

# Effects of salinity on egg and fecal pellet production, development and survival, adult sex ratio and total life span in the calanoid copepod, *Acartia tonsa*: a laboratory study\*

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**Abstract** The effects of salinity on the copepod, *Acartia tonsa* in terms of daily egg production rate (EPR), hatching success, fecal pellet production rate (FPR), naupliar development time and survival, sex ratio, and total life span were determined in laboratory conditions through three experiments. In experiment 1, EPR, hatching success, and FPR of individual females were monitored at salinities of 13, 20, 35 and 45 during short-periods (seven consecutive days). Results show EPR was affected by salinity with the highest outputs recorded at 20 and 35, respectively, which were considerably higher than those at 13 and 45. Mean FPR was also higher in 35 and 20. In experiment 2, the same parameters were evaluated over total life span of females (long-term study). The best EPR and FPR were observed in 35, which was statistically higher than at 13 and 20. In experiment 3, survival rates of early nauplii until adult stage were lowest at a salinity of 13. The development time increased with increasing of salinity. Female percentage clearly decreased with increasing salinity. Higher female percentages (56.7% and 52.2%, respectively) were significantly observed at two salinities of 13 and 20 compared to that at 35 (25%). Total longevity of females was not affected by salinity increment. Based on our results, for mass culture we recommend that a salinity of 35 be adopted due to higher reproductive performances, better feeding, and faster development of *A. tonsa*.

**Keyword:** *Acartia tonsa*; salinity; egg and fecal pellet production; sex ratio; life span; Caspian Sea

## 1 INTRODUCTION

Copepods are very important in marine food chains and are considered as good, natural food for marine fish larvae because of such advantages as high levels of highly unsaturated fatty acids (HUFA), antioxidants, astaxanthins, vitamins E and D, digestive enzymes, and they represent suitable sizes in different species and at various life stages (Støttrup and McEvoy, 2003; McKinnon et al., 2003; Drillet et al., 2011).

Among the environmental parameters, temperature and salinity have been considered as principal factors affecting seasonal and spatial distribution patterns of copepods in nature. Previous research on calanoid copepod productivity have shown clear effects of

differences in salinity on egg production rates (Castro-Longoria, 2003; Chen et al., 2006; Holste and Peck, 2006; Camus and Zeng, 2009), development and survival (Trujillo-Ortiz, 1990; Chinnery and Williams, 2004), as well as sex ratio and total life span (Milione and Zeng, 2008).

The genus *Acartia* is a member of the subtropical, coastal pelagic zooplankton, and is dominant in many estuaries and semi-enclosed systems. Different species of genus *Acartia* such as *A. tonsa*, *A. clausi*, *A. biflosa* and *A. sinjiensis* are frequently used in

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