SHORT COMMUNICATIONS

EXPERIENCE OF THE FORCED FATTENING OF *HALICHOERUS GRYPUS* (PHOCIDAE) PUPS IN THE BIOTECHNICAL AQUA COMPLEX OF THE MURMANSK MARINE BIOLOGICAL INSTITUTE, KOLA SCIENTIFIC CENTRE OF THE RUSSIAN ACADEMY OF SCIENCES

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Received: 11.07.2017

The most important stage of keeping seals in captivity conditions is training of pups which have finished breast-feeding to feed on solid food (fattening). On expedition in 2016 the Murmansk Marine Biological Institute (MMBI) staff captured five pups of the Atlantic gray seal (*Halichoerus grypus grypus*) for the purpose of carrying out experimental studies. The caught animals were transported to the MMBI aqua complex in Gadzhievo. Three of the five captured animals began to feed on thawed fish without additional measures. A forced battening method was successfully applied for the two remaining animals. Additions made to the original technique of forced battening have proved its efficiency.

Key words: aqua complex, captivity conditions, fattening, forced fattening, gray seal, pup

Introduction

One of the most interesting mammalian groups for studying are the Pinnipeds and, in particular, representatives of the Phocidae family. Simultaneous living in water and land-air environments allows the pinnipeds, being secondary-aquatic animals, to preserve the capabilities of terrestrial mammals. Pinnipeds are able to hold their breath for a long time and withstand water pressure at depths over 100 m. They are able to regulate the heat loss in the water due to the narrowing of blood vessels and counter-current heat exchange (Pearson et al., 2014). In addition, unlike cetaceans (Cetacea Brisson, 1762), earless seals (Phocidae Gray, 1821) and eared seals (Otariidae Gray, 1825) have a sufficiently developed sense of smell (Laska et al., 2008; Voynov et al., 2013) and vision (Mass & Supin, 2007; Griebel & Peichl, 2003). They are able to move overland and to be for a long time outside the water environment.

The staff of the Murmansk Marine Biological Institute, Kola Scientific Centre of the Russian Academy of Sciences (MMBI) has accumulated numerous data on the feeding, adaptation and maintenance of the earless seals under conditions of captivity (Kavtsevich & Erokhina, 2007). Studies of pinnipeds under the captive conditions have made it possible to obtain data on the physiology, behaviour, capabilities of sensory systems, biochemistry and blood cytology of these animals (Kavtsevich & Erokhina, 2007; Ishkulov et al., 2013; Voynov et al., 2013; Yakovlev et al., 2016).

The grey seal (*Halichoerus grypus* Fabricus, 1791) is one of the most prominent species of the northern earless seals. Its Atlantic subspecies *Halichoerus grypus* ssp. *grypus* (Fabricius, 1791) is included in the Red Data Book of Murmansk region (Kavtsevich & Erokhina, 2014). A close connection with the coastal zone allows these animals to acquire a high degree of resistance to external factors. That causes their low mortality under artificial conditions (Kondakov, 2005). This feature allows *Halichoerus grypus* to be the most promising species of marine mammals when they are used as an element of biotechnical systems in the Arctic seas (Matishov et al., 2007, 2015).

The study of the keeping and adaptation of marine mammals under captivity conditions can be of great importance for nature conservation work directed to the reproduction and replenishment of populations of rare and endangered species (Vishnevskaya et al., 1990). One of the most

important tasks at the initial stages of adaptation of seals under captivity conditions is the primary fattening of pups. The success of this stage can affect both the animal survival and the possibility of their further training (Kavtsevich & Erokhina, 2007).

The status of a protected species limits the possibility of withdrawal of wild animals from their natural environment. Therefore, there are few studies devoted to the primary fattening of *Halichoerus grypus* pups, especially in Russian-language publications. In this regard, one of the tasks of our study was to describe the experience gained in successful forced fattening of *Halichoerus grypus* pups and changes introduced by the authors into the methodology used previously.

Material and Methods

In order to conduct research, the MMBI staff received permission to capture *Halichoerus grypus* pups. The capture was carried out near the Bolshoy Kiy Island, Murmansk region (Fig. 1).

This island is located in the Varanger Fjord Bay, Barents Sea, 2 km from the Peninsula Rybachiy. South-west of the Bolshoy Kiy Island there are Bolshoy Aynov and Maly Aynov islands. They are also considered as the sites of coastal rookeries of *Halichoerus grypus* and belong to the nature protection zone of the Kandalaksha Nature Reserve. The eastern and north-eastern coastal parts of the island have a gently sloping shore and they are close to the Rybachiy Peninsula. Due to such a location, the sea disturbance is less in this area. That in turn allows us to make landfall directly to the shore with a small vessel. In 2005, the MMBI staff conducted a successful expedition to catch *Halichoerus grypus* pups on this island. Therefore the expedition of 2016 was carried out at the same place.

The check out of the research group from Murmansk was held on 23 December 2016. The staff of the expedition (four employees) and equipment were placed on a ship based in the Liinakhamari village. After a short transition, the expedition staff reached the Bolshoi Kiy Island. During the expedition, the staff members, being scattered at a short distance from each other, were moving along the island coastline. If a puppy was found (Fig. 2), all expedition members gathered, after which an animal was placed in a net bag and was left at the same place (Fig. 2).

The capture of animals was carried out without any special gear. Approaching a pup, one of the employees fixed his hind flippers. And at that time a second employee put the net bag over the pup's head. Then the net bag was carefully stretched around the animal body. In our opinion, the mentioned method of capturing is the most gentle, because it allows us to immobilise an animal with the least amount of manipulations. At the same time the experience of catching and transporting the seals shows that the animals captured this way behave more calmly than the seals placed in the transport box.

Fig. 1. The place of capture of *Halichoerus grypus* pups, Bolshoy Kiy Island.

Fig. 2. *Halichoerus grypus* pup, the detected animal (left) and an animal placed in a net bag (right).

For capturing the entire coast and central part of the island were surveyed. In total, seven individuals were found. Four of them animals had molted and three ones were in a state of molting. Mature *Halichoerus grypus* (two individuals) were registered once: in the water at a distance of about 15 m from the shore. The pups were found in the eastern and north-eastern parts of the coastal zone of the island. All the caught seals had finished the period of milk feeding. In total, five animals were selected. Two of these pups still had the embryonic fur (at the body area, while the head and fins were free of fur), and the other three had completed molting. At the selection, we took into account the degree of animal aggression in relation to humans.

Pupping dates of *Halichoerus grypus* in colonies of the Murman are from late October till mid-December, depending on the colony (Kondakov, 1998). The lactation period lasts 2–3 weeks (18 days on average). After that the animals can starve within 10 to 28 days. The reasons for this starvation are not completely revealed. Although there is a suggestion that the physiological changes occurring in that period may be related to the development of the ability to dive (Hall, 2002). Taking into account the feeding and starvation periods, we have approximately estimated the age of the captured animals at 4–6 weeks, depending on the molting stage.

13 Hours after the capture all animals were taken to the MMBI aqua complex in Gadzhievo. There the pups were placed in coastal aviaries on the snow (Fig. 3). An aviary was a box (2.0 × 1.5 m), the walls of which were made of wood and carbon fiber. Snow in the aviary was supplemented when it was melting and contaminating. At the first few days the animals tried to crawl away from humans. But pups gradually began to get used to the presence of employees. And in some cases animals even allowed to touch them without showing a defensive behaviour. All captured animals did not have external signs of exhaustion (underfeeding), despite the difference in size. In natural conditions, young seals begin to eat after a period of obligatory fasting. For this reason, forced fattening was not applied during the first weeks (Mishin & Kavtsevich, 2001). Daily, animals were offered thawed Atlantic herring fillets. In most cases, the fish did not cause interest. But in some cases a pup sniffed, and in consequence, attempted to grasp the proposed feed. Feeding fish was carried out both with direct contact (by hands), and with the help of a rod with a fish fixed to its end. During feeding employee touched whiskers and the mouth of an animal by the fish in order to call the grasping reflex of a pup. Over time, some captured animals (three of the five) began to suck at the proposed fish, and then swallowed it.

Fig. 3. *Halichoerus grypus* pups placed into coastal aviaries in the MMBI aqua complex in Gadzhievo.

Results and Discussion

Three of the five captured pups began to eat independently without applying of forced fattening. The first pup began to eat independently after 23 days since the capture moment (15 January, 2017). The second and the third animals began to eat independently after four weeks since the capture moment (21 January and 22 January, 2017 respectively). It should be noted that animals captured before the molting end started to eat independently (without forced fattening) after four weeks. The decision to conduct a forced fattening was depending on the fatness of an animal and the characteristics of its behaviour.

The appearance and behaviour of one of the animals differed from the others. This pup showed less (with respect to other pups) activity. Its reaction to the approaching humans was less pronounced than of the other animals. There was a slight weight loss. For this reason, it was decided to start a forced fattening.

In the practice of MMBI research, if an animal refuses to independently eat fish, the following method of forced fattening is usually used. One employee holds the animal head, expanding its jaws apart. At this time the second employee pushes the fish into the mouth, pressing on the root of the animal's tongue (Kavtsevich & Erokhina, 2007). As a rule, this procedure should be carried out repeatedly until the moment when a pup starts taking the food himself. Undoubtedly, the stressful nature of the mentioned method implies caution when deciding whether to initiate a forced fattening.

To facilitate the process of forced fattening, we have attempted to introduce some changes into the original methodology. For this purpose, before the initiation of a forced fattening, 300 ml of the prepared solution were injected orally (using a catheter) to an animal (on 09.01.2017). There was prepared 1000 ml solution of the following composition: 500 ml of sodium chloride (NaCl) 0.9%, 500 ml of 5% glucose, 1 dose of Rehydron®, 20 ml of domperidone (Motilium®). The components included into the solution were used in order to increase (activate) the gastrointestinal tract motility and to replenish the water-salt balance. Half an hour after the injection of the solution, the animal was forcibly fed by the thawed Atlantic herring fillets (100 g). At the next feeding (two hours after the solution injection), a pup began to eat the proposed fish independently. On 18.01.2017, the same procedure was carried out with one more pup who refused to eat fish independently. The only difference was that after the solution injection the forced fattening was not carried out. And this pup began to eat independently already at the next feeding. Thus, after a single injection of the described solution, both pups began to eat independently.

At the moment, all five animals are situated in sea aviaries of an open-air type in the MMBI aqua complex in city Polyarny, under the conditions of the Kola Bay. Every day the MMBI staff works with them to develop the skills of initial and general training, which are necessary for carrying out experimental works.

Conclusions

As a rule, the majority of fattened animals begin to eat independently the proposed food. But in some cases a pup can refuse the fish for quite a long time. The reasons for this behaviour are difficult to describe. In such cases, forced fattening is an obligatory measure to prevent the depletion of an animal. The main task of this procedure is rather to train independently eating the solid food than simple feeding.

The practice of using the solutions of «Rehydron» and sodium chloride (NaCl) during fattening of marine mammals and other animals is widespread in case of refusal to eat (due to illness or other reasons) for captive animals or in case of the rehabilitation of wild animals. There is a difference of the cases presented above from the fattening process of seal's pups which did not begin to eat independently. It consists in the fact that a young animal tries the solid food at the first time only after a natural fasting period. That is why the main purpose of carrying out the forced fattening is a stimulation of the gastrointestinal tract work and increase of food motivation. For these purposes, domperidone (as part of Motilium®) was used as the active component of the solution; Rehydron® and 0.9% sodium chloride (NaCl) solution were used as auxiliary elements to physically and chemically stimulate the walls of the stomach.

Of course, there was an absence of a statistically significant number of individuals participating in this study. Despite of that, the obtained results suggest that the use of the described solution makes it easier to carry out the procedure of forced fattening, thereby reducing the stress pressure on an animal. This in turn facilitates the process of adaptation of seal pups to captive conditions, allowing faster cure and/or rehabilitate an animal after a disease or injury in the wild.

References

Griebel U., Peichl L. 2003. Colour vision in aquatic mammals – facts and open questions. *Aquatic Mammals* 29(1): 18–30.

Hall A. 2002. Gray seal *Halichoerus grypus.* In: W.F. Perrin, B. Würsig, J.G.M. Thewissen (Eds.): *Encyclopedia of marine mammals*. California: Academic Press San Diego. P. 522–524.

Ishkulov D.G., Mikhailuk A.L., Pakhomov M.V. 2013. Peculiarities of gray seals color perception. *Herald of the Kola Science Centre RAS* 4: 88–94. [In Russian]

Kavtsevich N.N., Erokhina I.A. 2007. Selection and adaptation of marine mammals to aquacomplex conditions In: G.G. Matishov (Ed.): *Experimental studies of marine mammals in conditions of Kola Bay.* Apatity: Publisher of Kola Scientific Centre of RAS. P. 75–124. [In Russian]

Kavtsevich N.N., Erokhina I.A. 2014. Gray Atlantic Seal. In: N.A. Konstantinova, A.S. Koryakin, O.A. Makarova, V.V. Bianki (Eds.): *The Red Data Book of the Murmansk Region, second edition*. Kemerovo: Asia-print. P. 566–567. [In Russian]

Kondakov A.A. 1998. *Biology and protection of gray seal (Halichoerus grypus Fabricius, 1791) of Murmansk coast*. PhD Thesis abstract. Moscow. 17 p. [In Russian]

Kondakov A.A. 2005. Features of gray seals fattening in captivity. In: *Marine Biotechnical Systems. Biological and technical aspects.* Rostov-on-Don: Publishing House of SSC RAS. P. 96–98. [In Russian]

Laska M., Svelander M., Amundin M. 2008. Successful acquisition of an olfactory discrimination paradigm by South African fur seals, *Arctocephalus pusillus*. *Physiology and Behavior* 93: 1033–1038. DOI: 10.1016/j.physbeh.2008.01.019

Mass A., Supin A. 2007. Adaptive Features of Aquatic Mammals' Eye. *The Anatomical Record* 290: 701–715. DOI: 10.1002/ar.20529

Matishov G.G., Kavtsevich N.N., Mikhailuk A.L. 2007. Marine mammals in biotechnical systems. In: G.G. Matishov (Ed.): *Experimental studies of marine mammals in conditions of Kola Bay.* Apatity: Publisher of Kola Scientific Centre of RAS. P. 33–58. [In Russian]

Matishov G.G., Voynov V.B., Mikhailuk A.L. 2015. *Guidelines for marine mammals training in biotechnical systems in the Arctic.* Rostov-on-Don: Publishing House of SSC RAS. 212 p. [In Russian]

Mishin V.L., Kavtsevich N.N. 2001. Feeding of pups. In: G.G. Matishov (Ed.): *Harp seal: current status of species and its role in functioning of the White and Barents Seas ecosystems*. Murmansk: MIP-999. P. 88–94. [In Russian]

Pearson L.E., Liwanag H.E.M., Hammilld M.O., Burns J.M. 2014. Shifts in thermoregulatory strategy during ontogeny in harp seals (*Pagophilus groenlandicus*). *Journal of Thermal Biology* 44: 93–102. DOI: 10.1016/j.jtherbio.2014.02.001

Vishnevskaya T.Yu., Bychkov V.A., Kondakov A.A., Mishin V.L. 1990. Gray seal. Biology and current status of populations, keeping animals in captivity and taming. Apatity: Kola Scientific Centre AS USSR. 46 p. [In Russian]

Voynov V.B., Zaytsev A.A., Litvinov Yu.V., Mikhailuk A.L., Pakhomov M.V. 2013. Sensory capabilities of Arctic seals in marine biotechnical systems. *Bulletin of Southern Scientific Centre* 9(4): 87–95. [In Russian]

Yakovlev A.P., Mikhailuk A.L., Grigoriev V.F. 2016. An estimation of parameters changes in gray seal behaviour when exposed to electromagnetic fields of extremely low frequencies in the range of 0.01–36 Hz. *Vestnik of MSTU* 19(1/2): 345–352. [In Russian]

ОПЫТ ПРИНУДИТЕЛЬНОГО РАСКОРМА ЩЕНКОВ *HALICHOERUS GRYPUS* (PHOCIDAE) НА БИОТЕХНИЧЕСКОМ АКВАКОМПЛЕКСЕ МУРМАНСКОГО МОРСКОГО БИОЛОГИЧЕСКОГО ИНСТИТУТА КОЛЬСКОГО НАУЧНОГО ЦЕНТРА РОССИЙСКОЙ АКАДЕМИИ НАУК

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При содержании настоящих тюленей в условиях неволи, важнейшим этапом является приучение щенков, окончивших молочное вскармливание, к питанию твердой пищей (раскорм). В ходе экспедиции 2016 г. сотрудниками Мурманского морского биологического института Кольского научного центра РАН (ММБИ) с целью проведения экспериментальных исследований было отловлено пять щенков атлантического подвида серого тюленя (*Halichoerus grypus grypus*). Пойманные животные были доставлены на аквакомплекс ММБИ в г. Гаджиево. Трое из пяти животных стали питаться дефростированной рыбой самостоятельно без применения дополнительных мер. Для двух оставшихся животных был успешно применен метод принудительного раскорма. Внесенные в изначальную методику принудительного раскорма дополнения показали свою эффективность.

Ключевые слова: аквакомплекс, принудительный раскорм, раскорм, серый тюлень, условия неволи, щенок