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# Draft Communication Strategy for Fiji's Use of the PacMAN Marine Invasive Species Decision Support Tool

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# 1. The Problem

Invasive Alien Species has been identified as one of the major drivers of biodiversity loss next to changing global temperature[1]. The increasing global trade has heightened the risk of invasive species incursions throughout the world. Currently, the information on local marine biodiversity and consequently marine invasive alien species (MIAS) is lacking in the Pacific Islands at large. Fiji is considered a hub of marine traffic among the Pacific Islands and therefore is highly susceptible to high-risk invasive species incursions. This means that the rate at which foreign organisms are established in ports worldwide has increased dramatically. New estuarine and marine species have been established once every 32 (San Francisco Bay) to 85 weeks in six studied ports in the US, Australia, and NZ, and the rate of establishment appears to be increasing (Hewit *et al.*; 2003). Eradicating and managing established invasive species is difficult and costly thus proactive early detection of high-risk species is vital. The utilization of science and technology to build effective institutions for PSID's resilience is very important and the cooperation of the Global North and the Global South is very crucial to bridging knowledge and technological gaps.

The Pacific Islands Marine Bioinvasions Alert Network (PacMAN) is a project lead by The University of the South Pacific, coordinated by the Intergovernmental Oceanographic Commission of UNESCO, and awarded by the Flanders UNESCO Science Trust Fund of the Kingdom of Belgium. It is a three-year pilot project that develops the on-ground tools and expertise to implement a marine invasive species monitoring program for the Fiji Islands. The program uses environmental DNA (eDNA) to identify potential invasive species and provides valuable scientific support for marine biodiversity risks through its objective to develop a marine "high risk" non-native invasive species-monitoring plan as well as create an easy-to-use (desktop) early warning decision support tool based on eDNA sequence data and high throughput bioinformatics analyses. A group of renowned experts in the field of marine invasive species taxonomy, DNA analyses, and data analysts have been actively involved as part of the project's scientific advisory group to assist with the design of a user-friendly monitoring plan and a decision support tool which may be reusable later in other small island states with existing laboratories. This collaborative approach has allowed PacMAN to confirm Fiji's newest marine invasive species *Didemnum perlucidum* (white colonial sea squirt) and an initial detection of *Amathia verticillata* (Spaghetti bryozoan) which now requires further validation. Of more concern is the detection of a new invasive this year from eDNA analyses sent in March. The Chinese green mussel *Perna viridis* has been detected in multiple sites as well as in multiple sample collections.

The decision support tool provides information on the risk level of new species detections, based on their known distribution and habitat ranges. This communication strategy sets out the framework to guide Fiji in the utilization of the PacMAN projects decision support tool.

## 2. The need for a National Communication Strategy

The PSID's lie within the largest ocean on Earth, the Pacific Ocean. This ocean space which contains 70% of the world's fisheries stocks as well as the world's largest assemblage of marine species continuously face a myriad of global oceans and provide tremendous ecosystem services from the largest carbon sink to the largest marine diversity with still new species of marine diversity of flora and fauna being discovered. Fiji is a country with boundless marine biodiversity earning it the name "the Coral Capital" of the world. The island archipelago has an exclusive economic zone (EEZ) of 1.28 million km<sup>2</sup> with Tourism as its primary industry from its attractive turquoise blue waters and lush green vegetation. Although there other marine industries, Fiji has increased its marine hull cleaning industry in recent years. As with all developments, there is a balance to equilibrium needed. This new industry now poses a serious threat to its Tourism and Mariculture (Pearl farming) industries due to the potential for marine invasive species introductions.

The transfer of IAS relates mainly to three main vectors: ballast water, biofouling and plastic waste.

1. **Ballast water** means "water which is taken on board a ship to control trim, list, draught, stability or stresses of the ship".[2] In other words, to improve stability, balance and trim, ships carry water in their ballast tanks. It is discharged or taken up when cargo is loaded or unloaded, or when a ship requires extra stability in harsh weather. When ballast water is taken up, so are the plants and animals that live in that water, and when ballast water is discharged, there is a risk of transfer of IAS to the area the ship has berthed.

2. **Biofouling** means the "accumulation of aquatic organisms such as micro-organisms, plants, and animals on surfaces and structures immersed in or exposed to the aquatic environment. Biofouling can include microfouling and macrofouling".[3] For ships, this occurs not only on their hulls but also in the niche areas (i.e. sea chests, bow thrusters, gratings, propeller shafts, etc.).[4]

3. **Plastics and pollution** means the accumulation of plastic debris and marine debris such as clothing, shoes, food packing, diapers, bottles, soda cans or any manufactured material that has been disposed or left intentionally or unintentionally in the marine environment.

The Ballast Water Management Act mandates the Maritime Safety Authority of Fiji (MSAF) to track ballast water release and therefore implement some level of management in shipping industries. Conversely, managing biofouling is more challenging, because of the complex and multisectoral nature of biofouling sources. These sources include a full range of anthropogenic

structures in the marine environment, including all ships, oil and gas platforms, aquaculture nets or cages, ocean energy equipment, etc. Some of these structures are capable of translocation between regions, resulting in the potential for the transboundary introduction of IAS,[5] making it impossible to address IAS solely by individual States at a national level only.

Plastic pollution constitutes 87% of marine litter also representing a fast-growing vector for marine invasive species[6]. Indeed, hardy invasive species capable of surviving long journeys on plastics are of great concern. Examples such as the Spaghetti bryozoan *Amathia verticilata* which is capable of regenerating asexually can indeed cause havoc in unsuspecting ways through its transfer both on ships as well as through pollution and plastics.

The PacMAN project has detected new marine invasive species through its 1-year monitoring (2021-2022) and validated the detection of the highly invasive *Didemnum perlucidum* (white colonial sea squirt) through a species-targeted qPCR assay. Other detections from the team's eDNA analyses are *Amathia verticilata* and *Perna viridis*. These new invasive species detections represent a common species invasion pattern with neighboring countries trading with Fiji such as New Zealand and Australia.

## **3. Key management authorities on the use of the pipeline**

### **3.1 Ministry of Environment and Climate Change (MECC)**

The Director for the Department of Environment (DoE) is the focal point for the Convention on Biological Diversity (CBD) in Fiji. It is guided in its daily operations by the following laws and regulations:

1. Drainage (Budget Amendment) Act 2018 (Principal Act: Drainage 1961)
2. Irrigation Act 1973
3. Environment Management Act 2005
4. Endangered and Protected Species Act 2002
5. Litter Act 2008 6. Ozone Depleting Substances Act 1998

As directed by the CBD, Fiji has passed its National Biodiversity Strategic Action Plan. Under Focus Area 4: Management of Invasive Species (IS)[7], Four strategic areas have been identified for prioritization namely:

**1. Strategic Area MIS1: Target research to support improved knowledge on invasive alien species in Fiji**

**2. Strategic Area MIS2: Strengthen national legislation, policies, and strategies to support effective prevention and management of invasive alien species.**

**3. Strategic Area MIS3: Improve monitoring and surveillance of invasive alien species in Fiji**

**4. Strategic Area MIS4: Raise awareness in Fiji, including with visitors, to reduce the introduction of invasive alien species**

The MECC will be a key actor in the coordination of invasive species at regional levels as well as drawing in funding to sustain monitoring and management efforts. Through its various legislation, it has the power to prosecute breaches in non-compliance.

### **3.2 Biosecurity Authority of Fiji (BAF)**

The Pacific Ocean and surrounding seas are critical shipping routes and therefore require a coordinated approach to avoid isolated management strategies for biosecurity authorities, especially in PSIDS.

The BAF plays a critical role under its Biosecurity Promulgation of 2008 giving the authority to monitor and protect Fiji from threats, conduct surveillance, monitoring as well reactive eradication containment or control of pests and diseases that may pose a harmful threat to animals, plants, and human beings.

While BAF may be tasked to operationalize the project's monitoring efforts, the decision support system may need a dual authorization process where both the identified focal point (MECC) and the current National Competent Authority (BAF) provide endorsements on the communication of alerts arising from new detections. This coordination strategy mirrors the Access and Benefit Sharing Clearing House system which has been suggested in Fiji's Cartagena Protocol's Policy Development Framework consultations and should be trialed once Fiji's ABS Implementation Framework (2016-18) has been accepted as well as the National Invasive Species policy developed during Fiji's GEF 6 Invasive species project.

It is noted that there are still areas that the tool can add on as new iterations come online. These may include:

1. Vessel tracking- Superimposition of vessel tracking data to assist in tracking of origin as well as further validate alerts

2. Stationary monitoring points of high ship traffic in Fiji and in the Pacific where there is a high berthing rate. This would need to be included in locally sustained monitoring and surveillance efforts at high-traffic sites as well

3. Linkage to climate data portals e.g. Ocean Acidification and algal bloom data e.t.c which can assist in correlation events to identify when and/or where new incursions can occur

### **3.3 Maritime Safety Authority of Fiji**

The Maritime Safety Authority of Fiji (MSAF) is a Statutory Authority established under the Maritime Safety Authority Act 2009. MSAF is responsible for regulating, facilitating, and promoting maritime safety, security, and protection of the marine environment. The statutory body comes under the Ministry of Trade, Co-operatives, Small and Medium Enterprises.

Although the body has a total of 34 legislations dealing with maritime operations, three regulations are aligned to the use of the pipeline and may be applied in the management of invasive threats namely:

1. Marine (Anti-fouling Systems on Ships) Regulations 2014- Regulates anti-fouling systems that are permissible for ships entering Fiji waters
2. Marine (Ballast Water Management) Regulations 2014- Enforcers and monitors compliance of Ballast Water Management by ships entering Fiji offices to prevent the introduction of harmful aquatic organisms and pathogens
3. Marine (Pollution Prevention and Management) Regulations 2014- Enforces and monitors the dumping of marine pollution into Fiji waters

With maritime trade and travel playing a crucial role in Fiji's life and economy, MSAF is responsible for the overall safety of all maritime operations in Fiji, focusing on two key areas:

1. Safety Regulation and
2. Marine Environment Protection

The heavy dependency by many Fijians on maritime travel means that MSAF must ensure that Fijians travel safely and the marine environment is free from pollution. Their mandate as captured in the Marine Pollution Prevention Management Regulation (2014) dealing with garbage disposal, Oil spills, and noxious substance release covers ship-to-shore activities. Coordinated waste management approaches with on-land waste management practices through the Department of Environment through their Environment Management Acts and Litter Act (2008). Although captured by MECC's legislation through its CBD mandate, Marine biodiversity, and marine conservation still have linkages to MSAF's operational mandates in marine pollution and ballast water management through the removal of invasive threats.

MSAF is also responsible for the following aspects of maritime operations:

- **Ships & Seafarers Registrar** – Responsible for maintaining a Ship Register and for meeting the Government's commitment under international convention.
- **Safe Shipping** – Ensure that all Fiji-registered vessels are seaworthy and are safely managed.
- **Compliance** – Ensure that all seafarers and maritime users comply with the laws that MSAF administers.

### **3.4 Fiji Ports Cooperation Limited**

Fiji Ports Corporation Limited (FPCL) is a Maritime company that owns and operates the four major ports in Fiji; Port of Suva, Port of Lautoka on Fiji's largest island of Viti Levu; Port of Malau is situated on Fiji's second largest island of Vanua Levu whilst Port of Levuka is at the old capital of Fiji.

A partially government company, it has diversified to include two entities in the Fiji Ports Terminal Services and Fiji Ships and Heavy Industries. The latter being the entity that provides hull cleaning services through the companies' reception facility at Suva Harbor.

The project sampling sites are located at the Suva Harbor Kings and Princess Wharfs, including a dolphin pier and a navigation beacon. A key area of concern which may need to be address in hopefully in the next project iteration is the assessment of other major ports under FPCL jurisdiction.

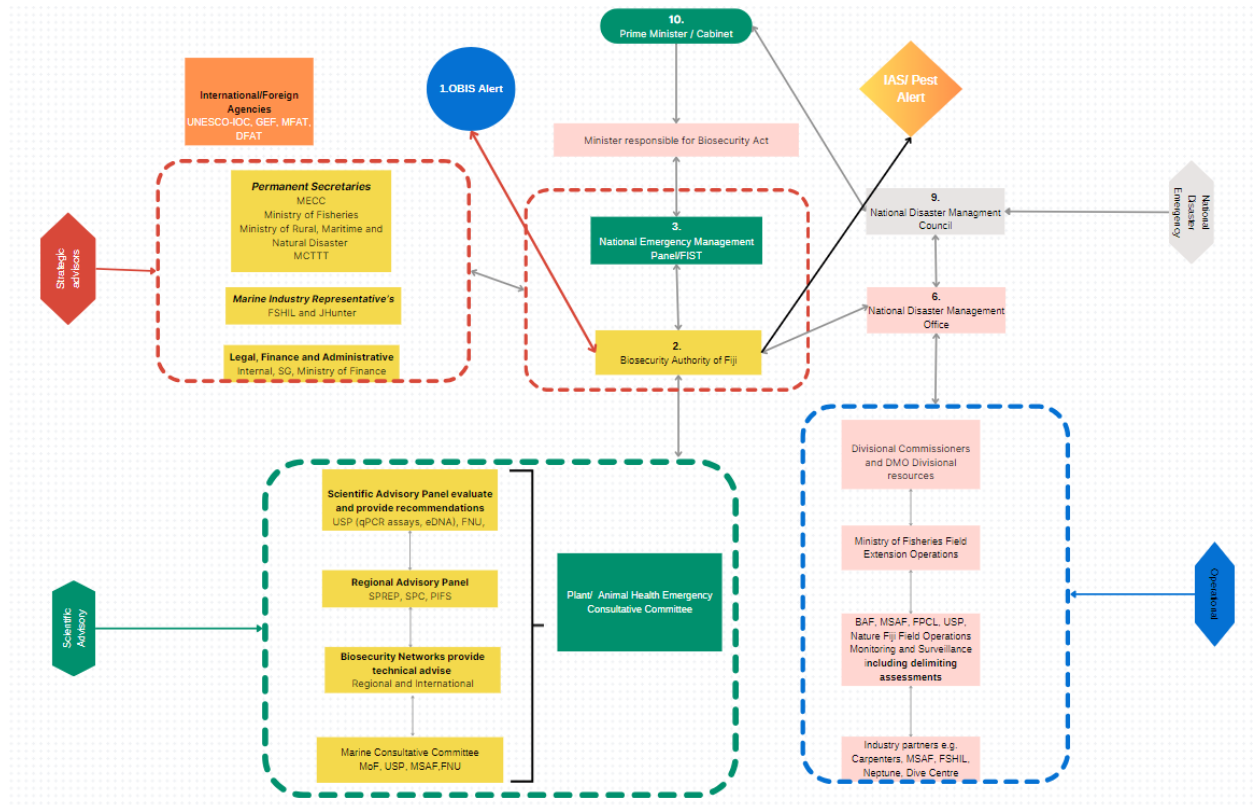
## **4. Communication strategy**

### **4.1 Dissemination of detections and/or alerts to local actors**

- Information needs to be received through an email prompt first to the BAF. A meeting is then called after the BAF through Fiji's National Emergency Management Panel have first agreed on the government approach and facilitating mechanisms. The MECC are also part of this important panel.
- The portal alerts will allow the BAF to convene its plant and animal consultative committee and seek advise widely with advisors before a delimiting assessment is conducted to find out the severity of incursion. If this is an isolated incident, only the National Disaster Management Office will be advised but key actions will be conducted between mandated ministries of MoEnv, BAF, MSAF and FPCL. However, if the severity and incursion is large, the National Disaster Management Council is led by the Prime Minister's office or a delegated authority. A public circulation of the outbreak will be disseminated by this council led by BAF in tandem with advice it receives from the National Emergency Management Panel.



The schema below in Figure 1 has been adopted from the BAF's current Pest and Invasive species Response Plan. It shows how the decision support system is centralized within BAF and the National Emergency Management Panel made up of senior Permanent Secretaries and Ministers of Government. The schema also shows its links to different stakeholder groupings which each play a specific role as a result of the data generated from the decision support system.



**Figure 1.** Communication plan for the use of the decision support system (Expanded version in Appendix B.

- The steps as outlined in Figure 1. are:
  1. OBIS alert to Fiji NCA
  2. Fiji NCA (BAF) receives the alert
  3. An alert is communicated to the National Emergency Panel
  4. BAF sends a request to the Scientific advisory panel to assist in evaluating the threat and provide recommendations. Regional agencies and biosecurity networks may also be included
  5. The BAF's plant and animal emergency committees or a hybrid of these two committees then coordinate together with the Operational partners which include the Divisional offices via the National Disaster Management Office (NDMO) on appropriate activities such as delimiting assessments, isolation, and establishing safe parameters to validate the nature of the incursion

6. When a PEST is detected, the BAF informs NDMO and issues a PEST alert
7. The pest and animal emergency committees liaise with stakeholders with operational mandates led by BAF as well as the advisory panels led by the Scientific advisory panel
8. The Strategic group consists of mandated ministries within the Fiji government with mandates intersecting in the use of the decision support system. They play a key decision making role as they liaise with both the NCA for biosecurity and focal point for Invasive species in Fiji on funding, legal, and administrative. Also part of this group is the private sector which may be working in the shipping and trading as well as tourism and aquaculture/mariculture
9. The National Disaster Management Council (NDMC) is the body that decides on the next course of action once a delimiting assessment has resulted in the validation of a new invasive species. The NDMC has the power to deploy security personnel and military in cases where isolation zones need to be created to decrease the threat of human-induced spread of the invasive species
10. The Prime Minister's office is notified by NDMC of a positive detection and the validation of the detection. The PM sends out a nationwide alert on the new invasive species
11. Only BAF can disable the pest alert when a detection has been irradiated or a suitable management strategy has decreased the severity of.

#### **4.2 Key implementers and communication formats**

- Key stakeholders that will need to receive the information are the BAF and MECC both of which are members of the FIST. A priority alert will be sent to the BAF and threat assessments including delimiting assessments will be conducted.
- BAF conducts investigations and generates a technical sheet that is then communicated as an Alert
- Threat levels are calculated once results have been received. If the threat is containable and can be eradicated or isolated, this is categorized as a PEST. The NDMO is advised but BAF under its act can issue an alert as seen in Figure 1.
- Other implementers which will be now classed as secondary actors needed for the communicate would be the Ministry of Rural, Maritime and Natural Disaster which houses the National Disaster Management Office, the Ministry of Fisheries, Fiji Ports Cooperation Limited, Academia such as USP and FNU, local based NGO's with local mandates such as Nature Fiji Mareqeti Viti as Industry partners. Other NGO's such as IUCN and CI can also be prompted due to their extensive marine programmes in Fiji and the region.

### **4.3 Follow up Strategies on potential invasions**

In the Internet of things, a flow-on effect of increased coordination can be envisaged from the launch of the decision support tool. Its utility in the country is immense from monitoring of new invasive species to an increase in Fiji's marine resource inventory data (with Ministry of Fisheries and MECC) to assist with biodiversity conservation efforts. Other followup strategies are:

- Sustained monitoring efforts at established sites e.g. Suva Harbor
- Extension of monitoring sites beyond Suva Harbor including at least one major site at Lautoka harbor and another from an undisturbed site e.g. Lau waters
- Increase networking with both New Zealand MPI and NIWA as well as Australian authorities through e.g. Marine Pest Sectoral Committee (MPSC)
- Increased regional sharing of knowledge and capacity through research at satellite labs in Australia (Deakin, MPSC), New Zealand (MPI, Cawthron) and Fiji (USP, BAF) will assist in the development of new assays, probe and primer design as well the establishment of a widely acceptable or taxon specific protocols to address marine invasions

### **4.4 Flow of information between local actors and prioritization regime**

#### **4.4.1 Pests**

- For controlled isolated cases, under the BAF operational priorities, these would be categorized as pests and will be dealt with through their Early Detection and Rapid Response protocols
- An alert is communicated to the NDMO but BAF will contain the pest with the assistance of its partners and key actors before sending out an Alert.
- The BAF after consolidation of scientific data, the completion of delimiting assessments and proper consultations within industry relevant stakeholders for management actions can then also proceed with public awareness in media especially in port areas and with the MSAF. An example of a pest alert can be seen in Appendix A.

#### **4.4.2 Invasive alien species**

- For high risk species detection where BAF has proven through eDNA analyses and qPCR targeted tests, delimiting assessments are conducted
- A species fact sheet is produced after all data are collated and the organisms is categorized as an Invasive alien species
- BAF after consulting with MECC and its advisory partners, convenes the national emergency panel who then send out an alert and elevate the priority to the National Disaster Management Council (NDMC) to coordinate if the need arises for a country wide approach coordination is needed from different sectors to control the spread of the invasive species

- NDMC will call for a nation wide alert and utilize all available resources in country including military and police if the need arises to limit access to specific sites as well utilize naval ships and dive teams for inspections e.t.c.

#### **4.5 How can the portal assist decision-making by the local actors**

Technical information from the portal can assist with building management plans and biosecurity strategies by managers and the government. Alerts will be forwarded to the FIST's scientific cohort who will then provide advise or further seek technical advise and a second opinion from their networks. As a proxy arrangement before BAF is able to replicate the full breadth of the PacMAN workflow to monitor for new detections, collect and process samples, analyse and interpret results, USP-IAS has will assist with the provision of funding. The portal will increase USP-BAF coordination on marine surveillance. With Fiji working with Australia to complete its Maritime Essential Services Centre, the ability to conduct surveillance further out in remote areas will be increased through the assistance of the Fiji Navy's patrol boats as well as MSAF and BAF involvement. The portal can assist rapid response assessments especially in the outer islands in Fiji.

#### **4.6 Customized settings for the decision support system**

The system should be able to record the official status of invasions, and house management actions by key implementers as well as provide valuable resources to assist users such as literature or publications related to species detected. It can also house relevant guides for ship or pleasure craft owners planning to enter Fiji waters. Examples of guides could be for in-water hull cleaning, ballast water registry data entry and pollution management on board ships.

An additional option that may be considered is the use of the system as Fiji's marine invasive species clearing house since all major actors are involved with MECC (Focal point under the CBD), BAF (the National Competent Authority), and Checkpoints such as MSAF, FPCL, and USP. Its proposed function already mirrors existing clearing houses such as the ABS-CH. The system will offer a more robust evidence-based approach to reporting that is not offered by any other clearing house. This option can be proposed later to local stakeholders in the projects exit meeting as a strategy to coordinate marine invasive species in Fiji.

## **5. Scope**

This communication strategy is designed to increase national coordination against the transfer of IAS in the Fiji waters via the utilization of the decision support system to improve the management and coordination pathways on the detection of new invasive species. The decision support tool will be an open source tool for use but the management of sensitive data may need to be conducted via in-country focal points at the MECC or at BAF.

The utilization of the Decision support tool may require a level of coordination within the country to:

1. Monitor sites of interest including replicating/adopting PacMAN workflow
2. Collect samples from sites and process samples according to the prescribed methods
3. Curate voucher samples and store these for provenance
3. Analyse eDNA samples and send for sequencing
5. Develop suitable qPCR assays for detected hits from NGS
6. Validate NGS hits through species-specific qPCR assays

## **7. Monitoring and Evaluation of the strategy**

The BAF are responsible for driving the implementation of this communication strategy and should meet with key stakeholders especially MECC either via the FIST or in a separate forum twice a year to evaluate the effectiveness of the decision support tool and to identify and address constraints. Progress should be evaluated in terms of the [Action Plan / Implementation Plan]. The implementation of the strategy will be regularly monitored and reviewed when necessary no later than every 5 years through a consultative process with members of the line ministries and relevant regional and international organizations as advisors.

In order to streamline the effectiveness of the communication strategy, a historical memory of decisions and management plans may be useful to assist future decisions. This has proven to be a weakness for Fiji government ministries due to shortages in man-power and an existing succession planning strategy to continue the work. The decision support tool can assist here by providing in-country action plans and perhaps management plans for each Invasive species acting as a repository for species-specific management actions for each marine invasive species detected and managed. Its open-source nature can then allow regional countries to better coordinate their response plans.

Other initiatives that can assist in improving local compliance and enforcement such as the GloFouling Initiative through IMO and locally managed by MSAF will be crucial to plug existing gaps in maritime practices of waster management, hull cleaning and ballast water management. The draft national biofouling strategy with MSAF will be an important document that can assist improving Fiji's enforcement and compliance strategies for ships entering our waters. The design of the communication strategy will ensure that all implementation actions as a result of a detection will be addressed by the mandated authorities in the operational grouping of schema Figure 1.

## **8. Decision support tool functionality**

Currently, the PacMAN system operates as follows:

- On a daily basis the system fetches occurrences of species that are listed in WRiMS for the area of interest and the past year. Occurrences can originate from PacMAN surveys or any other OBIS dataset.
- Every occurrence is checked against WoRMS to establish if the occurrence happened within the native or introduced range of the species. Specifically for data generated by the PacMAN bioinformatics pipeline, we will check potential taxonomic annotations from multiple annotation algorithms.
- If the occurrence did not happen in the known native range of the species, or if the species is listed on a priority list for the area of interest, it is recorded as a detection in the system.
- Unless alerts have been disabled for a specific species/area of interest combination, the detection receives the "alert" status and is listed on the portal home page.
- Alerts can be disabled for a specific species/area of interest combination, for example because the introduction is well known and being managed, because the risk analysis system erroneously assumes the species is introduced, etc. Which user roles can disable alerts remains to be decided.
- Detections link back to the molecular or other (images) evidence so they can easily be verified.
- For every species listed in WRiMS we have a summary map showing the known distribution from WoRMS/OBIS/GBIF as well as the thermal range. This shows which WRiMS species are a potential risk for the area of interest. This currently does not incorporate connectivity through currents or human activities.

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# Appendix A. Pest Alert



## Pest Notification - Little Fire Ant Infestation alert for Fiji

For Immediate Release

09 January 2024, BAF Headquarters, Suva

BAF would like to bring to your attention the presence of **Little Fire Ants (LFA)** (*Wasmannia auropunctata*) in a few areas of the Fiji Islands.

### Description

This ant is a uniform yellow-red to light brown; all workers are 1.5 mm in length (half the size of a sesame seed). LFA does NOT build mounded dirt nests; instead, they nest in various habitats, including in trees, around potted plants, on irrigation lines, and in electrical boxes. They are slow-moving and easily dislodged from leaves, plants and trees. The Little Fire Ant, also known as the electric ant, is a small yet formidable pest with a painful sting.

### Current Infestation Status:

- Beqa Island
- Parts of Sigatoka Area (Olosara near the seaside with additional detection around Sigatoka Research Station)
- Areas within Namosi Province
- Leluvia Island

### Impacts:

Human Health: Painful sting causing welts lasting for weeks.

Agriculture: Infestation in fields and farms, damaging crops and stinging workers. Promotion of plant pests like aphids, white flies, and scale insects.

Social: Infestations in houses, beds, furniture etc.

Animal Health: may sting pets and farm animals.

### Call to Action:

Vigilance and reporting of any unusual Ant activities.

Implement stringent biosecurity measures to prevent further spread.

Your cooperation is crucial in mitigating the impact of the Little Fire Ant infestation. Together, we can safeguard our environment, agriculture, and the well-being of our communities.

For any inquiries or reports, please contact [info@baf.com.fj](mailto:info@baf.com.fj) or dial 331 2512 and register your details.

BIOSECURITY ADVICE



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