Report on the adverse impacts of exploitation of marine resources (habitats, fish and invertebrates)

Prepared for
Hong Kong Biodiversity Strategy and Action Plan

Prepared by
Marine Impacts Assessment Focus Group

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Executive Summary

The following is a list of activities or issues which were identified by the Marine Impacts Assessment Focus Group as having an adverse impact on marine biodiversity in Hong Kong. They are listed according to whether they are assessed to be High, Medium or Low priority activities or processes. Within each grouping, the individual activities or processes are listed according to the category they fall under, not according to priority. This is a decision for the Marine Biology Working Group.

HIGH PRIORITY
High importance. High urgency. Requires priority attention

Marine fish and invertebrates are not protected using current legislation
Important conservation areas are not adequately protected under current legislation
High Ecological Value Habitats are not protected using current legislation
Impact of visitors on High Ecological Value (intertidal) Habitats
Alien Invasive Species
Use of Septic tanks and soakaway (STS) systems in floodplains
Discharge of restaurant waste and greywater in storm water drains
Inadequate set of water quality objectives
Coastal eutrophication, harmful algal blooms and episodic hypoxia events
Environmentally unfriendly product additives
Water extraction for cooling (as death traps for billions of marine larvae)
Clam digging on intertidal mudflats
Razor shell digging using salt
Sediment runoff from development and construction sites
Trans-national Wildlife Crime
Sentencing statements in wildlife crime cases

MEDIUM PRIORITY
High importance. Low urgency. Requires further study, systems are already in place or requires less urgent attention

Reclamation and construction, including rivetment (Sea walls/Embankments/Stream walls)
Underwater acoustic disturbance
Diversion of stream flows
Fishing non-target species
Ghost nets
Fishing in stream mouths
Eco-tourism and visitors
Mariculture
Oyster farming
Illegal discharge of waste
Surface runoff
Climate change
Marine traffic (Passenger, Freight, Construction, Recreational Vessels)

Offshore (marine) extraction
Offshore (marine) dumping
Global Fishing effort

LOW PRIORITY

Low importance. Low urgency. Something to be aware of, requires further study or less urgent attention

Breakwaters (tide dominated/wave dominated)
Artificial habitat creation and protection schemes

Not considered due to late identification

Contaminants released from sediment dredging
Chlorination residues in treated sewage and cooling water
The release of toxic substances (e.g. heavy metals and TNT) from firework display
Historical dumping of weapon munitions and unignited bombs at sea
Improper mitigation measures for protecting high ecological value habitats during and after the construction work

HIGH PRIORITY activities or issues

The Marine Impacts assessment Focus Group has identified the following High Priority issues, which are having an adverse impact on marine biodiversity in Hong Kong, based on their importance, urgency, extent of the problem, impact of proposals, criticality, do-ability and likely biodiversity return. Comments have also been made on specific areas of concern where applicable. We believe they require priority attention.

Marine fish and invertebrates are not protected using current legislation

Comment: Marine fish and invertebrates are not protected using current legislation, but Cap 171, the Fisheries Protection Ordinance could be used to protect priority marine species of conservation concern identified by the Status, Trends and Red List Assessment Focus Group.

Important conservation areas are not adequately protected under current legislation

Comment: The Tai Ho Wan case has highlighted the serious inadequacies of Hong Kong laws to protect the conservation of biodiversity through the system of designated areas. Conservation decisions are currently made on the basis of development criteria, not the conservation of biological diversity and there is little legislative recourse to deal with individuals who destroy important non-protected biodiversity or designated conservation areas. Proper protections for designated conservation areas need to be considered, including the enactment of legislation, with serious legislative consequences for offenders.

High Ecological Value Habitats are not protected using current legislation

Comment: High Ecological Value Habitats are currently not protected in Hong Kong. Whilst the report focuses on mangroves and seagrass beds, priority should be given to implementing proper protections for the sites identified by the Marine Habitat Assessment Focus Group as being important for conservation. See Figure 2 of Marine Habitat Assessment Focus Group report.

Impact of visitors on High Ecological Value (intertidal) Habitats

Comment: The impact of visitors on an intertidal mudflat poses a considerable threat to intertidal mudflat ecology and is the subject of a report: "Impact of visitors on High Ecological Value (intertidal) Habitats. A special report on Tung Chung Bay". At the moment, conservation in the context of "balancing development with conservation needs" currently means avoidance of development, not conservation of biodiversity, and in new developments, such as the expansion of Tung Chung, no consideration is given to the impact that increased residents or increased visitors to an area will have on local biodiversity.

Invasive Alien Species

Comment: The issue of invasive alien species is of global concern. Whilst many alien species have entered Hong Kong accidently, certain practices, such as religious fish release ceremonies are resulting in the intentional release of voracious predatory species, such as the Sabah Giant Grouper, which represents a clear and unacceptable threat to local biodiversity. We have focused on this species in the hope of triggering a wider debate on this issue.

Use of Septic tanks and soakaway (STS) systems in floodplains

Comment: Improperly placed Septic Tanks and Soakaway (STS) systems represent a long term and continuing threat to biodiversity, because they are often situated in the lower reaches of floodplains, many of which discharge into important and sensitive ecological sites. Septic Tanks and Soakaway (STS) systems cannot work in floodplains, yet this has been a long standing and accepted practice in Hong Kong. Whilst we accept that this is a legacy issue, we recommend that for future developments, more stringent standards than are being currently applied are implemented, and that priority consideration be given to avoiding areas identified by the Marine Habitat Assessment Focus Group as being important for conservation. See Figure 2 of Marine Habitat Assessment Focus Group report.

Discharge of restaurant waste and greywater in storm water drains

Comment: The discharge of restaurant waste and greywater in storm water drains represents a long term and continuing threat to biodiversity, because such drains invariably discharge a frightening concoction of chemicals into inshore coastal waters, often directly into important and sensitive ecological sites, yet this has been a long standing and accepted practice in Hong Kong. Whilst we accept that this is a legacy issue, we recommend that consideration be given to focusing priority attention on sites identified by the Marine Habitat Assessment Focus Group as being important for conservation. See Figure 2 of Marine Habitat Assessment Focus Group report.

Inadequate set of water quality objectives

Comment: The inadequate set of water quality objectives (e.g. only cover a small subset of chemical pollutants without numerical trigger values for management for most chemicals) is in need of review. A revision of the current WQOs is urgently needed.

Coastal eutrophication, harmful algal blooms and episodic hypoxia events

Comment: We identified this as an activity or issue which is having an adverse impact on marine biodiversity in Hong Kong quite late in our deliberations, so we have included it in our list of our High Priority issues, but because of time constraints, we have not been able to conduct further research into this matter at this stage.

Environmentally unfriendly product additives

Comment: The impacts of 'emerging contaminants' on natural systems are rarely understood, but are a globally recognised area of concern. Hong Kong needs to join this "concern".

Water extraction for cooling

Comment: We identified this as an activity or issue which is having an adverse impact on marine biodiversity in Hong Kong quite late in our deliberations, so we have included it in our list of our High Priority issues, but because of time constraints, we have not been able to conduct further research into this matter at this stage.

Seawater extraction for cooling (as a death trap for billions of marine larvae), for example the larger scale of the District Cooling System (DCS) at the Kai Tak Development (KTD) area using seawater cooling is highly worrisome.

Clam digging on intertidal mudflats

Comment: Clam digging is relentless, un-regulated and out of control at a number of important intertidal mudflats in Hong Kong, resulting in untold damage to the mudflats, seagrass beds, juvenile horseshoe crab nursery grounds and the possible extirpation of *Lingula anatina* on some local mudflats. The current approach to "combat" such activities is "increase education", whereas effective prevention strategies combine elements of publicity, education, community involvement **and** enforcement. It should also be noted, many of the clams collected in Hong Kong are gathered for sale in local markets, posing a serious health risk to consumers because of the locations and conditions in which they are often collected.

Razor shell digging using salt

Comment: This is a new activity in Hong Kong, but one which poses a considerable threat to intertidal mudflat and seagrass bed ecology. We believe using salt like this constitutes a cruel practice and could be addressed with the threat of enforcing Cap 169 – Prevention of Cruelty to Animals Ordinance, until a longer term solution to the problem is found.

Sediment runoff from development and construction sites

Comment: Sediment runoff from development and construction sites poses a current and continuing threat to coastal biodiversity because of a lack of understanding and adequate controls, but it is an issue which can be easily mitigated for if understood.

Trans-national Wildlife Crime

Comment: Hong Kong is a global centre for wildlife trade, including but not limited to Aquarium Trade, Live Reef Fish Trade (LRFT), Treasures of the Sea, Traditional Chinese Medicine (TCM), and under Principle 3 of the Convention on Biological Diversity, we are obliged to

ensure wildlife trade activities here do not result in, or cause damage to the environment of other countries.

Sentencing statements in wildlife crime cases

Comment: Whilst Hong Kong is a global trade centre and transportation hub, it is important that criminals are discouraged from attempting to make use of our facilities for illegal purposes. In terms of illegal trafficking of wildlife, this means ensuring courts are properly informed, so that appropriate punishment can be delivered in deserving cases, by presenting a comprehensive statement of facts laying out all matters relevant to the case.

Introduction

This report documents the work of the Marine Impacts Assessment Focus Group on identifying activities or issues which are assessed as having an adverse impact on marine biodiversity in Hong Kong.

Aim

The aim of this report is to identify issues for consideration and discussion in the BSAP process. On many topics, we have not conducted comprehensive research, but rather have identified key issue or examples to trigger discussion, further research and hopefully on some issues, action.

Scope and approach

The Focus Group drew up a list of activities under the following eight areas:

1. Marine and coastal habitat loss, damage and degradation
2. Adverse impacts of exploitation of marine resources
3. Invasive alien species
4. Marine pollution through waste and waste water disposal;
5. Climate change
6. Marine Traffic
7. Wildlife crime
8. Others

We then prioritized each of the activities we identified under these categories on the basis of whether they were having a high, medium or low adverse impact on marine biodiversity in Hong Kong **and** as to whether they required urgent attention. Because of resource constraints, we then focused the majority of our effort on the High Priority areas.

Focus Group members

Professor Kenneth Leung
Dr Ang Put
Dr Qiu Jianwen
Dr Andy Cornish
Mr P.K.Lee
Mr. Tony Nip
Mr. Kevin Laurie

Contents of this report

The report comprises five sections:

1. Introduction
2. Prioritization process

3. High priority activities or issues
4. Medium priority activities or issues
5. Low priority activities or issues

The report is accompanied by three Annexes:

Annex A – Photographs - Adverse impacts of exploitation of marine resources (habitats, fish and invertebrates)
Annex B - Impact of visitors on High Ecological Value (intertidal) Habitats. A special report on Tung Chung Bay
Annex C. Water Quality Case Studies. Discharge of restaurant waste and greywater in storm water drains

List of contents

Convention on Biological Diversity and relevant Aichi Targets

In compiling this report, the work of the Marine Impacts Assessment Focus Group has been guided by the following Articles of the Convention on Biological Diversity and the relevant Aichi Targets, which are listed below:

Convention on Biological Diversity

Article 7. Identification and Monitoring

Each Contracting Party shall, as far as possible and as appropriate, in particular for the purposes of Articles 8 to 10:

(c) Identify processes and categories of activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity, and monitor their effects through sampling and other techniques;

Article 8. In-situ Conservation

Each Contracting Party shall, as far as possible and as appropriate:

(h) Prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species:

(1) Where a significant adverse effect on biological diversity has been determined pursuant to Article 7, regulate or manage the relevant processes and categories of activities: and

Article 10. Sustainable Use of Components of Biological Diversity Each Contracting Party shall, as far as possible and as appropriate:

(b) Adopt measures relating to the use of biological resources to avoid or minimize adverse impacts on biological diversity;

Article 14. Impact Assessment and Minimizing Adverse Impacts

Each Contracting Party, as far as possible and as appropriate, shall:

(b) Introduce appropriate arrangements to ensure that the environmental consequences of its programmes and policies that are likely to have significant adverse impacts on biological diversity are duly taken into account;

Relevant Aichi Targets

Strategic goal B. Reduce the direct pressures on biodiversity and promote sustainable use

Target 5: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and **degradation** and fragmentation is significantly reduced.

Target 8: By 2020, **pollution,** including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.

Target 9: By 2020, **invasive alien species** and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.

Target 10: By 2015, the multiple **anthropogenic pressures** on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.

Strategic goal C. Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity

Target 12: By 2020 the **extinction of known threatened species has been prevented** and their conservation status, particularly of those most in decline, has been improved and sustained.

Marine Impacts Assessment Focus Group
Prioritization process

A three-step process was used to list the activities or issues which adversely impact on Marine Biodiversity in order of high, medium or low priority:

Step 1 - Identify the activities or issues which impact on Marine Biodiversity, under the following categories:

1. Marine and coastal habitat loss, damage and degradation
2. Adverse impacts of exploitation of marine resources
3. Invasive alien species
4. Marine pollution through waste, waste water disposal and other activities;
5. Climate change
6. Marine Traffic
7. Wildlife crime
8. Others

Step 2 – Prioritize the activities or issues which adversely impact on Marine Biodiversity

A two by two Hi/Lo Importance/Urgency prioritization matrix was used to identify high (Q1), medium (Q2) and low (Q3 and Q4) priority impacts.

Step 3 – List the priorities in order of importance and urgency for action

The impacts were listed according to priority. Comments on Level of Certainty (high/medium/low) have also been made.

PRIORITIZATION PROCESS STEP 1
Identify the activities or issues which adversely impact on Marine Biodiversity

The first step in identifying the activities or issues which have an adverse impact on marine biodiversity in Hong Kong was to list them according to category:

1. Marine and coastal habitat loss, damage and degradation

Reclamation and construction, including rivetment (Sea walls/Embankments/Stream walls)
Breakwaters (tide dominated/wave dominated)
Artificial habitat creation and protection schemes
Underwater acoustic disturbance
Diversion of stream flows
Sediment runoff from development and construction sites
Improper mitigation measures for protecting high ecological value habitats during and after the construction work

2. Adverse impacts of exploitation of marine resources

Marine fish and invertebrates are not protected using current legislation
Important conservation areas are not adequately protected under current legislation
High Ecological Value Habitats are not protected using current legislation
Fishing non-target species
Ghost nets
Fishing in stream mouths
Clam digging on intertidal mudflats
Razor shell digging using salt
Eco-tourism and visitors
Mariculture
Oyster farming
Water extraction for cooling

3. Invasive alien species

Fish release ceremonies
No controls on inshore drainage work leading to spread of invasive species.

4. Marine pollution through waste, waste water disposal and other activities

Use of Septic tanks and soakaway (STS) systems in floodplains
Discharge of restaurant waste and greywater in storm water drains
Illegal discharge of waste and wastewater from farms and industries
Water extraction for cooling (as death traps for billions of marine larvae)
The inadequate set of water quality objectives (e.g. only cover a small subset of chemical pollutants without numerical trigger values for management for most chemicals)
Surface runoff

Coastal eutrophication, harmful algal blooms and episodic hypoxia events
Marine dumping of waste from vessels
Marine dumping of contaminated muds
Contaminants released from sediment dredging
Chlorination residues in treated sewage and cooling water
Environmentally unfriendly product additives (e.g. endocrine disrupting chemicals in detergents, shampoos etc.)
The release of toxic substances from firework display
Historical dumping of weapon munitions and unignited bombs at sea

5. Climate change

6. Marine Traffic

Marine Traffic (Passenger, Freight, Construction, Recreational Vessels)

7. Wildlife crime

Trans-national Wildlife Crime
Sentencing statements

8. Others

Offshore (marine) extraction
Offshore (marine) dumping
Global Fishing effort

PRIORITIZATION PROCESS STEP 2
Prioritise activities or issues which adversely impact on Marine Biodiversity

The second step was to prioritize the activities or issues which have an adverse impact on marine biodiversity in Hong Kong according to Importance and Urgency using a two-by-two Hi/Lo matrix:

1. Marine and coastal habitat loss, damage and degradation

Reclamation and construction, including Rivetment (Sea walls/Embankments/Stream walls)
Importance: High
Urgency: Low

Breakwaters (tide dominated/wave dominated)
Importance: Low
Urgency: Low

Artificial habitat creation and protection schemes
Importance: Low
Urgency: Low

Underwater acoustic disturbance
Importance: High
Urgency: Low

Diversion of stream flows
Importance: High
Urgency: Low

Sediment runoff from development and construction sites
Importance: High
Urgency: High

2. Adverse impacts of exploitation of marine resources

Marine fish and invertebrates are not protected using current legislation
Importance: High
Urgency: High

Important conservation areas are not adequately protected under current legislation
Importance: High
Urgency: High

High Ecological Value Habitats are not protected using current legislation
Importance: High
Urgency: High

Fishing non-target species
Importance: High
Urgency: Low

Ghost nets
Importance: High
Urgency: Low

Fishing in stream mouths
Importance: High
Urgency: Low

Clam digging on intertidal mudflats
Importance: High
Urgency: High

Razor shell digging using salt
Importance: High
Urgency: High

Eco-tourism and visitors
Importance: High
Urgency: Low

Mariculture
Importance: High
Urgency: Low

Oyster farming
Importance: High
Urgency: Low

Water extraction for cooling
Importance: High
Urgency: High

3. Invasive alien species

Invasive alien species
Importance: High
Urgency: High

No controls on inshore drainage work leading to spread of invasive species.
Importance: High
Urgency: Low

4. Marine pollution through waste and waste water disposal;

Use of Septic tanks and soakaway (STS) systems in floodplains
Importance: High
Urgency: High

Discharge of greywater in storm water drains
Importance: High
Urgency: High

Discharge of restaurant waste in storm water drains
Importance: High
Urgency: High

Illegal discharge of waste
Importance: High
Urgency: Low

Surface runoff
Importance: High
Urgency: Low

Inadequate set of water quality objectives
Importance: High
Urgency: High

Coastal eutrophication, harmful algal blooms and episodic hypoxia events
Importance: High
Urgency: High

Environmentally unfriendly product additives
Importance: High
Urgency: High

Water extraction for cooling
Importance: High
Urgency: High

5. Climate change

Climate change
Importance: High
Urgency: Low

6. Marine Traffic

Marine Traffic (Passenger, Freight, Construction, Recreational Vessels)
Importance: High
Urgency: Low to High

7. Wildlife crime

Trans-national Wildlife Crime
Importance: High
Urgency: High

Sentencing statements in wildlife crime cases
Importance: High
Urgency: High

8. Others

Offshore (marine) extraction
Importance: High
Urgency: Low

Offshore (marine) dumping
Importance: High
Urgency: Low

Global Fishing effort
Importance: High
Urgency: Low

PRIORITIZATION PROCESS STEP 3
List the priorites in order of importance and urgency for action

The third step was to list the activities or issues which have an adverse impact on marine biodiversity in Hong Kong according to priority, then comment on certainty.

Other factors were also considered at this stage including extent of problem, impact of proposal, criticality, do-ability and likely biodiversity return. Comments have also been made on specific areas of concern where applicable.

1. High Priority - High importance. High urgency. Requires priority attention

Marine fish and invertebrates are not protected using current legislation
Importance: High
Urgency: High
Certainty: High
Comment: See Executive Summary.

Important conservation areas are not adequately protected under current legislation
Importance: High
Urgency: High
Certainty: High
Comment: See Executive Summary.

High Ecological Value Habitats are not protected using current legislation
Importance: High
Urgency: High
Certainty: High
Comment: See Executive Summary.

Impact of visitors on High Ecological Value (intertidal) Habitats
Importance: High
Urgency: High
Certainty: High
Comment: See Executive Summary.

Invasive Alien Species
Importance: High
Urgency: High
Certainty: High
Comment: See Executive Summary.

Use of Septic tanks and soakaway (STS) systems in floodplains
Importance: High
Urgency: High
Certainty: High

Comment: See Executive Summary.

Discharge of restaurant waste and greywater in storm water drains
Importance: High
Urgency: High
Certainty: High
Comment: See Executive Summary.

Inadequate set of water quality objectives
Importance: High
Urgency: High
Certainty: High
Comment: See Executive Summary.

Water extraction for cooling
Importance: High
Urgency: High
Certainty: High
Comment: See Executive Summary.

Environmentally unfriendly product additives
Importance: High
Urgency: High
Certainty: High
Comment: See Executive Summary.

Clam digging on intertidal mudflats
Importance: High
Urgency: High
Certainty: High
Comment: See Executive Summary.

Razor shell digging using salt
Importance: High
Urgency: High
Certainty: High
Comment: See Executive Summary.

Sediment runoff from development and construction sites
Importance: High
Urgency: High
Certainty: High
Comment: See Executive Summary.

Trans-national Wildlife Crime
Importance: High

Urgency: High
Certainty: High
Comment: See Executive Summary.

Sentencing statements in wildlife crime cases
Importance: High
Urgency: High
Certainty: High
Comment: See Executive Summary.

2. Medium Priority - High importance. Low urgency. Requires further study, systems are already in place or requires less urgent attention

Reclamation and construction, including rivetment (Sea walls/Embankments/Stream walls)
Importance: High
Urgency: Low
Certainty: High
Comment:

Diversion of stream flows
Importance: High
Urgency: High
Certainty: High
Comment:

Fishing non-target species
Importance: High
Urgency: Low
Certainty: Low
Comment: Requires more study.

Ghost nets
Importance: High
Urgency: Low
Certainty: High
Comment:

Fishing in stream mouths
Importance: High
Urgency: Low
Certainty: Low
Comment: Requires more study.

Eco-tourism and visitors
Importance: High
Urgency: Low

Certainty: High
Comment:

Mariculture
Importance: High
Urgency: Low
Certainty: High
Comment: Raising of voracious predatory fish which are then sold for religious release ceremonies is a cause for concern.

Oyster farming
Importance: High
Urgency: Low
Certainty: High
Comment:

Illegal discharge of waste
Importance: High
Urgency: Low
Certainty: High
Comment: Legislation and systems are already in place to deal with offenders.

Surface runoff
Importance: High
Urgency: Low
Certainty: High
Comment:

Climate change
Importance: High
Urgency: Low
Certainty: Low
Comment: Certainty on impacts on biological diversity is low.

Marine Traffic (Passenger, Freight, Construction, Recreational Vessels)
Importance: High
Urgency: Low to High
Certainty: High
Comment: Priority issue of concern: Direct discharge of sewage discharge from local passenger, freight, construction and recreational vessels

Offshore (marine) extraction
Importance: High
Urgency: Low
Certainty: High
Comment: Systems are already in place to deal with most aspects.

Offshore (marine) dumping
Importance: High
Urgency: Low
Certainty: High
Comment: Systems are already in place to deal with most aspects.

Global Fishing effort
Importance: High
Urgency: Low
Certainty: High
Comment: A Convention on Biological Dicersity Article 3 Issue.

3. Low Priority - Low importance. Low urgency. Something to be aware of, requires further study or less urgent attention

Breakwaters (tide dominated/wave dominated)
Importance: Low
Urgency: Low
Certainty: High
Comment:

Artificial habitat creation and protection schemes
Importance: Low
Urgency: Low
Certainty: Low
Comment:

4. Not considered due to late identification

Contaminants released from sediment dredging
Chlorination residues in treated sewage and cooling water
The release of toxic substances (e.g. heavy metals and TNT) from firework display
Historical dumping of weapon munitions and unignited bombs at sea
Improper mitigation measures for protecting high ecological value habitats during and after the construction work

SECTION 1 HIGH PRIORITY
(High importance, High urgency. Requires priority attention)

Fish and marine invertebrates are not protected using current legislation

Note: When reading this section, **please refer to the photographs in Annex A** of this report.

Status and Trends

Despite there being legislation to protect fish and marine invertebrates in Hong Kong, it is not being widely used, leaving fish and invertebrates vulnerable to unregulated exploitation. The following case shows the consequences of not using this legislation.

Case study. Between 1980 and 2001, a Japanese pharmaceutical company set up a clandestine horseshoe crab bleeding facility in Hong Kong, to extract Tachypleus Amoebocyte Lycate (TAL) from local populations of the Chinese horseshoe crab, *T. tridentatus*. TAL is used in bacterial endotoxin detection.

This facility was set up in a shark fin warehouse in Sheung Wan and horseshoe crabs were delivered there on a daily basis from the local trawling fleet. The crabs were bled dry, then returned to the fishermen for disposal (Novitsky.2012)

In parallel with these clandestine bleeding activities, adult populations of *T. tridentatus* in Hong Kong saw considerable population declines at around 90%. Similar declines were witnessed in China. Because of these activities *T. tridentatus* is now provisionally assessed as being Critically Endangered in Hong Kong, whilst it is Endangered in China.

Whilst this study focuses on *T. tridentatus,* this situation applies to all aquatic life (except turtles) in Hong Kong.

Systems in place.

Three ordinances relate to the various aspects of protection that can be afforded to fish, animals and invertebrates in Hong Kong:

(a) Cap 169 – Prevention of Cruelty to Animals Ordinance;
(b) Cap 170 – Wild Animals Protection Ordinance; and
(c) Cap 171 – Fisheries Protection Ordinance.

Under these ordinances, the following definitions apply:

Cap 169 – PCAO - "animal" (動物) includes any mammal, bird, reptile, amphibian, fish or any other vertebrate or invertebrate whether wild or tame;

Cap 170 – WAPO - "animal" (動物) means any form of animal life other than fish and marine invertebrates;

Cap 171 – FPO - fish (魚類) includes all forms of aquatic life and turtles.

Based on the above, the legislative intent of the law drafters is clear. Cap 169 offers protection to animals, fish and invertebrates from cruelty, Cap 170 offers protections to animals and Cap 171 offers protections to all forms of aquatic life, which by definition includes fish and invertebrates. It is also important to note, Cap 170 (WAPO) and Cap 171 (FPO) are "sister" ordinances. They were designed to be mutually exclusive, at the same time complementing each other.

Comment

The FPO provides for the protection of fish and invertebrates as follows:

Under Section 4 – Regulations of the FPO (Cap 171), The Chief Executive in Council may by regulation provide for: (c) **the prohibition or restriction of the taking of any variety of fish, or fish of any size, from the waters of Hong Kong;** (g) the protection of spawning areas; and (h) generally, **the protection or regulation of fishing**.

Under Section 4A – Orders of the FPO Regulations (Cap 171), The Secretary (Secretary for Food and Health) may, by order published in the Gazette — (a) designate any area of the waters of Hong Kong to be a fisheries protection area to promote the **conservation and management** of **marine** and fisheries **resources.**

Using these provisions under the FPO, it is possible to ban the capture and retention of horseshoe crabs (an invertebrate) in Hong Kong and declare all Hong Kong waters a horseshoe crab fisheries protection area.

Gaps to be filled

(1) Details of species deserving protection will be provided by the BSAP Status and Trend and Red List Focus Group.

(2) There is currently no agreed mechanism to propose species deserving of protection.

Priority Actions

Priority 1. Agree on a mechanism to propose species deserving of protection.

Priority 2. Compile a comprehensive list of species deserving protection.

Priority 3. Initiate the regulatory and gazetting processes.

References

Novitsky, T.J. (2012) *The search for an LAL/TAL alternative – science, politics, and the future of horseshoe crab*. Seminar presentation at City University of Hong Kong, Hong Kong, 29 February 2012.

Important conservation areas are not adequately protected under current legislation

Note: When reading this section, **please refer to the photographs in Annex A** of this report.

Status and Trends

According to Chapter 10, Section 1.1 of the Planning Department website, "**Conservation is considered here in terms of land use**, which can be shown by zoning on town plans. In such conservation zones, there is a general presumption against development and the uses which are permitted may be subject to the imposition of appropriate conditions. This chapter explains the policies and measures which are available to provide for conservation in town plans in Hong Kong. It is not intended that all aspects of conservation will be included. **Wider issues such as the maintenance of biological and geological diversity are not discussed** but they are acknowledged as motivating forces for reserving land for conservation use".

The designation of conservation zones in Hong Kong is therefore considered as a planning issue, not a conservation of biodiversity issue and this is highlighted by the fact that the "protections" that most conservation designations carry "**a general presumption against development**".

Major conservation zone classifications are listed in Chapter 10. Conservation, Section 3 Conservation of Natural Landscapes and Habitats, under the section on Statutory Town Plans:

Statutory Town Plans

3.5.2 The Town Planning Ordinance empowers the Town Planning Board to prepare town plans with statutory land use zones under clause 4(1)(g) for 'country parks, coastal protection areas, sites of special scientific interest, green belts or other specified uses' to promote conservation or protection of the environment.

Some of the major conservation zones on statutory town plans i.e. OZPs and DPA Plans include :

(i) "Country Park"	To reflect a country park or special area as designated under the Country Parks Ordinance (Cap 208), where all uses and **developments require consent** from the Country and Marine Parks Authority.
(ii) "Coastal Protection Area"	To conserve, protect and retain the natural coastlines and the sensitive coastal natural environment, including attractive geological features, physical landform or area of high landscape, scenic or ecological value, with a minimum of built development; and to cover areas which serve as natural protection areas sheltering nearby developments against the

		effects of coastal erosion, with **a general presumption against development.**
(iii)	"Site of Special Scientific Interest"	To conserve and protect the features of special scientific interest such as rare or particular species of fauna and flora and their habitats, corals, woodlands, marshes or areas of geological, ecological or botanical/biological interest which are designated as SSSI and to deter human activities or developments within the SSSI, with **a general presumption against development.**
(iv)	"Green Belt"	To primarily conserve the existing natural environment amid the built-up areas/at the urban fringe, to safeguard it from encroachment by urban type development, to define the limits of urban and sub-urban development areas by natural features, to contain urban sprawl as well as to provide passive recreational outlets, with **a general presumption against development.**
(v)	"Conservation Area"	To protect and retain the existing natural landscape, ecological or topographical features of the area for conservation, educational and research purposes and to separate sensitive natural environment such as SSSI or Country Park from the adverse effects of development. There is **a general presumption against development in this zone.**

To avoid duplication of statutory authority, development control in the "Country Park" is mainly carried out by the Land Authority (i.e. Director of Lands) on advice from the Country and Marine Parks Authority.

3.5.3 To **regulate developments** within the wetland area around Mai Po Marshes and Inner Deep Bay near the Ramsar Site, the following land use zones are introduced:

(i)	"Conservation Area" (for wetland only)	To **discourage new development** unless it is required to support the conservation of the ecological integrity of the wetland ecosystem or the development is an essential infrastructure project with overriding public

		interest.
(ii)	"Other Specified Uses (Comprehensive Development and Wetland Enhancement Area)"	For conservation and enhancement of ecological value and functions of the existing fishponds or wetland through **consideration of application for development or redevelopment** under the "private-public partnership approach". The "no-net-loss in wetland" principle is adopted for any change of use in this zone.
(iii)	"Other Specified Uses (Comprehensive Development to include Wetland Restoration Area)"	To provide incentive for the restoration of degraded wetlands adjoining existing fish ponds through **comprehensive residential and/or recreational development** to include wetland restoration area, and to phase out existing sporadic open storage and port back-up uses on degraded wetlands.

Development within these zones should also comply with the Town Planning Board Guidelines for Application for Developments within Deep Bay Area (TPB PG-No. 12B) (Planning Department website. Undated).

Comment

Whilst these designations protect ecologically important sites from development, they do not address the conservation of biodiversity.

Example

The Tai Ho Stream on Lantau was designated a Site of Special Scientific Interest (SSSI 63) in 1999, because it is one of the few remaining medium-sized natural streams stretching from uplands to the lowland estuary and because it supports the greatest diversity of fresh water and brackish-water fish in the territory. The SSSI includes the mangrove and seagrass beds which are close to the mouth of the stream, and which provide shelter and food for a variety of intertidal and marine invertebrates. Tai Ho Wan is also a well documented important and active horseshoe crab spawning ground and nursery area.

In August 2014 villagers cut down the mangrove stands at the mouth of the Tai Ho Stream in a direct challenge to government plans to formally protect the area, whilst the government appears unable to do anything, because the damage was conducted on private land.

Gaps to be filled

(1) The Tai Ho Wan case highlights the serious inadequacies of Hong Kong laws to protect the conservation of biodiversity through the system of designated areas.

Priority Actions

Priority 1. An urgent review needs to be conducted into the designation of conservation zones in Hong Kong, to address the issue of incorporating the **conservation of biodiversity** as a main theme when such designations are made.

Priority 2. The enactment of legislation with serious consequences for offenders needs to be considered to allow for the enforcement of protections.

References

Planning Department website. Chapter 10. Conservation, Section 3 Conservation of Natural Landscapes and Habitats. Undated. Available online at: http://www.pland.gov.hk/pland_en/tech_doc/hkpsg/full/ch10/ch10_text.htm#3.

High Ecological Value Habitats are not protected under current legislation

Note: When reading this section, **please refer to the photographs in Annex A** of this report.

Current situation

SUSDev21 identified Mangroves, Seagrass Beds and Intertidal Mudflats as High Ecological Value Habitats in intertidal areas in Hong Kong:

Because of their easy access at low tide, many of these habitats are facing threats from multiple sources and in practice, there are limited or no real protections in place for any of these habitats.

(a) The lower reaches of natural watercourses are heavily fished with monofilament nets which are stretched across entire stream mouths, crab box nets are laid out along the sides of watercourses and fishermen using handheld nets looking for bait.

(b) Mangroves are frequently being visited by Eco-tours, nature lovers as well as by gleaners looking for certain species of bivalve and gastropod.

(c) Intertidal mudflats, some with seagrass beds are continuously subject to fishing with monofilament nets, stake netting (needs licensing), crab box nets, electric fishing, clam diggers and gleaners. In addition, these areas are increasingly being promoted as areas for family beach recreation activities, sunset watching, family visits to go 'crabbing', clam digging and more recently, razor shell fishing with salt. A vehicle was recently driven the seagrass beds at Ha Pak Nai, to test the feasibility of promoting beach driving.

Such activities are widespread, incessant and highly damaging. Such activities may already have lead to local extirpations of *Lingula anatina* at locations like Shui Hau and if such activities are not stopped at Tung Chung and Shui Hau, the juvenile *Tachypleus tridentatus* foraging grounds will be rendered un-useable and *T. tridentatus* will be extirpated at these two locations.

Mangroves

Example 1. The Tai Ho Stream, Lantau, Hong Kong was designated a Site of Special Scientific Interest (SSSI 63) in 1999, because it is one of the few remaining medium-sized natural streams stretching from uplands to the lowland estuary and because it supports the greatest diversity of fresh water and brackish-water fish in the territory. The SSSI includes the mangrove and seagrass beds which are close to the mouth of the stream, and which provide shelter and food for a variety of intertidal and marine invertebrates. Tai Ho Wan is also a well documented important and active horseshoe crab spawning ground and nursery area.

In 2012, one of the mangrove stands at the mouth of the Tai Ho Stream was cut down but the government was unable to do anything, because the site was on private land, demonstrating the limited protections offered to mangroves in Hong Kong.

Seagrass Beds.

In January 2002 the Coastal Community Group of AFCD initiated a baseline information survey to chart the distribution of seagrass beds in Hong Kong, to facilitate their conservation. Of the 53 sites visited, seagrass beds were found at 16 sites, 11 of which had not been previously reported. Three species were recorded, with distribution as follows: *Halophila ovalis* – found at 13 sites, *Halophila beccari* – found at 3 sites, and *Zostera japonica* – found at 7 sites.

The largest *H. beccari* bed, and also the largest seagrass bed in Hong Kong occurs at Ha Pak Nai and covers an area of approximately four hectares. (FONG. 1998).

Among the 16 seagrass sites studied in the survey, six of them are protected under different conservation status in Hong Kong ("Site of Special Scientific Interest" for Lai Chi Wo, San Tau and Sheung Pak Nai; "Marine Park" for Hoi Ha and "Coastal Protection Area" for Ham Tin and Sheung Sze Wan) as all the three seagrass species can be found.

All established seagrass beds are considered important habitats under the Environmental Impact Assessment Ordinance. Any proposed development that may affect this habitat has to undergo the ecological impact assessment process, so as to avoid / minimize the threats to the seagrass communities. (Kwok et al. 2005).

Example 2. The *H. beccari* seagrass beds at Pak Nai (Aap Chai Hang) are an important nursery ground where juvenile horseshoe crabs develop and they are one of the only localities in Hong Kong where the juveniles of both species of horseshoe crab in Hong Kong have been observed to co-exist.

In 2009 an oyster farmer started planting mangroves on one of the seagrass beds at Aap Chai Hang to silt up the stream which discharges there, to stop the sand from the stream from affecting her oysters. In the process, this activity is destroying the seagrass bed and therefore threatens the survival of the juvenile horseshoe crabs there.

Because the government has rented (Short Term Tenancy Agreement) the whole of the intertidal seabed in Deep Bay to the oyster farming industry, they are unable to intervene.

Comment

Under Section 4A – Orders of the Fisheries Protection Ordinance Regulations (Cap 171), The Secretary (Secretary for Food and Health) may, by order published in the Gazette — (a) designate any area of the waters of Hong Kong to be a fisheries protection area to promote the **conservation** and management of **marine** and fisheries **resources.**

Stake netting - No person shall in the waters of Hong Kong- (2a) erect or maintain a stake net except under, and in accordance with, a licence issued under Regulation 68 of Chapter 313A, Shipping and Port Control Regulations – Control of Fishing.

Gaps to be filled

(1) The laws in Hong Kong currently do not offer adequate protections from human activities, including exploitation, to High Ecological Value Habitats in coastal areas including Mangroves, Seagrass Beds and Intertidal Mudflats.

Priority Actions

Priority 1. Measures should be put in place to protect High Ecological Value Habitats from human activity. Under Section 4A – Orders of Cap 171, Fisheries Protection Ordinance the Secretary for Food and Health may, by order published in the Gazette - (a) designate any area of the waters of Hong Kong to be a fisheries protection area to promote the conservation and management of marine and fisheries resources. This could include introducing 'Restricted areas/restricted times' policies.

Priority 2. A proper monitoring system should be put in place to identify and address threats to High Ecological Value Marine Habitats.

Priority 3. In the long term, consideration should be given to introduce legislative protections to protect High Ecological Value Marine Habitats.

Priority 4. Consideration should be given to building board walks to promote and protect High Ecological Value Habitats in intertidal areas.

References

FONG Chung-wai, Terence. 1998. *Distribution of Hong Kong seagrasses.* Porcupine 18. Available online via: www.hku.com

Kwok. P.W., Yang. K.Y., Tong. Y.F. and Lam. C.P. 2005. *Distribution of seagrasses in Hong Kong*. Hong Kong Biodiversity Issue No. 8. AFCD HK

Impacts of increasing visitor numbers on High Ecological Value Habitats

Note: When reading this section, **please refer to the photographs in Annex B** of this report (Adverse impact of visitors to intertidal mudflats- A Special Report on Tung Chung Bay).

Status and Trends

Many previously remote areas in Hong Kong are being opened up to development. Tung Chung is being expanded, the Lantau Development Advisory Committee is currently considering how best to realize Lantau's development potential and country park enclaves are being opened up to allow for expanded village developments.

What is also common to many of these areas is that they lie adjacent to High Ecological Value Habitats and better infrastructure and increased populations results in increased visitor numbers to these ecologically important and sensitive areas.

What is also common, is that whilst there are mechanisms in place to guide planning decisions, there are no mechanisms in place to consider the impacts that these increased visitor numbers will have, or the pro-active conservation of biodiversity when these planning decisions are being made.

At the moment, the approach of "balancing development with conservation" is in reality a matter of balancing development with avoidance of development, while not considering conservation of biodiversity.

Example

The intertidal area at Tung Chung Bay is situated next to a major and mixed population centre and like many mudflats in Hong Kong, is connected to good transport routes and is easily accessible.

Tung Chung is now undergoing an expansion, with development in the east adding a new population of 117,000 people, in addition to increased development of commercial offices, all of which will lead to more visitors to the mudflat, increasing the already unacceptable levels of exploitation documented in this report even further.

Horseshoe crab habitat requirements

Tung Chung Bay is an important horseshoe crab locality, being an active horseshoe crab spawning ground and nursery area for the two species of horseshoe crab that live in Hong Kong, *Tachypleus tridentatus* (Chinese horseshoe crab) and *Carcinoscorpius rotundicauda* (Mangrove horseshoe crab).

Horseshoe crabs have different habitat requirements during different stages of their life, related to spawning and early juvenile development, juvenile development and adult life. All of these habitats are present in Tung Chung Bay, where in terms of habitat use:

(a). adults of both species use streams to navigate across mudflats and beaches to reach their spawning locations along the high tide line,

(b). *C. rotundicauda* spawns along stream banks in mangrove stands and rests in stream beds when the tide recedes during spawning events,

(c). juvenile *C. rotundicauda* forage in stream beds and on the area of the intertidal mudflat with a predominantly muddy component,

(d). juvenile *T. tridentatus* forage on the area of the intertidal mudflat with a predominantly sandy component,

(e). sub-adults of both species forage in the sub-tidal area, whilst pairs of mating adults congregate in subtidal areas prior to spawning.

Gaps identified

(1) Whilst much of the conservation effort in Hong Kong focuses on mitigating or avoiding development, much of the conservation pressure comes from more mundane human activities, most of which are currently not considered an issue;

(2) There are currently no protections in place to protect the high ecological value habitats at Tung Chung, or elsewhere from the activities documented in this report;

(3) The prevailing view of marine resources in Hong Kong focuses on "fisheries". It is time to consider the use of marine resources is not limited to fishing. It includes a wide range of activities, including science, recreation, education and ecotourism;

(4) The powers that are available to regulate or manage many of these activities, and protect these habitats under the Fisheries Protection Ordinance Regulations and Orders (Cap 171) are not used.

Priority actions

Priority (1). The environmental impact of any increase in population or visitor numbers in any environmentally sensitive area now has to be a key consideration when taking any expansion project forward.

Priority (2). A study should be undertaken to identify all environmentally sensitive area in Hong Kong which have suffered increased visitor numbers, with a view to identifying areas critical for conservation and areas amenable to exploitation, with a view to designating different areas for different activities, with the primary objective of protecting the ecologically most sensitive areas;

Priority (3). Subject to the findings of Priority (2), the powers that are available to regulate or manage many of these activities, and protect important habitats under the Fisheries Protection Ordinance Regulations and Orders (Cap 171) should be used.

Priority (4). In future development plans next to any environmentally sensitive area, consider capitalising on the scientific, educational and ecotourism potential of the area when formulating the plans;

Priority (5). In all current and future land development plans, an overarching concern should be on the balance between land development and conservation of biodiversity, specifically through habitat protection. In all cases, due consideration should be given to ecologically sensitive habitats, especially on the issue of designation of protected areas/zones. Such considerations should not be limited to mudflats. They should be made in respect of all habitats. This is a CBD "mainstreaming" issue.

Priority (6) Consideration should be given to constructing board walks in suitable environmentally sensitive areas, to both protect and promote the environment.

Comment

Many of the activities shown in the photographs accompanying this report could be regulated under the Fisheries Protection Ordinance Regulations (Cap 171).

Under Section 4 – Regulations, the Chief Executive in Council may by regulation provide for (c) the prohibition or restriction of the taking of any variety of fish, or fish of any size, from the waters of Hong Kong; (d) the prohibition or restriction of the use of any specified kinds of net or of nets having a mesh of any specified size for the purpose of fishing; (g) the protection of spawning areas; (ga) the prohibition or restriction of the use of any apparatus of a class or description specified under paragraph (gb), for the purpose of fishing; and (h) generally, the protection or regulation of fishing. (Under the regulations, fish (魚類) includes all forms of aquatic life and turtles).

Under Section 4A – Orders, The Secretary (Secretary for Food and Health) may, by order published in the Gazette, (a) designate any area of the waters of Hong Kong to be a fisheries protection area to promote the conservation and management of marine and fisheries resources. It should be noted, use of marine resources is not limited to fishing. It includes such activities as science, education and ecotourism.

Alien invasive species

Status and Trends

The following pathways for introduction of alien invasive species into the Hong Kong Marine Environment are of concern:

1. Intentional release of marine organisms (e.g. the red drum fish and Sabah groupers) during religious release ceremonies,

2. Introduction of exotic marine species (e.g. the solitary ascidian *Ciona intestinalis*, the slipper limpet *Crepidula onyz*, the boring isopod *Sphaeroma walkeri*, and the mussel *Mytilopsis sallei*) through the release of ballast water in the marine environment of Hong Kong,

3. Release of exotic species (e.g. the Sabah groupers) through escape from mariculture activities (the introduction could be intentional (e.g. introduce exotic species for farming) and unintentional (e.g. release of exotic species associated with the imported oysters for farming),

4. Release of exotic species (e.g. the blue-ringed octopus) from aquarium trade and pets' owners,

5. No controls on inshore drainage work leading to spread of invasive species.

Example 1: Sabah Giant Grouper

The Sabah Giant Grouper, a cross-breed bred in Malaysian fish farms specifically for consumption. The fish has become a popular choice for release in Hong Kong as it is large and relatively cheap at HK$60 to HK$90 a catty (600 grams). It looks like a local giant grouper, but costs less. The current scientific consensus is that hybrid grouper are infertile – but since their reproductive cycle isn't fully understood, this is far from fact.

At an Intergovernmental Forum of the six Coral Triangle countries in early 2013, experts noted:

(a) One major breakthrough in the culture of grouper in Malaysia is the Sabah Hybrid. First developed by scientists at the University Malaysia Sabah (UMS), the Sabah Hybrid has gained popularity among fish growers for its fast growth rate and low mortality rate. Several variants have since been produced in private hatchery facilities.

(b) Malaysia has been producing a lot of hybrid groupers. It is good in one way, but it also poses a risk to wild stocks. It was important to use hybrids carefully because it is very easy for them to escape into the wild and interbreed with wild fish.

(c) The hybrids are not capable of natural reproduction – they have to be injected with hormones to bear eggs. But there is no guarantee that the hormones that induce spawning are not found in fertilizers or pesticides used for the agriculture industry. Fertilizers and pesticides can contaminate the sea as runoff and if they contain the right hormones, **there**

is potential for these hormones to induce spawning in any hybrid groupers that escape into the wild (SEAFDEC. 2013).

How is this issue dealt with elsewhere

The central Taiwan Government amended their Wildlife Conservation Act this Jan (Article 32 and 46) as they identified that the problems of mercy release are very serious. However, the exact wordings are still not available. Relevant announcement is at below link.

Taiwan (Wildlife Conservation Act – Amendment (Articles 31 and 46 in Jan 2014)
http://www.ey.gov.tw/en/News_Content2.aspx?n=1C6028CA080A27B3&sms=E0588283EFAA02AD&s=D1AE282D63439F11

But at least two counties of Taiwan already have their own laws regulating mercy release (see below, in Chinese only):

Taichung (a county of Taiwan) 臺中市放生保育自治條例
http://210.69.115.31/GLRSout/NewsContent.aspx?id=3012

Nantou (a county of Taiwan)
南投縣放生保育自治條例
http://link.nantou.gov.tw/glrsout/LawContentDetails.aspx?id=FL042915&KeyWordHL=&StyleType=1 (in Chinese only)

Links related to similar laws in the UK, Australia and US are attached below:

UK

https://www.gov.uk/nonnative-wildlife

Page 15 item 14 in the Wildlife and Countryside Act relates to live animal release
http://jncc.defra.gov.uk/PDF/waca1981_part1.pdf

RSPCA summary of UK Wildlife legislation
http://www.rspca.org.uk/allaboutanimals/wildlife/laws

NNSS - None native species secretariat (see attached leaflet)
https://secure.fera.defra.gov.uk/nonnativespecies/index.cfm?pageid=328

Australia

Australian Department of the Environment – laws and regulations
http://www.environment.gov.au/biodiversity/wildlife-trade/exotic-animals/index.html

USA

In the US, the Lacey Act protects native biodiversity interests from invasive/exotics and injurious wildlife (See also the section in this report on Trans-national Wildlife Crime).

Summary of Lacey Act and listed species
http://www.fws.gov/injuriouswildlife/

Example 2: *Spartina anglica*

Common names: common cord grass (English), Englisches Schlickgras (German), rice grass (English), townsends grass (English)

Spartina anglica is a perennial salt marsh grass which has been planted widely to stablize tidal mud flats. Its invasion and spread leads to the exclusion of native plant species. It is currently spreading across the *Halophila beccari* seagrass beds in Deep Bay. Cord grass is being spread by flood prevention works in the lower reaches of rivers in Deep Bay, because no mitigation measures are being taken to control the spread of root fragments when excavation work is being undertaken on cord grass outcrops.

Gaps to be filled

(1) It is recommended the issue of the religious release of the Sabah Giant Grouper be raised with the Animal Welfare Advisory Group (under AFCD), in the hope of triggering a wider debate on these activities.

(2) An advisory be prepared on mitigation measures to prevent the spread of cord grass during flood prevention works in Deep Bay.

Priority Actions

Priority 1. Take **URGENT** action to address the release of predatory species of concern at religious fish release ceremonies. Priority focus on the Sabah Giant Grouper.

Priority 2. Consideration could be given to contacting local spear fishing groups to recruit them to hunt existing Sabah Great Grouper and other high profile invasive alien species.

Priority 3. An advisory be issued by the Drainage Services Department to prevent the spread of cord grass during flood prevention works in Deep Bay.

References

SEAFDEC. Coral Triangle initiative. Live Reef Food Fish Trade Intergovernmental Forum Bangkok, Thailand, January 31 and February 1, 2013. Available online at: http://www.coraltriangleinitiative.org/sites/default/files/resources/LRFFTInter-GovernmentalForum31Jan-1Feb2013FullProceedingsReport_21Feb13_Final_V3.pdf

Use of Septic tanks and soakaway (STS) systems in floodplains

Status and Trends

Floodplains and alluvium

About 5% of Hong Kong is occupied by rivers and their floodplains and deposits in the lower reaches of rivers largely comprises alluvium (Owen. B & Shaw. R. (2007) Hong Kong landscapes. Shaping the barren rock. HKU Press).

During particularly heavy rainstorms, flooding in the rural low-lying areas and natural flood-plains in the northern part of the territory and in parts of the older urban areas may occur (Drainage Services Department website.Undated)

Alluvium is permeable. Water flows freely through it and water levels in alluvium can rise or fall because of the groundwater level, rates of precipitation and the influences of sea level, including tides and storm surges. Because of this, river valleys with alluvium are susceptible to flooding, hence the name floodplains (Laurie.2014)

Government guidelines on sewage disposal

Because of the geomorphology of Hong Kong, these flooplains have historically and are currently the focus of village type habitation, but because of their remoteness, there is rarely existing sewer or planned public sewers for the areas, so that at present, houses would typically be served with their own on-site septic tanks and soakaway (STS) system. Any increase in residential developments would require additional facilities, including their own individual STS system, which need to comply with relevant standards and regulations, such as EPD's Practice Note for Professional Person (ProPECC) 5/93.

According to the relevant EPD standards and regulations: Guidance Notes on Discharges from Village Houses, this involves dispersing untreated wastewater into the surrounding soil and relying on the soil to remove the polluting material from the wastewater and adequate purification can only be achieved after the wastewater has travelled a fairly long distance through the ground.

Specifically, the Guidance Notes on Discharges from Village Houses state "Polluting material is only removed from the wastewater after travelling a long distance in the soil. Pollution would result if a STS is located too near to a beach, a stream …" (Para 6 of the Guidance Notes) and "A STS system is not feasible in areas with high ground water table" (Para 24 (b) of the Guidance Notes).

Why septic tanks won't work in floodplains and alluvial deposits

Floodplains are prone to flooding, so according the government's own guidelines, STS systems are not feasible in floodplains.

Alluvial deposits allow for rapid drainage, so no matter how far the distance, interstices in these deposits means adequate purification cannot be achieved before the wastewater reaches the sea, and because many of Hong Kong's village habitations are at the mouth of a watershed, this means all of the pollutants in the wastewater will ultimately be deposited in the sea.

International situation

There are numerous studies on this. This report refers readers to a review undertaken in Northwest USA entitled "Septic System Impact of Surface Waters" and there are many more (Tri-State Water Quality Council. 2005).

Threats to biodiversity

Two of the main nutrient products of STS systems are nitrogen and phosphorous (Department of Local Government, New South Wales)

Many coastal areas in Hong Kong have coral communities. Two of the worst nutrient threats to coral communities are excess nitrogen and phosphorous. For example, if wastewater is not properly treated nutrients such as nitrogen and phosphorous in the waste can stimulate prolific growth of algae, which overgrows corals, or form algal mats which prevents new polyps from settling and establishing themselves. Worst still, some chemicals in the wastewater could simply kill the more sensitive species of coral in the bay. (Global Coral Reef Alliance.1994).

Other threats

Example: Down the drain' chemicals - Ibuprofen posing potential threat to fish

Many rivers contain levels of ibuprofen that could be adversely affecting fish health, researchers report. To establish the level of risk posed by ibuprofen at the country scale, researchers in the UK examined 3,112 stretches of river which together receive inputs from 21 million people.

The results of the research show closer attention should be paid to the environmental impacts of drugs such as ibuprofen which are freely available in supermarkets, chemists and elsewhere. While the study focused on pharmaceuticals, the approach developed could also be valuable in assessing the risks of other **'down the drain' chemicals** and could help inform understanding of the important **dissipation processes for pharmaceuticals in the pathway from the patient to the environment** (Boxall et al. 2014).

Gaps to be filled

(1) There is a low level of understanding in Hong Kong on the Geotechnical Constraints of undertaking development in floodplains or on alluvial deposits associated with using on-site septic tanks and soakaway (STS) systems in such areas.

(2) The Hong Kong Geological Survey has produced an incredible series of Geological Maps documenting the geology of Hong Kong and geological maps represent the most fundamental

planning tool available to planners, yet they are not routinely used in Hong Kong when making development decisions.

Priority Actions

Priority 1. A formal review be conducted of the siting of on-site septic tanks and soakaway (STS) systems in floodplains and on alluvial deposits.

Priority 2. When any developments in coastal floodplains are being considered, recognition must be given to the Geotechnical Constraints associated with undertaking development in floodplains or on alluvial deposits associated with using on-site septic tanks and soakaway (STS) systems in such areas.

Priority 3. Mandatory use of Geological Maps be made when making land development decisions in Hong Kong

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Global Coral Reef Alliance . *Coral reefs, Sewage and Water Quality Standards*. 1994. [online]. Available online at: http://www.globalcoral.org/CORAL%20REEFS.%20SEWAGE,%20AND%20WATER%20QUALITY%20STANDARDS.htm

Laurie, K. (2014) Presentation to Town Planning Board on 8 May 2014. Geological Constraints on Village House Development in Hoi Ha, Pak Lap and So Lo Pun.

Tri-State Water Quality Council . *Septic System Impact of Surface Waters*. 2005.

Discharge of restaurant waste and greywater in storm water drains

Note: When reading this section, **please refer to the Powerpoint in Annex C** of this report.

Status and Trends

Storm water and urban run-off are released directly into local waters with negligible treatment. Locally this can alter the salinity of the water column and cause nutrient and contaminant enrichment, but of particular concern is the local practice of discharging restaurant waste and greywater into storm drains for disposal.

Added to this is the fact new compounds and chemicals are being synthesised every day. The impacts of 'emerging contaminants' on natural systems are rarely understood, but are a globally recognised area of concern. Much of this concern stems from the nontraditional pathway in which the contaminants make it into the environment; from manufacturing plants to the consumer, then through established consumer waste systems. These contaminants can be from pharmacological cosmetic products, through to new waste material from the emerging field of nano-technology (Hedge et al. 2013)

We have added a Powerpoint at Annex C of this report with case studies of Lung Mei Village in Tai Po and Ma Wan New Village in Tung Chung, to illustrate the extent of the problem locally.

Example: Certain kinds of sunblock react with the sun's rays when they enter the water to create hydrogen peroxide, a compound found in bleach and household cleaning products. Unfortunately for the aquatic environment, the substance used to keep kitchen counters sparkling clean can also prove toxic to plants that are essential to the underwater food chain.

Chemicals from sunscreens (i.e., UV filters) accumulate in the sea and have toxic effects on marine organisms, for example the photoexcitation of inorganic UV filters (i.e., TiO_2 and ZnO nanoparticles) under solar radiation produces significant amounts of hydrogen peroxide (H_2O_2), a strong oxidizing agent that generates high levels of stress on marine phytoplankton. The inorganic oxide nanoparticle content in 1 g of commercial sunscreen produces rates of H_2O_2 in seawater of up to 463 nM/h, directly affecting the growth of phytoplankton (Sanchez-Quiles et al. 2014)

The problem with this is, many village developments in coastal areas in Hong Kong are geared towards weekends tourists, who when they shower, will be discharging such new novel chemicals directly into local coastal waters via storm drains.

Gaps to be filled

(1) There is little or no understanding of what is being directly discharged into the environment via storm drains, where it is being discharged or what impact it is currently having now, or is likely to have in the future.

(2) The impacts of 'emerging contaminants' on natural systems are rarely understood, but are a globally recognised area of concern. Hong Kong needs to join this "concern".

Priority Actions

Priority 1. We recommend overlaying a map of areas where restaurant waste and greywater is being discharged into storm water drains on the sites identified by the Marine Habitat Assessment Focus Group as being important for conservation (See Figure 2 of Marine Habitat Assessment Focus Group report), and taking action to address these important conservation areas first.

References

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Sánchez-Quiles. D. & Tovar-Sánchez. A. Sunscreens as a Source of Hydrogen Peroxide Production in Coastal Waters *Environ. Sci. Technol.*, 2014, *48* (16), pp 9037–9042. DOI: 10.1021/es5020696 Publication Date (Web): July 28, 2014. Available online at: http://pubs.acs.org/doi/abs/10.1021/es5020696

Inadequate set of water quality objectives

We identified this as an activity or issue which is having an adverse impact on marine biodiversity in Hong Kong quite late in our deliberations, so we have included it in our list of our High Priority issues, but because of time constraints, we have not conducted further research into this matter at this stage.

Comment

The inadequate set of water quality objectives (e.g. only cover a small subset of chemical pollutants without numerical trigger values for management for most chemicals)
Comments: Review and revision of the current WQOs are urgently needed.

Coastal eutrophication, harmful algal blooms and episodic hypoxia events

Status and Trends

We identified this as an activity or issue which is having an adverse impact on marine biodiversity in Hong Kong quite late in our deliberations, so we have included it in our list of our High Priority issues, but because of time constraints, we have not conducted further research into this matter at this stage.

Environmentally unfriendly product additives

Status and Trends

The impacts of 'emerging contaminants' on natural systems are rarely understood, but are a globally recognised area of concern. Hong Kong needs to join this "concern".

Example: Micro-Beads

Micro-Beads are minute plastic beads that are manufactured and used in consumer products such as toothpaste and cosmetic scrubs to produce a "feel good factor". After use, they are immediately discharged into waste water systems. This is pollution by design.

Micro-Beads were patented in the 1970's, but have only been used as a disposable entity in consumer products recently. Micro-plastics in the marine environment is still a new science, but they are known to accumulate toxic contaminants and are ingested by a wide range of organisms. A major concern with Micro-Beads is that because of their small size, they have a large surface area by volume, so as a consequence of their use, huge numbers of readymade, highly efficient toxic accumulators are being intentionally released into the environment.

What action has been taken elsewhere to tackle the problem of Micro-Beads?

Unilever, Procter and Gamble, Johnson and Johnson and the Body Shop have announced they will phase out the use of Micro-Beads in all of their products, but many scrubs on sale in Hong Kong still use Micro-Beads.

Comment

Some of these issues could be addressed using the Product Eco-responsibility Ordinance, Cap 603.

The purposes of this Ordinance are—

(a) to minimize the environmental impact of various types of products, which may include plastic shopping bags, vehicle tyres, electrical and electronic equipment, packaging materials, beverage containers and rechargeable batteries; and

(b) to that end, to introduce producer responsibility schemes, schemes based on the "polluter pays" principle, or other measures, which may require manufacturers, importers, wholesalers, retailers, consumers or any other parties to share the responsibility for the reduction in the use, or the recovery, recycling or proper disposal, of those products.

(2) Such schemes or measures may include (but are not limited to) the following—

(a) a product take-back scheme under which a manufacturer, importer, wholesaler or retailer is required to collect certain products for proper waste management;

(b) a deposit-refund scheme under which a consumer is required to pay a deposit to be refunded on the return of certain products to a specified collection point;

(c) the imposition of a recycling fee to finance the proper waste management of certain products;

(d) the imposition of an environmental levy to discourage the use of certain products; and

(e) the restriction on the disposal of certain products at any designated waste disposal facility as defined in section 2 of the Waste Disposal (Designated Waste Disposal Facility) Regulation (Cap 354 sub. leg. L).

(1) In this Ordinance, unless the context otherwise requires — "product" (產品) includes any article, material and substance;

Under Section 21, (1) The Secretary may, after consultation with the Advisory Council on the Environment, by order published in the Gazette, amend Schedule 1, 2, 3 or 4.

(2) An order made under this section to amend Schedule 1, 2 or 4 is subject to the approval of the Legislative Council.

Gaps to be filled

(1) The impacts of 'emerging contaminants' on natural systems are rarely understood, either globally, or in Hong Kong.

Priority Actions

Priority 1. Requires more study.

Water extraction for cooling

We identified this as an activity or issue which is having an adverse impact on marine biodiversity in Hong Kong quite late in our deliberations, so we have included it in our list of our High Priority issues, but because of time constraints, we have not conducted further research into this matter at this stage.

Key issues

This activity can result in the death of billions of marine larvae.

Clam digging on intertidal mudflats

Note: When reading this section, **please refer to the photographs in Annex A** of this report.

Status and Trends

According to SUSDev 21, intertidal mudflats and seagrass beds are identified as high ecological value habitats in Hong Kong, yet a number of these habitats are now subject to unregulated and out of control clam digging, which is threatening to destroy all sensitive biodiversity in these habitats.

Clam digging has always been popular in Hong Kong, but with the opening up of remote coastal areas through development, plus the desire to attract visitor dollars, coupled with the power of the internet, clam digging as an activity is now both widespread and out of control in many places.

Here is a promotion for Shui Hau from the NgongPing 360 website: Shui Hau - Situated only 35 minutes away from NP360, Shui Hau is the biggest mud-flat in Lantau, which has already been classified as a Coastal Protection Area. Famed as clam diggers' heaven, Shui Hau is where you can find shops that offer the necessary gear for your clamming adventure when the tide recedes.

There are currently three main types of clam digging on intertidal mudflats:

(a) clam digging on a commercial scale, for supply to local markets,
(b) clam digging for food, on a subsistence level,
(c) clam digging for fun, often followed by eating the clams afterwards.

Sub-tidal clam digging is done by access from the land and also, from boats using dredges or divers attached to air hoses. The impact on the inter-tidal environment and seagrass beds in some areas is catastrophic, for example:

(a) at Tung Chung, clam digging on the intertidal mudflat is destroying the juvenile *T. tridentatus* foraging ground there. The situation is now so severe, it will likely result in the extirpation of *T. tridentatus* at Tung Chung if not urgently addressed

(b) at Shui Hau, recreational clam digging is destroying the juvenile *T. tridentatus* foraging ground there. At Shui Hau the situation is so severe, it may result in the extirpation of *T. tridentatus* at Shui Hau if not addressed.

(c) at Ha Pak Nai, recreational clam digging is destroying parts of the *Halophila beccari* seagrass beds and juvenile *T. tridentatus* foraging ground there.

(d) recent information suggests clam digging may be responsible for recent population declines and extirpations of *Lingula anatina* at a number of sites.

Gaps to be filled

(1) Knowledge - the general extent or impact of this practice is unknown.

(2) The laws in Hong Kong do not offer adequate protections to either seagrass beds or high ecological value habitats.

Priority Actions

Priority 1. It is recommended seagrass beds be desgnated as fisheries protection areas to promote the conservation and management of marine and fisheries resources, under Section 4A – Orders of Cap 171, Fisheries Protection Ordinance, to restrict these activities.

Priority 2. A proper monitoring system be put in place to identify and address threats to seagrass beds.

Priority 3. From a human health perspective, no clam digging should be allowed on mudflats downstream from any villages discharging untreated waste water or using septic tanks and soakaway systems in alluvial deposits, from fear of catching infectious diseases or causing infectious disease outbreaks.

Priority 4. Research be commissioned to ascertain extent and environmental impact of the problem.

Priority 5. Monitoring of vulnerable areas be initiated.

Priority 6. Consideration of building board walks in sensitive areas, eg Tung Chung to protect the mudflat, at the same time allowing access to the better clam digging areas.

Comment:

Environmentally, the issue is not the clams. It is the damage to the habitat of other animals such as juvenile horseshoe crabs that is being destroyed by digging for the clams. Shui Hau is used by wind surfers, so is not suitable for a board walk.

Razor shell digging using salt

Note: When reading this section, **please refer to the photographs in Annex A** of this report.

Status and Trends

According to SUSDev 21, intertidal mudflats and seagrass beds are identified as high ecological value habitats in Hong Kong, yet at least one of these habitats at Ha Pak Nai is now subject to unregulated and out of control razor shell fishing using salt, which is threatening to destroy all sensitive biodiversity in these habitats.

Razor shell digging with salt is a new phenomenon in Hong Kong, which wasn't seen until recently, but it has the potential to become widespread and out of control very quickly. It is already out of control at Ha Pak Nai.

Like clam digging, razor shell fishing using salt is being promoted online. Here's an example of information available on the internet: Online video: 视频：发现了蛏子的巢穴，不停撒盐 . . . 结果蛏子成群结队从沙子往外跳 (Translation: Video: found a razor's lair, kept sprinkle salt ... Results razor jump out in droves from the sand). Available online at: **http://videolike.org/view/yt=ursOtfooPNj**

Gaps to be filled

(1) Knowledge - the general extent or impact of this practice is unknown.

(2) Neither seagrass beds nor high ecological value habitats are protected in practice in Hong Kong.

(3) The laws in Hong Kong do not offer adequate protections to either seagrass beds or high ecological value habitats.

Priority Actions

Priority 1. Razor shell fishing using salt could be considered a cruel practice and therefore could be addressed with the threat of enforcing Cap 169 – Prevention of Cruelty to Animals Ordinance.

Priority 2. Under Section 4A – Orders of Cap 171, Fisheries Protection Ordinance the Secretary for Food and Health may, by order published in the Gazette - (a) designate seagrass beds to be fisheries protection areas to promote the conservation and management of marine and fisheries resources.

Priority 3. A proper monitoring system be put in place to identify and address threats to seagrass beds.

Priority 4. Research be commissioned to ascertain extent and environmental impact of the problem.

Priority 5. Monitoring of vulnerable areas be initiated.

Comment:

Environmentally, the issue is not the razor shells. It is the damage to the habitat of other animals such as juvenile horseshoe crabs that is being destroyed by use of salt to search for razor shells.

Sediment runoff from construction sites

Status and Trends

A geological continuum in a river system or watershed comprised a cycle of uplift, erosion, transportation and deposition. In Hong Kong this process begins at the top of the hills and ends on the seabed.

The constituents of eroded material are dependent on the nature of the country rock and when deposited the components are classified according to size: boulder, cobble, pebble, sand, silt, mud and clay. The general principle is the larger the component, the earlier it is deposited in the transportation process. Also, as particle size decreases, cohesiveness increases.

When development is taking place, particularly in the lower reaches of river valleys, a new cycle of erosion, transportation and deposition is initiated. The problem with this is, many of these developments are initiated in areas where sand, silt, mud or clay have previously been deposited and because Hong Kong is naturally subject to heavy downpours of rain and extreme weather events and following the principle that whatever happens upstream will have downstream consequences, when exposed, these can be eroded and transported downstream where they are re-deposited, often with catastrophic consequences for downstream sensitive receivers.

Example. Hong Kong has a history of this. In the 1980's, the loss of a coral community was recorded on the eastern shore of Hoi Ha Wan because of soil and sand runoff, when trees and rocks were removed from the surrounding hills for reclamation of land at the Ma On Shan new town (Study on coral communities in Hoi Ha Wan, published in Marine Pollution Bulletin (2007)). This event represents a classic case study to show what can go wrong if attention is not paid to the risks associated with disrupting a geologic continuum and because muds and clays are highly cohesive, corals, hydrozoans and sessile benthic ciliate and filter feeders are particularly susceptible to such events.

Gaps to be filled

(1) Sediment runoff from development and construction sites poses a current and continuing threat to coastal biodiversity because of a lack of understanding and adequate controls, but it is an issue which can be easily mitigated for if understood.

Priority Actions

Priority 1. The following principles need to be reinforced in all levels of planning and development in Hong Kong:

(a) Watersheds and rivers are a single system, from the tops of the hills to the bottom of the sea.

(b) Whatever you do in a river system upstream will have downstream consequences,

(c) Because of its geology, geomorphology and weather, Hong Kong is susceptible to sediment run-off events.

Priority 2. Sediment curtains are used to prevent such events when dredging projects are undertaken in the sea. Similar precautionary measures should be mandated for land based projects in vulnerable areas.

Trans-national Wildlife Crime

Status and Trends

In simple terms, it is wrong for someone in one country to benefit from a crime committed in another country. This principle is already applied in many areas of law enforcement and in 2011 efforts started to extend it to encompass the growing global problem of 'wildlife crime'.

CBD: Article 3: Principle (Global Footprint)

States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and **the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction**.

Background

Aware that CITES alone could not stop the growing problem of the illegal exploitation of wildlife, in April 2011 the United Nations formed the International Consortium on Combating Wildlife Crime (ICCWC) to combat the growing threat posed by Trans-National Wildlife Crime. This coalition comprises CITES, INTERPOL, The World Bank, The World Customs Organisation and the United Nations Office on Drugs and Crime. See the link below:

http://www.cites.org/eng/prog/iccwc.php

What is wildlife crime?

According to the ICCWC:

(a) 'Wildlife' means all fauna and flora. 'Fauna' are animals, birds and fish. 'Flora' are plants.

(b). 'Crime', refers to acts committed contrary to national laws and regulations intended to protect natural resources and to administer their management and use.

This may start with the illicit exploitation of natural resources, such as the poaching of an elephant, uprooting of a rare orchid, unauthorized logging of trees, or unlicensed netting of sturgeons.

It may also include subsequent acts, such as the processing of fauna and flora into products, their transportation, offer for sale, sale, possession, etc. It also includes the concealment and laundering of the financial benefits made out of these crimes.

Some of these crimes will take place solely in the country of origin, whilst others will also occur in the country of destination, where live fauna or flora specimens, or their parts and derivatives, are finally consumed.

In simple terms, if a country enacts laws to protect a particular species or category of wildlife, or designates conservation zones or protected areas and these laws are violated, any removal of wildlife in contravention of these laws becomes an illegal act in that country and no one in another country should profit from this.

How does this apply to Hong Kong?

Hong Kong is a centre for a number of wildlife trades, including:

(a). Aquarium (pet) trade,
(b). Live Reef Fish Trade (LRFT),
(c). Treasures of the Sea (Abalone, Sea Cucumber, Shark Fin, Bladder),
(d). Traditional Chinese Medicine (TCM) (Sea horses, Manta Ray gill rakers, Ginseng and others).

Whilst much of this trade respects the laws, rules and regulations of other nations and is carried out in a legal, responsible and acceptable fashion, some of it does not.

As a destination nation for these trades, in accordance with Article 3 of the Convention on Biological Diversity (CBD) it is incumbent upon Hong Kong to ensure that all wildlife trade conducted in Hong Kong respects the laws of other nations.

Hong Kong is a party to Convention on International Trade in Endangered Species (CITES) and the Protection of Endangered Species of Animals and Plants Ordinance, Cap. 586 is used to enforce Hong Kong's obligations under CITES.

How is this handled elsewhere?

Legislation – The Lacey Act (USA) - Under the Lacey Act, it is unlawful to import, export, sell, acquire, or purchase fish, wildlife or plants that are taken, possessed, transported, or sold: 1) in violation of U.S. or Indian law, or 2) in interstate or foreign commerce involving any fish, wildlife, or plants taken possessed or sold *in violation of* State or *foreign law*.

The Lacy Act covers all fish and wildlife and their parts or products, plants protected by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and those protected by State law. In 2008, the Lacey Act was amended to include a wider variety of prohibited plants and plant products, including illegally logged woods, for import.

When the Lacey Act was passed in 1900, it became the first federal law protecting wildlife. It enforces civil and criminal penalties for the illegal trade of animals and plants. Today *it regulates the import of any species protected by international* or domestic *law* and is also used to prevent the spread of invasive, or non-native, species.

See details of the Lacey Act at the following link:

http://www.fws.gov/international/laws-treaties-agreements/us-conservation-laws/lacey-act.html

See text of the Lacey Act at the following link:

http://www.fws.gov/le/pdffiles/Lacey.pdf

Gaps to be filled

(1) Hong Kong does not have legislation to combat trans-national 'wildlife crime'.

Priority Actions

Priority 1. In order to meet Hong Kong's obligations under Article 3 of the Convention on Biological Diversity (CBD) Hong Kong should implement legislation to regulate trade in 'illegal wildlife'.

Sentencing in wildlife crime cases (Trans-national Wildlife Crime)

Status and Trends

The illegal trafficking in wildlife crime is a serious issue and one that Hong Kong is obliged to address under the Article 3 Principle of the Convention on Biological Diversity.

As such, Hong Kong must make the most of the deterrent effect of its current legislation, but this is often not the case.

Example: In January2014 two Egyptian men were stopped at Chep Lap Kok. In their suitcases, customs officers discovered 128 live tortoises, stuffed head-to-tail into knotted stockings. The pair had no valid documents for the animals, which had a market value of HK$320,400. The pair said stockings were used to transport tortoises in Egypt, and that the animals were given enough food and water for three days before being checked in as luggage.

The pair told the court they did so to protect the rare creatures from political turmoil in Egypt. The Magistrate said he believed there was a "commercial value" for the pair in the offence, but accepted that their aim was to "increase the numbers of the tortoises".

The pair each admitted one charge of cruelty to animals. The first defendant admitted one charge of importing a rare species and was fined HK$40,000. The second defendant admitted two import offences and was fined HK$45,000. They were given two-month jail sentences, suspended for 18 months (SCMP. 2014).

Comment

According to the IUCN Red List of Threatened Species, these tortoises are listed as critically endangered, with projections are that they may be extinct in the wild within a generation. Collection for international trade is a major threat to these species.

They are also listed on Appendix 1 of the Convention on International Trade in Endangered Species (to which Hong Kong is a signatory) and an export permit is needed proving that strict conditions concerning the survival of that species have been met.

International smuggling of these tortoises in Asia has been well documented, in part because of the myth that tortoise livers confer health benefits.

The court accepted in mitigation the assertion that the accused had been concerned about the fate of the tortoises in Egypt and intended to take them overseas for breeding, which is extremely surprising given the tortoises concerned are not native to Egypt or mainland Africa, but are endemic to Madagascar.

Gaps to be filled

(1) The full facts in this case do not appear to have been presented to the court, resulting in no deterrent sentence being administered.

(2) The cost of keeping and returning species in cases like this also needs to be reflected to the courts, so that appropriate costs to be borne by the defendants can also be considered in such cases.

Priority Actions

Priority 1. The information provided to the courts in such cases needs to be tightened up. Perhaps "an Email Advisory Panel" can be set up to advise on the conservation status of any animals in future seizures, to allow for all pertinent facts in such cases to be provided to the judicial process.

References

SCMP. Egyptian pair must shell out fines for trying to import rare tortoises. 15 March 2014. Available online at: http://www.scmp.com/news/hong-kong/article/1448828/egyptian-pair-must-shell-out-fines-trying-import-rare-tortoises

SECTION 2 - MEDIUM PRIORITY
(High importance. Low urgency. Requires further study, systems are already in place or requires less urgent attention)

Reclamation and construction, including rivetment (Sea walls/Embankments/Stream walls)

Status and Trends

Reclamation is a major issue, because it not only leads to permanent an irrevocable loss of habitat, the wider impacts such as hydrological changes can also be considerable.

On the marine front, there are two principle areas of concern:

1. Loss of off-shore habitat, particularly critical spawning, nursery, foraging areas and migratory routes,
2. Loss of coastal habitat, in particular critical spawning, nursery and foraging areas.

Priority Actions

Priority 1. As a matter of policy, no off-shore habitat, particularly critical spawning, nursery, foraging areas and migratory routes be the subject of development pressure and no new loss of natural coastline should be considered without serious justifications.

Underwater acoustic disturbance

Status and Trends

Anthropogenic noise originates from a variety of sources and it can impact on biodiversity in a number of ways.

In Hong Kong, when considering development projects in marine areas, the focus is mainly on ground-borne noise, percussive piling and marine traffic noise, whilst the acoustic disturbances from general construction work are rarely considered as a major issue, normally being assessed as "… low to moderate for general construction works" (3rd Runway EIA).

The video below is an above and underwater recording of general construction work being undertaken on the Hong Kong Macau-Zhuhai Bridge and not only shows the difference between above water and below water noise, but also the distance underwater noise carries, in this case generated by the use of pneumatic drills. http://vimeo.com/100778428

The following are examples of the different ways anthropogenic noise can impact on biodiversity:

Example 1 – Dolphins

Section 8.5.27 - Studies have shown that because of the efficient transfer of sound in water, dolphins can detect noises associated with vessels similar to dredgers at distances up to approximately 5 km. Noise disturbance interferes with communication and echolocation pulses which are used for navigation and feeding, leading to behavioural changes. There is evidence suggesting that some cetacean species will minimise their use of areas affected by underwater noise.

Section 8.5.27 - Most dolphins can hear within the range of 1 - 150 kHz though the peak for a variety of species is between 8 - 90 kHz[. Dredging and large vessel traffic generally results in mostly low frequency noise typically in the range of 0.02 - 1 kHz which are below the peak range of 8 - 90 kHz reported for dolphins and therefore, would not likely cause problems. Percussive piling work will be involved in the construction process but only for the two ferry piers on the southern part of the Theme Park reclamation. Mitigation measures will be required during construction to prevent unacceptable impacts to marine mammals in the vicinity of the works if the construction takes place during the autumn and winter when dolphins are thought to use the area (EPD. EIA register (2000).

Example 2 - Anti-predator behaviour in fish

Animals must avoid predation to survive and reproduce, and there is increasing evidence that man-made (anthropogenic) factors can influence predator−prey relationships.

A laboratory study how additional noise (playback of field recordings of a ship passing through a harbour), compared with control conditions (playback of recordings from the same harbours without ship noise), affected responses to a visual predatory stimulus.

The anti-predator behaviour of two sympatric fish species was studied, the three-spined stickleback (*Gasterosteus aculeatus*) and the European minnow (*Phoxinus phoxinus*), which share similar feeding and predator ecologies, but differ in their body armour.

The effects of additional-noise playbacks differed between species: sticklebacks responded significantly more quickly to the visual predatory stimulus during additional-noise playbacks than during control conditions, while minnows exhibited no significant change in their response latency.

The results suggest that elevated noise levels have the potential to affect anti-predator behaviour of different species in different ways (Voellmy et al. 2014)

Gaps to be filled

(1) Whilst attention is paid to ground-borne noise, percussive piling and marine traffic noise when considering development projects in marine areas, the acoustic disturbances from general construction work, such as the use of pneumatic drills is afforded low priority.

Priority Actions

Priority 1. Requires more study.

References

EPD. EIA register (2000) Construction of an International Theme Park in Penny's Bay of North Lantau together with its Essential Associated Infrastructures - Environmental Impact Assessment Available at: http://www.epd.gov.hk/eia/register/report/eiareport/eia_0412000/index.html

Voellmy IK, Purser J, Simpson SD, Radford AN (2014) Increased Noise Levels Have Different Impacts on the Anti-Predator Behaviour of Two Sympatric Fish Species. PLoS ONE 9(7): e102946. doi:10.1371/journal.pone.0102946 Available online at: http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0102946

Diversion of stream flows

Status and Trends

A geological continuum in a river system or watershed comprises a cycle of uplift, erosion, transportation and deposition. In Hong Kong this process begins at the top of the hills and ends on the seabed.

The constituents of eroded material are dependent on the nature of the country rock and when deposited the components are classified according to size – boulder, cobble, pebble, sand, silt, mud and clay. The general principle is the larger the component, the earlier it is deposited in the transportation process. Also, as particle size decreases, cohesiveness increases.

Some of these deposits play an important role in habitat formation, for example:

(a) Pebbles and sand form alluvium – important in marsh and wetland formation.

(b) Sand - important in intertidal area and sandy beach formation.

(c) Sand, silt, mud, clay – important in mangrove, seagrass bed and intertidal mudflat formation.

Rock erosion also leads to the release of minerals and water washing down hillsides carry nutrients in the form of leaf and plant litter.

The disruption of stream flows through drainage schemes can lead to channeling of sediments, minerals and nutrients away from intertidal/sub-tidal habitats into drainage systems, so they are carried out to sea, not naturally deposited where they should be.

Gaps to be filled

(1) There is a general lack of knowledge of this as an issue.

Priority Actions

Priority 1. Raise awareness.

Fishing non-target species

Note: When reading this section, **please refer to the photographs in Annex A** of this report.

Status and Trends

Irrespective of the circumstances, the prevalent attitude towards unwanted fisheries catch in Hong Kong appears to be "catch and kill".

For example, Mangrove horseshoe crabs (*Carcinoscorpius rotundicauda*) have little value in Hong Kong. They are inedible because they contain tetrodotoxin, if caught in sufficient quantities they could be sold for Buddhist release ceremonies, but otherwise they only represent a nuisance to fishermen. Because of this, the prevalent practice amongst fishermen in Hong Kong appears to be capture and kill, despite the fact the circumstances of their capture next to the sea could result in their immediate and safe release.

This attitude is not limited to Mangrove horseshoe crabs. Visits to any popular fishing locations in Hong Kong will reveal small or unwanted fish discarded on the ground to die, rather than released.

Gaps to be filled

(1) Knowledge - the general extent of this practice is unknown.

(2) Enforcement - no laws are currently used to protect fish from such practices, so there is no deterrent to prevent them from taking place.

Priority Actions

Priority 1. public education – many of these activities could be addressed with the public education of fishermen.

Priority 2. Some of these activities could be addressed with the threat of enforcing Cap 169 – Prevention of Cruelty to Animals Ordinance.

Priority 3. Some of these activities could be addressed by identify and legislating to protect species deserving of protection.

Ghost nets

Note: When reading this section, **please refer to the photographs in Annex A** of this report.

Status and Trends

Ghost nets are globally and locally recognized as an issue of conservation concern.

Gaps to be filled

(1) Knowledge - the general extent or impact of this practice is unknown.

(2) Enforcement - no laws are currently used to protect the environment from the disposal or abandonment of fishing nets, so there is no deterrent to prevent them from being disposed of or abandoned.

(3) Cleanups – neither government nor private cleanups are addressing the real issue, which is prevention.

Priority Actions

Priority 1. Public education – many of the activities resulting in the disposal or abandonment of fishing nets could be addressed with the public education of fishermen.

Fishing in stream mouths

Note: When reading this section, **please refer to the photographs in Annex A** of this report.

Status and Trends

According to SUSDev 21, natural watercourses are identified as high ecological value habitats in Hong Kong, yet there appear to be no restrictions on the methods, timings or types of aquatic life that can be caught.

Sometimes people fish at stream mouths using fyke nets, gill nets, etc., and this would greatly affect diadromous species and organisms living in estuaries. If the streams being affected are habitats for diadromous/ brackish species of very high conservation concern, the effect caused by this activity could be disastrous.

Some estuaries are spawning grounds/ nurseries for species of conservation concern like horseshoe crabs and the netting activity would also affect these species. The severity of the impacts caused by this activity is site-specific.

For example, gill netting at the mouth of Tai Ho Stream could cause a high ecological impact as the migratory fish, Ayu Sweetfish (*Plecoglossus altivelis),* which is considered to be critically endangered has only been recorded there.

Gaps to be filled

(1) Knowledge - the general extent or impact of this practice is unknown.

(2) Important estuaries should be identified (e.g., locating on the migratory route of important diadromous species),

(3) Estuaries of high ecological value, where fishing with nets has been observed, such as Tai Ho should be protected.

Priority Actions

Priority 1. Estuaries of high ecological value should be incorporated into the protected area system through zoning or designation of special area/ country park/ marine park.

Priority 2. Alternatively, fishing activities in these important estuaries should be regulated (e.g., fish moratorium).

Eco-tourism and visitors

Note: When reading this section, **please refer to the photographs in Annex A** of this report.

Status and Trends

According to SUSDev 21, intertidal mudflats and seagrass beds are identified as high ecological value habitats in Hong Kong, yet there are no controls on any of the activities that can be undertaken on them.

Eco-tourism is currently being promoted as an activity to bring visitors and revenue to some of the more remote beaches in Hong Kong. This ranges from professionally arranged guided tours, through poorly arranged tours to open invites to families to explore 'biodiversity' on their own.

Many Eco-tour destinations are in areas with mangroves, seagrass beds and intertidal mudflats. Unfortunately, unaccompanied visitors, or guided tours in sensitive areas can destroy the habitat the visitors are coming to see and unsupervised 'eco-tourism' has had devastating consequences in certain areas, for example the destruction of the marine habitat and marine organisms at Lung Mei – the 'Lung Mei' effect and tourists playing with starfish at Hoi Ha and other locations.

Gaps to be filled

(1) Knowledge - the general extent or impact of that Eco-tourism and visitors are having on biodiversity is unknown.

(2) Apart from the Geopark and Marine Reserves, there appear to be no rules governing the activities of visitors to high ecological value habitats in Hong Kong.

Priority Actions

Priority 1. Study be commissioned to ascertain extent and impacts of the problem.

Priority 2. Monitoring of vulnerable areas be initiated.

Priority 3. A Code of Conduct be developed for all Eco-tourism.

Priority 4. Licensing for Eco-tourism to sensitive areas.

Priority 5. Consideration of building board walks in sensitive areas, eg Tung Chung.

Mariculture

Status and Trends

In Hong Kong aquaculture includes marine fish culture, pond fish culture and oyster culture. In 2013 production from the aquaculture sector was 3,300 tonnes valued at $147 million which was 2 per cent in weight and 6 per cent in value of the total fisheries production.

Marine fish culture involves rearing of marine fish from fry or fingerlings to marketable size in cages suspended by floating rafts usually in sheltered coastal areas. The species cultured changed gradually over the recent years depending on the availability of imported fry. Common species under culture include **green grouper, brown-spotted grouper, giant grouper, Russell's snapper, mangrove snapper, goldlined seabream and star snapper**.

Fry are mostly imported from the Mainland, Taiwan, Thailand, Philippines or Indonesia. Traditionally, marine cultured fish are fed with trash fish. In recent years, with the department's extension effort, increasing number of marine fish farmers have changed over to use moist or dry pellet feed which significantly reduces pollution caused by fish feed and improves both the feed efficiency as well as fish health.

Marine fish culture is protected and regulated by the Marine Fish Culture Ordinance (Cap. 353) which requires all marine fish culture activity to operate under licence in designated fish culture zones. Currently, there are 26 fish culture zones occupying a total sea area of 209 ha with some 987 licensed operators.

The majority of the licensed farms are small, family-based and consisting of one to two rafts with average total area of around 290 m. With effect from June 2002, the marine fish culture licence is transferable. The estimated production in 2013 was about 1,005 tonnes valued at $94 million which catered about 6 per cent of local demand for live marine fish (AFCD website. Undated).

While often considered more ecologically acceptable than extraction from wild stocks, issues such as escape of exotic species, disease transmission, use of unsustainable fishmeal, and localized habitat destruction during development of facilities, need to be addressed (Hedge et al,2013).

Gaps to be filled

(1) Some of the common species under culture include non-native voracious predatory fish, such as the Sabah Giant Grouper which are being bought and released in religious release ceremonies, posing a serious threat to local reef and aquatic biodiversity.

(2) Mariculture may rely on wild caught fish fry and small fishes (as feed) collected from local water and beyond.

Priority Actions

Priority 1. An urgent review be undertaken to ensure controls are put in place to prevent the purchase and release of release of non-native voracious predatory fish which originated from the local mariculture industry.

References

AFCD website Marine fish culture, pond fish culture and oyster culture. Undated. Available online at: https://www.afcd.gov.hk/english/fisheries/fish_aqu/fish_aqu_mpo/fish_aqu_mpo.html

Hedge L.H., Johnston E.L., Ayoung S.T., Birch G.F., Booth D.J., Creese R.G., Doblin M.A., Figueira W.F., Gribben P.E., Hutchings P.A., Mayer Pinto M, Marzinelli E.M., Pritchard T.R., Roughan M., Steinberg P.D., 2013, Sydney Harbour: A systematic review of the science, Sydney Institute of Marine Science, Sydney, Australia

Oyster farming

Status and Trends

Culture of oyster has been practised along the intertidal mud flat of Deep Bay in northwestern corner of Hong Kong for at least 200 years.

Traditionally, oysters are cultured by the bottom culture method with spat collected by laying rock, concrete tile or post as cultch on the mud flat in May or June. The oyster spat takes four to five years to grow to marketable size. In recent years, some farmers turned to fattening of medium size oysters imported from the Mainland. Majority of them adopt the raft culture method, i.e. oysters placed in baskets suspended from rafts.

These oysters take about six to twelve months before marketing. Production in 2013 was about 108 tonnes (meat only) valued at $ 9 million (AFCD website).

Comment

We have identified this as an activity or issue which is having an adverse impact on marine biodiversity in Hong Kong, but we do not believe it currently requires urgent attention, so we have accorded it medium or low priority status. Because of resource constraints, we have not conducted further research into this matter at this stage.

References

AFCD website. Marine fish culture, pond fish culture and oyster culture. Available online at: https://www.afcd.gov.hk/english/fisheries/fish_aqu/fish_aqu_mpo/fish_aqu_mpo.html

Illegal discharge of waste

We have identified this as an activity or issue which is having an adverse impact on marine biodiversity in Hong Kong, but we do not believe it currently requires urgent attention, so we have accorded it medium or low priority status. Because of resource constraints, we have not conducted further research into this matter at this stage.

Comment: Legislation and systems are already in place to deal with offenders.

Surface runoff

We have identified this as an activity or issue which is having an adverse impact on marine biodiversity in Hong Kong, but we do not believe it currently requires urgent attention, so we have accorded it medium or low priority status. Because of resource constraints, we have not conducted further research into this matter at this stage.

Comment: Novel engineering design could enable collection of urban surface runoff for wastewater treatment during the dry season.

Climate change

Status and Trends

Whilst the impact of climate change is unpredictable on biodiversity, the following are some scenarios that need to be considered in Hong Kong:

(a) growth and development of some species, particularly molluscs and echinoderms, is retarded at elevated temperatures and associated pH levels, whilst other species may be resilient to such changes, leading to changes in local biota,

(b) increased temperatures may see an increase of more tropical species in local waters,

(c) sea level rises may impact on mangroves and seagrass beds, particularly as coastal erosion in many areas may be retarded by the positioning of anthropogenic structures, Also, because some human settlements are located on low lying coastal areas in Hong Kong, adaptation to climate change may require coastal armouring to protect these settlements, posing a direct threat to biodiversity in some of these areas,

(d) increased storm activities are likely to place coastal infrastructure under threat, so that conversely, harbour barrier habitats such as mangrove and seagrass will become more important for infrastructure protection.

(e) long-term climate change may simultaneously alter many environmental parameters (e.g., temperature, pH, physical water column structure, nutrient bioavailability) that regulate biodiversity and function of marine ecosystems, with as yet unknown consequences (Hedge et al, 2013).

Gaps to be filled

(1) A lack of marine biodiversity baseline for us to understand how climate change influences our biodiversity,

(2) A lack of intensive and systematic studies on climate change parameters (e.g. sea levels) at regional scale,

(3) A lack of studies on the marine species tolerance to temperature and pH changes mediated by climate change,

(4) A lack of studies and predications on how sea level changes can influence mangrove and wetland habitats in Hong Kong,

(5) Whilst large scale development projects tend to consider the impacts of climate change, building resilience into coastal infrastructure and developments is currently not factored into development or planning decisions at lower levels. The Town Planning Board for example is not

routinely briefed on potential future impacts of climate change, which means decisions made now do not consider the future impacts of mitigation measures on important biodiversity.

Priority Actions

Priority 1. To protect biodiversity from the impact of future climate change mitigation measures, the impacts of climate change, climate change considerations need to factored into current coastal development and planning decisions at all levels.

References

(Hedge L.H., Johnston E.L., Ayoung S.T., Birch G.F., Booth D.J., Creese R.G., Doblin M.A., Figueira W.F., Gribben P.E., Hutchings P.A., Mayer Pinto M, Marzinelli E.M., Pritchard T.R., Roughan M., Steinberg P.D., 2013, Sydney Harbour: A systematic review of the science, Sydney Institute of Marine Science, Sydney, Australia).

Marine Traffic (Passenger, Freight, Construction, Recreational Vessels)

We have identified this as an activity or issue which is having an adverse impact on marine biodiversity in Hong Kong, but we do not believe it currently requires urgent attention, so we have accorded it medium or low priority status. Because of resource constraints, we have not conducted further research into this matter at this stage.

Gaps to be filled

We believe the following areas are worthy of further consideration:

(1) Vessels associated collision impacts to marine mammals,

(2) Vessel associated competition for the navigation route against marine mammals,

(3) Vessel associated uses and release of highly toxic antifouling chemicals causing endocrine disruption in marine organisms (e.g. imposex in marine gastropods) and seafood contamination,

(4) Vessels associated underwater noise,

(5) Marine dumping of waste from vessels,

(6) Vessel associated waste and wastewater as well as oil discharges.

Priority Actions

Priority 1. A priority issue of concern is the direct discharge of sewage discharge from passenger, freight, construction and recreational vessels into local waters.

Offshore (marine) extraction

We have identified this as an activity or issue which is having an adverse impact on marine biodiversity in Hong Kong, but we do not believe it currently requires urgent attention, so we have accorded it medium or low priority status. Because of resource constraints, we have not conducted further research into this matter at this stage.

Comment: Systems are already in place to deal with most aspects.

Offshore (marine) dumping

We have identified this as an activity or issue which is having an adverse impact on marine biodiversity in Hong Kong, but we do not believe it currently requires urgent attention, so we have accorded it medium or low priority status. Because of resource constraints, we have not conducted further research into this matter at this stage.

Includes the marine dumping of contaminated muds.

Comment: Systems are already in place to deal with most aspects.

Global Fishing effort

Status and Trends

Many companies which are based in Hong Kong conduct activities in other jurisdictions, which have a direct impact on the biodiversity of those jurisdictions.

Example: Pacific Andes Enterprises (HK) Ltd, Hong Kong

Pacific Andes International Holdings Limited (PAIH), listed in the Stock Exchange of Hong Kong, is a vertically integrated frozen food company with main emphasis on frozen seafood. PAIH currently sources frozen fish from over 30 countries and operates and manages 18 frozen fish processing factories in China and the U.S.; and also markets and distributes its products to over 32 countries around the world (HKTDC.Com).

Pacific Andes Shipping Conglomerate operates the Lafayette, the world's biggest factory ship for fish processing, the Lafayette. At any given point of time, the Lafayette is capable of processing and churning out around 1,500 tons of fish each day, serving a fleet of trawlers which supplies it with fish.

The functions of the ship are quite simple. The fishing trawlers come au courant of the processing ship with their caught wares and deposit them into the pumping posts built on the vessel. There are three such posts, of which two of them operate simultaneously, while the third is brought under operation only if the weather conditions are harsh. Through these posts, the fishes are then re-directed towards a basal storage area with a capacity to store around 7000 tons of fish. All-in-all, there are 32 such basal storage areas, which are fitted with pumps and which use vacuity to send the fishes to the sequentially following processing stages.

Through the pumps, the fishers are channelised towards funnels, which then re-direct the fishes to the grading equipments. These machineries offer greater accuracy when it comes to sorting and grading the fishes – nearly six to 10 times better as compared to manual sorting – after which, manual sorting and grading is carried out in order to finally inspect the fish quality. The twice graded and sorted fishes are then deposited in the appropriate processing containers. The next step in the process is the re-direction of these fishes to the freezing equipment (232 in totality) where, over 12,000 fishes are frozen at a single oscillation. Post this step, the frozen fishes are stored in cartons before loading them onto a moving ramp. Ramps with a capacitance of around 14,000 tons of fishes can be stored effectively at a temperature of -26 degrees in containers in the ship's cargo section. Alternatively, the frozen cargo can be appropriately moved to the vessels waiting to carry the cargo to the coast for further utilisation. Through the Lafayette, a systematic approach to the aspect of processing fish is achieved (Marine Insight. 2011).

Gaps to be filled

We have identified this as an activity or issue which is having an adverse impact on marine biodiversity outside of Hong Kong, but we do not believe it currently requires urgent attention,

so we have accorded it medium or low priority status. Because of resource constraints, we have not conducted further research into this matter at this stage.

References

Marine Insight (2011). Lafayette – The World's Biggest Ship for Fish Processing. 9 October 2011. Available online at: http://www.marineinsight.com/marine/types-of-ships-marine/video-lafayette-the-world%E2%80%99s-biggest-ship-for-fish-processing/

Section 3 - LOW PRIORITY
(Low importance. Low urgency. Something to be aware of, requires further study or less urgent attention)

Breakwaters (tide dominated/wave dominated)

Status and Trends

The placement of breakwaters can have different impacts according to whether the coastal area is tide dominated or wave dominated. Breakwaters result in loss of habitat.

Tide dominated areas

Breakwaters in tide dominated areas such as intertidal mudflats and mangroves reduce the dynamic hydrological interaction between the sea and the intertidal area, changing the entire dynamic of the intertidal area. Loss or reduction of tidal influences results in …

Examples of such breakwaters include the breakwater at Tai O mangrove, Lantau and the breakwater at Sam Pak Wan, now Siena Bay Discovery Bay, Lantau – a seawall was constructed in a Habitat Loss Compensation Scheme to protect the remaining mangroves in the area.

Wave dominated areas

Breakwaters in wave dominated areas, whilst they result in loss of habitat, they also create habitats and in some cases, establish Marine Protected Areas. Both Discovery Bay Marina and Clearwater Bay Country Club Marina have diverse and robust populations of large fish because fishing is prohibited in the marinas.

Comment

Breakwaters are not advisable in tide dominated coastlines.

If breakwaters are to be built in wave dominated coastal areas, rather than think in terms of habitat compensation schemes, another option would to be incorporate habitats as a design feature, for example, adding “reef balls” to create artificial reefs on the outside (high energy environment) and inside (low energy environment) - five star accommodation for reef fish!

Artificial habitat creation and protection schemes

We have identified this as an activity or issue which is having an adverse impact on marine biodiversity in Hong Kong, but we do not believe it currently requires urgent attention, so we have accorded it medium or low priority status. Because of resource constraints, we have not conducted further research into this matter at this stage.