2.1 Identifying issues and potential risks in proposals for species translocations for aquaculture development (Working Group Exercise 1)

Identifying issues and potential risks in proposals for species translocations for aquaculture development

Learning objectives: To assist workshop participants in identifying the major issues and risks that are raised by proposals for aquatic species translocation (introduction or transfer) for aquaculture development.

Learning outcomes: Participants are able to screen a request or proposal to introduce or transfer a live aquatic animal and make a decision as to whether the proposal can be immediately rejected or approved, held pending collection of missing essential information, or referred for further evaluation and possible risk analysis.

Module duration: WG Exercise – 1 hour (40 minutes preparation, 20 minutes presentation); Supporting lecture(s) – to be determined based on the individual course being given.

2.1.2 Summary of Working Group Exercise 1 and of supporting lecture material

Working Group Exercise

Working Group Exercise 1 (Resource Document 1.1) presents each WG with a series of questions designed to stimulate thought and discussion on the possible benefits and risks of a hypothetical species movement and develop skills for the critical evaluation of proposals for species movements. The questions are to be discussed among the group and a consensus reached as to the best response to each. The exercise is supported by the provision of:

- **Aquatic Species Translocation Scenarios** (an example scenario for a hypothetical transfer of mangrove crab is presented as **Resource Document 1.2,** see page 51) and
- **Aquatic Species Profiles** (see **Resource Document 1.3,** see page 52 which provides an example profile for mangrove crab).

Using these documents (and with facilitator support), the WGs are asked to complete a **Preliminary Proposal Evaluation Form** (**Resource Document 1.4,** see page 57). The WGs then reassemble in plenary to present, discuss and justify their decisions. The discussion chairperson and the course facilitators assist in organizing the WG findings into a concise format which they then summarize for the participants.

Supporting lecture material

Lecture material supporting WG Exercise 1 must be developed on an individual course and country-specific basis. As shown in the example workshop programme given as **Table 1** (see page 7) it might consist of a series of presentations prepared by national and international experts on:

(i) regional trends in aquaculture and key issues for sustainable development (**Presentation 2**, see page 15),
(ii) the current status and future trends in national/state aquaculture development (**Presentation 3**, see page 15),
(iii) national historical experience with movements of live aquatic animals and current or likely future proposals for introductions and transfers (**Presentation 4**, see page 15) and
(iv) a review of current national and/or state procedures for assessing proposals for translocations of aquatic species (**Presentation 5**, see page 15).

Working Group Exercise 1

Identifying issues and potential risks in proposals for species translocations for aquaculture development

Time allotted: 1 hour (40 minutes preparation, 20 minutes presentation)

Purpose: The exercise will assist participants in identifying the key issues and risks that will need to be addressed for four potential introductions/transfers of aquatic species.

Methods: Participants will be divided into four Working Groups (WGs) based on interest in the commodities being assessed. WGs will elect a chairperson to lead their discussions, a rapporteur and a presenter.

Materials: Each WG will be provided with brief "translocation scenario" for an introduction/transfer of an aquatic species **(Resource Document 1.2**), an aquatic species profile (**Resource Document 1.3**), a proposal evaluation form (**Resource Document 1.4**), and a white board and/or flip chart and coloured markers. Consultants and experts will be available to answer questions and act as resource persons.

Outputs: Members of each WG should discuss the questions listed below and reach a consensus as to their answers. WGs should prepare a concise summary of their responses for presentation to plenary.

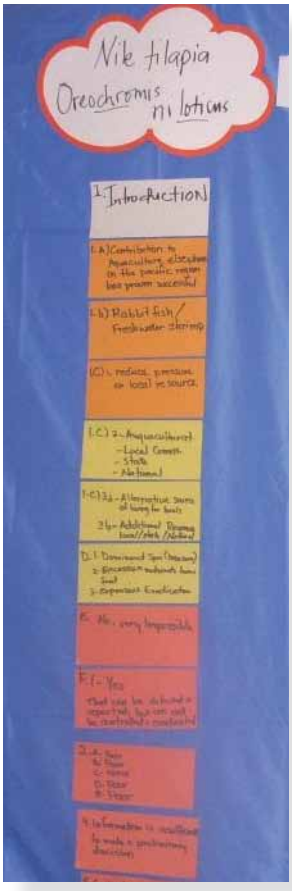
Working Group Exercise 1

Outputs: Members of each WG should discuss the questions listed below and reach a consensus as to their answers. WGs should prepare a concise summary of their responses for presentation to plenary.

1. Does the proposed translocation involve a species introduction or a transfer?

A. If an introduction:

a. What are the justifications for introducing this species?



b. From your knowledge of FSM's aquatic fauna, can you name a native species that could fill this need?

c. Benefits:
- What benefits might occur if the species was introduced?
- Who will benefit?
- How significant are the benefits likely to be?

d. What negative impacts could potentially result from the introduction?

e. Once introduced, if the species becomes established in natural waters and becomes invasive or a pest, is it likely that control or eradication would be possible?

f. If the introduced species should bring in an exotic disease, what is the likelihood that the disease would be:
- Rapidly detected and reported by aquaculturists or governments?
- Controlled or eradicated?

Working Group Exercise 1

B. If a transfer:

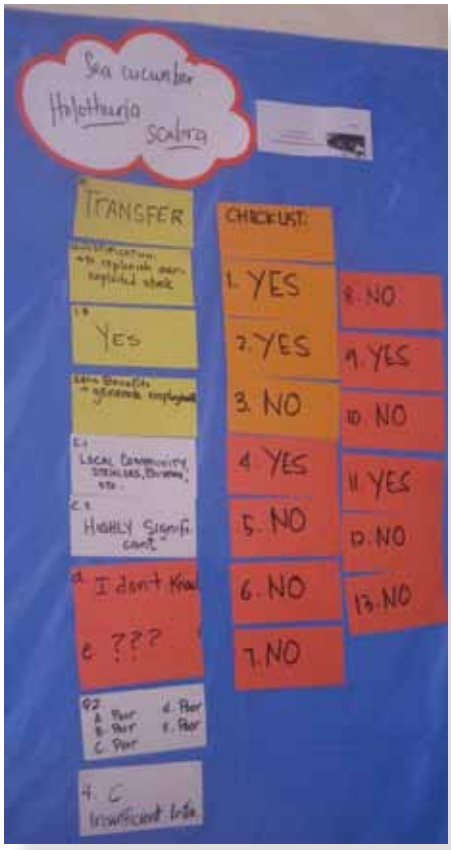
a. What are the justifications for transferring this species?

b. Is it likely that a breeding programme using native stocks of the same species could be established?

c. Benefits:
- What benefits might occur if the species was transferred?
- Who will benefit?
- How significant are the benefits likely to be?

d. What potential negative impacts could result from the transfer?

e. If the transferred stock should bring in an exotic disease, what is the likelihood that it would be:
- Rapidly detected by aquaculturists or government?
- Controlled or eradicated?



Working Group Exercise 1

2. What is your initial impression of the general state of knowledge (excellent, good, fair, poor, none) of this species with regard to:

a. Development of aquaculture technology for its culture
b. Genetics (e.g. breeding techniques, population structure)
c. Pathogens and diseases
d. Ecology (geographic distribution, life cycle, breeding, migratory habits, population biology, feeding habits, etc.)
e. Past experiences with introductions/transfers.

3. Each group will be provided with a preliminary proposal assessment form (Document 1.3, see page 53**) that they should complete.**

4. What is the preliminary group consensus with regard to a proposal to introduce/transfer this species to FSM (provide support for your decision)?

a. likely to be accepted
b. likely to be rejected
c. information is insufficient to make a preliminary decision

5. What further evaluations or risk analyses would you be likely to recommend for this introduction/transfer?

a. Critical evaluation of the justification, proponent's capabilities to accomplish it (financial, technical, etc), and magnitude of the benefits (social, economic, ecological) likely to be realized?
b. Consideration of potential ecological/environmental/pest risks?
c. Consideration of potential genetic risks?
d. Consideration of potential pathogen risks?
e. Evaluation of other countries' experiences with the species in question?
f. Other evaluations?

Mangrove crab (*Scylla serrata*) to Kosrae State, Federated States of Micronesia

As Competent Authority for aquatic animal health in Kosrae State, your department has just received a letter from the leader of a local community-based aquaculture project requesting your assistance in facilitating a permit to transfer juvenile mangrove crabs from other states within FSM.

The juvenile crabs will be purchased from collectors in Pohnphei, Yap or Chuuk states, who will collect them from wild stocks. Upon arrival in Kosrae, they will be transported by road to the aquaculture site where they will be stocked directly into pens constructed in a mangrove area. Crabs will be "fattened" by feeding with trash tuna obtained from transshipment boats in port and upon obtaining sufficient size, will be marketed both locally and possibly to the restaurant trade in Guam.

The transfer of crabs from sources outside Kosrae State is justified by the proponent by the fact that local crab populations are already being harvested to the point where the State Fisheries Department feels that any further increase in collecting pressure would be detrimental to the sustainability of local populations.

The proponent envisions a continuous requirement for 1 000 juvenile crabs to be translocated at six-month intervals. He has also suggested that if adequate domestic supplies of juveniles cannot be obtained, that the possibility of importing juvenile crabs from the Philippines will be considered.

Aquatic species profile[1,2]

Scylla serrata Forskal, 1775

Common names: Mangrove crab, Mud crab, Serrate swimming crab, Samoan crab

Identification: *Scylla serrata* is a large swimming crab with four blunt frontal teeth, all more or less in line with each other. The carapace is smooth, with strong transverse ridges. Gastric area of the carapace with a relatively faint H-shaped groove, setae on carapace restricted to the hepatic region. Nine broad teeth on each anterolateral margin, all of similar size and projecting obliquely outwards. Strong chelipeds with well developed spines on outer surface of carpus and on anterior and posterior dorsal parts of propodus. Color is variable and has been described as entirely grayish green or purple-brown or as deep ferrugineous brown ranging to light purplish brown. There are irregular small whitish spots on the carapace and fifth legs. Color has been used to separate fresh specimens of *Scylla* spp., but this feature is useless in preserved material.

Taxonomic notes: The taxonomy of *Scylla* is confusing, with one or several species recognized depending upon the author. It has been reported that *S. serrata* exhibits different phenotypes and that these forms were differentiated by Southeast Asian fishermen on the basis of color. The existence of four forms of *Scylla* has been recognized in Viet Nam and the Philippines. Some authorities have regarded the four species as a single species, considering that morphological differences are due to variation in environment. Based on genetic studies, the existence of three species was noted in Japan: *S. serrata*, *S. tranquebarica*, and *S. oceanica*. Based on PCR-RFLP analyses, a fourth species has been noted in the Indo-West Pacific, *S. paramamosain.*

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[1] Compiled from: Perry, H. 2010. *Scylla serrata*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. RevisionDate: 4/11/2006 (available at: http://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=192); FAO Species Fact Sheets (http://www.fao.org/fishery/species/2637/en); http://www.sms.si.edu/irlspec/scylla_serrata.htm.

[2] Note that in this summary all reference citations have been removed.

Aquatic species profile

Scylla serrata Forskal, 1775

Size: A male specimen was reported as having a 190 mm carapace width.

Habitat: This crab inhabits soft muddy bottoms in brackish water along the shoreline, mangrove areas, and river mouths where it digs deep

Reproduction: Becomes reproductively mature starting at around 90 mm carapace width, often within the first year of life. Male crabs approach female crabs before the females have undergone a precopulatory molt, grasping them with their chelipeds and first pair of walking legs and carrying them around for up to several days until the females molt. On molting, males turn the females over and initiate copulation, delivering non-motile spermatozoa that may be retained by the females for up to several weeks to months before being used to fertilize multiple clutches of up to 2 million eggs each. Females bearing egg masses on their pleopods migrate offshore (up to 50 km) where the eggs hatch in a few weeks.

Larval development: An extended larval duration has been reported. Experimental work has revealed a mean larval development time to the megalopa stage ranging from 20.6 to 22.6 days at 25°C, shortened by several days at higher developmental temperatures. One hundred percent larval mortality at 15 ppt salinity and high survival at salinities above 20 ppt have been noted. This finding is consistent with the observed migration of egg-bearing females to high-salinity offshore waters prior to spawning.

Temperature tolerance: Adults and subadults are broadly eurythermal, while larvae exhibit a somewhat narrower tolerance. An impressive tolerance range of 3- 45°C has been reported for *S. serrata* in the Karnafully River estuary, Bangladesh. Successful pen culture of the species has been reported in waters that ranged seasonally between 25 and 36°C. However, considerable larval mortality has been reported at temperatures above 25°C. Larval tolerance of temperatures as low as 5 °C has been reported, although individuals become inactive below 10°C.

Aquatic species profile

Scylla serrata Forskal, 1775

Salinity tolerance: Adults are broadly euryhaline, although individuals other than spawning females preferentially inhabit brackish inshore habitats. Specific metabolic responses have been reported that allow animals to persist at low salinities (i.e. amino acid catabolism and formation of ammonia to reduce osmolality at 10 ppt), as well as high salinities (i.e. initiation of urea synthesis and moderation of nitrogen excretion at 40 ppt).

Diet: *Scylla serrata* is principally a carnivore, preying on small invertebrates such as molluscs, crustaceans and polychaetes and on small quantities of detritus and plant material.

Associated species: No obligate associations are known, although infestation of the gill chambers of the crab by cyprid larvae of stalked barnacles of the genus *Octolasmis* has been documented.

Native range: *Scylla serrata* is noted to have a native Indo-Pacific distribution that likely encompasses East and South Africa to Tahiti, north to Okinawa, and south to Australia and New Zealand.

Economic significance: Commercially-harvested in areas where it has been introduced and populations have become established. It is considered an excellent and sought-after delicacy in Asia and females with mature ovaries are particularly expensive. The mud crab is the most important crab for commercial culture in the Indo-West Pacific region and commands a high price in both the domestic and export markets.

Scylla serrata has now spread throughout the Indo-Pacific, occurring in Japan, the Philippines, Indonesia, East and South Africa and the Red Sea.

Means of introduction: Most introductions have been intentional with the intent to establish commercial fisheries. The mud crab is noted to have an extended larval phase and that suggests a high dispersal potential. A study of genetic differentiation in Indian Ocean populations,

Scylla serrata Forskal, 1775

however, found reduced gene flow, even between geographically close sites. In contrast, another study reported that the southwest region of Australia was colonized by large numbers of *S. serrata* from northwest Australia through a planktonic recruitment event enhanced by a strong 1999/2000 Leeuwin Current.

Invasion history: In 1962, Approximately 30 pairs of *S. serrata* were intentionally released to coastal waters in Collier County on the Gulf coast of Florida in an effort to establish a commercial crab fishery. This introduction failed to lead to an established population and the present status of the species in Florida is currently unknown. *Scylla serrata* was also intentionally introduced to Hawaii between 1926 and 1935, with established populations noted by 1940. Established populations now reportedly occur off of Maui, Hawaii, and Kauai.

Although most initial introductions of *S. serrata* were intentional releases for the purposes of establishing commercial fisheries, the protracted larval period likely confers high dispersal potential to populations of new recruits. The species has successfully spread through most of the Indo-Pacific, now occurring in Japan, the Philippines, Indonesia, East and South Africa and the Red Sea.

Impacts of introduction: *Scylla serrata* is economically important as both a wild-harvested stock and a commercial aquaculture product and is commercially harvested in those areas to which it has been intentionally introduced and where established populations have resulted. Large-scale negative economic impacts resulting from introduction of this species have not been reported. Ecological impacts resulting from introduction of *S. serrata* into areas in which the species has become established have yet to be assessed. The animal has been described as an active, aggressive species, and some degree of competition with co-occurring native species is likely. In Hawaii, commercial fishing keeps the population of mud crabs under control and the species is not considered invasive.

Aquatic species profile

List of information in an aquatic species profile

- Common names
- Identification
- Taxonomic notes
- Size
- Habitat
- Reproduction
- Larval development
- Temperature tolerance
- Size
- Habitat
- Reproduction
- Larval development
- Temperature tolerance
- Salinity tolerance
- Diet
- Associated species
- Native range
- Economic significance
- Means of introduction
- Invasion history
- Impacts of introduction

Preliminary proposal evaluation form

Table 2 outlines the minimum information needed by the Competent Authority (CA) to make a rapid preliminary screening of a request (preproposal) to introduce or transfer an aquatic species. This information can be used to develop a commodity description and make a decision if the request can be:

(i) immediately approved;
(ii) immediately rejected; or
(iii) routed to more detailed evaluation and a possible risk analysis.

If a decision is made to conduct a risk analysis, the proponent will be asked to supply additional information (a formal proposal may be required) and the risk analysis team will need to conduct a preliminary literature review to identify issues and define the scope of the analysis to be conducted. An example of the detail to be required in a proponent proposal to translocate an aquatic animal can be found in Annex A of the International Council for the Exploration of the Sea (ICES) (ICES, 2005).

The ICES approach is to have the proponent supply as much of the background information as possible (a time consuming process, ensuring that the request to introduce/transfer a species is not frivolous or ill-conceived). However, the requirements can be separated into:

(i) information that must be supplied by the proponent as essential to the CA to make initial decisions and to scope a risk analysis; and
(ii) information that is important to a detailed decision-making or risk analysis process, but is based on scientific literature, expert opinion, etc. and which can be supplied/obtained by the proponent, the CA or the risk analysis team if it is required.

Preliminary proposal evaluation form

Note that the CA should consider developing a standard protocol with guidelines to proponents for proposal submission and also a set of standard procedures or guidelines to CA staff for conducting proposal evaluations.

Using the **Table 2**, the WG should check the essential information requirements against the "Translocation Scenario" provided by the trainers and record whether the information is present and given in sufficient detail. The WG can consult the "proponent" by direct questioning to obtain any missing information.

TABLE 2

Checklist of questions for ensuring that the information needed to make a preliminary decision on a request to translocate an aquatic species has been provided by the proponent.

	Checklist Item	Yes/No
1	Organism to be translocated is clearly identified by common and scientific name?	
2	Source of animals to be translocated is clearly indicated (country, supplier, wild population, hatchery, exporter, etc.)?	
3	Life cycle stage is clearly specified (e.g. eggs, fry, postlarvae, juveniles, adults, broodstock)?	
4	Quantity to be translocated is clearly indicated (number of shipments, number of organisms/shipment)?	
5	Proposed date(s) of shipment is indicated?	
6	Availability of information/guarantees on health status of supplying stock/ facility, population of animals is clearly indicated (e.g. mortality records, diagnostics records of facility; health certificate to accompany shipments (including nature of any diagnostics tests to be performed))?	
7	Pre-transit checks to be made on health status of animals (inspection, diagnostics, quarantine, etc.) (if any) are indicated?	
8	Pre-transit checks for “fellow travellers” (if appropriate) are described?	
9	Justification/rationale for translocation is provided? (including description of expected end uses)?	
10	Person/business/agency responsible for reception of translocated animals is clearly indicated?	
11	Initial destination of translocated organisms is clearly indicated and clearly described?	
12	Post-entry sanitary measures to be carried out by the proponent (if any) are described (quarantine, diagnostics, treatments, etc.)?	
13	Additional post-entry measures (if any) for monitoring of health status, ensuring secure holding of organisms (prevention of escapes) and contingency planning for escapes/disease outbreaks to be applied by proponent are described?	

2.2 Identifying current risk analysis frameworks and procedures (Working Group Exercise 2)

Identifying current risk analysis frameworks and procedures

Learning objectives: To assist workshop participants in identifying and understanding the relevant international and regional agreements, memberships and guidance relative to risk analysis and the current national risk analysis frameworks and procedures that are in place for their country.

Learning outcomes: Participants will have basic understanding of the relevant international standards, treaties, agreements and memberships relevant to risk analysis for aquaculture development and an understanding of their country's status, rights and obligations with regard to membership/ participation in them.

They will understand how proposals to introduce/transfer aquatic animals into their country arise and how they are currently processed.

From this, they will begin to consider what changes may been needed to improve the process and meet international obligations and standards.

Module duration: WG Exercise – 1 hour (40 minutes preparation, 20 minutes presentation); Supporting lecture(s) – to be determined based on individual course.

2.2.2 Summary of Working Group Exercise 2 and of supporting lecture material

Working Group Exercise

Working Group Exercise 2 (Resource Document 2.1) is best conducted in plenary. The participants are asked to outline the major steps in the current national process used to reach a decision on a proposal to introduce or transfer an aquatic species. They are then asked to assess the current process with regard to various broad criteria relevant to risk analysis. They are asked to identify the international and regional treaties, agreements and memberships that obligate their country when considering introductions and transfers, to evaluate their nation's past experiences, identify current problems related to invasive species, and weigh the value that their country places on its natural biodiversity.

The discussion chairperson (chosen from among the participants) and the course facilitators assist in organizing the WG findings into a concise format which they then summarize for the participants.

Supporting lecture material

Lecture material supporting this exercise may include presentations on:

(i) current national/state procedures for assessing proposals for translocations of aquatic animals (Example Programme, **Presentation 5**).
(ii) overview of risk analysis **(Presentation 6)**
(iii) pathogens and pests: issues and impacts based on global experience **(Presentation 7)**
(iv) relevant international treaties, agreements and guidance **(Presentation 8)**.

Working Group Exercise 2

Identifying current risk analysis frameworks and procedures

Time allotted: 1 hour (40 minutes preparation, 20 minutes presentation)

Purpose: The exercise will assist participants in understanding how proposals to introduce/transfer aquatic species to FSM are made and to begin to consider where improvements to the process might be needed.

Methods: WG Exercise 2 is best conducted in plenary. Participants will chose a discussion moderator who will be assisted by the course trainers. They should be given a short period to consider the questions individually before the group discussion begins.

Materials: Participants will be provided with copies of the relevant national/state regulations, procedures and/or guidance related to introductions/transfers of aquatic species, and a white board and/or flip chart and coloured markers. They will also consider the information presented in the relevant plenary presentations.

Outputs: Participants should discuss the questions listed below and reach a consensus as to their answers. The course moderator and the trainers should prepare a concise summary for presentation to plenary at the end of the exercise (continued on next page)

Working Group Exercise 2

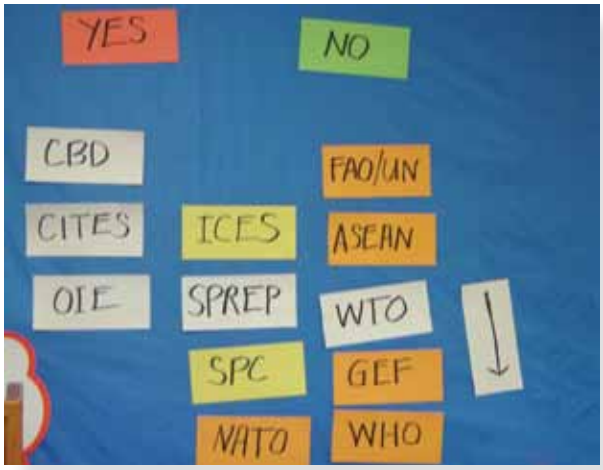
Outputs: Participants should discuss the questions listed below and reach a consensus as to their answers. The course moderator and the trainers should prepare a concise summary for presentation to plenary at the end of the exercise.

1. Using a flow diagram, briefly outline the major steps in the current process used in FSM to reach a decision on a proposal to introduce/transfer an aquatic species.
2. Is the process (answer - yes, no, not sure):

a. Clearly defined by national legislation and policy documents?
b. Consistently applied across all sectors (livestock, plants and aquatic animals)?
c. Consistently applied to all proponents and proposals?
d. Consistent with best international practices?
e. Transparent?
f. Formulated so as to provide adequate stakeholder consultation/input?

Working Group Exercise 2

3. How can the process be improved?
4. What are some of the major international treaties and memberships that obligate FSM when considering introductions and transfers? (examples: World Trading Organization, World Organisation for Animal Health, United Nations, FAO, Convention for the International Trade of Endangered, Convention of Biological diversity, United Nations Convention on the Law of the Sea)
   What are the relevant regional agreements and working groups regarding introductions of aquatic species?



5. How would you describe the general experience of FSM with regard to introductions and transfers of aquatic species for aquaculture development?
6. How would you describe the general experience of FSM with regard to detecting and preventing/eradicating invasive species in general?
7. What are the major invasive species problems currently affecting FSM?
8. How would you describe the value that FSM places on its natural biodiversity?

2.3 Pathogen risk analysis – scoping to hazard identification (Working Group Exercise 3)

2.3.1 Overview

Pathogen risk analysis – scoping to hazard identification

Learning objectives: To assist workshop participants in understanding the preliminary activities that need to be undertaken prior to initiating a risk analysis (e.g. preparation of a commodity description, preliminary decision-making, assembling a risk analysis project team, establishing criteria for hazard identification and developing a risk communication strategy) and conducting a preliminary screening of an abbreviated list of pathogens for potential hazards.

Learning outcomes: Participants will have basic understanding of what is needed to commence a pathogen risk analysis and will have some basic experience with identifying potential hazards for their particular commodity.

Module duration: WG Exercise – 2 hours 45 minutes (2 hrs preparation, 40 min presentation); Supporting lecture(s) – to be determined based on individual course offering.

2.3.2 Summary of Working Group Exercise 3 and of supporting lecture material

Working Group Exercise

For WG Exercise 3, the WGs will continue to use the materials provided in previous exercises (e.g. **translocation scenario** (**Resource Document 1.2**), **species profile** (**Resource Document 1.3**), etc. They will also be provided with a **commodity description form** (**Resource Document 3.2**) **a list of five possible hazards** (**Resource Document 3.3**) and **associated Pathogen Profile Sheets for each pathogen** (**Resource Document 3.4**) summarizing information on pathogen biology, pathogenicity, host range, etc. They will also consider the information presented in the relevant plenary presentations. Each WG will have access to a course resource person, who will play the roles of:

(i) the "proponent" of the proposal; and
(ii) an expert on host and pathogen biology.

During the exercise, the WGs will evaluate the commodity description for completeness and will make an initial decision (approve, reject, request more information). They will then define the scope of a hypothetical risk analysis. Using the pathogen list and the pathogen profiles, they will then conduct a short hazard identification. Finally, the WGs will conduct a brief risk communication exercise, in which they identify potential stakeholders and outline a risk communication strategy.

Supporting lecture material

Lecture material supporting this exercise may include presentations on:

(i) current national/state procedures for assessing proposals for translocations of aquatic animals (Example Programme, **Presentation 5**) and
(ii) overview of risk analysis (**Presentation 6**) and
(iii) pathogens and pests: issues and impacts based on global experience (**Presentation 7**) and
(iv) relevant international treaties, agreements and guidance (**Presentation 8**).

Working Group Exercise 3

Pathogen risk analysis – scoping to hazard identification

Time allotted: 2 hrs 50 min (2 hrs preparation, 50 min presentation)

Purpose: The exercise will assist participants in understanding the risk analysis process by planning and initiating a pathogen risk analysis and will cover:

(i) preparation of a commodity description,
(ii) preliminary decision-making
(iii) assembling a risk analysis project team,
(iv) developing a time frame,
(v) establishing criteria for hazard identification and
(vi) developing a risk communication strategy.

Methods: Participants continue with the four WGs formed during Exercise 1. WGs will elect a chairperson to lead their discussions, a rapporteur and a presenter.

Materials: WGs will continue to use the materials provided in previous exercises (e.g. translocation scenario, aquatic species profile, relevant guidance). They will be provided with a **Commodity Description form** (**Resource Document 3.2**) and **an abbreviated list of five possible hazards** (**Resource Document 3.3**) and associated **Pathogen Profile Sheets** (**Resource Document 3.4**) for each pathogen summarizing information on pathogen biology, pathogenicity, host range, etc. They will also consider the information presented in the relevant plenary lectures. Each WG will have access to a course resource person, who will play the roles of:

(i) the "proponent" of the proposal and
(ii) an expert on host and pathogen biology.

[4] Note: This and subsequent exercises assume that the commodity has already been evaluated with regard to potential economic/social benefits and that any concerns related to possible ecological/pest invasive/environmental/genetic risks have been addressed (i.e. the species has, in principle, been cleared for translocation and the conditions under which this will occur have been established; the remaining issue is "can this movement be accomplished without undue risk of introducing serious pathogens?").

Working Group Exercise 3

Outputs: WGs will consider the following questions/activities and be prepared to justify their decisions. WGs should prepare a concise (10 minutes) summary for presentation to plenary.

1. **Commodity description**
   a. Using the Translocation Scenario (**Resource Document 1.2**) and the Preliminary Proposal Evaluation Form (**Resource Document 1.4**), each group should complete, as far as possible, the blank Commodity Description Form (**Resource Document 3.2**). Does the commodity description lack any information essential to making a preliminary decision on how the request to import should be handled? (If "yes", the WG should ask the "proponent" for any additional information or clarification required to complete these documents.)
   b. Does the information provided by the proponent with regard to the source, life cycle stage, end use, health status of the originating stock and/or the shipment and any other risk management measures provide sufficient guarantee to allow immediate approval to import?
   c. Or, is the proposal clearly unacceptable such that the request can be immediately rejected?

2. **Scoping the risk analysis**
   Using the guidance provided, the WG should define the scope of the risk analysis. This should include:
   a. time frame
   b. composition of risk analysis Working Group (expertise needed)
   c. internal oversight (risk analysis project team)
   d. external review
   e. criteria for preliminary listing of potential hazards (provided as **Resource Document 3.5**)

Working Group Exercise 3

3. Hazard identification

Using the list of five pathogens provided for their commodity, the WG should discuss each organism in turn, comparing it with the agreed upon criteria for identification as a potential hazard (see **Resource Document 3.5**). Information should be entered into the blank table provided (Table 3 **Resource Document 3.6**). Which of the pathogens require further consideration during risk assessment? (i.e. which are potential hazards?)

4. Risk communication

The WG should:

a. Identify a preliminary list of stakeholders for the risk analysis
b. Develop a risk communication strategy that will ensure that all potential stakeholders will be aware of the pending risk analysis and will be able to contribute to it.
a. Identify the communication methods (television, radio, newspaper, e-mail, telephone, public meetings, etc.) that will be most effective in reaching the stakeholders
b. Identify key points in the risk analysis timeframe where risk communication should be scheduled.

Commodity description form

Commodity description form
Species to be translocated:
Proposed date of importation:
Life cycle stage to be imported:
Importer:
Exporter:
Source:
Proposed number of shipments:
Volume:
Proposed destination:
Health status:
Proposed risk reduction measures:
Other relevant information:

Abbreviated list of potential pathogens for a commodity

Example

(A) Mangrove Crab

1. Whitespot syndrome virus
2. *Vibrio harveyi*
3. *Amyloodinium ocellatum*
4. *Sacculina granifera*
5. Mud crab reovirus (MCRV)

Pathogen sheet

Mangrove crab reovirus (MCRV)

Mangrove crab reovirus (MCRV)

MCRV has recently been described as a serious pathogen of mangrove crabs. Its viral nature and high pathogenicity are characteristics that could allow it to become a serious transboundary aquatic animal disease (TAAD) of wild and cultured mangrove crabs.

Species affected: This virus is only known to affect mangrove crab (*Scylla serrata*). The possibility that MCRV causes diseases in other crabs or that other crustaceans may act as carriers has not been investigated.

Geographical distribution: MCRV has so far only been recorded from southern China.

Economic impact: Reported to have caused large losses of cultured mangrove crabs and "sleeping disease".

Pathology: The virus infects connective tissue cells of the hepatopancreas, gills and intestine, developing in the cytoplasm. One hundred percent mortality was observed in mud crab experimentally infected by intramuscular injection, bath inoculation and oral inoculation, while cohabitation infection caused 80 percent mortality.

Diagnosis: An RT-PCR detection method has been developed.

Control: As with other viral diseases, the only means of control in aquaculture situations is the destruction of the infect stocks, disinfection of aquaculture facilities and elimination of possible carrier organisms. Once established in wild crab populations, the control or elimination of MCRV would probably be impossible.

References:

Weng S.P., Guo Z.X., Sun J.J., Chan S.M. & He J.G. 2007. A reovirus disease in cultured mud crab, *Scylla serrata*, in southern China. *Journal of Fish Disease*, 30(3): 133-138.

Criteria for a pathogen, parasite or disease

For consideration as a potential hazard, all these criteria must be met:

- The pathogen or parasite, disease or syndrome is likely to be caused by a biological agent.
- The pathogen or parasite, disease or syndrome is reported or likely to infect the life cycle stage of the commodity that will be translocated.
- The pathogen or parasite, disease or syndrome is present or potentially present in the exporting country (if international source) or region (island) or State (if a domestic source is used).
- The pathogen or parasite, disease or syndrome is absent from the importing country (if international movement) or state or local population (if a domestic movement), or, if present, it should be an OIE-listed disease or a disease subject to a programme of eradication or control.
- The pathogen or parasite, disease or syndrome causes significant disease in the commodity or in other species found in the receiving country or State.

Blank table for hazard identification

TABLE 3
Pathogens, parasites and symbionts [insert species scientific and common names] (Y=Yes, N=No, P=Plausible,?=Uncertain).

Pathogen (scientific and common name)	Infects [insert life cycle stage]	Causes significant disease?	Further consideration required?	References	Comments
1.					
2.					
3.					
4.					
5.					

Pathogen	Infects Cycle stage	Causes Signif. Disease	Further Consid.	Pathogen	Comment
AKOYA Virus	SPAT Adult	Yes	Yes	Yes	
P. olsemi	Adult	Yes	Yes	Yes	
Papovaviridae Papova-like Virus	~~Larvae~~ ~~Pedps~~ ADULT	Yes	Yes	Yes	
Ostracoblabe implexa (shell disease)	SPATS	Yes	Yes	Yes	NEED Picture
Sulcascaris sulcata	~~Stomach~~ ~~ulcers~~ ADULT	Yes	Yes	Yes	Pearl Oyster

Pathogen	Life cycle	Signifi Cant Dx	Further Consideration	References	Comments Decision
Carapus (Fish) Marlini	N	N	NO		Of no interest / no value
Cymatoce sp. isopod	Y	Y	3N, 2Y NO		
Skin Ulcerative disease	Y	Y	Yes		
Liosaccinus ~~and~~ Orbicularis crab	N	N	NO		Sea Cucumber Crab
Lichelmeria Mandibulata Copepod	—	—	NO		Sea Cucumber

2.4 Determining an appropriate level of protection (ALOP) (Working Group Exercise 4)

Determining an appropriate level of protection (ALOP)

Learning objectives: To assist workshop participants in understanding the concepts of appropriate level of protection (ALOP) and appropriate level of risk (ALOR) and to help them determine the explicit or implicit ALOP for their country.

Learning outcomes: Participants will have basic understanding of ALOP and how the risk analyst can determine national ALOP for application in aquatic animal pathogen risk analysis.

Module duration: Working Group Exercise – 40 minutes (15 minutes individual preparation, 25 minutes plenary discussion); Supporting lecture(s) – to be determined based on individual course offering.

2.4.2 Summary of Working Group Exercise 4 and of supporting lecture material

Working Group Exercise

WG Exercise 4 is a short exercise that is best conducted in plenary, the discussion moderator being a local expert selected from among the participants. The participants will independently consider the exercise questions and be prepared to justify their decisions.

The discussion moderator will then assist by moderating the group discussion and with the assistance of the course facilitators, will prepare a concise summary for presentation to plenary.

Supporting lecture material

Lecture material supporting this exercise may include presentations on:

(i) national experience with movement of live aquatic animals; and
(ii) current national/state procedures for assessing proposals for translocations of aquatic animals (Example Programme, **Presentations 5 and 6**, country/course-specific presentations); and
(iii) overview of ALOP/ALOR (**Presentation 9**)

Working Group Exercise 4

Determining an appropriate level of protection (ALOP)

Time allotted: 40 minutes (20 minutes preparation, 20 minutes presentation).

Purpose: The exercise will assist participants in determining the likely explicit or implicit national ALOP.

Methods: This WG Exercise is best conducted in plenary, with the discussion moderator being selected from among the participants.

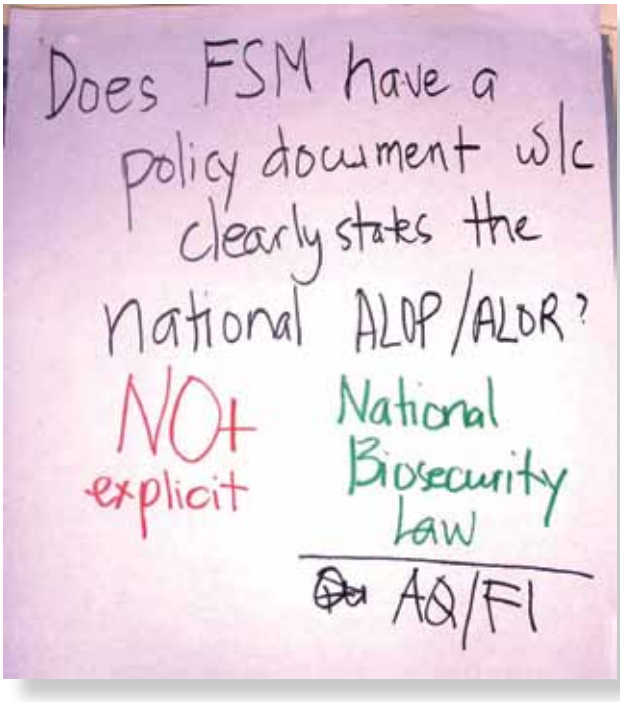
Materials: Each WG will be provided with any relevant policy statements and several recent examples of import decisions from the aquaculture/fisheries, plant and terrestrial animal sectors. WGs should also take into consideration relevant plenary presentations.

Outputs: The participants will independently consider the following questions/activities and be prepared to justify their decisions. The discussion moderator will assist by moderating group discussion and with the assistance of the course facilitators, will prepare a concise summary for presentation to plenary (continued on next page).

Working Group Exercise 4

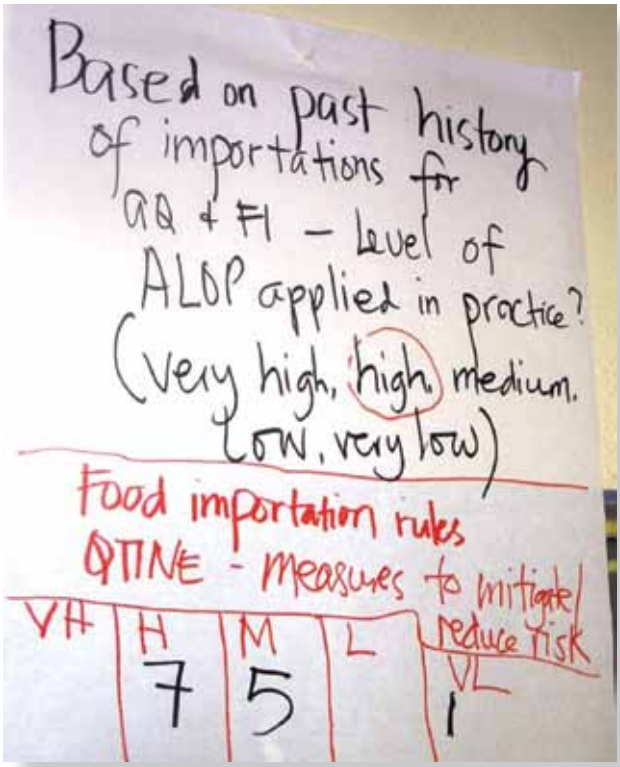
Outputs: The participants will independently consider the following questions/activities and be prepared to justify their decisions. The discussion moderator will assist by moderating group discussion and with the assistance of the course facilitators, will prepare a concise summary for presentation to plenary.

1. Does your country have a policy document that clearly states the national ALOP/ALOR?



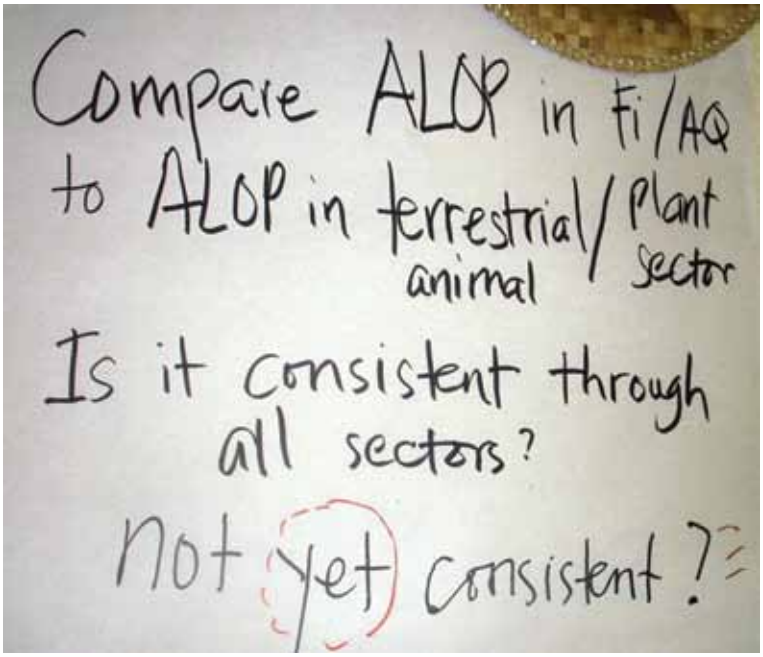
Working Group Exercise 4

2. Based on past history of importations for the aquaculture and fisheries sectors, what level of ALOP has been applied in actual practice for this sector (e.g. very high, high, medium, low, very low)?



Working Group Exercise 4

3. Compare your estimated ALOP for the aquaculture/fisheries sectors with recent experiences for the plant and/or terrestrial animal sectors. Does the ALOP appear to be consistent across all three sectors?



Working Group Exercise 4

4. Based on this exercise and your knowledge of the value that the citizens of your country place on their natural ecosystems and biodiversity, their social values and the national need for economic development, what do you think the national ALOP should be?

2.5 Risk assessment (release, exposure and consequence assessment, risk estimation); risk management (risk evaluation) (Working Group Exercise 5)

Risk assessment (release, exposure and consequence assessment, risk estimation); risk management (risk evaluation)

Learning objectives: Continuing to build understanding of the pathogen risk analysis process through completion of the risk assessment portion (exposure assessment, release assessment, consequence assessment and risk estimation) of a simplified risk analysis for the assigned commodity. Understanding of the risk evaluation portion of risk management by use of the ALOP agreed upon in WG Exercise 4 to determine if the unmanaged risk is acceptable.

Learning outcomes: Participants will gain a basic understanding of the risk assessment portion of a qualitative pathogen risk analysis. They will be introduced the use of scenario trees and pathways analysis, the combining of risk likelihoods and the estimation of total risk. They will gain experience in determining if an estimated risk level is acceptable or unacceptable.

Module duration: WG Exercise – 2 hour 10 minutes (1 hour 30 minutes preparation, 40 minutes presentation); Supporting Lectures – 60 minutes (Supporting lectures Part 8 and Part 9)

2.5.2 Summary of working group exercise 5 and of supporting lecture material

Working Group Exercise

WG Exercise 5 (**Resource Document 5.1**) is one of the **most intensive exercises of the series**. Using translocation scenarios and other supporting documents provided in earlier lessons and with additional new material, the participants will continue the simplified risk analysis for their commodity. Using one of the hazards identified, they will conduct the release and exposure assessments by developing **scenario trees** and using **pathways analysis**, estimating and combining likelihoods in each to **obtain release and exposure estimates** and determining if the risk estimate for each is negligible or non-negligible. They will then combine these risk estimates to obtain an **overall risk of release and exposure**.

They then proceed to **consequence assessment**, drawing up a list of the five most serious consequences that might result from the pathogen becoming established in the new environment. Consequences are estimated and an overall estimate of consequence obtained. The participants then **combine the three risk estimates** (release, exposure and consequence) to obtain an **estimate of the overall risk** posed by the hazard. To complete the risk evaluation step of risk management, they then **compare the estimated total risk to a ALOR matrix to determine if the hazard poses significant risk**.

Lecture material supporting this exercise include Lecture Series Part 8 – Risk Assessment and Part 9 – initial section on overview and risk evaluation).

Supporting lecture material

Lecture material supporting this exercise may include presentations on:

(i) national experience with movement of live aquatic animals and
(ii) current national/state procedures for assessing proposals for translocations of aquatic animals (Example Programme, **Presentations 5 and 6**, country/course-specific presentations), and
(iii) overview of ALOP/ALOR (**Presentation 10**)

Working Group Exercise 5

Risk assessment (release, exposure and consequence assessment, risk estimation); risk management (risk evaluation)

Time allotted: 2 hours 10 minutes (1 hour 30 minutes preparation, 40 minutes presentation)

Purpose: The exercise will assist participants in understanding the risk assessment portion of the pathogen risk analysis process and will cover (A) Risk assessment: (i) Release Assessment, (ii) Exposure assessment, (iii) Consequence assessment and (iv) Risk estimation; and (B) Risk management: (i) Risk evaluation.

Methods: Participants will continue with the four WGs established during WG Exercise 1. WGs will elect a chairperson to lead their discussions, a rapporteur and a presenter. Each WG will be asked to further evaluate two of the potential hazards that they identified during WG Exercise 3.

Materials: Each WG will use the information provided/developed during WG Exercises 1-4 (translocation scenario, commodity description, relevant guidance, pathogen profiles; ALOP). They will also consider the information presented in the relevant plenary lectures. WGs will be provided with:

(i) Definitions of descriptive likelihoods (**Resource Document 5.2**);
(ii) Blank scenario tree (**Resource Document 5.3**);
(iii) Matrix for combining risk likelihoods (**Resource Document 5.4**);
(iv) Matrix for adding pathways likelihoods (**Resource Document 5.5**);
(v) Definition of consequence levels (**Resource Document 5.6**);
(vi) Matrix for combining consequences (**Resource Document 5.7**);
(vii)Matrix for estimating total risk posed by a hazard (**Resource Document 5.8**); and
(viii) Example matrices for comparing overall risk with ALOR (Resource Document 5.9). Each WG will have access to a course resource person, who will play the roles of:
(i) the "proponent" of the proposal and
(ii) an expert on host and pathogen biology.

Working Group Exercise 5

Outputs: WGs will consider the following questions/activities and be prepared to justify their decisions. WGs should prepare a concise (10 minutes) summary for presentation to plenary.

1. **Release assessment**
   a. Using the example blank scenario tree provided as a model (**Resource Document 5.3**), develop a scenario tree with two major pathways for pathogen release. Show all the major steps that would need to be completed for the pathogen to move from the source country to the border of FSM.
   b. Using the definitions of likelihoods (**Resource Document 5.2**), estimate the likelihoods for completion of each of the steps in each pathway.
   c. Using the matrix for combining risk likelihoods (**Resource Document 5.4**), calculate the likelihood of completion for each pathway.
   d. Using the matrix for adding pathway likelihoods (**Resource Document 5.5**), combine the likelihoods for the two pathways to get an estimate of the likelihood of release occurring.
   e. Is the risk of release non-negligible? (If the risk of release is negligible, the risk analysis would stop here).

Working Group Exercise 5

2. Exposure assessment

a. For a pathogen having a non-negligible risk of exposure, develop an exposure scenario tree with two major pathways (**Resource Document 5.3**). Show all the major steps that would need to be completed for the pathogen to move from the border of FSM to exposure of cultured and/or wild stocks and its establishment in the natural environment.

b. Using the definitions of likelihoods (**Resource Document 5.2**), assign likelihoods for completion of each of the steps in each pathway.

c. Using the matrix for combining risk likelihoods (**Resource Document 5.4**), calculate the likelihood of completion for each pathway.

d. Using the matrix for adding pathways likelihoods (**Resource Document 5.5**), combine the likelihoods for the two pathways to get an estimate of the likelihood of exposure occurring.

e. Is the risk of exposure non-negligible? (if the risk of exposure is negligible, the risk analysis for the hazard would be completed).

3. Combining release and exposure likelihood estimates

a. Using the matrix for combining risk likelihoods (**Resource Document 5.4**), combine the release and exposure estimates to obtain an estimate of the Likelihood of Release x Exposure.

b. Is the combined estimate of likelihood of release x exposure non-negligible? (if negligible, the risk analysis for the hazard would be completed)

4. Consequence assessment

a. Draw up a list of the 5 most serious consequences that might result from the pathogen becoming established in aquaculture and the natural environment. Consider both direct and indirect impacts.

Working Group Exercise 5

b. Using the descriptions of consequences provided (**Resource Document 5.6**), make a preliminary assessment of the level of consequence in each case.
c. Using the matrix for combining consequences (**Resource Document 5.7**), combine the individual consequences to obtain an overall estimate of consequence.
d. Is the overall consequence non-negligible? (if negligible, the risk analysis for the hazard would be completed).

5. Risk estimation

a. Using the matrix for estimating total risk (**Resource Document 5.8**), combine the estimate of likelihood of release x exposure with the consequence estimate (risk = likelihood x consequence!) to obtain the overall risk estimate for the hazard.

6. Risk Management – Risk Evaluation

a. Using the ALOR matrix (**Resource Document 5.9**), compare your total risk estimate for the hazard(s) with the workshop's suggested ALOP (ALOR) for FSM. Is the risk posed by the hazard(s) acceptable or unacceptable?

Definitions for descriptive likelihoods

In qualitative risk analysis, release and exposure assessment use various terms to describe the likelihood of an event occurring. Note that definitions can differ between individual risk analyses and risk analysts; thus, it is important to define likelihood descriptors at the start of each risk analysis.

For this exercise, we will use a system with five levels of likelihood ranging from high to negligible.

Example with five terms:

- **High:** Event would be expected to occur
- **Moderate:** There is less than an even chance of the event occurring
- **Low:** Event would be unlikely to occur
- **Very low:** Event would rarely occur
- **Negligible:** Chance of event occurring is so small that it can be ignored in practical terms

How to use this matrix: To combine 2 likelihoods, find the likelihood of event 1 occurring in the top row and the likelihood of event 2 in the left column – the box where they intersect is their combined likelihood (for example: if the likelihood of event 1 is moderate and the likelihood of event 2 is high, their combined likelihood is moderate). This matrix is used for:

- combining likelihoods of completing steps along a pathway
- combining likelihood of release and likelihood of exposure

Blank scenario tree

A scenario tree can have as many pathways as necessary to describe how release or exposure can take place (i.e. you can add as many branches (pathways) to the scenario tree as needed). In this instance, only one pathway is given.

To use the scenario tree:

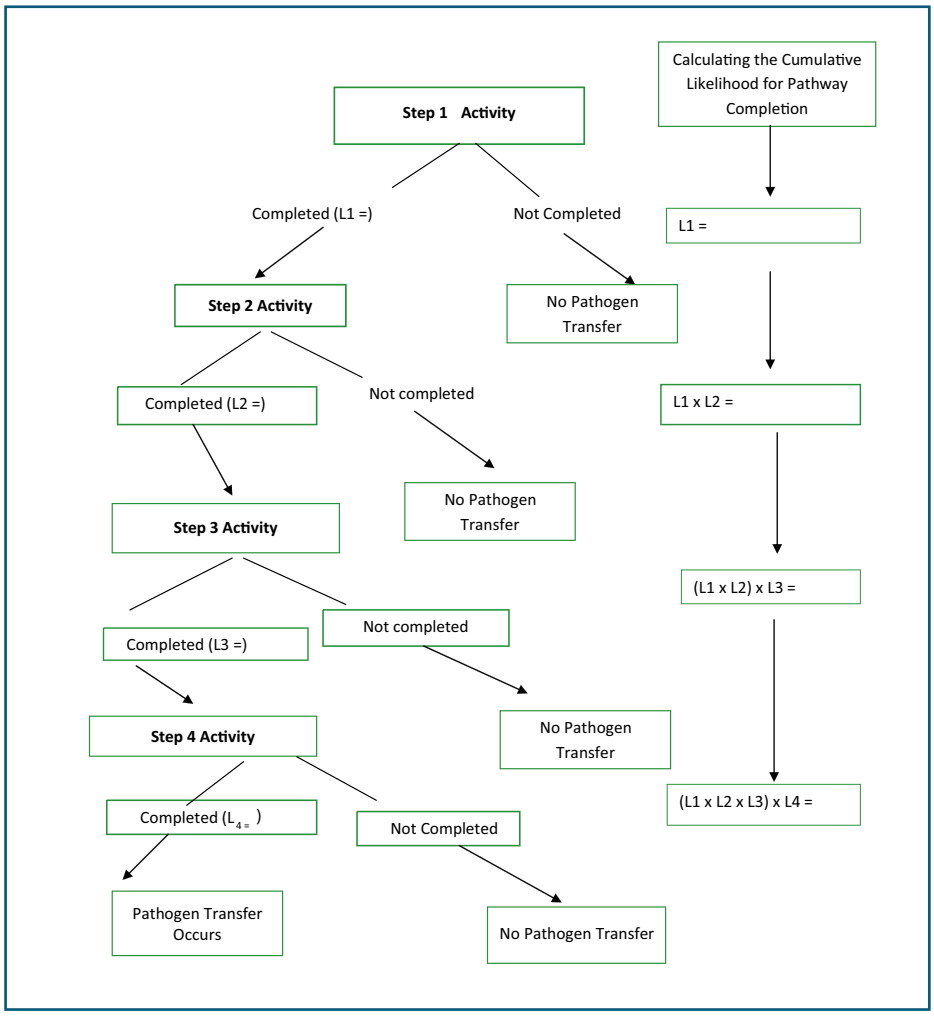
- From the starting point (e.g. for release, the source population in the exporting country) identify each important pathway by which the pathogen could move to the end point (e.g. for release, the border of the importing country).

- For each pathway, identify each step in the pathway that must be successfully completed for the pathogen to complete the pathway (place the name of the step in the large box above each fork in the pathway)

- For each step in the pathway, estimate the likelihood of the step being completed using the definitions given in Document 5.2 (place the likelihood estimate for each step (L) in the small box for each step). Note that each step in the pathway has two choices ("yes" – completes the step and "no" – no pathogen transfer occurs)

Blank scenario tree

Simplified Scenario Tree with a single pathway having four steps. In this simplified example, the likelihood that infected animals will successfully complete the pathway can be expressed as LC = (L1 x L2 x L3 x L4). L_1 = likelihood of completing Step 1, etc.



Matrix for combining risk likelihoods

How to use this matrix: To combine 2 likelihoods, find the likelihood of event 1 occurring in the top row and the likelihood of event 2 in the left column – the box where they intersect is their combined likelihood (for example: if the likelihood of event 1 is moderate and the likelihood of event 2 is high, their combined likelihood is moderate). This matrix is used for:

- combining likelihoods of completing steps along a pathway
- combining likelihood of release and likelihood of exposure

Estimated likelihood of event 1

Estimated likelihood of event 2	Negligible	Very low	Low	Moderate	High
High	Negligible	Very low	Low	Moderate	High
Moderate	Negligible	Very low	Low	Low	
Low	Negligible	Very low	Very low		
Very low	Negligible	Negligible			
Negligible	Negligible				

Matrix for adding likelihood pathways

When a scenario tree has more than one pathway, this matrix can be used to add the cumulative likelihoods obtained for each pathway to obtain an estimate of the overall Likelihood of release or exposure. Note that each pathway is an independent event and thus combining likelihoods across pathways is **additive,** while completing a given step in a single pathway is dependent upon first successfully completing the preceding steps and thus combining likelihoods within a pathway is **multiplicative**.

Example:
Estimates obtained for Pathways 1, 2 and 3 are very low, moderate and moderate, respectively.

Estimate for the entire scenario tree is:
(1) very low + (2) moderate = (1 + 2) moderate;
(1+ 2) moderate + (3) moderate = high

Estimated likelihood of pathway 1

Estimated likelihood of pathway 2	Negligible	Very low	Low	Moderate	High
High	High	High	High	High	High
Moderate	Moderate	Moderate	High	High	
Low	Low	Low	Moderate		
Very low	Very low	Very low			
Negligible	Negligible				

Consequence assessment definitions of qualitative rankings

In this example a system of five levels of consequence is used:

- **Catastrophic:** Disease would significantly harm economic performance at an industry level and/or cause serious and irreversible environmental harm.

- **High:** Disease would have serious biological consequences (e.g. high mortality or morbidity) and would not be amenable to control or eradication. It could significantly harm economic performance at an industry level and/or cause serious environmental harm.

- **Moderate:** Diseases would have less pronounced biological consequences and may be amenable to control or eradication. It could harm economic performance at an industry level and/or cause some environmental effects, which would not be serious or irreversible.

- **Low:** Diseases would have mild biological consequences and would normally be amenable to control or eradication. Effects on economic performance and the environment would not be serious or irreversible.
- **Negligible:** Diseases would have no significant biological, ecological or economic consequences and would not require control or eradication.

Matrix for combining consequences

When a scenario tree has more than one pathway, this matrix can be used to add the cumulative likelihoods obtained for each pathway to obtain an estimate of the overall Likelihood of release or exposure. Note that each pathway is an independent event and thus combining likelihoods across pathways is **additive,** while completing a given step in a single pathway is dependent upon first successfully completing the preceding steps and thus combining likelihoods within a pathway is **multiplicative**.

Example:

Estimates obtained for Pathways 1, 2 and 3 are very low, moderate and moderate, respectively.

Estimate for the entire scenario tree is:

(1) very low + (2) moderate = (1 + 2) moderate;

(1+ 2) moderate + (3) moderate = high

Estimated consequence 1

Estimated consequence 2	Negligible	Low	Moderate	High	Catastrophic
Catastrophic	Catastrophic	Catastrophic	Catastrophic	Catastrophic	Catastrophic
High	High	High	High	Catastrophic	
Moderate	Moderate	Moderate	High		
Low	Low	Moderate			
Negligible	Negligible				

Matrix for estimating total risk posed by a hazard

Estimated consequence of release and exposure

Estimated likelihood of release and exposure	Negligible	Low	Moderate	High	Catastrophic
High	Negligible Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk
Moderate	Negligible Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk
Low	Negligible Risk	Very low Risk	Low Risk	Moderate Risk	High Risk
Very low	Negligible Risk	Negligible Risk	Very low Risk	Low Risk	Moderate Risk
Negligible	Negligible Risk	Negligible Risk	Negligible Risk	Negligible Risk	Negligible Risk

Matrix for use of ALOR in risk evaluation

The following example matrices show the division between Acceptable and Unacceptable risk for two ALOPs.

(a) Matrix showing division between acceptable and unacceptable risk for a country having a very high ALOP (very low ALOR) – all outcomes with an estimated risk above "very low" are unacceptable. The ALOP is the dividing line between "green" (acceptable risk) and "red" (unacceptable risk).

Estimated consequence of release and exposure

Estimated likelihood of release and exposure	Negligible	Low	Moderate	High	Catastrophic
High	Negligible Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk
Moderate	Negligible Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk
Low	Negligible Risk	Very low Risk	Low Risk	Moderate Risk	High Risk
Very low	Negligible Risk	Negligible Risk	Very low Risk	Low Risk	Moderate Risk
Negligible	Negligible Risk	Negligible Risk	Negligible Risk	Negligible Risk	Negligible Risk

(b) Matrix showing division between acceptable and unacceptable risk for a country having a moderate ALOP (moderate ALOR) – all outcomes with an estimated risk above "moderate" are unacceptable. The ALOP is the dividing line between "green" (acceptable risk) and "red" (unacceptable risk).

Estimated consequence of release and exposure

Estimated likelihood of release and exposure	Negligible	Low	Moderate	High	Catastrophic
High	Negligible Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk
Moderate	Negligible Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk
Low	Negligible Risk	Very low Risk	Low Risk	Moderate Risk	High Risk
Very low	Negligible Risk	Negligible Risk	Very low Risk	Low Risk	Moderate Risk
Negligible	Negligible Risk	Negligible Risk	Negligible Risk	Negligible Risk	Negligible Risk


WTO
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ASEAN
APPROVE
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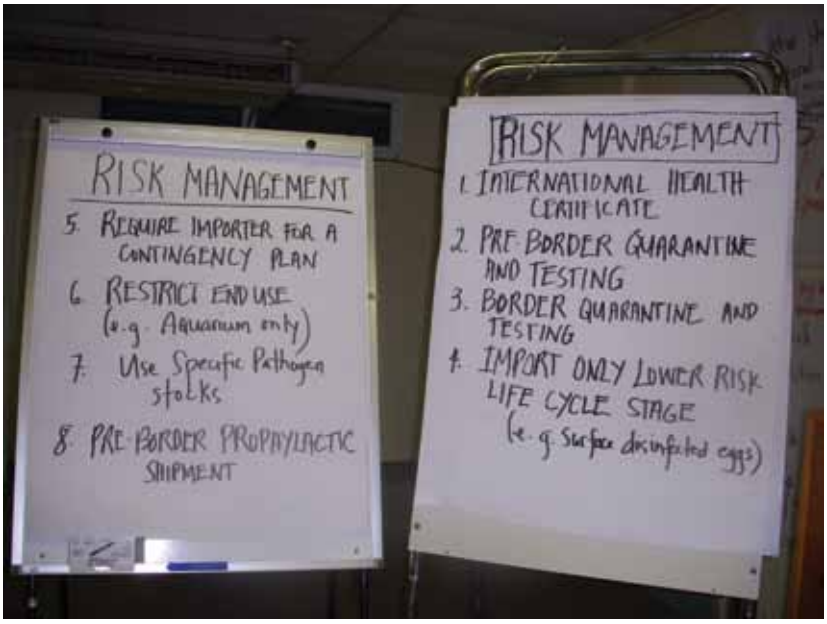

RISK MANAGEMENT
5. REQUIRE IMPORTER FOR A CONTINGENCY PLAN
6. RESTRICT END USE (e.g. Aquarium only)
7. Use Specific Pathogen stocks
8. PRE-BORDER PROPHYLACTIC SHIPMENT
RISK MANAGEMENT
1. INTERNATIONAL HEALTH CERTIFICATE
2. PRE-BORDER QUARANTINE AND TESTING
3. BORDER QUARANTINE AND TESTING
4. IMPORT ONLY LOWER RISK LIFE CYCLE STAGE (e.g. Surface disinfected eggs)

2.6 Risk management (option evaluation, implementation, monitoring and review) (Working Group Exercise 6)

Risk management (option evaluation, implementation, monitoring and review)

Learning objectives: This exercise completes the simplified pathogen risk analysis process. The participants learn how to conduct options evaluation by identifying risk management options and ranking them as to probable effectiveness and feasibility and calculating their likely effectiveness in reducing risk. They will also learn the basics of the implementation and monitoring and review of the risk analysis process.

Learning outcomes: Participants will gain a basic understanding of the risk management portion of a qualitative pathogen risk analysis. They will gain further experience in use of scenario trees and pathways analysis, the combining of risk likelihoods and the estimation of total risk. They will be introduced to evaluating risk management options and begin to consider how the selected option(s) might be implemented and their effectiveness monitored and reviewed.

Module duration: WG Exercise – 1 hour 40 minutes (1 hour 20 minutes preparation, 20 minutes presentation); lecture – 60 minutes (Supporting Lectures Part 9)

2.6.2 Summary of Working Group Exercise 6 and of supporting lecture material

Working Group Exercise

As with WG Exercise 5, WG Exercise 6 is rather demanding and its successful completion is critical to the participants' understanding of the risk analysis process. It continues to build understanding of the pathogen risk analysis process through completion of the risk management portion of the risk analysis. Continuing with the simplified risk analysis for their assigned commodities, the participants will conduct options evaluation by identifying risk management options and ranking them as to probable effectiveness and feasibility. Using the scenario tree/pathways approach, the WGs will identify at what points in the pathway(s) their risk management measures will be applied, estimate new likelihoods for these steps and calculate and evaluate new risk estimates. They will also consider the logistics of implementing and monitoring and review of the suggested risk management measures.

Supporting lecture material

Lecture materials supporting this exercise should include presentations on the options evaluation, monitoring, and monitoring and review portions of the risk management process (**Presentations 11-12**, in the Example Programme given in **Table 1** (see page 7).

Working Group Exercise 6

Risk management (option evaluation, implementation, monitoring and review)

Time allotted: 1 hour 40 minutes (1 hour 20 minutes preparation, 20 minutes presentation)

Purpose: The exercise will assist participants in understanding the risk management portion of the pathogen risk analysis process and will cover (i) options evaluation, (ii) implementation, (iii) monitoring and review.

Methods: Participants will continue with the four WGs established during Exercise 1. WGs will elect a chairperson to lead their discussions, a rapporteur and a presenter. Each WG will further evaluate one of the hazards identified during Exercise 5 as having an unacceptable level of risk.

Materials: Each WG will use the information provided/developed during WG exercises 1-5 (proposal, commodity description, relevant guidance, information on aspects of pathogen biology, pathogenicity, host range, etc.) They will also consider the information presented in the relevant plenary lectures. WGs will also use the previously provided

(i) Definitions of risk levels;

(ii) Table for combining risk probabilities;

(iii) Table for calculating overall risk, example of blank scenario tree, definitions of consequences, table for combining consequences.

Each WG will have access to a course resource person, who will play the roles of

(i) the "proponent" of the proposal and

(ii) an expert on host and pathogen biology.

Working Group Exercise 6

Outputs: WGs will consider the following questions/activities and be prepared to justify their decisions. WGs should prepare a concise (5 min) summary for presentation to plenary.

1. Options Evaluation

a. Prepare a list of five risk management options that might be effective in reducing the risk posed by the hazard.

Working Group Exercise 6

b. Using a table format, list estimates for the following parameters for each identified option (use the following ranking system : very high, high, medium, low, very low)
   i. likely effectiveness

   ii. likely feasibility for proponent and/or FSM to implement

c. Now, based on the above, rank the options from 1 to 5 in order of their probable usefulness

d. Are any of the options likely to be unacceptable to the proponent because of the cost or technical difficulty?

e. Using the exposure and release scenario diagrams for the hazard that you prepared during Exercise 5, identify the step(s) in the pathway(s) where the risk management measure will affect the likelihood(s) of the step(s) being completed.

f. Agree upon new likelihood estimates for completing these steps.

g. Now recalculate the estimate of exposure &/or release using the methods from Exercise 5. Did the risk management measure change the estimate(s)?

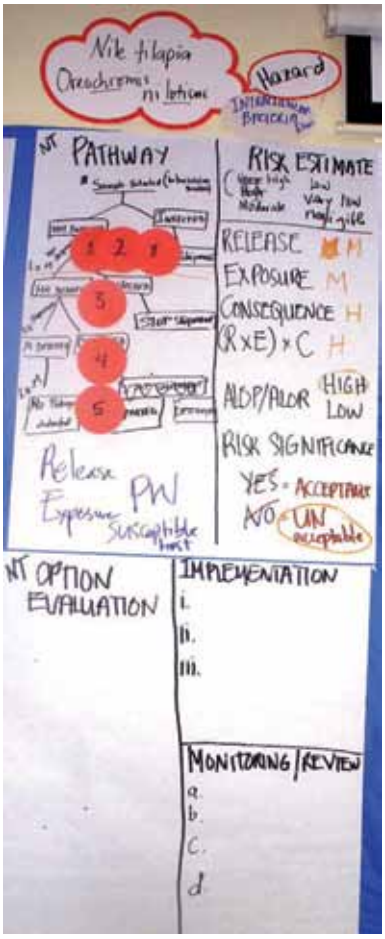
h. If yes, recalculate the total risk estimate (now the managed risk estimate) as per Exercise 5. Is the level of risk for the hazard now acceptable?

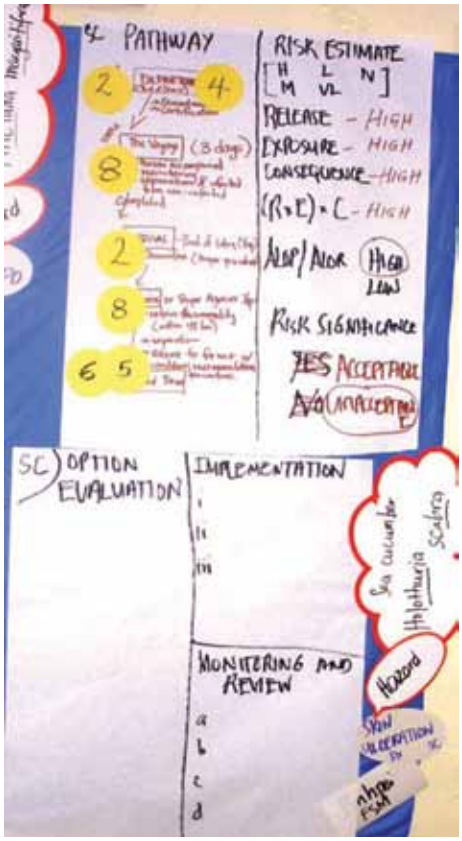
i. If not, what would you do next?

Working Group Exercise 6

2. Implementation

a. Describe briefly how you would implement the risk management measure. Consider:
   i. Who should set the standards?
   ii. Who should implement it?
   iii. Who should pay for it?

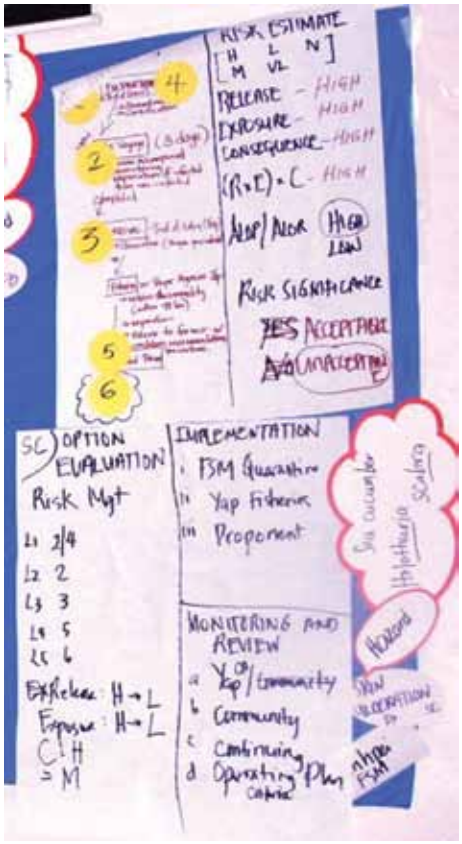




Working Group Exercise 6

3. Monitoring and review

a. Who should set up the monitoring programme and standards?
b. Who should do the actual monitoring?
c. How long will the monitoring continue?
d. What criteria would be used to decide if the importation process should be terminated and the stock destroyed?



2.7 Implementing risk analysis: identification of needs and recommendations (Working Group Exercise 7)

2.7.1 Implementing risk analysis: identification of needs and recommendations

Overview

Learning objectives: In this short concluding WG Exercise which is conducted in plenary, the participants are asked to think critically about how risk analysis is currently conducted in their country and to identify areas that can be improved and make recommendations how this might be accomplished.

Learning outcomes: Using the knowledge and experience that they have gained during the workshop, participants will be able to apply new insight that will lead to the improvement of the risk analysis process as currently applied in their country.

Module duration: WG Exercise – 1 hour 40 minutes (1hour 20 minutes preparation, 20 minutes presentation); lecture – 60 minutes (Supporting Lectures Part 9)

2.7.2 Summary of Working Group Exercise 7 and of supporting lecture material

Working Group Exercise

This concluding exercise asks participants consider current risk analysis procedures and capacity in their country, identify areas that should be improved, and suggest ways to achieve the required expertise and capacity.

The outputs of the WGs can later be synthesized by the trainers into a list of recommendations to FAO and the national lead agency for future development of national risk analysis capacity.

Supporting lecture material

Lecture material supporting this exercise can include presentations prepared based on workshop outputs (i) summarizing the results of the risk analysis exercises and presenting the results of consultants case studies (e.g. **Presentations 12 and 13** in the Example Programme given in **Table 1**).

The results and recommendations of the WG Exercises are to be summarized in the workshop's concluding presentation (e.g. **Presentation 13**) and detailed in the Workshop Report for follow up by the national competent authorities and by FAO.

2.7.3 Working Group Exercise 7

Implementing risk analysis in FSM: identification of needs and recommendations

Time allotted: 1 hour 10 minutes (50 minutes preparation, 20 minutes presentation)

Purpose: In this exercise participants will consider current risk analysis procedures and capacity in FSM, identify areas that should be improved, and suggest ways to achieve the required expertise and capacity. The outputs of the four WGs will later be synthesized by the FAO team into a list of recommendations for future development of national risk analysis capacity.

Methods: Participants will continue with the four WGs established during Exercise 1. WGs will elect a chairperson to lead their discussions, a rapporteur and a presenter. Following WG presentations, the outputs will be organized by the facilitators and presented to plenary for further discussion by a moderator chosen from among the participants.

Materials: Each WG will draw upon the experience and knowledge of its members and on knowledge and information gained during the workshop. WGs should be supplied with flip charts and post-its for use in their presentations and during plenary summary.

1. How important is understanding and applying risk analysis to managing introductions and transfers of aquatic species to/within FSM?

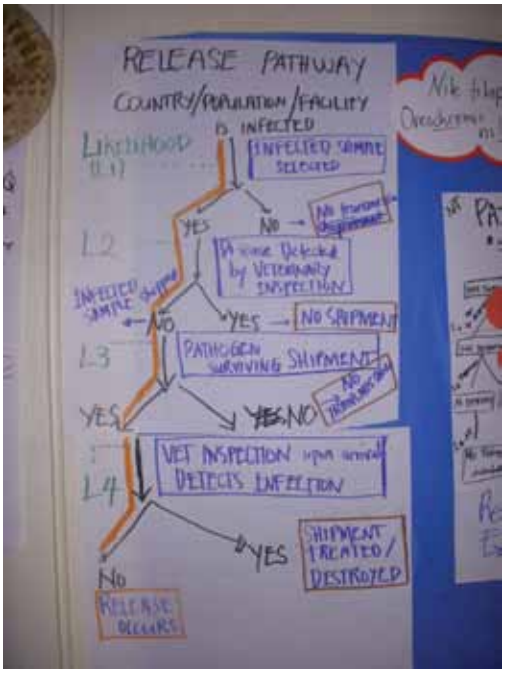
2. Rank the seven areas of risk analysis according to their importance to sustainable aquaculture development in FSM (financial, social, environmental, pathogen, food safety and hygiene, genetic, ecological (including pests and invasives))

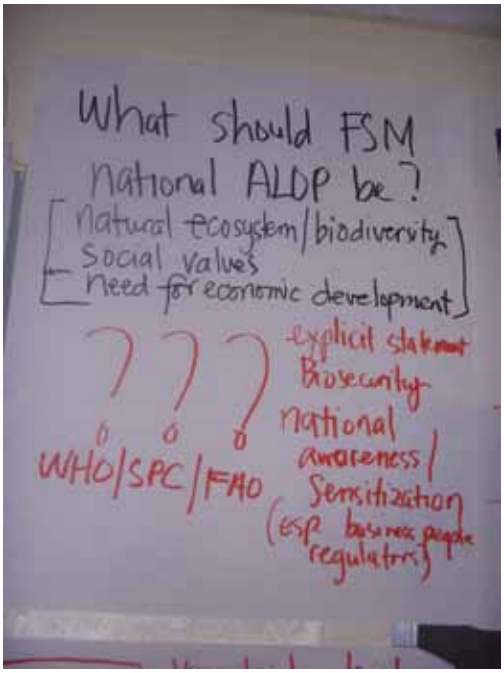
3. What are the main problems/constraints to applying risk analysis in FSM (list from highest to lowest importance) (for example, consider the general areas of budget, infrastructure, legislation, knowledge, manpower, capacity, etc.)

Working Group Exercise 7

4. For each constraint, list some possible solutions (these should be practical and have a real possibility of being implemented in FSM, even if no external funding is obtained).

5. What other recommendations would the WG like to make to the competent authorities of FSM or to FAO?


RELEASE PATHWAY
COUNTRY/POPULATION/FACILITY
INFECTED
INFECTED SAMPLE SELECTED
YES
NO
L2
Disease Detected by VETERINARY INSPECTION
NO SHIPMENT
L3
PATHOGEN SURVIVING SHIPMENT
YES
NO
L4
VET INSPECTION DETECTS INFECTION
YES
SHIPMENT TREATED/ DESTROYED
NO
RELEASE OCCURS


What should FSM national ALOP be?
Natural ecosystem/biodiversity
Social values
Need for economic development
???
explicit statement
Biosecurity
national awareness/ Sensitization
WHO/SPC/FAO