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ASEM Aquaculture Platform (AqASEM)

Instrument: Special Support Action

Deliverable 2
Workshop programmes & outcomes

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Project coordinator name: Patrick Sorgeloos
Project coordinator organisation name: Ghent University

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Dissemination Level		
PU	Public	**X**
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

CONTENT

Workshop 1: Diseases & Health management
Barcelona (Spain), Oct 24 - 26, 2004

PROGRAM

Day	Time	Activity
Sunday 24th of October	09:00-09:30	Introduction to ASEM Aquaculture Platform Project objectives by Patrick Sorgeloos
	09:30-09:45	Welcoming remarks Workshop mechanism By Tim Flegel and Victoria Alday- Sanz
	09:45-11:30	**Participant presentations, session I:** **(15 min presentation and 5 min discussion each)** - Tim Flegel - Evelyne Bachere - Melba Reantaso - Mohamed Shariff - Marcela Salazar **Rapporteurs:** - Supranee Chinabut - James F. Turnbull
	11:00	Coffee break
	11:30-13:00	**Participant presentations, session II:** - Supranee Chinabut - Luc Grisez - Mike Horne - Patrick Smith - Just Vlak **Rapporteurs:** - Melba Reantaso - Victoria Alday- Sanz
	13:00-14:00	Lunch at the hotel
	14:00-16:00	**Participant presentations session III:** - Kidchakan Supamattaya - Victora Alday- Sanz - C.V. Mohan - Ignacio de Blas - Antonious Suwanto - Qingying Wang **Rapporteurs:** - Marcela Salazar - C.V Mohan
	16:00	Coffee break
	16:00-18:00	**Participant presentations, session IV:** - Gilda Lio Po & Roselyn de la Cruz Usero - Zsigmond Zeney - Mitsuru Ototake - Jimmy Turnbull - Nguyen Van Hao - Jenny Rodriguez

		Rapporteurs: - Luc Grisez - Evelyn Bachère
	18:00	End of the session
		Dinner

Monday 25th of October	09:00-09:15	Breakout working groups Working mechanism
	09:15-13:00	Working group session
	13:00-14:00	Lunch at the hotel
	14:00-18:00	Working group session
	18:00	End of the session
		Dinner

Tuesday 26th of October	09:00-12:00	Presentations of the working group recommendations
	12:00-12:10	Coffee break
	12:10-13:00	Final discussion
	13:00	Workshop closure
	13:00-14:00	Lunch at the hotel

PARTICIPANTS

Name	Function	Affiliation & Address	Country	tel / fax	e-mail
Victoria ALDAY-SANZ	researcher	INVE Technologies nv , Hoogveld 93, B-9200 Dendermonde	Belgium	tel: 32 52 40 95 9 fax: 32 52 40 95 85	v.alday-sanz@inve.be
Evelyne BACHERE	researcher	Ifremer/Cnrs/UM2, Université Montpellier 2. Place E. Bataillon, CC 80, F-34095 Montpellier cedex 5	France	tel: 33 04 67 14 47 10 fax: 33 04 67 14 46 22	ebachere@ifremer.fr
Supranee CHINABUT	Senior Advisor on Fish Disease	Department of Fisheries, Jatujak, Bangkok 10900	Thailand	Tel 66 2 5796803 fax 66 2 561 3993	supranee@fisheries.go.th supraneecb@yahoo.com
Ignacio DE BLAS	Professor Infectious Pathology and Epidemiology	Veterinary Faculty, University of Zaragoza, Miguel Servet 177, 50013 Zaragoza	Spain	tel: 34 976 76 10 00 ext 4111 fax: 34 976 76 16 12	deblas@unizar.es
Roselyn DE LA CRUZ USERO	Laboratory Head	Negros Prawn Producers Marketing Cooperative Inc., NEDF Bldg., 6th St., Bacolod City	Philippines	tel (063)(34) 434 2559 fax (063)(34)4332131	nppmci@mactan.ph
Jean DHONT	ASEM Secretary	Laboratory of Aquaculture & Artemia Reference Center (ARC), Ghent University, Rozier 44, 9000 Ghent	Belgium	tel: 32 9 264.37.54 fax: 32 9 264.41.93	Jean.Dhont@UGent.be
Dan FEGAN	Regional Technical Manager-Aquaculture	Alltech Biotechnology Corp. LTD., 5th Floor Preecha Building, 2533 Sukhumvit Road, Bangchack Prakhanong, Bangkok 10260	Thailand	tel: 66 2742 4545-46 fax: 66 27424547	dfegan@alltech.com
Timothy W. FLEGEL	Professor & ASEM Aq. Platform Management Committee	Faculty of Science, Mahidol University, Rama 6 RoadBangkok 10400	Thailand	tel: 66-2-201-5870 to -5873 fax: 66-2-247-7051	sctwf@mahidol.ac.th
Hiroshimi FUSHIMI	Professor & ASEM Aq. Platform Management Committee	Laboratory of Aquaculture and Stock Enhancement, Fukuyama University, Ohama, Innoshima, Hiroshima 722-2108	Japan	tel: +81-8452-4-2933 fax; +81-8452-4-3449	hfushimi@ma.fuma.fukuyama-u.ac.jp
Luc GRISEZ	Research Manager	Intervet Norbio, Singapore Pte. Ltd., 1 Perahu Road, Singapore 718847	Singapore	tel: 65 63971121 fax: 65 63971131	luc.grisez@intervet.com
Barry HILL	Vice President of the OIE Aquatic Animal Health Standard	Center for Environment, Fisheries and Aquaculture Science (CEFAS), The Nothe, Weymouth DT4 8UB,	United Kingdom		b.j.hill@cefas.co.uk

	Commission (AAHC) & Chief Advisor for Fish and Shellfish Health				
Mike HORNE	Research Director	Novartis company	Scotland	tel: +44-1786 448 200	mike.horne@ah.novartis.com
Zsigmond JENEY	researcher & Representative NACEE (Network of Aquaculture Centers of East Europe)	Research Institute for Fisheries, Aquaculture and Irrigation (HAKI), H-5541 Szarvas. Anna Liget 8 Hungary	Hungary	tel: +36-66-515-314 fax: +36-66-312-142	jeneyz@haki.hu
Gilda LIO-PO	Head of Fish Health Section	Fish Health Section, Southeast Asian Fisheries Development Center, Tigbauan, Iloilo 5021	Philippines	Tel. 63-33-3362965 or 5119170; 5119171 fax No. 63-33-5119070	liopo@aqd.seafdec.org.ph
C.V.MOHAN	Regional Aquatic Animal Health Specialist	Network of Aquaculture Centres in Asia-Pacific (NACA), P.O.Box 1040, Kasetsart Post Office, Bangkok 10903	Thailand	tel: 66 2 561 1728 fax: 66 2 561 1727	mohan@enaca.org
Truong Trong NGHIA	Vice Dean	College of Aquaculture and Fisheries, Can Tho University	Vietnam	tel: +84 913 974 775 fax: +84 71 830 323	ttnghia@ctu.edu.vn
Mitsuru OTOTAKE	Chief of Bio-defence Group	Aquatic Animal Health Division, National Research Institute of Aquaculture, FRA, 224-1 Hiruta, Tamaki-cho, Mie, 519-0423	Japan	tel: +81-596-58-6411 fax: +81-596-58-6413	ototake@affrc.go.jp
Melba REANTASO	Chairperson FHS/AFS Fishery Resources Officer (Aquaculture)	Fisheries Department, FAO, Viale delle Terme di Caracalla, 00100 Rome	Italy	tel: + 39 06 570 56473 fax: + 39 06 570 53020	Melba.Reantaso@FAO.Org
Jenny RODRIGUEZ	Researcher	Fundacion CENAIM-ESPOL, (Centro Nacional de Acuicultura e Investigaciones Marinas) Guayaquil	Ecuador.	tel: 593 4 2269751/2 fax: 593 4 2269492	jrodrigu@cenaim.espol.edu.ec
Marcela SALAZAR	Scientific director	CENIACUA, Carrera 8ª # 96-60 Bogota	Colombia	tel:57-1-636-9770, fax 57-1-236-4003/ 57-1-218-6644	msvallej@cable.net.co
Mohamed SHARIFF	Professor & ASEM Aquaculture Platform Steering Committee	Faculty of Veterinary Medicine, Universiti Putra Malaysia, 43400 Serdang, Selangor	Malaysia	tel: 603 8946 8288 fax: 603 8948 8246	shariff@vet.upm.edu.my

Patrick SMITH	Director of New Business Development	Schering Plough Animal Health, Aquaculture	UK	tel: +44 1799-528167 fax: +44 1799-52.55.46	Patrick.smith7@spcorp.com
Patrick SORGELOOS	Professor & ASEM Aquaculture Platform Management Committee	Laboratory of Aquaculture & Artemia Reference Center (ARC), Ghent University, Rozier, 44, 9000 Ghent	Belgium	tel: 32 9 264.37.54, fax: +32 9 264.41.93	Patrick.Sorgeloos@UGent.be
Kidchakan SUPAMATTAYA	Professor & ASEM Aquaculture Platform Management Committee	Faculty of Natural Resources, Prince of Songkla University, Had Yai, Songkhla 90112	Thailand	tel: 66 74 286226 fax: 66 74 429865 mobile: 66 9 7332984	kidchakan.s@psu.ac.th
Antonius SUWANTO	Professor of Microbiology	Department of Biology, Faculty or Science and Mathematics, Bogor Agricultural University, Jl. Raya Pajajaran, Bogor 16144	Indonesia	Tel/Fax: 62-251-315107	asuwanto@indo.net.id
Jimmy TURNBULL	Senior Lecturer in Aquatic Animal Health	Institute of Aquaculture, University of Stirling, FK9 4LA Stirling, Scotland	United Kingdom	tel: 44 1786 467913 fax: 441786472133	JFT1@STIR.AC.UK
Nguyen VAN HAO	Director	Research Institute for Aquaculture N° 2, Ministry of Fisheries, 116 Nguyen Dinh Chieu Street 1, Ho Chi Minh City	Vietnam	tel: 84 8 8226496 fax: 84 8 8226807	haoria2@hcm.vnn.vn
Just M. VLAK	Professor	Laboratory of Virology, Wageningen University, Binnenhaven 11, 6709 PD Wageningen	Netherlands	tel: 31-317-483090 fax: 31-317-484820	just.vlak@wur.nl
Qingyin WANG	Deputy Director	Yellow Sea Fisheries Research Institute, Chinese Academy of Fishery Sciences, 106 Nanjing Road, Qingdao 266071	P.R. China	tel: +86-532-5822959 fax: +86-532-5811514	qywang@public.qd.sd.cn

RECOMMENDATIONS

A. On DIAGNOSTICS, INTERCALIBRATION AND CERTIFICATION OF LABS

The participants recommended that this area of research and development should be approached from the position of need or demand from the end user. There is a demonstrable demand for identification of diseases and advice on their control and these two aspects must be linked. This concept is reflected in the recommendations.

1. Support long term training and capacity development since there is a need for: • people to transfer research information to farmers (information brokers) • pathologists, epidemiologists and diagnosticians • a repository of case studies • more veterinary style training for post-graduates in aquatic animal health • vocational training of primary response people as undergrads or certificate holders • farm-level short courses on topics such as sample collection, purpose and record keeping, as face to face exercises (courses, workshops, mentorship, etc.), as remote exercises (distance learning, publications, etc.) or as a mixture of both
2. Support networking
3. Support projects on the delivery of diagnostic advice and development of decision-making tools at the farm level, for shrimp and finfish in ponds and for finfish in cages
4. Support projects on auditing and certification of diagnostic laboratories including standardization/validation of existing methods (including equivalency), calibration and proficiency testing to identify training needs and updating of manuals of methods by: • identifying methods currently in use • identifying labs and partners for “ring tests” (EU/ASEAN/Other) and designating roles of participants; circulating of double blind samples to EU and Asia for comparison of pathogen identification test results; using one lab to co-ordinate each test method / disease; necessarily including public and private labs and commercial kits (potential examples include KHV of fish by PCR and histology, WSSV of shrimp by PCR, EUS of fish by histology, Martellia of shellfish by histology, Bonamia of shellfish by histology, and Streptococcus species). • identifying training and capacity building requirements based on ring test results • preparing detailed manuals of methods to support capacity building
5. Support the development and distribution of continuous cell lines for fish and support research on development continuous cell lines for mollusks and crustaceans
6. Support work on the conservation, characterization and preservation of strains by promoting linkage between existing reference culture collections and other institutions for bacteria parasites, fungi and viruses
7. Support the development of pond side diagnostic tests that will lead to improved decision making for and by farmers (e.g., by allowing early disease detection)
8. Support the development and use of multiple pathogen identification tests but ensure that they observe the same limitations as individual tests and are incorporated into a decision making process I don’t understand this
9. Support work on determining the sensitivity and specificity of existing immuno, genetic or clinical- based tests so that appropriate sample size guidelines can be formulated

B. On EPIDEMIOLOGY, HEALTH MANAGEMENT AND EXTENSION

Europe and Asia will benefit from the development of aquatic animal health services and capability in Asia to ensure both compatibility and equivalent standards between both regions. Early warning, control and containment of aquatic animal diseases require development of skills in epidemiology including risk (hazard) identification, assessment, communication and management. It is important that these skills be developed at the farm and extension levels and that they support investigative and research needs.

10. Build capacity in aquatic animal pathology and epidemiology in both Europe and Asia by supporting:
    - establishment of university consortia
    - academic institutions in Asia to develop expertise in aquatic epidemiology
    - exchange of science researchers and students between regions
    - the use of theoretical expertise in epidemiology in Europe combined with disease challenges in Asia to develop applied epidemiological capacity in both regions
    - networking to improve exchange of information and expertise between Europe and Asia (e.g. PANDA (Permanent Advisory Network for Diseases in Aquaculture) and Asia Regional Advisory Group; Regional resource experts, FHS-AFS (Fish Health Section of the Asian Fisheries Society))
    - collaboration to upgrade capacity in epidemiology in Asia to improve surveillance and diseases reporting for disease management and control.

11. Stimulate research to facilitate practical application of disease emergency response strategies (exotic disease, new disease, changes in the pattern of existing disease) in Asia by supporting:
    - research to develop early warning, early response (eradication/ containment) and contingency planning systems
    - work on the identification of risk factors through epidemiological studies (e.g. observational and questionnaire based studies)
    - development of emergency preparedness systems to handle new pathogens including effective and timely outbreak investigation and containment measures
    - development of surveillance and disease reporting systems
    - training at different levels (farmer, extension workers, disease support centers)
    - networking to improve exchange of information and expertise between Europe and Asia
    - development of management interventions – (e.g. risk reduction strategies)
    - work on evaluation of present structures to handle hypothetical disease outbreak scenarios and develop models

12. Support work to evaluate the present capacity to handle a hypothetical disease outbreak and develop an improved, effective response model (use KHV as a case study to identify any weaknesses within the system)

13. Stimulate research on epidemiological studies to assess disease control intervention strategies (risk management measures) by supporting:
    - tests of control strategies biologically or in a livelihoods context (double blind tests)
    - development and testing of cost-effective biosecurity methods
    - monitoring of environmental quality to determine whether a return to more extensive systems is warranted
    - testing of the reliability of commercial probiotics and verification in the field
    - development of more effective disease prevention and management strategies by collaboration with farmers and transfer of research results

14. Support research on risk analysis information requirements, including:
    - basic research to support the risk analysis process (taxonomy, biological pathways to understand exposure/release/consequence/ assessments)
    - impact studies of introduced species (e.g. *P.vannamei*)
    - impact studies of introduced pathogens (e.g. KHV, TSV)

15. Support research on disease outbreak investigations including work on: • reduction of disease transmission risks through the application of effective and timely outbreak investigation and containment measures • case studies to critique previous disease outbreak investigations and identify specific areas for capacity development • development of model scenarios for potential spread of pathogens by different modes of transmission • development of primary intervention ("paramedic") support to conduct initial outbreak investigations and establish primary containment strategies so that the information can be used to prepare a basic field manual for outbreak investigation and containment • preparation of a field manual on outbreak investigation
16. Support research to develop practical extension approaches for wider adoption of better management practices (BMPs) involving farmers (e.g., employ self help groups and a cooperative approach)
17. Support studies on risk factors for particular diseases • Using KHV as an example • Use NACA (Network of Aquaculture Centers in Asia) to set up a task force • Initiate training to improve local knowledge and skills in diagnosis and epidemiology • Set up a reliable diagnostic and monitoring system and carry out epidemiological risk analysis

C. On MOLECULAR EPIDEMIOLOGY AND DISEASE MECHANISMS

General requirements
18. Support networking to improve exchange of information and expertise and encourage ASEM members to join PANDA
19. Designate and support reference labs and sources of standardized control materials and depositories (for cell lines, pathogens, reagents, etc.) in Asia (governmental laboratory network between Europe and Asia) (i.e., like the EC Community Reference Laboratories)
20. Support training and capacity development at all levels 21. Set up an internet training course for molecular epidemiology 22. Development of technical manuals for standard methods
Host related research priorities
23. Stimulate work on functional genomics for health monitoring and for gene markers to be used in selection by supporting research on: • development of markers for immune status • development of standard assay sets for the host response to pathogens, therapeutics, prophylactics and abiotic factors • isolation and identification of anti-viral genes in fish and invertebrates
24. Support research on the immune response of invertebrates such as mollusks and shrimp
25. Support research on the immune response (including innate) in tilapia, carp or catfish (*Pangasius* spp.) (freshwater) and Asian sea bass (*Lates calcalifer*) or grouper (*Epinephelus* spp) (marine)
26. Support linkage between EU and the Asian and Pacific Consortium on Genomics of *Penaeus monodon*
Agent related topics
27. Support the development of molecular methods for tracing and monitoring multiple pathogens and the interaction between pathogens in cultured and wild populations
28. Support study on the means of viral transmission
29. Support the study of whole genomes of pathogens
30. Support study on the development of continuous crustacean and mollusk cell lines
Host pathogen interaction
31. Support studies on the molecular mechanisms of pathogenesis and virulence (e.g., study of cellular receptors and viral attachment proteins, etc.)
32. Support study on the effect of dual or multiple infections in crustaceans
33. Support work on the development of model systems to study host-pathogen interactions

D. On VACCINE DEVELOPMENT AND NEW TREATMENTS

Disease prophylaxis and therapy

General issues
34. Support networking to improve exchange of information and expertise
35. Support development of training programs on the proper use of vaccines and therapeutics
36. Support the development of Asian facilities for conservation and preservation of pathogen strains and host cell lines
37. Support development of standardized challenge tests and alternatives for them
38. Support projects for the development of continuous cell lines (especially invertebrates)
39. Set up an ASEM working group for harmonization of registration requirements in Asia
Induced protection against specific pathogens (including vaccine development)
40. Support vaccine development for diseases of socio-economic importance
41. Support research on the development of specific antiviral and antibacterial therapies in shrimp
42. Support research on the development of blockers of viral receptors and RNAi
Treatments
43. Support research on efficacy, safety and feasibility of using herbs (including medicinal plants) and their ingredients or other natural bioactive compounds as alternatives to antibiotics for disease therapy
44. Support research on efficacy, safety and modes of application for immunostimulants and probiotics
45. Support research on the development of new antiparasitic and antifungal agents
46. Support work on efficacy, safety and modes of application for phage therapy and *Bdellovibrio* therapy
47. Support work on quorum sensing pathway control of bacterial virulence

Workshop 2: Environment & Ecosystem preservation
Qingdao (PR China), April 23 - 26, 2005

PROGRAMME

Day	Time	Activity
Friday, April 22 Fuxin hotel	18:30-20:00	welcome banquet (offered by China Society of Fisheries)
Saturday **April 23** Yellow Sea Fisheries Research Institute	08:00/08:15 08:30-09:00	Bus departure from hotel (meet in hotel lobby) • Introduction to ASEM Aquaculture Platform • Project objectives by Sorgeloos Patrick
	09:00-09:15	• Welcoming remarks • Workshop objectives and mechanism By Tang Qisheng & Kautsky Nils
	09:15-10:30	Presentation of participant (5-10 min each)
	10:30	Coffee break
	11:00-13:00	• Summary of online discussion • Agreement on main workshop topics • Plenary discussion or working groups? (by Kautsky Nils & Tang Qisheng)
	13:00-14:00	Lunch
	14:00-16:00	Discussions
	16:00	Coffee break
	16:15-18:00	Discussions
	18:00	End of the session
	18:30-20:00	Banquet offered by Yellow Sea Fisheries Research Institute (building next to hotel)
Sunday **April 24**	07:30-22:00	Meeting in hotel lobby at 07:30 Excursion to marine aquaculture facilities (fish, mollusk, seaweed...) (including lunch and dinner)
Monday **April 25**	08:00 08:30-12:00	Bus departure from hotel Further discussion (coffee break in between)
	12:00-13:00	Lunch
	14:00-16:00	Presentation about freshwater integrated aquaculture practices in China (slides and video) by staff from Ocean University
	???	Dinner (not decided yet)
Tuesday **April 26**	08:00 08:30-11:45	Bus departure • Summary of discussion outcomes • Editing of recommendations (coffee break in between)
	11:45-12:00	Closing remarks
	12:00-13:00	Lunch
	13:00	Departure of participants

PARTICIPANTS

Name	Function	Affiliation & Address	Country	tel / fax	e-mail
Sorgeloos Patrick	Professor ASEM Aquaculture Platform Management	Laboratory of Aquaculture & Artemia Reference Center (ARC), Ghent University, Rozier, 44, 9000 Ghent	Belgium	tel 32-9-2643754 fax 32-9-2644193	Patrick.Sorgeloos@UGent.be
Bao Zhenmin	Professor	Ocean University of China, Qingdao	China	tel/fax 86-532-2031960	zmbao@ouc.edu.cn
Chang Jianbo		Hydrobiology institute of China Academy of Science, Wuhan	China		jbchang@ihb.ac.cn
Dong Suanglin	Professor Vice President of Ocean University of China	Ocean University of China, Qingdao	China	tel 86-532-2032827 fax 86-532-2032799	dongsl@mail.ouc.edu.cn
Fang Jianguang	Professor	Yellow Sea Fisheries Research Institute Qingdao	China	tel 86-532-5822957 fax 86-532-5811514	fangjg@ysfri.ac.cn
Jin Xianshi	Professor	Yellow Sea Fisheries Research Institute Qingdao	China		
Liu Hui	Researcher	Yellow Sea Fisheries Research Institute Qingdao	China		
Mai Kangseng	Professor	Ocean University of China Qingdao	China		kmai@ouc.edu.cn
Sun Xiaoxia	Associate Professor	Institute of Oceanology, Chinese Academy of Sciences, Qingdao	China	tel 86-532-2898770 fax 86-532-2898867	xsun@ms.qdio.ac.cn
Sun Huiling	Researcher	Yellow Sea Fisheries Research Institute Qingdao	China		
Tang Qisheng	Professor & Workshop organizer	Yellow Sea Fishery Research Institute, Qingdao	China		ysfri@public.qd.sd.cn
Wang Yan	Professor	Shanghai Fisheries University, Shanghai	China		wangyan@shfu.edu.cn
Zhang Quanqi	Professor	Ocean University of China	China	tel 86-532-2031931	qzhang@oue.edu.cn

		Qingdao		fax 86-532-2032799	
Zhuang Zhimeng	Researcher	Yellow Sea Fisheries Research Institute Qingdao	China		
Pekar Ferenc	Senior Scientist	Research Institute for Fisheries, Aquaculture and Irrigation (HAKI) Anna-liget 8, H-5540 Szarvas P.O.Box 47, H-5541 Szarvas	Hungary	tel 36-66-515308 fax 36-66-312142	pekarf@haki.hu
Choo Poh Sze	Science and Policy Specialist	WorldFish Center	Malaysia	tel 60-4-6202219 fax 60-4-6265690	p.choo@cgiar.org
Yusoff Fatimah Md	Professor Deputy Director	Institute of Bioscience Universiti Putra Malaysia 43400 UPM, Serdang, Selangor Malaysia	Malaysia	tel 60-3-89472102 fax 60-3-89472101	fatimah@ibs.upm.edu.my
Verdegem Marc	Professor	Fish Culture and Fisheries Group Wageningen University	Netherlands	tel 31-6-53948708	Marc.Verdegem@wur.nl
Bryceson Ian	Professor	Norwegian University of Life Sciences	Norway		ian.bryceson@umb.no
White Patrick	Consultant	Akvaplan-niva, Polar Environment Centre, Tromso BP 411, Crest, Cedex 26402	Norway France	 tel/fax 33-4-75431901	patrick.white@wanadoo.fr
Lopez Nelson	Chief Inland Fisheries and Aquaculture Division	Bureau of Fisheries and Aquatic Resources (BFAR) Arcadia Building, 860 Quezon Avenue Quezon City, Metro Manila 3003	Philippines	tel/fax 63-2-3730792	nlopez@bfar.da.gov.ph (office) munchvin@edsamail.com.ph (home)
Primavera Jurgenne	Senior Scientist	SEAFDEC Aquaculture Department Tigbauan, Iloilo 5021	Philippines	tel 63-33-3362965 fax 63-33-3351008, 63-33-5119070	jhprima@seafdec.org.ph (office) nykjprim@skyinet.net (home)
Rosario Westly	Chief National Integrated Fisheries Technology Development Center	Bureau of Fisheries and Aquatic Resources (BFAR) Bonuan-Binloc Dagupan City 3003	Philippines	tel 63-75-5230385 fax 63-75-5235412	westlyrosario@yahoo.com

Kautsky Nils	Professor & Workshop organizer	Tropical Marine Ecology and Ecotoxicology Department of Systems Ecology Stockholm University SE-106 91 Stockholm	Sweden	tel 46-8-164251 fax 46-8-158417	nils@system.ecology.su.se
Troell Max	Professor	Beijer Institute, Stockholm	Sweden	tel 46-8-6739532	max@beijer.kva.se
LeVay Lewis	Professor	School of Ocean Sciences University of Wales Bangor Menai Bridge Anglesey LL59 5EY	UK	tel 44-1248-388115 fax 44-1248-716367	l.levay@bangor.ac.uk
McLeod Doug	Consultant		UK		DouglasMcLeod@aol.com
Nguyen Thi Xuan Thu	Researcher	Research Institute for Aquaculture No.3 33 Dang Tat, Khanh hoa Nha Trang city	Vietnam	tel 84-58-831298 fax 84-58-831846	thuabmm@dng.vnn.vn

RECOMMENDATIONS

A **first round of discussion** grouped under a number of headings as listed below was carried out. The points raised under these discussions are summarized as bullets under each heading.
Based on the first round of discussion the most important questions were selected for a **second round of discussions**, that also started to **identify gaps in knowledge and needs for research** as listed**.**

- FIRST ROUND OF DISCUSSIONS: Identifying the issues
    - Issue 1. How can we minimize effects of aquaculture on the ecosystem and its potential to produce goods and services?
    - Issues 2. How could we move towards more sustainable grow-out systems?
    - Issues 3. Is it possible to convert or rehabilitate abandoned aquaculture systems to other production systems or back to natural habitats e.g. mangroves?How should this be done?
    - Issue 4. How can we reduce fish-meal dependence in aquaculture?What sources of fish-meal should be used? What is the need and potential for developing environment - friendly feeds?
    - Issue 5. What sustainability criteria should aquaculture fulfill? Which species should be farmed and what methods are preferable?
    - Issue 6. How can we combine these topics with social/gender equitability.
- SECOND ROUND OF DISCUSSIONS: Identifying gaps in knowledge and key issues for further research
    - A. Resource use
    - B. Systems, species and methods (culture environment):
    - C. Waste output, linkages to the environment (impact effects)
    - Discussion on traditional integrated farming in China
- OVERALL COMMENTS AND CONCLUSIONS

FIRST ROUND OF DISCUSSIONS (identifying the issues)

Issue 1: How can we minimize effects of aquaculture on the ecosystem and its potential to produce goods and services?

1. Impact of aquaculture goes in 2 directions. Negative impacts are well documented, but there are also some positive effects of aquaculture on the environment.
2. The question is very broad:
    - Different farming systems and species cultured need to be considered.
    - Types of effects should also be specified.
    - Scale of investigation should be defined. High density aquaculture can be OK, if the number of farms is limited.
3. Still little is know about the feeding ecology in aquaculture systems.
4. Farmers learn from their mistakes. For instance with high density cage aquaculture in lakes or reservoirs, excessive development caused massive fish kills and high levels of pollution. Farmers learn from these mistakes.
5. In many cases it is necessary to educate farmers, and one should be prepared to repeat year after year until better farming practices take hold.
6. Attention should be given to optimize the interaction between researchers and farmers. The intention must be there to learn from each other.
7. What is the best way to apply or enforce environmental regulations? Impose? Incentive?
8. Some regulations are applied indirectly, for instance through trade regulations (mollusks for example).
9. Regulations include political will, environmental issues, technical aspects and biological/ecological issues.
10. Thought must be given optimizing ecosystem services
11. China :

- there are two ways to reduce impact of aquaculture:
  - limit the level of aquaculture development within an area or region
  - reduce the impact through the (combined) application and/or control of autotrophic and heterotrophic processes
- Combine the use of fed (=pellet or trash fish eating) and extractive (=herbivores and omnivores) species within farming systems, while improving the nutrient efficiency in the system.
- More information is needed on comparative studies of nutrient budgets in different farming systems

12. We should try to document traditional systems with regard to the basic ecology of the system
13. It is important to consider bio-safety issues and product quality. This relates to:
    - import regulations
    - use of chemical, incl. antibiotics and pesticides
14. More attention should be given to integrated types of farming:
    - agricultural – environmental economics
    - e.g. salmon & mollusk farming
    - danger of use of poultry slaughter waste in aquaculture
15. More thought can be given on how to use public awareness to improve aquaculture sustainability:
    - e.g. list in restaurant menu how a product was produced and score it in terms of sustainability
    - inform public on farming practices
16. Carrying capacity of farming systems can be studied at different scales
    - areas
    - zones
    - regions
    - and should be integrated over the different levels
17. Important issues in aquaculture are:
    - biodiversity (e.g. Atlantic salmon in the Pacific, *L. monodon* in West Africa, *L. vannamei* in Asia.
    - genetic diversity
    - providing goods and services through farming without impact on the environment is not possible, and this must be recognized, when discussing aquaculture development
    - This stresses the need to adopt a practical approach.
18. Fish oil replacement: one approach can be to look how PUFA's are produced in natural systems and to design systems that (partially) produce these products.
19. The benefits for strategic long-term research should be recognized. An example is the closing of the culture cycle of *L. vannamei*. If the same effort would have been put in closing the cycle of *L. monodon*, then today *L. vannamei* would not have been introduced in Asia.

Issues 2. How could we move towards more sustainable grow-out systems?

(What are possibilities for reduction and management of effluents (nutrients and particulate wastes) through recycling, biofilters, natural/constructed wetland filters etc.? What is the potential for integrated aquaculture-agriculture-silviculture systems (including polyculture)?)

1. Mediterranean study showed that there is a positive impact of aquaculture on fisheries close to cage culture site. Other studies however showed that wild fisheries was destroyed due to aquaculture development.
2. Biodiversity issue: stock enhancement programs benefit from aquaculture hatcheries in Philippines, but with salmon culture, there was a negative impact on genetic diversity from stocking programs.
3. Biodiversity issues: different stocks of seabass; Mediterranean vs. Atlantic stocks, the latter being adapted to lower temperatures. When grown in the Mediterranean Sea the growth is enhanced.

4. Is it possible to select species for the type of waste produced? This in a way is related to domestication, which is mandate of another ASEM-workshop. Interaction is recommended.
5. Selection for salt tolerance & cold tolerance in tilapia culture. There is a lot of danger of selecting for salt tolerant tilapias. In Philippines, a hybrid between *S. niloticus* x *S. mossambicus* is looked into.
6. Lobster culture in Vietnam, use of wild fry. Is an issue in Central Vietnam. No data are available on the population dynamics of this species. Maybe by reducing the number in the wild, some culling on wild fry extraction might have a positive effect of survival in adult wild stocks.

Which problems have we identified? Solutions? Tentative project suggestions?

1. Integration was mentioned already several times.
2. Freshwater inland pond aquaculture? In Central Europe are good systems for retaining nitrogen, and there is not intensive pond culture. Intensive tank systems are becoming more important. Now farmers need to pay for nutrient discharge (N, P, COD and salt content). ==> High interest to reduce nutrient discharge from farming.
3. How to impose 'payment' for discharge of nutrients? Use same norms as for agriculture?
4. Special case in Hungary is crop rotation with aquaculture as one of the crops.
5. Aquaculture regulation can help improve environmental performance of aquaculture. For instance, limit the amount of feed that can be applied ==> feed conversions improve.
6. Brackish water ponds, mostly in mangrove areas. Use mangroves as filter, or combine shrimp culture with other species. Tilapia/milkfish in combination with shrimp culture. Extensive systems use a lot of space, intensive systems put in a lot of pollutants. Solution is somewhere in the middle.
7. Intensifying existing systems often leads to problems? Is it possible to intensify aquaculture systems? Should it be done? There are two levels: improve at farm level and improve at regional/national level.

Issues 3. Is it possible to convert or rehabilitate abandoned aquaculture systems to other production systems or back to natural habitats e.g. mangroves?How should this be done?

1. Philippines :
    - some areas were really abandoned (too much land). So, in most cases mangrove areas should be re-established:
        - restore hydrology
        - if needed, do active planting of mangroves
        - combine replanted mangroves with aqua-silviculture
    - Restored mangrove areas perform functions very well. Aqua-silviculture needs a lot of research still.
2. Most of these farms have been abandoned. But in Malaysia, the value of coastal ponds is high, and in one way or the other the pond area is reused again (other crop, or crop rotation, ...). A lot of abandoned areas have no legal basis (expired lease, illegal construction).
3. triple times loss:
    - function
    - equity
    - use of area
4. Use of fallowing should not be overlooked. Is good technique to minimize impact.
5. Try to mimic the natural habitat for shrimp.

Issue 4. How can we reduce fish-meal dependence in aquaculture?What sources of fish-meal should be used? What is the need and potential for developing environment - friendly feeds? (Note: this is also a topic of another working group)

1. Improving feeding strategies can reduce the requirement for fish meal rich fish feeds.

2. In shrimp culture there was progress with feeding strategies. In Philippines there is intensive farm where shrimp were trained to feed in special areas, so most of the pond bottom is staying clean.
3. There is intensive for farmer to improve feeding efficiency because it reduces production costs.
4. Fast and slow feeding fish. It is possible to reduce the fish meal content in the diet.

Issue 5. What sustainability criteria should aquaculture fulfill? Which species should be farmed and what methods are preferable?

Discuss e g. in relation to "Code of conduct for Aquaculture", "Brundtland commission", and FAO prognosis for future aquaculture development.

1. Are we farming for profit or for protein? Should we focus on omnivorous species.
2. Aquaculture farming species should be adapted to the local situation, including environmental conditions.
3. How can one control if a code of conduct is followed?

Issue 6. How can we combine these topics with social/gender equitability.

- Presentation: Carrying capacity and sustainability in Sungo-bay (in preparation of field visit on 24/4/05).
- Use different models to estimate carrying capacity of natural systems, mainly based on N. Model based production of seaweed is lower than present seaweed production.
- Therefore, combine fed aquaculture with seaweed culture. Many types of polyculture are today practices: many shellfish species, crabs, finfish, etc...

SECOND ROUND OF DISCUSSIONS

Identifying gaps in knowledge and key issues for further research

The following key issues were identified for further discussion:

A. inputs resources (resource use)
B. systems and methods (culture environment)
C. waste output, linkages to the environment (impact effects)

A. Resource use

1. Environmental requirements for aquaculture
    a. pollution and transfer through the aqua-food-chain
    b. resource demands of different culture systems
    c. disease transfer through the aqua-food-chain
    d. site requirements and relation to other users
2. General need for studies on nutrient dynamics and budgets in aquaculture systems and receiving waters (different levels of the food chain), including the role of micro-organisms.
    a. internal cycling of nutrients in closed systems
    b. facilitate development of favorable (food) organisms in systems
3. Feed studies
    a. Feed ingredient studies (incl. fish oil and fish meal replacement)
    b. Improvement of feed conversion efficiencies, feeding ecology, feeding strategies
        i. provide alternatives for farmers to move away from fish biomass (trash fish)
        ii. alternative diets for carnivores?
        iii. nutritional studies of specific species
        iv. environmental friendly feeds
        v. feeding strategies (rations, feeding frequency, distribution of feed)

    c. Competition for resource use: incentives to develop alternatives for fish oil and fish meal sources for aquaculture. Studies should also relate to social equity aspects and food security
        i. fish as human vs. animal food?
        ii. competition for natural food between aquaculture, birds and other species.
        iii. Effect of changes in fishing behavior on the ecosystem (e.g. fish extraction for fish oil and fish meal or as trash fish
4. Effects of collection of wild broodstock/fry/fingerlings for aquaculture
    a. ecosystem and biodiversity effects (e.g. by-catches)
        i. impact on fisheries resources
        ii. extinction and local depletion
        iii. disease transfer
        iv. genetic drift
    b. economic impacts of reduced stocks of broodstock/fry/fingerlings
5. The impact of domesticated species on natural stocks
    a. genetic impacts
    b. disease spread and transmission
    c. biodiversity and ecosystem effects
6. Development of novel farming systems that reduce the need for external (essential) inputs, including fresh water use & minimal water exchange systems
7. Aquaculture planning at a landscape/seascape, community, national and regional level (socio-ecological resilience, mono vs. polyculture)
    a. Land and water use for aquaculture up to level of ICZM and watershed management
    b. coordination and integration with other users in the coastal zone or wetland
    c. marine protected areas and RAMSAR sites
    d. Integration and contribution of aquaculture to coastal landscape and protection (vulnerability to storms, cyclones and tsunami's)
8. Enhance the role of aquaculture in stock enhancement and ranching activities
    a. genetic, ecological and health criteria
    b. self recruiting species
    c. providing access to aquatic resources for the poor

B. Systems, species and methods (culture environment):

1. Understand and assess the potential for improvement of nutrient retention/efficiency through polyculture, IAA, crop rotation and management (incl. innovative waste treatment techniques)
    a. challenge in open systems
    b. quality of effluents
    c. analysis of the ecological economics
2. Effects of polyculture or integrated culture, and intensification on disease pressure in farming systems (crop rotation, polyculture, green water)
3. Assess the carrying capacity for (new) extractive species and new uses for these species
4. Studies on alternative farming systems for reduced dependency on chemicals
5. Optimize culture system to reduce environmental impacts (culture intensity related) while maintaining profitability using LCA and footprint analysis
6. Domestication and closing life cycles of target species, incl. hatchery produced fry to reduce pressure on wild stocks
    a. SPF-stocks
    b. Problem of too narrow genetic basis and inbreeding of culture stocks
7. The integration of ecological, social and economic resilience of whole farming systems, considering different scales
    a. temporal
        i. Laguna de Bay, eutrophication over time, depletion of resources (relates to carrying capacity)
        ii. aging of farming systems (e.g. reduced shrimp production over time)
    b. intensity

c. spatial; local, regional and global

8. Research on novel (economically viable) farming systems
    a. that reduce the need for external (essential) inputs
        i. minimize water use and develop minimal water exchange systems
        ii. aquaponics
        iii. periphyton
        iv. C:N ratio manipulation
    b. that study the feeding ecology and basic biology of extractive (= PP and secondary species and detrivores) species.
9. Possible environmental risks and benefits of selective breeding (e.g. triploids, GMOs)

C. Waste output, linkages to the environment (impact effects)

1. Baseline information on impacts (nutrients, water quality, ecological, incl. system level) of different culture systems
    a. cage culture systems (especially tropical systems)
    b. fish pens
    c. coastal ponds (e.g. mangrove areas)
    d. footprint studies
2. Type and scale of impacts of aquaculture on sensitive habitats (coral reefs, seagrass beds, mangroves, wetlands and other sensitive aquatic ecosystems)
3. Impacts on drinking water quality , aquifers, salinisation
4. Fate and effects of nutrients, organics and chemicals
    a. magnitude of legal/illegal use (e.g. antibiotics, pesticides and heavy metals)
    b. modeling studies
    c. effects of pre/pro-biotic and immuno-stimulant products
    d. effects on non-target species and the surrounding environment
5. Interactions: impact of aquaculture on the environment and *vice versa* and interactions among aquaculture systems (e.g. self-pollution, synergism)
6. Possible interactions among aquaculture, ecosystem health and human health (microbial, toxic substances, residues, ...) and food safety
7. Dynamics of algal blooms and red tides (affecting aquaculture or resulting from aquaculture) incl. mitigation
8. Assimilation capacity, carrying capacity and their relation to ecosystem resilience (environmental capacity)
    a. modeling
9. Impacts of aquaculture on biodiversity and ecosystem functioning – GMO's, domesticated species, deliberate/accidental introductions of exotic species
10. Methods for habitat rehabilitation of abandoned farming areas (mangrove areas, wetlands, coastal zones)
11. Use of natural/constructed wetlands for aquaculture waste treatment/use of aquaculture for waste water treatment
12. Development of tools for environmental management of aquaculture (indicators, models)
13. Research on effectiveness of regulations and incentives to achieve responsible aquaculture
        1. code of conduct, best management practices (BMPs)
    2. levies on waste discharge
    3. subsidies
    4. product labeling
14. Research on implications of underlying differences in objectives between Asia and Europe (food safety, economic benefit, minimal nutrient accumulation) for environmental impacts

Discussion on traditional integrated farming in China

- There is a need to understand the wisdom accumulated in traditional systems before the systems disappear (provide a scientific basis)
- It is not meaningful to try to preserve traditional systems unchanged

- Once the underlying principles are understood
    - they can be applied in other integrated systems (e.g. marine systems)
    - existing systems can be further optimized (introduction of valuable species, supplement with fertilizers, etc.)
    - they can be applied in other countries, specifically poor countries
- Need to internalize externalities for long-term sustainability: lessons for modern aquaculture
- Lessons can also be learned from other types of integrated aquaculture like for instance rice-fish culture
- Integration and disease problems

OVERALL COMMENTS AND CONCLUSIONS

The group acknowledged that different farming systems have different effects on the environment but did not go into detail by defining specifically for which systems research is needed, but rather listed general problems in aquaculture that need attention.
In general problems will increase with intensity of farming i,e density of animals farmed, amounts of inputs given, and density between farms.
Management of the outside farm environment is often more difficult than other aquaculture management as there is less incentives for farmers and the aquaculture industry to manage, unless it hits back on the activity itself. Local impacts are more likely to be managed as they are more easily perceived and the risk of hitting back is greater, whereas regional and global impacts are usually not taken into account by the industry. More focus needs to be put on such regional and global issues.
Aquaculture is often regarded as any industrial enterprise. Whereas direct impacts on the socio-economics of local communities are sometimes taken into account, indirect effects, such as environmental degradation, reduced coastal fisheries are usually less understood and not internalized.

If the priorities are taken from each heading (Inputs, Systems and Outputs) then they can be grouped into broad categories as follows:

1. Understanding of the fate and dynamics of the processes
    - Investigate the nutrient dynamics in the different production systems
    - Investigate the assimilation rate of the environment to aquaculture impacts
    - Investigate the baseline impacts from the different aquaculture systems
    - Try to model and understand carrying and production capacities of the environment
2. Ways to limit inputs and optimize production systems to minimize impacts of aquaculture
    - Improving nutrient retention in systems by improving FCRs and using integrated/polyculture systems
3. Ways for planning and effective management to minimize impact of aquaculture.
    - Based on carrying/production capacity information find effective methods for planning and control of aquaculture development to have minimum impact and be sustainable

Workshop 3: Domestication & Breeding Bangkok (Thailand), May 16 - 17, 2005

PROGRAMME

Day	Time	Activity
Sunday May 15	20:00	informal get together and dinner
Monday May 16	08:00 - 08:30	• Introduction to ASEM Aquaculture Platform and the project objectives by Sorgeloos Patrick
	08:30 - 09:00	• Welcoming remarks • Workshop objectives and mechanism by Hans Komen and Kanit Chaiyakam
	09:00 - 10:30	Presentation of participants (5-10 min each)
	10:30	Coffee break
	11:00-13:00	• Summary of online discussion • Agreement on main workshop topics • Plenary discussion or working groups? by Hans Komen and Kanit Chaiyakam
	13:00-14:00	Lunch
	14:00-16:00	Discussions
	16:00	Coffee break
	16:15-18:00	Discussions
	18:00	End of the session
	???	Dinner offered by DOF, Thailand
Tuesday May 17	08:30-12:00	Further discussion (coffee break in between)
	12:00-13:30	Lunch
	14:00-16:00	Further discussion (coffee break in between)
	???	Dinner offered by INVE
Wednesday May 18	08:30-11:45	• Summary of discussion outcomes • Editing of recommendations (coffee break in between)
	11:45-12:00	Closing remarks
	12:00-13:30	Lunch
	13:30	Departure of participants

PARTICIPANTS
(alphabetical per country)

Name	Function	Affiliation & Address	Country	e-mail & URL
Graham Mair	Senior Lecturer	School of Biological Sciences Flinders University GPO Box 2100 Adelaide SA5001 (formerly with Asian Institute for Technology, Thailand)	Australia UK	graham.mair@flinders.edu.au
Patrick Sorgeloos	Professor ASEM Aquaculture Platform Management	Laboratory of Aquaculture & Artemia Reference Center, Ghent University, Rozier 44, 9000 Ghent	Belgium	Patrick.Sorgeloos@UGent.be www.ugent.be/aquaculture
Yuan Wang	President Moana Technologies LLC	International Aquaculture Biotech Cie NV/SA, Belgium Moana Technologies LLC, Kona, Hawaii, USA Shrimp Culture Research & Development, Thailand	Belgium, USA, Thailand	yuan@moanatech.com
Andreas Mueller-Belecke	Assistant Professor	Institute of Animal Husbandry and Genetics Research Group of Aquaculture and Aquatic Ecology Albrecht-Thaer-Weg 3 D-37075 Göttingen	Germany	amuelle5@gwdg.de www.gwdg.de/~uatz/
Zsigmond Jeney	Senior Scientist	HAKI, Szarvas & NACEE	Hungary	jeneyz@haki.hu
Hiroshimi FUSHIMI	Professor & ASEM Aq. Platform Management	Laboratory of Aquaculture and Stock Enhancement,	Japan	hfushimi@ma.fuma.fukuyama-u.ac.jp

	Committee	Fukuyama University, Ohama, Innoshima, Hiroshima 722-2108		
Masanori Okauchi	Cheaf of genetics and breeding section	National Research Institute of Aquaculture Breeding Group, Farming Biology Division Nansei, Mie, 516-0193	Japan	okauchi@fra.affrc.go.jp
Saleem Mustafa	Professor	Borneo Marine Research Institute, Universiti Malaysia Sabah Beg Berkunci-2073 88999 Kota Kinabalu, Sabah	Malaysia	saleem@ums.edu.my
Aileen Tan Shau-Hwai	Lectuer/Scientist	Centre For Marine & Coastal Studies Universiti Sains Malaysia 11800 Penang	Malaysia	aileen@usm.my
Raul Ponzoni	Project Leader (Geneticist)	Aquaculture and Genetic Improvement WorldFish Center PO Box 500 GPO, 10670 Penang,	Malaysia	r.ponzoni@cgiar.org www.worldfishcenter.org
Hans Komen	Professor & Workshop organizer	Wageningen University and Research Center	Netherlands	Hans.Komen@wur.nl
Joebert Toledo	Consultant	Intergated Services for the Development of Aquaculture and Fisheries Mac Arthur Highway Tabuc Suba, Iloilo 5021	Philippines	jdtoledo41@yahoo.com
Emilia Quinitio	Scientist	Breeding Section SEAFDEC Aquaculture Department Tigbauan, Iloilo 5021	Philippines	etquinit@philwebinc.com etquinit@aqd.seagdec.org.ph www.Seafdec.org.ph

Laszlo Orban	Associate Professor	Temasek Life Sciences Laboratory National University of Singapore 1 Research Link, The NUS Singapore 117 604	Singapore	laszlo@tll.org.sg www.tll.org.sg/
Mali Boonyaratpalin	Official Consultant	Department of Fisheries Jatujak, Bangkok. 10900.	Thailand	milib@fisheries.go.th
Kanit Chaiyakam	Workshop Host	Marine Shrimp Research and Development Institute Coastal Fisheries Research and Development Bureau Departement of Fisheries Jatujak, Bangkok. 10900	Thailand	kanit@nicaonline.com
Malinee Witchawut	Workshop Host	Marine Shrimp Research and Development Institute Coastal Fisheries Research and Development Bureau Department of Fisheries. Jatujak. Bangkok. 10900.	Thailand	malineew@fisheries.go.th
Siri Ekmaharaj	Shrimp Culture specialist.	Dept. of Fisheries, Jatujak, Bangkok, 10900	Thailand	sirit@fisheries.go.th siritookwinas@yahoo.com
Renu Yashiro	Director	Rayong Coastal Fisheries R&D Center Tapong, Rayong 21000	Thailand	renuy@yahoo.com www.rayonngfisheries.com
Wongpathom Kamonrat	Geneticist	Freshwater Fisheries R&D Bureau. Dept. of Fisheries. Jatujak, Bangkok.10900	Thailand	wongpatk@fisheries.go.th
Watana Leelapatra	Director	Aquatic Animal Genetics Research and Development Institute. Klong	Thailand	wolekfc@hotmail.com

		Luang, Patumthani 12120		
Jintana Nugranad	Fisheris Biologist	Prachuap Khiri Khan Coastal Fisheries R&D Center Klong Wan, Prachuap Khiri Khan	Thailand	jinna@cscoms.com
Tanan Sungorntanakit	Director	Petchaburi Fisheries Test and Research Center.Banlaem , Petchaburi.76100	Thailand	tanan_2503@yahoo.com www.fisheries.go.th
Sanga Leesanga	Director	Chumphon Fisheries Test and Research Center. Tung ka. Chumphon. 86100	Thailand	leesanga@hotmail.com www.fisheries.go.th
Prathak Tabthipwon	Vice Dean	Faculty of Fisheries Kaestsart University Jatujak, Bangkok. 10903	Thailand	prathak.t@ku.ac.th www.ku.ac.th/fisheries
Somkiat Piyatiratitivorakul	Chairman	Center of Excellence for Marine Biotechnology (CEMB), Dept. Marine Science, Faculty of Science Chulalongkorn University Patunwan Payathai Bangkok. 10330	Thailand	psomkiat@chula.ac.th
Boonsirm Withyachumnarnkul	Professor	Faculty of Science CENTEX SHRIMP, Mahidol University Bangkok	Thailand	boonsirm@yahoo.com
David Kawahigashi	Manager	SyAqua Thailand Sygen Internation, UK	Thailand UK	David.Kawahigashi@syaqua.com
Thuy Nguyen	Research Associate	Network of Aquaculture Centers in Asia-Pacific, NACA	Thailand	Thuy.nguyen@enaca.org www.enaca.org

Nuanmanee Pongthana	Director	Patumthani Aquatic Animal Genetics Research Center Pathumthani Prov.	Thailand	nagri@loxinfo.co.th
Jeff Prochaska	Manager NBC	SyAqua Thailand Sygen International, UK	Thailand, US	Jeff.prochaska@syaqua.com
Truong Trong NGHIA	Vice Dean	College of Aquaculture and Fisheries, Can Tho University	Vietnam	ttnghia@ctu.edu.vn

Observers:

- Evgueni I. Fell, Vitan Cie, Moscow, Russia Tel. +7(095)-777-6822 E-mail : efell@vitan.ru

RECOMMENDATIONS

Objectives of the Workshop:

1. To identify problem areas in the field of genetic management and improvement of aquatic animals
2. To prioritize these problem areas
3. Discuss how the problems could be solved and develop an action-oriented agenda
4. Prioritize a set of recommendations as a base for future cooperative actions

Problem areas are to be discussed in the context of food security and sustainable economic development. This means thinking beyond technical issues to include such issues as societal constraints, historical preferences and future economic developments.

1. TO IDENTIFY PROBLEM AREAS IN THE FIELD OF GENETIC MANAGEMENT AND IMPROVEMENT OF AQUATIC ANIMALS

The discussion was initiated by identifying major areas around which problems could be grouped. Three areas were identified, namely "Resource use", "Species tools and methods" and "Environmental and societal impact". Within each of these areas specific problems were identified.

Resource Use

1. In the context of the workshop, domestication was broadly defined as "a process whereby reproduction and further rearing becomes feasible under human control". Little is known of the effects of domestication of aquatic species on (loss of) genetic diversity. Domestication should be carried out with a view to conserving genetic diversity and across a range of culture system environments taking GxE interactions into account
2. There is a need for cooperation through consortia (eg. Universities and DoFs) to work with industry to apply selective breeding programs. The knowledge base concerning genetics of aquatic animals and the principles of selective breeding needs to be strengthened for both University and State sectors**.**
3. There is an urgent need for support services and means to improve understanding of selective breeding and population genetics to make the technologies more accessible and applicable.
4. There may, in circumstances where seed producers cannot be expected to play the major role in production of improved seed, be a need for centralized national seed production and management centers.
5. There are some species (e.g. those species difficult to breed or maintain in captivity or those in which domestic seed production is not economically feasible) in which aquaculture could be continued with sustainable harvest of wild caught seed. For such species there is a need for recommendations on utilization of wild stocks.

Species tools and methods

6. QTL (quantitative trait loci) are used in livestock mainly as marketing tools; there are not many examples of their effective use for improving traits (e.g. marbling in beef). Initial work with fish has yet to produce results. Few aquatic species have comprehensive genetic linkage maps. There are high density genetic linkage maps for zebrafish and medaka and medium density linkage maps are being developed for

salmonids, tilapia, Japanese flounder, fugu and tetraodon. Fully sequenced genomes are available for fugu and tetraodon and are under development for zebrafish and medaka. High density genetic linkage maps should be developed for some additional commercially important species (e.g. shrimp).

7. There is a need to address the limitations imposed by the biology of some species (reproduction, physiology, disease control) to remove key constraints to domestication and genetic improvement. Geneticists, breeders (reproductive biologists) and veterinarians should collaborate in the early stages of domestication and research on captive breeding.
8. There is a need for the development and comparative analysis of more basic genetic management and selection protocols that can be used where the higher level breeding programs (e.g. those using pedigreed animals and BLUP-EBV) are not feasible due to resource limitations.
9. We need codes of practice for genetic management of domesticated stocks (e.g. for introduction of new species, stock transfers, domestication etc.)

Impact on environment

10. We do need more understanding of environmental impact of aquaculture on genetic diversity (both by exotic species and by "genetic pollution")
11. Genetic user restricted technology (GURT) can be applied to render genetically improved breeds infertile. There is a clear advantage to aquaculture of having 100% efficient GURTs to reduce the risk of crossbreeding of cultured exotic species/strains with native stocks and thus there is a demand for the development of these technologies. GURT reduces environmental impact of exotics and genetically improved strains and permit brand control and protection.
12. Restocking programs can be used for increasing aquatic production but there is a need to recognize the potential impacts on biodiversity caused by the genetic effects of domestication.
13. Live "gene" or "strain" banks and (cryopreserved) gamete banks should be fundamental to conserving genetic diversity, and additionally can provide reference material (e.g. for estimating genetic gains) and act as back ups for genetic improvement programs.
14. There is a need to develop genetic conservation protocols to enable safer exchange of genetic material through frozen sperm etc. Cryo-technologies need to be further adapted for fish (especially for new species) and better developed for crustaceans.

Impact on society

15. Genetically improved stock often does not reach the end user due to problems with dissemination. Over the years, several attempts have been made to distribute improved stock to farmers. There is a need for a critical review of successful and unsuccessful dissemination programs to better understand the issues involved.
16. There may be a need for development of certification programs for improved fish varieties, probably based on livestock industry approaches. However, to date there is no experience in this area in aquaculture. In order to asses the importance of the problem a review of the role certification strategies for livestock is needed.

2. DISCUSSION AND PRIORITIZATION OF PROBLEM AREAS.

The discussion of the problem areas made it clear that problems and priorities are different depending on the scale of the breeding operation and the stage of maturation of the industry. Therefore the prioritization of problems was devided up into three categories:

1: Natural populations (restocking programs, impact of aquaculture and use of wild caught seed)

For many new species there are still reproductive bottlenecks which inhibit successful domestication. In other cases, cultural preferences and the scale of the market (local, regional) constrain the development of an aquaculture industry and dictate that animals are to be harvested from the wild. In both cases sustainable aquaculture relies on the appropriate utilization of wild caught broodstock or seed. In some cases there is also a need to restock hatchery reared animals back into the natural environment. Where domesticated stocks are used for this purpose there are important issues relating to the genetic pollution of wild stocks and potential loss of genetic diversity in the wild. Escapes from aquaculture, which can occur in large numbers, can have smilar effects on natural populations.

2: Small scale breeding operations

The majority of aquatic species in S-E Asia are farmed on a regional or national scale, and production levels are typically small. For these species there is little or no capital investment available to set up large scale sophisticated breeding programs and genetic management and improvement will thus rely on tailor made small-scale breeding programs.

3: Large scale breeding operations

Finally there are species which have an economic importance beyond the national or regional level. For these global commodity species, such as shrimp and tilapia, breeding is or is likely to be in the hands of a few specialized large companies. A large number of farmers directly or indirectly will rely on the success of these companies in genetically improving their seed stock in terms of growth rate, disease resistance and other economically relevant traits.

Based on these considerations it was decided that the problem areas would need to be reformulated and prioritized for each category. The workshop members formed three working groups to develop a set of recommendations for each category, which were then centrally discussed and fine-tuned. Prioritization was based on the consensus view from the workshop group and final weightings were set by specialists within each category. The recommendations are summarized below, for each category separately (natural populations, small scale aquaculture, large scale aquaculture).

3. DEVELOPMENT OF AN ACTION-ORIENTED AGENDA

"Natural Populations" (impact of Aquaculture, restocking programs and use of wild caught seed in aquaculture)

1. *Support the establishment of restocking strategies including:*
   - *Support and encourage ASEM members to initiate research on population biology of aquatic resources including the characterization of life cycles in relation to local environmental condition and the elucidation of stock structure using genetic markers.*
   - *Support and encourage ASEM members to conduct socio-economical research on coastal communities to understand issues with candidates for restocking. Basic studies on the population structure, genetic variability and ecology of selected species are important.*

2. *Support to R&D on hatchery-technology to minimize possible impacts on biodiversity caused by using limited number of broodstock animals and genetic changes in hatchery reared stock. Support capacity-building in broodstock development of major aquatic*

species

3. *Support the development of cooperative networks for exchange of information on trading and using wild caught seed. Promote the collaboration of scientists (geneticists, physiologist etc.) and breeders to improve culture methods and address constraints of current breeding practices. Disseminate available information on genetic variability of major species. (e.g. stock enhancement working group of FAO)*

4. *Promote and intensify research into new alternative resources to reduce pressure on traditional resources including the domestication of new candidate species.*

5. *Recommendations of genetic protocols related to restocking should take into account the capabilities of the parties involved and where necessary include support to overcome resource constraints.*

"Small-scale breeding operations"

1. *Accessibility of selective breeding*

Develop support services that will make the application of genetic technologies feasible in situations in which local capacity is a limiting factor.

2. *Need for more basic breeding programs*

Develop genetic improvement programs that can be implemented with limited resources and in the absence of individual identification, but that are scientifically sound and sustainable in the long term (i.e. for durations of 10 years or more).

3. *Domestication environments and strain performance*

Support the conduct of domestication of new species and of genetic improvement programs of cultured species in a range of logical environments in order to detect genotype by environment interactions in case they are important, and encourage the conduct of strain evaluations of cultured species in a range of environments, by an independent body or organization.

4. *Genetics taken into account in domestication*

Encourage the involvement of geneticists in the initial stages of domestication, specifically in using strategies that avoid subjecting the population to bottlenecks that may result in reduced genetic variability.

5. *Cooperation and knowledge base*

Support capacity building activities such as conduct of training programs in genetics (population, quantitative, molecular), development of manuals and software on the theory and practice of genetics applied to aquatic animal improvement, the development of data base information on resource groups and persons in different areas, and the establishment of networks of relevant subject matter areas. Practically, the strengthening and broadening of services provided by existing networks such as NACA or INGA could be contemplated. Typical services would be the provision of a discussion forum in which users could post questions and get answers, or the listing of useful linked sites on the subject.

6. *Need for structured seed production*

Support the development of structured and technically regulated seed production that will capitalize on the genetic improvement made in breeding centers. This will prevent genetic

deterioration of the improved stock, and will enable effective and equitable dissemination of high quality seed of the superior genetic material.

7. *Need for review of case studies of dissemination of improved stock*

Encourage the conduct of studies documenting and evaluating the success or failure of different cases of dissemination of newly developed and improved strains, when possible to the point of assessing impact at the farmer and consumer level. Studies need to be conducted at different levels, namely, national or regional depending on the particular circumstances. Information thus generated will converge to a common platform from where it will be readily available. This will provide a fruitful field of multidisciplinary work between aquaculturists and socio-economists.

8. *Environmental impact*

Encourage the conduct of environmental impact studies related to the development and deployment of genetically improved strains of aquatic animals.

9. *Use of sperm cryopreservation*

Encourage the development of sperm cryopreservation protocols and use of frozen sperm for conservation, insurance, strain dissemination and estimation of genetic change purposes.

"Large scale breeding operations"

1. *Central or regional facilities*

Central/regional facilities should be set up in ASEM countries (see the example of National Broodstock Centers in Vietnam) and used to implement codes of good practice, including breeding, genetic improvement, biosafety and water management. These facilities could serve also as back up, through live or cryopreserved "gene" and gamete banks, to the public and private sector. They should also serve as training centres for all the above areas, including advanced breeding methods.

2. *R&D efforts addressing persisting biological constraints to improve current technologies*

There is a need to address the limitations imposed by the biology of some species (e.g. reproduction, physiology and disease control) to remove key constraints to genetic improvements. Geneticists, breeders (reproductive biologists) and veterinarians should collaborate in the early stages of domestication and research on captive breeding.
Specific target areas are:

- *P. monodon*
  reproduction and nutrition in captivity; gamete preservation.
- *O. niloticus*
  Increased fillet yield, salt and stress tolerance; Synchronization of spawning; Hormone-free production technology.

3. *The need for quarantine facilities*

For some of the species (e.g. shrimp) it is desirable to set up national or regional quarantine facilities. They should be built by the government and they could be operated as commercial facilities.

4. *R&D for the generation and/or improvement of genetic linkage maps*

Efforts should be directed at the development of a medium (at least) density genetic linkage map for all aquaculture species used at large scale breeding operations. Such maps are essential for identification of genes coding for important monogenic traits and for QTL searches as well.
For those species, where the genetic linkage map is not available, the best option is comparative genomics, especially in case of finfish, where several medium to high density linkage maps (e.g. zebrafish, medaka, salmonids, etc.), as well as fully sequenced (Japanese fugu, Tetraodon) or partially sequenced genomes (zebrafish and medaka) are available in the public domain. These two approaches should also be extended to some of the invertebrate species such as Artemia, which is used as live feed in large scale breeding operations but for which the strains are not characterized or selected. The potential for Artemia to be used as a Crustacean model organism should be explored

5. *Genome Projects*

It is desirable to initiate genome projects for some of the most important species depending on their economical importance and evolutionary position. They could be initiated similarly to the mapping efforts, however due to their high cost they would need the support of international grant agencies and research community. One such forming project is the Shrimp Genome Project, which is aiming to sequence fully the genome of Penaeus species.

6. *Environmental Impact Assessment (EIA) studies*

More research is needed on the environmental impact of aquaculture on the genetic diversity of natural populations. Such studies should be conducted in parallel on the potential effects of introduced exotic species and "genetic pollution" caused by farmed strains. They should be performed by specialized academic institutions from international or state-financed grants.

7. *R&D on GURT technologies*

The possibility of "genetic pollution" caused by the farms should be minimized. GURT technologies leading to sterility of marketed specimen or restricting their viability to special conditions (e.g. dependence on certain amino acids) should be developed.
Since such technologies would provide clear advantages to the companies running large scale breeding programs, we propose that private companies should tightly collaborate with academic institutions to work out potential solutions.

8. *Certification program*

A certification program which includes independent assessment of the health and performance of genetically improved strains should be set up in every ASEM country by the government, using examples from the livestock industry.

Workshop 4:	Education & Training Iloilo (The Philippines), September 24-27, 2005

PROGRAMME

General Objectives of the Asia-Europe Meeting (ASEM) Workshops

1. To formulate very specific recommendations (for the European Commission) on future directions in research, trade and production between Asia and Europe
2. To forge new alliances or reinforce existing ones between the European Union and Asian partners for joint research, trade policies, and production methods

Objectives of the Education and Training Workshop on 24-27 September 2005

The ultimate goal is to determine future actions to improve: (i) aquaculture education in Europe and Asia, and (2) the interaction between the two regions.

At the end of the workshop, the participants should be able to:

1. Recognize the strengths, deficiencies, variations, and opportunities in aquaculture education and training in Asia and Europe
2. Identify the special topics of common concern that should be incorporated in formal academic courses and informal training courses in Asia and Europe to make them more relevant and effective to the aquaculture industry
3. Formulate plans and methods to upgrade and fine-tune the aquaculture curriculum and syllabus in formal education and informal training courses in Asia and Europe
4. Determine how universities, training centers, government agencies, and international organizations in Asia and Europe can work better to improve aquaculture education and training

Workshop Program

23 Sep	**Arrival in Manila, Iloilo, and SEAFDEC/AQD Tigbauan**

Saturday 24 Sep	**Arrival in Iloilo and SEAFDEC/AQD Tigbauan**
	Check in at AQD Guest Houses and Apartments
4 pm	Tour of AQD facilities
7 pm	Dinner at South Grill Park

Sunday 25 Sep	**Meeting Day 1**
8 am	**Registration**
8:30 am	**Opening ceremony**
	First welcome remarks
	Second welcome remarks
	Introduction to the ASEM Aquaculture Platform and project objectives
	Workshop mechanics and objectives
9:30 am	**Self-presentation by participants (2 min each)**

	Coffee break
10.30 am	**Discussion**: **Advances in Aquaculture E&T in Asia**
	Overview (30 min): *Aquaculture E&T in Asia*
	Aquaculture E&T in Japan
	Master programs in fish health
	Innovation and entrepreneurship
	Development of web-based training courses: Striving for effective training and dissemination in the European and Asian context
	An overview of BSc/MSc fisheries/aquaculture at RUA - past experiences with AIT - MSc program by RUA and project supported by French - Asia-link project with AIT - Cambodian aquaculture needs for research and trade
1 pm	Check AQD Library, internet, email
2 pm	**Discussion: Advances in Aquaculture E&T in Europe**
	Overview (30 min): *Aquaculture E&T in Europe*
	Globalization of European education by 2010
	Development of AQUALABS
	AQUATT educational database
	Bologna Process
	ERASMUS MUNDUS
	Review of academic courses, joint Masters, etc.
	Aquaculture E&T in France
3:30 pm	Coffee break
4 pm	**Discussion: Special Common Concerns in Aquaculture E&T**
	Sustainable production systems
	Codes of conduct for responsible aquaculture
	Socioeconomics, investments
	Seafood trade and regulations
	Seafood safety
	Effluent treatment
	Harmonization of Asian and European aquaculture/fisheries policies (seeking for common concerns, obstacles, solutions, etc.)
	Watershed level management of fisheries (water framework directives or similar)
6:30 pm	Dinner sponsored by SEAFDEC/AQD (Breakthrough Restaurant)

Monday 26 Sep	**Meeting Day 2**
(Mon)	
8 am	**Discussion: How can we make aquaculture education more effective?**
	Teacher E&T
	Accreditation and certification of fisheries/aquaculture schools (WAVE project)
	Syllabus review and upgrading, to include creation of ERASMUS MUNDUS syllabus
	Newer and locally relevant books with attention to global issues
	Incorporating new technologies into teaching
	Online courses for distance learning (AIT, Stirling, ORION)
	Website, Support tools - databases, glossaries, resources online

	Education database, Aqualex Online Glossary + portals, intranets
	How can Cambodian aquaculture education comparably effective as other ASEAN member countries (disparity reduction)?
	Problem based learning (teamwork, theory+practice)
	Case studies preparation
	PC based planning of enterprise management (technology+economics)
9:45 am	Coffee break
	Discussion: How can we make aquaculture training more responsive?
	Analyses of training needs analyses from Europe, building on PROFET findings
	How to develop training materials for topics such as: sustainable production systems, food safety, environment protection, socioeconomics, position of women in aquaculture, trade regulations
	Incorporating new technologies into training: online courses for distance learning (SEAFDEC/AQD), websites
	Production of extension manuals, self-instructional videos, CDs
	On-farm technology demonstrations
	Shift in education towards inland (freshwater) aquaculture/fisheries from marine topics to follow global production tendencies
	Interdisciplinary approach towards sustainable aquaculture (multifunctionality, integration of water- and environmental management, recreation, biodiversity, etc.)
	Development of a "joint" B.Sc. structure that can serve as basis for (international) M.Sc. education in 1) aquaculture and fisheries 2) environmental conservation/management 3) wetland management (more would enroll the B.Sc. if it has triple M.Sc. options)
12 noon	Lunch (TID Room 10)
1 pm	**Informatics demonstration: topics?**
	Check e-mail, rest
2 pm	**Discussion: How can Asia and Europe work together in Aquaculture E&T?**
	Europe/Asia partnerships, funding
	Ecological/biodiversity based E&T combined with practice oriented research
	Alumni network for graduates (intercontinental exchange of graduates)
4 pm	Coffee break
4:30 pm	**Tour of the University of the Philippines-Visayas, Miagao**
7 pm	**Dinner sponsored by UP-Visayas (where?)**
9 pm	Distribution of draft Summary and Action Plans for comments

27 Sep	**Meeting Day 3**
8:30 am	**Discussion: Summary and Action Plans**
	Presentation and discussion of draft
9:30 am	Coffee break
	Presentation and approval of revised Summary and Action Plans
11:30 am	**Closing ceremony**
12 am	Lunch
2 pm	Check-out from AQD (for those leaving on 27 Sep)
2:30 pm	Departure for Iloilo Airport for PR 144 flight 1650 h
	Optional tour of Metro Manila or Iloilo City

PARTICIPANTS
(alphabetical per country)

NAME	FUNCTION	AFFILIATION & ADDRESS	COUNTRY	E-MAIL & URL
Sena De Silva	Professor	School of Ecology and Environment Deakin University PO Box 423 Warrambol, Victoria	Australia	sena.desilva@deakin.edu.au
Patrick Sorgeloos	Director	Laboratory of Aquaculture & Artemia Reference Center Department of Animal Production Ghent University Rozier 44, B-9000 Gent	Belgium	patrick.sorgeloos@UGent.be url : www.aquaculture.ugent.be
Jean Dhont	ASEM Secretariat	Laboratory of Aquaculture & Artemia Reference Center Department of Animal Production Ghent University Rozier 44, B-9000 Gent	Belgium	jean.dhont@ugent.be url: www.aquaculture.ugent.be www.asemaquaculture.org
Chhouk Borin	Dean	Faculty of Fisheries Royal University of Agriculture P.O.Box 2696 Phnom Penh	Cambodia	012898095@mobitel.com.kh
Jean-Claude Guary	Professor	Conservatoire National des Arts et Metiers (CNAM) Directeur de l'Institut National des Sciences et Technique de la Mer (Intechmer) Directeur du LERMA BP 324, F-50103 Cherbourg Cedex	France	guary@cnam.fr
Patrick White	Senior Consultant	Akvaplan-niva AS BP 411 Crest Cedex 26402	France	patrick.white@wanadoo.fr
Bernd Ueberschaer	ENBI – Project Coordinator Project Manager - LarvalBase	Leibniz – Institut fur Meereswissenschaften (IfM – GEOMAR) Forschungsbereich Marine Okologie (FB 3) Arbeitsgruppe Fischereibiologie Duesternbrooker Weg 20 24105 Kiel	Germany	bueberschaer@ifm-geomar.de

Margaret Eleftheriou	Head	Multi-Media Unit Hellenic Centre for Marine Research Crete Centre PO Box 2214 Heraklion, Crete	Greece	margaret@her.hcmr.gr url: www.hcmr.gr
Laszlo Stundl	Lecturer	University of Debrecen Centre for Agricultural Sciences Böszörményi Street 138 Debrecen H-4032	Hungary	stundl@agr.unideb.hu
David Murphy	Manager	AquaTT PO Box 8989 Dublin 2	Ireland	david@aquatt.ie
Hisashi Kurokura	Professor	Graduate School of Agricultural and Life Sciences Faculty of Agriculture, Department of Global Agricultural Sciences The University of Tokyo 1-1-1, Yayoi, Bunkyo-ku Tokyo 113-8657	Japan	akrkrh@mail.ecc.u-tokyo.ac.jp
Hiroshi Fushimi	Professor	Laboratory of Aquaculture and Stock Enhancement Department of Marine Biotechnology Faculty of Life Science and Biotechnology Fukuyama University Ohama, Innoshima Hiroshima 722-2108	Japan	hfushimi@ma.fuma.fukuyama-u.ac.jp
Mohamed Shariff	Professor	Faculty of Veterinary Medicine Universiti Putra Malaysia 43400 Serdang, Selangor	Malaysia	shariff@vet.upm.edu.my
Jiang Zengjie	Assistant Professor	Chinese Academy of Fishery Sciences Yellow Sea Fisheries Research Institute 106 Nanjing Road Qingdao 266071	P.R. China	jiangzj@ysfri.ac.cn
Tereso Abella	Director	Freshwater Aquaculture Center Central Luzon State University 3119 Science City of Muñoz Nueva Ecija	Philippines	teri_abella@yahoo.com
Helen Vicente	Graduate Program Coordinator	School of Marine Fisheries and Technology Mindanao State University-Naawan 9023 Naawan Misamis Occidental	Philippines	drhvice@yahoo.com

Rafael Guerrero III	Executive Director	Philippine Council for Aquatic and Marine Research and Development Department of Science and Technology 4030 Los Baños, Laguna	Philippines	pcamrd@laguna.net
Romeo Fortes	Professor, Dean	College of Fisheries and Ocean Sciences Institute of Aquaculture University of the Philippines-Visayas 5023 Miagao, Iloilo	Philippines	telyos@yahoo.co.uk
Paul S. Teng	Professor, Director	Natural Science & Science Education National Institute of Education Nanyang Technological University 1 Nanyang Walk	Singapore	psteng@nie.edu.sg
Daniel Montero	Professor, Researcher	Grupo de Investigación en Acuicultura Instituto Canario de Ciencias Marinas University of Las Palmas de Gran Canaria PO Box 56 35200 Telde, Las Palmas, Canary Islands	Spain	dmontero@iccm.rcanaria.es
Kim Jauncey	Senior Lecturer & Vice Dean	Faculty of Natural Sciences Institute of Aquaculture University of Stirling Stirling FK9 4LA, Scotland	United Kingdom	kim.jauncey@stir.ac.uk
Le Thanh Luu	Director	Research Institute of Aquaculture No. 1 Dinh Bac Commune Tu Son District, Bac Ninh Province	Vietnam	ria1@hn.vnn.vn
Nguyen Anh Tuan	University Lecturer and Vice Rector	Cantho University 3/2 Street, Campus 2 CanTho City	Vietnam	tuants@ctu.edu.vn
Rolando R. Platon	AQD Chief	Aquaculture Department Southeast Asian Fisheries Development Center Tigbauan, Iloilo, Philippines	Philippines	aqdchief@aqd.seafdec.org.ph rrplaton@aqd.seafdec.org.ph
Koichi Okuzawa	AQD Deputy Chief	Aquaculture Department Southeast Asian Fisheries Development Center Tigbauan, Iloilo, Philippines	Philippines	okuzawa@aqd.seafdec.org.ph
Celia Lavilla-Pitogo	Head, Fish Health	Aquaculture Department Southeast Asian Fisheries Development Center Tigbauan, Iloilo, Philippine	Philippines	celiap@aqd.seafdec.org.ph

Gilda Lio-Po	Aquaculture Researcher	Aquaculture Department Southeast Asian Fisheries Development Center Tigbauan, Iloilo, Philippines	Philippines	liopo@aqd.seafdec.org.ph
Teodora Bagarinao	Head, Training and Information	Aquaculture Department Southeast Asian Fisheries Development Center Tigbauan, Iloilo, Philippines	Philippines	dorisb@aqd.seafdec.org.ph
Teresa de Castro-Mallare	Training Specialist	Aquaculture Department Southeast Asian Fisheries Development Center Tigbauan, Iloilo, Philippines	Philippines	decastro@aqd.seafdec.org.ph
Ruby Bombeo	Training Specialist	Aquaculture Department Southeast Asian Fisheries Development Center Tigbauan, Iloilo, Philippines	Philippines	rfbombeo@aqd.seafdec.org.ph

RECOMMENDATIONS

WORKSHOP OUTCOMES

The first day of the workshop concentrated on ASEM General Objective 2, that of forging new alliances and reinforcing existing ones for the purpose of joint research.
This was achieved through a series of presentations from Asian and European universities, research institutes and organisations on current educational provision in both the academic and the vocational sectors. These presentations may be found on the ASEM project website.
In the light of this exchange of information, much of it new to the workshop participants, there was much discussion from all participants, during which the following draft recommendations were made and agreed by all remaining participants.
The Recommendations are listed numerically following the workshop's objectives, with brief explanations as to how and why certain actions are recommended.

RECOMMENDATIONS

Objective 1: to recognise the strengths, deficiencies, variations, and opportunities in aquaculture education and training in Asia and Europe

During the presentations, it quickly became clear that there is a very wide variety of courses and types of course delivery across both Asia and Europe, much of which is occurring in response to the rapid rate of change both in the worldwide aquaculture industry as well as in international educational policy. The focus of aquaculture education and training provision has changed considerably in recent years in both Asia and Europe. One result is that there is an acknowledged lack of knowledge and awareness about tertiary education and training provision on each side of the ASEM education and training partnership. Until this lack (i.e., deficiency) concerning the pathways of communication both within regions and between regions is remedied, the strengths, weaknesses and opportunities cannot be identified.

1) To focus on the academic sector, specifically M.Sc. and Ph.D. (this should include Master, Master of Science and professional M.Sc., which is more vocationally oriented)

2) To generate a new network which will use synergies and structures already in place in Asia (e.g., the proposed Aquaculture Education Consortium (AEC), NACA, SEAFDEC; national networks (e.g. ViFiNET, PhilFIN), Asian Fisheries Society (AFS) and South East Asian Chapter (WAS); in Europe (e.g. Aqua-TNET, AQUATT)), by using existing collaborations from projects or programmes that are being or have been carried out, on a bilateral or multilateral basis. The network should be set up by a small representative group at a meeting lasting no less than 4-5 days

3) To consider Vocational Education and Training (VET) as it is carried out at the operative/subsistence farmer level, at the next stage of the project, as training provision in this area is very diverse throughout both regions

4) To identify subject areas, courses or modules which could be used or adapted for sandwich/split-centre delivery at M.Sc. or Ph.D. level.

5) Exchanges should cover staff as well as students, initially making use of existing collaborations and networks

6) To explore existing alumni activities in order to identify synergies and successful strategies with a view to strengthening the ASEM platform network

7) To build an online database providing details of all aquaculture/aquatic science courses from all ASEM aquaculture members

Objective 2: to identify the special topics of common concern that should be incorporated in formal academic courses and informal training courses in Asia and Europe to make them more relevant and effective to the aquaculture industry

8) That all copyright-free materials/courses which are available to the ASEM aquaculture platform (e.g. MARINVEST workshop presentations) should be made available to the network

9) Topics of Common Concern: not presented in order of priority (should recognise different countries´ specific needs)
    a. Waste water management
    b. Environmental issues
    c. Legal Aspects and Policies
    d. Food safety requirements and regulations under different aspects (e.g. hygiene, HACCP, Harmful Algal Blooms (HABs), antibiotics, Traceability issues)
    e. Integrated aquaculture / multi-species production/ multifunctional (e.g. recreational, ecotourism, sport fishing)
    f. Ornamental aquaculture
    g. Domestication and breeding
    h. Nutrition (e.g. use of alternative feed components)
    i. Fish health
    j. Standardisation of analytical and related methodologies
    k. Responsible farming and ethical issues
    l. Business planning, management and marketing (special need for Added Value products)
    m. Gender issues
    n. Promotion of positive aspects of aquaculture

Objective 3: to formulate plans and methods to upgrade and fine-tune the aquaculture curriculum and syllabus in formal education and informal training courses in Asia and Europe

10) To obtain and compile records of ASEM aquaculture curricula containing the up-to-date and accurate information received from all partners (see Recommendation 1)

11) To identify existing Asian credit systems and explore the possibility of credit recognition protocols within Asia and between Europe and Asia, taking account of all the recent changes in accreditation and credit recognition procedures

Objective 4: to determine how universities, training centres, government agencies, and international organisations in Asia and Europe can work better to improve aquaculture education and training

12) To identify innovative information systems, training tools and techniques (e.g. CD-ROM, video, radio, TV, mobile phone, online resources, role play/case study activities) which have been used effectively in aquaculture education

13) To select and promote successful Case studies which exemplify the use of some of the above-mentioned tools in order to disseminate good practice throughout the network

14) To identify and enhance opportunities for mobility exchanges (see below for list) as well as the mechanisms (such as funding, facilitators) in Asia (national and regional) and between Asia and Europe

15) To promote practical and skills training as recognised components of academic courses

16) To identify and promote best practice educational methodology for different end-users (students, farmers, operatives, certificate/diploma holders, entry level (APL) workers)

Workshop 5: Food safety, Trade & Regulatory aspects Athens (Greece), March 22-24, 2006

PROGRAMME

Specific objectives

The remit of the fifth ASEM Workshop, to examine food safety from a variety of aspects, though admittedly very wide in scope, has never been more relevant to the international agenda. The Bangkok Declaration on Aquaculture Development (2000) summed up the challenge and the opportunities for the industry. *"As consumer awareness increases, aquaculture producers, suppliers and processors will need to improve the quality of products and enhance product safety and nutritional value. The incentives for this will be potentially higher prices, lower insurance rates and increased consumer demand."*

Aquaculture in the Far East has changed its role very considerably over the last few years: there has indeed been a considerable increase in production of high value species, looking to enter the profitable export market as well as to meet growing internal market demand. In order to maintain the present level of production, as well as to make more than an empty gesture toward the goal of sustainable aquaculture, several inter-dependent issues have to be taken into account. The present ASEM workshop highlights these issues in its five thematic areas. The workshop is intended to elicit serious discussion on the part of all stakeholders represented and therefore there will be a minimum of formal presentations which will provide a framework for the issues under discussion. It is anticipated that the discussions will lead to a set of recommendations which will help participants to square the circle: to ensure the production of quality products of high market value and to protect the environment exploited by the aquaculture industry. The involvement of producer associations will guarantee that producers' and traders' perspectives will find their way into the workshop's recommendations.

Arrival of participants, 21st March

DAY 1	Wednesday, 22nd March 2006

Day 1 will take place in the Agricultural University of Athens, Votanikos (Iera Odos), Athens, to which participants will be transported by bus from the President Hotel, and where there will also be a tour of the installations.

9:00	Pick up by bus at the hotel
10:00–10:05	Welcome S. Papoutsoglou (Co-Host, Agricultural University of Athens, Greece)
10:05–10:10	Welcome HCMR Representative (Dr. M.Alexi)
10:10–10:20	Welcome Greek Government Representative (GSRT)
10:20–10:35	AQUACHALLENGE Beijing-brief Intro (Prof. A.Eleftheriou)
10:35–11:00	ASEM Platform: Aims and expected results (Prof. P.Sorgeloos, Project Coordinator, Ghent University, Belgium)
11:00–11:15	Coffee break
11:15–11:30	Introduction -Food safety (Courtney Hough, FEAP)
11:30- 12.30	ROUND TABLE for introduction of participants
12:30-13:30	========== Lunch ==========
13:30-15:00	Thematic area 1 Environmental aspects There is general acceptance by producers that intensification of culture systems to meet increased demand causes increased environmental impact and that high quality products cannot be produced in a poor environment. The maintenance of good environmental conditions is of paramount importance for fish health. Disease spread by poor environmental conditions will lead to serious financial losses and may also result in persistent loss of water quality. One of the roles of regular monitoring in aquaculture is to reveal problems before they result in serious impacts to the environment and/or cause catastrophic consequences in production. Improved

techniques and methodology arising from BEP can lead to a reduction in environmental impacts. By identifying the effects of aquaculture production on the water column and the sediments, either by traditional techniques or by whole system monitoring and assessment which looks to the carrying capacity of an area, it may be possible to achieve a system which monitors the integrity of the whole system and is capable of evaluating the health of the system, in a way that is compatible with the interests of all the stakeholders involved. Once producers realise that their production capacity is close to breaching not only the environmental limits but also the carrying capacity of their farm, then a mutually beneficial solution could be found whereby environmental health is established by the use of BEP, or at least BATNEEC. Carrying capacity needs to be linked to the effects of the impacts and to what degree impacts are acceptable. Countries have their own standards for environmental monitoring and their own preferred methodology and technology used to achieve these standards. Good environmental practice, linked to a realistic set of regulatory measures, brings demonstrable benefits to all the players in the different conflicting interest groups.

Chairperson Prof. H. Rosenthal, Germany

Contributors: General overview of aquaculture and environment interactions Dr. I.Karakassis, University of Crete; Dr Nafsika Karakatsouli, Agricultural University of Athens (AUA).

Rapporteur: Prof. Eleftheriou, University of Crete

15:00-15:15 Coffee break

15.15–17.00 **Thematic Area 2 : Health hazard aspects**

Producers must ensure the absence of residues from antibiotics, and take measures to lessen the risks caused by viral and bacterial contamination in their aquaculture products. Work is being done in this area in the Seafood Plus Network, particularly in respect of assessment of bacterial associated contamination, as well as the development of standard reference methods for viruses in shellfish.

Chairperson: David Lyons, Food Safety Authority of Ireland

Contributors: Nutrition and food quality: effects of peptic enzymes on fish quality Dr Stratos Papoutsoglou, AUA, Athens
Mr Steve Rex, Qualifish Limited, UK
Mrs Jamilah Bakar, Faculty of Food Science and Technology
University Putra Malaysia
MSc Malinee Smithrithee
Niracha Wongchinda

Rapporteur: Mr C.Hough, FEAP

17.00-18.00 Tour of AUA aquaculture facilities

17.45à18.00 Return to President Hotel by bus

20.00 Dinner at President Hotel

DAY 2 Thursday, 23rd March 2006 - Meeting Room, President Hotel

09.00-11.00 **Thematic Area 3: Consumer perceptions**

Consumers want a quality product that is healthy and of proven high nutritional value. Negative perceptions and concerns about food safety can be tackled by increasing consumer confidence in aquaculture by utilising systems that allow traceability, certification, labelling. Recent research shows that the concept of traceability is not well known amongst seafood consumers, though the same report showed that there was considerable interest in a safety guarantee and a quality mark for seafood.

Chairperson: Dr J. Stefanis, Selonda, Greece / FEAP President

Contributors: "Consumer perceptions" Dr Olga Kehagia, AUA, Athens
"Organic Aquaculture" Prof. C.Vamvakas, DG Fisheries, European Commission
Dr George Chryssochoidis, AUA, Athens

Rapporteur: Mr C.Hough, FEAP

11.00-11.15 Coffee Break

11.15-13.00 **Thematic Area 4: Regulatory aspects**

Compliance with national and international regulations, certification and traceability issues, have become important aspects for all producers wishing to retain product share in the export market. Specifically for aquaculture products there is a need for an integrated food chain quality control and traceability of food products, all the way from egg, via larva to the end product.

Chairperson: Dr Ventiris, FGM, Greece

Contributors: Dr Joop Luten, RIVO (Netherlands & NIFA Norway) "General overview of current issues";
Panos Christofilogiannis (AQUARK): Greek Quality Certificate,
Courtney Hough (FEAP)

Rapporteur: Prof. P.Sorgeloos, Ghent University

13.00-14.00 ========== Lunch ==========

14.00- 15.45 **Thematic Area 5: Identification of risk factors**

The HACCP system, developed to address all the relevant hazards in food production and incorporating every step from harvesting, processing and distribution of products, was adopted by the WHO/FAO Codex Alimentarius in the form of a general guideline. It is thus the basic reference for international trade disputes under the World Trade Organization (WTO) "Agreement on the Application of Sanitary and Phytosanitary Measures". Though not all countries have as yet decided to make the HACCP system obligatory for aquaculture products sold or consumed in internal markets, HACCP systems are regarded by the developing countries mainly as non-tariff barriers erected by developed countries.

Chairperson: Dr Alicia O. Lustre, National Food Authority, Manila, Philippines

Contributors: Prof. George-John Nychas (AUA, Athens),
Evangelos Evmorfopoulos "The application of HACCP principles in primary production and particularly in aquaculture"

15.45-16.00 Coffee Break

16.00-17.00 Regulatory aspects or other unfinished sessions continued

17.00-18.00 Meeting of Rapporteurs to draft recommendations

20.00 Workshop Dinner (Alexander Hotel, transport by bus)

DAY	Friday, 24th March 2006

09.00-11.00 Drafting of Recommendations based on rapporteur presentations and workshop feedback

11.00–11.15 Coffee Break

11.15-12.30 Drafting of Recommendations based on rapporteur presentations and workshop feedback

12.30 -13.30 ========== Lunch ==========

13.30 End of Workshop

PARTICIPANTS

NAME	FUNCTION	AFFILIATION & ADDRESS	COUNTRY	E-MAIL
Patrick Sorgeloos	Director	Laboratory of Aquaculture & Artemia Reference Center; Department of Animal Production; Ghent University; Rozier 44,; B-9000 Gent	Belgium	patrick.sorgeloos@UGent.be
Courtney Hough	Secretary-General; FEAP	Federation of European Aquaculture Producers; Rue Nicolas Fossoul 54; B-4100 Boncelles; Belgium	Belgium	courtney@feap.info
Marie-Louise Scippo	Researcher	Université de LIEGE Faculté de Médecine Vétérinaire Département des Sciences des Denrées Alimentaires, Secteur Analyse CART (Centre d'analyse des résidus en trace) Bd de Colonster, 20,Bat B43b SART TILMAN B-4000 LIEGE	Belgium	mlscippo@ulg.ac.be
Constantin Vamvakas	Professor	DG-Fisheries, EC	Belgium	Constantin.Vamvakas@cec.eu.int
Xi-Chang WANG	Professor	College of Food Science and Technology SHANGHAI FISHERIES UNIVERSITY No.334, Jungong Rd. Shanghai 200090	China	xcwang@shfu.edu.cn; wangx_c@hotmail.com
Harald Rosenthal		World Sturgeon Conservation Society	Germany	haro.train@t-online.de
Olga Kehagia	Researcher	Agricultural University of Athens, 75 Ieros Odos; Votanikos,; Athens 11855 Greece; Home address; Stratigou Makrygianni 3; 15341 Agia Paraskevi Athens	Greece	kehagia@aua.gr
Panos Christofilogiannis	Company Director	AQUARK, Management Solutions for Aquatic Resources; 143 Papagou Avenue, 15773 Zografou, ATHENS	Greece	panos@aquark.gr - panosvet@otenet.gr
Evangelos Evmorfopoulos	EFET Food Inspector/Lecturer	TEI, Athens; 82 Socratous St., 17672 Kalithea, Athens (home)	Greece	eevmorfop@teiath.gr
George-John Nychas	Professor	Dept Food Science & Technology; Lab of Microbiology & Biotechnology of Food; Agricultural University of Athens, 75 Ieros Odos;	Greece	gjn@aua.gr

		Votanikos,; Athens 11855		
Nafsika Karakatsouli	Lecturer	Department of Applied Hydrobiology, Faculty of Animal Science,; Agricultural University of Athens; Iera Odos 75, 118 55 Athens	Greece	nafsika@aua.gr
Ioannis Karakakassis	Associate Professor	Department of Biology, University of Crete; P.O.Box 2208, Heraklion 714 09, Crete	Greece	karakassis@biology.uoc.gr
Stratos Papoutsoglou	Researcher	Department of Applied Hydrobiology,; Agricultural University of Athens, 75 Ieros Odos; Votanikos,; Athens 11855	Greece	stratospap@aua.gr
John Stefanis	Company Director	Selonda SA, 26-30 Nav, Nikodimou Street; Athens 10556 ; Session Chairman	Greece	stamataki.k@gr.selonda.com
A.Ventiris	President	Federation of Greek Maricultures, Athens, Greece; Session chairman	Greece	fgm@ath.forthnet.gr
S.Papoutsoglou	Professor	Agricultural University of Athens, 75 Ieros Odos, Votanikos,; Athens 11855 Greece; Co-host, Workshop	Greece	sof@aua.gr; www.aua.gr
G. Chryssochoidis	Professor	Agricultural University of Athens, 75 Ieros Odos, Votanikos,; Athens 11855 Greece	Greece	gc@agribusiness.aua.gr
A.Eleftheriou	Retired Professor	University of Crete, Greece; Co-host Workshop	Greece	telef@her.hcmr.gr
Dr Kriton Grigorakis	Researcher	nstitute of Aquaculture, Hellenic Centre for Marine Research,; Hellenic Centre for Marine Research; Aghios Kosmas, GR-166 10, Hellinikon,; Athens, Hellas	Greece	
Iorgos Kotoulas	Researcher	Hellenic Centre for Marine Research, Crete Centre, PO Box 2214, Heraklion, Crete	Greece	
Maria Alexis	Researcher	Institute of Aquaculture, Hellenic Centre for Marine Research,; Hellenic Centre for Marine Research; Aghios Kosmas, GR-166 10, Hellinikon,; Athens, Hellas	Greece	malexi@ath.hcmr.gr;
David Lyons		Food Safety Authority of Ireland Abbey Court Lower Abbey Street	Ireland	dlyons@fsai.ie

		Dublin 1		
Jamilah Bakar	Professor	Faculty of Food Science and Technology; University Putra Malaysia; 43400, Serdang, Selangor	Malaysia	jamilah@putra.upm.edu.my
Hatijah Hashim	Researcher	Consumers Association of Penang	Malaysia	hatijah55@yahoo.com
Joop Luten	European Business Developer	Norwegian Institute of Fisheries and Aquaculture Research, Muninbakken 9-13, Postboks 6122, 9291 Tromso, Norway.; Coordinator, RTD Seafood from source to consumer, Seafood Plus	Norway	joop.luten@fiskeriforskning.no
Alicia O. Lustre		National Food Authority, Manila, Phillipines	Philippines	lustre@pacific.net.ph
Malinee Smithrithee	Senior Fisheries Biologist	Department of Fisheries	Thailand	mwitchawut@hotmail.com; malineew@fisheries.go.th
Niracha Wongchinda	Senior Food Technologist	Department of Fisheries	Thailand	nirachaw@fisheries.go.th
Steve Rex	Managing Director	Qualifish Limited Airor, St martins, Cullicudden, by Culbokie Ross-shire, IV78JT	UK	steverexaqua@aol.com
Trang Si Trung	Professor	Seafoods Processing Faculty University of Fisheries 02 Nguyen Dinh Chieu Nha Trang	Vietnam	trungdanphuong@yahoo.com

RECOMMENDATIONS

1. Environmental issues

Aquaculture – as any other industry – has the potential to become a polluter IF not managed properly. With the growth of the industry and globalisation of markets the need for tighter regulations is obvious.
In some parts of the world (especially in Europe and North America) aquaculture is over-regulated (compared to other water resource users) while the regulatory framework in most ASEM countries is developing rapidly. More importantly, the monitoring and enforcement measures of the existing regulations are gradually becoming effective. However, there is lots of room for improvement.
The workshop addressed many of the environmental and social issues and the interactions between aquaculture in various environments and various species groups with inland and coastal habitats, but also stressed the effects of other water resource users that need to be regulated to meet the needs of environmental safety and quality of the aquaculture industry.

The following key recommendations were expressed (formulated) during the Round Table discussions of Thematic Area 1 (Environmental issues):

Recommendation 1
It is strongly recommended to develop carrying capacity models that incorporate the existing knowledge base on specific and locally documented environmental effects into large-scale assessment tools that can be employed by regulatory authorities to limit the extent of aquaculture production in the planning licensing process.
Justification:
Over the past two decades a wealth of information has been accumulated in scientific publications, reflecting the efforts of national and international research programmes. This knowledge base should be more aggressively utilized by modern approaches to carrying capacity assessments in order to allow for long-term regional planning and area-oriented management of the industry.

Recommendation 2
It is strongly recommended to regulate other coastal resource users as to meet aquaculture environmental safety requirements for sustainable development. It is supposed that this objective can be best achieved through the development of decision support systems (so-called Expert systems) that assess the interactions of ALL stakeholders of the water resource system under concern (e.g. water-shed based systems; coastal areas at ecosystem level) with aquaculture as an EQUAL RIGHT USER of the water resource who needs also protection from the ill-effects of insufficiently regulated industries
Justification
Aquaculture regulations have developed extensively in most parts of the world although their implementation can be improved in many areas. Research on the environmental impacts of aquaculture systems clearly demonstrated that besides the impacts identified there are also many interactions with other users of the aquatic resource systems, both in freshwater and coastal marine ecosystems. Many of these industries do impact on the environment and subsequently on aquaculture and need to be monitored, regulated and controlled to the extent to permit safe and sustainable operation of adjacent aquaculture systems. **Sofar, regulations fort hese industries did not take the protection needs of aquaculture into account**. Examples are

the shipping industry and the release of domestic sewage from communities near aquaculture farms.
The shipping industry releases massive amounts of **„waste water" (called ballast water)** which contains huge numbers of non-native species, including parasites and pathogens that can affect and have affected aquaculture systems. The introduction of micro-algal species that develop toxic blooms in the North Sea (and elsewhere) affecting huge areas of shellfish farming. This is one of the negative effects that will **persist** while shellfish farmers will neither be compensated for the loss of production nor the opportunity for further development**. Untreated waste water effluents from coastal communities** affect the aquaculture industry in coastal waters, rendering the waters unsuitable (e.g. coliform counts, organic load) for aquaculture operations. Aquaculture systems exposed to external pollution by other coastal resource **users cannot effectively employ BEPs, BATs and HACCP** systems. Aquaculture must be considered as **an equal right resource user** – as any other stakeholder in coastal and riverine shoreline areas – **that needs to be adequately protected through co-management measures**.

Recommendation 3
It is recommended to assess effective monitoring tools as integral part of BEPs and BATs with the aim to minimize costs and efforts while sufficiently addressing environmental quality standards
Justification:
Although BEPs and BATs can only be part of the needed voluntary guidelines for environmental and product safety, they are considered to be useful tools to serve a dual purpose, to safeguard the aquaculture operation through internal (system specific) standards and external (environmental) standards. BEPs and BATs are considered important elements in a control system that offers **tracebility** and **transparency** of the environmental interactions. Monitoring programmes for various aquaculture systems have been tested extensively. Often they have been costly and unnecessarily complex. The existing knowledge indicates that **effective** and **cost-effecitve** monitoring systems can be **simplified** through proper selection of key environmental factors **without losing the level of reliability needed for safe environmental management**. However, before implementing simplified monitoring programmes there is a need for verification through accompanying research programmes (jointly implemented by research institutions and the industry), because the requirements often are aquaculture **system specific, species-specific and area (ecosystem)-specific.**

Recommendation 4
It is highly recommended to support strategic research programmes to assess the effects of climate change on the aquaculture industry in ASEM countries.
Justification:
Climate change is a **reality**. In many freshwater and coastal systems we will see slightly rising temperatures, which will at least **temporarily exceed** past seasonal **temperature maxima**. It is well established that temperature **affects metabolic rate, nutritional requirements and susceptibility to disease.**
In particular disease agents and parasites show a drastically different (more aggressive) **performance profile** when temperatures are moving towards their **physiological optimum**. A rise of even 0.5°C average ambient summer temperature in culture systems will increase the risk of disease outbreaks which otherwise have previously been perfectly under control. Additionally, for many **aquaculture species**, these **summer temperatures** are **above their physiological optimum**. Furthermore, disease agents which have sofar not been a risk factor will have to be considered as potential risks, because the annual temperature profile did not

raise above the minimum critical level where these agents could proliferate. Therefore, **new diseases will evolve** for which we **do not yet have any prophylactic method in place**. If strategic research is not initiated on this subject now, the industry will be unprepared in the future (4-8 years time horizon) to adequately respond to the environmental change.
Also, with climate change, **extreme conditions** (e.g. hot and/or short summers) will vary at a larger amplitude as has been witnessed in the past. This applies not only for the temperature regimes of coastal water systems but also for river and lake systems where dry weather flow, spring floods due to extreme rainfalls will become more frequent scenarios, affecting the annual temperature profil significantly (on top of the changes we see through increasing constructions of hydropower dams and reservoirs).
Sea level rise also affect the temperature regime in tidal areas as it affects the time of water coverage of tidal flats during high tide and air exposure during low tide, thereby influencing energy transfer of radiation with significant effects on the nearhsore temperature profiles.
Finally, **changed temperature profiles** with slightly shifts in annual cycles **will also affect metabolism and nutritional optima** for the established cultured species. This will need adjustments in the feed composition to respond to the altered physiological profiles. Although nutrition research is advanced, there is still a need for a wide variety of aquaculture species to investigate the nutritional consequences of such temperature changes (both in freshwater and marine aquaculture).

Recommendation 5
It is strongly recommended to invest into research on BAPs and BATS for Integrated aquaculture systems with particular emphasis on the needs for HACCP
Justification
Integrated aquaculture systems seem to offer ample opportunities to operate environmental friendly, because it is believed that they mimik to some extent natural ecosystems (higher species diversity compared to monoculture systems. These systems are considered to mimik - to same extent- natural systems (higher species diversity), produce a higher variety of products (diversification), although there will be less volume per species produced. The advantage is also seen in intercropping, serving different markets thereby fostering some independence from one ort he other supply chain. Most importantly, integrated systems offer the opportunity to RECYCLE nutrient and engery flows. Conceptually, WASTES of one production line in the integrated system will become a NEW RESOURCE for the next production line. This principle is already an important one in rural aquaculture in many regions of the traditional aquaculture world. However, there has been no assessment yet to which extent and under which operational conditions such systems can become compatible with the HACCP system. Sofar, the design of HACCP has in principle focussed on MONO-CULTURE systems. There is an urgent need to investigate the conditions and criteria under which integrated systems can be effectively included into a HACCP safety and quality control system.

Recommendation 6
It is strongly recommended to develop Aquaculture risk assessment and management tools that have global validity
Justification:
The available knowledge on environmental impact, interactions with the environment and other resource users as well as the socio-economic impacts and consequences of aquaculture have been studied fairly well. To enhance the utility of this knowledge and in order to improve the practical management of aquaculture at the industry and regulatory level, the development of

risk assessment methodologies are necessary. Risk assessment comprises four major steps: (a**) risk identification** (Environmental Impact statement), (b) **risk assessment** (similar to EIA (Environmental Impact Assessment), (c) **risk communication** (creating awareness and knowledge to the industry, trade, regulatory authorities, politics and the public at large on perceived risks and actual risks (risk), and (d) **risk management** (leading to a multi-criteria decision analysis involving environmental costs, operational costs, economic viability and acceptable level of environmental change). ASEM can be seen as an excellent forum to address risk assessment methodologies beyong the local and regional concerns and, therefore, joint projects in this area should be promoted (perhaps with the cooperation of the respective working groups of GESAMP, ICES and EIFAC who have recently started to consider the principle needs in this important management area.

Recommendation 7

It is strongly recommended to invest in research and development projects that involve more effectively modern communication systems (GIS, remote sensing) to minimize or avoid external environmental and human-induced hazards

Justification

There is an **urgent need** to better **safeguard** the aquaculture industry (and other industries which depend on aquatic resources) **against external risks beyond the control** of these industries. However, aquaculture and other industries could be **better prepared** to respond if **early warning systems** would be in place. The value of early warning systems using modern communication tools by exploting the state of the art in remote sensing and GIS applications has recently become highly apparent when considering hurricans and Tsunamis. Modern remote sensing systems provide now opportunities to gain information on the development of extreme storms, but also on extreme ocean waves and wave hight development with fairly accurate forecasting capabilities while also receiving reliable predictive changes in sea surface temperature profiles (time horizon hours to days) and also on position, extent and further development (area coverage) of coastal algal blooms.

2. Health Hazard Aspects

Standard Reference Methodologies

The workshop reported significant difficulties encountered in terms of the techniques and methodologies used for measuring contaminants and residues in aquaculture products, resulting in significant frustration and potentially damaging effects on trade.

Standard Reference methodology for the analysis of contaminants in fish and shellfish is required at an international level. In order to assure the maintenance of equitable trade conditions, it is recommended that international cooperation measures be established so as to provide, at a minimum, information flow on new or revised analytical procedures for contaminants and to enable the timely implementation of these within the producing countries affected.

Quality Management Systems

Aquaculture can use a range of monitoring systems that are directed towards the assurance of quality factors within regulated and/or certified management systems. In addition, although HACCP is well established in final product processing, its current impact in rearing procedures is less so. There are a large number of voluntary schemes available to aquaculture but there is concern that 3rd party schemes, increasingly imposed by product buyers, can provoke inequitable and unfair market conditions for the production sector.

While a global standard could be difficult to establish, it is strongly recommended that focused work be done so as to develop clear levels of equivalency that should be recognized between inspection and certification bodies established in Asia, Europe and North America.

Feeds for Sustainable Fish Farming

There is increasing pressure to find alternative and renewable sources of appropriate proteins and oils for incorporation into compound feeds for aquaculture. There is concern that the effects of plant-based products may not be adapted to the welfare of fish and shrimps and that the nutritional profile of the final product may not be as good when compared to those using feeds containing ingredients of animal [fish] origin.

While noting that most recent food scares started because of feed contamination, it is recommended that more research should be done on the formulation of feeds that are best adapted to the nutritional and metabolic requirements of the fish species in question and without compromising the human health benefits.

The use and/or recycling of nutrient-rich products within aquaculture feeds requires further examination, clearly distinguishing benefits from hazards. Research based on risk assessment for the use of such materials within compound feeds is also required.

It is further recommended that a transparent approach to the use of different raw materials within compound feeds be adopted, particular for consumer and producer communication aspects.

3. Consumer Perceptions

Consumer confidence in aquaculture products

Scientific studies and consumer research work clearly indicate a lack of consumer knowledge on food hazards and associated risks. At the same time, the consumer does not necessarily understand the benefits of traceability and related quality-oriented measures.

It is recommended that attention be given to building circumstances that can provide a proactive information supply line on the consumer guarantees provided by producers and suppliers of aquaculture products

Organic Aquaculture

While many consumers appreciate the provision of organic products, organic aquaculture is not yet an important part of production. The plethora of different National and International standards leads to confusion of the consumer.

It is recommended that an international basic organic standard be developed for different types of aquaculture, containing precise definitions and principles, which could also incorporate quality aspects.

This standard could be subject to National certification and promote the development of organic aquaculture.

Consumer Behaviour

Sustainable aquaculture demands the social and economic acceptability of its products. Consumer behaviour is a complex domain and one that has not received much attention within the production and supply of aquaculture products to the market.

It is recommended that more research, at national and international levels, be made on the understanding of the consumer motivations and behaviour in respect of different aquaculture products. This will enable constructive and effective decisions to be taken on the content of communication efforts made concerning aquaculture.

4. Identification of risk factors

Since there seem to be differences in environmental parameters and therefore apparent pathogens in Asia compared to Europe, there is a need for further research on public health hazards along aquaculture production in Asia, mainly focusing on **a**) coastal area effluent runoff and industrial pollution, and **b**) predominant parasites, pathogenic bacteria and viruses in aquaculture. Collaboration between E.U. and Asia on bilateral research programs would strengthen current knowledge on pathogens in Asian aquaculture and reveal ways to eliminate them, therefore is highly recommended.

As compared to the conditions in Europe, the numerous small farms in Asia, mostly artisanal family operations, present a much bigger challenge to introduce uniformity in application of good aquaculture practices, traceability and HACCP. Producers in Asia need to be informed that several potential hazards exist in aquaculture and that if they are not cautious or meticulous in following good aquaculture practices, their produce might be rejected. Further collaboration of top-level officials from Asian Governments with Europe by means of workshops, meetings and bilaterally funded projects is highly recommended and will ensure that highest priority will be given towards improvement of good aquaculture practices in Asia.

The difficult task of informing and training of thousands of small-scale aquaculture producers might become easier if there were active Farmer's Organisations to work hand-in hand with the national Governments towards aspects of food safety in production, adaptation of HACCP and traceability. Any possible support from Europe to facilitate this process and share experiences are highly recommended.

Workshop 6:	Food security Firenze (Italy), May 7- 9, 2006

PROGRAMME

Specific objectives

Food security is not anymore about producing more or the technology to produce more. It is about basically making the products accessible and affordable. It has also to do with balance of emphasis of govt policies -- high value export oriented or affluent local market -oriented, and low value-high volume mass food (like milkfish and carps). A link to trade would mean emphasis on export and might lead to a neglect of the inland fisheries! among others. The "others" are the neglect of improvements on local distribution infrastructures and handling of products for local markets.

DAY 1	Sunday, May 7, 2006 - Polo Scientifico Sesto Fiorentino - CNR

8:30	Pick up at hotel, transfer to CNR Institute (today's venue)
9.30–9.50	Welcome address (James Muir & Pete Bueno)
9.50–10.15	ASEM Aquaculture Platform: Aims and expected results (Prof. P.Sorgeloos & Jean Dhont, Project Coordinator, Ghent University, Belgium)
10.15-11.15	ROUND TABLE for introduction of participants
11.15–11.30	Coffee break
11.30–12.30	Introduction of workshop themes and discussion topics (James Muir)
12.30-13.30	========== Lunch ==========
13.30-15.30	**Thematic area 1: The international and national politics of food insecurity** Policies in trade, aid, subsidies, commercialization and industrialization of aquaculture, resource allocations, ethical issues (animal welfare) and their impacts on food security. **Chairperson:** Rohana Suabsinghe **Rapporteur**: Flavio Corsin
15.30-15.45	Coffee break
15.45–17.45	**Thematic Area 2**. **Aquaculture systems and practices and food security** What practices negatively/positively impact on food security and how are these being addressed? What are the indicators of impacts? If none, what could be done to develop the indicators? **Chairperson**: Md Shariff **Rapporteur**: Cecile Brugere
17.45-18.00	Return to hotels
20.00	Dinner in the city centre (details to be communicated later)

DAY 2	Monday, May 8, 2006 – Fortezza da Basso

09.00-11.00	**Thematic Area 3**. **Best practices** Inventory, describe and (if time and patience allow) assess the better management practices and worst practices that, respectively abet or adversely affect, food security. Keep the focus on aquaculture and environment, aquaculture trade, and culture-based fisheries. "Practices" refer to policies, programs, corporate and farmer behaviors, management practices, farming systems, farm operation, etc. **Chairperson**: Flavio Corsin **Rapporteur**: Marc Verdegem
11.00-11.15	Coffee Break
11.15-13.00	**Thematic Area 4**. **A critical look at low trophic species, low input, low risk systems** Do they really contribute to food security? In what way? If so, how can the system be made more attractive to rural entrepreneurs who might find high value species a better investment option? And whose being marketed and processed actually create more income and employment along the market chain and ancillary activities? **Chairperson**: Rafael Guerrero **Rapporteur**: Max Troell
13.00-14.00	========== Lunch ==========
14.00- 15.45	**Thematic Area 5**. **Technology and services and food security** If the food security role of aquaculture is agreed (i) to include producing huge quantities of low cost fish and (ii) generating higher income and more employment from the production and trade of high value species, what are the implications of these on the focus of technology development and diffusion? Resource allocations? Emphasis of credit, research, extension and other technical services? **Chairperson**: Chen Jiaxin **Rapporteur**: Lindsay Pollock
15.45-16.00	Coffee Break
16.00-17.45	**Thematic Area 6**. **Exchange between ASEAN+3 and EC** Are there experiences, technologies, practices, that farmers of each bloc can adopt from each other that would help improve food security. How to facilitate the exchange and adoption? **Chairperson**: Patrick Sorgeloos **Rapporteur**: Marc Verdegem
17.45-19.00	Meeting of rapporteurs to draft recommendations
20.00	Dinner in the city centre (details to be communicated later)
…	Further recommendations drafting by rapporteurs if required

DAY	Tuesday, May 9, 2006 – Fortezza da Basso

09.00-11.00	Drafting of Recommendations based on rapporteur presentations and workshop feedback
11.00–11.15	Coffee Break
11.15-12.30	Drafting of Recommendations based on rapporteur presentations and workshop feedback
12.30 -13.30	========== Lunch ==========
13.30	End of Workshop

PARTICIPANTS
(alphabetical per country)

NAME	FUNCTION	AFFILIATION & ADDRESS	COUNTRY	E-MAIL & URL
Patrick Sorgeloos	Professor	Laboratory of Aquaculture & Artemia Reference Center Department of Animal Production Ghent University Rozier 44, B-9000 Gent	Belgium	Patrick.Sorgeloos@UGent.be url : www.aquaculture.ugent.be
Jean Dhont	ASEM Secretariat	Laboratory of Aquaculture & Artemia Reference Center Department of Animal Production Ghent University Rozier 44, B-9000 Gent	Belgium	jean.dhont@ugent.be url: www.aquaculture.ugent.be www.asemaquaculture.org
So Nam	Deputy director	IFReDI, Department of Fisheries	Cambodia	sonammekong2001@yahoo.com
Chen Jiaxin	Professor	Yellow Sea Fisheries Rsearch Institute 106 Nanjing Road, Qingdao, China 266071	China	cjxin828@public.qd.sd.cn
Nandeesha	Professor	College of Fiehseries Central Agricutltural University, Lembucherra – 799001 Agartala, Tripura State	India	mcnraju@yahoo.com mcnraju@gomail.com
Rohana Subasinghe		Fishery Resources Division, Fisheries Department FAO Vialle delle Termi di Caracalla, 00100 Roma	Italy	Rohana.Subasinghe@fao.org
Cecile Brugere	Aquaculture economist	Fishery Policy & Planning, Fisheries Department FAO Vialle delle Termi di Caracalla, 00100 Roma	Italy	Cecile.Brugere@fao.org
Mohamed Shariff	Professor	Faculty of Veterinary Medicine Universiti Putra Malaysia 43400 Serdang, Selangor	Malaysia	shariff@vet.upm.edu.my
Marc Verdegem	Lecturer	Aquaculture and Fisheries Group Wageningen University P.O.Box 338 6700AH Wageningen	Netherlands	Marc.Verdegem@wur.nl

Rafael Guerrero III	Executive director	Department of Science and Technology Philippine Council for Aquatic and Marine Research and Development Jamboree Road, Timugan, Los Baños 4030 Laguna	Philippines	pcamrd@laguna.net; aquabios@laguna.net
Dawn Jamandre	President	Jamandre Industries Inc 88 Rizal street, La Paz, Iloilo	Philippines	jamandreindustries@yahoo.com
Emil Yulo	Operations manager	Alsons Aquaculture Corporation	Philippines	aa-ges@saranganibay.com.ph
Max Troell		Beijer Institute, Stockholm	Sweden	max@beijer.kva.se
Pedro Bueno	Director General	NACA PO Box 1040, Kasetsart Post Office Bangkok, 10903	Thailand	pete.bueno@gmail.com pedro.bueno@enaca.org
James Muir	Professor	University of Stirling	UK	j.f.muir@stir.ac.uk
Lindsay Pollock	Post-doctoral researcher	University of Stirling Stirling	UK	ljp1@stir.ac.uk
Flavio Corsin	Project leader	NACA NAFIQAVED building 10, Nguyen Cong Hoan Ba Dinh, Hanoi	Vietnam	flavio.corsin@gmail.com
Le Xan	Vice-director	Research Institute of Aquaculture No. 1 Dinh Bac Commune Tu Son District, Bac Ninh Province	Vietnam	lexancb@hn.vnn.vn

RECOMMENDATIONS

Food security and policy

1. Aquaculture will increasingly contribute to global aquatic product supply and will support food security through a) direct production of aquaculture products which can be consumed or marketed, b) employment generation and c) supply of widely affordable aquatic products. These should be reflected in government policies and implementation.
2. There is a strong link between poverty, vulnerability and food security. Poverty reduction strategies should assign a stronger role to aquaculture for its importance in achieving food security. There are also important gender issues to be addressed.
3. Approaches should be developed at the national level. Policy should ideally be formed by multi-stakeholder participation, and should balance needs for export and domestic supply. .

Aquaculture systems and practices

4. It is important to consider the sustainability of aquaculture production systems. Neglect of this will ultimately have an impact on food security. Sustainability includes ecological, technological, social and economic elements, applying at different scales (global, regional, national, local).
5. Although food security is internationally agreed to be an important development goal, other drivers of aquaculture development, such as income, investment, and market forces must also be recognised.

Better Management Practices (BMP)

6. To effectively contribute to food security, Codes of Conduct and Better Management Practices should specifically address social (incl. gender) and economic aspects.
7. Product certification and ethical consumption should be actively used to increase food security by ensuring good social practice,, while minimizing cost penalties for small-scale producers.
8. Successful regional methodologies such as cluster management should be documented and spread among and between farmers.

Low trophic, low input and low risk systems

9. Incentives should be provided for farming low trophic species to improve food security.
10. Integrated cultures where low-value species are added to existing cultures for maximization of production should be encouraged and further investigated.
11. Where appropriate, ornamentals and other non-food species should be promoted for income generation.

Technology, services and food security

12. The complete value chain for aquaculture needs to be considered in promoting food security.
13. Governments should provide enabling environments for the private sector to contribute to food security. This should include market access and research support.
14. Producers should have access to information, credit and means of reducing risk. Successful experiences in networking, synergy with NGOs and application of new IT should be promoted.

Exchanges within ASEM

15. National organizations that ensure stakeholder participation should be created or strengthened to yield local benefits. This process can benefit from experiences from European producer/professional organizations as well as those in the Asia-Pacific region.
16. Information exchange, better management practices and producer organization experiences between farmers in ASEM should be encouraged. Opportunities for joint ventures and partnerships to support food security should be promoted.