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NOTE

# Zooplankton and Phytoplankton Dynamics with the Construction of River Mouth Dam in Kum River Estuary, Korea

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**The construction of river mouth dam has prevented seawater from backwarding to upstream in Kum river estuary since 1990. Field observations on environmental factors, and zooplankton and phytoplankton dynamics have been carried out three times with two month interval in the summer and autumn in 2000 at three selected stations in Kum river estuary. Blockade of seawater flowing backward to upstream caused sharp contrast of zooplankton fauna and phytoplankton flora between upstream and downstream of the river mouth dam. Freshwater cladocerans *i.e., Bosmina longisrostris* and *Daphnia galeata* dominated in the upstream, and marine copepods of *Acartia omorii* and *Paracalanus crassirostris* occurred abundantly in downstream of the dam. Freshwater diatoms did not distributed in the downstream of the dam except *Melosira varians,* while marine diatom of *Cylidrotheca closterium* occurred in benthic waters both in upstream and downstream of the dam. The construction of the river mouth dam seems to play an ecological role to blockade the input of marine organism into the upstream in Kum river estuary.**

**Key words : River mouth dam, Kum river, zooplankton, phytoplankton, blockade**

Kum river flows westward to the Yellow Sea. River mouth dam was constructed to store freshwater resources in Kum river estuary in 1990 (KARIC, 1997a). There were a number of construction of dams or lock gates in coastal areas of Korean peninsula. It was revealed to change the brackish ecosystem where the artificial blockade was constructed between seawater and freshwater, and even between seawater and seawater (cf. Kim and Lee, 1994 for Inchon dock). With the construction of the dam, seawater input has been blockaded in the upstream of the dam in Kum river estuary. Then the upstream area has been changed to have the characteristics in freshwater ecosystem, gradually (cf. Yang *et al*., 2001 for Nakdong river mouth dam). Shin and Cho (2000a, b) described the eutrophication in Kum river reservoir and reported the bloom of *Stephanodiscus* spp. in winter season and *Microcystis* spp. in the summer. Then, the objective of the study is to clarify the impact of dam construction on the distribution of zooplankton and phytoplankton.

Three times of field observation were carried out at three selected stations in both upstream and downstream of the river-mouth dam in Kum river estuary during the study period (June-October 2000). Station 1 located at the front of newly constructing maritime village in the river mouth, station 2 just down the dam and station 3 just up the dam, respectively. Quantitative zooplankton samples were collected with Kitahara plankton net (mouth diameter: 25 cm, mesh aperture: 0.1 mm) and fixed with 4% neutralized formalin. Phytoplankton was collected with Van-Dorn water sampler both from surface (30 cm depth) and bottom waters, and fixed with lugol solution. Environmental factors, *i.e.*, pH and water temperature (Hana HI 9023C), and DO

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**Table 1.** Seasonal variation in environmental factors (water temperature, pH and DO) in Kum River estuary during the period of study from June to October, 2000.

| Month | June | | | August | | | October | | |
|---|---|---|---|---|---|---|---|---|---|
| Station; Surface | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Temperature (°C) | 24.9 | 25.3 | 24.1 | 30.1 | 27.9 | 29.6 | 24.8 | 22.1 | 24.8 |
| pH | 7.51 | 7.65 | 7.27 | 7.47 | 7.01 | 8.01 | 9.32 | 7.71 | 7.55 |
| DO ($mgl^{-1}$) | 8.2 | 8.5 | 9.0 | 4.2 | 8.9 | 9.6 | 6.1 | 6.5 | 9.5 |

| Month | June | | | August | | | October | | |
|---|---|---|---|---|---|---|---|---|---|
| Station; Bottom | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Temperature (°C)) | 25.5 | 25.5 | 23.6 | 29.9 | 28.4 | 28.1 | 24.2 | 23.8 | 23.6 |
| pH | 7.50 | 7.54 | 7.11 | 7.32 | 7.84 | 7.49 | 9.44 | 7.90 | 7.41 |
| DO ($mgl^{-1}$) | 7.2 | 6.3 | 7.7 | 2.2 | 2.8 | 6.4 | 3.1 | 2.1 | 6.9 |

(YSI 51B) were measured. Zooplankton samples were examined to species level under a dissecting microscope (Zeiss SV11) and compound microscope (Zeiss Auxiolab), and phytoplankton, under compound microscope, respectively.

Water temperature fluctuated between 23.6~25.5°C in June, 27.9~30.1°C in August and 22.1~24.8°C in October, respectively (Table 1). Due to shallow water and high tidal movement, no distinct difference was observed between surface and bottom except in October at stn. 3 where the surface temperature was 2°C higher than bottom one. This result agrees well with that reported by Shin and Cho (2000b) where water temperature arose to 30°C in the summer and around 20~25°C in June and October in 1998 and 1999 at just up the dam. pH varied around 7.5 except in October at stn. 1 where was higher than 9.3 both in surface and bottom. In August, stn. 3 showed more or less higher pH of 8.01. while pH in stn. 3 showed higher pH than 8 in August 1998 and less pH than 7.0 in August 1999 (Shin and Cho, 2000b). DO varied between 3.1 mg/l (in October at the bottom of stn. 2) and 9.6 mg/l (in August at the surface of stn. 3). Higher DO was measured at stn. 3 than those at stns. 1 and 2, and surface water showed higher D.O than those of bottom waters. Since Shin and Cho (2000b) measured DO only in the surface at stn. 3, they reported DO higher than 7 mg/l during their study period from January 1998 to September 1999. Low DO values observed by us suggested that bottom waters were not mixed well with surface ones in the study area due to the decrease of tidal mixing at there. Decomposition of sedimentary sewage seemed to demand oxygen consumption at the bottom, too (Kang and Song, 2000).

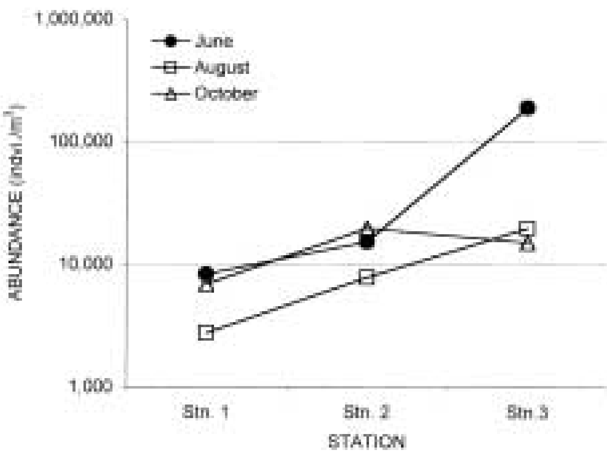


**Fig. 1.** Zooplankton abundance change at three stations in Kum river estuary from June to October, 2000.

A total of 31 taxa of marine zooplankton and 18 taxa of freshwater zooplankton were distributed during the present study. Among marine zooplankton, 12 species of copepod occurred and showed the prosperity in species number, while 11 cladocerans distributed. Minimum abundance of 2,759 indiv./$m^3$ was recorded at stn. 1 in August and the maximum was 190,433 indiv./$m^3$ at stn. 3 in June (Fig. 1). Except the outstanding abundance due to the outburst of *Noctiluca scintillans* and *Bosmina longirostris* in June, zooplankton abundance never exceeded 20,000 individuals/$m^3$ during the rest of the study period. Marine copepod of *Acartia omorii* and copepodites dominated at stns. 1 and 2, while freshwater clacoceran of *Bosmina longirostris* and freshwater copepod of *Cyclops vicinus* occurred abundantly at stn. 3.

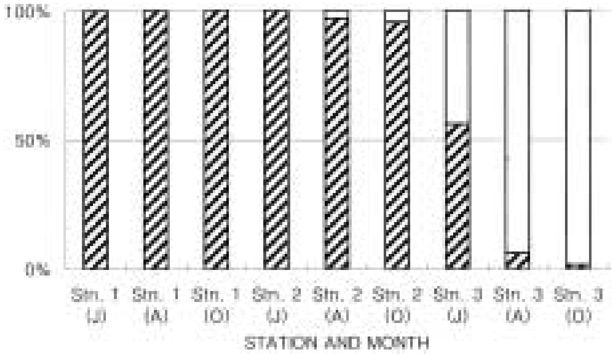


**Fig. 2.** Percentage composition of marine and freshwater zooplankton at three stations in Kum river estuary from June to October, 2000. Hached area: marine species, open: freshwater species.

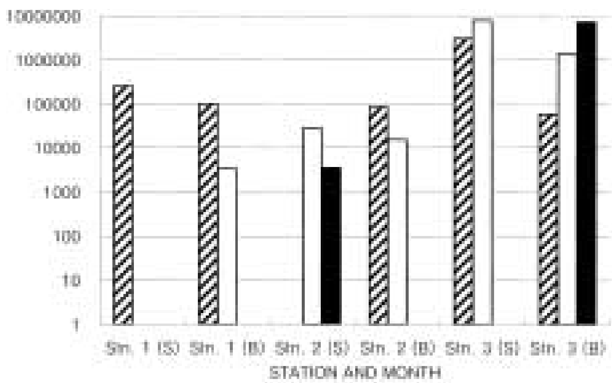


**Fig. 3.** Phytoplankton standing crops at three stations in Kum river estuary from June to October, 2000. Hached column: June, open: August, solid: October.

Marine zooplankton occurred at stn. 1 and a few number of freshwater cladocerans and copepods distributed at stn. 2 in August and October (Fig. 2).

Except the abundance of *Noctiluca scintillans* in October, more than 90% of zooplankton fauna consisted of freshwater zooplankton at stn. 3 (Fig. 3).

Phytoplankton standing crops were recorded to be maximum of 7,735,000 cells/l at the surface of stn. 3 in August and minimum of 3,398 cells/l at the bottom of stn. 1 in August, respectively. *Skeletonema costatum* dominated at stns. 1 and 2, while *Pediastrum duplex* and *Cryptomonas* spp. did at stn. 3 in June. Kim and Boo (1998) also reported the *P. duplex* in high frequency and standing crops at the upstream of Kum river mouth

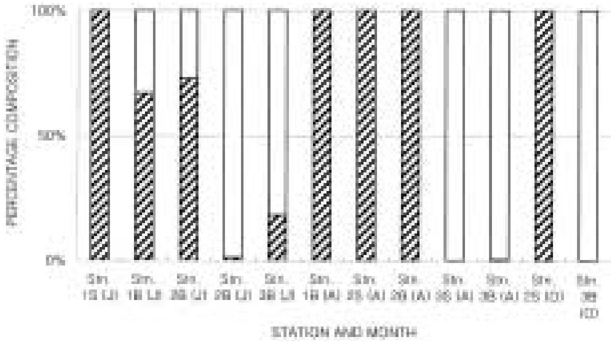


**Fig. 4.** Percentage composition of marine and freshwater phytoplankton at three stations in Kum river estuary from June to October, 2000. Hached area: marine species, open: freshwater species.

dam. Only marine diatoms occurred both in surface and bottom waters at stn. 1, whereas 30% of phytoplankton standing crops consisted of freshwater ones in bottom waters at stn. 2 (Fig 4).

No such an occurrence of freshwater diatoms was observed at stations located down the dam in August and October. In October more than half of phytoplankton standing crops consisted of *Melosira granulata* and *M. granulata* var. *angustissima* at stn. 3.

In comparison with phytoplankton study in Nakdong river estuary (Lee *et al.*, 1993, 1994, 1995; Seo and Chung, 1994), a few studies on phytoplankton was carried out in Kum river (Shin and Cho, 2000b). Some reports on the phytoplankton dynamics in Kum river estuary (KARIC 1996, 1997b) dealt with the seasonal variation in phytoplankton standing crops, $2.98\times10^6-2.37\times10^7$ cells/l at the upstream of the dam and $1.00\times10^6\sim1.10\times10^7$ cells/l at the downstream in 1994 ~1996. Our results on standing crops at stn. 3 was more or less similar to those reported by KARIC, however, even the maximum standing crops of $2.6\times10^6$ cells/l was quite lower than those reported by KARIC at the downstream of the dam. This suggests that the primary production became to decrease with the construction of the dam at downstream waters of the dam, while upstream waters became to be eutrophicated (cf. Shin and Cho, 2000a).

We suppose the biological productivity will decrease at the downstream of the dam in Kum river estuary and eutrophication will be a serious problem in upstream waters.

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## REFERENCES


Kang, Y.M. and H.G. Song. 2000. Effect of bottom sediment on oxygen demand of overlying water in onshore of lake Paldang. *Korean J. Limnol.* **33**: 23-30 (in Korean with English abstract).

KARIC (Korea agricultural and rural infrastructure corporation). 1996. Reports on the environmental impact assessment of rice paddy construction at Kum river I area. 31-33pp. (in Korean).

KARIC (Korea agricultural and rural infrastructure corporation). 1997a. Report on the maintenance of the river mouth dam in Kum river. 462pp. (in Korean).

KARIC (Korea agricultural and rural infrastructure corporation). 1997b. Reports on theenvironmental impact assessment of rice paddy construction at Kum river I area. 93-94pp. (in Korean).

Kim, J.T. and S.M. Boo. Population dynamics of the cholorococcalean members (Chlorophyta) in Kumgang river, Korea. *Korean J. Limnol.* **31**: 219-224 (in Korean with English abstract).

Kim, S.W. and J.H. Lee. 1994. Seasonal distribution of zooplankton communities in Inchon dock, an artificially closed marine embayment facing the Yellow Sea, western *Korea. J. Korean Soc. Oceanogr.* **29**: 376-382.

Lee, J.A., A.R. Choi, and I.K. Chung. 1995. Phytoplankton stoichiometry and nutrients status of the Sonakdong river. Korean J. Phycol. **10**: 37-44.

Lee, J.A., K.J. Choi, O.S. Kwon, and I.K. Chung. 1993. A study on the environmental factors in Nakdong estuarine ecosystem. *Korean J. Phycol.* **8**: 29-36.

Lee, J.A., K.J. Choi, O.S. Kwon, I.K. Chung, and B.Y. Moon. 1994. Primary production of phytoplankton in Nakdong estuarine ecosystem. *Korean J. Limnol.* **24**: 69-78.

Seo, J.K. and I.K. Chung. 1994. The phytoplankton community structure in the Nakdong river mouth. *Korean J. Limnol.* **27**: 227-250.

Shin, J.K. and K.J. Cho. 2000a. Water quality assessment by algal growth potential (AGP) from midstream to downstream of the Kum river. *Korean J. Limnol.* **33**: 244-250 (in Korean with English abstract).

Shin, J.K. and K.J. Cho. 2000b. Seasonal dynamics and pollution status of the water quality in the Kum river reservoir. *Korean J. Limnol.* **33**: 251-259 (in Korean with English abstract).

Yang, H.J., K.H. Kim, and J.D. Kum. 2001. The fish fauna and migration of the fish way of the Nakdong river mouth dam. *Korean J. Limnol.* **34**: 251-258 (in Korean with English abstract).


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