**References and Notes**

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21 June 1966

## Sonic Detection of a Fresh Water–Salt Water Interface

A sound wave transmitted from one medium to another of different physical characteristics will be partially reflected, depending on the properties of the two media and upon the thickness of the mixing volume between them. The strength of the reflection at a plane boundary layer depends on the difference in density, the difference in sound velocity, and the thickness of the mixing layer. Usually the temperature and salinity gradients in the open ocean are not sufficiently abrupt to produce an echo of detectable amplitude with conventional sonar of long pulse duration.

The depth of the Charles River basin is controlled by a lock which connects the basin to Boston Harbor. When the tide is high, the lock introduces a considerable quantity of salt water with each operation. The cold salt water apparently flows under the fresh water and, under drought conditions, may attain a considerable depth.

It has been found that the layer between salt and fresh water can be seen in some areas of the Charles River basin by a 12-kc sonar (*1*) of 0.1-msec pulse duration and recorded on an Alden chart. For example, the sonar records (Fig. 1) show a faint salt-fresh water interface at the start in the main basin. At this time, the depth of the interface from the surface is about 3.3 m in the main basin of the river. The boat entered the sailing lagoon at the east end of the basin (*A*) where the underwater dykes between the islands form a closed lagoon. The salt layer is 2.4 m down inside this lagoon and extends to the end of the lagoon at the dyke on the north side.

Notice should be taken of the irregular shape and the variable intensity of the interface sonar record. Perhaps there are intermittent clumps of material, with echo-producing properties, floating at the interface. Perhaps there is intermittent mixing of the fresh and salt water, with a thick gradual gradient between.

The short-pulse sonar system appears to be a useful method of finding fresh-salt water interfaces in rivers and in offshore aquifers. For example, a sonar presenfation of the sewer outlet near Deer Island light in Boston Harbor shows where warm fresh water pours into cold salt water. A column of fresh water can be seen rising to the surface and drifting away with the tide.

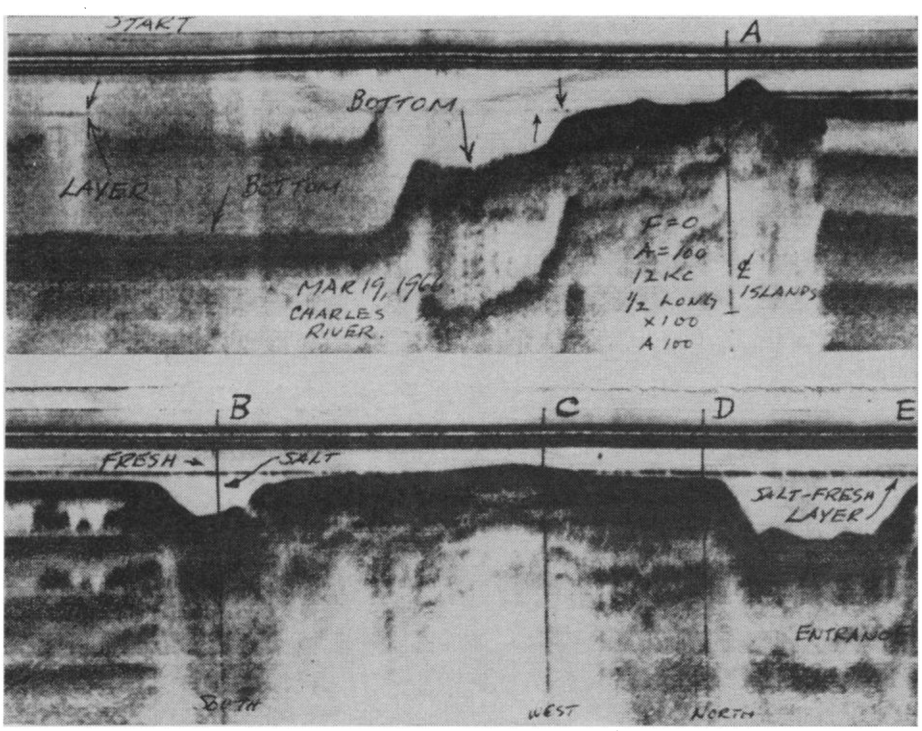


Fig. 1. Sonar records.

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3 August 1966

## Ice Nuclei from Automobile Exhaust and Iodine Vapor

Abstract. *When exposed to a trace of iodine vapor, the submicroscopic particles of lead exhausted by automobiles produce nuclei for the formation of ice crystals. Concentrations of particles exceeding $10^6$ per liter can be directly sampled from the exhaust pipe of an idling motor. Concentrations of from $10^4$ to $10^5$ per liter have been found in rural air downwind of auto roads; the concentration at one rural site has increased by an order of magnitude in 13 years. The phenomenon may provide a method of modifying clouds, and of determining (and monitoring) the percentage of automobile exhaust in a polluted atmosphere. It may be an important factor in inadvertent modification by man of the climate.*

A newly discovered phenomenon produces concentrations of ice-crystal nuclei (see cover) as high as $10^6$/liter in the free atmosphere where automobiles have been operating. The phenomenon may provide an important new technique for extensive overseeding in supercooled clouds; it may also present a highly sensitive and simple method for detecting submicroscopic particles of lead in auto exhaust, and thus provide a practical technique for establishing an auto-exhaust index in polluted air. It may also elucidate in an unexpected way the manner in which man is inadvertently modifying atmospheric clouds over extensive areas of the United States.

In the simplest terms, the phenomenon depends on the formation of less