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(RESEARCH ARTICLE)

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First record of potential epiphyte grazing species in commercial seaweeds (*Kappaphycus spp.*), Philippines

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Abstract

Commercial seaweeds (*Kappaphycus spp.*) being widely cultivated at sea face inevitable challenges such as ice-ice disease and epiphyte infestations. Hence, this research provided the first record of potential epiphyte grazing species associated with cultivated seaweeds. A total of 26 seaweed farms were surveyed for 7 months, from April to October 2022, to record the occurrence and abundance of blenny fish. Results from the visual census survey showed a total of 984 sightings of blenny fish (*Petroscirtes spp.*). The highest occurrence of blennies was recorded in planted seaweeds (81.4%), followed by ropes (12.3%) and floats/buoys (6.3%). Blennies are found to spend the majority of their time resting, swimming, and grazing on the algal epiphytes that are attached to seaweeds. These tiny fish, which are associated with cultivated seaweeds but are overlooked in seaweed farms, are critically important and can contribute little pressure to controlling epiphytes.

Keywords: Blennies; Bio-control; Epiphytes; Ecological importance; Seaweeds

1. Introduction

The province of Camarines Norte is the leading producer of commercial seaweeds (*Kappaphycus spp.*) in the Bicol region [1]. Seaweed farming is still booming and attracting attention despite the years that have passed since its introduction. However, despite the thriving economy brought forth by seaweed farming, fishermen continue to struggle with the industry's inherent difficulties. Seaweed farming faces inevitable challenges such as disease ("ice-ice") and epiphyte infestation, which have resulted in a massive decline and loss in production. Infestation by epiphytes and the high incidence of 'ice-ice' disease are major problems in the province. An excessive load of algal epiphytes reduces photosynthetic rates in farmed seaweeds, resulting in diminished fitness, stress, and eventually 'ice-ice' disease.

The epiphytic phenomenon is a major problem affecting the productivity of seaweed globally [13, 4, 10, 21]. The open sea allows spores and propagules of other algae to migrate with the current and adhere to farmed seaweed and develop as competitors [15]. Due to competition for space and nutrients, epiphytes may reduce the growth rate and biomass of farmed seaweeds [2] as well as the yield and quality of carrageenan, resulting in economic loss [16, 22, 15].

Hence, the occurrence of a potential epiphyte grazing species may contribute to controlling the growth of epiphytes in commercial seaweeds. A study showed that epiphyte-feeding species can control epiphyte buildup and improve growth in seagrass [14]. However, the presence of epiphyte grazing species in farmed seaweeds (*Kappaphycus spp.*) has not been fully explored and observed in the field. There have been no records that have shown potential epiphyte feeding species on cultivated seaweeds like on seagrass as shown in different studies conducted [6, 20, 23].

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With blennies feeding on algae [11], having a common food item such as detritus and plants found in the diet, composed of cyanobacteria and all algae, coralline algae, filamentous algae, red algae, and algal fronds [9], blennies can serve as potential bio-control species in seaweed epiphytes. Despite what appears to be numerous studies describing the blenny's habitat and food habits, no research has been conducted into its potential importance as a bio-control of epiphytes in highly economically important commodities (carrageenan-producing seaweed) such as *Kappaphycus spp*. The occurrence of blennies on commercial seaweeds and grazing activity on epiphytes are not yet observed in the field because of their small size and cryptic behavior, which makes them easily overlooked and appear to have no significant importance on seaweed farms.

2. Material and methods

2.1. Sampling site

This study was the first to report the occurrence and behavior of blenny fish in commercial seaweeds. The feeding and diet composition of blennies from related literature and studies were also reviewed to relate and emphasize its occurrence and ecological importance to seaweed farming. An assessment of blennies was conducted in twenty-six (26) seaweed farms in Camarines Norte, Philippines, covering five (5) municipalities, namely Capalonga, Jose, Panganiban, Paracale, Vinzons, and Mercedes (Figure 1).

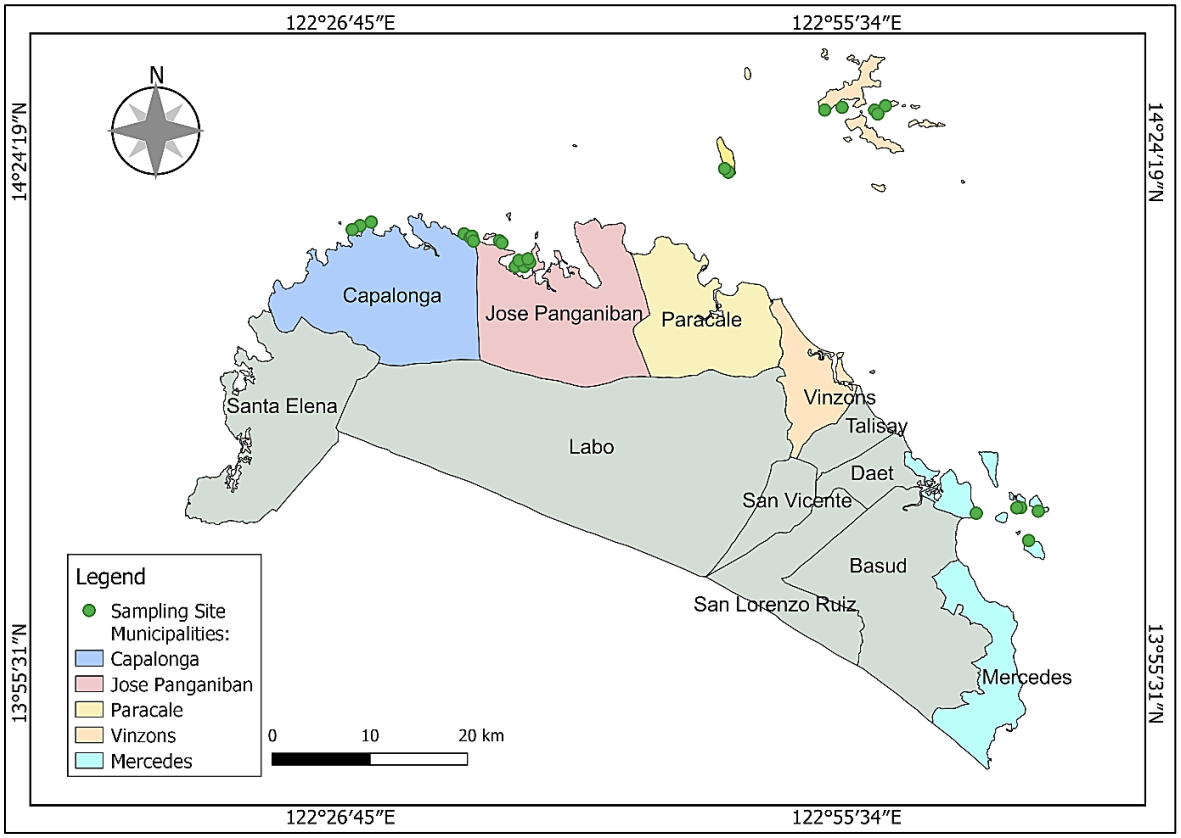

Figure 1 Location map of Camarines Norte, showing the sampling sites of the study

2.2. Data collection

Seaweed farms were surveyed for seven (7) months, starting from April to October 2022. Sightings of blennies were recorded using the visual census method, which counts the number of individuals while swimming along seaweed lines (Figure 2). Blennies' occurrences were noted using an underwater slate, taking notes of the abundance and occurrences in floats, ropes, and planted seaweed. Only blennies inside the seaweed production areas, attached to and swimming near planted seaweed, floats, and ropes, were recorded during the survey. They were cautiously observed and counted using snorkeling equipment and an underwater camera to document their occurrence and observe their behavior. Using morphological traits and characteristics found on the website fishbase.org [5], blennies species were recognized to the genus level.

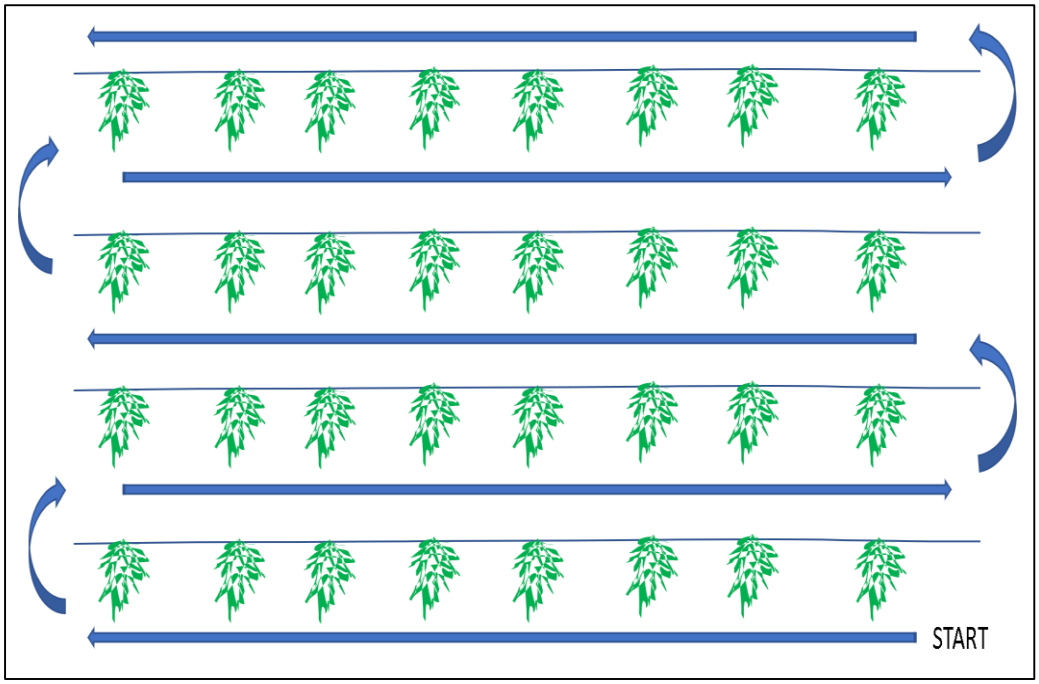

Figure 2 Sampling design of the study used in recording the occurrence of blennies in seaweed production areas, showing the swimming pattern (blue arrow) along the seaweed (green color) culture lines during data collection

3. Results and discussion

3.1. Blennies sightings

A total of 984 sightings of blennies were recorded at 26 seaweed farms. As shown in Figure 3, the highest number of sightings were recorded in the municipality of Mercedes (359), followed by Vinzons (245), Jose Panganiban (172), Paracale (114), and Capalonga (94). Blennies were discovered to spend most of their time in planted seaweeds, which constituted 81.40% of their occurrence, followed by ropes (12.30%) and floats/buoys (6.30%) as shown in Figure 4. In seaweed farms, blennies can be found at a variety of depths and habitat types (corals, seagrasses, wild seaweeds, and sandy bottoms) where seaweed production areas are located.

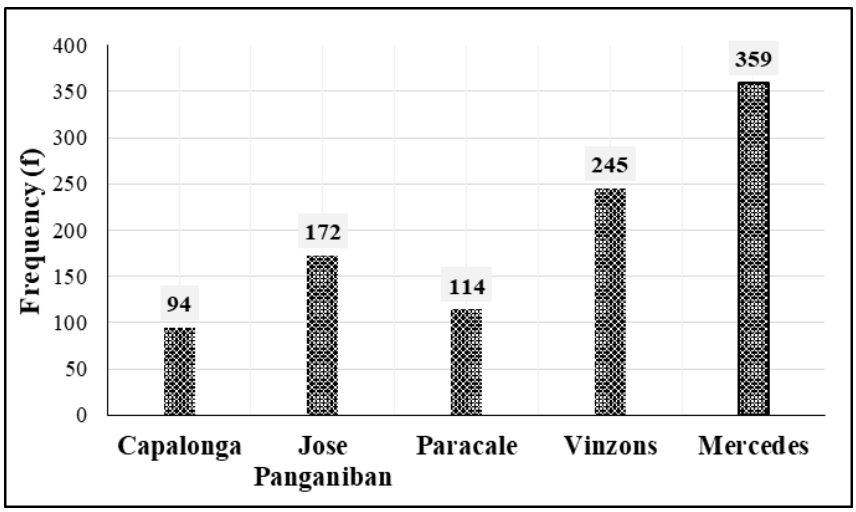

Figure 3 The number of blennies sightings in seaweed farms showing total abundance per study site

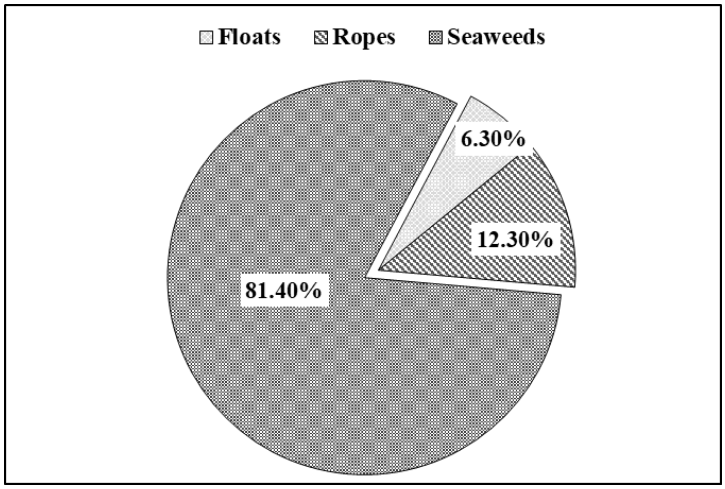

Figure 4 Abundance of blennies, showing the percentage of occurrence in ropes, floats, and planted seaweeds

3.2. Description

Blenny fish, *Petroscirtes spp.*, are highly cryptic and difficult to spot on seaweeds. They are poor swimmers, solitary, and are found to spend most of their time resting and swimming on planted seaweeds. Their body color may vary depending on the coloration of seaweed cultivars influenced by different environmental conditions (Figure 5). Locally, blennies are called "Anas" and currently have no commercial value or economic use in the area. In the field, they are observed to be closely associated with cultivated seaweeds and very abundant during the planting season and when seaweeds are in the grow-out or marketable stage. As a result, after harvesting, blennies are reported to remain on seaweed lines (ropes) and float, awaiting the next out-planting of new seedlings. Moreover, these tiny fish are often observed by seaweed farmers in the field and are suspected to be grazing on algal epiphytes attached to the seaweed's thallus. However, blennies are usually ignored and overlooked in seaweed farms due to their small size, limited scientific information, and lack of commercial value.

Figure 5 Life habit of blennies (black arrows), showing cryptic behavior and active feeding on algal epiphytes present on cultivated seaweeds (*Kappaphycus spp.*)

3.3. Diet composition

Blennies are the most abundant fish community in shallow waters and tidal pools [8], playing a key role in biodiversity and the functioning of coastal ecosystems [19]. They are small nektonic fish [17] that feed on algae and eelgrass [12], including epilithic diatoms, small barnacles, and polychaetes [18]. Guts of blennies contained primarily structureless organic matter (gurry) and various types of nonmotile benthic organisms (foraminifera, sponges, and filamentous algae) [4]. Previous research has already shown that some species of blennies can reduce the epiphytic load on seagrass blades [7], but not in cultivated seaweeds.

3.4. Ecological importance

Blennies prefer and seek refuge in farmed seaweeds rather than their natural habitat, most likely to avoid predators and to take advantage of the food available on seaweeds. This behavior is noticeably based on an algal buildup on the body and color, which is the same as the host seaweeds. Blennies' occurrence and high biomass may contribute to controlling the early development of epiphytes and algal load on seaweeds. Their movement and life habits of swimming and resting on seaweeds can have a significant contribution to stirring up dirt, mud, and algal loads attached to the seaweed's thalli. Particularly during the out-planting stage, when epiphytic organisms are just beginning to emerge [1].

There may be a major and hitherto unappreciated contribution to epiphytic algae's grazing pressure coming from the relatively low blennies biomass seen in seaweed habitats, but epiphyte biomass may be reduced as a consequence of the high occurrence and prevalence of blennies species. Their presence in cultured seaweeds may place little strain on the removal and growth of algal epiphytes, which can lead to epiphyte outbreaks and ice-ice diseases.

4. Conclusion

Kappa-carrageenan-producing seaweed is widely cultivated at sea; thus, attachment of epiphytes is inevitable and difficult to control. Hence, blenny species tightly associated with farmed seaweeds identified in this study are somewhat critical and may have significant importance in controlling epiphytes in commercial seaweeds. More detailed related studies, such as the diet of blennies species found on cultured seaweeds and their grazing efficacy on epiphytes, shall be explored.

Compliance with ethical standards

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Disclosure of conflict of interest

The author declares that they have no conflict of interest.

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