FINAL REPORT

Population management of the amphibian community at Warbler Woods Land & Water Reserve

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INTRODUCTION

This report details on-going work at Warbler Woods Nature Preserve (WWNP), Coles County, Illinois, an 81.5 ha piece of land owned by L. Barrie Hunt. The overall project concerns the removal of two fish species from two ponds in the southeast portion of the property so that these ponds can be better utilized by endemic amphibian populations as breeding sites.

Study Site

Four ponds in the southeast section of WWNP (Figure 1) are labeled from East to West: A, B, C, and D. Ponds A and B are separated by a 5 m ridge of secondary deciduous forest and understory vegetation. Ponds B and C are separated by 80 m of old field that has been planted with seedlings of deciduous hardwoods in accordance with an existing IDNR restoration objective. Ponds C and D are separated by 280 m of primarily old field that also has been planted with seedlings of deciduous hardwoods. A small access road leading to a barn and an extension of deciduous forest ravine bisecting the old field also separate the latter two ponds.

Based on the results of a 1997 IDNR survey, pond B contains a stable population of small *Ameiurus melas* (black bullhead catfish), whereas pond C contains a stable population of centrarchids (*Lepomis macrochirus* [bluegill], and *Lepomis cyanellus* [green sunfish]). All ponds have stable populations of a variety of invertebrate species (*e.g.*, snails, aquatic insects/larvae, *etc.*). IDNR has suggested the removal of fish from ponds B and C to improve conditions for amphibian breeding activity. I am interested in

comparing amphibian species' use of these ponds before and after the fish removal is undertaken.

Status and Objectives

In May 2000, drift fence/pitfall trap arrays were constructed around all four ponds as a means of monitoring amphibian use at the ponds. Initial data from this trapping effort was reported to IDNR at the end of FY2000-2001. In that report, I recommended application of Rotenone™ to ponds B and C in early December 2001. The basis for the recommendation was that 1. all of the fish should be killed; 2. the smallest number of amphibians will be affected (most having begun to over-winter outside of the ponds by that time); and, 3. that all of the rotenone will be flushed out of the system prior to amphibian breeding activity at the ponds during Spring 2002.

The present report provides data that extends the understanding of the amphibian populations using the ponds at WWNP as breeding sites. I also report on the status of the fish removal at ponds B and C, and the response of the amphibian community at those sites. Lastly, I provide further recommendations to IDNR for the continued management of amphibians at WWNP.

MATERIALS & METHODS

In May 2000, drift fences and pitfall trap arrays were constructed around ponds A, B, C, and D (with coverage of 100 %, 75 %, 60 %, and 80 % of their circumferences, respectively). Due to fluctuating water levels that damaged the fencing, the coverage was reduced in 2001 to 95 %, 70 %, 50 %, for ponds A, B, and C, respectively. Buckets were

inserted flush with the soil surface every 7.5 m on both sides of the fence. These traps were checked on an alternate day basis from 1 March to 1 December 2001 and 20 February 2002 to the present. Individuals collected in the traps were measured (snout-vent length [SVL], total length [TL]), and toe-clipped to indicate their capture during a particular year (cohort-specific; Dodd and Cade 1998).

Following recommendations from last year's Final Report, Rotenone™ was applied to Ponds B and C on 7 December 2001, using a combination of portable broadcast sprayers. Additionally, Rotenone™ was poured into small pools in the inflow channel at the south end of each of these ponds to prevent juvenile fish escaping the effects of the poison by swimming "up-stream." Water temperature at the time of Rotenone™ application ranged from 6 to 7 °C. Subsequent rains in the ensuing weeks flushed the poison from these ponds. Rotenone™ has an effective potency time of approximately 20 days, so any residual poison was rendered inert well prior to any amphibian breeding activity in 2002.

This project is being conducted by J. Brian Towey, a graduate student in my laboratory. He was an undergraduate student who was salaried to conduct the monitoring effort at WWNP between January and June 2001. The funds from the current grant period were used to offset travel costs to and from the site, to purchase supplies necessary to maintain the integrity of the drift fences/pitfall trap arrays, and to purchase commodities to conduct water quality testing at each of the four ponds at WWNP. These latter tests are still on-going, so this report provides only qualitative descriptions of water quality, and details the second year of monitoring the amphibian populations.

RESULTS

In late June 2001, we observed a soapy effluent entering Pond D, along the southern-most edge of WWNP. This effluent was traced to a laundry sewerage pipe from the neighboring private property. The land owner was contacted and informed of the problem. We received full and immediate cooperation from the land owner – the laundry effluent was redirected to a septic tank within three weeks of notification. However, the discovery of this anthropogenic input into Pond D likely decreased amphibian breeding success at this site. As such, population trends for Pond D should be interpreted with caution.

The effects of the Rotenone™ applied on 7 December 2001 were noticed within 1 h of application, with many of the centrarchids in Pond C observed having a loss of equilibrium and gradually dying. The *Ameiurus* in Pond B also succumbed to the Rotenone™, with an estimated 10 dead fish per meter of shoreline 24 h following application. However, in May 2002, *Ameiurus* were observed in Pond B, albeit in much lower numbers than had been noted in the two previous years of the study. The water quality in these ponds has otherwise remained relatively unchanged.

Table 1 lists the species of all amphibians and reptiles (taxonomy follows Phillips et al. 1999) that have been observed at WWNP since the beginning of the study. Two species have been added to the list since last year – the plains leopard frog (*Rana blairi*) and the rough green snake (*Opheodrys aestivus*) – bringing the total species count to 24 for this site.

The attached figures illustrate temporal patterns of use of the various species collected in the fence/trap arrays. Note, that not all of the amphibian species found at

WWNP are represented in these figures because some species are not conducive to the trapping regime used in this study (*e.g.*, *Hyla chrysoscelis* x *versicolor, Acris crepitans blanchardi*) or were caught in very low numbers (*e.g.*, *Rana blairi*). Other species were never observed using the ponds but rather seen in close proximity to them (*e.g.*, *Eurycea cirrigera, Bufo woodhousei fowleri*). Table 2 lists mean body sizes for those species for which I have adequate data based on collection in pitfall traps, as well as the occurrence of recaptures. The following are comments on each of the species' temporal usage patterns of the ponds.

Ambystoma texanum – The adults of this species is most active at WWNP in March and April (Figure 2), with a metamorph emergence from ponds occurring in June (the latter age-class comprising most of the individuals recorded for that month). This species favored ponds A and D in 2001 but has shown successful use of Pond C in 2002 (following the fish removal; Figure 3). Of the 368 adult and metamorph individuals observed at the site, 6.8 % have been recaptured, usually at the same pond where they were first trapped. The large increase in numbers observed at Pond C in 2002 may indicate that this species' ability to reproduce successfully in this pond was suppressed by the centrarchid fish prior to their removal.

Bufo a. americanus – This species is most active from April to June (Figure 4), with most of the June activity being represented by recent metamorphs leaving the ponds for terrestrial habitat. Most of the individuals of this species were observed at ponds A and B (Figure 5). The pond usage pattern is not easily explained, but may reflect historical population trends at WWNP. Of the 1387 adult and metamorph individuals collected, 3 % have been recaptured, usually at the same pond where they were first trapped. The low

recapture rate may reflect low survivorship experienced by the metamorph cohort for each year. The higher numbers of individuals observed at Pond B in 2002 may reflect an increase in reproductive success due to the much lower numbers of predatory catfish in that pond.

Rana catesbeiana – This species could be described as a generalist; individuals are usually active between March and November, with a few individuals still present in December (Figure 6). The peak metamorph emergence period from the ponds occurs from late-August to September. Furthermore, bullfrogs do not appear to favor any particular pond (Figure 7) – their low number at Pond D during 2001-2 is a sampling artifact (pitfall traps were not always able to contain frogs between sampling periods) because many individuals were observed at this pond during the sampling period. The relatively low numbers reported for 2002 reflect the fact that most metamoprhs of this species have yet to emerge from the ponds this year (and thus, have not been trapped). Of the 98 adult and metamorph individuals collected, 12.3 % have been recaptured, usually at the same pond where they were first trapped.

Rana sylvatica – Adults of this species exhibited a peak of activity at the ponds during March (Figure 8), with a metamorph emergence from ponds occurring in June. Most of that activity was observed at pond D, but the numbers of individuals using other ponds have gradually increased between years of the study (Figure 9). A higher level of activity at Pond D in 2002 may reflect having had the laundry effluent redirected away from that pond in June 2001. Only one of the 124 adult and metamoph individuals has been recaptured, indicating that the population is larger than is reported herein (especially at pond D).

Pseudacris crucifer – The adults of this species are most active between March and April, with a few individuals still present in later months of the year (Figure 10). In addition to a few breeding choruses, 28 individuals were collected in the pitfall traps, primarily at pond A (Figure 11). None of these individuals have been recaptured, but this is likely due to the excellent climbing abilities of this species (they are collected from the pitfall traps far less often than other species using the same breeding habitats).

Most of the amphibian breeding activity appears to be concentrated around ponds A and B (Figure 12). However, most of these individuals are represented by recent metamorphs of *Bufo a. americanus*. Although Pond B is the largest breeding site (in terms of water volume and shoreline distance), it does not appear to support a higher number of amphibian species or density if the *B. a. americanus* metamorphs are ignored. Assessments of relative abundance for each of the species (Table 1) are based on numbers seen &/or heard throughout the study, and in comparisons with densities observed at sites other than WWNP. It should be reiterated, however, that these assessments are subjective, and that not all species of amphibians are conducive to the trapping regime outlined in this study.

STATUS & RECOMMENDATIONS

Of the species that I listed as "rare" or "very rare" (Table 1), I do not believe that IDNR should be concerned about the population status of any of them because these species all have large populations elsewhere in their geographic distribution. Furthermore, with the exception of *Bufo woodhousei fowleri*, all of these species happen

to be at or near a boundary of their geographic distribution. In such instances, populations are often smaller in size &/or more transient in nature (Gilpin 1987, Goodman 1987, Sjögren 1991). Phillips et al. (1999) caution that isolated populations of *Rana sylvatica* may be more susceptible to extinction than similar populations of other frog species. Therefore, I suggest continued monitoring of amphibians at all four of the ponds at WWNP.

Three of the studies species, *Ambystoma texanum*, *Pseudacris crucifer*, and *Rana sylvatica* all experienced population increases between the two most recent years of the study (pooled data from all ponds). I suggest that the intervention steps taken during 2001 (re-directing the laundry effluent, and removing the fish) have contributed to the increased population sizes for these species. Particularly encouraging is the increased recruitment of *A. texanum* observed at Pond C, and of *R. sylvatica* observed at Pond D. I suggest that any continued monitoring efforts direct particular attention these species because their breeding efforts are so explosive (and their use of the ponds relatively brief). The trend for *P. crucifer* is less certain because densities are relatively low, and this species is better assessed using breeding chorus data (Gerhardt et al. 1987) than pit-fall traps.

Because the effort to eliminate all of the *Ameiurus* from Pond B during the Rotenone™ application in December 2001 was not successful, I recommend that IDNR re-apply this poison to Pond B. To ensure that this second application does succeed, I suggest an application date in the second week of January 2003. Rotenone™ retains its potency for longer periods of time when applied at colder temperatures. As such, an application in mid-January (under an ice layer) should provide enough exposure to the

poison to kill the remaining *Ameiurus* in Pond B. This suggested application date will also be early enough to ensure that the poison is flushed out of Pond B prior to any breeding activity in Spring 2003.

Assessment of Risks

1. One of the side-effects of Rotenone™ application discussed in last year's Final Report, was the effect that the poison would have on tadpoles of *Rana catesbeiana*. I suggested that any losses of individuals of this species were acceptable given that adults would not be effected by the poison and these adults would reproduce in the following year. In fact, the Rotenone™ application did not seem to effect all of the *R. catesbeiana* tadpoles, as several large individuals (indicating their having been present during Rotenone™ application) were observed along the shoreline of Pond C several weeks after the poison was applied.

2. In last year's Final Report, I also suggested that *Chelydra serpentina* might be negatively influenced by the Rotenone™ application. However, evidence of nesting activity by female *C. serpentina* this year, indicates that they were unaffected by the presence of the poison in December 2001.

Taken together these assessments lead me to suggest that IDNR personnel should not be concerned about the effects of future Rotenone™ applications, providing that they are each separated by a time interval of several months. Furthermore, Rotenone™ application should not coincide with any of the months during which amphibians actively breed at these ponds (February through September). I also recommend that all *Ameirus melas* be removed from Pond B even if successive Rotenone™ applications are required.

Acknowledgments – I thank J Fish, D. Foster, P. Hampton, A. Leffel, and especially J.B. Towey for their assistance with maintaining the drift fence/pitfall trap arrays and monitoring the arrays to collect amphibians. I am grateful to IDNR for partially offsetting the funding for this project. I am also indebted to R. Szafoni for advice, M. Mounce for logistical assistance, and to L.B. Hunt for granting permission to conduct research on his property.

LITERATURE CITED

Dodd, C.K., Jr., and B.S. Cade. 1998. Movement patterns and the conservation of amphibians breeding in small, temporary wetlands. Conservat. Biol. 12:331-339.

Gerhardt, H.C., B. Diekamp, and M. Ptacek. 1989. Inter-male spacing in choruses of the spring peeper, *Pseudacris* (*Hyla*) *crucifer*. Anim. Behav. 38:1012-1024.

Gilpin, M.E. 1987. Spatial structure and population vulnerability. Pp. 125-139 *in* Viable Populations for Conservation. Cambridge Univ. Press, Cambridge.

Goodman, D. 1987. The demography of a chance extinction. Pp. 11-34 *in* Viable Populations for Conservation. Cambridge Univ. Press, Cambridge.

Phillips, C.A., R.A. Brandon, and E.O. Moll. 1999. Field Guide to Amphibians and Reptiles of Illinois. Illinois Natural History Survey, Champaign, IL.

Sjögren, P. 1991. Extinction and isolation gradients in metapopulations: The case of the pool frog (*Rana lessonæ*). Biol. J. Linn. Soc. 42:135-147.

Table 1. Species list of amphibians and reptiles observed at Warbler Woods Nature Preserve between May 2000 and June 2002. Qualitative assessments of abundance of amphibian species are provided based on trapping and other survey efforts. * = species for which sufficient data exist to illustrate temporal or habitat usage patterns – see attached Figures. † = species abundance assessed from breeding choruses.

ORDER URODELA		Relative abundance
Family Ambystomatidae –	*Ambystoma texanum**	common
Family Plethodontidae –	*Eurycea cirrigera*	very rare (only 3 seen)
ORDER ANURA		
Family Bufonidae –	*Bufo a. americanus**	very common
	Bufo woodhousei fowleri	rare
Family Hylidae –	*Acris crepitans blanchardi*	common
	Hyla chrysoscelis x *versicolor* †	common (regularly heard)
	*Pseudacris crucifer**	moderate
	Pseudacris triseriata †	rare (few choruses heard)
Family Ranidae –	*Rana blairi*	very rare (only 1 seen)
	*Rana catesbeiana**	very common
	Rana utricularia	rare (poss. moderate?)
	*Rana sylvatica**	common
ORDER CHELONIA		
Family Chelydridae –	*Chelydra serpentina*	
Family Emydidae –	*Terrapene c. carolina*	
	unidentified emydid (probably *Chrysemys* or *Trachemys*)	

Table 1, continued.

ORDER SQUAMATA

Family Scincidae – *Eumeces laticeps*

Family Colubridae – *Diadophis punctatus*

Elaphe o. obsoleta

Lampropeltis c. calligaster

Lampropeltis t. triangulum

Nerodia s. sipedon

Opheodrys aestivus

Storeria dekayi wrightorum

Thamnophis s. sirtalis

Table 2. Mean sizes (± 1 standard deviation) and number of recaptures of adult amphibians trapped in drift fence/pitfall arrays around four ponds at Warbler Woods Nature Preserve between May 2000 and June 2002. Only those species for which sufficient data are available are listed. (SVL = snout vent length; n = sample size).

			# of recaptures	
Species	SVL (mm)	n	2001	2002
Ambystoma texanum	78.6 ± 1.2	279	12	13
Bufo a. americanus	63.2 ± 1.6	186	30	12
Pseudacris crucifer	27.1 ± 6.6	28	0	0
Rana catesbeiana	63.1 ± 2.9	65	9	3
Rana sylvatica	53.3 ± 0.5	117	1	0

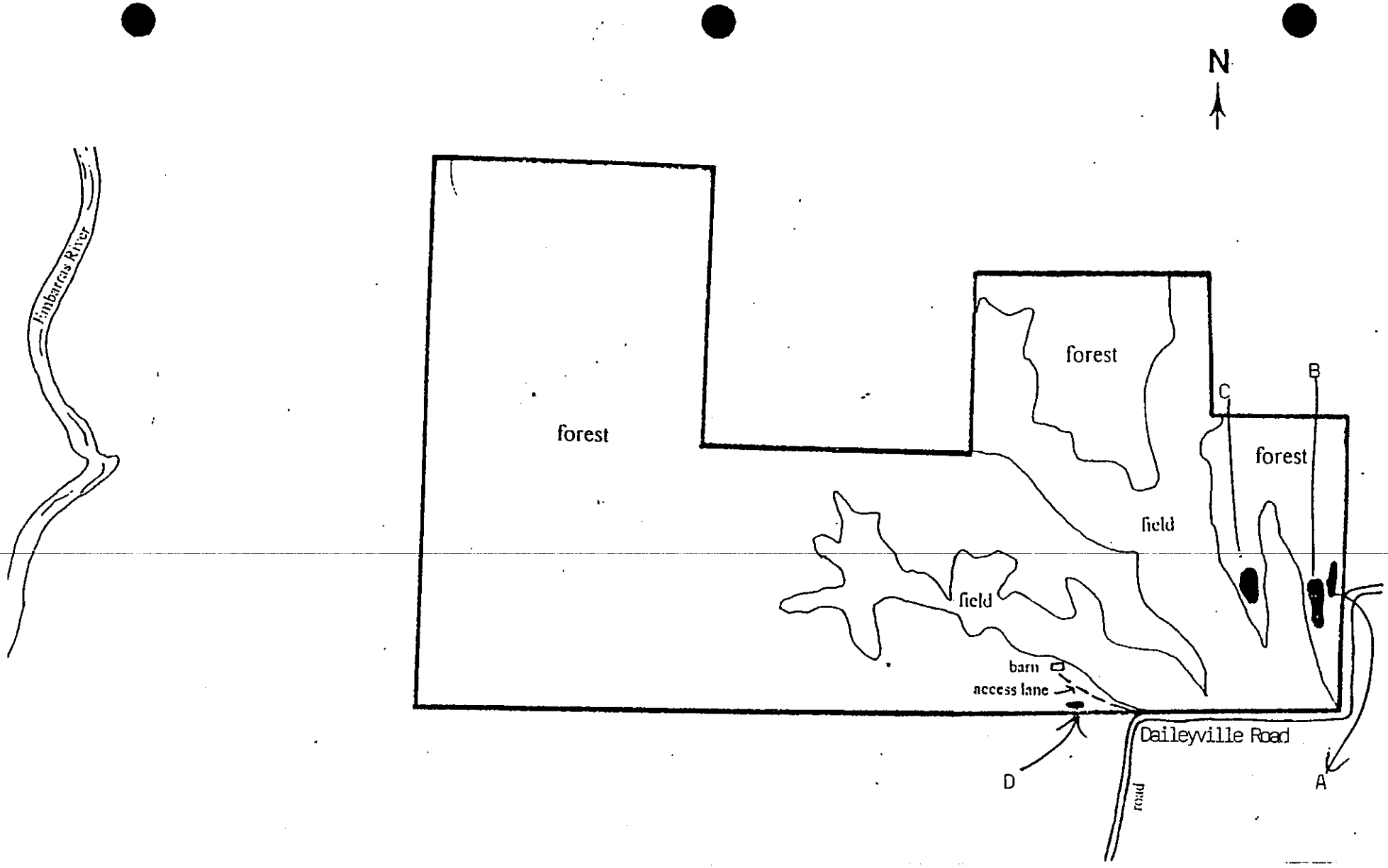

Figure 1. Diagram of Warbler Woods Land & Water Reserve, Coles Co., IL, showing general habitat types and position of ponds surveyed for amphibians from May 2000 - June 2002. [Scale: 1 cm = 78.7 m].

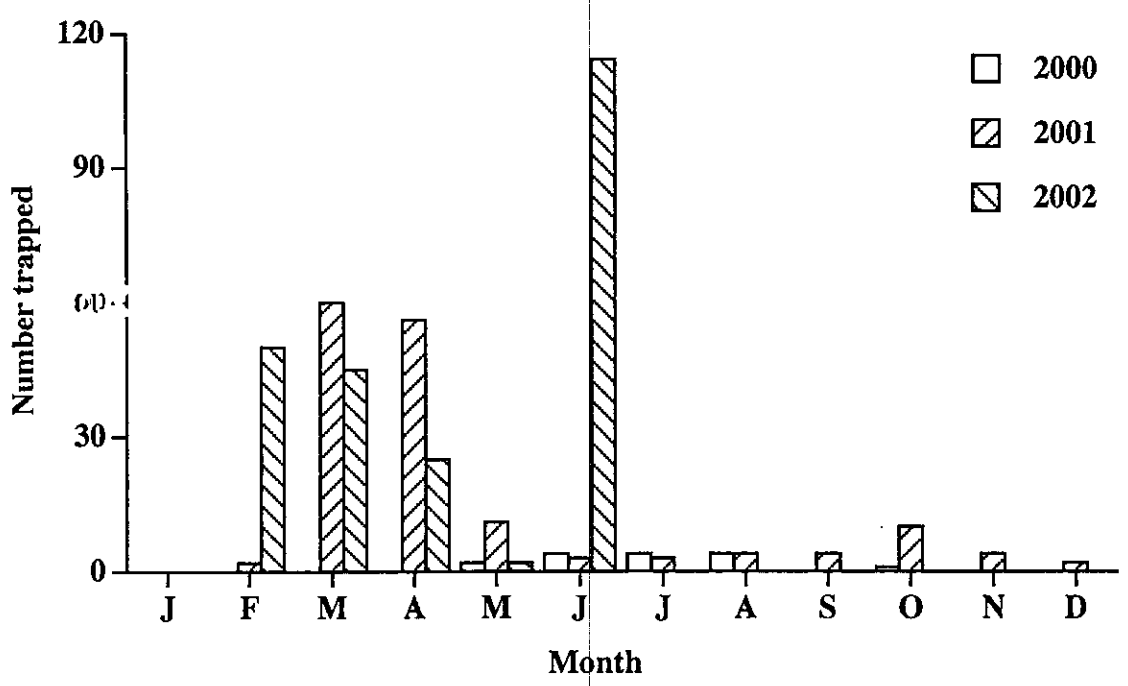

Figure 2. Number of *Ambystoma texanum* observed in each month at WWNP, shown by sampling year.

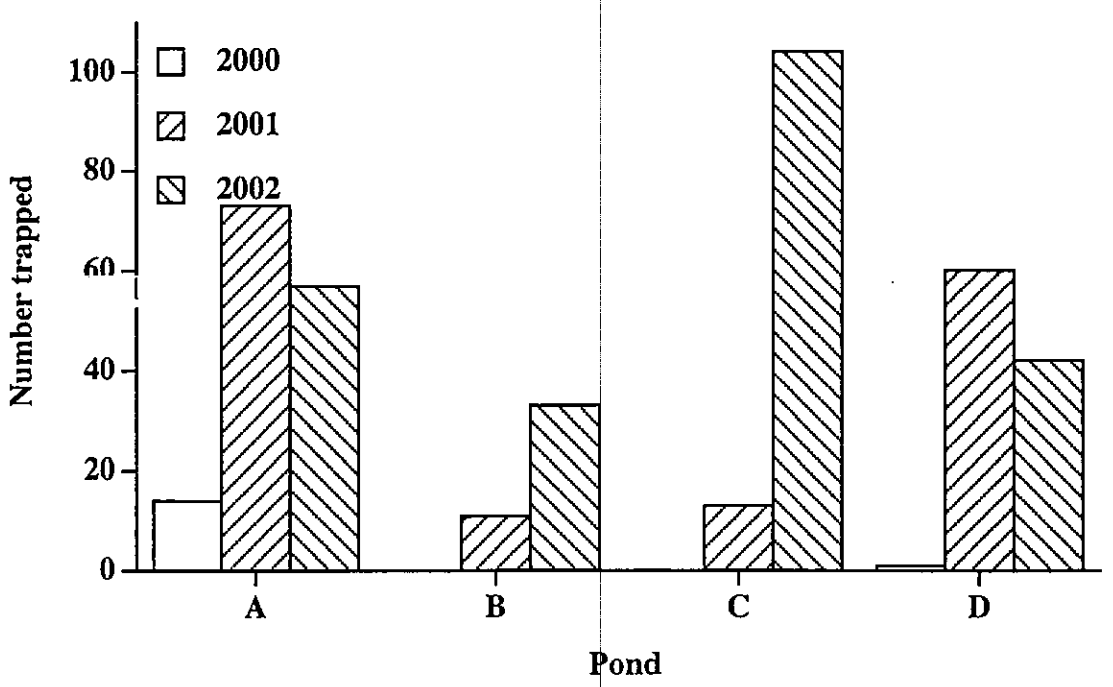

Figure 3. Number of *Ambystoma texanum* observed in each of the ponds at WWNP during the three sampling years.

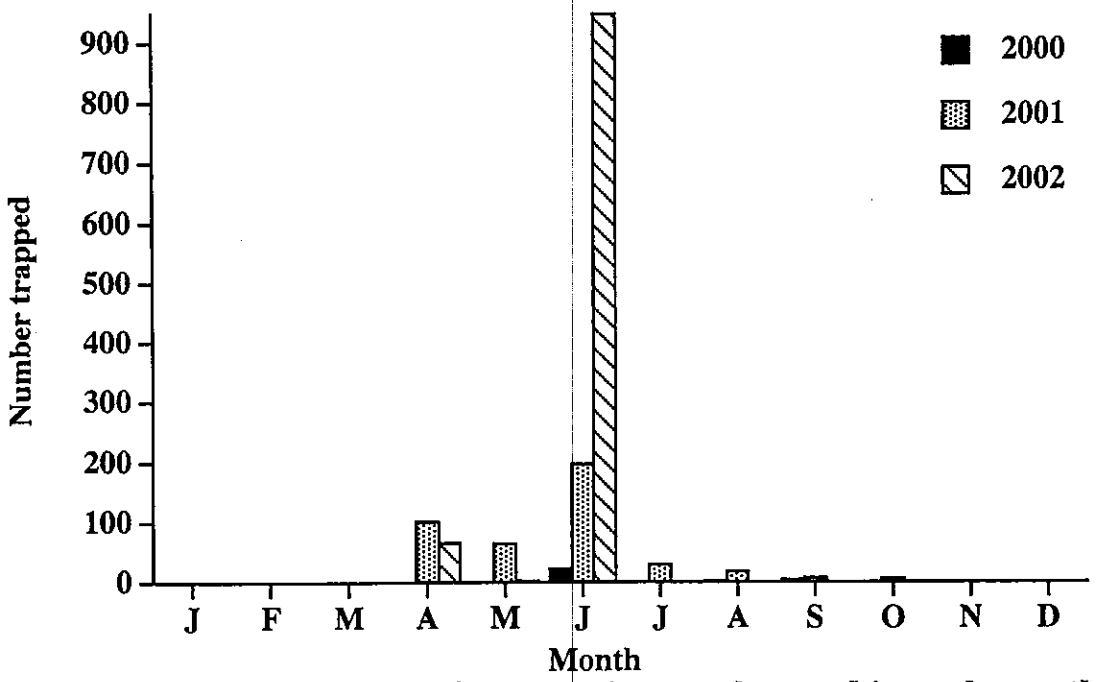

Figure 4. Number of *Bufo a. americanus* observed in each month at WWNP, shown by sampling year.

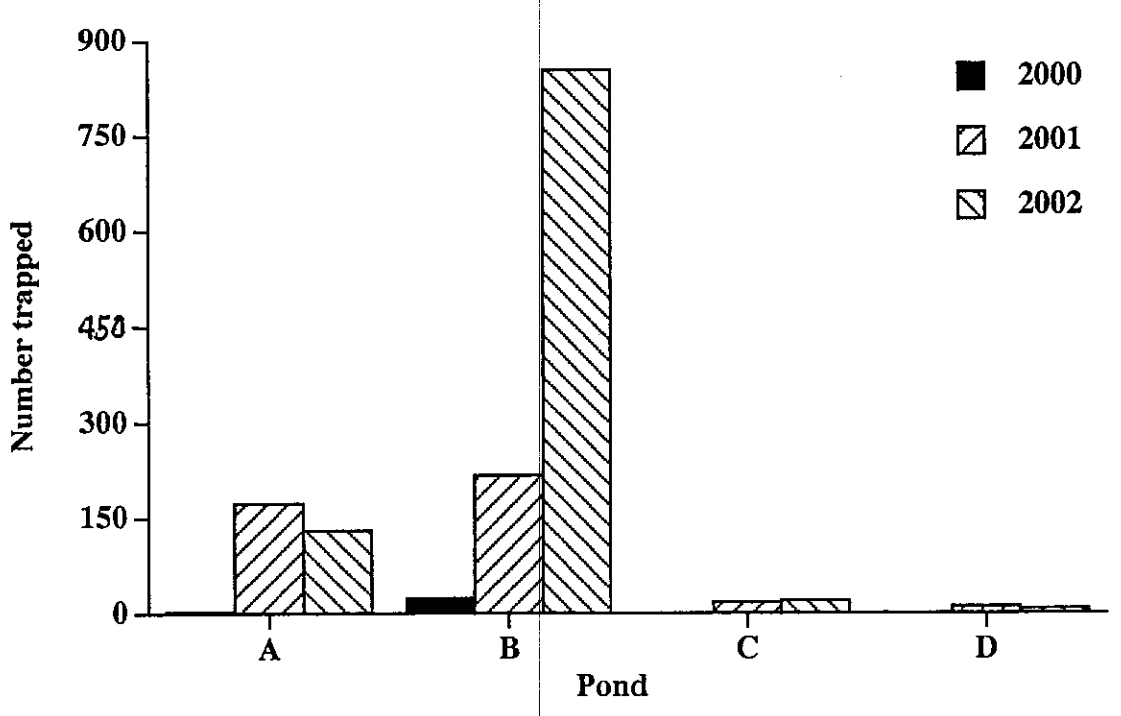

Figure 5. Number of *Bufo a. americanus* observed in each of the ponds at WWNP during the three sampling years.

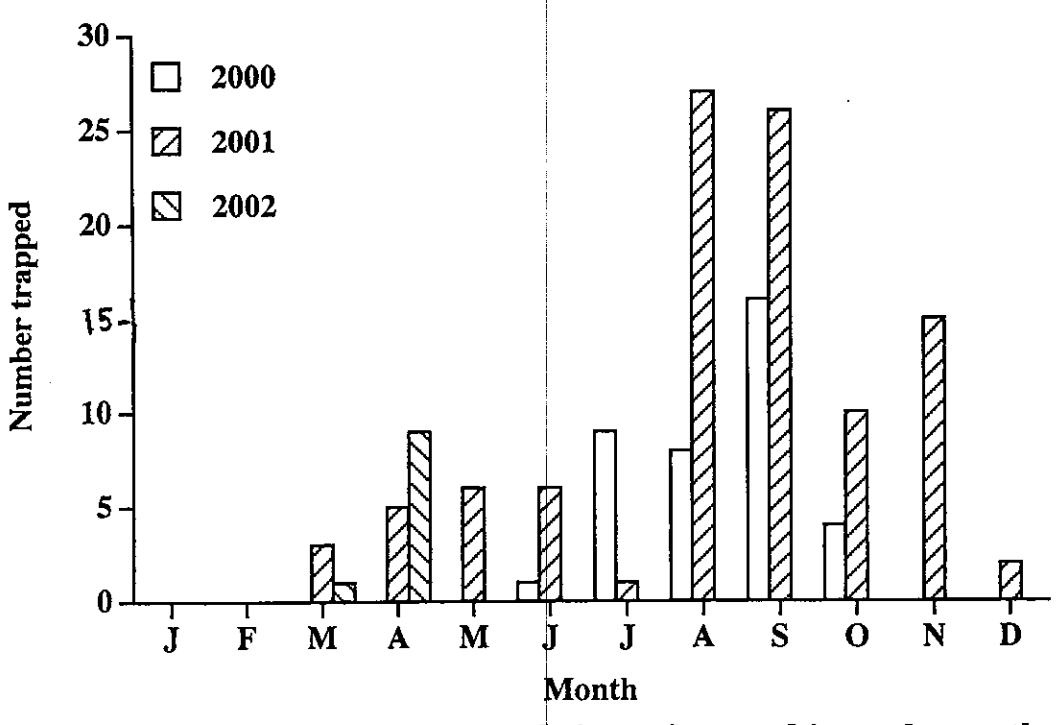

Figure 6. Number of *Rana catesbeiana* observed in each month at WWNP, shown by sampling year.

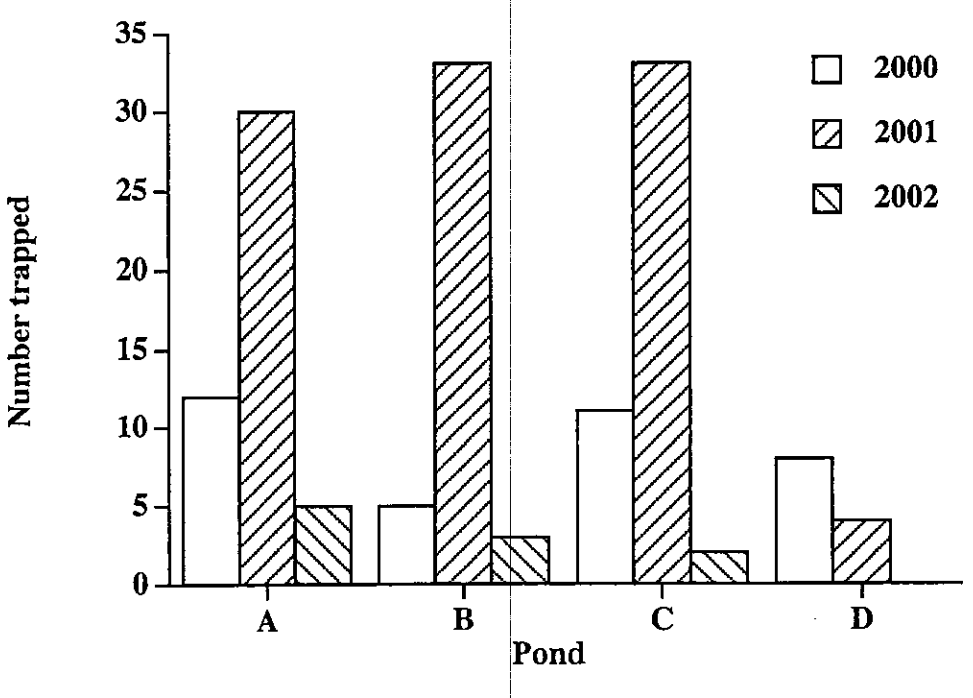

Figure 7. Number of *Rana catesbeiana* observed in each of the ponds at WWNP during the three sampling years.

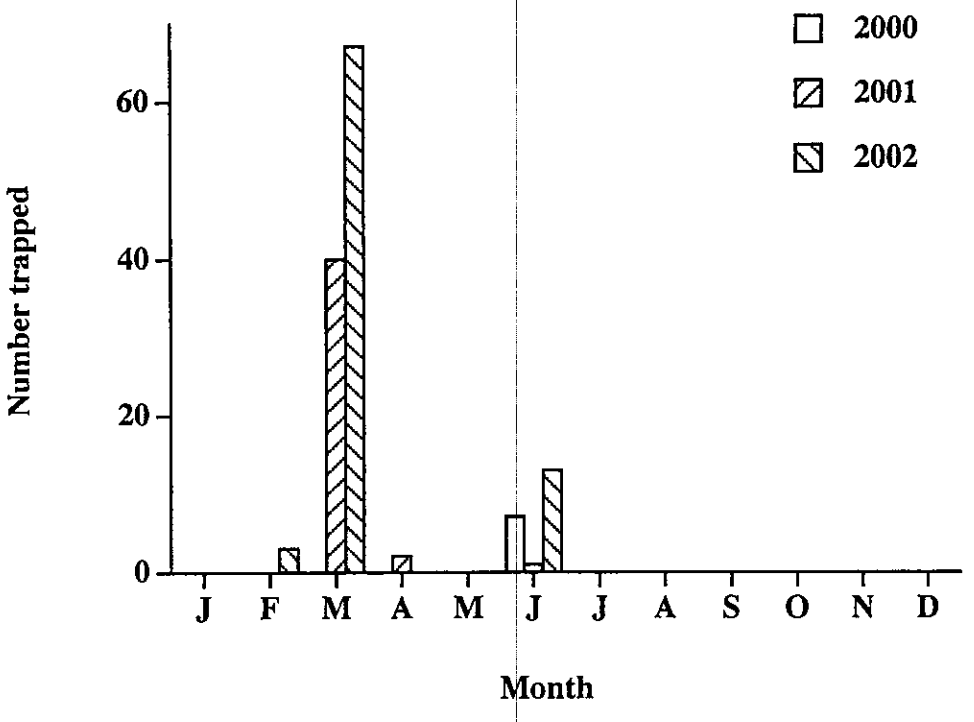

Figure 8. Number of *Rana sylvatica* observed in each month at WWNP, shown by sampling year.

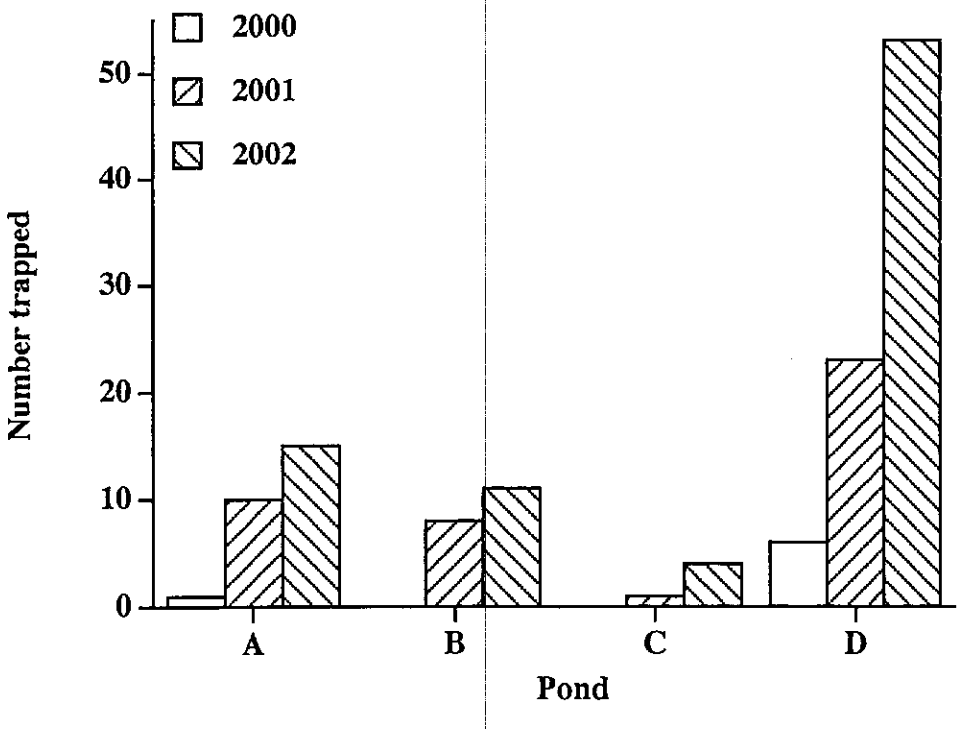

Figure 9. Number of *Rana sylvatica* observed in each of the ponds at WWNP during the three sampling years.

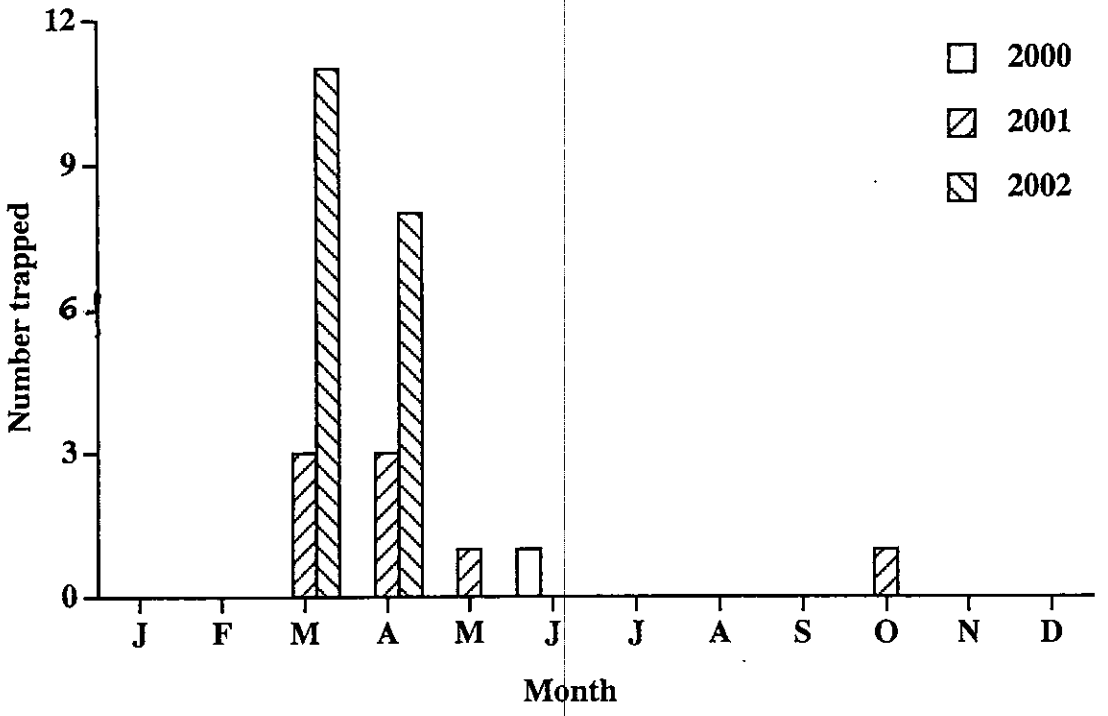

Figure 10. Number of *Pseudacris crucifer* observed in each month at WWNP, shown by sampling year.

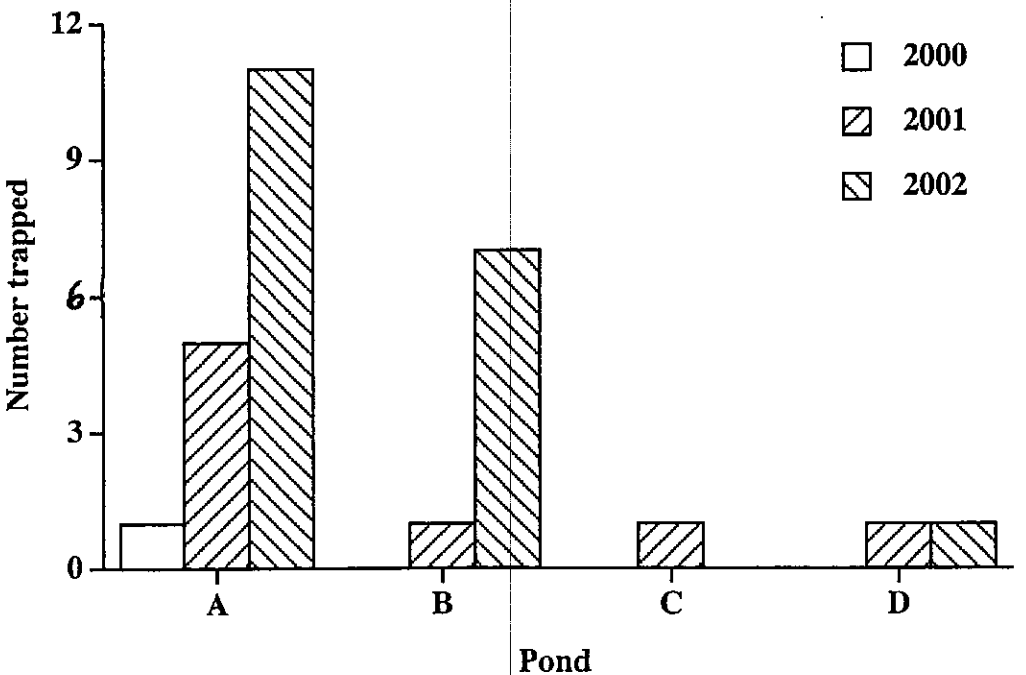

Figure 11. Number of *Pseudacris crucifer* observed in each of the ponds at WWNP during the three sampling years.

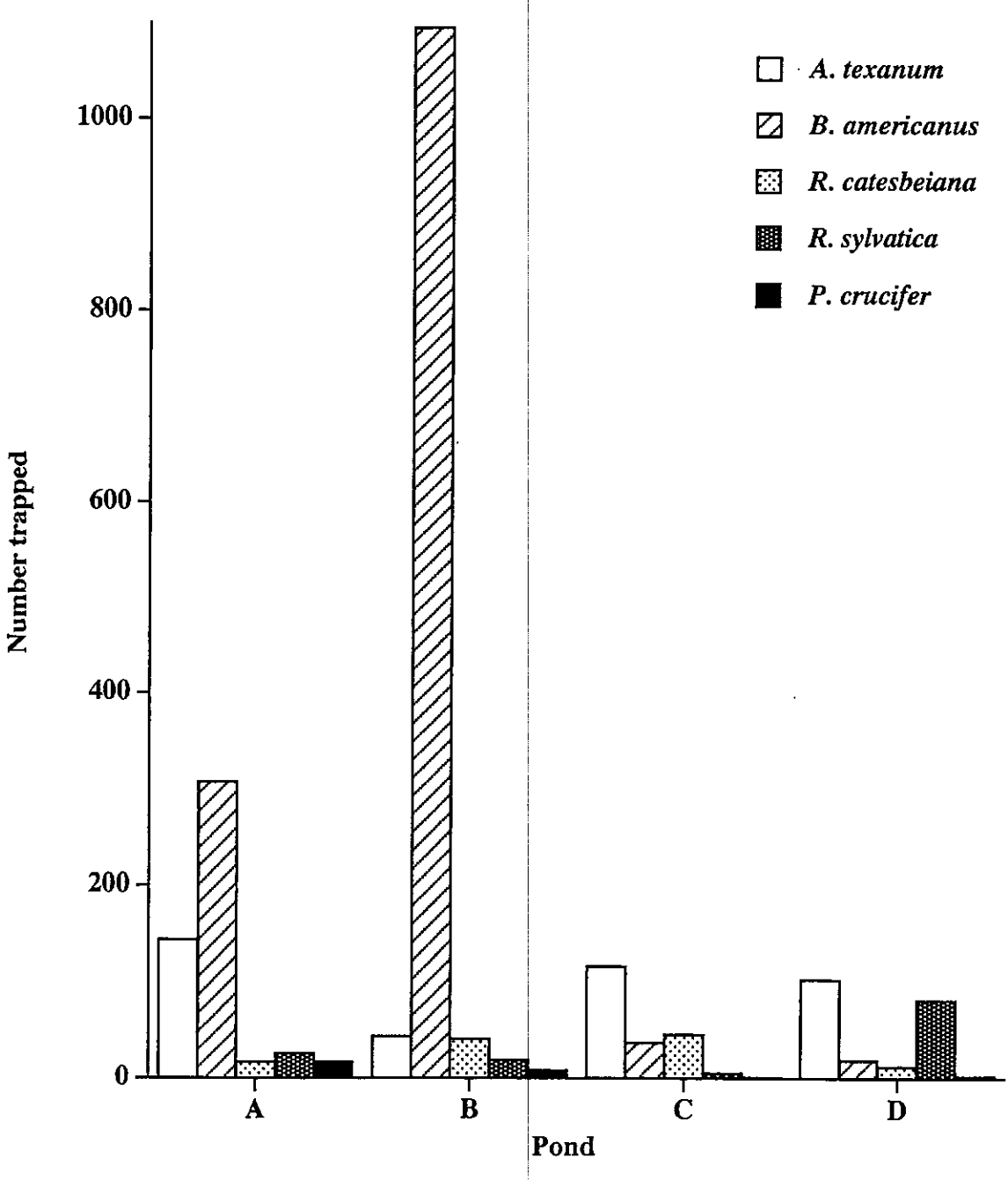

Figure 12. Number of individuals of each of four species of amphibians observed in each of the ponds at WWNP during the entire sampling period (15 May 2000 through 15 June 2002).