PacMAN
Pacific Islands Marine
Bioinvasions Alert Network

PacMAN Local Advisory Board Meeting

10 November 2022

University of the South Pacific
Graduate School of Business, Statham Campus,
Vatuwaqa, Suva, Fiji

UNESCO

Group picture PacMAN local advisory board meeting. From left to right: Chaminda Dissanayake (BAF), Adi Miriama Vuiyasawa (USP), Senivasa Waqairamasi (DOE), Saara Suominen (OBIS, UNESCO/IOC), Joape Ginigini (USP), Sandeep Singh (DOE), Pieter Provoost (OBIS, UNESCO/IOC), Sesoni Komaisoso (MSAF), Isoa Korovulavula (USP), Gilianne Brodi (USP), Kelly Brown (USP), Chinthaka Hewavitharane (SPC), Nanise Tuqiri (Min of Fisheries), Mohammed Zulla (SPREP), Ward Appeltans (OBIS, UNESCO/IOC), Craig Sherman (Deakin University), Anthony Talouli (SPREP), Saketa Rabuatoka (USP).

Board members not present: Tuverea Tuamoto (BAF), Neomai Ravitu (Fisheries), Selai Manuel (Fiji Ports Corporation), Hans Wendt (IUCN), Molly Powers (SPC) and Omirete Tabureka (SPC).

Executive Summary

The PacMAN local advisory board meeting was held at USP campus on the 10 November 2022 in Suva, Fiji. The meeting brought together 18 representatives of 8 different local stakeholder institutions working in the marine field of Fiji. The purpose of the meeting was to discuss the progress of the PacMAN project and the development of the PacMAN decision support tool to meet the needs of all local stakeholders in monitoring marine invasive species.

The meeting was opened by Dr Isoa Korovulavula, the director of the Institute for Applied Sciences (IAS) at the University of the South Pacific (USP) in Suva. Ms. Sandeep Singh, the director of the Department of the Environment at the Ministry of Environment and Waterways in Fiji, provided her welcome words and chaired the meeting. The importance of PacMAN as bringing the issue of marine invasive species to the forefront of discussion in Fiji was stated, as well as the need for more data and more regional collaboration in the field of marine invasive species. During the last two years, the PacMAN project team has had to meet virtually as the COVID pandemic stopped all international travel. Despite this, the project has advanced well, and is ready to move on the final steps of developing the operational monitoring and the decision support tool. The main objectives of the meeting were to gain insights in the local stakeholder requirements and operations.

The project progress was presented by Mr Joape Ginigini of IAS, the local project manager of PacMAN. In the first two years, the project has been able to develop a monitoring plan and collect field samples from the port of Suva. A total of 112 specimens have already been sorted from these collections, without an indication of the presence of any of the species on the invasive species watchlist. The project has been active in linking the results to stakeholder needs through different outreach activities. Interest on the project has been received from different regional partners active in the South Pacific. The local stakeholders indicated the importance of keeping the watchlist flexible, and considering allowing the monitoring and addition of also pathogenic species in the future. In a next phase, the PacMAN project could also include monitoring for harmful algae and toxins. It was iterated that the current objective of the project is to monitor new introductions to the area, not any possible existing marine invasive species. The local stakeholders agreed on the revised monitoring plan, as recommended by the international scientific advisory board, and appreciated their input.

Mr Pieter Provoost (UNESCO/IOC/PacMAN data manager) introduced the elements of a decision support system and led the conversation on the stakeholder needs for this tool. The PacMAN decision support tool will provide risk evaluations for invasive species based on the likelihood of introduction, establishment, and local spread. A variety of data and information sources will feed into this process, including data on transport pressure, physiological traits and environmental tolerances, life cycle characteristics, and ecological factors as well as a species invasive history. Other existing decision support tools were briefly introduced, and several questions were provided to guide the discussion on stakeholder needs with regards to the development of the decision support tool. The need for the decision support tool was agreed by all stakeholders. They recommended that a verification step of positive detections is necessary

and should be done by experts, if possible locally, and a plan will need to be made for how the information will flow from the scientists to the appropriate mandated institutions. An alert system analogous to a tsunami warning system was suggested as this is working well in Fiji and the region. There was strong support that the decision support system should also track management actions, and emergency response plans should be made as soon as possible, as this is already available for terrestrial and aquatic (freshwater) invasive species, but not yet for marine species.

The next and final year of PacMAN will be crucial, in both the technical sampling as well as close engagement with the stakeholders. PacMAN will work closely with the national invasive alien species working group. PacMAN has the potential to become an important information resource to assist the region in dealing with invasive species and can complement regional work on biosecurity at SPC. The meeting was closed by Ms Sandeep Singh who thanked all meeting participants.

1. Opening Session and Adoption of Agenda

Dr Isoa Korovulavula (USP/IAS Director) opened the meeting on 10 November 2022 at 09:14 AM and welcomed all participants, especially Ms Sandeep Singh, director of the Ministry of Environment, as well as representatives from the Ministry of Fisheries, Maritime Safety Authority, SPREP, SPC and of course the OBIS team of UNESCO. Apologies were received from our only missing stakeholder, the Ports authority. We have an important day to cover as much as we can and I look forward to discussing the concrete actions to establish an effective IAS monitoring system. PacMAN is the first stepping stone, and sharing of knowledge, skills and information is key, not only in Fiji, but around the region. I wish to thank the local stakeholders for their continued support and compliments to our team to implement the project.

Mr Joape Ginigini (USP/PacMAN local project manager) provided us with house keeping information.

Ms. Sandeep Singh (Director Ministry of Environment and project advisory board chairperson) addressed the board and apologized for missing the first board meeting when we endorsed the PacMAN monitoring plan (meeting report available here). She thanked the USP-IAS team for organizing this meeting and welcomed all participants including our friends from UNESCO and Australia. Welcome to Fiji! The PacMAN project has one year left and it is important to continue the communication among each other. IAS causes a major risk to marine biodiversity and ecosystem health and consequently to ecosystem services that are crucial to our livelihoods and human wellbeing.The increase in movement of goods and services across the globe has heightened the risk of invasive species throughout the world and Fiji is no exception. While the government of Fiji is active in biodiversity monitoring through the Fiji invasive Alien Species Task Force (FIST), the Biosecurity Authority of Fiji (BAF) and the National Invasive Species Strategic and Action Plan (NBSAP) and Early Detection Rapid Response (EDRR); many of these initiatives are focused on terrestrial biodiversity. However, it is our goal through the

PacMAN project that we will strengthen the science based decision making on marine invasive species. I don't think that there has been much work done in this space before, so we very much welcome this project. It is very timely and extremely important from the Fijian government point of view. So we would like to thank UNESCO for giving us the opportunity to be part of this project and we see it as one of the very important projects. The department of environment has always been very supportive of this project. Fiji is considered a hub of marine traffic among the Pacific islands and therefore it is an entry point for high risk invasive species in the area. However, there are limitations in terms of information on local marine biodiversity and consequently on marine invasive alien species all around the Pacific. It is through the NBSAP that Fiji listed its priorities and as such addressed the management of invasive alien species, as reflected in focused area 4 of the NBSAP. The concern and efforts in these focus areas are geared towards the establishment of the invasive species database. The increased coordination between local and regional networks on invasive species management and renewed surge in national effort to raise the standard of biosecurity which is a surveillance programme such as those found in EDRR through BAF is a high priority to the Fiji government. The PacMAN project contributed to the national effort in raising awareness and building capacity in marine invasive species. Colleagues, we know that the PacMAN project has completed its trial phase of developing and ground-proofing its methodology and will now progress into its final year of implementation phase, the final iteration of the project marine monitoring plan which was endorsed at the First Board meeting; as well as test out the final version of the decision support tool. However, all this will be subject to endorsement of the meeting today. With the global shift into the marine science space, The Decade of Ocean Science, the PacMAN project could not have come at a more perfect timing. The project is committed to meeting National priorities and we would like to thank everyone who is part of this project. We hope that we will be able to work together and coordinate better with all the government agencies and other agencies that are part of this project. Bigger than invasive species, is the threat to biodiversity and eliminating invasive species as an underlying driver of biodiversity loss will ultimately require collaborative efforts from all actors in government and the scientific community to advance the science-base of invasive species management. Alot is still not understood, there are a lot of gaps in science and in the data and we should have the right science and data to be able to innovate the right policy decisions going forward. We try to manage it also through other legislative processes we have at the Department of Environment, but even at Suva Harbour there are a lot of things that remain unknown. We would like to thank you all for partnering with the government agencies (Environment, Ministry of Fisheries, MSAF, BAF) in collecting data that will feed into our decision making, and let’s complete the FIST task force.

Mr Ward Appeltans (UNESCO/IOC PacMAN project coordinator) said it’s an honor for the OBIS team to finally be in Fiji, and meet everyone in person. We started the project two years ago, but due to COVID19 we haven’t been able to meet everyone in person. So why did we start this project in Fiji? The Flanders government of Belgium has a trust fund to support UNESCO’s science activities and a large part of that fund goes to ocean activities under the Intergovernmental Oceanographic Commission (IOC) of UNESCO. IOC is a competent UN body for marine scientific research, capacity development and transfer of marine technology. With 150 Member States many of them are developing countries including small island states,

so activities that support the participation of all countries in ocean science is a priority for IOC. Through PacMAN, we are developing science capacity in one of the most biodiverse but at the same time most vulnerable parts of the world. The PacMAN project also indirectly provides the underlying data, tools and science aspects to the IMO-led GloFouling project which is developing guidelines for biofouling (cfr ballast water guidelines), to which Fiji is one of the 12 participating countries. This means PacMAN directly contributes to national and global policy requirements. Covid however posed many challenges for our teams to work together, and we had to rely on weekly online meetings to which we all had to adapt to, but also allowed us to have a very good and effective collaboration despite the distance between Fiji and Europe.

Mr Appeltans continued by saying we are in a crucial moment of the project now and need to move towards the operational phase of the project which includes the development of a decision support system. The objective of this meeting therefore is to gain insights in the local stakeholder requirements and operations. The system should provide the right information to the right agencies and make sure it is used in the right way. The co-design part with local stakeholders is key and also critical for PacMAN to become sustainable in the future. With the participation of the local stakeholders including regional bodies such as SPC and SPREP there is a good chance that we will succeed and that PacMAN will gradually be rolled out in other Island states effectively forming a network of interconnected nodes, which is important for the prevention and mitigation of the spread of invasive species. Before I close, I want to express sincere thanks to the Biosecurity Authority of Fiji for offering their new lab facilities and qPCR machine. This is a great example of how local stakeholders can collaborate and strengthen each other rather than compete leading to valuable resources being wasted.

A short roundtable was made for introductions.

There were official apologies from the Fiji Ports Authority and GEF 6 coordinator for National Invasive Species for not being able to join.

The advisory board adopted the agenda without changes.

2. Project Progress Report

Mr. Joape Ginigini provided an overview of the status of the implementation of the PacMAN work plan as well as an update on the monitoring plan and the recent changes proposed by the PacMAN scientific advisory board, which met on 20 October 2022. The PacMAN video screened as a prelude to the overview of the project's progress. The progress of the project deliverables was presented through the slides available here: https://oceanexpert.org/event/3679.

The projects progression from the co-development phase and the establishment of the monitoring plan both in year 1 and year 2 of the project cycle was briefly reflected with a more detailed discussion on the team’s latest efforts to develop expert capacity in country through its

first stakeholder training for local experts assisted local advisory board members understanding of the immense breadth of work that the team has managed to produce since the inception of the project.

The latest results from the morphological taxonomy analyses conducted at USP was presented with an indication of zero hits to date on any detections from the project's prioritized watch list of 12 taxa. This data will be further corroborated by DNA analyses that the team has been conducting. There were 112 different morphological identified taxa but further resolution will be needed. The morphological taxonomy team has been in contact with experts on any query taxa that was found. The dominant taxa were phyla Bryozoa, Chordata (ascidians), Porifera (sponges), Arthropoda (barnacles and crabs) and Mollusca (oysters). The data management and decision support tools updates were given by Pieter Provoost the PacMAN data manager.

A vital aspect of the overview was the linking of the project's work to local stakeholder needs. Through various awareness workshops and conferences, the team has managed to present on PacMAN in numerous meetings. The Fiji team has managed to garner more interest at the national level meetings for BAF's GEF 6 funded project titled "Building Capacities to Address Invasive Alien Species to Enhance the Chances of Long-term Survival of Terrestrial Endemic and Threatened Species on Taveuni Island, Surrounding Islets and Throughout Fiji Project". This national project is a 3-year Invasive Species development project which ends in 2023. The PacMAN fits into their national projects strategic Outcome 1: Strengthened IAS policy, institutions and coordination at the national level to reduce the risk of IAS entering Fiji. The

project will strengthen policy, institutions, coordination and outreach efforts on biosecurity across Fiji and develop a national coordination mechanism to facilitate effective communication, coordination and participation among stakeholders and to leverage increased funding for biosecurity. Through the project team's effort, there has been a closer linkage between the national efforts including contributing to the current draft policy under construction as well as the draft National Invasive Species Framework of Strategic Action (NISFSAP). Finally, the local manager stressed the importance that national bodies and committees e.g. Fiji Invasive Species Task Force mandated to coordinate Invasive Species management begin working closely together to capture efforts that PacMAN is developing into national level operations at key line ministries and agencies.

As a result of the growing interest from the project's wide awareness strategy to national efforts as well regional initiatives, huge interest has been created from different potential partners. These included indications from Cawthron in New Zealand, Deakin University in Australia, SPC and SPREP.

The local project manager presented on the adaptations made to the monitoring plan during the trial phase. These can be seen on the presentation slide available at https://oceanexpert.org/event/3657#documents.

The following stakeholders provided comments:

Ms Sandeep Singh expressed her appreciation for the amount of effort made in the science aspects and collection of samples. **It will be important to understand what those 12 high risk species mean for Fiji and what next steps will need to be taken in case they are detected.**

Dr Chinthaka Hewavitharane requested **the watch list of high risk species to remain flexible.** Currently the focus is on detecting larger organisms, but also bacteria and viruses may have negative impacts on e.g. fisheries and animal/human health. It would be important to include monitoring for bacteria and viruses that may come with invasive species and may have an adverse effect on food production.

Mr Joape Ginigini responded that for this pilot phase we are trying to balance ecology with economy through careful considerations of economically important species such as *Perna perna* and *Perna viridis* but this is definitely something to consider. Although it is not the focus of the qPCR activities for the moment, those microbial species might still be detected through the metabarcoding analyses that will be conducted.

Mr Ward Appeltans added that including detection of harmful algae and their toxins could also be part of a next PacMAN phase if there is a need and interest.

Dr Gilianne Brodie reminded that the scope of the project is on what hasn't come in yet, not managing what has already arrived. She added that our scientific advisory board members bring in excellent connections with overseas taxonomic expertise that is needed to help identify species, e.g. a bivalve specialist in Australia who helped confirm the identification of a juvenile bivalve which resembled one of the risk species.

The local stakeholders expressed appreciation of the work done by the project team, agreed on the revised monitoring plan, and welcomed the involvement and contribution of international experts. The board is also looking forward to the campaign results which will be the first ever baseline of a marine species inventory for the Suva Harbor.

3. PacMAN Decision Support System

Mr Pieter Provoost (UNESCO/IOC/PacMAN data manager) introduced this agenda item. Notes about the decision support architecture and data sources are available at https://iobis.github.io/pacman-decision-support and his presentation can be downloaded from: https://oceanexpert.org/event/3657#documents. He recalled that it is very important to have input from the stakeholders for the decision support system in this meeting.

Risk-based decision support systems generally consist of the following high-level components: hazard identification, risk calculation, risk management, and risk communication. Risk calculation usually involves risk calculation matrices which take into account likelihood and consequences of certain outcomes to come to a final risk score. High impact but very unlikely

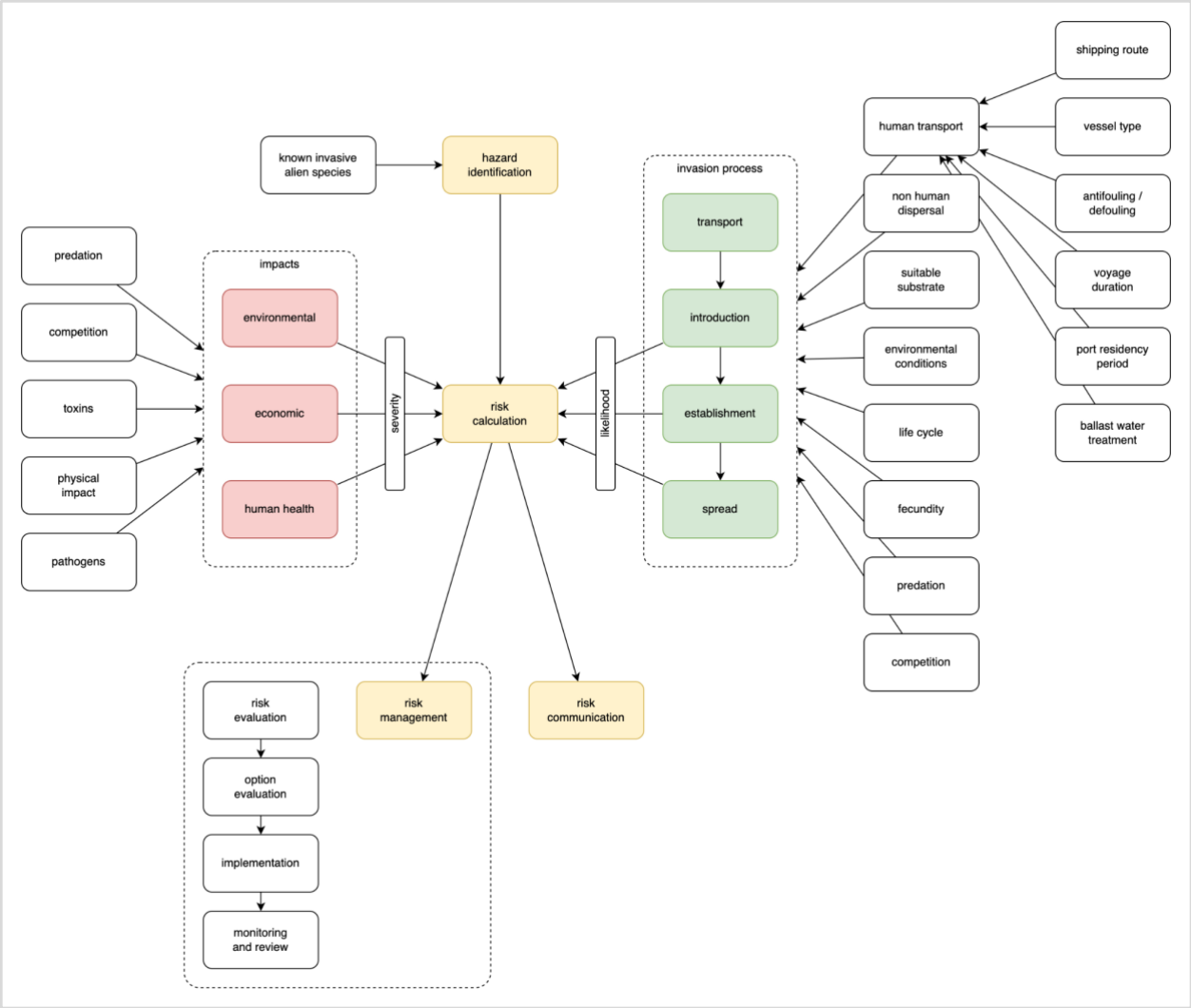
scenarios for example will result in a medium risk level which may or may not warrant allocation of resources depending on the chosen risk tolerance.

Table 10: Risk calculation matrix (modified from Campbell 2008).

N = negligible
VL = very low
L = low
M = moderate
H = high
E = extreme

Likelihood \ Consequence	NEGLIGIBLE	VERY LOW	LOW	MODERATE	HIGH	EXTREME
NEGLIGIBLE	N	VL	VL	L	L	L
EXTREMELY LOW	VL	L	L	L	M	M
VERY LOW	VL	L	L	M	M	M
LOW	L	L	M	M	H	H
MODERATE	L	M	M	H	H	E
HIGH	L	M	M	H	E	E

In the case of alien invasive species, the likelihood of introduction, establishment, and local spread is often estimated using a semi-quantitative approach that integrates both expert opinion and primary data. A variety of data and information sources can feed into this process, including data on human (shipping routes, vessel types and other vectors, biofouling and ballast water treatment) as well as non-human (ocean currents, vagility) transport pressure, physiological traits and environmental tolerances, life cycle characteristics, and ecological factors such as competition and predation which may influence survival and invasiveness. Expected impacts are often based on a species invasive history.



Many risk analysis frameworks are currently being used, such as the family of screening kits based on the Australia Weed Risk Assessment model (AuWRA) including the Cefas Aquatic Species Invasiveness Screening Kit (AS-ISK), the US Fish and Wildlife Service ERSS and FISRAM, and the Australian Government Department of Agriculture, Fisheries & Forestry (DAFF) species biofouling risk assessments. These tools typically rely heavily on expert opinion for risk score calculation. PacMAN will take a more data-based approach which is also the case for tools like the OSPAR-HELCOM Ballast water exemptions and Vessel-check which is being used by BAF.

We identified a number of data sources which will feed into the PacMAN decision support system, such as OBIS and GBIF for species detections, WRiMS and GISD for species distributions and native/introduced ranges, Bio-ORACLE and Copernicus Climate Data Store for environmental layers, UN Global Platform for AIS data, and perhaps OLTraj for particle trajectories.

We hope to have an open discussion on the topic with the help of the following questions:

- What type of risk analyses would you like to see in the system? For example: high risk species for a particular area, high risk vessels based on port of origin.
- Which kind of signals would be of interest to you or your organization? For example, risk analyses for the wider geographic region, or only information about detections in or near your area?
- What type of alerts would you like to receive from the system? Do you expect alerts to be vetted by an expert or do you prefer receiving machine generated alerts which may need verification?
- How would you like to integrate the PacMAN decision support system into your operational processes? Do you have any technical requirements from the system?
- Is there an interest in tracking management action through the decision support system?
- Is there any need for managing information related to alien invasive species which is not covered by existing databases such as WRiMS, GISD, and the CABI Invasive Species Compendium?
- Are there any other features which the PacMAN decision support system could deliver but we haven't thought of?

Mr Anthony Talouli said the proposed PacMAN Decision Support System sounds very useful and is greatly needed in the Pacific Islands. The system should look into the high-risk species and what the current vessel traffic routes are, which would be very helpful for MSAF and BAF.

The board agreed that we need **a system that both provides a risk analysis of species and vessels (port of introduction)**. Dr Chinthaka Hewavitharane said it would be useful to be able to identify **where the possible hotspot is and where the species could spread to** (for the second level of management). A risk analysis for the wider geographic area will be helpful, as spread can happen from island to island.

The advisory board members agreed that **positive detections should be verified by experts to ensure credibility**. Dr Gilianne Brodie stressed that invasive species could have serious implications on Fiji's economy and impact trade and commerce. However we need to be careful and take the potential lack of accuracy of eDNA into account especially when local species are closely related.

Mr Kelly Brown suggested **including local experts in the confirmation of the species and alerts.** There are many experts that can join, that are doing research and should be consulted.

Dr Craig Sherman also said that understanding the limitations of the tool is important. Molecular tools are not definitive confirmation, it is an alert system, a red flag and more work is needed to confirm the detection. You need to get people in the water to conduct morphological taxonomic validations of any species detections.

The discussion continued on the alert communication protocols and management actions. The advisory board agreed that the communication flow will require agreement between the various agencies, who should receive them, can this be ensured, and who is mandated to send the alert. The board also stressed that the information should be dealt with in confidentiality before the appropriate agencies have decided on the next steps. **Such a communication protocol is urgently needed (let's not wait until there is a detection).**

Dr Isoa Korovulavula suggested that we could develop a **communication alert system that is analogous to the tsunami warning system. We need a hub that can help in communicating this through the respective regional agencies**. Mr Anthony Talouli agreed that several emergency alert systems are active in the region with a focus on Pacific security, such as for cyclones, tsunamis, health, shipping related emergencies, fisheries, as well as biosecurity. PacMAN could build on this, but it might require a central clearing-house.

Clarity was sought about where the system would run. Mr Pieter Provoost replied that physically the system will sit at OBIS, at the international level. There are technical solutions to enable this to also sit at the national level if there is a wish for this.

Although the PacMAN project focuses on the science and monitoring and was not going to deal with the management implications, the board had a long discussion and felt it was important that the **Decision Support Tool also tracks management actions**. Advice will be required as to what actions are needed once an invasive species is detected and confirmed, and which agency will be responsible for which actions, such as (i) collecting and analysing more samples, (ii) vessel checks, (iii) looking at traffic routes, (iv) assessing the potential economic impact, (v) vessel cleaning and clearance, and (vi) final decision on additional measures such as eradication.

Mr Ward Appeltans suggested that we need a simulation with different scenarios. Dr Craig Sherman said that Australia has **response management plans for each different type of taxa** (not necessarily for each species separately), which would be very useful for Fiji and will help in understanding the framework, responsibilities and resource requirements.

Dr Chaminda Dissanayake said that a response management plan already exists for terrestrial and aquatic invasive species and is currently in the final stages for endorsement at ministerial level. Ms Sandeep Singh confirmed and said that the emergency response plans are to be executed by the agencies.

The board concluded that **MOUs and SOPs will need to be developed and highly welcomed that next year PacMAN will provide training on the decision support tool**.

4. Any Other Business and Cross-Cutting issues

Mr Ward Appeltans said that the third and final year of the current project will be challenging but crucial. The project team will need to run the science (monitoring campaigns) and at the same time engage the stakeholders in co-designing the decision support tool. It will be important that **each agency identifies a focal point** with whom we can communicate on a regular basis. The PacMAN project has resources to coordinate this, including funding for a workshop and training course.

Ms Sandeep Singh suggested that **PacMAN works closely with and feeds into the national invasive alien species working group**. This should be the mechanism to get PacMAN on the agenda of the National Environment Council. This will be the legislative step to get longer term sustainability for the activities. However, it will be important that there is a **clear understanding of the potential economic impact (the cost of no action) versus the resource requirements for monitoring and management**.

The board agreed with that suggestion but said that the working group is currently strongly focused on agriculture and not on marine species. This should be a good opportunity to change that.

At the regional level, SPC has recently established a biosecurity section and is working on a Pacific biosecurity network. Although its focus is mostly on diseases, PacMAN would complement these activities and be a welcome addition. At SPREP, Dr Zula Mohammed will become the lead contact point for PacMAN. PacMAN has the potential to become an important information resource to assist the region in dealing with invasive species. What is missing in the region are agencies with marine specialists to provide assistance. The involvement and connection with Australia and New Zealand would be beneficial. Through the GEF6 project, SPREP is also developing an information portal on invasives (mostly terrestrial) and PacMAN could feed (marine) information into this.

5. Closing of the meeting

Ms Sandeep Singh closed the meeting and thanked all the representatives of the different agencies and ministries and our international friends from UNESCO and Australia, and USP for organizing the meeting.

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