The effect of insertion of a dummy acoustic transmitter on the survival of pouting, *Trisopterus luscus* L.

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Acoustic fish telemetry is an often used technology that can provide valuable data on fish movement, behaviour and habitat use. In recent years, many novel applications and ameliorated transmitter designs have made it an increasingly popular tool in fisheries research (1-4), resulting in substantially improved knowledge on behavioural, ecological and physical issues (5-9) of many fish species in previously out-of-reach environments. Heupel et al. (1) stated "any aquatic species to which a transmitter can be attached or implanted without modifying the behaviour of the animal is potentially suited to this technology". The size of the transmitter and the disturbance to a fish should be minimized in order to study the fish behaviour (10).

Monitoring of fish communities in wind farms in the Belgian part of the North Sea (BPNS) revealed that pouting, *Trisopterus luscus* (Linnaeus, 1758), was present in high densities in the vicinity of the wind turbines during parts of the year. There is evidence that food availability for pouting increased at these wind turbines (11). To study the spatio-temporal migration and site fidelity of pouting at the offshore wind farms, we plan to use acoustic telemetry. However, pouting is a very sensitive species which survives manipulations only in very low percentages (pers. observations). As knowledge of survival rates is indispensable to an assessment of the likelihood of success of a tagging experiment, a laboratory experiment was set up to investigate the potential for pouting to be used in acoustic telemetry studies. To our knowledge, this is the first experimental study in acoustic telemetry on pouting and the information obtained could be valuable for future applications.

The pouting individuals used in the experiment were collected at a wind farm in the BPNS, using hook and line gear. After capture, fish were kept in an aerated water tank for transportation to aquarium facilities (water temperature of 14°C) at the Institute for Agricultural and Fisheries Research. After an acclimatisation period of five to seven days, the fish were starved for two days (12) before the surgical operation, in order to maximize the intestinal space for tag insertion. Surgical procedures were similar to those of Baras & Jeandrain (13), Arendt et al. (14) and Jadot et al. (15). Prior to tagging, the fish were anaesthetized in a 0.3ml l^{-1} 2-phenoxyethanol solution. Following anaesthesia, the fish, showing no reaction to external stimuli, slow opercular rate and loss of equilibrium (16), were placed ventral side up in a V-shaped support. Most of the body, except the ventral side, stayed in the water and a continuous flow of aerated water was pumped over the gills to avoid gill damage and to provide a continuous oxygen supply (17). A small incision (15-22 mm) was made on the mid-ventral line and a dummy acoustic transmitter (Vemco, coded, V9-1L) was inserted in the visceral cavity. The incision was closed with two sutures (polyamide monofilament, DS19 3/0). All instruments and transmitters used were disinfected with iso-betadine®. In total 15 specimens were tagged with a dummy transmitter. The 10 specimens of the control group were anaesthetised to mimic the handling procedure.

After the surgical procedures all pouting were stocked together in a fish tank (2 x 2 x 0.5m³) on recirculation (i.e. a closed system in which no extra water is added). The tank was checked daily for survival and tag retention. Pouting were fed with fish fillets. The experiment ran for six weeks.

Fish survival rates were compared using chi-square tests. A Two-way contingency table was constructed for survival (dead-alive)/treatment (tag-control) comparison. Statistical analysis was performed in R (version 2.5.1 www.r-project.org). T-tests on the difference in total length of pouting between the treatments were carried out in Statistica (version 7.0, Statsoft, Tulsa, Oklahoma). A significance level of $p < 0.05$ was used in the tests and results expressed as mean ± SD.

The fish length varied between 14.5 cm and 27.5 cm, and between 17.3 cm and 28.5 cm for the tagged and control group respectively. No significant differences in length were present between the groups (T-test, $p = 0.49$). In the first week after surgery a significant difference in survival rate (χ^2-test, $p = 0.041$) was detected between the tagged group (survival: 66.7 %) and the control group (survival: 100 %). Data screening showed that there was a tendency to better survival in larger fish within the tagged group. The fish that died had an average length of 20.5 ± 3.5 cm, while the fish that survived had an average length of 23.2 ± 4.2 cm. However, no significant differences in length were present between the groups (T-test, $p = 0.24$). From the second week onwards there was no further mortality in either group. However, one tagged fish expelled its dummy transmitter in the third week. During the whole period of the experiment all fish ate well and a small increase in length was observed. In the tagged group, overall average length increased from 22.8 ± 4.3 cm to 23.2 ± 4.2 cm, while in the control group it increased from 23.0 ± 4.2 cm to 23.2 ± 3.9 cm. Individual length increment was not monitored as several individuals lost their external identification tag during the experiment. Only fish that survived the experiment were used to calculate average lengths. The experiment took place in the run-up to the spawning season and post-mortem investigation revealed that some specimens had maturing gonads.

Although the experiment was small-scale (due to the limited number of pouting that could be caught), some clear trends were revealed. Tagged individuals had a significantly lower survival probability compared with non-tagged individuals. The results suggest that survival may be influenced by length. Larger animals tended to have higher survival chances, compared with smaller specimens. The experiment clearly showed that if tagged animals died, it was within the first week after surgical procedures. Therefore, we suggest that pouting does have the potential to be used in telemetry experiments.

However, as survival is indispensable to the maximum likelihood of success of a tagging experiment, only animals in good condition should be released. Therefore, fish should be monitored for an observation period of one week after surgical procedures to allow them to recover from stressors (18). In addition, specimens above a minimum length should be used. We suggest this minimum to be at least 23 cm, which is the average length of the tagged fish that survived. All pouting in captivity ate well, increased slightly in length and their gonads matured, so it appeared that tagging did not influence their growth and feeding behaviour.

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