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Seabed Drifters Used to Study Bottom Currents off Kodiak Island

W. JAMES INGRAHAM, JR., and JAMES R. HASTINGS

Although surface currents are usually emphasized in fishery-oceanography studies, bottom currents—particularly over the continental shelf—are also of great interest. A convenient plastic device for measuring bottom currents is the Woodhead-type seabed drifter, which consists of a perforated disc, 18 cm in diameter, attached to a 55-cm long stem (Fig. 1). A 5-gram weight is attached to the lower end of the stem, giving the assemblage a slightly positive buoyancy and causing the drifter to orient itself in an upright position within a few meters of the bottom. Within the last 10 years this device has been used by a number of other people (Lee et al., 1965; Lauzier, 1967; Morse et al., 1968; and Gross et al., 1969), and the rate of recovery was as high as 25 percent.

In May 1972, a modest study of residual bottom drift in the Kodiak-Afognak Island group of Alaska was carried out by the Northwest Fisheries Center of the National Marine Fisheries Service, Seattle, Washington, as part of a Marine Resources Monitoring Assessment and Prediction (MARMAP) cruise. Woodhead-type seabed drifters were released from the RV *George B. Kelez* between Albatross and Portlock Banks in hopes that recoveries would provide some knowledge of the speed and direction of bottom currents in this area, where no data were available. Some data on geostrophic currents are available offshore seaward of the shelf break where the Alaskan Stream flows southwestward at an average speed of 50 to 100 cm/sec (determined by computations from serial temperature and salinity data versus depth). These computations are not reliable in the area of the shallow continental shelf and neither sufficient vessel time nor funds were available to measure currents directly. Groups of five drifters each were bound together by inserting the stems through holes in small salt blocks which served as weights to carry the drifters to the seabed. After a short time on the bottom (approximately one-half hour), it was assumed that the block would dissolve and that the individual drifters would respond to prevailing bottom currents. A total of 475 drifters was released—25 at each of 19 locations, but 100 were released on Portlock Bank (Fig. 2).

After 1 year, 15 recoveries were reported: 6 in fish trawls, 4 in crab pots, and 5 on shore—a rate of return of less than 3 percent. Of the 25 released about 6 kilometers (4 miles) southeast of Cape Chiniak (lat. 57°33′N, long. 156°06′W) 2 were recovered on Cape Chiniak and 4 were recovered southwestward near Ugak Bay. Seven other drifters released between the shore and mid-shelf were recovered south and west of their release points.

Only two other exceptions to the general southwestward trend were reported in the northeastern part of the area. South of Afognak Island near shore one northeasterly recovery was reported, and one northwesterly recovery was reported from the larger group released on Portlock Bank. Thus, the general direction of bottom flow appears to be southwestward, similar in direction to the offshore boundary current but with a strong inshore component. Speeds ranged from 0.2 to 1.3

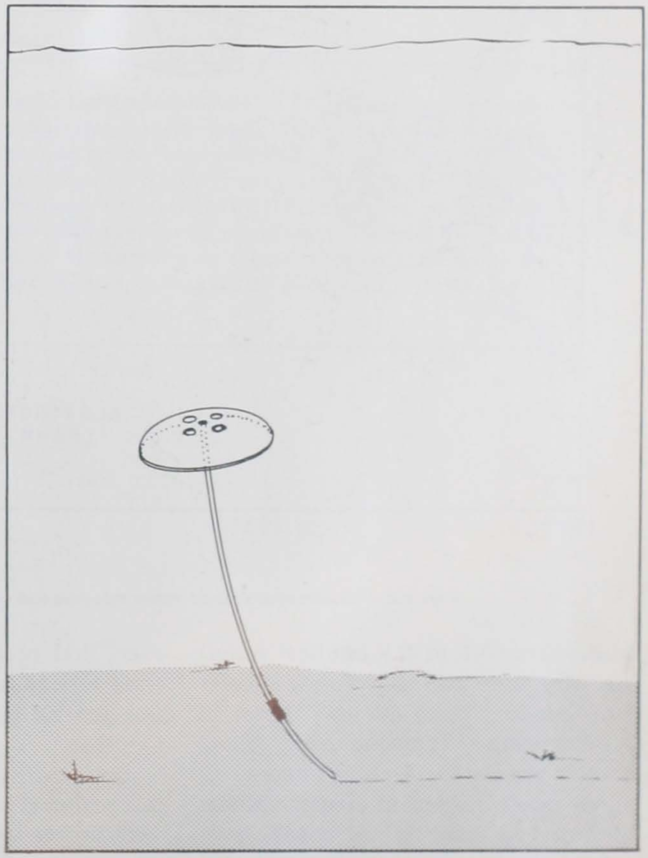

Figure 1.—Woodhead-type seabed drifter.

W. James Ingraham, Jr., is an Oceanographer, Northwest Fisheries Center, National Marine Fisheries Service, NOAA, Seattle, WA 98112. James R. Hastings is a Lt.(jg) NOAA Corps.

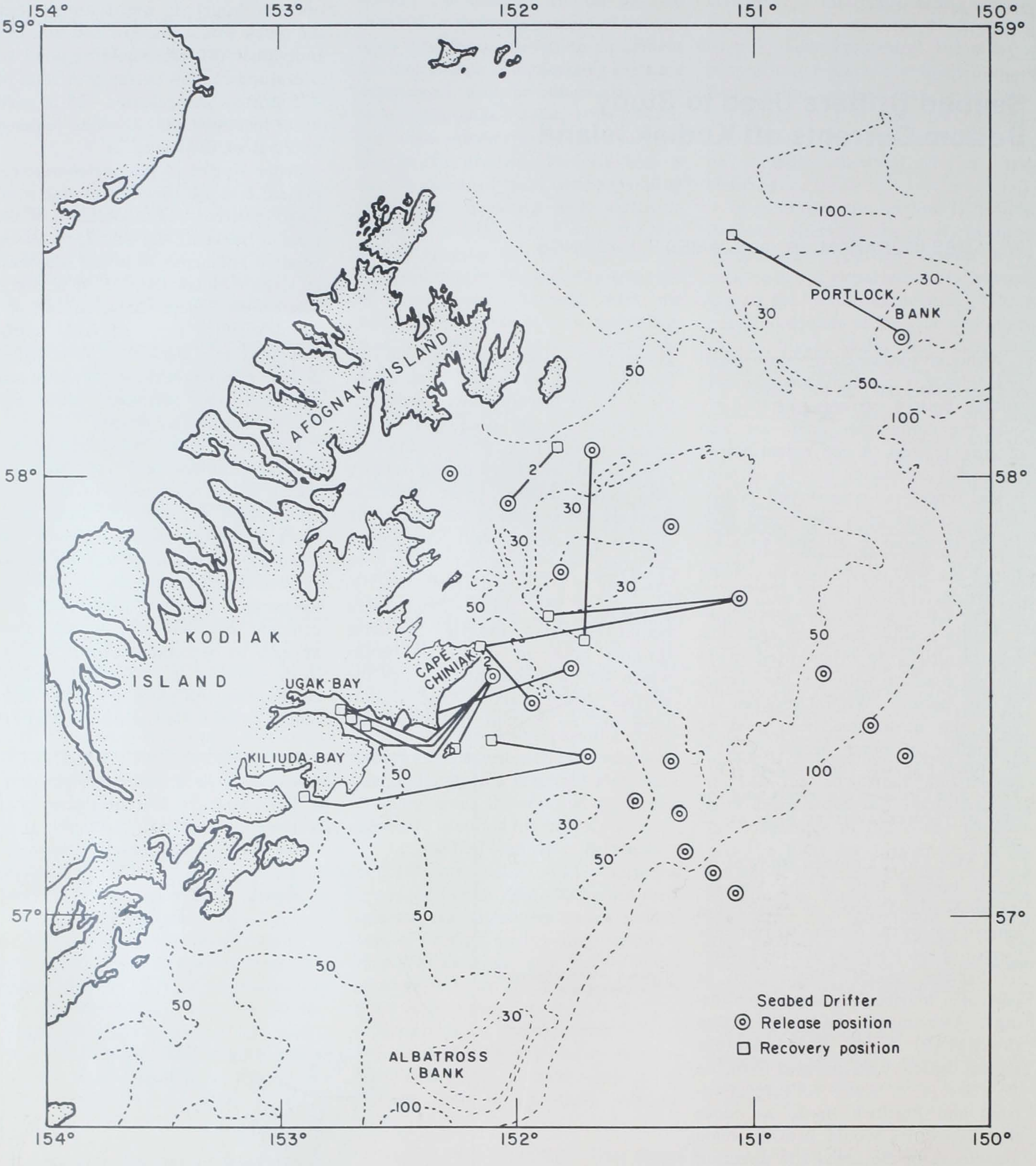

Figure 2.—Locations of seabed drifter releases and recoveries, RV *George B. Kelez*, May 1972 (depth contours in fathoms).

kilometers (0.1 to 0.7 nautical miles) per day and averaged 0.4 kilometer (0.2 nautical mile) per day. Most of Kodiak Island's coastline is rugged and thinly populated. Hence limited returns were expected from drifters stranded on shore. It was hoped, however, that recoveries would be made from foreign fishing vessels trawling in this general area, but none have been reported.

Any future studies of bottom drift in this region should be on a larger scale, with drifters released over several seasons. Lauzier (1967) used two different methods of seabed-drifter release for his study of bottom drift along the Canadian Atlantic coast: (1) releases of large numbers over a large area within a relatively short time span (cruise-type releases); and (2) releases at a given location at regular intervals over a long time period (land or nearshore releases). These methods proved to be highly effective.

Some similarities were observed between results of our study and those in other areas. Lee et al. (1965) found that returns from the Atlantic Coast study of bottom drift indicated a rate of drift of 0.2-1.67 kilometers (0.1-0.9 nautical miles) per day for the period April 1961 to August 1964 from Nova Scotia to Florida. Gross et al. (1969) found that speeds of 0.7-2.4 kilometers (0.4-1.3 nautical miles) per day occurred in the inner continental shelf areas near the mouth of the Columbia River and that very few drifters (usually less than 5 percent) were recovered from those release locations where the bottom depth exceeded 90 meters. Although 3 of our 15 returns were reported from depths exceeding 90 meters, these were released in channels on the inshore portion of the shelf. The presence of the intense Alaskan Stream probably contributes to the absence of local returns from releases on the outer shelf near the shelf break.

A comprehensive saturation-type study with large numbers of seabed drifters released over a long time span in the Kodiak-Afognak Island group would provide significant new knowledge about the environment that would be useful to fisheries research in this highly productive area. Alverson and Chatwin (1957) have suggested that near-bottom currents have a significant effect on the transport of demersal eggs and bottomfish migration. Hebard (1959) measured currents near the surface and bottom in the southeastern Bering Sea and discussed their effect on the movement of crabs during planktonic larval stages. Several king crab studies have been undertaken in the Kodiak-Afognak Island group. It was found that king crabs follow yearly migration patterns, returning to the Kodiak-Afognak Island area during the winter to breed in these relatively shallow waters (Powell and Reynolds, 1965; McMullen, 1967).

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