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Fish electrical repeller ELZA2 as a prevention of European otter (*Lutra lutra*) access to fish farming facilities

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Abstract

The European otter is a common fish predator spread over the majority of the Czech Republic territory. As a protected predatory species, its feeding habits conduce to conflicts between aquaculture and nature protection. Thus, an efficient non-lethal prevention of otter access to aquaculture facilities is highly desired and actually does not exist. The aim of this study was to check the efficiency of fish electrical repeller ELZA2 as a feasible protection against European otter access to trout farms. Negative reaction of otters to the electric field elicited by the repeller was confirmed in this study and thus, the efficiency of the electrical repeller ELZA2 proved to be satisfactory.

Key words: European otter, predation on fish, trout culture, protection

Introduction

Recently, the number of otters in the Czech Republic increased considerably (Poledník and Poledníková 2006). Individual populations and their expansion were described by e.g. Grendziok and Lojkásek (1995), Benda (1996) and Poledník et al. (2005). Aquaculture facilities (pond and trout farms) are supposed to play a key role in otter spreading (Dulfer et al. 1996).

The otter is a carnivore species (Kučerová and Roche 1999) and a food opportunist. The occurrence and proportion of individual fish species in otter diet varies in accordance with their abundance and especially with their availability and capture vulnerability (Chanin 1985, Carss 1995). On average, 80 - 95% of otter diet consists of fish (Kruuk et al. 1993) with daily consumption rate corresponding to 0.4 - 0.9 kg (Ruiz-Olmo 1995). The amount of food ingested rises in winter period (1.5 kg per day) and also during lactation when nursing females require a higher volume of food (Veselovský 1998).

As presented in many otter food studies from various habitats, fish that occur in otter diet are usually between 10 and 15 cm (Mason and Macdonald 1986, Kožená et al. 1992, Hájková 2001, Roche 2001, Kortan et al. 2010). However in carp ponds and breeding units, otters are able to catch even bigger fish, weighing up to several kg (Adamek et al. 2003).

The conflicts between nature protection requirements and economic interests of fish farmers are increasing with rising numbers of otters (Kranz et al. 1998, Kranz 2000, Poledník et al. 2005, Kloskowski 2005). Otter attendance of fish farming facilities is intensified in winter, when otters focus their hunting efforts upon available prey. In that time period majority of waterbodies is frozen and otter visit sites of high fish density (such as trout farms and storage ponds) with considerably increased frequency. In practice, the protection of these facilities from otter attendance is impossible or extremely difficult. The only available protection of trout farms and small ponds is by implementing an electric wire fence. Its mode of functioning is quite satisfactory, however some critical points remain particularly in winter time - when thick snow layers and open inlet and outlet canals remain always as "vulnerable" sites of a fish farming facility efficiently protected by electric wire fence.

Since fish density is a stimulative factor for the selection of feeding sites by otter (Kruuk et al. 1993, Kruuk

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1995, Carss 1995), trout farms constitute a very "seductive" food resource particularly during the winter period with seriously restricted prey availability on another waterbodies. Thus the inlet and outlet canals are posing a certain continuous risk of free otter access beyond control. The only ways how to secure these sites are dense mechanical screens but their installation is always associated with frequent clogging requiring regular control and cleaning.

This study deals with the applicability of fish electrical repeller for protection of fish farm inlets and outlets against otter access. ELZA2 is an electrical device originally assigned for prevention of undesirable fish entry into small hydropower plants inflows however it may be successfully installed also for control of fish entry into fish farming facilities via inflow and outflow canals (Adámek 1997).

Materials and methods

Study area

The pilot experiments with electrical repeller installation aimed at the prevention of otter access were performed on four sites on the territory of the Czech Republic - trout farm Milence (1) (49°16'26.707"N, 13°9'7.421"E, Nov 2007 - Feb 2009) and Domašov nad Bystřicí (2) (49°43'18.394"N, 17°27'3.184"E, Nov 2008 - Aug 2010), trout hatcheries Pstruží (3) (49°33'57.42"N, 18°21'0.887"E, Jan 2009 - Aug 2010) and the Station of Fauna Protection Pavlov (4) (49°42'5.009"N, 15°20'14.334"E, 29 Apr - 11 June 2009).

The electrical repeller ELZA2

The electrical fish repeller ELZA2 (Radomír Bednář Co., Olomouc, Czech Republic) is powered by low voltage source (12V DC) which is increased by the transformer unit and subsequently shaped into short acicular pulses with rapid forehead lead lines and exponential shape of run-down curve. The output pulses are divided into several outputs through only one active electrode. The others are phase-delayed (pulse delayed), therefore there is no necessity to set-up any parallel configuration of electrodes. The repeller consists of following elements: 1) device "ELZA2" - plastic box size 200x150x85 mm, 2) adapter 12V/1A, 3) electrodes (Fig.1) - copper tubes 22/1 with specificity length, max 0.4 m distant, 4) service cables to electrodes. The most important factors influencing the ELZA2 efficiency are water conductivity, stream bed composition, water temperature and oxygen content.

Parameters: supply voltage 10 - 15 V; supply current 600 mA max; output voltage 6 - 12 V; frequency 10 Hz; energy discharge 0.053 J; supply 7 W.

Experimental methods

Immediately after the installation, the device was left turned off for 7 - 14 days to enable otter to get acquainted and accustomed with new "disturbing" element. Once clearly evident indication of otter throughpass was recorded, the device was switched on into operation and the site was checked daily for signs of otter presence (snow footprints, fish prey remains).

Studies with captive otters were arranged with the aim to lure them on live fish in a pond separated from otter's housing pond by a channel provided with ELZA2 electrodes.

Note: Faculty of Fisheries and Protection of Waters, University of South Bohemia, is accredited as user facility Ref. No. 22760/2009-17210 according to Law 246/1992 about "Animal welfare" with testimony for user facilities Ref. No. 22761/2009-17210. Research staff of RIFCH USB involved in the project possess a testimony according to §17 of Law 246/1992 about "Animal welfare".

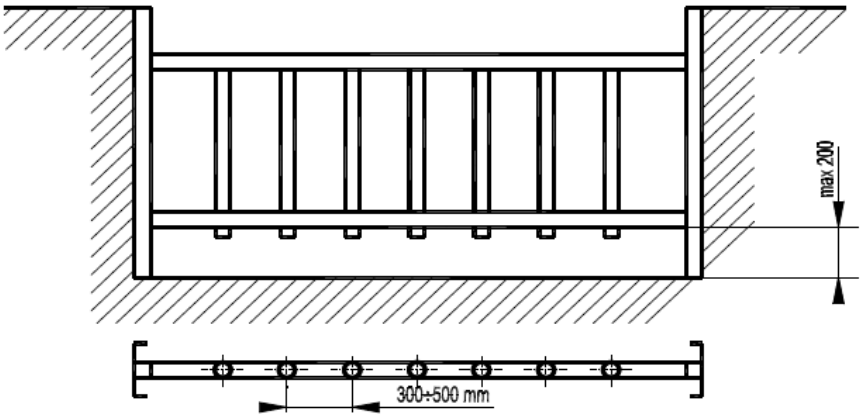

Fig.1. Positioning of the electrical repeller ELZA2 copper electrodes.

Results and discussion

The electrical equipment ELZA2 is designed as a protection device against fish entry into sites where their presence is undesirable. The application of this device was first time tested as prevention against otter access.

Trout farm sites (wild otters)

Milence

The electric repeller was in function since November 2007. For the period of subsequent two-year lasting operation, only one otter visit (24th February 2009) was recorded. This event happened during the period of extremely low temperatures (around -20°C). Under such unfavourable weather conditions with drastically reduced ability to catch food fish in the wild, otter may be roused to extreme solutions - in this case to pass through the electrodes in operation. Actually, under these circumstances, otter suffer from hunger for long and on the other hand, they need more food for compensation of energy looses due to severe frost (Veselovský 1998). This contradiction often implies a reduced perception of endangering.

Pstruží

The equipment was put into action since January 2009. The otter invaded the facility area first time fourteen days after installing with switched off electricity. This corresponds to the fact that otter is very perceptive to any change in its environment and any new barrier leads to the avoidance of it for several days or weeks (Veselovský 1998). Altogether, otter penetration into the protected site was recorded five times during the period of repeller operation (Table 1). Otter passed twice through the electrodes which were frozen in ice and three times otter burrowed the hole underneath the farm fence. Electrodes frozen in the ice layer disallowed the inherence of electric fields around the electrodes. The device was in function but the otter did not perceive the electric field in certain distance from electrodes.

For the time remaining, otter footprints were recorded in snow on inlet banks several times in the distance of 1 m from the electrodes. They demonstrated otter stopped swimming, left the water and examined the possibility of penetration via underneath the fence.

Domašov nad Bystřicí

The equipment was installed in November 2008 and no signs of otter visits were recorded since thereafter despite losses caused by otter predation were quite serious during previous periods.

Table 1. Wild otters´ attendance (number of visits per week) at protected trout hatcheries and farms prior to and during ELZA2 operation. Note: * estimation by respective farm managers

Site	Previous years*	7-14 days prior to operation	During ELZA2 operation (reason for failure)		
			Electrodes in ice	Extreme frost	Fence undermining
Milence	2-3	1	0	1	0
Pstruží	2-3	2	2	0	3
Domašov n. B.	3	1	0	0	0

Captive conditions

Three males (4 - 13 years old) and one female (17 years old) were used separately for the experimental purposes. Their response upon the operation of the electrical repeller was absolutely unclear since two of the animals avoided crossing the repeller electrodes despite the device was switched off. On the other hand two otters crossed the electrodes regularly even during the period of switched on device. It was obvious that behavioural alterations in captive otters are accentuated in the extent which unable them to be used as model animals for this kind of experiments.

Conclusion

Otter negative response (avoidance) to the operation of electrical repeller was proved in field studies on Czech trout farms. Previous regular otter penetration into farms (usually 2 - 3 times per week) was put down significantly during the 1- to 2-year periods of ELZA2 operation. Otter visits into "protected" trout farms were restricted just on occasional penetrations caused by extreme conditions - deep frost, ice frozen electrodes and fence undermining. Experimental evaluation of ELZA2 efficiency against otter penetration cannot be done with captive animals due to their altered behavioural patterns.

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References

Adámek Z. (1997). Electronic fish barrier ELZA2: The results of pilot testing of its function and efficiency. *Bull.VÚRH JU Vodňany*: 166-170.

Adamek Z., Kortan D., Lepic P. and Andreji J. (2003). Impacts of otter (*Lutra lutra* L.) predation on fishponds: A study of fish remains at ponds in the Czech Republic. *Aquaculture International*, 11: 389-396.

Benda P. (1996). Current distribution of otter, *Lutra lutra* (Linné, 1758) in the Elbe sandstones (Czech Switzerland). *Vydra*, 7: 23-25.

Carss D.N. (1995). Foraging behaviour and feeding ecology of the otter *Lutra lutra*: A selective review. *Hystrix*, 7: 179-194.

Chanin P. (1985). The natural history of otters. Croom Helm Ltd. London: 180 pp.

Dulfer R., Foerster K. and Roche K. (1996). Habitat use, home range and behaviour. In: Dulfer R., Roche K. (Eds): First phase management plan for otters in the Třeboň Biosphere reserve. Nature and Environment No.93, Council of Europe Publishing: 31-47.

Grendziok P. and Lojkásek B. (1995). Surveying and food of otter (*Lutra lutra* L.) in the South-East Moravian region in 1993 - 1995. *Vydra*, 6: 45-52.

Hájková P. (2001). Food ecology of otter (*Lutra lutra*) in upper part of the Hornád catchment area. MSc. Thesis, Fac.Nat.Sci. UK Bratislava, 53 pp.

Kloskowski J. (2005). Otter *Lutra lutra* damage at farmed fisheries in southeastern Poland, I: an interview survey. *Wildlife Biology*, 11: 201-206.

Kortan D., Adámek Z. and Vrána P. (2010). Otter, *Lutra lutra*, feeding pattern in the River Kamenice (Czech Republic) with newly established Atlantic salmon, *Salmo salar*, population. *Folia Zoologica*, 59: 223-230.

Kožená I., Urban P., Štouračová, I. and Mazur I. (1992). The diet of the otter (*Lutra lutra* L.) in the Poľana protected landscape region. *Folia Zoologica*, 2: 107-122.

Kranz A. (2000). Otters (*Lutra lutra*) increasing in Central Europe: from the threat of extinction to locally perceived overpopulation? *Mammalia*, 4: 357- 368.

Kranz A., Toman A. and Roche K. (1998). Otters and fisheries in Central Europe - what is the problem? *Boku-Rep. Wildl. Res. and Game Manage*, 14: 142-144.

Kruuk H. (1995). Wild Otters: Predation and populations. Oxford University Press, Oxford, 285 pp.

Kruuk H., Carss D.N., Conroy J.W.H. and Durbin L. (1993). Otters (*Lutra lutra* L.) numbers and fish productivity in rivers in north-east Scotland. *Symp. Zool. Soc. Lond.*, 65: 171-191.

Kučerová M. and Roche K. (Eds) (1999). Otter conservation in the Třeboň Biosphere Reserve and Protected Landscape area: Scientific background and management recommendations. Internal document of the Council of Europe, Strasbourg, 103 pp.

Mason C. F. and Macdonald S. M. (1986). Otters: Ecology and Conservation. Cambridge University Press, 236 pp.

Poledník L., Poledníková K., Roche M., Hájková P., Toman A., Culková M., Hlaváč V., Beran V., Nová P. and Marhoul P. (2005). Rescue programme - care for otter (*Lutra lutra*) in the Czech Republic in 2006 - 2015. Praha: AOPK ČR, 2005, 85 pp.

Poledník L. and Poledníková K. (2006). The Law No. 115/2000 about recompensation of losses caused by expecially protected animals - suitable for long-term solution for otter (*Lutra lutra*) in the Czech Republic? *Příroda*, 25: 131-137.

Roche K. (2001). Sprainting behaviour, diet, and foraging strategy of otters (*Lutra lutra* L.) in the Třeboň Biosphere Reserve (Czech Republic) - summary of a PhD thesis. *Vydra*, 11: 5-9.

Ruiz - Olmo J. (1995). Observations on the predation behaviour of the otter *Lutra lutra* in NE Spain. *Acta Theriologica*, 40: 175-180.

Veselovský Z. (1998). Otter. Aventinum Praha, 46 pp.

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