

For information

**LEGISLATIVE COUNCIL
PANEL ON ENVIRONMENT AFFAIRS**

Artificial Reef Programme

Purpose

At the meeting of 15 December 2009, Members requested the Administration to provide information on the Artificial Reef Programme in Hong Kong for Members' reference. The requested information is provided in the ensuing paragraphs.

Background

2. The Agriculture, Fisheries and Conservation Department (AFCD) has launched the Artificial Reef Programme in 1996 with the objectives to :

- enhance fisheries resources,
- rehabilitate degraded habitats,
- protect spawning and nursery grounds, and marine protected areas, and
- enhance habitat quality in open seabed areas.

3. As at today, AFCD has deployed 668 artificial reefs (AR), totaling 179 130 m³. Deployment sites include marine parks, fish culture zones, Port Shelter, and Long Harbour. Different materials have been used, including redundant vessels and marine structures, prefabricated used-tyres and concrete modules, and quarry rock. A brief summary of the AR deployed is at the Annex.

4. Specially designed AR known as biofilters have also been deployed in fish culture zones with a view to improving marine environment underneath fish rafts and in the surrounding waters. Biofilters provide abundant hard surfaces for the development of attached marine organisms. These organisms comprise mainly filter feeders

which remove nutrients and suspended particles generated from fish culture activities.

Results of Artificial Reef Programme

5. AFCD has been conducting underwater monitoring, including visual counts of fish number and species in the AR, since 1998 to assess their effectiveness in enhancing fisheries resources and marine habitats.

Fisheries resource and marine habitat enhancement

6. It is generally agreed that AR can increase habitat complexity, in particular when deployed in simple habitats like soft muddy / sandy bottom by providing hard surface habitats which support more marine invertebrates and fish. In addition, AR are effective in protecting important spawning and nursery grounds from the damaging effects of bottom trawling. Given the lack of hard bottom habitats in Hong Kong waters and the presence of trawling activities, AR can effectively serve the purposes of protecting and enhancing fisheries resources and marine habitats.

7. AFCD's monitoring results have revealed that the number of fish and species were larger in the AR deployed on soft mud bottom than the surrounding natural soft mud bottom (Table 1). The AR also supported a much larger number of high and medium value commercial fish than natural rocky shores. They were utilized consistently by many species of resident commercial reef fishes, including jacks, breams, snappers, groupers, grunts, sea-perches and sweetlips.

Table 1: Number of fish and species recorded in AR per unit survey time.

	Natural rocky shore	Soft mud bottom	AR
Average number of individuals	1 018	165	4 889
Average number of species	20	2	17

Total number of species	36	10	222
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8. AR also attract plankton feeding fish at which they feed more efficiently. The complex structure of AR also provides protection for small fish. AFCD's monitoring has found that the AR have been used extensively by fish species like Cardinal fish as feeding grounds and, grunts and breams as refuge from predators.

9. The ability of AR to protect and support fish vulnerable to trawling has been demonstrated by the permanent presence of large numbers of John's snapper in the AR. This resident snapper used to be commonly caught by trawlers over muddy / sandy seabed in the past. Today the population is severely depleted and rarely caught. Underwater surveys have revealed a resident population of over 70 mature, reproductive individuals in the AR. Other species rarely found in local waters today, including the Longtooth grouper and Painted sweetlip, were also seen in the AR.

10. AR are also used by some commercial fish species as spawning grounds. An example is the Coral trout, a highly prized grouper. Prior to deployment of the AR in the Yan Chau Tong Marine Park, no Coral trout were recorded during the baseline surveys. However, since 2001 (after AR deployment) large numbers of juveniles and adults have been recorded in the AR and the surrounding area. Other commercially important fish, including mangrove snappers, sweetlips and black breams, have also been observed using the AR as spawning grounds.

Improving marine environment in fish culture zones

11. According to studies commissioned by AFCD and conducted by the City University of Hong Kong, the filter feeders attached to the biofilters deployed in fish culture zones can remove nutrients and suspended particles equivalent to the discharge from fish rafts culturing two tonnes of fish. The studies concluded that biofilters could help improve the marine environment in fish culture zones and in surrounding waters in the long run.

Long-term benefit to fisheries resources

12. Commissioned by AFCD, the University of British Columbia conducted a cost-benefit analysis on, among others, the AR programme. The analysis demonstrated that AR deployment would benefit local fisheries resources and marine habitats in the long-term. It also pointed out that the effectiveness of AR would be more prominent if coupled with suitable management measures. It was estimated that if 10% of local waters is deployed with AR and with suitable management measures, the economic value of fisheries resources would increase by 15% in 10 years and 52% in year 30 after deployment (Table 2).

Table 2: Estimated increase in economic value of fisheries resources after AR deployment

Year after deployment	Increase in economic value of fisheries resources (\$M)	Estimated growth (%)
10	1,126	15
15	1,761	28
20	2,365	38
30	3,410	52

**Agriculture, Fisheries and Conservation Department
January 2010**

Artificial Reef Deployment in Hong Kong

	AR Volume (m³)	Number	Type of AR Deployed
Marine Parks			
Hoi Ha Wan Marine Park	9 530	93	Vessels, tyres and biofilters
Yan Chau Tong Marine Park	19 820	293	Vessels, tyres, quarry rocks, concrete modules and biofilters
Tung Ping Chau Marine Park	1 910	7	Marine concrete structures
Important spawning and nursery grounds			
Outer Port Shelter	103 270	119	Vessels, concrete modules, tyres, quarry rocks, marine structures and construction structures
Long Harbour	33 420	42	Vessels, tyres and quarry rocks
Feeding stations for Chinese white dolphins			
Sha Chau and Lung Kwu Chau Marine Park	5 580	66	Vessels and containers
Chek Lap Kok Marine Exclusion Zone	3 600	10	Vessels and quarry rocks
Fish Culture Zone			
Kau Sai Fish Culture	1 020	16	Biofilters

Zone			
Sham Wan Fish Culture Zone	450	10	Biofilters
Lo Tik Wan Fish Culture Zone	330	8	Biofilters
Kat O Station	200	4	Tyres