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THE WORLDFISH CENTER AND ITS RELEVANCE FOR INTEGRATED IRRIGATION AND AQUACULTURE

Mark Prein^a and Randall Brummett^b

^a WorldFish Center, Penang, Malaysia

^b WorldFish Humid Forest Ecoregional Center, Yaoundé, Cameroon

Prein, M. & Brummett, R. 2006. The Worldfish Center and its relevance for integrated irrigation and aquaculture. In M. Halwart & A.A. van Dam, eds. *Integrated irrigation and aquaculture in West Africa: concepts, practices and potential*, pp. 161–164. Rome, FAO. 181 pp.

Abstract

The WorldFish Center (formerly known as ICLARM - the International Center for Living Aquatic Resources Management) was established in 1977 and since the mid 1980s has conducted research on rice-fish systems which are an essential part of integrated agriculture-aquaculture (IAA), and more specifically, integrated irrigation-aquaculture (IIA) farming systems. Its current mandate is to strive for more equitable distribution of the benefits derived from fishing and aquaculture, general improvements in the livelihoods of fishing and fish farming households; access to fish at affordable prices for poor consumers; reduced environmental impacts of fishing; increased number of fish farmers; and the protection of aquatic biodiversity. The strategic plan 2000–2020 places a high priority on the development of freshwater pond aquaculture, including rice-fish farming in irrigation systems and in fenced-in enclosures in agricultural lands. Although more widely developed in Asia, previous studies on rice-fish culture activities took place in Africa (Malawi and Ghana). The number of initiatives by the WorldFish Center and collaborative partners related to IIA (rice-fish farming in large-scale and small-scale irrigation systems, community-based fish culture) are being increased to monitor the technical feasibility and household adoption of IIA activities in Africa.

Mandate

The WorldFish Center was established by the Rockefeller Foundation in 1977 as the International Center for Living Aquatic Resources Management (ICLARM) with a mandate to conduct strategic research on issues relevant to the poor in tropical developing countries. In 1992 the Center became one of 16 international centers (also referred to as “Future Harvest Centers) under the Consultative Group on International Agricultural Research (CGIAR). The goals of the Center are to strive for more equitable distribution of the benefits derived from fishing and aquaculture, general improvements in the livelihoods of fishing and fish farming households; access to fish at affordable prices for poor consumers; reduced environmental impacts of fishing; increased number of fish farmers; and the protection of aquatic biodiversity.

The main foci of technical research have been on aquaculture of freshwater and coastal organisms and the assessment and management of coastal and continental fisheries. In addition, research is conducted on the genetic improvement of cultivated fish species, such as tilapia and carp, and the management of aquatic biodiversity. Overarching, and closely involved in all technical fields, is policy research, legal and institutional governance and impact assessment and priority setting. In recent years, the latter research has developed into the largest programme.

The WorldFish Center presently has nine country offices with posted staff in the Pacific, Asia, Africa and the Caribbean, including its headquarters in Penang, Malaysia. As of 2003, the Center has ongoing projects through formal agreements with around 250 partners in 51 countries (WorldFish Center, 2003a). The Center's core competencies (WorldFish Center, 2003b) are:

- Facilitating research;

- Stock assessment of coastal fisheries;
- Culture and stock enhancement of coral reef invertebrates;
- Global databases for managing aquatic resources;
- Methods for developing improved fish strains;
- Smallholder aquaculture development;
- Watershed approach to aquatic resource management;
- Socioeconomic research including institutional and governance analysis of the fisheries sector in developing countries.

As a key mode for the operation and implementation of its mission, the Center engages in formal partnerships with numerous types of stakeholders, for which it has a formal partnership policy. The Center has numerous multi-partner projects, and several multi-country, multi-disciplinary projects. It is in the process of adopting a focus on impact pathways for research, and expects that in the future, partnerships and networks will change to include more non-research partners to improve uptake and dissemination, including a wider range of disciplines. The partnerships are grouped into:

- National Agricultural Research and Development Systems (NARS in the CGIAR lexicon);
- Non-Governmental Organizations (NGOs);
- Individual scientists/researchers;
- Regional and international organizations;
- Advanced Scientific Institutions (ASIs) usually located in industrialized countries;
- Farmers and fishers.

Strategic plan

The WorldFish Center's Strategic Plan for 2000–2020 (ICLARM, 1999) places a high priority on the improvement of freshwater pond aquaculture, which includes rice-fish cultivation in irrigation systems and fenced-in enclosures in temporarily flooded agricultural lands.

Freshwater pond aquaculture

Total aquaculture production from tropical developing countries and East Asia in 1994 amounted to 15.1 million tonnes of which approximately 10.4 million tonnes were derived from freshwater aquaculture in ponds. Tilapia production doubled between 1988 and 1994 whilst carp production is suggested to have risen seven fold. Farmers can usually exercise rights over ponds and they are the most easily “manageable” of the production systems currently in use. New technology, if made available and applied to fish of value to the poor, can increase production efficiency so that further growth in output is likely. The main constraint to improved adoption in the smallholder sector is low yields due to lack of appropriate management methods and high feed costs. Higher levels of intensification suffer from lack of a systems approach, high disease incidence and inequity in the distribution of benefits. The WorldFish Center will concentrate on:

- Development of appropriate combinations of technologies for improved management, i.e. nutrition and reproduction, with an emphasis on genetic enhancement of food fish species;
- Integration of aquaculture methods into farming systems;
- Ex-ante estimation of the socio-economic impacts of aquaculture that might influence adoption and the marketable supply of improved fish.

The WorldFish Center will conduct its strategic genetic enhancement research increasingly through its Egyptian aquaculture facility. Other research will focus on field-level assessment and introduction of integrated aquaculture systems (including rice-fish) to those countries in Asia and sub-Saharan Africa with high concentrations of poor people and high potential for aquaculture development. Over the 20-year strategic planning period, the WorldFish Center will also evaluate the development of aquaculture systems with a focus on maximizing benefits accruing to poorer sectors of society, including both consumers and producers. These will be largely in the form of increased production, improved nutrition and better income for farm households, and affordable high-quality protein for consumers. Additional impacts are expected from improved efficiency of land and water use through integration.

Streams, rivers and floodplains

Lotic ecosystems represent a new area of work for the WorldFish Center (Dugan 2003). New knowledge about the importance of streams, rivers and floodplains show that large numbers of poor people depend

upon these highly variable resource systems to support complex livelihood strategies. Our analysis suggests that total productivity from lotic ecosystems in developing countries increased from approximately 3.5 million tonnes to 4.3 million tonnes in 1994. It is widely accepted that these may be large underestimates due to having left out the subsistence catch. Threats to this resource system include reduction in catches, and loss of biodiversity through habitat alteration. There is a generally weak knowledge base about access rights and the potential for enhancing production within floodplain systems, resulting in inappropriate policies and weak institutional support.

Focusing on the resources and the people who use them, WorldFish will seek to arrest loss in biodiversity, increase per capita fish production, and develop the research methods and data needed to improve policy and build an adequate institutional framework to support sustainable resource management. Improved access to and use of floodplain resources are anticipated to have relatively high gender benefits.

Activities under the Strategic Plan will concentrate on the development of appropriate ecological-economic models (including people as an integral part of the ecosystem analysis) and integration of ecological, institutional and policy analyses. Central to this work will be the valuation of resources, development of action plans to mitigate threats, and the elaboration of technical, policy and legal frameworks under which access can be allocated among competing resource users.

Medium term plan 2003–2005

During the Medium Term Plan (MTP) period (WorldFish Center, 2002) "... a new research initiative into the improvement of fish production (naturally occurring and stocked) in seasonally fenced areas will be implemented. ... In collaboration with the national partners ..., trials will be conducted on community-based fish culture in seasonally flooded and fenced areas, following the achievements and experiences gained from recent work in Bangladesh and Viet Nam" (WorldFish Center, 2003c).

During the MTP period, social science studies will examine the adoption patterns and agreed institutional arrangements among communities already implementing the community-based fish culture approach. The expansion of this community-based aquaculture approach in Bangladesh and Viet Nam will be monitored.

Past and ongoing activities by research programmes

The publications produced by the Center on Integrated Agriculture-Aquaculture (IAA) since 1990 include outputs (articles, reports, reviews, conference and workshop proceedings) of research on rice-fish culture and floodplain aquaculture.

A large project on Community-Based Fisheries Management (CBFM) in Bangladesh is studying, on a large scale, the different approaches to community and policy and the policy and legal environment required to enable its sustainability (e.g., Sultana and Thompson, 2003; see also numerous other contributions). Management of dry-season refuges or protected areas, and restocking of selected waterbodies are areas related to IIA.

Activities in Africa: past, ongoing and planned IIA

In early 2003, the Center released its plan for work in Africa (Dugan, 2003; WorldFish Center, 2003d), which includes initiatives for increased utilization of existing perennial and seasonal waterbodies and of traditional and more technical water management systems, such as irrigation.

In Malawi, Chikafumbwa (1994) studied the rice-fish culture activities of around 1500 farmers, and the opportunities for their expansion, and pointed out the importance of taking an holistic view of the farming system so as to identify opportunities for integration. Indeed, working with farmers to understand the role that aquaculture plays on small-scale farms has now become a key aspect of the Center's work in Africa (Brummett & Noble 1995). As part of a research project by the Water Research Institute and the WorldFish Center on the potential of IAA to enhance traditional smallholder farming systems in Ghana, a trial was conducted on the feasibility of rice-fish culture in a large irrigation scheme of the Irrigation Company of the Upper East Region, ICOUR (Kumah *et al.*, 1996).

A project implemented by FAO with support from IFAD on introducing IIA in smallholder irrigation schemes in southern Africa (Malawi, Zambia and Zimbabwe) will have inputs by the WorldFish Center at

the Malawi site on monitoring of household level impact of such technology introductions.

Recently, the WorldFish Center established a new approach to community-based fish culture (Dey and Prein, 2000; 2003; *in press*). As part of a possible new project under the CGIAR Challenge Program Water and Food, the approach is planned to be expanded in four countries in Asia (Viet Nam, Cambodia, Bangladesh and India), and possibly Mali as a first site in Africa.¹ Other sites in Africa are under consideration, e.g. eastern Guinea and northeast Nigeria.

¹ Editors' note: This proposal has been approved by the CGIAR and the project has become operational in 2005 and the WorldFish Center has teamed up with WARDA-IVC and FAO to assess the opportunities for implementing the approach in Mali.

References

- Brummett, R.E. & Noble, R.** 1995. Aquaculture for African smallholders. ICLARM Tech. Rep. 46. International Center for Living Aquatic Resources Management, Manila, Philippines.
- Chikafumbwa, F.** 1994. Farmer participation in technology development and transfer in Malawi. In R.E. Brummett, ed. Aquaculture Policy Options for Integrated Resource Management in Sub-Saharan Africa. *ICLARM Conference Proceedings* 46. Manila, Philippines, International Center for Living Aquatic Resources Management.
- Dey, M.M. & Prein, M.** 2000. Case 3: Fish in deepwater ricelands. In PRGA Program. ed. *Equity, well-being, and ecosystem health: participatory research for natural resources management*, p. 19–20. CGIAR Program on Participatory Research and Gender Analysis, CIAT, Cali, Colombia. 62 pp.
- Dey M.M. & Prein, M.** 2003. Participatory research at landscape level: floodprone ecosystems in Bangladesh and Vietnam. In B. Pound, S.S. Snapp, C. McDougall, and A. Braun, eds. *Managing natural resources for sustainable livelihoods: uniting science and participation*, pp.223–225. London, Earthscan and IDRC, Ottawa, Canada. 252pp.
- Dey, M.M. & Prein, M.** Community-based fish culture in seasonally deep-flooding ecosystems. IFAD Technical Advisory Notes 1, Aquaculture Series, IFAD, Rome (*in press*).
- Dey, M.M. & Prein, M.** Community-based concurrent rice-fish culture in seasonal moderately deep-flooding ecosystems. IFAD Technical Advisory Notes 2, Aquaculture Series, IFAD, Rome (*in press*).
- Dey, M.M. & Prein, M.** *Community-based fish culture in seasonally flooding ecosystems*. WorldFish Center Technical Report (*in prep.*).
- Dugan, P.** 2003. Investing in Africa: the WorldFish Center's African Strategy in summary. Naga, WorldFish Center Quarterly 26(3):3–8.
- Kumah, D., Bagbara, D. & Ofori, J.K.** 1996. Rice-fish culture experiments in the Tono irrigation scheme. P. 42–47 In M. Prein, J.K. Ofori & C. Lightfoot, eds. Research for the future development of aquaculture in Ghana. *ICLARM Conference Proceedings* 42, 94 pp.
- Prein, M. & Dey, M.M.** 2001. Rice and fish culture in seasonally flooded ecosystems. In IIRR, IDRC, FAO, NACA and ICLARM. *Utilizing Different Aquatic Resources for Livelihoods in Asia: a Resource Book*, pp. 207–214. Silang, Cavite (Philippines), International Institute of Rural Reconstruction, 416 pp.
- Sultana P. & Thompson, P.** 2003. Methods of consensus building for community based fisheries management in Bangladesh and the Mekong delta. *CAPRI Working Paper 30*. Washington DC, IFPRI. (also available at <http://www.capri.cgiar.org/pdf/capriwp30.pdf>).
- WorldFish Center.** 1999. ICLARM Strategic Plan 2000–2020. Penang, WorldFish Center, 27 pp. (also available at http://www.worldfishcenter.org/publications/corp_mtp0305.asp).
- WorldFish Center.** 2002. ICLARM the WorldFish Center 'Action 2003' - Medium Term Research Plan 2003–2005. Penang, WorldFish Center, 129 pp. (also available at http://www.worldfishcenter.org/publications/corp_mtp0305.asp).

WorldFish Center. 2003a. WorldFish Center Annual Report 2002. Penang, Malaysia.

WorldFish Center. 2003b. Our commitment and capabilities. Penang, Malaysia.

WorldFish Center. 2003c. Medium Term Plan 2003–2005. Penang, Malaysia.

WorldFish Center. 2003d. Strategy for Africa and West Asia 2002–2006. Penang, Malaysia.

