

DFID RENEWABLE NATURAL RESOURCES KNOWLEDGE STRATEGY

AQUACULTURE AND FISH GENETICS RESEARCH PROGRAMME

Annual Report 2001/02

Part I

Prof. J F Muir,
Institute of Aquaculture
University of Stirling



Traders in tilapia fry in Sri Lanka, a common occupation across S and SE Asia. The supply of seed for aquaculture and for stocking water bodies is one of the most critical inputs, and one in which quality, value, market links and social impacts are critical factors. It is estimated that half a billion fish fry are produced annually in Thailand alone, and that supply systems, often extending for 100s of kms, involving a wide range of intermediaries, are growing significantly in many developing countries. The AFGRP, through research in broodstock and genetic quality, and in fry production and markets, is taking a key role in improving these systems and in developing guidelines in policy and practice for national and local application.

April 2002

**AQUACULTURE AND FISH GENETICS RESEARCH PROGRAMME:
ANNUAL PROGRAMME REPORT, 2001-02
Institute of Aquaculture, University of Stirling.**

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Executive summary

1. This year marks the joining of the former Fish Genetics Research Programme with the Aquaculture Research Programme to form a new and more integrated Aquaculture and Fish Genetics Research Programme (AFGRP). Since its commencement in April 2001, considerable progress had been made in developing the advantages from this new synergy. However, more can be done. The present report demonstrates the achievements of the two programmes in combining output to date, an outline of the challenges in meeting the obvious potential to be realised in the sector, and a view of the way these are to be addressed.
2. The programme has also changed substantially due to the completion of a number of significant projects and the commissioning of a new portfolio. Existing projects have been extensively reviewed, and a number of changes put in place to ensure that outputs are well focused to the new programme objectives, and that dissemination and potential impacts are given particular emphasis.
3. A number of achievements can be reported, ranging from specific scientific advances, through field level uptake, to strategy and policy influence. These cover a broad front from specialised genetic techniques, through practical aquatic health management strategies, to a range of production-related initiatives involving poor households and communities. A total of 22 peer reviewed publications, 15 other publications, 2 workshops and 44 other activities have resulted, including 20 conference seminars, reaching a wide range of recipients.
4. Programme development has addressed a selection of issues concerning strategic positioning, value addition to existing or recent projects, and the wider dissemination of project or programme level outputs. These have successfully been completed and have contributed usefully. Spend has been 10.0% of total. A range of programme development inputs has been identified for next year.
5. New programme activities include the commissioning of three new projects, on environmental capacity, bacterial disease of *Pangasius* catfish, and on Asian regional aquatic health strategies. Three further projects, on aquaculture supply, markets and poverty targeting, on water management strategies, and on rural and per-urban aquaculture in Sub-Saharan Africa are being developed.
6. Dissemination activities have remained strong, and the newly developed programme website (<http://www.dfid.stir.ac.uk>) now has access to a range of present and previous project information. Considerable activity has also occurred through project workshops and via institutional linkages. Uptake of programme outputs appears to be good, but further steps will be put in place to assess and reinforce this.
7. Achievement on milestones has been variable, partly delayed by the time required to merge the programmes. However, progress is good, and new milestones have been set out to guide the delivery of a number of important outcomes. Future directions for the programme are outlined and include a number of strategy initiatives, further consideration of supply/market linkages and future poverty-targeting directions, and a strengthening emphasis on uptake and impact.
8. The programme spent 83.1% of its allocation on projects; The % of project funds were spent on collaborators in developing countries = 41.6%; in UK 58.3%, though this has been affected by UK-based expenditure in initiating new projects and is expected to shift more towards developing country participants next year.

1. INTRODUCTION AND GENERAL OVERVIEW

1.1 The programme vision

Global trends in aquaculture output have continued to be strongly positive (Box 1), with little sign so far of significant constraint. However, these broad trends overlie considerable regional variation and key differences in economic drive, environmental support and social impact. Considerable popular attention has focused on expansion of the intensive commercial sector – producing salmon, shrimp and high value marine fish, which is currently undergoing major structural change, reflecting their fully internationalised status. The science base of these subsectors, critical in their development, now faces major demands associated with technical efficiency and environmental impact. The market, environmental and political acceptability of these increasingly resource-dependent subsectors is likely to continue to occupy public dialogue, with growing implications concerning scientific progress, political appreciation, international policy, and trade. These will be important for the areas of the AFGRP's engagement - the very significant sectors involving and benefiting poorer communities, typically far less intensive, with lower comparative resource demands and environmental impact, but with far greater scale and social dependency.

The challenges for aquaculture, its resource base and its range of stakeholders remain considerable. Targets are to double output in the next 10-15 years to maintain current per capita supply, though this growth must be heavily qualified with respect to regional variability in markets, resources and human capacity. Aquaculture and its outputs will have to become more accessible to a wider range of people, in both rural and urban settings, using resources efficiently, while countering increasing competition from other resource users, and increasing impacts of environmental degradation and climatic instability. As noted in the 2001 ARP Annual Report, much of the expected output gain would centre around the livelihoods of the world's least resourced people, with associated resource demands and environmental implications, income, employment, market and other social and economic effects, and key issues of organisations, institutions and policy.

While development can be complex and challenging, and is not universally achievable, aquaculture can also be transformational – it offers new access and opportunity, creates new product and consumers, opens new markets, involves new groups of people, and gives new value to resources. In particular, it offers new opportunities for poverty-targeted development, whether associated with production, employment or food supply and consumption. The vision of the AFGRP is therefore:

- to address the growth demands of the sector and its poverty-linked features,
- to recognise the very distinctive transformational characteristics,
- to understand its dynamics with respect to human and social development aims and
- to contribute selectively but with effect to the areas of understanding required to bring such transformation to benefit.

As outlined further in Box 2, and corresponding with DFID's poverty alleviation and livelihood contexts, the AFGRP has set out a strategic approach to poverty targeted research to guide its present priorities. This is reflected in turn in the new AFGRP logframe (see Annex 1), developed from the earlier ARP

Box 1 Aquaculture trends

- In 2000, global production reached ~ 43 m tonnes worth \$5 bn, over 40 % of total aquatic production by weight. This was dominated by developing countries, producing 39m tonnes (compared with 4m tonnes in developed countries. (FAO 2001)
- Some 36 m people full or part time in primary fisheries and the aquaculture sector. Aquaculture employment continues to grow, now accounting for 25%; almost 95% of those who rely on fish as their main livelihood live in developing countries. (Aerni 2001).
- In these developing countries the contribution fish makes towards total animal protein is 20% compared to just 6.5-8.5% in the developed world (Aerni 2001).
- Aquaculture production grew by about 5% per year between 1950 and 1969 and by about 8% per year during the 1970s and 1980s, this has further increased to 10% since 1990. By 2030, aquaculture is expected to dominate fish supplies (FAO 2000).

Box 2 AFGRP development objectives

- Targeted research to remove constraints, reduce vulnerability and maximise potential for people involved in or benefiting from stocked aquatic resources.
- Increased focus on ways in which stocked and culture systems, and its related bio-technical elements such as genetics, might best be supported and developed.
- The delivery of benefit to poor households and communities through knowledge delivery and uptake, directly or via a range intermediary agents.

structure, which places the primarily technical emphases of the former FGP within a framework of development and application. The main part of the former FGP's research content fits directly into the process of stocking and culturing aquatic species, though a component also bridges across, through enhanced fisheries and the management of biodiversity into the research areas of the FMSP. In the new AFGRP logframe, OVI's are related primarily to livelihood gains associated with output, efficiency, environmental quality, reduced

production risk and better realised financial or food supply value.

The current AFGRP purpose and outputs are defined as follows:

Purpose:

Productive benefits of aquatic resources for poor people generated and sustained through improved knowledge of aquatic stocks and their selection, enhancement and culture.

Outputs:

1. Enabling contexts for aquatic stock selection and production, livelihood impacts defined and indicators developed, in present and emerging inland and coastal aquatic systems.
2. Practical strategy developed and applied for aquatic stock identification, selection and improvement in target enhancement and aquaculture systems.
3. Improved culture and enhancement systems based on natural and human resource relationships, and their effective use of productive inputs (broodstock, seed, nutrients) in target regions.
4. Livelihood risks/constraints of environmental, stock quality or aquatic health factors reduced in target systems through improved techniques and strategies for assessment, control and management
5. Improved global knowledge base on aquatic stocks and culture practice established and disseminated through project linkages, national and international networks, workshops and publication.
6. Successful promotion and uptake of improved approaches, and impacts measured, through local institutional/uptake pathways

Strategies for the geographic focus of the ARP set out in 2001 continue to guide the new AFGRP. Though the FGP's existing involvement in tilapia genetics in S Africa has shifted the overall emphasis more quickly towards Sub-Saharan Africa, the programme's primary focus remains with the major dependent population and resource systems in Asia.

Depending however on the linkage opportunities for the AFGRP's capability and knowledge base, and on broader population trends, poverty indicators, food and income need, resource access, and institutional conditions, the case for selected geographical extension is maintained. Box 3 summarises the current approach and its elements.

Box 3 Geographic focus and related issues for the AFGRP

- S and E Asia - major global food supply issues and growing significance of aquaculture; a range of external and internal changes; enhanced fisheries linkages; issues of markets, aquatic and environmental health; major development programmes, policy issues, GO and NGO institution building, protection of target groups – major priority
- Sub-Saharan Africa – significant demands and good NR potential, growing markets and increasing export potential; human resource, organisational and investment constraints; social and environmental impacts of commercial sector; good linkage opportunities, demand for inputs; selected links with DFID and other programmes; - emerging priority
- Latin America - good NR and specific demands, significant globalisation and biodiversity issues; lower poverty target opportunities; possible indirect links; low priority
- Former Soviet Bloc – possible information links; negligible
- Island states – possible niche issues; informal assistance, guidelines; negligible

As a consequence of this, and of more detailed analysis within regions, key countries are:

- Bangladesh, India, Sri Lanka Vietnam, Lao PDR, Cambodia

Countries for which programme linkages would be retained and/or developed include:

- Pakistan Thailand, Indonesia, China, Philippines, Korea,
- Uganda, Zambia, Malawi, Ghana, Nigeria, S Africa, Zimbabwe

One of the main challenges in creating the new AFGRP has been the merging of the more technically oriented genetic science elements of the FGP into the increasingly poverty-oriented and livelihoods-based approaches of the AFP. While genetic gains *per se* offer substantial potential for change, regardless of the production system or the social or economic context, an important practical consideration has been to ensure that the emerging science would be capable of entering widespread practice, and that this would not risk contributing to the commonly observed 'technology gap' problem, whereby technical improvement, often introduced with the best of intentions, provides differential advantage to the more skilled and resourced, further diminishing opportunities for the disadvantaged. By building from the approaches developed in the ARP, which in turn call on the principles of DFID White Papers on "Eliminating World Poverty" and " Making Globalisation Work for the Poor", and the Sustainable Livelihoods (SL) approach, the aim has been to refocus FGP outputs towards directly realizable aims, while not losing sight of the longer term gains.

In all cases, the programme seeks to understand better the social, environmental and technical context in which aquatic stocking and culture activities can be carried out, and in which future growth and its impact is likely to be experienced. Endorsed in particular by the outputs of the joint FGP/ARP Workshop on Poverty Targeting in Research (Hanoi, Nov 2000), the AFGRP has sought to engage more strongly with local communities and institutions, and to develop methods of enquiry and process research which would enable local and external knowledge to interact effectively. If the challenges of the aquaculture sector are to be understood and an effective response mobilized at both practical levels and in terms of influencing policy, a clear vision needs to be developed of how this is to be achieved.

The basic operating hypothesis of the ARP remains valid for the AFGRP - that though many technical elements are understood and are potentially accessible to those with resources and markets, many subsectors and their practitioners face constraints related to interactions between technical knowledge and the social, economic and institutional context. These constraints need to be understood and the processes identified to enable them to be overcome. Though the potential for aquaculture remains very high, and the forces underlying current sectoral growth rates are likely to continue, the support and promotion of the sector will require care to ensure that benefits can be delivered as widely as possible. Such an approach requires full engagement with target communities and national and regional institutions. The successful development and demonstration of impact would also be expected to influence policy both at national and international level, and should then lead to far more effective sectoral support, generically, and in terms of poverty alleviation.

1.2 Programme activity in the year

Table 1 outlines current projects and their status. These contribute primarily to outputs 2, 3 and 4 of the programme, though are also increasingly contributing to outputs 5 and 6 (see later sections). Together with programme development activities and related work by the Programme Manager in output 1, good progress has been made in each of the six outputs. With the commencement of two new projects, R 8093 "Impacts of bacillary necrosis disease (BNP) on Pangasius farming", and R8094 "TROPECA – practical guidance on environmental capacity for aquaculture", nine projects were operational during the year, compared with seven AFP projects and three FGP projects in the previous year. A further project, R8119 "Improved aquatic animal health management strategies in Asia" is also just in its early stages, subject to late revisions in the RD1 and workplan. One project completed during the year, and three others were provided with extensions into the 2002-03 period. Further project details may be found in Volume 3.

Table 1 Current AFGRP projects

Code	Title	Investigators	Locations	Other
R7052	Improving freshwater fish seed supply and performance in smallholder aquaculture systems in Asia	Edwards/McNiven, AIT; Little, IoA,	Laos, Thailand, Vietnam and Bangladesh	Output 3: (9/97-2/01; extended to 6/02)
R7064	Small-scale farmer managed aquaculture in engineered water systems: critical design and management approaches	Murray/Little, IoA	India and Sri Lanka	Output 3: (12/97-extended to 3/02)
R7284	Genetic improvement and utilisation of indigenous tilapia in southern Africa	Hoffman/Brink, Univ of Stellenbosch; Mair, AIT	South Africa	Output 2: (12/98-12/01; extension to 6/02)
R 7463	Strategies for improved diagnosis and control of bacterial disease in small-scale fresh water aquaculture	Thompson/Crumlish, IoA/AARHI Thailand	Vietnam and Thailand	Output 4: (8/99-3/01; extended to 2/02)
R7590	Genetic improvement strategies for production in exotic carps for low input aquaculture in Asia	Mair, AIT; Penman/McAndrew, IoA; Basavaraju, UASB; Hussain, BFRI; Tuan, RIA#1	Bangladesh, Vietnam and India	Output 2 and 3; (4/00-3/04)
R7591	Production of novel strains of growth enhanced tilapia which are also reversibly sterile	McLean, Univ. of Southampton	Southampton	Output 2 (4/00-3/04)
R7917	Self-recruiting small species in aquatic systems	Little, IoA; Yakupitiyage/Demaine, AIT; Lorenzen, IC London;	Cambodia, Thailand, Vietnam, W Bengal and Bangladesh	Output 2 and 3 (11/00-3/04)
R8093	Risk issues and socio-economic impact associated with BNP in Pangasius spp. farmed in the Mekong Delta, Vietnam	Crumlish, IoA; Dung, CanTho Univ.	Vietnam	Output 4 (10/01-3/03)
R8094	Practical guidance for the estimation and allocation of environmental capacity for aquaculture in tropical developing countries (TROPECA)	Hambrey/ Nautilus Consultants; Khulna University; Can Tho University; IoA	Bangladesh and Vietnam	Output 3 and 4 (1/02-12/04)
R8119	Improved aquatic animal health management strategies in Asia	Turnbull/Corsin, IoA; Morgan, U Liverpool; Chinabut, AAHRI; Hao, RIA#2; Mohan, UAS Mangalore; Dung, CanTho Univ.; Stirrat/Rajak, USussex	Vietnam and Thailand	Output 4 (4/02-3/04)

Points of note are:

Output 1

- Programme level inputs have continued into a number of international and regional initiatives. Work on Sustainability Indicators for aquaculture is now being drafted for FAO as an input to the Code of Conduct for Responsible Fisheries. Programme level discussions have also been carried with respect to a range of regional initiatives, multiple research/development agency linkages, and broader dissemination themes.
- Key strategy developments are being taken forward following the successful award of the AFGRP management contract to 2005. An initial study on linking poverty-based needs with aquaculture development potential is under way, studies on genetic management strategies are being commissioned, and programme development studies are being established on nutrient supply constraints for aquaculture, and for supply/consumption strategies in meeting poverty goals.
- Inputs have been provided to a recent ICLARM/FAO/intergovernmental consultation on Sub-Saharan African species introduction strategies, and contributions are being made to a major ICLARM/Govt of Bangladesh research strategy programme.

Output 2

- The project on "Genetic improvement and utilisation of indigenous tilapia in southern Africa" (R7284) has demonstrated the potential for genetic management of local stocks but has not established a substantive 'genetically male' tilapia population within its time-frame (though the means are now

available to do this). Valuable and transferable knowledge has been gained of local species and strains, and there have been important local development impacts. These are being secured more effectively through a short extension.

- The R7590 project "Genetic improvement strategies for production in exotic carps for low input aquaculture in Asia" is proceeding well, with a range of findings and practical applications. Focus is shifting further towards using knowledge in practical hatchery contexts, (links with Output 3) and in developing approaches which can be taken up regionally and locally to secure and extend benefits of better genetic management.
- Project R7591 on "Production of novel strains of growth enhanced tilapia which are also reversibly sterile" has been the focus of considerable press attention, rather exaggerating the progress and current impact of the work. While useful demonstrations of genetic manipulation have been recorded, there remain many scientific issues to address, let alone the practical implications. The project will be shortly under formal review to determine how best to focus its remaining activities.

Output 3

- The fish seed project R7052 has interacted with target communities and institutions to develop much improved understanding of issues of quality, supply and performance, routes of supply, and the roles of various individuals and agents. Opportunities have now been identified for better performance across a range of indicators. New proposals (see later) have been put forward to develop understanding further, and to link with genetic management issues.
- Project R7064 on small-scale engineered water systems has defined and communicated key issues and has developed increasingly useful outputs, with good local partnerships in India and Sri Lanka, and further developments in uptake through CARE and local NGO projects.
- Project R7917 on small self-recruiting species, is developing a range of findings with collaborative partners in Bangladesh, Thailand, Laos and Vietnam, confirming the often unrealized importance of these stocks for poorer groups, and the potential for maintaining them
- The "TROPECA" project - R8094 "Practical guidance for the estimation and allocation of environmental capacity for aquaculture in tropical developing countries" (linking with Output 4) has commenced, and is developing a range of case study contexts in Bangladesh and Vietnam. Links with the DFID Bangladesh programme have also been established with respect to environmental and allocation issues in shrimp farming, which is currently subject to considerable policy engagement.

Output 4

- Project R7463 on bacterial diseases in freshwater fish is completing well, drawing together stronger farmer/ livelihoods links with bacterial aquatic disease risks and impacts in key systems and farming contexts in Thailand, Laos and Vietnam; findings are leading to useful publications and workshop outputs on practical strategies for control of bacterial disease, and are feeding in to approaches to new project R8093
- A new project R8093 "Risk issues and socio-economic impact associated with outbreaks of BNP in *Pangasius* spp. farmed in the Mekong Delta, Vietnam" has commenced well, with local stakeholder workshops. As these catfish are increasingly being exported to N America, generating strong competitive responses from USA catfish producers, the work is also taking on a very important international trade dimension, which is now being picked up through adjunct studies.
- After some delays in the design stage, a further new project (R8119), developing from the R7051 epidemiology project, is focused on using new perspectives on disease impact, risk analysis and risk reduction strategies to refocus the operation and delivery of national aquatic health systems. Initial workshops have recently been completed for Vietnam and India, and discussions are under way to extend this to Bangladesh.

Outputs 5 and 6

- A strong level of output and publication has been recorded across the programme, with a range of different levels of potential impact, from household to policy level. These are discussed in later sections.

Expenditure has been in line with programme budgets, at 100% of the allocated amount. There have been no supplementary funds this financial year, though contributory support has been obtained from a number of sources for project related activities such as national or regional workshops.

1.3 Success stories

As noted previously for the ARP, the programme's wide range of activity and its interactions with a range of institutional partners and beneficiary groups has been an important area of success. This continues to promote the approach whereby researchers are fully concerned with development process and impact, and in which scientific and other knowledge processes must be linked with local needs to generate directly beneficial outputs. Details of some of the particular success stories of 2001-02 period are provided in Annex 2 Table 2 summarizes the key features.

Table 2 Success stories

Project	Features	Location	Beneficiaries
R7052 Fish Seed Quality	Increased seed quality and market access, wider production	SE Asia	Hatchery operators, farmers
R7064 Aquaculture in engineered water systems managed by farmers	Improved, sustainable fish availability in stocked community waters	Sri Lanka/India	Poor communities in upper and interlinked watershed areas
R7284 Genetics of tilapia in southern Africa	Improved awareness in indigenous tilapia culture, management of genetic resources	Southern Africa	Partners, collaborators, hatcheries and farmers
R7590 Genetic Improvement of Carp	Guidance on improved carp genetic management	S and SE Asia	Hatchery managers, operators and farmers
R7591 Growth Enhanced Tilapia	Technology innovation for reversible sterility for fish	UK based, global applications	Food security projects and potentially rural poor
R7917 Self Recruiting Species	Understanding of importance of SRS (self recruiting species) in livelihoods	SE Asia	Target institutions, rural poor

1.4 New knowledge or innovation

A number of areas can be identified within the programme, including:

- R7052 (Fish Seed Quality): New knowledge on fry production and quality management; improved mechanisms for information transfer focusing on the extent and underlying causes of poor quality fish seed and practical approaches in solving the impacts are being identified.
- R7064 (Aquaculture in engineered water systems managed by farmers): key constraints to promoting and sustaining aquaculture in very dry areas have been identified. The use of mapping to understand the resource and access of poor people is a novel approach. The project is challenging conventional assumptions and the approaches that currently dominate policy and practice in the country.
- R7284 (Genetics of tilapia in southern Africa): this is the first time that technology for single sex production has been transferred and applied to the development of an indigenous aquatic species. Information on genetic structure and diversity of tilapia has provided valuable information for future management and sustainable utilization. Assessment techniques for cross breeding are the first developed in S. African fisheries. The first commercial farming system for the indigenous tilapia has been set up.

- R7590 (Genetic Improvement of Carp): the first microsatellite loci¹ have been developed for Chinese carp. This should aid in genetic management programmes, wild population analysis and other areas. A new marking technique has been developed, and the first gene bank for certain carps has been established - this may become a standard tool in broodstock management and conservation of germplasm.
- R7591 (Growth Enhanced Tilapia): The isolation of the tilapia beta actin promoter² is an important achievement in determining mechanisms and potential controls for sterility management in aquaculture stocks.
- R7917 (Self Recruiting Species): Life history data for key self-recruiting species in each country (Cambodia, Thailand, Vietnam, West Bengal and Bangladesh) are being elucidated.

2. PROJECT MANAGEMENT STRATEGY

2.1 Management structure of programme

The management of the new AFGRP continues under the responsibility of Prof. James Muir, former ARP Programme Manager, with inputs as required from Prof Brendan MacAndrew (Institute of Aquaculture - genetic science/transfer of FGP) and Prof. R H Richards (Institute of Aquaculture - aquatic health). Prof. John Beardmore (Programme Manager, FGP) has been retained to advise on former FGP activities, and a small external panel has been established to advise the programme management, comprising Dr Malcolm Beveridge (Director, SERAD Freshwater Fisheries Laboratory, Pitlochry - aquaculture environments/systems), Dr Elizabeth Harrison (University of Sussex - social and development issues) and Mr Michael Pickstock (WREN Media - dissemination strategies). Administrative support is provided by Mrs Melanie Cruickshank and Stirling Aquaculture support staff. The award of the new Programme contract has also supported the appointment of Dr Polly Douglas as Programme/Dissemination Officer.

One of the main tasks on commencing the 2001-02 period was to take over the documentation and administration of the former FGP, to merge accounting, reporting and administrative systems, to validate and develop past and present project information, and to develop corresponding dissemination materials. These elements are outlined in Box. 4

The programme logframe (Annex 1) provides the context for the defining the relationship between specific project and related activities, and the progress to achievement of programme purposes. As developed from previous ARP reporting, the management approaches for the six output levels can be described as shown in Table 3. The main differences are in Output 2, which covers most of the technical elements of the former FGP.

Box 4 Key administration actions taken for the merger between ARP and FGRP Programmes.

- Documents for all past and present projects; Final technical reports, peer and non-peer reviewed and other dissemination materials.
- Transfer project accounts from University of Wales Swansea to the University of Stirling.
- Contact past and present researchers, verify and correct status of outputs; complete and disseminate AFGRP bibliography.
- Storage/filing systems for completed project outputs in both hard and digital formats.
- Programme support/dissemination officer post September 2001.
- Digitalise, catalogue and classify dissemination outputs for AFGRP website.
- Design and create AFGRP website, including access to project outputs in PDF format.
- Recipient database/mailling list for AFGRP outputs, with contacts areas of interest.
- Collect and store images from past and present projects.

2.2 Needs and demands for research

Towards the end of the 2000-01 period, with a number of ARP projects nearing completion, programme

¹ a microsatellite is a region of DNA which can be used as a genetic marker

² a beta actin promoter is responsible for 'switching on' the beta actin gene which is present in all cells. Beta actin is a protein necessary to maintain healthy cell structure.

funds started to become available for new investment. The FGP component was relatively fully spent, though the completion of R7284 (Genetic improvement and utilisation of indigenous tilapia in Southern Africa) will release further resources. To identify needs and demands for research, the AFGRP has relied on maintaining regular contact with existing projects, institutions, and key individuals, on communication with DFID country and regional programmes, and on active participation in regional and international fora. These processes have developed a good awareness of emerging issues and potential partnerships. The AFGRP has been widely publicised in regional meetings and through its website and other means, and is always accessible for proactive proposals.

Table 3 Management approaches for programme outputs

Output description	Management approach
1. Enabling contexts for aquatic stock selection and production, livelihood impacts defined and indicators developed, in present and emerging inland and coastal aquatic systems.	Direct programme management action, selected programme development; links between AFGRP and other agents, international agencies, NARS, networks; take up ideas, findings from AFGRP projects in broader context, establish/make more widely available strategic views on aquaculture and its potential
2. Practical strategy developed and applied for aquatic stock identification, selection and improvement in target enhancement and aquaculture systems.	Take up existing FGP research projects and link these to wider programme objectives, move towards practical delivery, local capacity building; develop future strategies; commission and develop AFGRP projects selected according to comparative advantage for investment
3. Improved culture and enhancement systems based on natural and human resource relationships, and their effective use of productive inputs	Identify, commission and develop AFGRP projects addressing key aquaculture systems and/or their component or contextual environment; selected according to potential poverty targeting, research need, comparative advantage for AFGRP investment
4. Livelihood risks/constraints of environmental, stock quality or aquatic health factors reduced in target systems through improved techniques and strategies..	Identify, commission and develop mainstream research projects, either specialised, or linked with Output 2/3 projects, addressing important identifiable constraints, potentially addressable through local management, control and/or institutional/strategic approaches.
5. Improved global knowledge base on aquatic stocks and culture practice established and disseminated through project linkages, networks, workshops etc	From mainstream project outputs, with programme level initiatives to interlink and thematise findings; communicated to end users, local institutions, development agents, through project linkages, national and international networks, workshops and publication
6. Successful promotion and uptake of improved approaches, and impacts measured, through local institutional/ uptake pathways	Emerging directly from specific projects, which all have local institutional links, and defined uptake pathways; together with programme initiatives to assess impacts, modify strategies; influence development agency and NGO programme and project design and operation.

Table 4 provides a breakdown of Programme Development expenditure for 2001-02. Three areas of Programme Development are identified – strategic inputs, programme dissemination and impact (reported in section 3) and new project development. Due in part to the change in programme scope, the need to extend existing impacts, and the need to explore future potential, expenditure has been higher than previous corresponding ARP amounts, at £86,025, or 10.0% of programme budget applied.

Table 4 Programme Development expenditure 2000-2001

Subject	Institution/agent	Outputs & Outcome
Strategic inputs		
<i>Aquaculture development and poverty targeting</i>	Mr M van Brakel, Inst of Aquaculture	Development of GIS-based information structures to define key links and opportunity/policy contexts
<i>Programme workshop</i>	AFGRP project staff & external advisers	Minutes meeting circulated to all project participants; programme actions determined.
Dissemination and impact		
<i>Dissemination of results</i>	CABI Publishing, Wallingford, UK	Publishing and distribution of book: Rural Aquaculture Eds. Edwards, Little & Demaine 500 copies published/circulated
<i>Design and testing of a portable field kit for gene banking tilapia germplasm</i>	Dr K. Rana, IoA	Development for practical use of field cryopreservation technique. For developing countries where infrastructure and support systems may be inadequate or cost effective.
<i>Practical shrimp disease strategies - viral cells in PL</i>	RIA No 2/AARHI/ IoA	Annex to FTR for R7051. Key information for development of practical disease control strategies for vulnerable farmers.
<i>Additional outputs from project R7064</i>	F. Murray, IoA Prof Bogahawatte, Peradeniya, Sri Lanka	Extension of R7064 to allow for completion of project activities and delivery of additional outputs
<i>Livelihood impacts of SRS related to aquaculture development in Bangladesh</i>	Dr Yakupitiyage, AIT Dr M. Bell, Dr G. Bell & Dr Little, IoA	Disseminate current field study results, plan and implement a range of limited intervention trials and place the findings in the context of aquaculture development strategies for the country
<i>KAR/AFGRP combined end of project workshop</i>	Dr. Gowing Univ of Newcastle; Dr Little, IoA	Recommendations for improved engineering management/ aquatic resources strategies; draft policy guidelines
New programme directions		
<i>Desk study/- genetics in enhancement fisheries</i>	Dr Ian Payne, MRAG	Review document; identification of future projects; a log-frame for projects related to the AFGRP log-frame.
<i>Workshop, Vietnam; health issues of Pangasius spp.</i>	Ms Dung CanTho/ Dr M. Crumlish IoA	Peer reviewed paper and a workshop report. Background development for R8093.
<i>Workshop; gene banking, gamete management technologies in Asia</i>	NAGRI, Thailand and Dr K. Rana, IoA	An overview of current research approaches employed and identify inconsistencies in methodology. Develop harmonised protocols to contribute to enhancing cultured and wild stocks
<i>Expert consultation; ICLARM</i>	Prof B McAndrew and Dr. K Rana, IoA	Bio-safety and environmental impact of genetic enhancement and introduction of tilapia strains/ alien species in Africa
<i>Dyke based crops around ponds in Bangladesh – extension models and impacts on livelihoods</i>	Prof. Wahab, BAU Mymensingh; Dr Little, IoA	Impacts of exchange of information between practitioners in a regular forum of stakeholders monitored through assessment of change in perception and practice. Adoption and adaptation to improved practices monitored over extended period
<i>Impacts of agrochemicals – livelihoods & human health</i>	AIT; Peradeniya, and IoA	Multipurpose aquatic systems in Central Thailand and NW Sri Lanka. Bulletins to chart progress of policy building process. An holistic analysis of the methodology and outcome.

2.3 New project proposals

The AFGRP programme has continued the open selection approach adopted by the ARP, in which, provided concepts relate to the programme logframe, particularly to outputs 2 - 4, they are judged primarily on research quality and potential for impact. Proposals directed at outputs 5 and 6, or containing a stronger element of dissemination and uptake are also increasingly to be encouraged. Alternatively, programme development work or a specific dissemination project may be proposed. The Programme Manager has provided guidance to ensure that the overall balance of activities, and the range of contexts and methodologies involved, meets broader programme aims. The aim has been to maintain a mix of strategic and applied approaches, though much of the current work lies at the applied level, with an increasing need to extend findings, principles and good practice.

As noted in previous ARP reports, the interface between research and development can sometimes be difficult to distinguish; the key for AFGRP interest is whether qualitative issues can be examined and more generalisable knowledge produced. This remains under review, and new project proposals are

judged on their ability to interact with local stakeholder needs while also creating more widely applicable knowledge. Following an initial process of screening and discussion, cross-cutting issues such as poverty targeting, social, economic and environmental contexts are first reviewed by the programme manager and then considered by the PAC at Concept Note stage. These issues are also re-appraised in ongoing projects as a matter of routine in management reviews.

2.4 Concept notes

Table 5 shows the AFGRP Concept Notes reviewed during the 2001-02 period. No specific trends could be discerned in their range and quality, though the bulk of proposals came from the existing research community. Numbers and quality of external proposals were still disappointing, in spite of continuing support provided in encouraging submissions from regional researchers and NGOs, and in advising on project targets and on Concept Note preparation.

Table 5 Concept notes in 2001-02

Code	Subject	Applicant	Address	Outcome
AFGRP01	Marathwada integrated Aquaculture Research project	Mr Jadhav Sitaram	Keshav Nagar Maharashtra, India	Rejected
AFGRP02	Community managed seasonal tanks in S Asia: enhancing their impacts on livelihoods of the poor	Little/Murray/Ross, IoA; CARE, Peradinya, Dhan Foundation, Tamil Nadu	IoA, University of Stirling	Accepted to RD1 with stronger partnerships
AFGRP03	Impact of production and marketing of freshwater aquatic products on rural livelihoods	Dey, ICLARM HQ; Thompson, ICLARM, Bangladesh; Little/Young, U Stirling	ICLARM, The World Fish Centre, Penang, Malaysia	Reworked CN once issues raised have been addressed.
AFGRP04	Role of aquaculture in the livelihoods of rural migrants and peri-urban and urban populations in sub-Saharan Africa:	Rana/Little, IoA; Ajaya/Ayinila, NIOMR Nigeria; Makika, TFI, Tanzania; Molope, ADG South Africa	IoA, University of Stirling, ICLARM	Not accepted in present form - phased approach may be considered. Revise CN for RD1
AFGRP05	Sustainability of tropical aquaculture feed options	Hambrey, Nautilus; Yakupitiyage, AIT; Barlow, MRC Cambodia; Hau, RIA#2	Nautilus Consultants Highland Office	develop as strategy notes through Programme development
AFGRP06	Alternative approaches to poverty alleviation in rural areas: small holder vs commercial scale development in fisheries and aquaculture	Hambrey, Nautilus; Edwards/Demaine, AIT; van Tu, Univ. Ho Chi Minh City; Sherstha, Nepal	Nautilus Consultants Highland Office	develop as strategy notes through Programme development
AFGRP07	Roles of production-enhancing pond inputs in small scale aquaculture systems in Asia	Yakupitiyage, AIT; Hassan, BAU, Shrestha, Nepal; Wijayawardena, Peradeniya; Phoung, CanTho univ.	AIT, Thailand	develop as strategy notes through Programme development
AFGRP08	Assessing health risks of contaminant transfer from managed peri-urban aquatic resources	Baird/Little, IoA; Boxall, Cranfield; Watterson, Stirling; Satapornvanit, Kasetsart U, Phung, NIHE Vietnam, Siriwardena, NARA, Sri Lanka	IoA, University of Stirling	Reject as a project – potential development activity to explore if there is a poverty related issue worth pursuing
AFGRP09	Participatory approaches to maintaining fry quality for rural aquaculture	D Little, IoA; regional partners including DFID Uganda and ICLARM Bangladesh	IoA, University of Stirling	Revisions to CN required – potential for funding
AFGRP10	Sea cucumber fishery and potential for mariculture project	Tamir Caras	24 Godfrey House, Bath Street, London	Rejected

Difficulties continue with the focus by proposers on specific biotechnical issues of undefined relevance to end-users. Concept notes received from more experienced (largely UK-based) contractors were of variable quality, though in most cases demonstrating an awareness of development aims. However in most cases, revision has been required to meet programme objectives and methodological standards.

2.5 Contributions of new projects

Two new projects, R8093 "Risk issues and socio-economic impact associated with outbreaks of BNP in *Pangasius* spp. and the "TROPECA" project - R8094 "Practical guidance for the estimation and allocation of environmental capacity for aquaculture in tropical developing countries" have commenced, and are starting to develop initial outputs. A further new project, R8119 – "Improved aquatic animal health management strategies in Asia", developed from the R7051 epidemiology project, has just commenced after some initial delays in establishing the design. All three projects are expected to contribute in significant ways to the AFGRP outputs and purpose, and all will involve close and ongoing relationships with national partners, and very good prospects for significant influence on policy and widespread impact in target communities.

2.6 Collaborative arrangements

The AFGRP continues to develop the collaborative arrangements made in previous years through its component programmes, with the aim of improving local capacity for knowledge building, uptake and promotion, and of developing continuing processes whereby programme outputs can be made available to larger target populations. A number of links are also developed with DFID country programmes and projects, and with other DFID supported research programmes. Table 6 outlines current linkages with other research institutions and target institutions.

As project activities evolve, the network of linkages is extending, particularly for uptake. More NGO and LCO groups are now being included as collaborators, as promotion and uptake become more critical in the current range of projects. Following the November 2000 Hanoi Workshop, a collaboration strategy had been developed for the ARP, which is now being taken further with the AFGRP.

Approximately 37.5% of the 2001-02 spend (41.6% of research project expenditure) was directed to collaborating institutions in developing countries, either as directly funded inputs from the programme or through indirect allocations from UK partners. This compares with 43.5% of spend (55.8% of research project expenditure) for the ARP in 2000-01. The reduction has been partly due to the greater level of genetics research expenditure in UK institutions and the much greater weighting to UK spend in the initial stages of the three new projects. The balance is expected to shift back to developing country spend next year as more genetics research expenditure shifts to practical application and as new projects develop local partner activities. As in previous years, most of the non-UK spend has been allocated to field research, support for local laboratory analyses, and local workshops. Capacity building within collaborating institutions continues as a secondary objective, mainly based on specific awareness raising and practical training, usually within project processes, or in end-of-project workshops, given to key individuals and groups.

Table 6 AFGRP Linking Institutions 2001-2002

Country	Institution	Role
Regional	ICLARM NACA; Network of Aquaculture Centres in Asia /STREAM AAHRI; Aquatic Animal Health Research Institution Aquaculture and Aquatic Resources Management Programme, AIT	Collaborator; location Collaborator; dissemination Dissemination Collab; location; dissemination
Thailand	NAGRI; Network of Genetic Research Institutes Department of Fisheries, Udorn Thani Fisheries Centre for R&D Ayudhya Fisheries Development Centre Dept of Fisheries, Ubon Rathathani University Ministry of Public Health Udorn Freshwater Fisheries Centre, Udorn Thani	Collab; location; dissemination Collab; location; dissemination Collab; location Collab; location Collab; location Collab; location, dissemination
Vietnam	RIA No 1, Hanoi; RIA No 2 Ho Chi Minh City, Coll. Agriculture and Forestry, Univ. of Fisheries, Ho Chi Minh City University of Fisheries, Nha Trang University of Can Tho, West-East-South (WES) project Department of Crop Science, CanTho University Aquaculture and Fisheries Science Institute (AFSI) Hue Agricultural University Support to Brackish water and Marine Aquaculture, Hanoi	Collab; location; dissemination Location; dissemination Collaborator; dissemination Collaborator; dissemination Collaborator Collab; location; dissemination Collaborator; dissemination Collaborator
Lao PDR	The Livestock and Veterinary Section, Div. Agric. and Forestry, AIT Aquaculture Outreach, Savannakhet	Collaborator; dissemination Collaborator; dissemination
Bangladesh	Department of Fisheries, Parbatipur Dept of Aquaculture, Bangladesh Ag. University, Mymensingh CARE Bangladesh, Dhaka Bangladesh Fisheries Research Institute, Mymensingh Intermediate Technology Development Group, Dhaka NFEP (DFID), Saidpur Khulna University	Location; dissemination Collaborator; dissemination Collaborator; dissemination Collaborator; dissemination Collaborator Collaborator; dissemination Collaborator
Sri Lanka	National Aquaculture Development Authority Dept of Agriculture Economics, Univ. of Peradeniya Wayamba Development Authority, Kurumegala Action Contre la Faim, Batticoola CARE Sri Lanka IIMI, Colombo Industrial Services Bureau, Kurunegala	Collaborator Collaborator Dissemination Collaborator, dissemination Collaborator, dissemination Dissemination Collaborator
India	University of Agricultural Sciences Bangalore Mangalore College of Fisheries Central Institute for Fresh Water Aquaculture, Orissa Samuha (NGO), Bangalore EIRFP, Gramin Vikas Trust, Jarkhand Department of Fisheries, Bangalore	Location; dissemination Collaborator; dissemination Collaborator Collab; location; dissemination Collab; location; dissemination Collaborator
Pakistan	Fisheries Research and Training Institution Sindh Fisheries Department	Dissemination Dissemination
Nepal	Fisheries Development Division Institute of Agriculture and Animal Science, Chitwan	Dissemination Dissemination
Philippines	Bureau of Fisheries and Aquatic Resources (BFAR) Freshwater Aquaculture Center (FAC) of Central Luzon State University (CLSU)	Collaborator, dissemination Collaborator
Cambodia	Department of Fisheries, Phnom Penh	Collaborator
South Africa	Faculty of Agricultural Sciences, University of Stellenbosch Department of Agriculture, Province Western Cape	Collab; location; dissemination Collab; dissemination
UK	CLUWRR, University of Newcastle Huxley School, Imperial College, London Natural History Museum, London Biometrics Unit, Rothamsted School of Biological Sciences, University of Southampton School of Biological Sciences, University of Wales, Swansea Scottish Agricultural College, Edinburgh Institute of Aquaculture, Stirling Dept of Vet. Clinical Science and Animal Husbandry, Liverpool Anthropology Subject group, University of Sussex	Collaborator Collaborator Collaborator Collaborator Location, Collaborator Location, Collaborator Collaborator Collab; location; dissemination Collab; location Collab; location

2.7 Programme Advisory Committee

The composition of the PAC over the 2001-02 period is shown in Box 5, with the exception of the demission of Prof. Beardmore, FGP manager, little changed from the previous period. Attendance of independent members was good, though alternates were increasingly used by Programme Managers. The role of the PAC in the appraisal and review of project concepts and project memoranda continued to be valuable, with a good level of critical debate on programme aims and on project content and execution. PAC chairing was consistent and rigorous, and external members have continued their care in maintaining independent status. This was put to particular test following a series of press-ridden Parliamentary Questions concerning research on genetically modified fish, funded through the FGP (now AFGRP) in which queries were made of the status and commercial interests of those involved in funding decisions. This served as an important reminder that the role of the independent PAC members has been to provide advice to the Programme Managers. They have no management or executive role in the operation of the Programmes and no commercial interest in any of the work undertaken by the Programmes.

Box 5 PAC Composition 2001-02

Independent advisers:

Prof. Peter Street (Chair), Royal Agricultural College
Dr. R. L. (Jock) Stirrat, University of Sussex
Dr. Malcolm Windsor, N. Atlantic Salmon Conservation Organisation.
Mr. Tim Sumner, DFID Environmental Adviser

Programme managers

Prof. John R. Beddington, MRAG Ltd, (Fisheries Management)
Mr. John Sanchez, NR International Ltd (Post-Harvest)
Prof. James F. Muir, University of Stirling. (AFGRP)

DFID

Dr Alan Tollervey, Lead NR Adviser

As in the ARP and FGP external reviewers are used to evaluate project FTRs. Selected for their specialism in the field in question, either UK or internationally based, these individuals give good, and constructive responses to reviews. The practice of the FGP in using external reviewers for mid-term assessment has been retained for the former FGP projects, and may be considered for AFGRP projects more widely, subject to assessment of their cost-effectiveness.

2.8 Other issues

Aside from the FGP reviews mentioned above, internal project reviews continued during the year, and several informal methodology seminars and programme-wide overviews were organised, normally at the University of Stirling. The Programme Manager contributed to a range of DFID RNR research strategy meetings, and discussed programme strategies informally with DFID and other staff in the Asian region, and contributed to discussions with ICLARM concerning linked research strategies. Further planning meetings with the KAR (DFID Engineering Research) large scale engineered water systems project were also held during the year.

3. DELIVERY OF OUTPUTS

3.1 Completed projects

Two projects were completed this year, the first being R7463 "Strategies for improved diagnosis and control of bacterial disease in small-scale fresh water aquaculture", for which the Final technical report is due to be submitted at the end of April 2002. The second, R7064 "Small scale farmer managed aquaculture in engineered water systems: Critical design and management approaches" is due to deliver its FTR at the end of May.

At the request of the principal investigators the completion dates for two projects: R7052 "Improving freshwater fish seed supply and performance in smallholder aquaculture systems in Asia" and R7284

“Genetic improvements and utilisation of indigenous tilapia in southern Africa” were extended into the next programme year. In the first case, successful development of the concepts and outputs of the project provided an important justification for extending activities to interact with a wider range of regional partners and agents, and to take existing work to a more conclusive stage in terms of establishing the benefits amongst participants. For the second project, unanticipated delays in developing appropriate broodstock, and consequent seasonal implications necessitated a longer period of primary investigation. More importantly, a range of valuable extension activities and partner programmes was commencing, and a short extension would allow these initiative to be supported and the project’s practical outputs to be more effectively put in place.

3.2 Early terminations

No projects were terminated.

3.3 Reporting record

In spite of delays in the handover of the FGP, reporting by project investigators from both of the former programmes was effective and timely. Reports from former FGP projects are still more copious than required and efforts continue to shift the emphasis of costly investigators’ time from internal reporting to external output.

According to programme records, quarterly report delivery to DFID was good, with narratives provided throughout. Detail for PCSs and PCRs, where relevant, has been made available in a timely and acceptable manner. Equipment inventories for the ARP component had been updated in 2000-01; those from the FGP have been updated this year and are now incorporated in the AFGRP list.

There are no outstanding FTRs though as in previous years, their timely production by investigators, and the pressure for external reviewers to respond within a tight timeframe remains an issue.

3.4 Peer reviewed publications

Details of peer-reviewed publications are provided in Annex 3, whilst Table 7 provides a comparative summary. Taking into account those that are in press and have been submitted a total of 22 peer reviewed publications is recorded. This is a slight increase over the combined total for 2000/2001 for the two programmes. A prominent output is the publication of “Rural Aquaculture” by CABI Publishing, containing key pieces of work from AFGRP projects addressing vital issues in the role of aquaculture in rural development, and citing key case studies from across South and South East Asia.

Table 7 ARP, FGRP & AFGRP, Publications record

	Prior 1995		1995/96		1996/97		1997/98		1998/99		1999/00		2000/01		2001/2002
	ARP	FGRP	ARP	FGRP	ARP	FGRP	ARP	FGRP	ARP	FGRP	ARP	FGRP	ARP	FGRP	AFGRP
Peer reviewed	45	31	8	6	10	13	3	10	7	4	9	6	8	11	14
In press															4
Submitted															4
Cumulative Peer	45	31	53	37	63	50	66	60	73	64	82	70	90	81	189
Non Peer reviewed	14	22	5	1	7	6	5	13	14	0	29	7	8	6	15
Total publications	59	53	13	7	17	19	8	23	21	4	38	13	16	17	33
Cumulative Total	59	53	72	60	89	79	97	102	118	106	156	119	172	136	341*

* excluding submitted papers

3.5 Other publications

Non-peer reviewed publications are detailed in Annex 4. The number of non-peer reviewed publications this year has remained relatively constant with 15 publications this year and 14 for the two separate programmes in 2000/2001 (Table 7). As with previous years such publications have ranged from institutional newsletters and journals, conference proceedings, invited papers and non-peer reviewed journals.

3.6 Other outputs

These are detailed in Annex 5. Table 8 summarises the overall distribution of these and other outputs. There has been a continued effort to disseminate knowledge to a broader and wider audience through seminars at conferences and presentations at international workshops; Examples include the ASEAN-SEAFDEC Conference on Sustainable Fisheries, Bangkok, Thailand and ICLARM Conference. Fish Genetic Research in Member Countries, Dhaka, Bangladesh. Additionally there is also a strong focus on the production of dissemination and extension materials utilizing local media and production of outputs in national dialect. However, the decline in working papers compared with the ARP record in 2000-01 is to be addressed, as these have been important contributions.

Table 8 Other programme outputs

Output	1998/1999		1999/2000		2000/2001		2001/2002
	ARP	FGRP	ARP	FGRP	ARP	FGRP	AFGRP
Other Outputs							
<i>Poster Presentations</i>	1	-	6	-	8	-	1
<i>Extension Materials and Activities (pamphlets, radio interviews, videos)</i>	7	1	1	1	13	2	7
<i>Conference Abstracts</i>	-	-	-	-	1	-	1
<i>Seminars</i>	4	-	22	-	13	-	20
<i>Theses</i>	-	1	10	-	9	-	3
<i>Workshops</i>	1	-	3	-	3	-	2
<i>Working Papers</i>	-	-	10	-	28	-	3
<i>Reports</i>	-	-	-	-	-	-	9
Other Outputs Total	13	2	52	1	75	2	46
Cumulative Other Total	13	2	65	3	140	5	191

4. UPTAKE PROMOTION

4.1 Approaches adopted

The AFGRP's approach to uptake follows the principles developed in the ARP, as set out in previous annual reports. This had been further endorsed, and developed, by the joint programme workshop in Hanoi, November 2001. Within the ARP and its projects, a useful range of information had already been brought forward, which together with other sources, has actively been developed and applied in the form of skills and knowledge. This approach is now being extended with the AFGRP, and former FGP projects are being encouraged, where necessary to develop more uptake-oriented activities. The programme already carries out a range of field level inputs and workshops with key collaborators, and now that more substantive research findings and lessons are available, these are being promoted within wider fora, including international meetings and workshops, broadcast linkages and other media. The dissemination strategy ideas initiated within the ARP in the 2000-01 period are also being taken up further to develop a

more explicit and targeted approach, linking with beneficiaries, and specifying the most cost-effective approaches for meeting longer-term purpose level targets.

Although separate funding has not been available as originally anticipated, the AFGRP is working with AIT on an integrated dissemination proposal, conceived to pull together, define and develop access to the best of recent and current research outputs, based around the combined knowledge base of the AIT/Outreach, AARHI and AFGRP programmes. This work had been initiated with a sectoral needs review, whose outputs are just now being reported. During the year, considerable discussions have taken place with CABI to develop an Aquatic Resources Management Compendium product, which may become the most practical means to incorporate the AIT concept, and may also usefully include outputs from the FMSP and PHFRP. Discussions continue on the way this product may best be developed and the processes through which it might most effectively be used as learning tool. External funding will also be required and content and approach will have to be negotiated with other stakeholders. The AFGRP has made contacts to link in with the proposed DFID SEA/NACA 'Stream' project and also continues a linkage with the SIFAR Onefish information programme, and provisionally agreed to provide editorial backup on aquaculture.

A range of mechanisms such as international and other peer-reviewed journals, papers and articles, videos and local extension material (translated where necessary) is actively maintained. This year marked the publication by CABI of a key text 'Rural Aquaculture' partly sponsored by the ARP/AFGRP, and containing a significant range of outputs from programme researchers and their collaborators. After some delays due to CABI staff changes, a timetable has now been established for the new international review series in aquaculture initiated by the Programme Manager. A new AFGRP website has been developed, with links set up for access to programme outputs, data sources, guidance materials and other network contacts. As described in the last ARP report, a range of programme and project material has currently being set up in pdf format, and this has been extended to current and most recent FGP materials. The aim is to provide full access by external users. The AFGRP continues to have access to the widely disseminated in-house publication 'Aquaculture News' produced by the Institute of Aquaculture. With a primary editorial role, this provides an excellent opportunity to promote the programme and its associated project activities. The programme staff and key researchers' extensive network of contacts, developed through a range of roles in international education and training role, is also an important resource, and continues to be developed. The role of key staff in the AFGRP network, as authors, scientific editors, and international advisers, and in training and dissemination, also serves to strengthen this function.

4.2 Action to promote uptake and application

Following the Nov 2000 Vietnam workshop, and the dissemination strategy table developed for the ARP at the 2000-01 annual report, which has been adopted for the AFGRP (see Annex 6), it had been the intention to develop more specific products and processes, and to establish priorities for future work. However, although the AFGRP carries from the ARP background a more explicit uptake objective, the administrative time taken in merging the two programmes, the time taken to collect and update research project materials, particularly from FGP sources, and externally-imposed delays in appointing a Project/Dissemination Officer has delayed the full implementation. However, as most of the administrative and information collection tasks are now completed, this will be an important priority for the coming year. This is not to discount the extensive promotion being undertaken at the project level, and the focus on application being required in existing and new projects, both of which are already delivering important impacts. Using elements of the dissemination strategy as a template, Table 9 summarises progress.

Table 9 Progress in dissemination

Targets	Output (for further details of examples see Annexes 3-5)
1 rural poor	R7052. Sittirach & Sangkaew (2002). Forum for Hatchery Operators Newsletter, produced and free distribution. R7284 Aquaculture Training Course attended by 28 small scale farmers in South Africa.
2 local knowledge agents; extensionists, field workers	Range of extension materials, often local language e.g. R7052 MacNiven <i>et al.</i> , report of research findings (in Thai) and R8093 Dung, T.T. Pangasius Problems. Vietnamese Aquaculturist Newsletter (in Vietnamese).
3 social change agents – NGOs and LCOs	Main interactions with CARE and ITDG, local NGOs/LCOs in Bangladesh, India, Sri Lanka e.g. R7052 Workshop on freshwater fish seed supply report distributed by e-mail to all participants. R7284 overview presentation to the animal production association in South Africa.
4 NARS and equivalent	Recent workshops with eg BFRI, RIAs no 1 and 2, range of new project interactions R8093 workshop report on DFID <i>Pangasius</i> project
5 Sectoral managers, policy, planning and development	Some documentary outputs; otherwise limited exposure – need to develop workshop opportunities. R7590 Mair & Dan (in press) Vietnamese government advances plans for national broodstock centres. R7064 Murray (2002) Report to steering committee on fish irrigation systems.
6 Regional/inter-national research community	Wide range of interaction but quality and content needs to be upheld. R7590 and R7917 both held workshops in Dhaka, with reports due for dissemination. The self recruiting species workshop was widely reported in the Bangladeshi press. R7064 Murray (2002) oral presentation to World Aquaculture Society Conference on managing aquatic resources to benefit the poor.
7 Bilateral/multi-lateral development agencies	Range of informal inputs at programme and project levels – need to build in more into processes R7590 Ayyappan <i>et al.</i> , (2001) Aquaculture genetics research in India: an overview. R7284 Mair (2001) Tilapia Genetics – Applications and Uptake in Global Aquaculture Advocate.
8 In-house DFID	Ongoing involvement but need to be more proactive in publicising the programme, Rural Aquaculture Book, sent to key DFID staff and researchers, web site set up www.dfid.stir.ac.uk including guidance on programme reporting methods
9 UK public	Inadvertent GMO exposure! range of initiatives with press, broadcasting but needs more promotion. R7917 and R7590 both had articles published in Aquaculture News which has a distribution of 2000.

Actions within the AFGRP to date, to be developed further in existing and new projects, and to be extended to programme level, have included:

- Selection and targeting of information and knowledge materials, both within project activities and by collating and developing external materials – for future dissemination products;
- The wider use of 'State of the System' and other participatory/interactive approaches during project activities and as a means of promoting concepts for change;
- Revisiting former FGP projects to consider ways in which outputs can be promoted beyond the traditional publication approaches;
- Holding project-based workshops during and at the end of the research cycle in each of the current projects; extensive use of internal feedback and followup on usage/application of findings, particularly in more participatory areas of research;
- Identifying opportunities for and participating in developing district, national or regional guidance notes and extension materials, in which validated AFGRP outputs can be usefully incorporated
- Providing strategic advisory inputs in organising, supporting, providing essential contextual materials to regional/international workshops
- Development of the AFGRP website and appropriate links, with availability of downloadable programme materials
- Arrangements with CABI publishers for the output of key documents, and possible development of a new Compendium product;
- Further discussions with publishers concerning special editions of key journals; editing role in Onefish (SIFAR web-based communications system)
- Extensive links with related email discussion groups including fishfolk, aqua-l, resecon, integrated systems, global knowledge.

4.3 Examples of uptake of programme outputs

Project and programme outputs within the AFGRP have been taken up in a range of contexts and at a range of levels. In broad terms these can be described as uptake by/through:

- *direct linkage* – specifically to farmers, households; usually more limited to sites of project action – eg nursery and stocking strategies in India and Sri Lanka, bacterial disease control in Vietnam, use of epidemiology recommendations in India and Vietnam; retention of SRS in field locations; application of cage culture findings in Bangladesh and Vietnam
- *national institutions* – development and use of fish seed quality criteria by the RIA no 1, Vietnam, Dept of Fisheries, Bangladesh, Dept of Fisheries Thailand; guidelines on shrimp disease management in Vietnam, Thailand and India; guidelines on carp hatchery management in Bangladesh and India; guidelines on water and aquaculture management in India and Sri Lanka; initial strategies on *Pangasius* disease in Vietnam.
- *process approaches* in most current projects with a range of target country institutions – research centres, line agencies at national and district level, extension institutions – change engaged through mutual learning – eg fish seed production performance, involvement e.g with CARE Sri Lanka
- *interaction through programme and project-linked work* with other target institutions such as NGOs and LCOs, and private sector individual end users e.g hatchery operators, fry traders, market and other agents.
- *DFID country programmes* – DFID/CARE CAGES project, Bangladesh (interaction between development and research, feedback of research outputs to project strategy and practice), NWFEP Bangladesh (practical concepts of seed supply and quality), potential inputs on short-cycle aquaculture to DFID India projects
- *other bilateral or multilateral donors/research agents* – links through ICLARM on genetics, SRS and seed supply; through AIT/Outreach with DANIDA and SIDA for fish seed quality; inputs to ADB on strategies for Sri Lanka; key material inputs to FAO/NACA for workshops and expert consultations.

4.4 Progress towards achieving developmental impact

The clearly defined and ambitious targets of the ARP have been retained in the revised and integrated AFGRP logframe. These were explicitly targeted towards addressing the needs of poor people, linked in turn with a range of project-level mechanisms for delivery. Successful achievement of developmental impact would require the delivery of demonstrated benefits to key communities, at a suitable scale, and its recognition requires that these benefits can be separated from those arising elsewhere. The potential to do so will be defined by the nature of the knowledge generated, the context in which it arises, and the extent to which outputs can either be scaled up directly or become part of district, national or regional policy processes. In this respect the Sustainable Livelihoods framework is useful tool in determining the potential nature of change brought about by knowledge and its application, and the relevance or applicability of promoting this;

- at the local level – where there is usually clearly definable impact but at a small scale,
- at a middle level, requiring reliable agents of change and support, with good connections to wider target communities, or
- at the policy level, where selective changes, applied in a context where policy actually translates to impact, can have wide-ranging effects, sometimes irrespective of the field level intervention.

To date, while the programme appears to be moving towards its purpose level OVIs, in both qualitative and quantitative terms, there is concern about the type and level of change it may be able to generate, either directly, or in conjunction with clustered initiatives. While specific research outputs may already have the capability of generating the targeted change, the challenge may lie in scaling up the application and the potential impact. This will be the primary programme concern of over the next years, matched in turn by establishing the means of demonstrating such impact. As noted earlier, it will be essential to establish effective ways of sampling impact in a number of key areas

In the 2000-01 ARP annual report, a number of primary development themes were identified, and these can be extended to include the FGP components, and to develop emerging issues, thus:

- Context and strategy – improving understanding of the changing roles and interactions of the

growing aquaculture sector at farm, community, regional and international level, to feed into programme strategy and into wider policy and development for; key issues include resources, employment, access, trade, supply, food quality and security; (Output 1)

- Strategies and policies; globalisation issues, conflict associated with sectoral development, particularly between commercial and artisanal producers, and other resource users (Output 1, 3).
- Seed supply – improving quality, consistency, diversity and continuity of seed supply, with better opportunities for small scale producers and/or lower cost of access, using simple methods and encouraging private/public sector linkages; improved quality of broodstocks; (Output 2 and 3)
- Improved production – seeking to improve livelihood outcomes, particularly associated with small-scale artisanal systems, combining issues of resource access and use, widening options, risk management, and delivery of benefits. (Output 3)
- Supply and markets; benefits to rural and peri-urban producers and their communities; increasing supply from aquaculture, change in market access and structures, real price reductions, producer-consumer benefit balance, value chains (Output 3)
- Food consumption issues; distribution, health and food quality; (Outputs 1, 3, 4)
- Risk reduction – understanding major aquatic health and environmental risk issues, developing practical, producer level risk identification and control strategies, and contributing to institutional and policy level awareness and response (Output 4)

4.5 Impact framework

This is outlined in Table 10 below, covering AFP, FGP and AFGRP projects active over the last 6 years. A theme structure is used to identify clustered projects - groupings over the programme history rather than formal programme themes within the AFGRP structure. Projects current during 2001-02 are marked *. As before, full shading denotes substantive completion of the defined pathway stage; grey shading definable but partial completion of the respective stage.

Most of the completed projects have reached uptake stage 'E', and a number have attained 'F' and 'G', at least at partial levels. As uptake pathways for earlier projects had not been so explicitly defined, the opportunity to reach stages 'G' and 'H' now depend primarily on the local institutions. These projects' outputs are usually in the form of specific biotechnical tools and techniques, or as guidelines or advisory materials, often incorporated into other, more general documents. Newer projects are moving steadily along the uptake pathway, though attention will be required to ensure they succeed in the later stages, an area which is commonly outwith direct project control.

Table 10 Impact Framework – combined and AFGRP projects

Project	A	B	C	D	E	F	G	H
<i>Theme – cryopreservation and storage – projects completed</i>								
R4523 Cryopreservation and manipulation of ova and milt in commercially important tropical species			Findings taken up into R4914					
R4914 Cryopreservation of eggs and embryos of commercially important tropical species								
R4915 Application of cryopreservation techniques for genetic management of commercially important tropical species								
<i>Theme – virus disease and diagnoses – projects completed</i>								
R4222Cb Studies on ulcerative disease rhabdovirus infection of rice field fish species in ASEAN countries			Findings taken up into R5525 and R5430					
R5525 Development of tropical crustacean cell cultures								
R5430 Studies on viruses associated with ulcerative disease of fish in the Indo-Pacific region								
<i>Theme Fungal disease, EUS diagnosis and control – projects completed</i>								
R4680 Taxonomy and culture of tropical fungi pathogenic to fish and shellfish			Findings taken up into R4723					
R4723 The taxonomy culture and pathogenicity of a new, highly invasive fungus from South and South East Asia			Findings taken up into R5902Cb					
R5902 Cb Diagnostic systems for the study of the molecular epidemiology and taxonomy of EUS fungus						Findings from both projects taken up into R6979		
R5997 Studies on the biology of the EUS <i>Aphanomyces</i>								
R6979 Applied studies on <i>Aphanomyces invaderis</i> , the fungal pathogen of epizootic ulcerative syndrome (EUS)								
<i>Theme – bacterial diseases of aquatic animals</i>								
R5998 Studies on the susceptibility of farmed <i>Rana tigerina</i> and <i>R. rugulosa</i> to frog septicaemic disease and its control							Findings taken into R6206Cb	
R6206Cb Study of bacterial diseases in frog hatcheries and evaluation of strategies to reduce antibiotic usage hazards								
R7054 Control of bacterial disease in small scale fresh water aquaculture			Findings taken up into R7643					
R7463 Strategies for improved diagnosis and control of bacterial disease in Small-scale fresh water aquaculture						Outputs/methods/local institutional links to R 8093 and R 8119		
<i>Theme – generic aquatic health</i>								
R4443 Studies on the culture of tropical prawns (penaeids) with particular reference to husbandry, disease and nutrition.								
R4689 The statistical basis to detect an infection and estimate its prevalence in tropical aquaculture								
R6426 Shrimp defence mechanisms and immunomodulation to enhance sustainability, reduce antibiotic usage in shrimp culture								
R7051 Epidemiology in aquatic disease control: risk factors for White Spot Disease in artisanal systems in Vietnam, India.						Outputs developed to R8119		
*R8093 Risk issues and socio-economic impact associated with Bacillary Necrosis Disease (BNP) in <i>Pangasius</i>								
*R8119 The Impact of Aquatic Animal Health Strategies on the Livelihoods of Poor People in Asia								
<i>Theme – Coastal aquaculture/shrimp</i>								
R4751 Development of Strategies for sustainable shrimp farming.			Outputs feed to R6011					
R6011 Coastal Aquaculture and Environment: Strategies for Sustainability								
<i>Theme – Aquaculture Systems</i>								
R6069Cb The development of approaches and methods for low input fish seed production for Sub-Saharan Africa						Production of widely disseminated handbook on fish hatcheries		
R6380Cb Addressing technical, social and economic constraints to rice fish culture in Laos, women's involvement								
*R7064 Small-Scale farmer-managed aquaculture in engineered water systems:								

*R7052 Fish Seed Quality in Asia									
R7100 Improved management of small scale tropical cage culture systems in Asia									
R7123 Fish in Irrigation Systems Technology									
*R7917 Self recruiting species in aquaculture-their role in rural livelihoods									
*R8094 Guidance for estimation/allocation of environmental capacity for aquaculture in tropical developing countries									
<i>Theme - capture fisheries improvement</i>									
R4537 Analysis of the gene flow of the Bermuda spiny lobster									
R4801 Genetic diversity and stock structure of Lake Tanganyika Kapenta introduced to African lakes.									
R4802 Molecular population genetics of <i>Penaeus</i> species in the Malaysian Peninsula									
<i>Theme – hatchery technologies and broodstock management</i>									
R4452 Production by mitotic gynogenesis of superior monosex clones of Tilapia and transfer of Technology to the Philippines								Outputs to R4803	
R4803 Genetic Means for the Production of Monosex Tilapia								Outputs to R 5068A	
R5068A Genetic manipulations for improved tilapia (GMIT) technology adaptation and development								Outputs to R 6058, R 6070A, R6938, R 7284	
R6058 Selective improvement of genetically male tilapia									
R6070A Genetic manipulation for improved tilapia – Technology adaptation and development II									
R6938 Improvement and evaluation of YY male technology									
*R7284 Genetic improvements and utilisation of indigenous tilapia in southern Africa									
<i>Theme - Carp and Tilapia Broodstock</i>									
R4700 Use of androgenesis to regenerate diploid fish from the genetic material of cryopreserved sperm									
R6059 Genetic improvement of Indian and common carps for aquaculture								Outputs to R 7590	
*R7590 Genetic improvement strategies for production in exotic carps for low input aquaculture in Asia									
<i>Theme – Transgenic Tilapia</i>									
R5069 Development of Transgenic Tilapia Fish								Outputs to R5502	
R5502 Development and Exploitation of Transgenic Tilapia Fish								Outputs to R 7113	
R7113 Development and use of Transgenic Tilapia								Outputs to R 7591	
*R7591 Production of Novel strains of growth enhanced tilapia which are also reversibly sterile									
<i>Theme – Social and economic assessments</i>									
R4721 Aquaculture in Sub-Saharan Africa									
R6437 Socio-economic analysis of the dissemination and impact of genetically male tilapia									

Key: black = substantially attained; grey = partially attained (in scope or in research content)

A - formal/informal agreement with target institution(s) - MOUs and/or workplans, workshops, resource allocations

B - generation of relevant research results (Output delivered); - reports, papers, workshop outputs

C - development of appropriate research-based products through adaptation/packaging; -

D - promotion of products into target institutions; - workshops, documents, videos

E - adoption of products by target institutions; - reports, workshops, publications

F - application and replication of results in target institution programmes; - practice, workshops, publications

G - promotion of technology or behavioural change among end-users by target institutions- workplans, reports, external assessments

H - adoption of technology by end-users and generation of economic benefits i.e. developmental impact (Purpose delivered); household and community assessments, reviews, income and consumption surveys

4.6 Reporting in media

The presence of a project involving genetic modification has led to a frenetic level of press attention during 2001-2001, and the need for patient downplaying has been the issue. Nonetheless, we have been successful in promoting our more real, less sensational achievements in a range of local press articles, World Service and associated newspieces, and some television footage in target countries. Opportunities are regularly sought to use the University Press office for those activities involving the programme or Stirling-linked researchers, and partners are also encouraged to use their own equivalents. The AFGRP has invited Michael Pickstock of Wren Media to provide strategic advice and practical assistance.

5. PROGRESS REVIEW AND PROGRAMME DEVELOPMENT

5.1 Progress against milestones for the year 1999/2000

Table 11 outlines the year's progress on the milestones set out for the new AFGRP management.

Table 11 Achievement of milestones for 2001/02

MILESTONE		Comments (bold target reached)
<i>General</i>	<i>Generic programme/management issues</i>	
01.1	Establish and make operational management/external advisory system, develop strategy to 2005	Management system in place; social specialist identified; first stage complete.
01.2	Develop and integrate new AFGRP activity structures	Completed
01.3	Operational website with generic programme functions	Pilot version running, improved version.
01.4	Social/environmental audit of all current projects	Contract TORs drafted but delayed
<i>Output 1</i>	<i>Enabling/influencing context for AFGRP</i>	
01.5	Develop strategies for sectoral research and development with FAO, ICLARM, others	Range of Activities under way
01.6	Sustainability indicators consultation – FAO/others	Completed
01.7	Develop concepts of sectoral food supply/security/safety with FAO, SIFAR, WHO, relevant DFID groups	Underway
01.8	Initiate concepts of sectoral development, markets, trade, globalisation – with FAO, IFC, IIFET other groups	Draft paper on globalisation; produced
<i>Output 2</i>	<i>Aquatic stocks – strategic issues</i>	
01.9	Assess nature and scale of benefits of fish genetic programme products in S Africa (link with Asia)	New CN to take this further, inputs to ICLARM strategy – report needed
01.10	Environmental, regulatory, socio-economic factors for uptake and benefits of transgenic tilapia assessed for at least 1 SE Asian country	TORs drafted
<i>Output 3</i>	<i>Productive aquatic systems</i>	
01.11	Guideline document on social and bioeconomic issues in developing semi-intensive production systems	Materials being collated
01.12	Key overviews/guidelines: role of seed; water resources; other aquatic species sectors in poverty-linked aquaculture.	Initial materials being collated
01.13	At least 1 new SL- oriented project in productive aquatic systems	Two projects due to start early 2002-03
<i>Output 4</i>	<i>Risk management/reduction</i>	
01.14	Develop at least one overview on current issues in aquatic health/risk management in SL in Asia.	Further materials to be collated; contract to complete
01.15	At least 1 new SL oriented project in aquatic health/env. managment	Completed R8093, R8094, R8119
<i>Output 5</i>	<i>Dissemination</i>	
01.16	Develop dissemination strategy and identify targets; set up publication links (e.g. CABI, etc)	Underway-also CABI initiatives
01.17	Complete remaining publication tasks – documents or website (cryogenics, shrimp, waste-water aquaculture)	pdf files on all key documents done
01.18	Develop dissemination programme with AIT and others, incorporating current AFGRP outputs	AIT questionnaire outputs to be finalised – new CABI initiative
<i>Output 6</i>	<i>Uptake and impact</i>	
01.19	Establish system of defining institutional linkages, uptake mechanisms and impact measurement	Under development; further discussions and prioritisation
01.20	Survey data on key projects to measure impacts and explore means to improve process	Draft TORs

Progress on the milestones during 2001-02 has been variable. The overall performance has been somewhat disappointing, though due in part to the considerable amount of programme level work required to merge the two programmes and to properly update and validate current and past project information from both programmes.

- *General programme targets* have been largely met, though the social and environmental audits had not been completed due to staff availability problems. This will be addressed early in 2002-03.
- *Output 1 targets* are still very much 'work in progress', though outputs have been developed in various ways. Only 01.6 has been completed substantively. A problem here is simply to define the issues more clearly as milestones, rather than descriptions of process, and this will be clarified in the new milestones.
- For *Output 2 milestones*, progress has been disappointing, though useful outputs have occurred through ICLARM consultations (01.9). While TORs are available for the studies, it has been difficult to identify suitable nominees in the time available, and these have been carried forward to 2003-03, when work will usefully coincide with major reviews of the two current genetics projects.
- In *Output 3*, 01.13 has been largely achieved and will be complete once the projects concerned have been initiated in the next programme period. 01.11 – social and bioeconomic issues has been held up by the Programme Manager's recent involvement in other DFID work, but will be addressed further next year. 01.12 will be pursued more actively next year, now that the background materials have been collated from the ARP and FGP projects, and staff resources can be freed up.
- The first milestone for *Output 4* (01.14) has not been completed, though useful background material has been collated. This was partly due to the unexpected non-availability of the person identified for this work, and the subsequent difficulty in obtaining an input at relatively short notice. This will be addressed actively in the next session, and recent and current projects should be invaluable sources of emerging ideas. Milestone 01.15 has been well completed, with not one but three new projects now under way.
- The dissemination area, *Output 5*, shows good overall progress. 01.16 is substantially complete, though the targeting exercise needs to have further feedback from projects and others. Though some of the former FGP documents have proved more difficult to access, a large number of former ARP and FGP materials is now available in pdf format. Milestone 01.17 can therefore be considered to be complete, as it now becomes an ongoing maintenance activity. 01.18 has been delayed by the long time it had taken AIT to develop its questionnaire, but this has now delivered results, and through links with CABI, we expect more explicit progress. The milestone will be updated to reflect further progress with these links.
- Progress on milestones associated with *Output 6* has been poor, and will require priority attention by the Programme Manager in the coming year.

5.2 Response to RSMP recommendations

Due to changes in procedure there were no specific RSMP recommendations for 2000-01. However, the Programme Manager had been able to discuss programme progress with DFID staff at various stages, and obtained useful guidance and feedback. Unfortunately, due to scheduling problems, it was not possible for a DFID representative to attend the programme workshop in December 2001. As this proved to be a very valuable means of reviewing project and programme performance, we would endeavour to secure some DFID presence in future occasions.

5.3 Milestones proposed for 2002/03

The programme milestones for next year are described in Table 12. To provide a common base for future monitoring, the milestones are reset from 2002, with annotations as appropriate to indicate those which contain significant carried forward elements. As in the previous year, these are organised according to the programme output structure. Specific date targets are identified.

Table 12 Milestones proposed for 2002-03

MILESTONE		Comments
<i>General</i>	<i>Generic programme/management issues</i>	
02.1	Complete programme strategy to 2005 (develop from 01.1)	First stages completed: target 8-02
02.2	Social/environmental audit of all current projects (from 01.3)	Contract TORs – target 6-02
02.3	Establish programme link options with EC 6 th framework, ICLARM	Target 09-02
<i>Output 1</i>	<i>Enabling/influencing context for AFGRP</i>	
02.4	"Think piece" on sectoral research and development for circulation/ discussion with FAO, ICLARM, others (develop from 1.5)	Range of activities under way; PD to be commissioned – target 12-02
02.5	"Think piece" on sectoral food supply/security/safety with FAO, SIFAR, WHO, relevant DFID groups (develop from 1.7)	Commission PD – target 9-02
02.6	"Think piece " on sectoral development, markets, trade, globalisation – with FAO, IFC, IIFET other groups (develop from 1.8)	Draft paper on globalisation; produced – overview paper target 9-02
02.7	"Think piece" on small-scale vs commercial aquaculture impacts in poverty targeting	Commission PD – target 9-02 (link with DFID Policy research?)
<i>Output 2</i>	<i>Aquatic stocks – strategic issues</i>	
02.8	Assess nature and scale of benefits of fish genetic programme products in S Africa (link with Asia) (develop from 1.9)	New CN to take further, inputs to ICLARM strategy – outputs from workshop 7-02
02.9	Environmental, regulatory, socio-economic factors for uptake and benefits of transgenic tilapia assessed for at least 1 SE Asian country (develop from 1.10)	TORs drafted – target 9-02
<i>Output 3</i>	<i>Productive aquatic systems</i>	
02.10	Guideline document on social and bioeconomic issues in developing semi-intensive production systems (develop from 01.11)	Materials being collated – target 12-02
02.11	Key overviews/guidelines: role of seed; water resources; other aquatic species sectors in poverty-linked aquaculture (from 01.12)	Initial materials being collated – target 9-02 as dissemination activity
02.12	Overview assessment of nutrient limitations in semi-intensive aquaculture	Commission PD – target 06-02
02.13	Commission project input on rural-peri-urban linkages – Sub-Saharan Africa and links with EC and other initiatives	Target 06-02
<i>Output 4</i>	<i>Risk management/reduction</i>	
02.14	Develop at least one overview on current issues in aquatic health/risk management in SL in Asia. (from 01.14)	Further materials to be collated; contract to complete – link with R8119 – 12-02
02.15	Regional or national workshop on aquatic health strategies - new approaches to management	Link with R-8119 – first target shrimp health management - by 09-02
02.16	Strategy paper/workshop for pangasius disease, management, trade issues in Asia	Link with R8093 – by 10-02
<i>Output 5</i>	<i>Dissemination</i>	
02.17	Develop dissemination programme with AIT and others, incorporating current AFGRP outputs (from 01.18)	AIT questionnaire outputs to be finalised, CABI decisions – by 09-02
02.18	Fully developed dissemination strategy and priorities	
<i>Output 6</i>	<i>Uptake and impact</i>	
02.19	Establish system of defining institutional linkages, uptake mechanisms and impact measurement (from 01.19)	Under development; further discussions and prioritisation – target 09-02
02.20	Survey data on key projects to measure impacts and explore means to improve process (from 01.20)	Draft TORs – initial recommendations by 12-02

6. CONCLUSION

As anticipated in the ARP annual report of 2000-01, the initiation of the new AFGRP has presented considerable management challenges, not least because of the immediate introduction into news management, and the time taken to obtain FGP accounts and background documents, but also because of the aims to be reached in merging the programmes to best effect. Unsurprisingly perhaps the culture and means of operation of the two programmes had been rather different, but it has been greatly to the credit of many of the FGP researchers that they have realised the importance of being able to find users and hence beneficiaries of their work. That in turn has placed far greater emphasis on selecting priorities for research focus, developing far more practical engagement with producers, and understanding more carefully where scientific knowledge can actually add value.

The commissioning of new projects during the year has provided an exciting range of future involvement in the sector, and should help to continue and consolidate the programme's growing international reputation as being in the lead of current thinking in its field. Further new projects are expected for the coming year, at which point the key programme objective will be to ensure a good balance is maintained across sub-sectors, and in regional and inter-regional interests. We may expect links to other target species groups (eg molluscs, aquatic plants), more cross-sectoral linkages, and some revisiting of the question of regional focus and comparative opportunities for poverty alleviation. Further to this, we would also expect greater focus on the impacts of increasing aquaculture supply n markets, and on the implications for employment and consumption, and hence to food supply and poverty targeting.

There are already positive indications that the programme will contribute strongly to international thinking on sectoral development. The challenges of applying a Sustainable Livelihoods perspective in the sector have already been noted, and the programme is making useful contributions. However, given the growth of the aquaculture sector and its potentially critical implications in poverty targeting, there is a need for wider and better developed analysis of its performance, potential, and policy dimensions. We would intend to commission a number of programme development initiatives to address these issues, and where possible, to stimulate and influence strategic approaches in the research community, and in particular, amongst development agencies and policy agents.

While partnerships have been developing well across a range of fronts, there is still scope for wider linkages, particularly for the uptake and dissemination objectives, and in ensuring that impact can be achieved. This increasingly important as the programme moves nearer to the end of the current funding cycle in 2005, by which time the overall record of investment should be capable of demonstrating verifiable benefit across a range of areas. A priority for the last year has been to collate programme outputs across all ARP and FGP projects so that the existing and emerging 'knowledge base' can be clearly defined. The priority now will be to consider how best this base can be used to effect, and how the impacts can be identified and measured. As noted before, there are excellent opportunities for achieving impact, though to do so on a sufficient scale and to extend the justifiable level of policy influence, good institutional links and effective dissemination and uptake will be key elements. There will be considerable emphasis therefore on consolidating and extending the key outputs of the programme and on scaling up impact.

Annex 1. AQUACULTURE AND FISH GENETICS RESEARCH PROGRAMME – (AFGRP) Logical Framework

NARRATIVE SUMMARY (NS)	OBJECTIVELY VERIFIABLE INDICATORS (OVI)	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>GOAL</p> <p>Livelihoods of poor people improved through sustainably enhanced production and productivity of RNR systems.</p>	<p>Food security indicators; measures of change in capabilities, assets and activities; access to services</p>	<p>National and local level monitoring of poverty and livelihoods (household survey, employment statistics) WHO reports. DFID evaluations.</p>	<p>Political stability maintained</p>
<p>PURPOSE</p> <p>Productive benefits of aquatic resources for poor people generated and sustained through improved knowledge of aquatic stocks and their selection, enhancement and culture.</p>	<p>By 2005, knowledge gains allow 500,000 poor people in S & SE Asia to improve food supply by 20% and income by 20%, based on yield increases related to better aquatic stocks, sustainable aquaculture and enhancement practices, and at least 100,000 people positively impacted by development activities incorporating programme outputs.</p>	<p>- National, FAO fisheries/aquaculture sector surveys and statistics, environment report - Evaluation of RNRKS and AFGRP - National reports to regional organisations. - reports of target institutions/key locations - household and community surveys/ monitoring against base-line data.</p>	<p>Poor people invest benefits to improve livelihoods</p>
<p>Outputs</p> <p>1. Enabling contexts for aquatic stock selection and production, livelihood impacts defined, and indicators developed, in present and emerging inland and coastal aquatic systems.</p> <p>2. Practical strategy developed and applied for aquatic stock identification, selection and improvement in target enhancement and aquaculture systems</p> <p>3 Improved culture and enhancement systems based on natural and human resource relationships, and their effective use of productive inputs (broodstock, seed, nutrients) in target regions.</p> <p>4. Livelihood risks/constraints of environmental, stock quality or aquatic health factors reduced in target systems through improved techniques and strategies for assessment, control and management.</p> <p>5 Improved global knowledge base on aquatic stocks and culture practice established and disseminated through project linkages, national and international networks, workshops and publication.</p> <p>6 Successful promotion and uptake of improved approaches, and impacts measured, through local institutional/uptake pathways,</p>	<p>By: 2001 outlines of key factors/indicators in stock selection and sustainable production; 2002, case definition of environmental, genetic, social, technical, institutional livelihood enabling contexts in target areas; 2003 inputs to policy</p> <p>By: 2001, selection and management strategies for 3 key regional enhancement/culture stocks; 2002 improved stocks in 3 target systems; 2004, use in 2 mesoscale systems.</p> <p>By: 1999 overviews of 2 key aquaculture systems; 2001 25% seed performance gain in 3 target locations; 2002 sustainable output gains of 25% in 3 target production systems; 2004, 5% productivity gains in 2 mesoscale systems</p> <p>By: 2000, key environmental/health/stock risks and impacts defined; 2001 livelihood risk definably reduced in at least 3 target systems; 2003, management approaches reduce livelihood risk across 2 mesoscale systems.</p> <p>By: 1999, internet access to AFGRP; collaborative network initiated; 2000, 2 development projects linked; significant outputs in 4 regional network activities; 2001, publication series set up; key outputs in 3 national/regional workshops; 2002, 3 major sectoral documents; 2004 major strategy review</p> <p>By: 2000 uptake and impact strategy defined; approaches piloted in 3 target areas; 2001, 4 AFGRP outputs adopted in 12 target institutions, 2002; uptake recorded in 12 target groups. 2004, measurable benefits in 15% of target base.</p>	<p>- reports, published documents, peer review publications,</p> <p>- reports, independent reviews of systems and practice, peer review publications; analysis of key stocks; policy and management documents</p> <p>- reports, independent technical and economic assessments; peer review publications; workshop content, application in analysis and techniques; impact measurement</p> <p>- reports, peer review publication; application in analysis and techniques, independent assessment uptake and use in laboratory and field practice; impact measurement</p> <p>- internet function; network information and reports, development project reports, reviews; network activity statements and programme details; workshop content and participation data; publication details, review content</p> <p>- reports, surveys of institutional activity; skill, attitude and knowledge assessments, impact indicators in target groups</p>	<p>- Natural resources of required quality remain available - climatic conditions remain favourable.</p> <p>- enabling environment (policies, institutions, markets, incentives) exists for widespread adoption of new technologies and strategies.</p> <p>- other sectoral factors remain stable - aquaculture offers potential for target groups and/or viable mechanisms for change</p> <p>- end-user linkages can be identified and maintained over the course of the programme</p> <p>- research activities enhance understanding sufficient to widen management options and improve risks/factor productivity.</p> <p>- uptake can be promoted in the target contexts</p> <p>- local institutions maintain cooperation, invest resources in uptake and application.</p>

Annex 2 AFGRP Success Stories.

R7052 Fish Seed Quality in Asia

An action plan is in place with a group of hatchery operators in Tambon Chaniang, Surin, based on their analysis of the problems that they face in the operation of their hatcheries. Initial aims that have been identified are:

- improvement of the market for fish seed (fry and fingerlings)
- increased broodstock management knowledge

To achieve these the farmers have developed specific objectives and action plans in order to achieve their goals. This represents the introduction of primary stakeholders taking the initiative within the research process with the intention of improving their own situations. The hatchery operators in the two groups are now working towards producing approximately half a billion fry and fingerlings which are traded to small-scale farmers throughout the northeast of Thailand, into Laos and Cambodia. Improved livelihoods are indicated through the sustained adoption and farmer-to-farmer spread of farming households who have adopted seed production in rice fields.



Fish seed traders at work in Thailand.

R7064 Small scale farmer managed aquaculture in engineered water systems: Critical design and management approaches.

The criteria for and mechanisms of intervention to improve productivity of community-managed water



Sri Lankan fishermen with fish catch from a community managed water body.

bodies has been refined by the action of research within communities in Sri Lanka. Simple and sustainable methods for improving fish production have been identified for and with communities, and impacts monitored. The approach has had most impact for interventions with poorer, upper watershed communities who have fewer alternative livelihood options and have a greater reliance on the natural resource base. Improved livelihoods have been indicated by increased availability of fresh fish and reduced expenditure on fish purchased from out with

the community.

R7284 Genetic Improvements and utilisation of indigenous tilapia in southern Africa.

Mozambique tilapia (*Oreochromis mossambicus*) is an indigenous tilapia species in southern Africa, until now the majority of genetic research has been carried out on Asian species of tilapia but this project aims to look at this African species.

Those most suited to further development in aquaculture in southern Africa have now been identified.

The genetic characterisation of strains has been completed.

This information has aided the choice of strains for use in small-scale aquaculture and for genetically male tilapia (GMT) production. They will form the basis of future strategies for further genetic improvement, and management of genetic diversity of Mozambique tilapia.



Oreochromis mossambicus the Mozambique tilapia

The information will also contribute towards responsible management and development of genetic resources, particularly with regard to indigenous species of tilapia. Good progress has been made with the adaptation and implementation of producing the supermale fish required to produce all male offspring, resulting in faster growing populations of tilapia. The presence of the project and its associated activity has been a catalyst for a surge in interest in tilapia culture throughout southern Africa. The level of interest is such that it is very likely that there will be a rapid expansion of tilapia culture representing a shift in thinking on the role of aquaculture, particularly in the rural development sector.

R7590 Genetic improvement strategies for production in exotic carps for low input aquaculture in Asia.



Majenhali, India - pond sampling

Genetic material has been obtained and screened from local carp species. Examples of each of the genetic types (strains) are being held at the three project sites (Vietnam, India and Bangladesh). Each of these strains are being evaluated for aquaculture production qualities and comparative results in each of the three countries have gone well and have started to yield important information on the properties of strains. The results from these trials will inform decisions and recommendations on future broodstock management and improvement strategies.

Introduced strains of common carp in India have been found to have considerably superior production traits to the local strains and can form

the basis for future improvements. Techniques have been established to determine parent species of offspring, specifically to collect information relating to hybridization between silver and bighead carps, which has been identified as a potential problem. Protocols for cryopreservation (freezing techniques) of sperm from common carp, grass carp and mrigal were developed in Vietnam and cryopreserved sperm gene banks have been initiated for strains of indigenous common carp.

R7591 Production of Novel strains of growth enhanced tilapia which are reversibly sterile.

Previous studies of growth enhanced transgenic tilapia presented minor problems in that they utilised genetic elements from two other species of fish, salmon and ocean pout, but crucially not tilapia. It was decided therefore to develop a new growth hormone utilising the "in house" library of *O. niloticus* genetic resources available to the project. The resultant tilapia would be "Autotransgenic" in that they would possess no non-native DNA. Occasional batches of tilapia eggs have now been injected with this new product of which some are now young fish and fry.



Left: normal tilapia, Right: reversibly sterile growth enhanced tilapia

Additional studies involving the crosses between red tilapia and growth-enhanced tilapia are indicating that the red dominance allele has been successfully introduced to these fish without the loss of growth enhancement.

R7917 Self recruiting species in aquaculture: their role in rural livelihoods.



Farmer presenting a fish trap, India.

Community level surveys on aquatic resource use and its effects upon livelihoods were completed in all five project countries (Vietnam, Thailand, Cambodia, India and Bangladesh). These surveys indicated that natural aquatic resources are important in rural livelihoods in all project countries. Rice field associated aquatic systems (including trap ponds, rice-fish culture systems, fish culture ponds in rice fields etc.) and household ponds (ponds in the immediate vicinity of dwellings) were identified as foci for further research.

A comparative study on the results from Vietnam and Thailand found that rural people in Thailand still depend on aquatic resources caught from the wild for food and income, and aquaculture is relatively unimportant where wild resources are abundant. In Vietnam, aquaculture and wild fishing are both important for food and income. Aquaculture tends to be more important to the rich, and wild fishing to the poor.

A household survey was carried out to provide key information on farmer-managed aquatic systems and to help in the selection of households for long-term monitoring. This survey confirms the existence of several different categories of

farmer-managed systems throughout the project areas.

Annex 3 AFGRP PEER REVIEWED PUBLICATIONS 2001-02

Published and in press

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R7052

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R7064

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R7590

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R7591

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R7917

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R8093

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R8119

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R7590

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R7052

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R7284

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R7590

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RIA-I annual Research Workshop 2001, 2002. (Mr. Tuan attended and presented project activities).

Others

Graham Mair now writes a regular column for the NACA magazine "Aquaculture Asia" entitled "Genes & Fish – Topical issues in genetics, biodiversity and fish breeding. The column regularly covers issues on which this project focuses and highlights these to a broad audience across the region. Three columns were published this year.

R7917

Reports

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Dhaka workshop report.

Anon (2001) Fish life history sampling and analysis guidelines and workshop report.

Back-to-office reports on all field visits.

Presentations

Presentation of project objectives, work plan and initial results at the Dhaka dissemination workshop.

Other dissemination

The Dhaka workshop (see above) has been widely reported in the Bangladesh media.

Data sets generated

Community level rapid appraisals of aquatic resource use

Household level baseline surveys

Household level monitoring surveys

Fish life history survey: sampling records and preserved specimens

R8093

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Annex 6 Dissemination strategy

Targets	Constraints/issues	Needs	Products	Delivery
1 rural poor	vulnerability, risk, limited access to resources and markets, empowerment poor access to relevant knowledge	ideas and examples for uptake, ways to protect maintain, add value, increase benefit, avoid direct or indirect harm	participatory learning, posters, drama shows, leaflets, possibly videos	local adaptive processes, workshops, co-develop materials with local partners and agents
2 local knowledge agents – extensionists, field workers	lack of resources, structural change, limited experience, poor top-down messages, heavy cross-sectoral demands	easily accessible ways to identify user needs, offer practical, possibly participatory support, compare results and impacts	training to engage with end users; guidance on ideas and methods, practical technical notes, videos	co-develop materials with agents and end users, for simple guidance notes, explanatory leaflets, videos, local language
3 social change agents – NGOs and LCOs	heavy cross-sectoral demands, sometimes limited awareness of aquatic potential, lack of track record/good practice examples	good examples of practical options available, realistic knowledge of issues and constraints, ways of incorporating sectoral options into wider actions	guidance on ideas and methods, case studies, practical technical notes, videos, web materials	co-develop case studies and strategy materials, with other local partners, workshops, open access to wider source bases.
4 NARS and equivalent	institutional/ disciplinary rigidity, lack of resources, misplaced remit, poor connections to demand, no feedback	encouragement in developing more responsive roles, engaging with end users, opening dialogue, changing approaches	training to engage with user groups; local needs assessments, guidance on ideas and methods, case studies, practical technical notes, key papers, videos, web materials	co-develop needs, ideas, methods, workshops, interact with external researchers to develop methodologies, share experiences, reinforce positive outcomes
5 Sectoral managers, policy, planning and development	time; access to thematic understanding of issues and approaches, awareness of potential, good practice, means to balance in wider responsibilities	good examples of practical options, knowledge of key issues, constraints, ways to incorporate sectoral options into wider actions, valuation and other tools	ideas and methods, case studies, technical notes, strategy papers, multi-use and spatial assessment and valuation tools, web materials	strategy and methodology workshops, demonstrations, sectoral and other conferences
6 Regional/international research community	drive for basic/generalisable research, abstracted mainly biotechnical approaches, outdated models of application to resource-poor groups	strategic guidance on research tools and approaches, impact and value for money assessment, options and interactions for NARs	strategy/review papers, workshop proceedings, guidance and advisory documents, case studies, appraisals	participate with NARs, sectoral agents, strategy and methodology workshops, conferences
7 Bilateral/multilateral development agencies	difficulties of abstracting/validating key issues/data from practical development processes; data to prioritise, develop concepts, interact on policy	strategic guidance/ideas on sectoral issues, options, approaches; awareness of key constraints, interactions, value issues, technical quality control	strategic guidance and advisory documents, strategy/review papers, workshop proceedings, case studies, appraisals	contribute to workshops, consultations, agency dissemination outputs, develop key documents, provide ad-hoc advice
8 In-house DFID	competition for time and resources; changing internal priorities, drive via advocacy, desire to influence others	clear lines between local actions and options, and wider policy issues, good explanatory/exemplary materials	case studies, guidance notes, policy briefing materials, success stories, presentation materials, websites	contribute to workshops, consultations, DFID dissemination outputs, provide key documents, ad-hoc advice
9 UK public	limited association with/ understanding of key issues and approaches, uncertainty of impacts and value for money	good explanatory and exemplary materials, understanding of key issues and linkages, reassurance of good practice	pictures, stories, articles, radio and TV cover, websites, teaching materials	interact with UK and other press, develop materials, storylines, pictures, personalise local agents and beneficiaries

Annex 7. Glossary of AFGRP – related terms

AAHRI	Aquatic Animal Health Research Institute, Bangkok, Thailand
ACIAR	Australian Council for International Agricultural Research
AIT	Asian Institute of Technology, Bangkok, Thailand
Allele	One of the variant forms of a gene at a particular locus, (location) on a chromosome. Different alleles produce variation in inherited characteristics such as hair color or blood type.
Allozymes	Multiple forms of an enzyme whose synthesis is controlled by more than one gene
Androgenesis	The process whereby an individual is formed from genetic information coming only from its father.
Anneal	To bring together, in a double helix, individual strands of DNA.
Antisense	The noncoding strand of the DNA double helix
Base Pair	Two nucleotides on separate DNA strands that are connected through hydrogen bonds
CARE	Major international relief and programme implementation agency
COFI	Commission on Fisheries – intergovernmental forum meeting every two years to review/approve FAO's fisheries programme
Chromosome	a nuclear body composed of DNA and protein and comprising a linear sequence of genes.
Clone	I) a group of individuals derived by mitosis from the same ancestor and genetically identical with each other II) A group of individuals derived by nuclear cloning where the nucleus is derived from the same individual. III) In genetic engineering, a specific length of DNA replicated many times in a carrier organism.
Construct	A complex DNA sequence used to carry a gene
Cryogenics	Methods for ultra-low temperature (freeze) storage of eggs and sperm (of fish and shellfish)
D.E.S.	Diethylstilboestrol- a feminising agent
Denature	To break the bonds between the two complementary strands of DNA separating them into single stranded molecules
Diploid (2n)	A cell possessing a double set of chromosomes
DNA:	Deoxyribonucleic acid - the chemical basis of heredity consisting of a double helical linear molecule with two chains of alternating sugar-phosphate groups linked by pairs of bases: adenine-thymine, cytosine-guanine.
DNA Polymerase	An enzyme required for DNA synthesis
DNA probes	Small parts of DNA selected to bind to pathogens - used to tag and identify them
E.E	Ethynylestradiol- a feminising agent
Electrophoresis	The separation of macromolecules (e.g. enzymes or DNA) in the presence of an electric current by differences in charge, size or shape.
Epidemiology	Process of understanding the associations between factors underlying the incidence and transmission of disease (without necessarily determining the causative agent or its specific characteristics)
EU INCO	European Union Research and Technology Development Programme for less developed countries.
EUS	Epizootic Ulcerative Syndrome – serious and often fatal ulcerative condition in freshwater fish
FCR	Food conversion ratio- a measure of the efficiency of an organism in converting food to flesh
FISH	Fluorescence <i>in situ</i> hybridisation. Technique for locating specific DNA sequences on specific chromosomes.
Gamete	The mature reproductive cell (egg or sperm) formed for sexual reproduction containing a haploid number of chromosomes.

Gene	A unit of inheritance controlling some aspects of the phenotype and containing an informational segment of DNA.
Gene frequency	Frequency of alleles at an individual or population level
Genetic (DNA) fingerprinting	Generally used to refer to the characterisation of an individuals genome by developing a DNA fragment band (allele) Pattern. These banding patterns will resemble a bar code and will be unique for each individual, except in identical twins or in members of a clone.
Genetic 1) identity and 2) distance	Inversely related quantitative measures of the genetic relationship between populations based on numbers and frequencies of alleles held in common
Genome-mitochondrial	The total set of genetic information within one mitochondrion
Genome-nuclear	The total set of genetic information within the nucleus of the cell
Genotype	The hereditary constitution of an individual.
GH	Growth hormone
GIFT	Genetic Improvement of Farmed Tilapia. An improved strain of Nile tilapia developed by ICLARM
GMO	genetically modified organism (=modified by DNA technology, not by breeding)
GMT TM	Genetically male tilapia (developed in the DFID FGPR programme).
GnRH	Gonadotrophin releasing hormone (An essential component of reproduction)
Gynogenesis	The process whereby an individual is formed from genetic information coming only from its mother.
Haploid (n)	A single set of chromosomes (half the full set of genetic material.)
Haplotype	The set of genes in one individual mitochondrion (mt DNA)
Heterozygosity	The presence of different alleles of a gene at one or more loci
Heterozygote	An individual possessing dissimilar alleles at one or more loci.
Homozygote	An individual possessing identical alleles at one or more loci.
Immunogenicity	The nature and characteristics of the immune response (of fish or shellfish) to specific pathogens
Immunostimulation	Stimulation of the immune systems (of fish or shellfish) to improve their resistance to disease
Immunomodulation	Control of the response of immune systems to modify resistance to disease
Inbreeding	Mating of individuals related by descent. The closer the relatedness the greater the degree of inbreeding
<i>in vitro, in vivo</i>	tested in the laboratory, with(in) the animal, respectively
ITDG	Intermediate Technology Development Group
LCO	Local community organisation
LIFDC	Low Income Food Deficit Country (definition used by FAO in determining comparative food supply/poverty status)
Linkage map	A linear representation of the relative position of different gene loci on a particular chromosome
Locus	The position of a gene on a chromosome
Meiosis	The process whereby a diploid chromosome set is reduced to a haploid set in gamete formation
Microsatellite DNA	Highly polymorphic regions of the genome which can be utilised as informative genetic markers.
Minisatellite DNA	Tandem array of from two to several hundred copies of a short (9-100 bp) sequence of DNA, usually interspaced, but often clustered in regions of the chromosome. When cut by restriction enzymes, produce DNA fragments of differing lengths, thereby enabling a DNA fingerprint to be obtained
Mitochondrial DNA (mt DNA)	DNA located in the mitochondrion. In animals it is generally a small circular molecule with 16,000 to 18,000 base pairs long.
Mitochondrion	A self-reproducing organelle, containing DNA, present in all cells
Mitosis	A nuclear division in which prior to actual division, the chromosome set is replicated and then a complete chromosome set, identical in number and kinds

	of chromosomes to the nuclear set of the parent cell, is passed to each of two daughter nuclei.
Mosaic	An individual in which, as a result of any one of a number of processes (mutation, nondisjunction, transgenesis), not all of the cells have the same genotype. Mosaics are often large scale e.g. left sides and right sides are genetically dissimilar
monoclonal antibodies	(Mabs) – probes used to identify pathogens and develop vaccines
MRC	Mekong River Commission
MST	Mixed sex tilapia
Mt DNA	see mitochondrail DNA
Mutation	1. Any heritable permanent change in the genetic material (gene, chromosome etc) 2. The process by which a gene (or chromosome) undergoes the permanent heritable change referred to in 1. 3. (Implicitly but uncritically) the individual expressing the mutation, this is better termed the mutant.
NACA	Network of Aquaculture Centres in Asia and the Pacific, Bangkok, Thailand
NARS	National Agricultural Research Stations (or fisheries/aquaculture equivalents)
$N_e m$	The product of effective population size times the rate of migration between populations
Neomale	An animal with female genetic constitution but male anatomy (sex reversed)
Non-disjunction	The rare failure of separation of paired chromosomes in cell division resulting in one daughter cell receiving both, and the other daughter cell none, of the chromosomes in question.
Nucleotide	The basic building block of DNA. It consists of a purine or pyrimidine base, a pentose (sugar) and a phosphate group.
Nucleus	The structure, normally present in typical cells, which contains the chromosomes
NORAD	Norwegian Development Assistance Agency.
On growing	Growing young fish or shellfish to market size
Passive immunisation	Process of injecting unexposed animals with materials from other animals exposed to pathogens
PCR	Polymerase chain reaction – a highly sensitive procedure for identifying biological molecules
Phagocytic cell	Cells which specialise in attacking and breaking down others, such as pathogens
Phenotype	The observable characteristics of an organism (e.g. body colour, blood pressure). The result of a combination of genetic factors and environment in varying degree.
Polymorphic	A locus is polymorphic in a population when there are two or more alleles in the population Population size (effective) The number of breeding individuals in the population concerned.
PRA	Participatory rural appraisal
Primer	A short single-stranded sequence of DNA which binds to a complementary sequence and initiates the extension of adjacent DNA regions. Primers can be designed to bind to a very specific region of the DNA, and initiate synthesis of a targeted sequence
PRINS	Primered In Situ DNA synthesis-a technique used for detecting the presence of specific DNA sequences in a chromosome
QTL	Quantitative trait locus (or loci). Genes contributing to the expression of a quantitative character like size
RAPD	See Random Amplified Polymorphic DNA
Random Amplified Polymorphic DNA	A technique allowing detection of DNA polymorphisms and hence genetic markers by randomly amplifying multiple regions of the genome by PCR using single arbitrary primers.
Restriction Enzyme	An enzyme capable of cutting DNA, each enzyme having a specific cutting site determined by a unique sequence of bases.

RFLP	Variations occurring within a species in the length of DNA fragments generated by a specific restriction enzyme.
RIA No 1, 2	Research Institute for Aquaculture No 1 and 2 , in Hanoi, Ho Chi Minh City respectively, Vietnam
Ribozyme	RNA molecule with highly sequence specific activity in cutting nucleic acids
RNA	Ribonucleic acid. This exists as some different forms in cells (mRNA, rRNA, tRNA).
RRA	Rapid rural appraisal
SEAFDEC	South East Asian Fisheries Development Center – intergovernmental network addressing sectoral development issues.
SEAADCP	South East Asian Aquatic Disease Control Project - DFID funded project based at AARHI, now completed
Sense strand	The strand of the double helix of DNA used to code for a product
Sex chromosome	a chromosome concerned with the determination of sex, in mammals X and Y
SIFAR	International network for co-ordinating research in Fisheries and Aquaculture – multi-agency funded, located at FAO, Rome
SRT	Sex reversed tilapia (by hormonal methods)
Strand (of DNA)	One of the two complementary, linear, components of the double helix.
Transgenic	An organism containing one or more genes or DNA sequences integrated into its genome as a result of a process involving techniques of DNA manipulation.
Triploid	Used of an organism or cell containing three sets of chromosomes in place of two (body cells) or one (gametes). Gametes produced by triploid individuals contain unbalanced and inviable chromosome complements triploids and are effectively sterile
Zygote	The cell formed by fertilisation of an ovum by a sperm and fusion of the two haploid nuclei to form a diploid nucleus.