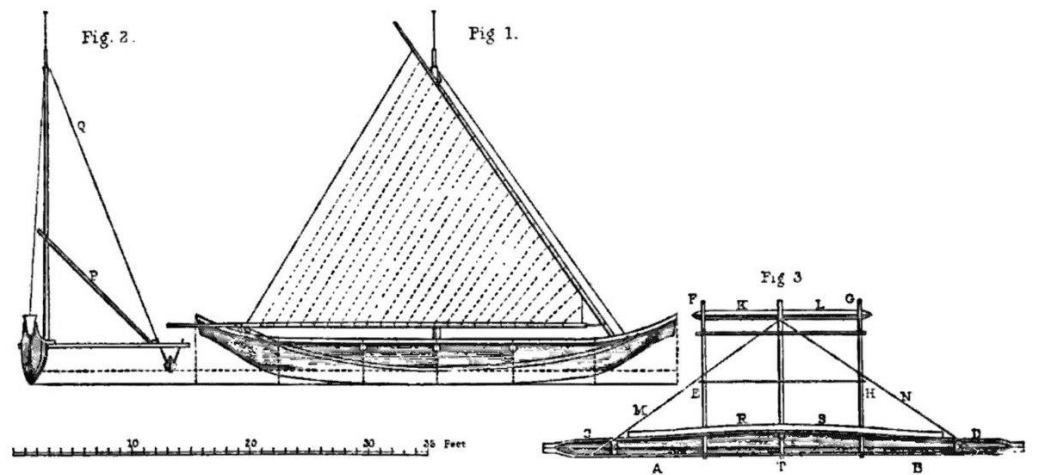


# ANCESTRAL VOYAGING KNOWLEDGE IN OCEANIA – I



*Sir Peirce Brett, Micronesian Proa boat of the  
Ladronne Islands, from Wikimedia Commons*

## Mobilizing indigenous knowledge for People, Ocean, Biodiversity and Climate

**About the paper:**

This paper has been commissioned by the UNESCO Local and Indigenous Knowledge Systems (LINKS) section in cooperation with the Small Island Developing States section, both within the Natural Sciences Sector.

The author, Dr Marianne ‘Mimi’ George is a renowned anthropologist and partner with various voyaging societies and Master navigators in the Pacific Region. She is Director of Pacific Traditions Society and an avid sailor.

This paper is part of a series of three commissioned works and an accompanying powerpoint. These may be found at: <https://en.unesco.org/links> and <https://en.unesco.org/links/transmission/canoe>

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**ACKNOWLEDGEMENTS BY the AUTHOR:**

This paper is not nearly comprehensive in representing AVK, AVK groups, Indigenous voyaging societies, scientists, policy makers, or existing scholarship. All deficits and errors are the fault of the author.

I thank Luke Vaikawi, E.D. of Holau Vaka Taumako Association Trustees, Inc., and Dr. Simon Salopuka, both of whom contributed to the content of this report, as well as the many leaders and representatives of 56 voyaging groups in the appended table. These people expressed what they can offer and what they need, to effectively transmit AVK to their descendants, and to work with voyaging groups who use modern technology, scientists and policy makers. A table with 80 voyaging groups represented includes 24 of these latter voyaging groups. The length and scope limits of this paper does not allow for publishing it herein. Nor does it allow for due

consideration of how these modern technology using groups perpetuate and revive cultural, spiritual, their navigational and networking heritage of ancestral voyaging knowledge and identities. It is hoped that by better distinguishing the two groups more support can be gained for them to begin to work much more closely together in the future.

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## 1. INTRODUCTION

This paper was commissioned by UNESCO with the aim of framing and describing the invisible body of knowledge held by indigenous Pacific Islanders who maintain ocean going voyaging capabilities<sup>1</sup>. The paper provides an historical and contemporary overview of indigenous knowledge of the marine and coastal environment through the lens of traditional navigation and voyaging knowledge, and particularly the ancestral knowledge systems of groups who use that technology as a lifestyle, and strive to teach it to others. The paper articulates how such indigenous knowledge provides important opportunities in achieving sustainable development and responding to contemporary and future challenges. As such, the aim is to provide knowledge holders and policy makers with relevant information to create an enabling environment for the transmission and application of this knowledge in different domains of island life.

The paper emphasises the inherent value of indigenous knowledge in the Pacific and indicates opportunities for transdisciplinary cooperation with science, and outlines opportunities for national and regional enabling policy environments that can support both intergenerational transmission of this knowledge and its application to major developmental challenges faced by the Pacific Small Island Developing States (SIDS) and other Pacific nations. For the purposes of this paper, the emphasis has been placed on developing countries that are considered SIDS by the United Nations.

The cases that are showcased here are knowledge holding communities that still use ancestral technologies in building their vessels and homes, such as making cordages from plant fibers, weaving sails from Pandanus leaves, and using ancestral navigation methods that are not now taught in voyaging societies of more urban, more ‘developed’ societies; that have been practiced in an unbroken chain through the generations rather than having been revived in recent decades after having not been practiced for generation; and that are based on rich systematic knowledge of both the local environment and the pre-colonial interisland networks of their ancestors.

The voyaging heritage of the Pacific holds a vast and relatively unknown knowledge-base about the ocean, its climate and biodiversity, and its relation to the ancestral routes and networks between some 25,000 islands of the Pacific Ocean. This dynamic body of knowledge is referred to herein as Ancestral Voyaging Knowledge (AVK). The knowledge-holders/groups who know these routes and networks, and who practice AVK technology and lifestyle are referred to here as “AVK – based”. This term is used to distinguish them from voyaging groups that use modern designs, materials, methods, and tools in reviving and teaching ancestral voyaging knowledge.

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<sup>1</sup> The ideas and opinions expressed in this paper are those of the authors; they are not necessarily those of UNESCO.

With the start of the UN Decade of Ocean Science for Sustainable Development (2021 – 2030), the UN Decade for Ecosystem Restoration (2021-2030), and the draft inclusion of traditional and indigenous knowledge content in the United Nations Convention on the Law of the Sea on conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction (BBNJ instrument), it is an opportune time to put Pacific traditional voyaging knowledge back in the centre of the actions for generating ocean knowledge, livelihoods and sustainable development.

## **1.1 TRANSDISCIPLINARY COOPERATION**

Over the past few decades, scientists, educators and policy makers have shown greater attention to the value of indigenous knowledge in contributing to our understanding of life on the planet, biological diversity, ecosystems and the changing climate situation. Since the UN Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992, there has been an accelerating uptake of indigenous knowledge in science assessments, prominently demonstrated in the 2019 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Global Assessment. However, most of the attention given to exchanges between scientists and indigenous knowledge holders has focused on terrestrial knowledge of specific regions, with little attention to the marine environment.

Indigenous and local knowledge has gained further recognition in the 2015 Paris Agreement on climate change, which led to the establishment of the Local Communities and Indigenous Peoples Platform (LCIPP). In this recognition pathway, the IPCC 2019 special report on the Ocean and Cryosphere in a Changing Climate makes various references to ILK and indicates that *“Historically, Pacific communities, who depend on marine resources for essential protein...use LK for management systems to determine access to, and closure of, fishing grounds, the latter to respect community deaths, sacred sites, and customary feasts”*.

## **1.2 AVK ORIGINS, SOURCES AND TRANSMISSION**

An astounding oceanic migration began when people sailed away from the Asian continent. Over 50,000BP (years before present) voyagers occupied New Guinea and Australia (Bird, 2019). By 30,000BP voyagers settled Taiwan/China, the Bismarck Archipelago and the main Solomons chain. Foundational searoads into remote Oceania were created as voyagers reached the Marianas in 3,500BP, and Samoa, Tonga, the Carolines by 3,000BP (Pugatch, 2021). By 1,100 to 750BP the outliers of Oceania, Hawaiian Islands, Madagascar, Aotearoa, and Rapanui were occupied (Howe, 2007; Crowe, 2019, Brucato, et alia, 2016). Most of these searoads were less than 400 km long. Some were longer than 4,000 km.

Voyagers observed and utilized unique resources and ecologies of each searoad, island and reef. Seafaring between islands, they created networks of social interactions, alliances and exchanges. The navigators, and farflung settler communities, adapted to local, regional, and planetary conditions, all of which changed through time. Sophisticated knowledge of ocean and island ecologies and inter-island voyaging technologies were proven as people responded to disasters, such as cyclones, tsunamis, volcanic eruptions, droughts, and climate changes.

From the 1500s on European colonizers brought diseases, technologies, economies, laws and policies that suppressed voyaging in the Pacific and subjugated its practitioners. By 1960, formerly robust networks of Pacific voyaging were gone, and communities on remote islands were isolated and unable to help themselves or each other (Howe, 2006; Nuttall, et al. 2022). Those indigenous islander communities who are too remote from urban technologies, or too poor to afford them, still depend on AVK designs, methods and materials for gardening, fishing, house-building, weather forecasting, etc. The diminished practice of inter-island voyaging has inhibited transmission of the depth and complexity of Pacific AVK to next generations.

Through the 1970s to 1990s some elderly expert practitioners of AVK in Kiribati, Central Carolines, the Lau Group, SE Solomons, and Papua New Guinea built vessels and made voyages to reopen languishing seaways. These efforts to revive the seagoing practice of AVK have been heroic, but the new generation of navigators struggle to achieve the level of competence of their teachers, and to reconnect islands and regions of ancestral voyaging networks.

In recent decades sea level rise and stronger, more frequent storms, are forcing people from atolls to flee to higher islands. Pollution from mining, logging, and over-fishing reduces the types of foods available, and increases the need to over-harvest wild resources. AVK contains baseline information about the climate, biodiversity and ocean. This makes it even more important that AVK is transmitted to new generations and applied to the contemporary problems of humanity.

Transmission of AVK now can generate new forms of employment, livelihoods and social cohesion based on the benefits of increased environmental knowledge and for effective marine conservation. For AVK knowledge-holders to make a substantive contribution to sustainable development goals, knowledge of the ocean ecosystem, and promotion of indigenous knowledge of biodiversity and climate, it will require national, regional and international engagement by educators, scientists, and policy-makers. That engagement will enable AVK knowledge holders to transmit place-based and trans-ocean AVK intergenerationally and trans-disciplinarily.

Four primary sources of AVK are :

- i) Women experts in all types of AVK:  
In all locales and regions, indigenous women are primary AVK actors and experts. They are recognised as such in their roles as heroic sources of AVK knowledge in many stories of AVK origins. Women's AVK about navigation is largely unreported. There are rare accounts of living women navigators (Huffer, 2008 and George, 2020) and 19th century reports of women professors in Micronesian navigation schools by ethnographers of the *Sudsee Expeditions*. Both women and men still know highly specific patterns and dynamic models of swells, currents, winds, biota, stars, and weather. Both recognise patterns and know how to respond to cycles and changes in the ocean, animals, plants, and climate. Both are guided by ancestral relationships with oceanic phenomena, and the protocols for knowledge transmission. Some women AVK navigators are alive and well today, though almost all of them are very

old. There are some differences in the roles, circumstances, and unique abilities of women which make them key transmitters of AVK.

- ii) AVK navigators who can make deep-sea voyages on ancient searoads between islands :  
It takes decades of ocean-going apprenticeship to master AVK navigational skills and to develop the intimate and respectful knowledge of oceanic phenomena that define experts of AVK. Navigators know weather and ocean patterns, the animals and plants living along certain routes, the positions in which stars rise and set, and up to 32 named positions wind comes from around the horizon, each of which is linked with particular swell patterns, seasons, and the visibility of oceanic lights (*TeLapa*) that signal the bearing and distance to land over 150 n.m. away. AVK experts know systematic correlations and calibrations between many types of observable phenomena. AVK navigators read the patterns of various phenomena, know how they are inter-related, and maintain respectful relationships with many types of oceanic phenomena.
- iii) AVK inter-island and inter-regional lineages and networks of communication, marriage, and exchange relationships;  
To prevent further AVK loss, AVK experts in the 56 voyaging groups (see Appendix 1) want to 1) transmit AVK to youth, and 2) co-create cross-cultural and cross-disciplinary projects to mitigate effects of climate change and revive biodiversity and traditional social-security networks across Oceania. They can most effectively do so at the same time as they revive inter-island relationships and physical interactions with other indigenous Pacific Islanders. AVK experts normally use what they know and teach it to others When building and sailing AVK vessels, and when sailing along ancient searoads. Voyaging practices require experiential applications of AVK in the context of actual voyages, which trigger sharing and exchange of AVK between responsible persons and communities as a part of inter-island networks. The extensive reach and detailed specificity of AVK networks makes the AVK of preparing for and making voyages the most suitable and available AVK for scientists and policy makers who co-produce knowledge about climate and biodiversity.
- iv) Communities of AVK practitioners in the Western Pacific that are now remote from urban centers and globalized / commercial economies:  
Today, there are only a very small, and rapidly dwindling, number of experts in systems of AVK as applied to navigation. Most experts who can teach the designs, materials, methods, tools, roles, skills, and relationships of AVK navigation reside in remote islands in the western Pacific. Their knowledge of the ocean ecosystem, biodiversity, and climate is foundational to their navigational expertise.

## 2. AVK NAVIGATION SYSTEMS

AVK navigation is a dynamic system, which provides a navigator a range of interrelated methods. These methods are mutually reinforcing—redundant—in that one may be called on to

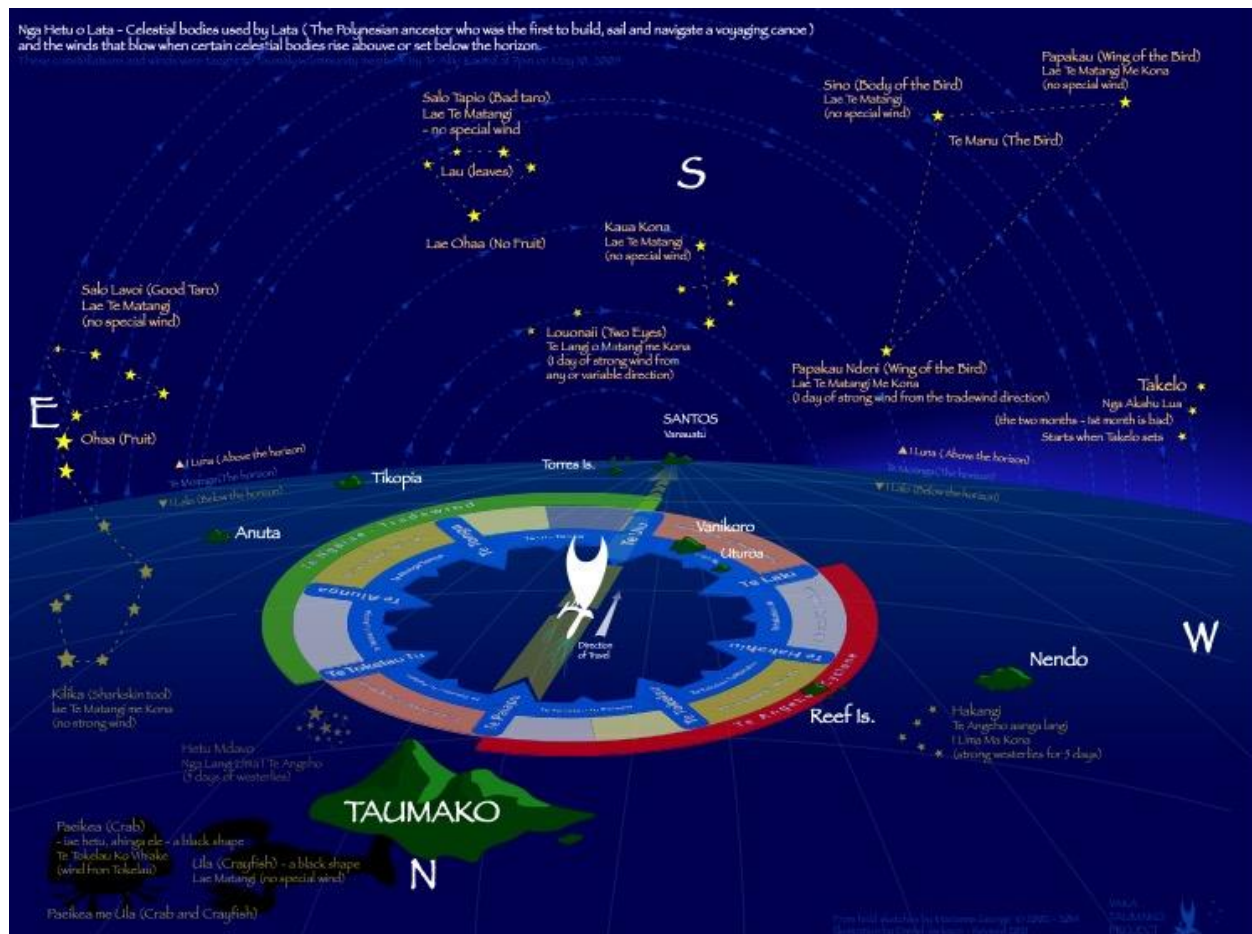
provide back up if one part of the system is not sufficient, e.g if the positions of stars cannot be seen then the patterns of ocean swells can be felt. Parts of the overall body of AVK navigational knowledge can be cross-referenced or substituted.

The systematic complexities and subtleties of AVK navigation systems were “the first to be lost” as practices of AVK voyaging decreased (Lewis:1972:78). Even now it is relatively easy for people to learn discrete navigation methods, such as following a series, or path, of stars that rise and set in the same position around the horizon. People who are otherwise not trained in navigation can learn that pertinent celestial night sky knowledge exists, such as that the zeniths of particular stars are linked with the location of particular islands. However it takes more knowledge and more practice to become skilled in navigating by zenith stars than it takes to follow star paths. Other relevant technical components of AVK are simple to model, but take much seetime and training to learn, such as reading swell patterns.

Competence in certain components of AVK does not provide the safety and redundancy of a complete system of knowledge. Systems of oceanic navigation involve complex inter-relationships of different types of patterned phenomena, which provide alternative and enriching backup methods to the navigator. For example, when celestial bodies are not visible, a navigator can read swell patterns. Furthermore swell patterns and the rise or set of certain stars foretell weather, bird behaviors, visibility of lights that show the way to land, etc. The extensive knowledge built into such relational systems have been described as four systems of ancient navigation knowledge:

- A. *Te NohoAnga Te Matangi* (TNTM) is the ‘wind positioning system’ as taught to Marianne George by Koloso Kaveia of Taumako, Solomon Islands, during 1993-2009. There are many circular images reported across the Pacific that have been called “wind compasses”. Kaveia’s model of TNTM has 32 named wind positions equally spaced around the horizon of the viewer. Each position is linked with patterns of phenomena that are sidereal, calendric/seasonal, weather/meteorological, oceanographic / swell patterns and currents, sea-routes, oceanic lights (including *te lapa*) and behaviors of animals, plants, clouds, etc. TNTM experts know how these patterned phenomena are correlated and calibrated with each other (George, 2012, 2020b). Kaveia regarded TNTM as the Polynesian navigation system that was handed down by his ancestors.





Copyright Vaka Taumako Project of Pacific Traditions Society; Diagram created by Daniel Jackson, based on information provided by Marianne George, based on teachings of Koloso K. Kaveia of Taumako, 1993 - 2008.

Caption: 11 asterisms (celestial bodies, groups, or dark shapes) are shown in this diagram. Each asterism rises and sets in particular wind positions, located at equal distances from each other, around the horizon of the white vessel. The wind positions are positions from which the wind can blow. This diagram shows 16 of the 32 named wind positions in the full system. The sectors between the named wind positions have names that are combinations of the two names on either edge of the sector (as is done in magnetic compasses). The depicted asterisms rise above the horizon in the wind positions of the tradewind season (green arc), and set below the horizon in the wind positions of the Cyclone Season (red arc). The asterisms that are above the horizon are partnered with asterisms below the horizon. Notations by some of the asterisms state weather that occurs when the asterisms rise or set. This diagram illustrates the interrelationship of patterned phenomena in the system named *Te Nohoanga Te Matangi* (TNTM). There are more phenomena and patterns in the TNTM body of knowledge than those illustrated in this diagram.

B. Sidereal systems of Carolinian navigators include a circular array of celestial movements, positions, and relationships linked with weather. Weather knowledge is linked with calendrics/time-keeping, seasons, wind positions, currents, etc. What is commonly called a ‘Sidereal Compass’ is a stick and stone diagram with 28 to 36 positions in which stars rise



and set around the horizon (Gladwin, 2013; Low, 2013; Holton et alia, 2015). There are key sidereal components in both *TNTM* and *Etak* systems.

C. *Etak* is the Carolinian navigation system that divides each inter-island route into 6 sections, each called an *etak*. In this deictic system, the vessel is not thought of as moving. Rather, the navigator is a fixed reference point about whom the islands and ocean move. This modality of navigation is inherently incompatible with a cartographic approach. The latter is land-based, i.e. based on landmarks. On the open ocean, from the perspective of the observer, everything is in motion, except the observer. The navigator perceives and interrelates knowledge of celestial bodies that are reference points for intermediate islands or reference “ghost” islands along the route and other related routes that may become useful if the intended route cannot be followed. Certain types of stormy or good sailing weather occur when certain stars rise or set. *Etak* expertise includes knowledge of wind positions, swell patterns, calendrics, sea states, what the nominal “ghost” islands are for particular routes, and what ancestral signs are seen when a navigator is lost (Gunn, 1980; Akimichi, 1980b). Carolinian voyagers who demonstrated seafaring mastery of *Etak* and the sidereal compass were recognised with in ritual called “*Pwo*.” The *Pwo* ritual expresses codified knowledge that each new generation learns and is responsible to teach to the next (Metzgar, 2006).

D. Swell patterns are a systematic body of knowledge that can be taught with visual models such as diagrams drawn in the sand by Kaveia of Taumako, and ‘stick charts’ created by Marshallese navigators. These mnemonic images represent refracted and reflected swell patterns and how they interact with each other in complex patterns. These models are not maps and are not used at sea. Learning to recognise and use swell patterns is only accomplished with prolonged visual and haptic training at sea. Various swell patterns correlate with position and distance away from island(s), wind strengths and bearings, weather, calendrics, currents, rising and setting positions of celestial bodies (George, 2020b and in press; Genz, 2008). Navigation by swell patterns when celestial bodies are not visible is relied upon by expert navigators of all systems.

AVK is expressed in many cultural forms that expert practitioners know, such as the place names and the characters and themes in oral traditions and dance performances. The names of places identify sea-routes, seasons and stars that are appropriate for certain voyages, type, locations and methods for gardening, fishing, or harvesting sea turtles. The names of reefs tell what is found there, when to go there, and what alignments between there and other islands, or the rising star one should follow. Some land and sea-mark names signal bearings that navigators should align with the rear and front of voyaging vessels. For example, the flowering of the *Crihimahi* plant on Taumako signals the season of *Te Ngatae* Tradewinds (see illustration) and of ritual events and performances that are made, and voyages occur because winds blow from particular positions fitting to the season. Names also tell what a navigation sign feels like, such as the swell named *Te Poroporo*, because it causes a navigator to feel like tripping forward when the vessel meets short swells which are reflected from an island. Names and stories tell voyagers what a particular part of a seaway feels like.

Oral traditions are performed at appropriate times, such as bedtime, during a particular season, a ritual, when certain stars are important to observe, or when one is planning a garden. Chants, songs, poems, dances, and shapes, carvings and lashings on vessels contain information and instructions about how to build, sail, and navigate. Imagery, such as the images of carvings that the mast is stepped into, and the images of particular lashings, are characters in stories and art forms. Plot twists and trickster behaviors present problems that may be encountered, and offer possible solutions to the problems.

### 3. INTERGENERATIONAL TRANSMISSION

Social and economic changes mean that today there are very few opportunities for experiential learning, because most children spend long days in school, and few schools have managed to connect AVK and marine knowledge with the formal curriculum. Many adults must leave their islands for years to earn an income, and whole families migrate to cities. It is most urgent that the remaining, aging, masters of AVK are able to train youths in relevant island and marine environments. The old generation of experts are passing on and children are losing the opportunity to learn from them, while plants, animals, land and ocean resources are being lost. These elders are living human treasures and support to them is critical for intergenerational transmission.

Many AVK experts are now willing to teach outside their former circle, creating new opportunities for intensive training of youth. It is now possible to develop school curricula and lesson plans for formal and informal teaching of experiential AVK. The key subjects are:

- Sail-training at sea, which requires frequent observations of marine ecosystems both on reefs and offshore. Doing this without engines does not scare away animals or harm the environment. It also trains students to be in a cooperative and caring relationship with marine biota and other phenomena;
- Navigation of inter-island AVK voyaging routes, which involves awareness of similar and different marine phenomena and biota at different islands;
- Reconstitution of inter-island AVK partnerships and networks which attend to mutual sustainability and resiliency, and which work together to maintain biodiversity and a healthy ocean.

AVK teaching programmes require inter-island and multi-stakeholder co-creation of:

- Building, sailing, and navigation of AVK vessels, including AVK group collaborations to assist in knowledge recovery in communities where it was lost, and sharing of resources with communities in need.;
- Documentation and archiving of AVK biodiversity knowledge suitable by each AVK group and by AVK networks;
- Programmes teaching AVK skills, roles, and steps for re-establishing inter-island networks, and how to overcome maritime and education law and policy obstacles;
- Programmes in which scientists use AVK methods and protocols to survey and manage diverse plants, animals, and resources of key island, reef and ocean area;
- Schools start or expand AVK voyaging programmes in which AVK experts teach children, in school

- Communities and NGOs start or expand AVK voyaging programmes in which AVK experts teach children, youths, and school-leavers;
- Health experts start or support AVK voyaging programmes for children and youths, either as therapy for youths who are distressed or depressed, or as cultural pride and community-building programmes for unemployed and at-risk youth;
- Negotiations occur between AVK experts and groups who define themselves as guardians of inter-regional resources, so that AVK of pelagic fish, migrating birds, and trans-Pacific searoads could be applied to all the above programmes.

Investing in AVK becomes a medium for mobilizing multiple evidence-based knowledge for decision-making and strengthening national science capacity. AVK has intrinsic value for Pacific communities and indigenous peoples; simultaneously it has the potential to strengthen Pacific knowledge mobilization and the promotion of scientific capacity that draws on the unique knowledge systems in the region. Actions to promote AVK in schools, such as promoting natural sciences amongst girls and boys in the Pacific region, and stimulating transdisciplinary knowledge cooperation in environmental assessments, align with the objectives and goals found in the SDGs, as part of the 2030 Agenda for Sustainable Development. These actions also align with the SIDS Accelerated Modalities of Action (SAMOA) Pathway, as well as with specific multilateral environmental agreements. International instruments, including the UNFCCC Paris Agreement, the Convention on Biological Diversity, the IPBES assessments, all now include components on indigenous and local knowledge, which are likely to be included also in the Biodiversity Beyond National Jurisdiction (BBNJ) agreement.

#### **4. TRANSDISCIPLINARY CO-PRODUCTION**

With the increase in attention to indigenous and local knowledge (ILK) within climate and environmental assessments, there is growing interest in co-production of knowledge through a creative transdisciplinary cooperation amongst indigenous peoples, local communities and scientists. This is the case with IPBES, and particularly the 2019 Global Assessment on Biodiversity and Ecosystem Services. This has created impetus for transdisciplinary experimentation and learning. Though accomplishing this is theoretically possible and potentially rewarding, co-production from different systems of knowledge requires a clear methodology, good relationships, a legal framework on intellectual property and free prior and informed consent. Below are guidelines and foci for co-production efforts in the Pacific Region.

- Traditional knowledge holders seek to be in the centre of efforts to revitalize AVK, and in dialogues between science and environmental conservationists. Custodians of AVK at each island and region should be approached with proposals that are compatible and consistent with their traditional and cultural methods for teaching endangered voyaging knowledge and skills. In this way the AVK can be engaged with for purposes which directly benefit indigenous communities. Such an approach empowers the holders of the traditional knowledge and builds trust relationships and ongoing cooperation between them and policy makers, scientists, and environmentalists.
- Indigenous knowledge intrinsically follows complex protocols interlinked to social and cultural parameters, and should not be isolated from its own context. Ethical and

methodological considerations can improve the long-term success of transdisciplinary cooperation and the revitalization of AVK.

- Ancestral protocols, skills and knowledge, and active relationships between islands and island groups, are essential to survival in remote communities of Oceania. Inter-island and regional coordination are required for success of all programs to protect and revive biodiversity on each island, reef, and oceanic region. Local communities cannot survive or co-produce in isolation. Networks of local communities provide the framework of AVK that is a firm foundation for transdisciplinary co-production. Scientific and educational proposals and programmes that have inter-island, regional and/or trans-Pacific scope are supportive to re-establishing or maintaining networks that provide security to people, biota, and the environment.
- Environmental awareness programs that include AVK are known to speed the elimination of harmful practices such as use of one-time plastics and reliance on industrialized foods that induce diabetes, heart disease and other conditions that take knowledgeable elders from their communities. Re-starting AVK management protocols requires negotiation, collaboration, and coordination between people of various islands and regions. Transport and communications are needed for transdisciplinary work to mobilize between islands. Efforts to prevent rampant pirating of sea products, destructive logging and mining practices, are urgently needed.

#### **4.1 COMMUNICATION TO SUPPORT AVK: Meetings, Conferences and Social Media**

Access to communication is required to create and launch inter-island cooperation and co-production. Penultimate research and policy reports must be reviewed by all the AVK communities that cooperated with or supported the research or presentations. Final reports must be provided promptly to AVK communities. Follow-up actions and schedules must be included in the project creation, planning and commitments.

Face-to-face meetings, discussions and agreements on site are irreplaceable. Yet, programmes can be carried out when adequate internet communications are established with remote islands of AVK groups. Text communicating devices increase safety and tracking, but are not sufficient for initiating agreements, exchanging documents, or working on research or programme problems. AVK experts need access to communications with outside partners during project co-creation, execution, conclusions, and followup. Efficient two-way communications during the entire process provides the foundation for rich and uncontested data gathering and results from AVK-involved projects.

Scientific research meetings and policy dialogues should include AVK experts as content presenters and research colleagues rather than as entertaining cultural performers. A few examples of transdisciplinary meetings with AVK presenters are:

- Scientists and AVK experts working closely in annual conferences of the Association of Social Anthropology in Oceania (ASAO). In recent years ASAO has paid the travel costs of 10 to 20 indigenous Pacific scholars so that they can present at ASAO conferences. These indigenous scholars also have top leadership positions in ASAO.

- The 2014 Sustainable Sea Transport Talanoa in Fiji, sponsored dozens of non-academically defined AVK experts and groups to co-conference with scientists, policy makers, and academics, as well as with indigenous participants in their own disciplines. (<https://www.fijitimes.com/ocean-transport-talanoa/>).
- The 2017 Ocean of Knowledge conference at University of California at Irvine, United States, was organised as an interdisciplinary gathering. AVK experts were sponsored, and all presentations and conferencing occurred in one venue, (<http://simonpenny.net/OK/>) where academics and AVK experts were co-presenters.

Social media are useful for sharing news, information and events. Many island communities have very limited or no internet capacity. They require both technology that works with low band width and access a fast enough Wi-Fi connection for uploading and downloading documents. Low-data platforms like Facebook are relied upon by many AVK voyaging groups, and AVK researchers have already been relying on low-data platforms to co-create knowledge and engage in scientific and educational cooperation. Examples of this range from ongoing research and documentation of ancient cultural astronomy by Martha Noyes of Hawaii and Piripi Lambert of Aotearoa, and educational voyaging program development by many groups ranging from the Vaka Taumako Project and Holau Vaka Taumako Association, to Waan Ailan Majeel, 500 Sails, and Drua Sailing Experience.

## 4.2 ONLINE EDUCATIONAL RESOURCES

UNESCO, in collaboration with Pacific partners and AVK knowledge holders, initiated an online compendium of multimedia educational resources on AVK and the Pacific heritage of the canoe, available on [The Canoe is The People](#) (TCITP) website. The online materials, a teacher's resource pack, available in English and Māori, was produced with the aim to showcase AVK of all Oceania and encourage schools and AVK experts to avail themselves of the resources and to stimulate teaching, learning and exchanges.

Since its inception decades ago, the TCITP project has stood as a unique and much needed resource. The online TCITP material contains a limited range of AVK content relative to the entire Oceania region. The TCITP initial resources have been well received and used in several countries, though overall, the site content needs substantive updates and revisions. The site needs to be made accessible to people with little access to the Internet and who cannot afford to pay for enough data to look through the site. All the content needs to be migrated to a more interactive platform.

Currently, no funds have been identified for upgrading the website and teaching materials; a resource mobilization strategy needs to be developed with the relevant stakeholders to reach out to potential donors.

For TCITP to reach its objectives of covering the full range of Oceania AVK, the following rearrangements should be ensured:

- The content provided by each navigator or AVK group be clearly identified as representing that particular navigator or AVK group.

- A diversity of all AVK navigators, or schools of AVK be represented, as well as a systematic web of knowledge that covers the whole Pacific region.
- AVK experts acquire direct input into the actual online presentation of their knowledge, and be able to access it in low connectivity conditions. The website content needs further expert investment to identify which AVK represents local, regional and/or universal AVK.
- A platform is needed for development of ongoing and proposed AVK research and education projects. One example is voluntary co-creation of a map and listing of ancient sea routes of Oceania (including the full span of Austronesian vessels and pre-historical voyaging routes), and the relationships, sharing, and exchanges of resources that these routes and networks made possible and that proposed research would make possible.
- An archive of living AVK for documentation of the AVK being practiced within a vast network of Pacific communities (see part c Policy Brief of this UNESCO assignment).
- Addition of an interactive blog to the site to meet the great need for AVK experts, and a trans-disciplinary (AVK experts, scientists, environmentalists, policy-makers) information exchange (mutually voluntary, mediated, blog), that would support inter-group contacts and communications.

AVK holders and collaborative partners such as UNESCO have invested resources on the TCITP, and most of these resources have been made available online. With further improvements, as noted above, the TCITP is uniquely positioned and has great potential to become a primary tool for knowledge transmission. In doing so, TCITP could demonstrate best practices and exemplary practices of co-production of knowledge about the ocean, biodiversity and climate change between AVK experts, scientists, and policy makers.



### 4.3 ETHICAL AND EXPERIENTIAL ENGAGEMENT

Transmission of AVK requires ethical engagement with navigational phenomena and indigenous value systems. Navigational concepts and rules require that people, ocean, sky, land are treated as ancestors. Fish, birds, and swells are relatives, who embody knowledge of interactive relationships between themselves, and between them and people. The patterns and relationships of AVK science are experientially felt and learned, rather than worked out on paper or in a lab. Learning skills thus include haptic perceptions and respectful interactions with phenomenal signs, like rainbows, currents, squalls, birds, twinkling stars, and *te lapa* – flashes of light that emanate from land into the deep sea and show the way to land.

AVK knowledge is held by people as they see, hear, smell, touch, and know things spiritually. People use that knowledge to navigate, and relate to every phenomenon as a person with an internal knowledge capacity of its own. Pacific youth are still passionate about learning ancient navigation skills. However the knowledge can only be gained by establishing respectful relationships with ancestral phenomena and people of other islands. The learning and the proof of competence, occurs when AVK vessels sail the searoads between islands, and appropriate relationships are forged and maintained.

### 4.4 CO-CREATION INITIATIVES

Books and papers have shown the value of creating understandings, agreements and planning on equal terms before programmes and research projects are initiated, The following are examples of Pacific co-production initiatives.

- A. Twenty years of inter-generational AVK transmission, and written and film productions about that AVK transmission were co-created under the auspices of the Vaka Taumako Project (VTP) of Pacific Traditions Society (PTS). From 2014 – 2020 these programmes were co-created under the auspices of the charitable NGO, Vaka Taumako Project of Solomon Islands/Vaka Valo Association. Since July, 2021 PTS has worked with the Holau Vaka Taumako Association (HVTA), a new charitable NGO of Taumako community, to achieve the same goals but with greater community inclusion and administrative capacity than was possible heretofore.

The project was created according to the fully formed idea of Master Navigator and Paramount Chief of Taumako, Koloso Kaveia. He asked Marianne George, an anthropologist and sailor, to help by acquiring a permit for the project from the Solomon Islands Ministry of Education. The Ministry recommended that the application come from the USA-based charitable organization, PTS, because Taumako had no academic, administrative or fundraising capacity. Kaveia and George were co-leaders, though George's role required her to be supportive, as "a partner from the outside," which was a traditional relationship between those who gave and fulfilled 'orders' for *TePuke* to be built and delivered, and for voyages to be taken.

The project aim was, and still is, for elderly experts to train a new generation to build vessels and navigate between distant islands using only ancient designs, materials, methods, and tools. Kaveia also asked George help to document his knowledge, and correct and elaborate on the navigation methods that David Lewis reported in the book *We, the Navigators*, particularly as regards *Te Nohoanga Te Matangi* – an ancestral Polynesian wind positioning system of navigation. Kaveia asked for video documentation, and for training for young Taumakoans to learn to use cameras and make films about their voyaging culture. Kaveia also asked for help to make international cultural exchanges and voyages so that Taumako youth could meet outsiders, and ancient partnerships and networks could be re-established throughout Oceania.

PTS did fund-raise for educational programs, and for chartering and capacity building of Taumako charitable organisations. Since 1998 Taumako voyaging experts and students have made 6 ocean-going vessels and 17 inter-island voyages. Many academic and popular articles were published, and two documentary feature films were made. Many cultural exchanges were produced in which Taumako voyaging leaders, crew, and video students went to Hawaiian Islands, Tahiti, Fiji, Vanuatu, Taiwan/China, the Pacific Northwest, and Australia.

- B. Another lengthy effort has been the revival of sea-roads of Micronesia, and the education of youth in ancient voyaging skills that have depended on Federated States of Micronesia (of Yap, Chuuk, Pohnpei, and Kosrae States) navigational practitioners (Metzgar, 2006). For these AVK expert navigators to transmit what they know to youths requires many voyages within and without the Central Carolines. The latest major effort was in 2016, when several crews successfully sailed from Carolines to Guam for the FestPac (Festival of Pacific Arts). The arrival of long-distance voyagers was the crowning event of the gathering. One problem the voyagers had was that the time of the festival was suddenly changed so that voyagers had to sail at a time of bad winds that were difficult and dangerous. FestPac and other Pacific gatherings could provide more attention to creating safe conditions and adequate support for the voyaging groups with most AVK to participate. The few remaining expert AVK navigators and their communities are severely under-resourced for a lot of what they do. AVK voyaging groups are trying to re-establish networks and apply their AVK to all scientific and policy solutions. They can succeed and be helpful when they are fully co-creating partners.
- C. During the last decade revival of construction of Drua vessels, and the unfunded 2020 *Home-coming Voyage* of Drua Experience, were accomplished (Drua Experience page, Facebook). Drua Experience crews learned from AVK experts in Lau Group, and made plans for transmitting the knowledge inter-generationally. Now, the reformed charitable NGO, Drua Sailing Experience, and community schools and cultural groups, are seeking support for more trans-Fiji voyages to revive transmission of AVK. Drua Sailing Experience is negotiating with maritime authorities to reduce and adjust the regulations and costs that are based on big ship and merchant marine standards. When these are recalibrated, and more costs of maritime operations are supported, traditional vessels will be able to make more voyages.

- D. The Amis Tribal People voyaging group Fara`ngaw, initiated the *Fayan* project—to “Restore the Bamboo Boat of Indigenous Fara`ngaw Nation of Austronesian Taiwan/China” under the auspices of the Association of Austronesian Community Colleges, National Taitung University, Luminous Hotel, Ocean Taiwan Foundation, and Taiwan Indigenous Conserved Territories Union. Five Taumako AVK experts were brought to Taiwan (province of China) to demonstrate and teach Fara`ngaw members how to make cordages, make lashings for a new bamboo raft, weave and create a Pandanus sail for the vessel, rig it and make trials sails in the ocean. First, they had to teach them how to swim. This project helped Fara`ngaw learn basic skills needed to sail safely in the ocean. The group is now preparing for an offshore voyage to Green Island in 2021.
- E. A survey of Breadfruit varieties was conducted by Dr. Simon Salopuka and Taumako colleagues with support of the Breadfruit Institute of the National Tropical Botanical Garden (of USA). In this project Dr. Salopuka, *et alia*, documented 76 distinct cultivars growing on the tiny island of Taumako, in Solomon Islands, including the name of each type, its origins, how it grows, how to maintain it, and how to prepare its wood, roots, sap, leaves, etc. for culinary and/or medicinal uses, for building vessels, etc. Dr. Salopuka wants to continue researching varieties that grow on other islands in the SE Solomons region. The Breadfruit Institute has undertaken this work in many countries, but the profusion of cultivars in the SE Solomon Islands is a cornerstone of their work (Salopuka, 2018). Leaders of the *Holau Vaka Taumako Association* (HVTa) now seek support for youth to work with AVK experts to identify and protect many different types of plants and marine resources used for building the different parts of the traditional voyaging vessel of SE Solomons region known as *TePuke* and *TeAlo*.
- F. Experts from the Vaka Taumako Projects (of both PTS and HVTa) and others have well begun retrospective efforts to correct misrepresentations of AVK in various institutions and papers. An example of this is ongoing efforts of PTS and Taumako AVK experts to correct misrepresentations of the types of Taumako vessels in print and museums, and an on-going project updating the names of hundreds of parts and materials used in construction of the biggest Taumako vessel, the *TePuke*. Another example is the 2015 paper by a few social scientists and a few AVK experts (Holton, *et alia*, 2015) entitled “East is Not a Big Bird: The Etymology of the Star Altair in the Carolinean Sidereal Compass.” In this paper, Carolinean authors correct Thomas Gladwin’s mistaken identification of Altair as the star called (in English) “Big Bird” (in his 1970 book *East is a Big Bird: Navigation and Logic on Puluwat Atoll*). This article was written in collaboration with academics and scientists after 45 years of mis-identification by academic researchers.
- G. The award-winning “Tupaia’s Endeavor” research project and article of Lars and Swartz (2019), resulted from their engagement with Tahitian, Māori, and other Polynesian scholars and AVK experts, to consider what navigational knowledge Tupaia had tried to convey to Captain Cook’s Botanist / Science Director, Joseph Banks, and junior officers. As they made maps representing over 70 islands (of the 130) that Tupaia informed them about the existence of, and sequences of islands that may have been identified and ordered according to sea-roads that afforded best navigation routes for seasons, resources and ecologies, inter-island relationships for sharing, etc.

## 5. SKILLS AND ROLES OF AVK EXPERTS

It has oft been written that “the last navigator died,” implying that the navigational AVK can never be fully revived or recovered. And yet, those who no longer have an AVK expert at home are learning skills from people of other areas. Also, knowledge from other applications of their knowledge system can be utilized for navigational practices. Much of the same AVK that is used in navigation is also applied in gardening, fishing, wild-crafting, forestry, weather forecasting, calendrics and time-telling. Navigational AVK is also recounted in a range of intangible heritage practices including oral traditions, music, dance, poetry, place names, etc. Important foundations of technology and skills of ocean navigation are described and used in other AVK disciplines. Therefore, practitioners of those applications of AVK were, and still are, a source of information, and models, as well as knowledge methodologies, for the revival of remote ocean navigation by subsequent generations.

AVK disciplines, skills and roles that AVK experts can teach include:

- Culture-hero stories, such as Lata the first voyager, and ‘star stories’ of Polynesian oral tradition. In those stories, listeners learn who, or what phenomenon, does what, how, when, where, with whom, and with what results.
- Identities, collaborations and agreements between matrilineal and patrilineal groups aligned with sky land, reef, and ocean phenomena / entities that provide climate, energy, food.
- Ancient knowledge interactions and relationships between island communities, and between them and colonial regimes, and governments that enforce global laws and policies.
- Ancient inter-island routes, partnerships, and networks of people and resources that were managed, shared, and exchanged before voyaging was stopped by colonization, and additionally, those very few routes and relationships that have been perpetuated or revived in recent decades.
- Models of systematic knowledge that explains inter-relationships between patterns of ocean, sky, island, and (other) ancestral phenomena.
- Movements of celestial bodies - relationships between rises, sets, nadirs, zeniths of celestial bodies with weather, seasons, wind, currents, animals, plants, swells, and lights.
- Knowledge of specific varieties and uses of plants, animals, stones, water, and other resources.
- Plant medicines and emergency foods, such as foods for lactating mothers, or fermented and dried foods that are good voyaging foods and also can be used during and after cyclones.
- Clearing, planting and tending of gardens and management of wild foods including those gathered on reefs and at sea.
- Harvesting and preparation of foods for workers when vessel construction, maturation rituals, and other work is done collaboratively.
- Production of cordages from coconut fiber, bark, vines, and grasses, such as those that are used in vessel and house construction, to haft adzes and make bows, slingshots, fishing nets and kites, etc.

- Lashing patterns and methods that are used in vessel and home construction, to make tools, etc.
- Lofting, weaving, sewing, rigging of sails, as multistage process involving labor of women, men, and children.
- Carving/shaping/creating vessel parts with adzes of various types and using many different techniques that are suitable for each part and each material according to growth patterns and structural qualities of different trees used for specific parts of the craft.
- Roles and commitments of crew members needed at sea and at other islands as modeled in oral traditions and taught according to one's level of experience at sea.
- Conditions and arrangements required for departure on a voyage, such as departing an island only when all affairs are settled and there is no rancor, and there is an understanding with people of the destination island that a visiting crew will be welcomed.
- What to bring to sea, such as spare equipment, tools, crew foods, gifts, and items to trade.
- How to load and balance vessels, for stability and safety of crew and cargo.
- How to sail in various conditions, including what to do in storms and emergencies, such as filling the hull with water, or reinforcing some structures. Also how to recover from, or deal with capsize, and how to repair storm damage.
- Which inter-island or teaching routes require what winds, seas, timing, signs, and conditions, the strategies and protocols for sailing on the routes; and relationships and networks between people of the islands and reefs.
- How to engage in respectful and helpful relationships with ancestral phenomena, such as calling for the wind to come from a certain position, calling for rain, or making dangerous waves lie down. The protocols involve expressions of gratitude to ancestors, and requests to send signs of how to reach land.
- Navigation by wind, swell, and sidereal patterns, seasons, routes, natural lights at sea, such as rainbows, lightening, and *Te Lapa*.
- Weather prediction and modification, including observations, prayers, materials, actions.
- Chants, songs, dances, poems, and rituals for occasions in the voyaging life.
- Protocols for marriages and partnerships with people of other islands.
- Maturation rights, gifting, and other normal relationship and interisland protocols.
- How to make agreements, keep relationships happy, reconcile differences and solve problems within crews, families, communities, strangers.
- How to raise children to be comfortable with the ocean and know the feelings and skills and roles of ocean life.
- How to interest small children by showing them how to make models and sail them.

## 6. RECOMMENDATIONS FOR TRANSMISSION, CO-CREATION AND CO PRODUCTION

There are many opportunities to use AVK to revive endangered species, reduce drivers of climate change, and make island life sustainable again. Key to success is revival of systematic AVK navigational practice, and reinstatement of the ancestral networks that undergird sustainable and resilient life in the Pacific and our oceanic planet. In general, AVK experts can direct scientific attention to ocean processes and patterns of phenomena that are local, regional,

and trans-oceanic, and that are changing or staying the same, as well as relationships between the patterns.

The following are recommendations for transdisciplinary co-creations and co-productions that would utilize and mobilize this valuable yet fragile body of human knowledge:

- Build capacity of voyaging schools and programs of those few groups who have the most AVK skills and can teach them. The AVK of women and navigational experts are the least reported. The AVK experts aligned with AVK groups in Appendix A. can teach others the skills that have been lost by most. To co-create the experts and the groups they work in need access to:
  - ✓ communications between communities on-island, between islands, regionally, and internationally
  - ✓ AVK vessels and support vessels as required for, or in lieu of, AVK vessels
  - ✓ Accommodations (spaces) for experiential teaching of youth at sea.
  - ✓ Capacity building of voyaging groups that aim to perpetuate and revive knowledge and have rare AVK skills to offer and need to relearn others from experts.

Other useful activities could include the following:

- Establish an international union of traditional seafarers of indigenous Pacific communities to gather and share AVK knowledge. As discussed at every meeting of voyaging societies, such as the canoe summit in Yap 2017, and the 2016 FestPac in Guam when dates were changed suddenly and voyaging crews were forced to sail in dangerous conditions
- Support ocean-going educational voyaging programs between voyaging groups. Inter-island voyages are the only way that AVK navigation can be taught. Critical island/ocean knowledge and life-skills cannot be learned in classrooms.
- Create experiential learning programs in school, with curricula to train children and youths to build, sail, and maintain small sailing boats, with AVK experts teaching the programmes.
- Support planning for voyaging group AVK experts to work with educators to co-create and co-teach curricula for inter-island school programs, with AVK experts teaching the programmes.
- School educators and AVK experts co-create and plan how to train out-of-school and at-risk youths to build and sail small, traditionally designed, outrigger vessels, with AVK experts teaching the programmes.
- Extend support for teaching by experts of AVK (including Intangible Cultural Heritage (ICH)) to indigenous people of mixed ethnic and cultural backgrounds, and particularly to those who migrated to urban areas for employments, education, because of rising sea levels. These youth seek opportunities to learn AVK and to work with scientists and educators. They require spaces in their urban and unfamiliar communities to interact. They need communications and logistic support to bring AVK materials to their urban locations, salary for coordinators and AVK Teachers, and office space to coordinate programs.
- Establish annual workshops to evaluate, update, and revise curricula of AVK programmes.



- Make all voyaging education programs equally available, and supportive, to all genders. Each AVK group decides how to do this appropriately. For discussion of transmission of AVK roles and skills of women, see “The Role of Women’s Ancestral Voyaging Knowledge (AVK)” in George, 2021a.
- Create a research programme to document and revive women’s navigational traditions and leadership roles in AVK schools of the Pacific.
- Create programmes for AVK experts to help youths to conduct surveys and create programmes of appropriate use and protection for plants, animals, and other resources of the ocean, reefs and islands.
- Policy-makers, scientists and AVK experts work together to make policies that:
  - \*stop pollution that harms plants, animals, weather, and ocean ancestors, and assist populations of declining and endangered species, of plants, animals, water quality, weather creation zones, forests, beaches, sea-beds, etc
  - \*change policies and laws that hinder perpetuation or revival of interisland voyaging and reformation of sustainability and resiliency-enhancing networks, including assistance for AVK experts for costs of acquiring passports, visas, permits, and clearances by maritime authorities, Immigration, Customs, and Biosecurity, and
  - \*facilitate or provide escort vessels that are required for AVK vessels, and basic communications capacities to bring safety, coordination, educational, economic and jobs enterprises and emergency services to remote island communities and voyagers traveling between outer islands, and to enable co-creation with scientists and policy makers
- Co-create educational seafaring programs for both urban and remote community youths, including small sailing vessels (dinghies) of traditional or hybrid designs and uses of them for traditional activities that advance a culture of sustainability, resiliency, and biodiversity.
- Document AVK learning and execution, including: video interviews with experts and guardians, indigenous names and photo record of each item, names of locations, how to use them, relationships between the items and people, how to maintain, manage, and share them, and what management capacities are needed to succeed.
- Expand the *Canoe Is The People* online resources to serve as an AVK reference platform that can contribute to the UN Ocean Decade on Ocean Science, the UN Decade on Ecosystem restoration, BBNJ implementation, and other relevant global environmental agreements.

## 7. CONCLUSION: Ways Forward

We live at a time when we need to understand our planet better and recognise those ways of living that align with the capacity and abundance of shared ecosystems. Historically, indigenous knowledge has been devalued and is now at risk. This paper provides insights into the richness of the ancestral knowledge systems of Pacific peoples and their relevance for sustainable development, improved livelihoods and education.

The paper reflects on tangible and intangible heritage which unites the entire Pacific region. AVK is not just about knowledge, it is also about values, about community and about good neighborliness. It is important for men and women, for elders and youth, and for scientists and policy-makers, to understand and embrace the value of AVK to substantially transform the future of the Pacific Small Island Developing States and other nations in the region.

In early stages of oceanic settlement, and for millennia, voyaging peoples of the Pacific relied on their traditional knowledge to survive and make challenging territories home. With this knowledge, not only were they able to build efficient and technically complex vessels to safely navigate the ocean, but also to interpret and engage with their oceanic environment, from celestial bodies to ocean streams, to guide them in their journeys. Now that ancestral voyaging knowledge is key to sustainable and resilient life for Pacific peoples, but also for all people and life forms on our oceanic planet.

The skills and roles of AVK experts are outlined in section 5, and specific recommendations are outlined in section 6. These were compiled from the explanations and reports of groups for whom AVK expertise is of paramount importance, and from the AVK experts of these groups who aim to transmit their knowledge to the next generation. Both the AVK experts and their students aim to work with scientists and educators to apply AVK to solving the problems they face (and we all face) now.

Indigenous peoples of the Pacific adapted to local conditions, and built a web of inter-island networks which enabled them to ensure their livelihoods and develop a rich socio-cultural life. AVK still gives indigenous islanders the capacity for resilience, connection, and openness to the outside world. However, AVK transmission and applications have been eroding with non-indigenous approaches to the problems. To avoid further degradation the AVK experts and their partners seek to initiate collaborative actions to transmit this knowledge to new generations through formal and informal education, gender and intergenerational interactions, and inter-islands cooperation.

When we create conditions and programmes that enable AVK experts to transmit AVK inter-generationally, the AVK experts and their students can also co-create programmes with scientists, educators, and policy-makers. The synergy of such programmes would allow a new generation of youth to effectively access AVK and would also deploy the extensive and systematic body of AVK in research and programmes that advance biodiversity, and ocean sustainability.

This is a model for transdisciplinary co-production of knowledge based on the understanding that reinstatement and expansion of trans-Pacific connections of AVK knowledge-holders (especially from remote islands of the Western Pacific) is needed to allow ILK holders to be an integral part of development projects, decision-making and policy instruments. The increasing recognition of ILK in global environmental processes and assessments, such as the UNFCCC Paris Agreement, IPCC reports, IPBES assessments, among others, allow their voices to be heard, and their agency to be activated as essential partners, in the areas of climate, ocean science and biodiversity.

## APPENDIX 1

### Pacific Island Voyaging Societies (2021)

This spreadsheet lists 56 Pacific voyaging groups whose central focus is maintenance or revival of AVK. As of April 2021, each group has experts who can teach the AVK that is missing in urban-originated groups that have had to depend on more modern technology and knowledge. Another spreadsheet is available that has 80 voyaging groups, including both the AVK-based groups and those that use modern technology but have members who want to learn AVK. This more comprehensive spreadsheet includes statements of goals and needs by leaders or members of each group. That spreadsheet is available on request from the author.

1 PLACE	COUNTRY	ORGANISATION NAME	KNOWLEDGE HOLDER(S) and LEADER(S)
2 Taumako residents of Duff Islands, Temotu Province	Solomon Islands	Holau Vaka Taumako Association Trustees, Incorporated	Fox Boda, Jonas Holani, James Mapua, Luke Vaikawi, and open to members of all Mata tribal groups of Duff Islands.
3 Taumako residents of Lata, Ndeni Island, Temotu Provincial Capital	Solomon Islands	Holau Vaka Taumako Associations Trustees, Incorporated	experts come from Taumako
4 Taumako residents of Honiara, Guadalcanal Island	Solomon Islands	Holau Vaka Taumako Association Trustees, Incorporated	experts come from Taumako
5 Vaeakau, Nifiloli, Pileni, and other Outer Reef Islands, Temotu Province	Solomon Islands	Families. (partnered with Holau Vaka Taumako Association Trustees Incorporated)	Ini Bala, Paul Taea, Ezekiel Dei
6 Vanikoro & Utupua Islands, Temotu Province	Solomon Islands	Families / tribes (partnered with Holau Vaka Taumako Association Trustees, Inc.	James Pae. Ezekiel Tamou. Thomas Swaio

7	Nuakata Island, Milne Bay Province	PNG	Pasana Group. Sailau Voyage	Justin John. Sanakoli John. Job Siyae.
8	Admiralty Islands, Manus Province	PNG	Climate Challenger 48 <sup>c</sup> outrigger 2012 voyage Manus - Bougainville return	Titan people. Manual Matawai Molean Polin Cholai, Ponchalon, Parkop Polkanau, late Manoi Ponawan, Pokakes Pondraken, and others
9	Admiralty Islands, Manus Province	PNG	Total (smaller than Climate Challenger	Lucas Kanamon. Skipper = Polapoi
10	Baluan Island settlement of Titan People, Identified with Mouk (or Mauk) Island, and small burial island, Admiralty Islands Manus Province	PNG	families	Titan sea-people. Elders sailed throughout Admiralty islands and were welcomed to stay in tidal areas when visiting islands.
11	Ninigo (Pihon, Amix, Liot, Luf are the 4 wards), West New Britain Province	PNG	pan-Ninigo community	John Melvin and Tiawa Kolonga: Everyone has multiple skills, and all of whom are qualified. The short lists below are a mixture of Elders and Juniors. The names are based on the 4 Wards; Pihon, Amix, Liot and Luf. Pihon has most candidates as fitting for their big population. Luf has the smallest number of candidates fitting their small population. The main reason is to provide assistance to Luf. Members will be seconded from Pihon to increase numbers of Luf teams. <b>Pihon Men:</b> 1. William Kolonga, 2. Enel Paose, 3. Lamech Emil, 4. Isaac David, 5. Nixon Luni, 6. Henry Wesngel, 7. Harry Kaeta. <b>Pihon Women:</b> 1. Esther Inal, 2. Kathleen Enel, 3. Eunice Lipton, 4. Hilda Nixon, 5. Edna Timothy, 6. Celynda Kolonga. <b>Amix Men:</b> 1. Miael Simak, 2. Michael

			Sinapling, 3. Jerry Mitil, 4. Semin Itilon. <b>Amix Women:</b> 1. Samikei Mikaei, 2. Olka Micah, 3. Mesia Semin, 4. Amen Limen. <b>Liot Men:</b> 1. Gideon Yolis, 2. Philip Tom, 3. Stanley Miling, 4. Kali Nelson. <b>C. Liot Women:</b> 1. Elsie Joel, 2. Rosen Gideon, 3. Amilyn Stanley, 4. Matlin Kali. <b>Luf Men:</b> 1. Meta Lun. <b>Luf Women:</b> 1. Lilly John, 2. Nem Okip
12 Tikopia	Solomon Islands	families / tribes	Ariki Mark for Ariki Kafika
13 Anuta	Solomon Islands	families / tribes	John Maui for Ariki Anuta
14 Bellona	Solomon Islands	families / tribes	Jerry Maiki Tengemoana
15 Port Vila	Vanuatu	Vanuatu Kultural Senta	families from Banks and Maskelyne Islands
16 Banks Grp.	Vanuatu	Vanuatu Kultural Senta	associates Vanuatu Kultural Senta
17 Maskelyne	Vanuatu	Vanuatu Kultural Senta	associates Vanuatu Kultural Senta
18 Uvea Wallis	New Caledonia	Association of Traditional Canoes. families	Vahai Tuulaki
19 Noumea	New Caledonia	Vakaledonie is our charitable org. Am starting an educational association	Philippe Naudin
20 Takuu Atoll consists of 13 islands, the largest one named Takuu, in NE of Bougainville Island in PNG, on same reef as Ontong Java group in Solomon Islands, grouped with Nukumanu, Fead/Nuguria Atolls	PNG	8 experienced men Vakahaila builders and 8 women's groups	We have five (5) clans on Takuu. Each kept their own methods of canoe making for generations and aim to transmit them to youth. Very few who are still alive on Takuu Island, some well into their seventies and nineties, still remember how to build the voyaging canoe we name "Vakahaila." Stories of one clan cannot be told to a person of another clan unless sanctioned by clan elders. They are told the stories of their origin, how their clan arrived and settled on Takuu Island, and how each clan was

given land by the Paramount Chief on Takuu also known as the “Pure”. Knowledge of land is all about how a taro patch or garden once given to its new owner is related to the ones near or around it, referring mostly to boundaries of demarcation that make a taro patch unique to the owner. Land stories also tell of previous owners of the taro patch up to time immemorable. Knowing the stories of your taro patches is like having in possession a contract of sales deed of owning a car or house. Traditions of Takuu Clans are straight and clear regarding ownership and sharing of taro gardens or coconuts patches. Stealing from a neighboring garden is not tolerated by all levels of Takuu Society and often resulted in harsh punishment involving hard manual labor. In recent times with the existence of village courts, people found guilty of stealing were either given community service or ordered to pay money or goods in compensation. Our current clan leaders, clan names, and areas of arts specialties are: 1) Tukuteata Kaiposu -Hareata & Teariki Clans - Canoe building and Crafts, Fishing, Gardening, Dancing and singing, 2) Ausi Tefuarani - Hareata Clan - Canoe building and Crafts, Fishing, Gardening, Dancing and singing, 3) Seuva Pate - Hareata Clan - building and Crafts, Fishing, Gardening, Dancing and singing, 4) Tefatu Apawa - Haremania Clan - Canoe building and Crafts, Fishing, Gardening, Dancing and singing, 5) Tekaso Napito - Hareata Clan -



			Canoe building and Crafts, Fishing, Gardening, Dancing and singing, 6)Nake Tapaia - Haremania Clan - Canoe building and Crafts, Fishing, Gardening, Dancing and singing, 7) Telo Nunua - Haremania Clan - Canoe building and Crafts, Fishing, Gardening, Dancing and singing, 8) Hahale Tekahu - Haremasani and Matua Clans - Canoe building and Crafts, Fishing, Gardening, Dancing and singing,
21	Trobriands	PNG	Linus Digim'Rima's brother, Dr Andrew Moutu, Dr Susanne Keuhling
22	Rai Coast, Madang Province	PNG	Mary Mennis
23	Gulf of Papua	PNG	in process.
24	Lavongai Region	PNG	Ailan Awareness is a non-profit organisation that aims to keep peace and revive cooperative and mutually beneficial relationships between people of Lavongai Province. During 2020 Ailan Awareness brokered peace between several armies of several communities that have been activity fighting each other for many years.

Canoe building and Crafts, Fishing, Gardening, Dancing and singing, 6)Nake Tapaia - Haremania Clan - Canoe building and Crafts, Fishing, Gardening, Dancing and singing, 7) Telo Nunua - Haremania Clan - Canoe building and Crafts, Fishing, Gardening, Dancing and singing, 8) Hahale Tekahu - Haremasani and Matua Clans - Canoe building and Crafts, Fishing, Gardening, Dancing and singing,

Linus Digim'Rima's brother, Dr Andrew Moutu, Dr Susanne Keuhling

in process

Lagatoi of Hiri Motu

John Aini. Family and trans-Lavongai Elders

25 Polowat	Chuuk State, FSM USA associate	Names of family, community, and organisations that request teaching and provide support to make it possible. When possible Mariano Benito works with Akilino Miki, as in programs in FSM, Guam, Saipan, Minnesota, etc.	Mayor of Polowat, Mariano Benito.
26 Houk	Chuuk State, FSM, USA associate	Family, community, and other organisations that request teaching and provide support to make it possible. When possible Akilino Micky and Mariano Benito work together...as in programs at FSM, Guam, Saipan, Minnesota, etc.	Mayor of Houk Island, Akilino Micky
27 Yap	FSM USA associated	family. Yapese Traditional Navigation Society (YTNS). 500 Sails in Saipan.	Ali Haleyalur.and sometimes associates Mariano Benito, Sesario Sewralur, Tony Pailug, etc.
28 Satawal	FSM, USA associate	family. Sewralur works in a Community College programme in Palau when can.	Sesario Sewralur, Tony Pailug, etc.
29 Lamotrek	FSM, USA associate	Waa`gey. Participants are from Lamotrik and other Central Caroline Islands	Larry & Regina Raigetel
30 Palau	FSM, USA associate	Palau Ocean Navigation or Palau Community College	Sesario Sewralur & family
31 Majuro	Republic of Marshall Islands.	Waan Aelōñ in Majel	Alson J. Kelen

	USA associate		
32 Ifaluk on Kaua‘i	USA (in Hawaii)	family & community	Santus Wichimai family
33 Ulithi to Satawal Islanders in Hawaii	USA (Hawaii) & FSM	Ramathau Club in Hawaii & Oceania Community Health in FSM/Chuuk	Max Yarawamai
34 Saipan	CNMI USA associate	500 Sails.Lalayak Project	Cecilo Raikiulipiy & Mariano Benito
35 Saipan	CNMI USA associate	500 Sails. Sirena Project	Cecilo Raikiulipiy & Mariano Benito
36 Saipan	CNMI USA associate	500 Sails Oceania Maritime Center	Cecilo Raikiulipiy & Mariano Benito
37 Guam	CNMI USA associate	Traditions About Seafaring Islands (TASI)	Frank Cruz
38 Pacific Harbor, Viti Levu based	Fiji	Drua Sailing Experience Pte Limited.	Setareki Ledua & Elenoa Buasali & families who are both Lau Group and Viti Levu based
39 Suva, Viti Levu based	Fiji	families from Lau in Suva	Tiu Tiua Bera & family
40 Cicia Island, Lau Isles	Fiji	family & community	Susana Yalikanacea, at Tarukua Village in Cicia
41 Naividamu, Faluga, Lau Grp.	Fiji	family & community	Meli, Domonisere
42 Kambara, Lau Grp.	Fiji	family & community	descendant communities Viti Levu
43 Moce, Lau Grp.	Fiji	family & community	Fuluna Tikoidelaimakotu Tuimoce
44 Ogea, Lau Grp.	Fiji	family & community	Joji Marau Misaele & Setareki Domonisere & Korovou Vakaloloma
45 Tabiteuea, Miaiki	Kiribati	Matua i Kiribati	Taunganga Anterea and other Kiribati experts throughout Kiribati who know parts of the AVK and can contribute to translating and interpreting the notebook that was given to Jaime Back for safekeeping by Taunganga Anterea.

46 Western Province	Solomon Islands	families	Tomoko are built and controlled by family groups that can be identified
47 Palawan	Philippines	family & community	in process Elena Clariza
50 Amis Tribal area	Taitung, Taiwan / China	Association of Austronesian Community Colleges, National Taitung University, Luminous Hotel, Ocean Taiwan Foundation, Taiwan Indigenous Conserved Territories Union	Professor Jessie Chiung Hsi Liu, Executive Director. Hokira and Laway of Fara`ngaw.
51 Pongso no Tao (sometimes named Lanyu or Orchid) Island	Taiwan / China	Community owners	Yami Tribe. Tao vessel owners in process
53 Whale Temples	Vietnam	Whale Temples. Mui Ne-Ham Tien.	Mr My and Mr Hung
54 Taipei	Taiwan / China	Conserved Territories Union	experts in each of 42 groups who are members
55 Butuan, Mindanao	Phillipines	Balangay cultural heir families	People of Tawi-tawi, Butuan area in Mindanao.
56 California, Philippines, and Pacific NW allied locations	USA	Baliksagadak	L Frank Manriquez, helped build the first ti'aatTongva canoe from the Los Angeles area in 200 years. and built one other which we have taken on tribal canoe journey four times. We are now building the third. They are planks steamed, glued and sewn. We were gifted a log to build a 'world' bangka which was built by many hands of intertribal connections ~ California natives, Maoris, mixed natives and islanders of Filipino descent, Filipinos and Filipino Americans. The master carvers of this bangka are listed in this video <a href="https://youtu.be/3Kssd6R5rns">https://youtu.be/3Kssd6R5rns</a> They included: Judy Talaugon, Chumash Bisayan, my mentor elder~ they have a tomol led by a female captain

Petpatsu@yahoo.com; Alexis Canillo, Pomo~Bisayan - he completed this world bangka; Philip H Red Eagle, co-founder of the Pacific Northwest Tribal Canoe Journey; Philip@nwrain.com; Mamerto Lagitan tindongan, Ifugao master carver, mumbaki; Lorenzo II Acompañada, Consultant in Mindanao

## REFERENCES

(\*denotes primary references):

- Bedford, S., Blust, R., Burley, D. V., Cox, M., Kirch, P. V., Matisoo-Smith, E., Naess, A.S., Pawley, A., Sand, C. and Sheppard, P. “Ancient DNA and its contribution to understanding the human history of the Pacific Islands” in *Archaeology in Oceania*, Vol. 53 (2018): 205–219 DOI: 10.1002/arco.5165
- Bird, M.I., Condie, S.A., O’Connor, S. *et al.* Early human settlement of Sahul was not an accident. *Sci Rep* **9**, 8220 (2019). <https://doi.org/10.1038/s41598-019-42946-9>
- Brucato, N., Kusuma, P., Cox, M.P., Pierron, D., Purnomo, G.A., Adeler, A., Kilvid, T., Letellier, T., Sudoyo, H. and Ricaut, F-X. 2016. “Malagasy Genetic Ancestry Comes from an Historical Malay Trading Post in Southeast Borneo” *Mol Biol Evol.* 2016 Sep; 33(9): 2396–2400. Published online 2016 Jul 5. doi: [10.1093/molbev/msw117](https://doi.org/10.1093/molbev/msw117). PMID: 27381999
- Cox, P, Banack, S. Cox, eds. 1991. eds. *Islands, Plants, and Polynesians: An Introduction to Polynesian Ethnobotany*. Portland, Oregon: Dioscorides Press
- Eckstein, L., Schwartz, A. 2019. “The Making of Tupaia’s Map: A Story of the Extent and Mastery of Polynesian Navigation, Competing Systems of Wayfinding on James Cook’s *Endeavour*, and the Invention of an Ingenious Cartographic System. *The Journal of Pacific History*, Taylor & Francis
- Feat, F. D. 1995, *Blackfoot Physics: A Journey into the Native American Universe*. Fourth Estate Ltd: London
- Finney, B.R. in *History of Cartography* David Woodward and G. Malcolm Lewis eds. “Nautical Cartography and Traditional Navigation In Oceania” U. Of Chicago Press Vol 2 Book 3. Ch.13. pp 443-492
- Finney, B.R. 1994 Wait for the West Wind *Journal of the Polynesian Society* Vol 98 No. 3 pp. 261-302.
- Finney, B.R., Irwin, G., Low, S, Neich, R. 2007, K.R. Howe, Ed. *Vaka Moana: Voyages of the Ancestors: The Discovery and the Settlement of the Pacific* U of HI Press, Honolulu
- Genz, J. H. 2008. Marshallese Navigation and Voyaging: Relearning and Reviving Indigenous Knowledge of the Ocean. Dissertation submitted to U. of HI Anthropology. May, 2008.
- George, M. 2012 “Polynesian Navigation and Te Lapa – “The Flashing”” *Time and Mind: The Journal of Archaeology, Consciousness, and Culture*. Vol 5 (2) pp. 135-174.
- George, M. 2017 “Te Laa o Lata: Gauging the Performance of An Ancient Polynesian Sail” *Journal of the Polynesian Society* 126 (4) pp. 377-416



George, M., Wyeth, H. 2020a. *We, the Voyagers: Our Vaka*. Pacific Traditions Society: Anahola

George, M., Wyeth, H. 2020b *We, the Voyagers: Our Moana*. Pacific Traditions Society: Anahola

George, M. 2021a. "ANCESTRAL VOYAGING KNOWLEDGE IN OCEANIA - I: Pacific Women's Knowledge." George, prepared for UNESCO, Local and Indigenous Knowledge Systems (LINKS) section in cooperation with the Small Island Developing States section, both within the Natural Sciences Sector. August 15, 2021. <https://en.unesco.org/links>

Gladwin, T. 1970. *East Is a Big Bird: Navigation and Logic on Puluwat Atoll*. Harvard

Gunn, M. J. 1980. "Etak and the Ghost Islands of the Carolines" *Journal of the Polynesian Society*. Vol. 89. No. 4. pp.299-507

Holton, G., Hachibmai, C., Haleyalur, A., Lipka, J., Rubinstein, D. 2015. "East Is Not a "Big Bird": The Etymology of the Star Altair in the Carolinian Sidereal Compass" *Oceanic Linguistics*, Vol 54. No. 2. (Dec, 2015) *U. of Hawaii Press*.

Howe, K.R. Ed. 2007. K.R. Howe, Ed. *Vaka Moana: Voyages of the Ancestors: The Discovery and the Settlement of the Pacific*, U of HI Press, Honolulu

Huffer, E. 2008. "Women and Navigation: Does the Exception Confirm the Rule?" *International Journal of Maritime History*. XX. No. 2 (December, 2008) pp. 265-284.

Leach, B.F. and Davidson, J.M. 2008. *The Archaeology of Taumako: a Polynesian Outlier in the Eastern Solomon Islands*. Monograph. New Zealand Journal of Archaeology Special Publication.

Lewis, D.H. 1972 (1996) *We, the Navigators: The Ancient Art of Landfinding in the Pacific*. U. of Hawaii Press (and Royal Institute of Navigation).

Low, S, 2013. *Hawaiki Rising: Hōkūle`a, Nainoa Thompson and the Hawaiian Renaissance*. Island Heritage Publishing. Waipahu, Hawaii.

Metzgar, E. 2006. "Carolinian Voyaging In The New Millennium" *Micronesian Journal of the Humanities and Social Sciences* 5(1/2 Combined Issue):293-305

Noyes, M. 2017. "From Kūkaniloko: the Celestial Rulers of Space and Time," *Te Kaharoa*, vol. 10.

Nuttall, Penny, George, Frain, 2021, in press. "Ancient Voyaging Capacity and Technology In the Pacific" *Cambridge History of the Pacific Ocean* Ed.

Nuttall, P. 2014 "Sustainable Sea Transport in the Pacific Talanoa." U. of South Pacific. Laucala Campus, Fiji.

- Penny, S. 2018 “Ocean of Knowledge Symposium.” U. of CA Irvine Campus.  
<http://simonpenny.net/OK/>
- Penny, S. 2020 Canoe-carving, Lamotrek style: An interdisciplinary study in crafting, design, engineering, and sustainability. Form Akademisk, Sweden. Vol 13, No 1. 2020
- Pugach, I., Hübner, A., Hung, H., Meyer, M., Carson, M.T., Stoneking, M. 2021. “Ancient DNA from Guam and the peopling of the Pacific” PNAS January 5, 2021 119 (1) e2022112118; <https://doi.org/10.1073/pnas.2022112118>
- Salopuka, S. 2018. Final Report of the Breadfruit Project (part 1), The Breadfruit Institute of National Tropical Botanical Garden.
- Salopuka, S. 2020. *We, the Voyagers: Our Vaka* narrations, translations, producer, and primary character. <https://www.vaka.org> and vimeo.com
- Salmond, A. 2014. *Tears of Rangi: Water, Power, and People in New Zealand*. HAU: Journal of Ethnographic Theory. journals.uchicago.edu
- Salmond, A. 2012. “Tupaia, the Navigator Priest” in *Tangata o le Moana: New Zealand and the People of the Pacific*. Eds. Mallon, S., Māhina-Tuai, K., and Salesa, D. Wellington: Te Papa Press
- Wilson-Hokowhitu, N. (ed) 2019. *The Past Before Us: Mo`okū`auhau As Methodology*. U of Hawaii Press: Honolulu
- Yen, D. 1974. “The Sweet Potato and Oceania: An Essay In Ethnobotany” *Bishop Museum Press*: Honolulu