and anal fins. Ventrally a double line of very minute melanophores was present longitudinally between the pectoral and pelvic fins.

DISCUSSION

Since the early works of Agassiz (1879) and Balfour and Parker (1881) descriptive information of larvae of *Lepisosteus* has been meager. For larval gar of known species, no data exist from within the Tennessee River Valley. No published studies on prolarval *Lepisosteus* other than the longnose gar are available for comparison. The hatching size and general development was comparable to that described by Agassiz (1879) for longnose gar from the northeastern United States.

Postlarvae of the longnose gar and the alligator gar, *L. spatula,* may be separated by the distinctive pigmentation of the alligator gar (May and Echelle 1968, Moore, et al. 1973), which has vivid, sharply delineated white areas on

myomeres given for *Lepisosteus* spp. by Hogue et al (1976). Numbers of preanal and postanal myomeres are reduced by early head musculature and caudal fin development in the prolarval phase. Changes in the morphometric proportions between the prolarvae and postlarvae were large (Table 1). Obvious morphological changes, such as caudal fin differentiation and elongation of the snout, increased the snout, head, and postanal length ratios while decreasing all others.

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LITERATURE CITED

Agassiz, A. 1879. The development of *Lepidosteus. Proc. Amer. Acad. Arts and Sci. 14:65-76.*

TABLE 1. *Means expressed as percent of total or head length, or modes of selected morphometric and meristic data for larvae of the longnose gar, L. osseus.*

	Range of Total Lengths	N	Percent Total Length (Standard Deviation): Preanal Length	Postanal Length	Head Length	Head Depth	Body Depth at Anus	Percent Head Length (Standard Deviation): Snout Length	Snout Width at Nostrils	Head Width	Eye Diameter	Mode (Range) of: Preanal Myomeres	Postanal Myomeres	Total Myomeres
Prolarvae	8.8-12.4	23	73 (.02)	27 (.02)	14* (.01) 20 (.02)	14 (.01)	11 (.01)	26 (.05)	45 (.08)	62 (.07)	32 (.04)	44 (43-46)	16 (13-19)	60 (57-61)
Postlarvae	23.5-27.7	17	66 (.01)	34 (.01)	26 (.01)	8 (.01)	7 (.01)	45 (.04)	17 (.02)	31 (.02)	18 (.01)	obscured by melanophores		

*At hatching = 14 (N = 9 specimens)
All other prolarvae = 20 (N = 14 specimens)

the dorsum not found on the longnose gar. The longnose gar also retains a bulbous tip on the snout not present on comparably sized (24 mm TL) alligator gar.

Moore, et al (1973) implied, without explanation, ease of differentiating between larvae of the longnose gar and the shortnose or spotted gar. Echelle and Riggs (1972) noted different coloration patterns for suspected larval spotted gar and known longnose gar from Lake Texoma in Oklahoma. Hogue et al. (1976) tentatively suggested that postlarvae of the spotted gar, *L. oculatus,* and shortnose gar, *L. platostomus,* had broader heads and less elongated snouts than the longnose gar, much as in the adults. Based on these characters, the present authors could discern two distinct groups of *Lepisosteus* spp. postlarvae among the few field collected specimens from the Tennessee and Mississippi Rivers utilized by Hogue, et al. (1976). The limited number of specimens, tentatively thought to be *L. oculatus* or *L. plastostomus,* precluded further comparisons.

The inclusion of prolarvae specimens in this study has expanded the ranges of preanal, postanal, and total

Balfour, F. and W. Parker. 1881. On the structure and development of Lepidosteus. Proc. Royal Soc. 33(217):112-119.

Beard, J. 1889. On the early development of *Lepidosteus osseus.* Proc. Royal Soc. 46:108-118.

Dean, B. 1895. The early development of gar-pike and sturgeon. Jour. Morphol. 11(1):1-62:4pl.

Echelle, A. and D. Riggs, 1972. Aspects of the early life history of gars (*Lepisosteus*) in Lake Texoma. Trans. Am. Fish. Soc. 101(1):106-112.

Eycleshymer, A. 1903. The early development of *Lepidosteus osseus.* Univ. of Chicago. Decennial Publ. 10:261-275; 3 pl.

Hogue, J., R Wallus, and L. Kay. 1976. Preliminary guide to the identification of larval fishes in the Tennessee River. Tennessee Valley Auth. Tech. Note B19. 66 pp.

Hubbs, C. 1943. Terminology of early stages of fishes. Copeia 1943(4):260.

May, E. and A. Echelle. 1968. Young-of-year alligator gar in Lake Texoma, Oklahoma. Copeia 1968(3):629-630.

Gasaway, C. 1967. A preliminary key to the identification of larval fishes of Oklahoma, with particular reference to Canton Reservoir, including a selected bibliography. Okla. Dept. Wildl. Conserv. Contribution No. 164. 33pp; 58 figs.

Moore, G., M., Trautman, and M. Curd. 1973. A description of postlarval gar (*Lepisosteus spatula* Lacepede, Lepisosteidae), with a list of associated species from the Red River, Choctaw County, Oklahoma. Southwest Nat. 18(3):343-344.

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NOTES ON THE HAIRY-TAILED MOLE (*PARASCALOPS BREWERI*) IN THE CUMBERLAND MOUNTAINS OF TENNESSEE

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ABSTRACT

Single *Parascalops breweri* specimens were captured on Brushy and Massengale Mountains in Campbell County, Tennessee. These specimens represent a southwestward range extension of approximately 65 km down the Cumberland Mountains in Tennessee. Quantitative habitat data are provided to characterize the capture sites.

INTRODUCTION

Previous records of the hairy-tailed mole (*Parascalops breweri*) exist from the Appalachian Mountains of eastern Tennessee (Kennedy and Harvey, 1979), the Cumberland Plateau and southeastern mountains of Kentucky (Barbour and Davis, 1974), and from Claiborne County in the Cumberland Mountains of Tennessee (Copeland, 1981). The Claiborne County record represents the first *P. breweri* specimen collected in the Cumberland Mountains of Tennessee. Since few specimens have been collected in Tennessee, very little information exists concerning the natural history of *P. breweri* in the State, and no quantitative habitat data for the species have been reported. Hallett (1978) has summarized the existing literature concerning *P. breweri.* The purposes of this paper are to report on two specimens of *P. breweri* captured in Campbell County, Tennessee, and to quantitatively describe the habitats in which each was found.

MATERIALS AND METHODS

The study areas were located on Massengale Mountain and Brushy Mountain in Campbell County, Tennessee. Victor mousetraps baited with a peanut butter and rolled oat mixture were used in sampling.

Capture sites were within the mixed mesophytic forest region described by Braun (1950) and were representative of conditions in much of Ecoregion Province 2210, Eastern Deciduous Forest (Bailey, 1976). This region is characterized by low mountains, where less than 20% of the land is gently sloping and the local relief is 305-941 m (Hammond, 1964). Abandoned, active, and newly reclaimed contour surface mines were in close proximity to the capture sites. Specimens upon which this report is based were deposited in the Memphis State University Museum of Zoology, Memphis, Tennessee.

Quantitative plant community data for each capture site were determined for 10 0.04-ha circular plots using a modification of the technique developed by James and Shugart (1970). Two perpendicular transects, each 22.6 m in length, were established within each plot, with sampling intervals designated at 1, 5, 10, 15, and 20 m along each transect (10 stations/plot). All herbaceous ground cover (<0.5 m in height) was identified within 1-m^2 plots at each of the 10 designated sampling intervals. Percent ground cover was measured on both sides of each sampling station (20/plot) using a comblike point count instrument composed of 10 teeth or points. The instrument was placed perpendicular to the ground, and the number of teeth in contact with vegetation was recorded (Mueller-Dombois and Ellenburg, 1974). Each tooth represented 10% cover, so vegetation contact with all 10 points represented 100% ground cover. Twenty of these measurements were taken within each plot and averaged to obtain a mean percent ground cover estimate for the woodland sites.

All understory woody vegetation less than 0.08 m d.b.h. and greater than 0.05 m in height was identified, and the number of stems along a 1-m path on each side of the established transects counted. Interplot stem densities were averaged and a mean stem density/ha calculated. Species composition and density of overstory vegetation (<0.08 m d.b.h.) were determined within each 0.04-ha circular plot. Percent canopy cover was determined by sighting upward from each sampling station (1-, 5-, 10-, 15-, and 20-m intervals along transects) and estimating the percentage of the canopy that was closed. Plot estimates were averaged to yield a mean canopy cover for each site.

RESULTS AND DISCUSSION

One specimen, an adult female *P. breweri,* was hand captured on 28 April 1980 on Massengale Mountain in loose, moist soil beneath a decomposing log. It measured 152 mm total length, 28 mm tail length, and 17 mm hind foot length and weighed 36 g. The capture site was located within a ravine on Massengale Mountain, approximately 300 m surface distance below a reclaimed contour surface mine, at an elevation of approximately 700 m (36° 17′30″ N, 84° 19′30″ W). A small stream was located within 10 m of the capture point. An oak-maple forest (85% canopy cover) with an understory of flowering dogwood (*Cornus florida*), red maple (*Acer rubrum*), and black gum (*Nyssa sylvatica*) occurred at the site. Understory stem density was 6,755 stems/ha. Herbaceous ground cover (39%) consisted of thoroughworts (*Eupatorium* spp.), tick-trefoil (*Desmodium* sp.), aster (*Aster* sp.), southern lady fern (*Athyrium asplenioides*), and poison ivy (*Rhus radicans*).

A second specimen (adult male) was trapped on 22 June 1980 on Brushy Mountain within 10 m surface distance of a newly reclaimed contour surface mine (36° 19′30″ N, 84° 17′30″ W). It measured 173 mm total length, 38 mm tail length, and 18 mm hind foot length and weighed 48 g. Elevation at this capture site was approximately 869m, and soils were very dry and hard-packed with little leaf litter present. Forest at the capture site consisted of an oak-maple overstory (85% canopy cover) and an understory of black gum, sassafras (*Sassafras albidum*), ash (*Fraxinus* sp.), and sugar maple (*A. saccharum*). Understory stem density was 9,719 stems/ha. Virginia creeper (*Parthenocissus quinquefolia*), brambles (*Rubus* spp.), and Solomon's seal (*Polygonatum* sp.) dominated the herbaceous ground cover (45%). The adjacent reclaimed surface mine supported various species of grasses and legumes, interspersed with rows of wildlife shrubs as described by Fowler and Turner (1981). Two ponds (<0.5 ha), located approximately 260 m and 390 m from the trap site, were the nearest permanent water sources.

These captures, plus the specimen collected by Copeland (1981), indicated that *P. breweri* is more widely distributed in Tennessee than previously thought. Until now, *P. breweri* in Tennessee was known primarily from the extreme eastern portion of the State. Due to the scarcity of records, it has been deemed in "need of management" in Tennessee by the Tennessee Wildlife Resources Agency. Although *P. breweri* appears uncommon in Tennessee, Barbour and Davis (1974) reported it to be the common mole in the eastern forested region of Kentucky. Low population densities, a secretive life style, and the absence of well-defined tunnels (Hallett, 1978) probably account for the paucity of information regarding this species in Tennessee. Additional investigations are needed within Tennessee to determine the exact status and range of the species. Quantified habitat data provided in this report should be useful in determining habitat suitability for *P. breweri*. Although conventional word descriptions of the physiognomy of an area are valuable, habitats can be compared more precisely if quantifiable habitat measurements are taken.

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LITERATURE CITED

Bailey, R.G. 1976. Ecoregions of the United States. Rare II Map B. USDA. Forest Service.

Barbour, R.W. and W.H. Davis. 1974. Mammals of Kentucky. University of Kentucky Press, Lexington. 322 pp.

Braun, E.L. 1950. Deciduous forests of eastern North America. Hafner Press, New York. 596 pp.

Copeland, J. 1981. Occurrence of the hairy-tailed mole in Claiborne County, Tennessee. Jour. Tenn. Acad. Sci. 56:114.

Fowler, D.K. and L.J. Turner. 1981. Surface mine reclamation for wildlife: A model reclamation plan for southern Appalachia. U.S. Fish and Wildlife Service Report FWS/OBS 81-09. 28 pp.

Hallett, J.G. 1978. *Parascalops breweri*. Mammalian Species 98:1-4.

Hammond, E.H. 1964. Classes of land-surface form in the 48 States. U.S.A. Annals Assoc. Am. Geog. Vol 54.

James, F.C. and H.H. Shugart, Jr. 1970. A quantitative method of habitat description. Audubon Field Notes 24:727-736.

Kennedy, M.L. and M.J. Harvey. 1979. Tennessee mammals: capsule description of 24 selected species. Tennessee Wildlife Resources Agency Tech. Pub., Nashville. 93 pp.

Mueller-Dombois, D. and H. Ellenburg. 1974. Aims and methods of vegetation ecology. John Wiley and Sons, Inc., New York. 547 pp.

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MALLARD FOOD HABITS IN WESTERN TENNESSEE

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ABSTRACT

During the 1977-1978 waterfowl hunting season, 763 mallard (*Anas platyrhynchos*) gizzards, from six counties in western Tennessee, were examined for food content. The three food items with the greatest percentage of occurrence were stout smartweed (*Polygonum densiflorum*), Pennsylvania smartweed (*P. pensylvanicum*), and common buttonbush (*Cephalanthus occidentalis*). The largest food volumes were observed for stout smartweed, corn (*Zea mays*), and blackgum tupelo (*Nyssa sylvatica*).

INTRODUCTION

Annual migrations dictate that mallards must be extremely adaptable in their use of natural and cultivated foods. As the distribution of natural and agricultural plant foods vary, so must the diet of mallards (Korschgen, 1955; Dillon, 1959; Wright, 1961). Mallards, probably more than any other duck, can utilize either crop grain or natural foods depending on availability. As wetland drainage, pollution, and siltation have reduced natural food resources, agricultural grains have provided substitute food sources for mallards. However, advances in crop genetics and harvesting techniques to reduce grain waste are rapidly eliminating grain as a food source. Bellrose (1980), citing all of the previous reasons, predicted that an increased reliance on natural foods by mallards will be necessary in the future.

Because mallard food habits vary geographically, and because plant distributions and abundance vary temporally, updated systematic analyses are needed to identify regionally important food items which sustain transient and wintering mallard populations. Only two studies, both over 25 years old (Schoffman, 1947; Rawls, 1954) have been published dealing with mallard food habits in Tennessee, and each was based solely on specimens from Reelfoot Lake. This study was conducted to review and extend the known information concerning feeding habits of mallards in western Tennessee.

MATERIALS AND METHODS

During the 1977-1978 waterfowl hunting season (winter),

the Tennessee Wildlife Resources Agency (TWRA), in cooperation with the United States Fish and Wildlife Service, conducted an investigation into lead shot consumption by mallards in western Tennessee (unpublished TWRA manuscript). Upon the completion of their study, 763 mallard gizzards were forwarded to the authors by TWRA for an analysis of their food content. Numbers of gizzards collected in each of six western Tennessee counties were as follows: Benton, 158; Dyer, 201; Lake, 130; Lauderdale, 110; Obion, 73; and Tipton, 91. Of the gizzards examined, 148 were found to contain no food materials. Consequently, this study reflects results from the analysis of 615 gizzards.

Procedures described by Davison (1940) and Martin et al. (1946) were followed in the analysis of food materials. Contents of each gizzard were separated and measured volumetrically in a graduated cylinder by water displacement. Food items amounting to less than 1% of total volume were recorded as trace, while others were recorded to the nearest 0.1 ml. Percent frequency of occurrence and percent aggregate volume of each food item were also recorded. Martin and Barkley (1973) and Schopmeyer (1974) were the primary sources used in the identification of food materials. Scientific and common names of plants follow Scott and Wasser (1980).

RESULTS

A total of 63 different food items was identified. The 20 most important of these are given in Table 1 along with their volumes, volume percentages, frequencies of occurrence, and percentages of frequencies of occurrences. Forty-three additional food items which occurred in trace amounts or in only a few gizzards were omitted; however, a list of these items is available from the authors upon request.

TABLE 1. *Important food items found in the gizzards of 615 mallards collected in western Tennessee during the 1977-1978 waterfowl hunting season. Food items are listed in order of greatest occurrence. Volumes are in ml.*

Latin Name	Common Name	Vol.	%Vol.	Freq.	%Freq.
Polygonum densiflorum	stout smartweed	84.3	35.2	229	37
Polygonum pensylvanicum	Pennsylvania smartweed	8.7	3.6	182	29
Cephalanthus occidentalis	common buttonbush	13.0	5.5	111	18
Sida spinosa	prickly sida	7.6	3.2	66	11
Panicum dichotomiflorum	fall panicum	4.7	2.0	66	11
Coleoptera	beetles	4.5	1.9	64	10
Polygonum lapathifolium	curltop ladysthumb	3.1	1.3	64	10
Polygonum hydropiperoides	swamp smartweed	2.7	1.1	64	10
Mollusca	snails and clams	1.8	1.0	61	10
Amaranthus tamariscinus	water hemp	2.2	1.0	49	8
Zea mays	corn	51.3	21.7	45	7
Panicum capillare	witchgrass panicum	6.1	2.6	45	7
Carpinus caroliniana	American hornbeam	2.4	1.0	33	5
Nyssa sylvatica	blackgum tupelo	15.2	6.4	25	4
Glyceria grandis	mannagrass	1.3	T*	24	4
Cassia sp.	senna	9.5	4.0	20	3
Nuphar advena	spatterdock cowlily	7.8	3.3	19	3
Glycine max	soybean	7.3	3.1	18	3
Urtica dioica	stinging nettle	1.1	T*	17	3
Orthoptera	grasshoppers	3.1	1.3	5	**

* T = trace

** less than 1%

DISCUSSION

Schoffman (1947) examined 32 mallard stomachs from Reelfoot Lake, Obion County, Tennessee and reported various species of smartweed, Schreber watershield (*Brasenia schreberi*), and giant southern wildrice (*Zizaniopsis miliacea*) to be the food types most often used during the 1947 hunting season. Additionally, Schoffman (1947) indicated that American hornbeam exhibited the highest volumetric percentage; however, he detected American hornbeam in only one mallard stomach. In this study, we found 15 food types with higher volumetric percentages than American hornbeam and found only a trace amount of Schreber watershield. During the 1950-1954 hunting seasons, Rawls (1954) examined 798 mallard gizzards collected from Reelfoot Lake and found that seeds of several plant species including species of smartweed and common buttonbush to be important food types. In this study, corn can be considered equally as important mallard food as smartweed and common buttonbush as indicated by their consumption volumes. Additionally, fall panicum and prickly sida were consumed in small quantities but with relatively high frequencies of occurrence.

Differences between this study and the two previous studies conducted on Reelfoot Lake may be the result of temporal variation in vegetation cover of the study areas or simply due to the larger size of sampling area in the present study. Animal food material, in general, does not appear to be a major food resource for mallards (Bellrose, 1980). This may be especially true of winter feeding habits since low temperatures would reduce abundance of invertebrate populations. Volumes and frequencies of animal food materials for this study were small (Table 1) and comparable to the findings of Korschgen (1955) and Dillon (1959). Smartweed species were, and continue to be, the most important mallard foods as indicated by volume consumed.

Rawls (1954) and this study indicated corn as the only important crop grain used by mallards in western Tennessee. Because corn consumption exhibited comparable volumes in both studies, no shifting trend in natural food versus commercial grain feeding behavior was evidenced since the earlier study was conducted. Western Tennessee mallards feeding habits, therefore, do not yet support the Bellrose (1980) prediction that mallards' diet will shift toward natural foods.

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LITERATURE CITED

Bellrose, F. C. 1980. Ducks, geese and swans of North America. 3rd ed. Stackpole Books, Harrisburg. 540 p.

Davison, V. A. 1940. A field method of analyzimg game bird foods. J. Wildl. Manage. 19:302-308.

Dillon, O. W., Jr. 1959. Food habits of wild mallard ducks in three Louisiana parishes. Trans. 24th North Am. Wildl. Conf. 24:374-382.

Korschgen, L. J. 1955. Fall foods of waterfowl in Missouri. Missouri Dept. Conser. P-R Ser. 14:41 p.

Martin, A. C., and W. D. Barkley. 1973. Seed identification manual. University of California Press, Berkeley. 221 p.

———, R. H. Gensch, and C. P. Brown. 1946. Alternative methods in upland game food analysis. J. Wildl. Manage. 10:8-12.

Rawls, C. K., Jr. 1954. Reelfoot Lake waterfowl research. Tennessee Game and Fish Comm. Final Report, Project W-22-R. 80 p.