

# **Production dynamics of the mysid *Neomysis awatschensis* (Brandt, 1851) in the Yura River estuary, central Sea of Japan**

## **Abstract**

Mysids occur abundantly in estuarine and coastal waters, serving as major food items for many fish species of commercial importance. The mysid *Neomysis awatschensis* (Brandt, 1851) is a common crustacean abundantly occurring and distributed in brackish waters adjacent to the coastal zones in Japan, tolerant to acute salinity fluctuations and temperature changes predominant in estuaries. The current study was conducted in the Yura River estuary, which is characterized by freshwater discharges that transports huge amounts of nutrients to the estuary grounds while sea-water intrusion deposits crucial phytoplankton in the estuarine ecosystem that initiates primary production. However, the importance of crustaceans such as mysid requires further investigations to understand their role in the estuary considering that they are key prey item for commercially important coastal fishes. This study focuses on the population dynamics of *N. awatschensis* in relation to estuarine environmental conditions in the salt-wedge estuary feeding habits and survival strategies.

## ***Production dynamics of N. awatschensis in the Yura River estuary***

Mysids play an essential role as the dominant prey species for coastal fishes. In Japan, the mysid *Neomysis awatschensis* is commonly distributed in estuarine and shallow coastal waters with high productivity due to supply of nutrients from the watershed. The present study investigates the distribution and life history of the mysid *N. awatschensis* in relation to biotic

and abiotic factors by monthly sampling from March 2014 to July 2015 at stations along the Yura River estuary, the central Sea of Japan.

The Yura River physical conditions change seasonally and are affected by its discharge. Salt-wedge-intrusions were frequently observed and found up to 18 km from the river mouth from April to December 2014 when river discharge was low, whereas in 2015 intrusions were less pronounced, possibly due to river mouth clogging. Clear seasonality was observed in mysid density, showing highest densities (up to 202 inds/m<sup>2</sup>) in spring and early summer in contrast with lowest densities (< 16 inds/m<sup>2</sup>) from late summer to winter. *Neomysis awatschensis* appeared to change its reproduction characteristics in response to changes in the environment, large-sized females occurred in spring to produce large numbers of eggs and larvae during the high primary production period. In late summer, the population declined due to increasing mortality of juveniles at high temperatures. In autumn and winter, high river discharge and low temperature suppressed reproduction and survival of *N. awatschensis*. It is notable that *N. awatschensis* occurred within a salinity range of 0–32 and no clear influence of salinity on the mysid density was found.

Those results suggest that reproduction is partially suppressed by variable and oligotrophic conditions in the Yura River estuary. Combined with the flexibility to seasonal changes in temperature and food availability, the great tolerance to acute salinity fluctuations allows *N. awatschensis* to maintain its population in the estuary.

### ***Feeding ecology of N. awatschensis in the Yura River estuary***

Spatial and seasonal variations in the diet composition of the hyperbenthic mysid *Neomysis awatschensis* were investigated. The mysid and its potential food sources were surveyed during the daytime along the Yura River estuary monthly from March 2014 to July 2015. The mysid

dietary ecology was studied through optical and scanning electron microscopy and stable isotope analyses. The stomach content analysis revealed that benthic diatoms (e.g. *Bacillaria paxillifer* and *Navicula* spp.) dominated in the stomach content of both juveniles and adults regardless of the site and season, indicating that *N. awatschensis* frequently ingested benthic diatoms at least during daytime whereas planktonic diatoms and green algae contributed minimally to mysid diet. The stable isotope analysis and subsequent Bayesian mixing model allowed an approximate estimate of food items of *N. awatschensis*: epilithic microalgae and marine particulate organic matter dominated under conditions of salt-wedge intrusion into the estuary, whereas without salt-wedge intrusion riverine particulate organic matter contributed significantly. Hence, the results indicate that *Neomysis awatschensis* is an herbivorous feeder, ingesting benthic–planktonic diatoms in addition to planktonic green algae in relation to prevailing environmental conditions in the Yura River estuary.

### ***Conclusion***

The study results revealed that *N. awatschensis* has succeeded in maintaining its population in the estuary due to its flexibility to food availability and tolerance to the fluctuating environmental conditions prevalent in the estuary.