(JI,

Rapid #: -3276374

4

Ariel

IP: 128.210.125.135

Status	Rapid Code	Branch Name	Start Date
Pending	LUU	Main Library	3/24/2010 8:00:37 AM

CALL#: Q11.R8

LOCATION: LUU :: Main Library :: Middleton Library (Main Collection)

TYPE:	Article CC:CCL
JOURNAL TITLE:	Proceedings of the Rochester Academy of Science
USER JOURNAL TITLE:	Proceedings of the Rochester Academy of Science
LUU CATALOG TITLE:	Proceedings of the Rochester Academy of Science.
ARTICLE TITLE:	A study of the New York State populations of the Hellbender, Cryptobranchut alleganiensis alleganiensis
ARTICLE AUTHOR:	BOTHNER, R. C , AND J. A. GOTTLIEB
VOLUME:	17
ISSUE:	
MONTH:	
YEAR:	1991
PAGES:	41-54
ISSN:	0096-4166
OCLC #:	LUU OCLC #: 1379666
CROSS REFERENCE ID:	892650
VERIFIED:	

BORROWER: IPL :: Main Library

PATRON: Burgmeier,Nicholas

PATRON ID:	
PATRON ADDRESS:	
PATRON PHONE:	
PATRON FAX:	
PATRON E-MAIL:	
PATRON DEPT:	FNR
PATRON STATUS:	Graduate
PATRON NOTES:	

Vol. 17 November 1991 Number!

PROCEEDINGS OF THE ROCHESTER ACADEMY OF SCIENCE

WETLANDS AND AQUATIC STUDIES

A STUDY OF THE NEW YORK STATE POPULATIONS OF THE HELLBENDER, *Cryptobranchus alleganiensis alleganiensis* (Daudin)

by
Richard C. Bothner and Jeffrey A. Gottlieb
Department of Biology
St. Bonaventure University
St. Bonaventure, New York 14778

ABSTRACT

The Hellbender population of New York State was studied in both the Susquehanna River and Allegheny River watersheds. The Susquehanna River population shows few adult specimens and no larval or immature ones. Two nests were found. The Allegheny Riverpopluationappears healthier, withgreaternumbersofspecimens andshowing allage groups. Twelve incidences of nesting were discovered in four years. Ecological densities for the Hellbender in the Allegheny River watershed were estimated by mark/release experiments. These results will form base line data for comparisons with future studies to determine the actual status of the Hellbender in New York State. Until these are done, we suggest putting the Hellbender in the "Special Concern" category.

In 1981 the senior author received a grant (#S 184357) from the Endangered Species Unit of the N. Y. State Dept. ofEnvironmentalConservation for studying the Hellbender, *Cryptobranchus alleganiensis alleganiensis* in New York State. This study occupied the summer and autumn seasons of 1981 and 1982. Further investigations on population density and nest sites were done by the junior author and formed the subject matter of his graduate research. This paper combines parts of these studies into a single contribution.

The purpose of these studies was to gain knowledge of the present distribution and abundance ofthe Hellbender inNew York State.Thisarea represents themost northern part of the range of this form, which has been recorded in this state from the Allegheny River and its larger tributaries and from the Susquehanna River and one of its larger tributaries, the Unadilla River (Bishop, 1941). Unfortunately, Bishop did not provide any data concerning the relative numbers or density of this form.

Accordingly, the seasons of 1981 and 1982 were spent investigating the Allegheny and Susquehanna River systems in New York State for the purposes of reestablishing old locality records, discovering new ones and gathering some idea of the abundance of this animal. Nests were also sought at the proper time. In addition, the junior author spent the late summer and autumn seasons of 1983-1985 and 1988 acquiring nest site information

and perfonning mark/release density studies in the Allegheny River drainageofNew York State. All this infonnation was used to help detennine the status of *Cryptobranchus alleganiensis a/leganiensis* in this state, thus allowing management recommendations to be decided upon. It must be emphasized that these data can only give an initial impression and are to be used as base line data for using in a comparison against future investigations. The comments ofBishop (1941) are too few and too vague("...sev. ads....." and"abdt.") to allow for comparisons.

MATERIAL AND METHODS

The two river systems (Fig. I) were investigated by either floating them in a flat bottomed skiff where practicable or by driving along parallel roads and examining likely habitat. This lattermethod was theprimary method used tostudy the immense Susquehanna drainage. The Allegheny River, on the other hand, has a much smaller drainage in New York State and was traversed byboat for itsentire length from the Pennsylvania line above Portville, N. Y. to the beginning of the Allegheny Reservoir below Salamanca N. Y.The tributaries were primarily investigated by wading.

Initially we attempted to use aSmith- Root Type VII 12 volt D. C.Electrofisher forour survey. This was borrowed from the N. Y. S. D. E. C. Wildlife Resource Center. Williams et al. (1981) reported good success electroshocking Hellbenders in Pennsylvania. Our results, however, were unacceptably poor - most of the salamanders appeared to be only slightly disturbed when actually touched by theelectrode and completely unaffected when they were close to, but not in contact with it. We finally concluded that it was better to lift every suitable rock we encountered. These animals are almost always found in flowing water 60 cm or less in depth. The daylight periods are spent beneath large flat rocks averaging above 30cm in"diameter", although they will also hide beneathother rubbleon the bottom. Any animals discovered were scooped up in a "trout net" or grabbed by hand. At each collecting site the following data were recorded: date, time, location, weather, air and water temperatures, current velocity (fast= over 0.4M/sec.; slow= less than 0.2M/sec.),sizeand depth ofrock cover, size ofspecimen to nearest cm and sexofspecimen which can only be detennined (short ofdissection) on adults in breeding condition, which for this area begins in July and persists into September (Smith, 1907; Bishop, 1941).

The mark/release and nest studies were done on the Allegheny River whose proximity to the St. Bonaventure University campus allowed much time to be spent there. These studies focused onspecific areas that the 1981 and 1982 survey found tocontain sufficient rock cover to harbor populations of Cryptobranchus. These areas were in Ischua Creek, Oswayo Creek and the Allegheny River proper (Fig. 2). They varied in depth from IO cm to about IM. After the first week in September, while oviposition is going on, the downstream edges of likely looking nest rocks were lifted slightly to check for eggs without unduly disturbing the nest or its male guardian. Captured Hellbenders were measured,sexed(when possible) and tagged.Tagging wasdone usinga"Buttoneer" button fastening machine to secure small, colored plastic tags (Pough, 1970) to the proximal dorsal edge of the tail blade of the salamander. The specimen was then released at the site of capture. The time interval between tagging and recapture varied from one to four weeks depending on weather - heavy rains cause prohibitive turbidity. Each riffle site used for mark/release studies was measured with a steel tape and the area expressed as M2 of habitable space (i.e. containing rocks large enough to afford cover for the Hellbenders).

Mark/release data were used to establish a Lincoln- Peterson Index of Population Density using the adjusted equation N = M(n+l)/R+l as suggested by Brower and Zar (1984). Ecological density of the Hellbender was then calculated by dividing the estimated number of animals in the sample site by the habitable area sampled. In addition, all instances of nesting were recorded and included the date, location, number of clutches contained in the egg mass and presence or absence of a guardian male.

RESULTS

I. The Susquehanna River Watershed.

Fig. 3 depicts the old locality records as well as those for this study for the Susquehanna and Unadilla Rivers. These are the only parts of the Susquehanna drainage known to harbor Hellbenders.

In 1981 lO specimens of the Hellbender were discovered, one of which escaped and could neither be measured nor sexed. Of the nine captured specimens four were female and five were male. The 1982 collecting trips were more successful, undoubtedly because we were now working familiar territory. Twenty specimens were collected of which 1.1 were female and 9 were male. A composite of both years reveals 29 examinable specimens (15 female and 14 male) for a virtual 1:I M:F ratio. All of the specimens, including the one that escaped, were over 40cmin total length, which, according to Smith (1907), suggests them to be five to sex years or older. No larval or immature Hellbenderrs were seen. In addition, two nest sites were discovered in 1982. The first site was in the Susquehanna River at Ouaquaga in Broome Co. and was discovered on IO Sept., 1982. Here, about 20 eggs were seen trailing out from very large (unliftable) rocks by the bridge abutment of Doolittle Road. The other site was in the Unadilla River just above the bridge, County Route I at Rockdale in Otsego County. The egg mass was disclosed by turning over a rock 100cm by 61 cm and consisted of perhaps 400 to 600 eggs. A more accurate count could not be made for the rock was immediately replaced before the eggs could wash away. According to the data of Smith (1907) this would probably represent the egg mass compliments of I or 2 females. This was on 11 Sept., 1982.

II. The Allegheny River Watershed.

Fig. 4 shows the old localities, as well as those for the present study, of the Hellbender in the Allegheny River watershed of New York State. This rather spotty distribution of sites reflects those areas of the river system where there are sufficient numbers of flat rocks large enough to conceal Hellbenders.

During the 1981 season 45 Hellbenders were discovered, 10 of which escaped and thus could not be measured. Also, in late August (26;27) of 1981 three mark/release studies were initiated; two on the Oswayo Creek and one on the Allegheny River. A total of 39 specimens were marked and released. Unfortunately, the weather turned very rainy right after this and the swollen, discolored waters did not recede until well into October by which time the salamanders would have scattered making a recapture attempt meaningless. In any event, the specimens collected for the initial marking and releasing can be used to show size distribution and sex ratios.

Most of the 1982 season was spent on the Susquehanna River; the rest was spent searching Conewango Creek, a western tributary of the Allegheny River in a vain attempt

to discover Hellbenders there. Table l shows the size distribution of all the Hellbenders collected in the Allegheny River during 1981, including those used in the unsuccessful mark/release experiments. Next to this isplaced theageestimates foreach sizeclass.These estimates are taken from Smith (1907) who studied the Hellbender in northwestern Pennsylvania. Specimens above 40 cm in total length can only be classified as over 5 to6 years.

During the years 1983-1985 and 1988 the junior author captured 219 specimens of Hellbenders. Of these, 153 were breeding adults and thus could be sexed. Table 2 presents the size distribution and estimated ages of these 219specimens. Fig. 5 graphically presents the combined results of Tables I and 2. A preponderance of older (sexually mature) individuals isevident. Smith's data(1907) suggest that sexual maturity isattained at atotal length ofabout 34 cm representing an age of3 - 4 years, although Bishop (1941) considers 5 - 6 years to be the age at which sexual maturity is attained.

A series of mark/release experiments was performed at eight different sites in the Allegheny River system. These sites represent areas of good rock cover and are located in Fig. 2. Furthermore, as a check on the accuracy of the technique, sites 7 and 8 were each worked twice - in 1985 and again in1988.The density estimates for bothyears were enough to engender confidence. These results appear in Table 3. The density data are expressed in terms of ecological density; that is, number ofindividuals per unit area of habitable space. Habitable space in thiscase means theestimated square meters ofcover rock in the test area. This is the method used by Nickerson (pers. comm.) and allows us to compare our figures with his (Nickerson and Mays, 1973).

The junior author, during the course of the mark/release studies, was able to obtain a total of lOsex ratio estimates on7 ofhis8 sites.Site 5 was worked earlier intheseason when the adults could not besexed. Added to these data are the sex ratios gleaned during the initial mark/release studies of26 and 27 August, 1981 that were, as stated above, unsuccessful. Table 4 presents these figures.

Incidences of oviposition or nesting were recorded on 12 occasions during the 1983-1988 phase of this study. The discovery of, and analysis of, nests, it must be understood, is rendered difficult for two reasons. First, the nest, which isalways located beneath a large rock, can be located beneatha rock much too large to lift an thus can remain undiscovered. The second problem relates to the ease with which the egg mass may bedisplaced and thus destroyed. The only safe way to uncover a nest is to slowly lift the suspected cover rock by its downstream edge just far enough to see the egg mass and, if possible, to estimate the numberof eggs contained in it. Any disturbance beyond this usually results in letting water currents in under the rock. These can wash away the eggs almost instantly and thus destroy the clutch. Smith (1907) observed that female Hellbenders can yield about 450 eggs per clutch. Bishop(l 941)records aclutchof3 l 7.Thus,anestwithanestimatednumberofeggs between 300 and 450 would presumably represent the contribution ofl or 2 females. Table 5 describes the nesting activities observed during this study.

DISCUSSION

I. 171e Susquehanna River Watershed.

Although all major tributaries of the Susquehanna River in New York State were searched, specimens of the Hellbender were found only in the Susquehanna River proper and in the Unadilla River, one of its larger tributaries. This conforms with the previous

literature (Bishop, 1941). We found Hellbenders at afew new locations as well as at all the older locations except at the New Berlin site. The river here appeared to be good habitat with moderate flow and plenty oflarge cover rocks. Perhaps further searching will disclose specimens here, too. Overall, the Hellbender population discovered in the Susquehanna watershed was a disappointment for several reasons. First, the number of specimens discovered (29) in two seasons seems very low. Secondly, the specimens were all over 40 cm in total length - in other words mature 5 to 6 years or older individuals (this fonn may have alongevity well in excess of30 years). The fact that no larval orimmature specimens were found is disturbing. Smith (1907) states that his smallest mature animals were a 33 cm male and a 25cm female. Thus there is noevidence ofa younger age group. Also, only two nests were found, although these appeared to be"healthy".

The quality of the waters in this river system appeared to be reasonably good - some sewage from the streamside hamlets and, of course, agricultural runoff. Nevertheless, the water when not in flood was clear and supported dense populations offish, especially small largemouth bass. Why then are there no juvenile Hellbenders? We cannot make accurate judgements on the status of Cryptobranchus in the Susquehanna River system until this question can be answered. There is the possibility that more specimens (perhaps even juveniles) might be utilizing cover in the deeper pools. Bait fishennen not infrequently catch Hellbenders while fishing the deeper stretches. Furthennore, on the advice of some local fishennen, we checked the Jennison Power Station below the town ofBainbridge in Chenango Co.They useriver water asacoolant and infonned us that for"many years" they removed an average ofoneortwoHellbenders per month from their intake grille.The water adjacent to this plant is too deep to collect.

Since all 29 specinlens we discovered were collected between July and September, we were able to sex all of them. Themale:female sex ratio we found was virtually 1:1 (14M; 15F). Sex ratios previously reported for the Hellbender vary, according toauthorities from 2 or 3 or more males: I female (Smith, 1907) to 1:1 (Nickerson and Mays, 1973). Bishop (1941) declares that on the breeding grounds the males are more abundant than the females or much more in evidence. Hillis and Bellis (1971) studied this animal in French Creek in northwestern Pennsylvania and detennined a ratio of 1.58M:IF.

II. The Allegheny River Watershed.

We found Hellbenders in the Allegheny River and all of its important tributaries and these confonned to most of the old locality records. The only old locality area where we didn't find specimens was at the mouth of Wolf Run which is now inundated by the Allegheny Reservoir. This is unfortunate for apparently this was once a fine area for the Hellbender. Alexander (1927) on p. 17 mentions discovering"... immense _males in numbers, each in his self excavated nest"., where the (Allegheny) river passes the mouth ofWolfRun.

All of the localities in the Allegheny Watershed coincided with the presence of sufficient numbers of large rocks to afford concealment for these salamanders. Indeed, within their range and within their physiological limits of tolerance, cover rocks are the "sine qua non" of Hellbender existence.

The Hellbender ismuch better represented in theAllegheny River Watershed than in the Susquehanna both as regards numbers of specimens and also as regards size (age) distribution. Its density in prime areas compares favorably with the data from Nickerson

and Mays (1973) who suggest densities (at 95% confidence level) of from I specimen per 6 - 7 M^2 to I specimen per I3 - I6 M2. This figure is for Missouri populations. Peterson et al. (1983) worked on the Ozark subspecies of the Hellbender and estimated densities of about I specimen per 20 M^2. These estimates are reasonably close to our N. Y. State estimates.

The size distribution data suggest a greater representationof sexually mature individuals. This has been noticed by other observers as well; Taber et al (1975) for example.

The sex ratios for the Allegheny River watershed Hellbenders varied considerable, but generally fall close to the ratios detennined by other authorities (see above).

Nesting data gleaned over the four seasons of study suggest a rather low reproductive effort. Since there are no'quantitative records of nesting for this area, it isn't possible to know if nesting activities are down in New York State.

We record several instances of a male guarding the nest. This has been observed by all other authorities as well. Unfortunately, we failed to record the presence or absence of a guardian male at every nest examined. We believe this habit to be far more common than our data would indicate.

In conclusion, we find the Hellbender to be of apparently very low density in the Susquehanna River watershed of New York State. Furthennore, there is a dearth oflarval and immature fonns. Nesting also appears to be oflow frequency. It is felt that for reasons as yet to be detennined the Hellbender is declining in the Susquehanna system although only future studies, when compared with ours, will be able to demonstrate this. In the Allegheny River watershed, on the other hand, the Hellbender appears to bedoing better. Most age classes are represented and nesting, although, not all that common, appears to be more frequent than in the Susquehanna. Comparison with future studies will shed more light on this problem.

Because of the lack of past quantitative data and also because of the paucity ofadult specunens and lack of juveniles in the Susquehanna River system we suggest that the Hellender, *ryptobranchus al/eganiensis al/eganiensis,* be placed in the "Special Concern status m New York State.

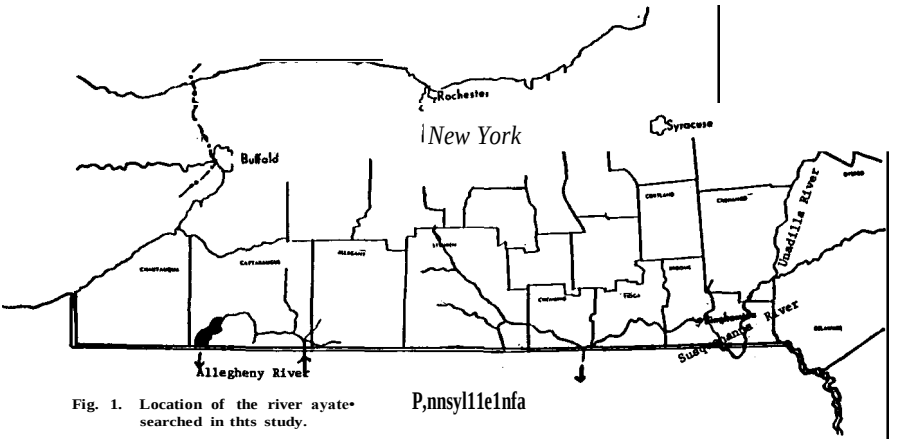
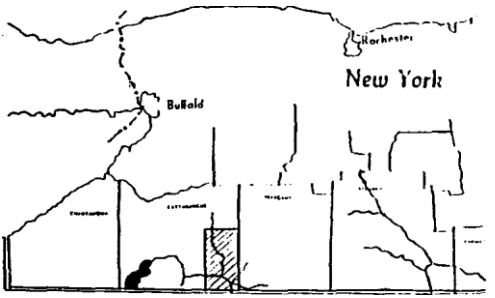
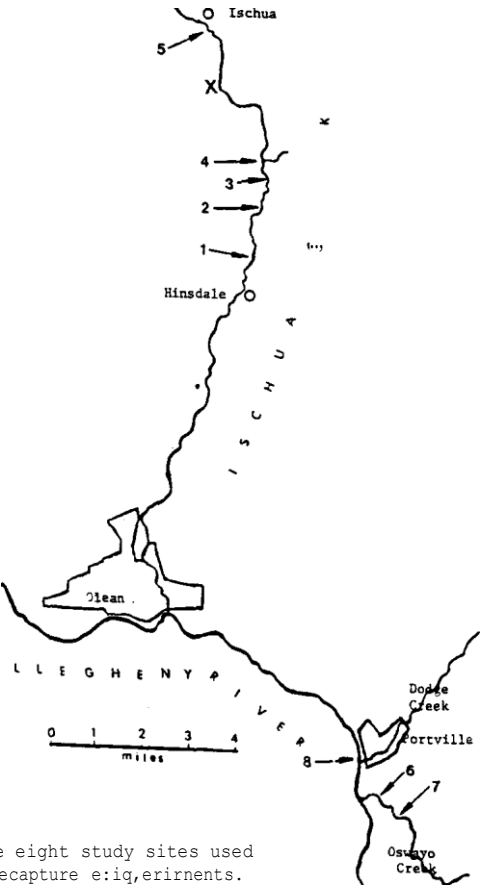


Fig. 1. Location of the river ayate• searched in thts study.

P,nnsyl11e1nfa





Fir,. 2. Location of the eight study sites used in the mark - recapture e:ig,erirnents. "X" refers to a nest found in a non-study area.

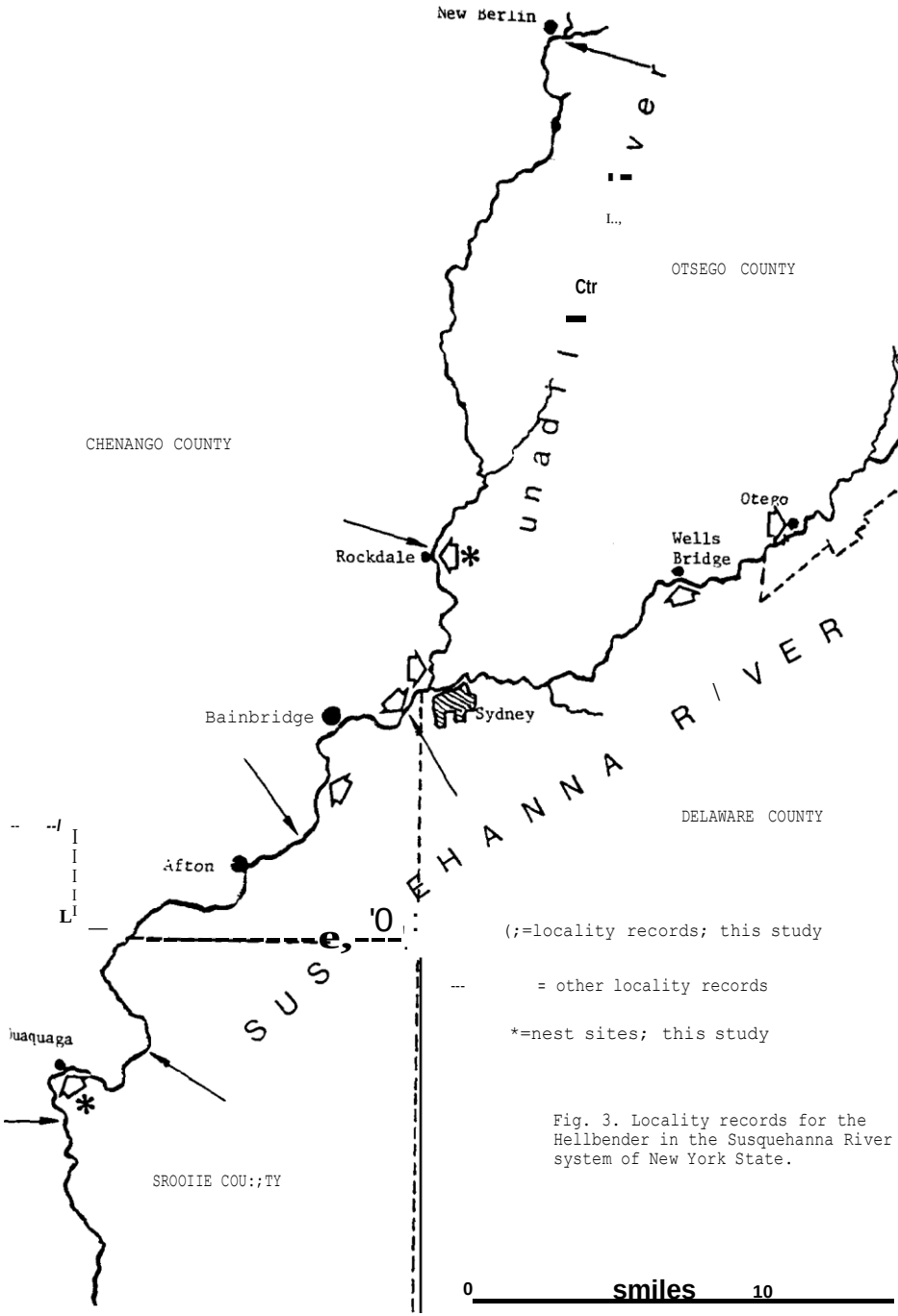


Fig. 3. Locality records for the Hellbender in the Susquehanna River system of New York State.

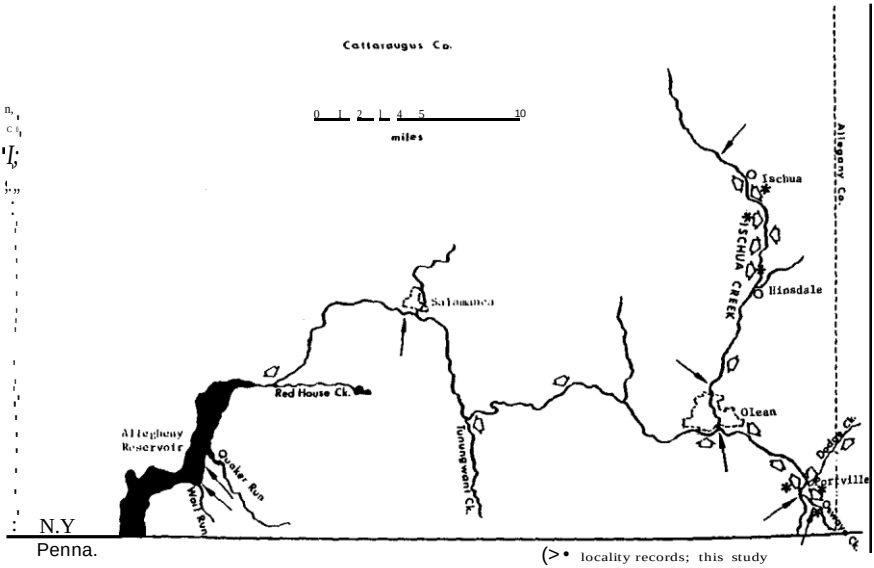


Fig. 4. Lo.:allty re,·.,rds for the llellbL'nJcr in Lhc Allegheny River system of New York State.

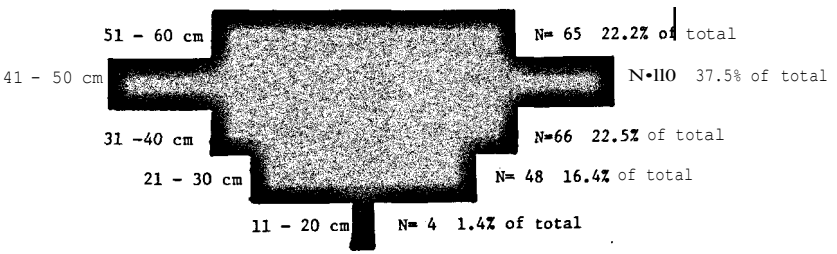
Table 1. Size distribution and estimated ages of Hellbenders collected in the Allegheny River system during the 1981 season. (N• 74)

Total Lensth (cm)		..1L	Estimated A!!ie	% of Total
51 - 60	**mature**	10	**over** 6 **years**	13.5
41 - 50		21	5 to 6 years	28.4
31 - 40		12	3 to 4 **years**	16.2
21 - 30	**immature**	28	2 to 3 years	37.9
11 - 20		3	1 - 2 years	4.0

Table 2. Size distribution and estimated ages of Hellbenders collected in the Allegheny River system during the 1983,4,5 and 1988 seasons. (N• 219)

Total Lensth (cm)		--1!....	Estimated Ase	7. of Total
51 - 60	**mature**	55	**over** 6 **years**	25.1
41 - 50		89	5 to 6 **years**	40.6
31 - 40		54	3 to 4 **years**	24.6
Zl - 30	immature	20	2 to 3 **years**	9.1
11 - 20		1	1 to 2 **years**	0.4

Fig. 5. Size distribution (total length in cm) of combined collections of Hellbenders during the entire study. (• 293)



Table]. Results of ma;rk/recapture experi.toe.nts on Hellbende1:s in the Allegheny River drainage of New York State, See Fig, 2 for location of sites.

Site /	Area studied 012)	% area covered by habitable rocks	Habitabl2 space (M)	Estimated N with 95% confidence limitf.	Ecological density (in di vi dual / M^2 of rock cover)
l	424	2	8.5	3(.06- .94)	l/2.8
2	1209	2-3	24.2-36.3	6(4.0-7.l)	l/4.0-1/6.0
3	806	2-5	**16.1-40.3**	5(2.3-7.7)	l/3.2-1/8.1
4	625	lO	62.5	23(4.2-42.4)	l/2.7
5	6049	8-10	483.9-604.9	40(20.8-60)	1/12.0-1/15.0
6	2082	6-8	124.9-166.6	24(6.8-41.6)	1/5.2-1/6.9
7 (1985)	1593	6-8	**95.6-127 .4**	52(39.4-64.6)	1/1 .8-1/2.5
7 (1988)				58(31.2-83.9)	1/1.7-1/2.2
8 (1985)	14003	3-5	420.1-700.2	40(0-692.6)	l/10.4-1/17.4
8 (1988)				45(30.6-59.9)	l/9.3-1/15.5

Table 4, Sex ratios of Hellbenders from the Allegheny River drainage in New York State, See Fig, 2 for locations of sites,

Site #	!!	!		M:F Ratio	
1	2	1	3	2:1	
2	0	5	5	0:5	
3	0	3	3	0:3	
4	8	5	13	1.6:1	
5					unsex:able due to season
6	5	8	13	1:1.6	1981 study
6	4	9	13	1:2.25	
7	1	2	3	1:2	1981 study
7	12	17	29	1:1.4	1985 study
7	14	17	31	1:1.2	1988 study
8	2	5	7	1:2.5	1981 study
8	12	9	21	1,3:1	1985 study
8	17	18	35	1:1.1	1988 study

Table 5. Incidences of nesting by the Hellbender in the Allegheny River drainage of New York State, See Fig. 2 for location of nest sites,

	Date	Probable number contributing F	
1	14 Sep '83	1	Brooding male present
4	19 Sep '83	1	
4	8 Sep '84	1	
4	8 Sep '84	1	
X	3 Oct '83	1	Non-study site; see Fig, 2,
6	21 Sep 'BS	1	Brooding male present
6	21 Sep '85		eggs exposed in open
6	Sep '88	1	
7	1 Oct '88	1	Brooding male present
8	17 Sep '85	2	
8	17 Sep 'BS		Large F trailing eggs from cloaca
8	22 Sep '88	1	Brooding male present

Alexander, W. P. 1927. The Allegheny Hellbender and its habitat. Buffalo Soc. Nat.Sci. (Hobbies) 7(10):13-18.

Bishop, S.C.1941.ThesalamandersofNew York. New YorkStateMus. Bull. No.324.365 pp.

Brower, J.E. and J.H. Zar. 1984. Field and laboratorymethods for general ecology. 2nd Edition, pp. iii-113. W.C. Brown, Inc., Dubuque. Iowa.

Hillis, R. E. and E. D. Bellis. 1971. Some aspects of the ecology of the Hellbender, *Cryptobranchusal/eganiensis a/leganiensis,*ina Pennsylvania stream. J. Herpetology. 5(3-4):121-126.

Nickerson, M.A. and C. E. Mays. 1973. A study of the Ozark Hellbender *Crypto· a/leganiensis bishopi*. Ecology. 54(5):1164-1165.

Peterson,C. L.,R.F. Wilkinson,Jr.,M. S.ToppingandD. E.Metter. 1983. Ageand growth of the Ozark Hellbender. Copeia 1983(1): 225-231.

Pough, F. H. 1970. A quick method for pennanently marking snakes and turtles. Herpetologica 26(4):428-430.

Smith, B. G. 1907. The life history and habits of *Cryptobranchus alleganiensis.* Biol Bulletin 13(1):5 39.

Taber, C. A., R. F. Wilkinson, Jr. and M. S. Topping. 1975. Age and growth of the Hellbender in the Niangua River, Missouri. Copeia 1975(4):633-639.

Williams, R. D. and G. V. Taylor. 1981. The Hellbender: a non-game species in need of management. Wildlife Society Bull. 9(2).