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Benefits of enrichment on the behaviour of ornamental fishes during commercial transport

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Highlights

- The effect of enrichment on fish behaviour during commercial transport was studied.
- Enrichment during transport reduced erratic swimming on arrival and post-transport.
- Enrichment during transport reduced chasing behaviours post-transport.
- Enrichment during transport reduced stress-related behaviours during recovery.
- Enrichment could reduce transport-stress for millions of ornamental fishes.

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63 **15 Abstract**
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66 16 Environmental enrichment is known to reduce stereotypical behaviours in a wide range of
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68 17 captive animals, providing clear welfare benefits in many species. However, one of the most
69
70 18 significant stressors faced by captive animals is live transport but whether enrichment can
71
72 19 alleviate transport stress is unknown. Using behavioural measures as indicators of fish
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74 20 welfare, we investigated whether the addition of environmental enrichment can improve the
75
76 21 welfare of ornamental fish during commercial transport. Pairs of bags containing variatus
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78 22 platy (*Xiphophorus variatus*) were transported by road with or without enrichment (plastic
79
80 23 loops) from a UK wholesaler to one of two stores, the first and the last store on a delivery
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82 24 route. Transport time to the first store was short (< 4 h) and longer (> 6 h) to the second. Fish
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84 25 behaviour and incidences of mortality, disease and injury were recorded immediately
85
86 26 following transport and during a four-week recovery period. Immediately post-transport,
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88 27 significantly fewer occurrences of erratic swimming were observed in the enriched group
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90 28 compared to the control group, and lower levels of chasing were recorded in the enriched
91
92 29 group during recovery. This study is the first to demonstrate the behavioural benefits of
93
94 30 enrichment during live transport of fishes under commercial conditions.
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98 31 *Keywords: environmental enrichment, ornamental fishes, stress, transport, welfare.*
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1. Introduction

Enrichment is often added to the housing of captive animals with the aim of improving their welfare (Carlstead and Shepherdson, 2000; Young, 2003). Enrichment is defined as an increase in environmental complexity that aims to reduce maladaptive and aberrant traits in animals (Näslund and Johnsson, 2016). Structural complexity can be added to provide enclosures mimicking the natural environment (Young, 2003), social complexity can enrich an animal's environment through housing with conspecifics or different species (Bloomsmith and Lambeth, 2000; De Rouck et al. 2005; Sloman et al. 2011) and dietary complexity can include food flavour, texture and shape variation (Skibieli et al. 2007; Rozek and Millam, 2011). Reported benefits of enrichment include improved feeding, lowered metabolic rates, positive behavioural changes and improved cognitive performance (Millidine et al. 2006; Rozek and Millam, 2011; Mileva and Bielajew, 2015; Grimberg-Henrici et al. 2016). While diversity in the environmental requirements of animals means that the response to enrichment is often species (Costa et al. 2018), life-stage (Ullah et al. 2017) and context-specific (Wood, 1998), positive effects of enrichment have been documented across a wide range of animals (Wood, 1998; Belz et al. 2003; Baumans et al. 2005; Milgram et al. 2005; De Rouck et al. 2005; DeVries et al. 2007; Ellis, 2009; Cornale et al. 2015; Sullivan et al. 2016)

For many captive animals, one of the major challenges to their welfare is the stress they encounter during live transport (Grandin, 1997; Harmon, 2009; Nomura et al. 2009). Given the benefits of enriched housing, it is possible that enriched transport could provide similar effects. Studies on the benefits of enrichment during transport are restricted to pigs and monkeys (Peeters and Geers, 2006; Fernström et al. 2008; Roldan-Santiago et al. 2015);

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180 57 while these studies have found mixed results there is some evidence to suggest benefits of
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182 58 enrichment during transport. For example, providing maize-filled balls to pigs during
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184 59 transport and lairage resulted in lower plasma lactate concentrations and reduced incidents of
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186 60 shoulder injuries compared to control pigs (N.B. significance was taken as $p < 0.1$) (Peeters
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188 61 and Geers, 2006). Addition of straw bedding during piglet transport attenuated physiological
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190 62 effects of transport stress (Roldan-Santiago et al. 2015). Social enrichment during simulated
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192 63 transport of cynomolgus monkeys (*Macaca fascicularis*) reduced stress-associated
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194 64 behaviours (Fernström et al. 2008).
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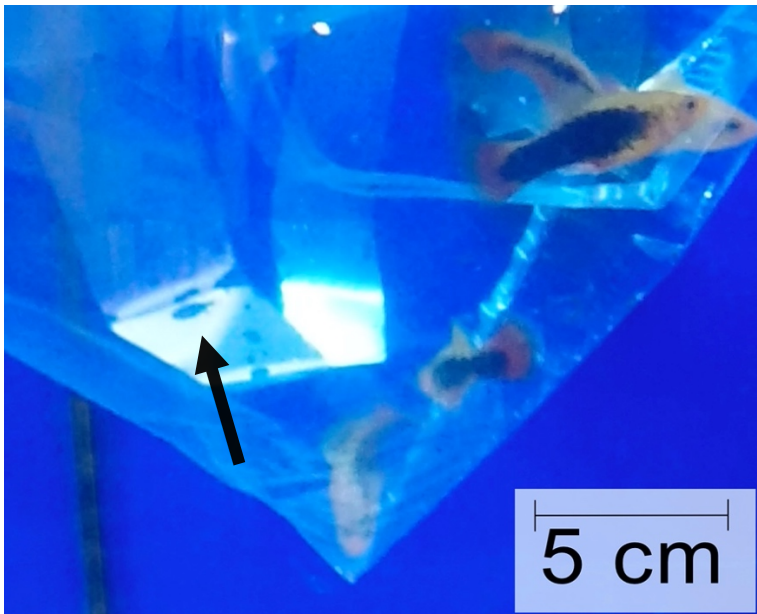
200
201 66 Ornamental fishes within the aquarium trade experience long transports (from a few
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203 67 hours to >48 h) by road and aeroplanes. Stressors associated with transport include handling,
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205 68 crowding and degrading water quality. The aim of the present study was to assess potential
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207 69 benefits of adding structural enrichment during commercial transport of ornamental fishes.
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209 70 We hypothesised that structural enrichment would provide shelter and disrupt physical
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211 71 contact between fish during transport, leading to reduced stress-related behaviours post-
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213 72 transport. The behaviour of variatus platy (*Xiphophorus variatus*), transported by road with or
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215 73 without enrichment (loops of floating plastic), was examined immediately post-transport and
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217 74 during four weeks of recovery at a retailer.
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220 221 75 **2. Methods**

222 223 224 76 *2.1 Study animals and data collection*

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227 77 Variatus platy (random mix of males and females) were transported from a UK
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229 78 wholesaler to two retail stores (journey range: 8.5-10.7 km). Transportation time to the first
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231 79 store was ~2 h 30 min (short transport) and 7 h to the second store (long transport). At the
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239 80 wholesaler, platys (~3.5 cm in length) were netted and placed into polythene bags containing
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241 81 tank water (5-10 fish in 1 l, 25.5 x 35 cm bags, bags were ~25% filled). The air at the top of
242
243 82 the bags was replaced with pure oxygen and the bags air-tight sealed and placed into an
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245 83 insulated packing box along with a variable number of other bags. The number of fishes in
246
247 84 the bags varied based on the orders that were placed by the stores. Twelve bags containing
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249 85 environmental enrichment (five plastic loops per bag, 31.3 cm in diameter and 1.8 ± 0.32 cm
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251 86 in width; mean \pm SD, Fig. 1) and 12 control bags without enrichment were tracked, with six
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253 87 bags of each treatment going to each store. On each journey, bags were tracked in pairs (one
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255 88 control, one enriched), and each pair was assigned a number for statistical analyses
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257 89 accounting for different journey times dependent on traffic delays. Pairs of bags tracked
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259 90 together always contained the same number and colour strain of fish. However, different
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261 91 pairs of bags contained different colour strains to ensure that the fish from different
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263 92 shipments could be identified. At store 1 (short transport) all the fish from one bag were sold
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265 93 prior to the end of the data collection, so this pair was excluded from statistical analysis.



94
95 Figure 1: Enrichment. Example photograph of plastic loop used as enrichment during
96 transport (indicated by the arrow).
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297
298 98 On arrival at the retail stores, bags were floated in separate recovery tanks for 30 min,
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300 99 during which time fish were recorded using a GoPro hero 5 camera set to 1080P (progressive
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302 100 scan) 120 fps (frames per seconds) with a wide angle. Cameras were mounted on a monopod
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304 101 attached to the outside of the tank. The bags were then opened to allow for slow mixing of
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306 102 the water and after a further 30 min the fish were released into the tank. Staff at the retail
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308 103 stores were unaware of the treatments or study aims to avoid any bias in daily husbandry
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310 104 practices. Preliminary trials found that water parameters in the bags on arrival at the stores
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312 105 were pH: 6.3 ± 0.34 ; oxygen: $188.65\% \pm 23.41$; and temperature: $23.5 \text{ }^\circ\text{C} \pm 1.22$ (mean \pm
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314 106 SD), and were not significantly different between transport times ($P > 0.1$ all parameters).
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316 107 Ammonia and nitrate remained at safe levels (i.e. total ammonia nitrogen < 0.93 ppm,
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318 108 unionised ammonia < 0.004 ppm, nitrate < 21.2 ppm) during transport and recovery.
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325 110 During recovery, fish behaviour was recorded once every 7 days for 4 weeks at
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327 111 random times of the day, but not within 1 h of feeding. The duration of recordings and the
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329 112 camera set up were the same as on arrival. Videos were subsequently used to analyse fish
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331 113 behaviour (Table 1) using Behavioural Observation Research Interactive Software (BORIS)
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333 114 (Friard and Gamba, 2016). Randomly selected focal fish were tracked for 3 min, repeated
334
335 115 consecutively from the start to the end of the video such that 10 individuals were tracked.
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337 116 Behaviours for each focal fish were then added to obtain a bag score. Due to the nature of the
338
339 117 enrichment analysing the videos blind was not possible as the enrichment was visible in the
340
341 118 videos recorded on arrival. Therefore, a subsample ($\sim 10\%$) of videos were analysed blind by
342
343 119 an additional observer (inter-observer reliability: Kendall's W coefficient: 0.99). From the
344
345 120 videos, any visible body and fin injuries were recorded for focal fish and given a severity
346
347 121 score from 0 – 3 where 0 = no injuries and 3 = major injury (Vanderzwalmen et al. 2019).
348
349 122 Scores for fin and body injuries were summed to obtain a total injury score recorded for each
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357 123 fish which were then summed to obtain a total injury score per bag. This score was then
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359 124 adjusted for the number of fish that remained at each data collection point to account for fish
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361 125 that had been sold or died. From arrival of the fish until the end of the 4-week recovery
362
363 126 period, mortality and occurrence of disease was recorded daily by the retail store staff. All
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365 127 fish were fed a commercial diet *ad libitum* twice daily and kept on a 12 h light/dark regime.
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367 128 Preliminary trials found that water parameters in the tanks at the stores were pH: 6.96 ± 0.51 ;
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369 129 oxygen: $101\% \pm 1.93$; temperature: $22.42^{\circ}\text{C} \pm 1.6$ (mean \pm SD), and were not significantly
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371 130 different between stores ($p > 0.1$ all parameters).
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131 Table 1. Ethogram of the behaviours recorded.

Behaviour	Description	Relation to welfare
Biting	Fish biting or nipping a conspecific.	Biting can cause injuries and may lead to mortality (Pitcher, 1986; Noble et al. 2012). Aggressive interaction has been associated with elevated
Chases	Occurrence of a fish chasing a conspecific.	stress (Vera Cruz and Brown, 2007; Kadry and Barreto, 2010; Gronquist and Berges, 2013).
Erratic swimming	Occurrence of rapid swimming and direction change in the absence of being chased.	Erratic swimming is an indicator of elevated stress, distress or pathogenic condition and may be used as a sign of poor welfare (Conte, 2004).
Ventilation rate	Frequency per minute (Alvarenga and Volpato, 1995).	Ventilation rate can increase as a result of stressors and is a highly sensitive mechanism involved in stress coping strategies (Barreto and Volpato, 2004; Martins et al. 2012).

133 2.2 *Statistical analysis*

134 R 3.6.1 was used for statistical analyses (Bolker et al. 2009; R Core Team, 2019). One
135 outlier from the bite data was removed as it was 22.5 SD away from the mean (Miller, 1991).
136 General linear mixed models (GLMM) were carried out on ventilation rate using the lme
137 function from the lme4 package (Bates et al. 2015). Treatment, recovery stage and transport
138 duration were set as explanatory variables; strain had no significant effect on behaviour and
139 was included as a random variable, as was pair number. Number of fish per bag was five in
140 all cases except in one pair where 10 fish per bag were ordered that week. Therefore, number
141 of fish was not included as a random variable due to the low variation causing singularity
142 when included in models. The interactions between the explanatory variables were also
143 analysed. The distribution of residuals was determined visually (R Core Team, 2019). For
144 response variables recorded as counts, a generalised linear mixed model (GLMM) using
145 poisson family from the lme4 package was used with the same variables as above (Bates et
146 al. 2015). As necessary, data were log or square root transformed to obtain normally
147 distributed residuals. Percentage data were expressed as proportions and a binomial GLMM
148 was carried out with the fixed and random variables as described above. The best fit model
149 was selected by disregarding explanatory variables that did not significantly improve the fit
150 of the model (Bates et al. 2015). The significance of the explanatory variables was tested
151 using ANOVA at $P < 0.05$ (Fox and Weisberg, 2011; Pinheiro et al. 2018) and pair-wise post-
152 hoc Tukey tests were carried out (Lenth, 2017). Figures were created using ggplot2
153 (Wickham et al. 2016).

154 2.3. *Ethics*

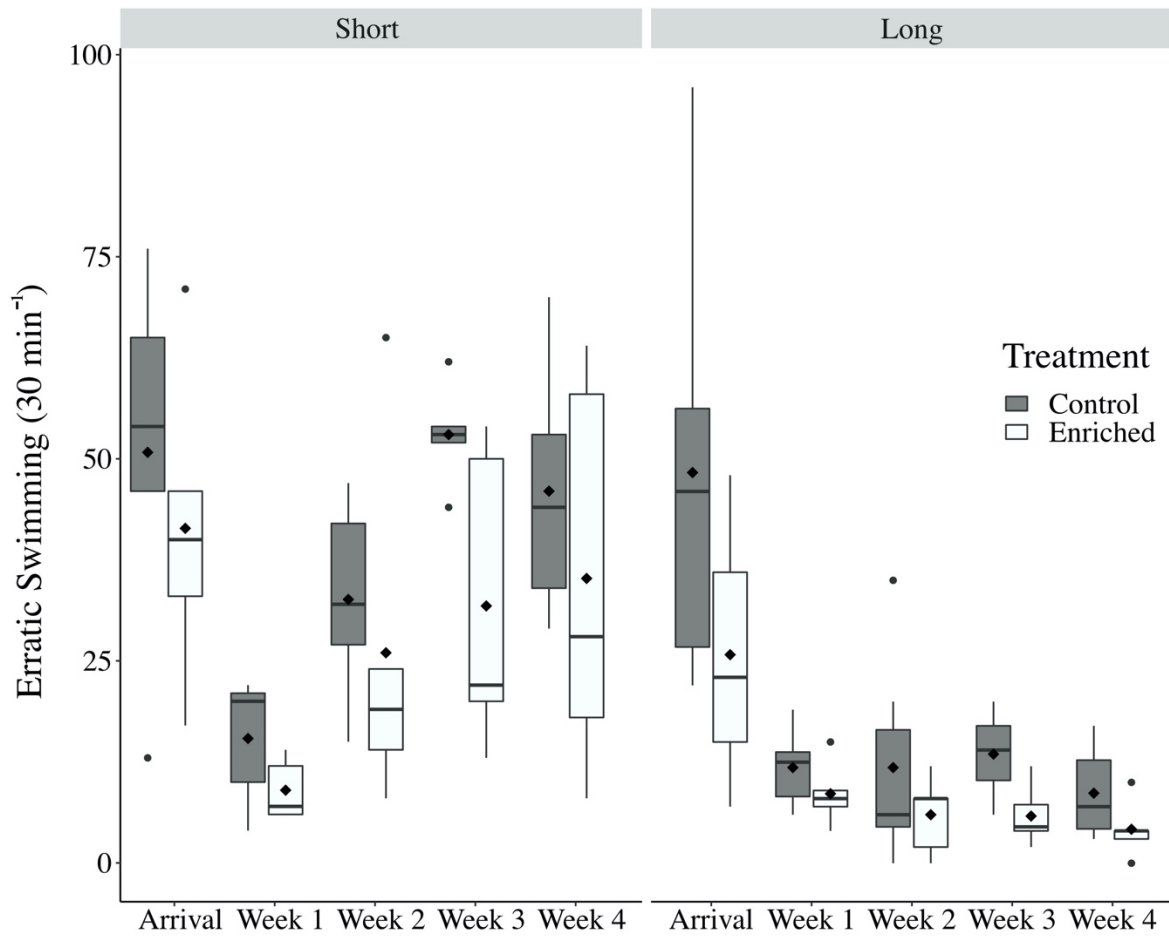
155 This study was approved by the University of the West of Scotland Ethics Committee as well
156 as the Animal Welfare Ethics Review Board at the Waltham Petcare Science Institute.

3. Results

Erratic swimming was significantly affected by treatment, recovery stage and transport duration (Table 2). Erratic swimming was consistently lower in fish transported with enrichment than controls (Fig. 2). In fish that experienced the short transport, erratic swimming decreased during week 1 of recovery but then rose within the following weeks to similar levels seen on arrival (Fig. 2). In fish from the long transport, however, erratic swimming was lower during recovery than on arrival and remained low throughout recovery (Fig. 2).

Table 2 ANOVA result of best fit model for erratic swimming and chasing with *F* values, degrees of freedom (df), and *P* values. Significant p-values are indicated in bold.

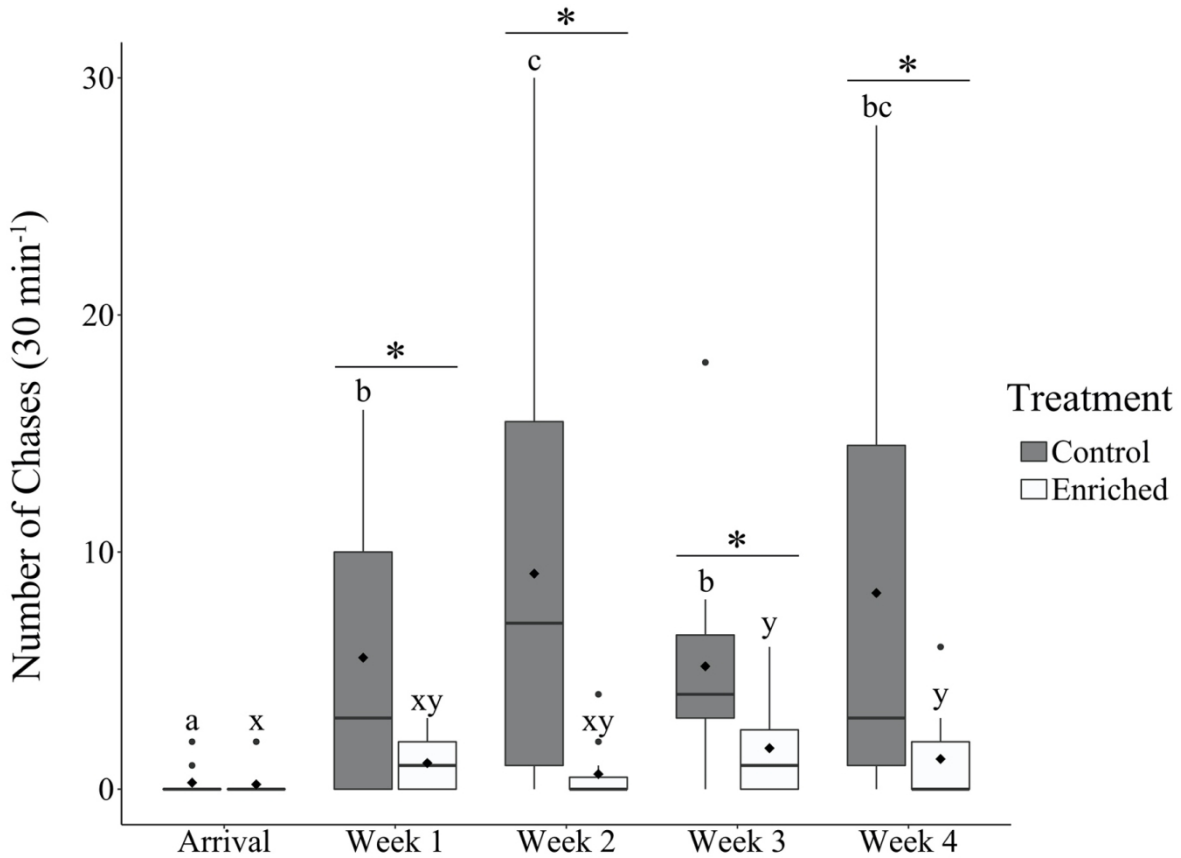
Behaviour	Fixed Effect	numDF	denDF	<i>F</i> -value	<i>P</i>
Erratic swimming	Treatment	1	78	125.8	<0.0001
	Recovery Stage	4	78	108.31	<0.0001
	Transport Duration	1	9	36.92	<0.0001
	Treatment * Recovery Stage	4	78	2.413	0.075
	Recovery Stage * Transport Duration	4	78	48.062	<0.0001
	Treatment * Transport Duration	1	78	0.391	0.563
	Treatment * Recovery Stage * Transport Duration	4	78	2.404	0.046
Chasing	Treatment	1	88	173.614	<0.0001
	Recovery Stage	4	88	35.09	<0.0001
	Transport Duration	1	5	0.008	0.842
	Treatment * Recovery Stage	4	88	16.184	<0.0001
	Treatment * Transport Duration	1	95	0.196	0.669



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169 Figure 2: Occurrence of erratic swimming in fish transported with or without environmental
 170 enrichment for a short and long transport. Data are mean (diamond), median, upper and lower
 171 25th percentile, and outliers, n=5 bags per treatment for short and n=6 for long transport.
 172 Asterisks indicate a significant difference between treatments within a time point (post-hoc
 173 Tukey, $P < 0.05$). Lowercase letters indicate significance between stage of transport within
 174 control (a-f) and enriched (v-z) treatments, with separate post-hoc analyses used for short and
 175 long transport duration. Boxes sharing a letter are not significantly different (post-hoc Tukey,
 176 $P < 0.05$).

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651
652 177 Chasing was significantly affected by treatment and recovery stage with a significant
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654 178 interaction between the two factors (Table 2). However, unlike for erratic swimming, there
655
656 179 was no effect of transport duration on chasing. Chasing behaviour was low on arrival at the
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658 180 stores for both treatments but increased during the recovery period, remaining lower in the
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660 181 fish transported with enrichment (Fig. 3). In fish from the control treatment, chasing was
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662 182 significantly higher than on arrival by week 1 of recovery and remained high, while the
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664 183 number of chases in the enriched treatment only began to increase slowly from week 3 of
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666 184 recovery (Fig. 3). Biting behaviour, injury score, mortality and ventilation rate were not
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668 185 significantly affected by treatment, recovery stage or duration ($P > 0.05$ for all, Table S1
669
670 186 supplementary material) and remained low throughout (Table S2 supplementary material).
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672 187 Occurrence of disease was too low to carry out statistical analyses.
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191 Figure 3: Occurrence of chasing in fish transported with or without environmental
 192 enrichment. Data are mean (diamond), median, upper and lower 25th percentile, and outliers,
 193 n=11. Asterisks indicate a significant difference between treatments within a specific time
 194 point (post-hoc Tukey, $P < 0.05$). Letters indicate a significant difference between stages of
 195 transport within control (a-c) and enriched (x,y) treatments where boxes sharing a letter are
 196 not significantly different (post-hoc Tukey, $P < 0.05$).

4. Discussion

Fish that were transported with enrichment showed a reduction in stress-associated behaviours including erratic swimming and chasing. Erratic swimming in the enriched group was lower on arrival at stores than in the control group, and during recovery fish shipped with enrichment showed lower levels of chasing.

Some chasing and biting are expected during hierarchy establishment, but prolonged chasing can lead to chronic stress for the fish subjected to the aggressive behaviour (Braddock, 1945; Scott and Currie, 1980). Following stress, fish can display displaced aggression behaviours, such as chasing, as a coping mechanism to manage their own stress (Sneddon et al., 2016). Reduced aggression could therefore indicate improved stress-coping capabilities in the enriched group (Sneddon et al., 2016). Lower levels of chasing in the enriched group may also suggest a less aggressive establishment of hierarchy. Biting behaviours are a greater welfare concern than chasing due to risks of injury and infection but were low throughout the present study.

Erratic swimming was higher following the short transport compared to the long transport, potentially as the longer time that elapsed between packing and unpacking allowed greater recovery from handling on route for the long transport fish. This hypothesis is supported by previous studies on fish transport which have found that handling is the most stressful part of transport and recovery begins within the first 2-4 h of transport duration (Pickering et al. 1982; Acerete et al. 2004; Nomura et al. 2009). The majority of studies that have considered the welfare of ornamental fishes during transport have used simulated transport and focussed on stress recovery for 24-96 h post-transport (Zanuzzo et al. 2012; Ramírez-duarte et al. 2013; Salaro et al. 2015; Pattanasiri et al. 2017). However, as animals

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829 221 can experience stress for extended periods of time following transport (Knowles et al. 1993;
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831 222 Dembiec et al. 2004; Fernström et al. 2008), in the present study indicators of stress were
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833 223 recorded for four weeks post-transport. While differences in behaviour between treatments
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835 224 were seen over this time frame, mortality, disease and injury were not affected by enrichment
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837 225 most likely as levels of all three remained low throughout the study.
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843 227 Although a wealth of literature exists on the use of environmental enrichment for fish
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845 228 holding conditions (Näslund and Johnsson, 2016), to the authors' knowledge, no previous
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847 229 studies have looked at the potential benefits of enrichment for fishes during commercial
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849 230 transport. However, there are a few studies that have considered benefits of enrichment
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851 231 during periods of acute stress. For example, zebrafish (*Danio rerio*) from enriched tanks
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853 232 released less cortisol than zebrafish from bare tanks following a pursuit stress (Giacomini et
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855 233 al. 2016) and a similar result was seen in jundiá (*Rhamdia quelen*) (Barcellos et al. 2009).
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857 234 Exposure to blue substrate prior, during and after a confinement stress also improved the
858
859 235 recovery rate of serotonin and plasma glucose in gilthead seabream (*Sparus aurata*) (Batzina
860
861 236 et al. 2014). The effects of enrichment during transport have been considered in other
862
863 237 animals showing positive effects of social enrichment in cynomolgus monkeys (Fernström et
864
865 238 al. 2008) and the addition of toys (Peeters and Geers, 2006) and substrate (Roldan-Santiago et
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867 239 al. 2015) for pigs.
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873
874 241 Plastic loops were chosen as the enrichment as they are already used within the
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876 242 ornamental trade to reduce the stress experienced by some species, meaning it is an
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878 243 enrichment which reflects current practice and could be implemented for other species. Prior
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880 244 to the present study, there had been no research on the use of plastic loops as enrichment
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888 245 during ornamental fish transport. Plastic loops are likely to disturb visual contact between
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890 246 fishes within the transport bag and might provide hiding places, however, further research is
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892 247 needed to better understand the functionality of the plastic loops as enrichment. More
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894 248 research is also needed to identify other potential forms of enrichment during ornamental fish
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896 249 transport across different species and life-stages. Consideration must be given to the fact that
897
898 250 the type of environmental enrichment provided is likely to affect both the response of the
899
900 251 animal and any beneficial effects which has been shown in non-transport related studies. For
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902 252 example, goldfish (*Carassius auratus*) displayed increased vigilance in the presence of a
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904 253 predator when a solid block was used as enrichment but not when artificial plants were
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906 254 available (Ingrum et al. 2010). Black bucks (*Antelope cervicapra*) were found to prefer a tree
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908 255 trunk/branch combination as enrichment compared to vertical brushes (Bono et al. 2016) and
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910 256 cattle (Charolais cross heifers) prefer scratching enrichments over olfactory enrichments
911
912 257 (Wilson et al. 2002). Goldfish also prefer enriched areas over non-enriched areas with no
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914 258 preference between artificial or real plants indicating that the functionality of enrichment can
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916 259 be more important than the material it is made from (Sullivan et al. 2016).

920 921 260 **5. Conclusion**

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924 261 Millions of animals are transported daily across the world. Transport is stressful for these
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926 262 animals, yet surprisingly few studies have assessed the effect of enrichment during animal
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928 263 transport. This study is the first to use enrichment during the commercial transport of
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930 264 ornamental fishes, finding a clear benefit in the reduction of stress-associated behaviours.
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932 265 With growing pressure on industries to improve the welfare of the animals they care for,
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934 266 further research into environmental enrichment to manage stress during commercial transport
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936 267 is warranted.
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947 269 *Acknowledgments*
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951 270 Many thanks to management and staff at the wholesaler and retail stores where data
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953 271 were collected.
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959 273 **6. References**
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460 **End Section Statements**

461 **Competing Interests**

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The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Myriam Vanderzwalmen: Conceptualization, Methodology, Formal analysis, Investigation, Writing - Original Draft

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Donna Snellgrove: Conceptualization, Writing - Review & Editing

Katherine Sloman: Conceptualization, Methodology, Writing - Review & Editing, Supervision

1 Supplementary Material

2 Table S1 ANOVA result of best fit model for biting, injury score, mortality and ventilation rate with *F* values,
3 degrees of freedom (df), and *P* values.

	Fixed Effect	numDF	denDF	<i>F</i> -value	<i>P</i>
Biting	Treatment	1	91	3.634	0.55
	Recovery Stage	4	91	0.366	0.83
	Transport Duration	1	9	0.098	0.75
Injury score	Treatment	1	72	0.044	0.833
	Recovery Stage	4	72	0.271	0.846
	Transport Duration	1	5	2.225	0.195
Mortality	Treatment	1	94	2.434	0.122
	Recovery Stage	4	94	0.764	0.551
	Transport Duration	1	5	0.054	0.825
Ventilation Rate	Treatment	1	92	0.003	0.955
	Recovery Stage	4	92	2.16	0.079
	Transport Duration	1	4	0.215	0.661

5 Table S2: Mean (\pm SD) for non-significant welfare indicators. Actual mortality data are not presented due to
 6 commercial sensitivity.

Stage	Treatment	Transport duration	Biting (30 min ⁻¹)	Ventilation rate min ⁻¹	Injury score (average per fish, see text)
Arrival	Control	Short	0 (\pm 0)	105.05 (\pm 9.11)	0 (\pm 0)
Arrival	Enriched	Short	0 (\pm 0)	99.70 (\pm 4.71)	0 (\pm 0)
Arrival	Control	Long	2.6 (\pm 5.81)	106.80 (\pm 10.20)	0.04 (\pm 0.09)
Arrival	Enriched	Long	0 (\pm 0)	116.49 (\pm 28.45)	0.08 (\pm 0.18)
Week 1	Control	Short	0 (\pm 0)	105.74 (\pm 5.71)	0 (\pm 0)
Week 1	Enriched	Short	0.80 (\pm 1.30)	98.66 (\pm 7.79)	0.08 (\pm 0.18)
Week 1	Control	Long	0.4 (\pm 0.89)	102.27 (\pm 12.75)	0.267 (\pm 0.60)
Week 1	Enriched	Long	0 (\pm 0)	106.41 (\pm 13.81)	0.32 (\pm 0.46)
Week 2	Control	Short	0.4 (\pm 0.89)	107.54 (\pm 14.60)	0.08 (\pm 0.18)
Week 2	Enriched	Short	0 (\pm 0)	110.57 (\pm 13.93)	0.2 (\pm 0.45)
Week 2	Control	Long	0.5 (\pm 0.55)	106.04 (\pm 13.62)	0.07(\pm 0.10)
Week 2	Enriched	Long	0.17 (\pm 0.41)	105.49 (\pm 13.23)	0.8 (\pm 0.167)
Week 3	Control	Short	0.2 (\pm 0.45)	111.89 (\pm 8.05)	0.28 (\pm 0.39)
Week 3	Enriched	Short	0 (\pm 0)	106.19 (\pm 7.88)	0.04 (\pm 0.09)
Week 3	Control	Long	0.33 (\pm 0.82)	112.83 (\pm 12.63)	0.12 (\pm 0.31)
Week 3	Enriched	Long	0 (\pm 0)	114.65 (\pm 20.74)	0.32 (\pm 0.49)
Week 4	Control	Short	0.2 (\pm 0.45)	106.73 (\pm 10.03)	0 (\pm 0)
Week 4	Enriched	Short	0 (\pm 0)	103.99 (\pm 10.03)	0.1 (\pm 0.22)
Week 4	Control	Long	0.5 (\pm 0.84)	102.41 (\pm 13.44)	0.5 (\pm 0.78)
Week 4	Enriched	Long	0 (\pm 0)	103.58 (\pm 17.01)	0.19 (\pm 0.30)

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