THE CHANNEL CATFISH SPORT FISHERY
OF THE LOWER RED RIVER

by

Don Macdonald

A Practicum
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of the Requirements for the Degree,
Master of Natural Resources Management

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Abstract

The lower Red River is the most popular angling area in Manitoba. Recently the channel catfish (Ictalurus punctatus) fishery in this area has undergone a dramatic increase in popularity leading to concerns about the potential for overexploiting the catfish population.

This study gathered baseline data on the lower Red River catfish population in order to determine its current status and the effectiveness of the current management regime. A variety of methods were used, including: hoop nets, gill nets, angling, tagging, ultrasonic tracking, and creel census.

Catfish segregated into different habitats based on size specific feeding requirements. They moved throughout the watershed, restricted only by physical barriers and the northern limit of their range. Movement appears to be necessary to gain access to optimum habitats for different stages of their life history.

The fishery offers a unique opportunity to catch large numbers of large catfish, with an average weight of 8.9 kg. Harvest of large catfish should be minimized to maintain the unique nature of the resource. Current regulations appear effective at restricting the harvest of large fish.

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Chapter 1

Introduction

The Red River between Lockport and Lake Winnipeg (Fig.1) is the scene of the most intense sport fishery in Manitoba (Lysack, 1986a). The 1985 Survey of Sport Fishing in Canada estimated that nine percent of the angler days in Manitoba were spent in this area. This fishery is valuable, both for the recreational opportunity it offers to residents of southern Manitoba, and for the tourism development opportunities it brings to the Selkirk area. In recent years channel catfish (*Ictalurus punctatus*) have become an increasingly important part of this fishery.

Prior to 1985, the Red River channel catfish fishery was largely ignored by all but a few anglers, most of whom were from the American Midwest. In 1985 the fishery was featured on Babe Winkleman's 'Good Fishing' television program. Several television programs and magazine articles followed, and the Town of Selkirk started to promote itself as the Catfish Capital of North America. Interest in the fishery increased, both for the fishing, and for the tourism development opportunities presented. Angling pressure on the catfish fishery also increased,however little was known of either the fishery or the biology of channel catfish in Manitoba.

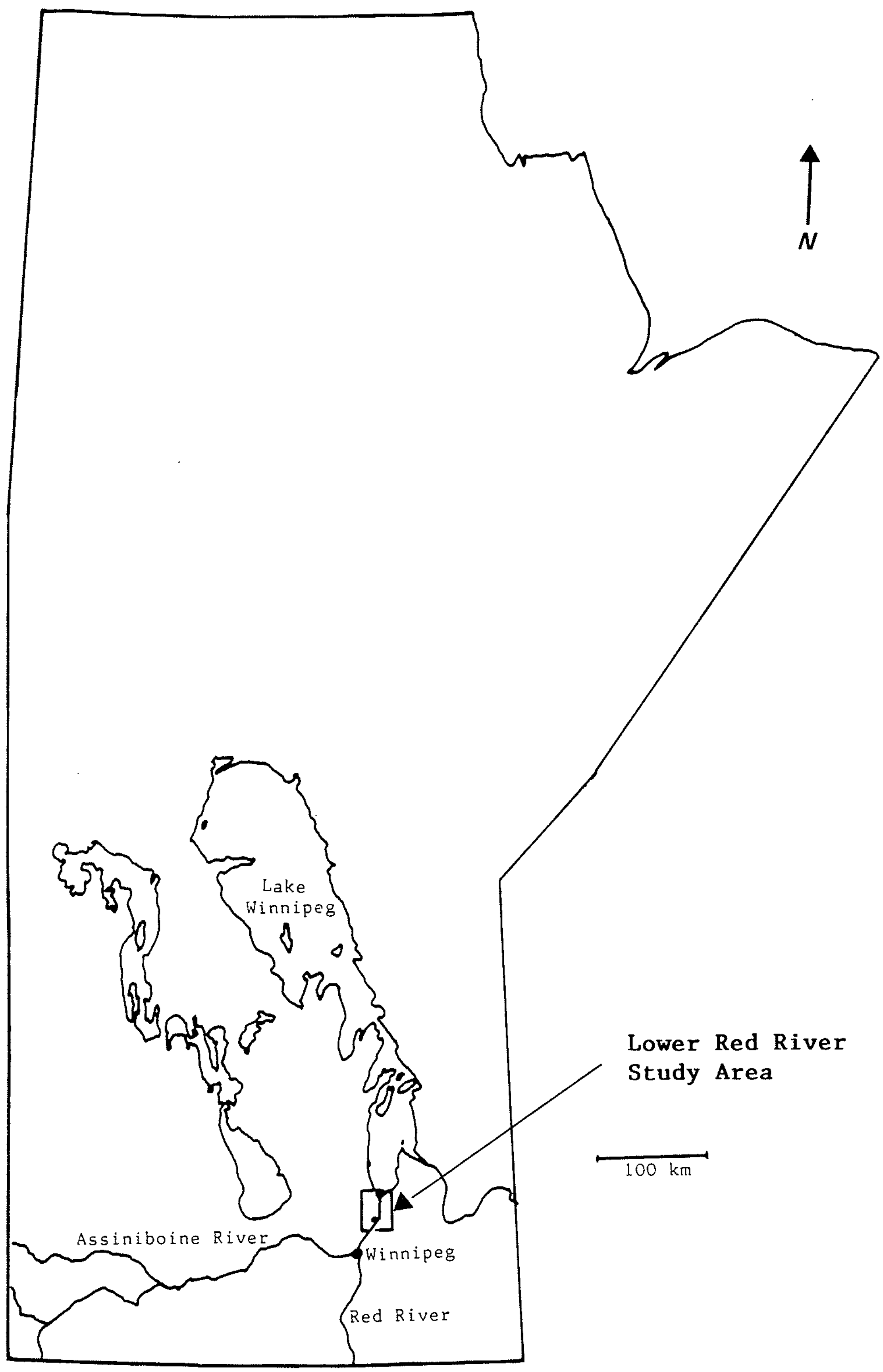

Fig. 1. The Red River and the lower Red River study area in Manitoba.

The lower Red River channel catfish fishery is unique in North America because of the trophy nature of the catfish stocks (Stewart pers. comm.). The value of the fishery appears to lie in the high numbers of large catfish caught by anglers. The Red River population has been relatively unexploited until recently compared to other catfish populations throughout North America.

1.1 Problem Statement

In recent years the popularity of the catfish sport fishery in the lower Red River has increased. There are concerns that the population of trophy sized catfish may be depleted. There is a lack of data about the current status of the sport fishery, and the catfish population. Regulation changes have occurred, and more changes have been proposed. Information is needed to manage this fishery properly.

1.2 Objectives

This study was intended to provide the information necessary for the preparation of a management plan. The objectives of the study were:

a) to obtain basic biological data on population structure and movements, needed for the management of channel catfish in the Red River below Lockport.

b) to review the literature for information applicable to the biology and management of channel catfish in the lower Red River.

c) to determine angler effort and harvest in the catfish sport fishery, both for resident and nonresident anglers, with emphasis on changes since the 1982 creel census.

d) to recommend appropriate guidelines for the management of this fishery, based on the information available.

1.3 Limitations

This practicum represents the first two years of study of the catfish population and sport fishery. Research into this fishery is continuing. This study is a preliminary assessment of the catfish population. Assessment of the impacts of the sport fishery is limited by the lack of baseline data on catfish in Manitoba in general, and the lower Red River in particular.

Chapter 2

Literature Review

2.1 Background

2.1.1 Management Mandate

The Manitoba Department of Natural Resources, Fisheries Branch has the mandate to manage fish resources in the Province of Manitoba. Management of sport fisheries is conducted following the considerations of the Sport Fishing Strategy:

- To protect, maintain and enhance the fisheries resource base.
- To provide recreational angling opportunities for residents.
- To generate an acceptable economic benefit to the Province from the use of the resource by industry and non-resident anglers.

The management philosophy which will be used in attempting to achieve the considerations of the strategy are:

- Limit harvest rather than angling or business opportunities in protecting the resource base.
- User involvement is essential in management and anglers and sport fishing industry recognized as primary clients of management.

2.1.2 Study Area

The Red River has its origins in Minnesota. It is a slow flowing prairie river draining an area of 287,500 km^2 (Lysack 1987). Several urban centres and intensive agriculture occur throughout the drainage basin. There are seven water control structures on the Red River in the United States (Janusz and O'Connor 1985). The only control in Manitoba is St. Andrews Locks and Dam at Lockport. This dam was completed in 1918, and was constructed to make St. Andrews Rapids navigable.

The Red River drains into Lake Winnipeg after flowing through Netley-Libau Marsh complex. The marsh is the delta of the Red River. It contains 17 major lakes, and with an open water area of 12,141 ha (Janusz and O'Connor 1985) is the largest peripheral marsh in Manitoba (Townsend in Janusz and O'Connor 1985).

In Manitoba the Red River passes through the City of Winnipeg, which has a population of about 600,000. This large urban population generates much of the angling pressure on the lower Red River. The Town of Selkirk, with a population of about 10,000, is 21 km north of Winnipeg. Selkirk has actively promoted the Red River fishery for tourism development. The community of Lockport is located about 5 km south of Selkirk. Lockport is a small community which relies heavily on the business generated by the lower Red River sport fishery. Anglers fishing on the lower Red River may launch their boats at either Lockport or Selkirk.

2.1.3 History of the Fishery

A catfish fishery has existed in the Lockport area for over 3,000 years (Hems pers. comm.). The fish bone present in an archaeological dig at Lockport was 90% catfish bone by weight. The catfish bones recovered indicate that a wide size range of catfish were exploited, some estimated to be as large as 14-16 kg. Prior to the construction of St. Andrews Locks and Dam, Lockport was the location of a series of rapids. It is assumed that catfish were speared in the shallow pools below the rapids. Catfish were probably highly valued for their oil content, and when corn cultivation started 700-800 years ago catfish remains were used for fertilizer. Catfish spines have always been part of Indian artifacts and were used as awls or needles (Scott and Crossman 1973).

Anglers in Manitoba have not traditionally considered catfish a desirable sport species. Although some local anglers did appreciate the catfish population, it was common to find large catfish tossed high on the shore to die.

American anglers, predominantly from Iowa, appreciated catfish and began to appear in increasing numbers throughout the 1970's and 80's. Prior to the imposition of creel limits for catfish, there were instances where very large numbers of catfish were harvested by some parties of anglers.

In 1985 Babe Winkleman recorded a television segment on the Red River catfish fishery, which aired prior to the summer of 1986. Interest in the fishery increased as other television shows and magazine articles highlighted the fishery. The Town of Selkirk began to actively promote itself as the Catfish Capital of North America. Changes in regulations were felt to be necessary to preserve the catfish population in the face of increasing pressure. Regulation changes had to be made with minimal biological information available on the catfish population.

2.1.4 Regulation Changes

Prior to 1981 there was no limit on channel catfish in Manitoba. In 1981 a limit of 8 was introduced. In 1986 this limit was reduced to 4, only one of which may be over 75 cm, natural total length. The changes in 1986 were felt to be necessary following the growing attention that was being focused on the Red River channel catfish population. The length limit was intended to limit the harvest of trophy sized catfish.

There was some opposition to the limit reductions by fishermen who were accustomed to taking large numbers of catfish home, and from local businessmen who felt that these fishermen would no longer come to this area to fish.

2.2 Catfish Biology

2.2.1 Red River Literature

The lower Red River catfish fishery has not been studied previously. There have been studies which provide valuable information for the management of this fishery. The sport fishery in the lower Red River was assessed in 1982 (Lysack 1986a). This provides detailed baseline data on the status of the sport fishery prior to it being promoted throughout North America. A catfish fishery did exist in 1982, however it formed only a small part of the lower Red River fishery.

The Netley-Libau marsh complex is a significant area of habitat available to fish in the Red River. The fish populations of the marsh complex were assessed Janusz and O'Connor (1985). The marsh was found to be extremely productive fish habitat. It was utilized by many species of Red River and Lake Winnipeg fish as spawning, rearing, and feeding habitat. Although channel catfish were not found to be using the marsh, the study was too limited by funding and time constraints to conclude that catfish did not utilize the marsh.

There is a significant commercial bait fishery on the lower Red River which was described by Lysack (1987). Emerald shiners (Notropis atherinoides) form the basis of this fishery. The importance of the Netley-Libau marsh to emerald shiner productivity was felt to be significant, but was not part of this study.

The hydrology of the Red River, and other tributaries to Lake Winnipeg was described in detail by Brunskill (1980).

2.2.2 Manitoba Catfish Literature

There was limited biological information on channel catfish in Manitoba. Moshenko (Januzs, pers. comm.) sampled 68 channel catfish in 1976 for age, length, weight, sex, and maturity. From 1972 until 1974 Clarke (pers. comm.) conducted a study of fish in the Red River in Winnipeg. This study provided some of the first data on the biology of catfish in Canada. The study area was a 50 km stretch of the Red River occurring within the City of Winnipeg. Most of the data came from 90 hoop net sets. Channel catfish was the most abundant species caught, comprising 25.6% of the catch. Numbered Floy tags were inserted at the posterior base of the dorsal fin of 1310 channel catfish. There were 28 recaptures of tagged catfish over the next 5 years. Catfish moved as far as 412 km south to Halstad, Minnesota, and 246 km north into Lake Winnipeg. Based on changes in seasonal abundance and tag recapture data, Clarke speculated that there might be two populations of channel catfish in the Red River, one comprised of larger individuals overwintering and spawning as far upstream as Halstad, Minnesota, then spending the summer in the lower Red River. The second population comprised of smaller catfish which move in from Lake Winnipeg to spawn, returning to the Lake in the summer and fall to overwinter. Clarke indicated that further study was needed to identify spawning and overwintering areas, and confirm their hypothesis on movement patterns.

2.2.3 Life History

A basic understanding of channel catfish biology and life history is needed to manage the lower Red River fishery. Since there is little available information concerning catfish in Manitoba, or even in Canada, literature from the United States must be used. Several studies have described the complete biology and life history of channel catfish in areas south of Manitoba (Davis 1959; Russell, 1965; Mayhew

1972; Elrod 1974; Starostka and Nelson 1974; Hesse 1982; Stevenson and Day 1986). These studies provided the basis for comparison with the Red River catfish population.

2.2.4 Habitat Suitability

McMahon and Terrell (1982) reviewed the literature on catfish habitat requirements throughout their life history when developing a habitat suitability index for channel catfish. This paper is more useful as a literature review than for calculating a suitability index since Layher and Maughan (1985) tested the habitat suitability index, and found that it was not as useful for 'broad-niche' species such as catfish as it was for more 'narrow-niche' species.

Hesse et al. (1979) determined the importance of tributaries for maintaining the river population of catfish in the Missouri River. Bailey and Harrison (1945) reported that catfish reproduction was highly successful in prairie rivers.

2.2.5 Management

Vanderford (1986) conducted a survey of catfish management techniques used throughout the United States. Of the 42 states which responded to the survey, channel catfish were considered an important sport fish in 64% and were actively managed in 62%. Most states stocked catfish as part of their management program. None specifically managed for trophy catfish populations.

2.2.6 Growth

Catfish growth rates can vary greatly, with significantly more rapid growth occurring the further south a population occurs (Scott and Crossman 1973). Growth rates for several populations throughout North America were described by Carlander (1969). Additional information on specific populations has been published by several authors (Appleget and Smith 1951; Davis 1959; Stevens 1959; De Roth 1965; Russell 1965; Schacht 1967; Elrod 1974; Mayhew 1974; Starostka and Nelson 1974; Hesse, Wallace and Lahman 1978; Hesse *et al.* 1982).

Catfish often grow to weights of over 14 kg in Canada (Scott and Crossman 1973). Bensley (*in* Scott and Crossman 1973) reported one of 17 kg in Georgian Bay. In waters other than the Great Lakes weights of 1 to 2 kg are most common with occasional fish up to 4.5 kg.

The Manitoba Master Angler Program maintains records of catfish over a qualifying weight which are entered in the program, and the Provincial record catfish. The International Game Fish Association (I.G.F.A.) maintains a record of the largest fish caught for several species including catfish. The largest catfish was 26 kg from the Santee-Cooper Reservoir in South Carolina in 1964. The catfish in Santee-Cooper Reservoir, South Carolina, have been described as the longest living, largest growing catfish ever reported (Stevens 1959). Catfish were aged up to 14 years, and observed up to 22 kg. There were additional reports of catfish caught by anglers of up to 35 kg. Some of this impressive growth may have been due to the flooding of this area when the reservoir was created 17 years earlier.

Catfish growth is generally more rapid in the first 3 years of life and slows dramatically after age 5 (Hesse et al. 1982). The greatest increment in length occurred in the third or fourth year of life (Russell 1965). Largest annual increase in length occurred in the second year of life (Starostka and Nelson 1974).

The maximum age of a catfish in Canada is felt to be about 24 years, however faster growing populations to the south are estimated not to exceed 14 years old, with some populations reaching only 7 (Scott and Crossman 1973). Carlander (1969) reported age compositions from several populations and with the exception of Magnin and Beaulieu

(1966) the oldest was 14 years. Elrod (1974) sampled a 17 year catfish in Lake Erie, however the majority of the catch was 5 to 9 years. Davis (1959) reported that few catfish in Kansas live more than 7 years. Russell (1965) caught only 4 fish over 7 years in the Missouri River, Nebraska. Starostka and Nelson (1974) found ages 2 to 18 in Lake Oahe, but fish older than 8 were poorly represented.

Catfish growth is temperature dependant, with increasing temperatures yielding increased growth (Andrews and Stickney 1972). Growth is poor below 21°C (McCammon and LaFaunce 1961; Macklin and Soule in McMahon and Terrell 1982; Andrews and Stickney 1972), and no growth occurs below 18°C (Starostka and Nelson 1974). Optimal temperatures for growth have been reported between 26°C and 30°C (Andrews and Stickney 1972; Chen in McMahon and Terrell 1982; Shrable et al. in McMahon and Terrell 1982).

Russell (1965) found that growth was most rapid in low turbidity waters, however these waters also showed poor survival of young because of predation.

2.2.7 Spawning

The behaviour of spawning catfish was described in detail by Clemmens and Sneed (1957), Busch (1985), and

Grizzle (1985). The age structures of populations of spawning catfish, including age at onset of sexual maturity, were described by Ackerman (1965), and Hesse et al. (1979). Catfish reproductive physiology was described in detail by Grizzle (1985).

Carlander (1969) reported that spawning usually occurs at 24°C, although temperatures ranged from 21° to 27°C. Helms (1975) found that spawning in the upper Mississippi River was more dependant on temperature than flow, and that it started at 18°C. Davis (1959) found that no egg development occurred at temperatures below 16°C.

Catfish spawning may occur over a prolonged period. In the upper Mississippi River it ranged in duration from 49 to 84 days from June through August (Holland-Bartels and Duval 1988). Spawning occurred from late May through July in Kansas (Clemmens and Sneed 1957), and Iowa (Harrison 1951; Ackerman 1965).

Catfish do not eat during spawning, and cannot be caught on baits (Bailey and Harrison 1945; Ackerman 1965).

2.2.8 Maturity

The age at which catfish reach sexual maturity can vary greatly. A summary of the literature suggests that maturity starts after 4 to 6 years, at a maximum total length of 330 to 560 mm (Carlander 1969). Catfish from southerly populations tend to mature earlier (Scott and Crossman 1973). Catfish from Louisiana and Texas may mature in less than two years (Carlander 1969; Scott and Crossman 1973). Ackerman (1965) reported that catfish in Iowa start to mature at 4 years, and are all mature by 7. In the Mississippi River catfish start to mature at 5 years and are all mature by 9 (Appleget and Smith 1951). Lake Erie catfish maturity was similar to the Mississippi River, although maturity in some individuals started as early as 2 years (De Roth 1965). Catfish in Lake Oahe, South Dakota began to mature at 6 years, and all were mature by 11 (Starostka and Nelson 1974). Catfish in Lake Sharpe, South Dakota, began to mature at age 7, and 50% were mature by age 12 (Elrod 1974).

2.2.9 Diet

The feeding habits of catfish at various stages of their life history have been well described in the literature. Catfish are omnivorous (Bailey and Harrison 1945; Russell 1965; Carlander 1969; Scott and Crossman 1973) and diet varies in proportion to availability (Bailey and Harrison 1945; Russell 1965; Busbee 1968; Mathur 1970; Bonneau et al. 1972; Walburg 1975; Zuerlein 1982). Diet also varies with the size of catfish. Catfish gradually change from insectivory to piscivory as they grow larger (Bailey and Harrison 1945; Russell 1965; Busbee 1968; Carlander 1969; Starostka and Nelson 1974; Zuerlein 1982).

2.3 Methodology

2.3.1 Length

Nielsen and Johnson (1983) defined the different methods of measuring the length of a fish. Fork length is commonly used in Canada, and is defined as "the distance from the most anterior part of the fish to the tip of the median caudal fins". Total length is defined as "the length from the anterior-most part of the fish to the tip of the longest caudal fin rays". There are two methods of measuring total length. American studies commonly use maximum total length which is measured with the lobes of the caudal fin compressed dorso-ventrally. European studies commonly use natural total which is measured with the tail in its 'natural' position.

A common problem in the literature is the inconsistent use of fork and total length to measure channel catfish.

McCammon (1956), Clarke (pers. comm.) and Manitoba's Fisheries Branch use fork length. Christenson (1952), De Roth (1965), Harrison (1953), Hesse et al. (1979), Mitzner (1968), and Schacht (1967) use maximum total length as is common in most American studies (Nielson and Johnson 1983). The Manitoba Master Angler Records and Manitoba's Fisheries Regulations use natural total length.

Carlander (1969) provides a conversion formula between fork and maximum total length, however it is derived from Magnin and Beaulieu (1966). It is not clear whether Magnin and Beaulieu measured natural or maximum total length. Elrod (1974) calculated a conversion from fork length to maximum total length.

2.3.2 Capture Techniques

Of the States surveyed by Vanderford (1986), only 8 reported that they had a satisfactory, consistent method of sampling catfish populations. Methods reported as consistent by some States were reported as inconsistent by others. Vanderford (pers. comm.) expressed surprise at how little seemed to be known about consistent, effective sampling techniques for determining channel catfish populations.

Harrison (1951) compared the effectiveness of seines, trap nets, basket traps, and baited hoop nets. Seine and trap nets did not work well in rivers. Basket traps had a small effective trapping area, and the set location had to be selected carefully. Hoop nets worked best, although the set location had to be chosen carefully. Nets had to be moved throughout the season as preferred habitats changed. McCammon (1956) demonstrated that set location was an important variable in catch success.

Stevenson and Day (1986) reported that gill nets were the most effective means of sampling in reservoirs, but the catch of non-target species was excessive. It is more difficult to collect age and growth data for catfish than for other species because of necessity of using specialized gear. Sampling methods such as trap nets and electroshocking fail to catch all sizes in adequate numbers with consistency, thereby introducing sampling bias.

The most common sampling technique is hoop nets baited with cheese trimmings (Ackerman 1956; Schacht 1967; Welker 1967; Hesse et al. 1979; Hesse 1982). Hesse (1982) successfully sampled 27,872 catfish in the Missouri River from 1974 to 1978, primarily using hoop nets with cheese trimmings as bait.

Baker (1962) compared cottonseed cakes with cut fish for use as bait capturing catfish in hoop nets. Fish bait was more effective for catching large catfish, cottonseed cakes for smaller catfish. Cottonseed cakes also attracted large numbers of carp. Ackerman (1965) and Schacht (1967) used mature female catfish as bait during spawning season. This was successful for capturing large numbers of catfish, but introduced a bias for males.

Hesse and Newcombe (1982) successfully estimated populations in the Missouri River by electrofishing catfish concentrated by early winter draw down of the river. This procedure involves considerable effort, and took over a year to develop. Hesse (pers. comm.) recommended this procedure as being less size selective than hoop nets.

2.3.3 Aging

Catfish ages are usually determined using pectoral spines (Davis 1959; Stevens 1959; Ackerman 1965; De Roth 1965; Russell 1965; Starostka and Nelson 1974). Dorsal spines, vertebrae, otoliths, clethria, and opercula can also be used (Appleget and Smith 1951; Russell 1965).

The oldest catfish in the literature was reported as 40 years from the St. Lawrence in Quebec (Magnin and Beaulieu 1966). The ages from this study cannot be accepted however, since aging structures were not used. Ages were determined from the size of the fish, using a growth rate derived from the increase in size between recaptures.

2.3.4 Sex Determination

Methods have been developed to sex channel catfish externally (Moen 1959; Norton, Nishimura and Davis 1976; Busch 1985). The presence of an external genital pore in females, which does not occur in males, allows external sexing to be conducted in the field with simple equipment and a high degree of accuracy (Norton, Nishimura and Davis, 1976). This offers an opportunity to collect sex data without killing the fish being sampled.

2.3.5 Marking

Various methods exist for marking catfish for mark and recapture studies. Summerfelt (pers. comm.) suggested cold branding with silver nitrate, tagging with Floy tags either through the opercle or below the dorsal fin, or ring tags around the pectoral spine. Hot branding and silver nitrate marks are effective, but last for less than a year (Brauhn and Hogan 1972; Moore 1982). Harrison (1953), Schacht (1967), and Welker (1967) implanted internal tags and marked fish by clipping the adipose fin. This method suffered from a total lack of recognition by fishermen. Christenson (1952), and Hubley (1963) used jaw tags. McCammon (1956) used disk-dangler tags (Carlin tags) and hydrostatic tags, but concluded that the hydrostatic tags were prone to loss. Hesse (1982) used modified disk-dangler tags. Clarke (pers. comm.) use Floy tags. Floy tags are used almost exclusively in Manitoba.

Tag loss can have serious consequences when interpreting the results of a mark and recapture study. Greenland and Bryan (1974) reported channel catfish tagged with Floy FD-67 tags had lost 90% of them after 12 weeks. This particular model of anchor tag cannot be inserted over 1 cm deep, and therefore cannot be placed so that the anchor passes between the interneurals engaging on the other side. Clarke (pers. comm.) received recaptures 5 years after tagging with Floy tags. Vassey (pers. comm.) reported 96% retention after one year when the Floy tag was properly inserted. Summerfelt and Turner (1972) compared the rate of loss of ring and spaghetti (Floy type) tags. In this study the spaghetti tags were passed through the opercle rather than inserting at the base of the dorsal fin. Tag losses were 0.083%/day. Penetrating the opercle on larger catfish, such as are found in the lower Red River, has proved impractical.

2.3.6 Ultrasonics

The use of ultrasonic transmitters to follow the movements of channel catfish was successfully reported in Ziebell (1973), and McCall (1977). Studies utilizing transmitters provide more detailed information on movements than mark and recapture studies. Tracking transmitter equipped fish provides an opportunity to determine spawning and overwintering movements in detail.

Hart and Sommerfelt (1975), noting the problems that can arise with externally attached, or stomach implant transmitters, reported a surgical procedure to implant transmitters in the gut cavity of flathead catfish (*Pylodictis olivaris*). Summerfelt and Moiser (1984) reported that channel catfish could expel surgically implanted transmitters and suggested that the mechanism was transintestinal expulsion. Marty and Summerfelt (1986) examined mechanisms of transmitter expulsion and produced recommendations for avoiding transmitter loss, concluding however that there was no way to guarantee against transmitter expulsion.

2.3.7 Creel Census

Lysack (1986a) reviewed the literature on creel census design prior to initiating the 1982 Red River creel census.

Lysack (1986b) described procedures for collection and analysis of creel census data which are considered a standard for Fisheries Branch in Manitoba.

Chapter 3

Methods

3.1 Study Area

The study area was restricted to the Red River and its tributaries between St. Andrew's Locks and Dam at Lockport and Lake Winnipeg (Fig. 2). This area is referred to as the lower Red River. The study was conducted during July and August 1987, and from May until October 1988.

3.2 Capture Methods

Vanderford (1986) concluded that no consistent, unbiased method of sampling catfish has been found. The incidental catch of species other than catfish from standard gangs of gill nets set in the Red River would be too large to handle. There would also be a problem with mesh size selectivity given the wide size range of catfish present. Although electrofishing has proven to be an effective sampling tool in some areas, it would have taken more time and money than were available to develop as a sampling method for this study. The primary sampling gear used for this study were hoop nets, and angling.

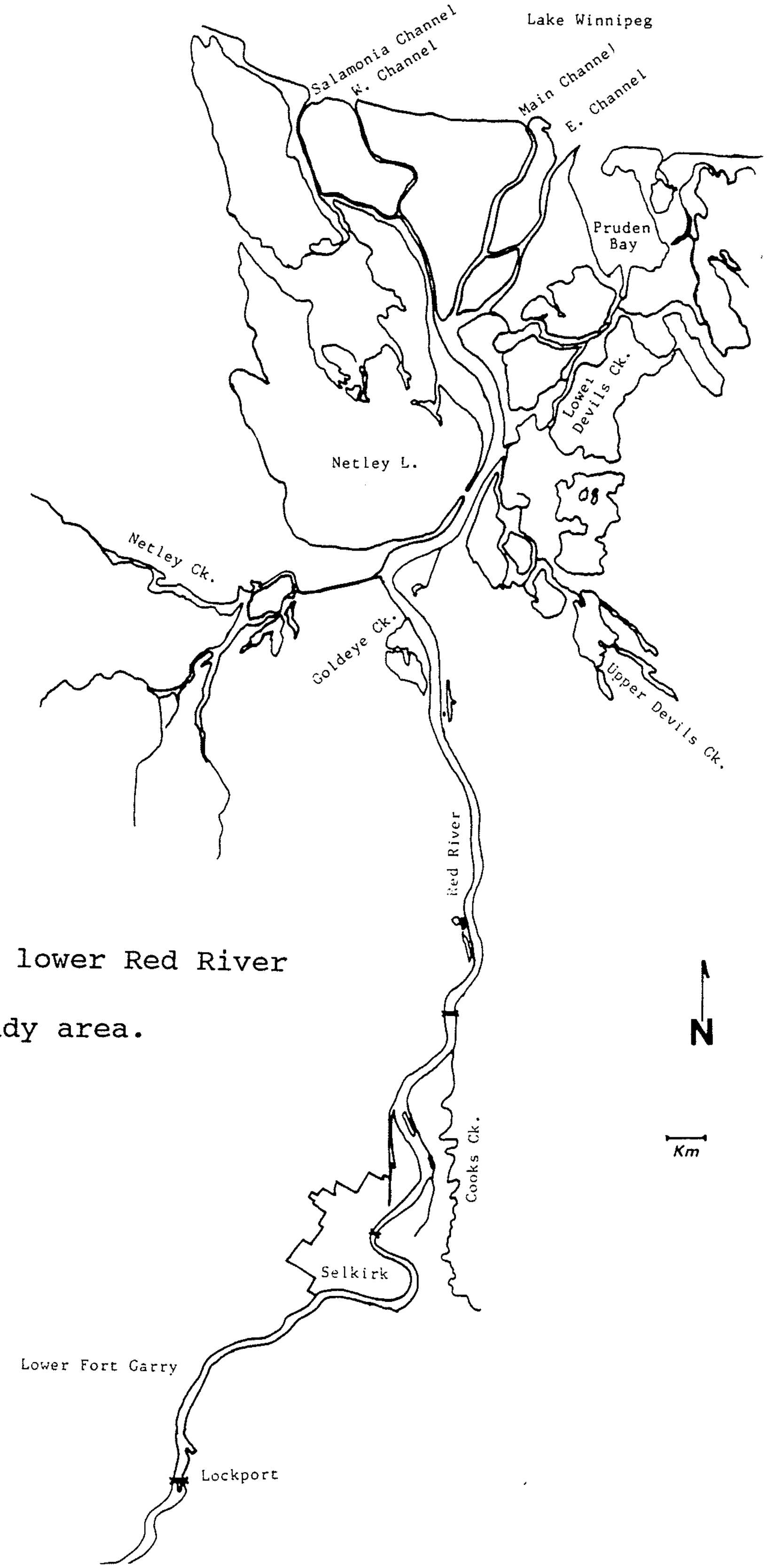

Fig. 2. The lower Red River study area.

3.2.1 Hoop nets

The literature (Ackerman 1965; Schacht 1967; Welker 1967; Hesse et al. 1979; Hesse 1982; Clarke pers. comm.) confirms that hoop nets are an effective means of capturing channel catfish in rivers. Hoop nets are used to capture catfish in large numbers in many American commercial fisheries. They are biased for certain sizes of catfish. Catches are dependant on the set location with small changes in location producing significant differences in the catch. A variety of locations were set to sample the different habitats available in the lower Red River. Special attention was paid to areas where anglers traditionally reported success. The emphasis was on capturing a sample of fish, not randomly sampling the habitats available.

The hoop nets were constructed of 2 cm bar measure nylon mesh, and 1 m diameter fibreglass hoops. Each net had three funnels and a pair of 5 m wings. Nets were typically set facing downstream using anchors to hold them in place. In 1987 cheese trimmings were used as bait for several sets. Since no significant difference in catch success was observed, bait was not used in 1988.

Hoop net sets presented a danger to boaters so they were usually confined to sets near the shoreline away from the main river channel. The nets were never set from the shore, but were set on the shoreline shelf which was normally 2-4 m deep. The centre channel of the river was usually 5-6 m deep.

All hoop net catches were sorted by species and counted. Each channel catfish caught was weighed, measured, and had the left pectoral spine removed for aging. Catfish were weighed on a Detecto-matic 15 kg x 50 gm hanging scale, and measured to the nearest 2 mm. Both fork length and natural total length were recorded. Catfish over 1 kg were tagged. Catfish under 1 kg were not tagged since few of these fish are caught by anglers and they were not likely to be recaptured. Catfish under 1 kg were considered marked by the removed spine.

3.2.2 Gill Nets

On a few occasions 50 m long, 15 cm stretched mesh, 12 gauge monofilament gill nets were set. These nets only were used to test locations under consideration as new hoop net sets, or in instances where hoop nets could not be set. These nets were used to capture channel catfish during the winter of 1987-88 on Cook's Creek, a tributary of the Red River (Macdonald 1988).

3.2.3 Angling

In order to increase the number of catfish sampled and tagged, and to obtain information specific to the portion of the population which is exploited by anglers, six anglers were asked to tag and sample their catches. This tagging started with one angler in the fall of 1986, increasing to six in 1987 and 1988. These anglers were each instructed in the use of tagging equipment and the importance of proper tag insertion to avoid tag loss. Some of the anglers were provided with Accu-weight T-50 tube scales to ensure the accuracy of reported weights. All catfish tagged by anglers had the left pectoral spine removed for aging.

3.2.4 Derbies

On July 5, 1987, the Selkirk Chamber of Commerce held a catch and release catfish derby, and on August 1 and 2, 1987, the Selkirk Game and Fish held their annual derby. Catfish entered in either of these derbies were weighed, measured, spine clipped, and tagged prior to being released. Catfish which appeared stressed were held in a transfer tank until they either recovered or died.

3.3 Tagging

Catfish weighing at least 1000 g were tagged with a pair of Floy FD-67 (21 mm exposed monofilament) anchor tags using a Dennison Mark II tagging gun with a heavy duty needle. The tags were inserted into the flesh below the dorsal fin, with the anchor passing between the interneurals. One tag was inserted on each side. Catfish have a tendency to reject tags if they are improperly inserted (Summerfelt and Turner 1972; Greenland and Bryan 1974; Moore 1982). Tagging with two tags was intended to minimize problems caused by tag lose, and to quantify them if possible. The removal of the left pectoral spine for aging served to mark any catfish which lost both its tags.

Signs publicizing the catfish tagging were posted at boat launches on the lower Red River as well as at bait and tackle stores in the Selkirk and Lockport areas. Anglers reporting the capture of a tagged catfish received a badge from Fisheries Branch, and a letter detailing when and where that fish was first tagged, what it weighed, and how old it was. In 1988 the tagging program was sponsored by Coors Sports. Anglers reporting the capture of a tagged catfish received a Coors Light cooler bag from Coors Sports in addition to the badge and letter from Fisheries Branch.

An estimate of the catfish population was planned if sufficient recaptures were made. The difficulty in describing the boundaries of the population, and determining immigration and emigration from the study area, meant that important assumptions of a mark and recapture estimate were violated. Because of the sampling bias which exists for certain sizes of catfish, separate estimates would have to be made for cohorts of catfish, not the entire population.

3.4 Ultrasonic Tracking

Sonotronics transmitting tags with a one kilometre range were used. These tags proved to be sufficient for most situations in the river. The range is greatly reduced in shallow water, and the signal may be obscured by vegetation or objects between the transmitter and the receiver.

One transmitter was surgically implanted into a catfish caught by angling near Lower Fort Garry on Sept. 15, 1987, in order to test the suitability of these transmitters. Eight more transmitters were implanted into catfish caught by angling at Lockport, and near Lower Fort Garry, on June 6 and 7, 1988. All the transmitters were implanted by Doug Leroux from Fisheries Branch Northeastern Region.

The same methods were used for all fish. Methods were chosen to avoid problems with tag expulsion reported by Summerfelt and Mosier (1984) and Marty and Summerfelt (1986). Catfish were caught by angling. Heavy angling gear was used to minimize the time spent playing the fish. Angling was selected as a capture method since it was an easy method of catching the required fish quickly, and selected for larger fish than other methods available.

All the transmitter implanted catfish were first weighed, measured, sexed, and had the left pectoral spine removed for aging. Fish were then placed ventral side up in a wooden trough lined with foam. The trough was designed so that water in the trough covered all of the catfish, including the gill area, except the incision site. The incision site was swabbed with antiseptic. All surgical materials were sterilized in isopropyl alcohol. A 3 cm incision was made mid ventrally, approximately 5 cm anterior of the anal vent. The incision through the skin and muscle layers was made using a scalpel. Once the peritoneum was exposed it was pulled away from the organs within the body cavity with forceps and cut with scissors. The transmitter was tested, then rinsed in isopropyl alcohol, and allowed to dry prior to insertion into the abdominal cavity. The incision was closed with 5 or 6 stitches, and swabbed with antiseptic. The catfish was held upright in the water to make sure that it could equilibrate, and then was released. No anaesthetic was necessary. Once placed ventral side up in the trough the fish did not struggle.

Tracking was conducted 3 times per week (Monday, Wednesday, and Friday) throughout the field season. Usually the entire river from Lockport to the mouth of the Red River was surveyed. Although the transmitters could not be tracked effectively in either Netley-Libau Marsh or Lake Winnipeg, the tracking did determine when they were not in the Red River. None of the surviving transmitter equipped catfish were detected upstream of Willow Springs from June 30 until August 30. During this time angling was also poor, with the majority of angling success occurring downstream of Willow Springs, near Goldeye Creek and in Devil's Creek.

3.5 Creel Census

Creel census data were analyzed using 'Creel Cruncher', a computer program designed by Lysack (1986a).

The creel census was designed to produce results comparable with the 1982 Red River creel census (Lysack 1986a) although staffing restrictions did not allow it to be as large scale. Censusing was restricted to anglers landing at the boat launches at Selkirk Park and Lily Ann's Place (Lockport). Anglers fishing from the shoreline were not censused.

The creel census was originally composed of 24 sampling strata, each of which required three replications. The sampling strata were; weekends versus weekdays; Lockport versus Selkirk; and the months of the open water season (May to October). Over the summer there was a requirement for 36 days of creel census at each of the two locations. A shortage of staff in May resulted in two strata, May weekend and week days at Lockport, being eliminated.

Anglers were interviewed at the end of their angling day. The creel census was conducted from mid afternoon until late in the evening after most anglers had departed for the day. Since the catfish fishery was assumed to be predominantly catch and release, anglers were asked both how many fish they retained, and how many they released. A mid-afternoon boat patrol of the river was used to count the total number of anglers and boats on the river on each day of creel census. Shoreline anglers were also counted.

Nonresident anglers staying at the campground at Selkirk Park were expected to represent a special sampling problem since these anglers often fish at night. Plans were made to conduct a census for a 24 hour period once nonresident angling became prevalent. In 1988 fewer nonresident anglers than usual stayed at the Selkirk Park campground, and their fishing effort and success did not warrant overnight censusing. This was confirmed by checking the Selkirk Park filleting shed in the mornings for evidence of catfish harvest, and in discussion with these anglers.

3.6 Water Temperature and Flow Records

Information on water temperature, levels, and flows in the lower Red River were obtained from two sources. The most complete collection of water temperature data (1979-1988) was provided by the Manitoba Hydro Selkirk Thermal Generating Station. Water temperatures were recorded weekly near the inlet to the cooling water pump house. Preliminary data (1979-1988) on water temperatures, levels, and flows measured at St. Andrews Locks and Dam at Lockport, were provided by the Water Resources Branch of Environment Canada.

3.7 Calculations

Routine statistical analyses were performed according to Snedecor and Cochran (1967). Length-weight relationships were calculated using least squares regression on the entire data set. Walford and Brody plots and the Brody-Bertalanffy equation were calculated according to Ricker (1975).

Whenever length is referred to in this text, the method of measurement is referred to using descriptions from Nielsen and Johnson (1983). Fork length (FL), natural total length (nTL), and maximum total length (mTL), have all been used to measure catfish in North America. Fork lengths are commonly used in Manitoba fisheries studies. The Manitoba Sport Fishing Regulations and the Master Angler Program both use natural total length. American studies commonly use maximum total length. In instances where fork lengths have been converted to maximum total lengths, the conversion used was TL = 29.708 + 1.0456 (FL) (Elrod 1974).

Chapter 4

Results

4.1 Capture Methods

A total of 1685 channel catfish were captured by various methods during this study (Table 1). Hoop nets were the most productive gear, however they were biased towards smaller catfish. Larger catfish were most effectively captured by angling.

4.1.1 Hoop Netting

From July 8 until August 31, 1987, hoop nets were set for a total of 173 net-nights at 9 locations in the Red River between Lockport and Selkirk (Fig. 3). Nineteen species of fish were caught in hoop nets during this study (Table 2). A total of 1010 channel catfish were caught, comprising 25% of the hoop net catch. Only the catch of silver bass (*Aplodinotus grunniens*), comprising 32% of the catch, exceeded the catch of catfish. Of the 1010 catfish caught, 116 (11.5%) were over 1000 g and large enough to tag. The remaining 894 were sampled but not tagged. The mean catch was 5.84 catfish per net-night. Cheese baits were used on 20 hoop net sets. There was no relationship between whether a net was baited or not, and the number of catfish caught.

Table 1. Number of catfish caught from each type of capture gear used, for each year, 1986-1988.

Method	1986	1987	1988	Total
Angled	18	154	134	306
Derby	-	122	-	122
Cook's Ck	-	-	116	116
Gill nets	-	-	14	14
Hoop nets	-	1010	117	1127
Total	18	1286	381	1685

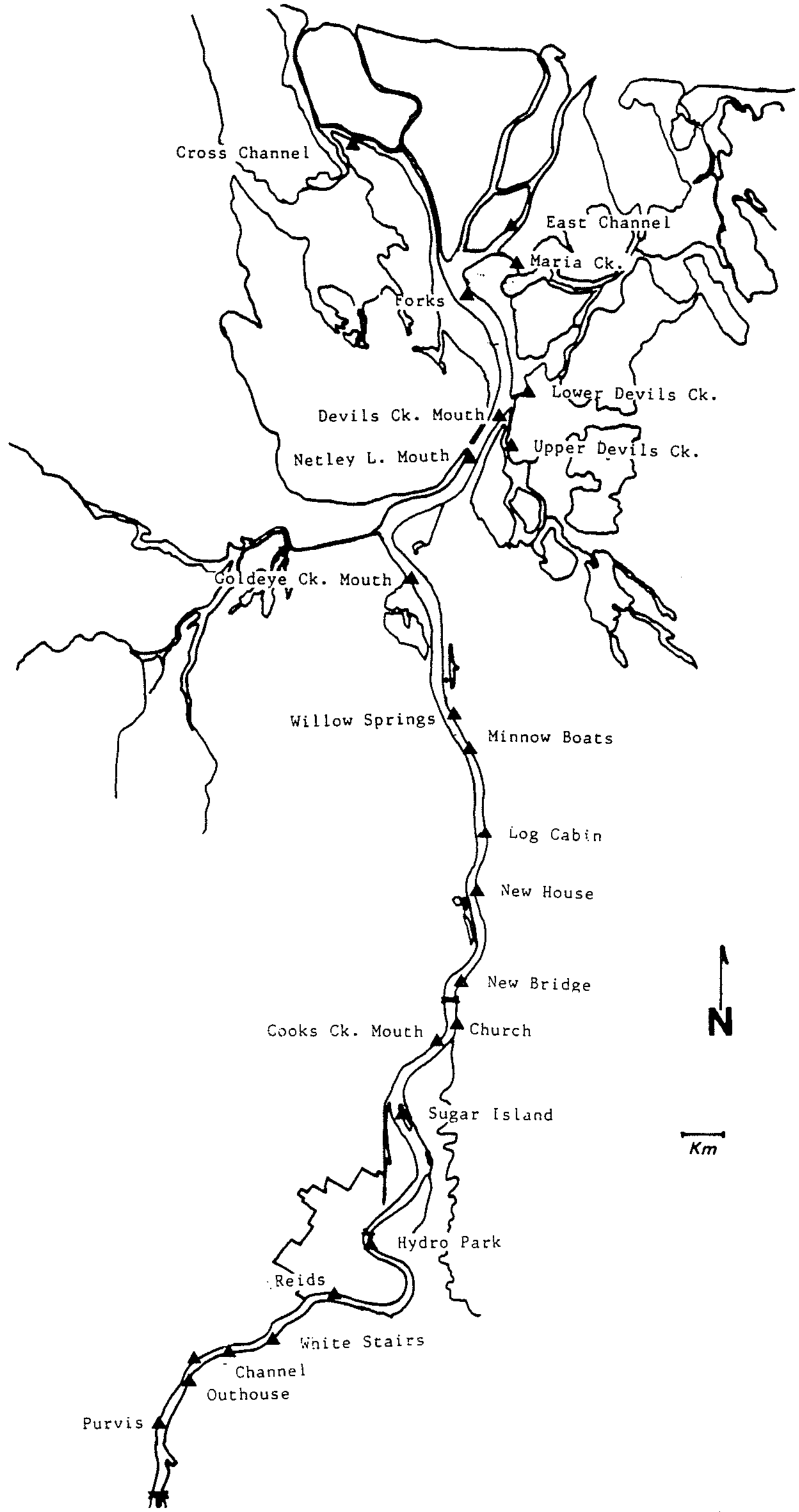

Fig. 3. Hoop net set locations.

Table 2. Species of fish captured in the lower Red River, 1987-88.

Common name	Scientific name
channel catfish	*Ictalurus punctatus*
black bullhead	*Ictalurus melas*
tadpole madtom	*Noturus gyrinus*
stonecat	*Noturus flavus*
walleye	*Stizostedion vitreum*
sauger	*Stizostedion canadense*
perch	*Perca flavescens*
tullibee	*Coregonus artedii*
black crappie	*Pomoxis nigromaculatus*
white bass	*Morone chrysops*
drum	*Aplodinotus grunniens*
goldeye	*Hiodon alosoides*
white sucker	*Catostomus commersoni*
shorthead redhorse sucker	*Moxostoma macrolepidotum*
bigmouth buffalo sucker	*Ictiobus cyprinellus*
quillback sucker	*Carpioides cyprinus*
carp	*Cyprinus carpio*
northern pike	*Esox lucius*
burbot	*Lota lota*

On July 27 and 29, 1987, river flows increased as water was released from the Lockport dam because of rising water levels upstream. During this period of increased flows the catch of catfish, especially large catfish, increased at the two set locations closest to the dam.

From June 13 until September 8, 1988, hoop nets were set for a total of 359 net-nights at 19 locations in an area extending from Lockport to Lake Winnipeg (Fig. 3). Despite more than doubling the 1987 netting effort, only 117 channel catfish were caught, 50 (43%) of which were large enough to tag. The mean catch was 0.33 catfish per net-night, 5.6% of the 1987 catch rate. Catfish comprised only 3.8% of the catch. Catfish numbers were exceeded by bullheads (40.3%), sauger (24.7%), silver bass (15.5%), and white suckers (6.7%).

Although far fewer catfish were caught in 1988 than in 1987, the catfish caught were larger. In 1987, 4.8% of the catfish caught in hoop nets were over 2.0 kg, while in 1988 21.4% were over 2 kg (Fig. 4).

In order to avoid conflict with boat traffic in the river most hoop net sets were made near the shoreline, away from the main river channel. Since angling typically occurs in the main river channel, it was important to determine whether there was a difference in the fish which could be found in

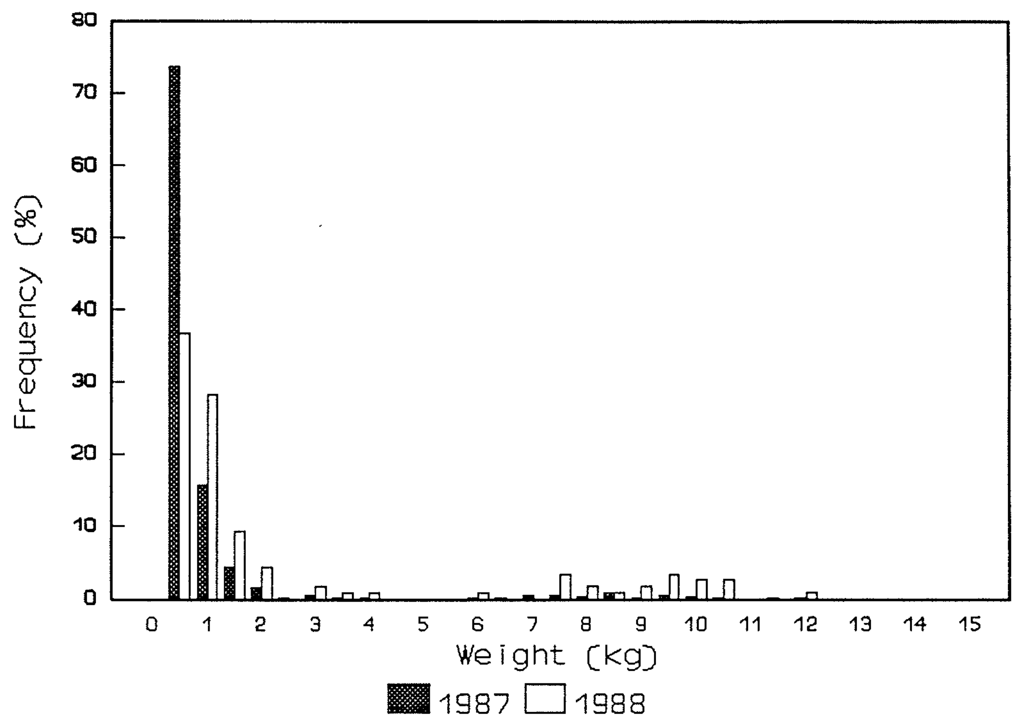

Fig. 4. Weight distribution of catfish from 1987 (n=946) and 1988 (n=117) hoop net catches.

these areas. In 1987 two set locations in the centre of the river channel were tested. When the catch from these channel sets is compared with the catch from the shoreline sets, it is apparent that the channel catch is dominated by older, larger catfish (Figs. 5-7). Since most hoop net sets could not be made in the centre channel the hoop net catch was biased towards the fish which were found in the shoreline habitats, such as small catfish.

The creeks and channels in the Netley-Libau area were of particular interest in 1988, however netting in this area was hampered by varying water levels and currents resulting from wind seiche on Lake Winnipeg. The currents displaced nets, or plugged them with debris. Some of the channels were used by boaters making hoop net sets impossible because of the navigation hazard which would exist.

In 1987 optimum set locations were located quickly, and nets were left in place, catching catfish with some consistency. In 1988, catches in the same areas were poor. Based on information from ultrasonic tracking and anglers, nets were moved towards the mouth of the river. Attempts were made to locate catfish by setting near the areas where the ultrasonic tagged catfish were tracked, or areas where angler success was reported. This resulted in frequent moving of the nets as new areas were tried. Netting was therefore less

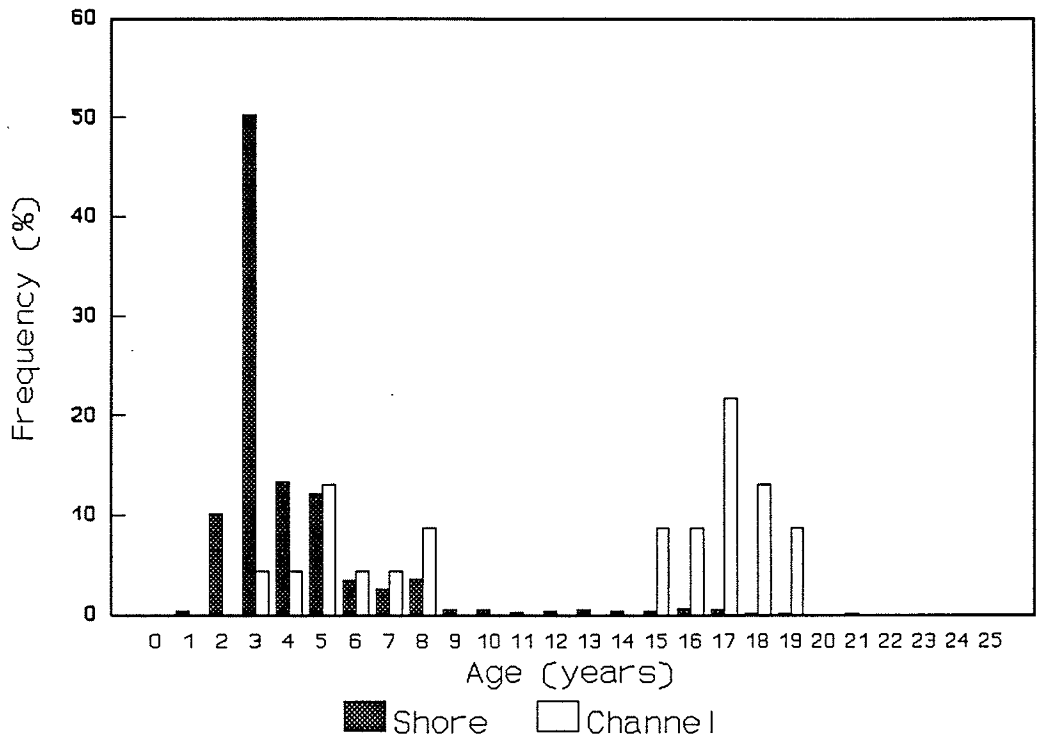

Fig. 5. Age distribution of catfish from shoreline (n=937) and centre channel (n=23) hoop net sets.

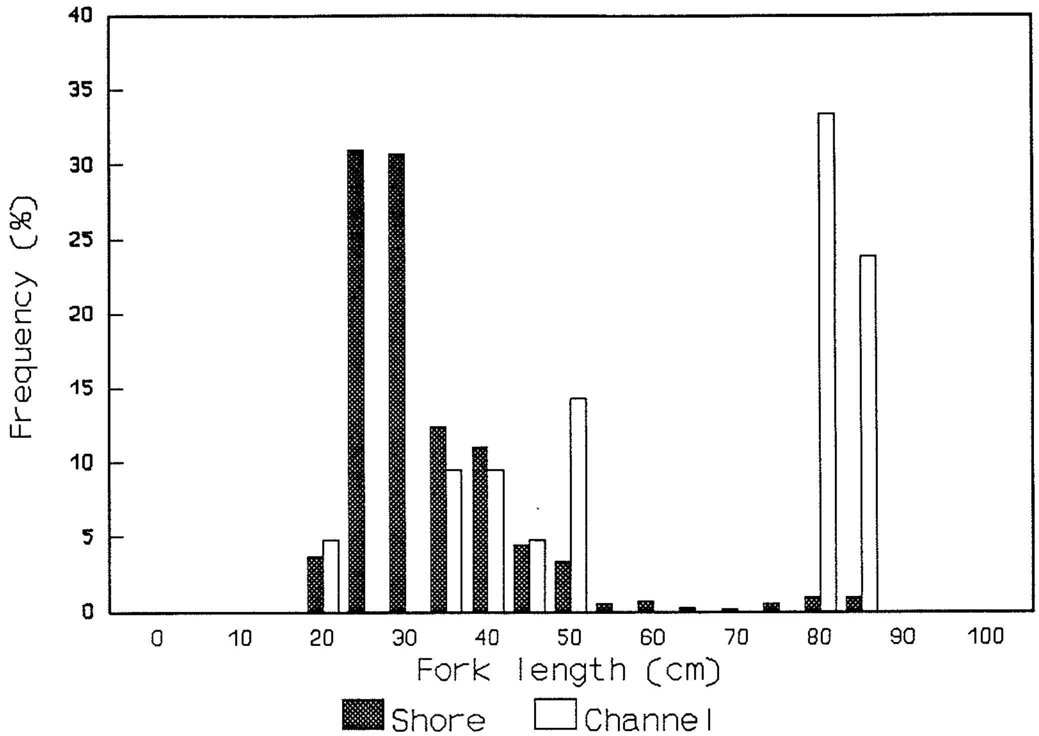

Fig. 6. Length distribution of catfish from shoreline (n=933) and centre channel (n=21) hoop net sets.

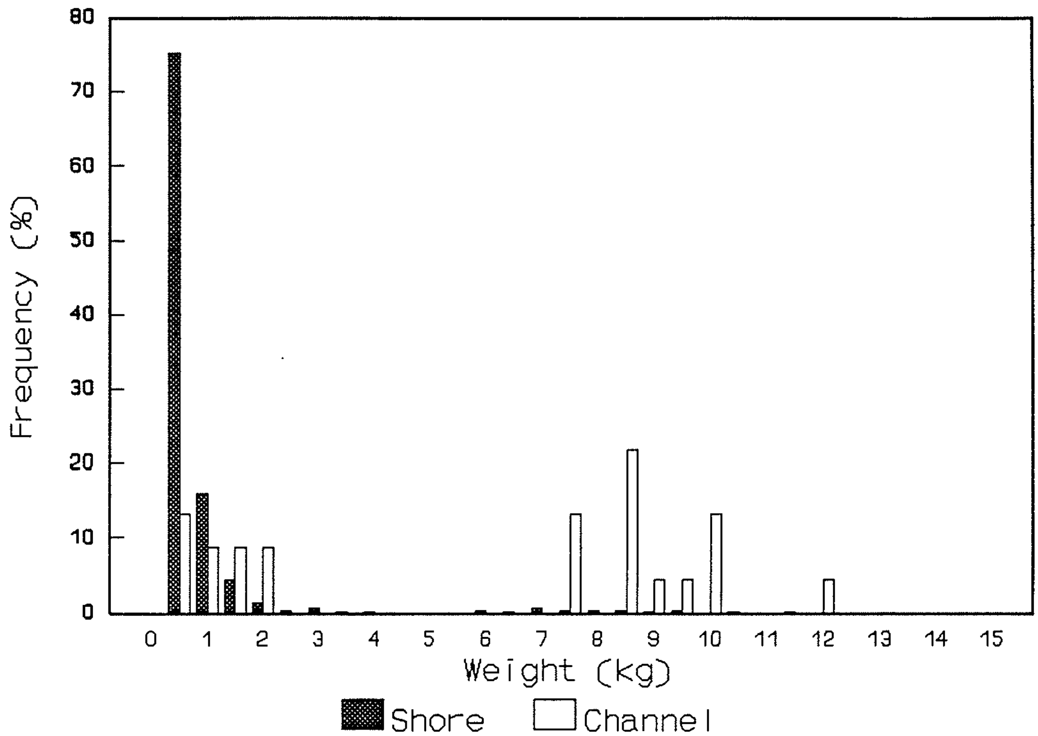

Fig. 7. Weigh distribution of catfish from shoreline (n=923) and centre channel (n=23) hoop net sets.

efficient than in 1987 since more experimentation with new areas was occurring. The area towards the mouth of the river was also much more difficult to work in because of currents caused by wind seiche on Lake Winnipeg. These currents often displaced nets, or plugged them with debris.

Fish caught by gilling were not included in the hoop net catch. More saugers and goldeye were caught by gilling than were caught in the nets. Although the catch of sauger per net-night was higher in 1987, the number of sauger gilled in some sets in 1988 exceeded the entire 1987 catch. Gilling saugers was a problem with certain set locations in both 1987 and 1988. In some cases the number of saugers gilled exceeded a thousand. These gilled sauger usually died and decomposed immediately, and created a significant public nuisance in an area of intense recreational use. For this reason hoop nets were never set in the area immediately below Lockport. Although this is an excellent area for angling catfish, it is both densely populated by sauger for much of the year, and an area of intensive public use. Nets filled with decomposing sauger rarely caught catfish.

No statistical relationships between catches and set location or time could be determined. Catches were highly variable. The number of fish caught and the species represented in the catch varied with both set location, and time. The general tendencies observed were that catfish were present and easily caught in hoop nets in 1987 but were not caught in 1988 despite a doubling of the effort involved. The netting program was not designed to produce an unbiased sample of the catfish population, or of the habitats available. It was intended to capture catfish, determining where and how they might be caught.

The selection of set locations resulted in considerable bias for both species composition, and size of fish caught. Catfish were not distributed randomly so the selection of appropriate set locations was crucial. Although a biased sampling method, hoop netting results provide a better understanding of the catfish population structure than other methods available. Set locations had to be carefully chosen if catfish were to be caught. The best set locations were usually the best angling locations. These prime locations were also confirmed by preferences of the tracked catfish.

4.1.2 Gill Nets

During the 1988 field season gill nets were used in a few instances to test areas prior to setting a hoop net, or in areas where hoop nets were not suitable. A total of 14 catfish were sampled and tagged in these nets. Since only one mesh size was used, the nets selected for specific sizes of catfish. The stiff monofilament mesh also rendered the nets ineffective.

During the winter of 1987-88 the effects of the warm water discharge from Manitoba Hydro's Selkirk Thermal Generating Station on the fish in Cook's Creek were investigated (Macdonald 1988). The catfish caught in Cook's Creek were included in some of the analysis of Red River catfish. Of 116 catfish sampled in Cook's Creek, 104 were tagged. Large numbers of smaller catfish were also caught in gill nets, but could not be sampled because of the cold weather.

4.1.3 Angling

Anglers involved in the tagging program caught, sampled, and tagged a total of 295 channel catfish. In 1986, 18 were tagged, 143 in 1987, and 134 in 1988. In 1987 a further 115 were tagged at derbies. The sample of catfish from derbies was biased towards older and larger catfish than those caught by anglers (Figs 8-10).

Tagging by volunteer anglers started in September, 1986, with only one angler. In 1987 and 1988 six anglers were involved throughout the open water season. Fewer catfish were tagged in 1988 than in 1987 despite increased efforts by the

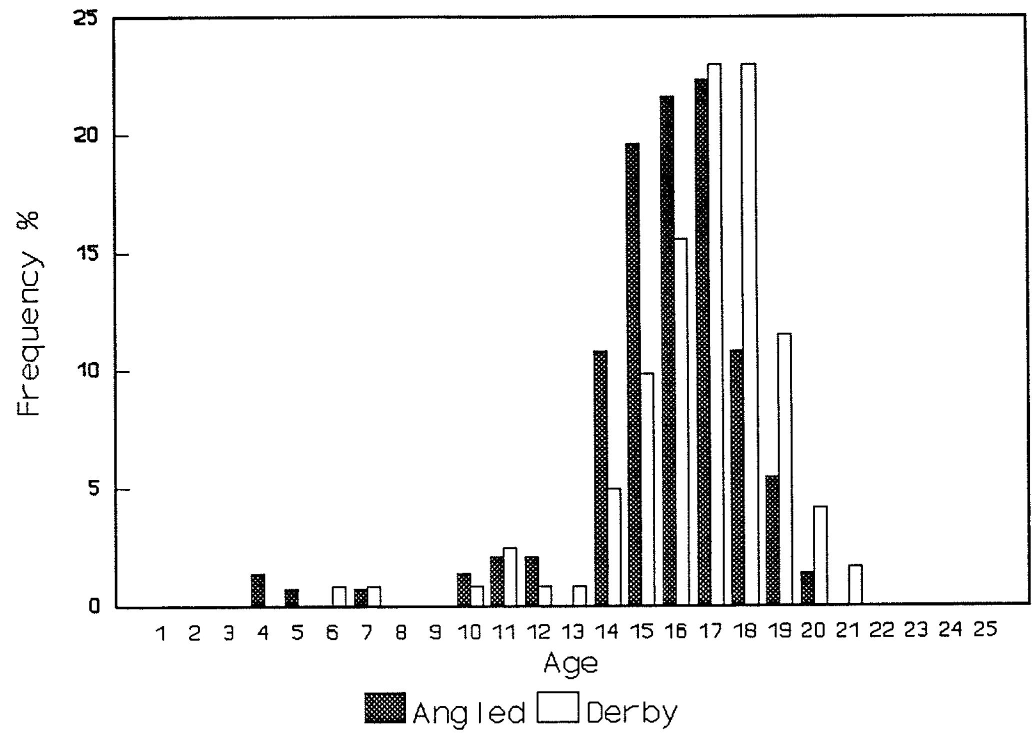

Fig. 8. Age distribution of catfish caught by anglers (n=148) and catfish registered in derbies (n=122).

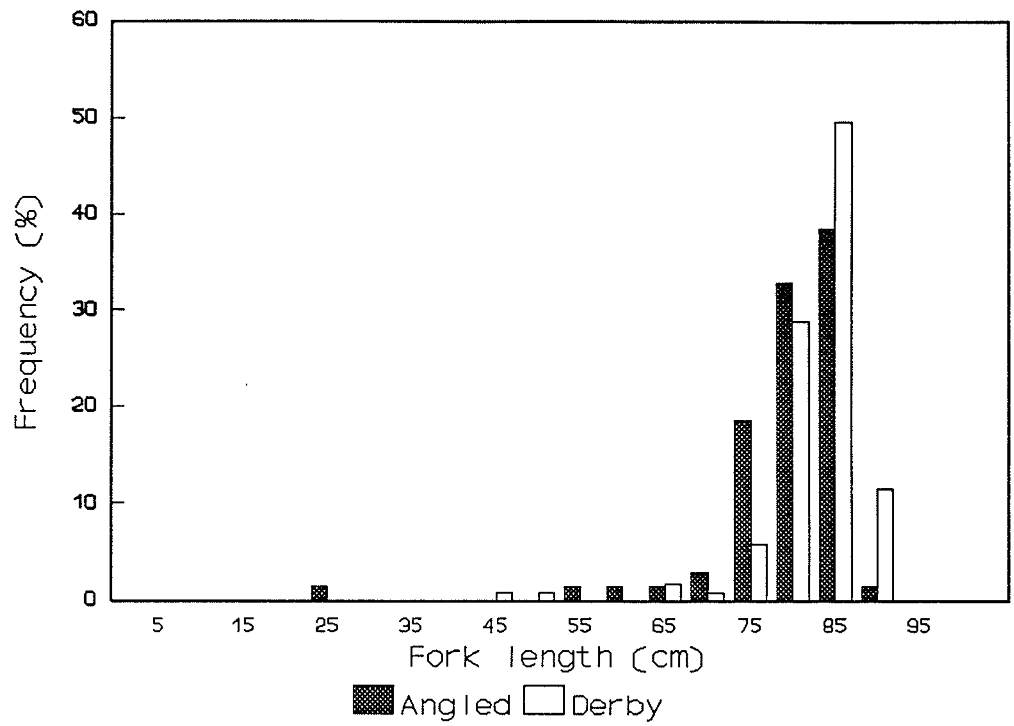

Fig. 9. Length distribution of catfish caught by anglers (n=90) and catfish registered in derbies (n=121).

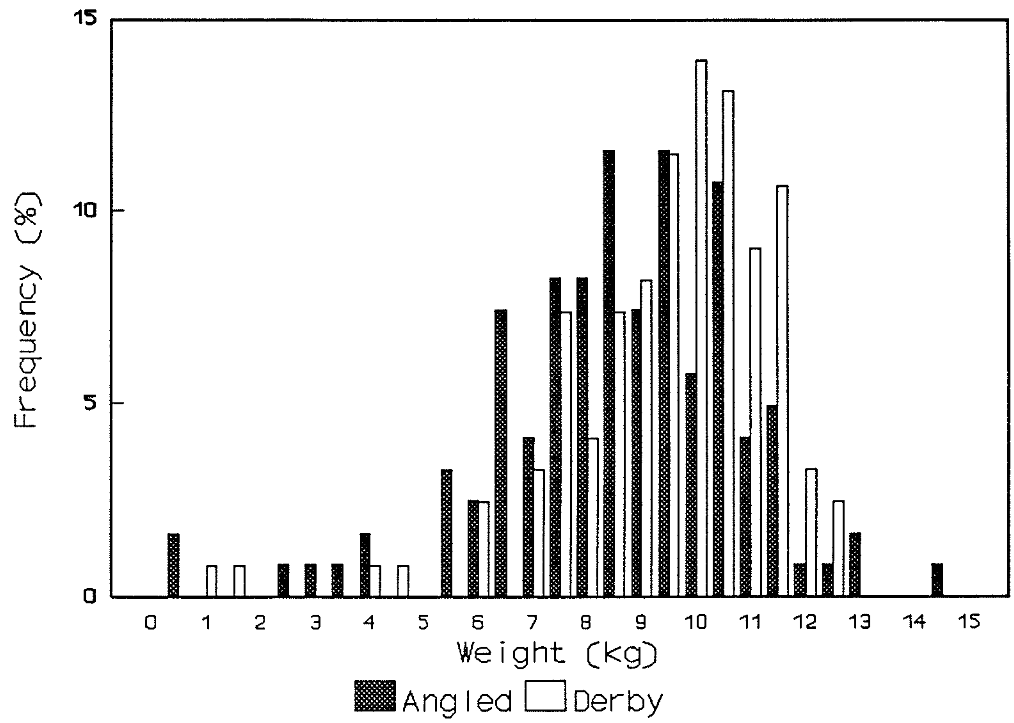

Fig. 10. Weight distribution of catfish caught by anglers (n=121) and catfish registered in derbies (n=122).

anglers involved. Angling success in 1988 was much poorer than in 1987. Angling at traditional locations between Lockport and Selkirk was good from the start of the season until mid June, when it declined. Angling success in this area did not improve throughout the rest of the summer. The catfish tagged by anglers in 1988 were predominantly caught either early in the season, or in areas towards Netley-Libau Marsh.

The mean age of the catfish angled in 1987 was 16.2 years, with the majority of those caught ranging from 14 to 19 years old. In 1988 the mean age was 17.1 years, with the majority of those caught ranging from 16 to 20 years (Fig. 11). In 1986 the mean age was 15 years, however only 18 catfish were sampled.

The weight frequency distributions for angled catfish from 1987 and 1988 are similar (Fig. 12). The mean weight of catfish angled in 1987 was 8.9 kg, and in 1988 was 8.7 kg. The weight frequency distribution ranges from less than 1 kg to over 14 kg, however most of the catfish caught were between 8 and 12 kg. Few catfish weighing less than 8 kg were caught by angling the lower Red River.

Catch per unit effort could be quite high for a recreational fishery. For example, in one day, one of the

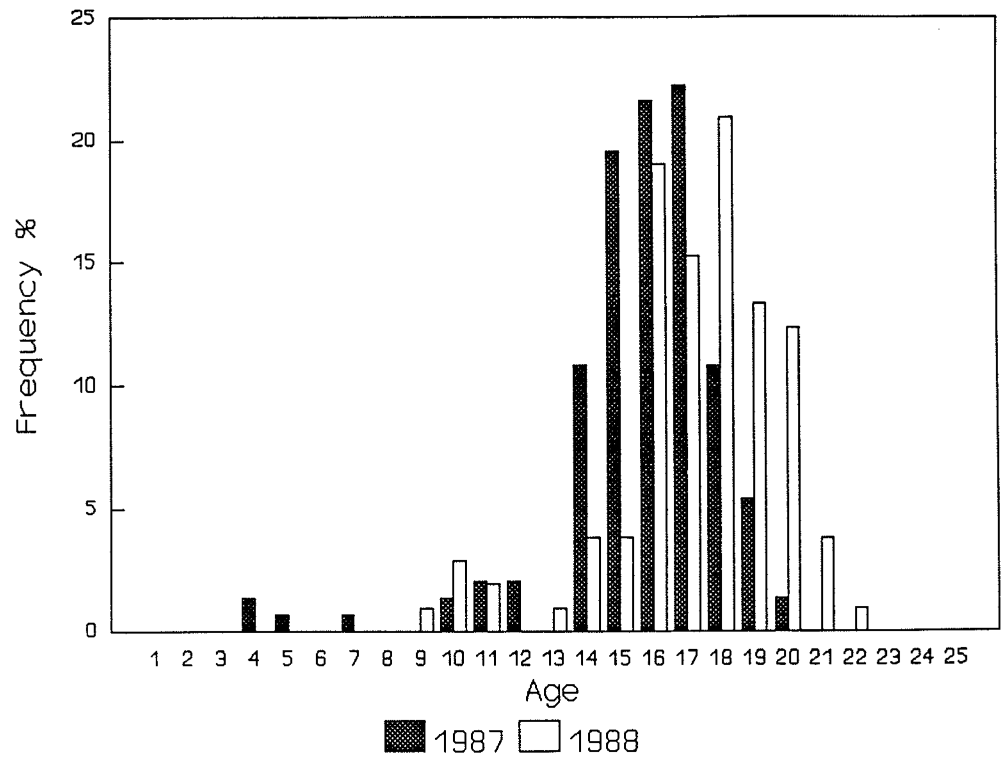

Fig. 11. Age distribution of catfish caught by anglers in 1987 (n=148) and 1988 (n=105).

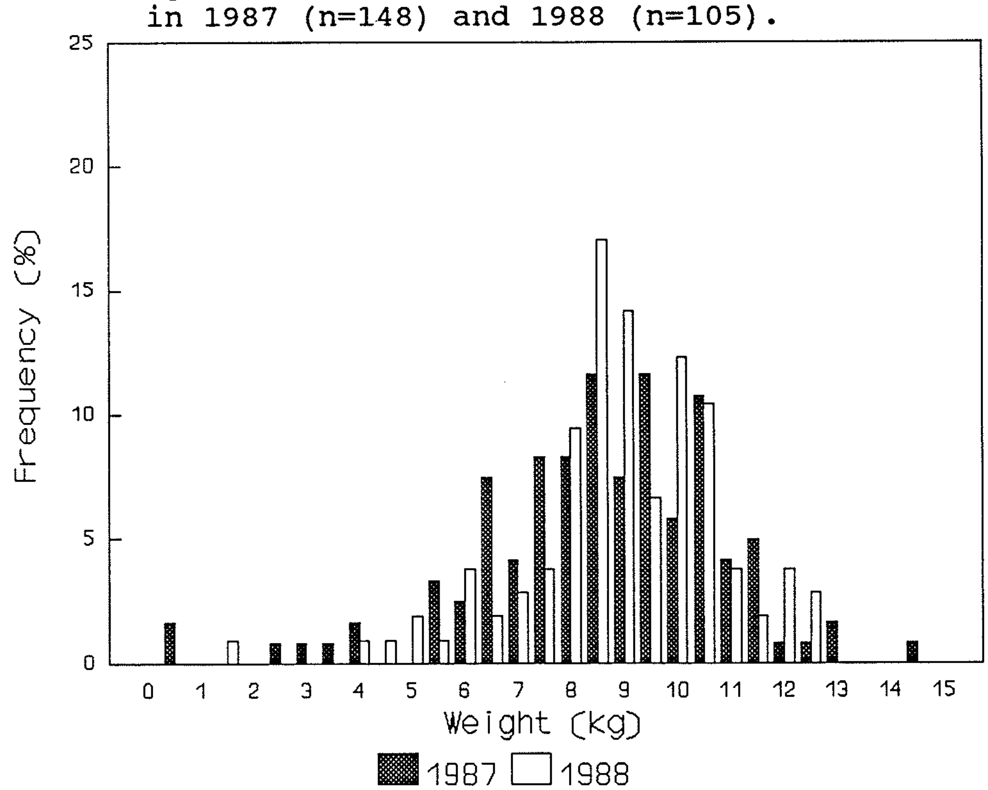

Fig. 12. Weight distribution of catfish caught by anglers in 1987 (n=121) and 1988 (n=106).

volunteer anglers fishing at a single location caught and tagged 30 catfish weighing a total of 262 kg without recapturing any.

Anglers provided valuable information on areas where catfish could be found. When fishing became difficult during the summer of 1988, anglers identified new areas which were subsequently netted. Catfish caught and sampled by anglers were considered representative of the portion of the population exploited by the sport fishery.

4.1.4 Derbies

In 1987 two catch and release catfish derbies were held. In cooperation with the derby organisers, catfish entered in the derby were tagged prior to their release. No major catfish derbies were held in 1988. The Selkirk Chamber of Commerce derby was held July 5, 1987. Fishing was poor at this time and although there were over 400 entrants, only 40 catfish were weighed in, and only 8 were tagged. Fishing had improved by August 1 and 2, 1987, when the Selkirk Game and Fish Association held their derby and 119 fish were weighed in, 114 of which were tagged. Five were judged as ineligible for release because of their condition and subsequently died.

Although sampling and tagging catfish was an objective, another reason for involvement with the derbies was to evaluate the catch and release aspect. Catfish caught during the catch and release derby survived with minimal effort necessary on the part of anglers. Of 122 catfish tagged at derbies, 4 were recaptured that summer, a recapture rate that approximates the rate for catfish tagged by other methods. The 5 mortalities observed at the time of the derby were the result of gross mishandling by a single party of anglers. With proper handling of fish by anglers the mortality rate for a catch and release catfish derby should approach zero.

4.1.5 Differences Between Capture Methods

There was a significant difference between the age and size distributions of catfish caught by angling and catfish caught in hoop nets (Figs. 13-18). Catfish caught by angling were typically over 13 years, and 6 kg. Catfish caught in hoop nets were predominantly less than 9 years, and 2 kg. There was a noticeable lack of catfish caught by any gear type between 9 and 14 years, and between 2 and 6 kg. Catfish in this age and size range were only observed in the small sample angled in the upper Red River.

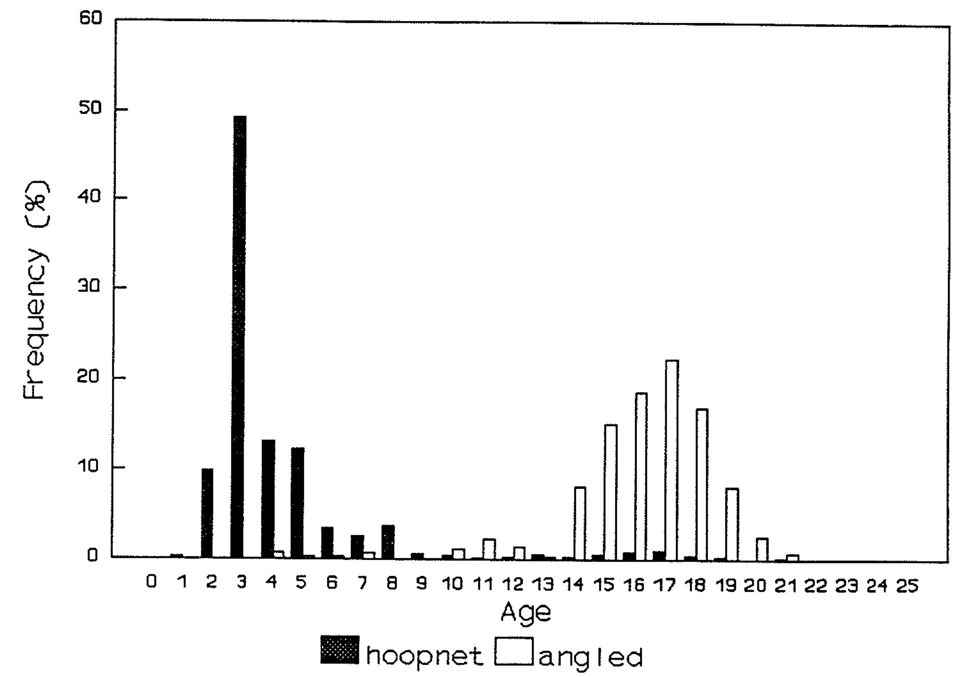

Fig. 13. Age distribution of catfish caught in hoop nets (n=960) and by angling in 1987 (n=272).

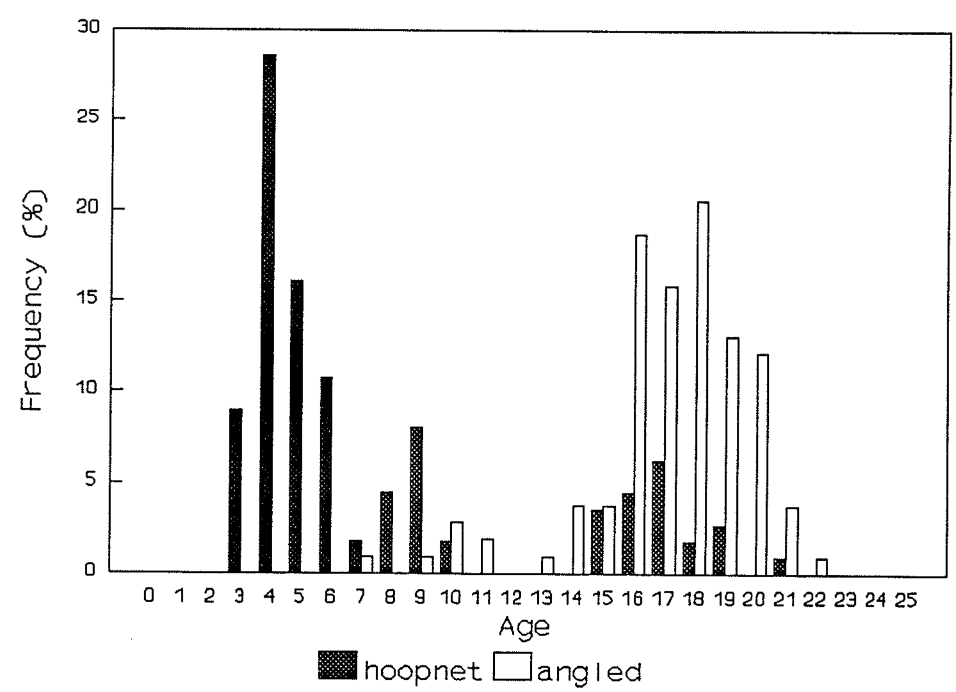

Fig. 14. Age distribution of catfish caught in hoop nets (n=112) and by angling (n=107) in 1988.

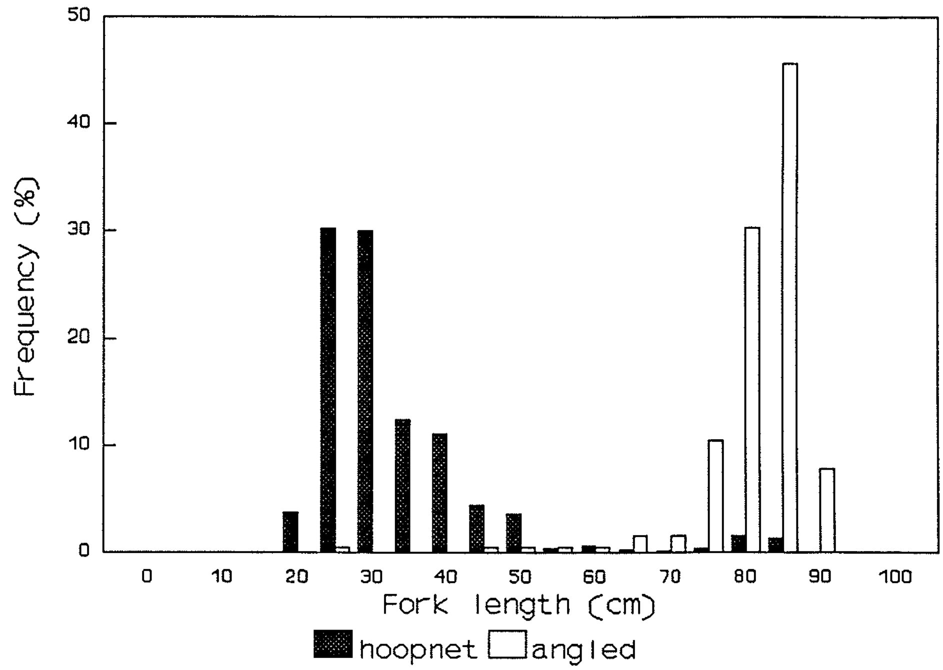

Fig. 15. Length distribution of catfish caught in hoop nets (n=954) and by angling (n=191) in 1987.

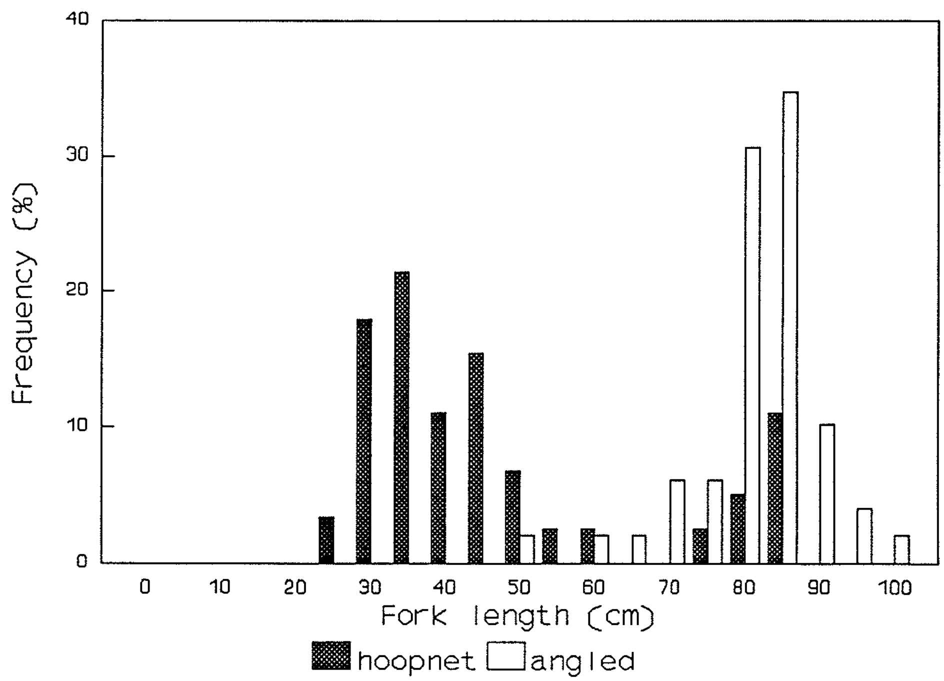

Fig. 16. Length distribution of catfish caught in hoop nets (n=117) and by angling (n=49) in 1988.

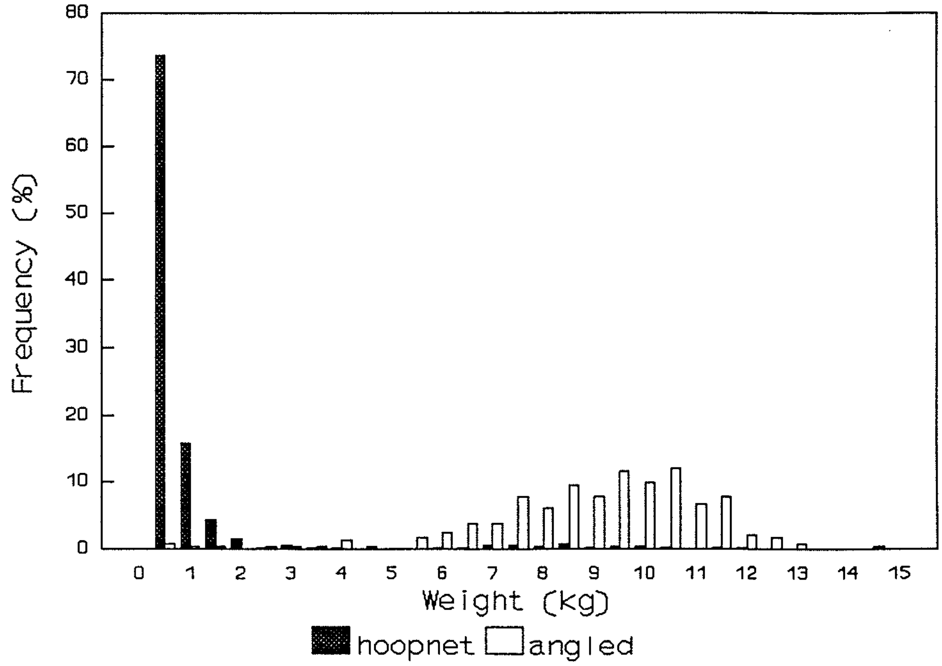

Fig. 17. Weight distribution of catfish caught in hoop nets (n=946) and by angling (n=243) in 1987.

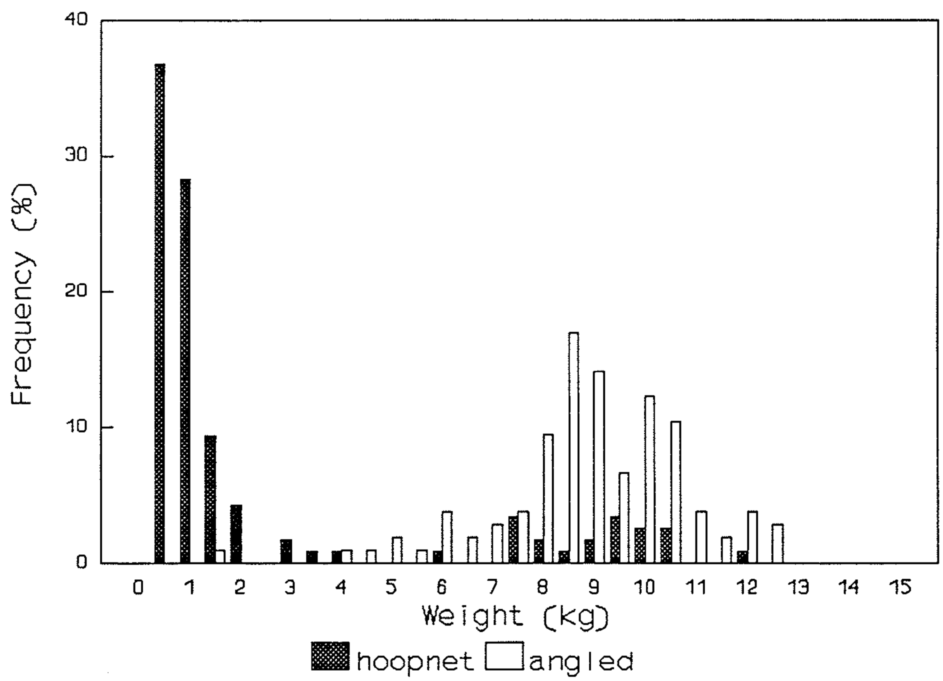

Fig. 18. Weight distribution of catfish caught in hoop nets (n=117) and by angling (n=106) in 1988.

4.2 Tagging

The number of catfish tagged by each capture methods is presented in Table 3. Of the catfish tagged by anglers in 1988, 28 of them were tagged in the upper Red River, within the limits of the City of Winnipeg. None of these has been recaptured.

4.2.1 Recaptures

Hoop nets set in 1987 caught 827 channel catfish, 717 of which were less than 1 kg and therefore not tagged, but marked by a fin clip. Thirty-five (4.9%) of these fin clipped catfish were recaptured that year. None were recaptured twice. In 1988, 127 catfish were captured, 89 of which were less than 1 kg and therefore not tagged. No fin clipped catfish were captured in 1988. No tagged catfish were recaptured in hoop nets.

At the time of writing, 28 tagged catfish have been recaptured (Table 4). This comprises 4% of the catfish tagged by the end of 1988. With the exception of one recaptured in a gill net set in Cooks Creek during the winter of 1988 (Macdonald 1988), all recaptures of tagged catfish were made by angling. All the recaptures were made in areas where

Table 3. Number tagged annually for each capture method.

Method	1986	1987	1988	Total
Angled	18	143	134	295
Derby	-	115	-	115
Cook's Ck	-	-	104	104
Gill nets	-	-	14	14
Hoop nets	-	122	50	172
Total	18	380	302	700

intensive angling occurred. This was an obvious source of bias in this and other tagging studies where there is no concerted attempt to recapture tagged fish.

Of the 28 recaptures, 3 were recaptured outside the study area. All 3 were recaptured upstream of the study area in the U.S.A. One of these was the first catfish recaptured. It was tagged on Oct. 19, 1986, between Lockport and Selkirk, and was recaptured by an angler fishing below the dam near Drayton, North Dakota on June 23, 1987. In the spring of 1989 two more catfish were caught outside the study area. One was caught by an angler at Catfish Haven, near Kennedy, Minnesota. It was tagged on July 11, 1988 between Lockport and Selkirk. The other was caught by an angler 8 km south of Pembina, North Dakota. It was tagged on June 26, 1988, near the mouth of Goldeye Creek. All three were large catfish tagged by volunteer anglers. The distance from the study area to the area they were recaptured exceeded 450 km, and required movement past the dam at Lockport.

The other 25 recaptures were within the study area, and did not demonstrate any extensive movements.

Table 4. Annual tagging and recaptures.

(Cumulative)	1986	1987	1988	1989
Tags at large	18	398	700	
Recaptures	0	8	18	28

4.2.2 Tag Loss

Three of the 28 catfish recaptured were observed to havelost one tag. Several of the recaptures made by anglers refer to only one tag number, so it is possible that some of the recaptures by anglers had lost a tag, however angler information was usually not specific enough to know whether tags were missing. Study staff did not capture any catfish which had lost both their tags. These catfish would still be identifiable by the removed left pectoral spine. Anglers would be unlikely to report a catfish without tags just because of the missing spine. The tag loss rate was at least 11%, however insufficient recaptures occurred to calculate the significance of this figure. It is apparent that significant tag loss occurred.

4.2.3 Population Estimate

Catfish moved both into and out of the study area. With no means of quantifying this movement, a valid population estimate could not be made. Even if movement into and out of the study area was not a problem, the number of recaptures was too low to make a valid population estimate.

4.3 Population Dynamics

4.3.1 Age Distribution

As has already been noted in Section 4.1, there was a difference between the size and age of catfish caught by various gear types. There was also a difference in the age composition of each years catch. The 1987 hoop net catch was dominated by three year, and the 1988 catch was dominated by four year old catfish (Fig. 19). These fish are members of the 1984 cohort.

There was no evidence of a single dominant year class in the angled catch (Fig. 11), however there may be evidence of a group of strong year classes moving through the fishery. The 1987 angled catch was dominated by catfish aged 14 to 18 years, while the 1988 catch was dominated by catfish aged 16 to 20 years.

Although considerable gear bias existed, the age composition of catfish from all sources demonstrates several poorly represented year classes (Fig. 20). Large numbers of young catfish (ages 3-9) were caught in hoop nets. Older catfish (ages 14-21) were caught by angling. Although few young catfish were caught by angling, many large catfish were caught in hoop nets. A group of ages is missing or under

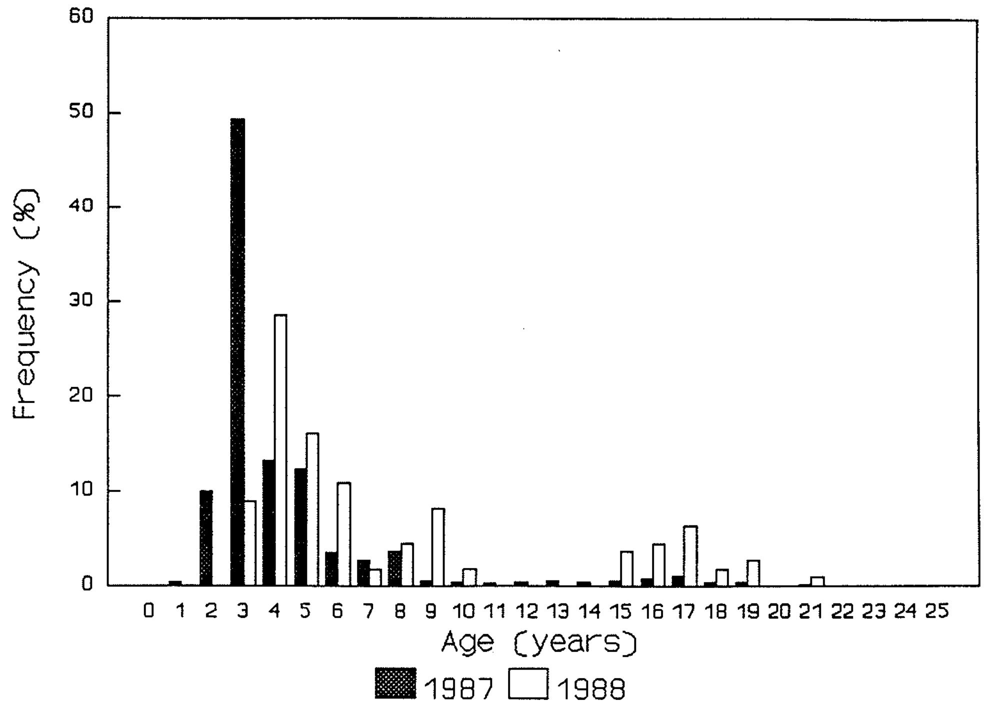

Fig. 19. Age distribution of catfish caught in hoop nets (n=960) in 1987 and 1988 (n=112).

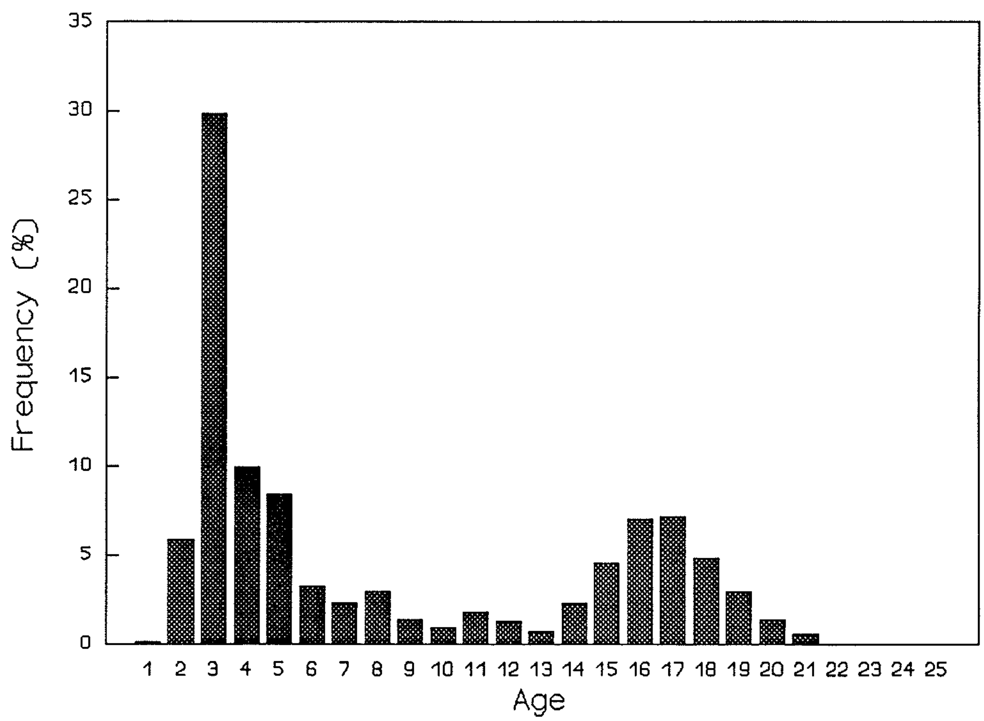

Fig. 20. Age distribution of catfish caught by all methods over the course of this study (n=1620).

represented in the sample. Anglers had reported a lack of small catfish prior to this study.

Bias from the sampling gear and set locations precluded using age distribution data to calculate mortality rates. The catches by any of the methods used could not be considered representative of the population as a whole.

4.3.2 Growth

Fork Length - Total Length Conversion

Although fisheries studies in Canada typically measure fish to the fork of the tail, the Manitoba Fishery Regulations (1987), specify that anglers are to measure fish from the 'furthest anterior point of the head to the furthest posterior point of the caudal fin'. This method of measurement is known as natural total length (Nielsen and Johnson 1983). In order to determine which sizes and ages of catfish would be protected by different length regulations, a conversion between fork length and natural total length was calculated. Both fork and natural total lengths were measured on 260 catfish ranging in length from 218 to 882 mm (FL). The relationship between fork length and natural total length

(Fig. 21) was:

$$nTL = 22.68 + 1.015 * FL \quad (R^2=0.997)$$

The 95% confidence interval for natural total length estimated from fork length was ± 21.72 mm.

Natural total length is more difficult to measure accurately than either fork length or maximum total length. Anglers were frequently observed measuring their fish incorrectly. Common problems were measuring the fork length or the maximum total length instead of the natural total length, or following the contours of the body instead of measuring the straight line distance. Those who did measure the length correctly, were often unable to do so with any degree of accuracy since minor adjustments in the position of the tail significantly altered the length measurement obtained.

Length-weight Relationship

The length-weight relationship was calculated using log transformed fork lengths and weights from 1295 catfish. In order to allow comparison with other studies, length-weight relationships were also calculated using natural total and maximum total lengths which were calculated from fork lengths.

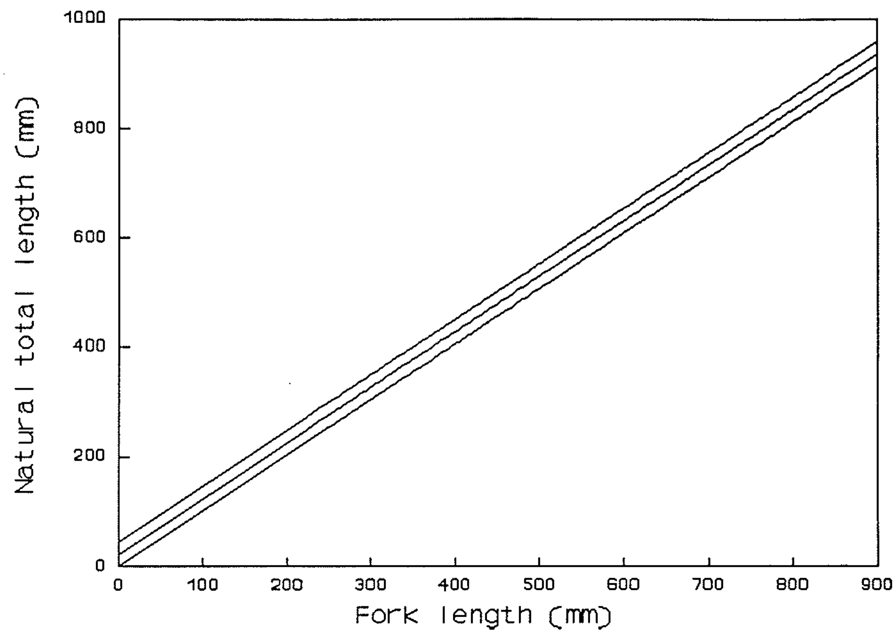

Fig. 21. Linear regression of fork length against natural total length with 95% confidence intervals.

The length-weight relationships were (length in millimetres, weight in grams) (Fig. 22):

$$\ln(wt) = -12.28 + 3.189 * \ln(FL) \quad (R^2=0.988;\ s.e.=0.174)$$

$$\ln(wt) = -13.59 + 3.366 * \ln(nTL) \quad (R^2=0.988;\ s.e.=0.169)$$

$$\ln(wt) = -13.36 + 3.316 * \ln(mTL) \quad (R^2=0.988;\ s.e.=0.170)$$

The 95% confidence intervals for weights predicted from lengths were wide for larger fish. For example, the predicted mean weight of an 85 cm (nTL) catfish was 9.1 kg. However the limits of the 95% confidence interval were 6.5 to 12.6 kg.

Growth

Walford (Fig. 23) and Brody (Fig. 24) plots were used to calculate the von Bertalanffy growth equation. Growth in fork length was described by the Brody-Bertalanffy equation (Fig. 25):

$$FL=1153.12*(1-e^{-0.0620*(t+1.231)})$$

Age specific mean fork lengths and weights are presented in Table 5, and Figures 26 and 27.

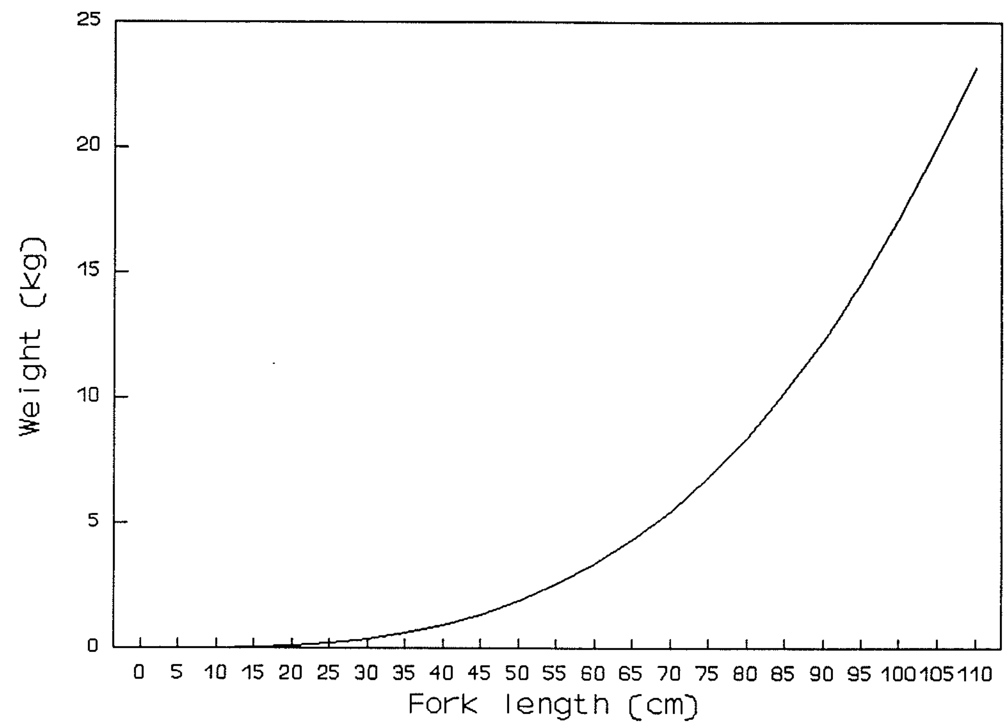

Fig. 22. Fork length-weight relationship for lower Red River catfish.

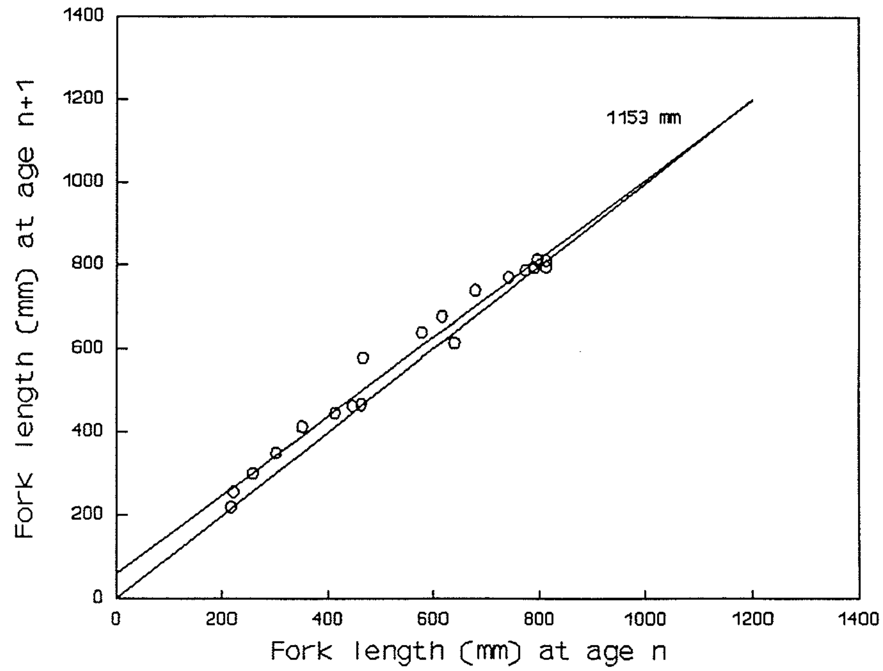

Fig. 23. Walford plot for lower Red River catfish.

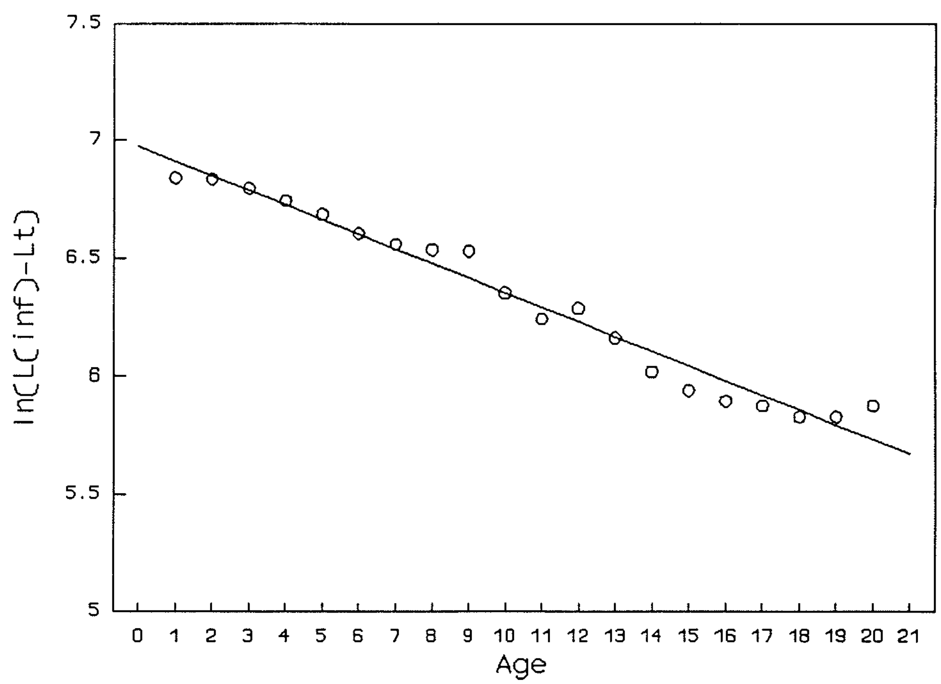

Fig. 24. Brody plot for lower Red River catfish.

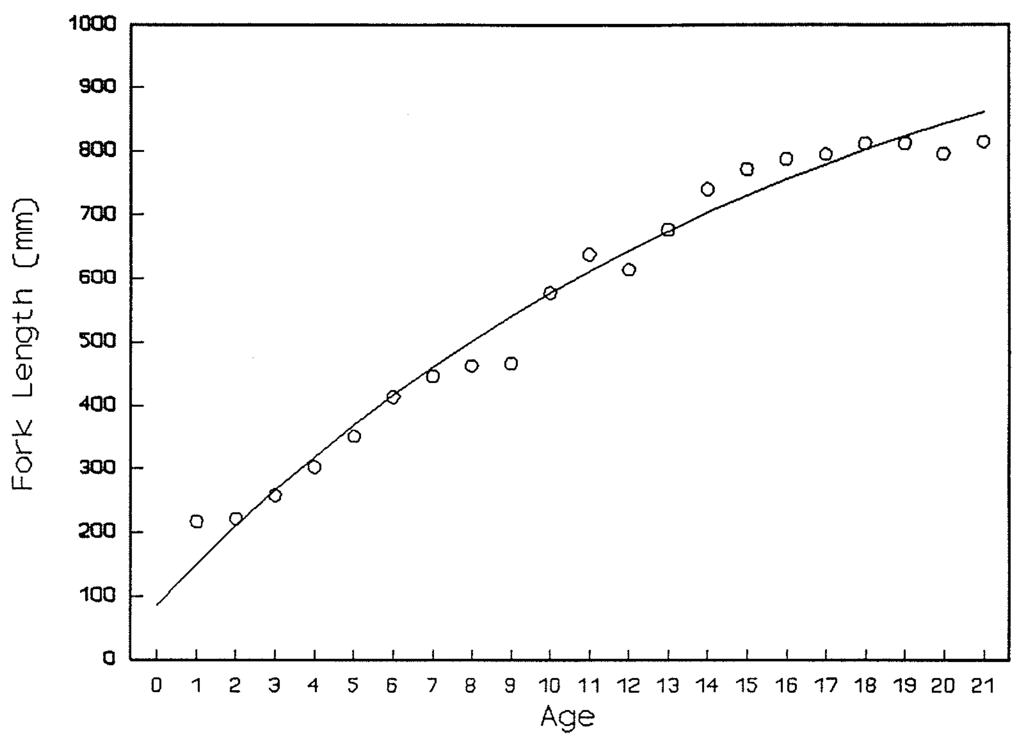

Fig. 25. Von Bertalanffy growth curve for lower Red River catfish.

Table 5. Age specific fork lengths and weights from channel catfish caught 1987-88.

	Number		Fork length (mm)		Weight (gm)	
Age	caught	sampled	mean	S.D.	mean	S.D.
1	3	3	216.7	25.8	140	34.6
2	95	92	221.5	29.0	156	82.3
3	483	473	257.8	32.3	239	88.3
4	161	157	302.3	47.5	402	176.0
5	136	132	350.9	38.0	584	172.0
6	53	51	413.3	76.1	1059	970.8
7	38	37	446.4	40.7	1189	379.4
8	48	46	463.0	40.4	1361	510.5
9	22	18	466.6	49.9	1398	520.2
10	15	11	578.3	134.5	3511	3116.0
11	30	20	638.9	92.5	4423	2515.0
12	21	13	615.2	77.1	3785	1820.0
13	12	8	678.2	114.6	5804	2818.0
14	38	26	741.5	91.3	7209	2501.0
15	74	53	772.6	62.0	8065	2196.0
16	114	80	789.1	56.9	8644	1835.0
17	116	86	795.9	41.7	9059	1815.0
18	79	55	812.7	45.9	9499	1541.0
19	48	33	812.5	36.5	9215	1390.0
20	23	12	796.6	41.4	8851	1322.0
21	10	8	815.5	21.8	9716	1606.0
22	1					
	1620	1414				

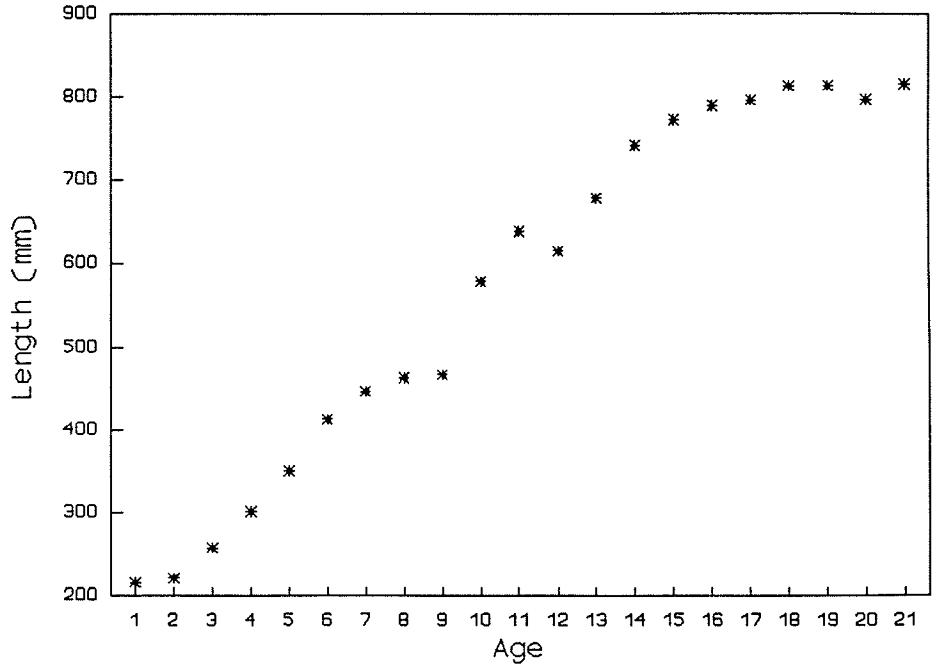

Fig. 26. Age specific mean fork lengths for lower Red River catfish.

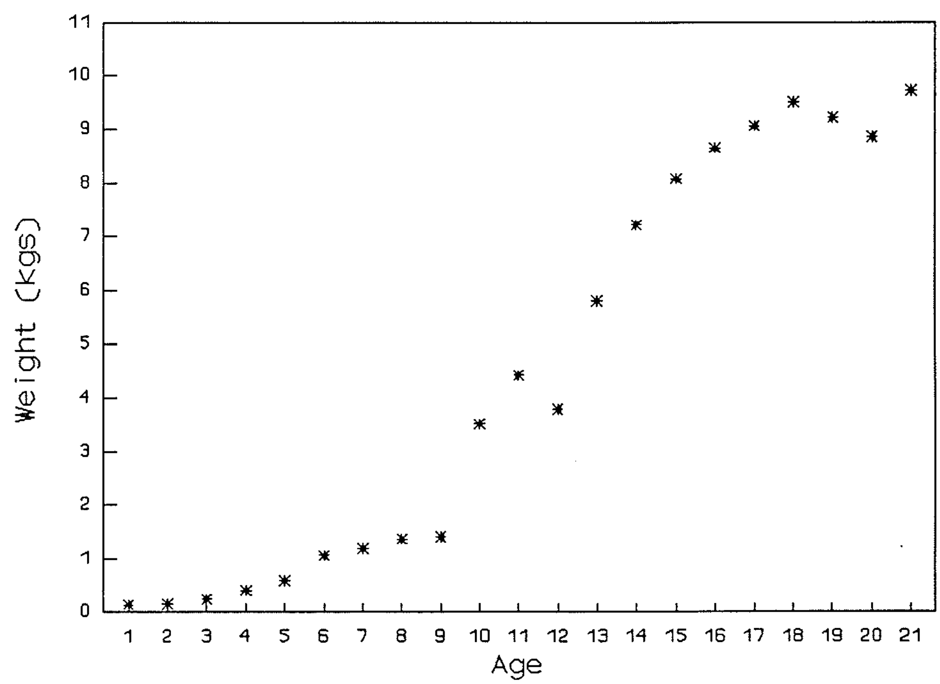

Fig. 27. Age specific mean weights for lower Red River catfish.

Size

The 1988 Manitoba Fishery Regulations limited anglers to four catfish, only one of which could exceed 75 cm. Of the catfish caught by angling in the lower Red River as part of this study, 92% exceeded 75 cm (natural total length) and could be considered protected by this limit (Fig. 28). The estimated weight of a 75 cm (nTL) catfish was 6.0 kg (95% confidence limits 4.3 to 8.2 kg).

For the 1989 angling season anglers were limited to one catfish exceeding 85 cm annually. Sixty-eight percent of the catfish angled in the lower Red were estimated to exceed this limit. The estimated weight of an 85 cm (nTL) catfish was 9.0 kg (95% confidence limits 6.6 to 12.6 kg).

4.4 Creel Census

A detailed analysis of creel census data from this study and from its continuation in 1989 is in preparation by Lysack and Kristofferson.

The fishery was predominantly catch and release as anglers released 74% of their catfish catch (Fig. 29). Few small catfish were caught by anglers. Although the 75 cm maximum length limit compelled anglers to release a large

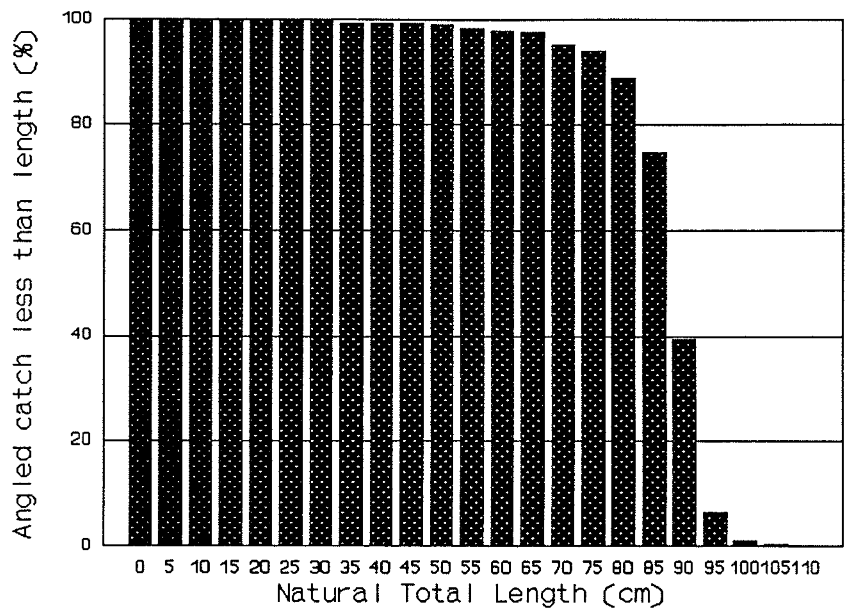

Fig. 28. Proportion of the angled catch of catfish which is above a given natural total length.

number of the fish they caught, many anglers stated they were fishing only for sport and did not intend to retain any.

Fishing success and effort appeared to be lower than in previous years. Angler success was best in spring, dropping off drastically in mid-June. Angler effort remained relatively constant throughout the summer, and increased in the fall as the walleye run began (Fig. 30).

4.5 Ultrasonic Tracking

An ultrasonic transmitting tag was surgically implanted into a catfish on September 15, 1987, to determine how effective ultrasonic transmitters would be in the study area. Tracking was conducted throughout that fall (Fig. 31). By October 7 it had entered Cook's Creek, a small tributary to the Red River which serves as a discharge channel for cooling water effluent from the Selkirk Thermal Generating Station. Large numbers of large catfish were observed in the creek at this time, apparently attracted by the warmth of the cooling water effluent. The transmitter equipped catfish was subsequently lost following a shutdown of the generating station on November 9. It was not found again in either Cook's Creek, or the Red River between Lake Winnipeg and Lockport. At that time the Lockport fish ladder was not passable, and the only way upstream was through the locks.

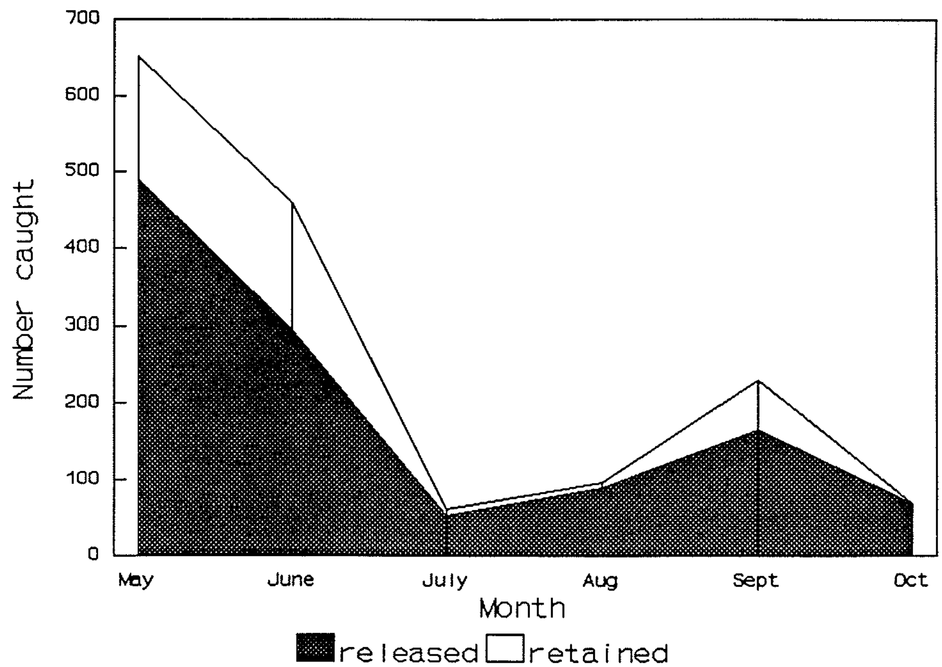

Fig. 29. Total monthly catch of channel catfish by anglers using Selkirk Park (May-Oct, 1988) and Lockport (June-Oct, 1988) boat launches on the lower Red River.

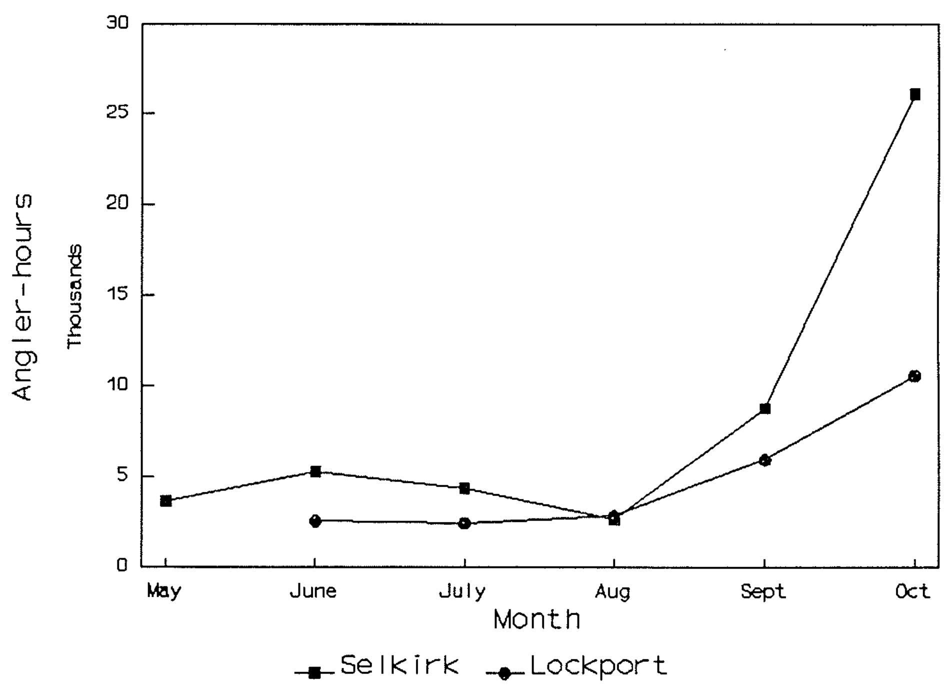

Fig. 30. Total monthly angler effort for anglers using Selkirk Park and Lockport boat launches, 1988.

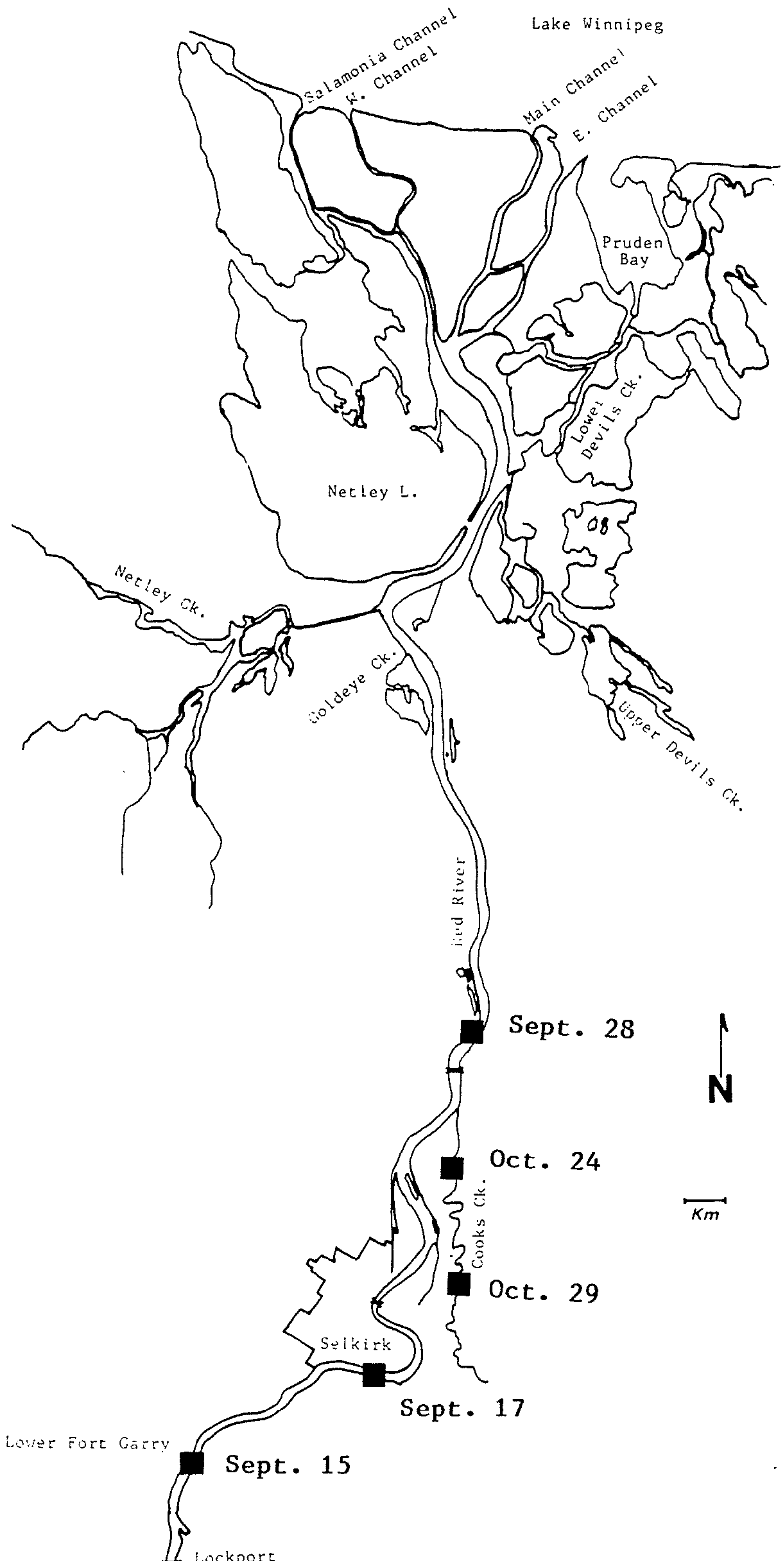

Fig. 31. Movements of ultrasonic implanted catfish in 1987.

In 1988, ultrasonic transmitting tags were implanted in eight adult catfish caught by angling at Lockport and near Fort Garry. The catfish are referred to using the pulse pattern of their transmitters. Their movements are summarized in Figures 32-39.

Shortly after the catfish were implanted with transmitters, they moved downstream. This movement coincided with a marked decline in angler success and poor hoop net catches in the river between Selkirk and Lockport.

Some of the transmitter equipped catfish moved rapidly. The most dramatic movement was 2-7-6 which was tagged at Lockport on June 7, and was caught and released by anglers on June 9 in Upper Devil's Creek, 37 kilometres away (Fig. 35). This fish stayed near the mouth of the Red River until September 6, when it was located south of Selkirk.

Several of the implanted catfish entered the creeks and channels of the Netley-Libau marsh complex. Ultrasonic transmitters are difficult to detect in shallow areas, and the signal can be obscured by vegetation. When catfish were detected in this area, it was usually when they left the marsh and returned to the river briefly. Efforts were made to track in the tributaries and channels, although the massive areas involved made this relatively futile. On two occasions it was

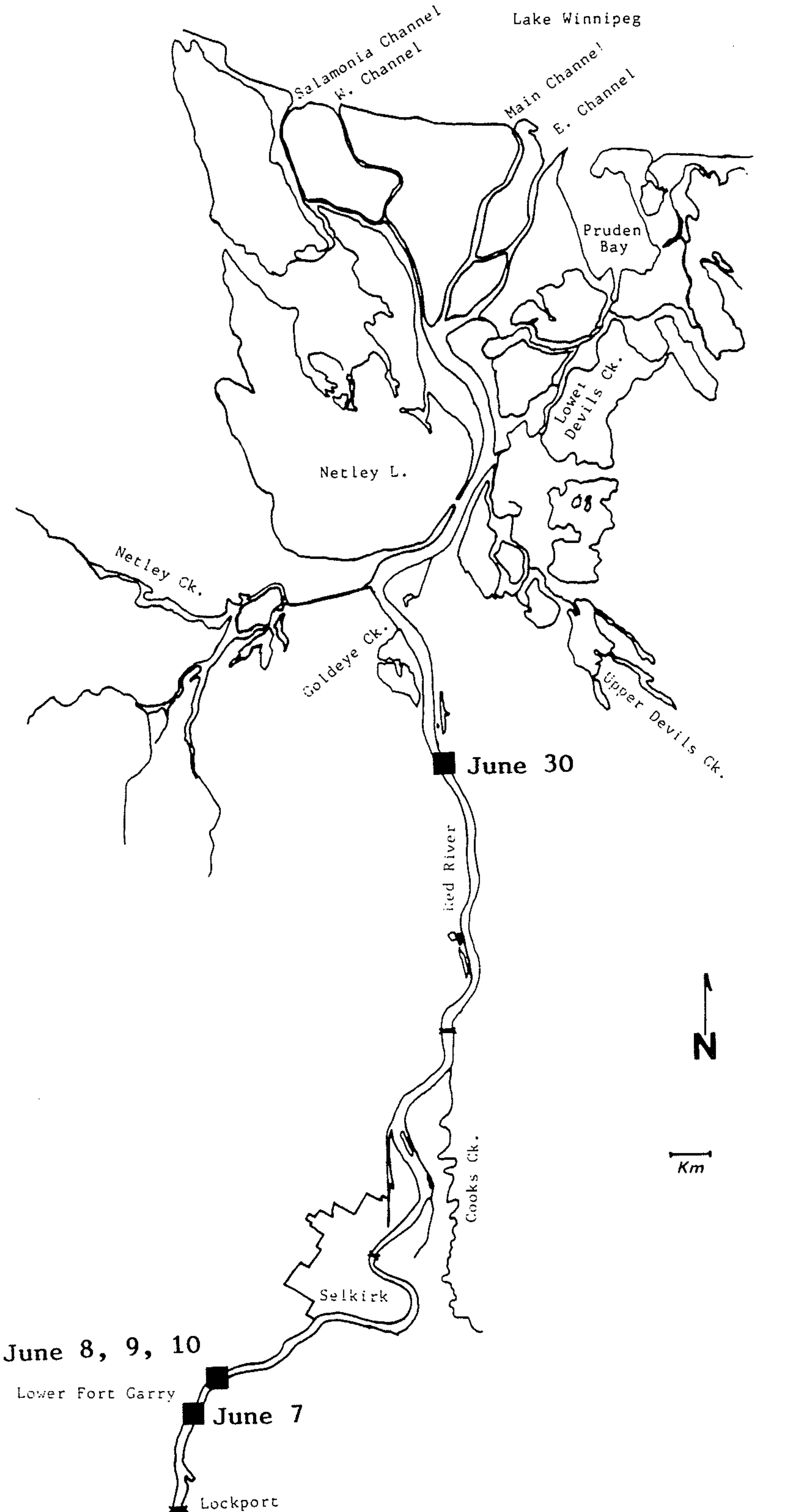

Fig. 32. Movements of the catfish implanted with ultrasonic tag 2-4-9.

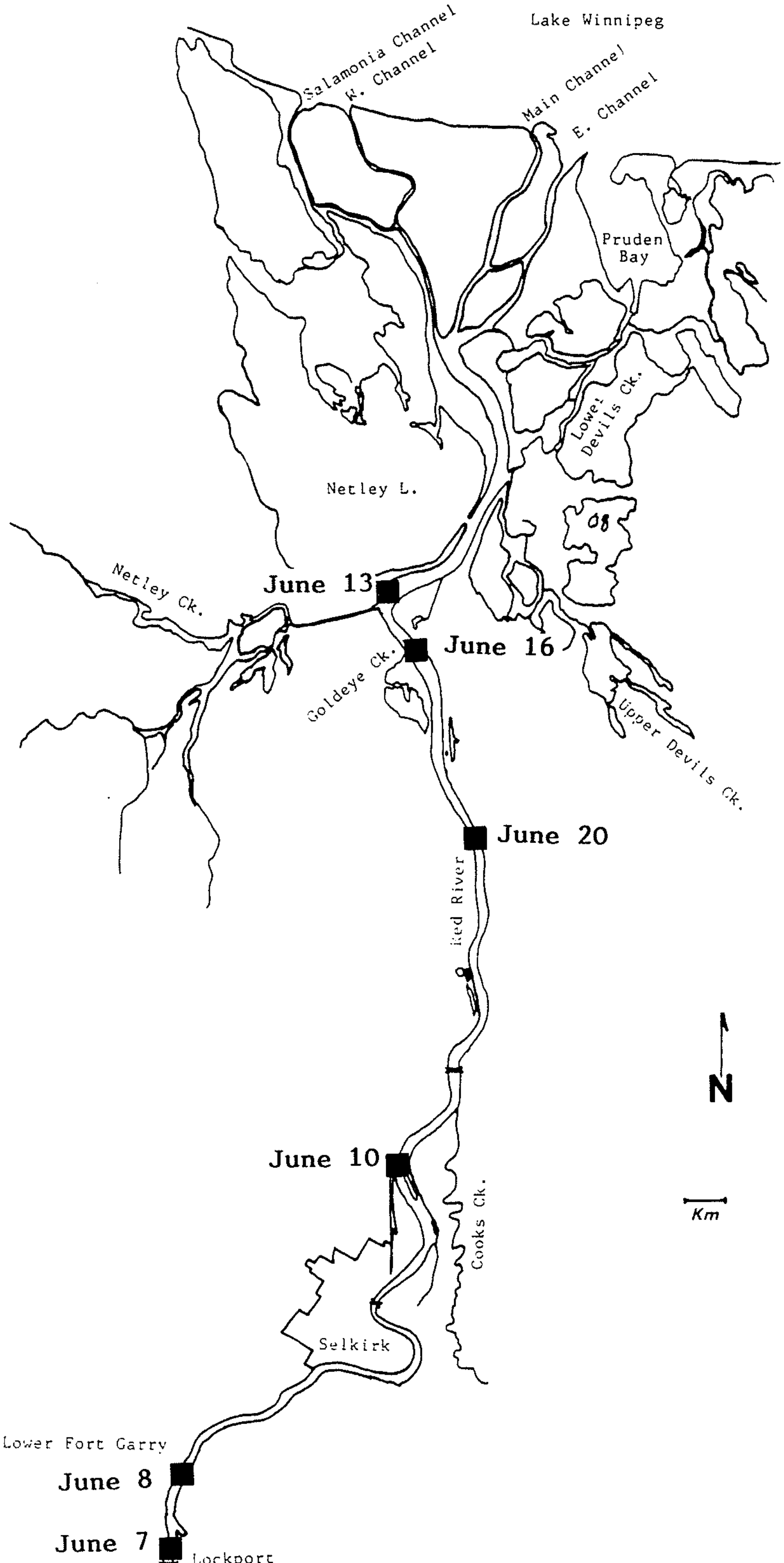

Fig. 33. Movements of the catfish implanted with ultrasonic transmitter 2-5-8.

Fig. 34. Movements of the catfish implanted with ultrasonic transmitter 2-6-7.

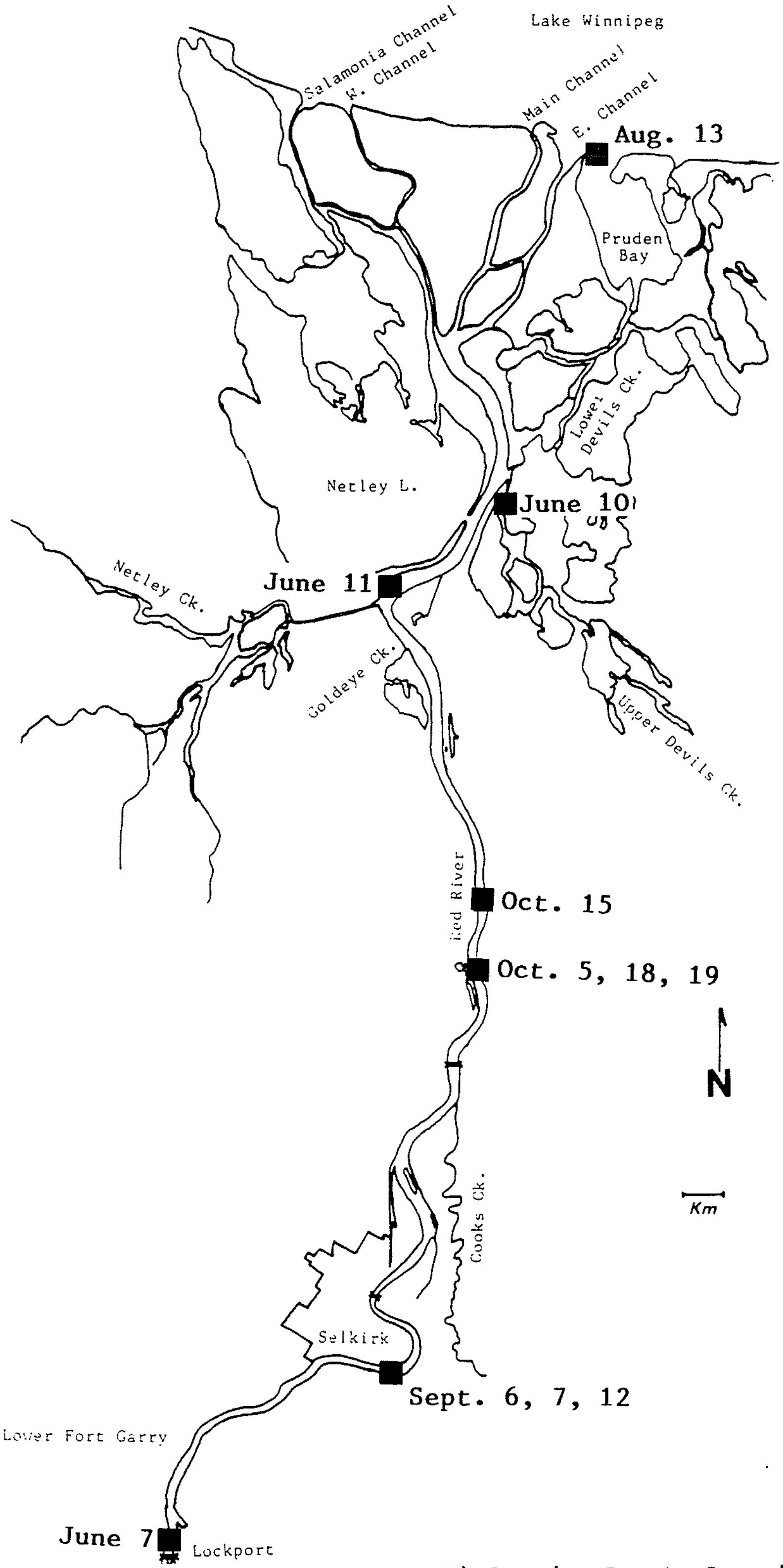

Fig. 35. Movements of the catfish implanted with ultrasonic transmitter 2-7-6.

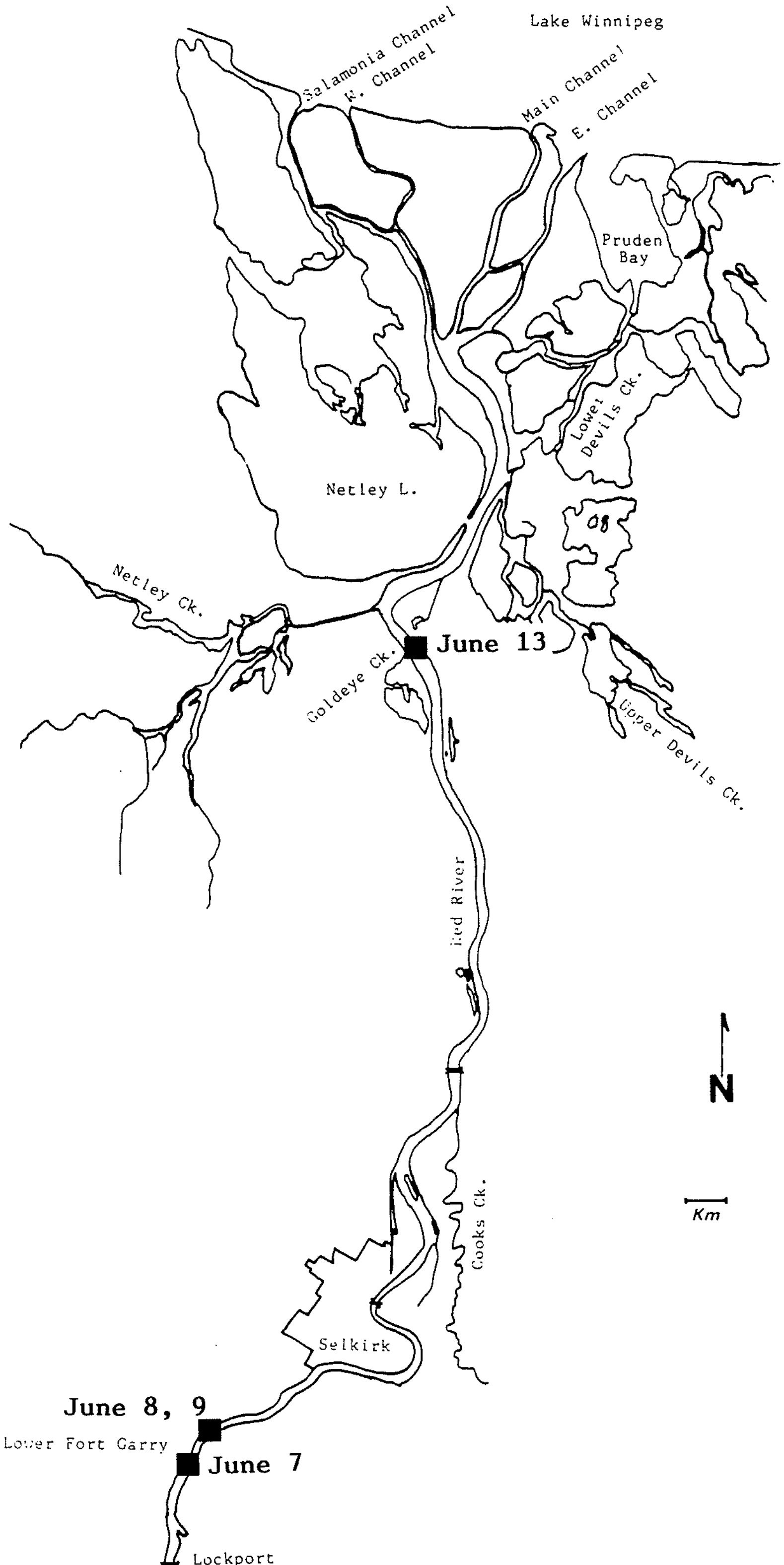

Fig. 36. Movements of the catfish implanted with ultrasonic transmitter 2-8-5.

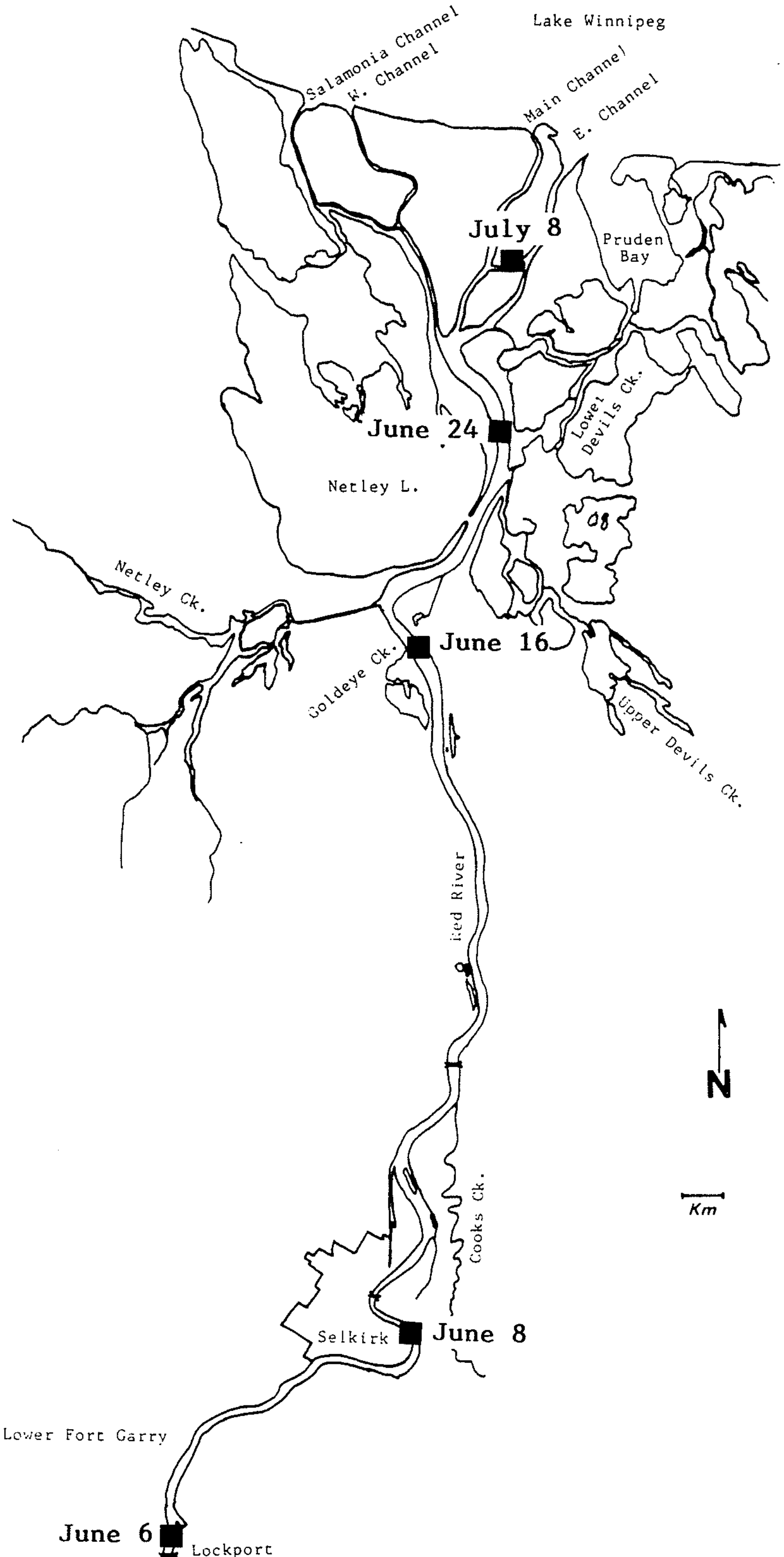

Fig. 37. Movements of the catfish implanted with ultrasonic transmitter 2-9-4.

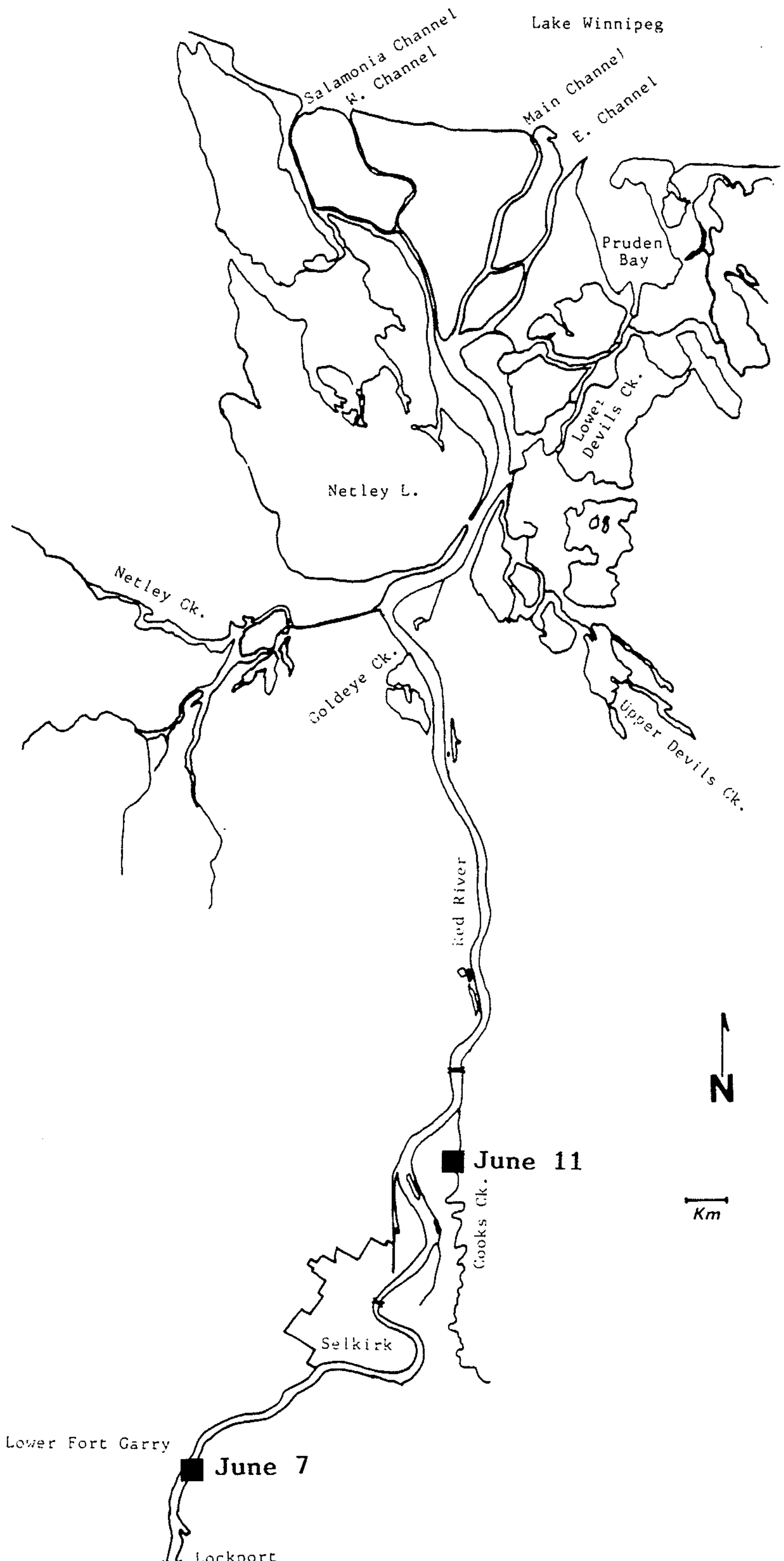

Fig. 38. Movements of the catfish implanted with ultrasonic transmitter 3-3-9.

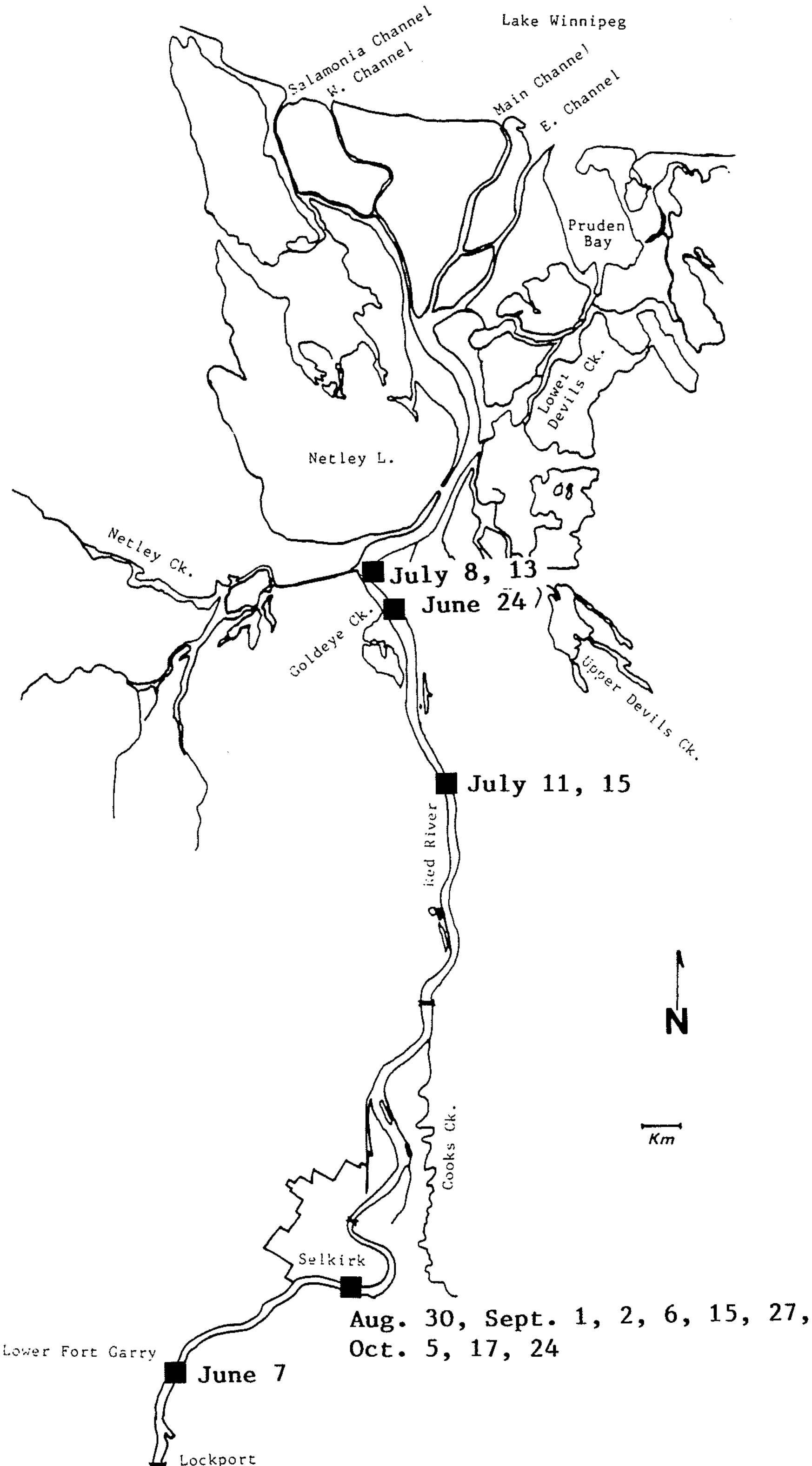

Fig. 39. Movements of the catfish implanted with ultrasonic transmitter 3-4-8.

successful. 2-9-4 was found in 2 m of water in Cross River on July 8 and 2-7-6 was found in Pruden Bay on August 18.

Three of the transmitter implanted catfish were presumed to have died during the summer. The catfish with transmitter 2-6-7 (Fig. 34) never moved far from the area it was tagged in, and by June 20 was felt to have totally ceased movement. The catfish with transmitter 3-3-9 (Fig. 38) moved into Cook's Creek by June 10. It was tracked moving upstream on June 11, but was not located after that date. The Selkirk Thermal Generating Station was operating at this time and water temperatures in Cook's Creek were 30°C, 5° above Red River ambient temperature. Catfish mortalities were observed along the shoreline in Cook's Creek shortly afterwards. There was a rumour that American anglers staying at Chesley's (a campground on Netley Creek) caught a tagged catfish in August. They apparently found an object inside, panicked, and threw the fish away. This rumour proved impossible to confirm.

Only two transmitter implanted catfish, 2-7-6 (Fig. 35) and 3-4-8 (Fig. 39) returned upstream in the fall to the area between Selkirk and Lockport.

There is no indication that any of the transmitter implanted catfish moved upstream of the dam at Lockport. During the summer of 1988 the fish ladder was not passable because of the low water levels in the river. The only means of passage upstream was through the boat locks. Catfish equipped with transmitters should have been detected moving upstream before they reached and passed the locks.

4.6 Red River Environmental Factors

4.6.1 Water Temperature and Flow Records

The most complete record of water temperatures from the Red River over the last ten years was maintained by Manitoba Hydro at the Selkirk Thermal Generating Station. Temperature records from 1987 were comparable to the mean weekly temperatures from 1979 to 1987, except that temperatures peaked at 24°C, 1° higher than the mean (Fig. 40). In 1988 the river warmed more rapidly than usual, reaching a peak temperature of 25°C in mid May, two months earlier than usual and 2° higher than the mean (Fig. 41).

Water temperature records were also maintained by Environment Canada at Lockport, and prior to 1984, by Manitoba Department of Environment at Selkirk Bridge. These records indicate that temperatures recorded at the Selkirk Thermal Generating Station did not necessarily represent the peak temperatures in the river. This was especially noticeable during the summer of 1983 when temperatures at Selkirk Bridge

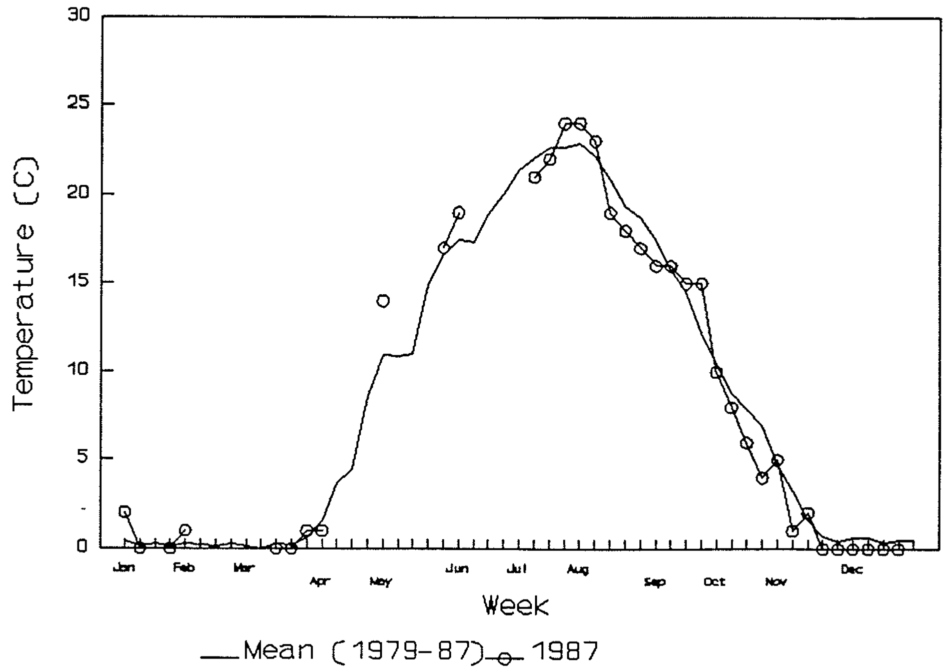

Fig. 40. 1987 temperature records from the Selkirk Thermal Generating Station intake on the Red River.

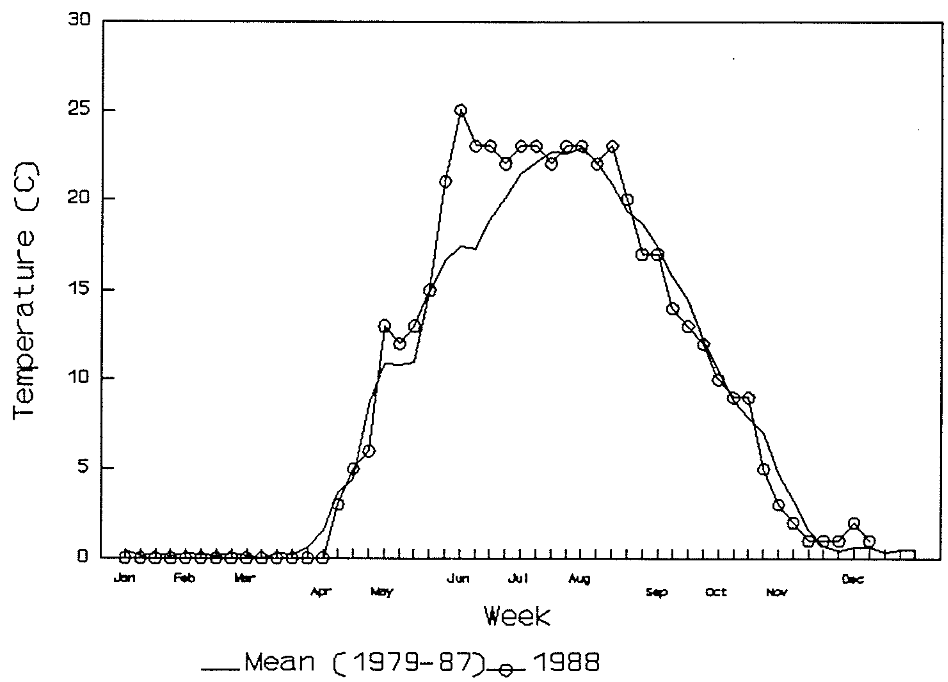

Fig. 41. 1988 temperature records from the Selkirk Thermal Generating Station intake on the Red River.

reached a peak of 31°C, exceeding temperatures at other locations by as much as 5°C.

Spring flows in the Red River at Lockport in 1988 were the lowest since 1981 (Fig. 42). The earlier warming, higher temperatures, reduced flows, and reduced water levels were all symptoms of the drought which occurred that year. These differences combined to produce a fish habitat in the lower Red River which differed considerably from previous years. Spawning temperatures were reached almost a month before normal. This affected the timing of spawning movements, and angler success as catfish left the area below Lockport much earlier than had been observed in previous years.

4.6.2 Substrate Survey

During the winter of 1988-89 the river bottom from Lockport to Selkirk was surveyed using an Eckman dredge through holes drilled in the ice (Kristofferson pers. comm.). This study was related to concerns about the effect on fish habitat that results from depositing dredging spoils into the river channel. Almost all the transects revealed a bottom covered in rock, typically solid limestone. Other substrates included hard clay, gravel, rock cobble, and mud.

The river bottom downstream of Lockport is predominantly

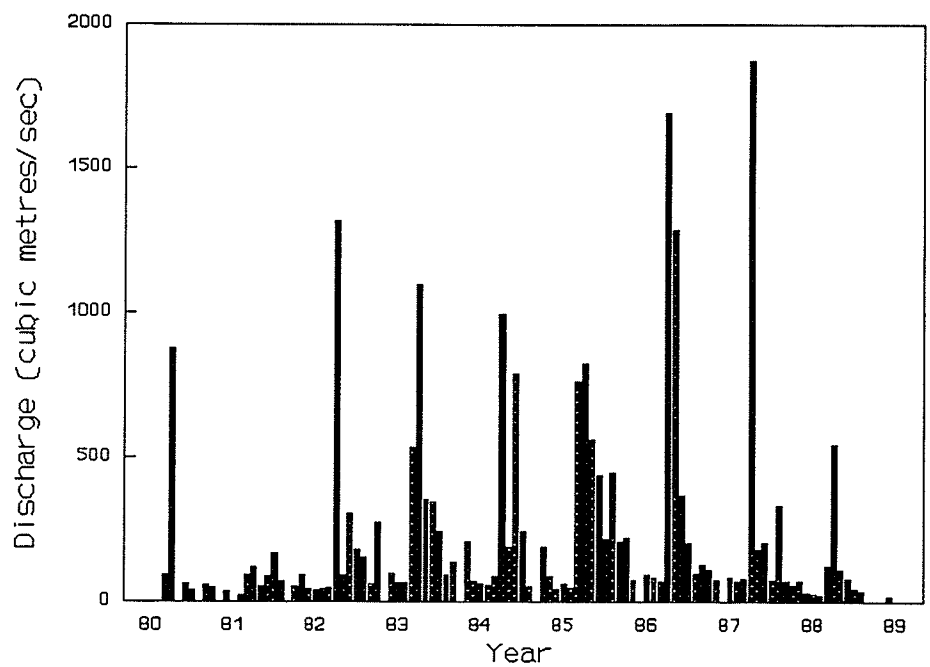

Fig. 42. Red River discharges at Lockport, 1980-89.

limestone and limestone cobble, with some areas of hard clay. Towards Selkirk the bottom substrate becomes muddier although rock is present throughout this area. Some areas of sand and gravel occur, but they are not dominant substrate types.

Chapter 5

Discussion

5.1 Catfish Biology

5.1.1 Size and Growth

Channel catfish from the lower Red River grow as fast as catfish from populations further south in North America. Growth in maximum total length (converted from fork length) of Red River catfish was compared with catfish from other areas (Fig. 43). Scott and Crossman (1973) noted the wide variability in growth rates which occur, and observed that growth was significantly faster in southern populations. This faster growth is most likely related to warmer temperatures since catfish growth increases with increased temperature (Andrews and Stickney 1972).

An unexpected finding was that growth of Red River catfish was similar, or even slightly faster than growth of Missouri River catfish (Hesse 1982) (Fig. 44). If catfish growth is primarily dependant on temperature, then Missouri River catfish should grow faster, since the period of water temperatures above 18°C is almost a month longer in Nebraska (Fig. 45). Hesse (pers. comm.) pointed out that the Missouri River has been dramatically altered by channelization which

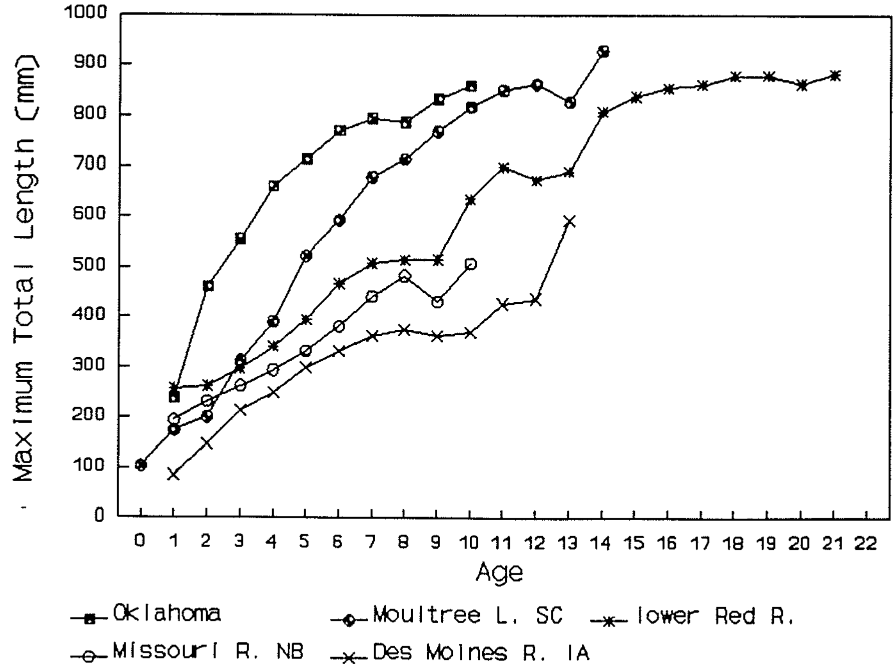

Fig. 43. Red River catfish growth compared with growth from more southern populations.

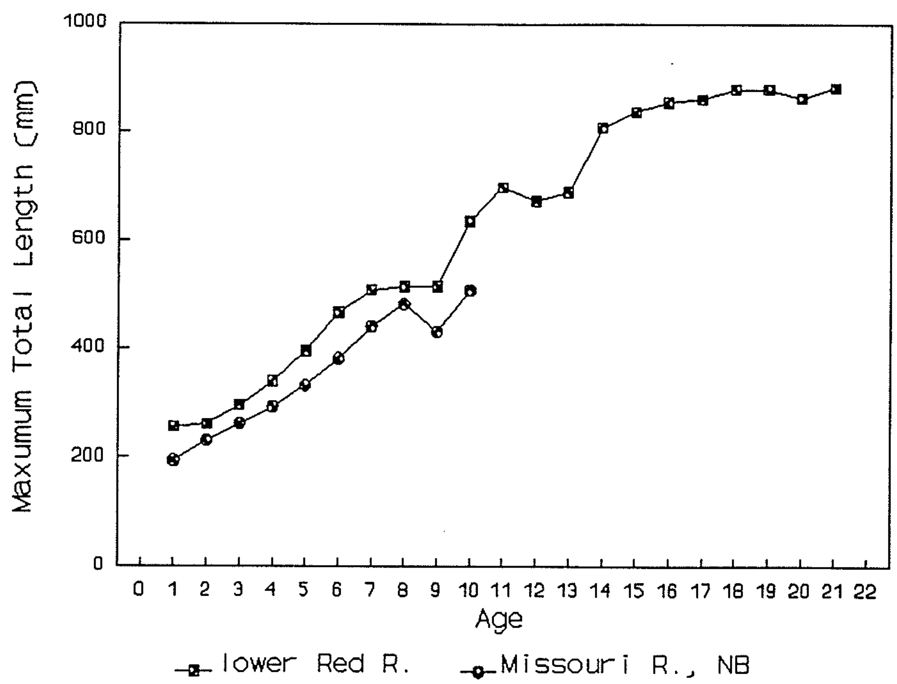

Fig. 44. Growth in length of catfish from the lower Red River, and the Missouri River, Nebraska (Hesse <u>et al.</u> 1982).

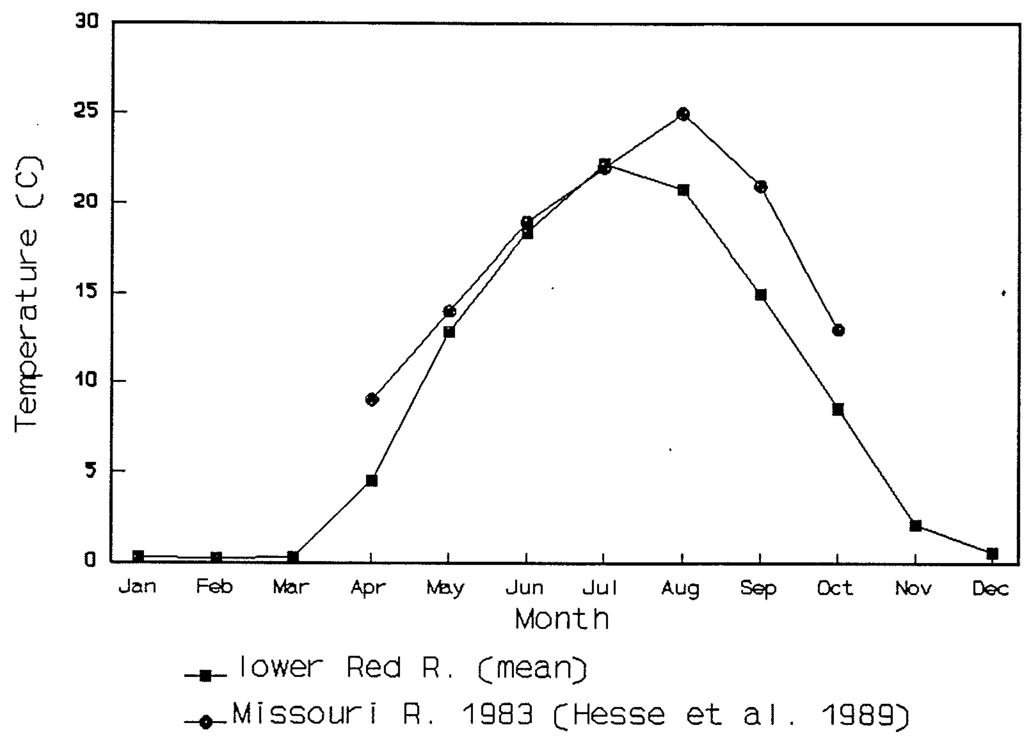

Fig. 45. Comparison of water temperatures from the lower Red River and the Missouri River.

has reduced both spawning habitat and the availability of forage. The Red River, as a relatively unimpacted system, may have more available forage.

Water temperatures in the lower Red River are well suited to catfish growth. Temperatures as high as 31°C have been measured in the main channel of the river. The period of water temperatures above 18°C averages approximately two and a half months. As has already been noted, some areas of the river offer warmer temperatures than the averages recorded. The optimum temperature for catfish growth occurs between 26°C and 30°C (McMahon and Terrell 1982). Growth is poor below 21°C (McCammon and LaFaunce 1961; Andrews and Stickney 1972; Macklin and Soule in McMahon and Terrell 1982), and no growth occurs below 18°C (Starostka and Nelson 1974).

The largest catfish sampled during this study was 14.5 kg (32 lb). The Manitoba angling record is a 16.3 kg (36 lb) catfish caught in the Red River in 1988. There have been unsubstantiated reports of catfish as large as 18 kg from reputable anglers.

When compared to records from other areas, catfish from the lower Red River are not the largest catfish in the world. Although Davis (1959) reported that catfish over 2.3 kg were rare in Kansas, the largest recorded at that time was 25 kg

(Hutt in Davis 1959). The 1988 I.G.F.A. record for an angled catfish is 26.3 kg (58 lb) from the Santee-Cooper Reservoir in 1964. Stevens (1959) reported that channel catfish from the Santee-Cooper Reservoir were the largest, longest lived, fastest growing, best condition channel catfish known. Stevens reported many channel catfish over 18 kg. Although the previously noted large catfish are from older literature, large fish are still caught in some areas. The 1988 I.G.F.A. line class records list several catfish caught this decade which are larger than the Manitoba record.

The unique feature of the lower Red River fishery is that the average weight of catfish caught by anglers is 8.9 kg (19.6 lb). Anglers have an opportunity to catch large numbers of large catfish. The fishery is so dominated by large fish that anglers report being unable to catch fish less than 75 cm in length.

The primary difference between the growth curves of Red River catfish, and those from other populations, is that Red River catfish appear to live longer. The oldest Red River catfish aged so far was 22 years. Fish this old were not found in the literature with the exception of Magnin and Beaulieu (1965). Magnin and Beaulieu (1965) did not use aging structures to determine the age of their catfish, instead they estimated the age from the difference in size between tagging and recapture. The ages estimated by this method cannot be considered valid. Carlander (1969) and Scott and Crossman (1973) both note that catfish older than 10 years appear to be rare. Carlander (1969) found none older than 14 which was from Moultree Lake, South Carolina (Stevens 1959). The oldest catfish found in the literature was one catfish of 17 years from Lake Sharpe, South Dakota (Elrod 1974). That one fish was an exception, the majority of the catch was aged 5 to 9 years.

A possible explanation for the presence of older fish in the Red River than are found elsewhere may be partially due to a slower growth rate than is found in southern populations. Southern populations generally grow faster (Scott and Crossman 1973), and fish with higher growth rates generally do not live as long (Carlander 1969). Another explanation is that the available literature on catfish generally concerns heavy exploited populations. Fish from these populations may be fully, or almost fully, recruited into these fisheries before they reach their maximum potential age. The Red River population has not been heavily exploited by anglers until recently, and has never been commercially fished.

5.1.2 Year Class Strength

Catfish year class strength is established during spawning (Helms 1975). Although variations in year class strength occur, Helms (1975) could not identify causative factors. Hesse et al. (1979) and Schainost (in Hesse 1982) found year class strength to be highly variable. Water levels were felt to be positively correlated with year class strength, but this could not be confirmed. Holland-Bartels and Duval (1988) found that high water flows had an adverse affect on spawn success, possibly by flushing nests.

Age compositions from both years of hoop netting catches from the Red River were dominated by a strong 1984 year class. Inspection of temperature and flow records from 1984 does not reveal any apparent reason for this. Data from subsequent years of this study should reveal how variable year class strength is.

The angling fishery was not dominated by a single year class, however the mean age of the angled catch from 1986 to 1988 was from the 1970 year class.

5.1.3 Habitat Partitioning

Prior to this study anglers had expressed concerns about the lack of smaller catfish being caught in the lower Red River. These concerns were highlighted following the imposition of the 75 cm maximum length limit in 1986 as anglers found it difficult to catch any catfish below the limit. There were concerns that the lack of small catfish may have indicated a problem with recruitment with serious implications for the future of the fishery.

This study confirmed that only 8% of the catfish angled from the lower Red River were less than 75 cm natural total length. The ages of the majority of angled catfish were between 14 and 21 years. Although the inability of anglers to catch significant numbers of smaller catfish was confirmed, the presence of smaller catfish was demonstrated by hoop net catches. The majority of catfish caught in hoop nets were less than 50 cm in length, and were between 2 and 9 years in age. While this alleviated concerns about spawning success in recent years, catfish between 9 to 14 years were poorly represented in catches by any gear type in the lower Red River.

There were also concerns that some undetermined environmental impact may have resulted in a lack of recruitment in recent years. There are several possibilities. The City of Winnipeg discharged raw sewage into the Red River prior to 1974, this occasionally resulted in anoxic conditions during winter ice cover (Beck pers. comm.).

Discharges from a sugar beet refinery in Halstad, Minnesota in 1979 resulted in anoxic water moving from Halstad to Winnipeg. This occurred under the ice, and although there was no way to confirm the magnitude of the fisheries impact, it was assumed at the time that most of the fish in that portion of the river were killed. The anoxic water was reoxygenated when it mixed with water from the Assiniboine at their confluence in Winnipeg (Beck pers. comm.).

The Lockport fishway was not operational from 1968 until 1983. This may have affected the ability of catfish to utilize habitats upstream, although movement in the spring may still have been possible.

There is another possible explanation for the lack of intermediate sized catfish in the lower Red River. While intermediate sized catfish between 500 and 750 mm in length and 9 to 14 years of age were rarely caught in the lower Red, they dominated the catch of anglers upstream of Lockport, both near the north Perimeter Highway and the junction of the Red and Assiniboine Rivers. The catfish caught in the upper Red River were the age classes and sizes which were missing from the lower Red (Figs. 46-47).

The distribution of different sizes of catfish in the Red River is most likely due to changes in habitat and diet requirements as catfish grow. Numerous studies have reported

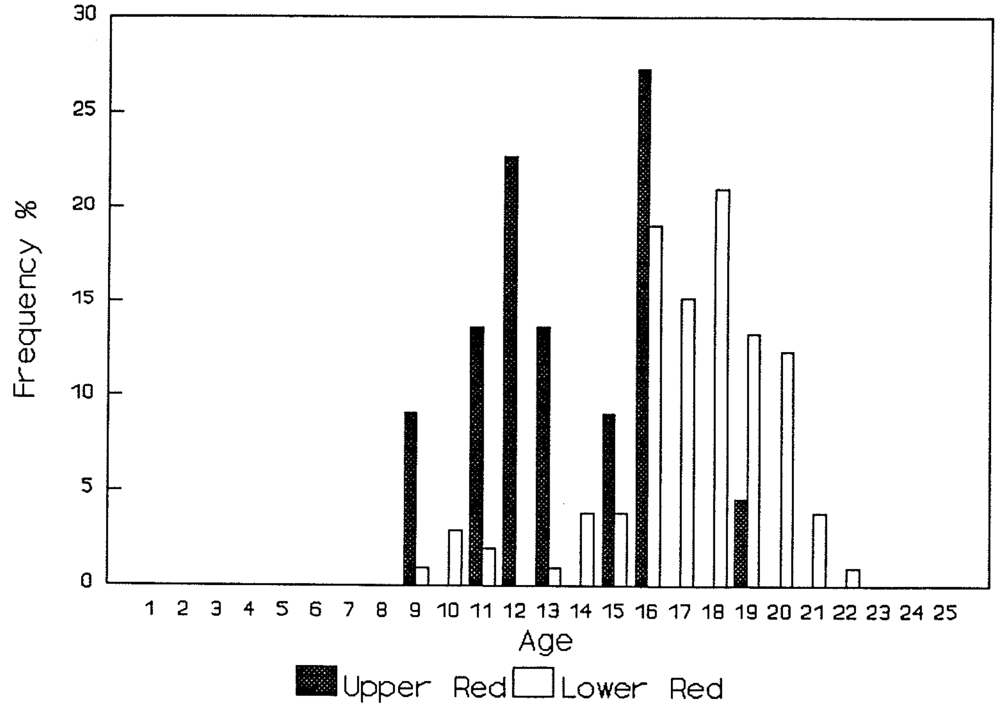

Fig. 46. **Age distribution of catfish caught by angling in the upper and lower Red River.**

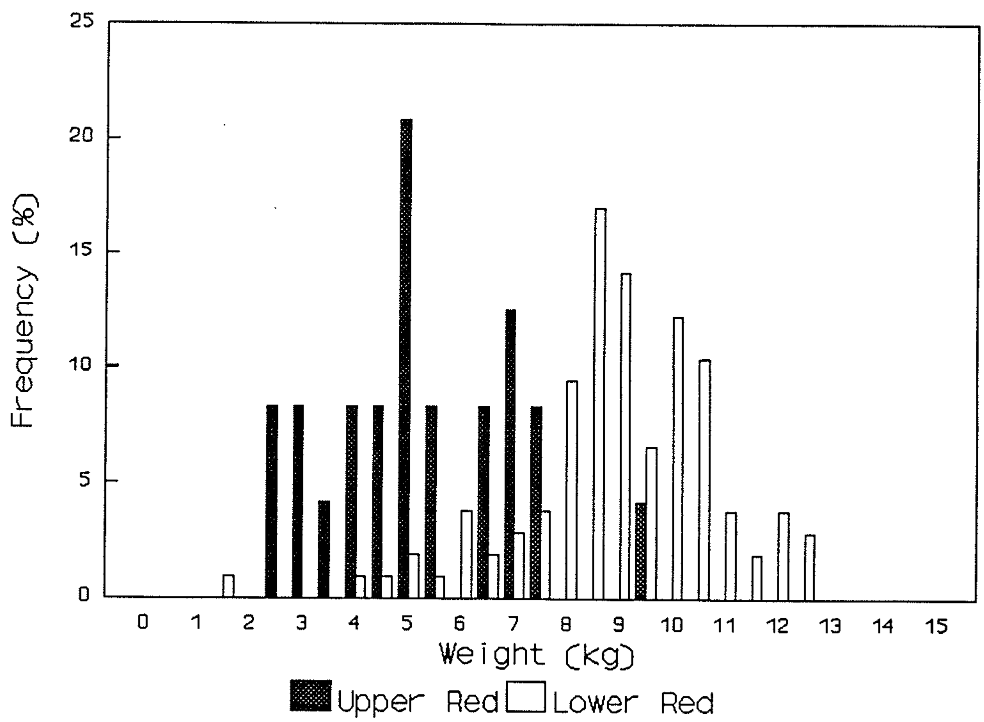

Fig. 47. **Weight distribution of catfish caught by angling in the upper and lower Red River.**

the shift in importance from insects to fish as catfish increase in size (Bailey and Harrison 1948; Russell 1965; Busbee 1968; Starostka and Nelson 1974; Zuerlein 1982). Starostka and Nelson (1974) found that fish started to become an important part of the diet of catfish between 300 and 400 mm (maximum total length). This importance increased as catfish grew, until fish dominated the diet of catfish over 500 mm. Bailey and Harrison (1945), Russell (1965), and Busbee (1968) also reported that catfish over 300 mm depend increasingly on piscivory as they grow.

There are no indications of recruitment failure in the Red River catfish population. The absence of certain sizes of catfish in the lower Red River appears to result from differences in habitat utilization for different sizes of catfish. The intermediate sized catfish which are uncommon in the lower Red River, are large enough to be piscivorous. Catfish between 500 and 750 mm are probably outcompeted for food by the larger catfish, and must opt for other habitats. Catfish under 500 mm are present in the lower Red since they are largely insectivorous, and therefore do not compete for either food or habitat with larger catfish. Funk (1955) observed that intermediate sized catfish were more mobile than either large or small catfish, and suggested that competition for food, and space forced intermediate sized fish to move further. Hesse *et al.* (1982) also observed that movements were density dependant in response to needs for food or spawning habitat.

The presence of a concentration of large catfish in the lower Red River below Lockport suggests that this must be preferred habitat. The dam at Lockport provides an area with well aerated water and abundant food for large catfish. This is probably the best habitat for large catfish in the Manitoba portion of the Red River. The sport fishery which has developed in this area demonstrates the abundance of prey species for catfish, and the existence of a concentration of large catfish. Large catfish dominate the habitat to the point that smaller catfish are excluded from it.

5.1.4 Movements

Range Movements

The movements of Red River catfish are limited only by physical obstructions and the northern limit to their range. Catfish are know to be more mobile than most species of warm water fish (Funk 1955). Tag returns were limited to areas of intense fishing pressure such as the lower Red near Lockport, and the upper Red near Halstad, Minnesota, yet they demonstrated dramatic movements. Clarke (pers. comm.) also demonstrated these wide ranging movements. Catfish tagged in the Lockport and Winnipeg areas have been recaptured after moving almost as far as is possible in every direction (Fig. 48).

The range of channel catfish in Manitoba extends throughout the entire Red River and its tributaries, as well as Lake Winnipeg and its tributaries at least as far north as Berens River. Movements throughout this range are restricted by the Pine Falls Hydro Generating Station on the Winnipeg River, the Portage La Prairie diversion dam on the Assiniboine, St. Andrews Locks and Dam at Lockport and seven water control dams in the United States on the Red River, water level control dams on the La Salle, Rat and Roseau Rivers, and the Winnipeg Floodway siphon on the Seine River (Fig. 49).

The movements of Red River catfish appear to be in response to spawning and feeding requirements. The catfish population may be utilizing different habitats throughout their range at different times of the year, or at different stages of their life cycle. Several authors (Harrison 1953; McCammon and LaFaunce 1961; Humpheries in Welker 1967; Muncy in Welker 1967; Hesse et al. 1982) have found that, with the exception of movements into tributaries, catfish movements are random. Hesse et al. (1982) attributed the extensive movement

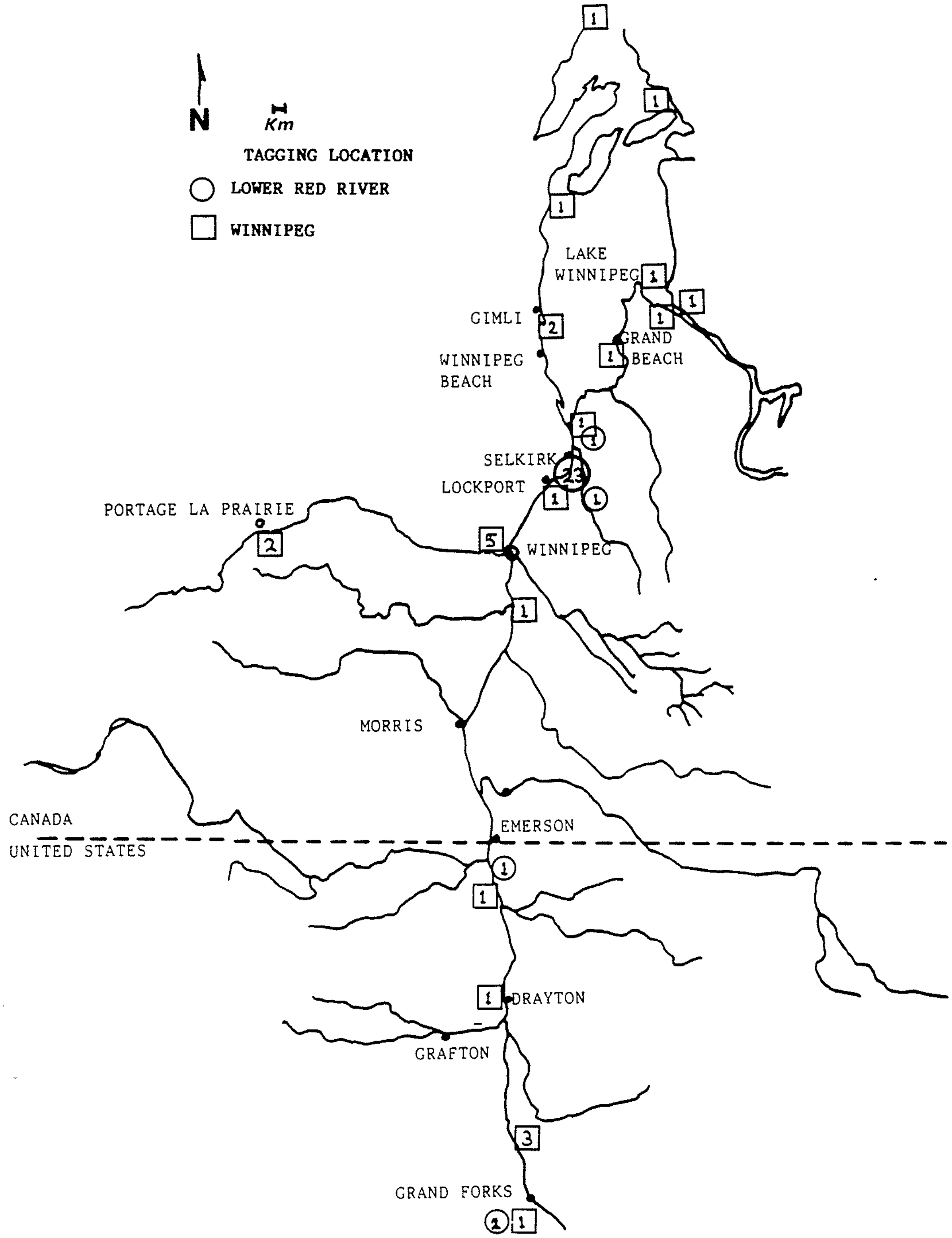

Fig. 48. Recapture locations of catfish tagged in the lower Red River, and in the Red River near Winnipeg (Clarke pers. comm.).

of Missouri River catfish to spontaneous, density dependent events such as the need for food, or suitable spawning locations. There was no pattern which could be explained by subpopulations with special migratory instincts. Funk (1955) reported that competition for food, space, or habitat can force movements.

Spawning Movements

Both the movements of ultrasonic transmitter implanted catfish and tag recaptures demonstrated the local movements which catfish make in the lower Red River. Several of the catfish implanted at Lockport moved downstream towards the mouth of the river and into tributaries of Netley-Libau Marsh in early June, 1988. Water temperatures had warmed unusually rapidly in 1988, and had reached temperatures considered optimum for catfish spawning by that time. This movement coincided with a decline in angler success in the area between Lockport and Selkirk, and an increase in success downstream in the Netley-Libau area. It appeared that most of the lower Red River adult catfish population engaged in a spawning movement into tributaries.

A seasonal decline in fishing success in the area below Lockport had been observed in previous years. The timing of the decline coincided with the presumed timing of spawning.

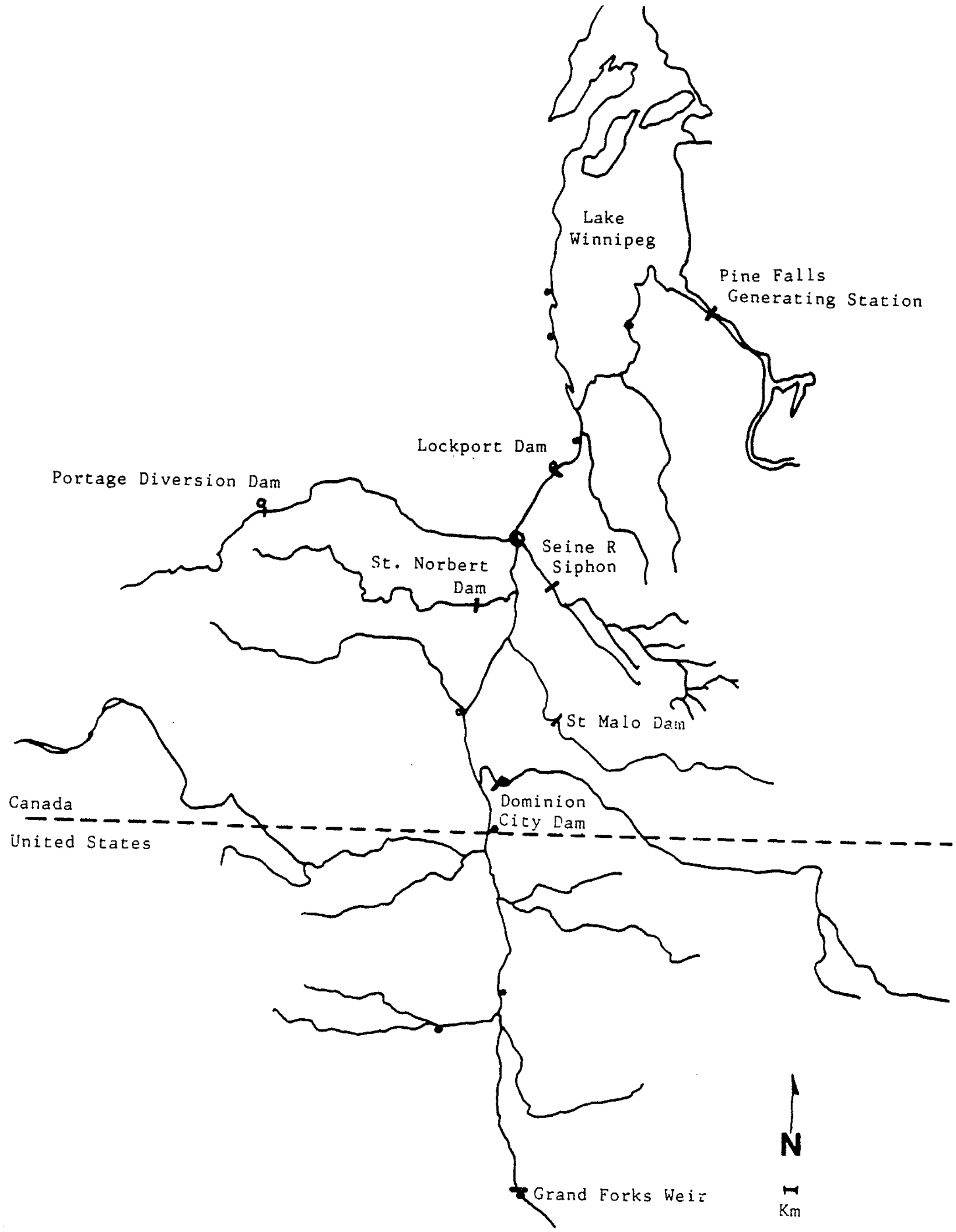

Fig. 49. Barriers to movement within the range of catfish from the lower Red River.

The same effect was observed by Hesse et al. (1979) in the Missouri River. The onset of catfish spawning would see a decline in catch success in the river, and a corresponding increase in success in tributaries, implying that catfish move into tributaries to spawn.

In previous years the coincidental improvement in angling in the Netley-Libau area was not noticed because this area was not intensively angled. Catfish angling in the Netley-Libau area was more intense in 1988 than in previous years. The angling success in this area following the decline in success upstream was therefore highlighted. Angling in the Netley-Libau area may have increased in 1988 because of the shift in research activities from the area below Lockport to the Netley-Libau area, which was inspired by poor catches below Lockport, and the movement of the ultrasonic implanted catfish.

Preserving Movement

The ability to move freely is crucial to the maintenance of the Red River catfish population. Movements into tributaries are necessary for access to spawning habitat. Tributary habitats are also important rearing areas. The Netley-Libau area was identified as especially important by this study. Hesse (1987) found that large numbers of Missouri

River catfish moved into tributaries to spawn, and to feed and stressed the point that tributaries required protection from impoundment and dewatering. Catfish at different stages of their life history occupy different habitats. The entire age composition of the population is not present in the lower Red River. Fish recruited into the fishery grow up in other parts of the watershed before moving into the lower Red. Maintaining the fishery requires that catfish, their habitat, and their freedom to move be preserved throughout their range.

'Fishing Holes'

Although transmitter implanted catfish made extensive movements throughout the study area, they were often found in specific locations. Many of these locations were already known to anglers as excellent angling areas. Some areas outside of the heavily angled stretch between Lockport and Selkirk were identified, and proved to be excellent angling locations once they were tried. The Red River near the mouth of Goldeye Creek proved to be one of these areas. One week four of the transmitter implanted catfish were located there. Both angling and hoop netting in this area proved successful. Tracking demonstrated that catfish preferred to hold in these specific areas, and when they did move, they moved rapidly to another area and then stayed there. No common variable which made these locations preferable could be identified.

Lockport Fishway

The only major obstruction on the Red River in Manitoba is the dam at Lockport. While this dam is probably one of the reasons that large catfish concentrated in this area, it is a potential barrier to movement. The dam also creates preferable catfish habitat by concentrating forage species in the well oxygenated water below it. The dam is equipped with a fishway which is known to be effective at passing most of the fish species found in the area, including catfish (O'Connor pers. comm.).

During summer 1988, the fishway was almost never functional because of low water levels on the downstream end. The outflow of the fishway ended with a substantial waterfall effect which denied passage to almost all fish. Fish passage was still possible, as it was during the period from 1968 to 1983 when the fishway was closed. The gates on the Lockport dam are opened each fall which would only allow passage on very rare occasions. The gates remain open until the spring runoff has past, a period during which movement through the gates should be possible. The navigational locks offer potential for fish movement upstream. Carp have been observed locking themselves upstream (Kolt pers. comm.). The water outlet for the locks is suitably located to attract fish to the lock entrance.

The lack of information about the catfish population prior to this study precludes identifying adverse impacts from the closure of the Lockport fishway from 1968 to 1983. Since the ability to move freely throughout their range appears to be important to catfish the fishway should be maintained in operation. Improvements to the fishway may be warranted to allow movement in low water years.

5.2 The Catfish Fishery

5.2.1 Creel Census

The lower Red River catfish fishery in 1988 differed from what had been observed in previous years. Angling success appeared to be reduced, as were the number of anglers. The drought that year was probably the single largest influencing factor. Drought conditions resulted in accelerated warming of the river and correspondingly early spawning. Catfish moved out of the area between Lockport and Selkirk to spawn, and fishing success below Lockport did not recover until fall. While some anglers were successful in the Netley-Libau area throughout the summer, angling success was poor in the most popular angling area below Lockport.

There are difficulties in comparing the results of the 1988 creel census with the 1982 census (Lysack 1986a). Angling for catfish formed only a small part of the Red River fishery in 1982, and the 1982 census was not designed to specifically target the catfish fishery. The 1982 census only recorded retained fish. Since the catfish fishery was felt to have a significant catch and release component by 1988, released fish were an important part of the 1988 census. Different objectives in the designs of the census' also led to the data being stratified differently. The 1982 census did not separate anglers in boats from anglers fishing from the shore, however there may be differences in the efficiency of these two groups and species that they target.

In 1982, 387 catfish were caught and retained by anglers expending 136,284 angler hours of effort in the Selkirk area. The Selkirk area included the Selkirk Park boat launch which was a strata in the 1988 census, but also included a large shoreline area not included in the 1988 census. In 1988, 358 catfish were retained by anglers using the Selkirk Park boat launch, however only 50,674 angler-hours of effort were expended. The harvest per angler-hour was 2.5 times the 1982 harvest.

The fishery has increased in popularity in recent years. The 1988 creel census provides only an indication of the increase in what was an atypical year. Further censusing of the fishery would be necessary to accurately determine the level of harvest.

An accurate comparison of the results of the 1982 and 1988 census data would require reanalysis of 1982 data after redefining the strata. The 1988 census was felt to represent an atypical year. The census was continued in 1989 and both the 1988 and 1989 census results are in preparation by Kristofferson and Lysack.

5.2.2 Master Angler Records

Manitoba's Master Angler program offers recognition to anglers catching fish over a minimum weight. The Master Angler Records were never intended to provide accurate statistics for fisheries management purposes. Trends in the Master Angler records may represent changes in fish stocks or angling effort, but may be biased by changing awareness or appreciation of the Master Angler program itself. Despite the potential for bias in the Master Angler records, there have been interesting trends in the catfish entries to the program since their introduction to the program in 1970.

The qualifying weight for channel catfish has gradually increased from 5.4 kg in 1970 to the current weight of 9 kg in 1986. Increases in the minimum qualifying weight were necessary to reduce the number of entries as the fishery became more popular. Each increase in the minimum qualifying weight usually resulted in a decline in the number of entries that year (Fig. 50). An exception was 1986, when the minimum weight was increased from 8 to 9 kg, and a record number of entries were still recorded. The previous year the media attention on the fishery had started to build which may have contributed to the increase in entries.

Over the history of channel catfish in the Master Angler program most of the catfish over 9 kg registered were from the Red River (Fig. 50). While the Red River is the source of the majority of Master Angler catfish entries, catfish are entered from other areas. The Assiniboine River, Winnipeg River and Lake Winnipeg have consistently made up a small percentage of entries, while tributaries to the Red, Assiniboine, and Lake Winnipeg provide occasional entries.

Some entries appear to be large burbot (Lota lota) mistaken for catfish. These include entries from the Burntwood and Churchill Rivers, and Gods Lake. These waterbodies are considerably north of what is currently considered the northern limit of channel catfish distribution. Large burbot are known to occur in these waters (Scott and Crossman 1973), and anglers likely confused them with catfish.

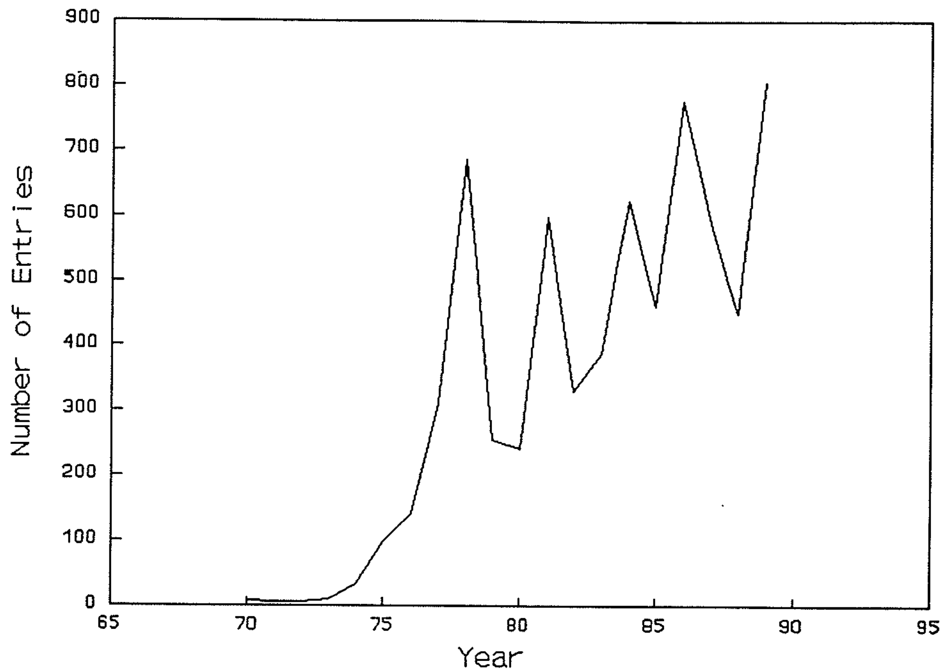

Fig. 50. Number of catfish entered into the Master Angler program annually.

Changes in the qualifying weight over the years have rendered comparisons between the total number of catfish entered each year meaningless. For purposes of comparison the current qualifying weight of 9 kg was used. From 1970 to 1980, few catfish over 9 kg were reported (Fig. 51). From 1980 to 1985 the number of catfish registered increased, with the largest increase occurring in 1986. Entries declined steadily during the next two years, before recovering to a new high in 1989. The majority of entries in any year was from the Red River.

The increase in the number of entries during the years leading to 1986 coincides with increased publicity for the fishery. The peak in 1986 saw the proportion of entries by American anglers increase to 41%, up from 12% only two years earlier (Fig. 52). The high level of American participation in the fishery continued in following years. The peak in 1986 may have been due to the publicity the fishery received during the previous year. The fishery had been extensively promoted, both by the attention it has received in angling publications and television, and by active promotion by the town of Selkirk.

Americans consider catfish to be their third most desirable sport fish, with 37% choosing it as most desirable

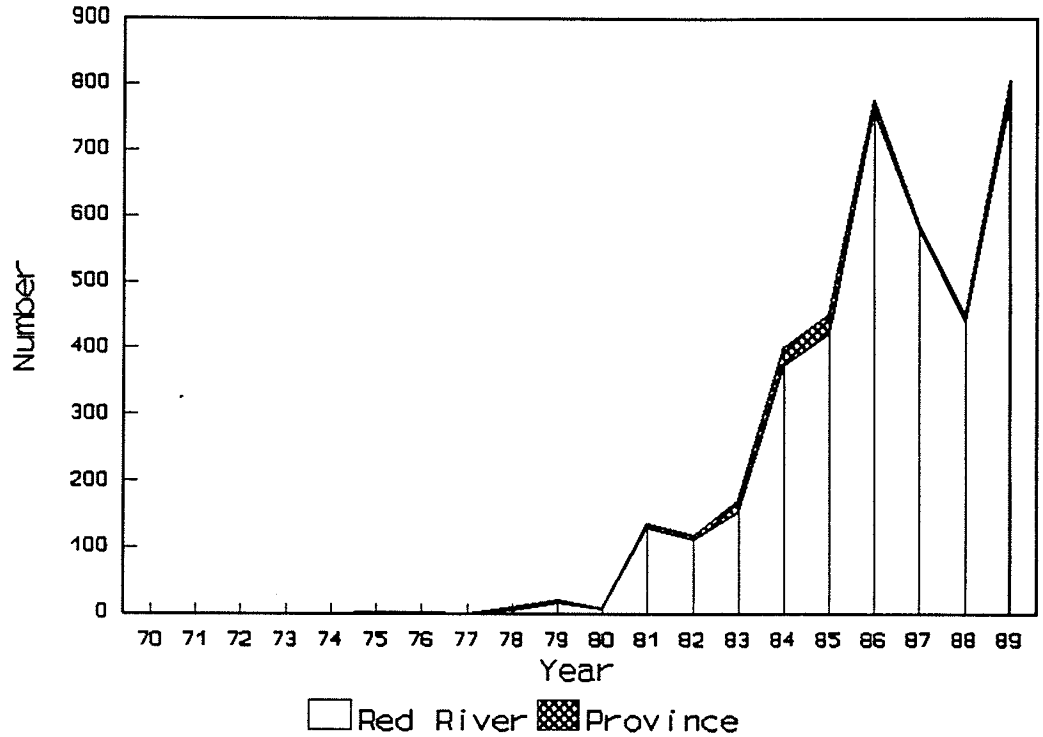

Fig. 51. Number of catfish 9 kg or larger entered in the Master Angler program annually, from the Red River and other locations in Manitoba.

(U.S.F.S. in Hesse and Mestl 1988). The average catfish caught by an angler in the Missouri River weighed 1.03 kg (Stone in Hesse and Mestl 1988). The 1985 Survey of Sport Fishing in Canada determined that only 0.7% of Manitobans considered catfish the most desirable catch.

The decline in the number of Master Angler catfish registered in 1987 and 1988 were likely due to weather which was unusually dry in 1987 and even worse in 1988. This would have influenced water warming rates, spawning times, and river flow conditions. This may have affected the fishing quality and the number of anglers fishing, thereby reducing the number of large catfish caught and registered. The angling limit for catfish was reduced from eight to four prior to 1986. This may also have had an adverse impact on the number of anglers participating in the fishery in 1987 and 1988. The limits did not appear to affect the number of anglers when they were introduced in 1986. The largest number of entries up to that point in time occurred in 1986.

Since 1980 the Master Angler program has offered a special badge for anglers who released their fish. The proportion of catfish which were released has increased from 27% in 1980, to 74% in 1988 (Fig. 53).

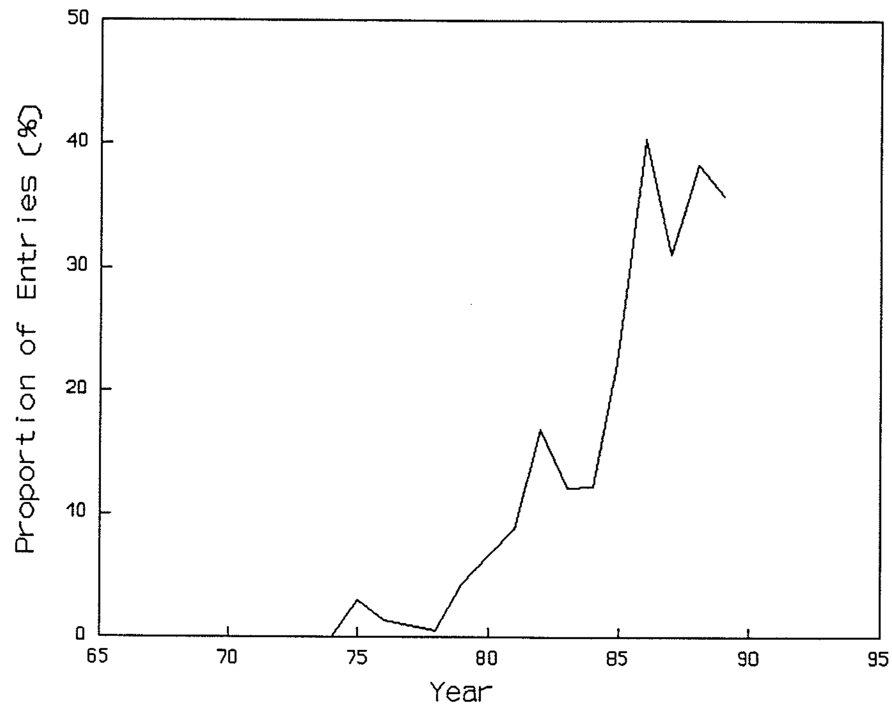

Fig. 52. Proportion of Master Angler catfish entered by American anglers.

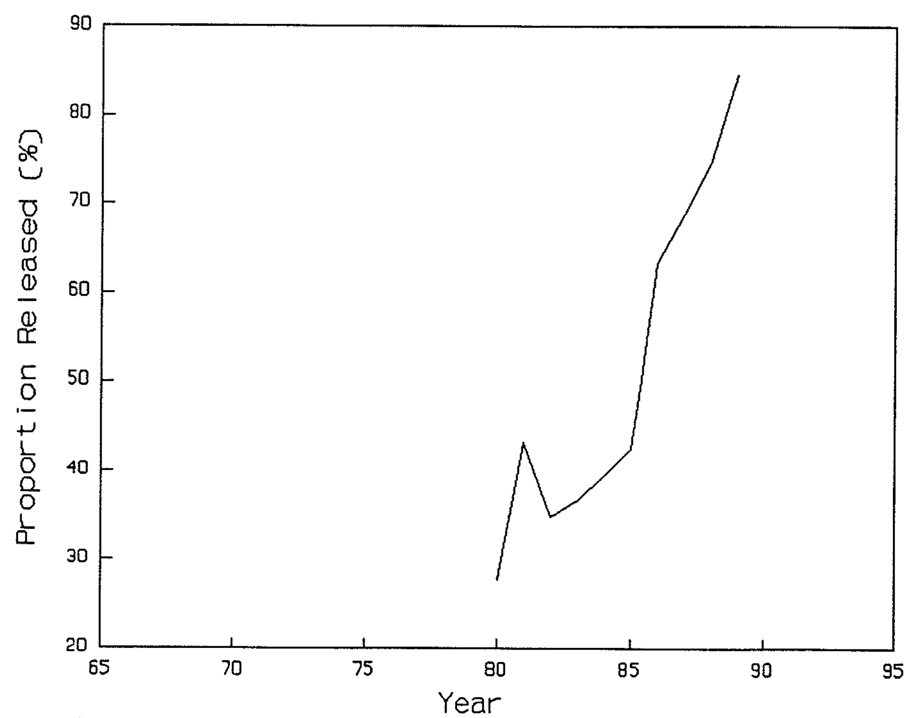

Fig. 53. Proportion of Master Angler catfish entries which are declared released annually.

5.3 Habitat

5.3.1 Habitat Utilization

Catfish are found throughout the Red River and its tributaries, in tributaries to Lake Winnipeg as far north as Berens River, and in Lake Winnipeg as far north as Grand Rapids. They have been shown to move throughout this range, limited only by physical barriers and presumably by temperature requirements at the northern limit of their range. Catfish are known to occur over a broad range of environmental conditions (Scott and Crossman 1973; Sigler and Miller in McMahon and Terrell 1982). There is a wide diversity of habitats available to catfish throughout this range and they may be utilizing the different habitats available in different areas at various stages of their life history.

The concentration of large channel catfish found downstream of Lockport utilizes a habitat offering high water temperatures, plentiful forage, and well oxygenated water below the dam. Optimum riverine conditions for catfish are characterised by warm temperatures (Clemmens and Sneed 1957; Andrews and Stickney 1972; Biesinger et al. in McMahon and Terrell 1982) and a diversity of velocities, depths, and structural features to provide food and cover (Bailey and Harrison 1948). Catfish will concentrate in the warmest sections of a waterbody (Ziebell 1973; McCall 1977; Stauffer et al. in McMahon and Terrell 1982).

Immediately upstream of Lockport the Red River is utilized by smaller catfish than are found below Lockport. Further upstream at Emerson, Manitoba and in the United States there are fisheries based on concentrations of large catfish. Tag returns indicate that these fisheries are probably based on the same catfish population as the lower Red River fishery.

Catfish are found in all the tributaries to the Red River. The Assiniboine River is the largest tributary, converging with the Red in Winnipeg. It is a more typical prairie river than the Red, with oxbows, backwaters, pools, riffles and braiding of the channel, and is also more typical catfish habitat.

Tributaries to the lower Red River, especially in Netley-Libau Marsh, provide spawning habitat for catfish in the lower Red River. The marsh also serves as a nursery area for juvenile catfish. The marsh is an extremely productive area utilized as a spawning and nursery area for many of the fish species found in the Red River and Lake Winnipeg (Janusz and O'Connor 1985) including emerald shiners which form the forage base for fish populations in Lake Winnipeg and the Red River (Lysack 1987).

The optimum lacustrine habitat for channel catfish consists of a large surface area, warm temperatures, high productivity, low to moderate turbidity, a complex shoreline, and abundant cover (McMahon and Terrell 1982). The south basin of Lake Winnipeg has minimal shoreline complexity, high turbidity, and water temperatures which are not optimal for catfish growth. The lake does not offer suitable spawning or nursery habitat, however it is excellent overwintering habitat.

Lake Winnipeg was the recapture location of 36% of the catfish tagged in Winnipeg by Clarke (pers. comm.). All recaptures were in close proximity to tributaries to the lake. Although no specific pattern of movement was determined, it appears that catfish from the Red River move into Lake Winnipeg and probably into tributaries to the lake. The Master Angler records contain entries from several significant tributaries to Lake Winnipeg such as the Brokenhead, Winnipeg, Manigatogan, Wanipigow, Fairford, Dauphin, and Bloodvein Rivers.

The tributaries on the east side of Lake Winnipeg are Pre-Cambrian shield rivers which are much less turbid than the Red River and its tributaries. The lack of turbidity may make cover a more important habitat requirement, since predation by perchids may be significant.

5.3.3 Spawning Habitat

At one time it was thought that catfish spawned downstream of Lockport, and that this was the reason for the large number of catfish in this area. There was no evidence that catfish spawn in the Lockport area and it appears that the concentration below Lockport is a feeding rather than a spawning accumulation. Catfish from the lower Red River were found to move downstream and into tributaries to spawn. Most spawning activity was concentrated in the tributaries and channels of Netley-Libau Marsh.

The suitability of channel catfish habitat is related to how well it fulfils spawning requirements (McMahon and Terrell 1982). Spawning is inhibited if suitable habitat is not available (Marzolf in McMahon and Terrell 1982; Grizzle 1985). Typical spawning sites are secluded semidark nests constructed by the male in cavities in the bank, undercut banks, submerged logs, roots or rocks (Scott and Crossman 1973; Pflieger 1975; Busch 1985; Becker in Holland-Bartels and Duval 1988). Cover is required, both visual and from current (McMahon and Terrell 1982).

The lower Red River between Lockport and Selkirk does not provide habitat which would be considered ideal for catfish spawning. The bottom is largely limestone bedrock, with some areas of cobble, silt, mud, or gravel. There are few areas with undercut banks or submerged trees. The river does not have defined pools and riffles, being of fairly consistent depth. Potential spawning habitat improves downstream towards Netley Creek, and is most suitable in the Netley-Libau Marsh complex at the river mouth. The marsh complex consists of large shallow lakes and marshes interconnected by creeks and channels. The lakes and marshes are turbid and vegetated to varying degrees providing cover for newly hatched catfish. Many of the channels and creeks are deep, scoured by currents resulting from wind seiche on Lake Winnipeg. These channels have steep, overhanging banks and muskrat holes offer nesting sites.

The movements of tagged catfish, ultrasonic tracking, and anecdotal accounts by anglers confirm that catfish move into the channels of the Netley-Libau Marsh complex during spawning season. The movement of catfish implanted with ultrasonic tracking tags in 1988 was especially conclusive. During early June they rapidly moved north from the Red River below Lockport towards, and then into, the marsh complex. During the spawning period none of the ultrasonically implanted catfish were found in the Red River between Lockport and Selkirk. Angling and hoop netting also indicated that most catfish left the Red River between Lockport and Selkirk during the spawning period.

Use of the marsh area by spawning catfish was confirmed by anglers and local residents who reported catfish activity in Salamonia Channel, Pruden Bay, and Devils Creek, all part of the marsh complex and suitable spawning habitats. Kristofferson (pers. comm.) confirmed that catfish utilize Netley-Libau Marsh for spawning and as a nursery area by capturing catfish ranging from 0 to 3 years while trawling channels in the marsh during 1989. Juvenile catfish are known to remain in tributary streams, migrating downstream to larger waterbodies as they grow older (Eddy and Underhill 1976).

Catfish in the lower Red River appear to be dependant on tributaries and the Netley-Libau marsh for spawning habitat. Little spawning occurs in the river channel between Lockport and Selkirk. Catfish populations in the channelized Missouri River are also sustained by tributary spawning (Hesse et al. 1979). Adult catfish move from the river into tributaries during spawning season. Adult catfish are known to be highly migratory and will move up very small streams to spawn (Trautman 1981). Bryan et al. (in McMahon and Terrell 1982) reported that catfish in large rivers are likely to move out of the river and into shallow, flooded areas to spawn.

5.3.4 Overwintering Habitat

As water temperatures fall, the metabolic rates of catfish fall and they seek wintering areas (Hesse and Newcombe 1982). They become lethargic, but not totally dormant, concentrating in main river channels and orienting to shelter from the current (Hawkinson and Grunwald 1979; Lubinski 1984). Overwintering habitat is characterized by deep water with boulders or debris to provide shelter from current (McMahon and Terrell 1982). Yearlings and subadults are more tolerant of currents than adults since they can overwinter by sheltering under boulders (Trautman 1981).

Although there has been no attempt to identify overwintering habitats utilized by catfish in the lower Red River, the river is deep enough for catfish to overwinter, and there are also many deep holes. The current in the Red River during winter is usually minimal, so there may be less need for shelter than has been observed elsewhere. The movements of one ultrasonic transmitter implanted catfish during the winter of 1988-89 demonstrated that catfish were active in the river during winter (Kristofferson pers. comm.). Catfish may also move into Lake Winnipeg to overwinter as suggested by Clarke (pers. comm.). Most of Netley-Libau Marsh freezes to the bottom and is unavailable as overwintering habitat (Janusz and O'Connor 1985).

5.4 Management

5.4.1 Regulations

The management of the lower Red River fishery has changed as the fishery has changed over the years. Manitobans have typically thought of catfish as an undesirable catch, and prior to 1981 there was no limit on catfish. A number of anglers, predominantly from Iowa, discovered the fishery and in 1981 a limit of eight was introduced. At that time little was known about either the fishery or the catfish population. The fishery began to attract media attention in 1985, and in 1986 limits were reduced to four catfish, only one of which could exceed 75 cm in length.

The unique feature of the lower Red River catfish fishery which attracted this attention was the high numbers of large catfish which anglers were catching. The introduction of a maximum length limit was intended to dramatically reduce the harvest of large catfish while leaving anglers with the option of taking smaller fish. The 75 cm limit was based on a small volume of data from the 1982 creel census (Lysack 1986a). The regulation effectively reduced the catfish possession limit to one, since anglers found it difficult to catch catfish smaller than 75 cm in length. This was felt to be an effective method of reducing harvest without reducing angling or business opportunities that the fishery provided, as per the philosophy of Manitoba's Sport Fishing Strategy (1985).

Maximum, minimum, and slot length limits are all used in the management of sport fisheries in Manitoba. Maximum length limits are a recent innovation in Manitoba and are the most commonly used. They are in place for walleye, large and smallmouth bass, northern pike, channel catfish, brook trout, lake trout, and all stocked trout. Maximum size limits are intended to conserve stocks of trophy sized fish. The intention is to distribute the harvest of large fish among more anglers and to conserve mature spawning stocks.

Vanderford (1986) surveyed catfish management in the United States. Management in most areas consisted of stocking and creel limits. At that time only two states used minimum length limits, none used either slot or maximum length limits. With the exception of Lake Moultree, and the Santee-Cooper tailrace (Stevens 1959), there are no accounts in the literature of catfish fisheries with mean ages, lengths, or weights as high as the lower Red River fishery. Maximum length limits would not be an effective management tool for fisheries exploiting smaller fish.

The use of maximum length limits has been effective, although there have been concerns about compliance. There have also been concerns that even with what is essentially a one fish limit, the harvest is larger than the population can sustain. The creel census did not provide a valid indication of the level of harvest which occurs. The fishery is not dependant on a small population of catfish local to the lower Red River, but a population which extends throughout the Red River drainage. The catfish exploited by the fishery are only a concentration of large catfish from this population. The low recapture rate of tagged catfish suggests that the fishery is not being overexploited at this time. Managing this fishery to maintain quality will require continued conservative management.

5.4.2 Catch and Release

The lower Red River catfish fishery has evolved into one which is predominantly catch and release in nature. The 1988 creel census determined that anglers released 74% of the catfish they catch. The 1988 Master Angler records also indicate that anglers released 74% of the Master Angler catfish which they entered in the program. This is due in part to the maximum length restrictions which limit the harvest of the large catfish which comprise the majority of catfish caught. There are also a large number of anglers fishing catfish solely for the sport of catching large fish, and voluntarily engaging in a no kill fishery.

Barnhart and Roelofs (1987) noted that "the definition of catch and release management has broadened from 'no kill, zero limit' only, to the use of 'special regulations' including size and possession limits which encourage anglers to release most of their catch, but allows them to keep some. Regulations encourage anglers to release the correct age and size of fish for the management purpose." While catch and release is an effective tool for maintaining the quality of a fishery, no kill can detract from the sport (May 1987).

Catch and release management can be used to produce a high quality fishery by recycling fish through the fishery several times, enabling them to live longer and grow larger (Wydoski 1977). While this works well under light to moderate angling pressure, hooking mortality and sublethal hooking stress may pose a problem when angling pressure is high. A catch and release fishery must be accompanied by low hooking mortality to be effective (Weithman and Anderson 1977).

Wydoski (1977) reviewed the literature on hooking mortality and concluded that initial mortality was usually related to hooking injury of vital organs. Most studies were related to salmonids, and none related specifically to catfish. Baited hooks were found to cause more mortality than artificial lures since the hooks are taken deeply. Single hooks were worse than trebles for the same reason. Barbless hooks did not result in significantly less mortality, however handling time was reduced which may have reduced stress.

There are few studies of hooking mortality for catfish. Rutledge (1974) found that 9% of angled catfish died of hooking injuries, and a further 36% died of disease resulting from handling and the caging required by the experiment. This study was limited to catfish under 30 cm in total length, and a large portion of the mortality may have resulted from the stress of the experiment itself. Vanderford (1986) reported that hooking mortality for catfish was poorly studied, however the State of Missouri had data which suggested that mortality was low.

Data from the lower Red River sport fishery suggests that catfish are well suited to catch and release angling. The most popular method of angling involves still fishing with a baited hook and a slip sinker, or a baited large jig. Although hooking injuries are usually most severe when angling with baited single hooks (Wydoski 1977), catfish angled this way are invariably hooked in the lip, and rarely suffer mortality from hooking injuries. Large numbers of catfish were angled as part of this study and hooking injuries which could result in mortality were never observed.

While hooking injury is avoidable and presumed to be rare, handling stress is a potential source of angling mortality. It is possible to land a large catfish, weigh or measure it, and release it, without adversely stressing the fish. Barbless hooks were observed to significantly reduce handling time. Unfortunately, perhaps because of their reputation as a tough, durable fish, catfish are occasionally treated with less care than other species of fish that anglers intend to release. Mortality of released fish usually results from gross mishandling.

The most common practice which excessively stresses catfish intended for release is to transport a large catfish to a scale on the shore to weigh it. While the situation is improved by the installation of weigh scales near the waters edge, fish should not be kept out of the water for any longer than necessary. This practice is especially serious because catfish fishing remains productive in the hottest weather of the summer. Keeping fish out of the water for even a brief period at this time of the year results in unacceptable levels of stress.

Transporting catfish to a scale occurs because few anglers have scales capable of weighing a large catfish. The recent change to the Master Angler program allowing anglers to enter lengths instead of weights should help.

Although many anglers in Manitoba have come to appreciate catfish as an excellent sport fish, there are still instances of catfish deliberately being killed and wasted (Kristofferson pers. comm.). Discarding catfish on the shoreline was a common practice prior to the publicizing of the fishery. The only solution to this problem will be angler education and peer pressure.

The 1987 Selkirk Game and Fish Association catch and release catfish derby demonstrated that catfish are well suited to catch and release derbies. While derbies must be, and are required to be, catch and release for important sport species, they may still have a detrimental impact if significant mortality occurs. Derbies must be properly organized to avoid unnecessary mortality, and anglers must be educated on how to handle their fish to minimize stress. Catch and release derbies provide an opportunity to educate anglers on catch and release.

The angling done as part of this study determined that 92% of the catfish caught were over 75 cm in length, and therefore protected by the length limit. In 1989 the regulations were further amended to allow anglers only one catfish per year over 85 cm in length. An estimated 68% of the catfish caught by anglers are affected by this regulation.

It is too early to determine the effect of the annual limit on catfish over 85 cm. The 75 cm limit has proven to be effective. Reducing the length limit to 65 cm would protect an estimated 97% of the catfish caught by anglers. Changes to the annual limit probably provide more protection than reducing the length limit for daily possession. If more protection is needed the annual limit may be reduced to include 75 cm catfish, or catch and release only could be instituted for catfish over a certain length.

Compliance is essential for any of these regulatory measures to be effective. Enforcement personnel are limited, although there has been a significant increase in enforcement on the lower Red River in recent years. Compliance can be increased through angler education, and peer pressure among anglers. The TIP program can be used to involve all anglers in the enforcement effort. The large number of anglers utilizing the lower Red River fishery provide a massive task to enforcement staff if their effort cannot be directed to specific problems.

5.4.3 Length Measurements

The development of a conversion formula from fork length to natural total length allows the biological data available (fork lengths) to be used in determining the effect of changes in length limit (natural total length) regulations. The available data could also be used to create a length weight conversion for use by the Master Angler program.

In 1989 anglers were allowed to submit lengths instead of weights to qualify for the Master Angler program. A table of estimated weights for various natural total lengths was supplied in the previous years edition of the Master Angler Awards. In 1989 there were 805 catfish entries, 46 of which were weights estimated from lengths. The minimum qualifying size for a channel catfish was 90 cm (natural total length), which was felt to be equivalent to a 9 kg fish. The table was derived from preliminary data from early in this study. The final data from this study indicate that 85 cm catfish average 9 kg, however there is considerable variation in weight for a given length.

The decision to use natural total length for regulations was based on the existing standard of using natural total length in the Master Angler program. Anglers were frequently observed to measure fish incorrectly. In the event that anglers measured maximum total length, or measured the length following the contours of the body, they were overestimating the length of the fish. This results in an error on the safe side, however anglers measuring fork lengths are underestimating the length of the fish and may be in violation of the regulations.

5.4.4 Public Involvement in Fisheries Management

The Red River Advisory Group

The Red River fishery is one of the most important fisheries in Manitoba in terms of the use it receives. To obtain an indication of the desires of users for the management of this fishery a series of public meetings were held in Selkirk. At the conclusion of this process a users advisory group, made up of local businessmen, anglers, and a representative from Fisheries Branch, was created to provide input and assist in the development of a management plan for the lower Red River. As part of this process the Advisory Group was provided with preliminary data from this study. Their management plan was released in December, 1988.

The Advisory Group made several recommendations pertaining to the management of the catfish fishery. The recommendations relevant to the channel catfish fishery were:

- All derbies should be no-kill for walleye and catfish.

  This was introduced for heavily fished waters such as the Red River in 1988. Derbies could be required to be barbless, and catch and release for certain species. The implementation of no-kill derbies for catfish should be successful. Catfish are capable of surviving catch and release derbies provided that reasonable care is exercised. Anglers and sponsoring organisations require information on how to handle fish for catch and release and assistance in organising derbies to minimize stress to the fish.

- Implement an annual quota of one for catfish over 85 cm in length.

  This was introduced in 1989. An 85 cm (nTL) catfish is approximately 9.05 kg (20 lbs.). This limit protects 68% of the catfish caught by anglers.

- Investigate means and regulations necessary to encourage a catch and release fishery for trophy catfish in the future.

A catch and release fishery for large catfish does not appear to be necessary at this time. Angler education is probably preferable to more regulation. Until it is shown that a catch and release fishery is necessary, or is desired by a large number of anglers, the population is well protected by the regulations in place. Further protection may be obtained by lowering the length of the catfish allowed under the annual limit. Changing this limit from 85 to 75 cm would change the portion of the population which is protected from 68% to 92%.

- Reduce the possession limit from 4, of which only 1 may exceed 75 cm, to 4, of which only 1 may exceed 60 cm.

  Reducing the length limit would mean that 98% of angled catfish would be over the limit instead of 92%.

- Conduct studies necessary for effective management of catfish populations. Protect habitat.

- Provide certified weigh scales to weigh fish close to the water at major access points.

Weigh scales were installed by Fish Futures Inc. in 1989.

Chapter 6

Conclusions and Recommendations

6.1 Conclusions

1) The catfish sport fishery on the lower Red River offers an opportunity to catch large channel catfish that appears to be unique in North America. The special nature of the fishery lies in the number of large sized catfish that are available to anglers.

2) The unique nature of this fishery appears to derive from the catfish population's history of being relatively unexploited compared to populations in the rest of North America. Excessive harvest of large catfish could easily eliminate the unique feature of this fishery. The Red River is a small and unproductive river in comparison with large rivers in the United States such as the Missouri or Mississippi. The catfish populations in these larger rivers have been depleted to the point where catfish the size of those in the Red River are rare. If the catfish populations of these tremendously large and productive rivers can be depleted than the population in the comparatively small Red River must be carefully conserved to avoid a similar fate.

3) The lack of earlier data precludes determining whether

the catfish population has suffered from the exploitation that it has received to date. The fishery appears to be exploiting a concentration of larger fish from a population which ranges throughout the Red River area.

4) The catfish exploited by this fishery are not specific to the lower Red River, but move throughout the Red River watershed. Movements occur throughout the range of catfish occurrence in Manitoba except where barriers to movement exist. It is not sufficient to merely protect the large catfish in the lower Red River from harvest. Catfish, their habitat, and their ability to move freely must be preserved throughout their range.

5) The growth rate of channel catfish in the Red River is comparable with catfish from southern populations, such as the Missouri River. There are catfish populations in other areas which do grow much faster, as there are areas where they have grown larger. The concentration of large catfish found in the lower Red River may be due a level of exploitation, which until recently, was much lower than in other parts of North America.

6) There is no lack of small catfish, and therefore no recruitment failure. A concentration of large fish are occupying the optimal feeding habitat in the system, and

appear to be outcompeting smaller adult catfish. The smaller adult catfish select habitats either upstream, or in Lake Winnipeg and its tributaries. Juvenile catfish, which have different diet and habitat requirements, are not subject to competition for either space or food and are present in large numbers.

7) Tributaries to the Red River are important spawning and rearing areas. The Netley-Libau Marsh complex appears to be a particularly important area of catfish habitat in the lower Red River.

8) The sport fishery for channel catfish has been observed to grow dramatically since Lysack's (1986a) 1982 creel census. The 1988 creel census was conducted in a year with poor angling success because of environmental conditions. It cannot be considered a reflection of the current status of this fishery.

6.2 Recommendations

1) The fishery should be managed to preserve the large catfish which make the fishery unique. Regulations should continue to restrict the harvest of larger older fish, encouraging the consumption of smaller catfish. Reducing the maximum size limit from 75 to 65 cm would not have a major

impact on the number of fish harvested. The annual limit of one on catfish over 85 cm imposed in 1989 should be effective. In the event that further changes are necessary, the annual length limit can be reduced to 75 cm, or the fishery may be made catch and release only for catfish over a certain size (ie. 85 cm).

2) Since the fishery is based on a concentration of larger fish which is recruited from a population that ranges throughout the Red River watershed, the population should be managed as one stock throughout its entire range. The entire catfish population must be protected from depletion, not just the portion of the population which is found on the lower Red River.

3) The freedom that catfish have to move throughout the Red River watershed must be preserved. Developments which would create barriers to fish movement should not be considered without making provision for fish passage. This applies not just to the Red River, but to its tributaries and tributaries to Lake Winnipeg as well. There is a danger of denying catfish access to important habitat such as spawning and rearing areas. It is important to remember that the catfish population appears to be wide ranging, and may be utilizing different habitats throughout their range.

4) Habitats utilized by catfish in various stages of their life history, such as spawning, rearing, and overwintering area, should be identified and preserved. The most important area discovered during this study was the use of the Netley-Libau Marsh complex as a catfish spawning and rearing area. Any development proposed for this area should consider the potential impact on the catfish population. Developments which would alter the movement of water through this area would likely have an adverse impact.

5) The status of the catfish population should be assessed periodically to determine whether more stringent management measures are required. The catfish sports fishery is a relatively recent phenomenon, and its impact on the population has not been determined. Using the data from this study as a baseline, future studies can determine whether the population of large catfish is being depleted. The optimum sampling method for determining the age composition of the portion of the population which is exploited by anglers is to use volunteer anglers to collect the data. Sampling anglers catches during a creel census would produce biased results since the current regulations restrict the harvest of larger fish.

6) As part of the effort to conserve stocks of large catfish, anglers who want to retain catfish should be

encouraged to retain smaller catfish. An effort should be made to inform anglers of the opportunity to capture smaller catfish that exists in other areas, such as the Red River upstream of Lockport, and tributaries on the east side of Lake Winnipeg.

7) Increasingly conservative regulations will have little effect if they are not accepted by anglers. A significant enforcement presence is justified in this area because of the level of use, and the value of the resource. Angler education must also play a role, publicizing the value of the fish, and the importance of proper handling. Anglers must accept some responsibility for protecting the fishery themselves, and can contribute towards the enforcement effort through the TIP program of the Manitoba Wildlife Federation.

8) The 1988 creel census was not representative of the status of this fishery. The creel census needed to be repeated, and was in 1989 (Kristofferson pers. comm.). Since the lower Red River is one of Manitoba's most important fisheries, regular censusing of the fishery should be conducted in the future as recommended by Lysack (1986a).

6.3 Further Study

1) The catfish population appears to make extensive

movements throughout the Red River watershed. A better understanding of these movements is needed to provide adequate habitat protection, and to determine the role which different habitats play. Because of the rapid and long ranging movements which have been observed, radio tracking would be more suitable than ultrasonic tracking. Tagging studies should tag in areas other than the lower Red River. The sport fishery on the lower Red River provides a concentration of capture effort. Fish tagged elsewhere and moving into the lower Red River are more likely to be recaptured than fish tagged in the lower Red River and moving elsewhere.

2) Factors affecting the recruitment of young catfish should be investigated. Hoop nets are an effective sampling method for smaller catfish and should be an effective means of detecting variations in year class strength. This study implied that year class strength in younger catfish varies and that the 1984 year class was a major contributor. Further study is necessary to determine whether this was a sampling artifact, or if there was a reason. Although baited hoop nets were not felt to be effective during this study, this technique is extensively used elsewhere and should probably be attempted again.

3) The contribution of Netley-Libau Marsh to the fish

populations in the Red River and Lake Winnipeg should be studied further. This is especially important if developments affecting water movement in the marsh area are being considered. This study implied that the marsh is an important spawning and rearing area for channel catfish. The degree to which catfish utilize this habitat should be investigated further.

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