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SWIMMING PERFORMANCES AND ENERGETIC EXPENDITURE IN *PAGRUS PAGRUS PAGRUS* (LINNAEUS, 1758)

PERFORMANCE DI NUOTO E METABOLISMO ENERGETICO IN PAGRUS PAGRUS PAGRUS *(LINNAEUS, 1758)*

Abstract - *The aim of this work was to estimate the baseline of the swimming performances of the red porgy (*Pagrus pagrus pagrus*), during the critical swimming tests (U_{crit}), together with the energetic expenditure at the different size of the fish.*

Key-words: *red porgy, U_{crit}, metabolic rate.*

Introduction - In fish, swimming is the most important factor influencing the Darwinian success. It is mainly studied trough prolonged swimming exercises and assessed by mean of the critical swimming test (U_{crit}), which represents the maximum aerobic activity a fish could expresses (Plaut, 2001). The U_{crit} is strictly linked with the fish physiological condition and, for this reason, it is often used as a welfare indicator. Critical swimming speed allows also to assess fish responses to many kind of stressors (FSBI, 2002) that generally have the effect of reducing the fish swimming capacity. Moreover, the muscular activity is strictly correlated with the oxygen consumption rate, that increases proportionally with the swimming speed, acting as an index of the activity of the aerobic metabolism (Smit *et al.*, 1971). The energy mobilization follows a pattern in which the amount of oxygen consumption is proportional to the work done during the muscular activity (Beamish, 1978). Aim of this work, is to get insight into the energetic physiology of red porgy, a species included in the IUCN red list and thus requiring particular management measures.

Materials and methods - 17 red porgies (21.3-37.6 cm total length) were randomly chosen for the U_{crit} test and were fasted for at least 12 hours before the swimming tests. Each fish were kept into the Blažka style swimming chamber for at least 60 minutes in resting water, and then was exposed to a low (0.1 m s^{-1}) speed water flux for 30 minutes (Brett, 1964). This was successively increased of 0.1 m s^{-1} every 15 minutes, until fish reached the fatigue condition. The absolute U_{crit} value was estimated according to Brett (1964). Relative U_{crit} was estimated as absolute U_{crit} per total fish length and expressed as body length per second. For the specimens whose maximum width was greater than the 10% of the inner diameter of the respirometer, the correction of the U_{crit} value was computed according to Smit *et al.* (1971). For 13 out the 17 fish the U_{crit} test was coupled with the assessment of the metabolic rate. The oxygen consumption rate (mg O_2/kg/hour) was assessed in the closed respirometer, during the last 5 minutes of each single swimming speed step, by mean of the DAQ-1 respirometer (Loligo Systems), whose probe was located in the inner part of the swimming tunnel. The correlation between swimming speed and relative U_{crit} was tested using Spearman's rank correlation test. The differences between the mean relative U_{crit} in red porgy and seabass (Carbonara *et al.*, 2006) were tested with the Kruskal-Wallis test. The Aerobic Metabolic Scope (AMS) was calculated as the Active Metabolic Rate (AMR) minus the Standard Metabolic Rate (SMR), computed as the Metabolic Scope extrapolated respectively at the U_{crit} and at 0 m s^{-1}.

Results - The mean relative U_{crit} of red porgy was 2.71±0.43 BL s^{-1}, a lower value than estimated in sea bass (mean relative U_{crit}=3.91±0.36 BL s^{-1}; Carbonara *et al.*, 2006). The correlation between relative U_{crit} and the body size was not statistically significant ($p>0.05$) (Fig. 1-A), while the correlation between swimming speed and oxygen consumption rate resulted positively significant ($p<0.01$) (Fig. 1-B). The AMS of the red porgy resulted 171.76 mg O_2/kg/hour.

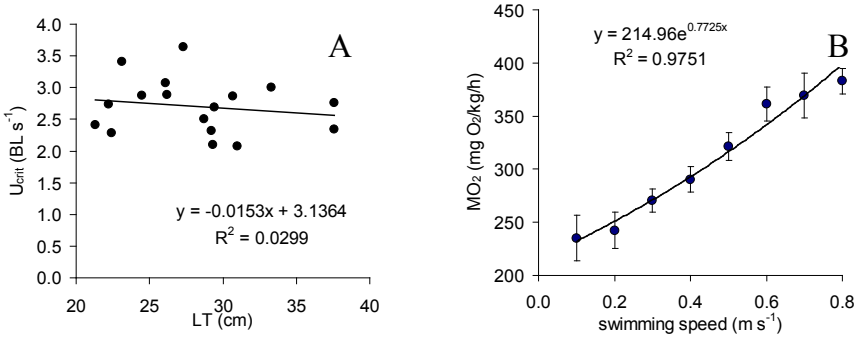

Fig. 1 - Baselines of the swimming performances (A) and of the oxygen consumption (B).
Baseline delle performance di nuoto (A) e del consumo di ossigeno (B).

Conclusions - In this study red porgy showed lower swimming performances ($p>0.05$) in comparison with other aquaculture species, such as seabass of the same size range. The low swimming capacity of red porgy is also highlighted by the lower AMS value in comparison to other species, like sea bass (Luna-Acosta *et al.,* 2011) and coho salmon (Lee *et al*., 2003). Such interspecific differences could be related to the species morphology, strengthening the idea that U_{crit} is an important ecological species-specific indicator, as well as the AMS, and both can help to better understand the energetic physiology of red porgy.

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