FIRST CATCHES OF *PSEUDASPIUS LEPTOCEPHALUS* (CYPRINIDAE), *TAKIFUGU XANTHOPTERUS* (TETRAODONTIDAE), AND *CORYPHAENA HIPPURUS* (CORYPHAENIDAE) IN THE WATERS OF THE SAKHALIN BAY (SEA OF OKHOTSK)

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Data on the first catches of redfin *Pseudaspius leptocephalus*, yellowfin pufferfish *Takifugu xanthopterus*, and common dolphinfish *Coryphaena hippurus* in Sakhalin Bay waters are presented. Other catch locations of *Coryphaena hippurus* in Sakhalin waters are presented. Issues related to these catches are discussed.

Keywords: migration, redfin *Pseudaspius leptocephalus*, yellowfin pufferfish *Takifugu xanthopterus*, common dolphinfish *Coryphaena hippurus*, Sakhalin Bay, Sea of Okhotsk.

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INTRODUCTION

Sakhalin Bay, with depths not exceeding 73 m, is located between the northern part of Sakhalin Island and the shore of the Eurasian mainland (Lotsiya ... 1999). Its flora and fauna are poorly studied. In particular, the species composition of fish in the bay was compiled from pelagic and bottom trawl surveys (30 stations) in late July-August 2006 in the moribund zone, and in the coastal zone by fixed net, seine and fry drag (26 surveys at 16 stations) in July 2006 and August 2000 and 2011 (Mukhametova et al. 2022; Kolpakov et al. 2023). Obviously, the list of fish species occurring in the bay obtained on the basis of these episodic surveys covering only the summer period is incomplete and should be supplemented during further studies. We report three species of fish that were recorded for the first time in Sakhalin Bay waters (Fig. 1a), as well as the capture of individuals of one of these species off southwestern Sakhalin (Fig. 1b).

MATERIAL AND METHODOLOGY

In the catch of a fixed seine set at the coordinates 53° 23′46″ N. lat, 141° 42′11″ E in Sakhalin Bay near Zotova Bank Island (Fig. 1a), on 03.09.2021, a fish of the carp family (Cypriniformes) with a flat wedge-shaped head (Fig. 2a) and an individual of the pufferfish family (Tetraodontidae Bonaparte, 1831) were found (Fig. 2b). Two *Coryphaena* sp. *coryphaena* (Fig. 2c) were caught with the same haul seine on 29.07.2021, and another one was caught on August 15. In the last days of August 2023, Coryphaena sp. was caught in a seine set at the coordinates 53° 34′35″N, 142° 30′15″E near the village of Moskalvo. While fishing on a wobbler on 30.08.2023 was caught coryphalus on the traverse of Nevelsk, at coordinates ~46° 40′44″N, ~141° 45′22″E. In a small haul seine (karavka) set in the vicinity of the village of Nevelskoye at a depth of 22 m. Nevodskoye at a depth of 22 m and at a distance of 1900 m from the shore at coordinates 47° 49′28″ N, 142° 03′35″ E. On 17.09.2020, at least 5 specimens of coryphaena were observed (Fig. 1b). All of the above captured fish were photographed. From these photographs, individuals were described and species identification was carried out using relevant publications (Atlas ..., 2003; Sokolovsky et al., 2009; Tuponogov and Kodolov, 2014). The length of Amur redfish was determined from photographs based on the ratio of fish length to the average stitch length of the stitching of the bottom of the polypropylene-laminated kraft bag under the fish. To analyze thermal conditions in Sakhalin Bay during the period of fish capture, satellite data on sea surface temperature (SST) obtained by the TeraScan® receiving station (SEASPACE Corp., USA), which has been in operation at SakhNIRO since 1997, were used.

RESULTS.

According to the description (Atlas ..., 2003), we identified the fish from the carp order as Amur flathead minnow *Pseudaspius leptocephalus* (Pallas, 1776): the body is elongated, its maximum height is 5.5 (4.0-5.0 according to the description) times less than the Smith's length (*FL*). Head large, wedge-shaped, its length 4.2 (3.0-4.0) times as long as *FL*. The mouth is semi-upper, the upper jaw does not reach the vertical of the anterior margin of the eye. Lower jaw

slightly protrudes forward. Dorsum greenish-gray, sides silvery, belly white. The iris of the eyes is slightly golden. Dorsal fin gray; pelvic, pectoral, anal and caudal - reddish (dorsal, pelvic, anal and upper part of caudal fins reddish, pectoral - yellowish gray).

The coloration of the captured dogfish was described (Sokolovsky et al., 2009) as identical to that of the yellow-finned dogfish *Takifugu xanthopterus* (Temminck et Schlegel, 1850): several oblique broad black stripes in the anterior part of the body, passing behind into parallel stripes. All fins are yellow in color when alive. There are no other species of the family Tetraodontidae with similar coloration.

According to published data, there are two species of *coryphaea* in Russian Far Eastern waters: the large *Coryphaena hippurus* Linnaeus, 1758 and the small *C. equiselis* Linnaeus, 1758. The small coryphaena was caught only once in the waters of Southern Primorye in the fall of 2000 (Gavrenkov, 2001). All caught coryphaena presented in the photos are described (Tuponogov and Kodolov, 2014) as belonging to the species large coryphaena: the body is oblong, compressed from the sides, tapering to the tail; the anterior contour of the head is rounded, almost vertical, keel-shaped; the highest body height is at the nape. Dorsal fin one, extending from the back of the head almost to the caudal fin; caudal fin deep-oval with long lobes; coloration of blue, green and golden shades.

OBSERVATION

The Amur flathead minnow, together with the small-sided *P. brandtii*, large-sided *P. hakonensis* and Sakhalin *P. sachalinensis* redds, and *P. nakamurai*, constitute the genus *Pseudaspius* (Fricke et al., 2024). The Amur redfish is found in the Amur River basin along its entire course from the rivers Onon, Kerulen, Khalkhin-Gol and Lake Buir-Nur, the Ingoda, Shilka, Argun, Sungari, Ussuri and Lake Khanka to the Amur estuary. Khanka to the Amur Liman (Berg, 1949; Nikolsky, 1956; Pisces ..., 1983; Bogutskaya and Naseka, 1996; Annotated Catalog ..., 1998; Atlas ..., 2003; Korsun et al, 2012; Novomodny, 2013; Antonov et al., 2019). Also recorded in rivers and lakes of northwestern Sakhalin (Safronov and Nikiforov, 1995; Bogutskaya et al., 2008;

Safronov et al., 2020). It usually stays in the riverbeds of rivers with cold and clear water, near shoals, and occasionally enters lakes in summer (Atlas ..., 2003). The opinion about the absence of significant migrations and exclusively sedentary lifestyle of this species (Novomodnyi, 2013) is questioned, at least with respect to individual individuals.

Previous surveys have shown that redfish are found in the estuaries of the Langry, Naumovka, Chingai and Pyrka rivers of northwestern Sakhalin, and according to reports from local amateur fishermen also outside the estuaries, in the sea coast from Rybnovsk village to the mouth of the Pyrka River (Safronov et al. 2020). A capture near Zotov Bank Island, located in the very south of Sakhalin Bay between the northeastern waters of the Amur estuary and the mouth of the river Naumovka, confirms the possibility of encountering the species. The capture near Zotova Bank, located in the southernmost part of Sakhalin Bay between the north-eastern waters of the Amur estuary and the mouth of Naumovka River, confirms the possibility of encountering sturgeon outside the river estuary, but not only in the Amur Liman but also in the waters of the southernmost part of Sakhalin Bay. It can be assumed that individuals of the species migrate outside the rivers during the period of severe desalinization of the Amur Liman and the adjacent Sakhalin Bay, and the colts caught near Zotova Bank were among such migrants. In our opinion, the occurrence of the stud in the coastal areas of the estuary and the bay indicates that fish from one river may migrate to the rivers nearest to it. It is possible that solitary migrating specimens of the zheremchus were the first migrants from the Amur River to develop the rivers of northwestern Sakhalin.

The *FL of* a caught Amurian sturgeon specimen was~ 35.6 cm, standard length (*SL*) -~ 32.3 cm. *SL* of specimens of this species from catches in Lake Sladkoye in 1993-2010 ranged from 23.9-55.0 (mean 40.8) cm (Safronov et al. 2020). The catch is expected and, in our opinion, it was only a matter of time before the presence of this species in the coastal waters of the southern part of the bay was officially recorded.

The yellowfin dogfish is one of 36 species in the genus *Takifugu* Abe, 1949 of the pufferfish family (Fricke et al., 2024). It is widely distributed in the northwestern Pacific Ocean and is known from waters off Japan (Temminck and Schlegel, 1850), Japan Sea (Chu et al., 2021), Yellow Sea (Lee, 1994), East China Sea (Yamaguchi and Kume, 2008; Sarr et al., 2024), and South China Sea (Teng et al., 2022; Yang et al., 2022), including waters off Taiwan Island (Hwang et al., 1992). It occurs at depths from 1 to 100 m (Lyczkowski-Shultz et al., 2014) in the sublittoral zone and estuaries on rocky substrate (Yamada et al., 1995 - cited in Lyczkowski-Shultz et al., 2014). In Russian Far Eastern waters, it is found mainly off the coast of Primorye, in particular, in the estuaries of the Razdolnaya and Artyomovka rivers (Barababanshchikov, 1999), Kievka Bay. Kievka (Ivankov et al., 2001), Olga Bay (Sokolovsky, Sokolovsky, 2001). Olga (Sokolovsky and Sokolovskaya, 1996), and in the estuaries of the Tumannaya (Popov, 1933) and Samarga rivers (Kolpakov and Kolpakov, 2002). In Prisakhalin waters, it was recorded along with other species of this genus: patterned (painted) *T. flavipterus* Matsuura, 2017, northern *T. porphyreus* (Temminck et Schlegel, 1850), red-finned *T. rubripes* (Temminck et Schlegel, 1850) and spotted-spined *T. stictonotus* (Temminck et Schlegel, 1850) by dogfish (Dyldin et al., 2017). The new capture is interesting because this species was previously recorded in Sakhalin waters only near the southern tip of the island, in Aniva Bay near the mouth of the Aniva River. The species was previously encountered only off the southern tip of the island, in Aniva Bay near the mouth of the Lyutoga River in August 2015 (Dyldin et al., 2016). Our capture extends the area of its distribution in waters off Sakhalin Island during the warm season far to the north (to 53° 23′46″N).

The large (common) *coryphaena*, or golden (golden) mackerel, together with the small coryphaena, constitute the genus Coryphaena of the family Coryphaenidae (Reshetnikov and Kotlyar, 2022; Fricke et al., 2024). It is a migratory pelagic fish, distributed in the Pacific, Indian and Atlantic Oceans, usually found in subtropical and tropical coastal waters near islands and far from the mainland (outside the zones of influence of river flow), characterized by relatively rapid growth (Scherbachev, 1973; World review ..., 1994). From early summer to fall, it makes seasonal

migrations to the seas adjacent to Japan (Sakamoto and Kojima, 1999). In contrast to the yellowfin dogfish, it has been observed quite frequently in Sakhalin waters, mainly off the southwestern coast (Probatov, 1951; Zverikova and Shvetsov, 1975; Velikanov, 2010). It was also recorded in Aniva Bay (Poltev, Poltev, 1975; Velikanov, 2010). Aniva Bay (Poltev, Sergeenko, 2001) and in waters off south-eastern Sakhalin (Gudkov, Nazarkin, 2006; Poltev, Tskhai, 2019).

The highest probability of passage of warmwater fish from the Tatar Strait through the Amur estuary into Sakhalin Bay was assumed to be in late June and July, a period when strong periodic through currents are annually observed under the influence of storm winds combined with a decrease in Amur River flow (Novomodny 2003). However, of the five cases of captures of heat-loving fish (large coryphaena and yellowfin dogfish) we presented, two each occurred in late July and August and one in early September, indicating the possibility of such penetration during the entire hydrological summer (July-September), at least in some years. Our assumption is supported by data obtained by the Pacific Branch of the All-Russian Research Institute of Fisheries and Oceanography in September 2003 (Vanin 2004), according to which surface waters in Sakhalin Bay and near the Shantar Islands were characterized by unusually high salinity (32.4-32.6‰) for this period of the year, indicating increased runoff into the Sea of Okhotsk from surface Japanese-Marine waters through the Nevelsky Strait. Nevelsky Strait. Of the 15 known sightings of large coryphaena in waters off Sakhalin (including Sakhalin Bay), one was recorded in June and September, three in July and ten in August, eight of which were recorded in the first half of the year (Table).

Records of captures of the large *coryphalan Coryphaena hippurus* in waters off Sakhalin Island

Period or date	Neighborhood	Number of fish or weight	Water temperature, °C (date, locality)	Source of information
VI.1973	П. Antonovo*	1		Zver'kova, Shvetsov, 1975
22-23.VII.2007.	C. Simakovo	300**		Velikanov, 2010
	M. Slepikowski	300**		Same
29.VII.2021.	O. Zotova Bank	2	24.1 (27.VII)	Our data

06.VIII.1950.	C. Apple	12		Probatov, 1951
Early August 1950	Same	1		Zver'kova, Shvetsov, 1975
02.VIII.2000.	To the right of the Suslova channel	15		Poltev, Sergeenko, 2001
Until 15.VIII.1999.	Hall. Aniva	2		Same
11.VIII.2004.	Southeast Sakhalin	1	16.0-17.0	Gudkov, Nazarkin, 2006
30.VII-05.VIII.2007.	C. Orlovo	4		Velikanov, 2010
03.VIII.2013.	Southeast Sakhalin	1	16.0-17.0 (01-10.VIII).	Poltev, Tschai, 2019
15.VIII.2021.	O. Zotova Bank	1	18.8-19.0	Our data
27.VIII.2023.	C. Moskalvo	1	17.5-18.9 (Sakhalin Bay), 19.2-21.2 (29.VIII, Baikal Hall)	Same
30.VIII.2023.	Г. Nevelsk	1	20.3 (29.VIII)	"
17.IX.2020.	C. Nevodskoe	5	19.3 (15.IX)	"

Note. * Currently c. Yablochnoye; ** in kg, other values are given in eq.

Previously, it was assumed that the majority of coryphalus catches in the first half of August were due to the maximum warming of the Tatar Strait sea waters during this period (Gudkov and Nazarkin 2006). However, according to average TPM values for July-September 1998-2022, the greatest warming of waters (18.3-18.8°C) off the southern part of the south-western coast of Sakhalin (46°-48°N) occurs in the second-third decade of August, and in the first decade of September the TPM is the same as in the first decade of August. This discrepancy may be due to the sporadic and random nature of the information on catches of large coryphalina, which does not reflect its actual distribution in Sakhalin waters during the warm season. As these catches were recorded at temperatures between 16.0 and 24.1°C, it can be assumed that the penetration of this species into waters north of Japan is not directly dependent on water warming, but is related to other factors, in particular the abundance and distribution of its food items. Averaged data for August show that the zone of influence of the warm Tsushima Current with a TPM of 18°C extends

to 50°N, while the TPM of more northern waters up to Nevelsky Strait is 17°C (Tskhai and Shevchenko, 2023), but is not a barrier for large coryphaena.

As in the case of the yellowfin dogfish, the capture of large coryphaena in Sakhalin Bay extends the area of its distribution in Sakhalin waters during the warm season far northward to 53° 34′35″N. Previously, its movement in this direction was limited to latitude 48° 50′ (Velikanov, 2010). Previously, when describing the capture of northern dogfish off northeastern Sakhalin, we considered the probable route of its migration through Sakhalin Bay (Poltev and Koinov, 2011). Our data confirm that some of the heat-loving fish species entering the Tatar Strait with the Tsushima Current during the warm season may reach the waters of Sakhalin Bay. These species are likely to be adapted to brackish waters, as the distilled waters of the Nevelskoy Strait and Amursky Strait are the most likely to reach the waters of Sakhalin Bay. Nevelsky Strait and Amursky Liman are not an obstacle for them. For example, northern dogfish (Kato et al., 2005) and yellowfin dogfish (Barabanshchikov, 1999) are known to occur in river estuaries, and occasionally the greater coryphaena (Johnson, 1978 - cited in Palko et al., 1982).

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ETHICAL STANDARDS

The peculiarities of coloration and morphology of fish were studied from their photographs, the fish themselves were not subjected to research.

CONFLICT OF INTEREST

The authors of this paper declare that they have no conflicts of interest.

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PICTURE CAPTIONS

Figure 1. Locations of yellowfin dogfish *Takifugu xanthopterus* (data: (◇) - ours, (◆) - from literature sources), Amur flathead minnow *Pseudaspius leptocephalus* (☆) and large *coryphaena Coryphaena hippurus* (data: (●) - ours, (▲) - from literature sources) in Sakhalin Bay (a) and off southern Sakhalin Island (b).

Fig. 2. Amur flatheaded rod *Pseudaspius leptocephalus* (a), yellowfin dogfish *Takifugu xanthopterus* (b) and large *coryphaena Coryphaena hippurus* (c) caught off Zotov Bank Island. Photos courtesy of A.F. Efimov.