

25. 26. Marine Vertebrate Audition

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This lecture will discuss basic and applied issues concerning the bioacoustics of marine vertebrates, with an emphasis on fish. The lecture will first consider why vertebrates hear and how hearing may have evolved. Issues that will then be discussed include hearing capabilities of fish and marine mammals, sound detection mechanisms of fishes, and the extraordinary diversity of hearing systems and hearing capabilities found among fishes.

The second part of the talk will focus on recent concerns and issues that have arisen as a result of the increased level of human-generated noise in aquatic environments. After considering the sources of human-generated sound, there will be a discussion of possible effects on marine organism and a review of the current literature on the subject.

Suggested readings:

- Coffin, A., Kelley, M., Manley, G.A., and Popper, A.N. (2004). Evolution of sensory hair cells. In: *Evolution of the Vertebrate Auditory System* (eds. G.A. Manley, A.N. Popper, and R.R. Fay). Springer-Verlag, New York, 55-94.
- Hastings, M. C. and Popper, A. N. (2005). Effects of sound on fish. California Department of Transportation Contract 43A0139 Task Order, 1. [http://www4.trb.org/trb/crp.nsf/reference/boilerplate/Attachments/\\$file/EffectsOfSoundOnFish1-28-05\(FINAL\).pdf](http://www4.trb.org/trb/crp.nsf/reference/boilerplate/Attachments/$file/EffectsOfSoundOnFish1-28-05(FINAL).pdf)
- Ladich, F., and Popper, A.N. (2004). Parallel evolution in fish hearing organs. In: *Evolution of the Vertebrate Auditory System* (eds. G.A. Manley, A.N. Popper, and R.R. Fay). Springer-Verlag, New York, 95-127.
- Popper, A.N. (2003). Effects of anthropogenic sound on fishes. *Fisheries*, 28:24-31.
- Popper, A.N., Fay, R.R., Platt, C., and Sand, O. (2003). Sound detection mechanisms and capabilities of teleost fishes. In: *Sensory Processing in Aquatic Environments* (eds. S.P. Collin and N.J. Marshall). Springer-Verlag, New York, pp. 3-38.
- Popper, A.N., Fewtrell, J., Smith, M.E., and McCauley, R.D. (2004). Anthropogenic sound: Effects on the behavior and physiology of fishes. *Marine Technology Soc. J.* 37(4):35-40.
- Smith, M.E., Kane, A.S., and Popper, A.N. (2004). Acoustical stress and hearing sensitivity in fishes: Does the linear threshold shift hypothesis hold water? *J. Exp. Biol.* 207:3591-3602.
- Wartzog, D., Popper, A.N., Gordon, J., and Merrill, J. (2004). Factors affecting the responses of marine mammals to acoustic disturbance. *Marine Technology Soc. J.* 37(4):6-15.