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The Effect of Bait Types on Catch per Unit Effort in Trapping the Oriental River Prawns *(Macrobrachium nipponense)*

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ABSTRACT

Opera house traps are the most popular gear used to catch the oriental river prawns in the Anzali Lagoon, Iran. In this study, the effect of two kinds of baits attached to opera house traps was subjected to an evaluation from April to September 2015 in the Anzali Lagoon. The opera house trap was designed for catching the oriental river prawns. A total of 20 opera house traps were randomly set along the shoreline at intervals of approximately 3 m. Ten traps were set baited by bread, and ten traps were set baited by fish. Results showed that the mean catch per unit effort (CPUE) was significantly different between the two different baits ($P < 0.05$). The maximum CPUE was recorded in July (22.95) with bread bait. During the period time of each treatment, the CPUE did not show any significant difference ($P > 0.05$). In addition, the length-frequency distributions of *M. nipponense* in opera house traps, baited with fish and bread, showed no significant difference ($P < 0.05$). Therefore, there was no difference between bread and fish baits of any size for absorbing the prawn. Results showed that, due to most factors affecting the CPUE of *M. nipponense*, bread proved to be a better bait selection.

INTRODUCTION

Freshwater prawn is one of the most abundant invertebrates in most aquatic ecosystems, and the oriental river prawn (*M. nipponense*) is natively distributed in the west of Asia, while in Iran, Uzbekistan and Iraq, they have been introduced **(New *et al.*, 2010)**. The same species were reported in the Anzali Lagoon in 2006 **(De Grave & Ghane, 2006)**. This species belongs to the phylum of Arthropoda; Order: Decapoda; Family: Palaemonida **(De Haan, 1849)**. It is an omnivorous species **(New *et al.*, 2010)**.

The Anzali Lagoon is located on the southeast coast of the Caspian Sea in the Guilan province. The location of this lagoon is between land and sea ecosystems and between freshwater and brackish ecosystems that make a particular form of ecotone, embracing a unique blend of plant and animal communities **(Aminisarteshnizi, 2021)**.

Obviously, the opera house traps are the most popular gear used to catch the oriental river prawns in Anzali Lagoon **(Khanipour *et al.*, 2020)**. This gear is more stable when deployed in deep water and easier to be lifted compared to any other one. One of the critical factors in trap fishing is bait. The bait is used to attract the prawns in the surroundings to enter the traps **(Ningtiyas *et al.*, 2020)**. Various types of baits can be used. Therefore, it is necessary to find the suitable bait that is available throughout the year, which is easy to obtain, and at the same time affordable. The popular baits for catching prawns in the Anzali lagoon are trash fish. However, the problem of fish bait is the high cost and the non availability during the whole year. This study compares fish bait with bread bits for catching the oriental river prawns.

The objective of this study was to test the effects of the two different baits on catch per unit effort in opera house traps used for catching the oriental river prawns in the Anzali Lagoon, Iran.

MATERIALS AND METHODS

Study area

Specimens of *M. nipponense* were collected from the Siah Darvishan river during the period extending from April till September, 2015 (GPS coordinates: 37° 25’ 026.42” N and 49° 27’ 307.12” E) (Fig. 1), which is a preferred habitat for the species.

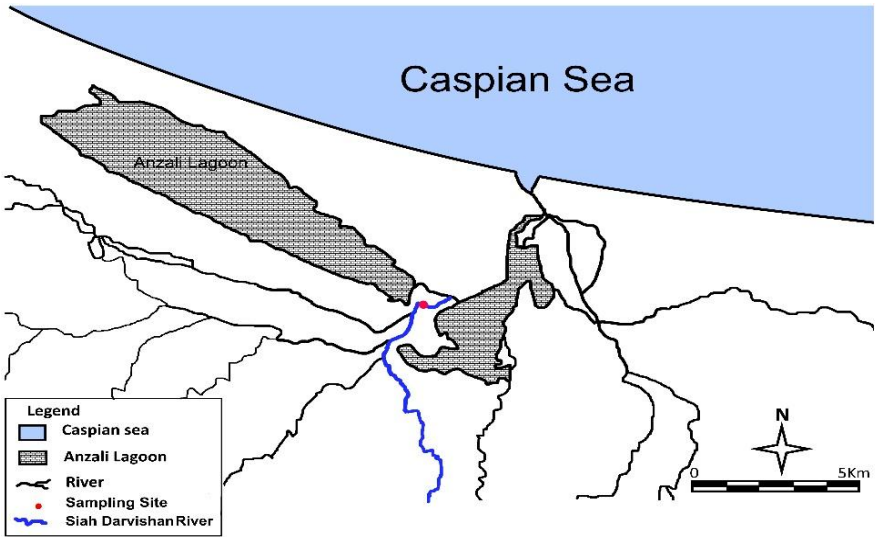

Fig. 1. Location of the study area. The circle is the sampling site.

Samples collection

Twenty opera house traps were simultaneously used for the sampling of the prawns in this study (Fig. 2). The traps were checked every 24 hours **(Aminisarteshnizi, 2021)**, and the samples were collected at night; ten nights per month for six (6) months (April to

September 2015). Ten traps were set baited by bread, and the other ten were set baited by fish.

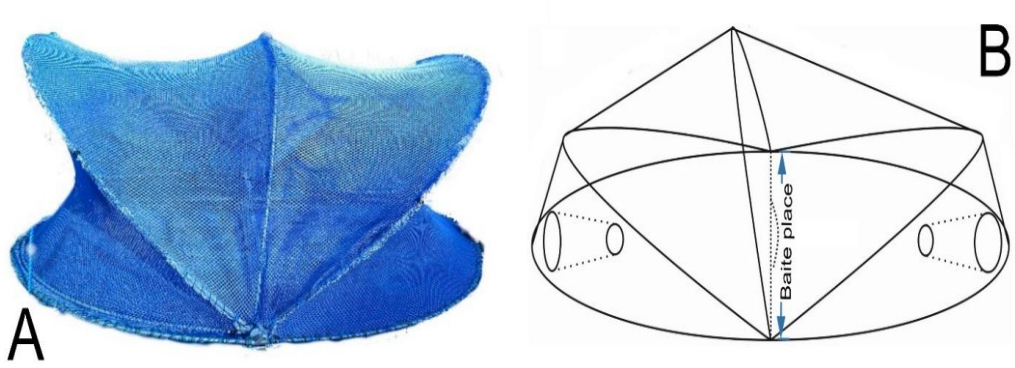

Fig. 2. Construction of opera house traps, **A:** a picture of designed opera house trap, **B:** Schematic diagram opera house trap

Catch per unit effort

Collected samples were removed and placed in iceboxes and transferred to the laboratory for further analyses. Total weight was measured on a digital scale with 0.1 g accuracy. CPUE was computed by using the following equation **(White, 1987)**:

$$\mathbf{CPUE} = \frac{\mathbf{Total\ catch}}{\mathbf{Unit\ Effort}}$$

Unit Effort = Traps × Long-lasting trap in the water; Total catch = Total weight of the catch.

Data analysis

Total catch was indicated in terms of the number or weight of *M. nipponense*, while the unit effort is one collection from the trap in 24 hours. Differences in catch rates among different months were determined using the variance (ANOVA) analysis. The CPUE differences for each bait type were determined using Duncan's multiple range test. For testing difference length-frequency distributions of *M. nipponense* in opera house traps, each bait type was determined using the Kolmogorov-Smirnov test. The analysis was done using SPSS (version 2019) software.

RESULTS

A total of 19207 prawns were trapped, 4801 (25%) of them were caught with fish bait attached toopera house traps, whereas 14406 (75%) were trapped with bread bait in opera house traps. The mean catch per unit effort (CPUE) was found between the sampling periods and the treatments (Table 1). The CPUE ranged from 5.92 to 9.39 for baited traps with fish, recording no significant difference among months ($P>0.05$). For

baited trap with bread, the CPUE ranged from 14.69 to 22.95, without showing any significant difference among months ($P > 0.05$). Differences in mean CPUE between the two treatments in all months were highly significant ($P < 0.05$) (Table 1).

Table 1. The prawn ratio in catch per unit by using two different types of bait in opera house traps

Month	Bread Bait		Fish Bait	
	Number of traps	CPUE	Number of traps	CPUE
April	10	17.23 ± 2.9^{a}	10	6.52 ± 0.3^{b}
May	10	19.68 ± 3.6^{a}	10	8.23 ± 0.4^{b}
Jun	10	18.23 ± 4^{a}	10	9.39 ± 0.9^{b}
July	10	22.95 ± 2.1^{a}	10	6.38 ± 0.2^{b}
August	10	16.65 ± 2^{a}	10	7.23 ± 0.6^{b}
September	10	14.69 ± 1.2^{a}	10	5.92 ± 0.4^{b}
Total	10	18.24 ± 1^{a}	10	7.28 ± 0.5^{b}

In both treatments, an increase was detected in the mean of CPUE in July. The overall average of the CPUE in fish bait traps in all the studied months was lower than that recorded in bread bait traps (Fig. 3).

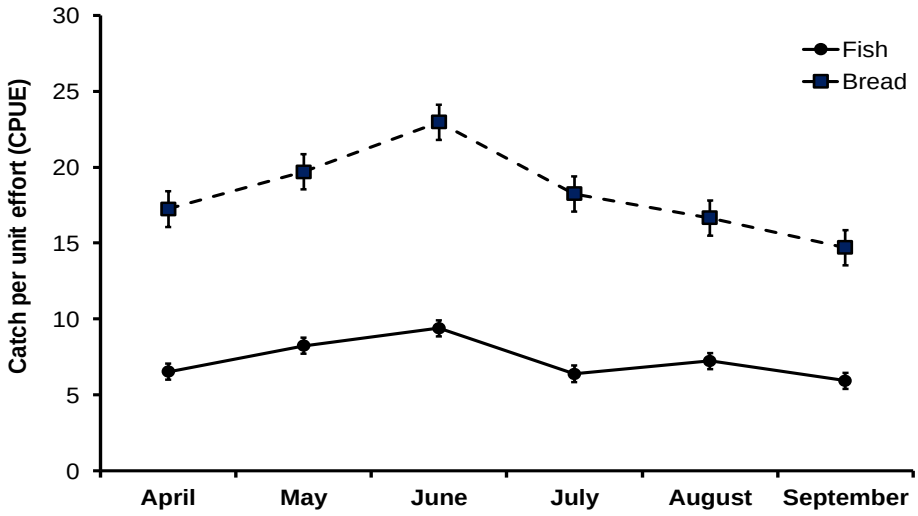

Fig. 3. Comparison of catch per unit effort (CPUE) between fish and bread bait

The percentage of length-frequency distributions of *M. nipponense* showed no significant differences between the two different baits in opera house traps (Fig. 4). Both baits of bread and fish attracted the exactly same size of prawns. The maximum number of prawns in the length-frequency range was from 14mm to 16mm.

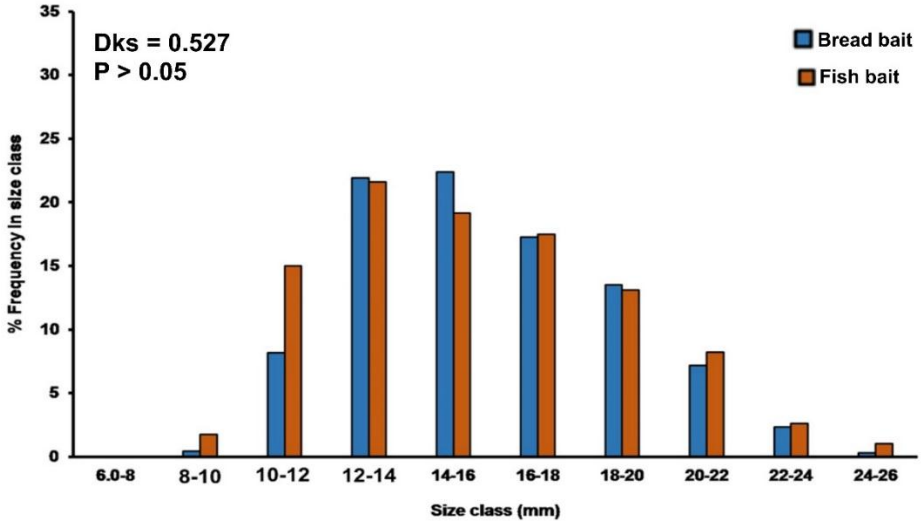

Fig. 4. Percentage of length-frequency distributions of *M. nipponense* in opera house traps baited with fish and bread

Water quality parameters in the Anzli lagoon were within the acceptable limits for the growth and development of *M. nipponense*. Water temperature was 21°C, the dissolved oxygen was 4.5 mg/L, and the pH was 8.1 during the sampling period.

DISCUSSION

Trap fishing is a relatively simple method used traditionally by fishermen worldwide to lure and catch aquatic animals **(Attar *et al*., 2002; Wakefield, 2015)**. Using traps has several advantages; it provides a passive fishing and can be left for several days without losing the catch, as for instance, when the weather is bad, the catch will continue beingtrapped in good condition **(Bacheler *et al*., 2013)**. Additionally, the expenses of operating those traps are remarkably low. In the future, traps may gain more importance because of the increased demands on responsible fishing due to their selective characteristics and their advantages regarding operation mode **(Major *et al*., 2016)**. It is important to mention that, a fishing pot is an eco-friendly fishing gear because its operation does not damage the environment and produces less bycatch.

When water level decreased, aquatic macrophytes (as biomass) has increased significantly **(Bolat *et al*., 2011)**. The temperature influenced the reproduction and growth pattern in *M. nipponense* **(New *et al*., 2010)**. **Abrahamsson (1983)** showed that the density of food has affected trap ability, catchability, and catch efficiency. During the warm season, the water level decreased in the Anzali lagoon (depth was 8.5 m), whereas the prawns' population increased. Therefore, in this study, the highest CPUE was in July because of the temperature and the depth of water.

Trap catch is affected by water temperature, water quality, feeding regime, population density and size structure, weather patterns and the moon phase, trap design, trap density, number of trapping days, trapping strategy, bait type and bait quantity **(Romaire, 1995)**. The best trap for catching *M. nipponense* in the Anzali lagoon is the opera house trap **(Khanipour *et al*., 2020)**. **Ningtiyas *et al*. (2020)** reported that the opera house trap is more stable when deployed in the deeper sea and easier to be lifted which makes this trap more suitable for the lake and lagoon.

Bait type and bait quantity are the essential factors in passive fishing. The bait attracts the fishes and, if choosing the right bait, can have selective fishing. **Smolowitz (1978)** reported that the goal of the bait is to produce a long-lasting product in the tarp. The bait causes the fish to stay in the trap without trying to escape. It must be stored for a reasonable time. If the bait is destroyed quickly, the number of fish that can absorb will be below, and if it stays in the water for a long time, it may cause ghost fish **(Smolowitz, 1978)**. In this study, when traps were checked after 24 hours, all bread baits were not found because they were eaten by prawns, but fish baits were still in the traps. Based on this result, both baits of bread and fish attracted the same size of prawns.

Carpenter *et al*. (2020) reported that consumable baits had the greatest effect on terrapin entrapment relative to conspecifics or non-baited crab pot; therefore, the bait was an essential factor in catching the crab. **Ningtiyas *et al*. (2020)** compared trash fish bait with chicken innard bait. They reported no significant effect between different baits on the catch of foldable dome fishing pots. The fisherman can replace trash fish bait with chicken innard bait because of the praise and availability of chicken innard bait. In this study, the result showed that bread bait attracted prawns more than fish bait. The reason may be the structure of bread. Bread bait has some advantages compared to fish bait, for example, bread is always in the market, easy accessed, and its price is much lower than that of the fish bait. **Bolat *et al.* (2011)** evaluated the effectiveness of baited and non-baited traps for catching crayfish. They showed crayfish behavior appears to have the most effect on catch per unit trapping effort, and there was no significant difference between the CPUE in baited and non-baited traps.

CONCLUSION

In conclusion, several things may affect baits, for example, the ecological factor of water, behavior of target species, easy access of bait, and the price of bait. Therefore, we need to know all the factors that can affect the CPUE and choose a suitable bait for the traps. These characteristics are different in each region for any target species, and studies should be conducted on different cases before starting fishing. In Anzali Lagoon, due to most factors affecting the CPUE of the oriental river prawn, bread was selected as a better bait.

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