GOVERNMENT OF WESTERN AUSTRALIA

Department of **Biodiversity, Conservation and Attractions**

Biodiversity and **Conservation Science**

Biodiversity and Conservation Science

Annual Program Updates 2019

December 2019

Animal Science Program

Key achievements for 2019

Species restorations, relocations and monitoring

- Undertook translocations of Shark Bay bandicoots and dibblers to Dirk Hartog Island. Monitoring suggests these species, and other small extant vertebrates on the island, are persisting well.
- A survey of water rats on Barrow Island has commenced preceding a planned translocation to the Montebello Islands.
- Ongoing monitoring of selected mammals and birds translocated from Barrow Island to the Montebello Islands indicates successful establishment, with populations broadly distributed across each island.
- Boodies, mala and golden bandicoots translocated from Barrow Island to a fenced enclosure at Matuwa (formerly Lorna Glen) continue to do well, although extremely dry conditions were coincident with a drop in boodie numbers. Bilbies, brushtail possums and golden bandicoots released outside the enclosure have persisted supported by ongoing introduced predator control.
- Survivorship of eastern grey kangaroos relocated from an urban area to state forest near Jarrahdale commenced in May 2019. Post-relocation monitoring over the subsequent 12-months is underway.

Cat eradication

- Refinement of feral cat control techniques regarding bait palatability, deployment, minimising non-target impacts and trapping continues. Research in southern jarrah forest has revealed low bait uptake by cats.
- Broadscale feral cat baiting in the Pilbara has resulted in quolls persisting in the presence of aerial baiting using Eradicat®, with their range expanding compared to a non-baited area.
- Research into the non-target impacts of Eradicat® suggest minimal impacts in the Dryandra Woodland, with red-tailed phascogales persisting after its application. This has implications for integrated fox and feral cat control programs at Dryandra and elsewhere in the south-west of Western Australia.

Researching monitoring techniques

- Innovative genetic approaches have been applied to monitor bilby abundance based on identifying individuals using DNA extraction from scats, which may become standard practice.
- Research into optimising monitoring for northern quolls reveals that camera-traps, combined with identifying individuals by their spot-pattern is likely to be more efficient than trapping.
- A recently developed program for analysing camera trap data has helped to both manage and analyse the enormous volume of images collected when researching spatial and temporal ecological patterns.
- Western ground parrot, night parrot and Australasian bittern monitoring protocols are being refined through use of audio recording units and automation of sound recognition.
- Microsatellite genotyping of ghost bat faecal DNA in the Pilbara has proven an effective, non-invasive method for assessing genetic diversity and monitoring movements of ghost bat populations.
- Landscape genomics research aiming to identify dispersal corridors and evolutionary refugia for multiple Pilbara mammal species is being undertaken to inform future translocations

Cane Toad eradication

- Trials in the Kimberley into the effectiveness of a taste aversion cane toad bait to protect northern quoll and goanna populations provided inconclusive results. Monitoring on Adolphus Island has shown both quolls and goannas have persisted despite cane toad invasion.
- A novel approach to finding and relocating female pythons inside the Waychinicup National Park potoroo enclosure to reduce predation on the Gilbert's potoroo is being refined. Since 2016, the population has been stable at between 20 and 30 animals, with frequent breeding and recruitment of young.

Plant Science and Herbarium Program

Key achievements for 2019

The Western Australian Herbarium

- Continued to provide taxonomic and location information on WA's flora that is essential for underpinning conservation and resource development planning decisions.
- The total number of lodged specimens passed 800,000 with 10,862 new additions and 423 plant names added to the WA Census.
- Plant taxonomy research continued to focus strategically on naming undescribed taxa with an emphasis on those of conservation concern together with major revisions of *Tephrosia* and *Stylideaceae*.
- Whole chloroplast sequencing analysis was used to identify introduction locations of Australian populations of the major weed *Passiflora foetida* to assist with identifying biocontrol agents.
- An assessment of restored Gondwana link species populations was completed and found that restoration practices have been effective in establishing ecological and genetic viability.

Publications

- The Herbarium journal Nuytsia published 23 papers, describing 58 new species and 7 new subspecies, with five additional taxa reclassified. These include 47 conservation listed taxa.
- The book *Marine Plants of Australia* (revised) was published by UWA Publishing. It presents over 600 species and will enhance biodiversity surveys and monitoring programs in marine parks.

Research

- Research began on the effectiveness of specific herbicides for controlling widespread weeds and their impact on co-occurring Threatened Flora and other native species on the Swan Coastal Plain.
- Staff collaborated with our partners at the NESP Threatened Species Hub and Australian Network for Plant Conservation to substantially revise, and publish, the Guidelines for the Translocation of Threatened Plants in Australia.

The WA Seed Centre - Threatened Flora Seed Vault

- Continued to provide training to an indigenous women's ranger program to develop seed banking capacity within the Tjunjtjuntjara community in the Great Victoria Desert.
- A very successful outreach project was run with the Woodlupine Primary School who established seed production areas for three conservation listed taxa, which will contribute significant numbers of seeds to the seed centre.

Citizen science

- Volunteers were trained, and coordinated, to assist with Priority Flora Surveys, research on threatening processes and recovery of Threatened Flora with regional colleagues in the Swan, South Coast and Wheatbelt Regions. This included monitoring recovery of the Eastern Stirling Range Montane Heath and Ticket Threatened Ecological Community, and Threatened Flora in the Stirling Range and Torndirrup National Park following bushfires in 2018.

Ecosystem Science Program

Key achievements for 2019

Research to inform hydrological management of key wetlands

- Analyses and reports were completed describing the hydrogeology of Toolibin Lake and springs at Walyarta, providing insights for hydrological management of these systems.
- Research on acidification of Muir-Byenup wetlands was extended with National Landcare Program II funding via the South West Catchments Council. Work continues, focussed on remediation potential.
- Hydrological functioning of the Ashfield Flats area on the Swan River, especially regarding transport contamination, is being investigated with funding from the Department of Planning, Lands and Heritage.

Biodiversity survey to provide insights for land management planning

- A survey of flora and vegetation within areas linking reserves in the Fitzroy Valley was completed to provide information for designing reserves under the Plan for Our Parks Program.
- A vegetation map of the Walyarta area of the 80 Mile Beach Ramsar site was completed to inform management of important wetlands and surrounding landscapes.
- A report on biodiversity values of rare peat forming springs across the Kimberley provides new insights into their conservation status and baseline data for environmental impact assessment.
- Staff contributed to a review of the environmental values, threats and management options regarding potential impacts of sealing the Cape Leveque Road in the Dampier Peninsula.
- The potential for listing Lake Carnegie, located in the Gibson Desert, as a new Ramsar wetland was investigated, including a reconnaissance trip with traditional owners.

Research to inform forest management

- New projects have commenced to address recommendations of the mid-term review of the 2014-23 Forest Management Plan dealing with effects of climate change on forest health.
- Studies continued at the Yarrigil 4L catchment to investigate effects of a second thinning trial on forest health and hydrology and two papers arising from the first thinning were published.
- Examination of herbarium specimens provided historical context for *Cardiaspina jerramungae* outbreaks on *Eucalyptus occidentalis*.

Understanding landscape scale genetics to inform restoration and rehabilitation

- Studies of the genetic structure and evolutionary history of flora species continues to provide guidance on appropriate seed collection zones for landscape rehabilitation in a drying climate.
- Studies of the genetic and physiological variation within Marri indicate climate adaptation and will contribute to improved decision-making for assisted gene migration.

Monitoring to understand ecological change and management effectiveness

- ForestCheck focussed on floristic responses to prescribed burns and wildfires.
- A study following a rare filling of Lake Toolibin suggested that prolonged drying has reduced invertebrate diversity. Waterbird abundances were also low, but within historical ranges.
- Published exploratory analyses of waterbird populations inhabiting the Warden and Gore Ramsar wetlands between 2006 to 2019 showed benefits for the management of water levels for waterbirds.
- A report on the first major survey of waterbirds since the 1980s in the Parry Lagoons area of the Lower Ord Floodplains Ramsar site showed that the site still meets at least some Ramsar criteria but highlighted the difficulty of interpreting infrequent survey data in a highly variable system.

Marine Science Program

Key achievements for 2019

Monitoring

- Ecological monitoring reports were completed, or are in preparation, for the Shark Bay and Barrow/Montebello marine reserves, Shoalwater Islands, Marmion and Ngari Capes marine parks.
- Flatback turtle nesting was monitored at Thevenard and Delambre islands, Eighty Mile Beach and Cape Domett. Staff assisted community and industry with nest monitoring at Cemetery Beach (Port Hedland), Mundabullangana Station and Ecobeach (Broome). Fox baiting was contracted at Mundabullangana Station to protect turtle nests.
- Monitoring continues for a variety of taxa in Walpole and Nornalup Inlets Marine Park (fish), Ngari Capes Marine Park (fish, seagrass), Shoalwater Islands and Marmion marine parks (seagrass and macro-algae), Shark Bay marine reserves (mangroves), Ningaloo marine reserves (shallow and deep water fishes, macroalgae, fish and coral recruits, coral and macro-invertebrates), Barrow/Montebello marine reserves (fish, coral and macro-invertebrates), Lalang-garram marine reserves (coral) and North Kimberley Marine Park (mangroves and coral). Seawater temperature was monitored across all reserves.

Research

- Completed, except for final papers, the Wheatstone environmental offset Project B: Improving the understanding of West Pilbara marine habitats and associated taxa: their connectivity and recovery potential following natural and human induced disturbance.
- Commenced fieldwork for the final project of the Pluto environmental offset Project 2 Patterns and distribution of major marine communities (incl. key functional groups) and large marine fauna in the Dampier Archipelago/Cape Preston Region to examine habitats, trophic webs and the transfer of energy from primary producers to consumers in waters of the Dampier Archipelago.
- Discovered flatback turtle foraging areas off Eighty Mile Beach using satellite tracking.
- Completed the report on a NESP-funded dugong distribution and abundance aerial survey from Shark Bay to Exmouth Gulf.
- Led fieldwork to the Dampier Archipelago to survey bottlenose and humpback dolphins and to biopsy humpback dolphins for genetic analysis.
- Led a census of snubfin dolphins in Yawuru Nagulagan/Roebuck Bay Marine Park that involved regional staff, joint managers and the local community, including training in the DolphinWatch app.
- Led a dolphin survey in Lalang-garram/Camden Sound Marine Park.
- Completed three final fieldtrips to the Dampier Archipelago area and commenced the final report of Pluto environmental offset Project 4 Establishment of long-term reference sites.
- Developed a major research project on the poorly known ecology and diversity of cryptobenthic fishes in WA's marine parks and reserves.

Awards

- Shaun Wilson was recognised by Web of Science as a Highly Cited Researcher for 2019.
- Claire Ross was awarded the 2019 Virginia Chadwick Award by the ARC Centre of Excellence for Coral Reef Studies for a 2018 PhD publication on mechanisms and drivers of coral calcification.

Fire Science Program

Key achievements for 2019

Program staff maintained intensive field survey operations into:

- Pre-and post-fire in *Banksia* woodlands examining plant community responses to variable fire intervals and time since fire.
- Responses by threatened mammals in the Kimberley to the fire mosaics created through savannah management.
- Fire severity in Jarrah and other forests to refine mapping and reporting protocols.

Research projects commencing

- A collaboration has commenced with South Coast Region examining fire return intervals for sensitive plant species across a South Coast rainfall gradient.
- A multi-institution project examining fire seasonality impacts on ecosystems and threatened species has begun, led by the University of New South Wales, with the NSW Office of Environment and Heritage, The University of Queensland, The Spanish National Research Council, South Australia's Department for Environment and Water, and the South Australian Water Corporation. A 3-year fire ecology post-doctoral research fellow is likely to be based with DBCA from 2020.
- A partnership has been initiated with various forest regions to develop a systematic approach to monitoring and reporting on the outcomes of prescribed burns and bushfires

Student supervision

- One Honours student and seven PhD candidates were supervised throughout 2019, with one PhD completion on the topic of seed lethal temperatures.

Publication highlights

- A 30-year experiment comparing impacts of varying fire season and frequency across Jarrah forest.
- Examining bird guild dynamics across a ~400-year fire chronosequence in the Great Western Woodlands.
- Gouldian Finch – examining fire extent and grass seed interactions.
- Black cockatoo – investigating the links between fire type and *Banksia* seed interactions.
- Mechanisms of fire seasonality and their effects on plant populations.
- Remote sensing of fire impacts and tree survival.

Conferences

- Numerous staff attended the inaugural Prescribed Burning Conference at the University of Western Australia in July contributing to at least 16 conference presentations.

King's Park Science Program

Key achievements for 2019

Restoration Science

- Continued to explore complex relationships between landscapes, landforms and soils underpinning plant performance in both intact and rehabilitation systems. Research activities focused upon local *Banksia* woodlands, *Triodia* systems and rare species within Pilbara ecosystems, the Great Sandy Desert, Goldfields and Midwest Banded Iron Formations.
- Completed a major project partnering with the University of WA that examined the point, patch and park scale processes in *Banksia* Woodlands to understand plant performance and soil water in changing climates.
- Finalised a project to understand interactions of soil paedogenesis and plant root establishment in dry stack tailings systems in the MidWest region to inform rehabilitation on mine tailings dumps.
- Undertook research to identify suitable analogue sites for various mine wastes in the Great Sandy Desert.

Rare Species

- Focussed on increasing ex-situ conservation and research activities for improving and extending collections of WA threatened plants as well as translocation activities for plants impacted by environmental degradation (e.g. mining, loss of natural habitats).
- Working with several Regions, two projects were commenced to develop micropropagation of the critically endangered species *Banksia ionthocarpa* spp. *chryosophoenix* and *Caladenia busseliana* for ex-situ conservation, cryobanking and future restoration and translocation purposes.

Conservation Genetics

- Continued to assess genetic diversity and its consequences for conservation and restoration of terrestrial, marine and soil microbiome systems.
- Research revealed the importance of nectar-feeding birds as pollinators for eucalypts, banksias and kangaroo paws. Birds can deliver effective pollination, wide pollen dispersal and high paternal diversity. Also, it was found that introduced honeybees can have negative impacts.
- Key population processes of seagrass (*Posidonia*) in the Shark Bay region of WA are being explored through an ARC-funded project with UWA that currently examine local adaptation and resilience to environmental stressors associated with climate change.

Seed Science

- Research into the development of new technologies to measure seed metabolic rate shows potential for improved prediction of decline in seed viability when in storage by providing seed quality testing within a matter of hours, rather than the days or weeks required for traditional viability testing. Improving seed use for broad scale restoration programs has focussed predominantly on the Pilbara and *Banksia* woodland systems through the design and development of mechanised direct seeding systems for precision seed sowing in waste rock landforms.
- Seed enhancement technologies are also being developed and applied to *Banksia* woodland systems where seed pelleting treatments, such as herbicide tolerance packaging, are being explored.

Perth Zoo Science Program

Key achievements for 2019

Western Swamp Tortoise

- A total of 91 eggs were laid with 47 hatchlings produced in the breeding colony.
- A record 73 juvenile tortoises were released to Moore River Nature Reserve in August.

Dibbler

- Eight pairs were sourced from Whitlock and Escape Island to provide founding stock for a Dibbler reintroduction to Dirk Hartog Island National Park.
- 24 Dibblers bred and 26 Dibblers were released to Dirk Hartog Island National Park on 7th October 2019

Numbats

- 12 Numbats bred with 9 numbats released to Dryandra Woodland on 9th December 2019.

Geocrinia Frog species

- The 2019 release of head-started *Geocrinia* took place on the16th September, with 120 *G. alba* juveniles and 38 *G. vitellina* juveniles released to sites near Margaret River on 17th and 18th September 2019, respectively.
- Field trips to collect clutches from the wild for releases in 2020 took place in September and October 2019 resulting in 9 clutches of *G. alba* (~111 individuals) and 6 clutches of *G. vitellina* (~80 individuals) being collected.

Black Cockatoo Conservation

- Field trips to monitor key Caranby's cockatoo breeding sites were completed in September, November and December 2019 with a total of 79 nestlings being measured and individually marked. Record dry conditions and extreme weather events had an adverse impact on the study population in the northern wheatbelt, while the southern wheatbelt study population had the best season recorded to date.

Research Outputs

- Nine peer-reviewed scientific papers and two book chapters published.
    - Eight conference presentations were delivered.
    - Six lectures were presented as part of accredited tertiary degree units.

Rivers and Estuaries Science Program

Key achievements for 2019

Program Delivery

- River Health and Rivers Science were merged to form Rivers and Estuaries Science comprising five staff. Program and operational plans have now been developed.
- More than 20 projects are underway, many already showing substantial achievements.

Water Monitoring

- Four new staff have been employed to service the Swan Canning estuarine and catchment monitoring project.
- Weekly monitoring of the estuary and catchment began in July 2019, with more than 3000 samples collected, analysed and reported to date.
- Oxygen levels within the Upper Swan Estuary and Canning River are being maintained at appropriate levels to support healthy ecosystem functioning.
- It has been identified that seagrass in Alfred Cove is in a stressed condition but is occurring at a smaller scale than previously thought.
- River quality monitoring information has been provided widely throughout the community via the West Australian newspaper.

Incident Response and Advice

- The program has provided more than 100 hours of advice to various clients.
- Information has been sourced, collated and communicated to the public on the presence of per-flourinated chemicals and persistent organic pollutants in water and biota.
- There have been emergency responses to multiple incidents, including five separate incidents of dolphin deaths, multiple fish kills and pollution events.
- A harmful *Alexandrium* algae bloom was identified in the Swan River in Autumn 2019. Subsequent sampling of water, Black Pygmy Mussels and Blue Swimmer Crabs was undertaken to track the event.

Communication and Publications

- Three journal articles; two reports; seven presentations; one magazine article; and multiple conference presentations have been completed.

Awards

- The Western School Prawn Restocking Project was awarded a ‘Highly Commended’ award in the environment category at the WA Seafood Industries Awards in July 2019.

Remote Sensing and Spatial Analysis Program

Key achievements for 2019

Feral Herbivores

- The four-year Fortescue Marsh Feral Herbivore project was completed to inform future feral horse management. This included the identification of marsh edge vegetation communities targeted by horses as floodwaters receded, barriers to horse movement and optimal collaring spacing for Judas programs.
- Spatial modelling techniques were applied in the Martu Determination Lands to identify feral herbivore hotspots, thus highlighting areas to be targeted in future aerial removal programs.

Swan and Canning catchments land use

- Land use and land cover datasets were produced as inputs into nutrient modelling currently being conducted by UWA. It used a combination of digital aerial photography and derived height data (from the Urban Monitor Project), mapping boundaries using a machine learning algorithm that vastly improved the automation of model production.

Pine wilding density assessment in the Gnangara region

- High resolution multispectral digital aerial photography was used to estimate the number of wilding pines per cleared stand within the Gnangara, Pinjar and Yanchep pine plantations to assist decision-makers to balance a critical food source for Carnaby's cockatoo and groundwater recharge rates.

Fire History and Fire Metrics

- Fire metrics were derived from the fire history of Millstream-Chichester and Karijini National Parks and Mungaroona Nature Reserve to understand the temporal fire regime and the changes due to management actions. This provides Pilbara Region with a flexible way to view and interrogate a suite of fire metrics, filter graphs dynamically and to quickly produce and share outputs for reporting.
- A comprehensive fire scar history for the Great Victoria Desert for the years 1995 to 2018 (inclusive) has been developed using Landsat satellite imagery. This will provide key information for habitat modelling and fire regime management.

Detecting seagrass extent in Shark Bay

- Classification of seagrass coverage from satellite imagery over the entire Shark Bay World Heritage Area (13000 km^2) in 2002, 2010, 2014 and 2016 has confirmed that over 1000km^2 was lost following the 2011 marine heatwave. This decline was more extensive than previously estimated, though some recovery has now occurred.

Facilitating the accessibility and discoverability of marine research datasets in the Kimberley region

- The WAMSI Kimberley Node project requires lead researchers to provide spatial dataset deliverables. These datasets are now available through the Corporate GIS menu which is a potentially useful way of communicating important scientific outcomes to regional staff. These data are assisting the development of Marine Monitoring in the Kimberley, in situ planning and communication with joint managers.

Species and Communities Program

Key achievements for 2019

Biodiversity Information

- Work is progressing with colleagues from Ecoinformatics integrating the Threatened and Priority Flora List, Fauna and Threatened Ecological Communities databases, as well as sharing this information with other parties through SLIP or targeted searches and should be delivered by mid-February.

Listing Process

- Evaluation of Threatened Ecological Communities under criteria for the Biodiversity Conservation Act (2016) has begun. A Ministerial Guideline (Number 4), consistent with the IUCN Categories and Criteria for Ecosystem assessment, is being developed to support this listing.
- Each of the 65 TECs currently recognised through the Environmentally Sensitive Areas policy is being evaluated against the IUCN criteria. Community consultation will take place from January to February 2020, prior to the nominations being provided to the TECSC.
- New nominations will be assessed by the TSSC in April 2020. Twenty-seven (14 fauna and 13 flora) species ranking reviews will be considered. At this meeting it is planned for the TSSC to endorse a revised Ministerial Guideline (Number 2) in addition to the Terms of Reference and Code of Conduct.

Recovery Planning

- Draft Interim Recovery Plans for are being completed for: *Conospermum galeatum*; *Kunzea similis* subsp. *similis*; *Gastrolobium argyrotrichum*; *Melaleuca* spp. Wanneroo; *Hibbertia barrettiae*; and Mandora Mound Springs Threatened Ecological Community
- The Principal Zoologist convened a meeting of Recovery Team chairs to improve collaboration and effectiveness of threatened species and ecological community recovery.

Wetlands and Off-Reserve Conservation

- The Wetland Mapping Project is progressing well. The first multicriteria evaluation model has been run using GIS software. Field work to ground-truth the outputs will commence in January.
- Mike Coote and Adrian Pinder travelled to Lake Carnegie to make a preliminary Ramsar assessment.
- State NRM has funded a data sharing agreement to ensure NRM organisations have access to our Land for Wildlife database.

Animal Ethics Committee

- The AEC met six times in 2019 and assessed 50 projects to facilitate scientific excellence.
- The fauna team is working with DPIRD to ensure that all science in WA has access to an AEC.

Flora and Fauna Authorisations

- Authorisation to take or disturb flora, fauna and ecological communities is required under the Biodiversity Conservation Act (2016). The Species and Communities Team is building systems and capacity to deliver a streamlined and risk appropriate s40 authorisation assessment process, and provided advice to DWER, DMIRS and DPLH on impacts on threatened species or ecological communities.
- In 2019, there were 123 threatened fauna, 190 threatened flora authorisations issued. Five Threatened Ecological Communities modification assessments were conducted.