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ORIGINAL RESEARCH PAPER

CENSUS OF PYGMY CORMORANT COLONY ON SKADAR LAKE USING FREE EARTH OBSERVATION SOFTWARE

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Key words:
Pygmy cormorant, breeding census, Google Earth, GPS, quadrate count.

SYNOPSIS

Quadrat count of Pygmy cormorant colony was tested using the GPS and free Earth observation software. This technique proved useful in field research by reducing time in the field, but also showed significantly different results in comparison to the distant count method.

Ključne riječi:
Mali kormoran, Census gniježđenja, Google Earth, GPS, probni kvadrat.

SINOPSIS

CENZUS KOLONIJE MALOG KORMORANA NA SKADARSKOM JEZERU POMOĆU BESPLATNOG SOFTVERA ZA SATELITSKO OSMATRANJE"

Brojanje kolonije malog kormorana metodom probnog kvadrata je testirano pomoću GPS-a i besplatnog softvera za satelitsko posmatranje Zemlje. Ova tehnika se pokazala korisnom na terenu zbog smanjenja vremena potrebnog za istraživanja, ali je takođe pokazala i znatno drugačije rezultate u odnosu na metod osmatranja iz daljine.

INTRODUCTION

The assessment of colonial water birds' numbers and distribution is one of the critical issues in the management and conservation of Skadar Lake (fig. 1). This is particularly true for colonial Pygmy cormorant (*Microcarbo pygmeus*) whose population on Skadar Lake is one of the largest in Europe (Voskamp et al., 2005). Count of occupied nests at the colony is tedious and requires prolonged human presence, which leads to disturbance in the most sensitive period. Counting of birds present at the colony from distance provides only approximation on the actual breeding number. Arrival/departure method tested at Prespa Lake (Willems & De Vries, 1998) was not viable on Skadar Lake because of multiple colony locations and lack of suitable ground observation point. This paper describes an attempt to census Pygmy cormorant's nests using stratified square sample, aided by the satellite imagery, and hand-held GPS.

Freely available Google Earth provides satellite imagery useful for habitat measurement and delimitation. It also supports the import of GPS file formats, which allows accurate visualization of research

area. GE-Path is a free application based on Google Earth's Keyhole format, which is used to calculate area and to create custom grid overlays.

This paper presents the GPS assisted quadrat count method tested on the Pygmy cormorant's colony at Skadar Lake.

STUDY AREA

Pygmy cormorant on Skadar Lake breed in a poly-specific colony Crni Žar together with five heron species (Vizi, 1997). The colony is built on inundated shrubs growing on a thick peat substrate. Total area of the colony is about 1.5 ha. The vegetation consists of willows, reed, rush, cattail, water lilies, water chestnut etc. Pygmy cormorant breeds only on willow trees, which can provide sufficient support. Patches of trees are surrounded by reeds and floating carpets of aquatic vegetation. Nests are densely distributed on the tangled branches, which makes entering the colony very sensitive. Anytime of the year, the colony can only be approached by a boat.

Figure 1: Location of Skadar Lake in Montenegro.

METHODS AND EQUIPMENT

Standard methodology of quadrate count is based on two assumptions: that the count area is known, and that organisms are relatively immobile during the count (Krebs, 1998). This method is therefore suitable for counting colonial bird nests during the incubation phase.

In this experiment, a semi-random quadrat selection was used (Sutherland et al., 2004) (fig. 2), which predefined the breeding microhabitats within mosaic structure of the colony area, namely the nest-bearing patches of trees and shrubs against the other aquatic vegetation.

First step was to record the colony perimeter in the field, using a handheld Garmin e-Trex GPS. The recorded track was then imported into Google Earth, allowing the area calculation and vegetation assessment on the satelite imagery.

Colony area mapping was performed on 27 May 2010, when the exact location and perimeter was recorded with GPS. Total area within the perimeter was measured 1.35 hectares. The microhabitat composition within the area was recorded and photographed. Breeding Pygmy cormorant adults were counted with binoculars from the boat outside the colony, at distance of 150m. Total number was estimated to 1700 breeding pairs.

The field measurements and custom 10x10m grid overlay made with GE-Path were loaded to Google Earth. The quadrat size of 10x10m is chosen to reduce necessary movement through the colony and provide good overview of the nests from a single point. For the purpose of semi-random sampling, research area was reduced from initial 1.35 ha to the actual

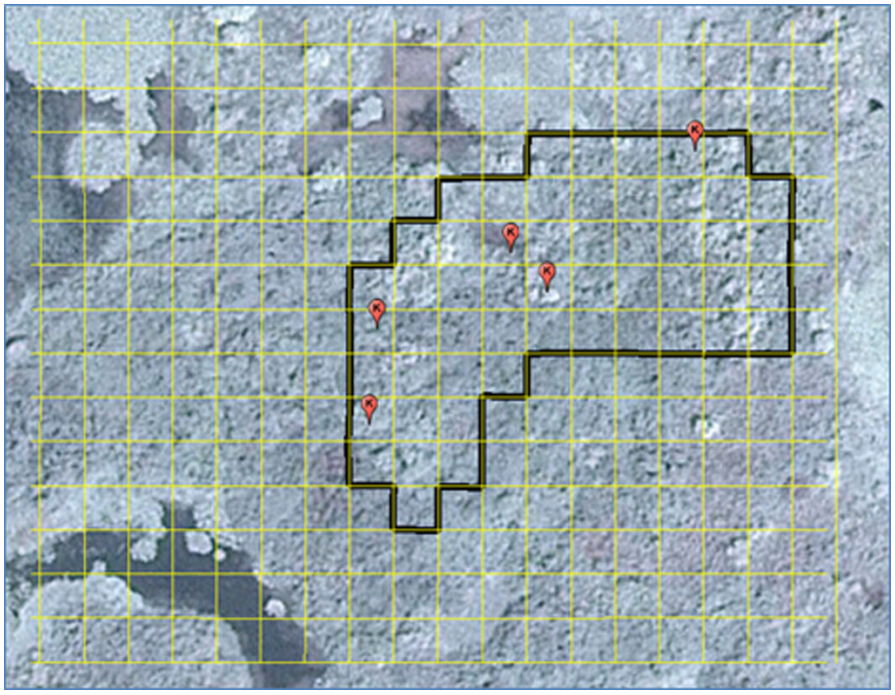

Figure 2: Google Earth image with 10x10m grid and selected quadrats.

nesting area with suitable nesting vegetation, comprising 53 quadrats. Total of five quadrats were selected randomly using Excel RANDBETWEEN function and marked for further research. The prepared grid with pre-selected quadrats was then transferred to hand-held GPS to be used in the field.

Figure 3: Pygmy cormorant clutch at Crni Žar colony observed with mirror pole.

RESULTS

Test sampling was conducted on 21 June 2010, at the peak of the breeding season. Total of 5 quadrats were counted, comprising 9.43% of total breeding area. The total number of Pygmy cormorant's nests were counted in each quadrat. To distinguish target nests from other species in the colony, a mirror pole was used for inspection of the nests' contents.

The table 1. shows the results of nest count in five sample quadrats.

Quadrat:	Number of nests:
K1	74
K2	18
K3	67
K4	55
K5	43

Table 1: Number of nests in sample quadrats.

Total of 257 nests were counted with mean value of 51,4 nests per quadrat. By extrapolating the mean to 53 quadrats, the total calculated number was 2.724 nests, which equals 1.362 breeding pairs.

DISCUSSION

In comparison to boat count, which was performed by counting visible birds from outside the colony, the number of breeding pairs calculated by nest sampling is 23% lower (factor of 0,78). The discrepancy can be attributed the remote counting limitations, which can't detect all the breeding birds which are out of colony, or remain at the nests. Moreover, all observed adult birds at the colony may not actually breed at the time. Free estimation by experienced researchers is thus required to approximate the actual number of breeding Pygmy cormorants. This study's results may enhance the estimations by including the calculated factor of 0,78 in future censuses.

CONCLUSION

GPS assisted quadrat count has been tested on the colony of Pygmy cormorant on Skadar Lake, using Earth observation software. The purpose of the experiment was to assess the usability of the available techological resources in context of decreasing the field effort and disturbance to the colony, while producing an accurate result.

In comparison to the results acquired by distant count, the sample quadrat count showed smaller number of Pygmy cormorant breeding pairs within the colony.

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