Investigations on the effect of angling on stress response in rainbow trout

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Abstract

Stress response in rainbow trout was investigated under different circumstances of catching, transport, and stocking. Angling resulted in lowest stress ractions, when compared to other treatments. Drag netting and transportation resulted in high primary and secondary stress reactions within a normal, physiological range of the parameters used. All stress reactions turned out to be fully reversible. The results suggest that catching fishes individually by angling is less stressing than other treatments usual in aquaculture.

Introduction

Welfare aspects are of increasing importance in angling. From the legal point of view it is justified that fishes suffer during catching, as long as they are utilized as foodfstuff. If good practice is applied, the legal requirements are fulfilled by licenced anglers. However, some criticism is frequently expressed concerning the practice of releasing fish in ponds for angling. Especially if those fishes are caught repeatedly after a short period of time, the reasonableness of this action is doubted by animal protectors. On the other hand, actual scientific results indicate, that stress causes no pain, suffering, fear or emotional distress in fishes (Rose, 2002).

To gather reliable data on the actual practices of commercial angling practices on fishes, a study was undertaken with rainbow trout (*Oncorhynchus mykiss*), a species which is frequently used in this context. In a series of experiments the effect of catch, keeping, transport, stocking, and repeated catch (angling) was investigated. Besides several physiological parameters concerning stress and flesh quality, fish behaviour, feed intake and growth were analyzed under defined, similar-to-practice conditions. The results of the stressors applied to the fish are interpreted with respect to primary, secondary and tertiary stress reactions described by Wedemayr and McLeay (1981), Mazeaud and Mazeaud (1988), and Wendelaar Bonga (1997).

Material and methods

Altogether 100 rainbow trout (average weight 432 g) were received from a commercial fishfarm. The fish were treated as follows:

(A). Catch of 10 trouts by angling from a production pond. The fish were stunned by a blow on the head. Blood samples were taken immediately.
(B). Catch of 120 trouts by drag-netting (seine). Out of this, 10 fish were stunned and immediately sampled. 110 fish were used in the following treatments (C – H).

Parameter	Unit	Treatment								Normal values Schreckenbach (unpublished)
		A	B	C	D	E	F	G	H	
		Angling from pond	Drag-netting from pond	5 h Transport / stocking	Angling after 1 d	Angling after 2 d	Angling after 6 d	Angling after 9 d	Angling after 15 d	
Cortisol	[ng/ml]	7.8	186.9	193.5	66.4	64.7	9.0	21.1	11.0	
Glucose	[mmol/l]	0.97	2.53	2.94	4.78	1.76	1.46	1.00	1.04	1.3-5.2
Lactate	[mmol/l]	0.47	3.39	2.00	0.76	0.69	0.43	0.65	0.68	0.3-6.6
Protein	[g/l]	39.36	44.36	41.46	39.13	38.32	36.82	37.13	38.58	18.2-64.5
Triglycerides	[mmol/l]	4.63	5.63	5.23	5.20	5.85	3.94	5.49	3.46	3.1-6.2
Cholesterine	[mmol/l]	9.86	10.51	9.72	7.03	9.18	6.69	9.69	8.15	5.5-12.3
Bilirubine	[μmol/l]	0.59	0.51	0.97	1.10	0.66	0.92	0.56	0.93	0.5-1.5
Calcium	[mmol/l]	2.69	3.23	3.12	2.71	2.91	2.78	3.03	2.71	2.1-3.8
Haematocrit		0.28	0.39	0.34	0.31	0.34	0.33	0.35	0.28	0.23-0.47
Haemoglobine	[mmol/l]	4.01	4.37	4.68	4.41	4.50	4.22	4.80	4.01	3.6-6.9
Erythrocytes	[Tpt/l]	0.91	1.19	1.20	1.22	1.09	1.06	1.24	0.94	0.7-2.0
MCV	[fl]	311.94	328.94	285.82	257.13	323.70	314.51	281.68	305.78	200-448
MCH	[fmol/l]	4.43	3.70	3.94	3.63	4.32	4.01	3.91	4.36	3.2-4.5
MCHC	[mmol/l]	14.20	11.27	13.80	14.14	13.34	12.85	14.09	14.17	9.5-15.1
Proerythrocytes	[Tpt/l]	0.0366	0.0518	0.0334	0.0375	0.0330	0.0280	0.0191	0.0110	0-0.08
Ery-Fragments	[Tpt/l]	0.0114	0.0194	0.0167	0.0077	0.0053	0.0082	0.0062	0.0107	0-0.02
Ery-Amitoses	[Tpt/l]	0.0071	0.0000	0.0014	0.0003	0.0006	0.0006	0.0004	0.0019	0-0.01
Thrombocytes	[Tpt/l]	0.0105	0.0123	0.0085	0.0064	0.0061	0.0075	0.0103	0.0078	0-0.04
Lymphocytes	[Tpt/l]	0.0321	0.0295	0.0316	0.0234	0.0140	0.0244	0.0212	0.0181	0-0.08
Granulocytes	[Tpt/l]	0.0023	0.0025	0.0024	0.0038	0.0035	0.0044	0.0051	0.0015	0-0.05
Monocytes	[Tpt/l]	0.0031	0.0021	0.0017	0.0019	0.0022	0.0018	0.0016	0.0007	0-0.007
Leukocytes	[Tpt/l]	0.0375	0.0341	0.0358	0.0291	0.0197	0.0306	0.0296	0.0203	0-0.1
Body weight	[g]	432.3	430.3	433.4	433.4	443.6	452.8	476.6	505.1	
Specific growth rate	[% bw*d]	0	0	0.52	0.35	1.29	0.77	1.08	1.04	1.2-1.5

Table 1. Average values of haematological parameters, body weight and growth of rainbow trout after catch by angling (A) and drag-netting (B) from a production pond, after transportation and stocking (C) and after repeated angling from net cage (D to H), compared with normal values.

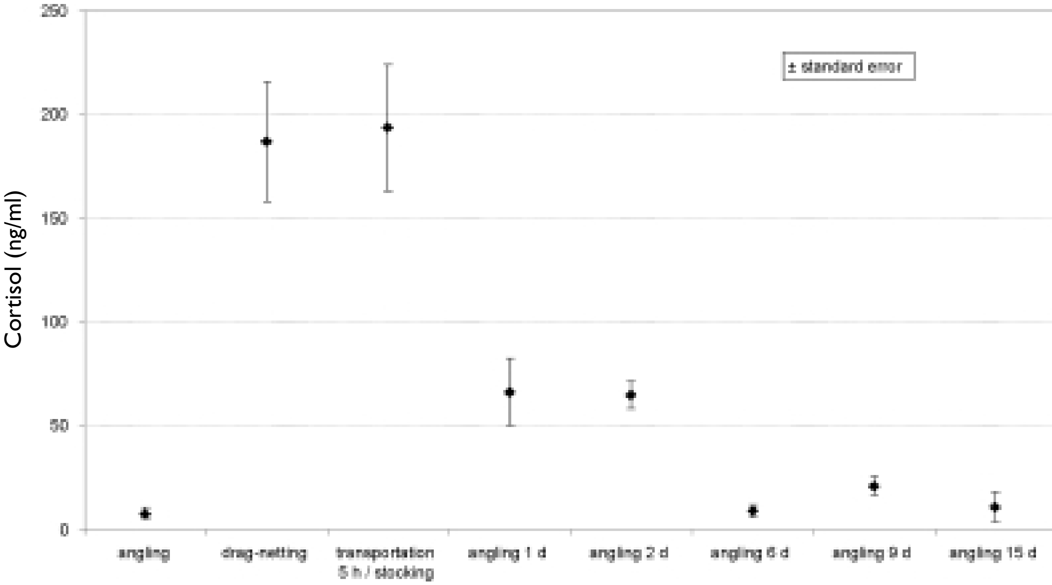

Figure 1. Blood cortisol level in rainbow trout in different stages of the experiment

(C). Intermediate holding of 80 trouts from (B) for 1 hour and transfer in a transport tank (0.60 x 0.65 x 1.25 m, with oxygen-supplier) (3.5 hours driving). Fish stocked into a net cage (3 x 3 x 4 m; 36 m^3).
(D). Angling from net cage 1 day after drag-netting, transportation, and stocking.
(E). Angling from net cage 2 days after drag-netting, transportation, and stocking.
(F). Angling from net cage 6 days after drag-netting, transportation, and stocking.
(G). Angling from net cage 9 days after drag-netting, transportation, and stocking.
(H). Angling from net cage 15 days after drag-netting, transportation, and stocking.

In the net cage the fish were fed a commercial dry feed at a rate of 0.8 – 1.0 %/d. Angling was carried out with a regular telescope-rod with twister (A) or hook with pasty bait. Duration of drilling was 30 to 60 s at 8.7 – 13,5 °C water temperature.

Immediately after drilling the trout were stunned by a blow on the head and deblooded by heard puncture with a heparinised syringe. The haematology was carried out according to Schäperclaus (1991) and Lehmann et al. (1994). Besides fish body weight and growth during the experimental period, the following parameters were analyzed after the treatments (A – H) mentioned above: Cortisol, Glucose, Lactate, Protein, Triglycerides, Cholesterine, Bilirubine, Calcium, Haematocrit, Haemoglobine, Erythrocytes, MCV, MCH, Pro-Erythrocytes, Erythrocyte-Fragments, Erythrocyte-Amitoses, Thrombocytes, Lymphozytes, Granulocytes, Monocytes, Leucocytes.

Results and Discussion

The results of the blood parameters investigated are summarized in table 1.

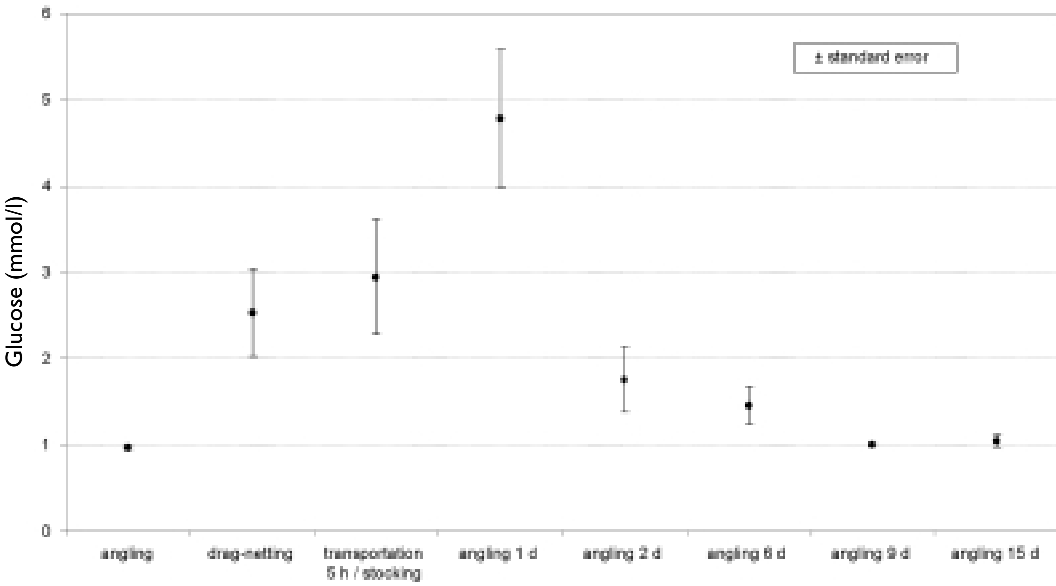

Figure 2. Blood glucose level in rainbow trout in different stages of the experiment

Primary, endocrine stress reactions can be identified by the blood cortisol level (Fig. 1). Angling from a production pond (A) did not result in increasing cortisol levels. In contrast to this finding cortisol concentrations were drastically increased after drag-netting (B), transportation and stocking (C). The effect of catch and transport is decreasing in the following days after treatment. Repeated angling after 1 (D) and 2 (E) days causes high cortisol levels. After 6 to 15 days a continuous decrease can be observed in this parameter.

Blood glucose concentration is a meaningful indicator for secondary stress in fishes (Fig. 2). The results show that angling (A) has no effect on this parameter. Glucose level is significantly increased after drag-netting (B), holding, transportation and stocking (C), as well as 1 day after repetitive angling (D). When angling is carried out after a resting period from 2 to 15 days (E to H) blood glucose concentration has already returned to normal condition.

Secondary stress can also be characterized by measuring the lactate level in fish blood (Fig. 3). Correspondingly to the results described before no significant increase can be observed after the angling procedure (A). This contrasts with the distinctive increase after drag-netting (B), holding, transportation and stocking (C). The sharp increase in lactate caused by drag-netting from the pond is already reduced during transportation, which is due to the intense oxygen supply in the transport container. Lactate levels return to normal conditions, when the stressed trout are allowed to recover for 1 to 15 days (D to H).

The other parameters are within the expected range for the regular adaptation process occurring under variable environmental conditions. Immune depression or adaptation dis-

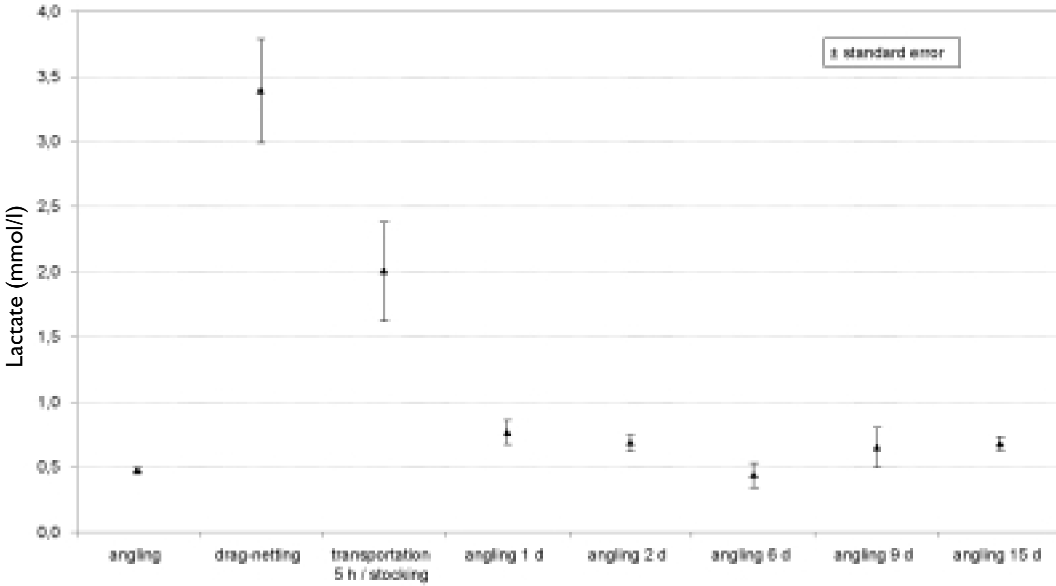

Figure 3. Blood lactate level in rainbow trout in different stages of the experiment.

ease do not occur in the present investigation. This result is supported by the natural behaviour, feed uptake and growth (specific growth rate: 1.2 – 1.5 % body weight/day) observed during the experimental period. Angling rainbow trout directly from a production pond with a short drilling period and immediate stunning followed by immediate blood sampling (A) caused no primary, secondary or tertiary stress reaction. In contrast to this finding drag-netting resulted in a sharp stress reaction (B), which is demonstrable after transportation and stocking (C) and after angling one day post stocking (D). In spite of repetitive angling the stress parameters investigated returned to normal values.

When compared to other catching methods, properly practiced angling causes only minor primary and secondary stress reactions in rainbow trout. Angling stress applied in this study caused only temporary divergent values in some blood components, which are within the normal range for these parameters. The cortisol-levels occurring after angling never reached values indicating acute stress (40 to 200 ng/ml), given by Pickering & Pottinger (1989). This finding is confirmed by the results published by Clements et al. (2002), which showed low cortisol-, glucose-, and lactate-levels after angling. Thus, if adequate environmental conditions are applied, angling does not cause any tertiary stress reaction and no general adaptation syndrome in rainbow trout. In contrast to these results, other catching methods caused a significant stress response.

In conclusion, it is clear that catching and transportation causes certain stress in fishes. However, stress response in rainbow trout was found to be lowest in the case of angling.

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