effectively at the site following disturbance. In order to document revegetation of the site, we also measured changes in the biomass of plant material over time. Although the rate of increase slowed in 1999 (1.05 m^3/month) compared to 1998 (1.52 m^3/month), the total biomass of vegetation at the site continued to grow throughout the study period.

Public education is key to the success of any conservation program. Thanks to a supplemental award from the National Science Foundation's Informal Education Program, we have been able to incorporate a public education component into our work on the base. Although Cuban iguanas comprise a conspicuous component of the local fauna and have been adopted as an informal mascot by many base residents, their biology and conservation status are not widely understood or appreciated. A major focus of our educational efforts has been to provide opportunities for the general public to participate actively in our field research effort. On three separate trips in 1997, we offered interested volunteers on the base the opportunity to participate in standardized iguana censusing and help collect data on antipredator and thermoregulatory behavior. Feedback from over 40 participants in the form of surveys was overwhelmingly positive, with 93% of respondents finding the research experience extremely worthwhile, 83% of respondents experiencing a positive shift in attitude regarding scientific research following their field experience, and 90% of respondents indicating that they would recommend the research experience to other base residents.

In collaboration with HVS Productions, we also produced a video that describes the basic biology of iguanas, their conservation status and requirements, and the goals, study methods, and results of our research program. Copies of the videotape have been distributed to the environmental office, library, and schools on the base. On each of our trips to the base, we have offered public lectures at which we provide information on iguanas, their conservation status, and how to appreciate and enjoy them without harming them. We have given numerous presentations to both elementary and secondary students on the base, prepared an endangered species pamphlet for incoming base personnel, and designed an Iguana Crossing sign for sites on the base where road casualties were known to have occurred.

Our work at Guantanamo Bay is but one example of the many contributions zoos are making to the conservation of West Indian iguanas. Over 20 American Zoo and Aquarium Association (AZA) member institutions have provided direct funding and other resources to West Indian iguana conservation projects, primarily in Jamaica, but also in Dominica, the Cayman Islands, the Dominican Republic, the Bahamas, the Turks and Caicos Islands, and the British Virgin Islands. With the help of zoos and other dedicated conservation partners, some of the rarest and most impressive lizards in the world are starting to make a comeback.

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NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in Volume 33, Number 1 (March 2002).

GYMNOPHIONA

OSCAECILIA ZWEIFELI (Zweifel's Caecilian). **PREDATION.** Virtually nothing is known about the ecology of *Oscaecilia zweifeli* (Lescure and Marty 2000. Atlas des Amphibiens de Guyane. Patrimoines Naturels, 45). At the field station of Nouragues (4°5'N, 52°41'W 110 m elev.), 8 km N of Saut Pararé, Arataye River, French Guiana, during the rainy season on 25 May 1999, one of us (RB) found, under a rotted trunk on the ground, an *O. zweifeli* (Museum National d'Histoire Naturelle, Paris [MNHN] 1997.6482) whose head was maintained by the chelicera of an adult giant tarantula, *Theraphosa leblondi* (Theraphosidae) (Fig. 1). The tarantula had produced a silk cocoon around the head of the dead caecilian; the head was already partly digested. When disturbed, the tarantula raised its forelegs and threw urticating setae. This specimen of *O. zweifeli* is the second one known from French Guiana, the species having been recorded in that country only from a single specimen from Cayenne (Lescure and Marty, *op. cit.*).

We thank J.-C. Baloup F. Catzeflis, P Charles-Dominique, M. Dewynter, P. Gaucher, G. Lenglet, and S Lochon for working facilities.

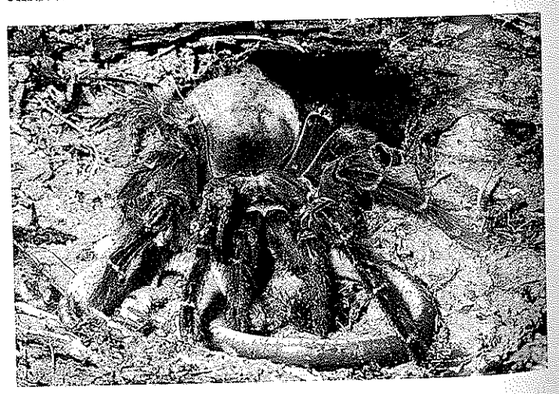

FIG. 1. Giant tarantula, *Therophosa leblondi* (Theraphosidae) preying on a Zweifel's caecilian, *Oscaecilia zweifeli*, at Nouragues Field Station, French Guiana, May 1999.

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CAUDATA

AMBYSTOMA LATERALE (Blue-Spotted Salamander). **HABITAT.** On 6 April 2001, a gravid female *Ambystoma laterale* was collected at George Wyth Memorial State Park, Cedar Falls, Black Hawk County, Iowa, USA. On 7 April 2001, a male (evidenced by a swollen cloaca) was collected at the same locality. *Ambystoma laterale* are listed State Endangered by the Iowa Department of Natural Resources and are only found at two sites within the State, Behrens Ponds, Linn County, and George Wyth Memorial State Park, Black Hawk County.

Before this study, only one individual of *A. laterale* had been reported (by a park visitor) at the George Wyth Memorial State Park site (1996) since the completion of the Hwy 218 expansion project in 1989, which runs adjacent to the park. It was feared *Ambystoma laterale* had been extirpated from the George Wyth site because of the altered hydrology caused by the highway expansion. Both specimens were returned to the exact locations where they were found. Future research will concentrate on gaining an accurate estimate of the size and genetic diversity of this geographically disjunct population.

We thank Gary Dusenberry (Director of George Wyth Memorial State Park) and the students of Field Zoology at UNI for their assistance. We also thank James W. Demastes for confirming the species identification and the opportunity to search for the salamanders under Iowa DNR permit number SC-5530101.

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AMBYSTOMA MACRODACTYLUM KRAUSEI (Northern Long-toed Salamander). **VOCALIZATION.** Vocalization has been documented in many terrestrial salamanders, often in association with defensive or aggressive behavior (Licth 1973. Can. J. Zool. 51:1055–1056; Brodie 1978. Copeia 1978:127–129). On 24 April 2001 at a wetland near Lost Horse Creek in the Bitterroot Mountains, Montana, USA (46°05'91"N, 114°15'82"W), a male *Ambystoma macrodactylum krausei* in breeding condition twice made a squeaking noise and three times produced a series of rapid clicks while being manipulated for photographs. The squeaks were produced with the mouth closed and might have been caused by expelling air through the nostrils. The clicks were produced by the salamander inflating its body and rapidly snapping its jaws 2–3 times. Both types of sound were audible from 0.5 m. Biological significance of the noises is uncertain because no defensive postures or aggressive movements were observed.

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DESMOGNATHUS CAROLINENSIS (Carolina Mountain Dusky Salamander) and ***PLETHODON WELLERI*** (Weller's Salamander); ***DESMOGNATHUS MONTICOLA*** (Seal Salamander) and ***DESMOGNATHUS WRIGHTI*** (Pygmy Salamander). ***GYRINOPHILUS PORPHYRITICUS*** (Spring Salamander) and ***DESMOGNATHUS OCOEE*** (Ocoee Salamander). **INTRAGUILD PREDATION.** Plethodontid salamanders are generalist predators as well as competitors, and thus fit the definition of intraguild predators (Polis et al. 1989. Annu. Rev. Ecol. Syst. 20:97–330). Hairston (1986. Amer. Nat. 127:266–291) experimentally demonstrated that both predation and competition structure salamander ensembles of *Desmognathus*. However, there is a paucity of records of interspecific predation by salamanders (perhaps because habitat partitioning effectively reduces opportunities for size-mediated predation) and the idea that predation is a significant ecological factor in structuring salamander ensembles has been questioned (Camp 1997. J. Herpetol. 31:613–616). Here I document three different predator-prey interactions based on disgorged stomach contents of wild caught salamanders. On 9 September 1995, a large (SVL 58.6 mm) gravid *Desmognathus carolinensis* was collected along Grandfather Trail on Grandfather Mt., Avery Co, North Carolina (USA) that disgorged a partially digested *Plethodon welleri* (TL 58 mm). On 20 June 1995, an adult *Desmognathus monticola* collected at Glade Gap, Nantahala Mountains, Macon Co., North Carolina disgorged a partially digested *Desmognathus wrighti*, not previously reported from this area. In September 1987 I flushed the stomach of an adult *Gyrinophilus porphyriticus* captured at Whiteside Mountain, Jackson Co., North Carolina; it disgorged a large male *Desmognathus ocoee* (SVL >50 mm).

These observations document three different predator-prey interactions involving six different species. In each case, not surprisingly, the larger individual ate the smaller individual, suggesting that body size evolution in plethodontids that coexist with other species of salamanders can drastically alter a species' role as predator or prey. For example, the large body size attained by *Desmognathus carolinensis* at high elevations throughout its range may be an example of ecological release. At these high elevation sites, it occupies a territory largely devoid of the large aquatic species (e.g., *D. monticola*, *D. quadramaculatus*, and *Gyrinophilus porphyriticus*) that normally prey upon the smaller species. Such ecological release may drive evolution of body size in high elevation populations of *D. ocoee* and *D. carolinensis* allowing these species to take on the role of dominant predator to prey upon smaller species.

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GYRINOPHILUS PORPHYRITICUS (Spring Salamander). **MALE COMBAT.** Behavioral interactions among plethodontid

salamanders in the field are scarce, particularly in less common species, and sexual behavior of many species has never been observed in the field (Arnold 1977. *In* Taylor and Guttman [eds.], Reproductive Biology of Amphibians, pp. 141–183, Plenum Press, New York). There is little published information about sexual behavior in spring salamanders. Bishop (1941. Salamanders of New York. Bull. New York State Mus. No. 324, Albany, New York) provided a detailed description (pp. 243–244) of an interaction between two specimens in the field, that he presumed to be a courting pair. This observation was also reported by Petranka (1998. Salamanders of the United States and Canada. Smithsonian. Inst. Press, Washington, D.C.). Bishop's description of *Gyrinophilus* courtship differs significantly from the elaborate courtship including tail-straddle walk that typifies courtship in the Plethodontidae (Arnold 1977, *op. cit.*) and that reported for closely related *Pseudotriton* (Organ and Organ 1968. Copeia 1968:217–223). It also differs from the description provided by Beachy (1997. Herpetologica 53:289–296) based on extensive observations from staged laboratory encounters.

On 21 September 1995 at Whiteside Mountain, Jackson County, North Carolina (USA), we encountered two large (SVL 86.7 mm and 90.6 mm) *G. porphyriticus* engaged in behavior remarkably similar to that described by Bishop. The two salamanders were in a shallow pool (~10 cm) in a small stream at the base of a rock face. The animals wrestled and writhed while biting each other aggressively. The behavior we observed resembled the aggressive interactions reported for many species of plethodontids (reviewed by Arnold 1977, *op. cit.*). After watching the salamanders engage in this behavior for about 10 minutes, they were collected and sacrificed the next day. Dissection revealed that both individuals were males, meaning that these behavioral interactions and probably those reported by Bishop (1941, *op. cit.*) are male-male agonistic behavior (sexual interference: Arnold 1976. Z. Tierpsychol. 42:247–300) rather than courtship behavior. The two specimens have been deposited in the North Carolina State Museum of Natural Sciences (NCSM 62159–62160).

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NECTURUS MACULOSUS (Mudpuppy). **PREDATION**. Predation on mudpuppies is not well documented. Herein I report predation on mudpuppies by mink (*Mustela vison*). During July 2001, Steven and Maureen Maslak of Rome, Maine, observed an adult mink carrying a mudpuppy in its mouth on the shore of Long Pond. The Maslaks often observe mink at this site, and often capture mudpuppies in their minnow traps. To my knowledge this is the first report of such predation.

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NOTOPHTHALMUS VIRIDESCENS (Eastern Red-Spotted Newt). **PREDATION**. No significant predation on adult eastern red-spotted newts, *Notophthalmus viridescens*, has been documented in the wild. Natural predation on the toxic adult newts might help explain their cryptic dorsal coloration.

During late September 1998, two female newts were placed in a minnow trap overnight in Binghamton University's Nature Preserve pond (Broome County, New York, USA), and one experienced limb and tail predation that provided the impetus for further investigation of newt predation. At 1700 h on 25 September and 2 and 9 October 2000 at the same site, three newts were placed in each of nine minnow traps set ca. 7 m apart, 45 cm deep, and 1.0 m from shore. Trap checks at 1000 h the following mornings revealed no newt captures. On 26 September, two of the 27 newts had disappeared and 11 had serious or fatal injuries: all lost limbs (Fig. 1), four had partial or total tail loss, and one had only the spine, head, and dorsal skin remaining (Fig. 2). On 3 October, one of the 27 newts was missing and one had lost a limb. No newts were injured or missing on 10 October. The first frost of the year occurred between the first and second trapping sessions, and two frosts occurred between the second and third. Injuries seemed to have been inflicted from outside the traps because many newts were found with their bodies partially pulled through the trap mesh. The predation seems to be crepuscular or nocturnal, as we have over 1500 newt captures in 3000 h of diurnal trapping (1000–1700 h) at the same population from March until June of 1999 and 2000 without an incident of predation (unpublished).

These are the first observations of natural and significant preda-

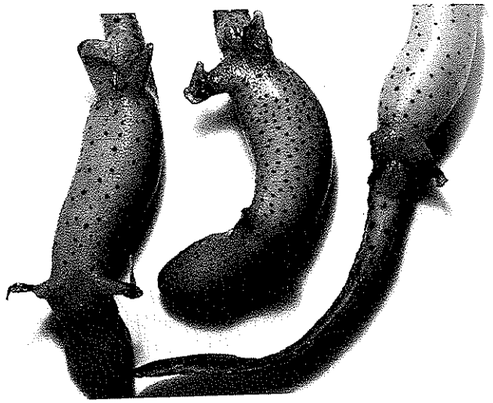

FIG. 1. Examples of limb predation on adult *Notophthalmus viridescens*.

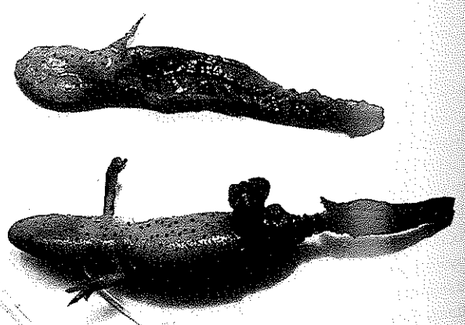

FIG. 2. Example of tail and ventral surface predation on adult *Notophthalmus viridescens*.