World Fisheries Trust's Experience in Fish Genetic Conservation

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Introduction

World Fisheries Trust is a science-based non-profit organization that works toward conservation of wild fish stocks through research, training and public awareness. Genetic conservation is one of WFT's program areas, and the organization has been involved both on the practical side (field gene banking and training) and in the development of policy since about 1991, mainly in Canada and South America (ICLARM 1998). In the first few years of WFT's existence, genetic conservation was proportionately more significant (in terms of budget and staff time) than it is today. At present, the bulk of our genetic conservation field work is in South America, and most of the rest of our time is devoted to research (salmon enumeration, DNA fingerprinting studies, enhancement, economic valuation studies, policy development research) and public awareness. Wherever WFT has been involved in fish genetic conservation the rationale has been the same: a broad range of wild genetic material is required for recovery programs aimed at rebuilding wild stocks and for development of sustainable culture of local species, and in many cases that wild genetic material is disappearing before habitat recovery, changes in fishing or other remedial measures can have any effect.

Genetic Conservation Fieldwork and Training in Canada

Canada has anadromous salmon populations on both coasts, most of which are born, die and spend at least half their lives in fresh water. The degree of genetic diversity contained in the many thousands of distinct reproductive populations or stocks makes them an extraordinary example of freshwater biodiversity in their own right, and

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presents as well an enormous challenge in conservation and management of that biodiversity. The depletion and eventual demise of the single-species Atlantic salmon fishery happened years before the world's attention had swung to fisheries collapses and even to freshwater biodiversity as something worth worrying about—the last commercial opening for Atlantics in Canada was in 1986. But Pacific salmon, of which Canada's six species comprise at least 5,000 genetically distinct stocks, are front and centre in the country's collective mind as this is written.

Concerns based on incomplete knowledge

In 1993 the American Fisheries Society undertook what was probably the most ambitious status report on freshwater biodiversity to date, a review and analysis of the number of fish in each of the more than 10,000 genetically distinct populations of six species of salmon in BC and the Yukon. The final report (Slaney et al. 1996) appeared in late 1996, and its main message—that, at the aggregate level salmon stocks other than coho were healthy but that in terms of maintaining the biodiversity represented by small, less economically important stocks there was cause for serious concern—was no surprise for scientists well aware that biodiversity was being lost as weaker stocks felt the pressure of sustained harvest on larger ones.

What was perhaps just as alarming were the study's limitations when it came to assessing the most critical components of salmon biodiversity: lack of information on many stocks dictated basing conclusions on only 57 per cent of the total. For over 4,000 stocks there were insufficient data to draw conclusions; the data do not exist because the stocks have little commercial importance and are infrequently assessed, but, as the authors point out, they are critical to the maintenance of biodiversity. Lack of data on nearly a thousand stocks resulted in estimates of extinctions that were biased low. Limitations in the two major, "official" databases on salmon stocks forced the authors to appeal widely to fisheries professionals and interest groups for verification of status.

The American Fisheries Society study sets the tone for salmon gene banking in Canada: inadequate and out-of-date data leading to conclusions that could alarm or reassure, depending on the audience. World Fisheries Trust's gene banking activities should be viewed in this light. World Fisheries Trust's genetic conservation activities in Canada are primarily in support of conservation of wild genetic diversity, although we have also provided technical advice to a number of aquaculture companies who wish to safeguard particular farmed broodstocks.

Field gene banking started in 1992 in response to a request from First Nations for technical assistance in preserving dwindling genetic variability in several species and stocks. Three years of collection and training of aboriginal workers followed; the Shuswap Nation have so far collected and cryopreserved genetic material from six stocks (three species). Although none of the collected material has yet been used, Fortier (this volume) describes the program and tentative plans for using some of the coho material in 1998. WFT has also trained workers from several other aboriginal groups; one of these, the Carrier-Sekani First Nation, has for the past three years pursued its own gene banking program.

The Canadian Department of Fisheries and Oceans, the agency responsible for management of most of Canada's anadromous fish species, enlisted World Fisheries Trust's technical assistance in a two year pilot gene banking program prompted by concerns for certain Fraser River sockeye stocks. WFT collected and cryopreserved 2,000 samples from 750 fish representing 15 stocks in 1995 and 1996. All of this genetic material is currently held in storage.

Methods

WFT's field gene banking in Canada is done entirely "on the river". Sperm is collected from unanesthetized wild males captured by net or weir, and cryopreserved immediately, on site, in large volume (10 ml) plastic straws. WFT employs a portable cryo kit with a working time in the field of about two weeks; the kit is brought to the scene of collection. We do not perform pre-freeze motility checks, although random samples are checked for post-thaw motility before a shipment enters long term storage. Samples are stored at the BC Artificial Insemination Centre (a livestock semen bank) and accessions are managed using SpermSaver, a software program developed at WFT. In general, the technique allows rapid response to remote areas, portability and the low cost achieved by freezing on site and storing under contract in a large volume semen bank.

Fertility using the frozen-thawed sperm is primarily dependent on the sperm:egg ratio used and is comparable to that reported for other salmonid sperm cryopreservation methods. Apart from fertility testing, none of the stored sperm has yet been employed in recovery programs. This may in part be due to the lack of a policy framework for fish gene banking in Canada. As this is written the Government of Canada is drafting policy on gene banking; without such policy, managers will not develop comprehensive strategies for collecting and using fish genetic resources in conservation.

Genetic Conservation Fieldwork and Training in South America

WFT began to adapt its field cryopreservation technology to South American migratory fish species in 1993 and has since worked in Colombia, Venezuela and most recently Brazil. We are involved as trainers rather than as practitioners of gene banking, and provide a Training Course on Fish Genetic Conservation that includes theoretical, practical and policy aspects of gene banking.

Gene banking migratory species in South America is done using the same field kit as used for salmonids, with modifications for sperm volume. Sperm from the South American species is generally frozen in 0.5 ml plastic straws, and cryoprotectants are modified from the mixtures used with salmon. Collection methods must also take into account the frequently smaller sperm volume delivered by these species. Training courses have been delivered in Venezuela, Colombia and Brazil to a variety of audiences from government, academia and the private sector. Fish for which successful field methods have been developed include *Piaractus, Prochilodus, Salminus, Brycon, Leporinus* and *Pseudoplatystoma.*

Colombian requirements for genetic conservation of migratory species are described by Diaz (this volume).

In 1997, WFT entered into a three-year CIDA-funded project to provide genetic conservation training to a variety of Brazilian partners from government, academia, the hydroelectric power sector and conservation NGOs. The aim of the project (see contributions by Godinho and Zaniboni, this volume) is to preserve migratory fish genetic diversity and utilize it in restocking programs and in the development of culture of indigenous species.

Development of Policies for Fish Gene Banking

World Fisheries Trust's field activities in gene banking and training have at times illuminated a lack of policies for collection and equitable sharing of fish genetic resources. In general, few nations or local governments have equipped themselves with such policies; as Pullin and Raymond point out (this volume), this lag may be due to the relatively early stages of utilization of global fish genetic resources. Whatever the reason, it can be a real impediment to conservation (Pullin et al., 1998). To try and address the need for policies, WFT is carrying out a project to develop model policy for equitable sharing of benefits from fish genetic resources by local and indigenous communities.

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References

Pullin, R. S. V., D. M. Bartley, and **J. Kooiman, (Eds.).** 1998. Policies for aquatic resources. ICLARM Conf. Proc. 00. (in preparation).

Slaney, T. L., K. D. Hyatt, T. G. Northcote, and **R. J. Fielden.** 1996. Status of anadromous salmon and trout in British Columbia and Yukon. Fisheries 21(10):20-35.