1980

Growth and survival of Penaeus monodon Fabricius zoeae on different diatom feeds

Suñaz, F. P.

Aquaculture Department, Southeast Asian Fisheries Development Center

Suñaz, F. P. (1980). Growth and survival of Penaeus monodon Fabricius zoeae on different diatom feeds. SEAFDEC Aquaculture Department Quarterly Research Report, 4(3), 7–11.

http://hdl.handle.net/10862/2372

Growth and survival of *Penaeus monodon* Fabricius zoeae on different diatom feeds

F. P. Suñaz

Penaeus monodon larvae reared up to M_1 stage in 300-l fiberglass tanks were fed with (1) mixed diatoms, (2) *Skeletonema costatum,* (3) *Chaetoceros calcitrans* and (4) *C. gracilis.* Feeding levels were maintained between 50 to 100 x 10^3 cells/ml. Two runs with two replicates each were done. The different diatoms were selected as they are widely used, available and can easily be mass cultured under local conditions. The study was conducted to determine the most suitable food for *P. monodon* zoea.

Results are summarized in Figure 1. Highest mean survival rate was obtained with larvae fed with *C. gracilis* (62.90%) followed by mixed diatoms (60.43%). No significant difference (P 0.05) was found among these values. Mean survival rates for *C. calcitrans* and *S. costatum* fed larvae were 43.28% and 8.95%, respectively (Table 1).

Greatest mortalities occurred in the early zoea stages (Z_1 to Z_2) for larvae fed *S. costatum* and late zoea stage (Z_3 to M_1) for those fed *C. calcitrans.* This could be due to the food size preference of the larvae (Frost, 1972; Martin, 1970). Takano (1968) indicated that *S. costatum* (8-10 u) could not support the larval stages of brine shrimp and it was presumed that the cell size might be too big for the early larval stages. Similarly, Yang (1975) observed that initially shrimp larvae can only ingest particle size of 3-5 u and that food sizes of 3-8 u provide some of the best larval food of various penaeid species. *C. gracilis* (4-6 u) falls within this size range. Mixed diatom populations contain a wide range of particle sizes enabling the larvae to easily select the preferred size of food.

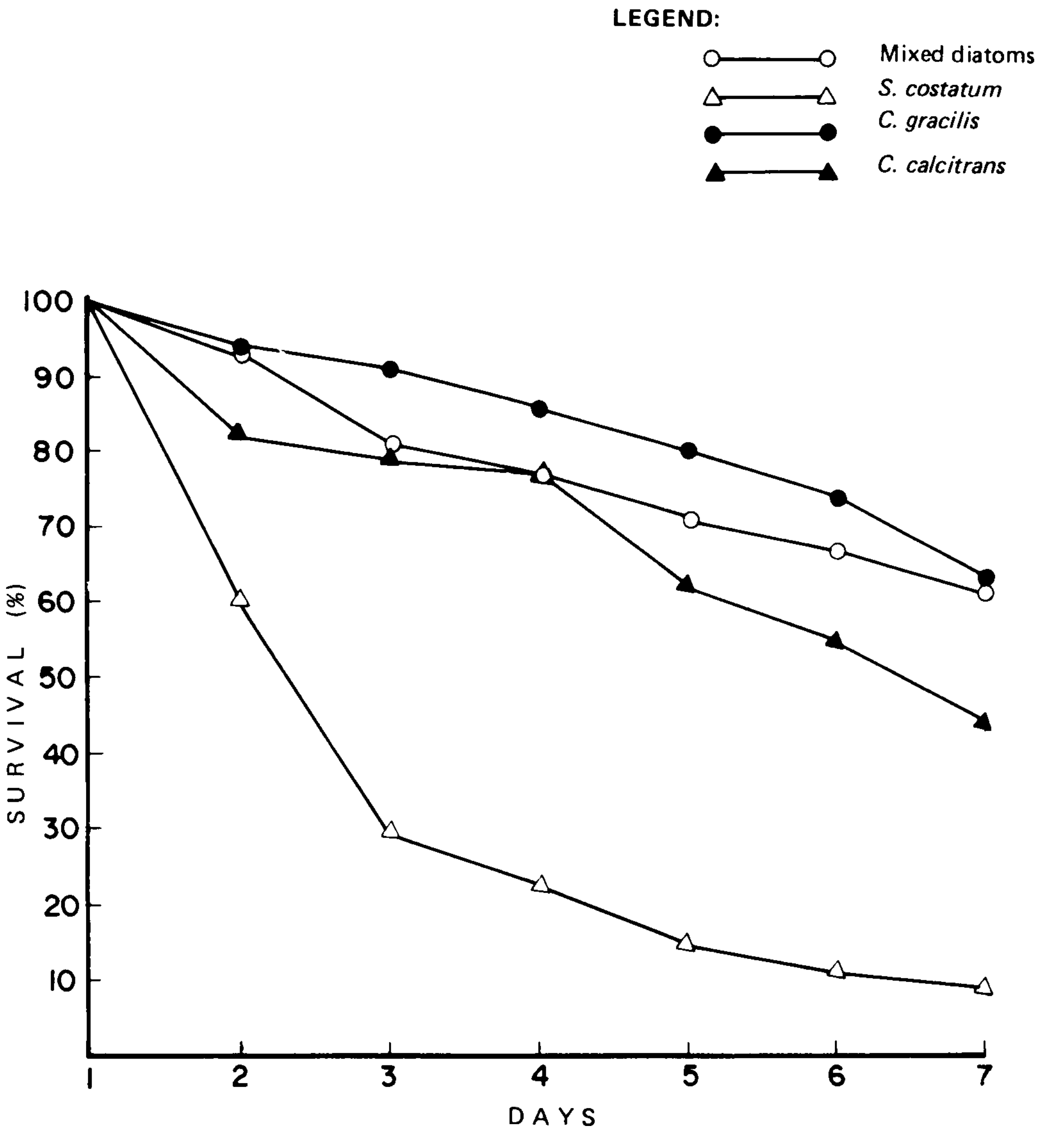

Figure 1. Mean daily survival of *P. monodon* larvae (N_6–M_1) fed different types of diatoms.

Table 1. **Survival and growth of *P. monodon* larvae ($N - M_1$) fed different types of diatoms**

TREATMENTS	Number of larvae Initial	Final	Survival rate[1] (%)	Zoeal period (days)
Mixed diatoms	15,000	9,065	60.43[a]	5
S. costatum	15,000	1,343	8.95[c]	6
C. gracilis	15,000	9,435	62.90[a]	5
C. calcitrans	15,000	6,468	43.28[b]	6

[1] Values with the same superscript are not significantly different from each other. at $P < 0.05$

The larvae fed *C. gracilis* and mixed diatoms were observed to grow faster and larger than those in *C. calcitrans* and *S. costatum* tanks as shown by the total number of days in the zoeae period (Table 1). Frost (1972) found that the size of the phytoplankton cells affect not only the feeding rate but the survival and growth rates of the animal as well. This means that more food is ingested and more nutrients required for growth are assimilated. Furthermore, non-synchronous metamorphosis was apparent in tanks fed *S. costatum* and *C. calcitrans* especially from Z_3 to M_1. Some larvae were already in the M_1 stage. This is a strong indication of unsuitable diet.

Food densities in the larval experimental tanks were monitored and observed (Fig. 2). Cell counts were generally lower in the morning than in the late afternoon. This implies that the food population may drop during the night as a result of either increased feeding by the larvae or slower rate of cell multiplication due to the absence of light, or both.

The *C. gracilis* population in the larval tanks were observed to be most stable (Fig. 2). At a concentration of 50 to 100 x 10^3 cells/ml no sudden drop occurred. The larval rearing media were clear and very little sediments were observed accumulating on the tank bottom.

In *C. calcitrans*–fed tanks, similar observations were noted except that the diatom population increased very rapidly . Estimated cell concentration would usually go beyond 100 x 10^3 cells/ml particularly in the afternoon. Regular dilution of the water media had to be done in order to maintain the cell density within the desired range. The mixed diatom population was

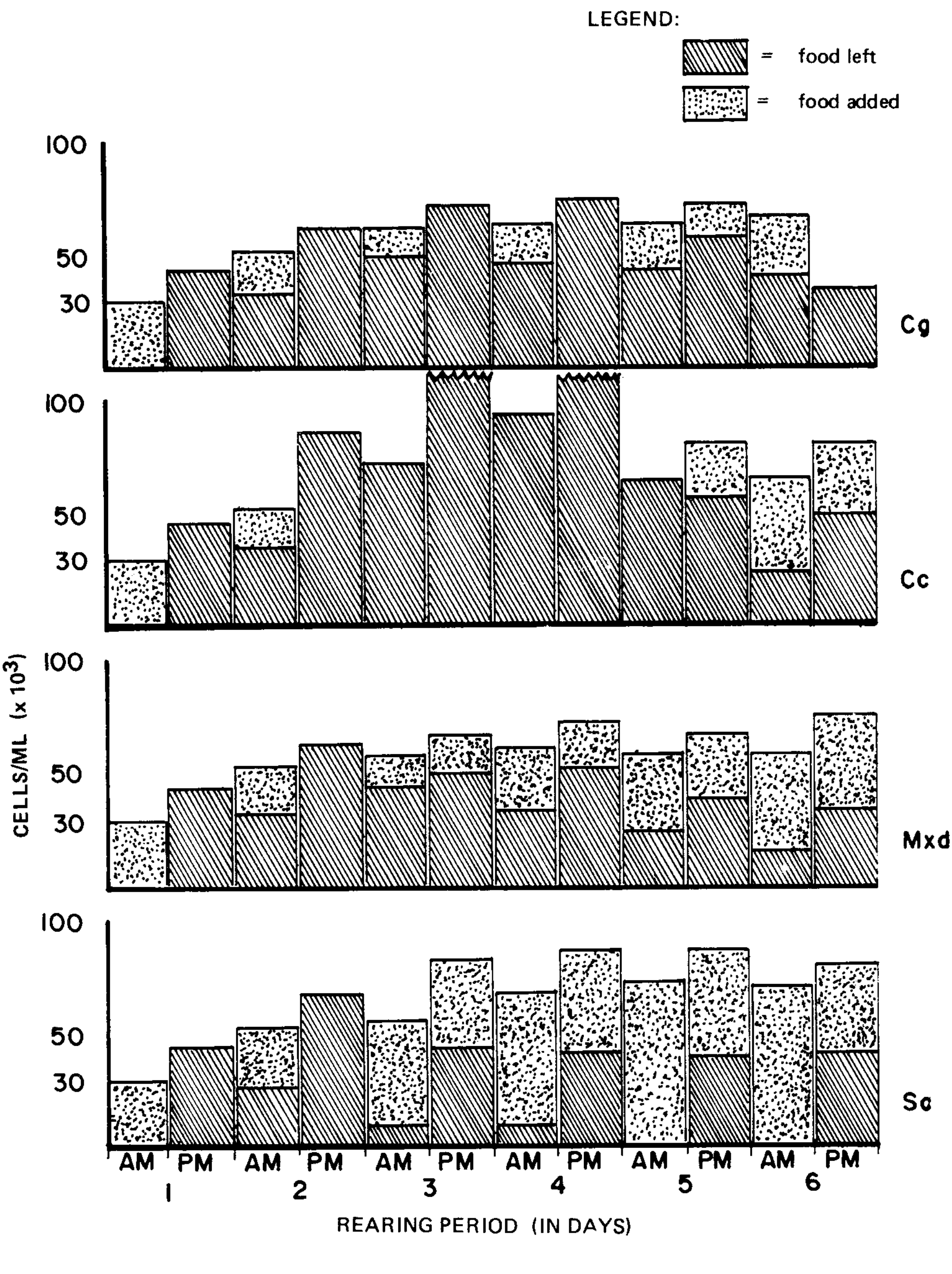

Figure 2. Characteristics of food population as observed in *P. monodon* larval rearing tanks.

maintained within the desired level only until the second day and then it gradually dropped below 50 x 10^3 cells/ml. Regular addition of mixed cultures had to be done. Collapse of *S. costatum* population occurred even as early as the second day and sediments started accumulating on the tank bottom.

Similar trends were also observed in the culture of these food organisms. *C. gracilis* and *C. calcitrans* were easier to maintain in large outdoor tanks for longer periods and densities of 1 x 10^6 cells/ml could easily be attained. *S. costatum*, on the other hand, could not stay for a long period at high density. The cells would start to clump together as soon as peak growth is reached and collapse of cultures would readily follow. Cultures could not easily be sustained especially under direct sunlight or when the water temoerature rose above 28°C. Mixed diatoms attained only a maximum density of 40 x 10^4 cells/ml. As the water medium was coarsely filtered, diverse communities always developed and ecological succession would easily occur. In order to avoid succession, constant renewal of cultures had to be done.

Many hatcheries have reported the use of mixed species of culture as food for the zoea larvae with considerable success. This may be true for shrimp culture as the diverse communities that develop are most often beneficial and suitable for the larvae as they metamorphose from herbivorous early zoea to omnivorous late zoea and mysis. However, there are also many disadvantages of mixed diatoms. Species composition is very dependent on the seasonal variability occurring in the natural waters. Undesirable species sometimes predominate and cannot be sorted out. When this happens hatchery operations may be completely stopped. Complete dependence on sunlight does not encourage high density cultures thus larger culture volumes are necessary. On the other hand, special skills and techniques and sophisticated apparatus required for unialgal cultures are not necessary.

The results of this study indicate that mixed diatoms and *C. gracilis* are much better food for *P. monodon* zoea. Addition of zooplankton such as rotifers is also recommended as early as Z_3 since the larvae starts to be omnivorous at this stage.

Literatured cited:

Frost, W.B. 1972. Effects of size and concentration of food particles on the feeding behavior of the marine planktonic copepod, *Calanus pacificus*. Limnol. Oceanogr., 17:805-815.

Martin, J.H. 1970. Phytoplankton-zooplankton relationships in Naragansett Bay. 4. The seasonal importance of grazing. Limnol. Oceanogr., 15:413-418.

Takano, H. 1967. Rearing experiments of brine shrimp on diatom diet. Bull. Tokai. Reg. Fish. Res. Lab. 52:1-10.

Yang, W.T. 1975. A manual for large-tank culture of penaeid shrimp to postlarval stages. Miami, Florida, Sea Grant Tech. Bull. No. 31. Univ. of Miami. 68 pp.