***CYNOPS PYRRHOGASTER* (Japanese Newt): PREDATION BY INTRODUCED *RANA CATESBEIANA* (Bullfrog).** Japanese Newts, *Cynops pyrrhogaster*, have tetrodotoxin in their skin, muscle, digestive organ and gonads (Tsuruda et al., 2001). This chemical blocks sodium channels of nerve and muscle (Narahashi, 2001). Therefore, their predators require resistance to this.

We captured Bullfrogs, *Rana catesbeiana*, at a field of iris in Higashi-Hiroshima, Hiroshima Prefecture, Japan (34°24'N, 132°43'E, 210 m above sea level) from 1999 to 2001, and studied their dietary habits by examining regurgitated stomach contents. From seven of these we obtained predated specimens of the Japanese Newt (Table 1). The condition of the nine newts ranged from near whole to merely bones. Other stomach contents included larvae of the Japanese Brown Frog, *R. japonica*, 10 types of aquatic invertebrates and 12 types of terrestrial ones.

On 21st June 1999 at 10:32 hrs, we tested for susceptibility of *R. catesbeiana* to tetrodotoxin by intraperitoneal injection. The tested individual was a female (123 mm SVL, 300 g body weight) captured on 15th June 1999 at ca. 00:00 hrs from the same site where Bullfrogs ate newts. The injected tetrodotoxin was 10 ml solution extracted from males of *C. pyrrhogaster* in Isahaya, Nagasaki Prefecture, and this toxicity was 1000 MU, corresponding to the level of toxin present in approximately two males (Tsuruda et al., 2001). One MU (mouse unit) is defined as the amount of toxin required to kill a mouse (20 g body weight) in 30 min after intraperitoneal injection (Kawabata, 1978). At 5 minutes after the injection, the frog lowered its head. At 17 minutes, she closed her nictitating membranes, and showed immobile hindlimbs and loss of righting reflex. At 28 minutes, her snout was touching the bottom of the container. At 203 minutes after injection, she jumped, and we considered her to have recovered.

Therefore, levels of tetrodotoxin as contained by two *C. pyrrhogaster* may not be enough to kill *R. catesbeiana* by digestion or even intraperitoneal injection. In previous reports, *R. catesbeiana* died after swallowing *Taricha granulosa* in an

Date	Time (h, ca.)	*R. catesbelana*		*C. pyrrhogaster*			Other Content
		Sex	SVL (mm)	Sex	SVL (mm)	Digested part	
1999-05-17	0220	Female	142	Male Female	42 46	Whole skin of both newts	*Hirudinea* sp. (1), *Geothelphusa dehaani* (1) and *Scolopendra subspinipes japonica* (3)
2000-04-20	0350	Female?	112	Female	50	Skin of limbs and tail	*Physa acuta* (2), *Hirudinea* sp. (3), *Chilopoda* sp (1), *Tipula* sp. larva (1), *Tipulidae* sp. adult (1) and *Pterostichinae* sp. adult (1)
2000-05-06	0120	Unknown	106	Male	40	Whole skin	*Araneae* sp. (1), *Orthetrum albistylum* nymph (1), *Gryllotalpa fossor* adult (1) and *Carabus* sp. adult (1)
2000-07-04	2110	Female	132	Unknown	–	All except for parts of bones (skull, vertebrae, mandibula, pelvic girdle and femora)	*Dolomedes* sp. (2), *Thomisidae* sp. (1), *G. dehaani* (2) and *Holotrichia* sp. adult (1)
2000-08-17	2230	Male	133	Female	41	Whole skin	*Oligochaeta* sp. (1), *D.* sp. (1), *Asellus hilgendorfi* (1), *Homorocoryphus lineosus* adult (1) and *T.* sp. larva (1),
2001-05-17	0230	Female	133	Female	47	Skin of head, limbs and tail	*P. acuta* (7), *Austropepla ollula* (1), *Ceriagrion melanulum* nymph (1), *Anax parthenope* nymphs (2), *Anisoptera* sp.(parts of *Anax*?) nymph (1), *Laccotrephes japonensis* adults (2), *Holotrichia* sp. adult (1) and *Rana japonica* larvae (56)
2001-06-04	0000	Female	121	Male Female	44 49	Whole skin of both newts	*Laccotrephes japonensis* adults (1) and *Holotrichia* sp. adult (1)

Table 1. Capture date and stomach contents of *Rana catesbeiana*. Snout-vent length (SVL) of *Cynops pyrrhogaster* was measured from the snout to the posterior end of the cloaca. In 'Other Contents', the number in parentheses following each animal represents the number of individuals.

experiment (Brodie, 1968), and have regurgitated predated individuals of *Notophthalmus viridescens* (Hurlbert, 1970) and *T. torosa torosa* (Jennings & Cook, 1998). *Taricha granulosa* was more toxic than *T. torosa*, *N. viridescens* and *C. pyrrhogaster* (Brodie et al., 1974). The Bullfrog was introduced from North America in 1918, and is now distributed in various parts of Japan (Maeda & Matsui, 1999). The present observation is similar to the observed predation on *T. torosa torosa* by Bullfrogs introduced into the American West (Jennings & Cook, 1998). Exotic Bullfrogs can therefore become a new predator on endemic newts. We noticed ponds where many Bullfrogs and few newts live, and have suspected influence of Bullfrogs on Japanese newts. We conclude that the predation pressure of Bullfrogs on Japanese Newts may cause population declines.

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