MEETING MINUTES

DAY 1: Tuesday 9 May 2023	Notes
Meeting Opening welcome and prayer	
Tom Burkot, JCU Australia **PacMOSSI Program Activity**	The goal of the PacMOSSI program is to strengthen vector surveillance and control programs of Pacific Island Countries and territories (PICTs) so as to contain mosquito-borne diseases and improve the well-being of Pacific communities. This is achieved by working with the existing manpower and infrastructure to empower countries to do more to encourage the collection and use of vector data in decision-making. Key achievements of the PacMOSSI project so far are: • 18 of 21 countries completed vector control needs assessment • 7 of proposed 8 training modules launched on the PacMOSSI website • 485 people from 6 regions worldwide enrolled in training • 2 face-to-face workshops conducted, in Brisbane, Australia (Sept and Oct 2022) and in Nadi, Fiji (March 2023). Upcoming workshop in Madang, PNG (end May 2023) and in-country mentoring planned for Nuku'alofa, Tonga (June 2023) • Vector surveillance supplies and equipment shipped • Data management modules (Tupaia) available, with Beyond Essential Systems to support implementation in selected countries • Countries supported for Strategic Plan development, as5 PICTs have received technical inputs, 3 have commenced development and one has finalized their Strategic Plan • Two operational research grant opportunities launched, with 10 applications received from 8 PICTs, 4 provisionally approved, 5 under review, and 1 withdrawn • Citizen Science model projects launched and materials developed, with 4 PICTs engaged
Tanya Russell, JCU Australia **Vector-borne diseases threats in the Pacific: Outbreaks, invasive vectors, changing behaviours**	Vector control is an extremely effective tool to control mosquito-borne diseases. • While malaria transmission has declined since the turn of the millennium, transmission can rebound quickly (as has been observed recently in Vanuatu, with an upsurge in cases in 2022) • There has been a substantial increase in the occurrence and severity of dengue outbreaks throughout the region. A major contributing factor is the lack of effective vector control and the introduction of *Aedes aegypti* across the region • The distribution of the two primary vectors is currently expanding, with both *Ae aegypti* and *Ae albopictus* are now common in many Pacific Islands • However, there is very little organized *Aedes* control across PICTs • It is important to understand the level and type of insecticide resistance in the region, and to select insecticides appropriately • Successful vector control requires knowledge of target mosquitoes, effective tools, strengthened capacity and capability of vector control programs (VCPs), strengthened

	guidance and strategic plans • Vector surveillance data should be collected with the primary purpose of supporting decision-making
Sala Saketa, SPC Fiji **SPC Contributions**	The Pacific Community (SPC) provides scientific and technical support through its 8 divisions that include the Public Health Division and Statistics for Development Division. SPC contributes to addressing vector-borne diseases (VBDs) broadly in the following areas: • Generation of data and surveillance • Provision of technical assistance during VBD outbreaks • Support through its laboratory network • Support for capacity building in collaboration with PacMOSSI consortium • Production of resource materials to support research • Support for risk communication and community engagement • Surveillance of VBDs conducted under the Pacific Public Health Surveillance Network (PPHSN), a voluntary network of ministries and departments of Health of the 22 PICTs • Provision of technical advice, procurement of test kits and consumables through LabNet for VBD • Contribution to the production of reference materials, such as the Manual for Surveillance and Control of *Aedes* Vectors in the Pacific, seroprevalence surveys in Vanuatu and New Caledonia, and development of a regional dengue early warning app • Production of information, education and communication (IEC) materials, training and translation of materials for risk communication and community engagement
Amanda Murphy, WHO Vanuatu **WHO support for Vector Control Capacity Building**	WHO supports capacity building for vector surveillance and control including through technical support and advice, practical support through vector control resources, networking and collaboration • Technical support through WHO guidance documents, technical advice through country offices and the Division of Pacific Technical Support in Suva • Provision of supplies and resources for VBD surveillance and control as well as other commodities (eg. dengue rapid diagnostic tests) upon request from Member States, such as through the vector control stockpile in Suva • Coordination of the Pacific Vector Network, which was established to support enhanced vector surveillance and control in PICTs and is jointly coordinated with SPC and the Pacific Island Health Officers Association (PIHOA)
Tanya Russell, JCU Australia **Capacity of vector surveillance and control in the Pacific**	Capacity of vector surveillance and control in the Pacific was presented with reference to: • Standardized assessment framework, of inputs, activities, outputs, outcomes and impact • Alignment with WHO guidance, including the Global Vector Control Response 2017-2030 and the Framework for a National Vector Control Needs Assessment • Needs Assessments conducted in each country to identify: a) bottlenecks to implementing vector surveillance activities, b) quality of vector surveillance programs against best practice, and c) prioritization of areas to support with training (with 18 or 21 countries completing these assessments) • *Aedes* vector control implemented in 2020, which included mainly larval source management, fogging or space spraying in indoor and outdoor spaces, and distribution of ITNs and repellents to febrile patients • PacMOSSI consultants providing the opportunity to develop and/or update Strategic Plans that incorporate *Aedes* control • Evaluation of staffing, to identify actions for engagement of communities through Citizen Science and operational research to optimize deployment of activities • Status of vector surveillance for *Aedes* to identify options for training provided through online platform and face-to-face workshops • Current samples techniques to identify development of priority Standard Operating

	Procedures to guide the use of different traps
	• Needs assessment reports have been issued to individual countries, and can be used to track changes over time
	• A live survey was conducted to solicit participant responses on how best to present these data, with the following key results:
	  ○ The VCNA was perceived as a useful tool and had been used by country partners to a) understand the situation, b) present the situation to decision makers, and c) guide surveillance and control decisions.
	  ○ There was an overall preference for the VCNA to be updated annually.
	  ○ It was considered useful to have a regional dashboard that presents data for all countries, and challenges for regional data sharing were highlighted.

Tom Burkot, JCU Australia **Anopheline surveillance recommendations**	*Anopheline* Surveillance recommendations were presented from the WHO Malaria Surveillance, Monitoring and Evaluation Reference Manual, with the goal of surveillance being to guide and maintain effective control. • Surveillance objectives were presented, with considerations identified that included the types of surveillance, where to measure (ie. location characteristics and number of sites), how often to measure (depending on transmission intensity), and which indicators to measure (depending on interventions). • There are different types of surveillance (with the overarching objective of maintenance of effective vector control): Baseline surveillance; Routine vector surveillance; Spot checks; Focal Investigations • Examples of considerations for high-moderate transmission and low transmission areas were presented, including location and number of sentinel sites and frequency of monitoring required to represent the range of vectors, transmission intensities, and interventions deployed • Surveillance indicators were also presented in reference to the interventions currently used or being considered for use, such as insecticide treated nets, indoor residual spraying, larviciding and house screening • Efficacy monitoring for insecticide-based products was also presented The future of vector control will be stratified interventions based on local data.
Leo Makita/Annie Dori, DOH PNG **Overview of PNG NDOH *Anopheles* vector surveillance activities**	The malaria situation for PNG was presented, which showed a significant increase in cases between 2021 and 2022. PNG has a total of 284 known mosquito species, of which four have been identified as primary and seven as secondary *Anopheles* vectors of malaria. The Malaria and Vector Borne Disease Program of the National Department of Health (NDoH) is responsible for implementing vector surveillance and control. Other agencies involved in implementation are PNG Institute of Medical Research (PNGIMR, which leads the STRIVE project), the Resource Sector, NCD City Authority, NAQIA, and Rotarians Against Malaria. Vector surveillance data is collected and managed by PNGIMR and reported to NDoH to guide decisions on vector surveillance in PNG. Adult and larval vector surveillance is ongoing at 8 sentinel sites, collections are conducted by a range of methods including BG sentinel raps, indoor and outdoor resting by aspiration, CDC light traps and human landing collections. Extensive information on vector composition and insecticide resistance status is therefore available for *Anopheles* in PNG. Data are used to inform decisions on vector control interventions and products, as well as community messaging. Key needs for effective vector surveillance including: • Information and/or guidance: guidance on surveillance methods, standard SOPs for data collection and analysis, rapid dissemination and integration of data, program maintenance resources, ongoing stakeholder collaboration • Operations: adequate funding, trained personnel, appropriate surveillance tools, data collection and management, response planning, community engagement and education • Research: to identify gaps, develop and evaluate new methods, assess environment drivers, knowledge sharing

Tessa Knox, Australia **Aedes vector surveillance recommendations of the Pacific Manual**	Two key publications outline the "what, why and how" of *Aedes* surveillance: • Framework for national surveillance and control plans for *Aedes* in the Pacific (2023, currently available in English) • Manual for surveillance and control of *Aedes* vectors in the Pacific (2020, currently available in English and French) Recommendations included in the Pacific manual were explained. PacMOSSI training modules align, and emphasize that vector surveillance is part of preparedness and response, and that vector surveillance data needs to be: • Standardized • High quality • Used for decision making The purposes of routine surveillance must be considered and clearly articulated (using the "so what" test) with design of vector surveillance programs governed by the risk of arbovirus outbreaks, arbovirus transmission scenarios and vector control activities. Operational priorities and priority indicators were explained using examples from Vector Control Needs Assessments.
Vimal Deo, MoH Fiji **Overview of vector surveillance activities in Fiji**	Fiji experiences endemic dengue and lymphatic filariasis in some localities, with outbreaks report earlier of Chikungunya and Zika. Surveillance systems focus on larval information collected routinely and validated through a sentinel survey every quarter. Three primary vectors and six secondary vectors have been identified. Vector surveillance is recognized as one of the most important aspects of vector control. In the past years, great importance has been given to adapting existing vector control techniques and developing new methods to enable general health personnel, communities and individuals to take actions in defence of their own health. A National Mosquito Strategic Plan is currently being developed, and currently adult surveillance (including for Wolbachia screening) is undertaken at 88 sentinel sites in 29 areas. Surveillance is undertaken using gravid traps with BG sentinel traps used sometimes. Key issues and challenges identified are: • Limited resources, HR, tech support and finance • Competing tasks/interests • Strategic Plan direction • Centralized systems for analysis and identification Key needs for effective vector surveillance included: • Guidance on development of new Strategic Plan for mosquito control • Operationally, develop insectarium, change to adult monitoring, case investigation links to entomological data • Research on insecticide resistance, *Wolbachia* in albopictus species, Citizen Science and Community Engagement, and density of species There was a query on whether the wealth of *Aedes* entomological data from Fiji has been analysed to determine if there are any associations with reported arboviral cases and also whether dengue cases are likely from areas with *Ae. albopictus* (considering the *Wolbachia* distribution program). However, available resources to comprehensively analyse the data have been limited; there has been a focus on clinical aspects with the last publication in 1998. However, new staff are interested to publish the data and technical assistance is available from WHO. There was also query on whether surveillance at points of entry helps to prevent vector incursions, and what may be required to ensure it is more effective. Participants from Samoa, New Caledonia and Queensland shared experience on PoE vector surveillance, and it was noted that there are limited known examples of surveillance preventing import or export; rather, incursions detected during surveillance away from PoEs guided rapid control

	activities. Sharing information on activities and experiences of PICs for PoE monitoring may be useful, as WHO guidelines are quite vague and not specific.
Tanya Russell, JCU Australia **PacMOSSI training opportunities**	Training opportunities were presented, that included: • Online PacMOSSI training, with 8 online modules currently available along with resources, handouts, and instructional videos. The training is tailored to suit different job roles eg. Program managers, Entomology/Environmental health officers, community engagement officers, data officers, research officers conducting operational research. So far there have been 485 enrolments, across six regions (with 74% from Oceania). Completion rates differ between the modules. Certificates are available on completion. • Supporting resources are available at https://pacmossi.org/resources/ and include: A guide to mosquitoes in the Pacific (2023); A morphological key to the common mosquito species in the Pacific including medically important vectors, and SOPS such as for CDC light trap assembly and deployment. • Regional face-to-face workshops with hands on training covering aspects of vector surveillance and control have been held in Brisbane (September and October 2022) and in Nadi (March 2023). • In country training and mentoring has been held in Palau, Fiji and Tonga for training on electronic data management.
Adam Craig, UQ Australia **Utilising citizen science to enhance vector surveillance**	Citizen Science is the voluntary involvement of the public in scientific research. By engaging participants from multiple locations, the model provides an opportunity to collect large amounts of data from numerous places at a relatively low cost. Community members are engaged and learn about vector-borne disease threats, providing the opportunity for health promotion/behaviour change communication. • PacMOSSI supports the development and initial implementation of Citizen Science activities, and provides resources (seed funding plus video training, participant guide, participant kits). PacMOSSI supports PICTs interested in exploring the utility of a citizen science as a strategy to enhance mosquito surveillance and community engagement • The model is very flexible and can be designed to meet local needs and contexts • The approach offers the chance to work across and influence other sectors • Currently four countries are engaged in Citizen Science projects, and are at different stages of planning and implementation • It was clarified that citizen science can be used to support risk awareness raising and teaching at primary school level (and that this has been useful successfully elsewhere, such as in the USA for the Great Mosquito Hunt project and in Zambia for *Anopheles* surveillance) • It was clarified that initially the PacMOSSI citizen science projects has focussed on collection of adult *Aedes* with BG traps, but that this proved challenging for logistical reasons so a switch was made to ovitrap collections.
Hugo Bugoro, SINU Solomon Islands **Citizen Science Activity in the Solomon Islands**	An overview was presented on the of PacMOSSI Citizen Science project in Solomon Islands. Students from 10 high schools in Honiara were engaged. 50 ovitraps were made and set by the students with support from SINU scholars. SINU scholars helped to harvest the eggs, flooded and reared mosquitos to adults, and identified mosquitoes to species level using morphologic methods. In round 1 of the project: • 2064 mosquitoes were collected with 790 (38.27%) reared to adults. • *Ae. albopictus* 73.3%; *Ae. aegypti* 13.5%; *Culicines* 12.8% were detected • Ovitrap Index (OI) ranged from 16.67% - 80% and was higher for *Ae. albopictus* It was noted that the widespread presence of *Aedes* mosquitoes, and an OI of >10%, is evidence of an elevated risk of an arboviral disease outbreak occurring, should disease be introduced into the population. Community-wide monitoring of both vectors is necessary. Positive student experiences included gaining new knowledge and skills, and participating in enjoyable and interesting projects - although 12.5% felt that the project was good but required time.

	Round 2 of the initiative was implemented in December 2022 with round 3 planned for Q4 2023.
Tessa Knox, Australia **Recommended Malaria vector control and evidence**	The WHO Guidelines development process was explained in brief (with an explanatory video available here). The WHO Guidelines for Malaria were displayed, and an explanation was provided on the structure of WHO recommendations (with an explanatory video available here). This included a mention of the strength of a recommendation, as well as the certainty of evidence that informed the recommendations. The WHO list of Prequalified vector control products was also presented. A video on the role of the Vector Control Advisory Group in reviewing the public health value of new interventions was played to the audience, as is available here.
Wesley Donald, Vanuatu **Overview of vector control in Vanuatu**	The malaria situation in Vanuatu was presented. The total number of mosquito species in Vanuatu is 22, with *Anopheles farauti* noted as the only vector of malaria as well as the primary vector of lymphatic filariasis and *Ae. aegypti* the primary vector of dengue. The National Malaria and Other Vector Borne Disease Control Program is the responsible department for implementing vector surveillance and control, with assistance from other programs of the Ministry of Health and other agencies including WHO, Rotarians Against Malaria, the World Mosquito Program and communities. Long-lasting insecticidal nets, targeted indoor residual spraying and larval source management are all undertaken. Releases of *Wolbachia*-infected *Ae. aegypti* were undertaken previously. To achieve success, vector control efforts in Vanuatu are reliant on: • Availability of funds • Capacity building of program staff • Availability of vector control tools – LLIN, Insecticides, PPE, Spray apparatus, laboratory, entomological apparatus, training, and field collection materials • HR support in each province • Community participation in prevention and treatment seeking • Effective collection and management of vector control data, used in decision making Planned approaches to strengthen vector control include development of a national vector surveillance and control strategy with increased training for IRS spraying and greater engagement of communities at the village level, and operational research to better understand *Aedes* mosquito breeding habitats and insecticide resistance status.
Tanya Russell, JCU, Australia **Aedes Vector Control recommended best practice**	The recommendations for *Aedes* vector control as outlined in the Manual for Surveillance and Control of *Aedes* Vectors in the Pacific were explained in brief with an outline of the purpose and advantage of vector control activities and interventions. Vector control interventions available such as larviciding to target larval source reduction, topical repellents/clothing/insecticide treated nets to minimize mosquito biting, screening houses, indoor/outdoor residual spraying. The efficacy of each control tool can differ depending on the epidemiological scenario and the vector species targeted. Vector control activities may be implemented proactively, undertaken before an outbreak occurs, or reactively, in response to an outbreak. Current guidance supports programs to move towards vector control operations that are focused on sustained proactive activities.
Odwell Muzari, Queensland Health, Australia **Case Study: Invasive species control in Torres Strait**	A presentation on control measures taken by Queensland Health was issued. This reviewed efforts for targeting invasive mosquito species in the Torres Strait, Australia, which has close proximity to Papua New Guinea. The *Aedes albopictus* control program focused on two islands in the Torres: Horn Island and Thursday Island. Control elements included: • Vegetation spraying • Yard inspections and treatment of larval habitats • Adult surveys and larval surveys

	• Community engagement A brief outline of the success of the response to a Dengue outbreak on Erub Island in 2016 was also presented, wherein dengue infected mosquitoes were targeted by spraying forest fringes. • Further information was sought from meeting participants on the sweep net collection process for *Aedes albopictus*. Advantages noted were the ability to cover large areas in a small amount of time with a simple collection method and minimal manpower. Adult sweep net results were indicated as being reliable when compared to immature surveys. However, this method was aimed at the collection of *Ae. albopictus* and may have limited use for *Ae. aegypti* – although this depends on collection locations, and has not been quantified or characterised. Further operational research (or even citizen science) may be useful to gather further data on this collection method for Pacific *Aedes* vector species. • Spraying targeting *Ae. albopictus* was also noted as having a limited impact on *Ae. aegypti* populations, which is expected due to the different habitats and behaviours of these vector species. However, *Ae. albopictus* is noted to be displacing *Ae. aegypti* with distribution of the latter now limited to two islands of the Torres Strait (compared to 90% of the islands previously).
DAY 2: Wednesday 10 May 2023	**Notes**
Tom Burkot, JCU Australia Meeting Opening Welcome and Key Points from Day 1	
Regina Akacich, BES Australia **Improved Data Management and Use**	The presentation included an explanation and demonstration of the Tupaia program, including a Data update and the advantages of electronic data collection. mSupply, an electronic logistics management system, was detailed. mSupply is an end-to-end supply chain software tracking the life span of equipment and supplies. • There were queries on the interoperability and data exchange capabilities between DHIS-2 and Tupaia given that DHIS-2 is used by some PICs. It was clarified that there is now an API for DHIS-2. The list of existing tools will be provided by Beyond Essentials for circulation. • The complexity of data management that ensures all sources and forms of data are consumed for decision-making was emphasized. This underscored the fact that there is no "one-size-fits-all" solution and that the process of identifying options should be driven by the Ministry of Health.
Osiro Lorin, MoH Palau **Data Management in Palau**	An example of data management of mosquito surveillance undertaken in Palau was presented. Two platforms were overviewed: VectorSurv which is a web-based data management and analysis platform used by vector control and public health agencies in some US states and US affiliated Pacific Islands, and Tupaia, the mosquito data database which will generate collected data into the PacMOSSI mosquito surveillance map. • It was emphasized that one of the most useful feature was offline functionality, given the limited internet coverage in many locations in the Pacific. This allows local storage of data and upload to the cloud when connected to the internet later. • Clarification was sought on the function of Tupaia versus Meditrak, and how these combine. It was explained that Meditrak is for data forms, inputs and management, whereas Tupaia provides the front end to consolidate data from multiple sources.
Maxine Whittaker and Maria Castellanos, JCU Australia **Strategic and operational planning for mosquito-borne disease control**	An overview was presented on strategic planning to create a long-term plan defining the vision and mission and deciding on goals and strategies for vector surveillance and control. Also discussed as operational planning for establishing short term goals outlining the day-to-day activities necessary to reach strategic goals. • It was emphasized that countries have different needs and requirements for strategic planning and PacMOSSI consultants are available to assist in meeting the planning needs of countries

	• Countries are well-aware of the key activities, but need support to ensure this is properly documented and used to formulate an evidence-based plan • It was noted that strategies need not be perfect, but should be useful. These can be adapted over time based on the changing situation. • Samoa was used as an example, to highlight the importance of defining strategies, activities, frequency and timelines for priority activities
Fata Paulo Seuseu, MoH Samoa **Strategic plan for Samoa**	The 10-year National Strategic Plan for Samoa – the first Strategic Plan to be developed in Samoa for the Prevention of Mosquito-borne diseases – was presented. This defined processes used in managing vector surveillance and control programming. Samoa has experienced multiple outbreaks of dengue, chikungunya, and Zika in the last 10 years, creating a significant burden on the health system and the population of Samoa. • The presenter thanked the PacMOSSI team for all of their contributions and announced that the Samoa strategy has now been endorsed by the Director-General.
Adam Craig, UQ Australia **Supporting country led Operational Research to improve mosquito-borne disease control**	The PacMOSSI Operational Research (OR) support scheme was described, including what operational research is, the PacMOSSI OR training module, the PacMOSSI OR grants scheme, and opportunities. Example projects for Operational Research small grants were shown. PacMOSSI is offering 5 kick starter grants of $10,000 for small projects led by MoH and 5 substantial grants of $25,000 for larger projects conducted by bigger teams. • There was a query on when the next round of operational research grants will be available to PICs. It was clarified that current work is focusing on getting current grants off the ground, but that countries could discuss further with the PacMOSSI team if interested in support • the prospect of collaborative multicountry OR activity was raised; meeting participants expressed interest and support for the concept
Edgar Pollard, Solomon Islands **Country example of Operational Research project**	A country research example was presented from the Solomon Islands, for a project that aimed to optimize larval rearing for local mosquitoes. • The operational challenge addressed was collecting sufficient adult mosquitoes for various resistance testing. Collection of larval specimens results in higher catch numbers suitable for resistance testing but optimized methods for larval rearing for *Aedes* and *Anopheles* in Solomon Islands has not yet been determined • Therefore, the overarching aim was to determine best field larval rearing techniques rearing larvae to adult stage, and research questions were: 1) What is the best feeding regime (food type & quantity) for larval rearing to produce maximum adults in optimized time? What is the best larval rearing water conditions (larval density/water volume, temperature, water source) to produce maximum adults in optimized time? The data collection approach, sample size, data analysis and data management processes were outlined, in order to serve as an example and provide lessons for other Pacific Island Countries when devising their OR proposals.
Lisa Rigby and Brady McPherson, ADFMIDI, Australia **Mosquito survey in Samoa**	An overview of how, why and where mosquitoes can be used for surveillance of vector-borne diseases was presented. In particular, the utility of molecular Xenomonitoring (MX) was highlighted using an example of monitoring for lymphatic filariasis elimination in Samoa. This involves the use of PCR to detect the presence of infection in mosquitoes, with associated advantages and disadvantages presented. Results from Samoa indicated that MX might be more sensitive than Ag for detecting changes in the short term such as when evaluating interventions like mass drug administration, but that both surveys together provide complementary information to detect the presence of residual transmission. Using both the primary mosquito species and other species increased the sample size and improved the ability to detect transmission and changes in prevalence. MX was identified as potentially useful in certain contexts, such as for: disease surveillance where passive surveillance systems are not effective; early warning for outbreak detection; elimination settings where

	prevalence is low; or, integrating surveillance to optimise resources spent on mosquito surveillance • It was acknowledged that use of the approach presented will not be suitable in all settings and circumstance, but there are specific use cases. • One query was on the application of xenomonitoring for informing program optimization in Samoa. It was clarified that at this stage, the intention of the surveillance system is to track progress of MDA and determine when it can be stopped. In the future, xenomonitoring may be useful to detect residual infections that could assist with the design of responses. There may additional opportunities to determine biting behaviour or vector competence, but this was not within the scope of the current project.
Nicolas Pocquet, Institut Pasteur de Nouvelle-Caledonie, New Caledonia **IPNC Overview**	An overview of medical entomology activities of the Institute Pasteur in New Caledonia was presented. The local context and challenges were presented, including the limits of conventional vector control. Current methods and approaches being used were presented, including : • MALDI-TOF as a tool for mosquito identification • Monitoring to detect levels and mechanisms of insecticide resistance in *Ae. aegypti* • Releases of *Wolbachia*-infected *Ae. aegypti* mosquitoes in Noumea 2020-2023, and possible extension to other New Caledonian cities in 2024 (with long-term monitoring of *Wolbachia* frequency and arbovirus cases to be undertaken). • Evaluation of the entomological situation in Wallis and Futuna, during the 2020-2021 dengue epidemic • Courses in medical entomology (English and French) every two years. Next course is in December 2023. • Opening of a "Vectopole"at the University of New Caledonia planned for 2024, which will include a BSL 1 to 3 with containment insectarium.
Stephan Karl, JCU Australia **PNGIMR/NATNAT Project**	The "NATNAT" initiative to build vector control capacity to reduce malaria transmission in PNG was presented. • Vector control an important component of malaria control in PNG which has 1.2 million malaria cases per year. Approximately 2 million long-lasting insecticidal nets are distributed in PNG annually, but it is unlikely that LLIN distribution alone can address the malaria vector control needs in the country • Efficacy to kill susceptible mosquitoes failed in nets delivered to PNG in 2013 due to a manufacturing change in the net coating formulation. The manufacturing change, involving a change to the coating, was not disclosed and led to inferior performance of long-lasting insecticidal nets in PNG • NATNAT project supported PNGIMR to extend the existing mosquito research laboratory facilities and establishing a semi-field testing site • Priority vector control tools for testing are insecticide treated nets, residual spraying, larval source management and spatial emanators • There was a question regarding whether traditional insecticide products are being tested – or novel products and new generation only. It was clarified that traditional products are also being tested.
Greg Devine, QIMRB Australia **Options for Wolbachia based Aedes control**	Other vector control technologies related to *Wolbachia* were presented. There is demonstrated efficacy of microbial control of human pathogens in adult vectors, using *Wolbachia* for *Aedes* control. Methods used include: • population replacement involving releases of the *Wolbachia* wMel strain (WMP), with a WHO approval of public health value expected in Q3/2023 • population replacement involving releases of *Wolbachia* wAlbB2 strain, which is often used for suppression rather than replacement • population suppression, with other strains under development. In population suppression, male mosquitoes don't bite (one of the foci for community engagement),

	female mosquitoes mate only once (so a single mating event with an incompatible male ends that females reproductive capacity), and efficacy most easily demonstrated in areas with limited immigration. For instance, the Australian government required mosquitoes intended for release to have an Australian genome (including full insecticide susceptibility). This was achieved by simple backcrossing. • QIMRB and UQ led the development and characterization of strain and UQ, CSIRO, JCU and QIMRB led the suppression trial. Results gained with average ratio of 10:1 / 5:1 wAlbB2: WT (or wMel). Suppression was detectable after 4 weeks. There was >80% adult suppression by week 14 (treatment vs control). Suppression lasted into the following season in two landscapes.
Audrey Lenhart, CDC USA **CDC – Overview of Entomology Branch and opportunities for collaboration**	The CDC's Entomology branch was introduced to the audience. The primary focus is on the biology, surveillance and control of malaria vectors, with some additional activity related to vectors of other parasitic diseases and some activity related to *Aedes*. The centre has a world class insectary and research facility. • Operational Research team conducts large scale field trials of novel tools, build evidence base for malaria vector control in the Americas, support operational research • Vector Genetics team is part of the Target Malaria consortium, mosquito cryopreservation and artificial insemination, technical assistance through molecular lab training, expertise in vector population genetics • Insecticide Resistance and Vector Control team develops recommendations for resistance monitoring and management, research on the biology of insecticide resistance, develop novel assays to detect molecular markers of resistance, provide technical assistance on resistance detection and management to global partners • US President's Malaria Initiative (PMI) Entomology team provides PMI entomology leads to support country teams, contribute to PMI technical guidance, provide PMI partners with CDC technical expertise in key areas • There was a query on whether genetic markers could be used for resistance testing. WHO reviewed potential for use of genetic markers for resistance rather than continued reliance on phenotypic tests. Genomic and transcriptomics approaches offer promise. However, given the complexity of mapping markers in multiple vector species and the location-specificity of resistance mechanisms, this may be complicated.
Tanya Russell and Tom Burkot, JCU Australia **PacMOSSI design of upcoming activities**	PacMOSSI goal is to strengthen vector surveillance and control programs of PICs and Timor-Leste, to contain mosquito-borne diseases and improve the well-being of communities. • A survey was conducted to solicit inputs from meeting participants on three areas identified as key priorities for future PacMOSSI initiatives:1. Workforce development, 2. Translation into policy and practice, and 3. Enhanced vector surveillance and control. The rationale for seeking feedback was that in acknowledging the extensive work yet to be done, there is a need to prioritise activities to ensure the needs of the partner countries are met. Key survey outputs were as follows: Workforce development o There was a need for ongoing vector surveillance training o The top priorities for additional future training were: a) *Aedes* control with targeted IRS and outdoor barrier spraying; b) *Aedes* control with larval source management; c) Community engagement and risk communication; and d) Control and surveillance at Points of Entry. o The preferred formats for face-to-face training were: a) in country mentoring, then b) subregional workshops. o The priority options for leadership development were: a) vector control management training, and b) training of the trainers. Translation into policy and practice o The highest priority topics for operational research were: a) the performance of

	different surveillance methods; b) how to best communicate surveillance-based information to decision makers; c) the efficacy of proactive vector control strategies; and d) the most impactful delivery of risk messages to the public. o There is a need for technical assistance to support the updating of national *Aedes* control strategic plans. Enhanced vector surveillance and control o The vector surveillance items with the highest need were: a) BG sentinel traps; b) sweep nets; c) forceps and consumables; d) microscopes; and e) ovitraps. o There was a preference for small grants to enhance vector surveillance activities, and the activities that need the most support were: a) geographic distribution of vectors; b) insecticide resistance; and c) vector investigation in areas with persistent transmission or regular outbreaks. o There was a strong interest in trialling citizen science from the countries. o The vector control items with the highest need were: a) insecticides; and b) IRS back-pack or hand-held sprayers. o There is a need to support electronic data management of vector surveillance and control data.
Feedback on the meeting	General discussions indicated the following: • Options for increasing entomological training, such as for public health or environmental health students, were discussed. At present the bachelor courses at Fiji National University (FNU) have very limited content on public health entomology. SPC have already had discussions with FNU on a standalone certificate that could be taken as part of a bachelors or diploma or as a standalone course. The complexity of embedding material into existing courses was noted, though so too were the opportunities. Participants were supportive that this is an important objective in order to ensure graduates who may work for ministries – such as Environmental Health Officers - are adequately trained in entomology. It was noted that sustainability of curriculum is essential and that it would be useful to further explore options. • There has been good uptake of PacMOSSI online training course material by students from Fiji National University, and it may be useful to formalize this into the curriculum. • It is important to identify any synergies in training, resourcing and implementation of IRS across all relevant vectors (especially to consider *Aedes* in malaria-endemic countries). WHO GMP is producing a global guidance document on IRS (including for *Aedes*) which will be an extension of the current *Anopheles* manual. It would be useful to examine materials developed for *Anopheles* IRS in PNG, Solomon Islands, Vanuatu and Timor-Leste or for *Aedes* from other regions (eg. PAHO) and adapt it for PICs. • A training of trainers on IRS and harbourage spraying would be useful, to ensure that others engaged in spraying during outbreaks (such as private sector) can also be trained by Ministries of Health. • There were discussions on Point of Entry monitoring, including the scope, purpose, approach and alignment with the International Health Regulations. New Caledonia noted that they had detected invasive species but not through Point of Entry monitoring; these were detected when already established away from PoEs. The obligations for cargo dispatch and receipt were discussed in terms of spraying to prevent exit or entry of vector species of concern. The meeting noted that further guidance is needed on Point of Entry monitoring, including an overview of how this has been useful to stop or limit incursions previously in PICs. • Participants indicated that in-country trainings are important, but that these may be able to be conducted through a training-of-trainer model. There was a suggestion to enhance bi-lateral capacity building through mentoring and group trainings between multiple PICs. • Operational grants were not applied for by numerous countries, and barriers to application were noted. Workshops to develop operational grants may be useful to ensure high-quality submissions relevant to PacMOSSI are provided. • The need for further technical assistance for strategy development was noted.

	Development of advocacy, risk communication and communication engagement strategies for vector-borne diseases and vector control has been incorporated into some national plans. It was noted that further guidance and support on planning for these areas would be useful. • Large events with high numbers of incoming travellers can significantly change risk profiles for individuals within PICs due to an influx of population, either coming from endemic countries or returning to areas without transmission and at risk of importation. Clearer guidance is needed on vector control planning in advance of mass gatherings, such as Pacific Island Forum Leaders meetings or Pacific Mini-Games. WHO has mass gathering guidance but this needs to be adapted: https://www.who.int/activities/managing-health-risks-during-mass-gatherings
All participants were thanked for their active engagement and contribution throughout the meeting. Sala Saketa, SPC Fiji closed the meeting with a prayer.	