

Nota científica

MORTALITY OF BLACK-BAND MYLEUS *Myloplus Schomburgkii* DUE TO POOR WATER QUALITY ASSOCIATED WITH OVERPOPULATION OF DUCKWEEDS IN A CULTURE POND IN THE PERUVIAN AMAZONIA

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ABSTRACT

Ponds covered with duckweeds release nutrients rapidly causing problems of eutrophication of the water that can reduce water clarity and harm water quality, creating a hypoxic or anoxic 'dead zone' lacking sufficient oxygen to support most organisms. In the present study, mortality of black-band myleus *Myloplus schomburgkii* Jardine, 1841 was suddenly perceived, motivating to investigate the factors that caused the death of the specimens registered in a fish pond in the Peruvian Amazon. After the counting of death fish, it was revealed that sixty individuals (75% of the total population) of *M. schomburgkii* died. The taxonomic identification of the aquatic plant revealed the presence of "duckweeds" locally named in Peru as "lenteja de agua" *Lemna minor* distributed throughout the pond. Physical and chemical water parameters revealed low levels of oxygen, acid water, and high levels of nitrate and phosphate. Since duckweeds cannot be completely eliminated from waters, which are conducive to its growth and have to be harvested periodically to prevent matting, proper management strategies therefore become critical to guarantee good quality of water in the pond and avoid deaths due to imbalances in physical and chemical parameters.

KEYWORDS: Hypoxia, *Lemna minor*, duckweeds, water parameters.

MORTALIDAD DE BANDA NEGRA *Myloplus Schomburgkii* DEBIDO A LA POBRE CALIDAD DEL AGUA ASOCIADA CON LA SOBREPoblACIÓN DE LENTEJAS DE AGUA EN UN ESTANQUE DE CRIANZA EN LA AMAZONÍA PERUANA

RESUMEN

Los estanques cubiertos de lentejas de agua liberan nutrientes de forma rápida causando problemas de eutrofización del agua que pueden reducir la transparencia y perjudicar su calidad, creando una "zona mortal" hipóxica o anóxica que carece de oxígeno suficiente para mantener a la mayoría de los organismos. En el presente estudio se observó la mortalidad del pez "banda negra" *Myloplus schomburgkii* Jardine, 1841, lo que motivó a investigar los factores que causaron la muerte de los ejemplares registrados en un estanque de peces en la Amazonía peruana. Tras el recuento de los peces muertos, se reveló que sesenta individuos (75% de la población total) de *M. schomburgkii* murieron. La identificación taxonómica reveló la presencia de la planta acuática *Lemna minor* denominadas localmente en Perú como "lentejas de agua" distribuida por todo el estanque. Los parámetros físicos y químicos del agua revelaron bajos niveles de oxígeno, agua ácida y altos niveles de nitrato y fosfato. Dado que la lenteja de agua no puede eliminarse por completo del agua, que favorece su desarrollo, hay que cosecharlas periódicamente para evitar que aumenten desmedidamente. Las estrategias de manejo son fundamentales para garantizar la buena calidad del agua del estanque y evitar mortalidades debido a desequilibrio de parámetros físicos y químicos del agua.

PALABRAS CLAVE: Hipoxia, *Lemna minor*, parámetros del agua.

Duckweeds are gregarious free-floating aquatic macrophytes commonly found in fresh water ponds that belong to Lemnaceae (Priya *et al.*, 2012). These plants rapidly take up nutrients from water and form thick floating mats over the water surface that has detrimental effects on aquatic life (Cronk & Fennessy, 2016). In that context, ponds with duckweeds often necessitates periodic removal of thick mats that if left to rot release nutrients rapidly, thereby compounding the problem of eutrophication (Mukhopadhyay & Dewanji, 2006).

The black-band myleus *Myloplus schomburgkii* Jardine, 1841, is an omnivorous species from the Family Serrasalminae, popularly known in Peru as “banda negra” is widespread in the middle and lower Amazon River basin, Nanay River and upper Orinoco River basin in South America (Jégu, 2003). This fish can grow up to 42 cm and reach 600 g, and it is considered as a potential species for the diversification of aquaculture production in the Peruvian Amazon, being highly demanded for aquarists of the Region Loreto, in Peru that exports its fingerlings to different countries of the world (Garcia *et al.*, 2018).

In the present study, mortality of *M. schomburgkii* was suddenly perceived, motivating to investigate the factors that caused the loss of these fish grown in a fish pond in the Peruvian Amazon.

Eighty individuals of *M. schomburgkii* with 25 ± 6.2 cm standard length were cultivated in a fish pond of the “Instituto de Investigaciones de la Amazonía Peruana” (Iquitos, Peru). From one day to another, mortalities were noticed early in the morning. Abundant duckweeds were observed covering the whole pond. Death fish were removed from the pond and counted to know the number of dead specimens.

In order to register the physical and chemical parameters, a Hanna Multiparameter and a kit Lamotte were used as soon as death fish were observed. These parameters were taken once at 10 am.

Sixty individuals (75% of the total population) of *M. schomburgkii* died from a fish pond. The taxonomic identification of the aquatic plant revealed the presence of “duckweeds” locally named in Peru as “lenteja de agua” *Lemna minor* distributed throughout the pond. Physical and chemical water parameters revealed low levels of oxygen, acid water, and high levels of nitrate and phosphate (see table 1).

The dissolved oxygen is a vital factor for fish kept under captivity, since itself has limiting

Table 1. Physicochemical parameters of the sampled pond at Instituto de Investigaciones de la Amazonía Peruana (Iquitos, Peru).

Parameters	Values	
Transparency	(cm)	35
Temperature	°C	25
Dissolved oxygen	O ₂ (mg/L)	1.0
Carbon dioxide	CO ₂ (mg/L)	30
pH	0 - 14	4
Hardness	(mg/L)	15
Total dissolved solids	TDS (mg/L)	17
Conductivity	Ce ⁻ (µS/cm)	35
Chloride	Cl ₃ (mg/L)	11
Phosphate	PO ₄ (mg/L)	2.9
Nitrate	NO ₃ (mg/L)	7.6

characteristics for this activity. Values inferior to 5.5 mg l⁻¹ lead fish to suffer from respiratory problems, which can lead to death (Blanco, 1994), therefore, it is of sum important to know those parameters that influence the oxygen

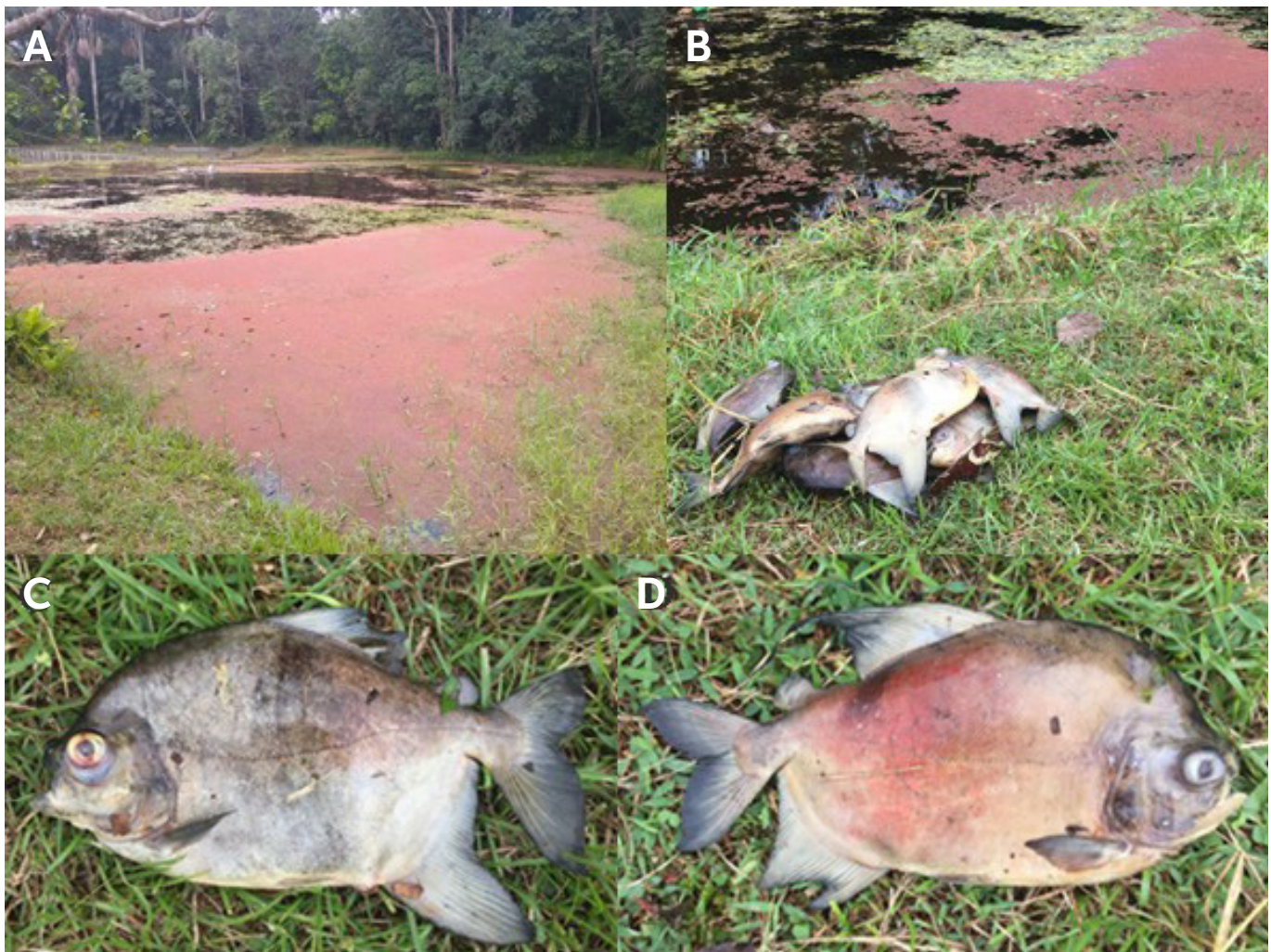


Figure 1. A. Pond covered with duckweeds, B. Dead specimens of *Myloplus schomburgkii* from pond covered with duckweeds, C and D. Lateral view of dead specimens of *M. schomburgkii*.

concentrations in the water and its availability for fish. Ponds with low covers of duckweeds allow a larger surface area of the pond to be exposed for sunlight penetration that promotes higher photosynthetic activity within the water, thereby resulting in higher dissolved oxygen (Pokorný & Rejmanková, 1983).

According to Sculthorpe (1967), at high covers, duckweeds often restrict the growth of submerged macrophytes by obstructing penetration of light for submerged species to develop. Samples of this effect were noticed in ponds covered by duckweeds, where the values of

dissolved oxygen ranged from 2.93 mg l^{-1} to 0.71 mg l^{-1} . In the present study, the value of dissolved oxygen reported was 1.0 mg l^{-1} , thus reiterating the negative impact of high duckweed coverage in fish ponds.

Dissolved oxygen is a very important variable for aquaculture ponds and phosphorus is a nutrient directly related to eutrophication. High values of phosphorus have been reported in duckweed-infested ponds (Khondker *et al.*, 1994) and also in the present study. The presence of this element could prove useful for management purposes, since as soon as there are

indications of higher phosphorus levels in the ponds, duckweeds could be manually removed before they assume exponential growths and start restricting water body use.

In aquatic ecosystems, phosphate (in minimal concentrations) is essential to stimulate primary productivity (Zhang *et al.*, 2008) and the development of trophic chains. However, its excessive presence favors eutrophication and loss of biodiversity (Sondergaard *et al.*, 2007)

Eutrophication is characterized by excessive plant and algal growth due to the increased availability of one or more limiting growth factors needed for photosynthesis (Schindler, 2006), such as sunlight, carbon dioxide, and nutrient fertilizers. The known consequences of cultural eutrophication include blooms of blue-green algae (i.e., cyanobacteria), degradation of recreational opportunities, and hypoxia. The most conspicuous effect of eutrophication is the creation of dense blooms of noxious, foulsmelling phytoplankton that reduce water clarity and harm water quality. Furthermore, high rates of photosynthesis associated with eutrophication can deplete dissolved inorganic carbon and raise pH to extreme levels during the day. Elevated pH can in turn 'blind' organisms that rely on perception of dissolved chemical cues for their survival by impairing their chemosensory abilities (Turner & Chislock, 2010). When these dense algal blooms eventually die, microbial decomposition severely depletes dissolved oxygen, creating a hypoxic or anoxic 'dead zone' lacking sufficient oxygen to support most organisms.

Since duckweeds cannot be completely eliminated from waters, which are conducive to its growth and have to be harvested periodically to prevent matting, proper management strategies therefore become critical to guarantee good quality of water in the pond and avoid deaths due to imbalances in physical and chemical

parameters.

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Recibido: 24 de abril de 2021 **Aceptado para publicación:** 15 de julio de 2021