



**E&P Sound & Marine Life  
Joint Industry Programme:  
Research and Development to Inform  
Decision Making, Risk Reduction and Management**



# Possible effects of anthropogenic sound on animals:

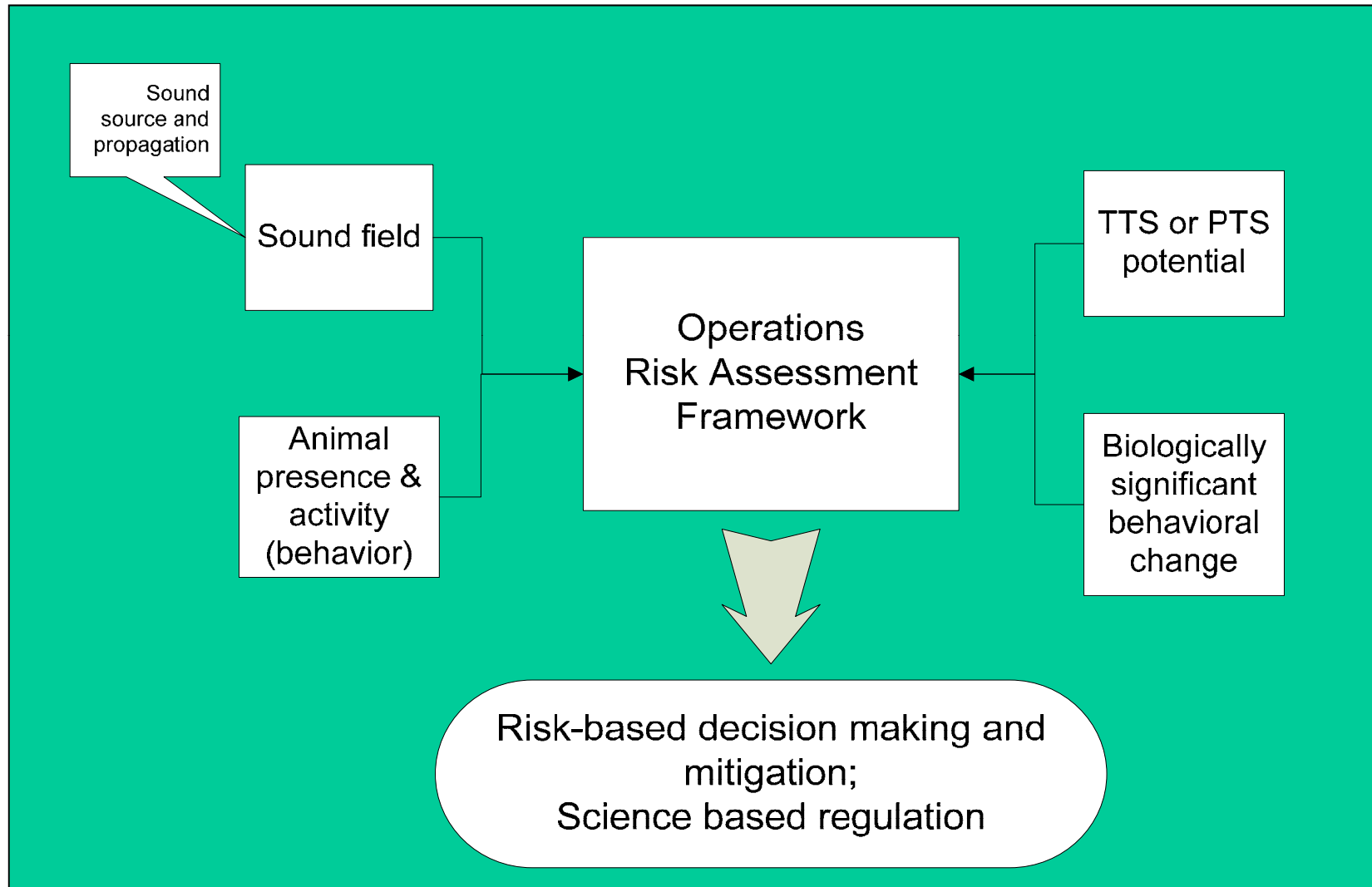
- Mortality e.g., strandings
- Temporary (TTS) or permanent (PTS) hearing loss
- Interference which could lead to undesirable behavioural changes in feeding, mating, shoaling, migration, etc.
- Interference with animal sonar or long-distance communication
- Undesirable effects on fishing and indigenous subsistence hunting
- Undesirable effects at other levels of the ecosystem including planktonic organisms and juvenile stages

**Problem: Lack of scientific data resulting in:**

- 1) Increased concern within ocean user community
- 2) Hampers E&P operational risk assessments causing operational delays, increased operational costs and potential safety risks



# E&P Management Strategy



- **JIP Objectives**
  - **Identify specific, operationally focused questions on potential effects of sound generated by the offshore E & P industry on marine life**
  - **Support research that tests scientific hypotheses and produces data needed to address these questions**
  - **Provide scientific information which reduces uncertainty**
  
- **JIP Research Goals**
  - **Improve understanding of potential environmental risks from oil and gas operations,**
  - **Inform and update policy decision makers and regulatory development processes**
  - **Determine basis for mitigation that is protective of marine life, cost effective, and credible with stakeholders**
  - **Maintain ability to operate seismic under low visibility conditions**



# Managed via the International Association of Oil and Gas Producers (OGP)

- **JIP Phase 1: 2005 Scoping Phase**
- **JIP Phase 2: 2006-2009**  
**3 year, 25 million USD research program, 14 participants**
- **JIP Phase 2 Extension: 2010-2012**  
**3 year, 11 million USD research program, 10 participants**

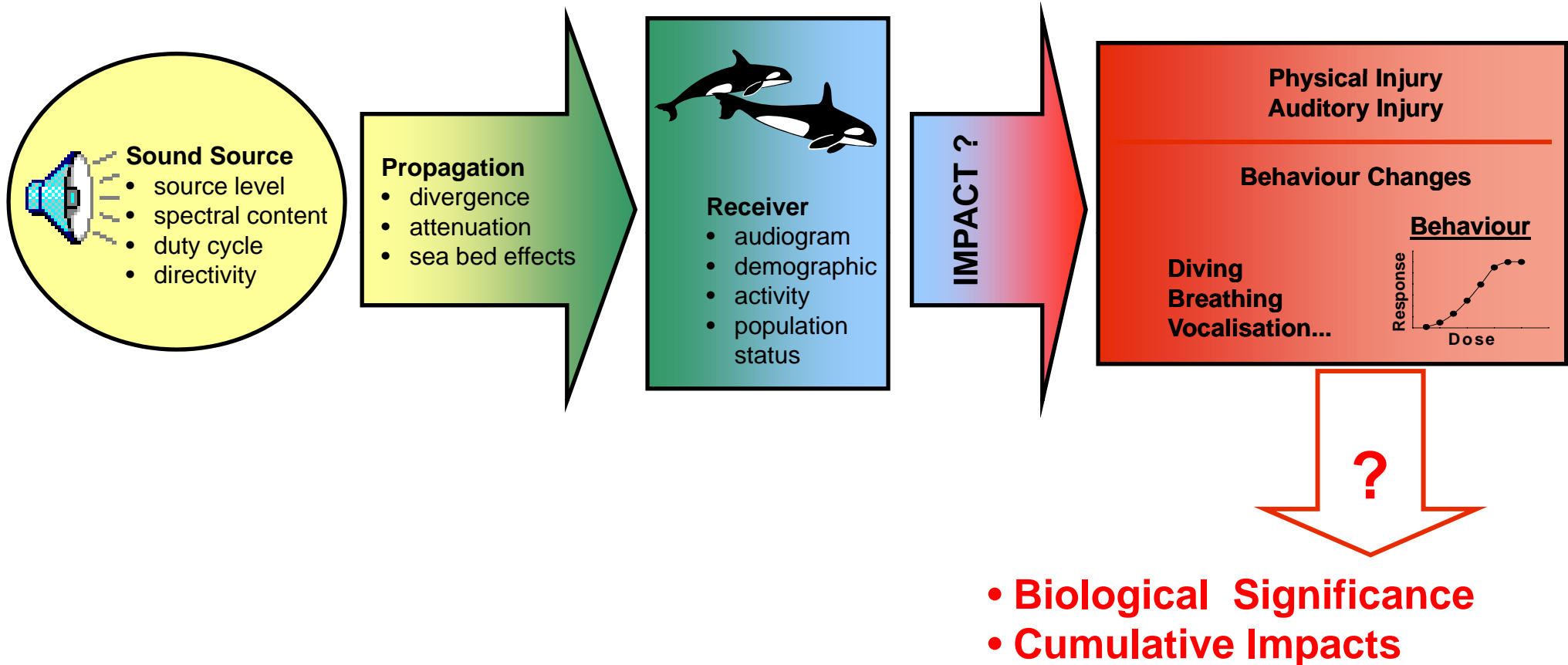


# Managed via the International Association of Oil and Gas Producers (OGP)

- **JIP funded research conducted by independent researchers and contractors**
  - Over 60 contracts awarded to universities, governments & independent contractors
- **Methods: fund research using bid/award process; publish all peer-reviewed results; data made available to public**
- **Priorities determined by business needs:**
- **Structure: Executive Committee, Technical Mgmt Committee, External Advisors**



# Source – Pathway – Receiver Model



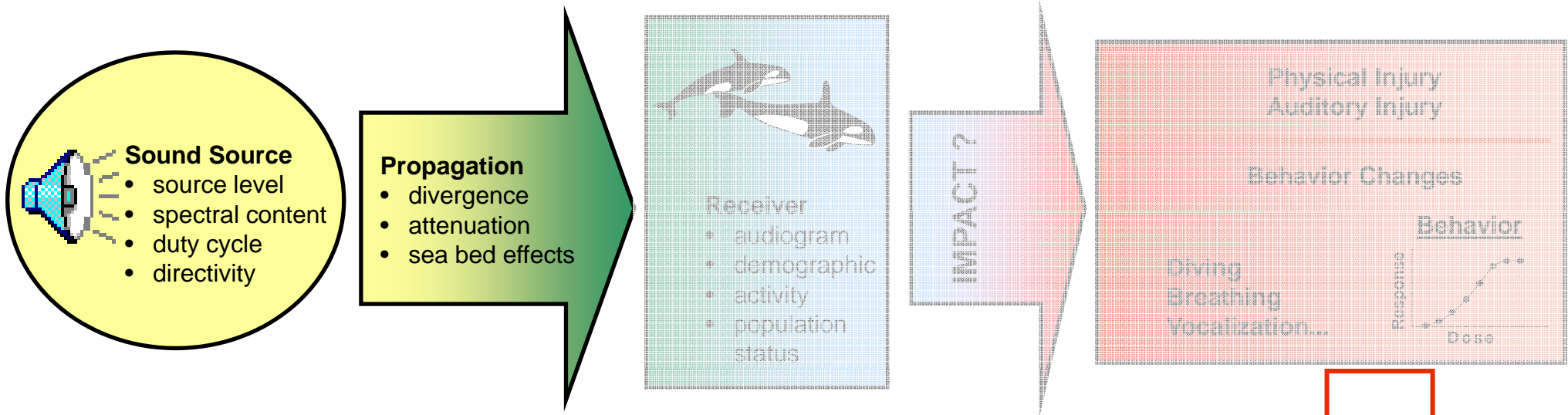
## JIP Phase 2

- **Category 1: Sound Source Characterisation and Propagation:**  
Better define the output from E&P industry sources and how the sound propagates
- **Category 2: Physical, Physiological, and Hearing Effects:**  
Characterise the physical and physiological effects of sound on target marine life, gain understanding on what and how animals hear, and how exposure affects hearing ability
- **Category 3: Behavioural Reactions of Marine Life and Biological Significance:**  
Better understand behavioural responses of marine life to industry sound sources, and The biological significance of these exposures
- **Category 4: Mitigation, Monitoring, Analysis & Management of Monitoring Data:**  
Reduce exposure of animals, thereby allowing industry to operate more effectively in areas which are subject to sensitivity restrictions and low light/visibility conditions
- **Category 5: Research Tools:**  
Includes development of satellite tags, autonomous buoys and other tools that enable us to conduct research in other categories
- **Category 6: Other:**  
Captures other activities such as the development of communication materials, external workshops, outreach, etc.





# Category 1 - Sound Source Characterization and Propagation

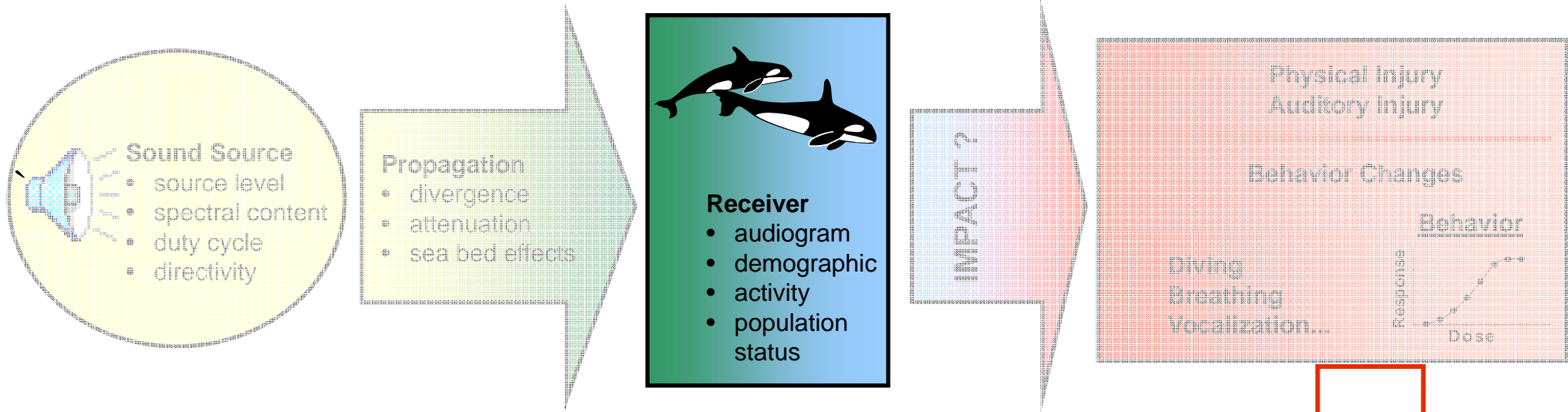


- **Sound source characterization and propagation: GOM 2007**
  - Gained understanding of standard industry seismic source array output in three dimensions up to 25kHz
- **Single and Cluster airgun and array calibration: Norway 2008-11**
  - Calibrated range enables high fidelity, spectral measurements up to 50kHz

- **Biological Significance**
- **Cumulative Impacts**



## Category 2 - Physical, Physiological, and Hearing Effects

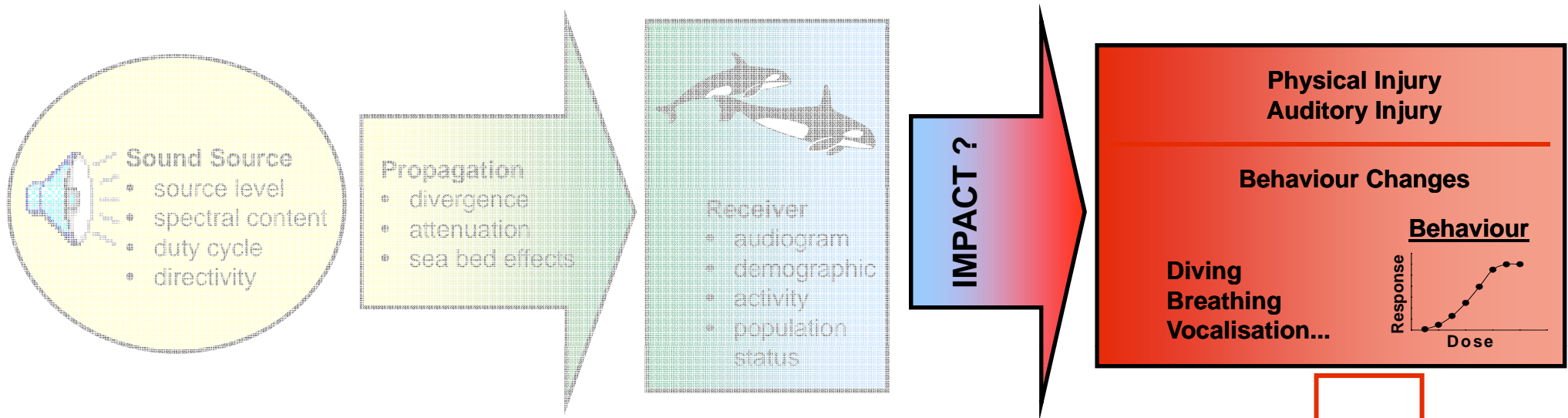


- **First anatomy based model of minke whale hearing complete**
- **Anatomy and behavioral based turtle audiogram in progress (complete 2011)**
- **TTS in odontocetes exposed to multiple air gun pulses began 2010**
- **TTS in arctic pinnipeds study began 2010**

- **Biological Significance**
- **Cumulative Impacts**



# Category 3 - Behavioural Reactions of Marine Life & Biological Significance

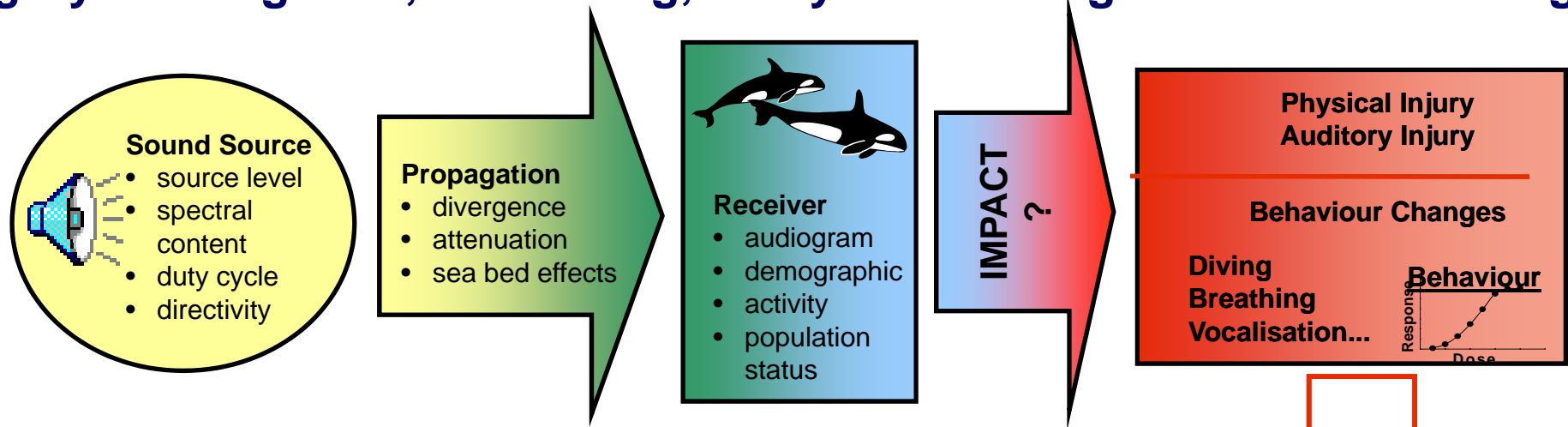


- **PCAD model: Developing transfer functions, focused on biologically significant impacts**
- **Alerting response assessment: determining which, if any, sounds may alert cetaceans. Field trials complete, results late 2010**
- **\$9M USD Behavioral Response Study in Australian Humpbacks funded with MMS 2010-2013**

- **Biological Significance**
- **Cumulative Impacts**



# Category 4 - Mitigation, Monitoring, Analysis & Management of Monitoring Data



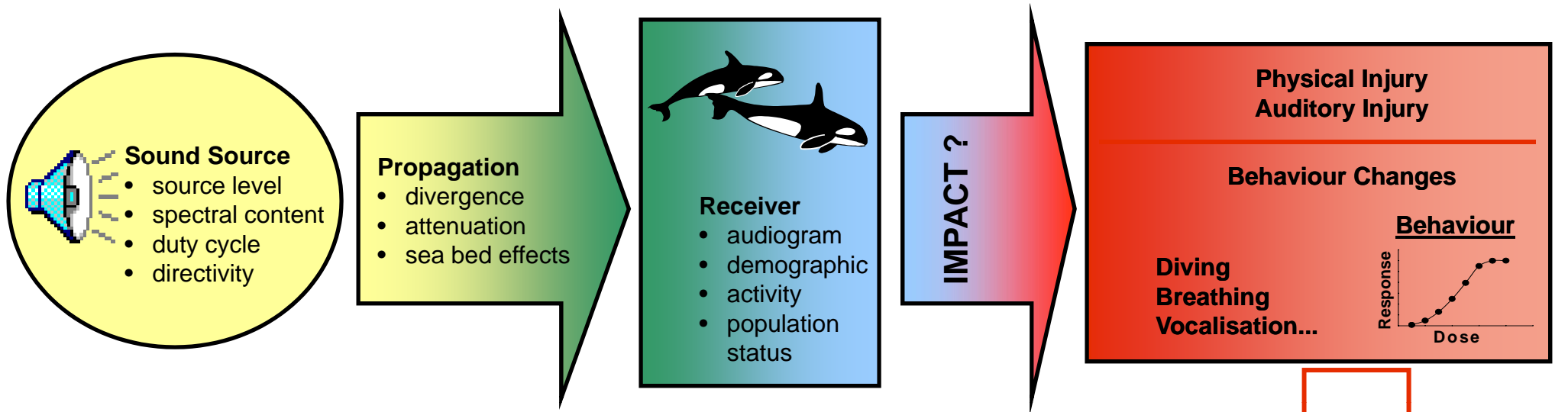
- Delivered open-source PAM data processing/user interface software (PAMGuard) in 2008
- Contributing supporter for DECAF – Density Estimation for Cetaceans from Passive Acoustic Fixed sensors project
- Completed Active and Fixed Passive Acoustic Monitoring technology reviews

- Biological Significance
- Cumulative Impacts





## Category 5 – Research Tools

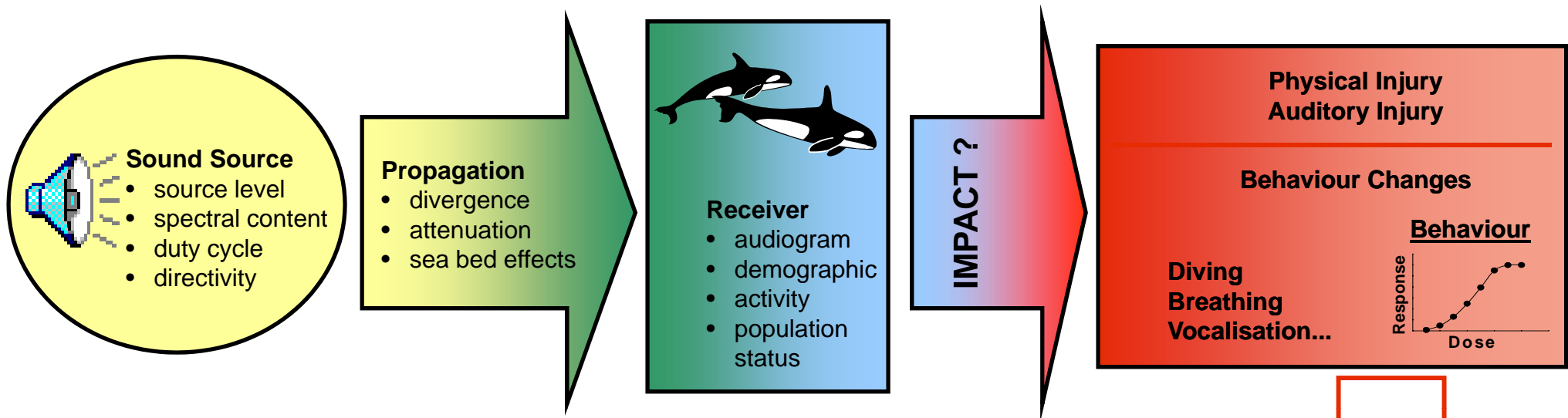


- Field testing of GPS/depth tags on Sperm whales in the Sea of Cortez
- Compilations of knowledge on underwater gliders
- Compilations of knowledge on unmanned aerial systems

- Biological Significance
- Cumulative Impacts



## Category 6 – Other



- Support for ASA workgroup on noise exposure criteria for fish and turtles
- Support for the International Conference on the Effects of Noise on Aquatic Life
- Support for the 17th biennial Conference on the Biology of Marine Mammals

- **Biological Significance**
- **Cumulative Impacts**



- **Many additional ongoing projects, projects in planning stage**
  - **More Information: [www.soundandmarinelife.org](http://www.soundandmarinelife.org)**
  - **JIP partners: Anadarko\*, BG, BHP Billiton, BP+, Chevron, ConocoPhillips, ENI, ExxonMobil, IAGC, Santos, Shell+, Statoil, Total+, Woodside,**
- \* Phase 2, year 1 and 2 participant only**
- + Phase 2 participant only**

