

Distribution and ecology of rare red-backed rat snake *Oocatochus rufodorsatus* (Cantor, 1842) in Primorye Territory (Southern Russian Far East)

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Abstract. This research presents new data on distribution, ecology and current condition of particular populations of *Oocatochus rufodorsatus* (Cantor, 1842), a rare snake species included into the Red Data Book of Primorye Territory. *O. rufodorsatus* was revealed to be abundant in the middle Komissarovka River basin and along the shore of Lake Khanka from villages Turiy Rog to Platonovo-Aleksandrovskoe (Khankaysky District, Primorye Territory). The number of *O. rufodorsatus* varied from 0.11 to 3.5 specimens per ha (0.84 sp. on average) and from 0.07 to 9.5 specimens per km on the routes (2.53 sp. on average). The largest number of snakes was found in mixed biotopes: 1) oak and broad-leaved forest at foothills – river bank overgrown with bushes and 2) floodplain forest – floodplain meadow. The highest number of *O. rufodorsatus* was recorded in spring (23.33 snakes per ha) and autumn (10 snakes per ha) near hibernacula. The earliest record for red-backed rat snakes emerging from hibernation was March 30, 2020. The study found *O. rufodorsatus* to inhabit the middle Komissarovka River basin along with *Gloydus ussuriensis* and *Elaphe dione*. In 2013 and 2018 the red-backed rat snake was an absolute dominant species. In 2015, 2017 and 2020 it became a dominant, and then a codominant species in 2014, 2016 and 2019. The primary threats to *Oocatochus rufodorsatus* are considered to be the destruction of hibernacula due to active rock excavation, wildfires in spring and autumn, and death on roadways.

Key words: herpetofauna, ecology, distribution, *Oocatochus rufodorsatus*, *Gloydus ussuriensis*, *Elaphe dione*, Komissarovka River, Lake Khanka, Russian Far East.

Introduction

All around the world the threat to different reptile species becomes more and more evident. Recent studies revealed a significant decline in biodiversity, which is, unfortunately, a global trend potentially dangerous to all reptile populations [Reading et al., 2010; Saha et al., 2018].

There are a number of intrinsic and extrinsic factors contributing to the extinction risk for many species. When speaking about snakes, intrinsic factors can refer to their certain morphological and ecological traits like size or habitat specialization [Chen et al., 2019] while extrinsic factors are usually connected with global temperature or precipitation changes. All these factors are known to influence snake populations worldwide, but human activity is the most significant contribution to the species vulnerability and extinction risk. Environmental issues such as

overexploitation of snakes and the loss of habitats are considered to increase the species decline greatly [Boehm et al., 2013; Todd et al., 2017].

While the habitat destruction is not connected with intentional killing of snakes, the overexploitation, however, is. In many countries, especially in Asia, snakes are not only killed out of fear but also harvested for commercial purposes. In China, Vietnam, Korea and Japan many wild snakes are collected and killed to be used to make different traditional medicines or for souvenir trade [Chen et al., 2019]. Serving as a raw material for different beverages, medical powder and other purposes, snakes are extracted from their habitats in great numbers by large manufacturers, which damages local populations [Sasaki, 2009]. Due to this fact, different conservation measures should be applied.

There are 10 species of snakes in Primorye Territory. Three of them are considered rare — the slender racer *Orientocoluber spinalis* (Peters, 1866), the red-banded snake *Lycodon rufozonatus* (Cantor, 1842), and the red-backed rat snake *Oocatochus rufodorsatus* (Cantor, 1842).

The first two species, included in the new Red Data Book of the Russian Federation, are known to have small population sizes and have only been recorded a few times in the southernmost part of Primorye Territory [Krasnaya kniga..., 2005; Kharin, Akulenko, 2008; Maslova, 2018]. *O. rufodorsatus* has a wider range in Primorye and in the middle and lower Amur River basin; there it is common and even numerous [Adnagulov, 2016, 2017; Dunaev, Orlova, 2014; Emelianov, 2018; Korotkov, 1985; Kryukov, 2014; Kharin, Akulenko, 2008; Stein, Kalinina, 2016]. Outside the Russian Federation *O. rufodorsatus* is recorded in north-eastern China, Korea and Taiwan [Uetz et al., 2021]. In the Republic of Korea, where the species is considered abundant and common, some traits of human-related ecological impact can be found. Water pollution and habitat degradation make finding these snakes more difficult [Macias et al., 2021]. That is why *O. rufodorsatus* is included in the Red Data Books of Primorye Territory [Krasnaya kniga..., 2005], Khabarovsk Territory [Krasnaya kniga..., 2019] and Jewish Autonomous Oblast [Krasnaya kniga..., 2014]. In Primorye Territory the snake has a status of a rare species at the edge of its area, and not having sufficient data on its ecology and biology [Krasnaya kniga..., 2005; Dunaev, Orlova, 2017].

The distribution of *O. rufodorsatus* in Primorye is fragmented, since the species prefers plains with bodies of water, while Primorye Territory is dominated by mountainous and forested landscapes. The western part of Primorye Territory has various landscape features combining different plain and mountainous types of biotopes. Khankaysky District, including the middle Komissarovka River basin, combines Pogranichny ridge (an offshoot of the East Manchurian Mountains) on the west and Ussuriysko-Khankayskaya plain on the east along the shore of Lake Khanka.

In the past this territory lacked any systematic herpetological research. Nevertheless, single records of *O. rufodorsatus* were described here. For example,

A. I. Chersky found this species in the Lake Khanka basin in 1911. These findings were recorded by A. A. Emelianov in his book “Amphibians and reptiles of the Soviet Far East” [Emelianov, 2018]. We repeatedly found red-backed rat snakes on different routes when monitoring *Pelodiscus maackii* (Brandt, 1858) in the Komissarovka River valley and on the shore of Lake Khanka during 2016–2018 [Makarchenko et al., 2017; Maslova, 2017; Maslova et al., 2018].

The purpose of this article is to systematize both original and literature data on the distribution of *Oocatochus rufodorsatus* in Khankaysky District, its number, interaction with other species of snakes and some aspects of its ecology.

Materials and methods

We conducted field research between 2013 and 2020 in the middle Komissarovka River basin and along the western shore of Lake Khanka in Khankaysky District of Primorye Territory (fig. 1).

The middle Komissarovka River valley has areas of meadow steppe (eastern sector of the Mongol Daurian flora area) and wet meadows with numerous bodies of water, mountains and hills. Primarily covered with oak forest, the mountains also contain an insignificant quantity of broad-leaved trees and fragments of relict pine forests. On the western shore of Lake Khanka there is a discontinuous line of shore ramparts covered with oak forest stretching from north to south. The shore itself consists of sand beaches and sandbars with psammophytic plant communities.

During the field research 104 counts were conducted at the record plots and 28 counts on the roads, covering 901.5 kilometers of routes. A total of 553 snakes were recorded, out of which 175 were *O. rufodorsatus*, including 34 road-killed specimens (89 snakes on plot counts, 70 on road counts, and 16 sporadic findings in the areas adjoining the plots). Standard methods of counting reptiles on routes and record plots allowed us to collect data on the number and density of snakes [Dinesman, Kaletskaya, 1952; Garanin, Darevskiy, 1987; Khairutdinov et al., 2016].

We collected data between 2013 and 2020 on four record plots in the Komissarovka River basin 10–20 km apart from one another.

Plot 1. A rock quarry constantly used by snakes as a hibernaculum. The total area size is about 1.5 ha. The quarry is located on the eastern side of the mountain, 11 km south of Komissarovo (44°53'35.8" N 131°50'49.5" E). The forest around the quarry consists of *Quercus mongolica* mixed with *Alnus japonica*, *Betula davurica*, *Acer mono*, *Populus tremula*, *Armeniaca mandshurica* and single *Pinus densiflora*. The plot contained traces of multiple wildfires.

Plot 2. The area around the bridge across the Garkalin stream, flowing into the Komissarovka River in 230 meters. It is situated 3 km south of Komissarovo (44°57'56.9" N 131°46'24.3" E). The total area of the plot is about 0.4 ha. The northern part of the plot is a wet sedge-reedgrass meadow with sporadic trees of *Salix*, *Ulmus* and *Alnus* genera. The southern part includes a rocky foothill covered with oak forest.

Plot 3. The plot area is about 3 ha ($44^{\circ}54'06.7''$ N $131^{\circ}35'32.9''$ E), it lies between two bridges across the Komissarovka River. The plot includes several different types of habitat: floodplain forest (*Salix*, *Ulmus*, *Alnus* и *Padus*), shingle banks and sand bars of the river, grass meadows and an oak forest in the adjoining foothill.

Plot 4. Total area of this plot is 0.5 ha ($44^{\circ}53'55.8''$ N $131^{\circ}44'46.8''$ E). It is a floodplain forest area around a bridge across a small creek flowing into the Poperechnaya River, a right tributary of the Komissarovka River.

Sporadic route counts were conducted from 2016 to 2020. The total length of the routes was 44 km (fig. 1).



Fig. 1. The study area: A — geographical location of Khankaysky District, Primorye Territory (black square) within the whole area of the species *Oocatochus rufodorsatus* (red background); B — study area with four record plots and three routes (yellow line — route 1; green line — route 2; blue line — route 3).

Рис. 1. Карта района исследований: А — местоположение Ханкайского района Приморского края (чёрный квадрат) в пределах ареала вида *Oocatochus rufodorsatus* (красное поле); В — исследованный участок с четырьмя учётными площадками и тремя маршрутами (жёлтая линия — маршрут 1, зелёная линия — маршрут 2, голубая линия — маршрут 3).

Route 1 (40.5 km) follows the road between Ilyinka and Dvoryanka through the Komissarovka River valley. The road mostly lies between open land and forest

biotopes, therefore the route contains four main types of segments: 1 — “oak and broad-leaved forest at foothills — river bank overgrown with bushes”; 2 — “oak and broad-leaved forest at foothills — floodplain meadow”; 3 — “floodplain forest — crop field”; 4 — “floodplain forest — floodplain meadow”. The route only contains two completely homogeneous segments: an open land biotope “crop field — wasteland” and a forest-type biotope “floodplain forest”.

Route 1 (2019–2020) starts 1.5 km away from the main road between Kamen-Rybolov and Turiy Rog (44°52'57.31" N, 131°57'06.29" E) and ends where the Komissarovka River approaches a forested mountain near Dvoryanka (44°90'29.13" N, 131°59'25.32" E).

Routes 2–3 are situated on the western shore of Lake Khanka between Novokachalinsk and Platonovo-Aleksandrovskoe. The routes follow beach ridges covered with *Q. mongolica* mixed with *A. japonica* and *B. davurica*, and sandbars with psammophytic plant communities (*Oxytropis chankaensis*, *Thymus przewalskii*, *Papaver amurense* etc.).

Route 2 (2018–2020). The route lies along the shore of Lake Khanka southward of Novokachalinsk (45°05'13.71" N 132°00'18.95" E) to a sandy beach (45°04'38.72" N 131°59'54.12" E). The route length is 1.5 km.

Route 3 (2016, 2019–2020). The route lies along the shore of Lake Khanka northward of Platonovo-Aleksandrovskoe (45°02'13.12" N 131°59'45.75" E) to a sandy beach (45°03'57.85" N 131°59'42.19" E). The route length is 2 km.

The terminology of V. V. Kucheruk with coauthors [1980] is used in this study to estimate the degree of dominance for *Oocatochus rufodorsatus* among other snake species: a monodominant (the proportion of each species in the counts is over 80%), an absolute dominant (50–79%), a dominant (30–49%), a codominant (10–29%) and a subordinate (less than 10%).

Results

In total, 89 *O. rufodorsatus* specimens were recorded at plots 1 through 4 between 2013 and 2020 (from 1 to 20 individuals per count). The species was found in 36.5 % of 104 counts. Its occurrence on the plots varied from 0.11 to 3.5 snakes per ha (0.84 in average) (tab. 1).

Plot 1 (fig. 2A) is a hibernaculum, so *O. rufodorsatus* was found there first. Between 2013 and 2020 the earliest record happened on March 30, 2020. A “mating ball” of *O. rufodorsatus* (fig. 2B) was found at Plot 1 for the first time on May 1, 2018. In 2020 several groups of mating red-backed rat snakes were recorded there on April 19. The latest finding of this species was recorded at Plot 3 on October 10, 2020.

Tab. 1. Absolute occurrence and density (sp./ha) of *Oocatochus rufodorsatus* in different habitats in the middle Komissarovka R. basin between 2013 and 2020.

Табл. 1. Встречаемость (абс.) и плотность (ос./га) *Oocatochus rufodorsatus* в различных местообитаниях в бассейне среднего течения р. Комиссаровка (2013–2020 гг).

Year	N of counts	Total N of snakes at the plots	Plot 1		Plot 2		Plot 3		Plot 4		Mean N of snakes / ha
			N of snakes / one count	N of snakes / ha	N of snakes / one count	N of snakes / ha	N of snakes / one count	N of snakes / ha	N of snakes / one count	N of snakes / ha	
2013	3	3	2	1.33	–	–	0.5	0.17	–	–	0.75
2014	13	9	1	0.67	–	–	0.83	0.28	1	2	0.98
2015	8	10	1.5	1	1	2.5	1.67	0.56	–	–	1.35
2016	10	3	0.25	0.17	–	–	0.33	0.11	0.33	0.67	0.32
2017	8	8	2	1.33	0	0	1	0.33	0.33	0.67	0.58
2018	9	18	5	3.33	0.5	1.25	0.5	0.168	0	0	1.19
2019	29	6	0	0	0.17	0.42	0.4	0.13	0	0	0.14
2020	27	32	5.25	3.5	0.6	1.5	0.5	0.17	0.2	0.4	1.39
Total	104	89		1.42 (0.17–3.5)		1.13 (0.42–1.5)		0.24 (0.11–0.56)		0.62 (0.4–0.67)	0.84 (0.11–3.5)

Note. N – number.



Fig. 2. Hibernation and mating of *Oocatochus rufodorsatus* in the rock quarry (Plot 1): A – the hibernaculum (photo by I. V. Maslova); B – mating process on May 1, 2018 (photo by N. E. Pokhilyuk).

Рис. 2. Зимовка и спаривание *Oocatochus rufodorsatus* на площадке 1: А – место зимовки в каменном карьере (фото И. В. Масловой); В – процесс спаривания 1 мая 2018 г. (фото Н. Е. Похилюка).

The highest number of *O. rufodorsatus* was recorded at the hibernaculum in late spring (from the third decade of April to the end of May) — 23.33 snakes per ha and in late summer-early autumn (from the end of August to September) — 10 snakes per ha (tab. 2).

Tab. 2. Seasonal occurrence of *Oocatochus rufodorsatus* in different biotopes within the middle Komissarovka R. basin from 2013 to 2020.

Табл. 2. Сезонная встречаемость *Oocatochus rufodorsatus* в разных биотопах бассейна среднего течения р. Комиссаровка (2013–2020 гг.).

Season	N of counts	N of counts when <i>Oocatochus rufodorsatus</i> were found	% of the total N of the counts in the season	Total N of <i>Oocatochus rufodorsatus</i> recorded	N of snakes / ha	
					Plot 1 (hibernaculum)	Plots 2–4
March	1	1	1	1	0.67	-
April – May	22	11	50	41	23.33	1.54
June – July	36	10	27.78	13	0	3.33
August – September	39	14	35.89	31	10	4.1
October	6	2	33.33	3	0	0.77

Note. N – number.

We observed a sudden decline in the number of *O. rufodorsatus* in the studied area (tab. 1, 3) in 2019. There were no records of *O. rufodorsatus* at Plot 1 and Plot 4 in 2019, and its number at Plot 2 and Plot 3 was significantly lower than previously (tab. 1). Based on the data from 10 road counts, the average occurrence of *O. rufodorsatus* on Route 1 was 0.25 snakes per km in 2019. Based on 15 counts, the occurrence in 2020 was 1.26 (tab. 3). We did not record any red-backed rat snakes on Routes 2 and 3 in 2019 (a single count on September 2). The highest number of *O. rufodorsatus* in 2020 was recorded on Route 3—9.5 snakes per km.

Tab. 3. Biotope distribution of *Oocatochus rufodorsatus* along the Komissarovka River (Routes 1–3) and the shore of Lake Khanka during 2016–2020.

Табл. 3. Биотопическое распределение *Oocatochus rufodorsatus* на маршрутах 1–3 вдоль р. Комиссаровка и побережья оз. Ханка в период 2016–2020 гг.

Year	N of counts	Total N of <i>Oocatochus rufodorsatus</i> found	Route 1		Route 2		Route 3	
			N of snakes found	N of snakes / 1 km	N of snakes found	N of snakes / 1 km	N of snakes found	N of snakes / 1 km
2016	1	3	–	0.07	–	–	3	1.5
2017	1	3	3	0.07	–	–	–	–
2018	1	3	–	0.07	3	2	–	–
2019	10	10	10	0.25	0	0	0	0
2020	15	51	29	1.26	3 (0–3)	2	19 (6–13)	9.5
Total	28	70	42	1.73	6	4	22	11

Note. N – number.

Three snake species *O. rufodorsatus*, *Elaphe dione* (Pallas, 1773), and *Rhabdophis lateralis* (Berthold, 1859) were common in more open landscapes on the western shore of Lake Khanka. The latter species was more abundant there than

in the Komissarovka River basin. A single individual of *Hebius vibakari* (Boie, 1826) and no *Gloydius ussuriensis* (Emelianov, 1929), *G. intermedius* (Strauch, 1868), and *Elaphe schrenckii* (Strauch, 1873) were recorded near Lake Khanka during 2016–2020 (tab. 3).

Thus, *Oocatochus rufodorsatus* is rather common in the Komissarovka River basin as well as two other snake species *Gloydius ussuriensis* and *Elaphe dione*. *E. schrenckii* and *Rhabdophis lateralis* switched between common and rare in different years while *Hebius vibakari* and *Gloydius intermedius* were rare as there were only single records during the study period (fig. 3).

In 2013 and 2018 *Oocatochus rufodorsatus* was an absolute dominant species. In 2015, 2017 and 2020 it became a dominant species, and then a codominant in 2014, 2016 and 2019. The number of *Gloydius ussuriensis* was high throughout the whole period of the research, except for 2013, which makes the species either a dominant or a codominant. Snake species *Elaphe dione* did not go higher than a codominant from 2013 to 2018, but in 2019 it became a dominant for the first time (fig. 3).

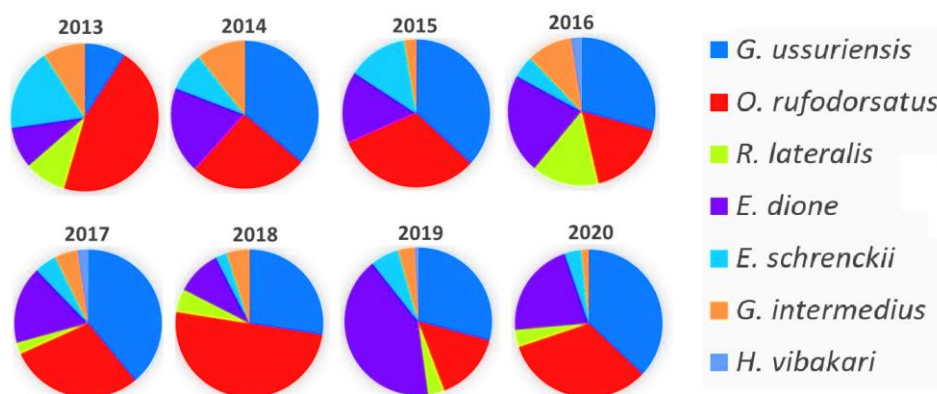


Fig. 3. Occurrence (%) of different snake species found in the middle Komissarovka River basin during 2013–2020.

Рис. 3. Встречаемость (%) разных видов змей в бассейне среднего течения р. Комиссаровка в 2013–2020 гг.

In 2019 we attempted to study the distribution of snakes in different mixed biotopes on Route 1 (tab. 4).

The largest number of snake species (four species) was recorded in the mixed “floodplain forest – floodplain meadow” biotope. The smallest number was recorded in an open land biotope “crop field – wasteland”. Despite the fact that we found an equal number of *Oocatochus rufodorsatus* and *Gloydius ussuriensis*, the first was only recorded in two kinds of mixed biotopes (“oak and broad-leaved forest at foothills — river bank overgrown with bushes” and “floodplain forest – floodplain meadow”) while the latter was found in five kinds of biotopes.

This vividly shows the specific habitat preferences of *Oocatochus rufodorsatus* and the flexibility of *Gloydius ussuriensis*.

Tab. 4. Absolute occurrence of different snake species in various biotopes in the middle Komissarovka River basin in 2019.

Табл. 4. Встречаемость (абс.) видов змей в различных биотопах бассейна среднего течения р. Комиссаровка (2019 г.).

Biotope type	Total number of snakes recorded during 12 counts					Total
	<i>Oocatochus rufodorsatus</i>	<i>Gloydius ussuriensis</i>	<i>Elaphe dione</i>	<i>Rhabdophis lateralis</i>	<i>Gloydius intermedius</i>	
Oak and broad-leaved forest at foothills – river bank overgrown with bushes	5	3	1	0	0	9
Oak and broad-leaved forest at foothills – floodplain meadow	0	1	0	0	0	1
Floodplain forest	0	0	1	1	0	2
Floodplain forest – crop field	0	1	0	1	0	2
Floodplain forest – Floodplain meadow	5	4	3	0	1	13
Crop field – wasteland	0	1	0	0	0	1
Total	10	10	5	2	1	28

Many *Oocatochus rufodorsatus* were found dead on the roads during the route counts every year. We found 5–10 dead snakes per km on some segments of Route 1 during 2013–2018. In 2019, 19 out of 28 recorded snakes were dead, which makes 67.9 % of all findings. *O. rufodorsatus* represented 31,6 % of the findings. The highest death rate of 42.1 % was observed in *Gloydius ussuriensis*. In 2020 we found 74 snakes on the road, 56 of which were dead including 44.6 % of *Oocatochus rufodorsatus* among them (fig. 4).

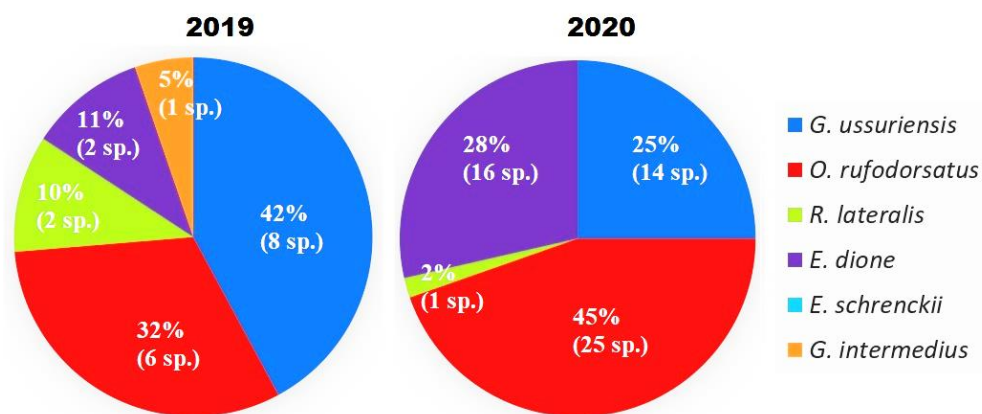


Fig. 4. Interannual variability in the occurrence (%) of different roadkill snakes species in the middle Komissarovka R. basin during 2013–2020.

Рис. 4. Частота встречаемости раздавленных на дорогах змей разных видов в бассейне среднего течения р. Комиссаровка в период 2019–2020 гг.

Discussion

The status of *O. rufodorsatus* in regional Red Data books is the same: a rare species at the edge of its distribution (the Red Data Books of Primorye Territory [Krasnaya kniga..., 2005], Khabarovsk Territory [Krasnaya kniga..., 2019], and Jewish Autonomous Oblast [Krasnaya kniga..., 2014]). Nevertheless, its number varies greatly within the Southern Russian Far East. While working in the Far Eastern Marine Biosphere Reserve, V. E. Kharin and M. V. Akulenko [2008] noted that the number of this species on routes was up to 100-120 snakes per km during 2004–2006. Similar data on the abundance of red-backed rat snakes in the southern part of Khasansky District and near Chernigovka (Chernigovsky District) was obtained by A. A. Emelianov in the beginning of the 20th century. Emelianov recorded 11 specimens along a 100 m lake shore stretch [Emelianov, 2018].

According to the Red Data Book of Khabarovsk Territory [Krasnaya kniga..., 2019], no more than 2–4 snakes per km were usually recorded on the routes in the most suitable habitats. 1 to 3 snakes per km could be recorded in some places of the Bolshekhokhtsirsky Nature Reserve, but for the last few years there have only been sporadic findings of this species there [Krasnaya kniga..., 2019].

Working on the routes in the Jewish Autonomous Oblast from 1994 to 2001 V. Kh. Kryukov obtained the following data: "...1994 – 0.4 snakes per 1 km, 1995 – 0.6; 1996 – 0.5; 1997 – 0.6; 1998 – 0.7; 1999 – 0.5; 2000 – 0.6; 2001 – 0.5; 2007 – 0.3; 2014 – 0.4...". He noted that on certain routes one could record up to 4 snakes per km [Kryukov, 2014, p. 123].

The population size of *O. rufodorsatus* in the Komissarovka River basin is larger than in the northern populations from the Middle Amur River basin but smaller than in populations from the southern part of Khasansky District. Furthermore, the Komissarovka's populations of the red-backed rat snake have a

common feature with the southern ones: the species has a dominant status. In the southern populations 75 % of all recorded snakes are *O. rufodorsatus* [Kharin, Akulenko, 2008]. It should be noted that V. E. Kharin and M. V. Akulenko also recorded significant changes in the number and species composition of snakes in 2004–2008. According to their data, the number of *O. rufodorsatus* in Pemzovaya Bay (Far East Marine Biosphere Reserve) decreased from 75 % to 25 % and the number of *Gloydius ussuriensis* and *Elaphe dione*, on the contrary, increased in the course of four years [Kharin, Akulenko, 2008].

We suppose that our work will become the beginning for long monitoring studies and will help to discover the mechanisms of population dynamics for different snake species sharing the same habitats.

Anthropogenic factor is one of the hypotheses concerning the reason for the decreasing number of *Oocatochus rufodorsatus*. The rock quarry at Plot 1 has been actively excavated for the last several years. The excavated area has doubled in size in the last five years. We suppose that as the considerable quantity of rocks had been removed, it seriously damaged the hibernacula and negatively affected the local population of *O. rufodorsatus*.

It should be also noted that 17 out of 28 dead *O. rufodorsatus* (68 %) found on the roads in 2020 were juveniles. This can probably be evidence of the anthropogenic factor contributing greatly to high mortality rates in juvenile snakes before their first hibernation.

Moreover, numerous wildfires occur in Khankaysky District every spring and autumn. In certain years the Komissarovka River valley and its hills and mountains are burnt repeatedly. This also damages the *O. rufodorsatus* populations not only directly by killing snakes but also by destroying their food sources.

In the Republic of Korea *O. rufodorsatus* is still considered abundant according to the Red Data Book of Korea [2011] and D. Macias et al. [Macias et al., 2021], but there are some negative tendencies which can be connected with the anthropogenic impact. The authors consider water pollution and habitat degradation to be the main threats to the well-being of these snakes. Nevertheless, Korean populations of red-backed rat snakes are not considered at high risk as they are supposed to be rather adaptive. The studies of roadkill in Korea [Kim, Lee et al., 2018] and China [Wang et al, 2013] both showed very low percentage of *O. rufodorsatus* among killed snakes. Such results may be attributed to the mountainous terrain in the studied area while red-back rat snakes are known to prefer open and aquatic habitats.

Conclusion

O. rufodorsatus was revealed to be abundant in Khankaysky District of Primorye Territory in the middle Komissarovka River basin and on the shore of Lake Khanka between Turiy Rog and Platonovo-Aleksandrovskoe. Field studies revealed that the number of *O. rufodorsatus* varied from 0.11 to 3.5 snakes per ha

(0.84 in average) and from 0.07 to 9.5 snakes per km (2.53 in average) on the routes. The largest number of *O. rufodorsatus* were recorded in a hibernaculum in spring (23.33 snakes per ha) and autumn (10 snakes per ha). The earliest record for red-backed rat snakes emerging from hibernation was on March 30, 2020. Group mating of *O. rufodorsatus* was observed on May 1, 2018. A significant decrease in red-backed rat snakes was recorded in 2019. The total mean density of the species in 2013–2018 was 0.8 snakes per ha and in 2019 it was 0.15 snakes per ha.

In general, *O. rufodorsatus* was a common and locally abundant species in the middle Komissarovka valley occurring there in sympatry with *Gloydus ussuriensis* and *Elaphe dione*.

The largest numbers of snakes were found in mixed biotopes: “oak and broad-leaved forest at foothills – river bank overgrown with bushes” and “floodplain forest – floodplain meadow”.

The primary threats to *Oocatochus rufodorsatus* were considered to be the destruction of hibernacula due to active rock excavation, wildfires in spring and autumn and death on roadways.

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К распространению и экологии редкого вида змей – красноспинного полоза *Oocatochus rufodorsatus* (Cantor, 1842) в Приморском крае (юг Дальнего Востока России)

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Аннотация. Приводятся новые данные по распространению, экологии и современному состоянию отдельных популяций занесенного в Красную книгу Приморского края красноспинного полоза *Oocatochus rufodorsatus* (Cantor, 1842). Выявлено, что *O. rufodorsatus* локально имеет высокую численность в бассейне среднего течения р. Комиссаровка и по западному побережью оз. Ханка на участке от с. Турий Рог до с. Платоно-Александровское (Ханкайский район, Приморский край). Показано, что численность *O. rufodorsatus* на учётных площадках варьирует от 0.11 до 3.5 экз. на 1 га (в среднем 0.84 экз.), а на учётных маршрутах — от 0.07 до 9.5 экз. на 1 км (в среднем 8.25 экз.). Максимальная численность вида отмечена в биотопах смешанного типа: 1) подножье горы, покрытое дубняком с примесью широколиственного леса, поросший кустарником берег водоёма и 2) пойменный лес, пойменный луг. Наибольшая встречаемость *O. rufodorsatus* зарегистрирована в местах зимовок в весенний (23.33 особи на 1 га) и осенний (10 особей на 1 га) периоды. Впервые наблюдался необычно ранний выход данного вида с зимовки – 30 марта 2020 г. Выявлено, что в бассейне среднего течения Комиссаровки в 2015, 2017 и 2020 гг. *O. rufodorsatus* являлся доминантом по отношению к *Gloydus ussuriensis* и *Elaphe dione*, а в 2014, 2016 и 2019 гг. стал субдоминантом второго уровня. Указаны первоочередные угрозы для *Oocatochus rufodorsatus* — разрушение человеком мест зимовок при добыче камня, весенне-осенние палы и смерть на дорогах.

Ключевые слова: герпетофауна, экология, распространение, *Oocatochus rufodorsatus*, *Gloydus ussuriensis*, *Elaphe dione*, р. Комиссаровка, оз. Ханка, российский Дальний Восток.