

# Comparison of zootechnical performances, welfare condition and quality traits of hybrid striped bass (*Morone chrysops* x *Morone saxatilis*) reared in different Italian farms

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**ABSTRACT** - Growth performances of sunshine bass (initial m.b.w.=200±50 g) were examined in 3 different rearing conditions: concrete square basins (HSB-1); raceways (HSB-2); natural ponds (HSB-3). Fish received the same extruded feed (prot. 48.8%; lip. 17.8%). The trial lasted 16 months in HSB-1 and HSB-2 and only 12 months in HSB-3 due to unfavourable welfare status and low growth performances. At harvest (after 16 months), sunshine bass reached a satisfactory mean weight without significant differences between groups. HSB-2 fish were longer with a smaller circumference, probably due to different hydrodynamics of the raceway. Glucose, cholesterol, triglycerides, protein, lactic dehydrogenase (LDH), aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP), creatine kinase (CK), glycogen of plasma or tissue were not affected by rearing conditions as well as the proximate composition and the fatty acid profile of the fillet.

*Key words:* Hybrid striped bass, Rearing technique, biometric and blood parameters, Meat quality.

**Introduction** - There is increasing interest in the rearing of hybrid striped bass (sunshine ♀*Morone chrysops* x ♂*Morone saxatilis*; palmetto ♀*Morone saxatilis* x ♂*Morone chrysops*) in Italy, and farming is expanding in the Northern regions. Rearing starts from larvae imported from the USA or Israel and, after a weaning phase in hatcheries, on-growing takes place in outdoor basins until a size of 800 g, requested by supermarket chains, is reached. In this study, qualitative and quantitative assessments were carried out on sunshine bass kept in three different rearing conditions. Zootechnical performances, morphobiometric traits and indices and plasma parameters were monitored through an on-growing cycle and used as indicators of the general conditions of the reared sunshine bass.

**Material and methods** - Sunshine bass with an initial mean weight of 200 g were reared in three fish farms (HSB-1, -2, -3) with different fattening conditions (Table 1). Fish received for 16 months the same extruded feed (protein 48.8%; lipid 17.8%). Weight was measured and blood samplings were carried out in all the groups at the beginning of the trial, every four months and at harvest. The main water quality parameters were monitored at every sampling time in each group and analysed in the lab following the standard procedures (A.P.H.A., 1989). At every sampling, 10 fish/group were netted and anaesthetized to collect blood by heart puncture with a heparinized syringe; plasma was separated by

centrifugation at 3000 rpm for 20 min, frozen at -20°C and stored for the subsequent assays. The following plasma parameters were determined spectrophotometrically (Bergmeyer, 1974): glucose; total cholesterol; triglycerides; total protein; LDH; AST ALT; ALP; CK. For hepatic glycogen, 5 livers/batch were dissected, weighed and frozen for glycogen analyses (Perry *et al.*, 1988; Pavlidis *et al.*, 2003).

Table 1. Fattening trial of sunshine bass: main farming conditions.

| Farmes   | HSB-1                          | HSB-2                         | HSB-3            |
|--|--------------------------------|-------------------------------|------------------|
| Rearing technique                                  | Square outdoor concrete basins | Raceways with gravelly bottom | Ponds            |
| Size of rearing basins (m <sup>3</sup> )           | 450 (m18x18x1.4)               | 600 (m120x5x1)                | 3000 (m100x30x1) |
| Origin of water                                    | Well                           | Well                          | Channel          |
| Range of water temperature (°C)                    | 18-25                          | 15-22                         | 2-30             |
| Water flow rate (l/sec/t)                          | 6-8                            | 12                            | 2-4              |
| Initial weight (g)                                 | 200±50                         | 200±50                        | 200±50           |
| Initial stocking density (kg fish/m <sup>3</sup> ) | 8.2                            | 4.8                           | 1.3              |
| Feeding ratio (% b.w./day)                         | 0.5-1.5                        | 0.5-1.5                       | 0.5-1            |
| Feed administration (no.meals/day)                 | 2                              | 2                             | 2                |
| Aeration/oxygen                                    | Present                        | Present                       | Present          |
| Expected final density (kg/m <sup>3</sup> )        | 30                             | 18                            | 5                |

In HSB-1 and HSB-2, quality traits of the fillet were examined in six fish/batch at the end of the trial; a portion of dorsal muscle, deprived of skin and subcutaneous adipose panicle, was collected, homogenised and submitted to the following analysis: dry matter (determined at 105°C for 24h); total nitrogen (Kjeldahl, conversion factor of N to protein 6.25); total lipids extracted with chloroform/methanol (2:1 v/v) (Folch *et al.*, 1956) and converted to fatty acid methyl esters according to Sukhija and Palmquist (1988). Total cholesterol was calculated using beta-sytosterol as the internal standard. At the end of the trial, the main zootechnical performances, morphobiometric parameters, condition index, hepatosomatic index and quality traits were also calculated. Data collected at every sampling were submitted to one-way ANOVA and differences among means were separated by the Student-Newman-Keuls test (SAS, 1989).

**Results and conclusions** - Water quality parameters showed the highest fluctuations in HSB-3, during the summer season (months 11-12) when the water temperature ranged around 30°C and total ammonia nitrogen increased over 1 ppm. At the 4<sup>th</sup> sampling, mean weight, some plasma parameters and survival rate were significantly (P<0.05) unfavourable in HSB-3 compared with the other two groups (Table 2). This situation led to the suspension of the fattening cycle of sunshine bass in HSB-3 after 12 months.

Table 2. Data concerning the 3 groups of sunshine bass after 12 months of fattening (4th sampling).

|                               | HSB-1                 | HSB-2                 | HSB-3                 |
|-------------------------------|-----------------------|-----------------------|-----------------------|
| Water temperature (°C)        | 25                    | 22                    | 30                    |
| Total ammonia nitrogen (mg/l) | 0.43                  | 0.38                  | 1.1                   |
| Mean weight (g)               | 615.7±76 <sup>a</sup> | 638.4±64 <sup>a</sup> | 453.8±97 <sup>b</sup> |
| Survival rate (%)             | 97                    | 98                    | 92                    |
| Plasma glucose (mg/100ml)     | 114±15 <sup>b</sup>   | 108±14 <sup>b</sup>   | 157±11 <sup>a</sup>   |
| Plasma total protein (U/l)    | 3.3±0.1 <sup>b</sup>  | 3.4±0.2 <sup>b</sup>  | 4.3±0.3 <sup>a</sup>  |

<sup>a, b</sup> P<0.05.

In the subsequent four months of the trial, the sunshine bass in HSB-1 and HSB-2 reached similar and satisfactory final mean weight (Table 3) whereas morphometric parameters showed some significant differences. HSB-2 fish were longer, with a smaller maximum circumference with respect to HSB-1 fish. As a direct consequence of the higher length reached by the HSB-2 group, the condition index was significantly lower. No significant differences were detected

Table 3. Main morphobiometric, production parameters and quality traits recorded at the end of trial.

|                                  | HSB-1                  | HSB-2                  |
|----------------------------------|------------------------|------------------------|
| Rearing cycle (months)           | 16                     | 16                     |
| Final weight (g)                 | 765.75±98.3            | 794.75±88.6            |
| Final length (cm)                | 36.5±1.3 <sup>b</sup>  | 39.4±0.7 <sup>a</sup>  |
| Max. height (cm)                 | 10.45±0.5              | 10.22±0.5              |
| Max. circumference (cm)          | 28.35±0.6 <sup>a</sup> | 26.65±0.4 <sup>b</sup> |
| Condition index                  | 1.58±0.4 <sup>a</sup>  | 1.3±0.2 <sup>b</sup>   |
| Hepatosomatic index              | 3.23±0.9               | 3.41±0.8               |
| Specific growth rate (%/d)       | 0.28±0.02              | 0.29±0.01              |
| Feed conversion rate             | 1.45:1                 | 1.42:1                 |
| Survival rate (%)                | 95                     | 95                     |
| Qualitative traits:              |                        |                        |
| Moisture (%)                     | 76.5±0.54              | 76.8±0.35              |
| Protein (% as is)                | 19.22±0.1              | 19.27±0.05             |
| Lipid (% as is)                  | 3.58±0.8               | 3.18±0.66              |
| Ash (% as is)                    | 1.10±0.03              | 1.12±0.03              |
| Total cholesterol (mg/100 g)     | 53±0.84                | 52.73±0.83             |
| PUFA Fatty acids (% of total FA) | 43.46±0.85             | 43.56±1.02             |

<sup>a, b</sup>  $P < 0.05$ .

in plasma and tissue parameters between the two groups. These data are in agreement with those reported in literature for this hybrid striped bass (Hrubec *et al.*, 2001). No differences emerged regarding the proximate composition and fatty acid profile (Table 3).

During the trial, water quality values remained within acceptable ranges for hybrid striped bass, even if this backcross hybrid seemed to be more sensitive to high temperature and water quality variations compared to palmetto bass. For this reason, concrete and raceway basins appear more suitable to rear this fish. In the raceway, sunshine bass underwent higher swimming training respect to those held in the square basin. The hydrodynamics of the rearing basin, water flow rate, water temperature and stocking density of this group were probably responsible for the different body shape, as reported in other fish species (Johnston, 1999; Hanson *et al.*, 2007). Nevertheless, no effect was found on the quality traits of the fillet of this fish that can be classified in the non-fatty fish category.

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