

share the blame for the beach litter problem.

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Survey and Findings of Beach Debris on Mustang Island, Texas

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The survey has been conducted since April 1978 to study the long-term variations in bird population along a 12-km stretch of Mustang Island Gulf beach in South Texas. Demographic and environmental variables have been measured in an attempt to assess the effect of human activities and seasonal variability of the beach environment in this area. During the study period, an increase in its use for commercial and recreational fishing, merchant and military marine transportation, offshore oil and gas activities, tourism, and residential and industrial development has occurred. Despite a recent downturn in some of these activities, the incidence of man-made debris and litter on the barrier island beaches continues to be a problem for marine and beach animals, as well as severely detracting from the aesthetic appeal of the beach. The economies of local communities have been hurt by the negative publicity,

as have the various industries (offshore oil and gas, shrimping, sport-fishing, tourism) frequently cited as the source of this debris.

Since 1983, the survey has included estimates of the quantity and type of beach debris, both natural and man-made. Over 1,000 observations have been made using a 0-5 rating system for some 40 categories of debris. In 1987, with the assistance of a grant from the Texas A&M Sea Grant Program, weekly counts of beach debris were taken, using the same technique developed for the bird surveys. A hand-held computer, with its keys reconfigured to allow single-keystroke entry for up to 256 categories of debris, was used to map the location and quantity of items along the entire 12 km (7.3 mi) study site. Distance-travelled was automatically entered into the record via an electronic odometer interfaced between the truck and computer. While this was being done, three 10-meter wide transects were cleaned from the shoreline to the high-tide line. Debris was collected and later sorted, categorized and weighed.

This method gives three scales of estimates on the amount and types of debris on Mustang Island beach: (1) the bi-daily gross estimates; (2) the weekly counts of items large enough to be seen from a slowly moving vehicle, and (3) the weekly "micro-trash" weighings. Methods 2 and 3 are being used to "calibrate" method 1. It must be pointed out that the error bars are often quite large for 1 and for some categories in 2, but are small for 3. Method 3, however, covers only three small beach zones, and extrapolating over the whole study site introduces further errors. The beach litter study business does not lend itself to high-precision results, and much remains in the realm of "detective work." This complexity is illustrated in Table 3.4 showing some of the factors, in

addition to those introduced by the methodology, affecting the study of debris and litter on a barrier island beach.

How can these data identify the source of the debris and litter found on the Mustang Island beach? More specifically, can the data show what may be attributed to the offshore oil and gas industry? There is not room here to discuss all the aspects of this problem, and the large amount of data is not yet fully analyzed.

Manufactured items from at least 34 countries (identified principally from bottles of galley-type litter) have washed up on Mustang Island beach in the past three years (Table 3.5). Only man-made litter from the U.S.A. and Mexico can definitely be said to have floated from the country of origin. Although natural debris is known to come to our shore from Central America and the Caribbean (C. McMillan, personal communication), as have bottles (Corpus Christi Caller Times 1987), the bulk of the foreign "household" (galley) materials have come from fishing boats, or more often, merchant-marine vessels. Except for the U.S.-originated litter of this type, oil and gas platforms and rigs cannot be the source of such materials.

The foreign material is the most conspicuous because of its exotic nature, not because it is the most abundant form of litter. By far the greater amount of galley material is of U.S. origin: 1-gallon milk jugs, egg cartons, styrofoam frozen-food packs. The great majority of these are typical Texas supermarket brands such as HEB, Park Manor, IGA, and Hygeia, as well as items designated for institutional use. This leaves shrimping, commercial fishing, U.S. merchant marine transport, and oil and gas operators and their service industries as potential culprits. I exclude the recreational fishing

industry from this list because of the institutional container sizes and product labels frequently found.

One category that I estimate under the code CHEM(icals) is definitely attributable to offshore oil and gas activities. Under this category come 55-gallon drums and the more abundant 5-gallon plastic pails and carboys of chemicals used in exploration and drilling. A decrease in the incidence of these items on the beach has occurred in the past two years. The decrease coincides with the downturn in drilling rigs operating in the Gulf and an increase in the companies' campaigns to educate offshore oil workers and to tighten littering regulations. Debris peculiar to associated activities, such as seismic surveying and the service and supply boats, continues to be found on the beach. These included write-protect rings, marker floats, and large plastic sheeting used to cover palletted cargo. The plastic sheeting has a long residence time on the forebeach and is difficult to remove during cleanup operations.

Rubber gloves, shrimp baskets, onion and sea-salt sacks, and Mexican bleach bottles can be attributed to the shrimping industry, while cold-chemical light sticks come from the longline fishing industry. Beverage cans, glass beer and liquor bottles, fast-food containers, and disposable picnic supplies may come from recreational fishing boats or may originate on the beach itself. Some kinds of driftwood, seagrasses, water hyacinth, mangrove seeds, and some household items originated in bays or rivers and were transported out to sea before being deposited on the beach. Certain items like cans, bottles, and food containers could have come from any or all of these sources.

Table 3.6 shows the results of all three methods of debris-estimating used for a single day, 28 May, 1987. Figure 3.1 is a map of certain categories of litter as they were distributed along the 11.8 km of beach on that same day. Notice that (a) the effects of beach-cleaning can be seen in the first 1/2 mile (City of Port Aransas jurisdiction) in the distribution of plastic bags, bottles and beverage cans; (b) a single, large Memorial Day weekend beach party at mile 1.4 shows as a spike in all of these (party-goers had left by the time of observation); (c) the location of people on the beach at the time of observation bears no relationship to the location of litter items; (d) the scavenging laughing gulls are attracted to the more littered beach areas; (e) the probing shorebirds are not affected by litter distribution; (f) natural debris is evenly distributed along the beach transect.

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Mr. Amos is the local observer for the National Stranded Marine Mammal and Turtle Networks, official cooperative observer for the U.S. Weather Service, and he maintains the tide gauge at Aransas Pass. He has an interest in photography and was awarded three prizes in the Audubon Society's 1983 Salon of Photography. Mr. Amos writes a regular column on the beach environment for a local newspaper and is editor of UTMSI's Newsletter and the institution's brochure.

Preliminary Findings for Beach Debris in Louisiana

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PROJECT HISTORY

Litter along Louisiana beaches has become an increasingly significant issue: Every beach in Louisiana is marred by visible litter. Many local residents blame the offshore oil industry, shrimpers, or other fisherman for the litter problem, while others blame recreational fishermen, the shipping industry or the local residents.

The Coastal Management Division (CMD) of the Department of Natural Resources has developed a campaign to promote public awareness and to improve public education about litter in Louisiana's coastal zone. The Louisiana Geological Survey is conducting two studies to help determine the extent and the sources of beach litter in Louisiana. This will help CMD to focus its campaign where it will accomplish the most.

ACCOMPLISHMENTS

To assess beach litter, the Louisiana Geological Survey is conducting quarterly beach surveys and collected data during the statewide beach cleanup. These studies will provide the first quantitative information about the litter accumulating on Louisiana beaches. In addition, the studies should help determine some of the sources of the litter.

The first survey involves quarterly sampling of six beaches in Louisiana. Three of the beaches are in the eastern part of the state (Grand Isle, Fourchon, and Belle Pass), and three are in the western part of the

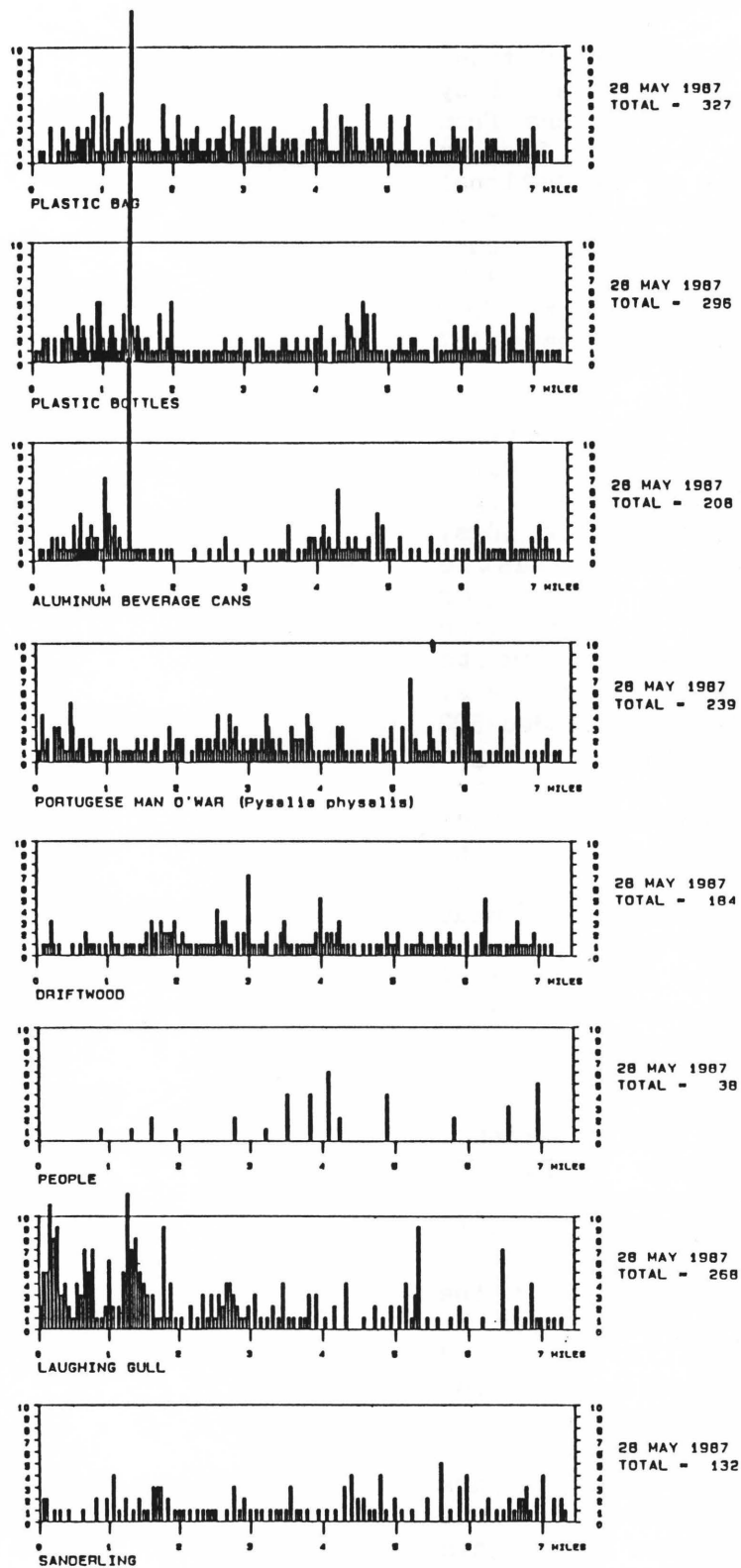


Figure 3.1.--A map of certain categories of litter as they were distributed along the 11.8 km of beach on that same day.

Table 3.4.

Some Factors Affecting the Distribution
of Debris and Litter on Mustang Island Beach

<u>Origins</u>	<u>Sources</u>
Offshore	Ships, Rigs, Platforms, Fishing, Recreational, Shrimp, Supply Boats
Bay	Fishing, Shrimping, Recreational Boats, Landfills, Dumping
River	Landfills, Dumping
Beach	Littering, Dumping
<u>Distribution</u>	<u>Factors</u>
Surf Zone	Tides, Waterlogging, Tarring, Turbulence
Shoreline	Tides, Winds, Longshore Drift, Offshore Currents, Windage, Burial, Tarring
Mid-Beach	Tides, Winds, Weather, Burial, Scavenging, Season, Traffic, Cleaning, Vegetation, Morphology
Dunes	Winds, Storm-tides, Dune-building
All-Beach	Camping, Popular Locations, Trash-Barrels, "Partying," Condominiums, Long-Term Beach Residents

Table 3.5.

Countries from Which
Trash has been found on
the Mustang Island Beach Survey

- | | |
|-------------------|-----------------|
| 1. ARGENTINA | 18. JAPAN |
| 2. AUSTRALIA | 19. KOREA |
| 3. BANGLADESH | 20. MEXICO |
| 4. BELGIUM | 21. MOROCCO |
| 5. BRAZIL | 22. NETHERLANDS |
| 6. CHINA | 23. NIGERIA |
| 7. CUBA | 24. NORWAY |
| 8. CZECHOSLOVAKIA | 25. SINGAPORE |
| 9. ECUADOR | 26. S. AFRICA |
| 10. FRANCE | 27. SPAIN |
| 11. GREECE | 28. TAIWAN |
| 12. HONG-KONG | 29. TRINIDAD |
| 13. INDONESIA | 30. U.K. |
| 14. IRELAND | 31. U.S.A. |
| 15. ISRAEL | 32. U.S.S.R. |
| 16. ITALY | 33. VENEZUELA |
| 17. JAMAICA | 34. W. GERMANY |

Origins of Man-Made Litter Believed
to Have Drifted Directly to
Mustang Island

- | | |
|--------------|----------------|
| 1. ALABAMA | 6. MEXICO |
| 2. CUBA? | 7. MISSISSIPPI |
| 3. JAMAICA? | 8. EAST TEXAS |
| 4. FLORIDA? | 9. SOUTH TEXAS |
| 5. LOUISIANA | 10. TRINIDAD? |

Table 3.6.

Debris and Litter Counts on Mustang Island Beach Survey, 28 May 1987

CODE	ITEM	RANK	COUNT	WEIGHT (Kg)
NATURAL DEBRIS:				
CRAB	Dead crabs	0	1	0.355
FISH	Dead fish	0	2	0
CABG	Cabbagehead jellyfish	3	601	0
PMOW	Portuguese Man O'War	2	239	0.593
PENS	Pen shells	0	1	0
DRIFT	Driftwood	4	185	128.296
SARG	Sargassum	3	---	2,174.831
HYAC	Water hyacinth	0	---	9.125
BEAN	Seabeans	-	---	2.923
GORG	Gorgonians	2	---	4.977
PLASTIC DEBRIS:				
PLAS	Plastic sheeting	3	199	0
PBAG	Plastic bags	-	327	0
PMSC	Miscellaneous bits of plastic	-	259	140.699
STYR	Styrofoam	-	122	11.297
FOAM	Other foam	-	10	0
PBOT	Plastic bottles	-	298	0
GBOT	Green bottles (Mexican)	3	57	0
MILK	One-gallon milk jugs	2	32	0
2STR	Two-stroke oil bottles	-	15	0
6PAK	Six-pack holders	-	19	0
CUPS	Plastic cups	-	84	0
LIDS	Plastic lids	-	77	0
EGGC	Egg cartons	-	14	0
PAIL	5-gallon containers	-	16	0
SACK	50-lb produce sacks	-	21	0
GARB	Full garbage bags	-	18	0
ROPE	Polypropylene line	5	131	17.578
FLOT	Fishing floats	3	11	0
NETS	Fishing nets	-	1	0
STIK	Light sticks	-	14	0
RING	Write-protect rings	-	2	0
HARD	Hardhats	-	1	0
BOTL	Bottles of all kinds	4	547	0
HOUS	Household garbage	4	589	0
----	Plastics of all kinds	3	938	151.996
NON-PLASTIC DEBRIS:				
BEVG	Beverage cans	3	209	0
OCAN	Other cans	-	27	0
GLAS	Glass bottles	-	177	0
BULB	Light bulbs	5*	24	1.264
FLOR	Fluorescent tubes	5*	16	0

Table 3.6.

Debris and Litter Counts on Mustang Island Beach Survey, 28 May 1987
(cont'd)

CODE	ITEM	RANK	COUNT	WEIGHT (Kg)
LGHT	Cigarette lighters	-	5	0
METL	Metal	-	5	28.361
PAPR	Paper	-	24	5.096
CART	Cardboard cartons	-	32	0
CRAT	Crates	-	6	0
55GL	55-gallon drums	-	1	0
LUBE	Tubes of grease	-	3	0
APPL	Appliances	-	2	0
REEL	Reels	-	2	0
WIRE	Wire	-	10	0
TIRE	Tires	-	1	0
TOYS	Toys	-	1	0
HAT	Hats	-	1	0
GLOV	Rubber gloves	-	28	0
SHOE	Shoes	-	31	25.636
CLTH	Cloth; clothing	-	4	0
FRUT	Fruit	2*	6	0
VEGS	Vegetables	2*	4	0
CHEM	Chemicals	24	5	0

DEMOGRAPHIC DATA:

SRMP	Shrimboats	-	1	-
CARS	Cars and trucks	-	11	-
PEOP	People	-	42	-
DOGS	Dogs	-	1	-
HORS	Horses	-	7	-

ENVIRONMENTAL DATA:

AIRT	Air temperature	26.6 degrees C
HUMI	Humidity	89.5%
SST	Sea-Surface temperature	26.9 degrees C
SSS	Sea-Surface salinity	36.07 ppm
WDIR	Wind direction	130
WSPD	Wind speed	15 kts
STAT	Sea-State	4
HT/L	Shoreline to high-tide line	8 m
D/L	Shoreline to dune-line	22 m
WETH	Weather	Mostly Cloudy windy, rough seas.