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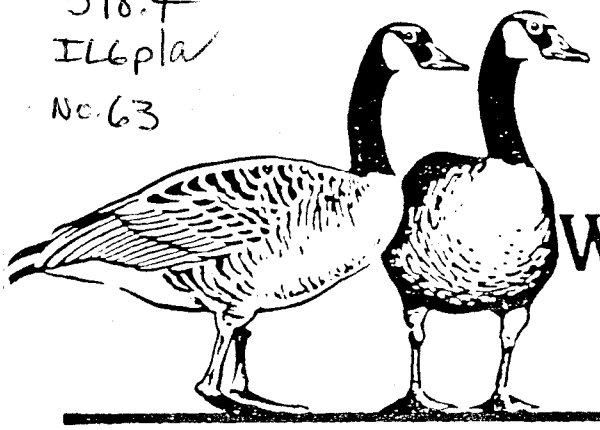

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DIVISION OF WILDLIFE RESOURCES

EVALUATION OF DIVING DUCK ENTANGLEMENT IN COMMERCIAL FISHING NETS IN ILLINOIS

William L. Anderson, Waterfowl Research Biologist

Abstract: The subject of diving ducks and other aquatic birds entangling and drowning in commercial fishing nets in Illinois was evaluated by compiling pertinent information from the literature and other sources. Of 16 states and provinces in the Mississippi Flyway, 14 (including Illinois) currently allow the dead-setting (i.e., leaving unattended) of trammel nets and/or gill nets. In 1987, 414 commercial fishermen reported catching 5.59 million pounds of whole fish in Illinois, exclusive of Lake Michigan. Trammel nets took 66% and gill nets <1% of the catch, which was valued at $1.63 million. Diving ducks and/or mergansers are present in the state from early October to 30 April. Diving ducks accounted for an average of 42.3 million bird use-days, and mergansers 1.6 million bird use-days, annually in Illinois in 1972-1983. From 1981-1987, an average of 59,477 hunters expended an average of 805,132 days afield and harvested an average of 416,533 waterfowl in Illinois. The economic value of duck hunting in the state in 1981 was $21.0 million. Losses of diving ducks in commercial fishing nets were documented for Illinois, for other states, and for other countries. The losses in Illinois are unacceptable, and the practice of dead-setting commercial fishing nets should be banned day and night from 1 October to 30 April.

Complaints periodically surface regarding the subject of diving ducks (redheads, canvasbacks, ring-necked ducks, scaups, goldeneyes, buffleheads, and ruddy ducks), and other aquatic birds becoming entangled and drowning in commercial fishing nets. Biologists, policemen, fishermen, bird watchers, and others have witnessed this phenomenon, which is manifested by dead-setting (i.e, leaving unattended) trammel nets and gill nets in waters frequented by diving ducks. Because both diving ducks and commercial fishermen are active in Illinois, the possibility exists that excessive

numbers of diving ducks are lost in nets. The purpose of this study was to (1) determine the abundance, distribution, and timing of diving ducks and mergansers migrating through Illinois, (2) delineate the intensity, distribution, and timing of commercial fishing activity, (3) conclude whether the interaction between diving ducks and commercial nets constitutes a problem, and (4) if a problem exists, recommend action for resolving it.

Acknowledgement is made to Illinois Department of Conservation (DOC) law enforcement personnel for providing descriptions of duck entanglements in commercial fishing nets; to Technical Section representatives of the Mississippi Flyway Council for providing commercial fishing regulations in states and provinces in the flyway; to J.S. Allen, A.W. Fritz, J.R. Hendricks, V.M. Kleen, T.J. Wakolbinger, and R.A. Williamson for critically reading preliminary drafts of this report; and to E.A. Anderson and T.H. Simpson for word processing.

METHODS AND MATERIALS

Data on diving duck and merganser populations in Illinois were obtained from Stephen P. Havera (1985), and data on commercial fishing activity were secured from Arnold W. Fritz (1988 and pers. commun.). Documentations of diving ducks and other aquatic birds entangling in fishing nets were compiled from the published literature and by soliciting DOC conservation police officers for accounts of their personal observations. Regulations for the commercial fishing of trammel nets and gill nets in various states and provinces were obtained via Technical Section representative of the Mississippi Flyway Council. Waterfowl hunting data and other information were obtained from appropriate literature.

RESULTS

Regulation of Trammel Nets and Gill Nets

In Mississippi Flyway. In a letter to the Mississippi Flyway Council dated 31 July 1962, William F. Nichols reported the loss of 2,320 diving ducks in 15 states from 15 December 1961 to 15 March 1962; this information was obtained by interviewing 307 commercial fishermen. The Law Enforcement Committee conducted a follow-up investigation and reported to the Council on 31 July 1963 that, "The loss of waterfowl resulting from commercial fishing activities is negligible and does not constitute a problem. The majority of states represented in the Council have promulgated commercial fishing regulations requiring operators of trammel and gill nets to attend such equipment while it is in use. The presence of the commercial fishermen in the immediate vicinity tends to discourage ducks from using water where the nets . . . are being operated and eliminates entrapment of diving or feeding waterfowl."

Regulations for trammel nets and gill nets apparently have been relaxed in the Mississippi Flyway in the 26 years since 1963. Of the 16 states and provinces in the flyway, only Ohio currently prohibits the use of trammel nets and gill nets for commercial fishing (Table 1). And, of the 15 states and provinces that allow either or both types of nets, only Missouri prohibits the practice of dead-setting.

In Neighboring States. In Missouri, trammel nets and gill nets can be legally used in the Mississippi and Missouri rivers, and portions of the Salt and St. Francis rivers, but the nets must be in attendance at all times. In Iowa, trammel nets and gill nets are permitted in the Mississippi and Missouri rivers, and selected inland waters, and the nets

may be dead-set day and night throughout the year. In Wisconsin, trammel nets are allowed in that portion of the Mississippi River bordering Iowa but dead-setting is prohibited; and gill nets are permitted in the Mississippi River, Great Lakes, and selected inland waters with dead-setting allowed. In Indiana, trammel nets and gill nets are restricted to the Ohio River where the nets may be dead-set. In Kentucky, trammel nets and gill nets, which may be dead-set, are allowed in the Ohio and Mississippi rivers and in Barkley and Kentucky lakes.

In Illinois. Conservation law permits commercial fishing with trammel nets and gill nets in the Mississippi River, the Illinois River from its mouth upstream to highway IL-89 near Spring Valley and, via contracts issued by the DOC, in other waters of the state. According to Division of Fisheries records, contracts were let for commercial fishing in 34 lakes and streams in 1987, with trammel nets being permitted in all cases (Table 2).

All trammel nets and gill nets that are set in any body of water in Illinois must be under immediate supervision of the operator, except the nets may be dead-set (1) day and night from May 1 through September 30, (2) from sunset to sunrise from October 1 through April 30 (excluding Carlyle Lake where contractors are allowed to dead-set 24 hours per day), or (3) when set under the ice. Nets set under the ice must be at a distance of not less than 100 yards from any natural opening in the ice.

Commercial Fishing Activity in Illinois

In 1987, 414 commercial fishermen reported catching 6.59 million pounds of whole fish in Illinois waters, exclusive of Lake Michigan (Fritz 1988). The Mississippi River accounted for 64% of the catch, Illinois River 9%, Rend Lake 9%, Carlyle Lake 2.2%, Rock River 2.2%, Anderson Lake

1.9%, Kaskaskia River 1.7%, Lyerla and Grassy lakes in Union County 1.7%, and Swan Lake in Mercer County 1.4% (Table 3). Several other lakes and streams contributed <1% each. Navigation pools 13, 18, and 19 on the Mississippi River accounted for 32% of the state-wide catch, and all pools combined (12-22 and 24-26) were responsible for 58%. In a typical year, commercial fishermen are most active from March 15 to June 15 and from September 15 to November 15 (Arnold W. Fritz, pers. commun.).

Trammel nets took 66% of the commercial catch of fish in Illinois in 1987 (Table 4). Gill nets accounted for <1%. The 1987 harvest of fish was valued at $1.63 million (Fritz 1988).

From 1978 to 1987, commercial fishermen in Illinois reported catching an average of 5,378,044 pounds of whole fish annually. The catch ranged from a low of 4,332,201 pounds in 1979 to a high of 7,108,044 pounds in 1986 (Arnold W. Fritz, pers. commun.).

Diving Duck Populations and Waterfowl Hunting in Illinois

Diving Duck Populations. According to aerial censuses conducted by the Illinois Natural History Survey (Havera 1985 and Fig. 1), southward migrating diving ducks begin arriving in Illinois in early October and reach peak populations during the first 2 weeks in November (Table 5 and Fig. 2). An average of 366,000 diving ducks were present in the census areas during 10-27 November 1972-1983. The fall migration has virtually completed its passage through Illinois by 10 December. For mergansers, migrating and wintering populations do not peak until after 1 December (Tables 6 and 7, and Figs. 3 and 4).

Northward migrating diving ducks return to Illinois beginning about 1 March and peaking during the week of 20-27 March (Table 5 and Fig. 5). The

number of birds counted in the census areas averaged 547,000 during the period 14-27 March 1972-1983. Virtually all of the migrants have passed through Illinois by 30 April. Peak counts of mergansers occur during the winter months (Figs. 6, 7, 8, 9, and 10).

Diving ducks accounted for an average of 42.3 million bird use-days, and mergansers 1.6 million bird use-days, annually in the census areas from 29 September to 24 April 1972-1983 (Table 8). For diving ducks, 73% of the use-days occurred in the central and northern portions of the Mississippi River--i.e., between Lock and Dam 26 at Alton and the Wisconsin border. In addition, 16% occurred on the Illinois River, 5% in northeastern Illinois, and 4% in the southern portion of the Mississippi River. For mergansers, the distribution of use-days was similar to that of diving ducks (Table 8).

Waterfowl Hunting. Because of prolonged drought conditions and drainage of wetlands in northern United States and the prairie pothole region of Canada, the continental duck population has been declining in recent years. In the 1960's and 1970's, the fall flight of ducks averaged about 90 million, but in the 1980's the flight was above 80 million in only 1 year. The flight was at all-time lows of 62 million in 1985 and 66 million in 1988 (Canadian Wildlife Service and U.S. Fish and Wildlife Service, Status of Waterfowl and Fall Flight Forecasts). Duck hunting regulations were reduced from a 50-day season and a maximum of 10 ducks per day in 1980-1984 to a 40-day season and a maximum of 5 per day in 1985-1987. The regulations were reduced again (to 30 days and 3 ducks per day) in 1988. Canvasbacks were given complete protection throughout the Mississippi Flyway during the 1986-1988 hunting seasons.

An average of 59,477 individuals participated in sport waterfowl (ducks, geese, and coots) hunting in Illinois from 1981 to 1987 (Table 9).

These hunters expended an average of 805,132 days afield and harvested an average of 416,533 waterfowl during these years. Duck hunting (regular season and September teal season) accounted for an average of 661,352 (82%) of the days afield and an average of 372,257 (89%) of the birds harvested (Anderson 1989). According to Carney et al. (1983), diving ducks made up 11% and mergansers 1% of the total duck harvest in Illinois from 1971 to 1980.

Waterfowl hunters spent an estimated $25.6 million in pursuit of their sport in Illinois in 1981 (Anderson 1983). Thus, the economic value of duck hunting in Illinois in 1981 was approximately $21.0 million (25.6 x .82 = 21.0).

Documentation of Bird Entanglement

In Literature. In summarizing the early literature, Bartonek (1965:15) stated, "Accidental and intentional netting of waterfowl has long been known to exist in North America. One of the earliest accounts of netting waterfowl is found in the Relation of the mission of St. Francois Xavier (Anonymous, 1899, p. 121). In the Relation of 1671-72, on Green Bay, Wisconsin, the following observation was made: 'Of this practice [netting ducks] the Savages are the inventor; for perceiving that Ducks, Teal, and other Birds of that kind dive into the water in quest of the grains of wild rice [which are] to be found there toward the Autumn season, they stretch nets for them with such skill that, without counting the fish, they sometimes catch in one night as many as a hundred wild fowl.' During later years market hunters would set gill-nets for Canvasback (Grinnell, et al., 1918; Phillips, 1925). Ellarson (1956) reviewed much of the literature on diving duck mortality through commercial fishing and reported

his findings on 9,215 ducks caught in nets on Lake Michigan. William F. Nichols (in. litt.) reported 1,904 and 2,320 ducks (mostly divers) being caught in trammel-nets on the Mississippi flyway during the winter and spring of 1960-61 and 1961-62, respectively."

As of the winters of 1969-70 and 1970-71, large numbers of ducks (oldsquaw) were still being caught in gill nets in Lake Michigan (Peterson and Ellarson 1975). The catching of birds in nets is costly to commercial fishermen in terms of time (to remove birds) and money (to repair or replace nets).

Bartonek (1965) documented the loss of 154 ducks, grebes, and loons in gill nets on Lake Winnipegosis, Manitoba, during the summers of 1961-1963. This investigator estimated that 450-900 ducks and 3,000 grebes and loons are netted annually in the southern half of the lake. However, Bartonek (1965:18) qualified his extrapolations by stating, "These estimates may be low, because one fisherman cited an example when three boats caught approximately 120 Redheads in a single haul of their nets. Another fisherman reported catching up to 50 Redheads a day for nearly two weeks; this period apparently coincided with the peak period of molting for Redheads." He concluded that commercial fishing is vital to the livelihood of the local people and suggested that normally no prohibitive regulation should be imposed upon the fishermen. Bartonek (1965:2) went on to say, that, should circumstances of reduced continental populations coupled with increased local concentrations of diving birds warrant additional protection, portions of the lake might be closed to fishing.

Nearly 5% of all bands recovered from 5,695 lesser scaups banded on Chesapeake Bay, Maryland in 1952-1957 came from birds caught in gill nets (Longwell and Stotts 1958). Heard and Curd (1959) reported the catching of

96 common mergansers in gill nets set during the winter of 1957-58 in Lake Carl Blackwell, Oklahoma; 31 of the birds were taken in one set. Douglass et al. (1970) stated that, "In certain areas of the Flyway some diving ducks have been caught and drowned in commercial fishing nets. In one recent incident, several thousand scaups and canvasback were drowned in trammel nets on the Mississippi River. Large numbers of redheads have been lost each year in fishing nets in major waterfowl wintering areas along the Texas coast." Of 2,108,880 nonhunting mortalities recorded for waterfowl in the United States and Canada during the period 1930-1963, 50,451 (2.4%) were attributed to fishing nets; 99% of the net mortalities occurred in the Mississippi Flyway (Stout and Cornwell 1976).

In a study of a gill net fishery in Pool 7 of the Mississippi River in Wisconsin, the commercial harvest of fish per duck (primarily scaups and canvasbacks) entangled averaged 1,200 pounds during fall migration and 22,000 pounds during spring migration (Ranthum 1974).

In Europe, Kirchoff (1982) estimated a minimum loss of 15,000 ducks per winter (1977-78 to 1980-81) to fishing nets set in the Baltic Sea along the coast of Schleswig-Holstein, Germany. Podkovyrkin (1977) determined that about 3,000 long-tailed ducks (oldsquaw) drowned in fishing nets in Lake Ladoga in October 1972, and that about 10,000 scaups perished in this manner each year in 1971-1973 along the Vybord Bay fairway in the Baltic Sea, Russia. This worker concluded that it was necessary to ban the use of fishing nets in the above-mentioned areas at the time of autumn passage of diving ducks.

Diving ducks also suffer mortality by becoming hooked on trotlines (McMahan and Fritz 1967, Turnbull et al. 1986).

Commercial fishing nets are known to entangle and drown river otter, an endangered species in Illinois. Anderson (1982) documented 7 cases of accidental catches of otters by commercial fishermen in Illinois and suggested that nets may be an important mortality factor for this rare carnivore. Otters have also been reported drowned in commercial fishing nets on the Mississippi River in Iowa (Sanderson 1954), and in crab pots set at a depth of 60 feet in Deep Bay, Alaska (Scheffer 1953). Muskrats and beaver, which are rodents, escape entanglement by chewing through the netting (William F. Nichols, pers. commun.).

Reports in Illinois. DOC conservation police officers familiar with waterfowl and commercial fishing activities were asked to comment on the subject of ducks entangling in commercial nets. Of the 8 officers who responded, all had personally witnessed ducks drowned in nets. Two officers felt that the numbers of ducks lost to nets were insignificant in their areas (Peoria Pool on the Illinois River and Pool 12 on the Mississippi River).

One officer reported seeing losses of ducks in commercial nets for nearly 20 years near Quincy on the Mississippi River and between Meredosia and Havana on the Illinois River. Another officer personally removed 9 mergansers from trammel nets set in Rend Lake in February 1989. A third officer reported losses of several divers and a few dabbling ducks in 2 separate instances on the Mississippi River. This officer also reported the loss of a cormorant to entanglement. The fourth officer documented the loss of 117 ducks (scaups, goldeneyes, and bufflehead) in a single setting of a trammel net (200 yards) below Lock and Dam 20 on the Mississippi River in February 1986. In addition, this officer stated that he sees 6-8 cases of ducks (usually 25 or more) drowned in nets every winter. On 22 March

1989, two DOC officers documented (in writing and in video) the loss of 27 ducks (7 mallards, 1 canvasback, 8 ring-necked ducks, 7 scaups, and 4 goldeneyes) in trammel nets set above Lock and Dam 18 on the Mississippi River. In this case, the officers, upon seeing the fishermen removing ducks from their nets, secured a boat and retrieved the 27 dead ducks.

In the 26-day period from 27 February to 24 March 1989, 29 commercial fishermen reported catching 56 diving ducks and mergansers in trammel nets set in Carlyle Lake (Arnold W. Fritz, pers. commun.).

DISCUSSION

In an evaluation of this type, a possible conflict emerges between the benefits and values of commercial fishing and those of the waterfowl resources. Legalized commercial fishing benefits society by offering income to a small number of individuals (414 in 1987) and by providing an inexpensive source of fish to the general public (6.59 million pounds whole weight in 1987). The commercial catch of fish in Illinois in 1987 was valued at $1.63 million. The waterfowl resources of Illinois are utilized for hunting by sportsmen (averaged 59,620 in 1981-1987) and enjoyed for bird watching by the general public. The economic value of duck hunting in Illinois in 1981 was estimated at $21.0 million, with diving ducks accounting for 11% of the duck harvest. Although no dollar value has been placed on bird watching in Illinois, it is almost certainly in the millions. In California, an estimated $27 million was spent on bird watching in 1987 (Loomis and Unkel 1989).

Based on the findings presented herein, it is apparent that migrating diving ducks and mergansers spend a great deal of time (>40 million bird use-days) annually in Illinois, and that they are most abundant on the

upper and middle portions of the Mississippi River. It is also clear that commercial fishermen work on all major rivers and many lakes, and that they, too, are most abundant on the upper and middle portions of the Mississippi River. The trammel net is the preferred fishing gear. Further, both diving ducks and commercial fishermen are most active in Illinois during the spring and fall months. These factors, coupled with the provision in Illinois Conservation Law that allows dead-setting, sets the stage for diving ducks, mergansers, and other underwater-swimming birds to encounter commercial nets. As a consequence, aquatic birds become entangled and drown in trammel nets and gill nets set by Illinois fishermen.

It is well documented that diving ducks are killed in commercial fishing nets in Illinois, in other states, and in other countries. Losses in excess of 100 birds in the single setting of a net are not uncommon. In Illinois, the largest recorded loss of this type was 117 ducks. Although the exact number of diving ducks and other birds that are killed in commercial fishing nets in Illinois is not known, the potential exists for the number to be substantial. Even the ordinary, day-to-day losses can equate to appreciable numbers of dead birds over a period of several months and, in fact, may account for more mortality than the dramatic large single catches that are often publicized. For example, if the approximately 300 fishermen who use trammel nets each catch an average of only 1-2 birds per week during fall and spring migration, the accumulative loss is 5,000-10,000 diving ducks.

Given the evidence at hand and the recognition that the continental duck population is at or near an all-time low, it is concluded that the losses of diving ducks in commercial fishing nets in Illinois is unacceptable.

Therefore, corrective measures are warranted and the following alternatives are presented for consideration. The preferred alternative is listed last.

Alternative I - No Action. The Commercial fish harvest would continue at the same level as at the present time. Diving ducks and other birds would continue to be lost at the same rate as at the present time.

Alternative II - Ban Trammel Nets and Gill Nets. The annual commercial fish harvest would be reduced by 66%. Losses of diving ducks and other birds to entanglement in nets would be reduced to zero.

Alternative III - Ban Dead-setting.

Alternative IIIa - Total Ban on Dead-setting. The annual commercial fish harvest would be reduced by 33%[a]. Losses of diving ducks and other birds to entanglement in nets would be reduced by 95%.

Alternative IIIb - Ban Dead-setting Day and Night from 1 October to 30 April, except under ice cover/Preferred Alternative. The annual commercial fish harvest would be reduced by 19%[a]. Losses of diving ducks to entanglement in nets would be reduced by 90%.

A "piecemeal" form of regulation such as banning dead-setting on the upper and middle portions of the Mississippi River was not proposed for two reasons. First, diving ducks are being caught in nets on virtually all bodies of water where commercial fishing is allowed. The presence of large

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[a]In calculating these values, it was assumed that a ban on dead-setting would reduce the commercial fish harvest with trammel nets and gill nets by 50% during the period the ban was in effect (Arnold W. Fritz, pers. commun.).

numbers of diving ducks is not a prerequisite for entanglement in nets (e.g., Carlyle Lake in 1989). Second, piecemeal regulations are confusing to the public and are difficult to enforce. Such a regulation would be detrimental to public relations and unacceptable from a law enforcement standpoint.

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Table 1. Use of trammel nets and gill nets, and the number of commercial fishing permits issues, in states and provinces in the Mississippi Flyway (March 1989).

State	Use Allowed		Dead-setting Allowed	Number of Commercial Fishing Permits in 1987
	Trammel	Gill		
Alabama	Yes	Yes	Yes	---
Arkansas	Yes	Yes	Yes	4,390
Illinois	Yes	Yes	Yes	1,907
Indiana	Yes	Yes	Yes	---
Iowa	Yes	Yes	Yes	548
Kentucky	Yes	Yes	Yes	764
Louisiana	Yes	Yes	Yes/No [a]	4,097
Michigan	No	Yes	Yes	172 [b]
Minnesota	No	Yes	Yes	505 [c]
Mississippi	Yes	Yes	Yes	---
Missouri	Yes	Yes	No	751
Ohio	No	No		
Tennessee	Yes	Yes	Yes	855
Wisconsin	Yes	Yes	No/Yes [d]	300 [b]
Manitoba	No	Yes	Yes	1,800
Ontario	Yes	Yes	Yes	920

[a] "Yes" for freshwater; "No" for saltwater.

[b] Includes native Americans.

[c] An unknown number of native Americans also fish on reservations.

[d] "No" for trammel nets; "Yes" for gill nets.

Table 2. Areas where commercial fishing was permitted by contract in Illinois in 1987, exclusive of Lake Michigan (information from Illinois Department of Conservation, Division of Fisheries).

Body of Water	County
Bear Creek	Adams
Rock Creek	Adams
LaMaine River, mouth to star route	Brown & Schuyler
Rawson Lake	Bureau
Lake Depue	Bureau
Mississippi River Fish & Wildlife Area	Calhoun & Jersey
Meridian Lake, Honey Point Gun Club	Cass
Rice and Big lakes	Fulton
Spoon River, mouth to 3 miles upstream	Fulton
Sinkers Club Lake	Fulton
Lake Cambon	Franklin
New Crystal Lake	Henderson
Upper Carthage Lake	Henderson
Shadow Lake	Henry
Grand Tower Chute	Jackson
Spoon Lake	Knox
Fox Chain 'O Lakes	Lake & McHenry
Horseshoe Lake	Madison
Sangamon River, mouth to IL-97	Mason, Menard, Cass
Johnson Slough	Mason
Wilcox and Otter lakes	Mason
Swan Lake ditch	Mercer
Swede Lake	Mercer
Hadley, McCraney, Kiser Division Channel	Pike
Landuit Lake	Rock Island
Mascoutah City Water Supply Pond	St. Clair
Curry Lake	Schuyler
Upper Smith Lake	Scott
Lake Warren	Warren
Erie Boat Club Pond	Whiteside
Lyerla and Grassy lakes	Union
Carlyle Lake	Clinton
Rend Lake	Franklin & Jefferson
Rock River	

Table 3. Reported catch of fish by commercial fishermen in Illinois in 1987, exclusive of Lake Michigan (data from Fritz 1988).

Area	Poundage	Percentage
Mississippi River		
Pool 12	23,229	0.4
Pool 13	696,750	10.6
Pool 14	150,952	2.3
Pool 15	138,550	2.1
Pool 16	75,211	1.1
Pool 17	133,032	2.0
Pool 18	529,601	8.0
Pool 19	885,421	13.4
Pool 20	65,015	1.0
Pool 21	55,946	0.9
Pool 22	150,304	2.3
Pool 24	31,702	0.5
Pool 25	399,889	6.1
Pool 26	502,538	7.6
Unpooled [a]	343,333	5.2
Total	4,181,473	63.5
Illinois River		
Alton Pool	214,789	3.3
LaGrange Pool	290,820	4.4
Peoria Pool	104,650	1.6
Starved Rock Pool	1,625	<0.1
Total	611,884	9.3
Wabash River	79,032	1.2
Kaskaskia River	115,009	1.7
Little Wabash River	8,288	0.1
Rock River	146,916	2.2
Embarras River	1,715	<0.1
Sangamon River	28,999	0.5
Skillet Fork River	10,380	0.1
Big Muddy River	3,260	0.5

Table 3 - continued.

Table 3. Continued - page 2.

LaMoine and Spoon rivers	11,781	0.2
Rend Lake (Franklin and Jefferson Co.)	599,591	9.1
Carlyle Lake (Clinton Co.)	148,661	2.2
Anderson Lake (Fulton Co.)	126,058	1.9
Lyerla and Grassy lakes (Union Co.)	110,630	1.7
Rice Lake (Fulton Co.)	26,300	0.4
Mississippi River Fish & Wildlife Area (Calhoun and Jersey Co.)	35,619	0.5
Spring Lake [b] (Mason Co.)	58,362	0.9
Swan Lake [b] (Mercer co.)	90,597	1.4
Lake Chautauqua [b] (Mason Co.)	29,848	0.4
Mermet Lake (Massac Co.)	4,180	0.1
Swede Lake (Mercer Co.)	35,051	0.5
Horseshe Lake (Madison Co.)	31,294	0.5
Lake Depue (Bureau Co.)	20,163	0.3
Bottomland Lakes [c]	47,057	0.7
Miscellaneous Lakes [d]	19,709	0.3
Barrow Pits and Drainage Ditches [e]	5,357	0.1

Table 3 - continued.

Table 3. Continued - page 3

Creeks [f]	360	<0.1
Total for Entire State	6,587,574	

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[a] Downstream from Lock and Dam 26 at Alton.

[b] U.S. Fish and Wildlife Service.

[c] Wilcox and Otter (Mason Co.), Grand Tower Chute (Jackson Co.), Upper Smith Lake (Scott Co.), and Honey Point Gun Club (Cass Co.).

[d] Mitchell (Franklin Co.), Landuit (Rock Island Co.), Carthage (Henderson Co.), Crooked (Lake Co.), New Crystal (Henderson Co.), Curry (Schuyler Co.), Shadow (Henry Co.), Fairy (Mercer Co.), Redwing Slough (Lake Co.), Erie Boat Club (Whiteside Co.), Oak Run (Mason Co.), Sinckers Club (Fulton Co.), and Spoon (Knox Co.).

[e] Upper Carthage Lake Ditch (Henderson Co.), Swan Lake Ditch (Mercer Co.), McCraney/Hadley/Kiser Ditch (Pike Co.).

[f] Big Creek (Clark Co.), Coon Creek (DeKalb Co.), and Rock Creek (Adams Co.).

Table 4. Types of equipment used to commercially catch fish in Illinois in 1987, exclusive of Lake Michigan (data from Fritz 1988).

Type of Equipment	Percentage of Catch
Trammel Nets	65.6
Hoop Nets	23.2
Seines	5.7
Trotlines	2.8
Basket Traps	2.4
Gill Nets	0.3

Table 5. Mean number and corresponding percentage of diving ducks by two-week periods for census regions of Illinois, 1972-1983.

Date	N.E. Ill. (1976-83)		Illinois River		Surface-mined Lakes (1981-83)		Northern Mississippi R. (1980-83)		Central Mississippi R.		Southern Mississippi R.[a]		Cooling Lakes & Reservoirs[b]		SUM OF WEEKS All regions
	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	
09/01-09/14	0		0		NF[c]		NF		3		NF		NF		3
09/15-09/28	0		1		NF		NF		55		NF		NF		56
09/29-10/12	176		672		0		NF		1,824		NF		NF		2,672
10/13-10/26	2,764	2.0	7,378	5.4	370	0.3	59,320	43.1	67,401	49.0	0		389	0.3	137,622
10/27-11/09	11,328	3.1	19,054	5.2	735	0.2	44,580	12.2	265,977	73.0	18,269	5.0	4,334	1.3	364,277
11/10-11/23	4,698	1.3	16,220	4.4	3,805	1.0	23,005	6.3	308,457	84.3	7,557	2.1	2,099	0.6	365,841
11/24-12/07	8,652	4.2	12,963	6.3	823	0.4	710	0.3	173,953	84.8	4,706	2.3	3,207	1.5	205,014
12/08-12/31	5,831	6.5	8,580	9.6	292	0.3	2,177	2.4	64,280	71.8	6,583	7.4	1,726	1.9	89,469
01/01-01/15	4,619	10.9	8,353	19.8	8	T[d]	2,742	6.5	17,597	41.7	7,268	17.2	1,632	3.8	42,219
01/16-01/31	4,708		NF		8		2,633		NF		5,149		909		13,407
02/01-02/14	3,395		3,900		53		1,928		NF		6,373		529		16,178
02/15-02/28	12,715	8.6	36,382	24.6	3,383	2.3	7,918	5.4	78,658	53.3	6,096	4.1	2,484	1.6	147,636
03/01-03/13	23,058	11.4	52,006	25.7	315	0.2	3,888	1.9	108,723	53.7	10,505	5.2	4,114	2.1	202,609
03/14-03/27	35,575	6.5	134,142	24.5	2,375	0.4	76,365	14.0	264,149	48.3	26,503	4.8	7,433	1.3	546,542
03/28-04/10	22,943		64,969		NF		NF		125,670		14,508		7,581		235,671
04/11-04/24	11,319		43,813		NF		NF		51,668		3,049		1,771		111,620

[a] Includes Carlyle and Rend lakes and Newton and Baldwin cooling lakes.

[b] Includes Clinton and Sangchris cooling lakes and Lakes Shelbyville and Springfield.

[c] No flights.

[d] Trace (<0.05).

Table 6. Mean number and corresponding percentage of common mergansers by two-week periods for census regions of Illinois, 1972-1983.

Date	N.E. Ill. (1976-83)		Illinois River		Surface-mined Lakes (1981-83)		Northern Mississippi R. (1980-83)		Central Mississippi R.		Southern Mississippi R.[a]		Cooling Lakes & Reservoirs[b]		SUM OF WEEKS All regions
	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	
09/01-09/14	0		0		NF[c]		NF		0		NF		NF		0
09/15-09/28	0		3		NF		NF		0		NF		NF		3
09/29-10/12	0		1		0		NF		0		NF		NF		1
10/13-10/26	0		0		0		0		9	100.0	0		0		9
10/27-11/09	140	20.4	86	12.6	0		65	9.5	394	57.5	0		0		685
11/10-11/23	413	10.6	578	14.8	40	1.0	328	8.4	2,415	61.9	111	2.8	17	0.4	3,902
11/24-12/07	1,773	12.9	2,896	21.0	48	0.3	228	1.7	7,856	57.0	739	5.4	237	1.8	13,777
12/08-12/31	1,775	10.5	2,905	17.1	48	0.3	678	4.0	9,303	54.8	1,979	11.7	274	1.6	16,962
01/01-01/15	1,832	14.3	3,117	24.3	0		913	7.1	4,350	33.9	2,295	17.9	319	2.5	12,826
01/16-01/31	1,148		NF		2		678		NF		1,624		65		3,673
02/01-02/14	908		645		12		383		NF		2,178		140		4,266
02/15-02/28	1,438	12.0	2,499	20.8	103	0.9	880	7.3	5,487	45.7	1,397	11.6	215	1.8	12,019
03/01-03/13	1,420	14.4	2,221	22.5	25	0.3	1,008	10.2	4,257	43.1	730	7.4	205	2.0	9,866
03/14-03/27	1,819	14.5	3,200	25.5	125	1.0	1,668	13.3	5,386	43.0	244	1.9	83	0.7	12,525
03/28-04/10	310		398		NF		0		1,618		44		57		2,427
04/11-04/24	256		231		NF		0		701		28		11		1,227

[a] Includes Carlyle and Rend lakes and Newton and Baldwin cooling lakes.

[b] Includes Clinton and Sangchris cooling lakes and Lakes Shelbyville and Springfield.

[c] No flights.

Table 7. Mean number and corresponding percentage of hooded mergansers by two-week periods for census regions of Illinois, 1972-1983.

Date	N.E. Ill. (1976-83)		Illinois River		Surface-mined Lakes (1981-83)		Northern Mississippi R. (1980-83)		Central Mississippi R.		Southern Mississippi R.[a]		Cooling Lakes & Reservoirs[b]		SUM OF WEEKS All regions
	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	
09/01-09/14	0		0		NF[c]		NF		0		NF		NF		0
09/15-09/28	0		0		NF		NF		0		NF		NF		0
09/29-10/12	0		0		0		NF		0		NF		NF		0
10/13-10/26	0		0		0		0		0		0		0		0
10/27-11/09	14	34.1	11	26.8	0		0		16	39.0	0		0		41
11/10-11/23	96	14.8	193	29.8	0		0		310	47.8	47	7.3	2	0.3	648
11/24-12/07	201	20.4	332	33.7	20	2.0	0		346	35.2	75	7.6	10	1.0	984
12/08-12/31	176	25.1	171	24.4	15	2.1	0		218	31.1	103	14.7	17	2.5	700
01/01-01/15	69	15.2	131	28.9	0		0		154	34.0	83	18.3	16	3.5	453
01/16-01/31	0		NF		0		12		NF		76		12		100
02/01-02/14	75		0		3		18		NF		60		9		165
02/15-02/28	85	15.0	201	35.5	30	5.3	55	9.7	133	23.5	55	9.7	7	1.3	566
03/01-03/13	143	16.1	391	43.9	13	1.5	0		254	28.5	69	7.8	20	2.3	890
03/14-03/27	190	23.8	165	20.6	0		145	18.1	210	26.3	60	7.5	30	3.4	800
03/28-04/10	200		178		NF		0		140		37		10		565
04/11-04/24	80		94		NF		0		76		35		5		290

[a] Includes Carlyle and Rend lakes and Newton and Baldwin cooling lakes.

[b] Includes Clinton and Sangchris cooling lakes and Lakes Shelbyville and Springfield.

[c] No flights.

Table 8. Average annual use-days for diving ducks and mergansers in census regions of Illinois, 29 September to 24 April 1972-1983. Numbers in parentheses are percentages.

N.E. Ill (1976-83)	Illinois River	Surface-mined Lakes (1981-83)	Northern Mississippi R. (1980-83)	Central Mississippi R.	Southern Mississippi R. [a]	Cooling Lakes & Reservoirs [b]	All Regions
			DIVING DUCKS				
2,257,742 (5.3)	6,542,767 (15.5)	211,148 (0.5)	4,264,695 (10.1)	26,523,362 (62.7)	1,867,298 (4.4)	612,063 (1.4)	42,276,457
			MERGANSERS [c]				
216,595 (13.1)	330,701 (20.1)	8,399 (0.5)	113,080 (0.6)	757,214 (46.0)	193,512 (11.7)	28,210 (1.7)	1,647,711

[a] Includes Carlyle and Rend lakes and Newton and Baldwin cooling lakes.

[b] Includes Clinton and Sangchris cooling lakes and lakes Shelbyville and Springfield.

[c] Common and hooded.

Table 9. Summary of Illinois Migratory Waterfowl Stamps purchased, hunter activity, and waterfowl harvest in Illinois from 1981 through 1987.

Year	Stamps Purchased	Hunters	Days Afield	Waterfowl Harvested [a]
1981	61,929	63,652	874,730	413,264
1982	57,691	58,766	795,807	392,897
1983	56,162	58,240	815,523	475,601
1984	55,250	56,533	748,390	420,357
1985	55,670	56,899	699,113	392,253
1986	59,734	61,876	887,446	467,164
1987	58,803 [b]	60,371	814,918	354,194
Mean	57,891	59,477	805,132	416,533

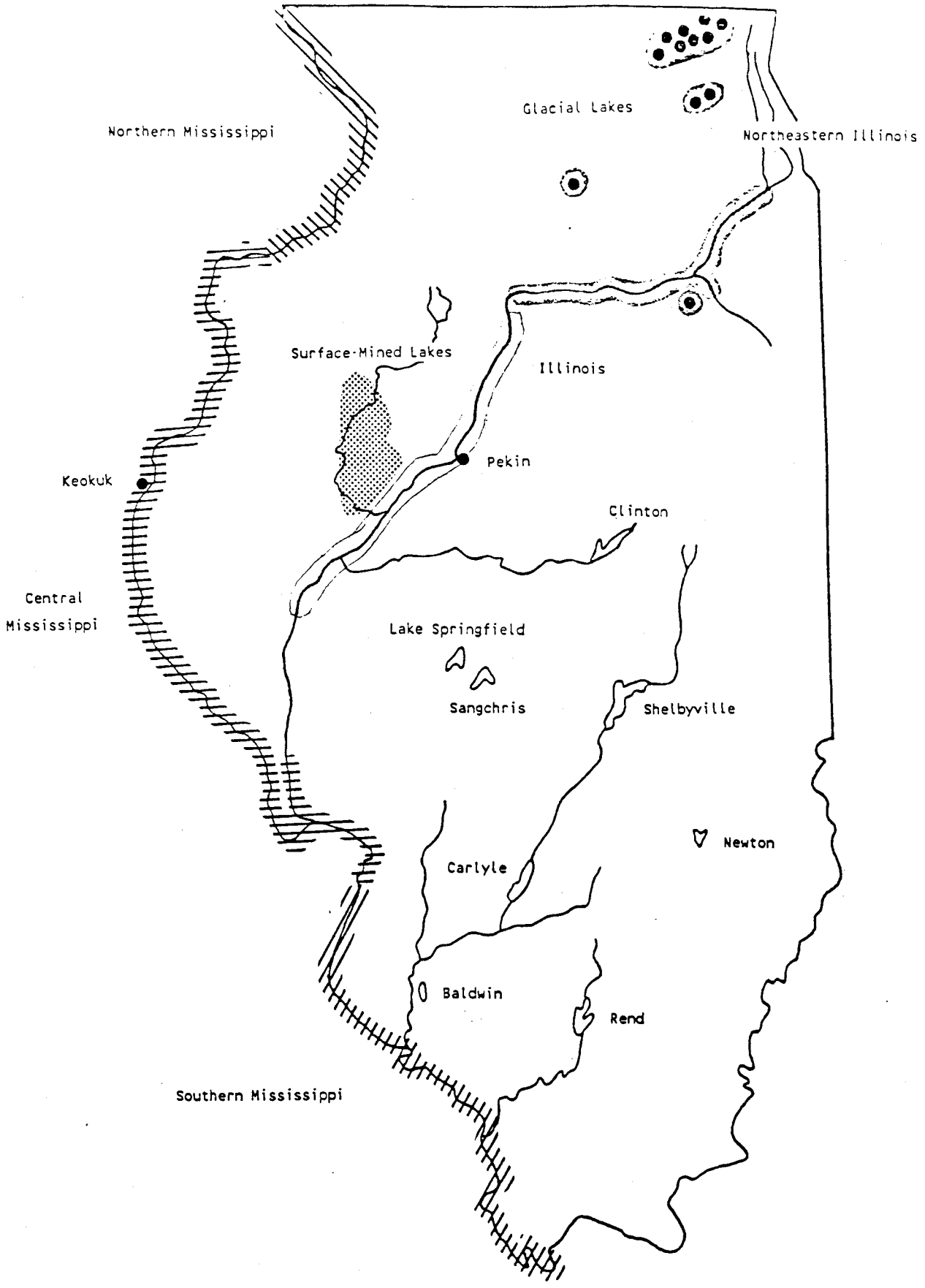

Figure 1. Regions and selected locations aerially inventoried for waterfowl.

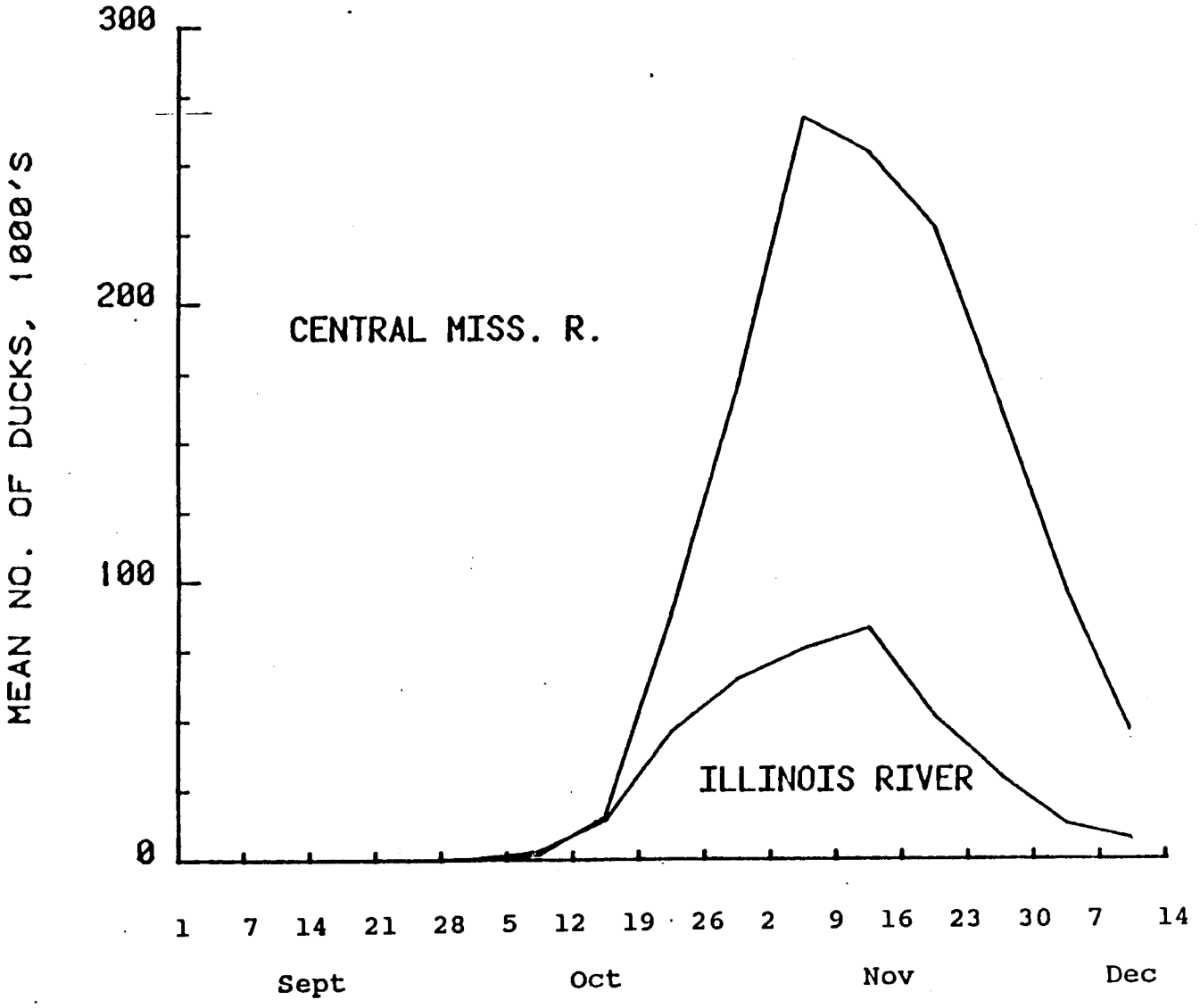

Figure 2. Mean number of all diving ducks censused per week during the fall in the Illinois River and Central Mississippi River regions, 1948-1980.

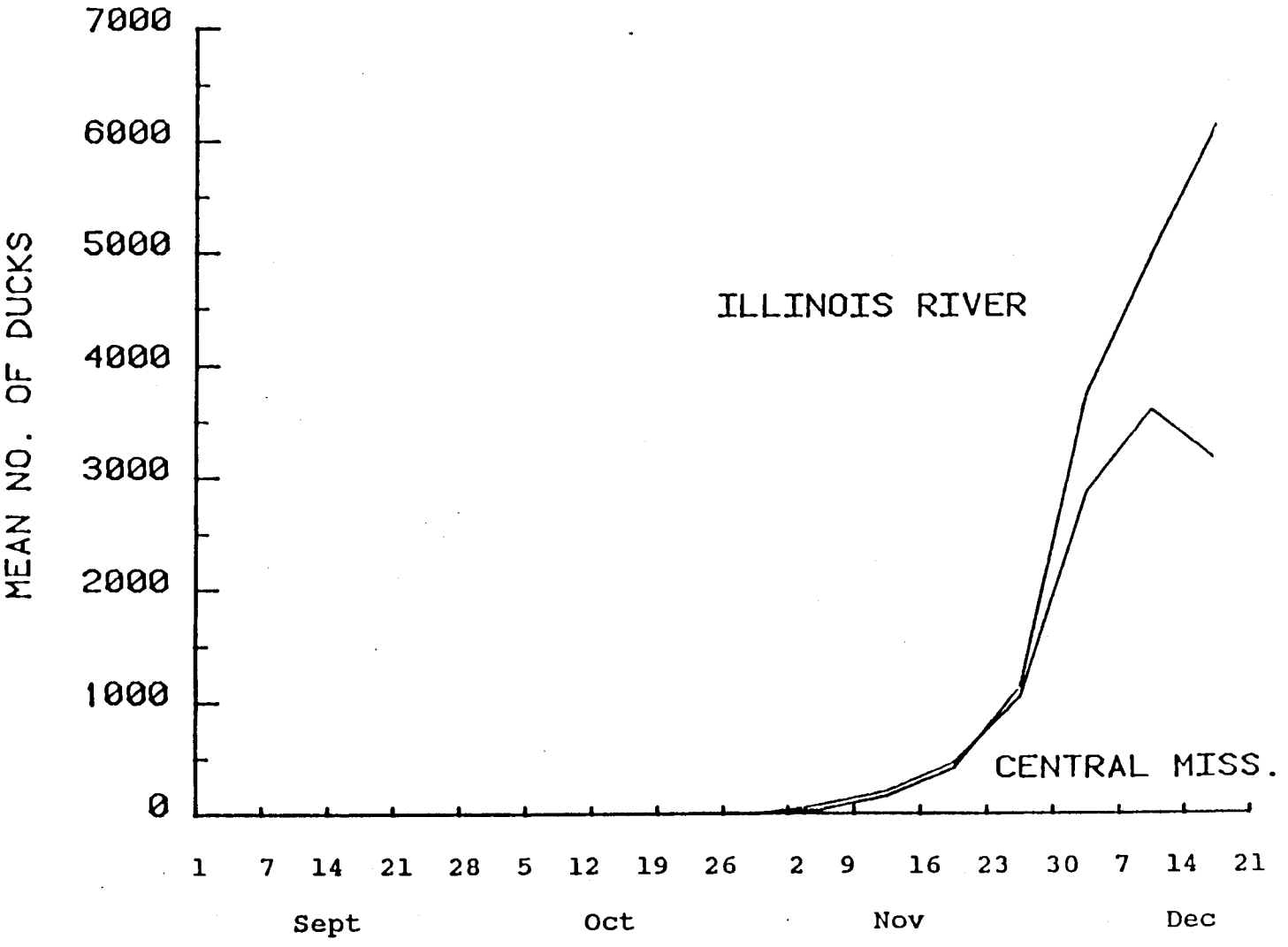

Figure 3. Mean number of common mergansers censused per week during fall in the Illinois River and the Central Mississippi River regions, 1948-1980.

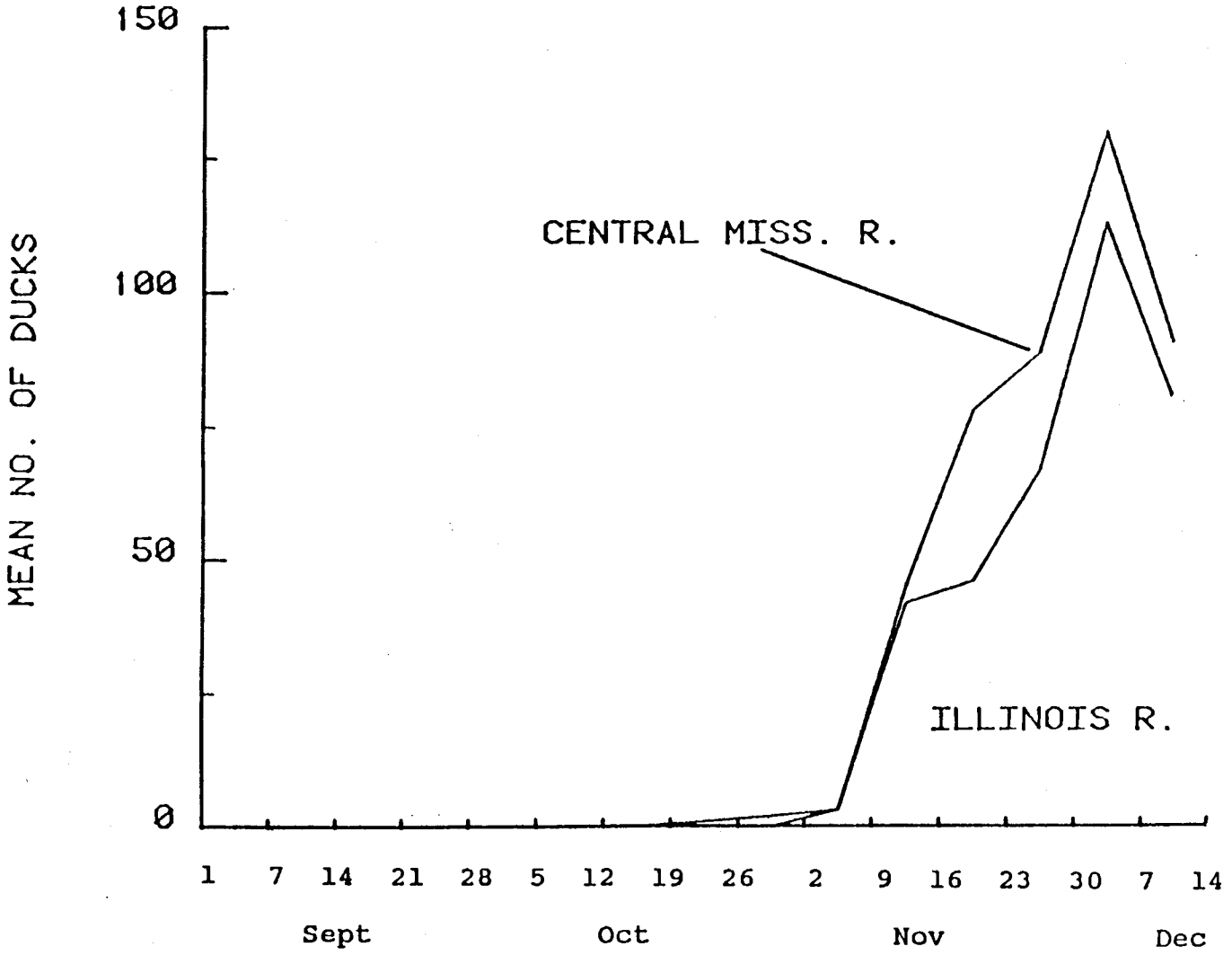

Figure 4. **Mean number of hooded mergansers censused per week during fall in the Illinois River and the Central Mississippi River regions, 1948-1980.**

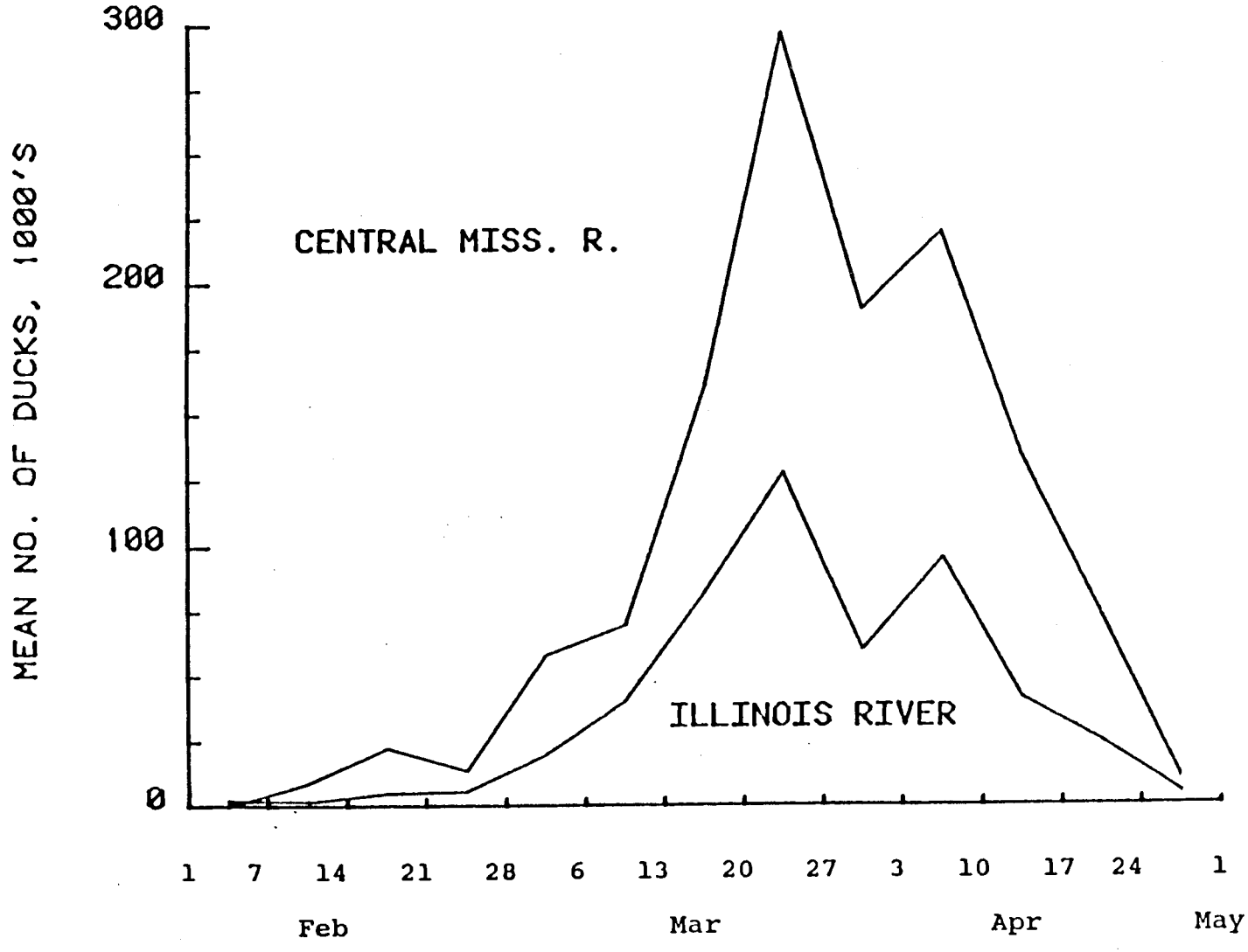

Figure 5. Mean number of all diving ducks censused per week during spring in the Illinois River and Central Mississippi River regions, 1955-1980.

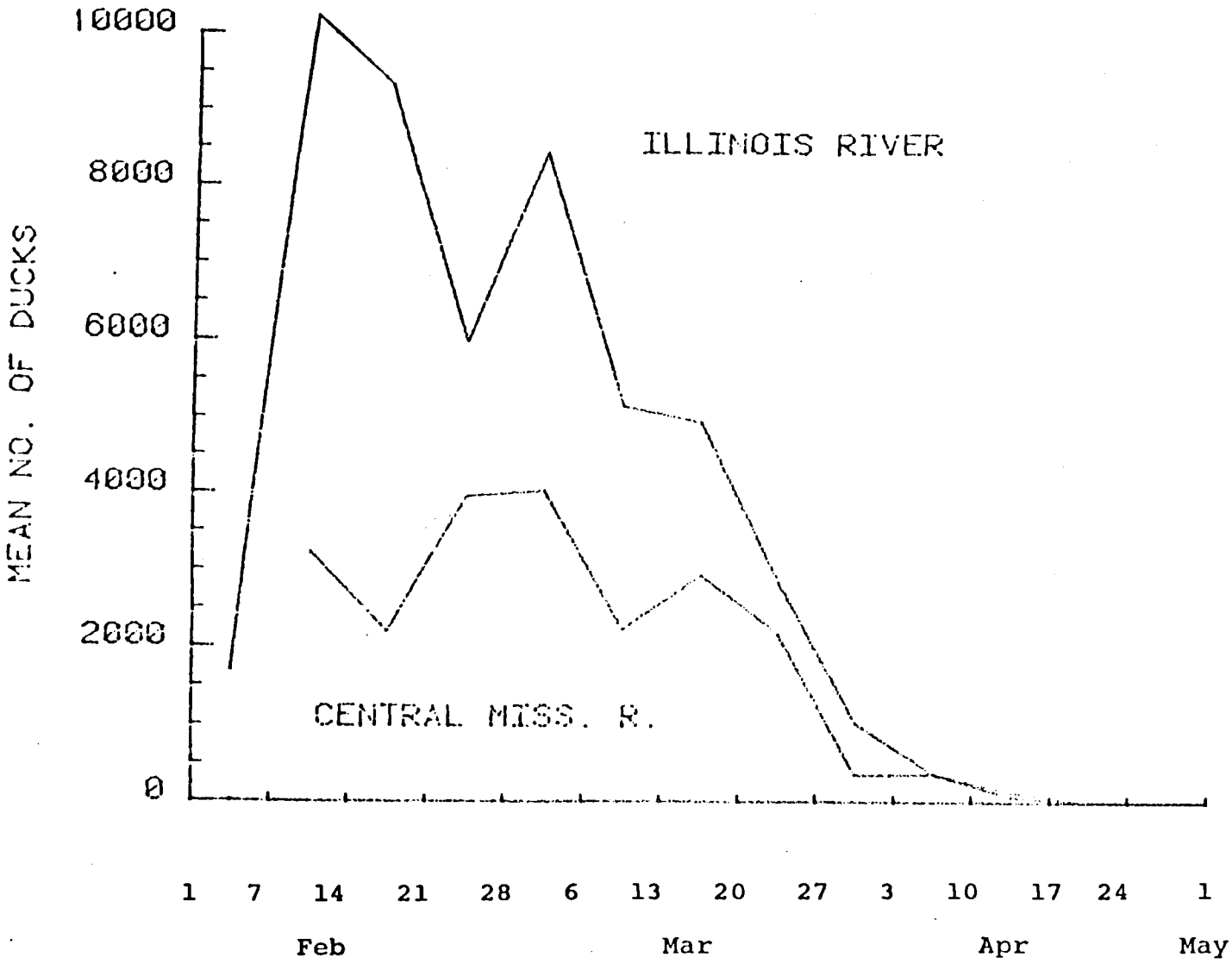

Figure 6. Mean number of common mergansers censused per week during spring in the Illinois River and Central Mississippi River regions, 1955-1980.

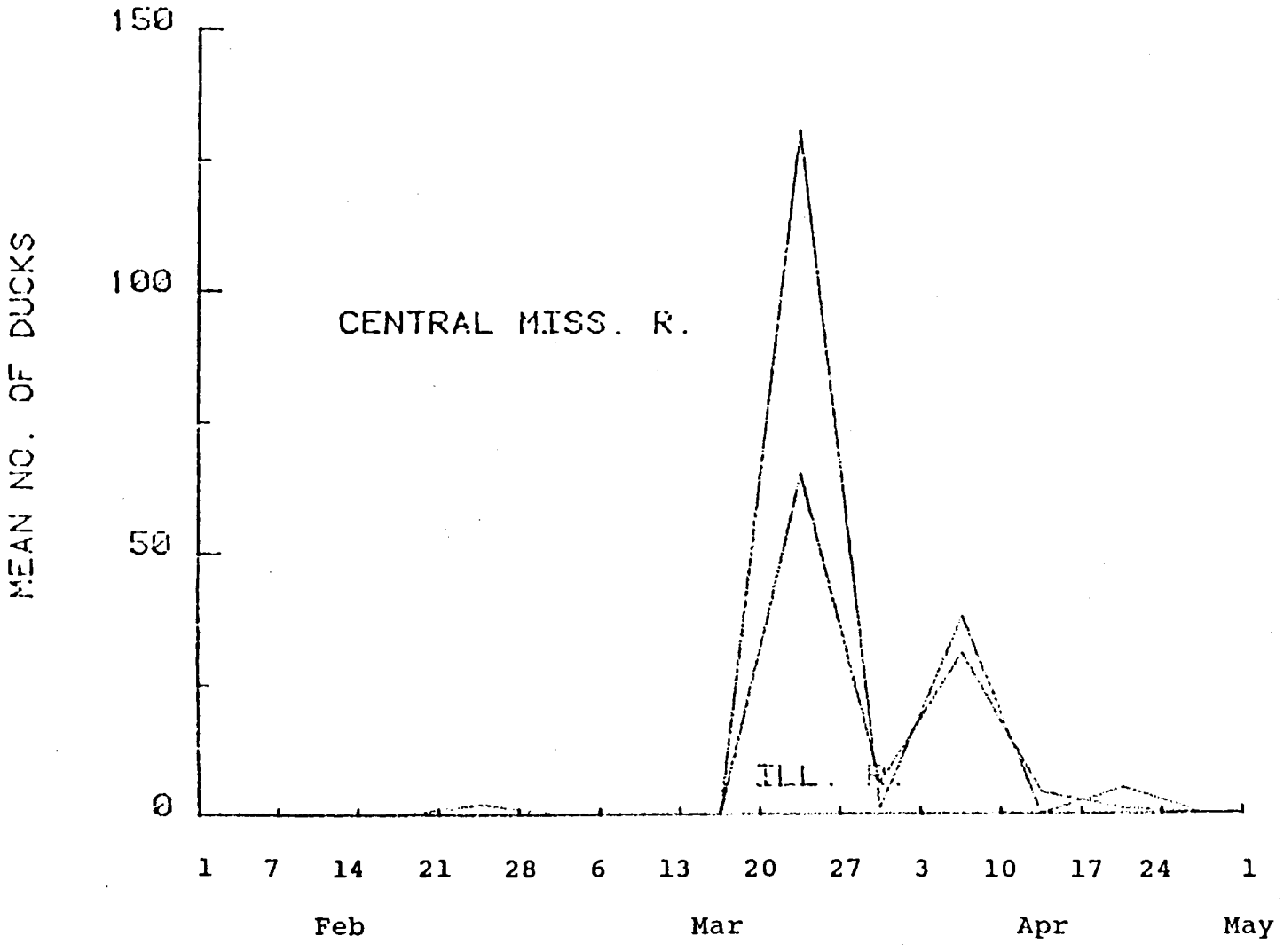

Figure 7. Mean number of hooded mergansers censused per week during spring in the Illinois River and Central Mississippi River regions, 1955-1980.

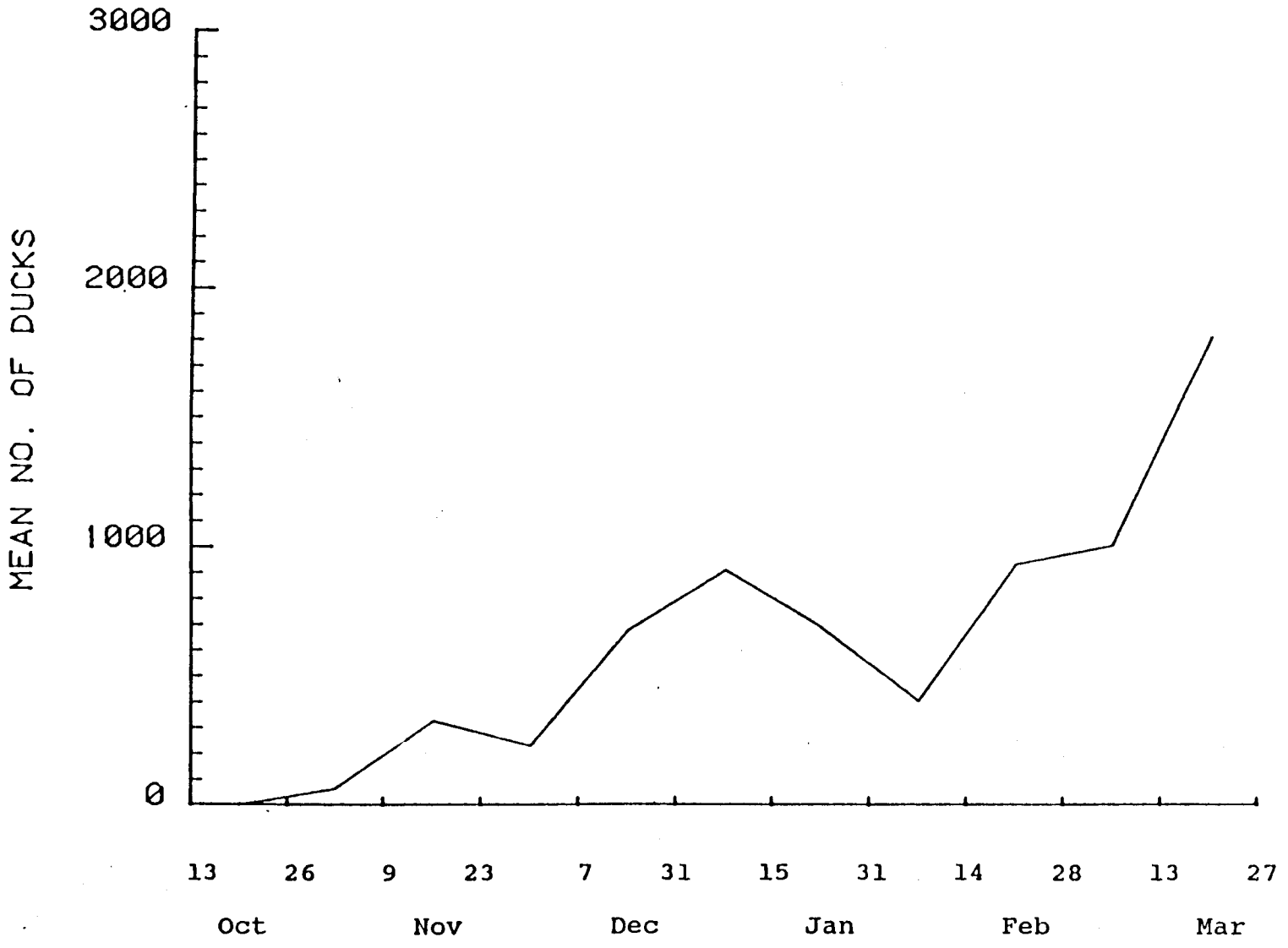

Figure 8. Mean number of all mergansers censused per week during October to March in the Northern Mississippi River region, 1980-1983.

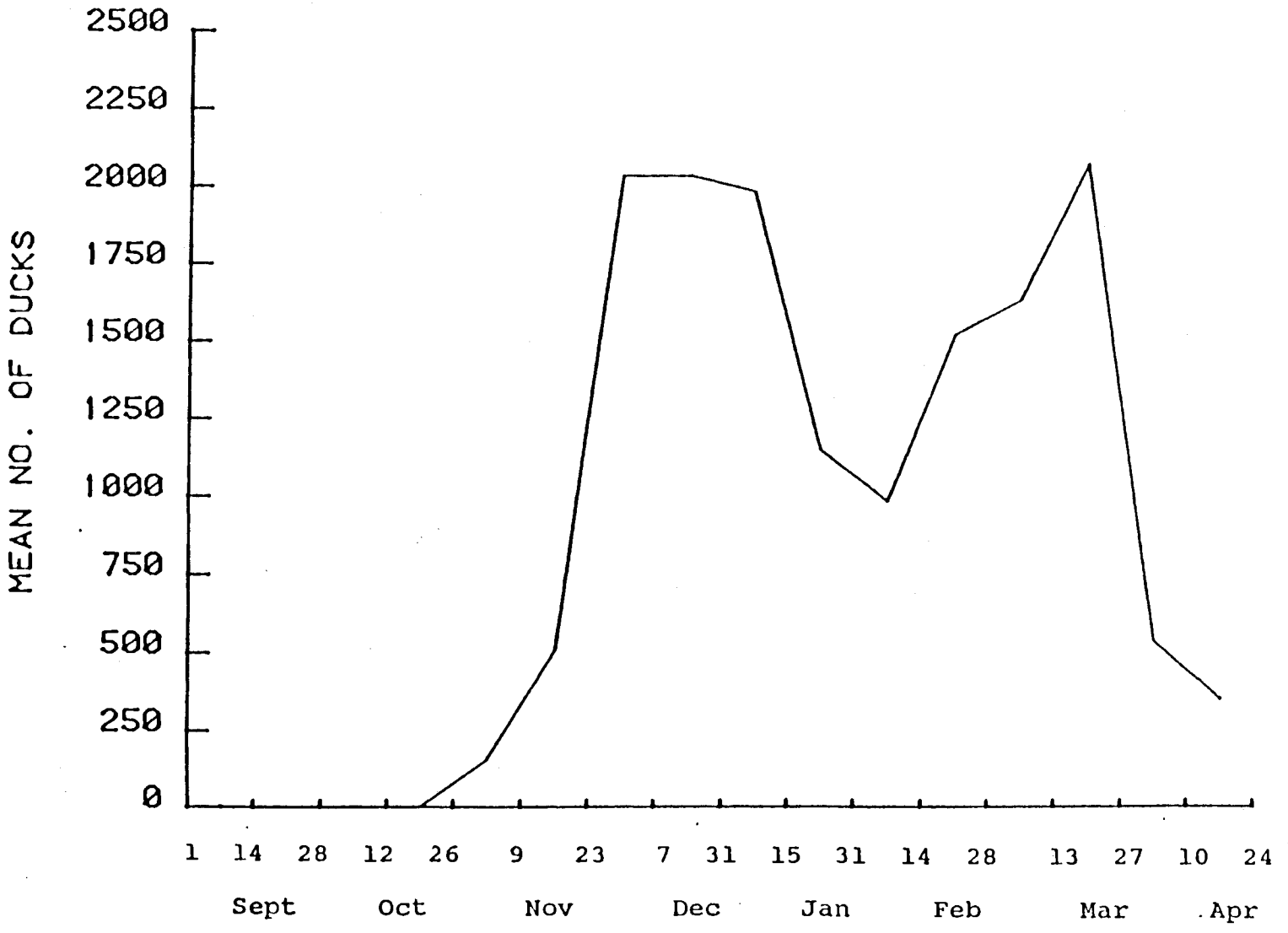

Figure 9. Mean number of all mergansers censused per week from September to April in the Northeastern Illinois region, 1976-1983.

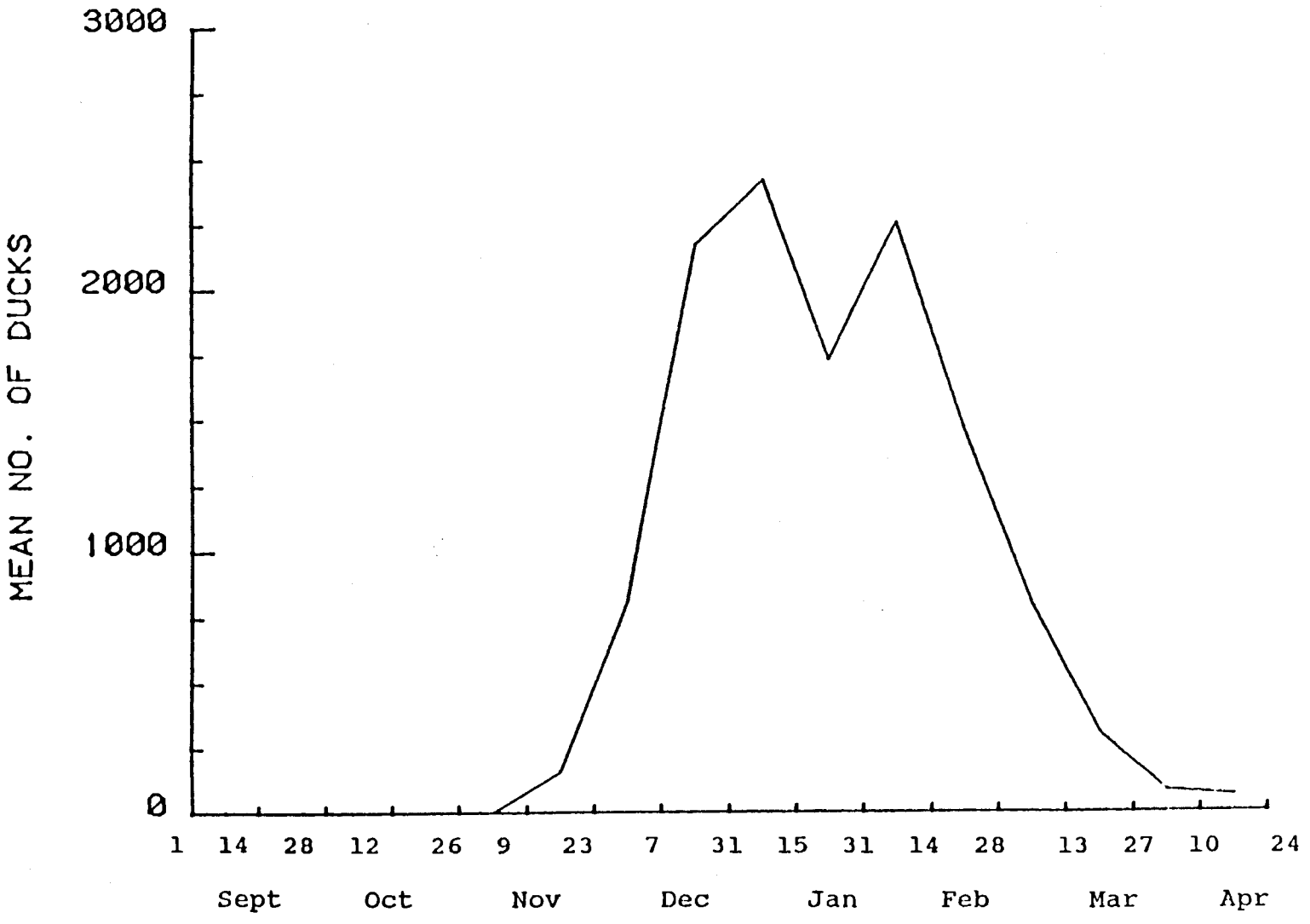

Figure 10. Mean number of all mergansers censused per week from mid-October through April in the Southern Mississippi River region including Carlyle and Rend lakes and Newton and Baldwin cooling lakes, 1972-1983.