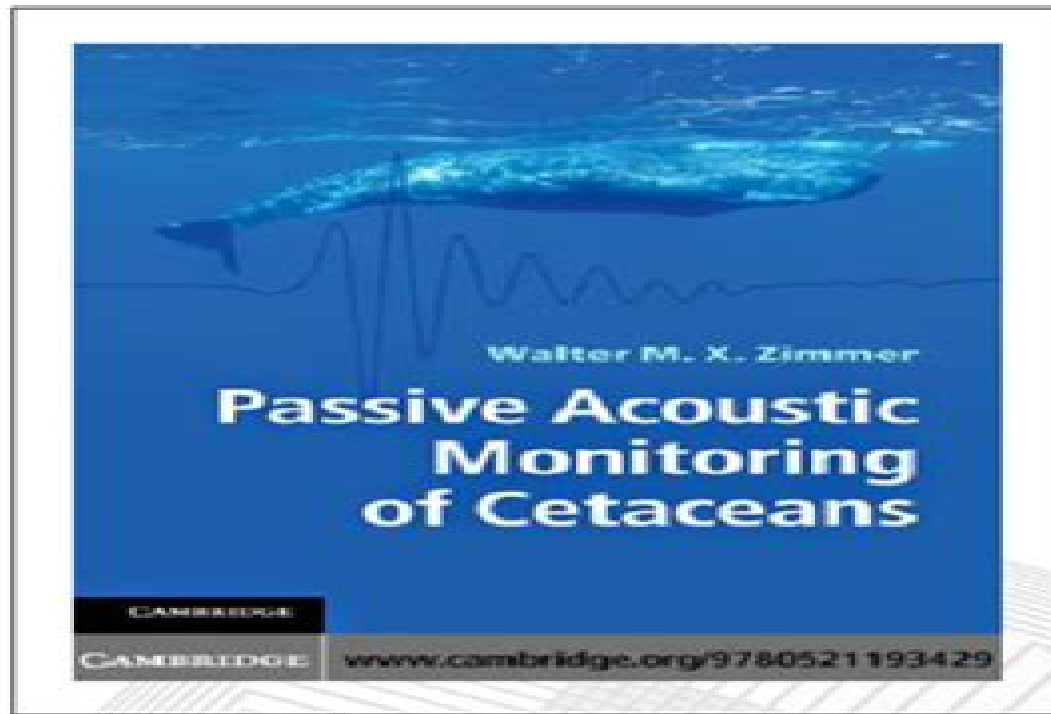


Passive Acoustic Monitoring of Cetaceans First  
Edition Walter M.X. Zimmer



# Passive Acoustic Monitoring Of Cetaceans

**Jianjun Gao**



## **Passive Acoustic Monitoring Of Cetaceans:**

**Passive Acoustic Monitoring of Cetaceans** Walter M. X. Zimmer, 2011-04-21 Passive acoustic monitoring is increasingly used by the scientific community to study survey and census marine mammals especially cetaceans many of which are easier to hear than to see PAM is also used to support efforts to mitigate potential negative effects of human activities such as ship traffic military and civilian sonar and offshore exploration Walter Zimmer provides an integrated approach to PAM combining physical principles discussion of technical tools and application oriented concepts of operations Additionally relevant information and tools necessary to assess existing and future PAM systems are presented with Matlab code used to generate figures and results so readers can reproduce data and modify code to analyse the impact of changes This allows the principles to be studied whilst discovering potential difficulties and side effects Aimed at graduate students and researchers the book provides all information and tools necessary to gain a comprehensive understanding of this interdisciplinary subject

**Impacts of Environment-Dependent Acoustic Propagation on Passive Acoustic Monitoring of Cetaceans** Carolyn M. Binder, 2018 Significant effort has been made over the last few decades to develop automated passive acoustic monitoring PAM systems capable of classifying cetaceans at the species level however these systems often require tuning when deployed in different environments Anecdotal evidence suggests that this requirement to adjust a PAM system's parameters is partially due to differences in the acoustic propagation characteristics The environment dependent propagation characteristics create variation in how a cetacean vocalization is distorted after it is emitted If these differences are not accounted for it could reduce the performance of automated PAM systems An aural classifier developed at Defence R accurate results are obtained by using perceptual signal features that model the features employed by the human auditory system In this thesis a combination of an at sea experiment and simulations with bowhead and humpback whale vocalizations was conducted to investigate the robustness of the classifier performance to signal distortion as a function of propagation range It was found that in many environments classification performance degraded with increasing range largely due to decreased signal to noise ratio SNR however in some environments as much as 40% of the performance reduction was attributed to signal distortion resulting from environment dependent propagation It was found that sound speed profiles resulting in considerable boundary interaction were important for producing sufficient signal distortion to affect PAM performance relative to the impacts of SNR Therefore in some environments the ocean acoustic properties should be taken into account when characterizing performance of automated PAM systems For the environments in which signal to noise issues dominate the use of multi element arrays is expected to increase the performance of automated recognition systems beyond the minor improvements to be gained from adjusting a PAM system's parameters Nonetheless propagation modelling should be used to complement PAM experiments to account for bias in probability of detection estimates resulting from environment dependent acoustic propagation

*Passive Acoustic Monitoring for the Detection and Identification of*

*Marine Mammals*, 2009 This project is intended to advance the state of passive acoustic monitoring Improved methods of identifying cetaceans are developed in order to contribute to the Navy's mitigation efforts **Advancement of Methods for Passive Acoustic Monitoring : a Framework for the Study of Deep-diving Cetacean** Alba Solsona Berga, 2019

Marine mammals face numerous anthropogenic threats including fisheries interactions ocean noise ship strikes and marine debris Monitoring the negative impact on marine mammals through the assessment of population trends requires information about population size spatiotemporal distribution population structure and animal behavior Passive acoustic monitoring has become a viable method for gathering long term data on highly mobile and notoriously cryptic marine mammals However passive acoustic monitoring still faces major challenges requiring further development of robust analysis tools especially as it becomes increasingly used in applied conservation for long term and large scale studies of endangered or data deficient species such as sperm or beaked whales Further challenges lie in the translation of animal presence into quantitative population density estimates since methods must control for variation in acoustic detectability of the target species environmental factors and for species specific vocalization rates The main contribution of this thesis is the advancement of the framework for long term quantitative monitoring of cetacean species applied to deep divers like sperm and beaked whales Fully automated methods were developed and implemented to different populations of beaked whales in different conditions This provided insight into generalization capabilities of these automatic techniques and best practices However implementing these tool kits is not always practical and alternative methods for additional data processing were developed to expeditiously serve multiple purposes including annotation of individual sounds evaluation of data in order to provide a highly dynamic technique and classification for quantitative monitoring studies This work also presents the longest time series of sperm whale presence using passive acoustic monitoring for over seven years in the Gulf of Mexico Echolocation clicks were detected and discriminated from other sounds to understand the spatiotemporal distribution and structure of the population A series of steps were implemented to provide adequate parameters and characteristics of the target population for density estimation using an echolocation click based method This allowed for the study of the Gulf of Mexico's sperm whale population providing significant progress towards the understanding of the population structure distribution and trends in addition to potential long term impacts of the well known catastrophic Deepwater Horizon oil spill and other anthropogenic activities The emergence of innovative approaches for detecting the presence of marine mammals and documenting human interactions can provide insight into ecosystem change These species can be used as sentinels of ocean health to ensure the conservation of their marine environment into the next epoch [Marine Mammal Observer and Passive Acoustic Monitoring Handbook](#) Victoria Todd, Ian Todd, Jane Gardiner, Erica Morrin, 2015-03-18 [Marine Mammal Observer and Passive Acoustic Monitoring Handbook](#) is the ultimate instruction manual for mitigation measures to minimise man made acoustical and physical disturbances to marine mammals from industrial and defence activities **Passive Acoustic**

**Monitoring of Cetaceans at Intertidal Weirs in Minas Basin, Nova Scotia** Monica L. Reed, 2014      **Acousting Recording System** Shannon Rankin, Jay Barlow, 2011

Technological advances in both software and hardware have led to dramatic improvements in systems used for passive acoustic monitoring (PAM) of cetaceans from a variety of platforms. While these advances have vastly improved the quality and quantity of data, the rapid evolution of hardware and software have made it difficult to allow for standardization and collaboration between researchers. Recently, government scientists responsible for PAM of cetaceans have been coordinating efforts in an attempt to standardize methods, including hardware and software, to allow for collaboration and comparison of results. In addition, standardization of methods will allow the various organizations to make the most of limited resources. One component of this standardization was to create a portable acoustic recording system that would be the primary hardware package for standard shipboard surveys using towed hydrophone systems and would allow recordings from the full range of cetacean sounds up to 160 kHz.

**Passive Acoustic Monitoring of Arctic Cetaceans** Joshua M. Jones, 2021

Arctic marine mammal habitats are changing rapidly while marine shipping is increasing in some areas of the Arctic. Passive acoustic monitoring can increase understanding of Arctic marine mammal responses to change and to stressors like ship traffic. The strength of inference from underwater sound recordings is limited by several factors that I address in this dissertation with the aim of improving the usefulness of acoustic monitoring findings for Arctic marine resource management. I provide spatial context for acoustic detections of bowhead whale sounds, enabling direct comparisons of acoustic presence across different locations and environmental conditions. Ice cover and noise substantially reduce the predicted listening area around underwater sound recorders. Spatially normalized acoustic detections reveal that bowhead whales utilize an area at least 140 km north of Alaska during their spring migration, migrating through large areas of 90% sea ice cover. I describe acoustic characteristics of beluga and narwhal echolocation clicks, which differ substantially in frequency content and rhythmic patterns. Sound absorption by seawater and apparent changes in animal orientation strongly affect frequency spectra of recorded clicks. Finally, I measure the underwater soundscape within a narwhal summer habitat and quantify underwater noise added by commercial ship traffic. The natural soundscape, excluding periods with nearby ships, is relatively quiet in an acoustically sheltered fiord. Distant sounds from regional shipping are apparent at a less sheltered location open to long range sound propagation. When ships pass the recording locations, sound levels are elevated above the median levels of natural sounds for periods ranging from 30 minutes up to 4 hours with each transit. Icebreaker and tanker ships radiate more underwater noise than general cargo and bulk carrier ships. Ship sounds overlap with common social sounds produced by narwhals and ringed seals at distances of 5 to 30 km from passing ships, possibly interfering with animal communication. Improved detection distance estimates and understanding of detection probability estimation, coupled with increased confidence in detection and identification of beluga, narwhal, and bowhead sounds, will facilitate passive acoustic density estimation of Arctic marine mammals, investigation of their relationships with

habitat and studies of their behavioral responses to ship traffic

**Passive Acoustic Monitoring of Large Whales in Offshore Waters of British Columbia**, 2010

Developing a Passive Acoustic Monitoring Network for Harbor Porpoise in California Eiren Kate Jacobson, 2017

Assessing the abundance of and trends in whale dolphin and porpoise cetacean populations using traditional visual methods can be challenging due primarily to their limited availability at the surface of the ocean. As a result, researchers are increasingly interested in incorporating non-visual and remote observations to improve cetacean population assessments. Passive acoustic monitoring (PAM) can complement or replace visual surveys for cetaceans that produce echolocation clicks, whistles, and other vocalizations. My doctoral dissertation is focused on developing methods to improve PAM of cetaceans. I used the Monterey Bay population of harbor porpoise *Phocoena phocoena* as a case study for methods development. In Chapter 2, I used passive acoustic data to document that harbor porpoises avoid bottlenose dolphins *Tursiops truncatus* in nearshore Monterey Bay. In Chapter 3, I investigated whether different passive acoustic instruments could be used to monitor harbor porpoise. I recorded harbor porpoise echolocation clicks simultaneously on two different passive acoustic instruments and compared the number and peak frequency of echolocation signals recorded on the two instruments. I found that the number of echolocation clicks was highly correlated between instruments, but that the peak frequency of echolocation clicks was not well correlated, suggesting that some instruments may not be capable of discriminating harbor porpoise echolocation clicks in regions where multiple species with similar echolocation signals are present. In Chapter 4, I used paired visual and passive acoustic surveys to estimate the effective detection area of the passive acoustic sensors in a Bayesian framework. This approach resulted in a posterior distribution of the effective detection area that was consistent with previously published values. In Chapter 5, I used aerial survey and passive acoustic data in a simulation framework to investigate the statistical power of different passive acoustic network designs and hypothetical changes in harbor porpoise abundance. As a whole, this dissertation used an applied approach to methods development to advance the use of PAM for cetaceans.

*Passive Acoustic Monitoring of Cetacean Distribution North-west of the Hebrides, 1997-1998* T. P. Lewis, Hebridean Whale and Dolphin Trust, 1998

*European Whales, Dolphins, and Porpoises* Peter G. H. Evans, 2019-12-04

European Whales, Dolphins, and Porpoises: Marine Mammal Conservation in Practice presents an intimate view of the workings of international conservation agreements to protect marine mammals, detailing achievements over the last 25 years, identifying weaknesses, and making recommendations that governments, scientists, marine stakeholders, and the public can take to improve conservation efforts. The book is written by an experienced marine mammal scientist and award-winning conservationist, providing a unique synthesis on their status, distribution, and ecology. In addition, it presents information on various conservation threats, including fisheries bycatch, contaminants, noise disturbance, plastic ingestion, and climate change. This comprehensive resource will appeal to marine mammal conservationists and researchers, as well as environmental and wildlife practitioners at all levels. Offers an accessible review on how scientists study this challenging

group of mammals to gather necessary evidence for conservation action Illustrates with striking images all recorded regional species including distribution maps key threats and specific research methods Includes contributions from leading scientists conservationists and members of government and international bodies like IWC and UNEP **Innovation and Discoveries**

**in Marine Soundscape Research** Bob Dziak, Adrienne Copeland, Ana Širovic, DelWayne Roger Bohnenstiehl, Ilse Catharina Van Opzeeland, 2022-04-04 **Small Cetacean Conservation: Current Challenges and Opportunities** Randall William Davis, Jeremy Kiszka, Rob Harcourt, Mark Meekan, Lars Bejder, Diego Horacio Rodriguez, Karen A. Stockin, 2022-09-23

Advances in Marine Vertebrate Research in Latin America Marcos R. Rossi-Santos, Charles W. Finkl, 2017-08-10 This book gathers the most recent research findings on ecology and conservation of marine vertebrates in Latin America making use of high technological methods to show readers the diversity of the marine research that has been conducted in these countries over the last decades The book brings authors from more than 23 institutions of 7 different countries developing the most diverse research aiming at ocean conservation through the ecology of different vertebrate animals such as whales dolphins manatees turtles seabirds and fish This book deals with technological advances and innovation in the ecology and conservation of marine vertebrates in Latin America This eclectic collection is broad in scope but provides detailed summaries of new methods that are deployed in the study of marine environmental conservation Key issues revolve around the development and application of educational methodologies in the field of marine vertebrate research which provide a rational basis for better management of marine environments using modern techniques associated with GIS satellite tracking aerial systems bioacoustics biogeochemistry genetics underwater videography species photoidentification molecular biology trophic ecological methods ethological methods and behavioural ecology among others Discussion and elucidation of these kinds of techniques are aimed at university level students and post graduate researchers The scope of this volume includes whales sharks rays dolphins tropical fishes turtles manatees as well as aspects of Latin American marine ecosystem conservation Researchers in this biogeographic region as well as others involved with marine vertebrate research will find this work essential reading **Passive Acoustic Monitoring of Marine Mammals in the Chukchi Sea, 9 September - 14 October 2008** ConocoPhillips Alaska, Inc, Cornell University. Laboratory of Ornithology. Bioacoustics Research

Program, 2010 *Listening in the Ocean* Whitlow W. L. Au, Marc O. Lammers, 2016-02-25 This title brings to light the discoveries and insights into the lives of many marine species made possible over the last decade by passive acoustic recorders PAR Pop ups ARF HARP EAR Bprobe C POD Atag and Dtag are the acronyms of some of the many PARs that have changed our understanding of how marine animals live and strive in the ocean Various types of PARs are used by different investigators in different areas of the world These recorders have accumulated copious amounts of very important data unveiling previously unknown information about large marine animals Temporal seasonal and spatial distribution patterns have been uncovered for many marine species There have been many discoveries new understandings and insights into how

these animals live in and utilize the ocean and the importance of acoustics in their lives Listening Within the Ocean summarizes these important discoveries providing both a valuable resource for researchers and enjoyable reading for non professionals interested in marine life **Alaska Outer Continental Shelf, Seismic Surveys in the Beaufort and Chukchi Seas** ,2007 **Noise and Vibrations in Offshore Wind Farms and Their Impact on Aquatic Species** Rui He,Lijun Dong,Xiaomei Xu,Apostolos Tsouvalas,2023-10-25 Title 50 Wildlife and Fisheries Parts 200 to 227 (Revised as of October 1, 2013) Office of The Federal Register, Enhanced by IntraWEB, LLC,2013-10-01 50 CFR Wildlife and Fisheries



## Unveiling the Magic of Words: A Report on "**Passive Acoustic Monitoring Of Cetaceans**"

In some sort of defined by information and interconnectivity, the enchanting power of words has acquired unparalleled significance. Their capability to kindle emotions, provoke contemplation, and ignite transformative change is truly awe-inspiring. Enter the realm of "**Passive Acoustic Monitoring Of Cetaceans**," a mesmerizing literary masterpiece penned by a distinguished author, guiding readers on a profound journey to unravel the secrets and potential hidden within every word. In this critique, we shall delve into the book's central themes, examine its distinctive writing style, and assess its profound effect on the souls of its readers.

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