Working Group 24: Environmental Interactions of Marine Aquaculture

Inter-Sessional FUTURE-AP Meeting Aug. 16-18, 2010

Dr. T Horii

Parent Committees:

- Fishery Science Committee (FIS)
- Marine Environmental Quality Committee (MEQ)

Co-Chairs:

- Ms. Ingrid Burgetz (Canada)
- Dr. Katsuyuki Abo (Japan)
- Dr. Brett Dumbauld (USA)

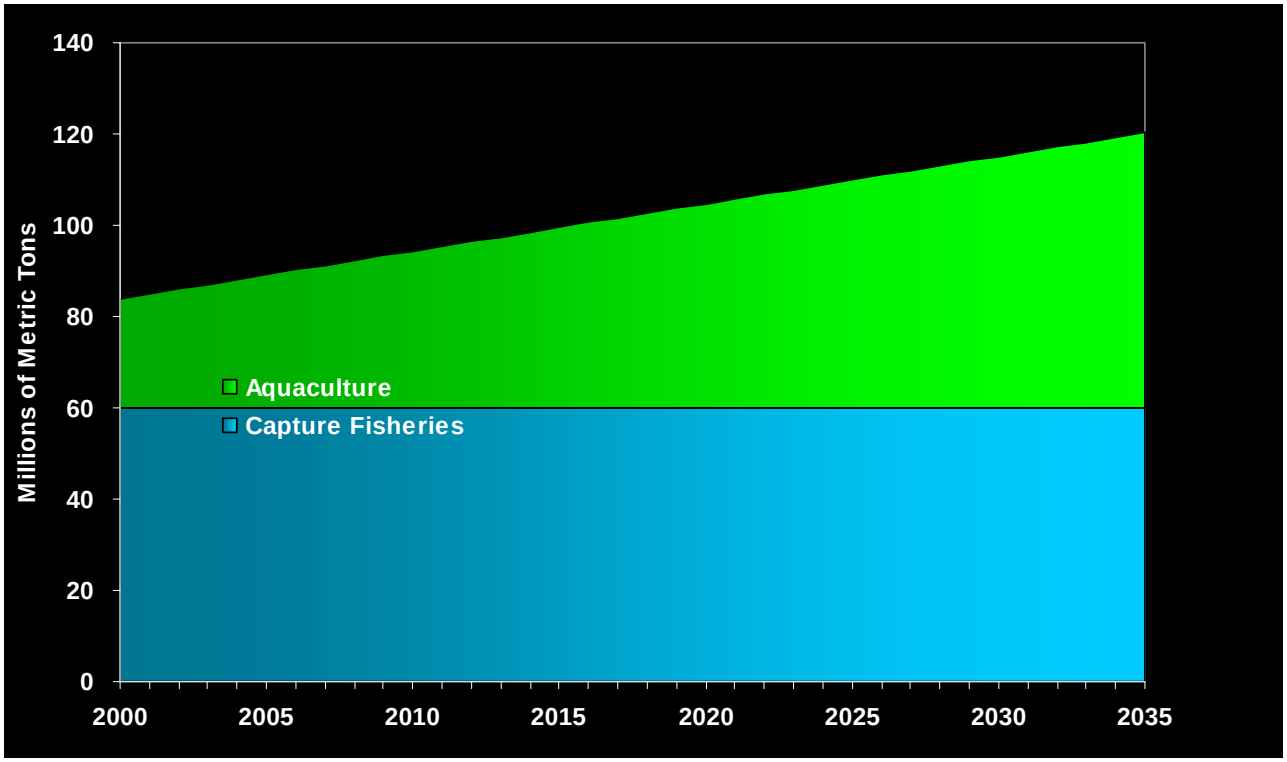
Members:

Canada(6), China(4), Japan(3), Korea(4), Russia(3), USA(4)

Duration

- Approved at PICES 2008 (2008-2011)

Aquaculture: The propagation and rearing of aquatic organisms in controlled or selected aquatic environments for commercial, recreational, or public purposes.



Global Aquaculture Production

Since 2003 various groups within PICES have focused on Marine Aquaculture. These include:

1. **WG-18**: Mariculture in the 21st century - The intersection between ecology, socio-economics and production (2003 - 2006)

2. **SG-MAR**: Study Group on Marine Aquaculture and Ranching (2006 - 2007)

3. **WG-24**: Working Group on Environmental Interactions of Marine Aquaculture (2008 - 2011)

WG-18 identified priority areas for study including:

1. Development of carrying capacity models.
2. Genetic management of aquaculture and released stocks.
3. Risk assessment of interactions between cultured, enhanced and wild fish.

SG-MAR recommended the formation of Working Groups to foster joint activities on:

1. Environmental risk assessment and interactions of marine aquaculture
2. Technology and management for aquaculture.

ICES-PICES meeting on environmental interactions of mariculture (2008)

WG-24 Environmental Interactions of Marine Aquaculture was approved at the 2008 annual meeting.

Interactions: farm effluents, escapes and pathogen transfer

2009 PICES Annual Meeting WG-24 Activities

Workshop

Interactions between Aquaculture and Marine Eco-systems

12 oral and 7 poster presentations were given
These covered most areas of interest to the working group

First WG Meeting

Prior to 2009 AM, member countries were asked to provide information in the following areas as they relate to aquaculture in their respective country:

1) Species of interest and production methods
2) Risk assessment methods and applications
3) Pathogens and diseases of concern in aquaculture

Responses received from member countries were reviewed during the 2009 WG meeting.

Mission of WG-24

Develop standard methods and tools to assess and compare the environmental interactions and characteristics of existing and planned marine aquaculture activities in PICES member countries.

Terms of References

1. Evaluate approaches currently being used in the different PICES countries to assess and **model** the interactions of aquaculture operations with surrounding environments.
   Dr. K. Abo to lead

2. Review and assess current **risk assessment** methods used to assess environmental interactions of aquaculture and determine what, if anything, should be changed for application in PICES countries to reflect ecosystem-specific aspects.
   Dr. E. Black to lead

3. Assess methods to detect, identify, evaluate and report on infectious **disease** events and potential interactions between wild and farmed marine animals.
   (LEAD: Dr. K. Amos retired, Dr. Brett Dumbauld acting since June 2010)

Terms of Reference and Activities

Activity 1: *Evaluate approaches currently being used in the different PICES countries to assess and model the interactions of aquaculture operations with surrounding environments*. (LEAD: Dr. Abo)

2009-2010 Activities:

Information from member countries was obtained and summarized for the first working group meeting (2009 AGM). Culture technologies and related marine species in the member countries were shared in the meeting.

- Due to the diversity of species in the various member countries, we decided to consider the use of functional groups (e.g. carnivorous fish, filter feeders etc.) rather than individual species.

- From this information, general themes suitable for more detailed study will be identified.

- The focus of this activity will be to develop improved understanding of interactions rather than the differences in production techniques between member countries.

Evaluate approaches currently being used in the different PICES countries to assess and model the interactions of aquaculture operations with surrounding environments.

Process:

Comparative assessment of the methodologies, applications, and outputs of different approaches used in assessment.

1) Identify 3-4 priority technologies & associated species and list interactions
2) Review literature for significance
3) Identify predictive methodologies

Relationship between Activity 1 and the FUTURE Scientific Program.

Activity 1 supports the development of standardized assessment and modeling tools within the PICES community and links with FUTURE's strategy of using coordinated monitoring, data compilation and retrospective studies to identify the key processes that are at highest risk from climate change and other anthropogenic stressors such as aquaculture. WG-24 and FUTURE activities will be complementary in gathering the necessary information to meet the central FUTURE goal of improving forecasting for the influence of these stressors on North Pacific ecosystems.

Terms of Reference and Activities

Activity 2: *Review and assess current risk assessment methods used to assess environmental interactions of aquaculture and determine what, if anything, should be changed for application in PICES countries to reflect ecosystem-specific aspects.* (LEAD: Dr. Ed Black)

2009-2010 Activities:

Risk assessment methods used in the various member countries were summarized. Non-standardized terminology was identified as a major impediment to future discussions on this topic. A list of possible definitions for risk assessment terms has been prepared for discussion at our next WG meeting.

Relationship between Activity 2 and the FUTURE Scientific Program.

Risk Assessment is an important tool that can be used to initially identify and prioritize areas to address within the FUTURE Program. Activity 2 is working towards understanding the different types of risk assessment methods used in member countries and how comparable the different approaches are.

Terms of Reference and Activities

Activity 3: *Assess methods to detect, identify, evaluate and report on infectious disease events and potential interactions between wild and farmed marine animals.* (LEAD: Mr. K. Amos retired, Dr. Brett Dumbauld acting since June 2010)

2090-2010 Activities:

Information from member countries was obtained and summarized for the first working group meeting (2009 AGM). Following the AGM Mr. Amos retired which limited our progress on this term of reference.

Relationship between Activity 3 and the FUTURE Scientific Program.

Although the role of disease in aquaculture is well understood its role in structuring wild populations has not been fully assessed. Changes in marine ecosystems are likely to be accompanied by increased incidence of disease in wild and farmed animals, as well as changes in the nature of interactions between wild and farmed animals with respect to disease. The application of standardized (or equivalent) diagnostic methods for pathogens by members of the PICES community could aid FUTURE to assess how factors such as climate change impact the health of aquatic animals and the consequences of such changes.

Expected Outcomes of WG-24

- Better understanding of aquaculture-environment interactions
- Evaluate methods and models to assess risks of interactions
- Improved communication and collaboration between scientists from PICES member countries
- Scientific information made available for variety of audiences.

Future plans of WG-24

These are to be discussed at the 2010 meeting

1. Review the interactions, modeling, and methods for risk assessment.
2. Review past coastal ecosystem changes that have been attributed to aquaculture activities in PICES member countries
3. Development of a Workshop or Session at the 2011 annual meeting. Topic to be determined. Possible focus on past and future coastal ecosystem changes caused by Aquaculture and/or other topics with WG-24's terms of reference.

Relationships to FUTURE

The terms of reference and activities within WG24 are closely linked to many of the questions posed in:

Research Theme 2: How do ecosystems respond to natural and anthropogenic forcing and how might they change in the future?

Research Theme 3: How do human activities affect coastal ecosystems and how are societies affected?

We have selected only a few points for discussion.

2. How do ecosystems respond to natural and anthropogenic forcing, and how might they change in the future?

Due to the importance of marine aquaculture to many PICES countries it seems likely that FUTURE research programs could use aquaculture as a means to address this question. Aquaculture is clearly one of the anthropogenic forcing functions, but is also influenced greatly by climate. The identification, standardization and development of tools for aquaculture interaction assessment by WG-24 will benefit such studies.

Research Theme 2 questions that are most relevant to WG-24 are 2.4, 2.5, 2.6 and 2.7.

Relevant questions of Theme 2 to WG-24

- 2.4. How do human uses of marine resources affect the processes underlying ecosystem structure and functions?
- 2.5. How are human uses of marine resources affected by changes in ecosystem structure and functions?
- 2.6. How can understanding of these ecosystem process and relationships, as addressed in the preceding sub-questions, be used to forecast ecosystem response?
- 2.7. What are the consequences of projected climate changes for the ecosystem and their goods and services?

3. How do human activities affect coastal ecosystems and how are societies affected by changes in these ecosystems?

In most PICES countries aquaculture is very important because it supports local and national economies and provides a major source of dietary protein. In some countries aquaculture is also viewed to have significant negative impacts on the environment and wild fisheries. For these reasons aquaculture is likely to figure predominantly in FUTURE's research activities and programs designed to address this question. The identification and standardization of tools used in the assessment of aquaculture impacts on the marine environment is a major goal of WG-24.

Research Theme 3 questions that are most relevant to WG-24 are 3.1, 3.2, 3.3 and 3.5.

Relevant questions of Theme 3 to WG-24

- 3.1. What are the dominant anthropogenic pressures in coastal marine ecosystem and how are they changing?
- 3.2. How are these anthropogenic pressures and climate forcings, including sea level rise, affecting near shore and coastal ecosystems and their interactions with offshore and terrestrial systems?
- 3.3. How do multiple anthropogenic stressors interact to alter the structure and function of the systems, and what are the cumulative effects?
- 3.5. How can we effectively use our understanding of coastal ecosystem processes and mechanisms to identify the nature and causes of ecosystem changes and to develop strategies for sustainable use?

Problem of WG-24

as Alex suggestion yesterday

- Leadership
- Focus — Wide ranged issues (ToRs)
- Aggressiveness

Different main interest by countries

Canada, USA	Risk assessment
China	Capacity, Multi-sp. culture
Korea	Capacity, Shellfish culture
Japan	Capacity, New species

- Other frameworks for global issues

Co-chair, Abo-san
Suggesting Focusing of the ToRs

- Impact of aquaculture activity (retrospective assessment in the countries)
- Affects of changing environments and climate change on aquaculture activities (retrospective assessment in the countries)
- Forecasting the interactions between aquaculture and environments

Including genetic issues, disease, risk assessment, modeling

WG-24 ToRs revising is needed to implement FUTURE *(personal suggestion)*

- Clear focus
- Global issues

Productivity changing by climate change and anthropogenic forcing,

Key species to evaluate productivities,

Resources enhancement corresponding to climate change,

- S7 on 2010 AM will give us important suggestions about future PICES activities on aquaculture

Session 7 (FIS/MEQ) - 'Economic relation between marine aquaculture and wild capture fisheries', on October 26 2010.

When we need new WG on Aquaculture after WG-24, we will propose it on 2011AM.

WG24 & S7 collaborative discussion on 2010 AM