

Final Report

**Application of Geographical Information System
Technology to Fish Conservation in Pennsylvania
Phase I**

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INTRODUCTION

A primary goal of conservation biology is to provide principles by which biological diversity can be preserved in the face of increasing anthropogenic impacts (Soulé 1985). Species extinction is one of the most obvious and permanent forms of biodiversity loss. Observing the loss of native fauna, however, is often difficult because it is rarely cataclysmic and often occurs on small scales. A shortcoming of many existing conservation programs is that they tend to be reactive rather than proactive (Scott et al. 1988). Moreover, conservation efforts are often expensive, time consuming, and lack assurance of success.

In Pennsylvania, nine fishes are currently listed as endangered, nine as threatened, and 28 as candidate species (Table 1; Anon. 1998) (collectively called ETC species). These vulnerable species account for approximately 30% of Pennsylvania's native fish diversity. While the terms endangered, threatened, and candidate have been clearly defined (PBTC 1995, Steiner 1997), establishing criteria to meet these definitions has been lacking and falls largely to expert opinion.

Under Section 2305 of the Fish and Boat Code, "the Executive Director shall establish a Pennsylvania Threatened Species List and a Pennsylvania Endangered Species List." Today, Pennsylvania's ETC fish list is the result of informed and educated judgements made by members of the Pennsylvania Fish and Boat Commission's Fish Advisory Committee, ichthyologists, fisheries biologists, and representatives of user groups (A. Shiels, personal communication, The Pennsylvania Fish and Boat Commission). However, a more objective system of classifying animals could be established with a better compilation of species records and of species location mapping

Table 1. – Current and proposed status of Pennsylvania fishes using a classification scheme that accounts for geographic and local abundance. E = endangered, T = threatened, C = candidate, X = extirpated, UL = unlisted, and D = delisted.

<u>Common Name</u>	<u>Scientific Name</u>	<u>Current Status</u>	<u>Proposed Status</u>
Ohio lamprey	<i>Ichthyomyzon bdellium</i>	T	C
northern brook lamprey	<i>Ichthyomyzon fossor</i>	E	E
mountain brook lamprey	<i>Ichthyomyzon greeleyi</i>	T	T
silver lamprey	<i>Ichthyomyzon unicuspis</i>	C	X
least brook lamprey	<i>Lampetra aepyptra</i>	UL	C
American brook lamprey	<i>Lampetra appendix</i>	UL	C
shortnose sturgeon	<i>Acipenser brevirostrum</i>	E	E
lake sturgeon	<i>Acipenser fulvescens</i>	E	E
Atlantic sturgeon	<i>Acipenser oxyrhynchus</i>	T	E
spotted gar	<i>Lepisosteus oculatus</i>	C	E
longnose gar	<i>Lepisosteus osseus</i>	C	C
bowfin	<i>Amia calva</i>	C	C
skipjack herring	<i>Alosa chrysochloris</i>	C	T
hickory shad	<i>Alosa mediocris</i>	C	E
goldeye	<i>Hiodon alosoides</i>	C	T
mooneye	<i>Hiodon tergisus</i>	C	T
cisco	<i>Coregonus clupeaformis</i>	UL	E
central mudminnow	<i>Umbra limi</i>	UL	C
eastern mudminnow	<i>Umbra pygmaea</i>	UL	C
silver chub	<i>Macrhybopsis storeriana</i>	C	E
gravel chub	<i>Erimystax x-punctatus</i>	E	E

continued.

Table 1. - Continued.

<u>Common Name</u>	<u>Scientific Name</u>	<u>Current Status</u>	<u>Proposed Status</u>
redfin shiner	<i>Lythrurus umbratilis</i>	C	E
hornyhead chub	<i>Nocomis biguttatus</i>	C	C
bridle shiner	<i>Notropis bifrenatus</i>	C	E
river shiner	<i>Notropis blennioides</i>	UL	E
ghost shiner	<i>Notropis burchanani</i>	C	E
ironcolor shiner	<i>Notropis chaleybaeus</i>	X	E
bigmouth shiner	<i>Notropis dorsalis</i>	UL	T
blackchin shiner	<i>Notropis heterodon</i>	C	E
southern redbelly dace	<i>Phoxinus erythrogaster</i>	UL	T
longnose sucker	<i>Catostomus catostomus</i>	E	E
smallmouth buffalo	<i>Ictiobus bubalus</i>	C	T
bigmouth buffalo	<i>Ictiobus cyprinellus</i>	UL	E
spotted sucker	<i>Minytrema melanops</i>	C	T
river redhorse	<i>Moxostoma carinatum</i>	C	C
black bullhead	<i>Ameiurus melas</i>	C	E
mountain madtom	<i>Noturus eleutherus</i>	T	E
tadpole madtom	<i>Noturus gyrinus</i>	C	E
brindled madtom	<i>Noturus miurus</i>	C	T
northern madtom	<i>Noturus stigmosus</i>	T	E
burbot	<i>Lota lota</i>	T	E
brook silverside	<i>Labidesthes sicculus</i>	UL	C
threespine stickleback	<i>Gasterosteus aculeatus</i>	UL	E
brook stickleback	<i>Culaea inconstans</i>	UL	C

continued.

Table 1. - Continued.

<u>Common Name</u>	<u>Scientific Name</u>	<u>Current Status</u>	<u>Proposed Status</u>
banded sunfish	<i>Enneacanthus obesus</i>	C	E
warmouth	<i>Lepomis gulosus</i>	C	E
longear sunfish	<i>Lepomis megalotis</i>	C	E
Eastern sand darter	<i>Etheostoma pellucida</i>	E	E
bluebreast darter	<i>Etheostoma camurum</i>	T	T
Iowa darter	<i>Etheostoma exile</i>	C	E
spotted darter	<i>Etheostoma maculatum</i>	E	T
tippecanoe darter	<i>Etheostoma tippecanoe</i>	E	T
channel darter	<i>Percina copelandi</i>	T	T
gilt darter	<i>Percina evides</i>	T	T
longhead darter	<i>Percina macrocephala</i>	E	T
Potomac sculpin	<i>Cottus girardi</i>	C	D
spoonhead sculpin	<i>Cottus ricei</i>	C	X
deepwater sculpin	<i>Myoxocephalus thompsoni</i>	C	X

(A. Shiels, personal communication, The Pennsylvania Fish and Boat Commission).

An objective method for identifying Pennsylvania's ETC species can be developed using historical and contemporary fish collections. Moreover, these data can be used to identify specific geographic areas where ETC species occur. Geographic representations of ETC species' distributions may provide a foundation for developing preventative (proactive) management strategies and aid conservation biologists to curb biodiversity loss. Additionally, predicting potential reductions in vulnerable species may help to identify geographic areas where restoration or conservation efforts are needed.

The objectives of this report are (1) to review current classifications of ETC species to ensure they are appropriately categorized and consider other species that should be added to the ETC species listing, (2) to document changes in distribution of ETC species in Pennsylvania over the past 30 years, and (3) to identify streams that historically supported or currently support diverse fish assemblages in each of the six major drainage basins in Pennsylvania and to develop a priority list of streams in each drainage that merit special consideration. We recognize that many fishes described in this report exist at the edge of their range in Pennsylvania, and thus are not rare within North America. However, these fishes represent an important component of Pennsylvania's diversity and as such each deserves the protection afforded under Section 2305 of the Fish and Boat Code. This investigation of Pennsylvania's fish diversity will show distribution patterns of vulnerable fishes, identify geographic areas that should be preserved, and provide a basis for proactive conservation efforts.

METHODS

Fish records from the Pennsylvania Fish and Boat Commission (PFBC), the University of Michigan's Museum of Zoology (UMMZ), the Pennsylvania State University (PSU), Edwin L. Cooper (ELC), Robin Heard (RH), Cornell University (CU), the National Museum of Natural History (SMITH), the Environmental Protection Agency (EPA), and the Academy of Natural Sciences in Philadelphia (ANSP) were assembled to produce this report (Table 2). All fish data were condensed into the ARC/INFO[®] geographic information system (GIS; ESRI 1995) and the Microsoft Office database ACCESS[®] v7.0 (Microsoft 1995). ARC/INFO[®] was used primarily to create distribution maps, while ACCESS[®] was used to query tabular data. We generated digital representations of contemporary databases (PFBC, RH, and EPA) using latitude and longitude information about each collection site. By manually digitizing sites, using site descriptions provided by collectors, we generated digital representations of historic databases (UMMZ, PSU, ELC, CU, SMITH, and ANSP) in ARC/INFO[®]. Unfortunately, some sites could not be accurately represented in a digital format because of poor site descriptions; however, most of these sites are described in the Results section even though they may not appear in our distribution maps. We scrutinized all databases for accuracy of species identification and site locality. We chose to remove or correct questionable data to ensure that maps accurately represented the occurrence of fishes in Pennsylvania.

Data were first analyzed by associating all fish collections with watershed boundaries that were derived by the Office of Remote Sensing (ORSER), using U.S. Geological Survey stream maps at a 1:100,000 scale. In total, 104 Pennsylvania

watersheds were delineated (Figure 1). We generated a frequency histogram of the number of watersheds where particular species were present to derive a measure of geographic range. Using this histogram, it became evident that several natural breaks existed. We elected to divide the watershed data as follows and assign a rank to each species based on their presence in a certain number of watersheds:

Rank	Watersheds (S = number of watersheds)
1	$S \leq 2$
2	$2 < S \leq 4$
3	$4 < S \leq 10$
4	$S \leq 104$

We used all available abundance data as a second criterion to aid in the determination of Pennsylvania's rare fishes. For example, if 17, 20, and 11 specimens of a species were collected at three different sites, then an overall abundance of 48 was given to that species. If data were not available, we assumed that at least one individual was collected to document its presence at a given site. This is perhaps a rather conservative approach, but given the fact that we are interested in rare fishes, it will be best to err on a more conservative side. We divided the abundance data as follows:

Rank	Catch (C = total catch)
1	$C \leq 10$
2	$10 < C \leq 30$
3	$30 < C \leq 120$
4	$C > 120$

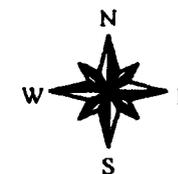
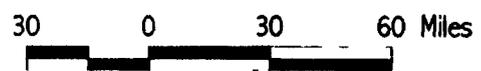
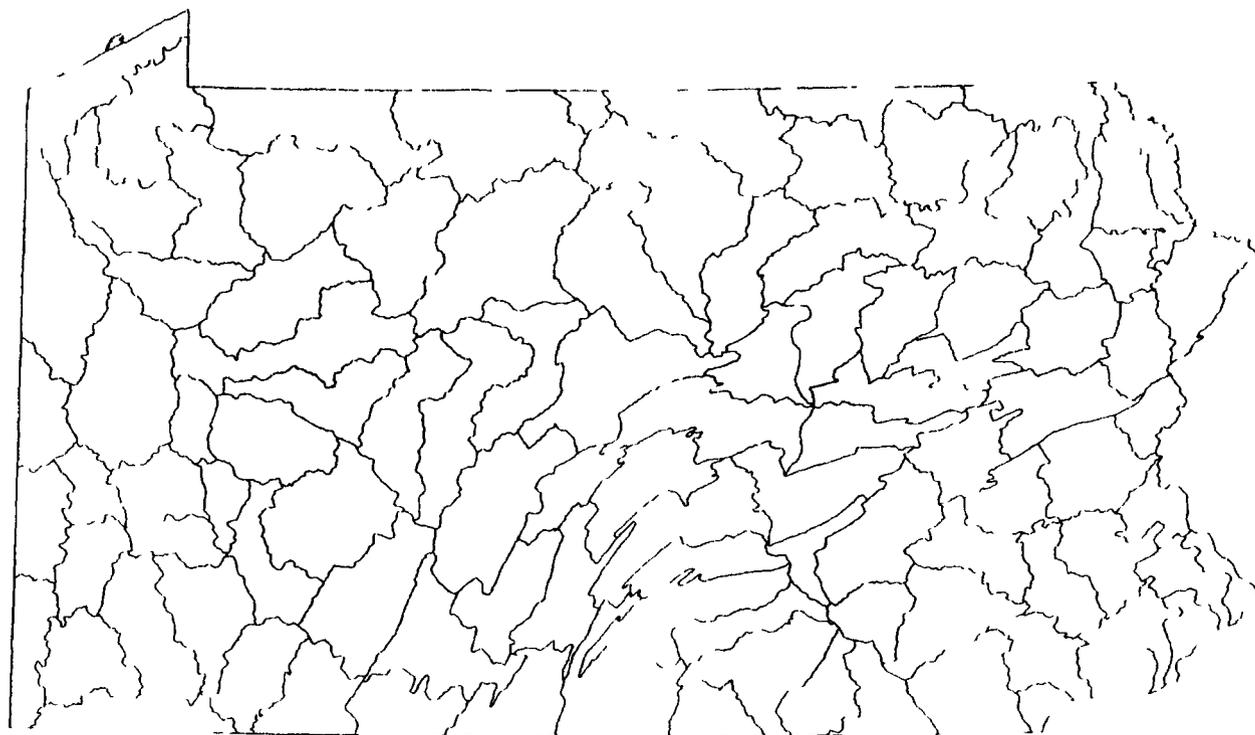
We used averages of these ranks to assign fishes as endangered, threatened, or candidate. Average ranks of 1 or 1.5 corresponded to an endangered fish. Endangered fish, using this scheme have a very limited geographic distribution occurring in four or less watersheds statewide with a low local abundance. These fishes are locally rare and geographically rare. Average ranks of 2 or 2.5 corresponded to a threatened fish. These

Table 2.- Databases used to construct this report.

<u>Database</u>	<u>Years Covered</u>	<u>No. of Sites</u>	<u>Donator</u>
Pennsylvania Fish and Boat Commission	1975-1995 1975-1997	10,780 (streams) 10,019 (lakes)	Pennsylvania Fish and Boat Commission, Bill Frazier
Edwin L. Cooper	1932-1983	1,500	The Pennsylvania State University
The Academy of Natural Sciences in Philadelphia ^a	1900-1989	530	The Academy of Natural Sciences in Philadelphia, William Saul and Jon Gelhaus
Cornell University ^a	1904-1989	404	Cornell University, Charles M. Dardia
The Pennsylvania State University	1974-1994	408	The Pennsylvania State University, Jay R. Stauffer, Jr.
The University of Michigan's Museum of Zoology ^a	1903-1974	165	The University of Michigan's Museum of Zoology, William L. Fink and Douglas Nelson
Robin Heard	1994-1995	70	Robin Heard
Environmental Protection Agency ^a	1993-1995	88	Environmental Protection Agency, The U.S. National Museum, Jeffrey Williams
The U.S. National Museum ^a	1900-1984	126	The U.S. National Museum, Jeffrey Williams

^a Data available through the Internet at: <http://www.biology.alberta.ca/jackson.hp/iwr/museums.html>

Figure 1 - Delineated watersheds of Pennsylvania



fishes have limited geographic distributions occurring in one to nine watersheds and are moderately abundant in local sites. These fishes may not be locally rare, but may be geographically rare. Average ranks of 3 or 3.5 corresponded to a candidate species. These fishes occur in four to ten watersheds statewide and are somewhat locally abundant.

Once a grouping of rare fishes were identified, we created dot distribution maps, using ARC/INFO® to document distribution patterns over the past 30 years. We selected this time period because it encompasses a substantial portion of Cooper's (1983) statewide survey (1958-1981), J. Stauffer's survey of fishes in eastern and western Pennsylvania funded by the Wild Resource Conservation Fund (1985-1989), and the complete records of the Pennsylvania Fish and Boat Commission (1976-1995 for streams and 1976-1997 for lakes).

A final goal of this investigation was to identify streams that harbor rare fishes. Using the GIS, we identified specific streams that have lost ETC species as well as streams and lakes that maintain populations of these species. A discussion of several key streams and rivers are provided.

RESULTS

Using our classification scheme, 28, 15, and 11 fishes would be classified as endangered, threatened, and candidate, respectively. This represents approximately, 35% of Pennsylvania's total native fish fauna. Of those fishes that we determined to be endangered, at least five need to be further sampled to help clarify appropriate distribution accounts (see discussion below). One species, the checkered sculpin (*Cottus sp.*) was not included in our analysis, but should be considered endangered (see p.43).

Of the nine fishes that were originally listed as endangered (Table 1), only six were classified as endangered using our scheme (Table 1). Three fishes were moved from threatened to endangered status and ten were moved from candidate to endangered status. In addition to these changes, we recommend that four new species be added to Pennsylvania's endangered species list.

Three of the nine fishes originally included in Pennsylvania's threatened fish list were retained after our analysis (Table 1). Three fishes were moved from endangered to threatened status and six were moved from candidate to threatened status. Using our scheme, two fish would be added to Pennsylvania's threatened list.

Of the 28 fishes that were originally listed as candidate (Table 1), only four remained classified as candidate using our scheme (Table 1). Fish species previously classified as threatened (1) were re-classified as candidate species. Six fishes previously unclassified were given candidate status. Only one fish, the Potomac sculpin was down listed as a result of our analysis and further review by an expert panel. In addition, three fishes currently listed in Pennsylvania should be considered extirpated (Table 3). Appendices at the end of this document contain species' distribution maps (A; 1965-1995), site locations for all collections reported here (B), and a list of streams that harbor rare fishes (C).

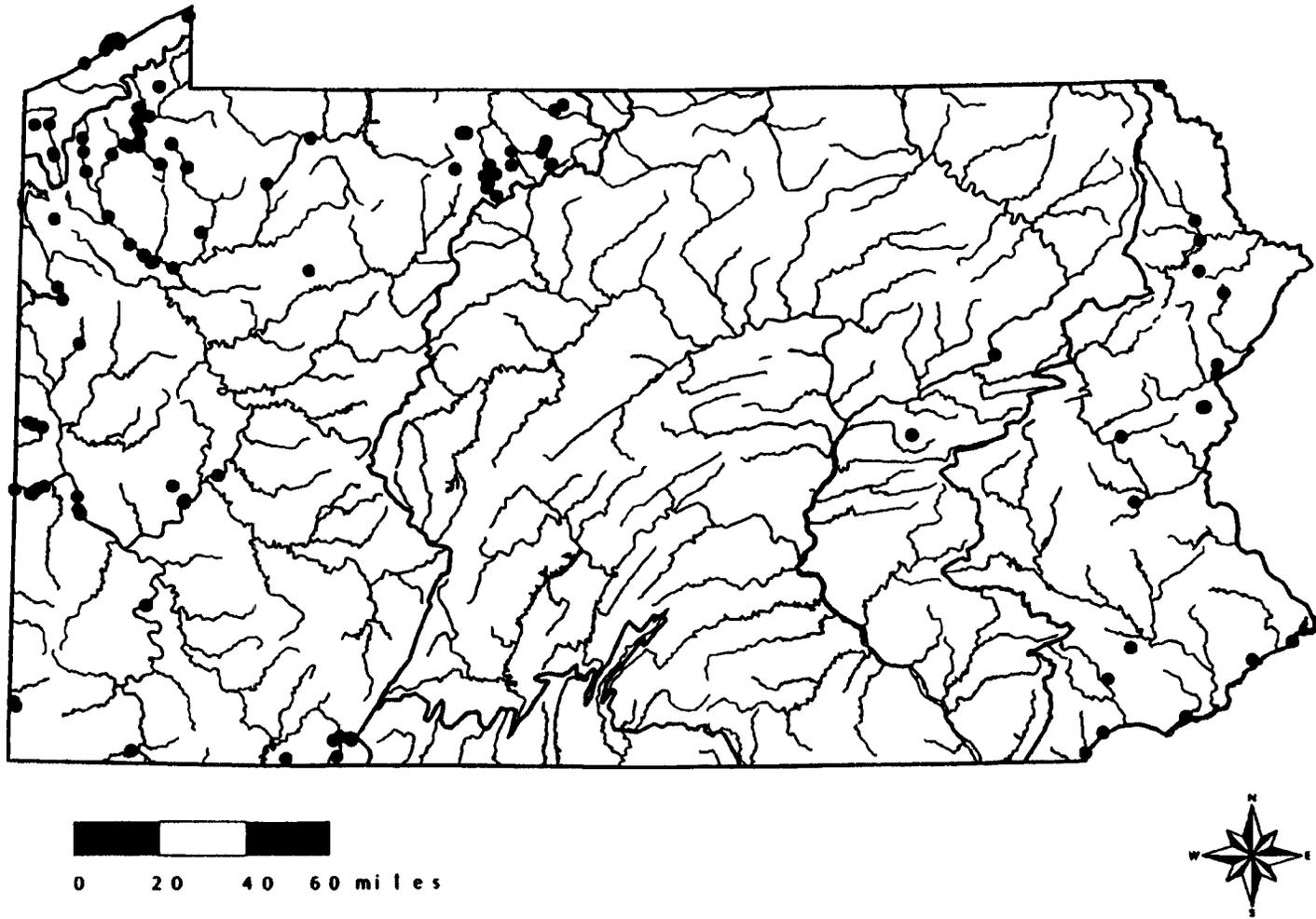
Recommended Endangered fishes

The majority of endangered fishes we identified using our classification scheme reside in the mid-order streams of the Ohio River drainage and the major rivers of the Ohio River drainage (Figure 2). The discussion that follows details each species we recommend for listing as endangered in Pennsylvania. Maps for each species'

TABLE 3. - Species believed extirpated from Pennsylvania rivers and streams. Refer to Table 1 for "Source" acronym.

<u>Species</u>	<u>Last Collected</u>	<u>Current status¹</u>
silver lamprey	1950	candidate
shovelnose sturgeon	1820	extirpated
longjaw cisco	1957	extirpated
popeye shiner	1853	extirpated
blacknose shiner	1938	extirpated
northern redbelly dace	1862	extirpated
southern redbelly dace	1973	extirpated
highfin carpsucker	1886	extirpated
lake chubsucker	1952	extirpated
blue catfish	1886	extirpated
pirate perch	1917	extirpated
mud sunfish	1935	extirpated
swamp darter	1911	extirpated
sharpnose darter	early 1900s	extirpated
deepwater sculpin		candidate
spoonhead sculpin	early 1900s	candidate

Figure 2. - Distribution of proposed endangered fishes.



distribution can be found in Appendix A, in taxonomic order.

Northern brook lamprey – Map 2

In Pennsylvania, Cooper collected seven individuals of this species in 1975 and the PFBC made collections in 1977. Currently it is designated as endangered and we believe this is appropriate given this species' limited distribution and low abundance. The northern brook lamprey (*Ichthyomyzon fossor*) appears in small North American populations throughout Wisconsin, Michigan, Indiana, Illinois, Kentucky, and Missouri (Lanteigne 1992). In general, habitat degradation, predation, lowering of water levels, and siltation appear to have negatively affected this species (Bailey 1959, Starrett et al. 1960, Scott and Crossman 1973).

Shortnose sturgeon – Map 6

As Pennsylvania's only federally endangered fish, the shortnose sturgeon (*Acipenser brevirostrum*) receives protection through the Endangered Species Act and therefore, cannot be legally exploited. The shortnose sturgeon is currently considered endangered in Maryland, Pennsylvania, New Jersey, and New York (Schmidt 1996). This species was collected in 1914 on the Delaware River near Tulleytown (ANSP database) and again in 1984 by the PFBC in the Delaware Estuary (PFBC database) (Argent et al 1997). The shortnose sturgeon occurs in rivers, estuaries, and near shore areas along the East Coast of North America (Lee et al. 1980).

The limiting factor for this species is the availability of large rivers with warmwater estuaries (Dadswell 1984). This sturgeon species has been taken as incidental catches in the shad, salmon, and bass gillnet fishery and the alewife trapnet fishery along the Atlantic coast (Dadswell 1979). In Pennsylvania, several shortnose sturgeons have

been killed by navigational dredging operations in the Delaware River near Tulleytown. In January 1998, three specimens were recovered from a dredge disposal area (A. Shiels, personal communication, The Pennsylvania Fish and Boat Commission). Incidental catches of this species in other portions of its range could negatively affect fishes that would normally move into the Delaware Estuary.

Lake sturgeon

Presently this species is considered endangered in Pennsylvania and Ohio, and threatened in New York (Schmidt 1996). Historical accounts of the lake sturgeon (*Acipenser fulvescens*) in Pennsylvania are those of Fowler (1919), who reported it from the Allegheny River at Tidioute and Warren, Warren Co.; the Allegheny River at Foxburg and the mouth of the Clarion River, Clarion Co.; the Ohio River at Pittsburgh, Allegheny Co.; and the Conemaugh and Kiskiminitas Rivers, Indiana Co. Jordan and Evermann (1902) remarked that this species is most abundant in lakes Erie and Ontario. Pollution, habitat degradation, dam construction, spawning habitat and water quality appear to limit this species (Houston 1987). Recent surveys in Lake Erie by the Ohio Division of Wildlife, Sandusky Fisheries Research Station have documented 74 sturgeon between 1989-1996, but no sturgeon have been collected in the Pennsylvania portion of the lake (R. Kenyon, personal communication, The Pennsylvania Fish and Boat Commission). Restoration efforts are underway in Pennsylvania in cooperation with other agencies that manage the fisheries of Lake Erie (R. Kenyon, personal communication, The Pennsylvania Fish and Boat Commission).

Atlantic sturgeon – Map 7

The Atlantic sturgeon (*Acipenser oxyrinchus*) occurs along the Atlantic coast

from Hamilton River, Labrador, or George River, Ungava Bay, to northeastern Florida (Lee et al. 1980). The PFBC reported this species in 1984 from a collection made in the Delaware Estuary (PFBC database). Cooper (1985) reported other collections of this species in the Susquehanna River and the Delaware River, but stated that “a combination of overfishing and habitat deterioration make it difficult to restore these populations.” Currently this species is considered threatened in Pennsylvania, but with continued declines this species should most likely be considered endangered. The U.S. Fish and Wildlife Service (USFWS) is presently reviewing the status of this species in consideration of listing under the Federal Endangered Species Act of 1973 (A. Shiels, personal communication, The Pennsylvania Fish and Boat Commission).

Spotted gar – Map 8

Cooper (1983) collected spotted gar in the Erie drainage. The PFBC, in 1989, collected another specimen from the Allegheny River (PFBC database). This gar is generally a southern species occurring in states that border the Gulf of Mexico, but specimens have been collected in the Mississippi River and the Great Lakes (Lee et al. 1980). The spotted gar (*Lepisosteus oculatus*) has become increasingly rare throughout its northern range due to long-term habitat degradation (Parker and McKee 1984). We recommend upgrading this species' candidate designation to endangered status.

Hickory shad

The hickory shad (*Alosa mediocris*) had been reported by Fowler (1919) in the lower Delaware River, but did not appear in any survey we included in this report. In an April 1997 survey, one hickory shad was collected from the Delaware River at Yardley (M. Kaufmann, personal communication, The Pennsylvania Fish and Boat Commission).

Presently, this species has been given candidate status, but given the long period between historic and recent collections and the low abundance of this species, endangered status should be considered. This species can be found throughout the Chesapeake Bay, but is one of the least abundant of the alosids (Lee et al. 1980).

Cisco – Map 14

The cisco, or lake herring (*Coregonus clupeaformis*), once considered extirpated by Cooper (1985) has been collected by the PFBC. The only historical record of the species is from a collection in 1957 near Lake Erie (Cooper 1983). At present, no special designation is given to this species in Pennsylvania, but given its rarity, endangered status appears most appropriate.

Silver chub – Map 17

The silver chub (*Macrhybopsis storeriana*) was collected near Lake Erie by Cooper in 1971 (ELC database) and in the Ohio River by the U.S. Fish and Wildlife Service in 1986 (PSU database) and the PFBC in 1990 and 1991 (PFBC database). An historical account by Evermann and Bollman (1885) describes this species as “abundant” in the Monongahela River.

Gravel chub – Map 18

Since 1925, the gravel chub (*Erimystax x-punctatus*) has only been reported at nine locations in the Allegheny River drainage (Argent et al. 1997). Cooper (1983) reports that this species is rare and widely scattered in Pennsylvania. In Kansas, this species is considered endangered (Platt 1974) and is now extirpated from many localities throughout the United States (Lee et al. 1980). The gravel chub is believed to be extirpated from Canada; the last specimens were captured in 1958 (Parker and McKee

1987b). This species is very sensitive to siltation and its presence may be indicative of good water quality (Scott and Crossman 1973).

Redfin shiner – Map 19

The redfin shiner (*Lythrurus umbratilis*) is endemic to North America and extends its range to northwestern Pennsylvania. Only three accounts of the redfin shiner have been reported during the last 30 years from collections made in the Erie and Allegheny drainages. The small population collected by Raney in the late 1930's appears to have disappeared from Pennsylvania's fauna (Raney 1938, Argent et al. 1997). Populations in Wisconsin have been given "watch status" (Les 1979); in Michigan are considered rare (Hubbs and Cooper 1936); and in New York are considered uncommon (Smith 1985). The major limiting factors for this species appear to be spawning habitat degradation, predation risk by piscivorous fishes, sensitivity to acid precipitation, and the distribution of sunfish nest hosts (Noltie 1989).

Bridle shiner – Map 21

The bridle shiner (*Notropis bifrenatus*), is now rarely taken in the Delaware drainage. It was reported in 1906 by Dr. W. Stone and H. W. Fowler in the Susquehanna River at York Furnace (ANSP database). Recent collection efforts document this species in Marshalls Creek, Monroe Co. and Pond Creek, a small tributary to Marshalls Creek. (Criswell 1998). Marshalls Creek populations appear very healthy and number in low thousands (Criswell 1998). Other historical sites that were resampled by Criswell (1998) yielded no fish. In October 1997, the EPA's Emergency Response Team, their consultant, USFWS, and the PFBC conducted electrofishing surveys along Aquashicola Creek, Carbon Co. that produced two bridle shiners (M. Hartle, personal communication,

The Pennsylvania Fish and Boat Commission). Currently this species is listed as candidate in Pennsylvania, and of special concern in North Carolina, Virginia, and Vermont (Schmidt 1996, Terwilliger 1991). Because of its seemingly rapid decline in Pennsylvania endangered status appears appropriate for this species. Existing populations will need to be monitored.

River shiner – Map 22

Historical accounts of the river shiner (*Notropis blennioides*) stem from collections in the Ohio and Monongahela rivers (Evermann and Bollman 1885, Krumholz 1981). The PFBC collected this species from the Conneaut Creek, Erie Co., the North Fork of the Little Beaver Creek, Beaver Co., and the Ohio River, Beaver Co. in 1990, 1992, and 1994, respectively.

Ghost shiner – Map 23

Two ghost shiner (*Notropis burchanani*) specimens were reported at one site in Pennsylvania by Cooper (1983), in 1978 from the Monongahela River near Elizabeth. Pennsylvania is this species' northeastern most limit. Upgrading its status from candidate to endangered may be appropriate until new surveys can be conducted to verify this species' presence in Pennsylvania.

Ironcolor shiner - Map 24

The ironcolor shiner (*Notropis chaleybaeus*) had historically been collected by in the Schuylkill River (Cope 1869). The ANSP maintains collections by Fowler taken from Mill Creek and the Delaware River, and collections by Mattern from Martin's Creek near Bangor. Thought extirpated, this species has been recently collected in Marshalls Creek, Monroe Co. near East Stroudsburg and Pond Creek (J. R. Stauffer, Jr., personal

communication, The Pennsylvania State University, University Park, PA). These are the only populations known in Pennsylvania (Criswell 1998) therefore, endangered status is recommended.

Blackchin shiner – Map 26

The only contemporary record of the blackchin shiner (*Notropis heterodon*) is from collections made by Cooper (1983) in 1977 from Pleasant Lake, Erie Co. This species was first reported by Raney (1938) from collections made in Conneaut Lake, Crawford Co. Currently listed as a candidate species, we recommend endangered status, but new surveys of this species should be done to validate its presence in Pennsylvania.

Longnose sucker – Map 28

The longnose sucker (*Catostomus catostomus*), although widespread in western United States and Canada (Lee et al. 1980), remains as a small relict population in the headwaters of the Youghiogheny River in southern Pennsylvania, northern Maryland, and northern West Virginia (Stauffer et al. 1995). It listed as endangered in all three states and also Ohio (Schmidt 1996). Our results indicate that this species is appropriately listed at this time.

Bigmouth buffalo – Map 30

The PFBC, between 1986 and 1997 documented the bigmouth buffalo (*Ictiobus cyprinellus*) during 14 separate collections, from Presque Isle Bay, Erie Co. Cooper (1983) reported only one validated collection from 1925 at Erie. This species is widespread in the Mississippi River system, but limited in the Great Lakes system (Goodchild 1990a). Unlike many other fishes, the bigmouth buffalo appears to be tolerant of turbidity and siltation, but may be limited by parasites and suitable spawning

areas (Goodchild 1990a). Pennsylvania's populations appear largely dependent on the health of the Lake Erie ecosystem.

Black bullhead – Map 33

Raney and Hollibaugh (CU database), Cooper, Heard (1995), and the US Fish and Wildlife Service (USFWS) made historical and recent collections of the black bullhead (*Ictalurus melas*) in 1968. Raney's (1938) collections were made at six localities in both the Beaver River, Mercer and Butler Counties, and Puckety Creek, near New Kensington, Westmoreland Co. Other catfishes were found in association with the reported black bullhead specimens (Raney 1938). Cooper's collection yielded 14 specimens from the N. Fork of Little Beaver River, while the USFWS collection yielded 3 specimens.

Mountain madtom – Map 34

French Creek, Crawford Co. yielded recent specimens of recent mountain madtom (*Noturus eleutherus*) collections. Historic Shenango River populations of this species appear to have declined (Raney 1938, Argent et al. 1997). Cooper (1985) classified this species as "vulnerable" because of its limited distribution and because of its sensitivity to ecological perturbations. Currently this species is classified as threatened in Pennsylvania and endangered in Ohio (Schmidt 1996), but because of its limited distribution we recommend upgrading its status to endangered in Pennsylvania.

Tadpole madtom – Map 35

Fowler (1919) documented the tadpole madtom (*Noturus gyrinus*) from several collections in southeastern Pennsylvania. Five contemporary collections of this species are reported here from Oil Creek, Crawford Co.; Lake Canadohta, Crawford Co.; Lackawaxen River, Wayne Co.; and Little Wapwallopen Creek, Luzerne Co. This

species has a u-shaped distribution which extends from Quebec south to Florida, along the Gulf of Mexico, and north along the Mississippi River to Manitoba (Lee et al. 1980). Because of its limited distribution in Pennsylvania we recommend upgrading this species' status from candidate to endangered.

Northern madtom – Map 37

A collection by Jay Stauffer, Jr. in 1985 from French Creek at Venango, is the most recent in our database for the northern madtom (*Noturus stigmosus*) (PSU database). This species is listed as threatened in Pennsylvania (Anon. 1998), “of special concern” in Kentucky, Mississippi, Tennessee, and West Virginia, and legally protected in Michigan and Ohio (Johnson 1987). Low population numbers in other collections suggest that this species has specific habitat requirements (Goodchild 1993b). In Ohio for example, this species is currently listed as endangered (Schmidt 1996). After reviewing the Pennsylvania collections, we recommend changing this species' status from threatened to endangered.

Burbot – Map 38

The burbot (*Lota lota*) is widely distributed throughout North America and Canada, but exists in relict populations in north-central Pennsylvania and the headwaters of the Susquehanna River in New York (Cooper 1983). Much like the longnose sucker, the burbot has a limited distribution in Pennsylvania. Currently, burbot within Lake Erie however, are relatively common (R. Kenyon, personal communication, The Pennsylvania Fish and Boat Commission). Commercial landings of this species between March and December 1997 totaled 8,910 for Lake Erie (R. Kenyon, personal communication, The Pennsylvania Fish and Boat Commission). The PFBC has issued a new Lake Erie

regulation that allows burbot to be spearfished, but inland-riverine populations that are currently classified as threatened should be considered endangered.

Threespined stickleback – Map 40

Cooper reported only one specimen of this species in his survey from Pennypack Creek, a tributary of the Delaware River, 1969 (ELC database). The PFBC reported this species from a collection in 1990 on Cedar Creek, a tributary to Lehigh River, Lehigh Co.

Banded sunfish – Map 42

The banded sunfish (*Enneacanthus obesus*) has been collected along the Atlantic coast (Lee et al. 1980), but in Pennsylvania it has only recently been collected by Cooper in 1978 from Crum Creek, a tributary to the Delaware River (ELC database) and Robins and Mehring in 1948 from Stony Creek in Dauphin Co. (Cornell database).

Warmouth – Map 43

This species is widely distributed in ponds, lakes and occasionally, streams throughout the eastern United States (Cooper 1983). The PFBC collected warmouth from the Shenango River, Crawford Co. in 1984 (PFBC database) and Cooper collected warmouth (*Lepomis gulosus*) from the Shenango River, Crawford Co.; Dunkard Creek, Greene Co.; and Lackawannock Creek, Mercer Co. in 1975, 1976, and 1981 respectively (ELC database). The warmouth, being a warmwater species, may be limited by seasonally cold water, and predation by larger fishes such as largemouth bass (*Micropterus salmoides*) (Crossman et al. 1996). Siltation and other factors limiting the growth of aquatic vegetation may pose a threat to warmouth (Smith 1979). Currently listed as a candidate species, we recommend endangered status because of limited distribution within several Pennsylvania lakes and streams.

Longear sunfish – Map 44

The longear sunfish (*Lepomis megalotis*), believed extirpated (Cooper 1985), had historically been found in northwestern Pennsylvania (see Cooper 1983), but accounts of this species include three major drainage basins. The PFBC reported this species from Valley Creek, Chester Co. in 1976, South Branch of Roaring Creek, Columbia Co. in 1977, and Dunkard Creek, Greene Co. in 1979 (PFBC database). Two historic collections taken by G. O. Hollibaugh document the longear sunfish in the Shenango River, Mercer Co. in 1935 (UMMZ database and Cornell database). The ANSP holds two collections of the longear sunfish, one taken by G. MacReynolds and H. W. Fowler in 1923 from Neshaminy Creek, Bucks Co. and another taken by P. E. Stacey and R. P. Hay in the Susquehanna River in 1980 (ANSP database).

The longear sunfish is common throughout the central United States with three subspecies now recognized (Meredith and Houston 1988). Specimens found in Pennsylvania are at the fringe of this species' distribution (Lee et al. 1980). The longear sunfish appears intolerant of silt (Carlander 1977) and prefers aquatic vegetation in clear shallow water (Scott and Crossman 1973). Competition with other sunfishes such as the bluegill (*Lepomis macrochirus*) and green sunfish (*Lepomis cyanellus*) for food and breeding areas may also limit this species (Carlander 1977).

Eastern sand darter – Map 45

Early collections reported by Raney (1938) were from French Creek at Venango, Crawford Co., taken by Ernest Lachner and Kellar Shelar. Cooper reported collecting four specimens in French Creek at Venango, in 1946 and five specimens in 1948 (ELC database). Cooper also collected one specimen of this species in Lake Erie, Erie Co., at

Presque Isle, in 1975 and two specimens in French Creek, Erie Co., two miles West of Mill Village in 1977 (ELC database). Early accounts by Evermann and Bollman (1885) were from the Monongahela River. Recent collections by Robert Criswell in 1992 have documented several other locations in French Creek, Crawford Co. where the eastern sand darter is present.

The eastern sand darter (*Etheostoma pellucida*) was classified as endangered in Ohio, Michigan, and New York and listed as a species of special concern in Indiana and Kentucky (Johnson 1987); we concur with the current endangered status for Pennsylvania's populations. Recent accounts of this species indicate its decline and extirpation throughout most of its range (Holm and Mandrak 1996). Factors contributing to this darter's decline in other states include siltation of critical habitat, impoundments, chemical pollution, and acid mine drainage (Smith 1971, Barnes 1979).

Iowa darter – Map 47

Pennsylvania represents the southeastern edge of this species' range. Historic collections made by Raney, Hollibaugh, Cannon, Bollman, Greeley, Greeley, Hollibaugh and Hubbs, and Trautman document this species from Honey Creek, a tributary of Little Beaver Creek in 1934; Shenango River, north of Mercer in 1935; Yellow Creek, a tributary of Neshannock Creek in 1934; Monongahela River, and its tributaries at Monongahela near Lock #9 in 1885; French Creek at Wattsburg in 1931; French Creek near Wattsburg in 1932; Little Bull Creek, east of Tarentum in 1935; and French Creek, near Wattsburg and near the NY state line in 1934, respectively (Argent et al. 1997). Collections taken in recent years are those of Cooper (ELC database) from Pleasant Lake, near Wattsburg in 1977; Lake La Boeuf at Waterford in 1977; Lake Erie, Presque Isle

Bay, at the mouth of Mill Creek in 1982; Cascade Creek, upstream from mouth in Presque Isle Bay in 1982; and the west end of Presque Isle Bay on north shore, Lake Erie in 1982.

Recommended Threatened fishes

The majority of threatened fishes we identified using our classification scheme reside in the headwaters of the Allegheny River and the major rivers of Pennsylvania (Figure 3). Pymatuning Reservoir holds the only Pennsylvania populations of the spotted sucker (*Minytrema melanops*). The discussion that follows details each species we recommend for listing as threatened in Pennsylvania. Distribution maps for each species are in Appendix A.

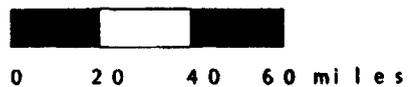
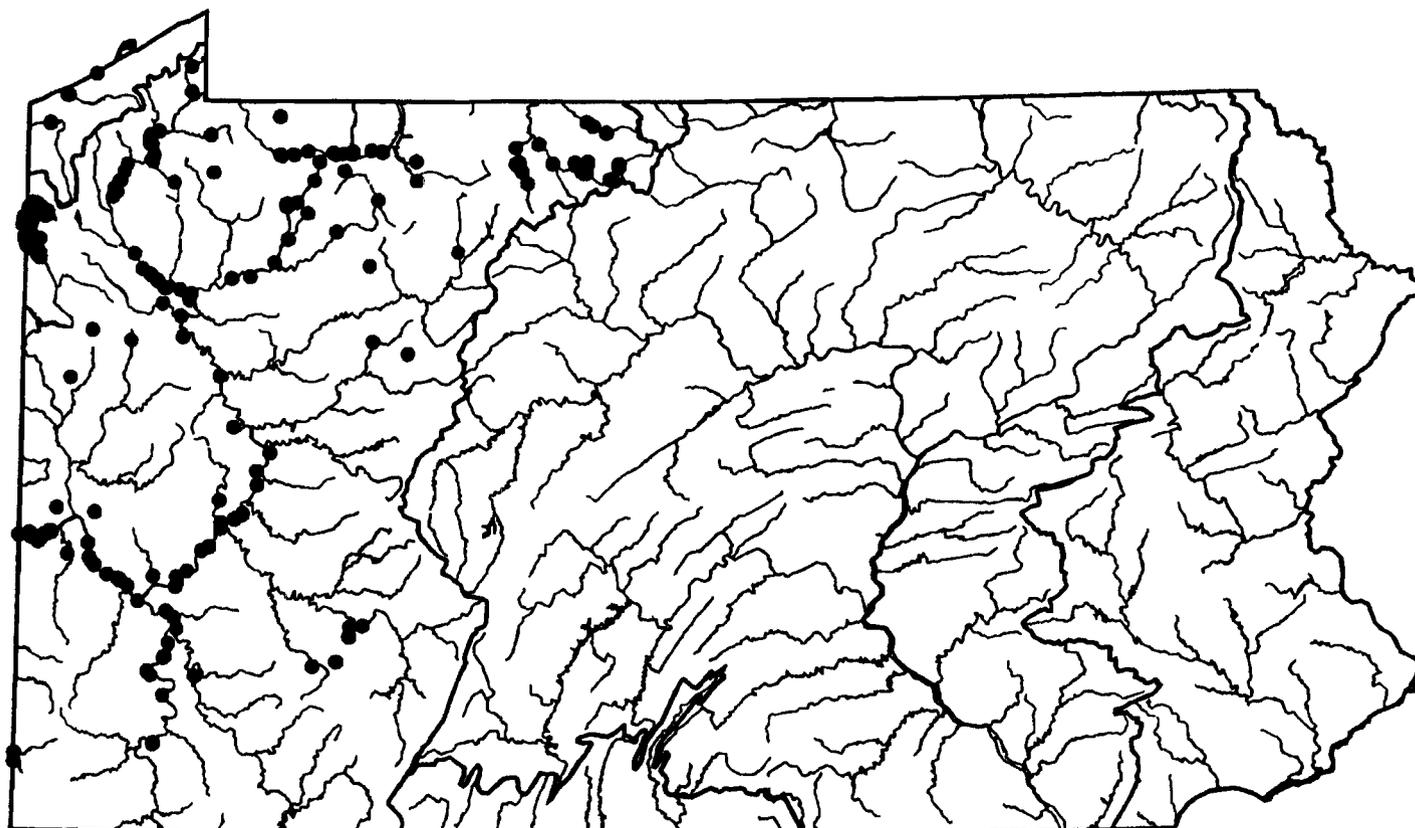
Mountain brook lamprey – Map 3

It appears that the mountain brook lamprey (*Ichthyomyzon greeleyi*) has been extirpated from many of the northwestern Pennsylvania streams it once inhabited, but several other populations currently exist in the state (Argent et al. 1997). In neighboring Ohio, this species is currently listed as endangered (Schmidt 1996). Many of the collections shown in the map are from the mid-1970s (Map 48, Appendix A). Our analysis indicated that this species could be considered candidate but after further review by an expert panel it was recommended that this species continue to be listed as threatened. This decision was spurred by the fact the no specimens have been collected since 1980 (Appendix B). New surveys should be undertaken, concurrent with another review of this species' status.

Skipjack herring – Map 11

The skipjack herring (*Alosa chrysochloris*), thought extirpated by Cooper (1985)

Figure 3. - Distribution of proposed threatened fishes.



and currently listed as a candidate species, has been collected at one site in the Allegheny River and several sites in the Ohio River (PFBC database). It occurs throughout the Mississippi River drainage in clear, deep water (Lee et al. 1980). Historical accounts of this species from the Ohio River can be found in Rafinesque (1820), who stated this species “seldom goes as far as Pittsburgh.” We recommend threatened status.

Goldeye – Map 12

Thought extirpated by Cooper (1985), the goldeye (*Hiodon alosoides*) has been collected at five locations by the PFBC in the Allegheny and Ohio Rivers. It prefers the quiet, slow-moving waters of large rivers and the muddy shallows of large lakes. Currently a candidate species in Pennsylvania, the goldeye should be re-listed as threatened.

Mooneye – Map 13

Considered extirpated by Cooper (1985), the mooneye (*Hiodon tergisus*) has been collected by the PFBC from 1987 to present. This species prefers large rivers, inhabiting portions of the Allegheny, Ohio, Monongahela, and Youghiogheny rivers. Presently the mooneye is considered a candidate species in Pennsylvania (Anon. 1998) and threatened in New York (Schmidt 1996). Given this species' limited distribution we recommend threatened status.

Bigmouth shiner – Map 25

The bigmouth shiner (*Notropis dorsalis*), found in a small isolated population in northcentral Pennsylvania, has a broad midwestern U.S. distribution. Habitat loss and human disturbance that increase siltation levels appear to be key limiting factors for this species (Clady 1976, Starrett 1951). Currently unlisted, we recommend threatened status.

Southern redbelly dace – Map 27

The most recent collections of the southern redbelly dace (*Phoxinus erythrogaster*) were from Cooper in 1973 from Blue Eye Run, Warren Co. Pennsylvania is the on the eastern fringe of this species' distribution and it may in fact be currently extirpated from the state, until new collections can be made we recommend threatened status.

Smallmouth buffalo – Map 29

The smallmouth buffalo (*Ictiobus bubalus*) has been collected frequently in the large rivers of the Allegheny drainage by the PFBC (PFBC database) Few historical collections of this species have been made in Pennsylvania (Cooper 1983), which may be a reflection of the difficulties associated with sampling large rivers. Currently, this species receives candidate status (Anon. 1998), but we believe threatened status may be more appropriate.

Spotted sucker – Map 31

Accounts of the spotted sucker in Pennsylvania are from 144 collections made by the PFBC in Pymatuning Reservoir. This species was collected in both sanctuary and public access waters. The spotted sucker is widely dispersed throughout the Mississippi River drainage, but appears near the edge of its range in Pennsylvania. Sampling of Pymatuning Reservoir tributaries may reveal other sites where this species occurs. Threatened status for this species appears most appropriate given these data, because it is widely distributed in Pymatuning Reservoir but appears geographically limited.

Brindled madtom – Map 36

The brindled madtom (*Noturus miurus*), was never historically abundant in

Pennsylvania and is now limited to several locations in the Erie and upper Allegheny drainages. Parker and McKee (1987a) document this species from the Canadian side of Lake Erie and its tributaries and the tributaries of Lake St. Clair. Very little is known of factors which may limit this species, but Trautman (1981) noted that siltation may negatively affect its numbers. Threatened status appears most appropriate given these data.

Bluebreast darter – Map 46

This species is sporadically distributed throughout its range and absent from many rivers within its range (Page 1983). Found in northwestern Pennsylvania from collections made in the French Creek watershed and portions of the upper Allegheny River, the bluebreast darter (*Etheostoma camurum*) typically inhabits large clean rivers with coarse gravel substrates (Kuehne and Barbour 1983). This species is currently listed as endangered in New York (Schmidt 1996). The current status of threatened appears most appropriate for this species at this time, but monitoring efforts should continue to ensure this species' presence in Pennsylvania.

Spotted darter – Map 48

Pennsylvania's spotted darter (*Etheostoma maculatum*) populations appear throughout the French Creek watershed. Like many other darters, this species has a disjunct North American distribution (Lee et al. 1980). Typically, the spotted darter inhabits gravelly riffles of large streams (Kuehne and Barbour 1983). Excessive sedimentation and siltation may significantly reduce the availability of large, loose, and rough substrates this species requires for refugia and reproduction (Kessler and Throp

1993). Currently listed as endangered, we believe that this species can be down listed to threatened.

Tippecanoe darter – Map 49

The Tippecanoe darter (*Etheostoma tippecanoe*) has been reported from several locations in the French Creek watershed and several sites along the Allegheny River in northwestern Pennsylvania. It appears in disjunct populations throughout its range (Lee et al. 1980), extending no further north than Pennsylvania. Because this species persists in so few places over such a large area within the United States, it is hypothesized that this darter has suffered enormous losses (Kuehne and Barbour 1983). This species prefers riffle areas of large rivers with moderate current, clean gravel, and depths between 10-50 cm (Kuehne and Barbour 1983). The major factors influencing this species' success in Pennsylvania are habitat degradation of large rivers, siltation, and pollution. Currently listed as endangered, we believe that this species can be down listed to threatened.

Channel darter – Map 50

The channel darter (*Percina copelandi*) has a wide but disjunct North American distribution, occurring as far south as Louisiana and as far north as Lake Ontario tributaries (Goodchild 1993a). In Pennsylvania, this species is found in the upper Allegheny River and its tributaries, and is considered threatened (Anon. 1998). The channel darter has been listed as rare in West Virginia (Miller 1972), "of special concern" in Kentucky and Quebec, protected in Michigan, and endangered in Ohio (Johnson 1987, Schmidt 1996). Factors which may limit this species include: communal spawning behavior, access to suitable spawning areas, degradation of suitable habitat, and

frequency of spawning conditions (Starnes et al. 1977, Trautman 1981, Goodchild 1993a). We concur with the currently listed status, threatened.

Gilt darter – Map 51

Recent collections of the gilt darter (*Percina evides*) indicate that this species is more widely distributed than previously thought. Several Allegheny River tributaries, the Allegheny River proper, and French Creek harbor this species. The Pennsylvania populations appear quite disjunct from those reported for other portions of this species' range (Kuehne and Barbour 1983). Currently, this species is designated as endangered in New York and extirpated from Ohio (Schmidt 1996). We concur with the currently listed status, threatened.

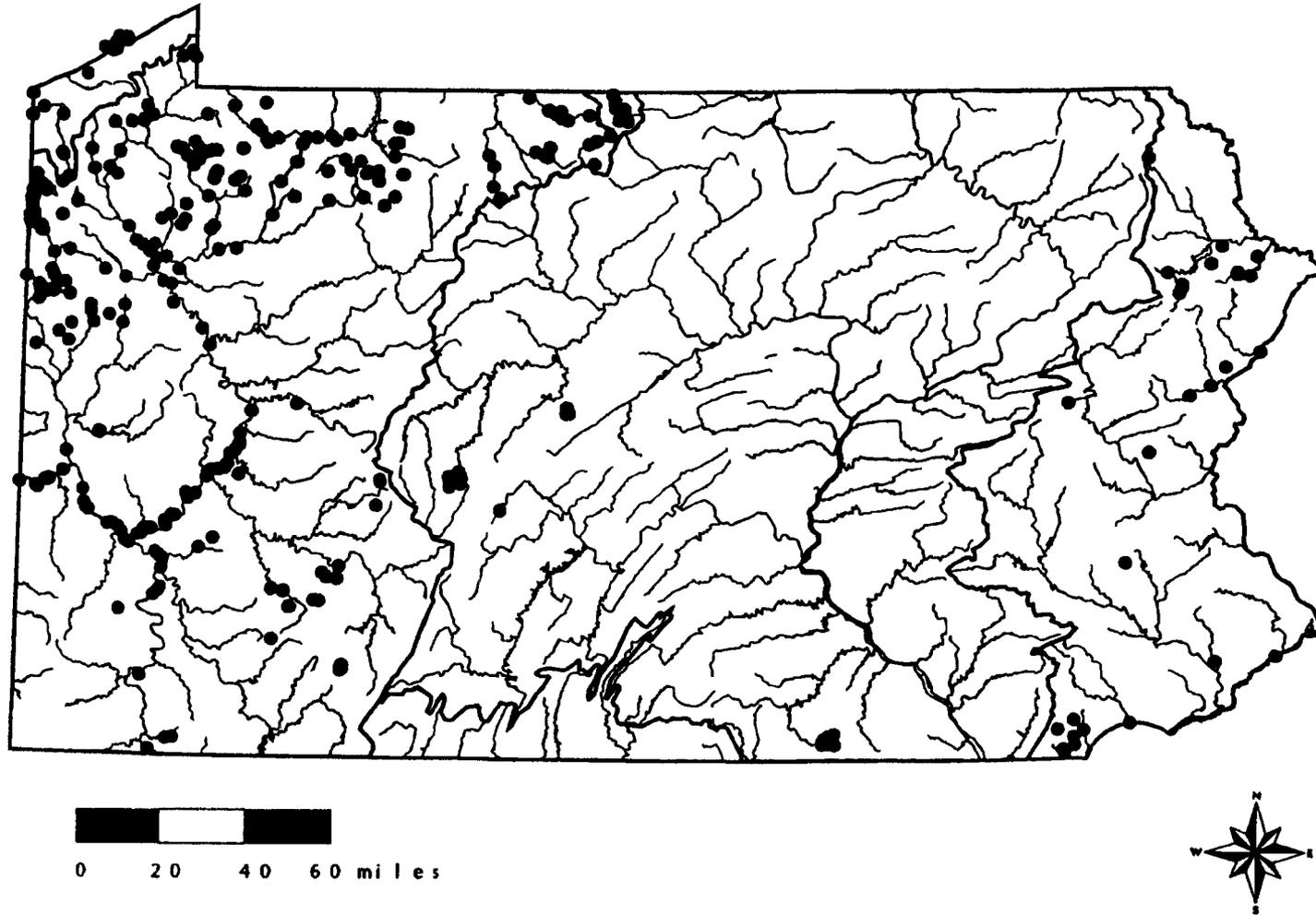
Longhead darter – Map 52

Pennsylvania is the northernmost region where this species occurs. Accounts of the longhead darter (*Percina macrocephala*) are largely from the Allegheny River and French Creek (PSU and PFBC databases). Like many other darters, the longhead requires clean gravel and is typically collected above or below riffles in clear moderate-sized rivers (Kuehne and Barbour 1983, Page 1983). It is presently considered extirpated from neighboring Ohio (Schmidt 1996), but threatened status appears most appropriate for the Pennsylvania populations.

Recommended Candidate fishes

The majority of candidate fishes we identified using our classification scheme reside in the headwaters of the Allegheny River, the major rivers of Pennsylvania, and the Delaware Estuary (Figure 4). The discussion that follows details each species we

Figure 4. - Distribution of proposed candidate fishes.



recommend for listing as candidate in Pennsylvania. Distribution maps for each species can be found in Appendix A.

Ohio lamprey – Map 1

The current threatened status afforded this species does not appear warranted at this time; because recent collections of the Ohio lamprey (*Ichthyomyzon bdellium*) indicate that it is common in the French Creek watershed and several tributaries to the Allegheny River. An earlier collection by Cooper (1983), near Pittsburgh, is now believed to be the least brook lamprey (*Lampetra aepyptera*) (E. L. Cooper, personal communication), which indicates that this species' range is limited to northwest and north central Pennsylvania. As of 1990, Ohio populations of this species were listed as endangered (ODNR 1990).

Least brook lamprey – Map 4

The least brook lamprey (*Lampetra aepyptera*) occurs in southwestern Pennsylvania. The majority of the records shown in Map 49 are from Cooper, who collected this species from several small streams in Westmoreland and Allegheny counties in the mid-1970s (ELC database). Candidate status appears appropriate at this time, but new surveys should be undertaken to assess these populations.

American brook lamprey – Map 5

The American brook lamprey (*Lampetra appendix*) is found in northwestern Pennsylvania. It has frequently been collected since 1950, but its range appears to be shrinking in some areas. In Ohio, this species is listed as state endangered (Schmidt 1996). Given these data, we recommend candidate status.

Longnose Gar – Map 9

The longnose gar (*Lepisosteus osseus*), a candidate species, is the most widely distributed gar in Pennsylvania. It can be found in the upper Monongahela River and the Ohio River, near Pittsburgh. It appears to be extirpated from both the Delaware and Susquehanna drainages. After applying our ranking scheme to this species, we believe that candidate status is most appropriate at this time.

Bowfin – Map 10

The bowfin (*Amia calva*) is currently listed as a candidate species in Pennsylvania and has a sporadic distribution. It has been collected from the Delaware River, Big Pond and Misery Bay near Presque Isle Bay, Lake Marburg, Black Moshannon Lake, Glendale Lake, Lake Leboeuf, and Lake Somerset. This species can readily be found in the central and eastern United States (Lee et al. 1980). Even though this species has a disjunct distribution, we believe that candidate status is most appropriate.

Central mudminnow – Map 15

The central mudminnow (*Umbra limi*) is limited to the upper Ohio and Erie drainages in Pennsylvania. It is however, quite common in lakes and ponds in central and eastern North America (Scott and Crossman 1973). Martin-Bergmann and Gee (1985), report that mudminnows are habitat specialists and resource generalists, inhabiting slow-moving streams and utilizing a variety of cover types and food items. Presently unlisted in Pennsylvania, our analysis indicates that threatened status may be appropriate; however, because of this species' cryptic habitat candidate status has been recommended by an expert panel.

Eastern mudminnow – Map 16

The eastern mudminnow (*Umbra pygmaea*) is currently found in several locations throughout the Delaware River, but has not been found in many historic sites. This species is currently unlisted in Pennsylvania. Like the central mudminnow, our analysis indicates that threatened status may be appropriate; however, candidate status has been recommended by an expert panel because of this species' cryptic habitat

Hornyhead chub – Map 20

The hornyhead chub (*Nocomis biguttatus*), has only been found in sporadic locations of the Allegheny and Erie drainages. We question the validity of the Delaware drainage sites, as this species tends to have a broad midwestern distribution (Cooper 1983). Recent collection efforts failed to document historical accounts by Raney (1938) (in Argent et al. 1997). This species prefers small gravelly streams and rivers (Scott and Crossman 1973). Mud and silt bottoms are not tolerated and turbidity limits the sight feeding ability of this species (Lachner and Jenkins 1967, 1971). Agricultural practices may also play a role in limiting this species' success (Trautman 1981). The candidate listing afforded this species appears appropriate at this time.

River redhorse - Map 32

While the river redhorse (*Moxostoma carinatum*) failed to meet our criteria for continued listing as a candidate species, it was the general feeling of the Fishes Technical Committee that this fish continue to receive candidate status in Pennsylvania. Presently, this species appears throughout the Ohio River drainage.

Brook silverside – Map 39

The brook silverside (*Labidesthes sicculus*) is widely distributed throughout

central North America and Florida (Goodchild 1990b), but in Pennsylvania occurs in small disjunct populations of the Ohio River drainage. It was listed as rare in both Maryland and Pennsylvania (Miller 1972). This species is very sensitive to siltation and may even disappear from waters that become too turbid (Goodchild 1990b). Because of their one-year life cycle, any event that hampers a particular year class could completely decimate a brook silverside population. Using our classification scheme, candidate status appears most appropriate at this time.

Brook stickleback – Map 41

Cooper (1983) stated that the brook stickleback (*Culaea inconstans*) species was “rare, though locally abundant in Pennsylvania.” Present collections of this species document its presence in Pymatuning Reservoir, Presque Isle Bay, Shenango River, and Allegheny River. While no special designation is given this species in Pennsylvania, we recommend candidate status.

State listed fish that are now believed extirpated from Pennsylvania

Silver lamprey

The silver lamprey (*Ichthyomyzon unicuspis*) is currently listed as candidate in Pennsylvania, threatened in Ohio, and status undetermined in West Virginia (Schmidt 1996). Records from the Cornell database show two historical accounts, one from Little Neshannock Creek, Mercer Co., on 20 May 1935 by Raney and Roberts and one from Lake Erie, July 1950 by Fred C. Ralph. Until new collections document this species' presence in Pennsylvania we recommend listing this species as extirpated.

Deepwater sculpin

Deepwater sculpin (*Myoxocephalus thompsoni*) is currently listed as a candidate

species in Pennsylvania (Anon. 1998) and endangered in New York (Schmidt 1996). Recent attempts to collect this fish reinforce the notion that this species is currently extirpated from Lake Erie (Parker 1988) and Pennsylvania. The only recent Pennsylvania collection of this species was reported in Cooper (1983) from Fowler's early work. Healthy populations of this species do appear to persist in northern area of Canada (Parker 1988). Factors that appear to limit this species include declining water quality, loss of suitable habitat, and predation and competition from lake trout and burbot (Parker 1988).

Spoonhead sculpin

Spoonhead sculpin (*Cottus ricei*) is currently listed as a candidate species in Pennsylvania and endangered in New York (Schmidt 1996). Even though this species has not been collected in Pennsylvania since the early 1900s (Cooper 1983), several populations appear to thrive in Canada (Houston 1990). The key limiting factor for this species is the availability of deep cold water lakes (Houston 1990). The continued listing of this species as candidate appears unwarranted until new collections have been made.

Questionable Pennsylvania fishes with limited distributions

The following are fishes that have been reported in Pennsylvania with limited distributions, but which should not be included in Pennsylvania's fish list. These fishes are all believed to be misidentified.

Bullhead minnow – Map 53

The bullhead minnow (*Pimephales vigilax*), is believed to be extirpated in Pennsylvania (Cooper 1985). The two collections reported in Appendix A at Cherry Run in 1979 and Horse Creek in 1982 are believed to be misidentified fishes. This species

was historically “abundant” in the Monongahela River (Evermann and Bollman 1885), but Cooper concluded that the Ohio drainage represented this species’ northernmost limit (Cooper 1983).

River carpsucker – Map 54

The records of the river carpsucker (*Carpionodes carpio*) collected by the PFBC in 1977 from Penns Creek, Centre Co. are more likely quillback (*Carpionodes cyprinus*). This species was reported in 1913 in the Beaver River near Pittsburgh (Fowler 1919), it is found today throughout the Mississippi River system, not the Susquehanna drainage.

Blue sucker – Map 55

Cooper (1983) reported the blue sucker (*Cycleptus elongatus*) collections made by Cope in the 1860s and other collections between 1925 and 1950. The collection reported here was taken by the PFBC in 1979 from Dunkard Fork of Wheeling Creek. Decline in abundance of blue suckers throughout their range has been attributed to habitat loss associated with construction of reservoirs and lock and dam systems (Robison and Buchanan 1988), siltation, pollution, reduced water velocity, loss of spawning habitat, and blocked migration routes (Beal 1963). The occurrence of this species in Dunkard Fork is highly questionable and without the benefit of voucher specimens cannot be included in Pennsylvania’s present-day fish fauna.

Greater redhorse - Map 56

The PFBC reports the greater redhorse (*Moxostoma valenciennesi*) from collections in Pithole Creek, a tributary to the Allegheny River in 1977; Hickory Run, a tributary to the Mahoning River in 1990; Presque Isle Bay in 1991; Shenango Lake in 1995; and Pymatuning Reservoir in 1992. Currently this species has no special

designation in Pennsylvania, but is listed as state endangered in neighboring Ohio (Schmidt 1996). It was the general feeling of the Fishes Technical Committee that this species may have been incorrectly identified and as such needs to be further sampled before a status review.

Blackbanded sunfish – Map 57

The blackbanded sunfish (*Enneacanthus chaetodon*) is believed to be extirpated from Pennsylvania (Cooper 1985). The collections reported in Appendix A from the Lackawaxen River in the Delaware drainage (PSU database) in 1987 are now believed to be bluespotted sunfish (*Enneacanthus gloriosus*). Previously blackbanded sunfish had been reported by Fowler (ANSP database) in the lower Delaware River in 1898. The blackbanded sunfish is more common to the east and south of Pennsylvania (Lee et al. 1980).

Orangespotted sunfish – Map 58

In 1979, the PFBC collected an orangespotted sunfish (*Lepomis humilis*) specimen, from the North Fork of Dunkard Creek. This specimen has since been described as a *Lepomis* hybrid, possibly a green sunfish (*Lepomis cyanellus*) hybridizing with a pumpkinseed (*Lepomis gibbosus*). The orangespotted sunfish is widely distributed in the eastern-central United States occurring throughout the Mississippi River and its tributaries (Lee et al. 1980). Like many species, the orangespotted sunfish may be limited by competition with other sunfishes for food (Cross 1967) and by predation from largemouth bass and muskellunge (*Esox masquinongy*) (Noltie 1990). Orangespotted sunfish, however, appear tolerant of some pollutants, and were considered the most tolerant among Oklahoma stream fishes (Cross 1950).

Fishes that are believed secure and may be down listed**Potomac sculpin – Map 59**

Several new collections of the Potomac sculpin (*Cottus girardi*) have been reported in the Susquehanna drainage (R. Criswell, personal communication). Collections made from February to July 1997 document Potomac sculpins from Cumberland, Franklin, Huntingdon, and Juniata counties. With this new information and the data listed in Appendix, we now believe that this species is secure in Pennsylvania and may be down listed from its present candidate status. concur with the current listing of candidate in Pennsylvania.

Fishes that were not considered in this analysis

Several fishes (Atlantic croaker, Atlantic menhaden, sheepshead minnow, weakfish, spot, striped mullet, naked goby, smallmouth flounder, hogchoker, and bay anchovy - see Argent et al. 1997 for distribution maps) have been collected recently by the PFBC and the ANSP in the Delaware estuary. These species are typically estuarine and it is largely unknown to what extent they are utilizing the Pennsylvania portions of the Delaware estuary. Further study is needed to determine if any special protection should be given to these species.

One new species, the checkered sculpin (*Cottus* sp.), is currently being described from Pennsylvania collections made in 1995 by Richard Raesly, Frostburg State University, Frostburg, MD (J. R. Stauffer, Jr., personal communication, The Pennsylvania State University, University Park, PA). This species is not included in our Analysis or Table 1, but may require endangered status in the future. A full description along with an official species name is expected soon (J. R. Stauffer, Jr., personal

communication, The Pennsylvania State University, University Park, PA).

The blue pike (*Stizostedion vitreum glaucum*) is recognized by us as a subspecies (Trautman 1981) of the walleye pike that inhabits Lake Erie, but given the available data we could not accurately assess its status in Pennsylvania. This fish is particularly difficult to identify satisfactorily because of the number of existing intergrades (Trautman 1981). New information should be collected to assess the populations of this fish.

Streams and Rivers with rare fishes

As part of our analysis, a listing of streams that support Pennsylvania's rare fishes is provided (Table 4). For a complete listing of streams that contained rare fishes refer to Appendix C. The following discussion provides an overview of specific streams that are critical to the maintenance of Pennsylvania's biodiversity and specific streams that support the only known Pennsylvania populations of selected species.

Allegheny River

The Allegheny River supports the highest diversity of rare fishes in Pennsylvania. Among its residents are 19 rare species, which include: the channel, bluebreast, longhead, gilt, tippecanoe, and spotted darters; the goldeye and mooneye; and the Ohio, American brook, mountain, and least brook lampreys. Because the Allegheny River is such a large system it provides a variety of habitats, but has suffered from reductions in water quality.

French Creek

French Creek proper harbors 10 rare fishes, half of which are darters (eastern sand, longhead, spotted, tippecanoe, gilt, bluebreast darters). Its tributaries also support a good many darters and other rare fishes. Probably no other watershed in Pennsylvania receives as much attention from scientists and environmentalists as French Creek, so the

Table 4. – Streams in Pennsylvania that support diverse communities of endangered, threatened, and candidate fishes. For a complete listing refer to Appendix C.

<u>Stream/River</u>	<u>Number of species</u>
Allegheny River	19
French Creek, Crawford Co.	10
Lake Erie, Presque Isle Bay, Erie Co.	8
Ohio River	8
Conneaut Creek	7
Monongahela River	6
Potato Creek, McKean Co.	5
E. Branch Oil Creek	5
Fishing Creek, Potter Co.	5
Delaware River	4
Mill Creek, Potter Co.	4
Oswayo Creek, Potter Co.	4
Pymatuning Lake, Mercer Co.	4
W. Branch French Creek	4
Delaware Estuary	3
Brokenstraw Creek	3
Oil Creek, Crawford Co.	3
Sandy Creek, Venango Co.	3
Bell Run, McKean Co.	3
Elk Creek, Erie Co., trib. to Lake Erie, near Lake City	3
Fourmile Run, Westmoreland Co.	3
Little Neshannock Creek, Mercer Co.	3
Marshalls Creek, Monroe Co.	3

future of rare fish communities in this region appears good.

Ohio River

The longnose gar, skipjack herring, goldeye, mooneye, silver chub, river shiner, brook silverside, and smallmouth buffalo reside in portions of the Ohio River. This river also serves as an important link to the Mississippi River and its fishes. Continued improvements in water quality from the Ohio's tributaries (i.e., the Allegheny and Monongahela rivers) should help to maintain its rare fishes.

Presque Isle Bay, Lake Erie

Bigmouth buffalo, spotted gar, longnose gar, eastern sand darter, and Iowa darter were all collected near Presque Isle Bay. In fact the only contemporary records for the bigmouth buffalo were from Presque Isle. Monitoring efforts need to continue.

Delaware River

The Delaware River historically supported two species of sturgeon and several other anadromous fishes. Of the Atlantic sturgeon, Jordan and Evermann (1902) remarked that "as late as 1820 thousands of this huge fish might have been seen in the lower Delaware." In recent collections however, only one site produced a specimen in a river, that in 1890 yielded an average catch of 60 fish per net and 5,023,175 pounds total catch (Jordan and Evermann 1902). The shortnose sturgeon, the only federally endangered fish found in Pennsylvania, inhabits the Delaware River. Today the Delaware River is still host to a variety of estuarine (e.g., inland silverside), anadromous (e.g., blueback herring), and freshwater fishes (e.g., eastern silvery minnow and bowfin), but the leviathans of the past are nearly extirpated from this region and many other fishes have declined. Future efforts in the Delaware River should focus on improved water

quality and habitat restoration. Continued sampling should also occur to monitor anadromous fish populations and estuarine species.

Marshalls Creek

Interest in Marshalls Creek, Monroe Co. is increasing with the recent discoveries of ironcolor and bridle shiner populations. The ironcolor shiner population is one of only two known in Pennsylvania. The bridle shiner is sympatric with the ironcolor shiner in Marshalls Creek and appears in good numbers.

Elk Lick Creek and Flaugherty Creek

These two streams support relict populations of the longnose sucker. Monitoring of these populations should continue to ensure their presence in Pennsylvania.

Pymatuning Reservoir

In addition to the brook silverside and central mudminnow, Pymatuning Reservoir harbors Pennsylvania's only known spotted sucker population. Currently, this reservoir is managed as a walleye (*Stizostedion vitreum*) fishery, but efforts should be taken to monitor the spotted suckers that remain and determine if this species inhabits any of Pymatuning Reservoir's tributaries.

DISCUSSION

Our ranking scheme provides an objective method to classify Pennsylvania's rare fishes based on a measure of overall geographic distribution and a measure of local abundance. In applying this technique we identified 65 fishes that could be considered rare, an increase from 30% to 40% of Pennsylvania's fishes. The majority of these rare fishes occupied Pennsylvania's large rivers and streams predominantly found in the upper Allegheny River drainage.

Members of several fish families appear to be more rare than other fish families in Pennsylvania (Figure 5). The families Cyprinidae, Percidae, Petromyzontidae, Catostomidae, and Ictaluridae contain the majority of the rare fishes we identified. Most of the species contained within the families Cyprinidae, Percidae, and Ictaluridae are short-lived, have relatively low fecundity, and occupy small geographic areas within the Commonwealth. Members of the families Petromyzontidae and Catostomidae however, are quite fecund and live 5 to 15 years. Because of the dichotomy associated with specific traits of these fishes and habitats occupied by them, conservation efforts will have to encompass a variety of habitat types and stream sizes. Therefore, future conservation efforts with respect to endangered, threatened, and candidate fishes should occur on larger spatial scales than stream reaches.

Conservation of Pennsylvania's rare fishes at the watershed scale would take into account the variety of streams and habitat types these fishes occupy. Using our ranking scheme, several watersheds appear to harbor more rare fishes than others do (Figure 6). While these findings are an important element to the maintenance of biodiversity, efforts should not stop here. Winston and Angermeier (1995) stated that a "conservation biologists' main goal should be preserving the viability of regional landscapes through maintaining their ecological integrity". To successfully accomplish this, we need a better understanding of how these rare fishes and their communities operate at larger spatial scales, such as the watershed scale.

RECOMMENDATIONS

After evaluating data collections listed in Table 1, we believe the following needs to be considered in an effort to protect Pennsylvania's rare fishes. First, a systematic

Figure 5. – Number of fishes in each Family proposed for listing as endangered, threatened, or candidate in Pennsylvania.

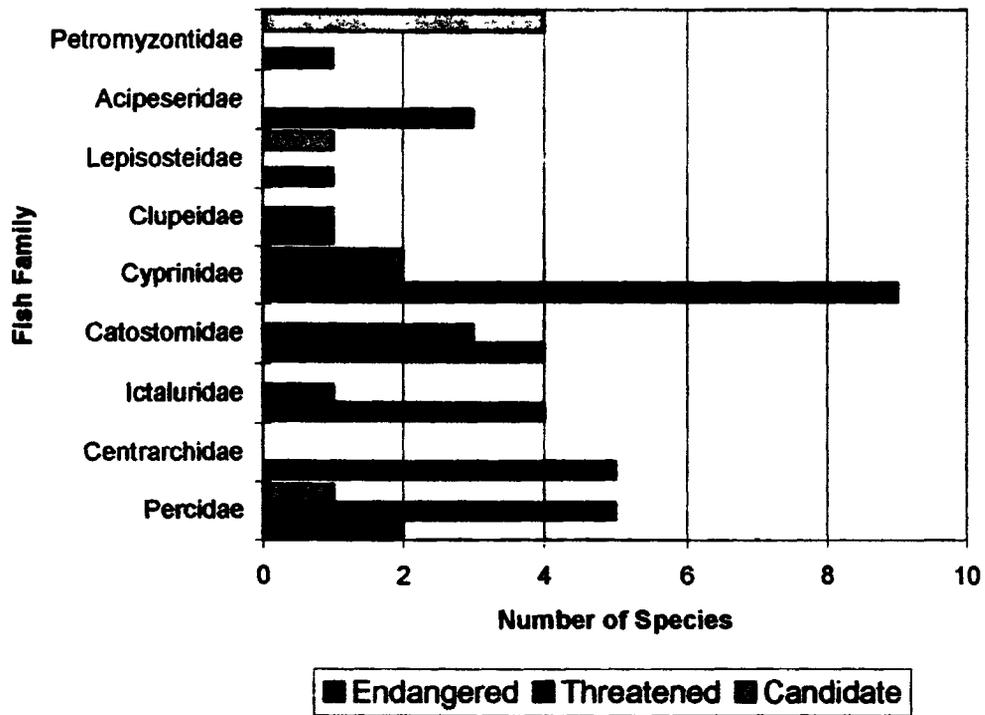


Figure 6 - Watersheds possessing rare fishes identified using a ranking scheme that includes both abundance and geographic data



monitoring and inventorying approach needs to be developed and maintained by a single organization. This may require the development of a new organization within the state or an extension of an existing organization's duties. The monitoring approach needs to include specific collection methods, precise site descriptions, voucher specimens, verified species identifications, and a measure of species abundance.

Second, new collections need to be made to verify the existence of those fishes whose records appear to be in question (e.g., greater redhorse) and those fishes that have not been collected in Pennsylvania for at least the last 10 years (e.g., Atlantic sturgeon). Such collections will help to refine the list of rare fishes and provide needed abundance data for other fishes.

Lastly, species classifications need to be reviewed at some specified time interval and appropriate measures need to be outlined with regards to the conservation or restoration of imperiled species and their habitats. More research will need to be done on several species to document their specific habitat requirements in Pennsylvania and to assess the suitability of available habitat.

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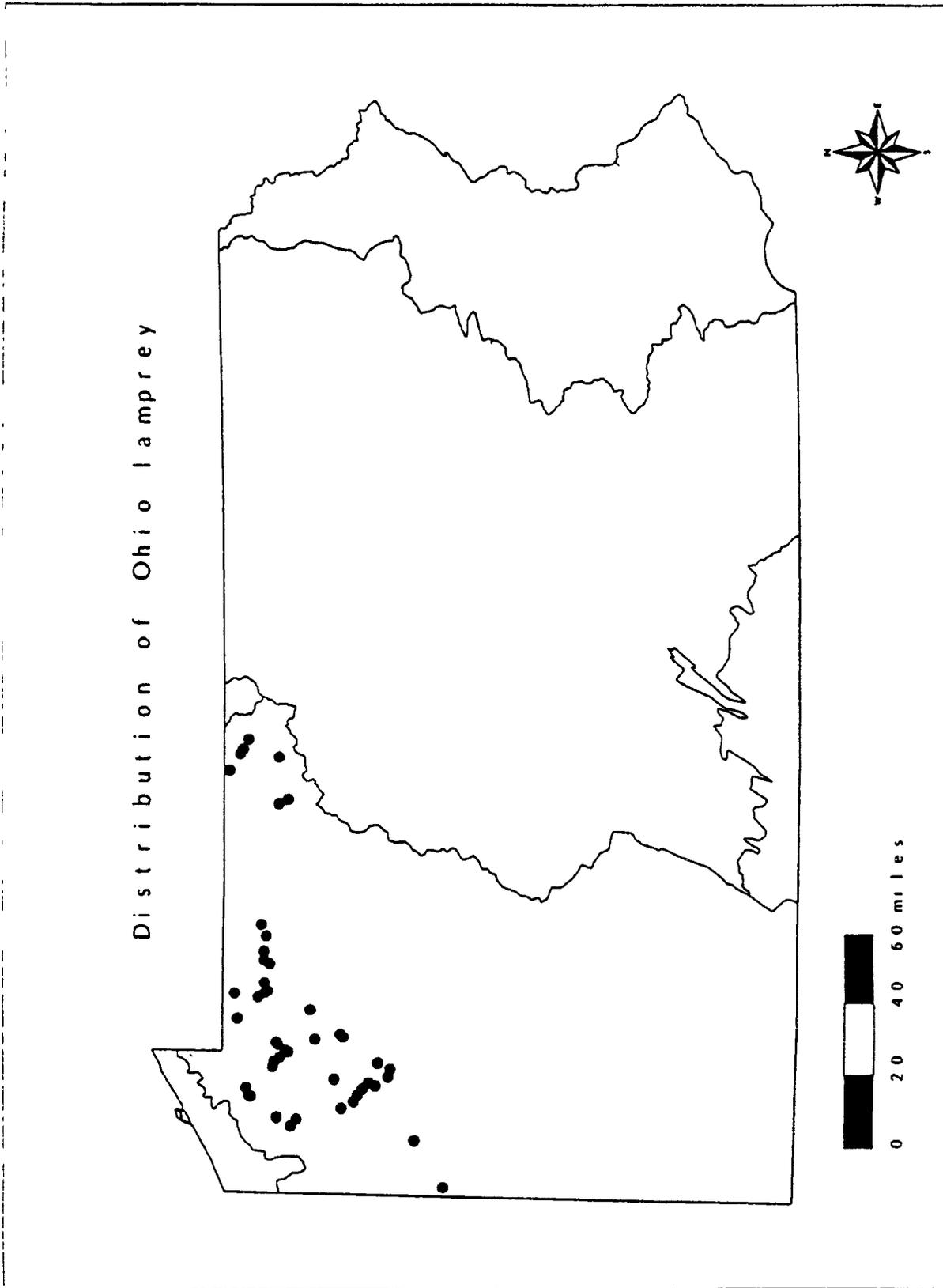
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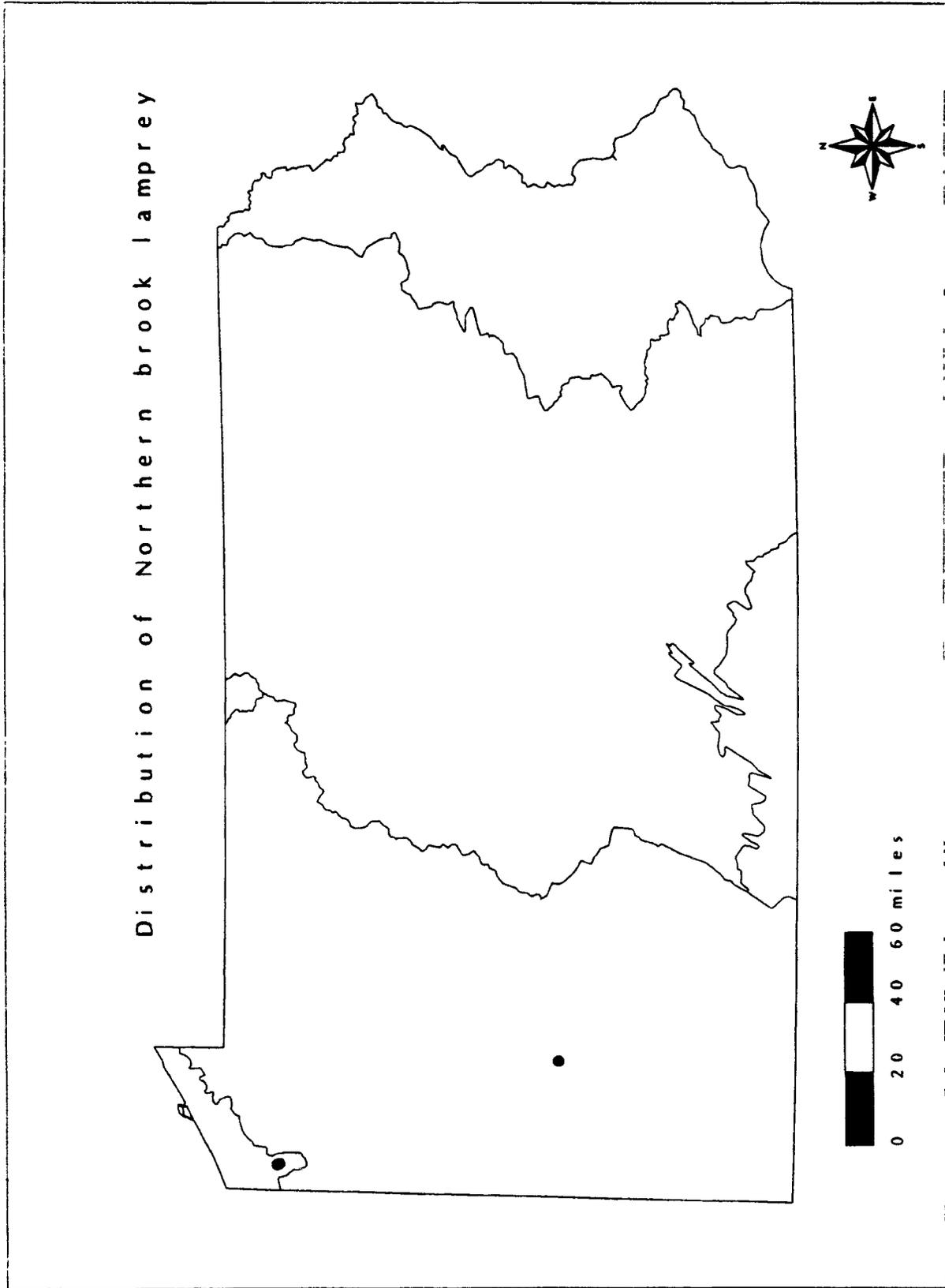
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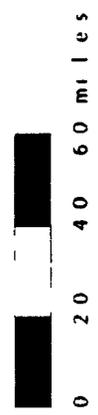
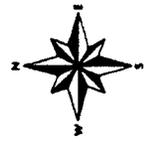
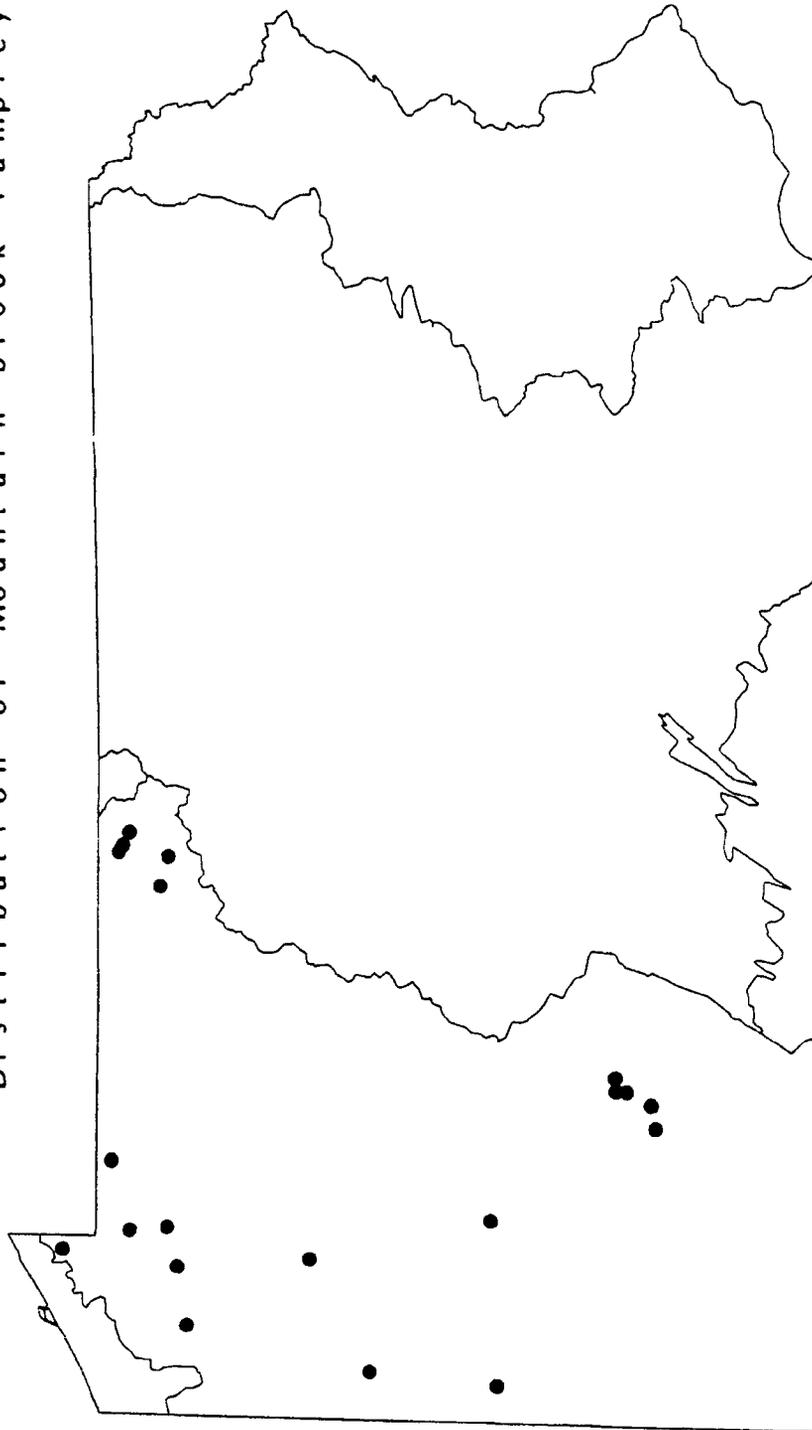
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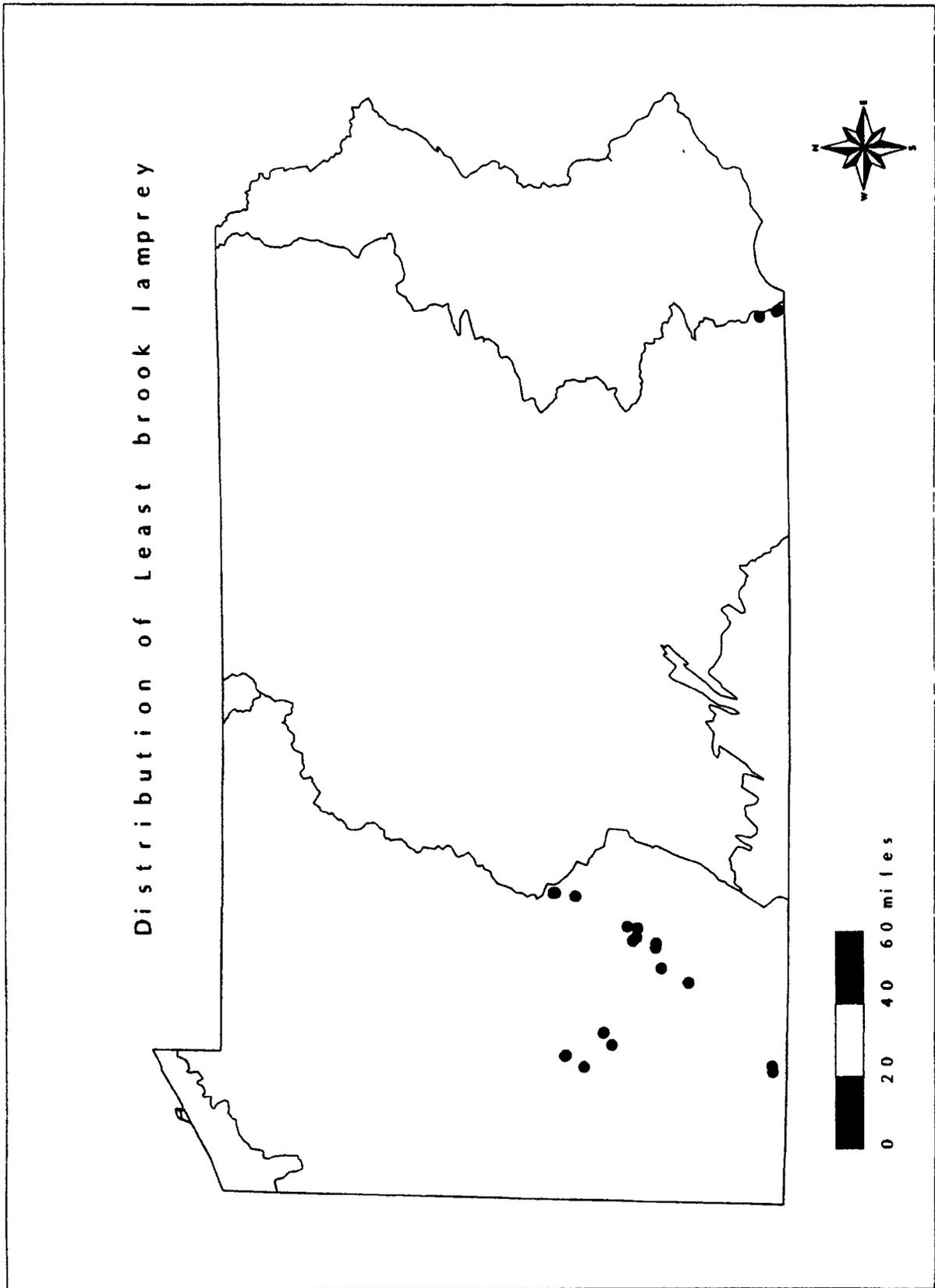
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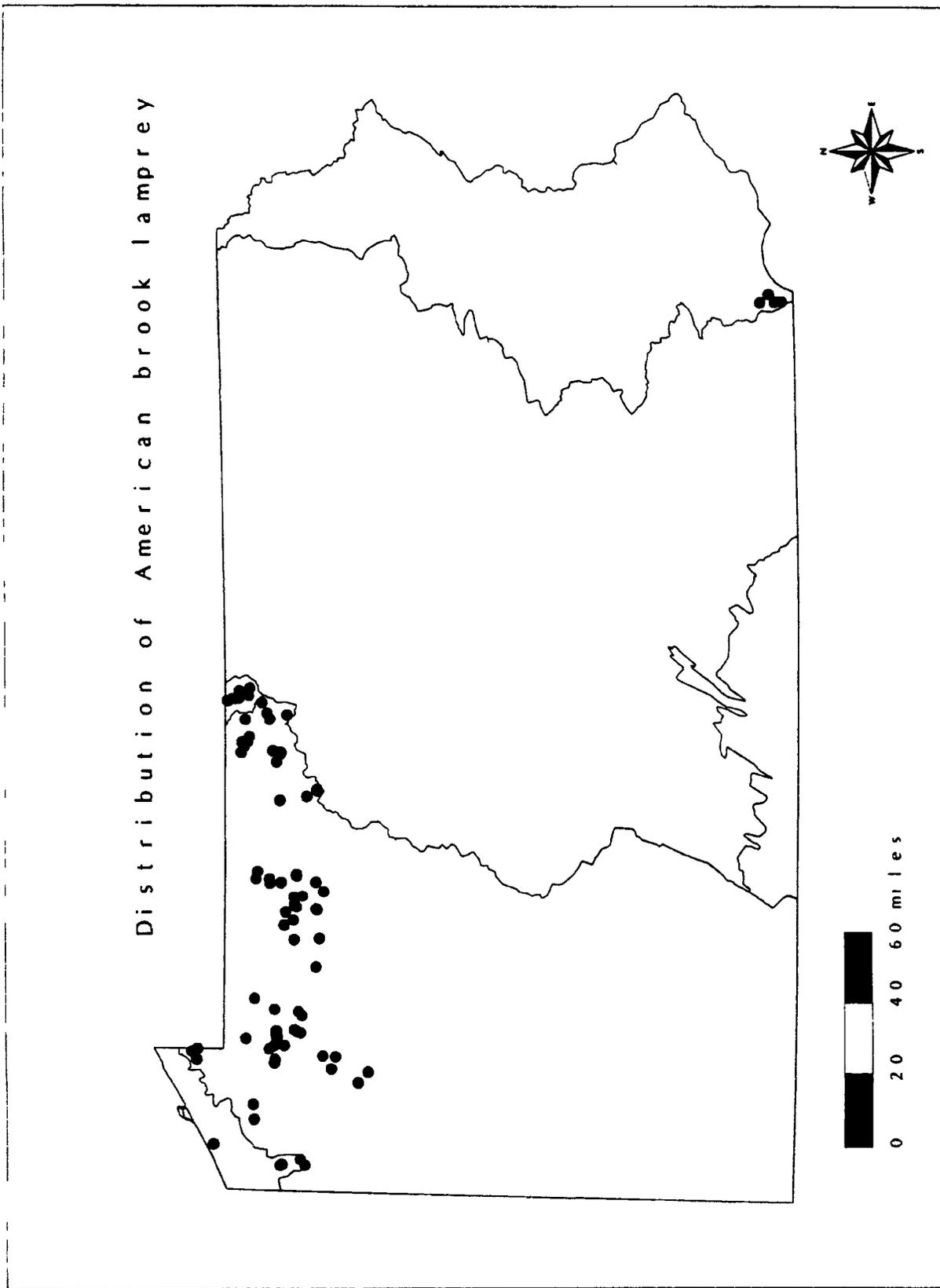


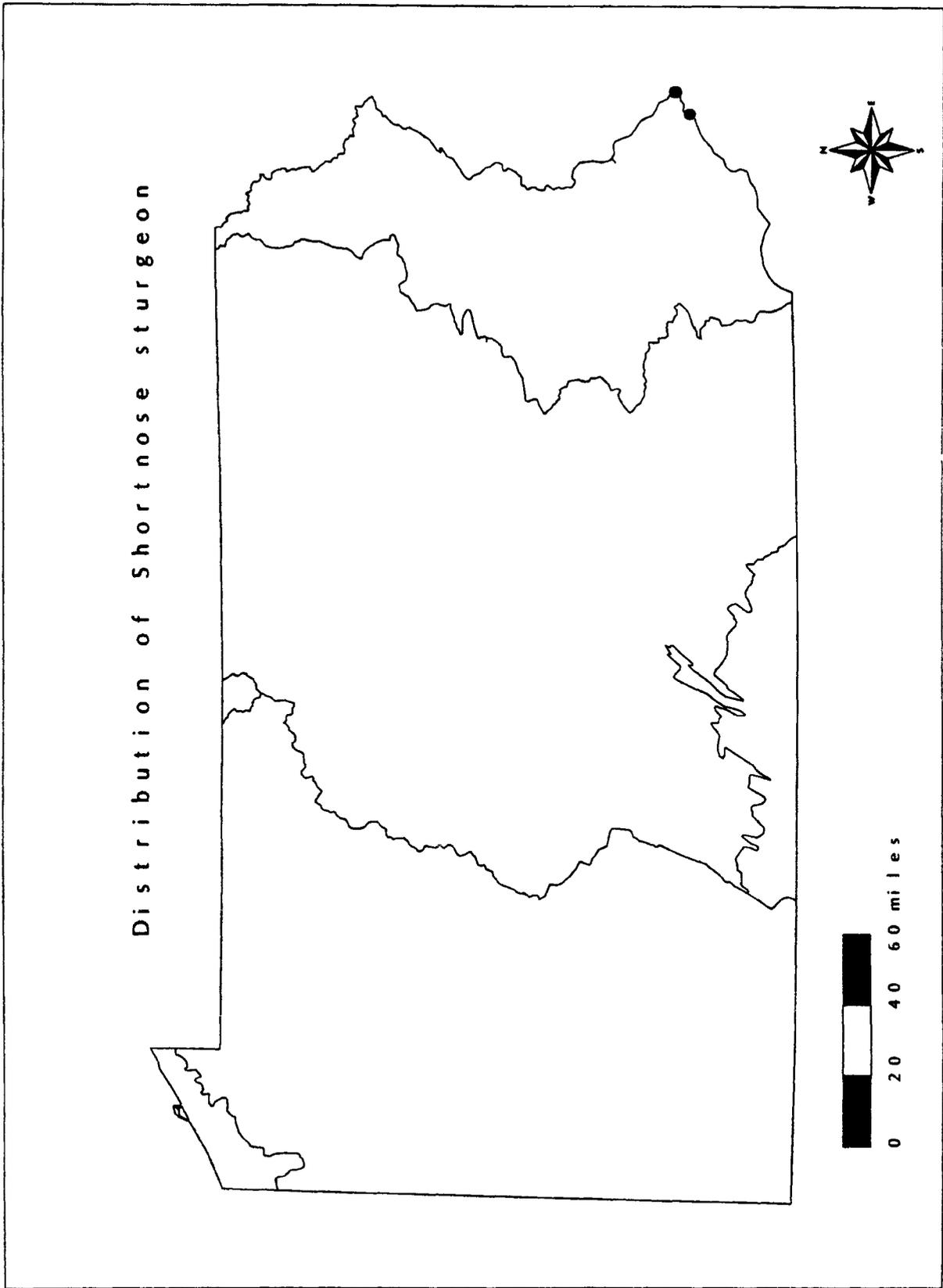


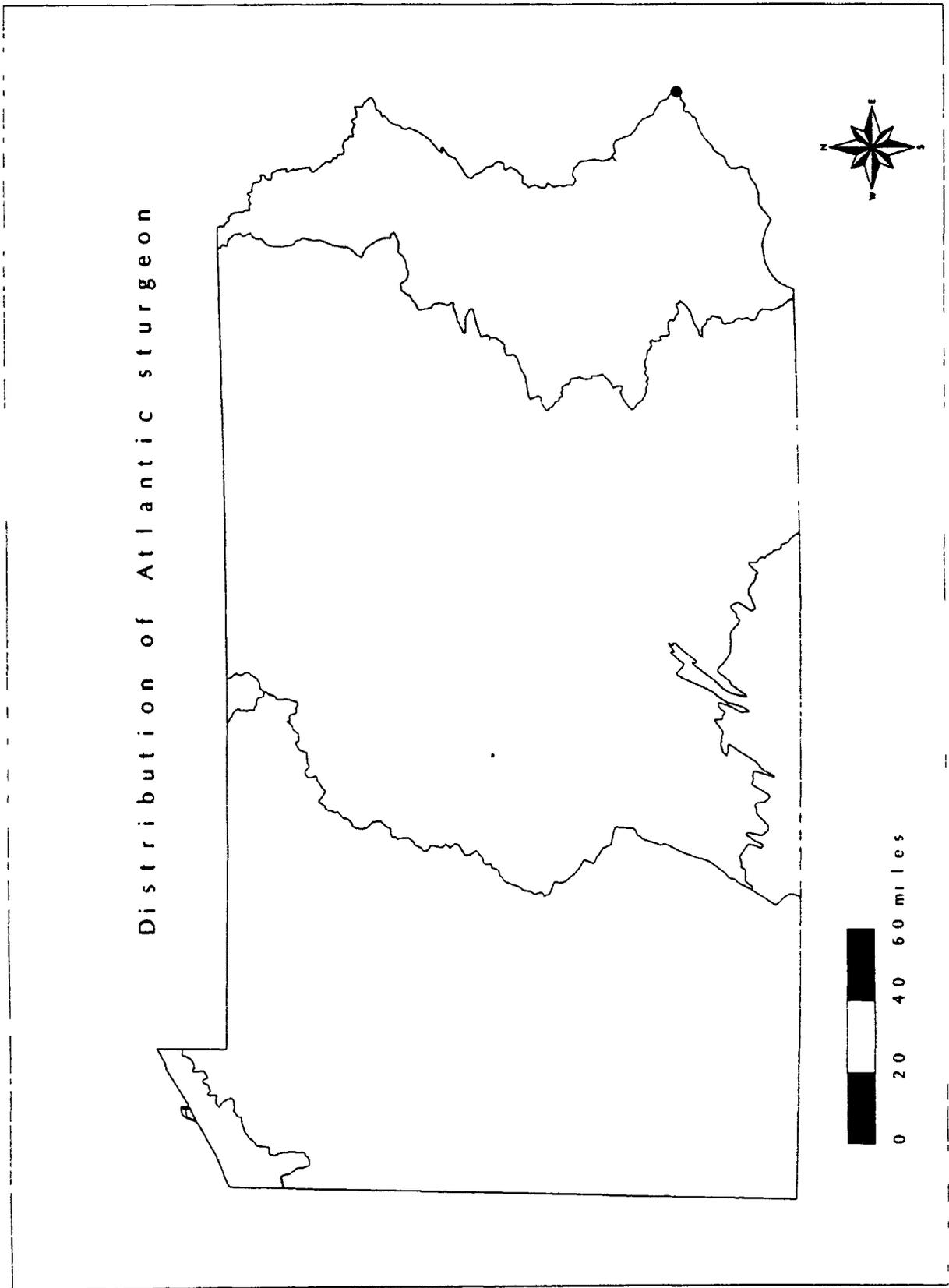
Distribution of Mountain brook lamprey

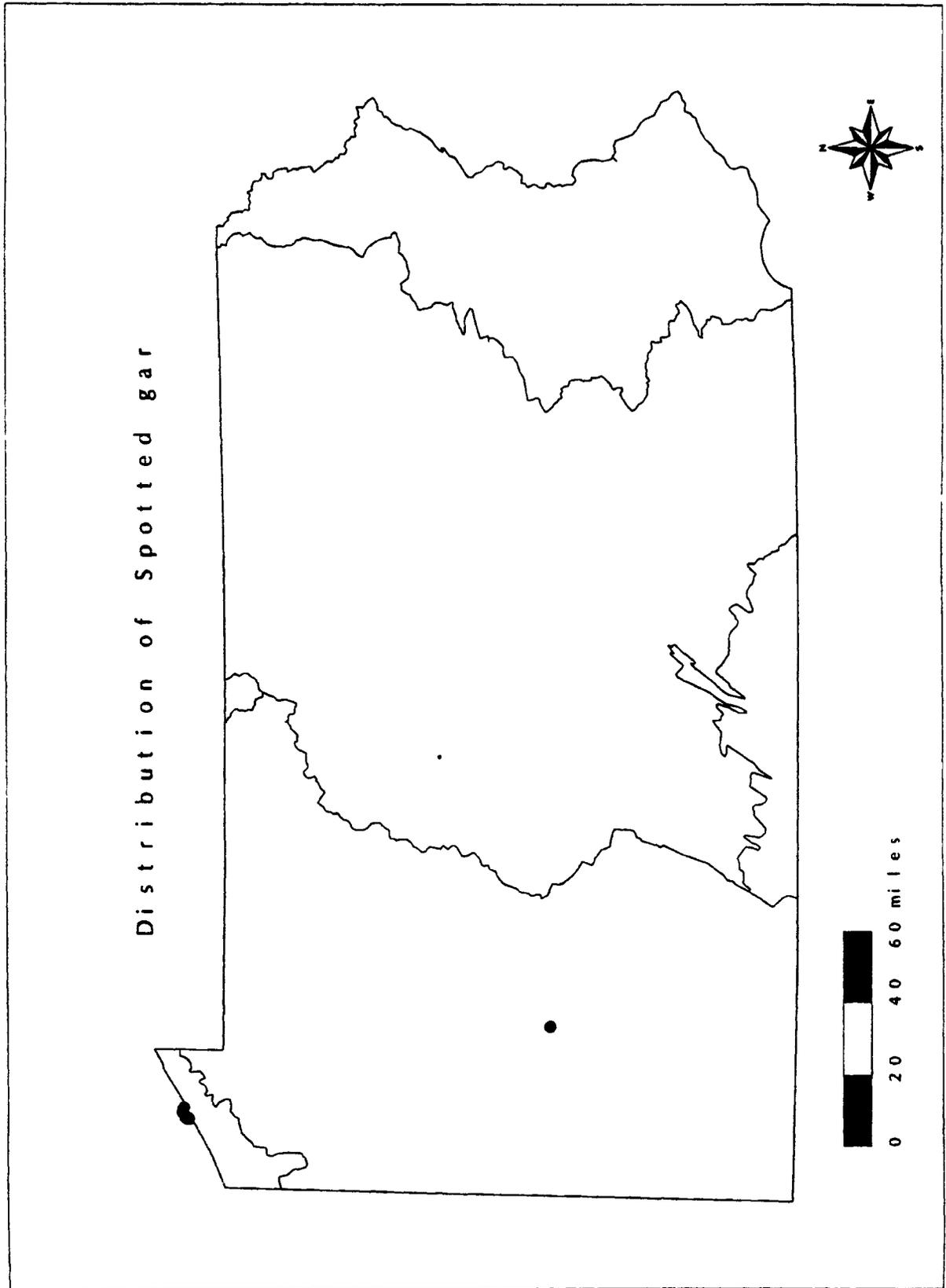


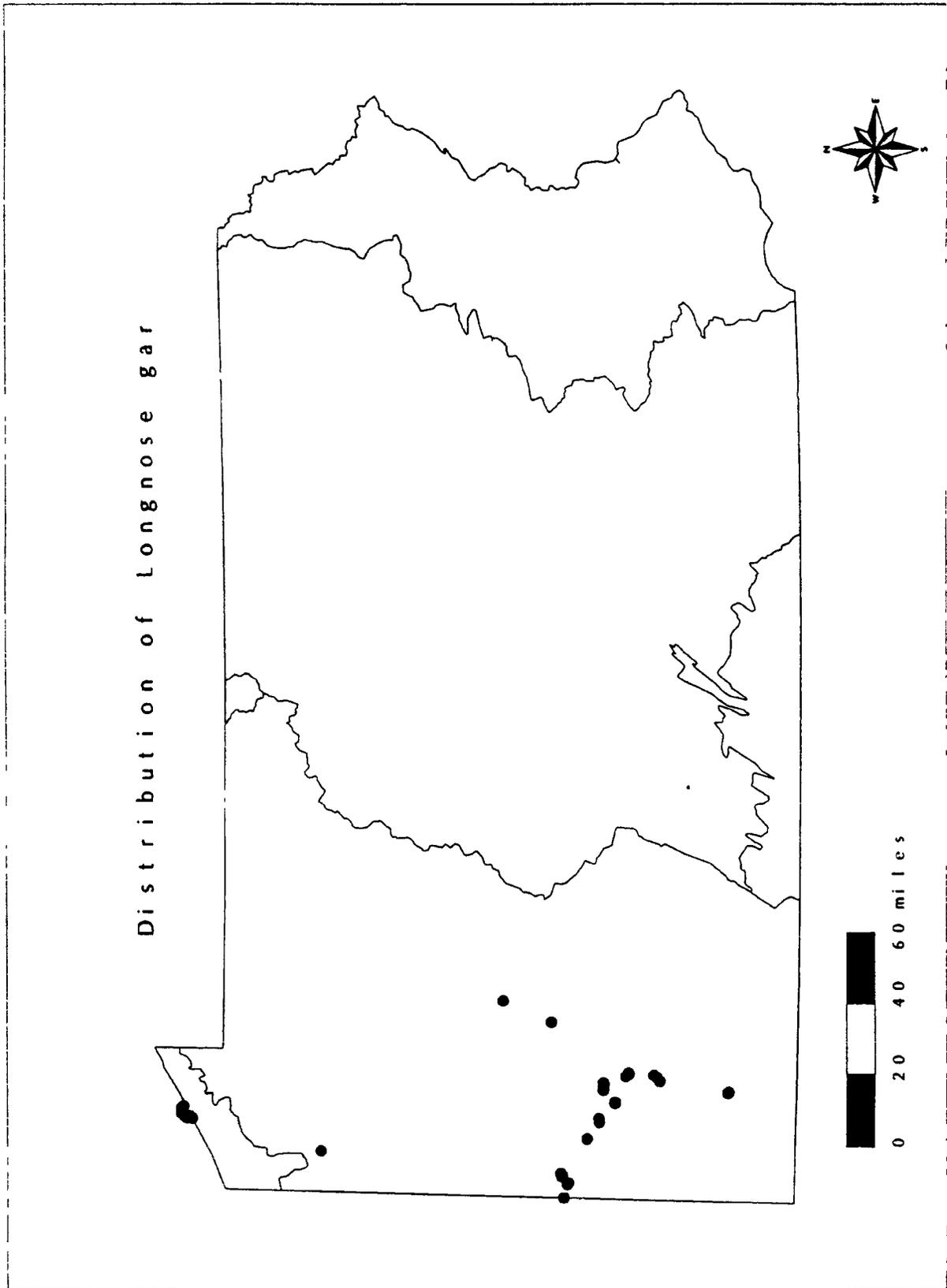


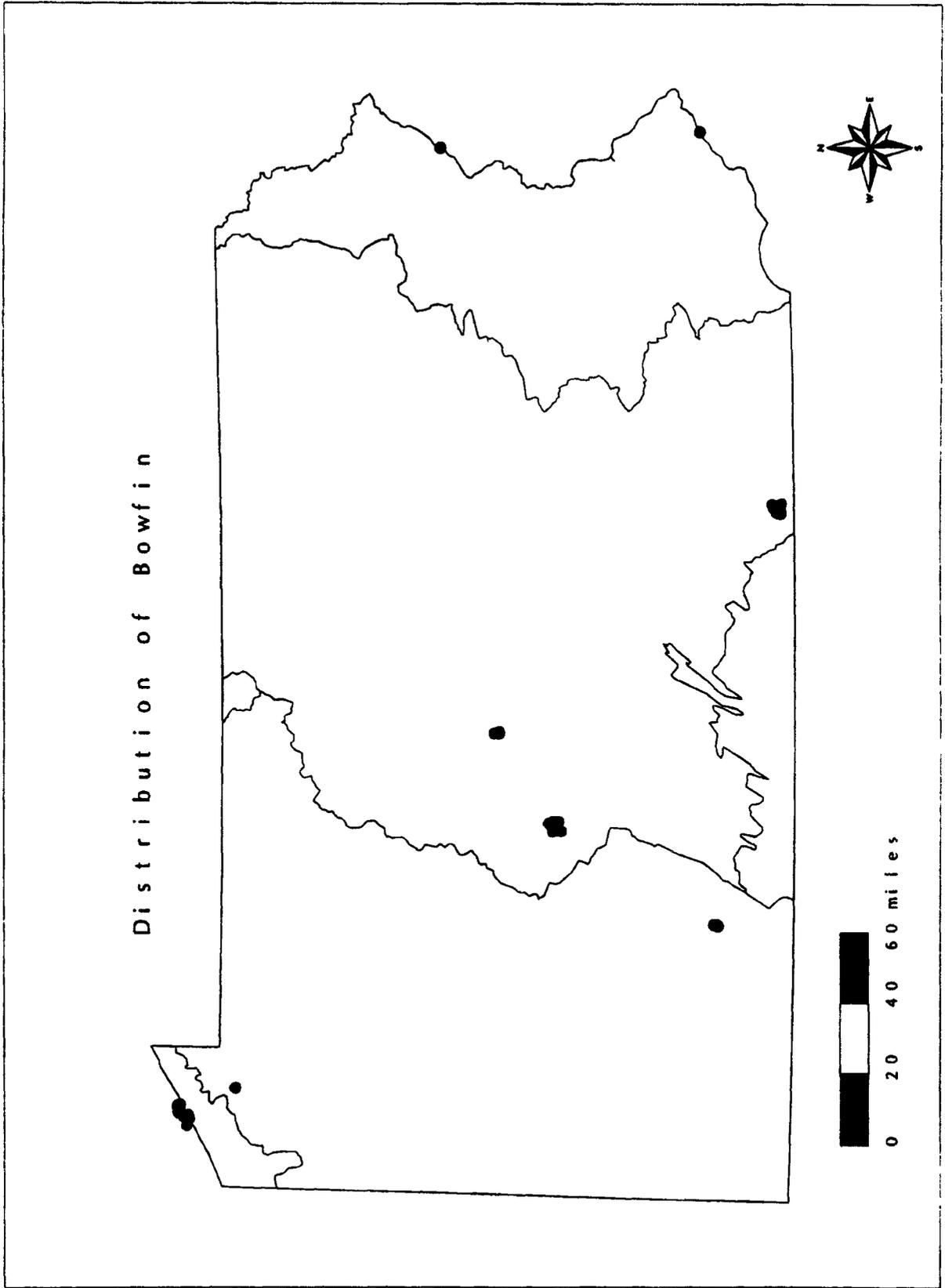


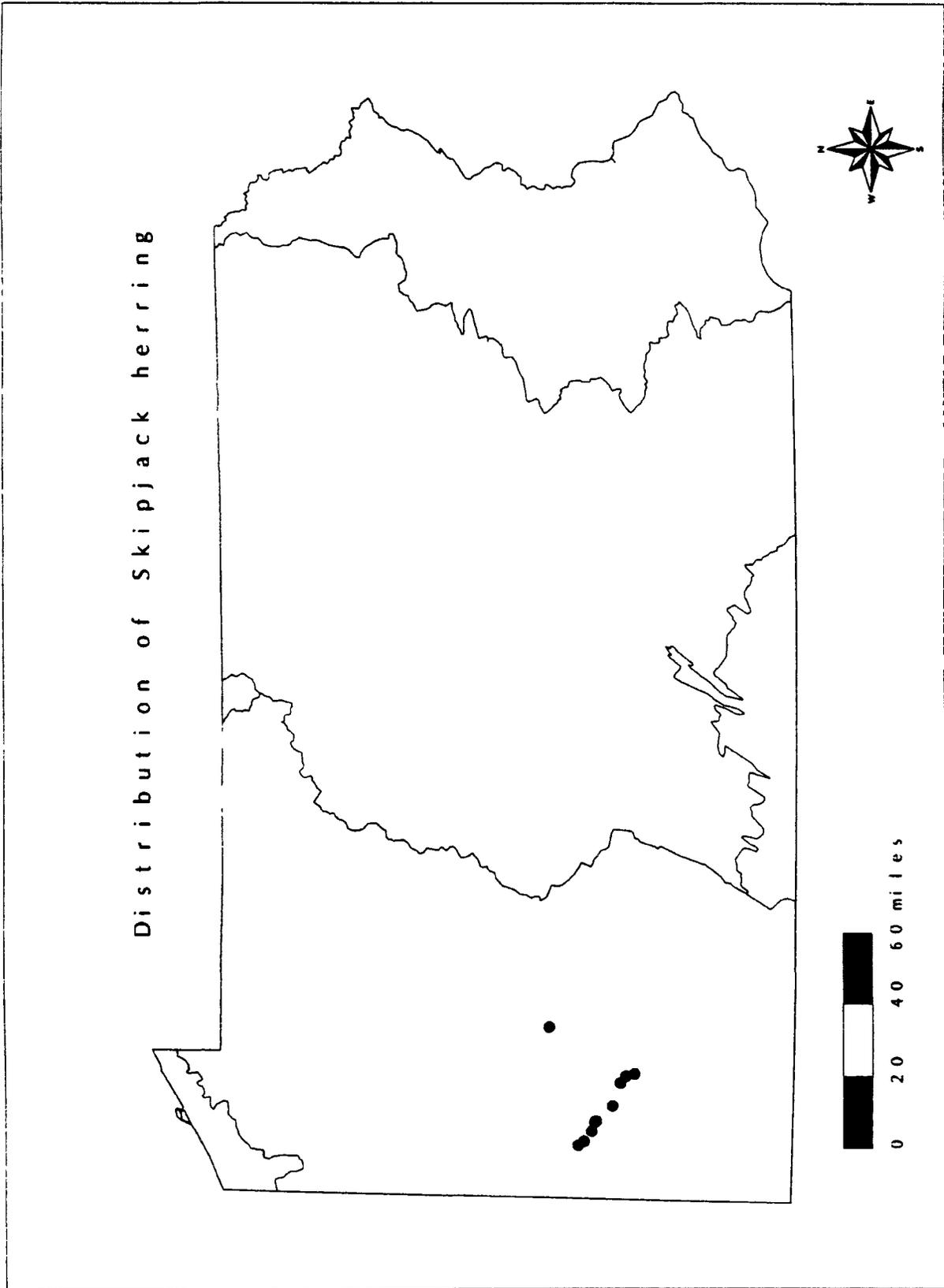


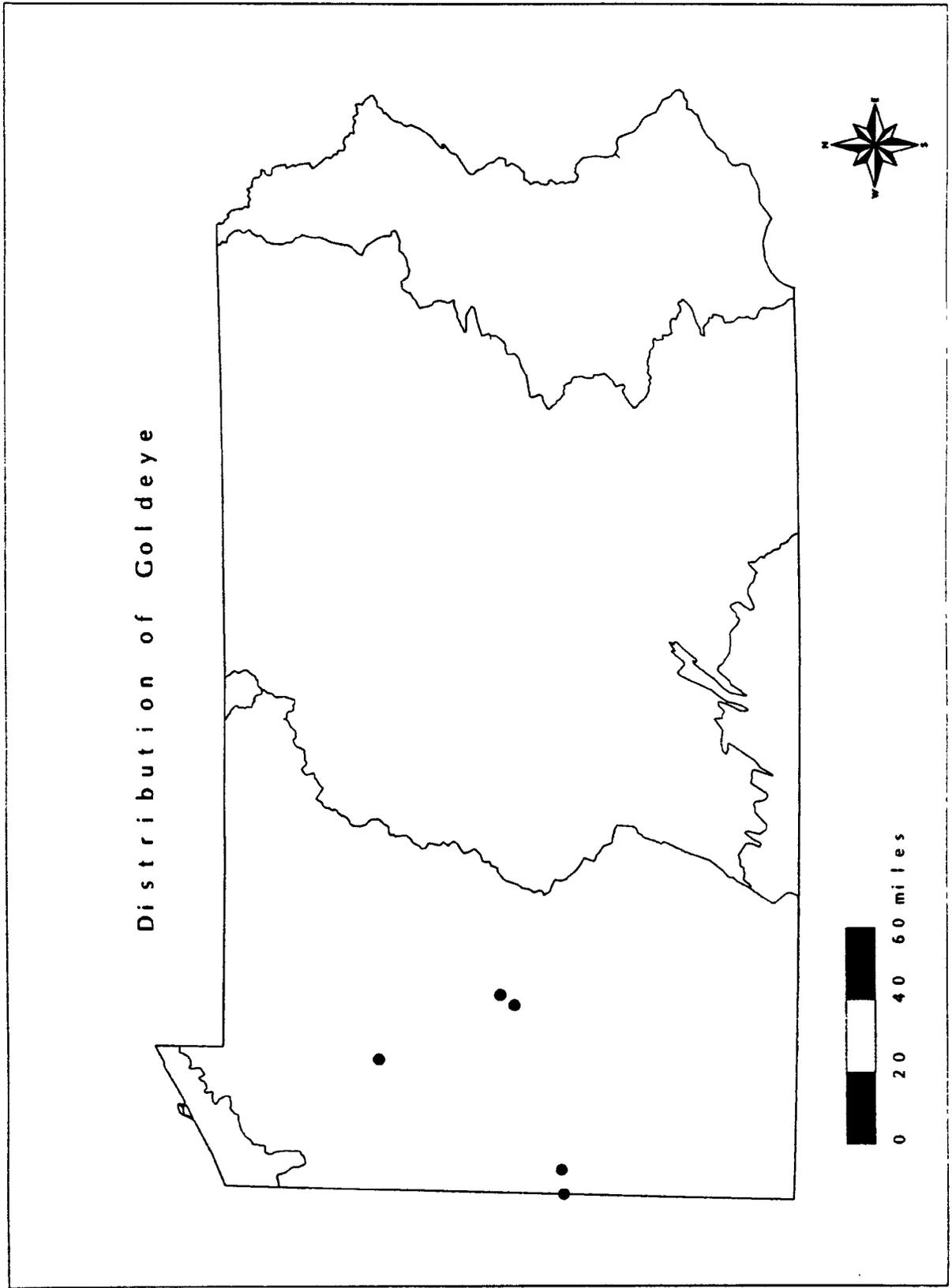


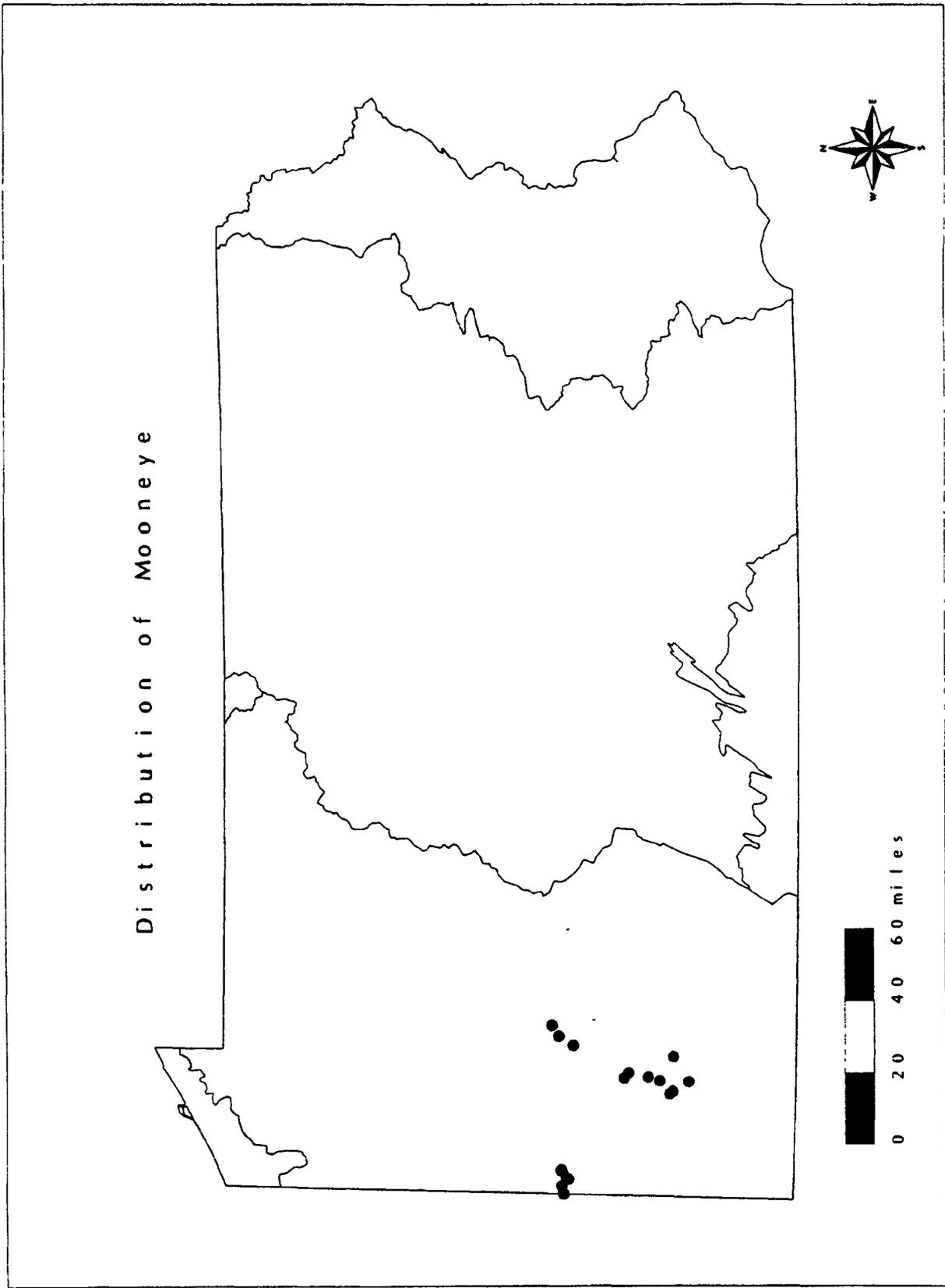


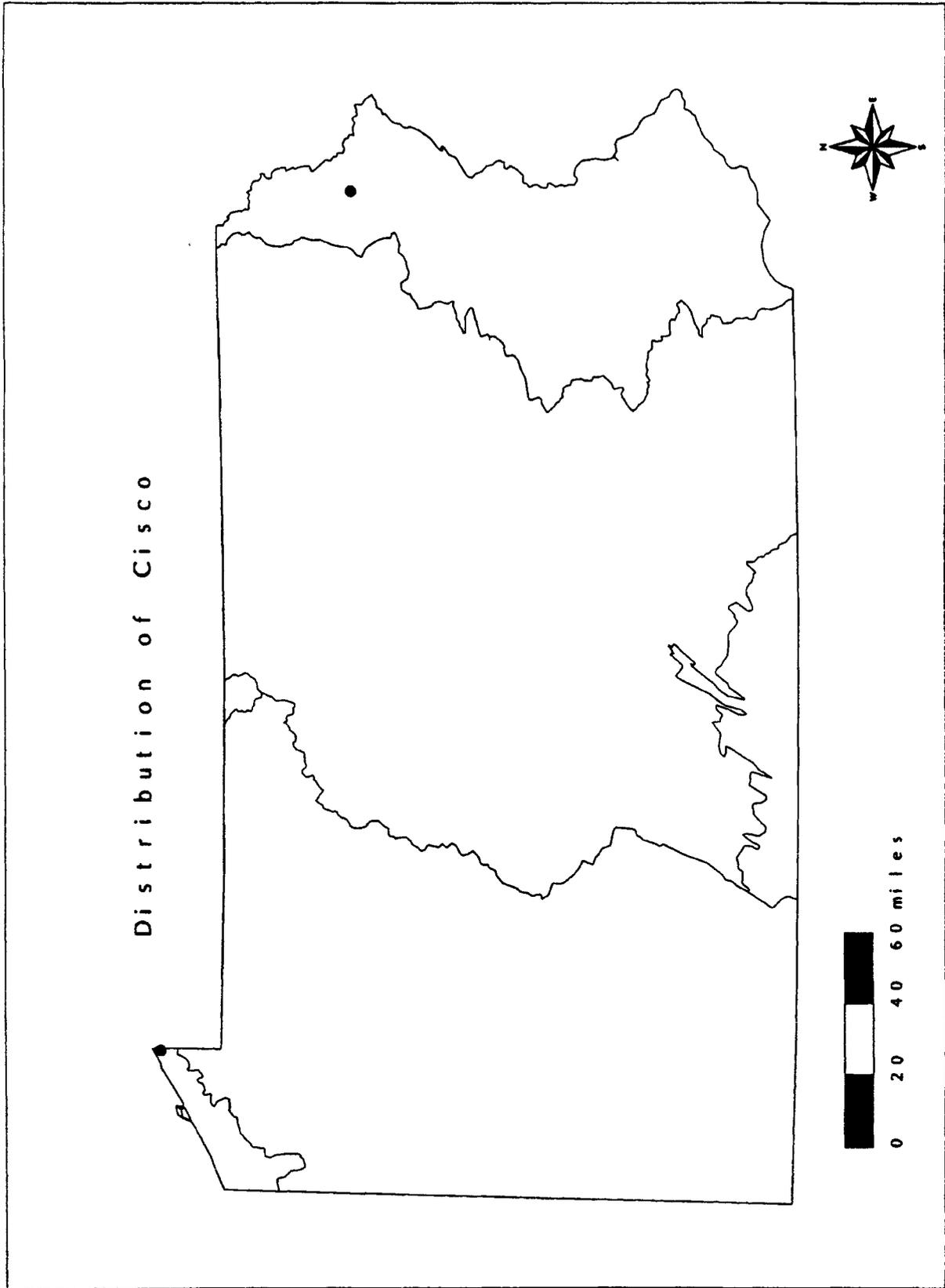


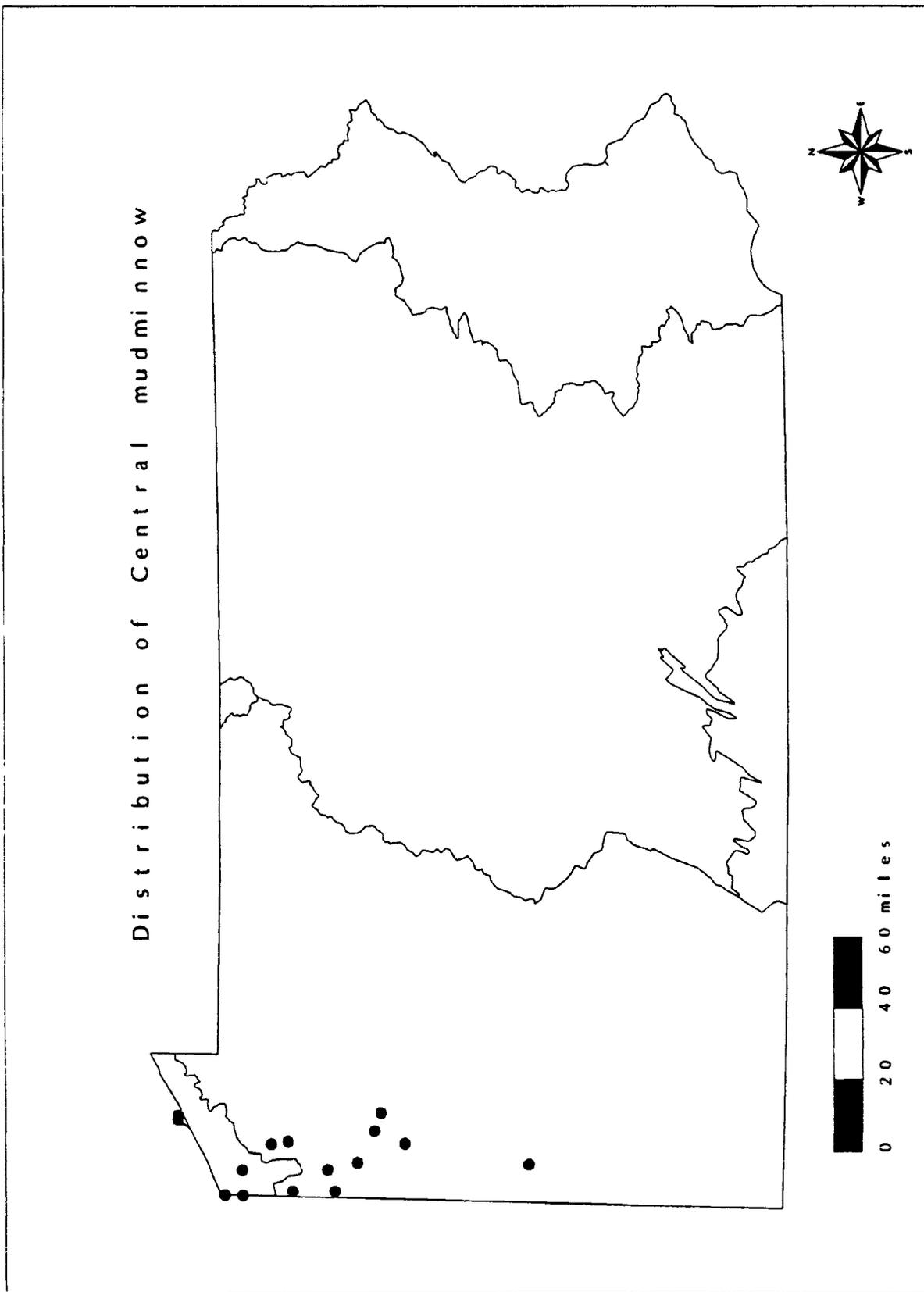


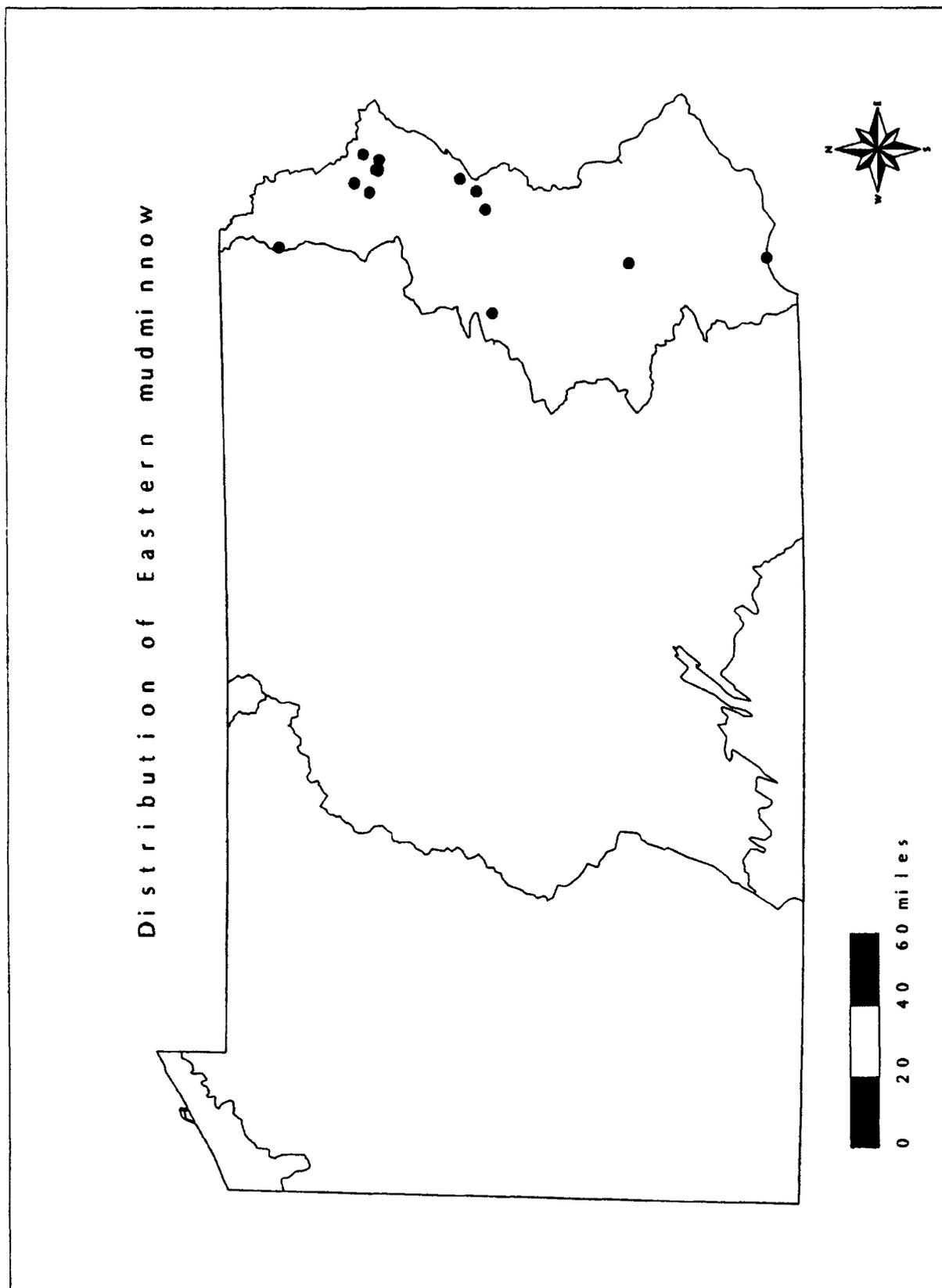


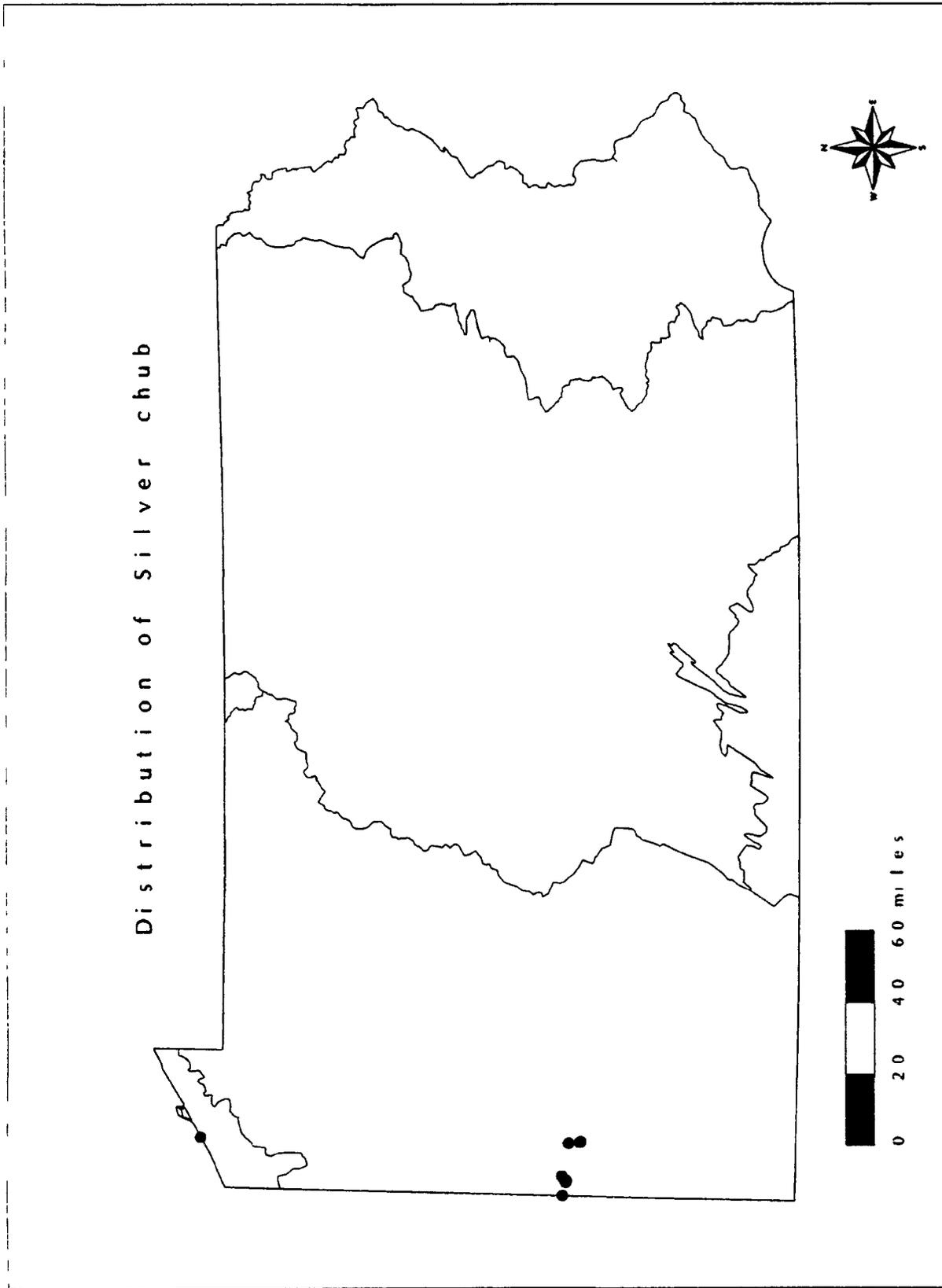


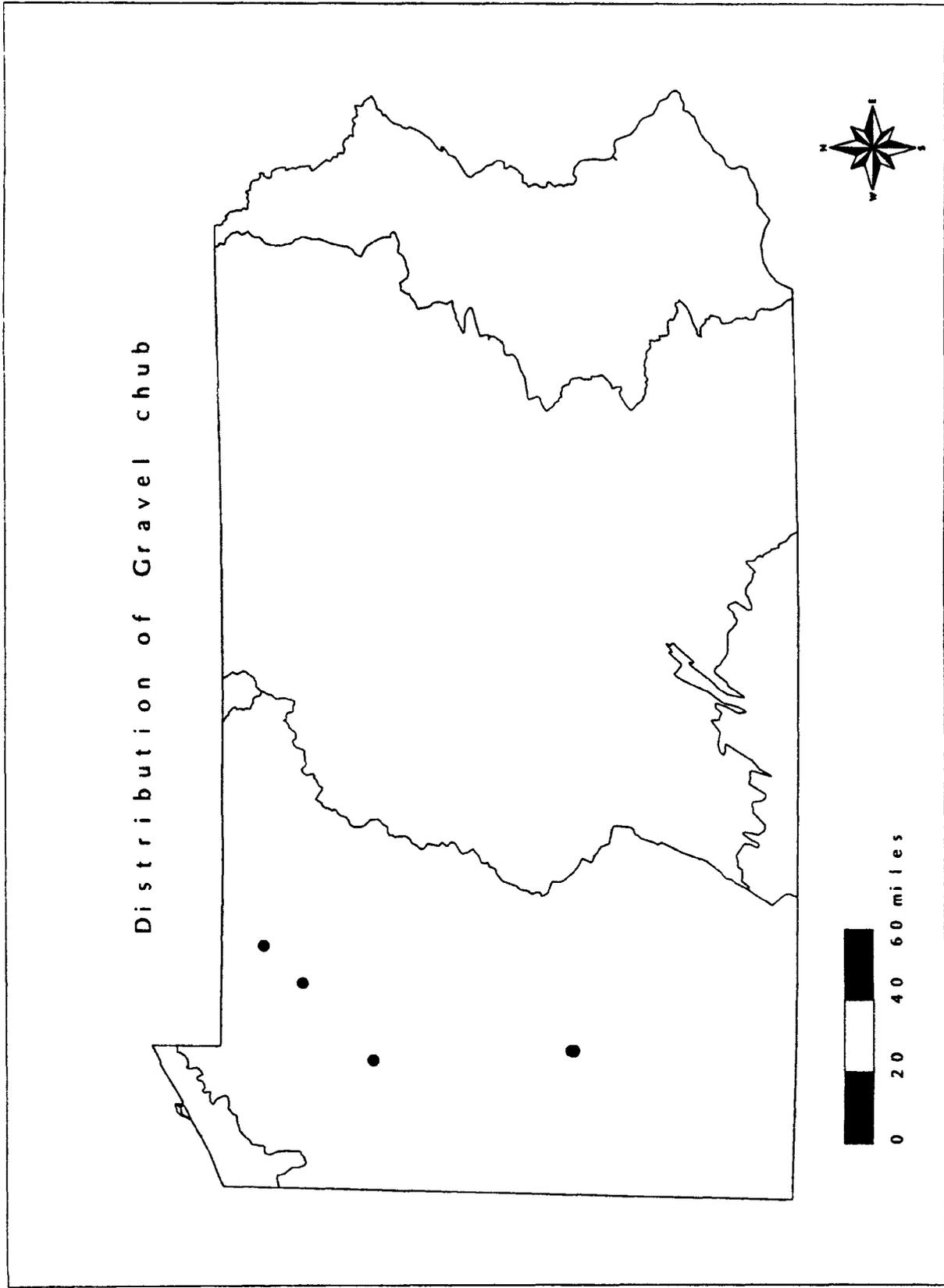


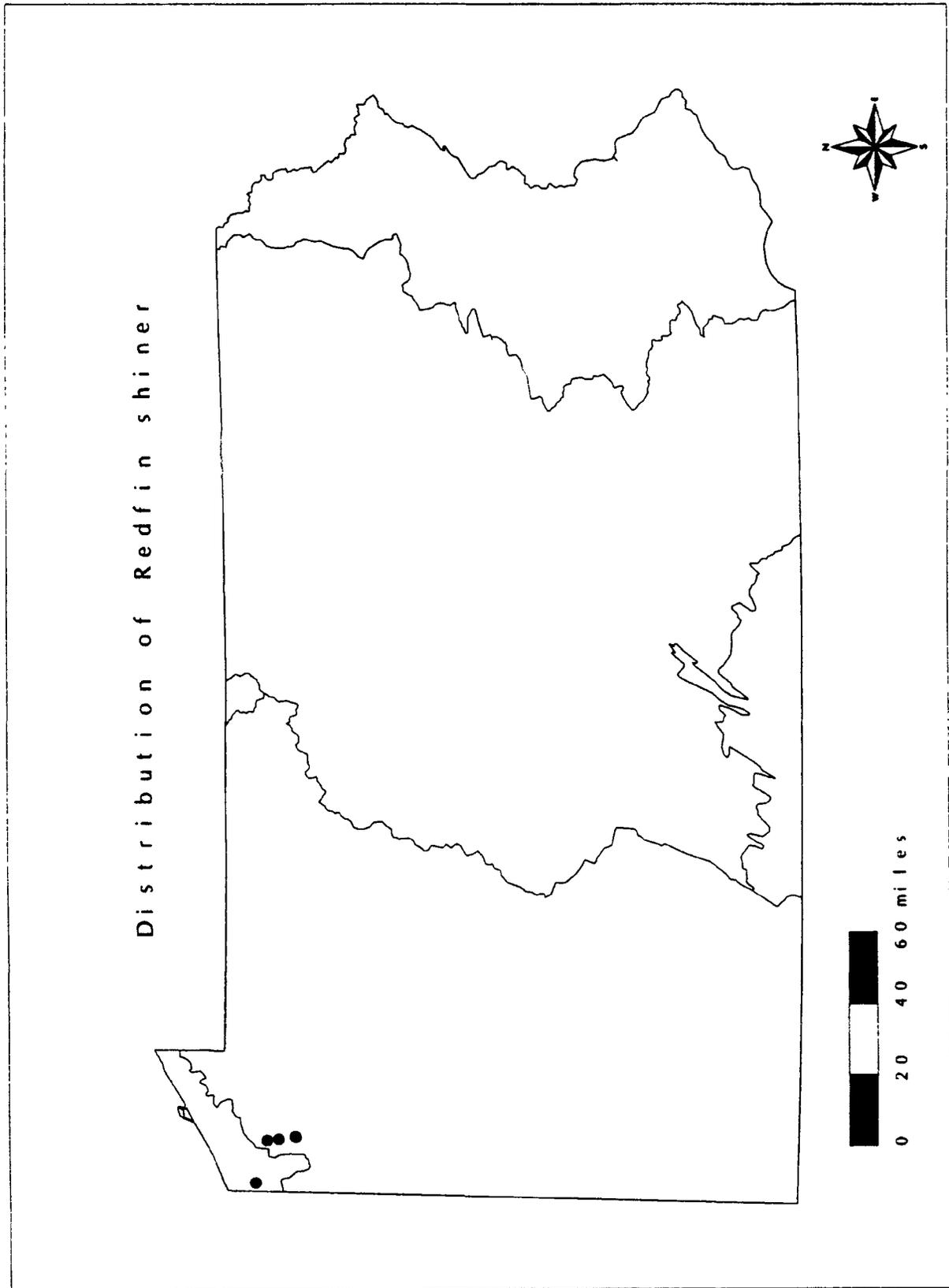


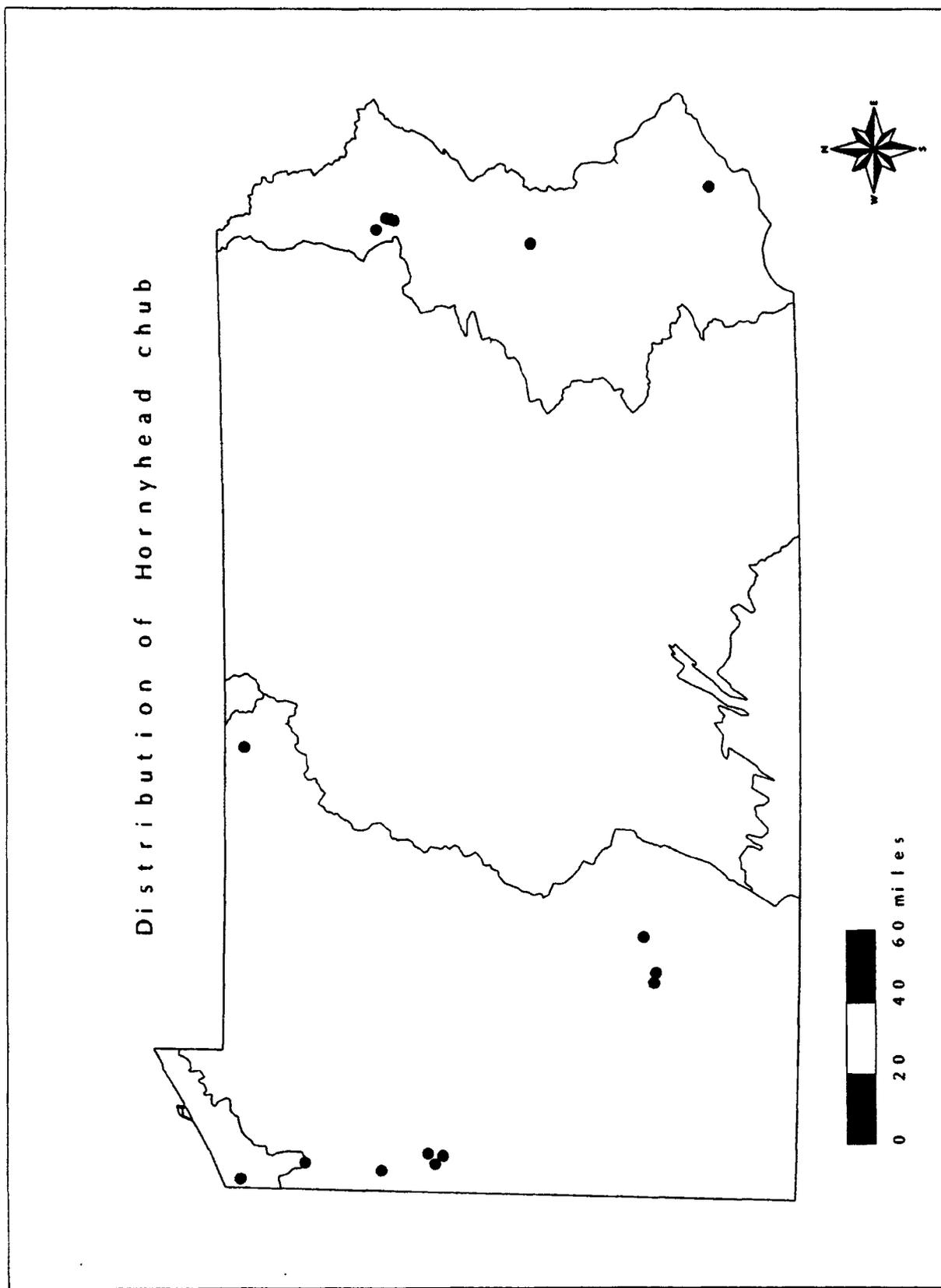




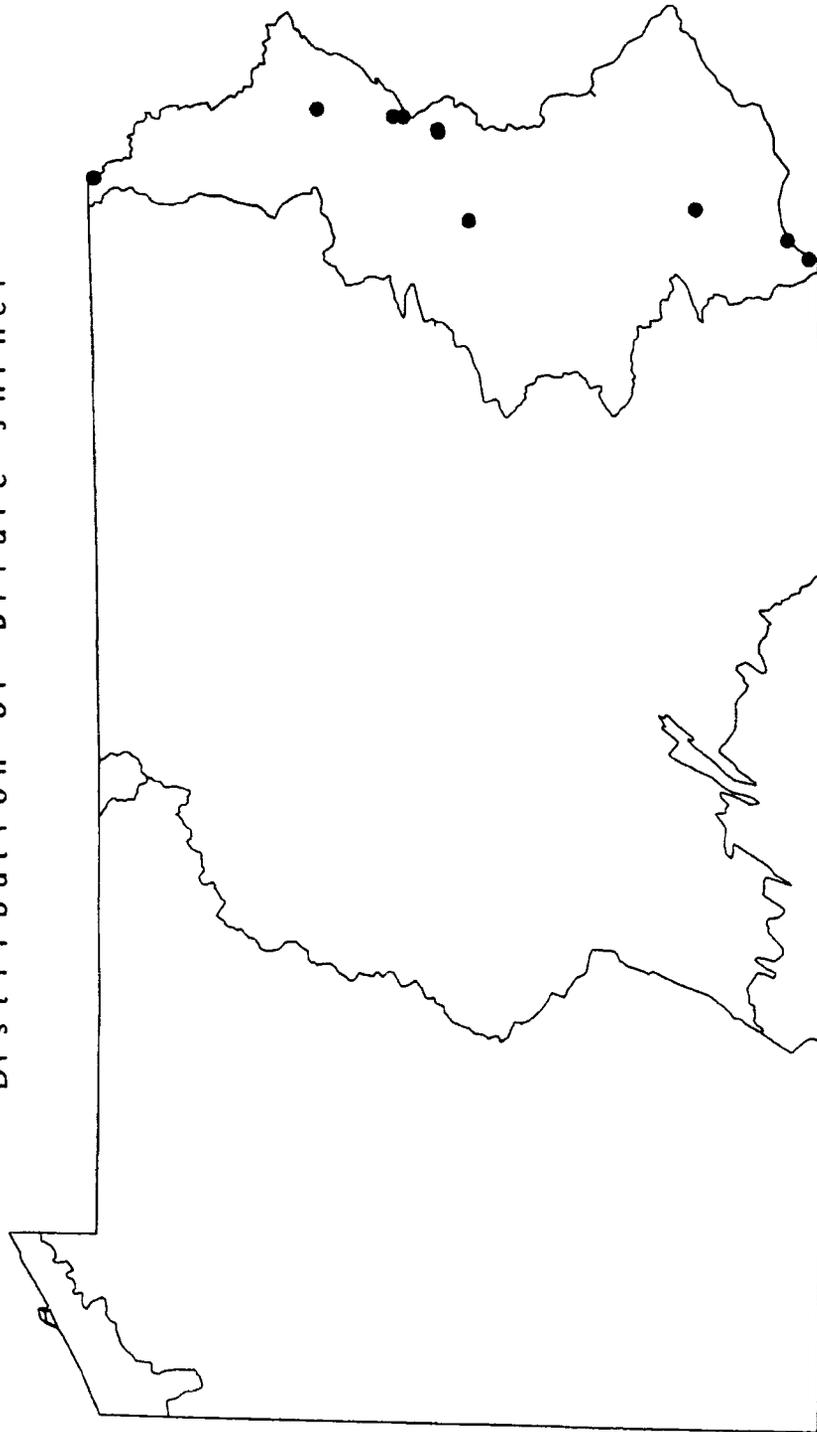


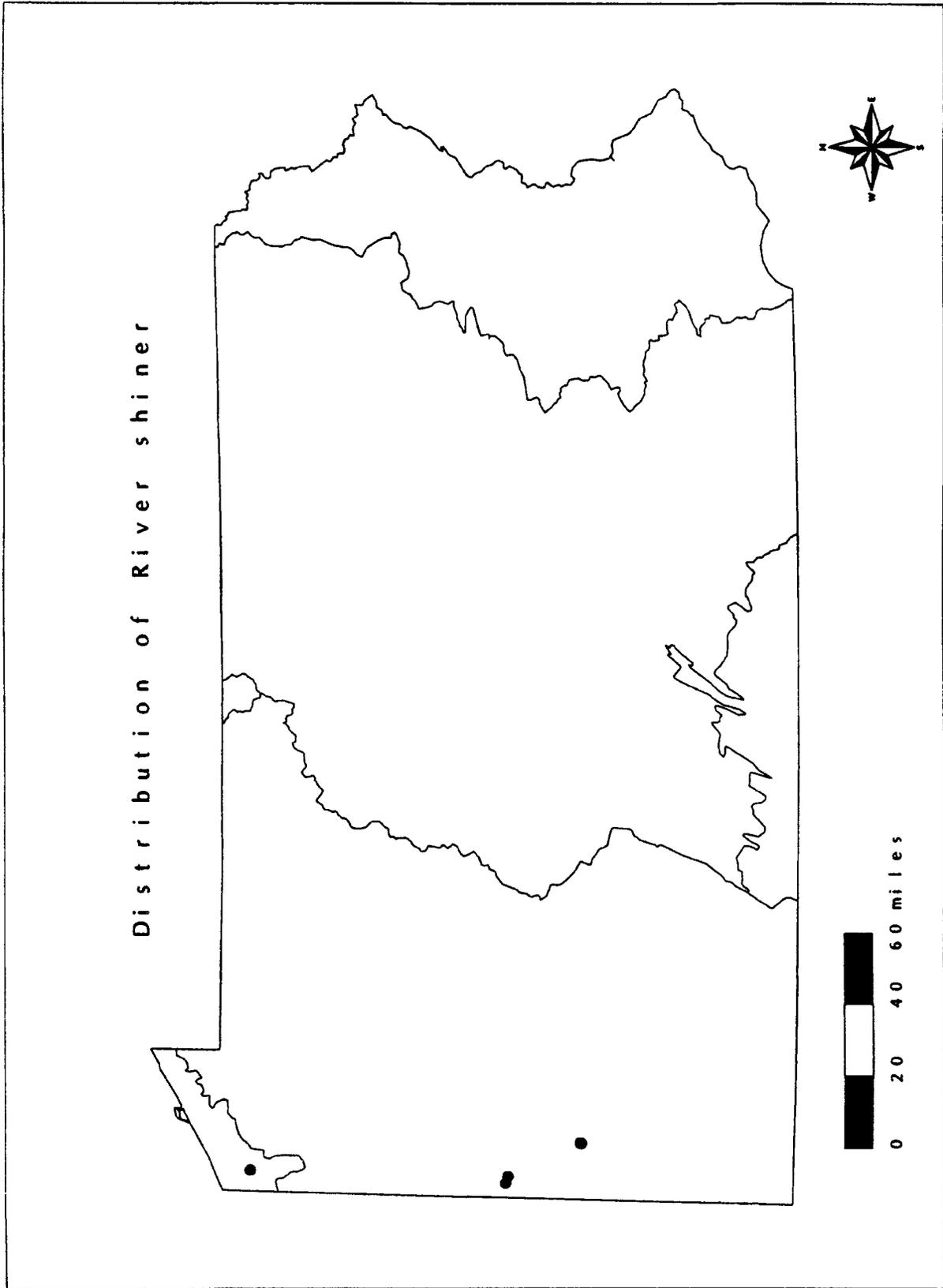


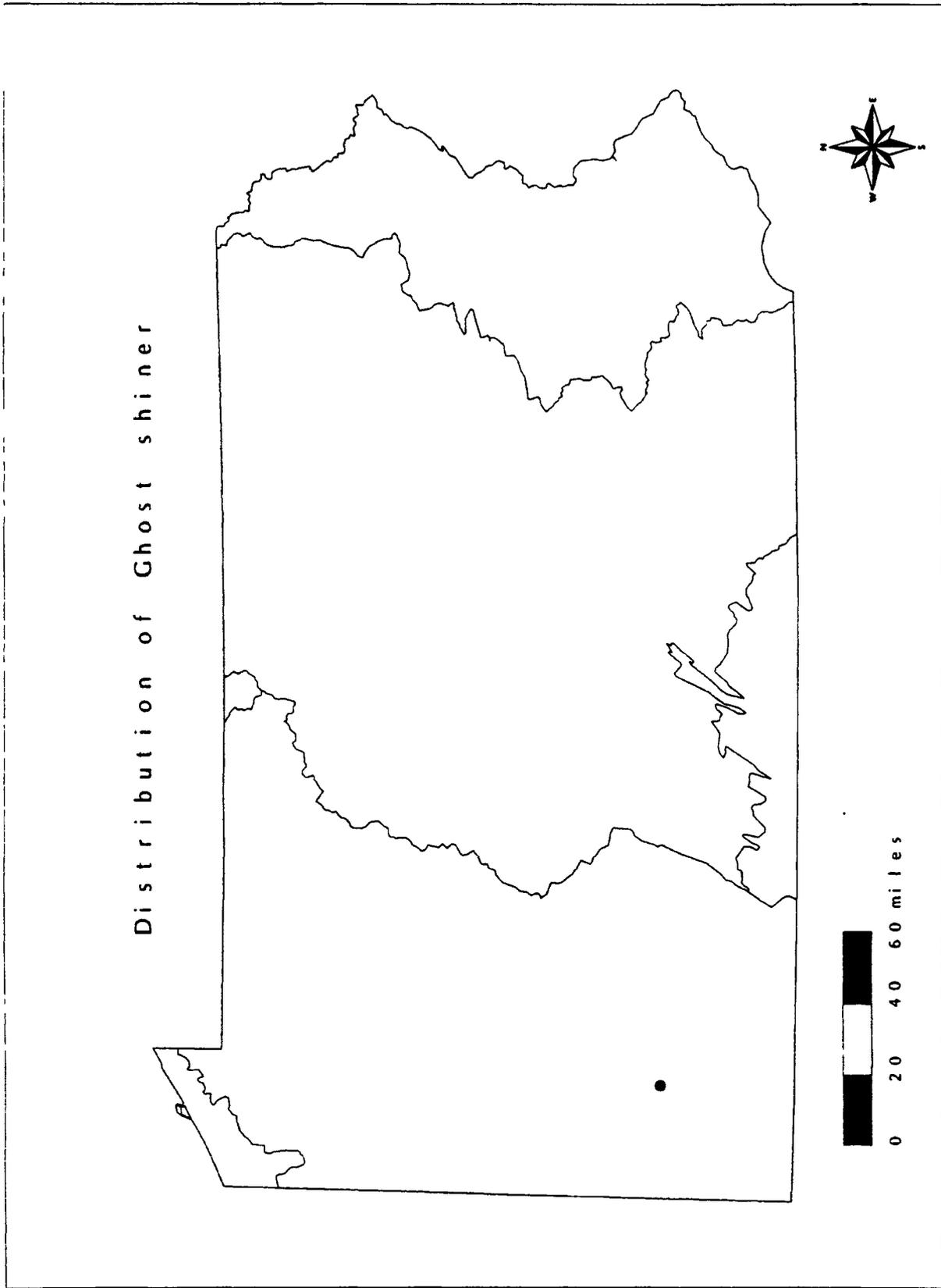


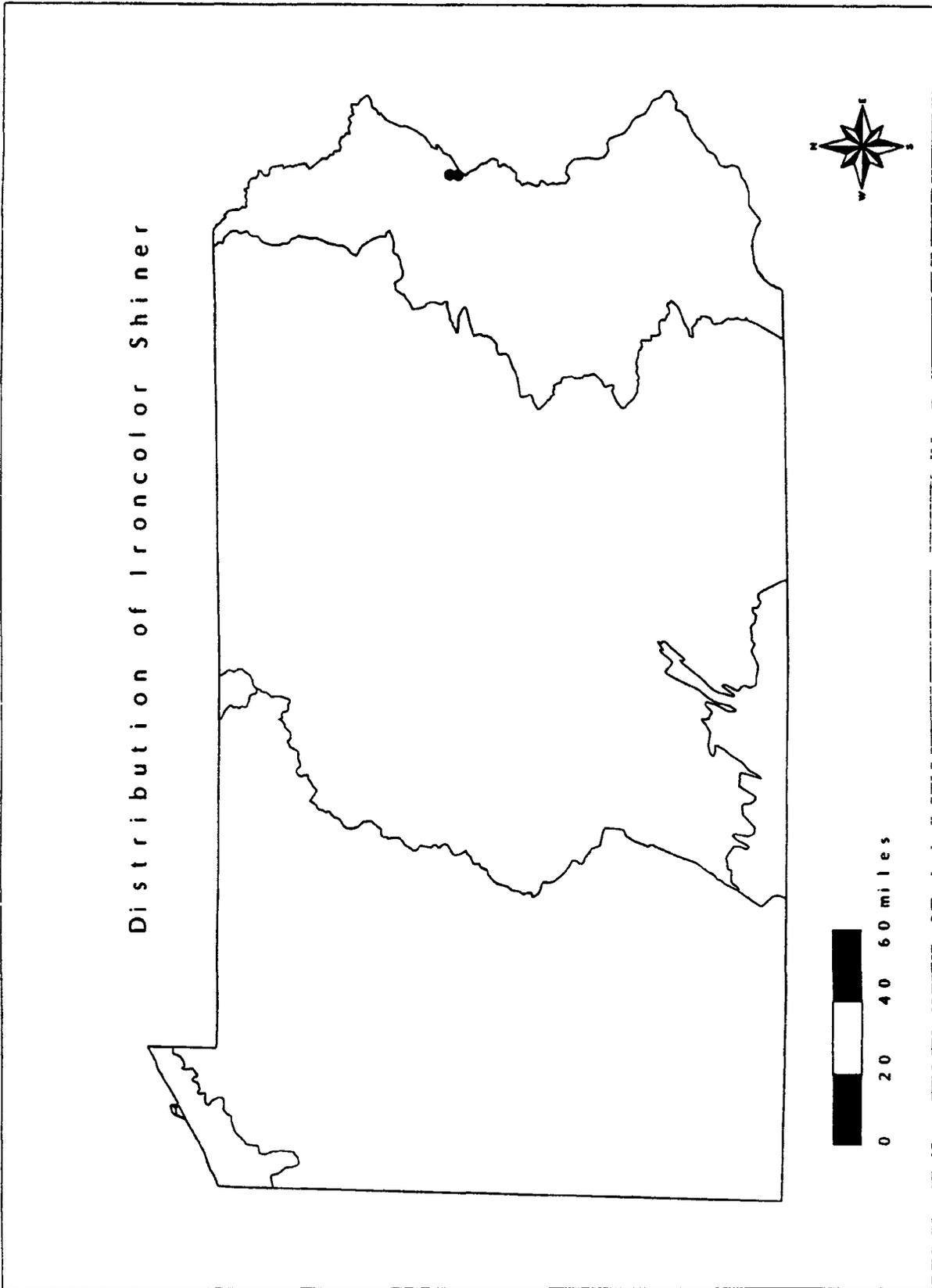


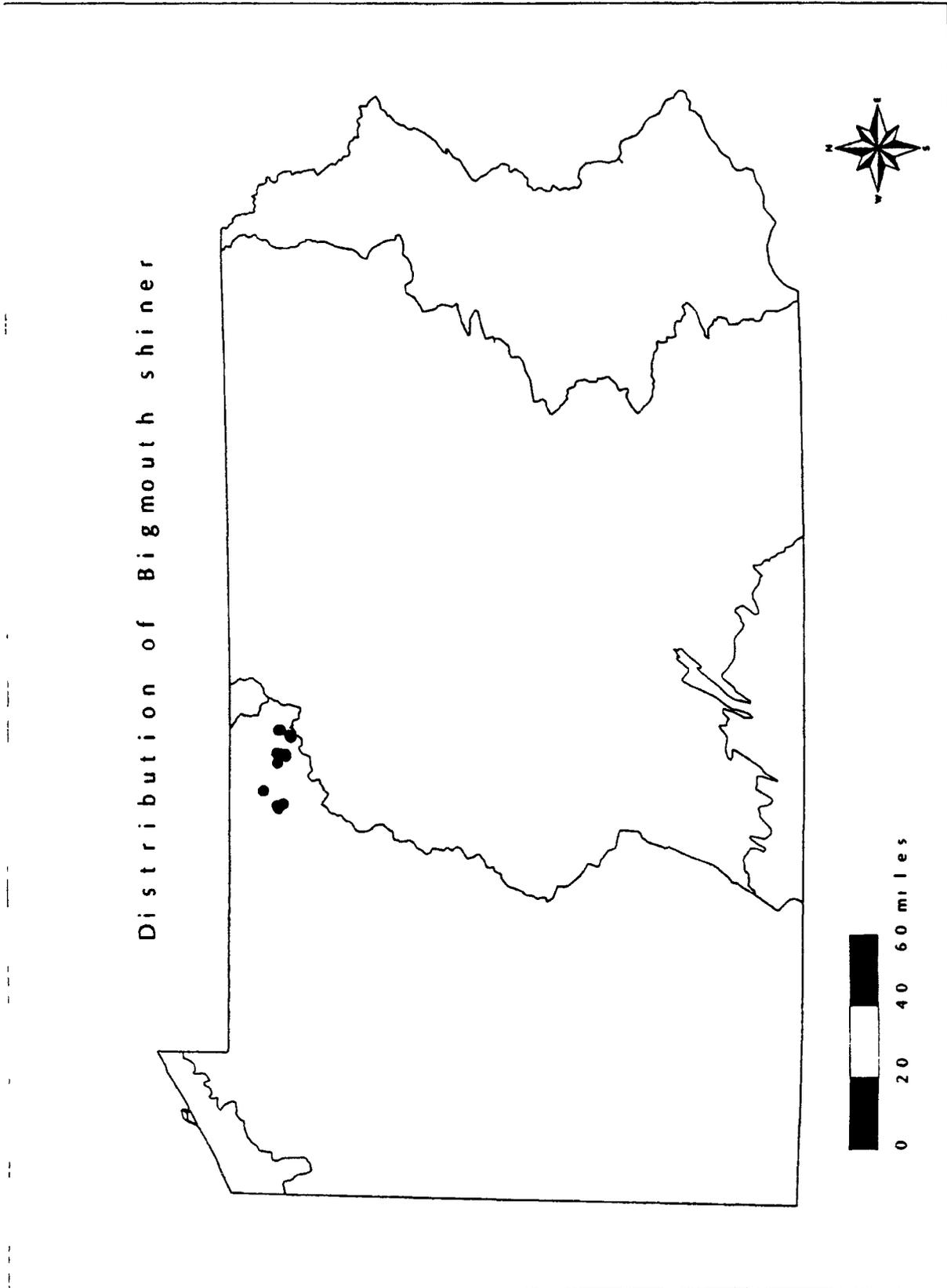
Distribution of Bridle shiner



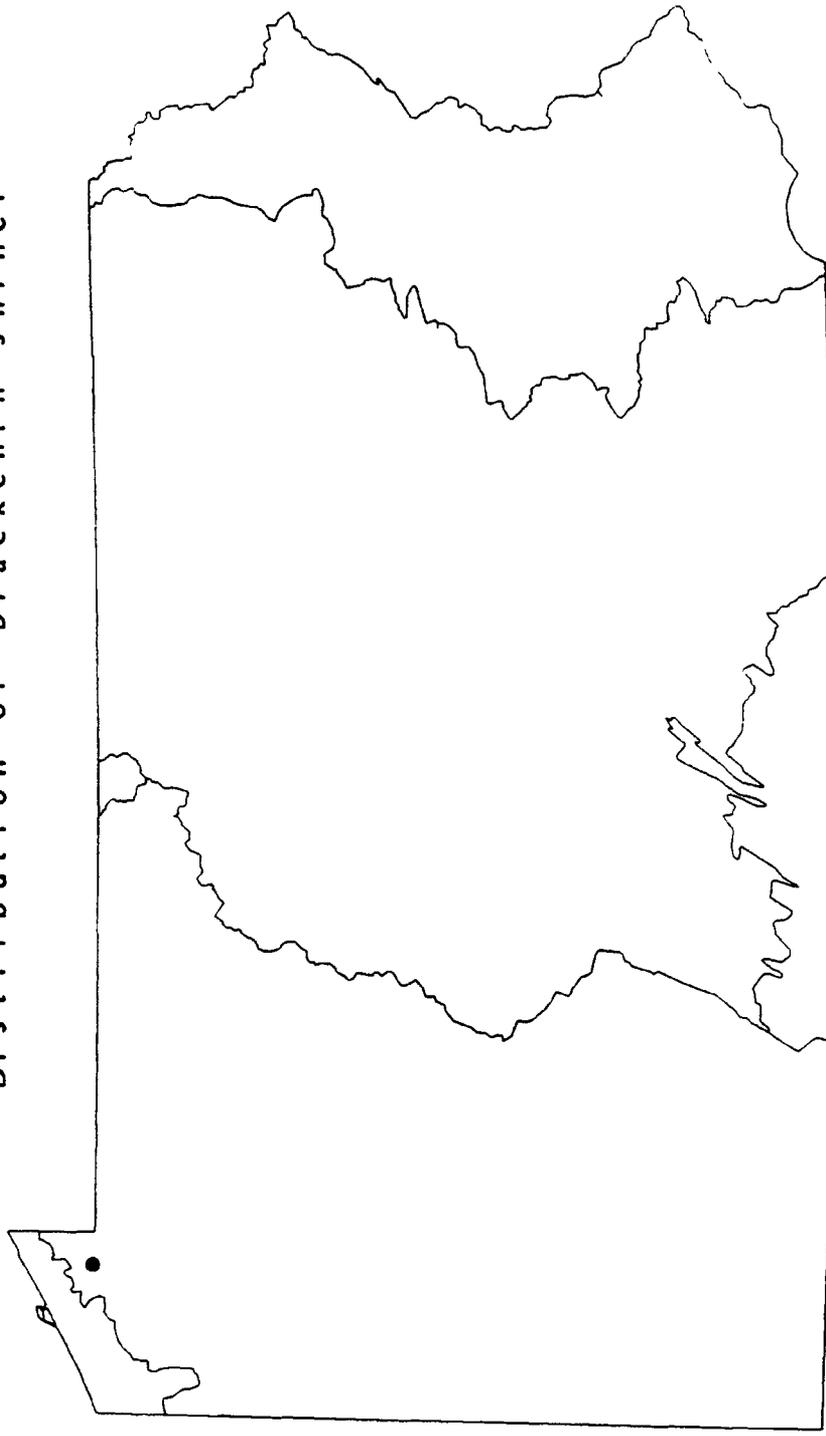


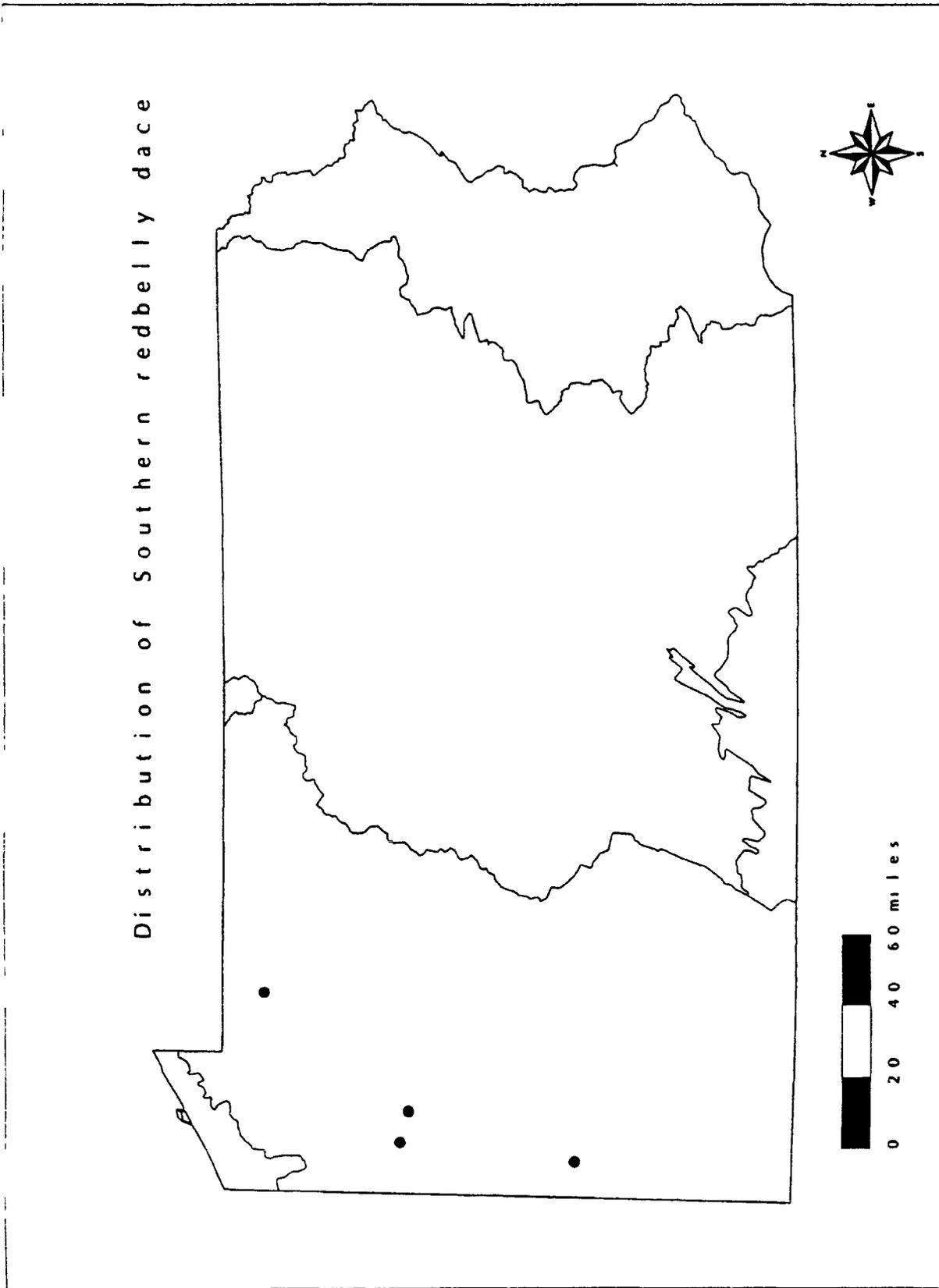


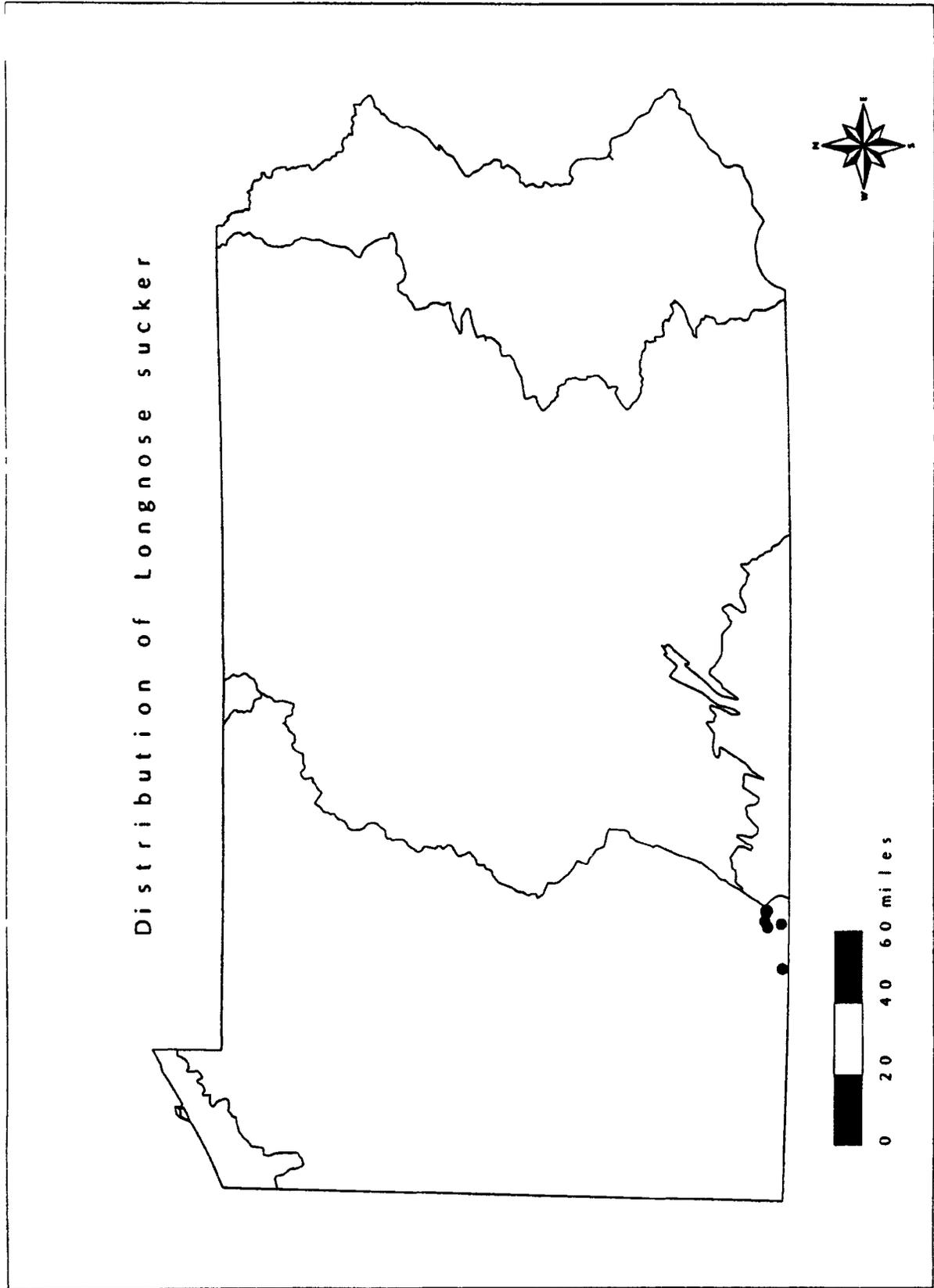


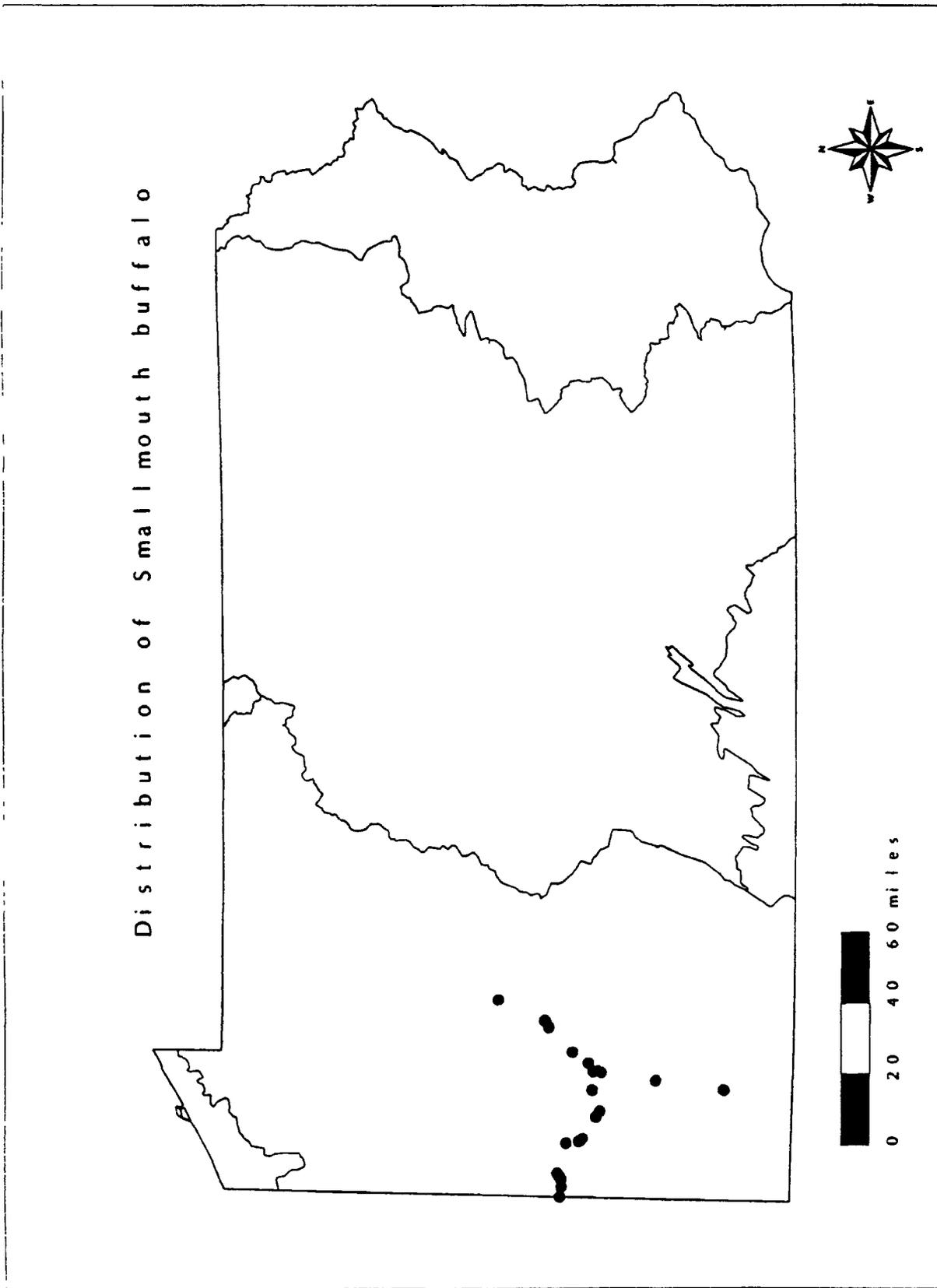


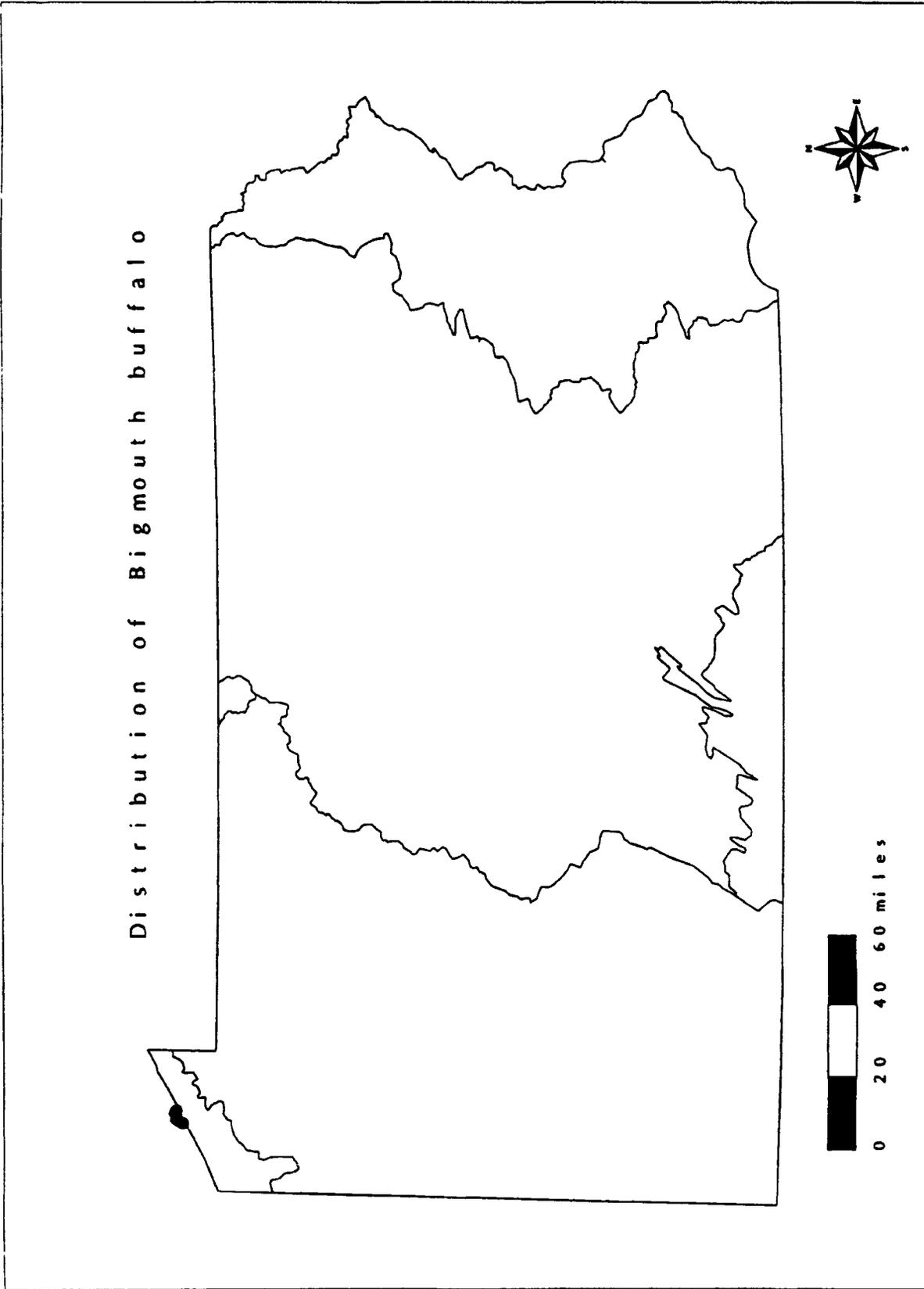
Distribution of Blackchin shiner

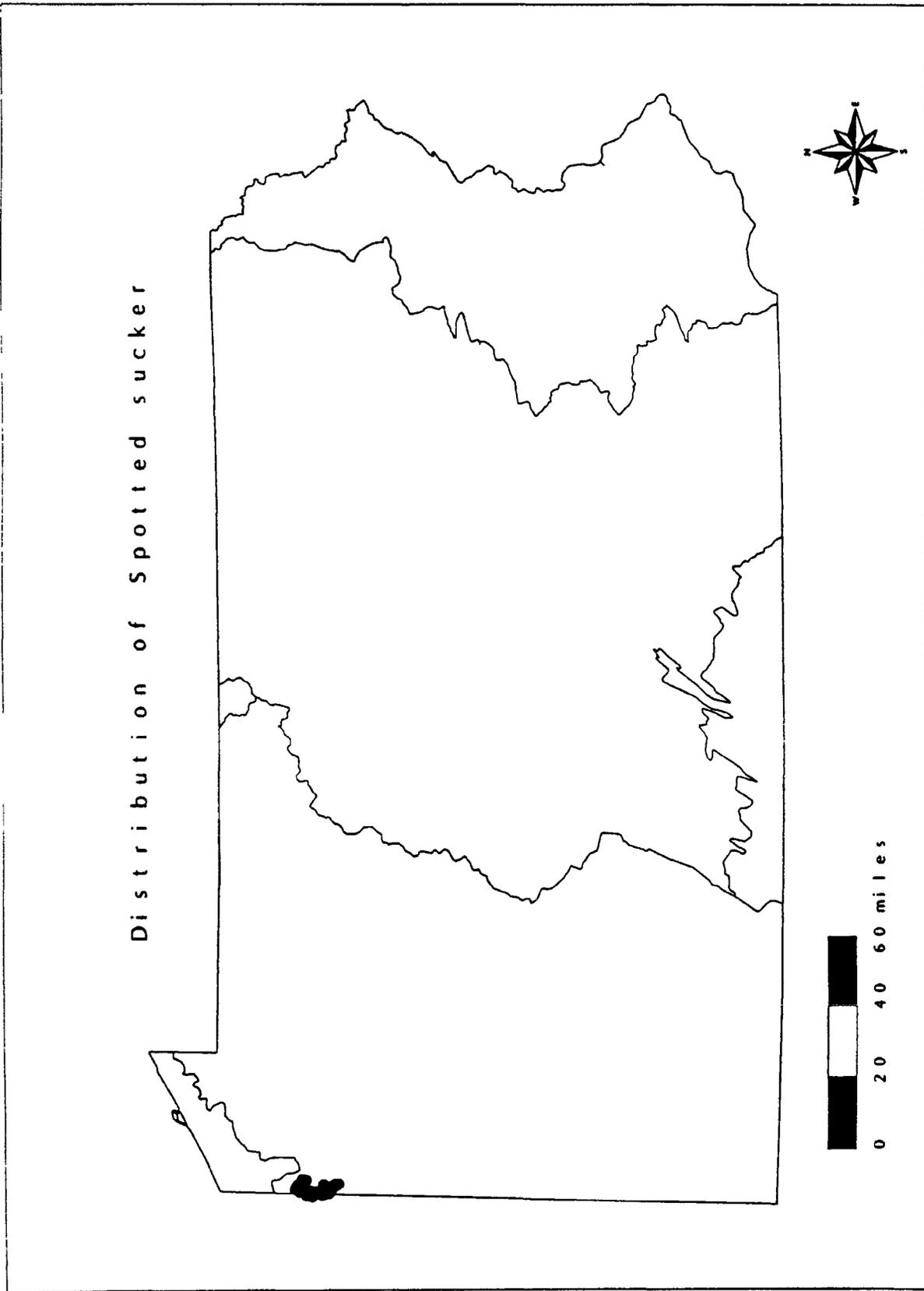


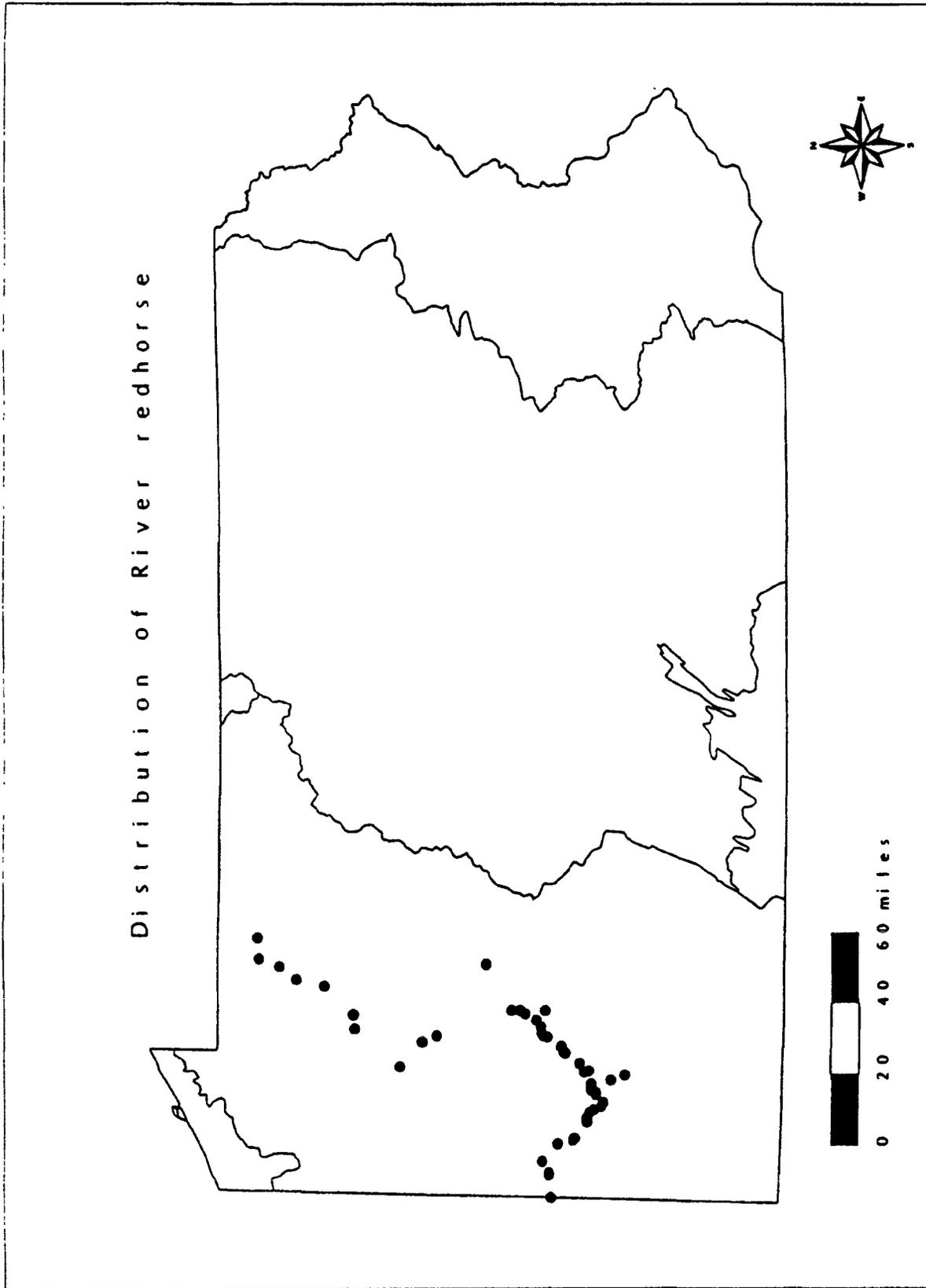




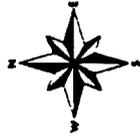
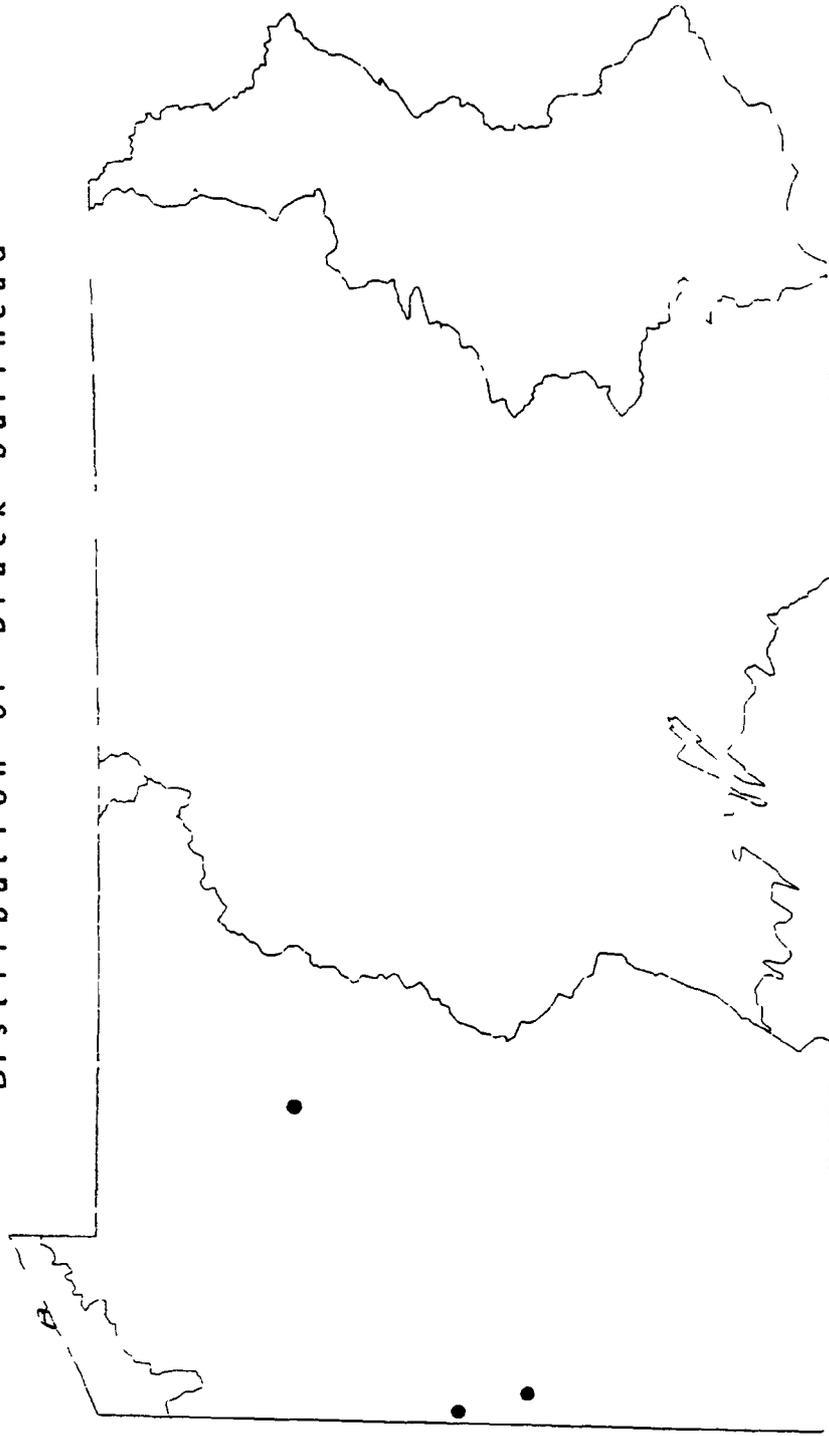


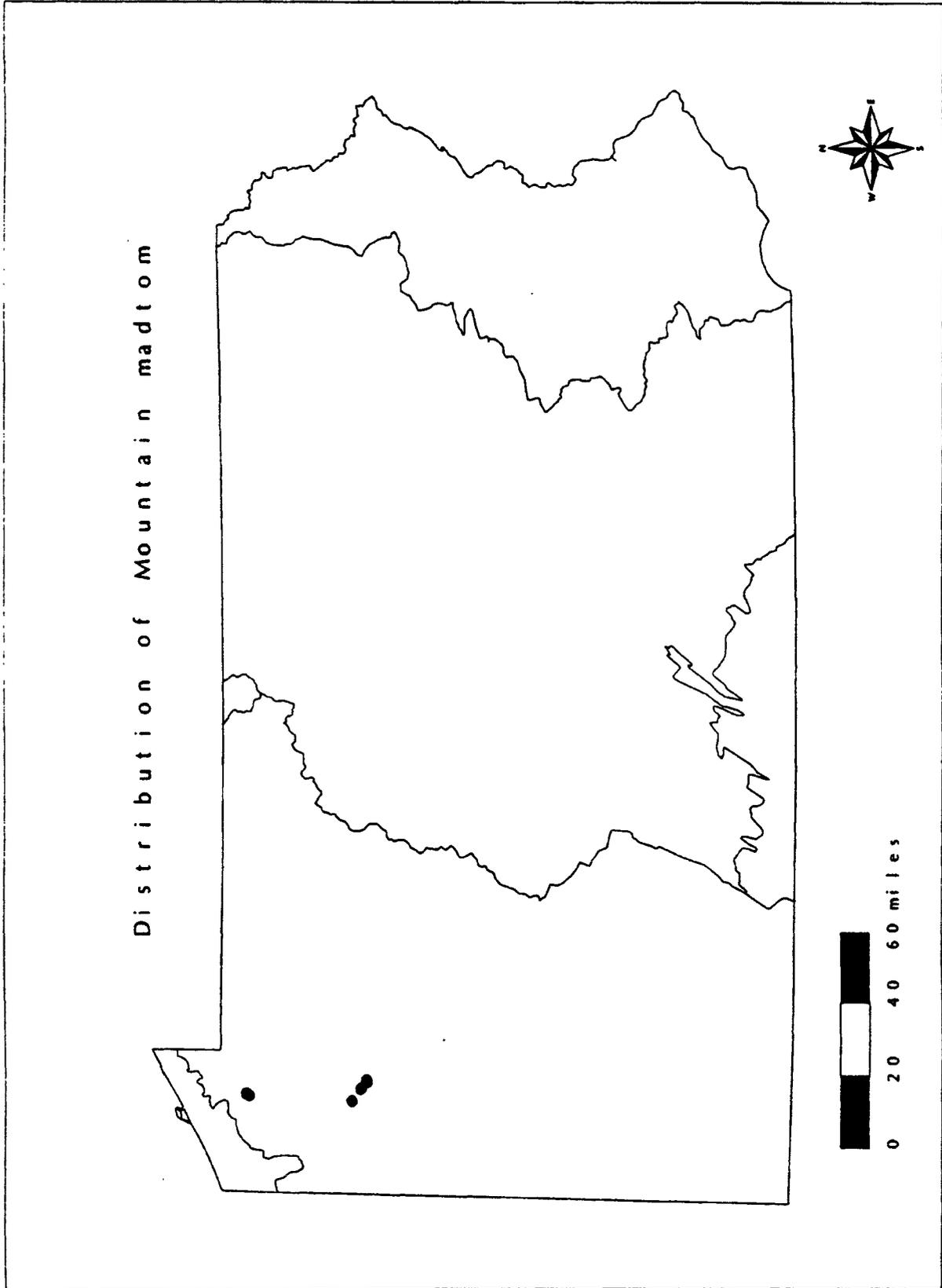




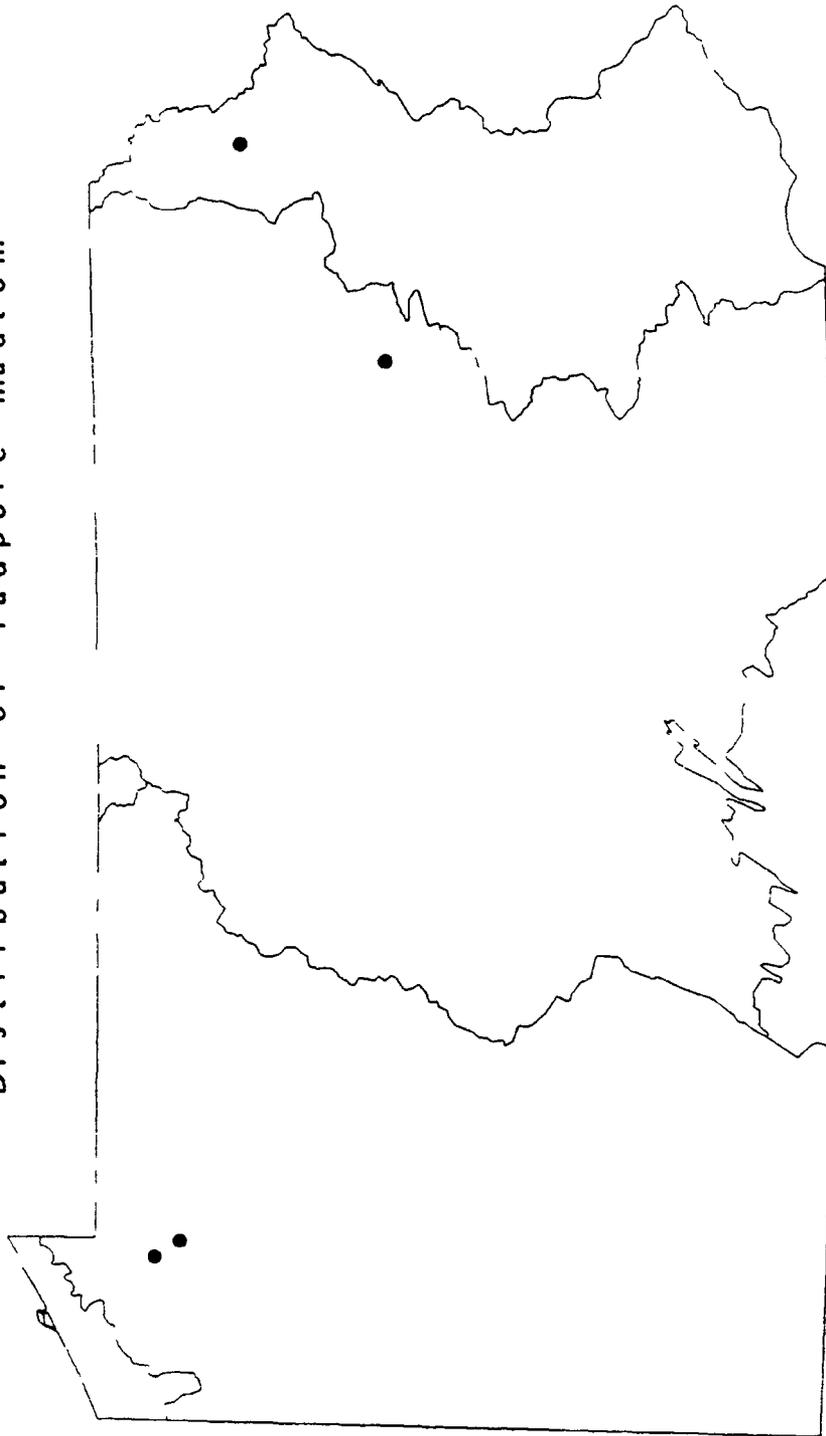


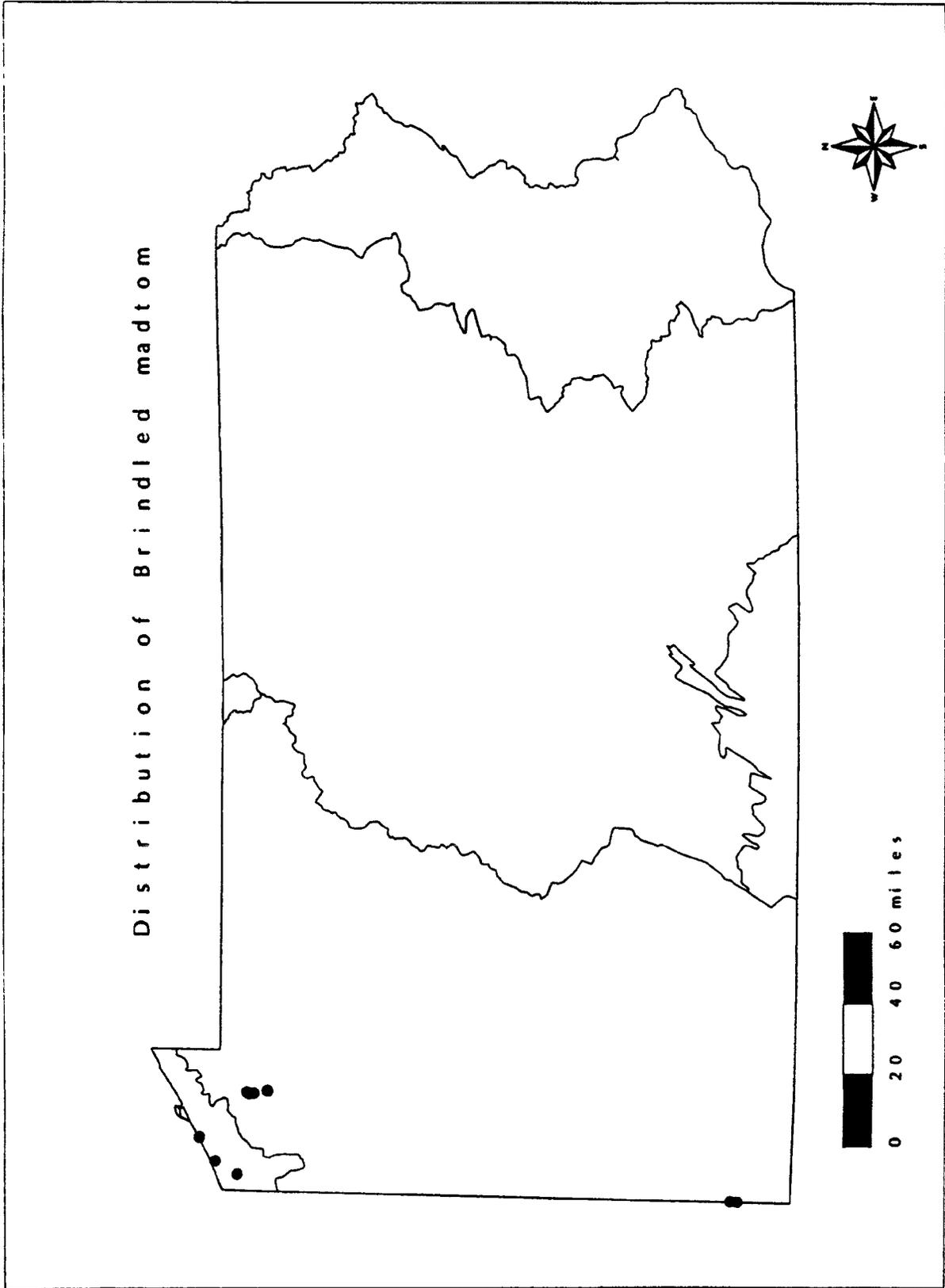
Distribution of Black bullhead

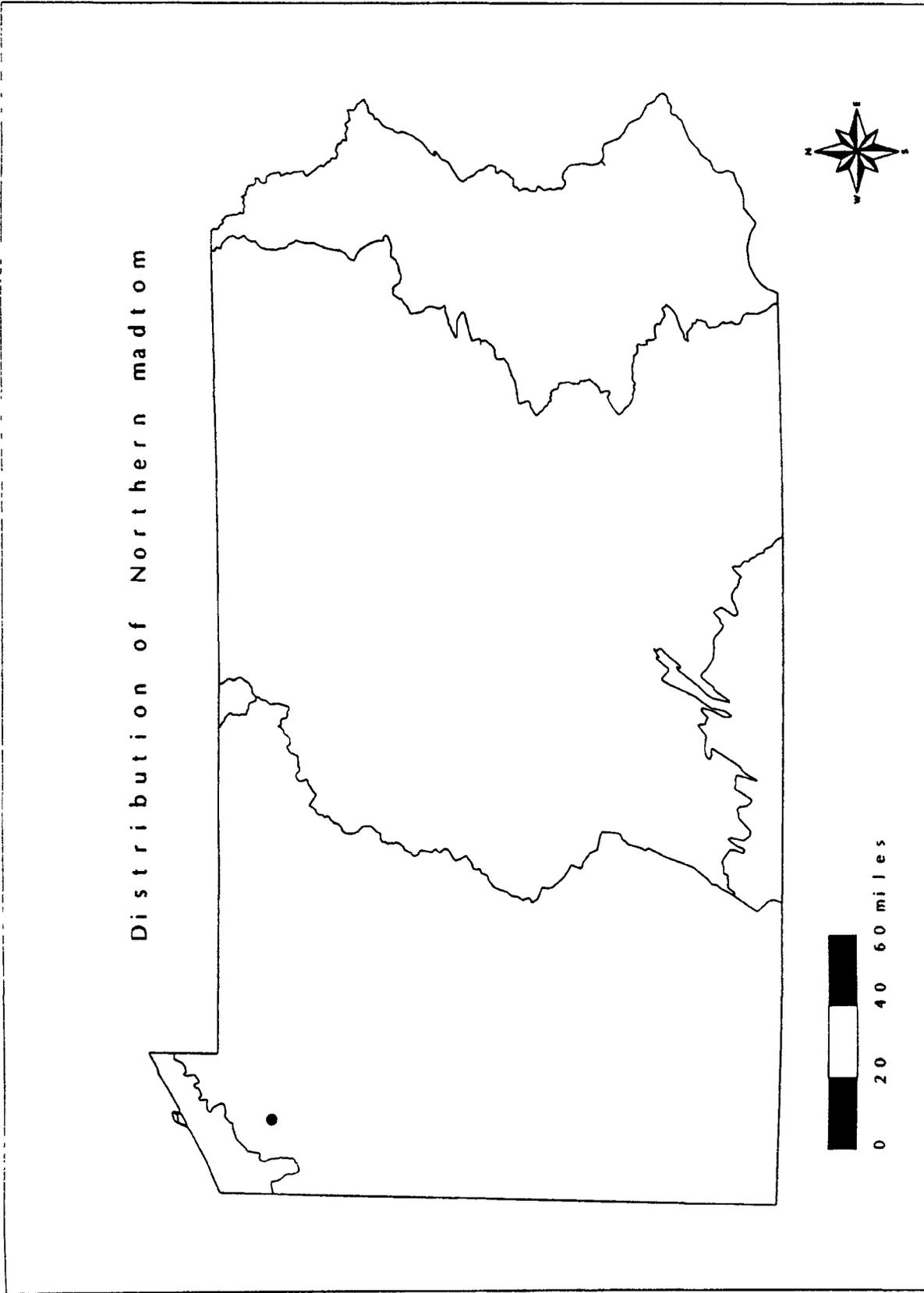


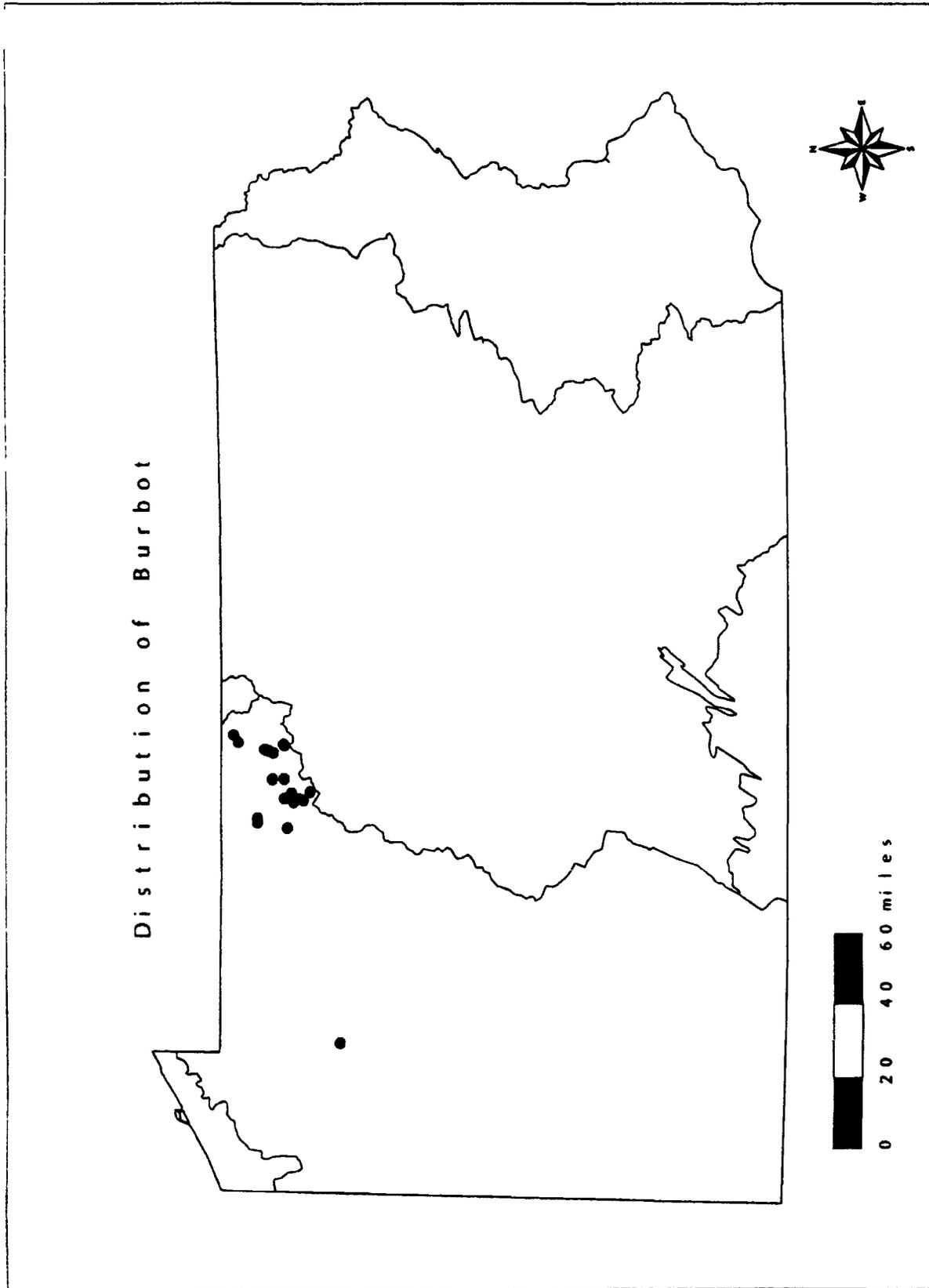


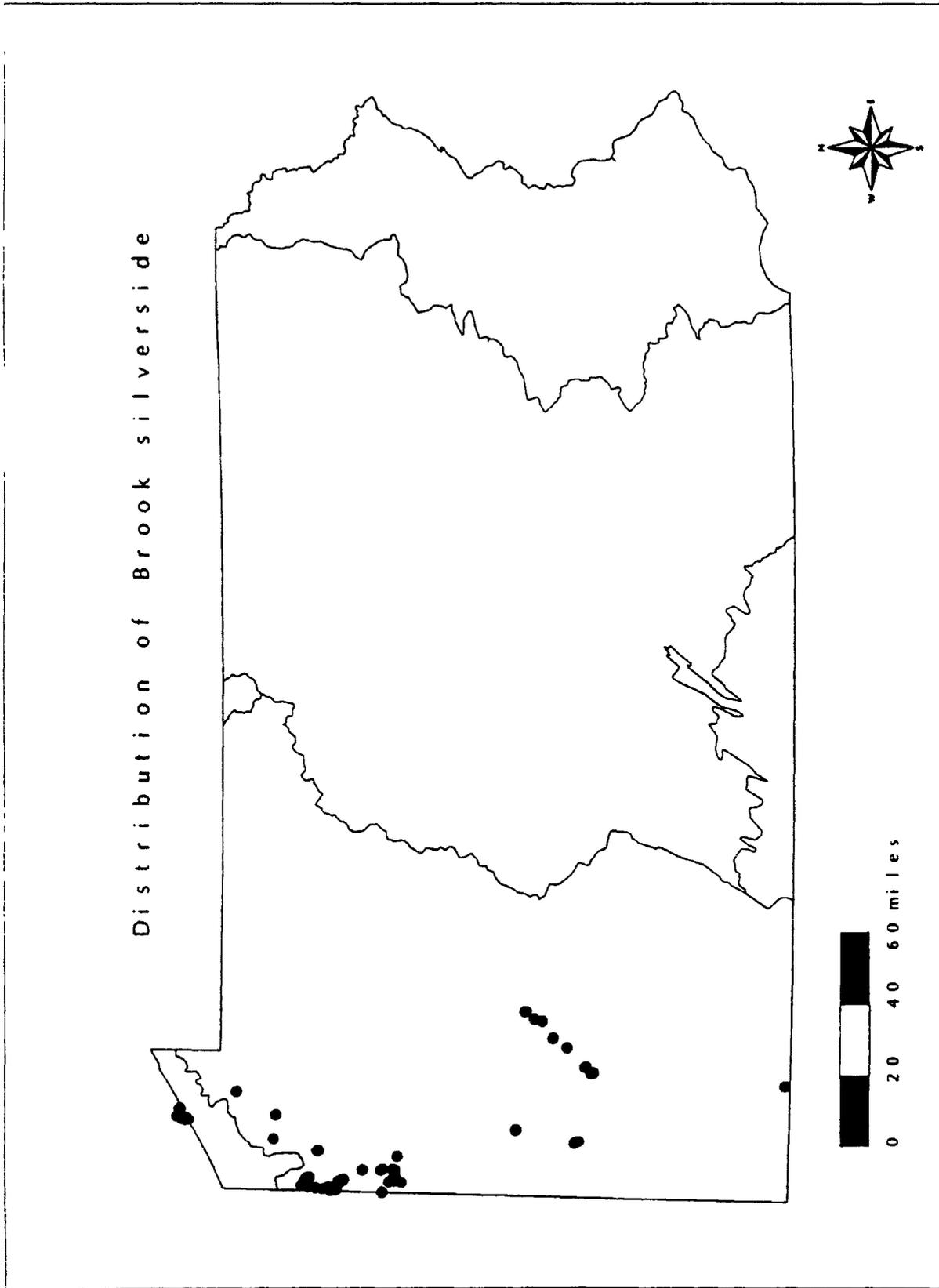
Distribution of Tadpole madtom

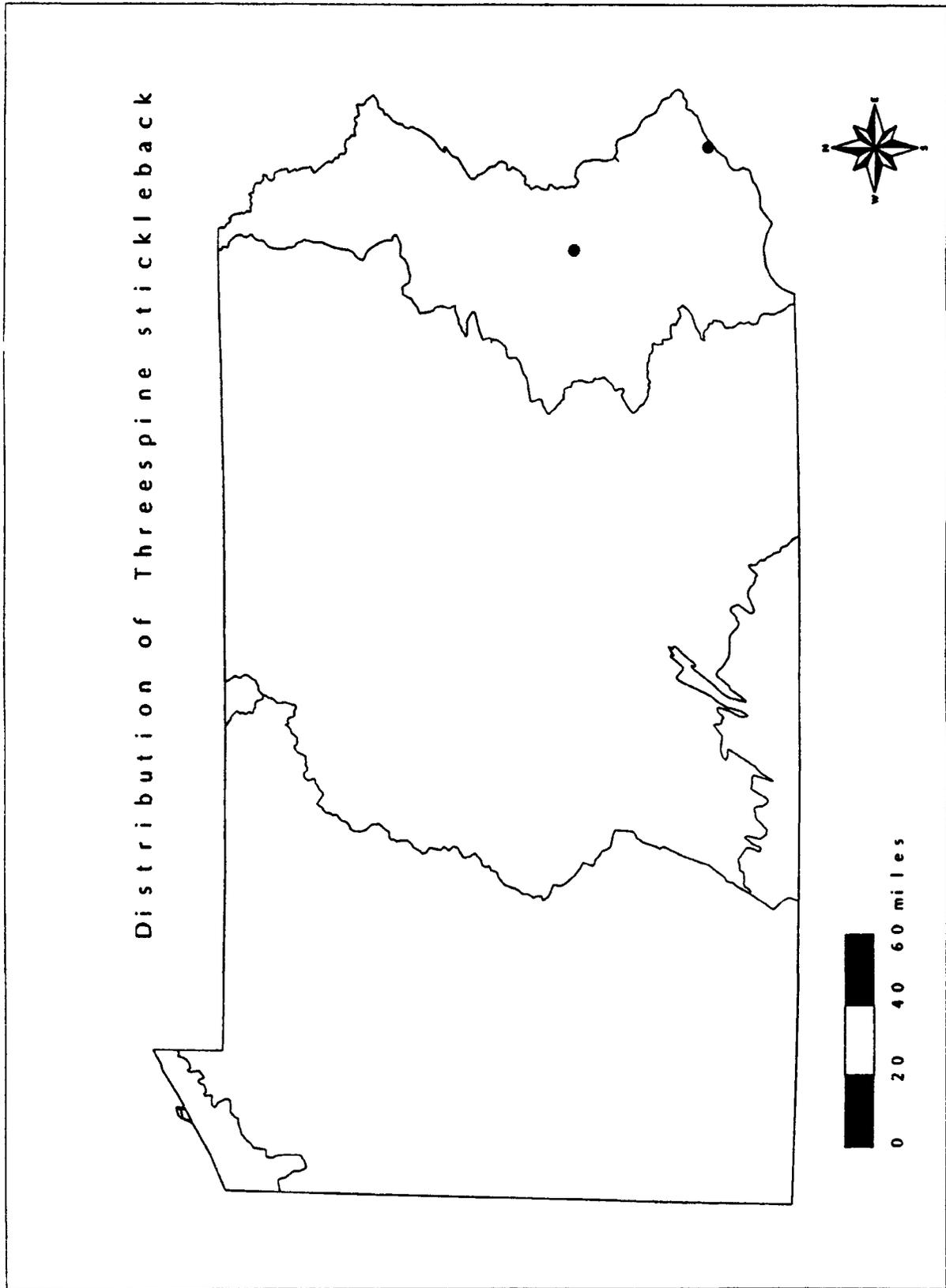


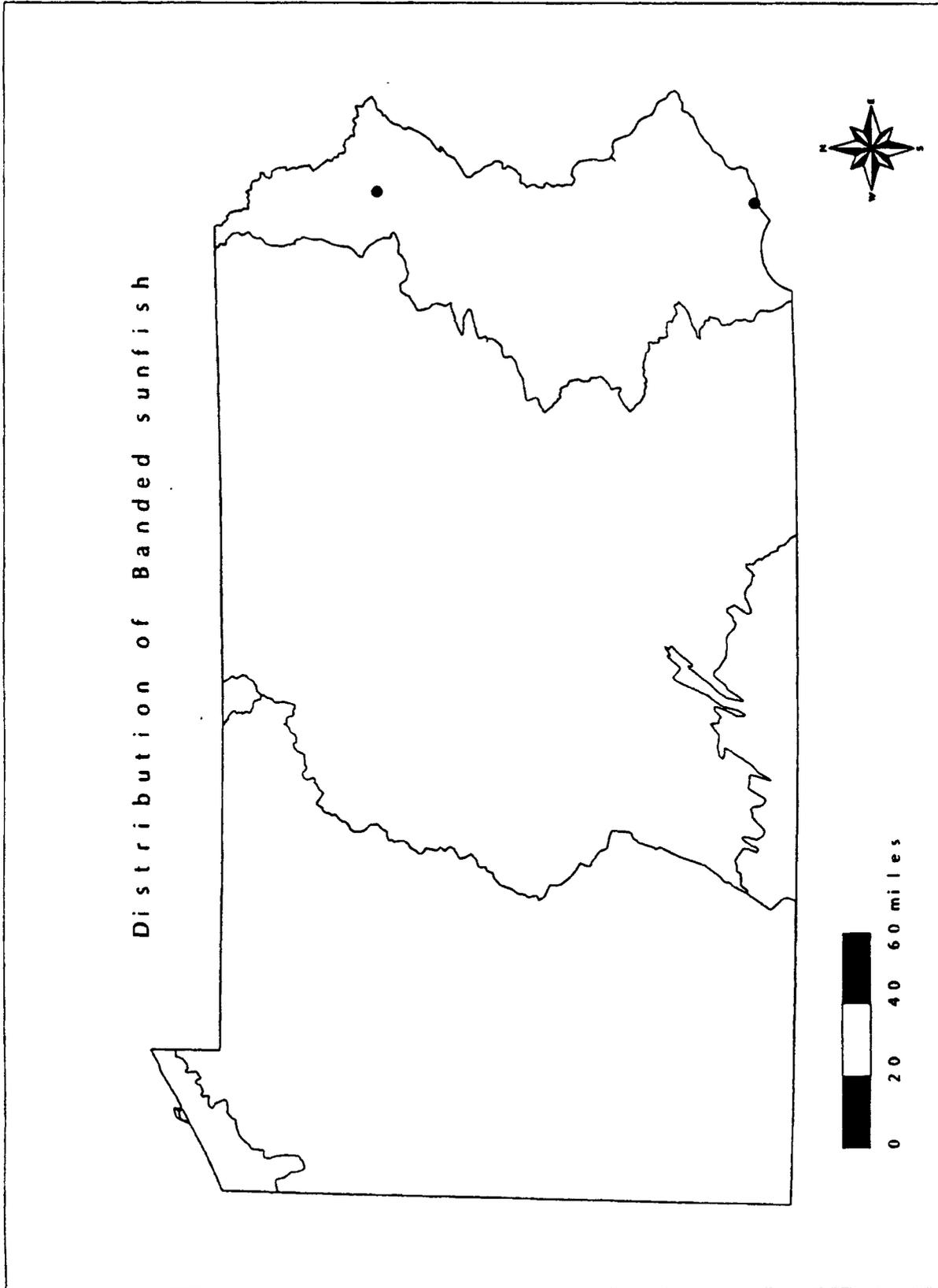


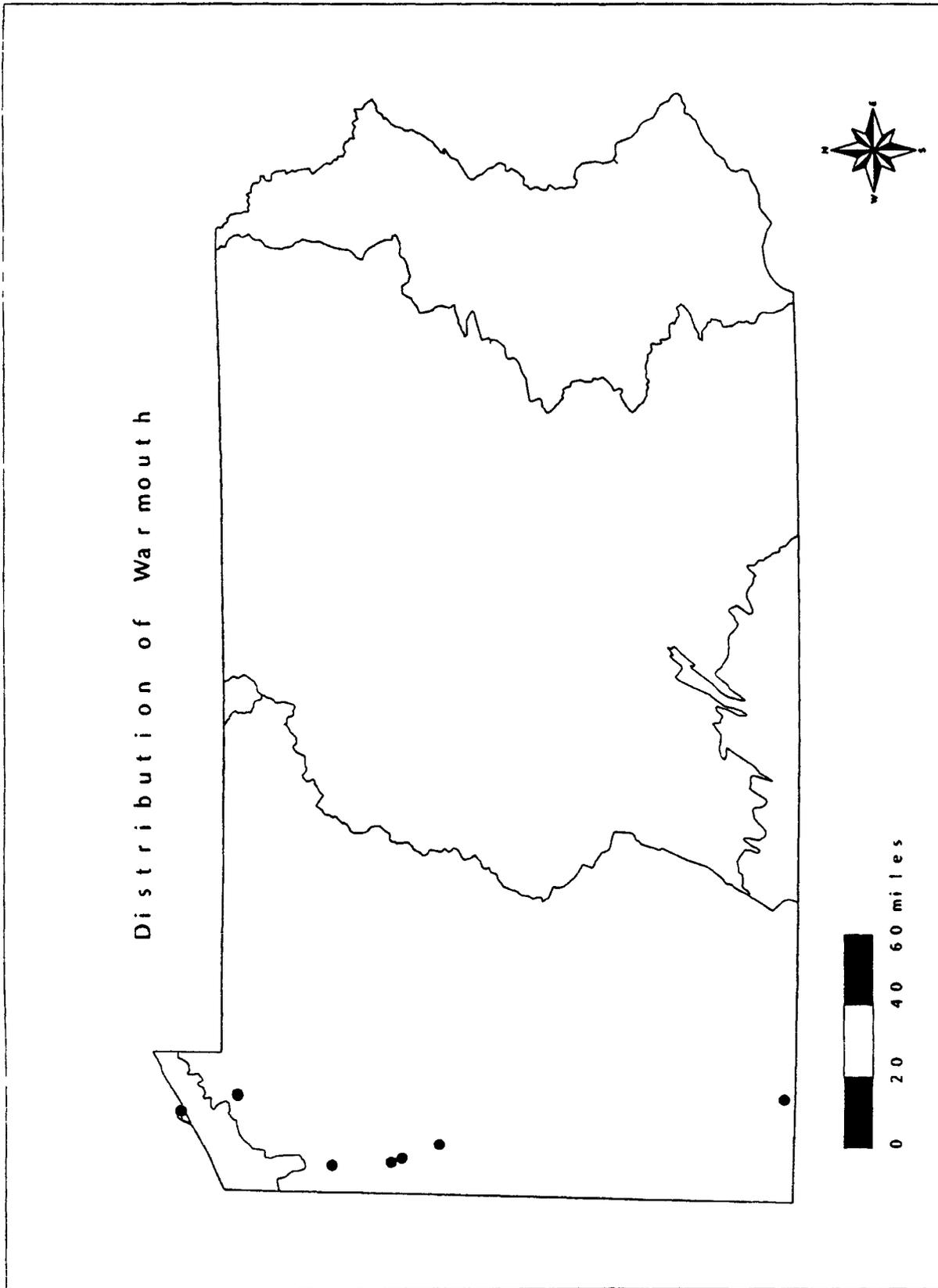


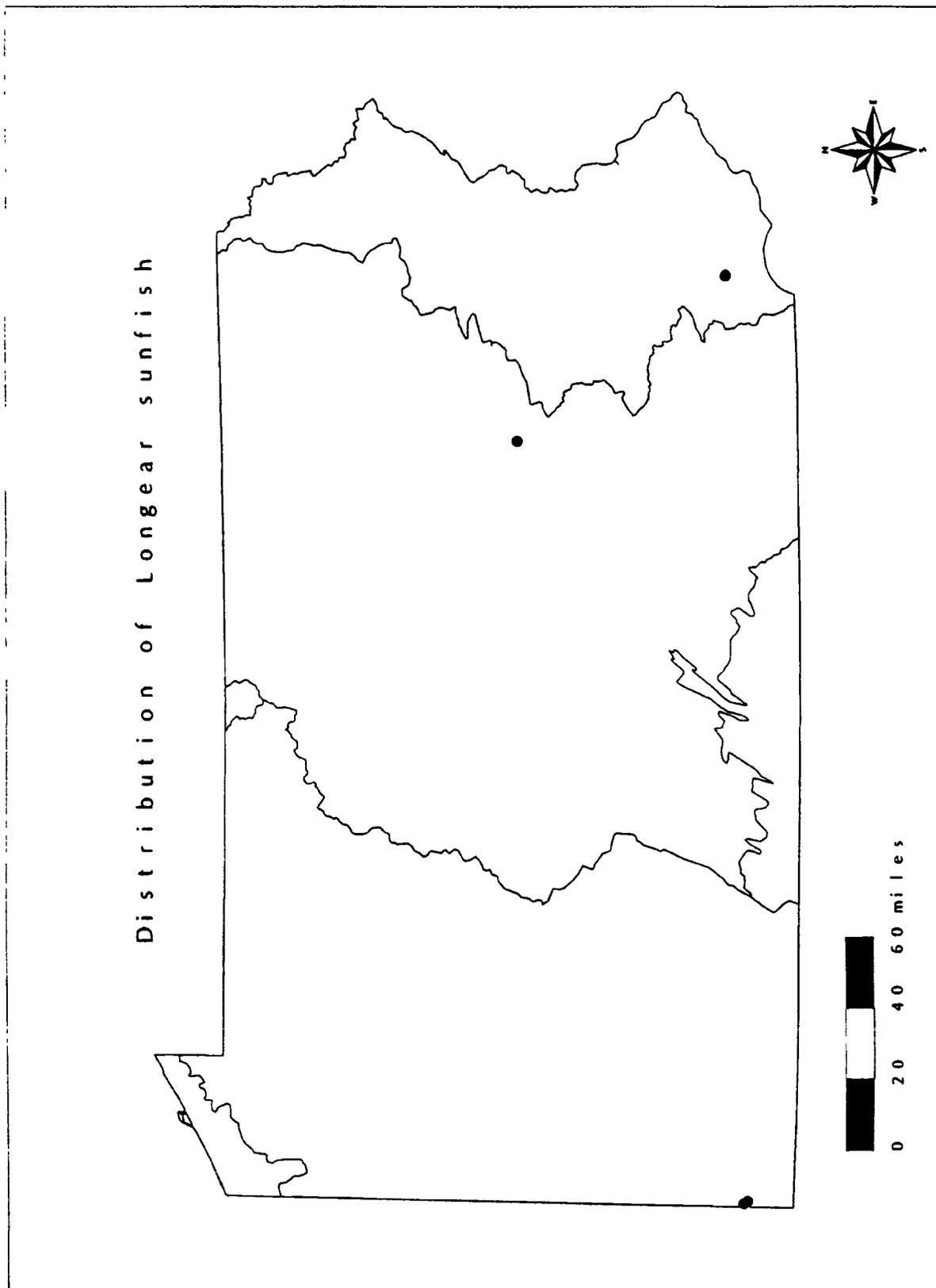


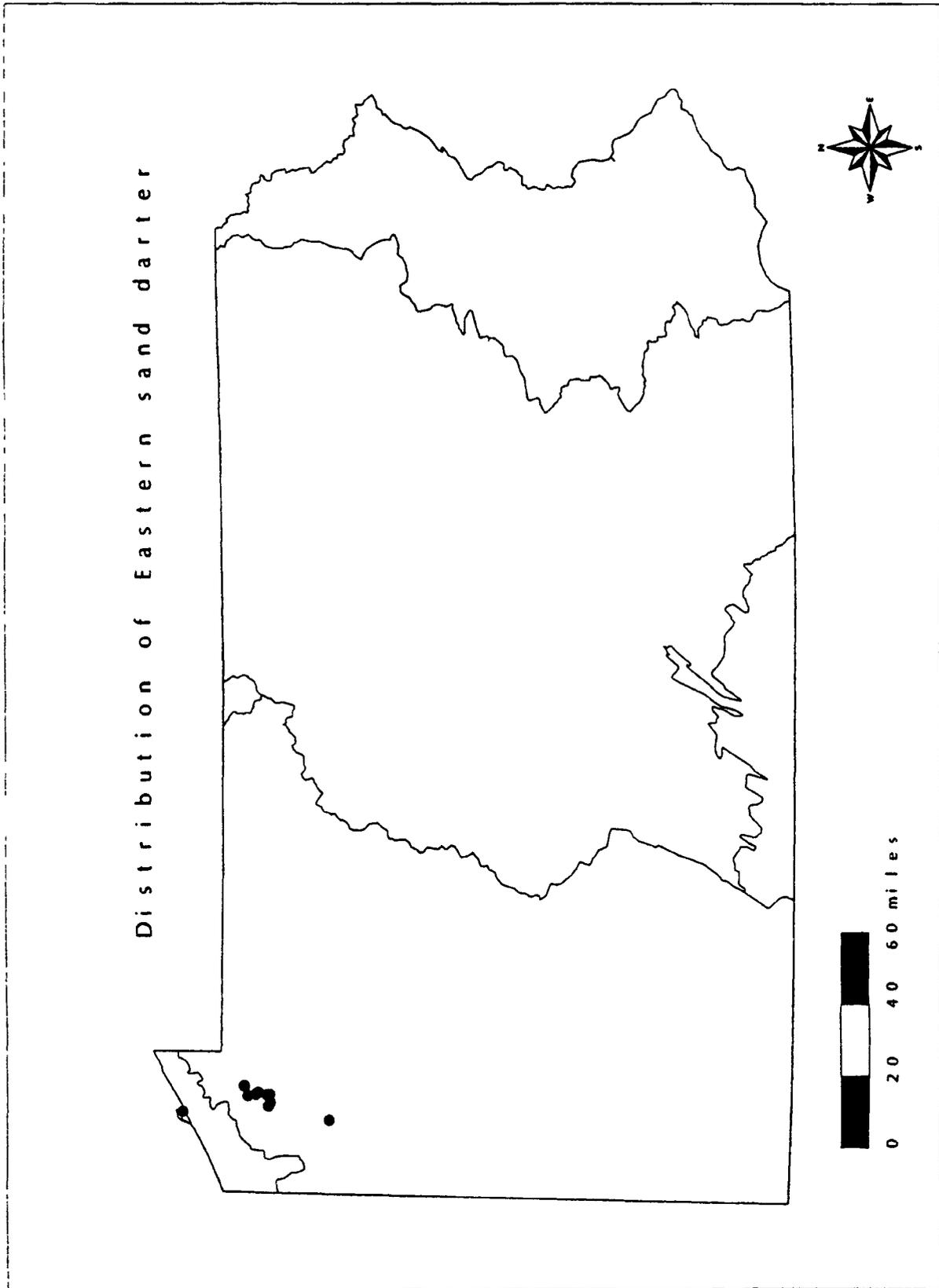


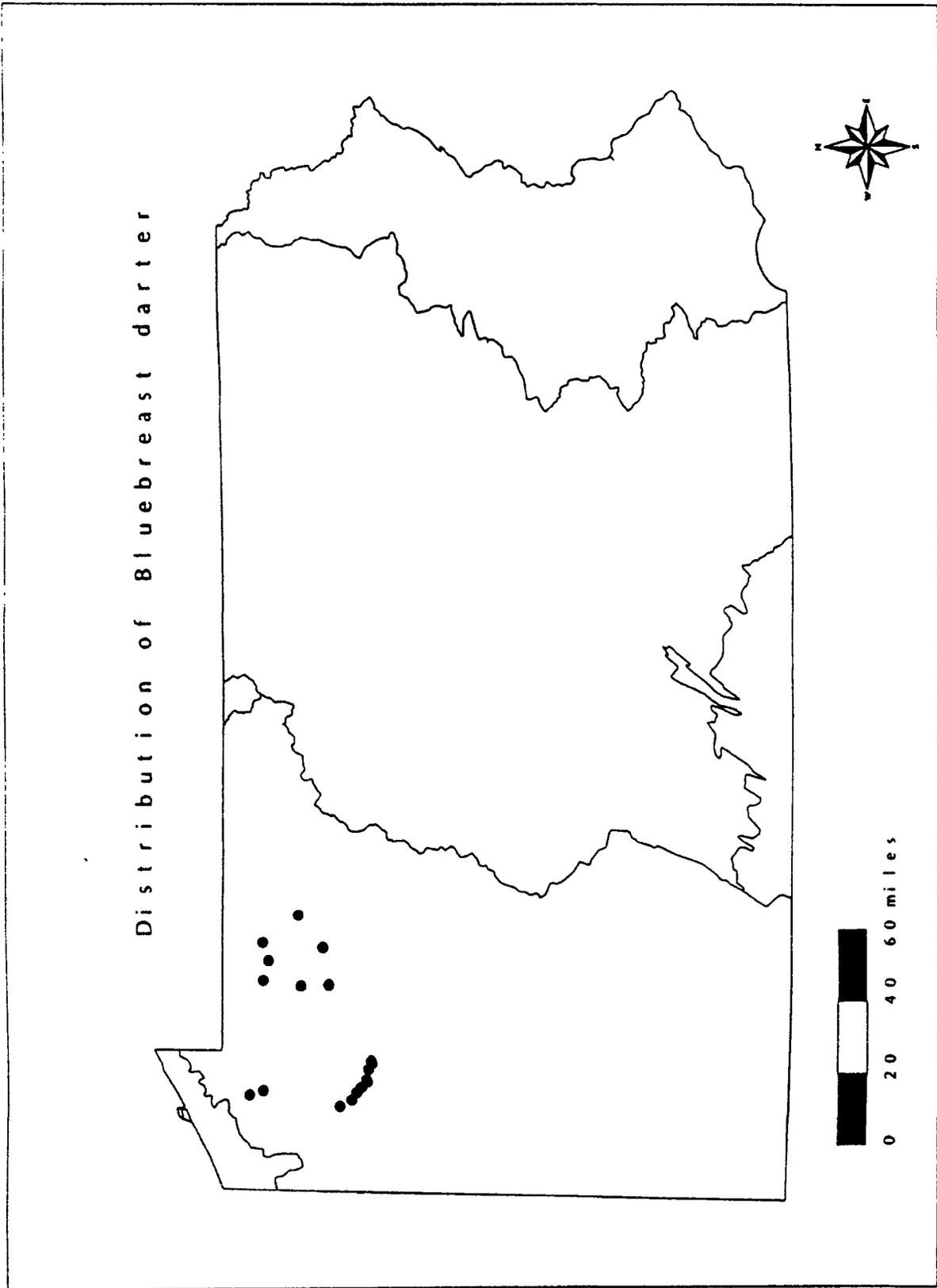


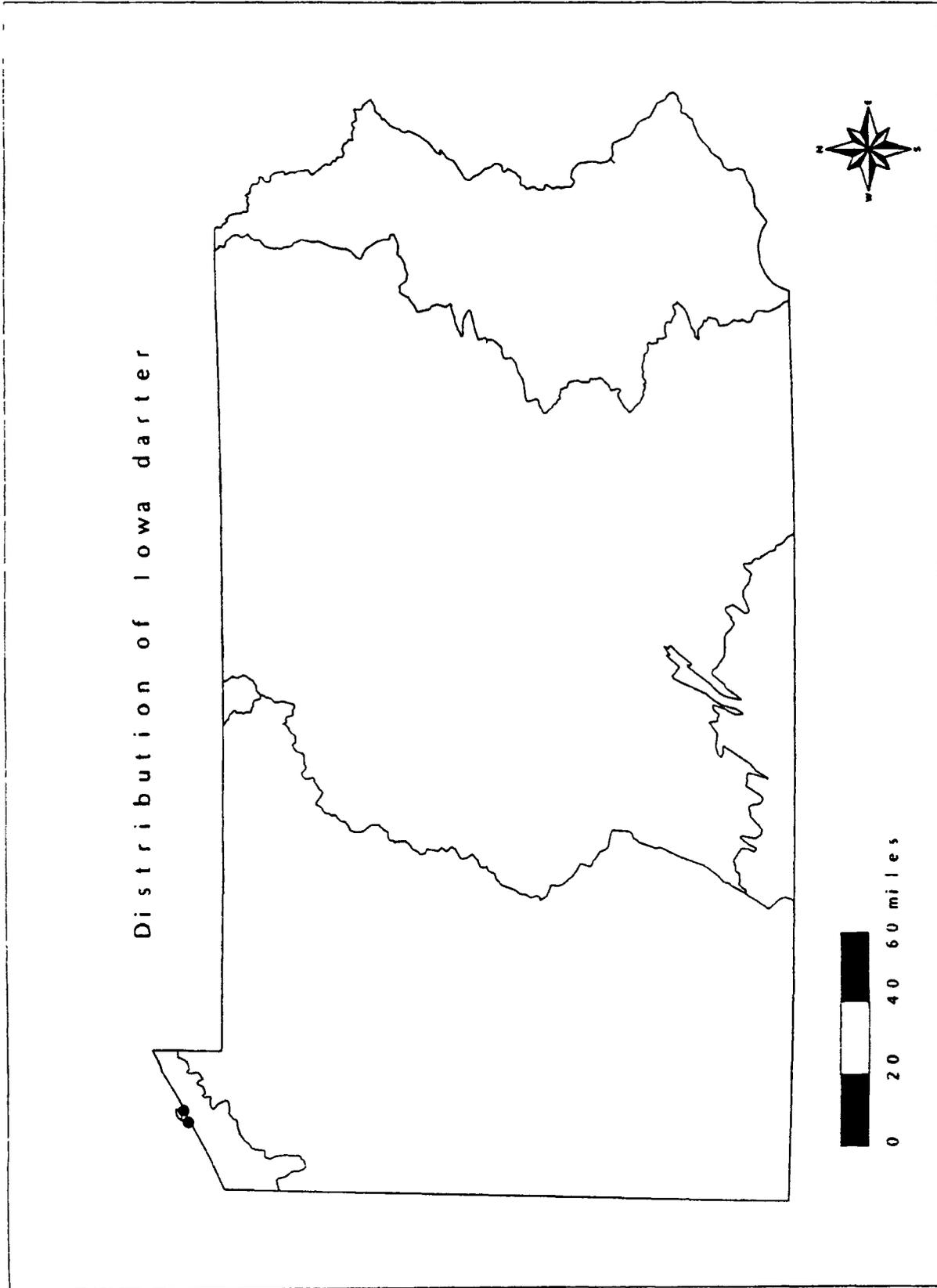


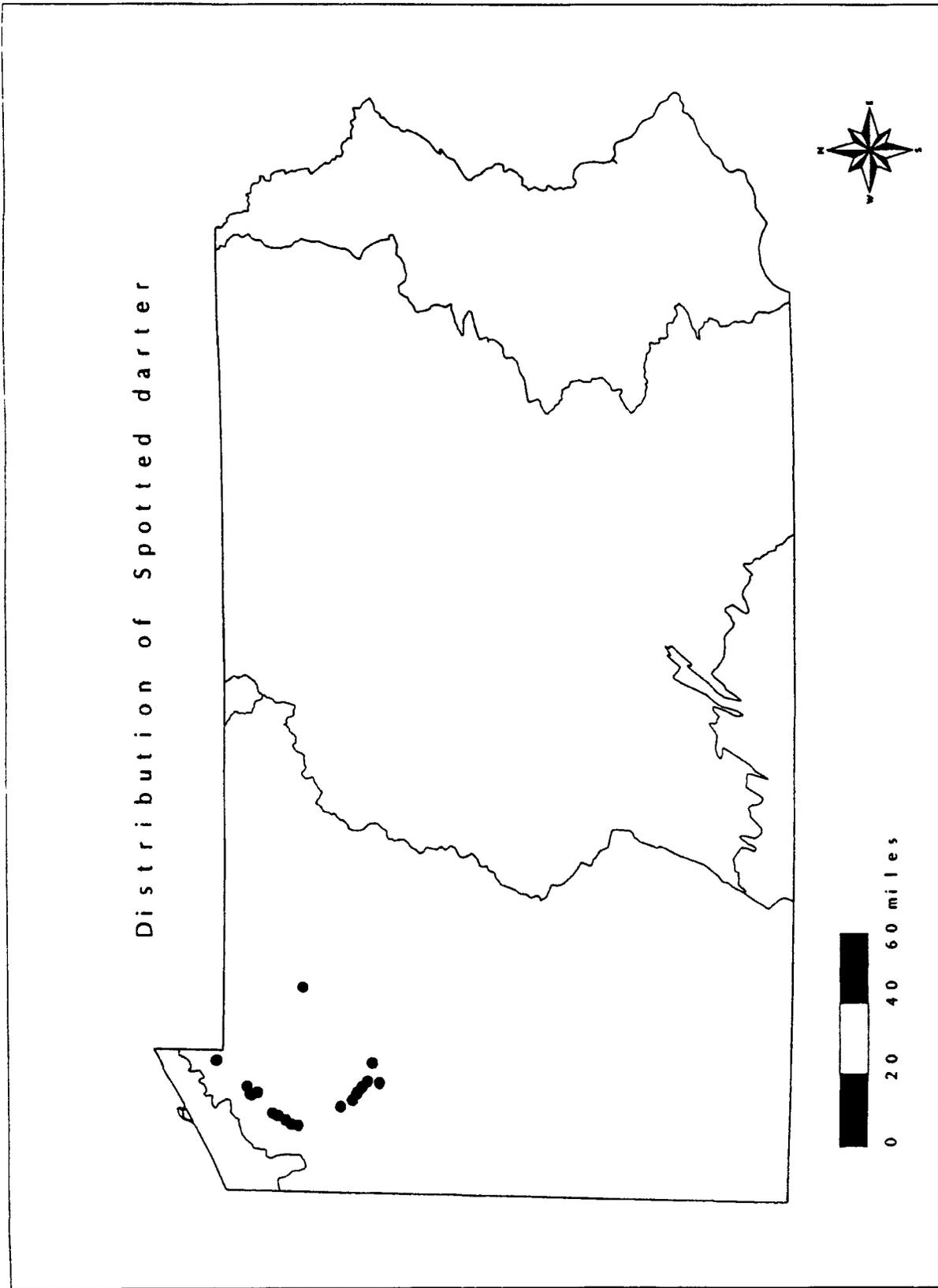


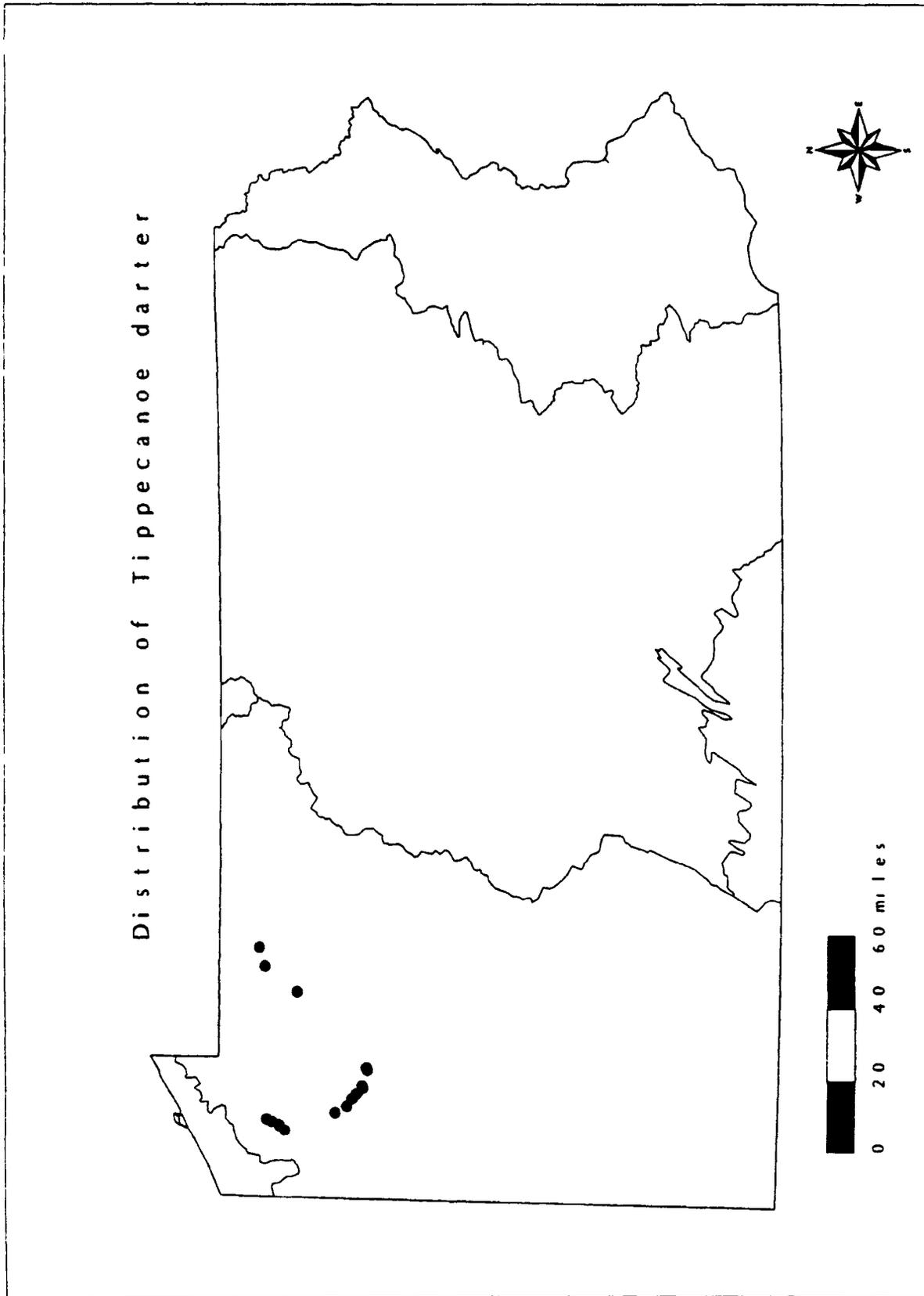


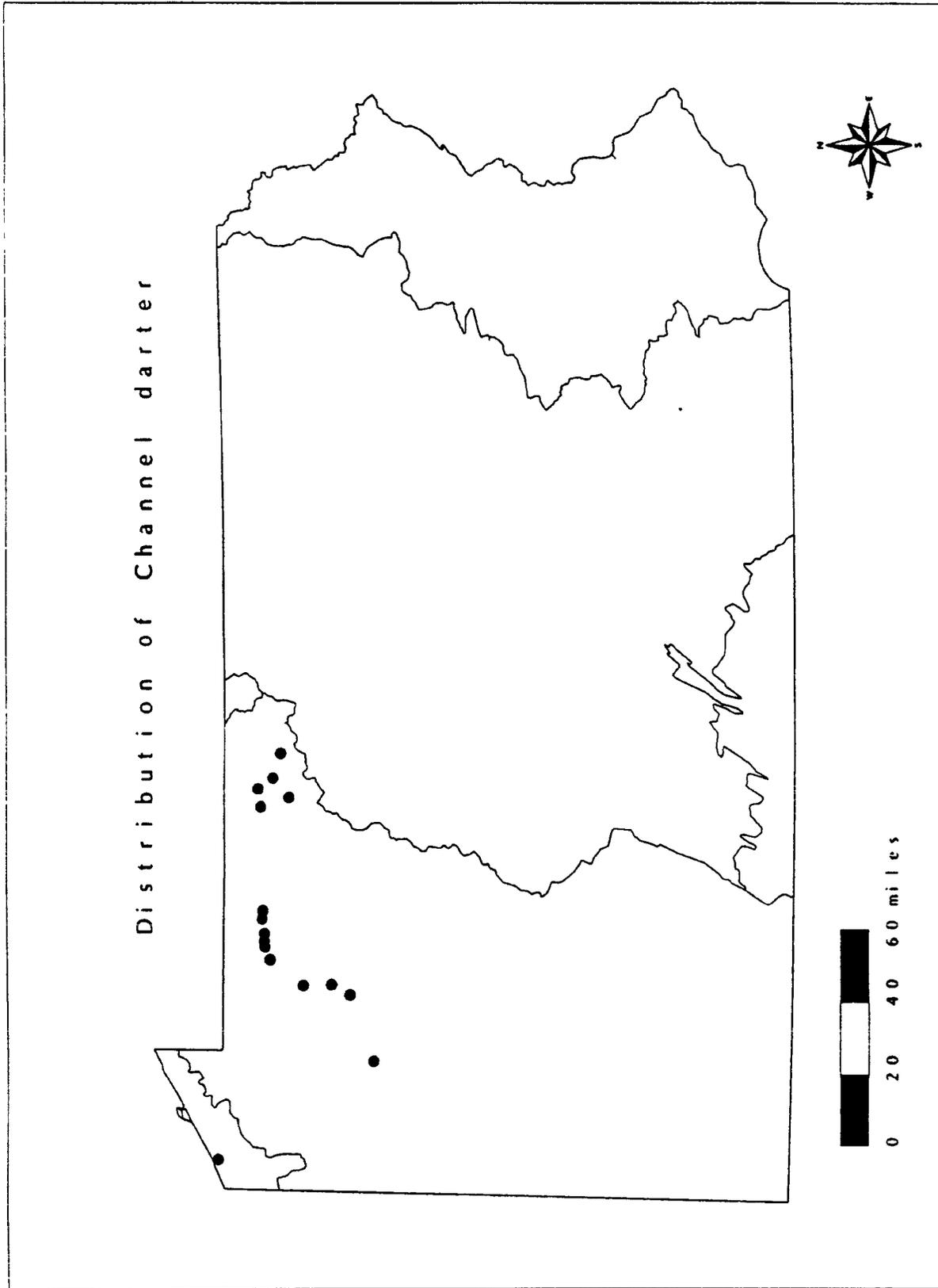


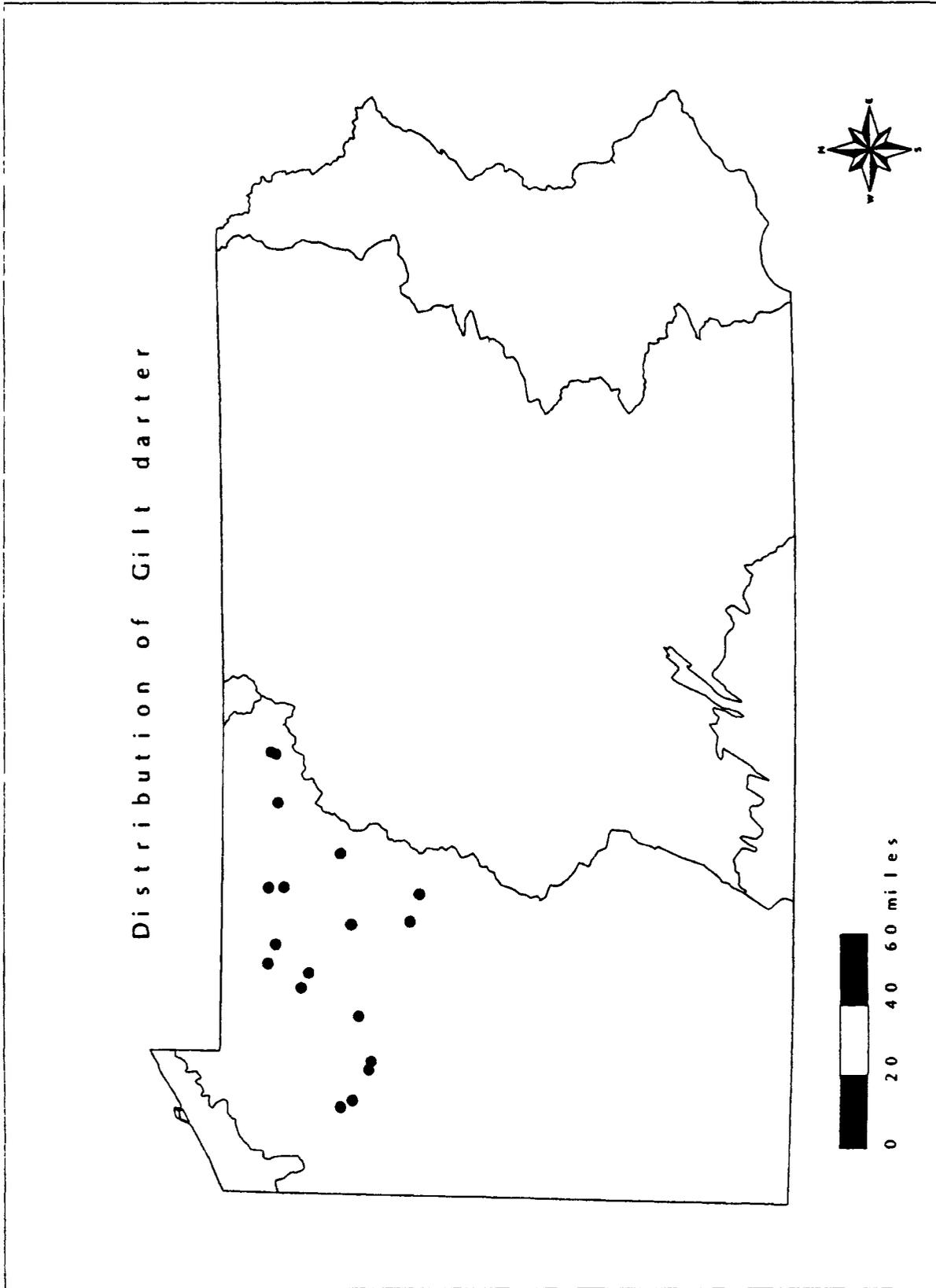


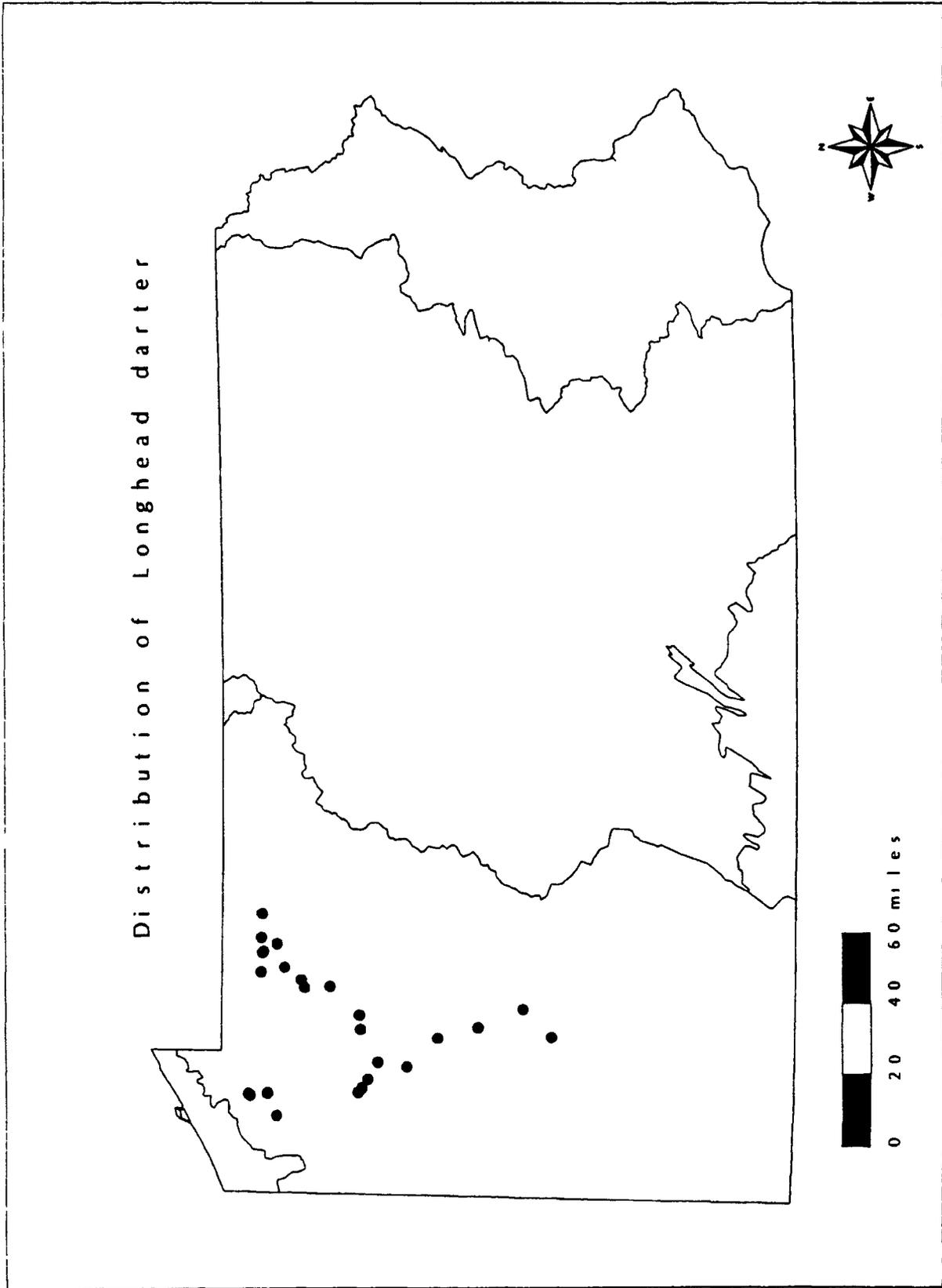


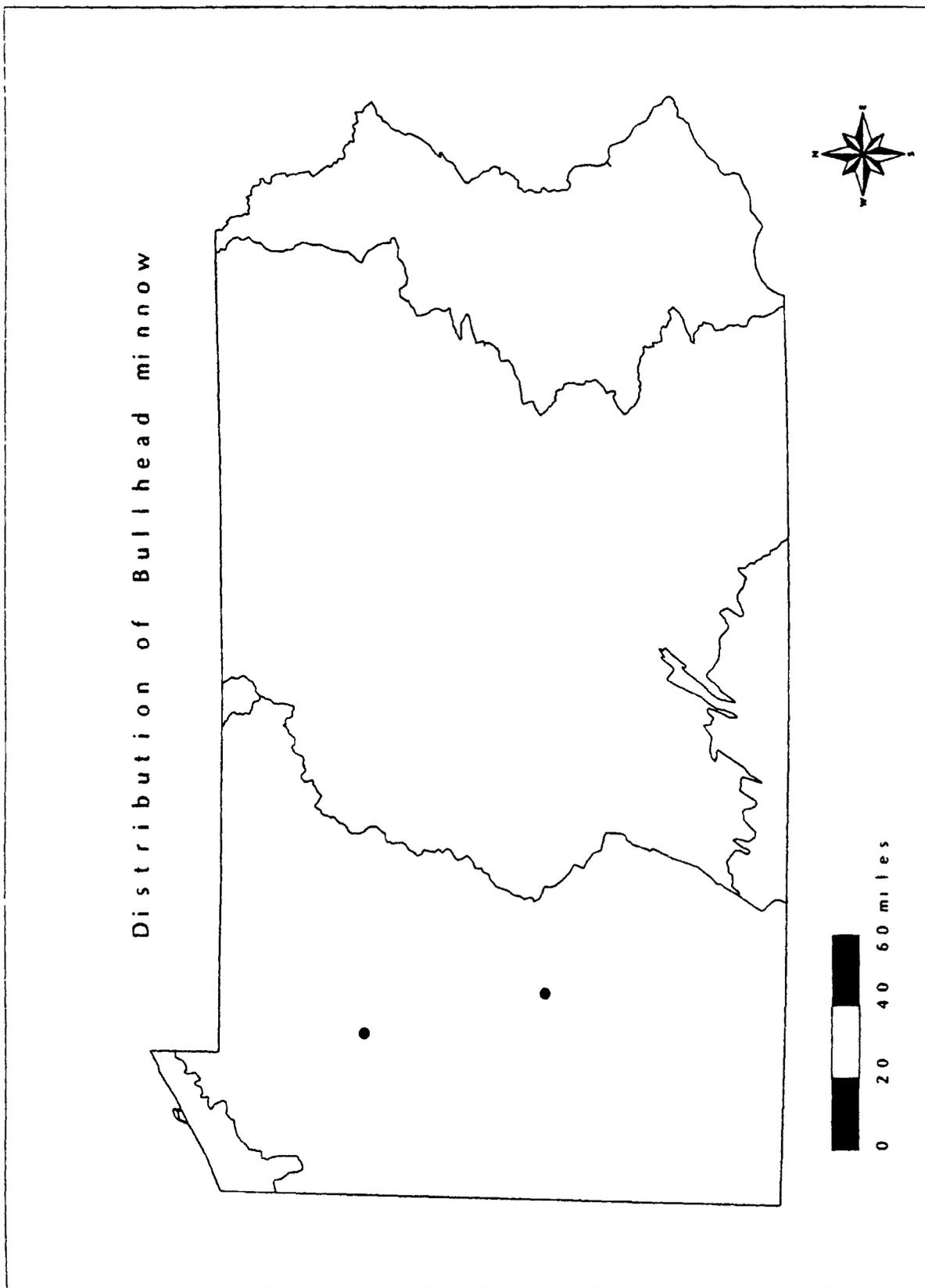


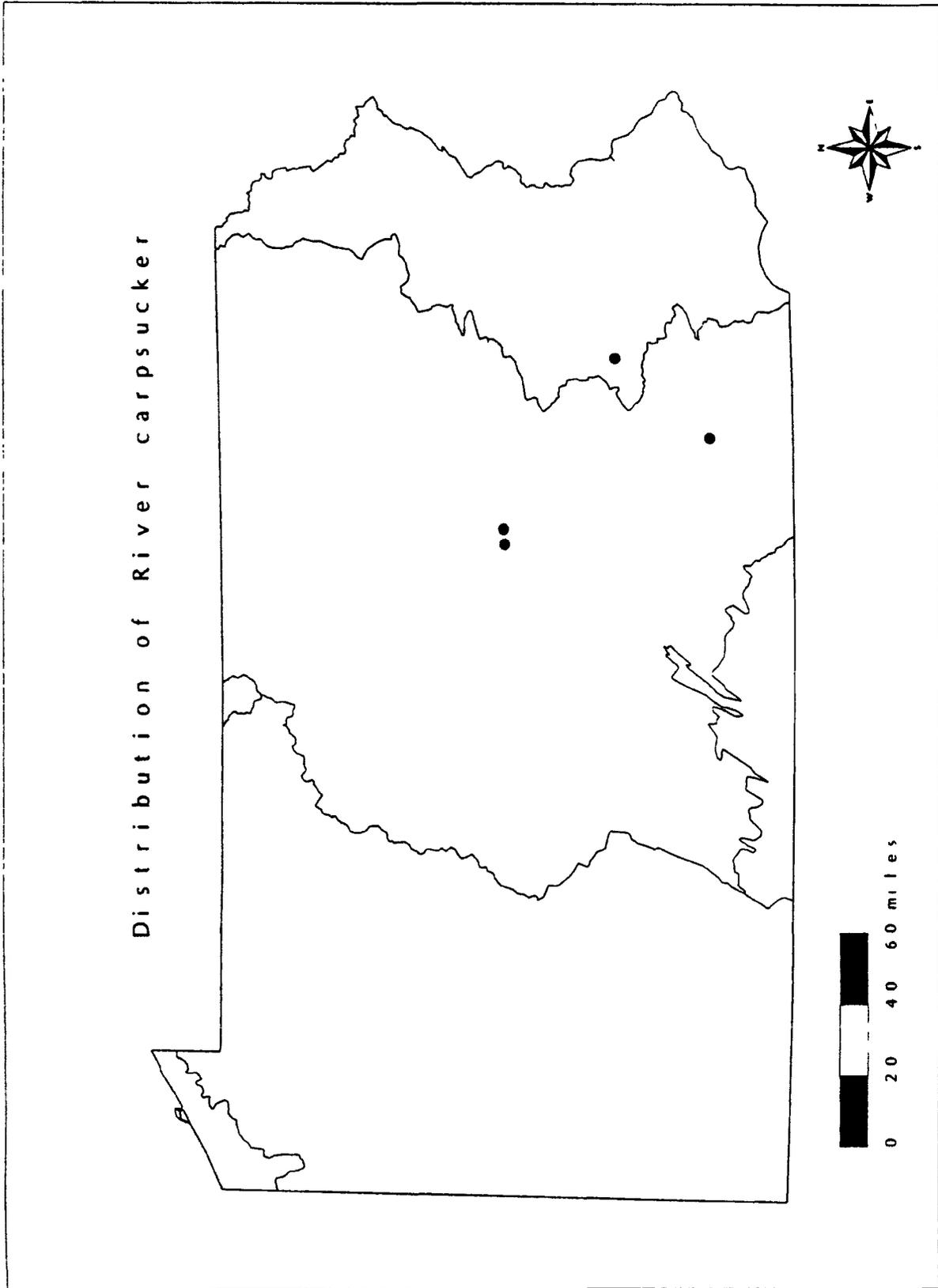


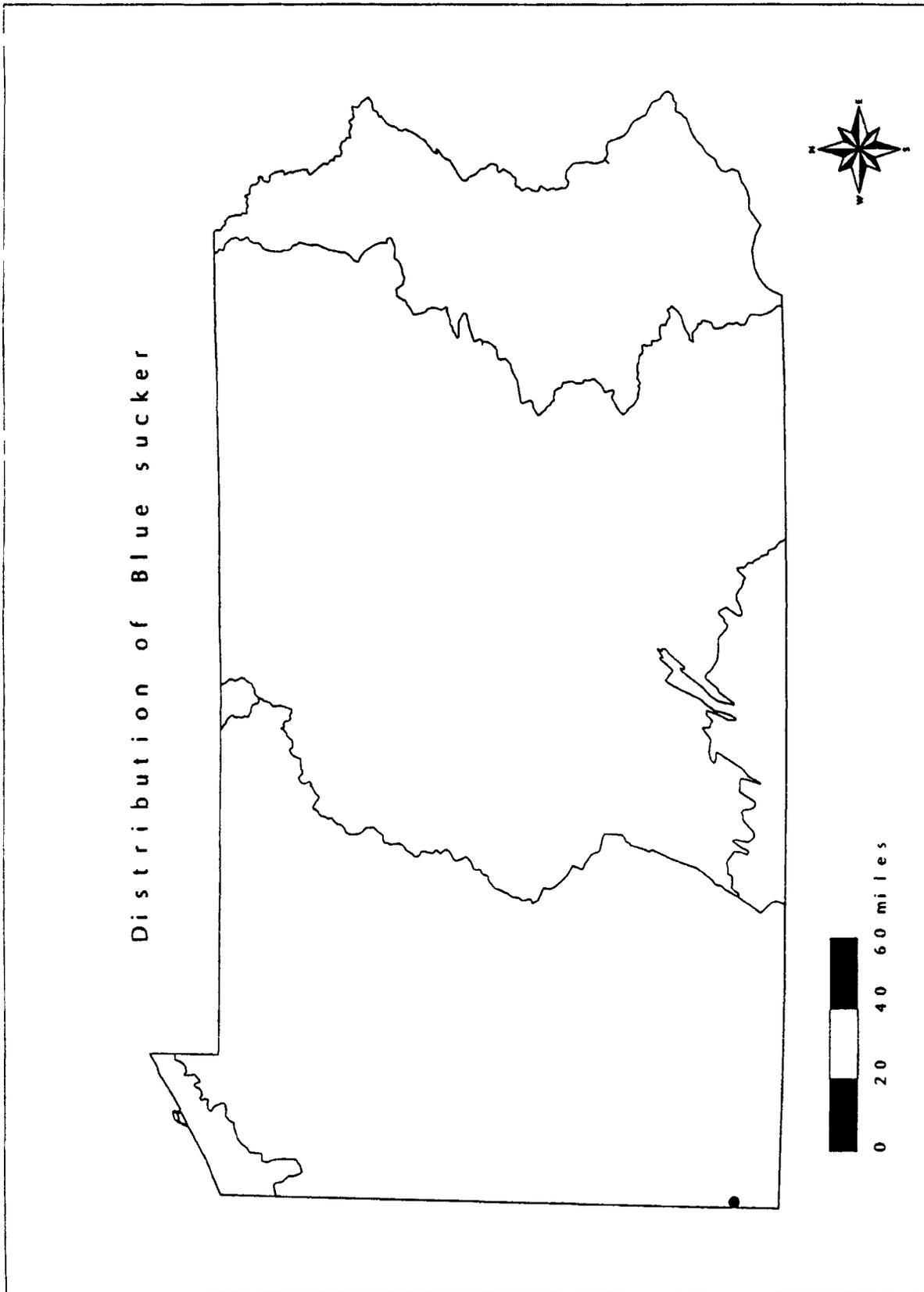


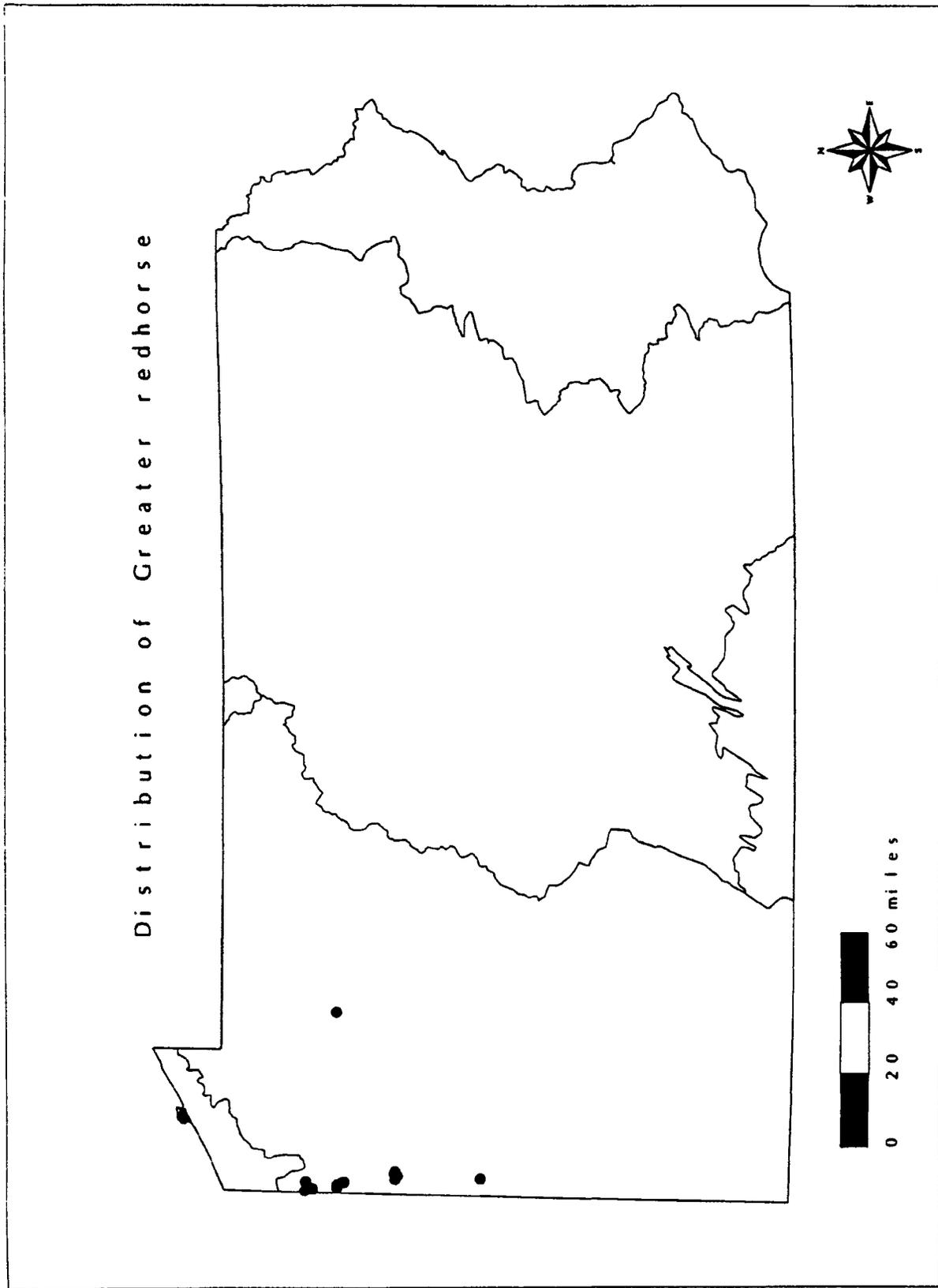


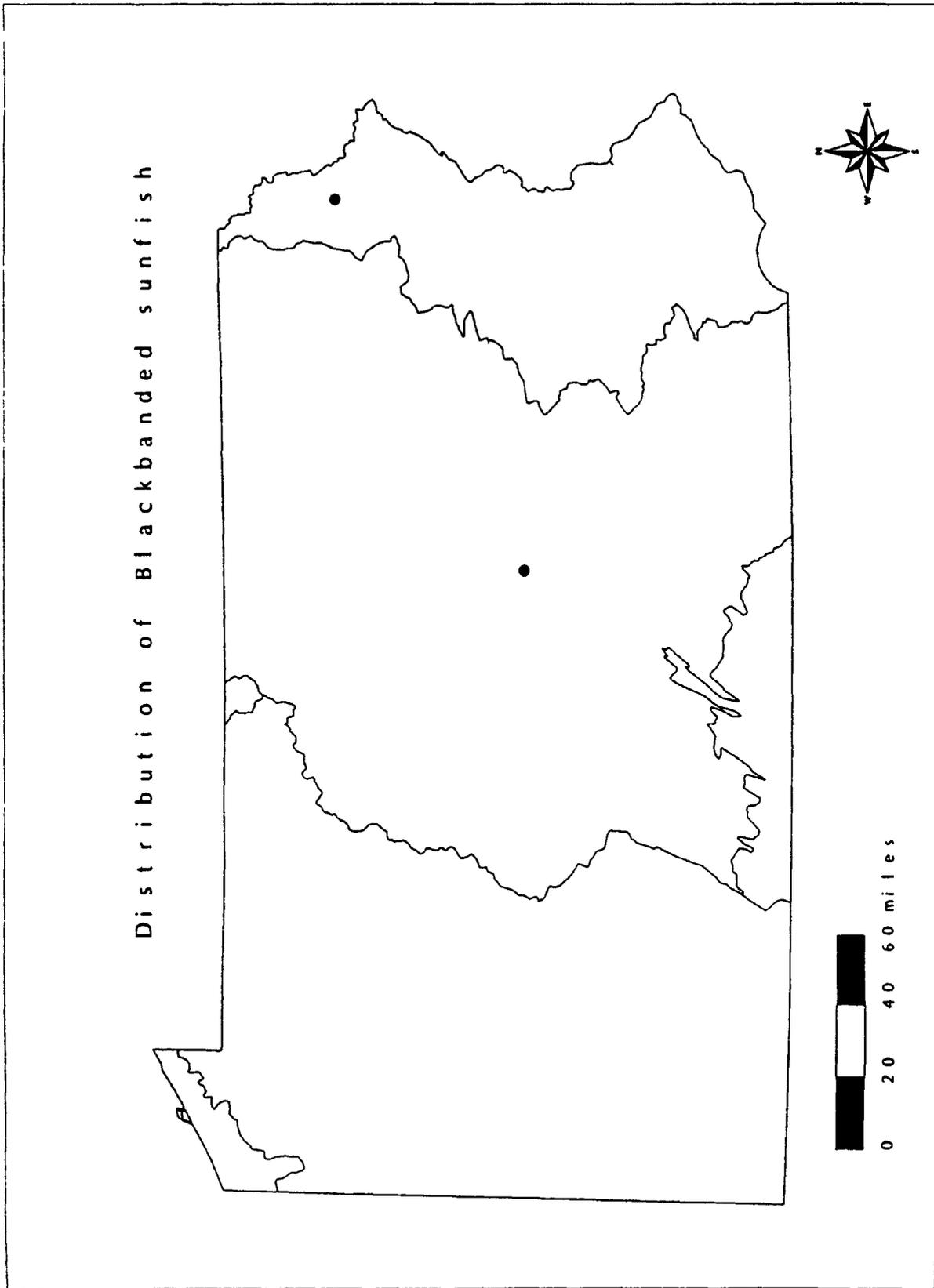


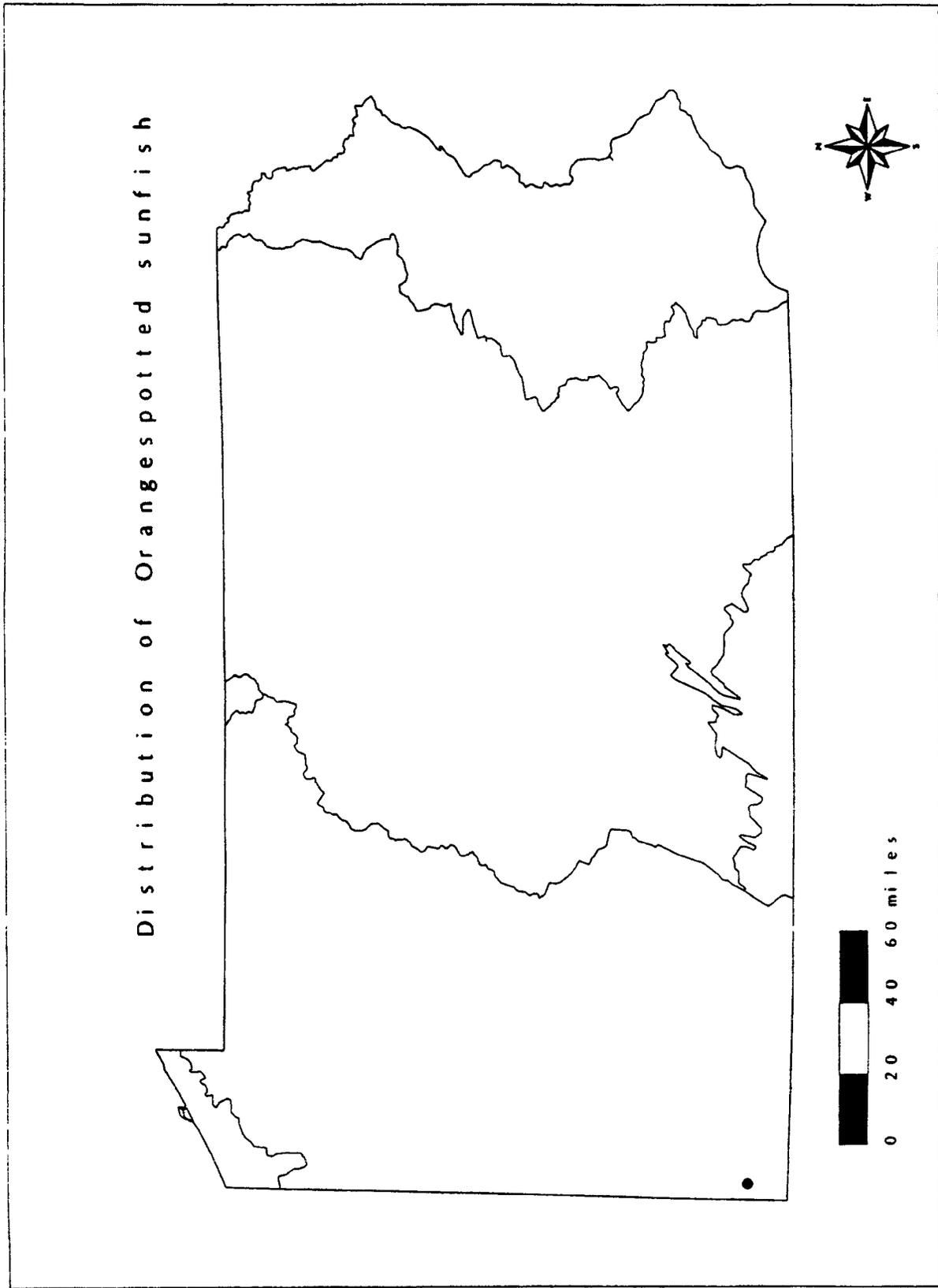


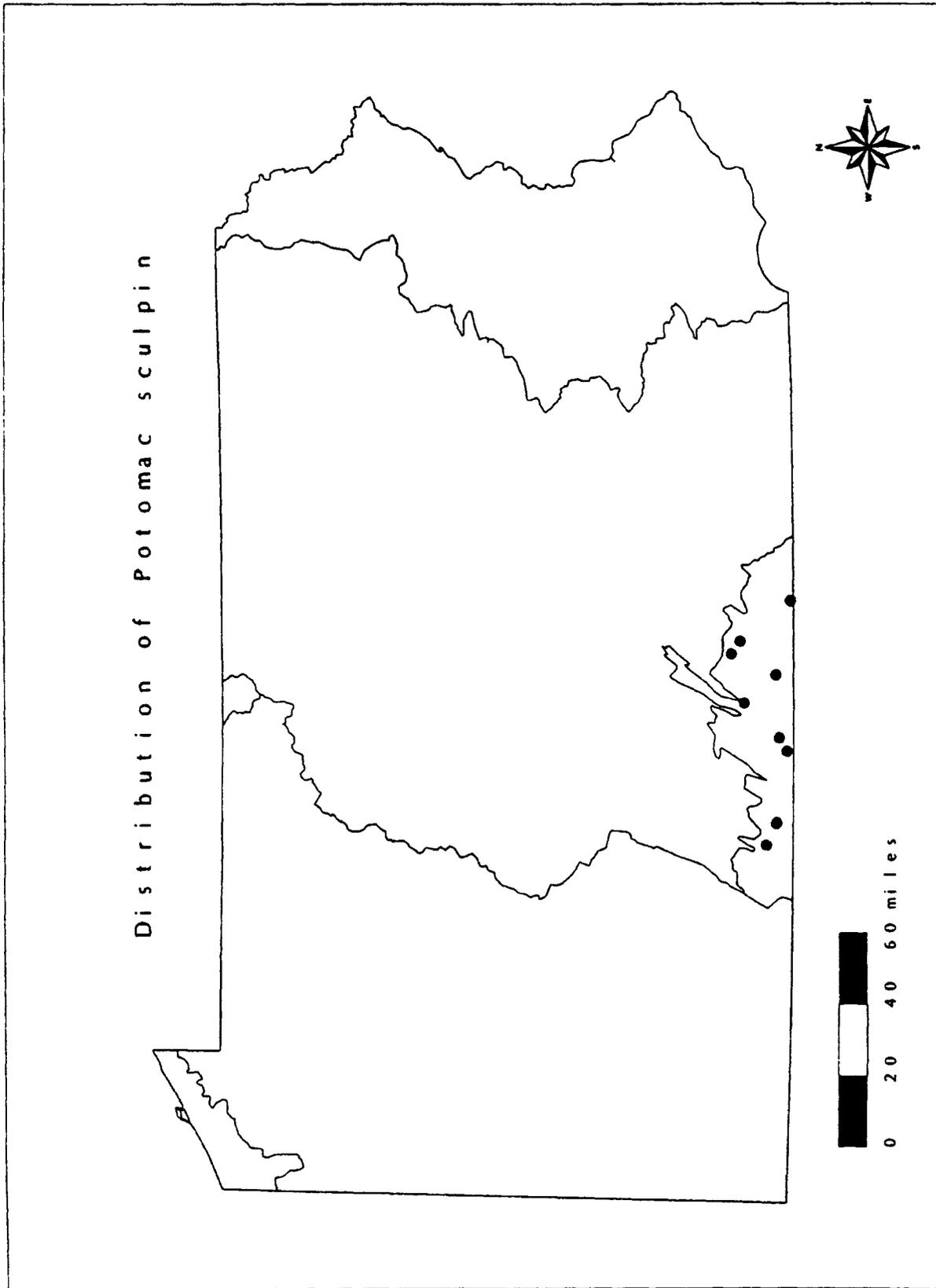












Stream/River	Number of species
Allegheny River	19
French Creek, Crawford Co.	10
Lake Erie, Presque Isle Bay, Erie Co.	8
Ohio River	8
Conneaut Creek	7
Monongahela River	6
Potato Creek, McKean Co.	5
E. Branch Oil Creek	5
Fishing Creek, Potter Co.	5
Delaware River	4
Mill Creek, Potter Co.	4
Oswayo Creek, Potter Co.	4
Pymatuning Lake, Mercer Co.	4
W. Branch French Creek	4
Delaware Estuary	3
Brokenstraw Creek	3
Oil Creek, Crawford Co.	3
Sandy Creek, Venango Co.	3
Bell Run	3
Elk Creek, Erie Co., trib. to Lake Erie, near Lake City	3
Fourmile Run, Westmoreland Co.	3
Little Neshannock Creek, Mercer Co.	3
Marshalls Creek, Monroe Co.	3
Blue Eye Run	3
Bull Creek	3
Conewango Creek, Warren Co.	3
Cussewago Creek, Crawford Co.	3
Dunkard Fork of Wheeling Creek	3
E. Branch Sugar Creek	3
Fishing Creek	3
W. Br. Fishing Creek	3

Stream/River	Number of species
Lake Leboeuf	3
Little Sugar Creek, Venango Co.	3
Little Brokenstraw Creek, Warren Co.	3
Loyalhanna Creek, Westmoreland Co.	3
Marvin Creek, McKean Co.	3
Schuylkill River, Philadelphia Co.	3
S. Branch Kinzua Creek	3
W. Branch Potato Creek, McKean Co.	3
Woodcock Creek, Crawford Co.	3
Big Pond, Presque Isle	2
Big Run, trib. to Shenango R.	2
Caldwell Creek	2
Chappel Fork	2
Chery Run	2
Colgrove Brook, McKean Co., at rte 46 crossing	2
Conneaut Lake	2
Crystal Lake	2
E. Hickory Creek	2
Elevenmile Creek	2
Genesee R., Potter Co.	2
Havens Run	2
Hendricks Creek	2
Kinzua Creek, McKean Co.	2
Lackawanoek Creek	2
W. Branch Lackawaxen River	2
Lake Erie, Presque Isle Ponds	2
Long Pond, Presque Isle, Erie Co.	2
McMichaels Creek	2
Middle Branch Genesee River, Potter Co.	2
Muddy Creek, Crawford Co.	2
Neshannock Cr., Lawrence Co.	2

Stream/River	Number of species
Pennypack Creek, Philadelphia Co,	2
Pine Creek	2
Pitchole Creek, Venango Co.	2
Pond Creek	2
Raccoon Creek, Erie Co.	2
Sartwell Creek, Potter Co.	2
Shannon Run, Westmoreland Co.	2
Shenango Lake	2
Shenango River, Crawford Co.	2
Shohola Creek, Pike Co.	2
S. Branch Tionesta Creek, Warren Co.	2
S. Branch French Creek, Erie Co.	2
Susquehanna River	2
Tionesta Creek, Forest Co.	2
Trout Run, Erie Co.	2
Tubmill Creek, Westmoreland Co.	2
W. Branch Tionesta Creek, Forest Co.	2
Warden Run, Venango Co.	2
W. Branch Little Neshannock Cr., Mercer Co.	2
White Clay Creek, Chester Co.	2
Wolf Creek, Mercer Co.	2
Appenzell Creek	1
Aquashicola Creek, Carbon Co.	1
Astabula Creek, Erie Co.	1
At T 520 (Woodstock Road) near West Fayetteville	1
Big Bushkill Cr at Rte 209 bridge in Bushkill, Pa.	1
Black Moshannon Lake	1
Blue Marsh Reservoir	1
Brandywine Creek	1
Brewer Run	1
Britton Run	1

Stream/River	Number of species
C. F. Walker Lake	1
Cedar Creek	1
Cherrytree Run	1
Chester Creek	1
Combs Creek	1
Conococheague Creek, Franklin Co.	1
Confluence of E and Middleast Branches of the Genessee R. in Hickcox, Pa.	1
Conneaut outlet just above Joint Sewer Authority for Conneaut outlet.	1
Cool Spring Creek	1
Cornplanter Run	1
Crooked Creek, Erie Co.	1
Darby Creek	1
Darrow Brook	1
Decker Brook	1
Dickering Creek	1
Dyberry Creek	1
E. Branch Conococheague	1
E. Branch Leboeuf Creek	1
E. Branch Big Elk Creek	1
E. Fork of Martin's Creek	1
Egypt Meadows Lake	1
Equinunk Creek	1
Evitts Creek E of Centreville, Pa.	1
Fairview Lake	1
Fivemile Creek	1
Flaugherty Creek	1
Fourmile Run, Warren Co.	1
Glendale Lake	1
Granny Brook	1
Haven's Brook, Mckean Co.	1
Haymaker Run, Westmoreland Co.	1

Stream/River	Number of species
Hereford Man Lake	1
Hickory Run	1
Hodgson's Run	1
Hokendauqua Creek	1
Holberts Creek	1
Hollister Creek	1
Horse Creek	1
Jackson Run, Rte 69 bridge 7.7 rd mi SE of junction with Rte 27	1
Kavanaugh Branch, McKean Co.	1
Kooser Run	1
L. Conneauttee Creek	1
Lake Erie, Erie Co., near mouth of Walnut Creek at a depth of 48 feet	1
Lake Erie, Presque Isle Bay, Erie Co., at mouth of Mill Creek	1
Lake Marburg	1
Lake Somerset	1
Lake Wallenpaupack	1
Licking Creek at route 928 in Dickey's Mountain	1
Little Conneauttee Creek	1
Little Elk Creek, Chester Co.	1
Little Mahoning Creek, Indiana Co.	1
Little Wapwallopen Creek	1
Little Yellow Creek	1
Ludington Run	1
Mahoning Creek, Armstrong Co.	1
Maple Creek	1
Marina Bay, Presque Isle, Lake Erie, Erie Co.	1
Martin Run, trib to S. Br. of Tionesta	1
Martin's Creek, Northampton Co.	1
Masthope Creek	1
Middleast Branch of White Clay Cr at Sharples Rd	1
Mill Creek, Westmoreland Co.	1

Stream/River	Number of species
Misery Bay, Presque Isle, Erie Co.	1
Mountain Creek, Fayette Co.	1
NNT Raccoon Creek	1
No name trib., Middleast Branchanch of White Clay Creek, Chester Co.	1
North Branch Wolf Creek	1
North Fork	1
North Fork Dunkard Fork Wheeling Creek	1
North Fork Little Beaver Creek	1
Northwest Branch Perkiomen Creek	1
Padan Creek, Crawford Co.	1
Patchel Run, Venango Co.	1
Pecks Pond	1
Penns Creek	1
Pine Run	1
Piney Creek	1
Pocono Cr.	1
Quacake Creek, Carbon Co., near Weatherly trib. to Lehigh R.	1
Queen Creek, Warren Co., trib. to Hickory Cr., Allegheny R.	1
Red Clay Creek at Marshall Road Bridgeast	1
Red Mill Brook	1
Reek Run, Potter Co.	1
Repine Run	1
Rock at Rt 15 bridge S of jct with Rt 97 near Gettysburg, Pa.	1
Sandy Creek, Mercer Co.	1
Sandy Run, Blair Co.	1
Service Creek, Beaver Co.	1
Shirley Run, Crawford Co.	1
Sides Run	1
Skinner Creek	1
Snyders Run, Westmoreland Co., 1/4 mi. upstream from Pa. rte 259 crossing	1
S. Branch Brandy Run	1

Stream/River	Number of species
S. Branch Roaring Creek	1
Spring Creek, Warren Co.	1
Sugar Creek	1
Sugar Run at Rt 321 bridge	1
Thompson Creek, Crawford Co.	1
Three Springs Creek	1
Tom's Creek at route 16 bridge near Zora, Pa.	1
Tonoloway Creek off route 65 at Johnsons Mill, Pa.	1
Town Creek, Bedford Co.	1
Trib to West Branch White Clay Creek, Chester Co.	1
Tunkhannock Creek	1
Turkey Creek	1
Tuscarora Creek	1
Twentymile Creek, Erie Co.	1
Two Mile Run, McKean Co.	1
Two Mile Run, Warren Co.	1
Tributary to Rock Creek at Business route US 15 North of junction with Weaner Road, Gettysburg	1
W. Branch of Conneaut Cr below confluence of Middleast Branch	1
W. Branch Caldwell Cr., Warren Co.	1
Wallenpaupack Creek	1
Walnut Cr 0.25 mi upstream of mouth	1
Walnut Creek	1
W. Branch Caldwell Creek, Warren Co.	1
W. Branch Clarion River	1
W. Branch Conococheaque Creek, Franklin Co.	1
W. Branch Millstone Creek	1
W. Branch of Conneaut Creek, Erie Co.	1
W. Branch of Fishing Creek, Potter Co.	1
West Pithole Creek, Venango Co.	1
West Valley Creek	1

Stream/River

Number of species

Willoughby Run at Rt 30 near Gettysburg
Willow Creek, McKean Co.
Wissahickon Creek
Wolcott Creek, McKean Co.
Youghiogheny River

1
1
1
1
1

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1975

Pa. moves to reduce standards on water

More toxic discharges would be allowed. Environmentalists called the plan a step backward.

By Paul Nussbaum
INQUIRER STAFF WRITER

Pennsylvania — currently the nation's second-largest discharger of toxic chemicals into streams and rivers — is proposing to relax some of its water-pollution regulations.

The change in state rules, proposed by the Department of Environmental Protection, would remove limits for discharges of certain toxic chemicals and ease the standards on others. The department said the changes would bring state rules into line with less-stringent federal rules and ease the bureaucratic burden for industries, manufacturers and developers.

State environmental officials said yesterday the proposed changes would not diminish the quality of Pennsylvania's water.

Environmental groups, though, attacked the proposed changes as a threat to clean water, and they accused the Ridge administration of "stealth rule-making" for failing to widely publicize the changes. Today is the last day for public comment on the planned changes to the state's water-quality standards and toxics-management strategy.

THE PHILADELPHIA INQUIRER
October 28, 1998

"This is a very complex and complicated rule-making, and DEP did the minimum public notice required," said Barbara Kooser of the Chesapeake Bay Foundation, one of the environmental groups critical of the proposed changes. Because Pennsylvania supplies about half the water entering the Chesapeake, the bay foundation was especially concerned about the proposed changes in pollution standards.

"The proposed changes to the water-quality and permitting regulations not only fall short of implementing any of the improvements called for [by the bay foundation in 1996]; the changes actually roll back the current protection of our waterways from the effects of toxic chemicals," she said.

Industries in Pennsylvania in 1996 released 22.8 million pounds of toxic chemicals into the state's streams, rivers and lakes. Only Louisiana, with 38.2 million pounds, reported more toxics released into its surface waters.

"This is one area where we don't want to be number one," said Robert Wendelgass, state director for Clean Water Action. "DEP needs to go back to the drawing board and develop new regulations."

See **POLLUTION** on A18

Pa. proposes reduction of clean-water standards

POLLUTION from A1
State environmental officials defended the changes as the result of improved scientific measuring techniques, revised federal standards, and a concern about lawsuits from dischargers.

"Some of the criteria were based on procedures that were about 20 years old and not scientifically defensible," said Stuart I. Gansell, director of the department's Bureau of Watershed Conservation. The new regulations are an effort "to address that and continue to protect the environment."

The federal Environmental Protection Agency establishes guidelines for water quality and requires states to meet or exceed them.

The proposed Pennsylvania regulations would allow companies to obtain a "general permit" from DEP for the release of toxic chemicals, rather than an individual permit for specific chemicals. That would reduce the ability of the state to monitor toxic discharges, Wendelgass said.

The new rules also would remove "aquatic-life criteria" standards — designed to protect fish and other organisms — for 76 chemicals, and for 19 of those chemicals, there would no longer be numeric standards at all. Aquatic-life criteria are often stricter than human-health criteria.

The chemicals for which numeric standards would be deleted include cobalt, which is highly toxic to aquatic life. Among the toxic chemicals for which less-stringent criteria could be used are phenol, toluene, xylene and formaldehyde, a known carcinogen.

For toluene, a petroleum-based additive to paints, inks and cosmetics, the standard would no longer be the 330 micrograms per liter of water set by the current chronic exposure level permitted by the strictest aquatic-life criterion. Instead, it would be a human-health standard of 7,000 micrograms per liter. In 1996, about 1,300 pounds of toluene were discharged into Pennsylvania streams.

For xylene, a petroleum-based solvent and cleaning agent, the standard would change from the current 211 micrograms per liter of water permitted by the strictest aquatic-life limit to a human-health standard of 70,000 micrograms per liter.

Environmentalists also objected to provisions that would restrict the department's ability to deny general permits to companies with a history of violations of previous air or waste permits.

"We believe that a company with a history of noncompliance with any DEP permits, whether for air, waste or water issues, should not be trusted with a general permit," Wendelgass said.

Although today is the final day in a 60-day public-comment period, the proposed regulations will not take effect until they have been approved by the environment committees of the state House and Senate, the Independent Regulatory Review Commission, and the attorney general. Opponents and backers of the new regulations are likely to carry the battle to the legislative committees, ran in the House by Rep. Robert Reber (R., Montgomery) and in the Senate by Sen. Roger Madigan (R., Bradford).

