

## **A New Research Programme on the Effects of Industry Sounds on Marine Animals**

by

Roger L. Gentry Ph. D, Programme Manager

### **Introduction**

Research into the effects of sound on marine animals has greatly increased over the past decade because of information needs in many segments of society including regulators, the regulated community, researchers, the courts and many others. Most of the research has been focused on marine mammals, but research on fish has recently increased, and the need for work on eggs, larvae and invertebrates is recognised. Worldwide, the U.S. Office of Naval Research (ONR) has been the major source of research funds (US\$5-7 M per year) on this topic for the past decade. Small programmes are maintained in several other agencies and in different nations, but taken together they have not equaled ONR's programme in scope or depth.

On May 18, 2006, a new research programme was started under the title **Joint Industry Programme (JIP) "E & P Sound and Marine Life"** having initial direct funding of at least US\$ 5 M per year committed. These funds were provided by oil and gas companies and trade associations acting as partners in what is called a Joint Industry Programme (**JIP**). All these companies are members of the **International Association of Oil and Gas Producers (OGP)** which will let the programme's research contracts from London. The programme focuses on sounds that are produced during the exploration and production (**E & P**) phases of offshore oil and gas operations and the effects these sounds may have on marine animals. Broadly, this programme will characterise the sound fields emanating from different industry activities, measure and model the propagation of these sounds in differing marine environments, describe and measure any effects this sound may have on marine animals, and develop, assess and improve mitigation measures. The fund will operate for a minimum of three years.

To date, 34 research topics have been proposed for funding under this programme. The programme's Executive Committee is preparing to establish priorities among these topics for funding in 2006. This paper describes the programme, lists the 34 research areas and invites the IWC Scientific Committee to; 1) comment on funding priorities, 2) identify research topics that are not included in the present list, 3) identify potential researchers not yet known to the scientific community through publication and 4) identify possible funding partners especially outside the U.S. The programme is soliciting comments from a number of entities, including IWC.

### **History**

The Oil and Gas Industry began initially discussing a research programme in the mid-1990s. In early 2005, nine companies formed a JIP with the goal of systematically *surveying existing knowledge gaps* as the possible basis of a research programme. This effort was referred to as JIP Phase 1. Under it a review was conducted of knowledge gaps, regional regulations, relevant international treaties and laws, potential funding partners and existing research programmes on sound and marine animals. In September 2005, OGP/JIP convened an international workshop in Halifax seeking stakeholder input on research that is needed to close these knowledge gaps. JIP Phase 1 members analysed the results of this meeting and produced a consolidated list of research topics that they recommended as the basis of JIP Phase 2 which

has the goal of *funding research to address the data gaps*. The list of research topics is given in Table 1 of this report, organised into seven subject categories.

## **Programme Organisation**

JIP Phase 2 is overseen by an Executive Committee comprising one representative of each partner company and a representative of the OGP secretariat which provides budgeting, contractual and other administrative support. The Executive Committee will be advised by an External Advisory Panel made up of leading figures from the scientific research and regulatory communities and science-based environmental groups. The Executive Committee will then determine the programme's major directions and funding priorities among research topic areas.

The Programme Manager will solicit proposals for specific research projects that fit within these topic areas. The received proposals will be rated for scientific merit by a Technical Advisory Panel made up of researchers with technical expertise appropriate to the proposals at hand. This panel will function like scientific review panels used by most science funding agencies. A Technical Management Committee made up of technical representatives of the JIP partners and the Programme Manager will use these ratings as one factor in selecting the proposals to be funded. Other selection factors will include relevance to the programme's goals as set by the Executive Committee; affordability, chances of successful completion during the contract period, and others. Research that addresses global issues in marine sound will have higher priority than research addressing local or regional issues. Project Managers with relevant technical expertise will be assigned to each study to help the contractor solve problems, coordinate with other projects and complete the contract successfully.

## **Scope**

The sound sources on which this programme focuses include seismic airguns, drilling, dredging, pile driving, construction equipment, explosive removal of offshore structures, and others. The taxa of concern include marine mammals, fish (eggs, larvae, juveniles and adults), turtles, birds and invertebrates. Researchers of any nation may apply and research may be conducted anywhere. The scope of this programme reflects the diverse interests of the JIP participants and the global nature of their operations.

## **Goals**

Industry's goal is to complete its projects on time and on budget. Therefore the goal of this programme is to provide new scientific data so that regulatory decisions and mitigation requirements for industry can be based on demonstrable facts instead of un-validated regulatory control measures. The programme's goal for each individual project is to apply practices at every step in its history, from how proposals were solicited to how the data were published, that follow what the scientific community considers to be fair practice and transparency. Only when data are acquired, reviewed and published according to established rules of science will they be acceptable to scientists.

## **Contracting Policy**

All research contracts will be managed through the OGP office in London. A variety of mechanisms may be used to fund projects, including;

- 1) sole source contracts;

- 2) joint funding with single or multiple partners;
- 3) requests for Proposals advertised in leading scientific journals;
- 4) contributions to pooled research funds such as the National Ocean Partnership Program, the National Fish and Wildlife Foundation (NFWF) and others; and
- 5) un-solicited proposals.

The distribution of funds among these various mechanisms is not determined ahead of time but will result from the proposals received and funding partners available. Most funds will be distributed as contracts, not grants. The policies governing research contracts, intellectual properties and publication will be modelled on those used in academic institutions.

## **Partners**

In addition to the direct funding by JIP participants, the programme is actively seeking funding partners with all entities world wide that have common interests in the research topics listed here. Cost-sharing is a necessary approach given the high cost of some research projects. To prevent replication of research effort, the programme will coordinate its activities with research programmes of other entities, such as government agencies, Navies, the pile driving and shipping industries and other programmes on E & P sources. The programme maintains close ties with professional committees that are developing noise exposure criteria for various marine animal groups, and with the worldwide science community that is reviewing and addressing the global issues in anthropogenic sound.

## **Stage of the Programme**

The process of establishing funding priorities for Year 1 began on May 18 at the first meeting of the programme's Executive Committee. The process is well under way but has not been concluded. There is still time for groups such as the IWC Scientific Committee to submit suggestions. Input is still being solicited from other sources, including the Executive Committee's External Advisory Panel. The programme's goal is to provide its first funding in summer 2006.

## **Products Expected**

The main products of this programme will be research papers published in peer-reviewed journals, but other intellectual properties (equipment, software, data sets etc) are also expected. To promote these products, annual reviews will be held to ensure that throughout the life of a contract the data products are prepared to eventually pass outside peer review. The Technical Advisory Panel and Technical Management Committee will participate in these reviews. Brief progress and final reports will be required from researchers for management purposes, but publication will be the primary product expected of all contractors.

## **Synopsis**

This programme intends to conduct high quality research that is selected, reviewed, and managed using best scientific procedures. It will operate for a finite period of time and cover a finite range of topics, but have a global scope. The programme's main requirement is that the scientific papers its contractors produce should:

- 1) meet the needs of the regulatory and regulated communities; and
- 2) meet the requirements for information that is used in scientific discourse.

The administrative structure of this programme is specifically designed to meet these two concerns. It is not possible to predict how many of the listed topics can be funded at any one time, or in what sequence. Some of these decisions will depend on the success of establishing co-funded research programmes with multiple outside partners.

## Table 1: Research topics under consideration for JIP Phase 2

**Category 1, Sound Source Characterization and Propagation:** Detailed information on characteristics of sound sources and improved models of sound transmission and Propagation:

- Source Characterization for E&P Sound Sources;
- Sound Propagation Models;
- Inventory and Assessment of Industry Research Material on Sound Source Characterization ;
- Develop Measurement Standards for Sound Source Characterization.

**Category 2, Physiological Effects (Auditory and Non-Auditory):** Greater understanding of the potential impacts of sound sources on the hearing ability of animals, as well as the potential to stress and damage non-auditory tissues, such as lungs or fish eggs:

- Auditory –Temporary Threshold Shift (TTS): Using E&P Sound Sources – Cetaceans;
- Auditory –Temporary Threshold Shift (TTS): Using E&P Sound Sources – Pinnipeds;
- Auditory –Temporary Threshold Shift (TTS): Using E&P Sound Sources – Fish;
- Physical Impacts: Fish (with air-filled cavities), Fish eggs and larvae, invertebrates;
- Stapedial Reflex in Marine Mammals;
- Development of Anatomical Ear Damage Models (physical);
- Epithelial/Hair Cell Damage in Fish Ears;
- Beaked Whale Issue: Nitrogen Bubble Formation.

**Category 3, Behavioral Reactions:** Greater understanding of the behavioral responses of animals to different sound sources, as well as their perception and sensitivity, and the potential effects of auditory masking Audiograms – Small Cetaceans and Pinnipeds:

- Audiograms – Fish;
- Anatomical Ear Models of Larger Whale Species (for developing audiograms);
- Relationship between Equal Loudness Curves and Audiograms;
- Electrophysiological Methods to Enhance Audiogram Collection (e.g., Auditory Brainstem Response [ABR]): Comparison of ABR to Behavioural Techniques;
- Electrophysiological Methods to Enhance Audiogram Collection (e.g., Auditory Brainstem Response [ABR]): Provide Co-funding to SWAT Programme

**Category 4, Mitigation and Monitoring:** Development of alternative sound sources or operating procedures that would lessen risk for acoustic impacts on marine animals, and research to evaluate, improve, or develop new mitigation methods or monitoring techniques:

- Marine Mammal Observers (MMO) Methods and Effectiveness;
- Collect and Analyze Marine Mammal Observer (MMO) Data;
- Monitor Animal Movements and Behavioural Reactions to Sound Exposure;
- Passive Acoustic Monitoring (PAM): PAMGUARD;
- Long-Term Monitoring: Baseline Monitoring (boat surveys and moored PAM buoys);

- Development and Improvement of Autonomous Buoys for PAM;
- Active Acoustic Monitoring (AAM);
- Airgun Ramp-Up (Slow Start) Efficacy (Includes developing alternative mechanisms for precise volume control);
- Attenuation Technology;
- Alternative Sound Sources and Sound Reduction; Alternate Seismic Exploration Sound Sources.

**Category 5, Research Tools:** Need for new or updated equipment or techniques to improve research data collection or monitoring efficacy:

- Animal Tagging Technology Development: Ongoing Tag Development, Data Transmission and Attachment Methods for Cetaceans and Other Marine Mammals.

**Category 6, Biological Significance:** Greater understanding of the potential for effects from sound on behavior, physiology, and reproduction to impact marine species at the population level:

- Biological Significance Workshops.

**Category 7, Cumulative Effects:** Greater understanding of the long-term effects of exposure to sound from E & P operations on marine animals, with an understanding of synergistic effects from other anthropogenic environmental stressors:

- Ocean Noise Budgets and Background Noise;
- Impacts on Prey;
- Cumulative Effects: Two Workshops with 15 Participants;
- Long-Term Monitoring: Meso-Scale Population Study (MPS).