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LIFESPAN FOR ULUA AUKEA

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A 25-Year Lifespan for Ulua Aukea

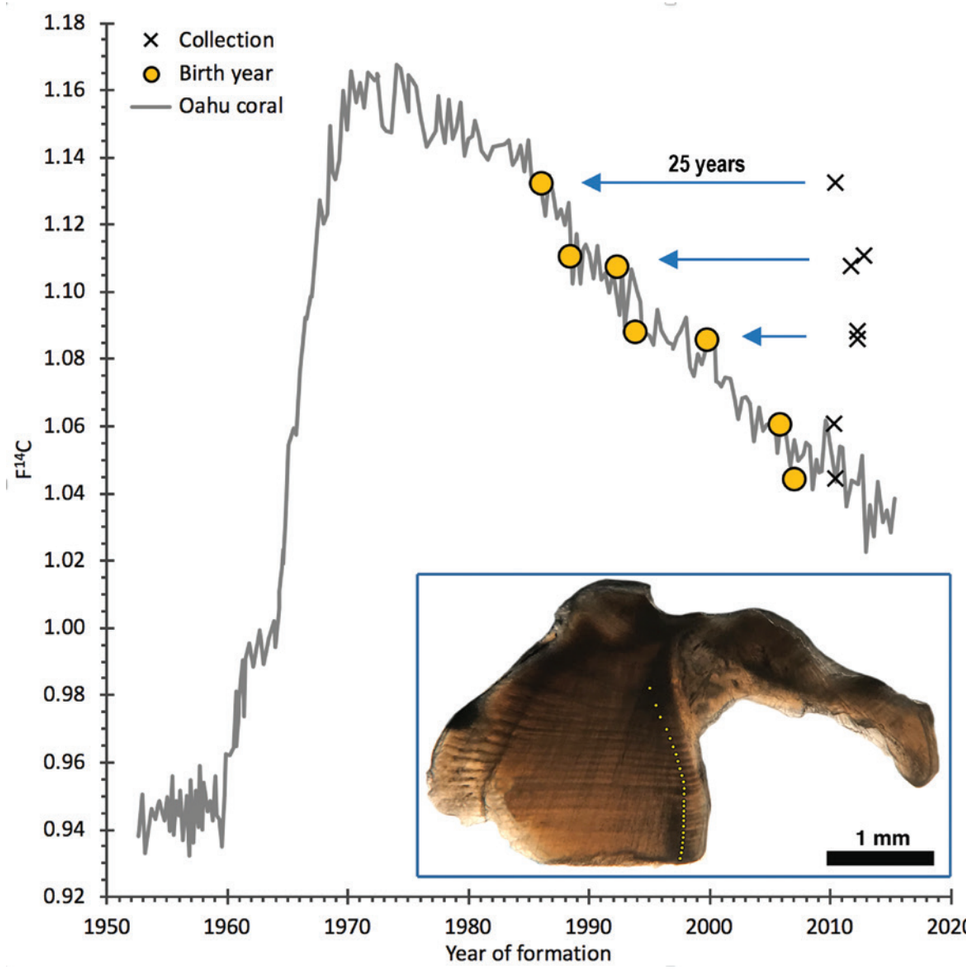
By Allen H. Andrews, Ph.D.
University of Hawai'i, Department of Oceanography

The largest of the ulua species in Hawaii — known locally as ulua aukea (white ulua) or as giant trevally (Caranx ignobilis) throughout its Indo-Pacific distribution — is an iconic reef fish that attains its greatest size in the Hawaiian Islands. They have a broad range that extends from Hawaii to the central South Pacific, through the Indo-Pacific and the seas of the Middle East, to Southern Africa where it has been shown to aggregate by the thousands. Despite its importance as an apex predator of tropical and subtropical reefs, contribution to regional fisheries across the Indo-Pacific, and attraction among anglers as a challenging quarry, an understanding of the age, growth, and lifespan have remained unresolved and largely unexplored.

To address some of the life history discrepancies for ulua aukea, I recently published a fisheries science study that indicates they do indeed grow quickly, but I also determined for the first time that the maximum age of this species is at least 25 years (see the fisheries journal Marine and Freshwater Research for details). To do this, I used a method of age validation called "bomb radiocarbon dating" — see Lawai'a Magazine No. 25 (blue marlin), No. 29 (Hawaiian grouper), and No. 31 (onaga) for examples of how the method works — to confirm that several large ulua aukea in the study were 20-25 years of age. These fish were recently collected by observant fishers from Oahu and the Big Island to investigate whether estimates of age — determined from growth zones counts in the fish ear stone (a structure called an otolith that grows rings like a tree) — were valid by tracing the bomb-produced radiocarbon signal from nuclear testing in the 1950s and 1960s. This information was combined with an older study that used a method called daily increment counting (you can see daily growth in otoliths under a compound microscope) to estimate ages up to 9 years, but the work was limited to fish that were smaller than maximum size. As a result, the information was incomplete in describing how ulua aukea grow over their full lifespan. With the addition of large, age-validated adults from my study, the first opportunity to describe growth through a 25-year lifespan led to more realistic growth characteristics — see the diagrams of the bomb radiocarbon signal and age-at-length with an example of a sectioned otolith aged to 25 years.

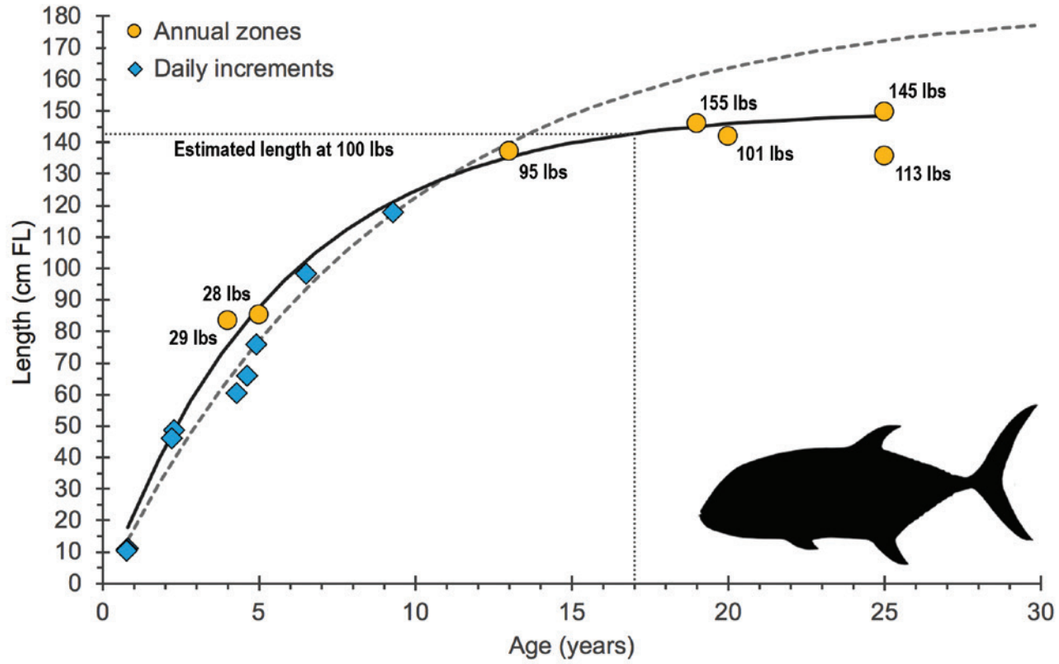
Giant trevally or ulua aukea (Caranx ignobilis) at Pearl & Hermes Atoll in Papahanaumokuakea Marine National Monument.

Photo: James Watt, NOAA Office of Marine National Sanctuaries, 2013



Radiocarbon results from each ulua aukea otolith plotted at the collection date (X's) and projected back to the birth year (circles) calculated from growth zone counting in the otolith sections (inserted image). Note that the annual zones (marked with small yellow dots) are visible in this otolith section for an ulua aukea that was 25 years old. The alignment of the calculated birth years for the measured radiocarbon values (F14C) with the Oahu coral 14C reference (follow the arrows from collection date to the coral reference) indicates that the otolith age estimates for each fish were accurate from 4 to 25 years.

In many cases during my time working in Hawaii and presenting to the public about the age and growth of fishes, I have been approached by fishers asking what the age of the elusive 100 lb. ulua aukea might be. According to a fish weight-to-body length relationship for ulua aukea in the Hawaiian Islands, a 100-pound fish would be approximately 143 cm fork length (4.7 feet FL). Given the revised age and growth data shown here, a 100-pound ulua aukea would be approximately 17 years old (see age-at-length figure). This is consistent with two of the fish that I aged in this study: a 95 lb. fish was 13 years old and a 101 lb. fish was 20 years old. Beyond this length and weight, however, it becomes difficult to determine age from the growth curve because length becomes strongly decoupled from age (this is called asymptotic length). Note that as the curve flattens out toward a maximum age of 25 years, there are fish that have lengths both above and below the length expected for a 100-pound ulua and that the heaviest fish (155 lbs.) was 19 years old. Hence, it is probably safe to say that an ulua aukea that is 100 pounds and more than 4.5 feet FL is older than 15 years, in general, due to the variability of age-to-length for this species near maximum size. This calls into question what the age of the largest recorded ulua aukea — a 191 lb. fish at a calculated length of 165 cm FL (5.4 feet FL) — caught off Maui in 1980 (Hawaii Fishing News State Record) may have been. Suffice it to say, we simply do not know based on the information we have available, except that it was almost certainly older than 15 years and could have been older than 25 years.



Age-at-length figure showing ulua aukea growth over time with a von Bertalanffy growth function fitted to the data from otoliths using annual growth zones (circles) and daily increment counting (diamonds) for the Hawaiian Islands. The growth estimated in the older daily increment study (dashed line) suffered from a lack of older adults. The bomb radiocarbon study filled in the needed lengths and ages to properly fit a growth function (solid line) through the life of this species. A calculated length of 143 cm (4.7 feet fork length) for a 100 lb. fish leads to an age of approximately 17 years, but it is important to notice that the weight of this species, once it reaches lengths close to maximum size, can be highly variable. For example, a 101 lb. fish was 20 years old, whereas the heaviest fish at 155 lbs. was 19 years old. The 2 smallest fish aged with annual zones and bomb radiocarbon were 4-5 years old and weighed just under 30 lbs. each.

On behalf of the fishermen of Hawaii, we would like to thank Allen Andrews for his hard work and dedication to sharing science and critical life history information with our community. Grounding management decisions based on sound scientific data is very important in sustainably managing our resources for our future generations.

We would also like to thank all of the anglers of Hawaii who participated and supported this project by graciously donating head (otolith) and egg (gonad) samples for this project. This project would not be possible without Hawaii's fishermen and the fishing community coming together. A very special "Thank You" to the following for all their help and support from the start of this project: S. Tokunaga Store Ohana, Mike Tokunaga, Eric Kuwana, Debbie and (the late) Reid Takayama, Neal Hazama, Annette Tagawa, Richard Beebe, Neil Kanemoto, Kurt Kawamoto, Naoki Hayashi, Dean Sensui and all of the fishermen that graciously allowed us to sample their ulua/papio catches.

Link to published fisheries science article: dx.doi.org/10.1071/MF19385