

## Biological research

The oxygen in every second breath you take has been created by phytoplankton through ocean photosynthesis. The oceans are effectively the world's lungs, the currents are the veins moving nutrients around, and the biological oceanographers are the doctors monitoring blood pressure and overall health.

Biological oceanographers will be able to use the TRIAXUS, a hydrodynamically designed vehicle, which can be towed behind the ship in an undulating flight path, to collect data from the surface to depths of 350 m in an undisturbed environment. Data can be collected over hundreds of kilometres, providing critical maps of phytoplankton, salt concentrations and temperature.

Marine biologists onboard *Investigator* will be able to study ocean life, including phytoplankton, sea cucumbers, worms, crabs, jellyfish, squids, sponges, and algae, and commercial fishery species like southern bluefin tuna. They will also collect samples to better understand the life cycle and ecosystems of marine plants and animals.

There are a number of CTDs available, including a 36 and 24 bottle system and a 12 bottle trace metal system, that are able to capture water samples to depths of 7000 m to study phytoplankton and other biological parameters.

A towed camera system is available, equipped with lights and electro-optical cables to allow real time video observation onboard, to depths of up to 6,000 m.

The sea floor mapping technology is able to provide a three-dimensional illustration of the sea floor features, and a smaller sonar towed behind the ship is able to provide intricate details of features, including species habitats.



*Investigator* is fitted with the latest fish assessment sonar that can reach to depths of 3,000 m and collect passive data on where species live, eat and breed. This, combined with the seafloor mapping technology, will greatly improve our understanding of ocean ecosystems.

Onboard *Investigator* there is also a range of sampling equipment, including nets, from small fine gauge surface nets, to large ocean trawling nets, to capture species down to 5,000 m, and sea floor sampling equipment, such as the multicorer, which is able to collect sediment samples to 50 cm into

the seafloor. There are incubation facilities that can keep species such as krill alive during transportation to land-based laboratories and refrigeration facilities to store sea floor sediment samples at 4°C.

Until now Australia has not had the capability to assess fisheries below 1,500 m water depth. *Investigator* is fitted with advanced fish school assessment technology that can collect data to 3,000 m below the ocean's surface. As the demand for fish products continues to rise, so must our understanding of commercial fisheries to sustainably manage these resources.



# Equipment capability

## Autonomous sea surface temperature (SST) radiometer

The SST radiometer uses infrared radiation measurements to determine the temperature of the sea's surface.

## Bongo nets

A very fine tubular mesh net that is to sample plankton.

## Corer boom

A starboard boom for the deployment of equipment from the side of the vessel, with a load limit of 20 tonnes. It can be used for deploying long and short sediment corer, benthic grabs, bongo nets etc.

## CTD

A device used to profile the conductivity and temperature of the water column. Extra sensors can be added to measure other variables such as phytoplankton, oxygen fluorescence and turbidity.

## 24 bottle carousel and frame

A cluster of 24 water sample bottles and sensors that is attached to a CTD.

## 36 bottle carousel and frame

A cluster of 36 water sample bottles and sensors that is attached to a CTD.

## Trace metal CTD system

Including a trace metal clean winch 12 bottle trace metal CTD. Trace metal clean cord to 300 m which can be connected to further wires to an ultimate depth of 6,000 m.

## CTD deployment boom

The CTD laboratory is a complete system for CTD deployment and recovery.

## Deck incubators

Deck mounted incubators with temp controlled unit for 4 x 0.25 m<sup>3</sup> incubators. These are seawater containment areas on the deck used for conducting experiments and observations of phytoplankton activity.

## Dissecting microscopes and peripherals

Dissecting microscopes for general laboratory use.

## Drop keels

Two drop keels that can be lowered or raised as needed.

- ◆ Camera – 360°
- ◆ EK60 with transducers working at 18kHz, 38kHz, 70kHz, 120kHz, 200kHz and 333kHz.
- ◆ Water intake
- ◆ ADCP 75kHz + 150kHz
- ◆ Hydrophone

## Electronic fish measuring boards

High resolution device used for measuring onboard fish samples.

## EZ net

A system of multiple fine mesh nets that can be opened at different depths and sensors, towed behind the ship and used for sampling areas of the water column at various depths up to 1,000 m.

## Fish finding sonar

Simrad SH90. Fish finder used to detect fish and krill schools close to the surface and map their distribution, it can also be used to map rapid changes in depth while swath mapping and iceberg detection in southern waters.

## Forward looking drop keel camera

Drop keel mounted camera for monitoring scientific equipment and marine life.

## Full ocean depth multibeam system

The Kongsberg/Simrad EM122 is a deep water sea floor mapping system, capable of working to full ocean depth.

## Laboratory incubators

Two 300 litre Steridium incubators.

## Long and short sediment coring system

A complete long sediment coring winch system to wire end. The coring system can take sediment core samples from 6 – 24 m long. The 3.5 ton long corer is deployed by winches and a dedicated steel corer handler located at the starboard side, for accurate control and set up. Can be deployed as a piston corer or gravity corer.

## Milli-Q systems

An ultra-pure filter for water in the laboratories. The outlets are located in the Hydrochemistry, Preservation, Clean Wet and Dry Laboratories, and water is also available for use elsewhere onboard.

## Multibeam scientific and fisheries echo sounder system

The Kongsberg/Simrad ME70 is a fish biomass sonar system located in the gondola, which spreads a signal in a fan shape to 120°, collecting data to 500 m depth and 3,000 m wide.

## Multi-corer

The K-C multicorer 70.000 can take multiple core samples to a depth of 1m below sea floor.

## Multi-frequency hydrophones

Four hydrophones are mounted in different locations along the keel, which are used to detect and record underwater acoustics, including the noise made by the vessel as well as noise from the ocean.

## Multi-frequency scientific split-beam echo sounders

The EK60 system with transducers working at 18kHz, 38kHz, 70kHz, 120kHz, 200kHz and 333kHz.

## Rock dredges

Consisting of a metal frame attached to the mouth of a chain bag, it's deployed behind the moving ship and used for sampling large rocks on the ocean floor.

## Shallow water multibeam scientific echo sounder system

The Kongsberg/Simrad EM710 is a very high resolution seabed mapping system with a flexible configuration for acquiring bathymetry and back scatter data down to 2,000 m.

## Sherman sleds

Two epibenthic sleds can be used to sample organisms over rough areas of sea floor such as seamounts.

## Side scan sonar

The Edgetech 4200FS multipurpose scan sonar with hydraulic winch is available by negotiation with Geoscience Australia.

## Smith McIntyre grab

This is a sampling device that uses bucket-like jaws to collect ocean sediments in a sampling area.

## Sound velocity probe

The sound velocity probe is used to measure the speed of sound.

## Trawl mensuration and monitoring systems

A device to assist in the collection of data associated with the trawl net, to ascertain the height, width and depth of the mouth of the net.

## TRIAXUS

A towed undulating CTD system to take horizontal profile measurements of the water column.

## Thermosalinograph

The thermosalinograph continually measures surface temperature of the ocean and salinity along the track of the ship, using the underway seawater system in the drop keel.

## Ultra short baseline (USBL) acoustic positioning system

The USBL system that determines the position of instruments deployed off the side or the stern of the ship, reporting their position relative to the ship.

## Underway water analysis instruments

These instruments measure pCO<sub>2</sub>, O<sub>2</sub>, and chlorophyll, and include bio-optical sensors.

## Vibro-corer

Used to retrieve continuous, undisturbed core samples. Available by negotiation from Geoscience Australia.

## XBT system

An expendable Bathythermograph, used to collect temperature profiles to calculate sound velocity data.

