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***For discussion on 27 March 2020***

**Development of a Risk Assessment Protocol for Identification of  
Invasive Alien Species**

**PURPOSE**

This paper briefs Members on the findings of a consultancy study on developing a risk assessment protocol for invasive alien species (IAS), under the Hong Kong Biodiversity Strategy and Action Plan (BSAP) 2016-2021.

**BACKGROUND**

2. IAS refer to non-native species that invade native habitats and cause adverse impact on native biodiversity, society or economy. The problem of IAS is well-recognised internationally. The Convention on Biological Diversity calls for the identification and prioritisation of IAS and their invasion pathways, as well as necessary eradication and/or other management measures.

3. There are a considerable number of alien species in Hong Kong, but not all alien species are invasive. To determine whether an alien species is invasive, several factors, including its introduction pathway, distribution in the wild, reproductive rate and its impact on local ecology, have to be considered. However, there is currently a paucity of information on alien species in Hong Kong. For some well-recognised IAS, such as *Mikania micrantha* (薇甘菊), *Sonneratia* species (海桑) and Red Imported Fire Ants (紅火蟻), control measures are currently in place to minimise their impact on biodiversity and the society. However, there is a need for better understanding of the current

situation, with a view to identifying IAS and their invasion pathways, as well as facilitating the prioritisation of management efforts.

4. Under BSAP Actions 7a and 7b, the Government will build up capacity for the management of IAS and enhance management measures. To take forward this initiative, the Agriculture, Fisheries and Conservation Department commissioned a consultancy study in November 2018, with the following objectives:

- (i) to review international best practices in managing IAS;
- (ii) to develop a risk assessment protocol for alien species; and
- (iii) to conduct risk assessment on herpetofauna, using the protocol developed in (ii).

## **STUDY METHODOLOGY**

5. The study started with a comprehensive review and comparison of IAS strategies adopted in various countries. The strategies reviewed included risk assessment and other aspects of IAS management, including prevention, management and prioritisation of efforts. Based on the best examples selected from the comprehensive review, the consultants developed a generic risk assessment protocol that could be applied to all major taxonomic groups in Hong Kong, with a team of local experts with expertise on herpetofauna, plants, marine fauna and freshwater ecosystems. Subsequently, risk assessments were carried out on arrived and potential alien herpetofauna using the draft protocol developed. A workshop involving local experts was held in October 2019 to discuss the preliminary results, as well as to enhance the results with unpublished information and expert knowledge. The purpose of this iterative process was to refine the draft protocol for better adaptation to local circumstances.

## **REVIEW OF INTERNATIONAL IAS MANAGEMENT STRATEGIES**

6. IAS management strategies of developed countries including the Great Britain, the United States, Australia, New Zealand and Japan were studied in detail. While the strategies vary in comprehensiveness and institutional setup, they all follow the approach suggested by the Convention on Biological Diversity, emphasising prevention as well as early detection and rapid response as the first line of defence supplemented with long-term control and management measures. Risk assessment forms an important

component of an evidence-based management strategy that gives priority to the most problematic species.

## **DEVELOPING A RISK ASSESSMENT PROTOCOL**

7. Risk assessment protocols of different countries were studied and compared in detail (**Annex A**). All protocols involve some sorts of questionnaires to be answered by the assessors. Some of the protocols include scoring methods to provide objectiveness, while others were largely qualitative. Having reviewed various protocols, the consultants had chosen to adopt the format and questions developed for the Great Britain as they addressed all aspects of risks, namely entry, establishment, spread and impact. The British protocol was relatively comprehensive and applicable to all major taxonomic groups. In addition, the consultants have incorporated a scoring system and simplified the draft protocol based on other protocols reviewed, taking into account the general lack of information on alien species in Hong Kong. The draft protocol was further refined through discussion with experts at the workshop, taking local circumstances into consideration.

8. Under the draft protocol developed for Hong Kong, four aspects of risks will be assessed and scored separately, viz. probability of entry, probability of establishment, probability of spread and probability of impact. The weighting of “probability of impact” is doubled due to its importance for potential risk and resource allocation from management perspective. The scores are summed up for a final score that indicates the overall risk level of the species assessed, which is categorised into three risk levels (i.e. low, moderate and high) (see **Annex B**). The draft protocol has been tested with more than ten alien species from different taxonomic groups, including plants, fish and birds. With its wide applicability across taxa confirmed, this protocol will be adopted for assessing the risks of alien species in Hong Kong from now on.

## **RISK ASSESSMENT FOR HERPETOFAUNA**

9. As part of the consultancy study, 16 species of herpetofauna were assessed using the protocol developed, including ten species that have already arrived (frogs: *Eleutherodactylus planirostris* (溫室蟾), *Lithobates catesbeiana* (美國牛蛙); lizards: *Calotes mystaceus* (白唇樹蜥), *Hemidactylus brookii* (密疣蜥虎), *Hemidactylus*

*frenatus* (疣尾蜥虎), *Physignathus cocincinus* (中國水龍); turtles: *Chelydra serpentina* (擬鱷龜), *Cuora amboinensis* (馬來閉殼龜), *Mauremys sinensis* (中華花龜), *Trachemys scripta elegans* (紅耳龜)) and six species that could potentially be introduced to Hong Kong (frogs: *Eleutherodactylus coqui* (多明尼加樹蛙), *Osteopilus septentrionalis* (古巴樹蛙), *Rhinella marina* (蔗蟾); lizards: *Anolis carolinensis* (綠安樂蜥), *Anolis sagrei* (沙氏變色蜥), *Podarcis sicula* (意大利壁蜥)). The potential species were selected from regional alien species databases and also based on such factors as climate similarity and trade with Hong Kong.

10. While there are three risk levels, no species was assessed as having high risk. Four species were assessed as having moderate risk (including *Eleutherodactylus planirostris*, *Lithobates catesbeiana*, *Rhinella marina* and *Trachemys scripta elegans*) and seven as low-risk species. The remaining species (such as *Calotes mystaceus* and *Mauremys sinensis*) were screened out at an early stage due to implausibility of causing significant impact in Hong Kong.

## **WAY FORWARD**

11. To manage alien species, conducting risk assessment is the typical step in the first place. Management (including prevention, early detection and rapid response and control) will be considered for species assessed as having moderate or high risk, taking into consideration factors such as cost-effectiveness of management measures and likelihood of success. This will help prevent the introduction of problematic species, identify those that have already arrived, and facilitate the decision of appropriate eradication or control measures to be taken.

## **ADVICE SOUGHT**

12. Members are invited to comment on the findings of the study, especially the risk assessment protocol developed.

**Agriculture, Fisheries and Conservation Department**  
**March 2020**

## Overview of Major IAS Risk Assessment Protocols Reviewed

System	Applicable Area / Region	Legal Status	Purpose	Target Taxonomic Group	Summary of Assessment Questions [It is suggested to tell the types of questions instead of the number breakdown]	Socio-economic Criteria Included	Terminology of Ranking Categories
Great Britain: Non-Native Species Risk Assessment V2 (2014)	Great Britain (England, Scotland, Wales and their islands)	Advisory	Species screening and impact ranking	Different Taxa	<ul style="list-style-type: none"> <li>• Species information and screening</li> <li>• Detailed questions <ul style="list-style-type: none"> <li>- probability of entry</li> <li>- probability of establishment</li> <li>- probability of spread</li> <li>- probability of impact</li> </ul> </li> <li>• Climate change</li> <li>• Research</li> </ul>	Yes	<ul style="list-style-type: none"> <li>• Very likely</li> <li>• Likely</li> <li>• Moderately likely</li> <li>• Unlikely</li> <li>• Very unlikely</li> </ul>
European Union: Non-Native Organism Risk Assessment Scheme v1.0 (2015)	European Union	Advisory	Species screening and impact ranking	Different Taxa	<ul style="list-style-type: none"> <li>• Species information and screening</li> <li>• Detailed questions <ul style="list-style-type: none"> <li>- probability of entry</li> <li>- probability of establishment</li> <li>- probability of spread</li> <li>- probability of impact</li> </ul> </li> <li>• Climate change</li> <li>• Research</li> </ul>	Yes	<ul style="list-style-type: none"> <li>• Very likely</li> <li>• Likely</li> <li>• Moderately likely</li> <li>• Unlikely</li> <li>• Very unlikely</li> </ul>
Harmonia+	Designed in Belgium and neighbouring area but can be applied to other areas	Advisory	Species screening and impact ranking	Different Taxa	<ul style="list-style-type: none"> <li>• Background information</li> <li>• Establishment and spread</li> <li>• Impacts on: environment ,plants, animal, human and infrastructure</li> </ul>	Yes (infrastructure)	<ul style="list-style-type: none"> <li>• Very high</li> <li>• High</li> <li>• Medium</li> <li>• Low</li> <li>• Very Low</li> </ul>
An Invasive Species Assessment Protocol Version 1 (NatureServe 2004)	Designed in US but not restricted to specific area, though not targeted for fragmented area	Advisory	Assessment of impact to biodiversity	Plants	<ul style="list-style-type: none"> <li>• Ecological impact</li> <li>• Current distribution and abundance</li> <li>• Trend in distribution and abundance</li> <li>• Management difficulties</li> </ul>	No	<ul style="list-style-type: none"> <li>• High</li> <li>• Medium</li> <li>• Low</li> <li>• Insignificant impact</li> </ul>

## Hong Kong Invasive Alien Species Risk Assessment Protocol

### **Section A- Species Information and Screening**

#### Stage 1. Species Information

1. Where is the species native?
2. What is the global distribution of the species (excluding HK)?
3. What is the distribution of the species in HK (including known or suspected, protected/non-protected areas)?
4. Is the species known to be invasive (i.e. to threaten species, habitats or ecosystems) anywhere in the world?
5. Describe any known socio-economic benefits and/or conservation value of the species in HK

#### Stage 2. Screening Questions\*

6. Does the species have intrinsic attributes that indicate that it could be invasive, i.e. threaten species, habitats or ecosystems? [*yes/no/unknown*]
7. Does at least one suitable habitat vital for the survival, development and multiplication of the species occur in HK? [*yes/no/unknown*]
8. Has the species entered with populations in new areas outside its original range, by natural means or by human assistance? [*yes/no/unknown*]
9. Could the species as such, or acting as a vector, cause economic, environmental or social harm in HK? [*yes/no/unknown*]
10. Does the species require another species for critical stages in its life cycle such as growth (e.g. root symbionts), reproduction (e.g. pollinators; egg incubators), spread (e.g. seed dispersers) or transmission, (e.g. vectors) ? [*yes/no/unknown*] (if answer is yes, then go to Q11)
11. Is the critical species identified in Q10 present in HK? [*yes/no/unknown*]

\*Stop assessment if any of the answers to Q6 to Q9 is “No”, or if answer to Q10 is “yes” and Q11 is “no”.

### **Section B- Detailed Assessment**

#### 1. Probability of **Entry**

- 1.1. How many active pathways (both intentional and unintentional) are relevant to the potential entry of this species? [*one/two/three/four/five or above*]
- 1.2. a. List relevant pathways through which the species could enter. Where possible give detail about the specific origins and end points of the pathways.
- b. Major pathway name (For major pathway answer Q1.3 to Q1.7):

- 1.3. Is entry along this major pathway intentional (e.g. the species is imported for trade) or unintentional (the species is a contaminant of imported goods)? [*intentional/unintentional*] (If intentional, skip Q1.5 & Q1.6)
  - 1.4. How likely is it that large numbers of this species will travel along this major pathway from the point(s) of origin over the course of one year? [*very unlikely/unlikely/moderately likely/likely/very likely*]
  - 1.5. How likely is the species to survive existing management practices during passage along this major pathway? [*very unlikely/unlikely/moderately likely/likely/very likely*]
  - 1.6. How likely is the species to enter HK undetected through this major pathway? [*very unlikely/unlikely/moderately likely/likely/very likely*]
  - 1.7. How likely is the species to be able to transfer from this major pathway to a suitable habitat or host? [*very unlikely/unlikely/moderately likely/likely/very likely*]
2. Probability of **Establishment**
- 2.1. How likely is it that the species will be able to establish in HK based on the similarity between climatic conditions in HK and the species's current distribution? [*very unlikely/unlikely/moderately likely/likely/very likely*]
  - 2.2. How widespread are habitats or species necessary for the survival, development and multiplication of the species in HK? [[*very unlikely/unlikely/moderately likely/likely/very likely*]
  - 2.3. How likely is it that establishment will occur despite negative association with other species (such as competition from existing species, predation, parasitism) in HK? [*very unlikely/unlikely/moderately likely/likely/very likely*]
  - 2.4. How likely are the biological characteristics of the species to facilitate its establishment? [*very unlikely/unlikely/moderately likely/likely/very likely*]
  - 2.5. How likely is the adaptability of the species to facilitate its establishment?
  - 2.6. Based on the history of invasion by this species elsewhere in the world, how likely is to establish in HK? [*very unlikely/unlikely/moderately likely/likely/very likely*]
  - 2.7. If the species does not establish, then how likely is it that transient populations (e.g. species unable to reproduce in HK but is established because of continual release) will continue to occur? [*very unlikely/unlikely/moderately likely/likely/very likely*]
3. Probability of **Spread**
- 3.1. How important is the expected spread of this species in HK by natural means? [*minimal/minor/moderate/major/massive*]
  - 3.2. How important is the expected spread of this species in HK by human assistance? [*minimal/minor/moderate/major/massive*]
  - 3.3. Based on the answers to questions on the potential for establishment and spread in HK, define the habitat/location/area threatened by the species.
  - 3.4. What proportion of the potential area/habitat suitable for establishment (i.e. those parts of HK the species could establish), if any, has already been colonised by the species? [*0%-10% / 11%-33% / 34%-67% / 68%-90% / 91%-100%*]
  - 3.5. What proportion (%) of the remaining area/habitat suitable for establishment, if any, do you expect to have been colonised by the species five years from now, assuming without any management measures? [*0%-10% / 11%-33% / 34%-67% / 68%-90% / 91%-100%*]

- 3.6. If 5 years from now is not a suitable timeframe for estimating the spread of this species, what other timeframe (in years) would be appropriate to estimate any further spread of the species in HK?
4. Probability of **Impact**
- 4.1. How great is the economic loss caused by the species within its existing geographic range excluding HK? [*minimal/minor/moderate/major/massive*]
  - 4.2. How great is the economic loss caused by the species currently in HK?
  - 4.3. How great is the economic loss caused by the species likely to be in the future in HK? [*minimal/minor/moderate/major/massive*]
  - 4.4. How important is the impact of the species on biodiversity (e.g. decline in native species, changes in native species communities) currently in HK (include any past impact in your response)?
  - 4.5. How important is the impact of the species on biodiversity likely to be in the future in HK? [*minimal/minor/moderate/major/massive*]
  - 4.6. How important is alteration of ecosystem function (e.g. habitat change, nutrient cycling, trophic interactions), including losses to ecosystem services, caused by the species currently in HK (include any past impact in your response)?
  - 4.7. How important is alteration of ecosystem function (e.g. habitat change, nutrient cycling, trophic interactions), including losses to ecosystem services, caused by the species likely to be in HK in the future? [*minimal/minor/moderate/major/massive*]
  - 4.8. How important is decline in conservation status (e.g. sites of conservation importance, protected area) caused by the species currently in HK?
  - 4.9. How important is decline in conservation status (e.g. sites of conservation importance, protected area) caused by the species likely to be in the future in HK? [*minimal/minor/moderate/major/massive*]
  - 4.10. How important is it that genetic traits of the species could be carried to other species, modifying their genetic nature and making their economic, environmental or social effects more serious? [*minimal/minor/moderate/major/massive*]
  - 4.11. How important is social, human health or other harm (not directly included in economic and environmental categories) caused by the species within its existing geographic range? [*minimal/minor/moderate/major/massive*]
  - 4.12. Indicate any parts of HK where economic, environmental and social impacts are particularly likely to occur (provide as much detail as possible).

### Overall Risk

The overall risk [low, moderate, or high] is determined based on the following formula:

Overall risk score =

Probability score (Entry × 1 + Establishment × 1 + Spread × 1 + Impact × 2\*)

\* Impact score is given a weighting of two because of its relative importance in determining the invasion risk