



Antarctic Ecosystem Research Division
 Southwest Fisheries Science Center
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 La Jolla, California, 92037
 USA

AMLR 2014 CRUISE PLAN

VESSEL: R/V IB *Nathaniel Palmer*

OPERATING AREA: South Shetland Islands, Antarctica
 August 19 to September 18, 2014

CHIEF SCIENTIST: Dr Christian Reiss

| ITINERARY: | | Sea Days | Port Days |
|---------------------------|-----------------|---------------------|----------------------|
| Port call in Punta Arenas | 16Aug- 18 Aug | | 3 |
| Cruise | 19 Aug- 18 Sep | 31 | |
| Port call in Punta Arenas | 19 Sep - 20 Sep | | 2 |
| Total Days | | 31 | 5 |

SCHEDULE OF EVENTS:

LEG I:

| | | |
|-----------------------------------|----|----------------|
| Transit to South Shetland Islands | 3 | 19 - 21 Aug |
| Calibrate Echosounder | 1 | 22 Aug |
| Conduct Large-area Survey | 24 | 23 Aug – 14Sep |
| Transit to Punta Arenas | 3 | 15 - 18 Sep |
| Total days | 21 | |

OVERVIEW: One of the goals of the U.S. AMLR field research program is to describe the functional relationships between krill, their predators, and key environmental variables. For the past 24 years the U.S. AMLR field program has been conducted in the vicinity of the South Shetland Islands and the Antarctic Peninsula. Shipboard mapping of these waters indicates that several water masses converge in the area, forming a hydrographic front along the shelf break north of the archipelago. High densities of phytoplankton and Antarctic krill are associated with the position of the frontal zone, although seasonal timing of their appearance can vary by several weeks. The U.S. AMLR program has also documented large year-to-year variability in the



reproductive success of krill and this variability has been associated with multi-year trends in the physical environment, including sea-ice and global atmospheric patterns.

In the austral winter of 2014 the U.S. AMLR program will conduct a quantitative survey of the pelagic ecosystem in the vicinity of the South Shetland Islands consisting of one 31 day leg (Figure 1). The survey in the South Shetland Islands will be similar to the 24-year time series of bio-acoustic krill surveys conducted by the U.S. AMLR program, in this region. It will represent the third year of a planned five year study of winter conditions contributing to the survival and year class strength of Antarctic krill.

OBJECTIVES:

1. Conduct a bio-acoustic, oceanographic and net-based krill survey in the vicinity of the South Shetland Islands to map meso-scale features of water mass structure, phytoplankton biomass and productivity, zooplankton constituents, and the dispersion and population demography of krill.
2. Calibrate shipboard acoustic system at Admiralty Bay (or other suitable anchorage) prior to conducting the large scale survey.
3. Collect continuous measurements of ship's position, sea surface temperature, salinity, turbidity, fluorescence, air temperature, barometric pressure, relative humidity, and wind speed and direction, and other standard data. **NO ADCP WILL BE COLLECTED.**
4. Collect underway observations of seabirds and marine mammals.
5. Deploy drifter buoys (number to be determined). 5 drifters will be deployed on southbound transit at 0.5 degree increments of latitude, beginning at the EEZ of Chile/Argentina. Similarly 5 drifters will be deployed on northbound transits at the same spatial scale. The remaining drifters will be deployed at the discretion of the Chief Scientist to provide data on the surface circulation during the austral winter cruise.
6. XBTs will be deployed at a spatial scale to be determined by the Chief scientist after examining satellite data immediately prior to the cruise. It is anticipated that the spatial scale will be approximately every 15km during each crossing, and occasionally throughout the cruise to provide additional hydrographic data for analysis regarding the structure of the ecosystem.
7. At each of the 100 or so stations that will be sampled, a CTD will be deployed to 750m, and bottles will be tripped at 11 depths. At open water stations either a tucker trawl or an IKMT net tow will be made to 650 or 170m, respectively. At ice covered stations, only an IKMT net tow will be made to 170m. Ice coring will be conducted at each ice station that can support placing researchers on the ice. At each ice station, 5 cores will be taken from approximately 100m from the ship.



OPERATIONS:

1. **South Shetland Survey (Figure 1).** Each leg will consist of a survey of ~112 CTD and net-sampling stations (time and weather permitting), along approximately 2400 n. miles of acoustic transects. Operations will be conducted 24 hours per day (~ 6 stations per day); desired transect speed between stations will be 10 knots, depending on sea state. The survey will be conducted in this order (after calibration) depending on sea state: Elephant Island Area then West Area, then Joinville Island Area, then stations in northwest Weddell Sea if ice conditions permit, then South Area.

2. **A) Acoustic transects.** Active acoustic data will be collected continuously using Simrad ES60 echosounder and hull-mounted transducers (38, and 120 kHz). Data will be logged and processed by computers located in the Computer Room. Continuous supply of vessel position and speed data from the ship's GPS receiver will be required for the EK60 system in the Computer Room.

B) CTD operations. CTD casts will be conducted to 750m or 10 m from the bottom using a Seabird SBE-9/11 CTD instrument, dissolved oxygen sensor, carousel, altimeter, fluorometers, light sensors, Niskin bottles and stand. Water samples (11 depths per cast) will be obtained at a series of standard depths.

C) Net sampling operations. During the survey, either a standard 2 m IKMT fitted with 505-micron mesh net, or the 4m² electronic multi-net tucker trawl supplied by the scientific party, will be used to sample zooplankton and micronekton (including krill). The ship will supply a deck cable terminating in the Computer Room on a quick release system to monitor depth and to trigger nets on the tucker trawl.

Primary sample processing for the will be conducted in laboratory compartments within the ship. Antarctic krill (*Euphausia superba*) will be separated from the catch and enumerated; salps (*Salpa thompsoni*) will be separated, counted and morphometric measurements collected from a sub-sample of the catch; other adult and larval euphausiids, ichthyoplankton, and zooplankton material will be identified, counted and preserved. Sub-samples of *E. superba* from each tow will be processed in the onboard laboratory space to determine length distribution of krill, weight, maturity stage, molt stage, sex ratio, reproductive condition, and gut fullness.

D) Phytoplankton / bacterioplankton operations: At every CTD station, water will be sampled for chlorophyll / bacterioplankton / nutrients and other variables. Samples will be collected at all depths in which Niskin bottles are fired, between 5 and 750 meters. In many cases multiple bottles will be tripped to ensure sufficient water is available for all the different research goals.

E) XBT operations: XBT and or XCTD probes will be deployed to collect hydrographic data to depths of up to 750 meters, during the Drake Passage transits and at other times during the cruise. The expendable probes are launched from the stern of the ship while underway along a high density line, every 15km, from the polar front (58 degrees South) to the



South Shetland Islands during southward transits. On northward transits of the Drake Passage, we will repeat similar deployments. Opportunistic sampling will be conducted between the Shackleton Ridge and Elephant Island, across the Bransfield Strait and along certain AMLR transects at 4km intervals.

F) Ice coring and sampling – Within the pack ice, and where the captain deems ice thick enough to support the weight of researchers, 3 scientists will be deployed to make 5 ice cores within an arc of 100m of the ship. Ice cores will be made, and will be sectioned into 10cm samples on the ice, before being placed into aseptic whirlpack bags, and then into coolers for transport back to the ship. It is expected that the ice coring operation will not exceed 3hours per station, and will include approximately 40 stations (approximately 5 days of shiptime).

3. **Acoustic system calibration.** Prior to the survey the ship will anchor in approximately 25 fathoms of water in Admiralty Bay (either Ezcurra or Martel Inlet, depending on ice and wind conditions) for the purpose of calibrating the acoustic system. **Ship's personnel will be required to run a transfer line under the hull before deploying the anchor.** The scientific party will supply all additional hardware and cables required for calibration. Historically, the best and most efficient calibration occurs with propellers disengaged from the shafts so that they do not turn.
4. **Deploying drifters:** Drifters will be deployed from the ship. Drifters will be released on three of the four transits between the SSI region and Punta Arenas, south of 58S. Additional drifters will be deployed in the Elephant Island region, in the Weddell, and along transits to the South Orkney Islands, as dictated by the chief scientist.
5. **Seabird and marine mammal observation.** Seabird and marine mammal observations will be made from one of the bridge wings or inside the pilot house during inclement weather along transects between stations and during the transits to and from Punta Arenas. Access to GPS position data and electrical power inside the pilot house will be required for a laptop computer.



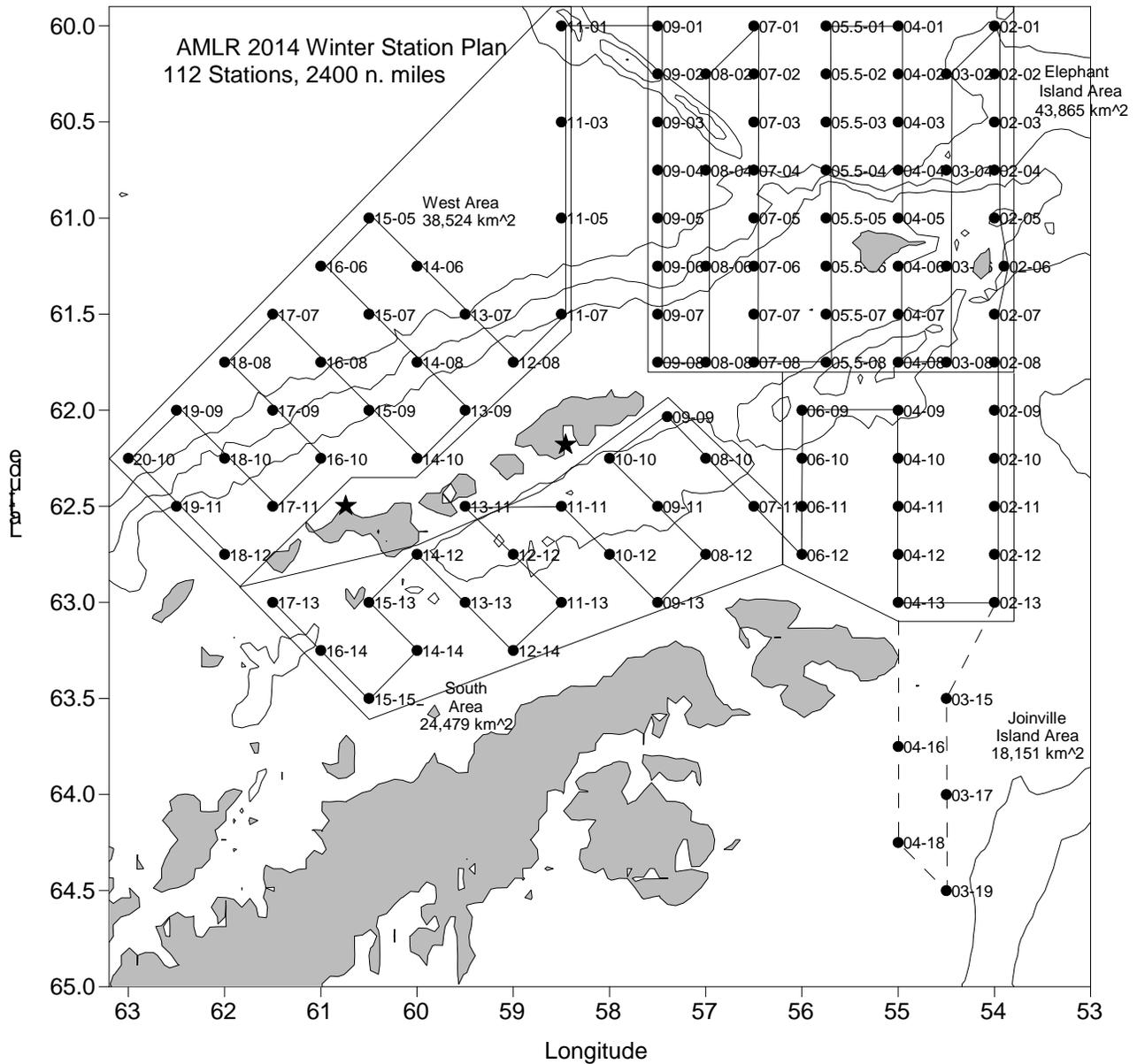


Figure 1. AMLR 2014 Winter station plan. Black dots indicate station locations; heavy lines indicate transects between stations; thin lines outline stratum; stars indicate locations of Cape Shirreff and Copacabana field camps; depth contours are 1000, 2000, and 3000 m. Surveys will be conducted in the following order: West Area, then Elephant Island Area, then Joinville Island Area, then stations in northwest Weddell Sea (if ice conditions permit), then South Area.