WHITE LAKE FISHERIES ASSESSMENT

1989 FISHERY ASSESSMENT

by

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Abstract
In 1989 the sixth follow-up trapnet survey and summer creel census was conducted on White Lake to monitor populations, species compositions and angling success.

A negative correlation between fish productivity and water level stabilization was confirmed.

Stocking of walleye fingerlings moderately increased fishable stocks, but did not result in increased natural reproduction. Existing size limits may be incorrect, creel limits may be excessively high for some species, and non-game fish are under utilized. Management direction for White Lake requires review.

Purpose
The purpose of the 1989 assessment was to:
a) document fisheries trends,
b) relate fish populations to changes in water regimes,
c) provide information for future management direction.

Background
White Lake is a major fishery in the Carleton Place District. It has a potential capability of sustaining 22,692 satisfactory angler recreation opportunities per year. This was valuated as $1,046,387 in 1989 in accordance with the "Surrender Value" methodology developed by F.H. Everest, U.S. Forest Service. While the pike and bass fishery is the mainstay of a significant tourist industry, the most important overall attraction is the pickerel component.

Fish populations in general, and pickerel stocks in particular, had deteriorated severely on White Lake as a result of heavy harvests, tourist camp expansions, heavy cottage development and a water regime which caused siltation of the spawning substrate. In order to improve water quality, fish habitat and fish populations, the Ministry, the tourist outfitters, the White Lake Water Quality Committee and the Arnprior Fish and Game Club developed a rehabilitation plan. This included a revised water management program, coupled with a pickerel restocking program, scheduled to last 10 years, from 1977 to 1986.

White Lake is situated on the edge of the Precambrian Shield, and is located within the townships of Bagot, McNab, Darling and Pakenham. The lake was created in its present form through the damming of Waba Creek in the mid 19th century. White Lake is quite shallow and rich in nutrients. Total surface area is 2,249.5 hectares, maximum depth is 9.09 meters, mean depth 3.35 meters, total dissolved solids measure 130 mg/l and the total shoreline extends to 98.496 kilometres. The potential yield is 7.79 kg/ha/yr or 17,520.5 kg/year. In 1981 the lake had 496 cottages plus 5 commercial resorts and 2 tent and trailer parks for a total of 812 development unit impacts.

Angling pressure varies between 50,000 and 80,000 rod hours per year depending on weather and other factors. Fishing is the documented recreational activity of 62% of all lake users in the summer and estimated at 90% of users in the winter.

The lake is classified as a Class II "Principal Fishery" in the Carleton Place District Land Use Guidelines, i.e. a water managed principally for angling recreation, with other recreational activities allotted a lower rating.

Angling quality targets for Class II warmwater lakes are 0.72 kg of game fish/angler day or 1.76 kg of panfish/angler day.

Description

A detailed description of the lake, its geological and geographical setting, its history and recreational potential is given in the 1985 White Lake Fisheries Assessment Report. Shoreline development, heavy angler use and particularly changes in rule curves brought about significant changes in the White Lake fishery between 1959 and 1989.

Water Regime

From the mid 1800's to the 1950's waters of White Lake were used to power a sawmill on Waba Creek. In consequence the lake was subjected to summer drawdowns up to 5 vertical feet.

Following a change-over of the sawmill to electric and diesel power, the dam was left to deteriorate. As a result the lake experienced gradually receding water levels during the summer.

After the reconstruction of the dam in 1968 summer water levels were stabilized to accommodate the boating lobby. Within 2 years negative effects began to manifest themselves upon the fishery. Pickerel spawning shoals silted over; midsummer algae blooms appeared, leaving green slime on the shores; rock rubble was covered by calcareous algae. As a result natural reproduction of shore spawning fishes was impaired. For a limited time anglers happily reported the catches of larger and larger pickerel (Figure 7). Shortly thereafter the fishery collapsed (Figure 3).

By 1977 the rule curve was changed to gradual mid-summer drawdowns. Water clarity improved visibly (personal observations Hans von Rosen, Morris Stewart, Bud Lindsay) and fish populations recovered (Figures 1, 2, 3, 4).

In light of this recovery the moderately severe water regime was amended in 1981 to appease the boating lobby. The amended rule curve permitted partial retention of spring freshet waters throughout the summer. This modified summer drawdown was practiced until 1989.

The 1989 trap netting survey shows that the modified rule curve may have caused a renewed decline of gamefish and coarse fish, coupled with an explosion of perch stocks.

Trap Net Sets - 1989

Methods and Materials

Equipment, net sites, fishing times, and lifting schedules were identical to previous surveys (1985, 1980 and 1974) or as close thereto as reasonably possible (Map #1).

Four eight foot trap nets, with 160 foot leads made entirely of 2 inch stretch mesh were fished from May 22 to June 13. Nets were lifted every 48 hours and were moved to other locations as soon as fishing efficiency decreased (Table 1). Fish were counted, measured, weighed, scale sampled, marked and released alive. Incidentally killed specimen were retained for contaminant analysis.

General Observations

The White Lake fishery is going through visible composition changes. Catchability of all species groups declined from 1958 to 1980 and increased from 1980 to 1985.

During the immediate past 4 year period (i.e. 1985 - 1989) panfish catchability doubled, while gamefish and coarse fish declined (Figure 1).

Population Estimates

An attempt was made to calculate standing stocks on the basis of recaptures of marked fish. No recaptures were made of marked Walleye or of marked Smallmouth bass, making a population estimate of these species impossible. Calculations of Largemouth bass and Northern pike were possible. However, the margin of error at the 95% confidence level is wide (Table 6).

Specific Observations

Walleye

Walleye catchability declined gradually from 1959 to 1969. The population crashed in 1974 and continued to exist at a very low level to 1980. A healthy recovery of walleye was noted in 1985 followed by a moderate decline to 1989 (Figure 2). Walleye made up 16% of the fish biomass in 1959, 20% in 1969, 3% in 1980, 8% in 1985 and 9% in 1989 (see Figure 6). This level is significantly below the potential productivity of 32% suggested in the Partitioning of Yield document (SPOF 12). The apparent difference in the catchability curve and the composition curve of Walleye, noted specifically in 1974 and 1989 (Figure 1 and figure 7) suggest a change in recruitment. The age distribution from the 1974 catch shows over-aged stock, showing recruitment failures after 1969. Similarly the 1989 age composition shows recruitment failures from 1983 through to 1986. Walleye age compositions exhibit strongly fluctuating year classes and irregular age curves (Figure 7). The mean age of the Walleye sampled varied as follows: 1974 - 7.37; 1980 - 6.47; 1985 - 5.40; 1989 - 7.28. Growth rates appeared to be greatest in 1980, when the population was lowest, and conversely growth rate of young fishes had increased in correspondence to the

apparent recruitment failure (see Figures 8 and 7).

Summer angling success for walleye is poor at a C.U.E. of 0.023 fish per rod hour. The calculated summer angling catch for 1989 was 812 walleye, of which less than 100 were harvested. While no current fall and winter walleye angling catch data exist, historical data suggest that combined fall and winter walleye angling catches equal or exceed summer landings (D.F.M.P. background data).

Walleye fingerlings of Bay of Quinte origin were stocked in July of 1981 (25,000) and 1982 (19,000) respectively. The stated purpose of this stocking was to bolster parent stock, in the hope of establishing a larger, self-reproducing walleye population.

1985 trap net catches indicate the unusually strong presence of 1981 fish. Similarly the 1989 trap net catches indicate a strong presence of 1981 and 1982 fish, confirming the survival of the plantings. Conversely there appears to be no visible increase of naturally reproduced walleye, which might have been expected in 1989 as offspring of the matured 1981 and 1982 hatchery fish. It follows that the "imported" Bay of Quinte walleye stock did either not spawn at all, or not spawn successfully in White Lake.

Northern Pike

Pike trapnet catchability decreased gradually from a C.U.E. (catch per net per day) of 3.85 in 1959 to 0.98 in 1980. The species made a recovery, indicated by a C.U.E. of 6.09 in 1985. In 1989 pike catchability had declined slightly to 4.57 (see Table 1 and Figure 2).

Pike make up 23% of the total catch by weight and are the most common game fish in the lake (Figure 6). The mean age of pike has shifted as follows (Figure 12a):

year	1974	1980	1985	1989
age	3.32	3.48	4.32	3.74.

Overall growth rates have declined (Figure 12b).

No year class fluctuations are apparent and natural reproduction appears adequate. The low mean age indicates that angling pressure on pike is high. Summer anglers caught 3,295 pike in 25,554 hours of angling in 1989. Fall and winter catches normally increase the catch by a further 20%. The annual harvest is estimated as 1,800 fish.

Smallmouth Bass

Smallmouth bass did exist in White Lake in moderately large numbers prior to the 1960's. Today Smallmouth play a minor role since Largemouth were introduced. Smallmouth bass are subject to widely fluctuating year classes (Figure 14) and exhibit the high mean age of 6.48 years. In 1989 the species made up 0.27% of the trap net catch by number (Table 3) and 1.19% by weight (Table 5b).

The angler catch was calculated as 1,674, the harvest as 250 fish. Smallmouth bass appear to have stabilized at a low level.

Largemouth Bass

Largemouth bass trapnet catchability increased steadily from 1959 to 1985, and decreased from 1985 to 1989 (Figure 2). The species was introduced in 1957 by a one time stocking of 5,000 Largemouth bass fingerlings. In 1989 Largemouth bass made up 8% of the catch by weight (Table 5b and Figure 6). While the 1974 and the 1980 age distributions appear irregular, the 1985 shows a healthy presence of all age classes (Figure 10a). This regularity does not continue after the hatch of the 1983 year class.

The mean age of Largemouth bass has gradually increased to 6.55 showing that the species is not suffering from over harvest. The existing minimum size limit of 30cm does not appear to protect females through their first spawning season at age IV (Figure 10b).

Anglers caught almost 5,000 but kept only 1,400 Largemouth bass in 1989, which makes this the most important sports fish species (Table 7).

Yellow Perch

Concurrent with the decline of walleye, pike and Smallmouth bass from 1959 to 1969 Yellow perch demonstrated a rapid population expansion (Figures 2 & 3). This is a classic reaction of a prey species where top predators are removed. However, following the alteration of the water regime to summer stabilization in 1969 perch declined for 10 years in spite of still diminishing top predator populations. It is thought this decline was a direct reflection of deteriorating water quality. By 1985 perch were making a come back.

In 1989, and corresponding to the recent decline of top predators, the perch population has exploded (Figures 3 & 6). While the mean size and weight of perch have declined their numbers have increased to the point where perch now constitute 27% of the total catch by weight (Table 5b). Perch catches by anglers in White Lake are high. Perch harvests are low, most fish being too small to be retained by anglers (Table 7).

Pumpkinseed

Pumpkinseed have experienced a spectacular decline from 1959, when they made up 58% by weight of all fish taken to 1989, when they made up 6% only (Table 5b). Catchability of pumpkinseed decreased recently corresponding to the perch recovery (Figure 3). Mean sizes and weights are low. Their contribution to the angling fishery is negligible.

Rock Bass
This species has always played a minor role in White Lake, amounting to less than 2% of net catches by weight (Table 5b). Rock bass mean sizes are small.

Brown Bullhead
Bullheads have showed a gradual decline from 1959 to 1980, followed by a spectacular rise in 1985. By 1989 bullhead catchability has declined to about 1959 levels (Figure 4). Bullheads still make up 19% of the observed fish composition by weight.

Bullheads in White Lake are moderately large, and exist in adequate numbers to support a limited hoop net fishery (Table 5b and Figure 19). The occasional year class fluctuations are unexplained. A moderately strong angling fishery exists on White Lake for 2 weeks each spring.

Common White Sucker
Net catchability of sucker has always been low (Figure 4) and there have been no visible fluctuations in White sucker density over the years (Figure 5). A limited harvest for sucker exists on 3 spawning streams in the spring. White sucker of White Lake grow to large sizes (Figure 20).

Other Species
American eel are present in White Lake in very low numbers. During the 1980 survey a single rainbow trout was netted. This fish was presumed to be a migrant from an upstream trout lake. Bait fish have also demonstrated notable population shifts within the past 30 years (personal communications with local bait fish harvesters). White Lake is known to contain a sizeable population of Golden shiners.

Angling Fishery Summary
Annual angling pressure has varied as follows:

1974	80,000 rod hours
1977	62,000 rod hours
1980	86,225 rod hours
1985	76,919 rod hours
1989	40,500 rod hours.

Fifty percent of the fish harvest is composed of game fishes by number. This translates into a harvest of 90% volume of game fish by weight and 10% volume of other species by weight.

The total potential yield is 11,200 kg/yr. Due to the drop in angling pressure, harvests walleye, smallmouth bass and pike were lower in 1989 than the allowable take. Harvests of largemouth bass exceeded the allowable level. Panfish and bullheads are under utilized.

This apparently healthy status exists only because anglers return 88% of all game fish which they catch (1989 summer creel). Winter anglers however are less conservation minded.

Habitat

The hinterland around White Lake is composed of private and Crown land in roughly equal proportions. Land grants in the 19th century extended "to the water's edge". As a result less than 20% of the shoreline of White Lake is owned by the Crown today. A moratorium has been placed on the sale of shoreline reserves.

Where the shoreline has been acquired by private landowners extensive backshore and nearshore alterations have been undertaken. This has had detrimental impacts upon the littoral zone, through erosion, infilling, siltation, and shade removal. It has also led to unauthorized alterations of the littoral area, by removal of stumps or rocks, by the removal of aquatic vegetation, by the construction of docks, retaining walls and unauthorized dredging and filling.

Through these activities the productivity of the lake has been impaired (Harker and McCombie, Evaluation of the Littoral Zone).

Spawning Habitat

(1) Walleye: Stream spawning habitat is extremely scarce, and is incapable of sustaining consistent recruitment. Some good shoal spawning substrate still exists, although it is threatened with damage from cottage shore alteration. The shoal spawning substrate is also subject to algae growth and increasing siltation when water levels are managed for summer stabilization.

(2) Smallmouth Bass: Smallmouth bass spawning shores are also subject to siltation and algae growth through water level stabilization.

(3) Pike: Extensive areas of excellent pike spawning habitat are present. However these areas are vulnerable to inappropriate water level manipulation in late March and early April. They are equally threatened by infilling of cottage frontages.

(4) Largemouth Bass: Spawning habitat for largemouth bass is still adequate. However it is subject to damage by cottagers who insist on "cleaning up" bays and shorelines.

(5) Spawning areas for perch and bullheads are excellent.

(6) Sucker spawning substrate is rare.

Water Management

When assessing the impact of water management on fish populations by means of trap netting and creels, an impact delay period of 4 to 5 years must be expected. This represents the time delay required for year classes of fish affected by rule curve changes to become vulnerable to assessment methods.

On White Lake water level manipulation falls into 3 phases (Table 7 and Figures 20 - 24):

1. Pre 1977. Phase of basic summer stabilization. Impacts of this phase remained monitorable until 1981. This period is characterized by rapidly declining fish populations (Figures 1 through 4). While the public complained loudly regarding the failing fishery, the water regime was favourably accepted. Attempts to communicate ecological cause and effect relationships regarding fisheries and water level manipulations failed.

2. 1977 - 1981. Period of relatively severe mid-summer drawdowns. Effects expected to be visible by 1985/86. This period is characterized by an overall recovery of all three components of the fishery, namely panfish, coarse fish and game fish (Figure 1). Most pronounced benefits were experienced by Northern pike, Largemouth bass, Walleye (Figure 2) and Brown bullheads (Figure 4). Additional reported benefits were a visible clearing of surface waters as well as a reduction of algae growth from shoreline rubble (personal communication von Rosen/Stewart and von Rosen/Lindsay).

   In spite of attempts to explain the ecological reasons for the water regime public reaction to this water rule curve was best described as hostile.

3. 1982 - 1989. Period of modified midsummer drawdowns. Effects expected to be visible by and after 1986.

   This most recent period was monitored in 1989. It is characterized by a decline of game fish, a decline of coarse fish and a rapid increase of pan fish (Figure 1). Particularly noticeable are the drop in bullheads (Figure 4) and the explosion of perch (Figure 3). Walleye catch profiles are characterized by an absence of young age groups starting with the 1983 year class.

Public acceptance of this latest water regime is only partially successful. The majority of lake users still indicate a preference for summer stabilization while happily acknowledging an improvement in the fishery. Public memory of the poor conditions prior to 1977 has now largely faded.

Stocking

(a) Introductions

Smallmouth Bass	1903	successful
Walleye	1921	successful
Largemouth Bass	1957	successful
Maskinonge	1968 - 1971	not successful.

(b) Maintenance Stocking
Augmentation stocking of walleye EE was carried out sporadically from 1935 - 1940 and from 1963 to 1976. Walleye fingerlings were stocked in 1976, 1981 and 1982 (Figure 7).

While the maintenance stocking of walleye in 1981/82 resulted in an increase in the walleye population, it has not resulted in the hoped for broadening of the brood stocks.

Discussion
The gradual decline of the White Lake fishery was accelerated when water levels were stabilized in 1969. This resulted in a crash of walleye, sucker, bullhead, perch and pumpkinseed populations (Figures 2, 3, 4). The decline reversed itself after the change in rule curves of 1977. Since this recovery includes species which were not stocked, it is postulated that the recovery must be due to improved natural reproduction, caused by a habitat improvement, i.e. the change in water management (Figures 21 through 24). Following a relaxation of the severe water management scheme in 1983 the historical response of the fishery to water level stabilization appears to repeat itself. Particularly noticeable is the reaction of the walleye vs perch populations.

Three actions appear to have compromised the fisheries management design 1977 - 1986.

Firstly - The stocking of 25,000 walleye fingerlings in 1981 and again 1982; even if carried out in response to public requests and even if carried out for the purpose of bolstering future parent stock.

Secondly - The relaxation of mid-summer rule curve; again in response to public opinion and in light of visible improvements.

Thirdly - the privatization of the operation of the dam to a local contract person. It is acknowledged that this privatization has produced savings in the operating budget of the dam. It has also caused unsatisfactory alterations to the flow regime.

Considered in retrospect these three compromises may have been management mistakes.

Stocking of walleye at the rate of 10 summer fingerlings per hectare appear to have bolstered the remnant natural walleye fishery. However, the fact that the severe water regime from 1977 through 1981 resulted in walleye age classes from years which were not stocked, as well as improved production of species which were not stocked, shows that natural reproduction benefitted from a fisheries oriented rule curve (Figure 7).

The stocked walleye do not seem to have had a positive impact on natural reproduction.

The minimum size limits of 30cm for Smallmouth bass appears to be only partially effective (Figure 14). The 30cm minimum size limit for Largemouth bass is not considered effective at this time (Figure 10).

The implementation of a slot size limit of 35cm to 50cm for walleye, to assure improved natural reproduction, will not succeed, unless natural shoal spawning is assured. This is not the case at present. Any size limit for walleye would be inappropriate if the walleye fishery were to be maintained on the basis of stocking alone.

Pike natural reproduction is excellent, but the pike population is showing evidence of occasional over harvest. The reduction of pike harvests through creel limits, or other means, warrants consideration.

Walleye, Largemouth bass, Smallmouth bass and Northern pike as well as bullheads and White sucker seem to be affected by timely water management practices. The present relaxed water regime has caused declines in all four species.

Water level adjustments by a local contract operator have been neither timely nor in accordance with the existing rule curve.

The bullhead population is large enough to accommodate a substantial annual harvest. This can only be achieved by means of a restricted commercial fishery.

Secondary benefits of such a restricted commercial bullhead fishery would be a lowering of average bullhead sizes, thus making them a better forage species, plus a reduction of bullhead predation on pickerel eggs. At present bullheads are under utilized.

General Recommendations:

- Consider to increase the minimum size limit for Largemouth bass to 35cm, to safeguard spawning stocks

- Consider to increase the minimum size limit for Smallmouth bass to 35cm in light of the fact that many anglers will be unable to identify the species

- Consider a creel limit of 2 pike and 2 walleye

- Consider cancellation of the slot size limit for walleye on White Lake if a fish stocking option is chosen

- Carry out an active habitat protection enforcement program

- Promote littoral habitat preservation through cottage associations, township building inspectors and the Arnprior Fish and Game Club

- Direct the angling public towards increased utilization of coarse fish, notably bullheads

- Investigate the possibility of carrying out a spawning bed improvement project on additional feeder streams

- Initiate a restricted commercial bullhead fishery in order to enhance the forage base for game fishes through increasing bullhead fecundity and reducing the mean age of the bullhead population.

Specific Recommendations (internal MNR only)
Identify White Lake Management Direction

3 Options:

Option 1
Manage as a pike/Largemouth bass fishery by operating the relaxed rule curve to the 1989 actual water levels. Contract the operation of the dam to a White Lake resident and accept the resulting loss of the walleye population. This will reduce the annual recreation output, through the loss of the walleye fishery in May and June, the loss of the winter walleye fishery, by an estimated total of 15,000 opportunities per year. In consequence it will have a negative impact on the tourist industry.

Option 2
Re-implement the severe 1977 rule curve and operate the White Lake dam with MNR staff. This will predictably result in annual public complaints about water levels. It will also increase annual dam operating costs from $500.00 to $2,000.00. This will maintain the

tourist industry, maintain a rudimentary walleye fishery if an appropriate size limit is in place.

Option 3
Operate a relaxed water regime through contract maintenance, combined with an annual walleye fingerling stocking program. Required stock for a satisfactory walleye fishery - 2,300 hectare x 100 fgl = 230,000 fgl/yr. While this would almost certainly create a walleye fishery it is economically not acceptable. 250,000 fgl. equals the total annual production of a complete hatchery. Smallmouth bass would be suppressed.

This approach would set a management precedent and result in wide range demands to stock virtually all other walleye fisheries. It would naturally find wide public acclaim.

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Bibliography

Lake Surveys:
Unpublished Lands and Forests and Ministry of Natural Resources reports:

Survey Year	Author	District
1959	Littkeman, Peter	Tweed
1969	Ellah, Robert	Kemptville
1975	Thomas, Evan	Lanark
1977	von Rosen, Hans	Lanark
1980	Hamilton, James	Lanark
1985	von Rosen, Hans	Carleton Place

Creel Census:
Unpublished M.N.R. District Reports

Survey Year	Author
1969, 1979, 1972	Gary Tupling & R. Baldwin
1973	Lynn Pratt
1976/77 (winter)	H. Mulholland
1977	J. Strachan
1980	J. Hamilton
1985	P. Aunger
1989	J. McNaughton (CREESYS)

Aerial Angler & Boat counts:
Unpublished M.N.R. District Reports

Survey Year	Author
1978/79	B. Gopsill & W. Lashley
1981	A. Macey

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vonRosen, H. and Evan Armstrong, 1982, Carleton Place District Fisheries Management Plan, Unpublished District Report, Carleton Place District

Land Use Plans:
Carleton Place District Land Use Guidelines, 1983, Ministry of Natural Resources District document, published.

Carleton Place District Fisheries Management Plan 1987 - 2000, Ministry of Natural Resources, published.

Table 1 TRAPNET CATCHES BY DAY FOR THE 1989 TRAPNET STUDY ON WHITE LAKE

DATE	NO. NET DAYS	Y. PICKEREL		SMB		LMB		N. PIKE		Y. PERCH	PUMPKINSEED	R. BASS	W. SUCKER	BULLHEAD	G. SHINER
		C	R	C	R	C	R	C	R	C	C	C	C	C	C
May 26	4	7	-	Nil	-	16	-	60	-	68	70	33	4	86	Nil
May 28	8	9	-	Nil	-	9	-	46	-	324	91	48	10	64	1
May 30	8	8	-	1	-	21	-	45	2	149	42	33	4	121	2
Jun 1	8	5	-	1	-	10	1	31	3	158	71	18	4	92	Nil
Jun 3	8	14	-	1	-	9	1	34	-	352	52	14	8	59	2
Jun 5	8	9	-	8	-	19	-	31	1	1030	148	22	3	57	Nil
Jun 7	8	7	-	6	-	3	-	35	-	859	118	32	6	184	Nil
Jun 9	8	7	-	Nil	-	12	-	27	1	482	148	37	5	594	Nil
Jun 11	8	5	-	1	-	11	-	25	-	426	139	18	2	42	Nil
Jun 13	8	1	-	1	-	18	1	27	-	695	84	12	Nil	33	1
Jun 15	8	8	-	3	-	8	-	23	1	672	125	20	Nil	51	Nil
TOTAL	84	80	-	22	-	136	3	384	8	5215	1088	287	46	883	6
C.U.E.	N/84	0.95		0.26		1.62		4.57		62.08	12.95	3.42	0.55	10.51	0.07

Table 2 TRAPNET CATCHES BY DAY FOR THE 1989 TRAPNET STUDY ON WHITE LAKE

NET NO.	NO. NET DAYS	Y. PICKEREL C	Y. PICKEREL R	SMB C	SMB R	LMB C	LMB R	N. PIKE C	N. PIKE R	Y. PERCH C	Y. PERCH R	PUMPKINSEED C	PUMPKINSEED R	R. BASS C	R. BASS R	W. SUCKER C	W. SUCKER R	BULLHEAD C	BULLHEAD R	G. SHINER C	G. SHINER R
1	8	8	-	1	-	19	-	48		171		67		28		11		173		1	
2	10	8	-	1	-	38	1	100	3	229		141		43		6		96		2	
3	8	8	-	Nil	-	6	-	31	2	136		43		46		8		35		1	
4	8	10	-	Nil	-	3	-	20	-	290		64		36		3		65		1	
5	14	23	-	7	-	15	-	86	2	1620		209		39		7		406		Nil	
6	6	2	-	5	-	5	-	12	-	555		17		10		1		Nil		Nil	
7	6	8	-	6	-	3	-	16	-	570		110		35		8		46		Nil	
8	8	5	-	2	-	18	-	22	-	463		249		20		Nil		11		Nil	
9	6	2	-	Nil	-	2	-	14	1	345		30		10		2		1		Nil	
10	6	2	-	Nil	-	12	-	24	-	359		61		8		Nil		19		Nil	
11	4	2	-	Nil	-	15	-	11	-	477		97		12		Nil		31		1	
TOTAL	84	80	-	22	-	136	3	384	8	5215		1088		287		46		883		6	
C.U.E.	N/84	0.95		0.26		1.62		4.57		62.08		12.95		3.42		0.55		10.51		0.07	
% of Total Catch		0.98		0.27		1.67		4.71		64.01		13.35		3.52		0.56		10.84		0.07	

Table 3 WHITE LAKE TRAPNET STUDIES - COMPOSITION AND CATHABILITY TREND BY NUMBER

SPECIES	1959 NO.	1959 %	1959 C.U.E.	1969 NO.	1969 %	1969 C.U.E.	1974 NO.	1974 %	1974 C.U.E.	1980 NO.	1980 %	1980 C.U.E.	1985 NO.	1985 %	1985 C.U.E.	1989 NO.	1989 %	1989 C.U.E.
GAME FISH																		
Y. Pickerel	n/a	3.41	8.77	n/a	2.49	2.93	n/a	0.53	0.37	17	0.33	0.12	152	2.06	1.73	80	0.98	0.95
Sm Bass	n/a	1.29	3.33	n/a	0.16	0.19	n/a	0.80	0.51	30	0.59	0.22	59	0.80	0.67	22	0.27	0.26
Lm Bass	n/a	0.01	0.04	n/a	1.17	1.38	n/a	3.36	2.15	275	5.40	1.99	354	4.80	4.02	136	1.67	1.62
N. Pike	n/a	1.50	3.85	n/a	2.35	2.76	n/a	4.28	2.63	135	2.65	0.98	536	7.27	6.09	384	4.71	4.57
		6.21	15.99		6.17	7.26		8.97	5.66	457	8.97	3.31	1101	14.93	12.51	622	7.63	7.40
PAN FISH																		
Y. Perch		6.00	15.43		29.32	35.41	n/a	20.13	12.86	1130	22.20	8.19	1386	21.52	18.02	5215	64.01	62.08
Pumpkinseed		81.87	210.46		54.99	64.74	n/a	57.71	36.55	2608	51.24	18.90	2438	33.08	27.70	1088	13.35	12.95
Rock Bass		0.16	0.41		1.94	2.28	n/a	3.36	2.15	228	4.48	1.65	346	4.69	3.93	287	3.52	3.42
		87.94	226.30		86.25	101.53		82.58	52.38	3966	72.92	28.74	4370	59.29	35.56	6590	80.88	78.45
COARSE FISH																		
Bullhead		5.22	13.43		7.20	8.47		8.04	5.50	637	12.52	4.62	1816	24.68	20.67	883	10.84	10.51
W. Sucker		0.62	1.59		0.34	0.40		0.43	0.27	23	0.45	0.14	78	1.06	0.89	46	0.56	0.55
G. Shiner		0.00	0.00		0.04	0.00		0.05	0.00	5	0.09	0.04	2	0.027	0.023	6	0.07	0.07
		5.84	15.02		7.58	8.87		8.52	5.77	665	13.06	4.80	1899	25.767	21.583	935	11.47	11.13
TOTALS		100.00	257.31		100.00	117.66		100.00	63.81	5088	100.00	36.85	7370	100.00	69.653	8147	100.00	96.98

Table 4 TRAPNET COMPOSITION IN % - WHITE LAKE 1959, 1969, 1974, 1980, 1985 AND 1989 - % BY NUMBER

	1959		1969		1974		1980		1985		1989	
GAME FISH												
Y. Pickerel	54.9	( )	40.3	(123)	6.46	(62)	3.72	(17)	13.80	(152)	12.86	(80)
Sm Bass	20.8	( )	2.6	(8)	9.06	(87)	6.56	(30)	5.37	(59)	3.54	(22)
Lm Bass	0.2	( )	19.0	(58)	38.02	(365)	60.18	(275)	32.15	(384)	21.86	(136)
N. Pike	24.1	( )	38.1	(116)	46.46	(446)	29.54	(135)	48.68	(536)	61.74	(384)
	100.00		100.0	(305)	100.00	(960)	100.00	(457)	100.00	(1101)	100.00	(622)
PAN FISH												
Y. Perch	6.8	( )	33.99	(1450)	24.56	(2180)	28.49	(1130)	36.29	(1586)	79.14	(5215)
Pumpkinseed	93.0	( )	63.76	(2720)	69.77	(6193)	65.76	(2608)	55.79	(2438)	16.51	(1088)
Rock Bass	0.2	( )	2.25	(96)	5.67	(503)	5.75	(228)	7.92	(346)	4.36	(287)
	100.00	( )	100.00	(4266)	100.00	(8877)	100.00	(3966)	100.00	(4370)	100.00	(6590)
COARSE FISH												
Bullhead	87.5	( )	94.93	(356)	94.82	(933)	95.76	(637)	95.79	(1819)	94.44	(833)
W. Sucer	12.5	( )	4.53	(17)	4.67	(46)	3.46	(23)	4.10	(78)	4.92	(46)
G. Shiner	00.0	( )	0.54	(2)	0.51	(5)	0.75	(5)	0.11	(2)	.64	(6)
	100.00	( )	100.00	(375)	100.00	(984)	100.00	(665)	100.00	(1899)	100.00	(935)

Table 5 (a) WHITE LAKE SPECIES COMPOSITION COMPARISON - 1959, 1969, 1974 - BY WEIGHT

SPECIES	1959 C.U.E.				1969 C.U.E.				1974			
	AVE WEIGHT	BY NO.	BY WEIGHT	% COMPOS	AVE WEIGHT	BY NO.	BY WEIGHT	% COMPOS	AVE WEIGHT	BY NO.	BY WEIGHT	% COMPOS
Y. Pickerel	1025	8.77	8989.25	16.242	1800	2.93	5274.00	19.947	1890	0.37	699.30	4.189
Sm Bass	980	3.85	3773.00	6.817	1240	2.75	3244.40	12.944	1030	2.63	2708.90	18.165
Lm Bass	700	3.33	2331.00	4.212	760	0.19	144.40	0.546	645	0.51	328.95	2.206
N. Pike	700	0.04	28.00	0.051	550	1.38	759.00	2.870	850	2.15	1827.50	12.255
			15121.25	27.322			9599.80	36.307			5564.65	37.315
Y. Perch	94	15.43	1450.42	2.621	94	34.51	3243.94	12.269	94	12.86	1208.84	8.106
Pumpkinseed	154	210.46	32410.84	58.559	154	64.74	9969.96	37.707	159	36.55	5628.70	37.744
Rock Bass	100	0.41	41.00	0.074	100	2.28	228.00	0.862	100	2.97	297.00	1.992
			33902.26	61.254			13441.90	50.400			7134.54	47.842
Bullhead	334	13.43	4485.62	8.105	334	8.47	2828.98	10.699	334	5.50	1837.00	12.318
W. Sucker	1156	1.59	1838.04	3.321	1156	0.40	462.40	1.749	1156	0.27	312.12	2.093
Am Eel	2150	0.00	0.00	0.000	2150	0.05	107.50	0.407	2156	0.03	64.50	0.433
Ch Catfish	1500	0.00	0.00	0.000	1500	0.00	000.00	0.000	1500	0.00	00.00	0.000
			6323.66	11.425			3398.99	12.855			2213.62	14.844
Weight in grams			55347.17	100.001			26440.5	99.562			14912.81	100.001

Table 5 (b) WHITE LAKE SPECIES COMPOSITION COMPARISON - 1980 - 1989 - BY WEIGHT

SPECIES	1980 C.U.E.				1985 C.U.E.					1989				
	AVE WEIGHT	BY NO.	BY WEIGHT	% COMPOS	AVE WEIGHT	AVE LENGTH	BY NO.	BY WEIGHT	% COMPOS	AVE WEIGHT	AVE LENGTH	BY NO.	BY WEIGHT	% COMPOS
Y. Pickerel	1825	0.12	219.00	2.615	1304	49.61	1.73	2255.92	8.223	1798	58.1	0.95	1712.38	9.567
Sm Bass	1005	0.98	984.90	11.762	1124	58.47	6.09	6845.16	24.950	812	36.5	0.26	212.67	1.188
Lm Bass	525	0.22	115.50	1.379	897	38.82	0.67	600.99	2.191	972	38.0	1.62	1573.71	8.792
N. Pike	705	1.99	1402.95	16.754	847	36.34	4.02	3404.94	12.410	914	52.7	4.71	4178.29	23.342
			2722.35	32.150				13107.01	47.775				7677.05	42.889
Y. Perch	94	8.19	769.86	9.194	94	19.75	18.02	1693.88	6.174	77	18.9	62.08	4780.42	26.705
Pumpkinseed	154	18.90	2910.60	34.759	154	16.51	27.70	4265.80	15.549	88	15.6	12.95	1139.81	6.368
Rock Bass	100	1.65	165.00	1.970	100	15.78	3.93	393.00	1.432	94	16.1	3.42	321.17	1.794
			3845.46	45.923				6352.68	23.155				6241.40	34.867
Bullhead	334	4.62	1543.08	18.428	334	27.65	20.67	6903.78	25.164	321	28.2	10.51	3374.32	18.851
W. Sucker	1156	0.14	161.84	1.933	1156	44.33	0.89	1028.84	3.750	1101	44.1	0.55	602.93	3.370
Am Eel	2150	0.04	86.00	1.027	2150	95.00	0.02	43.00	0.156	n/a	n/a	0.00	0.00	0.000
Ch Catfish	1500	0.01	15.00	0.179	n/a	n/a	0.00	00.00	0.000	n/a	n/a	0.00	0.00	0.000
Golden Shiner	n/a	n/a	0.00	0.000	n/a	n/a	0.00	00.00	0.000	65	16.4	0.07	4.64	0.026
			1805.92	21.567				7975.62	29.070				3981.89	22.247
Weight in grams			8373.73	99.640				27435.31	100.000				17900.34	100.000

TABLE 6 POPULATION ESTIMATES FOR WHITE LAKE 1989

POPULATION ESTIMATES FORMULA - $P = \frac{Mlu + rl}{r}$

M - marked and released fish, excluding last days catch

r - recaptured

u - unmarked fish, exluding first days catch

Standard Error Formula $SE = \frac{P\ (P-m)\ (P-u)}{Mu\ (P-1)}$

Game Fish Species	1989 Population	+ or -
Y. Pickerel	-	-
Smallmouth Bass	-	-
Largemouth Bass	5,077	1,405
Northern Pike	14,982	1,540
Total	20,059	

Yellow Pickerel

$P = \frac{72\ (73 + 0)}{0} = 00$

Note: no recaptures, unable to calculate

Smallmouth Bass

$P = \frac{19\ (22 + 0)}{0} = 00$

Note: no recaptures, unable to calculate

Largemouth Bass

$P = 128\ (116 + 3) = 5077.33$ $SE = \frac{5077\ (5077 - 128)\ (5077 - 136)}{128 \times 136\ (5077 - 1)}$

Calculated Population = $5077 + 2810 = \frac{5077\ (4949)\ (4941)}{17408\ (5076)} = 1405$

Northern Pike

$P = 361\ (324 + 8) = 14982$ $SE = \frac{14982\ (14982 - 361)\ (14982 - 384)}{361 \times 384\ (14982 - 1)}$

Calculated Population = $5077 + 2810 = \frac{14982\ (14621)\ (14598)}{361 \times 384\ (14981)} = 1540$

Table 7

White Lake Water Levels

Original Rule Curve 1977 - 1980		Amended Rule Curve 1981 - 1989	
January 1	2.5	January 1	2.5
January 15	2.5	January 15	2.5
February 1	2.5	February 1	2.5
February 15	2.5	February 15	2.5
March 1	2.5	March 1	2.5
March 15	3.5	March 15	3.5
April 1	4.5	April 1	4.5
April 15	5.2	April 15	5.2
May 1	5.2	May 1	5.2
May 15	5.0	May 15	5.0
June 1	4.5	June 1	5.0
June 15	4.5	June 15	4.5
July 1	4.0	July 1	4.0
July 15	3.5	July 15	3.75
August 1	3.5	August 1	3.6
August 15	3.5	August 15	3.5
September 1	3.0	September 1	3.0
September 15	2.5	September 15	2.5
October 1	2.5	October 1	2.5
October 15	2.5	October 15	2.5
November 1	2.5	November 1	2.5
November 15	2.5	November 15	2.5
December 1	2.5	December 1	2.5
December 15	2.5	December 15	2.5

Note:
- All levels to be considered within a 6" fluctuation margin. No drawdowns later than September 15th regardless of level attained.
- Contract operator not successful in maintaining design water levels on time.

FIGURE 1. WHITE LAKE - TRAPNET C.U.E. BY NUMBER FOR GAME, COARSE, PAN AND TOTAL FISH

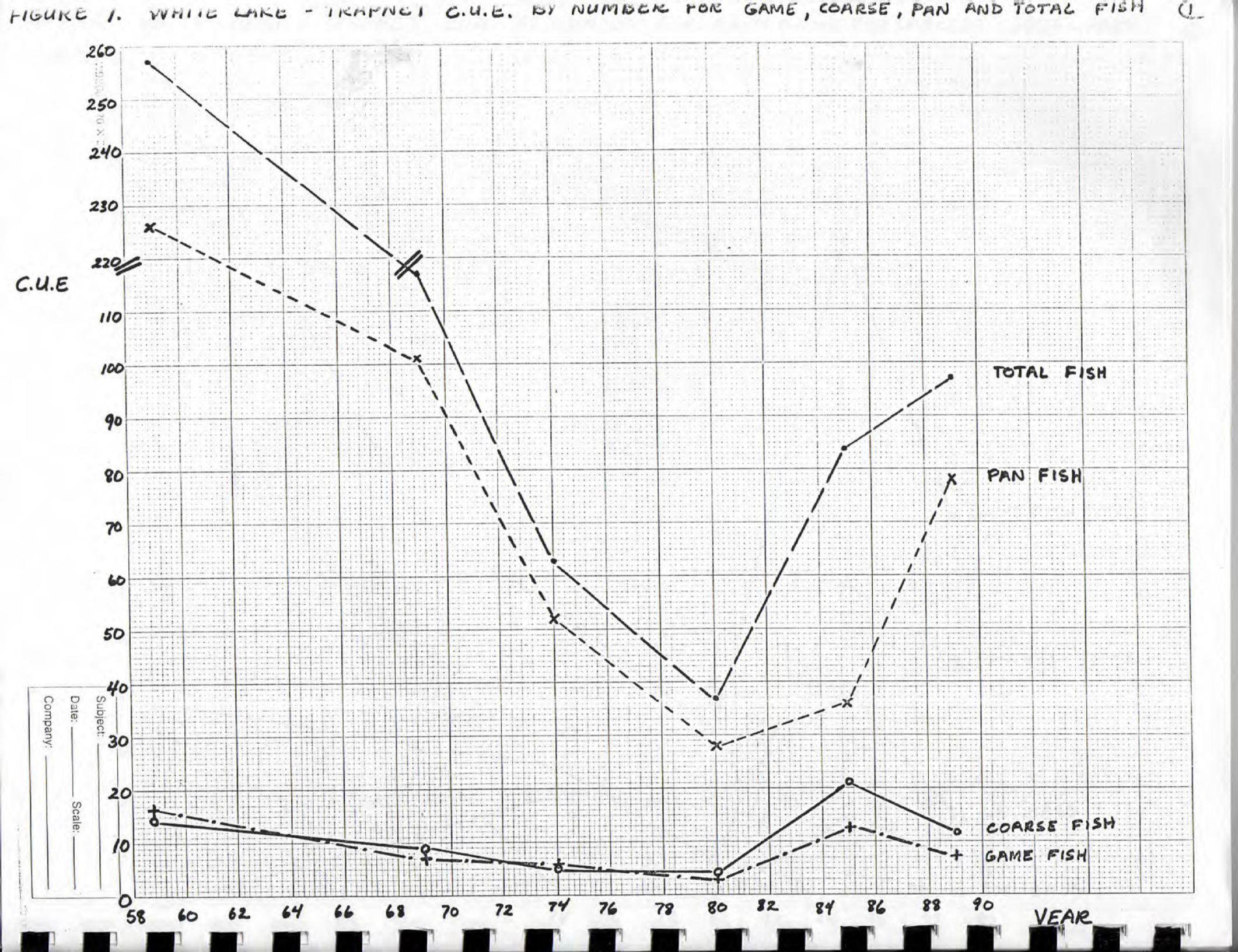


FIGURE 2. WHITE LAKE - TRAPNET C.U.E. BY NUMBER FOR EACH GAME FISH SPECIES, 1959–1989

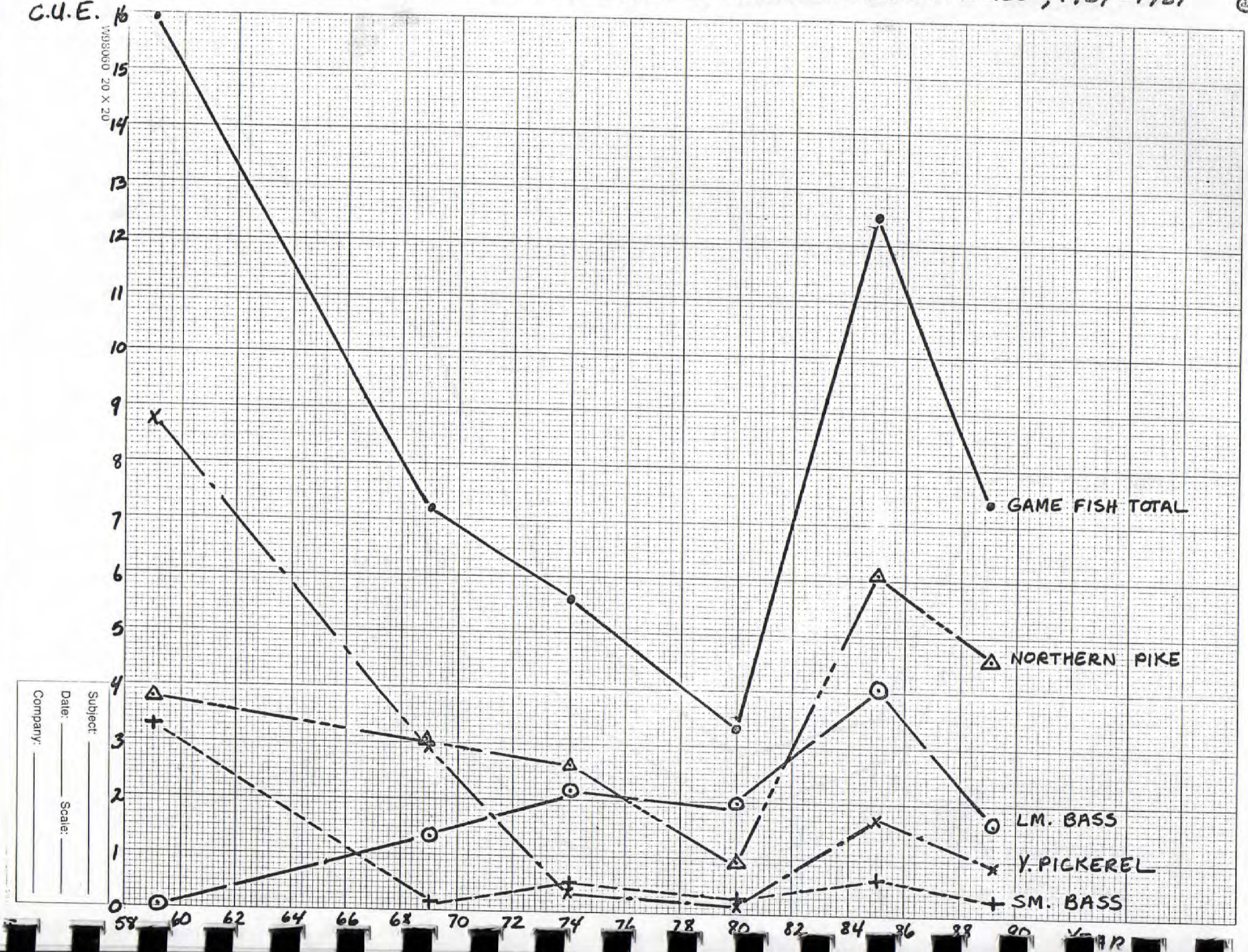
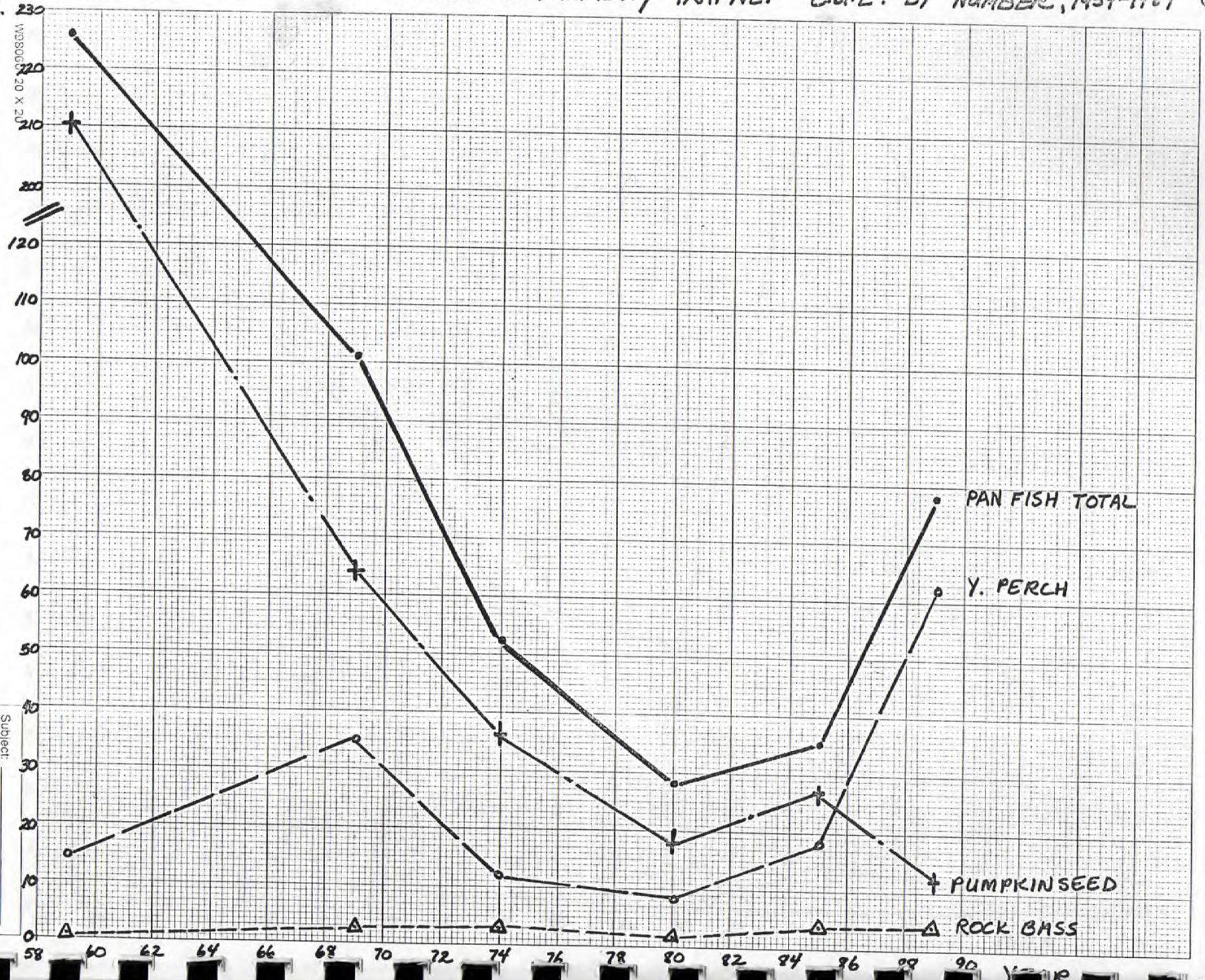


FIGURE 3. WHITE LAKE - POPULATION TRENDS OF PANFISH / TRAPNET C.U.E. BY NUMBER, 1959-1989 (3)



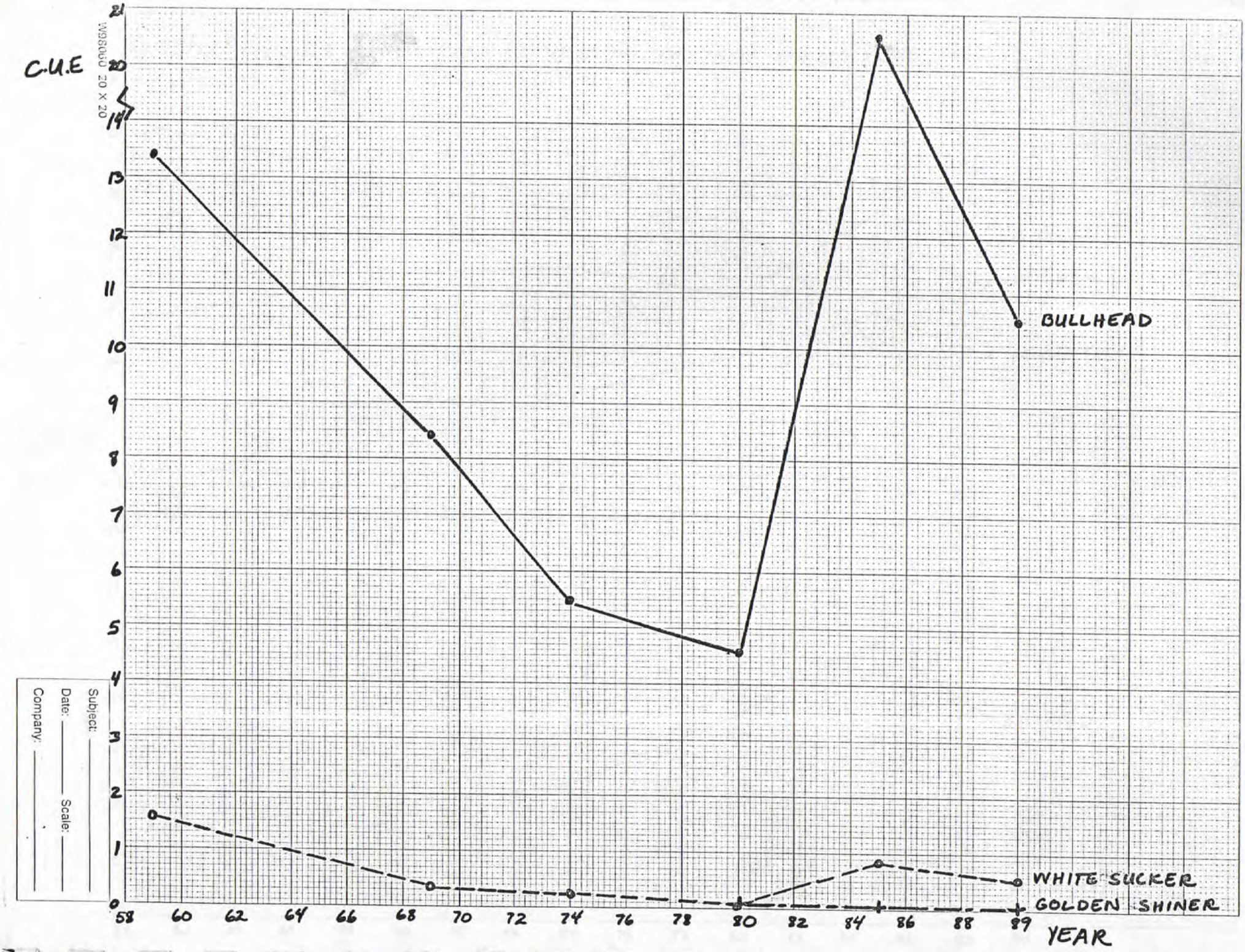
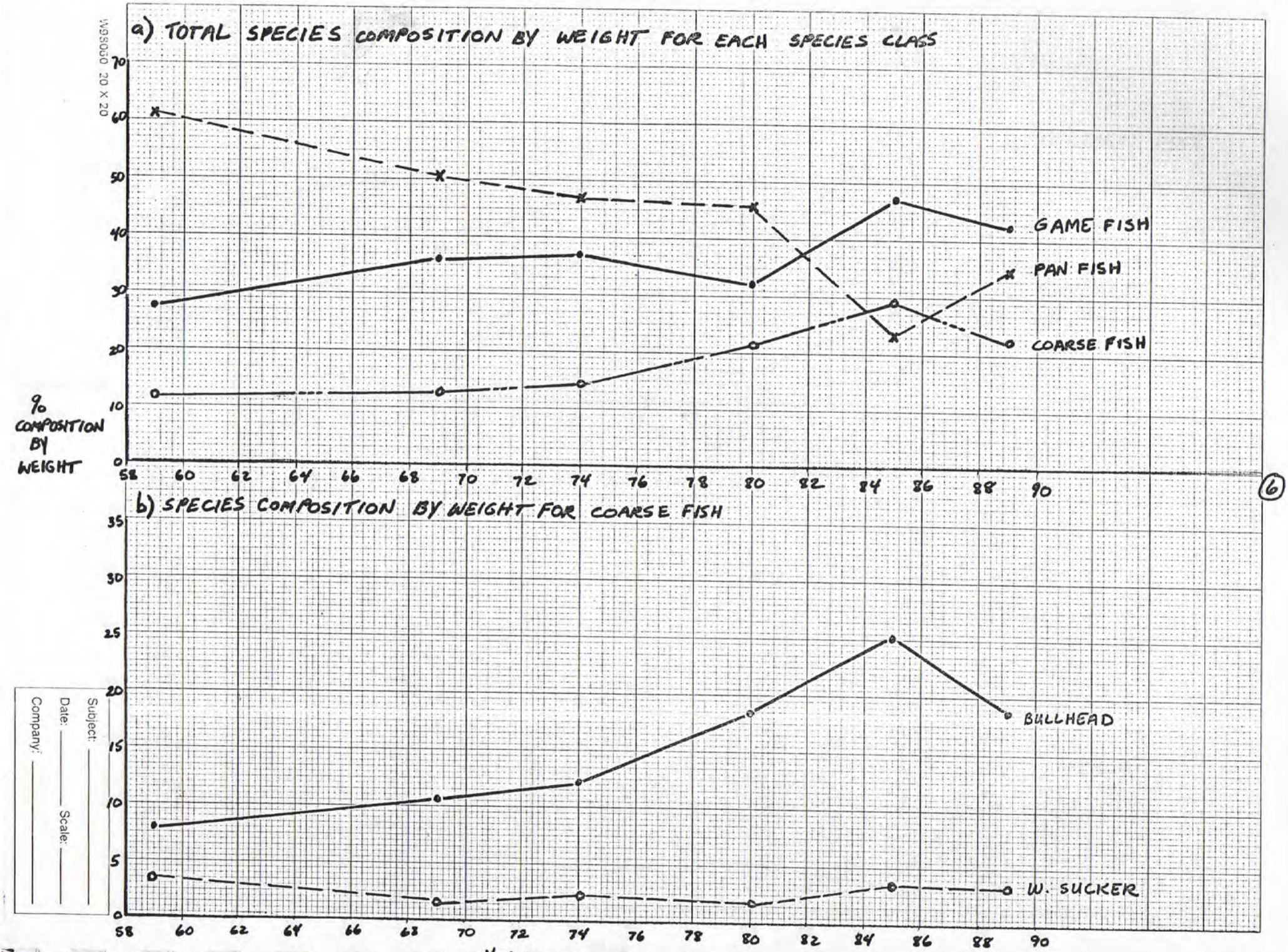

C.U.E
W9800 20 X 20
21
20
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
58
60
62
64
66
68
70
72
74
76
78
80
82
84
86
88
89
YEAR
BULLHEAD
WHITE SUCKER
GOLDEN SHINER
Subject:
Date:
Scale:
Company:

FIGURE 5. WHITE LAKE - SPECIES COMPOSITION BY WEIGHT, 1959-1989.



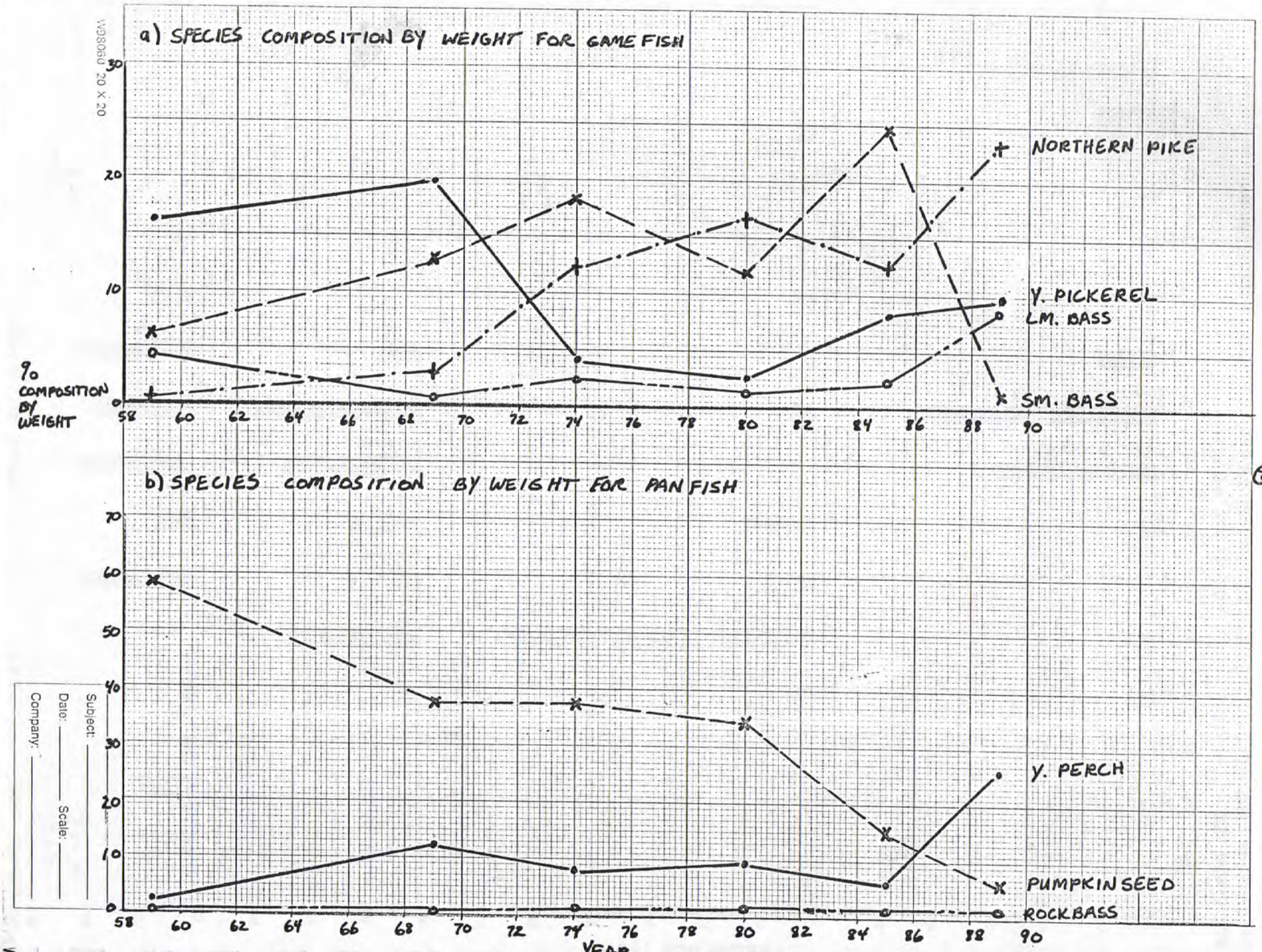
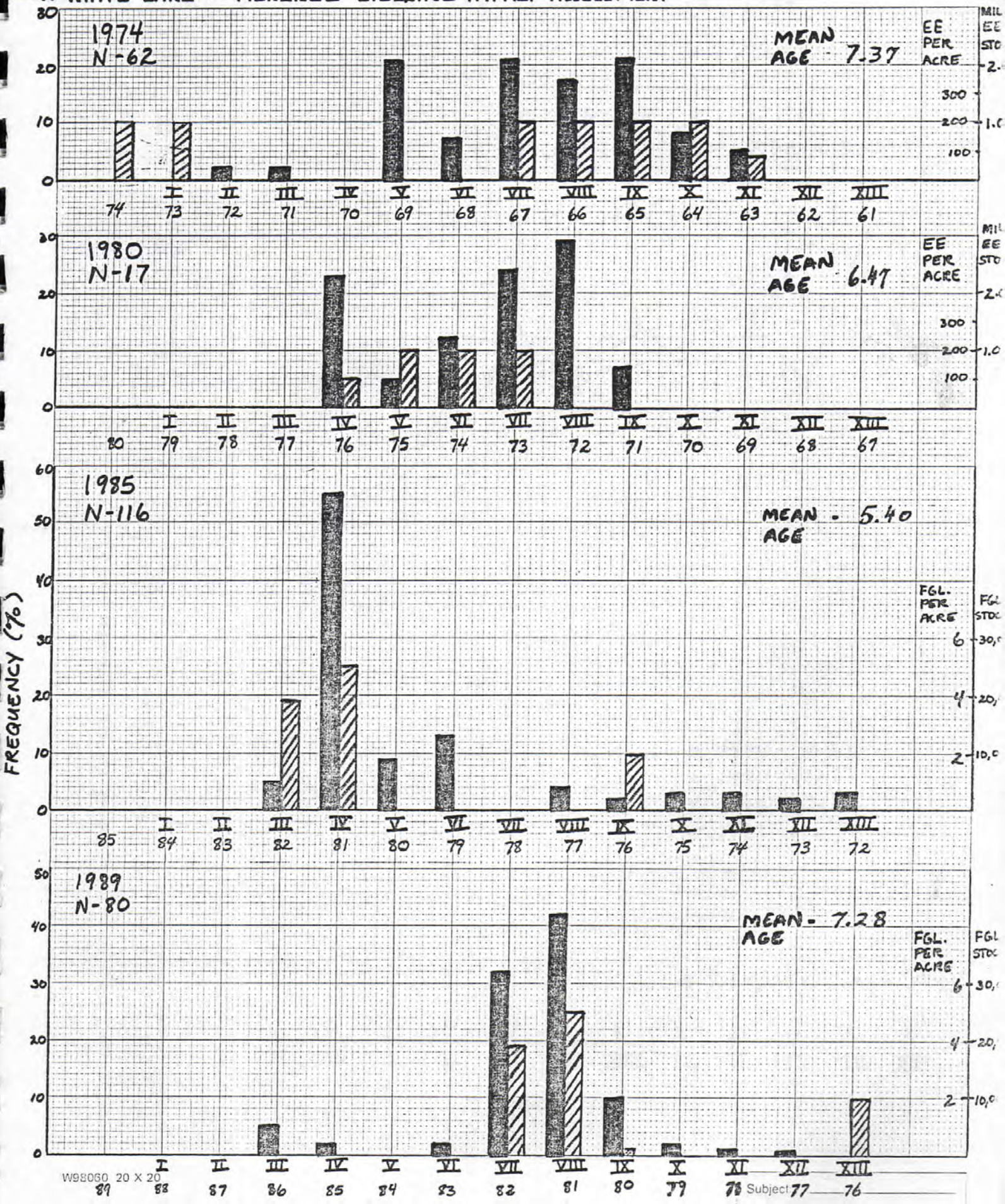

a) SPECIES COMPOSITION BY WEIGHT FOR GAME FISH
NORTHERN PIKE
Y. PICKEREL
LM. BASS
SM. BASS
% COMPOSITION BY WEIGHT
b) SPECIES COMPOSITION BY WEIGHT FOR PAN FISH
Y. PERCH
PUMPKINSEED
ROCKBASS
YEAR
58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90
0 10 20 30 40 50 60 70
Subject:
Date:
Scale:
Company:

FIG. 7. WHITE LAKE - PICKEREL STOCKING IMPACT ASSESSMENT



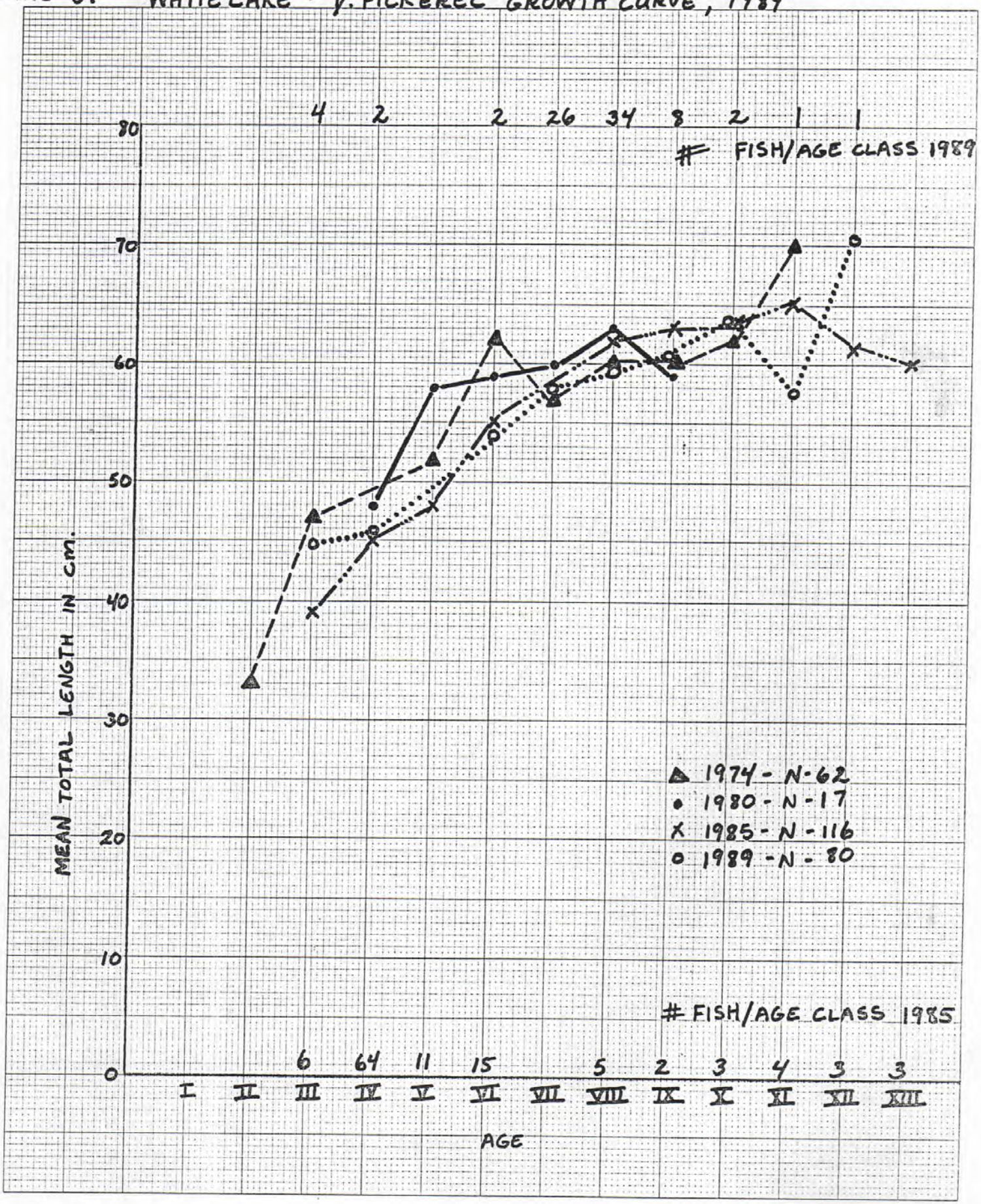
W98060 20 X 20

Subject

Date: Scale:

Company:

FIGURE 8. WHITE LAKE - Y. PICKEREL GROWTH CURVE, 1989



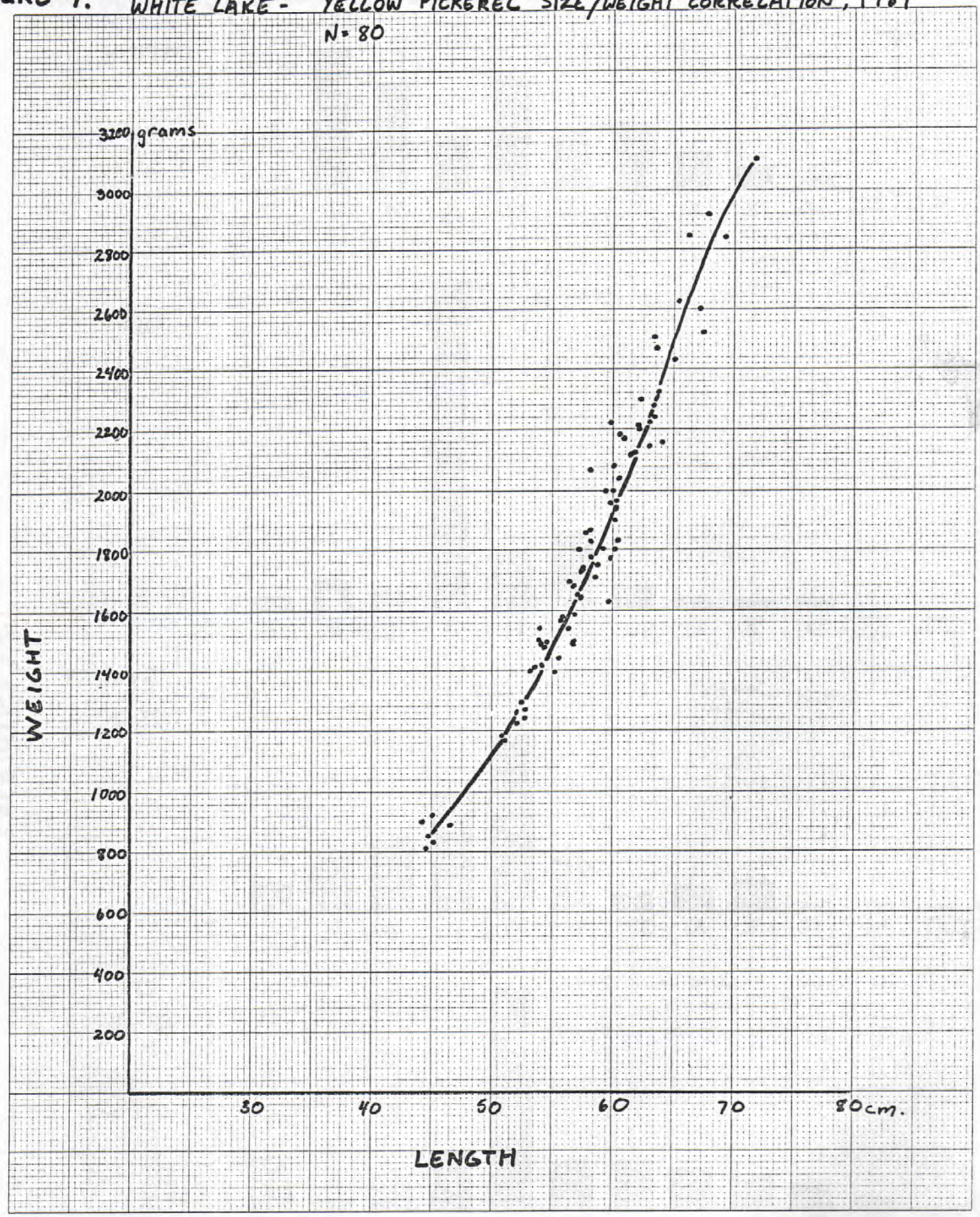
W98060 20 X 20

Subject: _____

Date: _____ Scale: _____

Company: _____

FIGURE 9. WHITE LAKE - YELLOW PICKEREL SIZE/WEIGHT CORRELATION, 1989



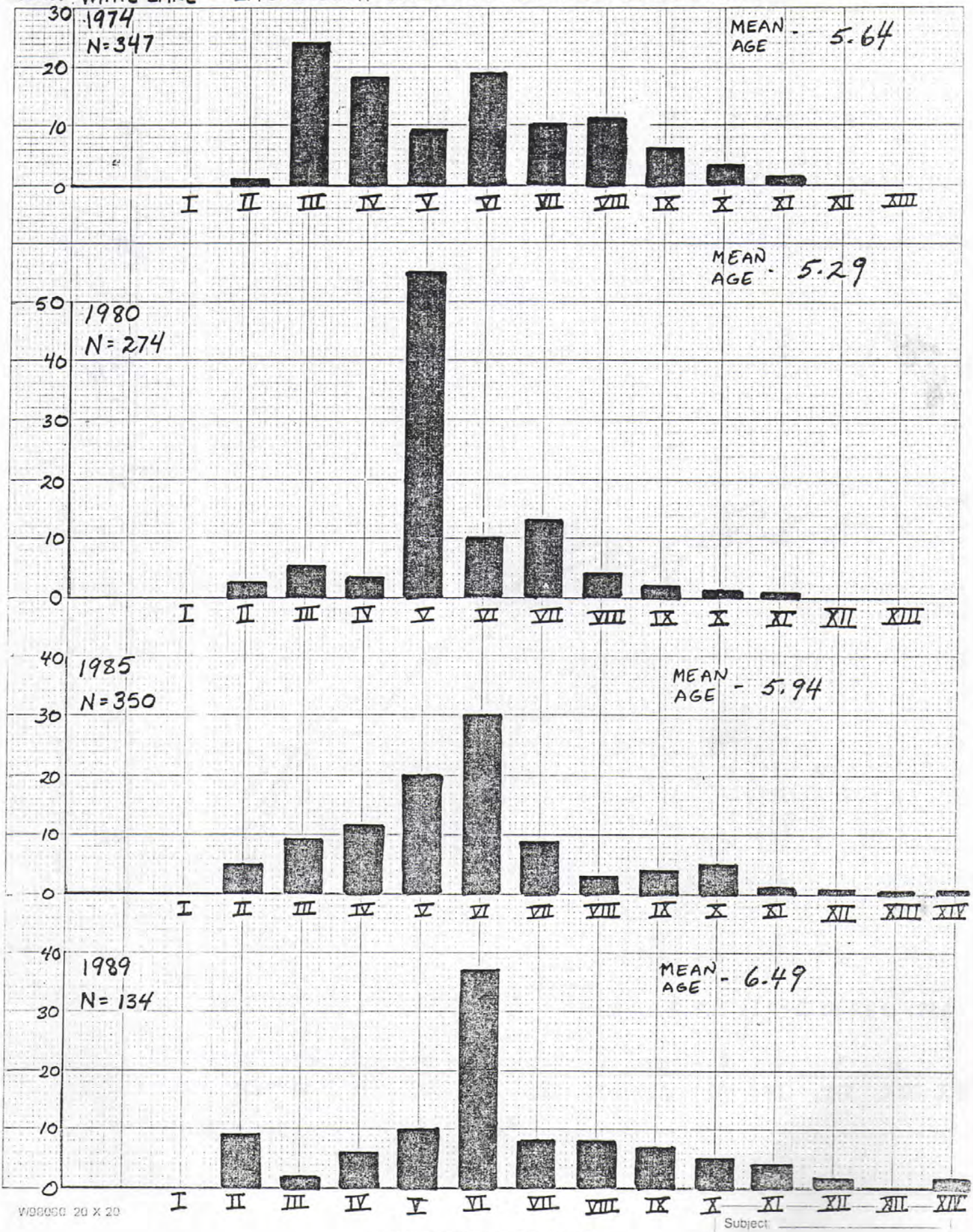
W98060 20 X 20

Subject: _____

Date: _____ Scale: _____

Company: _____

FIG 10a. WHITE LAKE - LARGEMOUTH BASS TRAPNET AGE COMPOSITION

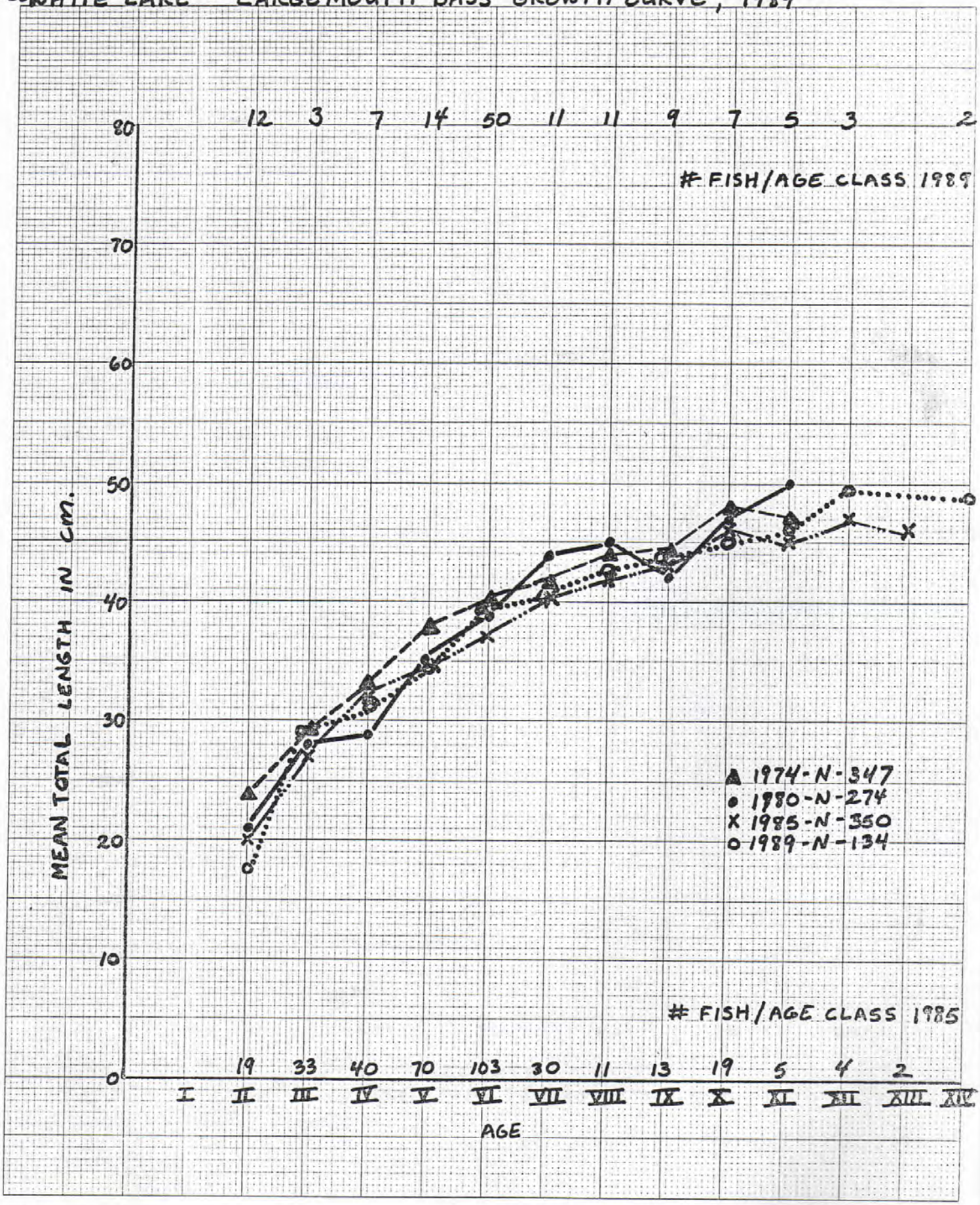


W88050 20 X 20

Subject:
Date: Scale:
Company:

FIG. 10

WHITE LAKE - LARGEMOUTH BASS GROWTH CURVE, 1989



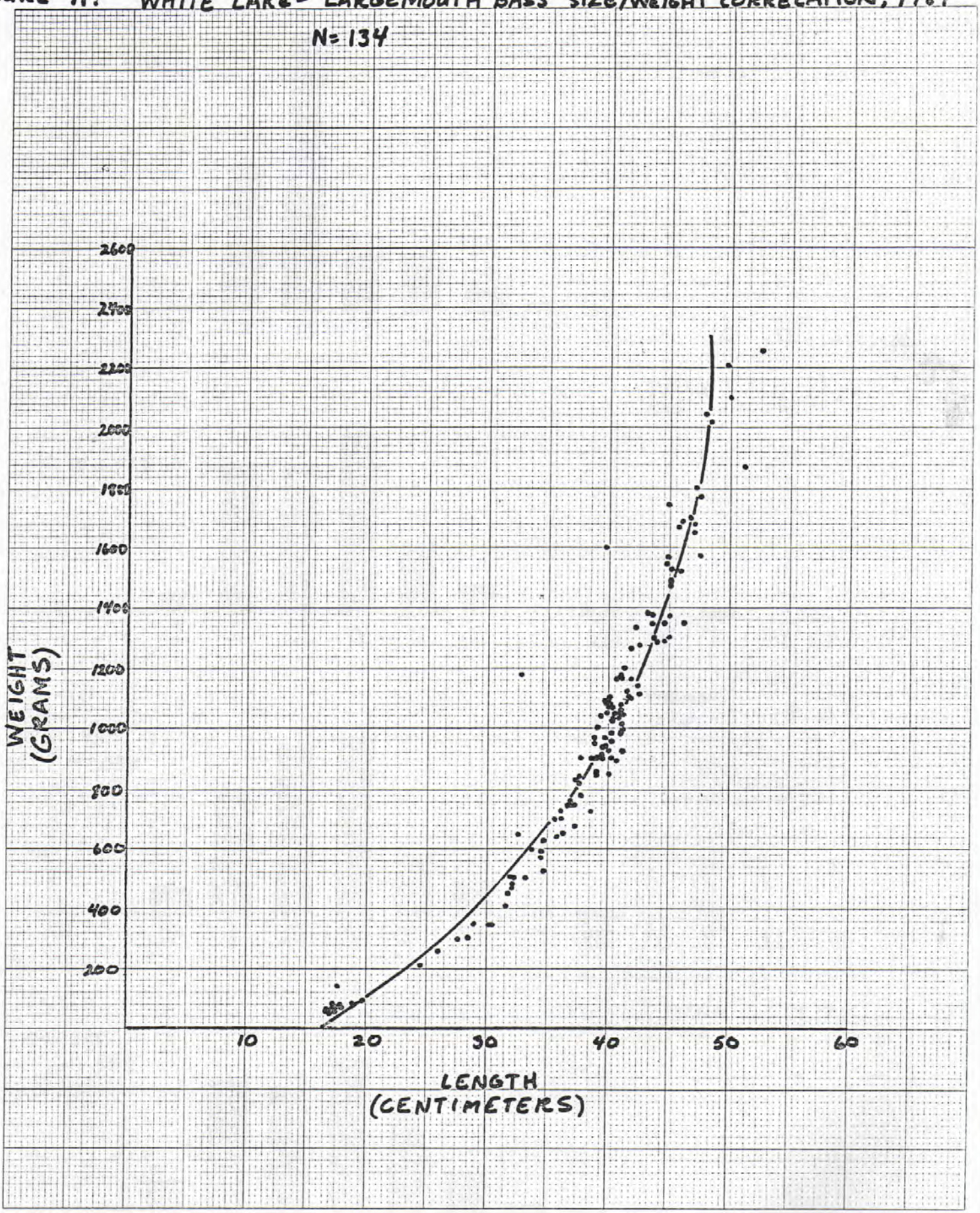
W98060 20 X 20

Subject: _____

Date: _____ Scale: _____

Company: _____

FIGURE 11. WHITE LAKE - LARGEMOUTH BASS SIZE/WEIGHT CORRELATION, 1989



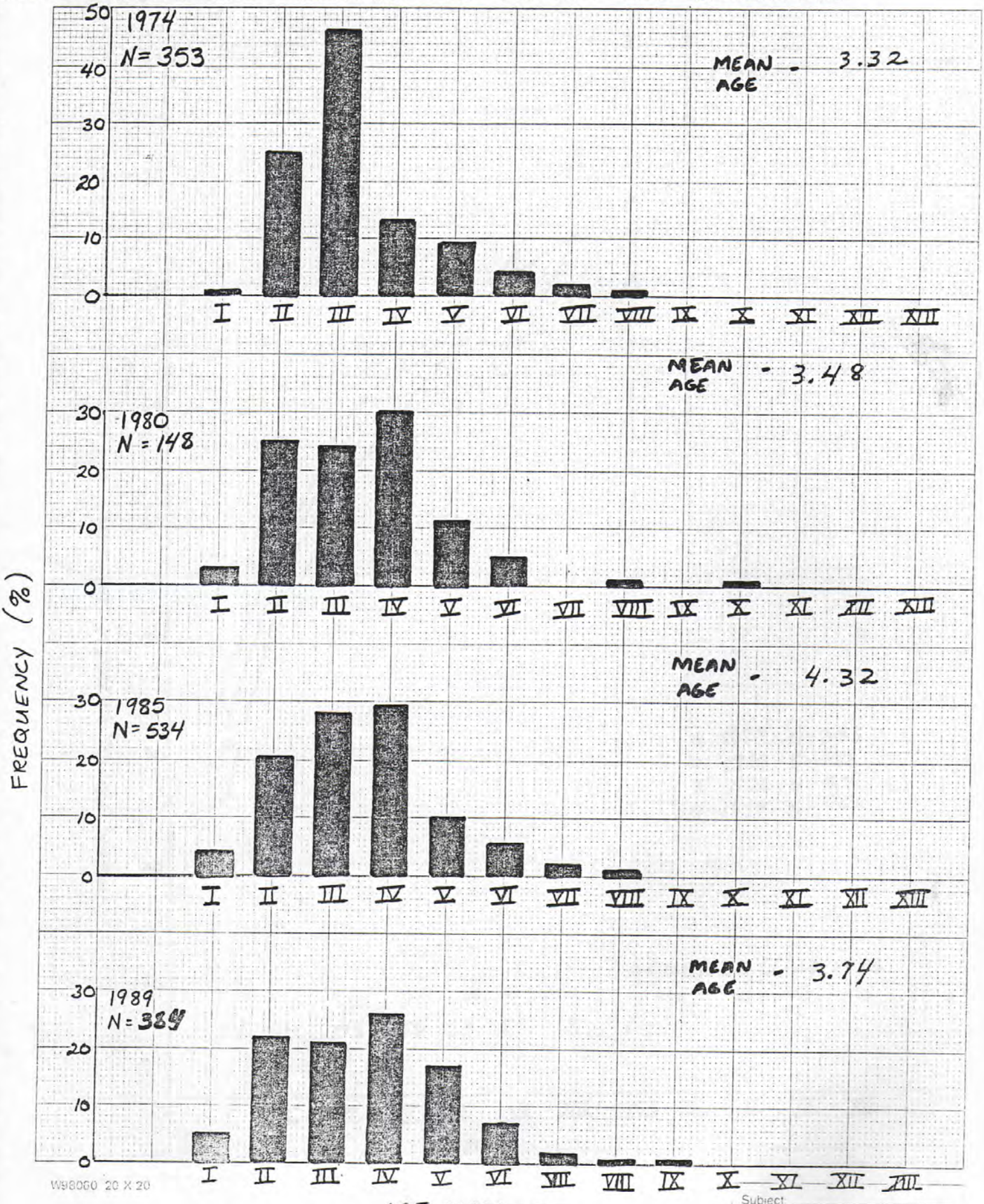
W98060 20 X 20

Subject: _____

Date: _____ Scale: _____

Company: _____

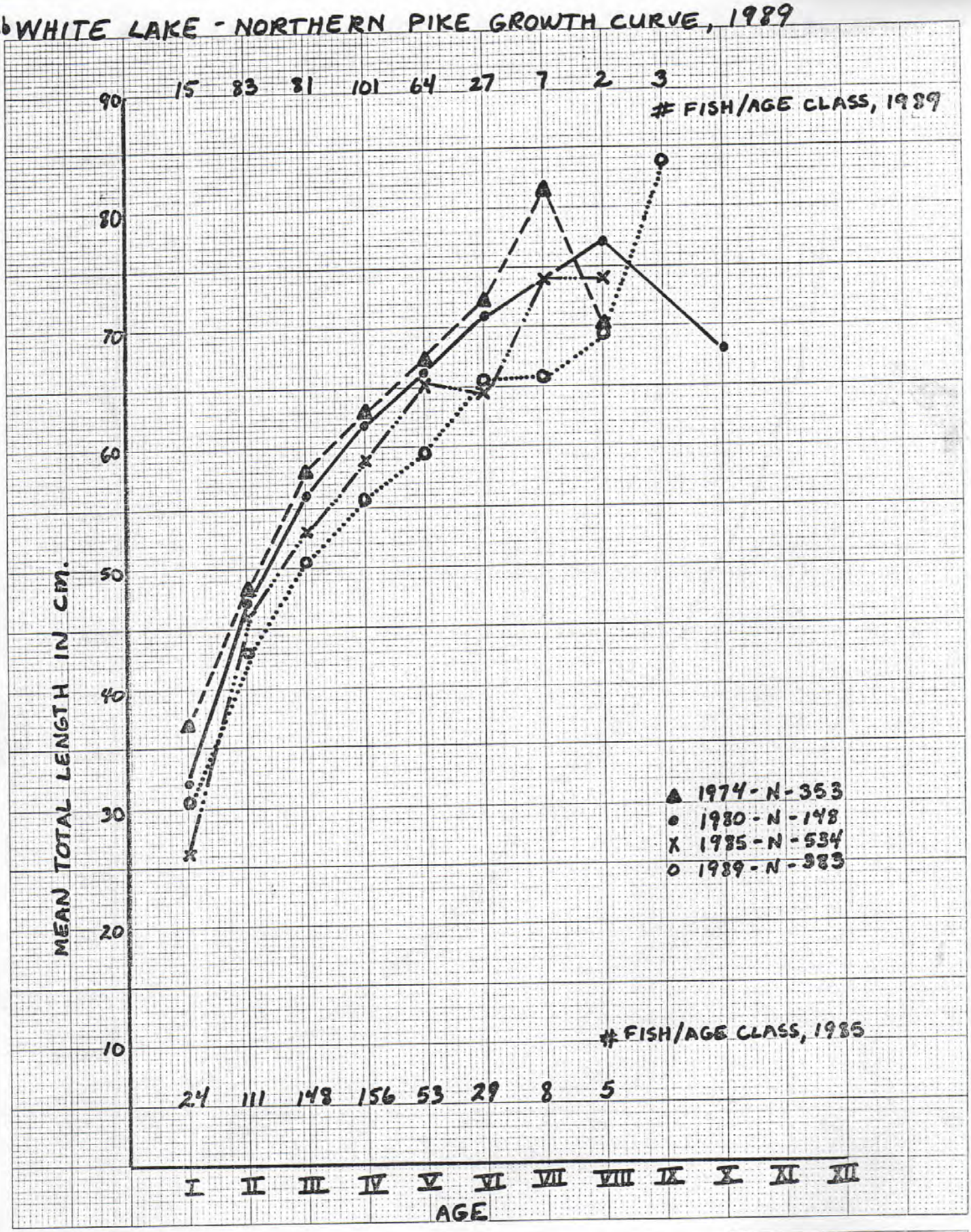
FIG. 12a WHITE LAKE - NORTHERN PIKE TRAPNET AGE COMPOSITION



W98060 20 X 20

Subject:
Date: Scale:
Company:

FIG. 12b WHITE LAKE - NORTHERN PIKE GROWTH CURVE, 1989



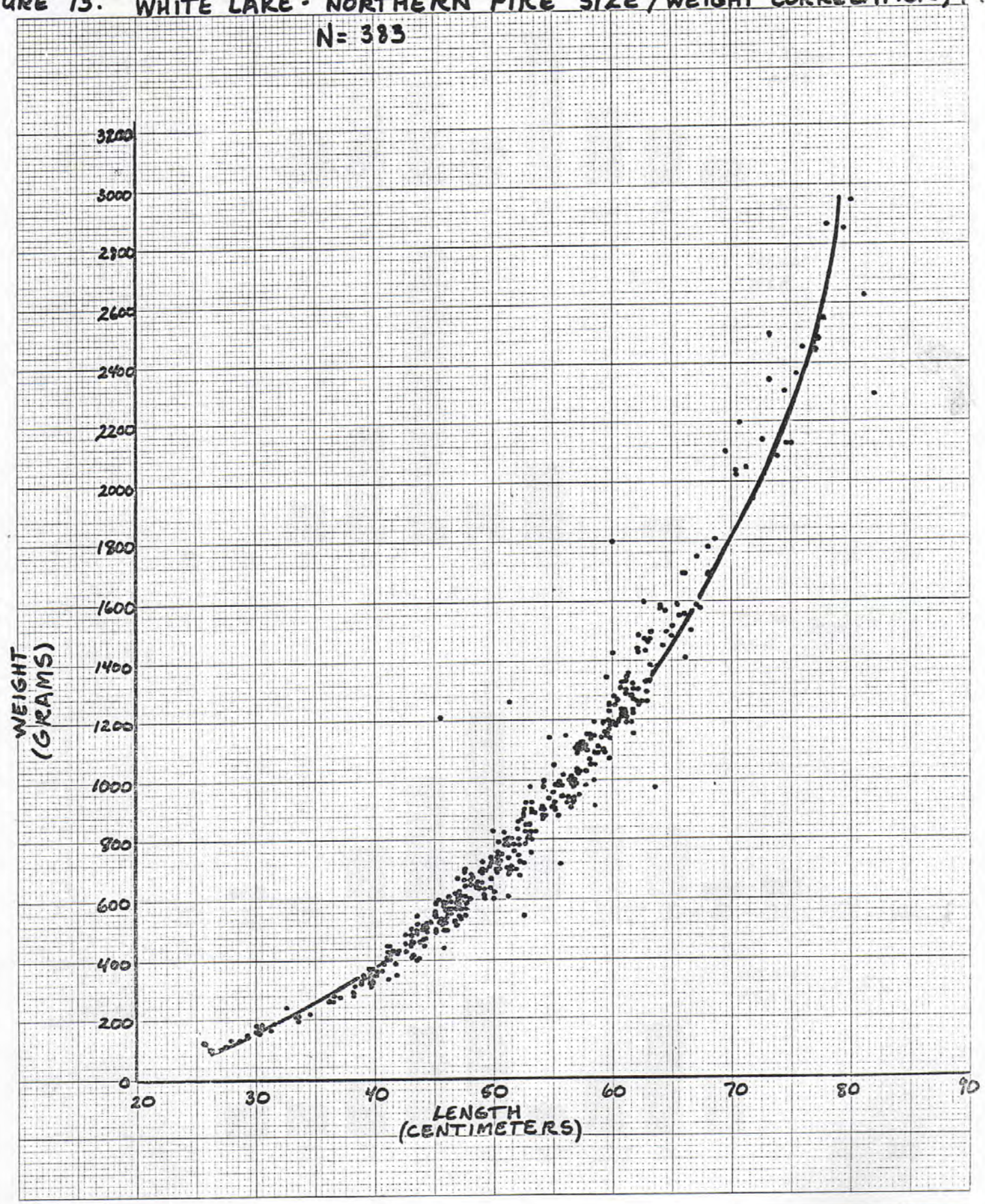
W98060 20 X 20

Subject: _____

Date: _____ Scale: _____

Company: _____

FIGURE 13. WHITE LAKE - NORTHERN PIKE SIZE / WEIGHT CORRELATION, 19



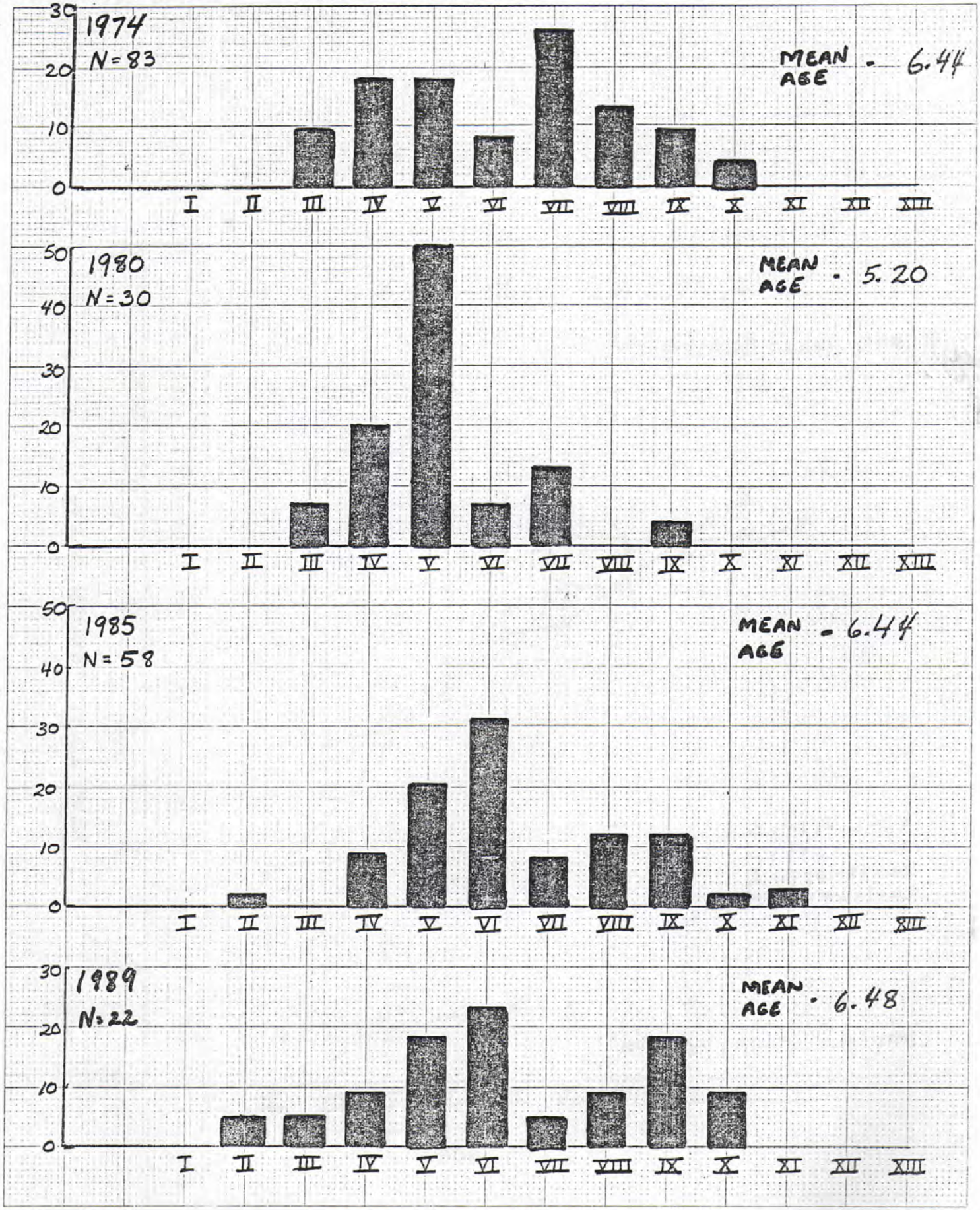
W98060 20 X 20

Subject: _____

Date: _____ Scale: _____

Company: _____

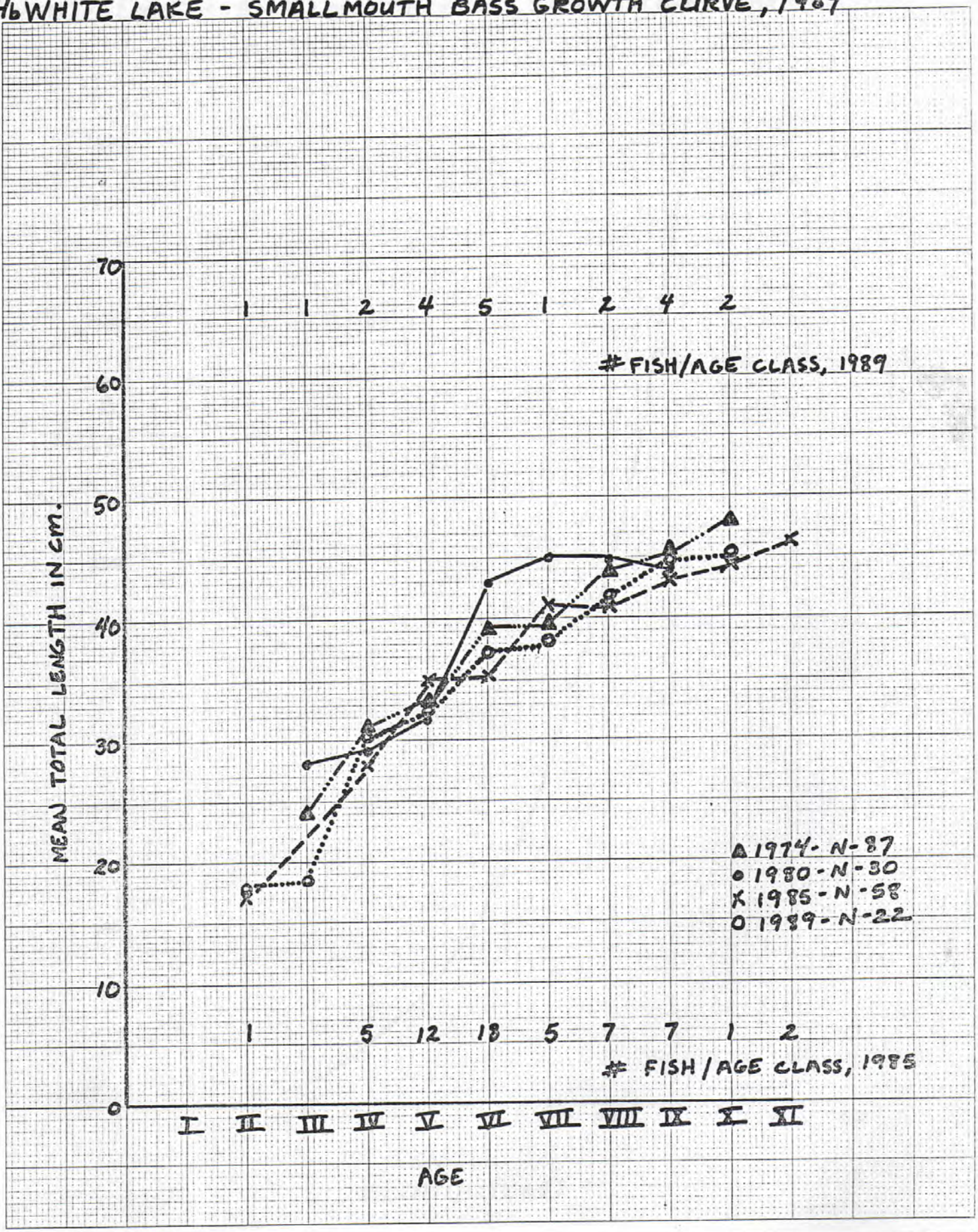
FIG 14a. WHITE LAKE - SMALLMOUTH BASS TRAPNET AGE COMPOSITION



W88060 20 X 20

Subject
Date Scale
Company

FIG. 14b WHITE LAKE - SMALLMOUTH BASS GROWTH CURVE, 1989



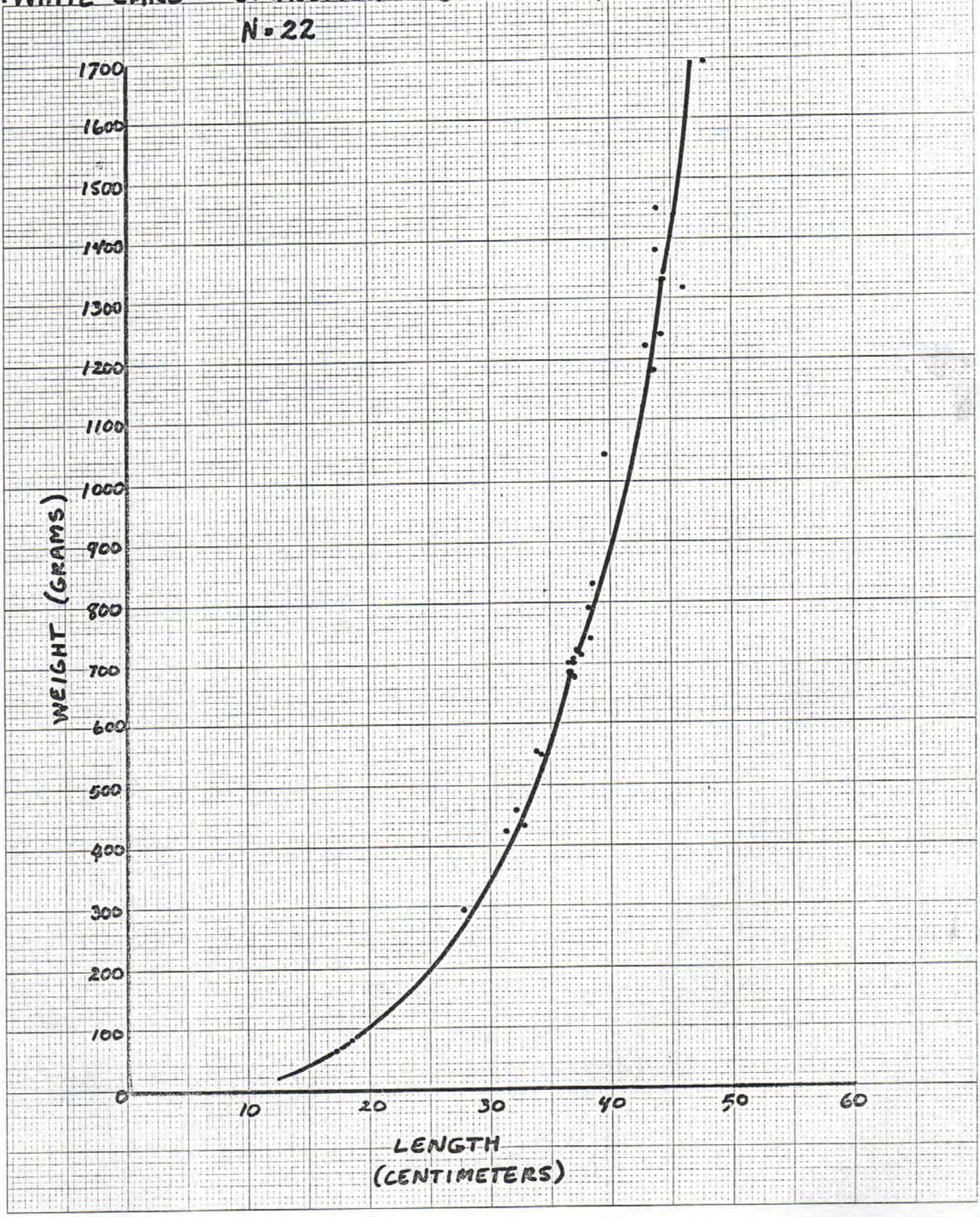
W98060 20 X 20

Subject: _____

Date: _____ Scale: _____

Company: _____

FIG. 15. WHITE LAKE - SMALLMOUTH BASS SIZE / WEIGHT CORRELATION, 198



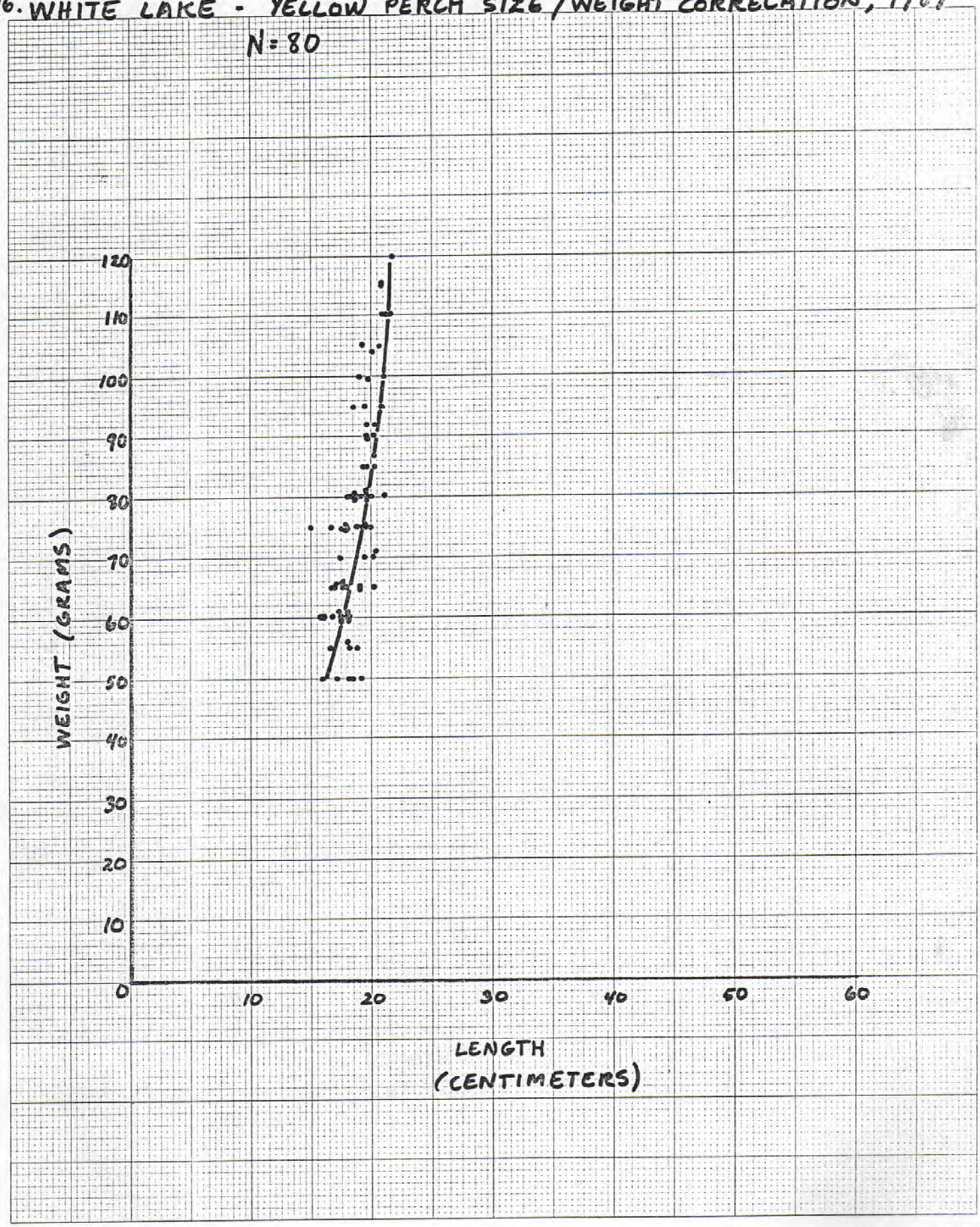
W98060 20 X 20

Subject: _____

Date: _____ Scale: _____

Company: _____

FIG. 16. WHITE LAKE - YELLOW PERCH SIZE / WEIGHT CORRELATION, 1989



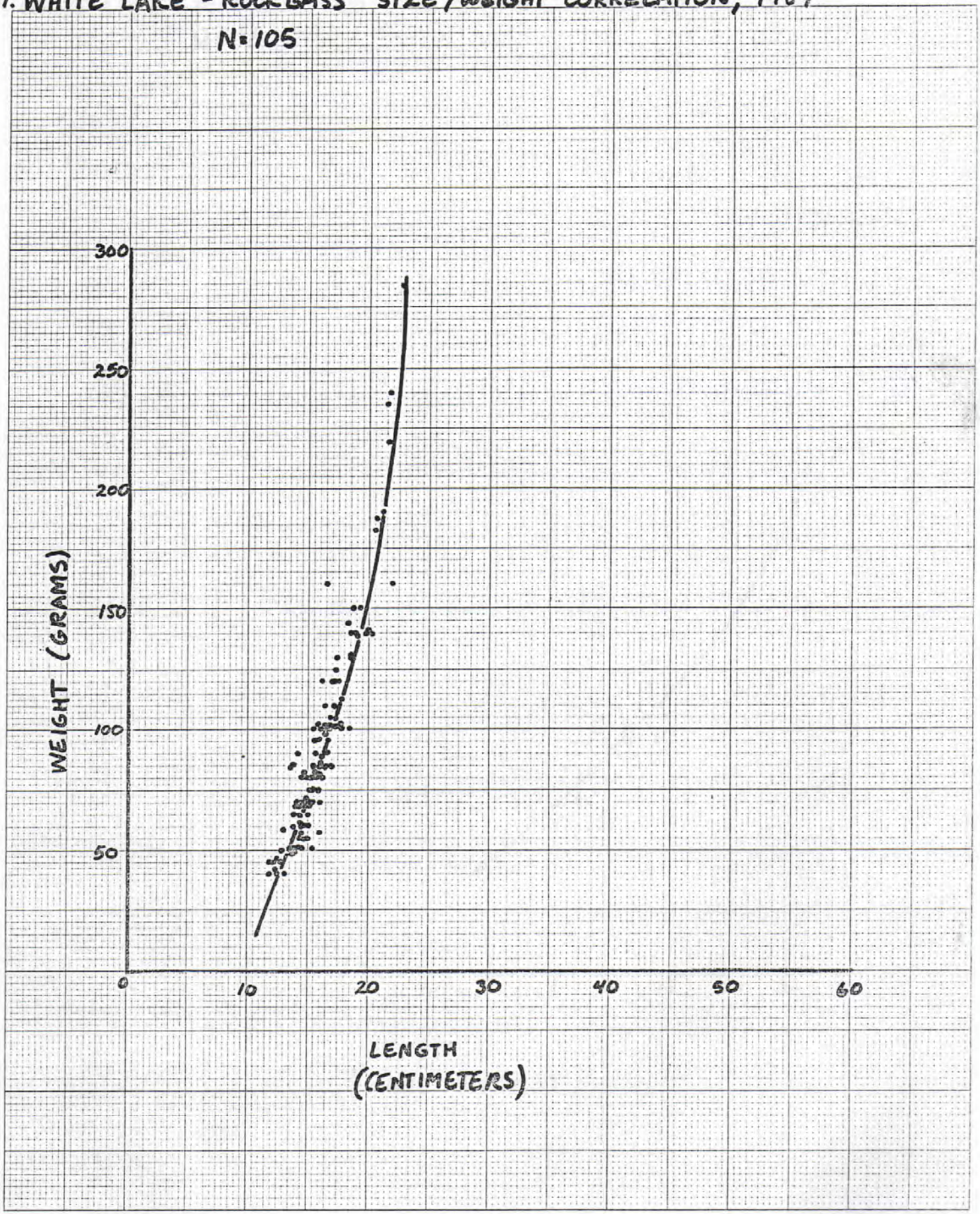
W98060 20 X 20

Subject: _____

Date: _____ Scale: _____

Company: _____

FIG. 17. WHITE LAKE - ROCK BASS SIZE / WEIGHT CORRELATION, 1989



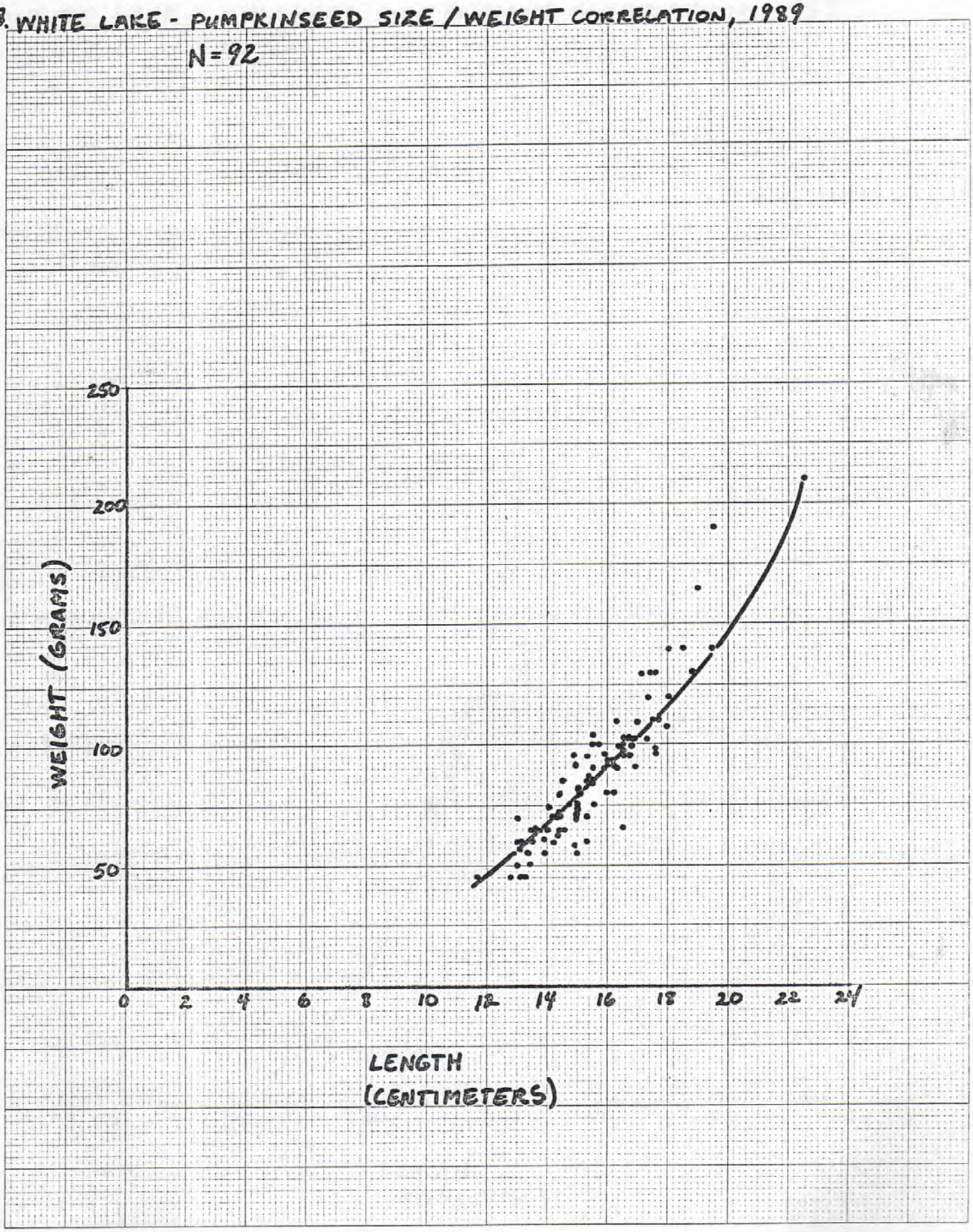
W98060 20 X 20

Subject: _____

Date: _____ Scale: _____

Company: _____

FIG. 18. WHITE LAKE - PUMPKINSEED SIZE / WEIGHT CORRELATION, 1989



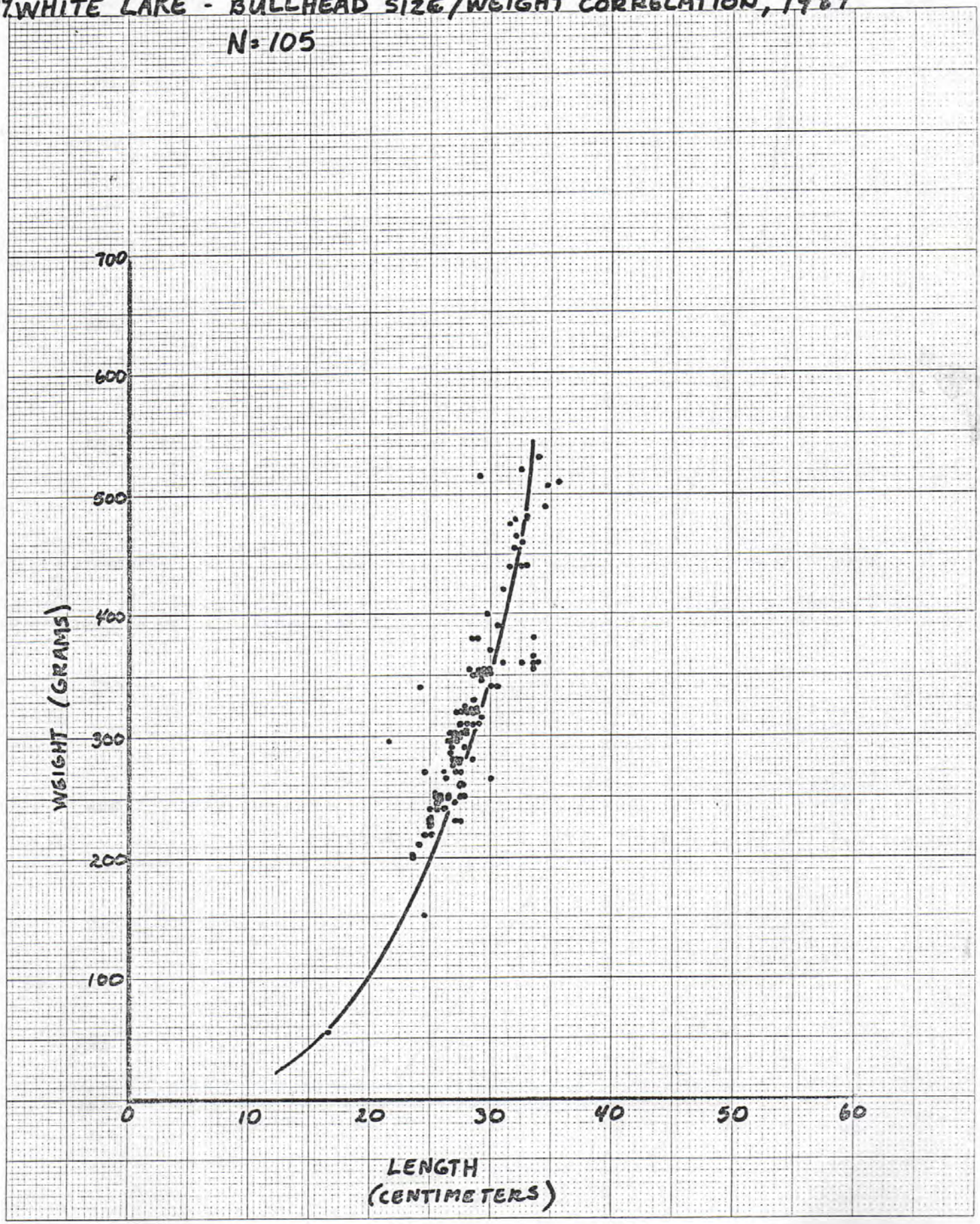
W98060 20 X 20

Subject: _____

Date: _____ Scale: _____

Company: _____

FIG. 19 WHITE LAKE - BULLHEAD SIZE/WEIGHT CORRELATION, 1989



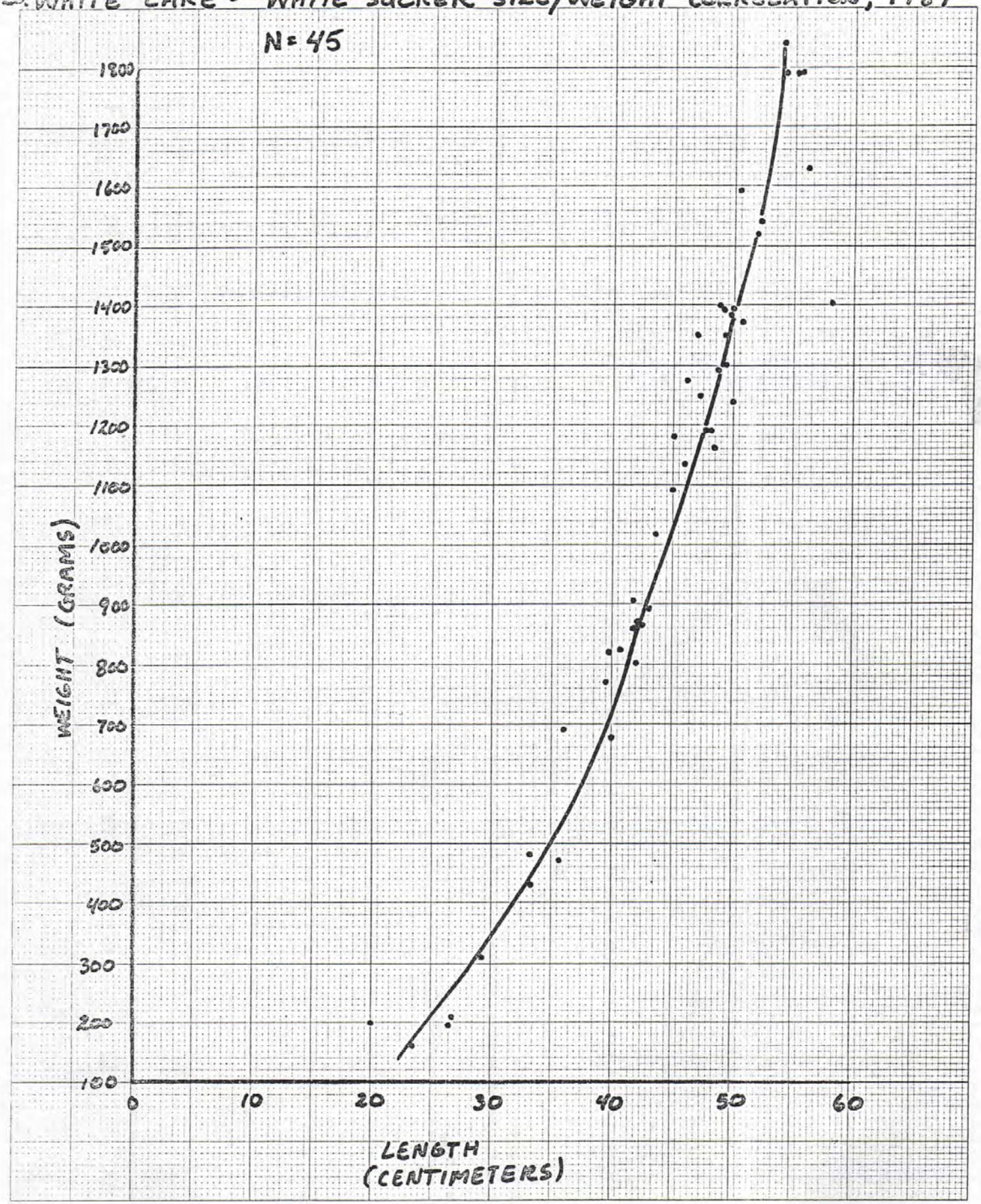
W98060 20 X 20

Subject: _____

Date: _____ Scale: _____

Company: _____

FIG. 20. WHITE LAKE - WHITE SUCKER SIZE/WEIGHT CORRELATION, 1989



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Subject: _____

Date: _____ Scale: _____

Company: _____

TARGET WATER LEVELS FOR 1972-76, 1977-80 AND 1981 - PRESENT

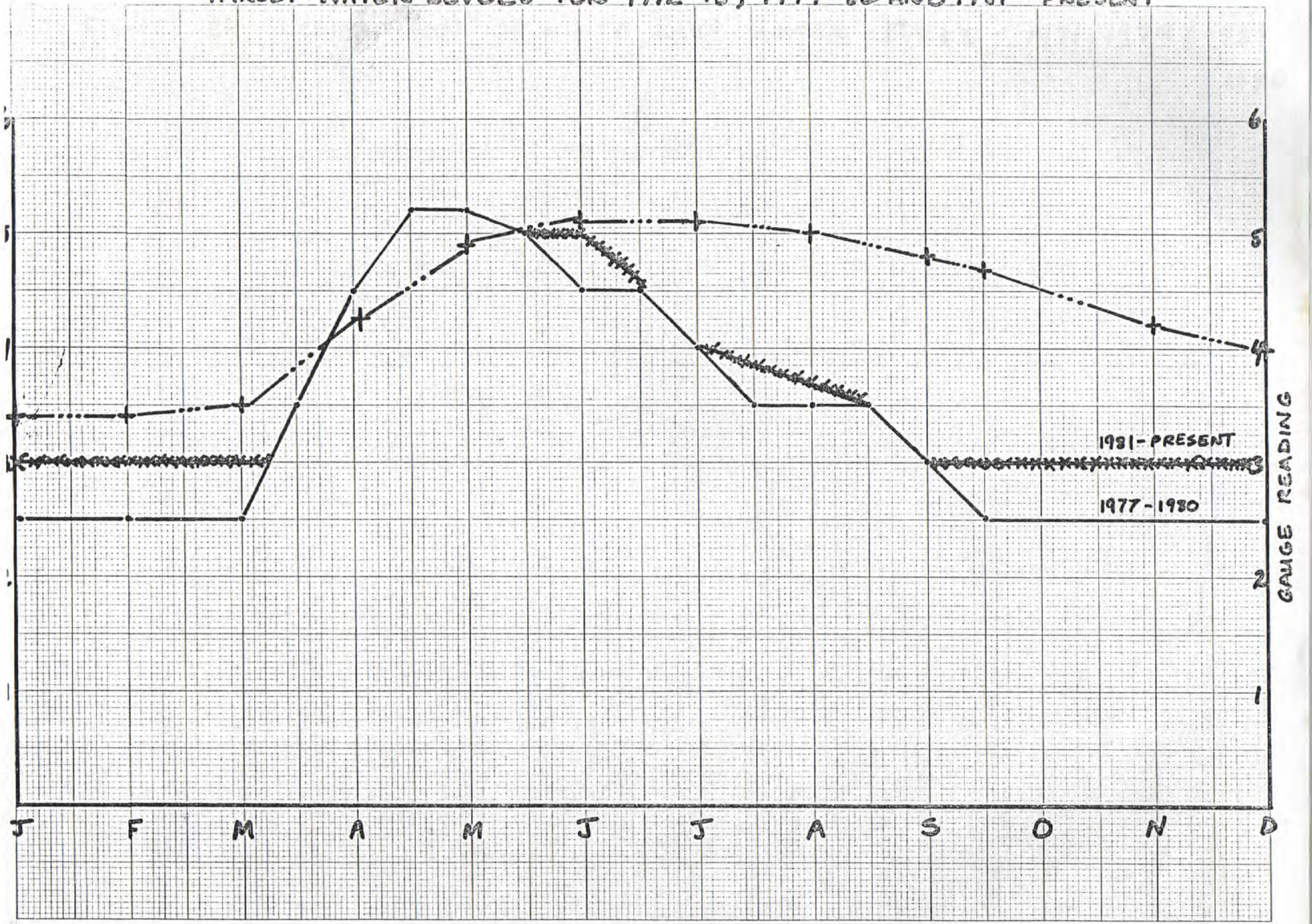

FIGURE 24. COMPARISON OF WHITE LAKE WATER LEVELS, 1971, 1979 & 1989. 1990

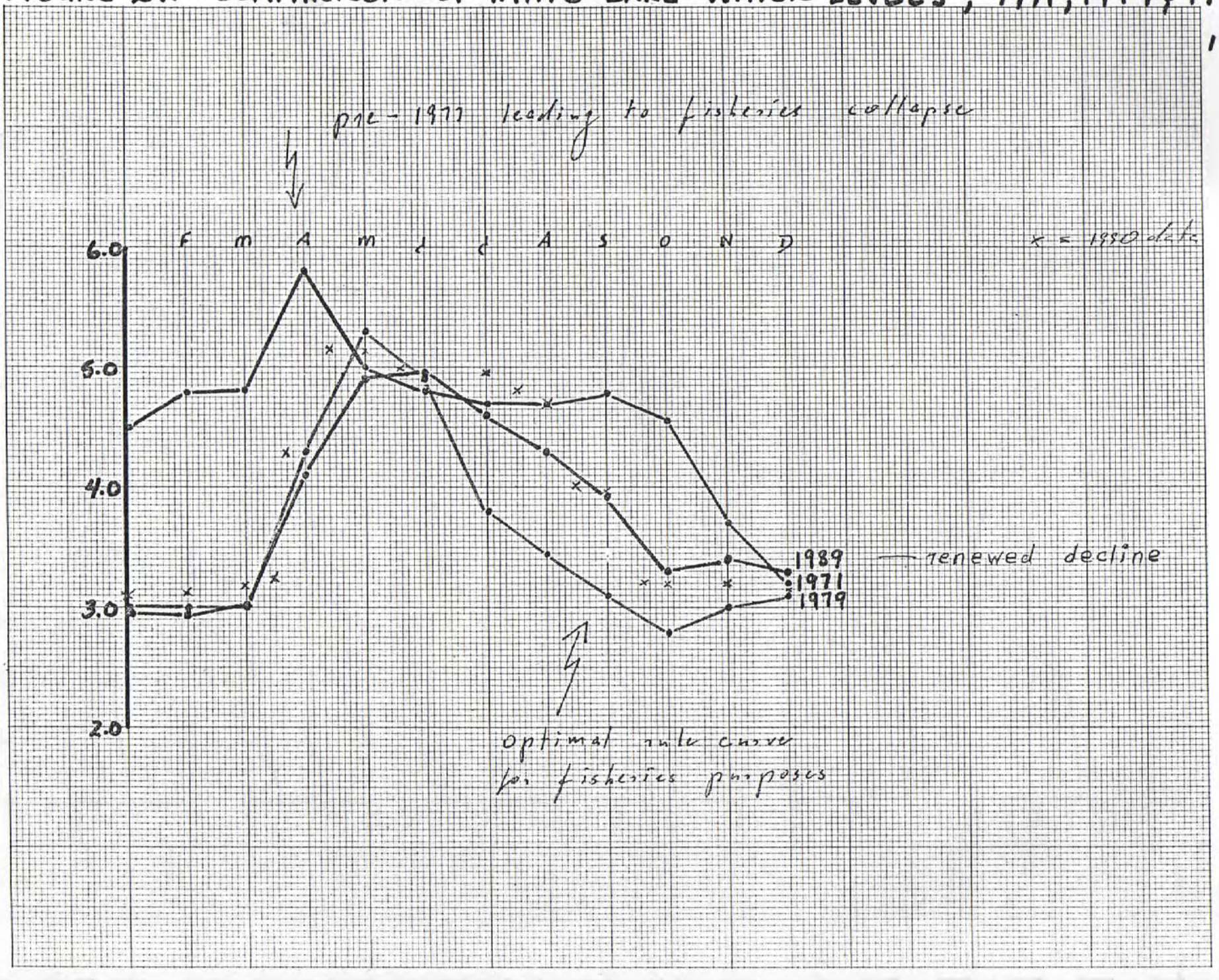

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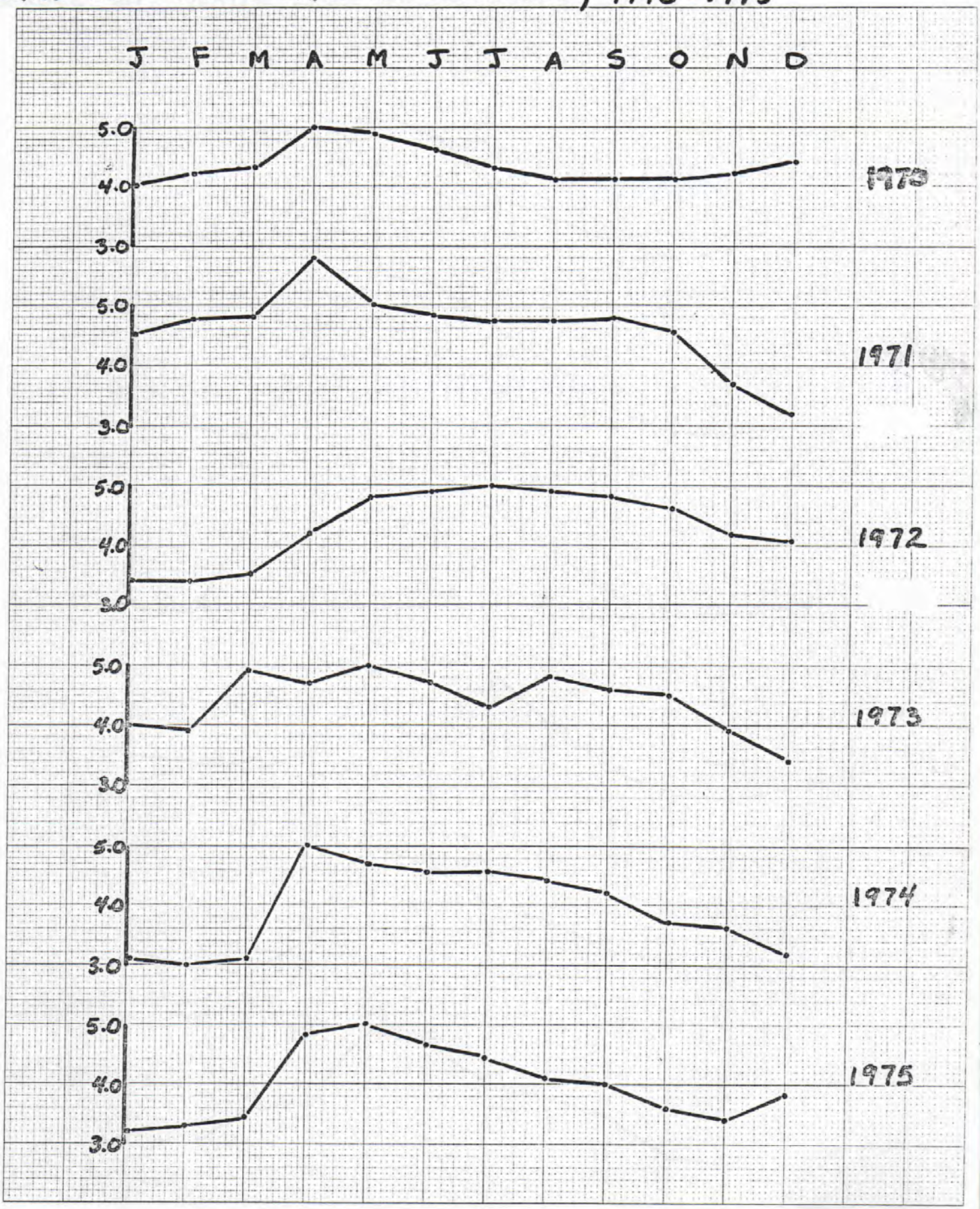
FIGURE 20. WHITE LAKE WATER LEVELS, 1970-1975



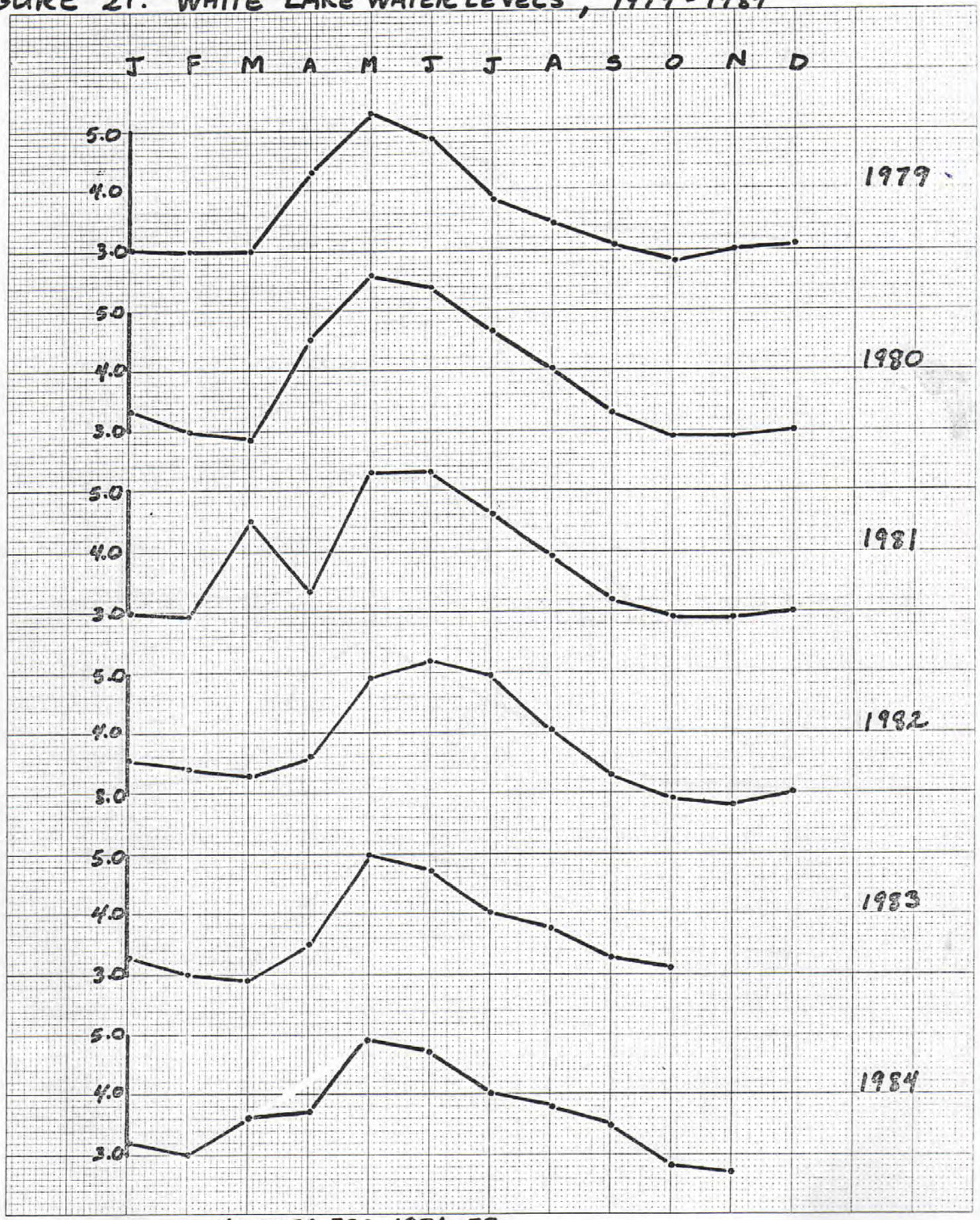
W98060 20 X 20

Subject:

Date: Scale:

Company:

FIGURE 21. WHITE LAKE WATER LEVELS, 1979 - 1984



NOTE: NO DATA FOR 1976-78

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Subject: _____

Date: _____ Scale: _____

Company: _____

FIGURE 22. WHITE LAKE WATER LEVELS, 1985-1989