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Sea Grant
National Sea Grant College Program

ENVIRONMENTAL QUALITY

Effluent Plume Studies Yield New Technologies

Studying sewage outfalls is a major challenge for water quality and wastewater management authorities in large urban areas. The University of Southern California Sea Grant Program, in a suite of interdisciplinary studies at the White's Point sewage outfall, has developed new methods for studying major sewage effluent plumes.

These new methods let scientists accurately map effluent plumes, identify particulates and distinguish effluent particles from phytoplankton and resuspended sediment particles. This Sea Grant work is among the first to systematically map the spatial distribution of resuspended sediments on the continental shelf, a measurement that is important to understanding ocean outfall systems. Work sponsored by USC Sea Grant also has improved a towed sensor array, initiated the measurement of plume optical properties, improved methods for extracting pore water from cores, developed a Benthic Sampling Effectiveness Measure and allowed the first *in situ* testing of outfall plume models.

Sea Grant research has been important in improving the "tow-yo" package for coastal research. The package is a towed sensor array adapted by Sea Grant scientists to gather simultaneous physical and bio-optical data at sites near the White's Point sewage outfall. The combination of "tow-yo" mapping with moored time series data in the outfall plume area has enabled scientists to increase the resolution of ocean sampling.

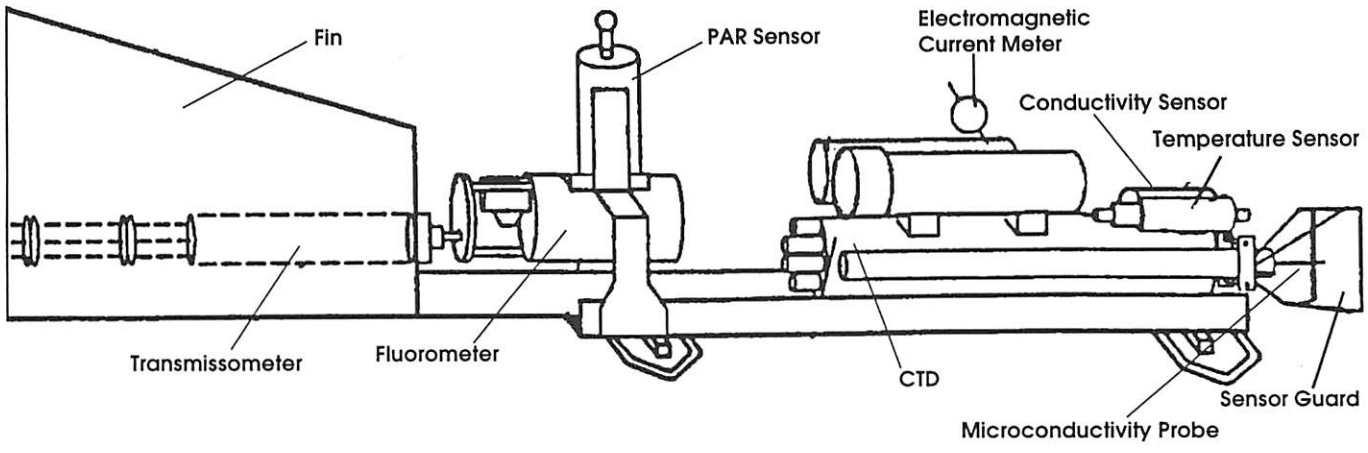
The Orange County Sanitation District plans to adopt the "tow-yo" package for monitoring, to replace the current use of fixed location profiles, and to develop a more dynamic sense of effluent dispersion and primary productivity response to the discharged nutrient regime in nearshore coastal waters. Other sanitation districts around the country may adopt this technology to improve their data-gathering capabilities.

USC Sea Grant research also provided some of the first measurements of the spectral optical properties of effluent plumes. These optical properties can distinguish effluent particulates from phytoplankton and bottom resuspension. This work opens the possibility of monitoring effluent plumes with remote-sensing technology, using satellite or high resolution aircraft sensors to increase accuracy and efficiency.

Ocean Outfall Study

In closely related studies, Sea Grant researchers have developed technology and techniques for extracting pore water from benthic cores, allowing scientists to measure

Schematic Of Tow-Yo Package



the flux of metals and nutrients into the water column from the sediments around sewage outfalls.

After modifying the "USC Lander" for core sampling and applying their new methodology, the researchers analyzed changes in pore water associated with fluxes of trace metals and nutrients around the sewage outfall. These are the first direct measurements of benthic recycling rates and the mechanisms that release bottom sediments containing heavy metals, nutrients and toxins, including DDTs. This and other USC Sea Grant research can be used to study the resuspension of contaminants on any continental shelf.

USC Sea Grant sponsored the development of the "BENSEM" (Benthic Sampling Effectiveness Measure) at California Polytechnic University, Pomona. Standard sampling methods involve towing an otter trawl net along the bottom to collect organisms and count changes in population density for resident species, but there is no way to determine whether the trawl is running on the ocean bottom or is skipping over the research area during the 10-minute sampling run. The BENSEM device counts the actual time the trawl is in contact with the ocean bottom, allowing for major improvements in the accuracy of coastal sampling methods.

Prototypes Tested

Prototypes of the BENSEM device were tested by the Los Angeles and Orange County Sanitation Districts. Local sanitation districts now use the BENSEM device and thus rely on Sea Grant results for improved standardization in sampling. This improved coastal monitoring procedures.

In addition to improvements in methodologies for gathering data and developing detailed maps of effluent plumes, techniques developed by Sea Grant scientists have provided accurate data for evaluating plume models developed by ocean engineers. The *in situ* testing of new technologies accomplished by USC Sea Grant researchers is one of the few outfall plume studies conducted under real ocean conditions using natural tracers. Previous analog studies of ocean plume behavior have relied upon artificial conditions in laboratory tanks.

Improvements in ocean modeling, sampling and coastal research are promising methodologies developed by Sea Grant researchers. These technological improvements foster improved information for coastal water quality authorities concerned with historical and present deposits of contaminants on the ocean bottom.

New and more accurate data collection will provide an improved information base upon which municipalities can make better, more informed decisions about wastewater treatment and disposal for sanitation and municipal authorities around the nation.

USC Sea Grant

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