



The Development of an Integrated PDA-GPS Protocol for Marine Debris, Mitigation and Decision-making



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Goal: To compile and analyze historical marine debris data and develop a protocol using personal digital assistant (PDA) to collect current and/or emergency response marine debris data. Then, plot data with GIS for more effective and efficient cleanup as well as trend analysis, which will help lead to solutions and public awareness.

Why is the Marine Debris Issue Important?

- Marine debris is pervasive and is not only aesthetically displeasing it is also potentially harmful to human health and the environment.
- Marine debris can hinder emergency response efforts and significantly contribute to cleanup after oil spills and disasters.
- At least 267 marine species have been affected by both entanglement or ingestion of marine debris.
- Marine debris can be a hazard to marine based industry, namely fishing and tourism.
- This research hopes to expand upon previous marine debris projects by examining beach cleanup data and personal digital assistant (PDA) data to systematically implement and test techniques that could be applied to various marine debris assessment situations.

History of Marine Debris Data Collection in New Hampshire:

- Through a collaboration between the University of New Hampshire, Blue Ocean Society (a community based non-profit), and the National Oceanic and Atmospheric Administration there has been years of data collected mostly from volunteer beach cleanups.
- There are 16 different beaches (22 locations) in New Hampshire that have been or still are being cleaned.
- The data from these cleanups is compiled and used to create charts and graphs which help visualize trends and can lead to mitigation strategies and techniques.

Historical Data for Jenness Beach, Rye, NH:

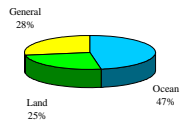


Figure 1: Sources of Marine Debris at Jenness Beach 2002-2006 (excluding cigarettes)

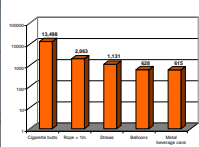


Figure 2: The Most Frequent Marine Debris Items Collected at Jenness Beach (2002-2006)

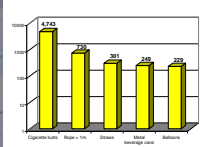


Figure 3: The Most Frequent Marine Debris Items Collected at Jenness Beach (2004)

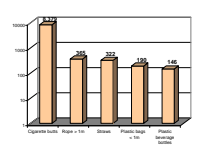
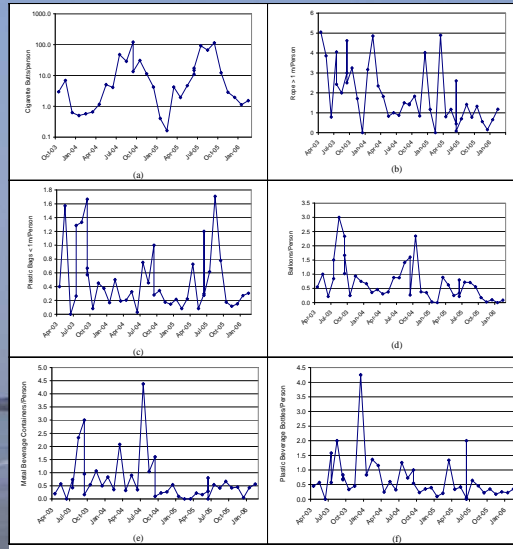


Figure 4: The Most Frequent Marine Debris Items Collected at Jenness Beach (2005)

Facts about Jenness Beach, Rye, NH:

- 1/3 mile stretch of beach
- The beach was cleaned on 118 occasions
- 18,64 volunteers participated in collecting a total of 5,966 lbs of debris
- The majority of the debris found in the past four years was ocean based (Figure 1)

Normalized Data for Jenness Beach, Rye, NH:



(a) Number of Cigarette Butts Collected per Volunteer over Time, (b) Number of Pieces of Rope > 1m Collected per Volunteer over Time, (c) Number of Balloons Collected per Volunteer over Time, (d) Number of Metal Beverage Cans Collected per Volunteer over Time, (e) Number of Plastic Beverage Bottles Collected per Volunteer over Time, (f) Number of Plastic Bags < 1m Collected per Volunteer over Time

Jenness Beach is a part of the National Marine Debris Monitoring Program (NMDMP) scientific study. The trends over time for six of the most frequent items found are displayed above. The data are normalized by the number of volunteers for each cleanup to facilitate comparison over time. Some general observations can be made: seasonal variability is observed with cigarettes, beverage containers (both metal and plastic) are relatively consistent, balloons and rope may be decreasing.

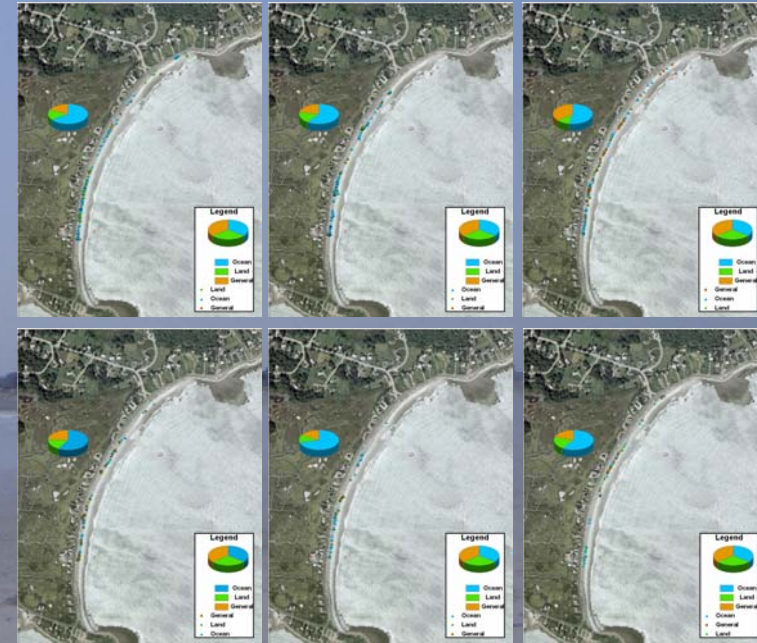
Personal Digital Assistant Usage:



- A PDA increases data collection, and transfer efficiency and accuracy (e.g., faster data download with no entry or interpretation errors).
- This system not only allows for the quantity and type of marine debris to be digitally logged, but also a longitude and latitude position for each piece of debris.
- These data can then be used in a GIS to create maps of the coastline with the location and type of debris visually displayed on aerial photography of the area.
- This technology could also be transferred to other applications of marine pollution monitoring, such as shoreline assessments following oil spills.



Dynamic Marine Debris Monitoring and Mapping:



Dynamic Marine Debris Monitoring and Mapping at Foss Beach, NH: Top row, left to right: June 14, 2007; June 21, 2007; June 27, 2007; Bottom row, left to right: July 6, 2007; July 13, 2007; July 19, 2007
Dynamic marine debris mapping for beaches that are not heavily influenced by land-based sources is important to better assess the transport and sources of debris, as well as movement and variability of debris over time. Mitigation strategies, including outreach and education efforts can also be more efficiently implemented.

Recommendations and Future Efforts:

Even with less than 20 miles of coastline, the marine debris issue is of significance in NH and new technologies that encompass monitoring and mapping play a key role in evaluating impacts of debris, as well as mitigation strategies that can then be transferred to other situations and locations.

The usage of PDAs should be expanded for data collection. More data collected with scientific protocols is needed to fully characterize pollution sources, transport and evaluate mitigation strategies. In the future, the data collected can be linked with other marine or emergency response data on a web-based platform that can be readily updated and understood by users and the public. This will also help inform the cleanup and mitigation effort decision-making process.

This research is funded by a grant from the NOAA Marine Debris Program. With special thanks to the Coastal Response Research Center.