

Deployment of an Underwater Photographic/Video Imaging System to Characterize Seafloor Habitats and Benthic Invertebrate Megafauna and Detect Vulnerable Marine Ecosystems

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Abstract A high resolution underwater photographic/video imaging system was designed and constructed prior to the 2008/09 AMLR field season. The system was tested during Leg I, and modified and deployed during Leg II of the AMLR Survey to collect images and video of seabed habitats, in situ benthic invertebrate megafauna, and Vulnerable Marine Ecosystem (VME) indicator taxa. In addition, acoustic transects were completed in the South Orkney Islands and northern Antarctic Peninsula to characterize seabed type and bottom topography. Results from the 2008/09 AMLR Survey include:

- Twenty-one video/photographic tows completed at depths up to 637 m;
- A total of 2,865 still photographs and 17 hours of high resolution video recorded;
- Identification of several potential VME risk areas.

Introduction

The AMLR Program began characterizing the seabed habitat features and benthic invertebrate communities of the South Shetland Islands during the 2002/03 AMLR Survey using a combination of acoustic, video, and sediment sampling methods. During the 2008/09 AMLR Survey, this program was continued in the South Orkney Islands and northern Antarctic Peninsula, with a combination of acoustic, video and still imagery transects. The objectives of this research are to map seabed characteristics, collect information on benthic and demersal habitats and invertebrate epibenthic megafauna, groundtruth benthic invertebrate results from trawl sampling (Chapter 10) and identify potential Vulnerable Marine Ecosystems (VME), as defined in Conservation Measure 22-06 (2008) by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR).

Methods

Digital imagery was obtained using a custom-built high resolution photographic/video imaging system on an open-frame, towed sled with individual pressure casings, developed by Sea Technology Services (Figure 11.1). The system used a Canon EOS 450D, 12.2 MP SLR with 16 GB memory for still images and a Canon Vixia HF11 HD with 32 GB memory for video images (Table 11.1). Data was transferred from the camera via an ethernet connection and processed using a PC running Windows Vista with remote camera and custom control and monitoring software. The system was shipped from Cape Town, South Africa to Punta Arenas, Chile on 20 December 2008 and delivered to the R/V *Yuzhmorgeologiya* prior to Leg I of the 2008/09 AMLR Survey.



Figure 11.1. (A) The photographic/video imaging system, and (B) the addition of skis and supports to the body of the system that enabled consistency of altitude off the seabed (see Protocol Deviations section for more information).

Table 11.1. Specifications for the towed-body photographic/video imaging system built for seabed and benthic habitat characterization during the 2008/09 AMLR Survey of the South Orkney and northern Antarctic Peninsula.

System Characteristic	Technical Specification
Depth rating:	Casings 1000 m, camera dome port 750 m
Towing speed:	1.5 to 2.5 knots
Towing cable:	Steel armoured, two copper cores, 7000 m long
Construction materials:	Stainless steel, nylon, acrylic
Casing types:	O-ring sealed, quick release, nitrogen purged
Power:	12 V 80 Ah AGM lead acid battery
Camera:	Canon EOS 450D, 12.2 MP SLR, 16GB memory
Camera lens:	Canon EF 24mm f/1.4L II USM, wide angle
Camera flashes:	Canon Speedlite 580EX II (x2), E-TTL controlled
Camera domed port:	Acrylic, optically matched to lens
Camera live feed:	Streamed TTL video (5fps) to deck PC
Camera control:	Full control from deck PC software
Video camera:	Canon Vixia HF11 HD, 32 GB memory with bulk battery
Video lighting:	ROS LED SmartLIGHT II (x3), continuous level control
Laser pointers:	Deep Sea Power & Light, SeaLaser 100 (x3), remote controlled
Laser spacing:	Triangle with 500 mm base and 400 mm sides
Depth sensor:	Sea-Bird SBE-50, 1000 m, accuracy 0.1 %, resolution 0.002 %
Acoustic altimeter:	PSA-916D, 100 m bottom detection, resolution 1 cm
Software:	Deck PC running Windows Vista, Remote Camera & STS custom control and monitoring software
Deployment duration:	2-3 hours before recharge

The system was tested at the end of Leg I before beginning Leg II deployments. A single tow was completed to a depth of 720 m in order check the watertight integrity and functionality of the system and to practice flight procedure above the seabed. This was followed by two shallower test tows to adjust photographic settings, ballast weights, and towing procedures.

During Leg II, the system was deployed in the South Orkney Islands where bottom trawl transects were taken; additional deployments were completed where trawls were taken off the the northern Antarctic Peninsula. This allowed collection of high-resolution imagery of undisturbed seafloor characteristics and in situ fauna to compare with

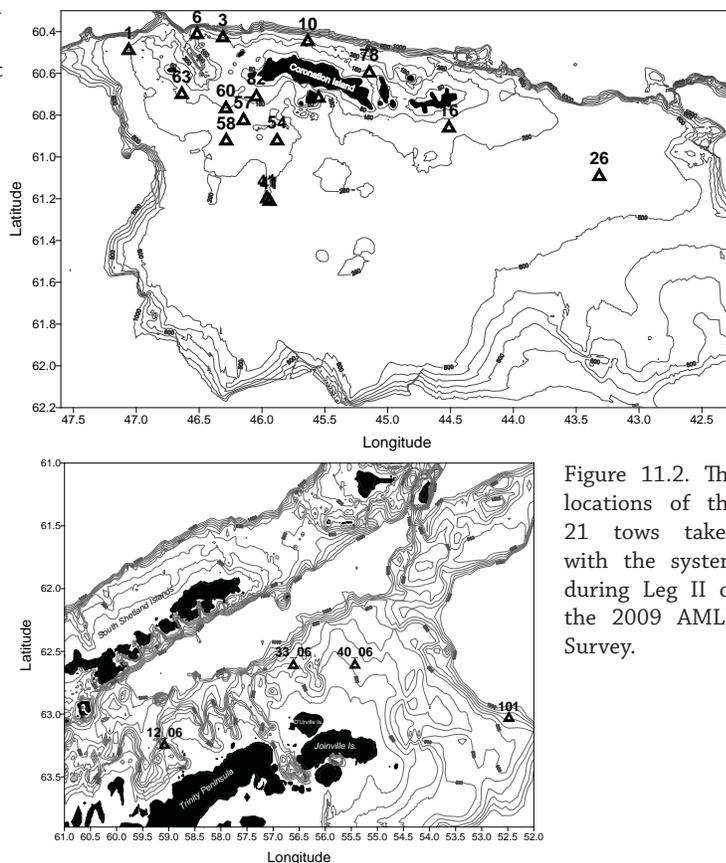


Figure 11.2. The locations of the 21 tows taken with the system during Leg II of the 2009 AMLR Survey.



Figure 11.3. A large field of stylasterid hydrocorals were captured on images taken at station 101, east of Joinville Island (max. depth: 637 m). Isidid bamboo coral can also be seen amongst the exceptional diversity of primnoid gorgonians.

results from trawl sampling. Transects ranged from 20 min to 1 hr.

Results

The photographic/video imaging system was deployed a total of 21 times during Leg II of the 2008/09 AMLR Survey. There were 17 deployments in the South Orkney

Table 11.2. Summary of trackline information for all deployments of the video/camera system during Leg II of the AMLR Survey.

Dip No.	Date Time (CMT)	Station Number	Depth (m)	Latitude, Longitude	Bottom Time	Photos Taken	Video Taken
1	02/10/09 12:18:27	3	157	6025.722742 S, 4618.637114 W	00:59:04	88	1
2	02/10/09 00:00:00	4	0		0	0	1
3	02/10/09 00:04:51	10	240	6026.855278 S, 4538.111853 W	00:57:08	153	1
4	02/11/09 00:38:44	78	98	6035.887761 S, 4508.710197 W	00:59:43	324	1
5	02/15/09 23:18:39	26	444	6105.588168 S, 4318.985752 W	00:58:24	92	1
6	02/17/09 20:01:36	16	197	6051.682711 S, 4430.767283 W	00:39:58	228	1
7	02/22/09 19:25:33	41	236	6112.739356 S, 4556.467641 W	00:20:26	26	1
8	02/22/09 22:54:54	41	246	6111.994422 S, 4557.634055 W	00:48:51	105	1
9	02/23/09 23:15:04	81	74	6043.096904 S, 4532.987015 W	00:39:51	69	0
10	02/25/09 11:26:05	57	198	6049.519407 S, 4608.789014 W	01:01:15	105	1
11	02/26/09 14:26:50	54	208	6055.363646 S, 4552.795036 W	00:43:09	1	1
12	02/27/09 01:33:05	58	225	6055.382368 S, 4617.057202 W	00:45:14	132	1
13	02/28/09 12:16:02	1	252	6029.397923 S, 4703.626674 W	00:41:47	135	1
14	03/01/09 16:22:00	6	218	6024.824533 S, 4630.997397 W	00:40:00	121	1
15	03/02/09 00:41:43	63	150	6042.018712 S, 4638.246711 W	00:48:35	176	1
16	03/02/09 20:09:51	82	104	6042.767771 S, 4602.667768 W	00:55:10	193	1
17	03/02/09 23:13:25	60	154	6046.132526 S, 4617.197827 W	00:53:09	184	1
18	03/05/09 03:12:58	101	637	6300.947414 S, 5222.802771 W	00:57:28	213	1
19	03/05/09 18:51:08	40_06	153	6236.578555 S, 5525.728743 W	00:53:45	189	1
20	03/05/09 00:06:49	33_06	229	6236.949076 S, 5636.032592 W	00:47:14	101	1
21	03/08/09 00:16:12	12_06	398	6314.926776 S, 5904.897490 W	01:00:38	230	1

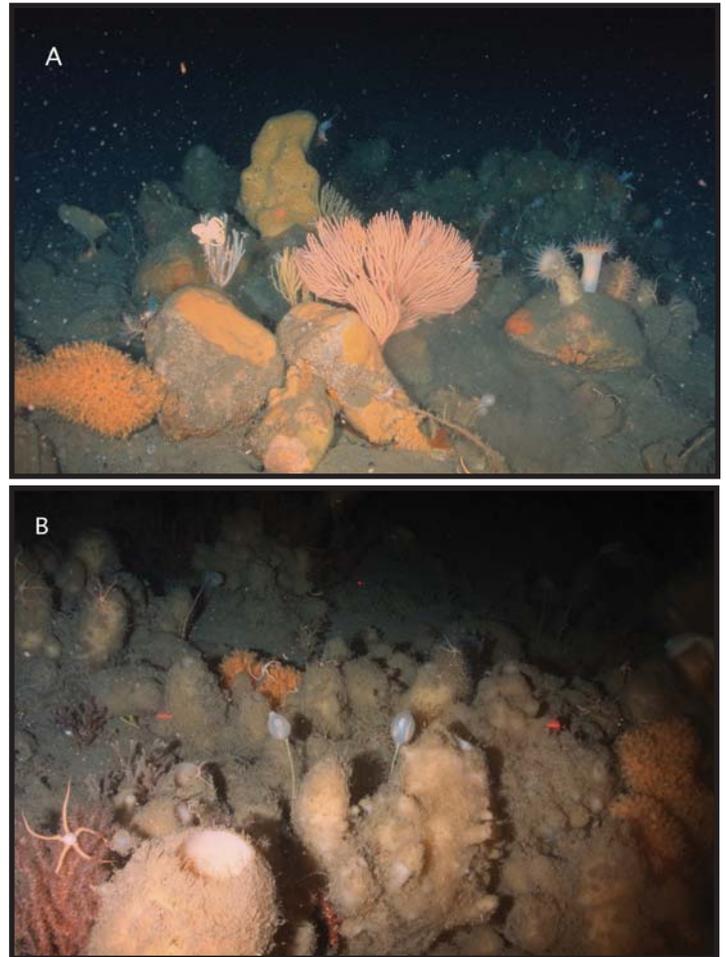


Figure 11.4. Northern Trinity Peninsula shelf, station 12_06 max. depth 398 m. (A) Vulnerable Marine Ecosystem indicator taxa (VME-IT; see Chapter 10) include several species of demosponge, a diversity of primnoid gorgonians (sea fan and bottle brush) and anemones. (B) Clusters of hexactinellid (glass) sponges like these were common along this transect. Hiding is a channichthyid fish, possibly *Chionodraco rastaospinosus*.



Figure 11.5. Tens of thousands of these scleractinian stony corals, *Flabellum*, were captured in images taken along this transect at station 6, north of the Inaccessible Islands (max. depth: 218 m).

Islands (Table 11.2) and four off the northern Antarctic Peninsula. The camera completed 17 hours of total bottom time; 2865 still photographs were taken, and video was recorded on 20 of the 21 tows (Table 11.2).

The images collected revealed several shelf and slope regions with high densities of Vulnerable Marine Ecosystem Indicator Taxa (VME-IT), including stylasterid hydracorals (Figure 11.3), demosponges and pimnioid gorgonians (Figure 11.4A&B), scleractinian stony corals (Figure 11.5), reef-forming bryozoans (Figure 11.6A), and filiose bryozoans (Figure 11.7). Also of note are hexactinellid sponges (Figure 11.4B) and bamboo corals (Figure 11.3). The data will be

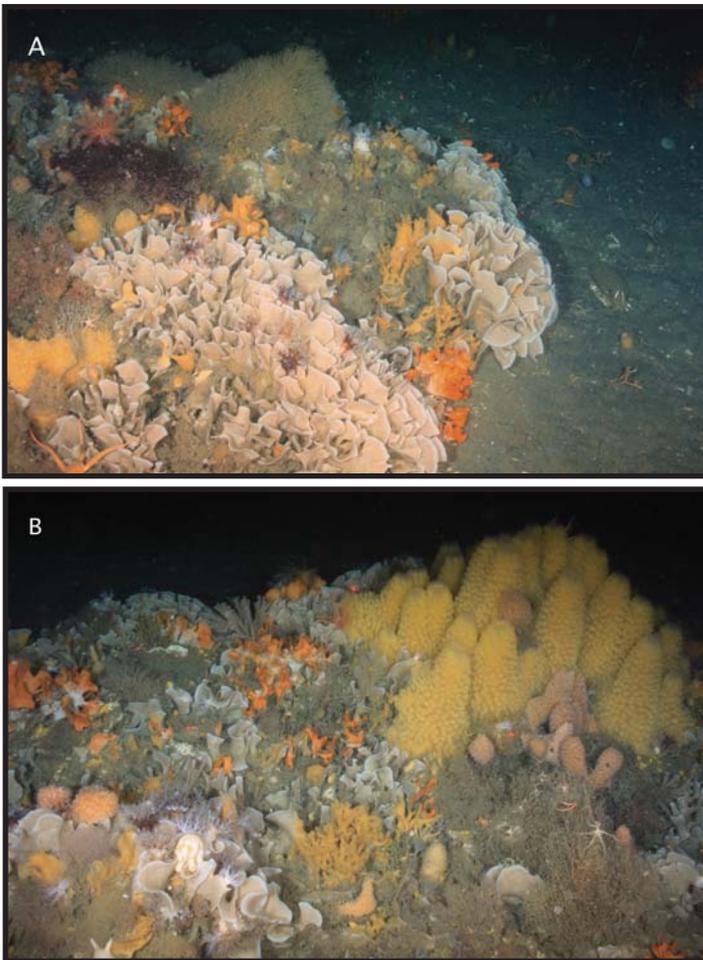


Figure 11.6. Station 33_06, north of D'Urville Island, Antarctic Peninsula, max. depth: 229 m. (A) Several hard bryozoans form complex reefs. (B) Demosponges and mats of filamentous bryozoans and hydroids add to the complexity of these reef systems.



Figure 11.7. A large biomass of foliose bryozoans can be seen in this image taken at station 40_06, north of Joinville Island (max. depth: 153 m), along with butterfly and other demosponges, a diversity of primnoid gorgonians and hydroids. The fish in the center is *Lepidonotothen nudifrons*.

used to identify areas with high diversity, complex community structure or vulnerable taxa.

Several potential VME risk areas were identified in the South Orkney Islands and the Antarctic Peninsula region using a combination of still images and trawl samples (Chapter 10). These sites are primarily characterized by dense communities of demosponges, hexactinellid glass sponges, bamboo corals and bryozoan reefs. Further analysis is required to confirm the characterization of these sites and appropriateness of notifications of potential VME risk areas. VME risk areas will be proposed to CCAMLR for inclusion in the CCAMLR VME registry.

Discussion

The photographic/video imaging system that was designed and engineered for use during the AMLR Survey was successfully deployed during Leg II of the 2008/09 AMLR Survey. This system has great potential to collect seabed still imagery and video during future AMLR Surveys. Video and photographic data collected during Leg II of the 2008/09 AMLR Survey are in the process of being analyzed by the Antarctic Ecosystem Research Division. The preliminary detection of several possible Vulnerable Marine Ecosystems in both the South Orkney Islands and northern Antarctic Peninsula region indicates the need for continued monitoring of the Antarctic benthic environment.

Protocol Deviations

There were considerable difficulties encountered during initial deployments in keeping the system flying consistently at an altitude of 2 to 3m off the seabed due to:

- the stern of the ship heaving in unpredictable surface swells
- inconsistent towing speeds
- changing cable angles
- the drag of the heavy towing cable without hair faired attachments
- the delay in the feedback loop from the live video view and altimeter, via the winch operator, to the response of the Traction Winch operation

Collaboration between the operator, scientists and a very resourceful Russian deck crew resulted in the design, construction and deployment of a towed-ski configuration to keep the cameras at a fixed altitude off the seabed. This was achieved by attaching two skis to additional supports under the camera sled. The towed-ski/camera configuration (a.k.a "Ski-Monkey") allowed the camera system to be de-

ployed at a fixed altitude off the seabed and resulted in a substantial increase in the quality and quantity of the still images and video footage.

This “Ski-Monkey” configuration was used for the last 15 tows of the cruise. Besides the improved quality of the photography, ongoing improvements were made to the software and the operating and handling procedure.

Disposition of Data

Data, imagery and video collected during Leg II of the 2008/09 AMLR Survey are available from Christopher Jones, Antarctic Ecosystem Research Division, Southwest Fisheries Science Center, 3333 North Torrey Pines Court, La Jolla, CA 92037; phone/fax – (858) 546-5605/546-5608; e-mail: Chris.D.Jones@noaa.gov.

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AMLR ANTARCTIC MARINE LIVING RESOURCES PROGRAM

AMLR 2008/2009 FIELD SEASON REPORT

Objectives, Accomplishments and Tentative Conclusions

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The National Oceanic and Atmospheric Administration (NOAA), organized in 1970, has evolved into an agency which establishes national policies and manages and conserves our oceanic, coastal, and atmospheric resources. An organizational element within NOAA, the Office of Fisheries is responsible for fisheries policy and the direction of the National Marine Fisheries Service (NMFS).

In addition to its formal publications, the NMFS uses the NOAA Technical Memorandum series to issue informal scientific and technical publications when complete formal review and editorial processing are not appropriate or feasible. Documents within this series, however, reflect sound professional work and may be referenced in the formal scientific and technical literature.

The U.S. Antarctic Marine Living Resources (AMLR) program provides information needed to formulate U.S. policy on the conservation and international management of resources living in the oceans surrounding Antarctica. The program advises the U.S. delegation to the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), part of the Antarctic treaty system. The U.S. AMLR program is managed by the Antarctic Ecosystem Research Group located at the Southwest Fisheries Science Center in La Jolla.

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