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Sensory quality farmed turbot under different rearing conditions: variable tank renewal rates

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Summary

Within the CRAFT project Turpro water quality was researched to be optimised in the turbot recirculation farming system. Within this task the tank renewal rate was varied and growth of turbot was monitored. Within this experiment the question was whether the tank renewal rate affected the eating quality or (off)flavour of the fillets. Farmed turbot (*Psetta maxima*) with a live weight on the range 100 g, were raised under controlled water flow-through conditions (tank renewal rates). Two batches were used for sensory analyses: 100% tank renewal rate (considered to be standard rearing conditions) and 800% tank renewal rate. For sensory analyses of food products the Quantitative Descriptive Analysis (QDA, also known as profile method) is common for characterization of the differences between products and to be able to provide sensory data for the interpretation of instrumental data. The method consists of procedures for describing and assessing the flavour of a product in a reproducible way. There was no significant sensory difference between the high and low tank renewal rate. Though there seems a tendency to more intense off odour both for the raw and the cooked fillet for the high tank renewal rate. The source for off-flavour in farmed fish is known to be metaisoborneol (MIB) and geosmin, both present in the water. The higher frequency of these products passing the fish (high flow through) apparently increased the up-take of these products by the fish. The results show that high flow through rates have a potential negative impact on the off-flavour of farmed turbot. To overcome this, special care for depuration must be taken.

1.   Introduction

Within the CRAFT project Turpro water quality was researched to be optimised in the turbot recirculation farming system. Within this task the tank renewal rate was varied and growth of turbot was monitored. Within this experiment the question was whether the tank renewal rate affected the eating quality or (off)flavour of the fillets.

2.   Materials and methods

Fish
Farmed turbot (*Psetta maxima*) with a live weight on the range 100 g, were raised under controlled water flow-through conditions (tank renewal rates). Two batches were used for sensory analyses: 100% tank renewal rate (considered to be standard rearing conditions) and 800% tank renewal rate (Schram et al., 2006).

Killing
All farmed fishes were killed by percussion and directly placed in ice-water. There after the fish were filleted and tested the same day.

Panel
The analytical sensory panel consisted of four persons, selected and trained for sensory analytical analyses and experienced in QDA (Quantitative Descriptive Analysis).

Training
Training for this experiment was not needed since the test followed up a large storage experiment for turbot using the same method and performed by the same panel members (Wageningen IMARES Report C049/06, 2006).

Analyses
For sensory analyses of food products the Quantitative Descriptive Analysis (QDA, also known as profile method) is common for characterization of the differences between products and to be able to provide sensory data for the interpretation of instrumental data. The method consists of procedures for describing and assessing the flavour of a product in a reproducible way. The separate attributes contributing to the formation of the overall impression given by the product are identified and their intensity assessed in order to build up a description of the flavour of the product. The QDA-analyses were carried out according to ISO standard 6564 (1985, Sensory analysis, Methodology flavour profile methods). The previously developed set of 29 attributes for assessing turbot was completed with three attributes describing the off-odour and flavour of the raw and cooked fillets (annex 1). 1 session was organized, testing two samples in duplicate. Before sensory analyses the turbot of each batch were filleted. The raw fillet was cut into pieces of 2 by 4 cm, for each panellist. The raw samples were presented prior to the cooked samples in randomized order, labelled with a three digit code, presented in aluminium boxes. The cooked samples were placed in aluminium boxes and prepared in a hot air oven filled with boiling water. Temp oven set at 180°C. Time preparation 5 minutes. Boxes with fish were presented to the panel immediately after cooking.
With the help of FIZZ® for window 2.10a (Biosystems), the panellists scored on a line scale from 0-100, with anchors on 0 and 100%. For the test artificial daylight (T>5000K) was used.

Statistical analysis

Statistical analyses of the sensory data were performed with SAS system for Windows V8. Analyses of Variance (ANOVA) were used for testing dependent variables (sensory attributes) against independent variables (conditions). For post hoc analysis Duncans test were used. Significance is presented at 95% ($p < 0.05$) confidence interval unless stated differently.

3.   Results and discussion

Sensory profile results

The turbot were very small and far from commercial size. Each panellist received a different fish for testing. The mean results are presented in table 1.

There was no significant sensory difference between the high and low tank renewal rate. Though there seems a tendency to more intense off odour both for the raw and the cooked fillet for the high tank renewal rate. The source for off-flavour in farmed fish is known to be metaisoborneol (MIB) and geosmin, both present in the water. The higher frequency of these products passing the fish (high flow through) apparently increased the up-take of these products by the fish.

4.   Conclusion

The results show high flow through rates have a potential negative impact on the off-flavour of farmed turbot. To overcome this, special care for depuration must be taken.
Take note of the small size of the turbot tested and no depuration has taken place in this experiment.

References

ISO (1985) Sensory analysis, Methodology flavour profile methods standard 6564 Genf, Switzerland: The International Organization for Standardization.

ISO (1988) *Sensory analysis - general guidance for the design of test rooms, 8589*. Genf, Switzerland: The International Organization for Standardization.

ISO (1993) *Sensory analysis - general guidance for the selection, training and monitoring of assessors. Part 1: Selected assessors, 8586-1*. Genf, Switzerland: The International Organization for Standardization.

E. Schram, R. Widjaja, C.J. Kloet, R. Schelvis-Smit, A.K. Imsland, M.C.J. Verdegem (2006) (submitted). The relation between tank water renewal rate and specific growth rate of turbot (*Scophthalmus maximus*).

Schelvis, A.A.M. (2006). Wageningen IMARES Report C049/06 Sensory quality of wild and farmed turbot reared under different light conditions and processed bled or unbled.

Table 1: Mean results QDA analyses for turbot reared under different conditions; 100% and 800% tank renewal rates. RA = Raw appearance, RO = Raw odour, CO = Cooked odour, CA = Cooked appearance, Te Texture, TA = Taste.

	flow 100%	flow 800%
R_A_crem	52,75	57,38
R_A_glas	42,5	38,63
R_A_grey	58	48,38
R_O_pota	10,38	9,25
R_O_hay	25,75	20,88
R_O_mari	14,75	25,13
R_O_must	**4,38**	**10,25**
R_O_sour	18,13	10,13
C_O_milk	29,5	28,88
C_O_hay	21,75	16,75
C_O_must	12,75	18,13
C_O_card	14,63	8,88
C_O_sour	3,38	11,88
C_O_fish	30	25,88
C_A_crea	33	27,88
C_A_grey	28,13	28,13
C_A_grey2	22	23,63
TE_firm	38,5	39,25
TE_tend	57,13	55,5
TE_fibr	50,38	56,13
TE_gran	27,5	18,5
TE_stic	42,75	43,75
TE_dry	43,63	23,5
TA_crea	20,13	19,75
TA_pota	33,88	27,25
TA_chic	15,63	20,5
TA_stoc	11,75	18,13
TA_wate	40,25	35,75
TA_sour	25,13	25,88
R_O_off	**16,75**	**27,13**
C_O_off	**5,75**	**17,75**
TA_off	28,63	33,13

Ir. H. van der Mheen

Signature: _____

Date: November 2006

Annex 1

Attributes for Turbot

attributes accronym	full name	scale	description
R_A_crem	raw appearance crème	not-much	the amount of creme colour
R_A_glas	raw appearance glassy	not-much	the amount of glassy appearance, transparent
R_A_grey	raw appearance grey	not-much	grey colour
R_O_pota	raw odour potato	weak-strong	odour of boiled potatoes
R_O_hay	raw odour hay	weak-strong	odour like hay, little musty
R_O_mari	raw odour marine	weak-strong	marine like the sea odour
R_O_must	raw odour musty	weak-strong	Reminds of a table cloth (damp cloth used to clean kitchen table, left for 36 hours on the table)
R_O_sour	raw odour sour	weak-strong	sour odour, spoilage sour, acetic acid
C_O_milk	cooked odour milk	weak-strong	boiled milk, fruity/mushy odour
C_O_hay	cooked odour hay	weak-strong	odour like hay, little musty
C_O_must	cooked odour musty	weak-strong	Reminds of a table cloth (damp cloth used to clean kitchen table, left for 36 hours on the table)
C_O_card	cooked odour cardboard	weak-strong	like wet cardboard
C_O_sour	cooked odour sour	weak-strong	sour taste, spoilage sour
C_O_fish	cooked odour fishy	weak-strong	TMA odour, reminds of dried salted fish, amine
C_A_crea	cooked appearance crème	not-much	the amount of crème colour
C_A_grey	cooked appearance grey	not-much	the amount of grey colour
C_A_grey2	cooked appearance grabby	not-much	the grabby appearance
TE_firm	texture firm	not-much	Evaluate how firm or soft the fish is during the first bite
TE_tend	texture tender	not-much	Evaluated after chewing several times
TE_fibr	texture fibrous	not-much	meaty texture, meaty mouth feel
TE_gran	texture granular	not-much	small granular particles
TE_stic	texture sticky	not-much	sticks to your teeth
TE_dry	texture dry	not-much	Evaluated after chewing several times: dry - pulls juice from the mouth
TA_crea	taste cream	weak-strong	like whipped cream, butter or popcorn
TA_pota	taste potato	weak-strong	like boiled potato
TA_stoc	taste stock	weak-strong	like stock, clear soup little salt taste
TA_chic	taste chicken	weak-strong	like chicken flavour
TA_wate	taste watery	weak-strong	juice no flavour
TA_sour	taste sour	weak-strong	sour taste, spoilage sour