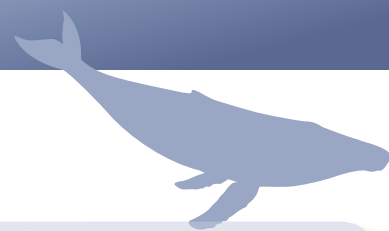


E&P Sound & Marine Life JIP



Annual report 2009



Fully committed and inspiring new work

By the end of 2009 the second phase of the Sound and Marine Life Joint Industry Programme (JIP) had allocated all of its funds. However, a few new projects were yet to be officially committed.

In total, the JIP's second phase has established 64 research projects worth more than \$22 million. There are more in the pipeline.

The results of all of these projects – spread among five research categories and a communications programme – will continue to become available between now and the end of 2013. They will be submitted for publication in peer-reviewed, independent scientific journals. All data will become available as well. Significantly, JIP-funded work has served as a catalyst. It has opened new research paths in the academic community – particularly in the areas of statistical methodology for estimating whale populations and studies of the links between the effects of sound on animals and the biological significance of these effects in the wider environment.

Fact-based results

By the end of 2009, the JIP had received some 1,900 pages of final reports from its research contractors. Most of these data are still unpublished. After rigorous peer review, material should appear in scientific journals during the course of the next two to five years.

Among the most noteworthy results by the end of 2009:

- A database now exists, organised by sound source, of current and future technologies to reduce sound generated by upstream activities.
- An experiment showed that trained dolphins do not experience nitrogen supersaturation during diving. This finding fails to support the hypothesis that cetaceans suffer from 'the bends' as a result of rapid ascent in response to sound.
- Researchers using anatomy-based models have estimated the hearing range of a baleen whale, the species thought to be most sensitive to E&P sound. Minke whales are estimated to hear between 120Hz and 25.9kHz (a span of 9-10 octaves, which is more than a grand piano).

A new beginning

In 2009 the majority of second phase participants decided to extend funding of the programme for up to another three years.

This extension will allow the JIP to build on important work already done and enable new research to assist regulatory and technical organisations in understanding the complex marine environment. It could bring total research funding for the programme to more than \$30 million by the end of the extension period.

- Three separate studies have shown that if industry operations have affected cetacean population trends in many parts of the world, the effects are either not detectable with current data, or cannot be separated from the other factors that drive population trends. Whaling has had the greatest effect on the trend in large whales, and fishing by-catch and targeted catches have had the largest effect on small cetaceans.
- The JIP led the expansion of a model (called PCAD) that links acoustic exposure of individuals to changes at the population level. It commissioned surveys of population models and of data useful to this model, and started a field study to gather new empirical data. Other agencies have begun to follow the JIP's funding lead.
- A multi-tiered risk assessment approach has been designed specific to industry use.
- An existing fisheries sonar has been shown to have the ability to detect non-calling marine mammals. Also, a survey has been completed of all marine mammal active acoustic

JIP Phase 2 Extension Members:

- BG Group
- BHP Billiton
- Chevron
- ConocoPhillips
- ENI
- ExxonMobil
- International Association of Geophysical Contractors (IAGC)
- Santos
- Statoil
- Woodside

methods that are now available for use in industry operations. Sonar may be a key technology in permitting seismic start-up in low visibility conditions.

- A software package called PAMGuard has been released that can interpret and display calls of vocalising marine mammals, locate them by azimuth and range and identify some of them by species. These abilities are critical for detecting animals within safety zones and enabling shut-down.
- A JIP report summarises a wide survey of existing marine mammal observer data that could be incorporated into a new database.
- A tutorial has been completed on how to build a passive acoustic monitoring system to survey marine mammal populations by their calls. Such a system could work throughout the life of a field. Also, a survey has been completed of technologies for recording and monitoring marine mammal vocalisations over long periods of time. Soon a report will be available that shows how call data can be used to estimate marine mammal population densities.
- Tags have proven to be the most useful system for assessing the behaviour of individual marine mammals. A JIP-sponsored workshop identified necessary tag improvements and the JIP has subsequently funded some of these.
- A survey is available that lists existing unmanned aerial systems (drones) that may be used to locate animals near industry operations.



JIP objectives

The overarching objective of the JIP is to identify specific, operationally-focused questions that relate to the effects of sound generated by the offshore E&P industry on marine life, and to pursue a research programme that will test scientific hypotheses and produce the data needed to address these questions.

The programme objective consists of four parts:

- Afford a more comprehensive understanding of the potential environmental risk(s) from oil and gas operations.
- Inform and update public decision-makers and regulatory development processes that affect E&P operations globally.
- Determine the basis for mitigation measures that are protective of marine life, cost effective, scientifically supportable and credible with outside stakeholders.
- Feed into planning for efficient and environmentally protective E&P project development.

Addressing a wider audience

The subject of sound and marine life is the focus of worldwide attention. So the JIP has taken a global approach in keeping the research and regulator communities informed about research progress.

Among the major conferences and symposia addressed by JIP representatives during the year was the eighth meeting of the Underwater Sound Forum (USF), held in London on 22 May. Speaking before an audience of UK civil servants, academics and NGOs, OGP Technical Director and JIP Coordinator John Campbell provided an overview of the programme, which proved timely since USF also discussed proposals for marine protected areas in the UK and the creation of a mitigation and monitoring database.

Another prime audience in 2009 was the OSPAR Commission, the mechanism by which fifteen governments of the western coasts and catchments of Europe cooperate with one another and the European Union to protect the marine environment of the North-East Atlantic.

In February JIP Chair John Young outlined the ambitions and achievements of the JIP for OSPAR's Biodiversity Committee at its Stockholm meeting. The following month he spoke before the Offshore Industry Committee in The Hague. And in June Dr Campbell, who also serves as OGP's representative to the OSPAR Commission, introduced the JIP Chair at the annual meeting in Brussels – a major focus of which was marine protected areas.

In November 2009, the US Minerals Management Service organised a workshop in Boston entitled 'The Status and Applications for Acoustic Monitoring of Marine Mammals'. Much of the presentation and discussion on the topic of Passive Acoustic Monitoring (PAM) drew on work funded by the JIP and was delivered by the JIP's principal investigators.

Also in November JIP had a presence at the Society for Marine Mammalogy Biennial Conference in Quebec City. There, during the five-day session JIP Chair John Young and Special Advisor Roger Gentry had the opportunity to meet with leading figures in the discipline and also encountered evidence of a worrying trend among some non-governmental organisations to accuse any research supported by industry or the military of being 'tainted'. This issue is being taken up by the joint OGP/IAGC Sound & Marine Life Task Force.

JIP yields new reporting system of choice

For more than a decade, guidelines issued by the UK Joint Nature Conservation Committee (JNCC) on conducting marine seismic surveys have been benchmark for regulatory agencies in many parts of the world. These have been adopted as written or adapted to suit local circumstances.

An integral part of these guidelines has been

a recommendation for the use of observers aboard seismic vessels to detect and record the presence of marine mammals in the vicinity of a seismic survey operation. A range of methodologies has been developed to capture these data, but the dissimilarity of reporting systems has made it difficult to extract and compile valuable information on animal populations.

In 2009, however, after a review, JNCC began recommending a unified system of recording and reporting developed using JIP funding. There is a clear reference to the programme on the JNCC web site with a link directly through to the JIP.

Field trials for PAMGuard

One of the potentially most practical outcomes of the JIP has been the development of a passive acoustic monitoring (PAM) software system known as PAMGuard.

PAMGuard has undergone a number of field trials, principally in the Gulf of Mexico. It has proved to be a capable and efficient system and will be a valuable asset to the industry as regulators increasingly require passive acoustic monitoring as a routine. The JIP's complementary body within OGP, the Environment Committee's Sound & Marine Life Task Force (run jointly with IAGC), is helping raise awareness of PAMGuard among E&P companies and the research and regulatory communities.



Naval accolade

The US Office of Naval Research (ONR) praised the JIP for its support of 'an impressive portfolio of research in the field of marine mammal science that has directly benefited the oil and gas industry'.

In a letter to OGP Technical Director John Campbell, an official of ONR's Marine Mammals & Biological Oceanography Program went on to single out the way in which the JIP 'has worked independently as well as co-operatively with various agencies in the US Government to support the world's leading researchers in the field of marine mammal science. The work these scientists have performed has been critical to helping establish current mitigation strategies and criteria, and continues to supply the basic information needed to improve upon established policies.'

Projects underway with commitment value (as of 31st Dec 2009)

By the end of 2009, the JIP had established a total of 64 contracts across five research categories and a communications function. The cumulative value of these contracts was around \$19 million.

Of these contracts, 35 (55%) had been completed by year-end. These are highlighted in blue. Twenty-nine projects were still in progress. Programmes in red were newly commissioned in 2009.

CATEGORY 1: SOUND SOURCE CHARACTERISATION AND PROPAGATION \$6.1 MILLION

- Source characterisation study 2006 – experimental design: *University of New Orleans*
- High frequency source characterisation experiment – deployment & retrieval of EARS (Environmental Acoustic Recording System) buoys: *University of Southern Mississippi*
- Source characterisation study – data analysis & modelling: *University of New Orleans*
- Source characterisation study – data analysis & modelling: *University of Louisiana, Lafayette*
- Charter of the vessel 'Fairfield Endeavour' for deployment of an air gun array used in source measurements in 2007: *Fairfield Industries*
- Positioning services for EARS buoys during collection of source measurements of an air gun: *Equipment & Technical Services Inc.*
- Computation of hydrophone positions on the 2007 sound source characterisation experiment using 3-D finite element hydrodynamic modelling: *Specialty Devices Inc.*
- Air gun measurement project – 2007, Western Norway: *PGS Geophysical*
- Air gun measurement project – 2008/09, Western Norway: *PGS Geophysical*
- Review of existing data on underwater sounds produced by the oil & gas industry: *Seiche Measurements Ltd*
- Workshop and review of 'noise control technologies' capable of reducing underwater acoustic footprints: *Noise Control Engineering Inc.*
- Environmental assessment of marine vibroseis technology: *LGL Ltd*
- Review of acoustic metrics and development of acquisition methodologies: *JASCO Research Ltd*

CATEGORY 2: PHYSICAL, PHYSIOLOGICAL & HEARING EFFECTS \$4.9 MILLION

- Auditory evoked potential audiogram, seasonal movement measurements and vocalisation of individual minke whales in Icelandic waters: *University of Southern Denmark/University of Hawaii*
- Blood nitrogen uptake and distribution during diving in bottlenose dolphins: *Scripps Institution of Oceanography*
- Creating a research strategy for measuring hearing in mysticete whales: *University of California, Santa Cruz*
- Modelling mysticete hearing (2007/8): *Woods Hole Oceanographic Institution, Boston University*
- Modelling mysticete hearing (2009/10): *Woods Hole Oceanographic Institution, Boston University*
- Temporary threshold shift (TTS) in dolphins exposed to multiple air gun shots: *SPAWAR Laboratory*
- TTS in dolphins exposed to multiple air gun shots – technical oversight: *University of California, Santa Cruz*
- An experimental design for measuring tissue injury in fish exposed to air gun shots: *Environmental BioAcoustics, LLC*
- A model for predicting the onset of auditory tissue damage in different species of fish: *Pennsylvania State University*
- Hearing ability in three life-stages of the loggerhead turtle (2008/11): *Virginia Wesleyan University*
- Airgun effects on arctic seals: auditory detection, masking and temporary threshold shift (2009/12): *University of California, Santa Cruz*

CATEGORY 3: BEHAVIOURAL REACTIONS AND BIOLOGICALLY SIGNIFICANT EFFECTS \$3.1 MILLION

- Multi-stimulus behavioural response studies to assess responses of beaked whales and other deep-diving cetaceans to naval sonars and seismic air guns: (joint programme co-funded with ONR and N-45, US Navy) with support/co-ordination by *Marine Acoustics Inc.*
- Cetacean population assessment study: *Sea Mammal Research Unit, University of St Andrews*
- Cetacean population assessment study: *Centre for Environment, Fisheries and Aquaculture Science*
- Cetacean population assessment study: *LGL Ltd, British Columbia*
- Cetacean population assessment study: *SeaWatch Foundation*
- Literature review of marine mammal population modelling: *Nova Southeastern University, Florida*
- Literature review on marine mammal and fish population modelling: *University of St Andrews*
- Literature review to estimate PCAD-related transfer functions: *Florida State University Research Foundation & Murdoch University*
- Relating behaviour and life functions to populations level effects in marine mammals: an empirical & modelling effort to develop the PCAD model; and use of electronic tag data and analytical tools to identify & predict habit utilisation of marine mammals in a risk assessment framework: *University of California, Santa Cruz*
- Application of risk assessment for evaluating the effects of sound on marine life: *LGL Ltd*
- Testing of potential alerting responses on tagged sperm and humpback whales off Sitka, Alaska: *University of California San Diego*
- Controlled Exposure Experiments to examine the effects of seismic airgun arrays on humpback whales – workshop & proposal preparation: *University of Queensland and Curtin University*
- Fish Behaviour – workshop on methods & technologies for studies, Stavanger, Norway

CATEGORY 4: MITIGATION AND MONITORING \$3.7 MILLION

- PAM (Passive Acoustic Monitoring) GUARD Phase III studies: *Scripps Institution of Oceanography, USA*
- PAMGUARD Phase IV studies: *Heriot-Watt University, UK*
- PAMGUARD Phase IV studies: *Oregon State University*
- PAMGUARD Phase IV studies: *Sea Mammal Research Unit, University of St Andrews*
- PAMGUARD Phase IV studies: *Ecologic, UK*
- PAMGUARD Phase IV studies: *Scripps Institution of Oceanography*
- PAMGUARD Phase IV studies – PAMGUARD field testing during the 2007 CODA survey: *Sea Mammal Research Unit, University of St Andrews*
- PAMGUARD support services through 2008-2010: *Sea Mammal Research Unit, St Andrews University*
- Integration and testing of an acoustic vector sensor into 3-D tracking PAM array to resolve left/right ambiguities: *Scripps Institution of Oceanography*
- Evaluation of low and high frequency sonar for detection of whales in relation to seismic survey explorations: *SIMRAD AS, Norway*
- Marine mammal observer (MMO) data analysis: *RSK Environment, UK*
- Estimating marine mammal population densities from fixed PAM data: *Sea Mammal Research Unit, University of St Andrews (co-funded with NOAA Acoustics Programme).*
- PAMGUARD software development – detection, classification & localisation capabilities: *Akoostix Inc, Nova Scotia*
- Development & implementation of acoustic classification of odontocetes with PAMGUARD: *Sea Mammal Research Unit, St Andrews University, UK and Institute of Sound & Vibration Research, Southampton*
- Review & inventory of current fixed installation PAM methods & technologies: *Bio-Waves, Inc, California*
- Fixed passive acoustic marine mammal monitoring for estimating abundance and mitigating the effect of operations on the marine environment: *Innovations in Signal Processing (INSIG), Inc, Rhode Island*
- Mitigation & Monitoring: review/inventory of current active acoustic methods & technologies; identification of potential areas of further development for the detection of marine mammals at sea during E&P activities offshore: *Defence Research & Development Canada – Atlantic*
- Development of software for real-time acoustic identification of cetacean species: *University of Hawaii*
- PAMGUARD industry field trial, Gulf of Mexico: *Sea Mammal Research Unit, University of St Andrews*

CATEGORY 5: RESEARCH TOOLS \$1.2 MILLION

- Testing of developed GPS depth tags on sperm whales in the Sea of Cortez – 2007: *Oregon State University*
- Testing of developed GPS depth tags on sperm whales in the Sea of Cortez – 2008: *Oregon State University*

- Animal tagging workshop: *Sea Mammal Research Unit, University of St Andrews*
- Inventory of unmanned aerial systems: *LGL Ltd*

CATEGORY 6: COMMUNICATION OF RESULTS \$195,000

- Publication of a special issue of 'Aquatic Mammals' – progress in using auditory evoked potential methods for studying hearing in marine mammals: *University of Western Illinois*
- Financial support for the international conference on 'the effects of noise on aquatic life' (Nyborg, Denmark): *University of Maryland*
- Support for a workshop on noise exposure criteria for fish & turtles: *Mote Marine Laboratory, USA*

- Co-sponsorship of the 17th biennial Conference on Marine Biology of Marine Mammals, Cape Town, South Africa: *Mote Marine Laboratory and University of Maryland*
- Support for a workshop on design of a research initiative to inform PCAD Model: *University of Aberdeen and Murdoch University, Western Australia*
- External Communications Support to the JIP: *Grayling Ltd, UK*
- JIP Programme Review meeting in Houston, October 2008

JIP finances

Since mid-2006, spending on projects has accelerated. Two thirds of funding recipients are organisations based in the United States; one third is based in Europe. To date, the JIP has kept to its commitment to limit management costs to less than 10% of project cost. This has been possible since companies funding the JIP have provided human resources to assist in projects. To prevent an increase in management costs, the same level of human resources from funding companies will be required.

Cash flow and commitment trends are illustrated right. These reflect the lag in expenditure on multi-year contracts.

Since the JIP operates on a January-December financial year, the latest review of accounts covers the period from 1 January 2009 – 31 December 2009 and states:

'...On the basis of our review which does not constitute an audit, we are not aware of any material modifications that should be made to the financial information for the year ended 31st December 2009. The income and expenditure account for the year ended 31st December 2009 and the balance sheet as at that date have been properly prepared from the underlying records.'

Kajaine Limited
Chartered Accountants and Registered Auditors
19th March 2010

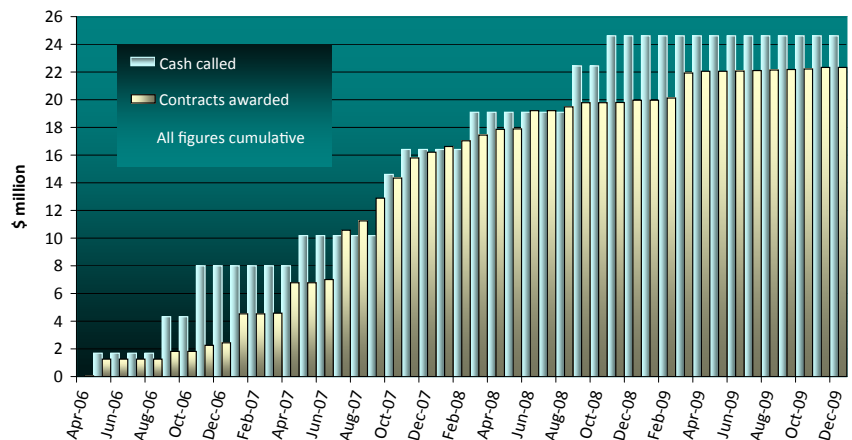
Under the Participation Agreement, participants have the right to audit the financial and other records generated and maintained by OGP and its appointed contractors.

JIP Document Management

As at end 2009, the JIP extranet had 125 registered users who had access to more than 2000 documents.



Cash Called and Contracts Awarded (as at Dec 2009)



Budgeted Spend vs Total Invoiced (as at Dec 2009)

