Journal of Aquaculture 12 (2) : 101~105 (1999)

Taxonomy of Preys in Natural Young Tarpon, *Megalops atlanticus*

Sung Hwoan Cho

Department of Fisheries and Allied Aquacultures, Auburn University, AL 36832, USA

Predator, tarpon (*Megalops atlanticus*) has a specific preferring preys in natural environments. To investigate this, young tarpon were captured and their stomach contents were weighed and sorted based on taxonomic groups. Average standard length and body weight for tarpon captured were 11.49 cm and 34.67 g, respectively. The average weight of the stomach contents in the tarpon was 0.83 g. The status of digestion extent of the consumed preys was 2.37 which indicated that preys were relatively well digested. The main preys in tarpon stomach were other fishes (mosquito fish and sheepshead minnow) and shrimp. Frequency occurrence of fishes in tarpon stomach was highest ($P<0.05$). Also, frequency occurrence of shrimp was higher than that of fly ($P<0.05$). Mean individual number of fish found in tarpon stomach was 2.66 per tarpon and it was higher than that of shrimp or fly ($P<0.05$). There was linear regression between the total weight of the consumed preys and the standard length of tarpon; Y (Total weight of preys) = 0.3151 X (Standard length of tarpon) - 2.7123, $R^2=0.6140$. Also, there was the strong linear regression between the total weight of the consumed preys and weight of the tarpon; Y (Total weight of preys) = 0.0299 X (Body weight of tarpon) - 0.0774, $R^2=0.7882$. These results indicated that the main preys for young tarpon in their natural environments were small fish composed of mosquito fish and sheepshead minnow and shrimp. And there was the stronger correlation between the total weight of preys and the body weight of tarpon than that between the total weight of preys and the standard length of tarpon.

Key words : Tarpon *Megalops atlanticus*, Stomach contents, Prey, Predator

Introduction

Quantitative and species information on preys is essential for an understanding of the habitat for predator fish. It can be known by investigating the stomach contents of predator fish, how much and what types of preys consumed by any specific stage of predator fish.

Several methods of stomach contents analysis were proposed by Hyslop (1980) and Bowen (1983). In their studies, each type of analysis method employed the different measurements of category and explained advantages and disadvantages of each method.

The principal methods used to obtain taxon-specific weight contribution were direct measurement, in which items were sorted by hand into taxonomic groups and then weighed individually or as a group; and length-weight regression, in which length was measured for a subsample of prey items and the weight for each item was then estimated by length-weight regression.

Direct measurement was often used for piscivorous fish because prey items could be easily identified and weighed (Knight et al., 1984;

Lyons and Magnuson, 1987). A multiple-regression model was developed for estimating the weight contribution of prey taxa in fish diets (Hayes and Tylor, 1991). By using this model, the effort and time of processing to sort and weigh individual preys could be reduced.

Gehringer (1959) reported that standard length of the leptocephalus of tarpon was 18.0 mm. And Harrington and Harrington (1960) showed that cyclopoid copepods was the main food of larval tarpon, *Megalops atlantica*.

However, there was few study on preys of young tarpon. Therefore, this study was conducted to find the types of prey of young tarpon in the natural environment. In order to investigate this, the stomach contents of young tarpon captured in the wild were sorted and then identified.

Materials and Methods

Young tarpon were captured on September 20 and 23 in 1996 at Scottsmoor (Northern Brevard, Florida, U.S.A.) and on September 25 and 29 in 1996 at Tarpon Hole (North Indian River County, Florida, U.S.A.) with a cast net or seine net between 10 : 00 and 11 : 00. The captured tarpon were preserved with formaldehyde solution and sent to the lab for further analysis. Body weight (g) and standard length (cm) of young tarpon were individually measured.

About 50 of the tarpon we captured were dissected and their stomach contents were removed. And the stomach contents from each fish were preserved in 10% formaldehyde solution in the vial for a day. Formaldehyde solution was replaced with 50% alcohol twice before identification of preys was performed. The stomach contents of each fish were sorted into taxonomic groups under a dissecting microscope and then identified. The total weight of the stomach contents of tarpon was measured and mean individual number of the consumed preys was counted and compared. However, some tarpon had empty stomachs, so they were out of further process.

Also, the consumed preys were divided into the three categories depending on the extent of their digestion; (1) least digestion-discrete body shape and eye pigment, (2) intermediate digestion-black eye pigment dispersed, and (3) well digestion-body tissue collapsed. Finally, the relationship between total weight of the consumed preys and standard length or weight of tarpon was calculated. Duncan's multiple range test was employed for statistical analysis at the level of 5% (Duncan, 1955).

Results

The size of tarpon captured, total weight of stomach contents and status of digestion of preys were given in Table 1. The average size of tarpon captured were 11.49±2.97 cm and 34.67±40.84 g for standard length and weight, respectively. The average weight of stomach contents of tarpon was 0.83±1.01 g. The mean status of digestion extent of preys was 2.37±0.77 which indicated that preys were relatively well digested.

The consumed preys were mainly other species of fish and shrimp (Table 2). Prey fish were mainly composed of mosquito fish (*Gambusia affinis*) and sheepshead minnow (*Cyprinodon variegatus*). Frequency occurrence of fish in tarpon stomach was highest ($P<0.05$). Also, frequency occurrence of shrimp was higher than that of fly ($P<0.05$). Fish as prey in tarpon stomach

Table 1. Average size of tarpon captured and total weight of consumed preys in tarpon stomach and digestion status of preys

Standard length (M±S.D.) (cm)	Wet weight (M±S.D.) (g)	Total weight of stomach contents (M±S.D.) (g)	Status of digestion of preys (M±S.D.)
11.49±2.97	34.67±40.84	0.83±1.01	2.37±0.77

Table 2. Group of preys, mean individual number of prey found in tarpon stomach, mean frequency occurrence of each prey per tarpon and observed rate of each prey in all tarpon

Group	Mean individual number±S.D.	Frequency occurrence of each prey in stomach (%)	Observed rate in all tarpon (%)
Fish	2.66 ± 2.84^{a}	88.0^{a}	95.1
Shrimp	0.39 ± 0.92^{b}	11.2^{b}	22.0
Fly	0.02 ± 0.16^{b}	0.8^{c}	2.4

Different superscript letters in the same column mean significant difference at $p<0.05$.

was found in 95.1% of tarpon samples and its mean individual number was 2.66±2.84 per tarpon. Shrimp as prey in tarpon stomach was found in 22.0% of tarpon samples and its mean individual number was 0.39±0.92 per tarpon. Mean individual number of fish found in tarpon stomach was significantly higher than that of shrimp or fly ($P<0.05$).

There was a regression response between the total weight of the consumed preys and standard length of tarpon; Y (Total weight of preys) = 0.3151 X (Standard length of tarpon) - 2.7123, R^2=0.6140 (Fig. 1). Also, there was the strong regression response between total weight of the consumed preys and body weight of tarpon; Y (Total weight of preys) = 0.0299 X (Body weight of tarpon) - 0.0774, R^2=0.7882 (Fig. 2).

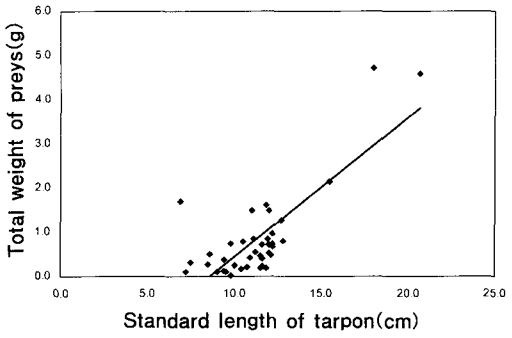

Fig. 1. The relationship between total weight of preys and standard length of tarpon; Y (Total weight of preys) = 0.3151 X (Standard length of tarpon) - 2.7123, R^2=0.6140.

Discussion

Total weight of the stomach contents in tarpon was 0.83 g and most of preys were relatively well digested. This may indicate that foraging time of tarpon was quite earlier than time we captured the tarpon. The mean status of digestion extent of preys in tarpon was closely related to when the tarpon fed on the prey. This could be further explained by the empty stomachs of some tarpon samples. The empty stomachs were found in 10.8% of tarpon samples. A high rate of empty stomach occurrence was probably because tarpon were captured long after foraging time of tarpon had passed. By improving this technique, we could the predict time of the main foraging activity for tarpon.

According to Harrington and Harrington

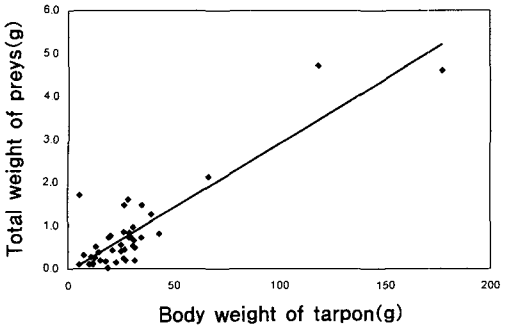

Fig. 2. The relationship between total weight of preys and body weight of tarpon; Y (Total wei ght of preys) = 0.0299 X (Body weight of tarpon) - 0.0774, R^2=0.7882.

(1982)'s study, abundance of ladyfish *Elops saurus*, tarpon *Megalops atlanticus*, Gulf killifish (*Fundulus grandis*), longnose killifish (*Fundulus similis*), white mullet (*Mugil cephalus*), tidewater silversides (*Menidia beryllina*), snook, (*Centropomus undecimalis*), striped mojarras (*Diapterus plumieri*), fat sleepers (*Dormitator maculatus*), and lyre gobies (*Evorthodus lyricus*) were reduced after impoundment in an Indian River County, Florida. And the following fish became abundant after impoundment; rainwater killifish (*Lucania parva*), marsh killifish (*Fundulus confluentus*), psheepshead minnows (*Cyprinodon variegatus*), mosquitofish (*Gambusia affinis*), and sailfin mollies (*Poecilia latipinna.*). But in this study, the most common prey found in the stomach contents of young tarpon was fish mostly composed of mosquito fish and sheepshead minnow. A whole body of prey was frequently observed in most of the tarpon, but half or part of prey was also observed in a few tarpon. Frequency occurrence of fish in tarpon stomach was 88.0 % and its mean individual number was 2.66 per tarpon (Table 2). Therefore, other species of small fish were the main prey for tarpon in the sampled regions. This probably indicates that tarpon had strong prey selectivity on mosquito fish and sheepshead minnow or two species of fish were the most abundant prey by the time we captured the tarpon. Therefore, abundance or availability of preys could influence the recruitment pattern of tarpon populations. Prey selection was governed by abundance of appropriate size in prey and preferences for forage species (Knight et al., 1984).

Harrington and Harrington (1960) showed that the frequency occurrence of fish in the stomach contents of larval stage of tarpon (size; 16~75 mm) caught during 4 years was 30.5%. And the most common prey found in the stomach of larval stage of tarpon was cyclopoid copepods and they were found in 97.3% of samples. The frequency occurrence of caridean shrimp, *Palaemonetesand* sp. in larval stage of tarpon was 2.9%. Also they emphasized that mosquito larvae were a prey source for larval tarpon. Harrington (1958) reported that there was prey preferences of larvivorous fish during the autumn of salt marshes and the annual peak of saltmarsh mosquito hatching.

However, in this study, shrimp was found in 22.0% of tarpon samples and its mean individual number was 0.39 per tarpon. In considering these results, there was tremendous change in preys from copepods to small fish as they grew from larvae to young. And shrimp was the second in frequency prey food in the young tarpon stomach.

Nematode in tarpon stomach was found in 9.8% of tarpon samples in this study. And it did not seem to be digested by tarpon, but to be parasite on tarpon stomach. Nie and Kennedy (1991) showed that nematode was a widely distributed parasite of the European eel and population of nematode increased over winter

through to late spring or early summer.

There was the stronger correlation between the total weight of the consumed preys and body weight of tarpon (Fig. 2) rather than standard length of tarpon (Fig. 1). This correlation indicated that a greater amount of prey could be found in the heavier size of tarpon.

In conclusion, as tarpon grow in the wild, the main prey for young tarpon average weighing 34.67 g and standard length of 11.49 cm were fish composed of mosquito fish and sheepshead minnow and shrimp. And there was the stronger correlation between the total weight of preys and the weight of tarpon rather than standard length of tarpon. More studies on energetic requirement change of tarpon as they grow and preferences prey types based on the age of tarpon are desired. Especially, information of early stages of tarpon are very important factors in understanding and evaluating the recruitment of tarpon populations.

Acknowledgements

I would like to thank Dr. J. M. Shenker for encouraging me to perform this study and helping me to identify preys.

References

Bowen, S. H., 1983. Quantitative description of the diet. in L. A. Nielsen and D. L. Johnson, editors. Fisheries Techniques. American Fisheries Society, Bethesda, Maryland, pp.325-336.

Duncan, D. B., 1955. Multiple range and multiple F tests. Biometrics, 11 : 1-42.

Gehringer, R. W., 1959. Leptocephalus of the Atlantic arpon, *Megalops atlanticus* Valenciennes, from offshore waters. Quart. Jour. Fla. Acad. Sc., 21 : 235-240.

Harrington, R. W., 1958. Morphometry and ecology of small tarpon, *Megalops atlantica* Valenciennes from transitional stage through onset of scale formation. Copeia, 1 : 1-10.

Harrington, R. W. and E. S. Harrington, 1960. Food of larval and young tarpon, *Megalops atlantica*. Copeia, 4 : 311-319.

Harrington, R. W. and E. S. Harrington, 1982. Effects on fishes and their forage organisms of impounding a florida salt marsh to prevent breeding by salt marsh mosquitoes. Bull. Mar. Sci., 32(2) : 523-531.

Hayes, D. B. and W. W. Taylor., 1991. A multiple-regression technique for analyzing stomach contents in fish. Transaction of the American Fisheries Society, 120 : 396-400.

Hyslop, E. J., 1980. Stomach contents analysis-a review of methods and their application. Journal of Fish Biology, 17 : 411-429.

Knight, R. L., F. J. Margraf and R. F. Carline., 1984. Piscivory by walleyes and yellow perch in western Lake Erie. Transactions of the American Fisheries Society, 113 : 677-693.

Lyons, J. and J. J. Magnuson., 1987. Effects of walleye predation on the population dynamics of small litoral-zone fished in a northern Wisconsin lake. Transactions of the American Fisheries Society, 116 : 29-39.

Nie, P. and C. R. Kennedy., 1991. Seasonal population dynamics of *Paraquimperia tenerrima* (Linstow) (Nematoda) in the European eel *Anguilla anguilla* (Linnaeus) in three localities of southwest England. Journal of Fish Biology, 39 : 441-449.