水研センター研報，第38号，119－120，平成26年
Bull. Fish. Res. Agen. No. 38, 119–120, 2014

Review of trophic interactions of the jumbo flying squid, *Dosidicus gigas*, in the southeast Pacific Ocean

Yoshiki KATO [*1], Toshie WAKABAYASHI [*1], and Mitsuo SAKAI [*1]

The Jumbo flying squid *Dosidicus gigas* (*D. gigas*), an oceanic-neritic species, is endemic to the eastern Pacific Ocean (Koronkiewicz, 1988). The squid is an important target species in Japan and other countries of the world, and a maximum annual global catch of 800,000 and over 750,000 tons/year was harvested in 2008 and 2010, respectively (F.A.O., 2010). Although the historical distribution range of this species comprised the Eastern Pacific waters from 30°N to 25°S (Nigmatullin *et al.,* 2001), the range has recently expanded poleward in both the northern and southern hemispheres. In addition, *D. gigas* has also been found in the submarine canyon system associated with Monterey Bay (37°N) since the 1997-1998 El Niño (Zeidberg and Robison, 2007), and individuals have been reported from as far north as southeastern Alaska (59°N) (Field *et al.* 2007, Staaf, 2010).

Prey preference has been reported to change from macroplanktonic invertebrates and fish fry in *D. gigas* juveniles, to fish and squid in *D. gigas* adults (Nigmatullin, 2001). The size of prey has also been reported to increase as the squid grows (Shchetinnikov, 1989). A recent study reported that *D. gigas* preys upon tuna (Olson *et al.* 2006) and Chilean hake *Merluccius gayi* (Alarcón-Muñoz *et al.,* 2008) caught in purse-seine sets. Analyses of mature *D. gigas* stomach contents showed that their diet consists predominantly of fishes, suggesting that this species is an opportunistic predator (Ulloa *et al.,* 2006). Detrended correspondence analysis ordination showed that the main prey items in the diet of *D. gigas* are associated with the target species of the respective fishery (Ibáñez, 2008). Cannibalism is common, but only among a relatively small number of juvenile squid (3-4%) (Ehrhardt, 1991). Laboratory and field observations have shown that adult squid (mantle length: 200 to 350 mm), consume 5 to 9% of their body weight a day (Nigmatullin *et al.,* 2001).

On the other hand, *D. gigas* is also an important prey species, with juveniles preyed upon by pelagic fish (Rosas-Aloya *et al.,* 2002), and adults, by larger pelagic fishes (Abitia-Cardenas et al., 1999, Rosas-Aloya *et al.,* 2002) and sperm whales, *Physeter macrocephalus* (Ruiz-Cooley et al., 2004).

Cephalopods play an important role in oceanic food webs; their populations are subject to marked fluctuations and their impact on prey populations is equally variable (Rodhouse and Nigmtullin 1996, Piatkowski *et al.* 2001). *D. gigas* is a particularly important prey and predator species in the southeastern Pacific Ocean (Markaida and Sosa-Nishizaki, 2003). Field et al. (2007) reported that their ability to prey on larger items is indicative of their potential impact on ecosystems. Nonetheless, despite their importance in pelagic ecosystems, their feeding behavior and the ontogenic changes in prey consumption are not well understood. Future studies will therefore examine ontogenic changes in foraging behavior using stable isotope analysis.

References

Abitia-Cardenas L. A., Galvan-Magana F., Gutierrez-Sanchez F. J., Rodriguez-Romero J., Aguilar-Palomino B., and Moehl-Hitz A., 1999: Diet of blue marlin *Makaira mazara* off the coast of Cabo San Lucas, Baja California Sur, Mexico. Fish. Res., **44**, 95–100.

Alarcon-Munoz R., Cubillos L., and Gatica C., 2008: Jumbo squid (*Dosidicus Gigas*) biomass off central Chile: effects on Chilean hake (*Merluccius Gayi*). Cal. Co. Fi. Rep., **49**, 157–166.

Ehrhardt N. M., 1991: Potential impact of a seasonal

2013年9月5日受理（Received on September 5, 2013）

*1 Tohoku National Fisheries Research Institute, Fisheries Research Agency, 25-259, Samemachi Shimomekurakubo, Hachinohe, Aomori 031-0841, Japan

migratory jumbo squid (*Dosidicus Gigas*) stock on a gulf of California sardine (*Sardinops Sagax Caerulea*) population. Bull. Mar. Sci., **49**, 325–332.

Field J. C., Baltz K., Phillips A. J., and Walker W. A., 2007: Range expansion and trophic interactions of the jumbo squid, *Dosidicus Gigas*, in the California Current. Cal. Co. Fi. Rep., **48**, 131–146.

F.A.O., 2010: FAO yearbook. fishery and aquaculture statistics. Rome, Italy. ISSN2070–6057

Ibáñez C. M., Arancibia H., and Cubillos L. A., 2008: Biases in determining the diet of jumbo squid *Dosidicus gigas* (D' Orbigny 1835) (Cephalopoda: Ommastrephidae) off southern-central Chile (34° S-40 °S). Helgol. Mar. Res., **62**, 331–338.

Koronkiewicz A., 1988: Biological characteristics of jumbo squid (*Dosidicus gigas*) caught in open waters of the eastern central Pacific from October to December 1986. ICES CM 1988/K:42

Markaida U. and Sosa-Nishizaki O., 2003: Food and feeding habits of jumbo squid Dosidicus gigas (Cephalopoda: Ommastrephidae) from the Gulf of California, Mexico. J. Mar. Biol. Assoc. U.K., **83**, 507–522.

Nigmatullin C. M., Nesis K. N., and Arkhipkin A. I., 2001: A review of the biology of the jumbo squid *Dosidicus gigas* (Cephalopoda: Ommastrephidae). Fish. Res., **54**, 9–19.

Olson R. J., Roman-Verdesoto M. H., and Macias-Pita G. L., 2006: Bycatch of jumbo squid *Dosidicus gigas* in the tuna purse-seine fishery of the eastern Pacific Ocean and predatory behaviour during capture. Fish. Res., **79**, 48–55.

Piatkowski U., Pierce G. J., Morais da Cunha M., 2001: Impact of cephalopods in the food chain and their interaction with the environment and fisheries: an overview. Fish. Res., **52**, 5–10.

Rodhouse P. G. and Nigmatullin C. M., 1996: Role as consumers. Phil. Trans. R. Soc. B, **351**, 1003–1022.

Rosas-Alayola J., Hernandez-Herrera A., Galvan-Magana F., Abitia-Cardenas L. A., and Muhlia-Melo A. F., 2002: Diet composition of sailfish (*Istiophorus platypterus*) from the southern Gulf of California, Mexico. Fish. Res., **57**, 185–195.

Ruiz-Cooley R. I. G. D., Aguiniga S., Mesnick S., and Carriquiry J. D., 2004: Trophic relationships between sperm whales and jumbo squid using stable isotopes of C and N. Mar. Ecol. Prog. Ser., **277**, 275–283.

Shchetinnikov A. S., 1989: Food spectrum of the squid *Dosidicus gigas* (Oegopsida) in the ontogenesis. Zool. Zh., **68**, 28–39.

Staaf D. J., 2010: Reproduction and early life of the Humbold squid. Ph.D. thesis, Stanford university, Monterey, U.S.A.

Ulloa P., Fuentealba M., and Ruiz V., 2006: Feeding habits of *Dosidicits gigas* (D' Orbigny, 1835) (Cephalopoda : Teuthoidea) in the central-south coast off Chile. Rev. Chil. Hist. Nat., **79**, 475–479.

Zeidberg L. D. and Robison, B. H., 2007: Invasive range expansion by the Humboldt squid, Dosidicus gigas, in the eastern North Pacific. Proc. Natl. Acad. Sci. U.S.A., **104**, 12946–12948.