

Darwin Fellowship - Final Report

(Please check guidance for submission deadlines, max 6 pages.)

Darwin Project Ref No.	13016/EIDPS016
Darwin Project Title	"The endangered otter and the invasive mink in Patagonia"
Name of Darwin Fellow	Laura Fasola
UK Organisation	Wildlife Conservation Research Unit, University of Oxford
Your Organisation	Profauna Organization
Your role in your Organisation	PhD student
Start/end date of Fellowship	July 2007-June 2008
Location	Oxford, UK
Darwin Fellowship funding (£)	
Type of work (e.g. research, training, other, please specify)	research, training, scientific publication along with thesis writing
Main contact in UK Organisation	David Whyte Macdonald
Author(s), date	Laura Fasola, 23 July 08

1. Background

- Briefly describe your involvement in the Darwin project before the start of your fellowship.

My initial involvement, since the beginning of the project in 2004, was as a full time field biologist with responsibilities including the design of field work protocols and leading one of the three fieldwork teams. During the laboratory phase I was responsible for the dietary analyses of faecal samples collected during fieldwork, and built a Geographic Information Systems (GIS) to summarise and enable visualization of all the information gathered in the field. This work was later used to contribute to: (a) the various reports submitted to the Darwin Initiative; (b) the action plan for the conservation of the endangered otter; (c) the control plan for the invasive American mink; (d) the 'Complete Report of Project Achievements' to be presented to local institutions involved in the conservation of Patagonian vertebrates (wildlife agencies at provincial level and National Parks Administration), and (e) scientific publications (some submitted whilst others are currently in preparation for submission this month). A large proportion of this work is the basis of my doctoral thesis, to be submitted before the end of 2008 at University of Buenos Aires University (Argentina).

- Describe aim and objectives of the Fellowship, and programme of work.

The aim of the Fellowship was to support the achievements of the Darwin project regarding the fulfilment of the articles of the CBC, mainly 5 (cooperation) and 17 (exchange of information) and also articles 12 (research and training) and 18 (technical and scientific collaboration).

The specific objectives of the Fellowship were to (i) develop the fellows scientific analytical and writing skills through assistance from other researchers, (ii) enable contact with experts in invasive species and carnivore conservation, (iii) attend a major conference and workshop, (iv) receive supporting guidance on doctoral thesis preparation and (v) gain the opportunity to work closely with Professor David Macdonald, the project's UK expert, and other scientists in the Wildlife Conservation Research Unit (WildCRU), many of whom are experts on similar species and conservation issues.

- Briefly describe the roles of the UK and Fellow's institutions.

The Wildlife Conservation Unit (WildCRU) is the UK host organisation for the Fellowship. The Unit, through the University of Oxford, provided access to all the bibliographic material required to fulfil the outlined objectives. Researchers within the Unit provided guidance enabling the fellow to acquire a range of new skills including data analysis tools and techniques and to develop scientific writing skills. Relevant experts within the unit also shared expertise in case studies that have similarities with the fellow's interests in terms of the species involved, the types of conservation problems they address and how their research informs policies. Furthermore, these experts trained the Fellow in new field techniques to be included in an upcoming conservation programme in Tierra del Fuego, Argentina.

The Fellow's home institution, Profauna, supported the Fellow's UK progress throughout the Fellowship. The strong relationship and efficient communication between Laura and Profauna allowed the Fellow's developing skills to be transferred successfully, and to be of immediate benefit to Profauna. At the workshop organized by Profauna in Tierra del Fuego last November 2007 Laura presented both the current achievements of the project and the opportunities the Fellowship has provided in the UK. Profauna also provided support for Laura to attend an international meeting on the conservation of otter species in South Korea (IUCN otter specialist group colloquium-October 2007). There Laura had the opportunity to talk to, and network with, other world experts on otter conservation, as well as increase her knowledge of new techniques designed to improve future otter studies. This information is invaluable for the new phase of the study of otters in Tierra del Fuego.

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- If you have undertaken a formal course of training, please provide a brief explanation of the course and a link to the course website if available.

Although this was not a specific objective of the Fellowship I attended a course of training at the University of Oxford, on Animal Management and Welfare (www.vet.ox.ac.uk/training/syllabus.html). The course contributed to the aim of the Fellowship, since it supported the achievement of some of the CBC articles (mainly 12 and 18). The issue of animal welfare is not yet well regulated in Argentina for activities involving animals other than for food production. The course increased my understanding of the legal and ethical discussions surrounding animal welfare and I gained an insight into the level of care and responsibility that should be achieved in order to conduct research work in accordance with the highest standards of animal welfare, even in the absence of formal regulations. Additionally I was trained in best practice in aspects of my work with animals, such as animal handling, use of anaesthesia and collecting fluids samples.

2. Achievements

- Summarise the work undertaken during your Fellowship. What were the main activities undertaken. Highlight any work undertaken but not originally planned and explain why this happened. Highlight any problems encountered and how they were overcome.

To date, within the WildCRU I have made significant progress in many aspects of my work. I have completed analysis of the data collected during the Darwin project and also improved and completed two scientific papers, which I had started in Argentina. Both were submitted to scientific journals and have undergone the review process, and one is already in press. This achievement involved the direct assistance and advice of D. W. Macdonald and the experts working in his research group (WildCRU), as well as the use of the University of Oxford's extensive library. I also contributed to an additional manuscript as the result of my collaboration with another Darwin Initiative project (Ref. 15006) during several stages: sample analysis, statistic analysis and manuscript writing. This paper is currently in press with an international Journal on Conservation.

At WildCRU I networked with, and attended talks given by a large number of experts working on conservation. The WildCRU regularly hosted seminars and lectures by prominent scientists from the Unit itself and from other UK and international organisations. The scope of topics ranged from detailed overviews of individual projects to global conservation issues. I furthered my knowledge and understanding of different conservation approaches and their use in solving conservation problems, including, (a) modelling in conservation, (b) the history and use of technology in conservation, (c) disease control in wildlife and the applicability of modelling, (d) wildlife-human conflict, (e) invasive species, (f) wildlife legislation and (g) farming and conservation. I attended WildCRU tutorials on GIS tools, which have greatly improved my GIS skills. I also had access to seminars at the University of Oxford's Zoology Department, where I had the unique opportunity to listen to world renowned speakers such as Lord May of Oxford, an expert on theoretical ecology and modelling applied to population and disease transmission dynamics.

In September 2007 I was a delegate at the International Felid Biology and Conservation Conference, organised by WildCRU, where I attended presentations by some of the world's most prestigious researchers working in carnivore ecology, on pure conservation research conservation to policy implementation.

I presented three topics from the Darwin Patagonian otter project at the IUCN Xth International Otter Colloquium, in South Korea, where I discussed many of the results and ideas arising from the Darwin project with world experts within my field. I also presented our achievements from the previous Darwin project to the local wildlife agency and local researchers, as well as park wardens and researchers from National parks during a workshop in Tierra del Fuego (Argentina). There, I had the opportunity to listen to prominent scientists from Argentina and Chile and to contact attendees who gave me invaluable feedback which will be important in developing future research in the area. The workshop also allowed the two organisations (WildCRU and Profaua-GEMA), as a collaborative team to strengthen our links with local stakeholders.

My doctoral thesis manuscript is now advanced (6 of 8 chapters finished) and on target to be submitted to the University of Buenos Aires before the end of 2008. The assistance

and advice of the researchers of the WildCRU were invaluable for enriching my manuscript, in terms of experiences, bibliographical guidance and reference material. In the final stages in Argentina I am continuing discussions and receiving advice from my Argentinean research group.

I was trained in the use of TDRs (Time Depth data recorders), a technique used to study deep diving and migrating animals since 1990s but extremely recently implemented on the study of shallow divers like the American mink (*Mustela vison*). These devices record information that can be used to describe and study the diving behaviour underwater. In addition, the information can be linked directly with studies that further the understanding of the way species (a) cope with energetic requirements, (b) succeed in the invasion process and integrate into a new community. Also, this knowledge can guide our understanding of survival difficulties faced by similar endangered species. The complete TDRs training comprised fieldwork (choosing sites, trapping, handling animals, deploying devices), data extraction (use of specific software to set the TDRs and to recover the information from them) and data analysis (use of specific software and refinement of the analysis in accordance to the species studied). I am currently involved in the refinement of analysis in order to extract more information from the data, to include the interpretation of the subjects activities on land. The latter, involved the learning of the usage of additional software. As a result of my training, work and analysis on TDRs during my stay in the UK I gained authorship on a new scientific publication that is currently in preparation on the topic. Although not originally planned, the additional training contributed to fulfilling the following articles of the CBC: cooperation (5); research and training (12), exchange of information (17) and technical and scientific cooperation (18). It will have a key role for my future in Argentina, since it will help secure my postdoctoral research career. I have ready received a proposal of work, to continue studies on diving behaviour of the invasive American mink in Tierra del Fuego, Argentina, where Darwin Initiative presence continues to raise the profile of wildlife conservation locally and nationally. This year, we are really pushing forward the presence of the Darwin Initiative in Tierra del Fuego and building links with the National Parks and local Wildlife Agency.

- What have been the main achievements of your fellowship? Key documents should be annexed to this report.
 - i. Networking with experts both in conservation in general as well as with particular expertise related to the conservation issues and situations tackled during the Argentinean Darwin project and my own thesis (article 17, related to objectives ii, iii and v).
 - ii. Library research applied to the completion of scientific manuscripts and my thesis process (objective i), as well as towards the foundation of more projects on invasive species in the Southern Cone of South America (article 17). This was skilfully guided and assisted by people from the WildCRU (articles 5 and 12, objective ii, v).
 - iii. Improvement of writing and analysis skills. This can be seen in the two articles already submitted, in two other articles currently under revision and completed doctoral thesis chapters (Articles 5, 17, 18; objective i, iv).

- iv. Learning and training of advanced technology (DTRs) applied to the study of diving behaviour of shallow divers. Novel fieldwork techniques; attendance of a course to ensure my work, once back in Argentina, will reach high standards of animal welfare; learning 3 new software packages for data extraction, data analysis and refinement of information extraction from original data (articles 5, 12, 18). A scientific article on this topic is currently in preparation.

3. Outcomes, lessons and Impact

- Do you feel that the work undertaken during your Fellowship has improved skills that are relevant and important for your work in your organisation? How are you planning to apply those skills in future work?

My experience at WildCRU has greatly improved my research skills, of which my refined scientific writing has immediate importance to my work and benefits my organization. My literature reviews and attendance of seminars have increased my knowledge and perspective, which I believe promotes my ability to incorporate ideas and research approaches to new challenges and further improves my contribution to my research group. During my stay in WildCRU I gained practical experience, by participating in fieldwork and discussion groups beyond my core subject (e.g research on rural biodiversity in relation to agricultural practices), which I expect to share with my colleagues, and I hope will serve to enhance our future portfolio of research. Particularly, the use of TDR is a new branch of study for my organization.

- What arrangements have been made for your future involvement, what more could be done, what discussions have taken place with your original employer to ensure that your new skills are utilised?

WildCRU, Profauna and the local national parks and conservation research organisations are closely liaising in order to secure the development of a new project in Tierra del Fuego, to further previous efforts and findings, and to fully utilise my new skills. The project will be on the study of diving behaviour of American mink (one of subjects of my thesis) using TDRs methodology and capitalising on my experience with this technology.

- Has the Fellowship helped to improve your capacity to solve practical problems related to the sustainable use and/or conservation of biodiversity in your country?

The Fellowship has increased my capacity to think critically on practical problems facing the conservation of biodiversity in Argentina and in particular, on the conservation of the endangered otter. I am better equipped to design research and implementation strategies in order to help the control of the invasive American mink.

- Have you had the opportunity to make contacts with other UK biodiversity institutions, intergovernmental organisations, NGOs or the private sector during your fellowship? Will these contacts be useful for your future work, and how are you planning to maintain them?

I have met an enormous network of relevant people associated with the WildCRU, including conservation researchers from throughout the UK. I hope and expect to keep in touch with people through the normal network of professional contacts.

- Any other issue emerging from your experience as Darwin Fellow that you would like to raise, or suggestions for improvements to the Darwin Initiative Fellowship scheme.

I would like to use this opportunity to express my sincere gratitude to Darwin Initiative for this wonderful opportunity. The experience is already improving my ability to develop research in my country and I have increased my conservation perspective not only academically, but also culturally. I am particularly grateful that my Fellowship was hosted in the University of Oxford as it gave me access to a rich diversity of scientists developing research in other fields, such as mathematics, philosophy, physics and chemistry. At a finer scale, within the WildCRU I was part of a discussion group, which helped improve my own critical reviewing skills, but invaluable provided critical, but supportive, review of my work from others.

I would like to suggest that all members on the Darwin Initiative Fellowship scheme be part of a mail list or similar contact network, in order to receive announcements of activities organised within the DI group.

As documents to be annexed:

Page 8-9:

Cover page and abstract of the manuscript:

Fasola L., Chehébar C., Macdonald D., Porro G. and Cassini M. Do alien North American mink compete for resources with native Southern River otter in Argentinean Patagonia? *Second revision Journal of Zoology, London.*

Page 10-11:

Cover page and abstract of the manuscript:

Ibarra, J.T., Fasola, L., Macdonald, D.W., Rozzi, R., Bonacic, C. (in press) Diet of the invasive American mink in wetlands of the Cape Horn Biosphere Reserve, Shouthern Chile. *Oryx.*

Page 12-13:

Thesis manuscript general structure (Spanish-English)

Page 14:

An illustrative scheme of the process of the work with data loggers.

TDR process illustration: (a) Tahmes River -January 2008; (b) Trapped mink; (c) Collared mink (holding a TDR); (d) Mink being released; (e) Mink colleting data; (f) First phase of analysis: identifying dive events using software MT-dive; (g) Summary after first phase, ready for statistical analysis; (h) exploring data, to classify behaviours other than diving; (i) classification.

Page 15:

(a) First slide of talk at workshop in Tierra del Fuego, Argentina (November 2007). (b) Opening Session of IUCN Xth International Otter Colloquium, Hwacheon otter South Korea (October 2007), (c) Laura Fasola at IUCN Xth International Otter Colloquium, (d) Laura Fasola during TDR fieldwork training.

I enclose a folder containing: scanned copy of abstract book of IUCN Xth International Otter Colloquium, and certificate of Animal Management and Welfare course.

Do alien North American mink compete for resources with native South American river otter in Argentinean Patagonia?

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Short Title Do alien mink compete with native Patagonian otter?

Abstract

American mink, *Mustela vison*, originally bred in fur farms, have become established in areas occupied by native endangered Southern river otter (*Lontra provocax*) in Patagonia. In accordance with European experience, this biological invasion in South America raises questions about the interaction between invasive mink and native otter, from the viewpoints of both community assembly and conservation.

We set out (1) to find which aspects of habitat structure were related to the distribution of signs of both this invasive species and Southern river otter *Lontra provocax* in Argentinean Patagonia and their most common prey, (2) to test general predictions of niche partitioning between these two species. Based on surveys of 447 of 600 m transects for otter and mink scats/footprints along the waterside of lakes and rivers in the Andean Patagonian region, we compared diet composition (from scat analysis) and micro-habitat preferences (from field signs) of the two species. Otters were more specialist than mink in habitat use and diet. Mink used different habitats in other river basins where otters were absent. Where they occurred together in the basin of the Limay River, the distributions of their signs were similar, and mink diet was more similar to that of otters. There was no detectable difference in otter diet before and after mink arrival to Limay basin. Contrary to the prediction of niche partitioning, and to the findings of European studies, resource use by mink was more similar to that of otters where the species occurred sympatrically than where they were allopatric.

Key words American mink, competition, invasive species, Patagonia, South American river otter.

2008.16.1

DIET OF THE INVASIVE AMERICAN MINK IN WETLANDS OF THE CAPE HORN BIOSPHERE RESERVE, SOUTHERN CHILE

Running head: Mink diet in Cape Horn wetlands-Chile

Word Count: 1.987

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Abstract

We investigated seasonal variation in the diet of a recently arrived invasive predator, the American mink (*Mustela vison*), in the Sub-Antarctic Cape Horn Biosphere Reserve, Chile. Diet was determined identifying undigested remains in 414 scats collected from 27 ponds in Navarino Island. The diet of mink in these wetlands consisted mainly of mammals and birds. Mammals, including both native and exotic rodents, were the predominant prey in all seasons, but birds were of equal importance during the summer (when birds breed and their abundance and diversity increases on the island). Exotic rodents were the only identifiable mammals prey item during winter. Native wetland birds constituted a substantial proportion of mink diet, greater than that reported in other areas of the world. Many birds breeding on Navarino are ground-nesting, a strategy evolved in the absence of native mammalian predators. Considering the international importance of this ecoregion, our results emphasise the need for an assessment of the impact of mink predation on the populations of native prey.

Key words: American mink, Cape Horn, diet, exotic invasive species, *Mustela vison*, seasonal variations, wetlands.

Distribución y alimentación de dos mustélidos semiacuáticos en Patagonia, el huillín *Lontra provocax* nativo y el visón americano *Mustela vison* introducido

(Distribution and diet of two semi-aquatic mustelids in Patagonia, the Southern River otter *Lontra provocax* and the introduced American mink *Mustela vison*)

Capítulo 1 (Chapter 1) Done

Información general (Background)

Objetivos del trabajo de tesis (Objectives)

Relevancia del trabajo (Importance of the present study)

Estructura de la tesis (Thesis structure)

Los mustélidos (Mustelids)

La familia Lutrinae (Lutrinae family) -El huillín (Southern River Otter)

Características del visón Americano (Characteristics of American mink)

El visón Americano en el mundo (The American in the World)

Área de estudio (Study area)

Ubicación y clima (location and climate)

Vegetación (Vegetation)

Presas (prey)

(All the chapters from the body of the manuscript are divided into 4 sections:

Introduction-Methodology-Results-Discussion

Capítulo 2 (Chapter 2) Done

Distribución actual del huillín en Patagonia. ¿Qué cambios se registraron en los últimos 20 años? Situación actual. ¿Una especie en peligro de extinción?

(Present distribution. What changes have been recorded during the last 20 years? Present situation. A threatened species?)

Capítulo 3 (Chapter 3) Done

Grado de expansión del visón Americano en Patagonia-Argentina.

(Degree of expansion of American mink in Patagonia-Argentina)

Capítulo 4 (Chapter 4) Done

Dieta del huillín en cuerpos de agua dulce de Patagonia Norte. ¿Responde el huillín al modelo de comportamiento alimentario propuesto para las nutrias?

(Diet of Southern river Otter in Northern Patagonia- Does the Southern river otter support the behavioural feeding model proposed for otters?)

Capítulo 5 (Chapter 5) Done

Dieta del visón Americano a lo largo de su rango geográfico en Patagonia.

(Diet of American mink along its geographical range in Patagonia)

Capítulo 6 (Chapter 6) Done

Interacción entre el visón Americano y el huillín en cuerpos de agua del norte de Patagonia. ¿Coexistencia?

(Interaction between American mink and Southern River otter in fresh water bodies of Nother Patagonia. Coexistence?)

Capítulo 7 (Chapter 7) in process (analysis done)

Análisis multi-escala de la distribución de macrocrustáceos de agua dulce en Patagonia-Implicancias sobre el patrón de distribución espacial del huillín.

(Multi-scale análisis of fresh water macro crustaceans in Patagonia- it's relationship with Southern river otter spatial distribution pattern).

Capítulo 8 (Chapter 8) in process

Conclusión final

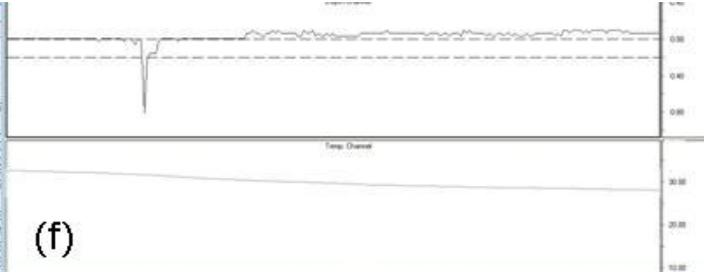
(Final Conclusion)



Vertical velocities		Down		Up		Entire dive		Bottom phase	
J	K	L	M	N	O	P	Max	Min	MeanBott
0.15750195	-0.01000443	-0.12499886	0.59638611	0.49641403	0.54141701	0.5562			
0.21998444		-0.21998444	0.44683558						
0.03108154	0	-0.01461317	0.22600896	0.16598241	0.20889852	0.2260			
0.24999771	0.01286283	-0.24999771	0.51760951	0.35758387	0.40009703	0.5176			
0.2	0	-0.26500435	0.76760722	0.51760951	0.6231641	0.7370			
0.2	0.375166	-0.17249165	0.94761912	0.63759486	0.78962924	0.7669			
0.2		-0.08333257	0.22600896						
0.2	0.399707	-0.13000107	0.83119364	0.64122248	0.7345256	0.7608			
0.2	0.999982	-0.06300087	0.70118128	0.51121012	0.61953117	0.6705			
0.37499657	0	-0.14400952	1.0669742	0.63696456	0.8426474	0.9440			
0.24999771	0.01000443	-0.17666957	0.66697784	0.5059522	0.56096525	0.5355			



TDR analysis process



Time	Temp	Moist	Temp	Moist	Temp	Moist	Temp	Moist
1,167	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
1,136	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
1,784	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
1,283	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
1,269	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
1,038	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
1,067	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.508	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
1,304	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.764	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.922	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.953	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

