

Population size reduction and geographic range of *Rhagophthalmus hiemalis* in Hong Kong

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ABSTRACT

Transect count method was used to study the population size of *Rhagophthalmus hiemalis*. Surveyors walked along a 2 km section of MacLehose Trail Stage 9. Four surveys were done in 2012-2014. 17 surveys were done between 28 December 2020 to 17 February 2021. For the number of recorded female adults of *R. hiemalis*, a reduction rate of 88% is detected. 30 surveys were done in 13 survey routes situated in similar habitat to that of type locality, covering the New Territories, Hong Kong Island and Lantau Island. Length of route ranges from 2.2km to 5.3 km. Three female adults of *R. hiemalis* were recorded in Shatin Pass in one visit on January 17, one more location of occurrence is added.

Key words: *Rhagophthalmus hiemalis*, Hong Kong, population size, geographic range

INTRODUCTION

Rhagophthalmus hiemalis is the second known species under this genus in Hong Kong (Yiu, 2017). It was first recorded on 4 January 2010 (a mating pair) in Tai Mo Shan, near Sze Lok Yuen. On 16 December 2012, two female adults were found in Tsuen Kam Au, near Kap Lung Ancient Trail. On 17 December 2012, 7 female adults were recorded along a section of MacLehose Trail Stage 9. Two female adults were recorded on 21 January 2014 in Mui Tsz Lam, Shatin. Male adults (Fig. 1) were recorded on 2 January 2014 in Tsuen Kam Au and on 24 January 2014 in Mui Tsz Lam, Shatin respectively.

Rhagophthalmus hiemalis was described as a new species in 2017 by Yiu. Both *R. motschulskyi* and *R. hiemalis* are only known in Hong Kong.

Flight period of *R. hiemalis* is from late December to Early March, but mostly recorded in January, in less disturbed natural habitats. Female adults were often seen lying on the sparsely vegetated slope surfaces near woodland margins, bending its abdomen upward such that light organ is facing upward (Fig. 2), displaying a continuous glow. The light display could be seen shortly after sunset and usually lasts for 2 hours. Light emission from female can be observed when the air temperature is 10°C or above. The light display is conspicuous that it can be clearly visible from 10 m distance. No light emission was observed from male.

The first Hong Kong Firefly Survey Team was established on the World Firefly Day (4 July) 2020. After 8 hours

lecture training and 12 hours practical training at night, in the wild, members would take part in firefly surveys. *R. hiemalis* is one of the main subjects of their surveys.

MATERIALS & METHODS

Population size

Transect count method is adopted. Surveyors walk along a 2 km section of MacLehose Trail Stage 9 (Fig.3) in a very slow pace – slower than 2 km per hour, and count the number of female adult of *R. hiemalis* seen, by identifying the light display along the road sides. Rules and skills were taught in a lecture and through an on-site demonstration video. It was also remarked that surveyor should get close to the light spot to ensure that it is a female adult displaying light by raising its abdomen and not a larva of other firefly species. Photo should be taken as far as possible. All the survey was done within the period of 18:30 to 20:00 when the firefly is most active, air temperature should not lower than 13 degree Celsius. Weather conditions including rainfall, wind, cloud cover and moon phase were also recorded to make sure that surveys were not done under extreme conditions.

Geographic range

13 survey routes (Fig. 4) situated in similar habitat to that of Tsuen Kam Au – type locality, were designated, covering the New Territories, Hong Kong Island and Lantau Island. Length of route ranges from 2.2km to 5.3 km. Surveyors walk along the routes in a very slow pace – around 2 km per hour, and count the number of female adult of *R. hiemalis* seen, by identifying the light display along the road sides. Rules and skills were taught in a lecture and through an on-site demonstration video. It was also remarked that surveyor should get close to the light spot to ensure that it is a female adult displaying light by raising its abdomen and not a larva of other firefly species. Photo should be taken as far as possible. All the survey was done within the period of 18:30 to 20:30 when the firefly is most active, air temperature should not lower than 13 degree Celsius. Weather conditions including rainfall, wind, cloud cover and moon phase were also recorded to make sure that surveys were not done under extreme conditions.

RESULTS

Population size

Along the MacLehose Trail Stage 9, four surveys were done in 2012-2014 by the author. 17 surveys were done

between 28 December 2020 to 17 February 2021, 15 done by survey team members and two done by the author. Number of recorded female adults of *R. hiemalis* in each survey is show in Fig. 5. Average number of recorded female adults of *R. hiemalis* in each survey from December 2012 to January 2014 is 5.50; the average number from December 2020 to January 2021 is 0.65.

Geographic range

Survey Route, date of survey and number of recorded female adults of *R. hiemalis* in each survey are list in the Table 1.

Amongst the 30 surveys, three female adults of *R. hiemalis* were recorded in Shatin Pass in one visit on 17 January with photo records; all the other surveys have no record.

DISCUSSION

One more occurrence location of *R. hiemalis* was discovered by the Firefly Survey Team members. Totally it is now known in four well separated localities. On the other hand, it was not found in other 12 potential locations during its flight period. Applying the standard of restrictedness threshold suggested by Fellows et al. (2002), Local restrictedness of *R. hiemalis* can be regarded as C= known to occur in three to four localities.

Comparing the average number of recorded female adults of *R. hiemalis* in each survey along the along a 2 km section of MacLehose Trail Stage 9, from December 2012 to January 2014 - 5.50, with the average number from December 2020 to January 2021 - 0.65. A reduction rate of 88% is detected. If the reduction rate continues and it applies to the whole population, *R. hiemalis* may become extinct in a few decades. Currently, the status in other three occurrence sites is not known. The cause of reduction in MacLehose Trail Stage 9 is not known. Therefore, variation of the population in other 3 sites may not be the same. Unusual clearance of vegetation along the slopes in MacLehose Trail Stage 9, where female adults of *R. hiemalis* were found is observed (Fig. 6, 7). Without cover by the vegetation, the habitat would have higher fluctuation on temperature and moisture level and becomes less suitable for the firefly. It is also not clear whether the clearance of vegetation is artificial or not. MacLehose Trail Stage 9 is also a section of a popular mountain bike route, mountain bikers riding outside the designated tracks and rolling over similar natural slopes in this area was commonly seen. It is proposed to keep close monitoring of the population *R. hiemalis* and to stop the destructive illegal biking in the Country Parks.

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TABLES & FIGURES

Survey Route	Date of Survey, all in 2021	No. of recorded female adults of <i>R. hiemalis</i>
Tai Tong Nature Trail	Jan 25; Jan 26	0
Tsing Yi nature Trail	Jan 16; Feb 3	0
Robin's Nest	Jan 15	0
Cloudy Hill North	Feb 6	0
Cloudy Hill South	Feb 4	0
Lan Nai Wan	Jan 14; Jan 24; Jan 30	0
Shui Long Wo	Jan 21; Jan 23; Feb 8	0
Shatin Pass	Jan 17	3
Black's Link	Jan 17; Jan 20; Jan 26; Jan 27; Jan 30	0
Mount Parker	Jan 16; Jan 17; Jan 25; Feb 1; Feb 6; Feb 8	0
Pak Mong	Jan 19; Feb 4	0
Fat Mun Ancient path	Jan 19; Feb 6	0
Mui Wo	Jan 27	0

Table 1. Survey route locations, dates of survey and number of recorded adults of *R. hiemalis*.



Figure 1. *Rhagophthalmus hiemalis* male adult. [Photo by author]



Figure 2. *Rhagophthalmus hiemalis* female adult. [Photo by author]

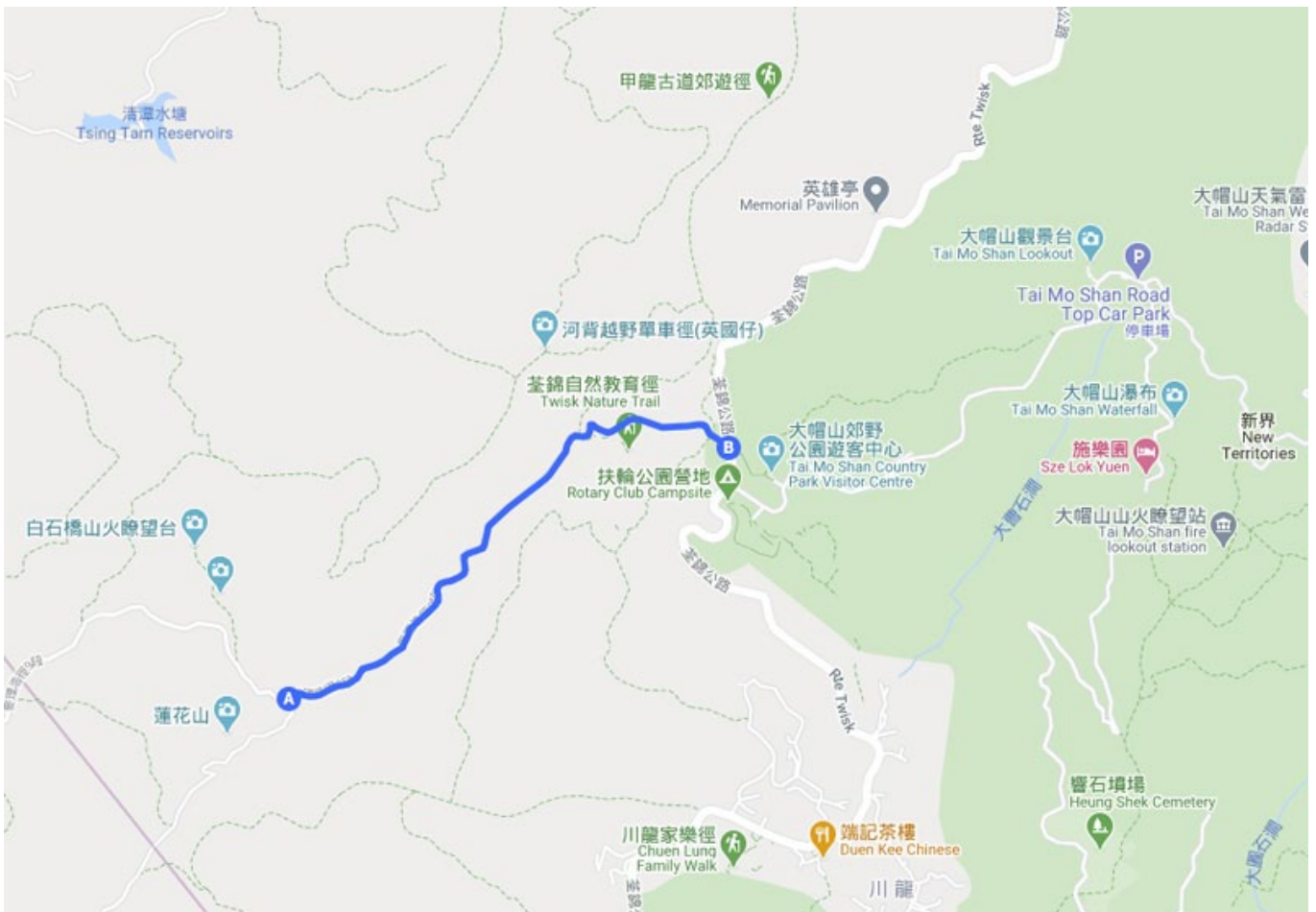


Figure 3. Belt transect survey route - 2km section of MacLehose Trail Stage 9. [Photo by author]

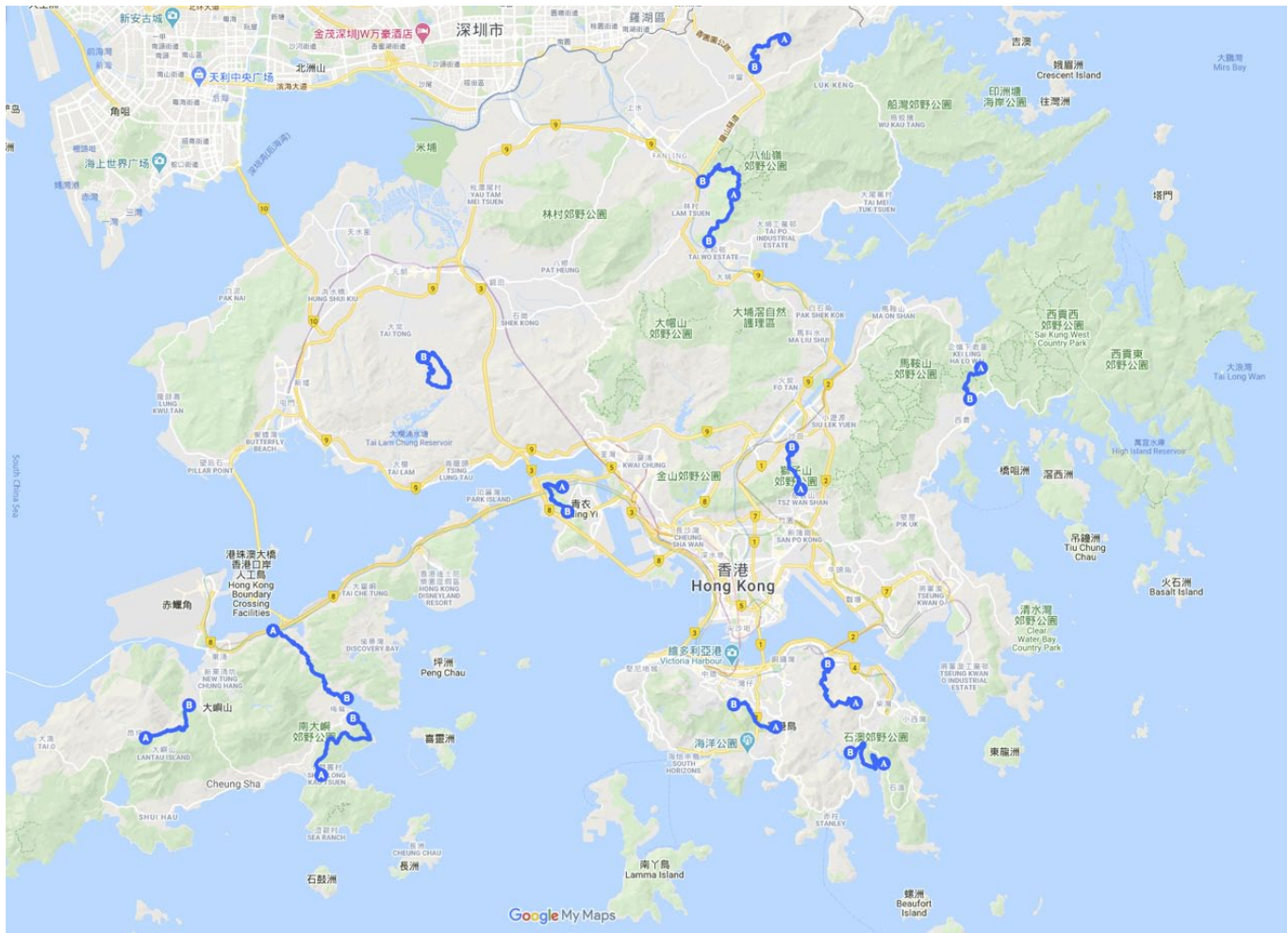


Figure 4. Distribution of the 13 survey routes. [Photo by author]

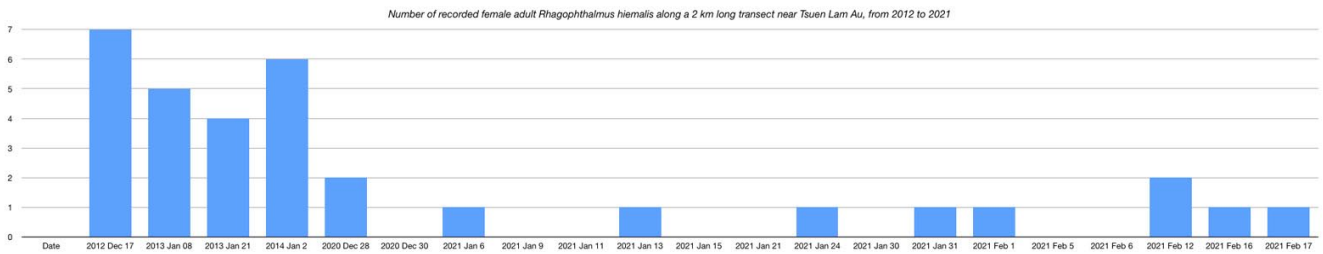


Figure 5. Number of recorded female adults of *R. hiemalis* in each survey. [Photo by author]



Figure 6. Unusual clearance of vegetation. [Photo by author]



Figure 7. Normal vegetation cover. [Photo by author]