

Exploitation and management of exotic and naturalized aquatic genetic resources in relation to native biodiversity



Puerto Varas, Chile
24-26 September 2003

FINAL REPORT



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Organized by:

Laboratory of Genetics & Aquaculture, Universidad de Los Lagos (Dr. Gonzalo Gajardo & Patricia Beristain), Osorno, and the Division of Population Genetics, Stockholm University (Prof. Nils Ryman & Dr. Linda Laikre).

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Facilitated by:

the Conservation Breeding Specialist Group (CBSG, www.cbsg.org).

Sponsored by:

the Genetics Society of Chile (www.sochigen.cl)

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SECTION 1.

Executive Summary

Executive Summary

Introduction

The introduction of exotic species constitutes a major threat to biological diversity, and there is scientific consensus that avoidance of such introductions represents one of the most important steps towards conservation and sustainable use of natural resources. However, aquaculture – the *prima facie* for world food production and a fast growing economic activity in the developing world – is often based on exotic species. This sort of paradox requires scientifically grounded cost-benefit analysis in order to establish sound management practices.

Chile has gained international reputation as a leading country in aquaculture, mainly through the farming of alien salmonid resources. A massive industry has put the country as the second largest producer of farmed salmon in the world. However, introduction of alien species is second only to loss of habitat as the major factor affecting native biodiversity on a global scale. These introductions can have severe direct impacts in the form of ecological displacement of native species, as well as more indirect effects through modification of the native population genetic structure. Experts agree on the importance of genetic concepts and techniques to assist in the characterisation, management and conservation of the genetic resources found among native aquatic species and to support sustainable fisheries and aquaculture. In a scenario of global economic relationships and regional trade agreements, it is vitally important to focus this required debate for developing countries.

To accomplish this broad goal, researchers in genetics and aquaculture from Universidad del Los Lagos (Chile) and Stockholm University (Sweden) collaborated to organize a 3-day workshop with participation from experts in aquaculture science and policy from South America, North America, and Europe. The workshop was designed to bring together a variety of stakeholders to act as a forum to:

- Raise public awareness of the possible effects of introducing alien species and populations;
- Provide background information on the main issues and implications related to species / population introduction, exploitation and management, including naturalized ones;
- Provide guidelines to government and fisheries authorities, fisheries industries, regional management bodies, and research funding agencies on the need to focus research and development strategies on evaluation, monitoring and mitigation activities along with education plans in order to minimize the spread and impact of alien species and populations;
- Discuss the impact of the sustainable management of self-sustaining populations of naturalized species that are economically valuable; and
- Organize a national task force to deal with exotic and native species in a systematic and coordinated manner.

The CBSG Workshop process

The workshop, entitled *Exploitation and Management of Exotic and Naturalized Aquatic Genetic Resources In Relation to Native Biodiversity*, was held 24 – 26 September at the Hotel Cabañas del Lago in Puerto Varas, Chile, Chile. A total of 29 experts participated in the discussions, with facilitation conducted by members of The Conservation Breeding Specialist Group, CBSG (Species Survival Commission, IUCN – World Conservation Union).

CBSG was invited to apply their particular style of workshop design and facilitation in order to maximize the productivity of the workshop participants. Effective conservation management of our biological resources is best built upon critical examination and use of all available biological information, but also very critically depends upon the actions of humans living within the area of concern. A crucial component of the workshop process conducted by CBSG is the enormous amount of information that can be assembled and analyzed that often, to date, has not been published. This information can come from many sources; the contributions of all people with a stake in the future of the species is to be considered and given equal validity. This information is then used in a structured deliberative process to identify the most effective and achievable conservation strategies to address the situation at hand.

At the beginning of the workshop, each participant was asked to introduce themselves and to identify their primary issue for the conservation of native aquatic biodiversity in the face of exploitation and management of exotic and naturalized genetic resources. Following this important social process, a series of very informative presentations were given on the following topics:

- Chilean policies and regulations for species introduction to aquaculture
- Stocking and conservation: A paradox for the government?
- The precautionary approach in relation to fishery management and introduced species
- Genetics of introduced salmon and trout: Lessons from New Zealand
- The ecological consequences of introducing alien species to Nordic aquatic environments
- The introduction of new species: An opportunity for economic development and the base for the aquaculture of native species

The information presented during this period, with diverse perspectives represented, was vitally important in setting the stage for the subsequent working group discussions.

The information gathered during this early phase of the workshop was then used to identify three main working group topics: Status of Native Aquatic Biodiversity, Biological Aspects of Exotic and Native Species Management, and Exotic and Native Species Management Policy.

Participants were then asked to join one of these groups at their discretion and each group was given the following tasks:

- Discuss and refine the topic-specific issues identified in the opening session;
- Prioritize the refined issues;
- Assemble and analyze information pertinent to the topic;
- Develop a priority list of short-term (i.e., 1-year) and long-term (5-year) goals for each issue;
- Develop and prioritize detailed actions steps for each high-priority goals; and
- Identify the many types of resources required to implement the high-priority action steps.

During the workshop, a smaller group of participants saw the value of convening a fourth group with the specific task of clearing up issues of nomenclature and terminology related to the management of exotic aquatic species. Each working group produces a detailed report on their deliberations, which is included in the document resulting from the meeting. A successful workshop depends on determining a set of outcomes where all participants, coming to the discussions with different interests and needs, feel accepting of the management strategies developed by all involved. Workshop report recommendations are developed by – and, therefore, are the property of – the workshop participants. This sense of local ownership greatly enhances “buy-in” of the results, with a significantly increased likelihood of successful implementation of the recommendations in the time immediately following the workshop.

Each group presented the results of their work in plenary sessions in order to provide an opportunity for everyone to contribute to the work of the other groups and to assure that issues were carefully reviewed and discussed by all participants. The recommendations coming from the workshop were accepted by all participants, thus representing a shared view of the actions necessary to address the issues.

Working Group Summaries and Recommendations

A summary of working group recommendations is presented below.

Status of Native Aquatic Biodiversity

This working group recognized that the lack of basic information on native aquatic biodiversity prevents effective management of that biodiversity. Therefore poor management threatens this biodiversity and could lead to unsustainable policy decisions.

There is a need for basic information on basic biology, the value of biodiversity, and the extent and breadth of aboriginal knowledge relevant to the issue of native aquatic biodiversity.

Furthermore, the group noted that access to existing information needs to be improved. For example, information on biodiversity is of restricted distribution and limited access. In addition, the distribution of research facilities is very spotty along the country, with important gaps. Finally, communication among stakeholders (scientists and others) is poor.

Recommendations

Goal: To increase and improve available information on aquatic biodiversity.

- Implement a Geographic Information System (GIS)
- Create a data management system specific for Chilean aquatic biodiversity

Goal: To increase and improve traditional and scientific knowledge on native aquatic biodiversity, human expertise on biodiversity, and its communication among different stakeholders.

- Develop a national aquatic biodiversity action plan.
- Build collections. To involve institutions such as: CONFEPACH, IFOP and SERNAPESCA

Goal: To ensure relevant science is inserted into national and regional policies for the sustainable management of aquatic biodiversity and education.

- To organize workshops including all relevant stakeholders for policy makers. Develop a newsletter and appropriate material (e.g., videos, CDs, posters, etc.) where science is digested for school students and the general public.

Biological Aspects of Exotic and Native Species Management

The Group first identified six major problems associated with the biological aspects of effects of established alien species and aquaculture on native species and ecosystems. We then identified the most important two problems: (1) The inclusion of biological information into education and policy making and (2) the effects of introduced alien species and aquaculture on native species and ecosystems.

Two subgroups were formed that dealt with the problems mentioned above and consideration of the use of exotic species in aquaculture rather than native ones. Each of these groups developed a detailed working knowledge of the facts and assumptions pertinent to these three points. We constructed a table and a flow chart that demonstrated possible effects of established alien species and aquaculture on the biology of native species and their ecosystems.

We next identified the primary goal for our topic: To develop guidelines based upon biological principles and information that will reduce the harmful effects of aquaculture and established alien species on biodiversity.

We considered ways that our goal could be achieved and listed twelve actions to achieve this goal. Among these recommended actions included that the group would write an article to be published in a Chilean fisheries journal that pointed out the possible harmful effects of aquaculture and established alien species on native biodiversity in Chile. We also recommended the group would review the literature on what is known about the effects of aquaculture and established alien species on native biodiversity. Further, we recommended that the data produced by Group 1 should be used to compare species distributions, demography, and genetic characteristics in geographical areas with and without aquaculture and/or established alien species. A final action was recommended by the plenary session related to organize a workshop for the industry aimed at explaining the possible effects of the industrial activities and the responsibilities of the industry.

Recommendations

Goal: To develop guidelines based upon biological principles and information that will reduce the harmful effects of aquaculture and established alien species on biodiversity.

- Assess the status of native biodiversity in the areas where aquaculture and/or established alien species are present. Make the information available in databases and publications.
- Identify the institutions that are involved in management and research in aquaculture and its effects on native biodiversity.
- Literature review of what is known about effects of aquaculture and established alien species on native biodiversity.
- Comparative studies of species distribution, demography, genetics in areas with and without aquaculture and/or established alien species
- Identify abiotic factors (physical and chemical) that should be monitored in order to evaluate the effects of aquaculture.

- Promote development of measures to decrease the spread of diseases from aquaculture to nature.
- Evaluate the feasibility for aquaculture to assist in conservation of native aquatic species.
- Investigate possibilities to find funding for projects dealing with the effects of aquaculture and established alien species on native biodiversity.
- Assess the presence and status of established alien species in Chile.
- Write a letter expressing the need for developing means and regulations aimed at preventing further release of individuals of established alien species into the wild, and spread of alien species into areas where they are currently not present.
- Write an article to be published in eg. a Chilean fisheries journal concerned about the effects of aquaculture and established alien species on native biodiversity.
- Write an article to be published in a Chilean fisheries journal concerned about the genetic effects of introduce aquaculture produced seeds into natural marine benthonic populations.
- Organize a workshop for the industry aimed at explaining the possible effects of the industrial activities and the responsibilities of the industry.

Exotic and Native Species Management Policy

This working group identified the most relevant issues regarding the current situation of management policies for exotic and native species. Among these issues the most urgent topics were the lack of an agreed diagnosis of the existing explicit and implicit policies. Therefore, it has been identified as a needed action, the development of a survey in order to gather information about 1) current situation of the coordination among national institutions and its policies, 2) coherence of the policies with international agreements and recommendations, 3) effectiveness of the policies to address relevant conservation issues and 4) aspects related to public involvement and transparency in the decision making process.

In order to advance in the solution of these problems of lack of information, the public fund FIP and FAP have been identified as possible sources of financing and a Technical Sheet asking for funding will be prepared. The required information for this document will be gathered by institutions with regional presence (CONAMA and Sernapesca), which will organize discussions on the specific objectives of the required diagnosis, with the aim of involving the Zonal Fisheries Councils on this necessity. These 5 Councils are crucial to get the approval.

The problem identified as second priority was the lack of information about effectiveness and compliance of policies and regulations on native and exotic species management. To solve this problem, the identified goal is the elaboration of an investigation focused on 1) native species status, 2) trophic chains status, 3) management measures/techniques to reduce negative impacts, and 4) public awareness (Facilitate access to public information).

Four activities were agreed to help solving these problems. Among them, the elaboration of a new system to assure compliance to sanitary and environmental regulation and also a management information system. This aspect has been worked out by the Undersecretariat for Fisheries and has already a timeframe to be realized. Regarding the required information on compliance of conditions given to introductions of exotic species, regional institutions will build up a matrix to gather compliance information. The required base line information about the

status of native species and trophic chains will be collected by scientists groups, which will evaluate the required funds and timeframe to achieve it. CORFO funds should be used for the advance in the development of environmental friendly techniques. Other funds should be used for the improvement of public awareness.

The third topic that needs urgent action is the improvement of the decision-making processes in relation to responsible introductions and restocking of alien species. Therefore the group agreed in 1) improvement and continuously review of ecologically and sanitary responsible criteria, 2) development of mechanisms to valorize impacts of introduced species (social, economic and environmental), 3) assure expert participation, 4) elaboration of an information system, and 5) improvement in the diffusion of assessment criteria for the evaluation of introduction processes.

To address these problems the group encourage the 1) regular interaction of the decision makers with the Technical Committee on EAS, 2) elaborate one or more technical sheet for the FIP or FAP to obtain necessary funds to for the development of valorization methodologies of impacts (social, economic and environmental) and for the development and linkage of databases, and 3) public funds can be also used in order to develop an effective strategy for public involvement improvement.

Recommendations

Goal: Elaborate a diagnosis of the existing policies and regulations on exotic and native species management, with special consideration to:

- Coordination and coherence of existing legal docs and the action of institutions (policy-enforcement-funding) at the National and Regional level.
- Coordination of them with international policies, agreements and recommendations
- Participation in the elaboration and compliance of the policies
- Promotion of effective conservation of native species and genetic variability
- Mechanisms to assure participation on international fora and agreements
 - To discuss and agree specific objectives of the project in Regions
 - To elaborate a technical sheet for the FIP to obtain necessary funds

Goal: To elaborate the investigation of the effectiveness and compliance of policies and regulations on native and exotic species management, specially focused to:

- Native species status
- Trophic chains status
- Management measures/techniques to reduce negative impacts
- Public awareness (Facilitate access to public information)
 - Propose a new system to assure compliance and obtain information
 - Elaboration of a regional matrix with compliance indicators for norms related to RAMA, D.S. 730
 - Gathering, collation, integration of available information on obj. 1 and 2. Identify further needs
 - To elaborate one or more technical sheet for the FIP or FAP to obtain necessary funds to clarify specific objectives 3 and 4

Goal: Improve environmental and sanitary mechanisms for the responsible introduction and restocking of species.

- Improve and continuously review ecologically and sanitary responsible criteria
- Development of mechanisms to valorize impacts of introduced species (social, economic and environmental)
- Assure expert participation.
- Elaborate and link database management systems
- Time frame and assessment criteria for the evaluation of introduction process
 - Maintain regular interaction with the Technical Committee on EAS
 - To elaborate one or more technical sheet for the FIP or FAP to obtain necessary funds to clarify specific objectives 2 and 4
 - Diffusion about timeframe and evaluation criteria for importation/introduction

Terminology

The term “naturalized”, referring to alien or exotic species that have established reproducing populations, is sometimes used in international and national fora and documents, as well as in management plans for species important for economic development or recreational use or that have special conservation concerns. The term is not frequently used in the scientific literature on alien species (also known as exotic or introduced species). In other contexts, however, the term may have implications for management and conservation that introduce ambiguity.

Different stakeholder groups have working uses of the term “naturalized” that vary depending on the culture and focus of the work.

For some users of the term, “naturalized” indicates that the alien species has been present in the environment for a considerable time (ranging from a few generations to several hundred years). Further, the term “naturalized” for some users implies a positive valuation of an established alien species. There is a risk that a naturalized species may be confused with a native species. A species that is called naturalized may therefore be assumed to be less “dangerous” than a “typical” alien species.

Thus, there is no standard agreement of what the term “naturalized” implies in terms of long-term persistence or value in an ecosystem. This lack of standard usage can lead to confusion that could hamper management and conservation efforts.

Recommendations

- The term *especies exóticas* should be used in Spanish. However, when translating into English, the term ‘alien species’ should be used (not exotic species).
- The term *established alien species* should be used instead of *naturalized* in the proceedings from this workshop.
- In Spanish, the equivalent of *established alien species* should be *especies exóticas establecidas*
- The workshop organizers should contact appropriate bodies and communicate the need for organizations such as CBD, FAO, IUCN Specialist Species Group to update their Spanish and other glossaries (definitions).

- The use of the terms found on the CBD web page www.biodiv.org/doc/cbd-voc.aspx and other standard glossaries such as the FAO should be used. Participants from this workshop should encourage the incorporation of these terms in working documents, regulations, discussions, etc.
- A wider review of the usage of terminology will be valuable. The workshop encourages the present ad hoc group to pursue and expand on this issue.

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SECTION 2.

Native aquatic biodiversity Working Group Report

Native aquatic biodiversity

Members of Group 1: Devin Bartley, Jorge Toro, Germán Pequeño, Ricardo Galleguillos, Gonzalo Gajardo, Gustavo Somoza, Doris Soto, Fernando Jara, and Brian Dyer.

Identification of issues

We identified that the lack of basic information on native aquatic biodiversity prevents effective management of biodiversity. Therefore poor management threatens this biodiversity and could lead to unsustainable policy decisions.

There is a need for basic information on:

- Basic Biology (See Table 1)
- Value of Biodiversity
- Aboriginal knowledge

Furthermore we noted that access to existing information needs to be improved. For example:

- Information on biodiversity is of restricted distribution and limited access.
- The distribution of research facilities is very spotty along the country, with important gaps.
- Communication among stakeholders (scientists and others) is poor.

The following assumptions (Table 1) underlie the issues and problems identified above

Table 1

Assumptions:	How do we know these assumptions are valid?
1. We assume that native biodiversity is valuable and should be protected	1. International conventions signed by Chile and 183 other countries.
2. We assume that the society needs this information	2. In any democratic society the public has the right to be informed about the state and potential value of the national resources.
3. We assume that better information on biodiversity leads to better policy making and management, but not sufficient.	3. The degree to which this assumption is valid needs to be studied. Accurate information is a necessary but not sufficient criteria for good decision making.
4. We assume that the information we have is accurate.	4. There are technical and scientific reviewed papers supporting these assumptions.

Data assembly and analysis

Chile possesses a wealth of native aquatic biodiversity. Some of it is relatively well known, but significant gaps exist (Table 2). We estimated there is approximately 1200 nominal aquatic species, 800 published papers on systematics of Chilean fishes, and approximately 200 publications are from Chilean authors, for example: Pequeño, Lamilla, Dyer, Meléndez, Chong, Oyarzún, Arratia, Vila, Gajardo, V.H. Ruiz, Campos, etc.

Table 2. Status of information on native species.

Groups	Basic Biology Information				potential impact of Alien species on...
	Systematics*	Genetics and Evolution**	General Biology***	Ecology***	
Fish	Medium	Low	Low	Low	High
Aquatic Mammals	High	Medium-high	?	?	?
Aquatic Birds	Medium-high	Low	Low	Low-Medium	?
Amphibians	Medium-high	Medium	Low?	Low	High
Molluscs	Low-Medium	Low	Low	Low	Medium
Crustaceans	Medium	Low	Low	Low	Medium
Other invertebrates	Low	Low	Low	Low	?
Algae	High	Low	Low-Medium	Low-Medium	?

Although there are problems with prioritization, we did so in order to be more practical; number of * indicates levels of importance. General Biology includes development and reproduction, physiology and behaviour.

Important data are missing that would better help us address this issue:

- Information on human experts within the country.
- Centralized information on funding sources.
- Collections and digitizing of information.
- Indigenous knowledge of biodiversity.
- Demographic information.
- Social and economic importance of native resources.

In addition to the above information, a mechanism of integrating different types of information was identified as an important and necessary tool and include the following:

- A geographic information system.
- A data management system.

The following references in Chile will be useful to address this issue:

- Biodiversity: Simonetti, J. et al. Biodiversidad en Chile. CONICYT.; Alveal, K. et al. Biodiversidad (2002). Universidad de Concepción.
- Molluscs: Osorio, Valdebenito, Stuardo., Campos, B
- Crustaceans: Retamal, M.A.; Bahamonde.
- Echinoderms: Larrain, A.
- Algae: Santelics, B.; Ramírez, M.E.; Westermeier, R.
- Fishes: Kong, I.; Lamilla, J.; Meléndez, R.; Oyarzún, C.; Pequeño, G.; Sielfeld, W., Dyer, B
- Amphibians: Cei, J.; Formas, R.
- Reptiles: Donoso-Barros, R.; Donoso, M., Veloso, A.
- Birds: Philippi, B.; Schlatter, R.
- Mammals: Aguayo, A.; Sielfeld, W.

Identification of goals

The general goal is to protect native aquatic biodiversity.

In this context, the following specific goals were defined:

1. To increase and improve available information on aquatic biodiversity.
2. To increase and improve traditional and scientific knowledge on native aquatic biodiversity.
3. To increase and improve human expertise on biodiversity.
4. To improve communication among different stakeholders on biodiversity.
5. To ensure relevant science is inserted into national and regional policies for the sustainable management of aquatic biodiversity and education.

Development of actions and projects

Goal 1. To increase and improve available information on aquatic biodiversity.

- a. To implement a Geographic Information System (GIS).
Actions: To contact “Comisión Nacional del Medio Ambiente” (CONAMA), “Servicio Meteorológico de Chile” (SMCH), “Instituto Geográfico Militar” (IGM), “Servicio Hidrográfico y Oceanográfico de la Armada” (SHOA) and “Subsecretaría de Pesca” (SUBPESCA) in order to access their existing information.
Geo-referenced information to be included:
 - Native and alien species identification and distribution data.
 - Water bodies.
 - Demographic information.
 - Land and water use information.
 - Environmental data.

Climatological data.
Oceanographic information.

Responsible parties: Brian Dyer (Universidad del Mar, Viña del Mar), FAO (Inland water resources and aquaculture service).

Timeline: Three years project beginning November 2004.

Outcome: an accurate tool for management, decision making, research and other purposes. Updated continuously. Available information at a webpage.

Collaborators: CONAMA, SMCH, IGM, SHOA, UACH, ULA, UDEC, MNHN, UANTOF, UAP, UV, UCN, UCH, SubPesca, CONA, Sociedad de Limnología de Chile.

Costs: 30.000 U\$S to hire collaborators (1 UF hour aprox). Administration: 25.200 U\$S. Expenses and overhead: 11.000 U\$S (10%). Computer and software: 10.000 U\$S. Local travels and per diem: 9.000 USD. Workshop: 30.000 U\$S. Publication: 10.000 U\$S TOTAL: 125.250 USD

Consequences: Improved access to information. Open access to information. Better decision making.

Obstacles: No present funding. Some information could be restricted or not available. Coordinating different institutions.

- b. To create a data management system specific for Chilean aquatic biodiversity.
Actions: Identify existing data owners. To contact individuals and all scientific societies in the country related with the subject. To contact FishBase Team as advisors. To do in a format compatible with FishBase but including all relevant aquatic taxa.

Responsible parties: Gonzalo Gajardo (ULA).

Timeline: Two years project beginning November 2004.

Outcome: A FishBase like data base including all other relevant aquatic taxa.

Collaborators: UACH, ULA, UDEC, MNHN, UANTOF, UAP, UV, UCN, UdelMAR, UCH, SubPesca, CONICYT, FishBase, FAO.

Costs: 20.000 U\$S to hire collaborators (1 UF hour aprox). Administration: 17.000 U\$S. Expenses and overhead: 9.000 U\$S (10%). Computer and software: 10.000 U\$S. Local travels and per diem: 6.000 U\$S. Workshop: 30.000 U\$S. Publication: 10.000 U\$S TOTAL: 83.000 USD

Consequences: Improved access to information. Open access to information. Better decision making.

Obstacles: No present funding. Some information could be restricted or not available. Coordinating different institutions.

Goals 2,3,4. To increase and improve traditional and scientific knowledge on native aquatic biodiversity, human expertise on biodiversity, and its communication among different stakeholders.

a. Actions: Development of a national aquatic biodiversity action plan.

- Studies on Systematics, Genetics and Evolution, Ecology, General Biology and Conservation

- Studies on uses of aquatic biodiversity.
- Human capacity building.
- Studies on traditional indigenous knowledge of aquatic biodiversity.
- Improve communication among different stakeholders on biodiversity

Responsible parties: Jorge Toro (UACH).

Timeline: Ten years project beginning November 2004

Outcome: A national strategy on aquatic biodiversity. A better use of the resources.

Collaborators: FAO, UACH, ULA, UDEC, MNHN, UANTOF, UAP, UV, UCN, UdelMAR, UCH, UNSAM, IUCN.

Costs: 7.000.000 USD.

Consequences: Improved and open access to information and integrated work among stakeholders. Improve decision making. Increased knowledge and management of biodiversity. Compliance to international agreements. Compliance with the national goal to be a developed country by 2010, based on the sustainable use of the aquatic resources. Provide updated information to improve educational programs. Publications, scientific and general public, of the value of our biodiversity.

Obstacles: No present funding. Some information could be restricted or not available. Coordinating different institutions.

b. Action: To build collections. To involve institutions such us: CONFEPACH, IFOP and SERNAPESCA.

Responsible parties: Germán Pequeño (UACH) and Brian Dyer (UdelMAR)

Timeline: Five years project beginning November 2004

Outcome: A series of regional reference and research collections and data base integration by a webpage. Improve the appreciation of the value of scientific collections.

Collaborators: UACH, ULA, PUCV, PUC, UDEC, MNHN, UANTOF, UAP, UV, UCN, UdelMAR, UCH, UMAG, MHN, MHNC.

Costs: 200.000 USD.

Consequences: Improved and open access to scientific material and information for research and management.

Obstacles: No present funding. Coordinating different institutions. Lack of the appreciation of the importance of the collections.

Goal 5. To ensure relevant science is inserted into national and regional policies for the sustainable management of aquatic biodiversity and education.

Actions: To organize workshops including all relevant stakeholders for policy makers. Develop a newsletter and appropriate material (e.g., videos, Cd's, posters, etc.) where science is digested for school students and the general public.

Responsible parties: Gonzalo Gajardo (ULA), Ricardo Galleguillos (UDEC)

Timeline: Continuous. One workshop every two years. Newsletter, every four months.

Outcome: More aware public and policy makers.

Collaborators: FAO, CONICYT.

Costs: Workshop: 30.000 US\$. Paper publications: 10.000 US\$. Multimedia pubs: 50.000 USD (for the first two years).

Consequences: Improved and user friendly access to information. Open access to readily understandable information. Better decision making.

Obstacles: No present funding. Very time consuming and require special presentation skills.

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SECTION 3.

Biological Aspects of Effects of Established Alien Species and Aquaculture on Native Species and Ecosystems Working Group Report

Biological Aspects of Effects of Established Alien Species and Aquaculture on Native Species and Ecosystems

Members of Group 2: Fred Allendorf (University of Montana, USA), Patricia Beristain (Universidad de los Lagos, Chile), Nelson Colihueque (Universidad de los Lagos, Chile), Alexandre Hilsdorf (Universidade de Mogi das Cruzes, Sao Paulo, Brazil), Tomás García Huidobro (Fundación para la Innovación Agraria, Chile), Linda Laikre (University of Stockholm, Sweden), Sandra Marín (Universidad Austral de Chile, Chile), Victor Martínez (Universidad de Chile, Chile), and Federico Winkler (Universidad Católica del Norte, Chile).

Executive Summary

The Group first identified six major problems associated with the biological aspects of effects of established alien species and aquaculture on native species and ecosystems. We then identified the most important two problems: (1) The inclusion of biological information into education and policymaking and (2) the effects of introduced alien species and aquaculture on native species and ecosystems.

Two subgroups were formed that dealt with the problems mentioned above and consideration of the use of exotic species in aquaculture rather than native ones. Each of these groups developed a detailed working knowledge of the facts and assumptions pertinent to these three (IT SHOULD BE 2 IN AGREEMENT WITH PREVIOUS PARAGRAPH) points. We constructed a table and a flow chart that demonstrated possible effects of established alien species and aquaculture on the biology of native species and their ecosystems.

We next identified the primary goal for our topic: To develop guidelines based upon biological principles and information that will reduce the harmful effects of aquaculture and established alien species on biodiversity.

We considered ways that our goal could be achieved and listed twelve actions to achieve this goal. Among these recommended actions included that the group would write an article to be published in a Chilean fisheries journal that pointed out the possible harmful effects of aquaculture and established alien species on native biodiversity in Chile. We also recommended the group would review the literature on what is known about the effects of aquaculture and established alien species on native biodiversity. Further, we recommended that the data produced by Group 1 should be used to compare species distributions, demography, and genetic characteristics in geographical areas with and without aquaculture and/or established alien species. A final action was recommended by the plenary session related to organize a workshop for the industry aimed at explaining the possible effects of the industrial activities and the responsibilities of the industry.

Finally, we decided that we needed to drink beer before we did any more work.

1. General information

During parts of the workshop the participants were divided into three working groups that focused on different aspects related to exploitation and management of exotic and naturalized aquatic genetic resources in relation to native biodiversity. These three topics were identified after workshop participants indicated what would be the principal problems to address in relation to workshop's objective. In this context, this report is the final result of the work of Group 2.

Group 2 focused on “Biological Aspects of Effects of Established Alien Species and Aquaculture on Native Species and Ecosystems”. In this context, Group 2 identified the following 6 problems as particularly relevant to the workshop objective:

- Terminology is confusing and needs clarification.
- Clarification is needed regarding reasons and effects of choosing native vs. exotic species for aquaculture.
- Management plans for established alien species are lacking and need to be formulated.
- Chile (as well as many other countries) lack an information system for assessing and documenting environment or genetic impact of aquaculture and established alien species on native biodiversity.
- Biological information is insufficiently incorporated in policy making processes and there is a general lack of conservation biology education among politicians and various stakeholders concerned with aquaculture and established alien species.
- It is possible that aquaculture promotes introduction of alien species because native species have lower aquaculture and commercial potential than the exotic ones.

The first problem was removed from the list because there was a workshop participant agreement in that a small group would try this problem as a separated topic. Therefore, representatives of each of the three working groups formed a new forth group to work on the terminology problem. Since the other 5 identified problems included a wide diversity of topics and looking for ways to be able to accomplish workshop objective it was decided to merge some of the topics and prioritize them. After this process, the final problems were concerned with:

- The inclusion of biological information into education and policy making
- Effects of introduced alien species and aquaculture on native species and ecosystems

Through the plenary sessions of the workshop it became clear problem concerning “The inclusion of biological information into education and policy making” was also analyzed by Groups 1 and 3. For this reason Group 2 concentrated in the “Effects of introduced alien species and aquaculture on native species and ecosystems”, progressing by formulating an overall problem statement.

2. Problem Statement

Established alien species and aquaculture in Chile may harm native biodiversity and ecosystems.

The statement includes the effects of both aquaculture and established alien species as they may affect native species and ecosystems differently. Several aspects of the ecology of native species, communities and ecosystems were identified and discussed as being potentially affected by aquaculture and/or native species. To support these ideas a series of examples obtained from literature is listed below:

2.1. Examples of the impacts of aquaculture and established alien species in Chile

2.1.1. Aquaculture

2.1.1.1 Escapes of cultivated fish:

There are 5 species of alien salmonid fishes in Chilean rivers not originating from deliberate releases (Soto et al., 2001).

2.1.1.2 Ecological interactions between escaped and native fish:

Competition and predation:

- Coho salmon have been observed to prey upon on native fishes (anchovies, sardines, mote, silversides; Soto et al., 2001). Large abundance of Coho salmon may also impact native fish, specially those more likely to compete with them (jurel, merluza, huaica) (Soto et al., 2001).
- Brown trout feed mostly on small fishes as *Basilichthys microlepidotus*, *Diplomystes* sp. and juveniles of trout, in Río Limari, (Winkler, pers. obs.) and also on other aquatic vertebrates and invertebrates (Arena, 1978; Artigas et al., 1985; Ruiz et al. 1993). Because of the invertebrates included in its diet it may be assumed that they compete with native species, such as Galaxids (Pérez et al, 2003), since salmonids and Galaxids in the southern ocean have similar ecological niches although they did not evolved together (Crook and Andrews, 1998).
- Rainbow trout feed mostly on aquatic invertebrates, mostly insects, and crustacean, but also, occasionally, on fishes and other vertebrates (Arena, 1978, Ruiz and Berra, 1993) then it may be assumed that they compete with native species, such as Galaxids (Pérez et al, 2003), since salmonids and Galaxids in the southern ocean have similar ecological niches although they did not evolved together (Crook and Andrews, 1998). Overlapping in the invertebrate diet items consumed by *Galaxia maculata* and *S. trutta* has being observed in Rio Cónдор in Tierra del Fuego (Vila et al., 1999). The effect of the presence of rainbow trout on the *Basilichthys australis* silverside trophic niche has been studied by Capella (1992).
- There are some records of sturgeon escaped from an aquaculture facility at Peñaflo (Santiago) into the Maipo river. However, there is no available data on interaction with natural fauna.
- The African toad (*Xenopus laevis*) is becoming an invasive species progressively colonizing new water bodies in central and mid north area of the country. There some evidences of negative interactions with native and introduced species (competition and predation).

2.1.1.3. Habitat modifications:

A positive effect of the dam building activity for *C. canadiensis* on the *Galaxia maculata* abundance has been reported by Vila et al. (1999) in Río Cónдор, Tierra del Fuego. This could be connected to a negative effect of the *C. canadiensis* presence on the abundance of *S. trutta*.

2.1.1.4. Introductions of diseases:

In Chile there are few studies carried out to determine the presence of diseases produced by virus and bacteria currently infecting cultivated salmon in native fish. A study by

Cassiogli et al. (1999) indicated that salmon in the wild are infested with pathogens present in cultivated salmon. With respect to native species, Cassiogli et al. (1999) reported the presence of ecto and endoparasites and a low frequency of flavobacteria. However, due to population of native fish are not under stressful conditions it is not clear if these disease agents affect the biology and ecology of native fish. Studies are needed to evaluate this issue further.

2.1.1.5. Behavioral modifications:

- Since pelletized food is added to the water column, native fish get used to coming close to the cages to feed on pelletized food (Sepúlveda et al., 2004, in press in Aquaculture).

2.1.1.6. Pollution:

- Pelletized food is being added to the water column and bottom from salmon cages (Norambuena, 2002) and as a consequence original content of organic matter in the bottom may be modified below cages (Norambuena, 2002).
- Since pelletized food is being incorporated by native fish (Sepúlveda et al, 2004, in press in Aquaculture) it is possible that drugs used to control diseases in salmon also are being incorporated by native fish. Although the actual effects are not currently determined it is likely that the natural equilibria of bacterium flora in fish and molluscs may be disrupted and previously non-pathogenic strains may become potentially pathogenic, decreasing the viability of natural populations. Furthermore, native fish can feed on molluscs that can be potentially a source with high concentration levels of antibiotic, damaging both native populations of fish and molluscs itself (San Martin, pers. comm.).
- Drugs used to control specific parasites, such as the copepod *Caligus rogercresseyi*, may also affect other zooplankton components (Sepúlveda et al., 2004, in press in Aquaculture).

2.1.2. **Established alien species:**

2.1.2.1. Community composition:

- Assemblage of caligid ectoparasites (*Caligus* spp. and *Lepeophtheirus* spp.) on native fish has changes from 1980. Carvajal et al. (1998) reported that *Caligus flexispina*, now *Caligus rogercresseyi* (Boxshall and Bravo, 2000) formerly found in the ocean islands of the Pacific Ocean, is currently the dominant caligid species found in continental waters on native fish species as a consequence of native fish feeding close to salmon cages.

2.1.2.2. Behavioral modification:

Information on the possible effects of established alien species on the behaviour of native species in Chile is lacking.

2.2.2.3. Ecosystem modification:

Information on possible modifications of native ecosystems as a result of the establishment of alien species in Chile is missing.

2.2.2.4. Genetic modification:

Information on possible effects of established alien species on the genetic diversity and composition of native species is missing.

2.2.2.5. Genetic structure of established alien species:

- The genetic structure of rainbow trout has been studied using protein electrophoresis in populations from lakes in the X Region (Gajardo et al, 1998) and IV Region (Cárcamo, 1999). Population from the IV Region show higher relative genetic diversity between populations than southernmost populations and commercial cultured strains (Cárcamo 1999).
- Also there is information on genetic variability in brown trout populations, based on protein electrophoresis and microsatellite data (Faúndez et al., 1997; Colihueque et al., 2001), that show differences in allele frequencies in a major scale along Chile (Faúndez et al., 1997).
- There is information on cultured strains of coho salmon (Torres et al 1996; Winkler et al, 1999; Pérez et al. 2001). There is also some information on a small sample of wild coho salmon (Winkler unpubl.).

2.2.2.6. Management priorities:

Established alien species motivate funding for projects to deal with specifically the management of those alien species. These funds could have been used for management and conservation of native species.

- Chilean fishermen claim that free-living salmon are damaging their regular coastal fisheries and have requested legal permission to establish a salmon fishery. This fact has motivated a long term study to clarify the ability of salmon to establish wild populations after successful reproduction (Soto et al., 2001).
- Sport fishing based on free-living salmon is becoming an important activity in southern Chile and because of that government institutions have been focused in give funds for research that allows them to appropriately manage sport fishing.

In summary, information reported in the literature indicates that aquaculture and established alien species affects native biodiversity in different ways. For example, aquaculture reduces biodiversity of certain species assemblages (ectoparasites) because of the dominance produced by the large number of available hosts in cages. Through competition and predation, salmon reduces the abundance of native fish. Excess of organic matter on the bottom on aquaculture sites due to pelletized food and excretion may reduce biodiversity of bottom communities. Effects of established alien species are documented on community composition and management priorities, information of genetic effects in alien species is missing.

It is possible that established alien species affect ecosystems and the behavior of native species in similar manners as has been observed in other countries. For example, salmon escaped from aquaculture cages that become established die on the rivers, this constitute a ocean derived nutrients and energy (contained in their bodies) that is deposited in the surrounding freshwater and terrestrial ecosystems, as been documented for wild salmon in the northern hemisphere (Schindler et al., 2003). However, information regarding the situation in Chile is lacking. The examples listed above are result of what Group 2 members were able to identify during the period of time assigned to the workshop and may not represent the overall effects of aquaculture and established alien species. Table 1 and Figure 1 summarize the possible effects of established alien species and aquaculture on the biology of native species and their ecosystems.

Based on problem statement and the evidence gathered during the workshop, Group 2 defined the one objective and one goal.

3. Objective

Reduce the harmful effects of aquaculture on Chilean native biodiversity

3.1. Goal

To develop guidelines based upon biological principles and information that will reduce the harmful effects of aquaculture and established alien species on biodiversity.

In order to achieve this goal Group 2 identified a series of actions that were discussed in plenary sessions. From those discussions it became clear that some proposed actions, or part of such actions, were similar to those proposed by Group 1. Therefore, they are listed for this group but details are explained under Group 1 action plan. An additional suggestion was made by the plenary session and that was to include the evaluation of potential positive effects of aquaculture, specifically, how aquaculture could benefit native population, for example through re-stocking decreased natural population with individuals produced in hatchery. From the last discussion during plenary session the following actions were approved by workshop participants.

3.2. Actions:

- Assess the status of native biodiversity in the areas where aquaculture and/or established alien species are present. Make the information available in databases and publications.
Responsible Parties: Brian Dyer (Universidad del Mar) from Group 1.
Timeline: see group 1, Goal 1
Outcome: Description (including an accessible database and official publications) of the conservation status of biodiversity in areas where aquaculture is established.
Costs: see group 1, Goal 1
- Identify the institutions that are involved in management and research in aquaculture and its effects on native biodiversity.
Responsible Parties: Tomás García-Huidobro
Timeline: April 2004
Outcome: Documentation (available on the Internet) of institutions that are involved in management and research in aquaculture and its effects on native biodiversity.
Collaborators: - Conicyt, Fia, Subpesca, Ifop
Costs: US\$ 2000
- Literature review of what is known about effects of aquaculture and established alien species on native biodiversity.
Responsible Parties: Federico Winkler (Universidad Católica del Norte)
Timeline: Autumn 2004
Outcome: Report of summary the state of the art

Collaborators: Nils Ryman (Stockholm University), Linda Laikre (Stockholm University), Universidad Austral de Chile, Universidad de Chile, Universidad de Los Lagos, Universidad del Mar, Universidad de Concepción

Costs: US\$4000

- Comparative studies of species distribution, demography, genetics in areas with and without aquaculture and/or established alien species (using data provided by Group 1)
Responsible Parties: Doris Soto (Universidad Austral de Chile), Sandra Marín (Universidad Austral de Chile)
Timeline: 2006
Outcome: Scientific publications
Collaborators: Universidad Austral de Chile, Universidad de Chile, Universidad de Los Lagos, Universidad del Mar, Universidad de Concepción, Universidad Católica del Norte
Costs: Total US\$21376 (Salary for 3 part-time staff for a year (US\$18976), statistical software US\$2000, and other materials (US\$400)).
- Identify abiotic factors (physical and chemical) that should be monitored in order to evaluate the effects of aquaculture.
Responsible Parties: Sandra Marín (Universidad Austral de Chile)
Timeline: November 2004
Outcome: Scientific publications, reports to government institutions
Collaborators: Universidad Austral de Chile, Universidad de Chile, Universidad de Los Lagos, Universidad del Mar, Universidad de Concepción, Universidad Católica del Norte, Producer associations, CONAMA, Ifop
Costs: Total: US\$ 13450 (Salary for 2 part-time staff for a year (US\$12650), other materials (photocopies, printing material, etc. (US\$800)).
- Promote development of measures to decrease the spread of diseases from aquaculture to nature.
Responsible Parties: Victor Martínez (Universidad de Chile) and Sandra Bravo (Universidad Austral de Chile)
Timeline: October 2004
Outcome: Scientific publications, reports to government institutions, informative charts
Collaborators: Universidad Austral de Chile, Universidad de Chile, Universidad de Los Lagos, Universidad del Mar, Universidad de Concepción, Universidad Católica del Norte, Producer associations, Sernapesca, Ifop, Fundación Chile, Ictiopathologists from industry
Costs: US\$ 7455 (1 Part-time salary, printing material and photocopies, informative charts)
- Evaluate the feasibility for aquaculture to assist in conservation of native aquatic species.
Responsible Parties: Federico Winkler (Universidad Católica del Norte), Nelson Colihueque (Universidad de Los Lagos), Victor Martínez (Universidad de Chile)
Timeline: December 2004
Outcome: Scientific review, guidelines for biologically sustainable restocking.
Collaborators: Devin Bartley (FAO), Fred Allendorf (University of Montana), Alexandre Hilsdorf (University of Mogi das Cruzes), Sandra Marín (Universidad Austral de Chile),

Universidad de Chile, Universidad de los Lagos, Universidad del Mar, Universidad de Concepción, Universidad Católica del Norte, Producer associations, Ifop, Fundación Chile, Fundación Chinquihue

Costs: Total US\$ 6452 (1 Part-time salary, printing material and photocopies)

- Investigate possibilities to find funding for projects dealing with the effects of aquaculture and established alien species on native biodiversity.
Responsible Parties: Tomás García Huidobro (FIA) and Alex Brown (Subsecretaría de Pesca), Gonzalo Gajardo (Universidad de Los Lagos),
Timeline: during 2004.
Outcome: Funding
Collaborators: IFS, CONICYT, FIA, CORFO, FIP, FMI, FNDR, Universidad Austral de Chile, Universidad de Chile, Universidad de Los Lagos, Universidad del Mar, Universidad de Concepción, Universidad Católica del Norte, Producer associations, Ifop, Fundación Chile, Fundación Chinquihue, CONAMA
Costs: -US\$ 500 (photocopies, printing material)
- Assess the presence and status of established alien species in Chile.
Responsible Parties: Brian Dyer (Universidad del Mar) Group 1, Goal 1
Timeline: See Group 1
Outcome: Report of the status of established alien species
Collaborators: -Regional Universities, Research Government Agencies
Costs: From group 1
- Write a letter expressing the need for developing means and regulations aimed at preventing further release of individuals of established alien species into the wild, and spread of alien species into areas where they are currently not present.
Responsible Parties: Gonzalo Gajardo
Timeline: April 2004
Outcome: Letter to authorities
Collaborators: all workshop participants interested
Costs: 0
- Write an article to be published in eg. a Chilean fisheries journal concerned about the effects of aquaculture and established alien species on native biodiversity.
Responsible Parties: Victor Martínez (Universidad de Chile)
Timeline: July 2004
Outcome: Popular science article, or editorial or essay
Collaborators: Members of group 2 and other interested participants of the workshop.
Costs: US\$600
- Write an article to be published in a Chilean fisheries journal concerned about the genetic effects of introduce aquaculture produced seeds into natural marine benthonic populations.
Responsible Parties: Federico Winkler (Universidad Católica del Norte)
Timeline: July 2004

Outcome: Popular science article, or editorial or essay

Collaborators: Members of group 2 and other interested participants of the workshop.

Costs: US\$600

- Organize a workshop for the industry aimed at explaining the possible effects of the industrial activities and the responsibilities of the industry.

Responsible Parties: Gonzalo Gajardo (Universidad Catolica del Norte)

Timeline: 2006

Outcome: A workshop

Collaborators: Devin Bartley (FAO, Rome, Italy)

Costs: Support provided by FAO.

Most of the actions included in this plan are oriented to gather the existing information related to different aspects that aquaculture activities and established alien species may affect and to analysis the information to produce documents and articles that would help authorities and researchers to identify future actions that will reduce the effects of aquaculture activities and established alien.

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Figure 1. Conceptual model of the potential effects of aquaculture and established alien species on native biodiversity and ecosystems

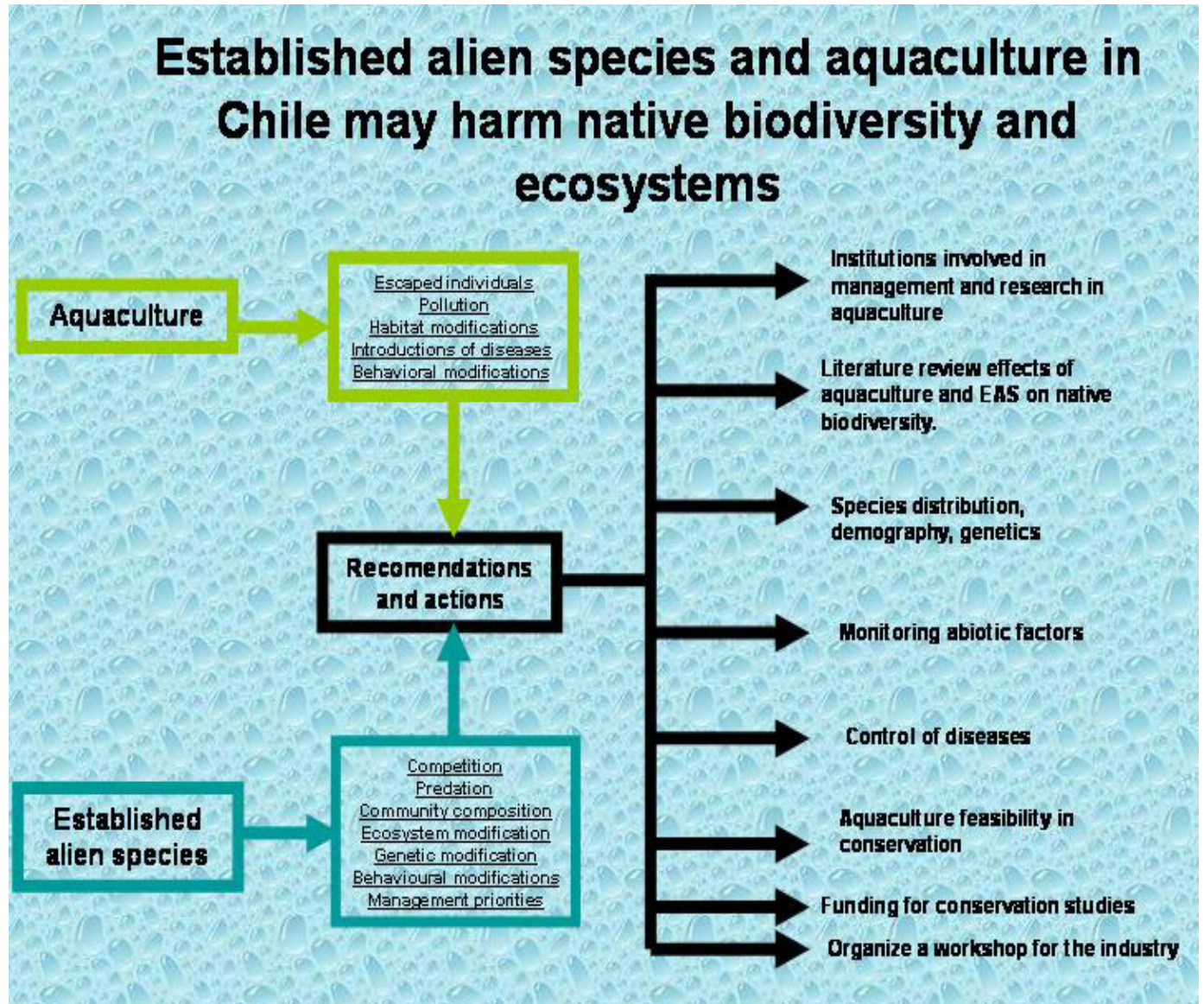


Table 1. Potential effects of aquaculture and established alien species on native biodiversity at different levels.

	Effects	Population Genetic Level			Species Level			Ecosystem level					
		Effective size reduction	Loss of variation through selection	Breakdown of genetic adaptations	Mortality rate	Carrying capacity	Behavior	Reproduction	Primary production	Community composition	Nutrient cycle	Trophic interactions	
Aquaculture	New diseases	X	X		X			X					
	Escapes	X	X		X			X				X	
		Predation											
		Food & resource competition		X		X	X	X	X	X	X	X	X
	Hybridization			X	X			X		X			
	Habitat alteration	X	X			X	X			X			
	Antibiotic		X		X				X		X		
Food					X	X		X					
Established Alien Species	Effluents								X				
	Habitat modification	X							X	X			
	Outnumbering	X				X			X	X		X	
	Hybridization			X						X		X	
	Predation	X	X		X								
	Food & resource												
	Competition				X	X	X	X	X	X	X	X	
Habitat alterations	X	X			X	X			X	X			

Exploitation and management of exotic and naturalized aquatic genetic resources in relation to native biodiversity



24-26 September, 2003
Puerto Varas, Chile

FINAL REPORT

SECTION 4.

Exotic and Native Species Management Policies in Chile Working Group Report

Exotic and Native Species Management Policies in Chile

Members of Group 3: Ricardo Norambuena, Gustavo Parada, Lilian Troncoso, Sandra Bravo, Alfredo Wendt, Tirso Poblete, Hugo Escobar, Alex Brown.

Facilitator: Yolanda Matamoros

Issues to be discussed:

1. Diagnosis of existing policies (social, cultural, economic, environmental consequences)
2. How do existing policies and regulations conform to international agreements
3. How to improve risk analysis tools
4. Balance economics with conservation.
5. Limits to development
6. How to give a value for economic and/or conservation factors (in able to do cost/benefit analysis)
7. How do policies coexist with economic and social and environmental aspects?
8. Law enforcement
9. Additional policy needs
10. Definitions of naturalized/established -important for policy development
11. Need for a policy promoting use of native species for aquaculture
12. Foment to the inscription of patents of the genetic information of native resources ownership of genetic resources.
13. Impact of intensive aquaculture on the ecosystem
14. Management of aquaculture and effects on the environment
15. Creation of genetic resources
16. Relationship between knowledge, legal issued and people (access to knowledge, principle of public participation)
17. Are policies and regulations effective and efficient for reaching goals?
18. Conflict resolution system for stakeholders
19. Compliance framework. How do we measure success?
20. Development of a bibliography database on exotic species management/experience/experts
21. Development of a decision-making procedure to improve transparency and information flow (technical, cultural, environmental, economical,...).

Problems:

1. Lack of an agreed diagnosis of existing policies. Weakness in:
 - Coordination (National (foundation organisms, private sector.../international (agreements,...))
 - Diffusion (clear, effective, participative)
 - Other topics (promotion of native species, patents, genetic reserves)

2. Decision making needs:
 - Clear time frame
 - Clear assessment criteria
 - Valuation of impacts (social, economic, environmental) + or –
 - Appropriate register and diffusion of the process and decisions about introduction of exotic species (scientific papers, case studies, reports)

3. Lack of information about policy/regulations effectiveness and compliance

Problems:

1. Lack of an agreed diagnosis of existing policies. Weakness in:
 - 1.1. Coordination (National (foundation organisms, private sector..../international (agreements,...)
 - 1.2. Diffusion (clear, effective, participative)
 - 1.3. Other topics (promotion of native species, patents, genetic reserves)

DATA ASSEMBLY

1.1 Coordination of national and Int'l policies and regulations Chilean policies and regulations: Which?

National Policy for Aquaculture

General Law for Fisheries and Aquaculture

Environmental Regulation for Aquaculture.

Sanitary regulation.

Certification.

First-importing species.

Rutinary importation

General Law for Environmental Protection

National Policy and Strategy for Biodiversity Conservation

International Agreements: Which?

1. CITES
2. Biological Diversity Convention
3. RAMSAR
4. APEC
5. FAO

1.2 Difussion: Which and How?

1. Official newspaper
2. Web pages (Conama, Subpesca, Sernapesca, CITES, CBD, RAMSAR)
3. Annual Reports

1.3 Other Topics(promotion of native spp, patents, genetic reserves)

Three Genetic reserves (Pullinque, Putemun, La Rinconada)

Working Group access genetic resources (CONAMA)

Goals

Problem 1. Deficient diagnosis of existing policies.

Goal: To elaborate a diagnosis of the existing policies and regulations on exotic and native sps. management, with special consideration to:

- 1.1 Coordination and coherence of existing legal docs and the action of institutions (policy-enforcement-funding) at the National and Regional level.
- 1.2 Coordination of them with international policies, agreements and recommendations
- 1.3 Participation in the elaboration and compliance of the policies
- 1.4 Promotion of effective conservation of native species and genetic variability
- 1.5 Mechanisms to assure participation on international fora and agreements

Activity	Resp.	Begin	End	Indicator of success	Collaborators	Resources	Obstacles	Consequences
To discuss and agree specific objectives of the project in Regions	Lily, Alfredo, Ricardo, Gustavo, Sandra	oct 03	jun 04	Agreement on specific objectives	Regional Offices of CONAMA and Sernapesca, private sector, university	Time	Institutional authorization, financial resources	Gain political support
To elaborate a technical sheet for the FIP to obtain necessary funds	Alex	jun 04	ago 04	Project realization	Lily, Alfredo, Ricardo	Time	other funding priorities	Information gathering

Problem 2. Lack of information about effectiveness and compliance of policies and regulations on native and exotic species management

Goal: To elaborate the investigation, specially focused to:

- 3.1 Native species status
- 3.2 Trophic chains status
- 3.3 Management measures/techniques to reduce negative impacts
- 3.4 Public awareness (Facilitate access to public information)

Activity	Resp.	Begin	End	Indicator of success	Collaborators	Resources	Obstacles	Consequences
Propose a new system to assure compliance and obtain information	Alex	Feb. 03	Dec. 04	Application of the new system	Public institutions, private sector,	\$ for preliminary assessments, time, HH	Political will	Environmental and sanitary improvement
Elaboration of a regional matrix with compliance indicators for norms related to RAMA, D.S. 730	Alfredo Lily	Oct. 03	Mar 04	N° existing Resolutions v/s N° audited resolutions	Sernapesca, CONAMA, Subpesca	HH	Other institutional priorities	Knowledge of current status and information for future actions
Gathering, collation, integration of available information on obj. 1 and 2. Identify further needs	Group 1	Tomorrow	ASAP	A Final report agreed by academic sector	Universities, Public sector	\$	Willingness	Reanalysis of management options
To elaborate one or more technical sheet for the FIP or FAP to obtain necessary funds to clarify specific objectives 3 and 4	Alex	oct 03	Aug. 04	Project (s) realization	Lily, Alfredo, Ricardo, Academic sector, private sector	Time	other funding priorities	Information gathering for management and regulation improvement

Problem 3. Weaknesses of decision-making processes related to responsible introductions and restocking of alien species.

Goal: Improve environmental and sanitary mechanisms for the responsible introduction and restocking of species.

- 2.1 Improve and continuously review ecologically and sanitary responsible criteria
- 2.2 Development of mechanisms to valorize impacts of introduced species (social, economic and environmental)
- 2.3 Assure expert participation.
- 2.4 Elaborate and link database management systems
- 2.5 Time frame and assessment criteria for the evaluation of introduction process

Activity	Resp.	Begin	End	Indicator of success	Collaborators	Resources	Obstacles	Consequences
Maintain regular interaction with the Technical Committee on EAS (obj. 1 and 3)	Alex	Nov. 02	No end	N° analyzed species/ N° new EAS N° new alien pathogens/decade	Academic sector Compliance of conditions by private sector	\$, HH	Willingness for voluntary work	Biodiversity protection
To elaborate one or more technical sheet for the FIP or FAP to obtain necessary funds to clarify specific objectives 2 and 4	Alex	Oct. 03	Aug. 04	Project (s) realization	Lily, Alfredo, Ricardo, Academic sector, private sector	\$, HH	Other funding priorities	Information gathering system for management and regulation improvement
Diffusion about timeframe and evaluation criteria for importation/introduction	Alex	Dec. 03	No end	reduction on time of analysis	Academic sector, Sernapesca, Subpesca (other depts.)	HH	Cooperation of collaborators	Efficient evaluations and responsible introductions

Conclusion

The group member identified the most relevant issues regarding the current situation of management policies for exotic and native species. Among these issues the most urgent topics were the **lack of an agreed diagnosis of the existing explicit and implicit policies**. Therefore, it has been identified as a needed action, the development of a survey in order to gather information about 1) current situation of the coordination among national institutions and its policies, 2) coherence of the policies with international agreements and recommendations, 3) effectiveness of the policies to address relevant conservation issues and 4) aspects related to public involvement and transparency in the decision making process.

In order to advance in the solution of these problems of lack of information, the public fund FIP and FAP have been identified as possible sources of financing and a Technical Sheet asking for funding will be prepared. The required information for this document will be gathered by institutions with regional presence (CONAMA and Sernapesca), which will organize discussions on the specific objectives of the required diagnosis, with the aim of involving the Zonal Fisheries Councils on this necessity. These 5 Councils are crucial to get the approval.

The problem identified as second priority was the **Lack of information about effectiveness and compliance of policies and regulations on native and exotic species management**. to solve this problem, the identified goal is the elaboration of an investigation focused on 1) native species status, 2) trophic chains status, 3) management measures/techniques to reduce negative impacts, and 4) public awareness (Facilitate access to public information).

Four activities were agreed to help solving these problems. Among them, the elaboration of a new system to assure compliance to sanitary and environmental regulation and also a management information system. This aspect has been worked out by the Undersecretariat for Fisheries and has already a timeframe to be realized. Regarding the required information on compliance of conditions given to introductions of exotic species, regional institutions will build up a matrix to gather compliance information. The required base line information about the status of native species and trophic chains will be collected by scientists groups, which will evaluate the required funds and timeframe to achieve it. CORFO funds should be used for the advance in the development of environmental friendly techniques. Other funds should be used for the improvement of public awareness.

The third topic that needs urgent action is the **improvement of the decision-making processes in relation to responsible introductions and restocking of alien species**. Therefore the group agreed in 1) improvement and continuously review of ecologically and sanitary responsible criteria, 2) development of mechanisms to valorize impacts of introduced species (social, economic and environmental), 3) assure expert participation, 4) elaboration of an information system, and 5) improvement in the diffusion of assessment criteria for the evaluation of introduction processes.

To address these problems the group encourage the 1) regular interaction of the decision makers with the Technical Committee on EAS, 2) elaborate one or more technical sheet for the FIP or FAP to obtain necessary funds to for the development of valorization methodologies of impacts (social, economic and environmental) and for the development and linkage of databases, and 3)

public funds can be also used in order to develop an effective strategy for public involvement improvement.

Glossary:

FIP	Fisheries Investigation Fund
FAP	Fisheries Management Fund
CORFO	Chilean Production Foment Organization
CONAMA	National Environmental Commission
SUBPESCA	Subsecretary of Fisheries
SERNAPESCA	National Fisheries Office
RAMA	Environmental Regulation for Aquaculture
RESA	Sanitary Regulation
D.S. 730	Introduced species regulation
EAS	Exotic Alien Species
HH	Working hours

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SECTION 5.

Terminology Working Group Report

Report from working group on terminology – what is meant by the term ‘naturalized’?

Group 4 members: Nils Ryman, Melanie Josefsson, Alex Brown, Gonzalo Gajardo, Linda Laikre, Devin Bartley

Background

The term ‘naturalized’, referring to alien or exotic species that have established reproducing populations, is sometimes used in international and national fora and documents, as well as in management plans for species important for economic development or recreational use or that have special conservation concerns. The term is not frequently used in the scientific literature on alien species (also known as exotic or introduced species). In other contexts, however, the term may have implications for management and conservation that introduce ambiguity.

Different stakeholder groups have working uses of the term ‘naturalized’ that vary depending on the culture and focus of the work.

For some users of the term, ‘naturalized’ indicates that the alien species has been present in the environment for a considerable time (ranging from a few generations to several hundred years). Further, the term ‘naturalized’ for some users implies a positive valuation of an established alien species. There is a risk that a naturalized species may be confused with a native species. A species that is called naturalized may therefore be assumed to be less ‘dangerous’ than a ‘typical’ alien species.

Thus, there is no standard agreement of what the term ‘naturalized’ implies in terms of long-term persistence or value in an ecosystem. This lack of standard usage can lead to confusion that could hamper management and conservation efforts. To reduce this confusion, the group proposes the following.

Recommendations

- The term ‘especies exóticas’ should be used in Spanish. However, when translating into English, the term ‘alien species’ should be used (not exotic species).
Responsible: Everyone
Time: Now and in the future
- The term ‘established alien species’ should be used instead of ‘naturalized’ in the proceedings from this workshop.
Responsible: Gonzalo (*editor*) and other participants
- In Spanish, the equivalent of “‘established alien species’ should be ‘especies exóticas establecidas’
Responsible: Everyone

- The workshop organizers should contact appropriate bodies and communicate the need for organizations such as CBD, FAO, IUCN Species Survival Commission to update their Spanish and other glossaries (definitions).
Responsible: Gonzalo and Melanie
Time: Within 6 months
 - The use of the terms found on the CBD web page www.biodiv.org/doc/cbd-voc.aspx and other standard glossaries such as the FAO http://www.fao.org/biotech/index_glossary.asp?lang=en should be used. Participants from this workshop should encourage the incorporation of these terms in working documents, regulations, discussions, etc.
Responsible: All participants
 - A wider review of the usage of terminology will be valuable. The workshop encourages the present ad hoc group to pursue and expand on this issue.
Action: Prepare a note for a scientific journal (e.g. Conservation Biology) explaining the problem and providing suggestions. This includes a literature review/search/analysis on the use of the term. Circulate draft among workshop participants.
Time: Completed draft manuscript within 6 months, and submittance within 8 months.
Responsible: Nils in cooperation with Gonzalo, Linda, Melanie, Devin and Alex
-
- **For the general workshop recommendations:** In line with the FAO precautionary approach, the term ‘responsible introductions’ should be used rather than ‘safe introductions’. (*Gonzalo*).

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SECTION 6.

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