BASELINE SEAGRASS AND MACROCYSTIS SURVEYS IN THE VICINITY OF PROPOSED FINFISH FARMING, OKEHAMPTON BAY TASMANIA

Report to

TASSAL

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Marine SOLUTIONS TASMANIA PTY LTD

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Note: Location maps throughout this report are representative only; for precise GPS coordinates, see the appendices.

[1] Cover photo, seagrass in Okehampton Bay, 11/10/2016 (photo by Marine Solutions).

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1 EXECUTIVE SUMMARY

Marine Solutions was contracted by Tassal to provide an assessment of the existing benthic marine environment in Okehampton Bay, East Tasmania. The scope for this project was to identify and characterize sensitive receptors, targeting seagrass and giant kelp communities within the Okehampton Bay area, and included the following:

- Underwater towed video to characterise the seabed habitat
- Map seagrass beds at the time of the study
- Identity any surface canopy-forming *Macrocystis pyrifera* present in the area.

Three major habitat types were recorded: soft sediments (sand), rocky reef and seagrass beds. Variations of these habitat types were present in the survey area (e.g. patchy seagrass, sparse seagrass, patchy reef, reef etc) with much of the area surveyed representing a mosaic of these habitat types. *Heterozostera sp.* (likely *tasmanica*) was identified in the survey. A detailed species audit was outside the scope of this study.

Findings from this survey are in concurrence with data available from SeaMap which demonstrates a patchy band of seagrass roughly following the shape of the coast, and therefore the depth contours, in Okehampton Bay, and sandy surrounds.

No *M. pyrifera* surface canopy was detected in a visual coastline search that extended over 4 km to both the north and south of Okehampton Bay.

2 INTRODUCTION

2.1 OBJECTIVES

The information in this report will provide a snapshot of the benthic characteristics in Okehampton Bay which is the proposed site for the establishment of a marine Atlantic salmon farm. The data provided here forms part of a baseline dataset and will inform the suitability of the proposed lease site within the already approved marine farming zone.

2.2 SCOPE

Marine Solutions Tasmania was contracted by Tassal to provide an assessment of the existing benthic marine environment in Okehampton Bay, East Tasmania. The scope for this project included the following:

- Underwater towed video to characterise the seabed habitat
- Map seagrass beds at the time of the study
- Identity any surface canopy-forming *Macrocystis pyrifera* present in the area.

The scope did not include a detailed species identification of the seagrass species present. Diver deployment would be required for this if needed in the future.

2.3 THE STUDY AREA

The study area was located in Okehampton Bay on the east coast of Tasmania (Figure 1).

Figure 1 Okehampton Bay on the east coast of Tasmania. Shaded area shows the zone, and the lease within the zone.

2.4 BACKGROUND

2.4.1 Seagrasses

Seagrasses are sub-tidal and intertidal plants found mainly in shallow waters of protected estuaries and bays across both temperate and tropical ecosystems. Reproduction is via flowers and seeds, which are small and seasonal or via rhizomes spreading (Edgar, 2008). Rhizomes anchor to the seafloor and act to stabilise the underlying substrate, underpinning their key role in maintaining sediment stability (Jordan et al, 2002). In addition, to maintaining sediment stability, seagrasses are important breeding and feeding grounds for a number of fish and invertebrate species. In tropical regions, in particular, seagrasses play a crucial role for providing food and habitat for multiple commercial fisheries and charismatic mega fauna such as the tropical rock lobster, dugongs and sea turtles. In temperate areas, albeit still critical for ecosystem functioning and health, seagrasses are not associated with as many commercial species. Southern Calamari *Sepioteuthis australis* utilise seagrass beds for egg-laying. The

density and spatial cover of seagrass in a given area can affect egg production and reproductive success (Moltschaniwskyj *et al* 2002); therefore, seagrass declines may impact the calamari commercial fishery.

Seagrasses, along with nutrients, are used as key indicators of ecosystem health because of their sensitivity to fluctuations in temperature, nutrients, CO_2 and light. These parameters may fluctuate naturally or be driven by human pressures such as coastal devleopment, boating, mooring scourings, sewage discharges, aquaculture and other marine activities. Seagrasses are currently in a state of expansion in Tasmania because warmer water temperatures and increased CO_2 levels are proving beneficial for asexual reproduction via rhizonmal spread. While this current state of expansion is expected to continue, seagrasses can also be negatively impacted by some human activities through their sensitivity to increased nutrients. Increased nutrients can result in increased turbidity and sedimentation and increased epiphytic growth (Rees, 1993). These scenarios result in reduced light energy available for seagrass photosynthesis and can therefore negatively impact seagrass growth. Alterations in ambient nutrient levels are likely to cause seagrass decline in coastal water bodies, and so anthropogenic nutrient inputs, such as from aquaculture systems should be closely monitored and managed accordingly.

2.4.2 *Macrocystis*

Macrocystis pyrifera distribution has dramatically reduced in extent over the last several decades. This trend is broad scale, being common across south eastern Australia and likely driven by multiple and interacting factors including increasing sea surface temperatures, changes in nutrient availability in warmer waters and changes in large scale oceanographic conditions (DSEWPaC 2012). Each of these threats is considered to be driven by climate change (DSEWPaC 2012). In particular, the increase in warm, nutrient poor water associated with the southward penetration of the East Australian Current (EAC) along the east coast has impacted on the integrity of the *Macrocystis* communities, since *Macrocystis* requires cool, nutrient rich water for optimal growth (Poloczanska et al., 2007).

M. pyrifera is listed under the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) as a threatened ecological community. The listing applies specifically to the 'Giant Kelp Marine Forests of South East Australia', with the status 'Endangered'. This ecological community is considered unique and extends from the ocean floor to the ocean surface, exhibiting a 'forest-like' structure with a

diverse range of organisms occupying its benthic, pelagic and upper-canopy layers (DSEWPaC 2012). The listed ecological community is characterised by a closed to semi-closed surface or subsurface canopy of *M. pyrifera*.

The key defining attributes of the ecological community are (DSEWPaC 2012):

- *M. pyrifera* plants which form a forest with either a closed or semi-closed surface or sub-surface canopy;
- *M. pyrifera* plants growing at a depth generally greater than eight metres below sea level;
- A rocky substrate for *M. pyrifera* plants to attach to;
- A diversity of marine species on the seafloor, in the understorey and throughout the water column. For example, other marine flora such as seaweeds and marine fauna including fish, molluscs (sea snails), bryozoans (lace corals), polychaetes (worms), crustaceans (crabs, isopods, amphipods), echinoderms (sea urchins, seastars) and sponges;
- Cold water with mean sea surface temperature between 5 °C and 20 °C;
- Moderate wave exposure; and
- Distribution restricted to waters off the coast of Tasmania particularly in the Bruny, Freycinet and Davey bioregions, but also the Boags and Franklin, Flinders and Otway bioregions, the coast of South Australia in the Otway and Coorong bioregions as far west as Margaret Bock Reef and the coast of Victoria in the Otway, Flinders, Central Victoria and Twofold Shelf bioregions as far east as Gabo Island.

3 METHODS

3.1 BENTHIC HABITAT MAPPING

To characterise the benthic habitat and elucidate the extent of the seagrass beds, towed video surveys were taken along six transects in the proposed finfish aquaculture site (Figure 2, see Appendix 1 for coordinates). The footage was recorded using a Scielex single CCD camera recording to a portable hard drive Archos PMA 400 unit at resolution of 440Tv lines and 512 x 582 pixels and is available as separate AVI files attached as Appendix 2.

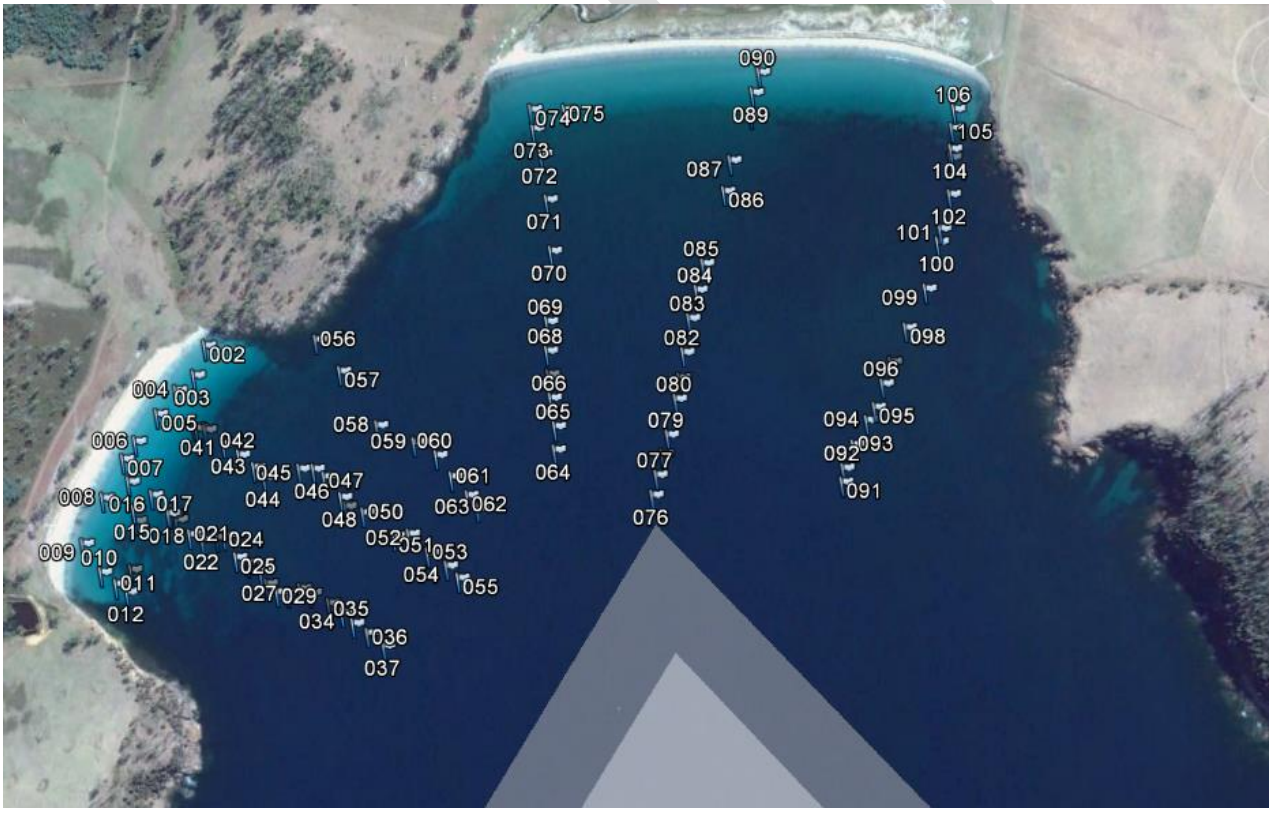

Figure 2 The location of the six video tow transects in Okehampton Bay, with northern tip of Okehampton zone (and lease within) area shown by shaded area in the south of the image (base image from Google Earth 2016).

3.2 *MACROCYSTIS PYRIFERA* SURVEY

To determine if surface canopy-forming *Macrocystis pyrifera* was present in the ecosystem adjacent to the proposed fin fish lease a visual survey was conducted along the coast over 4 km south and 4 km north of Okehampton Bay (Figure 3). A research vessel was used to travel along the coastline to look for *M. pyrifera* surface canopy. Constant observations of the vessel's sounder were also made along the track, to detect any sub-surface growth.

Figure 3 The route of the *Macrocystis pyrifera* survey (red line) in the Okehampton Bay region. The zone area (and lease area within) are shown by shaded area.

4 RESULTS AND DISCUSSION

4.1 BENTHIC HABITAT MAPPING

Three major habitat types were recorded, these being soft sediments (sand), rocky reef and seagrass beds. Variations of these habitat types were present in the survey area (e.g. patchy seagrass, sparse seagrass, patchy reef, reef etc; see Figure 4). *Heterozostera sp.* (likely *tasmanica*) was identified in the survey (note that a detailed species audit was outside the scope of this study). Reef was found along the western and eastern sides of Okehampton Bay. In the western side of the bay, areas comprised of reef, seagrass and sand were identified; these were categorized as mosaic habitat. In the south west corner of the western beach a significant bed of microphytobenthos (MPBs) was present (Figure 6b). MPBs indicates that the sediment in this area of the bay is not very mobile and not often disturbed. From the beaches of Okehampton Bay, sand extends to seagrass beds and back to sand again toward the middle of the bay (Figure 4). Findings from this project are in concurrence with data available from SeaMap which demonstrates a patchy band of seagrass roughly following the shape of the coast in Okehampton Bay, and sandy surrounds (Figure 5).

Video files of all transects are attached as Appendix 2.

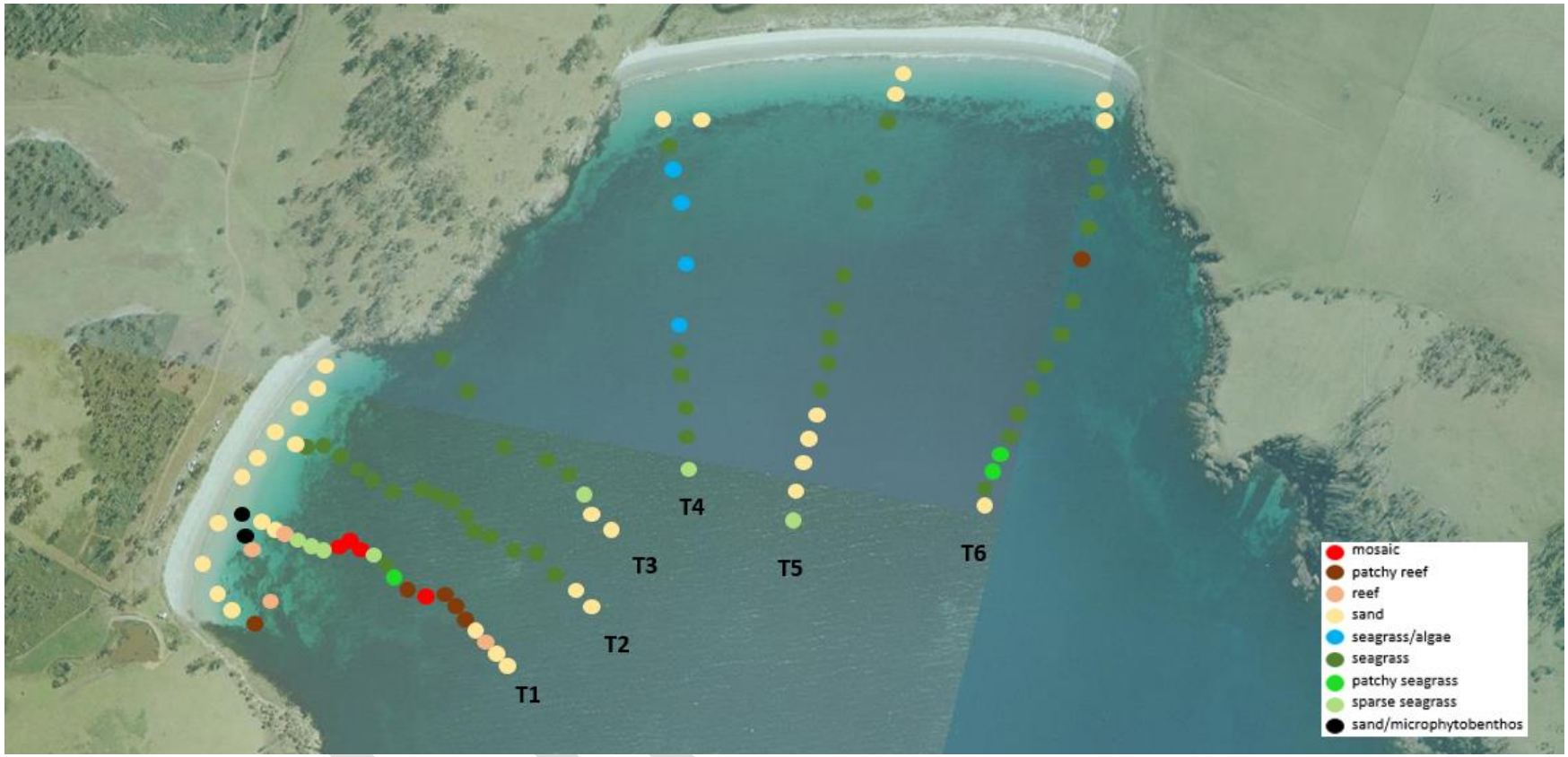

Figure 4 Characterisation of the habitat types along six transect in Okehampton Bay. Note the location of towed video surveys are representative only. For precise GPS coordinates, see Appendix 1.

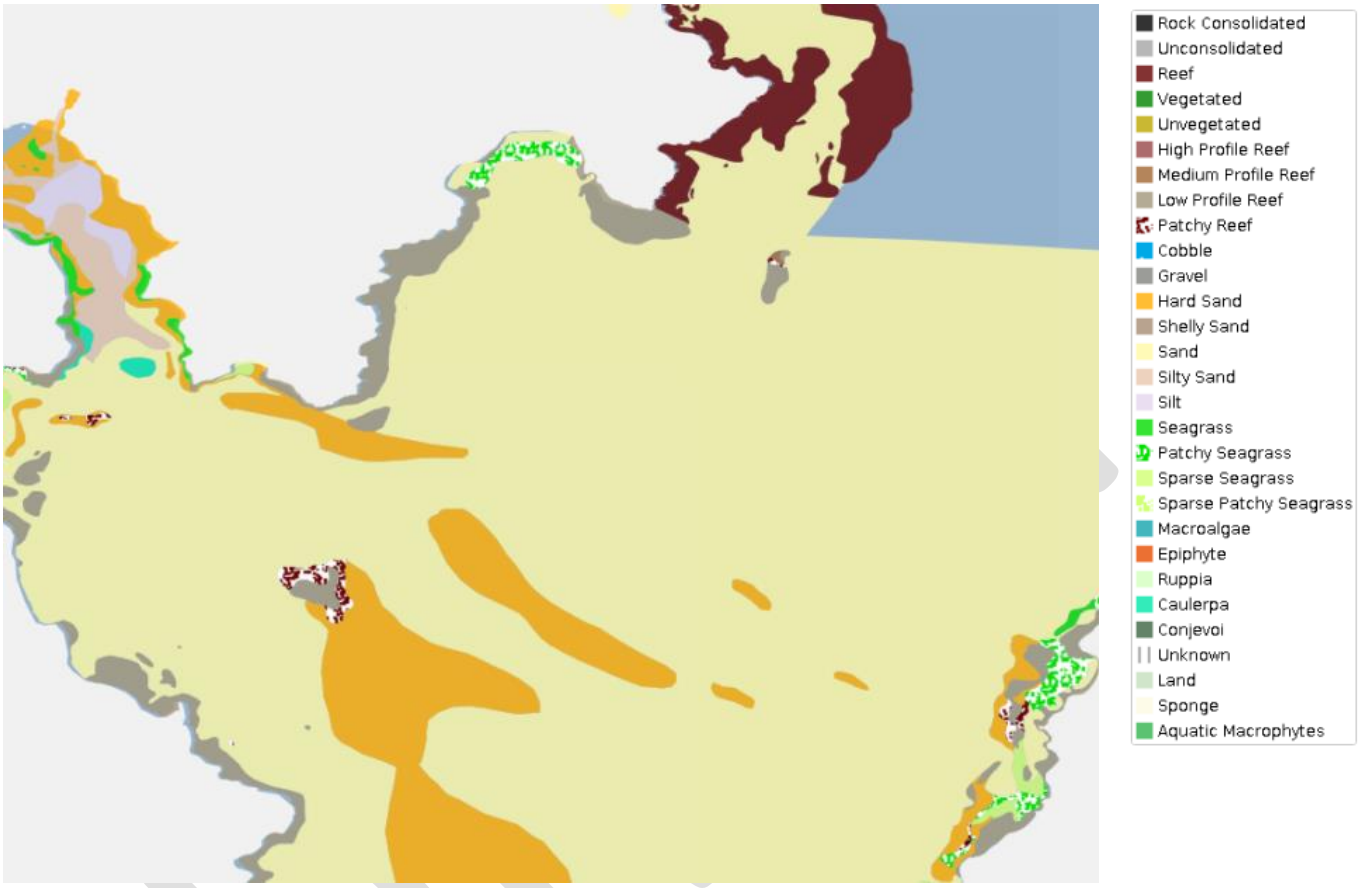

Figure 5 Benthic habitat characterisation in Okehamptom Bay and surrounding areas (source: SeaMap[2])

[2] SeaMap accessed on 24/10/2016 from http://temperatereefbase.imas.utas.edu.au/portal/search

a) Spider crabs (*Leptomithrax gaimardii*) on mosaic habitat

b) Sand and mycrophytobenthos

c) Patchy seagrass

d) Reef

e) Sparse seagrass

f) Mosaic

g) Seagrass and algae

h) Patchy reef

i) Sand

Figure 6 Stills taken from the underwater towed video showing various benthic habitat types.

4.2 *MACROCYSTIS PYRIFERA* SURVEY

No *M. pyrifera* surface canopy was detected within over 4 km to both the north and south of Okehampton Bay. Additionally, no detections diagnostic of subsurface *Macrocystis* growth were made by the vessel's sounder. For the past several decades, wide scale declines of *M. pyrifera* has been recorded around Tasmania. These declines are attributed to southward extension of warm, nutrient poor waters from the East Australian Current.

4.3 AERIAL IMAGERY THROUGH TIME

Aerial imagery sourced from Google Maps (DigitalGlobe) shows little movements of seagrass beds from 2008 through to 2014. The seagrass is consistently present at similar distances from the shoreline on the beaches. This indicates a relatively stable seagrass community in Okehampton Bay.

a) Map data: Google, DigitalGlobe 31/3/2014

b) Map data: Google, DigitalGlobe 8/1/2013

c) Map data: Google, DigitalGlobe 16/3/2010

d) Map data: Google, DigitalGlobe 1/10/2008

e) Map data: Google, DigitalGlobe 9/4/2008

Figure 7 Aerial imagery of Okehampton Bay from 2008 to 2014. Visibility of seagrass beds varies between images. From Google Maps (source DigitalGlobe).

5 CONCLUSIONS

The benthic near-shore habitat in Okehampton Bay was comprised of seagrass, algae, sand and reef. Beyond approximately 600 m offshore, sand was the dominant benthic habitat. These findings were in concurrence with both SeaMap habitat data and towed video surveys. No *Macrocystis pyrifera* was found during extensive visual surveys along the coastline north and south of the proposed lease site.

The nearshore seagrass distribution appears to have been relatively stable since 2008 as demonstrated by aerial imagery. However, the aerial imagery provides only an indication of seagrass distribution and is in no way comprehensive. It is recommended that ongoing seagrass surveys be conducted to determine the health and temporal and spatial variance of seagrass beds in Okehampton Bay. Fixed diver swum transects would be useful to collect data pertaining to stem length, stem density, fronds per stem and epiphytic growth.

6 REFERENCES

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7 APPENDICES

Appendix 1. GPS coordinates of sampling locations in Okehampton Bay

	Grid zone		Easting	Northing
Transect 1 Start	55	G	579577.1406	5291780.813
Transect 1 End	55	G	579925.4478	5291549.667
Transect 2 Start	55	G	579642.2944	5291882.713
Transect 2 End	55	G	580039.0308	5291650.393
Transect 3 Start	55	G	579828.049	5292011.678
Transect 3 End	55	G	580069.5458	5291756.225
Transect 4 Start	55	G	580157.1085	5292354.817
Transect 4 End	55	G	580186.783	5291841.938
Transect 5 Start	55	G	580502.344	5292406.779
Transect 5 End	55	G	580333.8489	5291772.188
Transect 6 Start	55	G	580788.7064	5292220.075
Transect 6 End	55	G	580621.1213	5291788.499

Appendix 2. AVI files of each of the six transects

See attached files “Transect 1”, “Transect 2”, “Transect 3”, “Transect 4”, “Transect 5” and, “Transect 6”