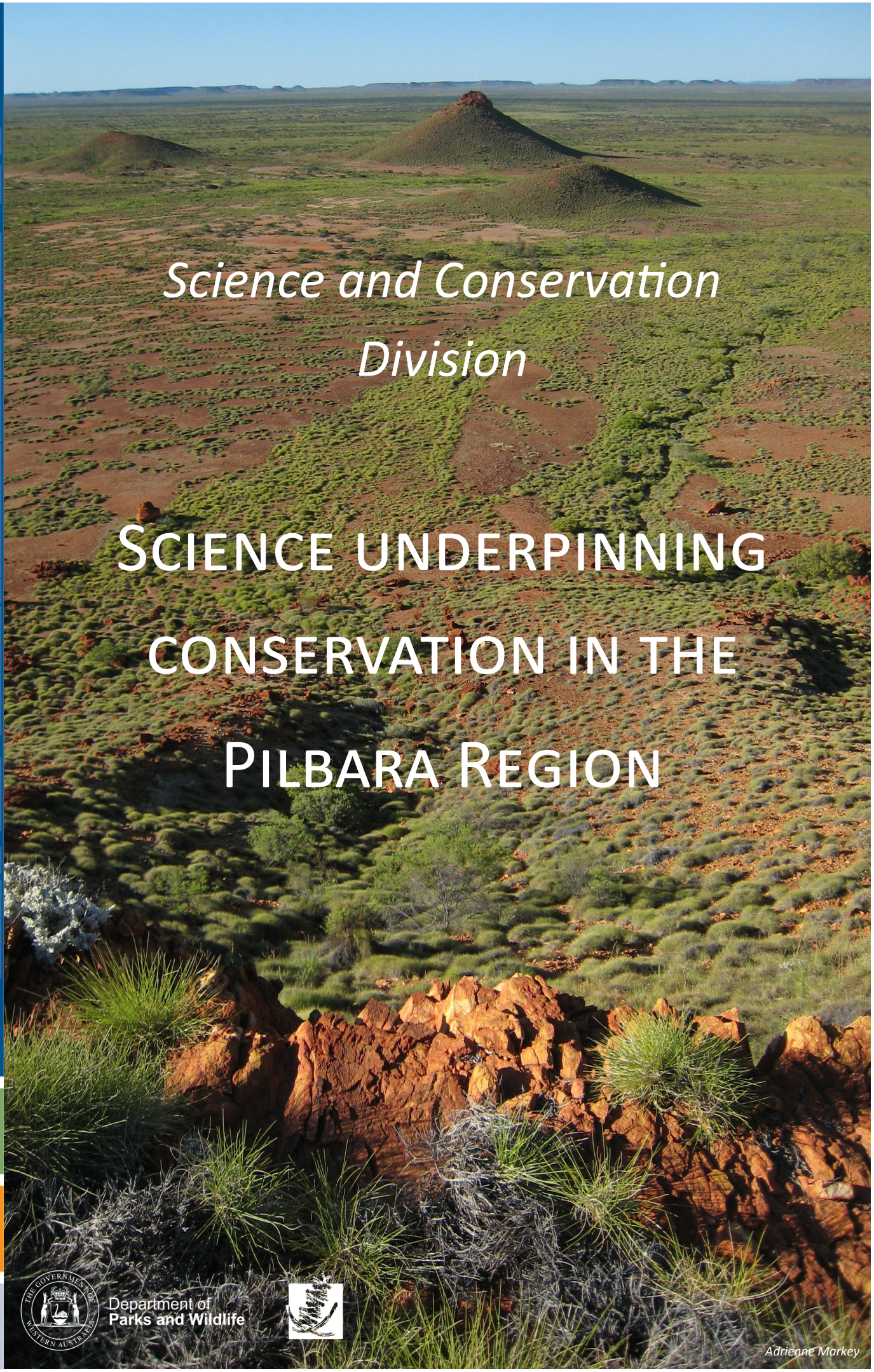


Science and Conservation Division

Science underpinning conservation in the Pilbara Region

Department of Parks and Wildlife

Adrienne Markey

FOREWARD

Effective communication of the outcomes of science is particularly important for ensuring the results inform conservation policy and wildlife, forest and parks management practice. Science undertaken in the Science and Conservation Division is carried out in collaboration with staff in the regions and our research partners, which include CSIRO, universities and industry. We highly value these partnerships, which deliver immense benefits in providing a scientific, evidence-based approach to conservation.

To facilitate communication with all regional staff we have produced a series of non-technical publications that describe the science we are undertaking in each of the regions of the Department. These 'Science in the Regions' publications capture a snapshot of current science activities that support wildlife, forest and parks management in each region, and are available on the website. Please contact any of our scientists if you would like more information on any of the topics described here.

Dr Margaret Byrne, Director, Science and Conservation Division

Bruce Maslin

Keith Morris

Judy Dunlop

Leanne Corker, Red Hill Station

Advances in understanding the ecology and threats to fauna

Populations of the bilby (*Macrotis lagotis*) and northern quoll (*Dasyurus hallucatus*) are under increasing pressure from mining activities in the Pilbara, but little is known of the distribution, abundance and habitat requirements of either species in the region. Current research aims to provide a better understanding of both species so that regional monitoring and survey programs can be developed.

The bilby is notoriously trap- and spotlight-shy, and so monitoring for indirect signs (e.g. scats, tracks and diggings) in large quadrats (2 ha) is often used to assess bilby presence in other parts of its range. In the Pilbara, bilbies are often found in areas with stony soils and low shrubby vegetation, so signs are more difficult to find. A focus of the research program for bilbies is to develop transect-based monitoring techniques applicable to Pilbara landscapes. Scats are also being collected for DNA analysis, to identify bilbies within an area and develop models of habitat use that will enable effective monitoring.

The northern quoll has suffered rapid and significant declines throughout its range in other parts of northern Australia after the arrival of the cane toad. While cane toads are predicted to eventually reach the Pilbara, the region may provide a stronghold for northern quoll populations. While northern quoll are generalists in both habitat and diet, they do best in rocky areas that provide abundant denning opportunities. For a small mammal they are also highly mobile. Mining activity may cause loss of critical habitat for the northern quoll, restrict access to foraging areas and create barriers to the dispersal of young. Motion-sensor cameras are being used at over 100 sites to record the presence (or absence) of northern quolls and understand their distribution across the landscape. Anecdotal and historical records are also being gathered. In early 2013, a long-term regional monitoring program for northern quoll began, and will be conducted twice annually for the next decade.

Regional survey and monitoring programs, structured to increase our knowledge of population dynamics and habitat use of the northern quoll and bilby, are improving the conservation management of both species, particularly in relation to future mineral exploration and mine development activities.

Research contacts: Dr Martin Dziminski (martin.dziminski@dpaw.wa.gov.au), Ms Judy Dunlop (judy.dunlop@dpaw.wa.gov.au), Mr Keith Morris (keith.morris@dpaw.wa.gov.au).

Advances in taxonomy underpinning conservation

Much of the flora of the Pilbara—even ecologically dominant and functionally important species such as mulga—are poorly understood taxonomically. Species of *Tephrosia*, for example, are frequently collected during vegetation surveys for mine development, but many cannot be identified. New species continue to be discovered, such as the recently described *Cochlospermum macnamarae*. Resolution of the taxonomy of widespread genera may also assist in understanding ecological changes within the landscape. *Ptilotus* and *Swainsona*, for example, are common across the Pilbara, and some species may be important indicators of ecological condition. As a nitrogen-fixing legume, *Swainsona* may also be of economic importance to pastoralists.

Scientists are seeking to clarify the taxonomy of many ecologically important or poorly known species from a range of families, assess their conservation status, and develop tools for their identification.

The biodiversity of marine benthic algae in several existing or proposed marine parks, including Ningaloo, Barrow Islands, the Montebello Islands and the Dampier Archipelago, is also being assessed. The *Marine Benthic Flora of North-Western Australia* will be published in two volumes as part of the Australian Biological Resources Study series *Algae of Australia.* Volume 1 is available now and Volume 2 will be published in 2016.

Research contacts: Mr Bruce Maslin (bruce.maslin@dpaw.wa.gov.au), Ms Ryonen Butcher (ryonen.butcher@dpaw.wa.gov.au), Mr Robert Davis (robert.davis@dpaw.wa.gov.au), Dr John Huisman (john.huisman@dpaw.wa.gov.au).


Daniel Brassington

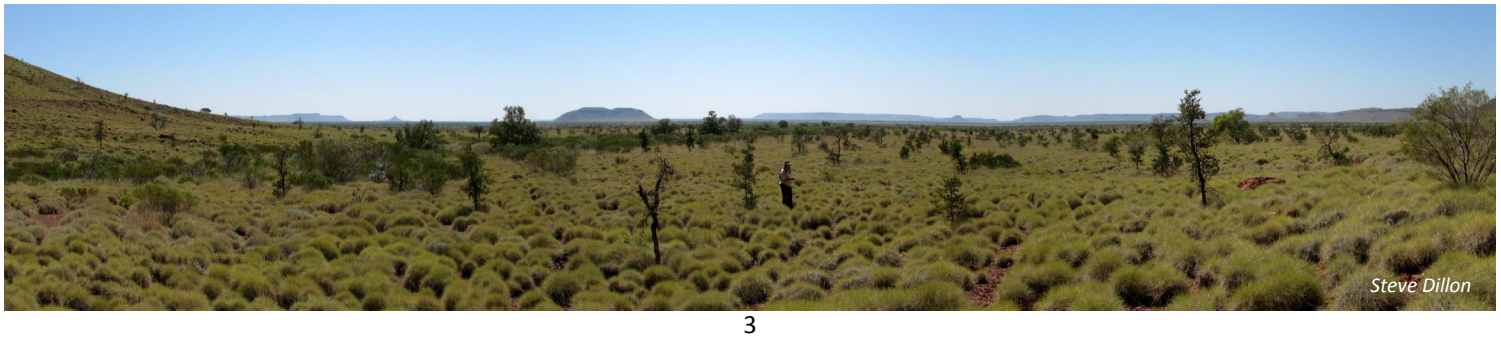

Steve Dillon

Which seeds from where? Using genetics to improve ecological restoration

In the past, strong arguments—such as the need to protect for local genetic adaptations to the environment—have been made for using only seed of 'local provenance' for restoration projects. While defining restricted seed collection zones is essential for species where there is significant genetic differences between populations, it may not be necessary for species with high levels of genetic diversity and low levels of differentiation between populations. An analysis of the genetic diversity and structure of the populations of a number of plant species commonly used in mine site revegetation in the Pilbara will identify appropriate seed collection zones, to ensure adequate supply of seed to meet demand.

Researchers have determined that seeds of snappy gum (*Eucalyptus leucophloia*) and Fitzroy wattle (*Acacia ancistrocarpa*) used for rehabilitation projects can be collected from across a wide area of the Pilbara; however, the Hamersley and Chichester ranges were identified as important historical refugia for *E. leucophloia*. The higher genetic diversity of these populations mean that targeted collection of seed is necessary for rehabilitation projects within this area. Atkin's wattle (*Acacia atkinsiana*) has low genetic diversity but significant differentiation between populations, and seed should be collected from restricted zones. Analysis is continuing on a range of other species.

Research contacts: Dr Margaret Byrne (margaret.byrne@dpaw.wa.gov.au), Dr Stephen van Leeuwen (stephen.vanleeuwen@dpaw.wa.gov.au).


Steve Dillon


Keith Morris


Keith Morris

Developing effective broad-scale strategies for the control of feral cats

The control of feral cats is one of the most important issues for fauna conservation in Australia. Any widespread control of cats requires effective aerial baiting techniques and with a toxin and a bait medium that is suitable for uptake by feral cats. A state-wide project focussing on a range of climate zones is assessing how the timing of baiting, baiting intensity and baiting frequency all influence the effectiveness of a baiting program, so that prescriptions for operational cat baiting can be determined.

The Fortescue Marsh was baited in 2012, with an estimated 60% reduction in cat abundance following baiting. Follow-up baiting occurred in 2013 and 2014. An important focus of the study is understanding whether non-target species that may be attracted to the baits, such as northern quoll, are affected, and investigating ways to minimise the impact on non-target species. Ongoing work to improve the effectiveness of cat-baiting operations directly contributes to the long-term conservation of threatened mammals and birds within the marshes.

Research contacts: Dr Dave Algar (dave.algar@dpwaw.wa.gov.au), Mr Neil Thomas (neil.thomas@dpaw.wa.gov.au).

A decision-support system for prioritising and implementing biosecurity on islands

The national conservation significance of islands such as the Montebellos and Barrow Island, amongst others, as refuges of remnant or translocated populations of threatened mammals is well known. Many of the 700 islands of the Pilbara provide critical breeding sites for sea birds and marine turtles. Increased use of the islands for recreation and oil, gas and mining development increases the likelihood of colonization of the islands by invasive species, with potentially significant ecological impacts. Black rats, in particular, can have devastating impacts on seabirds, particularly small seabirds that nest in burrows, such as shearwaters and petrels.

Scientists from the Division are working in collaboration with partners at James Cook University to develop a decision-support system that will assist managers in prioritizing their management of biosecurity risks to the islands in the most cost-effective way. The islands in the Pilbara region are the first in Western Australia to be addressed. The first workshop between scientists and island managers was held in February 2013, where the approach to developing the system was reviewed and preliminary information gathered. The database for the Pilbara islands, containing information on island characteristics, species diversity and associated threats is now 90% complete. Once gaps in the data are filled, the decision -support system will be reviewed and tested in collaboration with island managers. Having a single, easily accessible database available for the Pilbara islands provides managers with a comprehensive tool to facilitate management planning and operations.

Research contacts: Dr Cheryl Lohr (cheryl.lohr@dpaw.wa.gov.au), Mr Keith Morris (keith.morris@dpaw.wa.gov.au), Dr Lesley Gibson (lesley.gibson@dpaw.wa.gov.au).


Keith Morris


Steve Dillon

Genes: using the hidden source of diversity to improve the conservation of rare fauna and reserve design

Genetic information is becoming an increasingly important component of decision making for conservation. Genetic tools are used to resolve the taxonomic boundaries between species, thus ensuring appropriate conservation listings. They can also be used to understand patterns of contemporary and historical diversity of a species within a landscape, thus improving decisions regarding the adequacy of the reserve system for conserving genetic diversity and genetic processes.

Scientists are using DNA markers to investigate the taxonomy of the Western Australian bandicoots, particularly the golden bandicoot (*Isoodon auratus*) and quenda (*I. obesulus fusciventer*), so that their conservation status can be resolved. The golden bandicoot was once widespread across inland Australia, but now is restricted to only a few populations, including those on Barrow and Middle islands. Because of its current threatened status, the golden bandicoot has been translocated to Hermite and Doole islands, and also to Lorna Glen. Researchers found that genetic diversity has been maintained in these populations but, in the longer term, if population sizes remain below 1000 animals, genetic diversity will decline over time and bandicoots from other areas will need to be introduced. Analysis of mitochondrial DNA, however, suggests that the golden bandicoot and quenda are the same species. Evidence from nuclear genes is also required to support any taxonomic change, and this analysis is ongoing. A taxonomic revision of the two species will have consequent implications for the conservation management of populations of golden bandicoots/quendas throughout the state.

Three common and widespread species in the Pilbara will be used to assess whether the current reserve system is adequate to conserve the genetic diversity of each species as exemplars of Pilbara fauna. The western pebble mouse (*Pseudomys chapmani*), sandy inland mouse (*P. hermannsburgensis*) and Pilbara ningaui (*Ningaui timealeyi*) were widely collected during the Pilbara regional biological survey, and so many tissue samples are available for DNA analysis. This analysis will identify hotspots of genetic diversity in small mammals in the Pilbara and inform future reserve planning and design.

Research contact: Dr Kym Ottewell (kym.ottewell@dpaw.wa.gov.au), Mr Keith Morris (keith.morris@dpaw.wa.gov.au)


Judy Dunlop


Shannon Armstrong

Investigating the impacts of a major coral bleaching event

In the summer of 2010–11, ocean warming, driven by an extremely strong Leeuwin current, led to a coral-bleaching event that affected reefs from the Dampier Archipelago to Rottnest Island. Marine scientists assessed the spatial and temporal extent of the bleaching, and investigated the response of coral after the event, at both local and regional scales.

Corals were bleached primarily at coastal locations, with the highest levels of bleaching in the Exmouth Gulf, where 95% of all coral was bleached, followed by the Barrow Shoals (77%) and Lowendal Shelf (34%). The proportion of coral bleached was strongly related to increasing temperature accumulation over the three months of summer, but temperature alone could not completely explain the patterns of bleaching.

There was also a strong location and depth effect, with corals less than four metres deep more likely to bleach, regardless of temperature. Because local conditions could lessen the impacts of bleaching events, coral monitoring programs need to consider a range of threatening processes and their potential interactions on coral health. This information will inform future disturbance response plans to allow timely and efficient assessment of the impact of bleaching events and subsequent coral recovery by marine park managers.

Research contact: Dr Shaun Wilson (shaun.wilson@dpaw.wa.gov.au).

Climate change, fishing and coral reefs

Climate change and unsustainable fishing are considered the two greatest threats to coral reef communities. They interact to change fish communities on coral reefs from different directions. Fishing, by removing top predators, has a top-down effect on fish communities, while climate change causes degradation of habitat, which may particularly affect the survival of juvenile fish. Further, a decline in the abundance of large, predatory fish may lead to an increase in the number of smaller predatory fish associated with a particularly habitat, thus directly increasing the predation of juvenile fish.

Scientists predicted that these interactions may be particularly important as recreational fishing pressure increases along the coastlines of Ningaloo and the Pilbara. Researchers found that the structural complexity of coral reefs, both live and dead, were important for both juvenile and adult fish. Fish biomass and diversity was highest where structural complexity was greatest. Corymbose (branching) corals supported a disproportionate number of juveniles of coral reef species compared with the less complex massive and encrusting corals. Yet the researchers also found that corymbose corals, such as *Acropora* and *Montipora*, are those most susceptible to injury or death during bleaching events.

While structurally complex coral habitat was important to many species, juveniles of species of both ecological and fisheries importance, such as yellow-tailed emperor (*Lethrinus atkinsoni*), were observed only in algal meadows. High fish diversity is dependent on the presence of both coral and macroalgal habitat, highlighting the importance of the continued management of multiple habitat types within marine parks. Although current fishing pressure in areas such as Ningaloo is low, fished reefs contained a higher abundance of small-bodied planktivorous fish. Whether this was related to the removal of larger predatory fish by fishers, or simply reflects specific habitat associations is not yet clear.

Research contact: Dr Shaun Wilson (shaun.wilson@dpaw.wa.gov.au).


Marine Science Program


Marine Science Program

Marine monitoring for better management

Long-term datasets help us understand the direction and rate of change in ecosystems, so that managers can identify change related to human activities from underlying natural change. The Western Australian Marine Monitoring Program (WAMMP) aims to provide such information to marine conservation managers, so that they can respond to changes in marine biodiversity and ecosystem condition as they become apparent. The program is a state-wide, long-term monitoring, evaluation and reporting program of both protected areas and threatened marine fauna.

Monitoring of the Gorgon dredge plume from early November 2011 to late February 2012 showed that there was still some evidence of the plume more than three months after the dredging occurred. The plume moved predominantly southward, contrary to a model that predicted that the plume would move northwards. There has been a gradual decrease in live coral cover in the Barrow Port Zones since 2010, compared with a stable level of live coral cover in the Montebello Islands Marine Park Sanctuary Zones over the same time period. Levels of coral disease are also greatest at sites exposed to the dredge plume.

Future monitoring will determine if dredge-related disease of coral persists. The corals of the Southern Barrow Marine Management Zone were affected by the 2010–11 ocean warming event, with 25–80% of corals bleached or partially bleached. Continued monitoring of the health of corals in the Montebello/Barrow Islands marine parks is needed to allow scientists to better predict the behaviour of dredge plumes and the short- and long-term impact of dredge spoil and elevated water temperatures on coral health.

Research contact: Dr Kim Friedman (kim.friedman@dpaw.wa.gov.au).