Advisory Council on the Environment
Nature Conservation Subcommittee

Restoration of Tung Chung Stream

Purpose

This paper reports the findings of the monitoring programme on ecological recovery of Tung Chung Stream.

Background

2.   Tung Chung Stream is about three kilometres long. A section of about 330 metres at the lower course of the stream was found damaged by unauthorised works in late 2003. The streambed was excavated and boulders and pebbles on the streambed were removed and stockpiled along the stream bank.   An access road along the stream bank and several temporary dams were formed. There were also earth filling activities reducing the stream width to 2-3 metres. The stream flow was impeded and the remaining flow was filled with sediments.   It was considered that the stream section and riparian habitats were damaged severely.   The incidence was reported to the Advisory Council on the Environment (ACE) in December 2003 (ACE Paper 37/2003).

Reinstatement works

3.   The Tung Chung Rural Committee admitted responsibility for the unauthorised works and undertook to reinstate the damaged section of the stream.   An inter-departmental Task Force was set up to examine the reinstatement plan and to oversee the subsequent implementation of the reinstatement works. A Specialist Group, comprising members of the ACE, green groups and interested parties, was convened by the Environment, Transport and Works Bureau to advise the Task Force on the reinstatement plan. The main objective of the reinstatement works was to restore the natural setting of the damaged section of the stream including the width, depth, topography, substrates and riparian habitats so as to promote natural recovery of the aquatic communities.   The reinstatement works commenced in mid February 2004 and

was completed in mid-April 2004.

Monitoring of Ecological Restoration

4.　　Following completion of the reinstatement works, the Agriculture, Fisheries and Conservation Department (AFCD) initiated a two-year ecological monitoring programme to monitor the progress of ecological recovery of the stream.　The monitoring programme covered physical characteristics, water quality, vegetation, aquatic macro-invertebrates and freshwater fish of the stream.　To set a benchmark to measure the progress of ecological recovery, an undisturbed natural section of the stream immediately upstream of the reinstated section was selected as a reference site.　Samplings were carried out concurrently at both the reinstated section and the reference section at three-month intervals.

Monitoring Methodology

Physical and chemical parameters

5.　　Physical and chemical parameters were measured to study the seasonal and spatial variations between the reference section and the reinstated section of the stream.　In each section, the key water quality parameters including water temperature, salinity, pH, dissolved oxygen, conductivity, total dissolved solid and several nutrient parameters were measured.　The technique of fixed point photography at several stations was employed to monitor the overall changes in physical setting.

Riparian vegetation

6.　　Plant communities along the reinstated bank were surveyed by walking transect method to investigate the natural colonization process at the riparian zone.　The plant species present at the undisturbed bank were also surveyed as reference of the original vegetation cover.

Freshwater fish community

7.　　The freshwater fish communities in the reinstated and reference sections were surveyed by bankside counting, hand netting and pot trapping.　Bankside counting was generally used if the site condition allowed.　Surveys were carried out at representative parts including pools and riffles at both reinstated

and reference sections.   All fish species collected from the trapping and netting were identified and enumerated on-site and were then released afterward.

Macro-invertebrate community

8.   The macro-invertebrate communities in the reinstated and reference sections were surveyed by kick-sampling method.   Macro-invertebrate samples were preserved and brought back to laboratory for identification and enumeration.

Monitoring Results

9.   All the physico-chemical parameters between the reinstated and reference sections were more or less the same since the commencement the monitoring programme.   Such results indicated the water quality of the reinstated section have been restored soon after the reinstatement works.   While the reinstated stream bank was dominated by herbaceous species over the monitoring period, more native tree species, such as *Cleistocalyx operculatus*, have been found colonising naturally along the reinstated stream bank at the end of the monitoring period.

10.   Bray-Curtis Similarity Index[Note 1] calculated for the species composition of freshwater fish between the reinstated and reference stream sections gradually increased since the reinstatement of the stream and reached the maximum in October 2004 (**Figure 1**).   Such result indicated that the destructed fish communities were largely restored six months after the reinstatement works.   The variations of the Index in the later part of the monitoring programme might be attributed to natural variation and inherent difference in fish species compositions between sites.   Similar trend for macro-invertebrates was observed.

11.   The cumulative numbers of freshwater fish species recorded at the reinstated and reference sections across time were given in **figure 2**.   The cumulative number of freshwater fish species of the reinstated section was initially less than that of the reference section but caught up later from October

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[Note 1] Bray Curtis Similarity Index is a measure of the similarity in two biological communities based on species composition and abundance. It is a coefficient calculated for multivariate analysis on difference in community structure. The Index takes value 100 when two communities are identical and takes value 0 when the communities have no species in common at all.

2004 onwards. This finding echoed the results of the Similarity Index analysis that the damaged fish communities have been largely restored six months after the reinstatement.

12.   The satisfactory progress of ecological recovery of Tung Chung Stream section was further supported by the presence of the fish species of conservation interest, *Acrosscheilus beijiangensis*. The species was found in the reinstated section throughout the monitoring period which implied that the fish species had recolonised the reinstated stream section.

13.   The availability of upstream source of drift was believed to the major factor for ecological recovery of Tung Chung Stream within a relatively short period of time. The upstream of the reinstated section was undisturbed with unpolluted water source from upper catchment. The drift provided the major source of organisms including fishes and macro-invertebrates for re-colonisation at the reinstated section which was indicated by the high similarity in species composition between the reinstated and reference section. In addition, the original boulders and pebbles that were returned to the streambed during the reinstatement works provided suitable substratum for the re-colonisation. The riparian vegetation of the undisturbed bank also provided suitable habitats for various organisms (e.g. dragonflies and damselflies) to breed along the reinstated section stream as aerial source for recolonisation.

14.   A series of photographs of the reinstated section of the stream showing the progress of restoration is given in **figure 3** and a photo of the undisturbed reference site is given in **figure 4** for reference*.*

Advice Sought

15.   Based on the findings of the monitoring programme described above, the ecological recovery of Tung Chung Stream is considered successful. The reinstated section has largely recovered and no further enhancement works are required. Members are invited to note the findings of the ecological monitoring programme.

Agriculture, Fisheries and Conservation Department
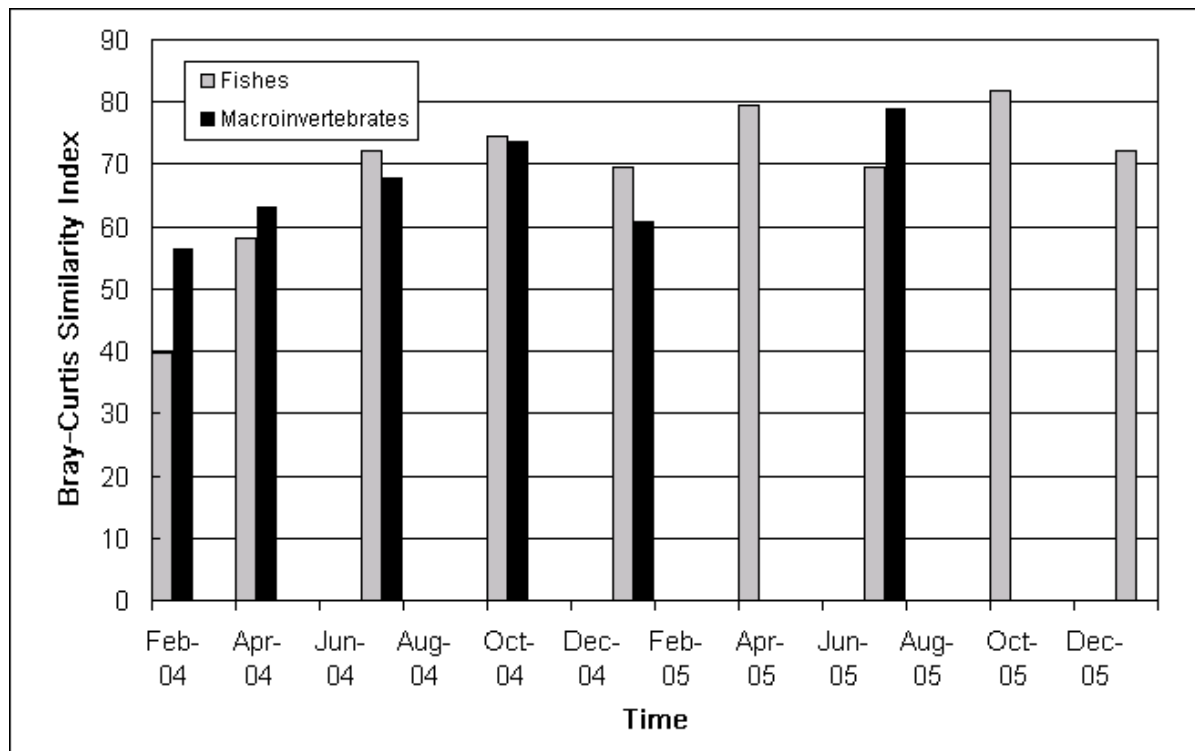**June 2006**

Figure 1: Degree of similarity of species composition of freshwater fish and macro-invertebrates between reinstated and reference sections of Tung Chung Stream at different times of monitoring from February 2004 to January 2006.
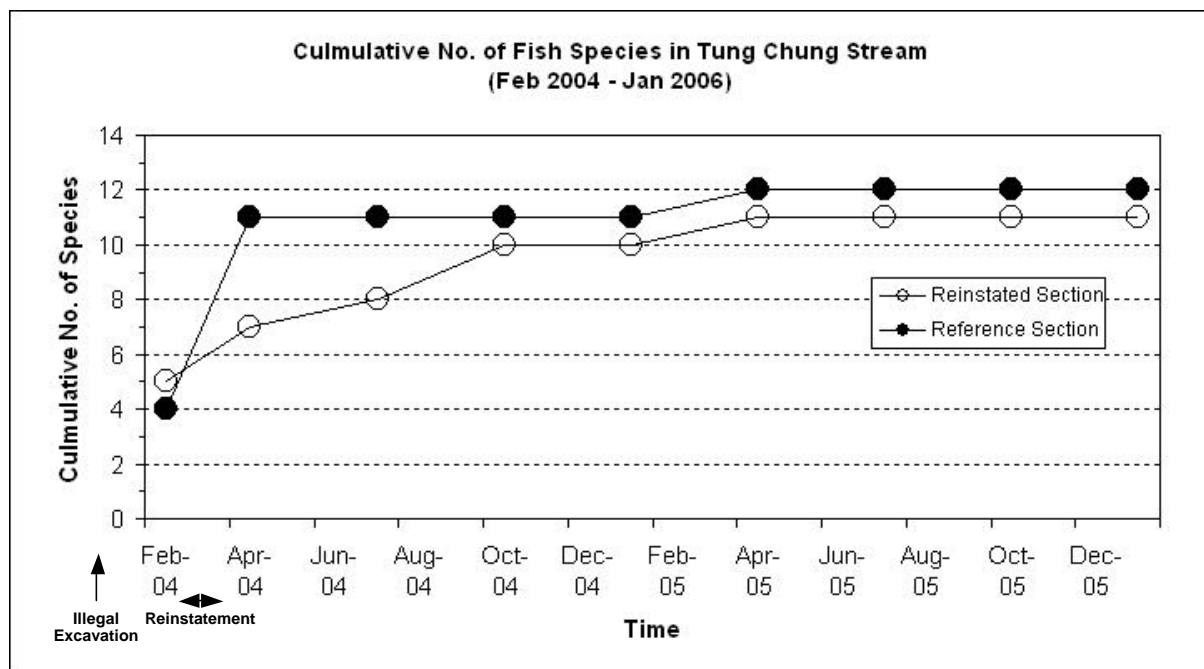

Figure 2: Cumulative number of species of freshwater fish in the reinstated and reference sections of Tung Chung Stream from February 2004 to January 2006.

Figure 3(a): The damaged section of Tung Chung Stream (photo taken on 7 Nov 2003)

Figure 3(b): After reinstatement (photo taken on 30 April 2004)

Figure 3(c): After heavy rainstorm (photo taken on 21 May 2004)

Figure 3(d): The recent situation of the reinstated section (photo taken on 21 April 2006)

Figure 4: The undisturbed reference section of Tung Chung Stream