

Discovery of Sound in the Sea 2014 Annual Report

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LONG-TERM GOALS

The long-term goal of this effort is to educate the public and stakeholders on the basic science of sound in the sea; how people and animals use underwater sound to accomplish many of the tasks for which we use light in air; and how sound in the ocean affects marine life. The products of this effort include an interactive on-line resource and printed materials.

OBJECTIVES

The objective of this effort is to develop and maintain resources that address the long-term goal. The resources include a website (Figure 1), a tri-fold educational pamphlet (available in multiple languages), and an informational, 16-page booklet (currently available in English and Spanish).

APPROACH

Efforts have focused on enhancing and expanding the scientific content of the *Discovery of Sound in the Sea* website that was launched in November 2002. During the past twelve years, Marine Acoustics, Inc. (MAI) and the University of Rhode Island's Graduate School of Oceanography (GSO) have developed a successful working relationship to create and maintain the website and associated printed materials, while ensuring that new peer-reviewed science is incorporated in a timely fashion. These resources undergo regular updates and rigorous scientific review by a panel of scientists in the field, led by Drs. Peter Worcester (Scripps Institution of Oceanography), James H. Miller (University of Rhode Island), and Darlene Ketten (Harvard University Medical School and Woods Hole Oceanographic Institution). MAI and GSO make all final decisions on the site content.



Figure 1: New mobile-friendly front page of “Discovery of Sound in the Sea” website (<http://www.dosits.org>)

WORK COMPLETED

During the twelfth year of research, MAI and GSO focused on several tasks to enhance and expand the website that was launched in November 2002, and to reach additional audiences that have not been targeted in the past. These tasks included the following:

1. Creation of readily available resources for regulators, a key stakeholder group from which the DOSITS team has received increasing inquiries. Regulators have needs for comprehensive, easy to understand, and rapidly accessible resources that will aid in making decisions related to underwater sound.
 - A. In the Spring of 2014, the DOSITS team conducted a needs assessment of the regulator community. The goal of this assessment was to evaluate the effectiveness of the DOSITS website as a tool for regulators and prioritize the development of other highly needed and appropriate resources. Over 100 participants directly involved in regulation, supporting regulators, or representing industry, provided data for the needs assessment, which was conducted using an online survey. Most of the respondents were from North America and Europe, with government employees and consultants comprising the majority. A little over

half of the respondents had professional training in acoustics, but most received on the job training and/or training at meetings. A very large portion (91%) of the respondents dealt with regulations focused on marine mammals, and less than half worked with regulations concerning fishes. Most respondents stated that they used peer-reviewed journals and technical reports as resources during the decision-making process, but many reported difficulty in accessing these resources. While websites were not currently the most commonly used resource, websites and short workshops were selected by a majority of respondents as the most useful, new resource(s) to be made available to the community.

- B. In response to results from the regulators needs assessment (and in consultation with the DOSITS Advisory Panel), the DOSITS team will create structured, online tutorials as a resource for this community. Respondents were significantly interested in material about animals and sound, especially those topics related to the potential effects of sound on marine animals. Therefore, the first tutorial to be created will investigate noise exposure and marine animals, highlighting hearing sensitivities across taxa, potential behavioral effects of underwater sound, masking/soundscapes, and mitigation/monitoring efforts to reduce potential impacts on marine animals. Tutorial content will be supported by existing pages within the DOSITS animals/effects sections. The tutorial will be reviewed at the December 2014 DOSITS Advisory Panel meeting and will be available on the DOSITS website in the Spring of 2015.
- C. The DOSITS homepage now includes a new front page feature that highlights “hot topics” in underwater acoustics. This feature allows for current and topical issues to be highlighted along with links to the foundational scientific content on the DOSITS site. “Hot Topics” currently highlighted on the DOSITS site include a discussion of marine mammal mass stranding events, a review of technologies used in the search for missing Malaysian Airlines flight MH370, and a brief summary of a study by Nachtigall and Supin (2014) describing how a false killer whale was able to reduce its hearing sensitivity when a warning sound preceded a loud sound. The DOSITS team will continue to scan scientific journals and media outlets for recently published literature that may be of prime interest to DOSITS audiences, especially that of the regulatory community.
- D. The DOSITS homepage also includes a new front page feature that highlights “What’s New” on the DOSITS website. It can be cumbersome to find new and/or updated content within the 400+ pages that comprise the DOSITS site. This new front page feature now provides a list of new and/or updated pages on the DOSITS site, offering immediate access to the most up to date information available for regulators and other DOSITS visitors.
- E. Related to the “Hot Topic” on marine mammal mass stranding events, the DOSITS team also created a “Fact Sheet” on marine mammal strandings. A PDF of this fact sheet is available for download from from the DOSITS Resources section (<http://www.dosits.org/resources/all/media/strandingfactsheet/>).

2. Updates to the *Science of Sound in the Sea* section.

- A. The original pages of the DOSITS website were created in 2001, over 13 years ago. Thus, some of the original DOSITS pages need to be revisited to replace outdated animations and update content. This includes many of the introductory pages under the Science of Sound section on the DOSITS website. The below pages were reviewed and edited with the DOSITS Advisory Panel, and the DOSITS team is working with Dr. Dan Russell at

Pennsylvania State University to create new, innovative animations and interactives to enhance this revised and updated content:

- i. Science > Sound > *What is sound?*
- ii. Science > Sound > How do you characterize sounds?
 - a. Amplitude (Intensity)
 - b. Wavelength
 - c. Frequency
- iii. Science > Sound > How are sounds made?

B. After review of other Science of Sound pages, the DOSITS Advisory Panel suggested adding a new content page on “Phase”, which denotes a particular point in the cycle of a wave. This topic had not been previously included in the Science of Sound section. The team developed this new topic, and it can be found under Science of Sound > Sound > How do you characterize sounds?

3. Updates to the *Animals and Sound in the Sea* section.

- A. Revised and updated Animals > Use of Sound > How to marine animals use sound?
- B. Revised and updated Animals > Use of Sound > Marine Mammals > Communication
- C. Revised and updated Animals > Use of Sound > Marine Mammals > Feeding
- D. Revised and updated Animals > Use of Sound > Marine Mammals > Navigation
- E. Revised and updated Animals > Marine Mammal Sound Production
- F. Revised and updated Animals > Effects > How do you determine if a sound affects a marine animal?
- G. Reviewed recently published, peer-reviewed literature to update existing scientific content, particularly the effects of underwater sound on marine life.

4. Expansion of the Audio and Technology Galleries. Contacts are continually made with researchers studying and using underwater sound, to provide material for revising and expanding the existing content in the Audio Gallery and Technology Gallery. Since these sections attract a high volume of web traffic, they need to be revised and updated on a timely basis.

- A. New sounds added to the DOSITS Audio Gallery in the last year include underwater recordings of red grouper, bubble curtains (pile driving activities before and after a bubble curtain was activated), and explosive sound sources. New content on dredging, Northern bottlenose whales, and dugongs are in development for the DOSITS Audio Gallery. In addition, longer audio files continue to be added when possible.
- B. Updated information on recent advancements with acoustic gliders was added to Technology Gallery page on Underwater Gliders. Scientists are increasingly using acoustic gliders to estimate and measure the presence, distribution, behavior, and/or habitat associations of many marine animals. In addition to expanding content to reflect recent research and publications, new graphics were added to the page and underwater sounds of fin whales and red grouper were also included. Cross links back to the DOSITS Audio Gallery were also added.

5. Enhancements to the DOSITS web site. Raytheon Web Solutions (RWS) has continued the efforts started last year to make the site more responsive and mobile device friendly. DOSITS is particularly improving the site layout and display for small mobile devices (phones). Video on the site will all display in a variety of formats, which will make all the content on the site easily accessible from any platform (mobile or desktop) or operating system. Improvements to the main left side navigation will improve usability of the site. A new menu system for sub-pages will improve the discoverability of "deep" content. The new menu will also be more user friendly on both traditional displays and mobile devices. Several back end server advancements will improve administration of the site.
6. Continued addition of cross-links between existing content. While an attempt was made to integrate new material with existing content, additional cross-references were needed among content pieces to provide a broader understanding of underwater sound. In addition, with eleven years of detailed web traffic data, cross-links from web pages that receive high amounts of web traffic, such as the Audio Gallery, can draw the user into pages that have traditionally received less traffic.
7. Translated and printed DOSITS public affairs publications. The DOSITS educational booklet provides an in-depth look at Sound in the Sea and targeted issues for interested stakeholders, policymakers, and the public. In 2011-2013 the DOSITS Team planned to translate the entire DOSITS website into Spanish. It was decided, however, that it was more cost effective to translate the 16-page educational booklet and tri-fold brochure into various languages. Spanish booklets have been well-received at several national and international conferences, have been sent to colleagues serving multilingual communities, and have been distributed in Mexico to whale watching and fishing boat operators. The DOSITS tri-fold brochure was recently translated to Spanish and is available for download from the Resources section of the DOSITS website. The tri-fold is also available in French and a translation of the brochure to German is underway.
8. Further promotion of the DOSITS project. The DOSITS project was again promoted at the 2014 National Science Teachers Association Meeting, which took place in Boston, Massachusetts. During the spring 2014 Acoustical Society of America (ASA) meeting in Providence, Rhode Island, the DOSITS team organized a special symposium on *Communicating the Science of Underwater Sound*. During this forum, invited speakers presented techniques and resources for improving the education of underwater sound. The special session was well-received and was co-sponsored by ASA Technical Committees on Education and Animal Bioacoustics. The DOSITS Team also participated in the "ASA School", an ASA event where graduate students and early career acousticians in all areas of acoustics learn about and discuss a wide variety of interdisciplinary acoustical topics. Internationally, the DOSITS project was again promoted with activities at the European Marine Educators Association Meeting in Gothenburg, Sweden. Results from the DOSITS Needs Assessment for Regulators were also presented at the 5th International Meeting on the Effects of Sound on Marine Mammals in Amsterdam, Netherlands.
9. Conducted peer review of the website. Review meetings with the advisory team were held at URI during November 2013 and June 2014 to review the draft revised version of the website. A December 2014 Advisory Review Meeting is also being planned. All new and revised content created for the website underwent peer review during this time period. In addition to the advisory team, the DOSITS scientific content has been reviewed by over 40 scientific experts (see <http://www.dosits.org/about/> for a complete list).

RESULTS

The “Discovery of Sound in the Sea” website has received an overwhelming response. It was first launched in November 2002. Through August 2014 DOSITS the site has seen more than 72 million hits and more than 6 million page views (Figures 2 and 3). In the 12 month period ending August 2014, DOSITS had more than 800,000 visits, a 66% increase over the previous 12 month period. This is the largest annual increase since the launch of the site.

For June through August, mobile devices accounted for 27% of the visits to the site. In the same summer time period, visitors to the site primarily came from North America (46%), with Asia (20%), Europe (18%), and Australia and Pacific Islands (9%) rounding out the other half of the visits. These data are from Google Analytics.

DOSITS often reports hits to the website as a metric of successful outreach. Page views and a calculated metric of visits (or visitors) can also be used to gauge traffic to a site; however, DOSITS receives a significant number of requests for media (primarily audio files) that are not associated with a specific page request. Because of this, DOSITS has continued to report hits. However, after the 2014 site redesign, the average number of hits per page decreased by a substantial amount relative to previous years. This was a calculated outcome of our design decision to make the site faster, more responsive, and easily usable on mobile devices. Thus, the use of hits as a gauge of the DOSITS site performance must be viewed in terms that are relative to the three phases of DOSITS development and not as an ongoing yardstick of performance throughout DOSITS history. To represent the three phases of development that DOSITS has undergone, a colored background and numbering is presented to reinforce the concept that the number of hits should not be compared across development phases (Figure 2). Page views provides more consistent insight into public use of the site considering recent changes to the site operation (Figure 3). Page views still under-represent some types of traffic to the site.

IMPACT/APPLICATIONS

The “Discovery of Sound in the Sea” website and printed publications are resources for educating and exposing the public and stakeholders to the basic science of sound in the sea and how it is used to communicate, navigate, and explore the oceans. By providing information in multiple formats, educators can bring this content into their classrooms; public affairs personnel can inform themselves of controversial issues and provide materials to Congress; and the public can begin to include science in their decisions. DOSITS is recognized as a resource by established journal outlets, as evidenced by our involvement in the January 2011 issue of National Geographic “The Big Idea” section (<http://ngm.nationalgeographic.com/2011/01/big-idea/noisy-ocean>).

TRANSITIONS

DOSITS is recognized as the world leader in education and outreach on underwater acoustics. With the appropriate permissions, the National Oceanic and Atmospheric Administration has incorporated components of the DOSITS Audio Gallery into its exhibit “Sounds of the Sea” for the Smithsonian Institution’s National Museum of Natural History Ocean Hall “Oceans Today” kiosks. These kiosks are located at the entrance to the Ocean Hall, thereby making it one of the first components that visitors to this newly constructed exhibit will encounter. This prominent placement ensures a very broad impact from the work of the DOSITS team.

RELATED PROJECTS

None.

PUBLICATIONS

“Discovery of Sound in the Sea” website

“Discovery of Sound in the Sea” CD-ROM

Scowcroft, G., Vigness Raposa, K., Knowlton, C., and Morin, H. 2011. Discovery of Sound in the Sea. University of Rhode Island. (16-page information booklet)

Scowcroft, G., Vigness Raposa, K., Knowlton, C., and Morin, H. 2010. Discovery of Sound in the Sea. University of Rhode Island. (tri-fold pamphlet)

Vigness-Raposa, K.J., Scowcroft, G., Knowlton, C., and Morin, H.M. 2014. Underwater Acoustics for Everyone. *Acoustics Today*. 10 (2): 50-59.

Vigness-Raposa, K.J., Scowcroft, G., Miller, J.H., and Ketten, D.R. 2012. Discovery of Sound in the Sea: An on-line resource. *In: The Effects of Noise on Aquatic Life* (Arthur N. Popper and Anthony Hawkins, eds.). Springer, New York.

Vigness-Raposa, K.J., Scowcroft, G., Knowlton, C., and Worcester, P.F. 2008. Discovery of Sound in the Sea Website: An educational resource. *Bioacoustics* 17: 348-350.

HONORS/AWARDS/PRIZES

2007 Acoustical Society of America Science Writing Award for Media other than an Article

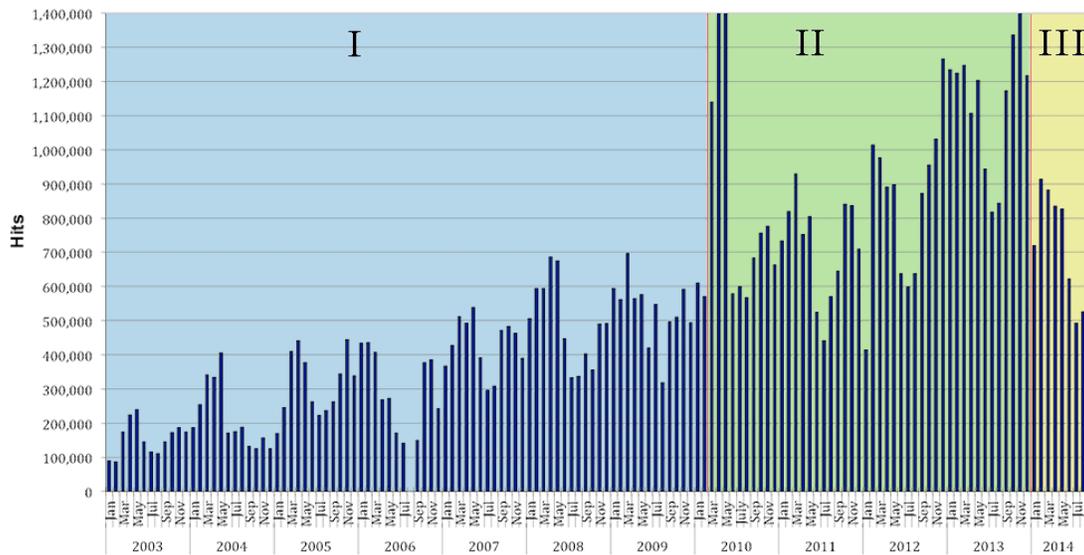


Figure 2: “Discovery of Sound in the Sea” website (<http://www.dosits.org>) traffic has historically been reported as “hits”, shown from 2003 though August 2014. The website has gone through three phases of development and the metric of “hits” should only be compared within a phase, indicated by the colored backgrounds and labels I-III.

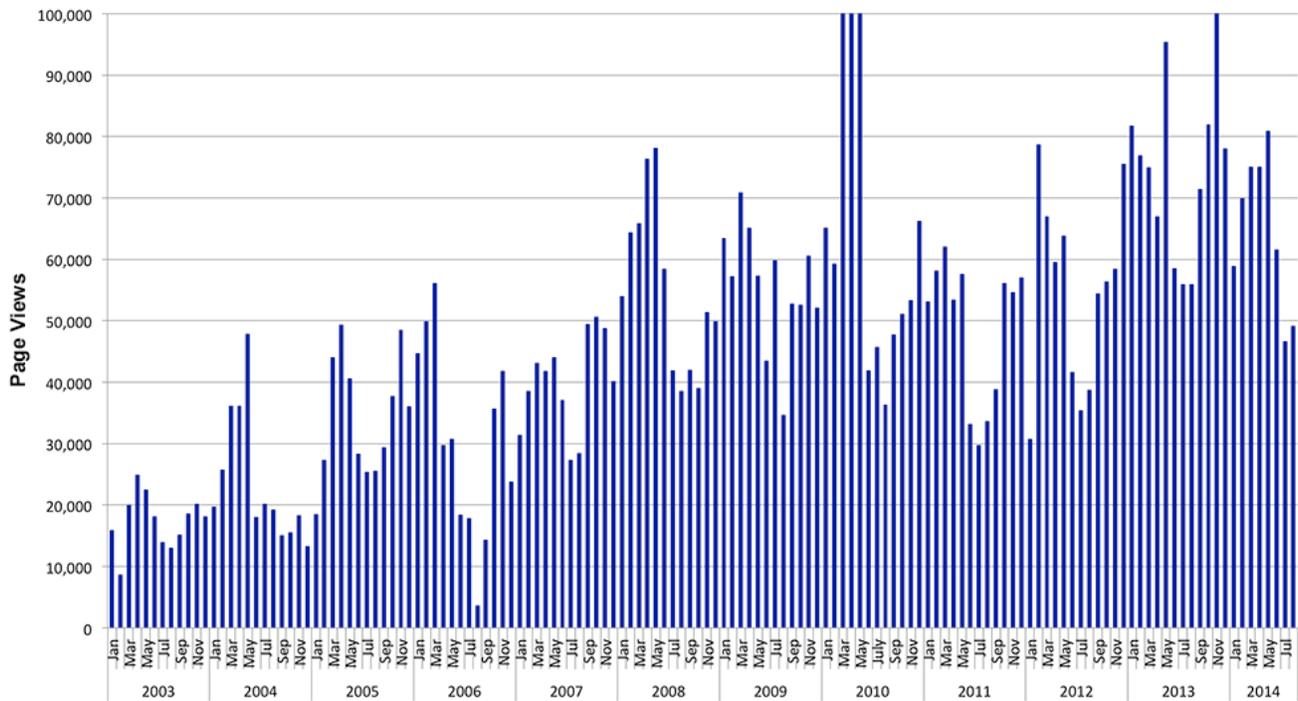


Figure 3: “Discovery of Sound in the Sea” website (<http://www.dosits.org>) traffic shown as page views from 2003 through August 2014.