HANDLING STRESS AFFECTS AVOIDANCE BEHAVIOURAL

RESPONSES OF JUVENILE WALLEYE, *Stizostedion vitreum*

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EXTENDED ABSTRACT ONLY – DO NOT CITE

Walleye, *Stizostedion vitreum* (Percidae), are subjected to a variety of handling-related stressors as part of normal transport and stocking operations to support recreational fishery programs. The objective of this study was to determine the effects of handling and transport stress on the avoidance response behaviour of juvenile walleye in the context of their ability to avoid predation after stocking.

The behavioural test chamber consisted of a VHS-video camera mounted vertically on a bracket above a 1.1-m-diameter circular × 30-cm-deep fiberglass tank. The entire apparatus was surrounded by a wooden frame enclosed with heavy black plastic to block external visual stimuli. A spotlight assembly consisting of four 150-W incandescent bulbs located above and directed into the tank provided an instantaneous noxious stimulus. The video camera and spotlights were controlled by a computer programmed to command the on-off timing of the video camera and spotlight operations.

We evaluated the response of the fish visible in the field of the camera by recording each trial frame-by-frame to document the movements of individual fish. In 1997, 50% of the surface area of the tank was exposed to the light stimulus (Fig. 1, areas N_1 and N_2). The behavioural avoidance response was characterized as the amount of time elapsed for individual fish to swim out of the field of view and seek cover (n = 15). The behavioural response was measured in 1998 as the amount of time required for individual fish (n = 30) to swim out of or among the individual squares within a grid marked on the floor of the pool (Fig. 1, areas N_1, N_2, N_3 and N_4).

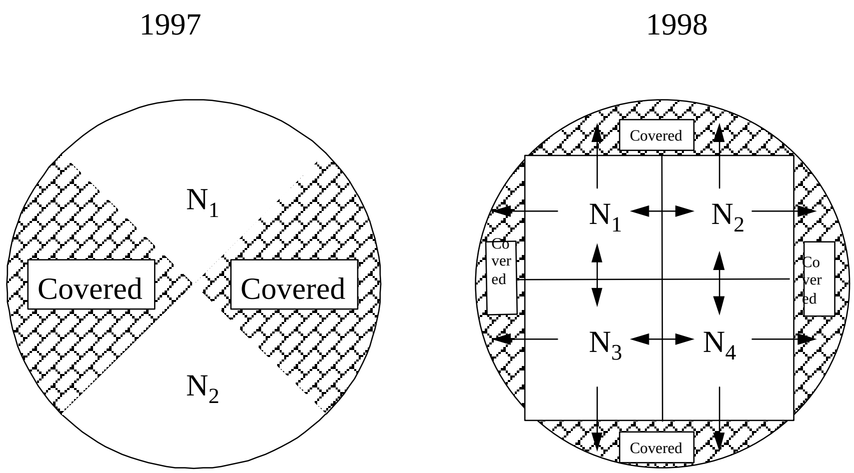

Figure 1. Layout of observation fields and cover patterns in the behaviour observation chamber for avoidance response experiments conducted with walleye fingerlings during 1997 and 1998.

In 1997, groups of fish were allowed to recover for intervals of 1, 12, 24 and 72 h following the stressor treatment (30-s handling – 1-h recovery – 30-s handling); 7-d acclimated unstressed fish served as controls. During 1998, the recovery intervals used were 1 h, 12 h after evening capture, 12 h after morning capture, and 24 h. Unstressed control groups were allowed 1 d to recover after transfer. Observations from replicate groups for each recovery period and control groups were recorded in both years. Fish were removed at the end of each observation period to collect blood samples.

The median avoidance response of fish allowed different recovery times after handling differed significantly in 1997 trials (Fig. 2). In 1997, the median time to seek cover for fish that had recovered for only 1 h was 11.4 s, which was significantly longer than for fish allowed longer periods of recovery and also for non-stressed control fish. The median times for fish to seek cover after recovering for 12, 24 and 72 h following handling, and control fish, were 3.0, 2.8 and 4.3 s, and 3.2 s, respectively, and did not differ from one another.

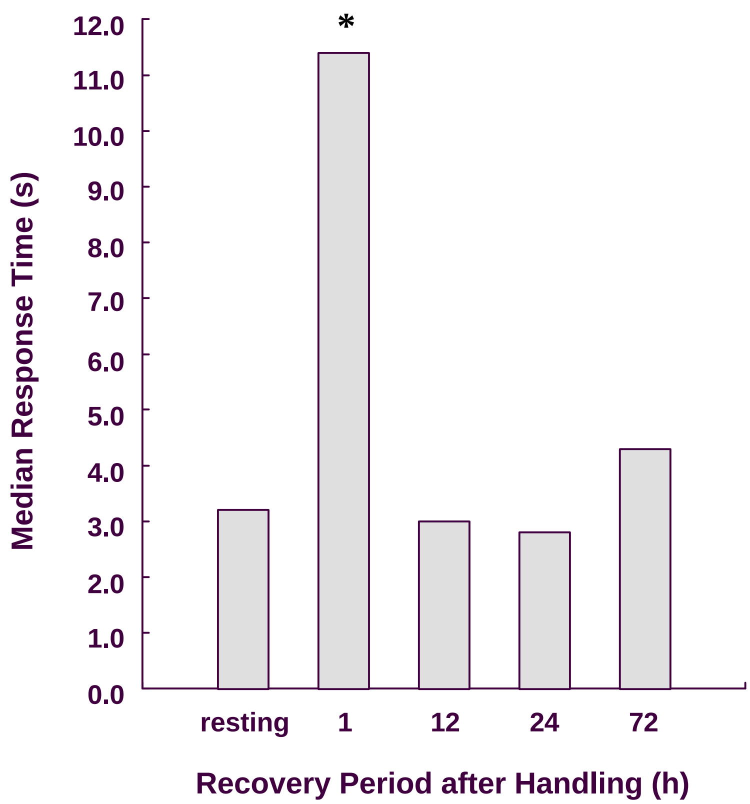

Figure 2. Median avoidance response times, pooled from two replicate trial series conducted in 1997, of juvenile walleye subjected a noxious light stimulus after varying durations of recovery following a handling stressor (* different from resting, *P*<0.05).

Fish that had only recovered for 1 h in 1998 trials responded more slowly to the noxious light stimulus than fish given 24 h to recover and also control fish (Fig.

3). The slowest avoidance response, however, occurred in fish that were tested 12 h after a handling stressor applied in the morning (AM); the median response time for this group was 9.6 s, which was significantly longer than that in either the 1-h recovery group or in fish tested 12 h after applying the stressor in the

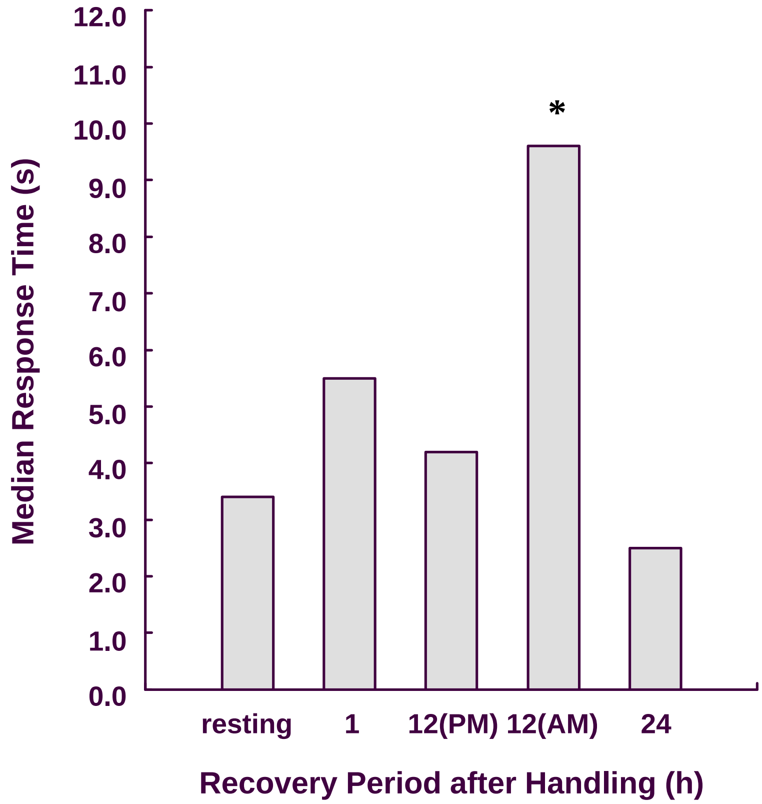

Figure 3. Median avoidance response times, pooled from two replicate trial series conducted in 1998, of juvenile walleye subjected a noxious light stimulus after varying durations of recovery following a handling stressor (* different from resting, *P*<0.05).

evening (PM) and sampled the next morning. In both years there were instances where individual fish did not move from the field of view for the entire 27-min observation period, but this only occurred in fish with only 1 h to recover from handling.

The group mean plasma cortisol concentrations in fish sampled after 1 h and 1 d of recovery (32 and 33 ng/mL) were higher than plasma cortisol in fish collected after observation following 12 h or 3 d of recovery (8.4 and 18 ng/mL). The lowest plasma cortisol levels were in undisturbed (resting) fish collected from the source tanks (3.1 ng/mL) and in the control fish minimally disturbed and sampled 7 d after transfer into the observation tank (6.7 ng/mL). Plasma cortisol concentrations again were lowest in resting fish (4.9 ng/mL) sampled in 1998 trials and highest at 1 h post-handling (29 ng/mL), but the mean value determined for resting fish did not differ from that in fish following 12 h recovery after handling in the morning (8.7 ng/mL). Similar levels of plasma cortisol were measured in fish sampled 1 d after handling (18 ng/mL), the minimally stressed control group (19 ng/mL), and fish that had recovered 12 h overnight after being handled in the evening (18 ng/mL).

Plasma concentrations of chloride ion in 1997 tests ranged from 86.1 meq/L in fish sampled after 1 h of recovery, to 96.1 meq/L in undisturbed fish; mean values were not different. Concentrations of plasma chloride ion in 1998 were lowest among fish that recovered from the handling stressor for 1 h, but the mean value of 98.4 meq/L for this group differed significantly only from those in fish sampled from undisturbed conditions (114 meq/L) and at 12 h after handling them in the morning (104 meq/L).

The results of these tests demonstrate that differences in behaviour of juvenile walleye can occur that depend on the amount of time fish are allowed to recover from a handling stressor. In both years the extreme example of fish not moving at all in response to the light stimulus was observed in groups of fish that only had 1 h to recover. The delayed response to the noxious stimulus suggests that juvenile walleye might be vulnerable to predation for at least an hour after being transported and stocked. The reduced ability to rapidly seek cover was a transitory phenomenon and when the fish were given more time to recover, the median avoidance response time was reduced. The rate of recovery differed slightly between years but when fish had recovered for 24 h after handling, the median avoidance response was reduced by at least 50% in both years. No direct correlation existed between plasma indices of stress and behaviour.

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