Catch composition and bycatch from glass eel fisheries in Cimandiri River at Sukabumi, West Java

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Abstract. Bycatch is the catch of non-target fish, including what is brought to port which are not is main target of retain and what is discarded at fishing area. Sirib (a type of push net) and bubu (trap) are fishing gear to catch glass eel in the five rivers (both upriver and estuary) from Sukabumi, West Java. The research was conducted in July 2019 to January 2020. The aimed of this study to analyze the catch composition of glass eel from Cimandiri River. Result of the study shows that the catch composition from Cimandiri River consist of 8–9 species. However, catch composition of trap is lower than sirib/pushnet due to traps are more selective than sirib instead of the fishing location from the traps is in upriver.

Keywords: bycatch; catch composition; Cimandiri; glass eel

1. Introduction
One of the estuarine ecosystems that have an important ecological role for the lives of sedentary aquatic biota and migratory fish such as eels is Estuary in Sukabumi, South Cost of Java [1]. Eels are already considered to be one of potential fish resources for export. The commodity of glass eel fisheries is high demand East Asia, especially in Japan, with kabayaki as a trade name. Glass eel from Cimandiri river, Palabuhan ratu, Sukabumi had three species; Anguilla bicolor bicolor, Anguilla nebulosa nebulosa and Anguilla marmorata [2]. However, the most desired one for exporting to Japan’s market is A. bicolor bicolor. Japanese consumes up to 70% of glass eel production in the world [3]. High export demand causes an increase in fishing intensity. It can directly or indirectly impact target populations and ecosystem depending on species involved (bycatch) in fishing activity. Bycatch concern in sustainable management is needed as an effort to maintain ecosystem health [4]. It is one of the most significant threats to maintaining healthy ecosystems [5]. Increased number of bycatch threat the sustainability of glass eel fisheries [6]. However, preserving glass eel fishery always in sustainable practices is crucial to ensure the source that will be used by the industry [3].
In general, almost all fishing activities produce bycatch. However, using different types of fishing gear causes different volumes of bycatch. Bycatch is the catch of non-target fish, including retained catch which are landed in fishing port and discards are that portion of the total catch which is thrown away to the sea. Glass eel fisheries in Sukabumi are located on several estuaries such as Cimandiri River, Cikaso River, Ciletuah River, Cibuni River, and Cikarang River [2, 8–10]. Cimandiri River is one of glass eel fishing area with the largest contribution of nearly 80% in 2018 to the production from all Sukabumi districts. Glass eel fishermen in Sukabumi uses hand lift net/sirib [9], push net, and trap (bubu). The operation of eel fishing gear were carried out by lifting up and swung the gears to the surface of the wave as it comes and sieved the fingerlings that tried to surface, the process is done without any fishing fleets.

Using hand lift net, push net, and trap as glass eel fishing gear in Cimandiri River causes various bycatch like juvenile fish, crustacea, and others that the composition still unknown. Data and information about the composition of bycatch Cimandiri River in Sukabumi have not been much studied. Therefore, it can be an input for management concept for glass eel fisheries and basis to certify that the traceability of the glass eel is in accordance with eco-friendly principles. The main objective of this study was to analyze the composition of catch and bycatch of the fishing glass eel in the Cimandiri River Sukabumi, West Java.

2. Material and method

2.1. Description of the study sites
Surveys were conducted on July 2019 (preliminary research), November 2019, Desember 2019, and January 2020. The location of the research was carried out in the Cimandiri River which is a place for catching glass eels. Sampling location for catch composition of glass eel following the habit of fisherman, 3 sampling locations were conducted consist of 2 sampling sites in the downstream, estuary (river mouth) and 1 site in the middle river/up river (figure 1). Normally, fisherman catch glass eel in the estuary using sirib/push net and using trap in the up river/middle river. Thus, in this research we used push net (sirib) and trap (figure 2) for sampling catch composition of glass eel in the estuary.

![Figure 1. Sampling location of glass eel fisheries in Cimandiri River.](image)

The Cimandiri River has special characteristics which is sandy beach and flat, fisherman only catch glass eel in the estuary or river mouth area.
Figure 2. Push net (sirib) and pocket are fishing gear that used by fisherman in the estuary for catching glass eel.

2.2 Species identification and data analyzed
The total catch from each site in the Cimandiri River was identified at the Macrobiology laboratory, Aquatic Resources Management, IPB University by using freshwater fish identification book [11-15]. This involved examining the colour pattern, morphology, lateral lines, fins and mouth, and character of the teeth, and scales.

3. Result and discussion

3.1 Result
3.1.1. Catch Composition. The target catch from Cimandiri River estuary show that the main catch in the eel fishery is glass eel seeds. Glass eel is the phase that occurs after leptocephalus. Glass eel undergoes changes in body pigment and enters the elver stage and then develops into yellow eel. During maturation, it will develop into silver eel and return to the sea to spawn and die as adult eels [16]. There are 6 rivers in South Java which is potential for fishing ground glass eel including Cikaso, Cimandiri, Cibareno, Palangpang and Cikarang. From Table 1 it can be seen that the Cimandiri River is the location that produces the highest glass eel compare to other locations.

Table 1. The catch of glass eel from each location in south Sukabumi.

| Month | Cikaso  | Cibuni | Cimandiri | Cibareno | Palangpang | Cikarang | Total (each month) |
|-------|---------|--------|-----------|----------|------------|----------|-------------------|
| Jan   | 126,000 | 107,800| 0         | 0        | 0          | 0        | 233,800           |
| Feb   | 68,700  | 60,200 | 26,600    | 0        | 0          | 0        | 155,500           |
| Mar   | 56,000  | 64,120 | 54,558    | 0        | 0          | 0        | 174,678           |
| Apr   | 0       | 27,650 | 314,300   | 0        | 0          | 0        | 341,950           |
| May   | 0       | 13,300 | 1,455,300 | 0        | 0          | 0        | 1,468,600         |
| Jun   | 24,500  | 9,200  | 2,569,000 | 0        | 0          | 0        | 2,602,700         |
| Jul   | 11,690  | 14,350 | 0         | 0        | 0          | 0        | 26,040            |
| Aug   | 51,730  | 11,200 | 223,500   | 0        | 17,050     | 0        | 303,480           |
| Sep   | 31,652  | 8,000  | 3,200     | 5,000    | 13,750     | 0        | 61,602            |
| Oct   | 115,400 | 38,070 | 385,400   | 2,900    | 20,900     | 0        | 562,670           |
| Nov   | 284,200 | 104,200| 474,410   | 7,200    | 20,055     | 0        | 890,065           |
| Dec   | 364,840 | 198,650| 306,208   | 14,425   | 13,790     | 12,050   | 909,973           |
| Total (per year) | 1,134,712 | 656,740 | 5,812,476 | 29,525 | 85,545 | 12,050 | 7,731,058 |

Source: Dinas Kelautan dan Perikanan Kab. Sukabumi 2019.

Based on table 1 on the catch of glass eel in Sukabumi Regency, it shows that the number varies every month. Cikaso River is known to have the highest catch occurred in December of 364,840
individual and the lowest was in April and May with 0 or no catch. The highest Cibuni River was in December of 198,650 heads and the lowest was in September, which was 8,000 individuals. The highest Cimandiri River was in June at 2,569,000 individual and the lowest in January and July was 0 or no fishing. The highest Cibarenno River is in December at 14,425 individual and the lowest is in January-August at 0 or no catch. The highest Palangpang River in October is 20,900 individual and the lowest is in January-July, which is 0 or no catch. Cikarang River only carries out fishing activities in December of 12,050 individuals, while in other months there are 0 or no catch. The highest catch of the total number of all locations throughout 2018 occurred in June of 2,602,700 and the lowest was in July of 26,040. In 2019, the Cimandiri River contributed to the total glass eel from Sukabumi reaching 75.2%.

In this study we classified the catch composition from 2 different fishing gear such as sirib/push net and trap. In the other side, organisms that caught as a catch composition during research consist of Malacostraca, Gastropoda and Actinopterigii (table 2).

**Table 2.** Catch Composition of target catch and bycatch from two different fishing gear at Cimandiri River.

| Species target                                      | Bycatch                              | Species target                                      | Bycatch                              |
|-----------------------------------------------------|--------------------------------------|-----------------------------------------------------|--------------------------------------|
| Glass eel of *Anguilla bicolor* bicolor, *Anguilla marmorata*, *Anguilla nebulosa* (figure 3) | *Ambassis naluia*, *Ambassis urotaenia*, *Butis* sp., *Callionymus sagitta*, *Caridina laevis*, *Eleotris melanosome*, *Glossogobius* sp., *Macrobrachium* sp., *Marsupenaeus japonicus*, *Metapenaeus* sp., *Parathelphusa maculate*, *Planiliza subviridis*, *Sillago* sp., *Terapon jarbua*, *Varuna litterrata* (figure 4) | Glass eel of *Anguilla bicolor* bicolor, *Anguilla marmorata*, *Anguilla nebulosa* | Glass eel of *Anguilla bicolor* bicolor, *Anguilla marmorata*, *Anguilla nebulosa* |

The main catch for sirib/push net and trap from cimandiri consists of *Anguilla bicolor*, *Anguilla marmorata* and *Anguilla nebulosa*. Meanwhile, bycatch from sirib/push net consists of 8–9 species each month and traps were recorded as not capturing bycatch (table 2).
Figure 3. Target catch; (a) *Anguilla bicolor*, (b) *Marmorata*, and (c) *Nebulosa*.

Figure 4. The bycatch from sirib/push net.

3.2. Discussion
The highest intensity is 6x10^4 mV and the lowest intensity is 0.1x10^4 mV. The highest intensity is yellow and the lowest is blue. The highest catch composition is sirib/push net with number of species that caught about 8–9 species each month. Richness and abundance of catch composition each time in the river are changes both spatial and temporal spectrum which affect the interaction between the distribution and abundance of fish [17, 18]. Increasing number of taxa catch composition from sirib/push net not affected with number of individu glass eel. Normally, number of taxa catch composition in Cimandiri River will rising when the river mouth open (no accretion) thus, it will followed by rising number of glass eel in the rivers.

In general, number of by catch composition by trap is lower than push net. Trap more selective than push net and normally operated in the up river where richness species in the upriver less than estuary or downstream. Also, trap is passive gear, only specific fish will have trapped. However, target catch from trap and push net mostly glass eel and bycath from the push net are juvenile and larva. Fishing practice is impacted to the retention of juvenile fishes and also have direct and indirect impact impact to ecosystem thus need caution for handling and give them back to the water [19, 20]. Furthermore, fisherman said that they are always give them back to the water with good condition (alive) but sometimes when there is no glass eel in the water and the catch composition very high, they also bring it back to their home only for consumption.

4. Conclusions
The catch composition from Cimandiri River consist of 8–9 species. However, catch composition of trap is lower than liftnet due to traps are more selective than sirib/push net instead of the fishing location from the traps is in upstream.

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