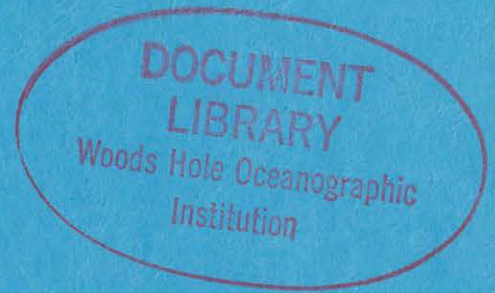


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FIELD EXPERIMENTS ON ELECTRICALLY EVOKED FEEDING
RESPONSES IN THE DOGFISH SHARK, *MUSTELUS CANIS*

by

Benjamin G. Dawson, Gail W. Heyer
René E. Eppi and Ad. J. Kalmijn

May 1981

TECHNICAL REPORT

*Prepared for the Office of Naval Research
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Field experiments on electrically evoked feeding responses in the dogfish shark, Mustelus canis. BENJAMIN G. DAWSON, GAIL W. HEYER, RENÉ E. EPPI, AND AD. J. KALMIJN.

From previous laboratory experiments, we learned that sharks, skates, and rays have an electric sense that enables them to detect voltage gradients as low as $0.01 \mu\text{V}/\text{cm}$ within the frequency range from DC up to 8 Hz. The animals use their electric sense in predation, cuing in on the bioelectric fields commonly produced by fish and aquatic invertebrates. To quantify the response, we analyzed the feeding behavior of the shark *Mustelus canis* in Vineyard Sound off Cape Cod, Mass. An electrode panel was embedded in the ocean substrate in a water depth of 2–3 m. Two salt-bridge electrodes, simulating a small prey fish, were placed 2 cm apart at a distance of 15 cm from a centrally located odor source. Another pair of salt-bridge electrodes, simulating a larger fish, were placed 5 cm apart at a distance of 30 cm on the other side of the odor source. DC current of $8 \mu\text{A}$ was applied to either one or both pairs of electrodes. Observations were made at night from a Boston Whaler with a glass-bottomed observation well. Liquified herring chum attracted and motivated sharks. Markings on the electrode panel enabled observers to measure the distances from the electrodes at which the sharks initiated attacks. Data were recorded on the size of the sharks (30–40 cm pups or 90–120 cm adults), the vigor of response, and the pattern of attack. Out of 136 responses, first-year sharks attacked the 2-cm electrodes 49 times from a distance of 15 cm or more measured along the dipole axis, which corresponds to a sensitivity of $0.04 \mu\text{V}/\text{cm}$ or higher. Of these 49 responses, 16 were from at least 18 cm, yielding a sensitivity of $0.02 \mu\text{V}/\text{cm}$ or better. Out of 112 responses, larger sharks attacked the 5-cm electrodes 44 times from a distance of 30 cm or more, equivalent to $0.01 \mu\text{V}/\text{cm}$ or better. Of these 44 responses, 15 occurred from at least 38 cm measured along the dipole axis, establishing a sensitivity of $0.005 \mu\text{V}/\text{cm}$ or better. With both pairs of electrodes on, the small sharks, after attacking the 2-cm electrodes, often veered away from the 5-cm ones. In sum, the results support the conclusion that these sharks, once motivated by odor, rely heavily upon their keen electric sense in executing their final strikes.

(This work was conducted as part of Kalmijn's project on electric and magnetic detection under contract with the Office of Naval Research, N00014-79-C-0071.)

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