Comment on "Some frequencies of underwater noise produced by fishing boats affecting albacore catch" [J. Acoust. Soc. Am. 66, 296–299 (1979)]

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An alternative explanation for the observations analyzed by Erickson is offered. Differences in catch-related success of boats participating in the West Coast Albacore fishery are attributed to the low-frequency content of vessel-radiated noise, which may attract albacore, rather than to the frequency structure above 1500 Hz.

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Through a correlational analysis,[1] Erickson has connected catch-related success with the radiated noise spectra of boats participating in the West Albacore fishery. Erickson observes that the spectra are of two types which are distinguished on the basis of their frequency structure above 1500 Hz. Boats with radiated noise spectra without peaks above this limit are, with a single exception, found to catch superiorly to boats whose spectra contain peaks above the same limit.

In view of the high auditory thresholds of the two albacore-related fishes, the yellowfin tuna (*Thunnus albacares*) and kawakawa (*Euthynnus affinis*), at 1000 Hz,[2,3] the approximate upper limit of tuna hearing,[3] Erickson's characterization of the radiated noise spectra in terms of their high-frequency structure appears inappropriate.

The alternative interpretation advanced here is that it is the low-frequency portion of the radiated noise spectrum which is decisive to catch-related success. This assumes, of course, that factors extraneous to the causative association of catch with vessel-radiated noise have been precluded by the original analysis.

The mechanism underlying the postulated direct association of low-frequency radiated noise and catch is suggested by Japanese work on the luring of fish by sound.[4-6] This has demonstrated that a number of species are attracted by low-frequency sound. It is known that both yellowfin tuna and kawakawa respond to low-frequency sound in the 100-to 1000-Hz range.[2,3] There is, moreover, at least some belief that tuna are attracted by low-frequency sound or noise, cf. Ref. 3 and the discussion attached to Ref. 4. Miyake's observations of reactions of yellowfin tuna and kawakawa to sound,[7] which were negative in some instances, do not provide significant controverting evidence because of their admitted ambiguity and otherwise limited character. It is suggested here that the albacore (*Thunnus alalunga*) is attracted by low-frequency sound. Differences in the catch-related success of boats engaged in the West Coast Albacore fishery must then be due to differences in the magnitude or quality of radiated low-frequency sound.

This hypothesis could be tested by a review of the measured radiated noise spectra. If the differences in attraction are due to the magnitude or overall weighted level of low-frequency sound, then the raw data should be consistent to the extent that differences in absolute noise levels can be determined. If the differences in attraction are due to the low-frequency structure of the spectrum, then single examples of power spectra of each boat may be sufficient for comparison. If, however, the source of differences is the temporal structure of low-frequency sound, then rather long-time records may be necessary to implicate the cause. Reclassification of the single anomalous datum noted by Erickson, if statistically significant, might constitute a crucial test of the hypothesis.

[1] G. J. Erickson, "Some frequencies of underwater noise produced by fishing boats affecting albacore catch," J. Acoust. Soc. Am. 66, 296–299 (1979).

[2] R. T. B. Iversen, "Response of yellowfin tuna (*Thunnus albacares*) to underwater sound," in *Marine Bioacoustics*, edited by W. N. Tavolga (Pergamon, New York, 1967).

[3] R. T. B. Iversen, "Auditory thresholds of the scombrid fish *Euthynnus affinis*, with comments on the use of sound in tuna fishing," F. A. O. Fish. Rep. 62(3), 849–859 (1969).

[4] T. Hashimoto and Y. Maniwa, "Research on the luring of fish shoals by utilizing underwater acoustical equipment," in *Marine Bioacoustics*, edited by W. N. Tavolga (Pergamon, New York, 1967).

[5] T. Hashimoto and Y. Maniwa, "Research on the luring of fish schools by underwater sound," in *Modern Fishing Gear of the World: 3*, edited by H. Kristjonsson [Fishing News (Books) Ltd., London, 1971].

[6] H. Suzuki and Y. Maniwa, "Field studies on the effect of artificial underwater sound in the attraction of the fish schools," in *Ocean '74, IEEE International Conference on Engineering in the Ocean Environment* (IEEE, New York, 1974).

[7] I. Miyake, "Observations on sound production and response in tuna," U. S. Fish. Wildl. Serv. Spec. Sci. Rep. Fish. 91, 59–68 (1952).

