Population biology and feeding habits of the nephridiopod lobster

*Metanephrops thomsoni* (Bate, 1888) in the East China Sea

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Abstract: Population biology and feeding habits of the nephridiopod *Metanephrops thomsoni* (Bate) was studied from a field survey sampled with bottom trawls in the East China Sea. The female/male ratio was 1.06:1. Three size-class groups were discriminated for both sexes, which may correspond to one to three-year-old cohorts. The average stage fecundity was 471 in each brood. Larger than two-year-size-class females are multi broods during the breeding season. Gut analysis showed that this lobster is a common carnivore and mainly consume crustaceans and fishes, regardless of sex and carapace length size.

Key words: *Metanephrops thomsoni*, Population biology, Feeding habitats, East China Sea

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Introduction

The nephridiopod lobster *Metanephrops thomsoni* (Bate, 1888) is distributed in the west pacific region of Korea, Japan, China, Taiwan and the Philippines (Kim, 1977; Baba, 1986; Holthuis, 1991; Chan and Yu, 1993). Although it is one of the economically important species in the region (Yamada et al., 1986; Holthuis, 1991), little is known of its eco-biology. Its larval development is described by Uchida and Dotsu (1973). Yamada et al. (1986) briefly described the reproductive biology of the lobster without biological data. To date there have not been any studies which examine its population biology and feeding habits.

In recent years, large number of *M. thomsoni* has been captured by commercial fishing from the northern part of the East China Sea. In this area, the lobster is occasionally captured on sandy mud bottom along with several penaeid shrimps and commercial fishes by trawl net fishing (Yamada et al., 1986; Cha et al., 2001). The lobster lays relatively larger eggs and has small fecundity compared to other similar-habitat-patterned crustacean (Yamada et al., 1986; Van Dover and Williams, 1991). This study examines the population structure, maturation and fecundity of *M. thomsoni*, based on the analysis of size distribution, the observation of gonadosomatic index, and the staging of ovarian and egg development. And, the feeding habitat of the lobster also is investigated using the foregut contents analysis.

Materials and Methods

Specimens of *M. thomsoni* were collected in December in 2003 by the research vessel *Tangmu 1* (2,159 tons), with a bottom trawl net (mesh size of the cod end 0.98 x 0.98 mm) in waters (32°58’-33°08’N 125°28’-128°00’E) known as the Korean fisheries blocks, 233, 240, 241 and 243 in the East China Sea (Fig. 1). The net with otter boards was towed 10 times during the daytime at depth 90-110 m for 60 min at 3.4 knot.

All the samples collected for this study were frozen on board shortly after capture and kept frozen (-80°C) until the analysis. Before the foregut contents analysis, the samples were thawed, sex was recorded and the carapace length (CL, the distance from the posterior edge of the eye socket to the middle hind margin of the carapace) was measured with a digital vernier caliper (CD-15C, Mitutoyo Corporation, Japan). To discriminate age cohort, the raw data were classified and length-frequency distributions were constructed using 1-mm intervals of CL. The cohorts were separated and fitted on the frequency distributions using a Bhattacharya’s method (Bhattacharya, 1967) within ELEFAN computer analysis program.

To examine foregut contents, the foregut was removed and opened for the all specimens. The contents were washed and put into a glass dish, and examined under a dissecting microscope (M5-Wild, Heerbrugg, Switzerland). Differences in the diet of male and female *M. thomsoni* and between size classes were investigated.

To examine fecundity and egg volume of oviparous females, the egg was removed from pleopods, separated by egg stage and counted, and it’s long and short diameters were measured under a microscope. Egg stage was separated by 5 stages: A, early spawned, early blastoderm; B, large blastoderm, gastulation; C, small egg visible; D, large eyes, outline of carapace and abdomen; E, pre-larval stage, eye large, abdomen long and separated from head. The female gonad maturation stage was described by gonadosomatic index (GSI). To examine GSI, the ovary was removed as above, dried (70°C) for 48 hr in dry oven and weighed.
Table 1: Diet composition of *Metanephrops thomsoni* collected from the East China Sea in December 2003 as a function of size in males and females. Values are no. of each food item (%) in relation to the total no. of all food items in sample

<table>
<thead>
<tr>
<th>Diet item</th>
<th>Size class midpoint (mm)</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>17.5</td>
<td>22.5</td>
<td>27.5</td>
</tr>
<tr>
<td>Crustacea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shrimps</td>
<td>16.7</td>
<td>35.7</td>
<td>16.0</td>
</tr>
<tr>
<td>Crabs</td>
<td>50.0</td>
<td>50.0</td>
<td>36.0</td>
</tr>
<tr>
<td>Hermitcrabs</td>
<td>-</td>
<td>7.1</td>
<td>4.0</td>
</tr>
<tr>
<td>Amphipods</td>
<td>44.4</td>
<td>64.3</td>
<td>24.0</td>
</tr>
<tr>
<td>Stomatopods</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Annelida</td>
<td>Polychaetes</td>
<td>44.4</td>
<td>7.1</td>
</tr>
<tr>
<td>Chordata</td>
<td>Fishes</td>
<td>22.2</td>
<td>14.3</td>
</tr>
<tr>
<td></td>
<td>Deterites</td>
<td>5.6</td>
<td>7.1</td>
</tr>
<tr>
<td></td>
<td>Unidentified</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Tables 1-3: Values are no. of each food item (%) in relation to the total no. of all food items in sample.
Fig. 1: Relative density of *Metanephrops thomsoni* at 4 sampling stations in the East China Sea.

Fig. 2: Size distribution of *Metanephrops thomsoni* collected from the East China Sea in December 2003.

Fig. 3: Changes in the egg volume of *Metanephrops thomsoni* at different egg stages (A-E) collected from the East China Sea in December 2003.

Fig. 4: Changes in the number of eggs of *Metanephrops thomsoni* in each egg stages (A-E) collected from the East China Sea in December 2003.

Fig. 5: Ln number of eggs per brood plotted against Ln carapace length for the five incubation stages (A-E) of *Metanephrops thomsoni* collected from the East China Sea in December 2003.

Fig. 6: Changes in gonadosomatic index of *Metanephrops thomsoni* in each egg stages (A-E) collected from the East China Sea in December 2003.
Foregut contents: No difference was found in the diet between the sexes, but the occurrence of two prey items (polychaetes and fishes) was relatively greater in males than in females (Table 1). The frequency of occurrence of prey items didn't differ significantly among size classes of the lobster (Table 1). The frequency of occurrence of crustaceans increased with the size of the lobster. Crustaceans were comprised mainly of shrimps, crabs, hermitcrabs, amphipods, and stomatopods. The small size group of the lobster prefers amphipods to other crustacean dietary groups.

Dietary analysis shows that *M. thomsoni* is a predator of slow-moving or sessile benthic organisms. The major prey was crustaceans and polychaetes. Mobile prey such as fish is a minor component of their diet. Small percentage of fish prey item suggested that *M. thomsoni* is semi-mobile predator. Wassenberg and Hill (1989) reported that fish remains were quite common in lobsters collected from both scientific and commercial trawl. They suggested lobsters feed on fish discarded from commercial trawl or other discarded material. However, the small benthic fishes such as, goby and flat fish, frequently occurred in this study area (Yamada et al., 1986). We found several fish back bones and fish scales in foregut contents of *M. thomsoni*. It can be suggested that the lobster feed on the small benthic fish. Since the lobster appears to consume carrion as it becomes available, there can be a suggestion that they are selective of active feeders.

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References


