Biodiversity research in the Laguna San Rafael National Park: programme review and forward planning

Proceedings of the second workshop of the

Laguna San Rafael National Park Biodiversity Research Programme

Coyhaique, Chilean Patagonia
March 30th - April 2nd 1998

Workshop sponsored by

Shell Chile

S. Rose & S. Herrera Encina
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Biodiversity Research in the Laguna San Rafael National Park: programme review and forward planning

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Prólogo

Entre el 12 y el 15 de Noviembre de 1996 se reunieron en Coyhaique, capital de la Undécima Región de Chile, 25 investigadores y administradores de recursos naturales, de Chile y el Reino Unido (UK). Su objetivo fue determinar una agenda para un programa de investigación sobre biodiversidad a desarrollarse en el Parque Nacional Laguna San Rafael, un área silvestre protegida de 1,7 millones de hectáreas. Este programa está financiado por la Iniciativa Darwin para la Sobrevivencia de Especies del gobierno británico, y es una colaboración entre Raleigh International, la Corporación Nacional Forestal (CONAF), the Natural History Museum de Londres (NHM), el Museo Nacional de Historia Natural de Santiago (MNHN), y el World Conservation Monitoring Centre de Cambridge (WCMC).

Este documento describe el segundo taller realizado en Coyhaique entre el 30 de Marzo y el 1° de Abril de 1998, que fue convocado para revisar el avance del programa y determinar su desarrollo futuro. Además de las actas del taller, este documento entrega un resumen de los estudios realizados a la fecha en este proyecto e incluye una completa bibliografía de las investigaciones relacionadas al PNLSR realizadas con anterioridad y un resumen de la evaluación del taller. También se presenta el resumen de un breve taller, de medio día, realizado el 2 de Abril de 1998 con el fin de dar a conocer a la comunidad local el potencial de este programa para la educación ambiental regional.

Para cada sesión del taller se esbozan los objetivos iniciales, seguidos por una síntesis de cada presentación o ejercico realizados, incluyendo algunos resultados si corresponde. Luego, el texto se refiere a aquellos puntos clave que provocaron alguna discusión particular. Por último, se entrega un resumen de las ideas esenciales de la sesión. Se han producido sendas versiones de estas actas, en castellano y en inglés. Las secciones de Prólogo e Introducción, así como algunas figuras, han sido escritas en forma bilingüe, y la versión completa en inglés puede ser solicitada a los coordinadores.

Agradecimientos

El apoyo continuo de **Shell Chile** ha permitido la participación de investigadores de diversas instituciones de Chile. Agradecemos también al personal de las oficinas de CONAF Regional y de Unidad de Gestión Patrimonio Silvestre (UGPS), y de Raleigh International en Coyhaique.

Además del financiamiemto principal de la Iniciativa Darwin, varias organizaciones del Reino Unido y Chile han apoyado este programa de investigación durante el último año. Agradecemos sinceramente a las siguientes organizaciones por su importante colaboración: People's Trust for Endangered Species, UK; British Council, Chile; Natural History Museum, Londres; Museo Nacional de Historia Natural, Santiago; Ernest Kleinwort Charitable Trust, UK; University of Durham, UK; Universidad de Chile; Universidad de Valparaíso. Chile; Institute of Terrestrial Ecology, UK; y British Airways.

Foreword

Between the 12th - 15th of November 1996, 25 Chilean and UK researchers and conservation planners participated in a workshop in Coyhaique, the capital of Region XI, Chile. The aim of this meeting was to determine an agenda for a biodiversity research programme to be undertaken in the Laguna San Rafael National Park (LSRNP), a 1.7 million ha. protected area in Region XI. This programme is funded by the UK Government's Darwin Initiative for the Survival of Species, and is a collaboration between the UK-based youth development organisation Raleigh International, Corporación Nacional Forestal (CONAF) the Chilean forestry and protected areas authority, the Natural History Museum in London (NHM), the Museo Nacional de Historia Natural in Santiago de Chile (MNHN), and the World Conservation Monitoring Centre (WCMC) in Cambridge, UK.

This document represents the proceedings of a second workshop, which took place in Coyhaique from March 30th to April 1st 1998. This meeting was convened to review progress of the research programme and to determine its future direction. In addition to the workshop proceedings, this document provides a summary of the research undertaken on the programme to date, a full bibliography of all research related to LSRNP and a summary of the workshop assessment. It also contains the proceedings of a half-day workshop to explore the potential for environmental education material which may be generated from the research.

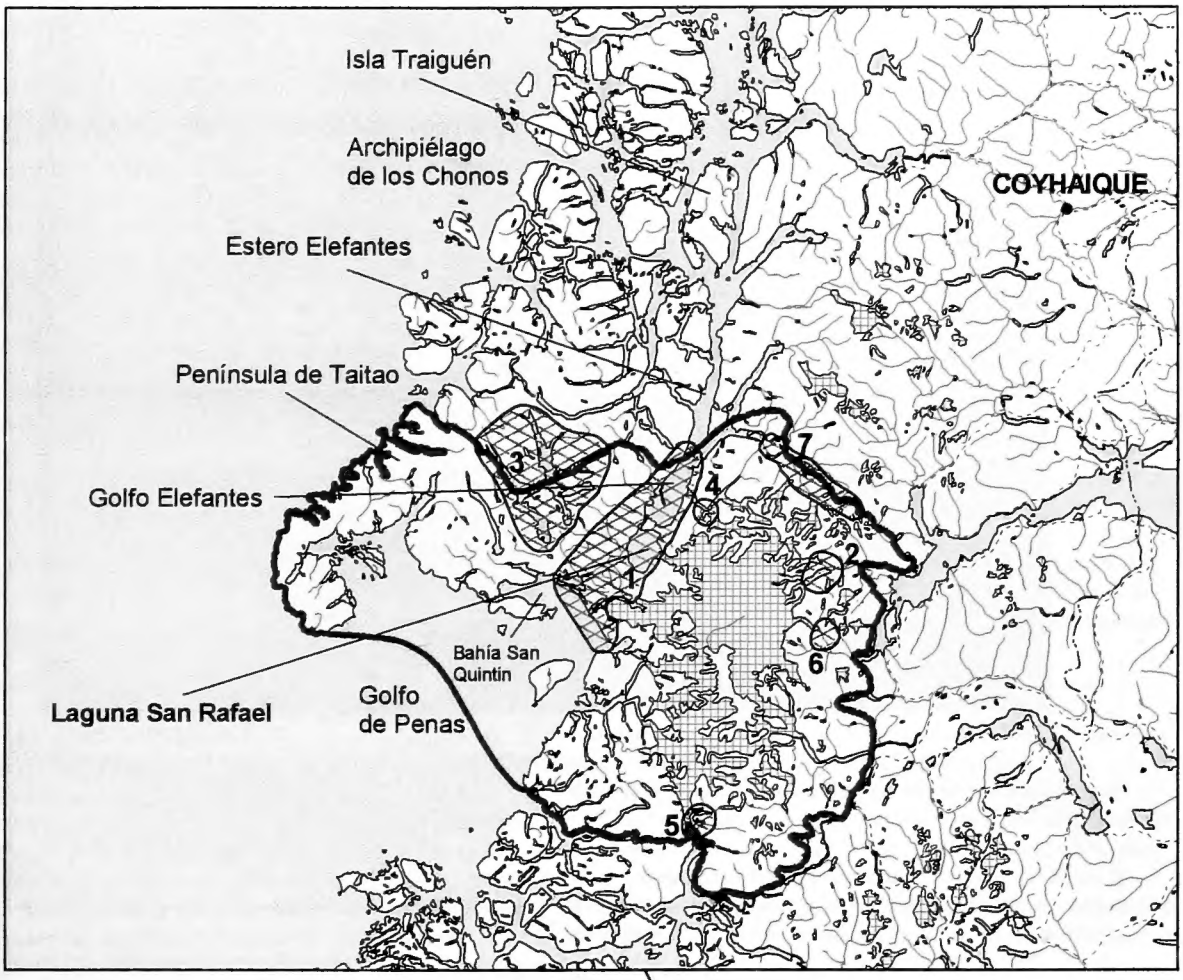
For each of the workshop sessions, the initial objectives are outlined, followed by a summary of any presentations or exercises undertaken, including results if appropriate. Any issues which provoked particular discussion or interest are then related in a 'Key discussion points' section. Finally, a summary of the key findings or resolutions from the session is presented. While the first two pages of these proceedings, and some of the figures, are written in both English and Spanish, the remainder of the document is in English and a Spanish version is available on request.

Acknowledgements

We are very grateful to **Shell Chile**, whose continued support enabled the participation of researchers from a range of institutions in Chile. Thanks also are due to the staff at CONAF's Natural Heritage (UGPS) and Regional offices, and to Raleigh International's Field Base in Coyhaique.

In addition to core funding from the Darwin Initiative, thanks are also due to the following organisations, whose support has enabled the programme to fulfill its potential during the last year: People's Trust for Endangered Species, UK; British Council, Chile; Natural History Museum, London; Museo Nacional de Historia Natural, Santiago; Ernest Kleinwort Charitable Trust, UK; University of Durham, UK; Universidad de Chile; Universidad de Valapaíso, Chile, Institute of Terrestrial Ecology, UK; and British Airways.

Figura 1 Parque Nacional Laguna San Rafael y alrededores
(Figure 1 Laguna San Rafael National Park and surrounding area)



50 0 50 100 Kilómetros

Leyenda (Key)

- Límites del PNLSR - aprox. (LSRNP Boundary - approx.)
- Áreas prioritarias (Priority research areas)
- Límite internacional - no oficial (Intl. border - approx.)
- Ríos (Rivers)
- Caminos (Roads)
- Hielo (Ice)
- Cuerpos de agua (Water bodies)

Áreas prioritarias (Priority areas)

1. Golfo Elefantes a Laguna San Rafael y el Istmo de Ofqui
(Golfo Elefantes to the Laguna San Rafael and the Ofqui Isthmus)
2. Lago Leones y alrededores (Lago Leones and surroundings)
3. Lago Presidente Rios
4. Area alrededor del glaciar Hualas (area surrounding the Hualas glacier)
5. Area alrededor del glaciar Steffen (area surrounding the Steffen glacier)
6. Area alrededor del glaciar Soler (area surrounding the Soler glacier)
7. Valle Exploradores (Exploradores Valley)

N
W E
S

Figure 2a) From Laguna San Rafael to Estero Elefantes, as seen from the Space Shuttle (NASA).

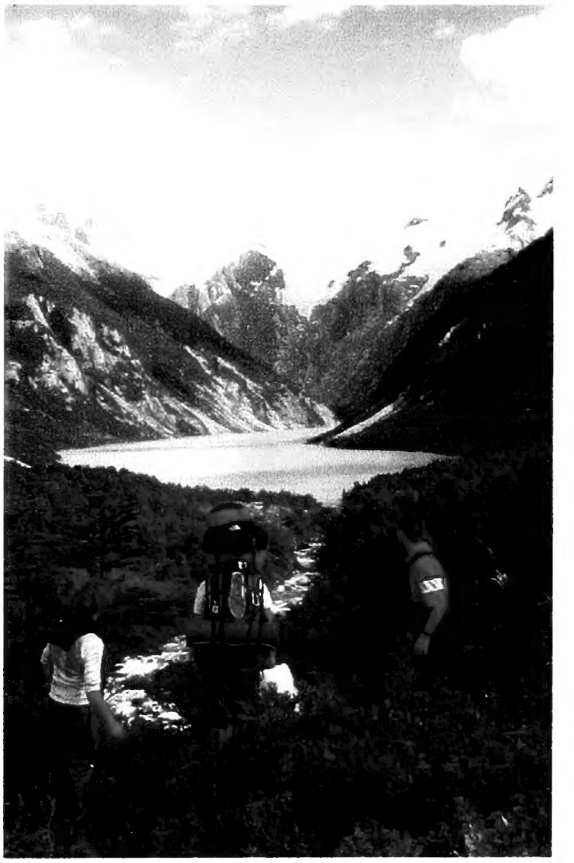


Figure 2b) The Lago Leones priority area was the focus of an insect survey between January and March 1998.

Programa de investigación sobre biodiversidad en el Parque Nacional Laguna San Rafael: introducción

Este programa de investigación se conoce como '*Estudios de biodiversidad y manejo de información en el Parque Nacional Laguna San Rafael*'. Se presenta aquí un resumen de sus objetivos principales y se puede encontrar una completa descripción del proyecto, incluyendo antecedentes, objetivos e información sobre los colaboradores, en las actas del primer taller, que pueden ser solicitadas a los coordinadores del proyecto (ver direcciones en Apéndice 1).

Objetivos

El objetivo central de este programa de investigación es obtener información sobre la diversidad biológica del Parque Nacional Laguna San Rafael (Figura 1), que pueda ser utilizada por la Corporación Nacional Forestal (CONAF) para su apropiada administración y protección. Además de realizar estudios de línea base, también se incluyen programas de seguimiento y estudios ecológicos de especies seleccionadas que puedan ser indicadores del estado de salud de ecosistemas o que tengan problemas de conservación. La capacitación institucional es un componente esencial para que este proyecto se mantenga en el largo plazo, por lo que también forma parte importante de este programa el entrenamiento del personal de CONAF en técnicas de manejo de información y de monitoreo biológico.

Manejo de información

El manejo de los datos es crucial para que CONAF use y produzca información en forma efectiva Abordando esta necesidad se ha implementado en la Unidad de Gestión Patrimonio Silvestre (UGPS) de Coyhaique un Sistema de Información Geográfica, basado en el software ArcView 3.0a, que cuenta con un sistema paralelo en la Oficina de Proyectos de Raleigh International en Londres. Estas dos oficinas conforman el 'coordinador central' del proyecto.

Colaboradores

Raleigh International es una organización que apunta al desarrollo de gente joven. En Chile, proporciona el apoyo logístico y de asistencia en terreno a la investigación, y facilita la comunicación entre las instituciones colaboradoras. En particular, el coordinador basado en las oficinas de Raleigh en Londres, mantiene contactos con los investigadores británicos y supervisa la planificación del proyecto.

El coordinador de *CONAF*, basado en la UGPS de Coyhaique, tiene la responsabilidad de contactar a los investigadores chilenos, colaborar en la organización de los proyectos y trabajar en conjunto con el personal de Raleigh.

El Museo de Historia Natural de Londres (NHM) y el *Museo Nacional de Historia Natural* en Santiago (MNHN), son las instituciones de donde provienen la mayoría de los investigadores. También colaboran profesionales de la *Universidad de Chile*, *Universidad de Valparaíso* y la *Universidad de Durham* (UK).

Finalmente, el *World Conservation Monitoring Centre* (WCMC), de Cambridge, UK ha facilitado los dos talleres realizados y ha proporcionado asesoría en el manejo de información sobre biodiversidad.

Laguna San Rafael National Park biodiversity research programme: introduction

The full title of this research programme is '*Biodiversity Surveying and Information Management in the Laguna San Rafael National Park*'. A summary of its main objectives is below and a full description of the programme, including background, objectives and project partner information is detailed in the proceedings of the first workshop, copies of which are available from the project co-ordinators (see address in Appendix 1).

Aims

The principal aim of this research programme is to obtain information about the biodiversity of the Laguna San Rafael National Park (Figure 1), for use by CONAF for management decision-making. In addition to undertaking baseline surveys of biological diversity, other objectives include monitoring programmes of selected taxa and ecological studies of particular species, such as those which may be useful indicators of ecosystem health, or those which are threatened or endangered. Building institutional capacity - essential for the project to be sustainable in the long term - is also a major part of the programme and takes the form of training for office and field-based CONAF staff in appropriate techniques, including information management and biological monitoring.

Information management

Management of data is crucial in enabling CONAF to produce and use information effectively. For this project, a Geographical Information System has been established at CONAF's Department of Natural Heritage (Unidad de Gestión Patrimonio Silvestre- UGPS) office in Coyhaique, with a parallel system in the Raleigh International Projects Office in London. A co-ordinator is in each of these offices, and together form the central co-ordinating 'hub' of the programme.

Project partners

Raleigh International is a organisation which aims to develop young people through their involvement in conservation and community projects on expeditions world-wide. In Chile, Raleigh provides logistical and manpower support for the research, and facilitates links between collaborating organisations. The Raleigh project co-ordinator maintains relationships with UK scientists and oversees project planning.

CONAF's co-ordinator is the locally based half of the hub, with responsibility for contacting Chilean scientific staff, undertaking project planning and management, and working closely with Raleigh's field staff.

The Natural History Museum, London (NHM) and the *Museo Nacional de Historia Natural* in Santiago (MNHN), are the two organisations where most participating researchers are based. Other collaborating research institutions include the *Universidad de Chile*, the *Universidad de Valparaíso (Chile)* and the *University of Durham* (UK).

The final key project partner is the *World Conservation Monitoring Centre* (WCMC), based in Cambridge, UK, who have facilitated both project workshops and have provided advice and expertise in biodiversity information management.

Part I: Workshop - Biodiversity and information management in the Laguna San Rafael National Park

Session 1: Introduction and programme overview

Monday 30th March a.m.
Led by Dennis Aldridge and Sergio Herrera (CONAF)

Aims

1. To provide an overview of the research programme and to summarise achievements to date;
2. To present the timetable and objectives of the workshop;
3. To introduce the workshop participants;
4. To review the key objectives of the programme.

Presentations

- Welcome speech by Dennis Aldridge, Head of CONAF UGPS Region XI.

"The pressures facing protected areas here are very real, and there is a very apparent lack of information available to those who are trying to manage and administer them."

"The decisions that we have made so far are largely based on sentimentality... decisions should be firmly grounded in reality."

- Project overview and summary of achievements, Sergio Herrera, Darwin Initiative Project Officer, CONAF.

"Most people only see the Laguna San Rafael, they don't know that it is a national park - there is more to it than just a spectacular glacier... last year approximately 20,000 people visited the Laguna San Rafael by boat, only 164 landed."

Key achievements of the last year:

1. Research

Fieldwork since November 1996 has focused on the following taxonomic groups:

- lichens
- diatoms
- marine algae
- mammals (esp. Güiña and Huemul
- beetles
- dragonflies
- chironomid midges
- crustaceans
- polychaetes
- molluscs (marine, freshwater and land)
- echinoderms
- bryozoa

Preliminary observations or collections have been made of:

- ferns and liverworts
- soil algae
- freshwater algae
- amphibians
- birds
- marine mammals

2. Project statistics

- 20 UK-based and Chilean biological scientists in the field;
- a total of 85 scientist-weeks of fieldwork conducted;
- around 250 Raleigh International Venturers and Staff actively involved in the research;
- 4 seminars given by UK-based researchers in Chile;
- more than 15 collaboration meetings;
- at least 30 UK-based or Chilean researchers have been involved in the project to date;
- and at least 17 different research, NGO, governmental or commercial institutions have a link with the programme.

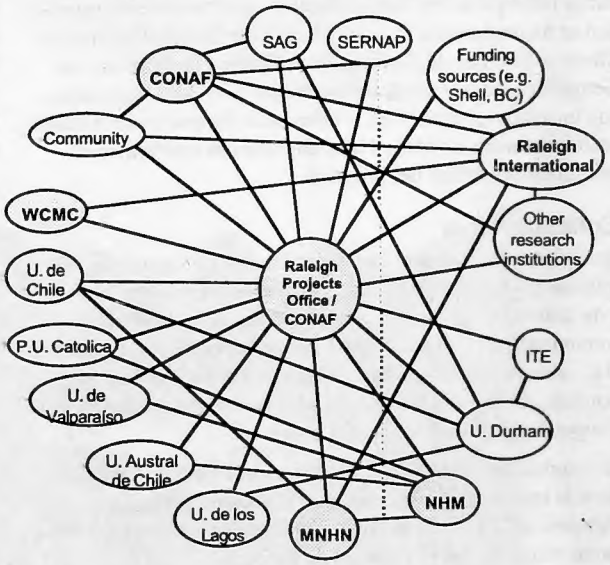
3. Collaborations

- Museo Nacional de Historia Natural (MNHN): A feature of the project is the strength of some of the collaborations which have arisen. In particular, the MNHN in Santiago has emerged as the key collaborating research institution in Chile, with some of their senior research staff undertaking fieldwork during the last year.

- Specimens agreement: The directors of each of the five principal project partners have signed an agreement determining conditions for deposition of specimens and the dissemination of information from this research programme.

- The diversity of organisations linked to the projects (at many different levels) is one of the key characteristics of this research programme. Figure 3 shows the network of inter-relationships co-ordinated from a central facilitating hub.

Figure 3 A facilitated network showing the links between organisations involved in the research programme.



4. Additional support

In addition to core funding from the Darwin Initiative, the following organisations have given financial assistance or supported the programme in kind (details in brackets):

- **Shell Chile** (two workshops);
- the **Ernest Kleinwort Charitable Trust**, UK (mammals and marine research);
- the **Natural History Museum**, London (all projects);
- the **People's Trust for Endangered Species** (mammals);

- the **British Council, Chile** (collaborations, marine research and mammals);
- **British Airways**, UK (marine research);
- the **University of Durham**, UK (mammals);
- the **Institute of Terrestrial Ecology**, UK (mammals);
- **Museo Nacional de Historia Natural** (marine research);
- **Universidad de Valparaíso** (lichens);
- **Universidad de Chile** (marine research and mammals).

Workshop Objectives

1. To review research undertaken during the first field season, paying particular attention to: how it relates to the priorities identified at the first workshop; collaborations established; direct use of information obtained for the management of LSRNP;
2. To ensure that the programme is meeting all of the objectives specified in the initial Darwin Initiative grant proposal;
3. To determine research priorities for the 1998/99 field season; either building on existing research or initiating new projects;
4. To discuss how the research programme may be continued in a sustainable way past the lifetime of the current grant (ends March 1999);
5. To propose ideas for the dissemination of results produced in the context of this programme, with a view to producing information which supports park management, research and environmental education.

- Introduction to the delegates: each of the delegates presented themselves and their role or interest in the programme. In addition to key representatives from each of the five principal project partners, CONAF was also represented by the head of UGPS (protected areas division) from Region X. Other Chilean delegates were from the Museo Nacional de Historia Natural, the Universidad de Chile, the Universidad de Valparaíso and the Universidad Austral de Chile. The local branch of Servicio Agrícola y Ganadero (the agriculture and wildlife service) was also represented. A number of delegates had worked in the field during the previous six months, including one each from the Natural History Museum, and the Museo Nacional de Historia Natural in Santiago. The full list is presented in Appendix 1.

- Review of programme objectives by Dennis Aldridge and Jonathan Cook (Head of Planning, Raleigh International)

This final part of the first session provided an opportunity to review and discuss some of the original objectives and issues defined in the Darwin Initiative proposal, all of which must be addressed by the end of the programme. The following points were raised:

Dennis Aldridge, objectives:
- Baseline surveys: essential;
- Monitoring: crucial to show changes in biodiversity and ecosystem health;
- Capacity building: training for CONAF and diffusion of information at a regional level;
- Applying the WCMC information management model to other areas: this is a long term objective.

Jonathan Cook, issues:
- Management issues: for example, Raleigh has worked in LSRNP for years, but are only now providing information directly for management purposes;
- CONAF as the client: the main criteria for success is whether the information will be useful for CONAF;
- Focus on objectives: the stated objectives of the project must be addressed. For example, training, monitoring of indicator species;
- Education: there is much potential, and it is very relevant to Raleigh volunteers;
- How can the project be made sustainable?

Summary

- This session reviewed the key achievements since the programme's inception and highlighted the fact that research undertaken to date has responded directly to priorities identified at the first workshop.

- The strength of collaborations and institutional links were recognised as a key feature of the research programme, but the need to maintain these links was stressed.

- The original objectives of the programme were reinstated and the importance of addressing each of these before March 1999 was recognised.

Figure 4 Workshop participants outside CONAF's regional office in Coyhaique.

Session 2: Biodiversity Information Management - the framework revisited

Monday 30th March, a.m.
Led by Donald Gordon and Javier Beltrán (World Conservation Monitoring Centre)

Aims

1. To revisit the biodiversity information management framework in the context of this research programme;
2. To determine how the information management system being developed supports this initiative.

Presentations

- Presentation of '*Overview: Components of a Biodiversity Information Management System*' by Don Gordon and Javier Beltrán of the World Conservation Monitoring Centre. The overheads used for this presentation are in Appendix 2. For more information, these consultants may be contacted at WCMC.

Key discussion points

Networks and partnerships

- Networks and partnerships are increasingly being used to solve problems in conservation and the environment and represent a move away from 'technology' as the answer to all problems. Technology is available and is very useful if manpower and other resources are available. But to make it work, people need to come together to collate, share and use information. This approach is 'strategic', based on partnerships and sharing data, rather than a 'tactical' project system designed to address one specific problem. (See overheads 11 and 12 in Appendix 2).

- Figure 3 is a good example of a 'facilitated' network, where a 'hub' facilitates links between all of the partner organisations. In this case, CONAF's UGPS office in Coyhaique and Raleigh's Projects Office in London represent the hub, through which individual organisations have formed new links. One delegate observed that the network has a higher level steering committee in the five directors of the project partners who signed the specimens agreement, which is an influential front to the network's activities.

Custodianship

- This issue relates to who is responsible for the information produced by the programme. Who will be the 'custodian' of the data? It might be the managing organisation or it might be a specific organisation agreed by all partners to be manager; for example, it might be the users (CONAF) or the producers (e.g. NHM or MNHN). Some countries define the custodian of such data by law.

"There are two levels of custodianship, the scientists who have custody , or ownership of the data, and CONAF, who will be the users of the data."

- It was agreed that the project partners need to determine a set of rules which answer questions such as the following: Who are the custodians? What are the rules of access to data? What is the role of the user? What further research is needed to support the information gathered? Who are the partners supporting the programme? What are the conditions of data exchange between organisations? These rules may be set out in a Data Access Agreement, which was considered suitable for the present situation. A further discussion centred around the possible economic outputs which information and intellectual property can sometimes provide. It was agreed that this subject needs more consideration.

Capacity building

- If an organisation does not have the experience, staff or money to run and maintain a tool such as the GIS system, then serious consideration must be given to capacity building. It was recognised that this is necessary for CONAF so that they can use and manage information produced effectively.

- In order to determine what actions are necessary to build CONAF's capacity to a sustainable position, a set of questions need to be asked, and the answers used to formulate a plan. These include: What is their capacity now? What needs are there? What resources are available? Are there areas which need consolidating and others which need starting? How can the research be integrated into a programme for increasing the capacity of CONAF?

- One delegate observed: "*some partners may be doing things themselves, so CONAF will not need to do it*". There is a need to use the network that exists (see above) and work with partnerships to use expertise efficiently.

Data standardisation / management

- A recurring theme throughout this session was the need to harmonise data into standard, comparable and globally acceptable formats, so that it may be shared effectively by the different people and organisations in the network. This not only applies to physical results, but also to documentation. These issues will be considered in Sessions 6 and 7.

- "*Getting primary data sets is important*", but their combined use will be more powerful if they can be compared.

"Following the comment of Dennis Aldridge, it is clear that there is a need to make decisions based on good information, rather than on sentimental attitudes."

The information cycle

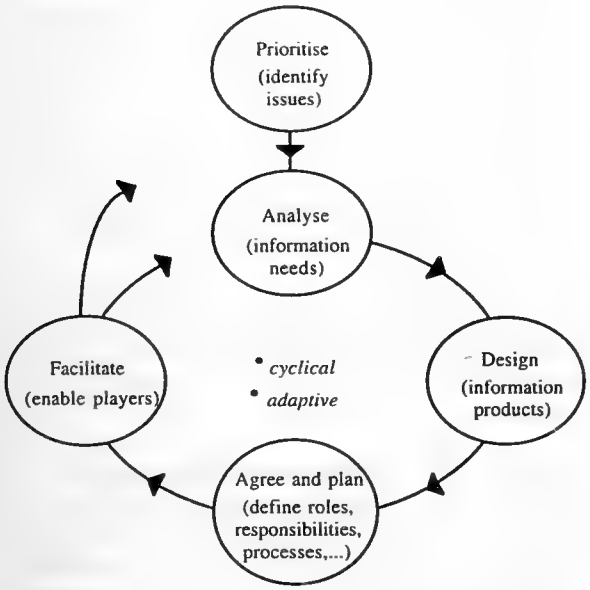
- The information cycle provides a framework for the development of a biodiversity information management system. The graphic below (Figure 5) shows first the need to determine key issues, then identifies information needs to address them. The issues and needs should be determined between the providers of data and the users of data; in this case between CONAF and the researchers. Information products are then designed to address key issues. A consensus was reached between delegates that products should be clear and simple, and it is hoped that the GIS will provide this sort of product helping CONAF to make decisions.

- One delegate commented on the flexibility of the cycle, and observed that even if the priorities change after this work-

shop, the process is 'cyclical and adaptive' and can vary where necessary. A further point was that the system could never be followed exactly - it is theoretical and is being applied to the real world - so should not impose constraints on any aspects of the project. For example one year ago mink was not stated as a problem, but it may now be necessary to find out more about it. Finally, different uses of the results were discussed. For example, species distribution data can be used by CONAF, or for environmental education.

"The use of data is the important part, and everything below must lead to it."

Figure 5 The information cycle.



Summary

- The information management framework presented in this session was well received by delegates, and it was agreed that this system is not only a useful tool for this research programme but is also more widely applicable.
- A significant resolution from this session was the need to remain flexible when undertaking a programme such as this. Not only do issues and priorities change, but so do the systems by which they may be addressed.
- This session highlighted the need to use the network of contacts which the programme has generated in order to make the most efficient use of expertise in producing information of use to park management.
- The rapprochement between scientists and CONAF was agreed to be highly beneficial to all parties. These links may lead to the development of different lines of research beyond the current Darwin Project.

"It is a complex environment, with many different players and complex issues, all of which need good information - the basic technical information is essential.."

Session 3: Project reviews

Monday 30th March, p.m.
Led by Sergio Herrera (CONAF) and Sam Rose (Raleigh International)

Aims

1. To review research undertaken in LSRNP between October 1997 and March 1998 - the first field season;
2. To present the basic criteria against which new project proposals should be developed.

The research completed during the first field season, (and one huemul survey undertaken in early 1997), has all been in direct response to priorities identified at the first workshop. Each researcher responded to the collective need by gathering information about their own taxonomic specialities, keeping in mind the relevance of the information collected to the management of the protected area.

In addition to undertaking research into more than half of the 20 priority taxonomic groups identified at the first workshop, the programme of research and data collection has also proceeded along the lines outlined in the Action Plan. As more information is produced by the researchers, CONAF are able to specify more exactly how future work should be undertaken to address their management goals and priorities.

Presentations

Brief summaries of each research project undertaken last year were distributed to delegates at the beginning of the workshop. These are outlined in Appendix 3. Those delegates in attendance who had been in the field showed some results from their work.

- María Eliana Ramírez (MNHN) presented details of the research into marine algae she undertook with David John in January and February 1998. *This presentation is summarised as a case study on the next two pages.*
- Gerardo Acosta (U. Chile) presented results from the research into the güiña undertaken with Ian Wyllie (ITE Monks Wood) between January and March 1998. This project is being supervised by Nigel Dunstone (U. of Durham).
- Mary Spencer-Jones (NHM) and Jaime Plaza (Raleigh staff) presented a summary of work undertaken on the marine biodiversity project between January and March 1998. This project involved 10 researchers from the UK and Chile, including María Eliana Ramírez (see above).
- Sergio Herrera and Sam Rose briefly presented key points from the lichen project (Wanda Quilhot and Mats Wedin) and from the insects and diatoms research (Steve Brooks, Kelly Jackson, Eileen Cox, Peter Hammond and Iain Sime).

Biodiversity and distribution of the marine benthic flora and fauna, and characterisation of biotopes in the Laguna San Rafael National Park (Aysén, Chile), and areas to the north

Raleigh International expedition 98A, phase 1, 18th January to 8th February 1998

Participants

David John (Marine algae - NHM), David Reid (Molluscs - NHM), Nicholas Evans (Marine ecology - NHM), Cecilia Osorio (Molluscs - Universidad de Chile), María Eliana Ramírez (Marine algae - MNHN) and 16 Raleigh International Venturers and staff.

General project objectives

To provide information about the species and habitats present in the area of the Laguna San Rafael National Park, and localities to the north of the park, to assist CONAF in developing a management plan for the area.

Specific objectives

1. Identify the intertidal and subtidal zone flora and fauna of LSRNP and the sector to the north (from the Golfo Elefantes to Isla Traiguén);
2. Accomplish an inventory of all the taxa encountered and present this data in the form of checklists or illustrated catalogues and in the latter case, to emphasise those species which are most representative of the area;
3. Classify, describe and map the marine benthic biotopes present in the area;
4. Identify potential effects of human activity on the marine benthic communities of the area and establish the status of conservation of the species and habitats;
5. Describe the distribution and abundance patterns of the marine benthic communities of the area and correlate with the main environmental variables.

Results

The preliminary results can be summarised as follows.

1. A total of 54 species of algae have been identified from an initial classification in the field: (32 Rhodophyta, 11 Chlorophyta, 1 Cyanophyta, 9 Phaeophyta and 1 Chrysophyta) and 21 species of invertebrates (5 bivalves, 11 gastropods, 1 echinoderm and 4 crustaceans).

2. Around 34 biotopes have been identified and classified in the following way:
   A.- Zonal biotopes of rocky shores: 12 to 13 characterised by algae, 8 characterised by animals, 2 by algae & animals;
   B.- Azonal biotopes of rocky shores: 4 to 5 characterised by algae;
   C.- Biotopes of soft sediment shores: 1 characterised by algae;
   D.- Provisional biotopes: 6 characterised by animals.

3. The biotopes and the diversity of algal species (probably also of animals) show a clear decrease within Laguna San Rafael in comparison to the areas sampled further north. This correlates with the reduced salinity present in the Laguna (20 ‰) more than with the decrease in water temperature.

4. The three areas sampled in or near the Laguna San Rafael National Park (Laguna San Rafael; Estero Elefantes and Golfo Elefantes) show differences in the composition and patterns of diversity of algae and biotopes, with the Laguna being the least diverse, the Estero being the most diverse and the Golfo having intermediate diversity.

5. Localised differences found in the biotopes and the species composition correlate with physical factors (type of substrate, slope of substrate, light, temperature, amount of exposure to the air, etc.) and biological factors (herbivory, competition).

6. The biotopes situated in wave-exposed situations tend to be dominated by animals, while those in sheltered areas are dominated by algae.

7. Only two seaweed-dominated biotopes are unique to the Golfo Elefantes and Laguna San Rafael, the *Mytilus-Adenocystis-Scytothamnus-Ceramium* biotope and the *Vaucheria* biotope.

8. The *Vaucheria* biotope is associated with the saltmarsh-type habitat to the immediate north of the San Rafael glacier; this association is probably related to the presence of extensive banks of mud in the intertidal zone rather than to reduced salinity alone.

Preliminary list of taxa of macroalgae collected along the approximately 187 km length of coastline samples in Region Aysén, from the Traiguén Island to Laguna San Rafael:

Total: 54 taxa, in 5 divisions

Division Cyanophyta (cyanobacteria)
1.- *Rivularia sp*

Division Chlorophyta (green algae)
1.- *Codium dimorphum*
2.- *Ulva rigida*
3.- *Ulva lactuca*
4.- *Enteromorpha ramulosa*
5.- *Enteromorpha compressa*
6.- *Enteromorpha intestinales*
7.- *Cladophoropsis brachyarta*
8.- *Prasiola tesselata*
9.- *Rhizoclonium ambiguum*
10.- *Cladophora sp*
11.- *Acrosiphonia pacifica*

Division Phaeophyta (Brown algae)
1.- *Macrocystis pyrifera*
2.- *Adenocystis utricularis*
3.- *Ectocarpus siliculosus*
4.- *Desmarestia patagonica*
5.- *Desmarestia ligulata*
6.- *Scytosiphon lomentaria*
7.- *Petalonia fascia*
8.- *Halopteris sp*
9.- *Scytothamnus asciculatus*

Division Chrysophyta
1.- *Vaucheria sp*

Division Rhodophyta (red algae)

1.- *Acrochaetium sp*
2.- *Nothogenia fastigiata*
3.- *Pugetia chilensis*
4.- *Callophyllis sp*
5.- *Corallina officinalis var. Chilensis*
6.- *Synarthrophyton patena*
7.- *Lithothamnion sp*
8.- *Mazzaella membranaceae*
9.- *Mazzaella laminarioides*
10.- *Iridaea tuberculosa*
11.- *Sarcothalia crispata*
12.- *Gigartina skottsbergii*
13.- *Ahnfeltia plicata*
14.- *Ahnfeltiopsis durvillaei*
15.- *Ahnfeltiopsis furcellatus*
16.- *Grateloupia doryophora*
17.- *Grateloupia intestinalis*
18.- *Prionitis lyalii*
19.- *Schyzymenia binderii*
20.- *Griffithsia sp*
21.- *Ceramium sp*
22.- *Catenella fusiformis*
23.- *Gelidium lingulatum*
24,. *Laurencia chilensis*
25.- *Heterosiphonia berkeleyii*
26.- *Myriogramme livida*
27.- *Pseudophycodrys phyllophora*
28.- *Cryptopleura sp*
29.- *Polysiphonia sp*
30.- *Bostrychia harveyii*
31.- *Porphyra columbina*
32.- *Hildenbrandia lecanellierii*

Preliminary list of animal taxa

Phyllum:

1.- Coelenterata: (medusas and actinias)
2.- Arthropods: (crustaceans; decapods, anphipods and cirripeds)
3.- Annelids: (polychaetes)
4.- Echinoderms: (asteroids, echinoids, holothurians, ophiuroids)
5.- Brachiopods
6.- Sipunculas
7.- Molluscs: (Polyplacophoras, bivalves, gastropods)
8.- Bryozoa
9.- Fish

Additional research into the marine environments of the Laguna San Rafael National Park and its surrounding area was undertaken on the second and third phases of the same expedition (98A).

Summary

- This session provided an opportunity to describe and review some of the research undertaken during the last field season. The main purpose was to review achievements to date and provide a context against which to make decisions regarding research to be undertaken in the next field season and in future;
- The advantage of projects where fieldwork was undertaken by scientists from both the UK and Chile was recognised. This is particularly so where the local flora or fauna is more likely to be known by Chilean researchers;
- Although all of the research projects could offer some information which might be of immediate use to CONAF, it is clear that the next stage - the analysis of results and working up of collections - will be a lengthy process;
- All but one of the principal project scientists wish to continue their work should it suit CONAF. They each highlighted why this would be of benefit to the research programme and how it might be undertaken;
- To support the last point, it was clear that much of the work undertaken so far is still preliminary, and would require continuation to be most effective.

Session 4: Using a Geographical Information System (GIS) for the management of biodiversity information

Tuesday 31st March, a.m.
Led by Sam Rose (Raleigh International)

Aims

1. To introduce the GIS - theory and background;
2. To show the potential of GIS as a tool for information management, using the ArcView software as an example.

Presentations

- Sam Rose (Darwin Initiative Project Officer - Raleigh International) gave a presentation about the use of GIS for the management and presentation of biodiversity information, drawing on examples of data gathered during the first field season.

Key discussion points

This presentation showed, by the use of examples, the possibilities made available using a GIS. Themes included:

- Integration and analysis of data from a number of different sources. For example, digital spatial data from WCMC, figures of visitor numbers from CONAF, or hand-input spatial data of study sites from the marine research project;
- Overlaying of different data layers (such as individual güiña home ranges) to show interaction between organisms;
- Use of different spatial scales (Region, LSRNP and within-LSRNP) to show different properties of the data and;
- The use of graphics to ease data interpretation.

Summary and examples

The installation of a basic, but useful and versatile GIS at the UGPS office in Coyhaique will be a crucial output of the programme. This system will enable CONAF to handle data produced by scientists in the field and use it for management and environmental education purposes in a manner not previously possible. It will also provide a management tool beyond this research programme which will be compatible with the recently released CONAF produced *Survey of the Native Forest Resources*, a complete survey of Chile's vegetation resources, based on GIS.

The following two pages illustrate examples of maps which may be created with a GIS by combining different data levels (data layers) to produce distinct information products.

Figure 6 shows three different maps relating to the algal diversity of the region, based on data collecetd by María Eliana Ramírez and Dave John in January and February 1998. Although Map 1 clearly shows the increasing algal diversity towards the north, this information is also displayed in chart form on the same sheet, so as to emphasise the differences and provide more detail.

Figure 7 shows the study area of the güiña research project along with some initial results. Based on the information presented in maps 1, 2 and 3, the fourth map on this sheet clearly shows how the home ranges (portrayed as minimum convex polygons) of all six tracked cats intersect in a small area centred on the CONAF ranger station.

Figura 6 Biodiversidad y distribución de algas
(Figure 6 Biodiversity and distribution of algae)

Mapa 1: Biodiversidad de algas entre Isla Traiguén y Laguna San Rafael
(Biodiversity of algae between Traiguén island and Laguna San Rafael)

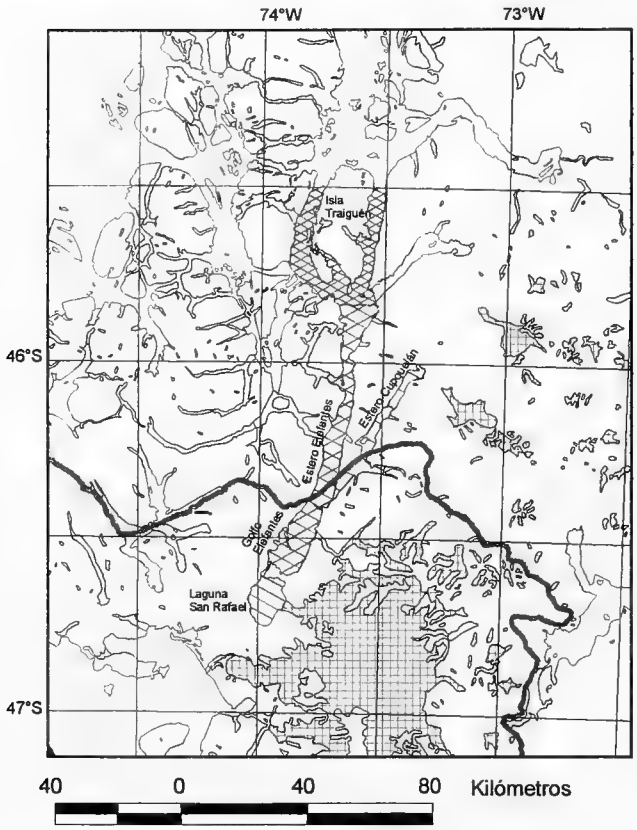
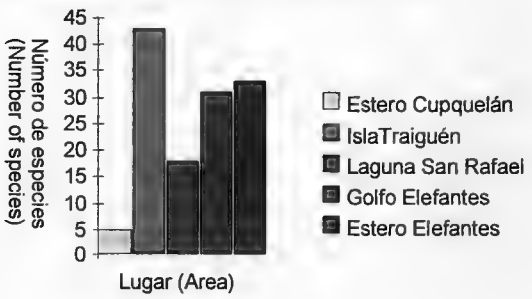


Gráfico de número de especies de algas
(Graph showing number of species of algae)



Leyenda (Key)

Número de especies de algas (Number of algal species)

- 1 - 5
- 6 - 18
- 19 - 33
- 34 - 43
- Distribución de Vaucheria sp.
- Distribución de Macrocystis pyrifera
- Biotopo Mytilus-Adenocystis-Scytothamnus-Ceramium
- Biotopo Bostrychia harveyi
- Hielo (Ice)
- Agua (Water)
- PNLSR límites - aprox. (LSRNP boundary - approx.)

Mapa 2: Distribución de dos especies de algas
(Distribution of two species of algae)

Mapa 3: Distribución de dos biotopos marinos (Distribution of two marine biotopes)

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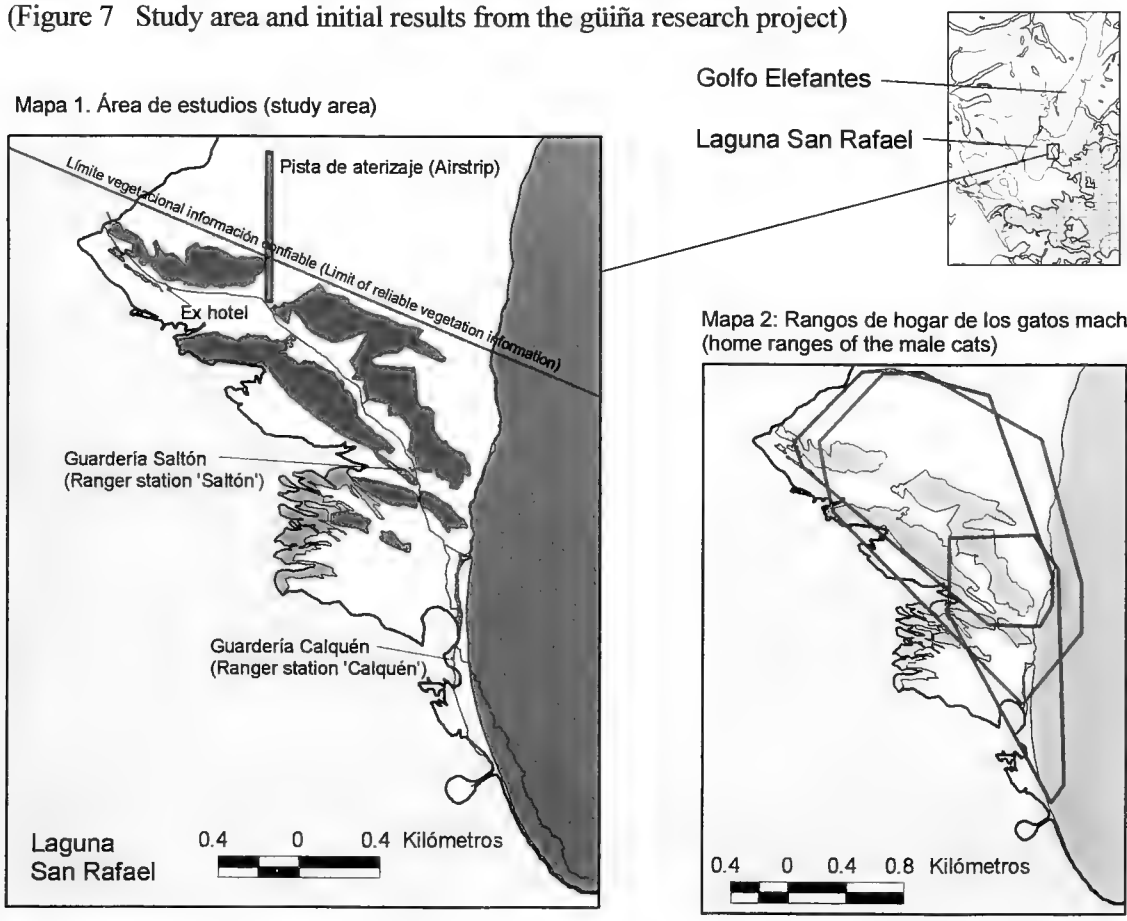
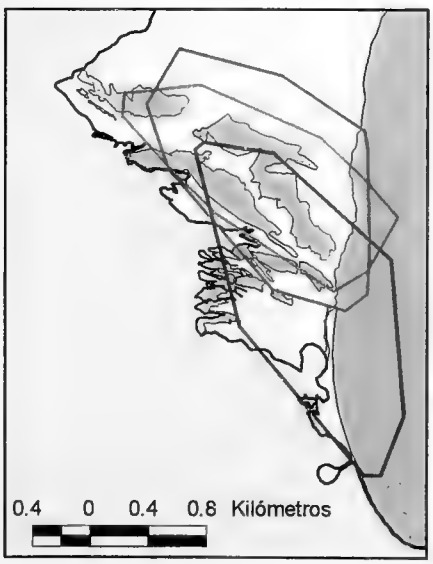
Figura 7 Área de estudio del proyecto güiña y resultados iniciales
(Figure 7 Study area and initial results from the güiña research project)



Leyenda (Key)

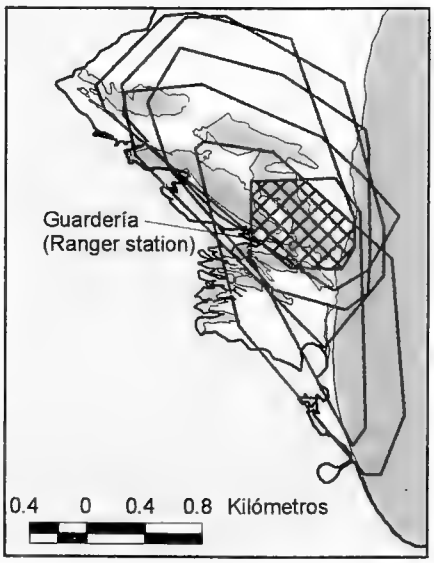
- Senderos (Trail system)
- Turbera (Salt marsh)
- Infraestructura (Infrastructure)
- Laguna San Rafael
- Vegetación mixta boscosa y arbustiva (Mixed forest and thicket vegetation)
- Ladera pronunciada - bosque / arbusto (Steep hillside - forest/thicket)

- Rango de güiña #1 - macho adulto (Range of kodkod #1 - adult male)
- Rango de güiña #2 - macho adulto (Range of kodkod #2 - adult male)
- Rango de güiña #3 - macho adulto (Range of kodkod #3 - adult male)
- Rango de güiña #4 - hembra adulta (Range of kodkod #4 - adult female)
- Rango de güiña #5 - hembra adulta (Range of kodkod #5 - adult female)
- Rango de güiña #6 - macho cría (Range of kodkod #6 - male kitten)
- Polígono de intersección de rangos de los gatos (Poygon of intersection of the cats' ranges)



Mapa 3: Rangos de hogar de los dos gatos hembras, y la cría macho (home ranges of the female cats, and the kitten)

Mapa 4: Rangos de hogar de todos gatos, y el polígono de intersección (home ranges of all cats and the polygon of intersection)



Session 5: CONAF's perspective

Tuesday 31st March, a.m.
Led by Dennis Aldridge (CONAF)

Aims

1. To review project progress from CONAF's perspective with particular reference to how the priorities identified at the first workshop have been addressed;
2. To define criteria by which projects proposed for the next field season should be developed.

Presentations

- Sergio Herrera reviewed the priority needs, information products and the Action Plan resulting from the first workshop.

- Dennis Aldridge presented CONAF's perspective of the project, which focused on the following points:

Information management
- The WCMC information management framework was acknowledged as an effective way of ordering and managing data, and essential for approaching the complex issues involved in this project.
- However, it was observed that such models are usually devised outside of the countries in which they are applied where the amount of baseline data is much greater than in the case of Chile - and in particular this region.

Priorities for research
- The first workshop produced a long list of taxonomic groups, leaving the possibility of research into many different aspects of biodiversity. This lacked focus because the priority needs were not clearly defined. In many ways the situation has not changed; CONAF still does not have specific priorities for the park, but need to know as much as possible.

CONAF's main criteria for choosing research projects for the next field season are summarised in the following box (Box 1).

Dennis Aldridge identified two further criteria:

- *Existing information*: There is information on plants and birds from the area, so it was suggested that delegates focus on groups for which there is little data, and;
- *Timescale*: Because of the limited time remaining, CONAF requested that some specific projects be defined which can be carried out over the next six months.

"The problem is difficult, rather messy in fact, it is a big park and there are lots of considerations - we are in a position where we need to give CONAF a steer on what to do."

Key discussion points

This discussion centred on the criteria mentioned above, and others which might prove useful.

Manpower
- If there is nobody from the UK interested in a certain field, could a Chilean who is interested take the lead in the research?
- Could Raleigh Venturers be used to undertake work for different research projects at the same location?

"One very important criteria is the availability of people to undertake the work."

Box 1 CONAF criteria for future research proposals.

CONAF criteria

Key issues facing park management

a) knowledge of biodiversity in and around the park
b) understanding the ecology
c) managing potential impact of people

Criteria for selection of priority projects

1. studies to concentrate on biological aspects only (no socio-economic components)
2. baseline surveys in areas of priority concern (e.g. under potential use from human populations) should:

a) include a range of taxonomic groups
b) cover a range of ecosystems/habitat/biota (e.g. marine)
c) consider species of conservation concern (e.g. threatened, endemics, medicinal)

3. there should be some continuity of lines of research
4. access and logistical problems should be addressed
5. any monitoring work should assess change in priority areas vis-à-vis tourism and in relation to global (climate) change
6. ecological studies (e.g. mink/other mammal interaction; population dynamics; distribution patterns)

Combining the above, key information products could be the use of the GIS to prepare a series of map overlays to assist in drawing together a zoning/park management plan. Other products could support use in scientific research and environmental education.

Existing information
- Is the whole idea of prioritising to concentrate more on groups about which little or nothing is known, rather than groups such as the vascular plants about which much is known?
- Perhaps alternative funding could be sought for work on groups about which a lot is already known, e.g. higher plants.

"The problem is that we need some way of deciding how to go from here, one way is to see what already exists - in very general terms for mammals, birds and higher plants."

Timescales
- Because of the limited time available, is it possible to use a number of different techniques on each individual project?
- Massive sampling at many places, of insects.for example, might be one way of getting information, but the amount of time it takes to work up the data is restrictive.
- In order to produce results quickly, could organisms be identified to a simple level (e.g. to family or genus)?

"There is only so much that can be done."

Quality and productivity as criteria
- Wanda Quilhot suggested that one criteria for which projects should continue might be to look at productivity of the researchers, to see how much work has been done in the first field season. This might be assessed by the number of papers produced, although it was recognised that papers can often take a very long time to reach publication.

- In response, Ian Gauld stated that the Darwin Initiative was not really set up as a means of producing high quality papers - many of which have limited use in the context of biodiversity conservation - and that papers which give a scientist good recognition are not necessarily the sort of papers that produce the information needed here.

"It is difficult to prioritise based on products because the priorities should be based on needs. If someone is unproductive, then the researcher should be changed rather than the project."

Specific problems

- In order to produce a set of focused priorities, rather than the general set which emerged from the first workshop, CONAF should identify exactly what problems the park faces or will face in the future.
- In response to this, Dennis Aldridge indicated that it is perhaps because the problems are not so clear at the moment that there is a need to get as much general information as possible in preparation for unforeseen problems.

One such problem facing LSRNP which was identified during this session was the use of marine environments, particularly the route into Laguna San Rafael.

A further potential problem facing the area is that of commercial activity, mainly tourism. Will any particular parts of the park be the focus of investment, and will any land be sold? In response to the first question, Dennis Aldridge commented that as yet there is little commercial activity of this type, but it is very likely in the coming few years. Regarding the second question, the possibility of park land being sold does not exist.

From the discussions in this session,the delgates identified a number of additional criteria to be taken into account when proposing projects:

- Logistical problems must be considered;
- Work should be done in priority areas;
- Continuity of projects will lead to monitoring;
- Ecological projects may not be achievable in the lifetime of this project.

Summary

- The criteria presented by CONAF were well received and provoked discussion. The participants could readily see their use for making future project proposals.

- One key conclusion was the identification of one specific problem facing LSRNP - that of marine environments - which the research can directly address.

Marine environments: case study

As can be seen from Figure 1, a sizeable area of the park is composed of water; parts of Golfo Elefantes, and Golfo de Penas, and all of Laguna San Rafael.

Figure 8 Marine research being undertaken in Laguna San Rafael

Technically, these areas are within the park, and CONAF recognises their jurisdiction over these zones. Nevertheless CONAF has not exerted the same authority over the marine areas as over the land. Following the Chilean Law 19,300 "Ley de Bases del Medio Ambiente" (1994), it is clear from articles 34 to 36 that CONAF is in charge of administering the system of protected areas, and is responsible for the management of the aquatic bodies, seashores, rivershores and wetlands included inside the perimeter of a national park, without prejudice to the corresponding authority of other government departments. Therefore there exists an overlap of functions which can lead to problems.

CONAMA's document "National strategy for the conservation and sustainable use of the biological diversity in Chile" in its version of April 1997, says in paragraph V. 1,2 "The protected areas in aquatic systems represent types of in-situ conservation, not only of the biological diversity associated to hydrobiological resources but also of the habitats and the ecological processes that maintain the structure and dynamics of the biological diversity components." The 1989 Fishing and Acquaculture law (18,892) establishes three categories of acquatic protected areas, namely: areas of management and exploitation of benthic resources; marine reserves, which protect continental and marine waters; and marine parks which protect exclusively marine waters. Of these two last categories, the reserves refer to both terrestrial and marine water bodies, and the parks only to marine areas. The outlined programme of this document include, amongst other points, the identification of aquatic areas representative of biological diversity, which need to be incorporated into a system of aquatic protected areas, and delimitation of responsibilities and institutional roles on which the system is based.

The workshop discussions about this important issue show that we are in a position to suggest a better delimitation of institutional roles in the case of LSRNP. We can also mention the importance of different marine ecosytems included within or associated to LSRNP which could form part of this system of protected acquatic areas. We need to address questions such as: are the biotopes found in particular areas? are they found both in protected and non-protected parts?

Although this is a very complex issue because of the involvement of several different government offices, this research programme will provide CONAF with high quality information that can be used to sustain CONAF's interests in LSRNP and its marine areas.

Session 6: The way ahead

Tuesday 31st March, p.m.
Led by Donald Gordon and Javier Beltrán (World Conservation Monitoring Centre)

Aims

1. To determine a set of research priorities for the 1998/99 field season in LSRNP

Presentations

- Delegates were divided into groups for this session and were asked to produce lists of project proposals for research in the next field season and beyond. Box 2 shows the guidelines used for this session, and reference material was provided in the form of the project summary forms (listing projects #1-7, see Appendix 3) and bibliography of research connected with LSRNP (see Appendix 5).

Tables 1,2 and 3 below show the results produced by each group.

Box 2 Guidelines for 'the way ahead' exercise.

The way Ahead

Given the criteria identified for park management, construct the table outlined below. The goal is for each group to derive a short-list of priority projects and provide justification for their choice. It is suggested that each group spend the first 45 minutes 'brainstorming' potential projects, followed by a further 45 minutes to rate ideas using a ranking system. Groups will then be asked to report back on their top project ideas (e.g. six) for consideration by park management.

In preparing the table below, resources available to consult include the Darwin objectives to the project, Proceedings and Action Plan from last year, list of projects completed and identified criteria

Priority projects	Personnel	Location	When	Access	Justification
1					
2					
3					
4					

Table 1 The Way Ahead - Group 1.

Priority Order	Project	Where	Justification (relates to the criteria in Box 1)	When	Logistical problems
1	Güiña (continuation)	Development zone of LSRNP	1,3,4,5 and 6	98/99	
2	Marine surveying (continuation of #5)	More exposed parts of LSRNP and Chonos Archipelago	1,3,4,5 and 6	99-	Difficult to access
3	Distribution of mink	LSRNP	1,2,4 and 6	98/99	
4	Ecology of birds and marine mammals	The navigation routes towards Laguna San Rafael	1,2,4 and 6	98/99	
5	Checklist of terrestrial and aquatic invertebrates in the priority areas (continuation of #3)	Soler, Neff and Steffen valley systems	1,2,3,4,5 and 6	98/99	Difficult to access
6	Baseline studies of the vegetation and fauna	Soler, Neff and Steffen valley systems	1,2,3,4,5 and 6	98/99	Difficult to access

Table 2 The Way Ahead - Group 2.

Projects and priority ideas	Description	Justification
1. Higher plants	Integrate existing information into the database	The information is hard to access
2. Insects	Continuation of studies and broaden the spatial and temporal coverage	Species or groups that are indicators of environmental change or quality
3. Marine biodiversity	Concentrate efforts on the higher diversity marine environments	These environments are widely distributed in LSRNP
4. Mammals	Continue with the study into the kodkod, in the same area and in other places	Species facing problems of conservation

Table 3 The Way Ahead, Group 3.

(Order of priority) Proposed Projects	Where	Who	Justification
Coastal ecosystems (2=) Molluscs and other phyla, Macroalgae, Macrophytes (3=) Freshwater and marine fish (2=) Marine mammals (6) Marine birds (except penguins)	Pacific coast and the more, sheltered fjords and lakes in LSRNP and on the Península de Taitao	MNHN NHM U. de Chile U. Austral	Improve the park's position as a marine protected area
Terrestrial ecosystems (3=) Amphibians (7) Vascular plants (5=) Cryptogams (1) Mammals (6) Birds	Within the priority areas (outside of LSR in the case of cryptogams)	MNHN NHM	The baseline necessary for undertaking advanced biological studies
Ecological studies (5=) Interactions between mink and other animals (4) Studies of other conspicuous species (e.g. guigna)	Priority areas (LSR, development zone)	U.Chile. NHMN U. Austral U. Durham	For research and environmental education

- CONAF's response: Dennis Aldridge gave the following response to the proposed research priorities.

Marine research
- High priority given by all groups. This could be an important change of emphasis and focus for CONAF.

Botanic information
- Very important to access and utilise what already exists. This could be used as a baseline for other studies and for example, for development of environmental education products.

Mink
- Although mink will be a problem in the park, much is known about their population ecology and behaviour from other studies around the world. Moreover, little can be done about them in the context of this project, apart from recording presence or absence in specific areas. For these reasons, the mink should be low on the list of research priorities.

Insects
- There is a keen desire to research the insect biodiversity - almost nothing is currently known about this group in LSRNP - and their use as indicator groups, although there is a need for a clearer definition of how this might be achieved.

Multi-tasking
- Could the scientist and Raleigh volunteer resources be used to better effect by undertaking more than one project in each area visited?

Summary of research priorities for 98/99 field season
The exercise described above was interpreted differently by each group. For this reason, and because each group comprised researchers from different specialities, it is not possible to draw an objective comparison and determine an absolute list of research priorities.

However there was some very clear correspondence between group outputs, and by drawing comparisons and taking note of CONAF's response the following summary lists of priority projects have been created. Level of priority indicates the relative level of endorsement for each of the different proposals.

Higher priority

- Marine biodiversity and distribution of biotopes in LSRNP and the Chonos Archipelago.
- Biodiversity of mammals in LSRNP, with an emphasis on the güiña.
- Species list of terrestrial and marine invertebrates in priority research areas, with an emphasis on insects.

Medium priority

- Cryptogams.
- Amphibians.
- Marine mammals.
- Baseline flora and fauna surveys in priority research areas.

Lower priority

- Freshwater fish.
- Marine and terrestrial birds.
- Distribution of mink in LSRNP.
- Higher plants.

Summary

- A number of common themes emerged in the priority lists produced by each group. In particular, marine research featured highly, as did mammal biodiversity, and the focus on individual endangered species.

- The lists produced give a clear and focused indication of what research might be undertaken during the next field season, and beyond, should funds allow.

- There was a clear indication given by all of the groups that the continuation of existing research into the next field season and beyond would be beneficial.

- CONAF provided a very clear indication, based on the suggestions shown above, of how they would like the research to continue.

Session 7: Sustaining the project

Wednesday 1st April, a.m.
Led by Donald Gordon and Javier Beltrán (World Conservation Monitoring Centre)

Aims

1. To discuss how the research programme might be continued past the end of Darwin Initiative funding;
2. To determine how a continued research programme would be sustainable in the long-term.

Presentations

- As for the previous session, delegates were divided into groups for this session and were asked to discuss how to make the programme sustainable in the long-term. Box 3 shows the guidelines used for this exercise.

Boxes 4, 5 and 6 show the results from each group

Box 3 Guidelines for 'sustaining the project' exercise.

Sustaining the project

The long-term sustainability and success of the programme being developed at Laguna San Rafael National Park is dependent on a number of key considerations. These include:

- Strategic development of research and long-term monitoring activities;
- Information management to support park goals and objectives, scientific research and environmental education;
- Capacity building of CONAF (and potentially other partners);
- Available funding.

Each group is to prepare a Strategic Plan for the project covering the aspects identified above. Each aspect could be presented along the following lines: (for example, for capacity building)

a) a short introduction / justification;
b) priority activities (including timing and responsibilities) and process;
c) implementation, outlining partnerships and potential sources of funding.

Box 4 Sustaining the Project - Group 1.

Strategy to continue research activities:
1. Create a consultative / assessment committee of scientists;
2. Continue with the administrative management of the research programme;
3. Extend the biological studies to include socio-economic aspects.

Management of information:
1. Increase public awareness of LSRNP;
2. Involve other public institutions, organisations.

Capacity building of CONAF:
1. Maintain and increase contacts with researchers;
2. Involve models from other national parks;
3. Improve contacts with UGPS of other regions.

Box 5 Sustaining the Project - Group 2.

1. Fungi and terrestrial invertebrates:
Introduction: Systematic and ad-hoc collections of different groups to constitute a collection in a known depository.
Justification: Constitutes 95% of terrestrial biodiversity.
Activities: Collection and conservation of specimens by MNHN, NHM, Raleigh Venturers, Guardaparques. Training of CONAF personnel in the collection of insects.
Financing: Darwin, British Council, CONAF.

2. Comparative study of fjords:
Introduction: Framework for the creation of a study area in marine environments in the south of Chile.
Justification: Strategic, political and biological.
Activities: Seek funds and prepare project proposals for the implementation of the idea.
Financing: E.U., WWF, National Geographic, Packard Foundation, NINA, British Council.
Responsible: Marine advisory group.

3. Organisation of information:
Introduction: Someone to co-ordinate and integrate existing information which has been collected from LSRNP, and to create a database.
Justification: It is necessary to arrange information in order to determine / address priorities.
Activities: To create a long-term post for the management of information. This might be within CONAF or external.
Financing: CONAF, British Council, WWF, etc.

Box 6 Sustaining the Project - Group 3

1 Development strategy for research activities and their continuation:

Introduction / Justification
- National parks are representative samples of ecosystems of national value;
- National parks are standards for comparison and the source of diversity and genetic heritage;
- LSRNP has international value as a UNESCO designated Biosphere Reserve;
- Chile has made an undertaking for the protection of biodiversity (Convention for Biological Diversity);
- Geopolitical reasons.

Activities
- Complete baseline studies;
- Establish priorities for ecosystem studies;
- Monitoring of the baseline information (for natural or man-made changes).

Implementation
- CONAF;
- Universities;
- International Organisations (e.g. UNDP);
- National institutions (e.g. FONDECYT);
- Political support for funding specific projects;
- Support of key people in the scientific world;
- Sponsors (e.g. companies).

2. Management of information, scientific proceedings and environmental education:

Introduction / Justification
- Availability, access and security of the information.;
- Knowledge, value, respect, defence of biodiversity;
- Dissemination.

Activities
- Compilation of information obtained from the work and from other sources;
- Scientific publications and the dissemination of biodiversity information at different levels (primary, secondary, universities and scientists);
- Workshops, seminars - meetings for the dissemination and integration of information.

Implementation
- same as for section 1.

3. Capacity Building of CONAF (and other partners):

Introduction
- Define the institutional status of CONAF - it is currently a "Corporación de Derecho Privado", meaning a partially private corporation;
- Define CONAF's role in the administration of coastal or marine areas, without prejudice to the competence of other institutions.

Activities
- Achieve a protected marine area as an annex to LSRNP, or better, to obtain the guardianship over it;
- Strengthen CONAF's research and information management abilities;
- Improve the administrative management of CONAF.

Implementation
- same as for section 1.

Key discussion points relating to sessions 6 and 7

The Way Ahead - exercise
- The diversity of solutions proposed to the tasks set was fascinating. The groups produced results at three very different levels, and although there are some important coincidences, they are each remarkably different.

Biodiversity in Chile
- Chilean biodiversity, in particular its insect fauna, is very different to the rest of South America, with a large number of endemics. In conservation terms Chile should be a global priority, an issue of relevance at the national and international levels.

Tropical vs. temperate
- There has been a long-standing bias towards researching biodiversity in the tropics at temperate zones' expense. This type of project will help to overcome this.

Steering committee
- This project has started a useful and productive process. To maintain this system, either a steering committee, or advisory groups for research themes would be most beneficial.

Key personnel
- Importance was placed on involving strategic personnel in the project for political and for fund-raising support.

The following two themes (discussed in detail earlier) were re-emphasised at this point:
- The importance of a central co-ordinator or hub to facilitate links between project partners;
- Capacity building for CONAF (staff and technology) as a means of making the project sustainable.

Summary

- This session emphasised aspects of the current research programme which are working well and should be continued:
  - It provided three very different perspectives on how the programme may be sustained in the long term - three frameworks for the future;
  - It provided a concise description of how a future research programme may take shape;
  - It shows the willingness by all parties towards continuation of the programme;
  - This type of exercise was effective in drawing on a wide range of skills and expertise to produce a variety of different possible scenarios;
  - The range of different ideas and possibilities for increasing the network and expanding the scope of the research programme was encouraging;
  - The importance of a number of key issues were re-emphasised during this session: a steering committee or scientific advisory group for CONAF, and information management.

Session 8: Workshop summary

Wednesday 1st April, a.m.
Led by Dennis Aldridge (CONAF)

Aims

1. To present CONAF's closing comments of the meeting;
2. To outline the key workshop conclusions;
3. To present an updated action plan.

Closing remarks: Dennis Aldridge

Information management (I)
- Funding for both Darwin Initiative project co-ordinators is limited. CONAF have a real concern that the situation might revert to pre-Darwin Initiative once the funding runs out, and they might be left with sophisticated equipment on the table without the necessary expertise to use it. One solution might be the creation of a position to manage information at a regional level. It is possible that external funding could be sought for the position.

Information management (II)
- One possibility would be for the MNHN to coordinate biodiversity information, as the main depository of specimens. However, they do not currently have the resources to undertake this task.

Collections
- NHM and MNHN could combine to create a reference collection of specimens which could either reside in Region XI or be lent out from the museums as appropriate.

Marine areas
- There is a strong desire to research the marine systems as a whole. This is not necessarily with the aim of creating new marine protected areas, but it is an area which needs further research and one for which bureaucratic issues could prove problematic.

Baseline studies; invertebrates
- There is a need to improve the knowledge of this group - particularly the insects - in the region, and also to look at the way this research is undertaken.

Steering committee / advisory groups
- This is an excellent idea and might either involve people who have worked in LSRNP or just provide guidance to CONAF. This should really be operated CONAF-wide, but as it stands would probably only be able to be done for LSRNP.

"What CONAF are doing here is good, and it would be impossible to go back to square one.

The success of this locally is very clear"

Key workshop conclusions

Collaboration and partnerships

- It was clear that co-operation of personnel from a number of key organisations, each drawing on their personal and institutional specialities, was critical to the success of the project to date.

- Direct collaborations in the field between Chilean and UK-based researchers were regarded as the most effective, and efficient, form of partnership, and should be encouraged wherever possible. It was also agreed that post-fieldwork meetings and seminars are very productive.

Programme objectives

- It was concluded that although the programme is meeting the majority of the objectives outlined in the original Darwin Initiative proposal, some areas (notably training) need more attention.

Information management

- Access to information produced by this programme is an issue needing further discussion and clear resolution. Specific mechanisms for data access should be determined and all partners should agree terms.

- The WCMC biodiversity information management framework was widely recognised as being a logical tool for application in this project and that it might be applied more widely.

- It was agreed that the action plan proposed after the first workshop has been successfully implemented, but that the updated plan (see next page) should remain flexible and adaptive, in line with the biodiversity information management framework.

- The need for capacity building within CONAF was recognised. In particular, immediate training is required to make effective use of the Geographical Information System.

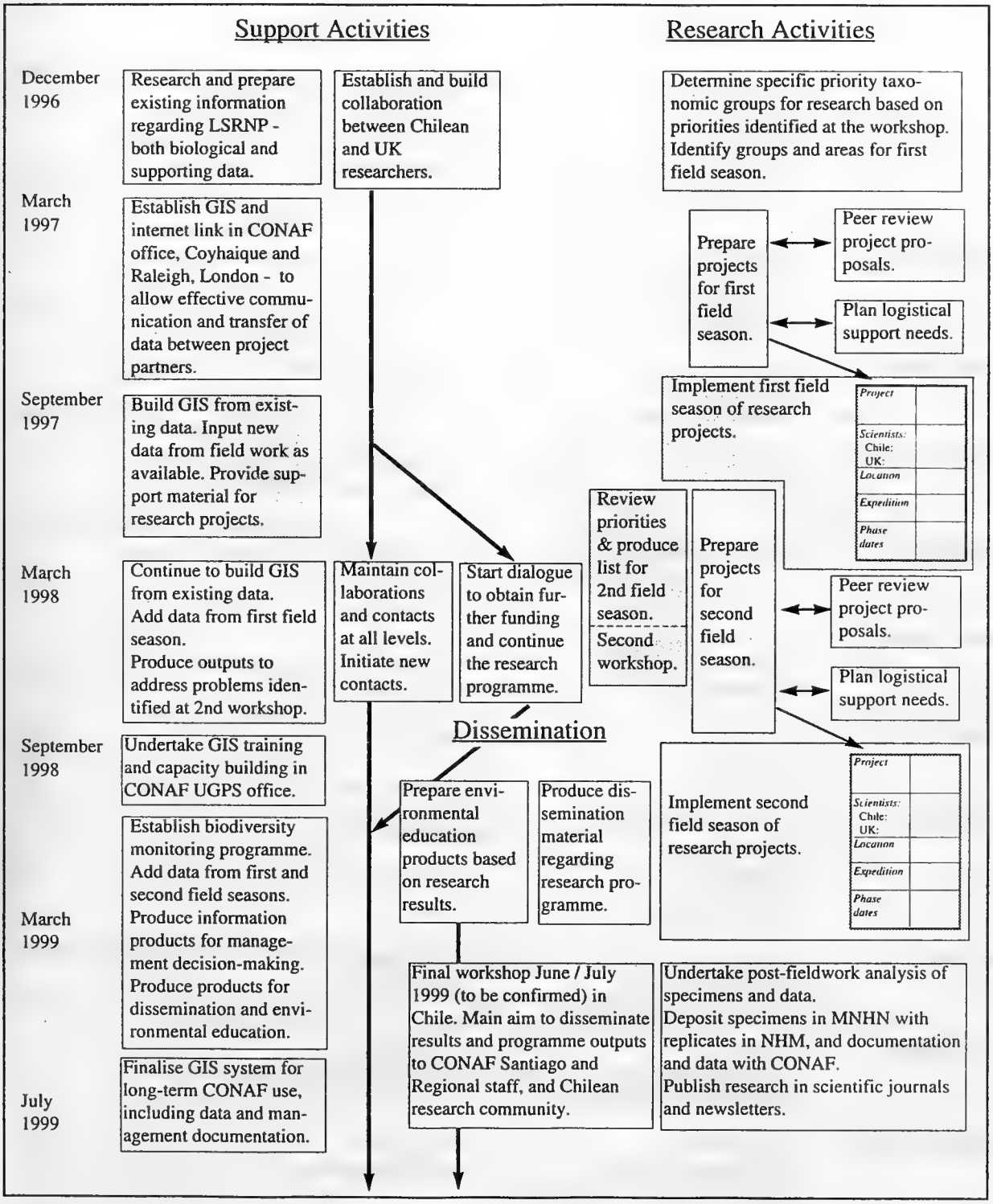
Long-term continuation

- There was unanimous agreement to make all possible efforts to maintain momentum and prolong the research programme beyond the lifespan of the Darwin Initiative grant.

- A consensus was reached that this programme might be used as a model to apply to other protected area or other regions in Chile, resources permitting.

Project Action Plan: December 1996 - July 1999

The following schematic diagram shows a revised action plan, determined by CONAF and Raleigh staff as a result of discussions during this second workshop. Shaded boxes show work already undertaken, and actions in clear boxes provide a schedule within which to achieve the revised project goals, with milestones necessary for the successful completion of the research programme. The overall plan has not changed substantially from that produced from the first workshop, but builds on the work undertaken to date and includes some new, specific tasks.



Appendix 1: List of delegates and project contact details

Name	Address	Telephone Email	Fax
Gerardo Acosta J.	Laboratorio Ecología Facultad de Cs. Veterinarias U. de Chile Av. Sta. Rosa 11.735 La Pintana Santiago, CHILE	56 2 681 5518 56 2 273 4820 esc-vete@abello.dic.uchile.cl (subject: Gerardo)	541 6840
Dennis Aldridge V.	U.G. Patrimonio Silvestre CONAF XI Región Bilbao 234, Piso 2 Coyhaique, CHILE	56 67 237070 ugps-xi@entelchile.net	237070
Cristian Bain L.	CONAF U.G. Patrimonio Silvestre CONAF XI Región Bilbao 234, Piso 2 Coyhaique, CHILE	56 67 237070	237070
Javier Beltrán	WCMC 219 Huntingdon Road Cambridge CB3 ODL, UK	44 1223 277314 Javier.Beltran@wcmc.org.uk	277136
Ariel Camousseight	Sección Entomología Museo Nacional de Historia Natural, Casilla 787, Santiago, CHILE	56 2 6814095 acamousseight@mnhn.cl	6817182
Jonathan Cook	Raleigh International, 27 Parsons Green Lane, London SW6 4HZ, UK	44 171 3718585 jc@raleigh.org.uk	3715852
Paula Cruces P.	SAG, XI Región Aysén Casilla 12-D Coyhaique, CHILE	56 67 231174 lperez@sag.minagri.gob.cl (subject: Paula Cruces)	231174
Emma Elgueta	Las Pircas 7390 Las Condes Santiago, CHILE	56 2 211 3040	
Gerardo Elzo A.	U.G. Patrimonio Silvestre CONAF X Región Amunátegui # 500 Casilla 792 Puerto Montt, CHILE	56 65 290711 / 290712	
Ian Gauld	Department of Entomology Natural History Museum London, SW7 5BD, UK	44 171 938 8809 idg@nhm.ac.uk	938 8874
Donald Gordon	WCMC 219 Huntingdon Road Cambridge CB3 ODL, UK	44 1223 277314 donald.gordon@wcmc.org.uk	277136
Sergio Herrera E.	Proyecto Darwin U.G. Patrimonio Silvestre CONAF XI Región, Bilbao 234, 2 piso Coyhaique, CHILE	56 67 237070 ugps-xi@entelchile.net	237070

Name	Address	Telephone Email	Fax
Fernando Jara	Laboratorio de Ecología Acuática Universidad Austral de Chile Casilla 1327 Puerto Montt, CHILE	56 65 255243 fjara@uach.cl	277141
Jaime Plaza	33 Beaufort Road London, W5 3EB, UK	44 181 997 6524 Jaime2312@hotmail.com	
Wanda Quilhot	Universidad de Valparaíso Escuela de Química y Farmacia Casilla 92-V Valparaíso, CHILE	56 32 281952 wquilhot@uv.cl	973016
María Eliana Ramírez	Sección Botánica Museo Nacional de Historia Natural Casilla 787 Santiago, CHILE	56 2 681 4095 mramirez@mnhn.cl	681 7182
Sam Rose	Darwin Initiative Project Raleigh International 27 Parsons Green Lane London, SW6 4HZ, UK	44 171 371 8585 sam@raleigh.org.uk	371 5116
Mary Spencer-Jones	Department of Zoology Natural History Museum Cromwell Road, London SW7 5BD, UK	44 171 9389302 msj@nhm.ac.uk	9388754
J.C. Torres-Mura	Sección Zoología Museo Nacional de Historia Natural Casilla 787 Santiago, CHILE	56 2 681 4095 jtorres@mnhn.cl	681 7182

Acronyms:

CONAF:	Corporación Nacional Forestal , Chile
MNHN:	Museo Nacional de Historia Natural, Chile
NHM:	Natural History Museum, UK
SAG:	Servicio Agrícola y Ganadero, Chile
WCMC:	World Conservation Monitoring Centre, UK
CONAMA:	Comisión Nacional del Medio Ambiente, Chile
BC:	The British Council, Chile
ITE:	The Institute of Terrestrial Ecology, UK

Contact details for more information about the project:

Chile **Sergio Herrera E.**, CONAF UGPS, XI Region, Bilbao 234, Piso 2, Coyhaique, Chile.
Tel: +56 (0)67 237070, Fax: +56 (0)67 237070 Email: ugps-xi@entelchile.net

UK **Sam Rose**, Raleigh International, 27 Parsons Green Lane, London SW6 4HZ, UK.
Tel: +44 (0)171 371 8585, Fax: +44 (0)171 371 5116, Email: sam@raleigh.org.uk

Appendix 2: WCMC presentation

Overview: Components of a Biodiversity Information Management System

30 March - 1 April 1998
Coyhaique, Chile

Information in Support of Sustainable Development

There is increasing pressure to make informed decisions on the basics of sound information, balancing conservation and resource use issues, and providing alternatives and options in support of sustainable development.

Information for Decision Support

- decision support
  - timely, comprehensive and accurate information needed to solve problems
  - presented in an understandable form
- complexity of environmental issues
  - multiple agencies and multiple disciplines involved
  - difference between project-based (tactical) and decision-support (strategic) systems

Key issues

- organisational/people issues need to be given priority
- development of collaborative arrangements and effective management of custodianship are vital
- data harmonisation, quality assurance and data documentation are also important

Information Management Contexts

- Local planning and resource management
- National policy development and implementation
- Regional and international initiatives and conventions

Local

- everyone is a decision maker
- information needs to be relevant at this level
- conflict between human need and environmental sustainability
- conflict between local resource requirements and national policy
- problems arising from cumulative impacts and 'tyranny of small decisions'

National

- policy responses to needs from local to international scales
- level at which sovereignty over environmental resources is recognised
- policies and programmes provide framework for environmental management
- sustainable development is inhibited by a lack of strategic information infrastructure

International

- conventions and agreements
  - obligations on states to report, leading to increased accountability
  - need to harmonise reporting obligations

International Conventions

- provisions related to information management, training, technology transfer are outlined in
  - Rio Declaration on Environment and Development
  - Convention on Biological Diversity
  - Convention on Climate Change
  - Ramsar Convention
  - ...

Example: CBD

- entered into force 1993
- now ratified by over 170 countries
- objectives include
  - "conservation of biological diversity"
  - "sustainable use of its components"
- promotes effective information management, capacity building and support for decision-making

Project (tactical) system

	Issues	
Decision-maker level	User needs	Information delivery
Operational level	Data	Information technology

National (strategic) system

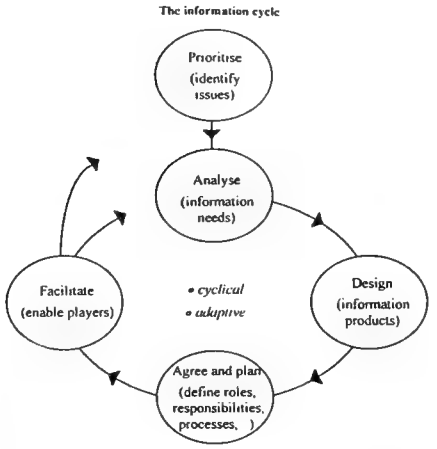
	Issues		
Decision-maker level	User needs		Information delivery
Organisational level	Networks	Custodianship	Capacity
Operational level	Data		Information technology

Processes for Managers and Decision-Makers

Information Cycle

- identify and prioritise issues demanding information
- determine the information needs of decision-making audiences
- design information products to address these needs
- define data and processing needed
- agree roles and responsibilities for information production
- enable players to fulfil their roles
- review performance

Information Cycle



Overview: Components of a Biodiversity Information Management System

1 Information and Policy
- establishing the basics
- linking information management and policy development

Overview: Components of a Biodiversity Information Management System (cont)

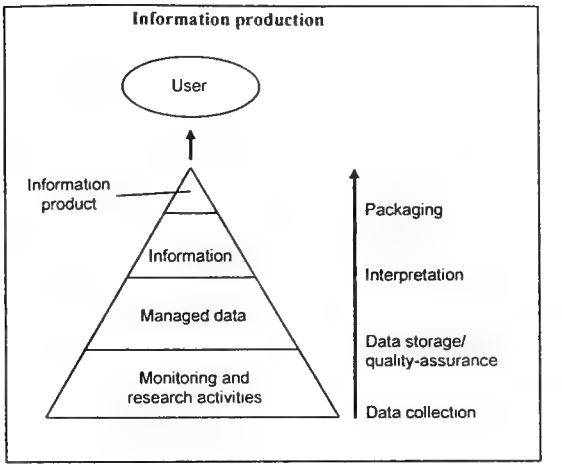
2 Information Needs Analysis
- why the analysis is necessary
- how it is done

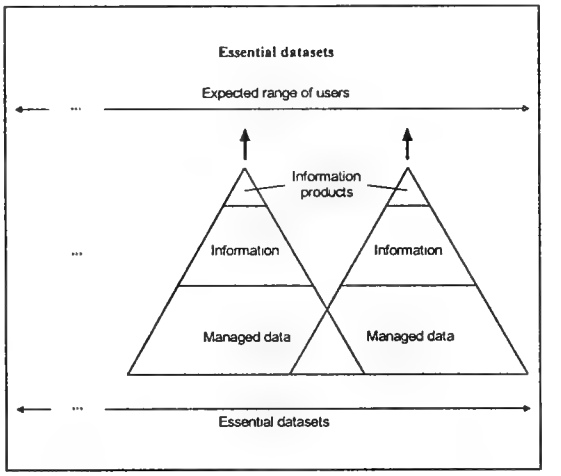
Overview: Components of a Biodiversity Information Management System (cont.)

3 Information Product Design
- what are good information products
- analysing data and processing needs
- developing and packaging products

Overview: Components of a Biodiversity Information Management System (cont.)

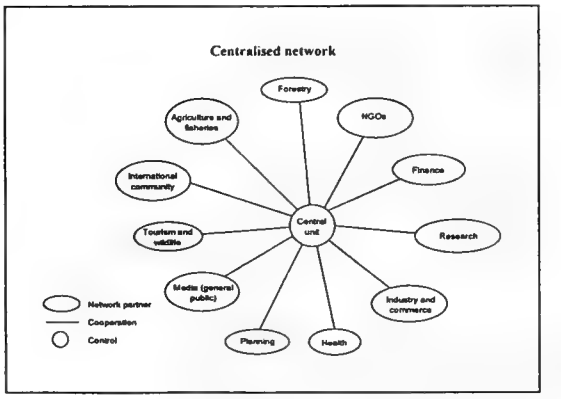
4 Information Networks
- network structures and operation
- roles and responsibilities

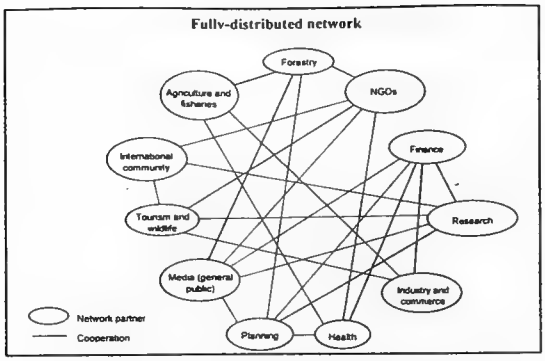


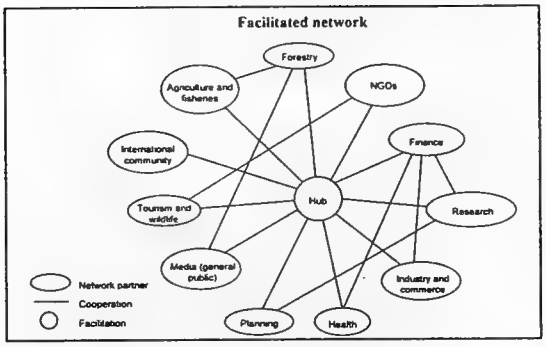


Network architectures

- centralised
- fully distributed
- facilitated







Overview: Components of a Biodiversity Information Management System (cont)

5 Data Custodianship and Access
- principles and management of custodianship
- data access agreements

Custodianship

- what is it?
- the custodian of a dataset is the agency, department, unit or individual best able to manage the dataset effectively
- custodianship can work at many levels

Responsibilities of custodians

- to co-ordinate the development of a dataset (perhaps in partnership)
- to maintain a dataset (e.g. update, backup)
- to ensure the quality of a dataset (e.g. adherence to standards, documentation, audit trail)
- to advise on appropriate uses of a dataset
- to provide access to a dataset

Rights of custodians

- to regulate access to a dataset (e.g. to prevent commercial exploitation or environmental risk)
- to safeguard intellectual property and copyright (e.g. acknowledgement by users, regulation of copying/ distribution)
- to receive feedback from users on data quality/ future requirements of a dataset (resource implications to be negotiated)

Responsibilities of users

- give feedback on perceived quality/reliability
- give feedback on requirements anticipated in the future
- observe standards set by the custodian
- keep custodian informed of usage, products generated

Access agreements

- access conditions for different classes of user (e.g. commercial, government, research, NGO...)
- details of any transaction costs
- permitted/ excluded uses
- how/ whether to distribute to third parties
- how to acknowledge
- a disclaimer

Overview: Components of a Biodiversity Information Management System (cont)

6 Information Management Capacity
- identifying strengths and weaknesses
- capacity building

Overview

- assessment of current capacity
- analysis of needs
- planning (to strengthen capacity in areas identified as deficient)
- capacity building

Assessment

- what to assess
  - data resources
  - facilities relating to information production (from data collection through to product packaging
  - human resources
  - institutional linkages/partnerships
- who to assess
  - network members,...others?

For more information contact

WORLD CONSERVATION MONITORING CENTRE

Email: info@wcmc.org.uk

Appendix 3: Project summaries

1. Biodiversity of mammals in LSRNP, with a focus on the kodkod

Principal researcher & institution — Nigel Dunstone (University of Durham, UK).
Associated researchers & institution — Leon Durbin (ITE Banchory, UK), Ian Wyllie (ITE Monks Wood, UK), Gerardo Acosta (U. de Chile, Chile).
Taxonomic groups — *Oncifelis guigna*, mammals, birds.
Study area — Development zone of LSRNP.
Dates — October 1997 - March 1998.

Project description

- Over six months, six kodkod were captured using live-traps, marked with ear-tags and PIT tags and fitted with radio collars. Their activity and home ranges were monitored throughout the day and night.
- Faeces samples were collected and tissue samples taken from the cats for dietary and genetic analysis.
- Automatic camera traps were used throughout the study area to monitor mammal diversity and detect the activity of animals in diverse habitats.
- Some mist-netting of birds was undertaken in order to register the presence of species in the area and to examine the characteristics of individuals.

Other meetings and / or contacts

Agustín Iriarte(SAG, Chile), Jaime Rau / David Martínez (U. de Los Lagos, Osorno, Chile), Juan Carlos Torres-Mura (MNHN)

Seminars

Nigel Dunstone gave a presentation called "*Ecology and pest status of the American Mink in the British Isles*", in the Facultad de Ciencias, of the Universidad de Chile on December 15, 1997.

2. Epiphytic macrolichens as a tool for the evaluation of forest biodiversity in LSRNP, and lichen collection for diversity and physiology studies

Principal researcher & institution — Mats Wedin (NHM, UK), Wanda Quilhot (Universidad de Valparaíso, Chile).
Taxonomic groups — Lichens.
Study area — Development zone of LSRNP and north side of Laguna San Rafael.
Dates — November 1997.

Project description

- Mats Wedin sampled the Nothofagus forest to the north of Laguna San Rafael, in order to describeits epiphytic lichen flora.
- Samples of lichens and lichenicolous fungi were collected from along a gradient from sea level to 250 metres altitude.
- Wanda Quilhot collected samples of a few lichen species for the analysis of change in UV protecting substances.
- Prof. Quilhot also collected samples of lichens from a particular species of tree in order to compare biomass under different conditions of substrate and light.

Seminars

Mats Wedin gave a talk in the Escuela de Química y Farmacia, Facultad de Medicina, Universidad de Valparaíso, titled "*Phylogeny and evolution of Caliciales (Ascomycotina) using rDNA sequences*", on November 25 1997.

3. A study of chironomid midges, diatoms and dragonflies in lakes and rivers of the southern Andes

Principal researcher & institution — Stéve Brooks (NHM, UK), Eileen Cox (NHM, UK).
Associated researchers & institution — Kelly Jackson (NHM, UK), Iain Sime (NHM, UK), Keith Bennett (University of Cambridge, UK -(consultant).
Taxonomic groups — Chironomid midges, diatoms and dragonflies.
Study area — The Leones and Neff valleys, on the eastern side of the North Patagonian ice-cap.
Dates — January - March 1998.

Project description

- Samples of chironomids and diatoms were taken from distinct bodies of water at altitudes ranging between 200 and 1500m asl.
- Adult chironomids were collected using hand nets, flight-interception traps and malaise traps; pupae were collected from the surface of the water using plankton nets; larvae were collected from the surface of rocks. Sediment samples were also taken by hand, with a corer and using an Ekman Grab.
- Other aquatic insects were also collected using the same methods.
- Measurements were taken of the physical and chemical properties of water, and water samples were taken and preserved for further analysis in the laboratory.
- Adult dragonflies were captured using hand nets.
- Samples of diatoms were taken from the edge of lakes and from the surface of rocks in lakes and rivers.

Other meetings and / or contacts:

José Arenas (Universidad Austral de Chile), Chile. Patricio Rivera (Universidad de Concepción, Chile).

4. A preliminary survey of the beetle fauna of the southern Andes

Principal researcher & institution Peter Hammond (NHM, UK).
Associated researchers & institution Kelly Jackson (NHM, UK).
Taxonomic groups Beetles.
Study area The Leones and Neff valleys, on the eastern side of the North Patagonian Ice-cap.
Dates January - March 1998.
Project description

- Samples of beetles were taken from distinct bodies of water at altitudes ranging between 200 and 1500 metres above sea level.
- The beetles and other insects were collected using hand-nets, flight interception traps and Malaise traps.
- Beetles were collected from trees and shrubs.

5. Marine biodiversity and the distribution of biotopes in LSRNP and the Chonos Archipelago

Principal researcher & institution Gordon Paterson (NHM, UK), David John (NHM, UK).
Associated researchers & institution María Eliana Ramírez (MNHN, Chile), David Reid (NHM, UK), Cecilia Osorio (U. de Chile, Chile), Nick Evans (NHM, UK), Mary Spencer-Jones (NHM, UK).
Taxonomic groups Algae, molluscs, crustaceans, polychaetes, echinoderms, bryozoa and sponges.
Study area Between the Laguna San Rafael (46° 40'S) and the Isla Traiguén (45° 40'S).
Dates January - March 1998.
Project description

- Biotopes and marine habitats in the intertidal zones were surveyed using transects and quadrat methods. The subtidal areas near the shore were sampled with small grapnels and dredges.
- Salinity, pH and temperature were measured in all of the study locations and hydrographic profiles were undertaken in specific areas in order to increase understanding of the biotopes and the marine system in general.
- Collections of marine algae and fauna were undertaken, with the aim of making an identification guide of aquatic biodiversity.
- Artificial substrates were located strategically for the long term monitoring of settlement and colonisation by organisms.
- Observation of marine vertebrates were made, in particular of: penguins; seals; otters; cetaceans; and land mammals.

Other meetings and / or contacts
Nicolás Rozbaczylo (Pontificia Universidad Católica de Chile, Chile).

6. Biodiversity of terrestrial and freshwater molluscs in LSRNP and the Chonos Archipelago

Principal researcher & institution Sergio Letelier (MNHN, Chile).
Associated researchers & institution David Reid (NHM, UK), Cecilia Osorio (Universidad de Chile, Chile).
Taxonomic groups Land and freshwater molluscs.
Study area Between the Laguna San Rafael (46° 40'S) and the Isla Traiguén (45° 40'S).
Dates February - March 1998.
Project description

- Terrestrial and freshwater molluscs were collected and their ecology studied throughout the study area.

Other Meetings and / or contacts
Nick Evans, David John, David Reid, Gordon Paterson, Mary Spencer-Jones (NHM, UK).

7. Diversity of copepods in LSRNP

Principal researcher & institution Geoff Boxshall (NHM, UK).
Associated researchers & institution Paul Clark (NHM, UK).
Taxonomic groups Copepod crustaceans, decapod crustaceans and other marine taxa (see #5).
Study area Laguna San Rafael, Río Negro, Bahía San Quintín and Golfo San Esteban.
Dates February - March 1998.
Project description

- Copepods (in all life stages) were collected from a number of different habitats, including: freshwater; glacial water; brackish and cold-water brackish; and marine.
- The marine surveying described in project #5 was continued in the area of the Bahía San Quintín - previously unexplored.
- Copepod parasites were collected from fish and invertebrates.

Meetings and / or contacts
Doris Soto (Universidad Austral de Chile, Chile), Fernando Jara, Carlos Jara (Chile), Pedro Báez (MNHN, Chile).
Seminars
Geoff Boxshall gave a talk called "*Advances in the biology and control of sea lice*" in the Universidad Austral de Chile, Puerto Montt on March 4. Paul Clark gave a talk "*Larval rearing techniques for decapod crustacea*" in the MNHN on March 9 1998.

Appendix 4: Workshop assessment

Participants completed an assessment form, prepared by the World Conservation Monitoring Centre, at the end of the workshop. This appendix summarises the results of the evaluation, and some key responses and suggestions provided by delegates:

Part 1. General evaluation of the workshop

In response to the question: *Have you enjoyed the workshop*?, 100% of participants answered "yes".

The following table summarises an evaluation of the workshop based on a rating system (1 = excellent, 2 = very good, 3 = good, 4 = fair / poor, 5 = very poor). Overall the workshop was rated between *excellent* and *very good* by participants.

Evaluation criteria (n=12)	**Average score**
Quality of instruction / facilitation	1.4
Workshop content	1.8
Range of topics covered	2.0
Duration of workshop	1.4
Quality of supporting materials	1.9
Relevance to the general project	1.3
Overall Average	**1.6**

Additional comments from participants after scoring the workshop indicated that the overall feeling was of a fruitful exercise - of a type which should be held more often - and of satisfaction in having exchanged ideas and gained knowledge.

Part 2. Specific feedback questions

Delegates were asked to respond to the following 8 questions. Their combined answers have been summarised into a paragraph following each question.

1. Did the workshop accomplish its objectives? Please comment.

   Summary: The majority of participants indicated that the workshop had achieved its aims, although some comments indicated that a number of outcomes could have been made more explicit - perhaps achieved by having more time. Several delegates thought that the workshop had not quite achieved its aims, one person indicating confusion as to whether the aims were to clarify needs for the park or to propose new projects. An interesting comment was "*Yes,* [the aims were met] *but it is up to CONAF to put the discussions to use, and in their turn, each delegate should improve their personal capacity to confront similar situations*"

2. Which aspects of the workshop did you like the most?

   Summary: Amongst a variety of responses, one aspect which stood out was the successful application of information management theory to the project; "*... the success of the idea of information management*". Working in groups was also well received, as was the structure and organisation of the workshop and the demonstration of the GIS. Finally, the informal atmosphere and interactions between delegates from different institutions were highly regarded.

3. Which aspects of the workshop did you find least useful?

   Summary: Three of 12 delegates didn't answer this question, while another stated that they could not identify any aspects of this type. Other responses were varied, ranging from the practical "*too much time was taken up in doing translations*" to remarks that some sessions were unnecessarily long, including the introductions, some explanations of methodology and the use of the GIS. One delegate observed that "*there was excessive introduction in order to arrive at the key point*".

4. What suggestions do you have for improving the efficiency of these types of workshops?

   Summary: Several participants suggested better time-keeping and one delegate suggested clearer chairmanship - although they did recognise that this might compromise the informal atmosphere. Other suggestions included more concise presentations, clearer objectives and the preparation of proposals and ideas prior to the meeting. For the purposes of this workshop it was suggested that "*...there could have been more researchers* [present]*who were in the field...*". One delegate remarked that "*the meeting was sufficiently efficient*" (translation).

5. Please indicate in which form do you think the workshop has contributed to:

   a) The overall success of the project.

   Summary: Delegates were generally very positive in their response to this question and the most common theme which emerged was that the workshop had established priorities, and provided the project with focus, direction and an action plan for the way ahead. The workshop also provided an opportunity to review work undertaken, integrate ideas and results, and enable project weaknesses to be discussed. Underlying this, many delegates indicated that the interaction and contact between scientists was fundamental to the overall success of the project and this workshop had allowed that to occur. One participant remarked "[The workshop] *helped to co-ordinate, inform and integrate the results, achievements and advances, and lead towards the development of future objectives*".

   b) The improvement of relations between institutions.

   Summary: The overwhelming response to this question was that the workshop was a very positive experience in improving relations between institutions, at both the individual and organisational level (nationally and internationally). Several delegates indicated that this was one of the most positive aspects of the workshop, and helped to iron out any misunderstandings which might be present. One delegate stated that the workshop "*emphasises the need to co-ordinate individual efforts*".

   c) Serving as a model which might be applied in other regions in Chile and / or other countries.

   Summary: Almost all delegates stated that this workshop,

and the model developed for the project, would be applicable more widely - one participant commented that the process adopted might prove to be one of the most interesting outcomes of the project. However, another delegate observed that for the model to be applied more widely, a high level of interest would need to be expressed by CONAF staff nationally.

6. Which topics should be covered in a future workshop?

Summary: Although four delegates did not answer this question, those who did focused on the following: the need for more detailed discussions on obtaining funding; the interpretation of information generated by the project (and application of the database for sustainable park management); the interactions between institutions; and integration of socio-economic themes. On a more technical note, one delegate was keen to discuss the "*effects of habitat fragmentation*" at a future date.

7. Final comments from the delegates included the following:

"*It was an excellent opportunity to integrate skills and knowledge*"

"*Ensure participants are committed to active involvement in the project, in all aspects*"

"[The workshop] *demonstrated the importance of meetings of this type*"

"*Ensure CONAF maintain leadership of needs and objectives*"

It was also pointed out that the results of the project are important, as are discussions of future strategy and the continuation of this initiative. It was recognised that much had been accomplished in the project in a short time.

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Part II Half-day Environmental Education Workshop April 2nd 1998, Coyhaique, Región XI, Chile

Introduction

"Ignorance is one of the most important causes of environmental impoverishment. With an adequate system of information, we can learn not only not to repeat the mistakes of others but also to benefit from others' achievements" Mustapha Tolba, ex-Executive Director UNEP (1980)

One of the key objectives of the Earth Summit in Rio de Janeiro 1992, was to increase awareness of biodiversity and the environment. Correspondingly, one of the aims of this Darwin Initiative project, part of a scheme which originated from the same conference, is to provide information which may be used for educational purposes within Chile.

To meet this aim, a half day workshop was convened in Coyhaique, by CONAF's regional Environmental Education Co-ordinator and facilitated by Donald Gordon and Javier Beltran from the World Conservation Monitoring Centre. This meeting directly followed the LSRNP biodiversity research programme review workshop and involved teachers with an interest or speciality in environmental education from the communities in and around Coyhaique, CONAF rangers and delegates from CODEFF (an environmental NGO).

This document outlines the proceedings of the workshop and summarises the outputs. Our thanks go to the delegates, and in particular to María Jimena Rojas the CONAF Environmental Education Co-ordinator who brought the meeting to fruition.

Background to the project

Since its inception, this biodiversity research programme in LSRNP has brought 20 scientists from the UK and Chile to study a wide range of taxonomic groups in the park. These range from the threatened wild cat - the güiña - to beetles, lichens and sea lice. Moreover, a comparable amount of research is yet to be undertaken before the project reaches its end.

The information being generated from this research is new to the region and each individual project has aims which fall into one or more of the following categories:

describing the diversity of life;
understanding the behaviour of organisms;
monitoring change in ecosystems.

These categories are all fundamental to understanding the wider environment, and the information resulting from each apply not only to LSRNP, where the work was done, but also regionally (e.g. the güiña is found throughout region XI), nationally (e.g. certain species of algae might only be found in this part of Chile) and internationally (e.g. lichens may help to monitor change in UV radiation levels).

One of the possible uses of this information is in the preparation of 'information products' which may be used by teachers to increase the knowledge and awareness of children about their local biodiversity and environments, and about national and international issues, such as the thinning of the ozone layer. This information may also be used in support of environmental decision-making by future generations.

As mentioned, one objective of the Darwin Initiative biodiversity research programme in LSRNP is to produce material of this type, responding directly to local needs. This half day workshop was the first stage of a consultative process to identify local priorities for educational material based on the information provided by the research in LSRNP.

Workshop aims

1. To instil awareness of the research programme in the local teaching community;
2. To determine the extent of environmental education resources available in Region XI;
3. To find out how the information being produced from this research might be useful to teachers in Region XI;
4. To create a list of priority educational information products.

Presentations

- Welcome and introduction to the meeting by María Jimena Rojas.

- Slide presentation and project overview by Sergio Herrera. Key points included:

  - LSRNP: not just the Laguna San Rafael
  - The Darwin Initiative: an international collaboration
  - Biodiversity of LSRNP: very little is currently known
  - Local knowledge: essential to complement research
  - Information: can be used at many different levels
  - Interpretation: how to translate scientific information for use at primary or secondary school levels
  - Goal of workshop: to find out from the delegates what is needed

  This presentation also included maps produced by the GIS system, which may be used to produce information products for educational purposes. See pages 12 and 13, for examples.

  It was remarked that slides of the flora and fauna, such as shown during this presentation, would be a useful resource.

"The technology and basic information is available.....we need to take scientific information and develop it for use by in an educational context."

- Discussion on current status of environmental education in Region XI - key points and comments:
  - Environmental education has only very recently been built into the curriculum. Because of this its potential is yet to be properly explored;
  - *"There is information, but nothing of much use"*: there is a need for material which will capture the imagination, and which is colourful and interesting. For example, there is a basic guide / checklist of the flora and fauna of the region, but it is completely unsuitable for school use;
  - There is information but no easy means of accessing it;
  - Information which is available is often at a level which is

too technical for children;
- CONAF have obtained sponsorship from a local company to produce a 24 page colour leaflet about the shrubs and tree flora of the area, including basic information such as common name, scientific name and description of the species.

- Most of the rest of the afternoon was taken up by a brainstorming session to produce concrete ideas for educational material. This session was led by Donald Gordon and Javier Beltran, WCMC.

Each delegate was given information about the projects undertaken in LSRNP. From this, they each devised one key idea for useful products, drawing on the following questions:

- *What are the issues needing information?*
- *What should its content be?*
- *What activities or information products are needed to produce required information?*

Each idea generated was written onto a label and stuck to a board. The ideas were then grouped together by issue for ease of interpretation and for discussion, as portrayed in the boxes below.

LICHENS AND FORESTS

Issue: Knowledge of forests and their influence on the climate/environment.
Content: Information about the variety of trees, and shrubs in the area, and the dominant forest types.
Activities or information products: Look for material from the literature, show slides about the region, and videos of the study area. Visit the park. Exhibition by project professionals.
Evaluation: Produce a folder with material obtained from the work, including a commentary about the visit and a display with work and samples.

Issue: Lichens as a tool for the evaluation of forest biodiversity.
Activities or information products: Make a collection of local lichens. Have a visit to see lichens around Laguna Toro y Escondida and to compare them with lichens in the city.

Issue: Biodiversity of forests in LSRNP. Lichens.
Content: interrelationships for the protection of species.
Activities or information products: Talks, field trips and videos of a diverse range of species and habitats.

Issue: Lichen physiology / environmental change.
Content: The changes in UV radiation protecting substances in lichens.
Activities or information products: Collect and identify lichens with accompanying material.

Issue: Lichens as a tool for the evaluation of forest biodiversity.
Activities or information products: Identification in the field, leaflets with common and scientific names.

GENERAL

Produce a written document and audio-visual material about all of the projects undertaken in LSRNP for environmental education.
Content: Investigation, place, condition, abundance, conservation and other subjects.

ANIMALS

Issue: Biodiversity of mammals with emphasis on the güiña.
Content: Distribution, conservation status, diet and other biological aspects.
Activities or information products: Video and talks with slides.

Issue: Güiña and beetles.
Content: Habitats. On what do they feed? What predates on them? Type of reproduction.
Activities or information products: Method of presentation: video.

Issue: Biodiversity of beetles.
Activities or information products: Field trips , collect and identify their location in the habitat.

Issue: Güiña.
Content: The difference between the domestic cat and the güiña, focusing on the natural history and behaviour.
Activities or information products: Videos, slides, poster, leaflets etc.

Issue: Güiña.
Content: Could they be in our fields and houses? Where are their habitats? Could they live with people? How do you react in front of a güiña?
Activities or information products: Video including interview with scientists and people from the countryside about the güiña.

Issue: Biodiversity of mammals (güiña and zorros).
Content: What there is, how they live and why they are important.
Activities or information products: Production of leaflets and posters.

Issue: Güiña.
Content: How could the güiña help control the hanta virus. Or which other species could do this. Habitat.
Activities or information products: Audio-visual display.

Other ideas for information products

- Slide pack: the flora and fauna of LSRNP and Region XI, with complete set of notes and descriptions.

- Visits for children to Laguna San Rafael with accompanying scientists and teacher.

- Talks and presentations on issues by relevant scientist or expert to groups of teachers.

- Annotated map of the protected areas of Region XI, with accompanying information about each area.

Summary

The ideas produced by the delegates had some common themes. In order of preference the main issues were:

1. The güiña and other mammals
2. Lichens (including their relevance to UV radiation)
3. Forests
4. Beetles

The preferred methods of communication were:

1. Video
2. Field trips
3. Talks (with slides)
4. Leaflets / posters

Conclusions

- The day established a new network between CONAF (main office and guardaparques) and environmental education teachers and instructors. María Jimena Rojas will act as the link between each group and the Darwin Initiative research programme. CONAF already have links of this type and are keen to see them expanded.

- The meeting proved useful in raising awareness of the research programme amongst the teaching community in Region XI.

- The delegates generated a wide range of interesting ideas for potential educational products and expressed clear indications of the methods in which they would wish to see this information communicated.

- The issue-driven approach to the generation of educational material was new to many of the delegates, and was a productive and interesting exercise.

The next steps

1. The project co-ordinators will use the concrete ideas generated by this workshop to prepare funding proposals.

2. Immediate steps will be taken to prepare an initial educational tool (e.g. a set of annotated slide packs of the local flora and fauna) which will be a resource for teachers available through CONAF.

3. Should funding proposals be successful, a further workshop will be convened to determine exactly how available resources should be spent.

Workshop participants

Name	School / Org.	Address, Tel
Emma Elgueta	Instituto Chiloé	Senda Darwin, Ancud, Región X 65 622744
Héctor Caballero	4 x la Ecología CONAF	Bilbao 234 Coyhaique Región XI 67 237070
María Jimena Rojas	CONAF	Av. Ogana 1060 Coyhaique, 231065
Alicia Pinuer G.	Escuela Diferencial España	Los Mañíos s/n Coyhaique 235912
Carmen . Cárcamo B.	Liceo Josefina Aguirre	Ibáñez 15, Coyhaique 233517
Ana María Pino H. / Elba González	Escuela Nieves del Sur	Los Pinos s/n 232070/ 231530
José Cayún	Escuela Pablo Neruda	Carretera Austral Km 32, Coyhaique, Región XI
Pedro Guerrero A.	Escuela Canadá	Prat 139, Coyhaique 231384
Antonio Sáez	Escuela Río Claro	Camino Aeródromo, Tte Vidal, Coyhaique 231399
Nora Contreras R.	Escuela José A. Silva Ormeño	J. Steffens 85,Balmaceda, Región XI 272114
Hipólito Medina	CODEFF Aisén	Bilbao/12 de Octubre, Coyhaique 234451
Hernán Velásquez	Reserva Nacional, Tamango	Río Neff 417, Cochrane, Región XI 522164
Don Gordon / Javier Beltran	World Conservation Monitoring Centre	Cambridge UK
Sergio Herrera E. Darwin Project Co-ordinator	CONAF	Bilbao 234 Coyhaique Region XI 237070
Sam Rose Darwin Project Co-ordinator	Raleigh International	27 Parsons Green Lane London SW6 4HZ, UK 44 171 371 8585

For further information, please contact Sergio Herrera E. or Sam Rose at the above addresses