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A wider look at the risk of ocean disposal of dredged material

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Dredged material in the United States cannot be dumped at sea if it is toxic in a laboratory test or if, in separate tests, certain chemicals are accumulated in the tissues of exposed organisms (EPA/USACE, 1991). This rule has been in effect since 1972 with enactment of the Marine Protection Research and Sanctuaries Act. Changes have occurred over the years in the testing procedures and changes since 1991 have increased the proportion of dredged material that is unacceptable for ocean disposal (NRC, 1997) This has delayed port maintenance and deepening projects while alternatives to ocean disposal are found and agreed upon by all concerned. The alternatives are either disposal on land or disposal in confined sites constructed within aquatic areas.

Disposal decisions based on risk assessments would consider more than the intrinsic properties of dredged material and the essential first step would be to define what is at risk from disposal (EPA, 1998). For ocean disposal it seems obvious that one wants to determine risk to individual human consumers of seafood, to individual members of endangered populations, and to populations of marine organisms. The extent of each of these risks depends more on the location and size of a dumpsite than on intrinsic characteristics of dredged material.

In terms of risks to human consumers of seafood it is instructive that, when assessing the same risk from agricultural use of sewage sludge, the EPA (1993) calculated human ingestion of sludge-derived chemicals on the basis of the ratio of sludge-amended land to total agricultural land. For the analogous consideration of dredged material, it is important to note that dumpsites are small relative to the ranges of marine organisms. Among the 122 designated sites off the US coasts (EPA/USACE,1991), the median and mean sizes are 3 and 5 sq. km, respectively, the largest is 39 sq. km and only 20 are larger than 10 sq. km. On the other hand, the ranges of marine species are large. Table 1, for example, lists the sizes of areas used by some East Coast fish. These areas, extracted from Ray et. al. (1980), are not the total range of a species but the smallest (e.g., spawning area) plotted by Ray et al. among the major areas (e.g., winter area or summer area). All the areas in Table 1 are of the order of 10,000 sq. km. So, at most, a dredged material dumpsite occupies 0.1% of the area required by a living marine resource. If a species of fish or shellfish harvested at a dumpsite is part of the typical human diet, the proportion taken from the dumpsite is a very small fraction of the total. Thus, as is the case with sewage-sludge on land where allowable levels of chemical contamination are well in excess of what is found in dredged sediment (O'Connor, 1998), determinations of human-health risk cannot be based just on levels of local contamination.

A cautionary point in this context is that resident organisms in harbors are accessible to subsistence fisherman who, in effect, are also resident at such sites. So while seafood available to the general human population is barely influenced by dredged material disposal, chemical contamination in harbors can affect the diet of subsistence fisherman.

Regarding risks to marine organisms, neither ocean dumping nor any alternative dredged material disposal can occur without local biological effects. Immobile benthic organisms that survive burial under dumped material will experience lifetime exposure to the material as will organisms that, while mobile in early life stages, come to settle upon a disposal site. Such resident organisms may suffer from that exposure. Historically used dumpsites support benthic communities that may or may not be degraded in terms of species composition and abundance. However, changes at the dumpsite must be considered acceptable for dredging to proceed. Moreover, none of the sites designated for dredged material dumping (EPA/ USACE,1991) are in uniquely important areas. For example, places where populations congregate or that provide refuge for early life stages would not be designated as dredged material dumpsites. The designation process, also, excludes areas that might be particularly important to endangered species.

By recognizing that local biological effects are acceptable and that risks to humans from local contaminant accumulation by fish and shellfish are diminished by the widespread distribution of seafood, judgments on ocean disposal of dredged material can be based on wider considerations than just characteristics of the material. The crux of the issue is to assess the risk to marine populations and to public health posed by the movement of contamination away from a dumpsite. Such an assessment might be done by examining the environments in the vicinity of dumpsites that, in the past, received material that, by present standards, would have been deemed unacceptable for ocean disposal.

Opinions expressed here are those of the author and do not necessarily represent those of the National Oceanic and Atmospheric Administration.

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Table 1. Sizes of areas used by commercially valued fish and shellfish off the U.S. East Coast. Areas for each species are the smallest shown among different types (e.g. summer, winter, spawning, or other area) by Ray et al.(1983)

Species	Smallest type of area	Areal size 10^4 km^2
Yellow Tail Flounder	spawning	2.3
Summer Flounder	winter	2.2
Winter Flounder	nursery	1.2
Spot	winter	6.0
Scup	winter	1.7
Atlantic Croaker	winter	1.1
Spiny Dogfish	spawning	5.4
Smooth Dogfish	spawning	2.7
White Hake	spawning	1.1
Red Hake	spring	2.5
Silver Hake	spawning	4.2
Atlantic Cod	spawning	3.3
Haddock	spawning	1.7
Atlantic Mackerel	winter	2.5
Spanish & King Mackerels	winter	2.0
Atlantic Herring	spawning	0.9
Atlantic Menhaden	summer spawning	1.1
American Shad	summer	3.6
Black Sea Bass	winter	1.5
Bluefish	spawning	3.1
Bluefish Tuna	smaller individuals	7.3
American Lobster		8.1
Spiny Lobster		1.2
Surf Clam		8.3
Ocean Quahog		10