Bioacoustics of Monterey Bay Pinnipeds: Extraction of Information from Acoustic Signals

Ronald J. Schusterman

University of California Santa Cruz
Institute of Marine Sciences
1156 High Street
Santa Cruz, CA 95060

Office of Naval Research
800 N. Quincy Street
Arlington, VA 22217-5000

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Two doctoral students at UCSC were supported by this ONR award. The students participated in an ongoing ONR funded research program on the bioacoustics of pinnipeds while developing and carrying out complementary independent investigations. During the award period, both students received specialized training in animal psychophysics, experimental design, and acoustic instrumentation and measurement. Both students completed and published significant original research related to sensory biology, communication, and cognition in seals and sea lions. Their concurrent participation in the primary ONR funded research program improved productivity and efficiency. The technical and research skills developed by the students while supported by this grant will be useful to independent and government supported research agencies.

Subject Terms:
- pinniped
- bioacoustics
- California sea lion
- harbor seal
- northern elephant seal

Ronald J. Schusterman
831-459-3345
FINAL REPORT

GRANT #: N00014-98-1-0603

PRINCIPAL INVESTIGATOR: Dr. Ronald Schusterman

INSTITUTION: University of California, Santa Cruz

GRANT TITLE: Bioacoustics of Monterey Bay Pinnipeds: Extraction of Information from Acoustic Signals

AWARD PERIOD: 1 April 1998 - 30 March 2002

OBJECTIVE: Provide training and support for two doctoral students investigating aspects of pinniped sensory systems and cognition related to ongoing ONR supported research.

APPROACH: Doctoral students are supported while being trained in a range of technical disciplines and experimental methods related to ONR funded research. Students participate in the ongoing research program while developing and carrying out complementary independent investigations.

ACCOMPLISHMENTS: Both students received specialized training in animal psychophysics, experimental design, and acoustic instrumentation and measurement. One of the students, Brandon Southall, investigated the effects of noise exposure on hearing by obtaining underwater and aerial masked hearing thresholds for three pinniped species (Phoca vitulina, Mirounga angustirostris, and Zalophus californianus). He also investigated other aspects of auditory processing in these species, including laboratory measurements of critical bandwidths and field measurements of biological signals and ambient noise levels. The other student, Colleen Reichmuth Kastak, investigated aspects of problem solving and memory with one pinniped species (Zalophus californianus). She demonstrated the capability of this species to form categories of functionally equivalent stimuli, use fast-mapping to expand these meaningful categories, and remember conceptual strategies for up to ten years. In addition to carrying out their independent research projects, both students consistently contributed to the collection of acoustic data in the laboratory that was critical to the success of the ONR funded research program.

CONCLUSIONS: Both students were highly successful, completing significant research and presenting their findings at professional meetings and in a range of peer-reviewed publications. Both students graduated with their doctorates in Ocean Sciences at the top of their class. The concurrent participation of the students in ongoing ONR funded research improved productivity and efficiency, allowing more research to be completed in a shorter period of time.

SIGNIFICANCE: The grant-supported students completed important research in the fields of animal sensory biology and animal cognition. For example, their findings improve our understanding of the effects of
noise on pinniped hearing and communication, and reveal some of the key
cognitive mechanisms used by pinnipeds to categorize and remember
significant sensory events. The technical and research skills
developed by the students while supported by this grant will be useful
to independent and government supported research agencies.

PATENT INFORMATION: N/A

AWARD INFORMATION:
Colleen Reichmuth Kastak, Outstanding Student Achievement Award, Ocean
Sciences Department, University of California Santa Cruz, 1998-1999.

Colleen Reichmuth Kastak, Invited participant in the Pauley Workshop on

Colleen Reichmuth Kastak, Invited talk to the American Psychological
Association, sponsored by division 25, San Francisco, CA, August 26th,

Brandon L. Southall, Invited talk to the 14th Biennial Conference on the

Brandon L. Southall, Invited talk to the 142nd meeting of the Acoustical

PUBLICATIONS AND ABSTRACTS (for total period of grant):

1. Schusterman, R.J., Kastak, D., Levenson, D.H., Southall, B.L., and
selection in pinniped biosonar. J. Acoust. Soc. Amer., 107:2256-
2264.

2. Kastak, D., Schusterman, R.J., Southall, B.L. and Reichmuth, C.
(1999) Underwater temporary threshold shift induced by octave-band
noise in three species of pinniped. J. Acoust. Soc. Amer.,
106 (2):1142-1148.

California sea lions: the role of different fish reinforcers.
Abstract presented November 28-December 3, Proc. 13th Biennial

4. Hayes, S. A., Kumar, A., Costa, D.P., Southall, B.L., Harvey, J.T.,
me roar; a playback experiment. Abstract presented November 28-
December 3, Proc. 13th Biennial Conference on the Biology of Marine
Mammals.

5. Holt, M. M., Schusterman, R.J., Kastak, D. and Southall, B.L.
Abstract presented November 28-December 3, Proc. 13th Biennial
Conference on the Biology of Marine Mammals.

6. Emery, J.H., Reichmuth, C., Schusterman, R.J., and Wilson, E.G.
(1999) Versatile signaling by female harbor seals (Phoca vitulina)
during the pup attendance period. Abstract presented November 28-


