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***Sustaining livelihoods and protecting biodiversity through
development of Pez blanco aquaculture***

Project No: 13/011



Second Annual Report

April 2005 - March 2006

**Professor Lindsay G Ross
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Please note that all hyperlinks in this report are live. Click on the links to access web pages, open associated documents, or to email Prof. Ross.

1. Darwin Project Information

Project Ref. Number	13/011
Project Title	Sustaining livelihoods and protecting biodiversity through development of Pez blanco aquaculture.
Country(ies)	United Kingdom - México.
UK Contractor	University of Stirling
Partner Organisation(s)	Universidad Michoacana de San Nicolás de Hidalgo
Darwin Grant Value	£172,850
Start/End dates	April 2004 – March 2007
Reporting period	1 April 2005 – 31 March 2006 Annual Report number 2
Project website	http://www.aquaculture.stir.ac.uk/gisap/Darwin/
Authors, date	Prof. Lindsay G. Ross, April 2006 Dr. Carlos A. Martínez-Palacios MSc. Alejandra Ahumada García MSc. Víctor Manuel Peredo Álvarez

2. Project Background

- This project is based in the Mexican Altiplano in the region of the Lake Pátzcuaro basin (Mesa Central of México). The region is home to a unique relict flock of Atherinopsid fishes, the *Chirostoma* group, locally known as whitefish or Pez blanco. The Pez blanco (*Chirostoma estor estor*) is a key species and a local symbol and has been the basis of an artisanal fishery for several centuries. Unfortunately, due to over-exploitation, change of land use and degradation of water quality in the lake the fish population has declined markedly in a short period and the species must now be considered as endangered.
- Our principal objectives are the implementation of Pez blanco aquaculture within the region. The project focuses on the transfer of technology for Pez blanco aquaculture to community groups and SME's which has the potential to reduce over-fishing. The recently completed associated large scale-hatchery facility (from complimentary funding) also has the potential to supply juveniles for restocking. Overall, this will help to avoid the constant pressure of fishermen on the natural population of Pez blanco, thus protecting biodiversity of this unique resource, and at the same time will sustain livelihoods.

3. Project Purpose and Outputs

- The purpose of this project is to contribute to the conservation of the natural populations of Pez blanco (*Chirostoma estor estor*) through aquaculture, as well as to transfer the technology already available for its culture. This project will allow the establishment of small scale aquaculture in the riparian area of Lake Pátzcuaro and other selected locations. The establishment of Pez blanco aquaculture will contribute to the rural economy of indigenous people (P'urhepecha ethnic group), due to the high prices of this species in the regional market. The price per kilo of Pez blanco can reach £15 at Easter time.
- Principal outputs will be: Training of campesinos, SME's and trainers, development of training materials, publication of training manuals, development of hatchery and production sites, assistance with design, operation and securing project funding, increasing awareness of biodiversity issues, publication of core science, investigation of related species, integrated systems, improving livelihoods, developing aquaculture and biodiversity strategy.
- The project objectives have not been significantly modified during the second year.

4. Progress:

Brief History:

Year 1:

- Project Associates (Alejandra Ahumada & Victor Peredo) recruited, May 2004.
- PI's initialise Darwin work, building on several years of previous development. July 2004
- Project Manager for year 1 (Dr A Campos Mendoza) appointed. August 2004.
- Project Associates travel to Stirling for MSc training. September 2004.
- Project Manager develops new contacts with target groups, September 2004 – March 2005.
- Finalising pond construction at Ichupio. Ponds stocked November 2004.
- Publicity events based on above. Articles in Trade Journals.
- Demonstration and training site developed at Ichupio December 2004.
- Large scale hatchery construction commenced at UMSNH, December 2004.
- First Project Consultative Group and BD network meeting, March 2005.
- Participation in talks, seminars, TV and Environmental fairs. Year 1.
- Papers published, given at conferences and in press. Year 1.

Year 2:

- Large scale hatchery construction completed. April 2005.
- Project Associates Alejandra Ahumada & Victor Peredo concluded MSc in Sustainable Aquaculture, University of Stirling, Stirling, Scotland, U.K. July 2005. Returned to post August 2005.
- Developing contacts with government agencies responsible for our activities. September 2005.
- Development of new calendar of visits to target groups for the project. September 2005
- Revision of projects prepared during Year 1 : developing improvements and submission of new ones. September 2005.
- Commenced monthly visits (at least) to all target communities. October 2005.
- Second Project Consultative Group and BD network meeting. December, 2005.
- Ponds at Ichupio site working well. Restocked February 2006.
- Developed project for SME's based at Ciudad Hidalgo trout farm and at Hidalgo. March/April 2005.
- Training site used for practical workshops on Aquaculture.
- Large scale hatchery now producing 40,000 juveniles per year. March 2006.
- Participation in talks, seminars, TV and Environmental fairs. Year 2.
- Papers published, given at conferences and in press. Year 2.

Progress in Year 2:

This summary is given against second year milestones from the original project document. In broad terms activities are now running, milestones have been met and in most cases outputs (see section 9) have been significantly exceeded.

Milestones from project proposal	Original target date	Progress on milestones to March 2006
Train 2 staff members in M.Sc. Sustainable Aquaculture at Stirling.	9/04 to 7/05	<ul style="list-style-type: none"> • Alejandra Ahumada & Victor Peredo returned to Mexico in April 2005 to conduct research projects aimed at field testing of training manuals and field development of BD strategy with target agencies and groups. • They satisfactorily completed their M.Sc. studies on Sustainable Aquaculture at the University of Stirling and took over the management and execution of the project. In September 2005.
Work on sustainable approach to on-growing through use of integrated systems with other native species.	4/05 to 3/06	<ul style="list-style-type: none"> • Dr. Antonio Campos Mendoza, former coordinator of the project in Morelia, has started to extend the technology of white fish aquaculture to the native Catfish <i>Ictalurus balsanus</i> in the communities of Tiquicheo, Tzitzio and some places in Guerrero. The first part of the project will focus on the reproductive season and maturity in the field and under controlled conditions.
Develop second tranche of pond trial sites with campesinos and SME's	4/05 to 3/06	<ul style="list-style-type: none"> • The establishment of lake side pond systems for the culture of this species, together with the training of indigenous people in aquaculture, is one of our major concerns. • The first site was stocked and also been established as a permanent demonstration area in which the field component of our courses can be delivered. It contains a teaching space and four ponds. These facilities continue to allowed us to train other groups interested in Pez blanco aquaculture. • A second trial site is now under construction at San Geronimo. This site is well advanced and about 60% of the construction is complete. We hope it will be ready for trials in summer 2006. The group of stakeholders has been sponsored by the municipal and state government, for the construction of two ponds of a quarter of hectare each. The goal of these stakeholders is to be able to use their ponds for an ecotouristic site, as well as for on-growing.
Extend technology to related candidate species.	4/05 to 3/06	<ul style="list-style-type: none"> • Work continues on <i>Chirostoma promelas</i>, a related species from Lago de Chapala in Jalisco state. This work is principally lab based at present, but is being conducted in collaboration with the state fisheries department in Jalisco.

Train stakeholders in pond management and on-growing using participatory techniques	4/05 to 9/05	<ul style="list-style-type: none"> A number of community stakeholder groups, from Tzitzio, Janitzio and San Geronimo, have been trained this year, as well as carrying out a series of expert visits. Workshops covered subjects in Aquaculture, Biodiversity and Livelihoods in the communities. Workshops were used to field test and evaluate our pond production manual, drafted by Mr Peredo, which has now been printed. They were also used to develop the draft biodiversity and aquaculture strategy.
3rd national Conference on Native Species for Aquaculture	9/05	<ul style="list-style-type: none"> The third national and first Latinamerican Conference on Native Species for Aquaculture, will take place in the "Centro Cultural Universitario" of Morelia Mexico, from the 18th to the 20th of October 2006. A web site has been constructed and is now active, see: http://www.aqua.stir.ac.uk/gisap/Conference/ This conference has been deferred to the third project year from year 2. The allocated funds have been agreed with DEFRA as a carry-forward to accommodate this change.
With SAGARPA & COMPECSA commence development of sustainable biodiversity plan(s) related to the activity and the species group	10/05 to 3/06	<ul style="list-style-type: none"> Ms Ahumada completed a MSc thesis on this topic in consultation with Mexican stakeholders. From this, a working draft of policies has been proposed. We will continue to discuss and develop this in collaboration with Mexican agencies for completion in early 2007.
Publish significant results in journals	4/05 to 3/06	<ul style="list-style-type: none"> Three articles are in press in BIOCELL, one in Journal of Fish Biology. Several articles have been submitted to journals. A number of popular and press articles have been produced.

Achievements this year:

- Completion of Project team
- Aquaculture training course planning
- Further development and publication of the underlying science
- Training of Trainers.
- Selection and screening of target groups
- Developing new/revised field contacts.
- Increasing training of Stakeholders.
- Training of SME's.
- Researched, prototyped and published the first field manual.

- Initial BD and aquaculture strategy now developed. A working draft will be generated for consultation over the next few months.
- Continued BD & Aquaculture Network meetings.
- Raising awareness in region and in country.
- Further development of website.
- Work on major conference, including web site.
- Special CONACyT TV programme, broadcast nationally.

Difficulties:

- There were some slight delays due to a brief gap in local project management. Dr Campos Mendoza left the group in April 2005, but his work was taken over by Ms Ahumada and Mr Perez in September 2005.
- There have been delays in pond culture projects, principally due to construction issues and administrative delays caused by extreme slowness of the various local organizations with whom we need to work. However, one of the two pond sites (Ichupio) has been completed and the second one (San Geronimo) is now under construction. We are currently running trials at Ichupio and expect to stock the San Geronimo site later this summer.
- A large number of broodstock were killed during major political difficulties at the Institute during 2005. This has been a continuing problem, but the situation is more or less under control now and hatchery production is increasing. This has nevertheless temporarily reduced our capacity to supply fish to projects.
- The Conference, originally planned for November 2005, has been deferred to October 2006 principally due to staff availability issues. We judge this to be a better target date. The website is now running and the budget allocated has been transferred to Mexico. This was agreed to be carried forward (email exchange with Margaret Okot [DEFRA] confirms).

Timetable for year 2 Apr2005-Mar 2006:

This is based on the original proposal and most major points remain the same. We will broaden the BD policy consultation to include other agencies, CONABIO etc. It is also very important to note that we have moved the proposed conference from the second year to the third year. Planning for this is now well advanced; see this link: <http://www.aquaculture.stir.ac.uk/gisap/Conference.htm>

<i>4/06 to 3/07</i>	<i>With SAGARPA and COMPESEA, develop sustainable aquaculture policies to ensure preservation of species flock. .</i>
<i>4/06 to 3/07</i>	<i>Develop final tranche of pond sites with campesinos and SME's</i>
<i>4/06 to 9/06</i>	<i>Train stakeholders in pond management and on-growing using participatory techniques</i>
<i>10/06 to 3/07</i>	<i>Train stakeholders in pond management and harvesting techniques.</i>
10/06	3rd national Conference on Native Species for Aquaculture – moved to Year 3.
<i>4/06 to 3/07</i>	<i>Further promote Darwin and biodiversity issues through press, TV and fisheries department</i>
<i>4/06 to 3/07</i>	<i>Publish significant results in journals</i>
<i>4/07</i>	<i>Produce Final Project Report(s)</i>

5. Actions taken in response to previous reviews:

- Points on SME links followed up as far as possible.
- Links with government agencies developing well.
- Modified reporting this year to include all published work as pdf's.

6. Partnerships:

- **Collaboration between Institute of Aquaculture and UMSNH:** This has, again, been excellent throughout the year, building on long-standing professional relationships between the Principal Investigators (Ross and Martinez) as well as excellent support from Project Associates Alejandra Ahumada and Victor Peredo (Local Project Staff). We do not anticipate any difficulties in this relationship over the project period.
- **Collaboration with other groups in Mexico:** Excellent collaboration continues with CIAD [Mazatlan], CIBNOR [La Paz] and INP [Mexico City].
- **Collaboration with other similar projects:** Our informal collaboration with researchers working on the South American Pejerrey, both in South America and Japan, reported in Year1, continues to be useful.

7. Impact and Sustainability:

- We have, again, made substantial efforts to promote the work this year, both in English and in Spanish. This has included a series of articles in popular trade journals and a number of newspaper articles, both local and national, in Mexico as well as more limited coverage in the UK.
- The trade journal coverage can be seen by following this link:
<http://www.aquaculture.stir.ac.uk/gisap/Pubs/Chirostoma.htm>
- Examples of the TV and press coverage can be seen by following this link:
<http://www.aquaculture.stir.ac.uk/gisap/Darwin/Chirostoma/Publicity.htm>

8. Outputs, Outcomes and Dissemination

Table 1. Project Outputs against second year targets:

↑ = outputs greater than plan		↔ = outputs same as plan		↓ = outputs less than plan	
Code No.	Quantity Projected	Quantity Achieved	Change ?	Description	
1B	1	0	↓	• Expected completion now December 2006	
2	2	3	↑	• Alejandra Ahumada García. BD strategy planning for aquaculture in Michoacán. Project completed July 2005. (Mexican, Completed M.Sc. in Sustainable Aquaculture, University of Stirling, Scotland,	

				<p>UK. July 2005)</p> <ul style="list-style-type: none"> Victor Peredo Alvarez. Manual for semi-intensive pond culture of <i>C. estor</i>. Project completed July 2005. (Mexican, Completed M.Sc. in Sustainable Aquaculture, University of Stirling, Scotland, UK. July 2005) Begonia Julian. Oxygen consumption of <i>C. estor</i>. Project commenced February 2006. (Spanish, studying M.Sc. Aquaculture at IoA, Stirling).
2	2	2	↔	<ul style="list-style-type: none"> Judith Sanchez Blanco. Anaesthesia, sedation and transportation of <i>C. estor</i>. Project completed January 2006. (Mexican, Completed M.Sc. in Aquaculture and Limnology, UMSNH, Mexico. March 2006). Lazaro Aguilar. Hatchery design and economics for pescado blanco aquaculture. (Mexican studying M.Sc. in Aquaculture and Limnology, UMSNH, Mexico).
3	2	4	↑	<ul style="list-style-type: none"> Tzitziqui Zumac Carranco. Enrichment of rotifers for first larvae of <i>C. estor</i>. (Mexican, studied at UMSNH) Rosa Linda Salgado Garcia. The effects of salinity on eggs, larvae and juveniles of <i>C. promelas</i>. (Mexican, studied at UMSNH) Rafael Delgado Duran. The effects of stress on gill Na/K ATP-ases in <i>C. estor</i>. (Mexican, studied at UMSNH).
6A	15	<p>122 contacts</p> <p>4 sessions</p> <p>15 contacts</p> <p>4 sessions</p>	↑	<p>Campesino sessions:</p> <ul style="list-style-type: none"> 10 campesinos from Ichupio 30 campesinos from San Gerónimo 48 community members: Ichupio, Janitzio, Erongarícuaro, San Jerónimo, Tzitzio and Morelia. Workshop on testing the training manual on aquaculture. 34 Community members: San Jerónimo, Islands (Yunuén, Pacánda & Janitzio) and Tzitzio. Workshops on Biodiversity issues and community participation, Species and fisheries, aquaculture and Programs on BD. <p>SME sessions:</p> <ul style="list-style-type: none"> 10 members from a trout farm, Ciudad Hidalgo, Mich. Further work with Tzitzio group. 1 campesino farmer/restaurateur and his family on Zirahuén Work with group from Hidalgo, Hidalgo.
6A	0			Government/NGO sessions:

		16 contacts 3 sessions	↑	<ul style="list-style-type: none"> • 6 Governmental Staff interviews on Biodiversity strategies in México, CBD landing process, aquaculture strategies and participation. • 8 Academic Staff interviews on Biodiversity strategies, Sustainable management of aquatic species in Michoacán, Participation and Aquaculture as an strategy for CBD. • 2 NGO's staff interviews on BD and aquaculture strategies, Governmental agencies, communication and participation of different stakeholders and Pez blanco Aquaculture as a BD conservation strategy.
6B	2	8	↑	<ul style="list-style-type: none"> • 8 weeks
7	0	1	↑	<ul style="list-style-type: none"> • Victor Peredo Alvarez and Lindsay G Ross. (2006). Manual Ilustrado de Entrenamiento en acuicultura semi intensiva. ISBN 1 85769 220 0 [see Table 2]
8	8 weeks	15 weeks	↑	<ul style="list-style-type: none"> • Three visits of Prof. L. G. Ross to Mexico (Project leader UK). • One visit of Dr. Carlos Martinez-Palacios to UK (Project leader Mexico). • One visit of Dr T Telfer (Environment specialist) to Mexico. Environment Report • One visit of Mr J Morales (PRA specialist) to Mexico. PRA visit report Ichupeo PRA report Erongaricuario PRA report San Geronimo PRA report
9	0	1	↑	<ul style="list-style-type: none"> • Draft biodiversity and Aquaculture Strategy for discussion. Resulted from M.Sc. thesis: BD strategy planning for aquaculture in Michoacán by Alejandra Ahumada García.
10	0	1	↑	<ul style="list-style-type: none"> • Field training manual completed and printed in March, 2006. • A more technical manual for producers, communities and SME's is in process and will be finished during 2006/early 2007.
11A	1	4	↑	<ul style="list-style-type: none"> • 1 Magazine article published, Aquaculture News (see Table 2). • 4 papers in press – to be published in BIOCELL April 2006 and in Journal of Fish Biology. (see Table 2)
11B	2	5	↑	<ul style="list-style-type: none"> • 3 papers submitted. (see Table 2) • 2 papers in preparation (see Table 2)

12A	0	1	↑	<ul style="list-style-type: none"> • GIS Database on <i>Chirostoma</i> species distribution completed in June 2005.
12B	0	1	↑	<ul style="list-style-type: none"> • Software and database installed in Mexico.
14A	1	1	↔	<ul style="list-style-type: none"> • 3rd National Conference on Native Species for Aquaculture • MOVED TO OCTOBER 2006 • Organisation well under way and web site active. See: http://www.aqua.stir.ac.uk/gisap/Conference/
14B	2	9	↑	<ul style="list-style-type: none"> • World Aquaculture Society meeting, Bali, Indonesia, May 2005. Presentation: Sustainable aquaculture of the Mexican silverside, <i>Chirostoma estor estor</i>, Jordan 1879: Transferring the technology to artesanal fishing communities. Lindsay G Ross*, Carlos A Martínez Palacios & Maria Luisa Rodríguez de Souza. • World Aquaculture Society meeting, Bali, Indonesia, May 2005. Presentation: Sustainable aquaculture of the Mexican silverside, <i>Chirostoma estor estor</i>, Jordan 1879: Biotechnical developments. Carlos A Martínez Palacios*, Ma Gisela Rios Duran, E Mayra Toledo Cuevas and Lindsay G Ross. • Instituto Tecnológico de Morelia (Morelia, Michoacán, México). Academic talk for Engineering BSc students: "Technology transference" MSc. Alejandra Ahumada G. • Invited talk: CIDEM [Centro de Investigacion y Desarrollo del Estado de Michoacán]. Seminar: "Sustainable aquaculture: Generating an activity which improves the quality of life". MSc. Alejandra Ahumada G. • Invited talk: CIDEM. Seminar: "Sustaining livelihoods and protecting biodiversity through development of Pez blanco aquaculture". MSc. Víctor M. Peredo Álvarez. • 2a Feria Ambiental Pátzcuaro 2006. Darwin Initiative Stand: "Pez blanco and technology transference: A conservation project". MSc. Alejandra Ahumada G & MSc. Víctor M. Peredo Álvarez • Invited talk: CIDEM. Seminar: Applied science and technology development to allow the conservation of pez blanco from Patzcuaro lake. Martínez-

				<p>Palacios, C.A., Ross, L.G.</p> <ul style="list-style-type: none"> • Invited talk: AMENA.[Asociación Mexicana de Expertos en Nutrición Animal]. Advances in nutrition of <i>C. estor estor</i>. C.A. Martínez-Palacios. • Invited talk: Tokyo University of Fisheries and Biotechnology Advances in culture and nutrition of <i>C. estor estor</i>. Martínez-Palacios. C.A. • Invited talk: CIDEM. Campos-Mendoza, A. Control de la reproducción en peces. • Invited talk: CIECO. [Centro de Investigaciones en Ecosistemas] Universidad Nacional Autónoma de México., Campos-Mendoza, A. El control de la reproducción en peces.
15A	0	5	↑	<ul style="list-style-type: none"> • Press release in La Jornada (National news paper) Hatchery finished. April 2005 • Press release in La Jornada, Investigación y Desarrollo. April 2005 • Press release in Procuraduría Agraria. April 2005 • Press release in ANIA. April 2005 • Press release in La Jornada Project Networking. May 2005.
15B	1	2	↑	<ul style="list-style-type: none"> • Press releases in La Voz de Michoacan and Cambio de Michoacán. (Local Newspapers)
15C/D	1	1	↔	<ul style="list-style-type: none"> • Article in Aquaculture News, Vol 32. (see Table 2).
17B	0	1	↔	<ul style="list-style-type: none"> • Continuation of Dissemination Network and Consultative group on conservation of biodiversity, December 2005. Current membership: • Professor Lindsay G Ross (Project leader, UK) • Dr. Carlos A. Martinez Palacios (Project leader Mexico) • Dr. Antonio Campos Mendoza (Project manager 2004-2005) • MSc. Alejandra Ahumada García (Project Manager 2005-2007) • MSc. Víctor M. Peredo Álvarez (Project Manager 2005-2007). • Cardiel Amezcu (NGO) • Dr. Edmundo Diaz Pardo (University of

				<p>Queretaro)</p> <ul style="list-style-type: none"> • Biol. Sergio Cortez (SAGARPA) • Biol. Catalina Rosas Monje (COMPESCA) • Sr. Leopoldo Perez Garcia (SME) • Sr. Mauricio Dolores Ponciano (Campesino) • Sr. Francisco Arregui Mendoza (Catfish aquaculture)
18A	0	1	↑	<ul style="list-style-type: none"> • TV Programme 30 minute Special on Pez blanco and Darwin Initiative. Dr Martinez-Palacios & Prof. Ross. Radioformula for CONACYT. Broadcast November 2005. • Available on CONACyT website. Follow this link: RADIO FORMULA <p>We are still trying to source a copy of this programme for installation on our DARWIN web site.</p>
18C	1	0		<ul style="list-style-type: none"> • None this year
20	0	1	↑	<ul style="list-style-type: none"> • Minor enhancements to Darwin Office in México (Office equipment). • Large-scale hatchery site created at UMSNH, based on complementary funding. Can be seen on our website: http://www.aqua.stri.ac.uk/HGISAP/Darwin/Hatchery.htm
21	0	1	↑	<ul style="list-style-type: none"> • Outreach training facility completed at Ichupio.
22	0	1	↑	<ul style="list-style-type: none"> • Pond array at Ichupio completed
23	0	1	↑	<ul style="list-style-type: none"> • PRODUCE-MICHOACAN \$120,000 Pesos Mexicanos. "Technology transfer for culture of pescado blanco de Patzcuaro". • PROMEP, Clave PTC-115: \$290, 000.00 Pesos Mexicanos. "Biología reproductiva del bagre del Balsas (<i>Ictalurus balsanus</i>), inducción hormonal y ambiental para estimular la actividad reproductiva"

Table 2: Publications

Type	Detail	Publishers	Available from: Use left click to follow links	Cost £
Field Manual	Victor Peredo Alvarez and Lindsay G Ross. (2006). Manual Ilustrado de Entrenamiento en	IoA, Stirling. ISBN 1 85769 220 0		£10

	acuicultura semi intensiva.		Training Manual	
Peer reviewed paper <i>In press</i>	Ross, L.G., Martínez-Palacios, C.A., Rodríguez de Sousa, M.L., y Campos-Mendoza, A., (2004) Darwin Initiative and the silverside fish <i>Chirostoma estor estor</i> : A link between aquaculture, biodiversity and livelihoods.	BIOCELL Argentina	Darwin & Chirostoma m/s	Nil
Peer reviewed paper <i>In press</i>	Martínez-Palacios, C.A., Racotta, I.S., Ríos-Durán, M.G., Palacios, E., Toledo-Cuevas, M, and Ross, L.G. Advances in applied research for the culture of Mexican silversides (Atherinopsidae).	BIOCELL Argentina	Advances m/s	Nil
Peer reviewed paper <i>In press</i>	Ríos-Durán, M. G., Hernández-Téllez, A.R., Martínez-Palacios, C.A. and Ross, L.G. The effect of transportation stress on tissue ascorbic acid levels of Mexican silverside (<i>Chirostoma estor estor</i> Jordan, 1979)	BIOCELL Argentina	Estor VitaminC m/s	Nil
Peer reviewed paper <i>In press</i>	Ross, L.G., ¹ Martínez-Palacios, C.A., ² Aguilar Valdez, Ma. del C., ² Beveridge, M.C.M. ³ and Chavez Sanchez, Ma. C ⁴ . 2006. Determination of feeding mode in fish: the importance of using structural and functional feeding studies in conjunction with gut analysis in a selective zooplanktivore <i>Chirostoma estor estor</i> Jordan 1880.	Journal of Fish Biology. 68: 1-13.	Feeding Anatomy m/s	Nil
Magazine Article	J Morales. Training workshop on Participatory Rural Appraisal (PRA) in Michoacán, Mexico. Work with three communities	Aquaculture News: 32.	PRA Article	
Peer reviewed paper <i>Submitted for publication</i>	Campos-Mendoza, A., Chavez-Sosa, J.C., Santoyo-Guzman, V.O., Martínez-Palacios, C.A. and Ross, L.G. (2004) The effect of photoperiod on reproduction of Pez blanco (<i>Chirostoma estor estor</i>) of lake Patzcuaro.	Journal of Applied Ichthyology	Estor Photoperiod m/s	Nil
Peer reviewed paper <i>Submitted for</i>	Carlos. A. Martínez-Palacios., Rosa. L. Salgado-García., Ilie. S. Racotta.,	North American Journal of		Nil

<i>publication</i>	Antonio Campos-Mendoza & Lindsay. G. Ross. The effects of salinity on eggs, larvae and juveniles of silverside (<i>Chirostoma promelas</i> Jordan and Snyder 1899) from Lake Chapala, Mexico.	Aquaculture	Promelas salinity m/s	
Peer reviewed paper <i>Submitted for publication</i>	CA Martínez-Palacios ; L Ambriz-Cervantes; M G Ríos-Durán; LG Ross & KJ Jauncey. Dietary protein requirement of juvenile Mexican Silverside (<i>Chirostoma estor estor</i> Jordan 1879), a stomachless zooplanktophagous fish	Aquaculture Nutrition	Estor protein m/s	
Peer reviewed paper <i>In preparation</i>	Lindsay G Ross., Judith Sanchez Blanca., Carlos Martinez-Palacios. Ilie. S. Racotta., & Mayra Toledo Cuevas. Anaesthesia, sedation and transportation of juvenile <i>Chirostoma estor estor</i> Jordan 1879 using benzocaine and hypothermia.	tba		Nil
Peer reviewed paper <i>In preparation</i>	Benjamín Aparicio, Ilie S. Racotta, Olivia Arjona, Carlos A. Martínez-Palacios and Elena Palacios. Lipid classes and fatty acids during embryogenesis of wild and captive silverside from Lake Pátzcuaro (<i>Chirostoma estor estor</i>).	tba		Nil

9. Project Expenditure

Table 3: Project expenditure during the reporting period (April 2005 to March 2006)

Item	Budget (please indicate which document you refer to if other than your project schedule)	Expenditure	Balance



Please note that these budget figures reflect the internal accounting mechanisms and recoding used within the University of Stirling and so some values may differ from the original Darwin/DEFRA budget proposal. DEFRA have agreed that minor residual sums are used to cover the cost of annual audit, resulting in a year-end balance of £0.

10. Monitoring, Evaluation and Lessons

- Monitoring has been continuous through almost daily email and by brief written and verbal reports from all participants to the UK and Mexican project directors. Continued regular visits from the UK project director have also been extremely important and valuable and have been managed so as to allow longer periods in Mexico than allowed for in the project
- Again, all outputs and outcomes have contributed qualitatively to the planned project purpose and objectives. Regular quantitative evaluation of achievements and the six monthly and annual reports against the project milestones shows that targets have been exceeded in most cases.
- An advisory group was established in year 1 and this provided useful input. Because of availability and location of members, we have decided that this group will meet every 6 months, rather than the three month interval originally proposed.
- Slow responses from have been experienced some collaborators and from the numerous government and state agencies with whom we need to interact. Although anticipated to some extent, this has caused needless delays and has affected the speed of implementation of some aspects of the project.
- The value of our in-country managers (Alejandra Ahumada and Victor Peredo) has been high this year since taking up their posts.

11. OPTIONAL: Outstanding achievements of your project during the reporting period (300-400 words maximum)

- Publication of our first illustrated manual on Semi Intensive Aquaculture. See:

[Illustrated Manual](#)

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

Annex 1. Report of progress and achievements against Logical Framework for Financial Year: 2005/2006

Project summary	Measurable Indicators	Progress and Achievements April 2005-Mar 2006	Actions required/planned for next period
<p>Goal: To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but poor in resources to achieve</p> <ul style="list-style-type: none"> • 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 			
<p>Purpose: Threatened fish species in Mexican altiplano lakes conserved through strengthened institutional capacity, work with stakeholders and increased public awareness.</p>	<p>Establishment of pond trial sites.</p> <p>Training of campesinos.</p> <p>Training of project staff (including to MSc).</p> <p>Development of policy on sustainability of the activity.</p>	<p>Sites established, see website.</p> <p>Many successful workshops operated</p> <p>Good progress reports.</p> <p>Now in working draft.</p>	<p>No major problems have arisen, other than bureaucratic delays. Cooperation is good and output is generally high.</p> <p>More is planned for 2006/7</p>
<p>Outputs:</p>			
<p>Staff trained in Sustainable Development</p>	<p>Project staff trained. In PRA</p> <p>2 MSc's in Year 2.</p>	<p>Target exceeded.</p> <p>Graduated and in post. + Field manual and BD strategy outputs.</p>	<p>This aspect is progressing well.</p> <p>More planned for 2006/7.</p>
<p>Campeños trained in pond management and grow-out techniques</p>	<p>Workshops held for numerous participants; see Table 1 and:</p> <p>http://www.aquaculture.stir.ac.uk/gisap/Darwin/Workshops.htm</p> <p>Functional production ponds achieved. See:</p> <p>http://www.aquaculture.stir.ac.uk/gisap/Darwin/Projects.htm</p>	<p>Project reports, pond outputs, performance monitoring programme.</p>	<p>Cooperation has been excellent.</p> <p>Further workshops and projects are planned for 2006/7.</p>
<p>Hatchery facilities completed</p>	<p>The new enlarged hatchery site created at UMSNH. See:</p> <p>http://www.aquaculture.stir.ac.uk/gisap/Darwin/Hatchery.htm</p>	<p>Hatchery operational March 2005. Egg and juvenile production is already high. This facility will supply all our field projects.</p>	<p>Support from Fondos Mixtos enabled this major development. The project was completed in mid 2005 and further complimentary funding (PRODUCE Michoacan and PROMEP) is maintaining the facility.</p>
<p>Small businesses involved in hatchery and supply side activities</p>	<p>Hatchery methods extended to 2+ SME business sites</p>	<p>Training given to SME staff. Assistance with project planning and construction is under way.</p>	<p>Excellent level of interest and cooperation.</p> <p>More planned for 2006/7.</p>
<p>State wide policy is developed on native fish species and sustainable aquaculture.</p>	<p>Policy manual completed in years 2/3 in conjunction with stakeholders</p>	<p>Under development. See:</p> <p>http://www.aquaculture.stir.ac.uk/gisap/Darwin/manuals.htm</p>	<p>COMPESCA cooperation is limited, but SAGARPA, CONABIO and PRODUCE is good. We continue to work on this through our Network.</p>