



Growth and gonad development of the sea urchin *Hemicentrotus pulcherrimus* in an *Eisenia* kelp bed in the Oshika Peninsula, northern Japan*

YUKIO AGATSUMA^{1,2}, NANAKO TODA¹, MAKOTO OGASAWARA¹, JUNJI KINOSHITA¹, MASAYUKI WATANABE¹, TOSHIYUKI MATSUI¹ & ERI INOMATA¹

¹ Graduate School of Agricultural Science, Tohoku University, Sendai, Japan

² Corresponding author; E-mail: agatsuma@bios.tohoku.ac.jp

*In: Kroh, A. & Reich, M. (Eds.) Echinoderm Research 2010: Proceedings of the Seventh European Conference on Echinoderms, Göttingen, Germany, 2–9 October 2010. *Zoosymposia*, 7, xii+316 pp.

Abstract

To elucidate growth and gonad development of *Hemicentrotus pulcherrimus* in the bed of *Eisenia bicyclis*, we examined gonad indices, gonad histology, gut content indices and ages of the sea urchins collected approximately monthly from March 2008 to September 2009 in Kitsunozaki in the Oshika Peninsula, northern Japan. We also monitored the densities of the kelp in six 1 m² quadrates. The kelp at 1- to 3-years of age decreased in density from January to July due to strong wave action. The urchin test diameters at 1-, 2- and 3-years of age were 12.7 mm, 23.7 mm and 30.5 mm, respectively and these growth rates were equal to that measured in *Sargassum* beds in previous studies. The gonad recovering stage was classified into the two sub-class stages; the recovering I stage with relict spermatozoa or ova surrounded by renewed nutritive phagocytes, and the recovering II stage with nutritive phagocytes filling the lumen. The recovering I stages was prolonged from February to April when the gonad indices were around 10% of total body weight, then rose sharply through the recovering II stage during May to August and the growing stage until October. The gonad indices rose sharply from November and reached a maximum of 18.8 in December when the gonad shifted from the premature to mature stages, then fell in January at the partly spawned and spent stages. Gut content indices were high at the recovering I stage, suggesting high availability of the drift thalli and lateral blades dislodged from the kelps and accumulation of nutrients in nutritive phagocytes.

Key words: Growth, gonad development, sea urchins, *Hemicentrotus pulcherrimus*

Introduction

Temporal and spatial variations of the growth and gonad production of sea urchins are closely associated with difference in the algal vegetations. It is well known that grazing front or change in feeding behavior from drift to attached algae as food source of stronglycentrotid sea urchins result in kelp deforestation (Breen & Mann 1976; Harrold & Reed 1985). In southwestern Australia, *Heliocidaris erythrogramma* consumes mainly detached fragments of large brown macroalgae, such as *Ecklonia radiata* (Vanderklift & Kendrick 2005; Vanderklift & Wernberg 2008). But, there are a few studies on the seasonal gonad production in relation to the seasonal algal biomass or the drift abundance (Endo *et al.* 2007; Basch & Tegner 2007).

The growth and gonad production of the edible sea urchin *Hemicentrotus pulcherrimus*, which is