# SHORTER COMMUNICATIONS

# Sexual Dimorphism, Diet, and Reproduction in the Swamp Skink, *Egernia coventryi*

Nick Clemann,[1] David G. Chapple,[2,3] and John Wainer[4]

[1]*Arthur Rylah Institute for Environmental Research, Department of Sustainability and Environment,
P.O. Box 137, Heidelberg, Victoria 3084, Australia; E-mail: nick.clemann@dse.vic.gov.au*
[2]*School of Botany and Zoology, Australian National University, Canberra,
Australian Capital Territory 0200, Australia; E-mail: david.chapple@anu.edu.au*
[4]*Primary Industries Research Victoria, Department of Primary Industries, Knoxfield Centre,
Private Bag 15, Ferntree Gully Delivery Centre, Victoria 3156, Australia*

Abstract.—The Swamp Skink, *Egernia coventryi*, is an uncommon species that inhabits wetlands and swampy heaths in predominantly coastal regions of southeastern Australia. We examined museum specimens to quantify the diet, reproduction, and sexual dimorphism of *E. coventryi*. The mean SVL of both adult males and females was 85–86 mm, and individuals attain sexual maturity at about 72–74 mm SVL. Although the sexes did not differ in body size (SVL), males have longer and broader heads than females, both in terms of absolute head size and head size relative to body size. Females ovulate in September and October with parturition occurring in late January or early February. However, not all adult females collected during the breeding season were pregnant, suggesting that female *E. coventryi* may not always breed annually. Litter size in *E. coventryi* ranged from 1–4, with a mean litter size of 2.6. *Egernia coventryi* is omnivorous and a largely opportunistic forager, with spiders (found in 16 of 47 individuals, 34%), beetles (26%), lepidopterans (17%), ants (11%), hemipterans (9%) and aquatic amphipods (9%) the most common animal prey items found in the alimentary canals of individuals. However, plant materials (e.g., fruits/berries, seeds, other vegetation) also were found in the stomachs of the majority of the specimens (66%). Sloughed skin (26%) and the tail fragment of another *E. coventryi* were found in the alimentary tracts of preserved specimens. The majority of specimens (76%) were infested with endoparasites, with one specimen containing 130 nematodes, although the mean number of nematodes per specimen was 8.87.

Despite recent interest in the Australian scincid genus *Egernia*, particularly in relation to the evolution of complex sociality and monogamy, surprisingly little is known about the biology and ecology of many species within the genus (reviewed in Chapple, 2003). The Swamp Skink, *Egernia coventryi*, is a medium-sized skink that occurs mainly in coastal regions in southeastern Australia, with a disjunct distribution from southeast New South Wales, through Victoria to southeast South Australia (Cogger, 2000; Clemann, 2001). Relatively few inland populations have been recorded for *E. coventryi* (Smales, 1981; Clemann and Beardsell, 1999). *Egernia coventryi* is currently listed as vulnerable in Victoria (Department of Sustainability and Environment, 2003), endangered in South Australia (Chapple, 2003) and rare or insufficiently known nationally (Cogger et al., 1993).

There are few empirical data on the biology and ecology of *E. coventryi*. Most of what is known is drawn from anecdotal observations or from unpublished reports, unpublished thesis research, or short naturalist notes. *Egernia coventryi* is an obligate inhabitant of wetlands or swampy heaths with dense vegetation, including both freshwater and saltmarsh habitats (Robertson, 1980; Smales, 1981; Schulz, 1985). It is a diurnal posturing heliotherm that basks upon fallen timber, driftwood, sedges, and tussocks and is generally active between early-September and early-May (early spring-late autumn; Robertson, 1980; Schulz, 1985; Clemann, 2001). It is a secretive species that

quickly retreats into shelter when disturbed, usually dense vegetation or burrows of its own construction, although it also uses the burrows of freshwater crayfish (*Engaeus sternalis*) as well as rocks, logs, tussocks, and sedges (Robertson, 1980; Schulz, 1985; Taylor, 1995; Clemann, 2001).

To date, there has been no published analysis of the diet of *E. coventryi*, although most medium-sized species of *Egernia* are primarily insectivorous and include plant material such as berries and flowers in their diet (Chapple, 2003). There has been no detailed examination of the reproductive ecology of *E. coventryi*, although available information indicates that it is viviparous and produces between one and six young in late January or early February, with mating occurring just prior to ovulation in October (Robertson, 1980; Chapple, 2003). *Egernia coventryi* is aggressive and territorial (Taylor, 1994, 1995; Clemann, 2001) and is one of only two species within the genus that are considered to be primarily solitary and lacking the complex sociality exhibited by the majority of their congeners (Chapple, 2003).

Until 1978, *E. coventryi* was considered to be *E. luctuosa*, which is now known to be restricted to southwestern Western Australia (Storr, 1978). Consequently, few specimens of *E. coventryi* were collected prior to this time and little research conducted. Difficulties in observing and catching *E. coventryi* have hampered study. *Egernia coventryi* is extremely secretive within its wetland and swampy heathland habitat, making it notoriously difficult to detect and capture using traditional techniques. Pitfall trapping is usually inappropriate in wetlands because the traps fill with water, and there are often few rocks and logs to roll to

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[3] Corresponding Author.

reveal sheltering individuals. Thus, most *E. coventryi* are collected using baited Elliott traps (pilchards or a rolled oats mix); however, even this method of collection has proved inefficient (Clemann et al., 1998; Clemann and Beardsell, 1999; Clemann, 2000).

Because of difficulties in obtaining adequate numbers of live individuals for study, we chose to examine all available specimens of *E. coventryi* from Museum Victoria to study the morphology, diet, and reproduction of this species. We had several major goals for this study: (1) determine whether *E. coventryi* exhibits sexual dimorphism; (2) enhance our knowledge of the reproductive ecology of *E. coventryi*; and (3) quantify the diet and infer the foraging behavior of *E. coventryi*. Such information is vital for the future management of this species. *Egernia coventryi* has experienced significant range reduction and local extinction since European settlement caused by vegetation clearance, the draining of wetlands and the introduction of predators (Clemann, 2001). Conservation efforts are underway in several localities, including a translocation and breeding program for one population affected by the construction of a water pipeline (Taylor, 1994, 1995). The success of future management efforts for this species will undoubtedly depend upon the type of detailed biological and ecological information presented here.

MATERIALS AND METHODS

We examined 54 nontype museum specimens of *E. coventryi* housed at Museum Victoria in Melbourne, Australia. This represents the majority of nontype *E. coventryi* specimens held within Australian museums (54 of 66 specimens; 82%). Our examination of morphology, reproduction, and diet in *E. coventryi* focuses exclusively on nontype specimens, because it was not permissible to dissect the 23 type specimens held at Museum Victoria.

*Morphology and Sexual Dimorphism.*—For all specimens, we recorded the following morphological variables to the nearest 0.1 mm: SVL; tail length (TL); head width (HW; horizontal line joining the anterior edge of each ear aperture); head length (HL; distance from the anterior edge of the ear aperture to the tip of the snout); and mouth length (ML; distance from the tip of the snout to the angle of the jaw). These measurements were used to calculate relative tail length (RTL; TL/SVL) and several measures of head morphology relative to body size: HW/SVL, HL/SVL and ML/SVL. We also noted whether each specimen had a complete original or regenerated tail. Body size variables (except for ratios) were log-transformed prior to analyses to meet the assumptions of the statistical tests we employed. We used unpaired two-tailed *t*-tests and analysis of covariance (ANCOVA) to test for sexual size dimorphism. All morphological analyses examining sexual dimorphism were restricted to adults (i.e., over 70 mm SVL).

*Reproduction.*—Sex and reproductive status of *E. coventryi* were determined by making a midventral incision and directly examining the internal reproductive organs. Female reproductive status was determined by noting the presence and number of embryos or oviductal young. Reproductive status was also related to the date of collection for each adult female; however, the collection data of one adult female was unknown. We used regression analysis to examine the relationship between maternal SVL and litter size. Male reproductive status was assessed through visual appearance of the testes (flaccid, semiturgid, turgid) and measuring the length and width of the left testis. Testis volume was calculated using the formula for the volume (V) of an ellipsoid, $V = 4/3\pi a^2 b$, where $a$ is half the width and $b$ is half the length.

*Diet.*—Dietary analysis was conducted on 54 specimens. The gut, intestines, and hind-gut were removed from each specimen and examined under dissecting and/or compound microscopes. Insects were identified to at least order, and to family, genus or species where possible. Other invertebrates were identified to either class or order. The presence of plant material was noted and classified into broad categories (e.g., fruit, seeds, leaves). In addition, we recorded the presence and number of endoparasites (i.e., nematodes) in the alimentary tract of each specimen (conducted on only 51 specimens).

RESULTS

*Morphology and Sexual Dimorphism.*—The specimens examined comprised 28 adult males and 19 adult females (Table 1). The largest male and female we recorded were both 98 mm SVL (Table 1). Seven specimens were juveniles (<70 mm SVL), of which the smallest specimen was 32 mm SVL. Males had greater head width, head length and mouth length compared to females (Table 1). Analysis of Covariance (ANCOVA) revealed that sexes differed in head shape despite the lack of dimorphism in absolute body size (i.e., SVL; Fig. 1). When SVL was taken into account, males had both wider (slopes homogenous $F_{1,43} = 2.52$, $P = 0.120$; intercepts $F_{1,44} = 12.92$, $P < 0.001$; Fig. 1A) and longer heads (slopes homogenous $F_{1,43} = 1.884$, $P = 0.177$; intercepts $F_{1,44} = 48.76$, $P < 0.001$; Fig. 1B) than females (Fig. 1). Mean SVL, TL and RTL did not differ significantly between the sexes (Table 1).

Twenty-six of the 54 (48.2%) specimens that we examined exhibited evidence of tail loss, although the incidence of tail loss did not appear to differ between males (15 of 28; 53.6%), females (eight of 19; 42.1%) or juveniles (three of seven; 42.9%).

*Reproduction.*—The smallest reproductively mature female was 72 mm SVL. Pregnant females were found between September and January (Fig. 2), which accords with the previously suggested reproductive cycle for this species. Females in September–October had recently ovulated eggs or early stage embryos, whereas the pregnant female collected in January contained nearly fully formed young (approximately 30 mm SVL), indicating that parturition was likely to be in late-January or early-February. Only eight of the 14 adult females collected during the reproductive period were pregnant, suggesting that *E. coventryi* may not always reproduce annually (Fig. 2). Litter size determined for eight females ranged from one to four young (2.63 ± 0.38). There was no relationship between female SVL and litter size ($N = 8$; $R^2 = 0.16$, y = 0.043x − 1.112; $F_{1,6} = 1.13$, $P = 0.329$).

The smallest male with semiturgid or turgid testes, indicating sexual maturity, was 74 mm SVL (Fig. 3A). The majority of males larger than this size displayed testes that were greater than 20 mm³ in volume (Fig. 3B). Males with turgid or semiturgid testes were

TABLE 1. Summary of sexual dimorphism in morphological traits in *Egernia coventryi* from Victoria. Measures are in millimeters. The last three columns present the results from unpaired two-tailed *t*-tests for sexual size dimorphism. Statistical tests were performed on log-transformed data (except for ratios).

| Trait | \multicolumn{3}{c}{Adult Male} | \multicolumn{3}{c}{Adult Female} | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | N | Mean ± SE | Range | N | Mean ± SE | Range | df | t | P |
| Snout–vent length | 28 | 85.41 ± 1.25 | 74–98 | 19 | 86.67 ± 1.80 | 72–98 | 45 | 0.538 | 0.593 |
| Head width | 28 | 11.35 ± 0.17 | 9.5–13 | 19 | 10.84 ± 0.15 | 9.4–12.2 | 45 | 2.063 | 0.045 |
| Head length | 28 | 16.93 ± 0.21 | 14.6–19 | 19 | 16.14 ± 0.25 | 14.2–17.5 | 45 | 2.391 | 0.021 |
| Mouth length | 28 | 14.13 ± 0.21 | 12.4–16 | 19 | 13.37 ± 0.196 | 11.7–14.6 | 45 | 2.497 | 0.016 |
| Tail length | 28 | 112.07 ± 4.96 | 33–155 | 19 | 98.84 ± 7.72 | 24–141 | 45 | 1.523 | 0.135 |
| Relative TL | 28 | 1.311 ± 0.053 | 0.379–0.1667 | 19 | 1.144 ± 0.087 | 0.261–1.646 | 45 | 1.721 | 0.092 |
| HW/SVL | 28 | 0.133 ± 0.001 | 0.115–0.146 | 19 | 0.126 ± 0.002 | 0.114–0.149 | 45 | 3.341 | 0.002 |
| HL/SVL | 28 | 0.198 ± 0.001 | 0.184–0.210 | 19 | 0.187 ± 0.002 | 0.176–0.211 | 45 | 5.629 | <0.001 |
| ML/SVL | 28 | 0.166 ± 0.001 | 0.149–0.180 | 19 | 0.155 ± 0.003 | 0.130–0.189 | 45 | 3.449 | 0.001 |

present for the majority of the year, although testis volume was generally greatest between October and March (Fig. 3C), coinciding with female follicular development and ovulation in October.

*Diet.*—The alimentary tracts of seven of the 54 individuals were empty, while the alimentary tracts of the remaining 47 specimens contained identifiable food items (Appendix 1). Spiders (number of individuals with prey item; 16, 34%), coleopterans (12, 26%), lepidopterans (eight, 17%), ants (Formicidae; 5, 11%), hemipterans (4, 9%) and aquatic amphipods (4, 9%) were the major invertebrate prey items found in the diet of *E. coventryi* (Appendix 1). Most prey items were 5–25 mm in length when ingested (Appendix 1). The presence of aquatic amphipods in the diet suggests that *E. coventryi* may forage in or near the water within its swampy habitat. Although *E. coventryi* appears to prey opportunistically upon insects and other invertebrates, the majority of specimens (31, 66%) were found to contain plant material (e.g., fruits, seeds, other vegetation) indicating omnivory. Sloughed skin was found in 26% of specimens (12 individuals). The stomach of a large male also contained an *E. coventryi* tail fragment, which was presumably ingested during the aggressive interactions that are common in this species.

Nematode endoparasites were evident in 39 alimentary tracts (76.5%), with a mean of 8.87 ± 3.31 nematodes (range 1–130 per stomach in infested skinks). Excluding the specimen with 130 nematodes, each alimentary tract contained a mean of 5.68 ± 0.91 nematodes (range 1–25).

DISCUSSION

Most aspects of the biology and ecology of *E. coventryi* that we examined were comparable to those previously reported for other similar-sized species of *Egernia* (reviewed in Chapple, 2003).

*Morphology and Sexual Size Dimorphism.*—The body sizes were substantially lower than those reported by Chapple (2003; largest 130 mm SVL, mean 100 mm SVL). Such a discrepancy may be the result of pooling museum specimens collected from across a wide geographic range, or collecting bias. However, the size at maturity found in the present study is consistent with the 70–75 mm SVL reported by Chapple (2003). Unlike several other species of lizard (e.g., Brown and Ruby,

1977; Smith, 1996), tail loss frequency did not differ substantially between the sexes (42% vs. 53%).

Sexual dimorphism in head size has been reported in many lizard species (e.g., Fitch, 1981; Brana, 1996), presumably because of an advantage of large head size in male-male competition and fights (Vitt and Cooper, 1985; Anderson and Vitt, 1990). Indeed, *E. coventryi* is an aggressive and territorial species, and fights can result in serious injury or death (Taylor, 1994, 1995), as evidenced by the presence of a tail fragment in a large
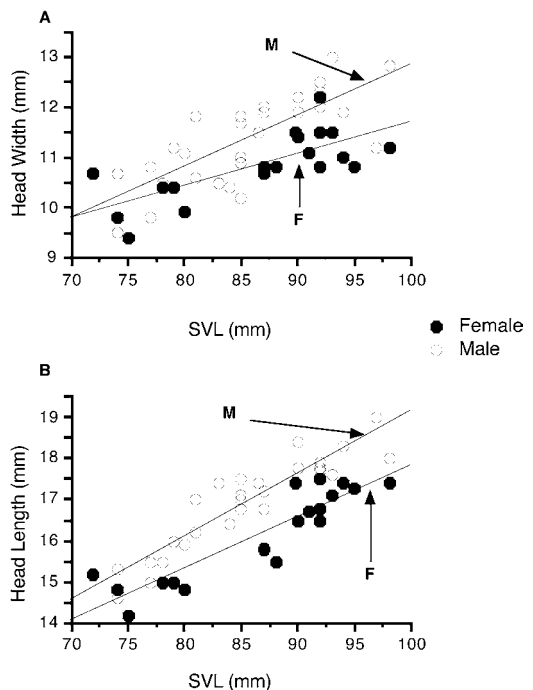


FIG. 1. Sexual dimorphism in body proportions in the Swamp Skink, *Egernia coventryi*, based on measurement of preserved specimens from the Museum Victoria. At the same snout–vent length (SVL), males have both broader (A) and longer heads (B). Refer to the text for details of the statistical analyses used.
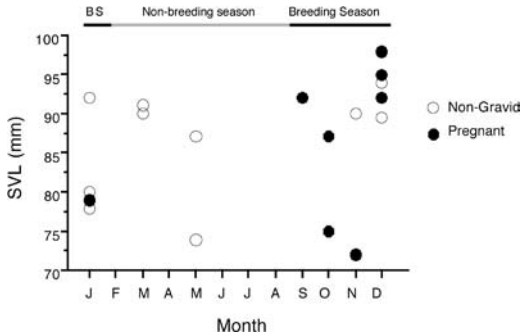
FIG. 2.    Reproductive status relative to the month of collection for nontype adult female Swamp Skinks, *Egernia coventryi*, from the Museum Victoria (N = 18). Solid circles indicate that females were pregnant and nonsolid circles indicate that females were not pregnant at the time of collection. All pregnant females were collected between September and January.

male (Appendix 1). Thus, male head size may be important in male-male competition and could be subject to sexual selection. Interestingly, similar levels of aggression have been reported in other species of *Egernia* that exhibit stable social aggregations (Chapple, 2003), and therefore additional explanations may be required to account for the apparent lack of complex sociality in *E. coventryi*.

*Reproduction.*—We found that not all sexually mature females collected during the breeding season were pregnant, which contrasts with records from the *E. coventryi* captive breeding program at Healesville Sanctuary in Victoria that indicate that all adult females reproduce each year (Taylor, 1995; Manning, 2002). However, these captive colonies are presumably well fed, which may provide the necessary nutritional resources to breed annually. There have been reports that not all adult females of the larger *Egernia stokesii* breed each season (Duffield and Bull, 1996), although most species of *Egernia* breed annually (Chapple, 2003).

The results of our study for both males and females support the previously suggested breeding season (Spring–October) and reproductive cycle (parturition in late January–February) of this species (Robertson, 1980; Clemann and Beardsell, 1999; Manning, 2002), and the general pattern observed within *Egernia* (Chapple, 2003). Litter size in the specimens that we examined was lower (1–4, mean 2.63) than reported previously (1–6, mean 2.5–3.0; reviewed in Chapple, 2003).

*Diet.*—Our data on the diet composition of *E. coventryi* support earlier findings (Douch, 1994; Appendix 1), that *E. coventryi* is omnivorous and appears to prey opportunistically on a variety of invertebrates. Dietary preferences of *E. coventryi* were consistent with most other similar-sized skinks in Australia (Brown, 1991), and its congeners (Chapple, 2003). Indeed, as is true of similar-sized skinks in the genus *Egernia*, plant material constituted a sizeable proportion of the diet (e.g., fruits, seeds, other vegetation; Brown, 1991). Within *Egernia* there is a strong relationship between body size and the proportion of plant material in the diet; larger species are primarily herbivorous and
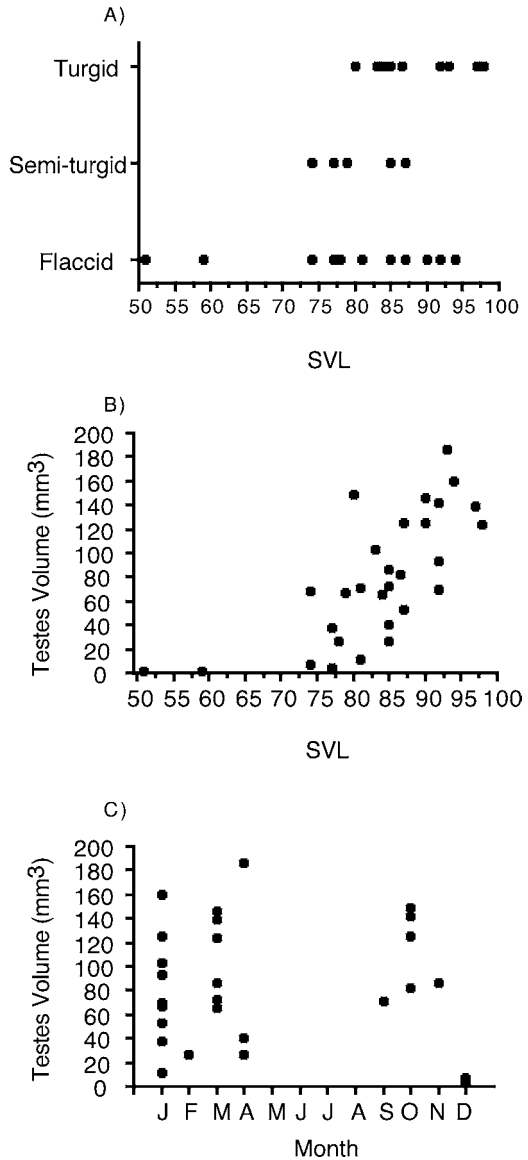


FIG. 3.    Reproductive status of male Swamp Skinks, *Egernia coventryi*, from the Museum Victoria. (A) Reproductive status (testes condition) in relation to body size (SVL; N = 30). (B) Relationship between SVL and testes volume (N = 30). (C) Seasonal variation in testes volume in sexually mature adult males (N = 27).

smaller species are predominately insectivorous (Chapple, 2003). According to this relationship, a species such as *E. coventryi* would have a diet that consisted of approximately 30% plant material (by volume; Chapple, 2003), an amount that is consistent with our data.

The presence of aquatic invertebrates in the diet of *E. coventryi* is not surprising considering the moist environments within which it resides and the fact that it has been observed to dive into the water to seek

refuge when disturbed (Schulz, 1985). Many of the habitats in which *E. coventryi* occurs are flooded regularly, so it is unknown whether aquatic invertebrates that have been stranded as the water recedes are preyed on opportunistically, or whether *E. coventryi* actively forages in the water.

Sloughed skin was found in a substantial proportion of the *E. coventryi* specimens that we examined. Several species of *Egernia* have been observed to ingest substantial amounts of shed skin (Hickman, 1960; Turner, 1997) compared to other Australian skinks (Brown, 1991). The frequency of slough that we found in the alimentary canals of *E. coventryi* suggests that this species actively ingests its shed skin (e.g., Turner, 1997). Nematodes have been recorded in most Australian scincid species, although *Egernia* species generally exhibit a relatively high intensity of infestation (Brown, 1991). Brown (1991) suggested that the intensity of infestation may be related to the high degree of herbivory exhibited by some members of the genus, although such a hypothesis remains untested.

To date, a lack of knowledge regarding the biology and ecology of *E. coventryi* have hampered efforts to effectively manage this threatened species. The major threats to *E. coventryi* are vegetation clearance and draining of wetlands, and conservation efforts have focused predominately on protecting habitat, translocations and captive breeding programs (Taylor, 1994, 1995; Clemann, 2001). Information on the life history, reproductive ecology, and diet of *E. coventryi* is vital to improve captive breeding programs and enable effective future management of this species.

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APPENDIX 1. Prey items identified from the alimentary canals of *Egernia coventryi* (*N* = 54) examined in this study. The alimentary canals of seven specimens were empty. The number of times each prey item was recorded in the remaining 47 specimens is shown. The bold numbers represent overall totals for particular taxonomic groupings (e.g., insect orders), with the numbers of *E. coventryi* alimentary canals with specific prey types (e.g., insect families) also provided. Prey items for *E. coventryi* identified by Douch (1994) are also shown (based on stomach flushing and scat analysis).

| Prey type | This study | Douch (1994) |
|---|---|---|
| Arthropods | | |
| Class Insecta | | |
| Order Blattodea (cockroaches) 15 mm long | 2 | X |
| Order Coleoptera (beetles) | **12** | X |
| Family Carabidae (ground beetles) 8–12 mm long | 3 | |
| Family Scarabaeidae 15–25 mm long | 2 | |
| Family Tenebrionidae (Darkling beetles) larvae 10–20 mm long | 2 | |
| unidentified larvae 6 mm long | 3 | |
| unidentified pupae 15 mm long | **1** | |
| Order Diptera (flies) 6 mm long | 3 | X |
| Order Hemiptera (true bugs) | **4** | X |
| Family Cicadellidae *Paracephaleus* sp. ~10 mm long | **1** | |
| Family Coreidae (heteropteran bugs) 7–15 mm long | **1** | |
| Family Enicocephalidae (gnat bugs) 6 mm long | **1** | |
| Order Hymenoptera (wasps, ants, bees) | **6** | X |
| Unidentified wasp | 1 | |
| Family Apidae honey bee (*Apis mellifera*) | 1 | |
| Family Formicidae (ants) *Iridomyrmex* sp., *Pheidole* sp. | 5 | |
| Order Isoptera (termites) | | X |
| Order Lepidoptera (moths, butterflies) | **8** | X |
| Family Noctuidae? larvae | **1** | |
| unidentified adult moth (and scales) | 3 | |
| unidentified larvae 1–30 mm long | **4** | |
| Order Neuroptera Antlion larvae | 1 | |
| Order Odonata (dragonflies, damselflies) | **2** | X |
| nymph (aquatic; mudeye) 15 mm long | 1 | |
| Order Orthoptera (crickets, grasshoppers) | | X |
| Order Trichoptera (caddlis-flies) | 1 | |
| Unidentified insect | **6** | |
| Unidentified insect pupae | **1** | |
| Unidentified egg mass | **1** | X |
| Class Arachnida | | |
| Order Araneae (spiders) | **16** | X |
| Family Gnaphosidae (ground spiders) | 1 | |
| Family Lycosidae (wolf spiders) 5–10 mm long | 3 | |
| Class Chilopoda (centipedes) | | X |
| Order Scolopendrida 40 mm long | 2 | |
| Class Diplopoda (millipedes) | 1 | |
| Subphylum Crustacea (Crustaceans) | | |
| Class Malacostraca | | X |
| Order Amphipoda (amphipods) | | X |
| aquatic 10 mm long | **4** | |
| Order Isopoda (Isopods) | | X |
| terrestrial 8–12 mm long | 3 | |
| Mollusca | | |
| Class Gastropoda (snails) | 1 | X |
| Plant Material | **31** | |
| Fruit (including Epacridaceae) ~3 mm diameter | 8 | X |
| Seeds (including Epacridaceae and grass seeds) | 7 | |

Appendix 1. Continued.

| Prey type | This study | Douch (1994) |
|---|---|---|
| Stamens | 1 | |
| Pollen | 1 | |
| Leaves, flowers grass fragments | 7 | X |
| Other (e.g. twigs, branches) | 15 | |
| Other | | |
| Slough | 12 | |
| *E. coventryi* tail fragment (7 × 2.5 mm) | 1 | |
| unidentified small skink | | X (also Schulz, 1985) |

# Predation on Hatchling and Juvenile Diamondback Terrapins (*Malaclemys terrapin*) by the Norway Rat (*Rattus norvegicus*)

Matt Draud,[1] Marc Bossert, and Sara Zimnavoda

*Department of Biology, C.W. Post-Long Island University, 720 Northern Boulevard, Brookville, New York 11548-1300, USA*

Abstract.—The Norway Rat (*Rattus norvegicus*) was a major predator on hatchling and juvenile Diamondback Terrapins (*Malaclemys terrapin*) in a New York population during three years (2001–2003). Rats killed young terrapins by evisceration through the plastron or carapace, exclusively at night, and during two distinct periods: (1) at emergence from nests in August and September; and (2) at emergence from hibernation in April. Predation rates were highest during peak emergence from nests and hibernacula. In the fall, hatchlings were mainly preyed upon within intertidal high marsh vegetation, where hatchlings normally occur after emergence from nests. We found no evidence of rat predation on eggs or hatchlings in nests. Predation in the spring also occurred in the intertidal high marsh, but rats killed juveniles in adjacent terrestrial habitats as well. We used data from a telemetry study of 24 wild hatchlings to estimate rat predation rates. Between 13 September and 22 October 2003, 16 of 24 (67%) radio-tracked hatchlings were killed by rats.

The early life history of the Diamondback Terrapin (*Malaclemys terrapin*) is largely unknown (Gibbons et al., 2001). Predation on nests (e.g., Burger, 1977; Roosenburg, 1992) and adult terrapins (e.g., Seigel, 1980) is well documented from throughout the range of the species, with Raccoons (*Procyon lotor*) considered to be the major predator. Considerably less is known about the predators on hatchling and juvenile terrapins, and virtually nothing is known about mortality rates of these early life-history stages.

As is true for most Chelonia, Diamondback Terrapins are long lived with delayed sexual maturity, and as such their populations are less capable of responding to chronic high juvenile mortality (Iverson, 1991; Congdon et al., 1993). There are good data relating to survivorship of adult terrapins, but much less is known about survivorship of hatchlings and juveniles, and this

has prevented accurate demographic modeling of terrapin populations (Gibbons et al., 2001). This is of particular concern because terrapin populations in some parts of its range are at risk. Therefore, data on the significance of various predators on early life-history stages is essential to the formulation of effective conservation and management plans for this and other chelonian species. To this end, we documented predation on hatchling and second-year juvenile Northern Diamondback Terrapins (25–41 mm carapace length) by the Norway Rat (*Rattus norvegicus*) in three consecutive field seasons (2001–2003) in Oyster Bay Harbor (OBH), Bayville, Nassau County, New York.

## Materials and Methods

The study site was a 0.15-ha stretch of intertidal high marsh on the shores of Oyster Bay Harbor, approximately 190 m long and 3–10 m wide, adjacent to a public beach in an urban setting (40°54′10″N, 73°32′54″W). The shorelines of Oyster Bay are highly developed and the

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[1] Corresponding Author. E-mail: mdraud@liu.edu