

Institution: University of Chester		
Unit of Assessment: UoA5 Biological Sciences		
Title of case study: Conservation research driving policy making and conservation action		
Period when the underpinning research was undertaken: 2014 – 2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Anna Muir	Dr. Senior Lecturer	2015 (ongoing)
Christina Stanley	Dr. Senior Lecturer	2015 (ongoing)
Simon Oliver	Senior Lecturer	2014 (ongoing)
Achaz von Hardenberg	Senior Lecturer	2015 (ongoing)
Andrew Lawrence	Associate Dean	2012 (ongoing)
Period when the claimed impact occurred: 2014 – 2020		
Is this case study continued from a case study submitted in 2014? N		

1. Summary of the impact (indicative maximum 100 words)

Research undertaken at the University of Chester (UoC) has directly impacted conservation strategies and policy-making at local, national and international levels. Our research has informed the evaluation of the conservation status of various wildlife species: i.e. the inclusion of Alpine ibex (*Capra ibex*) in the new 'Green Status of Species' framework of the International Union for the Conservation of Nature (IUCN) and the "Favourable Conservation Status" document for the conservation of natterjack toads (*Epidalea calamita*) in the UK. Research outputs produced at UoC, have also been used as evidence in support of national and international legislation: i.e. the maintenance of the fishing ban for sea cucumbers along the Egyptian coast of the Red Sea; the enforcement of international trade restrictions for thresher sharks (*Alopiidae*) under CITES Appendix II and amendments to the UK Agriculture Act 2020 to allow semi feral ponies to be used in Public Payment for Public Goods schemes. Finally, our research has contributed to the improvement of local habitat management plans, benefitting the long-term conservation of natterjack toads in the Gronant Dunes and Talacre Warren SSSI, Wales and thresher sharks in the Philippines.

2. Underpinning research (indicative maximum 500 words)

At the beginning of the last REF period in 2014-15, the Department of Biological Sciences at UoC, started a considerable investment in the recruitment of new research active academic staff members with the vision to develop and expand its research and teaching activities in the field of conservation biology. This follows the explicit research strategy of the Department to contribute to the Sustainable Development Goals of the United Nations by producing impactful scientific evidence informing conservation action and policy making both at the national as well as at the international level. While the Conservation Biology Research Group at UoC is relatively young, the deliberate strategy by the department to support and incorporate the previously started long-term research projects lead by the newly recruited staff paid off and allowed, in a short time, the production of novel impactful research outputs.

The research group lead by Anna Muir (AM) has recently published some unexpected results on the conservation genetics of the natterjack toad, a rare Priority Species under the UK Post-2010 Biodiversity Framework. Their study [R1] showed that translocated Natterjack populations suffer strong inbreeding but are maintaining low but stable populations sizes, nevertheless. This is against expectations but suggests that populations may start to decline in the future. The study highlights the importance of long-term genetic monitoring of reintroduced populations and has implications for their management. The research recommends the implementation of genetic rescue (i.e. the supplementation of populations with further individuals to increase the genetic pool) in these populations to reduce inbreeding and thus guard against a future population declines.

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Research on semi-feral ponies conducted by Christina Stanley (CS), started before she joined UoC in 2015, culminated with a collaborative perspectives paper in 2019 on the role semi-feral ponies play in the conservation management of natural grasslands [R2]. This research is based on both evidence in the literature, including work by CS on Carneddau ponies in Wales, and novel analyses of genetic data. It strongly suggests that the specific physiological and behavioural adaptations of native ponies to a feral life, which are shaped by natural selection rather than by artificial selection, make them particularly suited to conservation grazing programmes as a more viable alternative to cattle with whom they share a largely overlapping dietary niche. This would support the preservation of equine genetic lineages currently at risk of extinction by increasing their value as a public good, alongside their recognised cultural heritage value.

The ongoing long term research program on the conservation of Alpine ibex started by Achaz von Hardenberg (AvH) while working for the Gran Paradiso National Park (GPNP) in Italy and for which he continued to take a leading role after joining UoC in 2015 (and currently jointly supported financially with a Sustainable Futures PhD grant by the UoC and GPNP), recently culminated in a thorough and timely assessment of the global distribution and conservation status of this species [R3]. While Alpine ibex is currently considered Least Concern under the IUCN Red list of species, it was on the brink of extinction in the 19th Century, with less than 100 individuals known in the area. Thanks to sustained reintroduction efforts in the second half of last century, the Alpine ibex is once again distributed across its whole original range on the Alpine Arch (ranging from France in the Western Alps to Slovenia in the Eastern Alps), with an estimated global population of 51,157-62,710 individuals [R3].

Simon Oliver (SO) has led studies on the behavioural ecology and conservation of rare and endangered (IUCN Red List) pelagic thresher sharks in the Philippines as part of a long-term research programme that he began prior to joining UoC in 2014. Pelagic thresher sharks are an important tourism attraction for SCUBA divers that visit Cebu Province, and contribute significantly to the local economy on Malapascua Island. A recent investigation undertaken by SO on the fine scale movements of pelagic thresher sharks shows how the sharks leave a shallow coastal seamount in the Central Visayan Sea where they are protected to cross trans-jurisdictional borders in the Philippines. These movements make pelagic thresher sharks vulnerable to fisheries on a daily basis [R4].

Since 2002, a long-term research project led by Andrew Lawrence (AL), in collaboration with partners in Egypt on the sustainable exploitation of sea cucumbers in the Red Sea has highlighted that the future value of sea cucumbers as a source of bioactive substances of potential medical use might be higher than the immediate use value provided by fisheries, supporting the urgent need for continued protection of the remaining, but already over-exploited stocks. These earlier studies have led to a molecular re-examination of the species occurring in the Egyptian Red Sea, which may be linked to the production of these bioactive substances [R5]. The original work developed a number of bioassays which found strong activity against *Candida*, leishmania parasites and two cancer cell lines from certain sea cucumber species in specific parts of their range. While this research began while AL was employed at a different institution, the collaboration continued after he joined UoC in 2012 as demonstrated by follow up studies in which the bioactive substances were purified and finally identified as saponins [R6].

3. References to the research (indicative maximum of six references)

[R1] Phillips, S., Geary, M., Allmark, M., Bennett, S., Norman, K., Ball, R. J., Peters, C. & Muir, A. P. (2020). The importance of long-term genetic monitoring of reintroduced populations: inbreeding in the natterjack toad (*Epidalea calamita*). *Herpetological Journal*, 30(3). <https://doi.org/10.33256/hj30.R159167>

[R2] Fraser, M. D., Stanley, C. R., & Hegarty, M. J. (2019). Recognising the potential role of native ponies in conservation management. *Biological Conservation*, 235, 112-118. doi.org/10.1016/j.biocon.2019.04.014

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[R3] Brambilla, A., von Hardenberg, A., Nelli, L., & Bassano, B. (2020). Distribution, status, and recent population dynamics of Alpine ibex *Capra ibex* in Europe. *Mammal Review* doi.org/10.1111/mam.12194

[R4] Oliver, S. P., Grothues, T. M., Williams, A. L., Cerna, V., Silvosa, M., Cases, G., Reed M. & Christopher, S. (2019). Risk and resilience: High stakes for sharks making transjurisdictional movements to use a conservation area. *Biological Conservation*, 230, 58-66. doi.org/10.1016/j.biocon.2018.11.013

[R5] Ahmed, M.I., Maher A.A. & Lawrence A.J. (2016) Identification of the Holothurian species of the Red Sea and Gulf of Aqaba using DNA barcoding technique. *Egypt. J. Aquat. Biol. & Fish.* 4:1-7.

[R6] Khattab, R. A., Elbandy, M., Lawrence, A.J., Paget, T., Rae-Rho, J., Binnaser, Y. S., & Ali, I. (2018). Extraction, identification and biological activities of saponins in sea cucumber *Pearsonothuria graeffei*. *Combinatorial chemistry & high throughput screening*, 21(3), 222-231.

4. Details of the impact (indicative maximum 750 words)

Conservation biology is a relatively new discipline with a strong applied focus. Ultimately, to have a measurable impact, it is crucial that the scientific evidence gained by conservation biologists goes beyond the remits of academic discourse to reach decision makers shaping policies affecting the conservation of biodiversity. The Conservation Biology Research Group in the Department of Biological Sciences at UoC has systematically worked towards the goal of having a positive impact on the conservation of wildlife and the sustainable use of natural resources by making sure their research informs new policies and conservation strategies. This has been facilitated by the strategy of the group to promote and strengthen existing and new collaborations and partnerships with the organisations and people at the frontline of applied conservation, i.e. governmental agencies and international organisations such the International Union for the conservation of Nature (IUCN) and the Egyptian Environmental Affairs Agency, protected areas such as the Gronant Dunes and Talacre Warren SSSI in the UK and the Gran Paradiso National Park in Italy and conservation NGOs such as Save Philippine Seas, the Amphibian and Reptile Conservation Trust and the Dartmoor Hill Pony Association. This coordinated effort resulted in strong and lasting impacts on policies, official assessments of the conservation status of species and targeted conservation actions. on a large range of species and geographical scales.

National and international impacts on policy

Major impacts on conservation policies directly stemmed from the research work by CS on the use of semi-feral ponies for conservation grazing schemes in the UK, by SO on pelagic thresher sharks in the Philippines and by AL on sea cucumbers in Egypt. The work by CS was instrumental to support arguments brought forward by the Dartmoor Hill Pony Association [S1] in a petition to the House of Commons Agriculture Bill Committee 2020 in November 2019, to ensure that semi-feral native ponies, which do not fall under any recognised breed society, would not be excluded from future conservation grazing programmes in the proposed system for Public Payment for Public Goods schemes. As a result of the petition [S2], which specifically cites the work co-authored by CS [R2], the wording of the Agriculture Bill 2019-21 (Published on the 16th January 2020) was changed removing the word “breed” when referring to equids used in conservation grazing. The bill finally got Royal Assent on the 11th November 2020, becoming the Agriculture Act 2020 [S3]. This seemingly minor change, has important consequences for the future preservation of rare and endangered genetic lineages of semi feral ponies such as the Dartmoor Hill Ponies in England and the Carneddau Mountain Ponies in Wales. Including semi-feral ponies in conservation grazing payment schemes, provides economic incentives for the maintenance of their populations as well as for the creation of satellite populations in other areas in which conservation grazing schemes are active, as a viable alternative to the use of cattle or domestic breeds of ponies. Satellite feral pony populations could serve as ‘insurance policy’ in the case of catastrophic events in the founder populations [R2]. On an international level, the body of knowledge produced by SO’s broad research on thresher sharks [see references in R4] was fundamental to shaping the arguments that were presented at the 17th meeting of the Conference of the Parties to CITES (CoP17) which was held in Johannesburg, South Africa in 2016. Data

generated from fieldwork by SO provided essential empirical evidence to support assertions that international trade in thresher sharks should be regulated. The CITES delegates were convinced, and international trade in thresher sharks is now CITES regulated under Appendix II [S4]. Finally, the work by AL on the sustainable use of sea cucumbers in the Egyptian Red Sea was crucial to securing a complete ban on the fishery of sea cucumbers and in maintaining this ban to the present day [S5]. The original projects involved research to develop community-based mariculture systems for sea cucumber to offset fishing and research into possible bioactivities in certain key species. The results from the survey work and failure of work to develop a mariculture system, led to the original bans on the fishery in 2003 and 2008. It also resulted in the training of Egyptian Environmental Affairs Agency (EEAA) Rangers in the survey monitoring techniques, which continue annually and have failed to show any recovery in commercial stocks to the present time. However, the bioactivity work and the recent work published in 2018, isolating and identifying the bioactive compounds of potential medical use [R6], further strengthened the evidence for the potential future value of sea cucumbers and their continued need for protection. This, together with the survey reports from by the previously trained EEAA Rangers, has been instrumental in the decision by the authorities to maintain the fishing ban to the present day [S5].

Impacts on the assessments of the conservation status of species

The evaluation of the conservation status of species, is a crucially important tool used by decision makers in the assessment of conservation priorities and drafting of new policies. The Conservation Biology Research Group at UoC contributes to this important exercise both at the national as well as on the international level. On an international level, the research presented in the recent paper co-authored by AvH on the distribution and conservation status of Alpine ibex [R3], made it possible for Alpine ibex to be one of the very first species to be assessed and to be included in the new “Green Status of Species” list of the International Union for the Conservation of Nature (IUCN) [S6]. The “Green Status of Species” list was developed by IUCN as a complement to the widely known “Red list of Threatened Species” to objectively assess the recovery of species and thus the impact of conservation actions. The final aim of this new tool, which has now been tested, validated and approved by IUCN, is to significantly impact decision-making and policy enhancement by providing an optimistic vision for the conservation of species. The Green Status assessment itself was written by AvH together with an international team of other Alpine ibex specialists [S7]. Due to its example as best practice in applying the Green Status of Species criteria and providing thorough documentation, it was chosen by the coordinator of the IUCN Species Conservation Success Task Force as a model assessment to guide the formatting of assessments for online display [S7]. On a national level, the research conducted by AM and her collaborators on the conservation genetics of natterjack toads has been confirmed for inclusion in the UK-wide “Favourable Conservation Status” document for natterjack toads compiled by the Amphibian and Reptile Conservation Trust together with Natural England and Natural Resources Wales [S8]. It informed the “Favourable Conservation Status” document that conservation actions are required to support translocated populations, potentially via translocation of further individuals to augment genetic variation, and highlights the importance of ongoing genetic monitoring. This has promoted management actions that aim to increase the number of breeding females to 25,000 individuals by 2030, including at sites of previous local extinctions.

Impacts on conservation actions

Besides impacting policies and the assessment of the conservation status of species, our research in conservation biology has had also direct impacts on conservation actions with immediate beneficial effects on the targeted species and environments. The research by AM has strongly informed directions for management of the Gronant Dunes and Talacre Warren SSSI, which hosts the only population of natterjack toads in Wales [S9]. The creation of new ponds for the natterjack toad population at this site have been agreed. The impact of this is that the carrying capacity of sites is increased to reduce inbreeding risk and increase population sizes in order to reach the Favourable Conservation Status targets. The research has also informed a recent successful funding bid (£7000) to the Welsh Government Sustainable Management Scheme for the creation of a new lined pond to secure reproduction sites in time of drought. The work for this funding was started in the winter of 2020. Finally, AM's research findings have influenced the annual training programme for surveyors and volunteers (around 20 individuals per year) such that the monitoring

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effort is increased in order to detect population declines as a result of low genetic diversity and they are summarised in the 2020 Annual Talacre Natterjack Toad report produced by Eni UK Ltd (custodian and manager of the SSSI) and shared with Natural Resources Wales & the Amphibian and Reptile Conservation Trust [S9]. On the international level, besides AL contribution to securing a fishing ban for sea cucumbers in Egypt, further project work was undertaken to develop a mariculture system for sea cucumber with funding from the Egyptian Science & Technology Development Fund (2016) and for which AL was part of the research team. This project established the first marine commercial invertebrate hatchery in Egypt which will help in the maximisation of invertebrate production to help in Egypt's Strategic Agriculture Plan for 2030. It trained at least 100 stakeholders in aquaculture techniques and established the first Egyptian gene bank for preservation of genetic diversity of commercial and non-commercial invertebrates in Egypt [S10].

5. Sources to corroborate the impact (indicative maximum of 10 references)

[S1] Written submission by the Dartmoor Hill Pony Association to the House of Commons Agriculture Bill Committee 2020 regarding Public Payment for Public Goods, Semi-wild Dartmoor Hill Pony herds.

[S2] Statement letter by the Dartmoor Hill Pony Association.

[S3] <https://commonslibrary.parliament.uk/research-briefings/cbp-8702/>

[S4] Statement letter by CoP17 attendee.

[S5] Statement letter by the Red Sea protectorate Manager, Egyptian Environmental Affairs Agency.

[S6] Statement letter by the coordinator of the IUCN Species Conservation Success Task Force

[S8] Statement letter by the trustee of Amphibian and Reptile Conservation Trust (ARC)

[S9] Statement letter by ENI UK Ltd, owner and manager of the Talacre and Gronant Dunes SSSI.

[S10] Project Achievements Report for the Egyptian Science & Technology Development Fund