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TECHNICAL COMMUNICATION

Aluminum Cans as Litter in Masonboro Sound, North Carolina†

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INTRODUCTION

The problem of litter in coastal waters has received much attention recently, partly because of well publicized spills of medical wastes and in part because of a generally heightened public awareness of environmental deterioration (*e.g.*, *TIME*, Jan. 2, 1989). Medical waste litter is a very serious problem, but medical waste is only a small fraction of the material dumped into coastal waters. Other kinds of litter are dumped in much larger quantities by a greater number of people. Measures taken to stop the dumping of "high profile" medical litter may not be effective with trash left by "ordinary" offenders. Therefore, measures to stop the dumping of common kinds of litter must target these mundane offenders.

This report describes work done under the premise that the nature of the litter in the coastal environment offers information about the identity and behavior of those who produce that litter. Recent efforts to collect and catalog the litter found on ocean beaches in Britain (DIXON and DIXON, 1981), Trinidad (SIUNG-CHANG and DEAN, 1984), and, in the USA, Texas, Oregon, and North Carolina (WOOD, 1989) provide a great deal of information about the composition of litter in the coastal environment. During "Beachsweep '88" volunteers collected over 136,000 pieces of litter from 270 km of North Carolina's beaches (FRIDAY, 1988). Beverage containers comprised 24,271 of these items, or 18.1%. The largest fraction of these were metal cans (11,107 collected; 44.9% of all beverage containers).

Aluminum cans were chosen as the focus of this study, not only because they are an important fraction of the litter found in the coastal environment, but because they also provide information that might be useful in addressing the litter problem. Aluminum cans are almost always identifiable. Even if their labels have completely faded, the cans are often stamped with the manufacturer's name. Plastic and glass bottles, on the other hand, often have paper labels that fall off or fade quickly. Glass

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bottles sink or break much more readily than aluminum cans, and so are lost before they can be sampled. Alcoholic beverages often come in aluminum cans, but are almost never packaged in plastic containers (O'HARA *et al.*, 1988).

Observations during beach cleaning operations in 1987 and 1988 suggested that litter on the beach face was only a portion of the total in the coastal environment (A. WOOD, N.C. Aquarium-Fort Fisher, *pers. comm.*). The marsh areas behind the beaches often appeared to be as badly littered as the beach faces; no consistent effort to clean the marsh areas was made during Beach Sweep in 1987 or 1988. No effort was made to clean litter from other areas in the coastal environment, such as dredge spoil islands that lie along the Intracoastal Waterway, a very popular recreation area. Observations suggested that these dredge spoil islands are heavily littered, so one of these islands was made the geographical focus of this study.

The aim of this study was to collect and categorize all the aluminum cans found on one dredge spoil island along North Carolina's Intracoastal Waterway. This study posed the following questions: What fraction of the cans are alcoholic beverage containers? What fraction are new, recently deposited cans? How many of these cans are available to move around in the coastal environment, as opposed to those cans that are solidly in place and unlikely to move?

METHODS AND MATERIALS

Aluminum cans were collected from a dredge spoil island (Lat. 34°09.20 N, Long. 77°51.23W) in Masonboro Sound, a portion of the proposed Masonboro Island Estuarine Research Reserve, located in southeastern North Carolina (Figure 1). The main axis of the island is oriented northeast to southwest. The Intracoastal Waterway passes along the northwest side of the island and separates it from the mainland, which is heavily developed. Tidal channels pass to the northeast and southwest of the island, and the southeast side of the island backs up against extensive *Spartina* marsh. Boat traffic passes along the Waterway, with a few boats, mostly those of clammers and fishermen, using the tidal channels. The island itself is lightly used, primarily by occasional hunters and fishermen. There is little exposed beach and the island is surrounded almost entirely by a fringing marsh with extensive woody shrubs just above the high tide mark.

Cans were collected from the entire island during three days in January 1989. Cans collected from each of the island's four sides (Figure 1) were collected and bagged separately. Although the vast majority of cans found (and other litter observed) were concentrated along the high tide mark, all areas of the island were searched for cans.

Cans were categorized in several ways and counted (Figure 2). Cans were counted as alcoholic beverage cans if any marks identifying them as such were seen. Completely unidentifiable cans and those with clear non-alcoholic markings were counted as non-alcoholic containers. "Old" cans were those with obvious fading of their paint, attached marine life, corrosion, or any other significant marks of wear that indicated they might have been present for a considerable period of time. "New" cans were those with no signs of wear or deterioration. Since any noticeable wear on a can sufficed to classify it as old, this set of definitions probably overestimates old cans. Mobile or floating cans were those with little or no material in them and which had not been crushed. Cans with any solid material inside them were counted as non-mobile. Subsequent examination of the material inside these cans revealed that many of them were likely to float at high tide or move with strong winds anyway, so the estimates of floating or mobile cans are probably low. Following sorting, counting, examination, and cleaning, the cans were bagged and taken to a recycling center.

RESULTS

A total of 1564 cans were collected during 6.5 hours of effort (Table 1). The majority of these cans were found on the northwest side of the island, facing the Intracoastal Waterway, but significant numbers were found on all sides of the island. A large majority of cans were found at or near the high tide mark, which was delineated by various kinds of flotsam and other debris. Some cans were found in the adjacent marsh, particularly in stands of *Juncus,* which appeared to trap them very effectively. The overall density of cans was 626/km of shoreline; maximum densities were found on the north-

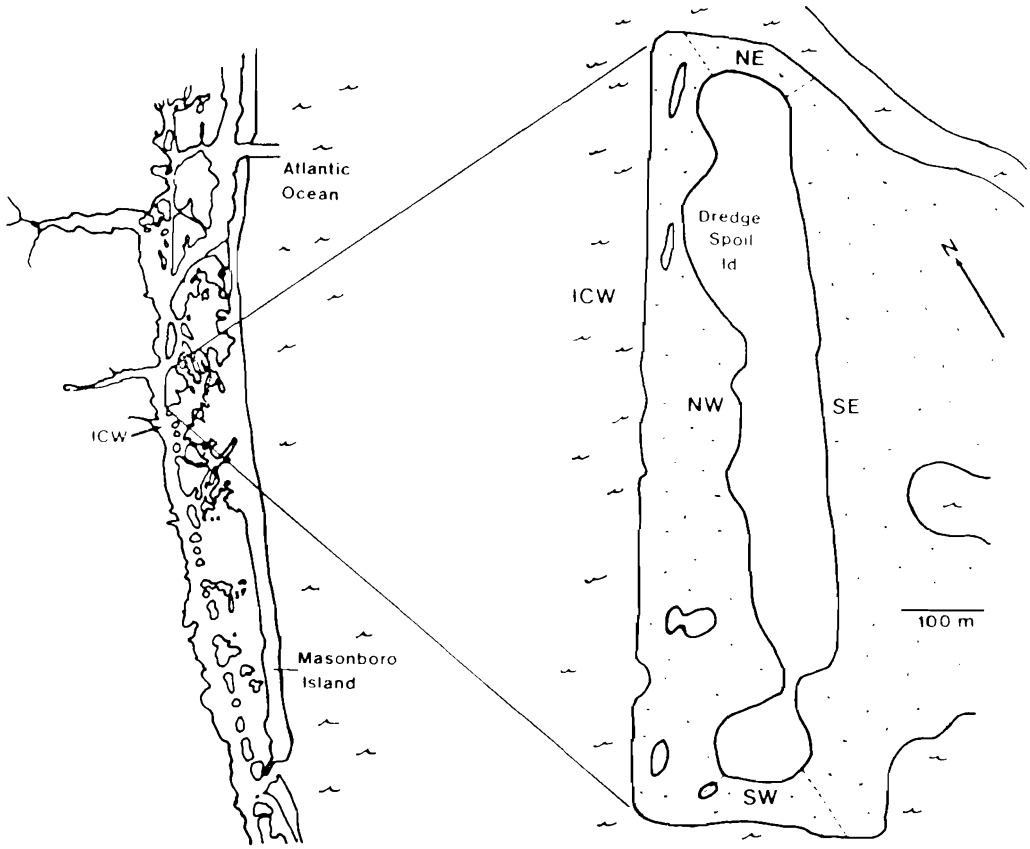

Figure 1. Map of dredge spoil island in Masonboro Sound, North Carolina, showing proximity to the IntraCoastal Waterway (ICW) and the four sides of the island from which cans were collected in January 1989. Stippled area around the island is *Spartina* marsh.

west side of the island (approximately 960 cans/km). Over 87% of the cans were identified as alcoholic beverage cans. The vast majority (97%) of cans were also identified as "old." Approximately 37% were identified as mobile, that is, empty enough to be likely to float around at high tide or be moved by strong winds. This latter estimate, as described above, is likely to be low.

Several observations indicate that aluminum cans have a long lifetime in this coastal environment. Although many of the cans had faded paint, very few had much visible corrosion, even those that were partially buried below the high tide mark. Many other cans were observed to have marine life (barnacles, oysters, algae) growing on them, also suggesting a long residence time.

Observations during and after the collection effort indicated that aluminum cans were among the most important forms of litter on this island. Plastic beverage containers were also quite common, and were also concentrated in the intertidal zone, especially in stands of marsh grass and in wrack deposited by the highest tides. Other kinds of litter observed included floats from crab traps, light bulbs, and many other miscellaneous items.

DISCUSSION

Intertidal zones in the marshes behind barrier beaches appear to harbor a very large quantity of litter, especially in areas with stands of high plants, such as *Juncus*. The 1564 aluminum cans collected along approximately

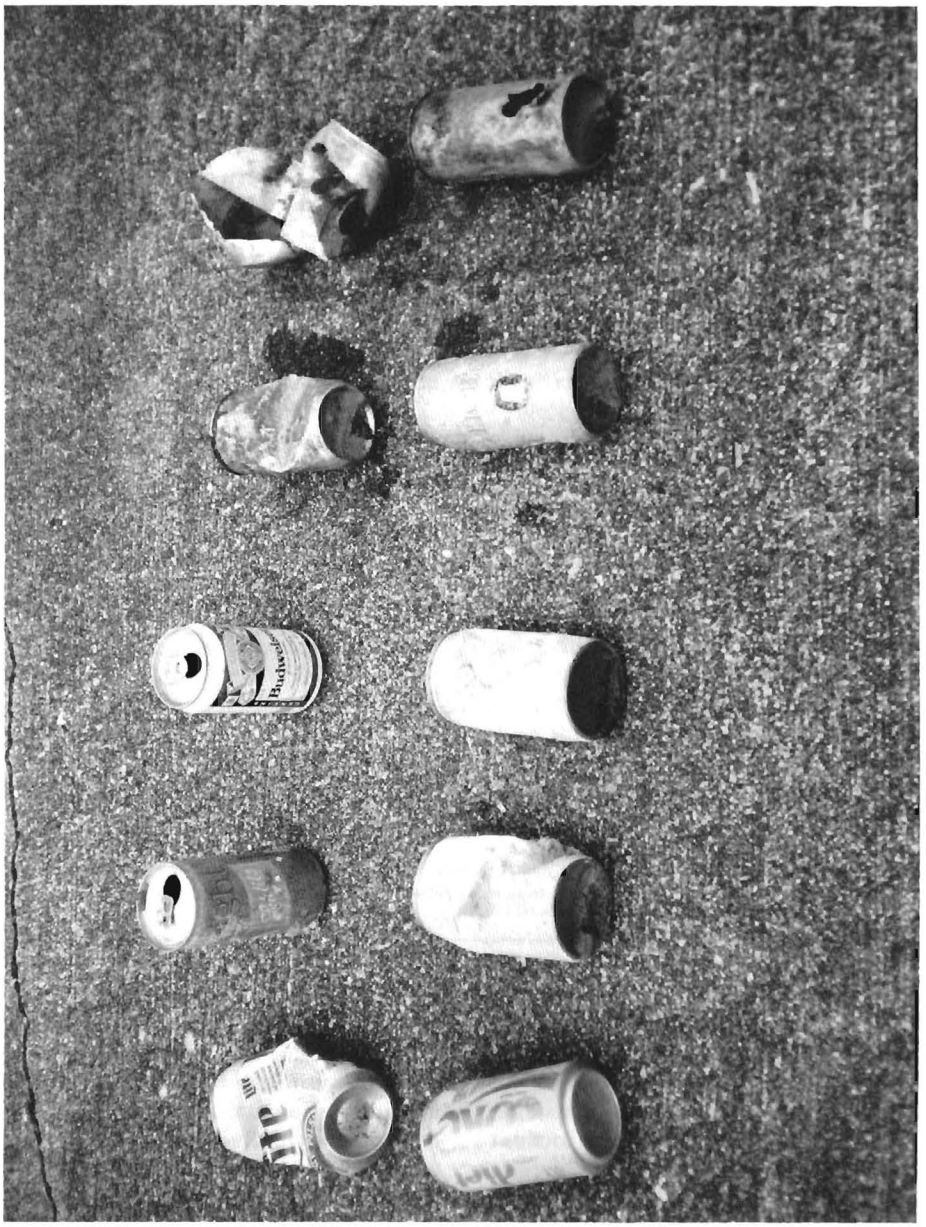

Figure 2. Photograph of representative aluminum cans collected on dredge spoil island in Masonboro Sound, North Carolina. All but one can were alcoholic beverage containers. Standing cans were mobile (able to float). First and third cans from left in rear row were classified as new. Note corrosion, faded paint, or encrusting life on other cans.

2.5 km of dredge spoil island shoreline in this study are equivalent to 14% of all the metal cans collected during Beach Sweep '88 along 270 km of North Carolina barrier beaches (FRIDAY, 1988). Furthermore, the concentration of cans reported in this study, approximately 626/km of shoreline overall, is considerably higher than concentrations reported in other studies of

Table 1. *Geographical distribution and kinds of aluminum cans collected on dredge spoil island in Masonboro Sound, North Carolina in January, 1989. Numbers of cans on each side of the island and of each kind.*

Northwest	Northeast		Southeast		Southwest
1147	109		257		51
Alcoholic	Nonalcoholic	Old	New	Mobile	Nonmobile
1373	191	1515	49	516	988

beach litter. DIXON and COOKE (1977) reported finding approximately 40 beverage cans/km of shoreline on a British beach. Approximately 78 cans/km of shoreline were found in Texas in its 1987 beach cleanup effort, with 21 cans/km reported in the Padre Island National Seashore (WOOD, 1987). North Carolina Beachsweep '88 yielded approximately 46 cans/km overall (FRIDAY, 1988). If similar ratios are repeated elsewhere in the coastal area and for other kinds of litter, there is a tremendous pool of litter in the coastal environment that is concentrated in marshes. Cleanup efforts such as Beach Sweep only touch the surface of this problem.

A fairly high proportion of the cans collected in this study appear to be mobile, that is, they could be easily moved around by wind or high tides. Although the method used to identify such mobile cans in this study estimated that approximately 37% of these cans were mobile, the bias in the method and concentration of cans at the high tide mark argue that many more of them are truly mobile. The large numbers of cans found along the southwest side of the island, well away from direct exposure to boat traffic, also suggest strongly that cans are moved quite readily through the marshes by non-human agents. This means that areas cleaned of litter can be littered again through the action of wind and tides alone. Any comprehensive cleanup effort in coastal areas must take into account this large pool of mobile litter that has otherwise been ignored.

Plastic debris should be at least as mobile as aluminum cans and is probably moved more effectively by wind. Thus, plastic litter in the coastal area presents the same problems: cleanup efforts must include marshes, not just beach fronts.

The large preponderance of alcoholic beverage containers among the aluminum cans collected in this study points to another dimension of the coastal litter problem. Many of the people responsible for littering the coastal environment are apparently recreational boaters under the influence of alcohol, even if they are not legally intoxicated. Aside from the problems this poses for boating safety, it means also that the behavior of this group will be correspondingly more difficult to affect. Virtually every beverage container is stamped with the admonitions, "Dispose of properly" and "Do not litter," as well as remarks identifying the can as "Recyclable aluminum." Given the large quantities of these containers making their way into the marshes anyway, some other approach clearly must be tried.

This study serves an additional purpose. The complete removal of aluminum cans from one dredge spoil island permits subsequent surveys of cans on this island that may help establish the rates at which old cans move around in the coastal environment and new cans are deposited. This kind of information will be valuable in assessing the effectiveness of cleanup campaigns and efforts to prevent littering in the future.

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