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NOTE

OBSERVATIONS OF *HYDRA* FROM A SUBMERSIBLE AT TWO DEEPWATER SITES IN LAKE SUPERIOR

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ABSTRACT. During a series of submersible dives at depths of 300 m and 400 m in southeastern Lake Superior, Hydra *were observed attached to a variety of hard substrates including individual rocks, the edges of large boulders, and the undersurfaces of sandstone ledges. Although widespread, populations were generally found in distinct clumps. Based strictly on morphological features, the species resembled* H. littoralis *or* H. carnea. *The finding of* Hydra *at depths of 400 m in Lake Superior, the deepest sounding in the Great Lakes, would indicate that* Hydra *are not limited by depth.*

ADDITIONAL INDEX WORDS: Benthos, plankton.

INTRODUCTION

In July-August 1985, the manned submersible *Johnson-Sea-Link II* made a series of research dives into Lake Superior to explore the bottom and to study the biology and geochemistry of the lake. During the expedition, large numbers of *Hydra* were observed on rocks and ledges down to the deepest part of the lake at a depth of 400 m. This paper documents these distributions and describes the general morphological features of the populations.

Hydra are widespread in the Great Lakes, having been reported from all of the lakes beginning as early as 1871. They have been collected in benthic grab samples (Smith and Verrill 1871, Hiltunen 1964, Schneider *et al.* 1969, Adams and Kregear 1969, Shrivastava 1974, Cook 1975, Loveridge and Cook 1976) and in plankton nets (Reighard 1894, Eddy 1927). *Hydra* have both a "planktonic" phase and an "attached" phase and, although the former is important for survival and dispersal, the latter phase is considered the more natural condition (Reisa 1973). Because of difficulties in sampling the hard substrates used for attachment (shells, rocks, boulders, etc.), quantitative estimates of *Hydra* are generally lacking. However, an indication of the potentially great abundance of *Hydra* in the Great Lakes has come from reports of massive accumulations on the nets of commercial fisherman (Clemmens 1922, Welch and Loomis 1924, Carrick 1956, Batha 1974).

Direct observations of *Hydra* under natural conditions have been restricted to shallow waters within the range of SCUBA. The manned submersible allowed direct observation of *Hydra* in a deepwater environment. In addition, the submersible had the capability of documenting these observations on videotape and retrieving rocks with attached specimens.

STUDY SITES AND METHODS

Observations and collections of *Hydra* occurred at two deepwater sites in southeastern Lake Superior. The first site was located at 47°12.05'N 86°0.5.15'W at a depth of 300 m; the other site was located at 46°54.50'N 86°36.00'W at a depth of 400 m. The bottom in this area of southeastern Lake Superior has been described as a series of complex troughs and shoals (Thomas and Dell 1978). The steeply-sloped shoals occurring between the deep troughs were composed of exposed till and lag deposits. At the first site, the shoal area consisted of rock and cobble outcroppings, rubble piles, and sandstone cliffs. At the second site, the shoal area consisted of clay till and large boulders. *Hydra* were found attached to the hard substrates in the shoal areas at both sites.

The mechanical arm of the submersible collected eight medium-sized rocks (largest about 11 cm × 15 cm × 7 cm) with attached *Hydra* during six dives to these two sites. Upon being brought to the surface, the rocks were placed in separate plastic bags containing lakewater. For the first few rocks, the *Hydra* were immediately picked off with forceps, counted, and placed in vials containing 5% buffered formalin. For all later collections, the *Hydra* were not picked off the rocks immediately but left undisturbed in the plastic bags where they gradually became extended and were thus in a more natural condition when preserved.

Video documentation was achieved with a Marine Optical Systems video camera mounted externally and controlled in the pilot sphere. The camera had a 3.5 mm × 6.5 mm wide angle zoom lens with a minimum focal distance of 6.8 mm and a maximum of infinity. The photographs as presented in this paper were taken off a video screen during playback of the tapes.

RESULTS AND DISCUSSION

A total of 290 individuals were picked off the rocks and examined. Positive species identification was not possible since no gonadic individuals were found. However, based strictly on superficial characteristics, the specimens most closely resembled either *H. carnea* or *H. littoralis*. No stalk was present on any of the specimens and tentacle number varied from 5-9 per individual ($\bar{x}$ = 6.5). Tentacle length was about equal to or slightly less than column length. Maximum length of the column, as measured on the extended specimens, was 7 mm. All *Hydra* were bright red when brought to the lake surface. Since *H. littoralis* is primarily found in areas of swift currents or along rocky, wave-swept shorelines (Pennak 1978), the individuals in our collections may indeed be *H. carnea.*

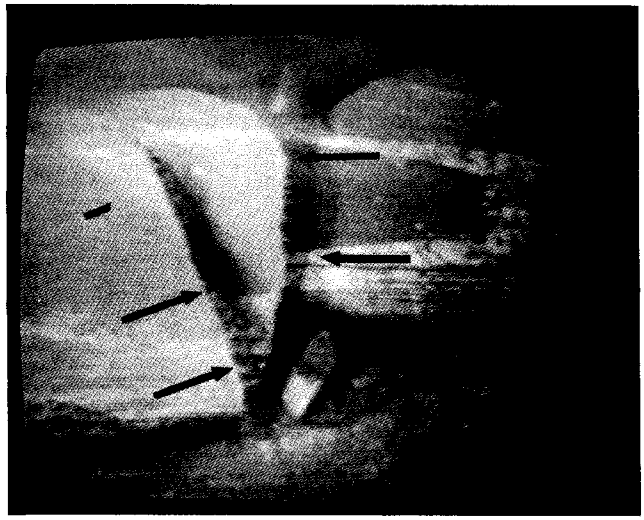

FIG. 1. **Hydra** *attached to edges of rock ledges (arrows point to* **Hydra***).*

Buds were found on 15% of the specimens. This compares to a budding incidence of 38% in summer and 20% in winter in a nearshore area of Lake Michigan (Batha 1974) and to a summer budding incidence of 60–80% in Lake Erie (Carrick 1956). Because budding is directly related to temperature conditions (Carrick 1956), the low proportion of budding individuals is likely a result of the constantly cold temperatures at the depths sampled (≤4°C).

At the first site, located at a depth of 300 m, *Hydra* were observed beneath and along the edges of rock ledges (Fig. 1), on individual rocks along cobbled slopes (Fig. 2), and even on an empty paint can found in the middle of a generally featureless bottom. At the 400 m site, *Hydra* were found attached to the edges of large boulders (Fig. 3). Despite this rather ubiquitous distribution, populations occurred in distinct clumps. Some rocks had dense colonies of *Hydra*, while other rocks of similar size located nearby were almost entirely devoid of animals. Also, distinct clumping was apparent on the facing of individual rocks (Fig. 4). Most individuals were oriented on the rock surface which faced the direction of particle flow. The video tape shows definite directional movement of suspended particles in the water,

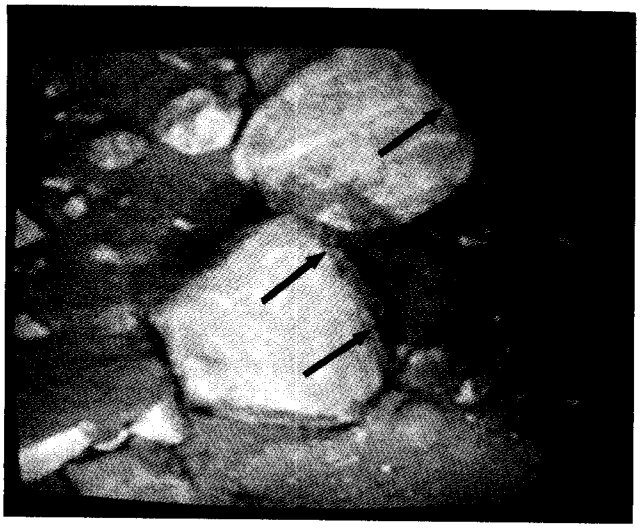

FIG. 2. **Hydra** *attached to individual rocks along cobbled slopes (arrows point to* **Hydra***).*

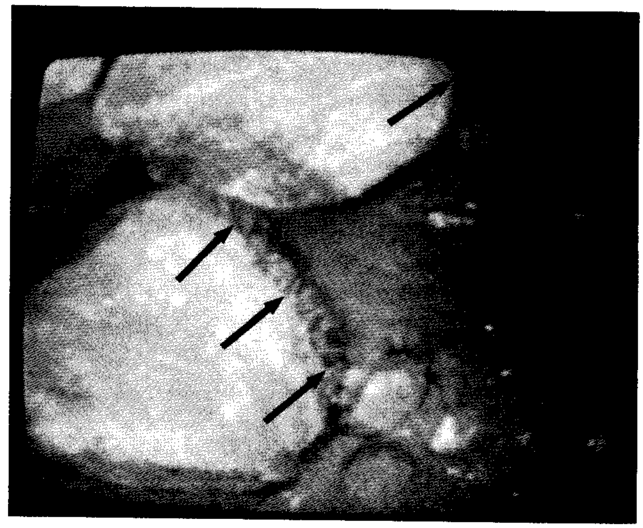

FIG. 4. An expanded view of Figure 2 showing the clumping of **Hydra** *on individual rocks. Water currents were moving from right to left as judged from the flow of suspended particles. The size of the lower rock is about 12 cm × 10 cm × 9 cm.* **Hydra** *were not observed on the surrounding smaller rocks (arrows point to* **Hydra***).*

although currents were not detected by the submersible. Batha (1974) noted that, on rocks dredged from Lake Michigan, *Hydra* were found in greatest numbers around the rock perimeter where it embedded in the substrate. He speculated that this allowed *Hydra* to capture benthic as well as planktonic prey. Such an orientation was not observed on the Lake Superior rocks (Fig. 2).

The most likely prey for *Hydra* at such depths were calanoid copepods. The bright red coloration, as seen in the Lake Superior *Hydra*, is typical of individuals that feed on copepods (Schulze 1917, Fox and Pantin 1944, Hyman 1931). Indeed, the video footage shows numerous calanoids swimming near the bottom and one of the *Hydra* specimens had a calanoid in its gut.

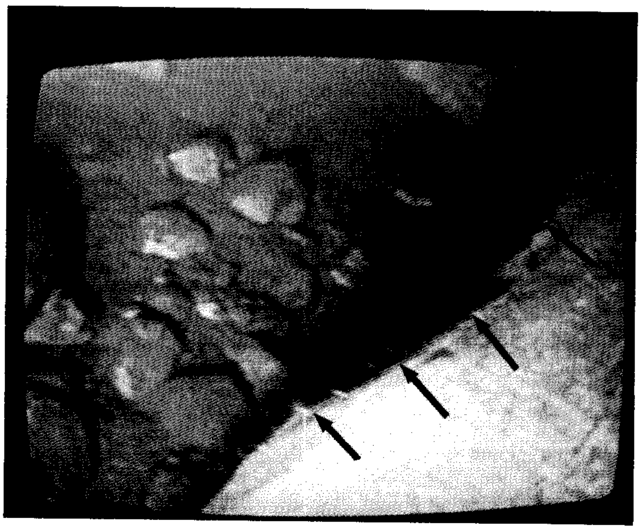

FIG. 3. **Hydra** *attached to outer edges of large boulders (arrows point to* **Hydra***).*

Although *Hydra* were common at our two dive sites, they apparently are not widely distributed throughout the lake. In an extensive lake-wide benthic survey, *Hydra* were found at only 4 of 400 stations (Cook 1975). All four of these stations were located in the southeastern end of the lake, and two were near one of our dive sites. In Lake Michigan, Batha (1974) reported *Hydra* attached to rocks in a nearshore area (to 30 m). However, a list of biota observed from a series of submersible dives into Lake Michigan at depths between 17 and 261 m did not include *Hydra*, even though the bottom at several of these sites had hard substrates potentially suitable for *Hydra* attachment (Powers and Robertson 1968).

Hydra are considered mainly littoral forms, but they also have been reported from great depths (Pennak 1978). For instance, *Hydra* have been collected from 289 m in Lake Superior (Smith and Verrill 1871) and from 220 m in Loch Ness (Murray and Pullar 1910). With the finding of *Hydra* at a depth of 400 m in Lake Superior, the deepest sounding in the Great Lakes, it appears that *Hydra* are not restricted by depth *per se*, provided there are hard substrates available for attachment and an adequate number of prey organisms.

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REFERENCES

Adams, C. S., and Kregear, R. D. 1969. Sedimentary and faunal environments of eastern Lake Superior. In *Proc. 12th Conf. Great Lakes Res.*, pp. 1-20. Internat. Assoc. Great Lakes Res.

Batha, J. V. 1974. *The distribution and ecology of the genus* Hydra *in the Milwaukee area of Lake Michigan*. Ph.D. thesis. University of Wisconsin, Milwaukee, Wisconsin.

Carrick, L. B. 1956. *A study of Hydras in Lake Erie*. Ph.D. thesis. Ohio State University, Columbus, Ohio.

Clemmens, W. A. 1922. *Hydra* in Lake Erie. *Science* 55:445–446.

Cook, D. G. 1975. *A preliminary report on the benthic macroinvertebrates of Lake Superior*. Fish. Res. Board Can. Tech. Rep. 572:1–44.

Eddy, S. 1927. The plankton of Lake Michigan. *Bull. Ill. State Nat. Hist. Sur.* 17:203–232.

Fox, D. L., and Pantin, C. F. A. 1944. Pigments in the Coelenterata. *Biol. Rev. Cambridge Phil. Soc.* 19:121–134.

Hiltunen, J. K. 1964. The benthic macrofauna of Lake Ontario. *Great Lakes Fish. Comm. Tech. Report* 14:30–59.

Hyman, L. H. 1931. Description of three new species and key to known species of *Hydra. Trans. Amer. Microsc. Soc.* 50:302–315.

Loveridge, C. C., and Cook, D. G. 1976. *A preliminary report on the benthic macroinvertebrates of Georgian Bay and North Channel*. Fish. Res. Board Can. Tech. Rep. 610:1–46.

Murray, J., and Pullar, L. 1910. *Bathymetric survey of the Scottish fresh water lakes*. Challenger Office. Edinburgh. Vol. II.

Pennak, R. W. 1978. *Fresh-water Invertebrates of the United States*. Second Edition. New York: John Wiley and Sons.

Powers, C. F., and Robertson, A. 1968. Biological exploration in Lake Michigan from a research submersible. In *Proc. 11th Conf. Great Lakes Res.*, pp. 117–123. Internat. Assoc. Great Lakes Res.

Reighard, J. E. 1894. Some plankton studies in the Great Lakes. Bull. U.S. Fish. Comm. 13:127–142.

Reisa, J. J. 1973. Ecology of *Hydra*. In *The Biology of* Hydra, ed. A. L. Burnett, pp. 59–105. New York: Academic Press.

Schneider, J. C., Hooper, F. F., and Beeton, A. M. 1969. Distribution of benthic fauna in Saginaw Bay, Lake Huron. In *Proc. 12th Conf. Great Lakes Res.*, pp. 80–90. Internat. Assoc. Great Lakes Res.

Schulze, P. 1917. Neue Beitrage zu einer Monographie der Gattung *Hydra. Arch. F. Biontologie* 4:33–119.

Shrivastava, H. 1974. Macrobenthos of Lake Huron. Fish. Res. Bd. Can. Tech. Rep. 449:1–45.

Smith, S. I., and Verrill, A. E. 1871. Notice of the invertebrate dredged in Lake Superior in 1871 by the U.S. Lake Survey. *Am. J. Sci.* 3:448–451.

Thomas, R. L., and Dell, C. I. 1978. Sediments of Lake Superior. *J. Great Lakes Research* 4:264–275.

Welch, P. S., and Loomis, H. A. 1924. A limnological study of *Hydra oligactis* in Douglas Lake, Michigan. *Trans. Amer. Microsc. Soc.* 43:203–235.