

22. Hydrodynamic Stimuli

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The sound wave created by a disturbance, whether it is a swimming marine mammal, croaking fish or waterfall, causes changes in pressure and fluid motion as it moves away from the source. The motion variables – “particle” displacement, velocity, and acceleration – are vectors and thus contain information about the location of the source, which is very important in underwater communications. But the particle motion associated with the acoustic disturbance has two components: one is caused by compression of the fluid by the source and thus related directly to the propagating wave or “true sound,” and the other is essentially a “flow” that would be present even if the fluid were incompressible. Close to the source, the “flow” is much larger than the particle motion due to “true sound.” This region is called the near field and its extent depends not only on the acoustic wavelength, but also on the size of the source. At lower frequencies associated with swimming motions and vocalizations of marine animals, the near field can extend for many body lengths, which creates a large region of biologically significant hydrodynamic stimuli associated with predator, prey and mate. Fishes have both a very sophisticated lateral line and a motion sensitive inner ear that can detect these stimuli. Results of several studies will be presented, which indicate detection of the near field “flow” is used by several species to localize prey and mates. Physical and mathematical hydrodynamic models used to mimic prey motion and mating calls in laboratory studies will also be discussed and presented.