



**TEXAS A&M UNIVERSITY  
DEPARTMENT OF OCEANOGRAPHY  
COLLEGE STATION, TEXAS**

**ACROSS MOORING RECOVERY CRUISE**

**ANTARCTIC CROSSROAD OF SLOPE STREAMS**

expedition aboard B.O. HESPERIDES

in the southwest Atlantic Ocean

January-February, 2010

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## Introduction

During the 2009 Antarctic field season, 3 moorings were deployed under the collaborative programs of the NSF funded ACROSS program (Dr. Alejandro Orsi, TAMU, PI), and the Spanish, ESASSI program (Dr. Mar Flexas, IMEDEA, PI) across the South Scotia Ridge near Elephant Island, Antarctica. Working in cooperation with the Spanish investigators from IMEDEA, 3 moorings were constructed to study the cross slope ventilation between the Weddell Sea across the South Scotia Ridge into the deep Antarctic Circumpolar Current (ACC). The Spanish team was responsible for design and fabrication of moorings M1 (600m) and M2 (1200m) while GERG was responsible for the third mooring M3 (1820m) (Figures 1,2 and 3). The mooring program called for a one year deployment with recovery planned for the Antarctic summer of 2010. All moorings were deployed from the Argentine naval vessel BO Puerto Desseado between February 22 and 27, 2009. This report discusses the mooring recovery operations which took place during January and February of 2010 on board the Spanish research vessel BO Hesperides.

## Operations

On January 23, 2010, John Walpert from Geochemical and Environmental Research Group (GERG) of Texas A&M University (TAMU) left College Station for Punta Arenas, Chile to join the Spanish team of Dr. Maria Mar Flexas (chief scientist) and technician Joan Puigdefabregas. Walpert met the Spanish team in Santiago, Chile before boarding a flight to Punta Arenas, Chile. The collaborative team was to fly to King George Island (KGI) on January 26 to join the Spanish research vessel BO Hesperides. While in Punta Arenas the team met with a Spanish film crew making a documentary for Spanish television. The documentary was focused on Spanish research in Antarctica and they wanted to film our team in discussions with the logistics coordinator for Spanish research in Antarctica. The interview took place on January 27 at the Cabos de Hornos hotel in Punta Arenas. Flight cancellations due to bad weather on KGI were likely going to have an impact on the amount of work we would be able to accomplish since the ship was on a fixed schedule. Poor weather prevented Walpert, Flexas and Puigdefabregas (here on referred to as “team”) from flying to KGI until January 29, at which time the team finally left Punta Arenas (Figure 4). The team was transferred from KGI to the research ship via zodiac along with several technicians bound for the Spanish research stations on Livingston Island and Deception Island.

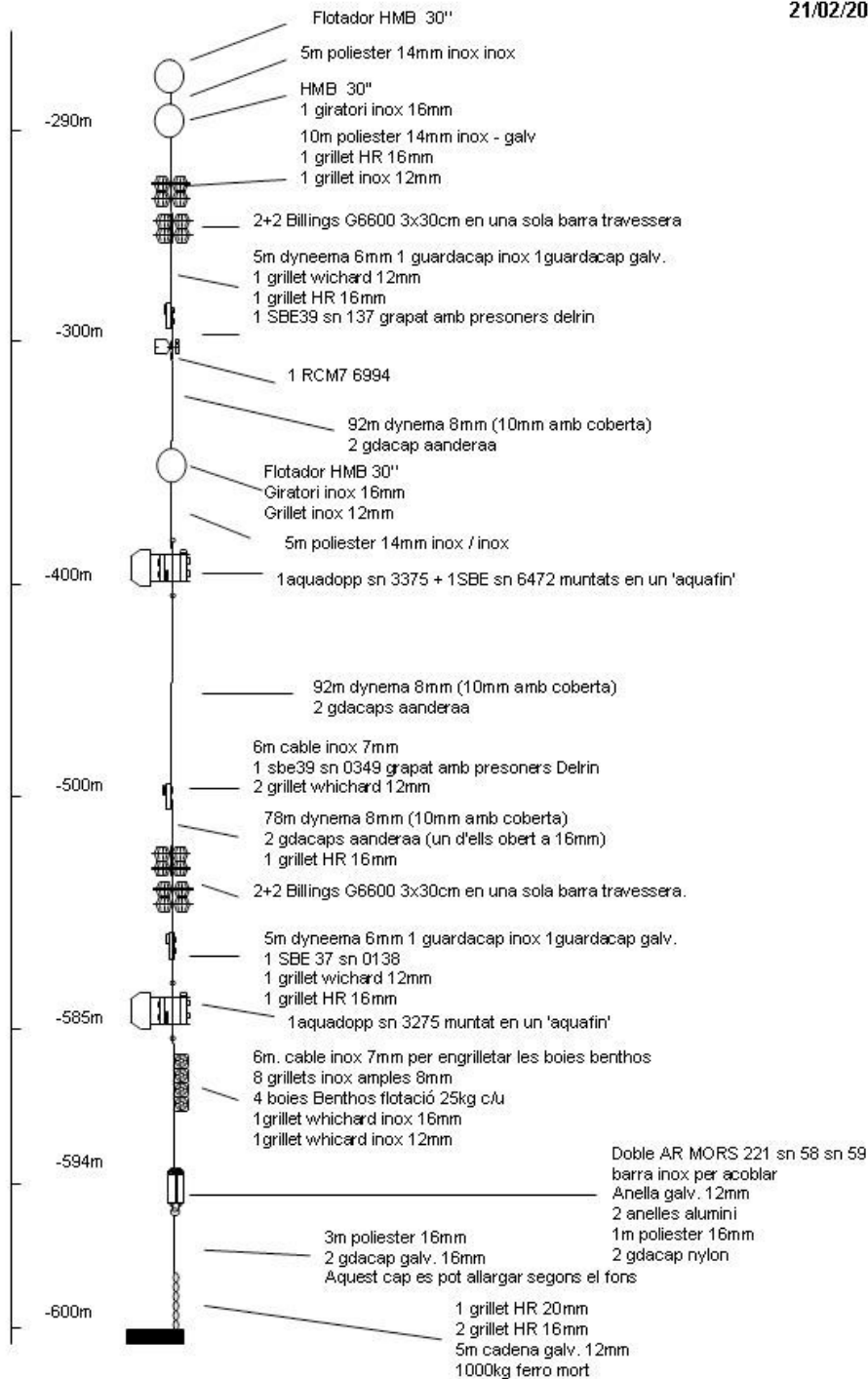


Figure 1: M1 mooring designed and built by IMEDEA

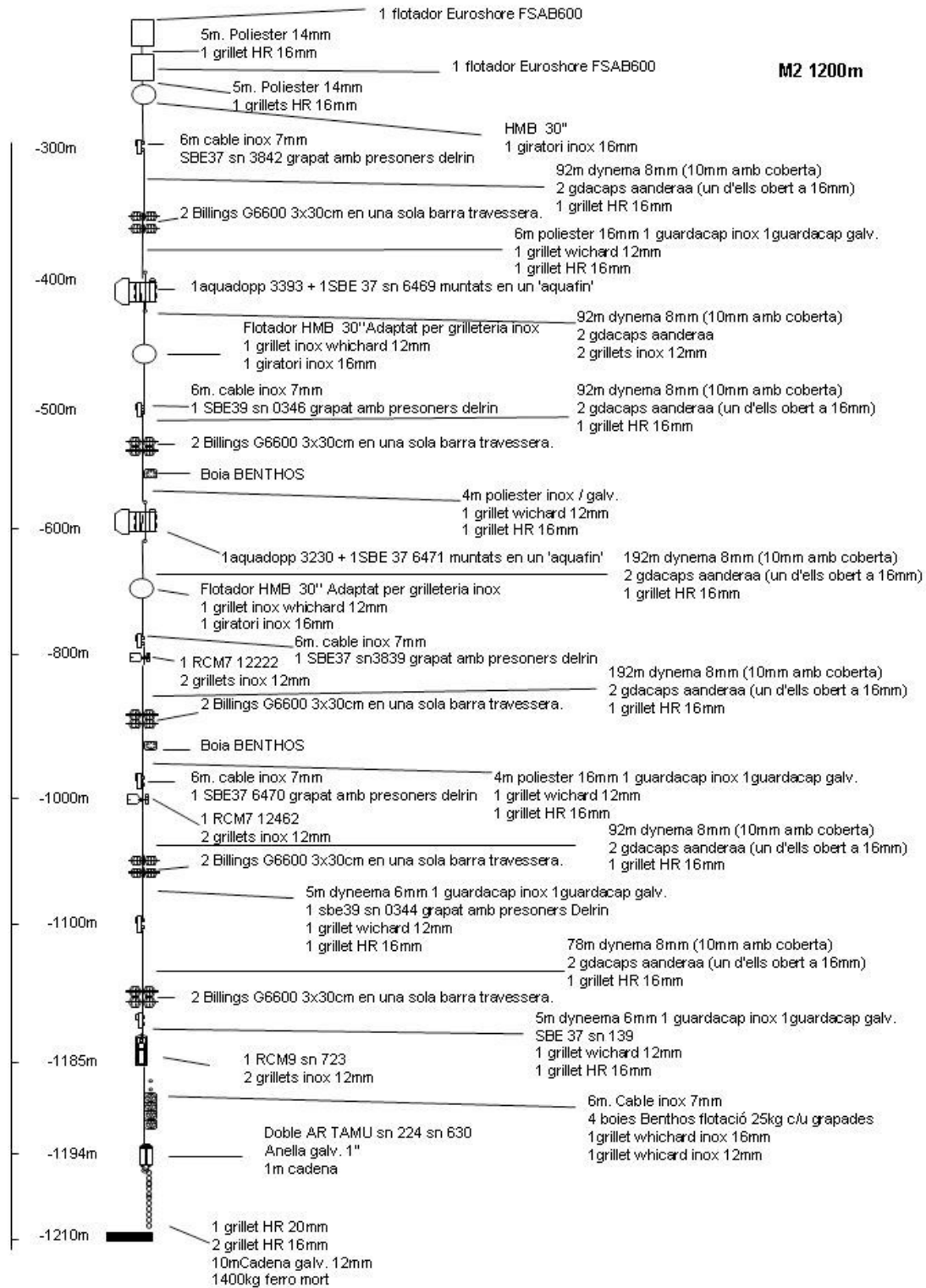


Figure 2: M2 mooring designed and built by IMEDEA

Mooring: M3  
 Nominal Depth: 1820 m  
 Deployed: Feb. 27, 2009

Lat: 60° 22.5302' S  
 Lon: 052° 57.7792' W

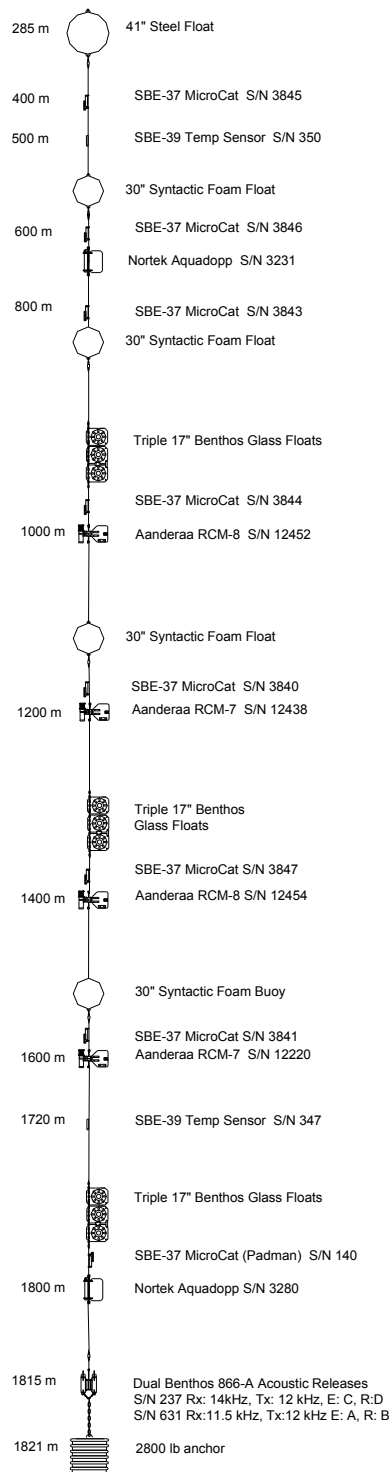


Figure 3: M3 mooring designed and built by GERG at TAMU



Figure 4; The team arrived on King George Island, Antarctica on January 29, 2010

After all technicians, scientists and supplies had been transferred to the Hesperides, the ship departed KGI at 1900 (local ship time) enroute to Livingston Island. While in transit to the island, the team were once again asked to discuss the upcoming mooring and CTD/LADCP operations so they could be filmed for the Spanish documentary. The ship dropped the first group of technicians off along with the film crew at the Livingston Island base camp at approximately 0430 in the morning before heading to the seismic and biological station on Deception Island. The ship dropped anchor at Deception Island (Figure 5) at approximately 0800 on the morning of January 30 at which time the technicians, scientists and supplies were transferred to the base.



Figure 5: Spanish base on Deception Island

The ship left Deception Island for the first mooring location at approximately 11:30 that morning. During the twenty hour transit, recovery and deck operations were discussed with the crew of the ship and the stern deck was setup with snatch blocks, tie off lines and stopper clamps. The recovery would make use of the ship's capstan and fairleads in order to bring the instruments and buoys to the stern and then use the ship's crane to lift the buoys onto the deck. There was no available winch in line with the back deck that could be used.

The team met with the ship's CTD/ADCP/LADCP technicians at 20:00 that evening to discuss the CTD and LADCP procedures and to review the script files for LADCP deployment. Some minor changes to the scripts were made to allow an offset in the pinging (0.5 seconds) in order to prevent potential interference caused by the Master and Slave pinging simultaneously. A procedure for naming the individual files was also implemented. The configuration of the ship's hull mounted ADCP was also discussed, but no changes were made to this file.

The ship arrived at the first mooring location, M1 (Figure 1) at approximately 0800 on January 31. Weather conditions were very good with only light winds (10-15 knots) and 4-5 foot seas. The mooring was released without any difficulties at approximately 0815 and the mooring and instrumentation were on board by 1000. During recovery operations there was a problem with the rope recovery line getting caught up in the large sheave on

deck. The operation had to be stopped several times in order to free the line from the block. (a large block was necessary in order to allow the shackles and pear links to pass through). The problem was discussed after the recovery was completed and the block replaced with a different one.

The ship proceeded to the mooring site M2 (Figure 2). A portion of this mooring was found floating on the surface last year, a day following its deployment. Several attempts to recover the mooring were unsuccessful due to the Puerto Desseado's inability to get close to the mooring in high winds. Before the mooring could be recovered, the ship was ordered to leave the location, and head for Elephant Island in order to take shelter from an on coming storm. Two days later, despite a long and extensive search, the mooring was not relocated. It was not known exactly where the mooring parted, but it was suspected that a newly spliced piece of Dyneema rope near the bottom of the mooring had failed, allowing the remainder of the mooring to surface. After the search was finally called off, the location and operation of the acoustic releases at M2 was re-confirmed. It was decided at the time to leave the remaining mooring in place until the 2010 recovery. A description of lost equipment is given in Table 1.

At 10:00 on the morning of January 31, 2010, the ship was once again on location at M2. The releases were enabled and interrogated. No consistent responses were received from either release. The team was using a new multi function deck box from Benthos that had never been used before. Several ranges were received, but never any that were consistent. After approximately one hour of attempted ranging and releasing, it was decided to try the spare, older deck box. This box was designed specifically for the 866 and 865 series of acoustic releases from Benthos and had a light indicator for release responses. As the deck box was set up, the light indicator kept flashing. The gain on the unit was turned almost all the way down before the indicator stopped flashing. Walpert asked the 2<sup>nd</sup> commander if the ship had a sounder operating at 12 kHz. The answer was yes, and it was in use. Walpert requested that the sounder be turned off. When the sounder was turned off, the light stopped flashing and the releases began to respond consistently to interrogation. After several consistent ranges, the release command was sent. After several minutes of continued ranging, it was determined that the mooring was still on the bottom. The second acoustic release was released and an indication (flashing light indicator) was received that it was already released. Several more minutes of ranging confirmed that both releases were still on the bottom, and both releases were open. Despite the indications, several more attempts were made to release the mooring, but the mooring remained on the bottom. Either the remaining mooring was fouled somehow in the anchor or there was no buoyancy left on the mooring to bring it to the surface. There was no doubt that both releases had opened.

At approximately 12:00, the ship left the mooring site at M2 for M3 (Figure 3). The ship was on station at 12:45 at which time the releases were interrogated. Solid consistent ranges were received from both acoustic releases. The mooring was released at approximately 12:48 and the first buoy was spotted on the surface at approximately 13:10 (Figure 6). Several attempts were made to recover the top buoy but wind conditions made it difficult.





Figure 6: M3 Mooring components as they surfaced

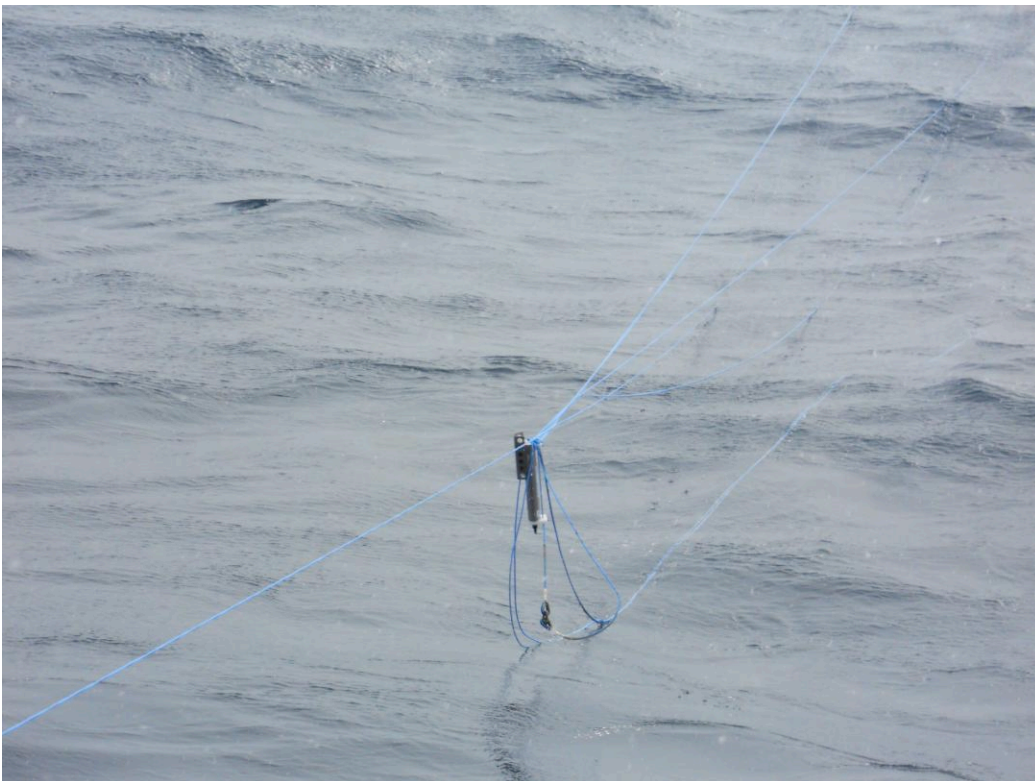


Figure 7: The first instrument to come aboard was a Seabird MicroCat fouled in mooring lines

The fact that the mooring lines had been fabricated using Dyneema rope, a high strength floating line, was a concern to the captain because of the potential for entanglement with the ships propellers. Caution was required in approaching the mooring. The top buoy was eventually recovered at approximately 14:58 at which time the real work began. It was soon discovered that the mooring had become fouled while floating at the surface (Figures 7, 8 and 9) which made the recovery challenging.



Figure 8: More fouling. An Aanderaa current meter is visible just below the surface



Figure 9: The entire mooring was fouled like this

The mooring recovery was completed by 1630. All instrumentation, although fouled in the mooring lines, were recovered in good condition. All Aanderaa current meters were intact with no missing rotors. The mooring lines were eventually sorted out on deck, coiled and all instrumentation rinsed and stowed by 17:30.

The ship returned to the site at M2 to once again try recovery operations. Once again several consistent ranges were received but the mooring was unable to surface. At 1745 the operations at M2 ceased.

CTD and LADCP operations commenced at approximately 20:00 that same evening with the intent to do 4 or 5 sites along the cross slope transect occupied by the moorings. The number of possible CTD's was limited due to the many weather delays the team experienced in leaving Punta Arenas. The intent was to re-occupy the same cross slope transect stations as were occupied last year. While CTD operations got underway, data recovery from the moored instrumentation commenced. In all 5 Aanderaa current meters, 4 Nortek Aquadopp current meters, 7 Seabird MicroCat C, T, P sensors, 4 MicroCat C,T sensors, and 3 Seabird 39 temperature sensors were recovered.

Table 1: List of equipment not recovered at site M2

| Make and Model/Description                          | S/N   | Qty | Owner               |
|---|-------|-----|---------------------|
| 30" HMB 3000m rated subsurface floats               | N/A   | 3   | TAMU                |
| Aquadopp DW Current Meter                           | 3393  | 1   | IMEDEA              |
| Aquadopp DW Current Meter                           | 3230  | 1   | IMEDEA              |
| Custom made Aquadopp Vane assemblies                | N/A   | 1   | IMEDEA              |
| Seabird SBE-37SM MicroCat w/pressure                | 3842  | 1   | TAMU                |
| Seabird SBE-37SM MicroCat w/pressure                | 6469  | 1   | IMEDEA              |
| Seabird SBE-37SM MicroCat w/pressure                | 6471  | 1   | IMEDEA              |
| Seabird SBE-37SM MicroCat w/pressure                | 3839  | 1   | TAMU                |
| Seabird SBE-37SM MicroCat w/pressure                | 6470  | 1   | IMEDEA              |
| Seabird SBE-37SM MicroCat                           | 0139  | 1   | Univ. of Washington |
| Seabird SBE-39                                      | 344   | 1   | Univ. of Washington |
| Seabird SBE-39                                      | 346   | 1   | Univ. of Washington |
| Aanderaa RCM-7 Current Meter                        | 12222 | 1   | IMEDEA              |
| Aanderaa RCM-7 Current Meter                        | 12462 | 1   | IMEDEA              |
| Aanderaa RCM-9 Current Meter                        | 723   | 1   | IMEDEA              |
| Benthos 866-A Acoustic Release                      | 224   | 1   | TAMU                |
| Benthos 866-A Acoustic Release                      | 630   | 1   | TAMU                |
| Benthos 17" Glass Floation in Hard Hats             | N/A   | 4   | IMEDEA              |
| Euroshore FSAB-600 Syntactic Foam Floats            | N/A   | 2   | IMEDEA              |
| Billings 12" Floats in hard hats (sets of 6 floats) | N/A   | 5   | IMEDEA              |

By 0630 the following morning, 6 CTD stations had been occupied and completed. Problems with the CTD (leaking termination) following the 6<sup>th</sup> station and the length of the next station (4 hours) prevented further stations from being occupied. Twenty five salinity samples were taken for sensor calibration over the six stations. Lowered ADCP data were recorded at all stations as was the ship's 75 kHz hull mounted ADCP. Data retrieval from the recovered mooring instruments continued until approximately 13:00 on the afternoon of February 1. With the exception of a clock issue with one data storage unit from an RCM-7 current meter and one failed RCM temperature sensor, one hundred percent data recovery was achieved from the remaining instruments. The clock issue can be corrected.

At 0700 February 1, the ship headed toward Ushuaia, Argentina to offload the science team and equipment.

The ship tied up in Ushuaia at 0900 February 4, 2010. Contact was made with Agunsa (TAMU agent) so that the equipment could be offloaded for shipment to College Station, Tx. All equipment was offloaded and in the hands of Agunsa by 1230 that afternoon.

## Acknowledgements

The Commander, officers and crew of the Spanish research vessel BO Hesperides are to be commended for their professionalism, patience and perseverance in recovering these moorings. The recovery of a mooring that has become fouled can be a dangerous and difficult task and it was done in this case quickly and without injury to personnel or equipment.