SIZING UP THE FOOD CHAIN: **WHAT DRIVES THE GREAT AUSTRALIAN BIGHT ECOSYSTEM?**

At a glance

Project title
Characterise seasonal and spatial variability of offshore/slope plankton and micronekton communities

Project summary
To study the microbial, planktonic and micronekton communities of the central and eastern Bight to see when and where deep-water pelagic food sources are plentiful, and what this means for the wider community.

Project investigators
CSIRO and SARDI

Program partners
CSIRO, BP, SARDI, the University of Adelaide and Flinders University are working on a $20 million research program to better understand the environmental, economic and social value of the Great Australian Bight.

Project contacts
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Overview

A better understanding of the Great Australian Bight ecosystem, particularly how food webs function in deepwater habitats, is vital to assessing the effects of future development.

As well as supporting nationally important commercial fisheries, the Bight is home to many species of high conservation value, such as blue whales, seals and white sharks.

The ecological links between these animals and the smaller species that sustain them, however, are poorly understood. This makes it difficult to predict how the food web structure could be affected by human activities.

This project will study the microbial, planktonic and micronekton (small fish, crustaceans and squid) communities of the central and eastern Bight to see when and where pelagic (open ocean) food sources are plentiful, and what that means for the wider ecosystem.

This understanding will help to explain patterns in the distribution, abundance and migration of top marine predators (and their potential vulnerabilities), and contribute to ecosystem modelling and monitoring on a regional and basin-scale.

The Challenge

Ecosystems of the central and eastern Great Australian Bight are fuelled by a seasonal upwelling of nutrient-rich water in the east, and a predicted year-round downwelling in the centre (a phenomenon that normally equates with a lower density of marine life).

However, the central Bight supports a high density of micronekton, seemingly at odds with scientific predictions.

Explaining this paradox – and its effect on the wider ecosystem – requires understanding the distribution of microbes, plankton and micronekton across the outer shelf, slope and deep ocean.

A key question is whether the recycling of decayed organic matter supports the dominant planktonic food web over the Bight's deep continental margin.

The Research

The project will combine at-sea biological sampling with advanced optical and acoustic mapping to characterise deep water pelagic community structure and identify key ecological processes in the central and eastern Bight.

Field and laboratory research will focus on the abundance and diversity of microbes, plankton

Below: *Zooplankton are an important component of marine food webs that link plankton to top predators.*

and micronekton – particularly those of importance to apex predators – and how these are influenced by the physical and chemical environment.

Acoustic (sonar) technology will be used at a fine scale, together with visual and biological sampling, to capture profiles of dominant biota, and at a broad scale to monitor the distribution of micronekton. The acoustic properties of key organisms will be determined.

Other field research will include:

- sampling to record seasonal patterns of phytoplankton and zooplankton abundance and composition;
- water and nutrient sampling for nitrate, nitrite, ammonium, phosphate, silicate, trace elements, and pigments;
- experimental studies of primary and secondary productivity such as bacterial grazing;
- identification of biological samples to the lowest practical taxonomic unit; and
- analysis of whole specimen or muscle samples to build a picture of food sources, food webs and microbial pathways between regions.

Above: *Micronekton are an important link between secondary producers and higher trophic levels in the food web.*

The Impact

A better understanding of food web structure and function in the Bight ecosystem is needed to help predict the effects of development in this region.

This project will identify the ecological processes that support and drive the key links in the Bight deep water food chain, and how they may affect the overall ecosystem.

A better understanding of the Bight ecosystem will underpin sustainable management practices for this important marine environment, including the capacity to predict and mitigate the potential impacts of human activities in the Bight.

The People

Dr Rudy Kloser of CSIRO specialises in the development and use of acoustics and optical methods to understand the structure and function of deepwater pelagic communities. He has led the development of bio-acoustic basin scale sampling within Australia's Integrated Marine Observing System (IMOS).

Dr Paul van Ruth of SARDI is a biological oceanographer and plankton ecologist. His interests focus on understanding the way in which variations in physical and chemical environmental parameters, whether driven by anthropogenic or climatic factors, shape marine planktonic communities and lower trophic ecosystem dynamics from global to local scales.

Dr Andy Revill of CSIRO specialises in studying the chemical signatures of marine food webs and how they can be used to help understand marine ecosystems and their sustainable management.

Dr Anthony Richardson of CSIRO and the University of Queensland has diverse research interests in marine ecology, focusing on understanding the effects of environmental variability on marine

Above: *Profiling multi-frequency acoustic and optical system for detecting and quantifying the micronekton (small fish, squids, crustaceans and larger gelatinous organisms).*

systems (in particular plankton dynamics) as a window to predicting impacts of climate change.

Dr Mark Doubell of SARDI is a physical and biological oceanographer who studies the bio-physical couplings and the mechanisms that influence the distribution of marine life. Mark's research focus has traditionally focussed on small-scale ocean processes and their influence on the ecology of microbial and planktonic communities. More recently, Mark has extended his work to applied fisheries and coupled ocean-biogeochemical modelling in order to support the sustainable development of fisheries and aquaculture. Mark has extensive sea-going experience, particularly in the waters of Australia's southern shelf and the Southern Ocean.

For more information
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