Analysis of Catch Composition Using Lift Net (Anco) Fishing Gear in the Alue Naga River Estuary, Banda Aceh

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Article Info	ABSTRACT
	The coastal area of Alue Naga, Banda Aceh City, is characterized by high fisheries potential and increasing pressure on estuarine resources due to small-scale fishing activities. One of the fishing gears commonly operated by local fishers is the *anco*, a traditional rectangular lift net deployed in estuarine waters. This study aimed to examine the catch composition, species dominance, and diversity associated with *anco* fishing gear in the Alue Naga River estuary, Banda Aceh. The research applied an experimental fishing approach with direct participation in fishing operations, complemented by the collection of primary and secondary data. Catch composition was assessed based on species abundance and biomass, while fish community structure was evaluated using the Shannon–Wiener diversity index (H′) and the Simpson dominance index (C). A total of 18 fish species were recorded during the study period. Greenback mullet (*Chelon subviridis*) was the most abundant species, contributing 60 individuals (0.448%) and a total biomass of 1,651 g (0.631%). In contrast, rabbitfish (*Siganus guttatus*) was the least abundant species, represented by a single individual (0.007%) with a biomass of 4 g (0.002%). The Shannon–Wiener diversity index (H′ = 2.039) indicated a moderate level of species diversity, whereas the Simpson dominance index (C = 0.236) suggested low dominance within the fish assemblage. Overall, the results indicate that *anco* fishing gear captures a relatively diverse fish assemblage with a balanced species composition and no clear dominance by a single species. These findings provide baseline ecological information that may support the development of sustainable management strategies for small-scale estuarine fisheries in the coastal waters of Banda Aceh.

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1. Introduction

Alue Naga is a coastal area of Banda Aceh City that supports small-scale fisheries and possesses considerable ecotourism potential. The area is characterized by an extensive coastline and relatively well-preserved mangrove ecosystems, which provide important ecological functions and economic opportunities. Despite these advantages, local communities continue to experience economic constraints due to limited and unpredictable income from fisheries activities (BPS Aceh, 2023).

One of the traditional fishing gears used by local fishers in Alue Naga is the anco, a rectangular lift net operated in coastal and estuarine waters. The anco consists of a net attached to crossed bamboo poles and is classified as a lift net based on its operational characteristics (Subani & Barus, 1989). This gear is typically deployed at distances of approximately 3–6 miles from the shoreline and operates passively at a small scale.

Due to its passive nature, the anco commonly captures species such as mullet, milkfish, anchovy, shrimp, crabs, and bilis, as well as other organisms depending on water depth and fishing ground characteristics (Sukamto et al., 2014). However, scientific information regarding the catch composition, species dominance, and diversity of fish captured using anco fishing gear in the Alue Naga River estuary remains limited.

Therefore, this study aimed to analyze the catch composition and community structure of fish assemblages captured by anco fishing gear in the Alue Naga River estuary. The findings of this study are expected to provide baseline ecological information to support sustainable management of small-scale estuarine fisheries in the coastal area of Banda Aceh.

Materials and Methods

Study Area and Period

This study was conducted in the Alue Naga River estuary, Syiah Kuala District, Banda Aceh, in January 2025. The location of the study area is presented in Figure 1.
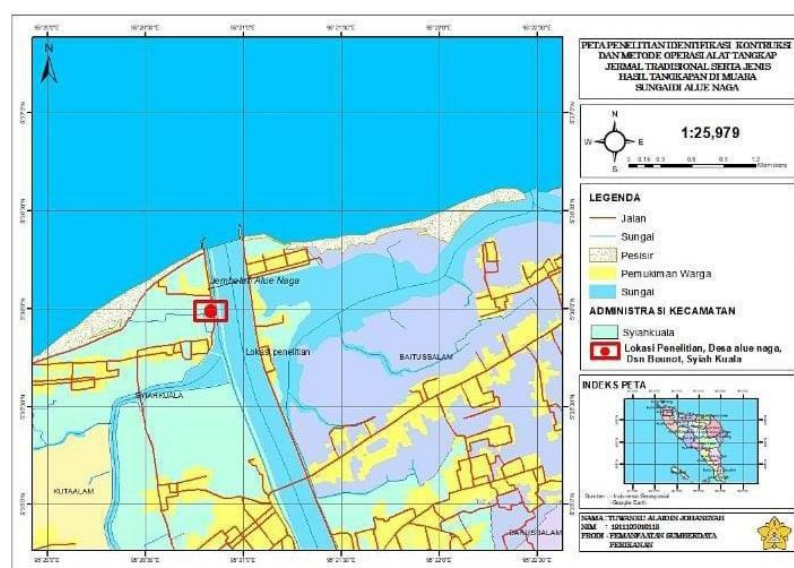

Figure 1. Research Location

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2. Research Methods

Data collection in this study employed an experimental fishing approach. Primary data were obtained through direct participation in fishing operations using anco fishing gear. Sampling was conducted comprehensively by recording all catches obtained during the fishing operations. The dominant fish species were identified, and the weight and total length of each captured individual were measured and recorded in data tables.

Secondary data were obtained from relevant literature sources, including scientific journals, official reports, and other supporting references related to the objectives of this study. The types of data collected in this study are summarized in Table 1.

Table 1. Primary and Secondary Data Used in the Study

Type of Data	Data Source	Data Collection Method
Number of fish caught	Fishing operations	Experimental fishing
Fish weight and length	Fish samples	Sampling
Fish species data	Identification guides	Species identification
Catch-related information	DKP reports / journals	Literature review

Data Analysis

Catch composition obtained from *anco* fishing gear was analyzed descriptively using Microsoft Excel. The proportion of each species in the total catch was calculated and presented in tables and graphs to describe catch composition per fishing trip (Simbolon et al., 2013). Species proportion was calculated as:

$$P_i = \frac{n_i}{N} \times 100\%$$

where n_i is the number of individuals of species i and N is the total number of individuals captured.

Species dominance was assessed using the Simpson dominance index:

$$C = \sum (\frac{n_i}{N})^2$$

Dominance was classified as low ($C < 0.4$), moderate ($0.4 \leq C \leq 0.6$), or high ($C > 0.6$) (Legendre et al., 1983).

Species diversity was evaluated using the Shannon–Wiener diversity index:

$$H' = -\sum_{i=1}^{S} P_i \ln P_i$$

Diversity levels were categorized as low ($H' < 1$), moderate ($1 \leq H' < 3$), or high ($H' \geq 3$) (Krebs, 2009; Nurudin et al., 2013).

3. Results and Discussion

Catch Composition

Based on the results of the study, a total of 18 species were captured using anco fishing gear in the Alue Naga River estuary. The catches consisted of greenback mullet (Chelon subviridis), decorated ponyfish (Secutor insidiator), tille trevally (Carangoides tille), humpback cardinalfish (Apogon sp.), whipfin silverbiddy (Gerres filamentosus), brown surgeonfish (Acanthurus nigrofuscus), blackspot snapper (Lutjanus fulviflamma), Hawaiian giant herring (Elops hawaiensis), Castelnau's jawfish (Opistognathus castelnaui), silver moony (Monodactylus argenteus), Papuan snapper (Lutjanus papuensis), grunter (Terapon jarbua), Malabar blood snapper (Lutjanus madras), rabbitfish (Siganus guttatus), Mozambique tilapia (Oreochromis mossambicus), mud crab (Scylla serrata), whiteleg shrimp (Litopenaeus vannamei), and narrow-lined puffer (Arothron manilensis).
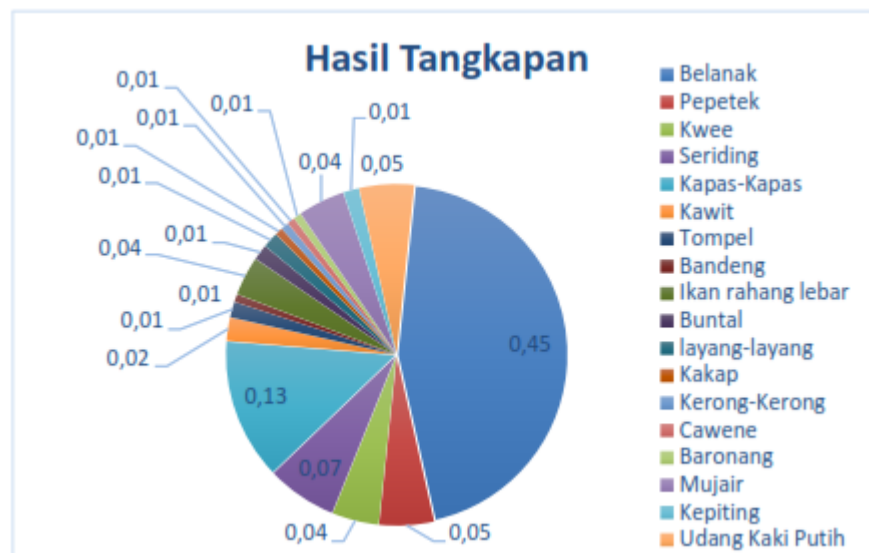

Figure 2. Catch Composition

Figure 2 shows the catch composition based on the results of this study. A total of 18 species were captured using anco fishing gear in the Alue Naga River estuary. The most dominant species by biomass was greenback mullet (Chelon subviridis), with a total weight of 1,651 g (0.45%), followed by whipfin silverbiddy (Gerres filamentosus) with 150 g (0.13%). In contrast, the least abundant species were rabbitfish (Siganus guttatus), weighing 4 g (0.01%), and Malabar blood snapper (Lutjanus madras), weighing 8 g (0.01%).

Composition of Main Catch (HTU), Bycatch (HTS), and Discarded Catch (HTB)

A total of 18 species captured using anco fishing gear in the Alue Naga River estuary were classified into three categories: 15 species as main catch (HTU), 2 species as bycatch (HTS), and 1 species as discarded catch (HTB). The composition of these catch categories is presented in Table 2.

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Table 2. Composition of Main Catch (HTU), Bycatch (HTS), and Discarded Catch (HTB) Using Anco Fishing Gear in the Alue Naga River Estuary

No.	Common Name (English)	Local Name	Scientific Name	Weight (g)	Percentage (%)
I. Main Catch (HTU)					
1	Greenback mullet	Belaneut	*Chelon subviridis*	1651	0.45
2	Whipfin silverbiddy	Bu ut	*Gerres filamentosus*	150	0.13
3	Humpback cardinalfish	Seredeng	*Apogon* sp.	85	0.07
4	Decorated ponyfish	Cirik	*Secutor insidiator*	44	0.05
5	Mozambique tilapia	Mujae	*Oreochromis mossambicus*	184	0.04
6	Tille trevally	Rambeu	*Carangoides tille*	72	0.04
7	Castelnau's jawfish	Dheut	*Opistognathus castelnaui*	86	0.04
8	Brown surgeonfish	Kawet	*Acanthurus nigrofuscus*	53	0.02
9	Blackspot snapper	Tanda	*Lutjanus fulviflamma*	26	0.01
10	Silver moony	Layang	*Monodactylus argenteus*	22	0.01
11	Hawaiian giant herring	Geumuloh	*Elops hawaiensis*	67	0.01
12	Papuan snapper	Tengar	*Lutjanus papuensis*	64	0.01
13	Grunter	Sikirong	*Terapon jarbua*	10	0.01
14	Malabar blood snapper	Kunyet	*Lutjanus madras*	8	0.01
15	Rabbitfish	Cabeh	*Siganus guttatus*	4	0.01
II. Bycatch (HTS)					
1	Whiteleg shrimp	Udeng puteh	*Litopenaeus vannamei*	22	0.05
2	Mud crab	Bieng	*Scylla serrata*	51	0.01
III. Discarded Catch (HTB)					
1	Narrow-lined puffer	Bukum	*Arothron manilensis*	16	0.01

Based on Table 2, the most abundant main catch species during the one-month study period was greenback mullet (Chelon subviridis), accounting for 0.45%, while the least abundant was rabbitfish (Siganus guttatus), accounting for 0.01%. For bycatch, whiteleg shrimp (Litopenaeus vannamei) showed the highest proportion (0.05%), whereas mud crab (Scylla serrata) had the lowest proportion (0.01%). The discarded catch consisted solely of narrow-lined puffer (Arothron manilensis), with a proportion of 0.01%.

Catch Diversity and Dominance

Analysis of catch diversity and dominance is an important ecological approach for evaluating the effectiveness of fishing gear and its potential impacts on fish resources. In the context of anco fishing gear, which operates passively and selectively targets demersal or near-bottom species, this analysis helps identify dominant species and assess the level of species diversity within fishing operations (Lestari et al., 2021). Furthermore, Rahman et al. (2024) emphasized that combining diversity and dominance analyses provides a scientific basis for sustainable fisheries management decisions.

By identifying dominant species, fishing communities can design management strategies to reduce excessive exploitation of particular species and maintain ecosystem balance. The diversity and dominance of catches obtained in the Alue Naga River estuary are illustrated in the following figure.
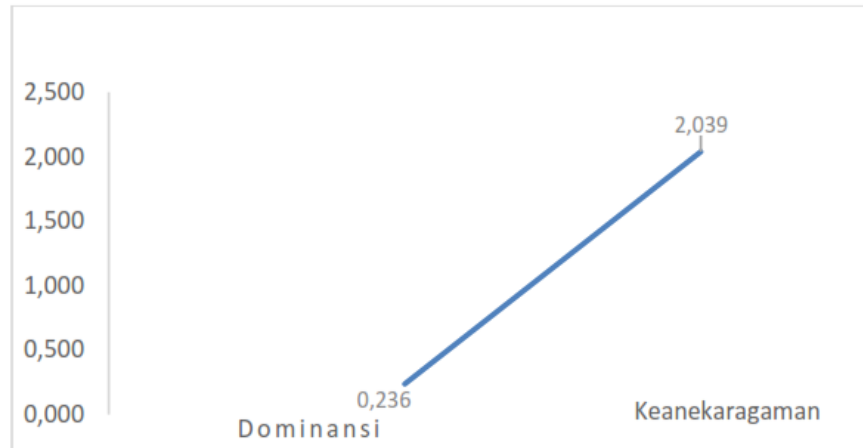

Figure 3. Diversity and Dominance Indices of Catches

Figure 3. Diversity indices, such as the Shannon–Wiener index (H′), are used to quantify species richness and the proportional distribution of species within the catch. In contrast, dominance indices, such as the Simpson index (C), are applied to assess whether one or a few species dominate the catch composition. High dominance values indicate that fishing activities tend to concentrate on a limited number of species, which may reflect increased fishing pressure on those species (Wibowo & Pranoto, 2022).

The diversity analysis showed that the Shannon–Wiener diversity index (H′) of anco catches was 2.039, indicating a moderate level of species diversity. Meanwhile, the Simpson dominance index (C) was 0.236, which falls into the low dominance category. Overall, these results suggest a relatively even distribution of species in the catch, as reflected by the low dominance value (C < 0.5) and a moderate diversity level (1 < H′ < 3).

Discussion

Catch Composition

Catch composition represents the variety and relative contribution of fish and other aquatic organisms captured during fishing operations. In fisheries studies, catches are commonly categorized into main catch (target species) and bycatch, which includes non-target species unintentionally captured during fishing activities (Ramdhan, 2008; Nofrizal et al., 2018).

The present study showed that the main catch obtained using anco fishing gear in the Alue Naga River estuary was dominated by estuarine-associated species, particularly greenback mullet (Chelon subviridis), followed by several small pelagic and demersal species such as decorated ponyfish (Secutor insidiator), whipfin silverbiddy (Gerres filamentosus), and tille trevally (Carangoides tille). Bycatch consisted primarily of whiteleg shrimp (Litopenaeus vannamei) and mud crab (Scylla serrata), while the discarded catch was represented solely by narrow-lined puffer (Arothron manilensis).

The dominance of commercially valuable species such as mullet, trevally, and snapper suggests that anco fishing operations tend to capture species with relatively high market demand. However, catch value is influenced not only by species composition but also by fish size and freshness, which are key determinants of market price (Hastrini et al., 2013).

The anco fishing gear used in Alue Naga is rectangular in shape, with a mesh size of 0.5 inches and dimensions of approximately 3 m in width and 5 m in length. Operationally, anco is classified as a passive fishing gear, as it relies on fish movement into the net before being lifted vertically. This fishing mechanism minimizes physical disturbance to the habitat and is generally considered environmentally benign compared to active fishing gears. Fish captured using lift nets typically remain in relatively good condition, although minor injuries may occur due to entanglement during lifting (Partadisastra, 2015; Haluan et al., 2012; Simeon et al., 2013).

Variability in catch composition is strongly influenced by environmental factors such as water clarity, currents, weather conditions, and seasonal fish migration patterns (Limbong, 2018; Fahik et al., 2022). Calm sea conditions and slightly turbid waters are often used by traditional fishers as indicators of fish presence. In addition, interannual climatic variability may affect fishing effort and total catch production, as differences in weather conditions influence both fish availability and fishing activities (Maunder et al., 2006). Due to its vertical lifting mechanism, anco fishing gear is relatively non-selective by species, allowing pelagic, demersal, and benthic organisms present above the net to be captured.

Catch Diversity and Dominance

Species diversity is a key indicator of ecosystem condition, as it reflects the structure and stability of aquatic communities (Jumiati, 2020). From a fisheries perspective, diverse and balanced fish assemblages are generally associated with more resilient ecosystems and sustained fishery productivity, which contribute to local livelihoods and regional economic development (Khaerudin et al., 2019).

The Shannon Wiener diversity index (H′) obtained in this study was 2.039, indicating a moderate level of species diversity. This value suggests that the fish assemblage captured by anco fishing gear in the Alue Naga River estuary is relatively heterogeneous, with no excessive dominance by a single species. Similar diversity levels (1 < H′ < 3) have been reported in other estuarine and coastal fisheries, where moderate diversity reflects a stable community structure (Suprapto, 2014; Sentosa, 2013).

The Simpson dominance index (C) recorded in this study was 0.236, which falls within the low dominance category. This result indicates that no single species dominated the catch composition, and species abundance was relatively evenly distributed. Low dominance values are commonly associated with balanced fish communities and suggest that fishing pressure is not concentrated on a limited number of species (Suprapto, 2014; Nugroho, 2015). The inverse relationship observed between diversity and dominance indices further supports the conclusion that anco fishing gear captures a relatively stable and evenly distributed fish assemblage in the Alue Naga River estuary.

4. Conclusions

This study provides baseline information on the catch composition and community structure of fish captured using anco fishing gear in the Alue Naga River estuary, Banda Aceh. The main conclusions are as follows:

a. The catch composition was dominated by greenback mullet (Chelon subviridis), with 60 individuals (0.448%) and a total biomass of 1,651 g (0.631%), followed by whipfin silverbiddy (Gerres filamentosus). The least abundant species was rabbitfish (Siganus guttatus), represented by a single individual with a biomass of 4 g (0.002%).

b. The Shannon–Wiener diversity index (H′ = 2.039) indicated a moderate level of species diversity, while the Simpson dominance index (C = 0.236) reflected low dominance. These findings suggest that anco fishing gear captures a relatively balanced fish assemblage without strong dominance by a single species.

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