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# HEAVY METAL POLLUTION OF TA-TU RIVER

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## ABSTRACT

**I. H. Chung and S. S. Jeng** (1974). *Heavy metal pollution of Ta-Tu River*, Bull. Inst. Zool., Academia Sinica 13(2): 69-73. Fishes and shellfishes of 17 species from Ta-Tu River were analyzed for concentrations of mercury, cadmium, copper, nickel, lead and zinc. Because the mercury concentrations in the shrimp and fishes caught down from Ta-Tu bridge were higher than those caught from upstream, it was concluded that the river was polluted by mercury down from the bridge.

Ta-Tu River divides Taichung and Changhua prefectures in central Taiwan, crossing the western plain to enter the Taiwan Straits. Several chemical and paper companies discharge their wastes into the river, make water of the river dark brown and malodorous as well. In some parts of the river there are still live fish, but the numbers are limited and the size small. Although of little food value, these fishes are good indicators of the biological effects of industrial wastes and of the degree of contamination by heavy metals. This paper reports on the heavy metal contents of the fishes caught in Ta-Tu River from the rivermouth and upstream over a distance of about 18 km.

## MATERIALS AND METHODS

Fishes and shellfishes of 17 species were collected from 5 stations along Ta-Tu River in March and April, 1974. The locations of the stations and the names of the fishes are shown in Fig. 1 and Table 1, respectively. Individuals of the same species of fish or shellfish caught in one station were grouped and treated as one sample.

Mercury, cadmium, copper, nickel, lead and zinc concentrations in whole body, muscle or viscera of the fishes were measured with atomic absorption spectrophotometry following methods reported by Jeng and Huang[1].

## RESULTS AND DISCUSSION

The Cd, Cu, Ni, Pb, Zn and Hg concentrations in fishes and shellfish caught in the Ta-Tu. River are shown in Table 1 and 2, respectively The conclusion is that the river is polluted by mercury down from Ta-Tu bridge. This fact could be demonstrated by the mercury content in the shrimp and fishes caught at the different stations as shown in Table 2. The mercury concentration of the shrimp caught upstream at station 5 was 0.09 ppm, whereas those caught from stations 4, 3 and 2 were 0.3, 0.2 and 0.5 ppm, respectively. Shrimp which move within a very limited distance may provide the best indication of local contamination of the water. The same trend of higher mercury con-

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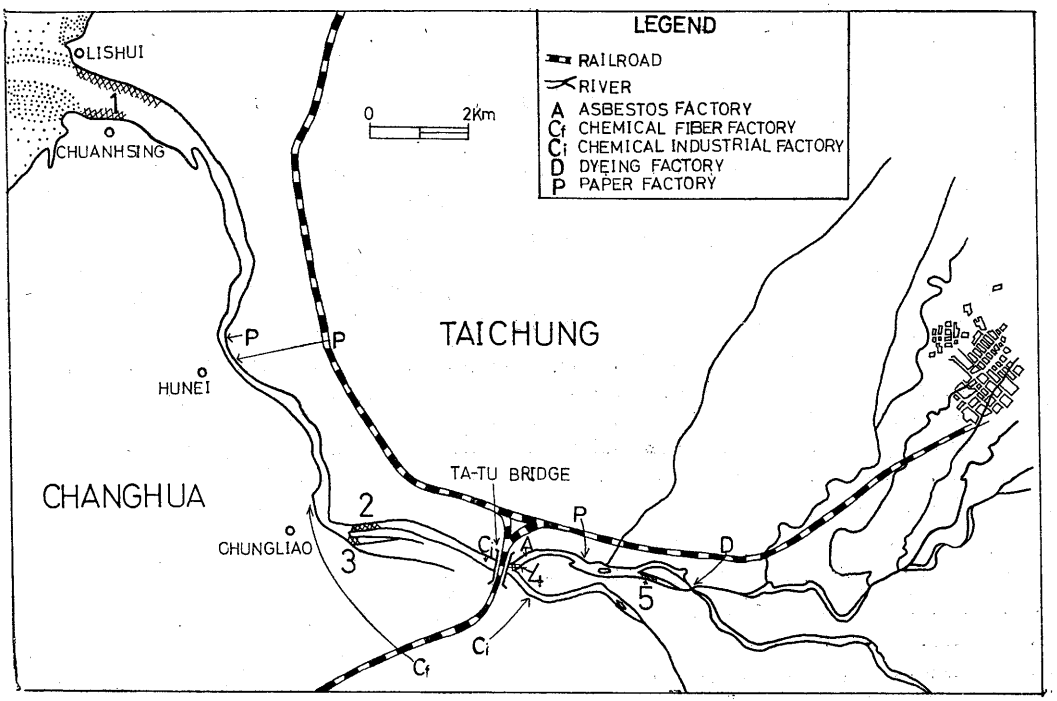


Fig. 1. Map of Ta-Tu River showing sampling stations.

centration in most of the fishes caught downstream could also be seen in Table 2. Hence, it was concluded that the origin of mercury pollutant was located near Ta-Tu bridge. Of stations 4, 3 and 2, the appearance of water at station 3 was clearer than that at stations 2 and 4, and the fishes caught at station 3 had lower concentration of mercury. This is easily explained by that station 3 is on a tributary of the river, thus receiving less pollutants.

Table 1 indicates that the Cu, Ni, Cd, Pb and Zn concentrations in the fishes caught from Ta-Tu River were not higher than those of Taiwan's cultured fishes[1], and there seems no significant differences among the different stations. Hence, it is considered that the river may not polluted by the heavy metals, Cu, Ni, Cd, Pb and Zn.

Attempts to catch fish from station 2 down to the estuary (Chungliao to Lishui, Fig. 1) were not successful, except several gobies and crab caught near the seashore. According to the local people, this river used to be full of fishes six or seven years ago. Which industries are responsible for the discharge of mercury and elimination of fishes will be determined by the water quality data of this river to be studied in a subsequent investigation. Because the contents of the mercury in the fishes are not higher than the permitted levels set by many countries[1] and hardly anyone catches fish from the river for food, there is no immediate hazard to health. However, measures must be taken before pollution worsens and damages aquatic lifes.

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TABLE 1

Heavy metal contents of fishes and shellfishes caught in Ta-Tu River.

| Station[a] | Sample | Mean total length (cm) | Mean body weight (g) | Part[b] used | (μg/g wet tissue) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Cd | Cu | Ni | Pb | Zn |
| 1 | a. *Periophthalmus cantonensis* (Osbeck) (4) 彈塗魚 | 5.9 | 1.5 | W | 0.2 | 1.4 | 0.7 | 0.4 | 38.9 |
| | b. *Helice latimera* Parisi 蟹 (5) | — | 9.5 | S | 0.05 | 15.7 | 0.3 | 0.5 | 33.3 |
| 2 | a. *Misgurnus anguillicaudatus* (Cantor) 土鰍 (1) | 10.2 | 5.2 | W | <0.2 | 1.8 | 0.8 | 0.2 | 21.9 |
| | b. *Mylopharyngodon aethiop* (Basilwsky) 青魚 (4) | 6.1 | 2.1 | W | <0.1 | 0.1 | 0.6 | <0.3 | 53.0 |
| | c. *Oxyurichthys microlepis* (Bleeker) 鬚鴿鯊 (2) | 4.8 | 0.9 | W | <0.7 | 0.3 | <2.7 | 0.1 | 23.6 |
| | d. *Cobitis taenia* (Linnaeus) 沙鰍 (4) | 7.6 | 2.5 | W | <0.1 | 1.7 | <0.6 | 0.2 | 81.9 |
| | e. *Rhodeus spinalis* Oshima 鱊 (4) | 3.5 | 0.6 | W | <0.3 | 0.2 | <1.3 | <0.7 | 34.0 |
| | f. *Tilapia mossambica* Peteres 吳郭魚 (1) | 6.2 | 3.1 | W | <0.4 | 3.0 | <1.4 | 0.2 | 26.6 |
| | g. *Parasilurus asotus* (Linnaeus) 鮎魚 (1) | 21.7 | 53.6 | M<br>V | <0.1<br><0.3 | 0.1<br>0.1 | <0.4<br><1.3 | <0.2<br>0.6 | 10.2<br>12.4 |
| | h. *Macrobrachium asperulum* (Cantor) 蝦 (3) | — | 7.4 | S | <0.2 | 2.5 | <0.6 | <0.3 | 22.5 |
| 3 | a. *Misgurnus anguillicaudatus* (Cantor) 土鰍 (1) | 16.1 | 27.3 | M<br>V | <0.1<br><0.3 | 1.4<br>0.4 | <0.6<br><1.3 | 0.1<br>0.2 | 20.4<br>28.9 |
| | b. *Mylopharyngodon aethiop* (Basilwsky) 青魚 (6) | 5.9 | 1.9 | W | <0.1 | 0.3 | <0.5 | 0.4 | 72.1 |
| | c. *Oxyurichthys microlepis* (Bleeker) 鬚鴿鯊 (18) | 4.8 | 1.9 | W | <0.1 | 0.2 | <0.6 | 0.2 | 23.8 |
| | d. *Rhodeus spinalis* Oshima 鱊 (5) | 4.2 | 0.6 | W | <0.2 | 0.4 | <1.4 | 1.0 | 45.1 |
| | e. *Carassius carassius* (Linnaeus) 鯽魚 (2) | 13.3 | 38.7 | M<br>V | <0.1<br><0.2 | 0.2<br>0.3 | <0.5<br><0.9 | 0.4<br>0.7 | 13.7<br>76.4 |
| | f. *Macrobrachium asperulum* (Fabricius) 蝦 (4) | — | 1.1 | S | <0.7 | 1.4 | 2.8 | <1.4 | 11.1 |
| 4 | a. *Misgurnus anguillicaudatus* (Cantor) 土鰍 (2) | 13.2 | 14.1 | M<br>V | <0.03<br><0.6 | 0.7<br>0.9 | <0.2<br><2.2 | 0.4<br>3.0 | 24.0<br>39.3 |
| | b. *Mylopharyngodon aethiop* (Basilwsky) 青魚 (2) | 5.9 | 1.6 | W | <0.5 | 0.9 | <0.5 | <1.8 | 47.8 |

(*continued*)

TABLE 1

Heavy metal contents of fishes and shellfishes caught in Ta-Tu River—(*Continued*).

| Station[a] | Sample | Mean total length (cm) | Mean body weight (g) | Part[b] used | (μg/g wet tissue) Cd | Cu | Ni | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|
| 4 | c. *Oxyurichthys microlepis* (Bleeker) (1)[c] 鬚鴿鯊 | 6.1 | 2.1 | W | <0.7 | 4.8 | <2.7 | 1.5 | 20.2 |
| | d. *Cobitis taenia* (Linnaeus) 沙鰍 (4) | 6.3 | 1.2 | W | <0.3 | 2.9 | <1.2 | 0.6 | 53.0 |
| | e. *Pseudogobio brevirostris* Günther (1) 短吻鐮柄魚 | 5.1 | 1.1 | W | <0.2 | <1.6 | 1.6 | 5.7 | 87.5 |
| | f. *Gambusia patruelis* (Baird & Girard) 大肚魚 (1) | 4.1 | 0.8 | W | <1.4 | 5.6 | <5.6 | 2.8 | 44.4 |
| | g. *Macrobrachium asperulum* (Fabricius) 蝦 (10) | — | 4.6 | S | <0.03 | 6.5 | <0.2 | 1.1 | 17.8 |
| 5 | a. *Misgurnus anguillicaudatus* (Cantor) 土鰍 (1) | 10.9 | 7.9 | W | <0.02 | 0.1 | <0.2 | <0.1 | 26.7 |
| | b. *Mylopharyngodon aethiop* (Basilwsky) 青魚 (1) | 8.2 | 3.8 | W | <0.03 | 1.7 | 1.1 | 0.4 | 81.2 |
| | c. *Cobitis taenia* (Linnaeus) 沙鰍 (1) | 5.6 | 0.9 | W | <0.1 | 0.9 | 4.0 | 1.3 | 55.3 |
| | d. *Tilapia mossambia* Peteres 吳郭魚 (1) | 11.4 | 33.7 | M<br>V | <0.03<br>0.5 | 0.6<br>1.8 | <0.3<br>1.7 | <0.1<br><0.1 | 24.4<br>20.4 |
| | e. *Parasilurus asotus* (Linnaeus) 鮎魚 (1) | 6.5 | 1.7 | W | <0.06 | 1.4 | 1.7 | <0.4 | 45.1 |
| | f. *Pseudogobio brevirostris* Günther (23) 短吻鐮柄魚 | 6.7 | 3.0 | W | <0.03 | 0.1 | 0.3 | <0.1 | 70.7 |
| | g. *Rhinogobius similis* (Gill) 川鰕虎 (11) | 4.8 | 1.4 | W | <0.02 | 0.5 | 0.3 | <0.1 | 36.7 |
| | h. *Zacco patatypus* (Temminck & Schlegel) 平鼬鱲 (15) | 8.4 | 6.4 | M<br>V | <0.02<br><0.02 | 0.1<br>1.1 | <0.3<br>0.9 | <0.1<br><0.1 | 36.8<br>39.3 |
| | i. *Gobiobatia pappenheimi* Krekenberg (10) | 6.5 | 2.2 | W | <0.02 | 0.1 | 0.2 | <0.1 | 57.9 |
| | j. *Macrobrachium asperulum* (Fabricius) 蝦 (9) | — | 4.7 | S | 0.02 | 5.1 | <0.2 | 0.1 | 11.3 |

a. See Fig. 1 for sampling stations.
b. W: whole body, S: shelled, M: muscle, V: viscera.
c. Number of individuals per sample.

TABLE 2

Mercury concentration of shrimp and fishes caught in Ta-Tu River.

| Sample | Station | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| a. *Macrobrachium asperulum* (Fabricius) 蝦 | — | S 0.5 | S 0.2 | S 0.3 | S 0.09 |
| b. *Pseudogobio brevirostris* Günther 短吻鎌柄魚 | — | — | — | W 1.0 | W 0.01 |
| c. *Parasilurus asotus* (Linnaeus) 鮎魚 | — | V 0.7 | — | — | W 0.2 |
| d. *Tilapia mossambica* Peters 吳郭魚 | — | W 0.2 | — | — | M 0.07<br>V 0.1 |
| e. *Rhodeus spinalis* Oshima 鱊 | — | W 0.4 | W 0.02 | — | — |
| f. *Cobitis taenia* (Linnaeus) 沙鰍 | — | W 0.5 | — | W 0.5 | W<0.09 |
| g. *Oxyurichthys microlepis* (Bleeker) 鬚鴿鯊 | — | W 0.2 | W 0.1 | W 0.4 | — |
| h. *Mylopharyngodon aethiop* (Basilwsky) 青魚 | — | W 0.3 | W 0.08 | W 0.3 | W 0.3 |
| i. *Misgurnus anguillicaudatus* (Cantor) 土鰍 | — | W 0.3 | M<0.1<br>V<0.3 | M 0.2<br>V 0.2 | M 0.2<br>V 0.3 |
| j. *Periophthalmus cantonensis* (Osbeck) 彈塗魚 | W 0.2 | — | — | — | — |
| k. *Helice latimera* Parisi 蟹 | S 0.1 | — | — | — | — |

W, M, V, S., See Table 1 for abbreviation.

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## REFERENCES

1. Jeng, S. S. and Y. W. Huang (1973). Heavy metal contents in Taiwan's cultured fish. *Bull. Inst. Zool., Academia Sinica*, **12**(2): 79–85.

# 大肚溪之重金屬污染

鍾以衡　鄭森雄

爲知臺灣河川受重金屬污染之情形，乃自大肚溪採集魚貝類 17 種，分析其中之鎘、銅、鉛、汞、錳及鋅之含量。由實驗得知採自中下游魚、蝦體內之汞含量高於上游。由此推知，大肚溪之水質自大肚橋以下已受到汞之污染。