

Discovery of Sound in the Sea

Gail A. Scowcroft
Office of Marine Programs
University of Rhode Island
Narragansett, RI 02882
phone: (401) 874-6724 email: gailscow@gso.uri.edu

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LONG-TERM GOALS

The long-term goal of this effort is to produce resources to educate the public, educators and students of all ages, and stakeholders on the basic science of sound in the sea; how people and animals use underwater sound to communicate, navigate, and explore the oceans; and the effects of sound on marine life.

OBJECTIVES

The objective of this effort is to develop and maintain resources that address the long-term goal. The resources include a website <http://www.dosits.org> (Figure 1), educational CD-ROM, 12-page informational booklet (Figure 2), and tri-fold educational pamphlet (Figure 3).

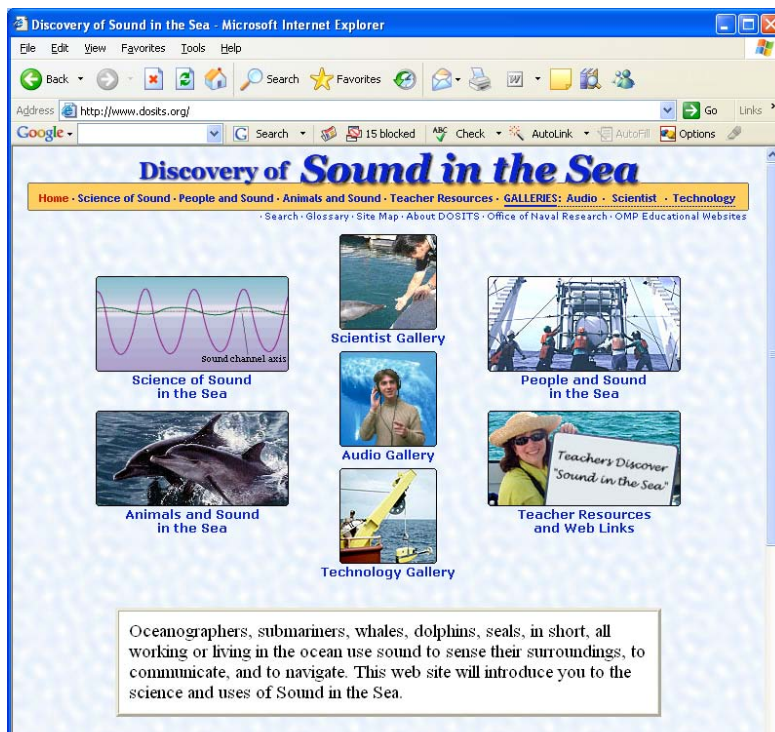


Figure 1: Front page of “Discovery of Sound in the Sea” website (<http://www.dosits.org>)

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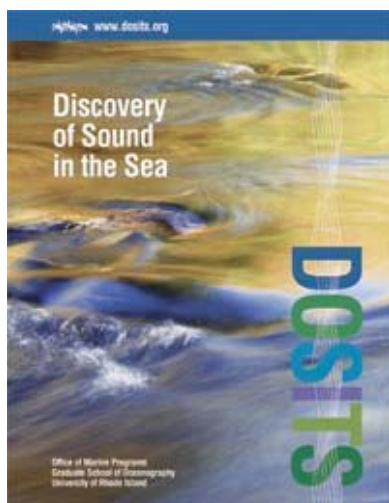


Figure 2: Cover of 12-page Booklet



Figure 3: Tri-fold Brochure

APPROACH

Efforts have focused on enhancing and expanding the website that was launched in November 2002, and developing structured online resources designed for policymakers and the media. During the past five years, the University of Rhode Island's Office of Marine Programs (OMP) has developed a successful working relationship with Marine Acoustics, Inc. (MAI). This relationship involves MAI drafting content material and providing technical guidance for OMP staff to produce additional science content and educational materials focused on sound in the sea and the effects of sound on marine animals. The quality of material on the website is enhanced by an advisory panel and external peer review committee.

WORK COMPLETED

During the fifth year of the DOSITS project, OMP focused on several tasks to enhance and expand the website, and to outreach to additional audiences that have not been targeted in the past. Tasks for this reporting period included the following:

- Development of a section on the historical perspective of people's use of underwater sound. The Acoustical Society of America recently celebrated its 75th anniversary. As part of its celebration, they published a book commemorating the history of acoustical studies and significant milestones in the development of the field of acoustics. This

section discusses the development of acoustics and how people's use of underwater sound has matured as the scientific field became established.

- Creation of structured online tutorials. The website is constructed as a typical free-flowing Internet environment. While this is effective, a more structured setting mimics more traditional educational resources. The structured tutorials direct the user through a series of web pages designed to lay the appropriate educational foundation and then build into more complex topics. The three structured tutorials include a Science of Sound Tutorial and a Technology Gallery Tutorial at the high school level, and an Effects of Sound Tutorial targeting public affairs officers and the general public.
- Needs assessment for educators. In July 2006, a needs assessment was conducted at the National Marine Educators Association meeting allowing marine educators to provide data to the DOSITS team regarding the need for additional topics and content. In addition, over 20 teachers from throughout the U.S. participated in an on-line survey. The results of the needs assessment and survey were analyzed and reported to the advisory committee at the Fall 2006 meeting. These results are helping to shape future DOSITS work.
- Production of backgrounder for journalists. The DOSITS team has been responsive to requests for information from the media and has been proactive in addressing misinformation in the popular press, particularly regarding the effects of sound on marine animals. To provide a more permanent resource for the media, a backgrounder, in the form of a case study of the scientific method, was created and will be posted on the website under a new section titled "Media Resources." In addition to serving as a resource for journalists writing about sound in the sea, this will allow the DOSITS team to be efficiently responsive by pointing the media in the right direction when misinformation is published.
- As part of the initiative to outreach to the media, the DOSITS team presented a workshop for the Metcalf Institute for Environmental Reporting (<http://www.metcalfinstitute.org>). The mission of the Metcalf Institute is to promote clear and accurate reporting of scientific news and environmental issues; to strengthen understanding and working relationships between members of the scientific community and members of the news media; and to provide opportunities for journalists to learn, on both a formal and an informal level, how to improve their skills in marine and environmental reporting. The workshop presented a case study of the scientific method using the marine mammal research that occurred as part of the Acoustic Thermometry of Ocean Climate (ATOC) project.
- Review and expansion of the section "What are the effects of anthropogenic sound on marine animals?" in the Animals and Sound in the Sea section. Bioacoustics is an active area of research, and the effects of underwater sound on marine animals continue to be investigated. In order to provide the most up-to-date, peer reviewed research findings to the public, this section of the website has received considerable attention.

- Revision and expansion of the Audio Gallery and Technology Gallery. Presentations have been given at recent scientific conferences that have provided contacts with researchers studying and using underwater sound. These individuals have provided material to revise and expand the two galleries. In addition, Cornell University's Bioacoustics Research Program is providing video clips that are being integrated into the Audio Gallery, allowing the website to showcase animals making sounds under water.
- Addition of cross-links between existing content. The DOSITS website has grown by leaps and bounds. While an attempt was made to integrate new material with existing content, it is clear that additional cross-references between content pieces would provide a broader understanding of this complex topic. In addition, with four years of detailed web traffic data, cross-links from web pages that receive high amounts of web traffic, such as the Audio Gallery, will draw the user into pages that have traditionally received less traffic.
- Production of a CD-ROM. The CD contains the revised version of the website for use while not connected to the internet, and PowerPoint files of the major sections of the website for teachers to use in their classroom. The PowerPoint files cover the website sections of Science of Sound in the Sea, People and Sound in the Sea, Marine Mammals and Sound in the Sea, Fish and Invertebrates and Sound in the Sea, the Name That Sound activity, and the Jeopardy activity, and are accompanied by Word documents that include teaching notes and suggestions.
- Publication of a tri-fold educational brochure and informational booklet. During 2005, the DOSITS team produced two valuable public affairs publications. The tri-fold brochure introduces the public to the issues and science content of DOSITS. The second publication is a 12-page educational booklet that provides an in depth look at Sound in the Sea and targeted issues for interested stakeholders, policymakers, and the public.
- Peer review of the website. A review meeting with the advisory team was held at URI during November 2006 and May 2007 to review the draft revised version of the website. 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 20 scientific experts (see <http://www.dosits.org/siteinfo/info1.htm> for a complete list).

DOSITS Products

CD-ROM

The DOSITS site has been well received by the education community in part due to the production of an educational CD-ROM that has been widely distributed. The DOSITS CD-ROM contains the full contents of the web site with some expanded video material as well as PowerPoint presentations on each of the four major DOSITS themes. Other materials included on the CD-ROM provide classroom activities based upon DOSITS content. The CD-ROMs have been distributed each year at the annual National Science Teachers Association convention, attended by over 20,000 science teachers. They have also been distributed at the National Marine

Educators Association annual meeting. Over 25,000 DOSITS CDs have been freely distributed thus far.

Tri-fold Brochure

The tri-fold brochure introduces the public to the issues and science content of Sound in the Sea. Over 2000 brochures have been disseminated at national meetings and institutes this year. This brochure also targets a general audience of stakeholders and educators and introduces the DOSITS site for further information. It serves as a visual guide to the web site while addressing some popular current misinformation on the effects of sound upon marine mammals.

Informational Booklet

A 12-page informational booklet has been published, providing an in depth look at Sound in the Sea and targeted issues for interested stakeholders and the public. Over 1000 have been distributed, including to the U.S. Congress and targeted government subcommittees. The booklet allows the reader to become familiar with factual scientific information. It dispels commonly held myths and includes background information on the science of sound, the relationship of sound and water, sound production and reception by people and animals, recent scientific research highlights, and our current state of knowledge on the impacts of sound in the sea upon marine animals. The booklet has also been distributed to a team of U.S. Navy lawyers.

RESULTS

The “Discovery of Sound in the Sea” website has received an incredible response. It was first launched in November 2002. Annually, the traffic on the DOSITS site exceeds three million “hits”. This level of traffic is outstanding and exemplifies the public and academic need for the information on the DOSITS site. A review of web traffic from the initial launch to March, 2007 is included in the Appendix B. It is interesting to note that the traffic peaks follow the academic cycle. The most popular pages visited are in the audio gallery. However, the science of sound section and pages on the effects of sound are also heavily visited.

IMPACT/APPLICATIONS

The “Discovery of Sound in the Sea” website and printed publications are resources for educating and exposing the public 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, teachers 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 improve their scientific literacy and begin to include science in their decision-making.

IMPACTS ON ONR OBJECTIVES

The DOSITS program has addressed several ONR objectives. It promotes ONR’s investment in the future by educating and exciting students and the general public about the marine environment. DOSITS also fosters academic interest in naval relevant science and engineering in high school and undergraduate students.

ONR is committed to obtaining and maintaining a diverse workforce that is well trained. To address this ONR objective, the DOSITS program has incorporated a school to career component. Participating teachers have received school to career training in DOSITS related

topics from OMP's school to career coordinator. Rhode Island high school students have been targeted and visited by the coordinator to encourage them to pursue careers in science or engineering.

Research funded by ONR has been incorporated into DOSITS materials. This research is the foundation for many important technologies and scientific discoveries featured on the DOSITS web site. Another ONR objective addressed by the DOSITS program is the connection of researchers and educators in a university setting with talented and motivated students and their teachers.

TRANSITIONS

The results of research done under this task are being used to further enhance and expand the website. Future work includes printing another edition of the two publications, the tri-fold brochure and educational booklet, to reach additional audiences and further enhance understanding of sound in the sea; developing, posting, revising, and editing online structured tutorials; adding newly published research to the website, particularly in the effects of sound section; and facilitating peer review of website material that is new or revised.

RELATED PROJECTS

Marine Acoustics Inc. is funded under a separate award for their participation in the "Discovery of Sound in the Sea" project.

REFERENCES

N/A

PUBLICATIONS

"Discovery of Sound in the Sea" website

"Discovery of Sound in the Sea" CD-ROM

Scowcroft, G., Vigness Raposa, K., Knowlton, C., and Johnen, J. 2006. Discovery of Sound in the Sea. University of Rhode Island. (12-page information booklet, download at <http://www.dosits.org/downloads.htm>)

Scowcroft, G., Vigness Raposa, K., Knowlton, C., and Johnen, J. 2006. Discovery of Sound in the Sea. University of Rhode Island. (tri-fold pamphlet, download at <http://www.dosits.org/downloads.htm>)

PATENTS N/A

APPENDIX A: KEY PERSONNEL AND PROJECT PARTICIPANTS

Gail Scowcroft, Principal Investigator

Associate Director, Office of Marine Programs, University of Rhode Island

As the Associate Director of OMP at the University of Rhode Island, the Principal Investigator is responsible for marine and environmental education programming and development. She has designed and teaches graduate courses in oceanography and global environmental change for educators and conducts professional development programs. She has been the principal investigator for many outreach initiatives. Having conducted independent research in paleo-oceanography and climate change for over 18 years, she obtained her teaching certificate in secondary science education with the goal of bridging the worlds of scientific research and education. Prior to her current position, the principal investigator was a consulting micropaleontologist for Woods Hole Oceanographic Institute in Woods Hole, Massachusetts from 1983 to 1988. There she conducted independent research, published research results, developed computerized image analysis systems, and wrote proposals for research funding. Before her association with Woods Hole Oceanographic Institute, she conducted independent oceanographic research at URI's Graduate School of Oceanography from 1975-1983.

Christopher Knowlton

Marine Educator/Scientist, Office of Marine Programs, University of Rhode Island

Mr. Knowlton is an ocean scientist whose research is focused on patterns of paleoproductivity with particular emphasis on the changes in surface water productivity on glacial/interglacial timescales. He has also conducted research in Antarctica using multi-channel seismic profiling to identify areas of climate change. He has taught several introductory courses in oceanography and geology at URI. He has also taught oceanography at Sea Education Association in Woods Hole, Massachusetts. He currently is the senior educator/scientist in OMP.

Jill Johnen

Ms. Johnen has an M.S. in Biological Oceanography from Moss Landing Marine Laboratories. Her research focused on the distribution of blue whales. MS. Johnen served as a marine research associate in OMP during this reporting period. Prior to joining OMP, she worked for 12 years for SAIC, Inc. producing environmental impact statements on Naval operations and marine mammals. She brings a wealth of content knowledge and experience to the DOSITS team.

Kathleen Vigness Raposa

Marine Acoustic Inc.

Ms. Vigness Raposa has an M.S. in Biological Oceanography from URI's Graduate School of Oceanography. Currently she works for Marine Acoustics Inc. preparing environmental documentation on the potential effects of underwater sound on marine species and monitoring marine mammal behavioral responses to manmade sound during acoustic sea tests. She also has extensive experience as a marine educator and has participated as an instructor in several teacher institutes.

Scientific Advisory Committee Members (including current and former members)

Dr. James Andrews, Office of Naval Research
Dr. Kurt Fristrup, National Park Service
Dr. Darlene Ketten, Woods Hole Oceanographic Institution
Dr. James Miller, University of Rhode Island
Dr. Peter Scheifele, University of Connecticut
Dr. Peter Worcester, Scripps Institution of Oceanography

Scientific Review Panel Members

Kyler Abernathy, National Geographic Society
Dr. James Andrews, Office of Naval Research
Dr. Jay Barlow, NOAA Fisheries Southwest Fisheries Science Center
Dr. Catherine Berchok, Scripps Inst. of Oceanography, F.V. Hunt Fellow
Dr. Carmen Bazua Duran, National Autonomous University (Mexico)
Dr. Gregor Cailliet, Moss Landing Marine Laboratories
Dr. Gerald D'Spain, Scripps Institution of Oceanography
Dr. Roger Gentry, ProScience Consulting
Dr. Megan Ferguson, NOAA Fisheries Southwest Fisheries Science Cen.
Dr. Michael Fine, Virginia Commonwealth University
Dr. Kurt Fristrup, National Park Service
Dr. Jason Gedamke, Australian Antarctic Division
Dr. Roger Gentry, ProScience Consulting
Dr. Sean Hayes, NOAA Fisheries Salmon Ecology Group
Dr. Darlene Ketten, Woods Hole Oceanographic Institution
Tom Kieckhefer, Pacific Cetacean Group
Dr. Ellen Livingston, Office of Naval Research
James Locascio, University of South Florida
Dr. James Lynch, Woods Hole Oceanographic Institution
Dr. Peter Madsen, University of Aarhus (Denmark)
Dr. David Mann, University of South Florida
Dr. Dave Mellinger, NOAA Pacific Marine Environmental Laboratory
Dr. Jennifer Miksis-Olds, University of Massachusetts Dartmouth
Dr. James Miller, University of Rhode Island
Dr. Douglas Nowacek, Florida State University
Dr. Susan Parks, Cornell University
Dr. Sheila Patek, University of California, Berkeley
Dr. Arthur Popper, University of Maryland
Denise Risch, University of Kiel (Germany)
Dr. Thomas Rossby, University of Rhode Island
Dr. Rodney Rountree, University of Massachusetts Amherst
Dr. Peter Scheifele, University of Connecticut
Dr. Ari Shapiro, Woods Hole Oceanographic Institution
Dr. Mike Simpkins, Marine Mammal Commission
Dr. Brandon Southall, NOAA Fisheries Acoustic Program
Dr. Kate Stafford, University of Washington Applied Physics Lab
Dr. Ian Stirling, Canadian Wildlife Service

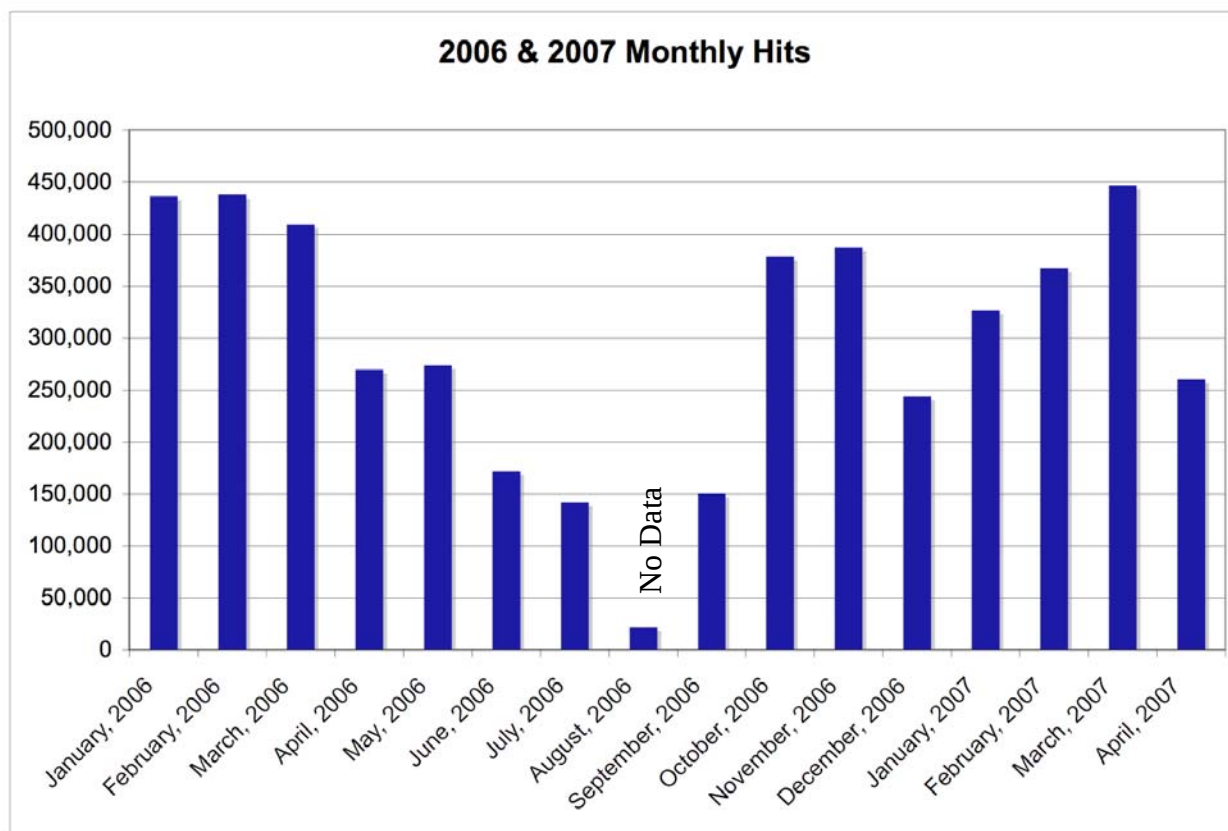
Dr. John Terhune, University of New Brunswick
Dr. Maya Tolstoy, Lamont-Doherty Earth Observatory
Dr. Sofie van Parijs, NOAA Fisheries Northeast Fisheries Science Center
Dr. Jacqueline Webb, University of Rhode Island
Dr. Peter Worcester, Scripps Institution of Oceanography

Appendix B: DOSITS Web traffic

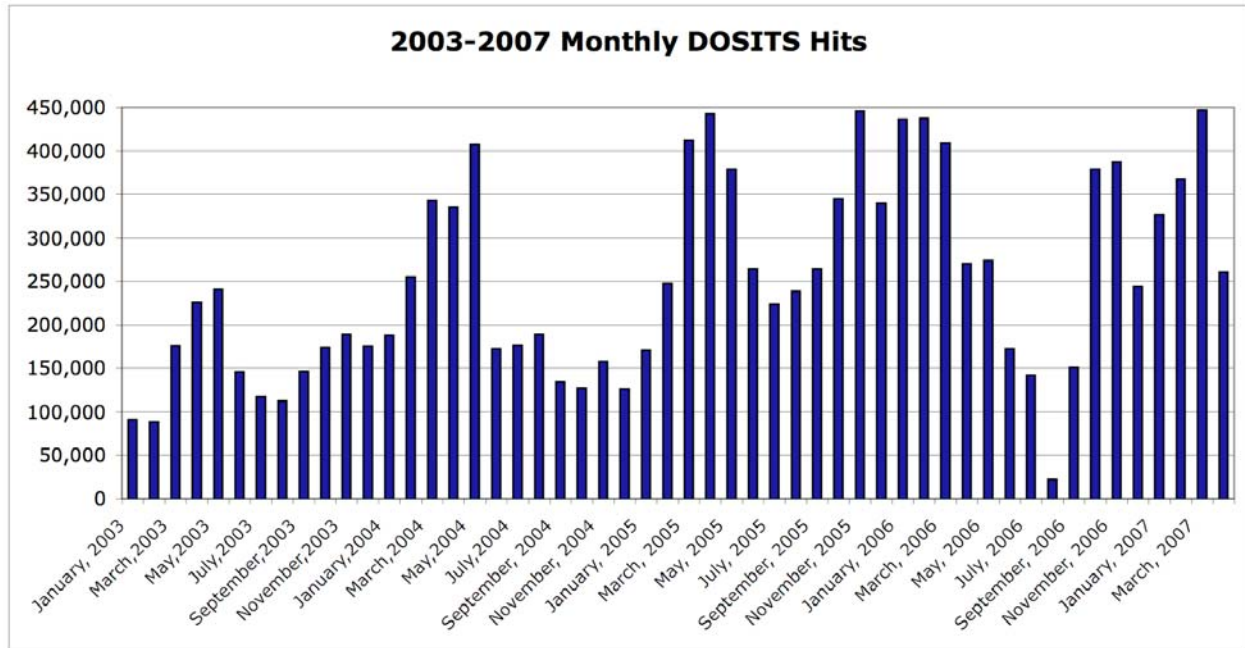
Discovery of Sound in the Sea Web Traffic Report

The Discovery of Sound in the Sea web site (DOSITS) was launched in November 2002. DOSITS is hosted on the Office of Marine Programs Web server located on the University of Rhode Island Bay Campus at the Graduate School of Oceanography. DOSITS has an average of over 3 million hits per calendar year and had approximately 3.3 million hits in calendar year 2006 and approximately 1.4 million hits from January to the second week of April in 2007. March 2007 had the highest total hits of any month since DOSITS launched (446,000). There were more than 18 GB of data transferred in 2006, mostly represented by audio files. OMP has worked to increase the exposure of DOSITS by having a stronger presence at additional meetings such as the National Science Teachers Association annual convention and the National Marine Educator's Meeting and giving a CD to every National Ocean Sciences Bowl coach for the 2006 and 2007 academic year competitions. We have also had multiple requests for the DOSITS CD from the community involved with teacher professional development.

The most popular pages continue to be the Audio Gallery. We hope to drive additional traffic to other parts of the website as we add links to the Audio Gallery pages in 2008.



Please note: Some data for August was lost due to a system crash and subsequent upgrade.



For this analysis all traffic from the URI/GSO Coastal Institute was excluded to remove all visits by OMP staff. All known robots and automated programs were also excluded. The traffic recorded by the web server is a minimum as AOL, other ISPs and many corporations cache popular pages. For example, proxy.aol.com is the ISP with the most traffic identified in the log files but many AOL users may not be recorded on our server if they request a file recently viewed by another AOL user. Because it is more art than science to translate hits into information like visits and unique visitors we have presented all the numbers in terms of hits. Additionally, many more people probably use DOISTS on a daily basis from the CDs and never connect to our server.