External Evaluation Report on the Aquaculture & Fisheries Collaborative Research Support Program (Cooperative Agreement No. EPP-A-00-06-00012-00)

A Report Submitted to the Bureau of Food Security, USAID

June 28, 2012

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NOTE: Includes an appendix with the AquaFish CRSP's response to this evaluation report

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List of Acronyms

ACRSP — Aquaculture CRSP
AquaFish CRSP or AquaFish -- Aquaculture & Fisheries CRSP
AU — Auburn University
BFS – Bureau for Food Security
BMP — Best management practice
FAC -- Freshwater Aquaculture Center
CGIAR — Consultative Group on International Agricultural Research
CLSU — Central Luzon State University
CRSP — Collaborative Research Support Program
EGAT — Bureau for Economic Growth, Agriculture and Trade
EPAC — External Program Advisory Council
FAO — Food and Agriculture Organization of the United Nations
FDA – Food and Drug Administration
FtF — Feed the Future
GIFT — Genetically Improved Farmed Tilapia
GOK — Government of Kenya
HCC — Host country collaborator
HAACP — Hazard Analysis & Critical Control Point
HBCU — Historically black colleges and universities
HC — Host country
IP—Implementation Plan
IPS — Integrated Production Systems
LAC — Latin American and the Caribbean
ME — Management Entity
MT – Management Team
NACA — Network of Aquaculture Centers in Asia, Thailand
NCSU — North Carolina State University
NFFTC — National Freshwater Fisheries Technology Center, Bureau of Fisheries and Aquatic Resources
NOAA – National Oceanic and Atmospheric Administration
NSF – National Science Foundation
OSU — Oregon State University
PDA — Pond Dynamics/Aquaculture CRSP
PI — Principal investigator
PIRE — Partnerships for International Research and Education
PLEI — People, Livelihoods and Ecosystems Interrelationships
RCE — Regional Centers of Excellence
SARNISSA –Sustainable Aquaculture Research Network in Sub-Saharan Africa
SEAFDEC –South East Asian Fisheries Development Center
UHH — University of Hawaii-Hilo
USDA – United Stated Department of Agriculture

USFWS – United States Fish and Wildlife Service
USG — United States government

Executive Summary

The mission of the Aquaculture & Fisheries Collaborative Research Support Program (AquaFish CRSP) is to enrich livelihoods and promote health by cultivating international multidisciplinary partnerships that advance science, research, education and outreach in aquatic resources. The AquaFish CRSP was awarded to Oregon State University on September 29, 2006 after an open national competition for the Management Entity (ME) and is different from the former Aquaculture CRSP in both organization and theme. Phase I activities took place between 2007 and 2009 and Phase II from 2009-2011. The AquaFish CRSP operates under a Leader with Associates (LWA) Cooperative Agreement that differs from the previous grant. Two Associate Awards have been received since 2007. The first was a USAID mission sponsored project in Mali on aquaculture and fisheries and the second was a USAID/Washington-funded award to scale-up technologies in Ghana, Kenya and Tanzania to support the Feed the Future Initiative.

The AquaFish CRSP is an integrated and widely diversified research and development program organized around four global themes (goals): 1) improved health, nutrition, food quality, and food safety; 2) income generation for small-scale fish farmers and fishers; 3) environmental management for sustainable aquatic resources use; and 4) enhanced trade opportunities for global fishery markets. The investigations are aligned under two topic areas-- Integrated Production Systems (IPS) and People, Livelihoods and Ecosystems Interrelationships (PLEI). Seven U.S. institutions participate in this program and currently conduct about 67 research-related investigations in collaboration with 10 additional U.S. institutions, and 31 host-country institutions located in 16 countries. The structure of the program mirrors the organizational purpose of land grant universities insofar as its investigations are conducted to address the three integrated pillars of research, teaching and outreach.

The Management Team that is led by Dr. Hillary Egna is professional and efficient in actively directing the programmatic activities of AquaFish CRSP. The Director, Dr. Egna, has 26 years of managerial experience and demonstrates forward-thinking strategic vision about research and programmatic actions. The ME has mentored and provided critical assistance to begin a new program with many new host countries (HCs) and principal investigators (PIs) for an effective transition into a new CRSP. The RFP for AquaFish projects was an open competitive process with broad national distribution of the RFP through various communication networks to reach interested institutions throughout the US. Proposals were selected for funding using a rigorous National Science Foundation style external scientific peer review process. A second RFPA was released to solicit additional projects in the Africa region that also underwent an external peer review before awards were made. The MT provided some match-making assistance with historically black colleges and universities (HBCU) with aquaculture expertise to encourage their participation. To assure country-level development relevancy, all funded projects were vetted with country USAID missions for concurrence.

The research portfolio consists of a broad scope of topics and science areas that address specific HC priorities in development outcomes for resource limited farmers and fishers. There are about 105 investigations (experiments, studies and activities) representing a large breadth of work. US PIs assist HC PIs in developing research objectives and plans aligned with AquaFish global themes based on HC problem statements. There is progressive transfer of US-based research and training expertise to HC

conditions in many science areas including nutrition and feeds, breeding and reproduction, systems development, shellfish development, social science and water and soils management. The areas of study represent many critical and contemporary issues with increasing integration of social science and supply and value chain studies for broader multidisciplinary solutions to development constraints. There is a strong emphasis to integrate outreach into all research studies that establishes an end-point directly linked to quantifiable impact indicators that align with the four AquaFish global themes.

Most of the research is solution-focused applied research with the aim to move science to practice with best management plans (BMPs) and on-farm short-(1-2 years) and medium-term (3-5 years) improvements linked to development goals. The basic research includes some biotechnology investigations (Philippines) with molecular genetics and pioneering work in new and emerging species with limited knowledge about basic biology, physiology, nutrition and reproduction. These are generally longer-term (6-10 years) investments with more uncertain outcomes of commercialization or farmer adoption of new species. The program is well balanced between "experiments" with testable hypotheses (38% of investigations), "studies," quantitative and qualitative (36% of investigations) and "activities," including outreach and information dissemination (26%).

AquaFish CRSP is aligned with the FtF initiative although it came into being at the end of the CRSP's life. There are natural synergies between the core work of the AquaFish CRSP described previously, and the FtF Initiative. In assessing the alignment of currently programmed work into the FtF Initiative (reference is the 2010 Guide), activities fall primarily under the following FtF objective: 3.3.1 Inclusive Agriculture Sector Growth. Gains in productivity can be driven by a number of factors, including improved access to agricultural inputs and knowledge, more efficient use of land and labor, enabling policy environments, and improved management of natural resources. AquaFish CRSP's work also addresses FtF objective: 3.3.2 Improved Nutritional Status by improving diet quality and diversity through the addition of highly nutritious animal source protein and micronutrients commonly found in diverse aquaculture and capture fishery products. The Program also aligns with BIFAD Title XII objectives related to pro-poor technologies and enabling policies through engagement with land-grant and other US university expertise and capacity to address global food and hunger needs through sustainable aquaculture development globally.

The AquaFish CRSP should be renewed based upon strong and demonstrated performance in research, outreach and development contributions, its alignment with FTF, and also because it is well managed. Since many of the topics central to the program are long-term by nature, the renewal should be for five years and not four. Well-reasoned and informed decision needs to be made on investment in new species given that they may not develop into economically viable value-chains. Overall, the evaluation team found few problems with AquaFish and none of which pose a significant obstacle for continued science and development impacts.

Recommendations

Recommendations proposed by the review team are structured around the key elements of the scope of work.

Research

1. AquaFish CRSP should continue to capitalize on previous investments in research and discovery through outreach and farmer training programs and accelerate development outcomes with regional and global collaborators.
2. Findings on reduced feed studies in Philippines and cost-saving findings for tilapia production should be explored for application in other parts of Asia, Africa and Latin America. Findings on reduced feed studies in Philippines were explored to document impact and penetration on farms and whether there is potential for broader application generally. Close management of feed inputs represents key opportunity to reduce input costs. Reducing culture intensity may be a more profitable management strategy in some, but not all conditions.
3. CRSP should be extended to five rather than four years based on previous experience in achieving grand challenge development outcomes and after consultations with the HC and US PIs. The Program is expanding into new countries and accelerating technology transfer in established locations. The timeline from research and discovery to development outcomes for targeted end-users requires a long-term investment as well as new approaches and partnerships and integration of practical information and communication technologies to expand and accelerate broader impacts.
4. AquaFish should continue future collaborative projects in select non-FtF countries because of sustained experience and demonstrated outcomes with numerous HC institutions. There are promising opportunities for non-FtF and FtF country collaborations to accelerate development outcomes and facilitate new capacity building for FtF countries in the same region. The development model can be replicated with proven country-level experiences and the continuity of successful long-term invaluable collaborations; some examples are Mexico, Philippines and Thailand.
5. There is increasing interest in marine aquaculture, including seaweed and shellfish that are important globally in many coastal countries. This may be an area of future investment with new US and HC PIs as well as new collaborative networks.
6. The use of genetic/genomic tools for measurement and production improvements is developing rapidly and insuring some training in these disciplines is critical for enhancing production efficiencies and applications of cutting-edge science.
7. New species selection criteria should assess the current state of knowledge and a feasible research timeline to achieve program development outcomes. Accelerated technology transfer may be achieved by connecting needed expertise across the global AquaFish CRSP program in the US and HCs.
8. Future work on air-breathing fish and native species should focus on the species with clear potential to meet development goals and not solely scientific inquiry. This area of research often involves long-term fundamental work that may be leveraged with basic-science focused

programs, like National Science Foundation PIRE in the US. The concern is for over-investment in native species, with very limited, if any small enterprise application in the future

9. It is reasonable to argue that the AquaFish CRSP (and early versions) developed the knowledge infrastructure that allowed this transformation to take place especially in the Government of Kenya campaign to "Grow Fish, Sell Fish, and Eat Fish". This example should be emphasized across the CRSPs and USAID as a model relationship for emulation.
10. Many projects originate at local or community levels and require subsequent scale-up efforts for broader impacts in more communities with opportunities for adoption.
11. Achieving large-scale country level impacts in aquaculture development requires long-term investment and relevant problem-solving research strategies to address knowledge gaps and development bottlenecks.
12. Research questions persist that require more investigation and pioneering breakthroughs under local conditions for development, some of these should keep the focus more basic and less outreach oriented.
13. Caution is urged to not over-promote or recommend protocols, practices or technologies that have not been fully evaluated under small and medium-farmer conditions and cost-benefit analysis to facilitate adoption for clearly proven farm-level benefits. A method or recommendation that appears appropriate for specific conditions in one country (reduced feeding strategies in Philippines) or region may not apply to other locations for many different reasons until fully evaluated at different farm or system levels.
14. Certainly in regions with growing aquaculture capacity and production, baseline studies on product availability, product forms and economic impact of aquaculture would be of value for future impact assessments related to AquaFish CRSP investments.
15. Already AquaFish CRSP has invested in the coordination of research on the biology and production of aquaculture species with enterprise and social impact evaluations, and this coordination is critical and requires continued emphasis.
16. Several production-oriented projects will benefit from follow-up economic, marketing or other socioeconomic factors impeding scale-up with more cost-benefit analysis data for new technologies and practices. This rationale is based not only on country level needs but broader scale-up and potential applications at country, regional and global levels. The findings from an EGAT Associate Award focused on scale-up and dissemination of AquaFish technologies and practices in three African FtF countries will provide more insights on scale-up strategies and opportunities.
17. The program may benefit by integrating a human health and nutrition project. Fisheries products offer highly nutritious protein for people of all ages with special emphasis on vulnerable children and pregnant women. In many rural areas with a scarcity of high quality animal protein, diets can be supplemented with local farmed fishery products.

Gender Integration

1. Gender visibility in the program can be enhanced by including gender integration as one of the global themes or as people's participation and gender inclusivity.

2. Gender integration strategy should be streamlined to address the gender concerns and women's participation in aquaculture and fisheries sector in the context of agricultural livelihood development.
3. AquaFish CRSP should identify a process to continually provide advisory support to the PIs in developing gender strategy and implementation of gender inclusivity activities.
4. AquaFish CRSP can establish accountability with gender budgeting approach as a monitoring mechanism.
5. Research in marketing, consumption patterns, labor allocation and value chain analysis should strive to adopt gender responsive paradigms.
6. AquaFish CRSP documents that across the HC program sites women are largely involved in postharvest phase aquaculture and fisheries sector. Hence, AquaFish CRSP should consider strategies for improving opportunities for women in postharvest phase both for income generation and household consumption.
7. Gender responsive monitoring and evaluation of AquaFish CRSP gender interventions would strengthen the gender integration efforts that have been initiated in the current phase as well as contribute to the knowledge base of gender strategies in agriculture production systems.

Short-term training and outreach

1. Review the effectiveness of large events touted as short-term training to improve the capacity building outcome.
2. Continue to explore options to obtain co-sponsorship with such agencies that have food security and commercial interest in aquaculture development.
3. Require that a system is put in place to follow up on the impact of short-term trainings among the farmer participants.
4. Expand options to improve and innovate south-south linkages in short term capacity building initiatives.

Network Development

1. It would be essential to broaden the horizon of AquaFish CRSP by bringing in development professionals and scientists who provide research support in socio-economic analysis.
2. Explore strategies to strengthen and support RCEs to develop multi-national regional leadership in initiatives such as regional network development, outreach and aquaculture policy oriented research and communication.
3. A concerted effort has to be made to keep an open door approach to integrate new partners and multidisciplinary and multi-sector expertise.
4. The inclusion of private sector participation should be encouraged throughout AquaFish program planning activities.
5. Explore support to build grass-root networks, and business oriented networks of aquaculture farmers trained by CRSP to strengthen farmer-to-farmer technology transfer opportunities.
6. Strengthen collaborations with international and regional organizations, institutions and agencies that have aquaculture research and development mandates for development outcomes that leverage unique strengths, such as FAO, ASARECA, ANAF, WorldFish and NACA.

7. To broaden the awareness and understanding of AquaFish CRSP activities in the US, electronic communications that include, *Aquanews,* can be expanded to reach more US government agencies with interests and programs linked to international aquaculture, including USDA, State Department, USFWS, NOAA and FDA. New US benefits may develop from these communication linkages. New collaborative opportunities may develop from communication outreach to more strategic regional and global programs with direct or indirect interests in international aquaculture development
8. The use of modern and fast-evolving information and communication technologies can be valuable tools to support learning and new knowledge objectives. The program should carefully assess the integration of appropriate options including CD, DVDs, online training modules, podcasts and other platforms with region-level HC input on needs, access, cost, preferences and real value to targeted end-users.

Relationship with USAID

1. USAID should conduct an external evaluation in year 4 in any future 5-year implementation plan to assess impacts and progress on completing stated project objectives. The evaluation helps direct future continuity and sustainability of effort for performance efficiencies and leveraging of HC and US research and training capacities.
2. Any future planned external evaluations of the AquaFish should be conducted at a time that facilitates direct engagement with US as well as HC participants to gain more knowledge of both perspectives about the program and current on-the-ground outcomes and accomplishments.

Management Entity

1. The ME should invest in developing an active advisory structure to participate in annual program assessments and management assistance from an objective external perspective. The ME should revisit this concept and determine whether it should be strengthened or whether an alternative advisory group should be developed.
2. The ME should carefully consider adding a position of Assistant Director to handle day-to-day and routine management roles that will enable the Director to focus on strengthening the global role of the CRSP as well as creating new synergistic regional and global partners to expand and accelerate development outcomes. Any new Associate Award adds to the ME work load as well. More time can be dedicated to strategic thinking, planning and actions to further leverage country level outcomes to regional scales and seek more effective south-south collaborations. Any increase in ME staffing and costs need to be fully justified based on a work load assessment, clear administrative functions, anticipated new productivity and overall program benefits.
3. An Assistant Director should be considered for the program following the development of job description that differentiates tasks between the current Director (Egna), Research Projects Manager (Evans) and the Assistant Director position.
4. Future programs may wish to consider the appropriate level of cost share and USAID should also be cognizant of the burden placed on host-country collaborators and some smaller US universities in raising the cost share.

Section I: Scientific and Technical Assessment Overview

This report is divided into three major sections. The first section provides an overview of the scientific approach of the Aquaculture & Fisheries Collaborative Research Support Program (AquaFish CRSP) and key findings. The second section develops a more detailed analysis of the project portfolio and issues associated with capacity building. The third section presents the management review. Several appendices are provided with additional information.

Organizational Structure: Integrated Research, Training and Outreach

The mission of the Aquaculture & Fisheries Collaborative Research Support Program (AquaFish CRSP) is to enrich livelihoods and promote health by cultivating international multidisciplinary partnerships that advance science, research, education and outreach in aquatic resources. The AquaFish CRSP was awarded to Oregon State University on September 29, 2006 after an open national competition for the Management Entity (ME) and is different from the former Aquaculture CRSP in both organization and theme. Phase I activities took place between 2007 and 2009 and Phase II from 2009-2011 as described in their respective implantation plans (IP). The AquaFish CRSP operates under a Leader with Associates (LWA) Cooperative Agreement that differs from the previous grant. Two Associate Awards have been received since 2007. The first was a USAID mission sponsored project in Mali on aquaculture and fisheries and the second was a USAID/Washington-funded award to scale-up technologies in Ghana, Kenya and Tanzania to support the Feed the Future Initiative.

The AquaFish CRSP is an integrated and widely diversified research and development program organized around four global themes (goals): 1) improved health, nutrition, food quality, and food safety; 2) income generation for small-scale fish farmers and fishers; 3) environmental management for sustainable aquatic resources use; and 4) enhanced trade opportunities for global fishery markets[1]. The investigations are aligned under two topic areas-- Integrated Production Systems (IPS) and People, Livelihoods and Ecosystems Interrelationships (PLEI). These two topic areas can be further divided into four topic areas for the IPS theme and six topic areas for PLEI. Seventeen U.S. institutions participate in this program and currently conduct about 67 research-related investigations in collaboration with 31 host-country institutions located in 16 countries[2]. A complete listing of the projects is listed in Appendix 8. The investigations can be further subdivided into three types: “experiments” that are structured around a testable hypothesis(es); “studies” that are less formal research, and sometimes descriptive; and “activities” that are outreach, communication and dissemination of findings from experiments or studies.

The structure of the program mirrors the organizational purpose of land grant universities insofar as its investigations are conducted to address the three integrated pillars of research, teaching and outreach.[3]

[1] See Appendix 8 for a list of the projects and investigations.
[2] Aquafish CRSP worked in a maximum of eighteen countries in the first phase.
[3] Hillary Egna, director of the AquaFish CRSP, first made this reference more broadly towards all CRSP programs but it is especially applicable to this CRSP.

This paradigm is exploited for the sake of organizing the report but with slight modification. Within the research category, some investigations are being conducted in pre-applied research on domestication but the majority are in applied science and adaptive research. Teaching and training activities will be captured through a description of the support provided to long-term trainees while outreach is captured through short term training, extension projects, technology transfer and information dissemination activities.

Management Team Leadership

Oregon State University (OSU) serves as the Management Entity (ME) of the AquaFish CRSP. Within OSU, the AquaFish CRSP Management Team (MT), led by Dr. Hillary Egna, is responsible for providing technical and programmatic leadership as well as the day-to-day administrative management of the CRSP. The MT is supported by OSU's Office of Sponsored Programs and the College of Agricultural Sciences.

The MT is professional and efficient in actively directing the programmatic activities of the AquaFish CRSP. The MT has mentored and provided critical assistance to begin a new program with many new host countries (HCs) and principal investigators (PIs) for an effective transition into a new CRSP. The Request for Proposals (RFP) for AquaFish CRSP projects was an open competitive process with broad national distribution of the RFP through various communication networks to reach interested institutions throughout the US. Proposals were selected for funding using a rigorous National Science Foundation style external scientific peer review process. A second RFP was released to solicit additional projects in the Africa region that also underwent an external peer review before awards were made. The MT provided some match-making assistance with historically black colleges and universities (HBCU) with aquaculture expertise to encourage their participation. To assure country-level development relevancy, all funded projects were vetted with country USAID missions for concurrence.

The Director, Dr. Hillary Egna, has 26 years of managerial experience and demonstrates forward-thinking strategic vision about research and programmatic actions. The MT stimulates new ideas such as pioneering work with air-breathing fish in response to future environmental variations in drought-stricken areas. The MT created the concept for Regional Centers of Excellence (RCEs) to build new regional linkages, promote networking opportunities and expand and accelerate outcomes from project results. Technical leadership is evidenced by active roles in organizing and chairing technical sessions at international conferences and invitation by the Food and Agriculture Organization of the United Nations (FAO) for a special workshop on 'Future Direction for Gender in Aquaculture and Fisheries Action, Research and Development.' The MT accelerated technology transfer and development outcomes with China-Mali-Kenya south-south collaboration for new rice-cum-fish enterprises for smallholders in Mali. The MT has redefined research projects with outreach components focused on end-users and solutions to farm-level conditions. The MT has integrated gender inclusivity at the project level for desired outcomes. The MT instituted a HC PI exchange program to create new synergies for a collective global community through sharing information and regional experiences to accelerate technology transfer opportunities between CRSP projects with regional-scale lessons learned.

The MT is a highly engaged and effective leadership unit that has fostered a global network of more than 300 collaborators, partners and stakeholders. The MT created an innovative online reporting system for US and HC principal investigators to input data and information needed for tracking, reporting and reimbursement purposes. This reporting tool is highly praised by the PIs and facilitates timely and efficient reporting and MT responses for data calls from USAID. To support communications and outreach the MT requires each research project prepare an article for the program's newsletter, *Aquanews*, which summarizes progress and significant findings in plain language.

The MT has done an excellent job of building on foundational work of earlier CRSP investments that date back to 1982 with an invaluable legacy of HC and US collaborators and highly productive institutional partners. Some previously trained HC students are now new HC PIs and some former US co-PIs are now new PIs in AquaFish CRSP. Strategic investments created HC capacities with facilities, equipment and specially trained human resources that are leveraged into new investigations, broader partnerships and effective long-term development programs. Previous projects demonstrated the effectiveness and success of the CRSP model throughout the world and positioned many US institutions for key leadership roles in international development projects. The accumulation of lessons learned and on-the-ground grassroots experience served to avoid pitfalls and duplication of effort with improved efficiencies and performance as evidenced by the results and outcomes for the current phases of AquaFish CRSP.

Previous global-scale work and new partners in AquaFish CRSP have enabled the program to broaden its collaborations with regional entities like NACA, SEAFDEC, and SARNISSA that capture the collective strengths of each program in common alignment of improving aquaculture and fisheries for small-scale farmers and fishers. The collaborations create new networks for communication of AquaFish CRSP project results and new multidisciplinary collaborations across regional and global programs that accelerate common development priorities and outcomes. In Asia, Africa and Latin America, former ACRSP foundational research and discovery work are now accelerating development outcomes from uptake by farmers through outreach and farmer training programs.

The review team noted that the researchers were very supportive of Dr. Egna's intellectual leadership of the program and extremely grateful for the development of online tools to facilitate the reporting requirements inherent to the CRSP structure. Oregon State University administration is supportive of Dr. Egna and facilitates her work within the university structure. The Director is an effective ambassador for the program both at her institution and in regional and global agricultural development forums.

Innovation and Contribution to Feed the Future (FtF)[4]

The design of the AquaFish CRSP pre-dated the advent of the FtF initiative by nearly four years. In 2010 when FtF was launched, the AquaFish CRSP was entering the final year of its five year cooperative agreement. Therefore, FtF was not integrated into the CRSP' original program design and planning. That said, there are natural synergies between the CRSP's core work and the FtF Initiative. In assessing the alignment of currently programmed work into the FtF Initiative, activities fall primarily under the

[4] Dr. Hillary Egna contributed to the substance of this section with a written contribution.

following FtF objective: 3.3.1 Inclusive Agriculture Sector Growth[5]. Gains in productivity can be driven by a number of factors, including improved access to agricultural inputs and knowledge, more efficient use of land and labor, enabling policy environments, and improved management of natural resources. The CRSP's work also addresses FtF objective: 3.3.2 Improved Nutritional Status by improving diet quality and diversity through the addition of highly nutritious animal source protein and micronutrients commonly found in diverse aquaculture and capture fishery products.

AquaFish CRSP additionally supports FtF objectives in *Expanding Markets and Trade* through the development and dissemination of market information for producers and enterprise owners, including activities that focus on equitable access for women and supply and value chain analyses. Greater access to market information can increase the ability of small-scale agricultural producers to participate in domestic and higher-value added export markets. By improving post-harvest market infrastructure, and understanding value chains, AquaFish aims to make markets work better for women and men agricultural producers and extend the reach and benefit of nutritious foods.

Working regionally across Africa, Asia and Latin America holds the promise of strengthening regional coordination and can add value and new synergies to activities at the country level. The program is consistent with FtF goals in its focus on accelerating inclusive agriculture sector growth through improved aquacultural productivity, expanding markets and trade, and increasing economic resilience in vulnerable rural communities. Improvements in nutritional status are expected by increasing access to diverse and high quality animal source foods.

Paying attention to cross cutting themes of gender, environment (climate variability), and natural resources management is expected to result in sustainable production systems and good nutrition for all family members. The AquaFish has collaborative projects in numerous FtF countries including; Nepal, Bangladesh, Cambodia, Mali, Ghana, Kenya, Uganda, Tanzania and Nicaragua. A 2010 Associate Award is focused on FtF objectives with funding to scale-up AquaFish research and outreach to capture measurable development impacts in Kenya, Ghana and Tanzania. This USAID/Washington-funded associate award demonstrates the direct alignment of the program with FtF priorities and will elevate the role of aquaculture and the CRSP to support this USG global agricultural development initiative.

The Program also aligns with BIFAD Title XII objectives related to pro-poor technologies and enabling policies through engagement with land-grant and other US university expertise and capacity to address global food and hunger needs through sustainable aquaculture development globally.

There is considerable concern by several long-term US and HC partners that the geographical orientation of FtF will lead to the non-renewal of activities if they are a not targeted FtF countries. Many of these nations provide a key regional resource for desired development outcomes and can facilitate scale-up and transfer of improved practices and technologies in target countries. For example research in Mexico is used in Nicaragua and research in the Philippines and China contributes to

[5]See the *Feed the Future: Global Research Strategy.* Available: http://www.feedthefuture.gov/sites/default/files/resource/files/FTF_research_strategy.pdf

practical problem-solving in Cambodia and Bangladesh. In a few cases, the lack of one-to-one correspondence between FtF-targeted countries and AquaFish CRSP host countries has caused considerable anxiety among partners. Yet there is ample evidence that host country research is useful in facilitating "south-south" scientific exchange for development objectives for example with the Mali project and its linkages to China and Kenya.

Key Messages from the Technical Analysis

The research portfolio consists of a broad scope of topics and science areas that address specific HC priorities in development outcomes for resource limited farmers and fishers. There have been about 100 investigations (experiments, studies and activities) representing a large breadth of work. US PIs assist HC PIs in developing research objectives and plans aligned with AquaFish global themes based on HC problem statements. There is progressive transfer of US-based research and training expertise to HC conditions in many science areas including nutrition and feeds, breeding and reproduction, systems development, shellfish development, social science and water and soils management. The areas of study represent many critical and contemporary issues with increasing integration of social science and supply and value chain studies for broader multidisciplinary solutions to development constraints. There is a strong emphasis to integrate outreach into all research studies that establishes an end-point directly linked to quantifiable impact indicators that align with the four AquaFish global themes.

Most of the research is solution-focused applied research with the aim to move science to practice with BMPs and on-farm short (1-2 years) and medium-term (3-5 years) improvements linked to development goals. The research includes some biotechnology investigations (Philippines) with molecular genetics and pioneering work in new and emerging species with limited knowledge about basic biology, physiology, nutrition and reproduction. These are generally longer-term (6-10 years) investments with more uncertain outcomes of commercialization or farmer adoption of new species.

The quality and depth of research are directly linked to HC infrastructures and capacities as well as applications of US-based research to HC development constraints and new opportunities. AquaFish research has resulted in numerous significant findings or breakthroughs. Examples include: integration of seaweed culture into traditional shrimp ponds in Indonesia and the Philippines with new value-added seaweed for export markets and seaweed food specialty products for domestic consumption; native snakehead hatchery development in Cambodia; new feeds development with local ingredients in Guyana and Tanzania; new alternative cost-saving feed and feeding strategies in Philippines; replacement or reduction of fish meal in aquafeeds with local ingredients in Cambodia and Vietnam; and increased survival and economic viability of farmed baitfish in Kenya as an alternative to wild-harvested baitfish. These areas of research are contributing to public goods evidenced by field testing, on-farm demonstrations and direct outreach and uptake by farmers and small businesses.

The linkage of science to policy can have significant implications for country-level transformations in AquaFish global themes and USAID priorities. Several projects are directly impacting new enabling policies including: new shellfish management protocols in Nicaragua and Mexico; renewed farming of native snakehead in Cambodia; and ban on introduced non-native species in reservoirs in China. In Kenya the AquaFish has developed a foundation of science-based BMPs and ongoing human capacity

building of researchers, extension officers and government policy-makers who are critical elements to implement a new national aquaculture development and stimulus initiative. HC aquaculture expertise and CRSP leveraging with FAO development interests are directing long-term planning and development activities. New investments in properly sited, designed and constructed ponds and a wave of new farmers will benefit from CRSP training and extended expertise. This level of integration of key CRSP program activities into national aquaculture planning accelerates development outcomes and the return to AquaFish CRSP programmatic investments. New methods of propagating native snakehead in Cambodia and new pelleted feeds for snakeheads that reduce the use of small fish important for human consumption in the Mekong River Basin have significant transnational policy implications for both Cambodia and Vietnam.

Some areas of research are likely on longer-term discovery trajectories with uncertain outcomes. This includes assessing domestication and commercial potential of new native species in Latin America (cichlids), Africa (bony-tongue catfish) and new innovative research on emerging air-breathing fish in each region that adapt to high densities and poor water quality conditions including drought areas. In the case of Mexico, farming of native gar is now a reality for some rural communities and local markets after about 10 years of investments by AquaFish CRSP and other local programs. Work continues to refine fingerling production, feeding, density levels and genetic selection to improve farming efficiencies.

Some research occurs at the nexus of aquaculture and fisheries with some species (snook in Mexico) under domestication assessment with potential as a farmed product and/or for public stock enhancement as well as cockle (shellfish) work in Nicaragua and native oyster hatchery research in Mexico.

There are several new ongoing studies that offer insightful findings and groundwork for future global-level collaborative research. They are 1) value chain analysis training for uniform data collection across regions and 2) a global-style experimental pond unit assessment to develop baseline of characteristics and strengthen research capacity for future work (Bangladesh, Ghana, Kenya, Tanzania, Cambodia, Nicaragua and Nepal).

There is increasing interest in marine aquaculture, including seaweed and shellfish that are important globally in many coastal countries. This may be an area of future investment with new US and HC PIs as well as new collaborative networks.

Section II: Scientific Portfolio and Contribution to Development Public Goods

The research portfolio is broad consisting of 50+ areas of inquiry or projects with several add-ons. Each research project has an integrated outreach element intended to inform, demonstrate and assess the application of results by targeted small-holder farmers or resource-limited fishers. The overall depth of work is adequate for the stage of research conducted and the rigor is confirmed by the scientific peer review process used by MT to assess each project investigation before funding. Seventy-four percent of investigations are research oriented and this is nearly equally divided between experiments with testable hypotheses and qualitative and descriptive studies. The breadth is adequate in that it connects research to outreach activities to inform and improve practices or lives of targeted end-users. Twenty-six percent of investigations specifically support farmer and extension outreach, communication and training activities. The planned studies are aligned with overall global themes and a system approach to achieve development outcomes.

The areas of study represent many critical and contemporary issues in global aquaculture development with increasing integration of social science supply and value chain studies for multidisciplinary solutions to development constraints. Most research is solution-focused applied research aimed to move science to practice with BMPs and on-farm improvements. The depth appears to be adequate based on numerous research breakthroughs, significant targeted development outcomes and completion of project objectives that leverage US and HC PI resources. Rigor and integrity are stressed by the ME and external peer-reviews help validate the quality of proposed research work plans. Numerous publications of project results in scientifically peer-reviewed literature indicate sound experimental methods.

AquaFish takes the extra step of synthesis and translation of research findings in the form of fact sheets, often including local language versions, and summary articles in *Aquanews* that is disseminated among the global network of more than 300 individuals.

The MT has done an excellent job of balancing research and implementation activities with the integration of an outreach element in all research projects to emphasize the critical importance of implementing activities toward development outcomes. The scope and extent of the implementation work depends on the type of research and verification of findings for relevant application by end-users. The on-farm trials and verification work supported by the CRSP are important steps between research and technology transfer. The need for research is critical to provide the foundation of knowledge and understanding of biological processes and aquatic systems and the connection with successful aquaculture operations. Programmatic emphasis is problem-solving applied research that addresses HC stakeholder real-world issues and some fundamental or basic research, for example, air-breathing fish and pioneering studies on the propagation potential of economically-valuable native species with limited knowledge of basic biology.

The environmental stewardship and sustainability theme is strongly supported and leveraged with previous work and showing on-farm impacts. For example Thailand farmers are now co-producing prawns and shrimp at lower densities with less water replacement and reduced impact on the

environment based on earlier CRSP research findings. Farmers in Africa are also learning of water conservation practices and improved fish production by not draining ponds at harvesting as traditionally done in the past.

To preserve biodiversity and prevent the introduction of non-native species, investment has targeted identification of native species that need basic knowledge on reproductive physiology and feeding prior to developing economically relevant culturing techniques. Development and implementation of biotechnological approaches has so far focused on measurement of hormone levels in blood. The use of genetic/genomic tools for measurement and production improvements is developing rapidly and insuring some training in these disciplines is critical for enhancing production efficiencies and applications of cutting-edge science.

There is an opportunity to focus on barriers to implementation through social science research to accelerate technology transfer and outreach. Already AquaFish CRSP has invested in the coordination of research on the biology and production of aquaculture species with the business and social impact evaluations, and this coordination is critical and requires continued emphasis.

"Basic" Science needed for Aquaculture Innovation

AquaFish CRSP is making investment in innovative pioneering research on new emerging native and air-breathing fish species with potential as farmed aquaculture species. Limited knowledge exists on their propagation and control of life cycle but favorable characteristics include survival in poor water quality conditions (lungfish in Uganda); chame (Mexico) and gars (Latin America) and promise for smallholders in drought-stricken areas of Africa, their adaptability to high densities and good growth. Investigators have produced new breakthroughs in spawning and experimental growth trials. Investigations in the Philippines employ biotechnology methods using a molecular biomarker to assess fecundity and growth performance in milkfish and tilapia. Basic feasibility and assessment studies in several countries on native species as potential farmed species are forward thinking and generating new basic knowledge.

Areas for Improvement

Biotechnology is identified as one AquaFish research area. Biotechnology offers new molecular-based tools and applications that can transform traditional research in areas of genetic improvement and breeding. HC research capacity can be strengthened with new capacity for cutting-edge research methods and equipment. Presently, AquaFish has limited biotechnology-related research. The Program may find practical applications of biotechnology to accelerate research solutions for development outcomes in the future. US PIs have trained some HC participants in biotechnology research for next generation research capacity.

There is a need and trend to diversify aquaculture species with many policy preferences for new or emerging native species over non-native or introduced species because of aquatic biodiversity and ecosystem conservation concerns. In addition farmed native species are being developed to reduce demand and pressures from native wild stocks that are over-harvested and impacted by natural habitat changes (Kenya, Nepal, and Mexico). Most research with new native species is at an early stage of domestication assessment and propagation under farming conditions. These areas of research should

be monitored carefully for additive results that support continued funding as well as market demand and enterprise potential. In the US there are numerous freshwater and marine species under investigation for commercial potential that has spanned 20—30 years with limited or no enterprise development. The evidence with most new and emerging aquaculture species suggests 10 or more years for farming applications with more effort to directly benefit limited-resource enterprises compared to well-financed large commercial operations. Few international development programs can sustain funding for this period of time and that positions AquaFish CRSP in a unique development role, should funding be maintained. New species selection criteria should assess the current state of knowledge and a feasible research timeline to achieve program development outcomes. Accelerated technology transfer may be achieved by connecting needed expertise across the global AquaFish CRSP program in the US and HCs.

Applied and Adaptive Research for Transformational Change

The majority of the research portfolio is applied research. There are numerous projects that have achieved significant breakthroughs in outcomes and progress to move science to practical applications that directly benefit targeted end-users. A real opportunity for broader impact is the regional application of country-level studies as well as inter-regional or larger global-scale benefits.

Significant Accomplishments in Applied Aquaculture Research

Research in the Mekong River Basin (Cambodia and Vietnam) has identified the importance and diversity of small fish in the diets of the poor in rural areas and increasing demand for the same fish as feed for snakeheads. The policy and fisheries resource issue is being addressed with transformational development of new hatchery capacity and breeding of native snakehead in Cambodia as a farmed source instead of wild harvested source and new sustainable pelleted feed technology for snakeheads with 50% less small fish (Cambodia and Vietnam). By shifting feeding away from small fish to a pelleted feed, pressure upon captured feed is reduced. This is important as these fish stocks are an important food and nutritional resource for the poor. Research is informing policy decision to lift the ban on snakehead farming in Cambodia.

Several advancements have been made in the area of feeds and feeding. Small farmers in the Philippines are realizing cost savings in feeding tilapia and milkfish as a result of AquaFish collaborative research that has resulted in a partnership with a local feed mill for commercial application. Studies revealed that reduced feeding is profit enhancing. In Tanzania, research has focused on using *Leucaena* and *Moringa* leaves as a replacement feedstock for soybean meal. This is in an early stage of research.

In Kenya, several decades of research in collaboration with the Aquaculture and AquaFish CRSPs have resulted in investments by the Government of Kenya (GOK) to support aquaculture development (described in detail later and in the trip report by Jeff Silverstein). It is reasonable to argue that the AquaFish CRSP (and early versions) developed the knowledge infrastructure that allowed this transformation to take place especially in the GOK campaign to “Grow Fish, Sell Fish, Eat Fish”. This example should be emphasized across the CRSPs and USAID as a model relationship for emulation. The relationship successfully stimulated broader investigations in fisheries and aquaculture through the

development of cultured baitfish (*Clarias)* for the Lake Victoria Nile perch fishery. This development has reduced the negative impact of harvesting fingerlings for the longline fishery.

Work in Mexico on native oysters resulted in construction of the first oyster hatchery of indigenous species and successful culturing and spawning techniques with superior qualities for tropical conditions compared to an introduced non-native species.

In Indonesia, a seaweed polyculture with shrimp combined with capacity building, led to innovation in processing seaweed and food science. Methods for manufacturing new products were developed and markets identified for value-added food products with export potential. This research followed a value-chain analysis that identified production benefits from the polyculture–seaweed improves shrimp production and line culture kelp produced a higher quality product—that then spilled over into additional species, e.g. soft shelled crabs.

In Ghana, CRSP relationships have contributed to transformational change through the development of private tilapia hatcheries to propagate and sell fingerlings rather than reliance upon government hatcheries. New economic opportunities were stimulated as a result of CRSP training and capacity building through devolution from government dependence to private sector growth. On the production side, the AquaFish CRSP demonstrated why farmers should not drain ponds at harvest but retain water at harvest through a set of best management plans (BMPs).

Policy Research for an Enabled Aquaculture Environment

In Nicaragua, a community-based policy support initiative for no-take zones for blood cockles was developed in collaboration with a local community over a period of four years and this had led to broader coastal zone management plans. This policy initiative builds upon previous UHH research to work towards certified shellfish products by addressing sanitation and human health concerns to meet HAACP standards. In this example AquaFish CRSP was part of a larger group of programs and donors in including the European Union.

In Mexico, AquaFish CRSP developed extension capacity to sustainably manage oyster farms and determined the maximum carrying capacity of these farms. This new policy to capped growth in the industry and also provided opportunities to work with native oysters as opposed to imported non-native species.

And as described above, production activities in Cambodia and Vietnam have been driven by policy bans to limit capture fisheries and aquaculture of snakehead so there is a close relationship between the two areas. This can also be said for the work in Indonesia where market potential and biodiversity concerns led the diversification of production systems.

Gender Analysis and Integration

The AquaFish CRSP, following USAID program review that identified a lacuna in gender integration approaches in research and activities, has been responsive by adopting program wide gender inclusivity

strategies[6]. The External Program Advisory Council (EPAC) review in 2010 focused on a gender integration strategy at the request of the MT. The RFP for proposals to participate in the AquaFish CRSP program has required that each participating university's proposal include the following: an overall gender inclusivity strategy; gender focused approaches in the technology transfer and dissemination interventions; and standalone gender focused investigation or activity. CRSP PIs participated in a USAID supported gender training program that focused on USAID guidelines for gender integration in funded projects. Following this workshop, PIs were tasked to develop gender inclusive sub-project design. As a result of setting a framework for gender integration, each subproject in the program presents a gender integration strategy and gender focused activity or activities. Across the AquaFish CRSP it is evident that efforts were made to include gender responsive approaches in outreach and research as standalone activities, and a commitment to address gender concerns is documented.

The AquaFish CRSP also strived to achieve the USAID requirement of 50% women's participation in sponsored training activities with considerable success but with variance among the participating universities and host countries. Yet, increasing women in graduate degrees is a work in progress with men showing slight advantage over women. Women's participation in short term training varied, depending on the technical subjects offered in the training and the PI's commitment to encourage women. For example, training related to fishery product preparation counted 100% women as trainees. The AquaFish CRSP also highlights the importance of women in science and promotes the issue in relevant forums. Participation of women as PIs, investigators, extension specialists and trainees is encouraged but still participation barriers persist due to the traditions of the CRSP and culture of participating countries. A few examples of standalone gender integration activities are: integration of gender concerns in value chain analysis; training of women in seaweed processing and developing commercial quality fish paste; training women in oyster culture and cockle collection and processing and training women in tilapia production and cage culture. There were efforts to partner with local women NGOs to target women for project driven interventions. The findings of current studies in progress and emerging efforts to develop sex-dis-aggregated data would add to a knowledge base on gender in agriculture production systems. The AquaFish CRSP has demonstrated a commitment to gender integration mandate in the current phase and made investment in program wide strategy with valuable outputs.

Areas for Improvement

PI's face constraints due to inadequate access to gender expertise in their respective institutions to develop gender responsive project design, and a lack of sustained gender advisory services. This may be explained by the nature of the CRSP scientist composition that does not include social scientists (other than economists) with expertise in people's participation and gender. Gender inclusive strategy statements as presented are too broad and not always tailored to reflect the technical focus of the AquaFish CRSP and also too ambitious for the given time frame. Thus, in some instances, the link

[6] See: Miller, Raymond J. and Deborah S. Rubin. "Effective Management for Collaborative Research Support Programs: Issues and Opportunities." November 2003.

between the strategy and the proposed AquaFish activities are not well demonstrated. The sustainability of women NGOs and collaborative interventions is a concern since US and HC institutional commitment to adopt, apply and sustain gender strategy is nascent and women's access to continued technology support is uncertain. The challenges ahead are: sustaining and expanding these initial investments, providing sustained technical support to scale up the activities, establishing accountability with gender budgeting approach as a monitoring mechanism, identifying additional funds, developing sustained commitment among investigators and participating institutions to buy in to gender inclusiveness strategies and institutionalization of gender strategies.

Impact Assessment Research

A non-competed impact assessment project was commissioned by the MT to provide broad assessment of program activities. The proposal was peer-reviewed. The proposal was reviewed and awarded to Oregon State University and Montana State University[7] economists. In addition to this project, a few projects are incorporating impact assessment into their activities (University of Connecticut, Purdue University). Project-embedded activities are on-going while the impact assessment project has been completed.

Several investigations were undertaken in the commissioned impact assessment project. After review of project reports, very little was learned from these studies overall. Described within the report are numerous explanations for the failure to meet the stated objectives and it is difficult to evaluate the reasons for the failure. Some explanations provided by host country participants indicate that the project investigator was not familiar with aquaculture and the approach was not appropriate (see Appendix 3 for comments from host country participants). The lead investigator indicates that the required data was not received from the country participants to conduct the analysis despite an organized session on the topic at the 2009 Annual meeting. Irrespective of where the problem lies, there is limited insight into the economic or human welfare impact the program has had outside of the case study visits to the Philippines and Kenya and the phone interview on Mexico described later in this report and in the appendices.

Areas for Improvement

The lead reviewer agrees with one of the impact assessment investigators that impact assessment was not integrated into most projects at the outset. Adding on impact studies to an ongoing project violates a key principle of impact measurement that a baseline be established prior to any intervention. There are several opportunities to initiate impact assessment activities. Research activity in Tanzania is still in a discovery stage, the work in Ghana is started but some activities are just building momentum. These are just two examples where strict impact assessment protocols could be established so that rigorous adoption studies could be conducted in the future. This is fundamental for identification of welfare-enhancing benefits consistent with FtF objectives. Projects may wish to follow the example of the University of Connecticut that has attempted to integrate impact analysis into their project with a

[7] The Montana State University economist became a faculty member of Oregon State University during the implementation.

dedicated scientist to train on technical topics. This will require broadening of team members in many projects.

Overall, this is a critical failure of the MT that is only tempered by the fact that thorough monitoring of project performance was conducted. The MT has kept good monitoring records of the projects, described later in the report, but this does not substitute for impact assessment. The MT should reach out to the aquaculture economics community for expertise in conducting analyses in the future. Many qualified individuals can be found on editorial and advisory boards of *Aquaculture Economics and Management* and *Marine Resource Economics.*

The Outcomes of a Strategic Vision over the Past Phases

The MT, working with US and HC PIs, organizes workshops and technical sessions at many international fora. These events help to achieve several elements critical to staying current and visionary in planning for the CRSP. Through these workshops, PIs get the opportunity to critically discuss their findings with colleagues. MS and PhD students present research in an international setting, and connections that will help them continue their professional careers are established. For all participants, including the CRSP director, innovative ideas and new strategic directions can be discussed and developed. These conferences are important for informing the ME and for the development of professional careers and for fostering long-term relationships based upon credible scientific capabilities, both among and between developed and developing countries. They provide a platform for sharing ideas, networking with world-class scientists, publishing research findings and strengthening the connections of the ME to the research and development community. CRSP efforts in this area also increase the visibility of the program and contribute to AquaFish CRSP information exchange. As a specific example, for the April 2011 Asian Fisheries Society meeting in Shanghai, China, the CRSP Director served on the scientific steering committee and co-organized sessions in the co-convened Ninth International Symposium on Tilapia in Aquaculture (ISTA 9) and the 9th Asian Fisheries and Aquaculture Forum (9AFAF). In addition there was full day session on *Accelerating Aquaculture Development in Poorer Countries*, organized and chaired by the AquaFish CRSP director.

The MT stimulated new ideas and applications of aquaculture such as pioneering work with air-breathing fishes in each region, understanding there may be unique qualities of these fishes to withstand environmental changes and stressors, high densities and poor water quality, associated with global climate change, for example. Such forward thinking programs demonstrate a mechanism by which the ME has suggested broad ideas to the CRSP community for further development.

The priority for incorporating biotechnology into the research portfolio reveals the CRSP Director's acknowledgement of the importance of bringing in a forward-looking methodology. The use of biotechnology is possibly best reflected in the Philippines where blood borne hormones are being measured with sensitive molecular methods as indicators of body growth and growth potential. This has been well supported by the CRSP and has led to opportunities for HC students (graduates) to further their professional development with modern molecular technologies.

There are numerous examples where the research activities and follow-on studies demonstrate a strategic sequencing. An excellent example is the work in Vietnam and Cambodia with the US PI Pomeroy. The work on replacing low value small "trash fish" in the diets for snakehead with pelleted feeds including larger proportion of plant proteins (investigations 07SFT01UC, 09SFT01UC) has fit well with the projects to develop indigenous snakehead species in Cambodia (09IND02UC). Investigations 07FSV01UC and 09FSV01UC develop value-added products from the small species that are being spared inclusion in fish feeds. Not only is the research strategically sequenced, but the collaboration across HCs has been promoted by involving Vietnam and Cambodia PIs in related projects to domesticate broodstock and train hatchery reared fish to take pelleted feed.

The oyster dynamics evaluation in Mexico led through the UHH PI (07IND03UH) led strategically into the follow-on hatchery practices project (09IND01UH). Development of capacity for oyster spat production and a microalga rearing has been achieved, though additional training and improved water treatment facilities appear to be needed for establishing long-term impacts and success.

Work on breakdown of methyl-testosterone by bacterial degradation in Mexico (07MNE07UA, 09MNE07UA) is a strategic project that could have broad worldwide impacts with the increasing reliance on masculinized tilapia worldwide. This research requires follow-up.

An example of CRSP project sequencing and strategic development from a broader perspective is exemplified by the Kenyan projects. The program in Kenya began in 1997 with cooperative research and training at Sagana Aquaculture Research and Development Center. A shorthand evaluation of the program evolution might be: Pond Dynamics/Aquaculture CRSP (PDA) was mostly basics of improving production beyond 1000kg/ha (or even above 100kg/ha). This required improved pond construction, pond management, water quality management, and record keeping. The Aquaculture CRSP (ACRSP) evolved to training and extension network development-thinking of aquaculture as a business. The AquaFish CRSP has led to development of value chains, marketing, networking and cluster development as well as identification of critical resource needs, specifically feed and genetically defined fish stocks, and environmental issues to address with best management practices (BMPs).

CRSP trained, and in many cases MS holding scientists, form a critical extension group of trainers and farmers (e.g. Mr. Kiama-Green Algae Farms; Enos and Jedidah Were-Jewlett Ltd., James Mugo-Mwea Fish Farms). These people, CRSP- trained and now involved in providing training through the CRSP are foundational to further growth and strength. The Aquaculture program at Moi University, built over 15 years by Prof. Charles Ngugi and others, is deep. It is currently building links with animal science and business schools to improve the commercial development of aquaculture enterprises. AquaFish CRSP continues to be critical source of specific projects against background of increased government funding for aquaculture. This example of the strategic development, based on central CRSP values of long-term relationships has yielded excellent development outcomes.

Moving Forward: Strategic Positioning in Aquaculture Science and Development

Advances and challenges are continuous for incremental and transformational improvements in poverty alleviation and improving livelihoods in rural communities in countries and regions with limited capacity for aquaculture research and outreach. Numerous projects have established strong HC collaborations with leveraged and expanded research capacities of facilities and trained professionals and students as specialized centers for long-term aquaculture research support and delivery of important public goods. A new project, *Experimental Pond Unit Assessment*, aims to establish a uniform research direction for basic work needed to develop small-scale aquaculture and customized management practices for diverse production systems (Uganda, Bangladesh, Ghana, Tanzania, Cambodia, Nicaragua, and Nepal). Contemporary and foundational research project areas that can contribute more impact if continued for another five years are aligned with production system design and best management alternatives; sustained feed technologies; quality seedstock development; human health impacts of aquaculture; food safety and value-added products development; technology adoption and policy development; marketing, economic risk assessment and trade; watershed and integrated coastal zone management; and mitigating negative environmental impacts.

Numerous projects have completed experimental work and transitioned into more outreach for end-user or use of new tools and technologies. Several short-term projects have ended with no continuation needed. Numerous projects have generated preliminary data that require field-testing or additional work to validate farm or business applications. Several production-oriented projects will benefit from follow-up economic, marketing or other socioeconomic research to identify factors impeding scale-up with more cost-benefit analysis data for new technologies and practices. This rationale is based not only on country level needs but broader scale-up and potential applications at country, regional and global levels. The findings from an EGAT Associate Award focused on scale-up and dissemination of AquaFish technologies and practices in three African FtF countries will provide more insights on scale-up strategies and opportunities.

Many projects originate at local or community levels and require subsequent scale-up efforts for broader impacts in more communities with opportunities for adoption. Numerous projects generate new knowledge, technologies, practices and tools with regional and global application that can be assessed by the global AquaFish community to leverage collective expertise across regions. Development-scale success linked to both creating and benefitting from HC capacity building require long-term sustainable collaborations as new science discoveries continuously improve next generation practices at the farm-level. AquaFish is influencing the actions of US and HC research enterprises to align sciences with global development outcomes and new pro-poor policy interventions.

Achieving large-scale country level impacts in aquaculture development require long-term investment and relevant problem-solving research strategies to address knowledge gaps and development bottlenecks. Numerous projects are developing preliminary data and information that show promise for application and uptake by targeted communities. Often the desired outcomes and application of results research require additional time for field verification, demonstration, and training before reaching a

larger community. Many projects are at a stage of scaling-up, and effective outreach methods and productive collaborators in research, extension and communities of farmers and fishers would be well timed. Research questions persist that require more investigation and pioneering breakthroughs under local conditions for development, some of these should keep the focus more basic and less outreach oriented.

There is a spectrum of conditions not only across the CRSP but even within countries involved with the CRSP, so it is impossible to generalize and state whether greater emphasis should be placed on outreach and scaling up. Nevertheless, there are clearly projects that would benefit from such an emphasis. For example, the cluster development projects in Kenya, best exemplified by the Bidii cluster (Vihiga) growing catfish fingerlings for use as bait in the Lake Victoria capture fishery. The Bidii cluster is one of four clusters that were attempted. The other three have not had the same success. It seems there is a real opportunity to invest further on outreach and attempt to scale successes more reproducibly. Certainly in regions with growing aquaculture capacity and production, baseline studies on product availability, product forms and economic impact of aquaculture would be of value.

In the Philippines the reduced feeding work is apparently being picked up and tested in many production settings, and the feed developed has been adopted by a major feed manufacturer. Greater focus on outreach and measurement of impact on farm would be appropriate. In addition, these methods are being transferred to milkfish and even marine species as a means of scaling the work. The physiological mechanism for how or why reduced feeding may work in such systems has not been developed, so maintaining the detailed research focus on this level of investigation is appropriate before looking toward outreach.

Interviews with US PIs suggest that several projects will end with the current Implementation Plan because of completion with no continuation plans or HC factors. The program model using HC input to identify local problems and focus areas of research is sound with the important consideration that feedback represents a synthesis of broader stakeholder input from targeted end-users for the program and is not solely investigator-driven. The inclusion of private sector participation should be encouraged throughout AquaFish program planning activities. The direct linkage of development goals and specific end-user needs and priorities in a local situational context should guide levels of effort and facilitate impacts. Future funds should be directed to high performance projects with sound assessments for furthering development impacts from follow-up or next generation projects sequentially planned from past foundational work and experience. Projects with 5 years of clearly limited accomplishments or severely constrained HC conditions should be discontinued in favor of strengthening core capacities and centers of excellence for small-farmer aquaculture research and technology development in each region.

AquaFish CRSP focuses on problem-solving applied research for evidence-based improved practices and technologies and this approach should continue as the major portion of the research portfolio. A smaller portion of the portfolio should fund basic or fundamental research, including biotechnology research and training, aimed at transformation breakthroughs to support development goals and targeted end-users. Few international development programs can sustain long-term funding for basic

research and associated human capacity building of next generation scientists with graduate level training. The scale of effort can be expanded to match the extent of constraints at a multi-country level, such as, production system design and best management alternatives; sustained feed technologies; quality seedstock development; human health impacts of aquaculture; food safety and value-added products development; technology adoption and policy development; marketing, economic risk assessment and trade; watershed and integrated coastal zone management; and mitigating negative environmental impacts.

Shellfish aquaculture is an area for potential expansion in coastal areas where artisanal fishing communities are concentrated with a need for expanded economic opportunities. More countries can benefit from sanitation, resource management and policies, culture methods and water quality certification capacity for new product development and marketing opportunities. Nicaragua and Mexico are case studies. The same applies to new seaweed crops and integrated trophic polyculture systems developed in Indonesia and the Philippines. The work in Cambodia and Vietnam is transformational in potential changes in snakehead farming policy in Cambodia and new small fishes management policy in the Mekong River Basin and new pelleted feeds for snakeheads. The core research area of sustained feed technologies cut across all regions and offers future opportunities to reduce feed costs, improve feed strategies (Philippines) and incorporate local and available low-cost alternatives to traditional aquafeeds. Understanding and fulfilling nutritional requirements of economically important species are critical to long-term sustainable development. New tools and applications for aquaculture development planning in inland and coastal areas, proper site selections, and efficient multiple uses of water resources with integrated aquaculture production will become increasingly important. Improved environmental management is a continuous field of research as pressures mount for increased production efficiencies, multiple uses of water and practical pollution mitigation of effluents. Projects in China and Thailand are improving production system operations and performance and these are key leaders in the aquaculture industry. They are not targeted FtF countries but they can provide important research findings for FtF countries.

AquaFish has a unique global research network that can be mobilized for innovative approaches for expanding impacts within and between regions. The south-south collaborative model of accelerated adoption of new rice-cum-fish systems in Mali and integration of new seaweed crops in Indonesia offer expanded opportunities. Research with indigenous species development is often linked with high value over-fished or depleting wild fishery stocks seeking a farmed alternative and supporting biodiversity and ecosystem conservation goals by prohibiting the introduction of non-native species. Farmers benefit from diverse choices of cultured fish and new market opportunities. Research time lines are generally long-term for enterprise level development outcomes. Careful ex-ante impact assessment of the benefits of this line of research needs to be conducted to avoid chasing the “next” new specie. While we encourage continuation, we stress that “depth” in a few high potential species should be pursued and not “breadth.” A commitment needs to be made to a few species and which ones they are should come from a strategic retreat and careful consideration of the risk/reward calculus. In addition, this type of work should seek out non-traditional partners such as those active in the NSF PIRE program.

Work in Africa covers a wide spectrum of development with CRSP impacts being seen in the increasing production from aquaculture in Kenya from less than 1000 metric tons/year in 2005 to nearly 20,000 metric tons/year in 2011 (personal communication, Sam Macharia-Kenyan Ministry of Fisheries); compared to Mali, a relatively new entrant in aquaculture production; or Ghana where private investment has been quite extensive surrounding the Lake Volta region. The experimental pond unit assessment (EPUA) project started under the AquaFish CRSP involving many of the HC's (Uganda, Bangladesh, Ghana, Tanzania, Cambodia, Nicaragua, Nepal and Kenya) has enabled initiation of best management practice (BMP) studies on water conservation practices and feeding practices. The overall goal of this EPUA approach is to establish a uniform research direction for basic work needed to develop small-scale aquaculture. Future AquaFish CRSP programs should draw upon the EPUA results to further develop methodology for customizing management practices for any given aquaculture system. In Kenya work has started on two of more than 10 BMPs identified for development and on-farm trials with the Kenyan HC PIs.

Feed availability is a critical issue for all the HC partners, so technologies for developing quality feeds with locally available ingredients, and fish species that can thrive on these diets is a direction already entered into by Tanzania, Uganda, Kenya and others, and requires increased focus in the future.

Another aspect that was emphasized by US and HC investigators was the interest in improved genetic stocks. There is great need for improved genetic material and the use of, and interest in, the GIFT tilapia developed by the WorldFish Center in a good example. Nevertheless the training in genetic improvement seems limited and practices such as "bringing in fresh blood" and outbreeding with unknown material to "minimize inbreeding" without evidence of inbreeding problems, do not have strong theoretical or practical support. Work on genetic improvement is a basic need, and already represents a real value added enterprise for some farmers, and could be extended to more.

The involvement of HC universities in the CRSP varies, however to the extent that long term relationships are established the CRSP has had critical capacity building impacts with positive effects on the universities in a number of countries, from supporting top graduate students, training farmers, extension and research specialists, and contributing to the ranks of university faculty. The CRSP projects form the basis of graduate student theses research in many instances. Furthermore the multifaceted approach of the AquaFish CRSP looking at fish production, product demand and marketing, clustering developments has influenced the University partners' long term planning, for example in Kenya, Moi University is currently in the process of establishing more formal ties among the Aquaculture and Fisheries school, the Business School and the Animal Sciences department to make their programs more comprehensive and relevant for commercial aquaculture development.

Long-term Training: Part of the Technical Contribution

The AquaFish CRSP has done an excellent job of annually documenting the number of long-term trainees fully or partially supported by the program. According to their database as of December 2011, a cumulative total of 325 long-term trainees, with most of the students coming from host-country institutions have enrolled in degree or non-degree programs since AquaFish CRSP inception. These students have received either partial or full funding from the program. At the current time,

approximately 188 students are enrolled illustrating the importance of partial funding and leveraged resources for student support.

Each annual report provides detailed information on long-term (and short-term) trainees that is not duplicated in this evaluation[8]. To summarize, the program has largely funded host-country students who have attended U.S. and non-U.S. universities. Mexico, China and Vietnam combined provide over 50% of the students. As expected, the majority of students specialize in aquaculture production sciences. There is a near balance between male and female trainees. It is commendable to note that Borlaug LEAP fellows have been selected from AquaFish CRSP HC participants attesting to the qualifications.

AquaFish CRSP Short-term Training and Capacity Building

AquaFish CRSP investment in short term training aims to reach stakeholders in aquaculture and fisheries in HCs through partnership with PIs. AquaFish CRSP had supported large number of events to reach diverse stakeholders in aquaculture system. Short term training is under 6-months' duration. Short term trainings include seminars, workshops, short-courses, and internships. Workshops focus on training host country extension specialists, fisheries officers, local fish farmers, processors, vendors, small business owners, and NGOs.

Since the inception in 2006 AquaFish CRSP projects have held over 200 short-term training sessions with over 6,500 participants, including approximately one-third women trainees. CRSP program maintains an extensive sex–disaggregated data base on short term training. The data base is comprehensive giving relevant information related to event name, organizer, PIs, participants list and cosponsors, if any. The lower percentage of women trained in short term events in some countries are attributed to the type of aquaculture or fisheries activities and gender differentiated activities and interest in the social context. A higher percentage of women in some countries is made possible by targeting training in issues that are relevant to women's roles as well as encouraging women to enter training events that have been dominated by men.

Most of the trainings were directly funded by AquaFish CRSP with a few host country institutions as co-sponsors such as Wuhan University and Institute of Hydrology CAS, China; DNP/Mali; University of Stellenbosch/SA; National Council of Science and Technology, Brazil; Ministry of Fisheries Development, Nairobi, Kenya; USAID Business Development Services, Kenya; and Moi University, Eldoret, Kenya. Most topic foci were on aquaculture science and development. Valuable south-south linkages were through HC investigators knowledge sharing (HCPI Information Exchange Project) and training of African rice farmers in Asia in rice-fish production systems. There were 284 individuals from Initiative to End Hunger in Africa (IEHA) focus countries who received training in 2009 representing 22.7 percent of all short term trainees. These short term trainings for skill building and sharing of information provide an opportunity to continually support learning to enhance the human capital in aquaculture sector. The intensive

[8] See pp.34-38 in the 2007 Annual Report, pp.65-67 in the 2008 Annual Report, pp.101-104 in the 2009 Annual Report, pp.116-119 in the 2010 Annual Report, and pp.116-118 in the 2011 Annual Report for detailed information.

hands-on master trainer program of two highly selected participants from each of four African countries at Auburn University strengthens future HC capacity to lead training programs for farmers, extension officers and other interested parties. The integration of online training modules as a training tool should be evaluated for HC training needs and any potential broader application if demonstrated to be cost-effective.

Innovative training programs using distance learning techniques are being used. Auburn University is leading this work and it is unclear, since it is too early to evaluate because the training is not complete, whether this mechanism is successful. Some participants were having difficulties accessing online modules. It appeared that this material could not be shared via DVD due to intellectual property concerns and this was causing difficulties. A thorough assessment of this activity needs to be conducted so it can be determined whether it is scalable to a broader set of participants. Any problems need to be identified to determine whether they can be addressed since this type of training is being used widely in some low income nations. If this program is a carefully guarded fee-for-service training, then consideration should be whether the program is cost-effective for AquaFish CRSP or whether a public good version should be developed.

Areas for Improvement

There is no evidence of systematic follow up on the trickle down of learning gains from the short term training at farmers' level. So there is a possibility the events would be quantifiable project outputs, but not necessarily would they result in a capacity building outcome.

Given the growing interest in aquaculture development and export oriented production goals in HCs, CRSP events could have been co-sponsored by other public and private sector entities.

Global Network for Aquaculture Development: Institutional Collaborations

The core mission of CRSP is to build a network of U.S. and developing country scientists as a foundational research driven knowledge base and support innovations in aquaculture development. In the current AquaFish CRSP implementation, an earlier vision of the research network has expanded to include diverse stakeholders in aquaculture sector development. Hence the project achieves the goal of building a network for aquaculture development. The AquaFish CRSP program is structured in a model of collaboration between US lead universities and institutional partners in developing countries with a few exceptions (South Africa and Thailand). Oregon State University, the seven lead sub-award US universities and their ten US university partners are currently linked with institutional partners in 16 countries located across Africa, East Asia, and Latin America. There are efforts underway to expand linkages in South-Asia. The project claims a network of 300 institutions including PIs, investigators and collaborators in the core projects and HC projects. The institutional partnerships in HC includes, beyond academic and research institutions, a wide range of national and regional institutions that provide research and development leadership in aquaculture sector. Beyond the network of scientists, through the investment in long-term training at degree level, AquaFish CRSP has network of scholars in the US and HC who contribute to aquaculture development. Finally the CRSP support to short term training builds HC local networks of participants with potential to collaborate on specific aquaculture and fisheries initiatives. Hence, it could be stated that AquaFish CRSP fulfills the mission of building a global

network for aquaculture development; nevertheless also see the discussion on expanding the information dissemination in the *web-presence, communication and monitoring* section below. The program network/outreach structure is formatted as Regional Centers of Excellence fostering leadership roles to coordinate and expand regional initiatives in aquaculture research and development as well as to promote regional networks. RCEs are grouped as Asia, East and Southern Africa, West Africa, Latin America and the Caribbean. AquaFish CRSP has taken initiatives to build/strengthen linkages with NGOs (women's NGOs in Africa); government agencies (Fishery Ministries in Asia, Africa, LAC and key regional institutions (SEAFDEC, NACA). AquaFish CRSP efforts to cosponsor national and international fishery and aquaculture events also contribute to building networks for outreach and information dissemination.

Areas for Improvement

AquaFish CRSP, like all other CRSPs with long standing mature institutional partnerships, presents a potential of exclusivity in CRSP and there may not be room for new actors.

Given the initial mission of CRSP as one of promoting a network of scientists not necessarily development professionals, the network is dominated by production scientists.

Research Investment

The initial total value of the AquaFish CRSP LWA Cooperative Agreement when it was awarded to Oregon State University on September 29, 2006 was $8.9 million. The total value was increased to $12.82 million in 2009. As of September 30, 2010, the full amount of $12.82 million had been obligated. On September 8, 2011, the CRSP received a no-cost extension through September 29, 2012. On May 3, 2012 the total value of the Leader Award was increased by $1.9 million and that full amount was obligated, but because this occurred so recently, the $1.9 million is not included in Table 1 below. The CRSP has received two Associate Awards since 2007. The first was a three-year $750,000 award from USAID/Mali for a project in Mali on aquaculture and fisheries and the second was a $1.1 million three year award from USAID/Washington to scale-up technologies in Ghana, Kenya and Tanzania to support the Feed the Future Initiative.

Of the $12.82 million awarded to AquaFish CRSP since 2006, 65% ($8.3 million) was allocated to 7 competitively awarded core research projects (Table 1). Approximately 14% was allocated to central research, outreach, impact, and capacity building projects, and approximately 15% allocated to management. Approximately 30% of the funds allocated to research projects has not been invoiced but is encumbered (data provided by the MT).

In FY2011, AquaFish CRSP received a no-cost extension through September 29, 2012, to allow students in degree programs to reach completion, to allow completion of work currently underway, and to facilitate a smooth transition between the existing 5-year Aquaculture and Fisheries CRSP award and any future 5-year award.

The AquaFish CRSP has been successful at leveraging additional funding for its activities. The three most recent annual reports document these awards. In 2009, approximately US$0.624 million was leveraged relative to the US$3.16 budget or a 1:5 leverage ratio (20%). In 2010, approximately US$0.442 million

was leverage or a 1:7 ratio (14%). Both years are inferior to the 1:1 leverage ratio targeted by research management.

Table 1. Budget summary of the AquaFish CRSP by expenditure center

Description	*IP 2007-2009 Allocation*	*IP 2009-2011 Allocation*	*Total Funds Allocated*	*Available balance as of last invoice**
Research Projects				
Competed Core				
University of Arizona	$400,401	$743,516	$1,143,917	$270,866
University of Michigan	$428,800	$1,060,279	$1,489,079	$361,983
North Carolina State University	$339,828	$864,902	$1,204,730	$384,606
Purdue University	$434,823	$931,000	$1,365,823	$362,894
University of Connecticut	$458,441	$715,447	$1,173,888	$338,445
University of Hawaii	$300,000	$732,526	$1,032,526	$403,964
Auburn University		$916,513**	$916,513	$376,675
Subtotal			*$8,326,476*	*$2,499,433*
Non-Competed				
Montana State University & Oregon State		$439,502	$439,502	$0
Cultural Practices LLC		$100,000	$100,000	$46,440
Indirect on first $25,000 per subaward			$93,375	$0
Personal Services Contracts			$141,500	$0
Total Research Projects	**$2,362,293**	**$6,503,685**	**$9,100,853**	**$2,545,877**
Central Research, Outreach, Impact and Capacity Building Projects				
Capacity Building			$930,459	$0
Synthesis Project			$600,000	$0
Communications			$224,514	$0
Total Central Research			**$1,754,973**	**$0**
Management				
Management			**$1,964,174**	**($55,332)**
TOTAL from Inception through September 29 2012			**$12,820,000**	**$2,490,545**

Source: Management Team
*Invoices and invoiced period only apply to subcontracted projects, all other balances include encumbrances.
**Programmed funding pending contract .

However, in 2011, AquaFish leveraged US$69.0 million largely due to a $US66.0 million Government of Kenya economic stimulus program for investment in a national aquaculture development. The annual report does not state how much of this money was used to support or AquaFish CRSP activities per the concept of "leveraging." While it is commendable to acknowledge the formative role that the previous aquaculture CRSPS and AquaFish played in the development of the research infrastructure in Kenya, attributing a causal relationship between the two would be difficult to do since the counterfactual is impossible to construct. Certainly there is a correlation between the two.

Nonetheless, if this large government expenditure is not taken into consideration, approximately US$2.98 was leveraged according to the 2011 annual report. This figure generates a 1:1 leverage ratio (approximately 101%) of the budget. Over the program, US$4.04 million has been leveraged or approximately 32% of the budget. Despite this low overall ratio, it requires stating that the overall cost-share by participants was 58%. Combining the cost share and the leveraged funds together (US$9.16 million) and juxtaposing this against the research budgets (net of management costs) generates a healthy leverage ratio of 1:1.21 or 84% of research expenditures and 1:1.4 ratio, or 71%, of the total budget. In addition to these figures are two leader with associate awards that could be considered as examples of leveraging.

Research Productivity and Impact

The AquaFish ME provided a list of 129 publications produced by scientists affiliated with the program. Using this list as a base, the publications were systematically reviewed for citations using the citation indexing software Publish or Perish (PoP)[9]. A total of 96 papers (or about fourteen per year) were located and their citations tabulated.

We could not locate all papers provided by the ME in PoP. Three publications were deleted from the original list because of repetition, and thirty-two documents were not found by POP due to the type of document. Fourteen publications were not captured in this count and peer-reviewed manuscripts in the Proceedings for the Ninth International Symposium on Tilapia Aquaculture (2011). The different documents that were not found include seven papers that were presented at Symposiums during 2006, eight articles that were submitted to the trade magazine *Global Aquaculture Advocate*, five papers were published in foreign languages (Vietnamese , Spanish, and Portuguese), and thirteen papers published in non-western journals (primarily Asian) in 2010.

Figure 1 describes the trend in publications of documents found, and not found by PoP, as well as the cumulative number of citations of the papers that were located. For those publications that have global access (they can be found in Google Scholar), the first three years show and increasing trend follow by a rapid decrease after 2010. Excluding the publications that were not found in 2006 and including all other publications (found and not found) for the following years, we see an increasing trend that falls considerable during the last two years. This fall in publications translates into a diminishing marginal citation trend towards the end of the period of study.

[9] Harzing, A.W. (2007) **Publish or Perish**, available from http://www.harzing.com/pop.htm

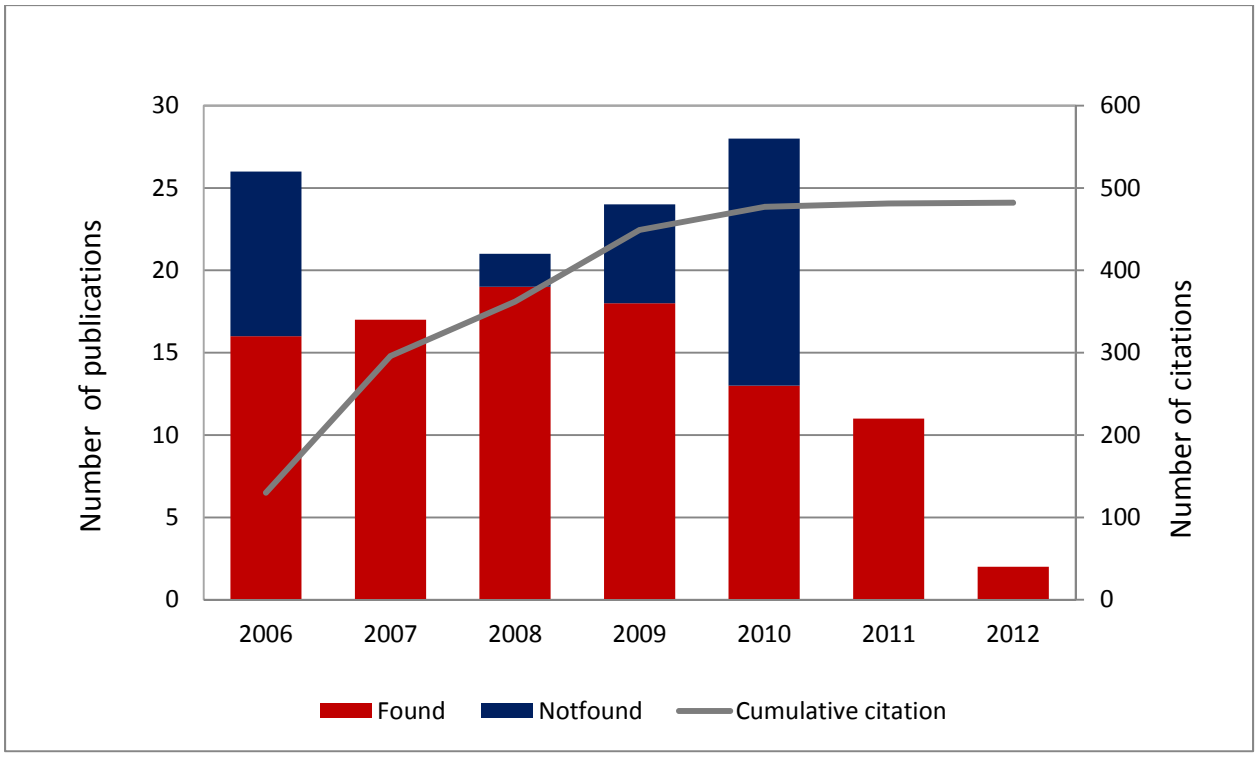

Figure 1. Number of publications found and not found by *PoP* per year, and cumulative citations from 2006 to February 2012

If the papers are grouped by number of citations that PoP was able to locate (Figure 2), what we observe that 55% of the total number of publications had 0, 1 or 2 citations. There are eight papers however that have been influential, reporting fifteen or more citations. The majority of the papers that have been influential relate with the Asian projects that AquaFish CRSP sponsors.

Rigor and integrity are stressed by the ME and external peer-reviews help validate the quality of proposed research work plans. Numerous publications of project results in scientifically peer-reviewed literature indicate sound experimental methods. The research portfolio is aligned to address and has made significant contributions in fulfilling the AquaFish goal,' *to develop more comprehensive, sustainable, ecological and socially compatible, and economically viable aquaculture systems and innovative fisheries management systems in developing countries that contribute to poverty alleviation and food security.'* The integration of outreach activities to all research projects encourages and facilitates development outcomes on farms and in rural communities. The integration of effective outreach components can shorten the time from discovery to application, enable co-development of practical solutions with farmers, and solve adoption barriers to achieve broader impacts.

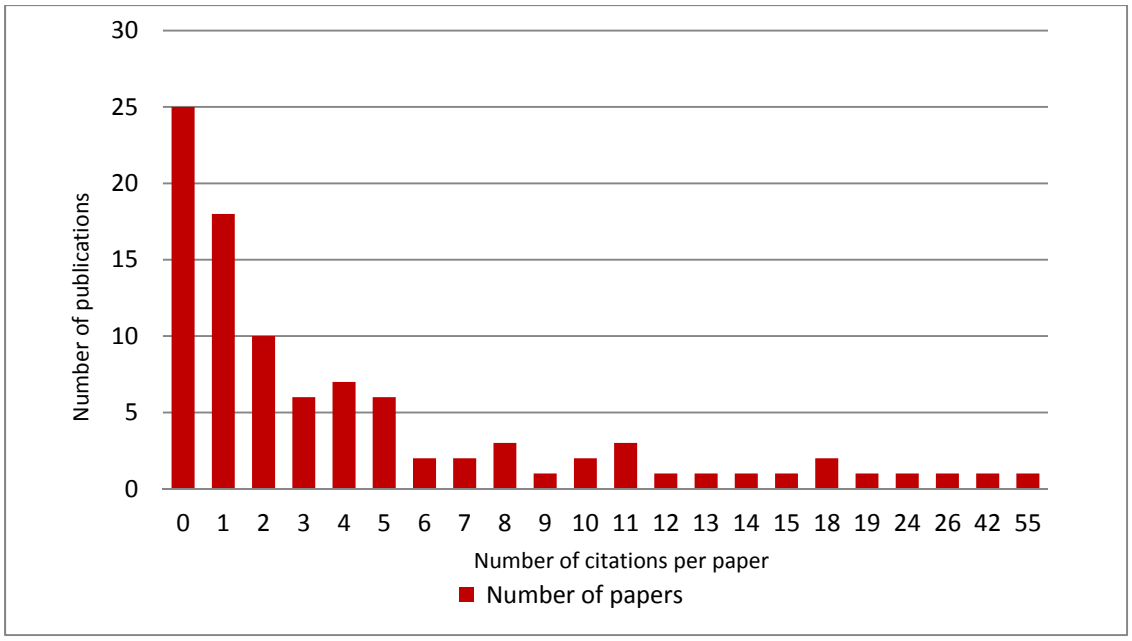

Figure 2. Frequency distribution of the number of citations per paper 2006- February 2012

The depth appears to be adequate based on numerous research breakthroughs, significant targeted development outcomes and completion of project objectives that leverage US and HC PI resources. The Program or US PIs have recruited strategic partnerships among US institutions to add depth and expertise as needed for specific projects.

All projects were vetted through local USAID missions and priorities were identified by HC stakeholders and considered in designing and planning project studies. The research is solution-focused to advance knowledge and understanding to support and stimulate aquaculture development among small and medium farms. The aquaculture-fisheries nexus projects in Vietnam, Cambodia and Mexico have policy-implications. The Mexico snook project at this stage can mature toward commercial aquaculture and/or public stock enhancement programs based on future propagation successes and policy decisions by HC. In numerous countries fish of traditional economic value in local markets sourced from artisanal or commercial capture fisheries are under stress from overfishing and/or habitat degradation with an increasing food security need for sustainable sources of farmed fish of the same or new substitute species.

With decades of international aquaculture development experience and a consultative global aquaculture network, AquaFish has the institutional knowledge to identify strategic major research themes and topics that align with AquaFish and USAID goals. They are reflected in the major research topics of production system design and best management alternatives; sustained feed technologies; quality seedstock development; human health impacts of aquaculture; food safety and value-added products development; technology adoption and policy development; marketing, economic risk assessment and trade; indigenous species development; watershed and integrated coastal zone management; and mitigating negative environmental impacts that address contemporary global aquaculture development areas. No changes are recommended. The Program may benefit by

integrating a human health and nutrition project. Fisheries products offer highly nutritious protein for people of all ages with special emphasis on vulnerable children and pregnant women. In many rural areas with a scarcity of high quality animal protein, diets can be supplemented with local farmed fishery products.

Input from Host-Country Collaborators

Dr. Egna indicated that the AquaFish network extended to over 300 collaborators but we were not able to draw information on the AquaFish CRSP from this entire network. Instead, we drew upon a subset of participants who were the most important and conducted two types of conversations: face-to face interviews, host-country visits, a telephone interview, and an online survey with quantitative, qualitative and open-ended responses.

Face-to-Face Interviews with Host-Country Collaborators and PI's

The team was able to conduct site visits to Kenya and the Philippines. Both countries were selected because they had been long-term participants in AquaFish and previous aquaculture-related CRSPs. They provide examples of the cumulative impact of aquaculture-related CRSP investment and the evolution of their projects within the CRSP structure and their respective countries. The aquaculture industries in Kenya and the Philippines are reaching a mature state and thus they provide a model for other nations developing their own industries.

Kenya Site Visit and Interviews

CRSPs have trained over 1500 fish farmers and the results have led to the whole spectrum of production from farmers with few resources available and improvement marginally above subsistence production to entrepreneurial growers that have increased pond area, intensified management and record keeping. The cluster project near Lake Victoria (Bidii project, Vihiga cluster) is one of the pinnacle achievements with a cooperative group of over 80 farmers that has developed a catfish fingerling production system and generated a new product of catfish fingerlings as bait for the capture fisheries on Lake Victoria.

Program evolution from PDA CRSP to ACRSP to AquaFish CRSP in shorthand could be, PDA was mostly basics of improving production beyond 1000kg/ha (or even above 100kg/ha)-this meant improved pond construction, pond management, water quality management, and record keeping. ACRSP evolved to training and extension network development-thinking of aquaculture as a business. AquaFish CRSP has led to development of value chains, marketing, networking and cluster development as well as identification of critical resource needs, specifically feed and genetically defined fish stocks, and environmental issues to address with best management practices (BMPs).

Future directions for CRSP work would be in research-feed and seed are major priorities; training in value chain development, baseline marketing studies, product development, cluster development; funding for continued education. The need for training of new faculty members was also mentioned by several extension officers as a need. A complete trip report is presented in Appendix 7.

Philippines Visit and Interview

In the Philippines CLSU (Central Luzon State University) has been a program partner since the early 1990s. Such a long standing collaborative research partnership is much valued. AquaFish CRSP partnership has been a catalyst to undertake research in new areas to expand the knowledge of aquaculture in wide ranging topics such as species, pond management, reproduction, feed mix and feed management. The research support for feed management studies resulted in findings that encourage farmers to adopt different feeding routines and have shown economic benefits to the farmers to cut costs in production. The AquaFish CRSP is housed in the Freshwater Aquaculture Centre (FAC) and is also linked to the College of Fisheries. Hence, the research and teaching interactions facilitate applying AquaFish CRSP research in teaching and involving students in research. AquaFish CRSP has supported university level education for the Filipino students both at graduate and undergraduate level. The research funded by AquaFish CRSP has contributed to faculty development with award winning research. The AquaFish CRSP supported short term training of people involved in aquaculture such as farmers, women, extension professionals and professionals. These examples demonstrate the AquaFish CRSP contribution to capacity building in the Philippines.

AquaFish CRSP partnership with SEAFDEC (South East Asian Fisheries Development Center) opens up research and outreach initiatives with a regional organization that has an extensive collaborative network in the South East Asia Region including World Fish Center and FAO. It is a constructive collaboration, since the organization has the mandate to undertake research that benefits small farmers and women in fishing households. AquaFish CRSP-CLSU collaborates with National Freshwater Fisheries Technology Center in the Bureau of Fisheries and Aquatic Resources (NFFTC) and it supplies fingerlings to centers all across the Philippines for distribution to farmers. The GIFT (Genetically Improved Farmer's Tilapia) Foundation project is a partner in the AquaFish CRSP-NCSU-CLSU program in the Philippines. GIFT project is funded by a seed company that provides loans for farmers to buy fingerlings and feed where CRSP scientists provide technology support. CLSU's linkages with the Philippines research, technology development and educational organizations offer a national network to draw expertise in aquaculture development. The SEAFDEC as a regional center brings to the project an extensive network of countries that have demand for fish and fishery products and regional institutions with expertise to promote fisheries and aquaculture. The combined expertise in CLSU and SEAFDEC institutional network can make a valid contribution to aquaculture development in SEA and holds potential to provide regional leadership in aquaculture and fisheries research and development.

The PIs were briefed about the FtF agenda by the CRSP director from ME-OSU; hence CRSP partners are aware that the Philippines are not a country included in FtF framework. PIs and administrators raised a concern about their continued collaboration with AquaFish CRSP. The PIs acknowledge the importance of undertaking impact assessment at the country project level on their own initiative. The need for high capital investment to develop aquaculture as a productive farm enterprise, and finding a niche in a fresh fish market dominated by commercial firms, deters entry of women in the production phase of aquaculture sector. A complete trip report is presented in Appendix 6.

Phone Interview with Dr. Wilfrido Contreras-Sanchez, Universidad Juarez Autonoma de Tasbasco, Mexico

An interview with one collaborator from Mexico was conducted by phone. Since there are multiple collaborators in Mexico, this interview should not be construed to cover all investigations. Gary Jensen had the opportunity to speak directly with Dr. Contreras-Sanchez on June 4, 2012 to obtain first-hand, current information and host country perspective on the importance and performance of AquaFish CRSP. He emulates the value of long-term sustainable collaborative work that began with his PhD training at Oregon State University in 1998 with completion of a degree in 2001 and current role as HC PI as well as leader for the AquaFish CRSP Regional Center of Excellence for Mexico and Central America.

AquaFish CRSP funding in Mexico since 1999 enables research and outreach activities that would otherwise be impossible for husbandry methods for several high value native fish species with new choices for small farmers and training rural indigenous people about advances and opportunities for food security with appropriate local technologies. Funds have been instrumental for building research capacity and supporting many BS and MS students with thesis options using aquaculture studies. The level and quality of human resource capacity building and career-long skills and training in aquaculture extend into long-term benefits in private and public sectors. AquaFish CRSP research findings are integrated into curricula and student classroom training on contemporary topics such as the latest discoveries to control the life cycle of native cichlids, gar and snook. AquaFish CRSP sponsors HC participation and US experts in new international networks and forums for native snook and native cichlid aquaculture and new synergies among research enterprises in Central and South America.

The ME created the innovative HC PI exchange program that assembled representatives from Asia, Africa and Latin America to visit other regions to learn first-hand from counterparts, farmers and others about different methods, species, approaches and successes in international aquaculture development. The exchanges accelerated learning with new ideas as well as strengthened a collective global AquaFish CRSP community for long-lasting collaborations. AquaFish CRSP funding has enabled sustainable work on native species unlike other institutions that have ceased work with lack of support or focused on popular non-native tilapia species. Work on native species is intended to relieve over-harvest pressures and preserve biodiversity of native genetic stocks. Next steps include refinement of feeds, genetic improvement and larval rearing of native gar, a new protocol for effective degradation of androgen steroid from effluents of tilapia hatcheries based field testing results, improve larval rearing of native snook for future farming and stock enhancement. The HC values the focus of program on integration of gender and outreach to rural and poor communities that might otherwise not be implemented and benefits unrealized. Some notable successes include introduction of gar aquaculture and uptake by private hatcheries for fingerling production and others for grow-out for local markets, use of effluents from fish systems to irrigate habanero peppers and new value-added products, new manual for spawning and larval rearing of native snook funded by Mexican government, and life cycle management of new native cichlids for rural indigenous communities. The work on gar has spanned 10 years and studies with androgen steroid began in 1998.

More work is needed in cost-analysis of new methods and practices and obtaining farm level economic impact data from AquaFish CRSP investments and development outcomes. There is strong

communication and collaboration among HC and US PIs who serve as valuable resources in project planning but also sources of information and referrals to US expertise on topics of HC interest. The HC institution cites the AquaFish CRSP in annual reports and has provided additional funds for an experimental facility for snook propagation.

Online Survey of Host-country Collaborators

An online survey consisting of closed-ended and open-ended responses was sent to 24 non-U.S. based host country collaborators (HCCs) from a list compiled by the ME A copy of this survey and the results is found in Appendix 3. The survey was administered from May 3 to May 19, 2012. An initial email was sent to all collaborators with follow-up reminders every second day. Only eighteen host country collaborators responded to the survey so representation of their responses must be viewed with caution. Rather than presenting this material statistically, it is described qualitatively due to limited responses.

Most questions asked for responses on an ordered Likert scale where the first class indicated "not important" while the fifth class indicated "very important." When possible, classes were used to designate ordered quintiles. The questionnaire was organized to identify geographical and scientific background, the relative importance of aquaculture in their countries and then shift to questions on scientific collaboration. The distribution of responses is presented in the Appendix 3.

Half of the responses came from Asian collaborators, 23% from African and 18% from Latin American and the Caribbean and the remainder declared as "other." Eighty-two percent of the respondents were from production fields with the remaining three from the social science, human health and "other" fields. All respondents indicated that aquaculture was very important or important to their country. Seventy-one percent of the respondents indicated that they allocate more than 60% of the professional time to aquaculture research.

In terms of scientific interaction, the responses suggest that HCCs play a very important role in setting research priorities, scientific methods and in taking leadership for developing written outputs including reports and scientific publications. Open-ended responses indicated that the relationships are very valuable and collegial and that South-South relationships and other methods of information and technology exchange should continue to be encouraged.

Financially, the importance of AquaFish CRSP funding was concentrated with 88% respondents indicating that it covered "nearly all" or "all" of their research costs. Only one individual indicating that AquaFish CRSP contributed very little to their research budget and many others cited it as "very important", indicating it covered 81-100% of their research activities. More than 47% of all responses indicated that AquaFish CRSP funding was of "average" or "very important" significance to their research program. Forty-one percent of the respondents indicated that they could not conduct research on these topics without AFCSRP funding.

Sixteen of the 17 respondents indicated that gender integration strategies have added value to their research and development activities but only 50% indicated that specific funds were allocated to gender research and activities. Fifty-three percent of collaborators indicated that they conduct formal impact

assessment of their activities but nearly 90% indicated that the outreach requirements of the project have improved the productivity of target farmers.

It appears that complying with financial reporting requirements and administrative requirements is roughly equal to, or easier than, other projects the respondents work with. Again, the numbers of respondent are too few to make any general statements. Review of the comments in Appendix 3 may assist in gaining an appreciation of HCCs' concerns and accolades.

Section III: Management Assessment

This section focuses on Oregon State University's management of the AquaFish CRSP.

Challenges facing the ME and MT

The MT has faced a number of important challenges during the current five year phase. At OSU, office space constraints have impeded work. Their long-time office in Snell Hall was condemned after a flood and moving to new space has contributed to a loss of momentum. The university has shifted from having dedicated administrative support to a model of "business centers" that are shared between numerous departments and/or offices. Since most of the AquaFish CRSP's administrative support needs are esoteric (meaning international, USAID or federal government-specific rather than Oregon-specific) processing of financial and administrative documents is difficult. Dr. Egna indicated that support for grant writing is lacking. During our meeting with the MT, we asked if she had considered moving to another organization more conducive to the CRSP's needs, but the discussion was not pursued.

The MT is short on staff. Dr. Egna indicated that an Assistant Director needs to be added in order to accommodate a perceived increase in workload that partially originates with USAID, their information needs, and potential associate awards. OSU supports nearly 100% of Dr. Egna's salary for work on CRSP activities and on CRSP-related OSU responsibilities. The need for additional staff should be evaluated with respect to the expected benefits.

As noted above, OSU administration considers Dr. Egna a valued colleague and she serves on numerous high profile committees for the university. Dr. Egna indicated that "Overall, it would be fair to say 90-95% of my time is related to CRSP, international development, and USAID work." The team observed that she is engaged in several university committees.

Programmatically, AquaFish CRSP suffered from the deaths of important international and U.S. contributors. In Mexico, a flood at the HC research station caused the loss of experiments and a 6-7 month delay in research outputs. The political crisis in Kenya caused a loss of data and trauma to key personnel. And an earthquake in China retarded progress.

Advisory Boards and Linkages to USAID

The ME and MT initiated a number of innovative boards to advise on program development. Despite the best intentions of these initiatives, not all have been successful.

External Program Advisory Council

AquaFish CRSP has taken an innovative approach to constructing its advisory board. Many CRSPs draw from administrators from participating institutions for membership but the AquaFish CRSP has developed an advisory board composed of external experts from outside institutions. The External Program Advisory Council (EPAC) was formed to fill this role. At the outset of the program, the EPAC was composed of participants from international organizations such as the Food and Agriculture Organization of the United Nations, CGIAR, World Wildlife Fund and national fisheries organizations.

According to the cooperative agreement, the role of EPAC is to "provide advice to the ME on global program direction; provides input into AquaFish CRSP Requests for Proposals; provides annual critiques of research projects during annual or regional meetings to assist the ME in gauging performance; identifies gaps and issues emergent from the global portfolio as projects are implemented…….The EPAC is a policy-setting programmatic advisory panel. Annual EPAC critiques are sent to USAID for review, and subsequently made available to program participants." While this approach to managerial oversight is novel and innovative, it appeared to lose functionality towards the end of the second phase. While funding may have been an issue, interest among participant may have also contributed to its effectiveness. Reports provided by EPAC tend to be short and superficial. An oversight/advisory board is a critical tool for the management entity and is required for effective program implementation, monitoring, redirection and function. The MT should revisit this concept and determine whether it should be strengthened or whether an alternative advisory group should be developed.

Internal: Development Theme Advisory Panel, the Regional Centers for Excellence and Emerging Issues Panel

In addition to EPAC, the MT formed internal advisory panels. The Development Theme Advisory Panel (DTAP) was formed to provide technical advice on emerging issues in aquaculture and determine whether these issues could be addressed through the AquaFish CRSP activities. Initially four DTAP panels were formed (on nutrition, income, environment and trade) and led by coordinators who were lead PIs from U.S. institutions. These appeared to become "hijacked," as stated by Dr. Egna, to channel information from the projects into reporting on USAID indicators.

A second internal advisory structure was formed to coordinate geographically-related program issues. These "Regional Centers of Excellence" or RCEs provide technical insight into Asia-, Africa- and Latin America and the Caribbean-specific issues. They act to coordinate regional activities and to provide an interface with other organizations as well as USAID missions. The RCEs appear to have functioned well and provided the selected leaders with a level or responsibility that was constructive to the program. These centers offer an opportunity expand host country input into AquaFish CRSP programming that may lead to new resources in the future. This type of participation is valuable by broadening governance.

The final internal advisory panel was the "Emerging Issues Panel" (EIP). The EIP was designed to provide insight and scientific to the MT on issues affecting the forefront of aquaculture and aquaculture research. The panel was designed to consist of OSU faculty volunteers who were not part of the AquaFish CRSP's activities. The EIP functioned initially but when the team interviewed project PI's,

many responded “what is the EIP?”. There is record of a meeting held in 2006 but no mention thereafter. As mentioned above, annual program reviews do not describe EIP activities so we are unable to evaluate their contribution to the MT.

Relationship to USAID

AquaFish CRSP has benefited from a stable long-term relationship with the Agreement Officer’s Representative (AOR). Harry Rea is a trained aquaculturalist who can contribute to scientific discussion and evaluate research and annual reports for their scientific content. He indicated that Dr. Egna has been diligent in consulting the AOR and that his concerns and criticisms were taken into consideration for programmatic development. He acknowledged a constructive rapport with the ME. The AOR was complimentary about the intellectual leadership of the MT, financial management of the program by OSU and the responsiveness of the ME and MT to information requests. Given the technical expertise of the AOR and the long-term relationship, this may be one of the closest relationships between USAID and any of the CRSPs. Other CRSPs would benefit from a similar type of relationship between the AOR and the CRSP, and USAID should invest in such relationships.

Award Processing and Administration

The ME indicated that the 35% cost share has posed considerable difficulties since many institutions had problems in raising this amount. At the same time, the Dr. Egna indicated that their proposal to host the ME set this amount because they felt it was needed to, among other things, add value to the overall program, encourage institutional buy-in at all levels, and provide a mechanism for PI support at subcontracting institutions be competitive in the bid process. While it is understandable that the cost share poses a difficulty, it does not absolve the MT of partial responsibility for the difficulty. Nonetheless, future programs may wish to consider the appropriate level of cost share and USAID should also be cognizant of the burden placed on host-country collaborators in raising the cost share.

The cost reimbursable structure of the sub-awards from the ME to sub-awardees has produced a chronic problem in the flow of funds to HCCs and US institutions. This is understandable and only compounded by the differing levels of financial management between HCCs, US universities, Oregon State University and USAID. A simple alternative is the movement away from cost reimbursable contract to performance based contracts, clear deliverables. Some universities have advance fund to HCCs in front of contracts in order to initiate research but not all universities will do this.

The MT reported that the financial management system at OSU underwent a drastic reorganization midway through the program. This reorganization, and a new accounting system, took approximately two years to get up to speed, according to Dr. Egna. On a positive note, OSU financial administration and the Director of the Office of Sponsored Programs, Patricia Hawk, indicated that the MT provides “some of the best scopes of work for subcontracts” and that Dr. Egna was “conscientious” and “knowledgeable of the intricacies of USAID requirements.” Audits have been favorable and indicate very strong compliance with export control mechanisms.

The AquaFish CRSP, and especially Dr. Egna, is deeply respected by OSU administration. Administrators described Dr. Egna as a “tough” and “tenacious” individual who works long hours to get the work done.

They value her as a colleague who is a strong advocate for the CRSP model, the AquaFish CRSP program, and someone who has raised the level of visibility of international programs at the university. They remarked that Dr. Egna is a good corporate citizen and representative of OSU who has made a strong contribution to graduate programming, cross-university engagement of departments and has generated broad exposure and visibility of OSU among other universities. By raising the profile of the ME to a university "center" the administration has had to commit resources to it and these resources have acted as cost-share.

Web Presence and Monitoring

The external face of the AquaFish CRSP, as presented through their webpage, is polished and professional (see http://aquafishcrsp.oregonstate.edu/.) The website provides a range of information including technical and scientific reports, forward linkages to additional information, current news and announcements and programmatic documents. The design is crisp and up-to-date and should be used as seen as a model for other CRSP websites.

Nevertheless, the visibility, reputation and achievement of the AquaFish CRSP is not well disseminated beyond the CRSP community, US PI's and HC PI's and perhaps a few additional satellite target groups. There are exciting research and outreach activities that are of interest to the broader aquaculture community. This lack of exposure within the domestic US aquaculture community and possibly in HC beyond the CRSP participants does suggest an opportunity for the CRSP to expand communication efforts going forward. Targeted outreach through information hubs such as the USDA NIFA managed Aquacontacts distribution, and NOAA Aquaculture Newsletter are two potential outlets. According to the MT, "AquaFish CRSP has broad international exposure and dissemination of achievements through a variety of electronic outlets, including listservs hosted by SARNISSA and IIFET, ACDI/VOCA, and others, as well as social media linkages through Facebook. Both international and domestic electronic distribution of material also occurs independently though partner institution outlets or other nodes (such as links through ISTA's website, SARNISSA's website, and podcast links through NCSU). Our website serves as an effective outreach and exposure tool. Over 100 non-CRSP websites link to it." A key element of future outreach efforts should be pointed evaluation of what/who the AquaFish CRSP community encompasses and how to target communication. Our evaluation team felt that there is a potential to continue to broaden the community, including additional university programs, public programs and private sector interests, too. This broader exposure may lead to broadening the stakeholder/support base for the project, increase the pool of talented science and development experts on which the CRSP draws and heighten the visibility and impact of successful projects.

The management team provided a copy of website traffic from Google Analytics from May 2010 to April 2012. The site was visited 24,655 times by 10,255 unique viewers. About 12,500 visits were from users looking for the site or redirects from the PDA CRSP website. 7,239 visits were from referrals from the Google search engine. A copy of the web traffic report is presented in Appendix 4.

In addition to these information sources, the website works as an interface between the MT and the project researchers accessible only though a password protected gateway. These web provides a very efficient method for the investigators to submit reports, check the status of missing documentation,

access more restricted project documentation, procedures manuals and other internal AquaFish CRSP documentation. What impressed the reviewers was the ease at which investigators could access the sites and provide the MT with the requisite documentation, the logical organization of the interface and its overall power to reduce administrative burden to both the MT and investigators. As mentioned above, this interface could be used as a model for other CRSP looking to streamline and reduce investigators' administrative time. Appendix 5 provides a screenshot of the interface for a specific project. This monitoring tool is effective and indicative of a thorough and comprehensive approach developed by the MT. This interface contributes to the monitoring of program activities. Overall, monitoring is excellent.

Communication

To expand the programs visibility, the Director implemented a targeted communications project "Telling the ACRSP and AquaFish Story" in 2009 with OSU's Extension and Experiment Station Communications. The MT has developed several communication pieces to explain AquaFish (and ACRSP) research and outreach activities to lay audiences using print and multimedia. The communication pieces were prepared to the highest level of quality and convey the program in a straightforward manner. These pieces have been distributed to global audiences using traditional story-placement strategies and they have also been on YouTube at a dedicated channel (http://www.youtube.com/user/aquafishcrsp?feature=results_main). Viewings of the videos placed on YouTube range in the hundreds with only one video indicated more than 1,000 views as of May 25, 2012. Taking advantage of such resources as this and focusing on developing outreach channels, both within HC's and within the US, as discussed above, would be an opportunity to reinforce and disseminate the good work and high quality communication pieces that have already been developed.

Even with this project, enhancing AquaFish CRSP's visibility should continue to be a focus going forward. There are exciting research and outreach activities that are of interest to the broader aquaculture community. Leaders of the aquaculture community (who happen to be on this review) do not see the AquaFish CRSP's profile in U.S. based aquaculture networks. Maybe to reach this user group, the project ought to investigate joining listservs, blogs or other networks to publicize AquaFish CRSP. This could also act to broaden interest in future RFPs. In addition, it appeared that private industry in the US was a limited partner of AquaFish CRSP, either in an advisory role, consultative or as a valued consumer of AquaFish CRSP information.

Appendix 1. Statement of Work for the External Evaluation

SCOPE OF WORK

External Evaluation of the Aquaculture & Fisheries CRSP

Award Number: EPP-A-00-06-00012-00

Purpose

The purpose of this evaluation of the Aquaculture & Fisheries Collaborative Research Support Program (AquaFish CRSP) is to assess program performance, to identify program successes and areas of concern, to provide recommendations to help program implementers improve program effectiveness, and to inform the U.S. Agency for International Development (USAID) on future programming and support of the AquaFish CRSP. As the program has now been ongoing for five years, this evaluation will serve to inform USAID on whether to extend the AquaFish CRSP as it currently exists, to suggest significant modifications to the program, or to not continue funding.

Background

The AquaFish CRSP Cooperative Agreement was awarded on September 30, 2006 to Oregon State University which serves as the Management Entity (ME). The AquaFish CRSP is one of the ten current CRSPs that are supported by USAID's Bureau for Food Security. The CRSPs are U.S. university-implemented agricultural research, training and capacity building programs that support USAID's development goals and objectives.

The AquaFish CRSP is developing more comprehensive, sustainable, ecologically and socially compatible, and economically viable aquaculture systems and innovative capture fisheries management systems that contribute to poverty alleviation and food security in developing countries through integrated research, training, outreach and capacity building activities. The CRSP was designed to improve livelihoods and promote health by cultivating international multidisciplinary partnerships that advance science, research, education, and outreach in aquatic resources by bringing together resources from U.S. and Host Country institutions. The CRSP strives to strengthen the capacities of participating institutions, to increase the efficiency of aquaculture and improve fisheries management in environmentally and socially acceptable ways, and to disseminate research results to a broad audience. The AquaFish CRSP aims to create and nurture strong global partnerships that develop sustainable solutions in aquaculture

and fisheries for improving health, building wealth, conserving natural environments for future generations and strengthening poorer societies' abilities to responsibly self-govern. These goals are accomplished through a global integrated, multidisciplinary, cross-cutting research and outreach program that increases aquaculture productivity, enhances environmental stewardship, supports women through gender integration, prevents the further degradation of aquatic ecosystems, and increases domestic and export market opportunities, thereby increasing food security, economic well-being, and standards of living for citizens in participating host countries.

To implement the program, Oregon State University has worked with 16 other US universities (Auburn, Connecticut at Avery Point, Michigan, North Carolina State, Hawaii at Hilo, Arizona, Purdue, Ohio State, Arkansas at Pine Bluff, Louisiana State, Texas Tech, Virginia Tech, Rhode Island, Georgia and Alabama A & M, and Montana) as well as 29 partners in 17 host counties.

AquaFish CRSP projects that have been implemented during the past five years include:

- Improved cost effectiveness and sustainability of aquaculture in the Philippines and Indonesia;
- Developing sustainable aquaculture for coastal and tilapia systems in the Americas (Guyana and Mexico);
- Improving sustainability and reducing environmental impacts of aquaculture systems in China, and South and Southeast Asia (China, Nepal, Bangladesh and Vietnam);
- Human health and aquaculture: Health benefits through aquaculture sanitation and best management practices (Nicaragua and Mexico);
- Development of alternatives to the use of freshwater low value fish for aquaculture in the Lower Mekong Basin of Cambodia and Vietnam;
- Improving competitiveness of African aquaculture through capacity building, improved technology, and management of supply chain and natural resources (Ghana, Kenya and Tanzania);
- Hydrology, Water Harvesting, and Watershed Management for Food Security, Income and Health: Small Impoundments for Aquaculture and Other Community Uses (Uganda and South Africa).

Additional details can be found at http://aquafishcrsp.oregonstate.edu).

Scope of Work

The CRSPs operate under initial five-year cooperative agreements. It is recognized that some research programs need more than five years to achieve the full scope of the potential from research efforts, and USAID and target beneficiaries will benefit more fully from continuation of programs where specialize technical expertise has been developed. Good performance during the first five-year period and continued relevance of the CRSP to the overall Agency portfolio and development priorities, and the availability of funds are necessary for considering a justification for a program extension. In particular, this means that the CRSP should also fit well with the Feed the Future (FtF) research agenda.

This evaluation will provide USAID and the ME with constructive feedback on the past performance and management of the AquaFish CRSP, but more importantly review plans for future endeavors and make recommendations regarding a possible five-year extension of the CRSP including a prioritization of activities that should be implemented during an extension or suggest significant modifications to the program, or not continue funding.

The evaluation will focus on progress the AquaFish CRSP is making towards achieving its stated research and development results. It will also consider how the CRSP is currently aligned with FtF, as well as consider research goals going forward for improved alignment with FtF. The evaluation will be completed by a small team of multi-disciplinary experts over the next three months. This External Evaluation Team (EET) will be composed of individuals who are specialists in areas relevant to the CRSP, but who are not affiliated with the program and do not have a conflict of interest. The ME will review this scope of work and the proposed candidates prior to the evaluation.

The planned evaluation will assess the CRSP's performance through review of project documents, a visit to the ME, and correspondence/communication with participants and stakeholders. The EET will gather findings and produce conclusions and recommendations to USAID based on the CRSP's progress up to the time of the evaluation. The EET will also recommend adjustments in implementation and research goals, if necessary, and ways in which the ME can better guide its partners to reach project objectives.

Areas of Evaluation: The EET will evaluate the CRSP in the following areas by responding to the questions below.

I. Technical Review

A. Technical Leadership

1. What are examples of technical leadership displayed by the ME?
2. What are examples of technical leadership displayed by the individual project Principle Investigators (PIs)?
3. How can the AquaFish CRSP be better aligned with FtF going forward? What suggestions do you have for aligning the AquaFish CRSP's goals and objectives, and projects with FtF? What suggestions do the ME and current PIs have?
4. If the AquaFish CRSP is extended for four years, versus five years, what effect will his have on capacity building, particularly the long-term degree training prospects for the program?
5. How has he CRSP cultivated a pipeline of students for long-term degree training opportunities? Have PIs and/or the ME been successful in cultivating/selecting the right students? What else, if anything, could be done to ensure that the long-term training is targeting the right individuals/institution?
6. How and with what results has gender been taken into consideration in research design, training and outreach strategies at the research activity level?
7. How does the ME facilitate engagement of the research activities or themes to other development programs in regions where the CRSP is active?

8. How well has the ME facilitated the participation of new partners? Give examples of how program RFAs are designed and how opportunities are advertised and made available for new PIs.
9. Are the levels of effort, award size and research project duration sufficiently balanced to allow the CRSP to achieve program goals and objectives?
10. What have been the significant accomplishments in terms of research, outreach, and dissemination?
11. How has the ME built on earlier investments?
12. What can be done to capitalize on these - to broaden or accelerate progress?
13. How does the ME continue to be forward thinking about research ideas and plans associated with the CRSP?

B. Research activities
1. Please describe whether the depth, breadth, and rigor of the research and development activities have been sufficient to allow the CRSP to achieve its stated goals and objectives.
2. In what ways are the research activities strategically sequenced to ensure targeted development outcomes with in a known period?
3. How relevant are the research activities to USAID's current FtF research strategy (see alignment document)? Are the Missions or other operating units (i.e., other Washington-based offices) aware of and have they sought to access the CRSP's technical, training and outreach expertise? Give examples.
4. Which projects are likely to make the most progress towards fruition if another five years is granted? Are they scalable for greater impact?
5. Do the results achieved to date and the expected outputs justify greater emphasis (effort and investment) on outreach and scaling-up for impact if another five year renewal is granted? Why or why not?
6. If another five years is granted, how should the program focus its efforts to achieve a greater level of effort or extend farther towards impact? Should there be a focus on fewer high performing activities? Should there be a different mix of activities along the research continuum? Which ones need to be refocused or discontinued? Among the projects making significant progress, which ones are scalable for a greater impact?

C. Program Focus
1. In general, comment on the depth versus breadth of the program.
2. What are the synergies across research activities that warrant the number of research activities in the portfolio? Have the activities been of sufficient depth to make an impact on the state-of-the-art or to apply existing knowledge to real life problems? Give examples.
3. Please comment on the quality and depth of the research and the relevance of the work to provide solutions to aquaculture and fisheries development problems? How could the major themes or topics be refined to increase impact?
4. How well has the ME balanced the research and implementation activities given the amount of funding provided? Please provide some direction or focus on how much emphasis should occur within the AquaFish CRSP portfolio on basic research, applied research, and implementation.
5. How does the AquaFish CRSP respond to Title XII's objectives?

D. Collaboration, capacity building and outreach
    1. What are some examples of partnerships and collaboration between host country and the U.S. PIs? How have they been effective at building the capacity of local researchers, policy makers and practitioners?
    2. Compared to the research activities of the CRSP, what has been the level of effort and investment in training and institutional capacity building? Has it been effective? How can impact of capacity building be captured (and measured) more effectively?
    3. What outreach strategies have been integrated into project design to increase likelihood of uptake and utilization of research results? What have been the most effective strategies for outreach at the country level?
    4. What have been the outreach efforts at the regional or "global" level?
    5. How has the ME communicated its activities to the global community through:
        a. Hosted events, peer-reviewed journals and published work?
        b. USAID Missions and other operating units?
        c. Other donors and partners such as the World Bank, IFC, IFAD/FAO, other bilateral development agencies, etc. How might the management entity better capture "impact" of their efforts at this level?

II. Administrative Review

A. What have been the roles/functions of the advisory committees and the administrative leadership? How cost effective has each been? Could they be more efficient? How?

B. What has been the substantial involvement and contribution of the USAID AOR?

C. What was the process for sub-award selection? How effectively did the process yield a high quality, relevant portfolio of activities? How consistent was it with the requirements of the cooperative agreement?

D. Program Management:
    1. What have been the challenges for the ME and how have they responded?
    2. How has the ME promoted and maximized values such as collaboration, capacity building, and outreach among sub-awardees?
    3. How have activities been reviewed?
    4. What systems are in place to keep research activity on track according to the CRSP's goals?
    5. In general, what has been the management style of the ME regarding PIs and sub-awardees? How could it be improved?
    6. How have management problems been addressed?

E. Financial Management:
    1. Have there been any problems regarding financial issues as perceived by CRSP participants at various levels (ME, Principle Investigator, Researchers, & in-country Collaborators)? How have problems been resolved?
    2. Have vouchers been processed in a timely way so as to minimize pipeline issues or payment lags?

F. Monitoring and Evaluation (M&E):
    1. What types of M&E have been undertaken by the ME?

2. Are the indicators used effective at capturing and communicating the outcomes and impacts of research activities? Are there appropriate indicators for the stage in the "research continuum"?
3. Have baselines, if necessary, been established? When?
4. Are data collected valid and of proper quality for reporting?
5. Have indicators capturing impacts and outcomes on higher levels been developed?

Evaluation Methodology: The evaluation will be based on a review of project documents, meetings, interviews and attendance at a CRSP meeting, if there is one planned during the evaluation period. The EET members will interact with the ME, program leaders and host-country stakeholders, as well as other relevant regional or global development and research communities. The evaluation will consist of the following steps:

A. The EET will schedule an internal team planning meeting (face-to-face or via phone) with the USAID Agreement Officer's Representative (AOR) and other USAID staff as needed. In this meeting and in a desk review the evaluators will ascertain the relevance of all the individual projects to the overall objectives of the CRSP. Evaluators will be familiar with a number of documents before the meeting, including the CRSP agreement, program operations and other documents, annual reports; original research activity proposals and work plans for Years 1-5. All of these, as well as other CRSP documents will be provided by the CRSP ME, and will constitute materials necessary for the Desktop Review. During this phase, the EET will review documentation relevant to the Areas of Evaluation, may conduct phone interviews with the ME, Principle Investigators and other stakeholders. The purpose of the Desktop Review is to provide background and determine the necessary and reasonable travel, site visits and in-person and virtual interviews required to properly execute the evaluation.
B. The EET will then discuss with the AOR an Evaluation Work Plan outlining the necessary interviews, travel to visit the ME and U.S. universities, and to attend a CRSP meeting, if there is one planned during the evaluation period, and time required to successfully complete the evaluation. If needed, a visit to one or more host countries may also be scheduled.
C. Conduct the evaluation.
D. Upon completion of the evaluation, the EET will submit a draft evaluation report to the AOR. The report should include recommendations for enhancing the performance and impact of the CRSP. It shall also make recommendation regarding a possible five-year extension of the CRSP as follows:
    a. Refinement of program themes or topics covered by the CRSP;
    b. Number and depth of activities in the CRSP's portfolio;
    c. Type of activities relative to the research and development continuum;
    d. Improving/expanding impact;
    e. Major organizational or procedural changes.

Evaluation Report: The EET will submit its draft report on or about June 1, 2012 after the field work is completed. This report will address the specific items mentioned in this SOW and any other relevant issues the EET feels should be addressed. The draft will be submitted electronically in MS Word format

to the CRSP AOR. USAID will share the draft with the ME for comments and to correct any erroneous or inaccurate information. USAID will then return comments and suggestions for consideration to the EET by June 15. The final revised report should be submitted to USAID no later than June 30. All comments should be sufficiently addressed. The report should be submitted in MS Word format to the USAID CRSP AOR An oral presentation (face-to-face or via phone) of the team's findings and recommendations will also be made to USAID and the ME. The following is a suggested outline for the report:

I Title Page
II Table of contents
III List of Acronyms
IV List of Tables
V List of Figures
VI Executive Summary
VII Findings and conclusions
    A. Responses to each item in the SOW
VIII Recommendations
IX Appendices
    A. Statement of work
    B. Itinerary
    C. List of Persons Contacted
    D. List of Materials reviewed

Level of Effort and Time Frame: The level of effort for the entirety of this scope of work will consist of no more than 30 person days for the Team Leader and up to 20 days for the other EET members over a period from on/about April 1 to June 30, 2012. The USAID Agreement Officer's Representative (AOR) will be available to the team as a resource person but will not contribute directly to preparation of the report.

Team Composition and Qualifications

The technical areas of focus of the CRSP require that expertise on the panel will be appropriate for the CRSP being evaluated. Team members must have the expertise necessary to evaluate the program and to address the evaluation questions. The team members must familiarize themselves with USAID's priorities and objectives in the economic growth sector, and particularly the USG Feed the Future research strategy. USAID will designate one team member as team leader.

Administrative/management review member (1): A senior administrator with a minimum of ten years experience managing multifaceted international development research and/or university-based programs. The preferred candidate will be familiar with both university-based programs and USAID (or other donor) funded programs. The Team Leader should a background agricultural/resources economics, aquaculture, fisheries, or rural development. The candidate would also have (1) demonstrated capacity to conduct program evaluation; (2) an understanding of USAID's foreign

assistance goals, and its particular objectives related to collaborative research, agricultural development and food security; and (3) the ability to analyze issues and formulate concrete recommendations orally and in writing.

Technical team members (3): Must be recognized experts on international development related to agriculture and/or rural development with expertise in the focus area of the AquaFish CRSP. Team members will be chosen from those who have experience in such areas as aquaculture, fisheries, animal sciences, and/or agricultural/resource economics. Technical team member candidates will also have demonstrated (1) capacity to conduct program evaluation; (2) thorough understanding of research methodology; (3) experience in effectively conducting outreach and dissemination to policymakers, development practitioners and/or the private sector; (4) the ability to analyze issues and formulate concrete recommendations orally and in writing. At least one team member should be familiar with gender issues in aquaculture and fisheries.

3/21/12

Appendix 2. Itineraries

All Evaluation Team Members-Portland, OR and Corvalis, OR 22-26 April 2012

USAID External Review Team Meeting, Portland Meetings

April 22, 2012

Team members travel to Portland, OR

April 23, 2012

8:00AM Team members meet for discussion

1:00PM-3:30PM Meet with AquaFish PI's and ME

3:30PM-6:30PM Meet with individual PIs

April 24, 2012

8:00AM-1:00PM Meet with individual PIs

PM- Travel to Corvalis, OR

USAID External Review Team Meeting, OSU Site Visit

Wed 25 April 2012

815a: Team meets Hillary Egna at Java Café, Library

830 - 945a: Extension and Experiment Station Communications

422 Kerr Admin

Peg Herring, Unit Head, EESC

Tiffany Woods, Science Writer

950-1045a: VP Research Office

Kerr Admin A312 (tower portion of the building just before the Graduate School offices)

Rich Holdren, Associate Vice President for Research

Pat Hawk, Director, Office of Sponsored Programs

11a-12p: CAS (College of Agricultural Sciences)

Strand 134 (first floor, south side of bldg)

Larry Curtis, CAS Associate Dean

1215p Lunch with Hillary Egna and Management Team

130-630p Meeting with Hillary Egna and Management Team, Strand Ag Hall

Depart for Portland

Revathi Balakrishnan Visit to the Philippines May 18-25

May 18-19 –Travel to the Philippines

May 20 (Sunday) – Met by Mr. Eddie Boy Jaminez Technology Transfer specialist, CFA and Dr. Bing Ayson SEAFDEC CRSP Investigator Preliminary discussion on CRSP linkage and focus in the PHLP. Purpose of reviewer visit in the context of CRSP USAID focus on CRSP purpose and impact during travel

May 21 (Monday AM) – Meetings with Dr. Remedios B. Bolivar and Dr. Bing Ayson at the CLSU-CFA ; Mr. Tereso A. Abella, Ph.D. Director, Freshwater Aquaculture Centre; Mr. Ruben C. Sevilleja, Ph.D. the President of the University and the CRSP scholars met were: Revelina Velasco, Roberto Miguel Sayco, Jamaica Mendoza, Sherwin Celestino, and Agnelee Romero.

Tour of facilities of institutions ons who are partners with AquaFish CRSP –CLSU and meeting the staff: National Freshwater Fisheries Technology Center, Bureau of Fisheries and Aquatic Resources, DOA -Ms. Jude Danting and Ms. Evelyn H. Zafra and GIFT project - Genetically Improved Farmed Tilapia, (-Mr. Ruben A Reyes, Feedmix Specialist II .

PM : Continued discussions with Dr. Bolivar and Dr. Ayson.

Visit to Aquaculture farm near CLSU in Munoz and discussions with farmer about his practices and economic returns on the enterprise

Tour of the CLSU campus facilities

May 22 (Tuesday) – Travel with Dr. Bing Ayson**,** Mr. Eddie Boy Jaminez Technology Transfer and CLSU graduate student. Discussions in travel with Dr. Bing. Breakfast stop at SAN Fernando; Visit to farms: 2 contract farmers in aquaculture and one commercial aquaculture farm

May 23 (Wednesday) – CLSU meetings with Dr. Bolivar and Dr. Ayson. Seeing departure of Dr. Bing Ayson in Domestic airport. Departure related tasks.

May 24—Return to the U.S.

Jeff Silverstein Visit to Kenya May 19-25

Day 1 (May 21) Nairobi and depart for Kisumu, visit farms

Day 2 (May 22) Arrive Kisumu and visit fingerling producers

Day 3 (May 23)to Eldoret visit tilapia producers, teaching facilities, Moi University

Day 4 (May 24) visit farms, back to Nairobi depart for U.S.

Appendix 3. Host Country Collaborator Survey Responses (copied from Adobe PDF response file)

Summary
Survey Name:
AquaFish CRSP Collaboration
Offering Name:
Collaborators 1
Offering Date:
5/3/12 to 5/19/12
Statistics
Started: **17** out of **24**
Opted out before starting: **0**
Completed: **17**
Drop outs after starting: **0**
Average completion times:
Average Time To Complete Survey: **1 day 50 minutes 26 seconds.**
Average Time Spent Before Quitting: **Not enough information.**

Question 1
Have you engaged in a collaborative research/development activity with a AquaFish CRSP collaborator during the current project (either Phase I or Phase II between 2007 to the present)? If no, you will directed to the closing page of the survey.

- Yes: 17 (100%)
- No: 0 (0%)
- N/R: 0 (0%)

Question 2
Which geographical area of the world are you located?

- Eastern & Southern Africa: 3 (17.65%)
- West Africa: 1 (5.88%)
- Central America & Caribbean: 2 (11.76%)
- South America: 1 (5.88%)
- South Asia: 1 (5.88%)
- Southeast Asia: 8 (47.06%)
- Other: 1 (5.88%)
- N/R 0 (0%)

Question 3
Please tell us your scientific or development area of expertise.

- Production science (e.g., breeding, physiology, feeds, aquaculture systems, pond dynamics, etc.): 14 (82.35%)
- Social science (agricultural economics, sociology, gender, etc): 1 (5.88%)
- Post harvest (storage etc.): 0 (0%)
- Food science (nutrition, food safety, new product development): 0 (0%)
- Human health: 1 (5.88%)
- Technology transfer (extension): 0 (0%)
- Other: 1 (5.88%)
- N/R: 0 (0%)

Question 4

4.1 How important is seafood (fish, shellfish, crustacean) consumption in your local diet?

- Not very important: 0 (0%)
- Somewhat, but below average: 0 (0%)
- Average: 2 (11.76%)
- Important: 8 (47.06%)
- Very important: 7 (41.18%)
- N/R: 0 (0%)

4.2 How important is aquaculture production in your country?

- Not very important: 0 (0%)
- Somewhat, but below average: 0 (0%)
- Average: 3 (17.65%)
- Important: 3 (17.65%)
- Very important: 11 (64.71%)
- N/R: 0 (0%)

4.3 How important is aquaculture trade (with other neighboring countries) to your country?

- Not very important: 0 (0%)
- Somewhat, but below average: 2 (11.76%)
- Average: 1 (5.88%)
- Important: 8 (47.06%)
- Very important: 6 (35.29%)
- N/R: 0 (0%)

4.4 What is future outlook and importance for growth over the next 5 years?

- Not very important: 0 (0%)
- Somewhat, but below average: 0 (0%)
- Average: 0 (0%)
- Important: 6 (35.29%)
- Very important: 11 (64.71%)
- N/R: 0 (0%)

Question 5

5.1 How much of your work/research time do you allocate to aquaculture research, studies and activities on an annual basis(including the time you allocate to AquaFish activities)? If you study human health issues and not only aquaculture, you can substitute "health" for aquaculture. Please differentiate "research" from administration, teaching etc.

- Not important (<20%): 0 (0%)
- Somewhat important (21-40%): 2 (11.76%)
- Average (41-60%): 3 (17.65%)
- Important (61-80%): 10 (58.82%)
- Very important (81-100%): 2 (11.76%)
- N/R: 0 (0%)

5.2 About how much time do you allocate specifically to AquaFish experiments, studies or activities on an annual basis?

- Not important (<20%): 0 (0%)
- Somewhat important (21-40%): 6 (35.29%)
- Average (41-60%): 6 (35.29%)
- Important (61-80%): 4 (23.53%)
- Very important (81-100%): 1 (5.88%)
- N/R: 0 (0%)

5.3 How important is the financial contribution from AquaFish to your experiments, studies and activities? In other words, what percentage of your research budget is funded by AquaFish?

- Not important (<20%): 1 (5.88%)
- Somewhat important (21-40%): 3 (17.65%)
- Average (41-60%): 3 (17.65%)
- Important (61-80%): 3 (17.65%)
- Very important (81-100%): 7 (41.18%)
- N/R: 0 (0%)

Question 6

Have gender integration strategies added value to AquaFish program development and implementation (Ex. research findings, technology adoption, human consumption etc.)?

- Yes: 16 (94.12%)
- No: 1 (5.88%)
- N/R: 0 (0%)

Question 7

Please add any comments you might have on gender integration.

- We always consider gender integration interventions in our AquaFish CRSP program; e.g. thesis research students; researchers' activities; fish farmers, fishers and fish processing activities; trainings.
- We have select students participating in AquaFish program based on female/male balance 50/50.
- Gender integration is one of the most important aspects of AquaFish CRSP, emphasized in all its research and development activities.
- Ministry of Fisheries Development policy recognizes importance of development of Fish Farmers Clusters and role of youth and women in aquaculture. Women are active in Value chain and fish trade.
- In Central America there is little involvement of women in aquacultural activities; however, the role of women in aquaculture is increasing, in our projects we insist on participation of women.
- Since culture is dominated by men, women have been trained in proper feeding management, as well as value addition and post harvest methodologies.
- We make it a point that women have key roles in the research. In our student support, we involved greater number of women.
- In my activity, to increase pond production, benefit option of farmers, that potencial to including the participation of women (Harvesting, Handling process and culture because it is easy for women and men to work together.
- Female co-workers assisted much with data capturing and creating order in research methodology and systematics.
- Generally, female students and scientists outreached male counterparts in many aspects such as experiment design, writing and active response on tasks once they got chance to perform.
- Involvement of female student in research and women participants in farmers field experiments.
- Gender integration has facilitated our research efforts involving women who are mainly involved in processing of aquaculture and in the marketing and economics of aquaculture products.

- In all our projects have participated in a balanced way either men or women

Question 8
Is there a specific allocation of funds for gender integration interventions in your AquaFish CRSP program?

- Yes: 8 (47.06%)
- No: 8 (47.06%)
- N/R: 1 (5.88%)

Question 9
Please add any comments to the question on budget allocation and gender activities.

- At least 20-30% of the total budget.
- Part of the budget is dedicated towards training which targets women who are establishing aquaculture farms in their communities as a source of income. They're provided with technical/practical advice
- Needed, but a rigid pre-set division of the fund specifically for a research or development activity may not always be necessary, unless the activity aims to deal with gender issues.
- A training workshop conducted in Kenya as part of the project from Oct 2009 to Sep 2011. The workshop and value chain intervention strategies were under investigation one with a stand alone
- We focus primarily in the inclusion of women in training and research.
- The project has funds allocated for workshops for both men and women (on updates in culture technologies) as well as workshops for women on value addition and post-harvest methodologies.
- Gender integration had become part and parcel of doing the experiments
- Training for women on the handling of seaweed for making candy, cake, dessert and some cooking product.
- I propose it should be ring-fenced and specific-driven in project terms of reference and outputs.
- 50% of funds for students are aimed at women students; and about half the budget overall involves women. Continuous funding support on women students attracted excellent candidates.
- No specific budget allocations are made for gender integration but we have operated largely with gender sensitivity in mind and providing funding where appropriate and necessary.
- No, there isn't any allocation of funds to that purpose.

Question 10
Do you undertake formal impact assessment of the field interventions in AquaFish CRSP?

- Yes: 9 (52.94%)
- No: 7 (41.18%)
- N/R: 1 (5.88%)

Question 11
Please add any comments on impact assessment activities undertaken.

- We have implemented the activity entitled "Assessing the impacts of sustainable freshwater aquaculture development and small-sized fisheries management in the Lower Mekong basin".
- Assessment on bait fish production for better Management of Lake Victoria and Development impacts of long term aquaculture training programme in Kenya
- A separate group has been commissioned to do the impact assessment. However, host country collaborators attended a workshop on impact assessment and should have some knowledge to do self asessment
- Through the initiative of a principal investigator, we did an impact assessment study on the use of
- feeds by tilapia farmers in a major tilapia producing region in the country
- 1. positive environment impact of water quality for shrimp culture 2. implementing how women used the seaweed for making cake variation.
- It should be incorporated pre-project planning and implementation.

- Honestly, impact assessment since 2010 was not a success, because of lack of economists' understanding on aquaculture field research and practices, and on primary data collection
- Production improvement by technology and awareness by partcipating fish farmers,
- No formal impact assessments of activities have been undertaken but we have considerable capacity building of farmers, extensionists, researchers and gender through various AquaFish training program
- Yes, We've done impact evaluations
-

Question 12

How effective has the integration of an outreach component to research projects been to reach, educate and improve production practices of farmers?

- Very effective: 8 (47.06%)
- Moderately effective: 7 (41.18%)
- Somewhat effective: 2 (11.76%)
- Not effective at all: 0 (0%)
- N/R: 0 (0%)

Question 13

How would you describe your input into setting the research objectives, hypotheses and development goals of your project?

- Poor, minimal input: 0 (0%)
- Weak, below average but positive: 0 (0%)
- Average, we shared equally setting the objectives: 8 (47.06%)
- Good, I provided more input into setting the objectives: 4 (23.53%)
- Excellent, I led setting the objectives: 4 (23.53%)
- N/R: 1 (5.88%)

Please add any comments you might have on setting the research objectives, hypotheses and development goals of your project.

Research objectives and proposals were once output of workshops and final proposals and research goals were prioritized from the participants' votes

We discuss with our colleagues the objectives and goals that I consider are priority for the region, providing information for the decision making process.

It is excellent that I could set up the objectives of our projects because the project objectives will contribute to achieve the objectives of our research institute in the country as well as in the region.

We always have a very interactive, demand-driven and participatory approach to setting our research prioroties and agenda. We collaborate with our counterparts also in the USA and try to set achievable and workable objectives in a development-oriented context. We have always strived to circulate and refine our research to answer specific problems. Being in Ghana places me in a position to validate the assumptions underlying our hypothesis with stakeholders.

All time i set research objectives and write research project then other partner review them.

We try to share equally all the settings

I have been the HC PI who generates research objectives based on the priorities of our country

Exchange of ideas (mostly through email) was the hallmark of the development of the concept and writing of the proposal for this project.

Still needed share objectives of the project to make useful for the farmers.

Question 14

How would you describe your input into setting the research methods used to reach your research objectives and /or test your hypotheses?

- Poor, minimal input on methods: 0 (0%)
- Weak, below average but positive: 0 (0%)
- Average, we shared equally setting the methods: 7 (41.18%)
- Good, I provided more input into setting the methods: 4 (23.53%)
- Excellent, I led setting the methods: 5 (29.41%)
- N/R: 1 (5.88%)

Please add any comments you might have about role in setting the research methods used to reach your research objectives and /or test your hypotheses.

- We discussed research objectives and methods with US lead PI and host country PI, based on field visits and consultation with local experts
- I always involve in setting up the research methods as this is a very important activity to achieve the research objectives. I always discuss with researchers and research assistants who involve in the projects to set up the research methods.
- These result from a shared and participatory approach which is demand-driven by our stakeholders. My input is derived from direct interactions with stakeholders and we share these with our collaborators and these are refined along the line to meet all requirements.
- We've always tried to accomplish our objectives
- After setting research hypotheses and objectives, I take lead in methodology based on
- available resources and expected adoption of technologies
- Decisions on the research methodologies to use in the conduct of the research as well as strategies to adopt in the outreach activities were reached through exchange of ideas.
- Sure, the method is very dependent on field situation combine with some references.

Question 15

Please describe your role in writing AquaFish research publications/reports. Reports include annual reports, research reports, working papers, conference papers, book chapters and manuscripts.

- I initiate and lead writing research publications/ reports on AquaFish activities: 2 (11.76%)
- I share writing research publications/reports equally with the PI and others on AquaFish activities: 8 (47.06%)
- I contribute to writing research publications/reports on AquaFish activities: 6 (35.29%)
- I do not contribute to writing research publications/reports on AquaFish activities: 0 (0%)
- Other: 0 (0%)
- N/R: 1 (5.88%)

Question 16

If you have any ideas to share on how could your research and development collaboration could be improved, please describe in the space below. Please do not include financial or administrative issues as these will be discussed in the next section.

- I am very happy with the current AquaFish CRSP management. The collaboration mechanisms have been effective and very successful. In the future South-South collaboration may be promoted.
- I believe that the strategies we have implemented are very efficient.
- Sharing and communicating research knowledge, information, human capacity among research partners could improve research and development collaboration.
- Research and development could be improved through greater involvement of women in aquaculture research and production. Females involved in aquaculture research remain fairly restricted.
- Improved methods of disseminating technologies developed by AquaFish will be key to adoption
- Perhaps more exchange visits?

Question 17

Relative to the project objectives, is AquaFish financing sufficient to meet the project objectives?

- Insufficient to meet objectives (<20%): 0 (0%)
- It somewhat covers the cost (21-40%): 0 (0%)
- It covers around half of research costs (41-60%): 2 (11.76%)
- It nearly covers the research cost (61-80%): 9 (52.94%)
- It fully covers research costs (81-100%): 6 (35.29%)
- N/R: 0 (0%)

Please add any comments you may:

- We collaborate with the using costs of the labs
- AquaFish financing requires a cost share of 50% and sometimes it barely just covers that and where needed we are able to leverage funds elsewhere to cover it.
- AquaFish CRSP financing is sufficient to meet the project objectives as we have set up the project objectives and budget.
- My institution cover other costs
- It nearly covers the research cost for the "AquaFish CRSP" activity. On Question 18: Essentially, I could not conduct research on the "AquaFish CRSP" topics without it. But AquaFish CRSP funds less than 20% of all my research activities.
- 1. AquaFish projects are usually engine of my internal projects, due to the excellent international network and interdisciplinary methods; 2.We have very good opportunity to apply for leveraging funds from some host countries based on AquaFish research outcomes; 3. some employees don't claim salary from the project since they are full time professors
- Based on RFP guidelines leverage funding does cover the 20% mainly from host countries
- It cover for fully activity, its not include salary or honorarium, this is enough and useful for farmers and research need only.

Question 18

How important is AquaFish funding to conducting your research/development activities?

- Essential, I could not conduct research on these topics without it: 7 (41.18%)
- Very important, it funds 61-80% of my research costs: 4 (23.53%)
- Important--it contributes around 41-60% of my research budget: 4 (23.53%)
- Somewhat important--it contributes around 21-40% of my research budget: 1 (5.88%)
- Not important, it funds less than 20% of my research activities: 1 (5.88%)
- Other: 0 (0%)
- N/R 0 (0%)

Question 19

How difficult is it to comply with financial reporting requirements implemented by the program to receive funds and/or reimbursements?

- Very difficult: 0 (0%)
- Difficult: 3 (17.65%)
- Similar to other projects: 6 (35.29%)
- Easier than most projects: 3 (17.65%)
- Not a problem at all: 5 (29.41%)
- N/R: 0 (0%)

Question 20

Overall, how would you rate the administrative requirements set up by the program to comply with USAID guidelines?

- The most burdensome of all projects I am involved with: 0 (0%)
- Much more burdensome than other projects: 3 (17.65%)
- About average relative to other projects: 7 (41.18%)
- Easier than most projects: 7 (41.18%)
- N/R: 0 (0%)

Question 21

Please add any additional comments that you would like to share regarding financial management of your project from the perspective of a host-country collaborator/investigator.

- When many investigators are involved in the research, the financial support for the investigators is reduced.
- The financial management of the project has been so convenient and excellent. It was not a problem at all.
- Operating within the university financial regulations, AquaFish funds are managed through the university Finance Office and under the financial regulations of Ghana.
- It take lots of time to prepare and approve the contacts, and to receive funds and reimbursements. Please simplify these processes/procedures.
- Financial management for AquaFish is relatively easy, doubts are easily clarified and inquiries solved promptly.
- Efficient, transparent, and easy to work with.
- My employer has adopted a good financial system, when fund reaches, the financial officer will break down the items according to proposal budget. Each item has its limitation thus you can't exceed
- Difficulties are with protocols in HC institutions. Reporting procedures have improved over the 15 years I have been a PI. Delay in receiving funds does however affect project implementation.
- The budgeting system is easier, and also reporting is clear. Because there is not budget line system that make difficult to revise if any changing in the field base on need requesting.

- End of Survey -

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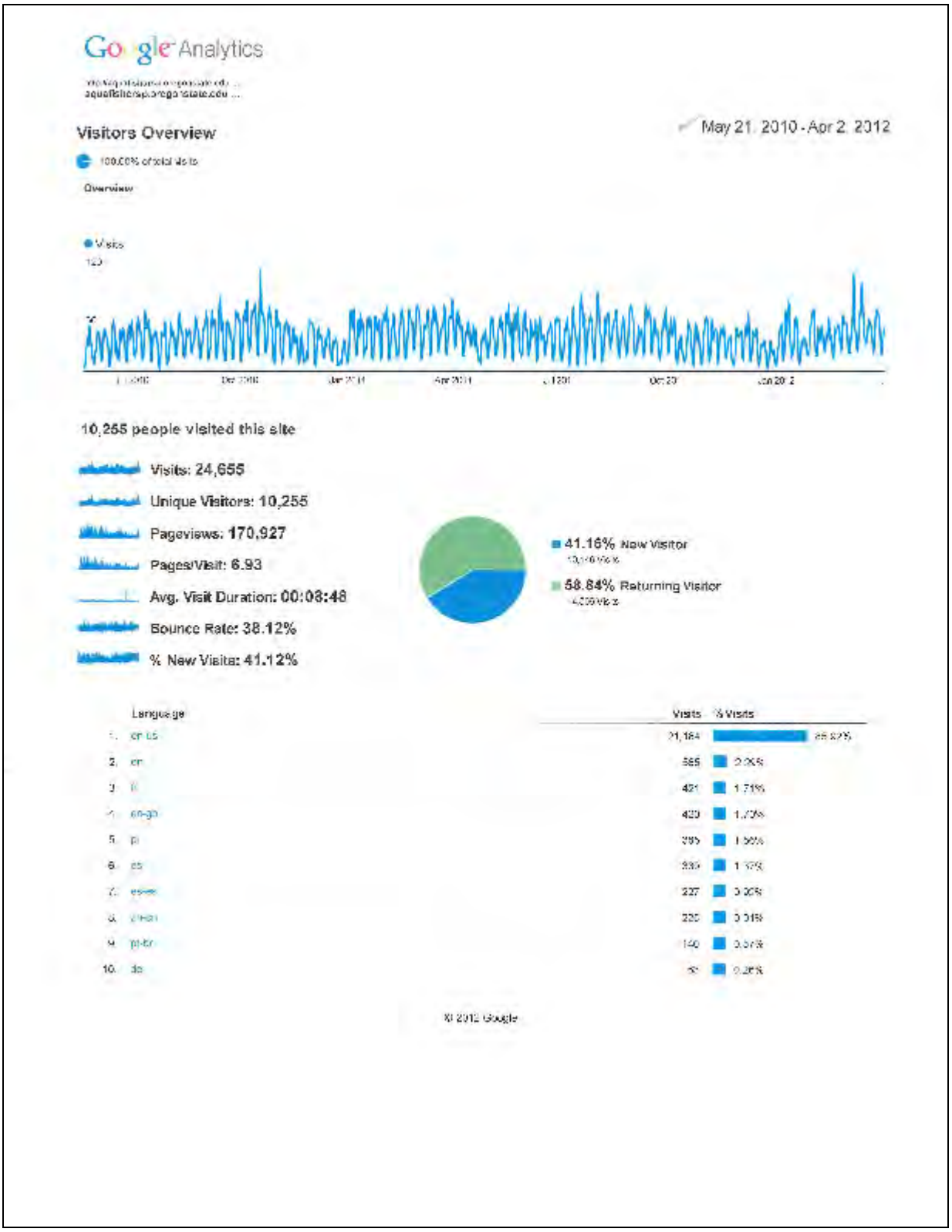
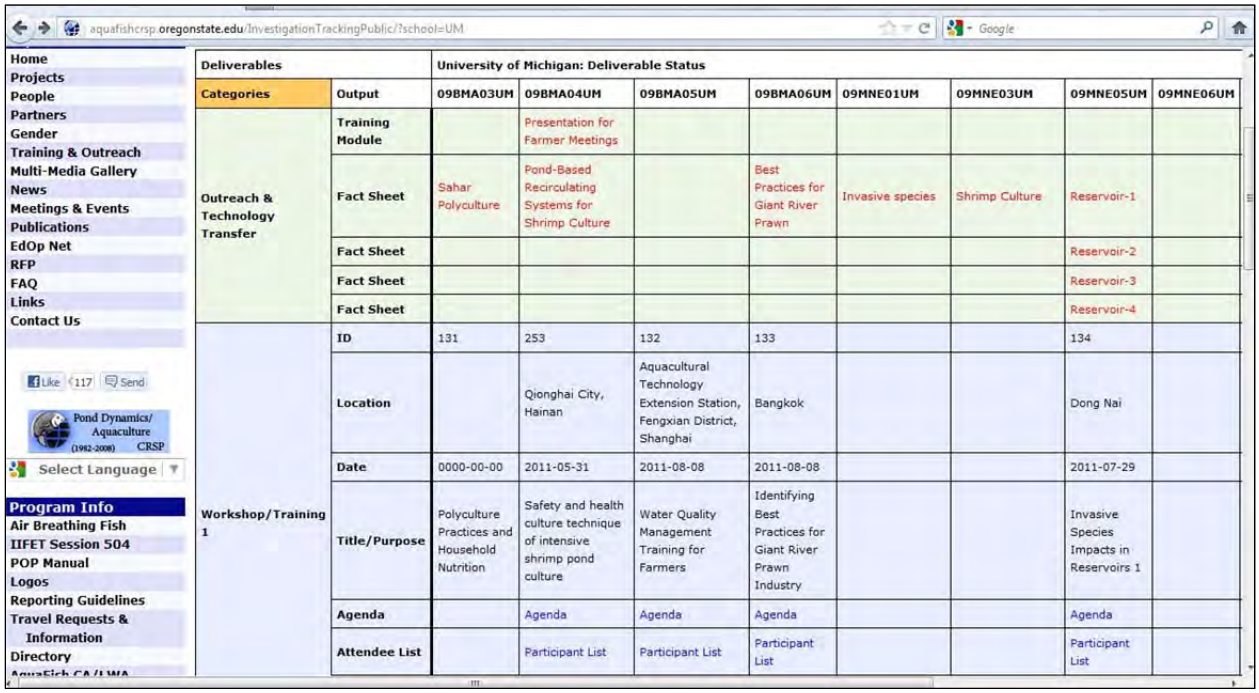
Appendix 4. Google analytics report from May 2010 to April 2012 (click to enter Adobe PDF file; also on file with AOR)



Appendix 5. Screen shots of the Investigator interface on the AquaFish CRSP website



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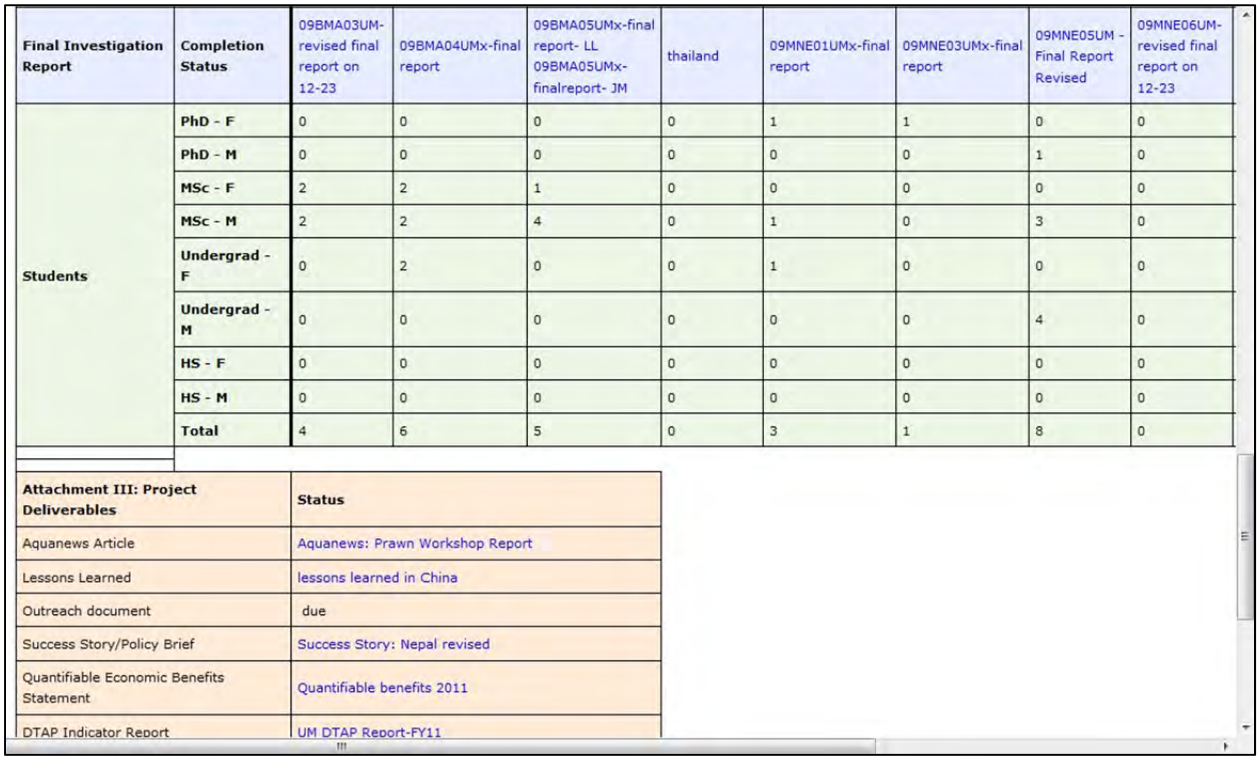
Pond Dynamics/ Aquaculture (1982-2008) CRSP

Select Language

Program Info
Air Breathing Fish
IIFET Session 504
POP Manual
Logos
Reporting Guidelines
Travel Requests & Information
Directory

Deliverables		University of Michigan: Deliverable Status							
Categories	Output	09BMA03UM	09BMA04UM	09BMA05UM	09BMA06UM	09MNE01UM	09MNE03UM	09MNE05UM	09MNE06UM
Outreach & Technology Transfer	Training Module		Presentation for Farmer Meetings						
	Fact Sheet	Sahar Polyculture	Pond-Based Recirculating Systems for Shrimp Culture		Best Practices for Giant River Prawn	Invasive species	Shrimp Culture	Reservoir-1	
	Fact Sheet							Reservoir-2	
	Fact Sheet							Reservoir-3	
	Fact Sheet							Reservoir-4	
Workshop/Training 1	ID	131	253	132	133			134	
	Location		Qionghai City, Hainan	Aquacultural Technology Extension Station, Fengxian District, Shanghai	Bangkok			Dong Nai	
	Date	0000-00-00	2011-05-31	2011-08-08	2011-08-08			2011-07-29	
	Title/Purpose	Polyculture Practices and Household Nutrition	Safety and health culture technique of intensive shrimp pond culture	Water Quality Management Training for Farmers	Identifying Best Practices for Giant River Prawn Industry			Invasive Species Impacts in Reservoirs 1	
	Agenda		Agenda	Agenda	Agenda			Agenda	
	Attendee List		Participant List	Participant List	Participant List			Participant List	

Figure 3. Screen shot for tracking page for investigations with hyperlinks to documents



Final Investigation Report	Completion Status	09BMA03UM-revised final report on 12-23	09BMA04UMx-final report	09BMA05UMx-final report- LL 09BMA05UMx-finalreport- JM	thailand	09MNE01UMx-final report	09MNE03UMx-final report	09MNE05UM - Final Report Revised	09MNE06UM-revised final report on 12-23
Students	PhD - F	0	0	0	0	1	1	0	0
	PhD - M	0	0	0	0	0	0	1	0
	MSc - F	2	2	1	0	0	0	0	0
	MSc - M	2	2	4	0	1	0	3	0
	Undergrad - F	0	2	0	0	1	0	0	0
	Undergrad - M	0	0	0	0	0	0	4	0
	HS - F	0	0	0	0	0	0	0	0
	HS - M	0	0	0	0	0	0	0	0
	Total	4	6	5	0	3	1	8	0

Attachment III: Project Deliverables	Status
Aquanews Article	Aquanews: Prawn Workshop Report
Lessons Learned	lessons learned in China
Outreach document	due
Success Story/Policy Brief	Success Story: Nepal revised
Quantifiable Economic Benefits Statement	Quantifiable benefits 2011
DTAP Indicator Report	UM DTAP Report-FY11

Figure 4. Screen shot of student tracking and ME deliverables

Appendix 6. Trip report to Philippines prepared by Revathi Balakrishnan

Report of AquacultureFish CRSP Evaluation Site Visit to the Philippines

Reviewer: Revathi Balakrishnan, AquaFish CRSP Evaluation Team Member
Travel Dates: May 19 to 24, 2012
Country: The Philippines

1.0. Purpose: The Philippines is one of the AquaFish CRSP partners in the current phase of CRSP (2007-2011 Work Plan) that is under review. Hence, a site visit was conducted to meet with program partners and review the field work supported by the AquaFish CRSP. The site visit was made to gain insights into the activities and collaborative network to achieve the CRSP mission from the host country investigators and institutional partners.

2.0. Program: The visit was made to the Central Luzon State University at Munoz, Nueva Ecija and the various partner institutions in the proximity that support AquaFish CRSP activities and aquaculture culture farmers who participate in the CRSP activities. The primary contacts for the review were the Philippines PIs namely, Dr. Remedios B. Bolivar, Freshwater Aquaculture Center, CLSU and Evelyn Grace Ayson, from South East Asian Fisheries Development Center- Aquaculture Development (SEAFDEC AQD), Iloilo, Philippines, who travelled to CLSU to participate in the review. The reviewer also met Mr. Ruben C. Sevilleja, Ph.D. the President of the University, and Mr. Tereso A. Abella, Ph.D. Director, Freshwater Aquaculture Centre as well as a few graduates who were funded by AquaFish CRSP for their studies. The reviewer held discussions with partners in the CRSP network namely, National Freshwater Fisheries Technology Center, Bureau of Fisheries and Aquatic Resources, DOA (Ms. Jude Danting and Ms. Evelyn H. Zafra) and GIFT project - Genetically Improved Farmed Tilapia, (Mr. Ruben A Reyes, Feedmix Specialist II) . Visits were made to four tilapia farms; one in the vicinity of CLSU and three in Pampanga area and these are on-farm trial farmer-cooperators. Mr. Eddie Boy Jimenez (research associate) facilitated the visit to visit tilapia farms in Pampanga. The CRSP scholars met were: Revelina Velasco, Roberto Miguel Sayco, Jamaica Mendoza, Sherwin Celestino, and Agnelee Romero.

3.0. Major Findings:

This section presents the salient findings and the view of the HC institutional leaders and principal investigators in the host country.

3.1. AquaFish CRSP and HC Research:

- CRSP support has been a catalyst to undertake research in new areas to expand the knowledge of aquaculture in wide ranging topics from species, pond management, feed mix and feed management that had some direct benefit to farmers.
- CRSP support averages $ 8000/per PI and that is a reasonable amount to support research in the Philippines and thus is a valuable investment to encourage new areas of research –such as value chain analysis.

- The research support for feed management studies resulted in findings that encourage farmers to adopt different feeding routines and have shown economic benefits to the farmers to cut cost in production.
- Researchers funded by CRSP have published award winning research to support their careers while contributing to aquaculture knowledge base.
- The research in NCSU feed development has resulted in the feed formula being used by a private feed company SANTEH in the commercial feed preparation that is sold to the farmers. CLSU researchers now buy the feed from the private company.
- The CLSU institutional set up for AquaFish CRSP is such that its research facilitates flow of research findings between research and teaching. The CRSP is housed in the Freshwater Aquaculture Centre and is also linked to the College of Fisheries. Hence the research and teaching interactions facilitate use of CRSP research in teaching and involving students in research.
- AquaFish CRSP–CLSU also facilitates research by US scholars in an international site to expand knowledge base in aquaculture. It also provides a site for HC graduate student research such as the one done by Impact Assessment Project's CRSP supported student research (Steve Buccola's student research).
- CRSP partnership with SEAFDEC creates links in research and outreach initiatives in a regional institution that has a collaborative network of institutions in the South East Asian Region with a potential to open up opportunities for south-south collaboration.
- CRSP partnership with SEAFDEC is productive in both production and postharvest research, since the organization has the mandate to undertake research that benefits small farmers and women in fishing households.
- The PIs concern about using chicken waste for feeding the fish illustrates the relevance of cultural differences in aquaculture development. According to the Philippines PIs there is nothing of chicken that is wasted in the Philippines and thus the concept of using chicken waste is not a realistic in the Philippines.

3.2. AquaFish CRSP and HC Capacity Building:

- According to the CFA administrator, CRSP has contributed to faculty development through support for research.
- CRSP has supported university level education for the Filipino students both at graduate and undergraduate level. A few of the students are currently employed in the Freshwater Aquaculture Center at CLSU. One of the students has been a Borlaug scholar and is very positive about the support she received through AquaFish CRSP.
- At the initiative of CLSU PI Dr. Bolivar the CRSP support was provided to UG students on the rationale that the pipeline for graduate studies is possible only by training undergraduates.
- Though many students have been trained by CRSP there is no systematic follow up on the placement of students and thus their current contribution to aquaculture sector (academic,

industry, government, NGO or extension) is not quantifiable. The tradition of following up the alumni is not a common activity in CLSU.

- Generally, farmer centered extension is weak in the Philippines. AquaFish CRSP has supported extension activities in their fishery sector.
- The Philippines program records an impressive number of short term training of various groups supported by AquaFish CRSP (technical professionals, farmer's groups and extension professionals). Women's participation is rather high in these training programs. However there is no follow up on the trainees to document the use of training in field situation. One has to assume that trickle down of knowledge to practice is happening.

3.3. AquaFish CRSP and HC Technology Transfer:

- The GIFT (Genetically Improved Farmer's Tilapia) project is a partner in the AquaFish CRSP-NCSU-CLSU program in the Philippines. The GIFT project is funded by a seed company that provides loans for the farmers to buy fingerlings and feed. GIFT is the facilitator between the farmer and the seed company to arrange for the flow of funds and fingerlings to the farmers, and acts as an agent between the farmers and the seed company (BAF). AquaFish CRSP scientists collaborate with the GIFT project on feed trails and technology support.
- National Freshwater Fisheries Technology Center in the Bureau of Fisheries and Aquatic Resources (NFFTC) is a collaborator with AquaFish CRSP-CLSU. NFFTC supplies fingerlings to centers all across the Philippines for distribution to the farmers.
- Hence, quantifying the CRSP supported training/technology transfer outcome presents a challenge to the Philippines site since there are many institutions (both government and private sector) in the region that are involved in freshwater aquaculture research and outreach (fingerlings distribution, feed supply and loans for farmers and basic advisory services). Many private sector aquaculture farms are vertically integrated and employ contract farmers to produce tilapia. These Seed companies and commercial tilapia farms cosponsor the CLSU events that are also supported by AquaFish CRSP –CLSU.
- Among the farmers visited one was in Munoz, near the university was a student of the PI and has a successful aquaculture farming operation along with his wife who is a faculty member in CLSU. The wife also has a training program for women in fisheries. The link between the farmer (multiple pond owner and operator) and CLSU is through technology advice. He had also worked in the US in a Tilapia farm in California. Hence the farm could be a showcase farm with a relatively well qualified farm family. It takes him four to five years to recover the initial investment in pond construction and stocking. The sale is through a buyer who has transport to take live fish to the market.
- A farm in Pampanga was facing a loss since the tilapia stock was dying due to fungus infection in the water; and the accompanying CLSU research associate and the feed company representatives were advising them, but the dead tilapia stock had to be destroyed. The water from the main river feeds into ponds and thus infection from one pond can enter all the ponds on both sides of the river according to the accompanying PI from SEAFDEC.

- Another farm in Pampanga was a contract farm where the tilapia and shrimp fingerlings are grown together in a hatchery pond to be fed later into the growing pond. A single farmer with the family help manages the many ponds. He has adopted the variable feed management advised by CLSU. The ponds belong to an owner with means to buy land and build ponds. The farmer is employed and supervised by a manager. The farmer gets a salary and 10 % of catch and the manager gets 5% of the catch. The buying agents bring boats with equipment to take the live fish to the market.
- A fourth farm is a commercial large scale tilapia farm and the owner has his own hatchery. The ponds are fed with chickens waste (droppings) by building chicken coups over the pond and also use commercial feeds. They also use the commercial feed.
- The need for high capital investment to develop aquaculture farm as a productive farm enterprise, and finding a niche in a market for fresh fish dominated by commercial firms, deters entry of women in the production phase of aquaculture sector. Women do not enter given the resource access constraints faced by rural women. But postharvest sector (processing of tilapia, milk fish, drying and smoking fish for market) holds promise for the entry of women in the aquaculture sector.
- Podcasting is being tested as ICT based information dissemination in local languages to promote aquaculture technology using the Facebook mode. But the true cost of podcasting and constraints to effective use are not fully recognized by the investigators. In all the farms visited perhaps one commercial scale farmer may have the technology sophistication to use this mode of communication. Additionally, the costs of paying for the download and data use are borne by the receiving farmer. The farmer bears the cost of information reception while the project promotes it as free information access to the farmers.

3.4. AquaFish CRSP–HC Aquaculture Network

- CLSU has been a program partner since the phase of Pond Dynamics and Aquaculture CRSP and thus has long a standing collaborative research partnership. This partnership is valued by the University and the Director of the CFA. CRSP–CLSU participation has contributed to the development of tilapia industry and small farm tilapia producers.
- CLSU is placed in the area that is promoted as the tilapia capital (along with being the rice granary of the Philippines). This places AquaFish CRSP activities in an area where aquaculture based livelihood is important both as a commercial enterprise and for employment opportunities.
- Many centers with mission to promote research, extension and learning on fishery and aquaculture are clustered in and around CLSU. These are NFFTC, College of Fisheries, and GIFT project. NFFTC is under the Bureau of Fisheries and Aquatic Resources of the Department of Agriculture and thus links to country wide centers promoting aquaculture initiatives.
- Collaboration with CLSU, which is a state university, provides opportunities to draw interdisciplinary faculty into research.
- In the current phase the program includes SEAFDEC, a regional center for fisheries development that is an intergovernmental organization established in December 1967 for the purpose of

promoting sustainable fisheries development in the region. Its current Member Countries are Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam. It collaborates with regional bodies that promote fisheries in the region. The organization maintains ASEAN-SEAFDEC strategic partnership initiatives. It had been providing leadership regionally and with the AquaFish CRSP in south –south Collaboration. It has linkages with FAO fisheries programs as well as with the World Fish center.

- It is concluded that CLSU and SEAFDEC together offer combined expertise to build regional leadership in the aquaculture development. CLSU has linkages with national research, technology development and educational organizations that offer a national network to draw expertise in aquaculture development. The SEAFDEC as a regional center brings to the project an extensive network of countries that have demand for fish and fishery products and regional institutions with expertise to promote fisheries and aquaculture. The combined expertise in these institutions can make a valid contribution to aquaculture development in SEA and can provide regional leadership in aquaculture and fisheries research and development. But a note of caution is that building south-south collaboration through a US project as a catalyst will present collaboration challenges.
- SEFDEC works with a regional university having expertise in social science to support women in aquaculture postharvest intervention (training and technical advice) and there are also private groups with whom SEFDEC collaborates to train women.
- CLSU has women in fisheries group to support gender integration interventions.
- The Philippines has been successful in using gender mainstreaming and women's empowerment strategies in the postharvest sector and women have room for participation in training and professional fields. Hence there could be lessons in the Philippines which could be adapted/adopted to improve women's participation in this sector within SEA region.

3.5. AquaFish CRSP and HC Project Stakeholder Perceptions

- The PIs were briefed about the FtF agenda by the CRSP director from ME-OSU. Hence they are aware that the Philippines is not a country included in FtF framework. Hence this concern was raised by the PIs and administrators.
- The PIs stated that the technical leadership for the project given to the Philippines investigator should be the responsibility of the investigator. ME's primary responsibility is to coordinate the project among the countries that participate, facilitate macro management including data base management and communication.
- The Philippines PIs were pleased with support provided by ME and have not had any issues in project administration.
- An area of concern is the fund flow as advance from the project on a reimbursement basis. The CFA had been supportive and providing funds to keep the project moving. The primary reason was the personal rapport between the director and the PI in CLSU. But at the CLSU administration level it would be helpful if the funds from the University were forthcoming as advance to keep the activities moving. Personal credit cards are being used at times of crunch.

- The country research projects were submitted by the Philippines PIs and the NCSU as the lead university packages them for submission in response to RFA from ME.
- CRSP is a close knit family, however the Philippines program was open to bringing in a new partner in SEAFDEC in the current phase and is open to inviting new stake holders.
- The AquaFish CRSP gender strategy was developed in NCSU and no consultation was held with the Philippines PIs in shaping the AquaFish CRSP gender strategy.
- The PIs did not understand the OSU –Impact assessment exercise and were not aware of any outputs.
- The PIs acknowledge the importance of undertaking impact assessment at the country project level on their own initiative.
- The CLSU PI had been a participant in AquaFish CRSP program for 12 years and values the interaction with scientists in the network.
- The SEFDEC PI is finding her niche among the AquaFish CRSP group who had been together for years as a team before her arrival.

Appendix 7. Trip report to Kenya prepared by Jeffrey Silverstein

Jeffrey Silverstein May 30, 2012

Trip report Kenya May 21-23, 2012, and discussion with Dr. Charles Ngugi in Baltimore, MD 18 May 2012.

General Impressions The work of the CRSP projects going back to PDA CRSP could be very broadly characterized as:
CRSPs have trained over 1500 fish farmers and the results have lead to the whole spectrum of production from farmers with few resources available and improvement marginally above subsistence production to entrepreneurial growers that have increased pond area, intensified management and record keeping. ACRSP evolved to training and extension network development-thinking of aquaculture as a business. AquaFish CRSP has led to development of value chains, marketing, networking and cluster development as well as identification of critical resource needs, specifically feed and genetically defined fish stocks, and environmental issues to address with best management practices (BMPs).
A CRSP-More practical, extension training, record keeping, aquaculture as business
AquaFish CRSP-Production systems, marketing, clusters-more sophisticated research on resource needs.

The people trained through CRSP programs form the foundation of aquaculture in Kenya, extension officers, Ministry officers, keystone farmers. Moi University continues to be a hub of basic and applied research and extension services. Over the past 4-5 years tilapia production is stated to have grown from 1000MT/year to nearly 20,000MT/year. I don't know how reliable these figures are.

The Investment by the Government of Kenya can be traced to CRSP efforts. CRSP provided many of the trained aquaculture specialists for extension and ministry, including quite senior officials such as Dr. Charles Ngugi. FAO funded work also leveraged CRSP work around cluster development. Following the 2008 Gov't crash, the government identified 7 sectors for development through the Kenyan Business Development Services, broadly referred to as Economic Stimulus Funds and Fish Farming Enterprise Program. Aquaculture was identified as having the most potential for success, largely because of the groundwork laid by CRSP, FAO and other projects. The government funding went to digging ponds, 300 ponds (300m2 per pond) in each of 160 constituencies (48,000 ponds).

The ongoing relationship between the Government of Kenya (GOK) investments and the CRSP project was described to me as the USAID funding performs a backstopping and targeted role. The GOK funds are building ponds, building hatcheries, funding fingerling production, while the CRSP funds education, training, and specific research projects (e.g. on farm BMP trials).

Future directions for CRSP work would be in research-feed and seed are major priorities; training in value chain development, baseline marketing studies, product development, cluster development;

funding for continued education. The need for training of new faculty members was also mentioned by several extension officers as a need.

Monday 21 May 2012-Nairobi vicinity (Central Region)

Sagana National Aquaculture Research, Training and Development Center Bethuel Omolo

Mr. Kiama-Green Algae Highland fish farm

James Bundi Mugo "JB" at Mwea Fish Farms

Gladys Kuria-M Sc.student from Moi University-met at hotel in Nairobi

Tuesday 22 May 2012-(Lake Victoria) Kisumu area

Kisumu Staion of Fisheries Development Office

Met with Michael Obadha (Regional Director of Fisheries-includes aquaculture), George Owiti (Principal fisheries officer(PFO)-Kisumu region), Rodrick Kundu (Fisheries Specialist), Norman Munalla and Stefen Djao (PFO's). All received Master's; George through Auburn U., others through Moi University with CRSP support.

Visit to Jewlett Enterprises-Enos and Jedida Were

Wednesday 23 May 22, 2012-(Western) Eldoret area

Visit to Moi university –Met with David Lusega, Julius Manyala (very involved with projects)

Monday 21 May, met Sammy Macharia and Judy Amadiva at the hotel before 9am. The ministers and deputy ministers of Fisheries were all out of country on business trips, so we went directly to visit Sagana National Aquaculture Research Center. There we met with Bethuel Omolo, Asst. Director of Fisheries. We discussed the long history of CRSP at **Sagana, this is where it all began in 1997** with the CRSP**. Focused initially on pond construction**. Over the next 2 days, everyone I met who had come through Sagana (which was everyone) talked about the **formative experience of hand digging ponds at Sagana**. Pre CRSP there were projects with Belgian development groups, however one difference that was pointed out was the **early and consistent contact between CRSP and Government of Kenya-keeping a National focus, not regional or local**. Current CRSP work under a no-cost relates to BMPs (Feed and Water Use). Currently Sagana Research Center employs 53 people (with Government and CRSP funds).

Visited Mr. Kiama at Green Algae Highland fish farm also in Sagana region. He has worked in pond construction with the CRSP for many years, originally training with CRSP instructors he is now a key resource and trainer for the CRSP. Highly diversified operation, producing ornamental goldfish and carp, selling small aquaria to hold ornamental fish, catfish fingerling and broodstock production, tilapia

production. He also digs ponds for other farmers, and does considerable consulting with CRSP and government programs and independently. When we were at Mr. Kiama's farm, we saw a newly dug 1cubic meter pond for raising catfish fingerlings at very high density based on technology he learned of from Indonesian farmers brought in by the government (Ministry of Fisheries). Not sure if this system will work, but Mr. Kiama is very resourceful and entrepreneurial. Mr. Kiama called himself "a child of the CRSP" said he owes everything to the CRSP.

Mwea Farms-met James Bundi Mugo (JB), farm manager. Earned BS and MSc degrees through CRSP, currently participating in BMP evaluations of feed and water use. Previously MSc student, Gladys Kuria, did cage cum pond study at Mwea farms. This farm also earns money through consulting activities, provide tours to new and learning fish farmers for a fee. JB has also traveled as a trainer on the CRSP workshop to Mali. Mwea farms will produce all-male tilapia fingerlings, previous all-male trials performed with hand (visually) sexed all-male tilapia. Interesting side point-JB runs on farm experiments for his own management information. Currently doing a study (1 factor, four ponds) comparing fingerling production under repeated partial harvest conditions or with a single end of season harvest. This is unpaid research being conducted to improve farm management and productivity in the future. I cite this as an example of capacity building and expertise this scientifically trained farm manager brings to the job.

Gladys Kuria-MSc student from Moi University (on business in Nairobi-had chance to meet). Conducted cage-cum-pond study with tilapia (all-male tilapia in cages, mixed sex in ponds). In addition to 10 month spent on the Mwea farm building cages, learning operations and conducting her experiment, she attended international conference in Malawi and made scientific presentation, did extensive work with youth groups in three communities (Kikuyu, Thika and Nyeri communities) to do fish farming in reservoir systems. She especially enjoyed working with farmers in community groups. Considers aquaculture an attractive opportunity for women as farmers and as career professional (research, extension, Ministry work).

Tuesday 22 May-flew to Kisumu, to Regional Director of Fisheries (Michael Obadha) office. Several programs with interest in aquaculture (Kenyan Business Development, Government stimulus program, AquaFish. Obadha and several others during the visit suggested that no more CRSP funds are needed for digging ponds-this is a technology that has been well developed and transferred by the CRSP. Other info picked up from discussions with extension folks:

- break-even yield [including paying farmers for their time] = 5.5 MT/ha/yr
- minimum economic farm size = 1,200 m2, minimum economic pond size 300 m2
- average farmer yield = 6.3 MT/ha/yr
- market size 200-250 g @ $3-5/kg ($2.50 is break even)

Continued on to Jewlett Enterprises run by Jedida and Enos Were. On farm there was production of chickens, ducks, geese, sheep (for weed control), sales of bottled gas, aquaculture nets and equipment. Trained by CRSP (both Enos and Jedida) and continue to consult with CRSP doing trainings domestic and international. The primary focus of this farm is fry and fingerling production of both tilapia (all male fry production) and catfish. Enos is engaged in genetic improvement as well, selecting for growth and fillet yield. Last year Jewlett farms supplied over 4 million tilapia fingerlings through government programs,

to farmers. Quote from Enos “CRSP made me what I have become”. Enos Were focused on intensification of production, interested in aeration to increase carrying capacity of ponds. Busy consulting business, at least 10 calls/day on farming techniques.

Wednesday 23 May to Eldoret, Moi Universityhub of aquaculture development in Kenya. International (Regional) center-students in Aquaculture from Uganda, Tanzania, Mali and Ghana in addition to Kenya. Training students for jobs in Ministry, farm managers, National Museums (conservation), banks (experts in fish farms for investing/loan purposes) etc. Heavily involved in USAID supported cluster concept. Started 4 clusters (Bidii has been highly successful, 3 others much slower to gel). Moi becoming Chepkoilel University. School of Aquatic Sciences joining with Animal Production and Business Services.

Appendix 8. Project listing and descriptive information

Project PI, Titleand Theme	*Institution*	*Investigations*
Russell Borski	**North Carolina State University**	1. 09QSD01NC Nile Tilapia Broodstock Selection, Seed Quality and Density-Dependent Growth in the Philippines
IMPROVED COST EFFECTIVENESS AND SUSTAINABILITY OF AQUACULTURE IN		2. 09SFT04NC Feeding and Feed Formulation Strategies to Reduce Production Costs of Tilapia Culture
THE PHILIPPINES AND INDONESIA		3. 09TAP02NC Internet-Based Podcasting: Extension Modules for Farming Tilapia in the Philippines
AQUAFISH PROJECT THEME		4. 09MER03NC Improving Supply Chain Opportunities for Tilapia in the Philippines
INCOME GENERATION FOR SMALL-SCALE FISH FARMERS AND FISHERS		5. 09MNE02NC Ration Reduction, Integrated Multitrophic Aquaculture (milkfish-seaweed-sea cucumber) and Value-Added Products to Improve Incomes and Reduce the Ecological Footprint of Milkfish Culture in the Philippines
		6. 09FSV02NC Demonstration of Sustainable Seaweed Culture and Processing in Aceh, Indonesia and the Philippines - Opportunities for Women to Improve Household Welfare
		7. 09SFT06NC Impact Assessment of CRSP Activities in the Philippines and
Kevin M. Fitzsimmons	**University of Arizona**	
University of Arizona		1. 09TAP01UA Aquaculture & Fisheries CRSP Sponsorship of the Ninth International Symposium on Tilapia in Aquaculture to be held in Shanghai, China
PROJECT TITLE		2. 09SFT03UA Expansion of Tilapia and Indigenous Fish Aquaculture in Guyana: Opportunities for Women
DEVELOPING SUSTAINABLE AQUACULTURE FOR COASTAL AND TILAPIA		3. 09QSD02UA Sustainable Integrated Tilapia Aquaculture: Aquaponics and Evaluation of Fingerling Quality in Tabasco, Mexico
SYSTEMS IN THE AMERICAS		4. 09IND05UA Consolidation of Native Species Aquaculture in Southeastern Mexico: Continuation of a Selective Breeding
AQUAFISH PROJECT THEME		5. 09MNE07UA Reaching the Farms Through AquaFish CRSP Technology Transfer: Elimination of MT from Intensive Masculinization Systems Using Bacterial Degradation
ENVIRONMENTAL MANAGEMENT FOR SUSTAINABLE AQUATIC		
RESOURCES USE		
James S. Diana	**University of Michigan**	1. 09BMA03UM Incorporation of tilapia (Oreochromis niloticus) and Sahar (Tor putitora) into the existing carp polyculture system for household nutrition and local sales in Nepal
PROJECT TITLE		2. 09BMA04UM Study on the effectiveness of a pond-based recirculating system for shrimp culture
IMPROVING SUSTAINABILITY AND REDUCING ENVIRONMENTAL IMPACTS OF		3. 09QSD03UM Development of polyculture technology for giant freshwater prawns (Macrobrachium rosenbergii) and mola (Amblypharyngodon mola)
AQUACULTURE SYSTEMS IN CHINA, AND SOUTH AND SOUTHEAST ASIA		4. 09MNE01UM Invasion of the red swamp crayfish (Procambarus clarkii) in China: genetic analysis of the invasion and the impacts evaluation
AQUAFISH PROJECT THEME		5. 09BMA05UM Development of indoor recirculating culture systems for intensive shrimp production in China
ENVIRONMENTAL MANAGEMENT FOR SUSTAINABLE AQUATIC RESOURCES USE		6. 09MNE03UM Integrating environmental impacts, productivity, and profitability of shrimp aquaculture at the farm-scale as means to support good aquaculture practices and eco-certification
		7. 09BMA06UM Identifying best practices to improve the giant river prawn industry in Thailand
		8. 09MNE05UM The impact of fish stocking on wild fish populations, fish production and the ecosystem of irrigation reservoirs in South Vietnam
		9. 09MNE06UM Evaluating the relationship between semi-intensive aquaculture and natural biodiversity
		10. 09WIZ03UM Improved Cages for Fish Culture Commercialization in Deep Water Lakes
		11. 09SFT07UM Sustainable feed and improved stocking densities for gar (Atractosteus spp.)
Maria Haws	**University of Hawai'i at Hilo**	1. 09IND01UH Developing hatchery methods for the mangrove oyster, Crassostrea corteziensis for the Pacific Coast of Mexico
PROJECT TITLE		2. 09IND03UH Induced spawning and larval rearing of the "chame" Dormitator latifrons in laboratory conditions
HUMAN HEALTH AND AQUACULTURE: HEALTH BENEFITS THROUGH		3. 09IND04UH Stock assessment of "Chame" Dormitator latifrons in Nayarit and South of Sinaloa México
IMPROVING AQUACULTURE SANITATION AND BEST MANAGEMENT PRACTICES		4. 09HHI01UH Co-management and bivalve sanitation for black cockles (Anadara spp.) in Nicaragua
AQUAFISH PROJECT THEME		5. 09HHI02UH Capacity building in aquaculture, fisheries management and coastal management for coastal women. Workshop: "Opportunities for Coastal Women in Fisheries, Aquaculture and Coastal Management
IMPROVED HEALTH AND NUTRITION, FOOD QUALITY, AND FOOD SAFETY		6. 09IND08UH Effects of environmental conditions on gills and gas bladder development in bimodal-breathers, gar (Lepisosteus sp.), pirarucu (Arapaima gigas) and bowfin (Amia calva)
Robert S. Pomeroy	**University of Connecticut-Avery Point**	1. 09SFT01UC Alternative feeds for freshwater aquaculture species in Vietnam.
PROJECT TITLE		2. 09IND02UC Sustainable snakehead aquaculture development in the Lower Mekong River Basin of Cambodia and Vietnam
DEVELOPMENT OF ALTERNATIVES TO THE USE OF FRESHWATER LOW VALUE		3. 09TAP03UC Development of alternatives to the use of freshwater low value fish for aquaculture in the Lower Mekong Basin of Cambodia and Vietnam: implications for livelihoods, production and market.
FISH FOR AQUACULTURE IN THE LOWER MEKONG BASIN OF CAMBODIA AND		4. 09FSV01UC Maximizing the utilization of low value or small-size fish for human consumption by improving food safety and value added product development (fermented fish paste) through the promotion of women's fish processing groups/associations in Cambodia.
VIETNAM: IMPLICATIONS FOR LIVELIHOODS, PRODUCTION AND MARKETS		5. 09MER04UC Value chain analysis of snakehead fish in the Lower Mekong Basin of Cambodia and Vietnam
AQUAFISH PROJECT THEME		6. 09MNE04UC Developing Management Recommendations for Freshwater Small-Sized/Low Value Fish in the Lower Mekong Region of Cambodia and Vietnam
ENHANCED TRADE OPPORTUNITIES FOR GLOBAL FISHERY MARKETS		7. 09FSV03UC Assessing the Impacts of Sustainable Freshwater Aquaculture and Small-Sized/Low-Value Fisheries Management in the Lower Mekong Basin Region of Cambodia and Vietnam
Kwamena Quagrainie	**Purdue University**	1. 09MER02PU Value Chain Development for Tilapia and Catfish Products: Opportunities for Women Participation
PROJECT TITLE		2. 09SFT02PU Assessment of Integrated Pond-Cage System for the Production of Nile Tilapia for Improved Livelihood of Small-Scale Fish Farmers in Kenya
IMPROVING COMPETITIVENESS OF AFRICAN AQUACULTURE THROUGH		3. 09SFT05PU Develop Feeding Strategies for Moringa oleifera and Leucaena leucocephala as Protein Sources in Tilapia Diets
CAPACITY BUILDING, IMPROVED TECHNOLOGY, AND MANAGEMENT OF SUPPLY		4. 09QSD04PU Evaluation of Performance of Different Tilapia Species
CHAIN AND NATURAL RESOURCES		5. 09TAP04PU Harnessing the Opportunities and Overcoming Constraints to Widespread Adoption of Cage Aquaculture in Ghana
AQUAFISH PROJECT THEME		6. 09IND06PU Development and Diversification of Species for Aquaculture in Ghana
INCOME GENERATION FOR SMALL-SCALE FISH FARMERS AND FISHERS		7. 09QSD05PU Training Program in Propagation and Hatchery Management of tilapia (Oreochromis niloticus) and catfish (Clarias gariepinus) in Ghana
		8. 09TAP07PU Effects of ACRSP and AquaFish CRSP Initiatives and Activities on Aquaculture Development in Kenya
Joe Molnar	**Auburn University**	
PROJECT TITLE		1. 09WIZ01AU - Effects of Watershed-Water Quality-Aquaculture Interactions on Quanitity and Quality of Water from Small Catchments in South Africa and Uganda
HYDROLOGY, WATER HARVESTING, AND WATERSHED MANAGEMENT FOR FOOD SECURITY, INCOME,		2. 09WIZ02AU - Surface Catchment Development and Sustainability Evaluation for Multipurpose Water Supply for Meeting Aquaculture and Other Water Need
AND HEALTH: SMALL IMPOUNDMENTS FOR AQUACULTURE AND OTHER COMMUNITY USES		3. 09BMA01AU - Evaluation and Improvement of Production Technology in Uganda: Case Studies of Small-Holder Cage Culture in Watershed Reservoirs and as an Alternative Livelihood for Fishers
		4. 09MER01AU - Market Assessment and Profitability Analysis of Aquaculture Enterprises in Uganda
		5. 09BMA02AU - Training and Outreach in Uganda and Surrounding Nations
		6. 09TAP08AU - Training Trainers for Long Term and Sustained Impact of Pond Aquaculture in Africa
		7. 09IND07AU- Prospects and Potential of the African Lungfish (Protopterus Spp): An Alternative Source of Fishing and Fish Farming Livelihoods in Uganda and Kenya
		8. Training Trainers for Long Term and Sustained Impact of Pond Aquaculture in Africa: Additional Participants from Kenya
Steve Buccola	**Oregon State University**	1. 09BMA07OR Assessment of AquaFish CRSP Discoveries
		2. 09TAP06OR Assessment of AquaFish CRSP Technology Adoption and Impact
		3. 09TAP07OR Project Planning Meeting on AquaFish Technology Discovery and Impact Assessment
CRSP Council		CRSP Council Knowledge Management and Communication Project
	Oregon State University	Telling a Compelling Story about ACRSP and Aquafish CRSP Impacts

Appendix 9: AquaFish CRSP Response to the External Evaluation Report Dated 06/28/12

AquaFish CRSP heartily thanks USAID/BFS, particularly Harry Rea, Rob Bertram, and Saharah Moon Chapotin, for organizing and initiating this review. Coming as it did after the program more or less ended on a no-cost extension in its 6th year, the review did not elicit a feeling of too little too late, but rather a collective sigh of relief. After all, AquaFish CRSP's many participants had been waiting for this scheduled review since 2009 when it was expected per USAID's award document.

AquaFish CRSP was reviewed from April to June 2012, under a shadow cast by some projects having ended, some researchers having gone on to other research, and some management staff having been laid off. That the effects of this CRSP's work and its key relationships sustained such a hiatus in funding* is a testament to the strength of the CRSP model and the positive work AquaFish participants do in making a difference. USAID/BFS recognized this situation, yet the review report barely mentions it. On top of the list of AquaFish's comments is that the review report needs to be digested with a good dose of situational reality. CRSP management, administrators, external advisors, researchers, faculty, businesspeople, farmers, extension agents, and students soldiered on amicably and cooperatively under considerable external stress. More importantly is that they donated their time and resources to this review. As well, their gracious universities, institutions, and organizations deserve our thankfulness in going well beyond the call of duty to boost USAID's investments.

AquaFish CRSP recognizes the review team who, in about two months, amassed a great deal of information about our complex program and tried to translate it into useful suggestions. This was an ambitious undertaking, and the reviewers are to be acknowledged for upholding the schedule and carving out time for three site visits: to Oregon, Kenya, and the Philippines.

AquaFish CRSP agrees with the majority of the reviewers' findings. It was gratifying to read this positive report with so many glowing commendations. AquaFish is proud of its many achievements since 2006, when this new program in aquaculture and fisheries was competitively awarded. AquaFish CRSP has made great strides --starting from scratch 5 ½ short years ago-- growing to encompass an engaged community of over 300 people who are willing to volunteer their time and resources to help this program get an extension for another 5 years. The report may have overreached in its attempt to tie this new CRSP to the old PD/A CRSP. In 2006, none of the former CRSPs PIs, researchers, or management (save the Director) were involved in AquaFish. Eventually, after a widely advertised, externally competed and reviewed proposal process, about 20% of former PD/A CRSP US PIs became AquaFish Lead Project PIs. In the US especially, this new CRSP has opened its doors to seek out new talent and institutions.

**USAID eventually obligated funding to the ME at OSU on 3 May 2012, well after effects of the NCE were felt.*

CRSP management and researchers themselves offered up frank self-reflection that formed the basis for many of the report's recommendations, and some of the criticisms. AquaFish appreciates the findings that do not place blame but advance an agenda of collaboratively developed partnerships in fisheries and aquaculture worldwide. In the following text, CRSP researchers and management respectfully disagree with some of the data and findings in the report, focusing on those that were errors of omission, contained inaccuracies, or were misrepresentations. This report is no different from most reviews in containing its share of subjective bias. Recognizing bias and the bases for alternative interpretations makes for a more balanced assessment.

Network Development and Visibility (pp. xi, 33, 34)

AquaFish appreciates that the review team recognized that the program achieves its stated CRSP goal of building a network of U.S. and developing country scientists to support innovations in aquaculture development. AquaFish CRSP has a wealth of linkages with international institutions including FAO, ANAF, WorldFish, and NACA in addition to affiliations with over 170 institutions and companies worldwide. That CRSP comes up among the top hits on a web search for 'aquaculture' is one demonstration that this program enjoys considerable visibility. Why then isn't the AquaFish CRSP a household word in the US? The reviewers used to the US aquaculture scene may be unaware that AquaFish CRSP is not part of a group typically marketed domestically such as the USDA RACs and NOAA Sea Grant Programs. Although AquaFish overlaps with both of these groups, for example, in its membership and leadership, it is primarily marketed internationally as is the case with all of the other CRSPs, and for that matter USAID.'

AquaFish exposure is further enhanced through co-sponsoring international conferences and student awards, and by organizing and chairing technical sessions at various events. CRSP is prominently credited for its co-sponsorships. Under-recognized in the report is that CRSP researchers regularly communicate and disseminate findings in the literature and at conferences. Whether this credit extends beyond the individuals to the program is a different matter and difficult to police, even though the MT does mandate through contract USAIDs - CRSPs branding and marking policy, and works with CRSP participants to understand the importance of getting the CRSP name out. Again, this chronic problem of visibility is one that USAID and all CRSPs are working on together to resolve. Largely motivated by AquaFish CRSP, in the past year the CRSP Council began an initiative to enhance the visibility of all CRSPs, while creating a common clearinghouse for information.

Impact Assessment Research (p.12)

In 2010 the Management Team commissioned an Impact Assessment (IA) project to supplement impact assessment work already being conducted by three of the seven core research projects. The MT agrees with the report that very little was learned from the peer reviewed, non-competed IA project; however, additional context is required to understand its shortcomings.

The IA project proposal received high marks from an external technical review panel consisting of four leading agriculture/aquaculture economists prior to USAID and MT approval. The work was deemed feasible and lack of baseline was not considered a fatal flaw. Further, the proponents, also well-known agriculture economists, were aware that limited impact assessment baselines were integrated into each investigation but nevertheless were

eager to conduct this work. Other salient facts are that USAID approved the proposal after reviewing it along with external reviewer comments, and the EPAC and Lead Project PIs were also given an opportunity to provide feedback and input into the project.
The report suggests that the MT did not reach out to the aquaculture economics community for conducting analyses; however, it is important to note that AquaFish CRSP did seek out such expertise. In September of 2009 USAID commissioned work focusing on, among other things, impact assessment work. The time horizon for implementing this work was narrow given that AquaFish was slated to end within two years. The MT initially sought out economists from both current AquaFish institutions as well as economists from other institutions to compete for the work. The MT did its due diligence in reaching out to the aquaculture economics community, getting reviews done, and obtaining USAID approval in a transparent manner and suggests that any failures occurred for other reasons.

Leveraged Funding (p.22)

As noted by the Review Team, AquaFish CRSP has been successful at leveraging additional funding. Overall, AquaFish CRSP has leveraged nearly $6 for every USAID dollar spent. Unfortunately the report is internally inconsistent regarding treatment of some of the funds leveraged by AquaFish CRSP. It is unclear why the reviewers chose to exclude funds leveraged by the Government of Kenya (GoK) for its Economic Stimulus Program (ESP) in several analyses, when the reviewers themselves recognized that CRSP "developed the knowledge infrastructure that allowed this transformation to take place especially in the GoK campaign to 'Grow Fish, Sell Fish, Eat Fish'" (p 9). The report continues, stating, "This example should be emphasized across the CRSPs and USAID as a model relationship for emulation." The Kenyan Secretary of Fisheries concurs, and has verified that CRSP was highly responsible for this leveraging.

It is also worth noting that AquaFish US Project PIs and Co-PIs are highly regarded researchers and educators in their fields and secure, on average, $590,000 per year from non-CRSP sources. Additional funding sources included USDA, NIH, NOAA, USAID, NSF, as well as private and international sources such as the World Bank, DANIDA, the MacArthur Foundation, and the David and Lucile Packard Foundation. These impressive data came to light in the past week thanks to a survey conducted by the Horticulture CRSP on behalf of the CRSP Council (see http://aquafishcrsp.oregonstate.edu/researcher_survey).

In summary, AquaFish CRSP is poised to move ahead into another successful five years. Let us hope that this review was not in vain, and that the BIFAD review of all CRSPs generates the same positive buzz, allowing not only this CRSP but others to pass into their next 5-year phase. Recommendations from this report can be woven into an extended program in aquaculture and fisheries. The many loyal AquaFish participants whose work is lauded in this report are standing by eagerly awaiting the opportunity to continue their and USAIDs important work.

Additional specific comments on the External Evaluation Report

List of Acronyms
• The list of acronyms contains errors.

Page viii
• An impact assessment study was completed to demonstrate that almost 50% of 58 farmers surveyed in the Philippines are adopting some form of reduced feeding strategy. The surveys also show that costs are reduced for farmers that adopt the new strategies (ref: Final Technical Report for investigation 09SFT06NC).

Page ix
• No examples or evidence from CRSP support the notion that CRSP is prematurely extending results. This sentence seems to reflect a general precautionary measure not specific to CRSP.

Page x
• Misleading statement. From inception, AquaFish has maintained a gender-disaggregated database for all trainees and participants. The MT maintains, and has posted online, gender integration strategies developed by this CRSP and all subcontracting partners, which include women's participation. This CRSP has been recognized for its forward-thinking approach to gender integration, gender data collection, gender budgeting, and overall capacity building. The surveys of host country researchers presented in this report show attention to gender. A number of the report's conclusions on gender seem unsupported by the data presented in the report, or by the record.
• Workshops have regularly been done with co-sponsorship. For example, the NCSU project had Aquaculture without Frontiers as sponsors; most of the larger workshops and meetings have enjoyed significant co-sponsorship from a number of organizations, local governments and institutions (e.g., WAFICOS, Gov Ghana, Kenya Min of Fisheries, IIFET, etc).
• Misleading statements about the composition of CRSP PIs. Many PIs have advanced training in the area of "socio-economic analysis". Two thirds of US PIs are trained (have PhDs) as social scientists (½ econ, ½ other social sciences) and the remaining 1/3 are life sciences.

Page xi
• The suggestion provided on page xi does not reflect later findings of this same report, especially regarding comments that relate to use of "modern and fast-evolving information and communication technologies."

Page 8
• Note that "Overall, USAID encourages the AquaFish CRSP to have a biotechnology component in some of its activities" (from [CRSP-condensed] USAID Goals and Guidelines), but that biotechnology in itself is not one of AquaFish's 4 research themes or 10 topic areas. It is addressed across several themes and TAs.

Page 11
• Misleading statement in report: Note that women comprise 48% of all graduate students, and 49% of undergraduate students.
• Needs clarification and specificity. As stated, it is unclear how the traditions of this new CRSP present barriers to the participation of women. No evidence is presented to support this statement.

• The second sentence is untrue as explained previously. The current composition of PIs have training in the social sciences and extension. One third of US PIs are trained as social scientists (other than economics). 2/3rds are social scientists, including economists.

Page 13

• Responsibility for the absence of an impact assessment baseline component built into the program from inception (2006) also lies with the granting agency for not providing that level of guidance when the Leader Award proposal was reviewed and approved.

Page 20

• Unclear whether the reviewers took into account the nature of each event in determining its effectiveness for a large number of people.

Page 21

• The implication that this CRSP operates within an exclusive network is incorrect and unsupported by the data. Six of the eight Lead US PIs had not been involved with the CRSP in a leadership capacity prior to the inception of AquaFish CRSP in 2006. Likewise, 6 of the 8 lead US institutions are new to their current role. An RFP was broadly distributed for this CRSP, with ample lead-time to encourage proposal submissions from any eligible institution. RFPs are competitively bid and externally reviewed, eliminating institutional bias. AquaFish strives to include new partners and to expand the reach of the program through new participants. The top institutions in the fields of fisheries and aquaculture tend to be involved in the program over long periods of time, however the personnel and roles change as research objectives are updated and priorities evolve.

Page 23

• Publish or Perish is based on Google Scholar and provides the most accurate citation counts for the following disciplines in:

- o Business, Administration, Finance & Economics;
- o Engineering, Computer Science & Mathematics;
- o Social Sciences, Arts & Humanities.

The developers of PoP do not encourage heavy reliance on Google Scholar for individual academics working in areas other than those listed above without verifying results with either Scopus or WoS. (see Harzing.com).

• Most if not all CRSP peer-reviewed papers are available as links on the CRSP website.

Page 26

• This network of 300+ includes students, farmers, scientists, development specialists, etc. who have been involved with the program in a number of capacities. At the time of the review, the subset of participants that were contacted were those who would be both willing and able to provide the necessary level of feedback given that some projects ended/winded down over this unfunded 6th year.

Page 29

• Need some recognition that these collaborations have been strongly encouraged in the past.

Page 31

• Context was added here to improve accuracy. EPAC was highly involved in the second phase

-- IP09-11. In fact, it was only in 2011 – in the final year and into the 6th unfunded year -- that EPAC and other groups winded down following USAIDs indecision on future extensions. EPAC still nominally exists and can be re-invigorated going forward. (The EPAC chair is involved in this review for example.)
• Poor data collection; no record supports the reviewers claim about DTAP. DTAP functioned well, and continues to function well providing input on proposals, new directions, etc. The challenge was that the DTAP members' workload became heavier and overall focus shifted more to USAIDs indicators. That DTAP could shift could be viewed positively (rather than how it was in this report) in its ability to adapt to a changed environment at USAID.
• The mislaid comment about PIs lack of knowledge about the EIP is to be expected since the EIP at OSU was designed to interact directly with the Director at OSU, and not with PIs.
• Inaccurate statement about EIP. Members of the EIP were involved throughout the 5+ years in proposal reviews, serving on CRSP-funded graduate student committees, advising the Director on emerging topics, on engaging with external organizations, and in networking for CRSP.

Page 32
• Decisions made regarding the cost share requirement are highly nuanced and balance many factors. In response to changes in the economic climate at Land Grant and other universities since 2006, the ME is looking to lower the cost share requirement. The ME brought this matter to the attention of the Review Team and sought their understanding of why the ME will be changing the rate in future. That the Team felt it important to place blame is unfortunate.

Page 33
• The comment about lack of visibility may reflect reviewer perception of the US "marketplace". AquaFish CRSP has broad international exposure and dissemination of achievements through a variety of electronic outlets, including listservs hosted by SARNISSA and IIFET, ACDI/VOCA, and others; podcasts; and social media linkages through Facebook. Both international and domestic electronic distribution of material occurs independently though partner institution outlets or other nodes (such as links through ISTA's website, SARNISSA's website, and podcast links through NCSU). The AquaFish website serves as an effective outreach and exposure tool. Over 100 non-CRSP websites link to it. Also of note is the presence of several AquaFish videos publically available on YouTube and Vimeo. No objection to the recommendation to continue broadening the CRSPs reach both internationally and domestically, but the review does not adequately show the current reach, which is considerable.

Page 34
• AquaFish CRSP does indeed have US industry partners, including: Fish Farmacy LLC, Goosepoint Oysters Inc., Shrimp Improvement Systems LLC. (AquaFish also has many HC industry partners.)

Page 58
• This is not correct. The Philippines HCPI does not think that SANTEH has commercialized the feed formulation developed by NCSU.
• This is a well-known factor in deciding to use any byproduct. This comment may refer to one PI, or be the reviewer's conjecture, and should be deleted as it is not representative of the CRSP. The CRSP is aware of trade-offs involved in using chicken litter, compost, scraps, etc, as there are competing uses that vary in space and time, and through cultural and other

preferences. Input availability, cost and other factors are assessed at a local level, and protocols are developed collaboratively with those constraints in mind. This misleading sentence implies the CRSP is not aware of this concept. Not only is CRSP aware, but CRSP has undertaken years of research on local v imported inputs, byproducts and feedstuffs, on cultural practices and norms, and on trade-offs thereof.

Page 60

• Regarding the promise for the entry of women in the post harvest sector, this is already happening probably at a smaller scale. There are towns in the province of Nueva where a livelihood project was developed for women in the area to do post-harvest of tilapia. The same is true in the processing of milkfish -- women traditionally are involved in this activity.
• The CRSP podcasts are free for download anywhere in the world. The NCSU project cannot be responsible for data charges on phone plans.

Page 65

• The statement about no longer needing additional investments in pond digging is a misconception by some people who are not actively involved in CRSP themselves. AquaFish did not invest at all in pond digging. Construction of many small ponds at Sagana and a few at Moi happened through funding for short courses on pond construction and management. Construction/digging was by trainees, as part of the training.