THE MARINE LABORATORY
Institute of Marine Science
University of Miami

FINAL REPORT

December 1961

Studies of Underwater Noise

to

Bell Telephone Laboratories
Whippany, New Jersey
Purchase Order, D-602526
Based on Prime Contract Nobsr 57093
Sonar Branch, Bureau of Ships
U. S. Department of the Navy

by

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SUMMARY

Several underwater noise pulses believed to be of marine animal origin, have been observed at a number of the U. S. Navy Oceanographic Stations. Based on the observations, a pair of hydrophones were installed off the west coast of Bimini, Bahamas, with the objective of identifying the sound sources. One hydrophone is in water 100 feet deep, at the edge of the Gulf Stream about one NM off shore. The other one is a mile further out in 1200 feet of water. Three types of pulses that have been observed at Bimini, designated as Types 1, 2 and 3 are of interest in this connection. Type 1 sounds are short pulses of approximately single frequency tone in the range from 20 to 30 cps. The pulses occur randomly in time and in this respect, differ from trains of similar pulses observed at Oceanographic Stations. Type 2 sounds are pulse trains of about one minute duration that correspond to trains observed at Oceanographic Stations. Type 3 sounds are somewhat similar to Type 2, but occur irregularly in trains of varying duration. Types 1 and 3 sounds occur at the shallow hydrophone site. With the aid of two additional hydrophones that have been installed and an underwater video camera in process of installation, the probabilities appear to be good, of tracking and identifying the soniferous animals. Type 2 sounds occur at the deep hydrophone site and identifying the animals poses difficult problems. If the animals become active for periods of several days or more, identification may become possible with the aid of a Vare Industries, tethered, underwater video vehicle which is capable of working to depths of 1200 feet.

INTRODUCTION

In this report, it is planned to summarize in outline forms, the work performed and results obtained and to give references to memoranda on the results. The work is continuing in part on contracts (Nonr 840 (13) and (16)), because of the termination of Purchase Order D-602526 before completion of the project.

EXPERIMENTAL PROCEDURES AND RESTUTLTS

1. Oceanographic Stations.

Information on the characteristics of noise pulses of interest was obtained from magnetic tape recordings made at the oceanographic stations. The results are given in an Interim Report, Observations on a Pulsed Source of Sound, The Marine Laboratory, University of Miami, John C. Steinberg, May 4, 1960, (CONFIDENTIAL)

2, Bimini Installation*

Because the identification of soniferous animals appeared to be improbable under the conditions of observation at the Oceanographic Stations, a pair of hydrophones were installed on the east bank of the Gulf Stream off Bimini, in November 1960, During the 15 months since installation, some 30 categories of sounds have been observed.

The installation and preliminary results are described as follows:

a. Technical Report, The Bimini Installation, ML 61202, The Marine Laboratory, University of Miami, June 1961.

* Partially supported by subject purchase order.

A two-hydrophone cable assembly was installed on the ocean bottom off the west coast of Bimini, Bahamas on 9 November 1960, by the Marine Laboratory, University of Miami, The cable was terminated at the Lerner Marine Laboratory, Bimini, with magnetic tape recording and analyzing equipment. The installation was made in order to study marine animal sounds under natural conditions, ambient noise, and sound propagation across the Straits of Florida. Preliminary observations indicate the presence of a variety of marine animal sounds and propagation conditions of theoretical and experimental interest.

b. Paper presented before Acoustical Society of America, November 1961 and accepted for publication in the Journal of the Acoustical Society of America, A Hydrophone Installation for the Study of Marine Animals, John C. Steinberg, Morton Kronengold and William C. Cummings.*

A hydrophone assembly with terminals in the Lerner Marine Laboratory, Bimini, Bahamas, has been installed on the east bank of the Straits of Florida in order to study the sounds produced by marine animals in the natural environment. Sounds from two bottom-mounted hydrophones, one in 100 feet of water and the other in 1200 feet, were recorded on dual track, magnetic tape on a twenty-four hour basis. The tapes were played back at eight times recording speed and monitored for sounds possibly of marine animal origin. More than twenty-five categories of sounds were observed during the initial period from November 1960, to July 1961. A number of the categories showed repetitive, diurnal patterns and possible seasonal patterns of soniferous activity. In general, sound categories at the shallow and deep sites were different. Usually, only a single category was heard from a hydrophone at One time. Some tentative identifications have been made.

c. Memorandum for File, Three Noises of Possible Marine Animal Origin, The Marine Laboratory, University of Miami, John C. Steinberg, August 25, 1961,

A description of the principal features is given of three types of noises, of possible marine animal origin, that have been received with the Bimini Hydrophone Installation. These sounds have been designated as Types 1, 2 and 3. Type 2 sounds which were observed at the deep site, correspond in detail with sounds observed at oceanographic stations. They consist of trains of one minute duration, of about 100 short pulses or spikes. The trains occur at 10 minute intervals for period of several hours. Identification of the source may be possible if it can be attracted into shallow water where identification techniques are under study. Type 3 sounds are of interest because they are somewhat similar to Type 4 sounds and do occur at the shallow site. Type 1 sounds are short pulses (0.5 sec. duration) of approximately single frequency in the range from 15 to 30 cps that occur at random intervals. Trains of somewhat similar pulses have been observed at Oceanographic stations. The pulses are of interest because they occur at the shallow site where identification may be possible. All three types appear to be seasonal and have been observed only in the winter months.

DISCUSSION

In July 1961, two additional hydrophones were installed at the shallow site and one additional one at the deep site. Terminal equipment for tracking and locating soniferous marine animals from sound arrival time differences at the hydrophones, was installed in the Lerner Marine Laboratory, Bimini, and connected by cable with the hydrophones. A tripod mounted underwater video camera with remote pan, tilt, focusing and floodlight control has been obtained and is in

process of installation at the shallow site. The installation will be connected by cable with a monitor and control circuits ashore. The equipment is being used to study techniques of identifying soniferous marine animals and the significance of their sonic activity, The studies include the use of remotely controlled sound playback, bait releasing means and colored light displays for attracting soniferous animals into the camera's range.

ACKNOWLEDCMENTS

The purchase order under which the work has beer, done began January 1, 1960 and ended October 15, 1961. The hydrophones, associated preamplifiers and terminal amplifiers, part of the cable, and installation assistance were furnished by Bell Telephone Laboratories. In this connection, the author gratefully acknowledges the help of Dr. W. A. Tyrrell, Dr. R. H. Nichols, Mr. A E. Melhose and Mr. H. J. Young of Bell Telephone Laboratories The author is indebted also for assistance in the program, to Messrs. Morton Kronengold, W. C. Cummings, Roger Dann, W. C. Green, Herman Kumpf, Jack Loewenstein of the Marine Laboratory, University of Miami and to Mr, Frank Marshall, former Resident Engineer and Mr, Robert Mathewson, Resident Director of the Lerner Marine Laboratory, Bimini, Bahamas Finally, acknowledgment is made of support from the Sonar Branch, Bureau of Ships, U. S Navy, and the Biology and Acoustics Branches of the Office of Naval Research.