FORECASTING PRODUCTIVITY IN **THE GREAT AUSTRALIAN BIGHT**

At a glance

Project title
Spatial and temporal variability in the shelf plankton communities in the Great Australian Bight

Project summary
To understand the drivers and timing of shifts in food web dynamics and the role of upwelling and downwelling in the region.

Project investigators
SARDI and CSIRO

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 contact
Dr Paul van Ruth
SARDI
E: paul.vanruth@sa.gov.au

Overview

The eastern Great Australian Bight is one of Australia's most productive marine environments, however little is known about the systems that support its rich biodiversity.

This project will look at food web dynamics across the Great Australian Bight by studying the region's tiniest organisms to understand how they influence the productivity of larger marine species including sardines, tuna, dolphins, seals, seabirds, whales, and white sharks.

These small organisms provide the food that underpins the pelagic or open water ecosystem. They include microbes (viruses and bacteria), phytoplankton (microscopic plants), and zooplankton (microscopic animals).

Researchers will examine how seasonal changes in oceanographic cycles, and the influence of upwelling and downwelling processes in the region, may cause changes in the amount and type of nutrients available to primary producers in the food web, which can have implications for the composition and size distribution of microbial and planktonic communities and food web dynamics.

The Challenge

The eastern Great Australian Bight is characterised by summer upwelling which enriches shelf waters with nutrients and enhances productivity in the region.

The new nutrients supplied during times of upwelling support a food web based around larger phytoplankton (the classic food web), leading to increases in productivity at higher trophic levels.

This enhanced productivity supports large populations of small pelagic fish such as sardines and anchovies. The region is also a significant feeding and breeding ground for important large marine species such as southern bluefin tuna, Australian sea lions, and long-nosed fur seals.

Conversely, downwelling processes dominate during winter, which suppress nutrient enrichment and reduce productivity.

In periods of downwelling plankton are more likely to rely on nutrients regenerated through microbial

Below: *Zooplankton are an important link between primary producers and higher trophic levels in the food web.*

processes, and the food web is likely to be characterised by smaller organisms (the microbial food web), leading to less productivity.

This project will test the theory that changes in upwelling and downwelling processes across the Great Australian Bight trigger shifts in food web dynamics between the microbial and classic food webs that will affect the overall productivity of the region.

The Research

The project will combine the analysis of archived plankton samples with examinations of new samples collected in shelf waters of the eastern and central Great Australian Bight.

Research will focus on the examination of spatial and temporal variation in the composition and size distribution of microbial, phytoplankton and zooplankton assemblages.

Results will be augmented by the analysis of data collected by the Southern Australian node of the Integrated Marine Observing System (IMOS), and the Bureau of Meteorology, to examine the influence of changes in the physical and chemical environment on microbial and plankton communities and food web dynamics.

Changes in food web dynamics will be compared with patterns in sardine biomass and recruitment to assess implications for higher trophic levels of the food web and overall productivity in the Great Australian Bight.

The Impact

Understanding the drivers and shifts in food web dynamics in the Great Australian Bight will help explain the way that the physical oceanography affects the region's food webs, enabling better estimates of the potential overall productivity in the region.

Establishment of baseline information on microbial and planktonic communities also provides critical information to help predict the effects of future human activities, and the ability to recognise and attribute variations within the system to either anthropogenic impacts or natural cycles.

The People

Dr Paul van Ruth of SARDI is a biological oceanographer and plankton ecologist. His interests focus on understanding the way that 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. He is the lead biological oceanographer for the Southern Australian node of IMOS.

Above: *Water sampling at different depths assists in identifying changes in food web dynamics.*

Above: *The Great Australian Bight is an important feeding ground for southern bluefin tuna. Food web changes affect productivity and the amount of food available for higher trophic predators (e.g. fish, sharks, whales and seals).*

A/Prof Tim Ward of SARDI is a fisheries biologist who is interested in the biology, ecology and stock assessment of small pelagic fishes and the assessment and mitigation of fishery interactions with non-target species and marine ecosystem. He has led several large and successful multi-disciplinary research projects in the Great Australian Bight and has published papers on the importance of the region's upwelling system in enhancing pelagic productivity and the effectiveness of the Great Australian Bight Marine Park in representing and protecting regional biodiversity.

A/Prof Anthony J. Richardson of CSIRO and the University of Queensland is a quantitative marine ecologist, focusing on understanding the effects of environmental variability on marine systems (in particular plankton dynamics) as a window to predicting impacts of climate change.

Dr Richard McGarvey of SARDI is a fisheries population modeller, with 30 years of experience in statistical modelling, population dynamic modelling, survey design and data analysis, and bioeconomic modelling. He retains a focus on modelling pelagic ecosystems, notably the dependence of organism body size and metabolic type on rates of trophic energy flow up the food chain.

For more information
Dr Steven Lapidge
Great Australian Bight Research Director
steven.lapidge@sa.gov.au

www.misa.net.au/GAB

bp
CSIRO
Government of South Australia
Primary Industries and Regions SA
SARDI
SOUTH AUSTRALIAN RESEARCH AND DEVELOPMENT INSTITUTE
THE UNIVERSITY of ADELAIDE
Flinders UNIVERSITY