Institution: University of Salford

Unit of Assessment: A5 Biological Sciences

Title of case study: Molecular Ecology and Conservation

1. Summary of the impact

Since 2008, the School of Environment & Life Sciences at the University of Salford has expanded its research in the field of population and conservation genetics, focusing on the application of molecular genetics and evolutionary theory on supporting the management of exploited living resources and conservation of endangered species and ecosystems. *Molecular Ecology and Conservation* demonstrates the following impact:

- Improving mechanisms for seafood authenticity and traceability, the identification of stocks and providing advice on their management;
- Supporting the conservation of endangered boreal species and endangered amphibians:

Increasing consumer awareness of the environmental implications of food choices, improving consumer confidence and food management policy, supporting environmental management and biodiversity, and guiding international conservation policy and management processes.

2. Underpinning research

The key researchers and positions they held at the institution at the time of the research are as follows: Professor Stefano Mariani (from 2011), Dr Robert Jehle (from 2008), School of Environment & Life Sciences.

Context: Mariani's research on seafood genetic identification demonstrated, for the first time, the mislabelling of many traditional mainstays of UK and North-European seafood commodities, with mislabelled species being sold to consumers. Mariani also focuses on evolutionary, ecological and demographic processes in endangered mammals. Jehle's research in population genetics and behavioural ecology has contributed to the conservation of amphibians through the documentation of spatial and temporal population processes. Generating public interest in stock and species management, and influencing international conservation policy, the impact of this case study is underpinned by the following research:

- **2007-onwards:** The study of patterns of spatial population structure in marine fish is crucial for identification of stock boundaries that form the basis for the units of assessments and management advice for Europe's major fisheries. As Chair of the Stock Identification Methods Working Group (SIMWG), Mariani provides annual expert feedback to the Science (SCICOM) and Advisory (ACOM) committees of the International Council for the Exploration of the Sea (ICES).
- **2013:** Stock Identification Methods provides a comprehensive review of approaches for studying the population structure of fishery resources, representing the perspectives of international experts on each method, assembled through a working group of the ICES, presenting interdisciplinary analyses about stock structure. Mariani et al offer a unified framework for understanding stock structure by promoting an understanding of the relative merits of each approach. **[1]**
- **2012:** Seafood mislabelling: The global fishing industry, influenced by consumer demand, determines the variety of fish available for consumption. Seafood mislabelling threatens consumer power to influence patterns of fisheries exploitation through informed choice. Mariani et al demonstrate an urgent need to go beyond the mere documentation of the phenomenon and learn more about the origins of this problem and the nature of factors influencing its occurrence, to develop solutions. **[2]**
- **2012:** Irish fish, Irish people: roles and responsibilities for an emptying ocean: Mariani et al investigate the roles and influences of various actors within the Irish seafood industry to understand its working dynamics, identifying improvements towards sustainability. Potential for influence on consumer choice, stocking and sourcing decisions, business management and fisheries policy was found within all levels of the seafood industry. The research concluded that responsible policy decisions and effective enforcement are necessary to improve the sustainability of the industry. **[3]**
- **2012-onwards:** The EU-funded project; LABELFISH: Interreg IVC: The Atlantic Network on Genetic Control of Fish and Seafood Labelling and Traceability, demonstrates the

commitment of international stakeholders to standardise genetic methods for the identification of commercial fish. Mariani has established a network of entities with an interest in developing a common strategy for the use of standardised, innovative analytical techniques to control genetic traceability and labelling of seafood products. **[9,10]**

- **2012-onwards:** Mariani's contribution in the field of empirical population genetics includes investigation of the evolutionary, ecological and demographic processes in endangered mammals, focusing on the American reindeer (caribou), supported by the Canadian Natural Sciences & Engineering Research Council (NSERC) and private companies involved in resource exploration, including Petroleum Technology Alliance Canada and Weyerhaeuser Timberland. **[4,5,11]**
- **2010:** Estimating the propagule size of a cryptogenic crested newt population: Amphibians are the most vulnerable class of vertebrates. Jehle's research has contributed to the conservation of all three extant orders of amphibians in both tropical and temperate ecosystems. Jehle et al describe the occurrence of cryptogenic crested newts *Triturus cristatus* c. 25km from their main range in an area where an introduction took place half a century ago, finding that the local *T. cristatus* occurrence is of natural origin. The result has major implications for our understanding of the species' habitat requirements. **[6]**
- **2011:** The Crested Newt: A Dwindling Pond Dweller: For a small, inconspicuous, largely nocturnal animal, the crested newt attracts considerable attention and awarded a high level of protection. Governments are required to establish nature reserves for them and to monitor their status, with significant penalties for destroying habitats. Jehle et al draw together research on the six species of crested newt across their range, examining their taxonomy, biology, ecology and behaviour, with special relevance to the great crested newt in the UK, with a focus on conservation and management. **[7]**

3. References to the research

Key outputs: Mariani

1. Cadrin S.X., Kerr L. & Mariani S. (2013): "*Stock Identification Methods: Applications in Fishery Science*". Elsevier/Academic Press, San Diego.
2. Miller D.M., Jessel A. & Mariani S. (2012): "Seafood mislabelling: comparisons of two western European case studies assist in defining influencing factors, mechanisms and motives". *Fish and Fisheries*, 13: 345–358. DOI
3. Miller, D D & Mariani, (S 2012): 'Irish fish, Irish people: roles and responsibilities for an emptying ocean', *Environment, Development & Sustainability*. DOI
4. Weckworth, B & Musiani, M & Cesare, N D & McDevitt, A & Hebblewhite, M & Mariani, S (2013), 'Preferred habitat and effective population size drive the landscape genetics of an endangered species', *Proceedings of the Royal Society of London - B*. DOI **(REF 2)**
5. Weckworth BV, Musiani M, McDevitt AD, Hebblewhite M and Mariani S. (2012). Reconstruction of caribou evolutionary history in western North America and its implications for conservation. *Molecular Ecology*, 21: 3610-3624. DOI

Key outputs: Jehle

6. Arntzen, J & Burke, T & Jehle, R 2010, 'Estimating the propagule size of a cryptogenic crested newt population', *Animal Conservation*, 13 (suppl 1), p.74-81. DOI **(REF 2)**
7. Jehle R, Thiesmeier B, Foster J (2011): *"The Crested Newt: A Dwindling Pond Dweller*". Laurenti, Germany, pp. 152. ISBN 978-3-933066-44-2. ISBN 9783933066442
8. Calboli FCF, Fisher MC, Garner TWJ, Jehle R (2011): "The need for jumpstarting amphibian genome projects". *Trends in Ecology & Evolution*, 26: 378-379. DOI

Key grants: Mariani

9. **2012:** Atlantic network on genetic control of fish and seafood labelling and traceability (LABELFISH), Defra, £38,514.00, Principal Investigator: S Mariani (100%).
10. **2012:** Atlantic network on genetic control of fish and seafood labelling and traceability (LABELFISH), Interreg IVC, £157,973.00, Principal Investigator: S Mariani (100%).
11. **2011:** Developing multivariate approaches to analyse ecological and genetic variation, University of Calgary, £12,700.00. Principal Investigator: S Mariani (100%).

Key grants: Jehle

12. **2011:** Nativeness of Great Crested Newt in Highland Scotland, Scottish Natural Heritage, £6,000.00. Principal Investigator: R Jehle (100%).
13. **2013:** Great Crested Newts and their use of the Farmed Landscape in England, Natural England, £36,000.00. Principal Investigator: R Jehle (100%).
14. **2013:** DNA fingerprinting of great crested newts from Derbyshire, £24,200.00, A One + Area 7. Principal Investigator: R Jehle (100%).

4. Details of the impact

The following are examples of impact derived from research in *Molecular Ecology and Conservation at the University of Salford:*

- **Continuing:** The Stock Identification Methods Working Group influences the EU Common Fisheries Policy, focusing on minimising mismatches between true biological stocks and traditionally perceived management areas and the formulation of improved approaches to defining stock units and the promotion of evidence-based management approaches. As a result of research by Mariani et al, management advice was devised for several species, including Atlantic herring, plaice, black scabbardfish, and oceanic redfish.
- **2012:** Irish fish, Irish people: roles and responsibilities for an emptying ocean**:** Responsible policy decisions and effective enforcement are necessary to improve the sustainability of the Irish fishing industry. A major socio-political impact of the detection of species substitution in the seafood market resulted in the establishment by the Irish government of a "*Food Fraud Task Force*" in 2012, to oversee trade operations in the food sector. The aim of the task force is to act as a communications, co-ordination and networking group, where intelligence and research can be further developed and shared.
- **2012-onwards:** LABELFISH is a network of laboratories and national bodies developing a common strategy and harmonised techniques to control the genetic traceability and labeling of seafood products sold on the Atlantic and a Europe-wide standardised approach to identifying and authenticating the major fish products traded in the EU. The UK government, through DEFRA, is co-funding this project and working with Mariani to ensure that the deliverables have maximum benefit to all stakeholders, including consumers, retailers, food processors and fishermen. **[a]**
- A key element of deriving impact from research into fish mislabelling is public engagement. Mariani's seafood mislabelling studies have been covered by *The Guardian*, prompting 129 comments and debate among the public, *The Independent*, *The Telegraph* and *El Pais*. The BBC series *Fake Britain*, *Newsround* and the Channel 4 documentaries *Dispatches* and *Food Unwrapped* commissioned Mariani to provide advice on matters of genetic identification, seafood traceability and fisheries sustainability. Public engagement has raised awareness about the environmental implications of seafood substitution. Mariani has also successfully engaged food processing organisations and fishing lobby groups including SEAFISH whose purpose is to secure a sustainable and profitable future for the UK seafood industry, which has promoted Mariani's research.
- **2012-2013:** Contribution to the Manchester Science Festival raised awareness about the diversity of fish species and their sustainability as food sources. A blind taste test of people attending a Manchester Science Festival event at the University of Salford found that only 15% could identify cod served up from a fish and chip van.
- **2013:** The Pelagic Freezer-Trawler Association (PFA) has commissioned Mariani to genetically screen fishery samples of horse mackerel (*Trachurus trachurus*) and provide an independent assessment on their degree of similarity. PFA represents the interests of 9 European pelagic freezer-trawler companies. The association has members in the UK, Ireland, France, Germany, Lithuania and the Netherlands, operating freezer-trawlers that process pelagic fish for human consumption. **[b]**
- **2011-onwards:** Research undertaken by Mariani in landscape genetics and phylogeography of mountain caribou led to the re-definition of conservation units by the Committee on the Status of Endangered Wildlife in Canada, influencing exploitation of natural resources (oil, gas, timber) in Alberta and British Columbia and leading to further

funded research in collaboration with the University of Calgary. **[c]**

- Jehle is the co-author of the IUCN Red List of Threatened Species™ assessment of 8 amphibian species of major conservation importance (*Lissotriton boscai, L. helveticus, L. vulgaris, Triturus carnifex, T. dobrogicus, T. marmoratus, T. pygmaeus, T. cristatus*). The IUCN Red List is committed to providing objective, scientific information on globally threatened biodiversity, providing the foundation for informed decisions about conservation from local to global levels. The List provides taxonomic, conservation status and distribution information on plants and animals that have been globally evaluated using the IUCN Red List Categories and Criteria, designed to determine the relative risk of extinction (i.e. those listed as Critically Endangered, Endangered and Vulnerable). **[d]**
- **2013:** Nativeness of great crested newts in the Scottish Highlands: Jehle's advice has supported the conservation management of UK amphibians, in particular the crested newt. The crested newt has declined in Europe, is very rare in Scotland and the rarest of three newt species native to Britain. Those which live in the Scottish Highlands, are separated by more than 80 km of unfavourable habitat from the main habitat in Central Scotland, so most assumed that they were introduced into the Highlands. Scottish Natural Heritage (SNH) commissioned Jehle to use DNA fingerprinting to discover if great crested newts are native to the Scottish Highlands. Jehle et al compared the DNA of eight populations from the Highlands with two reference populations from the northern limits of their more continuous distribution in Central Scotland and showed that great crested newts are almost certainly native to the region and Highland newts are genetically distinct from those in central Scotland. SNH intends to devise new strategies, the creation of new ponds and the regulation of translocation schemes. David O'Brien of SNH said: "*A number of us suspected the great crested newts were native to the Highlands, and we're thrilled to find that this hunch was right. It's important to know the newts' origins, as they're rare and protected nationally and internationally. This research gives even more reason to conserve the small, unique populations of great crested newts in the Highlands.*" **[12,e]**
- **2011, 2013-onwards:** Jehle et al were commissioned by Natural England in 2013 to Great Crested Newts and their use of the Farmed Landscape in England. **[13]**
- **2013:** Jehle was commissioned by a A One + Area 7 to investigate the genetic impacts of a large-scale newt translocation due to construction work along the A6 in Derbyshire contracted by the Highways Agency. Jehle demonstrated that translocated populations are genetically healthy but have survived in isolation, initiating the implementation of measures towards improving habitat modifications to increase connectivity. **[14]**
- Jehle's involvement in the Council of the Tropical Biology Association influences the remits and targets of this prestigious organisation, which is the primary NGO for conservation capacity building in Africa. The University of Salford is one of the few UK members (alongside Cambridge, St Andrews, Edinburgh, Liverpool, Leeds, Aberdeen, Nottingham, Belfast Universities). **[f]**

5. Sources to corroborate the impact

a) Letter of Support for LABELFISH from Defra
b) Pelagic RAC, 2012. Minutes of the PRAC Working Group, Amsterdam, July 2012. Available at: http://www.pelagic-rac.org/media/pdf/Minutes%20WG%20II%20meeting%2011%20July%202012.pdf
c) COSEWIC, 2011. Designatable Units for Caribou (*Rangifer tarandus*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 88 pp. Available at: http://www.cosewic.gc.ca/eng/sct12/COSEWIC_Caribou_DU_Report_23Dec2011.pdf
d) IUCN Red List http://www.iucnredlist.org/search
e) Nativeness of great crested newts (Triturus cristatus) in the Scottish Highlands, Scottish Natural Heritage, 2013 http://www.snh.org.uk/pdfs/publications/commissioned_reports/570.pdf
f) Council of the Tropical Biology Association http://www.tropical-biology.org/network/tba_members.htm