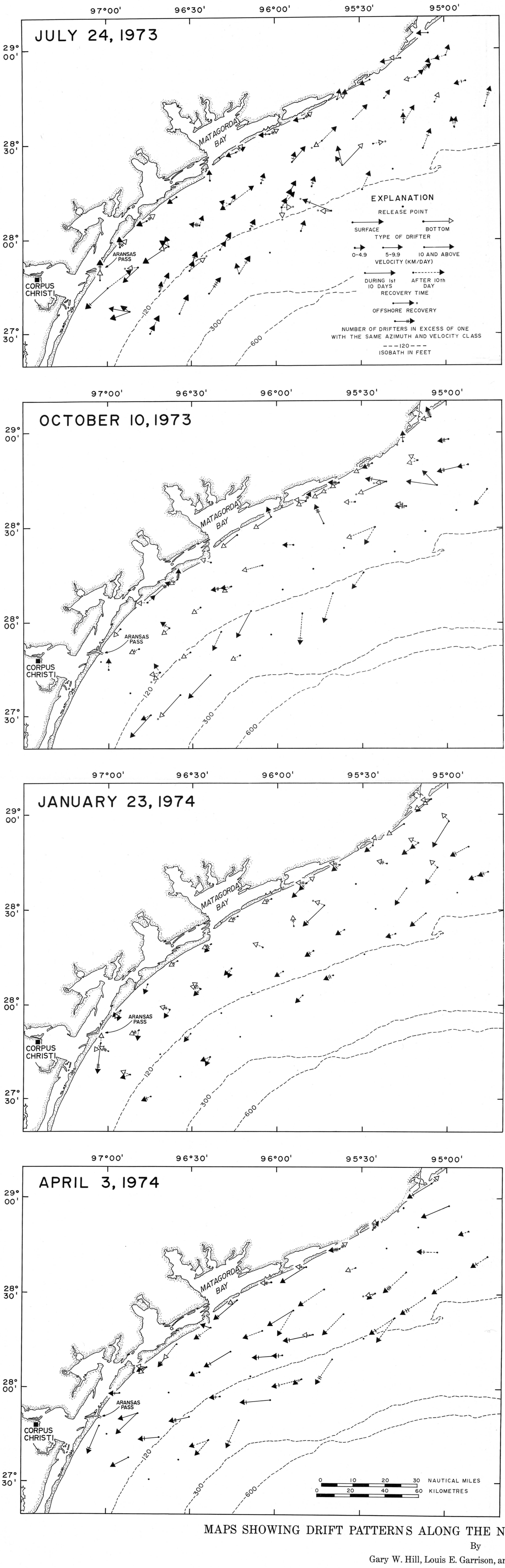
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-714



INTRODUCTION

An investigation of the rates and directions of drift in the northwestern Gulf of Mexico was initiated in January 1970 as part of a program to study depositional processes and sediment movement off the southern Texas coast. The first phase of that program, a study of coastal drift off south Texas, was reported by Hunter and others (1974). They reported on a three-year program of seasonal releases of both bottom and surface drifters on the south Texas shelf; this study confirmed the hypothesis that the yearly cycle of coastwise water movement is largely controlled by seasonally changing winds. They also showed complex convergences of both surface and bottom waters which shift along the coast, as well as a layered drift structure which periodically directs surface and bottom waters in opposite directions. Results of several drift studies in the northwestern Gulf of Mexico which preceded this study are summarized by Hunter and others (1974).

The second phase began in July 1973, when the study was shifted to the coast off north-central Texas. This report presents the first year results in the north-central area where studies are continuing.

METHODS

For the present study, surface drift was measured by the net movement of ballasted drift bottles. The drift of bottom water was determined by plastic seabed drifters of the Woodhead type which have come into general use for drift studies (Bumpus, 1965; Harrison and others, 1967; Conomos and others, 1970). Five surface drifters and five bottom drifters were released at each of 48 stations on each release date by dropping them from an airplane whose location was fixed by Loran A or by Tacan. The release points were 12 nautical miles (22 km) apart along four lines roughly paralleling the coast between Galveston and Aransas Pass. These lines were generally 1, 10, 20, and 30 nautical miles (2, 19, 37, and 56 km) offshore in water depths averaging about 30, 65, 95, and 155 feet (9, 20, 30 and 46 metres). Releases were made seasonally from July 1973 to April 1974.

Most information on drifter recovery came from the public, who picked them up on open beaches. Beaches not accessible to the general public were searched by project personnel on weekly or semi-weekly schedule for 6-8 weeks after each release.

RESULTS

The number of returned drifters varied with the season, the distance of release point from shore, and the type of drifter; an over-all total of 23 percent of the drifters released were recovered (table 1). Most drifters were found on Gulf of Mexico beaches between Galveston and Port Isabel, Tex.; a few were found on beaches north and south of these points, in the lagoons and bays, or by shrimp boats at sea. Most recoveries from the outer lines were made within 60 days of the release date, and most of those from the line closest to shore were made within 10 days of release. The net-drift velocities, which were calculated from the straight-line distance and elapsed time between release and recovery and are thus minimum velocities, ranged from 0.10 to 39 km/day. Recoveries made more than 60 days after release were disregarded.

Return of drifters within a few days after each release from points scattered along the whole Texas coastline created some confidence in the promptness and geographical representation of recoveries in this area. On the other hand, the rarity of returns from the beaches north of Galveston and south along the Mexican coast may be due in part to factors other than coastal circulation, as those sectors are less accessible to visitors.

Drift patterns indicated by individual releases

July 24, 1973.--Many surface drifters but relatively few bottom drifters were found after this drop. The surface drift offshore was directed mainly to the north, except in the most southwest part of the area where some southward drift occurred. Near the beach, southward drift prevailed on the surface but net drift at the bottom was strongly northward. This northerly directed bottom drift extended about 10 miles offshore, but farther out the pattern became confused where a relatively high percentage of bottom drifters recovered at sea indicated a seaward component of drift along the bottom.

October 10, 1973.--Fewer surface drifters but about the same percentage of bottom drifters were recovered compared to the July release. Surface drift appeared to be principally northward in the nearshore area and southward in the offshore area. Surface-drift velocities in the central and southern areas of the outer release lines were greater than in the northern and inner half of the study area. Bottom drift was uniformly southward with a slightly shoreward-directed vector.

January 23, 1974.--A smaller percentage of surface drifters but a substantially greater percentage of bottom drifters were recovered compared to previous releases. Surface drift was uniformly southward at all distances from shore. Except for some southward drift in the nearshore area, bottom drift was generally to the west and northwest. Bottom drift was decidedly onshore whereas surface drift tended to be somewhat offshore directed. Drift rates were generally much reduced compared to other releases.

April 3, 1974.--A large number of surface drifters but few bottom drifters were returned. Drift was uniformly southward both at the surface and near the sea floor and at all distances from shore, but velocities were greater than those of the January release. Surface drift showed an onshore trend over most of the study area, although offshore vectors in the outer release lines resemble the drift patterns seen in the October release.

DISCUSSION

Drift pattern

Preliminary data from the present study are generally consistent with the concept of a yearly cycle of seasonally changing coastal drift (Hunter and others, 1974) and extend these observations northeastward as far as Galveston, Tex. These seasonal drift patterns can be accounted for to a large extent by seasonally changing winds (fig. 1), but as noted by Kimsey and Temple (1964), the pattern characteristic of a given season can be delayed, prematurely stopped, or modified by winds atypical of the season.

An explanation of rates and directions of drift relative to seasonal variation in wind direction, drift convergences of both bottom and surface waters, and onshore-offshore components of drift may be found in Hunter and others (1974).

Comparison with drift patterns along the south Texas coast

Since the present study is an extension of that reported by Hunter and others (1974), some useful comparisons between the north-central and south Texas coasts can be made.

The general pattern of drifter returns for the two areas was very similar (table 1), although the present study had a slightly higher over-all percentage of drifters recovered due to the greater return of bottom drifters, including more recoveries at sea.

A seasonal change of drift patterns from northward drift in the summer to south or southwesterly drift in the winter was found to be common to both areas. However, southward drift is more extensive in the fall and spring along the north-central Texas coast than off south Texas, and the complex convergence zones of the southern Texas coast were generally absent in this study area.

Onshore and offshore components of drift are alike in both study areas. Surface drift is generally onshore in the summer and offshore in the winter. Bottom drift is generally onshore in the winter and offshore in the summer.

ACKNOWLEDGEMENTS

We thank Dr. Joseph H. McGowen (Bureau of Economic Geology) and students from the University of Texas, who helped to search sections of beaches not accessible to the general public. We are also grateful to the United States Coast Guard and Miller Brewing Company for continuing their logistic support of these studies, to Mr. Perry Bass for allowing us to search for drifters on his beaches, and to Lt. Col. W. T. Newsome of the U.S. Air Force for his cooperation in the search for drifters on the beaches of the Matagorda Air Force Base.

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_____1963b, Decennial census of United States climate--summary of hourly observations, 90th meridian time zone, Galveston, Texas, Municipal Airport, 1951-1960: U.S. Weather Bureau, Climatography of the United States No. 82-41, 15 p.

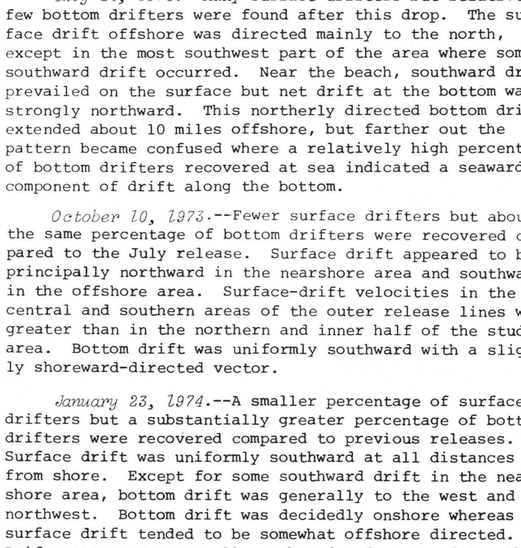

Table 1.--Tabulated recovery data[1]

			DATE OF RELEASE				AVERAGE OF ALL RELEASES[2]	AVERAGE OF ALL RELEASES[3]
			JULY 1973	OCT. 1973	JAN. 1974	APRIL 1974		
PERCENT RECOVERIES	SURFACE DRIFTERS	INNER RELEASE LINE	33	48	27	43	38	45
		OUTER THREE RELEASE LINES	46	21	18	30	29	25
		ALL FOUR LINES	43	28	20	33	31	30
	BOTTOM DRIFTERS	INNER RELEASE LINE	33	27	43	27	33	29
		OUTER THREE RELEASE LINES	7 (4)	10 (3)	14 (1)	2 (1)	8 (2)	3 (1)
		ALL FOUR LINES	13	14	21	8	14	10
	ALL DRIFTERS ALL LINES		28	21	21	21	23	20

[1] PERCENTAGES IN PARENTHESES ARE OFFSHORE RECOVERIES
[2] THIS STUDY
[3] DATA FROM HUNTER AND OTHERS (1974)

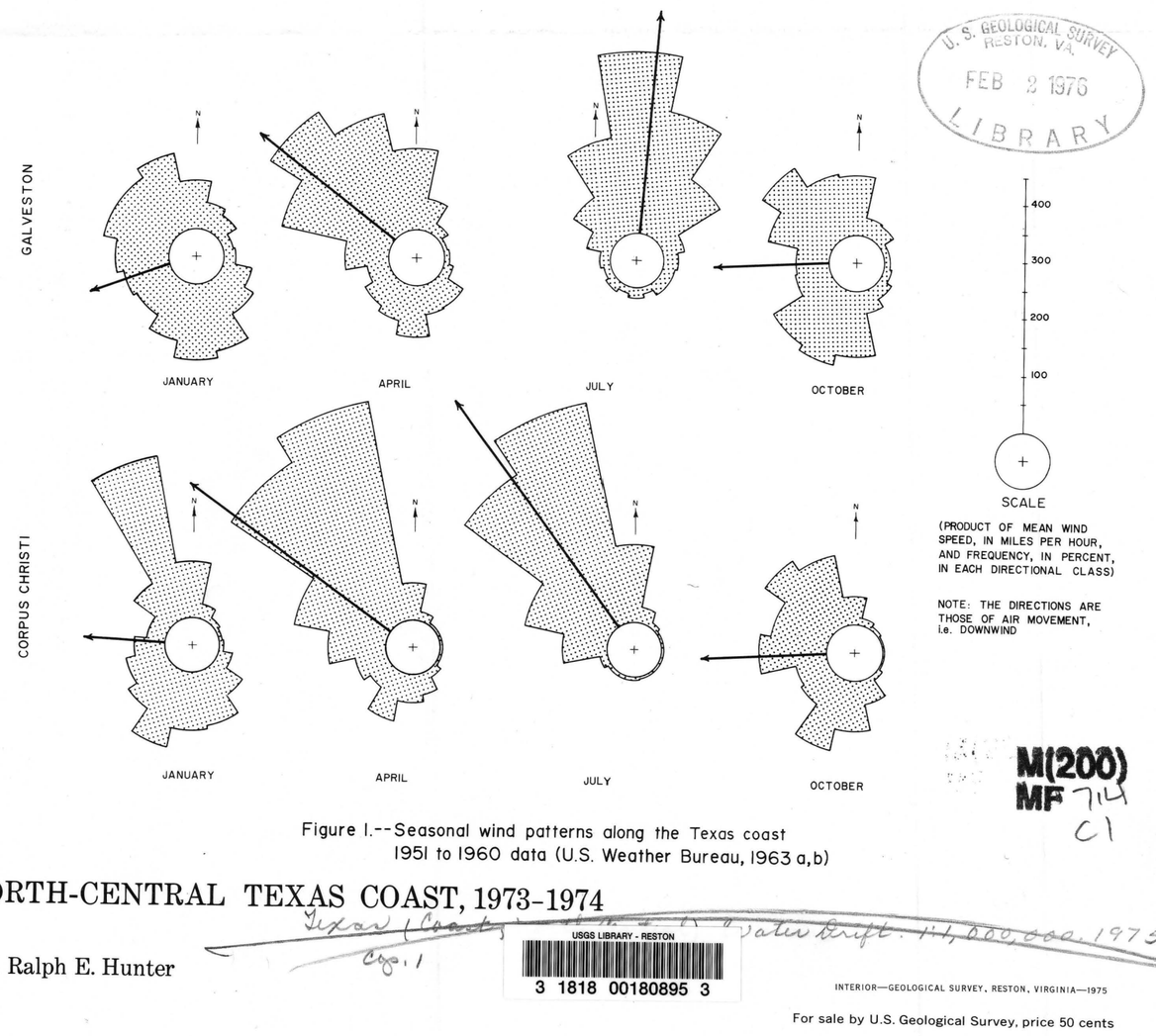

Figure 1.--Seasonal wind patterns along the Texas coast 1951 to 1960 data (U.S. Weather Bureau, 1963 a,b)

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MAPS SHOWING DRIFT PATTERNS ALONG THE NORTH-CENTRAL TEXAS COAST, 1973-1974

By

Gary W. Hill, Louis E. Garrison, and Ralph E. Hunter

1975

Texas (Coast) ... Water drift ... 1975
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