Digital Shoreline Cleanup and Marine Debris Assessment Techniques

Emerging field tools for spill response and reducing pollution from marine debris

M/V *New Carissa*

With the onset of an oil spill, the potential for harm to critical marine resources increases rapidly. The NOAA Office of Response and Restoration (OR&R) supports the U.S. Coast Guard with scientific support throughout such an incident to protect resources and restore them. This task requires that OR&R scientists quickly collaborate with other authorities (federal, state, local) and with experts (scientific, industrial, and community-based), to analyze oceanographic, chemical, and biological factors to determine which locations and resources will be impacted. Before, during, and after a spill reaches coastal shorelines, it's critical that the extent of oiling and factors that affect cleanup (i.e., marine debris, critical habitat) be rapidly and repeatedly surveyed and assessed using the Shoreline Cleanup and Assessment Technique (SCAT). Data generated through SCAT must then be synthesized into operational products (i.e., maps, resource inventories, reports, etc.) that guide time-critical shoreline protection and cleanup decision making.

Historically, SCAT operations have not systematically assessed marine debris. Floats, fishing gear, plastics are a few examples. Floating marine debris often mimics the transport behaviors of oil, being influenced by ocean currents, tides, and wind patterns. Consequently, areas of marine debris accumulation can be indicators of where oil is likely to collect during an oil spill. Additionally, oiled marine debris can complicate cleanup efforts. Outside of spill events, marine debris pollution degrades habitats, impacts coastal communities, and presents ongoing hazards depending on its type and location.

In order to increase the efficiency of SCAT and reduce marine debris pollution, OR&R, in collaboration with the University of New Hampshire Environmental Research Group and the Coastal Response Research Center (NOAA/UNH partnership), is developing a marine debris integrated SCAT framework that consists of:

- Extended SCAT data structure
- The Electronic SCAT Interface (eSCAT) to survey with PDA-GPS integrated devices
- Mobile wireless network
- Database for managing data (including photographs)

This directly supports GIS mapping and aids in the creation of other products needed during a response and in analyses of marine pollution.

Resources at Risk

Passive Use

Commercial

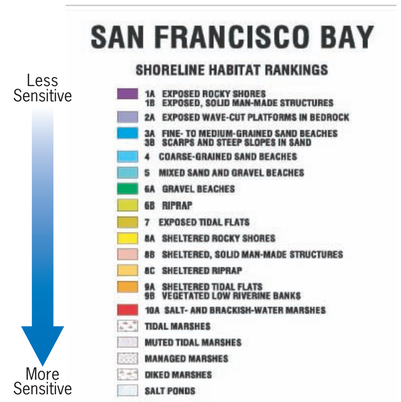
Ecological

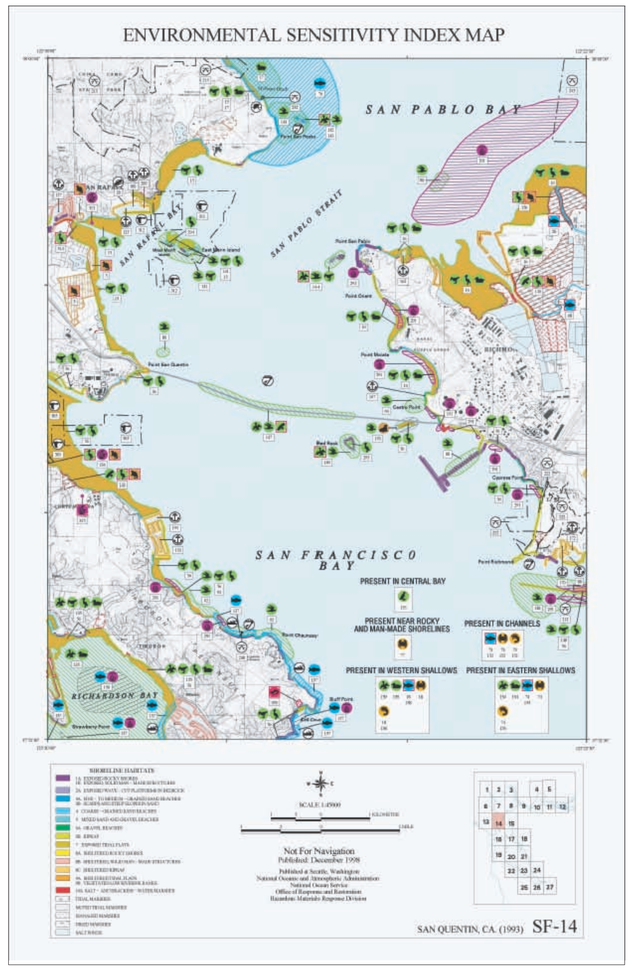
Recreational

Subsistence

Environmental Sensitivity Index Maps (ESI)

ESI maps depict shoreline environments and their relative sensitivity to spills and cleanup efforts. ESI maps show shoreline and habitat types. Temporal variations and detailed biological and human use information is also presented.





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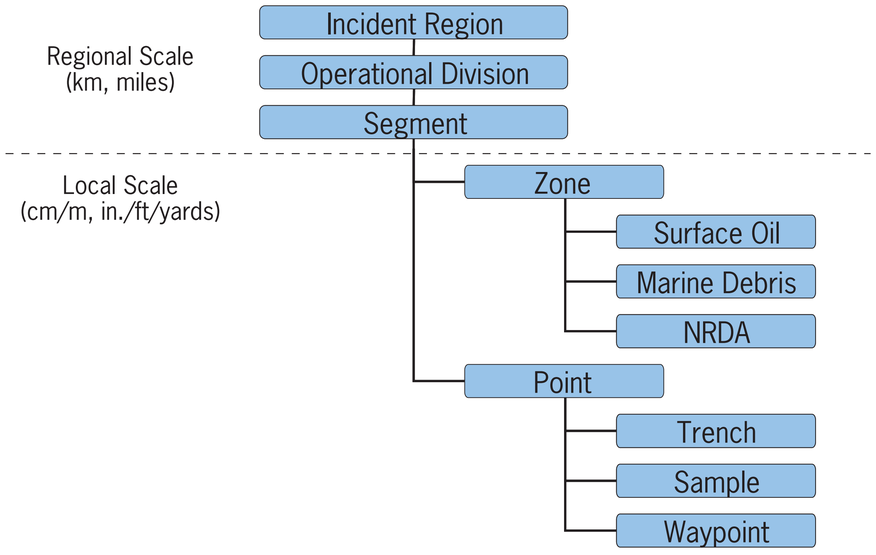
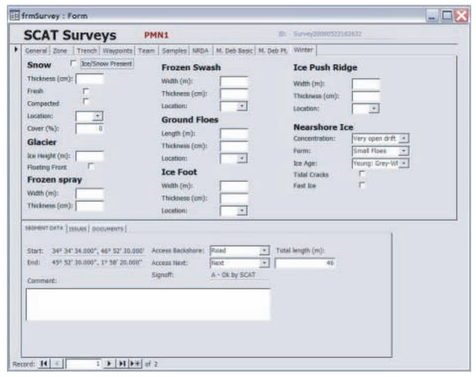
SCAT Framework

Spill events vary significantly in their spatial scales. SCAT supports the decision-making process that is used to evaluate regional priorities and decide how response assets should be mobilized by collecting local observations.

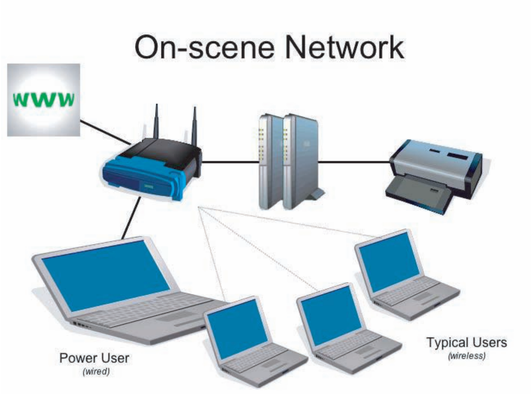
SCAT Database Structure



SCAT Database



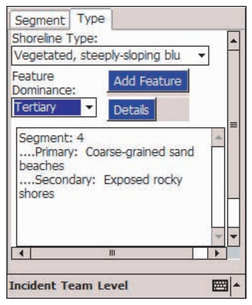
A database is used to manage data collected in the field by SCAT, marine debris, and NRDA teams.



After SCAT data is gathered, it can be relayed back to the command post using wireless or satellite communications. Within the command post, a simple and mobile wireless network facilitates distribution so that reponse products can be quickly generated.

The Electronic SCAT Interface (eSCAT)

Field tools combine the power of GPS with the convenience of desktop computing. Now in development, it is designed to mirror established SCAT data collection methods and improve data quality, facilitate data management, and expedite the flow of data from the field into products for decision making.

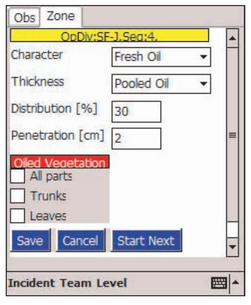


1

When a SCAT team visits a shoreline segment, they record the geomorphology (ESI shoreline type) and other segment features.

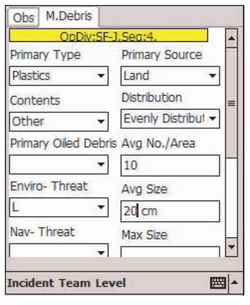
2

While surveying a segment, different types of data are recorded as points or patches. Oil and marine debris are often best characterized as patches.



3

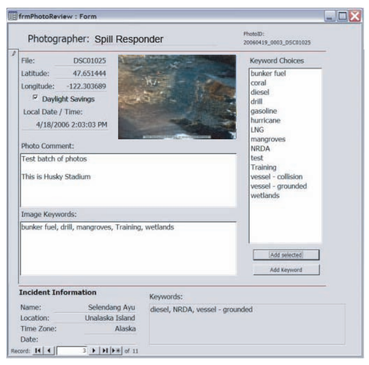
Observations of the oil features and interaction with the shoreline substrate help ensure the best cleanup methods are mobilized.



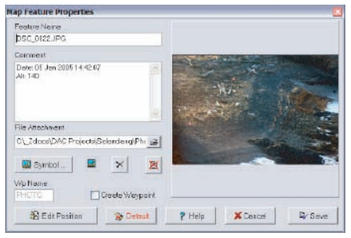
4

Marine debris sources, collection points, and threat level are valuable to response, restoration, and coastal protection.

Photologger



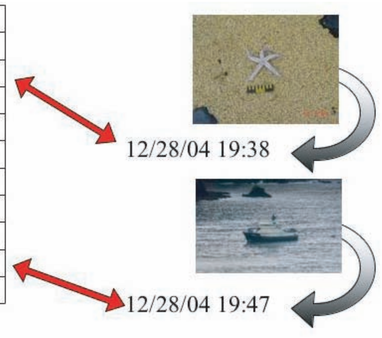
PhotoLogger is a database designed to manage photos taken during an incident. Using PhotoLogger, hundreds of photos can be quickly logged to archive status. Additional information about the photo may also be added.



When a user clicks on an image located on a PhotoLogger-linked GIS map a summary of the waypoint and photo appear.

Lat	Long	Date-Time
53.89183	-166.559	12/28/04 19:37
53.87542	-166.569	12/28/04 19:38
53.84156	-166.597	12/28/04 19:39
53.80691	-166.651	12/28/04 19:40
53.75851	-166.73	12/28/04 19:42
53.72937	-166.796	12/28/04 19:43
53.72706	-166.909	12/28/04 19:45
53.72271	-166.99	12/28/04 19:46
53.7054	-167.048	12/28/04 19:47
53.67942	-167.078	12/28/04 19:48

Track File



In order to georeference photographs, a surveyor photographs the GPS clock and uses proprietary software to synchronize the camera clock with the GPS clock. The program then reads the digital timestamp on each photograph and applies a time correction, making a GPS timestamp for the photo. The photo can then be mapped to the GPS track point with the closest temporal proximity.

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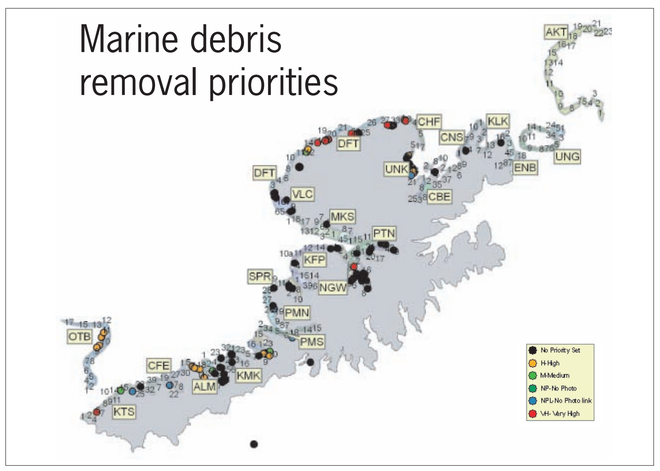
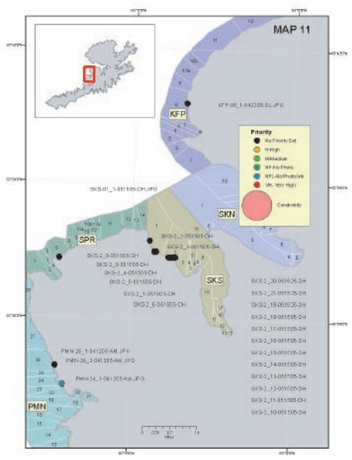
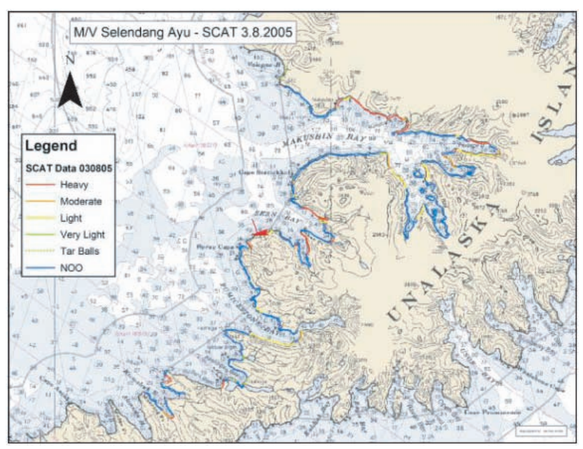
M/V Selendang Ayu: An example of integrated SCAT and Marine Debris assessments

In December 2005, the M/V Selendang Ayu *wrecked on the island of Unalaska (in the Aleutian Islands of Alaska). Its payload of soybeans and fuel impacted local fisheries and pristine habitats.*

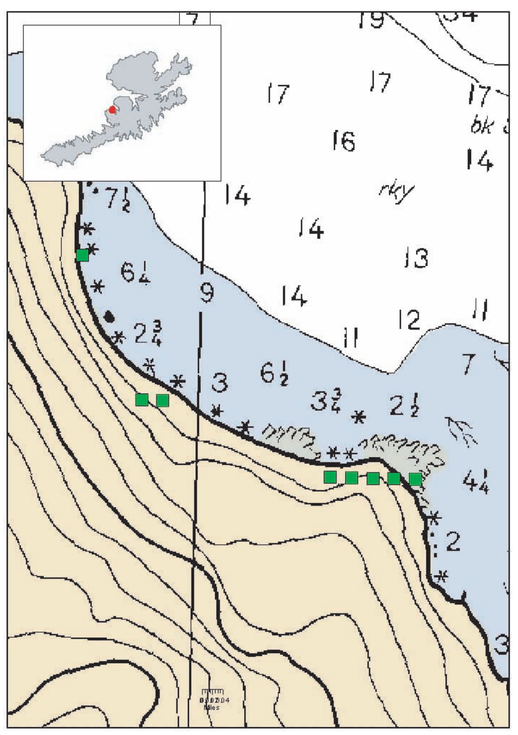




Extreme conditions present during the initial response to the M/V Selendang Ayu *incident lead to the loss of a USCG helicopter. Subsequent SCAT missions collected data on the helicopter debris field and led to the recovery of the "black box". Because debris was catalogued along with the oil, it could be easily found and cleanup efforts could be prioritized.*



Over 500 miles of shoreline were surveyed for oil and marine debris. The marine debris component removes over 14,000 lbs. of fishing gear and other large products from the pristine shoreline using the same response contractors. Marine debris removal can be an aspect of the restoration of an oil spill, improving the environment by leveraging capabilities and resources by integrating technologies. SCAT data was analyzed by segment to create shoreline oiling maps showing the degree of oiling.



Within the incident region, marine debris and biological concerns (domestic sheep pictured) can be identified and quickly mapped.