Institution: Imperial College London

Unit of Assessment: 5 Biological Sciences

Title of case study: 10 - Development and implementation of the IUCN - World Conservation Union's Red List and its application by governments and conservation organisations worldwide

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

Research staff in the Centre for Population Biology (CPB) at Imperial developed a range of species conservation assessment tools and methodologies based on population modelling carried out by CPB research staff. The introduction in 1994 of a scientifically rigorous approach to determine risks of extinction that is applicable to all species, based on underlying research at Imperial and described in paper [6], has led to a rigorous and robust approach that is used by governments, conservation organisations and researchers worldwide. In particular, these tools have been applied in the **IUCN Red List of Threatened Species**™ and have made a fundamental contribution to this conservation measure. This Red List is widely recognized as the most comprehensive, objective global approach for evaluating the conservation status of plant and animal species. It plays a prominent role in guiding conservation activities of governments, NGOs and scientific institutions and has led to the formation of the **Red List Index**. Results from the Red List Index have led to worldwide bodies rethinking conservation targets and indicators and strongly influenced the Convention on Biological Diversity's 2020 Aichi targets.

2. Underpinning research (indicative maximum 500 words)

Researchers at the Centre for Population Biology (CPB) at Imperial College London carried out ground-breaking research into the relationships between extinction risk, range size and population dynamics [1, 2]. The Imperial research showed that it was possible to predict extinction risk based upon range size, changes in abundance and biological characteristics such as fecundity and meta-population structure. Based upon this scientific foundation, G. Mace and R. Lande proposed new criteria for assessing the extinction risk of all species based on a simple population model, which were then developed into a new IUCN Red Listing process which was launched in 1994. Red lists categorise species into threatened categories (Critically endangered, Endangered, Vulnerable) and other categories (Near Threatened, Least Concern, Data Deficient, Extinct in the Wild and Extinct) based on threshold values for key biological characteristics, including the rate of population decline, population fragmentation and range size. These categories and their criteria are simple and generalisable enough to be used on any species, from fungi to elephants, but are based on strong principles of population ecology to which researchers at the Imperial College CPB had significant inputs [1, 2]. IUCN formed a working group to develop, test and review these categories and criteria, which was chaired by Georgina Mace, and ran from 1992 to 1998. The group included Kevin Gaston and E.J. Milner-Gulland. Gaston was a Royal Society URF at Imperial College from 1994-1995. E.J. Milner-Gulland was chosen to sit on the working group based on her research expertise, developed at Imperial from 1998-1991.

In 2003-2006, researchers at Imperial College explored the application of the red listing process at regional and national levels, using Central Asia as a case study [3]. This research formed the basis for a better understanding of the role red listing might play in national conservation policy, and found that there should be a more nuanced use of the categories and criteria because national borders are not necessarily biologically meaningful (e.g. a country may contain very few individuals of a globally common species). In 2006-2012, Georgina Mace was involved in a number of high profile research projects using the red lists to assess the status of the world's biodiversity, which informed global conservation policy [4, 5]. The full scientific background of the IUCN Red List criteria exists in informal publications, but the science was summarised and developed in [6]. This paper is the top-cited paper in the journal *Conservation Biology* since 2008 (out of 840 papers published at 12/3/2012).

The key researchers carrying out research underpinning the development of the red listing process

during the assessment period were:

- John Lawton, Professor, Director of CPB until 1999, at Imperial 01/04/89-30/09/07
- Tim Blackburn, Research Associate, at Imperial 01/05/91-30/09/00
- Georgina Mace, Chair in Conservation Science and Director of CPB, at Imperial 01/11/06-31/07/12
- E.J. Milner-Gulland, Professor of Conservation Science, at Imperial 01/10/88-30/09/91 and 01/01/99 – present

3. References to the research (* References that best indicate quality of underpinning research)

[1] * Lawton, J. H., "*Range, population abundance and conservation*", Trends in Ecology & Evolution, Vol 8, Issue 11, 409-413 (1993). DOI, **343 citations (on 15/4/13)**

[2] Gaston, K. J. and T. M. Blackburn, "*Conservation Implications of Georaphic Range Size—Body Size Relationships*", Conservation Biology, 10(2), 638-646 (1996). DOI, **79 citations (on 15/4/13)**

[3] Collen, B., Bykova, E., Ling, S., Milner-Gulland, E.J., Purvis, A., "*Extinction risk: a comparative analysis of Central Asian vertebrates*", Biodiversity and Conservation, 15, 1859-1871 (2006). DOI, **9 citations (on 15/4/13)**

[4] * M. Hoffmann,...,G.M. Mace, et al (2010) "*The Impact of Conservation on the Status of the World's Vertebrates*", Science, 330 (6010), 1503-1509 (2010). DOI, **108 citations (on 15/4/13)**

[5] Baillie J.E.M, Collen, B., Amin, R., Akçakaya, H.R., Butchart, S.H.M., Brummitt, N., Meagher, T.R., Ram, M., Hilton-Taylor, C. and Mace, G.M., "*Toward monitoring global biodiversity*", Conservation Letters, 1(1): 18–26 (2008). DOI, **43 citations (on 15/4/13)**

[6] * Mace G.M., Collar N.J., Gaston K.J., Hilton-Taylor C., Akcakaya H.R., Leader-Williams N., Milner-Gulland E.J. & Stuart S.N., "*Quantification of Extinction Risk: IUCN's System for Classifying Threatened Species*". Conserv. Biol., 22, 1424-1442 (2008). DOI, **136 citations (on 15/4/13)**

Grants to Imperial College for this research:

[G1] NERC Core funding to the CPB, PI Georgina Mace, 2006-2011.

[G2] *INTAS (European Community)* "*Correlates of extinction risk for Central Asian Biodiversity*". PI: E.J. Milner-Gulland. Collaborators: Institutes of Zoology, Kazakhstan, Uzbekistan and Tadjikistan; Institute of Deserts, Turkmenistan; Institute of Botany, Kazakhstan; Swedish Threatened Species Unit; the World Conservation Union. (€146,500, Oct 2000 - April 2003).

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

The impact of the work is in the contribution of a scientifically rigorous approach for determining extinction risk, applicable to all species, to the development, evaluation and implementation of the leading measure of global species conservation status, the **IUCN Red List of Threatened Species™** [A]. This is a list of the threat status of 63,837 species, including nearly all of the world's birds, mammals, and amphibians, of which 31% are threatened with extinction [B]. The IUCN Red List is a major data source with detailed documentation on the threats, distribution and conservation actions for the species. The Red List for threatened birds has 1,132 citations in Google Scholar [10/4/13], and the 2000 Red List of threatened species also has over 1,000 citations [10/4/12]. Alterations to the Red List are announced on an annual basis, and always garner substantial press attention [e.g. C].

The IUCN Red List "*contains the most comprehensive assessment of the status of the world's plants and animals*" [D]. As such it "*plays an important role in multiple international agreements*" [D] and informs international policy processes including:

1) providing unbiased data on species status in order to demonstrate progress made towards implementation of the 2020 Aichi Targets of the Convention on Biological Diversity (CBD) [B]
2) the UN Millennium Development Goals, which use the IUCN Red List to track progress towards targets of reducing biodiversity loss [D, E]
3) National Biodiversity Strategies and Action Plans (NBSAPs). Data from the Red List has informed the NBSAPs, which are the principal instruments for the implementation of the CBD,

of 177 countries [D]
4) multi-lateral agreements, such as the Convention on the International Trade in Endangered Species (CITES) [D]

Non-governmental organizations also make use of the Red List. For example:
5) Conservation International uses data from the Red List to inform spatial prioritization schemes and to select targets for conservation projects [D]
6) The Zoological Society of London has developed a sampled approach to assess the conservation status of entire taxa, such as invertebrates, which would have been impossible without the data in the Red List [D]
7) International funding bodies, such as the Critical Ecosystem Partnership Fund, use the Red List to assess proposals [D]

In order to produce the Red List, the IUCN Species Programme within the IUCN Species Survival Commission (SSC) draws on and mobilizes a network of IUCN members, comprising scientists and partner organizations working in almost every country in the world, who collectively hold the most complete scientific knowledge base on the biology and conservation status of species. Researchers at Imperial College, particularly those at the Centre for Population Biology, have played a "*pivotal role in both the formulation and continual development of this list*" [D]. The Chair of the SSC of the IUCN confirms that science carried out at Imperial formed a "*fundamental part of the scientific underpinning of the Red List Categories and Criteria, as demonstrated by the highly cited paper on the Red List methodology by Mace et al. (2008)* [6] *. As well as supplying much of the fundamental science, Imperial College researchers were also deeply involved in the actual formulation of the Red List Categories, into which species are placed, as well as the rules used by assessors to allocate species to these Categories*" [B]. Georgina Mace, Kevin Gaston and E.J. Milner-Gulland were all part of the group that developed and tested these Categories, which required a trade-off between scientific rigour and usability by the conservation community, before their general rollout [B].

The IUCN confirms that Imperial researchers have also contributed to the "*adaptation of the Red List to the regional and national scales*" [B]. This was "*very much wanted by governments, who were keen to see how their own species were faring*" but was "*not straightforward because political boundaries are not often meaningful in biological terms*" [B]. The Imperial project, led by E.J. Milner-Gulland in Central Asia and resulting in paper [3], was "*one of the earliest large-scale exercises in developing and testing Red Lists at the regional and national scales, and also represented a major capacity-building effort, bringing rigorous and repeatable Red Listing methods to the newly independent states of the Former Soviet Union. Several of these governments now use the IUCN Red Lists as the basis for their national conservation legislation*" [B]. As an example, work with Imperial College and in-country partners led to the application of the IUCN Red List system of categories, criteria and methods to the assessment of the "*extinction risk of the threatened species of 5 Central Asian countries at the national, regional and global levels*" [F].

The beneficiaries of the Red List are conservation NGOs worldwide, who use it to monitor the status of threatened species and as a component of prioritisation and strategy-setting. It has also been used to develop a **Red List Index** (RLI), which is one of the official indicators of the status of biodiversity used by the 193 countries that are signatories to the Convention on Biological Diversity [G]. The RLI "*is based on the movement of species through the categories of the IUCN Red List. The RLI shows changes in the overall status (extinction risk) of sets of species, with RLI values relating to the proportion of species expected to remain extant in the near future without additional conservation action*" [H]. Governments have committed to halt the rate of loss of biodiversity, and the RLI enables reporting on their progress towards this target [G]. The CBD signatories committed to a reduction in the rate of loss of biodiversity by 2010, with a set of indicators (including a Red List index) determining whether they had reached this target. Failure to meet the target led to a major rethinking of both targets and indicators and to a substantial push to improve conservation action, outlined in the CBD's 2020 Aichi targets [I]. The RLI [A] is a key metric that spurred this action. The Red List (and RLI) is the primary indicator for Target 12 of the Aichi agreement: '*By 2020, the extinction of known threatened species has been prevented and their conservation*

status, particularly of those most in decline, has been improved and sustained' [J]. RLIs are now widely adopted at the policy level and have been used to report on and against various processes and indicators including the CBD's 2020 Aichi Biodiversity Targets, CBD's "*2010 Biodiversity targets, the UN Millennium Development Goals, by CITES, CMS, and for regional policy fora (e.g., SEBI in Europe)"* [G]. They have also *"been well profiled in global assessments such as the Global Biodiversity Outlook-3 and Global Environment Outlook 5*" [G].

The IUCN Red List is, however, not intended just to chart the declines of species; in addition its aim is to "*raise awareness of the status and threats to species in order to catalyse conservation action. The key to halting the extinction crisis is to target efforts towards eradicating the major threats faced by species and their environment; only then can their future be secured. The IUCN Red List acts as a gateway to such efforts, by providing decision makers with a goldmine of relevant information. As an example of successful conservation action, the Arabian Oryx was nearly hunted to extinction, with the last wild individual believed to have been shot in 1972. Now thanks to concerted conservation actions, the wild population stands at more than 1,000 individuals. In 2011, the species was downgraded from Endangered to Vulnerable on the IUCN Red List, making history as the first species once listed as Extinct in the Wild to have improved by three threat categories*" [B].

It is clear that the research efforts from the Centre for Population Biology at Imperial College, which fundamentally influenced the formulation of the Red List, as well as the associated Red List Index, have had considerable impact. The IUCN Red List "*is the gold standard for international assessments of species status*" [B] and through the "*Red List, the work of Imperial's researchers continues to have significant impact on conservation priority setting and decision making*" [D].

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

[A] The IUCN Red List, http://www.iucnredlist.org (archived at https://www.imperial.ac.uk/ref/webarchive/qlf on 31/5/13)

[B] Letter from Chair of the IUCN Species Survival Commission of the IUCN, 3/5/13 (available on request from Imperial)

[C] Typical press attention to the annual launch of the IUCN Red List: 2012 http://www.bbc.co.uk/news/science-environment-18511312 (archived at https://www.imperial.ac.uk/ref/webarchive/klf on 29/5/13), 2011 http://news.mongabay.com/2011/0616-hance_iucn_redlist_2011.html (archived at https://www.imperial.ac.uk/ref/webarchive/rlf on 31/5/13)

[D] Letter from Director of Conservation Programmes, Zoological Society of London, 3/5/13 (available on request from Imperial)

[E] UN uses IUCN Red List to measure success of Millennium Development Goals, http://www.iucn.org/index.cfm?uNewsID=1611 (archived at https://www.imperial.ac.uk/ref/webarchive/gtf on 9/10/13)

[F] Letter from Executive Secretary, Saiga Conservation Alliance (available on request)

[G] CBD-mandated Biodiversity Indicators Partnership webpage on the Red List Index, http://www.bipindicators.net/rli (archived at https://www.imperial.ac.uk/ref/webarchive/vlf on 31/5/13)

[H] Bird Life International webpage on the status of the world's birds over the last 20 years, which describes the Red List Index, http://www.birdlife.org/datazone/sowb/casestudy/72 (archived at https://www.imperial.ac.uk/ref/webarchive/57f on 15/11/13)

[I] CBD Aichi Biodiversity Targets, http://www.cbd.int/sp/targets (archived at https://www.imperial.ac.uk/ref/webarchive/zlf on 31/5/13)

[J] Target 12 of the CBD 2020 Aichi Biodiversity targets, http://www.cbd.int/sp/targets/rationale/target-12/ (archived at https://www.imperial.ac.uk/ref/webarchive/ylf on 31/5/13)