

A Note on the Design of Sea-Surface Drifters

The Woodhead sea-bed drifter (WOODHEAD and LEE, 1960) is now in wide usage, but although it is generally agreed that surface drift bottles have considerable disadvantages in indicating water movement in the upper layers of the sea no alternative design of surface drifter has yet become standardised.

In an attempt to design a satisfactory surface drifter experiments were carried out in the Irish Sea during 1965. The intention was to find surface drifters which were inexpensive, easily assembled, with their major part well below the sea surface and able to follow small vertical movements of the water so that the movement of the drifters would be representative of more than a very shallow surface layer, and which would be recovered in reasonable numbers. The basic design of the drifter used is shown in Figure 1. The cap, tag, stem and 7 g copper weight are already used in the Woodhead sea-bed drifter. Suitable surface floats are commercially available as are lengths of courlene twine, copper tubing and plastic tubing which can be cut to make the remaining components. The length of courlene twine can be varied as required. The positive buoyancy of the surface floats used, in water of density 1.025 g/c.c is about 15.5 g, and of the stem, cap and copper weights – 9 g, so that the drifter readily takes up the desired position in the water.

During July and August, 1965, 174 of these surface drifters were released around Anglesey, between Anglesey and the Isle of Man and west of the Isle of Man. Of these 88 had 24 cm lengths of courlene between the float and the stem and 86 had 82 cm lengths. Five months after the releases 6 (7%) of the shallow drifters had been returned and 5 (6%) of the deep drifters. This compared with 44% of sea-bed drifters released at the same positions. Of the surface drifters returned two had been recovered at sea and two in enclosed coastal waters, namely the Menai Straits.

Due to the small percentage returns further releases were made in October and November, 1965. At each of three positions within three miles of the Anglesey coast between Benllech and Puffin Sound on 21. October, 1965 10 surface drifters with 24 cm lengths of courlene, 10 with 82 cm lengths, and 10 with the surface float attached directly to the loop in the stem were released. The returns of the different types within three months of release were 6 (20%), 5 (17%) and 6 (20%) respectively. From these results it has been assumed that the absence of courlene does not significantly affect the return rate. On 12. November, 1965 at a position approximately three miles south of Criccieth in Tremadoc Bay plain caps and surface drifters with varying lengths of stem and courlene between the cap and the surface float were released. The numbers of each type of drifter released and returned within two and a half months of release are shown in Table 1.

In addition to the returns from all of these releases 13 surface drifter caps which had separated from their stems when the cap split around the stem have been returned. This however only amounts to 3½% of the total number released, and it appears from the returns of the plain caps released in Tremadoc Bay that a cap is very much more likely to be returned if it becomes separated from the

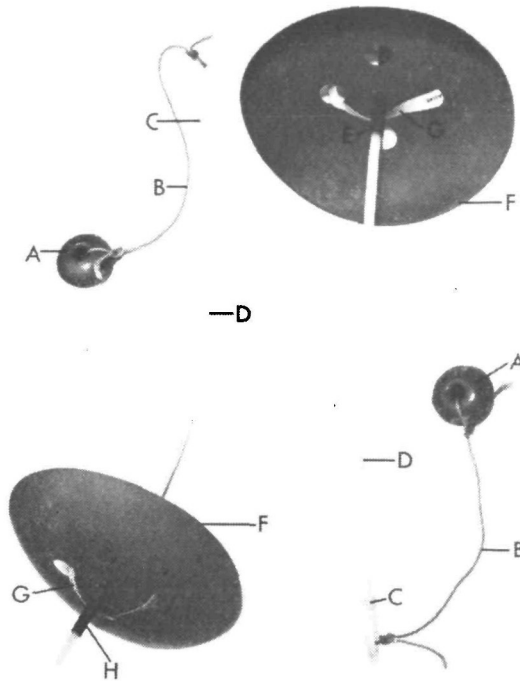


Figure 1. The Menai Bridge Sea-Surface Drifter.

A: Surface float; B: Courlene twine; C: Plastic sleeve; D: Plastic stem; E: 10 g copper weight; F: Red plastic cap; G: Tag with instructions and index number; H: 7 g copper weight.

remainder of the drifter than is the drifter itself. Brass washers are now incorporated between the cap and the 7 g weight to prevent this happening.

In discussing the significance of these results the extent to which the area concerned can be regarded as typical must be considered. The drifters have been found between Pwllheli in Tremadoc Bay and the Isle of Jura, including the coast of the Isle of Man and Northern Ireland, and it seems unlikely that any peculiar conditions exist over such a wide area. Furthermore, surface drift bottles released in the Irish Sea have given return rates of about 50% within a few months of release (e.g. DANIEL and LEWIS, 1930). It seems therefore that there must be a general reason why surface drifters of this design are less likely to be recovered along the coast than sea-bed drifters or surface drift bottles. A possible explanation may lie in the transport of water at different levels when a wave moves on shore as shown by BAGNOLD (1947) and RUSSELL and ORSORIO (1958) using hydraulic models, and theoretically by LONGUET-HIGGINS (1953). The results of all of these workers indicate that when a wave moves onshore there is a net transport of water shorewards in a bottom layer and a net transport of water off-shore above it. BAGNOLD found this layer to extend to the surface whereas RUSSELL and ORSORIO and LONGUET-HIGGINS found there to be

Table 1
Sea-surface drifters released in Tremadoc Bay on
12. November 1965

Length of stem (cm)	Length of courlene (cm)	No. released	No. returned	% age returned
0	0 (plain cap)	20	19	95
5	7	20	17	85
36	0	20	4	20
40	24	20	6	30
40	82	20	2	10
40	200	20	2	10

a surface layer in which the net movement was onshore. However, if we imagine this surface layer to become less than 36 cm thick as the shore is approached it will be seen that whereas surface drift bottles and very shallow surface drifters (such as the shallowest used in Tremadoc Bay) will be carried right onto the shore in the surface layer those with the cap 36 cm or more below the surface will never reach the shore whilst waves are moving onshore. It might be expected that in high winds this surface layer moving onshore will extend deeper than 36 cm and hence an analysis was made of wind strength immediately prior to the recoveries of surface drifters with caps 36 cm or more below the float. Wind data from Ronaldsway, Isle of Man were used. It was found that 54% of the surface drifters released up to 21. October 1965 which were recovered, were found within two days of winds of 30 knots or more, whereas winds of such strength were experienced on only 8% of the days between August 1965 and mid-January 1966.

It appears, therefore, that if surface drifters with caps 36 cm or more below the surface are used the return rates will be very low, whereas if shallower surface drifters are used the return rates will be very much higher but their movement will probably be representative of no more than a very shallow surface layer.

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