Egyptian Journal of Aquatic Research 43 (2017) 297–302

HOSTED BY

Contents lists available at ScienceDirect

Egyptian Journal of Aquatic Research

journal homepage: www.sciencedirect.com/locate/ejar

Full length article

Relationships of body lengths with mouth opening and prey length of nemipterid fishes (Regan, 1913) in the Gulf of Thailand

Mithun Paul [a], Siriporn Pradit [b,*], Sukree Hajisamae [c], Permsak Prengmak [d], Fazrul Hisam [e], Sriwita Chaibundit [d]

[a] Marine and Coastal Resources Institute, Prince of Songkla University, Thailand
[b] Coastal Oceanography and Climate Change Research Center, Marine and Coastal Resources Institute, Prince of Songkla University, Thailand
[c] Faculty of Science and Technology, Prince of Songkla University, Pattani, Thailand
[d] Southern Marine Fisheries and Development Centre, Songkhla, Thailand
[e] School of Fisheries and Aquaculture Sciences, Universiti Malaysia Terengganu, Kuala Terengganu, Malaysia

ARTICLE INFO

Article history:
Received 11 September 2017
Revised 11 November 2017
Accepted 19 November 2017
Available online 29 November 2017

Keywords:
Nemipteridae
Total length-fork length
Length-mouth area
Predator-prey length
Gulf of Thailand

ABSTRACT

This study aims to investigate the relationship among total length (TL) of fish with mouth opening namely horizontal opening (M_H), vertical opening (V_H), mouth area (M_A) and fork length (FL) of seven sympatric nemipterid fish species and to know the relationship between total length and consumed prey length of five sympatric species sampled from the Gulf of Thailand in 2015. A total 883 fish were investigated collected from both cruise surveys and fishing port survey. TL was linearly and log-linearly related with both M_V and M_H for three and four species, respectively. M_A's were always the log linear relation of TL and shapes were nearly oval for all species. FL in all TL-FL relationships were proportional to the TL's in all species ($r2 = 0.94$, $P < .01$), except for the female *N. tambuloides* ($r2 = 0.84$, $P < .01$). PL increase significantly ($P < .05$) with predator length for all five species except in pisces prey item for *N. nematophorus* ($P > .5$) and in invertebrate prey items for *N. tambuloides* ($P > .5$). So, this study clearly confirms that nemipterid fishes of different sizes feed on all different specific prey items according to its own body size and feed according to size class for prey items available nearby.

Introduction

Body form and mouth opening size determine the success of foraging and fish diet accordingly and that are the most important factors (Breck, 1993, Magnhagen and Heibo, 2001). Both predator and prey body size is crucial in aquatic communities to be successful in foraging (Hughes, 1997; Juanes, 1994; Persson, 1990; Scharf et al., 2000). Karpouzi and Stergious (2003) stated that fish tends to enlarge the prey items size range consumed with increasing body size, in addition to enlarging the regular size of eaten prey items. Visual acuity, ability of digestion, mouth dimensions and improvement in swimming performance have attributed this increasing in prey size among the other factors which factors support increasing predators to consume bigger prey items successfully (Galis, 1990; Hart, 1997; Juanes, 1994; Juanes and Conover, 1994; Kaiser and Hughes, 1993; Keast and Webb, 1966; Werner and Gilliam, 1984; Wotton, 1998). Moreover, fractional trophic level defines the position of an organism which have a positive relation with body size (Cohen et al., 1993; Pauly et al., 1998b) within a food web largely (Pauly & Palomares, 2000; Pauly et al., 1998a). Accordingly, a morphological characteristic such as mouth area, opening as well as fish total length decides the sorts of prey items consumed in most cases (Norton, 1991; Keast and Webb, 1966; Werner, 1979). The vertical mouth opening acts as an essential part in the catch of prey by predator while vertical mouth opening restricts or controls the size of the prey items captured (Cunha and Planas, 1999).

Nemipteridae family is an important catch of both commercial and artisanal fisheries (Russell, 1990). It's commonly known as threadfin bream which is extensively found in tropical Indo-pacific regions (Russell, 1993) mainly between 34°N–11°S latitudes and 31°E–133°W longitudes. Fishes of this family has become an important demersal resource caught throughout the year in small trawlers along the Egyptian Mediterranean coast (ElHaweet, 2013). Nemipterid fish forms a total 11–20% of the total catch of

Peer review under responsibility of National Institute of Oceanography and Fisheries.

* Corresponding author at: Coastal Oceanography and Climate Change Research Center, Marine and Coastal Resources Institute, Prince of Songkla University, 90112, Thailand.

E-mail addresses: siriporn.pra@psu.ac.th (S. Pradit), md.fazrul@umt.edu.my (F. Hisam).

https://doi.org/10.1016/j.ejar.2017.11.001
1687-4285/

trawl landings in India (Joshi, 2005). It is also reported as an economic species from Japan, Taiwan (Russell, 1993), Indonesia, China (Ping et al., 2011) and some other countries as well. In Gulf of Thailand, the total fish catch contribution of demersal fish is 17% (Paul et al., 2015). Nemipteridae was also a huge portion of trawl catching for last few years but this resource is declining in almost every year (Stobutzki et al., 2006). Careful management is therefore highly required. This study therefore aims to investigate the scientific information on the fish ecology since ecological data of these seven sympatric species are limited. So, the main objective was (1) to find out the correlation among fish total length with mouth opening (horizontal, vertical & mouth area) and fork-length for seven sympatric demersal fish species and (2) to study the relationship between total-length with the length of consumed prey items for five sympatric demersal fish species in the bottom water of the lower part of the South China Sea. This information will be useful for the understanding of some ecological phenomenon and may serve as useful data for future management of these fishery resources.

Materials and methods

Study area and sample collection

The study area located between 6°41′42″–9°18′10.8″N and 10 1°2′13.2″–102°3′7.2″E. Survey sites were situated at the southern part of South China Sea, also regarded as coastal waters in southern Thailand (Fig. 1). Sampling areas are divided into grids and samples were collected from 23 stations. Samples were collected by two ways of sampling. Firstly, the fishes were collected by three cruises sampling (April–July 2015) with a bottom trawl net (39 m headline, 51 m ground rope, and 4 cm mesh cod-end line) on board of M.V. PRAMONG 9 (25.5 m long research vessel from Southern Marine Fisheries & Development Centre, Songkhla, Thailand). The towing speed was 2.5 knot/h and every hauls were conducted for 1 h. All trawling was operated during day time. Secondly, sample was collected by 3 times survey from five main fishing ports (From gill nets fishing boats only) in five provinces of southern Thailand covering the same area of field trawling. Cruise samples were preserved immediately in freezer and fishing port samples were preserved immediately into ice and bringing into laboratory for further analysis.

Fig. 1. Study area showing the lower part of the South China Sea.

Laboratory analysis

Targeted samples were separated from other trawl/gillnet catch. Targeted samples were (i) *Nemipterus nematophorus* (Bleeker, 1854), (ii) *Nemipterus mesoprion* (Bleeker, 1853), (iii) *Nemipterus nemurus* (Bleeker, 1857), (iv) *Nemipterus tambuloides* (Bleeker, 1853), (v) *Scolopsis taeniopterus* (Cuvier, 1830) (vi) *Nemipterus hexodon* (Quoy & Gaimard, 1824), and (vii) *Nemipterus furcosus* (Valenciennes, 1830). Total length and fork length were measured by a measuring scale into nearest centimeter. Mouth opening (both horizontal and vertical) were measured using a caliper with maximum force (using hand) into nearest millimeter (Mitutoyo, CD-15PS, Japan). Then, fish samples were gutted open by a surgical ocular scissors, sexes were identified by visual gonad observation (Dan, 1977). The stomachs were cut and open in Petri dish by a corneal scissor and the food items identification and measurement were conducted under a binocular microscope (OLYMPUS, Model SZ2-ILST). Total length of all the undigested and just a slightly digested unbroken prey items were recorded using a caliper for bigger food item and the smaller prey items with an ocular micrometer (10X) for only five fish species, namely (i) *N. mesoprion* (ii) *N. hexodon* (iii) *N. nematophorus* (iv) *N. tambuloides* and (v) *S. taeniopterus* following to Karpouzi and Stergious (2003).

Data analysis

Total length and fork length relationship were identified using the following equation:

$$FL = a\ TL + b, \quad \text{where a \& b are constant}$$

Both mouth openings were regressed against total length (TL) and the r^2 value determines the relationship either linearly or log linearly. The following equation were used to determine the relationship of mouth area (M_A) with vertical (M_V) and the horizontal (M_H) by following Erzini et al., 1997.

$$\text{Mouth Area } (M_A) = 0.25 \times \pi \times M_V \times M_H$$

Statistical analysis

All data analysis was carried out in Microsoft excel for mean, minimum and maximum. Analysis of regression was done to find the co-relation among total length, fork length, vertical mouth opening, horizontal mouth opening and mouth area. Analysis of regression was done to observe the changes in prey size in relation to the patterns of prey sizes. Scatter diagram (total fish length vs. consumed prey length) and least-square regressions were produced for 5 major fish species verses 2 major group of prey (Invertebrate and Pisces) in order to estimates their relationships. All data were transmitted to log(x + 1) and then used to perform all statistical analysis.

Results

Length composition

A total of 883 samples from seven different species were analyzed. Both total length and fork length are found minimum for *N. nematophorus* is 5.30 cm and 4.60 cm where maximum lengths are found to be 28.30 cm and 24.80 cm for *N. hexodon*. Details of mean, maximum and minimum for all seven species are given in Table 1.