

## TWO ADDITIONAL RECORDS OF *CRASPEDACUSTA SOWERBYI* LANKESTER IN THE TENNESSEE RIVER SYSTEM

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### ABSTRACT

New records of *Craspedacusta sowerbyi* from Gunter'sville and Kentucky Reservoirs, Tennessee River Miles 389 and 120 (km 626 and 193), are presented. Water quality parameters and plankton taken in conjunction with the collections are listed. Three previous reports from the State of Tennessee are examined.

### INTRODUCTION

The oriental species, *Craspedacusta sowerbyi*, a native of the Yangtze River basin in China, is widely distributed in temperate waters of the world and represents the only freshwater "jellyfish" in North America. Two other species of *Craspedacusta*, *C. iseana* in Japan and *C. sinensis* from the upper basin of the Yangtze River along with four species belonging to the genus *Limnocyclus* found in Africa and India, comprise the freshwater medusa fauna (Lytle, 1960; Hutchinson, 1967).

The life cycle of *C. sowerbyi* contains two forms, a colonial hydroid and a medusa. Two to four individuals

usually make up the hydroid which reproduces asexually by two modes of budding and by producing medusae; the medusae in turn may reproduce sexually. Feeding of both forms centers upon small benthic and planktonic invertebrates (Bushnell and Porter, 1967; Pennak, 1978).

*Craspedacusta sowerbyi*, originally discovered in England in 1880, was first found in the United States in 1908. The relationship between the hydroid and the medusa was not proven until 1924 (Pennak, 1978).

The medusae are typically associated with standing bodies of water and the hydroid chiefly with running waters (Lytle, 1960; Hutchinson, 1967). Such a system of lentic and lotic waters occurs in the Yangtze River basin (Hutchinson, *op. cit.*). In discussing the James River, Lytle (1960) concluded that after the hydroid had been introduced and had successfully colonized the system, construction of impoundments produced environmental conditions, such as increased temperature, conducive to the development of medusae.

One of the unique aspects of *C. sowerbyi* is its sporadic appearance. Bushnell and Porter (1967) and Pennak (1978) reported that the hydroid stage, covered with a sticky mucous that readily accumulates debris, is seldom found because of its small size and inconspicuous nature. The medusae, on the other hand, may be common in a body of water for several years only to disappear for long intervals of time; in some instances they may appear on only one occasion (Pennak, *op. cit.*). The freshwater "jellyfish" has been recorded primarily from small artificial lakes in about 50 localities in the United States including Washington, Oregon, California, several mid- and southwestern states, and most states east of the Mississippi River with the exception of northern New England (Pennak, *op. cit.*).

Populations of *C. sowerbyi* medusae have been reported three times from the State of Tennessee, twice in the Tennessee River system and once in the Cumberland River system. In 1938 thousands of medusae appeared for approximately 45 days in Andrew Jackson Lake near Knoxville (Powers, 1938). Chadwick and Houston (1953) recorded a bloom of *C. sowerbyi* in Burton's Creek, a tributary of the Tennessee River near Tennessee River Mile (TRM) 132 (km 212), Kentucky Reservoir. In the Cumberland River system, Isom and Sinclair (1962) listed three sightings in the Caney Fork River in the vicinity of Center Hill Reservoir and two sightings in the Cumberland River, one above, the other below Old Hickory Dam.

#### RESULTS AND DISCUSSION

During the summer of 1978, personnel from Resource Consultants, Inc. collected specimens of *C. sowerbyi* from the mid-channel of Kentucky and Guntersville

Twelve medusae were collected on June 26 from Kentucky Reservoirs, in Tennessee and Alabama respectively. Kentucky Reservoir (TRM 120) by 12 larval fish tows which filtered 424.2 m<sup>3</sup> of water (28.3 medusae/1000 m<sup>3</sup>). In Guntersville Reservoir (TRM 389) on June 29 four *C. sowerbyi* were taken in 12 larval fish net hauls which filtered 558.3 m<sup>3</sup> of water (7.2 medusae/1000 m<sup>3</sup>).

In general, although many reports have been made concerning the appearance of *C. sowerbyi*, information dealing with the actual concentration of medusae, physio-chemical conditions, and plankton populations at the time of collection has been infrequently recorded. Smrček (1970) in reporting the collection of three medusae from Burt Lake, Michigan recorded several physio-chemical parameters (pH 8.1, total alkalinity 222 ppm, total dissolved solids 175 ppm, and water temperature 26 C, among others) and provided a list of planktonic and benthic organisms taken in conjunction with the discovery of the medusae. Bushnell and Porter (1967) presented 13 new site locales for *C. sowerbyi* in Michigan and described in some detail the ecological conditions of three of the locations—Clear Lake, Otis Lake, and Augusta Creek; the hydroid form only was found in the latter two. Physio-chemical measurements included: Clear Lake—pH 7.3 to 7.9, Otis Lake—pH 7.0 to 7.3, and Augusta Creek—pH 7.9 to 8.0, alkalinity as bicarbonates 198 ppm to 208 ppm, and water temperature 19 to 21 C. In addition, Bushnell and Proter (*op. cit.*) listed the associated organisms of the three locations and discussed some aspects of the feeding behavior and prey of *C. sowerbyi*. Physio-chemical data and plankton taken from Kentucky and Guntersville Reservoirs are presented in Tables 1 and 2.

TABLE I: Physio-chemical data for Kentucky (TRM 120) and Guntersville (TRM 389) Reservoirs, June 26 and 29, 1978.

Parameters*	Kentucky Reservoir		Guntersville Reservoir	
Suspended Solids mg/l	11	(7-19)	16	(3-38)
Settleable Solids mg/l	0.1	(0.1-0.1)	0.11	(0.1-0.2)
Turbidity NTU	16	(12-22)	18.4	(7-47)
Light Penetration cm	65	(55-75)	64	(45-80)
Water Temperature C	28.0	(27.5-29.0)	28.0	(27.5-28.0)
Dissolved Oxygen mg/l	6.7	(5.6-8.1)	5.2	(5.1-5.4)
pH	7.7	(7.6-7.8)	7.3	(7.3-7.4)
Acidity mg/l as CaCO <sub>3</sub>	6	(5-9)	4	(2-6)
Alkalinity mg/l as CaCO <sub>3</sub>	48	(46-50)	51	(48-53)
Hardness mg/l as CaCO <sub>3</sub>	73	(59-85)	63	(62-68)
Specific Conductance umhos	150	(150-150)	165	(165-165)
Iron mg/l	1.03	(0.72-1.54)	1.69	(0.43-5.18)
Manganese mg/l	0.06	(0.03-0.10)	0.10	(0.05-0.19)

\*Values reflect average of 12 samples from four mid-channel locations at three depths. Light penetration from the four surface mid-channel locations only. Range of all measurements shown in parenthesis.

TABLE II: Plankton collected in Kentucky (TRM 120) and Guntersville (TRM 389) Reservoirs, June 28 and 30, 1978.

	Kentucky Reservoir	Guntersville Reservoir	Kentucky Reservoir	Guntersville Reservoir
Crustacea				
Cladocera				
<i>Alona guttata</i>		X		
<i>Bosmina longirostris</i>	X	X		
<i>Daphnia retrocurva</i>	X	X		
<i>Diaphanosoma brachyurum</i>	X	X		
<i>Holopedium gibberum</i>	X	X		
<i>Leptodora kindtii</i>	X	X		
Copepoda				
Cyclopoida				
<i>Cyclops bicuspidatus thomasi</i>		X		
<i>Cyclops vernalis</i>	X	X		
<i>Mesocyclops edax</i>	X	X		
immatures	X	X		
Calanoida				
<i>Diaptomus pallidus</i>	X	X		
immatures	X	X		
Harpacticoida				
<i>Nitocra lacustris</i>		X		
Nauplii	X	X		
Rotifera				
Bdelloidea				
<i>Philodina</i> sp.		X		
Monogononta				
<i>Asplanchna girodi</i>	X	X		
<i>Brachionus argularis</i>	X	X		
<i>B. budapestinensis</i>	X	X		
<i>B. calyciflorus</i>	X	X		
<i>B. caudatus</i>	X	X		
<i>B. havanaensis</i>	X	X		
<i>B. quadridentatus</i>		X		
<i>Cephalodella</i> sp.	X	X		
<i>Conochiloides</i> sp.	X	X		
<i>Euchlanis</i> sp.		X		
<i>Filinia</i> sp.	X	X		
<i>Hexarthra</i> sp.	X	X		
<i>Kellicottia bostoniensis</i>		X		
<i>Keratella cochlearis</i> (group)	X	X		
<i>Monostyla</i> sp.	X	X		
Protozoa				
<i>Actinosphaerium</i> sp.	X	X		
<i>Diffugia</i> sp.	X	X		
Contracted protozoa	X	X		
Nematoda	X	X		
Insecta				
Diptera				
<i>Chaoborus</i> sp.	X			
Pyrrophyta				
<i>Ceratium hirundinella</i>	X			
Chlorophyta				
<i>Pediastrum simplex</i> var. <i>duodenarium</i>	X	X		
<i>Pediastrum duplex</i>	X	X		
<i>Pleodorina</i> sp.		X		
<i>Radiolium</i> sp.	X	X		
<i>Spirogyra</i> sp.	X	X		
<i>Staurastrum</i> sp.	X	X		
Chrysophyta				
<i>Asterionella formosa</i>	X	X		
<i>Fragilaria crotonensis</i>	X	X		
<i>Fragilaria</i> sp.	X	X		
<i>Melosira granulata</i>	X	X		
<i>Melosira varians</i>	X	X		
<i>Synedra acus</i>	X	X		
<i>Synedra ulna</i>	X	X		
Cyanophyta				
<i>Merismopedia</i> sp.	X			

Although the alkalinities of Burt Lake and Augusta Creek differ from those of the Tennessee River, the pH (7.3 to 8.1) and temperature (26 to 29 C) of the locales containing medusae appear roughly similar. Among the various factors which may exert themselves upon medusa formation by the hydroid, temperature seems to be the most significant. Lytle (1960) states that the increased temperatures associated with small impoundments and standing waters are known to influence the onset of medusa bud production. Laboratory studies by McClary (1959) found that medusae were produced in the rather narrow temperature range of 26 to 33 C. Correspondingly, most sightings of *C. sowerbyi* medusae have occurred in the summer and early fall months (McClary, *op. cit.*; Lytle, 1960; and Pennak, 1978) when optimum water temperatures would

occur.

From the examination of over 100 published appearances of *C. sowerbyi* in the United States, Lytle (1960) observed that stream and river populations were reported less than a dozen times but evidently did occur in the Kentucky, James, and Potomac Rivers. This apparent lack of lotic populations in the United States differs from the situation reported by Lytle (*op. cit.*) for China and especially Europe where stream and river populations may be more the rule than the exception. Whether the observations by Isom and Sinclair (1962) from the Cumberland River system and those of Chadwick and Houston (1953) and of the present report from the Tennessee River system indicate that *C. sowerbyi* has successively colonized these systems remains tentative.

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