



# Global Conference on Aquaculture 2010

**Farming the waters for People and Food**

**22-25 September 2010, Phuket, Thailand**

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## Biosecurity and Bangkok Declaration

Progress and emerging issues in:

- 3.11 Aquatic animal health (AAH)
- 3.13 Genetics
- 3.14 Biotechnology
- 3.15 Food quality and safety

Biosecurity issues not covered in the Bangkok Declaration

- Biological invasions
- Climate change


Conclusions and way forward

Recommendations

*The term biosecurity was not used in the Bangkok Declaration*

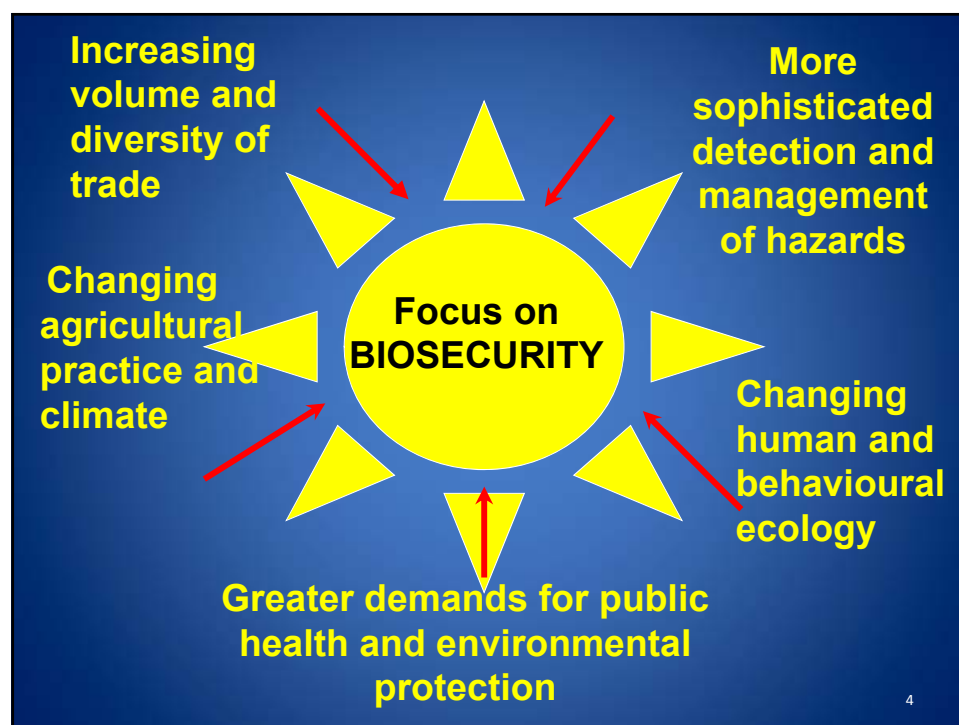
## What is biosecurity?

- A **strategic** and **integrated** approach that encompasses both **policy** and **regulatory** frameworks; biosecurity is aimed at **analyzing** and **managing** the **RISKS** of the sectors dealing with:

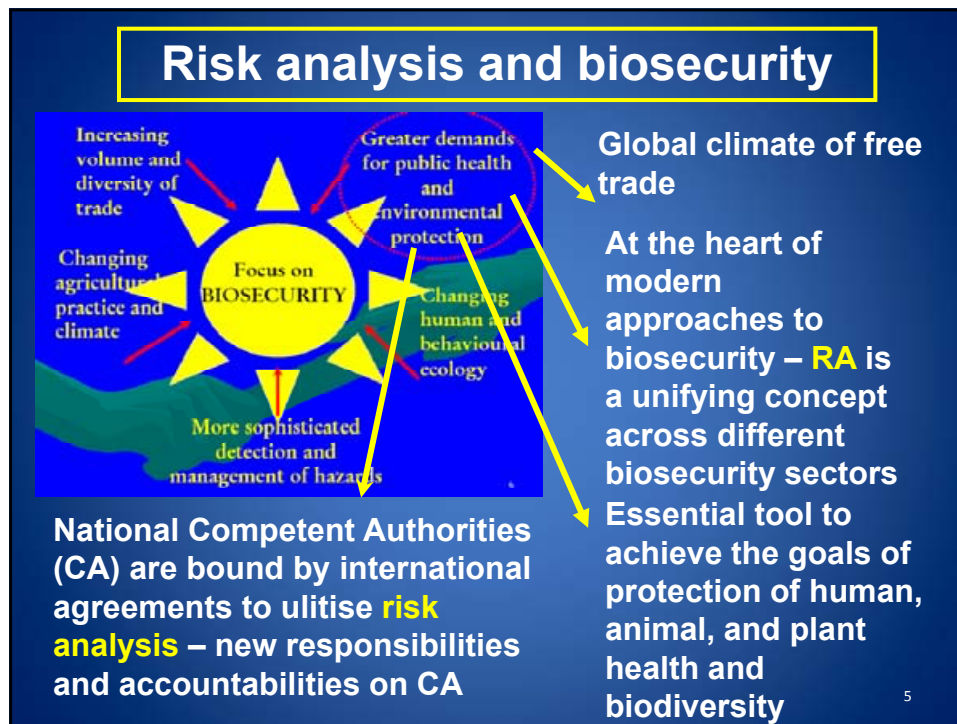


<b>Food safety</b>	<b>Animal life and health</b> (including aquatic animal)	<b>Plant life and health</b>	<b>Environment</b>
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## Biosecurity and risk assessment

- The aim of biosecurity is **prevention** of disease as **treatment** is often not an option
- Risk analysis (RA) involves risk **identification**, risk **assessment**, risk **management** and risk **communication**
- RA is only as good as the amount of data available  
inadequate data = qualitative RA; adequate data = quantitative; aquaculture RAs are nearly always qualitative
- RA is a decision-making tool; identifies needs for research, precautionary measures

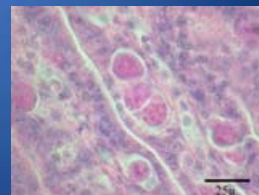
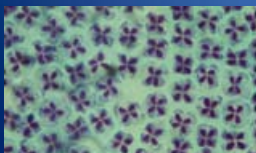
## Biosecurity and Aquaculture

- In aquaculture, biosecurity is a collective term that refers to the concept of *applying appropriate measures* (e.g., *proactive disease risk analysis*) to reduce the probability of a biological organism or agent spreading to an individual, population, or ecosystem, and to mitigate the adverse impact that may result (Arthur *et al.* 2004).
- RA incorporates the best information available on aspects of husbandry, epidemiology, and sound science.
- WTO SPS Agreement emphasizes the need to apply risk analysis as a basis for taking any SPS measures

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### 3.11 AAH: Transboundary AA Dx

- Poor or lack of effective biosecurity measures
  - irresponsible movement of animals for aquaculture; lack of control on movements, especially zoning; inability to detect pathogens in apparently healthy animals; poorly understood pathogen pathways (feed, ornamentals, shipping), misunderstanding and misuse of SPF stocks, etc.
- Unanticipated negative interactions between cultured and wild populations
- Enhancement of marine and coastal areas through stocking of animals raised in hatcheries
- Climate change; Other human-mediated movements of aquatic animals



### 3.11 AAH: ornamental fish trade

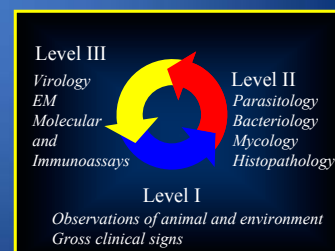
- Major industry:
  - 1 billion movements/year, 4000 freshwater and 1400 marine spp., 100 countries;
- Highly unregulated; involves high volume of transshipments that mask the origin of individual shipments
- Due to complexity of the trade, guarantees of the health status difficult, if not impossible.
- Pathogens and parasites poorly known; Lack of data for Import Risk Assessments (IRAs)
- Pathogens include KHV, SVC, EUS, gourami iridovirus
- Have not received the detailed attention it deserves



high value, e.g. koi carp =  
USD 100 000/pc

### 3.11 AAH: disease control

- Complex and combination of pathogen detection, prevention, treatment and general health management
- Bringing diagnostic methods and biosecurity measures to farm level (more training and extension work)
- Rapid disease detection
- Molecular and immunodiagnostic techniques
- Nanotechnology





### 3.11 AAH: Impacts of TAADs

- **Socio-economic terms:**
  - Losses in production, income, employment, market access or market share, investment and consumer confidence
  - Food shortages
  - Industry failure or closure of business
- **Impacts on wild populations and biodiversity:**
  - Aquatic community structure through changes in predator and prey populations; possible extinction of species
  - Changes in host abundance (e.g. altered genetic demands, altered host behaviour, increased mortality, decreased fecundity, increased susceptibility to predation, etc.)
  - Reduction in intra-specific genetic variation; Local extirpation of susceptible components of aquatic communities



### 3.11 AAH: Veterinary medicinal products

- **ideal: full “toolkit”** — products and services (vaccines for prevention of diseases; immunostimulants /feed additives to enhance performance of the fish under farming conditions, other treatment products to cure any new or sporadic future infections).
- full testing and documented - quality, efficacy and safety.
- support of accurate diagnostic services from vets, health professionals, extension workers
- effective health management plans
- **Challenge:** in regions with many species cultured, many diverse pathogens, a diverse environment and variable access to knowledge and information; tedious approval process



## 3.14 Biotechnology

### Immunodiagnosics:

Lateral flow technology; rapid (< 10 min), sensitive, pond-side, cheap, easy to perform.

### Molecular techniques:

Multiplex PCR; several species, very sensitive, specific, high throughput.

LAMP; fast, field test, needs training.

**GMOs:Benefits:** improved growth, disease resistance, freezing resistance, reproductive sterility. **Risks:** escape from farms, ecological risk, management

**There is considerable resistance to GMOs by the public**

## 3.14 Biotechnology: shrimp farming

- Pond-side immunodiagnostic strips
- For carriers, LAMP + electrophoresis, or lateral flow diagnostic strips
- 'Vaccines', viral coat and binding proteins, efficacy?
- Double stranded RNA and egg yolk antibodies, protection against viruses
- SPF stocks, but problem with double infections, cultured/wild cross-infections, co-cultivation





### 3.15 Food quality and safety: antimicrobials and residues

- **Potential risk:** development of transferrable resistance genes in bacteria in aquatic environments by horizontal gene transfer to other bacteria and ultimately reach human pathogens
- 50 years of investigation; **no consensus** has been achieved as to whether this potential impact has had an adverse effect on human health.
- **Need for prudence:** improve diagnostic and technical advice to producers



### 3.15 Food quality and safety: vaccination

- Used for extracellular bacterial infections (Gram –ve, some Gram +ve), but not for intracellular bacteria
- Ineffective against viral infections (partial IPN, ISAV)
- Adjuvants may cause lesions affecting animal welfare
- Vaccination of small fish difficult (oral or immersion, low antibodies, live or recombinant vaccines used)
- Inactivated vaccines (gene insertion for virulence production)
- Live vaccines (virulence factor deletion)
- Reduce use of antibiotics; only one strategy to prevent AADx



### 3.15 Food quality and safety: food-borne pathogens

#### Food borne-trematodes from raw fish

- Infect >18 million people (<500 million at risk)
- <90% in extensive subsistence ponds in N. Vietnam (<5% in intensive culture)
- Unacceptable in exported fish (-20° C kills)
- Several species infect intestines and liver
- Reservoir hosts (cats 49%, dogs 35%, pigs 14%)

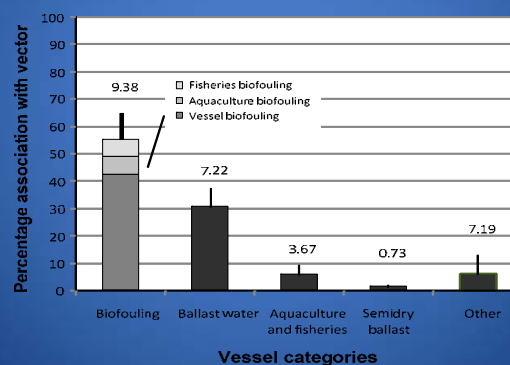
#### Food-borne *Salmonella* contamination of aquaculture products

- <5% of foodborne salmonellosis but still a major problem causing large number of import refusals
- birds, frogs, rodents and reptiles may bring in *Salmonella* into aquaculture systems

### Not in the Declaration: Biological Invasions

#### The spread of invasive species

Bio-fouling (left), ballast water, aquaculture & fisheries, semi-dry ballast, other (right)



### Not in the Declaration: Climate Change

- Spread of parasites and diseases (*Perkinsus olseni* in clams, EUS in south Africa??)
- Pathogen virulence may change
- Changes in marine pH and shellfish
- Destruction of coral reefs
- Escape from storm-damaged facilities

But climate change may adversely affect the existence of some pathogens, and parasites with multi-host life cycles



### Global efforts

- **FAO**: assessment of aquatic biosecurity capacity and performance – basis for developing national and regional programmes: Africa, Gulf Region, Pacific Islands, Western Balkan region; capacity building
- **OIE**: diagnostic code and manual; focal points on aquatic animal health; PVS – performance of veterinary services; concepts (safe commodities; compartmentalization; zoning; animal welfare)
- **FAO/OIE/government collaboration**: bringing together fisheries/aquaculture and veterinary authorities
- **FAO One Health Programme** – A Comprehensive Approach to Health: **People, Animals and the Environment** based on “One World, One Health” (FAO, OIE, WHO, UNSIC, UNICEF, WB)

## WTO SPS Agreement - Main Regulatory Instrument

Codex Alimentarius Commission (FAO/WHO)	Food safety
World Organization for Animal Health (OIE)	Animal (including aquatic animal) life and health
International Plant Protection Convention (IPPC)	Plant life and health

**International  
Standards**



**Sectoral  
Concerns/Issues**



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Important treaties and agreements related to international  
trade in aquatic organisms and their products

<b>Binding - Obligatory</b>	<b>Non-binding - Voluntary</b>
Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) Aquatic Animal Health Code (OIE)	ICES Code of Practice on the Introduction and Transfers of Marine Organisms
Convention on Biological Diversity and the Cartagena Protocol on Biosafety (UNEP)	EIFAC Codes of Practice and Procedures for Introductions and Transfers of Marine and Freshwater Organisms
Convention on International Trade in Endangered Species (CITES)	Asia Regional Technical Guidelines on Health Management for the Responsible Movement of Live Aquatic Animals in Asia (TGBCIS)
European Union (EU) related legislation and directives	FAO Code of Conduct for the Responsible Fisheries (CCRF)

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## Regional progress

- **Asia (NACA):** Improving regional and national capacity; Capacity building activities; Harmonising experts, centres, laboratories; Technical assistance provided; Food safety – zoonotic diseases; Quarterly Aquatic Animal Disease Reporting System
- **Latin America and the Caribbean:** variable in biosecurity capability; no unified regional document; committees have identified needs; harmonising resources (experts, laboratories); Farm level strategies (COPs and GMPs); identification of regional (non-OIE) diseases; protection of biodiversity
- **EU Animal Health Strategy (2007-2013):** prevention is better than cure: prioritisation of EU intervention (precautionary principle); modern animal health framework (OIE, Codex Alimentarius); animal-related threat prevention, surveillance and crisis preparedness; science, innovation and research (community and national reference laboratories)

## National progress

- **Australia:** **Federal:** IRAs, international issues and disease reporting, co-ordinating national and state emergency response, facilitating exports, overseas capacity building, ornamental fish, invasive pests (ballast water, hull-fouling); **State government:** control high risk activities, disease surveillance and monitoring, emergency response, controlling movements, farm biosecurity standards, training and public awareness.
- **Malaysia:** Biosecurity Division
- **Belize:** consolidation of animal, aquatic animal, crop/plant protection laws (Belize Agricultural Health Authority)
- **National strategies/health plans:** several countries in Asia, Australia, US, Canada, Bosnia and Herzegovina





## Networking/Professional Organizations

- Japanese Society for Fish Pathology
- OIE Aquatic Animal Health Standards Commission (50 years)
- Fish Health Section/American Fisheries Society (40 years)
- Fish Health Section/Asian Fisheries Society (24 years)
- European Association of Fish Pathology (at least 20 years)
- Major scientific journals: DAO, JAAH, JFD, Fish Pathology (Japan), EAFP Bulletin, DAA; disease articles in other general aquaculture publications and other subject specific journals
- Newly emerging:
  - AVMA (< 5 years)
  - NACA Advisory Disease Group (8 years)
  - Major veterinary conferences included aquatic animal health as one keynote presentation
  - Major changes in veterinary curriculum (2009 - recent global meeting of Deans of Veterinary Universities)

## Conclusions

- Aquaculture development (intensification, diversification and trade) brings new challenges to sustainable development of the sector; **biosecurity issues become a major concern**
- Disease intelligence, research, technologies and information have greatly improved – **need to involve especially farmers/producers** into the equation for effective implementation
- Need to keep pace with species, systems, technologies and environments in order to understand/determine **appropriate biosecurity measures** that can be put in place at every step of the **culture cycle/value chain at all levels**
- Efforts should be focussed on **prevention**, and **maintaining healthy and safe aquatic production**
- **Risk analysis** is an important decision-making tool but should be supported with infrastructure, human capacity, research and information.





## The Way Forward

- **Surveillance** programmes and **diagnostic** services to detect and identify the arrival and spread of pests and diseases;
- **Timely assessment** of the threats from new or expanding species;
- **Rapid response** to eradicate new pests and diseases before they establish and spread;
- Standardization of science-based **identification of all risk pathways** and high-risk organisms, and implementation of **pre-border, border and post-border** measures to prevent pests and diseases from entering the country;
- **National frameworks** to regulate, manage and control biosecurity.
- Infrastructure, human capacity, research and information to implement the above
- **Capacity building, capacity building, capacity building at all levels**
  - **NATIONAL COMMITMENT**

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## EXPERT PANEL MEMBERS

Drs **Alexandra Adams** (Institute of Aquaculture, Stirling, Scotland); **J. Richard Arthur** (Private Consultant, Barriere, B.C., Canada); **Cristina Chávez** (Unidad Mazatlán en Acuicultura, Mexico); **Tim Flegel** (Faculty of Science, Mahidol University, Thailand); **Roar Gudding** (National Veterinary Institute, Norway); **Eric Hallerman** (Department of Fisheries and Wildlife Sciences, Virginia State University, US); **Chad L. Hewitt** (Australian Maritime College, Australia); **Jesper Hedegaard Clausen** (Royal Veterinary and Agricultural University, Denmark); **C. V. Mohan** (NACA, Thailand); **Ramesh Perera** (Biosecurity Australia, Canberra, Australia); **Peter Smith** (National University of Ireland, Ireland); **Robin Wardle** (Intervet, UK)

FAO Focal Points: Drs **Devin Bartley**, **Iddya Karunasagar**, **Rohana Subasinghe**, **Melba Reantaso**

**Murphy's Law:** "Whatever can go wrong, will go wrong – *in any given situation, if you give it a chance...*"

**Corollary to Murphy's Law:** "Left to themselves, things can go from bad to worse"

**An ounce of prevention is worth a pound of cure** --- Trying to avoid problems in the first place is better than trying to fix them once they arise.

**ONE WORLD – ONE HEALTH**

integrating people, animals, environment<sup>29</sup>