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防洪改善计划对鸟类的生态影响

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摘要:香港特别行政区新界内有 23 hm^2 的鱼塘和 22 hm^2 的耕地,在"元朗-锦田-牛潭尾主要防洪改善计划"中被改变成两条防洪渠(防洪渠 60 号和 43 号)。于该防洪改善计划中的生态监察调查中发现这两条防洪渠的鸟类数量均较原先的生境大大减少。在耕地改变成防洪渠 43 号的过程中,鸟类密度由 33.9 只/hm^2 减少至 2.2 只/hm^2。在鱼塘改变成防洪渠 60 号的过程中,鸟类密度由 5.2 只/hm^2 减少至 0.4 只/hm^2。研究亦发现一些原本在鱼塘和耕地很常见的鸟类物种因为生境被改变而消失。这些转变可能和食物,植被及生境复杂程度的减少有关。另一方面,为纾缓因这防洪改善计划中损失的耕地生境,渠务署在防洪渠 43 号的河岸铺上混凝土草格,促进植物繁衍,为鸟类提供生境。但研究发现以混凝土草格建造的草坡并未能提供有效的纾缓措施,取代耕地生境以减少生态影响。

关键词:香港;鸟类密度;鸟类种数;防洪改善计划;防洪渠;混凝土草格

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Ecological impacts of flood control project on birds

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Abstract: A total of 23 hm^2 of fishponds and 22 hm^2 of cultivated lands in the New Territories of Hong Kong Special Administrative Region (HKSAR) were converted to two flood control channels (Channels 60 and 43) by the Main Drainage Channels Project for Ngau Tam Mei, Yuen Long, and Kam Tin (MDC Projects). Post-construction ecological monitoring surveys showed that bird abundance of the two flood control channels were lower than those of the habitats they replaced. Conversion of cultivated lands to Channel 43 resulted in decline of mean bird density from 33.9 individuals/hm^2 to 2.2 individuals/hm^2. Conversion of fishponds to Channel 60 resulted in decline of mean bird density from 5.2 individuals / hm^2 to 0.4 individual/hm^2. This was probably due to declines in food abundance, vegetation cover and habitat complexity. Losses of ecological habitats were observed. The inner embankment of Channel 43 was lined with grasscrete to provide wildlife habitats to mitigate the loss of cultivated lands. This mitigation measure, however, proved ineffective.

Key words: Hong Kong; bird abundance; species richness; flood control project; flood control channels; grasscrete

Introduction

Most lowland rivers in HKSAR are small, narrow and sinuous, and typically have cultivated lands and/or fishponds along either bank. Flood control projects usually involve straightening and widening these natural river channels to increase flow rates during floods. Such channelization not only destroys riverine habitats, but also affects adjacent wetland habitats. Fishponds and cultivated lands have been shown to be important bird habitats[1-3]. The MDC Projects involved the conversion of 112 hm^2 of fishponds and 30.2 hm^2 of cultivated lands in the central and northwest New Territories of HKSAR to six flood control channels. This paper reports the impact on bird communities of conversion of fishponds and

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cultivated lands to flood control channels in HKSAR. The effectiveness of grasscrete as a channel lining to mitigate losses of natural habitats of birds is also discussed.

1 Study Areas and Methods

1.1 Study Areas

Bird communities at two flood control channels of the MDC Projects, Channel 43 and Channel 60, in the New Territories of HKSAR were studied. Construction works in both channels were completed in late 1998.

The area covered by Channel 43 was originally cultivated land. This channel measured 2.2 km in length, 100 m in width and 22 hm^2 in area. The upper half of the inner embankment slopes was paved with grasscrete (3.5 m width) to provide wildlife habitat, in mitigation to the loss of cultivated land. The lower embankment slope was concreted because it was considered that vegetation growing on the lower slope could reduce water flow rates thereby degrading the hydraulic performance of the channel. This would conflict with the flood control objective of the drainage channel, which was designed for 1 in 50 year floods.

The area covered by Channel 60 was originally freshwater fishponds. Channel 60 measured 1.7 km in length, 120 m in width and 23 hm^2 in area. The embankments of Channel 60 were covered by concrete and rubble, a typical design of drainage channels in HKSAR.

1.2 Methods

The winter (November-February) and spring (March-May) bird communities of Channels 43 and 60 were surveyed using the transect count method. A 2.1 km transect along the north embankment of Channel 43 and a 1.7 km transect along the west embankment of Channel 60 were sampled 31 times between November 1998 and January 2002. All birds seen within the channels were identified using 10 × 42 binoculars and counted. Surveys were usually done in the morning. Bird density is expressed as mean number of birds hm^{-2} ± standard error, and was calculated by dividing the total number of birds by the area sampled and number of surveys.

Impacts to bird communities due to conversion of wetland habitat to drainage channel could be assessed by comparison of the bird communities at same locations before and after construction. However, there were no quantitative data describing pre-construction bird communities. Therefore impacts were assessed by comparison of bird counts and species numbers on nearby reference habitats that were similar to those lost due to channel construction. Descriptions of these reference habitats are shown in Tables 1 & 2.

The effectiveness of grasscrete in providing bird habitats was investigated through comparisons of bird abundance and species richness between Channel 43 and Channel 60 using the pairwise t-test.

2 Results

A total of 44 species was recorded in Channel 43. Mean bird density was (2.2 ± 0.3) individuals/hm^2 (Table 1). This compares with 60 species and 33.9 individuals/hm^2 on reference habitats (nearby cultivated lands). A total of 20 species was recorded in Channel 60 (Appendix 1). Mean bird density was (0.4 ± 0.1) individuals/hm^2. This compares with 60 species and 5.2 individuals/hm^2 on reference habitats (fishponds).

Bird density declined by 93.5% after conversion of cultivated land to a grasscreted flood control channel. Bird density declined by 92.3% after conversion of fishponds to Channel 60 (Table 2). Numbers of recorded bird species will typically increase with area covered and number of surveys. Despite the larger area sampled, greater number of surveys and longer survey period, bird species richness on Channels 43 and 60 were lower than those in nearby reference habitats they replaced.

Two bird species that are common in the cultivated lands and fishponds were absent in flood control channels. White-breasted Waterhen *Amaurornis phoenicurus* are commonly found in cultivated lands, freshwater fishponds and streams, yet was absent from both Channel 43 and Channel 60. Little Grebe *Tachybaptus ruficollis* is commonly found in freshwater fishponds, was absent in Channel 60.

Mean bird density in the grasscrete-lined Channel 43 was 5.5 times higher than on rubble-lined Channel 60. Species richness in Channel 43 was 2.2 times higher than on Channel 60. The differences were statistically significant (bird

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density: $t = 4.83$, $p < 0.0001$; species richness: $t = 4.39$, $p < 0.0001$).

Table 1　Area sampled, number of surveys, population density and species richness in cultivated lands and Channel 43

Item	Channel 43	Cultivated lands[3]
Density (individuals/hm^2)	2.2	33.9
Total species richness	44	60
Area sampled (hm^2)	22	4.7
Total number of surveys	31	17
Survey period	Nov 1998—Jan 2002	Feb—Oct 1997

Table 2　Area sampled, number of surveys, population density and species richness in fishponds and Channel 60

Item	Channel 60	Fishponds①
Density (individuals/hm^2)	0.4	5.2
Species richness	20	60
Area sampled (hm^2)	23	16.9
Total number of surveys	31	19
Survey period	Nov 1998—Jan 2002	Jan 1998—Jan 2000

3　Discussion

Aquatic biota are usually more severely impacted by river regulation projects than are terrestrial biota[4~6]. However, most lowland rivers in HKSAR are heavily polluted and largely devoid of aquatic life. Therefore, river channelisation in rural areas of HKSAR usually causes impacts to wildlife utilising those cultivated lands and fishponds that are channelised in the process of widening the natural riverbed.

Decline in bird abundance and species richness, and loss of ecological niches in flood control channels were probably due to loss of food supply, vegetation cover and habitat complexity. Due to the commonness and widespread distribution of White-breasted Waterhen and Little Grebe in HKSAR, their absence in the two channels during 31 surveys could not be due to chance. Rails are typically secretive birds that occupy habitats where escape cover is available in the form of dense ground vegetation. Such habitat is lacking on flood control channels. The connection of flood control channel with sea creates brackish environment and means the disappearance of freshwater habitats, in which Little Grebe inhabits.

Comparison of bird densities on cultivated land and grasscrete-lined channel showed that the effectiveness of grasscrete to provide bird habitat in flood control channels is limited. Although grasscrete-lined flood control channels did not support bird communities as species-rich or abundant as cultivated lands, they represented an improvement over flood control channels with bare concrete embankments. Use of grasscrete embankment lining is recommended as an alternative to bare concrete or coarse rubble embankment in flood control channels. When the natural channel bank or an earthen lining can be used, bird habitat value will be the greatest.

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References:

[1] Young L and Chan G. The significance of drained fish ponds for winter waterbirds at the Mai Po Marshes, Hong Kong. Ibis, 1997, 139(4): 694~698.

[2] Young L. The importance to ardeids of the Deep Bay fishponds, Hong Kong. Biological Conservation, 1998, 84(3): 293~300.

[3] Kwok H K and Dahmer T D. Bird communities of cultivated lands in Hong Kong. Memoirs of the Hong Kong Natural History Society, 2001, 24: 181~188.

[4] Zhang Y X, Malmqvist B and Englund G, *et al*. Ecological processes affecting community structure of blackfly larvae in regulated and unregulated rivers: a regional study. Journal of Applied Ecology, 1998, 35(5): 673~686.

[5] Baattrup-Pedersen A and Rils T. Macrophyte diversity and composition in relation to substratum characteristics in regulated and unregulated Danish streams. Freshwater Biology, 1999, 42(2): 375~385.

[6] Humphries P, Serafini L G and King A J, *et al*. River regulation and fish larvae: variation through space and time. Freshwater Biology, 2002, 47(7): 1307~1331.

① Kwok H K and Dahmer T D. Bird communities and conservation management of fishponds in Hong Kong. Hong Kong Naturalist