PILOTAGE ADVISORY COMMITTEE

CONSULTATION DOCUMENT ON THE ARTIFICIAL REEF DEPLOYMENT STUDY

INTRODUCTION

The purpose of this consultation document is to present the major findings of the Artificial Reef Deployment Study (hereafter referred to as "the Study") commissioned by the Agriculture and Fisheries Department (AFD) and to invite views on its major recommendations, in particular, the proposals for deployment of artificial reefs (ARs). AFD will draw up an appropriate strategy to deploy and manage ARs in Hong Kong waters in the light of the outcome of the consultation.

BACKGROUND

2. At the meeting on 8 December 1995, the Finance Committee approved the implementation of an AR project to promote bio-diversity of the marine environment in the waters of Hong Kong and rehabilitate and enhance fisheries resources. The AR project is being implemented in two phases under a five-year programme between 1996-97 and 2000-01. The first phase involves the deployment of ARs in existing marine parks. The second phase will involve the deployment of ARs outside the existing marine parks.

3. In Phase 1, redundant vessels, tyres, quarry rock and concrete modules are deployed as ARs in the Hoi Ha Wan and Yan Chau Tong Marine Parks. Twenty boats, over 200 tyre modules and eight quarry rock ARs have so far been deployed. Phase 1 will be completed in September 1999. AFD is conducting self-contained under-water breathing apparatus (SCUBA) surveys (involving counting of fish species and numbers on and around ARs) and acoustic surveys (involving assessment of fish biomass and size range within an entire AR deployment area) and commissioned the Hong Kong University of Science and Technology to carry out invertebrate monitoring surveys to assess the performance of ARs deployed in Phase I in enhancing fisheries resources. The initial survey results are very encouraging. Juveniles of many high-value reef fish, including breams, snappers and grunts have already begun to establish impressive populations around the ARs. In addition, sizeable grouper and snapper adults have also taken up residence on several ARs. Over 100 fish species have so far been recorded on the ARs deployed.

4. To implement the Phase 2 deployment programme, the Study was commissioned to identify suitable sites for AR deployment outside marine parks and to recommend AR site management plans. The main Study tasks are to –

(a) conduct a two-stage stakeholder and public consultation exercise;
(b) review international experience with ARs;
(c) review and recommend legislative controls;
(d) undertake economic and ecological modelling to examine the impact of ARs;
(e) select sites for AR deployment outside marine parks; and
(f) formulate and recommend AR site management plans.

The Study is now completed. The major findings and recommendations are summarised below.

MAJOR STUDY FINDINGS AND RECOMMENDATIONS

5. The information gathered during the Study indicates that the deployment of ARs, in combination with suitable management measure on fishing operations and community support, represents a promising and cost-effective means of enhancing marine ecological resources and rebuilding a high value and sustainable fishery for Hong Kong.

6. The Study points out that the AR project could not succeed without effective management of fishing operations. It recommends that fishing effort in areas of ARs must be adequately managed, as the fish aggregation effects of the ARs may facilitate capture and exacerbate stock depletion.

7. The Study recommends that –

(a) Five Marine Special Areas (MSAs)[note], representing 10% of Hong Kong waters, should be set up for inshore fisheries management, protection, and the deployment of ARs. These areas are located at the West Sokos and Shek Kwu Chau, East Po Toi, Ninepins, Outer Port Shelter, and Shek Nga Chau **(Appendix 1)**. Three management options are proposed for these MSAs **(Appendix 2)** as follows –

Option 1 No-take MSA
This option involves closing the entire MSA to fishing. This would allow stocks to rebuild significantly faster than with controlled fishing allowed under Options 2 and 3.

Option 2 Limited Access Zone within an MSA
This option involves designation of certain areas within the MSA as Limited Access Zones (LAZs). The immediate area surrounding the AR complex and waters in between AR complexes would be closed to fishing. Fishing within the LAZs would be limited to fishing permit holders only.

Option 3 LAZ & Fishable Reefs within an MSA
Compared to Option 2, this option involves designating some ARs deployed within the MSA as LAZs as well. Fishing within the LAZs including the fishable reefs would be limited to fishing permit holders only.

The proposed management plans, goals and objectives for the five recommended MS As are shown in **Appendix 3**.

(b) Amendments be made to the Fisheries Protection Ordinance (Chapter 171) for designating and management of MSAs.

(c) Community-based MSA Management Advisory Groups (including fishermen representatives) should be established for each of the recommended MSA to enhance local involvement in AR deployment and management. A key responsibility of the proposed MSA Management Advisory Groups is to participate in the process of permit allocation for fishing operations permitted within the

(note) A Marine Special Area is an area designated specifically for the purposes of managing fisheries resources through controls on fishing operations.

specific MSA. The Management Advisory Groups will advise AFD, and will form a link with the scientific and educational community, and the general public to facilitate the implementation of the AR deployment project.

(d) Fishing controls at ARs should be established as soon as possible and effectively enforced.

8. The Study's cost benefit analyses show that if ARs are deployed under a combination of 24 hour response and periodic on-site patrols by AFD, and a community outreach programme, the economic value of the fishery could increase by as much as 30% after 15 years and 52% after 30 years, over and above increases in the fishery without ARs.

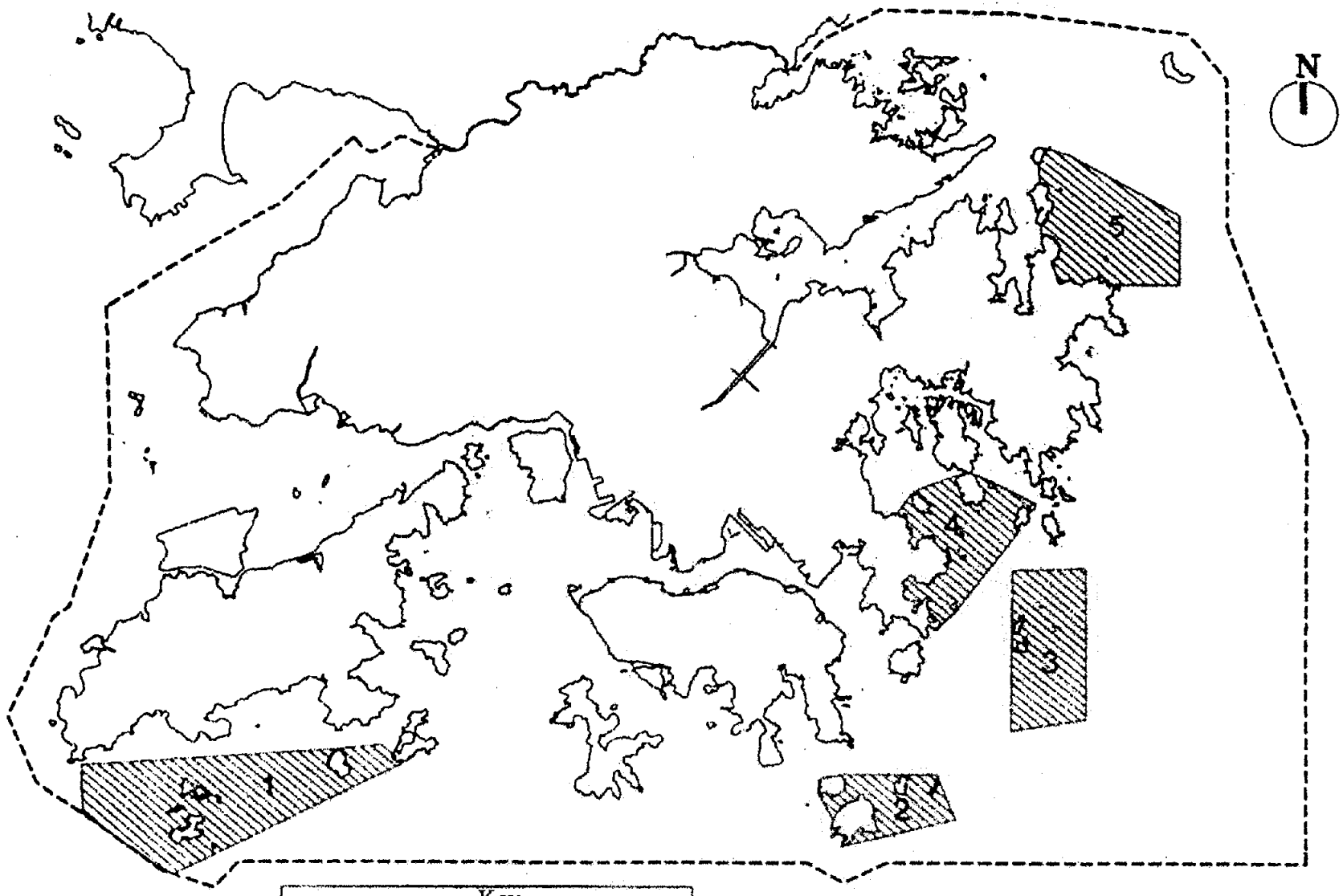
PUBLIC CONSULTATION

9. As part of the Study, the consultants have consulted the major stakeholders and taken into account their views in formulating their recommendations on site selection and management plans for the deployment of ARs. The results of the their initial consultation indicate that most fishermen engaging in small-scale operations, government departments, non-government organisations, academic groups, and shipping concerns are supportive of AR deployment. However, some purse seine and a majority of the trawl fishermen are not supportive of the programme. Some even question the cost effectiveness and the economic value of ARs in enhancing fish stocks in Hong Kong waters. Issues raised by the consulted groups are summarised in **Appendix 4**.

10. AFD welcomes any comments on the recommendations of the Study before it finalises the deployment and management strategy to implement the Phase 2 AR project.

11. Written comments can be sent to AFD, 14 Floor Canton Road Government Offices, 393 Canton Road, Kowloon on or before 30 September 1999. For enquiries relating to the Study, please contact Mr. Keith Wilson, Senior Fisheries Officer, at 2733 2205 or Mr. Albert Leung, Fisheries Officer at 2733 2437.

Agriculture & Fisheries Department
June 1999

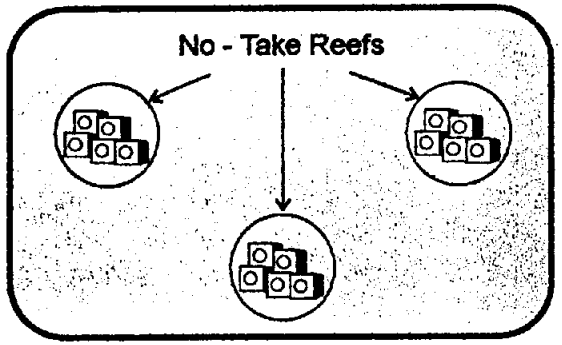


Key

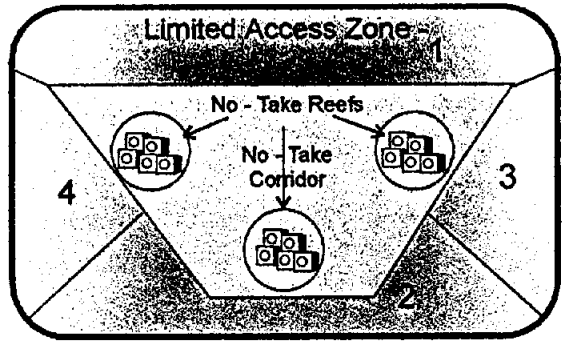
Marine Special Areas

1 West Sokos & Shek Kwu Chau
2 East Po Toi
3 Ninepins
4 Outer Port Shelter
5 Tap Mun & Shek Ngau Chau

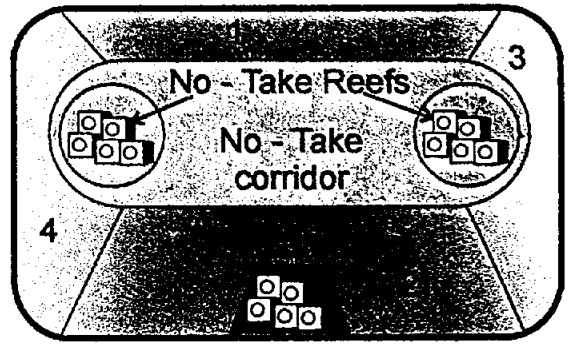
Appendix 1



OPTION 1 - NO-TAKE MARINE SPECIAL AREA (MSA)



OPTION 2 - MSA AND LIMITED ACCESS ZONE (LAZ)



OPTION 3 - MSA , LAZ & FISHABLE REEFS

OPTIONS FOR MANAGING MARINE SPECIAL AREAS

Appendix 2

APPENDIX 3a - SITE SPECIFIC MANAGEMENT PLANS FOR THE 5 RECOMMENDED MARINE SPECIAL AREAS

	WEST SOKOS SHEK KWU CHAU MSA	EAST PO TOI MSA
Site Specific Goals	**West Sokos:** The site is located on the old Sokos MBA. The main deployment goal is to rehabilitate a habitat and a fishery that may have been degraded in the past as a result of the dredging operations. **Shek Kwu Chau:** The site is located within known spawning and nursery grounds of commercial fish species and the AR aims to provide habitat and shelter for these resources.	A large proportion of the site is located on the former East Po Toi MBA which was dredged for sand between 1991 and 1995. The main goal in deploying an AR at this site is to rehabilitate a habitat and a fishery that may have been degraded in the past as a result of the dredging operations.
Site Specific Threats	**Vessel Collision:** All principal fairways were screened out of consideration for AR deployment. The threat of collisions outside fairways has been mitigated by designing the units so the minimum available water depth is 5.1 m. **Anchor Damage:** All existing and potential anchorage areas and typhoon shelters were screened out of consideration for AR deployment. Again, as with vessel movements there are few restrictions on where vessels can anchor (eg no anchorage in principal fairways). The units proposed for deployment have been designed so that accidental anchor damage would not compromise the physical integrity of the deployed structure.	**Storm Events:** Storm damage can occur to the deployed reefs as a result of either the winter monsoon storms or summer typhoons. The ARs proposed for the site are designed to be resistant to a 1:50 year storm event. **Scour & Stability:** The areas within the site where seabed currents were prohibitively high have been avoided. **Trawl Damage:** As for Ninepins.
Site Specific Objectives	**Objective 1:** Enhancement of the marine ecological resources in a habitat degraded in the past as a result of sand borrowing operations. **Expected Outcome:** The provision of hard substrate will encourage the settlement of diverse assemblages of epibenthic assemblages onto the ARs increasing the ecological value of the area post deployment. An increase in the abundance, biomass and species diversity of infaunal benthic assemblages is predicted in the vicinity of the ARs (and Limited Access Zones). **Objective 2:** Enhancement of the commercial fisheries resources of the WSSKC MSA. **Expected Outcome:** An increase in the abundance of the demersal fisheries resources within the MSA and immediately adjacent to it. **Objective 3:** Enhancement of spawning and juvenile marine resources through provision of habitat (specific to the Shek Kwu Chau AR deployment complexes within the MSA). **Expected Outcome:** An increase in the abundance of ichthyoplankton in the Shek Kwu Chau no-take zone. An increase in the abundance of juvenile commercial fisheries resources in the Shek Kwu Chau no-take zone and areas adjacent to the MSA. **Objective 4:** Enhancement of prey populations for marine mammals that use the area as a feeding ground. **Expected Outcome:** An increase in *Sousa chinensis* feeding in the area. An increase in *Neophocaena phocaenoides* feeding in the area.	**Objective 1:** Enhancement of the marine ecological resources in a habitat degraded in the past as a result of sand borrowing operations. **Expected Outcome:** The provision of hard substrate will encourage the settlement of diverse assemblages of epibenthic assemblages onto the ARs increasing the ecological value of the area post deployment. An increase in the abundance, biomass and species diversity of infaunal benthic assemblages is predicted in the vicinity of the ARs (and Limited Access Zones). **Objective 2:** Enhancement of the commercial fisheries resources of the EPT MSA. **Expected Outcome:** An increase in the abundance of the pelagic fisheries resources within the EPT MSA and immediately adjacent to it. Increase in the abundance of rocky shore fishery resources within the EPT MSA.
Permitted Fishing Operations	Hand Lining = Year Round Long Lining = Year Round Gill Netting = Seasonal Cage Trapping = Seasonal	*Limited Access Zone* Gill Netting = Seasonal Cage Trapping = Seasonal Purse Seining = Seasonal Hand Lining = Year Round *Fishable AR* Cage Trapping = Seasonal Hand Lining = Year Round Long Lining = Year Round
Recommended Management Option	West Sokos No-take Zone - 12.80 km^2 Shek Kwu Chau No-take Zone - 3.18 km^2 Limited Access Zone - 45.32 km^2	No-take Zone - 6.55 km^2 Limited Access Zone - 4.90 km^2 Fishable AR - 3.00 km^2

APPENDIX 3b - SITE SPECIFIC MANAGEMENT PLANS FOR THE 5 RECOMMENDED MARINE SPECIAL AREAS

	NINEPINS MSA	OUTER PORT SHELTER MSA
Site Specific Goals	The proposed site at the Ninepins is surrounded by very large expanses of open seabed where high profile, hard surface habitat is thought to be limiting the abundance of marine and fishery resources. With this in mind, the AR at this site should be deployed with the aim of providing high profile, hard surface habitat to enhance marine resources and fish stocks.	The site is located within known spawning and nursery grounds of commercial fish species and the AR should aim to provide habitat and shelter for these resources.
Site Specific Threats	**Trawl Damage:** To resist trawl and fisheries impacts the AR units were designed to be stable against trawl loads of up to 20 kN, have a resistance to direct impact of trawl boards travelling at 3 ms^{-1}, and have a low aspect ratio to prevent overturning or rolling. This threat is minimised further by recommending prohibition of trawling within the MSA. **Storm Events,Scour & Stability:** As for East Po Toi	**Trawl Damage:** As for Ninepins **Anchor Damage:** As for West Sokos Shek Kwu Chau
Site Specific Objectives	**Objective 1:** Enhancement of the marine ecological resources through provision of hard substrate habitat in an area dominated by soft mud habitats. **Expected Outcome:** The provision of hard substrate will encourage the settlement of diverse assemblages of epibenthic assemblages onto the ARs increasing the ecological value of the area post deployment. An increase in the abundance, biomass and species diversity of infaunal benthic assemblages is predicted in the vicinity of the ARs (and Limited Access Zones). **Objective 2:** Enhancement of the commercial fisheries resources of the NP MSA. **Expected Outcome:** An increase in the abundance of the demersal fisheries resources within the NP MSA and immediately adjacent to it. An increase in the abundance of rocky shore fishery resources within the NP MSA. **Objective 3:** Reduction of Fishing Effort on Natural Rocky Reefs in the NP MSA. **Expected Outcome:** An increase in the abundance of rocky shore fishery resources within the NP MSA particularly on the natural rocky reefs which will attract fishermen currently fishing solely on natural reefs.	**Objective 1:** Enhancement of the commercial fisheries resources of the OPS MSA. **Expected Outcome:** An increase in the abundance of the demersal fisheries resources within the OPS MSA and immediately adjacent to it. An increase in the abundance of rocky shore fishery resources within the OPS MSA. **Objective 2:** Enhancement of spawning and juvenile marine resources of the OPS MSA through provision of habitat. **Expected Outcome:** An increase in the abundance of ichthyoplankton in the Outer Port Shelter no-take zone. An increase in the abundance of juvenile commercial fisheries resources in the Outer Port Shelter no-take zone and areas adjacent to the MSA. An increase in the use of the area by spawning commercial fisheries resources. **Objective 3:** Reduction in Fishing Effort on Natural Rocky Reefs in the OPS MSA. **Expected Outcome:** An increase in the abundance of rocky shore fishery resources within the OPS MSA particularly on the natural rocky reefs which will attract fishermen currently fishing solely on natural reefs.
Permitted Fishing Operations	*Limited Access Zone* Gill Netting = Seasonal Cage Trapping = Seasonal Hand Lining = Year Round *Fishable AR* Cage Trapping = Seasonal Hand Lining = Year Round Long Lining = Year Round	*Limited Access Zone* Gill Netting = Seasonal Cage Trapping = Seasonal Purse Seining = Seasonal Hand Lining = Year Round *Fishable AR* Cage Trapping = Seasonal Hand Lining = Year Round Long Lining = Year Round
Recommended Management Option	No-take Zone - 9.40 km^2 Limited Access Zone - 20.50 km^2 Fishable AR - 3.60 km^2	No-take Zone - 11.86 km^2 Limited Access Zone - 7.06 km^2 Fishable AR - 4.44 km^2

APPENDIX 3c - SITE SPECIFIC MANAGEMENT PLANS FOR THE 5 RECOMMENDED MARINE SPECIAL AREAS

	SHEK NGAU CHAU MSA
Site Specific Goals	The proposed site at the Shek Ngau Chau is surrounded by very large expanses of frequently trawled open seabed where high profile, hard surface habitat is thought to be limiting the abundance of marine and fishery resources. With this in mind the ARs in this site should be deployed with the aim of providing high profile, hard surface habitat to enhance marine resources and fish stocks.
Site Specific Threats	**Vessel Collision:** To eliminate the threat of collisions with container traffic to Yantian the ARs were moved closer to shore and were either deployed in the deepest possible waters or were restricted in their height. **Hypoxia:** The site is located near to an inshore area where hypoxia events have occurred in the past. ARs are located in areas where seabed current speed should prevent stratification of the water column and prevent hypoxia. **Mainland Fishermen:** The site has been located as close to the Hong Kong coastline to mitigate the threat of illegal fishing by mainland fishermen on the AR. **Anchor Damage & Trawl Damage** as for Outer Port Shelter.
Site Specific Objectives	**Objective 1:** Enhancement of the marine ecological resources through provision of hard substrate habitat in an area dominated by soft mud habitats. **Expected Outcome:** The provision of hard substrate will encourage the settlement of diverse assemblages of epibenthic assemblages onto the ARs increasing the ecological value of the area post deployment. An increase in the abundance, biomass and species diversity of infaunal benthic assemblages is predicted in the vicinity of the ARs (and Limited Access Zones). **Objective 2:** Enhancement of the commercial fisheries resources of the SNC MSA. **Expected Outcome:** An increase in the abundance of the demersal fisheries resources within the SNC MSA and immediately adjacent to it. An increase in the abundance of rocky shore fishery resources within the SNC MSA. **Objective 3:** Decrease of Fishing Effort on Natural Rocky Reefs in the SNC MSA. **Expected Outcome:** An increase in the abundance of rocky shore fishery resources within the SNC MSA particularly on the natural rocky reefs which will attract fishermen currently fishing solely on natural reefs.
Permitted Fishing Operations	*Limited Access Zone* Gill Netting Cage Trapping Hand Lining = Year Round *Fishable AR* Cage Trapping Hand Lining = Year Round Long Lining = Year Round
Recommended Management Option	No-take Zone - 16.0 km^2 Limited Access Zone - 13.9 km^2 Fishable AR - 9.2 km^2

Issues Raised During the First & Second Stage Public Consultation Forums

FIRST STAGE

GOVERNMENT

ARs should not pose a threat to existing or future use of waterways.
ARs should ideally be 200m from existing rocky shore habitat.
ARs could be used to encircle and protect existing valuable habitat.
Degraded habitats may benefit most from AR deployment.
The lifetime of an AR should be at least 20 years.
ARs must not be an excuse for legalised dumping of waste.
Permits are required under the EIA Ordinance to deploy ARs.
Ex gratia will not be paid as a result of AR deployment.
ARs will not succeed without appropriate regulation and management.
Limited funds for enforcement means that community support for the programme must be strong.
Educating the community about ARs must be a dedicated and ongoing effort.

FISHERMEN

Fisheries resources in decline, AR a positive step.
Trawlers not supportive of the programme at present.
Fishing controls should apply to all fishermen.
Non-fishable reefs are acceptable and perceived as necessary.
Community involvement in enforcement not feasible at present.
Heavy penalties for illegal fishing are needed.
Government enforcement required.
Government must tackle the problem of illegal fishing by mainland fishermen.

ACADEMIC & CONSERVATION GROUPS

Support of the fishing community critical for success.
Ensure no disturbance to existing ecological environment.
Location within Marine Parks acceptable but may lead to increased fishing pressure.
Selection of materials and design should be driven by the biological functions of the AR.
Recreational uses need to be controlled.
Establish heavy fines for illegal fishing as a deterrent.
Need a fundamental review of fisheries policy in Hong Kong.

SECOND STAGE

GOVERNMENT

Phasing the deployment of ARs at the sites should be considered.
The Ping Chau site was formally opposed due to concerns over marine traffic impacts.
AR deployment at the West Sokos site should not impact marine mammal populations.
The possibility that some areas could be designated as Marine Protected Areas should be incorporated into the site management plans.
AR deployment, using DGPS, should be conducted in compliance with Marine Department's regulations in control and notification of marine works.
Monitoring surveys should be conducted at regular intervals post deployment to assess the structural integrity of the ARs.
ARs should only be marked with buoys when necessary and operationally feasible.

FISHERMEN

Cheung Chau fishermen supported no-take Marine Special Areas (MSAs).
Kat O & Po Toi O fishermen supported deployment of all ARs within a no-take zone.
Tuen Mun, Shau Kei Wan and Chai Wan fishermen supported deployment of some ARs within a no-take zone.
Sai Kung fishermen did not express an opinion.
Aberdeen & Tai Po fishermen stated that ARs are not wanted/no further deployment of ARs in their area.
Compensation for loss of fishing grounds should be considered.
Government must tackle the problem of illegal fishing by mainland fishermen.

ACADEMIC & CONSERVATION GROUPS

Concerns regarding placement of ARs near existing high conservation value habitat.
Need for MSAs to cover a significant percentage of Hong Kong waters.
Difficulty of managing proposed Ping Chau site although it was acknowledged that the area has high potential in terms of environmental benefits of AR.

SHIPPING GROUPS

Concerns over the site at Ping Chau due to container traffic to Yantian.
AR deployment should avoid popular local anchorages.
Locate ARs away from principal fairways requiring maintenance dredging.
ARs should be located on the Admiralty Chart as there are significant changes in water depth.
Post deployment surveys should update bathymetry and position of the deployed ARs.