Pulsar Satellite Radio Beacon Application Experience in the Telemetry of Brown Bear (Ursus Arctos L.)

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Abstract

This study shows application experience of pulsar satellite radio beacons (Russian production) in studying brown bear ecology. During 2011–2013 three brown bears were equipped with satellite collars fitted with a radio beacon in the Primorsky region and the Kostroma region. The animals were tracked using satellite technology and telemetry. We obtained data on brown bear space use and daily and seasonal movements. Our results show possibility of using this method for the study and conservation of wild animals.

Keywords:
Brown bear
Ursus arctos
Satellite radio beacon
Satellite collar
Animal ecology
Telemetry

Introduction

Satellite beacons are widely used for the study of animal ecology (Webb et al., 2008; Hebblewhite and Haydon, 2010; Tomkiewicz et al., 2010; Petrunenko et al., 2011; etc.). They replaced the VHF radio transmitters, which for many years had been used in zoological studies (Mech, 1983; Sokolov and Sukhov, 1986; Kenward, 1987; Miquelle et al., 1993; Seryodkin, 2011; etc.). Nowadays radio telemetry and satellite technologies allow information to be obtained on the location of animals and their movements, extent of the territory, particular features of the space and habitat utilization, daily activity mode and other environmental issues that are important for understanding the ways to preserve the animals. Providing the opportunity for continuous and all-year-round monitoring of marked animals’ displacements on vast territories and obtainment of highly accurate data on their location, the satellite beacons have led zoological research to a new level.

Although the ecology of the brown bear (Ursus arctos Linnaeus, 1758) has been diversely studied (Bromley, 1965; Kudaktin, 1987; Pikunov, 1987; Pazhetnov, 1990; Danilov, 1991; Zheleznov, 1991; Seryodkin, 2012; etc.), application of the contemporary research methods has potential to explore some of the predator’s ecology aspects crucial for its preservation and rational use. Production of the satellite beacons initiated in Russia facilitates their use for studying the many features of the brown bear and other types of wild animals such as reindeer (Okhlopkov et al., 2012).

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Materials and Methods

Study of the brown bear ecology in the Sikhote-Alin biosphere reserve was carried out in the framework of the park joint program in association with the Wildlife Conservation Society and Pacific Geographical Institute, FEB RAS (Seryodkin, 2011). The research in “Kologrivskiy les” was implemented within the program “Research of the large predator and hoofed animals’ ecology and habitat in the Federal State Budgetary institution “Kologrivskiy les” and cross-border territories with combined methodology” (Zaitsev and Chernyavin, 2012).

For the study of the brown bears pulsar radio beacons produced by the “ES-PAS” Ltd. (Moscow) were attached to the collars. The appliance contains GPS receiver that detects the location of the marked animal and transmitter that sends the geographic coordinates to the Argos system satellites. Then the satellites transmit the data to the terrestrial stations and afterwards to the researcher.

The bear trappings for marking purposes were implemented through the use of pad holding traps (Seryodkin et al., 2005). The traps were located on wood trails and oat field. The immobilization was carried out by application of remote injector 4V.310 (manufactured by Telinject, Germany) and anesthetic medication with Zoletil 100. Three brown bears were marked by the collars with radio beacons in two regions (Table 1, Fig. 1). Trapped animals were weighed (Fig. 1).

The approximate age of the animal was estimated by dental attrition. In 2011 two mature males were trapped on the wood trails in the Sikhote-Alin biosphere reserve (Dzhigitovka river basin, Dalnegorsk area, Primorsky region). Bear #1 and Bear #2 were marked with the collars on September 23 and October 12, respectively. Bear #3 was trapped on the oat field on September 18, 2013 in the Londushka river basin in the “Kologrivskiy les” state natural reserve (Kologrivskiy area, Kostroma region).

Results and Discussions

Tracking of Bear #1 was being implemented within one month (Table 1, Fig. 2).

The distance from the trapping location to the last destination point was 43 km, the maximum distance between the places of dwelling summed 44 km. The minimum distance covered by the animal per month, calculated as the sum of distances between proximate points summed 70 km. In nine cases it was possible to determine the lineal diurnal course of the bear (lineal distance between two locations in approximate time period of 24 h). The average indicator was 4 km with a minimum of 0.2 km and maximum of 17.5 km.

The monitoring of Bear #2 provided 113 points with the location coordinates determined by the GPS receiver (Table 1).

Table 1
Characteristics of the brown bears marked with pulsar satellite beacons and tracking data.

<table>
<thead>
<tr>
<th>No. of animals</th>
<th>Sex</th>
<th>Age, years</th>
<th>Weight, kg</th>
<th>Area of research</th>
<th>Period of monitoring</th>
<th>Number of GPS locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
<td>8–10</td>
<td>235</td>
<td>Sikhote-Alin natural reserve</td>
<td>23.09–23.10.2011</td>
<td>27</td>
</tr>
<tr>
<td>2</td>
<td>Male</td>
<td>6–7</td>
<td>180</td>
<td>Sikhote-Alin natural reserve</td>
<td>12.10–18.11.2011</td>
<td>113</td>
</tr>
<tr>
<td>3</td>
<td>Male</td>
<td>Approx. 10</td>
<td>≥165</td>
<td>“Kologrivskiy les” reserve</td>
<td>18.09–5.10.2013</td>
<td>80</td>
</tr>
</tbody>
</table>

Fig. 1. Weight measuring of the brown bear marked with the pulsar satellite beacon in the Sikhote-Alin reserve.
The maximum distance between the places of stay summed 46 km. The minimum distance covered by the bear during the entire monitoring period and calculated as a sum of distances between the points was 122 km. Detected 26 times the average lineal diurnal course was 2.8 km with minimum 0.07 km and maximum 9.3 km.

Bears #1 and #2 during the monitoring period were dwelling in the area of cedar and broadleaved forests. In this period they subsisted on Korean pine nuts (Pinus koraiensis) accumulating the fat stores for the winter period. It is known that during the period fat storing Sikhote-Alin brown bears can make significant displacements (Seryodkin et al., 2012). Minor diurnal displacements were interchanged by long distance walks (Fig. 2).

The first were caused by the intensive feeding with the nuts, while the second were related with the transits between river basins. Bear #1 had these transits longer making up to 17.5 km per day (lineal distance) at which time it crossed the main dividing ridge of the Sikhote-Alin region.

As distinct from its congeners from Sikhote-Alin reserve, during the period of monitoring Bear #3 was making minor displacements. The largest covered distance between the visited points summed 5 km only.

The application of satellite tracking enabled the analysis of individual brown bear displacements in the Primorsky and Kostroma regions. Also there is a positive experience of pulsar satellite beacon application in the Western Yakutia where bear tracking was carried out in 2012 (Nikolaev et al., 2012). There the average diurnal displacement distance of the bear was 13–19 km (maximum of 28 km). Therefore the experience of the pulsar beacon application has proved that they can be used successfully for the study of brown bear ecology in various regions of Russia. Obtained information through this equipment can be used for the analysis of diurnal course and seasonal displacements, calculation of the habitat areas and study of other animal ecology aspects. This scientific data can be used in the planning of activities on brown bear population control in hunting farms and natural areas of protection.

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References


