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for information

Situation Report for Mirs Bay Seabed Kill

1. Introduction

A report received 25 July 1994 of a red tide at Tai Long Wan and many dead sea urchins observed at Ngo Mei Chau (Crescent Island) was the first indication of water quality problems in Mirs Bay this summer. Preliminary assessments indicate an area of approximately 60 km² of Mirs Bay sea-bed below 2 metres in depth has suffered extensive mortalities of sessile benthic marine organisms including soft and hard corals. The main impact has been in the area of Mirs Bay north of Tap Mun Chau i.e. north of the mouth of Tolo Harbour.

2. Water Quality Monitoring and Field Investigations.

Sampling and field studies carried out during late July and the first two weeks of August indicated that the red tide was not extensive and unlikely to be a cause of the mortality. The algae has been identified as *Ceratium furca* which is non toxic and now discounted as a cause of the water quality problems. The water sampling data revealed evidence of a distinct stratification of the water column in Mirs Bay and Port Shelter characterised by a thermocline* at shallow depth and bottom water with low dissolved oxygen, low temperatures and high salinity. Fish have been observed swimming in the well oxygenated surface waters and have been largely unaffected by the incident.

By the second week of August the thermocline had begun to rise to 3 metres in depth and consequently a larger area of sea-bed was exposed to water with low dissolved oxygen levels. Numerous dead organisms were found in Hoi Ha Wan although hard corals were not affected. However, the latest information gathered in late August indicates that extensive areas of coral in Double Haven and Hoi Ha Wan has suffered mortality. The thermocline was measured at between 2-3 metres on 25 August 1994 at O Pui Tong but the temperature change was not as marked as in previous weeks indicated that mixing of the water column had commenced.

3. Cold water invasions

A phenomenon of cold water invasion during the summer and autumn has been documented in a series of papers published by AFD in the early seventies and in published work carried out by PRC in Daya Bay during 1987, 1988 and 1989. The cold water intrusion is believed to be a natural phenomenon associated with an up welling of Luzon Straits shelf water and high volume summer discharges from the Pearl River. The late summer intrusion has been observed in sheltered bays in Hong Kong waters in every year of the AFD studies and similarly in the Daya Bay investigation. EPD's data gathered from Mirs Bay since 1991 also indicates low bottom water dissolved oxygen occurring each July. In previous years the minimum levels of dissolved oxygen recorded in Mirs Bay have not dipped much below 2.0 mg/l whereas this summer levels have reached critically low levels in places as low as 0.2 mg/l.

4. Conclusions

A phenomenon of cold open sea shelf water is known to invade sheltered bays along the coast of Guangdong during the summer and autumn. During the summer of 1994 the presence of cold, hypersaline shelf water has been detected from late July in Mirs Bay and was still present at the end of August. The formation of the thermocline observed in Mirs Bay is associated with poor mixing of surface water with lower waters and is a key factor in development of low levels of oxygen in the bottom layer of water. As the cold water moves into shallow Bays the oxygen demands of the bottom water and sediments deplete oxygen levels. The replenishment of oxygen in the bottom water from surface water has been seriously impeded by the presence of a distinct and well established thermocline.

The factors responsible for the invasion of open sea shelf water are not fully known but almost certainly associated with the large summer discharge of water from the Pearl River. The extensive rainfall experienced this year and the subsequent high volume of freshwater discharge from the Pearl River are likely to be responsible for the extent of the shelf water intrusion observed this year and the associated deleterious impact on the benthic fauna.

The passage of typhoon Harry at the end of August will undoubtedly have broken down the stratification allowing mixing of the water column and the replenishment of dissolved oxygen to lower waters.

5. Further Studies

A short but comprehensive Seabed Kill Investigation of the Mirs Bay area has been commissioned by CED, GEO following consultation with AFD and EPD which will be undertaken by Binnies Consultants. The study will map the area of sea bed affected and detail the extent of damage incurred by the marine ecosystem.
The investigation will include water quality and sediment monitoring, Remots seabed profile photography and underwater dive surveys.

6. Early Warning

The findings of the Seabed Kill Investigation will be appraised and consideration given to monitoring requirements in future and the development of an early warning procedure for relevant departments, organisations and mariculturists.

* Thermocline; a boundary layer, found in lakes and enclosed seas, between warm upper water and cooler lower water, that is usually maintained only under calm summer conditions.

Agriculture and Fisheries Department
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