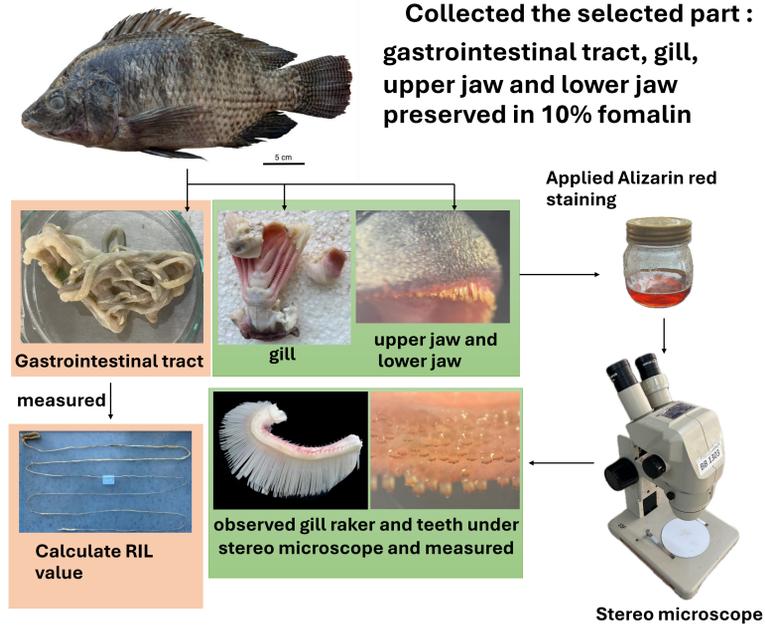


Abstract

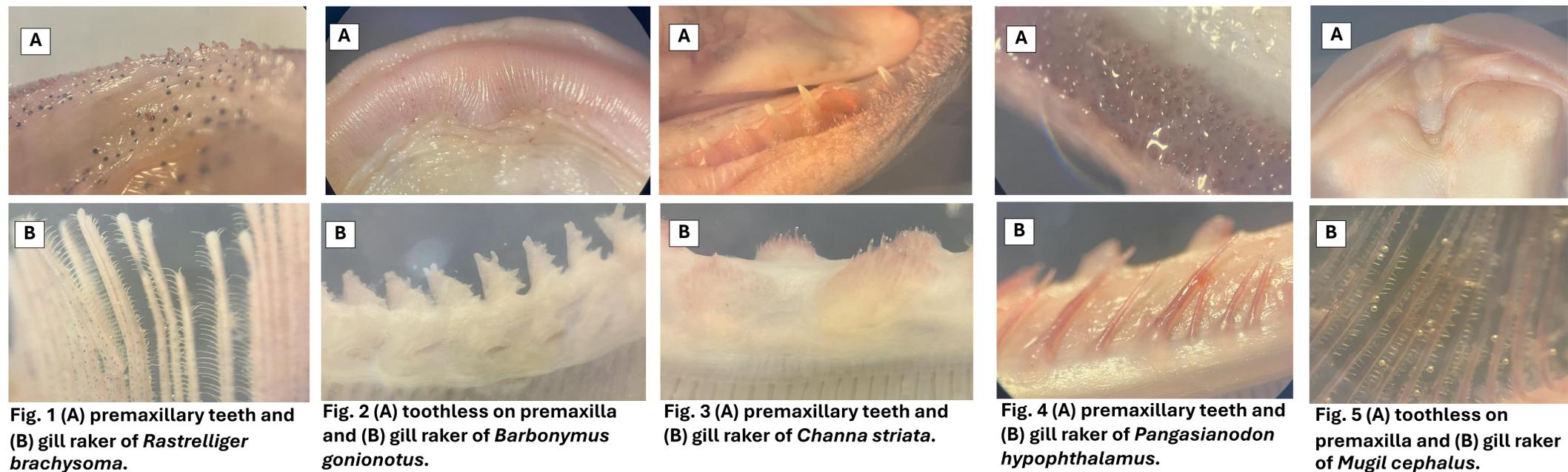
The objective of this study is to investigate the correlation between the morphology of the oral cavity, gill rakers, and gastrointestinal tract of nine fish species, categorized into five different feeding groups. Three main parts of structures were collected from 27 fresh specimens and preserved in 10% formalin solution before examination under stereomicroscope. Bony structures (like teeth, gill arch, gill rakers) were stained with Alizarin red solution before investigation. In respect of structures in their oral cavities, it showed that planktivorous fishes possess not prominent, small teeth with spaced apart. Whereas, carnivorous fishes, *Lutjanus russellii* have more prominent teeth, with canine or fang-like teeth used to grasp prey. On the other hand, herbivorous fishes do not have teeth inside their oral cavity, but in *Barbonymus gonionotus*, pharyngeal teeth with soft lumps are present, which are used for grinding food, without any sharpness. In omnivorous fishes, multiple types of teeth are found depending on their diets, such as in *Pangasianodon hypophthalmus*, where villiform teeth are present. Lastly, in detritivorous fishes, only pharyngeal teeth are found, appearing as short spines. Regarding the morphology of gill rakers on the first gill arch, it revealed that the fish with the longest gill rakers is *Rastrelliger brachysoma*, a planktivorous species, (2.2 cm in length) with slender, and equipped with comb-like denticles used for filtering small plankton from the water. The second longest gill raker is found in the *Hypophthalmichthys nobilis*, a herbivorous species, (1.63 cm in length). While *Channa striata*, a carnivorous species, has the shortest gill rakers (0.2 cm in length), which are widely spaced, with sharp denticles. In contrast to herbivorous species, the gill rakers lack of spines. In terms of the relative intestinal length (RIL), it was discovered that *Oreochromis niloticus*, omnivorous species, had the highest value (7.41) following with *Hypophthalmichthys nobilis*, herbivorous species, (5.37), in contrast to *Selaroides leptolepis*, planktivorous species, had the lowest value (0.47). According to results of this study, it could provide the fundamental data about anatomical structures of digestive systems correlated to feeding strategy of fishes.

Methodology



Introduction and Objective

Fish, a crucial economic and aquatic resource in Thailand, which are rich in nutritional values (low unsaturated fats, low cholesterol, and high protein content). As a demand for fish increases, necessity of aquaculture is required to increase the supply. This study focuses on the relationship between the morphology of the oral structures, gill rakers, and digestive tracts of nine fish species with different feeding habits, grouped into five categories. The fish species include: *Rastrelliger brachysoma* and *Selaroides leptolepis*, representing planktivorous fishes; *Barbonymus gonionotus* and *Hypophthalmichthys nobilis*, representing herbivorous fishes; *Channa striata* and *Lutjanus russellii*, representing carnivorous fishes; *Oreochromis niloticus* and *Pangasianodon hypophthalmus*, representing omnivorous fishes; and *Mugil cephalus*, representing detritivorous fishes (Vicharn, 2020; Priyanart and Penkae, 1982; Priyaporn, 2006; Sarka et al., 2024; Winich, 2014; Duanchai, 2017; Pichet, 2016; Mousa et al., 2016). The objective of this research is to study the relationship between the morphology of the oral structures, gill rakers, and gastrointestinal tracts in the nine species and its various feeding strategies.



Results and Discussion

The results showed that the oral cavity of *Channa striata* (fig. 3A), a carnivorous fish, had prominent canine teeth used for gripping and tearing prey [2]. Herbivorous fish do not have any teeth on the jaw, however, *Barbonymus gonionotus* (fig. 2A) had plates of pharyngeal teeth, used for grinding food before swallowing. *Rastrelliger brachysoma* (fig. 1A) is a planktivorous fish with small teeth or none on the jaw. Omnivorous fishes had a various type of teeth depending on their feeding behaviors. For example, *Pangasianodon hypophthalmus* (fig. 4A) possessed small teeth on premaxilla, In *Mugil cephalus* (fig. 5A), detritivorous fish, no teeth on the jaw as in herbivorous fish. In the study of gill rakers, *Rastrelliger brachysoma* (fig. 1B) had long, dense, comb-like gill rakers to filter small plankton floating in the water [1]. *Barbonymus gonionotus* (fig. 2B) had shorter gill rakers than planktivorous fish. There were short spines on the gill raker to filter plant debris and algae [1]. *Channa striata* (carnivorous fish) (fig. 3B) had a fewer gill rakers with small spines to capture preys. *Pangasianodon hypophthalmus* (omnivorous fish) (fig. 4B) had flat, thin, and narrow triangular gill rakers. The gill rakers found in *Mugil cephalus* (detritivore) (fig. 5B) were similar to planktivorous fish in having long and slender gill raker used to filter small debris. According to results of a gastrointestinal tract, fish species with the highest RIL value was *Oreochromis niloticus* (fig. 6), which was an omnivorous fish. Due to the difficulty of plant digestion, fish needs a long intestine to increase the area for digestion and absorption [3]. On the other hand, carnivorous fish have the shortest intestine to process the meat.

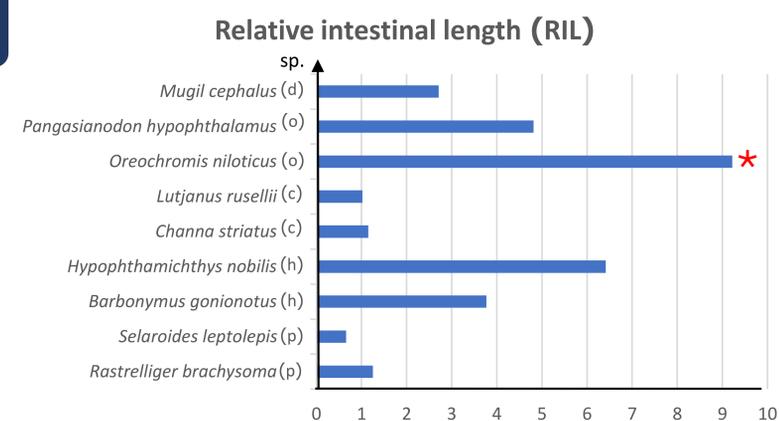


Fig. 6 A comparison of the mean values of relative intestinal length in 9 fish species. Abbreviation : d = detritivore, o = omnivore, c = carnivore, h = herbivore and p = planktivore.

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