

Darwin Initiative Annual Report

Important note:

To be completed with reference to the Reporting Guidance Notes for Project Leaders – it is expected that this report will be about 10 pages in length – Submission deadline 30 April 2007

Darwin Project Information

Project Ref Number	162/15/020
Project Title	Reducing the Impact of Exotic Aquaculture on Chilean Aquatic Biodiversity
Country(ies)	UK, Chile, Canada, USA, New Zealand
UK Contract Holder Institution	University of Wales Swansea (UWS)
UK Partner Institution(s)	NERC Centre for Ecology & Hydrology, Banchory UK) University of Victoria (BC, Canada) US Geological Survey (USA) Oregon State University (USA) Victoria University of Wellington (New Zealand)
Host country Partner Institution(s)	Universidad de Los Lagos (ULA) - Chile
Darwin Grant Value	£193,844
Start/End dates of Project	01 October 2006 / 30 September 2009
Reporting period (1 Apr 200x to 31 Mar 200y) and annual report number (1,2,3..)	01 October 2006 – 31 March 2007 Half-yearly report 1 (6 months)
Project Leader Name	Dr. Carlos Garcia de Leaniz
Project website	www.biodiversity.cl
Author(s), date	Carlos Garcia de Leaniz, Gonzalo Gajardo, Kyle Young 30 April 2007

1. Project Background

Salmon farming is one of the most buoyant and lucrative business in Chile, capitalizing on a highly valuable export commodity that generates significant revenue. Chile is set to overtake Norway as the world's top salmon producer, and the industry is considered a successful example of the country's commitment to free market, world trade and economic growth. Yet, salmonids are not naturally present in the Southern Hemisphere and constitute a potential threat to indigenous species. Under such a scenario, the Darwin Initiative "Reducing the impact of exotic aquaculture on native aquatic biodiversity" is drawing attention to the potential impacts of salmon farming on Chile's unique aquatic ecosystems, with a view of making the industry more sustainable. The project is based at region X ("Los Lagos"), where most of the salmon farming industry is concentrated and from where it has continued to expand since the 80's. The area (Figure 1) is characterized by a complex hydrology and high aquatic biodiversity, with high levels of endemism. Several of the native aquatic species (from a total of 130) are listed as endangered.

The basic problem the project seeks to address is to evaluate and monitor the interaction of exotic salmonids (accidental escapes from hatcheries and net cages, as well as salmonids deliberately stocked for sport fishing) upon native species, in particular fishes. University of Los Lagos, the host-country institution, has its main campus in Osorno (Lake district – Figure 1), and another in Puerto Montt (Pacific coast). The University's mandate is to attend local problems with creative solutions, and so this project represents a timely contribution to such endeavour.

2. Project Partnerships

The partnership between the UK lead institution (UWS) and the Chilean host partner (ULA) was particularly fruitful during these first 6 months of the project (October 2006-March 2007). It benefited from fluent and frequent email and telephone contacts, in addition to three visits by the UK leader to Chile during this period. The partnership was also reciprocal in many respects. For example, funds for equipment were entirely allocated to the genetics laboratory in Osorno in order to boost its capacity to meet the project objectives, which are closely related to CBD. Thus, commitments to CBD supported by the project include the assessment (and eventually reduction) of loss of biodiversity in key Andean aquatic ecosystems potentially impacted by the development of exotic aquaculture (CBD's 2010 target). In return, the Chilean project coordinator invited the UK project leader to give a plenary conference at the annual meeting of the Chilean Genetics Society held in Viña del Mar in November (1-5) 2006 (abstract in Annex 3). Funding for this visit was obtained from the International Genetics Federation (USA) and allowed us to promote the Darwin Initiative to a wide audience of geneticists, university students, and officials in key government positions within the aquaculture, and biodiversity sectors. Chilean officials also participated in a one-day workshop on national planning for biodiversity management, hosted by the local project coordinator, Dr. Gajardo.

This first project workshop ("Reducing the Impact of Exotic Aquaculture on Native Aquatic Biodiversity", Puerto Montt, 17-18 January 2007) benefited from the participation of nearly all the project partners from UK, Canada, and USA, as well as all the main Chilean stakeholders (workshop program and abstracts in www.biodiversity.cl). The work of the local project coordinator Dr. Gonzalo Gajardo, and of the logistics coordinator Dr. Francisco Orellana, were key in securing the active participation of Chilean stakeholders (who were self-funded), and in obtaining additional funding for items not originally contemplated in the budget, such as simultaneous translation, coffee-breaks, etc. The effort done in this respect by officials of Universidad de Los Lagos, and in particular by the Rector of the University (Sr. Aguilar), is greatly appreciated.

Other Collaborations

Professor Ian Fleming (Director of Ocean Sciences Centre, Memorial University of Newfoundland, Canada) kindly agreed to become the project's external advisor and to provide the keynote lecture during the First International Darwin Workshop. Important links were also forged with national and international groups during the first few months of the project. Thus, Dr. Günter Försterra and the Director of Fundacion Huinay (Dr. Vreni Häussermann) invited the project partners to carry out field work at the Huinay field station (where large numbers of exotic salmonids were recorded and filmed underwater in the local river by Dr. John Volpe, the Canadian project partner). Plans were also made between the UK partner and Fundacion Huinay for Aquaculture MSc placements for next year. Meetings have also been held with WWF-Chile, as well as with other NGO's (sport and professional fishermen), government agencies (CONAMA, SubPesca), and representatives of the salmon farming industry, including INTESAL (the salmon association), Marine Harvest, and salmones Multi-Export. Collaborations were developed with Dr Evelyn Habitt (Universidad de Concepcion, Chile) who agreed to participate in the workshop and to chair one of the sessions, with Dr. Brendan Gara (Falklands Islands) and with Cristian Correa, a Chilean PhD student. Thus an application for a Darwin Fellowship was submitted with Cristian Correa with support from McGill University (Canada), and a Darwin Scoping Award was submitted in collaboration with Dr. Gara to examine interactions between introduced salmonids and endemic galaxiid fishes in the Falklands Islands.

3. Project progress

The key activity milestone for year 1 was the development of a suitable sampling program and the molecular & isotopic toolkits.

3.1 Progress in carrying out project activities

Activity 1. Research & monitoring of exotic and naturalized fish species, in relation to **Output 1** (Assessment of abundance, distribution, and impact of exotic and naturalized salmonids). The activity milestones for year 1 were to develop and field test diagnostic methods for species identification, stock assignment and trophic niche overlap, and begin screening of fish. Progress during the first six months was adequate but slower than expected, due to delays in the recruitment of suitably qualified personnel and shipment of vital equipment. We initiated the 2007 field season with two primary goals: assess whether methods used to determine the presence/absence and relative abundance of fish species in hydrologically similar regions of North America are transferable to Chilean Patagonia, and establish and conduct initial 'baseline' surveys of sites for long-term monitoring in the Aisen River basin, the location of the southernmost concentration of salmonid farming in Patagonia. With help from all partners during the January workshop, a sampling field protocol involving a combination of snorkeling and electro-fishing was agreed, and protocols for collecting samples and carrying out mtDNA and microsatellite analysis were transferred from U. Wales Swansea to U. Los Lagos.

The agreed target for the project was to survey a total of c. 80 marine and freshwater sites for the presence of exotic and naturalized salmonids, and to sample 12 aquaculture facilities (8 in the sea and 4 in freshwater) for baseline data on genetic variation and isotopic signatures of two main farmed species, Atlantic salmon (*Salmo salar*) and rainbow trout (*Oncorhynchus mykiss*). Distribution data and samples of brown trout (*Salmo trutta*) and native galaxiids would also be recorded whenever possible. During the first sampling season, we were able to collect tissue for genetic and isotopic analysis and scales for life history analysis from nearly two dozen individuals of *Oncorhynchus mykiss*, the main aquaculture species in the Aisen River estuary. One salmon farm and 8 rivers in the Aisen watershed were surveyed. We set up and swam two downriver surveys (totalling 11 km) in the Maniguales River, one of the two major systems that join to form the Aisen River approximately 20 km from tidewater. Densities of adult salmonids were similar in each. The ratio of *O. mykiss* to *Salmo trutta* was approximately 1:1 in a reach from river km 7-12 and 3:1 in a reach from river km 17-23. We did not observe any escapees of either *O. mykiss* or *S. salar* during these or any other survey. We identified locations for 18 night time swim monitoring sites in 8 tributaries of the Aisen basin (GPS coordinates and location marked on map). We surveyed 14 of these sites totalling 670 linear meters of channel. The ratio of *O. mykiss* to *S. trutta* varied from 1:0 to 0:1. Five sites had high concentrations of *O. mykiss* fry and channel characteristics appropriate for spawning. In five sites we observed *O. tshawytscha* fry, expanding the known breeding distribution of this naturalized species.

We also documented the presence of two native species in two different rivers within the Aisen basin. As expected from previous work on central Patagonian rivers, we encountered few native species during our night swims and none during day swims. During a night swim in a small, low-elevation tributary we observed three adult *Aplochiton zebra*. Our survey was 3km above a lake with a known *A. zebra* population. Poor access prohibited us from conducting more surveys to determine how the lake population influenced the composition of the riverine community. During a survey of a side channel pool in the upper Simpson River (over 100 km from the mouth of the Aisen) we observed a single adult *Odontesthes mauleanum*, to our knowledge the first known occurrence of this species in this system. As the monitoring program expands, we will continue to identify and focus our sampling effort on the few remaining areas with populations of native species. Data on fish samples, sampling sites, and fish farms were entered in cross-referenced databases.

Activity 2. Capacity building and training in assessing impact of exotic invasions in relation to **Output 2** (Development of monitoring and impact assessment programme with trained personnel). The activity milestones for year 1 were to have initial meetings with stakeholders, to develop GIS database, molecular and isotopic diagnostic toolkits, run training workshops, and establish sampling strategy and field protocols. Progress on this activity was generally very satisfactory. Planning visit by UK staff to Chile

was completed ahead of time, in August 2006 and a Memorandum of Agreement was written and signed thereafter. Job positions were advertised in national and international venues, and several candidates were shortlisted and interviewed by the UK leader and Chilean host partner, either in person or via telephone. The two research positions are now in place (Dr. Kyle Young- Evolutionary Ecology of Salmonid Invasions; Sr. Carlos Flores - Molecular Methods). Equipment was ordered and most was purchased and received during the first 6 months of the project. The ULA Genetics & Aquaculture laboratory was remodeled by the University of Los Lagos, and after the purchase of the new equipment with the Darwin Initiative is now fully operational to carry the molecular analyses. Development of GIS database is in progress, and development of molecular protocols was completed. A network of sampling stations for monitoring the impact of exotic salmonids was identified, and relevant sampling permission were sought from Government . Testing of toolkit for molecular stock identification is in progress.

The first training workshop took place during 16-19 January 2007 at Pto Montt with the participation of 12 students, all stakeholders, and nearly all partners. This ended with a joint declaration of intent endorsed by all stakeholders (see point 11 below and www.biodiversity.cl). We originally planned to train in the field two volunteers this season. Jane McDonald, an ecologist on leave from the Australian Museum in Sydney, and Andrea Masuero, a Chilean marine biologist were shortlisted for field training. Unfortunately, a week before her training was to begin, Andrea Masuero accepted an permanent position with the Chilean government and withdrew her application. During Jane's first week, Dr. Kyle Young assigned her relevant reading and conducted informal tutorials on fish identification and behaviour, stream ecology, fluvial geomorphology, and watershed processes. Once in the field, Dr. Young spent the first week teaching Jane how to quantitatively describe stream habitat at the 'unit' scale (e.g. riffle, pool, etc.), how to record the fish community in such a site using night-time snorkel surveys, and how to estimate the relative abundance of adult salmonids at the 'reach' scale (4-10 km) using day-time downriver swims in larger channels. Though it takes years to 'master' each of these methods, Jane's comfort level in the water made her a quick study and within a week she was able to describe habitat, read a river and accurately identify and count fish. Work in the next period will involve further training of personnel and recruitment of additional volunteers/students.

Activity 3. *Education programme and dissemination of results* in relation to **Output 4** (Educational events and media coverage for local people, fish farmers, and rest of stakeholders). The activity milestones for year 1 were to develop an education programme, to establish a project website, and to attract media interest. Progress on this activity during the first six months of the project can also be considered satisfactory. All major stakeholders actively participated in the first workshop and the joint statement was publicized via the webpage and the media. The Darwin project was also publicized at conferences and seminars and featured in several media events. Initial press releases were produced by University of Wales Swansea and Universidad de Los Lagos, and a newsletter article was sent to the Darwin Initiative Secretariat for inclusion in the April 2007 Darwin Newsletter. A project website (www.biodiversity.cl), initially in English and later also in Spanish was developed and launched on time for the first project workshop, and this is regularly updated and linked to all partners, stakeholders and sponsors. Dissemination material (flyers, fact sheets) was produced and distributed during the first workshop and also at three conferences and seminars. A powerpoint slide show outlining the background, aims and methodology of project was developed and presented at three Aquaculture seminars in Chile and Spain. Further education events will take place during the next period, as per logical framework. Two manuscripts, as well as press releases, are in preparation, and plans are also being made to attend a suitable conference.

3.2 Progress towards Project Outputs

Overall progress towards achieving project outputs can considered satisfactory. Valuable links, based on mutual trust, respect and the need for rigorous scientific data, have been forged with the salmon industry and other key stakeholders, including NGO's and Government. It is hoped that continuing dialogue with stakeholders will help to develop (and ensure necessary endorsement of) MAP and CBP towards the end of the project. The main challenges and difficulties lie in the logistics of the project, which in Chile are particularly complicated, and the extreme difficulty of sampling remote aquatic ecosystems, particularly in autumn and winter.

3.3 Standard Output Measures

Training output measures

Training output measures include the attendance by 12 Chilean students (2 undergraduate and 8 postgraduate) to the first project workshop (total attendance c. 45 people each day). Students were issued with official certificates of attendance, jointly signed by the UK leader on behalf of University of Wales Swansea, and the local host coordinator on behalf of Universidad de Los Lagos. Project partners also provided advice and training to RA's during and after the workshop. Dr. Young trained a project volunteer during the first field season. Other training output measures include an information leaflet highlighting the project objectives and main features, a powerpoint presentation describing the project, a project website in English and Spanish, as well as protocols for field sampling, DNA extraction, mtDNA RFLP analysis, and microsatellite amplification.

Research output measures

Research output measures include a total of 14.2 weeks/person (99 days) spent in Chile working on the project by partners from UK, Canada, and USA during the first 6 months of the project (including Project External Advisor – Prof Ian Fleming). It also includes discussions on a multi-authored manuscript on the role of aquaculture as a source of invasive species, currently in preparation.

Dissemination output measures

Dissemination output measures include the organization of a local community seminar (Vina del Mar, 3 November 2006) and project training workshop (Pto Montt, 16-19 January 2007), the presentation of the project at three seminars (Vina del Mar, 2 November 2006; Santiago de Chile, 23 November 2006; La Laguna – Spain, 27 March 2007), one feature article in the Darwin Newsletter, four press coverages in the Chilean press, 2 features in the local radio station, and a regularly updated project website (www.biodiversity.cl)

Physical output measures

Physical output measures include the allocation of £27,918 in equipment to the ULA Genetics & Aquaculture laboratory, as well as \$1,000 contribution from the International Genetics Federation that was used to allow the UK to give a plenary conference at Annual Meeting of the Chilean Genetics Society and publicize the project. Contributions in kind include an estimated £4,318 paid directly by partners and stakeholders to attend the first workshop and over £10,500 in time invested by partners in the project, as outlined in Table 1.

Table 1 Project Standard Output Measures

Code No.	Description	Year 1 Total	Year 2 Total	Year 3 Total	Year 4 Total	TOTAL
Training outputs						
2A	UG Chilean students attending 1 st workshop	4				
4B,D	Training	1 week				
4C	PG Chilean students attending 1 st workshop	8				
5	RA's training	2				
6A,B	Attendance of 1 st workshop and seminar	40				

7	Education/training material produced: information leaflet, PowerPoint slideshow, fish sampling protocol, DNA extraction protocol, RFLP mtDNA protocol, microsatellite amplification (multiplex) protocol, website	7				
Research outputs						
8	Time spent in Chile by partners (weeks/person) UK partners: 7.4 Canada partner*: 3.4 US partners: 3.4	14.2				
11A,B	1 peer-reviewed MS in Preparation	1 (in prep)				
Dissemination outputs						
14A	Project training workshop, Local community seminar	2				
14B	Presentation conferences/seminars	3				
15A,B	Press coverage in Chile	4				
16A	Newsletter	1				
17B	Project website, regularly updated and linked to all partners	1				
19C	Radio features in Chile	2				
Physical outputs						
20	Equipment	£27,918				
23	International Genetics Federation Contributions in kind: Fundacion Huinay (transport, accommodation & subsistence field trip) ULA Housing Volunteer Accommodation & subsistence paid by partners & stakeholders to attend workshop Travel expenses paid by partners & stakeholders to participate in workshop Time spent in project (all partners)	US\$1,000 £618 £500 £1,200 £2,000 £10,500				

Table 2 Publications

Type * (eg journals, manual, CDs)	Detail (title, author, year)	Publishers (name, city)	Available from (eg contact address, website)	Cost £
Journal paper in preparation	Biological invasion theory: has aquaculture changed the rules of the game?	In prep		
Journal paper in preparation	Is exotic aquaculture sustainable?	Revista Chilena de		

		Historia Natural (in prep.)		
--	--	-----------------------------	--	--

3.4 Progress towards the project purpose and outcomes

Overall progress towards achieving the project's ultimate goal (*To build, in collaboration with government, industry and other stakeholders, the capacity for assessing, monitoring, and reducing the impact of the accidental or deliberate introduction of exotic fish species on Chilean aquatic biodiversity*) may seem a long way off after only six months into the project but we believe that the necessary steps are being taken. The basic assumptions hold true and the indicators seem adequate

3.5 Progress towards impact on biodiversity, sustainable use or equitable sharing of biodiversity benefits

We believe that the most lasting legacy of our project will be the quality of our scientific results regarding the impact of salmonids upon native aquatic biodiversity, and the development and endorsement of a Management Action Plan and Code of Best Practices in relation to salmonid farming in Chile.

4. Monitoring, evaluation and lessons

Already covered in sections above.

5. Actions taken in response to previous reviews (if applicable)

Not applicable, as this is the first report

6. Other comments on progress not covered elsewhere

No further comments seem necessary

7. Sustainability

Scarcity of suitable baseline data was highlighted by all stakeholders as one of the most important threats to achieving sustainability in the Chilean salmonid industry. Thus, the success of our project will largely depend on the quality of our data on extent and impact of exotic salmonids upon native species, principally fishes. This, we believe, will in turn generate trust and interest and foster capacity for biodiversity.

8. Dissemination

Dissemination activities during the first six months of the project included the organization of a local community seminar (Vina del Mar, 3 November 2006) and project training workshop (Pto Montt, 16-19 January 2007), the presentation of the project at three seminars (Vina del Mar, 2 November 2006; Santiago de Chile, 23 November 2006; La Laguna – Spain, 27 March 2007), one feature article in the Darwin Newsletter, four press coverages in the Chilean press, 2 features in the local radio station, and a regularly updated project website (www.biodiversity.cl)

9.

7

10. OPTIONAL: Outstanding achievements of your project during the reporting period (300-400 words maximum). This section may be used for publicity purposes

I agree for ECTF and the Darwin Secretariat to publish the content of this section

**Reducing the Impact of Exotic Aquaculture on Chilean Aquatic Biodiversity
Joint statement endorsed by all Stakeholders**

Under the auspices of the Darwin Initiative, “Reducing the Impact of Exotic Aquaculture on Chilean Aquatic Biodiversity”, participants in the Working Group recognized the enormous economic and social importance of aquaculture (salmon farming) in Chile, but also on the need to identify those problems that might exist as a consequence of the culture of exotic species (salmonids), and the lack of reference studies (base line data). For these reasons, the Working Group agreed to:

1. Support and facilitate research studies designed to obtain reference data on the distribution, prevalence and impact of exotic species escaping from aquaculture facilities, as well as those studies designed to mitigate possible impacts caused by aquaculture escapees
2. Increase communication and commitment between stakeholders, in order to ensure the final success of the project
3. Work in collaboration with all stakeholders to ensure that Chilean Aquaculture becomes increasingly more sustainable, contributing in this way towards the strengthening of the sector and the protection of the natural environment

Puerto Montt, 16th January 2007

Signed:

Miguel Stutzin (CONAMA, Chile), Adolfo Alvial (INTESAL- SalmonChile, Chile), Roberto Bravo (INTESAL- SalmonChile, Chile), Jorge Ríos (INTESAL- SalmonChile, Chile), Marcelo Urrutia (Salmones MultiExport, Chile), Brendan Gara (Falklands Islands Development Corporation, UK), José D. Núñez (Corporación Río CONTACO, Chile), Daniel Portales (Club de Pesca Ríos del Sur, Chile), Luis Vásquez (Club de Pesca Ríos del Sur, Chile), Vreni Häussermann (Fundación Huinay, Chile), Günter Försterra (Fundación Huinay, Chile), Guillermo Giannico (Oregon State University, USA), Jason B. Dunham (US Geological Survey, USA), Ian a. Fleming (Memorial University, Canada), John Volpe (University of Victoria, Canada), Kyle A. Young (Universidad de los Lagos, Chile), Francisco Orellana (Universidad de los Lagos, Chile), Gonzalo Gajardo (Universidad de los Lagos, Chile), David N. Carss (NERC Centre for Ecology & Hydrology, UK), Carlos García de Leániz (University of Wales Swansea, UK)

Annex 1 Report of progress and achievements against Logical Framework for Financial Year: 2006/07

Project summary	Measurable Indicators	Progress and Achievements April 2006 - March 2007	Actions required/planned for next period
Goal: To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but constrained in resources to achieve The conservation of biological diversity, The sustainable use of its components, and The fair and equitable sharing of the benefits arising out of the utilisation of genetic resources		See joint statement by stakeholders in www.biodiversity.cl Pto Montt, 16 th January 2007	(do not fill not applicable)
Purpose To build, in collaboration with government, industry and other stakeholders, the capacity for assessing, monitoring, and reducing the impact of the accidental or deliberate introduction of exotic fish species on Chilean aquatic biodiversity	1. New knowledge on the distribution and abundance of exotic fish species and their impact upon native aquatic biodiversity 2. Endorsement of a Management Action Plan (MAP) and Code of Best Practice (CBP) in relation to exotic species, introductions and protection of native aquatic biodiversity 3. Increased understanding and public awareness of threats to native bio-diversity resulting from foreign fish introductions	A joint statement, endorsed by all stakeholders on the need to carry out rigorous research was one of the main outputs from the first project workshop	1. Organization of second training workshop, dissemination 2. Expansion of sampling program 3. Development of databases 4. Testing of molecular methods for GSI 5. Submission of 2 MS: 1 popular science, 1 scientific paper
Output 1. Abundance, distribution, and impact of exotic and naturalized salmonids assessed	1. Findings endorsed by the scientific community and stakeholders	Progress adequate but slower than expected. Abundance and distribution of exotic and naturalized salmonids should also be measured by development of (and reference to) database, in addition to endorsement by scientific community and stakeholders	
Activity 1. Research & monitoring of exotic and naturalized fish species		A sampling field protocol involving a combination of snorkeling and electro-fishing was developed, as well as protocols for collecting samples and carrying out genetic analysis. One salmon farm and 8 rivers in the Aisen region were sampled. Work in the next period will involve expanding the coverage of fish farms and sampling sites, as well as the beginning of genetic analysis	
Output 2. A monitoring and impact assessment programme with trained personnel established	2. GIS database & molecular and isotopic toolkits for identification of exotic and farmed fish species developed, tested, and at least 2 staff trained	Development of GIS database in progress. Development of molecular protocols completed, and network of sampling stations for monitoring identified and agreed. Staff in place. Testing of toolkit for molecular stock identification in progress.	
Activity 2. Capacity building and training in assessing impact of exotic invasions		As per activity 1, involving 2 new hired staff (RA's), 2 technicians and one volunteer. Work in the next period will involve further training of personnel and recruitment of additional volunteers/students.	
Output 3. MAP, CBP, and possible exclusion zones for protecting aquatic biodiversity from exotic invasions	3. MAP and CBP peer reviewed and presented at international conference	Discussed with stakeholders at first workshop, though this output is expected to be completed by end of project. Continuing dialogue with stakeholders will help to develop (and ensure necessary endorsement of) MAP and CBP	
Activity 3. Research & monitoring of exotic and naturalized fish species		As per activity 1.	
Output 4. Educational events and media coverage for local people, fish farmers, and rest of stakeholders	4. Participation of fish farmers and rest of stakeholders in educational events, Darwin project featured in media	Considerable progress was achieved in relation to this output. All major stakeholders actively participated in first workshop and a joint statement was agreed and publicized (via webpage and media). Darwin project was also publicized at conferences and seminars and featured in several media events.	
Activity 4. Education programme and dissemination of results		Further education events will take place during the next period, as per logical framework. Two manuscripts, as well as press releases, are in preparation, and plans are also being made to attend a suitable conference	

Annex 2 Project's full current logframe

Project summary	Measurable Indicators	Means of verification	Important Assumptions
<p>Purpose To build, in collaboration with government, industry and other stakeholders, the capacity for assessing, monitoring, and reducing the impact of the accidental or deliberate introduction of exotic fish species on Chilean aquatic biodiversity</p>	<ol style="list-style-type: none"> 1. New knowledge on the distribution and abundance of exotic fish species and their impact upon native aquatic biodiversity 2. Endorsement of a Management Action Plan (MAP) and Code of Best Practice (CBP) in relation to exotic species, introductions and protection of native aquatic biodiversity 3. Increased understanding and public awareness of threats to native bio-diversity resulting from foreign fish introductions 	<ol style="list-style-type: none"> 1. Project reports, workshop proceedings and publications in peer-reviewed journals 2. Documentation and correspondence for MAP and CBP 3. Records of educational programme and training workshops. Development of professional curricula on sustainable aquaculture. Students trained under programme pass their courses 	<ol style="list-style-type: none"> 1. Project findings are understood and accepted by the salmon industry, regulatory agencies and all stakeholders. Policy makers use findings to help reduce the impact of exotic species on local biodiversity 2. Market forces and increased recognition on the impact of exotics facilitate the shift towards more sustainable fish farming 3. Curriculum development is implemented by ULL with the launch of a MSc in Sustainable Aquaculture
<p>Outputs 1. Abundance, distribution, and impact of exotic and naturalized salmonids assessed 2. A monitoring and impact assessment programme with trained personnel established 3. MAP, CBP, and possible exclusion zones for protecting aquatic biodiversity from exotic invasions 4. Educational events and media coverage for local people, fish farmers, and rest of stakeholders</p>	<ol style="list-style-type: none"> 1. Findings endorsed by the scientific community and stakeholders 2. GIS database & molecular and isotopic toolkits for identification of exotic and farmed fish species developed, tested, and at least 2 staff trained 3. MAP and CBP peer reviewed and presented at international conference 4. Participation of fish farmers and rest of stakeholders in educational events, Darwin project featured in media 	<ol style="list-style-type: none"> 1. Publication of results in peer reviewed, national and international scientific journals 2. Project reports, scientific papers, abundance and distribution maps, species database, fish escape assessment protocol, project website 3. Workshop proceedings, MAP and CBP published and distributed, copies sent to Darwin Initiative 4. Educational leaflets, press releases, media coverage, reports 	<ol style="list-style-type: none"> 1. Sampling strategy and logistic support are appropriate for project objectives and facilitate the collection of data 2. Adequate performance of molecular and isotopic diagnostic toolkits to produce desired results 3. Successful liaison with industry, government agencies and rest of stakeholders for project support 4. Links to educational media and NGO's are established (already in place via ULL)
<p>Activities 1. Capacity building and training in assessing impact of exotic invasions 2. Research & monitoring of exotic and naturalized fish species 3. Education programme and dissemination of results</p>	<p>Activity Milestones Yr1. Initial meetings with stakeholders. Develop GIS database, molecular and isotopic diagnostic toolkits and run training workshops, establish sampling strategy and field protocols. Follow-up training workshops in Yr2 & Yr3. Yr1. Field test diagnostic methods for species identification, stock assignment and trophic niche overlap, begin screening. Yr2 & Yr 3. Continue screening, workshops to discuss results. Yr 3. Writing of scientific publications, MAP and CBP. Yr1. Develop education programme, establish website, and attract media interest. Yr2-Yr3. Develop MSc curriculum, presentation of results at international conferences. All years: annual reports, workshops proceedings, update webpage. At least 2 scientific peer-reviewed papers submitted by end of Yr 3</p>	<p>Assumptions 1. Program receives required support from University (in place). 2. Research methods and tools are adequate. Required baseline information is provided by industry and regulatory bodies 3. Successful liaison with stakeholders and media interest. Support from University</p>	

Annex 3 onwards – supplementary material (optional)

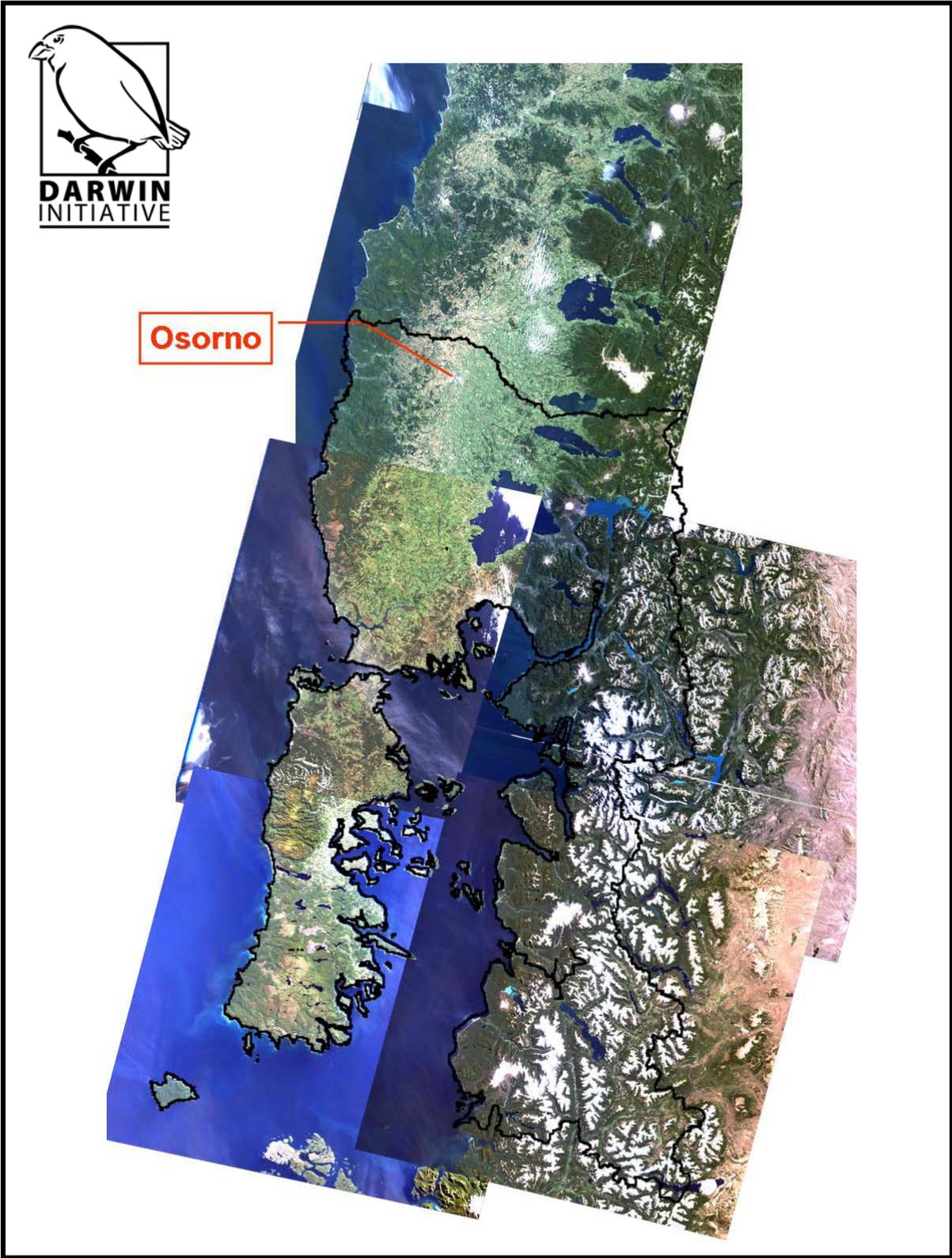


Figure 1. Satellite map of Region X (Los Lagos) where most of the Chilean salmon farming is concentrated

Figure 2. Salmon farm in Lake Llanquihue (X Region Chile)



Figure 3. Some of the participants and public who attended the open conferences on Reducing the Impact of Exotic Aquaculture, held at Puerto Montt (17-18 January 2007)



Figure 4. Ricardo Norambuena from SubPesca (Chile) during his presentation “The national policy on aquaculture and introduction of exotic species: some reflections”.



Figure 5. Dr. John Volpe , from University of Victoria (Canada) during his presentation “Behavioural ecology of farm-escaped Atlantic salmon in coastal British Columbia, Canada“



Figure 6. Stakeholders meeting during one of the sub-committees



Checklist for submission

	Check
Is the report less than 5MB? If so, please email to Darwin-Projects@ectf-ed.org.uk putting the project number in the Subject line.	Yes
Is your report more than 5MB? If so, please advise Darwin-Projects@ectf-ed.org.uk that the report will be send by post on CD, putting the project number in the Subject line.	No
Do you have hard copies of material you want to submit with the report? If so, please make this clear in the covering email and ensure all material is marked with the project number.	No
Have you completed the Project Expenditure table?	Yes
Do not include claim forms or communications for Defra with this report.	OK