AQUANEWS

Sustainable Aquaculture for a Secure Future

POND DynAMICS/Aquaculture COLLABORATIVE RESEARCH SUPPORT PROGRAM NEWSLETTER

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Green Water Revolution in Northeast Thailand

by C. Kwei Lin

The CRSP has spent years trying to make ponds green. Green water indicates plenty of algae and other creatures which are essential for good fish production. As fish farmers and research biologists, the first comfort for us after fertilizing the ponds is seeing the water turn green. The data crunchers are contented with seeing a straight regression line and high correlation between phytoplankton levels and fish yield. Green water makes us all happy. After all, we are able to produce tilapia from those green ponds at yields as high as 8,000 kg/ha/year—almost one order of magnitude greater than the legendary Hickling's ponds in Malacca a few decades ago.

We at the Asian Institute of Technology (AIT) have been working in collaboration with the Royal Thai Department of Fisheries (DOF). Armed with convincing data and graphs of impressive fish production resulting from our experimental ponds, we gave seminars to the biologists of the DOF on principles and practices of pond fertilization. We then received authority from DOF to pursue extension work in Thailand. The next step was to transfer our pond fertilization technology to the producers—the small-scale farmers in rural northeast Thailand.

CKWEILIN

Crops growing on the dykes of fish ponds in northeast Thailand.

This region is the target for many international aid projects due to its large population, its relative poverty, and a harsh climate. The poor in this region depend a great deal on fish for their protein intake. Annual per capita fish

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Charles Frederick Hickling (C.M.G., M.A., SC.D) was a British fisheries officer who served as the Fisheries Adviser to the British Colonial Office and acted as Director of the Tropical Fish Culture Research Institute, Malacca, Federation of Malaya (Malaysia). As a pioneer of aquaculture he was an advocate of fish farming as a means of providing stocks which could be managed more effectively and with greater productivity than natural fisheries. In spite of his enthusiasm for the potential of aquaculture as a source of food production, he never envisaged that it could attain the levels of productivity that have been currently achieved.

He authored a number of aquaculture and fisheries related books, among them **Fish Culture** *(1962) and* **The Farming of Fish** *(1968).*

Interview with an Alumnus

by John Baker

Brigitte Goetze, CRSP Deputy Director, met with Marco Iván Rodríguez at the World Aquaculture Society Meeting in Seattle this year to learn how research carried out under the CRSP filters down to farmers.

In 1978 Rodríguez attended Auburn University for a nine-month training course, followed by four months of fish processing in Peru, two months in Mexico working on fish and shrimp nutrition, and four months in Israel working on fish production and farming and studying in an extension training program.

In 1984 he became the manager of the Honduran Dirección General de Pesca y Acuicultura's Research Station at El Carao, where he came into contact with the CRSP research program. El Carao Station is the PD/A CRSPs research site in Honduras. Rodríguez also participated with the CRSP in the Land Use and Productivity Enhancement (LUPE) project. This was a joint USAID and Honduran Ministry of Natural Resources project to develop agriculture, including aquaculture, in upland areas, with an emphasis on sustainability and the protection of water quality.

In Rodríguez' opinion, the most important aspect of the CRSPs work has been research into the sex-reversal of tilapia. He believes that the CRSP has developed the best sex-reversal techniques in the world—techniques which he now uses on his own farm.

In 1992 he left the CRSP site at El Carao to become manager of a commercial fish farm in Honduras called Red Tilapia San Eduardo. Two years

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PD/A CRSP Comings and Goings

CRSP participants bid farewell to Dr. Phil Helfrich, Director Emeritus, Hawaii Institute of Marine Biology, who retired from the PD/A CRSP this spring after a long and productive tenure with the program. Helfrich began his early collaboration with the CRSP in 1983 as a principal investigator. In 1986 he was appointed to serve as University of Hawaii representative on the CRSPs Board of Directors. Since 1989 he served as Board Chair. We wish him much good fortune in his future endeavors.

Oregon State University's Dr. L.J. (Kelvin) Koong was recently appointed to serve on the PD/A CRSP Board of Directors. Koong is Associate Dean of the College of Agricultural Sciences and Associate Director of the Oregon Agricultural Experiment Station. We welcome him to the program and look forward to his participation in the CRSP in the coming years.

The Program Management Office has added a new member to the team—Financial Manager Clare LaFond. LaFond comes to the CRSP from the private sector and brings with her considerable experience and expertise in financial analysis, planning, and administration. When we say were pleased that she's on board, we really mean it!

The CRSPs External Evaluation Panel now counts member Dr. Kevan Main, Deputy Director of the Harbor Branch Oceanographic Institution, among its ranks. Before her work with HBOI, Main served as Director of the USDAs Center for Tropical and Subtropical Aquaculture. We look forward to her contributions to the program as a member of the EEP.

Another addition to the PD/A CRSPs Board of Directors is Dr. Shadrach Okiror-Okiror from the University of Arkansas at Pine Bluff. Okiror-Okiror is presently Director of International Programs at UAPB and has extensive overseas experience in agricultural development. Welcome!

Retiring from the CRSP is Wayne Seim, long-time CRSP principal investigator and one of the chief reasons the CRSPs research efforts in Rwanda were so successful. (As many of you know, the CRSP was forced to abandon work there in 1994 because of great political upheaval.) Seim's collaboration with the CRSP began in 1985. His decision to retire from the Department of Fish and Wildlife at Oregon State University carried with it his stepping down from involvement in the CRSP. Seim will be missed by many, and we wish him the best of luck in the future.

POND© Feedback

by John Baker

Excelente. Muy Bueno. Thanks—Fernandez Bouzas, Spain
Thank you for supplying this software to users free of charge—very important in developing countries—Eddy, Australia
This is a highly informative website for aquaculture producers—Caratao, USA

POND© software, the decision support system for aquaculture, developed by CRSP researchers at Oregon State University, has been made freely available to interested parties through the Internet. John Bolte and Shree Nath of the CRSPs Data Analysis and Synthesis Team at OSU have made the program downloadable from a WWW site.

Comments left by those downloading the software from the Web site suggest that POND© is being positively received by a variety of users from around the world. Recipients of the software include businesses, systems modelers, speculative and practicing aquaculturists, students, researchers, government agencies, and overseas development groups. The program is being applied to a wide range of aquacultural projects, freshwater and marine, tropical and cool water. The program is similarly being applied to a wide range of finfish, including carp species, salmonids, tambaqui, and tilapia, as well as crustaceans.

POND© Version 3.0 focuses on providing a detailed view of pond aquaculture at both the individual pond and facility levels. Analysis is accomplished primarily by the use of simulation models combined with an economics package that can generate enterprise budgets for a pond facility. The models are organized hierarchically and proceed from simple ones (where fish growth, pond volume, and water temperature are the only state variables) to more complex ones which describe phytoplankton, zooplankton, bacterial, and water quality/sediment dynamics in addition to fish growth, pond volume, and water temperature.

POND© can be accessed at the URL: <http://biosys.bre.orst.edu/pond/pond.htm>. √

The program has been downloaded by people in: Argentina, Australia, Brazil, Canada, Chile, Colombia, Denmark, Ecuador, Hungary, Italy, Malaysia, Mexico, New Zealand, Norway, Portugal, Philippines, South Africa, Spain, Thailand, Turkey, UK, US, and Venezuela.

Tilapia Aids Shrimp Farming

By John Baker

Taura Virus Syndrome has significantly affected shrimp production in Latin America. The Taura virus can result in mortalities of 70-90%. In response to this problem, many shrimp farmers in Honduras and Ecuador are now cultivating tilapia. Some farms are experimenting with fish-shrimp polyculture, while in areas where shrimp culture is no longer profitable, some producers are making use of existing ponds by turning them over exclusively to cultivating tilapia.

Although tilapia are primarily cultivated as a freshwater fish, their

Interview

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later he started his own Palillos Fish Farm in Comayagua, producing fingerlings and broodstock. The farm, employing five permanent and two to three temporary staff, produced half a million fingerlings in 1996 with plans to produce one million in 1997. It also produced 50,000 broodstock, exporting to Brazil and Guatemala. Rodríguez reports that there is a great demand for tilapia and that he is able to sell everything that he produces.

"People love them," he notes. The preferred harvest size is 200-250 g. Rodríguez used to give a week-long study course at the Escuela Agricola Panamericana in Zamorano, on optimum harvest size, called "The Size of Your Hunger."

Rodríguez provides technical assistance to other fish farms including the four big tilapia farmers in Honduras. He also provides free technical assistance to his own clients. In fact, Rodríguez stipulates that he will only supply fingerlings and broodstock to farmers on the condition that they follow his husbandry advice —expertise gained through the CRSP. Not only does this practice protect Rodríguez from taking unjust blame in the event that fish supplied by him die in the hands of untrained customers, but it also serves to transfer techniques developed by the CRSP to local farmers. Over a four year period he has supplied fingerlings, and accompanying aquaculture advice, to some 25 farmers.

Rodríguez believes strongly in the need for the adequate training of fish farm workers. Currently poor stock management leads to fish mortalities. Hands-on teaching is needed to effectively teach techniques of fish stocking, handling, and management. Training oppor-tunities do already exist, but in some cases the course leaders themselves would benefit from a continuing education program to keep them abreast of improved techniques.

According to Rodríguez, tilapia may even have a role in the shrimp-farming business. Currently shrimp-farming faces the problem of pollution from farms, and the adverse effects that this can place on local environments. There is a need to im-prove water quality on shrimp farms, and the addition of tilapia and clams to shrimp systems may be one way to achieve this. Sooner or later, Rodríguez believes, there will be a need for more workers trained in fish production within the shrimp farming business. √

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Marco Iván Rodríguez

natural habitats experience a range of salinities. Their naturally high tolerance to salt water provides potential for adoption by shrimp farmers, who cultivate penaeid shrimps which are marine species. Nile and blue tilapia can tolerate salinities as high as 36-40‰, growing well in salinities of 36‰, while *O. mossambicus*, Florida, Taiwanese, and other strains of red tilapia can grow well at 36‰–full strength sea water.

High levels of salinity do seem to adversely affect tilapia reproduction, and tolerance to salinity increases with size, so fingerling production is still best carried out in freshwater or low salinity conditions. However, fingerlings can be stocked into ponds or cages placed in ponds, or supply or drain canals.

Pond salinities in the shrimp farming regions of the Pacific Coast of Central America experience low salinity (less than 25‰) during and after the rainy season, from May to December. This 7-8 month period provides the best tilapia growing season on that coast. However, rainier conditions on the Atlantic Coast may allow tilapia culture to be carried out in shrimp ponds year round.

Initial experimentation with shrimp-tilapia polyculture seems to be meeting with favorable results. In the Philippines, shrimp-tilapia polyculture has been found to be more productive than monoculture of tiger shrimps or Nile tilapia.

In Honduras it has even been suggested that tilapia consume shrimp which are killed by Taura virus in the pond and hence, possibly, reduce the spread of the virus between the crustaceans. √

Sources:

Shrimp Industry's Interest in Cultivating Tilapia, Acua-Noticias Zamorano, 1 July 1996.

B.W. Green. Inclusion of tilapia as a diversification strategy for penaeid shrimp culture. Proceedings of IV Simposio Centroamericano De Acuacultura, Tegucigalpa, Honduras, 22-24 April, 1997.

New Education Advisory Panel for Honduras

by Marion McNamara, Education Development Component Coordinator

The Education Advisory Panel for Honduras first came together in Tegucigalpa, Honduras, in April when its inaugural meeting was held just before the Central American Symposium on Aquaculture (22-24 April). The panel is made up of people throughout the spectrum of Honduran aquaculture —that is, representatives of government, educational institutions, and private business.

The panel agreed that there is a great need for training at all levels for aquaculture development to "take off" in Honduras. General areas of need include long-term training to develop human capacity for research and research administration so that aquaculture research stations can, in the future, operate under the direction of Hondurans. Short-term needs include technical training in production management and techniques and business management training to help farmers develop business plans and improve their marketing strategies.

One of the panel's recommendations was that the CRSP Education Development Component (EDC) support a graduate student to study at a CRSP-affiliated university for a Master's degree relating closely to CRSP research topics, and with an emphasis in research and research administration.

The panel will also help develop a schedule of short courses to be offered in Honduras over the next four years. Short courses will address topics of immediate concern to producers and will be self-supporting through participants' registration fees. Carole Engle, a CRSP researcher based at the University of Arkansas at Pine Bluff, will present the first short course in early September, introducing concepts on business plan development, farm management, and marketing. Later in the year, more in-depth workshops on each topic will follow up the introductory session.

Some members of the panel requested that EdOp Net, the educational opportunities network monthly newsletter, be made available in Spanish. As a result, a Spanish-language version of the August issue of EdOp Net will be reviewed by the Honduras Education Advisory Panel to determine if it is useful enough to be circulated to the general public.

The panel is continuing its work by developing criteria for selecting a candidate for the graduate student opportunity to be chosen this fall, and by assisting in the development and promotion of short courses. Members of the panel agree that working on the advisory panel creates an opportunity for aquaculture producers, educators, researchers, and government officials to network. The EDC will use the Honduras panel as a model in establishing similar panels in the other countries where the PD/A CRSP collaborates and where human capacity development is a limiting factor in the growth of aquaculture. √

If you're not already getting it, you might want to subscribe to EdOp Net. Here's why...and how.

EdOp Net is a free monthly newsletter published by the Education Development Component (EDC) of the Pond Dynamics/Aquaculture CRSP. The EDC works to increase training and education opportunities that complement CRSP research activities. Each month, **EdOp Net** provides updates on education, training, and employment opportunities that may be of interest to PD/A CRSP participants and to aquaculture researchers, students, and practitioners in the general aquaculture and development communities.

EdOp Net is provided in both electronic and paper formats. To receive **EdOp Net** each month, send an email request to <mcnamarm@ucs.orst.edu> and specify whether you would like to receive an electronic or hard copy (include your full address in either case). **EdOp Net** can also be accessed on the World Wide Web at: <http://www.orst.edu/Dept/crsp/edops/edop.html>.

Members of the Education Advisory Panel for Honduras are:

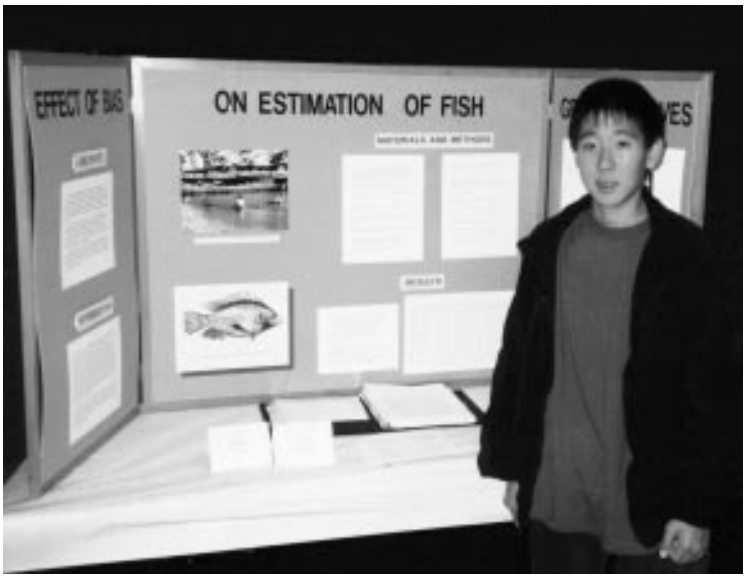
Francisco Avalos, Executive Director, Asociacion Nacional de Acuacultores de Honduras, (ANDAH)
Medardo Galindo, Gerente General of the Federation of Agricultural Exports of Honduras (FPX)
Rosa Garcia, Director, Direccion General de Pesca y Acuacultura (DIGEPESCA)
Bartholomew Green, Co-Principal Investigator, PD/A CRSP Honduras project
Daniel Meyer, Head, Animal Sciences Department of the Pan-American Agricultural School (EAP)
Dr. Marco Polo Micheletti Bain, Vice-Minister, Secretaria de Agricultura y Ganaderia
Marion McNamara, CRSP Education Development Component Coordinator
Luis Morales, Chief, Research Department, DIGEPESCA
Marco Tulio Sarmiento, Chief, Aquaculture Department, DIGEPESCA
Alberto Zelaya, Gerente General, ANDAH

High School Student's Analysis of CRSP Data Wins Award

by John Baker

Ryan Mashiyama, a 9th grader at Waiakea High School, Hawaii, received an award in the Senior Research division of the annual Hawaii State Science and Engineering Fair, held in Honolulu earlier this year. His project "The effect of bias on the estimation of fish growth curves" was a mathematical investigation of sampling bias incurred by seine netting. Ryan's mentor for this project was Kevin Hopkins, a former CRSP Principal Investigator. Ryan was able to use PD/A CRSP data as his source of measurements of seine-netted fish.

The purpose of the Science and Engineering Fair is to encourage and recognize the efforts and results of scientific investigations by secondary students that go beyond normal school studies. √



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Ryan Mashiyama and his award-winning presentation.

The following is the abstract of Ryan's Hawaii State Science and Engineering Fair presentation.

The effect of bias on the estimation of fish growth curves

Aquaculturists use growth curves to predict the growth and size of fish. Data used to form these growth curves usually come from whole population measures at stocking and harvest combined with data from seine sampling (i.e., catch the fish sample in a drag net) during the period between stocking and harvest. It has been noted that seine sampling tends to collect larger fish leading to biased (i.e., systematically incorrect) estimates of size. This project was conducted to determine the effect of this bias on the estimation of fish growth curves.

The source of data in this study was the Collaborative Research Support Program in Pond Dynamics/Aquaculture which conducts aquaculture research around the world. Data from 81 ponds were used. Von Bertalanffy Growth Functions (VBGF) were computed from the data as collected and from data which had been adjusted to remove bias. The VBGFs and Phi Prime, a standard estimator of growth performance, were then compared.

It was found that the bias from seine sampling would cause growth curves to be artificially high during the period between stocking and harvest. However, if the culture period was extended substantially, the curves derived from biased data would be too low. Also, Phi Prime was, on average, approximately 2% too high if it was derived from biased data. Thus, it is essential to correct seine sample data to remove bias before using that data to estimate fish growth curves.

NOTE: *Kevin Hopkins is expanding and editing Ryan's presentation, with the view to submission for publication in an aquaculture journal.*

Availability of Spanish Translation of Seafood HACCP Regulations

The Seafood Hazard Analysis Critical Control Point Regulations, 21 Code of Federal Regulations, Part 123-Fish and Fishery Products is available in Spanish for US $15 (includes postage and handling). The translation was done by CETI, a company that started about a year ago translating documents and is dedicated to providing communication service between English and Spanish. CETI works on a part-time basis (generally after 7:30 pm EST) translating documents. The translation of document 21 CFR Part 123 is their first publication venture to help the industry, academia, and regulators in Latin America. The translated document is not a substitute for the English HACCP regulation. The purpose of the translation is to serve as a tool for the Spanish-speaking countries in understanding the English version of the seafood HACCP regulation. Copies of the document can be obtained by sending a Money Order (no check or credit card) for $15.00 dollars (U.S.) to: Nydia Rivera, CETI Translation and Publication Service, 7865 Thor Drive, Annandale, VA 22003-1437, Phone: 703/560-4499.

Source: Pamela Tom, Sea Grant Ext Program, Food Sci & Tech Dept, University of California, Davis, CA 95616-8598.

NOTE: the Seafood HACCP Regulation is available on FDA's website at <http://vm.cfsan.fda.gov/~lrd/haccpsub.html>

Streptococcus iniae under the Microscope

Most aquaculturists have by now heard the stories about *Streptococcus iniae* since its rather splashy appearance on the aquaculture scene as another Mad Cow phenomenon—this time with a piscine twist.

We present here a brief round-up of items on this issue and progress being made to assess the threat to fish and humans from *Streptococcus iniae.* We especially invite reader comments and contributions to help distribute the latest findings about *Streptococcus iniae* and the real risk to fish and humans. Tell us what you know! — *Ed.*

Setting the Scene for a Discussion about *Streptococcus iniae*

by John Baker

Streptococcus iniae is a bacterium of significance to aquaculture and to tilapia farming in particular. The bacterium was originally isolated and described from abscess material in an Amazon freshwater dolphin (*Inia geoffrensis*); however, it is more widely found in intensively cultured fish. Intensive culture provides conditions that enable the rapid spread of pathogens. Likewise, poor conditions, imposing stress on fish, are very likely significant in the development of clinical disease and mortalities. Streptococcal infections have been found in all major tilapia-producing countries, including Taiwan, Japan, Israel, and the Americas. Streptococcal bacteria have become increasingly important agents of infection in both fresh- and saltwater fish culture.

The bacterium is the most significant source of streptoccal infection associated with disease in tilapia and hybrid striped bass in the US and has also been associated with disease in rainbow trout and coho salmon. In Israel it has been commonly associated with disease in a wide range of fish, including trout, tilapia, and ornamental fish.

Streptococcus iniae has also been reported as the source of bacteremic illness in humans, in Texas in 1991 and in Ottawa, Canada, in 1994. Four, more recent, cases in December 1995 and February 1996 in Ontario, Canada, attracted media attention, and indicated tilapia as the source of infection. All four patients had been preparing fresh whole fish, three of which were known to be tilapia. In two cases the fish were taken live from holding tanks. Transmission of the bacterium from fish to humans seems to occur through wounds incurred during the preparation of fish caused by knives or bones.

Currently, infection in humans responds well to antibiotics. However, the potential of *Streptococcus iniae* to cause disease in humans has implications for the treatment of the pathogen in fish. Berridge et al. (1997) warn "We must be ever vigilant in our use of antibiotics in food fish to minimize the potential for development of antibiotic resistance which might hamper the effective treatment of infections in man. Inappropriate antibiotic therapy in tilapia could not only induce problematic resistance in *S. iniae* (for both fish and man) but could also initiate resistance in other *Streptococcus sp*. with potentially dire consequences." √

Sources:
B.R. Berridge, S. Lawhon, A Eldar, H. Bercovier, D.E. Low, M. Weinstein and P.F. Frelier. Proceedings of IV Simposio Centroamericano De Acuacultura, Tegucigalpa, Honduras, 22-24 April, 1997.

Invasive infection due to *Streptococcus iniae*: A new or previously unrecognized disease. Canadian Bacterial Surveillance Network (CBSN) Newsletter, May 1996.

Research Initiative to Investigate *Streptococcus iniae* in farmed fish

The United States Department of Agriculture Agriculture Research Service has initiated a research project to investigate the epidemiology of *Streptococcus iniae* in tilapia, hybrid striped bass, and channel catfish culture, with the aim of solving the problems associated with bacterial infection in cultured fish. The project requires the cooperation of fish farmers, research institutions, and industry associations to facilitate the collection of data from cultured fish populations.

Persons interested in contributing to this project by allowing sampling should contact Dr. Phil Klesius. Data collected will be treated with confidentiality.

Contact:
Dr. Phil Klesius, Agriculture Research Service Project leader
Phone: 334-887-3741
Fax: 334-887-2983
Email: klesiph@vetmed.auburn.edu.

Source:
American Tilapia Association Newsletter, Summer 1997.

ATA Update on *Streptococcus*

by Ray DeWandel, President, American Tilapia Association

The American Tilapia Association has been working with fish culturists and the university network for several years to control fish diseases. Surveys of commercial growers of both tilapia and hybrid striped bass have indicated *Streptococcus* bacteria to be major problem worldwide, which leads to the mortality of millions of adult and juvenile fish each year. When news reports were published in Canada in the spring and summer of 1996 indicating possible human infection of *Streptococcus* from handling live fish, aquaculturists and researchers met in an open forum to discuss the situation.

First, many of the researchers doubted the accuracy of the findings and believe that the infections were from a different bacteria than is commonly found on fish. Secondly, since thousands of people are working on tilapia and bass farms and processing plants in the USA and overseas, and no one has reported being infected by *Streptococcus* bacteria even when it is present on their site, a rash of five of six infections over a half year period in Toronto would seem to be beyond the realm of probability. Thirdly, a nationwide survey of fish farms by the USDA-CDC for the *Streptococcus* bacteria identified in Toronto is being launched an early results indicate non imminent danger to people handling fish even on a daily basis.

The ATA recommends simple, common-sense guidelines for handling seafood, and indeed all food products. Although the risks of foodborne illnesses are always present, even when opening and drinking a can of soda pop. Proper precautions such as rinsing food products—animal and vegetable—with fresh, chlorinated water will minimize the potential for contamination. ATA assures the public that seafood products are generally safe and wholesome when handled and prepared using common sense. √

ATA Fact Sheet on Quality Control of Seafood

1 Bacteria may be found on the surface of many raw food products, including the surface of whole raw fish.

2 Care should be taken when handling all types of raw fish, especially if the fish are being gutted, de-boned or filleted. The preparation of raw fish remains safe, if consistent with the following guidelines:

- a Keep hands and utensils clean. Kitchen surfaces such as cutting boards should be washed with hot soapy water, chlorinated water, and disinfected with household bleach at 200 ppm solution.
- b Use care when handling sharp knives or fish bones. Avoid cuts or skin punctures.
- c Always wear kitchen gloves when preparing raw fish, and cotton gloves when handling live fish to provide a non-slip grip.

3 Among the bacteria generally involved in common skin infections (cellulitis) are *Streptococcus* and *Staphylococcus* (Strep and Staph). Strep has been found on both freshwater and marine fish around the world.

4 The safety of consuming fish is not in question. It is safe to eat properly cooked seafoods. However, food poisoning from other organisms can arise from eating raw shellfish or finfish. Consumers are encouraged to properly cook their seafoods.

5 It is possible that bacteria can cause infection by entering the skin through cuts which occur after contact with knives or sharp fish bones during the preparation of whole raw fish. The best precaution is to avoid direct contact between the bacteria and the bloodstream. This means rinsing raw fish in chlorinated water and wearing gloves when filleting or dressing raw seafood.

6 Though infection with any bacteria can be serious, streptococcal infections are not more dangerous than other common skin infections. Skin infections are not contagious and cannot be passed from one person to another.

7 Signs of bacterial skin infections include pain, redness, heat, and swelling in the affected area of skin. There may or may not be fever. If redness or swelling should develop after preparing raw fish, medical attention should be sought without delay.

8 Cellulitis is commonly treated with any of several types of antibiotics, including penicillin. The treatment is painless, inexpensive, and very effective if treated early.

9 The Center for Disease Control, the National Aquaculture Association and the American Tilapia Association assure the public that seafood products are generally safe and wholesome when handled and prepared using common sense.

These guidelines first appeared in the American Tilapia Association Newsletter, Autumn, 1996. They are reprinted here with permission of the American Tilipia Association.

Fishellaneous Items

Mike Sipe for Tilapia International, Florida, has been carrying out growth trials of chocolate hybrids, which are genetically male. His findings so far have led him to suggest that the rapid growth of the hybrids could allow as many as four growth cycles per year.

Source: Fish Farming International 23, no. 11, November 1996.

The Gift of Tilapia

A foundation, GIFT Foundation International Inc., has been launched in the Philippines to continue the selective breeding and research program that developed "Super Tilapia." Super tilapia is the nickname of a strain called GIFT Tilapia—GIFT being short for Genetic Improvement of Farmed Tilapia—which was developed by an ICLARM project. It shows higher survival and grows 60% faster than traditional stocks, allowing three fish crops per year, instead of the previously obtained two.

The new foundation will be run as a not-for-profit organization and will be responsible for distributing improved stock and aquaculture technology to farmers and a network of private hatcheries.

The GIFT Project is funded by the United Nations Development Program and the Asian Development Bank.

Source: *ICLARM Newsbriefs 41, Sept. 1996.*

Allen and Maria Reames have developed a tilapia-asparagus integrated system in Desert Center, CA. Irrigation water pumped from wells is used to fill oxygenated tilapia ponds and tanks. Waste water from the tilapia is then used to irrigate asparagus and grapefruit. Maria Reames claims that irrigation with fish effluent enhances asparagus vigor and growth.

Source: Aquaculture Magazine, January/February 1997.

U.S. Tilapia Production Expected to Decline

Although the ATA is still conducting nationwide interviews with Tilapia producers, preliminary data indicates a decline in production for 1996 after major increases over the past several years. The major constraints to production are high costs of production such as feed, electricity, freight to market and labor; high costs for construction such as for recirculating systems; losses due to disease and system failures; and low market prices, below the cost of production in many systems.
With the decrease in supply and increases in feed costs, producers are asking for higher prices at the farm gate and more stringent credit terms for buyers.
ATA will be contacting producers throughout the next few weeks and plans to publish its Annual Situation and Outlook Report by mid-summer. The report will detail domestic production by Region and will include the final Tilapia import statistics by country of origin. ATA President Ray DeWandel is asking for input on volumes and prices from producers in the USA and overseas.

Source: *American Tilapia Association Newsletter, Summer 1997.*

Transgenic Tilapia

The transgene, which when introduced to the genetic material of salmon, under the trade mark AquAdvantage™, leads to massively increased growth rates, has also been introduced into tilapia. Preliminary evidence shows a doubling in size for AquAdvantage™ tilapia compared to controls. Aqua Bounty Farms, the patent-holder, is hoping to license use of AquAdvantage™ fish in such a way to eliminate up-front fees, instead securing payment in the form of royalties on sales.

Source: *World Aquaculture, March 1997.*

Foreign Aid Funding - Does it Matter?

Source: USAID Developments, 3:2/Winter 1997

"Every dollar that we devote to preventing conflicts, to promoting democracy, to stopping the spread of disease and starvation, brings a sure return in security and savings. Yet international affairs spending today is just one per cent of the federal budget...," President Clinton said in his State of the Union address to Congress on Feb. 4.

USAIDs request out of that one per cent of the federal budget is only 0.42 percent—less than one half of one percent of the budget.

Secretary of State, Madeline Albright, USAID Administrator Brian Atwood and other top officials are urging Congress to reverse the decline in foreign assistance funding.

Albright, in her first appearance before Congress as the new secretary of state, told the House International Relations Committee on Feb. 11, "We have deeply reduced our foreign assistance programs, and we now contribute a smaller percentage of our national income to growth and democracy in the developing world than any other industrialized nation..."

Albright challenged the committee: "We must not forget that developing countries around the world offer the fastest-growing markets for American companies. We must continue to encourage these countries to participate fully in the global economy. And where possible, we should support their reforms through our bilateral development assistance and through the multilateral development banks."

Albright also noted the consequences of not providing assistance . "The threats of global warming, pollution, deforestation and loss of biodiversity may not be as dramatic as those posed by nuclear missiles or a terrorist's bomb," she said. "But if we ignore them we will surely pay the price in terms of poor health, lost jobs and the deterioration in our quality of life. That is why we must continue to forge bonds of cooperation in protecting the health and productivity of our common heritage of air, water, and land..."

USAIDs programs advance both US foreign policy goals and the well-being of some of the world's neediest people. Of the $19.4 billion requested by the president for programs in international affairs, USAID would manage $7.2 billion, which includes both USAID programs and programs administered by USAID in cooperation with other agencies.

USAID works with developing nations and countries in transition to support democracies and market economies. US exports to countries receiving USAID assistance grew by $98.7 billion from 1990 to 1995, supporting roughly 1.9 million jobs in the United States. By the year 2000, four out of five consumers in the world will live in developing nations.

Meeting ~ ISTA IV ~ Meeting

The International Symposium for Tilapia in Aquaculture IV will be held 9-12 November in Orlando, Florida. Conference sessions will cover a wide range of topics including:

- Marine fish, bait species, ornamentals, and shellfish
- International trade, competition among small producers, farming systems, live transport, and economics
- Quality control, management for ponds and tanks, pollution control, breeding strategies, genetic conservation

Optional tours to aquaculture facilities on east and west Florida coasts, EPCOT Land of Living Seas, and Harbor Branch Oceanographic Institute will also be available.

Meeting ~ WAS ~ Meeting

As you may know, meetings of the World Aquaculture Society are major international aquaculture events, bringing together technical, producer, and supplier segments of the aquaculture industry.

WAS '98 or the International Triennial Conference and Exposition of World Aquaculture Society, National Shellfisheries Association, and American Fisheries Society Fish Culture Section, will be held at Bally's Hotel in Las Vegas, Nevada, USA, from 15-19 February 1998. It will be hosted by the California Aquaculture Association and held jointly with the Western Regional Aquaculture EXPO.

Please refer to p.15 for contact information on both of these conferences.

Green Water Revolution

. . . from p. 1

consumption is around 20 kg, and the total regional demand for fish is more than 200,000 tonnes/year, of which less than 10% comes from local aquaculture. To a large extent the people depend on the harvesting of wild fish and on imports from central Thailand. Adding to the financial hardships imposed by a depressed economy, people in northeast Thailand commonly have to pay more for their fish at market than do people in other parts of the country.

Traditionally, aquaculture in northeast Thailand has been confined to backyard ponds used for holding fish captured from rice fields during the rainy season. Such ponds often serve multiple water uses during the dry season, such as washing, bathing, and irrigation as well as fish holding. Ponds receive little or no fertilizer input. Green water and algal scums are associated with dirty water, which is undesirable in terms of the daily use of these ponds. In telling farmers to make water green by putting fertilizers in their pond, we have had to surmount age-old tradition. It is a huge cultural and practical gap for us to overcome.

Fortunately, the water supply situation has changed in northeast Thailand during the last decade. To solve the problem of water shortages during the dry season, the Thai government has built numerous water bodies including village, watershed, and fish ponds and reservoirs. As a result, the use of surface waters is diversifying and changing from multi-purpose backyard ponds to ponds dedicated solely to fish culture. Many farmers have now diversified into aquaculture and have built fish ponds in the middle of their rice fields. Even so, it can still be a major task to persuade them that green water is good for fish. To overcome the conceptual problem and to spread the word of the CRSPs green water technology, AITs aquaculture outreach unit, in collaboration with Thai fisheries extension officers, has launched a program in Udorn province. We hired a local artist to produce comics, cartoons, posters, and pamphlets using the local dialect and locally identifiable characters to convey the new way of growing fish. We even recorded and distributed an audio cassette of songs based on the local ballad tradition, so that farmers can listen to tapes on making green-water ponds while they are working in the fields.

We started the green water campaign three years ago with little more than 20 volunteer farmers in Udorn province. The results have shown that these farmers have been able to increase fish production in their ponds from 500 kg/ha or so to 2,000 kg or more in one crop. The number of fish farmers using our guidelines has now risen into the hundreds and is still increasing. √

A recent advertisement for farm-raised fish spotted in a major U.S. newspaper.

Notices of Publication

~A New Distribution Format ~

For many years the PD/A CRSP has issued Notices of Publications to announce newly-published work carried out under PD/A CRSP sponsorship. From now on, instead of mailing out individual NOPs, there will be a space reserved in each issue of *Aquanews* for publicizing recently published work of CRSP researchers. As with NOPs to date, to receive a full copy of a report, please contact the author/s directly unless it is otherwise noted.

CRSP Research Report 97-103

Timing of supplemental feeding for tilapia production

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The staged addition of feed to fertilized fish ponds was evaluated by adding fertilizers to 15 ponds stocked with Nile tilapia *Oreochromis niloticus*, then adding feed at half ad libitum rates once fish in the ponds reached a target weight. Each pond was stocked with 750 fish (3 fish/m^2), and each treatment included three ponds with first feeding at (a) 50 g, (b) 100 g, (c) 150 g, (d) 200 g, and (e) 250 g. Ponds in Thailand (at the Ayutthaya Freshwater Fisheries Station, Royal Thai Department of Fisheries) were maintained for 236-328 d until the fish reached 500 g.

Growth was similar for all treatments under fertilizer alone (1.17 g/d) and was also similar when feed was applied (3.1 g/d). Feed application rates averaged 1.17% BW/d, indicating substantial use of natural food. Pond water quality did not deteriorate under supplemental feeding. Feed conversion rates averaged 1.03. Multiple regression indicated that 73.8% of the variance in growth was explained by design variables (feed input and days), while 86.2% of the variance in growth was explained by adding dissolved oxygen content and alkalinity into the equation.

The most efficient system was to grow fish to 100-150 g with fertilizers alone, then add feed. First adding feed (at 50% ad libitum) once fish reached 100 g produced the highest predicted annual revenues ($6,164 per hectare). Results of this experiment indicated that either critical standing crop occurred early (before the first fish sample) or did not occur at all in these ponds.

This abstract was excerpted from the original paper, which was published in the Journ. of the World Aquaculture Society, 27(4)1996:410.

CRSP Research Report 97-104

Optimal resource allocation by fish farmers in Rwanda

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Although many small-scale fish farming projects around the world promote fish production as a source of low-cost protein, increasing evidence demonstrates fish to be an important cash crop, even for limited-resource farmers. A mathematical programming model was developed from survey data of Rwandan farmers to determine optimal resource allocation on subsistence farms in Rwanda. The specific objective of the study was to determine farm plans that maximize returns to a representative Rwandan farm family's resources, subject to constraints of the farm family's proteinic and caloric requirements. Soybeans, sweet potatoes, and maize were selected to meet household nutritional requirements. Fish production was selected as the principal cash crop, in most cases lending support to the evidence that fish is more important as a cash crop than as a primary protein source in Rwanda

This abstract was excerpted from the original paper, which was published in the Journal of Applied Aquaculture, 7(1)1997:1-17.

Notices of Publication (cont.)

CRSP Research Report 97-105

Observations and model predictions of daily areal primary production in a eutrophic brackish water culture pond

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Observations of daily gross primary production of oxygen per unit area in a eutrophic, brackish water shrimp culture pond over a 14-day period are compared with predictions from two models in order to assess the utility of the model approaches for ponds and to refine observational protocols and techniques for pond assessment.

The models predicted rates (3.2 to 37.7 g O_2 m^{-2} d^{-1}) which exceeded observations (4.7 to 15.7 g O_2 m^{-2} d^{-1}) at all but the lowest light levels. Observed rates were also lower than other observations at similar light levels. These shortfalls are attributed to (1) the inadequacy of the method for estimation of community respiration as a component of gross production, in the absence of direct observation; and (2) the possibility of nutrient limitation of rates in the pond ecosystem.

The models are sufficiently sensitive to chosen parameter values, and the day-to-day variation of the parameters in the ecosystem likely sufficiently variable, that daily determinations of parameters should be made when possible, with particular attention to timing and use of surface water. Field observations of daytime community respiration, and improved knowledge of its controlling factors and relationships, are important needs for the advancement of model treatment of photosynthesis in ponds.

Eutrophic pond ecosystems have characteristics (vertical temperature structure resembling natural water bodies, complete light extinction within the shallow water column) which make them amenable to study as microcosms of some general aspects of aquatic primary production, particularly problems involving the prediction of daily areal rates from small-scale volume-based rate data.

This abstract was excerpted from the original paper, which was published in the Ecological Modelling International Journal on Ecological Modelling and Systems Ecology, 88(1996):83-92.

CRSP Research Report 97-106

Comparison of three mixing devices in earthen culture ponds of four different surface areas

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Mechanical mixing of culture ponds with low-powered devices can conserve photosynthetically-produced dissolved oxygen, and so reduce the need for more expensive aeration. This work aimed to test inexpensive, easily obtained devices and to establish the utility of quantifying stratification and mixing processes in power units to facilitate comparisons and projection of requirements to new situations. Three mixing devices of power consumption less than 0·25 hp (63·5-173·6 W) were compared in tropical earthen ponds of surface areas ranging from 200 to 1400 m^2. Mixers were operated during the time of maximum stratification in control ponds (13:00-16:00 h), to standardize test conditions. Performance was assessed as reduction in a pond's stratification energy (SE), contained in the uneven vertical distribution of mass.

Neighboring unmixed ponds showed very similar diel cycles of SE; unmixed ponds also showed similar patterns on successive days, but varied more than neighboring ponds assessed simultaneously. The mixing device of greatest power consumption, a fan-blade aerator-mixer (AM) operated below water surface, reduced stratification energy more quickly than a submersible impeller pump (SP) and an air-lift (AL). The AM and AL were more efficient than the SP, but all were of low efficiency (less than 0·1%). Efficiencies were related to pond size, with perimeter/area ratio being significant but surface/volume not so. Mixing effects propagated rapidly horizontally.

The AM applied sufficient power to exceed the observed daytime rate of increase in stratification energy, i.e. to prevent stratification, in ponds of all sizes except the largest. The AL and SP did not apply power at sufficient rates, and the AM would have been inadequate at other times. It is not necessary, however, to prevent stratification completely for all mixing applications.

This abstract was excerpted from the original paper, which was published in Aquacultural Engineering, 15(5)1996:381-396.

Notices of Publication (cont.)

CRSP Research Report 97-107

Inclusion of tilapia as a diversification strategy for penaeid shrimp culture

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The potential for tilapia culture in brackish water shrimp ponds is evaluated. Aquaculturally important tilapia are the Nile tilapia (*Oreochromis niloticus*), blue tilapia (*O. aureus*), red tilapia (*Oreochromis spp.*) and, to a lesser extent, Mozambique tilapia (*O. mossambicus*). Nile and blue tilapia can tolerate salinities as high as $36^0/00$ to $40^0/00$, but best growth occurs at salinities below $20^0/00$ Red tilapia, either from Florida or Taiwan, survive and grow well in salinities of $36^0/00$. Mozambique tilapia is able to tolerate salinities as high as $120^0/00$, but good growth is reported through salinities of $36^0/00$. While these tilapia can spawn in waters of various salinities, greater fingerling production is achieved in freshwater or slightly saline ($2^0/00$ to $5^0/00$) waters. Maximum salinity tolerance in tilapia appears to be reached at a total length of 50 to 70 mm. Acclimation of tilapia from freshwater to saline water appears best accomplished by increasing salinity from 2.5-$5^0/00$ daily until the desired salinity is reached, although some producers acclimate more rapidly. Season, choice of culture species, source of tilapia fingerlings, market, and management/logistical considerations of tilapia-marine shrimp polyculture are discussed. Along the Pacific coast of Central America, polyculture of tilapia and marine shrimp may be limited to 6 to 7 months each year during and immediately following the rainy season depending on the tilapia species. Tilapia can be stocked directly into ponds or into cages placed in ponds, supply canals or drain canals. Both cage culture of tilapia in shrimp farm supply canals, and polyculture of tilapia and shrimp in production ponds are being implemented on shrimp farms in Latin America. Management systems have been developed for this polyculture where either tilapia or shrimp is the principal culture species.

This abstract was excerpted from the original paper, which was published in IV Symposium on Aquaculture in Central America: Focusing on Shrimp and Tilapia, 22-24 April 1997: 85.

CRSP Research Report 97-108

Semi-intensive shrimp pond management and quality of effluents

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A collaborative research program was established in Choluteca, Honduras, in 1993 to establish a baseline of estuarine water quality in the shrimp producing regions and to study the impact of pond management on effluent water quality. Participants in the program included Auburn University AL, the Ministry of Natural Resources, Government of Honduras, the National Association of Honduran Aquaculturists (ANDAH), Pan-American Agricultural School at Zamorano, Honduras, and the Federation of Export Producers (FPX). This report summarizes studies on effluent quality from ponds and makes associations between pond management and effluent quality.

This abstract was excerpted from the original paper, which was published in IV Symposium on Aquaculture in Central America: Focusing on Shrimp and Tilapia, 22-24 April 1997: 203.

Notices of Publication (cont.)

CRSP Research Report 97-109

The Pond Dynamics/Aquaculture CRSP-sponsored proceedings of the third conference on the culture of tilapias at high elevations in Africa

Karen Veverica, Editor
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Auburn University, Alabama 36849

This was the third conference of its kind to be held for Rwanda, Burundi, and Kivu province in the east part of Zaire. High elevation was understood to be greater than 1,000 meters. During the conference, country reports were presented describing the extension service and providing technical data following a list of points included in the conference invitation. Technical papers on rice-fish culture and extension strategy were presented from Burundi. Papers on rabbit-fish culture, composting regimes, elevation-related tilapia production and tilapia-clarias polyculture were presented from Rwanda. Kivu province presented a paper on the Zaire Peace Corps fish culture sustainable extension service. Attendees included ministry personnel, university professors, FAO personnel, university students, Peace Corps volunteers, station managers, model farmers, extension and training specialists, and some trainees.

The organization and operation of the extension services in all three countries were compared. Fish culture extension has been assured mainly by Peace Corps volunteers in Zaire, with very few Zairian counterparts on hand. In Rwanda, although some Peace Corps volunteers have recently commenced activities in fish culture, Rwandese extension agents are responsible for all fish culture extension. Burundi is in the midst of re-vamping its fish culture extension service. It previously relied on Peace Corps volunteers but now has funding to train its own extension agents. However, Burundi presently has a freeze on hiring for government jobs and has opted to use extension agents already working in other domains such as forestry. A very lively discussion of the advantages and disadvantages of each country's extension service took place. All three countries have active farmer training programs. (The foregoing are the first two paragraphs of the publication's Executive Summary.)

This abstract was excerpted from the original publication, entitled The Pond Dynamics/Aquaculture CRSP-Sponsored Proceedings of the Third Conference on the Culture of Tilapias at High Elevations in Africa, 41(1997): 1.

CRSP Research Report 97-110

The CRSPs: International Collaborative Research Supports Programs

John M. Yohe, Pat Barnes McConnell, Hillary S. Egna, John Rowntree, Jim Oxley, Roger G. Hanson, David Cummins, and Avanelle Kirksey*

The Collaborative Research Support Programs (CRSPs) are communities of U.S. Universities, U.S. Agency for International Development (USAID) and USAID missions, and developing countries national agriculture research systems (NARS), other U.S. federal agencies, international agricultural research centers (IARCs), private agencies, industry, private voluntary organizations (PVOs), and other developing country institutions. Their scientists, in close collaboration with one another and for the mutual benefits of their programs, carry out agricultural research and training around identified constraints to food production, storage, marketing, and consumption. More specifically, they include components which address food and agricultural policy/planning, natural resource management, plant and animal improvement (including basic genetics, biodiversity, applied genetics and biotechnology), plant and animal physiology and improved production practices, plant and animal protection, socio-economic and socio-cultural factors influencing production and consumption patterns; cultural constraints to technology adoption and development; and improved food processing, household food security and human nutrition. Through shared resources, peer review and institutional support, these communities of scientists and institutions give emphasis to the needs of small scale producers and the rural and urban poor. (The foregoing is the introductory paragraph to this book chapter.)

This abstract was excerpted from the original publication, which is Chapter 19 in Disease Analysis through Genetics and Biotechnology: Interdisciplinary Bridges to Improved Sorghum and Millet Crops, In: J.F. Leslie and R.A. Frederiksen (Editors), Iowa State University Press, 1(1995): 321.

*To order this publication contact:
Publications
PD/A CRSP
400 Snell Hall
Oregon State University
Corvallis OR 97331, USA.

Upcoming Conferences and Expositions

Date	Topic/Title	Event Location	Contact Information
Aug 10-13	Aquaculture Trondheim '97	Trondheim, Norway	European Aquaculture Society, Slijkensesteenweg 4, B-8400 Oostende, Belgium, Tel: +32 59 323859, Fax +32 59 321005, email: eas@unicall.be
Aug 13-16	AquaNor '97	Trondheim, Norway	AquaNor, Nidarohallene, N-7030 Tronaheim, Norway, Fax: +47 73 516135
Aug 24-27	American Fisheries Society Annual Trade Show	Monterey, California, USA	Amy Fink, American Fisheries Society, 5410 Grosvenor Lane, Suite 110, Bethseda, Maryland 20814-2199, Tel: (301) 897 8616 ext 214, Fax: (301) 897 8096
Sept 7-12	Practical Short Course on Aquaculture Feed Prep, Nutrition and Feed Mgmt	Texas, USA	Dr. Mian N. Riaz, Rood Protein R&D Center, Texas A&M University, College Station, TX 77843-2476, Tel: (409) 845 2741, Fax (409) 845 2744, email: mnriaz@tamu.edu
Sept 8-11	Stock Enhancement & Sea Ranching	Bergen, Norway	PUSH, Bontelabo 2, N-5003 Bergen, Norway, Fax: +47 55 31 73 95, email: borthen@telepost.no
Sept 17-21	World Fishing Expo.	Vigo, Spain	Patricia Foster, Nexus Media Ltd., Top Floor, 84 Kew Road, Richmond, Surrey, TW9 2PQ, UK, Tel: +44 181 332 9273, Fax: +44 181 3329335
Sept 19-21	Aquaculture Pacific Exchange	Cambell River, BC, Canada	Master promotions Ltd, P.O. Box 565, Saint John, New Brunswick, Canada E2L 3Z8, Fax: +1 (506) 658 0750
Sept 21-23	26th Fish Feed and Nutrition Workshop	Frankfort, Kentucky, USA	Carl Webster Tel: (502) 564 9109 or James Tidwell Tel: (502) 564 9104
Oct 5-11	3rd Intl Abalone Symposium	Monterey, California, USA	Catherine Ashley, California Sea Grant College, 9500 Gilman Dr, La Jolla CA 92093-0232; Fax 619 534 2231; email: cashley@ucsd.edu
Oct 22-27	IV Ecudorian Aquaculture Conference	Guayaquil, Ecuador	Conference Information: Tel: +593 4 269455, Fax: +593 4 269456.
Oct 23-25	Fish Africa '97	Culemborg, Cape Town, So. Africa	Clare Northcott, EMAP Heighway, Meed House, 21 John St, London WC1N 2BP, England; Tel +44 (0) 171 470 6301; Fax 44 (0) 831 9362, email: claren@meed.emap.co.uk or EMS, PO Box 630302, Benmore 2010, Johannesburg, South Africa, Fax +27 11 783 7269
Nov 2-5	Sustainable Aquaculture 2nd Intl Symposium	Oslo, Norway	Nils Svennevig, MARINTEK, PO Box 4125, Valentinlyst, N-7002, Trondheim, Norway, Fax: +47 73 595660
Nov 9-12	ISTA IV	Orlando, Florida, USA	Kevin Fitzsimmons, University of Arizona, 2601 E. Airport Drive, Tucon, AZ 85706, USA; Tel; 520 741 1990; Fax 520 573 0852; email kevfitz@ag.arizona.edu
Feb 15-19 1998	World Aquaculture Society, Aquaculture '98	Las Vegas, NE, USA	Aquaculture '98 Conference Manager, 21710 7th Place West, Bothell, WA 98021, USA; Tel 1-206-425-6682; fax 1-206-483-6319; email worldaqua@aol.com
Mar 18-20	Aquaculture International 98	Glasgow, Scotland, UK	Emap Heighway, MEED House, 21 John Street. London WC1N 2BP, England, Fax: +44 171 831 2509

Workshops and Short Courses

Date	Title/Topic/Site	Contacts
Year-round	Work Experience in Hatcheries Techniques/ Asian Institute of Technology, Thailand	Aquaculture Short Course Unit, Ag & Aquatic Systems, School of Env, Resources & Development, GPO Box 2754, Bangkok 10501 Thailand; Fax 66 2 524 5484; email: somchai@ait.ac.th
Year-round	Training & Research in Fisheries & Stock Mgmt/Wageningen Agricultural University, the Netherlands	G. van Eck, Dept of Fish Culture & Fisheries, PO Box 338, 6700 AH Wageningen, The Netherlands; Tel 31 8370 8330; Fax 31 8370 83937; email: gerrie.va.eck@alg.venv.wau.nl
Sept 10-17	Texas Shrimp Farming Course Port Arkansas, Texas	Sea Grant College Program Office, Attn: Lynn Propes, 1716 Briarcrest Suite 702, Bryan, Texas 77802-2700, USA Tel 409-845-7524; Fax 409-845-7525; email lpropes@unix.tamu.edu

Selected Aquaculture Internet Resources

PD/A CRSP Web Site

Program information, technical reports, and the newsletter *Aquanews* can be found at the PD/A CRSP Website: http://www.orst.edu/dept/crsp/homepage.html. This site also has links to:

POND©, the decision support software for aquaculture;
EdOp Net, a resource for those in search of employment, education and training opportunities in the field of aquaculture; and many others

PD/A CRSP Central Database

The PD/A CRSP Central Database is the world's largest repository of tropical pond aquaculture data, which has been collected from CRSP experiments since 1982. Currently, CRSP researchers at Oregon State University, Drs. John Bolte and Doug Ernst, are in the process of making the database available directly via the Web. Web users will be able to query the database, extract particular datasets of interest, and view the results of their queries graphically. The database will be accessible from the CRSP home page, or at: http://biosys.bre.orst.edu/crspDB.

University of Idaho Aquaculture Information Service On-line

The University of Idaho Aquaculture Research Institute has made an aquaculture database available via the internet. The aquaculture information database originated in 1989 with a grant provided by the United States Department of Agriculture. The grant was administered by the Western Regional Aquaculture Center in Seattle, Washington, which sponsored the Aquaculture Information Service and databases until March 31, 1994.

Thanks to a new sponsorship from the Northwest Area Foundation, the University of Idaho Aquaculture Information Service (UIAIS) was able to transfer all accumulated aquaculture data to a new database server connected to the Internet.

The aquaculture databases can be accessed from the UIAIS's homepage: http://www.uidaho.edu/ag/aquaculture/ or via telnet: telnet raven.csrv.uidaho.edu and typing fish at the login prompt. Or use the IP address for Raven: telnet 129:101.119.222.

Phone: 208-885-5830
Fax: 208-885-5968
E-mail: aqua@uidaho.edu

AIT Aquaculture WWW Site

The Agri-aqua server at the Asian Institute for Technology (AIT) maintains the AIT Aquaculture Web site providing information on aquaculture and promoting the work of AIT Aquaculture.

http://www.agri-aqua.ait.ac.th
email - aasp@ait.ac.th

AQUANEWS

Director: Hillary S. Egna
Aquanews Editor: Danielle Z. Clair, with assistance from John Baker

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