A BASELINE ENVIRONMENTAL ASSESSMENT AT THE SITE OF THE PROPOSED SCUTTLING OF THE *HMAS TOBRUK* IN SKELETON BAY, NORTH EAST TASMANIA

Report to

Business Enterprise Centre

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Marine SOLUTIONS TASMANIA PTY LTD

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[1] Cover photo, above water outlook from the proposed scuttling site, 2014.

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3 Executive Summary

In June 2014, Marine Solutions was contracted to undertake an environmental feasibility study for the scuttling of the *HMAS Tobruk* in Skeleton Bay, north east coast of Tasmania. The *HMAS Tobruk* is a 127 m naval ship scheduled for decommission in 2015. It is proposed that the scuttled vessel will create a new artificial reef for the purpose of dive tourism. This report assumes that the vessel hull and interior will be cleaned to an acceptable level prior to hand-over. The multifaceted survey found no ecological contraventions to the scuttling of this vessel at Skeleton Bay.

Bathymetry and the spatial extent of reef environment were mapped throughout the survey area. On the basis of suitable depth and substrate, an approximate potential site for the scuttling of the *HMAS Tobruk* was identified. The exact location for scuttling will need to be chosen in consideration of exact vessel height and detailed analysis of the wave climate. Divers collected photos and video footage of the seabed at the potential scuttling site.

Biological surveys identified a biodiverse community of fish, invertebrate and algal species. Divers conducted fish counts along two transects above reefs at each of the east and west of Skeleton Bay, each measuring 100 m x 10 m (i.e. total area of 4000 m^2), recording fish species and size class.

The scuttling of the *HMAS Tobruk* and its establishment as a dive wreck site is not expected to have a detrimental impact on any Matters of National Environmental Significance (MNES) investigated herein, including world heritage properties, national heritage places, wetlands of international importance, listed threatened species and communities, migratory species and Commonwealth marine areas.

Threatened/protected species sighted during surveys included seals and dolphins. Three additional protected marine species (all mammals) were identified by the Natural Values Atlas as occurring within 500 m of the potential scuttling site. The scuttling of the *HMAS Tobruk* is not considered likely to have a detrimental impact on any threatened or protected species.

Jet probing of the sand at the proposed location indicated no underlying hard substrate in the top 2m of seabed at the sites tested. Sediments at the proposed scuttling site were medium-grained (90% of sediment sample was between 0.125 mm and 0.25 mm in grain size) and relatively dense (fast settling), indicating that any plume generated by a ship contacting the seabed would likely be short-lived.

Based on previous studies it is expected that over time the presence of the wreck on the seabed will cause elevation of some contaminants in the localised sediments surrounding the ship. Sediment

samples have been retained, should the project progress and require baseline contaminant testing of sediments.

Water quality parameters were collected at a number of sites within the study area, providing a pre-scuttling baseline for future reference. An Acoustic Doppler Current Profiler (ADCP) measured current velocity and direction over one month. Currents were predominantly low velocity near the sea bed, and increased closer to the surface which is consistent with many coastal areas. The peak wave direction recorded during the ADCP deployment was ~95°. The current velocities were congruent with recreational diving sites.

Should this project proceed to the next stage, a series of further works will be required, including but not limited to;

- A detailed Notice of Intent outlining the project
- An application for a seabed lease under the *Tasmanian Crown Lands Act 1976*
- A permit under the *Environment Protection (Sea Dumping) Act 1981*
- Evidence of compliance with the *Environment Protection and Biodiversity Conservation Act 1999*
- A full environmental risk assessment
- A diver access/egress plan informed by a naval architect
- A feasibility study and business plan
- Stakeholder liaison and communication.

The results of our surveys indicate that Skeleton Bay contains a site with suitable depth range to scuttle a ship the dimensions of the *HMAS Tobruk*, and sufficient sand depth on the seabed to support the resting wreck. No major potential ecological contraventions resulting from the scuttling of the *HMAS Tobruk* at the proposed site in Skeleton Bay have been identified.

4 Introduction

4.1 Purpose and Scope

Marine Solutions has been contracted to conduct an environmental feasibility study for the scuttling of the *HMAS Tobruk* to form an artificial reef in Skeleton Bay, Tasmania. The document details the methods and results of the study undertaken, including characterisation of:

- Habitat
- Localised hydrodynamics
- Biological community
- Sediments
- Water quality

4.2 Legislation

The Commonwealth *Environmental Protection (Sea Dumping) Act 1981* regulates the dumping of waste at sea in fulfilment of Australia's obligation under the international London Protocol to prevent marine pollution by dumping of material at sea. The scuttling of a ship falls under one of seven permissible categories (category IV: "vessels and platforms or other man-made structures at sea"), as listed in Annex 1 of the Protocol. In order to scuttle a ship, a government-issued permit is required.

All development planning within Tasmania is governed by Tasmania's Resource Management and Planning System (RMPS). The seven main statutes that lend legislative effect to the RMPS are:

- *Land Use Planning and Approvals Act 1993 (LUPAA);*
- *Resource Planning and Development Commission Act 1997;*
- *Resource Management and Planning Appeal Tribunal Act 1993;*
- *State Policies and Projects Act 1993;*
- *Environmental Management and Pollution Control Act 1994 (EMPCA);*
- *Historic Cultural Heritage Act 1995; and*
- *Major Infrastructure Development Approvals Act 1999.*

Threatened species are protected under the *Threatened Species Protection Act* 1995 (*TSPA*, Tasmanian state legislation) and/or the *Environment Protection and Biodiversity Conservation Act* 1999 (*EPBCA*, Australian Government legislation). Under the *TSPA*, no listed species is allowed to be collected, disturbed, damaged or destroyed without a permit. Under the *EPBCA*, any action with significant impact on a listed threatened species and/or community is prohibited without approval (*EPBCA* Section 18 and 18A). In addition to threatened species legislation, the *Fisheries (General and Fees) Regulations 2006* under the *Living Marine Resources Management Act 1995* (*LMRMA*) prohibits the taking/possession of a number of marine species. Additional species are protected by the schedules of the *Wildlife (General) Regulations 2010* (Regulations under the *Nature Conservation Act 2002* (*NCA*)).

4.3 Proposal

The *HMAS Tobruk* (specifications shown in Table 1 below) was commissioned into the Royal Australian Navy in 1981. Its decommissioning is scheduled for 2015. In the past two decades, several decommissioned naval ships have been intentionally scuttled to create artificial reefs and new dive sites (Cole and Abb 2011; Figure 1). A proposal exists to scuttle the *HMAS Tobruk* in Skeleton Bay.

***Table 1 Spatial specifications of the* HMAS Tobruk**

Length:	127 m
Draft:	4.9 m
Beam:	18.3 m
Tonnage:	3353 t

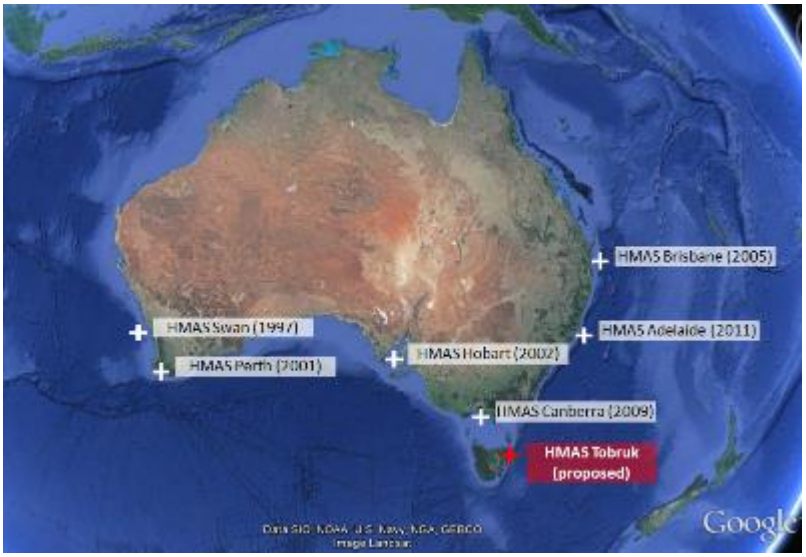


Figure 1 Approximate locations of naval wrecks around Australia (Cole and Abbs 2011).

4.4 Location and Study Site

Skeleton Bay is located immediately south of Binalong Bay on Tasmania's north east coast. The region is frequented by recreating locals and tourists. There is vehicle access and a carpark behind Skeleton Beach. A picnic area is located on the on the shore ~200 m west of the beach (Figure 2). The entire land

around Binalong Bay and Humbug point, encompassing the entire coastline of Skeleton Bay, is zoned 'Environmental Protection' under the *Break O'Day Planning Scheme 1996* (Inspiring Place 2013).

Skeleton Bay experiences relatively good in-water visibility ranging from ~10 m to ~30 m, depending on time of the year (best in winter) and prevailing weather conditions. There are a variety of existing dive sites, or potential dive sites within the bay and surrounds. The coast is fringed by granite boulders, which provide interesting underwater topography and host a diverse marine community. Should the *HMAS Tobruk* be sunk in Skeleton Bay, these fringing reefs provide suitable shallower sites for follow-up dives (Figure 2).

The shoreline surrounding Skeleton Bay lies within the southern section of the Bay of Fires Conservation Area under State Legislation, which extends from Binalong Bay to Eddystone Point.

Figure 2 Recreational facilities surrounding Skeleton Bay

5 Habitat Characterisation

5.1 Bathymetry

A process of bathymetric mapping was undertaken in order to identify any marine features or significant habitat boundaries in the immediate vicinity of the proposed scuttling site.

The study area was mapped using a Northstar Explorer 6600 dual frequency (50/200 Hz) single beam echo sounder, logging GPS positions and water depth each second to a laptop computer. Depths were measured to the nearest tenth of a metre, and tidally and barometrically corrected for Chart Datum using St Helens tide charts and observations from the Bureau of Meteorology. Furthermore, the single beam return pulse strength was used to classify the substrate "reef" or "sand" and hence map the reef boundary. Classifications were confirmed with towed video observations over the assumed reef/sand boundaries, using a single CCD camera recording to a portable hard drive Archos PMA 400 unit. The resultant mapping file was interpolated using GIS software Surfer 11.0, thus creating a bathymetric profile of the area. The area mapped, and the resultant bathymetry and reef mapping can be seen in Figure 3.

The bathymetry around the proposed scuttling site is representative of a typical coastal environment, whereby depth increased with increasing distance from the shore. The depth contours highlight marine features such as ridges and flats. Two ridges corresponding with fringing reefs run through the study site outward from Boat Harbour Point (western point) and Grants Point (eastern point), respectively. The proposed scuttling site is situated between these two ridges where the depth is 34 to 38 metres (Chart Datum). There is also a large patch of reef located seaward of Boat Harbour Point, beginning in ~34 m water depth. No other remarkable features were noted in the bathymetry of the study area.

Overall, the bathymetry around the proposed scuttling site suggests that it would be a suitable area for scuttling based on the depth of the site, sand characteristics and absence of any reef structure in close proximity to the site. Although we have not been able to obtain precise measurements on the air-draft of the *HMAS Tobruk*, the depth of the proposed scuttling site appears to be suitable for scuttling this vessel as it will eliminate shipping navigation impediments and also be within the depth range of recreational SCUBA diving activities. The habitat mapping indicates there is a large area of sand around the proposed scuttling site suitable for accommodating the settling of the wreck on the bottom without impediment from reef or other hard structure.

The final location and orientation for scuttling will need to be chosen in consideration of exact vessel height and wave climate. Based on the bathymetry, we would recommend the ship be scuttled with the bow pointing in a west/south westerly direction into Skeleton Bay so that the highest point of the ship (the superstructure), which is towards the stern, settles in deeper water. The final alignment should be determined with the aid of wave modelling to ensure the vessel minimises its profile to the prevailing waves, thus minimising stresses on the hull due to storm surge.

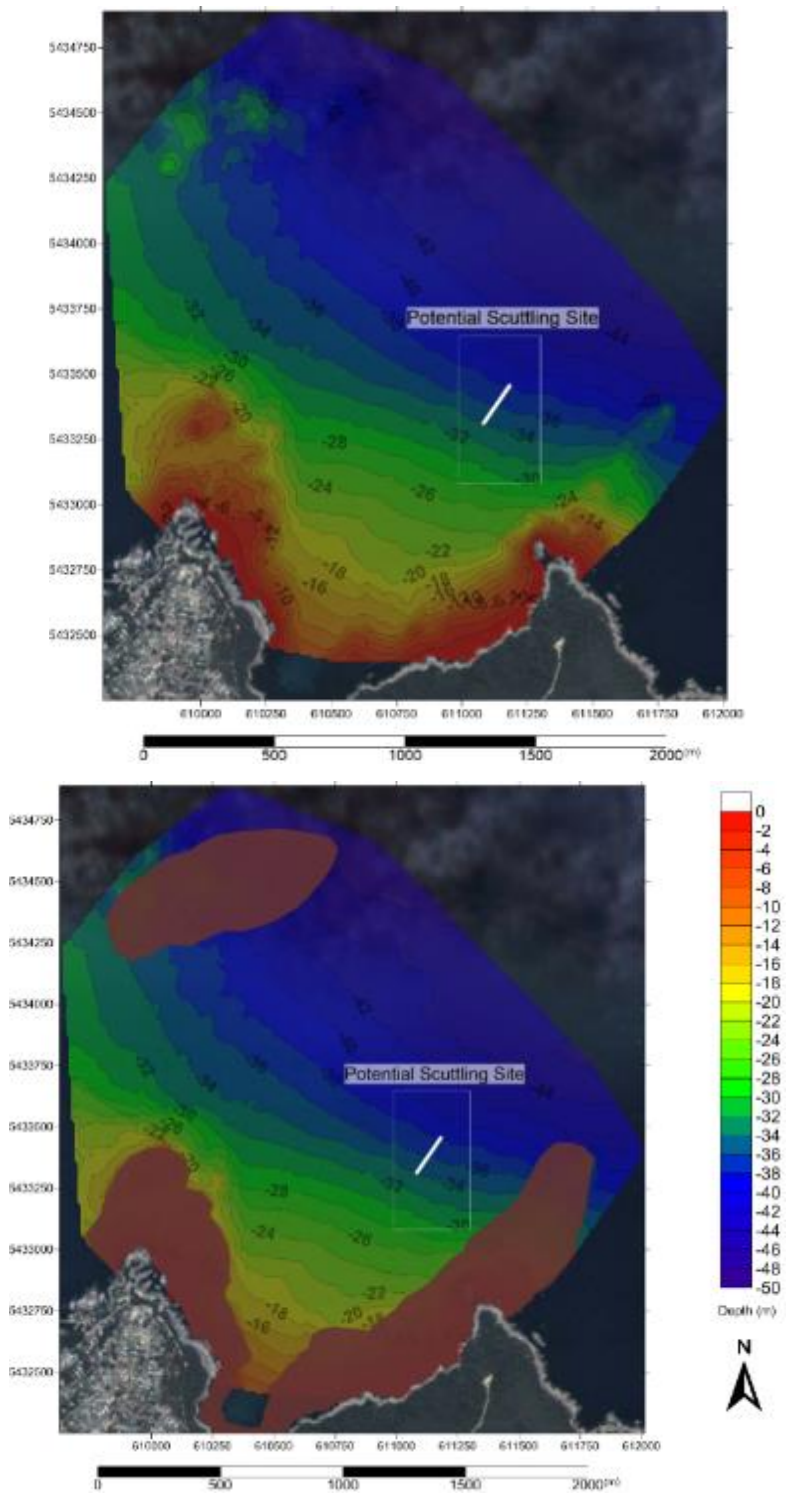


Figure 3 Bathymetric map of the area surrounding the potential scuttling site (top), and reef habitat overlaid on bathymetry map, shown in brown (bottom).

5.2 Subtidal Habitat

To characterise the subtidal environment and provide information about the location and frequency of potentially unsuitable or sensitive habitats, towed video surveys were taken at ten point locations in the area surrounding the proposed scuttling site and also along a 200 m long transect at the proposed scuttling site (Figure 4). This footage was taken 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 on DVD attached as Appendix 1.

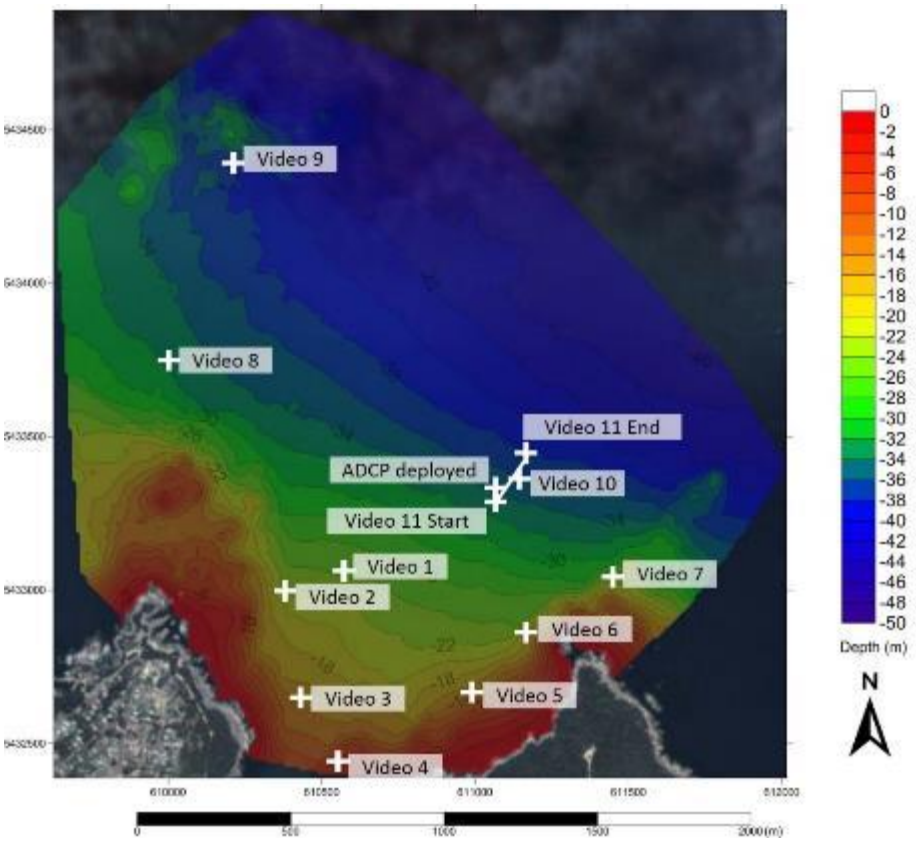


Figure 4 Locations of the towed video surveys conducted in the area of the proposed scuttling site, and the site of the ADCP deployment (the proposed scuttling site is shown by the white line along which Video 11 was recorded).

Note: Location of towed video surveys are representative only. For precise GPS coordinates, see the appendices.

Two major habitat types were recorded, these being soft sediments (sand), and high profile rocky reef. Predominantly, the rocky shoreline extends subtidally and creates high rugosity rocky reef supporting a typical complex reef community of algae, invertebrates and fish life. At some distance offshore, the rocky reef meets a flat sand boundary, and the habitat transitions rapidly to mobile sand. This transition occurs variously between 3 m and 25 m depth. There is a discrete patch of high profile reef located North West of the proposed scuttling site, and this can be clearly seen in Figure 3.

Sand was the dominant habitat in the remainder of the survey area, and covered the central part of Skeleton Bay, and the remaining offshore areas. The reef edge at all the towed video sample locations was devoid of sand scouring, indicating very little sand movement, but sand corrugations were present at most towed video locations.

The variety of habitats can clearly be seen in Figure 5, and each video file is available in the Appendix 1.

a) Proposed scuttling site (Video 10)

b) Video 1

c) Video 2

d) Video 4

e) Video 5

f) Video 6

g) Video 8

h) Video 9

Figure 5 Images showing the different compositions of the seabed around the area of the proposed scuttling site

5.3 Hydrodynamics

An Acoustic Doppler Current Profiler (ADCP) was deployed by divers at the potential scuttling site (Figure 4 above) at a depth of approximately 36 metres for a period of 28 days (1st July to 28th July 2014), measuring current velocity and direction over this time. The Aquadopp current profiler was a 1 Mhz model with a laterally mounted head to minimise the blanking distance at depth. With the instrument deployed on the seabed and in an upwards orientation, all post-processed data is referenced as metres away from the instrument and therefore the seabed. Due to a blanking interval, whereby the instrument is unable to sense water velocity within 0.4 m of the transducer, and the size of the unit, the deepest possible depth recorded by the unit was ~0.8 m above the seabed. Current velocities from surface water were represented using data from 0 m to 11 m; the mid-water velocities were sampled between 11 m and 22 m above the seabed; and bottom water velocities were calculated between 22 m and 33 m.

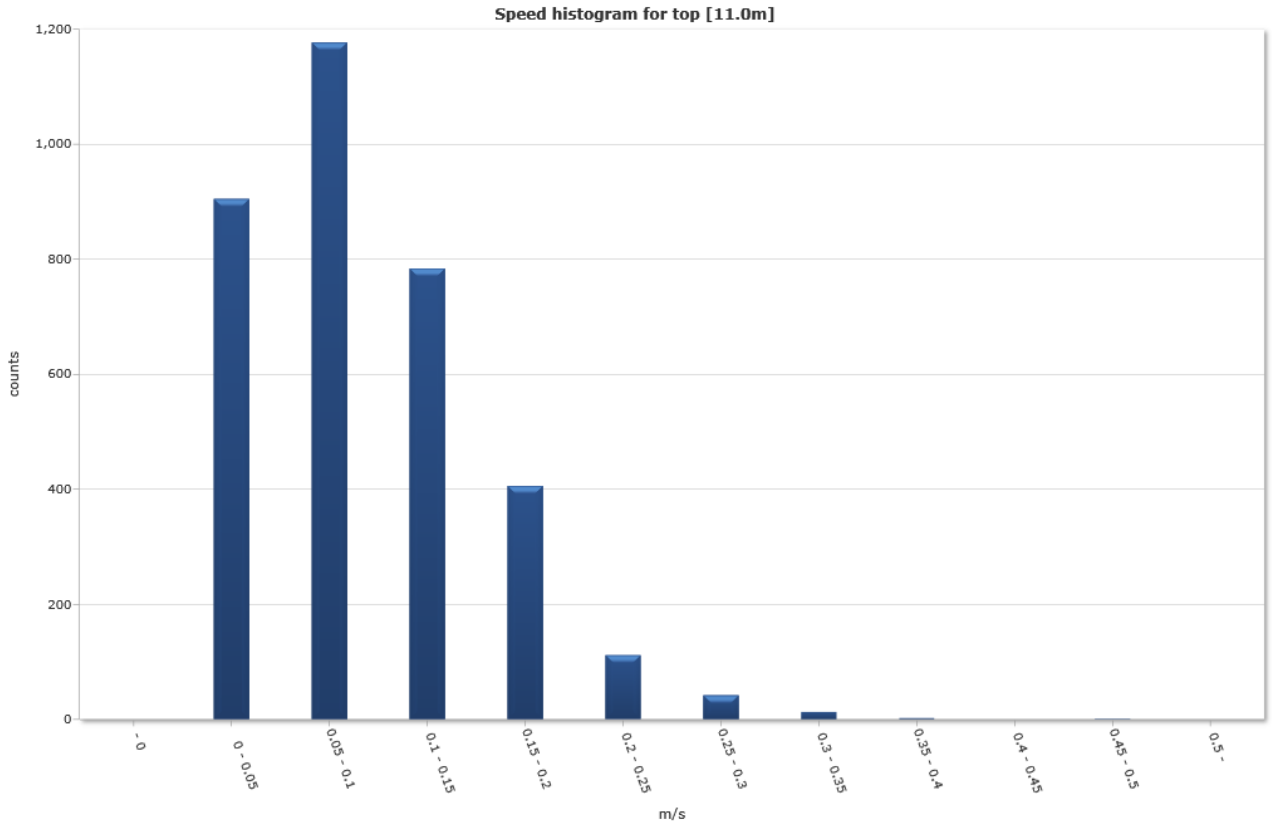
The data were collected over a full month tidal cycle. Although maximum current speeds may at times exceed those recorded by the ADCP, the data are an informative representation of the approximate range reasonably expected throughout the year. The successful deployment of the ADCP provided information that, not surprisingly, the highest current velocities were found in the surface waters, with current speeds decreasing with depth (Figure 6). The predominant current speed for surface water was between 0.05-0.1 m S^{-1}, and was 0-0.05 m S^{-1} for mid and bottom waters. The maximum current velocity recorded at the surface for the 28 day deployment period was 0.5 m S^{-1}, 0.29 m S^{-1} mid-water, and 0.22 m S^{-1} at the bottom. These current velocities would be classified as low and should not restrict diving activities at the proposed scuttling site. Current direction was clearly influenced by tidal currents, with the ebb and flow current direction nearly being in opposition.

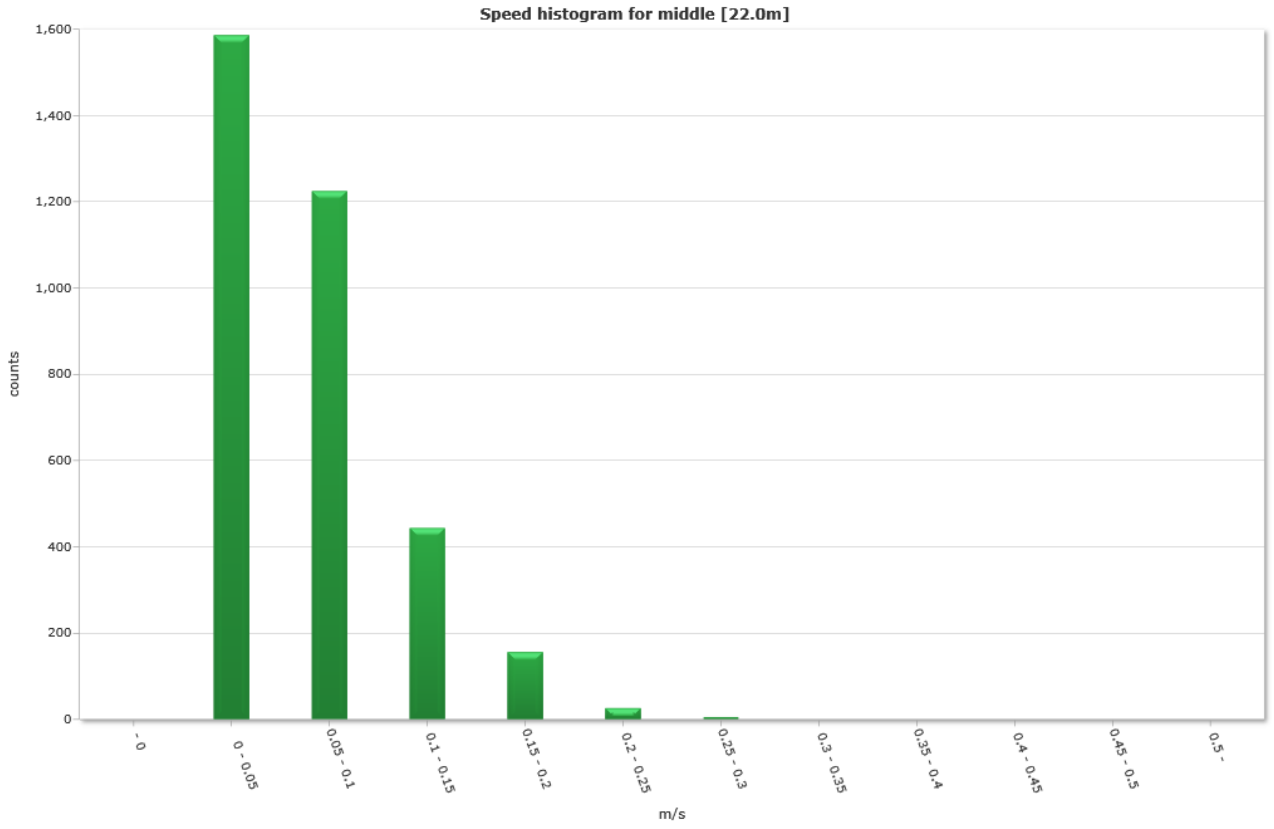
The average significant wave height at the proposed scuttling site did not exceed 3.15 m for the 28 day deployment period (Figure 7). Wave height will not affect the scuttling of the vessel since it is recommended scuttling should take place in calm weather. Despite this, the maximum significant wave height (3.15 m) indicates potential maximum wave heights in excess of 6 m, and the effect of storm surge upon the wreck needs to be considered. It is also worth noting that large wave heights would preclude diving being undertaken safely.

The peak wave direction during the ADCP deployment was found to be approximately 95 degrees, but ranged between 38 degrees and 139 degrees (True) (Figure 8). This is consistent with the site being protected by Eddystone Point in the north and Grants Point to the south.

Currents here are not thought to be an impediment to the successful sinking of the ship and its utilisation as a dive wreck. Other dive sites in the area are dived year-round, including St Helens Rock, Merrick Rock, The Doughboys and Elephant Rock (Jacques 1997), despite being located in more exposed positions than the proposed scuttling site and therefore likely experiencing stronger currents.

Given the recorded wave information appears a little more easterly than logic dictates, we would recommend a 30 year hindcast model of sea conditions at this location to inform the angle at which the vessel should be scuttled. The peak wave period in this instance was strongly influenced by a single storm event causing large easterly swells, and the direction of these swells may not be indicative of the average swell direction at this location. A 30 year hindcast weather model for this location would be a cost effective method for better understanding the range of likely weather conditions at this location, and the likely number of days diving may be impacted by large swell heights. While the east coast of Tasmania is considered a climate change hotspot that may be subject to rapid change over the coming decades, a 30 year hindcast model represents the best information available for informing the expected weather conditions.


Speed histogram for top [11.0m]
counts
1,200
1,000
800
600
400
200
0
- 0
0 - 0.05
0.05 - 0.1
0.1 - 0.15
0.15 - 0.2
0.2 - 0.25
0.25 - 0.3
0.3 - 0.35
0.35 - 0.4
0.4 - 0.45
0.45 - 0.5
0.5 -
m/s


Speed histogram for middle [22.0m]
counts
1,600
1,400
1,200
1,000
800
600
400
200
0
- 0
0 - 0.05
0.05 - 0.1
0.1 - 0.15
0.15 - 0.2
0.2 - 0.25
0.25 - 0.3
0.3 - 0.35
0.35 - 0.4
0.4 - 0.45
0.45 - 0.5
0.5 -
m/s

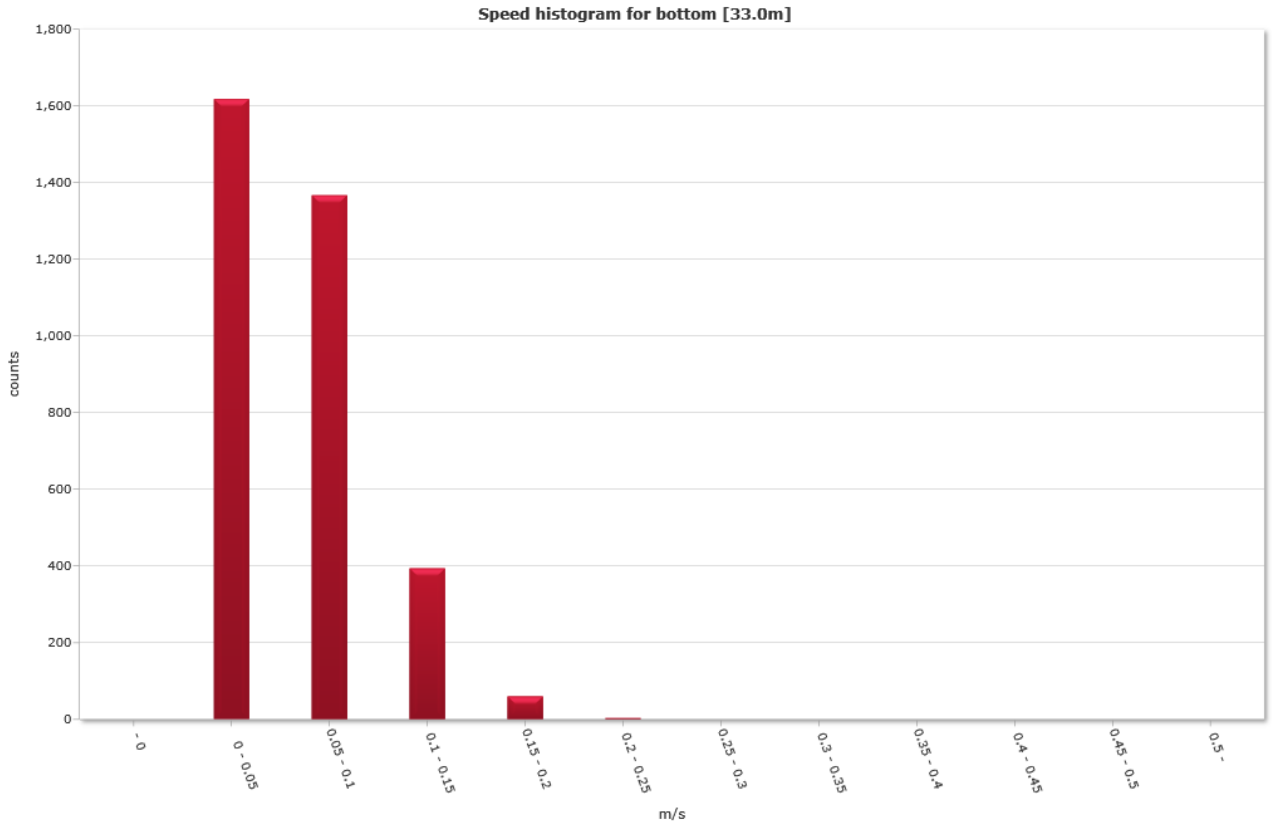


Figure 6 Count of different current speeds for top (0-11 m; blue bars), mid (11-22 m; green bars), and bottom (22-33 m; red bars) waters at the proposed scuttling site

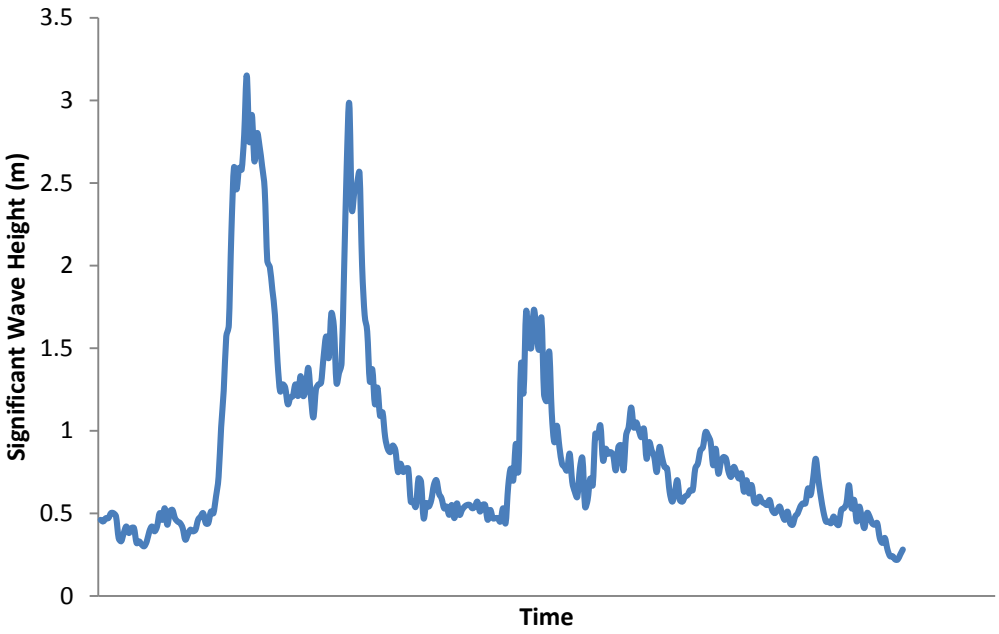


Figure 7 The mean significant wave height (m) for the duration of the ADCP deployment (28 days) at the proposed scuttling site.

Figure 8 The minimum and maximum average direction (in degrees) of current flow at the proposed scuttling site

5.4 Sedimentation

In accordance with the ADCP data, large swells are experienced at the proposed scuttling site. Despite such swells, the seabed-mounted ADCP was still sitting proud of the sand when retrieved by divers and had not buried, indicating a stable sand environment at this depth (~35 m metres). Further, the reef edges captured during towed video surveys do not exhibit lines of sand scour which can indicate sand movement in large swell conditions. Settling time experiments (cross-reference section 10.3) suggested that the sand at the proposed scuttling site is primarily reworked marine sediments which fall from suspension readily and are unlikely to remain suspended following disturbance.

Given the observations made on site, information on current and wave activity, and the nature of the sand in the area, it is not expected the wreck will accumulate sediment at a rate in excess of surrounding habitats.

5.5 Geology

The northeast coast of Tasmania is geologically stable. A search of the Minerals Database Tasmania (2014) indicated that no mineral deposits have been recorded in the Skeleton Bay/Binalong Bay region. No geological impediments to the scuttling of the vessel at this site are apparent.

6 Matters of National Environmental Significance

Under the *Environmental Protection and Biodiversity Conservation Act 1999*, actions that have, or are likely to have a significant impact on a matter of national environmental significance (MNES) require approval from the Australian Government Minister for the Environment (the Minister). The Minister will decide whether assessment and approval is required under the *EPBC Act*.

There are nine matters of national environmental significance under the *EPBC Act* (DoE 2014a). These are:

- World heritage properties
- National heritage places
- Wetlands of international importance (listed under the Ramsar Convention)
- Listed threatened species and ecological communities
- Migratory species (protected under international agreements)
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mines)
- A water source, in relation to coal seam gas development and large coal mining development.

Each is discussed individually in the subsections below.

6.1 World Heritage Properties

A declared World Heritage Property is an area that has been included in the World Heritage List, or declared by the Minister to be a World Heritage property.

The nearest World Heritage Properties to the proposed scuttling site are Australian Convict Sites at Maria Island and at Brickendon Estate south of Launceston (DoE 2014b).

No World Heritage Properties will be affected by the proposed activity.

6.2 National Heritage Places

A National Heritage Place is a place that has been included on the National Heritage List on the basis of natural, historic and/or indigenous places of outstanding heritage value (DoE 2014a).

The nearest National Heritage Places to the proposed scuttling site are Australian Convict Sites at Maria Island and at Brickendon Estate south of Launceston (DoE 2014b). Therefore, no National Heritage Places will be affected by the proposed activity.

6.3 Wetlands of international importance (listed under the Ramsar Convention)

A Wetland of International Importance is an area that has been designated under Article 2 of the Ramsar Convention or declared by the Minister to be a declared Ramsar wetland under the *EPBC Act* (DoE 2014a).

The nearest Ramsar Wetland to the proposed scuttling site is an area of approximately 46 acres near Stieglitz (DoE 2014b) (Figure 9). This area is geographically sufficiently removed from the proposed scuttling site that the proposed activity is not expected to have any impact on the wetland.

Figure 9 Map showing the nearest Ramsar Wetland (bound by blue line) to the proposed scuttling site.

No Wetlands of international importance will be affected by the proposed activity.

6.4 Listed threatened species and ecological communities

There are a number of marine species listed as threatened that may occur in the vicinity of the proposed scuttling. Threatened species are protected under the *Threatened Species Protection Act 1995* (*TSPA*, Tasmanian state legislation) and/or the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBCA*, Australian Government legislation). In addition to threatened species legislation, the *Fisheries (General and Fees) Regulations 2006* under the *Living Marine Resources Management Act 1995* (*LMRMA*) prohibits the taking/possession of a number of marine species, including Syngnathids (seahorses, seadragons and pipehorses), Handfish, Threefin Blennies, Limpets/False Limpets of three superfamilies, and five species of shark. Additional species are protected by the schedules of the *Wildlife (General) Regulations 2010* (Regulations under the *Nature Conservation Act 2002* (*NCA*)), under which a person must not take, buy, sell or have possession of any protected wildlife or any product of any protected wildlife without a permit.

Under the *TSPA*, listed species cannot be collected, disturbed, damaged or destroyed without a permit. Under the *EPBCA*, any action with significant impact on a listed threatened species and/or community is prohibited without approval (*EPBCA* Section 18 and 18A).

Threatened/protected species sighted during surveys included fur seals (most likely Australian fur seals *Arctocephalus pusillus*) and dolphins (*Delphinus delphis*), all of which are protected under the *Environmental Protection and Biodiversity Conservation Act 1999*.

A further three threatened marine species, all mammals, were identified by the Natural Values Atlas (*NVA*; DPIPWE 2014) as occurring within 2000 m of the potential scuttling site. Only one of these, the Southern right whale, was identified occurring within a 500 m radius of the study area. The results of the NVA search are summarised in Table 2 below. No threatened aquatic communities were identified within 2000m of the proposed scuttling site.

The sinking of the HMAS Tobruk is considered unlikely to have a detrimental impact on any threatened or protected species.

Table 2 Summary of threatened marine species identified in a search of the Natural Values Atlas. Note that the scope does not extend to terrestrial or avian biota.

		Species	*EPBC Act* listing	*TSP Act* listing
Within 500m radius	Verified records	Southern Right Whale *Eubalaena australis*	Endangered	Endangered
	Based on habitat mapping	-	-	-
Within 2000m radius	Verified records	Southern Right Whale *Eubalaena australis*	Endangered	Endangered
		Humpback Whale *Megaptera novaeangliae*	Vulnerable	Endangered
		Southern elephant seal *Mirounga leonine*	Vulnerable	Endangered
	Based on habitat mapping	Australian grayling *Prototroctes maraena*	Vulnerable	Vulnerable

6.4.1 Marine Mammals

All cetaceans (whales and dolphins) are protected under schedules of the *Wildlife (General) Regulations 2010* (Regulations under the *Nature Conservation Act 2002*) and under the *EPBC Act 1999*. Two species of dolphins are commonly seen in Tasmanian waters: common dolphins (*Delphinus delphis*) and bottlenose dolphins (*Tursiops truncatus*). Blue, Fin, Sperm, Minke and Sei whales may occur in Tasmanian waters during winter migrations, but generally occur offshore. Southern Right (*Eubalaena australis*) and Humpback whales (*Megaptera novaeangliae*), both of which were identified in the NVA search of the area, also migrate along coastal routes and may occur nearer to shore between May and November.

All cetacean species now listed as threatened were heavily exploited by shore-based and pelagic whaling operations throughout the 19th and 20th centuries, and today exist as remnant populations of their former numbers (Baker and Clapham 2004). In 1986, an international moratorium on commercial whaling was implemented. Today, Humpback Whales and Southern Right Whales are estimated to be recovering at a rate of 10% (Bannister and Hedley 2001) and 7% (IWC 2001) per annum, respectively. Current threats to Humpback and Southern Right Whales include commercial

whaling/scientific-permit whaling, acoustic pollution, entanglement (e.g. marine debris, fishing equipment), ship-strike injury and water quality degradation (DSEWPC 2014).

Dolphins are frequently sighted in Skeleton Bay, and would foreseeably be sighted regularly by divers in the area. Conversely, although Humpback Whales and Southern Right Whales have been recorded in the region (DPIPWE 2014), the rarity of occurrence means that any interaction between whales and the wreck would likely be infrequent. Whales generally exhibit an avoidance behaviour of fixed objects and are therefore not likely to directly contact a wreck.

Two pinniped species breed in Tasmanian waters: the Australian Fur Seal *Arctocephalus pusillus* and the New Zealand Fur Seal *Arctocephalus forsteri* (the latter of which is listed as Rare under state legislation) (DPIPWE 2012). The New Zealand Fur Seal's distribution is generally restricted to the south and west of the state, so it is unlikely to occur in the region. Other pinniped species may occur as wandering vagrant individuals in the area, including the Australian Sea-Lion *Neophoca cinerea*, the Southern Elephant Seal *Mirounga leonina* and the Sub-Antarctic Fur Seal *Arctocephalus tropicalis*. The most common pinniped to occur in the area, the Australian Fur Seal, *Arctocephalus pusillus* is not listed as threatened but is protected. Historically, sealing until the 1920's reduced populations of all Tasmanian seal species. Current processes threatening pinnipeds include entanglement in fishing equipment, competition for food with commercial fishing operations and incidental capture by commercial fishing operations (DSEWPC 2014). Seals would foreseeably be sighted regularly by divers in the area.

The presence of the wreck once sunk is not considered to pose a direct threat to cetacean or pinniped populations. However, the process of scuttling may detrimentally impact marine mammals and other noise-sensitive fauna. The main consideration is that underwater detonations may result in distress and/or barotrauma to animals in the vicinity, which can be lethal (Richardson *et al* 1995). An appropriate mitigation would be adherence to government guidelines for seismic activity as provided in DEWHA's (2008) *EPBC Act* Policy Statement 2.1, which requires that a Marine Mammal Observer surveys the area for at least 30 minutes prior to works start-up, and that works are delayed or ceased, depending on proximity, should marine mammals be sighted. Action guidelines as per DEWHA (2008) are shown in Figure 10, and are dependent on the sound levels animals are likely to receive. Peak pressure for linear charges, such as the cutting charges typically used in vessel scuttling, is 30% to 70% lower than for point source detonations. Impulse strengths are 30% to 55% lower (Lewis 1996). Therefore, assuming that cutting charges are used to scuttle the vessel, it is

expected that the sound exposure level will be considerably less than 160 dB re 1 µPa2^{-S} (trigger for more conservative zoning as per Figure 10, DEWHA (2008)).

It would sensible to schedule scuttling outside whale migrating season (I.e. outside of the months of May to November) to minimise the risk of delays to works.

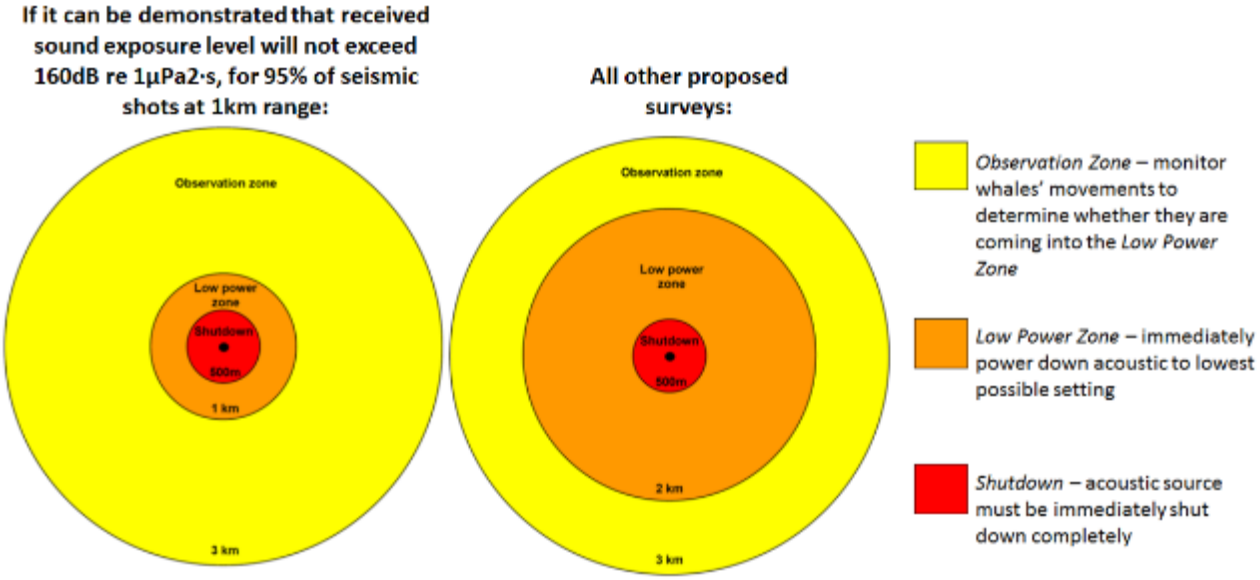


Figure 10 Precaution zone definitions as per DEWHA's (2008) guidelines for seismic activity.

6.4.2 Syngnathids

There are no Syngnathids (seahorses, sea dragons and pipehorses) listed as threatened under state or federal legislation, however all Syngnathids are formally protected under state legislation. Although there is no evidence of serious population declines in Australia, Syngnathids are at risk of overexploitation for traditional Asian medicine and the aquarium trade (Pogonoski *et al* 2002). Syngnathids are resilient to short-term habitat disruption, and will readily colonise manmade structures (Pogonoski *et al* 2002), therefore the sinking of a vessel to form an artificial reef structure could increase the numbers of Syngnathids locally. The proposed activity is unlikely to detrimentally affect populations of any Syngnathid species.

6.4.3 Australian Grayling

The Australian Grayling *Prototroctes maraena* is native to Tasmania and southeast mainland Australia. Australian Grayling have a diadromous lifecycle, inhabiting fresh water streams as adults, and migrating to coastal seas as larvae. Spawning takes place in late spring/early summer (Bryant and Jackson 1999). Larvae are transported to sea in stream/river currents, and return as migrating juveniles approximately 4-6 months later (Bryant and Jackson 1999).

The most serious threat facing the Australian Grayling population is habitat alteration resulting in barriers to migration, such as damming. Pollution of waterways is also considered a threat to their survival.

Although the Natural Values Atlas identifies potential habitat for the Australian Grayling within 2000 m, none is identified within 500m, nor are there any verified records of this species within the 2000 m radius of this NVA search. Furthermore, the activity of scuttling a vessel is not considered a potential threat to the species (the main threats being barrier to migration and water pollution).

6.5 Migratory species protected under international agreements

Migratory species are those animals that migrate to Australia and its external territories, or pass through or over Australian waters during their annual migrations (DoE 2014a).

Listed migratory species[2] are those listed in the:

- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
- China-Australia Migratory Bird Agreement (CAMBA)
- Japan-Australia Migratory Bird Agreement (JAMBA)
- Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)

Refer to Section 6.4.1 (Marine Mammals) for information pertaining to migratory cetaceans.

Note that the scope of this report does not extend to birds. A comprehensive investigation on the impacts of the scuttling of the HMAS Tobruk and its establishment as a wreck site should be

[2] An EPBC-listed migratory species list can be found at http://www.environment.gov.au/cgi-bin/sprat/public/publicshowmigratory.pl

conducted as a component of the environmental risk assessment required to be undertaken, should the proposal proceed to the next stage.

6.6 Commonwealth marine areas

A Commonwealth marine area is any part of the sea within Australia's Exclusive Economic Zone and/or over the continental shelf of Australia, that is, not State or Territory Waters (DoE 2014a). The Commonwealth marine area encompasses an area 3 to 200 nautical miles from the coast.

The proposed scuttle site is only ~0.3 nautical miles off the coast, therefore it is spatially distant from the Commonwealth marine area.

The proposed activity is not expected to impact Commonwealth marine areas.

6.7 The Great Barrier Reef Marine Park

The Great Barrier Reef Marine Park is a world heritage-listed coral reef ecosystem of over 344,000 square kilometres off the coast of Queensland (DoE 2014a). There are no significant biological, ecological, or environmental links between the Great Barrier Reef Marine Park and the proposed scuttling location. Therefore, the proposed scuttling is not expected to impact the Great Barrier Reef Marine Park.

6.8 Nuclear actions (including uranium mines)

Nuclear actions are beyond the scope of this investigation. An investigation into nuclear actions should be conducted as a component of the full environmental risk assessment required to be

undertaken, should the proposal proceed to the next stage. To the author's knowledge, no nuclear actions[3] are occur or are anticipated to occur within the region of the proposed scuttling site.

6.9 A water source, in relation to coal seam gas development and large coal mining development.

Water resources are beyond the scope of this investigation. An investigation into water sources in relation to coal seam gas/coal mining development may be conducted as a component of the full environmental risk assessment required to be undertaken, should the proposal proceed to the next stage.

[3] Definition of nuclear actions is provided at http://www.environment.gov.au/epbc/what-is-protected/nuclear-actions

7 Introduced Marine Pests

Marine pests are introduced into Australian waters and translocated by a variety of vectors (e.g. ballast water, biofouling, aquaculture operations, and ocean current movements). Once introduced, they often thrive as they may lack predators and/or competitors in their new environment (Whitehead 2008). Pests can have a significant impact on human health, fisheries and aquaculture, infrastructure, tourism, biodiversity and ecosystem health.

Seven species have been declared as pests under State legislation[4]. These are:

- Northern Pacific sea star (*A. amurensis*),
- European shore crab (*Carcinus maenas*),
- European fan worm (*Sabella spallanzanii*),
- Japanese Wakame (*Undaria pinnatifida*),
- Black striped mussel (*Mytilopsis sallei*),
- European Carp (*Cyprinus carpio*), and
- Green algae (*Caulerpa taxifolia*).

Many more are recognised as pests by the National Introduced Marine Pest Information System (NIMPIS 2014).

No introduced pest species were observed at this site throughout surveying, although the study area is within the known range of Japanese wakame *Undaria pinnatifida*, European shore crabs *Carcinus maenus* and New Zealand screw shells *Maoricolpus roseus*. It should be ensured that no marine species are translocated as a result of vessel/equipment movement, by adopting a thorough cleaning protocol. Hull cleaning can be conducted in-water or by dry docking at a suitable location. North east Tasmania is not deemed a suitable location for this due to the associated risks of contamination and marine pest transfer. A qualitative risk assessment for marine pest transfer will be a critical component of the recommended full environmental risk assessment, prior to the transport of the vessel to Tasmanian waters. Existing state legislation provides controls by which to prevent the translocation of marine pest species.

[4] *Fisheries (General and Fees) Regulations 1996*, *Part 20: Noxious* fish, outlined in the *Living Marine Resources Management Act 1995*

The waters around north-east Tasmania are well-recognised as a range extension hotspot (RedMap 2014; Pitt *et al* 2010; Ling *et al* 2009). Known processes independent of the proposed scuttling, such as extension of the East Australian Current, have resulted in a range of marine species exhibiting a pole-ward range expansion (Pitt *et al* 2010). This is important to acknowledge in the context of ongoing monitoring, particularly in the context of differentiating range extending species from introduced species.

8 Fish Count Transects

In order to characterise the fish community present in the area, underwater visual fish count transects were conducted, whereby paired divers swam along transects above reef habitat recording fish species and size class at each of the east and west of Skeleton Bay. Each transect measured 200 m x 10 m (i.e. total area of 4000 m^2). It should be noted that the bias of this method towards conspicuous fish is well-recognised (Cheal and Thompson 1997), therefore cryptic species such as gobies and blennies are typically underrepresented. Refer to Appendix 5 for the raw data from the fish count transects.

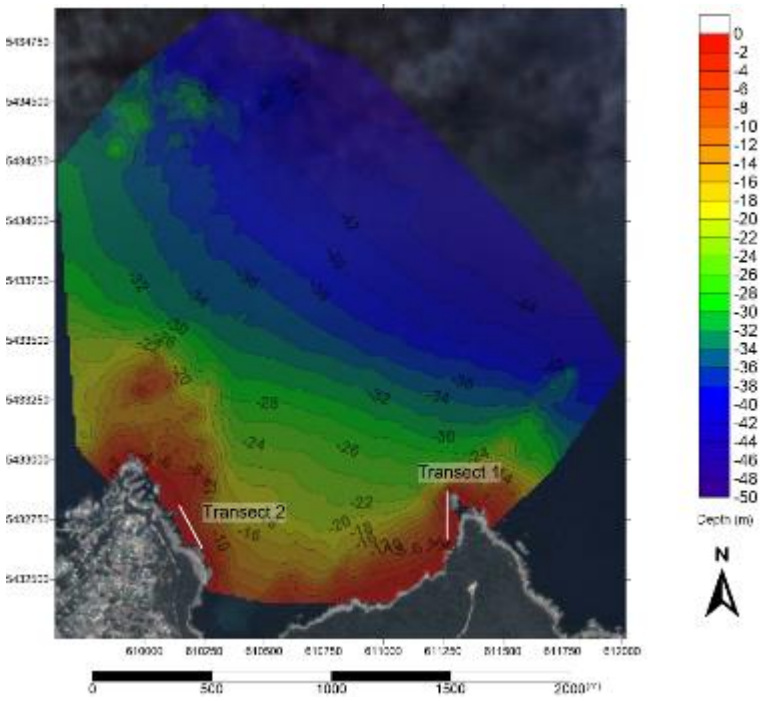


Figure 11 Map showing locations of fish count transects in the east (Transect 1) and west (Transect 2) of Skeleton Bay

Note: Location of fish count transects are representative only. For precise GPS coordinates, see the appendices.

A total of 464 individual fish were recorded during fish count transects. The fish assemblages on the eastern side of Skeleton Bay were notably more numerous than those on the western side of Skeleton Bay (Figure 12); 78% of the total fish count was observed on the eastern side, compared with 22% on the western side. This difference is largely attributable to a school of butterfly perch (*Caesioperca lepidoptera;* family Serranidae) observed on the eastern transect. Conversely, species richness was higher on the western transect, with 28 species observed compared with 19 species on the eastern transect. Table 3 lists the most abundant fish species observed during fish count transect surveys. An additional 20 species not listed in this table were observed, but no more than 3 individuals of any one of these species were observed. For a full species list, refer to Appendix 4. Figure 13 shows the abundance of fish by family on both the western and eastern transect.

Table 3 The most abundant fish species observed during the fish count transect surveys.

Family	Common name	Scientific Name	Total number of individuals counted	
			East Skeleton Bay	West Skeleton Bay
Serranidae	Butterfly perch	*Caesioperca lepidoptera*	203	1
Plesiopidae	Blotch-tail hula fish	*Trachinops caudimaculatus*	64	36
Labridae	Bluethroat wrasse	*Notolabrus tetricus*	15	16
Dinolestidae	Longfin pike	*Dinolestes lewini*	29	0
Scorpididae	Sweep	*Scorpis aequipinnis*	20	2
Cheilodactylidae	Banded morwong	*Cheilodactylus spectabilis*	7	5
Pempheridídae	Bullseye	*Pempheris* sp.	0	10
Girellidae	Zebra fish	*Girella zebra*	3	3
Labridae	Purple wrasse	*Notolabrus fucicola*	3	3
Mullidae	Goatfish	*Upeneichthys vlamingii*	5	1

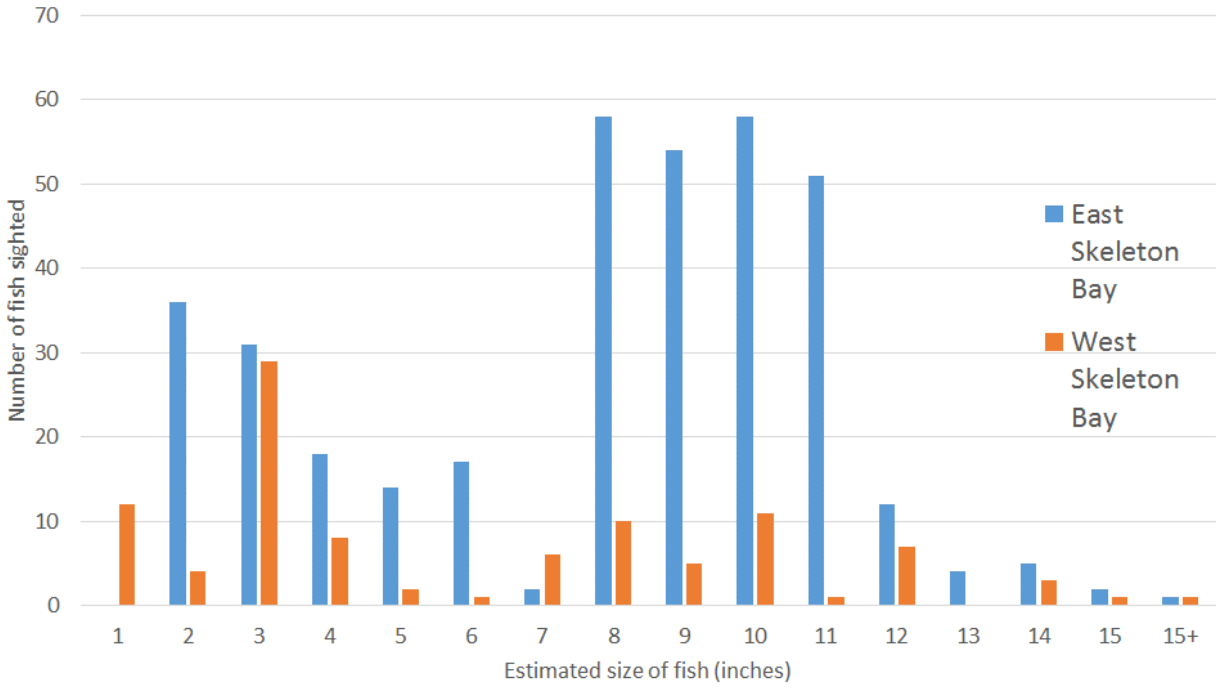


Figure 12 Total number of fish observed in eastern and western fish transects by size class.

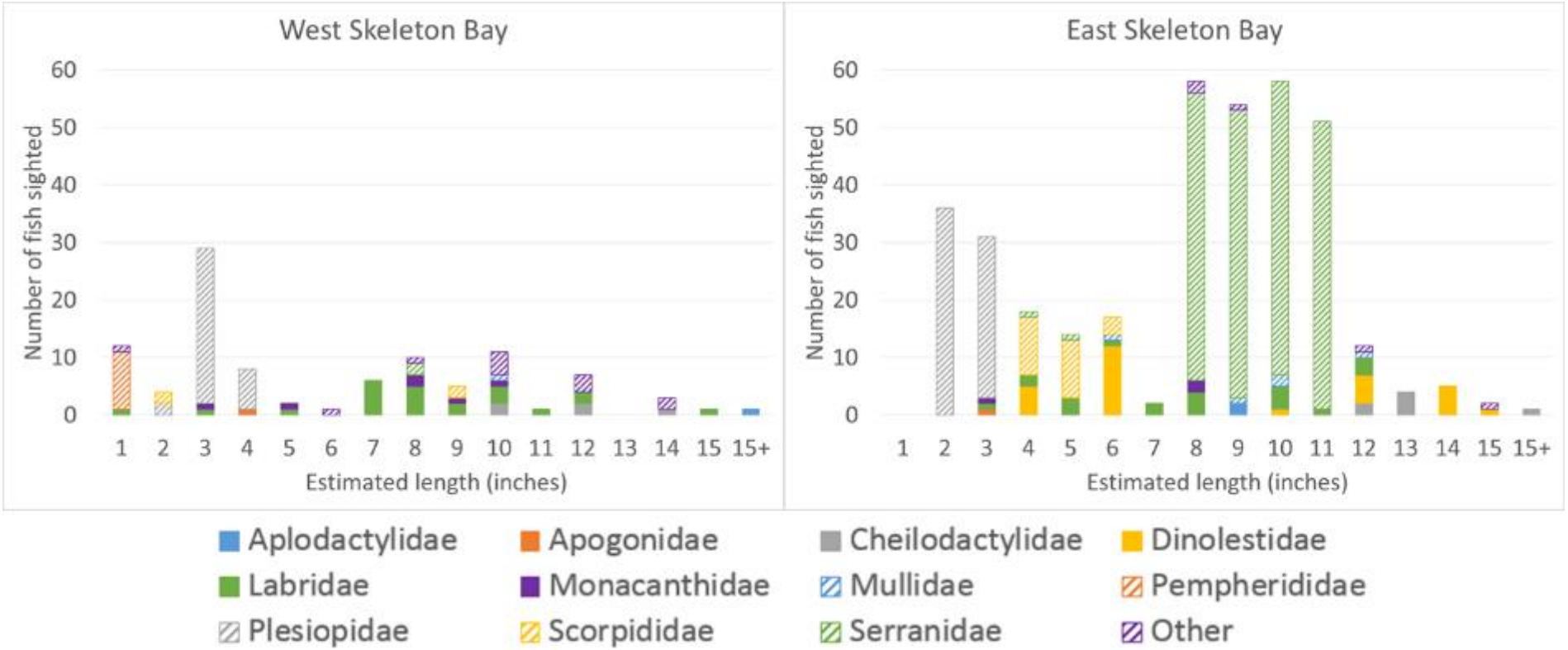


Figure 13 Abundance and diversity by family of fishes sighted in West (left) and East (right) Skeleton Bay. (Note that category "Other" includes families Enoplosidae, Girellidae, Latridae, Odacidae, Pomacentridae and Urolophidae). Refer to Appendix 5 for raw data.

Fish species were also observed on towed video recordings. Notably, a relatively high density of gurnards (family Triglidae; possibly *Pterygotrigla polyommata* or *Lepidotrigla vanessa*) were recorded on the sand at the proposed scuttling site (see Appendix 1 Video 11 ~09:54). Approximately 5 individuals can be seen in 10 seconds of video recording.

9 Impacts on Sharks and Shark/Human Interactions

Many species of sharks are found around north east Tasmania, a small number of which may be harmful to humans. In response to concerns raised in public forums, Marine Solutions has been asked to comment directly on the potential of the *HMAS Tobruk* to impact on shark behaviour and shark/human interactions.

The main species of concern relating to potentially dangerous shark/human interactions in Tasmania is the Great White Shark (*Carcharodon carcharias*). The Great White Shark can be found in all marine environments in the southern half of Australia (DEWHA 2009). They are sometimes found in association with areas of high prey density, such as seal colonies (DEWHA 2009). Tagging studies have determined that individual Great White Sharks appear to undergo seasonal migrations, travelling as far north as central Queensland in autumn/winter and returning south in spring (CMAR 2007). While reports of Great White Shark sightings in north-east Tasmanian waters are uncommon, it is not outside of their known range, and although unlikely, it is possible that individuals may occur within the vicinity of Skeleton Bay.

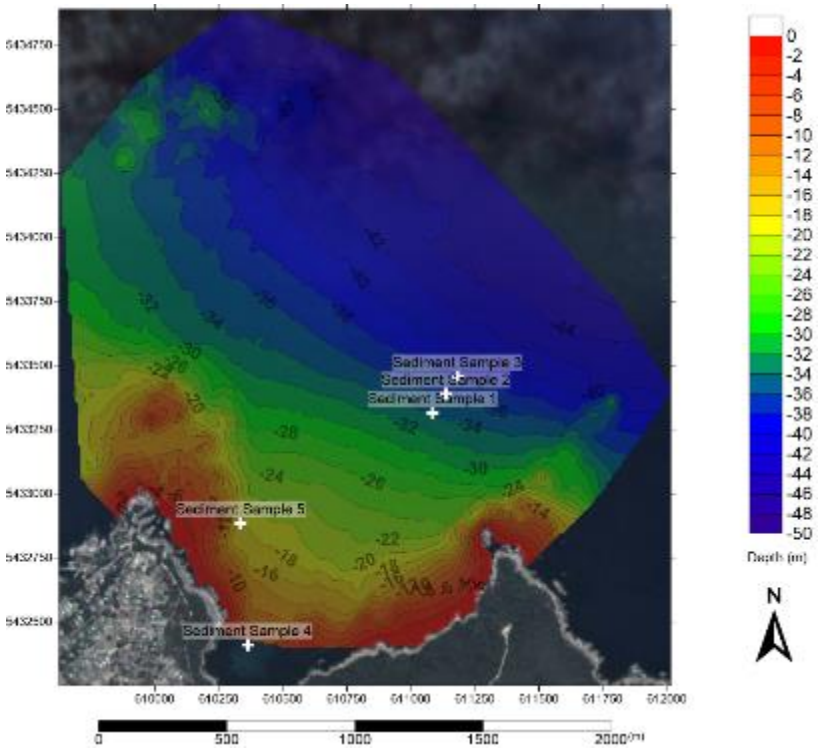
While a variety of shark species will invariably visit the area over time, there is no evidence to suggest that scuttling a wreck will increase the frequency of visits, or the longevity of time the sharks remain in the area. It has been shown repeatedly using archival and sonic tags that great white sharks travel large distances, and are not resident in an area (e.g. DSEWPC 2011; Weng *et al* 2007; Bruce & Bradford 2008; Bruce *et al* 2006). The wreck will act as a large area of high rugosity reef, which is not expected to attract or repel sharks any more or less than any other high rugosity reef, of which there are already substantial areas in the region.

Many shark species are protected, as their numbers have been declining. The main process threatening Great White Sharks is commercial fishing. Beach netting and baiting for human protection is also recognised as a threat to the species, however this is not practised in Tasmanian waters. It is not thought that scuttling a wreck will be a contributing factor to the processes threatening shark populations.

10 Sediments

10.1 Contaminants

Sediments were collected from five sites within Skeleton Bay. Three of these, Sample 1, Sample 2 and Sample 3, were collected from the seabed in the immediate vicinity of the proposed scuttle site. Some sediment samples were retained, should the next stage of the project go ahead and contaminant testing be required. Sediment contaminant testing will provide a baseline level of contaminants such as metals and total petroleum hydrocarbons prior to the wreck being scuttled.



Sediment Sample 1 - Proposed scuttled site south
Sediment Sample 2 - Proposed scuttled site mid
Sediment Sample 3 - Proposed scuttled site north
Sediment Sample 4 - Towards head of bay
Sediment Sample 5 - Reef edge, western side of bay

Figure 14 Map showing locations of the 5 sediment samples collected.

Note: Location of sediment sampling sites are representative only. For precise GPS coordinates, see the appendices.

A study of sediments in the vicinity of the *Swan* (naval vessel scuttled off Western Australia in 1997) indicated that, although not detectable 5 months post-scuttling, sediment enrichment was evident in the immediate surrounds 12 months post-scuttling (MacLeod *et al* 2004). Enrichment of chromium, copper, iron, lead and zinc was evident after 12 months, but only copper exceeded the Environment Australia (2002) guidelines. Enrichment was directly attributable to metal corrosion and degradation of protective paint layers. No enrichment was evident for petroleum hydrocarbons, aluminium or cadmium. Similar results were observed for the *Perth* (scuttled in Western Australia in 2001) and the *Hobart* (scuttled in South Australia in 2002). Enrichment at the levels observed on the naval vessels the *Swan,* the *Perth* and the *Hobart* are not considered to result in adverse environmental impacts. Based on such previous studies, metals contamination of the sediments around the scuttled *HMAS Tobruk* is not expected to have a large impact on marine life, however, ongoing long-term monitoring of sediments for metals and TBT should be conducted. It is essential that all contamination risks are adequately understood prior to scuttling, and that the vessel is prepared in a manner that ensures the minimisation of negative effects on the marine environment. Cleaning of the vessel hull of antifoulant prior to its dispatch to northeast Tasmania is considered to be an essential component of environmental risk mitigation.

10.2 Jet Probing

Jet probing of the sand was conducted at 8 locations between 35 m and 39 m depth (Figure 15); the jet probe penetrated the sub-surface sediment relatively easily at all 8 locations to the full length of the probe, indicating that there is no underlying hard substrate in the top 2 m of seabed at the sites tested.

Note: Analyte levels have been measured by NATA-accredited laboratories.

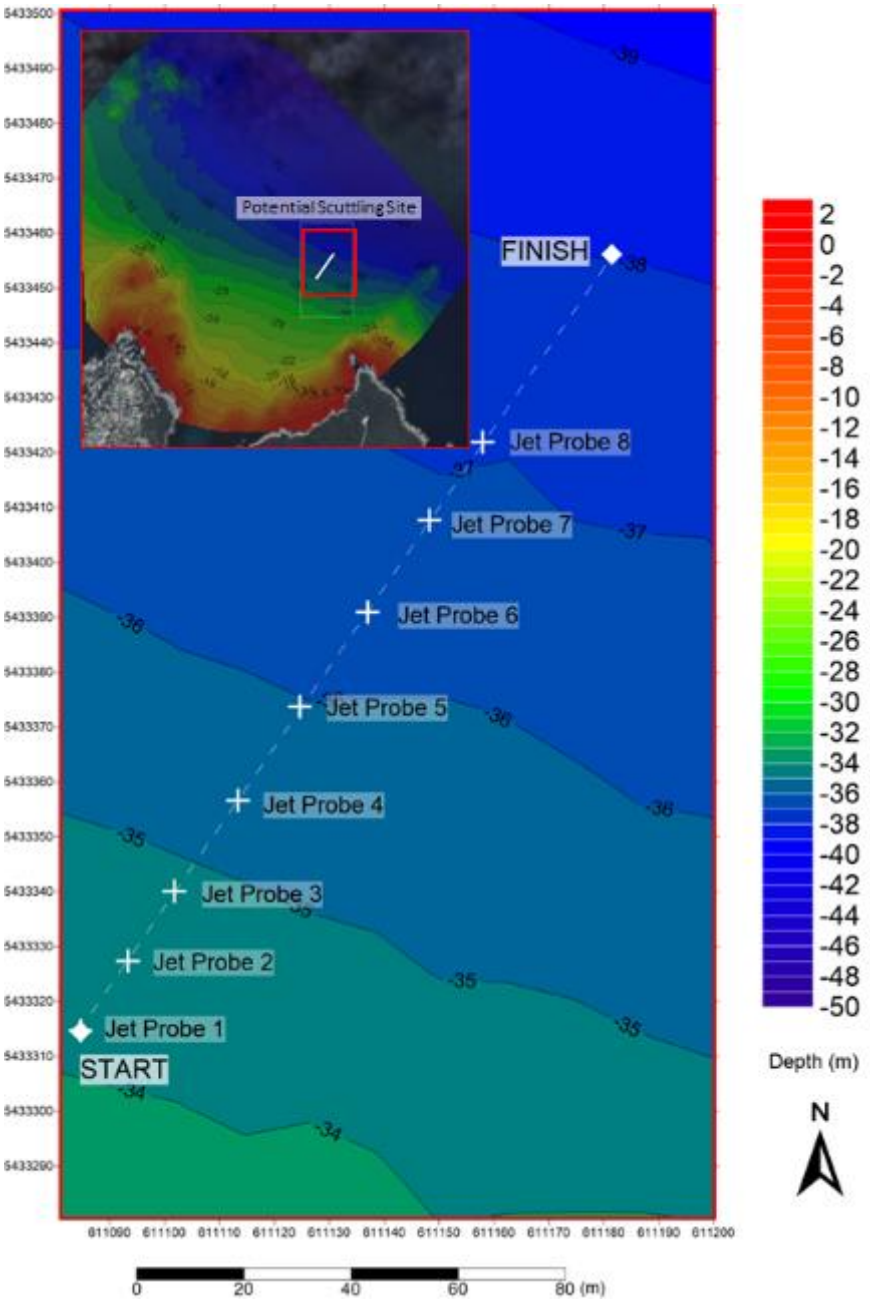


Figure 15 Map showing jet probe locations within the proposed scuttling site.

Note: Location of jet probing sites are representative only. For precise GPS coordinates, see the appendices.

10.3 Particle Size Distribution and Settling Times

As a wreck hits the bottom, sediment disturbance can cause a plume which may impact the environment. To inform the extent and duration of any potential plume, particle size distribution and a particle sediment test were conducted.

The particle size distribution showed that 90% of sediments were medium-grained, between 0.125 and 0.25 mm in size (Figure 16).

A particle settlement test revealed that sediments from the potential scuttle site are mostly dense, settling quickly. Only twenty seconds post-agitation, a large fraction of the total sediment had settled as a layer on the bottom of the test container. There is also a fraction of fine, easily suspended sediment, as evidenced by the high turbidity of water remaining at the conclusion of the experiment (45 minutes post-agitation) (0).

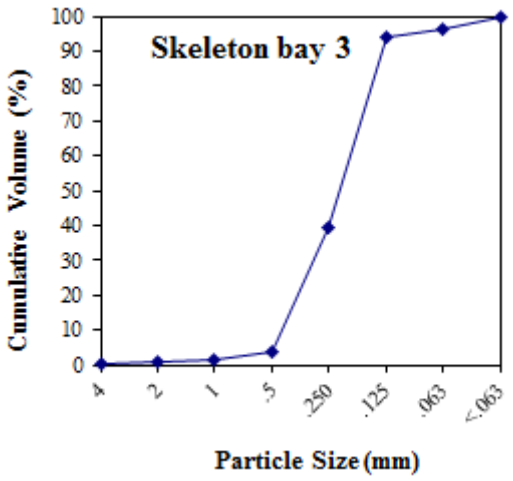


Figure 16 Particle size distribution of a sediment sample from the potential scuttling site.

11 Corrosion and Colonisation

The vessel will ultimately corrode in the marine environment, and the likely mix of dissimilar metals may speed corrosion in some areas relative to other areas of the vessel. The rate of deterioration of metal objects underwater is dependent on the flux of oxygen to the metal surface, and therefore the water depth, with water movement generally decreasing with increasing depth (MacLeod *et al* 2004). Based on previous studies of naval wrecks in similar environments, it is expected that corrosion rates will increase over time in the years immediately following, but will remain slow even after several years underwater (MacLeod *et al* 2004).

Serious structural degradation of the HMAS Tobruk resulting in diver safety hazard is considered unlikely, with other wrecks in Tasmanian waters (e.g. Tasman, Nord) having lasted in excess of 100 years in a reasonably intact state, despite being in a comparable environment. However, ongoing periodic structural monitoring is required as a measure of prudence (see section 14). Doppler testing can assess the hull thickness if required. We hypothesize that, given years, the wreck may become encapsulated by biological foulants, which would cause partial or whole separation of the anodic and cathodic sites effectively slowing the corrosion rate. Professional advice should be sought as to the design and implementation of a structural monitoring program.

The vessel will provide hard substrate for the settlement of sessile invertebrates and algae. It is also expected to attract mobile organisms, including reef fish. Periodically, the hull and superstructure will corrode to the point where some of this encrusting colonisation material is 'sloughed' off to create drift algae and sponges.

12 Water Quality

Water quality measurements were recorded using a calibrated YSI 6920 V2 multi parameter water quality probe at five sites (WQ1 – WQ5; Figure 17) for the proposed scuttling site. Measurements were taken at approximately 1.0 m intervals in depth throughout the water column from the surface to the bottom at each sample site. Water quality parameters measured were:

- Temperature (°C)
- Conductivity (mS cm^{-1})
- Salinity (ppt)
- pH
- Turbidity (NTU)
- Dissolved Oxygen (%)

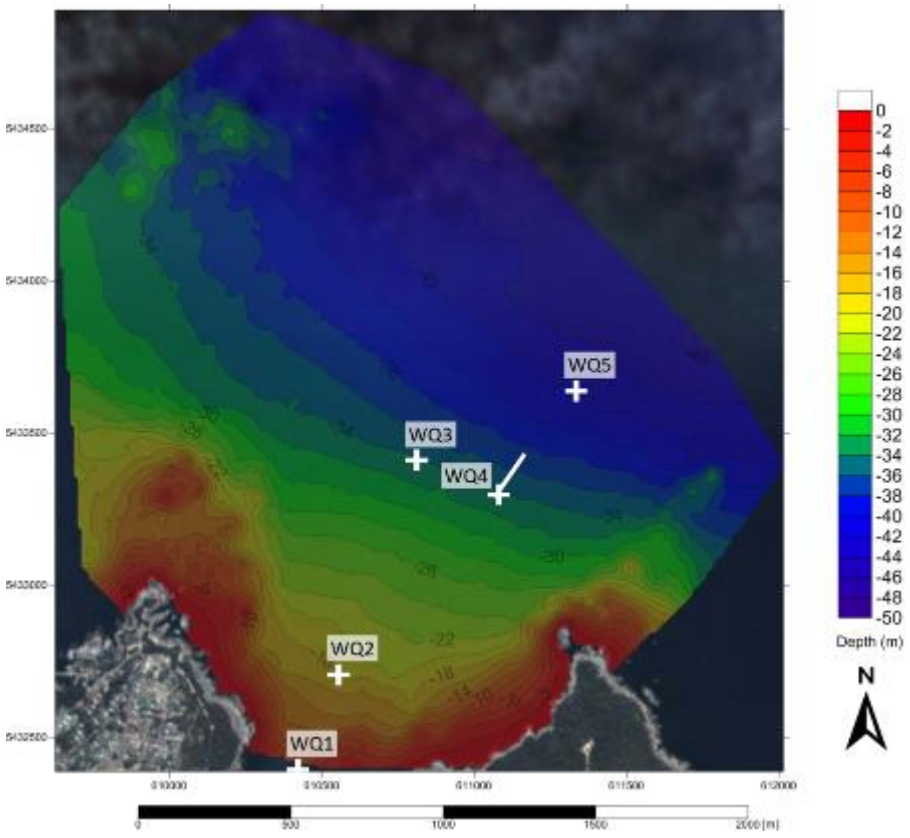


Figure 17 Location of water quality in relation to the proposed scuttling site

Note: Location of water quality sampling sites are representative only. For precise GPS coordinates, see the appendices.

No obvious trends were observed between the five sample sites for conductivity (Figure 18B), salinity (Figure 18C), or turbidity (Figure 18E). There was some variation in measurements between the WQ1 sample site and all other sample sites for temperature (Figure 18A), and dissolved oxygen (Figure 18F). Temperature and dissolved oxygen concentrations were marginally lower at WQ1 than the other water quality sampling sites. This is due to the shallow nature of the WQ1 site compared to other sites. There was also a slight difference in pH readings between sample sites, which appeared to be a consequence of pH readings not stabilising rapidly enough between sample sites, as the pH progressively increased from the first sample site (site WQ1) to the final sample site (site WQ5). However, this difference was only very minor, with the difference being 0.03 between the first and last sample sites.

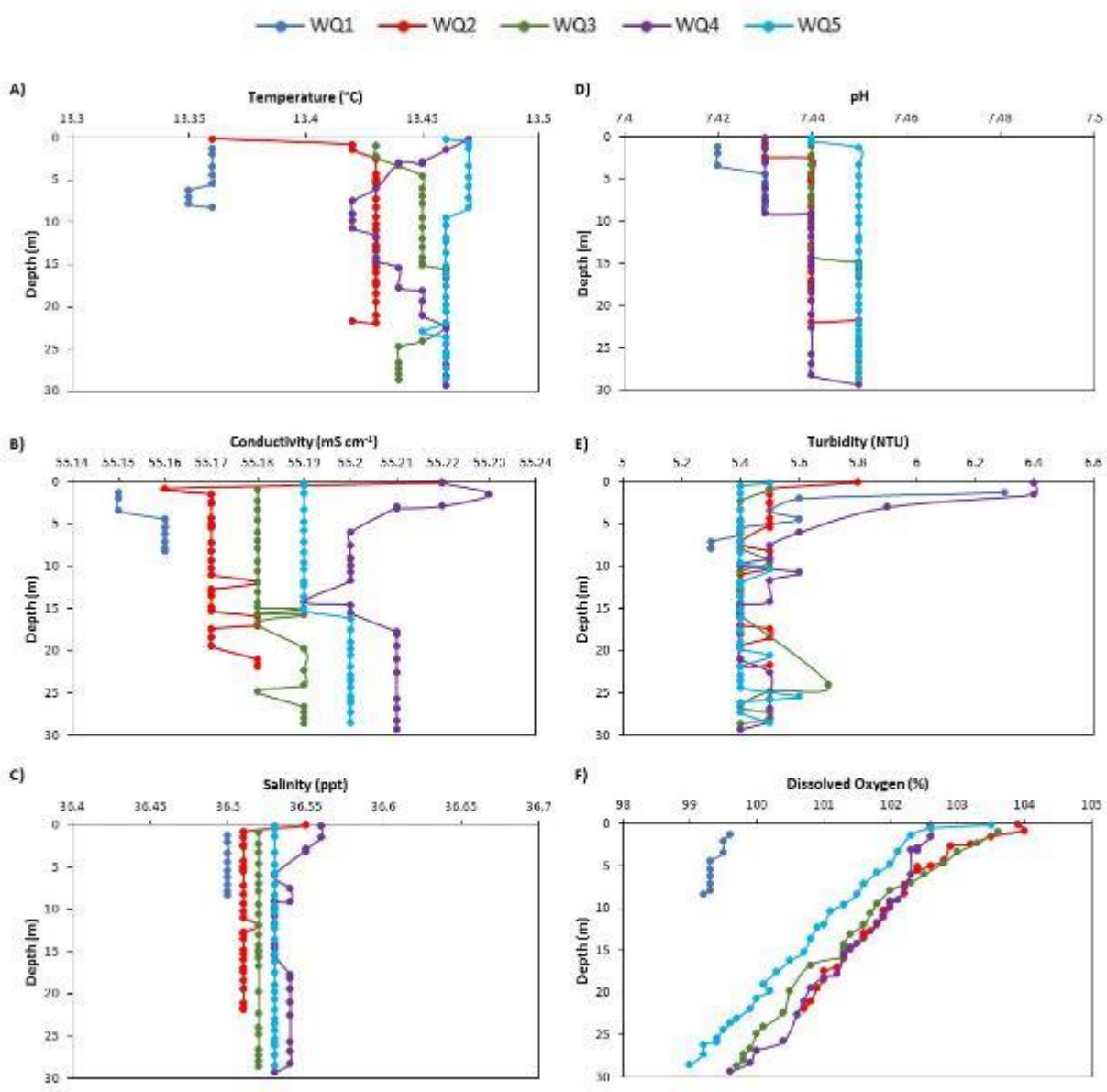


Figure 18 Water quality measurements conducted at five sites in the area of the proposed scuttling site

Water temperatures were relatively stratified, with no major changes in temperature with depth at most sites apart from measurements taken at the proposed scuttling site (WQ4). The temperature at WQ4 gradually decreased by 0.04 °C from the surface to 7.5 m depth before increasing again by 0.03 °C between 11 m and the sea floor. This minor difference in temperature may be due to the sub-surface current experienced by divers near the WQ4 site while retrieving the ADCP.

Conductivity, salinity, and pH remained consistent with depth at all sample sites. There was a slight decrease in conductivity (55.22 to 55.16 mS cm^{-1}) and salinity (36.55 to 36.51) between the surface and 1m at WQ2. Conductivity and pH ranged between 55.23 and 55.15 mS cm^{-1} and 7.45 and 7.42, respectively over all sites examined. Salinity measurements were between 36.56 and 36.50 ppt for all sites examined.

Turbidity was similar across all water quality sampling sites, with a slightly higher turbidity in surface waters across all sites. The higher turbidity on the surface is likely due to the considerable wind chop experienced on the day of sampling (refer to Appendix 2). Turbidity ranged between 6.4 and 5.3 NTU over all sites examined.

Dissolved oxygen concentrations were higher on the surface at all sampling sites, which is a consequence of increased aeration caused by wind chop on the water surface on the day of sampling. As is typical of marine systems, dissolved oxygen concentrations decreased with depth but still remained at high levels, ranging between 99.0% and 103.9%, for all sites.

13 Fisheries/Aquaculture Interactions

Skeleton Bay and the waters around northeast Tasmania are utilised by both commercial and recreational fishers. Rock lobster and abalone are the primary targets of fisheries in the region. Scalefish are also targeted commercially (see Table 4) and recreationally (primarily flathead) in the region. There are no aquaculture operations in the immediate vicinity of the proposed scuttle site; however, there is a well-established ` farming industry in St Helens.

Table 4 Summary of fishing methods and commercially targeted scalefish species in north-east Tasmania (Hartman and Lyle 2011).

Fishing Method	Target Species	Comments
Purse seine netting	Squid Jack Mackerel Redbait Garfish	Not applicable at proposed scuttling site (legislation prohibits use within 1 nm offshore)
Beach seine netting	Australian Salmon Garfish	Not applicable at proposed scuttling site (used from shallow shore base)
Graball/small mesh netting	Blue Warehou Banded Morwong Flounder Other (opportunistically – bycatch)	Not applicable at proposed scuttling site (used on rocky reefs)
Handline	Striped Trumpeter Wrasse	Reef associated species
Dipnet	Garfish Squid	Not applicable at proposed scuttling site (used from shallow shore base)
Dropline/longline	Striped Trumpeter	Reef-associated species
Spear	Flounder	Not applicable at proposed scuttling site (depth of site)
Fish trap	Wrasse	Reef-associated species
Squid jig	Squid	

It is likely that a fishing exclusion zone will be imposed, encompassing the area immediately around the wreck, so that fishers will not pose a hazard to divers on the wreck. The physical displacement of fishers from fishing grounds is not thought to be an issue for rock lobster or abalone fishers, as the wreck will be located on sediment not reef, and therefore will not impede access to these fishers' targeted habitat. The displacement of scalefish fishers could pose a potential conflict, with recreational flathead identified as the most likely fishery to be impacted. However, any impact is

thought to be minimal as the area will be relatively small and is not considered to be high-value to fishers relative to the wider area of available fishing grounds surrounding the site. There will not be any impacts on trawl fishers, as under state legislation[5], the holder of a general trawling fishing licence is prohibited from trawling within 1 nautical mile of any part of the coast of Tasmania (except Ile des Phoques), so there will be no spatial overlap.

Colonisation of fish to the wreck may result in a localised increase of some species' populations. There may be a spill-over effect to adjacent reefs outside of the anticipated fishing exclusion zone, potentially resulting in increased fishing opportunities in the region.

Any broad scale impact from sinking the vessel, or leaks and other contamination post-scuttling, could have a correspondingly significant effect on fisheries. In particular, TBT antifoulant is widely recognised as developmentally toxic to molluscs. This report assumes that the vessel hull and interior will be cleaned to an acceptable level prior to hand-over; therefore such impacts are expected to be negligible.

[5] *Fisheries (scalefish) Rules 2004; <http://www.thelaw.tas.gov.au/tocview/index.w3p;cond=;doc_id=%2B91%2B2004%2BAT%40EN%2B20141009000000;histon=;prompt=;rec=;term=>*

14 Ongoing Monitoring

Marine Solutions (2014) has prepared the following document (currently in draft): "*Proposed Monitoring Plan for the Wreck of the HMAS Tobruk in Skeleton Bay, North East Tasmania*", that addresses information in relation to;

A) The environmental approvals process to scuttle a vessel
B) The pre scuttling planning process
C) The post scuttling environmental and structural monitoring

The plan outlined has been constructed in consideration of other monitoring plans adopted for similar naval ship scuttling projects in the past, including the HMAS Perth (Western Australia, 2001) the HMAS Swan (Western Australia, 1997) and the Troy D (Tasmania, 2006). Rough costs have been provided; however it is emphasised that these are indicative pricings only; accurate pricings are difficult to estimate at this stage. The relevant monitoring will become evident during the development of the notice of intent to scuttle, and throughout the approvals process.

Two distinct types of monitoring will likely be required:

1. Environmental monitoring (independent monitoring to assess environmental effects over the initial 1-5 years).
2. Structural assessment/monitoring (independent structural assessment on an ongoing basis approximately every 5-10 years. The advice of a suitably qualified engineer should be sought to determine the appropriate frequency at which such assessments need occur).

Environmental monitoring will include multiple aspects including, but not necessarily limited to:

- photo monitoring of quadrats (primary colonisation)
- logging of fish species identified on the vessel(secondary colonisation)
- photo monitoring of gastropods colonies located on the vessel (secondary colonisation)
- Sediment contamination monitoring
- Water quality monitoring
- Monitoring of adjacent reefs to determine if the wreck has 'drawn' fish from the reefs.

By working with the local diving community, a community-based colonisation and ecological monitoring program can be developed, with considerable merit in terms of both community

involvement and value-adding to understanding impacts. It is stressed that community-based programs cannot be relied upon as the sole monitoring mechanism, and must be treated as complimentary to any monitoring requirement made under permit.

It should be acknowledged that the waters around north-east Tasmania are well-recognised as a range extension hotspot (RedMap 2014; Pitt *et al* 2010; Ling *et al* 2009). Therefore it is reasonable to predict that species that are not currently known from the area will colonise and/or increase in abundance in the area, due to processes entirely independent of the proposed scuttling.

15 Conclusions

The results of our surveys indicate that Skeleton Bay contains an environmentally suitable area for the scuttling of a vessel the dimensions of the *HMAS Tobruk*. This is on the basis of:

- Suitable water depth range to avoid shipping navigation impediments, but not so deep as to preclude recreational SCUBA diving;
- Sufficient sand depth on the seabed to support the resting wreck; and
- Minimal foreseen detrimental impacts on existing Natural Values.

At this stage, we suspect that that the most suitable alignment for the scuttled vessel is an alignment perpendicular to the seabed depth contours, so as to decrease the amount of surface area of the vessel exposed to the predominant swells and current. The bow should face the shore, so that the highest points of the vessel are sitting in deeper water. However, further investigations are warranted to confirm the peak wave direction at this site

The site chosen is a mobile sand environment spatially removed from the nearest reef, therefore it is depauperate in fish, algae and invertebrates. There is a risk of detrimental impacts during scuttling on individuals within close vicinity. However, based on site characteristics, any impact is unlikely to be large-scale.

One major consideration is the potential impact to marine mammals as a direct result of acoustic trauma during detonation of explosives used to scuttle the vessel. Guidelines for seismic activity provided by DEWHA (2008) must be adhered to. To minimise the risk to whales, and the risk of delays to planned works, scuttling should be avoided between May and November if possible, as whales are more common in Tasmanian waters throughout these months.

Should this project proceed to the next stage, there are some critical areas of work to be conducted including but not limited to;

- A Notice of Intent outlining the project
- An application for a seabed lease under the *Crown Lands Act 1976*
- A permit under the *Environment Protection (Sea Dumping) Act 1981*
- Evidence of compliance with *the Environment Protection and Biodiversity conservation Act 1999*

- A diver access/egress plan informed by a naval architect
- A feasibility study and business plan
- A full environmental risk assessment
- Stakeholder liaison and communication
- A detailed vessel preparation plan to remove all hydrocarbons, plastics, asbestos, electrical cabling, fuel voids, coffer dams and any other potentially noxious substances/structures prior to scuttling
- A detailed scuttling plan outlining marine mammal, spectator, vessel management etc. on the day of the scuttling.

In summary, no major potential ecological contraventions resulting from the scuttling of the *HMAS Tobruk* at the proposed site in Skeleton Bay have been identified. When compared to other wreck sites around Australia, and globally, it provides many positive characteristics for a quality dive experience including;

- Spectacular topside scenery
- A short boat ride limiting seasickness and allowing multiple trips/day
- Good water visibility
- Low current velocities
- Protected from the prevailing westerly winds

Should this project proceed to the next stage, we have every confidence that the natural values of the Binalong Bay, Skeleton Bay and Bay of Fires Conservation Area would not be compromised by the scuttling of the *HMAS Tobruk* at the proposed location.

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17 Appendices

Appendix 1. DVD of video transects

See DVD attached with this report.

Appendix 2. Operational Summary

Date:	01/07/2014	02/07/2014	28/07/2014
Onsite work commencement:	~08:50	~09:00	~10:00
Onsite work concluded:	~15:30	~12:30	~13:00
Personnel:	I. Cooksey S. Ibbott M. Jensen L. Smith	I. Cooksey S. Ibbott M. Jensen L. Smith	I. Cooksey M. Jensen L. Smith
Aspects covered included:	- Bathymetry and habitat mapping - ADCP deployment - Towed video recording - Jet probing - Collection of sediment samples	- Fish count transects	- Retrieval of ADCP - Water quality measurements at 5 sites
Wind:	0 - 5 knots W	0 – 5 knots W/NW	15 – 20 knots N
Cloud cover:	2/8 increasing to 7/8	2/8	6-8/8
Sea:	Calm	Calm	Choppy, 1m swell
Tides (Hobart):	(05:26 - 0.5m) (12:30 - 1.1m) (16:36 - 1.0m) (22:14 - 1.3m)	(06:00 - 0.6m) (13:00 - 1.1m) (18:01 - 1.0m) (23:04 - 1.2m)	(03:33 - 0.5m) (10:19 - 1.0m) (13:26 - 1.0m) (20:28 - 1.3m)

Appendix 3. GPS locations of sampling sites

Site	Zone	Easting	Northing	Notes	
ADCP	55 G	611095.2	5433316	Position of ADCP deployment	
FISH T1 START	55 G	611264.9	5432866		
FISH T1 END	55 G	611265.2	5432670		
FISH T2 START	55 G	610244.5	5432638		
FISH T2 END	55 G	610146.8	5432809		
JP1	55 G	611107.1	5433312	Jet probing sites	
JP2	55 G	611127.9	5433341		
JP3	55 G	611160.2	5433360		
JP4	55 G	611172.4	5433372		
JP5	55 G	611178.3	5433362		
JP6, JP7, JP8	55 G	*Exact GPS locations not recorded. Refer to* Figure 15 *for approximate locations.*			
Sediment Sample 1	55 G	611085	5433315	Sediments collected. Marine Solutions have retained samples, should future analysis be required	
Sediment Sample 2	55 G	611136.6	5433389		
Sediment Sample 3	55 G	611181.7	5433457		
Sediment Sample 4	55 G	610361.8	5432409		
Sediment Sample 5	55 G	610334.7	5432884		
Video 1	55 G	610588.9	5433080	Sand, middle of bay	Towed video transect sites
Video 2	55 G	610389.2	5433003	Reef edge west	
Video 3	55 G	610441.2	5432656	Reef edge west	
Video 4	55 G	610570.3	5432451	Reef edge west	
Video 5	55 G	611006.7	5432675	Reef edge west	
Video 6	55 G	611195.5	5432904	Reef edge east	
Video 7	55 G	611473.5	5433067	Reef edge east	
Video 8	55 G	610019.2	5433765	Reef edge west	
Video 9	55 G	610225.8	5434421	Reef edge north-west	
Video 10	55 G	611153.6	5433374	Proposed scuttle site	
WQ 1	55 G	610409.6	5432390	Water quality sites	
WQ 2	55 G	610603.4	5432739		
WQ 3	55 G	610930.3	5433378		
WQ 4	55 G	611091	5433316		
WQ 5	55 G	611437.2	5433817		

Appendix 4. List of all observed subtidal species

		Common Name	Scientific Name
Algae & Seagrasses	Brown algae	Common kelp	*Ecklonia radiata*
		Bristled crayweed	*Seirococchus* sp. (*axillaris*?)
		Crayweed	*Phyllospora comosa*
		Fanweed	*Zonaria* sp.
		Succulent seaweed	*Carpoglossum* sp.
		Bull kelp	*Durvillaeaa* sp.
	Green algae	Codium weed	*Codium* sp.
		Caulerpa weed	*Caulerpa* sp.
	Red algae	Plocamium weed	*Plocamium* sp.
		Encrusting corraline algae	
		Rosy corraline algae	*Haliptilon roseum*
Invertebrates	Arthropods	Red bait crab	*Plagusia chabrus*
	Molluscs	Black-lip abalone	*Haliotis rubra*
		Turbo shell	*Turbo* sp.
		Nudibranch	
		Red triton	*Charonia lampas*
	Echinoderms	Long-spined sea urchin	*Centrostephanus rodgersii*
		Egg urchin	*Holopneustes* sp.
		Purple urchin	*Heliocidaris erythryogramma*
	Other	Sponges	
		Zooanthids	
Vertebrates	Fish	Marblefish	*Aplodactylus sp.*
		Southern cardinalfish	*Vincentia conspersa*
		Banded morwong	*Cheilodactylus spectabilis*
		Magpie perch	*Cheilodactylus nigripes*
		Longfin pike	*Dinolestes lewini*
		Old wife	*Enoplosus armatus*
		Luderick	*Girella tricuspidata*
		Zebra fish	*Girella zebra*
		Wrasse, Castelnau's	*Dotalabrus aurantiacus*
		Purple wrasse	*Notolabrus fucicola*
		Bluethroat wrasse	*Notolabrus tetricus*
		Senator wrasse	*Pictolabrus laticlavius*
		Rosy wrasse	*Pseudolabrus rubicundus*
		Wrasse	I.D. not confirmed
		Bastard trumpeter	*Latridopsis forsteri*
		Leatherjacket	I.D. not confirmed

	Bridled leatherjacket	*Acanthaluteres spilomelanurus*
	Toothbrush leatherjacket	*Acanthaluteres vittiger*
	Brown-striped leatherjacket	*Meuschenia australis*
	Goatfish	*Upeneichthys vlamingii*
	Herring cale	*Odax cyanomelas*
	Bullseye	*Pempheris sp.*
	Long-snouted boarfish	*Pentaceropsis recurvirostris*
	Blotch-tail hula fish	*Trachinops caudimaculatus*
	White ear	*Parma microlepis*
	Scaly fin	*Parma victoriae*
	Mado sweep	*Atypichthys strigatus*
	Sweep	*Scorpis aequipinnis*
	Sweep	*Scorpis lineolata*
	Butterfly perch	*Caesioperca lepidoptera*
	Barber perch	*Caesioperca rasor*
	Banded stingaree	*Urolophus cruciatus*
Mammals	Common dolphin	*Delphinus delphis*
	Australian fur seal	*Arctocephalus pusillus*

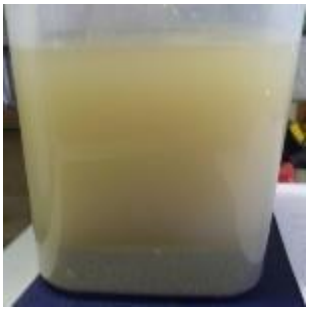
Species identified using Edgar (2008) and Jansen (2000) where not previously known.

Appendix 5. Fish Count Transects: Raw Data

Family	Common name	Scientific name	Number of individuals counted	
			East total	West total
Aplodactylidae	Marblefish	*Aplodactylus sp.*	2	1
Apogonidae	Southern cardinalfish	*Vincentia conspersa*	1	1
Cheilodactylidae	Banded morwong	*Cheilodactylus spectabilis*	7	5
Dinolestidae	Longfin pike	*Dinolestes lewini*	29	0
Enoplosidae	Old wife	*Enoplosus armatus*	0	3
Girellidae	Luderick	*Girella tricuspidata*	0	1
	Zebra fish	*Girella zebra*	3	3
Labridae	Wrasse, Castelnau's	*Dotalabrus aurantiacus*	1	1
	Purple wrasse	*Notolabrus fucicola*	3	3
	Bluethroat wrasse	*Notolabrus tetricus*	15	16
	Senator wrasse	*Pictolabrus laticlavius*	0	1
	Rosy wrasse	*Pseudolabrus rubicundus*	2	1
Labridae?	Unidentified wrasse	*?*	0	1
Latridiidae	Bastard trumpeter	*Latridopsis forsteri*	0	1
Monacanthidae	Bridled leatherjacket	*Acanthaluteres spilomelanurus*	1	2
	Toothbrush leatherjacket	*Acanthaluteres vittiger*	1	1
	Brown-striped leatherjacket	*Meuschenia australis*	1	2
Monacanthidae?	Unidentified leatherjacket	*?*	0	1
Mullidae	Goatfish	*Upeneichthys vlamingii*	5	1
Odacidae	Herring cale	*Odax cyanomelas*	1	1
Pempheridae	Bullseye	*Pempheris sp.*	0	10
Plesiopidae	Blotch-tail hula fish	*Trachinops caudimaculatus*	64	36
Pomacentridae	White ear	*Parma microlepis*	0	1
	Scaly fin	*Parma victoriae*	0	1
Scorpididae	Mado sweep	*Atypichthys strigatus*	0	2
	Sweep	*Scorpis aequipinnis*	20	2
	Sweep	*Scorpis lineolata*	3	0
Serranidae	Butterfly perch	*Caesioperca lepidoptera*	203	1
	Barber perch	*Caesioperca rasor*	0	1
Urolophidae	Banded stingaree	*Urolophus cruciatus*	1	1

Appendix 6. Photographic record of sediment settling trial


t = 0 seconds


t = 30 seconds


t = 45 seconds


t = 1 minute


t = 2 minutes


t = 4 minutes


t = 17 minutes


t = 30 minutes


t = 45 minutes