

“Conservation Systematics of the
western Pilbara fauna” Project
Annual Report

1 July 2014 – 30 June 2015
Western Australian Museum

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1.0 Executive Summary

This annual report for the “Conservation Systematics of the Western Pilbara fauna” Project (the project) covers the period 1 July 2014 to 30 June 2015.

A total of \$956,577 of Net Conservation Benefits (NCB) funds was expended against the \$1,528,280 NCB budget available for the project in 2014/15.

All 12 milestones scheduled for 2014/15 have been met.

The focus during 2014/15 was to reach full productivity with our molecular workflows, to develop the species pages, and begin conservation assessments.

In 2015/16 the focus will be on maintaining the current levels of productivity, and to begin publishing some of the newly produced datasets.

2.0 Introduction

The project has made rapid progress in the 2014/2015 financial year. We have achieved all the required milestones.

The highlights include

- Producing 14,087 sequences (quality assured), from 5,108 specimens.
- Recruitment of 2 extra PhD students, with 4 students now supported by the project
- Carrying out two terrestrial field trips, September 2014 and March 2015.
- Carrying out one marine field trip (April 2015).
- Maintaining project management documents and structures (detailed Work Plan, Communications Plan, meeting of Steering Committee, submission of reports).
- Submitting the first scientific publication.
- Purchasing of equipment for laboratory and staff (ultra-freezer, computers, PCR machines)
- Producing 50 species pages, with all taxa having been assessed for conservation status.

3.0 Commentary

3.1 Financial performance 2014-15

The milestones have been met with considerable savings to the budget.

	Income	Expenditure (July 2014- June 2015)	Closing Balance (30 June 2015)
Instalments (left over from previous instalments)	\$1,528,280		
Interest	\$0		\$0
Expenditure		\$956,577	\$956,577
Total			\$571,703

Item	Budget	Actual Expenditure	Variance	Percentage Variance
Overall Project Funding (NCB)	\$5,173,418	\$1,151,776	\$4,021,642	-77.74%
Overall Project Funding (in-kind)	\$1,212,000	\$363,600	\$848,400	-70.00%
Project Funding to end of current financial year (NCB)	\$1,483,831	\$1,151,776	\$332,055	-22.38%
Project Funding to end of current financial year (in-kind)	\$363,600	\$363,600	\$0	0.00%
2014/15 Project Funding (NCB)	\$1,162,637	\$956,577	\$206,060	-17.72%
2014/15 Project Funding (in-kind)	\$242,400	\$242,400	\$0	0.00%

3.1.1 NCB detailed expenditure against budget lines

Line	Jan 2014-June 2014			July 2014-June 2015			Total Difference to date
	Budget	Actual	Difference	Budget	Projected Actual	Difference	
Salary	\$141,143	\$134,903	\$6,240	\$452,985	\$463,902	-\$10,917	-\$4,676
Fridges	\$22,000	\$19,377	\$2,623	\$22,000	\$24,572	-\$2,572	\$51
Molecular Costs	\$115,551	\$10,636	\$104,915	\$346,652	\$223,409	\$123,244	\$228,159
Field Work (TZ)	\$0	\$5,328	-\$5,328	\$100,000	\$80,000	\$20,000	\$14,672
Field Work (AZ)	\$0	\$0	\$0	\$140,000	\$98,388	\$41,612	\$41,612
Computing	\$30,000	\$14,862	\$15,138	\$6,000	\$19,726	-\$13,726	\$1,413
Website	\$0	\$0	\$0	\$20,000	\$33,015	-\$13,015	-\$13,015
PhD support	\$0	\$0	\$0	\$70,000	\$12,742	\$57,258	\$57,258
Relocations	\$10,000	\$10,095	-\$95	\$0	\$0	\$0	-\$95
Conference support	\$2,500	\$0	\$2,500	\$5,000	\$825	\$4,175	\$6,675
TOTAL	\$321,194	\$195,199	\$125,995	\$1,162,637	\$956,577	\$206,060	\$332,055

Molecular Costs – This year the project team achieved full production in the lab, producing the required 12,000 sequences. This sequencing has been done at considerable saving to the NCB budget, with the molecular costs now \$123,244 under budget for the 2014-15 period, and \$228,159 under budget for the project. These savings have been achieved through efficiencies of scale; the cheaper cost of sequencing and consumables when larger quantities are being processed and purchased, especially when using government tendering processes.

Field Work – To date, two terrestrial expeditions have been conducted (September 2014 and March 2015), and one marine trip (April 2014). These expeditions were also carried out at considerable saving to the budget.

Student Support – The original budget for student support included a full stipend for two students. We have pursued a different model, and now support 4 students with top up scholarships, who have all brought their own stipends. This has ensured that the students are of high quality, and that more money can be spent supporting their operating, conference and training costs.

3.2 Milestone performance 2014-15

Green – milestones due by the submission of this report

Milestone	Due date	Completion	Comment
2. Field surveys are undertaken	30-Jun-15	Sept 2014 (TZ), March 2015 (TZ), April 2015 (AZ)	Three expeditions were carried out in the period.
3. Incorporation of specimens into the WA Museum's collections and databases	30-Jun-15	Completed and ongoing	Specimens from the expeditions were registered, and are continuing to make their way into the molecular lab and different parts of the collection.
4. A minimum of an additional 3,000 specimens are sequenced. NOTE: This milestone should now be interpreted as 12,000 individual sequences	30-Jun-15	30-Jun-15	14,087 sequences have been produced in this period, which is equivalent to the 3,000 specimens at 4 genes.
5. A minimum of 50 species are assessed using IUCN criteria	30-Jun-15	30-Jun-15	Assessments are for species presented in the species pages (below)
6. A minimum of one publication is submitted to a peer-reviewed journal	30-Jun-15	20-Jun-15	A review paper has been submitted to Invertebrate Systematics
7. The Species Pages website is developed and launched with a minimum of 50 species	30-Jun-15	mid July 15	Pages were made live in mid July.
8. Recruitment of two Ph.D. students	30-Jun-15	2014/15	4 students have been recruited
9. Co-supervision of Ph.D. students in conjunction with the University of Western Australia	30-Jun-15	completed and ongoing	
10. Assistance in the development of research proposals for each Ph.D. student	30-Jun-15	completed and ongoing	
11. Preparation and submission of a six-monthly update	31-Jan-15	31-Jan-15	Submitted
12. Preparation and submission of the 2014-2015 Annual Report	31-Aug-15	31-Aug-15	This document
1. Annual Revision of a Detailed Work Plan for 2015-2016	31-May-15	31-May-15	Completed and approved by Steering Committee

Yellow –milestones for 2015/16

Milestone	Due date	Completion	Comment
2. Field surveys are undertaken	30-Jun-16		
3. A minimum of an additional 3,000 specimens are sequenced	30-Jun-16		
4. Incorporation of specimens into the WA Museum's collections and databases	31-Dec-16		
5. A minimum of 100 species are assessed using IUCN criteria	30-Jun-16		
6. Submission of a minimum of five publications to peer-reviewed journals	30-Jun-16		
7. A minimum of 100 species are added to the Species Pages website	30-Jun-16		
8. Co-supervision of Ph.D. students in conjunction with the University of Western Australia	30-Jun-16		
9. Assistance in the annual reporting of Ph.D. student projects	30-Jun-16		
10. Preparation and submission of a six-monthly update	30-Jun-16		
11. Preparation and submission of the 2015-2016 Annual Report	31-Jan-16		

3.3 Media achievement and communication 2014/15

Dr Wilson gave a presentation on the Conservation systematics of the Pilbara marine fauna at CSIRO Floreat on the 26 of November, at the Pilbara Marine Conservation Partnership (PCMP) Symposium.

The WAM Molecular Systematics Unit blog now hosts eight blog posts and one picture gallery. Six of these blogs and the photo gallery were produced in this reporting period. They cover topics about DNA barcoding, marine biodiversity, and introductory pieces on some of the students.

- <http://museum.wa.gov.au/explore/blogs/msu/>
- <http://museum.wa.gov.au/explore/galleries/wildlife-pilbara>

Through our field work, we engaged with;

- Traditional owners of Millstream Chichester NP (Yindjibarndi), Broome (Yawuru) Port Smith (Karajarri), 80-Mile Beach (Nyangumarta), Onslow (Thalanyji), and others.
- Ningaloo Marine Park Manager, Peter Barnes (18th September 2014). We discussed work directions with the NCB project and this has resulted in subsequent park management related collaborations (e.g. identification of marine stingers in Ningaloo Marine Park).
- Karijini NP and Millstream Chichester NP Park Rangers (March 2015).

Publication – Wilson, NG & Kirkendale LA (submitted) Putting the “Indo” back in the Indo-Pacific: resolving marine phylogeographic gaps. Invertebrate Systematics.

We have produced >50 species pages hosted on the Western Australian Museum website.

- <http://museum.wa.gov.au/online-collections/content/ncb>
- At the moment the pages are awaiting more features, which have not been finalised by the submission of this report. These will be rolled out over the next few months, including an advanced searching function and mapping tool.
- When the pages are stable and fully functional, we will officially launch them to the public.

3.4 Outputs reporting 2014/15 (based on milestones)

Major outputs and outcomes achieved for the period 1 July 2014 to 30 June 2015 are as follows.

3.4.1 Management and Coordination

One technician left at the end of January to take up a postdoctoral position in France. This necessitated a new advertisement and recruitment process, and resulted in hiring Diana Prada, who began work in April 2015. This staffing turnover meant that we 'lost' nearly three months of technical assistance. This loss of technical assistance was overcome by the hiring of an additional technician to concentrate effort on subsampling available tissue in the collection. This activity was endorsed by the Steering Committee (see minutes, 6 Feb 2015), as it had already been identified as a bottleneck to production of sequences. This position was successfully recruited in April and ends in September 2015.

Since the last annual report, we have successfully implemented a Lab Information Management system, which houses the thousands of lab workflows undertaken in the NCB. This system sits alongside the CMIS (the museum database system). It provides information that is submitted with registered specimens, such as Genbank numbers, if it has been extracted, and other molecular details. This allows future researchers to go to the archived DNA extraction or sequence, rather than re-extracting DNA and consuming precious tissue.

We have also set up a shared database network, which allows researchers to directly work on sequences in a shared space, which is routinely backed up by the DCA servers.

Three of the four PhD students began working on the project in this reporting period (Layton, Umbrello, Perina).

Kara Layton commenced in January 2015, and has already submitted her thesis plan, which was accepted by the Graduate Research School at the University of Western Australia (UWA) with no revisions. She has completed a course in R-programming, and is currently attending a very demanding Scientific Diver Course, which UWA requires for her to continue with fieldwork. She has submitted two small grant proposals to assist with fieldwork costs outside the Pilbara area, and contributed a blog post for the Molecular Systematics Unit (MSU). She has also generated a large proportion of data for her first thesis chapter (delimiting species of *Chromodoris* nudibranchs) and is presenting those findings at the International Barcoding of Life conference in Canada in August 2015.

Linette Umbrello commenced in September 2015, and has submitted her thesis plan, presented a talk to UWA's School of Animal Biology and at the WAM seminar series, and had her thesis plan approved. She is investigating the

phylogeography and biogeography of Australian dunnarts in the Pilbara and surrounding arid zones, and has already produced 24 mtDNA sequences for each of 4 species.

Guilia Perina is based at Edith Cowan University (ECU), and is studying the taxonomy, phylogenetics, systematics and biogeography of the crustacean stygofauna family Bathynellidae. She started in September 2014, and has had her thesis plan approved and given a talk at ECU about her project. She has produced a molecular dataset for species residing in aquifers around Ethel Gorge.

Karl Gruber started in early 2014 and is study the phylogenetics, phylogeography and conservation of the spider genus *Aname*. He has produced a large dataset aimed at exploring relationships among members of the genus in the Pilbara. He is also investigating an interesting contact zone among divergent lineage of a species complex, *Aname mellosa*. This contact zone is found east of Karijini National Park.

Field trips

A two-week expedition was conducted in September 2014, sampling terrestrial and intertidal invertebrates between Broome and Exmouth. This trip was very successful for insects, land snails and marine invertebrates.

A three week expedition was conducted to Karijini and Millstream-Chichester NPs in March 2015. We targeted vertebrates and invertebrates. MCNP was very burnt and less productive, but we had great success in Karijini, recording the first epigeal Shizomid for the Pilbara.

A 13 day marine expedition was conducted in April 2015, taking a group of 13 scientists and technicians to the Montebello Islands and Muiron Islands. Although bad weather curtailed some diving activities, a large amount of material was still collected. Together with the 'marine' collections taken during the September coastal trip, we have taken over 2500 lots of material, suitable for genetic work.

3.4.2 Data

The NCB project has produced 16,062 sequences in total, from 5,108 specimens. These sequence data are being used to resolve taxonomic questions in many groups. We are developing species pages and carrying out conservation assessments on species where the species boundaries have been resolved as part of this project. Over 50 species pages and conservation assessments have already been carried out.

3.4.3 Reporting and Auditing

All reporting and auditing is on schedule. We have maintained regular contact with the Steering Committee and submitted the annual and update reports according to the deadlines.

3.5 Planned activities 2015/16

3.5.1 Field Surveys

The second marine expedition will sample the marine environments of the Dampier Archipelago, planned for May 2015. The same company used for the last marine trip has been engaged and action has been taken on permits and indigenous engagement.

The terrestrial team will be funding a series of smaller expeditions, run by WAM curators, to key locations in the Pilbara that benefit the project. This is to maximise the success of each trip, by taking experienced collectors on specific trips.

3.5.2 Sequencing

We have put workflows into place to produce significant numbers of sequences over the next 12 months. By the next annual report, we will have a total of 28,000 sequences. Depending on the number of sequences per individual tissue sample, this will include approximately 11,000 individual specimens.

3.5.3 Species Assessments

We aim to have 150 species assessed by June 30 2016 (a further 100 in addition to the current 50). These will be assessed against the IUCN Red List Criteria.

3.5.4 Journal Publication

There are a number of taxonomic descriptions, systematics, and phylogeographic datasets that will be appropriate for publication by this deadline. We foresee no difficulty achieving this milestone.

3.5.5 Species Pages

We have given considerable effort to setting up the species pages to seamlessly integrate with the museum CMIS databases. As such, producing future species pages should be relatively easy, and producing a further 100 pages should be achieved within the period.

A public launch of the species pages is planned for approximately Feb/Mar 2016. This gives time to ensure the webpage is fully operational, and to have significant content to launch.

3.5.6 PhD Students

The four students will continue to work on their projects under the supervision of Nerida Wilson and Joel Huey.

3.6 Planned financial mitigation strategies

We have projected the savings we expect to see across the whole project, based on current expenditure, and savings in certain aspects of the project (see table below).

Overall, we expect to save \$992,107 across the project based on current activities, and we have proposed the following changes to take advantage of these savings and value add to the project. In our experience in the first 18 months of this project, the main limiting resource to increasing the outputs of the project was staff time. As such, the proposals below are to add staff with specialised roles, thus adding specified values to the project, accompanied by additional milestones to ensure value to the NCB and to capture reporting.

The budgeted cost of these additional components is given in brackets after each heading below.

	Jan 2014-June 2014			July 2014-June 2015			July 2015-June 2016		July 2016-June 2017		July 2017-June 2018		July 2018 - Dec 2018		TOTAL
Line	Budget	Actual	Difference	Budget	Actual	Difference	Budget	Projected difference	Budget	Projected difference	Budget	Projected difference	Budget	Projected difference	Projected difference end of project
Salary	\$141,143	\$134,903	\$6,240	\$452,985	\$463,902	-\$10,917	\$476,648	\$0	\$502,138	\$0	\$523,443	\$0	\$252,250	\$0	\$0
Fridges	\$22,000	\$19,377	\$2,623	\$22,000	\$24,572	-\$2,572	\$22,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Molecular Costs	\$115,551	\$10,636	\$104,915	\$346,652	\$223,409	\$123,244	\$346,652	\$100,000	\$346,652	\$100,000	\$346,652	\$100,000	\$296,690	\$286,690	\$814,849
Field Work (TZ)	\$0	\$5,328	-\$5,328	\$100,000	\$80,000	\$20,000	\$135,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Field Work (AZ)	\$0	\$0	\$0	\$140,000	\$98,388	\$41,612	\$160,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Computing	\$30,000	\$14,862	\$15,138	\$6,000	\$19,726	-\$13,726	\$6,000	\$0	\$6,000	\$0	\$6,000	\$0	\$6,000	\$0	\$0
Website	\$0	\$0	\$0	\$20,000	\$33,015	-\$13,015	\$20,000	\$0	\$10,000	\$0	\$0	\$0	\$0	\$0	\$0
PhD support	\$0	\$0	\$0	\$70,000	\$12,742	\$57,258	\$70,000	\$20,000	\$70,000	\$40,000	\$70,000	\$60,000	\$0	\$0	\$177,258
Relocations	\$10,000	\$10,095	-\$95	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Conference support	\$2,500	\$0	\$2,500	\$5,000	\$825	\$4,175	\$5,000	\$0	\$5,000	\$0	\$5,000	\$0	\$2,500	\$0	\$0
TOTAL	\$321,194	\$195,199	\$125,995	\$1,162,637	\$956,577	\$206,060	\$1,241,301		\$939,791		\$951,096		\$557,440		\$992,107

3.6.1 Additional components

Extension of Research Scientist contracts for 12 months (\$287,988).

Nerida Wilson and Joel Huey have been contracted until the end of 2018, when the project is intended to cease. However, with the savings to the budget, we have an opportunity to extend their contracts for 12 months. While the current milestones will be achieved in the allotted time, the amount of data being produced by the project will exceed the number of publications that can be produced in the project's current timeframe. As such, an extension to Dr Wilson and Dr Huey's contracts will ensure that more data is analysed and published, maximising the value and outputs of the project.

To ensure value, we would add another 6 publications in the calendar year of 2019.

Addition of Postdoctoral Researcher (3 yr contract, \$359,934) and Next Generation Sequencing Projects (\$75,000)

The project has the opportunity to add a research component that would put the WAM NCB project at the cutting edge of molecular systematics in the scientific community. It has been discussed with the Steering Committee that Next Generation Sequencing (NGS) would be a valuable addition to the project. NGS is a new sequencing technology where a greater proportion of the genome is sequenced (often 100s of thousands of basepairs), for each individual. However, technical restrictions make it hard to carry out on many thousands of specimens, as required by the current NCB project. As such, we are proposing a targeted approach for groups that would benefit from such sequencing depth. With the addition of this extra component, a postdoctoral researcher would be required to carry out the NGS projects, and who can also assist the students who are proposing NGS sequencing. This researcher will have specialised skills in bioinformatics, which will also help researchers Wilson and Huey handle the many thousands of sequences being produced through the current Sanger sequencing.

This component includes employing the researcher for three years, and \$75,000 worth of NGS.

To ensure value, we would add another two publications in the 2018 calendar year. These publications will be in high ranking, international journals, focusing on the data produced by NGS projects.

This position has already been provisionally approved by WAM, and can be advertised immediately, pending Board approval.

Addition of 1.0FTE Technical Officer for 2016-2018 (\$241,552)

The main bottleneck in the molecular workflows is taking tissue samples from the specimens and bringing them into the laboratory. This is because the specimens need to be located from either the WAM wet store or recent field

storage, their registration crosschecked, and then subsampled- this can be as simple as taking a small piece of muscle, or as difficult as dissecting a tiny leg under a microscope. Considering the need to bring hundreds of new samples into the lab every week, the “subsampling” step is a significant impediment to our workflows.

Since considerable savings to the budget were first observed in early 2015, we decided to employ two 0.5FTE technical officers for 5 months (May-September 2015), which was approved by the Steering Committee in January 2015. These staff have been a key part to achieving our sequencing milestones, despite losing a technical officer in the lab for several months. We are proposing to put two 0.5FTE technical officers on for the remainder of the project (2016-2018).

We cannot add extra milestones onto the project with the addition of the 1.0FTE technical officer position. This position will alleviate a major risk to the project's success, and will allow researchers and lab technicians to spend more time on their main project roles.

Broadening of the geographic scope of the project

At present the project is restricted to the “western Pilbara”. However, since the questions being addressed by this project transcend geography and are shaped by taxonomic context, we have been doing a small amount of sequencing of specimens sampled outside the Pilbara. However, these are few and only chosen to address questions that are primarily based in the Pilbara. It would provide us with more opportunities to build the project if we redefined the geographic boundaries of the project to include the whole Pilbara, Barrow Island, Cape Range, for terrestrial components, and to expand the marine boundaries north into the Kimberley and south towards Shark Bay). This expansion would also decrease the risk that we run short of tissues later in the project. Overall, this would allow us to more comprehensively test distributions, and to potentially build datasets around the newer areas explicitly, rather than just including a small number of samples for “context”.

3.6.2 Overall changes to the budget

The newly proposed budget that includes the suggested implementations from 3.6.1 is detailed below.

	Jan 2014- June 2014	July 2014- June 2015	July 2015- June 2016	July 2016- June 2017	July 2017- June 2018	July 2018 - June 2019	July 2019 - Dec 2019	Total
Salary	\$141,143	\$452,985	\$576,896	\$702,634	\$723,939	\$496,492	\$143,994	\$3,238,082
Fridges	\$22,000	\$22,000	\$22,000	\$0	\$0	\$0	\$0	\$66,000
Molecular Costs	\$10,636	\$223,409	\$284,152	\$284,152	\$246,652	\$10,000	\$0	\$1,059,002
Field Work (TZ)	\$0	\$85,000	\$50,000	\$50,000	\$0	\$0	\$0	\$185,000
Field Work (AZ)	\$0	\$100,000	\$100,000	\$100,000	\$0	\$0	\$0	\$300,000
Computing	\$15,000	\$20,000	\$15,000	\$15,000	\$15,000	\$15,000	\$7,875	\$102,875
Website	\$0	\$20,000	\$20,000	\$10,000	\$0	\$0	\$0	\$50,000
PhD support	\$0	\$15,000	\$50,000	\$30,000	\$10,000	\$0	\$0	\$105,000
Relocations	\$10,000	\$0	\$0	\$0	\$0	\$0	\$0	\$10,000
Conference support	\$2,500	\$5,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$57,500
Total	\$201,279	\$943,394	\$1,128,048	\$1,201,786	\$1,005,591	\$531,492	\$161,869	\$5,173,458

Changes included in the budget lines above

- Salary – added new staff to salary line, including an extra 12 months at the end for the Research Scientists.
- Adjusted Molecular Cost line to account for expected savings, plus adding \$75,000 of NGS sequencing to July 2015-June 2016 and July 2016-June 2017.
- TZ Field Work – split \$100,000 across the next 2 years, and removed the remaining \$50,000 for use elsewhere.
- AZ Field Work – Re-costed the two planned expeditions and rolled the remaining \$100,000 into a third expedition in July 2016-June 2017.
- Computing – Increased the amount to be in line with costs incurred this financial year.
- PhD – with the requirement that students bring their own stipend, and their sequencing costs being supported by the main molecular line, this line is dramatically over budgeted. We have re-costed this line to match expected rollout. The remaining money has been moved to other lines.
- Conference support – This amount has been boosted, and money has been added to the final year.

3.6.3 Assurances of a balanced budget

These additional staffing changes have the potential to exceed the budget, if some of our projected savings do not eventuate. To ensure a balanced budget at

the end of the project, we will only offer the positions for 12 month periods, with potential extension if funds allow and savings continue as predicted. We will assess budget expenditure 6 monthly (these reports, steering committee meetings, NCB Board meetings), and demonstrate that we are on target. If we are not on target, and are looking at budget deficit, we will either not extend the postdoc or technical officer. The final 12 month extension to researchers Wilson and Huey will only proceed if those funds are available at the end of 2018.

We feel that this constant monitoring and ability to change the length of contracts will ensure we do not exceed the budget.

4.0 Conclusion

A total of \$956,577 of Net Conservation Benefits (NCB) funds was expended against the NCB budget in 2013/14. All milestones have been met, and the project team is on track to achieve the next round of milestones.

With these considerable savings to the project, relative to the initial budget, the project team have proposed a series of value adding components.