FIELD & LABORATORY

Volume XXI June, 1953 Number 3

Ecological Observations Upon the Fresh-Water Sponges in Dallas County, Texas

E. P. Cheatum & Joseph P. Harris, Jr.

Published distributional and ecological data on the fresh-water sponges of Texas are meager.[1] Besides Marcus Old's (1936) report on sponges collected by us the only other published report for this region is a description of *Asteromyenia plumosa* by Weltner (1895) from McKinney, Collin County, Texas. Dr. Old reported *Spongilla fragilis* from a small pond 1½ miles west of Dallas, and from Parson's Slough near Seagoville in Dallas County; *Trochospongilla horrida* from Elm Fork of the Trinity River, Dallas County; *Asteromyenia plumosa* from White Rock Lake, Dallas; and *Ephydatia crateriformis* from the East Fork of the Trinity River in Rockwall County.

The Southwest presents an environmental situation quite different from that in the northern and eastern sections of the United States. These sectional differences are shown in the physical appearance, growth and gemmule production of fresh-water sponges.

We report here data collected by us from 1932 to 1952. A taxonomic key to the six species found near Dallas is also presented. We are indebted to Professor Marcus Old of Ursinus College for verifying or correcting our identifications.

Growth

Spongilla fragilis appears to be the most widely and abundantly distributed species in this area. Our largest sponge colonies of this species and of *Trochospongilla horrida* occur in Parson's Slough near Seagoville, and in a small lake near Hutchins. But for all species most of the colonies are irregular in shape, averaging *ca.* one-third inch in diameter. Many colonies, however, grow much larger; one

[1]Two papers on fresh-water sponges have been received since our manuscript was submitted. These are: JEWELL, MINNA E. 1952. "The genera of North American fresh-water sponges. *Parameyenia*, New Genus." (Trans. Kansas Acad. of Science 55: 445-457.) MOORE, WALTER G. 1953. "Louisiana fresh-water sponges. with ecological observations on certain sponges of the New Orleans area." (Trans. Amer. Micr. Soc. LXXII: 24-32.) Dr. Jewell's revision affects one genus (*Ephydatia*) included by us. Dr. Moore lists 6 species of sponges from New Orleans, only one of which (*Spongilla fragilis*) is found in the Dallas vicinity.

encrusting colony of *S. fragilis* some twelve feet long and eight inches wide was found in Parson's Slough, growing on a submerged log. The maximum thickness for any one colony, collected in any habitat, did not exceed a half-inch.

Sponges have been found attached to twigs, logs, roots, metal, limestone rocks, and clam-shells. When on submerged or floating logs, colonies usually are of uniform height on the exterior, thus forming a smooth colony. If the bark of the log is deeply fissured, the fissures are usually filled with sponge and the depth of growth there may be as great as three-fourths of an inch. With the exception of one sponge-colony collected in headwaters of the San Marcos River at San Marcos, Texas, all of our sponge colonies are of the "low-growth" encrusted type (Fig. 1). Growth-form cannot be used as a means of generic or specific identification among our species studied.

During the fall, winter and early spring of 1936 and 1937 sponge colonies in three habitats were marked and measured each month to discover if growth is continuous throughout the year. Measurements are expressed in centimeters and water temperature in Fahrenheit. The results were as follows:

Species	Habitat	Number	Oct. 1 50° min. 69° max.	Nov. 8 50° min. 65° max.	Dec. 5 44° min. 57° max.	Jan. 7 38° min. 54° max.	Feb. 10 42° min. 55° max.	Mar. 1 41° min. 61° max.
S. fragilis	Parson's Slough	1.	1.0	1.3	2.0x1.5	2 x2.5	Dead	----------
		2.	2.5x3	2.5x3.5	3.0x4.0	3.0x4.0	3.5x5	3.5x5.0
		3.	3 x3.5	3.3x3.6				
		4.	0.7	2.0	2.5	2.5	2.8	3.5x4.0
A. plumosa	Hutchins Lake	1.	2.0	2.5x3.0	3.0x3.2	3.0x3.8	Lost	----------
		2.	2.5	2.5x3.5	3.2x3.5	3.5x3.5	3.8x3.5	3.8x3.5
		3.	3.5x5	Lost	----------	----------	----------	----------
		4.	1.0x2.5	2.0x3.0	2.5x2.0	2.8x3.0	3.0x3.0	3.7x3.5
		5.	3.0x4	3.5x5.0	4.0x5.2	4.0x5.0	Dead	----------
		6.	1.0x1.5	1.2x2.5	2.0x3.3	2.0x3.2	2.2x3.5	2.3x3.0
T. horrida	White Rock Lake	1.	1.5	2.0	2.0x2.5	2.0x2.5	2.0x3.0	2.0x3.0
		2.	3.8	3.8	4.0x4.5	3.0x4.0	2.0x4.0	2.0x4.0
		3.	2.0	3.5	3.0	Dead	----------	----------

Measurements were also made of the growth-rate of sponges during the late spring, early summer, and early fall of 1937 in two habitats, with the following results:

Species	Habitat	Number	Apr. 6 54° min. 74° max.	May 5 62° min. 79° max.	June 1 68° min. 86° max.	Sept. 10 71° min. 84° max.	Oct. 7 60° min. 74° max.
S. fragilis	White Rock Lake	1.	3.8x6.5	4.0x7.2	4.5x8.0	Fused with another colony	
		2.	4.0x6.2	5.0x6.5	5.5x7.2	5.0x7.5	7.2x8.5
A. plumosa	White Rock Lake	1.	3.0x3.5	4.0x4.0	4.0x4.0	4.0x6.0	5.0x7.0
		2.	3.0x4.5	3.0x5.0	3.0x5.0	Dead	----------
T. horrida	Parson's Slough	1.	4.0x5.0	4.2x6.2	4.4x6.5	5.0x6.0	5.5x7.8
		2.	4.0x5.0	5.5x5.5	6.0x4.0	6.2x5.0	6.5x6.0
		3.	3.5x5.0	4.0x5.0	Dead	----------	----------

The above data show that sponges grow the year round, but that growth proceeds at a slower rate during the colder months.

Color

The majority of the larger sponge colonies found in this region are dark gray, chocolate brown, or black in color. It was at first thought that some of dark color was due to particulate matter which had settled into the sponge mass; but microscopic examination of many dark colonies has revealed relatively "clean" and healthy sponges. In habitats of relatively clear water for this region (turbidity less than 50 p.p.m.) dark, almost black colonies of sponges occur in abundance. It may be (as suggested by Jewell, 1935) that

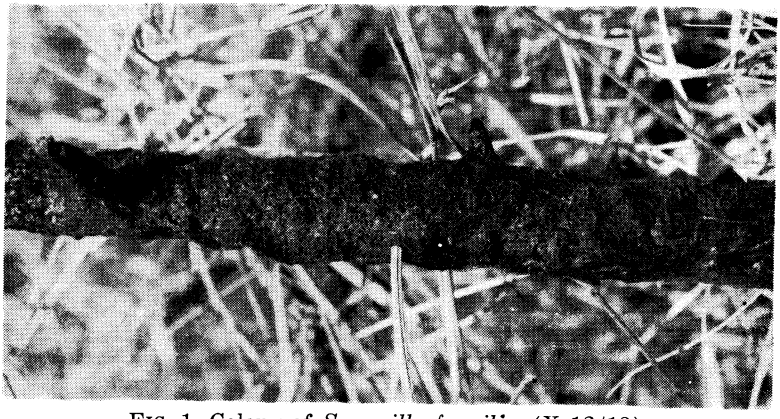

FIG. 1. Colony of *Spongilla fragilis*. (X 12/13)

deepened color of the colony may be due to increased organic content of the water. Such a correlation was especially evident at Parson's Slough; there, many of the sponges were dark-colored, and the waters much higher in content of organic stains. It is to be noted, however, that associated with these dark sponges were some pale gray and light brown colonies.

Asteromyenia plumosa was found growing on the basal stalks of cattails and sedges at White Rock Lake. It is the only species in this region that showed various shades of green, and only a few colonies were found in these shades. This scarcity of green sponges is probably due both to high turbidity in many of our habitats, as well as to the fact that most sponges grow on the lower surfaces of objects, unexposed to direct sunlight.

As a general rule, the presence of large sponge colonies in any habitat in this section indicates the presence of small

colonies, irrespective of the season. Most of these young colonies, often present on submerged logs in large numbers, are of gray or brown color.

Turbidity

Sponges seem to grow as abundantly here in muddy ponds and sluggish streams as in clearer waters. Turbidity usually ranged from 20 to 150 p.p.m. in most habitats where sponges were found; but Elm Fork and East Fork of the Trinity River showed at times turbidity readings as high as 5300 p.p.m. Nevertheless, floating logs and submerged willow roots were found literally plastered with *Trochospongilla horrida* and *Ephydatia crateriformis*. Since colonies in such turbid waters are usually as expansive as those growing in clearer ones, it appears that turbidity, at least in this region, is not a limiting factor in sponge occurrence.

Most of our sponges grow in the lower surface of submerged objects. Potts (1918) suggested that gravity aids in freeing sponges from the suspended particulate matter, so that the danger of clogging incurrent and excurrent canals is much lessened. We have collected, however, a few colonies of *Trochospongilla horrida* (in Elm Fork of the Trinity River, seven miles northwest of Dallas) which were growing on the upper surface of submerged water-clogged logs and practically buried in mud. After the mud had been washed from these colonies they appeared as healthy as those living on the under surface of floating logs. How long the colonies had been covered with mud is not known. This confirms the observations of Wurtz (1950) who found some species growing in mud and concluded that wood was "apparently the preferred substrate for most species." Similar observations have been made for *Spongilla fragilis* and *Ephydatia crateriformis*.

Gemmule Production

According to Potts (1918), gemmule production may occur in some sponges as early as August; in others they may not occur until winter. Annandale (1911) states that "in Europe, North America, and Japan, gemmules are produced at the approach of winter." Old (1932) concludes that "one may expect to find sponges with gemmules early in any favorable season," and that "sponges do not necessarily wait for the approach of winter to produce gemmules, although

it should be stated that the probability of finding gemmules in large quantities is greater then than at the start of the favorable season."

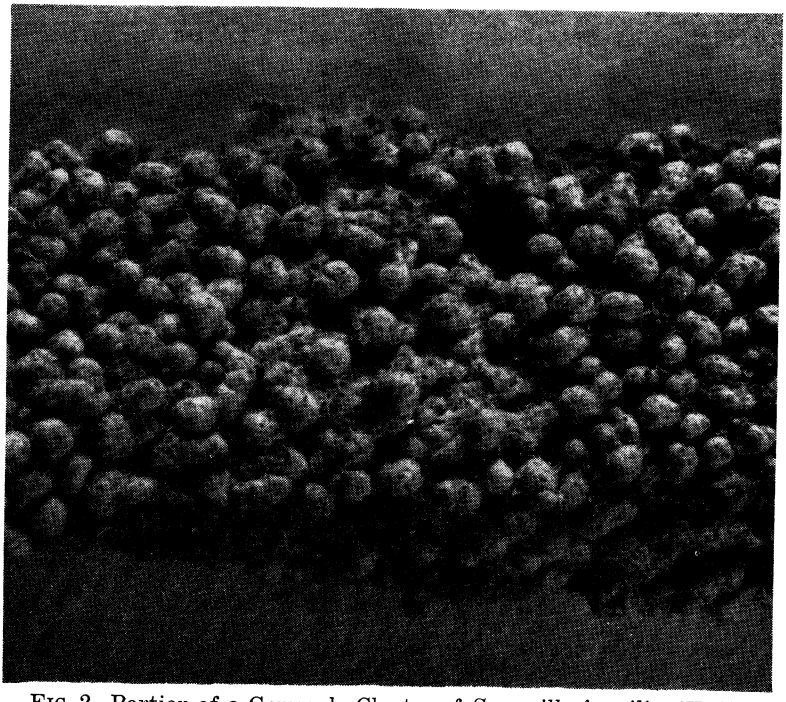

FIG. 2. Portion of a Gemmule Cluster of *Spongilla fragilis*. (X10)

Spongilla fragilis, Asteromyenia plumosa, and *Trochospongilla horrida* have all been found producing gemmules throughout the year, near Dallas. Such information was obtained by watching the growth rate of young colonies. The perennial growth in our species is probably due to our much higher average temperature than that of the northern and eastern parts of this country. During most of the winter at Dallas, sponges show growth, even though sporadic and slow. This is due to the frequent recurrence of low temperatures in northers which seldom last longer than one week. *Ephydatia crateriformis* has also been collected with gemmules throughout the year; but we do not know whether the building process is a continuous one for this species. Observations on *Trochospongilla leidyi* and *Spongilla lacustris* are limited since we found but few colonies of these species. A few colonies of *T. leidyi* were found on the East Fork of the

Trinity River near Rockwall; and a similar number of colonies of *S. lacustris* were collected along the Elm Fork of the Trinity River northwest of Dallas. Most of them had gemmules.

Gemmules are ordinarily deposited in pavement-like fashion (Fig. 2) on the object to which the sponge is attached. In a few large colonies of *Spongilla fragilis, Trochospongilla horrida,* and *Asteromyenia plumosa,* "nests" of gemmules extending throughout to the upper surface of the sponge growth have been found, in addition to those attached to the substrate.

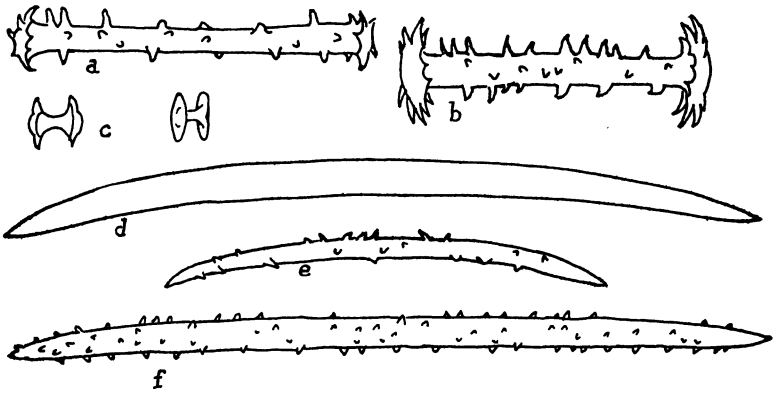

FIG. 3. Spicules of Dallas Fresh-Water Sponges. (a) Long birotulate spicule of *Ephydatia crateriformis;* (b) Short birotulate spicule of *Asteromyenia plumosa;* (c) Short birotulate spicules of *Trochospongilla leidyi;* (d) Smooth skeleton spicule of *Spongilla fragilis;* (e) Spined gemmule spicule of *S. fragilis;* (f) Spined skeleton spicule of *Trochospongilla horrida.* [Actual lengths of the objects figured, in micra: *a* (50), *b* (40), *c* (10), *d* (230), *e* (140), *f* (230).]

Maximum production of gemmules appears to be in the late fall and early spring. Warm days which follow several days of low temperature appear to stimulate gemmule production in old as well as in younger colonies.

Chemical Factors

In the waters from around Dallas, their alkalinity is due largely to soluble bicarbonates (62 to 135 p.p.m.) The normal carbonate p.p.m. content is low.

In determining the silica content, double filtration was used to free water of suspended material. This obviously eliminated all but the dissolved and colloidal silica. Silica was determined by the accepted hydrochloric acid method.

The silica content varied from 5 to 24.9 p.p.m. in habitats examined.

Platinum-cobalt standards were used to determine the true color of water. Most waters examined showed a color of 25 or less, with the maximum color occurring at Parson's Slough. The low color in most habitats indicates a low food or organic content, and this probably is an important factor in the limitation of sponge growth in our section.

KEY TO THE SPONGES OF THE DALLAS LOCALITY

1. Gemmules without birotulate spicules.....2
   Gemmules with birotulate spicules.....3
2. Flesh spicules present and spined.....*Spongilla lacustris*
   Flesh spicules absent.....*Spongilla fragilis*
3. Rotules with toothed margins.....4
   Rotules with smooth margins.....5
4. Only one type of birotulate spicule present; spicule with a long slender and abundantly-spined shaft.....*Ephydatia crateriformis*
   Two types of birotulate spicules; one type with long, smooth, slender shaft; the other type with short, stout, spined shaft — *Asteromyenia plumosa*
5. Skeleton spicules smooth.....*Trochospongilla leidyi*
   Skeleton spicules strongly spined.....*Trochospongilla horrida*

SUMMARY

1. All sponges observed near Dallas are of the low-growth, encrusting type.
2. Most of the larger sponge growths are gray to chocolate-brown, or tven black in color, while the smaller colonies are usually yellow or gray.
3. Most of our sponges grow on the lower surfaces of logs, very few being exposed directly to the sunlight.
4. The growth-form and general external appearance of the six species studied are similar; hence identification of the species must be based upon microscopic examination.
5. In this region *Spongilla fragilis, Asteromyenia plumosa* and *Trochospongilla horrida* will show perennial growth; this is probably true also for *Ephydatia crateriformis, Trochospongilla leidyi* and *Spongilla lacustris.*
6. While gemmules appear to be produced most abundantly during the fall and spring months, their production may continue throughout the year, and is not usually followed by cessation of sponge growth.
7. The size- and growth differences in sponges in this section when compared with those of the northeastern parts of the United States, may be largely due to low organic content of the water and its high turbidity, as compared to the relatively high organic content and clearer waters in the north.
8. A taxonomic key to the six species represented in this area is included.

BIBLIOGRAPHY

ANNANDALE, N. 1911. Fresh-water sponges, hydroids, and Polyzoa. *Fauna of British India.* London, (p. 251).
JEWELL, MINNA E. 1935. An ecological study of the fresh-water sponges of northeastern Wisconsin. *Ecol. Monogr. 5*:461-504.
OLD, MARCUS D. 1932. Taxonomy and distribution of the fresh-water sponges (Spongillidae) of Michigan. *Papers, Mich. Acad. Sci., Arts & Letters 15*:439-77.
———— 1936. Additional North American fresh-water sponge records. *Trans. Amer. Micr. Soc. 55*:11-13.
POTTS, EDWARD. 1918. The sponges (Porifera). *In* Ward & Whipple, *Fresh-Water Biology* (Wiley), pp. 301-15.
WELTNER, W. 1895. Spongillidenstudien III. Katalog und Verbreitung der bekannten Suesswasserschwaemme. *Arch. f. Naturgesch.*, Teil I, *61*:114-44.
WURTZ, CHARLES B. 1950. Fresh-water sponges of Pennsylvania and adjacent States. *Notulae Naturae,* Acad. Nat. Sci., Phila., No. 228, p. 7.