

# APPENDIX 2 – FISHERIES AND BIODIVERSITY

## 2.2 Cruise Report Biodiversity Survey FV Zeearend

### NAMIBIAN MARINE PHOSPHATE

### NMP BIODIVERSITY VERIFICATION SURVEY

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CRUISE: NMP Biodiversity Verification Survey  
SAILING: Walvis Bay - 06:00 Wednesday 18th June 2014  
RETURN: Walvis Bay – 09:00 Friday 27th June 2014

***Prepared for:***

Namibian Marine Phosphate (Pty) Ltd.

***Prepared by:***

Capricorn Fisheries Monitoring cc



August 2014

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## 1 SUMMARY

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The FV *Zeearend* sailed from Walvis Bay, Namibia on 18<sup>th</sup> June 2014 to conduct a Biodiversity Verification Survey in the proposed marine phosphate target dredge area, Sandpiper - 1 (SP-1), which is located in the Mining Licence Area (MLA), ML 170. The survey was successfully completed on 27<sup>th</sup> June 2014. The primary objective of the cruise was to conduct a bottom trawl survey to assess the abundance, biodiversity and distribution of commercial and other demersal fish species, epifauna, seabirds and marine mammals. The duration of the survey was eight days, during which 24 stations were completed. Each station was sampled using a double codend monk trawl net with a 20 mm codend liner net (so that the smaller epifauna organisms were retained).

A total of 28 tonnes was caught in the trawl net with an average of 1.2 tonnes per station. A total of 48 species (fish, epifauna, seabirds and mammals) was identified during the survey, of which 31 comprised fish and epifauna species, 15 seabirds and 2 marine mammals. In terms of total numbers, the fish comprised 38 421 specimens, the epifauna 131 423, seabirds 2196 and marine mammals 323. These figures excluded red jellyfish (*Chrysaora fulgida*), which were not counted. Water column characteristics were found to be consistent with those expected in the region. South Atlantic Central Water was present throughout the survey and relatively low oxygen conditions were experienced near the bottom. In general throughout the survey the bottom water layers averaged 10.68 °C, which was 2.5-4 °C cooler than the surface water.

Objectives met during the survey included:

- Estimation of the abundance (density) of the main commercial species such as hake, monk, sole and horse mackerel;
- Collection of biological information (length, weight, sex, maturity stage, stomach content) on the commercial species;
- Collection, identification, weighing and photographing of epi-benthic species;
- Collection of environmental and hydrological data using visual observations and a CTD;
- Identification and recording of marine mammals and seabirds in the area; and
- Collection of baseline data (establishment of site information base) for future monitoring;

## 2 PERSONNEL

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There was a team of six scientists and professional staff and support from the vessels crew. Professional samplers included specialists on epifauna (benthic), fish, environmental (CTD) and mammals and birds. In addition the team included two Namibian NatMIRC scientists who provided local knowledge and experience relating to Namibian species and conditions.

| PERSONNEL            | ROLE                | NATIONALITY |
|----------------------|---------------------|-------------|
| Melanie Smith        | Chief scientist     | SA          |
| Victor Ngcongo       | Chief technician    | SA          |
| Dr Robert Williamson | Data manager        | SA          |
| Tim McClurg          | Epifauna specialist | SA          |
| Kate Munnik          | CTD scientist       | SA          |
| Ester Nangolo        | Scientist           | NAM         |
| Malakia Shimhanda    | Technician          | NAM         |

### 3 OBJECTIVES

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To address the numerous questions and issues raised by the reviewers and other responses to the Namibian Marine Phosphate (NMP) Environmental Impact Assessment (EIA, 2012) (*Japp, 2012: Appendix 1a. Namibian Marine Phosphate – Environmental Impact Assessment of Fish, mammals and seabirds: Proposed monitoring and verification of Impacts in the proposed Mining Area*), a Biodiversity Verification Survey of the proposed area to be dredged (SP-1) was carried out. The survey design was aligned with standard scientific biomass surveys with randomly selected stations. The biodiversity survey, which investigated a very small part of the broader Namibian EEZ, responded to the concerns expressed by NMP specialist consultants (detailed in the EIA, Midgley 2012) and independent reviewers of the EIA, including MFMR. A primary concern raised being that the data provided by NatMIRC for the EIA had few historical data points inside the primary target dredge area of SP-1. The biodiversity survey served to augment the limited original baseline information significantly, allowing for improved confidence in the assessments of the impacts. The survey has provided comparative data to address the following issues:

- The biodiversity indicated in the EIA;
- Size structure of the main commercial fish species of the target dredge site and MLA compared with areas outside;
- Biological information on the main commercial species to verify if there are any notable deviations from the information and assumptions made in the EIA;
- To verify the spatial distribution and possible differences in the fauna in, and adjacent to, SP-1;
- Determine a recruitment index based on size and sex structure of the main species caught using a bottom trawl in, and adjacent to, SP-1 and to test whether the results deviated significantly from those determined by the EIA.

Essentially, the survey and verification report, (*CapFish 2014, Impact Assessment - Verification Phase: Fish, Mammals and Seabirds*) were designed primarily to quantify the biodiversity of the area and to compare this with the known information for the region. The survey also obtained commercial data on the target catch (monk), hake and bycatch species. This allowed for a rough estimate of spawner biomass and recruitment, creating a baseline for future surveys in the area if dredging proceeded. Specific objectives were to:

- Estimate the abundance (density) of the main commercial species such as hake, monk and horse mackerel;
- Collect biological information (length, sex, maturity stage, stomach content) from the commercially important/exploited species;
- Collect, identify and photograph epifauna species identify, collect and photograph epifauna species and at the same time determine the nature of the substrate and bottom profile;
- Collect environmental data using visual observations and a CTD;
- Record/identify the occurrence of surface species such as marine mammals and seabirds in the area;
- Collect baseline data for future monitoring.

## 4 SURVEY DESIGN

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Mining Licence Area (MLA), ML 170 lies approximately 60 km offshore from Conception Bay in water depths of 190 to 300 m and covers an area of 2233 km<sup>2</sup>. The phosphate deposits will be extracted by dredging up to 3 km<sup>2</sup> annually for the duration of the mining licence (20 years) in the target mine area described as Sandpiper-1 (SP-1). Subsequently with further approvals, mining could take place in the future in SP-2 and SP-3 (Figure 1).

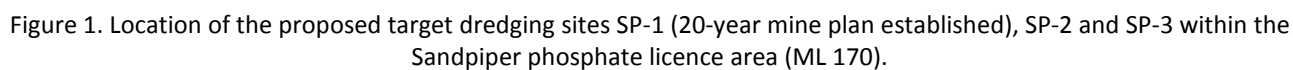
The monkfish bottom trawler, FV *Zeearend* was used to sample 24 stations within, and in close proximity to, the target dredge area SP-1 (Figure 1). Stations were randomly selected by dividing the survey area into grid blocks (2.5 nm x 3 nm). In each grid block two stations were randomly selected using Microsoft Excel. Where possible, the first random position was selected and if there was a limitation then the next position on the list was selected. This process was continued until two stations were selected per grid block<sup>1</sup>. Stations that were not suitable for trawling included those in water shallower<sup>2</sup> than 200 m, those inside the environmental reference site areas, and within 500 m of the oceanographic instrument mooring anchor.

The original locations of the stations were randomly selected such that a broad distribution of the entire SP-1, and just outside SP-1, would be sampled. However, given that trawling is limited to waters deeper than the 200 m isobath, most of the stations on the eastern side of SP-1 had to be relocated westward to deeper water. The survey coordinates in decimal degrees of the original and actual start and end trawl positions is given in Annexure 1.

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<sup>1</sup> Note that two stations per grid block were selected to allow for one day and one night trawl per grid block

<sup>2</sup> Related to the survey permit conditions as issued by MFMR – Letter MFMR to NMP 060614



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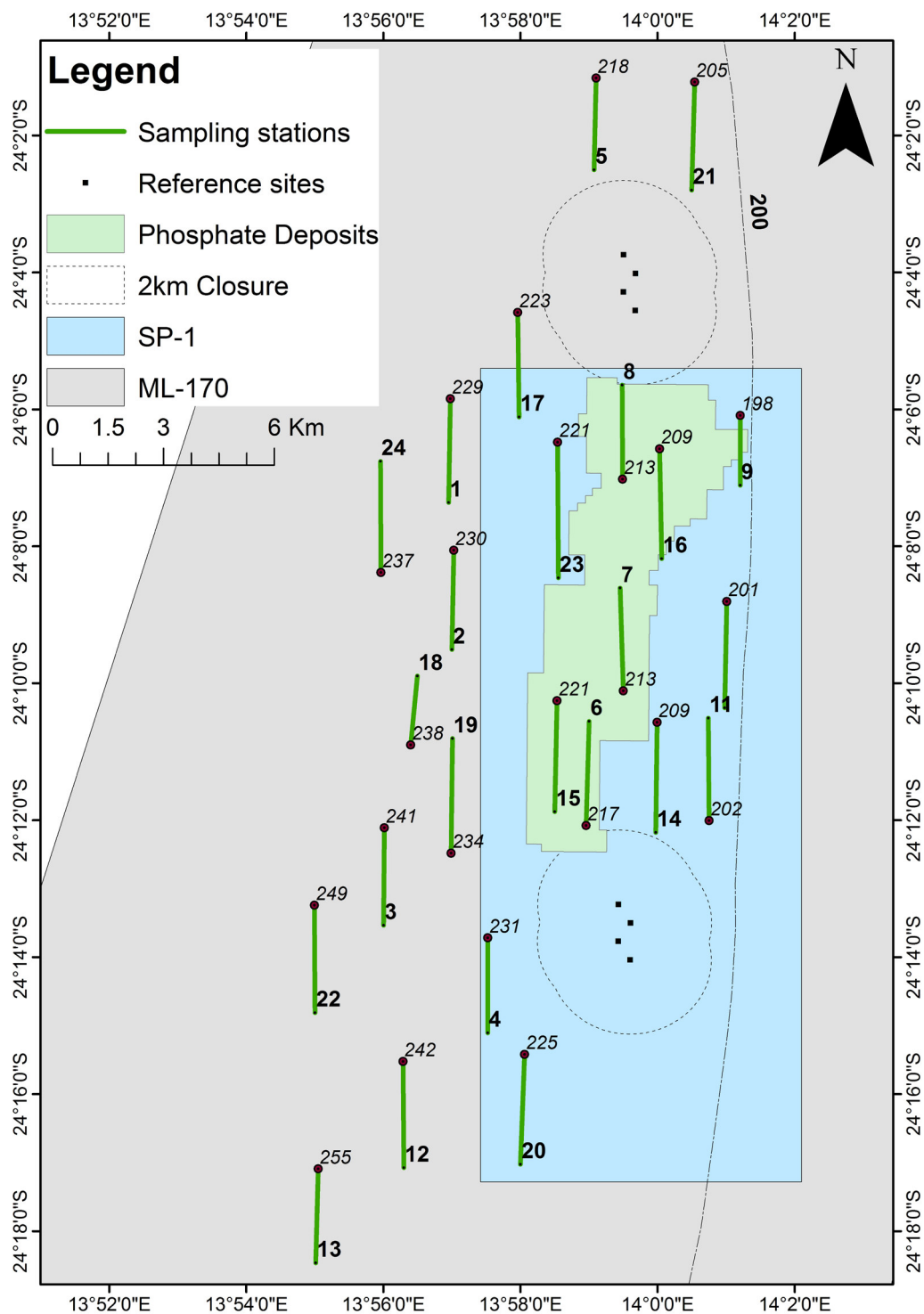


Figure 2. Location of the 24 stations (trawl lanes) within and surrounding SP-1. Benthic sites refer to the environmental sample sites, which was closed (2 km around the sites) to survey trawling. Note all the stations were in water deeper than 200 m.

Trawl speed averaged three knots with trawl duration of 30 minutes, this being the time the net was in contact with the seabed. The trawls were orientated in a north/south direction and the distance covered at each station was approximately 1.5 nm. The length of the trawl wire was also recorded.

On average four stations were sampled per 24 hour period for the eight day survey period. Adverse weather conditions prevented sampling on one day. Twelve stations were sampled during the day between 07h00 - 17h30 and the remaining twelve during the night between 20h00 – 07h00. For daytime trawls the net was not deployed before sunrise and was raised approximately 30 minutes before sunset. In foggy or overcast conditions, these time restrictions were increased to 60 minutes after sunrise and 60 minutes before sunset. For night trawls the net was not deployed before sunset and was raised 30 minutes before sunrise. Time, location and depth were recorded per station.

## 5 TRAWLING GEAR AND SAMPLING EQUIPMENT

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A commercial type Viking double-belly monkfish bottom trawl with a head length 86 m, footrope 108 m and vertical net opening 45 m was used. The distance between the wings during towing was approximately 40 - 50 m. The trawl was rigged with tickler chains along the footrope. The “Thyborun” trawl doors were 4.2 m square in size, weighing around 800 kg each. The codend mesh size was 120 mm but in order to retain small fish and epifauna fauna, a 20 mm inner-liner was integrated into the codend.

A Multi-probe internal logging conductivity, temperature and depth (CTD) recorder was encased inside a stainless steel protective housing and specially-designed net bag, which was attached to the head rope of the trawl net using shackles and cable ties. The CTD was lowered at every station with the trawl net through the water column to within 1 m of the seafloor. The CTD was fitted with temperature, conductivity and dissolved oxygen sensors. The CTD was removed after each trawl to download the data and check the unit.

Two digital scales tested and calibrated, were used in the onboard factory for measuring the quantities of the catch (fish and epifauna) and were calibrated to measure catch weight from 1 g to 50 kg.

## 6 METHODS

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Processing of the catches was achieved through team work by all scientists and crew. Key components (principally fishes and jellyfish) were extracted first and the remaining material was then transferred to a sorting table where it was rigorously screened for epifauna.

The entire catch (or a subsample in the case of large catches) was sorted into species. Monk, hake, and sole were further sorted by sex. The total catch weights (kg) and number of each species (and sex where applicable) were recorded (Annexure 2 and 3). Length frequency (total length) data were collected for all commercial species (Annexure 4). For non-commercial species such as rat tails, only the weight and number of fish were recorded. If the catch was > 1.5 tonnes, the main fish species (hake, monk, sole and horse mackerel) were removed from the catch and the rest was sub-sampled by randomly selecting and measuring approximately 100 kg. Biological sampling of 15 fish per species

(individual weight and length measurements, sex, maturity stage, stomach contents) was done for hake and monk per station.

All invertebrate species retained by the net and landed as part of the catch were identified to the lowest possible taxon, counted and weighed. All large, whole epifauna species retained in the wings of the net were also included in the data counts. Photographs of invertebrates were taken for each trawl to provide an overview and a snapshot image of invertebrates occurring at each station

Density was calculated for each species per station using the swept area method. The swept area per hour at station, **SA**, was calculated by:

A total of 48 species (fish, epifauna, seabirds and mammals) was identified during the survey, of which 31 were fish and epifauna species, 15 were seabirds and 2 were marine mammals. In terms of total numbers the fish comprised 38 421 specimens, the epifauna 131 423, seabirds 2196 and marine mammals 323. These figures excluded red jellyfish (*Chrysaora fulgida*,) which were not counted.

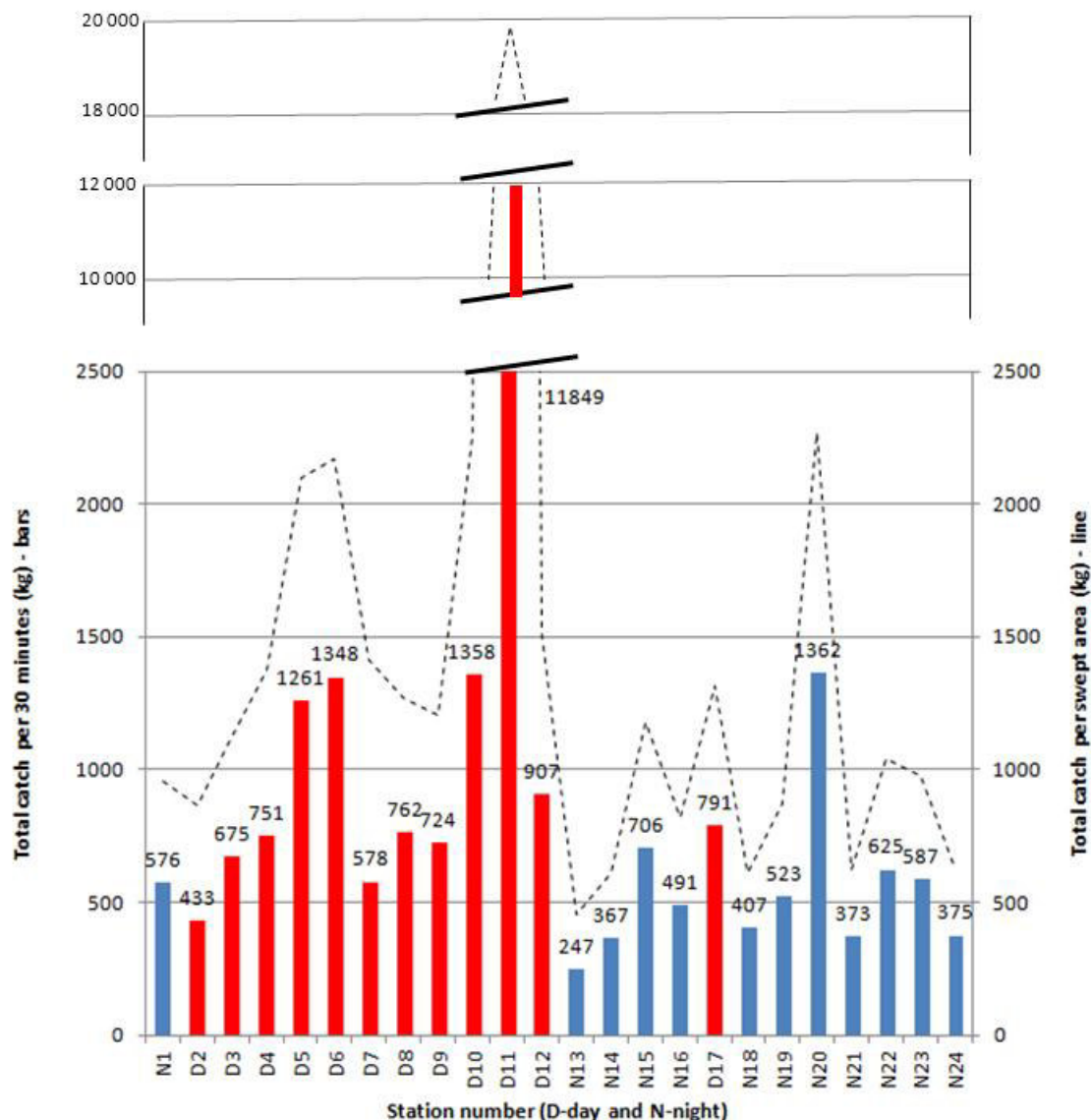


Figure 3. Total catch weight (kg) per 30 minute trawl and per swept area.

Note: Average catch per station is 1.2 tonnes per half hour and the average catch per swept area is 0.7 tonnes.  
Station 11 was dominated by jellyfish and thus the maximum extent is not shown.

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Table 1. Number (and where applicable weight) for all the species identified and recorded during the biodiversity survey

| No                                | Common name               | Scientific name                            | Weight (kg) | Number   |
|-----------------------------------|---------------------------|--|-------------|----------|
| <b>Fish and Pelagic Component</b> |                           |  |             |          |
| 1                                 | Angelfish                 | <i>Brama brama</i>                         | 3.06        | 2        |
| 2                                 | Bonefish (long fin)       | <i>Pterothrissus belloci</i>               | 3.23        | 17       |
| 3                                 | Shallow water hake        | <i>Merluccius capensis</i>                 | 1920.89     | 13791.95 |
| 4                                 | Goby (pelagic)            | <i>Sufflogobius bibarbatus</i>             | 56.20       | 6564     |
| 5                                 | Gurnard Capensis          | <i>Chelidonichthys capensis</i>            | 0.60        | 2        |
| 6                                 | Jacopever                 | <i>Helicolenus dactylopterus</i>           | 54.42       | 928      |
| 7                                 | Jellyfish (purple)        | <i>Chrysaora africana</i>                  | 0.05        | 1        |
| 8                                 | Jellyfish (red)           | <i>Chrysaora fulgida</i>                   | 17722.98    | 0        |
| 9                                 | Jellyfish (white)         | <i>Aequorea forskalea</i>                  | 405.24      | 1959     |
| 10                                | Maasbanker                | <i>Trachurus trachurus</i>                 | 21.42       | 143      |
| 11                                | Mackerel                  | <i>Scomber japonicus</i>                   | 8.38        | 4        |
| 12                                | Monk                      | <i>Lophius vomerinus</i>                   | 1703.56     | 3565.76  |
| 13                                | Rat Tail Short Nose Rough | <i>Coelorrhinus simorhynchus</i>           | 672.48      | 9530     |
| 14                                | Shark (bluntnose sixgill) | <i>Hexanchus griseus</i>                   | 2.79        | 2        |
| 15                                | Squid (Angola flying)     | <i>Todarodes angolensis</i>                | 174.29      | 1058     |
| 16                                | Squid (flying)            | <i>Todaropsis sagittatus</i>               | 0.05        | 1        |
| 17                                | West Coast sole           | <i>Austroglossus microlepis</i>            | 157.26      | 316.85   |
| <b>Epifauna Component</b>         |                           |  |             |          |
| 18                                | Hermit crab               | <i>Parapaguridae</i> sp.                   | 4.81        | 7        |
| 19                                | Mantis shrimp             | <i>Squilla</i> sp.                         | 19.64       | 853      |
| 20                                | Prawn                     | <i>Funchalia woodwardi</i>                 | 0.06        | 6        |
| 21                                | Prawn (Solenocera)        | <i>Solenocera africana</i>                 | 0.22        | 70       |
| 22                                | Sea cucumber (white)      | <i>Pseudocnus thandari</i>                 | 0.20        | 43       |
| 23                                | Sea pen                   | <i>Verellidae</i> sp.                      | 28.37       | 76612    |
| 24                                | Ascidians                 | <i>Molgula</i> sp.                         | 4616.91     | 108813   |
| 25                                | Sponge (brown)            | <i>Porifera</i> sp.                        | 376.63      | 1334     |
| 26                                | Starfish (long armed)     | <i>Astropecten</i> sp.                     | 0.03        | 5        |
| 27                                | Starfish (short armed)    | <i>Odontaster australis</i>                | 0.05        | 15       |
| 28                                | Swimming crab             | <i>Bathynectus piperitus</i>               | 113.36      | 2613     |
| 29                                | Whelk (dog)               | <i>Nassarius wolfii</i>                    | 0.01        | 7        |
| 30                                | Whelk (sponge)            | <i>Faciolariidae</i> (plus sponge) sp.     | 2.82        | 25       |
| 31                                | Whelk (tulip)             | <i>Fasciolariidae lugubra</i>              | 7.23        | 188      |
| <b>Seabird Component</b>          |                           |  |             |          |
| 32                                | Sub Antarctic skua        | <i>Catharacta antarctica</i>               |             | 436      |
| 33                                | Kelp gull                 | <i>Larus dominicanus</i>                   |             | 1        |
| 34                                | Tern                      | <i>Sternidae</i>                           |             | 1        |
| 35                                | Cape Gannet               | <i>Morus capensis</i>                      |             | 13       |
| 36                                | Cape cormorant            | <i>Phalacrocorax capensis</i>              |             | 1        |
| 37                                | Storm petrel              | <i>Hydrobatidae</i>                        |             | 75       |
| 38                                | Albatross                 | <i>Diomedidae</i>                          |             | 33       |
| 39                                | Shy albatross             | <i>Thalassarche cauta</i>                  |             | 160      |
| 40                                | Black browed albatross    | <i>Thalassarche melanophrys</i>            |             | 253      |
| 41                                | Yellow nosed albatross    | <i>Thalassarche chlororhynchus/carteri</i> |             | 9        |
| 42                                | Pintado petrel            | <i>Daption capense</i>                     |             | 19       |
| 43                                | Petrel                    | <i>Procellariidae</i>                      |             | 10       |
| 44                                | White chinned petrel      | <i>Procellaria aequinoctialis</i>          |             | 999      |
| 45                                | Shearwater                | <i>Puffinus</i>                            |             | 8        |
| 46                                | Sooty shearwater          | <i>Puffinus griseus</i>                    |             | 104      |
| <b>Marine mammal Component</b>    |                           |  |             |          |
| 47                                | Cape fur seal             | <i>Arctocephalus pusillus pusillus</i>     |             | 73       |
| 48                                | Dusky Dolphin             | <i>Lagenorhynchus obscurus</i>             |             | 250      |

The CTD with the attached temperature, salinity and oxygen sensors was attached to the trawl net to allow recordings to be collected simultaneously with trawling. The complete CTD report (CTD deployment report FV *Zeearend*. Lwandle 2013) can be found in Appendix 2: 2.3. In summary 22 of the 24 trawls undertaken during the biomass verification survey provided acceptable results for temperature and 19 trawls yielded reasonable salinity results (with exceptions being: Trawls 13, 14, 17, 20 and 21). The trawls where successful temperature and/or salinity data were recorded can be compared to the fisheries and biomass data from the respective trawls. Temperature profiles showed a well-mixed upper water column in most cases, with slight stratification occurring from Trawl 10 onwards. This is to be expected as the survey took place just after an extended period of rough seas and considerable wave action in the survey area. The weather conditions calmed significantly from Trawl 5 onwards and this may have allowed slight stratification of the upper layers of the water column. In general the upper water column was approximately 2.5 – 4 °C warmer than the near seafloor temperatures (>200 m). Temperature on or near the sea floor throughout the survey averaged 10.68°C. This is within the range of expected winter values for the region (Shannon and Nelson 1996).

Salinity and temperature data indicated the presence of South Atlantic Central Water (SACW) for the majority of the survey. SACW upwells from approximately 200 m below the surface with a salinity of 34.7-35.65 PSU and temperatures between 8 and 16°C (Shannon and Nelson 1996, Mohrholz *et al.* 2001, Duncombe Rae 2005). The dissolved oxygen levels near the seafloor for most of the trawls were low (approx. 3-10 %) as can be expected in the continental shelf zone offshore of Namibia (Monteiro and van der Plas, 1996).

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## 8 CRUISE NARRATIVE

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### ***Wednesday 18 June 2014***

All scientific personnel were on board FV *Zeearend* by 07h00 on Wednesday 18 June 2014. Emergency drills were conducted at 10h00. The vessel set sail at 07h40 rounding Pelican Point and heading southwards to the survey area. Winds were in a southerly direction (19+ knots) and sea conditions were moderate (1.8 m). It took seven hours to sail to the survey area - **Station 1**. The net was deployed at 17h50 and the entire operation including sampling took five hours to complete. Initially the CTD and frame were attached to the head rope of the trawl net above its mouth. In theory this was the safest place for the CTD to be positioned as it was clear from most of the metal tickler chains, bobbins and steel cabling. However, due to the configuration of the net setting gear and associated stern rollers, attaching the CTD to this position proved problematic. During the first deployment the CTD frame was rolled back onto one of the stern rollers as the net was being set. This caused damage to the steel frame but did not damage the CTD itself. For subsequent trawls the CTD was placed higher up the top rope.

Station 1: Night trawl, depth 229 m.

### ***Thursday 19<sup>th</sup> June 2014***

No stations were conducted today due to unfavourable weather and sea conditions. Southerly winds reached 35 knots and waves were moderately high at 5.5 m. The CTD frame was bent back into shape and reinforced with steel rods.

### **Friday 20<sup>th</sup> June 2014**

Favourable weather conditions - wind direction south, light breeze (11 knots) and small wavelets (0.2 m) therefore sampling resumed at **Station 2**. Operations were delayed for about 30 minutes to resolve problems with the calibration of the oxygen sensor on the CTD. In the end the CTD was deployed but the oxygen sensor was not working. Sampling was slow but thorough. The entire catch was weighed, counted and, for the commercial fish length frequency was measured. Hake and monk were staged and stomach content data collected. For **Station 3** the oxygen sensor on the CTD was repaired and calibrated. For subsequent trawls the CTD successfully collected temperature, salinity, oxygen and depth. Bag weight was relatively small (650 kg) and sampling was completed in 1.5 hours. A small six gilled cow shark *Hexanchus griseus* weighing 1.15 kg was caught. **Station 4** was dominated by ascidians (350 kg) thus hake, monk, sole, rat tails, squid and jellyfish were removed from the stocker pond first before the rest of the catch was subsampled i.e. 5 out of 19 bins<sup>4</sup> were sorted and sampled.

Station 2: Day trawl, depth 230 m.

Station 3: Day trawl, depth 241 m.

Station 4: Day trawl, depth 231 m.

### **Saturday 21<sup>st</sup> June 2014**

Very calm sea conditions with a light breeze from the west. It was decided that Station 5 would be conducted near the end of the survey if time permitted since we had already lost a sample day due to unfavourable weather conditions. All the stations sampled today therefore fell inside the phosphate deposit area within SP-1 (Figure 1). **Station 6** was a large catch >1.3 tonnes thus monk, hake, sole and jellyfish were removed first before the rest of the catch was subsampled i.e. 7/22 bins were sorted and sampled. White sea cucumbers (*Pseudocnus thandari*) were recorded at this station. For **Station 7** hake, monk, jellyfish, squid and sole were removed before 4/9 baskets were subsampled. This station had the highest abundance of gobies (*Sufflogobius bibarbatus*) and a single cape gurnard (*Chelidonichthys capensis*) was caught and measured. A large pod (about 150 individuals) of dusky dolphins (*Lagenorhynchus obscurus*) was sighted while the observer was keeping a continuous watch for marine mammals. They were leaping and swimming next to the bow of the vessel. **Station 8** was completed successfully; hake, monk and jellyfish were removed before the rest of the catch was subsampled.

Station 6: Day trawl, depth 217 m.

Station 7: Day trawl, depth 213 m.

Station 8: Day trawl, depth 13 m.

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<sup>4</sup> Note a full bin was approximately 30 kg.

### **Sunday 22<sup>nd</sup> June 2014**

Sea conditions were glassy and very calm with no wind. The entire catch at **Station 9** was sorted and sampled (i.e. no subsamples were taken). Adult horse mackerel (*Trachurus capensis*) were caught at this station as well as several small starfish (*Odontaster australis*). During the mammal observations 100 dusky dolphins were sighted about 1700 m from the vessel. For **Station 10** the entire catch was also sorted and sampled. A decomposed dead seal was caught in the net and a large whale vertebra bone. **Station 11** was completely dominated by the red jellyfish (*Chrysaora fulgida*) with 11.8 tonnes caught while the net descended to the seafloor and therefore does not show a true reflection of the catch composition for that station. Nevertheless, the rest of the catch (50 kg) was sampled entirely and included two angel fish (*Brama brama*). **Station 12** was subsampled after removing hake, monk, rat tails, gobies, squid and jacobever from the catch.

Station 9: Day trawl, depth 217 m.

Station 10: Day trawl, depth 198 m.

Station 11: Day trawl, depth 202 m.

Station 12: Day trawl, depth 242 m.

### **Monday 23<sup>rd</sup> June 2014**

Sea conditions were very calm and water surface was like a mirror. No wind and no swell. For **Station 17** the hake, monk, jellyfish, squid and sole were removed and 4/12 bins were sorted and sampled. Two bonefish (*Pterothrissus belloci*) were found at this station. **Station 15** was also subsampled after monk, hake, jellyfish and sole were removed and 4/16 bins sorted and sampled. For **Station 16** sea temperatures were warm with a CTD reading of 10 °C at the sea floor. To reduce the time spent removing the CTD from the net bag and frame a small hole was made for ease of access to the data port of the unit. 4/10 bins were subsampled for this station.

Station 17: Day trawl, depth - 223 m.

Station 15: Night trawl, depth - 221 m.

Station 16: Night trawl, depth - 209 m.

### **Tuesday 24<sup>th</sup> June 2014**

Sea conditions were calm and glassy with a light breeze from the south-west. **Station 23** was subsampled and 4/13 bins were sorted. One prawn species (*Solenocera africana*) was found at this station. **Station 5** was a relatively large catch (>1.2 tonnes) dominated by ascidians and hake. Three adult chub mackerel (*Scomber japonicus*) greater than 50 cm were also found at this station. The entire catch was sorted at **Station 21**. A single lantern fish (*Lampanyctodes hectoris*) was found at this station but was not recorded given that it belonged to the unsorted sample. For **Station 14** the entire catch was sampled since night trawls appear to be smaller than day trawls. A different but not unique purple coloured jellyfish (*Chrysaora africana*) was found at this station.

Station 23: Night trawl, depth - 221 m.

Station 5: Day trawl, depth - 218 m.

Station 21: Night trawl, depth - 205 m.

Station 14: Night trawl, depth - 209 m.

### **Wednesday 25<sup>th</sup> June 2014**

Weather conditions picked up slightly with a gentle south-westerly wind (7 knots) and larger wavelets (0.7 m). **Station 13** was a particularly small catch (270 kg) thus the entire catch was sampled. The substrate was dominated by dead clam shells. 19/30 bins were subsampled for **Station 20** due to the

large amount of ascidians. **Station 19** was similar in biodiversity and abundance but 4/11 bins were sampled.

Station 13: Night trawl, depth - 255 m.

Station 20: Day trawl, depth - 225 m.

Station 19: Night trawl, depth - 234 m.

#### **Thursday 26<sup>th</sup> June 2014**

There was a switch in the wind direction from a gentle north-west breeze (7 knots) to a strong southerly wind (22+ knots) with 3 m waves. **Station 18** catch was fairly small and therefore the entire catch was sampled. During **Station 22** the oxygen readings on the CTD were recording unusual values, which could have been a result of being bumped slightly during deployments. *Jacopever* (*Helicolenus dactylopterus*) dominated this station. For **Station 24** the oxygen sensor was re-calibrated and working well for the last station of the survey. Catch was fairly small but a subsample was taken.

Station 18: Night trawl, depth - 238 m.

Station 22: Day trawl, depth - 249 m.

Station 24: Night trawl, depth - 237 m.

## **9 REFERENCES**

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- Duncombe Rae 2005 - Duncombe Rae CM. 2005. A demonstration of the hydrographic partition of the Benguela upwelling ecosystem at 26°40'S. *African Journal of Marine Science* **27**(3):617–628.
- JNCC (2010) Marine mammal recording forms (Detailed sighting records). Joint Nature Conservation Committee.
- Mohrholz *et al.* 2001 - Mohrholz V, Schmidt M, Lutjeharms JRE. 2001. The hydrography and dynamics of the Angola Benguela Frontal Zone and environment in April 1999. *South African Journal of Science* **97**:199–210.
- Monteiro PMS, van der Plas AK. 1996. Low Oxygen Water (LOW) variability in the Benguela System: Key processes and forcing scales relevant to forecasting. In: Wefer G, Berger WH, Siedler G, Webb DJ (eds) *The south Atlantic: Present and past circulation*. Springer-Verlag Berlin, Germany, pp 163–210.
- Shannon and Nelson 1996 - Shannon LV, Nelson G. 1996. The Benguela: Large scale features and processes and system variability. In: Wefer G, Berger WH, Siedler G, Webb DJ (eds) *The south Atlantic: Present and past circulation*. Springer-Verlag Berlin, Germany, pp 163–210.

**Annexure 1. Coordinates for the original and actual trawl stations. trawl duration (decimal hours) and depth are also shown.**

| Station Number | Date Start | Time Start | Day or Night | Start Bottom Depth | End Bottom Depth | Trawl time (hr) | Original start latitude | Original start longitude | Original end latitude | Original end longitude | Actual start latitude | Actual start longitude | Actual end latitude | Actual end longitude |
|----------------|------------|------------|--------------|--------------------|------------------|-----------------|-------------------------|--------------------------|-----------------------|------------------------|-----------------------|------------------------|---------------------|----------------------|
| 1              | 18-Jun-14  | 18:05      | N            | 229                | 231              | 0.5             | -24.09                  | 13.95                    | -24.12                | 13.95                  | -24.10                | 13.95                  | -24.12              | 13.95                |
| 2              | 20-Jun-14  | 07:35      | D            | 230                | 235              | 0.5             | -24.13                  | 13.95                    | -24.16                | 13.95                  | -24.13                | 13.95                  | -24.16              | 13.95                |
| 3              | 20-Jun-14  | 12:35      | D            | 241                | 244              | 0.5             | -24.19                  | 13.93                    | -24.22                | 13.93                  | -24.20                | 13.93                  | -24.23              | 13.93                |
| 4              | 20-Jun-14  | 16:12      | D            | 231                | 232              | 0.5             | -24.23                  | 13.96                    | -24.25                | 13.96                  | -24.23                | 13.96                  | -24.25              | 13.96                |
| 5              | 24-Jun-14  | 15:05      | D            | 218                | 216              | 0.5             | -24.30                  | 13.98                    | -24.28                | 13.98                  | -24.02                | 13.99                  | -24.04              | 13.98                |
| 6              | 21-Jun-14  | 07:13      | D            | 217                | 219              | 0.5             | -24.20                  | 13.98                    | -24.18                | 13.98                  | -24.20                | 13.98                  | -24.18              | 13.98                |
| 7              | 21-Jun-14  | 11:56      | D            | 213                | 214              | 0.7             | -24.18                  | 13.99                    | -24.15                | 13.99                  | -24.17                | 13.99                  | -24.14              | 13.99                |
| 8              | 21-Jun-14  | 16:00      | D            | 213                | 213              | 0.5             | -24.13                  | 13.99                    | -24.10                | 13.99                  | -24.12                | 13.99                  | -24.09              | 13.99                |
| 9              | 22-Jun-14  | 07:05      | D            | 198                | 198              | 0.5             | -24.10                  | 14.03                    | -24.13                | 14.03                  | -24.10                | 14.02                  | -24.12              | 14.02                |
| 10             | 22-Jun-14  | 10:22      | D            | 201                | 202              | 0.5             | -24.14                  | 14.03                    | -24.17                | 14.03                  | -24.15                | 14.02                  | -24.17              | 14.02                |
| 11             | 22-Jun-14  | 13:45      | D            | 202                | 203              | 0.5             | -24.20                  | 14.04                    | -24.23                | 14.04                  | -24.20                | 14.01                  | -24.18              | 14.01                |
| 12             | 22-Jun-14  | 17:00      | D            | 242                | 244              | 0.5             | -24.25                  | 14.02                    | -24.28                | 14.02                  | -24.26                | 13.94                  | -24.28              | 13.94                |
| 13             | 25-Jun-14  | 00:55      | N            | 255                | 255              | 0.6             | -24.28                  | 13.99                    | -24.26                | 13.99                  | -24.28                | 13.92                  | -24.31              | 13.92                |
| 14             | 24-Jun-14  | 21:55      | N            | 209                | 210              | 0.5             | -24.20                  | 14.00                    | -24.18                | 14.00                  | -24.18                | 14.00                  | -24.20              | 14.00                |
| 15             | 23-Jun-14  | 19:00      | N            | 221                | 222              | 0.5             | -24.19                  | 13.98                    | -24.17                | 13.98                  | -24.17                | 13.98                  | -24.20              | 13.98                |
| 16             | 23-Jun-14  | 22:20      | N            | 209                | 209              | 0.5             | -24.13                  | 14.01                    | -24.11                | 14.01                  | -24.11                | 14.00                  | -24.14              | 14.00                |
| 17             | 23-Jun-14  | 12:55      | D            | 223                | 224              | 0.5             | -24.08                  | 13.97                    | -24.10                | 13.97                  | -24.08                | 13.97                  | -24.10              | 13.97                |
| 18             | 26-Jun-14  | 00:55      | N            | 238                | 238              | 0.5             | -24.16                  | 13.94                    | -24.18                | 13.94                  | -24.18                | 13.94                  | -24.16              | 13.94                |
| 19             | 25-Jun-14  | 21:55      | N            | 234                | 233              | 0.5             | -24.18                  | 13.95                    | -24.21                | 13.95                  | -24.21                | 13.95                  | -24.18              | 13.95                |
| 20             | 25-Jun-14  | 17:40      | N            | 225                | 225              | 0.5             | -24.26                  | 13.97                    | -24.28                | 13.97                  | -24.26                | 13.97                  | -24.28              | 13.97                |
| 21             | 24-Jun-14  | 18:55      | N            | 205                | 205              | 0.5             | -24.30                  | 14.03                    | -24.28                | 14.03                  | -24.02                | 14.01                  | -24.05              | 14.01                |
| 22             | 26-Jun-14  | 18:52      | N            | 249                | 252              | 0.5             | -24.23                  | 14.02                    | -24.21                | 14.02                  | -24.22                | 13.92                  | -24.25              | 13.92                |
| 23             | 24-Jun-14  | 01:35      | N            | 221                | 221              | 0.5             | -24.21                  | 14.03                    | -24.18                | 14.03                  | -24.11                | 13.98                  | -24.14              | 13.98                |
| 24             | 26-Jun-14  | 22:15      | N            | 237                | 235              | 0.5             | -24.10                  | 14.04                    | -24.08                | 14.04                  | -24.14                | 13.93                  | -24.11              | 13.93                |

## Annexure 2. Summary of weight per species per station.

| Station Number                   |                            | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10   | 11    | 12  | 13  | 14  | 15  | 16  | 17  | 18  | 19  | 20  | 21  | 22  | 23  | 24  |
|----------------------------------|----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Sampling Time (Day/Night)        |                            | N   | D   | D   | D   | D   | D   | D   | D   | D   | D    | D     | D   | N   | N   | N   | N   | D   | N   | N   | N   | N   | N   | N   | N   |
| Water Depth at start (m)         |                            | 229 | 230 | 241 | 231 | 218 | 217 | 213 | 213 | 198 | 201  | 202   | 242 | 255 | 209 | 221 | 209 | 223 | 223 | 238 | 234 | 205 | 249 | 221 | 237 |
| Fish and Pelagic Component       | Common name                |     |     |     |     |     |     |     |     |     |      |       |     |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Aequorea forskalea</i>        | Jellyfish (white)          |     |     | 15  | 4   |     | 13  | 17  | 25  | 39  | 53   |       | 32  | 61  | 6   | 29  | 13  | 10  | 13  | 29  | 11  | 5   | 30  | 5   | 3   |
| <i>Austroglossus microlepis</i>  | West Coast sole (female)   | 11  | 4   | 4   | 3   | 7   | 6   | 5   | 4   | 1   | 2    | 1     | 6   |     | 7   | 6   | 7   | 2   | 7   | 21  | 9   | 4   | 4   | 7   |     |
| <i>Austroglossus microlepis</i>  | West Coast sole (male)     | 1   |     | 1   | 1   | 2   | 1   | 1   | 1   |     | 1    | 1     | 2   |     | 1   | 2   | 2   | 1   | 0   | 1   | 9   | 1   | 0   | 1   |     |
| <i>Austroglossus sp.</i>         | Sole                       |     |     |     |     |     |     |     |     |     |      |       |     |     |     | 0   |     |     |     |     |     |     |     |     |     |
| <i>Brama brama</i>               | Pomfret                    |     |     |     |     |     |     |     |     |     |      | 3     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Chelidonichthys capensis</i>  | Cape gurnard               |     |     |     |     |     |     | 0   |     | 0   |      |       |     |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Chrysaora africana</i>        | Jellyfish (purple)         |     |     |     |     |     |     |     |     |     | 0    |       |     |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Chrysaora fulgida</i>         | Jellyfish (red)            | 180 | 132 | 123 | 243 | 113 | 673 | 480 | 232 | 567 | 1165 | 11800 | 463 | 96  | 101 | 122 | 161 | 311 | 105 | 112 | 56  | 215 | 169 | 144 | 110 |
| <i>Coelorinchus simorhynchus</i> | Rattail (short nose rough) | 18  | 44  | 34  | 20  | 77  | 14  | 6   | 11  | 4   | 4    |       | 39  | 8   | 12  | 52  | 17  | 54  |     | 55  | 16  | 25  | 79  | 44  | 42  |
| <i>Helicolenus dactylopterus</i> | Jacopever                  |     |     | 5   |     |     |     |     |     |     |      |       | 7   | 5   |     |     |     |     |     |     |     |     | 35  |     | 3   |
| <i>Hexanchus griseus</i>         | Shark (bluntnose sixgill)  |     |     | 1   |     |     |     |     |     |     |      |       |     |     |     |     |     | 1   |     |     |     |     |     |     |     |
| <i>Lophius vomerinus</i>         | Monk                       | 37  |     |     |     |     |     |     |     |     |      |       |     |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Lophius vomerinus</i>         | Monk (female)              | 44  | 62  | 39  | 40  | 38  | 49  | 27  | 35  | 31  | 19   | 14    | 52  | 7   | 31  | 33  | 19  | 60  | 36  | 45  | 23  | 34  | 58  | 39  | 47  |
| <i>Lophius vomerinus</i>         | Monk (juvenile)            |     |     |     |     | 1   | 1   | 1   | 1   |     |      |       | 2   |     | 3   | 1   | 1   | 1   | 1   | 4   | 2   | 2   | 1   | 2   | 2   |
| <i>Lophius vomerinus</i>         | Monk (male)                | 46  | 63  | 34  | 32  | 37  | 31  | 21  | 29  | 14  | 15   | 8     | 52  | 10  | 13  | 36  | 15  | 39  | 24  | 42  | 21  | 20  | 87  | 39  | 44  |
| <i>Merluccius capensis</i>       | Hake                       | 104 | 37  |     | 14  | 197 |     |     |     |     |      |       |     |     |     |     |     |     |     |     |     | 0   |     |     |     |
| <i>Merluccius capensis</i>       | Hake (female)              | 14  | 38  | 33  | 48  | 56  | 66  | 51  | 73  | 32  | 41   | 7     | 87  | 12  | 42  | 35  | 31  | 57  | 17  | 26  | 41  | 26  | 33  | 42  | 31  |
| <i>Merluccius capensis</i>       | Hake (male)                | 15  | 30  | 32  | 35  | 46  | 39  | 38  | 43  | 17  | 21   | 2     | 57  | 7   | 36  | 30  | 20  | 46  | 8   | 16  | 23  | 25  | 31  | 32  | 17  |
| <i>Pterothrissus belloci</i>     | Bonefish (long fin)        |     |     |     | 0   | 1   |     |     |     |     |      |       |     |     |     | 1   | 0   | 0   |     |     |     |     | 0   | 0   |     |
| <i>Scomber japonicus</i>         | Mackerel                   |     |     |     |     | 6   |     |     |     |     |      |       |     |     |     |     |     |     |     |     | 2   |     |     |     |     |
| <i>Sufflogobius bibarbatus</i>   | Pelagic goby               | 3   | 1   | 2   | 1   | 2   | 1   | 7   | 3   | 1   | 2    | 0     | 4   | 1   | 3   | 3   | 6   | 2   | 4   | 3   | 2   | 4   | 1   | 0   | 2   |
| <i>Todarodes angolensis</i>      | Squid (Angola flying)      | 3   | 20  | 9   | 31  | 6   | 22  | 7   | 14  | 3   | 2    | 2     | 19  | 1   | 2   | 5   | 2   | 13  |     | 3   | 2   | 2   | 8   |     | 3   |
| <i>Toderopsis sagittus</i>       | Squid (flying)             |     |     |     |     |     |     |     |     |     |      |       |     |     |     |     |     | 0   |     |     |     |     |     |     |     |
| <i>Trachurus trachurus</i>       | Maasbanker                 |     |     |     |     |     |     | 0   |     | 3   | 10   | 8     | 0   |     |     |     |     |     |     |     |     |     |     |     |     |

SECTION D, APPENDIX 2 – FISHERIES AND BIODIVERSITY  
2.2 Cruise Report Biodiversity Survey FV Zeearend

| Station Number                        |                         | 1          | 2          | 3          | 4          | 5           | 6           | 7          | 8          | 9          | 10          | 11           | 12         | 13         | 14         | 15         | 16         | 17         | 18         | 19         | 20          | 21         | 22         | 23         | 24         |
|---------------------------------------|-------------------------|------------|------------|------------|------------|-------------|-------------|------------|------------|------------|-------------|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|------------|------------|------------|------------|
| Sampling Time (Day/Night)             |                         | N          | D          | D          | D          | D           | D           | D          | D          | D          | D           | D            | D          | N          | N          | N          | N          | D          | N          | N          | N           | N          | N          | N          | N          |
| Water Depth at start (m)              |                         | 229        | 230        | 241        | 231        | 218         | 217         | 213        | 213        | 198        | 201         | 202          | 242        | 255        | 209        | 221        | 209        | 223        | 223        | 238        | 234         | 205        | 249        | 221        | 237        |
| Epifaunal Component                   |                         |            |            |            |            |             |             |            |            |            |             |              |            |            |            |            |            |            |            |            |             |            |            |            |            |
| <i>Astropecten</i> sp.                | Starfish (long armed)   |            |            |            |            |             |             |            |            |            |             |              |            | 0          |            |            |            |            |            |            |             |            |            |            |            |
| <i>Bathynectes piperitus</i>          | Swimming crab           | 3          | 3          | 2          | 5          | 12          | 9           | 4          | 5          | 3          | 5           | 1            | 3          | 5          | 8          | 7          | 6          | 4          | 2          | 3          | 9           | 8          | 3          | 5          | 3          |
| <i>Callinassa africana</i>            | Mud prawn               |            |            |            |            |             |             |            | 0          |            |             |              |            |            |            |            |            |            |            |            |             |            |            |            |            |
| <i>Fasciolaria lugubris</i>           | Whelk (tulip)           | 0          | 0          | 0          | 0          |             |             | 3          |            |            |             |              |            | 6          | 0          | 0          | 0          | 0          | 0          | 0          | 0           | 0          | 0          | 0          |            |
| <i>Funchalia woodwardi</i>            | Prawn                   |            |            |            |            |             |             |            |            |            |             |              | 0          |            |            |            |            | 0          |            |            |             |            |            |            |            |
| <i>Molgula</i> sp.                    | Ascidians               | 69         | 56         | 317        | 347        | 644         | 368         | 175        | 280        | 6          | 17          |              | 62         |            | 100        | 324        | 185        | 162        | 146        | 131        | 1101        |            | 8          | 211        | 23         |
| <i>Nassarius wolffi</i>               | Whelk (dog)             |            |            |            |            |             |             |            |            |            |             |              |            | 0          |            |            |            |            |            |            |             |            |            |            |            |
| <i>Odontaster australis</i>           | Starfish (cushion star) |            |            |            |            |             |             |            |            | 0          | 0           |              |            |            |            |            |            |            |            |            |             |            |            |            |            |
| Paguridae                             | Hermit crab             |            |            |            |            |             |             |            |            |            |             |              |            | 5          |            |            |            |            |            |            |             |            |            |            |            |
| Porifera                              | Sponge (brown)          | 26         | 28         | 22         |            | 12          | 10          | 2          | 3          | 0          | 1           |              | 20         | 45         | 1          | 20         | 3          | 25         |            | 26         | 32          | 3          | 73         | 12         | 46         |
| <i>Pseudocnus thandari</i>            | Sea cucumber            |            |            |            |            | 0           | 0           | 0          |            |            |             |              |            |            |            | 0          | 0          |            |            |            | 0           |            |            |            |            |
| <i>Pterygosquilla armata capensis</i> | Mantis shrimp           | 1          | 1          | 1          | 1          | 1           | 1           | 1          | 1          | 0          | 0           |              | 1          | 2          | 1          | 1          | 1          | 1          | 1          | 3          | 1           | 0          | 3          | 2          | 0          |
| <i>Solenocera africana</i>            | Prawn                   |            |            |            |            |             |             |            |            |            |             |              |            | 0          |            |            |            |            | 0          | 0          |             |            |            |            | 0          |
| Veretellidae                          | Sea pen                 | 1          | 1          | 1          | 1          | 1           | 1           | 1          | 1          | 1          | 1           | 1            | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1           | 1          | 1          | 1          | 1          |
| <b>Total Biomass (kg)</b>             |                         | <b>576</b> | <b>522</b> | <b>675</b> | <b>826</b> | <b>1261</b> | <b>1303</b> | <b>847</b> | <b>762</b> | <b>724</b> | <b>1358</b> | <b>11849</b> | <b>907</b> | <b>272</b> | <b>367</b> | <b>706</b> | <b>491</b> | <b>791</b> | <b>366</b> | <b>523</b> | <b>1362</b> | <b>373</b> | <b>625</b> | <b>587</b> | <b>375</b> |

### Annexure 3. Summary of numbers per species per station.

| Station Number                   |                            | 1   | 2   | 3   | 4   | 5    | 6   | 7   | 8   | 9   | 10  | 11  | 12  | 13  | 14  | 15  | 16  | 17  | 18  | 19  | 20  | 21  | 22  | 23  | 24  |
|----------------------------------|----------------------------|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Sampling Time (Day/Night)        |                            | N   | D   | D   | D   | D    | D   | D   | D   | D   | D   | D   | D   | N   | N   | N   | N   | D   | N   | N   | N   | N   | N   | N   | N   |
| Water Depth at start (m)         |                            | 229 | 230 | 241 | 231 | 218  | 217 | 213 | 213 | 198 | 201 | 202 | 242 | 255 | 209 | 221 | 209 | 223 | 223 | 238 | 234 | 205 | 249 | 221 | 237 |
| Fish and Pelagic Component       | Common name                |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Aequorea forskalea</i>        | Jellyfish (white)          |     |     | 215 | 4   |      | 29  | 26  | 55  | 86  | 114 |     | 69  | 116 | 14  | 64  | 28  | 21  | 31  | 64  | 25  | 71  | 908 | 12  | 6   |
| <i>Austroglossus microlepis</i>  | West Coast sole (female)   | 16  | 6   | 7   | 5   | 15   | 11  | 6   | 13  | 4   | 5   | 3   | 7   |     | 17  | 15  | 19  | 5   | 13  | 31  | 20  | 12  | 6   | 15  |     |
| <i>Austroglossus microlepis</i>  | West Coast sole (male)     | 1   |     | 1   | 4   | 6    | 2   | 3   | 2   |     | 2   | 3   | 3   |     | 2   | 5   | 5   | 2   | 1   | 2   | 13  | 4   | 1   | 2   |     |
| <i>Austroglossus sp.</i>         | Sole                       |     |     |     |     |      |     |     |     |     |     |     |     |     |     | 1   |     |     |     |     |     |     |     |     |     |
| <i>Brama brama</i>               | Pomfret                    |     |     |     |     |      |     |     |     |     | 2   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Chelidonichthys capensis</i>  | Cape gurnard               |     |     |     |     |      |     | 1   |     | 1   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Chrysaora africana</i>        | Jellyfish (purple)         |     |     |     |     |      |     |     |     |     | 1   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Chrysaora fulgida</i>         | Jellyfish (red)            |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Coelorinchus simorhynchus</i> | Rattail (short nose rough) | 165 | 441 | 427 | 284 | 1068 | 234 | 105 | 251 | 127 | 41  |     | 510 | 94  | 376 | 783 | 490 | 57  |     | 940 | 344 | 593 | 874 | 925 | 402 |
| <i>Helicolenus dactylopterus</i> | Jacopever                  |     |     | 83  |     |      |     |     |     |     |     |     | 108 | 83  |     |     |     |     |     |     |     |     | 615 |     | 39  |
| <i>Hexanchus griseus</i>         | Shark (bluntnose sixgill)  |     |     | 1   |     |      |     |     |     |     |     |     |     |     |     |     |     | 1   |     |     |     |     |     |     |     |
| <i>Lophius vomerinus</i>         | Monk                       | 94  |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Lophius vomerinus</i>         | Monk (female)              | 68  | 105 | 69  | 75  | 92   | 83  | 27  | 64  | 45  | 33  | 13  | 102 | 18  | 46  | 58  | 33  | 93  | 83  | 88  | 51  | 57  | 110 | 68  | 82  |
| <i>Lophius vomerinus</i>         | Monk (juvenile)            |     |     |     |     | 12   | 7   | 8   | 17  |     |     |     | 11  |     | 21  | 8   | 13  | 7   | 11  | 25  | 11  | 17  | 10  | 11  | 10  |
| <i>Lophius vomerinus</i>         | Monk (male)                | 86  | 127 | 81  | 73  | 90   | 71  | 33  | 62  | 26  | 42  | 15  | 133 | 24  | 34  | 72  | 41  | 91  | 67  | 94  | 52  | 45  | 176 | 85  | 90  |
| <i>Merluccius capensis</i>       | Hake                       | 763 | 310 |     | 213 | 730  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 1   |     |     |     |
| <i>Merluccius capensis</i>       | Hake (female)              | 79  | 287 | 254 | 322 | 347  | 586 | 264 | 566 | 272 | 350 | 43  | 513 | 63  | 307 | 275 | 206 | 434 | 87  | 156 | 286 | 149 | 176 | 297 | 149 |
| <i>Merluccius capensis</i>       | Hake (male)                | 112 | 250 | 260 | 234 | 329  | 385 | 234 | 385 | 163 | 230 | 17  | 470 | 44  | 285 | 251 | 163 | 376 | 57  | 115 | 206 | 166 | 209 | 271 | 98  |
| <i>Pterothrissus belloci</i>     | Bonfish (long fin)         |     |     |     | 2   | 6    |     |     |     |     |     |     |     |     |     | 3   | 1   | 2   |     |     |     |     | 1   | 2   |     |
| <i>Scomber japonicus</i>         | Mackerel                   |     |     |     |     | 3    |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 1   |     |     |     |     |
| <i>Sufflogobius bibarbatus</i>   | Pelagic goby               | 139 | 149 | 173 | 98  | 309  | 131 | 462 | 263 | 74  | 232 | 1   | 397 | 53  | 354 | 350 | 573 | 270 | 590 | 424 | 223 | 459 | 324 | 340 | 175 |
| <i>Todarodes angolensis</i>      | Squid (Angola flying)      | 52  | 134 | 70  | 174 | 18   | 148 | 24  | 99  | 16  | 18  | 12  | 115 | 4   | 9   | 26  | 14  | 66  |     | 11  | 9   | 5   | 25  |     | 10  |
| <i>Toderopsis sagittus</i>       | Squid (flying)             |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |     | 1   |     |     |     |     |     |     |
| <i>Trachurus trachurus</i>       | Maasbanker                 |     |     |     |     |      |     | 1   |     | 24  | 67  | 50  | 1   |     |     |     |     |     |     |     |     |     |     |     |     |

SECTION D, APPENDIX 2 – FISHERIES AND BIODIVERSITY  
2.2 Cruise Report Biodiversity Survey FV Zeearend

| Station Number                        |                         | 1           | 2            | 3           | 4            | 5            | 6            | 7            | 8           | 9           | 10          | 11          | 12          | 13          | 14          | 15           | 16          | 17          | 18          | 19          | 20           | 21          | 22          | 23          | 24          |
|---------------------------------------|-------------------------|-------------|--------------|-------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|-------------|-------------|-------------|-------------|--------------|-------------|-------------|-------------|-------------|
| Sampling Time (Day/Night)             |                         | N           | D            | D           | D            | D            | D            | D            | D           | D           | D           | D           | D           | N           | N           | N            | N           | D           | N           | N           | N            | N           | N           | N           | N           |
| Water Depth at start (m)              |                         | 229         | 230          | 241         | 231          | 218          | 217          | 213          | 213         | 198         | 201         | 202         | 242         | 255         | 209         | 221          | 209         | 223         | 223         | 238         | 234          | 205         | 249         | 221         | 237         |
| Epifaunal Component                   | Common species          |             |              |             |              |              |              |              |             |             |             |             |             |             |             |              |             |             |             |             |              |             |             |             |             |
| <i>Astropecten</i> sp.                | Starfish (long armed)   |             |              |             |              |              |              |              |             |             |             |             |             | 5           |             |              |             |             |             |             |              |             |             |             |             |
| <i>Bathynectus piperitus</i>          | Swimming crab           | 92          | 88           | 41          | 117          | 143          | 204          | 64           | 145         | 73          | 107         | 31          | 87          | 108         | 172         | 175          | 156         | 98          | 66          | 73          | 176          | 212         | 68          | 126         | 79          |
| <i>Callinassa africana</i>            | Mud prawn               |             |              |             |              |              |              |              | 1           |             |             |             |             |             |             |              |             |             |             |             |              |             |             |             |             |
| <i>Fasciolaria lugubris</i>           | Whelk (tulip)           | 9           | 3            | 5           | 10           |              |              | 14           |             |             |             |             |             | 89          | 1           | 15           | 12          |             | 6           | 5           | 3            | 1           | 8           | 16          | 10          |
| <i>Funchalia woodwardi</i>            | Prawn                   |             |              |             |              |              |              |              |             |             |             |             | 3           |             |             |              |             | 3           |             |             |              |             |             |             |             |
| <i>Molgula</i> sp.                    | Ascidians               | 3226        | 7760         | 1275        | 40371        | 9207         | 5435         | 10939        | 4001        | 89          | 242         |             | 884         |             | 209         | 4622         | 2638        | 2308        | 2314        | 1873        | 15728        |             | 109         | 3014        | 328         |
| <i>Nassarius wolffi</i>               | Whelk (dog)             |             |              |             |              |              |              |              |             |             |             |             |             | 7           |             |              |             |             |             |             |              |             |             |             |             |
| <i>Odontaster australis</i>           | Starfish (cushion star) |             |              |             |              |              |              |              |             | 10          | 5           |             |             |             |             |              |             |             |             |             |              |             |             |             |             |
| Paguridae                             | Hermit Crab             |             |              |             |              |              |              |              |             |             |             |             |             | 7           |             |              |             |             |             |             |              |             |             |             |             |
| Porifera                              | Sponge (brown)          | 219         | 285          | 46          |              | 97           | 22           | 11           | 7           | 1           | 1           |             | 42          | 85          | 5           | 41           | 23          | 51          |             | 164         | 165          | 17          | 151         | 91          | 95          |
| <i>Pseudocnus thandari</i>            | Sea cucumber            |             |              |             |              | 6            | 10           | 1            |             |             |             |             |             |             |             | 10           | 12          |             |             |             | 3            |             |             |             |             |
| <i>Pterygosquilla armata capensis</i> | Mantis shrimp           | 54          | 50           | 39          | 24           | 34           | 26           | 18           | 19          | 2           | 4           |             | 39          | 48          | 12          | 20           | 40          | 80          | 44          | 67          | 36           | 3           | 124         | 101         | 18          |
| <i>Solenocera africana</i>            | Prawn                   |             |              |             |              |              |              |              |             |             |             |             |             | 3           |             |              |             |             | 31          | 32          |              |             |             |             | 4           |
| Veretellidae                          | Sea pens                | 3240        | 3240         | 3240        | 2945         | 3240         | 3352         | 2209         | 3240        | 3240        | 3240        | 3240        | 3240        | 2945        | 3240        | 3240         | 3240        | 3240        | 3600        | 3240        | 3240         | 3240        | 3240        | 3240        | 3240        |
| <b>Total Counts</b>                   |                         | <b>8415</b> | <b>13235</b> | <b>6287</b> | <b>44953</b> | <b>15752</b> | <b>10736</b> | <b>14450</b> | <b>9190</b> | <b>4253</b> | <b>4734</b> | <b>3430</b> | <b>6734</b> | <b>3795</b> | <b>5104</b> | <b>10034</b> | <b>7707</b> | <b>7205</b> | <b>7002</b> | <b>7404</b> | <b>20592</b> | <b>5052</b> | <b>7135</b> | <b>8616</b> | <b>4835</b> |
| <b>Numbers of Taxa</b>                |                         | <b>17</b>   | <b>15</b>    | <b>18</b>   | <b>17</b>    | <b>19</b>    | <b>17</b>    | <b>20</b>    | <b>17</b>   | <b>17</b>   | <b>18</b>   | <b>12</b>   | <b>19</b>   | <b>18</b>   | <b>17</b>   | <b>20</b>    | <b>19</b>   | <b>19</b>   | <b>16</b>   | <b>18</b>   | <b>19</b>    | <b>17</b>   | <b>19</b>   | <b>17</b>   | <b>17</b>   |

## Annexure 4. Length frequency graphs for the main commercial species

