

POST-HARVEST HANDLING OF LIVE MARINE FISH IN HONG KONG

by

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Abstract

In 1976 the annual production of live marine fish in Hong Kong was estimated at 2,070 tonnes and valued at U.S.\$ 10.62 million. Three quarters of these fish are produced by the capture fishery sector and the remainder by the culture fishery sector. The capture fishery sector consists basically of longliners and gill-netters and exploits fish from the accessible coral reef areas. The culture fishery sector produces live fish mostly by cage culture. The pattern of post-harvest handling and marketing is similar for both capture and culture fish although the former involves more elaborate handling procedures. At present, the mortality due to post-harvest handling of the capture fish is substantial. Improvement of the fishing methods, the design of vessels and, in particular, the seawater circulation system used on board such vessels can reduce handling and transport mortalities. The condition of the seawater in which fish are kept alive for wholesaling should be favourable to the survival of the fish. The possible use of a tranquillizer to avoid excessive injury to the fish during handling should also be studied.

INTRODUCTION

Live marine fish marketed in Hong Kong are produced by both the capture and culture fishery sectors. Over the past decade, increased consumer demand for live fish, especially among the Chinese population, has elicited the rapid growth of this industry. Thus in 1976 an estimated 2 070 tonnes of fish were marketed earning a total income of U.S.\$ 10.62 million (Cheng, 1977). The capture fishery supplied by far the greater proportion of fish (1 496 tonnes), although these commanded a lower average price (U.S.\$ 4 640/tonne) than their culture counterparts (around U.S.\$ 6 400/tonne). The economic viability of this industry is as dependent on the availability of the resource as on efficient methods of post-harvest handling. This paper examines the latter aspect and suggests means of improvement to reduce the mortalities which occur at present.

THE CAPTURE FISHERY

Captured live marine fish come predominantly from coral reef areas. Fishing grounds of major importance include the Pratas Reef, the Taya Islands, the Paracel Reefs and the McClesfield Bank (Fig. 1). Other more distant grounds are also fished. Longliners and gill-netters fish in these grounds and the gears employed include handlines, longlines, gill-nets, purse seines and traps. Each vessel is equipped with a number of live-fish holding tanks which are usually situated forward. An average-sized tank might measure 1.0 x 1.4 x 1.4 (depth) m. The tanks are individually sealed from each other and are provided with small holes in the bottom to enable circulatory exchange of water with the sea. The tanks may also have motor-driven aerators to provide adequate aeration.

Each trip varies from 10 days to over a month depending on the catch, the weather and the distance to the fishing ground. The actual time spent fishing is, however, usually between 7 and 10 days. The peak season for the coral reef fishery is between February and May when the northeast monsoon has subsided and before the southwest monsoon sets in. The Pratas Reef is the most commonly fished ground during these months owing to its relatively rich resource and proximity to Hong Kong. It has been estimated that over 150 vessels are engaged in this fishery during the peak season. However, when the southwest monsoon is at full strength, which affects the operation of the smaller vessels, this number declines. A proportion of the vessels also switch to grounds in the neighbourhood of the Taya Islands.

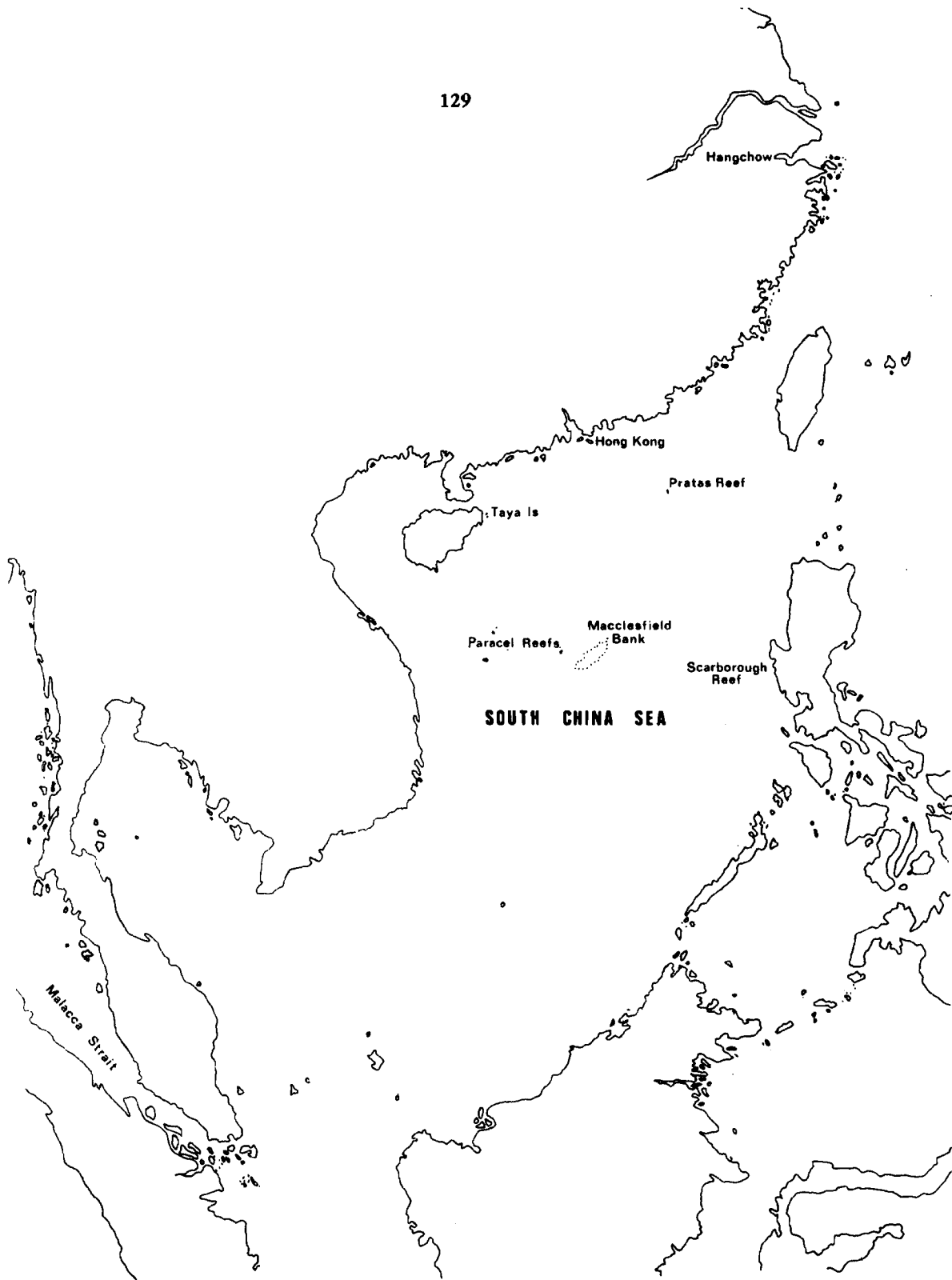


Fig. 1 — A map showing the grounds exploited by the live marine fish fishing fleet of Hong Kong.

Post-harvest handling

The live fish are kept in floating cages which are cylindrical in shape and made of nylon netting, supported by two circular metal rings each 1.0 m in diameter. The catch is sorted by size and transferred into the vessel's holding tanks. During transit, the fish are generally not fed because of congestion in the tank and the unsettled physiological state of the fish. On arrival at the home port, the fish are sorted into species, weighed and sold to wholesalers at mutually agreed prices. Prices for different species may vary by a wide margin as a result of differences in consumer demand. The price of the same species may also vary depending on the condition and seasonality. A list of the average wholesale prices of over 50 common species, together with their sizes as recorded in recent sampling surveys at various landing sites, is given in Table 1.

Table 1

Common live marine fish species landed in Hong Kong:
their average size and wholesale price (August 1977)

Species	Common Name	Size (cm)	Price (U.S.\$/Kg)
<i>Cromileptes altivelis</i>	High finned grouper	40	35.56
<i>Plectropona leopardus</i>	Leopard coral trout	60	7.11
<i>P. maculatum</i>	Leopard coral trout	60	7.11
<i>Epinephelus megachir</i>	Long finned grouper	25	5.69
<i>E. medurensis</i>	Long finned grouper	25	5.69
<i>E. Kohlari</i>	Kohlori's grouper	40	4.99
<i>E. fucoguttatus</i>	Flower cod	80	8.18
<i>E. awoara</i>	Yellow grouper	30	6.40
<i>E. akaara</i>	Red grouper	25	16.34
<i>E. fasciatus</i>	Black-tipped red grouper	20	6.40
<i>E. tauvina</i>	Green grouper	100	8.18
<i>E. fasciomaculatus</i>	Rock grouper	18	6.40
<i>Cephalopholis argus</i>	Peacock rock cod	18	7.11
<i>C. urodelus</i>	Flag-tailed grouper	25	6.40
<i>Variola louti</i>	Lunnar-tailed grouper	30	8.18
<i>Psammoperca waigiensis</i>	Red-eyed perch	35	13.51
<i>Lutjanus gibbus</i>	Humpback red snapper	38	13.51
<i>L. bohar</i>	Two-spotted snapper	60	2.13
<i>L. vitta</i>	One-banded snapper	25	9.25
<i>L. argentimaculatus</i>	Mangrove snapper	70	10.67
<i>L. kasmira</i>	Yellow snapper	18	8.89
<i>L. russelli</i>	Russell's snapper	30	10.67
<i>L. rivulatus</i>	White-blotched snapper	45	24.89
<i>Macolor niger</i>	Black and white snapper	45	2.84
<i>Lethrinus miniatus</i>	Long-nosed emperor	45	3.91
<i>L. variegatus</i>	Variegated emperor	25	3.91
<i>L. nebulosus</i>	Sprangled emperor	25	3.91
<i>L. ornatus</i>	Yellow-striped emperor	25	3.91
<i>Plectorhycus nigrus</i>	Black sweetlip	55	5.33
<i>P. flavomaculatus</i>	Orange-spotted sweetlip	55	5.33
<i>P. chaetodonoides</i>	Barliquium sweetlip	55	5.33
<i>Hemigymnus melapterus</i>	Thick-lipped wrasse	30	8.89
<i>P. curvieri</i>	Banded sweetlip	55	5.33

<i>Scarus bicolor</i>		30	10.67
<i>S. microrhinos</i>	Blunt-headed parrot fish	35	2.13
<i>S. jordani</i>	Jordan's parrot fish	30	10.67
<i>S. ghobban</i>	Blue-barred parrot fish	30	14.22
<i>S. fasciatus</i>	Tattooed parrot fish	35	10.67
<i>S. frenatus</i>	Yellow-finned parrot fish	40	10.67
<i>S. limbatus</i>		35	16.00
<i>S. janthochir</i>		50	10.67
<i>S. longiceps</i>	Long-nosed parrot fish	25	10.67
<i>S. erythrodon</i>	Red-toothed parrot fish	25	10.67
<i>Cheilinus undulatus</i>	Double-headed wrasse	45	21.34
<i>C. anchorage</i>	Yellow checked tusk fish	30	8.89
<i>C. fasciatus</i>	Scarlet-breasted wrasse	25	4.98
<i>Choerodon schoenleinii</i>	Black-spotted tusk fish	45	23.11
<i>Kyphonsus lembus</i>	Large-tailed drummer	40	2.84
<i>Siganus sutor</i>	Gold-spotted rabbit fish	18	4.27
<i>S. fuscescens</i>	Fuscous rabbit fish	15	4.27
<i>Parupeneus trifasciatus</i>	Three-banded goatfish	20	4.98
<i>Pseudupeneus barbarinus</i>	Yellow goatfish	25	4.98
<i>Upeneus cyclostomus</i>	Yellow goatfish	25	4.98
<i>Goniistius zonatus</i>	Flagfish	25	11.38
<i>Holocentrus ruber</i>	Yellow striped soldier fish	20	2.40

The fish which are sold to wholesalers are kept in cages and barges; the barges have circulatory and aerating systems similar to those installed on the fishing vessels. The fish are normally fed minced, trash fish. When orders for live fish arrive from the retailers such as restaurants and markets, the required species are loaded and delivered on lorries which are fitted with aerated tanks. During the entire process the handling of the fish is reduced to a minimum to avoid excessive injury. At the retail destination, the fish are transferred to aquaria until required for human consumption. Fish weighing over 300 g are generally considered marketable. Smaller fish, especially some groupers and snappers, are sometimes sold as fry to farmers for fattening and culture. In addition, a number of exotic species are often sought by aquarium fish dealers.

THE CULTURE FISHERY

Cultured live marine fish are mostly produced by cage-culture methods. The largest number of culture units are found in Sok Kwu Wan, Ma Nam Wat, Po Toi O and Tap Mun. Other cage-culture sites are shown in Fig. 2. In 1976, a total of 974 culture units and 9 impoundments covering a total area of 23.43 ha were recorded (Cheung, 1976). The fish are cultured in cages made of wire or nylon netting and suspended from wooden drafts. Fish of the same species and size are generally kept inside the same cage. The cages are usually not served by aerators as circulation resulting from tidal movements is usually adequate.

Post-harvest handling

The marketing of cultured marine fish is generally dependent on fish size and consumer demand. At harvest, fish are transferred by means of a scoop net from the culture cage to a carrier boat, equipped with holding tanks. In the case of impoundment culture, the fish are herded by means of a seine net and selected for sale. The carrier boat transports the fish to another location where they are weighed and sold to wholesalers. These fish are then handled through the same channels as for the captured species. A list of the most common 20 species cultured in Hong Kong is given in Table 2.

**LIVE MARINE FISH
CULTURE SITES**

- 1 Sha Tau Kok
- 2 Ap Chau
- 3 Kat O
- 4 Sai Lau Kong
- 5 Wong Wan
- 6 Tap Mun
- 7 Kau Lau Wan
- 8 Chek Keng
- 9 Yim Tin Tsai
- 10 Ha Hang
- 11 Tai Mei Tuk
- 12 Loo Foo Fat
- 13 Wu Kai Sha
- 14 Ting Kok
- 15 Po Toi O
- 16 Leung Shuen Wan
- 17 Kau Sai
- 18 Tai Tau Chau
- 19 Sai Kung
- 20 Ma Nam Wat
- 21 Pak Sha Wan
- 22 Hang Hau
- 23 Tin He Wan
- 27 Cheung Chau
- 28 Deep Water Bay
- 29 Ma Wan
- 30 Mu: Wo
- 31 Peng Chau
- 32 Po Toi
- 33 Sok Kwu Wan
- 34 Shap Long
- 36 Tai Tam
- 37 Tsing Yi
- 38 Tung Chung

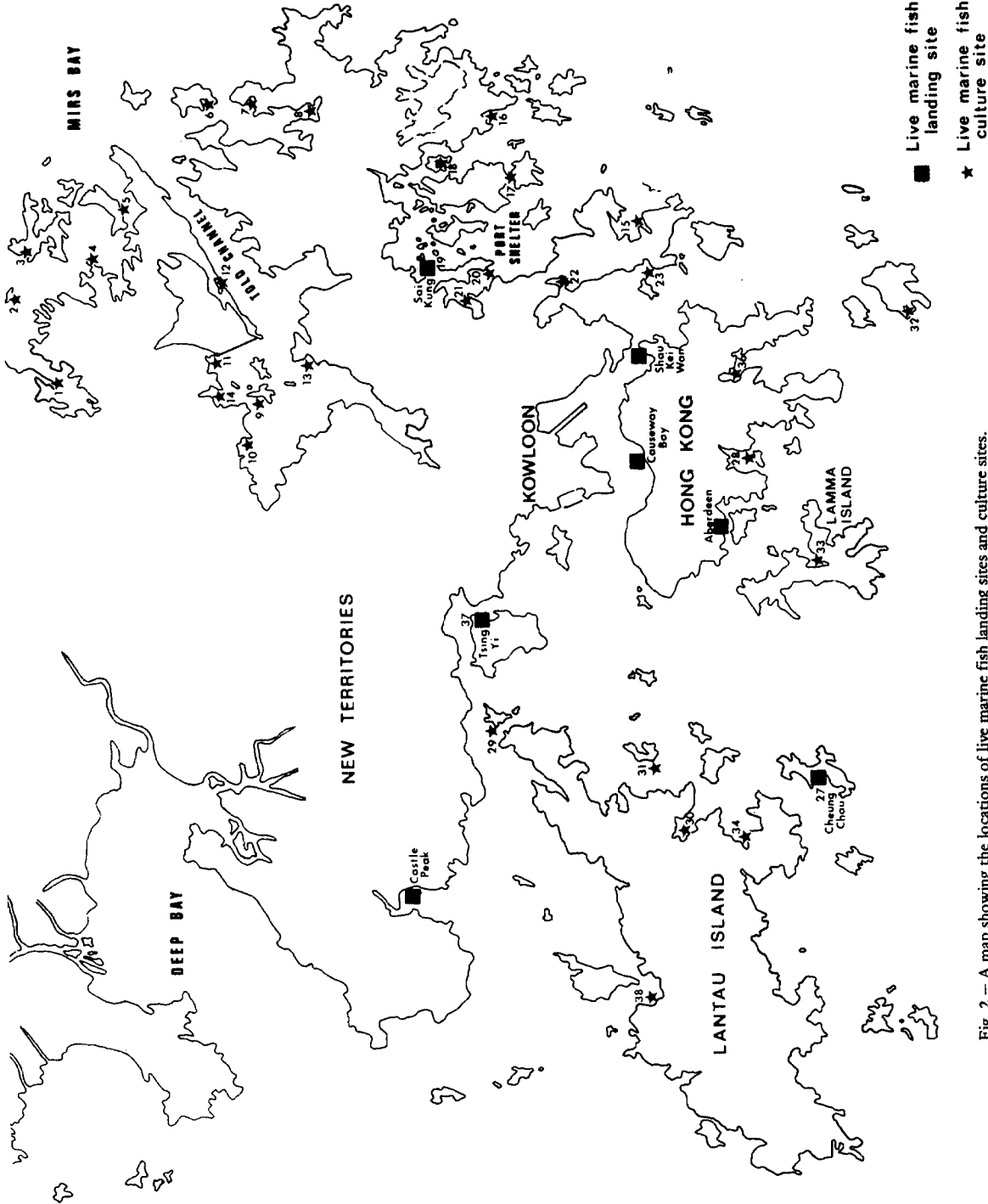


Fig. 2 — A map showing the locations of live marine fish landing sites and culture sites.

Table 2

Common species cultured in Hong Kong:
their average market size and wholesale price (October 1976)^{a/}

Species	Common name	Size (cm)	Price (U.S.\$/kg)
<i>Spinepheus akaar</i>	Red grouper	35	15.91
<i>E. brunus</i>	Mud grouper	40	6.34
<i>E. awoara</i>	Yellow grouper	25	6.93
<i>E. tauvina</i>	Green grouper	50	12.21
<i>Cromileptes altivelis</i>	High-finned grouper	35	30.21
<i>Lutjanus sanguineus</i>	Red snapper	30	5.89
<i>L. russelli</i>	Russell's snapper	25	6.67
<i>L. lineolatus</i>	Banded red snapper	20	9.10
<i>L. johni</i>	John's snapper	20	11.31
<i>L. argentimaculatus</i>	Mangrove snapper	30	11.97
<i>Chrysophrus major</i>	Red pargo	20	3.99
<i>Rhabdsarga sarba</i>	Gold-lined seabream	18	6.20
<i>Mylio latus</i>	Yellow-finned seabream	15	7.54
<i>M. berda</i>	White seabream	18	7.49
<i>Pomadasys hasta</i>	Head grunt	10	3.16
<i>Plectorphychus spp.</i>	Sweetlips	30	8.35
<i>Siganus spp.</i>	Rabbit fish	15	9.30
<i>Lates calcarifer</i>	Sea perch	25	4.74
<i>Therapon jarbua</i>	Tiger fish	18	3.55
<i>M. macrocephalus</i>	Black seabream	18	8.55

DISCUSSION ON MORTALITY FACTORS AND MEANS OF IMPROVEMENT

At present, mortality due to post-harvest handling of captured live fish is substantial; over 50 percent of the fish caught do not survive. Recent interviews have shown that the most significant factor is injury, inflicted by the fishing gear. The correct choice of gear is therefore of utmost importance. For example, although purse seining and trapping cause the least injury and are therefore preferred, the number of species captured is limited; traps are also relatively inefficient. Handling is not uncommon but is labour-intensive and longlines are generally efficient provided the fish are not hooked for too long. Gill-nets inflict the most damage and fish caught by this method suffer the highest mortality.

Excessive agitation of the water within the holding tanks during rough weather is another cause of mortality. Better stability of the boat in rough weather and improvements in the circulating system on board will help to reduce such losses. A suggestion for an improved circulatory system is shown in Fig. 3. In this system, water is pumped into the holding tank through reinforced rubber tubing and excess water is allowed to overflow through an L-shaped discharge pipe. The discharge pipe is designed to allow adjustment of the water level and the L-shape prevents most of the back-flow of water when the vessel pitches. When emptying the tank water can be pumped out simply by reversing the positions of the tubes used in the filling process. This circulatory system has two advantages. First, the volume of water inside the tank can be kept at any desired constant level to accommodate varying quantities of fish. Second, adequate aeration is provided through the spraying action of the inflowing water.

^{a/} Source, Cheung 1976

Massive fish mortalities have also been experienced by wholesalers who keep their fish near the landing sites. The landing sites in Aberdeen, Tsing Yi, Causeway Bay and Shau Kei Wan are all located within the typhoon shelter areas where pollution from urban and industrial discharges is considerable. The landing site in Castle Peak is exposed to the effects of the south-west monsoon as well as the waters of the Pearl River discharge which can cause a drastic reduction in salinity in that area. Therefore, a new location should be considered for the purpose of centralizing all live fish wholesaling activities. Ideally, this should be in the northeast sector of Hong Kong where hydrographic conditions are under the influence of oceanic currents favourable to the survival of marine fish species.

Mortality through post-harvest handling is much lower in cultured fish than in the capture fishery. This is possibly a result of the fish being acclimatized to environmental conditions in captivity. However, injury leading to mortality may still result during transit, especially from the producer to the wholesaler, when the fish tend to be excited and unsettled. While it is possible to use tranquillizers to reduce such injuries, this method cannot be recommended until their side effects are proved to be harmless. To the consumer, the vitality of the fish is as important as its general appearance.

REFERENCES

- Cheng, K.W.J., Statistics on fishery production, January-December, 1976. *AFD Econ. Market. Occas. Pap.*, 1977(6)
- Cheung, P., Preliminary results of the mariculture survey. Hong Kong, Agriculture and Fisheries Department 1976 (Unpubl. mimeo)

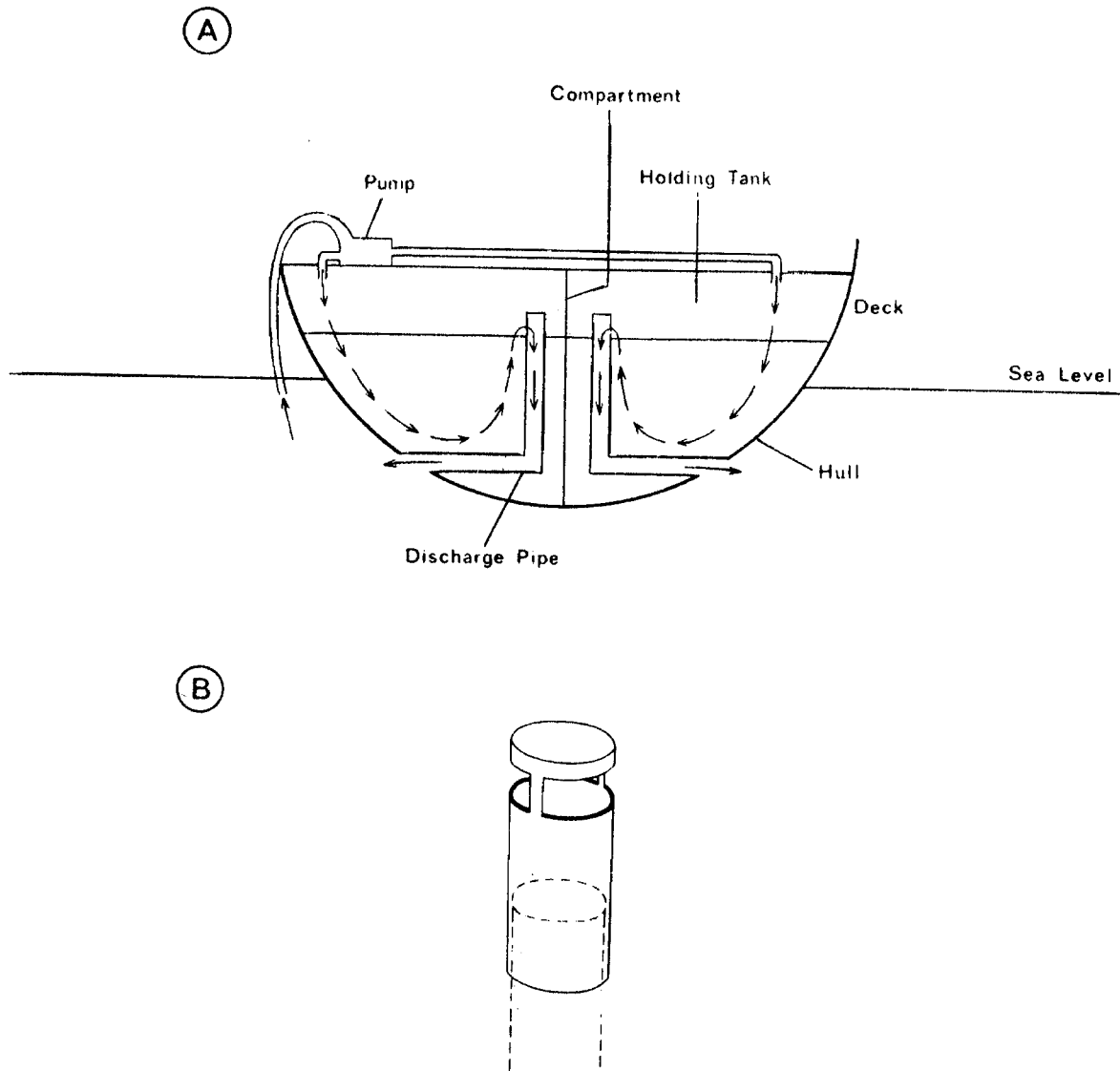


Fig. 3 - A : A schematic drawing of the improved circulatory system.
 B : Detail drawing of the top of the discharge pipe.