JOURNAL OF TROPICAL BIOLOGY AND CONSERVATION 8 : 51 – 61, 2011

Research Article

Blue-green algae and nutrient concentrations in two *Tor tambroides* aquaculture ponds differing in construction

Mohd Nasarudin Harith and Ruhana Hassan

Department of Aquatic Science, Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia.

ABSTRACT. Two mahseer fish *(Tor tambroides)* aquaculture ponds located in Serian district, Sarawak were investigated for blue-green algae composition and nutrient dynamics in a six month period (January to June 2007). A total of 35 blue-green algae species belonging to 11 genera and four families were recorded. Genera *Chroococcus*, *Nostoc*, *Oscillatoria*, *Pleurocapsa* and *Synechocystis* were found in both ponds. Potential toxin producer genera, *Microcystis* and *Anabaena* formed a visible brown bloom on the surface of the earth pond. The highest blue-green algal cell density was recorded in June for the earth pond (1,009,000 cells $m\ell^{-1}$) and in January for the HDPE pond (521,000 cells $m\ell^{-1}$). The highest chlorophyll *a* concentration was documented in June for both ponds (10.2377 $\mu g\ell^{-1}$ in HDPE pond and 172.1160 $\mu g\ell^{-1}$ in the earth pond). Nutrient concentration, namely soluble reactive phosphorus (SRP) (0.01-2.02 $mg\ell^{-1}$ in HDPE pond, and 0.01-0.29 $mg\ell^{-1}$ in earth pond), ammonia-nitrogen (0.01-0.90 $mg\ell^{-1}$ in HDPE pond and 0.01-0.45 $mg\ell^{-1}$ in earth pond) and nitrate (0.02-0.08 $mg\ell^{-1}$ in HDPE pond and 0.01-0.05 $mg\ell^{-1}$ in earth pond) were also recorded. This finding suggested that the earth pond is prone to experience algae bloom and at the same time, could support greater population of blue-green algae. Results also showed that SRP and nitrate are not the only factors that influence blue-green algae composition in aquaculture ponds but rather a combination of other multiple environmental factors.

Keywords: Blue-green algae composition, HDPE pond, earth pond, nutrients, *Tor tambroides*

INTRODUCTION

Cyprinid Fish, genus *Tor,* commonly known as mahseer, is distributed throughout Southeast Asian regions (Roberts, 1999). One of the members of the genus, *Tor tambroides,* is an indigenous fish of Sarawak (de Silva *et al.*, 2004). Locals call this fish "empurau." In natural rivers in Sarawak, *T. tambroides* plays an important role in ecology as they feed on wild fruits, reflecting their status as the primary consumer in a complex riverine food web. In addition, *T. tambroides* is associated with mountainous streams and rivers, preferring clear, swift flowing waters with stony, pebbly and rocky bottoms (Inger & Chin, 1990), therefore becoming one of the bioindicators of a non-polluted river.

In South-east Asian regions, particularly in Sarawak, *empurau* has economic importance as it could fetch RM400.00 to RM600.00 per kilogramme depending on size, grade and whether the fish comes from wild or semi-wild stock. It is common in top-notch river fish specialty restaurants in Sarawak to

Received 24 January 2011. Revision accepted 25 February 2011

have a menu of *empurau* costing RM1,300.00 per dish, reflecting the high status of this fish. Due to its overwhelming demand, there are reports saying that wild *empurau* is now experiencing 'overfishing.' The Sarawak State Government has many conservation programmes in place to combat the declining population of *empurau*. One of the programmes is the *T. tambroides* artificial propagation research, established at the Indigenous Fisheries Research and Production Centre (IFRPC), Tarat, Serian, with the aim of increasing the aquaculture production of this species as well as producing fries to carry out systematic re-stocking at selected rivers.

In IFRPC, two types of pond constructions are commonly used in the cultivation of *T. tambroides*. Earth ponds are constructed without using any bottom-lining material, while high density polyethylene (HDPE) ponds are lined with high density polyethylene plastic. Observation and communication with IFRPC staff during field trips indicate that it is common to have algae bloom in selected aquaculture ponds. Although there were reports on mass mortality of fish in certain ponds at certain times of the year, there is no conclusive and strong evidence yet on causes of such incidents. Laiping & Hassan (2010) had reported that ponds at the IFRPC Serian supported many species of blue-green algae (cyanobacteria), and some were confirmed as toxin-producer species using the Polymerase Chain Reaction (PCR)-based technique. It is well known that in mineral-rich eutrophic systems, for example shallow ponds in tropical regions, blue-green algae produce high cell densities and sometimes they produce toxins that could endanger animals and human health (Codd *et al.*, 2005).

This paper describes our early work on assessment of blue-green algae assemblages in two types of ponds (earth pond and HDPE pond) at IFRPC, documentation on concentration of selected nutrients in those ponds as well as discussions on the relationships between them.

MATERIALS AND METHODS

The IFRPC Tarat, situated in Serian district, was selected for the blue-green algae study. Two types of *Tor tambroides* aquaculture ponds, namely pond AP22 and P12, were selected based on the recommendation from the IFRPC. Pond AP22 is an earth pond layered with black HDPE (High Density Polyethylene) which was stocked with 120 individuals of F1 *empurau* fries (approximately 0.07 g weight per individual fish). P12 is an earth pond stocked with 70 individuals of F1 *empurau* juveniles (approximately 0.07 g weight per individual fish). The stocking was done by the IFRPC staff. The number of fries and juveniles released in each pond were based on availability of stocks and the management plan of the IFRPC. The mean depth of both ponds was approximately 0.4 m. The surface areas of Pond AP22 and P12 are 495m^2 (33 × 15m) and 648m^2 (36 × 18m), respectively. Sampling was conducted monthly from January 2007 to June 2007 (stocking stage until rearing stage). In this paper, AP22 will be referred to as HDPE pond while Pond P12 will be referred to as an earth pond.

The sampling of cyanobacteria was adapted from blue-green algae and algae sampling procedures by Chorus & Cavalieri (2000). Blue-green algae samples from the water subsurface were collected using the 2ℓ Wildco® water sampler (SN: 4109) and sieved through 20 μm mesh net size of a custom-made sieve. Specimens retained in the sieve were kept in separate Kortell® polyethylene bottles, preserved with Lugol's solution and transported back to the laboratory for species identification and enumeration. During sampling, selected ambient physico-chemical parameters such as temperature, pH, dissolved oxygen (DO) and turbidity were measured *in situ* using Horiba's Multiprobe W-22XD Series. The values were recorded in triplicates.

Subsurface water samples were also taken for chlorophyll *a* determination and nutrients analysis. Water samples were placed in Kortell® polyethylene bottles, labeled and