

## FISH FAUNA IN GUNUNG HALIMUN NATIONAL PARK AND THE ADJACENT AREA

Ike Rachmatika<sup>1,M</sup>, Djadja S Sjafei<sup>2)</sup>, W Nurcahyadi<sup>2)</sup>

<sup>0</sup> Division of Zoology, Research & Development Center for Biology, LIPI

<sup>2)</sup> Faculty of Fisheries and Marine Sciences, Bogor Agricultural University

### ABSTRACT

Gunung Halimun National Park is known to be the area of head waters of a number river systems originate. However, there has been no information on fishes diversity at this area. In this regard, a series of ichthyofauna study was conducted from 1996 to 2000. Thirty seven species belonging to 13 families and 26 genera have been found in the rivers and streams in Gunung Halimun National Park and its adjacent area. Gobiidae was dominant, comprising 13 species or 36,36 %, followed by Cyprinidae comprising 5 species or 16.13 %. These Gobioid species were derived from Cisukawayana and Cimaja River, two of the rivers existing in Gunung Halimun National Park which flow south, to the Indian Ocean. In river flowing north i.e, Cikaniki, Ciberang and Cidurian, even from the middle of Cisadane River these fishes were not found. The fishes species which were found in common in rivers flowing north and south were *Rasbora aprotaenia*, *Puntius binotatus*, *Channa gachua*, *Clarias batrachus*, *Poecilia reticulata* and *Xiphoporus helleri*. Up to the present ten fish species were found within the park such as *R. aprotaenia*, *P. binotatus*, *T. tambra*, *C. gachua*, *P. reticulata*, *P. latipinna*, *Cyprinus carpio*, *Monopterus albus*, *Glyptothorax platypogon* and *Lentipes* sp. It was found that genus *Lentipes* and *Schismatogobius marmoratus* extend their range to Java (new record for Java) as well as *Rasbora aprotaenia* extends its range to southern Java.

**Key words:** Fishes diversity, ichthyofauna, Gunung Halimun National Park

### INTRODUCTION

The information on fish fauna in rivers within and around the Gunung Halimun National Park, as well as the fish collection from this area is still lacking. The information on fish fauna available near this park or Bogor (Buitenzorg) was alluded by Jordan and Seale (1907), Robert (1993), in part, fish fauna at this park was reported by Rachmatika (1998) and Nurcahyadi (2000).

A comprehensive fish fauna study is required that the information on fish diversity, abundance and distribution, will be a base line data for future monitoring. There are river systems flowing south (Indian Ocean) such as R. Cimaja, R. Cisukawayana, R. Cimadur, R. Cibareno and R. Citarik and flowing south (Java Sea) such as R. Cikaniki/Cisadane, R. Cidurian and R. Cijung, that in general these opposite slope river systems are separated by the Halimun mountain, which according to Nijima (1997) this mountain was formed as a result of Bayah Dome occurring in Pleistocene era (10 - 20 million years ago).

The objective of this study are:

(1) to examine fish diversity and their distribution

(2) to test a hypothesis that fishes in rivers flowing north is different than those in rivers flowing south

(3) to evaluate the importance and the potential of conservation

### METHODOLOGY

Sampling stations were segment of river or stream, which is c. 50 - 100 m long. In stream, electric fishing gear (12 V, 10 A) was employed for about 1 hour per station, while in river, cast net was performed for ten times per station in addition to electric fishing gear operation. The collected fish specimens were fixed by formalin 10 %. Then, in Laboratorium of Ichthyology of Division of Zoology, Research Center for Biology LIPI (The Indonesian Institute of Science), these specimens were preserved by alcohol 76 % and deposited in Museum Zoology Bogor as permanent collections.

The fish identification was based on Weber and de Beaufort (1913; 1916; 1936; 1953), Brittan (1954), Robert (1993) and Kottelat *et al.* (1993), Watson and Kottelat (1994), whereas for Gobioid method of Prince Akihito *et al.* (1988);

Hoese and Allen (1990) were used. The collection from R. Cisukawayana and the middle of R. Cisadane (at Cidokom village, Rumpin in 1992) are also used for discussion. In revealing the localities, term of Sungai (S ) that refers to a particular stream or tributary, and term of Kampung (Kp.) that refers to a group of households, and a part of Desa (Village) were used. Abundance was estimated by dividing the total number of particular fish species by the number of station of occurrence, then the level of abundance designated was based on 0 -10 individual per station for low abundance, 10-20 individual per station for moderate abundance, and more than 20 individual per station for high abundance category.

Water quality parameters such as pH, dissolved oxygen, water temperature and conductivity were measured *in situ* by using Kagaku Kit-Type UC Series. In few localities in Cikaniki, Cisukawayana, Cimaja, Ciberang and Cidurian River, water samples were taken for chemical analysis such as BOD<sub>5</sub>, alkalinity, nitrate (N -NO<sub>3</sub>), nitrite (N-NO<sub>2</sub>), and orthophosphate.

### COLLECTING STATIONS

In Cikaniki River, the first survey that was conducted from December 27, 1995 to January 5, 1996 covered five stations where this period coincided with the rainy season. The second survey, which was conducted from June 14 to June 28, 1999 coincided with the dry season (Nurcahyadi, 2000). This second survey covered former collecting sites and five additional sites located upstream. These sampling stations are stretched from Leuwi (water pool) Kekep (at Kp. Cilanggar) until the curug (waterfall) Cikudapaeh.

In R. Cisukawayana, the first survey, which was conducted from February 29 to March, 5 1999, coincided with the rainy season, was located at the mouth of S. Citimur (7 stations). The second survey that was conducted from July 1 to July 14, 1999 coincided with the dry season was located at

these localities (Nurcahyadi, 2000). The third survey, which was conducted from September 27 to October 1, 1999 covered the head water within the park (3 stations, at Mushola Geger Hanjuang, at the head water of S. Citimur and at the confluence of S. Citimur and S. Cisukawayana). In the middle part was at Desa Pasir Badak and Desa Margalaksana and the lower part was at the water purification service in Desa Cikakak, Cisolak.

In R. Cimaja, the survey was conducted from February 23 to February 28, 1999. It covered S.Cisarua (2 stations, at the confluence of Cimaja and Cisarua and at the bridge connecting to Ds. Cipta Rasa.), Ciguyang (2 stations, at the bridge of the main road to Panguyangan and at the bridge of the road to Ds. Cipta Rasa), S. Cipeuteuy (3 stations, behind the Guest House, at the bridge to Kp. Cipta Rasa, at Situ Legok Batu). In R. Cimaja River, 2 stations were all located at Kp. Ciganas and Panguyangan, Ds Sima Rasa. In the period of September 23 to September 28, 1999, the survey was at Cisarua *i.e.* at the confluence of S.Cisarua and S. Ciawitali (2 stations), below Curug Cisarua (2 stations), below Curug Ciawitali (2 stations) and up Curug Ciawitali (1 station, within Gunung Halimun National Park).

In R. Ciberang and R. Cidurian, the survey was conducted in the dry season ( July 21- August 2, 2000). In Ciberang River, all sampling sites were within the park, and there were each 2 sampling sites in R. Ciberang and S. Ciberang Deet. In S. Cikalap, S.Ciparay, S. Cipangbeasan and S. Ciawitali (tributaries of R. Ciberang), there was one sampling station in each of these tributaries. In R. Cidurian, there were two sampling stations and one station in each of its tributaries, S. Cibeureum, S. Cisamad, S. Cikatomas, S.Cilongok and S. Cipatat (Figure 1).

### RESULT

#### Fish Species Diversity

Up to the present, the number of fish species, occurring in Gunung Halimun National Park and

the adjacent area is 37 species (Table 1). They belong to fourteen families and six orders. The fishes mostly belong to Gobioid and Eleotriid fishes, or complimentary fishes as represented by 39.39 % , that some of these *i.e.* *Lentipes*, *Sicyopus* and *Sicyopterus* require further taxonomic examination. Primary, secondary, diadromous and complimentary fresh water fishes exist at this park; excluding primary and secondary freshwater fishes, two other categories are assigned as peripheral freshwater fishes (Helfman *et al.*, 1977) that refers to the fishes that colonize inland water throughout the marine route (Banareescu, 1990).

There were nine fish species belonging to Ostariophysi. River by river examination, it was found that the percentage of Ostariophysian fish in each river flowing north *i.e.* Cikaniki, Cidurian and Ciberang Rivers are higher than in Cisukawayana and R. Cimaja (Table 2), eventhough the sampling sites are just at the upper part of these drainages or plus from the middle section of R. Cisadane (for Cikaniki). Up to the present, nine fish species can be found in stream and river within GH National Park *i.e.* *Channa gachua*, *Glyptothorax platypogon*, *Puntius binotatus*, *Rasbora aprotaenia*, *Poecilia reticulata*, *P. latipinna*, *Monopterus albus*, *Lentipes* sp. and *Tor tambra*. In addition Carp, *Cyprinus carpio* is found to be cultivated by people in the ponds in enclave area within the park, such as in Kp. Citalahab, Desa Mekarsari.

Exotic fishes such as *Poecilia reticulata*, *P.latipinna*, *Xiphoporus helleri* and *Oreochromis mossambicus* exist at this park either within or adjacent the park. The localities in which these fishes lived were mostly water whose the bank that was already converted into agricultural land or human settlement (open water), a habitat mostly occurred in R. Cisukawayana, R. Cimaja and R. Cidurian. In forested stream these fishes was not found. The occurrence of the exotic fishes, such as *P. reticulata* in this habitat type agree with Munro's finding (1990), that this fish in Singapore

live in area that was relatively disturbed or polluted by human activities.

### Fish composition in rivers flowing north and south

In R. Cimaja and R. Cisukawayana, where sampling activities were more intensive than in the northern area (Table 2), there were accumulatively 13 species of Gobiidae and 3 species of Eleotrididae from 25 fish species found in these rivers. Ostariophysi which were found from these two rivers are *R. aprotaenia*, *P.binotatus* and *O.hasseltii*. In contrast, in rivers flowing north *i.e.* in R. Ciberang, R. Cikaniki and R. Cidurian, the Ostariophysi that were found were seven species (50 %) from 14 fish species that were found minus fishes from the middle section of R. Cisadane. They are *Nemachilus fasciatus*, *Nemachilus* sp., *Hemibagrus nemurus*, *Glyptothorax platypogon*, *Tor tambra*, *R aprotaenia* and *P. binotatus*. Gobiidae and Eleotrididae have not been found. Six species *i.e.* *R.aprotaenia*, *P.binotatus*, *C. gachua*, *C. batrachus*, *P. reticulata* and *X. helleri* are shared in the rivers flowing north and flowing south.

### Distribution

In general, fishes occurring in GH National Park have wide geographic distributions. *R. aprotaenia*, however, occurred only in North Java (Brittan, 1954 and Kottelat *et al.* 1996) (Table 1). By finding this fish in the southern area of southern Java, this fish locally extends its known range. Genus *Lentipes* that was formerly found in Hawaii (Maciolek, 1978), Japan (Prince Akihito *et al.* (1988), Bali (Watson and Kottelat, 1994), Irian Jaya (Allen, 1997; Watson and Allen, 1999; Allen, 2001), was found in R. Cimaja and R. Cisukawayana, as well as *Schismatogobius marmoratus* that was formerly found in Sulawesi, Philippines, and Japan (Kottelat *et al.* 1993) was found in R. Cisukawayana.

Ecologically, the occurrence of Cyprinidae in GHNP i.e. *R. aprotaenia*, *P. binotatus* and *T. tambra* in the observed area followed the presence of forest along the river/stream (Fig.2). From close observation in R. Cisukawayana, *R. aprotaenia* and *P. binotatus* are distributed in the upstream area (forested stream) whose the riparian forest is either primary forest or disturbed forest where the water is partly shaded by the vegetation. While the occupation of Gobioids were mostly in the middle and lower part whose the banks are already open or converted to agricultural land (open stream), in which the water temperature was apparently higher (Table 3). In this river, a small size Gobioid i.e. *Lentipes* was found to be distributed from the lower part (15 m wide, 50 m above sea level) to the upstream forested area where the stream is already narrow (0.75 m wide, 1134 m above sea level). There was no tendency that the existence of these fishes followed the high concentration of all dissolved ions (salinity), since the salinity detected in the sampling stations of Cimaja and Cisukawayana were at the range from 0.009 ppt to 0.058 ppt, value that was at the range of freshwater category (Boyd 1990; Reid and Wood, 1976).

#### General water quality

Water quality such as dissolved oxygen, pH, and nitrite in Cikaniki, Cisukawayana, Ciberang and Cidurian Rivers was within the range for aquatic life especially for fishes. The dissolved oxygen ranged from 4.11 to 8.6 mg/l for main rivers, and from 4.43 to 7.46 mg/l for tributaries. The pH value was at the range from slightly acidic to neutral, i.e. from 5 to 7.13 for main rivers, and from 6.10 to 7.29 for tributaries. The nitrite (N-NO<sub>2</sub>), in these rivers was very low ranging from 0.003 to 0.006 mg/l for main rivers, and less than 0.01 to 0.008 mg/l for tributaries. However, it has relatively poor alkalinity or poor in carbonate (CO<sub>3</sub>) and bicarbonate (HCO<sub>3</sub>) system. It ranged from 0.30 to 34 mg/l for main rivers and from 6.75 to 50 mg/l for tributaries.

The orthophosphate value ranged from 0.02 to 0.99 mg/l for main rivers, and from 0.01 to 0.20 mg/l for tributaries, the conditions described by Wardoyo (1978) as water with low until very good productivity for tributaries, and moderate until excellent productivity for main rivers.

It was found that the water quality of Cidurian, Cimaja and most part of Cisukawayana Rivers, whose riparian ecosystem was already converted into agricultural land or human settlements had higher temperature, pH, and ionic content (conductivity) (Table 3). The orthophosphate value in the lower part of Cisukawayana River that is apparently high (0.99 mg/l) was still at the normal level.

## DISCUSSION

### Ichthyofauna feature

The high occurrence of Gobioid and Eleotriid in rivers flowing south can be associated with the theory of devoid niche (Myers 1951 in Inger and Chin, 1962, and in Banarescu 1990) where in the void of Ostariophysian fishes, the Gobioid will be dominant. In these rivers (Cimaja and Cisukawayana) the Ostariophysian that were found only *R. aprotaenia*, *P. binotatus*. In contrast, in rivers flowing north such as Cidurian, the Ostariophysian fishes is relatively high (six species or 50%), i.e. *P. binotatus*, *R. aprotaenia*, *H. nemums*, *Glyptothorax platypogonoides*, *Nemachilus fasciatus*, *Nemachilus* sp. even from just seven collecting stations (Table 2). In R. Cikaniki/Cisadane the Ostariophysian fishes was nine species (64.28%) if combined with the middle of Cisadane's collection that consist of *Lobocheilus falcifer*, *Glyptothorax robustus*, *Mastacembelus unicolor*, *Homaloptera gymnogaster*, *H. waasinkii*, *Crossochilus cobitis*, *Puntius orphoides*, *Nemachilus fasciatus*. If follow this theory, it is predictable that Gobioids (if these are present in the lower part) might be not dominant in these rivers.

Table 2 shows that the number of fishes in R. Cisukawayana River might represents the actual fish species living in this river. Fishes that were found in common in rivers flowing south and north were *R. aprotaenia*, *P. binotatus*, *C. gachua*, *C. batrachus*, *P. reticulata* and *X. helleri*. Historically, the existence of primary freshwater fishes that were found in common in these direction opposing rivers (i.e. *R. aprotaenia*, *P. binotatus*, *C. gachua* and *C. batrachus*) in the head water of Cisukawayana and Cimaja might be the result of the head water capture of drainages in northern area of Halimun mountain in the pascapleistocene. The genetic analysis might confirm on how long they have diverged from their parent population i.e. from Northern form, and is the period of divergent concomitant with the emerging of barrier (Halimun mountain). This mountain might have acted as a relative barrier for the northern species i.e. primary fresh water species to spread south. Another Asian fishes i.e. *O. hasseltii* that occurred in S. Ciguyang (2 -6 m wide, 700 m above sea level, a tributary of Cimaja River), might be derived from the ponds existing in the village. As it is known that in its natural range, *O. hasseltii* occurred in lakes and large rivers at the low elevation (Karnasuta, 1993), and there has no collection of this fish in MZB from the rivers flowing south.

### Conservation Aspects and Potency

#### Conservation Aspects

There are some efforts that are already established by people living in the surrounding the park especially in the southern area. Firstly, written prohibition on the emerging stone in the river (Cisukawayana) for not fishing using poison and electric fishing gear. Secondly, unwritten regulation imposed by sesepuh of Gunung Halimun (Abah Anom) help increase people awareness toward the sustainable fish diversity.

There should be awareness toward fish diversity conservation in the northern part as in this

area Local Leader for Conservation (Kader Konservasi) is also available. In this northern part Soro, *T. tambra* occurred in Ciberang Deet and Ciberang Besar (these sites can be reached in 2 hours and 3 hours walking respectively from Cisarua Village). The characteristic of habitat for *T. tambra* was having good riparian forest, clear water (especially in Ciberang Deet), stony substrate, and fast current (0.584 - 0.943 m/sec.) (Table 3). Informed by the field assistance, occurrence of this fish reached Bentang waterfall (Curug Bentang). Part of stream/river within this park in which *Tor tambra* and other fish occurred can function as reservat or area that supply stock for downstream area i.e. outside the park. According to the PHP A policy (1989), it is prohibited to catch the fish in this area. This site function as breeding and nursery ground. Larvae and juveniles of *T. tambra* were found in the bank of Ciberang Deet; while the adults were found in the deep pools ( $\pm 2$  m deep) of S. Ciberang Besar.

Potential threat to the fish populations is riparian forest conversion. As depicted in Figure 2, the existence of Cyprinid fish depends on the presence of the forest along the river. The forest provide shade, water quality stability, and food resources as well. The other threat is traditional gold mining that would decrease water quality. This activity was informed by the field assistance to occur in S. Ciberang several kilometers upstream from the mouth of S. Ciberang Deet.

#### Potency

A number of fish species such as *Tor tambra* could be developed as an aquaculture commodity for food fish, ornamental fish and sport fishing (Table 1). *Clarias batrachus* and *Clarias* cf. *teijsmanni* can be used for further selection for food fishes. Ikan sarolek, *Macrogathus aculeatus* can be developed later as an ornamental fish. Likewise paray, *Rasbora aprotaenia* can be developed later as ornamental fish. Bogo, *Channa gachua* (Dwarfsnake head) had price up from

S \$ 30 to S\$ 60,- per adult fish (Ng and Lim, 1990) also can be developed as ornamental fishes as this fishes has colourful fins. There are at least five species of Gobioids from GH National Park and adjacent area that have beautiful coloration, especially the male. For example *Sicyopterus* cf. *macrostatholepis*; it has bluish body coloration and orange caudal fin.

#### Recommendation in relation to the fishes conservation

1. Further forest conversion should be prevented. For Cyprinid fishes, the riparian forest provide shade, water quality stability, and food resources as well.
2. Population monitoring (along with water quality) especially for those having economic potencial such as *T. tambra*. There should be pilot projects in surrounding area that perform the rearing and breeding of this fish
3. Monitoring on fish population including the intrusion of exotic fish in to the park
4. Reinforce the law to whom who use any harmful means such as electric fishing, poisoning for fishing in the rivers even outside the national park

#### ACKNOWLEDGEMENT

We would like to thank to Ir. A.J. Arief M.Sc and Dr. Sih Kahono who invited us to do ichthyofauna survey in Gunung Halimun National Park, as well as to JICA and PHP A- staff who made the survey possible. Also we would like to thank to Pak Suhara and family, Pak Dadang, Pak A' Munim, Enday, Dodoy for their assistance in the field as well as to Pak Ujang and family in Cisarua that provide lodging and field assistance.

#### LITERATURE CITED

**Allen GR. 2001.** *Lentipes multiradiatus* , a new Species of Freshwater Goby (Gobiidae) from Irian Jaya, Indonesia. *Aqua, Journal of Ichthyology and Aquatic Biology* 4 (3), 121-124.

**Allen GR. 1997.** *Lentipes watsoni*, a new Species of Freshwater Goby (Gobiidae) from Papua New Guinea. *Ichthyol.Explor. Freshwaters* 8 (1), 33 - 40.

Akihito Prince, Hayashi M and Yoshino T. **1988.** *Suborder GOBIOIDEI* - Off print from " The Fishes of Japanese Archipelago: 2nd.

**Banarescu P. 1990.** *Zoogeography of Freshwaters. Vol I. General Distribution and Dispersal of Freshwater Animals.* AULA-Verlag Wiesbaden, 511 p.

**Brittan S. 1954.** *Revision of the Malayan Rasbora.* Institute of Science and Technology Monograph, 3. Manila.

**Boyd C. 1990.** *Water Quality in ponds for Aquacultures.* Alabama Agricultural Experiment Stations, Auburn University, Alabama.

**Eschemeyer N. 1998.** *Catalog of the Genera of Recent Fish.* California Academy of Sciences, 697 p.

**Helfman GS, Collette BB and Facey DE. 1997.** *The Diversity of Fishes.* Blackwell, Science, Inc. USA, 528 p.

**Hoese DF and Allen GR. 1990.** Description of two new Freshwater *Glossogobius* (Pisces:Gobiidae) from Northern Papua New Guinea. *Rec. West. Aust. Mus. Suppl.* 34,117-129.

**Hubb and Lagler. 1954.** *Fishes of the Great Lakes Region.* University of Michigan Press, Ann Arbor, Michigan.

**Jordan DS and Seale A. 1907.** List of Fishes Collected in the River at Buitenzorg, Java By Dr. Douglas Houghton Campbell. *Proceedings of the United States National Museum Vol* 33,535 - 543.

**Karnasuta. 1993.** Systematic Revision of Southeastern Asiatic Cyprinidae Fish Genus *Osteochilus* with Description of two new Species and a new Subspecies. *Kasetsart University Fish Research Bulletin No.19.*

**Kottelat M, Wirjoatmodjo S, Whitten A and Kartikasari SN. 1996.** *Freshwater Fishes of Western Indonesia and Sulawesi.* Periplus Edition Limited.

**Maciolek JA. 1978.** Taxonomic Status, Biology, and Distribution of Hawaiian *Lentipes*, A Diadromous Goby. *Pacific Science* 31 (4), 355 - 362.

**Munro AD. 1990.** Singapore Freshwater Fishes. Essay in Zoology. *Papers Commemorating*

- the 40 th Anniversary of Dept. Zoology, National University of Singapore 476 p.
- Nijima K. 1997.** Summary of Draft of Gunung Halimun National Park Management Plan Book II. Pages 75 -116 Dalam *General Review of the Project. Research and Conservation of Biodiversity in Indonesia Vol. I.* LIPI-JICA-PHPA.
- Nurcahyadi W. 2000.** *Keanekaan Hayati Ikan di S. Cikaniki dan S. Cisukawayana, Taman Nasional Gunung Halimun.* Skripsi Sarjana Perikanan, Fakultas Perikanan dan Ilmu Kelautan, Institut Pertanian Bogor.
- Reid GK and RD Wood. 1976.** *Ecology of Inland Waters and Estuaries.* Second Edition. D.Van Nostrand Co. 485 p.
- Robert T. 1989.** *The Freshwater Fishes of Western Borneo (Kalimantan Barat, Indonesia).* California Academy of Science, San Fransisco. Memoirs of the California Academy of Science Number 14.
- Robert TR. 1993.** *The Freshwater Fishes of Java, as Observed by Kuhl and van Hasselt 1820-1823.* Zoologische Verhandelingen. The National Natuurhistoris Museum, Leiden.
- Wardoyo STH. 1978.** Kriteria Kualitas Air untuk Keperluan Pertanian dan Perikanan. *Seminar Pengendalian Pencemaran Air.* Direktorat Jendral Pengairan Departemen Pekerjaan Umum. Bandung 13 - 18 November 1978.
- Watson RE and Kottelat M. 1994.** *Lentipes whittenorum* and *Sicyopus auxilimentus* two new Species of Freshwater Gobies from the Western Pacific (Teleostei: Gobiidae: Sicydiinae). *Ichthyol. Explor. Freshwater* 5 (4), 351-364.
- Watson RE and Allen GR. 1999.** New Species of Freshwater Gobies from Irian Jaya, Indonesia (Teleostei: Gobioidei:Sicydiinae). *Aqua, Journal of Ichthyology and Aquatic Biology.* 3 (3), 113 - 118.
- Weber M and de Beaufort LF, 1916.** *The Fishes of the Indo-Australian Archipelago. Vol II.* Malacopterygii, Myctophoidea, Ostariophysii: I Siluroidea. E.J.Brill Lt Leiden.
- Weber M and de Beaufort LF. 1916.** *The Fishes of the Indo-Australian Archipelago. Vol HI.* Ostariophysii: II. Cyprinoidea, Apodes, Synbranchii. E.J.Brill Ltd. Leiden.
- Weber M and de Beaufort LF. 1922.** *The Fishes of the Indo-Australian Archilepago Vol IV* Heteromi, Solenichthyes, Syntognathi, Microcyprini. E.J.Brill Ltd. Leiden.
- Weber M and de Beaufort LF. 1953.** *The Fishes of the Indo-Australian Archipelago Vol X* Gobioidae. E.J.Brill Ltd. Leiden.

Table 1. Fish species found in the Gunung Halimun National Park and its adjacent area, classification, distribution and the potency

No.	Species and Classification <sup>1)</sup>	Division <sup>2)</sup>	Local Name	River by river distribution	Abundance and Potency	Geographic Distribution <sup>3)</sup>
1.	Order Anguilliformes					
	Family Anguillidae					
	<i>Anguilla bicolor</i> <sup>QAc</sup> Clelland, 1845)	P	Lubang	Csk <sup>6)</sup> , Cmj <sup>6)</sup>	L;F	-East Africa to the Philippines, New Guinea and North Australia
	Family Moringuidae					
	<i>Gymnothorax polyummodon</i> Bleeker, 1853	P	Moa, Pucuk Kiray	Csk <sup>6)</sup>	L;F	-Sumatra, Borneo, Java, Sulawesi, Moluccas, New Guinea, Palawan Sri Lanka, Fiji
2.	Order Cypriniformes					
	Family Cyprinidae					
	<i>Cyprinus carpio</i>	1 <sup>st</sup>	Kantjra, Lauk Mas	In the ponds along Ckn, Cdr, Cmj	F	-Originally from Japan, China, and Central Asia; introduced throughout the world
	<i>Osteochilus hasseltii</i> (Valenciennes in Cuvier & Valenciennes, 1842)	1 <sup>st</sup>	Nilem	Cmj <sup>6)</sup>	L;F	-Sundaland, Indochina, Burma
	<i>Puntius binotatus</i> Valenciennes, 1842	1*	Beunteur	Csk <sup>6)</sup> , Cmj <sup>6)</sup> , Ckn <sup>5)</sup> , CdY <sup>6)</sup>	M; Om	-Sundaland, Bah, Lombok, Philippines, Indochina
	<i>Puntius</i> sp.	1 <sup>st</sup>	Beunteur	Csk <sup>6)</sup>	L;Orn	-Cisukawayana River
	<i>Rasbora aprolaenia</i> Hubbs & Brittan, 1954	1 <sup>st</sup>	Paray	Csk <sup>6)</sup> , Ckn <sup>5)</sup> , Cdr <sup>6)</sup>	M;Orn	-Java North
	<i>Tor tambra</i> (Valenciennes in Cuvier & Valenciennes, 1842)	1 <sup>st</sup>	Soro	Cbr <sup>5)</sup>	L;F;Om;SF	-Sundaland
	Family Cobitidae					
	<i>Nemachilus cf. fasciatus</i> (Valenciennes in Cuvier & Valenciennes, 1846)		Jeler	Cdr <sup>6)</sup>	L; Ora	-Sumatra South, Java
	<i>Nemachilus</i> sp.	1 <sup>st</sup>	Jeler	Cdr <sup>6)</sup>	L;Oni	-Cidurian, West Java
	Family Bagridae					
	<i>Hemibagrus cf. nemurus</i> (Valenciennes in Cuvier & Valenciennes, 1840)	1 <sup>st</sup>	Sengal	Cdr <sup>6)</sup>	L;F;Orn	-Sundaland, Indochina
	Family Sisoridae					
<i>Glyptothorax piatypogon</i> (Valenciennes in Cuvier & Valenciennes, 1840)	1 <sup>st</sup>	Kehkel	Ckn <sup>5)</sup> , Cbr <sup>5)</sup> , Cdr <sup>6)</sup>	L;Orn	-Sumatra, Borneo, Java, Malaya	
Family Clariidae						
<i>Clarias batrachus</i> Linnaeus, 1758	1 <sup>st</sup>	Lele	Cdr <sup>6)</sup>	L;Orn;F	-Sundaland, Simeulue, Burma, Philippines, Indochina	
<i>Clarias cf. Teijsmanni</i>	1 <sup>st</sup>	Karae	Cdr <sup>6)</sup>	L; Orn; F	-Sundaland	
3	Order Cyprinodontiformes					
	Family Poeciliidae					
	<i>Poecilia reticulata</i> Peters, 1859	2 <sup>nd</sup>	Bungkreg	Csk <sup>6)</sup> , Cmj <sup>6)</sup> , Ckn <sup>5)</sup> , Cd <sup>6)</sup>	L; MC	-Venezuela, introduced to Sundaland, Sulawesi
	<i>P. latipinna</i>	2*	Bungkreg	Ckn <sup>5)</sup>	L; MC	-Mexico, Southeastern USA
<i>Xiphoporus helleri</i> , Heckel 1848	2 <sup>nd</sup>	CinirPutri	Cmj <sup>6)</sup> , Cdr <sup>6)</sup>	L;Orn	-Mexico; introduced to Java N, Sulawesi	



Table 2. The number of fish species and family in relation with the number of stations and the longitudinal zone of rivers/stream observed at the Gunung Halimun National Park

No.	River System	Direction of the flow	Number of Stations	Number of Fish species	Number & % of Ostanophys.>	Number of Family	Part of river system
1.	Cisukawayana	South (Hindian Ocean)	18	18	3(16.66%)	8	Head water, Middle and Lower part
2	Cikaniki	North (Java Sea)	10	6	6 (60%)	5	Upper part
	(+ Cisadane collection)		11	14	9 (64.28%)	8	Middle part
3	Cimaja	South (indian Ocean)	28	13	2 (15.38 %)	8	Upper part, Middle part
4	Cidurian	North (Java Sea)	7	12	6 (50%)	9	Upper part
5	Ciberang	North (Java Sea)	8	2	2(100%)	2	Upper part

1) Robert (1998)

Table 3. Physical and chemical parameters in several main rivers " in GHNP

No	Parameters	Cisukawayana 1999		Cikaniki 1999	Cimaja 1999	Ciberang 2000	Ciberang Deet 2000	Cidurian 2000	
		DS <sup>2</sup> /Up	RS/Mp,Lp	DS <sup>2</sup> /Up	RS/Up	RS/Up	DS/Up	DS/Lp	DS/Up
		Range (5 st)	Range (2st.)	Range (10st)	Range (2st)	Range(1 st)	Range (1St)	Range (3 st)	Range (2st)
1.	Depth (m)	0.12-0.35	0.20-0.50	0.07-3.86	-	2	0.20-1.5	0.20 - 0.40	
2	Width (m)	2.27 - 9.40	6-15	4.50 - 20	-	6-10	8-14	8-12	
3	Velocity (m/sec.)	0.20 - 0.65	-	0.50-1.44	-	0.58-0.89	0.40-1.16	0.32-0.44	
	Conductivity	0.01-0.04	-	-	-	0.03-0.07	0.04	0.05-0.15	
4	T (o C)	18.0-21.0	-	17.0-19.80	-	21.1-22.6	19.0-19.1	18.1 - 19.9	21.60-21.80
5	Stream Bank	PF, RF&CP	RF, CP, AP	PF, RF &CP	PF; RF & CP	RF,CP, AP	PF	PF	PF,AP
6	Canopy coverage (%)	1 - 98	0	1-98	-	0	80	5-80	0-5
7	PH	5	6.65-6.85	5-6	6.87 - 7	7	6.83 - 6.87	6.67 - 6.95	7.07-7.13
8	Dissolved Oxygen (mg/l)	5.35 - 6.99	7.51-7.66	4.11-6.99	7.75- 7.98	8.04	7.8 - 8.6	7.5 - 8.5	5.80 - 7.60
9	BOD	0.21- 3.29	4.83-6.28	0.41-4.52	2.08 -2.62	1.31	-	-	-
10	Orthophosphate (mg/l)	0.02 - 0.06	0.15-0.99	0.05-0.08	0.04	0.053	0.031	0.33	0.053
11	Nitrate (mg/l)	0.10-0.91	3.51-3.59	0.11-0.39	0.24 -0.36	<0.1	0.169	0.11	0.011
12.	Alkalinity (mg/l)	0.60-1.40	17.2-23.5	0.30-0.80	14.2-19.5	0.57	34	32	34
13.	Hardness (mg/l)	-	-	-	-	-	12	12	10
14	Nitrite (mg/l)	-	0.01	-	0.006-0.008	0.05	0.006	0.60	0.009

1) Main River, 2) Nurcahyadi (2000)

DS: Dry Season; RS: Rainy Season; Mp: the middle ; Lp : lower part of the river

PF: Primary Forest; CP: Crop Planted; AP: Annual Planted

3) Salinity: in Upper Cisukawayana 0.00; Middle Cisukawayana 0.045 gr/kg; Lower Cisukawayana 0.009 gr/kg

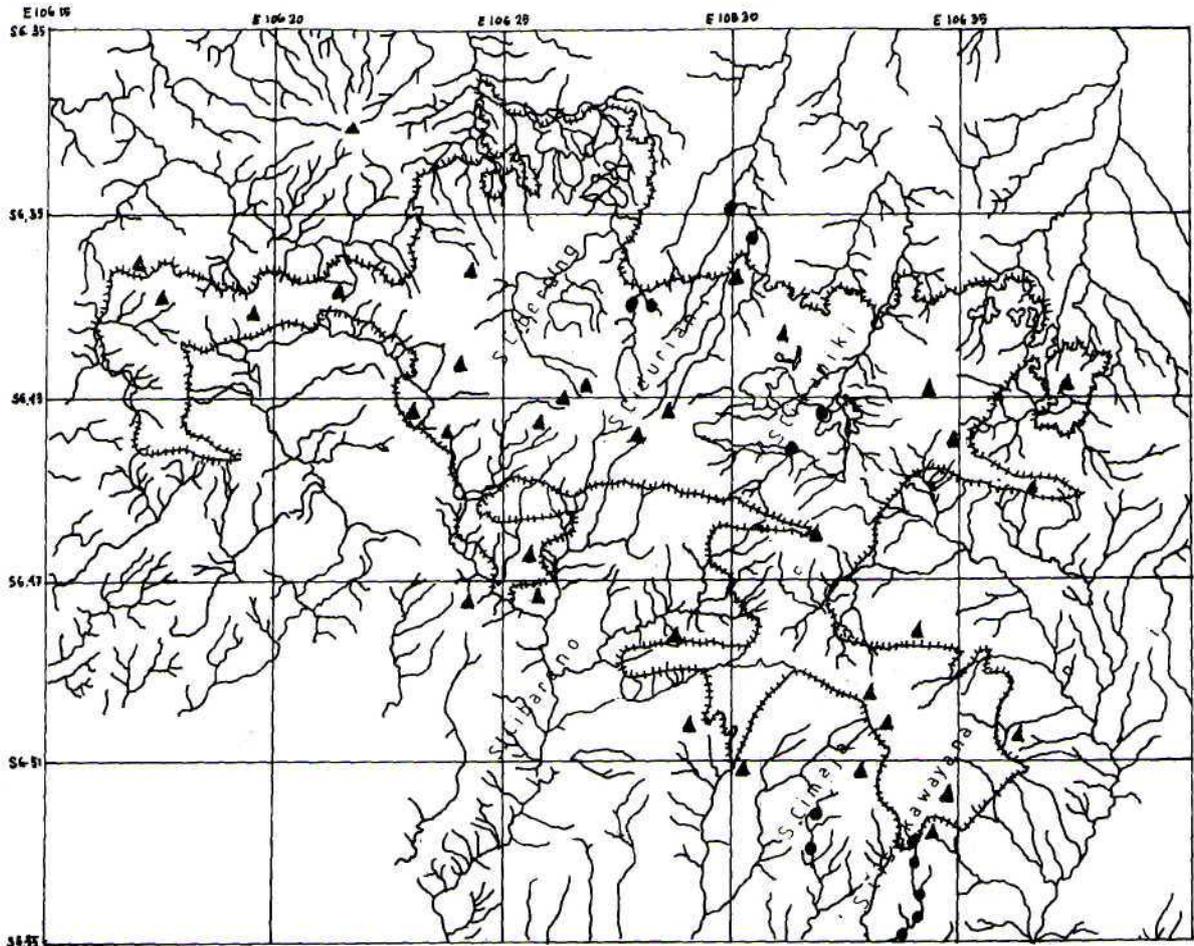


Fig 1. The location of fish fauna study in Gunung Halimun National Park and adjacent area

- . Group of sampling sites
- River
- > Park boundary
- ▲ Mountain

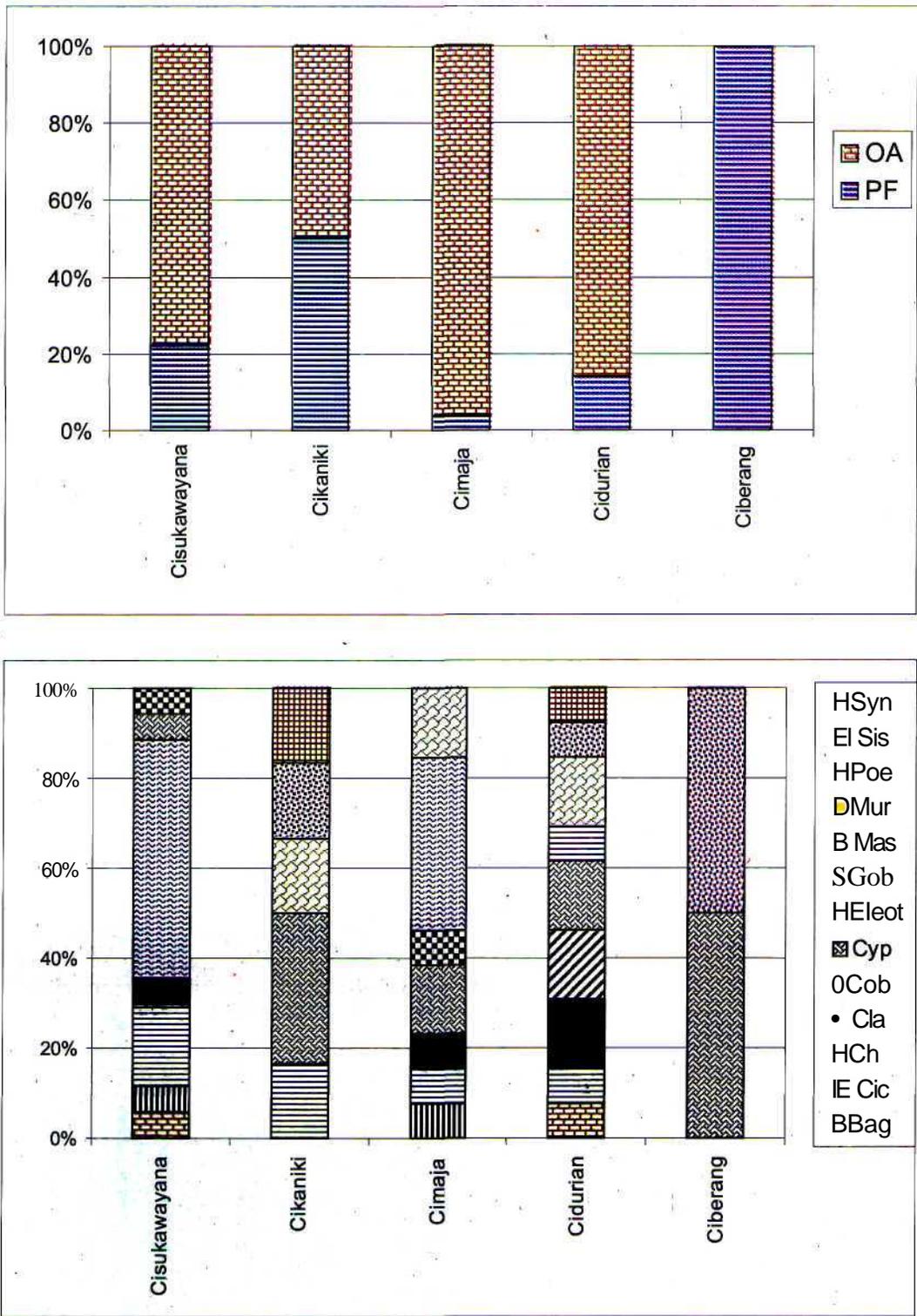


Fig.2. The portion of primary forest (PF) and open area (OA) of the bank of the sampling stations in relation with fish families found in five river systems in GHNP. Syn: Synbranchidae, Sis: Sisoridae, Poe: Poecilidae, Mur: Muraenidae, Mast: Mastacembelidae, Gob: Gobiidae, Eleot: Eleotrididae, Cyp: Cyprinidae Cob: Cobitidae, Cla: Clariidae, Ch: Channidae, Cic: Cichlidae, Bag: Bagridae Ang: Anguillidae.