Hunter Island Press acknowledges the support of the Tasmanian National Science Week Co-ordinating Committee and CSIRO Marine and Atmospheric Research, Hobart, who have helped make this exhibition and catalogue possible. National Science Week is an initiative of the Australian Government - www.scienceweek.gov.au

An Australian Government Initiative

Catch – Alicja Boyd
Etching on Hahnemuhle paper

Argo – Sarah Robert-Tissot
Linocut and block print on BFK paper

Rough seas – Fred Duncan
Mixed media on BFK paper

the True Naming – Marinelle Basson
Digital ink print on Hahnemuhle paper

Sous la mer – Brett Littleton
Screenprint on Fabriano paper





Since 2005 Hunter Island Press Inc. (HIP) has organised two exhibitions each year for our members: our annual Mini-print Exhibition and Sale (all prints 21 x 21 cm) and an open Member's Exhibition. Additionally, we have sought to work with other community groups and organisations to develop interesting opportunities for HIP printmakers to explore different ways of making work. These have included:

- Surf Life Saving Australia: "Reel Heroes: Safe Beaches" with four other Australian studios (PAWA, Impress, Warringah and Newcastle);
- Pardalote Press: "Haiga" – creating images for published Tasmanian Haiku poets;
- Meadowbank Estate: "Harvest" – a limited edition boxed set of prints developed from harvest day at the Meadowbank Winery; and now,
- CSIRO Marine and Atmospheric Research: "Over the Edge" – where 21 artists have been paired with a CSIRO scientist and asked to interpret their area of research for this exhibition at the Henry Jones Art Hotel during National Science Week.

Each of these projects has been a worthwhile experience for our members but all agree that "Over the Edge" has been a special experience and they have relished the opportunity to work with and interpret the essential research of the scientists of the CSIRO.

John Ingleton – President
Hunter Island Press Inc

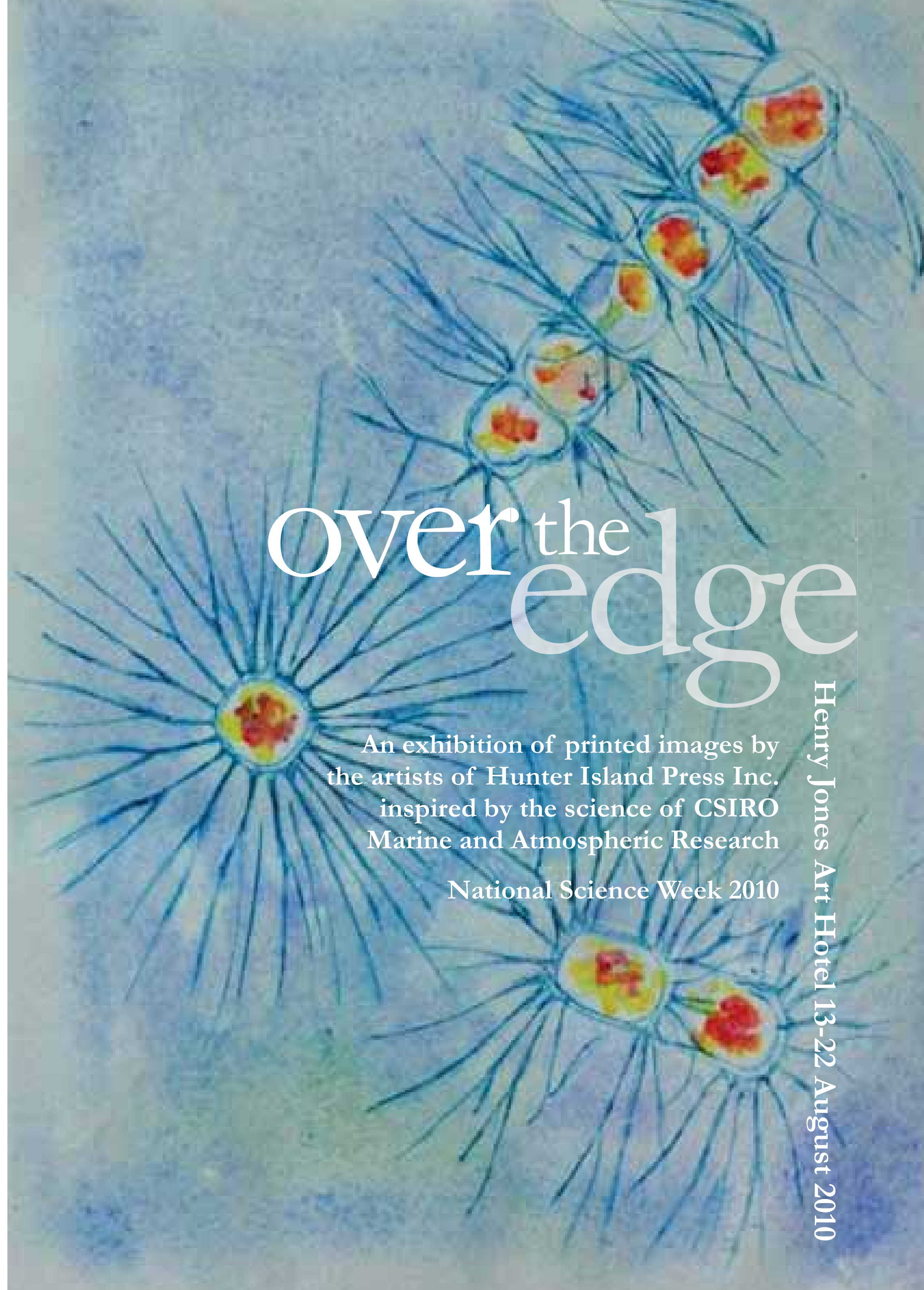
CSIRO moved its marine scientists into new laboratories at Hobart's Battery Point in 1985. The biologists began intensive studies of the ecosystems supporting commercial fisheries around Tasmania. The oceanographers headed for the Southern Ocean, assisting global efforts to understand ocean circulation and its role in climate.

In 2010, as CSIRO Marine and Atmospheric Research celebrates 25 years at Hobart, marine scientists still need to see what's happening in the ocean. With the help of technicians and engineers they use instruments on satellites and remote ocean platforms; physical, visual, and acoustic sampling from ships; smart tags attached to marine animals; and advanced laboratory and data analysis techniques. Their findings support decision-making relating to fisheries and conservation, coastal development, aquaculture and climate.

The artworks inspired by scientists in the "Over the edge" collaboration focus a creative lens on this fascinating and vital research.

hunterislandpress.org.au

www.csiro.au



over the edge

An exhibition of printed images by the artists of Hunter Island Press Inc. inspired by the science of CSIRO Marine and Atmospheric Research

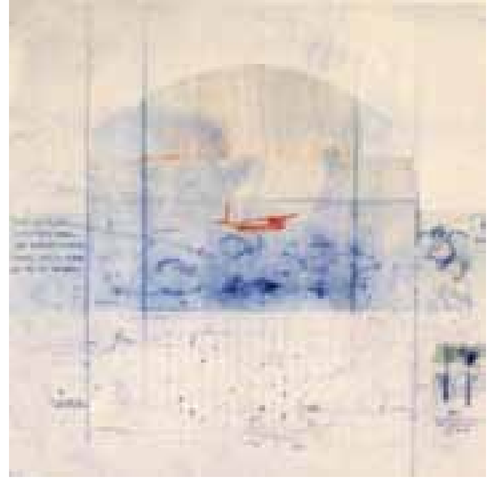
National Science Week 2010

Henry Jones Art Hotel 13-22 August 2010

Hunter/hunted – Ros Meeker
Etching

Coriolis squid – John Ingleton
Lithograph and block print on BFK paper

Southern blue fin tuna – Tamayo Leahy
Linocut on BFK paper



Whale sighting at Casey and Bunger Hills –
Deborah Asmather
Etching and drypoint on BFK paper

Larval cray gets away – Jill Stephenson
Collograph

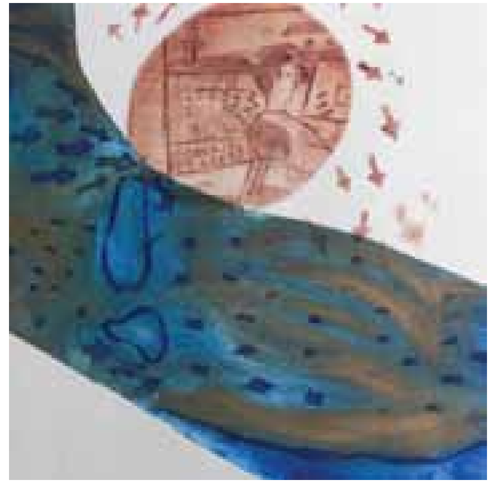
Hairy Friends (Basteriastrum sp.) –
Annick Ansselin
Monoprint on BFK paper

Light meter (PRR-600) – Margaret McAteer
Screenprint

Itinerant troops – Brett Meeker
Reduction block print

Siren fingerprint – Cath de Little
Etching on BFK paper

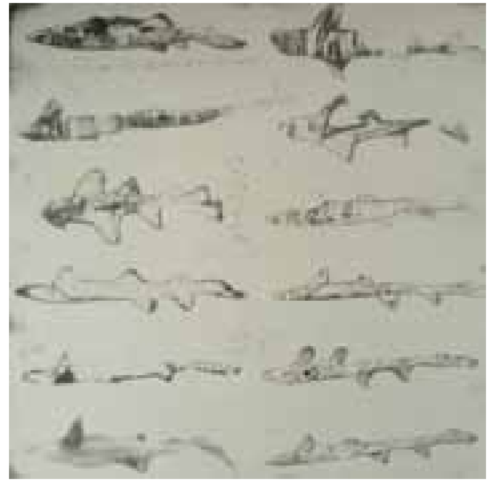
The Tori pole as silent witness – Carolyn Canty
Composed digital print with stencil and lino block on Stonehenge paper



Creating a flow – Jenny Dean
Mixed media

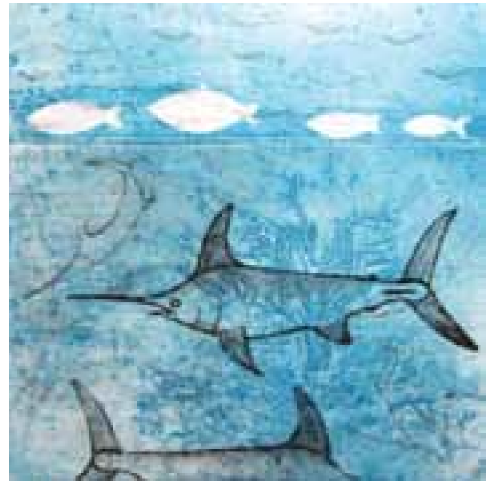
In for the count – Diane Foster
Archival ink print

Drift – Angela O'Brien-Malone
Frottage



Understanding sharks – Kaye Green
Lithograph

Pteronisis alderson – John Robinson
Screenprint with wash on Fabriano paper



Swordfish – Janice Luckman
Mixed media with embossing on BFK paper

over the edge

A collaboration between Hunter Island Press artists and scientists from CSIRO Marine and Atmospheric Research, Hobart

National Science Week
Hobart 2010

Printmakers	Scientists
Annick Ansselin	Pru Bonham
Deborah Asmather	Natalie Kelly
Marinelle Basson	Phil Alderslade
Alicja Boyd	Caroline Sutton
Carolyn Canty	Geoff Tuck
Cath de Little	Lesley Clementson
Fred Duncan	Tim Ryan
Jenny Dean	Scott Condie
Diane Foster	Natalie Dowling
Kaye Green	Heidi Pethybridge
John Ingleton	Anne-Elise Neiblas
Brett Littleton	Lesley Clementson
Janice Luckman	Natalie Dowling
Margaret McAteer	Karen Wild-Allen
Tamayo Leahy	Naomi Clear
Brett Meeker	Esmee van Wijk
Ros Meeker	Marinelle Basson
Angela O'Brien-Malone	Jock Young
Sarah Robert-Tissot	Esmee van Wijk
John Robinson	Phil Alderslade
Jill Stephenson	Russ Bradford

Curators:
Marinelle Basson & Carolyn Canty

Catalogue and project manager:
John Ingleton

Hunter/hunted

Much of the imagery and information supplied to me by Marinelle Basson was very engaging. Yet as much as I enjoy educating myself on various science subjects, I find my response to biology always anthropomorphic. *Hunter/hunted* depicts, in part, the story of a southern bluefin tuna fitted with the archival tag number 0490516. At first I thought of him as a tourist, a free spirit. Then I was taken with the notion of the hunt. A hunt for food for both man and fish, as well as the corresponding hunt for information by science.

Ros Meeker – Printmaker

The field of fisheries science provides scientific information to help decision-making for the sustainable management of fish stocks. My research focuses on oceanic fish, southern bluefin tuna (SBT) in particular.

Knowing the size of a fish population, or the proportion being harvested, is important to determining the size of catch that is sustainable. One method of estimating these quantities involves putting tags on fish, releasing them and recording where, when, and how many tagged fish are recaptured by the fishery. These standard tags only tell us where the fish was tagged and where it was recaptured. Electronic tags, however, collect continuous temperature, depth and light data.

We can use these data to estimate where a fish has been on each day of its journey between tagging and recapture. This information can substantially improve our estimates of the proportion being harvested, and provides unusual insights into the behaviour of these amazing fish.

The biomass of breeding aged SBT is estimated to be at a very low level. The global total allowable catch for 2010 and 2011 has been reduced by about 20 per cent to help rebuild the breeding biomass.

Marinelle Basson – Scientist

Coriolis squid

My first reading of Anne-Elise's paper had me thinking of climate change and pelagic fisheries so; even before meeting her, I had an idea to use the temperature scale as part of my image making. At that early stage I envisaged incorporating tuna and orange roughy into the project to represent shallow and deep level fisheries.

When we were finally able to get together to discuss her work I realised that, while climate change is an important component of Anne-Elise's research, the key element is the Coriolis force created by the rotation of the earth. Named after a 19th-Century French engineer-mathematician Gustave-Gaspard Coriolis in 1835, this force deflects water 90° from the angle of the wind. When alongshore winds flow parallel to certain coastal areas, water is deflected either offshore or onshore, creating upwellings and downwellings respectively. Coastal upwelling winds push warmer, nutrient depleted, surface water offshore and draw cooler, nutrient rich, deeper water toward the surface. Coastal upwelling habitats can be crucial to the productivity of coastal fisheries.

Since so much of my recent work has involved the French, this French connection and the temperature differentials from my original idea together with Anne-Elise's research on arrow squid (*Nototodarus gouldi*) and gummy shark (*Mustelus antarcticus*) fisheries became the inspiration for my work

John Ingleton – Printmaker

Coastal upwelling is the process by which alongshore winds push surface water offshore. This surface water is then replaced by cold, nutrient-rich water from the ocean depths. Once the nutrient-rich water reaches the surface sunlit zone, phytoplankton (floating alga) bloom and feed the rest of the food web.

Upwelling regions comprise just one per cent of the global ocean by area, but account for 20 per cent of global productivity. However, some of these productive ecosystems are under threat due to their vulnerability to climate change.

Understanding and assessing the impacts of climate change on primary and fisheries productivity in upwelling ecosystems will be vital for guiding adaptive management procedures aimed at sustaining ecosystem health and fisheries viability.

Anne-Elise Nieblas – Scientist

Creating a flow

I met Scott Condie in his office at the CSIRO in February, 2010. While I got envious of his water views, he seemed worried about what to do with me. The work he was doing was dry (artistically): numbers, figures and graphs.

I was intimidated by this collaboration. Seeing the process of making art through the scientist's eyes; Scott monitors the ocean currents and I, indulgently, create a subjective image of this process. Added to this, I saw some wonderful digital images in the foyer and wondered what was left for me to do. I questioned this traditional form of printmaking. Why persist with the laborious process of re-etching the plate, applying the ink, wiping if off, re-positioning the image . . . ? Why am I so captivated by the texture of the line or the rich colours printed on wet paper? Out of the five images I created, I used two.

I felt pressure to prove the validity of the artistic process to myself and scientists. I re-created Scott's ocean currents; put him in the office with the million dollar views and made him become part of the current. The image making process draws me along and it seems that the print itself reveals a truth. The process is intuitive and that is the beauty of it. Maybe the true secrets of the ocean currents are revealed.

Jenny Dean – Printmaker

Jenny's views on the process are particularly interesting to me. I imagine that the challenge of moving beyond what is achievable on a computer is very real for many artists. Comparisons of the two seem both inappropriate and unavoidable.

Acknowledging the obvious tensions between analytical and intuitive approaches, I feel that the work of scientists and creative artists have much in common. On a practical level however, I found I had little idea about how to make the connection between Jenny's art and my science. While I was thankful that this responsibility largely fell to Jenny, I would have liked to have the insight to contribute more.

The print appears to capture the changing interaction between ocean currents and island habitats as perceived by a scientist. As the scientist, I'm immersed in the marine environment, but at the same time somewhat disconnected sitting in my office. Perhaps this also reflects my incomplete and possibly erroneous understanding of many aspects of the complex marine system.

Scott Condie – Scientist

The Tori pole as silent witness

This collaboration has opened my eyes to the amount and breadth of really interesting marine research that happens in Hobart. Like many Tasmanians, I was broadly aware of issues that concern the oceans that surround our island, but I started to take more notice of local and international events which curiously seemed to suddenly abound in the media. I guess I now had a new and different focus, indeed a bonus of the collaboration.

After pursuing a range of my own research activities, including reading some of Geoff's papers, and talking to him, I opted to try and produce an image that hopefully would focus optimistically on issues around longline fishing and the threat to populations of marine birds. One of the practices used by some nations is to distract the birds that hover above the baited lines as they enter the water. This is done by long, flapping, coloured streamers attached to Tori poles which are mounted on the rear of the fishing boats.

Over a composed digital background I have used stencils and lino blocks to produce this narrative. I hope *The Tori pole as silent witness* captures many of the elements of this research in some meaningful and visually interesting way.

Carolyn Canty – Printmaker

My colleagues and I apply modelling methods to help guide the management of fish populations harvested for restaurants and fish and chip shops across southern and eastern Australia. The fish species include orange roughy, flathead, blue grenadier and ling. An integral part of our work is the close communication we maintain with the Australian fishing industry, fisheries managers and other scientists.

Our involvement with seabirds arose in the mid-1990s when it became apparent that many of the world's albatrosses, shearwaters and petrels were suffering major population declines believed to be linked to longline fisheries. These oceanic seabirds forage widely and are attracted to the baited hooks and offal associated with fishing vessels. Fishing operations are now recognised as a major threat to the world's 22 albatross species, 18 of which are listed as threatened or endangered.

The models that we have developed quantify the impacts of fishing on seabird populations by estimating the numbers of birds caught in relation to their total population size. We also participate in national and international efforts to resolve this important global conservation issue.

Geoff Tuck – Scientist

Southern blue fin tuna

The statistics say that the population of southern bluefin tuna has dramatically decreased in recent years. As a Japanese citizen who thoroughly appreciates the taste of fresh bluefin tuna, I have to confess that this issue is too complicated to debate. Though the worldwide quota system tries to maintain a steady number of bluefin tuna, it is clear that their high value in the Japanese markets provides a strong incentive for fishers to catch them.

How we manage to maintain the southern bluefin tuna stock is a deadly important matter to us. I do not want tuna to end up with the same fate as whales in the whirl of argument. We succeeded in farming salmon which are migratory too, so hopefully in near future we might be able to enjoy tuna that are born and bred in farms.

Fresh southern bluefin tuna greatly contributes to a Japanese eating culture. So now is the time when we should really appreciate natural resources given to us. They will not last for ever if we do not appreciate, protect and conserve them.

Tamayo Leahy – Printmaker

My work on tuna and billfishes contributes to understanding the age, growth and behaviour of tuna and billfish stocks caught around Australia. A particular focus is southern bluefin tuna (SBT) which are caught in the southern Pacific, Atlantic and Indian oceans and are highly prized as sashimi.

To manage the SBT stock, a worldwide quota is divided between fishing nations. The global quota has been reduced by about 20 per cent to help rebuild the breeding biomass which is estimated to be at a very low level.

The SBT quota relates to scientific stock assessments which require estimates of how many fish from each age group make up the total population. The ages of captured SBT are determined from microscopic examination of their ear bones, or otoliths, which display seasonal growth similar to tree rings.

CSIRO has tagged more than 130 000 SBT, some 10 per cent of which have been re-caught. The number of tag recoveries helps us estimate the proportion of SBT that die from natural causes and the proportion caught by fishing. Tagging studies also provide valuable information about where fish go and how fast they grow.

Naomi Clear – Scientist

Whale sighting at Casey and Bunger Hills

After conversations with Natalie Kelly and reading her reports I began considering the details of the research we wanted to incorporate. The aerial survey method used to collect data seemed central and also the location in east Antarctica. I found the maps of the flight paths, (parallel lines near Casey and Zig Zag near Bunger Hills), sea ice and whale sightings fascinating and noted the clarity with which they conveyed information. I was aiming to evoke a little of the vastness of this continent which is largely white and reflective ultimately holding one in a sense of awe.

The whales do not figure in the print. Instead I began imagining the act of seeing: the rigour of concentrating and refining one's vision in order to see the whales in such conditions. In the margin is the sentence spoken upon sighting a whale. I saw the International Whaling Commission reported on the news and was struck by how far it was from Antarctica yet part of this process. Hopefully this research is successful in influencing the balanced management of the minke whale populations in Antarctica and, by extension, all that exists in this environment.

Deborah Asmather – Printmaker

Although Antarctic minke whales are the most abundant of the great whale species, research presented to the International Whaling Commission indicates an apparent decrease in their number in the past few decades. But whether this decrease is real, or merely the result of the survey method, remains a point of contention.

One theory suggests the apparent decrease in Antarctic minke whales is due to animals moving further into these ice zones and away from the view of the (non-ice strengthened) research ships. This theory gave rise to the idea that perhaps whales in pack-ice could be counted from the air. From this concept, the Australian Antarctic Division, in collaboration with CSIRO, has built an aerial survey program to study minke whale distribution and abundance in pack-ice in regions adjacent to the Australian Antarctic Territory.

For the past three summers, we have flown over pack-ice, counting whales and measuring other environmental factors that may influence whale distribution. Preliminary results from this research have been presented to the International Whaling Commission and it is hoped coming results from this project will assist in the management of Antarctic minke whale stocks.

Natalie Kelly – Scientist

Siren fingerprint

Satellites are used to detect minute phytoplankton in the world's oceans by identifying their signature pigments or biomarkers. As an artist, I found this combination of the astronomical and the sub-microscopic, related to understanding and conserving life in our global seas, very inspiring. The beauty, symmetry and diversity of phytoplankton alone invites their artistic exploration.

Their story is told in technicolour, as many have unique or signature pigments for particular species. These pigments do more than add colour and variety to the earth's oceans, such as in the 'red seas'; they also play a vital role indicating the health of the marine world. Satellites 800 km above the earth pick up an ocean colour image and translate it graphically. The resulting information can reveal a vibrant marine ecology with abundant microbial health, or its colours can be indicators of harmful ecological shifts such as increased eutrophication or the presence of toxic algal blooms.

My image *Siren fingerprint* attempts to portray this dual nature in a phytoplankton species from the dinoflagellate class, which has a signature orange pigment, Peridinin. These are creatures with a vibrant and complex beauty. However, like the sirens of old, there is danger in their allure. Their bright orange beacon can warn of elevated populations which may be toxic to fish or shellfish or even humans.

Cath de Little – Printmaker

The research area I work in is called satellite ocean colour remote-sensing. Satellites with ocean colour sensors orbit the earth collecting signals of light reflected from the surface of the ocean. From these signals, images of the distribution of phytoplankton (floating microalgae) biomass can be produced for science-based projects.

It constantly amazes me that microscopic plant life can be detected so far above the surface of the ocean and that through the satellite imagery we can get a global perspective of the distribution of these phytoplankton and their importance in the health of the oceans.

In some cases the microalgae have specific properties that can be detected by the satellite sensor, thereby signalling their presence in a particular region. An example is the coccolithophorids (cells encased in calcite scales) which are extremely reflective of light, a property the satellite sensor can detect. Other classes of algae without a calcite structure are also detected by the amount of light they absorb or scatter within the surface water.

Lesley Clementson – Scientist

In for the count

I love eating fish and watching the marvels of life beneath the sea on TV. Fish are such an essential part of our daily lives – as food, leisure and sport, medications, fertilisers, cosmetics and oils, to name just a few.

With the growing effects of climate change, water temperatures, overfishing, natural or man-made disasters, there is a real need for proactive rather than reactive approaches and methods to explore the possible implications of such effects on the sustainability of fish stocks.

As a result of this project, I have become more aware of the importance of the work undertaken by the CSIRO – in particular the relationship between computational modelling methods and real life problems in helping to prevent overfishing and maintaining sustainable fish stocks.

Like Natalie, I too have used a computer to illustrate the mathematical simulations used in predicting tuna numbers. I have built up several layers and superimposed some of Natalie's population dynamics equations relating to this. After discussing several images with her, we selected one she felt was most representative of her work.

Diane Foster – Printmaker

An ideal way to assess the condition of a marine fishery would be to pull the plug on the ocean, count the fish, and then refill the ocean. But in the real world, fisheries managers rely on computer modelling to guide their decision-making. This method can be particularly useful when factors influencing the dynamics and size of fish populations are poorly understood. A model lets us look inside a simulated fishery in a way we can't do in real life; to manipulate fish populations and see the consequences for the catch.

My recent fisheries modelling projects have evaluated management strategies for broadbill swordfish and deepwater crustaceans and stock-status indicators for tuna and billfish; determined optimal sample sizes for obtaining albacore size data; and looked at how fishers and fishing fleets respond to management cues.

Another recent interest has been assisting with the development and implementation of the Commonwealth Fisheries Harvest Strategy Policy which sets the criteria for harvest strategies designed to assist the recovery of overfished stocks and prevent future overfishing.

Natalie Dowling – Scientist

Larval cray gets away

After discussing the subjects of Russ Bradford's marine research I became fascinated with the planktonic form of the rock lobster, phyllosoma. My imagination was fired by the vision of these transparent changing forms being swept along in the ocean. Each female produces millions of eggs but very few of these survive the long journey in around the Tasman Sea and back to shore where they metamorphose into a rock lobster.

How to transform this idea into print form has been an interesting challenge. From an artistic point of view I chose to depict a larval stage of the lobster or crayfish as it is commonly named, struggling in the currents of the ocean. The image of the phyllosoma being transparent and jellylike with spidery legs, and the impression of swirling currents, was what I was what I sought to express. To do this I chose a collagraph which enabled me, in a painterly fashion, to depict the ideas of transparency, movement and the depth and turbulence of the wild ocean.

Jill Stephenson – Printmaker

The smallest marine organisms are some of the most beautiful and intriguing. Take for example the larval rock lobster. In the early days of marine exploration, the life history of the rock lobster was an enigma. Even today, most people would not recognise its larval form, or phyllosoma, (Greek for leaflike body), which barely resembles the adult. The transparent phyllosoma has a flattened body ideally suited to drifting on ocean currents. Indeed, the phyllosoma of the southern rock lobster may ride on ocean currents and eddies for up to 18 months before it metamorphoses into something resembling the adult form.

The prevailing currents along the southern edge of Australia flow west to east. With such a long planktonic life, how do the phyllosoma adrift on these currents avoid being swept eastward to New Zealand and beyond? It appears that eddies may be the key to moving the phyllosoma against the prevailing currents and returning them to regions where the eggs hatched: safe habitats in which to settle and mature.

Russ Bradford – Scientist

Hairy Friends – Bacteriastrum sp.

Art meets science. The two worlds have much in common and have a symbiotic relationship, if allowed. Nature provides the subject. The artist and the scientist observe, analyse and record nature, then show it and/or explain it.

As a retired scientist with a love of microscopic structures and art, this project was a wonderful opportunity for us to combine our skills and appreciation of marine organisms. I have learnt a great deal about phytoplankton from Pru.

Phytoplankton are amazing: self contained, carrying out the basic functions of life (respiration, metabolism, growth and reproduction), as well as being the major producer of oxygen in our oceans and atmosphere. We cannot live without these organisms, yet they are largely unknown.

Phytoplankton are fantastic and exquisite in appearance. They seem delicate and fragile, yet with silica often part of their exoskeleton, they are tough. I am sure they have inspired some of the creations that feature in science fiction movies!

Pru has been extremely generous with her time, providing specimens, micrographs and much information, giving me access to her microscope to check detail in vivo, as well as references. I am very grateful to have been part of the project.

Annick Ansselin – Printmaker

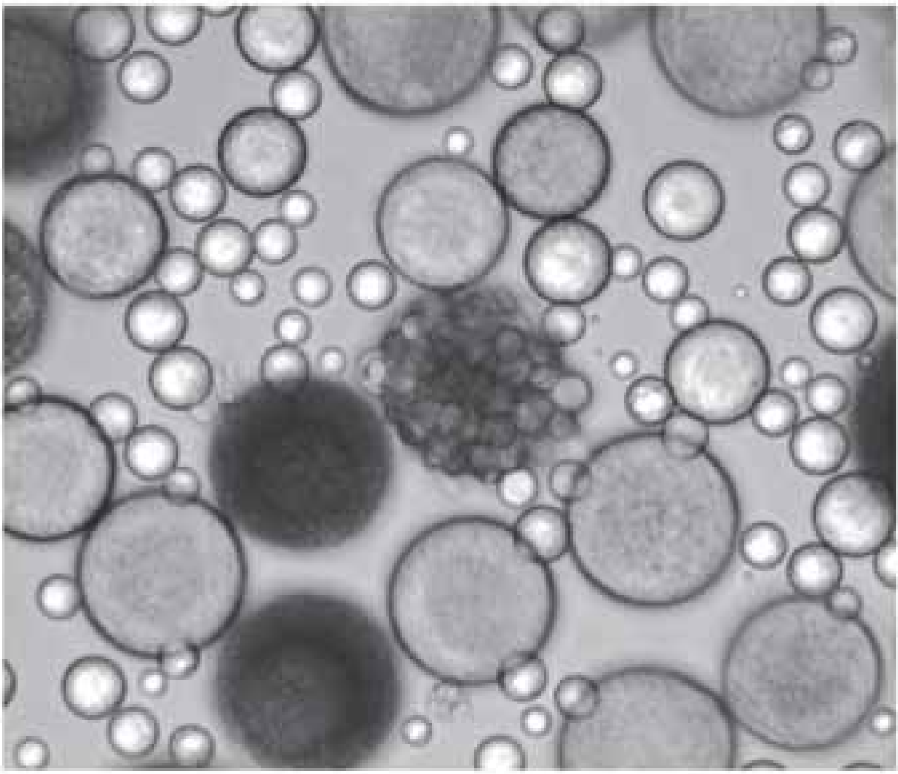
Microalgae are microscopic aquatic plants that form the 'grass of the sea'. They are very important in taking up carbon dioxide and producing atmospheric oxygen, and are the base of most marine food chains.

There are thousands of microalgal species with wonderful shapes like pill boxes, ladders, needles, canoes, soccer balls and stars. One of my favourites, *Dinophysis tripos*, looks like twin egg beaters. I never tire of counting all the beautiful algae and tiny animals I find down the microscope.

Many algae have spikes, wings and bristles to keep them afloat near the sunlit surface of the ocean where they perform photosynthesis. Algae living at the bottom of the ocean can glide on the sand or attach to seaweeds. Some can swim using tiny whip-like attachments (flagella). Once I scooped up a bloom of the harmful alga *Gymnodinium catenatum* from Port Cygnet and saw the chains swimming in my hand like tiny malignant caterpillars.

Our work has included algal grazing studies: looking at how fast algae are consumed and whether grazers select some types of algae preferentially. The line between algae and grazers is blurry and many species of 'algae' can also become mini-predators.

Pru Bonham – Scientist



These single-cell organisms called thraustochytrids were photographed at the CSIRO Australian National Algae Culture Collection in Hobart. Thraustochytrids are a rich source of omega-3 oils in the ocean food web. CSIRO scientists are investigating their potential for production on an industrial scale. Photo: Dion Frampton, CSIRO.

A selective breeding program developed by scientists from the CSIRO Food Futures Flagship based at Hobart is helping to ensure the quality and efficiency of Tasmania's Atlantic salmon industry. Breeding programs are also being developed for the Pacific oyster and abalone industries. Photo: Peter Whyte, CSIRO.

Drift

Schools of fish, squid and other animals swim the waters of the open ocean, and plankton – microscopically small animals and plants – drift on the currents. This image is about the drifters. I was initially drawn to the contrast between the vastness of the open ocean and the very small size of many of the animals which drift there. As the work progressed the image became focussed upon the strangeness, the 'otherness' of these microscopic drifting animals. The image is poetic: no real animals are pictured here. The image is a frottage. The paper has been prepared with ink, acrylic medium and shellac, and many layers of frottage have been applied using coloured pencils. This process is very slow and has a rhythmic quality to it. I hope that the resulting image captures the idea of drifting in the pelagic environment.

Our collaboration was based mainly around the papers written by Jock Young. Jock's research interests have gravitated towards the micro end of the scale, and this interest in plankton also informs the artwork.

Angela O'Brien-Malone – Printmaker

My research traces the relationships between large tuna and billfish, and the food webs that sustain them. I explore the oceanographic processes that concentrate nutrients at the bottom of food webs, and the many dietary connections that meander through phytoplankton, zooplankton, small fish and squid, to intermediate species and top predators. I also look at how top predators such as tuna and billfish cohabit in a relatively similar environment. Do they have subtle ways of 'taking it in turn' to feed on the available prey?

I am increasingly interested in what goes on at the bottom of the food web, as not all increases in nutrients lead to these bigger fish. There are many different types of phytoplankton – such as diatoms and dinoflagellates – but not all lead to active food webs.

Jock Young – Scientist

Understanding sharks

Trophics, trophodynamics, deep-sea shark, chimaeras, foodweb, shark biology, marine ecology, eating habits of shark, stomach contents . . . These are terms which I had never really encountered previously or had any interest in exploring until I met Heidi Pethybridge at the CSIRO earlier this year. Following our meeting I immersed myself in Heidi's graphs, notes, research findings and documentation and wondered how I would finally make a decision about how to make one artwork which would pay homage to Heidi's work and dedication to her subject.

After struggling with being swamped with too much information I suddenly settled on the simple idea of creating a work to reflect both our passions. Heidi loves sharks and I love making lithographs. I wanted to refer to the importance of different levels of the deep sea and I was also keen that my work should indicate the great variety of sharks that exist in our oceans so I decided to create a somewhat diagrammatic/chart-like composition and make use of some of Heidi's handwriting. I then proceeded to make a lithograph of twelve sharks using watery tusche washes.

Kaye Green – Printmaker

My research investigates the biology, feeding ecology and life-history of deep-sea sharks and chimaeras. My shark samples are collected from trawlers that fish to depths of 2000 metres off south-eastern Australia. The vessels seek fish such as blue grenadier and orange roughy, but in the process capture many unwanted fish and sharks. Once my samples are collected, they are brought to the lab where I dissect them and take tissue samples. I look at the stomach contents to identify the sharks' diets, and conduct biochemical tests to determine, for example, levels of heavy metals such as mercury, and the energy invested in reproduction. Further dietary details are gleaned by analysing the fat profiles of various shark tissues.

My research sheds light on deep-sea food webs, part of the marine ecosystem about which little is known or understood. It contributes to the ecologically sustainable management of fisheries by providing the scientifically based information about the wider ecosystem and community affects of fishing. My project is interesting as it applies novel techniques to the investigation of shark biology and ecology.

Heidi Pethybridge – Scientist

Light meter (PRR-600)

The project started for me with a meeting with Karen who was very helpful and forthcoming with photos and information about her area of expertise. The instrument in the image I chose to print is a Biospherical Profiling Reflectance Radiometer (PRR-600).

For my artwork I have used one of the photographs that Karen had taken on a field trip. It shows the light meter coming out of the ocean. I was drawn to this particular image because of the reflection of light on the water's surface. Following further communication with Karen I decided to print the Beer Lambert equation on the image to link the artwork to the specific area of research.

I use screen printing as it allows me to experiment with colour in a way that no other printmaking method does. I also often incorporate text in my prints.

Margaret McAteer – Printmaker

We carried out research off the western Australian shelf in May 2007 on the Marine National Facility Research Vessel *Southern Surveyor*. One of my jobs was to deploy this Biospherical Profiling Reflectance Radiometer (PRR-600). The radiometer records the underwater light available for photosynthesis and growth by marine plants and algae. In simple terms, it is a specialised light meter. The Beer Lambert equation shown is a mathematical description of the observed underwater light field that we use in our computer simulations of aquatic primary production.

Karen Wild-Allen – Scientist

Itinerant troops

We are all aware of the massive ice juggernauts that wander about the poles threatening ships for Hollywood's dramas and the seemingly endless expanses of uninhabitable ice-scape from which they are cleaved. Modern media allow us to view this life-threatening precinct from an easy chair as we marvel at its colour and scale. My foray into the nature of ice, its kinds and classes, showed me other types much less familiar; the researchers' pictures startled my understanding.

I viewed rank upon rank of little 'bergs' blanketing vast expanses of sea, overlaid, ordered and structured: a physical graphic of the interactions of water, weather and tide. These were not the more familiar shards of gigantic shattered glaciers. At risk of appearing anthropomorphic, this ice body seemed to grow, like a bacterial culture, its thickening ranks of blue and white assembling to the horizon. These flotillas of elemental entities appear territorial, organised and defensive. The lesser denizens seem to conspire to maintain their territory by tactics of number and surprise rather then daunting size. Like garrisons, arising to fortress their private domain as conditions demand, then vanishing again into the cold black sea.

Brett Meeker – Printmaker

My work as a physical oceanographer involves analysing measurements made deep in the Southern Ocean between Tasmania and Antarctica by Argo floats and research voyages. The measurements enable oceanographers to study the state of the ocean, global ocean circulation and the impacts of climate change.

Argo floats drift freely with the ocean currents measuring ocean temperature, salinity and velocity. They regulate their buoyancy and withstand enormous pressures while descending two kilometres deep and rising to the surface every 10 days to relay data via satellite. With more than 3000 floats deployed globally, the Argo program has revolutionised observational oceanography. In the remote Southern Ocean, their profiles outnumber those collected historically through ship-based hydrography.

Oceanographers also collect data using instruments deployed on research voyages that measure salinity, temperature and depth. Repeated measurements at the same locations in different years reflect changes in water mass properties with time. Working at sea in remote and inhospitable regions such as the Southern Ocean and deploying instruments in the seasonal ice zone can be challenging. However it's also a privilege to study a part of the world that few people have the opportunity to experience.

Esmee van Wijk – Scientist

Pteronisis alderson

After meeting with Phil Alderslade and having a crash course in Octocorals I left realising that the links between art and science are many and where do I start. I must admit to being a little overwhelmed. I was interested in the way Phil sometimes recorded the shapes of the material he studied through an electronic microscope. He can also use an adapter on his light microscope that allows him to draw the outlines and shapes of the sclerites with minute precision and they are also beautiful drawings. The preserved corals were also very beautiful, making me feel overawed by nature.

I decided to create a new octocoral that is closely based on the sclerites and axis of *Pteronisis incerta*. This new coral might be found in the D'Entrecasteaux Channel at depths greater than eight metres. It has a symmetrical shape that pays homage to some of the characteristics of *Pteronisis*. Its colours are also similar to other octocorals, rather muted pastel tones. There is a hint of filmy water over the view of this coral that is reminiscent of looking at sclerites on a slide through a microscope. It has been named Pteronisis alderson.

John Robinson – Printmaker

As a taxonomist, I work rather like a detective. My main job is to identify specimens of octocorals and to publish scientific papers that describe new genera and species, a vocation I have enjoyed for close to 40 years. For the past three years I have studied octocorals from depths of over 3000 metres as part of a CSIRO sea mount research project. Common names for octocorals are soft corals, sea fans, sea whips and sea pens.

Most soft corals do not have a rigid internal skeleton. Instead, they have microscopic calcareous granules called sclerites embedded in their tissues. Along with the specimen form, the shape, arrangement and location of the sclerites are major characters used in the identification process.

If I do not know the species name of a specimen from experience, I note all the relevant characters, or clues. This involves the extensive use of microscopes. Then I search and follow the literature trail for a matching species description. Often the oldest descriptions, sometimes older than 200 years, are most important, but these are often badly illustrated, so it may be necessary to borrow specimens from national or international natural history museums for comparison.

Phil Alderslade – Scientist

Rough seas

My print interprets CSIRO research into the physics, chemistry and biology of our oceans. A buoy transmits data – perhaps on temperatures (depicted in the colour band) or currents or fish populations. My central theme is research on orange roughy (Hoplostethus atlanticus). Big aggregations were discovered around Tasmanian seamounts in the 1970s. A massive fishery developed but the fish stock collapsed within a decade – partly because the age of breeding populations had been severely underestimated. Recent research provides hope for recovery through protection and management of populations.

The image contains messages of danger at sea. The words of Victor Hugo – that disasters at sea are beyond the grasp of human science – refer to shipwrecks, but I think they also apply to the orange roughy story. SOS – Save Our Souls, Save Our Species, Save Our Seas, Save Our Science, Save Our Selves!!!

There are personal resonances too. I love the sea – Tasmania's cold water invigorates my body and soul. Many years ago, my wife Diana worked with the Fisheries Development Authority, assessing the age of orange roughy. I saw mountains of roughy landed at Sullivans Cove. Trawlers from Wollongong – my home town – sailed south for the plunder. My father was a signaller in the war – childhood memories of us tapping out messages in Morse code – none as urgent as those being transmitted from the oceans today.

Fred Duncan – Printmaker

My work involves using underwater acoustics to map the biological components of deepwater marine ecosystems. We use echosounders to send repeated pulses of sound through the water column. The maps of reflected sound, or echograms, reveal features such as seafloor structures, schooling fish, and the diffuse but ubiquitous micronekton species (small fish, crustaceans and jellyfish).

Our acoustic surveys take us to the deep-sea seamounts and canyon systems where commercially important fish such as orange roughy and blue grenadier aggregate each winter for their annual spawning.

A key challenge is to accurately determine species and their contribution to the total acoustic signal. In the case of orange roughy this is particularly difficult as they live in very deep water (~800 metres) with a mix of other species. High frequency and multi frequency acoustic instruments, deployed deep in the ocean, help us to distinguish between orange roughy and other species.

We complement our acoustic measures with net sampling and underwater video and digital still images. These acoustic, net and optical methods were developed for fishery specific applications, but are now being applied further afield as we endeavour to map micronekton across the vast ocean basins.

Tim Ryan – Scientist

Catch

Caroline Sutton is a biologist with the acoustic group at CSIRO Marine and Atmospheric Research. Caroline's role is to process the biological samples that are used to compare and ground truth the acoustic data. The ultimate aim of the research is to estimate the mass and distribution of micronekton. I was shown lots of images of mostly very small fish – micronekton are small – generally less than 10 cm long. We also talked about factors that might affect 'the catch', such as the size of the net's mesh, fish behaviour that might result in net avoidance or herding in reaction to the noise of the ship and/or seeing the fishing gear, day and night cycles, seasons, climate and cyclical changes.

I have been inspired by our collaboration to consider ways of artistic interpretation of Caroline's work. I tried to show how it is actually done, to hint at some aspects of the interference and possibly make the viewer think about its ultimate aim: to establish the health of our marine environment and to ensure its viability in the future.

Alicja Boyd – Printmaker

Micronekton refers to small fish, squid, crustaceans and jellyfish preyed upon by top predators such as tunas, billfish, sharks, seals and seabirds. It forms the core of the ocean food web, transferring energy up from the phytoplankton. Our research aims to estimate the mass and distribution of micronekton in the Southern Hemisphere. To do this we use echosounders to record the acoustic backscatter reflected by micronekton through a slice of ocean from approximately 1000 metres deep to the surface.

My role is to quantify the weight and acoustic reflectivity of biological samples used to interpret the acoustic backscatter. Biological samples are collected with a towed net at 200-metre intervals, then categorised by functional group (fish, crustacean, squid, gelatinous), body shape, length and weight. The fish are also checked for the presence and type of swim bladder because this influences their acoustic signature.

By comparing the biological catch to the backscatter we know that most of the acoustic signal comes from small, gas-bladder fish, the myctophids, and that these fish move up and down in the water during the night and day respectively. These data can be used to extrapolate micronekton biomass on large (ocean basin) scales.

Caroline Sutton – Scientist

Sous la mer

Whilst researching phytoplankton as a starting point for this work, it occurred to me that so much man-made design takes its inspiration from shapes and forms that occur in the natural world. Some of the imagery in this work was taken from the *Dictionnaire Encyclopédique Trousset*, originally published in Paris between 1886 and 1891. The title, *Sous la mer*, is French for 'under the sea' and the work is meant to convey a sense of the alien world, unknown and unknowable, that exists beneath the waters that are so fundamentally part of our lives and identities on an island home.

Brett Littleton – Printmaker

The research area I work in is called satellite ocean colour remote-sensing. Satellites with ocean colour sensors orbit the earth collecting signals of light reflected from the surface of the ocean. From these signals, images of the distribution of phytoplankton (floating microalgae) biomass can be produced for science-based projects.

It constantly amazes me that microscopic plant life can be detected so far above the surface of the ocean and that through the satellite imagery we can get a global perspective of the distribution of these phytoplankton and their importance in the health of the oceans.

In some cases the microalgae have specific properties that can be detected by the satellite sensor, thereby signalling their presence in a particular region. An example is the coccolithophorids (cells encased in calcite scales) which are extremely reflective of light, a property the satellite sensor can detect. Other classes of algae without a calcite structure are also detected by the amount of light they absorb or scatter within the surface water.

Lesley Clementson – Scientist

the True Naming

When we met, Phil was busy identifying a soft coral collected on a recent survey to the south of Tasmania. The sample of coral was now trapped in a carefully labelled jar. This coral turned out to be a new species and genus, in the family Isididae. To establish that, Phil had to look back at other similar corals that have already been described and named. As far back as 1758, Linnaeus, the inventor of the scientific naming convention for living organisms, named the first member of this family.

A still life seemed like a natural choice to reflect the essential links with the past and show the 'tools of the trade', including Phil's laboratory notes. The melancholy coral in the jar dreams of the sea, but it has become a treasure; it is the primary reference sample for this newly named species.

But why do we name things? Linnaeus wrote: "Without names, our knowledge of things would also perish". The title, *the True Naming*, reflects the ancient notions that the True Name of something perfectly describes its essence, and that knowing something's true name gives us power over it – a power which we can choose to use in a positive or negative way.

Marinelle Basson – Printmaker

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Most soft corals do not have a rigid internal skeleton. Instead, they have microscopic calcareous granules called sclerites embedded in their tissues. Along with the specimen form, the shape, arrangement and location of the sclerites are major characters used in the identification process.

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Phil Alderslade – Scientist

Argo

When I initially met Esmee, she showed me the Argo floats, the boxes they are stored in, the data that are collected from them, their global position and their trajectory in the oceans. Armed with sheets of data and images from Google Earth, and with our conversation fresh in my mind, I felt inspired to transform the information into art.

My prints are lino cuts. The challenge is to cut lino with precision and to maintain the integrity of lines. It requires a certain rhythm that offers meditative quality and opportunity to express raw scientific facts.

In this work I refer to lines from data records and images of the Argo floats in the Southern Ocean. I specifically chose the lines that show the currents that circle Antarctica. The colourful way the data are presented lends itself to artistic interpretation. I have moved away from the linear format by bending the salinity and temperature information around the central circle – the earth. The dots are the Argo floats – the fine lines represent their journey around the world.

The vital work that Esmee Van Wijk and other scientists do is locked in the realm of academics and occasionally brought to our attention when we consider the very real and topical event of climate change. I hope that my work bridges the two worlds between art and science and that it especially makes sense to Esmee.

Sarah Robert-Tissot – Printmaker

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Esmee van Wijk – Scientist

Swordfish

Natalie Dowling is a fisheries researcher who uses modelling to develop indicators of fish stock health and to test different management scenarios.

One of Natalie's projects involved developing a management strategy evaluation framework for the Eastern Tuna and Billfish Fishery. My understanding is that broadbill swordfish, having the most vulnerable life history characteristics of the target species, was the most suitable species around which to evaluate management options. Her methodologies informed initial quota recommendations for the Australian Fisheries Management Authority.

As swordfish was the modelled species, I chose this for my key image and I depict it partially out of the frame to represent its vulnerability to overfishing and its potential risk of disappearing from the marine environment. By partitioning the numbers of fish in the top half of the image I suggest that this could be the percentage of the modelled fish population or an indication of the quantitative population model of the fishery. My embossing of numerous fish of different sizes represents the fish population in its various stages of growth and development.

My aim was to illustrate visually the simulated fishery using the swordfish population as an example and create a visual virtual marine landscape.

Janice Luckman – Printmaker

An ideal way to assess the condition of a marine fishery would be to pull the plug on the ocean, count the fish, and then refill the ocean. But in the real world, fisheries managers rely on computer modelling to guide their decision-making. This method can be particularly useful when factors influencing the dynamics and size of fish populations are poorly understood. A model lets us look inside a simulated fishery in a way we can't do in real life; to manipulate fish populations and see the consequences for the catch.

My recent fisheries modelling projects have evaluated management strategies for broadbill swordfish and deepwater crustaceans and stock-status indicators for tuna and billfish; determined optimal sample sizes for obtaining albacore size data; and looked at how fishers and fishing fleets respond to management cues.

Another recent interest has been assisting with the development and implementation of the Commonwealth Fisheries Harvest Strategy Policy which sets the criteria for harvest strategies designed to assist the recovery of overfished stocks and prevent future overfishing.

Natalie Dowling – Scientist