

Killer whale status and live-captures in the waters of the Russian Far East

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Abstract

Killer whale ecology and population structure have been studied in detail in the eastern North Pacific, but much less information is available from the western North Pacific, where live-capturing have started in recent years. In this paper we summarize the current information about killer whales and the live-capture procedures in the western North Pacific. We have described two killer whale ecotypes in the Russian Far East: fish-eating and mammal-eating ecotypes similar to resident and transient killer whales found in the Northeastern Pacific. Resident killer whales were encountered much more frequently than transients off eastern Kamchatka, near the Commander Islands and Kuril Islands. Transient killer whales prevailed in the western and northern Okhotsk Sea and off Sakhalin Island. Mitochondrial control region haplotypes were different for resident and transient killer whales. Genetic analysis of microsatellite DNA showed that resident and transient killer whales belong to reproductively isolated populations. Values of stable isotope $\delta^{15}\text{N}$ were significantly higher in transients, indicating their higher trophic level. Using the photo-identification method, we have identified 688 resident killer whales in Avacha Gulf, Kamchatka, and more than 800 around the Commander Islands. Some mixing occurs between Avacha Gulf, Commander Islands and the other regions of eastern Kamchatka, but the extent of the mixing varies. We also identified 26 transient killer whales in Avacha Gulf and 18 transient killer whales near the Commander Islands. Recapture rate of transient killer whales in that area was low. In the western Okhotsk Sea no dedicated study has been conducted. We identified 55 transient killer whales through the opportunistic studies. There were multiple resightings within and between seasons in the same area and in adjacent areas. Only transient killer whales have been observed so far in this region. During the period of 2002-2011, six killer whales were captured in different areas of the Russian Far East. In 2012-2013, seven killer whales were captured in the western Okhotsk Sea: one young female in 2012, and six whales of unknown sex and age in 2013. The live-capture of killer whales raises concerns because it targets the same local stock of transient killer whales in the western Okhotsk Sea. Russian officials deny the existence of killer whale ecotypes in the Russian Far East, and consequently do not manage fish-eating and mammal-eating killer whales as different management units. No reliable abundance estimates of either killer whale ecotype in the Okhotsk Sea is available.

INTRODUCTION

Killer whale ecology and population structure have been studied in detail in the eastern North Pacific, but much less information is available from the western North Pacific. In recent years live-capture of killer whales has been undertaken in the waters of the Russian Far East. In this paper we summarize the current knowledge on the ecology and population structure of killer whales in the western North Pacific and the available information about the live-capture procedures.

Devoted long-term studies on killer whales (*Orcinus orca*) have been conducted in two main areas of the Russian Far East: Avacha Gulf (1999-2013) and the Commander Islands (2008-2013) (e.g., Burdin et al., 2007; Filatova et al., 2009; Ivkovich et al., 2010). Additional data have been collected in other areas since 2002 during ship-based work and short-term field expeditions along the eastern Kamchatka coast, Kuril Islands, and western Okhotsk Sea.

ECOTYPES

We have described two killer whale ecotypes in the Russian Far East: fish-eating and mammal-eating ecotypes (Burdin et al., 2007; Filatova et al., 2014) similar in appearance and behavior to resident and transient killer whales found in the Northeastern Pacific (Ford et al., 1998). We have observed resident killer whales feeding on fish

(salmon, Atka mackerel, cod) and transient killer whales feeding on marine mammals (minke whale, fur seal, Dall's porpoise, bearded seal, ringed seal, and, according to interviews and recovered carcasses, bowhead whales). Resident killer whales were encountered much more frequently than transients off eastern Kamchatka, near the Commander Islands and Kuril Islands. Transient killer whales prevailed in the western and northern Okhotsk Sea and off Sakhalin Island.

We have conducted genetic analysis from 92 biopsy samples (Table 1, Figure 1).

Table 1. Number of biopsy samples from resident and transient killer whales.

	Resident	Transient
Karaginsky Gulf	2	0
Avacha Gulf	45	5
Commander Islands	11	2
Western Okhotsk Sea	0	27



Figure 1. Russian Far East seas. Locations of biopsy samples used for genetic and stable isotope analysis are shown in black triangles. Shaded area indicates the location of 2012-2013 captures.

Mitochondrial control region haplotypes were different for resident and transient killer whales. Resident killer whales from all regions had SR haplotype. Among transient killer whales, NT1 haplotype was most frequent. All transient whales from Avacha Gulf had NT1 haplotype. In the Commander Islands, one whale had NT1 haplotype, and another – NT3 haplotype. Among western Okhotsk Sea samples, 15 had NT1 haplotype and 5 had a previously undescribed transient haplotype.

Genetic analysis of microsatellite DNA showed that resident and transient killer whales belong to reproductively isolated populations ($F_{st}=0.2361$, $p < 0.00001$). Cluster analysis (program Structure 2.3.3) also revealed clear heterogeneity: the study samples were more likely to be divided into two groups – resident and transient ($\ln Pr_{K=1} = -2173$; $\ln Pr_{K=2} = -1800$) (Figure 2).

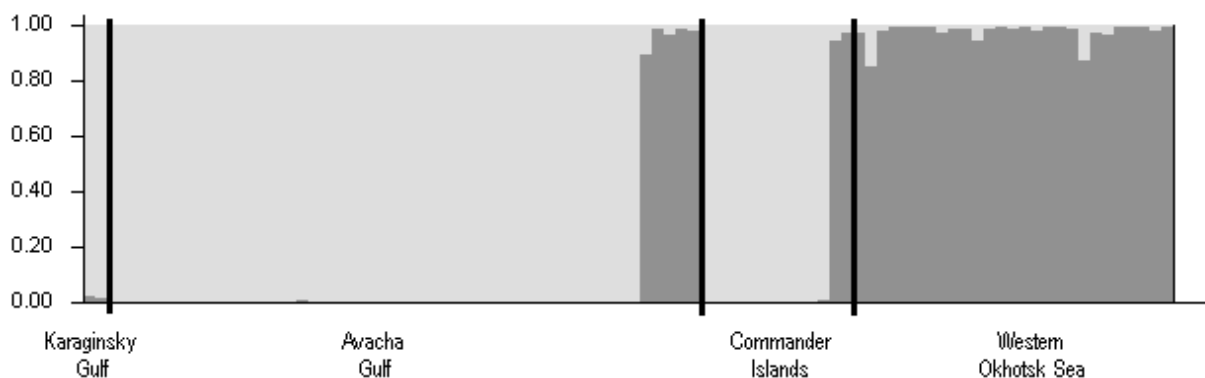


Figure 2. Probability of belonging of samples (n = 92) to one of two hypothetical genetic clusters. Program Structure v 2.3.3, model «Locprior», 500000 replicas.

We conducted stable isotope analysis of 46 skin samples: 25 from Avacha Gulf, 2 from Karaginsky Gulf, 11 from the Commander Islands and 8 from western Okhotsk Sea. The stable isotope analysis confirmed our visual observations: values of $\delta^{15}\text{N}$ were significantly higher in transients, indicating their higher trophic level (median \pm SD: residents – $13.7 \pm 0.4\text{‰}$, transients – $16.8 \pm 0.8\text{‰}$; Mann-Whitney test: $U = 0$, $p < 0.0001$).

We have studied killer whale social structure and social behavior in Avacha Gulf using photoidentification technique. The social structure of Avacha Gulf resident killer whales was similar to the structure of residents from Northeast Pacific (British Columbia, Washington State and Alaska). They formed social units that included maternal relatives and were stable for at least 10 years (2002-2011). The mean size of these units was 4-8 animals. They included up to three generations of whales and no dispersal from the maternal unit was observed.

We also found significant differences in aggregation sizes of Avacha Gulf resident (mean = 28,6) and transient (mean = 3,6) killer whales (Mann-Whitney test: $U = 22,5$, $p < 0.001$).

In summary, we have shown that resident and transient killer whales in Russian waters represent sympatric, reproductively-isolated populations with stable ecological and behavioral differences.

LOCAL STOCKS

Using the photo-identification method, we have identified 688 resident killer whales in Avacha Gulf, Kamchatka, and more than 800 resident killer whales around the Commander Islands. According to the identification rate, most of the killer whales which use Avacha Gulf are already identified to date. Only a few new identifications have been made in recent field seasons. The level of identification of new whales in the Commander Islands is still high, which indicates a greater number of animals using this area.

The level of site fidelity was higher in Avacha Gulf and lower in the Commander Islands. More than half of all identified animals visited Avacha Gulf for two years or more. About 80% of killer whales identified in the Commander Islands were encountered there only during one year.

The killer whales found in Avacha Gulf have different home ranges. We have determined that Avacha Gulf is the core summer feeding area for 271 individual killer whales in 33 matrilineal units, roughly half the number of whales and matrilines found in Avacha Gulf. The other half visit the Gulf occasionally and their core area is unknown.

Some mixing occurs between Avacha Gulf, Commander Islands and the other regions of eastern Kamchatka, but the extent of the mixing varies. We have found high rates of matches between the coastal areas of eastern Kamchatka (from Avacha Gulf to Karaginsky Gulf) – apparently, killer whales in these areas belong to one community. The number of matches between the Commander Islands and Avacha Gulf is low. In the Commander Islands we have encountered many whales not seen anywhere else. This indicates that a significant number of killer whales come to the Commander Islands from some non-investigated area (possibly the western Aleutian Islands). In general, the Commander Islands appears to be a crossroads for the movements of killer whales from different regions. This would explain the large number of identified animals and the low repeated identification rate.

We also identified 26 individuals in seven groups of transient killer whales in Avacha Gulf and 18 individuals in eight groups near the Commander Islands. Recapture rate of transient killer whales was low. In Avacha Gulf two of seven transient groups were encountered twice in the period from 2002-2011, and one group was observed in three encounters. All repeated encounters with same groups happened in different years. In the Commander Islands one

group was encountered three times in two years, and one solitary transient male was encountered six times in four years.

In the western Okhotsk Sea no dedicated study has been conducted. Our opportunistic observations during beluga whale research resulted in mammal-eating killer whale sightings in the bays of the western part of the sea: from Udskeya Gulf to Sakhalin Gulf. The majority of encounters occurred in Akademiyaya Gulf, likely due to the higher work-effort in this area. In 2011-2013, in addition to killer whale biopsy material, photographs were collected opportunistically. We identified 55 killer whales (the analysis of the photos collected in 2013 is incomplete at present). So far, two matches with adjacent areas have been found: one – to an amateur photo taken in 2009 near Shantar Archipelago (within 150 km from the place where we met this individual); the other one – to a photo taken by the gray whale research team off eastern Sakhalin Island in 1998 (about 500 km to the east). Within our photo-collection, three individuals from the same group were sighted twice, in 2011 and 2012 in Akademiyaya Gulf. Within a season, there were multiple resightings (up to three times) of certain family groups. An unusually large aggregation of mammal-eating killer whales was recorded in 2011: a group of over 30 individuals repeatedly visited the western arm of Akademiyaya Gulf (Shpak, Shulezhko, 2013).

More effort and a dedicated project are required to study the local stock or stocks of mammal-eating killer whales in the western Okhotsk Sea. The existing information may be narrowed down to the following: 1) only mammal-eating killer whales have been observed so far in this area; 2) they are distributed along the entire coastline from the western coast of the sea to Sakhalin Island, 3) despite a very small number of identified animals, we have found matches across years within the region and within adjacent regions, which suggests that the number of the local stock (stocks) is quite limited.

KILLER WHALE CAPTURES IN THE RUSSIAN FAR EAST

LLC "Utrishsky Delphinariy" (also known as "Utrish Dolphinarium") attempted the first killer whale capture off Eastern Kamchatka in 2002, but did not succeed. The first successful capture occurred in Avacha Gulf in 2003. A group of resident killer whales was encircled by a net. One young female was captured and at least one whale was entangled and suffocated. The captured female died about one month later in a holding facility on the Black Sea.

In 2005-2010 LLC "Pavlovskaya Sloboda" tried to capture killer whales in the Northern Okhotsk Sea (Taujskaya Bay). During this period capturing attempts failed (TINRO, 2014).

One killer whale was captured in 2010 by LLC "Utrishsky Dolphinariy" in the western Okhotsk Sea, but later escaped from the sea net enclosure (according to the information from the capture team).

The Pacific Research Fisheries Center TINRO (2014) reported that during the period of 2002-2011, six killer whales were captured in the Russian Far East. From those, only 3 killer whales mentioned above (two captured in 2003 (including the one that suffocated) and one in 2010) were officially announced.

In 2012-2013, captures were undertaken in the western Okhotsk Sea by the group of companies (LLC "White whale", LLC "Sochinskiy Delphinariy") which are related to an umbrella company "White Sphere". They reported the capture of one young female killer whale in 2012, and six killer whales in 2013. The sex and age of the six killer whales captured in 2013 are not precisely known. Two killer whales (a juvenile female and young male) were exported to China, two were reported to be sent to Moscow, and the fate of three others is unknown.

The live-capture of killer whales raises concerns because it takes place in a limited area in the western Okhotsk Sea. All killer whales encountered there during studies belonged to the transient ecotype. In that area whales often travel close to shore looking for seals, which makes them susceptible to being captured from small boats. The captures in 2010-2013 repeatedly targeted the same local stock of transient killer whales, although abundance estimates used to justify the captures covered the whole Okhotsk Sea, including waters west of Kuril Islands that are frequented by resident killer whales. TINRO have reported abundance estimates of 3,130 killer whales for the whole Okhotsk Sea (TINRO, 2014), but they did not make a distinction between ecotypes. Russian Federal Fisheries Agency and the relevant resource institutes refuse to recognize the existence of killer whale ecotypes in the Russian Far East, and consequently do not manage fish-eating and mammal-eating killer whales as different management units. No reliable abundance estimates of either killer whale ecotype in the Okhotsk Sea is available.

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