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 Rifts in the global economy are leading to increased demand for aquaculture products

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New technology for producing protein enriched pea-flour, Blast frozen worms; Waste recycling system

UNDERSTANDING SOY TO BENEFIT AQUACULTURE

A coalition seeks to share information on the use of soybeans in aquafeeds

MILLING AROUND

Aquaculture is the only way to meet surging demand, but challenges to future growth loom, new FAO report says; Book review and more ...

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Cover photo by courtesy of Inve Technologies nv: Feed pellets coated with Sanolife Bacillus Above: P. monodon from a feeding trial in India.
In this issue

In this issue Dr. Olivier Decamp explains Inve's years of development and evaluation work on mixtures of selected Bacillus strains that improve the health of shrimp and fish by controlling pathogens and improving water quality. On the technology front, Buhler's high-capacity twinscrew extrusion system, ECOtwin, is highlighted: it has been designed specifically for pet-food and aquafeed production. A database that characterizes the levels of the various anti-nutritional factors – specifically lectins, oligosaccharides and trypsin inhibitors found in soybean meal is just one outcome of a coalition of researchers, aqua farmers, feed manufacturers and others with an interest in the utilization of say in aquafeed. Gil Griffis invites you to get involved. We hope you enjoy these and the other articles in this month’s issue.

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Probiotics, being natural and beneficial bacteria, are now well accepted and widely used in shrimp aquaculture as health management tools to increase productivity and profits. Potentially, they may have one or more beneficial functions for aquaculture producers:

- To improve water and pond bottom sediment quality, leading to less stress on reared animals and thus improved health and growth
- To reduce the environmental impact by degrading some of the waste products from the effluent
- To control pathogenic bacteria and manage the overall microbial ecosystem
- To stimulate the immune system
- To improve gut flora and hence lead to lower disease incidence and increased food assimilation
- To stimulate appetite and improve nutrition by the production of vitamins, detoxification of compounds in the diet, and by the breakdown of indigestible components

**APPROPRIATE FOR AQUACULTURE**

_Bacillus_ strains are appropriate for aquaculture for several reasons:

- _Bacillus_ are ubiquitous bacteria, found in soil, freshwater and seawater, and also in the gastrointestinal tracts of crustaceans, fish, terrestrial animals and even humans.
- _Bacillus_ strains can be selected that perform the functions listed above.
- _Bacillus_ can be produced at very high concentrations at a moderate cost compared to non-spore forming bacteria. Furthermore, being spore formers, they are easy to transport and store as spray-dried powders.
- They can be applied easily in the water or to the feed.
- The _Bacillus_ genus is well studied and tools exist to evaluate their safety to humans. (Moriarty et al., 2005; Decamp & Moriarty, 2006)

The development of suitable probiotics is...
not a simple task. It requires empirical and fundamental research, full-scale trials, and the development of appropriate monitoring tools and production under stringent quality control.

Within the last six years, INVE has developed, evaluated for efficacy, cost/benefit and safety, and commercialised mixtures of selected *Bacillus* strains that improve the health of shrimp or fish by controlling pathogens and improving water quality by modifying the microbial community composition of the water and sediment.

The performance of the water conditioner Sanolife MIC in shrimp larviculture has been reported at conferences such as LARVI’05 or Asiaresist workshop and in publications.

More recently the benefit of a similar mixture applied through the live food has been documented for guilthead seabream and Japanese flounder larviculture (*Decamp et al.*, 2006).

**PERFORMANCE EVALUATION**

The performance of the Sanolife *Bacillus* strains, when applied through the feed (top dressed at the farm site or at the feed mill), has been evaluated in shrimp grow out (*Litopenaeus vannamei*, *L. stylirostris* and *Penaeus monodon*), in Asia, the Pacific region and Latin America.

The application of these bacteria (concentration ranging from $1 \times 10^7$ to $1.5 \times 10^9$ cfu/g feed according to rearing conditions), in association with suitable pond management led to marked benefit to the farmers:

**Faster growth**

Scientists at IFREMER showed, in a con-

![Figure 1](image1.png)

**Figure 1**

Growth rates of *L. stylirostris* (evaluated in tanks, 26 day period at the IFREMER laboratory, St. Vincent, New Caledonia) and *L. vannamei* (evaluated at Aquinor farm, Northeast Brazil, over the complete production cycle).

![Figure 2](image2.png)

**Figure 2**

Survival rates of *L. vannamei*, *P. monodon* and *L. stylirostris* in control and Sanolife ponds. Data on *L. vannamei* collected in Ecuador, data on *P. monodon* collected in India and data on *L. stylirostris* collected in New Caledonia.
trolled experiment with replicates, that there was a very significant increase in growth rate when the Sanolife *Bacillus* was mixed with the feed pellets shortly before feeding the shrimp (Moriarty et al., 2006). Similar improvements in growth rates were recorded with *L. vannamei* under commercial conditions in Ecuador and Brazil (Figure 1).

**Higher survival**
The application of the Sanolife *Bacillus* led to an increased survival rate in all studied species (Figure 2). In a test carried out with *L. vannamei* in Ecuador (7 ponds with total area 96 ha), the survival rate increased by 62%!

**Improved Feed Conversion Ratio**
For the three species evaluated in the three regions, a marked reduction in FCR was recorded (Figure 3).

**Larger animals at harvest**
In a trial carried out in India with *P. monodon* (Andrah Pradesh, triplicate treatment and control ponds), the application of Sanolife *Bacillus* led to larger average animals at harvest (23 g versus 19 g) and 25% of the biomass being larger animals (34 g) fetching a much higher price. A combination of higher survival with larger size animals lead to higher biomass and, more importantly, together with a more efficient use of compound feed, higher income for the farmers.

---

**Figure 3**
Food Conversion Ratio of shrimp from control and Sanolife ponds. Data on *L. vannamei* collected in Ecuador, data on *P. monodon* collected in India and data on *L. stylirostris* collected in New Caledonia.

**Figure 4**
Monthly weight gain (as percentage increase) after 1 and 2 months rearing of Japanese flounder in a recirculation system. The fish were stocked at 60-80g.
In all these trials, the net profit was therefore far greater when the probiotics were used. Ongoing trials indicate similar benefits in fish farming (Decamp et al., 2006). Japanese flounder, reared in a Chinese commercial recirculation system, gained markedly in weight each month when the Sanolife Bacillus probiotics were combined with the water and their feed (Figure 4).

**FEED INCORPORATION**

The requirements for successful probiotics include a reliable improvement of animal health as well as improved cost benefit. The mode of delivery should be easily applicable for the farmers. Applying probiotics as a top dressing at the farm is not practical when dealing with large aquaculture operations.

The characteristics of Bacillus spores permit a different mode of delivery, viz.: by incorporating the spores in the feed at the feed mill. The resistance of spores can be explained by various factors, such as the presence of the thick proteinaceous spore coats; the reduced permeability of the spore core to hydrophilic agents; or the reduced water content in the spore core (Setlow, 1999). Bacterial spores are inactivated by a combination of heat and pressure, and it is of no surprise, therefore, that Bacillus spores are not able to withstand the combination of heat, moisture and pressure encountered during the extrusion process. Biourges et al. (1998) reported that the extrusion-expansion and drying process resulted in the loss of >99% of the spores of a Bacillus cereus strain. On the other hand, the ability of spores to handle 80°C for up to one hour (Havenaar et al, 1992, cited in Gil-Turnes et al. 1999; INVE Technologies, unpublished) indicates they might be pelletized without appreciable loss of viability. Vaerewijck et al. (2001) even reported that over 15% of the Bacillus subtilis group (B. subtilis, B. amyloliquefaciens and B. licheniformis) that had been isolated from feed concentrates for dairy cattle, were very heat-resistant, i.e. able to survive 30 minutes at 100°C. A more suitable approach is powder coating or post coating, which appear to be an efficient and convenient way to add Bacillus spores to the diet despite some losses (Biourges et al., 1998).

Experiments by INVE Technologies (unpublished) showed that up to 90% of the Sanolife Bacillus spores were recovered following top coating with oil. Storage tests with shrimp feed that had been coated with the Sanolife Bacillus spores indicate that the concentration of viable spores remained above the specifications over a period of 6 months when the coated pellets were stored at temperature ranging from -4°C to +30°C in the dark.

![Figure 5](image-url)

**Figure 5**

Concentration of spores in shrimp feed that had been top coated with Sanolife Bacillus spores following storage in the dark at 4 different temperatures.

-20°C
-4°C
20°C
30°C
Various parameters will affect the recovery of Bacillus spores following the coating process:

- **Heat sensitivity varies among strains and species.**
  The sporulation conditions influence the pressure resistance (Margosch et al., 2004), indicating that conditions prevailing during the fermentation/production of the Bacillus spores may affect their performance during the feed manufacturing process.

- **Set-up at the feed mill.**
  This includes, but is not limited to, the temperature of the pellets being sprayed with the Bacillus spores or the homogenisation of the oil-probiotic mixture.

- **Suitable enumeration method.**
  The enumeration procedure is based on the heat treatment of the sample, in order to kill vegetative cells, followed by serial dilution and spreading on agar plates. Natural spore populations exhibit tight adherence to soil particles and are not readily overcome by the extraction and purification procedure (Nicholson & Law, 1999). Spores are sticky, making it difficult to obtain a homogeneous separation of all spores from samples before serial dilution for plating on nutrient agar.

**CONCLUSIONS**

Selected Bacillus strains improve the health of shrimp or fish by controlling pathogens and improving water quality by modifying the microbial community composition of the water and sediment.

Not all Bacillus strains are suitable as probiotics for aquaculture. Bacillus can be coated onto feed at the farm and at the feed mill, in an oil-phase top dressing after pellet production. Strain-specific variation in heat/moisture/pressure tolerance exists but Bacillus spores cannot survive extrusion. Probiotic bacteria enter the gut or attach to external surfaces of the animals either directly from the water or via attachment first to food or other ingested particles. Thus, they can be used in aquaculture both as water and sediment quality conditioners and as feed supplements. These probiotic strains are not therapeutic agents, but will alter directly or indirectly the composition of the microbial community in the rearing environment and the shrimp intestinal tract. Probiotics are only effective and cost-beneficial when they are properly applied together with suitable farm management.

For more information contact:
Dr. Olivier Decamp: o.decamp@inve.be.

**References:**


Moriarty, D.J.W., Decamp, O., Pham, D., De Decker, S., Ansquer, D., Harache, Y., Bador, R., Lavens, P. 2006. Sanolife Probiotics prove successful in IFREMER and New Caledonian shrimp farms. AQUAculture Asia Pacific. in press.


New Dimensions in Twin-Screw Extrusion Technology.

The Buhler twin-screw extrusion systems set standards in performance, flexibility and ease of operation: a reliable platform for exciting new products, advanced formulations and aquaculture diets.

**Buhler Extrusion Systems are your reliable partner for aquaculture diets.**
The new, high-capacity twinn Screw extrusion system, ECOTwin, has been developed in collaboration with leading customers especially for petfood and aquafeed applications. The ECOTwin sets new standards in terms of flexibility, product quality, and production cost reduction. The Buhler ECOTwin extrusion system is made up of the extruder, the preconditioner, and the peripheral equipment. Its performance data is tailored to the specific needs of petfood and aquafeed production. Its modular design ensures that users’ current and future requirements can be optimally satisfied.

HIGH DEGREE OF SANITATION
The system is distinguished by its high operating reliability and ease of operation. Its easy cleaning and access to all critical zones ensure a high degree of sanitation. The new ECOTwin allows separate selection and online control of the cooking degree and the bulk density of the end products. This is possible thanks to the patented SME and Density Control modules. The Density Control module additionally allows much of the thermal energy to be recovered and odor emissions to be reduced. The SME module consists of a throttling device with two valve cylinders. In their open position, they map the contour of the inside of the extruder barrel, and when closed the contours of the screw diameter.
Closing of the valve cylinders increases the retarding length of the material ahead of the throttle, causing the filling degree and retention time to increase. This, in turn, increases the specific mechanical energy (SME). When the cylinders open, the opposite happens. The module can be installed at any point of the processing section and not only at the end of the extruder. This allows the process sections of cooking and forming to be separated.

**DRAWBACKS ELIMINATED**
Traditionally, three possibilities exist to control the cooking degree: by changing the product moisture, by adjusting the screw configuration, and by varying the extruder screw speed. Controlling the SME via the product moisture is uneconomical, since any water added to the product must be extracted again in a subsequent drying stage, which requires additional energy. Adjusting the screw configuration requires a conversion of the screw shafts. This is very costly, resulting not only in long downtimes, but also in higher consumption of raw materials. The variation of the screw speed will change the throughput. But as a rule, the maximum screw speed is used to maximize the throughput rate. All these drawbacks have been eliminated by the SME module. The mechanical energy input can be selected quickly during ongoing production and be maintained constant within narrow tolerances.

**OPEN EXTRUDER BARREL**
The Density Control module is based on an open extruder barrel. The opening is provided with a degassing socket and a hold-down mechanism, which prevents product particles from being discharged from the barrel along with the steam. In general, three modes of operation are applied. In the positive-pressure mode, fresh steam is added, which raises the product temperature, increases product expansion at the outlet, and thereby leads to a lower bulk density. In the pressure-neutral mode, the steam discharged is returned straight to the preconditioner. In the negative-pressure mode, the steam is discharged via a vacuum system, intensifying product cooling, reducing product expansion at the die, and thereby increasing the bulk density of the product. In this operating mode, too, the extracted energy is returned to the preconditioner in the form of hot water along with any odors generated, slashing the energy requirements and thereby cutting costs.

For more information on the ECotwin, please contact: Christopher Rubin, Sales representative for the Extrusion Systems business unit at Buhler in Uzwil. es.buz@buhlergroup.com

FEED TECHNOLOGY UPDATE — September 2006
NEW TECHNOLOGY FOR PRODUCING PROTEIN ENRICHED PEA FLOUR

For the production of protein-enriched pea flour, Alpine supplies specially designed systems to process whole peas into a high- and a low-protein pea flour.

The peas are pre-crushed with an Alpine HA hammer mill, and the shell fraction is subsequently separated using an Alpine MZM zigzag classifier. For the protein enrichment step, the pre-crushed and cleaned material runs though a metal separator before entering the Alpine Zirkoplex ZPS classifier mill for fine grinding. As shown in the flowsheet, this classifier mill is connected in-line and upstream of an Alpine Turboplex ATP ultrafine classifier,
which separates the pea flour into a high-protein and a low-protein fraction.
The high-protein product is separated from the classifying air in a downstream automatic reverse jet filter. Depending upon the protein values of the feed product and the customer requirements, a fines fraction with a protein value of up to approx. 55% (in dry substance) can be achieved in the final product. The coarse fraction (low-protein product) then shows a protein value of approx. 12% (in dry substance). This data is based on a 24% protein content in the feed product and a high/low protein relation of 35%/65%.

More information:
food@alpine.hosokawa.com
www.alpinehosokawa.com
Blast freezing is a very important feature of the product, Seabait, SPF marine polychaete worms (ragworms). Seabait worms represent an ideal food for many species of fish and shrimp. The worms are grown under optimised conditions of light and temperature (process patents granted) to achieve an exceptional consistency of quality throughout the year. The specialised diet provided ensures maximum nutritional content at the point of harvest.

Blast freezing preserves this high nutrient content in the product for the end user – the hatcheries throughout the world. Blast freezing is well recognised as the method of choice for preservation of foods. And a ragworm is simply an ideal food for shrimp and fish.

The combination of pack design and freezer specification enables the ragworms to be frozen from the chilly 20°C at which they are grown to -18°C in the shortest possible time. Blast freezing helps to keep food looking good - it helps to keep ragworms looking good, and tasting good too.

The blast freezing process not only locks in the maximum nutrient value and flavour (to stimulate a rapid feeding response in the shrimp or fish); the rapid freezing also enhances the quality of the thawed product. The key to this quality enhancement is the speed of the freezing process. The slower the worms are frozen, the larger the ice crystals that would be formed. Large ice crystals will damage the tissues of the worms resulting in a poor quality product typified by the formation of cloudy water on thawing. The very rapid freezing promotes only micro-ice crystal formation, which leave the tissues in near-perfect condition after thawing, since the micro-ice crystals occupy a volume only slightly greater than the liquid substance from which they are formed. Leakage and nutrient loss is virtually eliminated and the nutrients are delivered exactly where they are needed - to the shrimp and fish brood stock.

Blast freezing also maximises biosecurity: since the worms have been cooled to -18°C within minutes of harvesting the potential for growth of harmful organisms is minimised and the SPF status is secured from freezer to customer. The blast-freezing process is, of course, more expensive than ordinary freezing as the extremely low final temperature and the speed with which that temperature must be attained in the heart of product require greater refrigerating power. The value to the customer however fully justifies the extra cost - no leakage, no loss of nutrients and maximum bio-security.

For more information: seabait@zagro.com.
Designed as a reclamation system to recover wet, under-processed product, a new Waste Recycling System (WRS) from Wenger Manufacturing promises to improve plant efficiencies through raw material, disposal and energy cost savings. “By using the WRS system to reclaim product that would otherwise require disposal in landfills or diversion to livestock feeders, we’ve already seen a documented return on investment in less than eight months,” says Galen Rokey, process technology manager for Wenger. “In addition to raw material cost savings, significant energy benefits are also being realized.” According to Rokey, the Wenger WRS system is used to reclaim under-processed product left over from extruder/preconditioner startup and shutdown that is too wet to grind or recycle into the raw recipe mixer. The recovered product is then liquefied and added back into the process in a slurry containing up to 12.5% solids, at a rate of up to 10% of the extrusion dry feed rate.
According to Rokey, the Wenger WRS system is used to reclaim under-processed product left over from extruder/preconditioner startup and shutdown that is too wet to grind or recycle into the raw recipe mixer.

The recovered product is then liquefied and added back into the process in a slurry containing up to 12.5% solids, at a rate of up to 10% of the extrusion dry feed rate. Make up water to the WRS slurry tank can be recovered from extruder cooling jackets, or from other factory sources where water might be discharged to a drain or otherwise wasted. Because the system can also be used to collect and recycle escaping steam and recipe fines that may be discharged from the preconditioner vent, the WRS can actually reduce energy consumption in the preconditioner by up to 25%. Reduced preconditioner maintenance costs and improved sanitation around the equipment are added benefits.

As Rokey explains, the Wenger WRS features a heavy-duty stainless-steel tank with a high-speed impeller for liquefying the under-processed material. A positive displacement pump and mass flow meter, which are included, then return the slurry to the preconditioner at a controlled rate. “This system is not designed for recycling dry product,” Rokey concludes. “Fines generated in the system that have a moisture level below 13 percent are best recycled by grinding and adding them back to raw recipe mixer at rates of zero to 20 percent. However, for those who have been losing money through the disposal of wet, under-processed products, Wenger now offers an effective, cost-saving solution.”

For more information contact:
info@wenger.com
www.wenger.com
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<td>Buhler’s ECOtwin is an extrusion system consisting of the extruder, the preconditioner and the periphery. Its capacity is matched to the specific requirements of industrial petfood and fish feed production.</td>
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| Learn more |

| **OPTIMA Single Screw Extruder** |
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**A better way to find products**

An online, graphic-rich directory, FeedLink is the new way to source feed equipment. And soon ingredients too. **FeedLink**: Always current, always there.

Membership enquiries to: sales@feedlink.com
The genesis of what has become the United Soybean Board (USB)-Aquaculture Industry Coalition took place in 2001 at a meeting to finalize USB’s plans for a coordinated long-term research and marketing program for aquaculture. Described as the Managed Aquaculture Program, or the Soy in Aquaculture (SM) Initiative, the objective of the research component was to determine the effects of the anti-nutritional factors found in soybean meal on rainbow trout and Atlantic salmon. The marketing objective was to promote more aggressively the use of soy-based feeds in India and Southeast Asia. The goal was to build demand for U.S.-grown and processed soybeans for the aquaculture industry.

USB, and the 640,000 American soybean farmers it represents, was encouraged by the accomplished of its sister organization, the American Soybean Association (ASA), in its successful effort to promote the use of soybean meal in China for over twelve years. This marketing program has ranged from hosting technical seminars on the economical advantages of using formulated soy-based feeds in lieu of traditional feeds to assisting feed mills to develop and produce the feeds with the required levels of quality. The results have far surpassed expectation, with the demand for soybean meal in fish diets in China growing from almost zero in 1996 to over four million metric tonnes today. Soybean farmers believed similar successes could be achieved in other countries, including the United States, and with different key commercial species.

WHY DO AMERICAN SOYBEAN FARMERS SUPPORT AQUACULTURE?
In early 2002, U.S. soybean farmers asked how they could support the domestic aquaculture industry and facilitate its more
rapid development. What must be done to create a stronger domestic market for the soybeans they grow?
The creation of a Coalition, consisting of representatives of soybean farmers and processors, aquafeed millers, feed ingredients manufacturers and fish farmers, was proposed. It was motivated by the fact that many key commercial fish farmers and aquafeed millers were seeking the same goals of building stronger their markets and lowering their costs. The development of soybean meal, as an economical, nutritional, renewable and environment-friendly alternative to fish meal, was in the interest of all parties.
They recognized that while the primary sources of farmed-fish production is outside of the United States, with major emphasis on Asia in general and China in particular, the U.S. does have a viable farmed-fish industry with growth potential. However, Americans consume far more fish and shrimp than we grow. The United States is the world’s second largest consumer of aquatic products, but only the twelfth largest producer. American soybean farmers, along with domestic aquafeed millers and fish producers believe that the U.S. can and should grow and market more of its own fish.
Doing so will create more jobs, enhance food security, improve food safety and contribute to a reduction in our negative trade balance in aquaculture. For U.S. soybean farmers, it will create a new market for soybeans grown locally. For the U.S. aquaculture industry, it will mean more soybeans locally processed and turned into feed, and fed to fish grown in local waters.

**SHARING IDEAS, DEFINING CHALLENGES AND DEVELOPING A COMMON CAUSE**
To determine the interest of the industry for a Coalition, an organizational meeting was hosted in Indianapolis in December 2004. The meeting was attended by representatives of soybean processors, aquafeed millers, ingredient manufacturers and state and national soybean organization staff and consultants.
Dr. Paul Brown, a professor of aquaculture at Purdue University and the lead researcher, described the role Purdue and six cooperating universities were contributing to studying the effects of trypsin inhibitors, saponins, lectins and genistein on Atlantic salmon and rainbow trout. He noted that nutritional research using soybean meal with a specific species often resulted in differing findings and asked if the differences could be in the levels of anti-nutritional factors in the soybean meal being used.
If so, it would be important to future research to have a database that characterizes the levels of the various anti-nutritional factors – specifically lectins, oligosaccharides and trypsin inhibitors found in soybean meal.
The idea would be for researchers to provide sample of the soybean meal they plan to use in their nutritional studies for testing and, in return, include the information in their research reports.
The data will be available to all interested...
parties to aid in the formulation of diets and
to serve as an important summary of soy-
bean meal use for future evaluations.
Dr. John Less, ADM’s Director for Animal
Nutrition for Specialty Feed Ingredients &
Corn Processing, agreed to provide the test-
ing service.
From the meeting came three conclusions:
1) all parties are seeking to build stronger
their respective businesses; 2) all parties
recognize the value of a plant-based alter-
native to fish meal; and 3) a Coalition is a
worthwhile educational forum for building
ties and sharing ideas.

GETTING TOGETHER AT THE WAS
CONVENTION
The first formal Coalition meeting took
place in New Orleans in January 2005, as
part of the American Chapter of the World
Aquaculture Society (WAS) annual conven-
tion. It was followed by the second meet-
ing, in Las Vegas, in February 2006.
Each was attended by an estimated 50 par-
ticipants including soybean and aquaculture
industry representatives, state and federal
government officials and scientists and
researchers involved with aquaculture.
At the Las Vegas meeting, the delegates
exchanged information about the state of
the industry, learned about new technolo-
gies and received updates on the status of
new research and legislation.
They included Mr. Richard Nelson of Nelson
& Sons, Mr., Michael Rubino of NOAA, Dr.
Richard Langan of the University of New
Hampshire, Mr. John Campen, Dr. Michael
Cremer and Ms. Karen Fear of USB, Ms.
Robin Schoen of the National Academies,
Dr. Diane Bellis of AgSource, Mr. Steve Hart
of Purdue University, Dr. Alan Davis of Au-
burn University, Dr. John Less of ADM, Dr.
Jeff Hinshaw of the North Carolina State
University, Mr. Hugh Warren of the Catfish
Farmers of America, Dr. Kevin Fitzsimmons
of the University of Arizona and Dr. Jeff

An invitation to join us!
USB wants to include you on their
database and to extend a personal
invitation to a meeting planned for San
Antonio during the WAS convention.
Your suggestions on issues to discuss
and challenges to be solved are also
needed.
If you have not been invited to previous
meetings please send your name, title
and related information to Gil Griffis,
the Soy in Aquaculture New Uses Con-
sultant for USB, at
giljangriffis@earthlink.net

Lutz of the University of Southern Missis-
pippi.
The speakers, whose subjects ranged from
the state of production and marketing of
specific species to the status of the National
Offshore Aquaculture Act, provided the par-
ticipants a solid summary of the overall
status of the aquaculture industry, with em-
phasis on the many opportunities that exist
to build markets and to make domestic
aquaculture even stronger.
The strength of the Coalition is in the num-
ber and diversity of knowledge and experi-
ence of its participants, meaning the more
of us involved in our annual meeting, the
more we can learn and share.

Learn more about the use of soybeans in
aquaculture feeds at the Soy-in-Aqua

Gil Griffis is the Soy in Aquaculture**(SM)
New Uses Consultant for the United Soybean
Board. He may be contacted at:
giljangriffis@earthlink.net

http://www.soyaqua.org/
Aquafeed Horizons will be the premier conference for the commercial aquaculture feed sector in 2007

**WHO SHOULD ATTEND?**

The conference is designed specifically to meet the information needs of professionals: formulators, technical directors, mill managers, company directors and other decision makers. The meeting will also provide invaluable insights for ingredient and equipment suppliers, researchers, veterinarians and others whose business depends on understanding the needs of aquaculture and the possibilities offered by advances in aquafeed technology and formulation. The conference will also afford an opportunity for networking and discussion between your peers in the industry and a chance to see the very latest in feed processing equipment and ingredients at the feed industry’s leading international trade show, Victam International 2007.

**TOPICS**

- Feed industry’s responsibility to the development of sustainable aquaculture
- Aquaculture in Central and Eastern Europe – production and markets
- Upgrading of marine raw materials: the importance in finding substitutes for fishmeal
- Innovative technology for farming barramundi in Europe
- Organic aquafeeds - ingredients and ideals
- Physicochemical properties of feed ingredients - impact on feed processing and quality
- Effects of extrusion processing and raw ingredient variation on nutritional and technical quality of the feed raw materials and their impact on the extrusion of aquafeeds
- Parameters affecting the fine grinding of aquafeeds using a hammermill
- Aquafeed drying
- Vacuum coating pelleted feed
- Increasing aquatic feed production through plant optimization
- Krill as a feed source
- Decontamination of fish oil and fishmeal - alternative technologies and challenges
- Current issues in aquaculture feed and formulation
- Fishmeal/fishoil bottleneck and status of replacements
- Formulating for quality: improving animal performance, feeding efficiency and product quality in aquaculture species
- Extrusion Technology in the production of aquatic feed

**PRESENTERS**

- FEFAC—speaker to be confirmed
- Eurofish—speaker to be confirmed
- Anders Aksnes, Fiskeriforskning
- Harrie Rutgers, Cell Aqua NL
- Peter Bridson, Soil Association
- Tor Andreas Samuelsen, Fiskeriforskning
- Mette Sørensen, Akva Forsk
- Brian Plattner, Wenger
- Louis Mourey, Stolz
- Andy Sharpe, Aeroglide
- Eduardo Perez, FeedTech Services
- Galen Rokey, Wenger
- Sissel Albrektsen, Fiskeriforskning
- Åge Oterhals, Fiskeriforskning
- Merryl Webster, Format International
- Peter Coutteau, Inve
- John Sweetman, Alltech
- Konrad Munz, Buhler AG
Nearly half the fish consumed as food worldwide are raised on fish farms rather than caught in the wild, says a new report from FAO. “The State of World Aquaculture 2006” was presented earlier this month to delegates from more than 50 countries attending the biennial meeting of the FAO Subcommittee on Aquaculture in New Delhi, India.

While in 1980 just nine percent of the fish consumed by human beings came from aquaculture, today 43 percent does, the report shows. That’s 45.5 million tonnes of farmed fish, worth US$63 billion, eaten each year. (Currently, freshwater and marine capture fisheries produce 95 million tonnes annually, of which 60 million tonnes is destined for human consumption).

Worldwide, consumer demand for fish continues to climb, especially in affluent, developed nations which in 2004 imported 33 million tonnes of fish worth over US$61 billion - 81% of all fish imports that year, in value terms.

But levels of captures of fish in the wild have remained roughly stable since the mid-1980s, hovering around 90-93 million tonnes annually. There is little chance of any significant increases in catches beyond these levels, FAO says.

The agency’s most recent global assessment of wild marine fish stocks found that out of the nearly 600 species groups it monitors, 52 percent are fully exploited while 25 percent are either overexploited (17%), depleted (7%) or recovering from depletion (1%).

Twenty percent are moderately exploited, with just three percent ranked as underexploited.

"Catches in the wild are still high, but they have levelled off, probably for good," explains Rohana Subasinghe of FAO’s Fisheries Department and Secretary of the Subcommittee on Aquaculture. This levelling off, coupled with a growing world population and increasing per capita demand for fish, spells trouble.

FAO’s report estimates that an additional 40 million tonnes of aquatic food will be required by 2030 - just to maintain current levels of consumption. The only option for meeting future demand for fish, Subasinghe argues, is by farming them.

There’s just one question: can aquaculture actually deliver? The jury is still out, according to FAO’s report.

"Aquaculture could cover the gap between supply and demand, but there are also many forces which could pull production in the opposite direction, making it difficult for the industry to grow substantially enough to meet demand in the decades to come," it notes.

Aquaculture has been experiencing a boom since the mid-1980s, sustaining a growth rate of around 8% per year. Today it continues to expand in almost all world regions, with the notable exception of sub-Saharan Africa.

Challenges ahead

But FAO is concerned that momentum could taper off if governments and development...
agencies don't adjust their policies to respond to emerging challenges that threaten to damper the sector's future growth.

One serious bottleneck, says FAO, is the lack of investment capital for producers in the developing world. Another is a shortage of land and freshwater for use in aquaculture. Rising energy costs also pose a problem, and environmental impacts and questions of product safety continue to require attention.

Fishmeal and oil
The agency's report also points to doubts regarding future supplies of fishmeal and oil, used to feed carnivorous cultured species, such as salmon, grouper and sea bream. Since 1985, world production of fishmeal and fish oil - manufactured using fish which are caught in large volumes but which are not consumed by humans -- has stabilized at 6 to 7 million tonnes and one million tonnes, respectively.

While the vast bulk of fishmeal is used for livestock feed, chiefly by the poultry sector, aquaculture now accounts for 35 percent of the world's fishmeal consumption. So as aquaculture's fishmeal needs grow, competition with terrestrial livestock for a limited resource will intensify, with ramifications for both price and availability. Key to resolving the dilemma will be continued progress in improving the efficiency of feed formulations - reducing the amount of fishmeal they contain - and coming up with adequate vegetable-based additives.

"We need to start planning now for handling these challenges, because aquaculture is crucial to the fight against global hunger," Ichiro Nomura, FAO Assistant Director-General for Fisheries, says.

"It offers a source of food that is rich in protein, essential fatty acids and vitamins and minerals. And it offers a way to boost development by providing jobs, improving people's incomes, and increasing returns on natural resource use. We must ensure that the sector continues to expand, sustainably, to provide more people with food and income, especially in areas like sub-Saharan Africa and Asia, where hunger and poverty prevail."

Related links:
- **FAQ report: State of World Aquaculture 2006**
- **More documents from the meeting in New Delhi**
- **FAO GLOBAL AND REGIONAL REVIEWS ON AQUACULTURE DEVELOPMENT**
- **REVIEW OF THE CURRENT STATE OF WORLD AQUACULTURE INSURANCE**
- **Article: Aquaculture, not just an export industry**
AQUA FEEDS: FORMULATION & BEYOND
Volume 3, Issue 1

Volume 3, Issue 1, 2006 of Aqua Feeds: Formulation & Beyond is now online:

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Crustacean feeds:  Nutrition, feeds and feeding of spiny lobsters - Simon J Irvin, Kevin C Williams

Shrimp feeding:  Feeding the white shrimp, Litopenaeus vannamei - Alberto J.P Nunes, Carvalho Aguiar Esau

Shrimp feed cost:  Shrimp feed cost reduction - A Victor Suresh

Legumes:  Processed grain legumes: potential plant ingredients in shrimp feeds - K P Kumaraguru vasagam

Fish oil replacement:  Spent bleaching clay from the edible oil refining as a novel source of dietary lipid for aquafeeds - Wing-Keong Ng, Chik-Boon Koh


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EUROPEAN COMMISSION RESEARCH WEBSITE
The EU Commission Research website has been revamped and is now considerably easier to navigate.
One of the best ways to find what you are looking for is to utilize the keyword index.
The Research site keyword index contains over 7200 English keywords. It also contains over 2000 keywords in German, French and Spanish, and a smaller list in Italian and Dutch.

WEAK EL NIÑO CONDITIONS MAY APPEAR BY YEAR'S END
Is there an El Niño (ENSO phenomenon) on the way? Because of its potential to disrupt marine life - and of particular interest to aquafeed producers - Peru’s fisheries—it is the topic of much discussion in the trade but even NOAA can only say "maybe".
Vernon Kousky, NOAA’s lead ENSO scientist for more than 20 years, said, "Based on recent trends there is a 50 percent chance that weak El Niño conditions will develop late this year and continue through early 2007."
"At the moment, it is too early to be certain as to whether or not El Niño will develop," Kousky added. The El Niño forecast is based on the Climate Forecast System, or CFS, model and recent trends in the ocean-atmosphere system.
Oceanic and atmospheric conditions are updated weekly on the Climate Prediction Center website. Forecasts for the evolution of El Niño/La Niña are updated monthly in the Forecast Forum section of CPC’s Climate Diagnostics Bulletin. The next ENSO Diagnostics Discussion is scheduled for 5 October 2006.

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Marine aquaculture has experienced rapid growth over the past several years. Most species of cultured marine mollusks, crustaceans and fish have a phase for which no formulated feeds currently exist. Development of techniques for successful routine live feeds production has been a serious challenge to the culture industry and has been the result of multi-disciplinary research efforts over the past several years.

“Live Feeds in Marine Aquaculture” provides a solid background of these efforts up to the year 2000. This book covers production of the standard groups of live feed, including chapters on rotifers, Artemia, copepods and microalgae. Each area is covered by different authors active in their field, allowing good depth in each subject. The topics covered include: the biology of each group of organisms, the methods for their culture, nutritional characteristics of the organisms, and applications. A chapter is devoted to production, harvest and processing of Artemia from natural lakes.

The strengths of this book include the breadth and depth of the material covered, bringing together a wide spectrum of research and technical development. Also, supporting each chapter is a good selection of literature for the interested reader to get into even more depth, if desired. For those interested in specific topics, there are three indices which greatly facilitate looking things up: a taxonomic index, a common names index and a subject index.

A series of appendices cover such topics as: procedures for assessment of rotifer cultures, decapsulation of Artemia cysts; enrichment procedure; and, web sites for culture collections.

According to the editors in the Preface, this book is aimed at researchers and advanced students in marine aquaculture. It would be a useful resource for people in other fields who wish or have a need to “diversify or improve their culture methods”. Of course, no book can replace the knowledge and understand that comes from hands on experience and direct communication with others in formal or informal settings. But, this book provides a good reference in the area of live feeds production.

Published by Blackwell Publishing.
336 pages, 58 illustrations.

Blackwell Publishing
The program for Aquafeed Horizons has been posted to the Conference Website. Eighteen international experts will address market and technical topics of prime relevance to the commercial aquaculture feed industry and those associated with the sector. One of the highlights will be a presentation by Cell Aquaculture, a young and truly innovative Australian company that has developed a sophisticated, yet simple and economical land based recirculating aquaculture system that is introducing barramundi to the world’s markets. The promising growth niche presented by organic aquaculture will be discussed by Peter Bridson, Aquaculture Programme Manager, Soil Association. The Feed Processing Technology session will present the latest concepts in feed processing and new equipment for the production of aquatic feeds, while the Feed Formulation session will focus on fishmeal alternatives, new ingredients, formulation concepts and applied nutritional science for aquatic species. The interaction between ingredients and processing will be a major theme of the technical sessions. Presentations by Fiskeriforskning, AKVAFORSK and industry presenters will examine the impact of ingredients on processing and vice versa. Discounted delegate fees for early registration has also been made available. Aquafeed Horizons will take place during Victam International 2007 in Utrecht, from May 9-10, 2007. For more information, visit the Conference Website or editor@aquafeed.com.

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