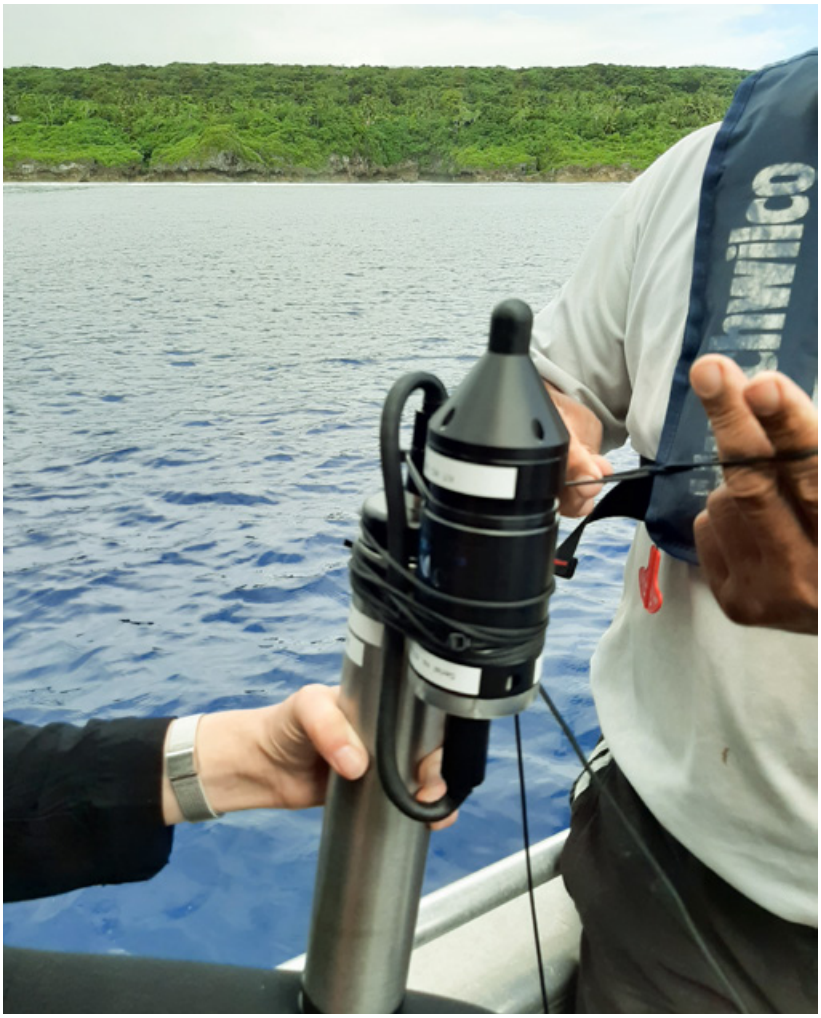
Can new tech help to reduce illegal activities in Pacific coastal fisheries and aquaculture?

SPC global study on new tools and technology

In 2021, the Pacific Community (SPC) commissioned a study on emerging technologies and their suitability for the monitoring, control and surveillance (MCS) of coastal fisheries and aquaculture. The study was conducted in response to SPC members' increasing interest in drones, small craft tracking systems, hydrophones, and automated cameras to assist with their coastal fisheries MCS operations.

The proverbial "net" was cast wide for this study so as to capture as many potential tools and technologies as possible. The findings come from an assessment of over 175 tools from over 135 companies around the world. Most of the research was done online using web resources. The consultant for this study contacted (via video conferencing) 75 different companies to better understand their offerings for the Pacific context.

A copy of the report from the study is available on SPC's digital library[1] for those members who express an interest in more information on emerging technologies or wish to undertake a trial with SPC's assistance.



Hydrophone ready for installation in Niue. Image: ©Ian Freeman, SPC

Key findings

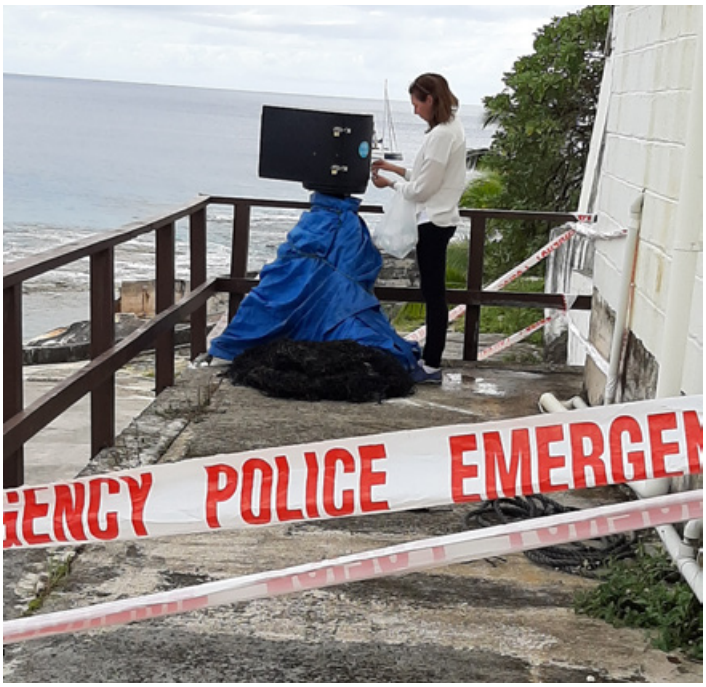
Fancy tools and technologies are not a panacea for coastal fisheries and aquaculture MCS everywhere in the world, including the Pacific Islands. Effective MCS comes from suitably skilled and resourced fisheries officers working with a clear mandate and authority to regulate fisheries rules and regulations. This work is made much easier if the rules and regulations are based on good science, fisheries management, and community involvement and awareness.

The findings of this report may not apply to every Pacific Island country and territory in every circumstance. All MCS solutions need to be tailored to the specific situation on the ground, taking into account resources, capacity and actual needs and circumstances. A number of key findings that are likely to have application in the Pacific Island context are presented below.

[1] https://purl.org/spc/digilib/doc/jif2s

[2] The AIS coastal or base station is the primary component in an AIS physical shore station, and the most important component in a coastal AIS network. The AIS base station receives and communicates AIS data from all AIS sources (e.g. AIS mobile stations, other AIS base stations, AIS aids to navigation units) within the coverage area.

[3] A geofence is a digital, or virtual, boundary established around a geographical area in an information system.



Long range robotic camera being set up in Niue.
Image: ©Ian Freeman, SPC

- **Baseline MCS tools and capacity** – Key equipment for field officers includes: 1) safety gear such as a first aid kit and protection from the natural elements; 2) a torch/flashlight; 3) multi- tool; and 4) a smart phone with a good digital camera. Access to binoculars, gauges and measuring devices should also all be included in fisheries officers' basic MCS kit. Participation in fisheries officer training, such as the Certificate IV in Coastal Fisheries and Aquaculture Compliance, is encouraged along with specific training in the deployment and use of tools and equipment used to gather evidence of an infringement. Access to awareness-raising material and presentations to give to communities on the importance of following rules and regulations is also critical for an officer working in the field.

- **Vessel tracking** – There are several small vessel monitoring systems (VMS) and solar VMS units on the market now, or in development, that target smaller artisanal vessels. Costs to purchase the devices have come down significantly, along with the cost of monthly cellular or satellite services that support the VMS. There is a range of features that increase the efficiency of a VMS, such as the ability to send emergency messages to authorities, warning signals that alert a fisher when they are entering closed waters, and the ability to report catch and effort data via a cell phone or internet connection. These features can help drive the uptake of VMS among fishers.

- **Automatic identification system (AIS)** – This technology offers a simple and inexpensive alternative to traditional VMS systems, which need cell or satellite access to work. AIS works on VHF radio signals that require line of sight for functionality. The coastal station or base station is generally located up high to cover the most area at sea. If the base stations[2] can be located around island areas for maximum coverage and/or vessels can relay signals via each other to a coastal station, there is very little in the way of running costs, other than retrieving data from coastal stations. The benefit of a simple solution for fishers that can alert them of geofences[3], send distress messages, and send or receive other messages makes this an interesting solution.

- **Shore-based monitoring**
  - **Active radio frequency identification** – This uses a system of sensors to count vessels as they move to and from port and launch sites. It is a relatively inexpensive and low-tech way of monitoring vessels.
  - **Cameras** – There are many camera options to choose from that have the capability of monitoring vessel movements and detecting infringements (or other illegal activity) in closed waters. Cameras can be miniaturised and fixed at specific locations where they are unlikely to be detected.

- **Radar and other systems** – Radar-based systems with commercially available components have good potential in the Pacific Islands, and are being trialled and/or used in American Samoa, the United States (Hawaii), Palau and Tuvalu. They may be good solutions for monitoring remote areas such as marine protected areas because they are multisensory systems with radar detection (Furuno), forward looking infrared, AIS identification, camera and weather sensors.

- **In-water monitoring**
  - **Unmanned surface vessels** – These may have an application for coastal fisheries monitoring if they can be operated in collaboration with other users to defray or minimise costs. They have long-range capability and are relatively undetectable, given their low profiles. But, due to their significant cost, they would also likely need to be deployed with other air/vessel assets at the same time to get the most benefit of their use.
  - **Hydrophones** – Acoustic sensors could give valuable insights into vessel or fisher activity patterns in remote areas. Acoustic sensors linked to cameras or other devices, such as auto learning processors, can determine if the sounds are vessels, explosives and potentially even spearfishing. Fisheries officers could use this information to get an idea of the amount of activity – such as number of boats, or number of spears shot – in a particular area and can even help to determine if there are patterns to this activity. For example, if it can be determined that there is a recurring time and/or day that the area is being accessed, this would give fisheries officers an idea of when they should go to the site or area in person to investigate.

- **E-reporting solutions** – There are many free and open-source e-reporting solutions on the market that collect catch and effort and location data, which is then transmitted to a central repository, either directly as it is collected or once the collector has internet or cell phone connectivity. There are two approaches to collecting catch data in coastal areas that have had some success: 1) training either local hires or volunteers to collect data at points of landing, and 2) using fishers to collect data, which would also give them more control over the data for their own use.

- **Fisheries officer field work solutions** – Two complementary and linked systems – Earth Ranger and SMART – were initially developed to support rangers working in Africa. Both systems are free and open source. The scope of these systems has since been expanded to support coastal fisheries officers, particularly in managing marine protected areas, and they have a very good potential as a tool for coastal fisheries management in the Pacific. Key potential benefits are that they can work as a quasi-intelligence solution over time and can help managers better target where fisheries officers should be operating.

- **Community engagement solutions** – There are several software packages that are used extensively elsewhere in the world that offer easy-to-use monitoring solutions that can be undertaken by communities. The range of these solutions is only limited by one's imagination and the complexity of the system being monitored. ODK Cloud is one such data collection system, and is used across a multitude of fields by organisations such as the Commonwealth Scientific and Industrial Research Organisation, World Health Organization and Red Cross.

- **Traceability solutions** – A significant number of traceability solutions exist that can track fish and invertebrates – from initial capture, right through to the end purchase (also known as "bait to plate"). These are currently used in the offshore tuna fishery to verify that tuna have been caught from sustainable fisheries. These have good potential for use in coastal fisheries as they can also be used for MCS purposes.

Field trials

Many of the emerging technologies have yet to be proven in the coastal fisheries context, and most will work best as part of an integrated package – rather than as stand-alone solutions – to address MCS issues in coastal waters. SPC is keen to undertake field trials to evaluate the effectiveness of the various emerging technologies and assist countries in strengthening their coastal fisheries and aquaculture MCS capacity at the community, national and, ultimately, regional level.

Several suppliers and vendors of some of the emerging technology equipment have indicated a willingness to participate in trials, and some have offered to trial their equipment free of charge. SPC has funding available that could go towards supporting the logistics and monitoring of the trial, rather than providing the equipment, so cost-effective pilot studies can be undertaken.

SPC members who are interested in further information and being part of these trials should contact:
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