No. 5

GREAT BARRIER REEF MARINE PARK AUTHORITY

BULLETIN

Drift Card Update

The Great Barrier Reef drift card study is a joint project of the James Cook University and the Great Barrier Reef Marine Park Authority to measure water movements on the Queensland continental shelf. There are two elements to water movements: currents and circulation.

A current is defined as the speed and direction of water flow at a given point in time whereas circulation is the nett movement averaged over a period of time (usually one or more tidal cycles).

Circulation is important for the transport of water-borne elements (e.g. fish and animal larvae, oil slicks, pollutants, ships) over long distances while the oscillating tidal currents fulfill this function over short distances of a few kilometres. Drift cards are one method of obtaining information on circulation of the surface water for periods of days to months.

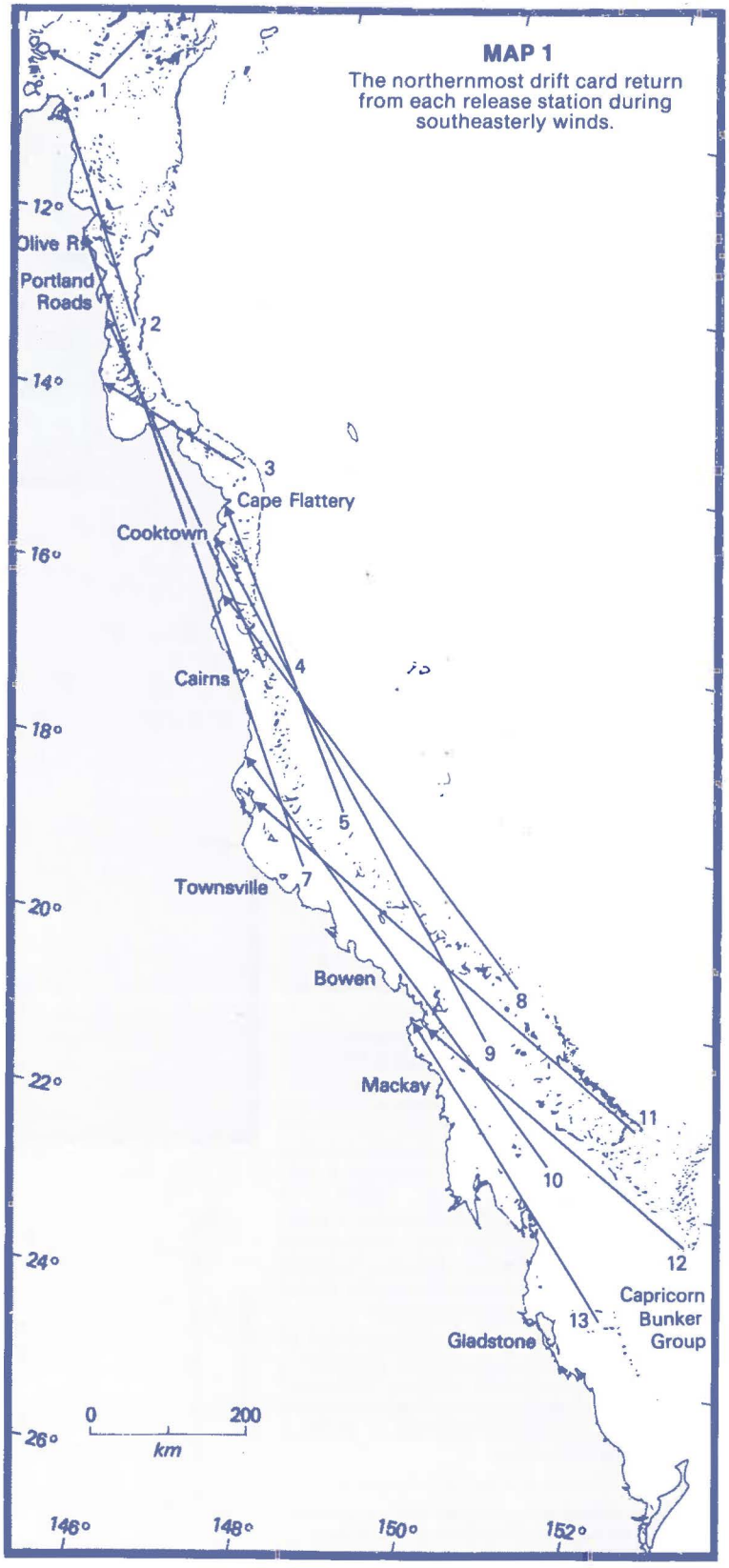
Drift cards are released each month from coastal surveillance aircraft at 13 stations between Torres Strait and the Capricorn Channel. For most of the year Southeast Trade Winds generate a northwestward surface flow along the Great Barrier Reef. Map 1 shows the position of the northernmost drift card recovered from each station during periods of southeasterly winds. The longest distance travelled by a card (straight line) was 920 km from near Townsville (18°S) to the Olive River (12°S).

When northwesterly winds are blowing (mainly summer months, particularly Nov-Dec) the circulation is to the southeast along the coast, south of about 15°S. Map 2 shows the position of the southernmost drift card recovery from each station in Nov—Dec 1981. Data for the area north of 15°S are lacking because no drift cards have been recovered in this period from stations 1 and 2.

Southeastward flow in the Great Barrier Reef probably results from extension of the southeastward flowing East Australia Current in the Coral Sea onto the continental shelf. The longest distance travelled (straight line) by a drift card in a southerly direction is 500 km from Lizard Island to Magnetic Island.

Recovery of drift cards from beaches depends on several factors. The scientifically important factors are those relating to water circulation and coastal topography. Some beaches act as natural collectors and are continually littered with driftwood, bottles and other rubbish thrown from ships. However, it is often difficult to identify these beaches from drift card results because of the patterns of human usage. A beach returning many drift cards may simply be an accessible popular recreation beach. As well as varying geographically, the permanent and holidaying coastal population is also unlikely to spend time on beaches during unpleasant weather.

Drift cards deliberately seeded on a Townsville beach firstly during ideal sunny weather and secondly during unpleasant, windy, overcast weather illustrate the different recovery response. In the first instance, cards were seeded at night to escape observation and the first cards were



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found early the following morning. In the prevailing pleasant beach conditions, 65% of the drift cards were found and returned within 48 hours of their being placed. In the second test six days elapsed before any cards were found. On the sixth day, the winds decreased and 29% of the cards were found, presumably as a result of repopulation of the beach. The total proportion of seeded cards not returned due either to the apathy of finders or to beach burial, concealment or removal by tides was 19% in the first test and 47% in the second test. These percentages are relatively high and, since most northern Queensland beaches are far less populated than Townsville beaches, illustrate the problems associated with drift card returns.

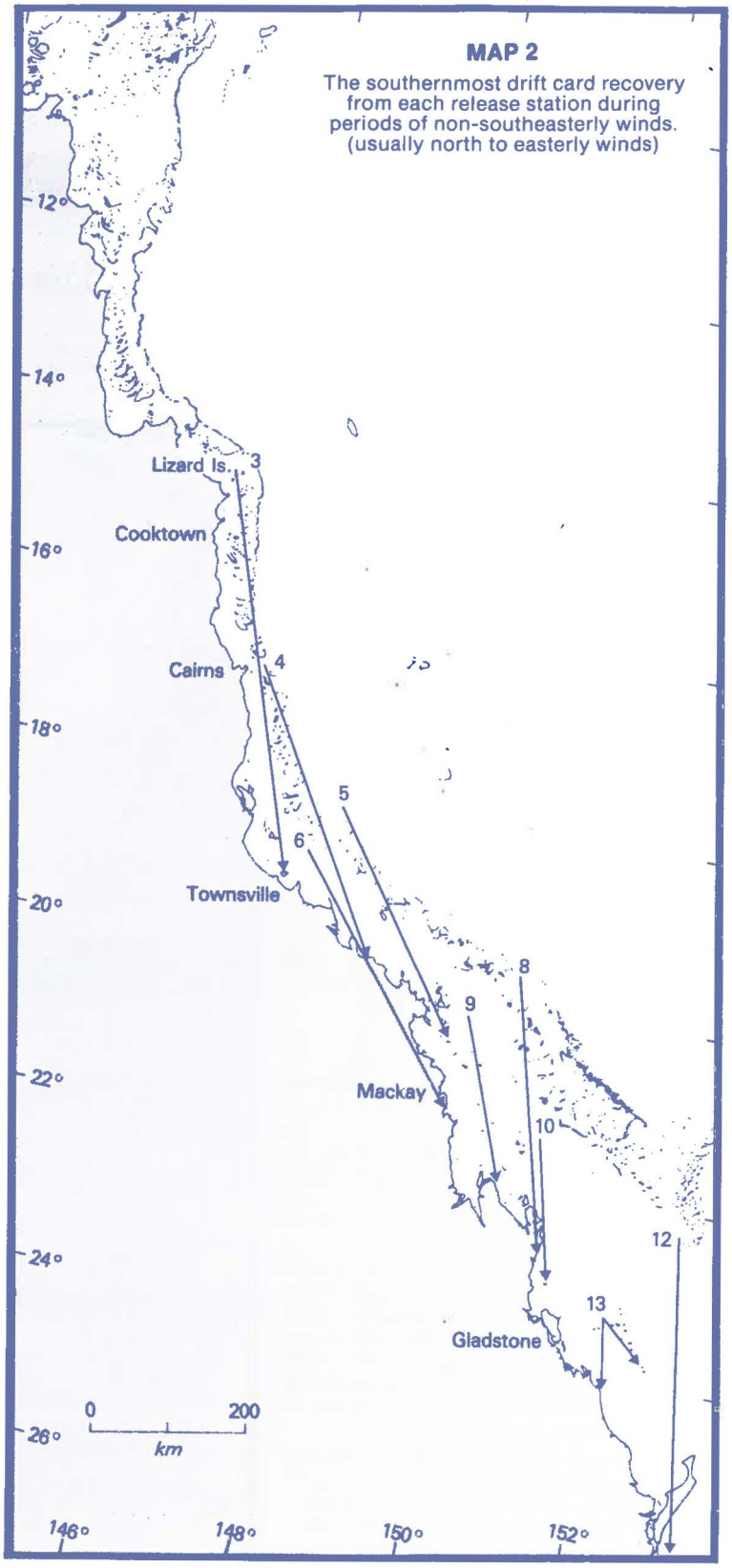
The percentage of recovered drift cards from each degree of latitude on the northern Queensland coast is shown in the bar diagram. Mainland recoveries are shown in black while island recoveries are white. The greatest number of mainland recoveries are from the Cooktown to Cape Flattery region while most island returns are the Whitsunday-Cumberland Islands. Drift cards are rarely picked up floating at sea although one card that had sunk was recovered in a fish trawl from 50 metres depth in the Capricorn Channel.

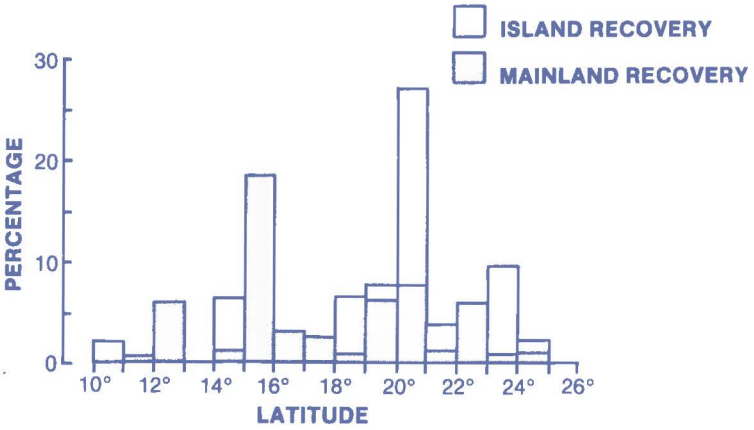
The great majority of coral reef animals are fixed to the bottom or have restricted mobility. Most fish are unlikely to travel a distance of a few kilometres to a nearby reef. This means that populations of animals removed or destroyed by human activities can be replenished mainly by successful reproduction of the surviving local population or by transport of planktonic (free drifting) larvae from distant regions. In cases where the surviving local population is small or in the usual situation where reproduction of a species occurs solely via planktonic larvae, the rate of replenishment depends, among other things, on whether the area is down-current of another reproducing population at the time of larval release.

The rate of circulation is also important with respect to the distance between habitats (e.g. reefs) and the survival time of the planktonic larvae. Larvae normally have a minimum period that they must develop in a planktonic form and a maximum time during which, if they are to reach adulthood, they must find a suitable environment in which to settle. This situation applies to replenishment of individual reefs and also to replenishment of non-reef areas such as scallop fishing grounds in the Great Barrier Reef lagoon.

With respect to pollutants there are three effects of currents and circulation. They act to spread pollutants over a wide area (e.g. transport of pesticides to distant offshore reefs), to transport pollutants out of the Reef area (e.g. removal of an oil slick into the Coral Sea) and to prevent excessive build-up of concentrations in the region of a continuing input (e.g. clearance at a sewage outfall). Here again the rate of dispersal from an area and the rate of contamination of new areas depend, in part, on the speed and direction of water circulation.

Finally, the importance of knowledge of surface circulation to navigation and search and rescue operators is obvious. Drift card data from the study have already been used by coastal surveillance aircraft to locate a disabled drifting boat.





The percentage of recovered drift cards from each degree of latitude on the northern Queensland coast.