Establish the rivers' bio-indicator system –a case study of Zhong-Kang river.

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Abstract.

Due to the increasing environmental discredits and concerns of ecological conservation, ecological engineering must be developed in order to meet the environmental requirement. The environment impact assessment surveys and investigations must be taken care of in any large land use projects and adopted by nature conservations and restoration methods whenever possible .

The objective of this study is to investigate the species composition and distribution of the aquatic insects, to monitor the change of community structure of aquatic insects in one-year study, and in the Zhong-kang river. Twelve sampling areas were selected from upstream to downstream. Monthly sampling of aquatic insects was classified in the laboratory .Water quality monitoring was collected monthly. Water quality parameters such as temperature, pH, conductivity, Dissolved Oxygen (D.O), suspended solid, ammonia , nitrate, and phosphate were analyzed.

The results indicated that 20 species of aquatic insects including 6 orders, and 12 families were classified in Zhong-kang river. The larvae of **Trichopteran** are the dominant species. The monthly change of the insect number suggested that the number increased in spring and fall, and declined in summer and winter. The assessment (fig2-7) illustrated that upper upstream contains the best water quality. However, water quality of downstream was the worst along the river.

For applying the aquatic insect species as bio-indicators, only species, ecological diversity, community similarity and seasonal succession change were studied. In addition, the aquatic insects communities grown on different artificially attached substance on riverbed were also studied . The primary result showed the restoration rate of insects species were great potential in further utility of Ecological Engineering.

Keywords. bio-indicator, ecological engineering ,environment restoration

Introduction

Recently, the Public Department of Taiwan has entered the field of Ecological Engineering, which has become the policy of the public construction and environment protection. The promotional action lies in concept declare and try-error stage, but shortage of related to functional flow diagram model. This situation brings many ecological engineering missing problems.

Therefore, planting trees took the crucial place of ecological engineering; rock river bank took the place of multi-habitat,key point and real value of ecological engineering were disregarded. What was the goal of construction? How could we make it in correct method? What were the target bios of this protection or preserve construction?

In fact, the true value of ecological engineering is protecting the niches of each species within the constructive environment. This value is based on the realization of physical environment of niche, ecological relationship between species and corridor requirement in landscape scale. For this reason, ecological research is necessary to develop ecological engineering. At present , the researches about bio-indicators in Taiwan were mostly focus on the indicate the variety of environment(benthic algae(Wu,1998,2000,Chen,2000, Yang, 2001,Chen,2002),fish(Lee,2003, Zheng,1996), aquatic insect(Pan,2002, Chang, ,1998, Kuo,2001,Zheng,1996).)

The objective of this study is to investigate the species composition and distribution of the aquatic insects, to monitor the change of community structure of aquatic insects in the past and to establish the bio-indicator system for the Zhong-Kang River(Tang & Lee,2002.) Therefor how to practicable and develop domestic ecological engineering examine or evaluate still have a remarkable long time to go.

Sample location and environment

The Zhong-Kang River Basin

The Zhong-Kang river is located at middle north of Taiwan. Zhong-Kang River begin from Center Mountain and down to the sea at Miao-Li. The total distance is 54.14 km.

Sample Selected

There are 5 different environmental zones from upstream to downstream and 12 sampling area selected, Shown as Table 1.

Table 1—Each sample name and GPS location at Zhong-Kang river

The zone of river	Sampling name	Code name	Latitude	Longitude
Upstream	Dong-He	DH	24°35.969’	121°02.013’
	Dong-Jiang	DJ	24°36.36’	121°01.10’
	Tian-Mei	TM	24°36.999’	121°01.10
	Uong-Sing	US	24°37.18’	120°97.43’
Influent	He-Bei	HB	24°43.78’	121°06.22’
	O-Mei	OM	24°40.233’	120°58.361’
Midstream	San-Wan	SW	24°39.715’	120°57.628’
	Nei-Wan	NW	24°40.65’	121°56.79’
Downstream	Ping-An	PA	24°40.284’	120°56.683’
	Dong-Sing	DS	24°40.751’	120°54.446’
Estuary	Zhong-Kang	ZK	24°40.286’	120°53.202’
	Wu-Fu	WF	24°39.838’	120°51.336’

Research Method

Sampling

- Using GPS record and make sure the sampling area locate.
- **Water sampling**

  Survey water temperature, transparency , pH, conductivity , salinity directly in stream.

  Collect 2 bottles of 1000 ML stream water. After taking the sampling. Put it in 4 ºC condition or lower Temperature to preserve ,in order to analysis nitrate([NO_3]),Phosphate([PO_4]) and Ammonia ([NH_3]) concentration by the Color meter in 24 hours.

  Collect 1 bottle of 100 ML water .Fixed of Dissolved Oxygen (DO) then make sampling Analysis.
- **Aquatic insects sampling**

  Using the totality of 12 times one year collection as a criteria at Surber collections for sampling aquatic insects in Zhong-Kang River.

  Collect 1 bottle of 100 ML water .Fixed of aquatic insects.

  Microscope survey

Water Analysis

Field survey
Water survey-including water temperature, transparency, pH, conductivity.(Lamotte-DHA3000,CDS5000)

Water sampling analysis
Water sampling analysis-including dissolved oxygen (DO), conductivity,. Nitrate concentration([NO_3]),
ammonium concentration ([NH_3]) , phosphate concentration ([PO_4]), salinity.
(Table.2)

Table 2 Water Quality Analysis Method

Item	Method of assay
Dissolved Oxygen (DO)	Iodine of fix amount
Nitrate ($[NO_3]$)	Cadmium fixed analysis
Phosphate. ($[PO_4]$)	Mobile to empty analysis - colorimetry
Ammonia($[NH_3]$)	Nessler colorimetry

Microscope survey

Record sampling correlated data-such as plankton sample depth and surrounding change from typhoons or other.
Examining all samples in a month

Organism identification.

Using dissecting microscope 10*4(Nikon Explore) to identification organism.
Identify aquatic insects orders classified in Zhong-Kang river.(introduction to the ecology of aquatic insects,1992, aquatic biology,1998)

Result

Water quality

D.O.

The DO value of upstream(DH、DJ、TM)is obvious higher than downstream(PA、DS、ZK), shown as Fig.1.

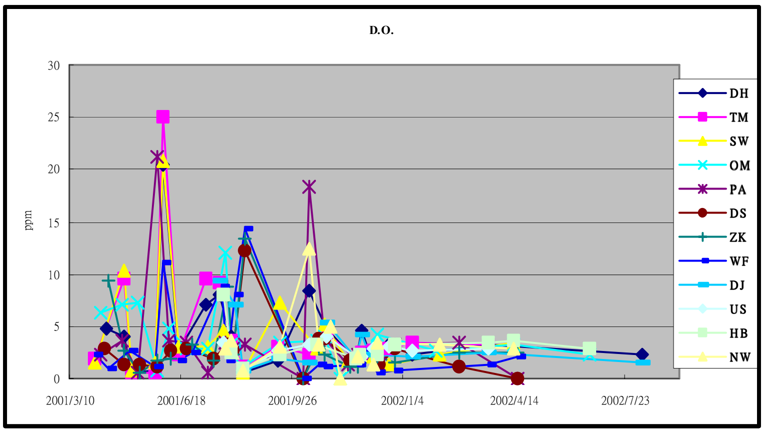

Fig.1.The season change of DO value at sites.

Nitrate Concentration (NO_3)

The Nitrate Concentration diagram shown as Fig.2 . The Nitrate Concentration value of downstream is higher than the others. First, NO_3 on upstream is under 1ppm and show a steady condition. Second,the value of NO_3 of downstream 0.76 is tripled to the others.

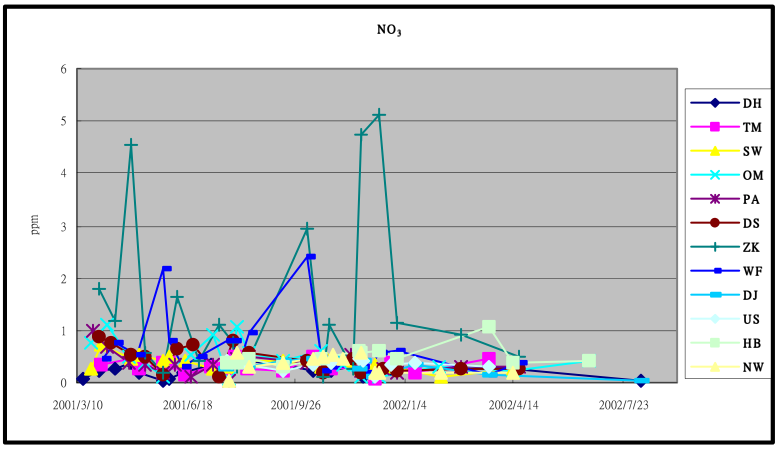

Fig.2. The season change of Nitrate Concentration at sites.

Phosphate Concentration (PO_4)

The PO_4 value of downstream is higher obviously, shown as Fig.3.

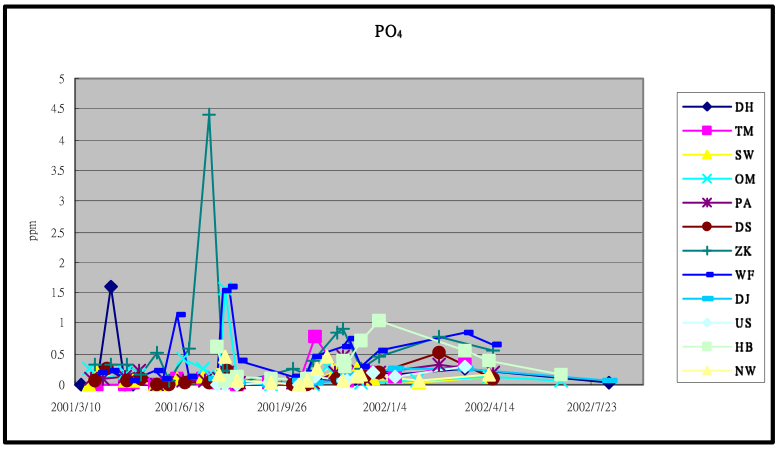

Fig.3.The season change of PO_4 value at sites.

Ammonium Concentration (NH_3)

The NH_3 value of downstream is higher obviously, shown as Fig.4.

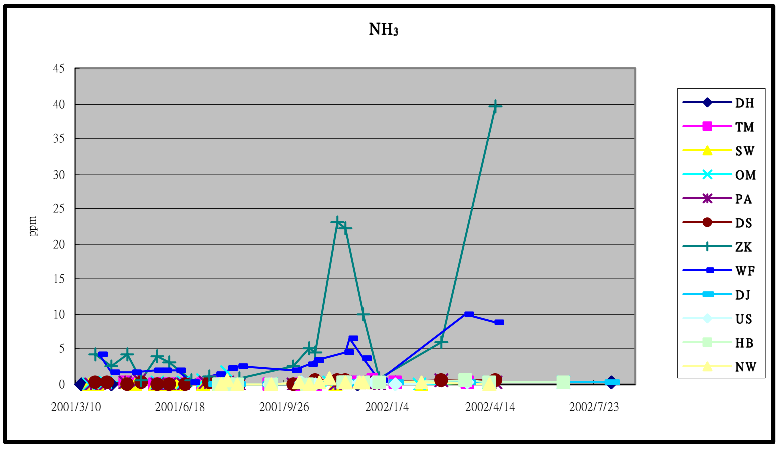

Fig.4. The season change of NH_3value at sites.

Water Conductivity

The value of water conductivity of downstream is higher obviously, shown as Fig.5.

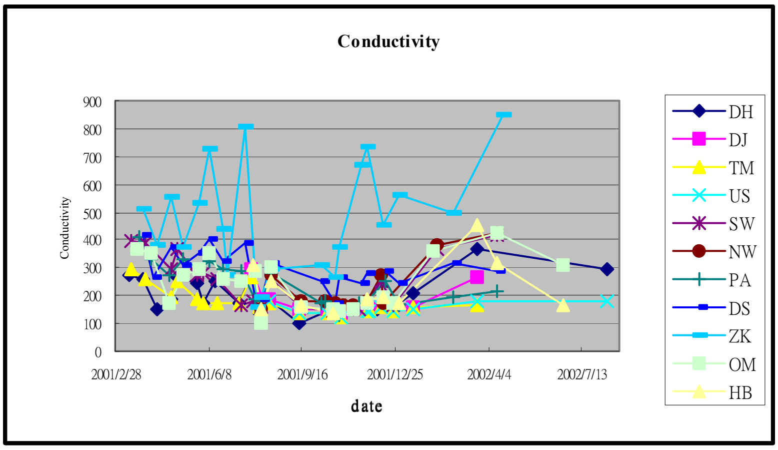

Fig.5.The season change of water conductivity at sites.

Water Temperature

Water temperature is between 14□(low water/December) to 29.8□(full water/June). The result shows temperature in a year on upstream is lower than on downstream, shown as fig.6.

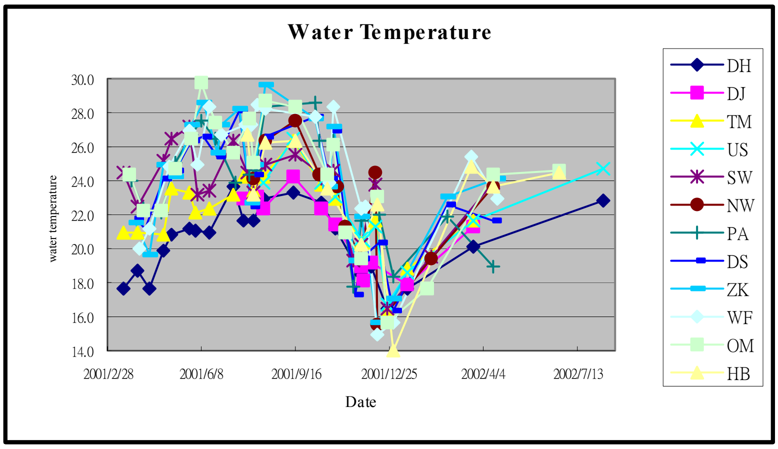

Fig.6 The seasons change of water temperature at sites.

Water pH

The conclusion was shown as fig.7. First, water pH of upstream is higher than downstream. Second, water pH nearby downstream is tendency to 7.

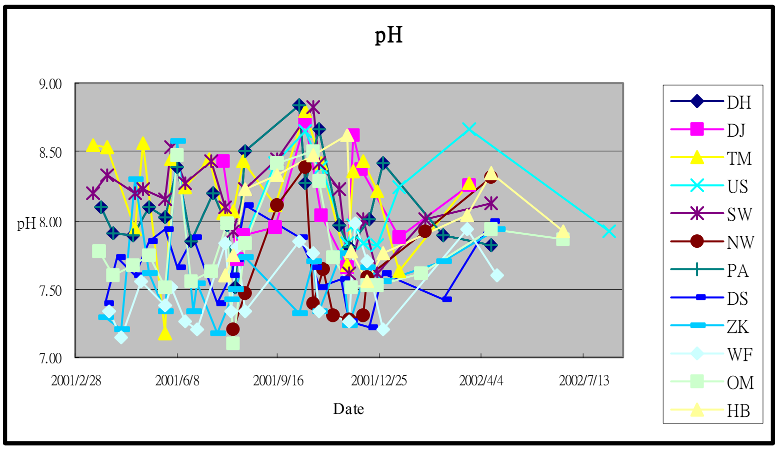

Fig.7 The season change of water pH at sites.

Aquatic insects

Chiroromus sp

The result was shown as fig.8. ***Chiroromus sp*** distributed random from March 2001 to August 2002. The amount of ***Chiroromus*** was increasing in August at downriver.

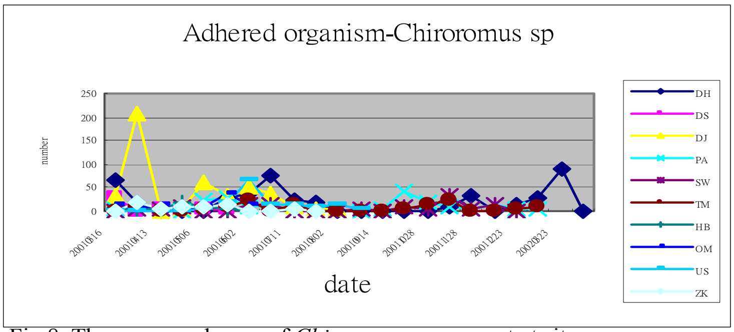

Fig.8. The seasons change of *Chiroromus sp* amount at site.

Tricoptera

The amount of ***Tricoptera*** was high on upstream and midstream. Although ***Tricoptera*** lives in clean water, it appears on downstream as PA, shown as fig.9.

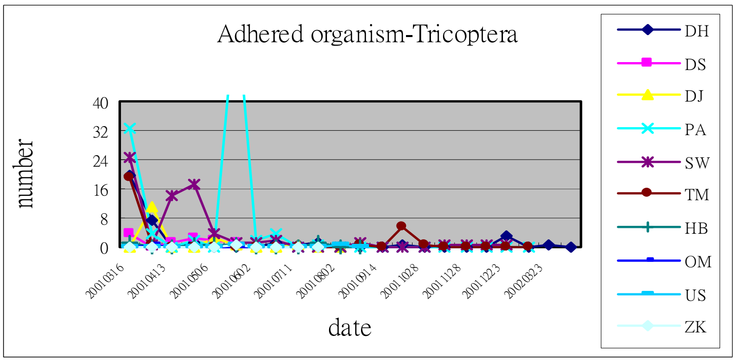

Fig.9. The seasons change of *Tricoptera* amount at site.

Ephemeridae

The amount of ***Ephemeridae*** was high on upstream and midstream, shown as fig.10.

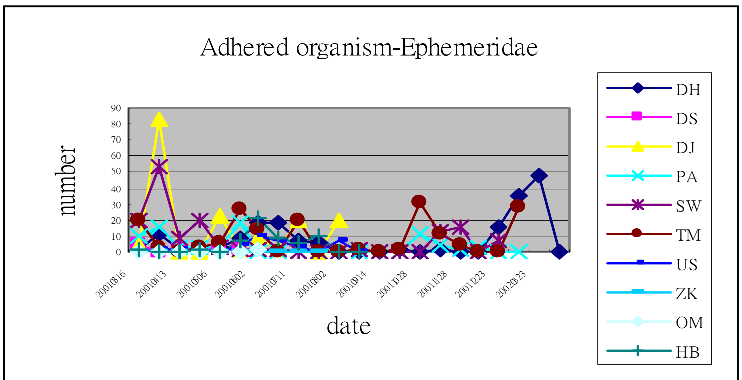

Fig.10. The seasons change of *Ephemeridae* amount at site.

Tubifex

The result was shown as fig.11. The ***Tubifex*** amount of downstream is higher than other sites.

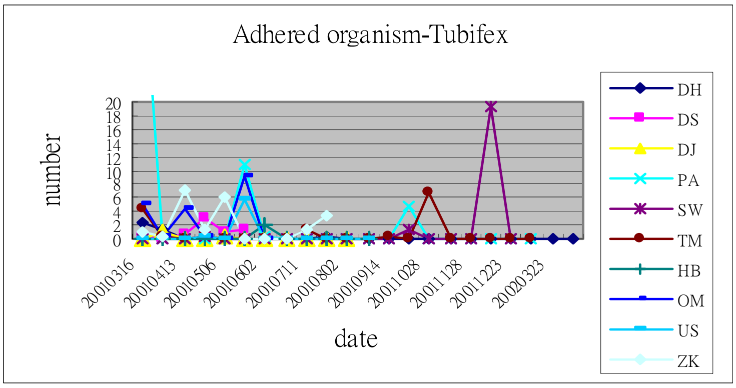

Fig.11. The season change of *Tubifex* amount at site.

Daphnia

Daphnia appear to the site with rich organic matter or static water. From the diagram 12 and 13, we can observe Daphnia appear midstream under the reservoir.

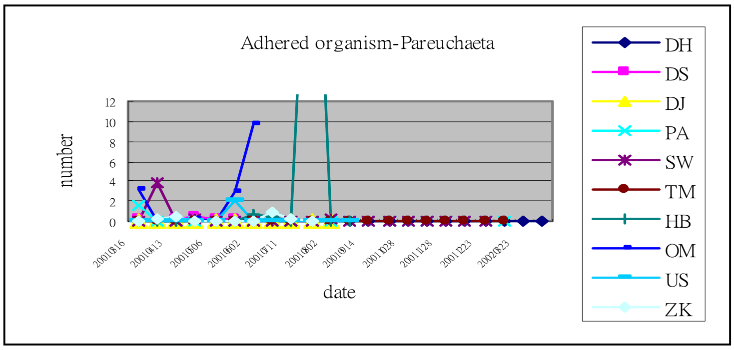

Fig.12. The season change of *Pareuchaeta* amount at site.

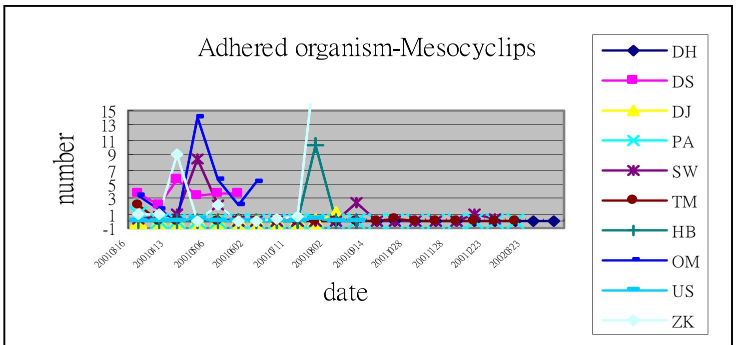

Fig.13. The seasons change of *Mesocyclips* amount at site.

Conclusion

Finding out the organism on upriver is less than on downriver and infer maybe velocity. From this study, we find seasons are influential to organism. As temperature rose and tourists came, ***Chiroromus*** not only reveal on polluted site or nearby downstream but distribute widely. Therefore, ***Chiroromus*** is not absolute polluted index. Another index species ***Tubifex*** is obvious seen on grave polluted area such as downstream with highly population density and developing industry.

The PO_4 value of downstream is obviously higher. It is due to substance deposit and industrial chemical fertilizer or home liquid waste drainage run to river.

DO on upriver is higher than on downriver. The conclusion shown high conductivity on downstream and it might be influenced by tide.

In July、August 2001 when typhoons came, water pH has drop down rapidly and restored at September.

The ***Chiroromus*** amount was increasing in August 2001 this might be influenced by the increasing amount of tourists.

Further research

Monitoring river organism can reflect not only the water quality directly, but the changing of water environment more then River Pollution Index (RPI). To ecological engineering, monitoring river organism is unexpendable . Thus, this study needs longer monitoring to provide complete data.

If we can combine assistance with local groups and nearby schools for long term monitor for long-term, it well be the best way to practice local teaching and environmental education.

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