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BIOCHEMICAL IDENTIFICATION OF A BLUEFIN TUNA ESTABLISHES A NEW CALIFORNIA SIZE RECORD

Large tunas are not commonly taken off the California coast and although stories exist of sightings of large yellowfin, *Thunnus albacares*, bluefin, *T. thynnus*, and bigeye, *T. obesus*, tunas, the current California size records for these species are 204 kg, 203 kg and 197 kg, respectively (Miller and Lea 1976). On 7 December 1981 a large tuna was captured in a shark gill net that was set 19.3 km south of Anacapa Island (lat 33°48.5'N, long 119°20.6'W). The fish was frozen after capture and sold 7 days later before a positive identification could be made. At the time of sale the fish's weight was determined in the round on a calibrated electronic scale to be 237 kg.

Few measurements were made of the tuna before it was butchered and sold. The total length was determined with a ruler to be approximately 198 cm. No photographs were taken of the fish, but the following physical description was offered by Mr. David Ptak, general manager of Chesapeake Fish Company: the fish was dark blue or black above and grayish white below, with some lighter vertical bars on the sides; the pectoral fins were short to moderate, reaching the 10th or 11th dorsal spine; the finlets were yellow; and the liver had a large central lobe with two lesser lobes, all of which were heavily striated on the ventral surface.

This description indicated that the large tuna, which would be a size record for any *Thunnus* species in California, was either a bluefin or bigeye tuna. Yellowfin tuna do not have striations of the ventral liver surface, whereas both bluefin and bigeye tuna may have completely striated ventral liver surfaces (Gibbs and Collette 1967). Bluefin and bigeye tuna can be separated on the basis of gillraker counts; however, gillraker counts were not made on the specimen and the head of the fish was not saved.

Due to a lack of meristic and morphometric data for the specimen, an alternate method of identification was employed. The relationships of scombrid fishes have been investigated with electrophoretic techniques and all *Thunnus* species can be distinguished on the basis of fixed allelic differences at one or more loci (Sharp and Pirages 1978). Bluefin and bigeye tuna can be separated by a fixed allelic difference at the glyceraldehyde-3-phosphate dehydrogenase (G-3-PDH) locus, an enzyme which occurs in high concentrations in tuna white muscle (Sharp and Pirages 1978). Fortunately, a small amount of the tuna's muscle had been maintained frozen by Mr. Ptak and was generously made available to the authors for an electrophoretic determination of its specific identity.

Samples of the tuna's muscle were run with samples of bigeye tuna and albacore, *T. alalunga*, muscle (frozen bluefin tuna muscle was not available for comparative purposes). Sample preparation and electrophoretic protocol followed the procedures of Graves and Rosenblatt (1980). A photograph of a gel slice stained for G-3-PDH activity is presented in Figure 1. The large tuna possessed an allele which had considerably slower anodal mobility than that of the bigeye tuna, yet slightly faster than that of the albacore. The mobility of the allele of the large tuna relative to the bigeye and albacore was similar to that reported for bluefin tuna by Sharp and Pirages (1978).

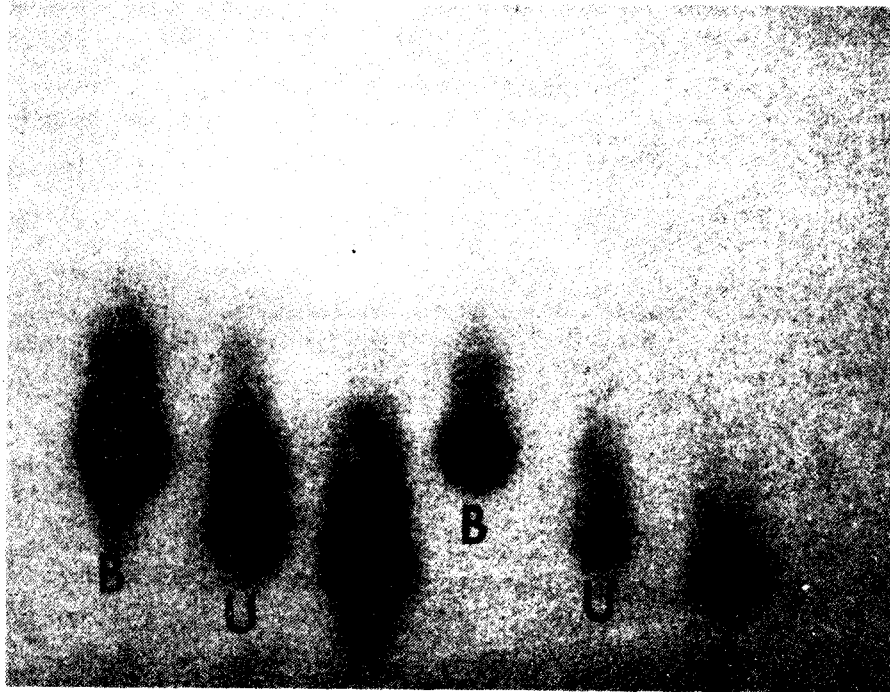


FIGURE 1. Electrophoretic mobilities of G-3-PDH alleles from three *Thunnus* species. Different stain intensities are the result of different tissue to grinding buffer ratios. B=bigeye tuna, U=unknown tuna (bluefin) and A=albacore tuna.

Although direct comparison with bluefin G-3-PDH was not possible, the large fish can be identified with confidence. The presence of striations on the liver of the specimen showed that it was not a yellowfin tuna. Because bigeye and bluefin tunas of the eastern Pacific are fixed for different alleles at the G-3-PDH locus, the lack of identity of the large tuna allele with that of the bigeye tuna demonstrated that the large tuna was not a bigeye tuna, and consequently must have been a bluefin. Furthermore, the mobility of the large tuna's G-3-PDH allele relative to that of the bigeye tuna and albacore was similar to that reported for bluefin tuna run under similar electrophoretic conditions (Sharp and Pirages 1978). On the basis of these results we conclude that the 237 kg tuna caught off Anacapa Island on 7 December 1981 was a bluefin tuna. This catch marks a substantial increase in the maximum size reported for this species in California waters.

Addendum: Since the paper has been edited a 180 kg bluefin tuna was speared off Guadalupe Island, Mexico during September 1982 and positively identified on the basis of morphological characters. In a direct electrophoretic comparison of muscle G-3-PDH, the mobilities of this bluefin and the 237 kg specimen were identical, providing positive evidence that the 237 kg fish was in fact a bluefin tuna.

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