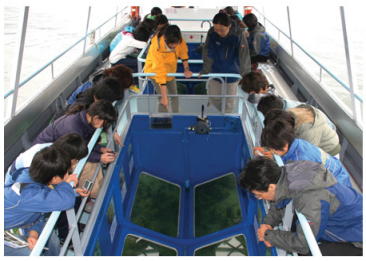
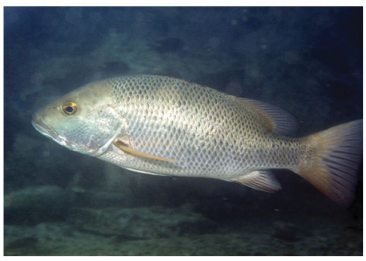
Rebuilding Hong Kong's Marine Fishery

An Evaluation of Management Options

Executive Summary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EXECUTIVE SUMMARY

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Hong Kong's fisheries are primarily concentrated in the waters of Hong Kong, the Pearl River Estuary and the adjacent continental shelf in the South and East China Seas. In 2005, there were an estimated 4,150 fishing vessels and 9,200 fishers in the Hong Kong fishing industry (www.afcd.gov.hk). Fishing fleets landed approximately 29,000 tonnes of fish from Hong Kong waters, i.e., the waters administrated by the Hong Kong SAR, contributing HK$ 552 million in landed value (AFCD Port Survey 2001/02, unpublished data).

Fisheries in Hong Kong have undergone dramatic changes over the past five decades. Just after the Second World War, most Hong Kong fishers fished in Hong Kong and along the coast of south China with sail-driven junks. Catches of predatory fishes such as groupers, snappers and yellow croakers were abundant. Since the 1950s, with financial and technical assistance from the Hong Kong government, fisheries in the country have become mechanized rapidly. As a result, fishing effort increased dramatically and fishing power of bottom trawlers, in particular, increased largely. Without proper fisheries management and limits on fishing effort, signs of over-exploitation of fisheries resources in Hong Kong waters became evident in the 1970s. Fisheries production was maintained by exploring new fishing grounds, further increases in fishing effort, and exploiting smaller and fast-growing species that could withstand higher fishing pressure. A scientific assessment in the 1990s, commissioned by the Hong Kong government and conducted partly by the Fisheries Centre, University of British Columbia, showed that the majority (12 out of the 17 studied species) of local commercial fish stocks were largely over-exploited. Most of the large food fish that once made up the major catches in Hong Kong waters were almost extirpated commercially. The Hong Kong marine ecosystem became dominated by juvenile fishes, and species with high turn-over rates, such as small fishes and invertebrates.

In view of the over-exploitation of local fisheries resources, the scientific assessment in the 1990s recommended a number of fisheries management and restoration measures. These included: (i) establishment of a fisheries licensing system; (ii) limiting new entrants into the fishery; (iii) establishment of protected areas for nursery and spawning grounds (i.e., Fisheries Protection Areas); (iv) habitat enhancement and restoration; and (v) engaging in fish restocking trials. In particular, setting up a licensing system and designating

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marine protected areas were deemed as high priorities by the UBC research team. So far, recommendations to enhance habitats has been implemented through the deployment of artificial reefs, and small-scale fish restocking trials have been conducted. However, benefits of these measures for restoring local fisheries resources have yet to be scientifically demonstrated.

In 2004, to implement the remaining recommendations from the scientific assessment, the Hong Kong government (Agriculture, Fisheries and Conservation Department) proposed the establishmentof a fishing license scheme, designation of Fisheries Protecton Areas (FPA) in Port Shelter, and Tolo Harbour and Channel (including Long Harbour) (Figure 1), and a seasonal fishing moratorium (from June to July). With the aims of facilitating effective management and restoration of local fisheries resources, WWF Hong Kong proposed amendments to the government initiatives. These amendments included additional conditions to the fishing license scheme to ensure proper reporting of catches by fishers, and designation of no-take FPAs instead of the government proposal that offered only partial protection.

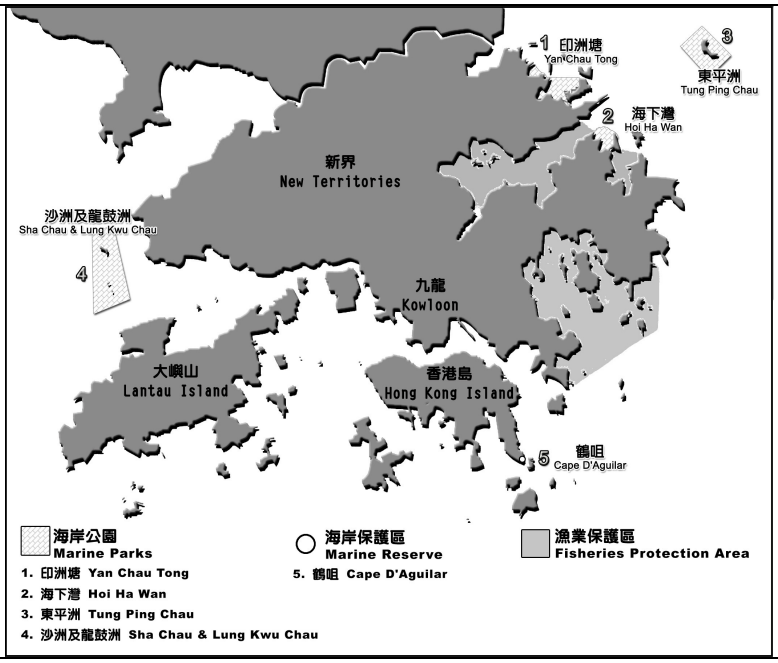

Figure 1. Map showing the existing marine parks and reserve, and the proposed Fisheries Protection Areas (FPAs) in Hong Kong.

The potential for these intiatives to lead to short-term negative socio-economic consequences for fishers is considered one of the key barriers preventing management action. Therefore, to properly and effectively implement these proposals, an understanding of the following are necessary: 1) the effects of these initiatives on fishing communities and Hong Kong society; and 2) fishers' willingness and ability to adapt to and accept these changes. This study is especially pertinent because it identifies, for the first time, the key socio-economic impacts, benefits and costs to fishers and wider communities from implementing the various management options.

In particular, the objectives of this study are to: (1) examine the economic and social consequences of implementing three possible fisheries management scenarios in Hong Kong; (2) evaluate the feasibility of creating alternative livelihoods under those scenarios; and (3) evaluate the economic consequences of successful implementation of the alternative livelihoods. Thus, findings from this study will provide critical information to the government of Hong Kong, non-governmental organizations, the private sector, and other stakeholders for examining the social and economic implications of different management plans for rebuilding Hong Kong's marine fisheries, and illuminating the way forward.

This study identified the management scenarios to be analyzed. This is crucial because these scenarios form the basis for the analysis of alternative livelihood strategies and the analysis of fisheries impacts presented in this report. The management scenarios we identified are:

Scenario 1

Status quo: Continuation of the fisheries and marine park management regimes in place in 2005:

4 marine parks (Hoi Ha Wan Marine Park, Yan Chau Tong Marine Park, Sha Chau and Lung Kwu Chau Marine Park, and Tung Ping Chau Marine Park) where trawling is prohibited and fishing with other methods is allowed with licenses;
1 marine reserve (Cape D'aguilar Marine Reserve) where no fishing is allowed;
Chek Lap Kok Marine Exclusive Zone where no fishing is allowed
Artificial reefs deployed in the Hoi Ha Wan Marine Park, Yan Chau Tong Marine Park, Sha Chau and Lung Kwu Chau Marine Park, Chek Lap Kok Marine Exclusion Zone, Outer Port Shelter and Long Harbour;
Fishing effort is not regulated in areas other than the above.

Scenario 2

Government initiatives: Introduction of the three proposed amendments to the Fisheries Protection Ordinance proposed by the HK SAR government, with timelines and framework as indicated by the HK SAR government in March 2006. This is in addition to the marine park management regime in place in 2005 (Scenario 1):

Scenario 2a:
Trawls are banned from fishing within Fisheries Protection Areas (FPAs) (Port Shelter, Tolo Harbour and Channel, and Long Harbour); all other fishing gears are allowed to fish in the FPAs, except where artificial reefs have been deployed;
Recreational fishing is not regulated;
Licensing system is in place and is used to control commercial fishing effort.

Scenario 2b:
In addition to scenario 2a, a seasonal moratorium that is in line with the moratorium in the South China Sea that is imposed by the mainland Chinese authority is implemented, i.e., trawls and purse seines are banned from fishing in Hong Kong waters during June and July.

Scenario 3

WWF initiatives: Introduction of all or part of WWF's "Save Our Seas" campaign objectives in 2007 (SOS: "Save Our Seas" Position Paper, 1 Dec 2005)

Scenario 3a:
No-take marine zones to cover all existing marine parks, and the proposed FPAs in Port Shelter, Tolo Harbour and Channel, and Long Harbour.

Scenario 3b:
Ban on bottom trawling in all Hong Kong waters, except in the southern waters (south of Lantau and Lamma Islands) where shrimp trawling is allowed.

Scenario 3c:
Creation of no-take zones covering the entirety of all HK's marine parks.

Scenario 3d:
Combination of Scenarios 3b and 3c.

Scenario 3d2:
Creation of no-takes FPAs in Port Shelter, Tolo Harbour and Channel, and Long Harbour

Scenario 3e:
Combination of Scenarios 3b and 3d2.

Scenario 3f:
Combination of Scenarios 3a and 3b.

This report attempts to collate options from fishers, recreational fishing, diving and marine-related tourism operators, and government officials on these management scenarios. Moreover, using ecosystem models, the potential impact of each scenario listed above on the different fishing groups and sectors in Hong Kong waters are studied. This report is organized into two main parts: 1) alternative livelihood strategies for fishers and fishing communities, and 2) models for assessing fisheries impacts.

Part 1: Alternative livelihoods for fishers and the fishing community

Effective fisheries management requires understanding of the socio-economic consequences of the management actions. Most experts agree that many fisheries around the world are in crisis, usually because fishing is depleting stocks faster than they can be replaced. Many would agree that actions are needed to stop the depletion. Unfortunately, managing fisheries and rebuilding stocks entails initial costs. In most cases, fishing will have to be reduced significantly in the short term. Subsequently, an important question is: what happens to the fishers while we wait for the fish stocks to rebuild? Our study addresses this question by conducting a survey of Hong Kong's

fishers, as it is widely considered that asking fishers is the best way to begin to find feasible solutions to fisheries problems. We interviewed fishers and recreational fishing and fishing shop operators, asking questions related to alternative livelihoods, buy-backs, compensation, no-take marine parks and a trawl ban.

Our survey found that 54% of interviewed fishers were willing to switch jobs from fishing, with the remaining 46% stating that they would not consider it. This result implies that there is a good potential for well-designed alternative livelihood schemes to succeed. Also, dive and recreational shop operators were generally receptive of hiring fishers as new employees. The most frequent reason given for not hiring fishers was that they did not have the required skills. Therefore, any well-designed alternative livelihoods scheme will have to address how to develop the necessary skills among fishers. Our study suggests that the current alternative livelihood options within the marine sector (passenger/leisure boat operator, recreational raft fishing, and deep sea tuna fishing) would not be able to provide sufficient number of jobs for the fishers who may potentially be affected by the management initiatives. Therefore, an alternative livelihoods scheme would also have to look outside the marine sector.

The survey results indicate that a total of 75% of the interviewed fishers were willing to participate in a buy-back scheme if they were reasonably compensated for their vessels. These numbers show that a significant number of the fishers are willing to switch from fishing with the right buy-back package put in place.

There was overall strong support among dive and recreational operators for a total ban of fishing in marine parks, with 86% of all respondents either agreeing or strongly agreeing with this proposal. All marine tourism operators agreed with a total ban of fishing in marine parks. Around half of the alternative livelihood operators thought their businesses would benefit from no-take marine parks. In contrast, among fishers, only the small-scale fishers using P4/7 boats thought that marine parks did provide some benefits. P4/7 is a license class for small glass-reinforced boats with outboard engines intended to be used for transportation to and from local mariculture rafts. However, many Hong Kong fishers employ boats with P4/7 license to fish in inshore waters. Thus they are categorized as the P4/7 sector.

When respondents were asked which scenario of the future they preferred, none chose to stay in the present situation (*status quo*). Different groups of fishers had different opinions about the range of proposed management policies, including the designation of partially or fully no-take areas, seasonal and annual trawl bans. The most prominent difference relates to the creation of no-trawl FPAs. While this had support from the P4/7 sector, it was, not surprisingly, opposed by the trawl sector. However, there were divergent opinions within the trawl sector. The big trawlers from one of the main fishing organizations opposed the policy outright, whereas smaller vessels (Tolo trawlers) were more receptive to the idea if they were to receive appropriate compensation.

Fuel cost has become the biggest concern for fishers as the high fuel price has largely lowered the profitability of all fishing sectors. Currently, government fuel subsidies cost taxpayers an estimated HK$ 48 million annually, while management of the fisheries, including enforcement, costs HK$ 24 million. In contrast, estimated benefits from the fisheries are roughly HK$ 150 million. This suggests that the economic performance of Hong Kong's fisheries is poor. The fisheries are sustained largely through the provision of government aid. Big trawlers are the worst affected by rising fuel costs due to their high fuel consumption. This is exacerbated by the fact that much of their capital is tied up in the vessel. It seems unlikely that the problem of high and increasing fuel costs is going to be solved soon. Also, the elimination of government subsidies that maintain or increase fishing capacity is part of ongoing World Trade Organisation (WTO) negotiations. If WTO agreement on subsidies elimination is reached, it may not be possible for Hong Kong to continue providing subsidies to its fishing sector (including the fuel subsidy). It may therefore be strategic for fishers to leave the fishing industry. This is probably why up to 75% of fishers are willing to participate in a buy-back scheme. It is important for both the government of Hong Kong and fishers to seize the opportunity to restructure marine fisheries to ensure restoration and sustainability of the resources while helping fishers adjust to the change.

Government can work to increase job and livelihood diversification for fishers. At the moment, fishers' ability to diversify their livelihood is constrained by factors beyond their control. These include a) strict regulations for converting fishing vessels to meet requirements for transporting passengers, as well as strict guidelines for commercial operation of recreational raft fishing (especially, for the P4/7 sector); b) shrinking demand for low wage labour suitable for the current fishers in Hong Kong; c) limited market and growth potential for recreational fishing and diving industries; and d) difficulties for fishers wanting to sell their boats as there is little demand for fishing vessels. In addition, fishers acknowledge that their poor education is an obstacle to finding employment in other sectors.

Surveyed fishers consistently indicated that coastal development and pollution had affected fish stocks (both mariculture and capture). This important observation, supported by other studies, suggests the need for integrated coastal zone management in tandem with fisheries management to help deal with the problems of Hong Kong waters in a holistic manner. Successful reform of the mariculture industry, which is currently in decline, also offers potential benefits such as a) alternative livelihoods for fishers; b) reduction of negative impacts of mariculture on capture fisheries; and c) serves as a good source of income and seafood for Hong Kong.

We observed divergent opinions about protected areas in our survey. Dive respondents were more optimistic about the creation of no-take marine parks. Recreational fishing respondents saw no-take marine parks from two perspectives: on the positive side they thought it would attract more recreational fishers by increasing the abundance of fish. On the other hand, it might decrease their business as recreational fishing would be banned in marine parks. A majority of the fishers interviewed thought that protected areas did not provide any sort of benefits. Contrary to findings in other

countries, most of the fishers did not think that protected areas had increased fish abundance or fish catch. Generally, the fishers were knowledgeable about the various management initiatives (e.g., Fisheries Protection Areas, Marine Parks and Reserve, etc.) proposed by the government. However, many of them did not believe the claims by the government, environmental groups or academia on the usefulness of the protected areas.

The negative opinions of fishers on the efficacy of marine parks may be a result of the lack of noticeable increase in catches and fish abundances from previously designated marine parks in Hong Kong. We think that their perceptions of failure are real and are likely due to sustained licensed and illegal fishing within the marine protected areas, so that fish abundance did not rebuild as anticipated. Nevertheless, the negative perception towards protected areas identified here may partly result from a limitation of the livelihoods survey and interview/questionnaire design.

A critical pre-requisite for successful restructuring of the fishing industry is effective control of fishing effort. To this end, the government should implement the fishing license scheme as soon as possible to lay the ground for other initiatives aimed at helping local fishing communities by restoring fishery resources. This re-emphasizes and reiterates the recommendations from earlier fisheries resources consultancy studies. Without a fishing license scheme, the number of vessels fishing in Hong Kong waters cannot be controlled, and vessels bought out may seep back in or be replaced by others.

In conclusion, this survey suggests that a sizable proportion of fishers in Hong Kong are willing to pursue alternative livelihoods under a well-designed fisheries adjustment program. Most fishers are pessimistic about the future development of Hong Kong fisheries because of the declining catches and increasing costs. Many are willing to switch to non-fishing jobs if opportunities are available. It therefore appears that the time is ripe for the Government of Hong Kong to work with fishers and NGOs to help secure the flow of fisheries benefits from Hong Kong waters to both current and future generations of citizens, and assist those who wish to switch to alternative livelihoods to do so.

Part 2: Economic impacts to the fishing industry and society

The goal of this part of the report is to assess the potential economic gain or loss to fishers and to Hong Kong society as a whole due to the implementation of different fishery management scenarios. The economic loss/gain to fishers is assumed to be the difference between the discounted net present value of profits (that is, the sum of profit over time in today's dollars) made under the *status quo* (present situation) management and that estimated under the different proposed management scenarios.

We undertake 3 types of assessments in this report: 1) cost-benefit analysis; 2) ecosystem modeling; 3) feasibility analysis using results from the livelihood study and ecosystem modeling.

The economic loss/gain to society is estimated using a cost-benefit analysis of the fisheries to society under different management scenarios. The benefits component includes profits from commercial fishing and from marine-related livelihoods such as recreational fishing, scuba diving and tourism. The cost component includes: *ex gratia* and vessel buy-back; monitoring, control and surveillance; retraining fishers; and subsidies on fuel and modification of fishing vessels to operate alternative livelihoods.

A distinction between benefits to fishers and to society is important because the gap between the outcomes preferred by private actors (i.e., fishers in the case of fisheries) and society in the use of environmental and natural resources is at the core of the challenges facing managers of these resources. This gap is due to what economists call 'externalities', which is a cost or a benefit arising from an economic activity that affects people (other than those who decide the scale of the activity). In this study, two things differentiate the way we calculate net present values to the fishers (represented by Hong Kong's various fishing sectors) and society. First, society is assumed to have a longer time horizon than private actors. Second, private actors, because they are businesses, are assumed to apply the market discount rate to calculate their present value of benefits, while society is assumed to use a lower discount rate because of its broader concerns, such as ensuring fisheries benefits to future generations (e.g., fish protein supply).

Data on benefits and costs of the management scenarios to the fishing sectors and to society are based on government published and unpublished data, results from the fishers' livelihood survey, and ecosystem modelling. Catches from Hong Kong waters were estimated from the government Port Survey in 2000/01. Analysis using global catch data shows that the government estimated catches in 2000/01 from Hong Kong waters appear to be up to 300% higher than the expected catches from areas that are geographically similar to Hong Kong. Thus, the catches are likely to be over-estimated by the government. Modelling of the Hong Kong marine ecosystem is based on a previously constructed ecosystem models (using the Ecopath with Ecosim modelling approach), updated with 2000/01 catch data. Notwithstanding the uncertainty in the input data, the results from the ecosystem simulation modelling (using Ecopath with Ecosim) are generally robust to such uncertainty.

In terms of net economic benefits, both fishers (as a group) and society would likely increase their long term benefits (25 years for fishers and an infinite time-horizon for society) by moving away from the current *status quo* management. In particular, benefits to the society are projected to increase many-fold. From an economic perspective therefore, the *status quo* scenario is not an optimum option. However, some fishing sectors and communities may lose from changing the *status quo*. Also, the performance of the private sector in the short and medium terms (5 and 10 years) is lower than in a 25-year time horizon. These may explain the opposition to change from some fishing sectors and communities. Given the potential large benefits to society of alternatives to the *status quo*, it may be beneficial to compensate losers in order to initiate action. This also highlights the need for the development of well-designed alternative livelihood schemes.

Overall, we estimate that management scenarios with a territory-wide trawl ban would deliver the highest net benefit to society (about HK$ 2.6 billion more than the *status quo*). The increase in net benefits, despite a decrease in landed values, agrees with economic theory: in a depleted, open-access system such as Hong Kong, competition among fishers leads to levels of fishing capacity or effort much greater than that needed to achieve maximum economic rent, thereby wasting potential economic benefits from the resources. As fish stocks decline, the situation becomes exacerbated, with even more fishing effort required to maintain the same level of catch.

In terms of biomass, our modelling suggests that (i) no-trawl fisheries protection areas (FPAs) and partially protected marine parks would be less effective in restoring the biomass of most fish groups, especially the large-bodied fishes, than scenarios with no-take FPAs and marine parks; (ii) a combination of no-take FPAs and marine parks would be effective in restoring the biomass of reef-associated fishes; (iii) for invertebrates, medium and large non-reef fishes and large pelagic fishes, a territory-wide trawl ban would be most effective in restoring their biomass; (iv) effects on the biomass of invertebrates and non-reef fishes could be seen in the short to medium term (5 years and 10 years); (iv) reef fishes (particularly medium and large-bodied fishes) respond relatively slowly to different fishing effort levels in each scenarios. In fact, our analysis shows that major changes in their biomass would be expected only after 25 years.

The slow recovery of major exploited stocks highlights the importance of protecting local spawning and nursery grounds. The proposed locations of the FPAs have been identified as spawning and nursery grounds for commercial species. In fact, this is a major reason for proposing the creation of FPAs in these areas. Thus, protecting these areas from all fishing activity should facilitate the recovery of depleted stocks. However, these spawning and nursery grounds could not be factored into the spatial simulation model employed in this study. Therefore, the recovery rate predicted from the simulation model may be conservative.

With respect to catch, our study reveals that (i) catch of invertebrates, mostly caught by trawlers and commanding high market prices, would generally decrease after the designation of FPAs, converting existing marine parks into complete no-take zones, or implementing trawl bans. Thus, these scenarios suggest a considerably reduced landed value for the trawling fleets; (ii) catches of reef-associated fishes show strong positive responses under most scenarios, particularly those with a combination of no-take FPAs and marine parks (Scenario 3a). Reef fishes are mainly caught by the P4/7 and miscellaneous sectors and these sectors would benefit most from the implementation of FPAs and marine parks; (iii) a territorial-wide trawl ban, although effective in restoring biomass, may lead to a relatively larger reduction in catch and landed values of the fisheries (~25% reduction in catch and landed value from the *status quo*). On the other hand, since the profitability of most trawl sectors is much lower than those for small-scale fisheries, a territory-wide trawl ban could increase overall profitability of the fisheries (up to HK$ 450 million more than the *status quo* in the 25-year timeframe), thus resulting in high net benefits compared to scenarios with no trawl ban; and (iv) overall, although

no-take FPAs and marine parks may result in a slightly larger reduction in catch in the short term (less than 5% in a 5-year timeframe), our modelling suggests a slightly higher catch in the medium and long term (~5% in 25-year timeframe), compared to the no-trawl FPAs scenario.

The modelling results are influenced by uncertainty in the data (especially catch data), by the model structure, and by a number of ecological assumptions. To understand how these uncertainties might have affected our results, we conducted sensitivity analysis and compared our results with those of earlier modelling studies. The comparisons suggested that our model outputs are reasonably stable, except for the catch levels used. The model does not explicitly incorporate the recreational fishing sector. However, data on recreational fishing catch are sparse while the catch data in the simulation model are probably overestimates. Therefore, we believe that the exclusion of recreational fishing in the model should not affect the conclusions of this study. On the other hand, the potential impacts from recreational fishing, especially if management scheme is not in place, should not be ignored. Further research is needed to provide more accurate and consistent catch estimates. The comparisons among the different scenarios are robust, but fine scale predictions from the model (in space and time) should be viewed with caution.

This study clearly demonstrates that moving away from the current *status quo* management, i.e., largely open access and unregulated fisheries, will provide long term benefits to both Hong Kong's fishers and society. The resulting short term reduction in fishing effort that restoration will entail will have to be addressed with the implementation of appropriately designed alternative livelihood programmes and buy-back schemes. With regards to alternative employment, current marine or fishing related options are not appropriate to accommodate the number of potentially displaced fishers. Thus, government and fishers will have to look for additional job opportunities outside the marine/fishing sectors.

Finally, we want to emphasize that the projected net benefits, both to fishers and to society, are based on the strong assumption that Hong Kong's fishery resources will be managed efficiently after the implementation of the new management scenarios. That is, there will be no growth in capacity and over-fishing of the stocks thereafter. This means that an effective licensing, monitoring, control and surveillance system, together with an incentive scheme for fishers to ensure sustainable and efficient fishing by the remaining Hong Kong fleet, will have to be put in place. It is also likely that the current method for recording catches will need to be revised so that accurate fisheries data is available to inform future fisheries management decisions.

WWF, the global conservation organization

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by:

- conserving the world's biological diversity
- ensuring that the use of renewable natural resources is sustainable
- promoting the reduction of pollution and wasteful consumption.

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