St Helena Government

# Marine life abundance and diversity surveys for long term monitoring

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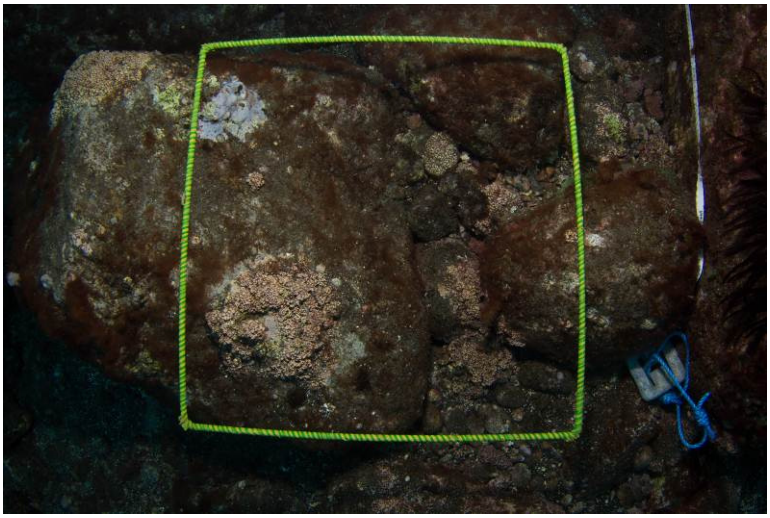

## Environmental Management Division

## Saint Helena Government

July 2014

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DARWIN INITIATIVE

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St Helena Government

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# Document history

**Marine life abundance and diversity surveys for long term monitoring**

Environmental Management Division

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# Executive Summary

Long term monitoring of the marine environment is imperative to establish baselines and can be critical in identifying both natural and anthropogenic changes to the biodiversity or habitats. Underwater visual surveys for fish diversity and abundance have been conducted since 2002 and enhanced to include invertebrates and habitats from 2013. Sites for continued monitoring are given along with proposed additional annual monitoring.

# 1 Introduction

To gain an understanding of reef community structure in different marine habitats in St Helena's inshore waters it is important to gather baseline data on abundance and diversity of fish and invertebrate species. For long term monitoring it is important to cover a variety of habitats and depth zones whilst also obtaining both seasonal and spatial coverage. Quantitative underwater visual surveys provide an effective tool to cover reasonably large areas and gather a variety of data.

Underwater fish surveys were carried out twice a year along eighteen sights on the leeward side of the Island. The surveys were started in October 2002 to gather information about abundance and distribution of fish populations, these continued for five years until April 2007 with surveys twice a year in summer (April) and in winter (October). There was a gap in data and then surveys were conducted in October 2011. In total 197 surveys were conducted over this time. The survey methodology was slightly adapted to include marine invertebrates and photo quadrats, to target a variety of habitat types and a range of depths. 90 surveys were conducted in April 2013 and 60 surveys in October 2013.

# 2 Methodology

A) Methodology used from 2002-2011: A fifty metre transect line is laid down from a pre-defined position on the seabed. The preferred depth was approximately 10m, with depth being no less than 4-5m and no more than 15m. Two divers swam 2m above the transect line and recorded all fish species 2m either side. The number and estimated length of each grouper (*Epinephelus adscensionis*), squirrelfish/hardback solider (*Holocentrus adscensionis*), blackbar soldierfish/softback soldier (*Myripristis jacobus*) and glasseye snapper/bullseye (*Heteropriacanthus cruentatus*) was recorded along with the number of spotted moray eel (*Gymnothorax moringa*). Target species were species that are heavily fished by inshore fishermen. The abundance of 13 endemic and 12 common species (species that are commonly found worldwide) were recorded using pre-defined abundance groups (see Henry et al 2013).

B) Methodology used from 2013: The survey team consisted of two species counters and a camera man. One counter placed a weighted end of a 50m tape measure at a selected position on the seabed (ensuring it wasn't dragged behind the diver). The tape measure was attached to the diver and reeled out behind them as they conducted the first count. The transect was conducted at a pre-set depth band and remained within a single habitat type (habitat type is noted on the top of the recording form). On the first count two divers recorded all invertebrate and bottom dwelling fish species in a one metre belt either side of the transect for fifty metres (ie 2mx50m). The camera man followed behind the counters and used a $1m^2$ quadrat to photograph (with a Canon 60D camera in underwater housing with 10mm wide angle lens) habitat randomly every two metres along the 50m transect line. Photographs were alternated from one side to the other along the line. At the end of the 50m the counters waited for the camera man to finish the quadrat photographs, then they returned down the length of the transect. On the second (return) count divers then counted all other fish species in a 5m belt either side of the transect line (ie 5mx50m). The cameraman followed

behind and reeled in the tape measure. At both ends of the transect line the camera man also took some general habitat photographs.

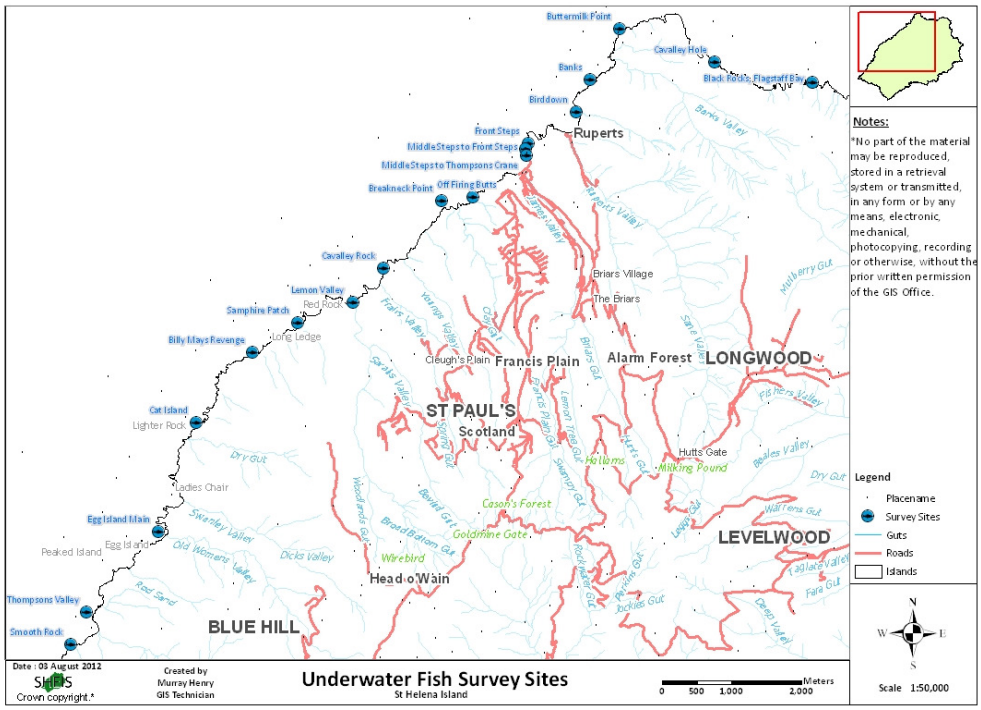


Figure 1: Historical fish survey sites from 2002-2011

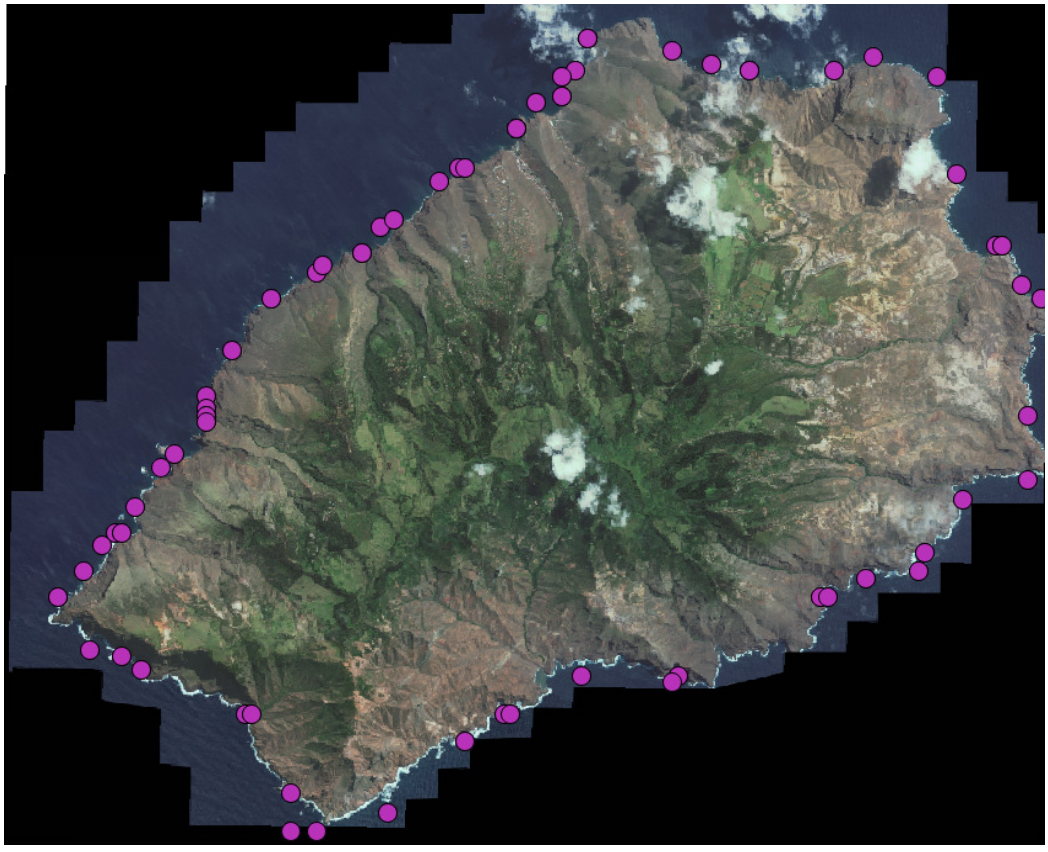

Figure 2: Historical fish survey sites 2013

For all sites from November 2012 JNCC sub-littoral habitat forms have been completed. On the form semi-quantitative (abundance scores) for all species seen within the dive (not just during the survey) for within the habitat are recorded. Details of the habitat are documented including substrate type including %, inclination, features of the rock and sediment, modifiers and site assessment. Data from the JNCC forms are entered into Marine Recorder; separated by survey type eg all habitat/biodiversity surveys in one event, wreck surveys in a separate event.

Prior to any surveyors conducting species count surveys they are required to learn all fish and invertebrate species and are tested on their knowledge (xMarine section/Species of St Helena/JNCC & survey form/St Helena species for survey TEST). Cameraman should have a trial dive to practise changing settings and ensuring the full quadrat is within the photo frame and the picture is not taken at an angle.

# 3 Long term monitoring sites

To identify both natural and anthropogenic changes to the biodiversity or habitats long term sites should be established collecting both temporal (seasonal and annual) and spatial data. It is imperative that sites remain within a single habitat type (eg all sand, all bedrock, all cobbles) and as far as possible along a depth contour. Depth bands are 5m (between 0-7m); 10m (between 7-14m) and 20m (14-21m), however it is more important to remain within a habitat type. 22 sites have been selected for biannual monitoring (April and October) and these are given in Table 1 and Figure 1. Each team of divers should be able to survey two sites in a day, however at some sites two transects on different habitats are possible (especially if one transect is sand). The exposed side of the island is more difficult logistically to survey but to ensure full spatial coverage a further 22 sites are to be surveyed in both seasons on a 5 yearly basis. The methodology as described in Section 2B should be used for all surveys.

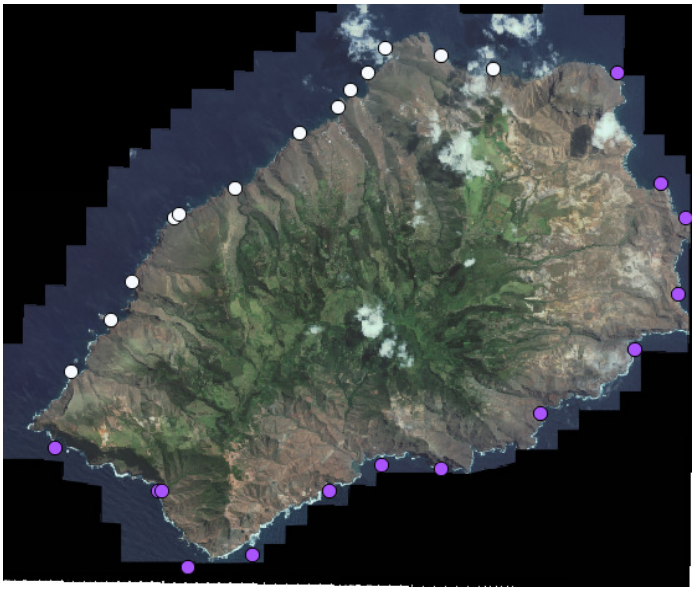

Figure 3: Biannual (white) and 5 yearly (purple) long term monitoring site locations

Table 1: Biannual and 5 yearly long term monitoring site locations, depth zone and habitat type. * denotes a survey which could be conducted as part of the same dive as the other survey at the same site

| Survey type | Site | Latitude | Longitude | Depth class | Habitat class |
|---|---|---|---|---|---|
| Biannual | Black rocks (Flagstaff Bay) | -15.912 | -5.682 | 7-14m | Bedrock/boulder |
| Biannual | Black rocks (Flagstaff Bay)* | -15.912 | -5.682 | 7-14m | Sand |
| Biannual | Cavalley Hole (Flagstaff Bay) | -15.909 | -5.694 | 7-14m | Bedrock/boulder |
| Biannual | Cavalley Hole (Flagstaff Bay)* | -15.909 | -5.694 | 14-21m | Sand |
| Biannual | Buttermilk Point | -15.907 | -5.707 | 7-14m | Bedrock/boulder |
| Biannual | Buttermilk point | -15.907 | -5.707 | 14-21m | Cobbles |
| Biannual | Banks | -15.913 | -5.711 | 7-14m | Bedrock/boulder |
| Biannual | Banks* | -15.913 | -5.711 | 14-21m | Sand |
| Biannual | Rupert's Bay | -15.917 | -5.715 | 7-14m | Bedrock/boulder |
| Biannual | Rupert's Bay* | -15.917 | -5.715 | 7-14m | Sand |
| Biannual | Wharf steps | -15.921 | -5.718 | 0-7m | Bedrock/boulder |
| Biannual | James Bay (middle steps to front steps) * | -15.921 | -5.718 | 7-14m | Sand |
| Biannual | James Bay (middle steps to Thompsons crane) | -15.921 | -5.718 | 7-14m | Bedrock/boulder |
| Biannual | Off Firing Butt | -15.927 | -5.727 | 0-7m | Bedrock/boulder |
| Biannual | Off Firing Butt* | -15.927 | -5.727 | 7-14m | Sand |
| Biannual | Bennetts Point | -15.962 | -5.766 | 14-21m | Bedrock/boulder |
| Biannual | Billy May Revenge | -15.947 | -5.756 | 7-14m | Bedrock/boulder |
| Biannual | Billy May Revenge | -15.947 | -5.756 | 14-21m | Boulder (& sand) |
| Biannual | near Bedgellet wreck | -15.946 | -5.755 | 14-21m | Cobbles |
| Biannual | Lemon Valley | -15.940 | -5.742 | 7-14m | Cobbles |
| Biannual | Lemon Valley | -15.940 | -5.742 | 0-7m | Bedrock/boulder |
| Biannual | Egg Island Main | -15.971 | -5.771 | 0-7m | Bedrock/boulder |
| Biannual | Egg Island Main* | -15.971 | -5.771 | 14-21m | Sand |
| Biannual | Black Rock Eyes (near Thompsons Valley) | -15.983 | -5.780 | 14-21m | Bedrock/boulder |

| | | | | | |
|---|---|---|---|---|---|
| Every 5 years | King and Queen rocks | -15.947 | -5.637 | 14-21m | Cobbles |
| Every 5 years | Manati Bay | -16.011 | -5.760 | 14-21m | Bedrock/boulder |
| Every 5 years | Manati Bay | -16.011 | -5.759 | 14-21m | Cobbles |
| Every 5 years | Porchus gate | -15.965 | -5.639 | 14-21m | Cobbles |
| Every 5 years | Powell's valley | -15.993 | -5.671 | 7-14m | Bedrock/boulder |
| Every 5 years | Powells Valley, Deep valley Bay | -15.993 | -5.671 | 14-21m | Bedrock/boulder |
| Every 5 years | Prosperous Bay | -15.939 | -5.643 | 0-7m | Cobbles |
| Every 5 years | Prosperous Bay | -15.939 | -5.643 | 7-14m | Cobbles |
| Every 5 years | Waterfalll (nr Sandy Bay) | -16.011 | -5.720 | 7-14m | Bedrock/boulder |
| Every 5 years | Waterfalll (nr Sandy Bay) | -16.011 | -5.720 | 14-21m | Cobbles |
| Every 5 years | Windy Cove | -16.001 | -5.784 | 14-21m | Bedrock/boulder |
| Every 5 years | Windy Cove | -16.001 | -5.784 | 7-14m | Bedrock/boulder |
| Every 5 years | Barn Point (lower flat rock) | -15.913 | -5.653 | 7-14m | Bedrock/boulder |
| Every 5 years | Barn Point (lower flat rock) | -15.913 | -5.653 | 14-21m | Sand |
| Every 5 years | Speery Island | -16.029 | -5.753 | 7-14m | Bedrock/boulder |
| Every 5 years | Speery Island | -16.029 | -5.753 | 14-21m | Bedrock/boulder |
| Every 5 years | Yam bay | -15.978 | -5.649 | 14-21m | Bedrock/boulder |
| Every 5 years | Yam bay | -15.978 | -5.649 | 7-14m | Bedrock/boulder |
| Every 5 years | Frightus Bay | -16.026 | -5.738 | 7-14m | Bedrock/boulder |
| Every 5 years | Frightus Bay | -16.026 | -5.738 | 7-14m | Bedrock/boulder |
| Every 5 years | Sandy Bay Island | -16.005 | -5.708 | 14-21m | Cobbles |
| Every 5 years | Sandy Bay Island | -16.006 | -5.694 | 7-14m | Bedrock/boulder |

Table 2: Summary of habitat types and depths zones for the long term monitoring sites

| | **Habitat class** | **0-7m** | **7-14m** | **14-21m** |
|---|---|---|---|---|
| **Lee side (Biannual)** | Bedrock/boulders | 4 | 7 | 3 |
| | Cobbles | | 1 | 2 |
| | Sand | | 4 | 3 |
| **Exposed side (every 5 years)** | Bedrock/boulders | | 9 | 5 |
| | Cobbles | 1 | 1 | 5 |
| | Sand | | | 1 |

# 4 Rupert's Bay wharf monitoring sites

In 2014 a large permanent wharf in Rupert's Bay area for cargo and commercial vessels is being built and as a result the bay area will be subjected to change caused by alterations in water movements and the increases in shipping traffic. Prior to the construction two monitoring sites were established and surveyed either side of the breakwater location to establish a baseline data set from which to monitor any changes in the ecosystem. Habitat type, species abundance, species diversity and the presence of any invasive species will be monitored using the methodology as described in Section 2B.

There were also three surveys conducted on 25th March 2013 at Rupert's Bay which provides some seasonal data for comparison. The locations of these sites were: first survey parallel to length of jetty, second survey parallel to length of jetty, 3rd survey parallel to shore. These were dive sites Q1, Q2 and Q3 and data is available in Clingham and Brown 2013 and in the excel data file "Dive survey data".

The two baseline sites were monitored on the 5th June 2014. These were dive sites Q151 and Q152 and data is available in Clingham and Brown 2014 and in the excel data file "Dive survey data".

Rupert's Bay monitoring site: Location -015.155N, -005.121W

Site 1 approximately 10 metres from the shore - old Buttress used as land mark. Survey conducted at 31 degree bearing line.

Site 2 approximately 20 metres from the shore off current landing steps ladder and NP glory first buoy. Survey conducted at 31 degree bearing line.

These two sites need to be resurveyed on immediate completion of the construction project and thereafter at six monthly intervals during April and October.

# 5 Additional Monitoring

Prior to any known large marine construction projects or establishment of any regulated effluent discharges into the marine environment quantitative surveys are required at the location to be impacted prior to any works being granted permission. This will allow EMD to establish the nature of the species assemblages and habitat that may be affected by the project. This will form part of the EIA (Environmental Impact Assessment) process under the land and planning regulations. Permission to continue should be based on level of impact and presence of any rare, sensitive or threatened species. If the project is granted permission to go ahead continued monitoring of the area impacted should be conducted to establish any longer term effects.

Sites of none regulated or accidental effluent discharges into the marine environment should be monitored immediately after the incident has been reported and subsequently on a regular basis to

establish damage levels and time for recovery. Data should be compared to the closet long term monitoring sites data for the same habitat and depth range.

# 6 Monthly monitoring

A single yearlong project should be conducted (when finances and staff time allows) to examine seasonal fluctuations in species assemblages and how they change over an entire year. To do this four sites should be monitored monthly. These surveys will also allow information on which months different species reproduce and hence identify which seasons species could be potentially more sensitive to either overfishing or impacts on their environment. Sites have been selected to cover a variety of habitat types. If oceanographic data becomes available additional sites could be added if different water masses are identified. During the monthly monitoring surveys it is important to differentiate between the presence of fry, juveniles and adults. At the end of each survey, size should be approximated for ten (if possible) randomly selected individuals for each of the following locally consumed species: grouper (*Epinephelus adscensionis*), squirrelfish/hardback solider (*Holocentrus adscensionis*), blackbar soldierfish/softback soldier (*Myripristis jacobus*) and glasseye snapper/bullseye (*Heteropriacanthus cruentatus*).

Table 3: Site suggestions for monthly monitoring

| Site | Latitude | Longitude | Depth class | Habitat class |
|---|---|---|---|---|
| James Bay (middle steps to front steps) | -15.921 | -5.718 | 7-14m | Sand |
| James Bay (middle steps to Thompsons crane) | -15.921 | -5.718 | 7-14m | Bedrock |
| near Bedgellet wreck | -15.946 | -5.755 | 14-21m | Cobbles |
| Off Firing Butt | -15.927 | -5.727 | 0-7m | Huge boulders/bedrock |

# 7 General specimen collection

129 new records have been found and identified within the two year period 2012-2014 and it is highly likely that there are still many more to be discovered. To build upon this, divers should always carry sample pots with them on every dive. Any specimens which are deemed to be unusual or first sightings should be collected and preserved. A taxonomist list is available, including required preservative and postal addresses for sending samples to, within the document “Marine Taxonomist contact list”. Samples must be labelled and data recorded.

# 8 Oceanographic surveys

Use of a CTD (Conductivity Temperature Depth) recorder would allow for data to be gathered island wide on oceanographic conditions. Ascension Island Conservation department have purchased a CTD

recorder under their current Darwin bid and there is the potential of using this on a short term basis. If this is possible an island wide survey should conducted dropping the CTD the full depth of the water column at as many locations as time allows. These should be conducted at least at 9 locations around the island (Figure 4) and at these locations at least 4 different depths (ie at four increasing distances away from the island) should be conducted (if time and weather permits more should be conducted).

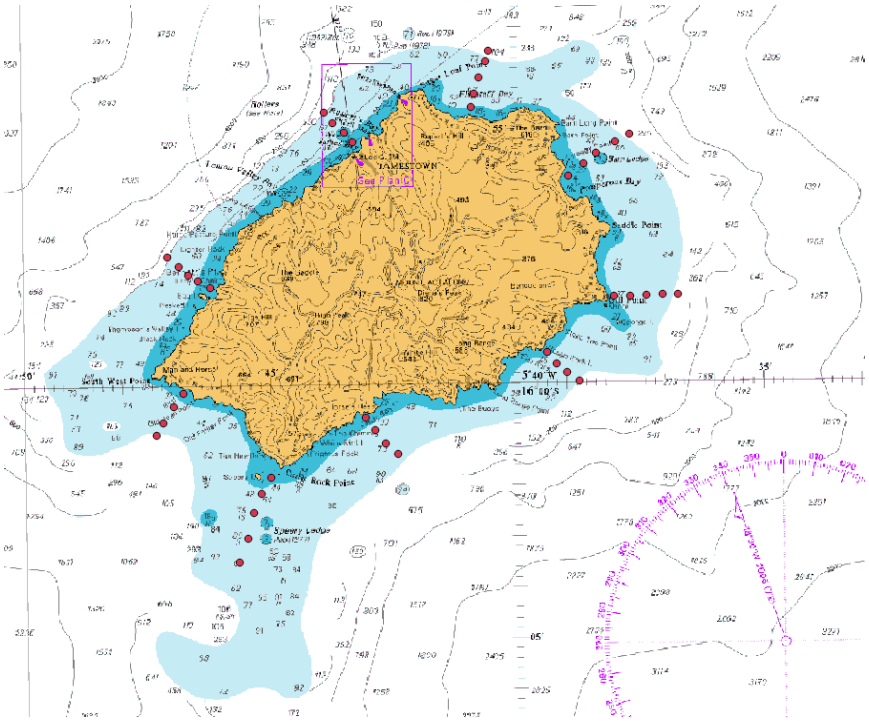


Figure 4: Proposed CTD stations around St Helena

Hobo temperature loggers should be placed at four locations: James Bay, Bedgellet, Buoy's Hole, South West Point, in ideally the same depth (around 10-15m). Table 4 gives approximate positions – suitable locations would need to be established choosing sites which are easy to find again eg attached to the wrecks. These should be left to record for six months before being collected, downloaded, cleaned and replaced immediately. Loggers should be attached to solid objects using cable ties and reference points need to be noted.

If further oceanography data becomes available prior to establishing the sites for the Hobo loggers then adjustment to the locations may be considered to areas with differing oceanography. Although it would be ideal to have temperature loggers placed on the exposed side of the island, in the first instance the sites in Table 4 are chosen for easy of deployment and retrieval. Figure 5 shows sea surface temperature (SST) maps for different times of year and indicates that the lee side of the island differs from the exposed side and therefore deploying the loggers on both sides of the island would be beneficial to compare these temperature differences throughout the year and should be considered when time and finances allow for deployment and retrieval on the exposed side. Suggested sites on the exposed side would include Manati Bay, Sandy Bay Buoys, Near Shore or George Island and Prosperous Bay.

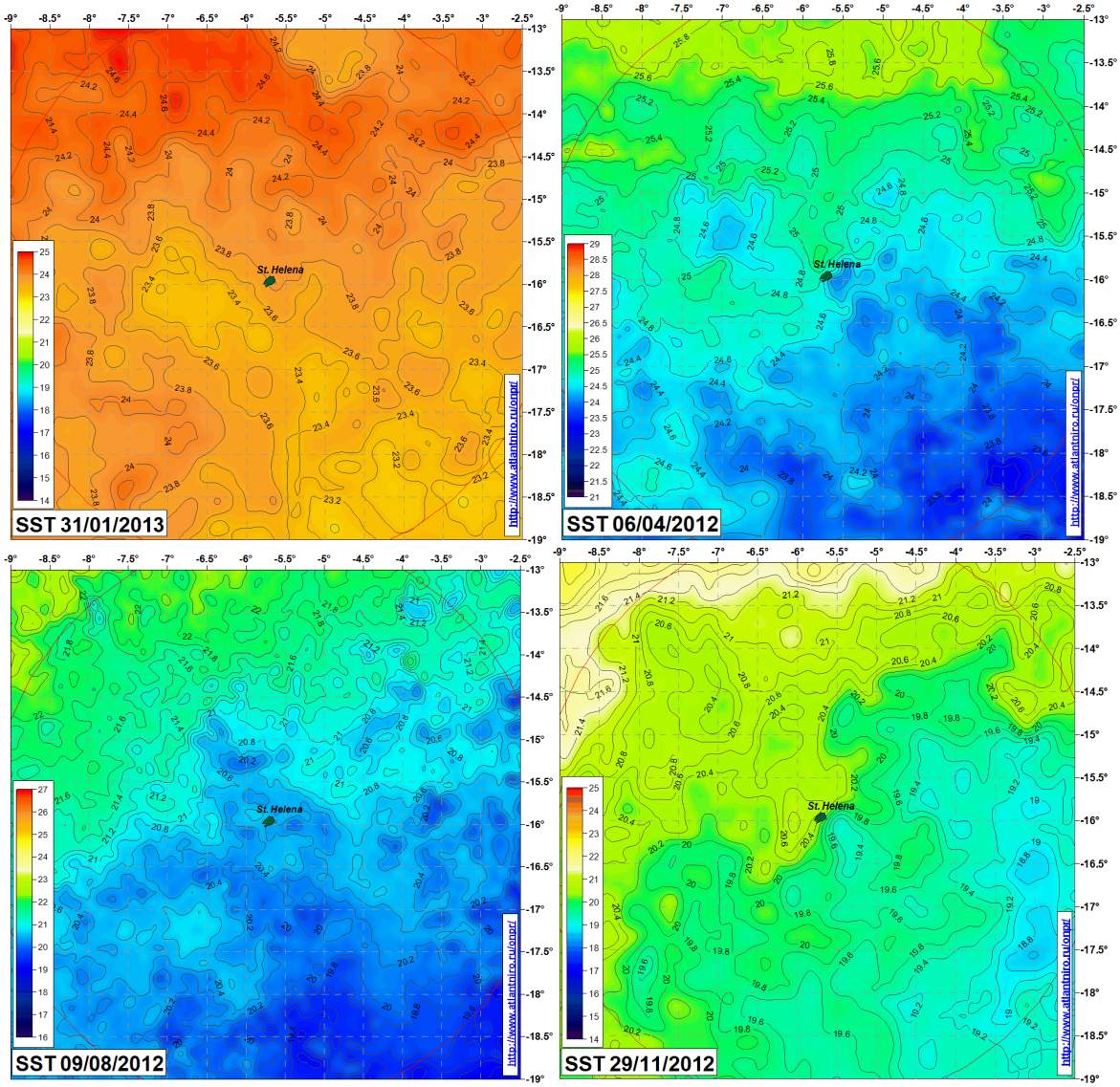


Figure 5: Sea surface temperature maps for the waters around St Helena

Table 4: Site suggestions for TD Hobo loggers recorders

| Site | Latitude | Longitude |
|---|---|---|
| James Bay (Papa Nui) | -15.921 | -5.718 |
| Bedgellet | -15.946 | -5.755 |
| Buoy's Hole | -15.911 | -5.688 |
| South West Point (Lower Eyes Reef) | -15.993 | -5.789 |

# 9 References

Henry, L., Clingham, E., and Beard, A. 2013 Underwater Fish Survey Report. EMD report

Clingham, E. and Brown J. 2013. Marine Ecology Survey at Rupert's Bay, St Helena in conjunction with the Air Access Project. EMD report

Clingham, E. and Brown J. 2014. Marine Ecology Survey at Rupert's Bay, St Helena in conjunction with the Air Access Project. EMD report

# 10 Appendix

## Appendix A. Survey data form

| | | |
|---|---|---|
| Date: | | Habitat description |
| Site code: | | |
| Surveyors: | | |
| Start depth: | End depth: | |
| Triggerfish | Black triggerfish/durgon | |
| | Ocean triggerfish | |
| Silver fish | Sea Chub | |
| | Pompano | |
| | Stonebrass Scad (yellow tail) | |
| | Round scad (clearish tail) | |
| | Mackerel scad | |
| | Rainbow runner | |
| Jacks | Almaco jack | |
| | Guelly jack | |
| | Black jack | |
| Surgeonfish | Ocean surgeonfish | |
| Butterflyfish | Hedgehog butterflyfish | |
| | St Helena butterflyfish | |
| Damselfish | Brown chromis | |
| | St Helena Damselfish | |
| | St Helena Gregory A | |
| | St Helena Gregory J | |
| | Sergeant major | |
| | Sea bream | |
| Filefish | Scrawled filefish | |
| | Unicornfish | |
| Goatfish | Yellow goatfish | |
| Needlefish | Keeltail needlefish | |
| Trumpetfish | Trumpetfish | |
| Razorfish | Marmalade razorfish A | |
| | Marmalade razorfish J | |
| | Yellow razorfish | |
| Boxfish | Cowfish | |
| | St Helena pufferfish | |
| | Porcupinefish | |
| | Reticulate burrfish | |
| Wrasse | St Helena wrasse A | |
| | St Helena wrasse J | |
| | Island hogfish A | |
| | Island hogfish J | |
| Parrotfish | St Helena Parrotfish A | |
| | St Helena Parrotfish J | |
| Grouper | Rockhind | |
| Soapfish | Greater soapfish | |
| Squirrelfish | Squirrelfish | |
| Soldierfish | Blackbar soldierfish | |
| Snapper | Glasseye snapper | |
| | | |
| Cephalopod | Octopus | |

| | | |
|---|---|---|
| Moray eels | Spotted moray | |
| | Brown moray | |
| | Fangtooth moray | |
| | Goldentail moray | |
| | Other eel (name) | |
| Goby | Ascension goby | |
| | Goldspot goby | |
| Blenny | Redlip blenny | |
| | Textile blenny | |
| Cardinalfish | Auxillary-spot cardinalfish | |
| Lizardfish | Bluntnose lizardfish | |
| | Diamond lizardfish | |
| Flatfish | St Helena flounder | |
| Triplefin | Ascension triplefin | |
| Dragonet | Baird's dragonet | |
| Hawkfish | Red spotted hawkfish | |
| Scorpionfish | Spotted scorpionfish | |
| | Red scorpionfish | |
| Echinoderms | Sand star | |
| | Purple seastar | |
| | 8-armed starfish | |
| | Pencil urchin –long spine | |
| | Pencil urchin –short spine | |
| | Black longspined urchin | |
| | Black short spine urchin | |
| | Sand urchin | |
| | Feather star | |
| Crustacean | Crayfish- longlegs | |
| | Slipper lobster | |
| | Hairy hermit crab (Dardanus) | |
| | Hermit crab stripey legs | |
| | Red reef lobster | |
| | Spray crab | |
| | Sponge crab | |
| Shrimp | Scarlet-striped cleaning | |
| | White striped cleaner shrimp | |
| Holothurian | Yellow banded sea cucumber | |
| | Red sea cucumber | |
| Polychaetes | Fireworm (very hairy) | |
| | Parchment worm | |
| | Devil worm | |
| Molluscs | Pen shell (Pinna rudis) | |
| | Triton's trumpet (Charonia) | |
| | Whelk (Stramonita) | |
| | Scallop | |
| | Cowrie shell | |
| | Conus | |
| Nudibranch | Warty umbrella snail | |
| | Sea hare | |
| | Side gill -(pleurobranchus) | |
| | Bornella (orange & white) | |
| | Tambja (green & black) | |