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A PLASTIC ENVELOPE SUBSTITUTE FOR
DRIFT BOTTLES

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ABSTRACT

A plastic envelope of 0.004-inch thick polyethylene is suggested as a substitute for drift bottles. The return card is sealed hermetically in the envelope, thus forming an inexpensive, compact and convenient means for studying surface currents by conventional drift bottle technique. Tests indicate that “drift cards” actually indicate surface flows and are not at the complete mercy of the winds.

In certain investigations of lake or ocean currents, drift bottles will provide information unobtainable otherwise. This is particularly true in shallow coastal regions and in areas with many shoals and islands or with an irregular coastline. However, drift bottles are fragile and may break either in handling aboard ship, or, more likely, when washed against rocky cliffs or beaches. To use them effectively, a great number should be released on a single cruise, in which case they will require considerable storage space aboard ship. The materials and labor required in preparing large numbers of bottles are often costly.

DRIFT CARDS

In the course of an extensive study of currents in western Lake Erie (Olson, 1950), it was necessary to consider seriously the likelihood of breakage of bottles when they stranded on rocky coasts. This problem was entirely eliminated by substituting flat transparent plastic envelopes for the glass bottles. The writer has called them “drift cards” to distinguish them from drift bottles in spite of the fact that the term “drift envelope” might be more logical.

The advantages of drift cards are many. There is no problem of storage aboard ship, since 200 cards can be held in one hand. The cards float “face up,” exposing no surface above the water and thus eliminating the need for ballasting. While no data on comparative costs are available, it is believed that cards will be considerably cheaper than bottles (less than one cent for materials alone).

Preparation. In a series of trials conducted by the writer, the most suitable material was found to be a transparent polyethylene sheet, 0.004 inch thick, made in the form of continuous tubing 6 inches wide
when flattened. The tubing is cut into strips 4 to 4.5 inches long; the return card is inserted into the tubing, which is then heat-sealed along the cut edges. Once the plastic is sealed, it is almost impossible to tear it with the fingers alone; therefore, the card should bear instructions to open with a sharp knife or scissors.

From examination of cards returned in good condition 18 months after liberation, it appears that the polyethylene envelope offers sufficient protection under most conditions. It was noted that cards returned from sandy beaches showed definite signs of sand abrasion; to overcome this problem, a greater thickness of plastic sheet (perhaps 0.006 to 0.008 inches) may be advisable.

**Multiple Releases.** Some workers with drift bottles have released but one bottle at a given point while others have released several hundred at one point. Since drift cards are cheap and easy to handle, there is little justification for the single-release method.

In the Lake Erie studies all cards were numbered serially from 1 to 1500 and a fixed procedure was adopted in releasing them. If, for example, 10 cards were to be released at one place, the 10 were withdrawn and their serial numbers checked. From a point near the stern of the vessel, the lowest numbered card was first thrown overboard and watched until it fell into the lake before the next card was thrown out. This almost trivial precaution is necessary to eliminate the possibility of the wind picking up the card and dropping it on top of the cabin or elsewhere where it might remain for an indefinite length of time before being blown into the sea eventually. This method also prevents two or more cards from sticking together in the water for an indefinite length of time.

In nearly all cases, 10 cards were released consecutively, usually within 30 seconds. This method of multiple releases provides more dependable data than would be obtained if the cards were released singly.

The value of multiple releases is well shown in the 441–450 series of the Lake Erie studies; 10 cards were released at 1147 hours on 21 July 1949 at a point three miles south and one mile east of the Detroit River Light. Of the 10 cards released, 9 were recovered, all in the immediate vicinity of Colchester, Ontario. The times of recovery are given below:

<table>
<thead>
<tr>
<th>Card No.</th>
<th>Date and time found</th>
</tr>
</thead>
<tbody>
<tr>
<td>441</td>
<td>27 July 1930 hrs</td>
</tr>
<tr>
<td>442</td>
<td>2 Aug 1530</td>
</tr>
<tr>
<td>443</td>
<td>2 Aug 1800</td>
</tr>
<tr>
<td>445</td>
<td>27 July 0700</td>
</tr>
</tbody>
</table>
A glance at these figures will show that the cards must have stranded during the afternoon of 26 July. The fact that five cards were also found the following day at 0700 and 1930 hrs is indicative that the beach was visited fairly frequently; thus the time adrift is established with reasonable accuracy.

On the same date, cards were also released at 19 other points. By comparing results from nearby points, additional confidence is given to the estimated time adrift.

**Effect of Wind on Drift Cards.** The fear has often been expressed that drift cards will be at the complete mercy of the winds, since they are light and float flat side up on the surface of the water. It is important that this question be resolved before the value of drift cards can be appraised properly.

In protected bays and small lakes, particularly during an algal bloom, it has been observed frequently that the surface waters will move in one direction while the water only an inch below the surface will move in a different direction. Extreme cases of this nature have not been reported in open waters of larger lakes and seas, and it is doubtful if the high turbulence found there will ever permit a micro-stratification of this nature. Obviously, if such conditions arise, the use of drift cards may be questioned.

The Lake Erie studies provide several striking examples of drift card travel that is independent of the prevailing or resultant wind. On 9 June 1949 at 1139 hrs, 20 cards (161-180) were released eight miles north and five miles east of Marblehead Light (on Catawba Peninsula). One card stranded on Cedar Point and 14 at Marblehead. On 12 June, cards were found at 1400, 1545, 1600 and 1900 hrs, establishing the time adrift as 3.1 days. The drift was 2.9 miles per day S 35° W when the resultant wind during this time was 3.5 mph due south (blowing toward the north).

Another example of the independence of drift and wind is given by the 1211 to 1281 series released on 22 August 1949 in the general vicinity of the mouth of the Detroit River. The 1211-1220 set was released at 1225 hrs and the last set, 1281-1290, was released at 1445 hrs; thus all cards were liberated during a 140 minute period. The 1211, 1221 and 1231 sets were released west of the Detroit River and all
drifted due west to WSW. The 1241 and 1261 sets were liberated at the Detroit River Light and all recoveries were made from Point Pelee, some 40 miles east. The 1251 set was liberated in the Detroit River. The cards were recovered in the same general neighborhood as the 1241 and 1261 sets, but they had to travel south in the Detroit River before swinging eastward to join the 1241 and 1261 sets. The 1271 set, released 1.5 miles south and 9.5 miles west of Colchester, all stranded at Colchester and traveled almost due east. On the other hand, the 1281 set, released about 12 miles SW of Colchester, also stranded at Colchester.

Thus, of 80 cards released within 140 minutes at eight fairly closely spaced points in a region wherein three distinct current systems originate, we found distinct drifts due west, due east, south and north-east. Similar results were obtained at other times, notably in the 421–481 series released on 21 July 1949 in the same general area. The drifts indicated by these cards are perfectly consistent with flow patterns established by other methods such as water mass analysis and the drift bottle studies of Harrington (1895). They indicate conclusively that drift cards are not at the complete mercy of the wind.

REFERENCES

HARRINGTON, M. M.

OLSON, F. C. W.