

A SURVEY OF FRESHWATER FISH FAUNA IN THE UPPER RIVERS OF CROCKER RANGE NATIONAL PARK SABAH, MALAYSIA

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ABSTRACT

The fish fauna distribution in six rivers in the Crocker Range National Park was examined. All the six rivers surveyed were generally shallow, fast flowing with clear water and rocky and sandy substrate. At the time of survey, all rivers gave excellent water quality data. A total of 17 fish species belonging to four families were sampled. The gastromyzontids represented the major species in all the rivers surveyed, comprising 59.5% of the total number of fish caught. Commercially valuable fish such as the Tor species was also found in the rivers studied.

INTRODUCTION

Sabah made up about one-tenth of Borneo's total land area, but more than one third of the freshwater fishes known from Borneo were also known to occur in Sabah (Nyanti 1995). The initial faunal survey carried out by Leon Vaillant (1983) and Weber and de Beaufort (1913-1922) resulted in the documentation of the majority of fish species found in Sabah. However, the most comprehensive survey of fish fauna in Sabah was undertaken by Inger and Chin in 1962. Their work included some of the secondary freshwater fish species as well as exotics. Other studies in Sabah included those of Maliau Basin (Marsh 1989), Tabin Wildlife Reserve (Taylor 1989), Kinabalu Park (Abdullah 1990), Tawau Hills Park (Nyanti et al. 1995) and Sayap-Kinabalu Park (Nyanti 1995). From these studies, more than 340 species of primary freshwater fish had been reported to occur in Borneo.

Although many surveys had been done on the Sabah freshwater fishes, none of these was carried out in the Crocker Range National Park, Sabah. Information on the number of fish species found in the upper river system of the Crocker Range National Park (CRNP) Sabah was scanty. More studies were required to provide detailed and specific information on the ecology, habitat utilisation and preference, the distribution and abundance of freshwater fish.

The Crocker Range National Park (139,919ha) in Sabah, Malaysia, stretched from south of Kundasang in the north, to Tenom in the south, approximately between latitudes 5° and 6° N and longitudes 115° and 119° E. To the east, the CRNP was bordered by the flood plain of the Pegalan/Padas river and to the west by the coastal plain of the west coast of Sabah. Results presented in this paper were obtained during the Crocker Range Expedition conducted in October 1999.

MATERIALS AND METHODS

Several collections of fishes were made at six selected river stations located on Sungai Mawau, Sungai Tandulu, Sungai Liawan, Sungai Senagang, Sungai Tikolod and Sungai Balayo (Figure 1). All the selected stations were located on the upper parts of the rivers, approximately 1000m above sea level in the Crocker Range National Park area. Selections of these stations were made based on the representation of overall habitat and accessibility during the study period. At each station, fish were collected using electro fishing device consisting of two copper electrodes on wooden handles, powered by a 500-watt portable AC generator. Fishes were then collected using dip nets or caught by hand. A cast net was also used at shallow pools of the river system. These devices were most suitable since all the stations were shallow, narrow and relatively fast flowing with rocky or pebble bottom.

River morphology and the characteristics of habitat chosen were recorded for all stations. General water conditions, several physicochemical parameters, the width of the river, and distance covered during sampling were also measured. Specimens were fixed in 10% formalin and later preserved in 70% ethanol. All specimens were deposited in the Museum of Ichthyology, Universiti Malaysia Sarawak. The fish were measured and identification follows those of Mohsin and Ambak (1983), Roberts (1989), Inger & Chin (1990) and Kottelat et al. (1994). Identification was to the lowest possible taxon.

RESULTS AND DISCUSSIONS

River characteristics

The characteristics and morphology of each station observed are described in Table 1. Generally, the rivers in the study areas were swift flowing. The water at all stations was clear with sandy, gravel and rocky bottom and the banks were lined by boulders and rocks. The shore vegetation consisted of primary forest. This appearance was typical of undisturbed forest stream at higher altitudes. However, local inhabitants reported that many of the fish habitats such as pools and deep areas were covered with sediments and rocks, due to the effects of the Greg storm in 1995. This happened to some rivers such as Sungai Tikolod and Sungai Liawan.

The physicochemical water parameters for the rivers surveyed were summarised in Table 2. The water temperature was generally cool, ranging from 18.3-26⁰C with a mean of 22.6⁰C for all the stations. It was probably because the study location was at a relatively higher altitude and enclosed by forest canopy in most part. Dissolved oxygen level of the water was high with a mean of 8.4 mg/l, indicating good aeration, which attributed to lower temperature and rapid flow rate. The mean pH of the rivers, ranged from 7.7 to 8.7 and the conductivity values were rather uniform. These conductivity values were similar to most unpolluted rivers found in Sabah (Lee et al. 1995).

Table 1: The characteristics of each station surveyed at the six rivers on the east side of Crocker Range Park.

Rivers	Depth (m)	Width (m)	Distance sampling (m)	Habitat description
Sg. Mawau (Station 1)	0.3-1.0	6-10	150	Fast flowing and clear water, Rocky and sandy bottom, river enclosed by forest canopy
Sg. Tandul (Station 2)	0.5-0.8	10-12	100	Fast flowing and clear water. Rocky bottom, covered by forest canopy.
Sg. Liawan (Station 2)	0.5-1.0	10-15	100	Fast flowing and clear water. Rocky and sandy bottom. Partially covered by forest canopy
Sg. Senagang (Station 4)	0.5-1.2	20-25	150	Fast flowing and clear water. Rocky and sandy bottom Partially covered by forest canopy and cocoa plantation
Sg. Tikolod (Station 5)	0.3-0.8	7-10	100	Fast flowing and clear water, with rocky, gravel and sandy bottom. Covered with forest canopy
Sg. Balayo (Station 6)	0.5-1.5	20-30	150	Fast flowing and slightly turbid water with rocky and sandy bottom. Enclosed by forest canopy.

Table 2. Mean of the some physico-chemical parameters of water measured in the Crocker Range Park rivers.

Rivers	Temperature (°C)	Dissolve oxygen (mg/l)	Conductivity (mS/cm)	pH	Turbidity (NTU)
Sg. Mawau	18.3	8.5	0.05	7.7	45.5
Sg. Tandulu	19.9	8.9	0.09	8.3	59.6
Sg. Liawan	26.0	8.3	0.12	8.3	38.9
Sg. Senagang	23.3	8.6	0.05	8.1	71.9
Sg. Tikoloid	21.2	8.3	0.12	8.0	44.2
Sg. Balayo	25.3	8.3	0.10	8.7	105.3

Fish fauna

A total of 17 species of fish belonging to nine genera and four families from the six rivers were collected (Table 3). Analyses based on the number of individuals caught, showed that 59.5% were represented by the family *Gastromyzontidae*, *Cyprinidae*, 37.7%, *Cobitidae*, 2% and *Sirosidae* 0.8% (Figure 2). *Protomyzon*, *Gastromyzon* and *Tor* species were the dominant genera of fish caught (Figure 3).

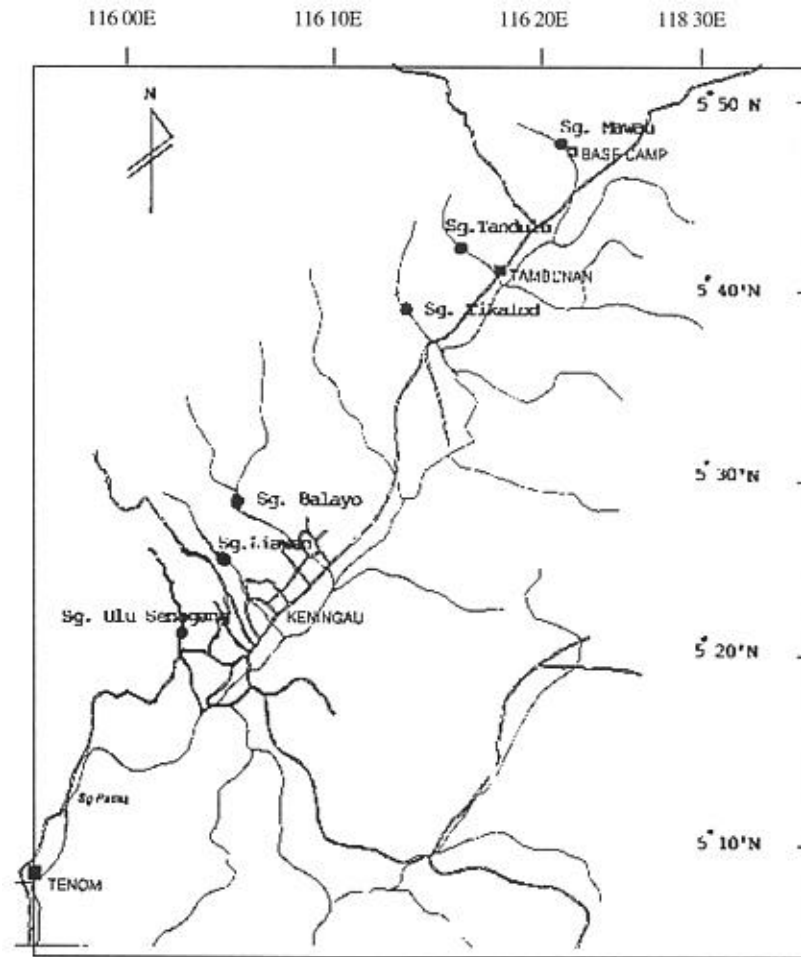


Figure 1. Fish fauna sampling stations at Crocker Range Park.

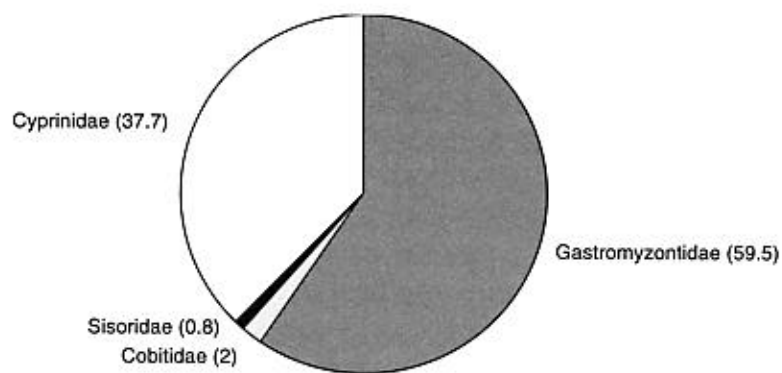


Figure 2. The percentage of fish family collected from the six rivers in Crocker Range Park.

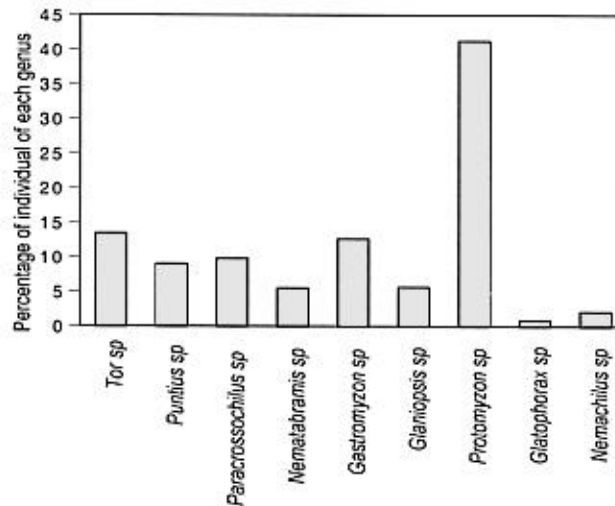


Figure 3. The percentage of individual fish per genus identified from the six rivers in Crocker Range Park.

The fish richness from the six rivers ranged from 7 to 14 species. However, the species collected at the study area was lower compared to other studies by Chin (1978), Taylor (1989), Abdullah (1990) in Sabah and Nyanti et al. (1998) in Bario, Sarawak. The relatively low number of fish species recorded at Crocker Range Park was probably due to altitude factors since the study sites were located 1000m above sea level. Similar observations were reported by Nyanti (1995) in *Sayap Kinabalu Park* and Nyanti et al (1995 in *Tawau Hills Park*. Wotton (1990) found that the species richness of fish assemblages tended to decline with depth or altitude. The large number of fish species recorded by Abdullah (1990) and Chin (1978) was probably due to their sampling stations located at lower altitude, below 600 m. Areas of lower elevation generally gave relatively higher number of species but the population size of each species might not be large (Nyanti 1995).

Due to the Greg Storm effect in 1995, many of the fish habitats in the rivers such as the pool and deeper water that existed earlier were lost and covered with sediments and rocks from the upper stream. Consequently, Sg. Liawan and Sungai Tikolod that were affected by this phenomenon contained less fish species diversity and had a smaller fish size compared with other unaffected rivers. For instance, *Tor* species caught in Sg. Tikolod and Sg. Liwan were smaller in size with an average weight of 30.3g compared to those caught in Sg. Mawau, with an average weight of 255g. According to the local people, before the Greg storm, bigger *Tor* species weighing more than 600g, could easily be caught in that area. Furthermore, it was reported that electric current and explosives had been used illegally in some rivers flowing through remote, logged-over forested areas. The use of illegal methods to catch fish was becoming a major factor contributing to the depletion of the freshwater fish resource here.

The distribution and composition of species in each habitat was closely related to various factors such as food availability, breeding sites, water current, depth, topography and water chemistry (Ali et al. 1988). General distribution of fish species collected from the six rivers at CRP was

shown in Table 3. Most of the rivers studied contained fishes that were anatomically well adapted to living in a fast flowing water environment. For instance, *Gastromyzon*, *Protomyzon* and *Nemachilus* species were aerodynamically shaped fish. Some of the fishes collected possessed a sucker structure under their body to keep them attached to the substrate in the boundary layer created by the water movement. Generally, *Gastromyzon*, *Nemachilus* *Nematabramis* species fed on algae growing on the rock as well as detritus and insects (Taylor 1989). Since the *Gastromyzon* species were dominantly found in the area isolated from anthropogenic disturbance, it was suggested that this species could be used as a bioindicator of water quality.

Table 3. The composition and distribution of fish fauna in Crocker Range Park.

Family/Species	River Station					
	S1	S2	S3	S4	S5	S6
CYPRINIDAE						
<i>Tor douronensis</i>	+	+	+	+	+	+
<i>Puntius sealei</i>	-	-	+	+	+	+
<i>Paracrossochilus acerus</i>	-	-	+	+	-	+
<i>Nematabrarnis everetti</i>	-	-	-	-	-	+
GASTROMYZONIDAE						
<i>Gastromyzon borneensis</i>	+	+	+	+	+	+
<i>G. monticola</i>	+	-	+	-	+	+
<i>G. lepodogaster</i>	+	+	-	+	-	-
<i>G. fasciatus</i>	+	-	+	+	+	+
<i>Glaniopsis hanitschi</i>	+	+	+	-	-	-
<i>G. denudata</i>	+	-	-	-	-	-
<i>G. gossei</i>	+	-	+	-	-	-
<i>Protomyzon whiteheadi</i>	+	+	+	-	-	+
<i>P. borneensis</i>	+	+	+	+	+	+
<i>P. aphelochilus</i>	+	+	+	+	+	-
<i>P. griswoldi</i>	+	-	+	+	-	+
SIROSIDAE						
<i>Glatophorax major</i>	-	-	-	+	-	+
COBITIDAE						
<i>Nechilus olivaceus</i>	-	+	-	-	-	-

S1: Sg. Mawau; S2: Sg. Tandulu; S3: Sg. Liawan; S4: Sg. Senagang; S5: Sg. Tikolod; S6: Sg. Balayo. (+) indicate presence and (-) indicate absence.

Although the freshwater habitat of Southeast Asia was dominated by cyprinid fish (Low-Mac Connell 1975, Ismail 1994), the fish compositions in the Crocker Range Park river systems were mainly dominated by Gastromyzontidae. This family was found in all the stations surveyed. Nyanti et al. (1995) reported that the gastromyzontids normally replaced the cyprinids at an altitude of more than 600m above sea level. The gastromyzontids were unique because some of them were considered endemic to Borneo, such as *Gastromyzon*, *Glaniopsis* and *Protomyzon* species (Inger and Chin 1990).

Tor douronensis was found in all sampling stations. Robert (1989), Inger and Chin (1990) found that about one-third of freshwater fishes in Western Borneo at lower altitudes in Sabah belonged to the family Cyprinidae. Although only a small number of fishes were caught, the presence of a large number of the *Tor* species in all rivers might indicate that the area could probably serve as a suitable habitat for this species. *Tor* species were generally observed to live in swift, clear and rocky bottom streams flowing in highland tropical forest. There appeared to be some interest in the communities living around the CRNP to culture this economically valuable fish along the river banks for food.

Some species notably the cyprinids might have the potential of being commercialised as ornamental fish. Species from the genus *Nematabramis* and *Puntius* were already being traded as ornamental fish (Taylor 1990). Generally, the fish fauna in the Crocker Range Park area was dominated by species that were anatomically adapted to live in fast flowing current with clear water and relatively higher dissolved oxygen concentration. Fishes living in fast flowing rivers tended to exhibit less variety because of the low variability of food supplies in such an environment. The variability of food in fast flowing streams were usually low because the fast turnover time of available food from the terrestrial inputs (Nyanti 1995). Constriction of the food web altered the quantity of some food and eliminated some specialised fishes (Watson and Balon 1984). However, Gastromyzontidae did not depend directly on the allocthonous input since this fish grazed on the algae growing on the rocks (Inger and Chin 1990; Nyanti et al. 1995). Thus, the surrounding undisturbed area of Crocker Range Park was vitally important for fish stock to maintain.

CONCLUSION

The surrounding undisturbed area of Crocker Range Park was vitally important in maintaining fish stock. The fishes of the Crocker Range Park in the upper rivers were dominated by the family Gastromyzontidae. These species have evolved a variety of mechanisms to adapt to living in swift flowing mountain rivers. The cyprinid fish such as *Tor* species, known as one of the commercially important fishes, were found in all the rivers studied. It was recommended that further studies should be done to develop techniques for culturing this exotic fish. The use of illegal methods to catch fish should be banned in the area to prevent further depletion of freshwater fish resources in the rivers and streams of the CRNP.

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