

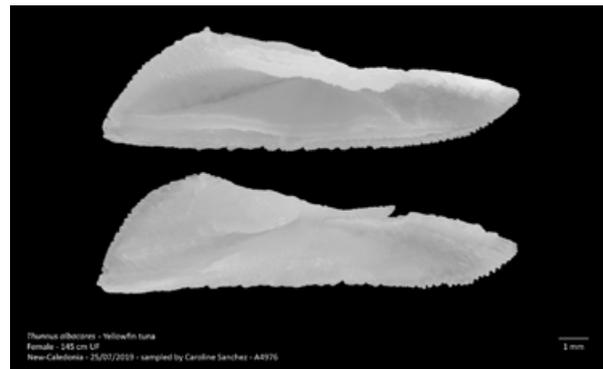
Help us find out how tuna age and how fast they grow and win USD 100!

Since 2006, the Pacific Tuna Tagging Programme, endorsed by the Western and Central Pacific Fisheries Commission and implemented by the Pacific Community (SPC), has been organising fish tagging events annually. On this year's pole-and-line tagging cruise through Solomon Islands, Papua New Guinea and Federated States of Micronesia, tunas labelled with conventional white tags also received an injection of strontium chloride to validate the deposition rate of the increment formations (often called growth rings) that are observed and counted in fish otoliths as a way to estimate fish age and growth.

Otoliths are small 'ear stones', calcium carbonate structures located on either side of the head. They allow fish to find their balance and perceive linear acceleration, both horizontally and vertically. As otoliths grow, they incorporate chemical 'markers' from the water (such as calcium, strontium, and other elements and stable isotopes). The concentrations of these markers reflect both the environment the fish swims through, and intrinsic processes such as physiology and metabolism. Once a marker is incorporated into a growth ring, it remains there permanently, providing a time-stamped chemical record of the fish's experience. By counting the growth rings on otoliths, scientists can estimate the age of a fish; however, the periodicity of ring formation needs to be validated. The external application of chemical markers during tagging events has proved to be a useful method in this regard.

Strontium chloride (SrCl_2) and oxytetracycline (OCT) markers have been widely used to validate increment formation in tunas (Wild and Foreman 1980; Wexler 1993; Wild et al. 1995; Clear et al. 2000). SrCl_2 is often preferred over OCT because of public health concerns; the United States Federal Drug Administration prohibits the use of OCT in wild fisheries, whereas SrCl_2 is a mineral that occurs naturally in seawater, and is regarded as safe for human consumption (Sax and Lewis 1987). SrCl_2 is even used in toothpaste to reduce dental hypersensitivity! Importantly, both strontium and chlorine are present naturally within otoliths, and previous studies using SrCl_2 for mark-recapture experiments on tuna have shown that SrCl_2 did not induce mortality (e.g. Clear and al. 2000).

Prior to the tagging cruise, a SrCl_2 solution was prepared at SPC's laboratory. Onboard the tagging vessel, the injection procedure is quite rapid. Following capture, the fish is placed on a tagging cradle and the scientists use a self-filling dosing syringe designed for continuous injection. To identify fish that have been injected with SrCl_2 , a white tag is placed behind the second dorsal fin. After injection in the muscle, the SrCl_2 is then metabolised and incorporated into the otolith structure. The strontium readily substitutes for the calcium in the otolith matrix, and the SrCl_2 injection leaves a distinct mark on the otoliths that is clearly visible under a scanning electron microscope. When a marked fish is recaptured, and knowing its time at liberty, the number of increments counted on the otolith after the mark can then be compared with the number of days since the fish



Yellowfin tuna otoliths. (Image: Elodie Vourey, SPC)

was tagged, providing a validated increment deposition rate. This information can then be used to age other fish of the same species, thus providing crucial data on age structure of tuna populations, which is necessary to accurately estimate stock status through the assessment models.

At the end of August 2019, 215 skipjack and yellowfin tunas had been injected with SrCl_2 , and SPC is aiming to tag 1000 fish. To be able to extract and analyse otoliths from tagged and re-captured fish, SPC scientists will need the entire fish. This also provides scientists the opportunity to collect other biological samples: the stomach, muscle, liver, gonads and the dorsal spine. A full set of analyses can be undertaken on the same fish; for example, measuring mercury and/or isotope concentrations, and analysing stomach content and conducting genetic analyses. To preserve the quality of the samples, following capture onboard purse-seine and freezer longline vessels, SrCl_2 -injected fish must be kept frozen at all times, whereas fish from 'fresh' longliners can be sampled upon arrival at port. Since 2009, biological sampling training, including otolith extraction, has been provided by SPC, and in each major port, samples can be collected by observers, port samplers or fisheries officers.

If, by chance, you encounter a white tag on a tuna, please contact SPC directly. We need to maximise our chances of extracting as many sets of otoliths as possible. New posters, which have been translated into several languages, are now available at www.spc.int/tagging. The finder of a fish carrying a white tag will be rewarded USD 100. In addition, the fish will be bought from the fishing vessel or the cannery where it was found at a price of USD 10/kg (weight of the

