

Around the world in an archival tag

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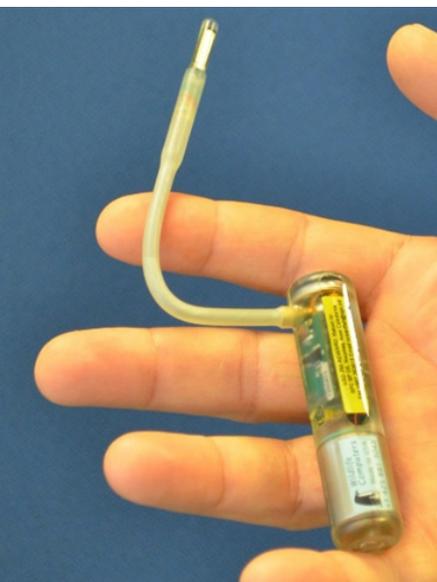


Figure 1. Archival tag. Image: ©SPC



Figure 2. Archival tag inserted into a yellowfin tuna ready for release (the fish was also tagged with a red spaghetti tag). Image: ©Fabien Forget

Tagging is used to study fish movements and behaviour. For stock management purposes, tagging can also facilitate estimates of mortality rates, whether natural or due to commercial or recreational fishing. Unless an acoustic or satellite tag is used, however, a tagged fish needs to be recaptured in order to obtain the relevant information. The probability of re-catching a fish as mobile as a yellowfin tuna, which has been tagged and released in the middle of an ocean that covers almost one-third the Earth's surface, may seem miniscule, but the reality is surprising and can produce some rather unusual stories. Here is one for you to think about.

Between July and August 2018, the Pacific Community (SPC) ran the 13th Central Pacific tagging cruise, which mostly involved sailing through the exclusive economic zones of Nauru, Kiribati and Tuvalu, plus adjacent international waters. The purpose of these cruises is to tag tuna in areas where the use of pole-and-line vessels is extremely difficult because of the lack of sufficient baitfish resources. Instead of live anchovies or sardines in baitwells, frozen bait and trolling lines are used to catch the tuna. This method is really only effective on bigeye and yellowfin tunas, and when they are associated with fish aggregation devices (FADs), whether anchored or drifting. Tuna are usually tagged with conventional “spaghetti” tags², but some are also fitted with an electronic tag called an archival tag (Fig. 1) that collects and records data on the surrounding environment, both within the fish and in the surrounding water body. Depth, the fish’s internal temperature, surrounding seawater temperature, and ambient light, are recorded every 30 seconds and stored in the tag’s memory. Inserted in the fish’s abdominal cavity through a minor surgical operation (Fig. 2), the tag can be recovered when and if the animal is ultimately recap-

tured. Tuna tagged in the central Pacific are most frequently recovered by one of the industrial purse-seine vessels operating in the region. This is a logical outcome because more than 70% of the annual commercial tuna fish catches in the central and western Pacific are taken by purse-seine vessels. This fishery is the biggest in its category (over 35% of all tuna catches throughout the world) and provides the largest tuna canneries on the planet. It was, therefore, unsurprising that someone working in one of the canneries contacted us, using the address printed on the tag, claiming that they had come across the tag at the beginning of the canning process.

Our tags are usually recovered by one of the large tuna canneries in the Indo-Pacific region, in particular in Thailand and Ecuador, but also in the Philippines, Mexico and American Samoa. This time, however, at the end of March 2021, we were contacted by a person working in a cannery in Spain, advising us that he discovered what he thought was a kind of GPS when cutting up frozen tuna using a bandsaw. (He attached a photo to his message.)

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² A spaghetti tag, also called a “dart tag” is a piece of coloured plastic tube that can be attached to a fish’s back. It has a unique ID code and an address written on it that helps tag finders to report the tag.



Figure 3. Archival tag sawn in two (on the right) and acoustic tag (on the left, black) recovered at a canning plant in Spain.

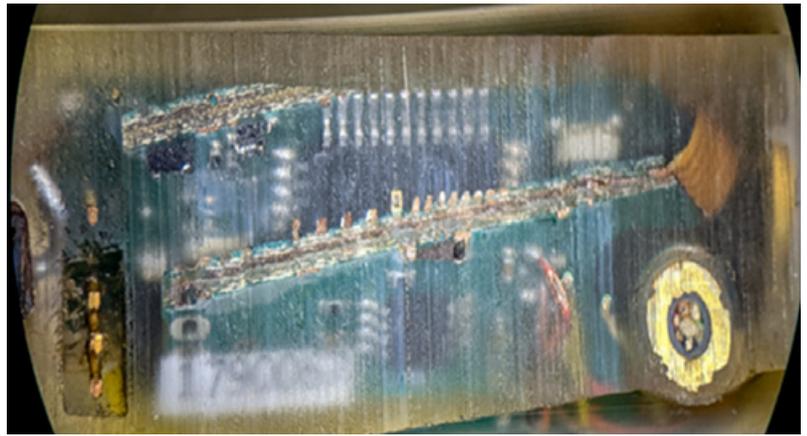


Figure 4. Electronic circuitry inside the tag. When connected to components from a similar tag, it was possible to access the data within the tag's memory.

Disaster! The saw sliced the archival tag in two, destroying the battery and some of the electronic components (Fig. 3). Unavoidably, we will not be able to recover the data that this tag had recorded throughout the period the fish spent at liberty before being caught by – what we assume to be – a Spanish purse-seine vessel somewhere in the Pacific. This is truly unfortunate because this yellowfin tuna was also carrying an acoustic tag that had enabled us to detect the times when the animal was close to a FAD where it had been caught and released on 30 July 2018. Potentially, we would have been able to recover more than two years of precious data on the behaviour of an adult tuna (the animal weighed about 20 kg when tagged, which is unusual). Most yellowfin tunas are tagged when they are juveniles, and are recaptured before they reach maturity.

After a few weeks of waiting, partly due to movement restrictions due to COVID, one of the company's engineers reported back, after having spent six hours repairing the electronic circuitry (Fig. 4) in the tag, and managed to recover 136 days' worth of data. A miracle!

After glancing through the data (Fig. 5), the temperature and pressure recordings showed us that the fish was recap-

tured on 13 December 2018, and was probably transferred from the purse-seine vessel to a refrigerated freighter around 11 or 12 January (a temperature drop from -14°C to -19°C, suggesting that the fish was probably transferred from the fishing boat's brine well to a better refrigerated hold in a cargo ship). The fish was probably transferred at some stage from the freighter to a container ship (a further fall in temperature), where it then travelled to Spain via the Panama Canal and was stored in the container or transferred to a cold store before ending up under the not-so-tender ministrations of the cannery's bandsaw...

But that is only part of the story. This is also the beginning of a detective's job to identify the purse-seine vessel that caught our fish. If the cannery cannot trace that vessel, we would need to search through the catch transshipment data around the dates of the obvious temperature changes, and lastly try to determine the place where the fish must have been caught by locating the vessel's fishing position at the date of recovery as recorded by the tag. And all that before we even begin the detective work on the behaviour of the fish itself over the three and a half months that elapsed between its tagging and recapture! Plenty to do my dear Watson!

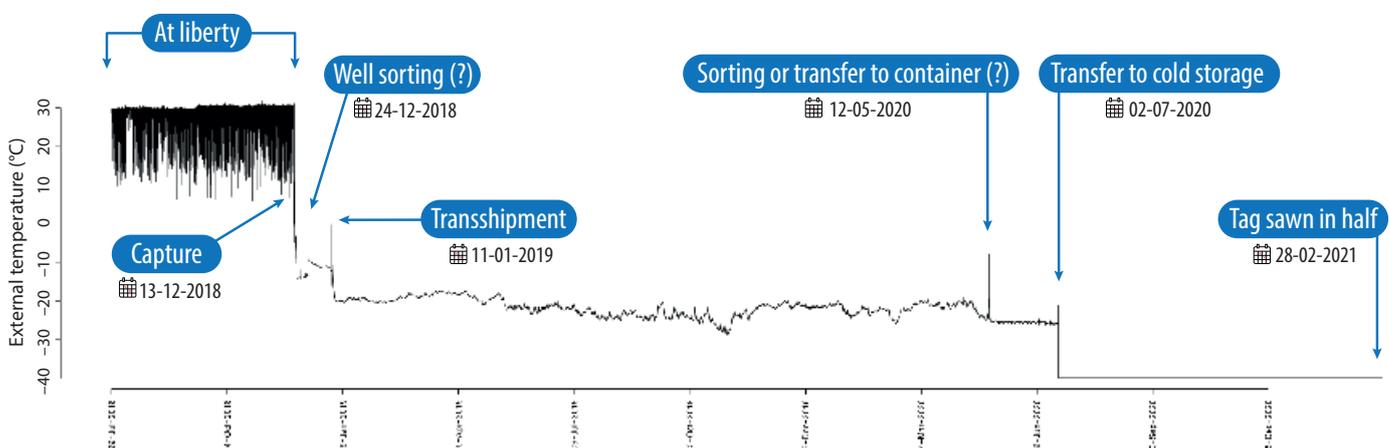


Figure 5. External temperature data extracted from the archival tag, and possible interpretations of the temperature variations over time.