Three Decades of Monitoring and Assessment

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Keywords: Disposal sites, monitoring, capping, recolonization, bathymetry

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**DAMOS Timeline**

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>1977</td>
<td>First DAMOS Cruise</td>
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<td>1979</td>
<td>STNH-N/S 1st Symposium April '78</td>
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<td>1982</td>
<td>Gordon Plume Dynamics</td>
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<td>1983</td>
<td>Hurricane David 6 Sept. '79</td>
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<td>Hurricane Gloria 27 Sept. '85</td>
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<td>1987</td>
<td>FVP FY82-87</td>
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<tr>
<td>1990</td>
<td>CS-1/CS-2</td>
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<td>1993</td>
<td>Mound Rings 1993</td>
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<td>1994</td>
<td>STNH/CS Core Survey 1990</td>
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<tr>
<td>1997</td>
<td>DAMOS Video 1999</td>
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<td>1998</td>
<td>Rockland Lobster Migration 2002</td>
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<td>1999</td>
<td>Mass Bay Final Designation July 1993</td>
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<td>2003</td>
<td>STNH/CS Core Survey 1990</td>
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<tr>
<td>2004</td>
<td>STNH Core Survey 2004</td>
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HISTORICAL BACKGROUND

• Most dredged material disposal sites in New England established prior to the 1940s.
• Little knowledge of ecological impacts of disposal until 1970s and 1980s COE and NSF research in Long Island Sound.

Historical View of Disposal Impact

• Disposal would have lasting negative local impacts similar to mine tailing areas (spoil areas) or with upland disposal of saline sediments
THE COLONIZATION MODEL

RATES OF FAUNAL RECOVERY

- Initial faunal recovery of muddy dredged sediment is rapid (within weeks) - pioneering species.
- Mechanisms include larval settlement, immigration of swimming adults, and survival of adults covered by sediment (1 ft or less).
- Full recovery takes about two years.
SEDIMENT PROFILE
CAMERA OPERATIONS

Increasing Time Following Physical Disturbance (e.g., DM Disposal)

STAGE 1  STAGE 2  STAGE 3
Sediment Profile Station Arrays

Mound Recolonization
BENTHIC PRODUCTIVITY

- Productivity on disposal mounds 6 times greater than on the ambient seafloor (Rhoads, Yingst, and McCall, 1978).
- Attributed to high rate of recruitment, exponential population growth, and high individual growth rates of pioneering organisms.

RESULTS

- Faunal Succession
  - The "universality" of successional model (Rhoads, Yingst, and McCall, 1978)
  - Validated by independent observations in Swedish and Scottish waters (Pearson and Rosenberg, 1976).
WORLD-WIDE APPLICATION

- New England
- New York Mud Dump Site
- Gulf of Mexico
- US West Coast (CA, OR, WA)
- Canada
- New Zealand
- Hong Kong
- East China Sea
- Ireland
- France, Italy, etc.

CONCLUSIONS

Technique allows integration of biological information with physical and chemical parameters observed in profile images.

Data products directly contribute to answering management questions related to environmental impact.
Understanding the physical and environmental consequences of dredged material disposal: history in New England and current perspectives

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Abstract

Thirty-five years of research in New England indicates that ocean disposal of dredged material has minimal environmental impacts when carefully managed. This paper summarizes research efforts and resulting conclusions by the US Army Corps of Engineers New England District, beginning with the Scientific Report Series and continuing with the Disposal Area Monitoring System (DAMOS). Using a tiered approach to monitoring and a wide range of tools, the DAMOS program has monitored short- and long-term physical and biological effects of disposal at designated disposal sites throughout New England waters. The DAMOS program has also helped develop new techniques for safe ocean disposal of contaminated sediments, including capping and confined aquatic disposal (CADs) cells. Monitoring conducted at many sites in New England and around the world has shown that impacts are typically non-detect and short-term. Findings made as they need to be disseminated to the general public, whose perceptions of dredged material disposal is generally negative and is not strongly rooted in current science.

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Keywords: Dredged material, Environmental assessment, Monitoring, Management, New England
Early Investigations

Table 1: Selected SR reports and related publications

<table>
<thead>
<tr>
<th>SR report number</th>
<th>SR report authors</th>
<th>Related publication</th>
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<tbody>
<tr>
<td>7</td>
<td>Gordon et al. (1972)</td>
<td>Rhodes (1976)</td>
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<td>16</td>
<td>Rhodes (1976a)</td>
<td>Rhodes et al. (1976)</td>
</tr>
<tr>
<td>22</td>
<td>Trottman and Trottman (1974a)</td>
<td>Trottman and Bolen (1972)</td>
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<td>Trottman et al. (1974a)</td>
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<td>Rhodes et al. (1977)</td>
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<td>50</td>
<td>Robertson et al. (1970)</td>
<td>Robertson and Gordon (1970)</td>
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<tr>
<td>51</td>
<td>Rhodes and Yang (1976)</td>
<td>Rhodes et al. (1977a)</td>
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<tr>
<td>57</td>
<td>Martin (1974a)</td>
<td>Martin (1974a)</td>
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</table>

Plume Dynamics

Fig. 1. Example of successive sediment concentration profiles in the water column before \( T = 45 \) and after barge disposal used to estimate plume losses. \( T \), time in minutes; \( z \), height in m above seafloor; \( c \), concentration in weight fraction. Redrawn from Gordon (1974).
Mussel Contaminant Accumulation

![Graph showing contaminant accumulation over time.](image)

**DAMOS Timeline**

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<td>Sissenwine &amp; Sala - Fishery Impacts</td>
<td>Gordon Plume Dynamics</td>
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<tr>
<td>1982</td>
<td>REMOTS</td>
<td>NUSC Ends Association</td>
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<td>1985</td>
<td>Hurricane David</td>
<td>July 1985</td>
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<tr>
<td>1993</td>
<td>Laser Line Scan</td>
<td>Boston CAD Cells</td>
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<td>1994</td>
<td>Disposal Area Monitoring Program Report</td>
<td>Jan ’78</td>
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<tr>
<td>1995</td>
<td>Sissonwine &amp; Saila - Fishery Impacts</td>
<td>Bokuniewicz et al. - Sediment Stability</td>
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<td>2004</td>
<td>Capping Monograph</td>
<td>1997-2002</td>
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<tr>
<td>2005</td>
<td>Rockland Lobster Migration</td>
<td>2002</td>
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**Events and Reports:**

- **Hurricane David:** 6 Sept. ’79
- **Hurricane Gloria:** 27 Sept. ’85
- **First DAMOS Cruise:** July ’77
- **REMOTS:** Aug ’92
- **Brenton Reef Survey:** Oct 1987
- **Laser Line Scan:** 1993
- **Boston CAD Cells:** 1997-2001
- **Disposal Area Monitoring Program Report:** Jan. ’78
- **Bridgeport Site Survey:** Aug. 1992
- **Capping Monograph:** 1995

**Reports:**

- **Tiered Monitoring Report:** 1994
- **DAMOS Video Report:** 1999
- **STNH/CS Core Survey:** 1990
- **Mass Bay Final Designation:** July 1993
- **STNH Cap Demo:** 1995-1997
- **Boston CAD Cells:** 1997-2001
- **Capping Monograph:** 1995
- **Bridgeport Site Survey:** Aug. 1992
- **Capping Monograph:** 1995
Disposal Area Monitoring System

DAMOS

DAMOS OBJECTIVES

(1979)

- Monitor sites to ensure no unacceptable impacts
- Develop management techniques to minimize impacts
- Improve understanding of processes and mechanisms
- Develop understanding of organism/sediment relations
- Distribute results to improve public understanding of effects
DAMOS ACTIVITIES

Monitoring
  Periodic Site Surveys
  Post-storm Surveys

Management Technique Development
  Confinement Berms
  CAD Cells

Monitoring Technique Development
  Laser Line Scan
  Sub-bottom Profiling

NEW ENGLAND DISPOSAL SITES

[Map of New England Disposal Sites with labels for each site, such as PDS, RDS, CADS, MBDS, CSDS, WLIS, CLIS, NLDS, RISDS, CCBDS, BBDS]

Dredged Material Management

- Project Proposed
- Project Evaluation
- Enforcement
- Disposal/Compliance Inspections
- Monitoring
TIERED MONITORING

Disposal Management
Disposal Mound Changes

Site 1 nautical mile square
Depths in meters  ● Targeted Disposal Point

Bathymetric Changes at Rhode Island Sound Site

Site 1 nautical mile square
Depths in meters  ● Targeted Disposal Point
Capped Mound Core Contaminant Distribution
11 Years Post-Capping

Core Log cm

- Brown Silt
- Shell Hash with Sand
- Clay, Shell Hash
- Black Dredged Material

<table>
<thead>
<tr>
<th>Component</th>
<th>Concentration</th>
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<tr>
<td>Zinc</td>
<td>0 ppm, 1000 ppm</td>
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<tr>
<td>Fluoranthene</td>
<td>*</td>
</tr>
<tr>
<td>Chrysene</td>
<td>*</td>
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</table>

* Not Analyzed  + Reported Detection Limit

CONFINED AQUATIC DISPOSAL CELLS: PHASE 2

CONFINED AQUATIC DISPOSAL CELLS: PHASE 2

SCHEMATIC OF CAD CELL

SUB-BOTTOM PROFILING
DAMOS Conclusions

- Environmental Health of Sites
- Site Stability
- Chemical Isolation
- Sediment Evaluation Assessment
- Management Technique Development

DAMOS Products