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Title:	Risk planning for Pacific aquaculture
Author(s):	Jamie Whitford, Tim Pickering

Summary/short description/key points:

Update RTMCFA on work undertaken by FAME on risks to PIC's aquaculture production.

Present an overview of the kinds of risks there are in aquaculture and highlight the importance of risk planning in managing them for aquaculture.

Invite members to discuss and share information on the types of aquaculture risks they face within their countries and territories and any gaps in their capacity to manage risks.

Set priorities for development of practical management approaches to each risk type and identify what works.

Outcomes and recommendations:

Participants are invited to identify the main PICT aquaculture risks for which management strategies may need to be developed for the region.

Risk planning for Pacific aquaculture

What is aquaculture risk?

1. Aquaculture is a key sector for development in the Pacific region and contributes to meeting nutritional, economic, and social needs of our people. Developments in aquaculture in the region continues to be constrained by key challenges relating to a high degree of risks which affects the growth of the sector and therefore limiting confidence in investment.

2. For the Pacific as elsewhere, aquaculture operations contain risks that need to be managed, to ensure sustainable production. Risk refers to the "*effect of uncertainty on objectives.*" For aquaculture, risk can be expected to result in stock losses. Risk in aquaculture is higher than in agricultural production, simply because the biology of the animals and plants under culture is less well known than those used for agriculture. This is the case for mariculture, with marine finfish production only being technologically sustainable since the 1970's, while agricultural experience extends back 10 000 years, in PNG for example. This results in an uncertainty of knowledge and decision making.

3. For Pacific island aquaculture ventures, risk analysis and planning may contribute to improving outcomes. Identification of aquaculture risks and their management potentially reduces their impact, improving stock performance and cash flow. It allows an approach where the uncertainty of knowledge does not result in a lack of decision-making.

What kinds of aquaculture risks are there?

4. Aquaculture risks can be broadly classified into socio-economic risks and physical risks. The first includes social, economic, marketing and production risks; while physical risks include natural disasters and infrastructure damage. Socio-economic risk may also include the impact of an aquaculture operation on its surrounds, while physical risks generally focus on risk to the aquaculture operation itself.

5. For Pacific island aquaculture, socio-economic risks include financial risks (production threats reducing yield or market threats affecting price), social risks (security threats, tenure and opportunity costs), food safety and health risks (stock for consumption being contaminated by chemical or biological hazards or health and safety risks to staff), ecological risks (hazards to the natural environment from aquaculture production from escaping stock predating or competing with endemic species, or their pests and pathogens negatively affecting the environment). Genetic risks, genetically improved stock or those produced from a limited gene pool have the potential to affect wild stock and reduce the natural genetic variability of wild stocks and physical risks from natural disasters, such as cyclones, pose a significant hazard.

Qualitative and quantitative risk analysis.

6. Aquaculture risk management involves the following steps: the **identification** of the risks (threats), assessing the **probability** of each risk, assessing the **impact** (consequence) of each risk, and proposing practical **management** of each risk, while considering its probability and impact.

7. A qualitative risk analysis is an informed *subjective* consideration of its probability and impact, while a *quantitative* risk analysis is informed through measurable financial impacts on the budgets and cash flows of an aquaculture operation. A qualitative risk assessment could be performed for all aquaculture projects, though quantitative risk analysis may not be required.

8. A quantitative risk analysis that may be practicable for PIC's aquaculture operations, is to determine the Expected Monetary Value (EMV) of risks **identified**. This involves the calculation, or estimate, for both the **probability** and the **impacts** of **identified** risks. EMV calculates **probability** as the number of risk events happening divided by the total number of events or time, and **impact (cost impact)**, as the amount having to be spent to manage the **impact**.

9. For a Pacific island aquaculture operation example below, the use of both qualitative, quantitative (EMV) Risk Analysis is undertaken for a developing pearl oyster aquaculture project in Fiji.

Case study: Community marine farm development in Fiji.

10. A community has secured funding and partnerships to develop a marine farm to on-grow and harvest pearl oysters produced in a commercial hatchery, for both meat and shell.

11. They have drafted a business plan to understand the resources needed and returns projected for the project over a ten-year period.

12. Within the community they have developed a **qualitative** risk analysis based on their own experiences with the adjacent commercial pearling industry that some community members have been employed in.

13. An analysis of the quantitative impact of identified risks on their revenues has been added also to their business planning.

Qualitative risk analysis

14. Risks identified include the physical risks of disease, predation, and cyclones and the socio-economic risks of a reduced or absent market and theft as shown in Table 1. Qualitatively in the experience of the community, the risk of disease is the most difficult to manage and with the highest consequences.

Table 1 Qualitative risk assessment (matrix) of the community marine farm.

Risk	Likelihood	Consequence	Risk rating	Management
Disease	Moderate	High	High	Restock
Predation	High	Low	Moderate	Increase labour and tech
Cyclone	Moderate	Low	Moderate	Submerge marine farm
No market	Low	High	Moderate	Identify markets
Theft	Low	Low	Low	Community management

Quantitative risk analysis

15. To perform a quantitative risk analysis and estimate the expected monetary value (EMV) of each identified risk needs data to establish its probability and the impact of its loss or damage on the operation. The EMV of each risk is simply its probability multiplied by its cost impact and is shown in Table 2.

Table 2 Risk analysis of the community marine farm

Risk	**Probability**	**Cost impact**	**EMV**	**Total EMV** *(financial reserve)*
Disease	30%	$36 000	$10 800	
Cyclone	16%	$30 230	$4,836	
Predation	30%	$37 520	$11 256	
No market	5%	$76 000	$3,800	
Theft	5%	$4000	$200	***FJD $30 892***

Risk of cyclone

16. The risk of cyclone damage is examined in detail by several agencies in Fiji and Fiji has experienced 4 **severe** cyclones causing widespread damage in the last 25 years. The probability of a **severe** cyclone affecting the marine farm over the 10-year project would be expected to be 16%.

17. The cost impact of a severe storm contains a level of uncertainty but is likely to damage the capital structure of the marine farm and cause a loss of stock. This is likely to be FJD 30, 230 (calculated from the production plan) assuming 25% of infrastructure and all anchors and 25% of stock are recoverable.

Probability: 16% Cost Impact: FJD $30 230

Risk of disease

18. Diseases of pearl oysters are known throughout the industries in the PIC's. To determine the probability of a disease event occurring we can look at peal oyster disease outbreaks reported. The probability of a disease outbreak can be calculated as 30%.

Probability: 30% Cost Impact: FJD $36 000

Risk of predation

19. Pearl oysters, especially spat and juveniles, are a prey for a variety of fish and invertebrate predators. Predation can be reduced with options such as site selection, labour efforts in controlling, and by an additional investment in culture gear.

Probability: 30% Cost Impact: FJD $37, 520

Risk of no market

20. Markets for pearl meat have been long established in S.E. Asia.

21. With a prospective domestic tourism market also, the risk of no market is likely to be low, the cost impact of having no market would be high.

Probability: 5% Cost Impact: FJD $76 000

Risk of theft

22. The risk of theft to the community pearl farm is judged as low by the community themselves, the site protected by traditional structures in place and the proximity of the community to the farm site. This tenure is strengthened by the formation of a legally recognized community trust and the trust's acquisition of an aquaculture license.

23. The risk of theft also includes financial impropriety, this could be managed by the operating budget containing provision for bookkeeping and auditing.

The cost impact of theft is also thought to be small.

Probability: 5% Cost Impact: FJD $4000

Summary

24. While the certainty of the **quantitative** analysis is affected by the use of incomplete or developing data, in this example, particularly for probabilities of the risks of **no market** and **theft**, the calculation of EMV has allowed for the provision of a reasonable and practicable financial contingency to be incorporated into the community marine farm budget.

Actions

- Identify and prioritise those aquaculture risks that members face for which capacity to manage them is insufficient, needing sub-regional and regional efforts to help address them.

Breakout groups

Purpose:

To identify the main PICT aquaculture risks for which management strategies may need to be developed for the region.

Task:

Perform a **qualitative** risk analysis of an aquaculture commodity of importance or interest:

1. For the chosen commodity, brainstorm a list of the main types of aquaculture risks that members are faced with.

2. List ways in which members have already adapted by addressing the risks associated with that aquaculture commodity.

3. Identify and prioritise the aquaculture risks for which capacity to manage them at national level is insufficient, so may need sub-regional and regional efforts to help address them.