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## **Results of drift card experiments and considerations on the movement of milkfish eggs and larvae in the northern Sulu Sea**

**Shigeru Kumagai and Teodora Bagarinao**

Drift card experiments were conducted in the waters off the southern and western coasts of Panay Island to determine the role that surface currents play in the movement and transport of the eggs and the larvae of milkfish from the spawning grounds to the fry collection grounds. The experiments covered a one-year period of four releases beginning December 1977 -- specifically December, March, June and September because the currents in March and September were of special interest, these months being the start of the two fry seasons in the western coast, Antique.

Of a total 2,384 drift cards released, 382 were recovered (Table 1). This average recovery rate of 16.02% is higher than any of those reported (3.3-11.2%) by several authors on drift studies.

During the December and March periods, the cards dropped in northern Cuyo East Pass were drifted west and southwestward; those in the southern stations northwestward, away from Antique coast. There also seemed to be a prominent drift along Antique from its southern end. The surface current in Panay Gulf likewise moved southwestward, away from the immediate coasts. Prevailing winds during these periods were from northeast with speeds of 2-9 m/sec. In both releases, majority of the cards were drifted with minimum speeds between 0.1 and 0.2 m/sec. Many cards had speeds between 0.2 and 0.4 m/sec.

In June, the surface drifts in Cuyo East Pass were toward north, parallel to the Antique coast, and once clear of the northwestern tip of Panay, northwestward along Mindoro or eastward to Masbate. The southern stations were also affected by a southerly current that brought some cards to Negros. The waters of Panay Gulf showed a northeasterly drift. Southeast winds prevailed in the study area starting June. About 70% of the recoveries of the June batch had minimum speeds of less than 0.1 m/sec.

**Table 1. Summary of drift card releases and recoveries.**

Dates of card releases	No. of stations	No. of cards released	No. of cards recovered w/n 30 days	Final no. of cards recovered	Recovery rate (%)
7- 11 Dec 77	26	564*	34	34	6.03
15 -- 21 Mar 78	31	620	59	70	11.29
22 -- 26 Jun 78	31	620	103	115	18.55
12 -- 15 Sep 78	29	580	156	163	28.10
Total / Ave .		2384	352	382	16.02

\* 44 cards of duplicate numbers were released in addition to 520 by oversight.

In the September period, surface drifts in Cuyo East Pass were along and toward the coast. The drift appeared stronger toward south and southeast, although close to the coast, and in the northern stations, it was generally northeastward. The cards in Panay Gulf were carried northeasterly. Once out of the northern Sulu Sea, the cards were subjected to other water movements in the numerous channels between and among islands so that the recoveries were made in widely different locations. Southeast winds prevailed in September but gradually gave way to northeast winds beginning October. More than 70% of this period's drift cards had minimum speed of less than 0.1 m/sec.

From the experiment, it appears that the surface currents in the northern Sulu Sea are the product of the regional (Southeast Asian) oceanic surface currents and the local monsoon winds. The monsoon winds seem to have a strong effect, they even deflect the course of oceanic currents such that a contrary current is produced, as particularly evident in northern Cuyo East Pass during the March and September periods. Many cards were also affected by tidal movement and/or some inshore currents.

Drift rates deduced from the interval between release and recovery are always minimum rates, for the actual routes could well be longer than the straight line or the shortest course used in computations and stranding could well occur long before recovery. Drift rates for the periods coincident with the northeast monsoon (mode less than 0.1-0.2 m/sec) are higher than those of the southwest monsoon (mode less than 0.1 m/sec). This may be due to the stronger northeast winds, with speeds of 2-9 m/sec, as compared with the southwest winds with speeds of only 1-4 m/sec. Hughes' (1956) recoveries of drift cards from west of the British Isles indicated that the top few centimeters of water travel in the direction of the gradient wind and at 2.2 to 3.3% of its velocity. The drift rates in the present study tend to agree with Hughes' estimate.

The fact that in the study 92% of the recoveries were made within the first 30 days following each release (Table 1) goes to show that the current patterns deduced are most representative of all the months covered by the study period. It is regrettable that May, a peak month in fry abundance, is virtually unrepresented in the results.

The surface drifts presented here are only the movements of the uppermost 20 cm of surface water; they represent only a very small part of at least 20 m deep water column where milkfish eggs and young larvae are distributed. Nevertheless, the surface currents drawn up here may be responsible for the transport of milkfish postlarvae (fry). It was observed that the near-shore currents move towards the coast of Antique particularly Hamtic and Culasi, the two separate locations where fry are most abundantly collected. The source of fry may not be far from the collection grounds. In Culasi, a good number of milkfish eggs have been found just off its shores. It may be that when milkfish larvae reach a size of 10 mm, they come up near the surface and are carried ashore by tidal water movements as well as by surface drifts caused by onshore winds. It is also possible that the fry collected along the Antique coast come from far away spawning grounds. There may be countercurrents in the deeper layers of offshore waters. The larvae in these deeper layers may be brought up and shorewards by these countercurrents. Schmittou (1977) concluded that the fry that occur in the southern coast of Antique come from the spawning grounds around Cagayan Islands. From this study there is no connection between the two localities in terms of surface drift. However, it is possible that the countercurrents mentioned are at work.

#### LITERATURE CITED

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