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## RECORD OF A NEW LOCALITY AND GENERAL DISTRIBUTION OF THE FAR EASTERN SKINK (*Plestiodon finitimus*) ON THE ISLAND OF KUNASHIR (KURIL ARCHIPELAGO, FAR EAST OF RUSSIA)

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A previously unknown population of the Far Eastern skink (*Plestiodon finitimus*) was discovered on the western slope of the Rurui volcano during a field study in a remote and poorly explored area in the northwest of Kunashir Island. The description of the area of this new find and the state of the discovered population are given. The modern distribution of Far Eastern skinks on the island of Kunashir is discussed.

**Keywords:** Scincidae; *Plestiodon finitimus*; new record; distribution; Rurui volcano; Kunashir Island; Russian Far East.

### INTRODUCTION

The Far Eastern skink (*Plestiodon finitimus* Okamoto and Hikida, 2012) is one of the rarest and most beautiful lizards of the fauna of Russia which is reliably known only from the island of Kunashir, Far East. The main distribution of this species is Japan: the islands of Hokkaido and the north-eastern and central parts of Honshu (Griffith et al., 2000; Brandley et al., 2012). For this reason, the Far Eastern skink is included in the Red Data Books of the Russian Federation (2001) and the Sakhalin Region (2016) with the status of the 3<sup>rd</sup> category of rarity — as a rare species known within Russia on the periphery of its range.

For the first time for the Kuril Archipelago, the Far Eastern skink was recorded in 1943 by the Japanese herpetologists T. Inukai and K. Musaka under the name *Eumeces latiscutatus* (Hallowell, 1860) (Inukai and Musaka, 1943). Until the beginning of the 21st century, it

was known under this name from Kunashir (Basarukin, 1983, 1989, 1998; Borkin and Basarukin, 1987; Griffith et al., 2000; Korotkov and Borkin, 2001; Orlov, 2001; Borkin et al., 2005). As a result of a detailed revision of the systematics and morphology as well as molecular identification of the members of the genus *Eumeces* Wiegman (1834), this generic name was preserved only for North African and South Asian species, whereas the East Asian and North American blue-tailed lizards were referred to the resurrected genus *Plestiodon* Duméril et Bibron, 1839 (Schmitz et al., 2004; Ananjeva et al., 2006; Brandley et al., 2012). Integrative analysis of DNA (DNA barcode) and morphology of populations of Japanese skinks resulted in revealing of cryptic species and differentiation of *P. latiscutatus* into two parapatric congeners: *P. latiscutatus* and *P. finitimus* (Okamoto and Hikida, 2012), the latter inhabiting Kunashir Island.

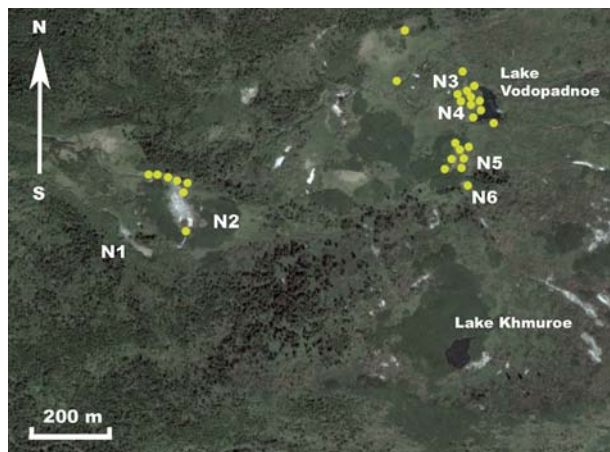
Kunashir Island skinks prefer to inhabit only the outlets of thermal waters; they can be found on the sandy, clay and rocky banks of warm streams, the stony coast of the sea, along the clay and stony-sand ravines, in open areas bordering bamboo, hydrangea and other vegetation, and also on the outskirts of mixed and coniferous forests.

During the period June 21 – 24, 2017, the second author carried out zoological studies on the western macroslope of the Dokuchaev Ridge, where previously undescribed group of thermal springs and small solfatar fields,

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**Fig. 1.** Map of “Dalniye Istochniki” with localities of records of the Far Eastern skinks (yellow circles): 1, solfataric field “Dlinnoye”; 2, solfataric field “Bolshoye”; 3, the first thermal platform; 4, the second thermal platform; 5, “Kisloye ozertso”; 6, Kislyi creek.

named “Dalniye Istochniki” (Sundukov and Kozlovski, 2017) were unexpectedly discovered. In August 3–9, 2017 the zoological group with the second and third authors and professor of the Moscow State University Kirill Makarov conducted a more detailed survey of newly discovered natural objects, where a new population of the Far Eastern skink was recorded.

## METHODS

Data collection during the field study was carried out by methods of field observations, including route survey of the territory, visual observation on sites, distribution in the area, study of habitats, collection of animals for measurements, weighing and photographing, and recording the data in a field journal. The following instruments were used during the study: a) the temperature of water and thermal gases was measured with an electronic thermometer “Digital thermometer JR-1” with a probe 11 cm long, with a temperature range from  $-50$  to  $+300^{\circ}\text{C}$  and a measurement accuracy of  $0.1^{\circ}\text{C}$ ; b) the acidity was measured using a universal indicator paper “Universal indicator paper pH 0–12” manufactured by Lach-Ner, s.r.o., Neratovice; c) geographical coordinates — using the GPS navigator “Gpsmap 64” manufactured by Garmin Ltd.; d) photos of skinks and their biotopes were made by cameras Sony Cyber-shot DSC-HX300 and Canon PowerShot SX10IS. The map of the research area was obtained from [www.google.com/maps/place](http://www.google.com/maps/place).

## RESEARCH AREA

The area with skink records is located in the northwest of Kunashir Island, at the altitudes of 400–560 m a.s.l.,  $44.457^{\circ}$ – $44.445^{\circ}$  N and  $146.084^{\circ}$ – $146.105^{\circ}$  E (Fig. 1). The topography of this region includes a relatively large (about 1 km in diameter), a cup-shaped depression in the middle part of the western slope of the Rurui volcano. Its bottom is densely cut with streams, ravines and narrow steep ridges that, in combination with dense thickets of bamboo (*Sasa* sp.) and cedar pine (*Pinus pumila*), make the terrain very difficult to move around (Fig. 2). The vegetation of the depression is mainly represented by a mosaic made of stone-birch (*Betula ermanii*) and dark coniferous forests, thickets of cedar elfin woodland (*P. pumila*) and Kuril bamboo (*Sasa* sp.). The banks of streams are occupied by willows (*Salix* spp.), alder (*Alnus hirsuta*) and high grass. Somewhat unexpected for these elevations and geographical location (the northern part of Kunashir) was the discovery at the bottom of the depression and its northern slope of oak groves with large (up to a meter in diameter) *Quercus crispula* trees, and on its slopes — maples of Mayr (*Acer mayrii*), dimorphants (*Kalopanax septemlobus*), elms (*Ulmus* sp.) and a number of other non-moral tree plants and lianas.

The first impression after the observations in the area of survey is that the cup-shaped depression is an ancient explosive crater formed on the western slope of the Rurui volcano as a result of a strong eruption. Postvolcanic activity in this area is rather weak:

— Solfataric fields are almost extinct, only some sulfur shells are warm, with the temperature of emerging gases  $+18.0$ – $24.7^{\circ}\text{C}$ . The smell of sulfur is clearly detectable for a few hundred meters. The water flowing through the solfatar field is acidic (pH = 4.0–4.2) (Fig. 3a).

— All surveyed “acid springs” are cool, with a water temperature of  $+18.0$ – $22.8^{\circ}\text{C}$ . In the places of their activity, typical white bottom sediment is observed as well as the algae specific for the hydrothermal springs. The water is acidic or close to neutral (pH = 3.5–6.8) (Fig. 3d).

— Gas emission in glades with “mofets” are weak, hardly oozing, without a noticeable smell, with temperatures from  $+57$  to  $+103.5^{\circ}\text{C}$ . The soil temperature at the surface of the glades is  $+55.5^{\circ}\text{C}$ , at a depth of 10 cm  $+78.1^{\circ}\text{C}$  (Fig. 3b).

Probably, one of the lakes in the surveyed region belongs to the hydrothermal phenomena. It is Lake Vodopadnoe, having a pH = 6.5, and the water temperature in August  $+8.3^{\circ}\text{C}$ . Along its western coastline and in the coastal zone, up to 3–5 m from the shore, the weak bot-



Fig. 2. General view of “Dalniye Istochniki.”

tom gas outcrops are observed, and white hydrothermally altered rocks are observed on the bottom of a waterfall (Figs. 3c, 6a).

#### NEW RECORD OF DALNIYE ISTOCHNIKI'S POPULATION OF *P. finitimus*

The discovery of a new *P. finitimus* fauna for the Kunashir fauna can be considered as accidental. During the first survey of “Dalniye Istochniki” on June 21–24, 2017 (Fig. 1), we planned to find skinks and pit vipers based on records of these reptiles in 2013 only in a few kilometers from the area, in “Neskuchenskiye Istochniki” (Orlov et al., 2014). The weather during this field work was quite favorable for the activity of the skinks: June 21 and 23 were sunny, warm days (air temperature +17–20°C), the vegetation state corresponded to the beginning of summer, and the snowfields remained only in the shape of small spots in valleys of the northern exposure at

altitudes of 700–900 m above the sea level. In search of insects and reptiles we surveyed the banks of reservoirs, and also overturned stones, logs and litter on the traversed routes however without success.

A second survey of the area was carried out on August 3–9 of the same year. Zoological team with Yuri and Larissa Sundukov and professor of the Moscow Pedagogical State University Kirill Makarov conducted a more detailed survey of “Dalniye Istochniki” (Fig. 1), where a new population of *P. finitimus* was discovered.

The weather was clear and hot with afternoon air temperatures on August 4–8 within +23–26°C (on August 7th up to +30°C) and night temperatures — to +13.5–16°C without rainy and foggy days. Visual observations showed that the local population of skinks is quite numerous (Fig. 4). For four days, August 5–8, 150 lizards were recorded on the traversed routes: about 1/4 of them were adults, up to 1/3 — large semi-adults and the remaining animals — young this year of birth.



**Fig. 3.** Habitats of the Far Eastern skinks in “Dalniye Istochniki”: *a*, solfataric field “Bolshoye”; *b*, “Pervaya teplaya polyanka”; *c*, “Ozero Vodopadnoye”; *d*, “Kisloye ozertso”.

The main concentration of lizards was observed along the banks of fresh water bodies (Lake Vodopadnoe and the bank of the stream near the Great Solfatar Field) and around the thermal places (the first and the second warm meadows (Pervaya and Vtoraya Teplye Polyanki) and sour small lake (Kisloye Ozertso). The adult and semi-adult skinks were mostly recorded along the banks of fresh water bodies whereas majority of small probably newborn individuals with 5 – 7 cm length with tail were found in thermal regions. In other places only a few adult and semi-adult lizards were observed.

Almost all the skinks prefer open sites well warmed by the sun. Most often adult individuals (Fig. 4a) were found basking on large rocks on the bank of the water-body whereas the young individuals (Fig. 4e,f) are recorded together with them or actively running along the edge of warm thermal glades. More rare lizards were recorded in thickets of tall grass. Single skinks were recorded in wetlands with a low sparse grass.

On the basis of observation of lizards from the newly discovered population in the south of Kunashir Island we are able to emphasize some characteristics of population from the “Dalniye Istochniki”:

1) the newly recorded population is mostly high altitudinal population in Kunashir. According to the literature data (Borkin and Basarukin, 1987, Basarukin, 1988, Litvinchuk and Borkin, 2016), the range of inhabited altitudes of the Far Eastern skink in Kunashir Island is 0 – 400 m a.s.l. The discovered population lives at altitudes of 390 – 530 m a.s.l.

2) high density of observed animals. Earlier, we have never noted such a high density of skinks in known habitats in the south of Kunashir Island. Perhaps this is due to lesser fearfulness of lizards in a remote area without people or with a low density of predators at these altitudes. During our field work we have noted only one young Japanese Ratsnake, *Elaphe climacophora*, 34 cm long at an altitude of 520 m a.s.l., and 3 shed skins, 90 – 95 cm long in the Great Solfatar Field at an altitude



Fig. 4. The Far Eastern skinks.



**Fig. 5.** The Far Eastern skinks records in Kunashir Island: 1, Dubovoye; 2, the caldera of Golovnin volcano; 3, external fumarolic field of Golovnin volcano; 4, “Yuzhno-Alekhinskiye istochniki”; 5, “Alekhinskiye istochniki”; 6, “Tretyakovskiye istochniki”; 7, “Stolbovskiye istochniki”; 8, north-western solfatar field of Mendeleev volcano; 9, springs in the upper stream of “Lechebnyi” creek; 10, Kislyi creek; 11, upper stream of “Doktorskiy” creek; 12, Goryachy Plyazh; 13, “Prasolovskiy Istochnik”; 14, “Dalniye Istochniki”; 15, “Neskuchenskiye Istochniki” (localities 1, 2, 13 were not confirmed by our observations).

of 390–400 m a.s.l. In addition, predatory mammals, nesting birds of prey and red ants of the genus *Formica* are completely absent at these altitudes.

3) the high proportion of adults in the population. During the surveys and under the stones normally mostly young, 5–10 cm long, lizards are recorded (at least 80% of all records) in the habitats of skinks in the south of Kunashir Island. In the “Dalniye Istochniki” population, more than 50% of adult or semi-adult individuals are noted. Perhaps this is also due to lesser fearfulness of lizards or a low number of predators. The latter contradicts the conclusions of Hasegawa (1990, 2003) for the populations *Eumeces okadae* Stejneger, 1907 (= *P. latisculatus* Hallowell, 1861) from Izu Islands, Japan and requires special studies.

4) absence of active lizards in the “Dalniye Istochniki” at the end of June. In the south of Kunashir Island, skinks are quite active from the second half of May. We still have no explanation for their absence at the “Dalniye Istochniki” during our observation in the end of June 2017.

## RECENT DISTRIBUTION OF *P. finitimus* IN KUNASHIR ISLAND

According to the latest data (Litvinchuk and Borkin, 2016), the Far Eastern skinks are noted in Kunashir Island from the following localities: Neskuchenskiye, Tretyakovskiye, Stolbovskiye, Alekhinskiye and Prasolovskiy istochniki, solfatar fields and hydrotherms of the Mendeleev volcano, the caldera of Golovnin volcano and the vicinity of the Dubovoye village (Fig. 5). Since these data were not checked during the last 20 years by experts-herpetologists, we conducted our own survey of these sites for the occurrence of lizards. During the field seasons of 2013–2017, skinks were found:

- at hydrothermal outlets of the external fumarolic field of Golovnin volcano;
- along the entire sea coast from Alekhino village to the external fumarolic field of Golovnin Volcano (Fig. 6b);
- near all three thermal springs of the Valentina spring near the Tretyakovo village (Fig. 6c);
- on the northern and north-western slopes of the Mendeleev volcano (the spring “Kislyi” from the solfatar field to the thermal spring “Rosinka,” the upper reaches of the “Doktorskiy” creek, the hydrothermal station “Tumany,” the medical baths of the Goryachy Plyazh village) (Figs. 6d, 7a);
- near thermal springs and in their environs on the creek Zmeinyi (Stolbovskaya);
- near all thermal sites and solfatar fields of “Dalniye Istochniki”;
- near all thermal manifestations of “Neskuchenskiye Istochniki” (Fig. 7b).

Surveys of the “Prasolovskiy Istochnik” made on August 16, 2013, June 15–17, 2014, September 18, 2016, and August 13, 2017 did not confirm the occurrence of skinks in the valley of the Severyanka River, as was indicated in the Red Data Book of the Sakhalin Region (Litvinchuk and Borkin, 2016) (Fig. 7c). In our opinion, the existence of a blue-tailed lizard is unlikely in the vicinity of the Dubovoye village (Litvinchuk and Borkin, 2016), since there are no thermal sites in the extreme south of Kunashir Island. During our field work in the vicinity of this village on June 8–22 and September 23–29, 2015, May 26–28, 2016, July 25–26, and August 21–24, 2017, there was not a single skink. The interviews of local people in the Dubovoye village and employees of military units in the south of Kunashir in July 2017 also have not provided any positive results.

The question if *P. finitimus* inhabits the caldera of the Golovnin volcano, remained unclear. These lizards were repeatedly indicated in the literature from caldera with



**Fig. 6.** Habitats of the Far Eastern skinks on the island of Kunashir: *a*, waterfall of Lake Vodopadnoye; *b*, sea shore near Alekhino; *c*, Valentina spring near Tretyakovo; *d*, near Rosinka spring by Kislyi creek.

significant areas of thermal manifestations (Fig. 7*d*). On the one hand, we spent a considerable amount of time in 2015 (July 13 – 21, September 1 – 13) as well as in 2016 (June 30 – July 8, July 23 – 27) and 2017 (July 5 – 10) to find skinks in caldera without any success. On the other hand, there is the information received from the inspector of the Kurilsky reserve, V. M. Olshevsky, about the observations of adult skinks near the western shore of Lake Goryacheye in August – September 2011, and data about the record of one unidentified lizard west of the lake Kipyashchee made by students of the Faculty of Geography of Moscow State University in August 2016. They raise the possibility for the discovery of the Far Eastern skink in this region. Perhaps now this population of *P. finitimus* is in a depressed state due to the extremely high density of the blood-red Ant, *Formica sanguinea* in the caldera. An example of the negative effect of the red fire ant (*Solenopsis invicta*) on the abundance

of the Mediterranean gecko (*Hemidactylus turcicus*) was described in a study from Texas, USA (McCallum and McCallum, 2014).

In conclusion, we would like to add that the populations of skinks in the south (Mendelev's volcano, Alekhino, Tretyakovo, Zmeinyi Spring and others) and the north-west (Neskuchenskiye and Dalniye Istochniki) of Kunashir Island are significantly separated from each other (more than 60 km) and, in our opinion, currently do not contact each other (Fig. 5). The further research is needed including molecular genetic analysis.

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**Fig. 7.** Hydrothermal phenomena. on the island of Kunashir: *a*, north-western solfatar field of the Mendeleev volcano; *b*, “Neskuchenskiye Istochniki»; *c*, Prasolovsky Istochnik; *d*, view from caldera of Golovnin Volcano.



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