



## **Vertical Stratification of Nitrifying Bacteria and Prediction of Trophic Status Floating Net Cages (Keramba Jala Apung) in Waduk Jatiluhur**

**Student :** Karisa Pepitasari

Final Project (2010), Degree program in Microbiology, School of Life Sciences and Technology-ITB, email : k\_pepitasari@yahoo.co.id

**Advisor :** Dr. Gede Suantika<sup>1</sup>

School of Life Sciences and Technology-ITB, email: gsuantika@sith.itb.ac.id

**Degree :** Degree science (S.Si), Conferred in July 2010

### **Abstract**

Waduk Jatiluhur at Kecamatan Jatiluhur, Kabupaten Purwakarta is surface water bodies which known for its used ecological and economic potencies. One of the economical potency is fishery using floating net cages method. Organic and inorganic wastes from the activity affect ecological condition of Waduk Jatiluhur especially its effect on water quality. As the result, eutrophication process may occurs on Waduk Jatiluhur due to changing of nitrogen budget balance of ammonium and rising of nitrite content. Based on this condition, it is important to carry out an experiment to investigate vertical stratification and time stratification of physical-chemical condition in floating net cages water, to examine composition and domination of nitrifying bacteria in floating net cages, to know how far nitrifying bacteria could be used for decreasing ammonium and nitrite concentration, and to predict trophic status in floating net cages. Nitrifying bacteria sampling were done five times with interlude time of two weeks from early January 2010 until early March 2010 using water sampling tool *Lamotte* at 0, 2, 4, 6, 8, 10, and 12 m deep. Water quality measurements include temperature, sunlight penetration, dissolved oxygen, alkalinity, pH, and conductivity which were done *in situ*, while ammonium, nitrite, nitrate, and orthophosphate measurements as nutrient parameter and organic content measurement were done in the laboratory (*ex situ*). Sampled nitrifying bacteria's ability in oxidizing ammonium and nitrite were also examined in laboratory. During experiment, two genus of nitrifying bacteria, *Nitrosomonas* (AOB) and *Nitrobacter* (NOB) were isolated. In general, proportion of nitrifying bacteria in each depth was fluctuated and was dominated by AOB. The highest proportion of nitrifying bacteria was found at 6 m deep (84,31%), while the lowest was found at 0 m deep (5,78%). Based on proportion of nitrifying bacteria genus in floating net cages, the highest AOB proportion was at 12 m deep (99,9%), while the lowest was at 8 m deep (8,52%). Based on laboratory test, the highest ammonium oxidation rate was met at nitrifying bacteria-inoculated culture from 4-8 m depth, while NOB did not show a significant result in declining the nitrite concentration. Using Principle Component Analysis (PCA) statistic test continued by Pearson bivariate correlation known that AOB abundance was very affected by NOB abundance ( $R^2 = 0,603$ ;  $P \geq 0,01$ ), while NOB abundance was very affected by conductivity ( $R^2 = 0,417$ ;  $P \geq 0,01$ ) and alkalinity ( $R^2 = 0,431$ ;  $P \geq 0,01$ ) water physical chemical parameter. Based on water trophic status analysis using dissolved inorganic nitrogen budget, water physical chemical water

parameter, and nitrifying bacteria abundance, it was estimated that floating net cages in Waduk Jatiluhur's trophic status was grouped as meso-eutrophic water.

**Keywords:** floating net cages activity in Waduk Jatiluhur, trophic status, vertical stratification, nitrifying bacteria, AOB, NOB, oxidation rate

## **Stratifikasi Vertikal Bakteri Nitrifikasi dan Prediksi Status Trofik di Perairan Keramba Jala Apung (KJA), Waduk Jatiluhur**

**Mahasiswa :** Karisa Pepitasari

Skripsi (2010), Program Studi Sarjana Mikrobiologi, Sekolah Ilmu dan Teknologi Hayati-ITB, email : k\_pepitasari@yahoo.co.id

**Pembimbing :** Dr. Gede Suantika<sup>1</sup>

Sekolah Ilmu dan Teknologi Hayati-ITB, email : gsuantika@sith.itb.ac.id

**Gelar :** Sarjana Sains (S.Si), Wisuda Juli 2010

### **Abstrak**

Waduk Jatiluhur di Kecamatan Jatiluhur, Kabupaten Purwakarta merupakan salah satu badan perairan permukaan yang bersifat serbaguna, terbuka, dan memiliki potensi sumber daya, baik secara ekonomi maupun ekologi. Buangan organik dan anorganik akibat kegiatan manusia, terutama kegiatan budidaya KJA di Waduk Jatiluhur berkontribusi signifikan terhadap proses eutrofikasi perairan. Salah satu penyebab terjadinya proses ini adalah berubahnya kualitas air terutama keseimbangan *budget* nitrogen yaitu meningkatnya kadar amonium dan nitrit di perairan. Berdasarkan kondisi ini, perlu dilakukan penelitian untuk mengetahui stratifikasi secara vertikal dan mewaktu kondisi fisika-kimia perairan KJA, komposisi dan dominasi dari bakteri nitrifikasi di KJA, mengetahui secara *ex situ* sejauh mana bakteri nitrifikasi berperan dalam menurunkan konsentrasi amonium dan nitrit, serta memprediksi status trofik di perairan KJA Waduk Jatiluhur. Pencuplikan bakteri nitrifikasi dilakukan sebanyak lima kali dengan selang waktu dua minggu dari awal Bulan Januari 2010 hingga awal Bulan Maret 2010 dengan menggunakan alat pencuplik air berupa *Lamotte* pada kedalaman 0m, 2m, 4m, 6m, 8m, 10m, dan 12m. Pengukuran kualitas air meliputi suhu, penetrasi cahaya matahari, DO, alkalinitas, pH, dan konduktivitas yang dilakukan secara *in situ* pada waktu pencuplikan, sedangkan pengukuran amonium, nitrit, nitrat, dan orthopospat sebagai parameter nutrisi dan kandungan organik air dilakukan di laboratorium. Untuk melihat kemampuan bakteri nitrifikasi yang tercuplik dalam mengoksidasi amonium dan nitrit dilakukan uji di laboratorium. Selama penelitian ditemukan dua genus bakteri nitrifikasi, yaitu *Nitrosomonas* (AOB) dan *Nitrobacter* (NOB). Secara umum proporsi bakteri nitrifikasi pada setiap kedalaman berfluktuasi dan secara umum didominasi oleh AOB. Proporsi bakteri nitrifikasi tertinggi dijumpai pada kedalaman 6 meter (84,31%), sedangkan yang terendah pada kedalaman 0 meter (5,78%). Dilihat dari proporsi genus bakteri nitrifikasi di KJA, proporsi tertinggi AOB berada pada kedalaman 12 meter (99.9%), sedangkan yang terendah berada pada kedalaman 8 meter (8.52%). Berdasarkan uji laboratorium, laju oksidasi amonium tertinggi dijumpai pada kultur yang diinokulasi bakteri nitrifikasi dari kedalaman 4-8 meter, sedangkan NOB tidak menunjukkan kinerja yang signifikan dalam menurunkan konsentrasi nitrit. Dengan menggunakan uji statistik *Principle Component Analysis* (PCA) yang dilanjutkan dengan korelasi bivariat *Pearson* dapat diketahui bahwa kelimpahan AOB sangat dipengaruhi oleh kelimpahan NOB ( $R^2 = 0,603$ ;  $P \geq 0,01$ ), sedangkan kelimpahan NOB sangat dipengaruhi oleh parameter fisika kimia air berupa konduktivitas ( $R^2 = 0,417$ ;  $P$

$\geq 0,01$ ) dan alkalinitas ( $R^2 = 0,431$ ;  $P \geq 0,01$ ). Berdasarkan analisis status trofik perairan menggunakan data *budget* nitrogen anorganik terlarut, parameter fisika-kimia air, dan kelimpahan bakteri nitrifikasi diperkirakan bahwa status trofik KJA di Waduk Jatiluhur termasuk dalam perairan meso-eutrofik.

Kata kunci: *bakteri nitrifikasi, AOB, NOB, laju oksidasi, stratifikasi vertikal, status trofik, KJA Waduk Jatiluhur*