless steel mesh and photographed before being fixed in 40% formalin solution buffered with seawater. After a period of 24 hours they were removed from the formalin solution, washed and transferred into alcohol. They were then sorted by phylum and identified to species level under binocular microscope using the

appropriate taxonomic keys.

Samples were faunally poor with only ten taxa present. All species found are typical of fine grained sediments of the North East Atlantic.

The assemblage recorded is close to the EUNIS LS.LSa.MuSa.Lan Lanice conchilega in littoral sand grouping but instead of *Macoma balthica*, *Abra* is present. (EUNIS code A2.24 – Polychaete/bivalve dominated muddy sand shores). The common cockle (*Cerastoderma edule*) was also present here. Though not appearing in the core samples this animal was noted on the shore. A lone Asian man was noted collecting these on the shore – presumably for food - in a plastic bag on the first day of the survey effort.

Taxa present in the core samples are presented in Table 1 below. Figure 23 presents images of sample residues from faunal cores taken on Transects 1 and 3.

Table 1: Taxa identified in core samples taken during the Ringaskiddy shore work, June, 2015.

Location		**Taxa present**
Transect	**Sample**	
T1	5A	*Abra alba* x 6*, Spiophanes bombyx* x1
	5B	*Abra alba* x 5*, Spio sp.(damaged)* x1*, Vaughanthompsonia cristata* x1, *Scoloplos armiger* x3
	5C	*Abra alba* x2*, Spio filicornis* x1*, Nephtys hombergii* x1*, Scoloplos armiger* x4, *Lanice conchilega* x1
T3	5A	*Abra alba* x6*, Spio filicornis* x1*, Nephtys hombergii* x1*, Scoloplos armiger* x3*, Capitella capitata* x1, *Exogone hebes* x1
	5B	*Abra alba* x7*, Spio filicornis* x2*, Palaemonetes varians* x1*, Scoloplos armiger* x3*, Phyllodoce maculata* x1
	5C	*Lanice conchilega* x1, *Palaemonetes varians* x1, *Phyllodoce maculata* x1

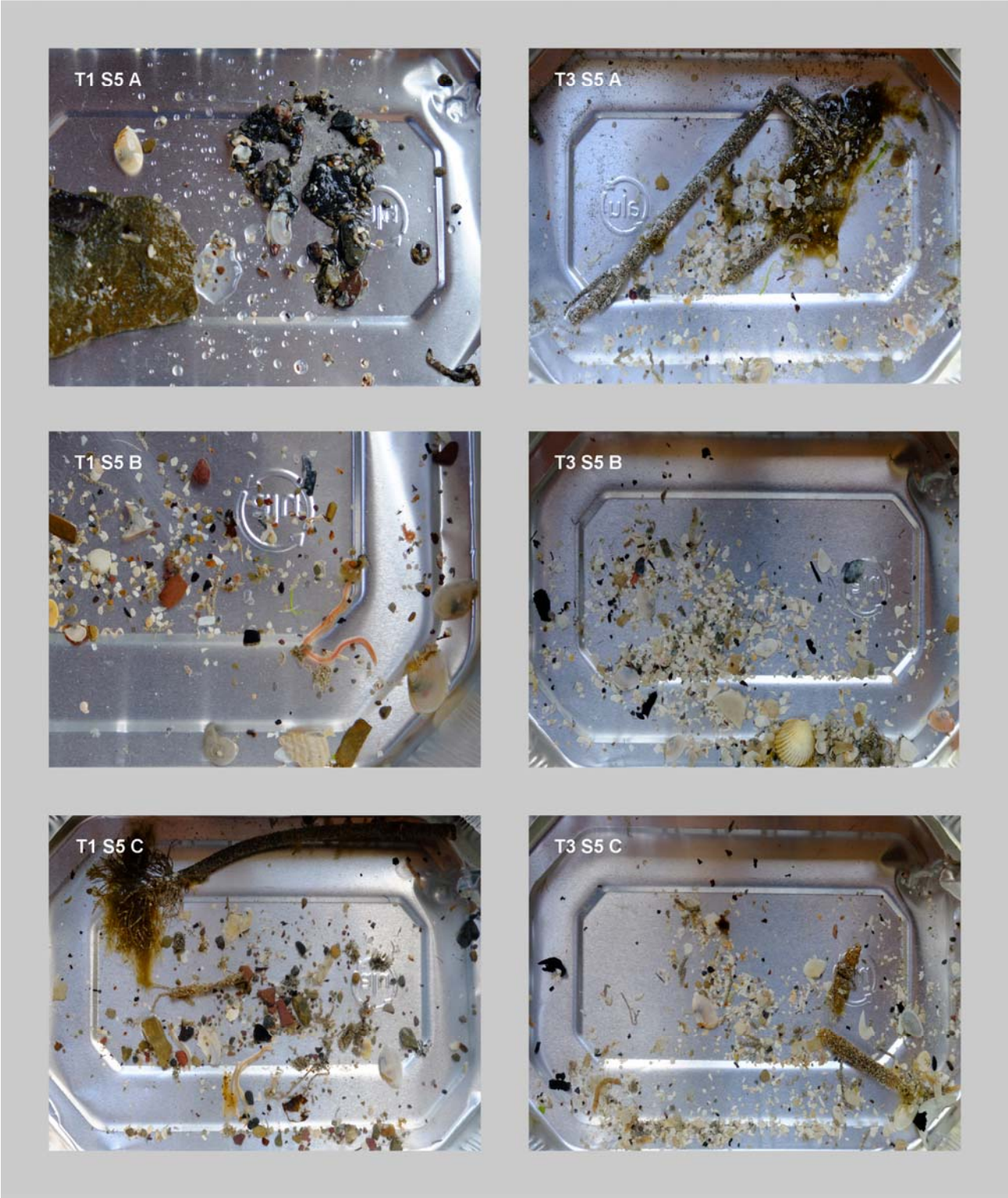


Figure 23. Processed sediment sample residues taken on the lower shore at Ringaskiddy and analysed for faunal content.

Co-ordinates of stations investigated during the current work are presented in Table 2 below. Informations sources consulted during the preparation of this report are presented in the Bibliography.

Table 2: Co-ordinatess of intertidal transect Stations at Ringaskiddy (in Decimal degrees).

Location Name		Position	
Transect	**Station**	**Latitude (decimal degrees North)**	**Longitude (decimal degrees West)**
T1	S1	51.83043º	008.30180º
	S2	51.83044º	008.30157º
	S3	51.83047º	008.30145º
	S4	51.83046º	008.30112º
	S5	51.83047º	008.30047º
	S6	51.83048º	008.30009º
T2	S1	51.82993º	008.30158º
	S2	51.82994º	008.30146º
	S3	51.83003º	008.30117º
	S4	51.83013º	008.30052º
	S5	51.83015º	008.30040º
	S6	51.83027º	008.30008º
T3	S1	51.82940º	008.30074º
	S2	51.82938º	008.30068º
	S3	51.82951º	008.30051º
	S4	51.82969º	008.29967º
	S5	51.82948º	008.29925º

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Fisheries

The following is based on a desktop survey that was undertaken on the fish communities in Cork Harbour as part of the Port of Cork Ringaskiddy Port Development Environmental Impact Assessment. This study relied almost exclusively on Inland Fisheries Ireland (IFI) surveys. In addition trawling was undertaken in Ringaskiddy Basin on August 27th 2013 within the Ringaskiddy Basin and at the edge of the Oyster Bank at the eastern approaches.

Marine and Estuarine Species in Greater Cork Harbour – IFI Surveys
As part of the Water Framework Directive (WFD) fish monitoring programme for transition waters around the Irish coast IFI have undertaken several surveys of the Greater Cork Harbour area using a combination of beach seines, fyke nets and beam trawls. Sprat, sand goby, juvenile mullet and common goby are the dominant species, followed by sand smelt, cod, flounder, plaice and five-bearded rockling. At least 10 of the top ranked 15 fish species encountered in the Cork Harbour survey are likely to occupy the same overall high dominance in every other estuary in the country that contains a comparable range of habitats. In total, during the 2010 survey 29 species were recorded. The top ranked species are extremely important as part of the ecology of the Cork Harbour system from a fisheries standpoint. These surveys extend only as far seaward as Monkstown on the western side and East Ferry on the eastern side of the harbour and do not include the lower and outer parts of the harbour.

Fisheries Field Survey
The following section outlines the baseline fisheries and the epibenthic macroinvertebrate data collected from the Ringaskiddy Basin and the immediately adjoining section of the Oyster Bank.
Beam Trawl Results
Plaice was the most frequently captured fish occurring in seven out of eight trawls and was also dominant numerically, being by far the most abundant species encountered. The remaining six species were only encountered in low numbers and each in just a single trawl, apart from sand goby, which was recorded in two. The results overall, probably attest to the dominance soft bottom habitats where one would expect juvenile flat fish in particular to be common. It is perhaps also a reflection of the fact that the basin is dredged every few years, the most recent occasion being autumn 2011. Two pelagic species, sprat and mackerel, were also noticed passing in small shoals just below the water surface in the inner area of the basin.

Of the invertebrates recorded, brown shrimp (*Crangon crangon*), green crabs (*Carcinus maenas*), swimming crabs (*Liocarcinus* spp.) and hermit crabs were the dominant crustaceans. One reasonably large brown crab (*Cancer pagurus*) was recorded while Palaemon shrimp (*Palaemon serratus*) were also recorded. The community overall points to the area as being part of the greater fish nursery area of Cork Harbour important for a wide range of juvenile
fish and mobile epibenthic crustaceans among other species.

Commercial Fishing
Salmon
According to the IFI Web-site –
‘The Wild Salmon and Sea Trout Tagging Scheme commenced for both commercial and recreational salmon fishing licence holders on 1st January 2001, having been provided for in the Fisheries (Amendment) Act, 1999 (No. 35 of 1999). This was followed by the introduction of Total Allowable Catches (TAC) for the commercial salmon fishing sector and bag limits for recreational anglers in 2002. Since 2007, following consultation with Inland Fisheries Ireland and the Standing Scientific Committee (of the National Salmon Commission), the Minister sets the total allowable harvest (for both commercial & rod caught fish) on an annual basis for each of the rivers which exceed the Conservation Limit. From 2010 onwards the Wild Salmon and Sea Trout Tagging Scheme for both commercial and recreational salmon fishing licence holders

is provided for in Section 69 of the Inland Fisheries Act, 2010 (no. 10 of 2010)'.
The Conservation Limit is the minimum number of returning adult fish that are considered to be required to maintain a sustainable salmon population in any given river. Any fish above this level can be harvested without damaging the population.
Up until 2007, commercially caught salmon in Cork Harbour were harvested using two methods, drift nets and draft nets, the latter operating entirely within the Harbour from Roches Point to the City Quays but mainly in the River Lee Estuary and Upper Harbour areas. In terms of catch, the drift net harvest was generally 9 to 10 times higher than the draft net landings, while the rod and line harvest was 30- 80% of the latter. In January 2007, following the countywide ban on drift netting for salmon, there was a large reduction in the number of salmon commercially harvested in Ireland. In the Lower Lee for example the catch dropped by around 80% as a result. However, despite the very significant drop in the number of fish being commercially landed, strict controls on the Total Allowable Catch were nevertheless maintained in order to assist recovery in the stocks around the country which had been suffering the adverse impacts of over exploitation for decades coupled in more recent times with a dramatic decline in sea survival rates in salmon. At about the same time, also as a means of improving the sustainability of the stock, a buy-out scheme for draft net licences, saw a reduction of nearly 50% of the draft net licenses in The Lower Lee from 33 in 2007 to 17 in 2008, a level at which license numbers have since been maintained.
The number of salmon harvested by the drift net sector in the Lower Lee district since 2004 and by comparison the corresponding numbers taken by anglers on rod and line has remained fairly stable from between 1200 and 1500 in that period with the exception of 2008 when only 686 fish were taken by the draft-net fleet. These figures are based on IFI's annual salmon and sea trout statistics. Sea trout are also taken in the commercial and angling sectors but in comparatively very low numbers.

Inshore Potting, Netting & Trawling
In addition to commercial salmon fishing in Cork Harbour, there is also a small inshore fleet of boats (<10m) potting and netting in the harbour and the harbour approaches. The boats are based in Cobh mainly and Aghada, around 14 in all, about half polyvalent licenses, fishing nets and pots, and half fishing pots only. They target a range of crustacean shellfish including green, brown (edible), velvet and spider crabs, lobster and shrimp. They also net for mackerel, cod and mullet. In addition, two trawlers operate out of Cobh, fishing the Lower Harbour particularly when weather conditions don't permit fishing outside of Roches Point.
Periwinkles are actively harvested along the extensive rocky shores of Cork Harbour. Shellfish collection was observed on day one of the current (2015) intertidal survey work. While these are the main species caught in recent times, previously eels were also trapped in places but that practice no longer continues in line with eel conservation efforts and consequently eel fishing licenses are no longer issued for Cork Harbour. There are boom and bust type fisheries for wild shellfish such as scallop and razor clams every few years when a dredger comes in and cleans out the stocks in a few days fishing and doesn't return again for a few years. The latter two species are usually taken in the lower harbour area. Boats from the West Cork pelagic fleet occasionally fish for sprat within the harbour on the way to herring grounds farther east.

Aquaculture
The main centre of aquaculture is the North Channel where oysters are grown. There is also an Oyster Order in force in the eastern part of the Harbour east of a line from Long Point to Cuskinny approximately.

Recreational Angling
Recreational angling is a very popular pastime all around Cork Harbour and there are 25 recognised shore angling marks distributed around the harbour especially in the lower and outer harbour areas.
The most popular summer species include mackerel, bass and flatfish with mullet and rays been

taken by more specialised anglers. In the winter, cod, whiting and flounder are regularly targeted. Conger eel and three-bearded rockling are taken in rocky reef areas and lesser spotted dogfish are plentiful throughout.