Distribution of *Cryptopotamon anacoluthon* (Kemp, 1918) (Crustacea: Brachyura: Potamidae), a freshwater crab endemic to Hong Kong

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Distribution of Cryptopotamon anacoluthon (Kemp, 1918) (Crustacea: Brachyura: Potamidae), a freshwater crab endemic to Hong Kong

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Abstract: Cryptopotamon anacoluthon (Kemp, 1918) is a tropical freshwater crab currently considered endemic to Hong Kong. The species is more widely distributed than previously known and potentially occurs outside Hong Kong; however, the habitat of the species is under threat due to developmental activities and channelisation of watercourses. It is hoped that understanding of the distribution of this species will aid in its conservation.

Keywords: Crabs, Crustacea, endemic, freshwater, habitat loss, Hong Kong, pollution, tropical.

Chinese Abstract: 鰓刺溪蟹是一種熱帶淡水蟹,目前被列為香港的特有品種。本文研究發現該種在香港的分佈較以往認識的更為廣泛，同時亦可能在香港以外的地方出現。然而，鰓刺溪蟹的棲息地正在遭受渠道化工程及其他種發展的威脅。本文希望增加對本種分佈的了解，以期幫助及促進本種的保育工作。

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Author Details: DAVID J. STANTON, MICHAEL R. LEVEN and TOMMY C.H. HUI are all professional ecologists at AEC Ltd. based in Hong Kong. They conduct surveys for a wide range of faunal groups and input into a range of large scale Environmental Impact Assessments and Strategic Planning studies in Hong Kong and Asia.

Author Contribution: DJS, MRL and TCHH all participated in the design of the study, acquisition of data, analysis and interpretation of data, and drafting of the manuscript. DJS And TH read and approved the final manuscript. All the authors have contributed equally to this paper.

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INTRODUCTION

First described from Hong Kong, Cryptopotamon anacoluthon (Kemp, 1918) is a tropical freshwater crab (Image 1). This species appears to be relatively stenotopic and is found in shaded shallow streams with clear or unpolluted, fast-flowing waters, rocky substratum, and leaf-litters, which serve as shelter and food (Ng & Dudgeon 1992; Esser & Cumberlidge 2008). The species is listed under the ‘Vulnerable’ (VU) category of the IUCN Red List of Threatened Species because it might be under long-term threat from rapid anthropogenic changes and also due to its limited distribution (Esser & Cumberlidge 2008). Its published range under Esser & Cumberlidge (2008) is limited to four locations namely, Wu Kwai Sha, Kwun Yum Shan and Tai Po Kau Forest Reserve in New Territories (Ng & Dudgeon 1992) and the Peak on Hong Kong Island (Kemp 1918). However, it is noticed that the species is fairly common and widespread in local unpolluted streams (Ng & Dudgeon 1992; Dudgeon & Corlett 1994; Kennish 1995; Maunsell Consultants (Asia) Ltd. 2005). It has not been recorded outside of Hong Kong to date (Ng & Dudgeon 1992; Maunsell Consultants (Asia) Ltd 2005).

IUCN stated that this species may be threatened by future degradation of clean streams, a result of human population increases and industrial and agrarian development and, incorrectly, that it is not found in a protected area (Esser & Cumberlidge 2008). According to a local conservation assessment, the species is listed as being of Potential Global Concern (Fellowes et al. 2002).

While some Chinese freshwater crabs have been quite well studied, most species are either known only from the type locality or from just a few localities. In these situations, further collections are necessary to ascertain their actual distributions (Cumberlidge et al. 2010). Therefore, we have reviewed literature and made field observations in Hong Kong in order to provide additional information on the distribution of C. anacoluthon.

MATERIALS AND METHODS

Study Area

The present study area, Hong Kong Special Administration Region (SAR), People’s Republic of China (PRC) (22°09’–22°37’N & 113°50’–114°30’E) is situated on the south China coast to the east of the Pearl River (Zhujiang) estuary (Fig. 1). Hong Kong occupies an area of 1,100km² and is made up of a section of the Chinese Mainland (Kowloon and the New Territories, 793km²) and islands, of which Hong Kong and Lantau are the largest (78km² and 147km², respectively). The topography of Hong Kong is generally rugged with little flat land; much of the flatter areas (c. 60km²) are a result of land reclamation (Dudgeon & Corlett 2004). The Shenzhen River to the north largely separates Hong Kong from the Shenzhen Special Economic Zone of the PRC.

The climate of Hong Kong is distinctly monsoonal and despite its subtropical nature has well-defined seasons associated with the east Asian monsoons (Carey et al. 2001). During winter, the continental high-pressure region over Siberia and Mongolia results in north or northeasterly winds that bring cool, dry air to Hong Kong (Dudgeon & Corlett 2004).

Literature review

A review of literature was undertaken to examine the known distribution of C. anacoluthon. Full details of
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Observations

A review of 110 EIA reports, published between 2002 and 2016, was undertaken and these are listed in Appendix 1. The findings of the present review, combined with additional data obtained from unpublished studies have revealed that C. anacoluthon is known from at least 25 locations at 22 sites in Hong Kong (Appendix 1, Fig. 1). The type locality is The Peak on Hong Kong Island (Kemp 1918).

C. anacoluthon have been found mostly in fast flowing watercourses, which pass through semi-mature secondary woodland with limited anthropogenic influences, and with altitudinal range from 8m to 827m. Examples of typical watercourses where the crab has been observed are shown in Image 2. Field observations by the authors are that numbers recorded are generally low, i.e., only several individuals.

DISCUSSION

Distribution and habitat requirements of C. anacoluthon

Esser & Cumberlidge (2008) stated that C. anacoluthon occurred in four locations in Hong Kong and the probable range may extend into coastal Guangdong. From the present review, however, it is clear that the species is more widespread than previously thought, i.e., with 25 identified locations and approximately 200km² area of occupancy. Esser & Cumberlidge (2008)
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suggested that the population of *C. anacoluthon* is not severely fragmented, though the watercourses within Hong Kong are often fragmented (Stanton & Leven 2016) and do not share downstream confluences, a result of urbanisation. Many watercourses have been piped or channelised in their lower sections, and these modifications are likely to inhibit the movement of crabs between catchments. Hence, it is likely that within this area of occupancy there are now a number of more or less isolated sub-populations.

**Mitigation and Conservation**

According to IUCN, no conservation measures are known to be in place for *C. anacoluthon*, and the species is not found in a protected area (Esser & Cumberlidge 2008); however, one of the sites listed by Esser & Cumberlidge (2008) was in fact protected at that time, as it is today. They also mentioned that habitat loss and pollution are the major threats to *C. anacoluthon*. Given its habitat requirements, many of the sites occur within upland, fast-flowing hill streams within wooded habitats, which are largely situated within country parks or protected areas (e.g., Tai Po Kau); however, those sites zoned ‘Green Belt’ under local planning guidelines are under pressure for housing developments (Authors pers. obs.). It should also be noted that the species does also occur at lower elevations, particularly in the western New Territories and on Lantau Island, where there are developmental pressures on lowland watercourses (see Appendix 2, Fig. 1).

Currently, there is no mechanism in place to protect the ecology of entire rivers and their catchments in Hong Kong (Dudgeon & Chan 1996; Cheung et al. 2010), and there is an urgent need for protection of the remaining rivers in their natural state (Hong Kong Birdwatching Society 2013); a similar situation is occurring in much of the rest of Asia (Cumberlidge et al. 2009, 2010).

When mitigation is prescribed through the EIA process in Hong Kong, it is usually in the form of watercourse preservation and the inclusion of riparian buffers and/or translocation exercises. Currently, there are no stringent guidelines for implementation of habitat management, riparian buffer zones or conducting species translocation (Stanton & Leven 2016). Projects for reducing habitat loss and fragmentation by watercourse restoration, recreation or enhancement and faunal conservation programs are being started or in progress (e.g., Cumberlidge et al. 2009, 2010; Hong Kong Birdwatching Society 2015) in Hong Kong and elsewhere in the southern China region. The restricted range of many crab species from China, together with
the ongoing human-induced loss of habitat in many parts of the region are a cause for concern, and it is considered that conservation activities should be aimed primarily at preserving the integrity of sites and habitats while closely monitoring key populations at the same time (Cumberlidge et al. 2010).

Many of the sites in Hong Kong are isolated, fragmented by a combination of developed areas (where downstream sections have been lost) and physical topography, and have few ecological linkages suitable for a predominantly aquatic species to exploit. Protection of known sites is therefore important, so that these can ensure the continued survival of the species, and suitable habitat management would also be beneficial either by providing increased habitat area or by providing corridors to link populations.

**IUCN Red List Status**

The present study is not intended to constitute a review of the IUCN listing of *C. anacoluthon*. Nevertheless, we suggest that the IUCN Red List of Threatened Species status of *C. anacoluthon* should be revisited in the light of our findings: it is most unlikely that the population size or its rate of decline and the extent of species occurrence or area of occupancy meet that the population size or its rate of decline and the present study will help to feed into this process.

**CONCLUSIONS**

*Cryptopotamon anacoluthon* is widely distributed within Hong Kong; recorded throughout the New Territories, Hong Kong and Lantau Islands. So far, the species has not been recorded outside of Hong Kong. Generally, *C. anacoluthon* prefers fast flowing upland streams shaded by secondary woodland; however, the species has also been recorded in lower elevations from several locations, notably on Lantau Island and in the western New Territories. Watercourses in which this species occurs are largely natural with limited anthropogenic impacts such as channelisation or modification, but as the requirement of land increases for development, such areas will be under threat. Watercourse restoration projects provide an opportunity to conserve habitat of the species, and its habitat requirements should be taken into account when restoration measures are planned for potentially suitable watercourses.

**REFERENCES**


Appendix 1. List of Environmental Impact Assessment reports reviewed during the present study. All reports can be viewed online at [http://www.epd.gov.hk/eia/index.html](http://www.epd.gov.hk/eia/index.html)

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<td>EIA-229/2015</td>
<td>Desalination Plant at Tseung Kwan O</td>
</tr>
<tr>
<td>EIA-230/2015</td>
<td>Chai Wan Government Complex and vehicle Depot</td>
</tr>
<tr>
<td>EIA-232/2015</td>
<td>Operation of the Existing Tai Lam Explosives Magazine at Tai Shu Ha, Yuen Long for Liantang/Heung Yuen Wai Boundary Control Point Project</td>
</tr>
<tr>
<td>EIA-233/2015</td>
<td>Tung Chung New Town Extension</td>
</tr>
<tr>
<td>EIA-234/2015</td>
<td>Development of Anderson Road Quarry Site - Rock Cavern Developments</td>
</tr>
<tr>
<td>EIA-235/2015</td>
<td>Development of Anderson Road Quarry Site - Road Improvement Works</td>
</tr>
<tr>
<td>EIA-236/2016</td>
<td>Site Formation and associated Infrastructural Works for Development of Columbarium, Crematorium and Related Facilities at Sandy Ridge Cemetery</td>
</tr>
<tr>
<td>EIA-237/2016</td>
<td>Additional Gas-fired Generation Units Project</td>
</tr>
</tbody>
</table>
### Distribution of Cryptopotamon anacoluthon in Hong Kong

**Appendix 2. Locations of Cryptopotamon anacoluthon obtained from literature and authors’ observations**

<table>
<thead>
<tr>
<th>Site</th>
<th>Latitude (N)</th>
<th>Longitude (E)</th>
<th>Altitude (m)</th>
<th>Number of locations</th>
<th>Conservation area</th>
<th>Source/Additional notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>New Territories</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kwun Yum Shan</td>
<td></td>
<td>114°01'28.01&quot;</td>
<td></td>
<td>827</td>
<td>1</td>
<td>SSSI; Authors’ unpublished data; Esser &amp; Cumberlidge 2008</td>
</tr>
<tr>
<td>Tai Mo Shan</td>
<td>22°24'23.71&quot;</td>
<td>114°10'50.78&quot;</td>
<td></td>
<td>157</td>
<td>Special Area</td>
<td>Authors’ unpublished data; Esser &amp; Cumberlidge 2008</td>
</tr>
<tr>
<td>Tai Po Kau</td>
<td>22°25'30.49&quot;</td>
<td>114°16'55.89&quot;</td>
<td></td>
<td>57</td>
<td>No</td>
<td>Ove Arup &amp; Partners Ltd. 2011</td>
</tr>
<tr>
<td>Tei Lung Hau</td>
<td>22°22'53.29&quot;</td>
<td></td>
<td></td>
<td>109</td>
<td>No</td>
<td>Mott Connell Limited 2005</td>
</tr>
<tr>
<td>Sam Dip Tam</td>
<td>22°30'16.62&quot;</td>
<td>114°14'36.37&quot;</td>
<td></td>
<td>102</td>
<td>No</td>
<td>Authors’ unpublished data. Found in an EIS within a Country Park Enclave - no formal protection</td>
</tr>
<tr>
<td>Fung Yuen</td>
<td>22°28'03.97&quot;</td>
<td>114°10'51.88&quot;</td>
<td></td>
<td>53</td>
<td>1</td>
<td>SSSI; Authors’ unpublished data; Mott Macdonald 2010</td>
</tr>
<tr>
<td>Wu Kiu Sha</td>
<td></td>
<td>114°53'49.98&quot;</td>
<td></td>
<td></td>
<td></td>
<td>Esser &amp; Cumberlidge 2008</td>
</tr>
<tr>
<td>Shap Sze Heung, Ma On Shan</td>
<td>22°25'22.79&quot;</td>
<td>114°53'43.38&quot;</td>
<td></td>
<td>33</td>
<td>No</td>
<td>Authors’ unpublished data</td>
</tr>
<tr>
<td>Tai Tung Wo Liu, Ma On Shan</td>
<td>22°23'22.40&quot;</td>
<td>114°16'33.04&quot;</td>
<td></td>
<td>20</td>
<td>No</td>
<td>Maunsell Consultants Asia Ltd. (2004)</td>
</tr>
<tr>
<td>Sha Ha, Sai Kung</td>
<td>22°18'18.69&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ove Arup &amp; Partners Ltd. 2014; AECOM 2016</td>
</tr>
<tr>
<td>Ma Yau Tong</td>
<td>22°18'18.69&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Maunsell Consultants Asia Ltd. 2005</td>
</tr>
<tr>
<td>Pak Shing Kok, Tsung Kwan O</td>
<td>22°26'40.09&quot;</td>
<td>113°58'52.68&quot;</td>
<td></td>
<td>41</td>
<td>-</td>
<td>Mannings (Asia) Consultants Ltd 2009</td>
</tr>
<tr>
<td>Pat Heung, Shek Kong</td>
<td>22°26'12.50&quot;</td>
<td>114°06'09.13&quot;</td>
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<td>65</td>
<td>No</td>
<td>Authors’ unpublished data</td>
</tr>
<tr>
<td>Kam Tin Road, Shek Kong</td>
<td>22°26'00.91&quot;</td>
<td>114°06'07.82&quot;</td>
<td></td>
<td>13</td>
<td>No</td>
<td>MTRC/AECOM 2009b</td>
</tr>
<tr>
<td>Shek Kong</td>
<td>22°26'27.18&quot;</td>
<td>114°05'09.22&quot;</td>
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<td></td>
<td>No</td>
<td>MTRC/AECOM 2009b</td>
</tr>
<tr>
<td><strong>Lantau Island</strong></td>
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<tr>
<td>Keung Shan</td>
<td>22°14'32.07&quot;</td>
<td>114°53'53.27&quot;</td>
<td></td>
<td>105</td>
<td>1</td>
<td>AECOM 2009b; Ove Arup &amp; Partners Ltd. 2015; Some sections of this stream are an EIS</td>
</tr>
<tr>
<td>Kwan Yum Shan</td>
<td>22°14'15.38&quot;</td>
<td>113°53'33.96&quot;</td>
<td></td>
<td>154</td>
<td>1</td>
<td>Authors’ unpublished data</td>
</tr>
<tr>
<td>Tai Ho, Lantau</td>
<td>22°17'32.22&quot;</td>
<td>113°58'43.07&quot;</td>
<td></td>
<td>8</td>
<td>SSSI</td>
<td>AECOM 2009b; Ove Arup &amp; Partners Ltd. 2015; Some sections of this stream are an EIS</td>
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<tr>
<td>Tung Chung Stream</td>
<td>22°16'19.06&quot;</td>
<td>113°55'47.06&quot;</td>
<td></td>
<td>c. 15</td>
<td>-</td>
<td>Ove Arup &amp; Partners Ltd. 2015; Green power 2016; Some sections of this stream are an EIS</td>
</tr>
<tr>
<td><strong>Hong Kong Island</strong></td>
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<td></td>
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<tr>
<td>The Peak</td>
<td>22°16'39.93&quot;</td>
<td>114°45'45.74&quot;</td>
<td></td>
<td>514</td>
<td>No</td>
<td>Kemp 1918; Esser &amp; Cumberlidge 2008</td>
</tr>
<tr>
<td>Braemar Hill</td>
<td>22°16'–22'17&quot;</td>
<td>114°11'–114°12&quot;</td>
<td></td>
<td>186-222</td>
<td>2</td>
<td>Authors’ unpublished data</td>
</tr>
<tr>
<td>Jardine’s Lookout</td>
<td>22°15'–22'16&quot;</td>
<td>114°11'–114°11&quot;</td>
<td></td>
<td>175-192</td>
<td>2</td>
<td>Country Park &amp; SSSI; Authors’ unpublished data</td>
</tr>
</tbody>
</table>

**Notes:**

1. Latitudes, longitudes and altitudes may be approximate for some sites as exact locations could not always be sourced from literature. Where left blank, location could not be determined.
2. SSSI - Site of Scientific Interest
3. EIS - Ecologically Important Stream. EIS are natural streams and rivers with important ecological functions such as providing habitats for diverse or rare animal or plant communities. These are listed on a register maintained by the Government of the Hong Kong SAR but are afforded no specific protection.
Flora richness as an indicator of desert habitat quality in Kuwait
-- Yahya Al-Shehabi & Kevin Murphy, Pp. 9777–9785

Distribution of Cryptopotamon anacoluthon (Kemp, 1918) (Crustacea: Brachyura: Potamidae), a freshwater crab endemic to Hong Kong
-- David John Stanton, Michael Robertson Leven & Tommy Chung Hong Hui, Pp. 9786–9794

Moths of the family Limacodidae Duponchel, 1845 (Lepidoptera: Zygaenoidea) from Bhutan with six new generic and 12 new species records
-- Jatishwor Singh Irungbam, Meenakshi Singh Chib & Alexey V. Solovyev, Pp. 9795–9813

Odonates of Coimbatore District, Tamil Nadu, India
-- M. Suhirtha Muhil & P. Pramod, Pp. 9814–9828

Twenty-three new records of mantodea (Insecta) from some states of India
-- Tushar Kanti Mukherjee, Geetha Iyer & Parbati Chatterjee, Pp. 9829–9839

On the feeding habit of the Guiana Dolphin Sotalia guianensis (van Bénedén, 1864) (Mammalia: Cetartiodactyla: Delphinidae) in southeastern Brazil (~220S): has there been any change in more than two decades?
-- Ana Paula Madeira Di Benedetto, Clara da Cruz Vidart Badia & Salvatore Siciliano, Pp. 9840–9843

Additions to the scorpion fauna (Arachnida: Scorpiones) of Kerala, India, with an illustrated key to the genera
-- K. Aswathi & P.M. Sureshan, Pp. 9844–9850

A new critical habitat for conservation of the White-bellied Heron Ardea insignis Hume, 1878 (Aves: Ardeidae) from Bhutan
-- Karma Wangdi, Tashi Dhendup & Tsethup Tshering, Pp. 9862–9863

First report of the parasitoid wasp Piestopleura Förster (Hymenoptera: Platygastroidea: Platygastridae) from India
-- Kamalanathan Veenakumari, Peter Neerup Buhl, Anandhan Rameshkumar & Prashanth Mohanraj, Pp. 9864–9865

A century later the Manipur Argus Callerebia suroria Tytler, 1914 (Lepidoptera: Nymphalidae: Satyrinae) recorded in its type locality in Manipur, India
-- Jatishwor Singh Irungbam, Harmenn Huidrom & Baleshwor Singh Soibam, Pp. 9866–9869

First record of the predatory stinkbug Eocanthecona concinna (Walker, 1867) (Pentatomidae: Asopinae) from India
-- Sadashiv Hanumant Waghmare & Sunil Madhukar Gaikwad, Pp. 9870–9873

New records of Aplousobranch ascidians to Indian waters from Andaman Islands

Additions to the flora of Coimbatore hills, Tamil Nadu, India

Diversity of two families Libellulidae and Coenagrionidae (Odonata) in Regional Institute of Education Campus, Bhubaneswar, Odisha, India
-- Priyamvada Pandey & Animesh Kumar Mohapatra, Pp. 9851–9857

A report on occurrence of aphidophagous predators of Aphis odinae (van der Goot) (Hemiptera: Aphididae) in cashew ecosystem from Goa, India
-- Ramasamy Maruthadurai & Narendra Pratap Singh, Pp. 9858–9861