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Seasonal Availability of Calanoid Copepods (genus *Acartia*) in Eastern Thailand Using a Light Trap, as Food Organisms for Marine Fish Larval Rearing

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Abstract - Zooplankton collected by the torch lighting method were investigated in a tropical coastal seawater pond in eastern Thailand. Copepods of the genus *Acartia*, such as *A. sinjiensis*, *A. erythaea* and *A. pacifica*, were predominant among the zooplankton collected. *A. sinjiensis* occurred almost throughout the year with a prolonged peak season from August to April. The highest abundance of adult *A. sinjiensis* aggregated under the light reached 35,700 individuals·l^{-1}. The occurrence of *A. erythaea* and *A. pacifica* was intermittent with a short-term peak from March to April, during which their abundance was higher than *A. sinjiensis*. The combination of water temperature and salinity was suggested to affect or regulate the biomass of these *Acartia* species. Among the *Acartia* species, *A. sinjiensis* seems to be the most important as a food organism available for marine fish larval rearing in eastern Thailand.

Calanoid copepods of the genus *Acartia* are common in coastal waters throughout the world. Their nauplii are excellent food organisms for marine fish larvae reared in earthen ponds (Ohno 1992). Singhagraiwan and Doi (1993) reported that the early stage nauplii of *Acartia* spp. reproduced in outdoor tanks are alternative food organisms to stabilize early larval survival of the red snapper (*Lutjanus argentimaculatus*), which are often difficult to rear with rotifers (*Brachionus* sp.) as initial food (Bonlipatanon 1988). At present, availability of wild *Acartia* adults is indispensable for production of ample amounts of nauplii for rearing marine fish larvae in tanks (Doi et al. 1994).

Large fluctuations in standing crop and composition of *Acartia* species are known to be related to water temperature and/or salinity (Conover 1956;

Tranter and Abraham 1971; Shanmugan et al. 1986; Pagano and Saint-Jean 1989; Ohno 1992). However, few studies have been carried out on their seasonal availability as food organisms in fish hatcheries.

Zooplankton were collected using the torch lighting method (Doi et al. 1994) at night twice a month from 4 November 1992 to 25 November 1993 in a 2.5-ha pond (depth: ca. 1.0-1.5 m) at the Eastern Marine Fisheries Development Center, Rayong, eastern Thailand. Pond water was partially changed (<5% per day) through two small sluice gates connected to the sea. To facilitate plankton collection, a 500-w torch light was set on a raft 20 m off the pond bank. Plankton congregated in the surface water below the light were scooped using a 15-l bucket 10 minutes after lighting. The collected zooplankton were concentrated by filtering through a 40-μm mesh net and preserved with 5% formalin.

The zooplankton samples were examined under a microscope to determine the numbers of adult *Acartia* species, while other zooplankton were identified to higher taxa.

Water temperature of the pond fluctuated between 25 and 30°C (mean 27.5°C) from November 1992 to February 1993 (Fig. 1a). Water temperature increased rapidly from 25°C on 25 February to 31°C on 25 March 1993 (the maximum of the year). It was stable at 28-30°C (mean: 29.4°C) from April to October 1993).

Salinity fluctuated between 30 and 32 ppt from November 1992 to January 1993, and increased to 33-35 ppt in March and April (Fig. 1a). It decreased sharply to 24 ppt from end of August to early September due to heavy rainfall, then gradually recovered to 30 ppt by 25 October 1993.

The abundance of zooplankton collected varied greatly from 6 individuals·l^{-1} on 10 July 1993 to 37,400 individuals·l^{-1} on 25 August 1993. The peak season occurred from 4 October 1992 to 25 April 1993 and from 25 August to 25 November 1993 (mean: 7,000 individuals·l^{-1}; N=19), and the low season from 10 May to 10 August 1993 (mean: 332 indivuals·l^{-1}; N=7).

The zooplankton species were predominated by three copepod species throughout the year, i.e., *Acartia sinjiensis*, *A. erythaea* and *A. pacifica*. The mean abundance of these three *Acartia* species including adults, copepodids and nauplii was 6,830 individuals·l^{-1} during the peak season, and 274 individuals·l^{-1} during the low season, consisting of 97.6% and 82.5% of zooplankton, respectively. Fluctuations in abundance of zooplankton collected by this method were relayed to the three *Acartia* species. Their developmental stages were mostly advanced copepodids and adults (copepodid stages 4-6) which have greater swimming ability.

Other organisms which occurred in low abundance were Calanoida (i.e., *Pseudodiaptomus* sp.), Cyclopoida (i.e., *Oithona* sp.), Harpacticoida (i.e., *Longipedia* sp.) and Gammalida, zoea of shrimps and crabs, nauplii of *Balanus* spp., larvae of Polychaeta, fish larvae, *Brachionus* sp., D-shape larvae of bivalves, gastropod larvae and *Oikoploura* sp.

Seasonal changes in adult abundance and composition of the three *Acartia* species are shown in Fig. 1b and 1c, respectively. The abundance of adult *A. sinjiensis* decreased in March-May and increased in July-August with two outstanding peaks in number, i.e., 12,800 individuals·l^{-1} on 10 March 1993 and 35,700 individuals·l^{-1} on 25 August 1993 (Fig. 1b). The occurrence of *A. erythaea* and *A. pacifica* was intermittent and usually less abundant than *A. sinjiensis*, except for March and April (Fig. 1b, 1c). The maximum abundance of *A. erythaea* adults was 14,900 individuals·l^{-1} on 25 April 1993, and that of *A. pacifica* was 2,220 individuals·l^{-1} on 25 March 1993, during which the abundance of *A. sinjiensis* adults was relatively low with 2,160 and 1,320 individuals·l^{-1}, respectively.

Although the population of *Acartia* observed in this study may be affected partly by water turbidity and the daily change of weather conditions such as wind velocity and rainfall, the present results seem to represent fundamentally the seasonal changes of their biomass in the pond. This study indicated that the dominant *Acartia* species in this tropical coastal pond shifted from *A. sinjiensis* to *A. erythaea* and *A. pacifica* during February-April, when both water temperature and salinity increased markedly (Fig. 1a), and reversed during May-July.

In natural habitat, *A. sinjiensis* is a brackishwater species (Mori 1940), whereas *A. erythaea* (and probably *A. pacifica*) is a neritic species (Yamaji 1956; Tranter and Abraham 1971). *A. sinjiensis* was abundant in August-October 1993 when water temperature was constantly high (28-30°C) but salinity was low (down to 24 ppt). However, this species seems not to propagate well when both temperature and salinity are high (>29°C, >33 ppt); while *A. erythaea* and *A. pacifica* may prefer such an environment. This study indicated that the combination of water temperature and salinity may affect or regulate the biomass of *Acartia* species in a tropical coastal pond.

Propagation of copepods of the genus *Acartia* has been achieved using wild-caught adults as brooders, e.g., for *A. tsuensis* (Ohno and Okamura 1988) and for *A. sinjiensis* (Doi et al. 1994; Singhagraiwan et al. 1994); and their nauplii are confirmed to be excellent food organ-

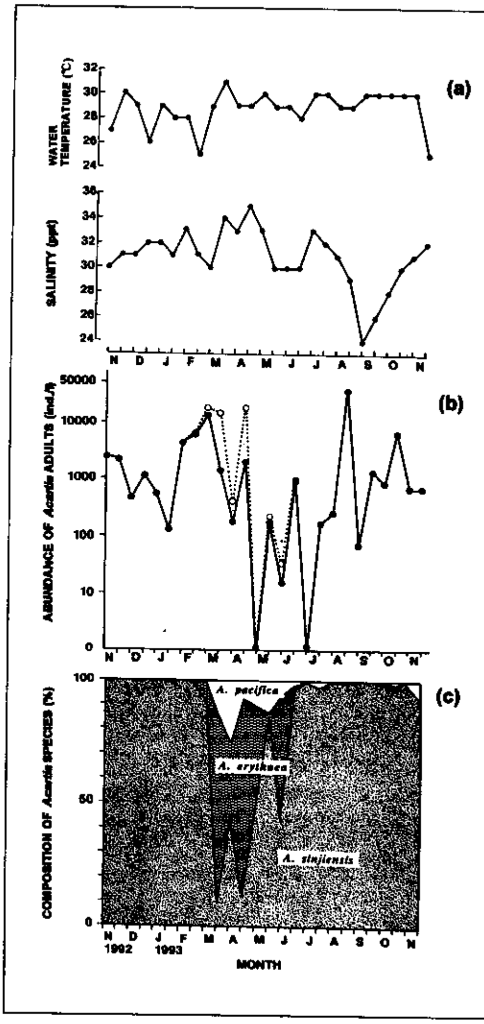

Fig. 1. Changes in water temperature and salinity (a), adult abundance of the three *Acartia* species collected (b) and their composition (c) observed in a 2.5-ha earthen pond. (●-●) in (b): *A. sinjiensis*; (○○) in (b): total of *A. sinjiensis, A. erythaea* and *A. pacifica.*

isms for early marine fish larvae (Ohno 1992; Singhagraiwan and Doi 1993). Based on the prolonged peak season of *A. sinjiensis* adults observed in this study, this species seems to be the most important *Acartia* species as food organisms available for marine fish larval rearing in eastern Thailand.

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