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FISH TAG REPORT SUMMARY
1972 - 1976
NIAGARA MOHAWK POWER CORP.

John F. Storr, Ph.D.

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JUN 16 1977

June 15, 1977

Miss Cheryl Blum
Environmental Engineering
Niagara Mohawk Power Corporation
300 Erie Boulevard West
Syracuse, NY 13202

Dear Cheryl:

Enclosed please find the corrected Fish Tag Report Summary for 1972 - 1976.

Sincerely,

Kenneth H. Goehle
Research Associate

pg
Enclosure

CONTENTS

1.1 SUMMARY OF RESULTS

Over the five years of study since its inception in 1972, the following conclusions about fish populations in eastern Lake Ontario can be drawn:

1) Of all the species studied, only yellow perch demonstrate a true migratory pattern. The rest of the species move back and forth along the shore with little predictability. Yellow perch, it was found, move eastward from Nine Mile Point toward North Sandy Pond in the late summer and fall, returning to the Nine Mile Point area through late winter and spring. The data to support this are presented in Section 3.2.1 of this report.

2) Brown bullhead, pumpkinseed, and yellow perch do not seem to be hindered by thermal plumes as they encounter them while moving along shore. This does not agree entirely with findings of Kelso (1976) and is discussed further in Section 4.2.

3) Rock bass, pumpkinseed, yellow perch, and brown bullhead range long distances, up to 70 miles, while smallmouth bass appear to be territorial, generally remaining within a small area near the shoreline.

4) Returns of same year tags have fallen off significantly each year indicating a decrease in fishing pressure, fewer fish, or a lessening of angler interest in the project. This is presented in Section 3.1 of this report.

5) Mortality of fish from all causes falls between 30 and 50% per year for all species tagged (Section 3.4).

6) There does not seem to be any consistent pattern of bait preference for any of the species studied (see Section 3.5).

7) Through the end of 1976 only six tagged fish have been returned from the screens of water intakes on Lake Ontario, three at the FitzPatrick Station and three at Nine Mile Point. Using formulae developed for mark-recapture techniques it would indicate that less than 0.03% of the lakewide fish populations are cropped by impingement (discussed in Section 4.1).

8) Growth rates have been determined for tagged species and are presented in Section 3.3 of this report.

1.2 INTRODUCTION

Marking and tagging of fishes is frequently used by the fishery biologist as a means of studying fish migrations, and of demonstrating the population structure, speed per day, total distances travelled annually, places of spawning and of feeding, areas that are interdependent in the system during the cycle of the fishes' life, and effects of fishing pressure on a given stock. By means of marking and tagging, it is also possible to follow fluctuations in the stock strength and to arrive at an estimate of the size of the fish stock concerned. A thorough knowledge of these questions is of fundamental importance for the rational exploitation of the com-

mercial and recreational fishes, and also for furnishing the necessary information needed to predict possible threats of overexploitation.

The idea of tagging fish is not a new one, for successful experiments were carried out in the last century. Tagging on a large scale was first done in the year 1872 (Fridriksson and Hasen, 1950). In 1892 the Scottish scientist Fulton (1893) marked fish by punching holes in the caudal fin of the herring. External tags were first used by Johansen in Denmark in 1922 (Fridriksson and Hasen, 1950). The most easily applied and successful external tag is the dart tag. Both the jaw tag and the opercular tag are more susceptible to infection and may interfere with feeding and respiration. The type of dart tag chosen for this study is discussed in Section 2.2.3.

Most tagging interests in fresh water are centered around salmonids (Power et al, 1966; Gilbreath et al, 1976; Jessup, 1976), with some interest in other important species such as smallmouth bass (Webster et al, 1959), brown bullhead (Kelso, 1974), and yellow perch and white sucker (Kelso, 1976). Important marine species usually tagged include Menhaden (Pristus et al, 1976), striped bass (Moore et al, 1975), and cod (Dickie, 1963; Jensen, 1967).

The problems with most of the tagging studies done in the past arise from three situations:

1) Very few fish tagged resulting in a very low actual number of returns;

2) The entire study restricted to one season with the tagging accomplished usually in less than one month's time; and

3) The tagging study involves only one species of fish.

Despite these limitations, many workers have drawn rather extensive conclusions from scanty data from only a few actual tag returns. This increases the possibility of chance occurrences greatly affecting the results of the study.

In this five-year study for Niagara Mohawk, almost 21,000 fish from 26 species were tagged over the period May to October of each year. The fish were also tagged at various locations to allow the overall movement patterns to be established.

By running such an extensive study it becomes possible to remove effects of short-term changes and determine the long-term patterns. As a result, valuable information is made available regarding the movement of fish populations within Lake Ontario.

2.0 OBJECTIVES AND METHODOLOGY OF THE STUDY

The primary objective of the study was to establish the movement of fish found in the area of the intake and discharge at the Nine Mile Point Unit #1 Nuclear Power Station. Once this was established it was expected that an evaluation could be made of the impact of impingement on the fish populations in the lake. As it has turned out, the considerable quantity

and quality of the data obtained resulted in analyses which far exceeded the original objectives and expectations.

2.1 THE OBJECTIVES OF THE STUDY WERE:

1) To examine the possibility of any impact of generating station impingement on the affected fish population, either a local fish community or the broader regional fish community, by establishing patterns of movement of fish in the lake.

2) To determine residence time at the Nine Mile Point area for as many fish species as possible.

3) To determine the extent and direction of dispersal patterns for various fish species and the extent of movement of individual fish.

4) To determine whether fish in the area comprise a transient community, or whether instead they are representative of a stable regional fish community with their transience governed by local conditions.

5) To ascertain whether or not the discharge plume has any effect on the along-shore movement of fish in the Nine Mile Point area.

2.2. METHODOLOGY

2.2.1 Netting

Throughout the study fish were caught in trap nets, tagged with a dart tag (Floy Manufacturing Co.), and returned to the lake at their place of capture. All fish captured except Salmonids (DEC request) were tagged and released. Information

concerning all fish that have subsequently been recaptured has been collected and analyzed.

In the first phase of the study, which began in July 1972, one trap net was used at transect E-1 at Nine Mile Point, set shoreward and east of the discharge in about eight feet of water. The net, manufactured by the Sterling Net Corporation, has a rigid frame and a double heart, and measures 4'x6'x8' in the body. The center lead is 125 feet in length with 30 foot wings. The bottom webbing is 3/4" stretch mesh, while the center lead is of 1-1/2" mesh. Four of these nets were used for the latter part of 1973 and throughout 1974, 1975, and 1976 at a series of stations along the Nine Mile Point shore. The four nets were set with the mouth shoreward and the body generally set in seven to ten feet of water about 1,000 feet apart along the Nine Mile Point shore at W-1, E-1, E-2, and E-3.

2.2.2 Tagging Locations

While there was only a single tagging location at Nine Mile Point in 1972 and 1973, a number of tagging stations were established in 1974 and continued through 1976. The objective of this dispersion of locations was to establish a series of four tagging locations beginning at North Sandy Pond at the eastern end of Lake Ontario, at Dempster Beach, Nine Mile Point, and the Oswego River area, locations where fishing pressure would be expected. These locations were roughly 10-15 miles apart. In the tagging program, tagging was to be carried out moving progressively from North

Sandy Pond westward until August, then reverse in the fall. Nine Mile Point was to remain as the principal tagging station. Two purposes were to be accomplished by this program:

1) Yellow perch were believed to winter in North Sandy Pond and spawn in the vegetation in that area, moving westward in the spring and eastward in the fall to return to North Sandy Pond. Since this is a major fish species tagged and returned at Nine Mile Point, it was hoped to follow the movement of this fish by establishing the above tagging program and thus expand our knowledge of this movement.

2) By tagging at locations other than Nine Mile Point, the broader pattern of movement of fish could be established to indicate any variation in general movements of species. Analyses of this tag return data will give a broader base for the analysis of fish movement and overcome the bias of a single tagging location at Nine Mile Point. Too many of the fish tagged at Nine Mile Point were being recaptured by the heavy angling pressure around the discharge, resulting in information of minimal value in determining fish movement.

In 1975 and 1976 the study was supplemented by Rochester Gas and Electric, which supported a tagging program at the Ginna Nuclear Power Station and the Sterling Site. The results of this supplemental study are not contained in this report, but are available to interested parties from RG&E.

2.2.3 Fish Tagging and Data Gathering

During the week of a tagging study, the fish were removed daily from the nets, a few at a time, placed in a plastic holding tank in the boat, measured for total length, and then tagged. The plastic dart tag used is manufactured by the Floy Tag and Manufacturing Co., Inc. The needle of the tagging gun was inserted into the fish musculature below and posterior to the center of the dorsal fin, with the anchor of the tag inserted to a depth of about 1/2", depending on the size of the fish. The tubing portion of the anchored tag contained the following two lines of printing:

Box 99 SUNY at BFLO 14214

#0000 Reward $2.00 Date

The two dollar reward was given to encourage the return of the tag and to compensate the returnee in small part for cost and trouble. When a tag was received, the cash reward, a letter indicating the date and location of the tagging of the fish, plus a questionnaire with a stamped, return address envelope were sent to the fisherman. A sample of the form letter and questionnaire is included with this report. Almost all questionnaires were returned, although the information supplied was often incomplete.

After the data are analyzed, a short summary letter of the results obtained to date is sent to each individual who has returned a fish tag. This is done to stimulate interest. A number of letters with questions were received from tag returners. These were always answered and usually were inquiries

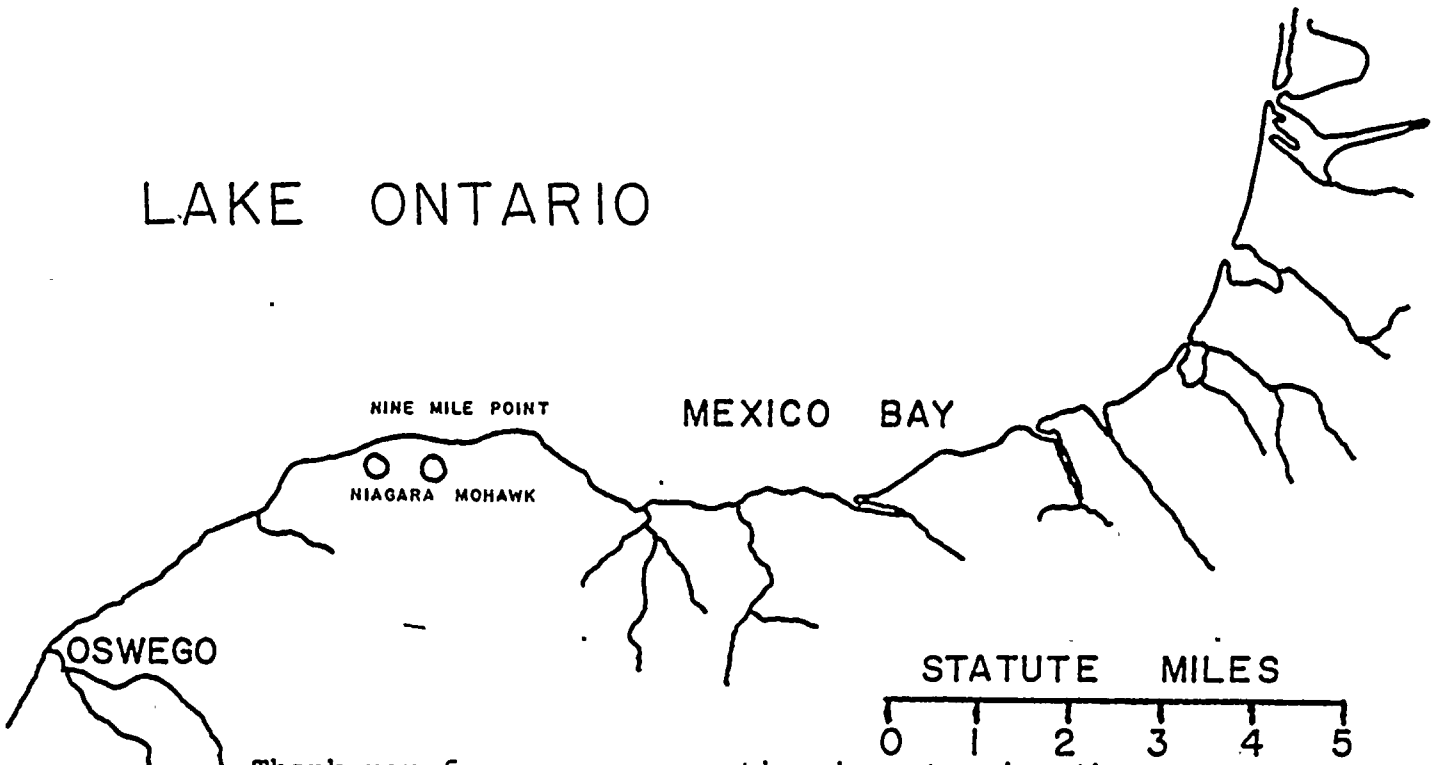
State University of New York at Buffalo

DEPARTMENT OF BIOLOGY

FACULTY OF NATURAL SCIENCES AND MATHEMATICS

To The Fish Tag Returner:

We have recently received your letter concerning the fish that you caught in Lake Ontario. The tagging program is part of a study sponsored by Niagara Mohawk Power Corporation on fish populations and their movements along the southern shore of Lake Ontario. The fish that you caught was tagged and released on _____ at the tagging location indicated on the map below.



Thank you for your cooperation in returning the fish tag. Enclosed with this letter is your $2.00 reward for each tag. We would greatly appreciate it if you would complete and return the enclosed questionnaire. This information is vitally needed for our on-going research program.

Thank you again for your help.

Sincerely,

John F. Storr

John F. Storr, Ph.D.
Department of Biology
SUNY/B

Enc.

HEALTH SCIENCES BUILDING BUFFALO, NEW YORK 14214 TEL.(716)831-2533

State University of New York at Buffalo

DEPARTMENT OF BIOLOGY

FACULTY OF NATURAL SCIENCES AND MATHEMATICS

Name of Tag Returner _____

Fish Species _____

Tag Number _____

Please provide to the best of your memory, the information requested below, and return this questionnaire in the enclosed stamped envelope.

1) What date was the fish caught?

2) At what location was the fish caught? (Please give location as detailed as possible).

3) What time of day was the fish caught?

4) About what was the size of the fish? (length and weight)

5) Did the tag cause irritation to the fish?

6) What type of bait or lure was used?

7) Do you recall about how many fishermen were in the area that day?

8) About how many fish of each kind did you catch that day?

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regarding fish populations or the future of the fishing in Lake Ontario. Some queries were directed to the DEC.

All tagged fish recaptured in trap nets were returned to the lake after the tag number, length of the fish, and the date of recapture had been recorded. In a few instances, sport fishermen have also informed us of the tag number, location, and date of a fish caught and again released. This has been helpful in detailing the movement of the fish along the shore and throughout the Nine Mile Point area.

2.2.4 Data Files and Analysis

Information supplied by the tag returns was consolidated on computer punch cards and then recorded on magnetic tape for computer analysis. The results of these analyses are included in Section 3 of this report. Machine analyses, using a Hewlett-Packard 9830A coupled to a plotter, were used to construct all tables and to produce the various plots used in this report. By using this methodology, levels of statistical confidence could be expressed for many of the results.

3.0 RESULTS OF ANALYSIS

From the beginning of the tagging program in 1972 to the end of 1976, 20,897 fish from 26 species were tagged and released into Lake Ontario (Table 3.0-1). Of these, 1517 fish from ten species have been recovered and their movements analyzed. Table 3.0-2 lists the species and indicates the numbers returned each year and the total returned. Table 3.0-3 analyzes these returns as a percent of the total tagged. It can be seen that our returns per species range from zero for several species to 15.1% for smallmouth bass. The overall return rate was found to be 7.3%.

3.1 STATISTICAL SUMMARY OF RETURNS

Only returns from yellow perch, pumpkinseed, brown bullhead, rock bass, and smallmouth bass were of sufficient number to allow for a meaningful analysis by statistical methodologies.

It was found that the greatest numbers of any one species are returned within the first two years, with very few fish being returned four years after tagging, and no returns five years after tagging (Tables 3.1-1 and 3.1-2b). First year returns ranged from 13.68% for smallmouth bass to 1.04% for brown bullhead (those fish showing a zero return rate are not considered in these analyses), while second year returns had a narrower range of 7.93% to 3.10% (Table 3.1-2b).

An interesting trend can be seen in Table 3.1-2a by looking at the percentage of a given species returned in the same year or second year from tagging. It would be expected that this number should remain constant, yet in most cases this percentage decreased significantly from 1972 to 1976. Figure 3.1-1 represents this graphically, showing yellow perch, rock bass, pumpkinseed, and brown bullhead as the percent of fish tagged which are returned within the first year. Since this is percentage, it is independent of the variation in actual numbers tagged, and if the fishing pressure and angler interest in returning the tags is assumed to remain constant, this percentage decreases significantly, as can be seen in the upper portion of the figure, which represents the mean percentage returned within the first year. This would indicate a decrease either in fishing pressure or angler interest in the project.

3.2 MIGRATION AND DISPERSION OF TAGGED SPECIES

Scatter diagrams were prepared plotting the distance travelled versus the days to recapture and a linear regression was performed on the points. This process allows for the elucidation of a numerical relationship between the two variables under study and an assessment of the degree to which the points on the axes correlate to this function. It was determined from these processes that, for the species tested, only yellow perch demonstrate an actual migratory pattern. Pumpkinseed, brown bullhead, and rock bass show only patterns of dispersion.

3.2.1 Yellow Perch

Figure 3.2.1-1 is the scattergram for yellow perch movements. Three results became obvious from the graph:

1) The clustering of returns would indicate that a major portion of the tagged yellow perch are moving seasonally in a body back and forth along the lake shore.

2) Certain locations (A and B) have predominantly more returns than intermediate distances.

3) The locations of the tagged fish seem to flow rhythmically with time. The hand drawn dashed line is included only to assist the reader in understanding our interpretation. There was no mathematical basis for its development.

The rhythmic movement pattern of the yellow perch suggests a definite migratory pattern. The horizontal axis on the figure represents the Nine Mile Point location with area "A" representing the distance to the Salmon River and "B" the distance to Sandy Pond. Thus, the fish which are tagged at Nine Mile Point during the summer are angled the following spring at Sandy Pond, then gradually shift westward to be back at their original tagging point one year later. The data also suggest a repeat pattern for the following year. The number of fish recaptured more than 500 days after tagging is, however, too low for reliable predictions of movements over such long periods of time.

Clustering of returns around the horizontal axis, at distance "A" and distance "B", suggest that the areas of most intensive fishing pressure are Nine Mile Point, the Salmon River, and Sandy Pond. In addition, there are scattered re-

turns from places between the major fishing areas, and as far away as the headwaters of the St. Lawrence River.

In Figure 3.2.1-1 tag returns are recorded for yellow perch tagged through the summer. Since spread along the X-axis is time dependent without regard to the month in which the fish were tagged, Figure 3.2.1-2 was developed using only returns from fish tagged in July. The migratory movement of these fish are both representative of all the yellow perch tagged and clarifies the seasonal pattern of movement. The fish leave NMP in the fall and are picked up in Sandy Pond by ice fishermen from December through March. Through April and May the yellow perch are moving westward past the Salmon River and by June and July have returned to the Nine Mile Point area. While this is a very distinct and obvious migratory pattern, a few yellow perch do stray further, either to the east or west (Figures 3.2.1-4 and 3.2.1-5).

Figure 3.2.1-3 represents the numbers of tags returned at various distances east and west of Nine Mile Point. Note that the highest returns come from definite locations experiencing high fishing pressure, i.e., Nine Mile Point (40%), Oswego Harbor (7%), the Salmon River (7%), and Sandy Pond (10%), as expected. About 12 times as many fish are returned from greater than 10 miles east of Nine Mile Point as are returned from greater than 10 miles west. This would evidence that most of the migratory movement is occurring eastward from Nine Mile Point.

nearly equal, with the easterly areas perhaps experiencing a slightly higher fishing pressure and thus skewing the results of the data analysis.

3.2.3 Brown Bullhead

The scattergram, Figure 3.2.3-1, for bullheads indicate a pattern of continual dispersal. Returns seem to be scattered randomly along the shoreline, and there is little tendency for this fish to remain at the point of tagging for any length of time. Some fish of this species have been shown to travel more than 20 miles in just a few days. The overall rate of movement, Figure 3.2.3-2, is about 0.093 miles or nearly 500 feet per day. Dispersion seems to be fairly constant with the fish ranging with an average of two miles the first season, 8-10 miles the second season, and 16-18 miles the third season. The mean dispersal for the three years lie along a straight line. Certainly this is representative of a classical pattern of dispersion in which the movement is random and very active. Two brown bullheads were picked up on the other side of the lake near Kingston, Ontario, a shoreline trip of nearly 120 miles. It may be concluded that although the bullheads seem to move freely and regularly over long distances there was no discernable repeated migratory pattern.

Movement to both east or west, Figure 3.2.3-3, appears to be fairly constant with the exception of a high incidence of returns from the Salmon River area, due to increased bullhead fishing pressure around the mouth of the river. This

was indicated from the report of tag returns for bullheads, which show that there is a small but active semi-commercial fishery in this location.

3.2.4 Rock Bass

Rock bass show a pattern of dispersal similar in some respects to both pumpkinseed and the brown bullhead. Dispersion occurs continuously, as with the brown bullhead, but there is more movement during the first season after tagging than for the other species, Figure 3.2.4-1. First season movements shown in Figure 3.2.4-2 indicate a dispersal rate of 0.157 miles or 830 feet per day. This is indicative of considerable movement on the part of the fish. Mean annual dispersion, Figure 3.2.4-3, is indicated as 5-7 miles the first season, 8-10 miles by the second season, and 12-14 miles by the third season, with an overall movement rate of 0.024 miles or 127 feet per day. The discrepancy between overall movement and movement during one season can be interpreted that these fish will range widely during the summer season, but move much less readily between seasons.

East-west movements, Figure 3.2.4-4, show no preference for directional movement with returns scattered evenly along the shoreline.

3.2.5 Other Species

Although there are returns for white perch, smallmouth bass, and white sucker, none have been recaptured in sufficient numbers to allow for a definitive analysis of their movements. Section 4.3 contains figures which repre-

sent the movement of fish from their tagging point to point of recapture. This was done by species and month. From looking at these maps, one cannot detect any indication of migration occurring within the more uncommon species. White perch and smallmouth bass seem to range freely along the shore with little preference for direction in this part of the lake. It is hoped that further returns in 1977 from these species will allow for a more definitive determination of their movements.

3.3 GROWTH RATES OF TAGGED FISH

Since the fish recaptured in our trap or gill nets can be measured accurately, it is possible to determine the amount of growth a fish has experienced in the interval between tagging and recapture. For the major species recovered, these are:

	Daily Growth mm/day	Annual Growth cm/year	
Yellow perch	0.136	4.96	Figure 3.3-1
Pumpkinseed	0.124	4.53	Figure 3.3-2
Bullhead	0.112	4.09	Figure 3.3-3
Rock bass	0.121	4.42	Figure 3.3-4

These figures represent the average daily growth over a one-year period and do not take into account variations in growth rate during different seasons of the year. These growth rates compare well with those given in Scott and Crossman, Fisheries Research Board of Canada Bulletin #184.

3.4 EXPLOITATION RATES AND EXPECTATION OF SURVIVAL

Using the method developed by Youngs and Robson (1975) we were able to calculate the annual exploitation for yellow perch, pumpkinseed, and rock bass as well as the probability of a fish surviving to the next season. In this technique the number of fish tagged in a given year is compared to the number of those fish returned during each successive year. Coupled with the total returns for a year, the exploitation rate is calculated.

E_i = Probability of being harvested during year i

S_i = Probability of surviving year i

$1-S_i-E_i$ = Probability of being killed otherwise during year i

N_i = Number of fish tagged during year i

R_i = Total recaptures from a given N_i.

C_i = Year total captures from all N_i

Defining $T_1 = R_1$ and $T_{i+1} = R_{i+1} + T_i - C_i$ and

$r_i = R_i/N_i$

Then,

$$E_i = r_i(C_i/T_i) \pm \left\{E_i/R_iN_i \times [E_i(N_i-R_i) + \frac{R_i(R_i-E_iN_i)}{T_i}]\right\}$$

and

$$S_i = \frac{r_i-E_i}{r_{i+1}} \pm \left\{Si^2[\frac{N_i-R_i}{N_iR_i} + \frac{N_{i+1}-R_{i+1}}{N_{i+1}R_{i+1}} + \frac{E_iN_i}{T_i(R_i-N_iE_i)}]\right\}$$

From these we find that the mean fishing pressure as percent of catchable fish along the southeast shore of Lake Ontario is:

Yellow perch	7.41% per year	Table 3.4-1
Pumpkinseed	8.02% per year	Table 3.4-2
Rock bass	6.74% per year	Table 3.4-3

As further data become available it may be possible to follow annual changes in fishing pressure. However, since no previous studies of this nature are available for Lake Ontario, it is impossible to interpret these numbers as representing light or heavy fishing pressure.

3.5 PREFERENCE FOR BAIT TYPES

A computer program was written to look at the success of various types of bait as determined from angler returns over the five-year period (Table 3.5-1). Worms seem to be the most effective bait for most species, followed by minnows, artificials and crustaceans. The high success level for worms probably reflects their popularity as a bait and the generally high preference for their use.

4.0 DISCUSSION

4.1 POSSIBLE IMPACT OF GENERATING STATION IMPINGEMENT ON TAGGED SPECIES

By looking at the numbers of tagged fish which are taken into the water intakes of the various power plants, and comparing this to the total number tagged, it is possible, using a basic mark recapture technique, to determine what percentage of the total population in the area are subject to impingement.

Out of 20,897 fish tagged over the period 1972-1976 and returned through the end of 1976, only six tagged fish were reported to be recovered through the intakes of power plants in Lake Ontario, three at the FitzPatrick Station and three at Nine Mile Point. Assuming that the tagged fish are available, and are as vulnerable to entrainment as untagged individuals, the conclusion from these data is that an extremely small percentage (6/20,897 x 100% or 0.03%) of the available fish are being impinged.

4.2 POSSIBLE IMPACT OF THE DISCHARGE PLUME ON THE MOVEMENTS OF FISH SPECIES

Concern has been expressed by public agencies that the existence of large plumes of heated water will interrupt the normal along-shore movements of some fish species, namely yellow perch and brown bullhead. Work done by Kelso (1974, 1975, 1976) concluded that yellow perch, brown bullhead, and white sucker coming in contact with lakeward flow, with or without the addition of heat, experienced alteration of their

swimming behavior. Kelso found that there was an increased tendency for localization of movements and interruption of normal along-shore movements.

Kelso's study only looked at the short-term effects within the limited area of the discharge. Our findings show that, of the three fish Kelso studied, only yellow perch demonstrate a regular migratory pattern. These fish move along the south shore of Lake Ontario in an annual cycle of westward movement during the spring and eastward movement in the summer, fall, and early winter. Although Kelso showed some interruption of movement, the fish left the area within a few days. We were unable to find any discernable effect on pattern of movement of fish. Brown bullhead movements, for example, were completely random and demonstrated only a pattern of dispersion.

Of all the species studies during this tagging program, no effects of the thermal plumes at Nine Mile Point or Oswego Harbor could be demonstrated.

4.3 FISH MOVEMENTS

Of the 26 species of fish tagged from 1972-1976, returns were received from only ten species and these are reported below.

4.3.1 Yellow Perch

As shown in Section 3.2.1, yellow perch are the only fish studied which demonstrate a regular migratory pattern. The actual monthly movements have been drawn on USGS maps attached to this section as figures. The map only shows the ultimate direction of movement and not the time factor. Figure 4.3.1-1 shows yellow perch which were tagged during May (all years combined). Fish tagged at Nine Mile Point, Dempster Beach, and Sandy Pond moved randomly and were returned from Little Sodus Bay to Clayton.

Yellow perch tagged in June, Figure 4.3.1-2, travelled much further before being recaptured. The direction of movement is primarily eastward, but westward movement does occur, especially from Dowie Dale. One fish was returned from near Irondequoit Bay, having travelled almost 50 miles and having passed the thermal plume at the Rochester Gas and Electric R. E. Ginna Nuclear Station. Returns from fish tagged in July, Figure 4.3.1-3, show a heavy eastward movement toward Sandy Pond. Again, some westward movement does occur. August tagging of yellow perch, Figure 4.3.1-4, also indicates heavy eastward movement. In September fish which are tagged demonstrate a predominant westward movement, Figure 4.3.1-5, as is evident with the October tagged fish, Figure 4.3.1-6.

4.3.2 Pumpkinseed

Pumpkinseed tagged in June at Nine Mile Point moved eastward a short distance into Mexico Bay, while in

July tagged fish ranged much further to the east and also to the west, Figures 4.3.2-1 and 4.3.2-2. Pumpkinseed tagged in August, Figure 4.3.2-3, showed greater movement than in July, with about equal preference for east and west. Returns ranged from Sodus Bay, about 25 miles to the west, to Henderson Bay at the St. Lawrence River in the east, about 40 miles distant. Distances travelled for returns from September tagging, Figure 4.3.2-4, again showed little preference for east or west, while the distances travelled were not as great as for fish tagged in August.

4.3.3 Brown Bullhead

Only three bullhead have been returned from a May tagging; these fish all moved eastward, two within the confines of Mexico Bay from North Sandy Pond to Selkirk, and one from Mexico Point to Oswego, Figure 4.3.3-1. June tagging, Figure 4.3.3-2, done at Nine Mile Point produced four returns. One fish moved a short distance west and the other three moved eastward into Mexico Bay. July tagging at Nine Mile Point produced many more returns, most of which were retaken within Mexico Bay to Sandy Creek. One fish moved all the way to the Canadian shore of the St. Lawrence River, a distance of about 60 miles, and another moved west almost to Sodus Bay. Again we see the movements being highly concentrated within Mexico Bay, Figure 4.3.3-3. Returns from August tagging of bullheads were the most numerous with the greatest numbers tagged at Nine Mile Point and returned from within Mexico Bay as far as Stony Point. A few bullhead travelled west, generally long

distances, with one passing the thermal plume at the Rochester Gas and Electric R. E. Ginna Nuclear Station, Figure 4.3.3-4. Many fish returns came from the September tagging. Most returns from Nine Mile Point tagging moved eastward, as far as Henderson Harbor, Figure 4.3.3-5. Only three bullhead were returned from the October tagging studies, and they showed the same movement pattern as those returned from May, Figure 4.3.3-6.

4.3.4 Rock Bass

Rock bass returns came from fish tagged in May, June, July, and August, Figures 4.3.4-1, 4.3.4-2, 4.3.4-3, and 4.3.4-4. The fish appear to travel great distances with little preference for direction. Returns of rock bass tagged at Nine Mile Point ranged from past the Rochester Gas and Electric R. E. Ginna Station in the west to the Canadian shore on the east. Fish tagged at North Sandy Pond moved westward past both the Nine Mile Point and Oswego thermal plumes.

4.3.5 Smallmouth Bass

Smallmouth bass were tagged and returns were small in number. Returns are in for fish tagged each month from May to September, Figures 4.3.5-1 to 4.3.5-5. Most of the returns moved short distances west in May and June, and short distances west in July, August, and September. Two moved long distances eastward; one in August moved around to the Canadian shore of the lake near the St. Lawrence River. With these two exceptions, smallmouth bass appear to have a limited range moving little from the point of tagging.

4.3.6 White Perch

Only seven white perch returns are in from three months, June, July, and August. Little preference for direction is evident, but the fish do tend to move moderately long distances, ranging from Port Bay 20 miles west to North Sandy Pond 20 miles east, Figures 4.3.6-1 to 4.3.6-3.

4.3.7 White Sucker

One return is in for each month, June, September, and October. Each of these fish moved eastward to the area around Selkirk, Figures 4.3.7-1 to 4.3.7-3. No movement patterns are evident from these returns.

4.3.8 Bluegill

Bluegill returns are only in for fish tagged during August and October. There were only three returns, and all of them moved westward, Figures 4.3.8-1 and 4.3.8-2.

4.3.9 Bowfin

One bowfin tagged in May at Nine Mile Point was returned from a short distance to the west, and one tagged in July moved from Oswego Harbor to South Sandy Creek, Figures 4.3.9-1 and 4.3.9-2.

4.3.10 Black Crappie

Two movements of black crappie are recorded for fish tagged in October. Both moved within the area around North Pond, Figure 4.3.10-1.

Table 3.0-1 Summary of Fish Tagged to Date
NMPC Tagging Project 1972 - 1976

Species	1972	1973	1974	1975	1976	Total
Pumpkinseed	481	1146	560	703	771	3661
White Perch	58	310	333	232	488	1421
Rock Bass	70	369	439	445	631	1954
Yellow Perch	220	1089	1313	721	764	4107
White Bass	0	0	1	9	9	19
Smallmouth Bass	16	56	16	16	22	126
Burbot	0	0	1	0	0	1
Brown Bullhead	107	1262	1652	2110	3171	8302
Carp	4	10	7	2	7	30
Goldfish	0	23	0	0	2	25
Black crappie	4	24	30	30	54	142
White Sucker	13	117	76	89	77	372
Gizzard shad	2	0	0	0	0	2
Bluegill	1	15	20	329	165	530
Eel	0	12	28	85	3	128
Pickerel	0	0	2	0	0	2
Northern Pike	0	1	2	0	5	8
Bowfin	0	1	12	16	0	29
Redhorse Sucker	0	11	1	0	0	12
Freshwater Drum	0	1	0	0	5	6
Black Bullhead	0	0	1	0	0	1
Walleye	0	0	2	0	2	4
Hogsucker	0	0	0	1	1	2
Largemouth Bass	0	0	0	5	6	11
Lake Trout	0	0	0	0	1	1
Stonecat	0	0	0	1	0	1
TOTAL	976	4447	4496	4794	6184	20,897

Table 3.0-2 Summary of Fish Returned to Date
NMPC Tagging Project 1972 - 1976

Species	1972	1973	1974	1975	1976	Total
Pumpkinseed	86	159	65	36	42	388
White Perch	0	6	6	7	5	24
Rock Bass	7	36	58	53	51	205
Yellow Perch	12	125	185	104	112	538
White Bass	0	0	0	0	0	0
Smallmouth Bass	7	3	6	1	2	19
Burbot	0	0	0	0	0	0
Brown Bullhead	0	49	132	61	83	325
Carp	0	0	0	0	0	0
Goldfish	0	0	0	0	0	0
Black Crappie	0	0	0	0	3	3
White Sucker	0	0	5	0	0	5
Gizzard Shad	0	0	0	0	0	0
Bluegill	0	0	0	2	6	8
Eel	0	0	0	0	0	0
Pickerel	0	0	0	0	0	0
Northern Pike	0	0	0	0	0	0
Bowfin	0	0	0	1	1	2
Redhorse Sucker	0	0	0	0	0	0
Freshwater Drum	0	0	0	0	0	0
Black Bullhead	0	0	0	0	0	0
Walleye	0	0	0	0	0	0
Hogsucker	0	0	0	0	0	0
Largemouth Bass	0	0	0	0	0	0
Stonecat	0	0	0	0	0	0
TOTAL	112	378	457	265	305	1517

Table 3.0-3 Percentage Returns Summary
NMPC Tagging Project 1972 - 1976

Species	Total Tagged	Total Returned	Percentage Recovery
Pumpkinseed	3661	388	10.6
White Perch	1421	24	1.7
Rock Bass	1954	205	10.5
Yellow Perch	4107	538	13.1
Smallmouth Bass	126	19	15.1
Brown Bullhead	8302	325	3.9
Black Crappie	142	3	2.1
White Sucker	372	5	1.3
Bluegill	530	8	1.5
Bowfin	29	2	6.9
TOTAL*	20,897	1517	7.3

*Total reflects all fish tagged. Those species showing zero returns overall have been excluded from this table.

Table 3.1-1 Summary of Returns by Species and Year
NMPC Tagging Report 1972 - 1976

Species	Year Tagged	Number Tagged	Returned in Year 1972	1973	1974	1975	1976	Total Returned	Percentage Recovery
Yellow Perch	1972	220	12	29	4	0	0	45	20.0
	1973	1089		96	87	6	1	190	17.4
	1974	1313			94	54	18	166	12.6
	1975	767				51	49	100	13.0
	1976	764					44	44	5.8
Pumpkinseed	1972	481	86	28	0	0	0	114	23.7
	1973	1146		131	37	11	2	181	15.8
	1974	560			28	6	1	35	6.3
	1975	847				19	21	40	4.7
	1976	771					18	18	2.3
Brown Bullhead	1972	107	0	4	2	1	0	7	6.6
	1973	1262		45	114	7	6	172	13.6
	1974	1652			16	50	12	78	4.7
	1975	2207				4	53	57	2.6
	1976	3171					12	12	0.4
Rock Bass	1972	70	7	3	1	0	0	11	15.7
	1973	369		33	23	11	3	70	19.0
	1974	439			34	20	6	60	13.7
	1975	606				23	22	45	7.4
	1976	631					20	20	3.2
Smallmouth Bass	1972	16	7	1	0	0	0	8	50.0
	1973	56		2	3	0	0	5	8.9
	1974	16			3	0	0	3	18.8
	1975	46				1	2	3	6.5
	1976	22					0	0	0.0

Table 3.1-2a Percentage Returned Each Year
NMPC Tagging Project 1972 - 1976

Species	Year Tagged	% Returned in Year 1972	1973	1974	1975	1976
Yellow Perch	1972	6.0	13.2	1.8	0.0	0.0
	1973		8.8	8.0	0.6	0.1
	1974			7.2	4.1	1.4
	1975				6.6	6.4
	1976					5.8
Pumpkinseed	1972	17.9	5.8	0.0	0.0	0.0
	1973		11.4	3.2	1.0	0.2
	1974			5.0	1.1	0.2
	1975				2.2	2.3
	1976					2.3
Brown Bullhead	1972	0.0	3.7	1.9	0.9	0.0
	1973		3.6	9.0	0.6	0.5
	1974			1.0	3.0	0.8
	1975				0.2	2.4
	1976					0.4
Rock Bass	1972	10.0	4.3	1.4	0.0	0.0
	1973		8.9	6.2	3.0	0.8
	1974			7.7	4.6	1.4
	1975				3.8	3.6
	1976					3.2
Smallmouth Bass	1972	43.8	6.3	0.0	0.0	0.0
	1973		3.6	5.4	0.0	0.0
	1974			18.8	0.0	0.0
	1975				2.2	4.4
	1976					0.0

Table 3.1-2b Summary of Annual Percentage Returns
NMPC Tagging Project 1972 - 1976

Species	Mean Percentage Returned First Year	Second Year	Third Year	Fourth Year	Fifth Year
Yellow Perch	6.88	7.93	1.27	0.05	0.00
Pumpkinseed	7.76	3.10	0.40	0.10	0.00
Brown Bullhead	1.04	4.53	1.10	0.70	0.00
Rock Bass	6.72	4.68	1.93	0.40	0.00
Smallmouth Bass	13.68	4.03	0.00	0.00	0.00

Table 3.4-1 Exploitation Probability and Survival Expectation for Yellow Perch NMPC Tagging Project 1972 - 1976

Year Tagged	Number Tagged	Returned in Year 1972	1973	1974	1975	1976	Total Returns	Recovery Ratio
1972	220	12	29	4	0	0	45	.205
1973	1089		96	87	6	1	190	.174
1974	1313			94	54	18	166	.126
1975	767				51	49	100	.130
1976	764					44	44	.058
Year Total Captures	(4153)	12	125	185	111	112	(545)	(.131)
Probability of Being Harvested During Year $\bar{x}$ = 0.0741 ± 0.0040		0.0533 ±.00449	0.0957 ±.00144	0.0831 ±.00100	0.0700 ±.00171	0.0682 ±.00163		
Probability of Surviving to Next Year		0.8629 ±.0505	0.6755 ±.0210	0.3843 ±.0269	0.2917 ±.0311	NC*		

*NC = Not calculated due to necessity of following year's data.

Table 3.4-2 Exploitation Probability and Survival Expectation for Pumpkinseed NMPC Tagging Project 1972 - 1976

Year Tagged	Number Tagged	Returned in Year 1972	1973	1974	1975	1976	Total Returns	Recovery Ratio
1972	481	86	28	0	0	0	114	.237
1973	1146		131	37	11	2	181	.158
1974	560			28	6	1	35	.063
1975	847				19	21	40	.047
1976	771					18	18	.023
Year Total Captures	(3805)	86	159	65	36	42	(388)	(.102)
Probability of Being Harvested During Year $\bar{x}$ = 0.0802 ± .0168		0.1788 ±.00598	0.1200 ±.00174	0.0481 ±.00139	0.0224 ±.000506	0.0317 ±.000827		
Probability of Surviving to Next Year		0.3726 ±.0280	0.5964 ±.0565	0.5625 ±.1384	0.5873 ±.1127	NC*		

*NC = Not calculated due to necessity of following year's data.

Table 3.5-1 Bait Success Determined from Angler Returns
NMPC Tagging Project 1972 - 1976

Species	Minnows	Worms	Crustaceans	Artificials
Yellow Perch	26.1%	54.0%	2.4%	17.5%
Pumpkinseed	6.0%	90.2%	1.7%	2.1%
Brown Bullhead	3.8%	83.0%	11.3%	1.9%
Rock Bass	13.8%	70.8%	1.5%	13.8%
White Perch	18.8%	75.0%	6.3%	0.0%
Smallmouth Bass	37.5%	50.0%	12.5%	0.0%
White Sucker	0.0%	100.0%	0.0%	0.0%
Bowfin	0.0%	100.0%	0.0%	0.0%
Bluegill	17.5%	50.0%	12.5%	25.0%
Black Crappie	66.7%	33.3%	0.0%	0.0%
Mean	18.5% ± 2.07	70.6% ± 2.31	4.8% ±.54	6.0% ±.92

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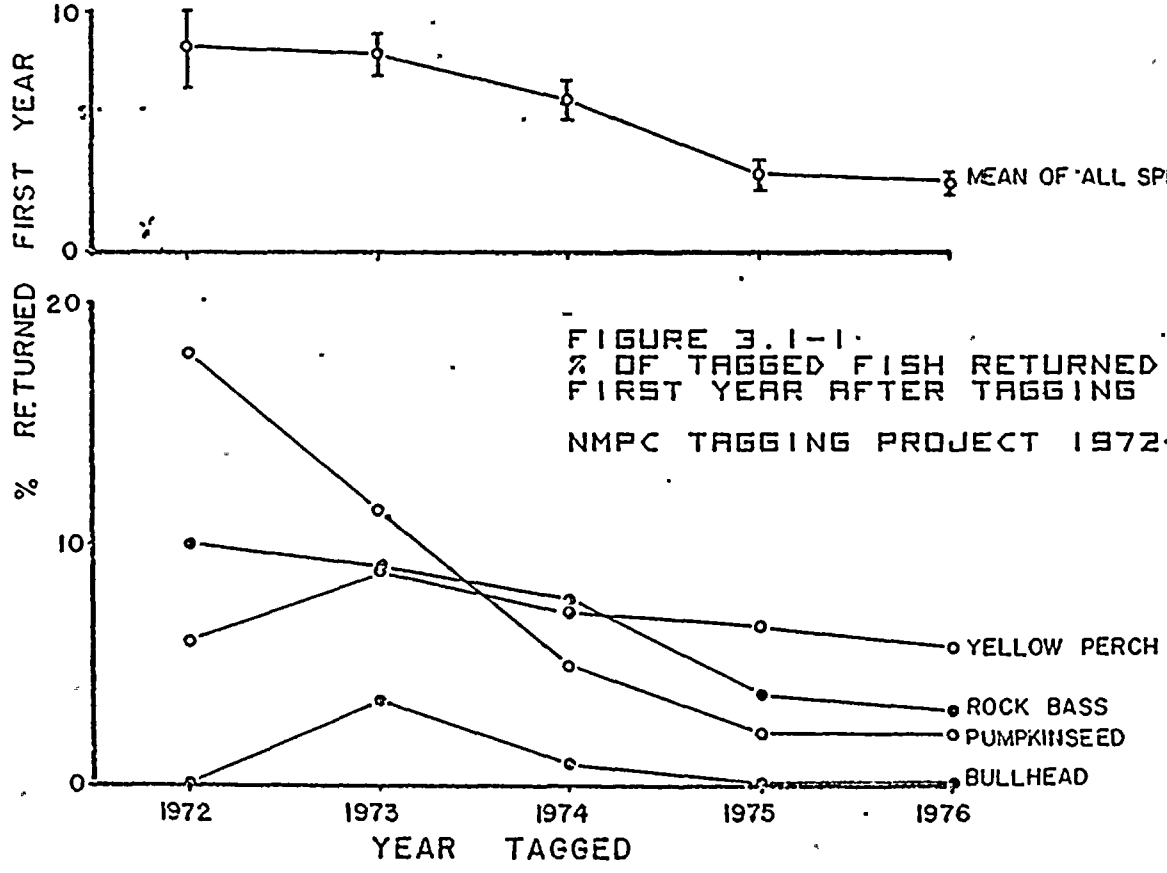


FIGURE 3.1-1.
% OF TAGGED FISH RETURNED DURING FIRST YEAR AFTER TAGGING

NMPC TAGGING PROJECT 1972-1976

FIGURE 3.2.1-1
YELLOW PERCH TAGGED AT NMP - ALL
NMPC TAGGING PROJECT 1972-1976.

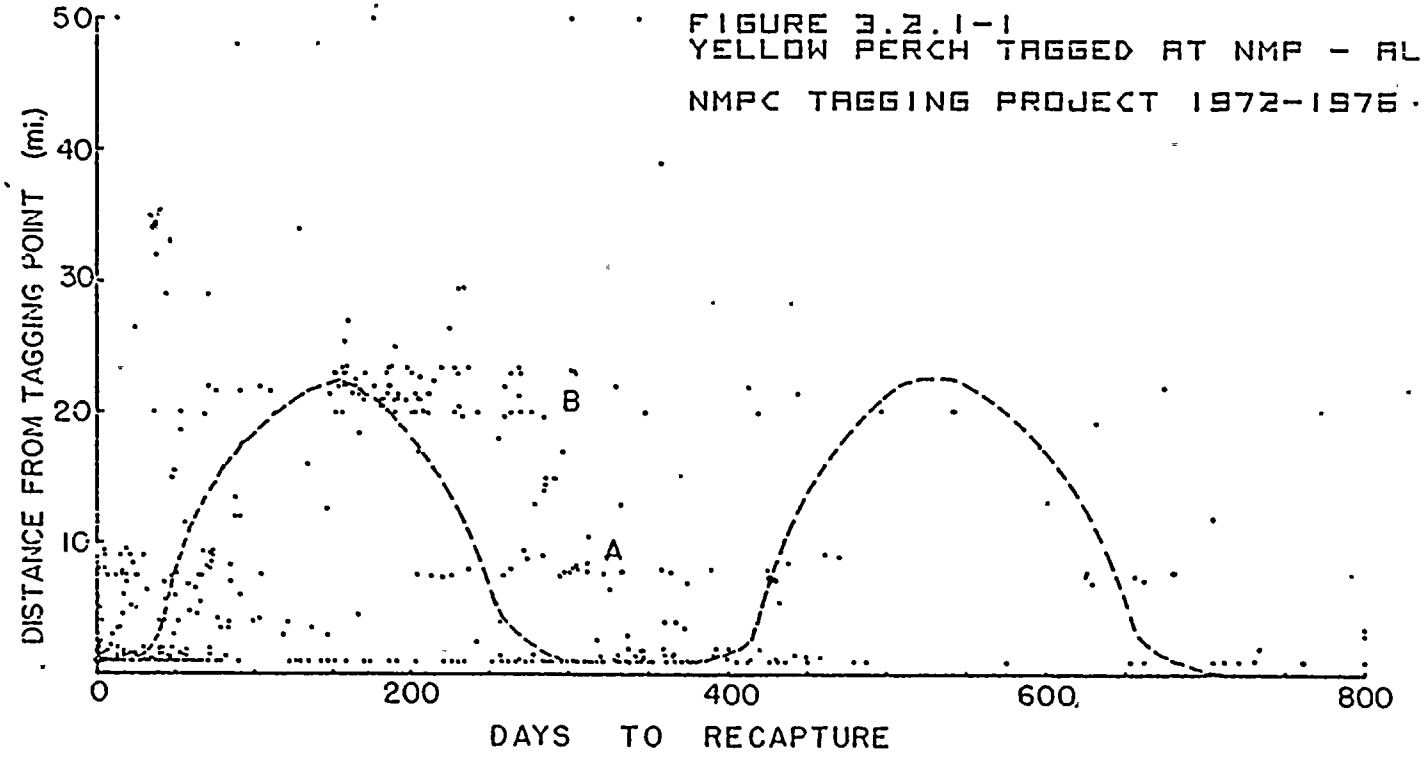


FIGURE 3.2.1-2
YELLOW PERCH TAGGED AT NMP - JULY
NMPC TAGGING PROJECT 1972-1975

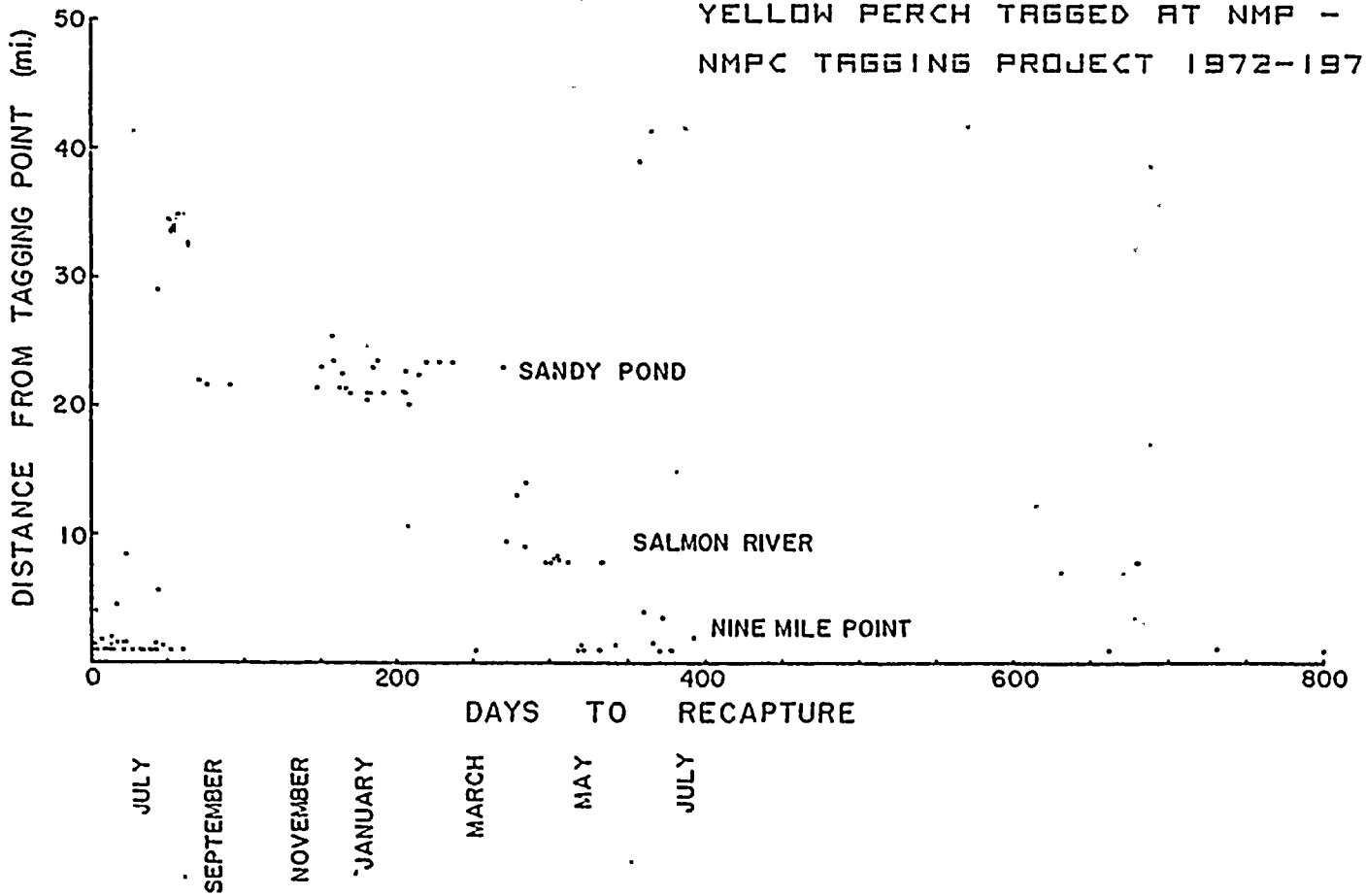


Table 3.4-3 Exploitation Probability and Survival Expectation for Rock Bass
NMPC Tagging Project 1972 - 1976

Year Tagged	Number Tagged	Returned in Year 1972	1973	1974	1975	1976	Total Returns	Recovery Ratio
1972	70	7	3	1	0	0	11	.157
1973	369		33	23	11	3	70	.190
1974	439			34	20	6	60	.137
1975	606				23	22	45	.074
1976	631					20	20	.032
Year Total Captures	(2115)	7	36	58	54	51	(206)	(.097)
Probability of Being Harvested During Year $\bar{x}$ = 0.0674 ± .0086		0.1000 ±.0252	0.0921 ±.00431	0.0830 ±.00527	0.0380 ±.00308	0.0238 ±.00474		
Probability of Surviving to Next Year		0.3144 ±.1527	0.7273 ±.0612	0.6526 ±.0835	0.5871 ±.0769	NC*		

*NC = Not calculated due to necessity of following year's data.

FIGURE 3.2.1-3
EAST-WEST MOVEMENTS OF YELLOW PERCH
NMPC TAGGING PROJECT 1972-1976

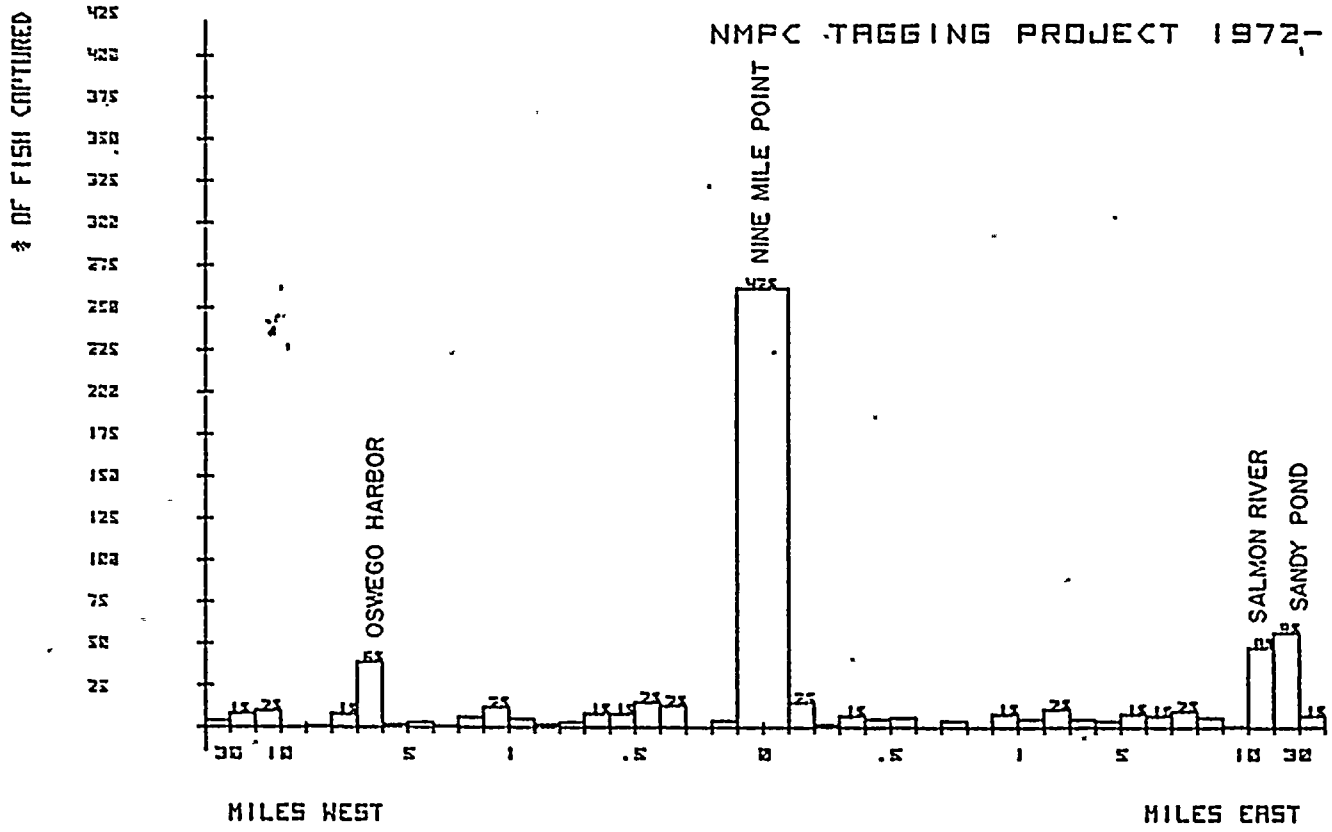


FIGURE 3.2.2-1
PUMPKINSEED TAGGED AT NMP - ALL
NMPC TAGGING PROJECT 1972-1976

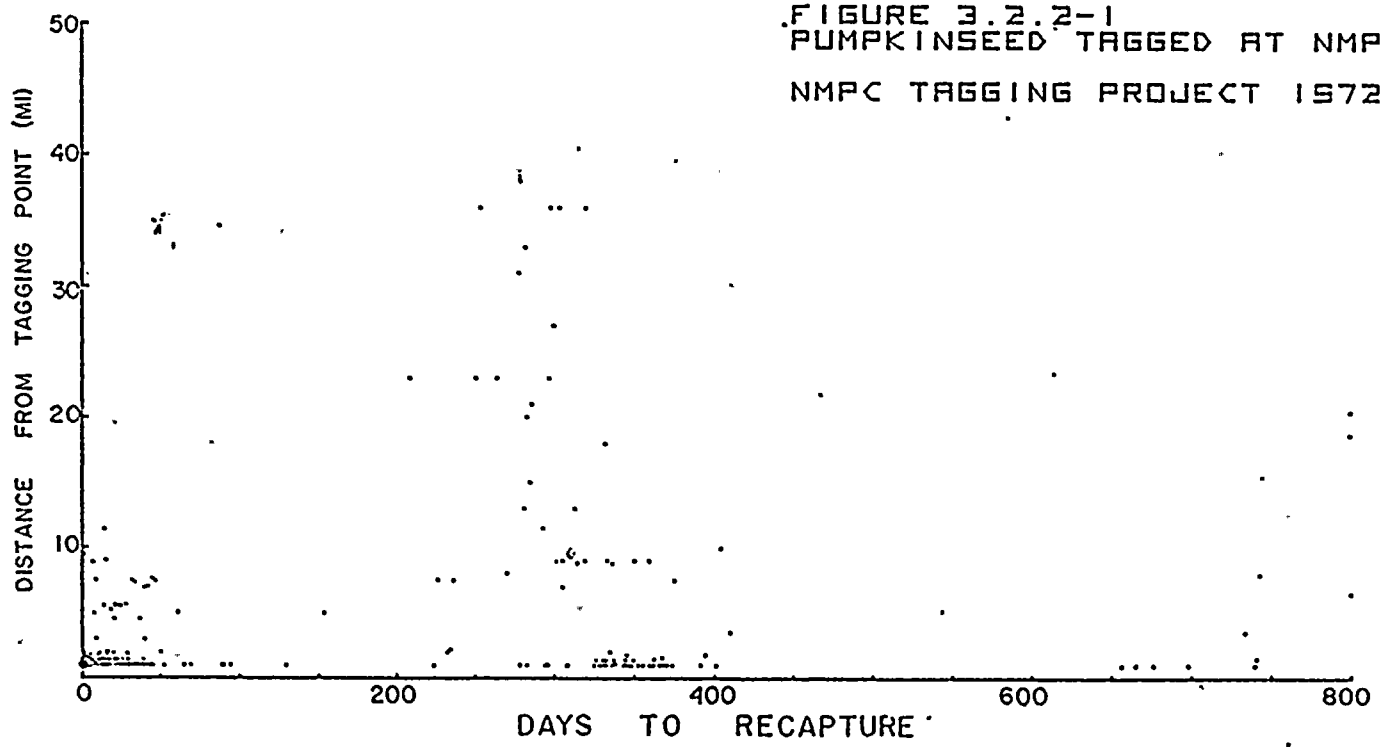


FIGURE 3.2.2-2
PUMPKINSEED RETURNED FIRST SEASON
NMPC TAGGING PROJECT 1972-1976

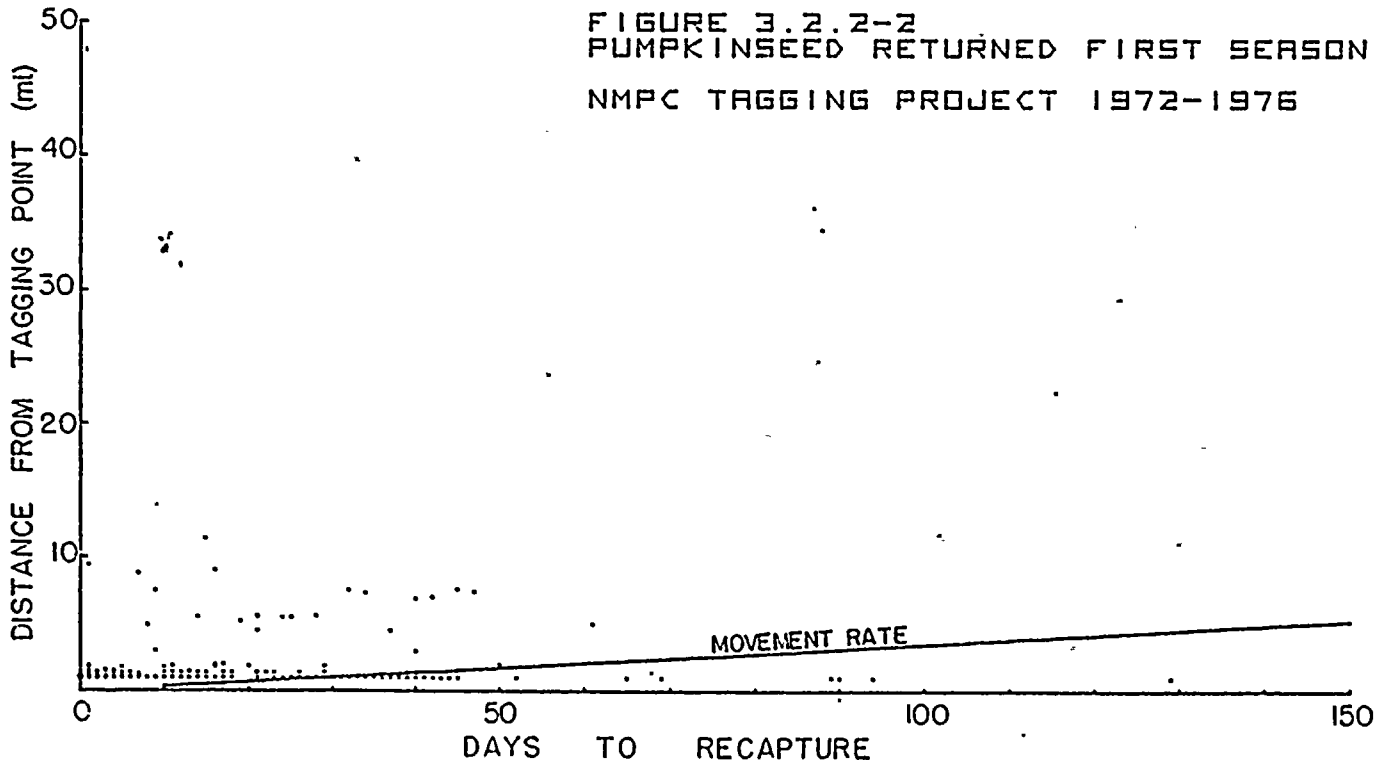
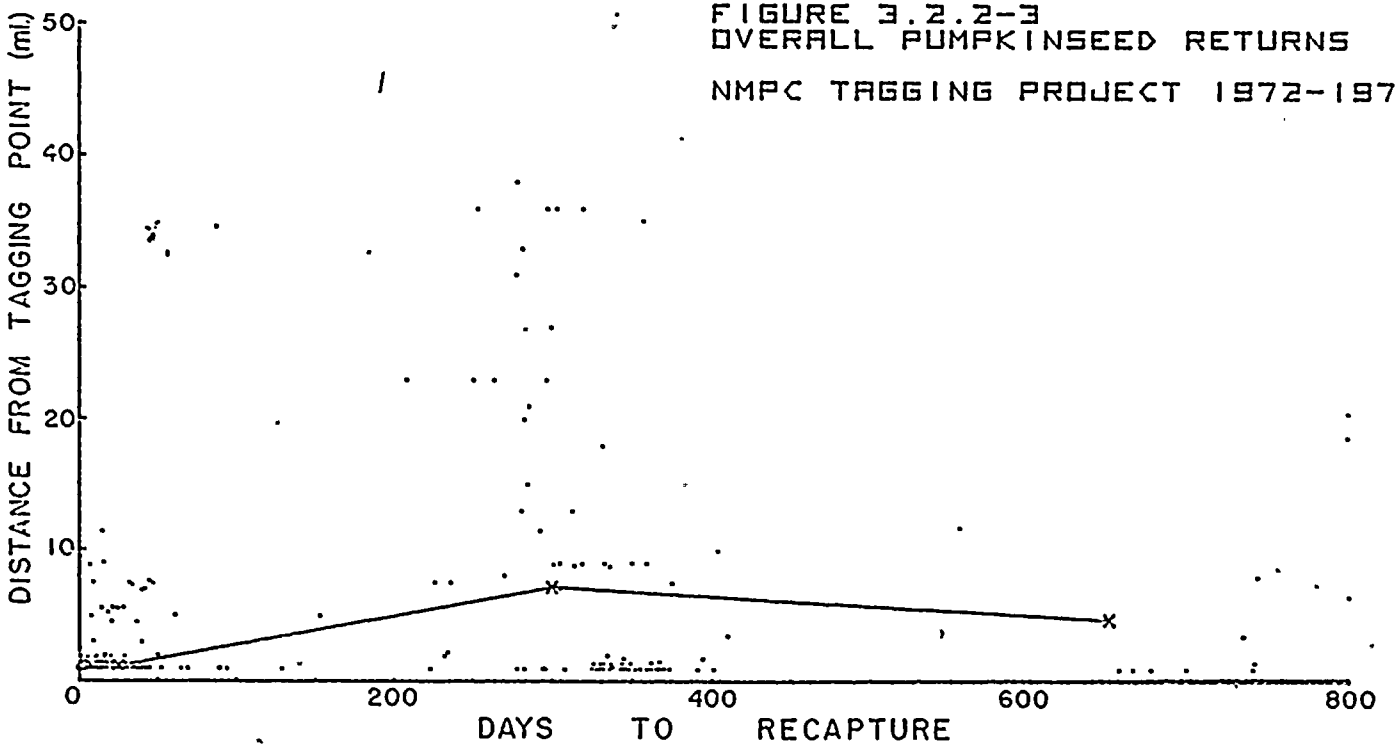


FIGURE 3.2.2-3
OVERALL PUMPKINSEED RETURNS
NMPC TAGGING PROJECT 1972-1976



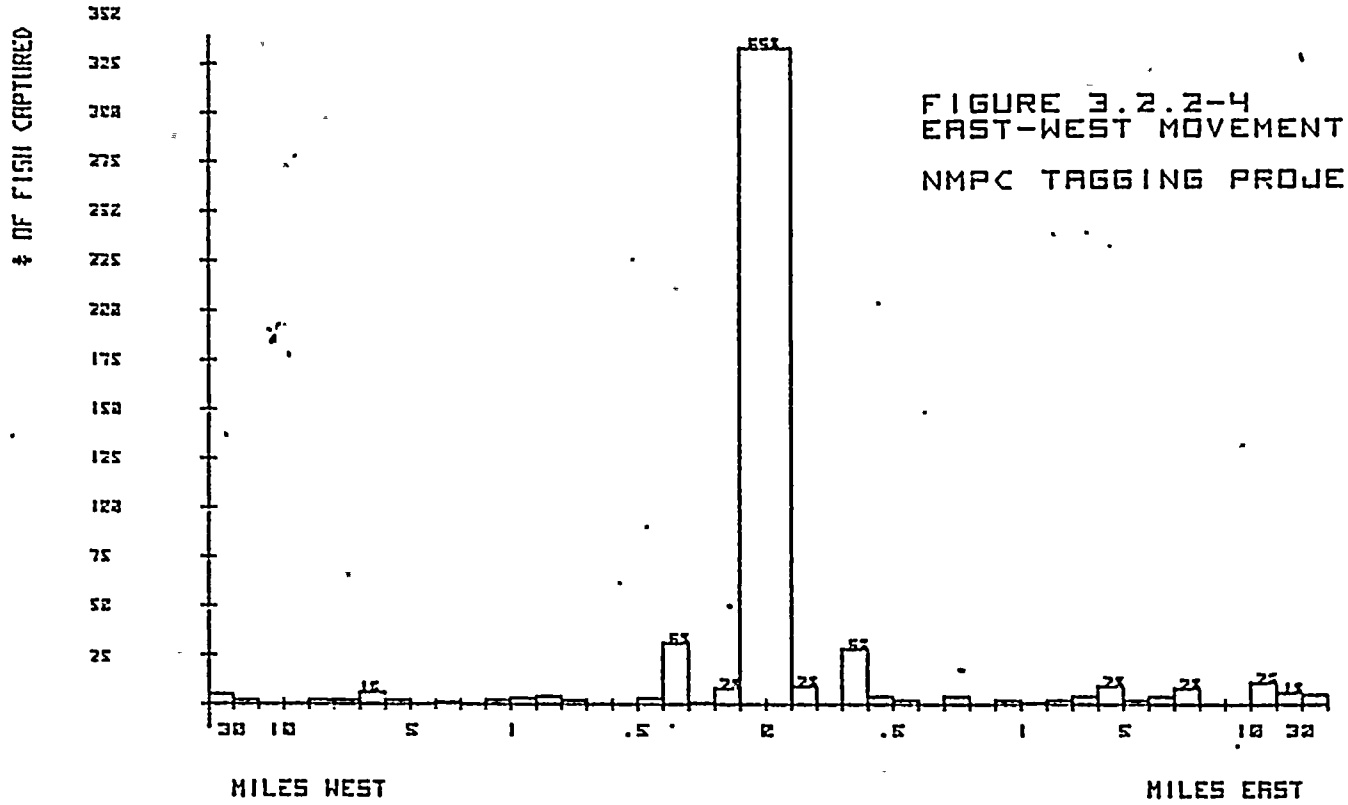


FIGURE 3.2.2-4
EAST-WEST MOVEMENTS OF PUMPKINSEED
NMPC TAGGING PROJECT 1972-1976

FIGURE 3.2.3-1
BULLHEAD TAGGED AT NMP - ALL
NMPC TAGGING PROJECT 1972-1976

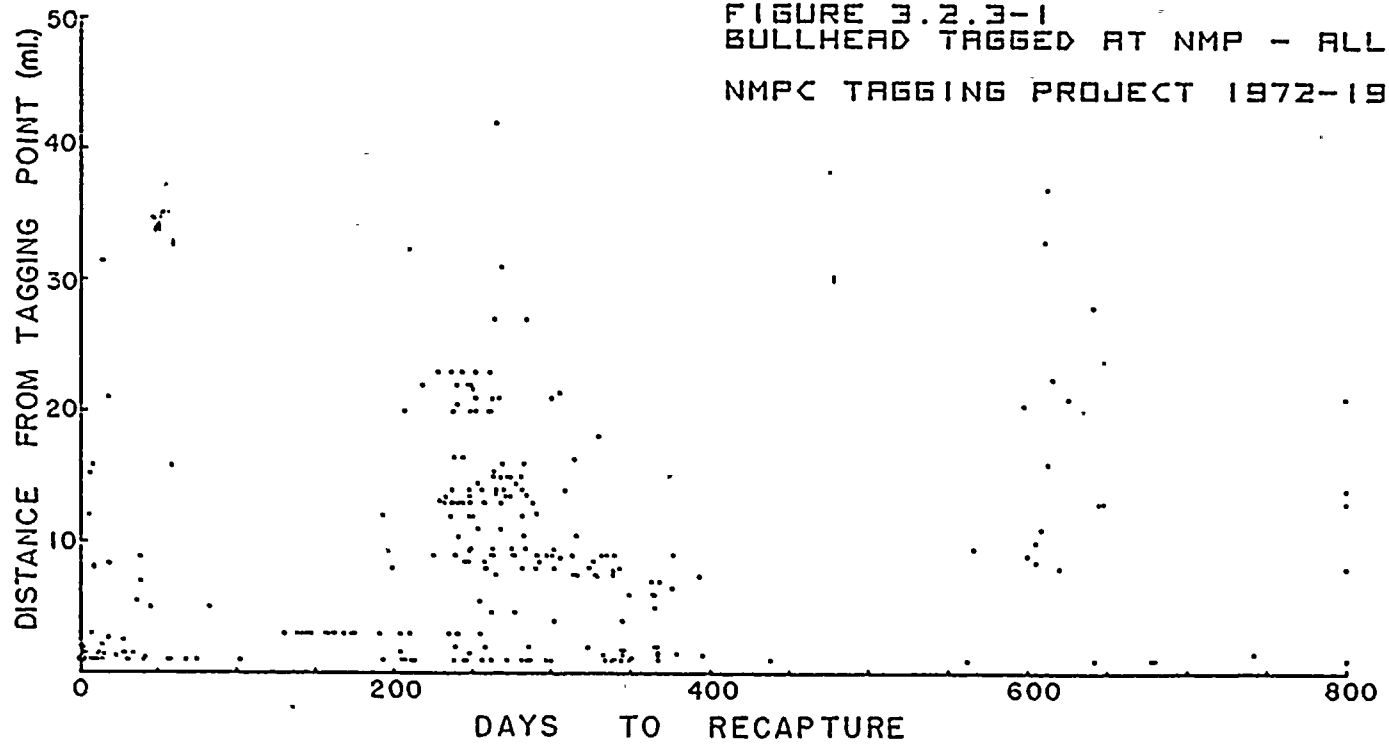
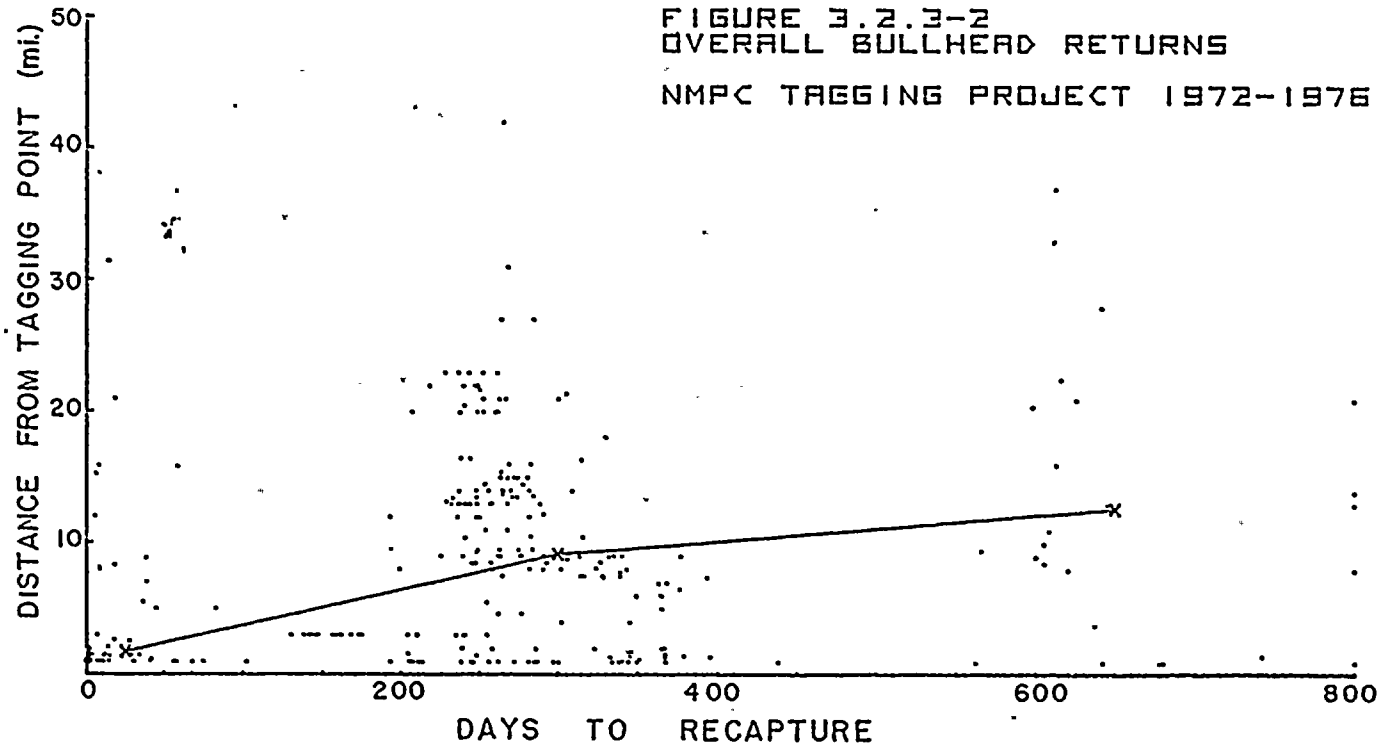


FIGURE 3.2.3-2
OVERALL BULLHEAD RETURNS
NMPC TAGGING PROJECT 1972-1976



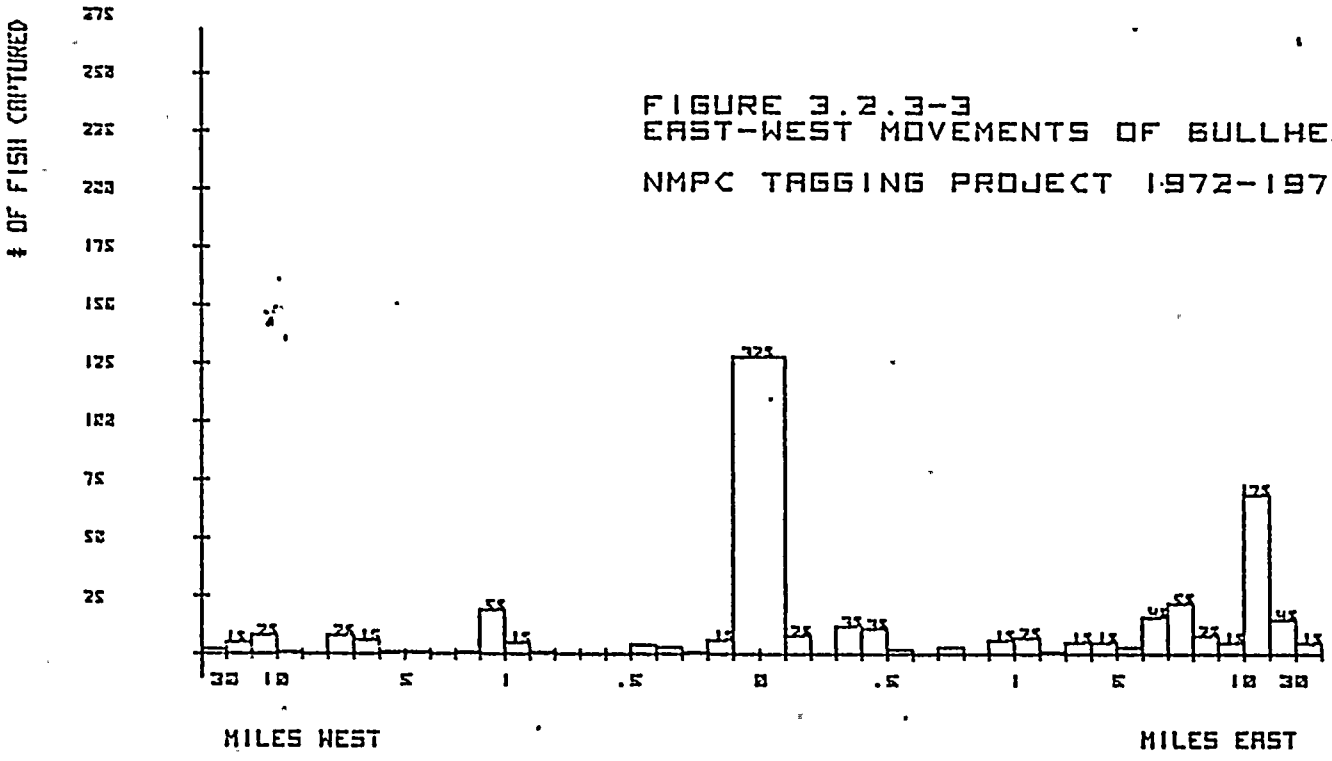


FIGURE 3.2.3-3
EAST-WEST MOVEMENTS OF BULLHEAD
NMPC TAGGING PROJECT 1972-1976

FIGURE 3.2.4-1
ROCK BASS TAGGED AT NMP - ALL
NMPC TAGGING PROJECT 1972-1976

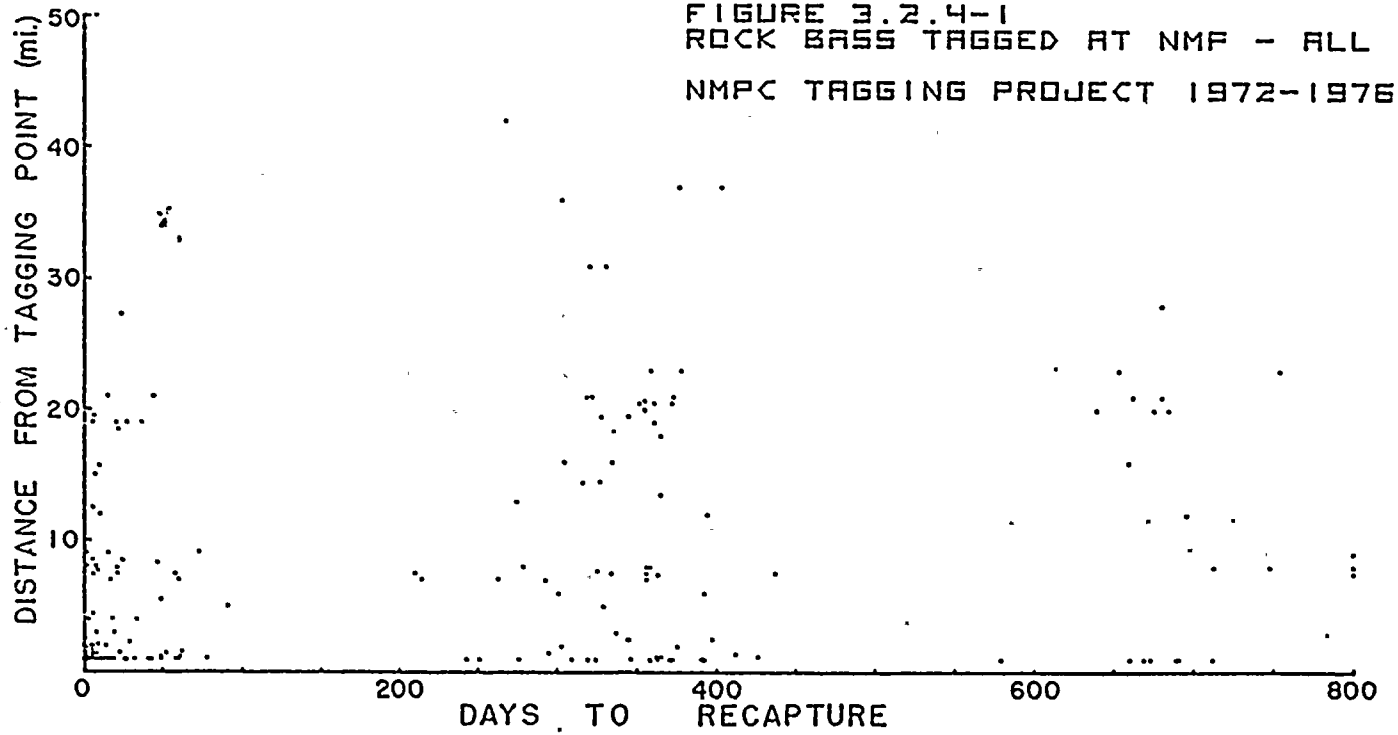
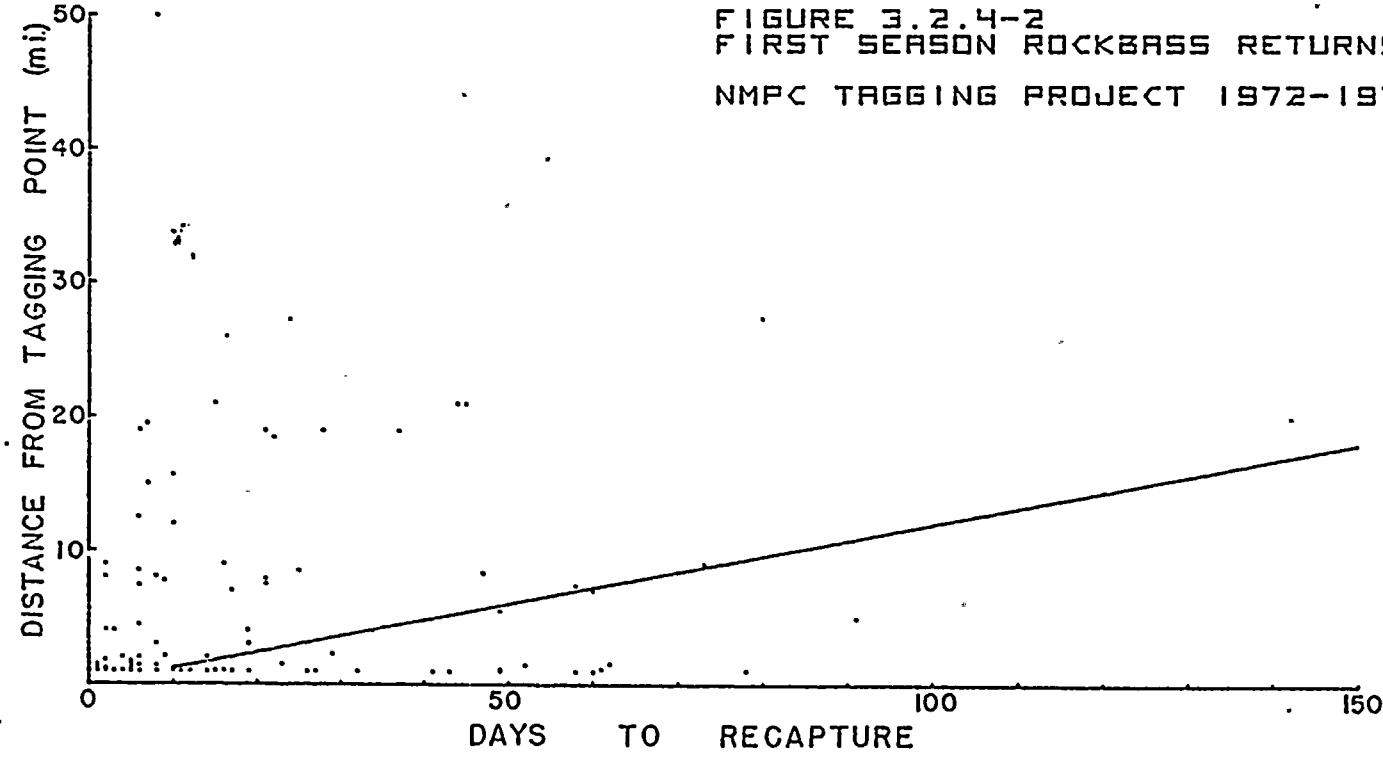


FIGURE 3.2.4-2
FIRST SEASON ROCKBASS RETURNS
NMPC TAGGING PROJECT 1972-1976



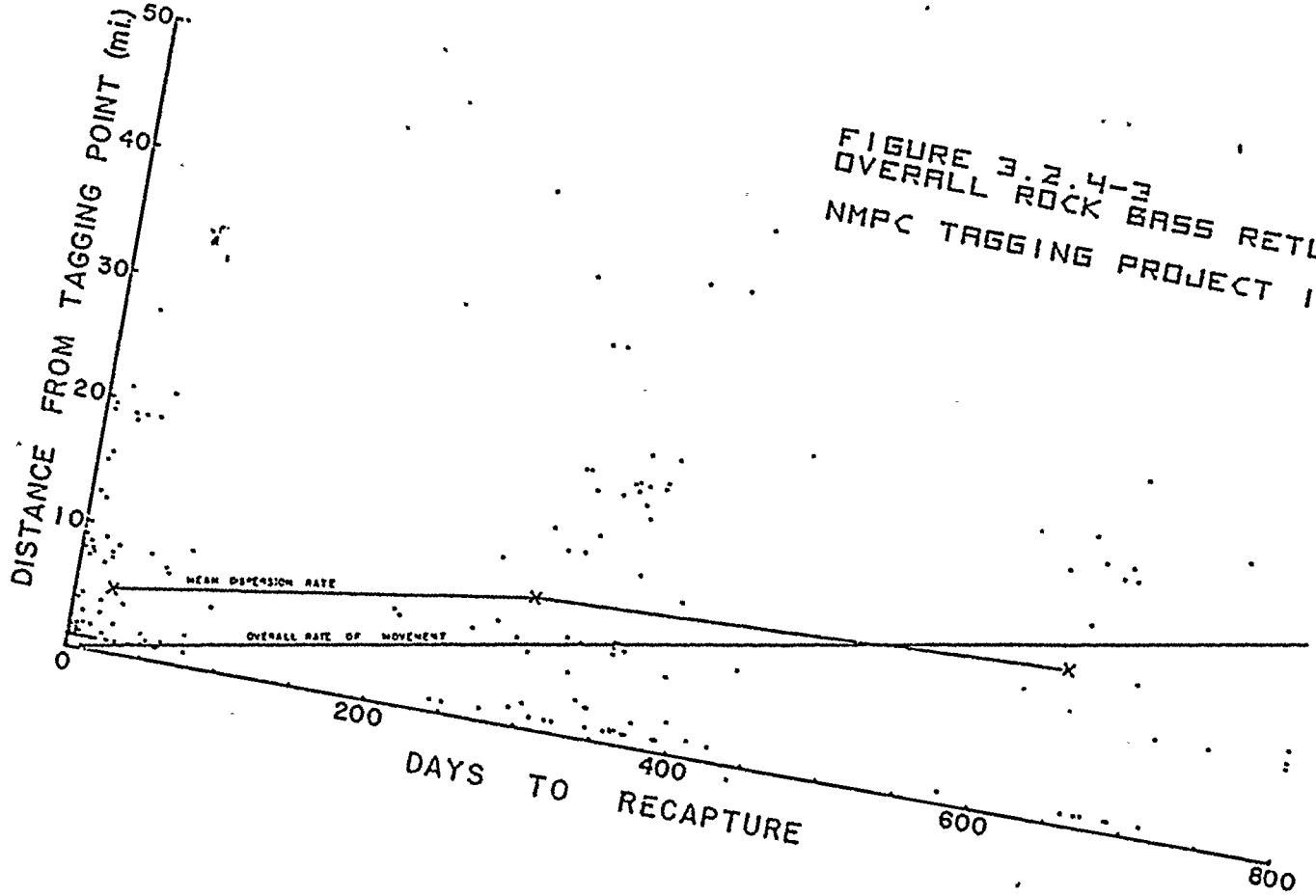
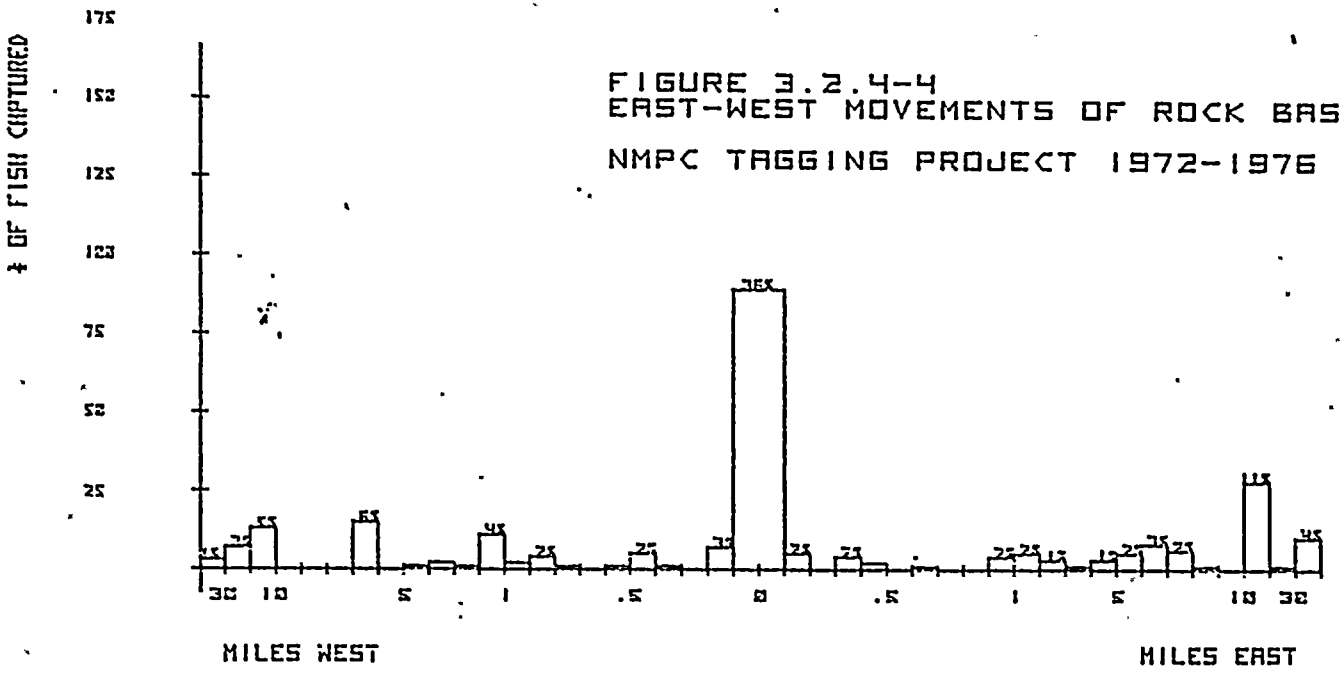


FIGURE 3.2.4-3
OVERALL ROCK BASS RETURNS
NMPC TAGGING PROJECT 1972-1976

FIGURE 3.2.4-4
EAST-WEST MOVEMENTS OF ROCK BASS
NMPC TAGGING PROJECT 1972-1976



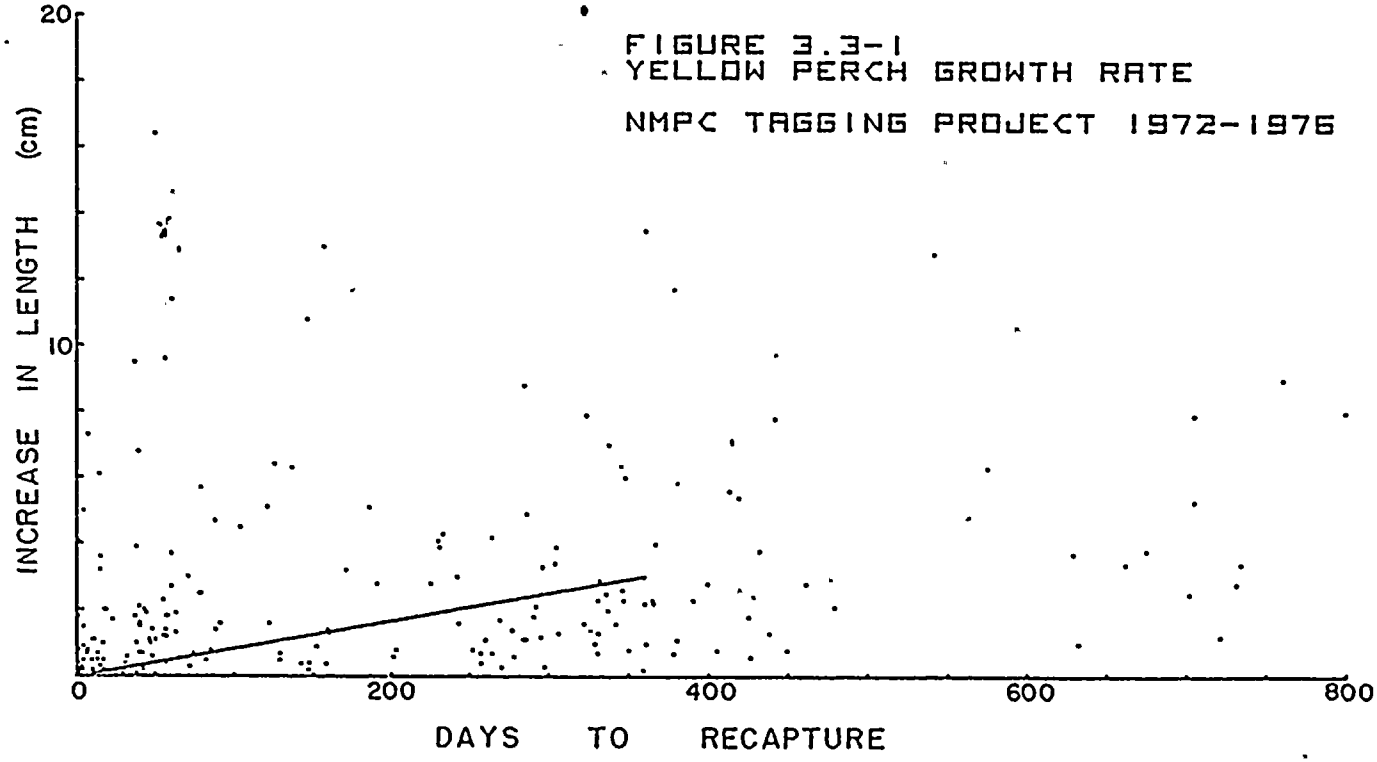


FIGURE 3.3-1
YELLOW PERCH GROWTH RATE
NMPC TAGGING PROJECT 1972-1976

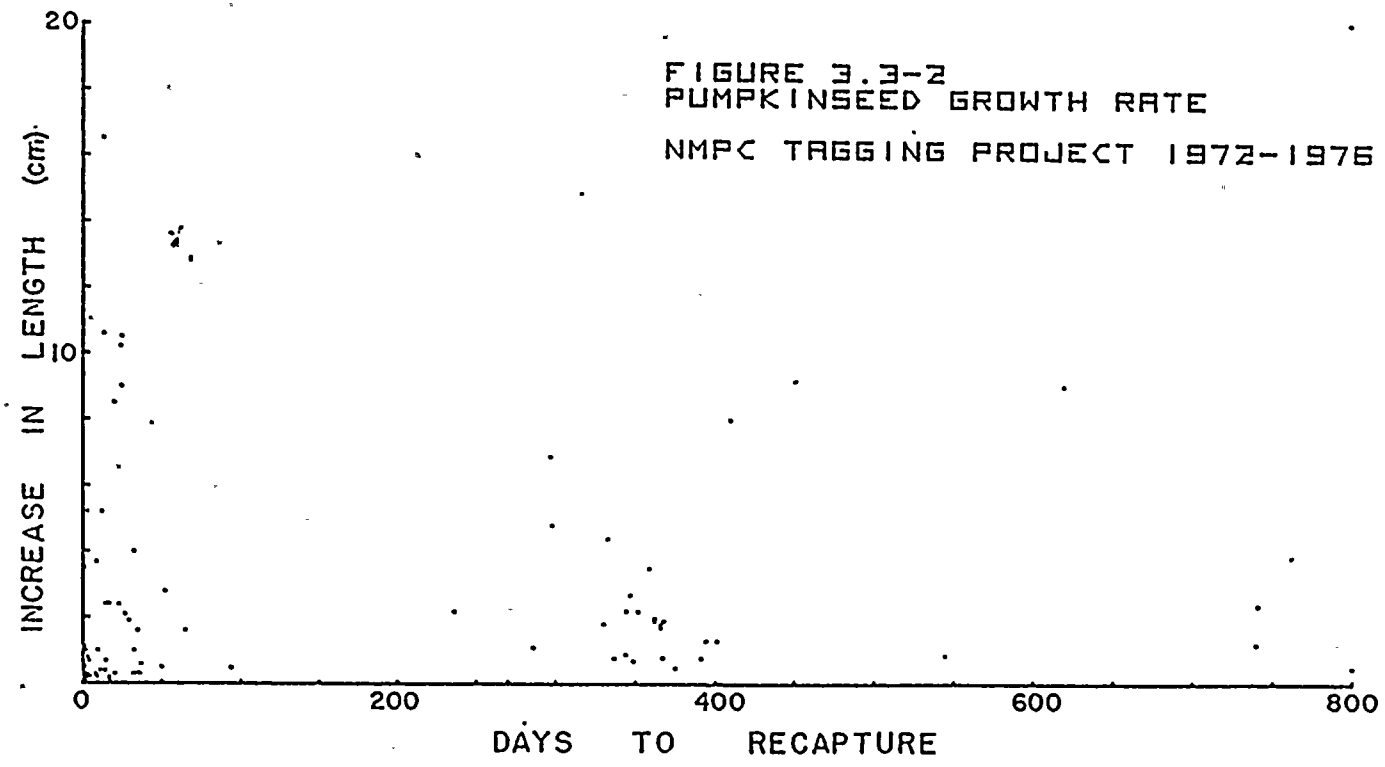


FIGURE 3.3-2
PUMPKINSEED GROWTH RATE

NMPC TAGGING PROJECT 1972-1976

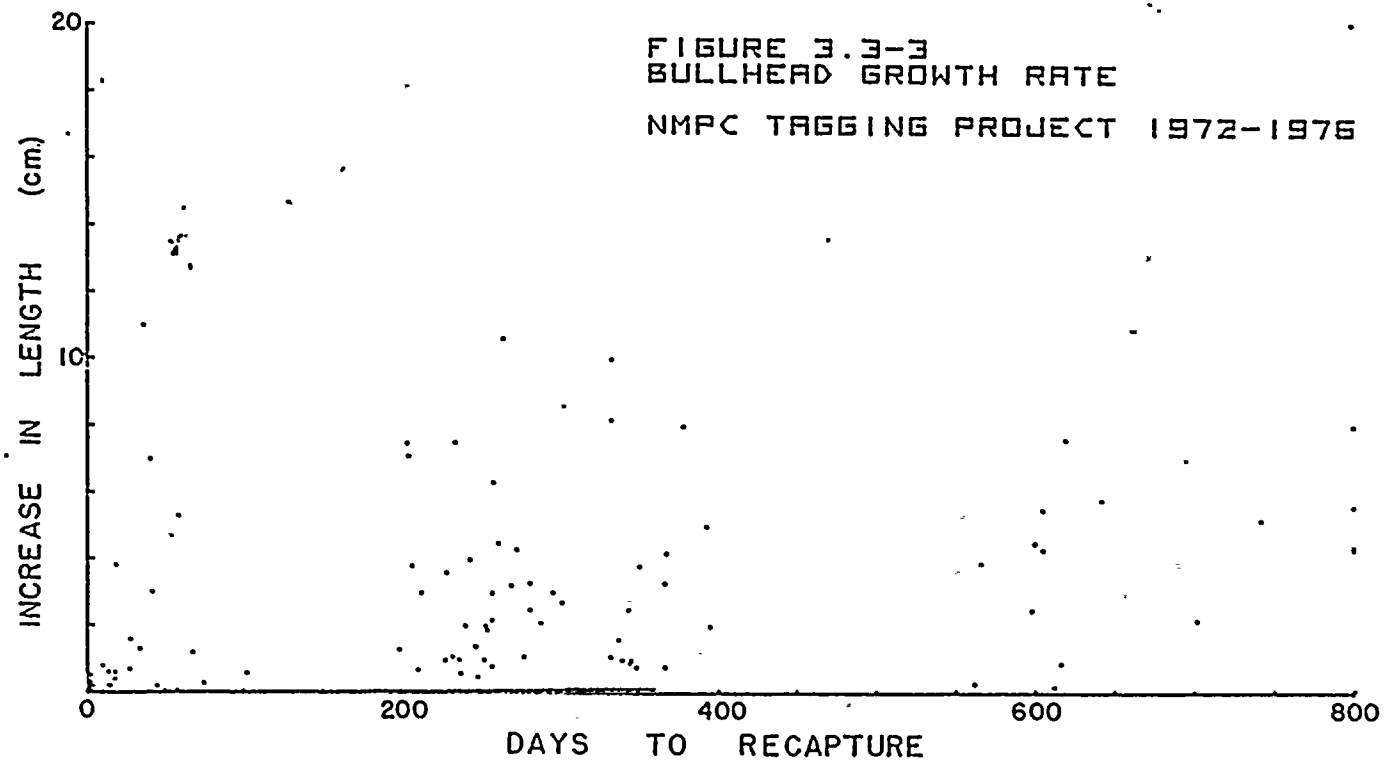


FIGURE 3.3-3
BULLHEAD GROWTH RATE
NMPC TAGGING PROJECT 1972-1976

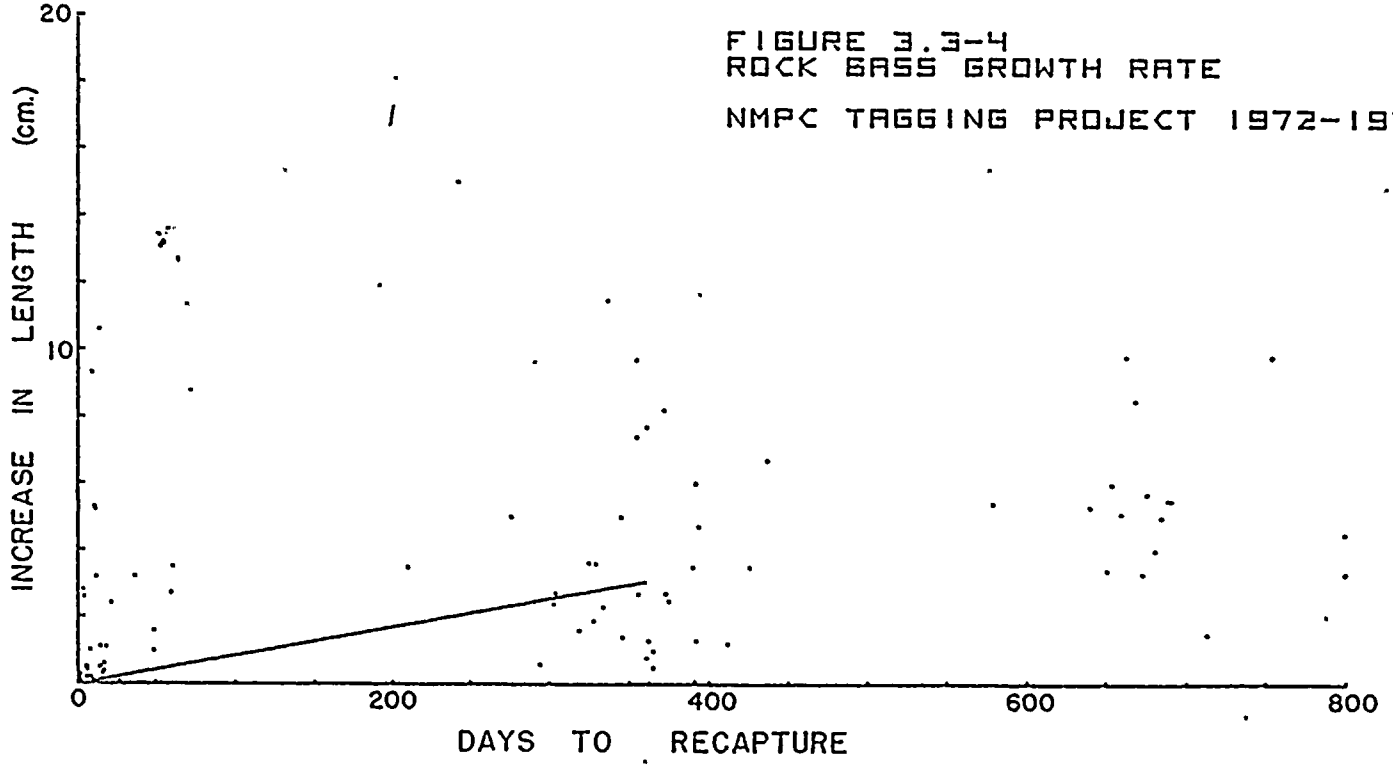


FIGURE 3.3-4
ROCK BASS GROWTH RATE

NMPC TAGGING PROJECT 1972-1976

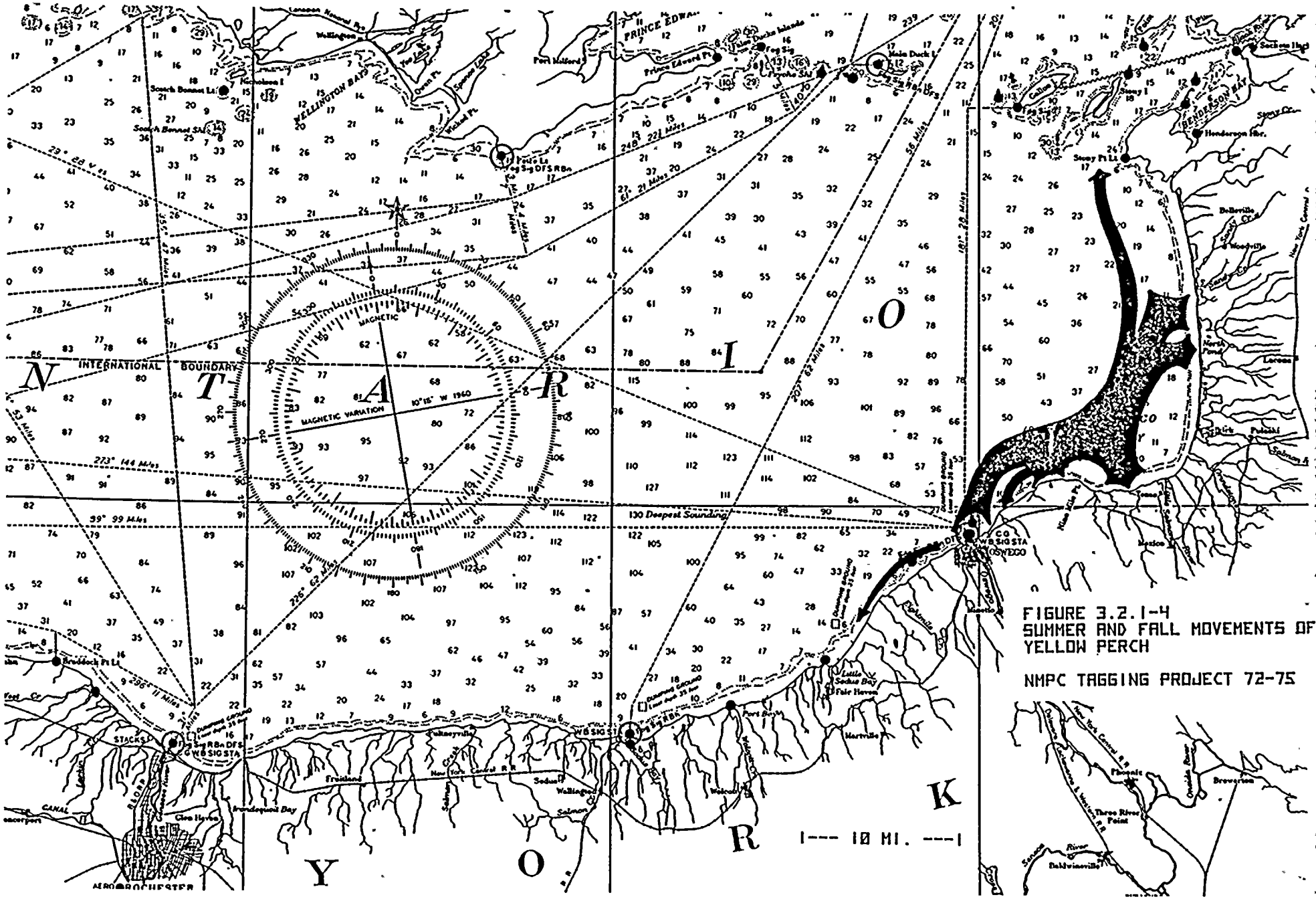


FIGURE 3.2.1-4
SUMMER AND FALL MOVEMENTS OF YELLOW PERCH

NMPC TAGGING PROJECT 72-75

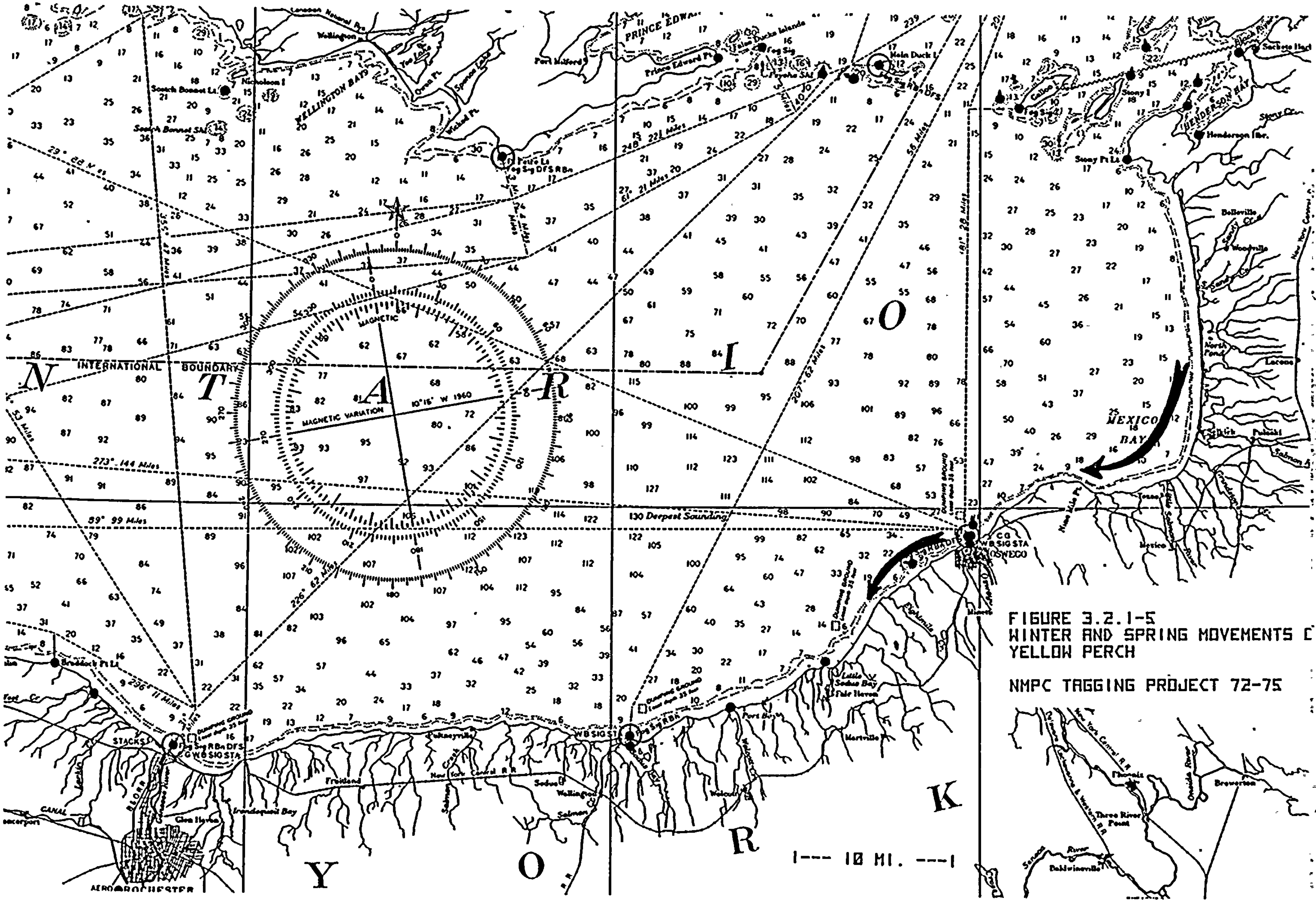


FIGURE 3.2.1-5
WINTER AND SPRING MOVEMENTS OF
YELLOW PERCH

NMPC TAGGING PROJECT 72-75

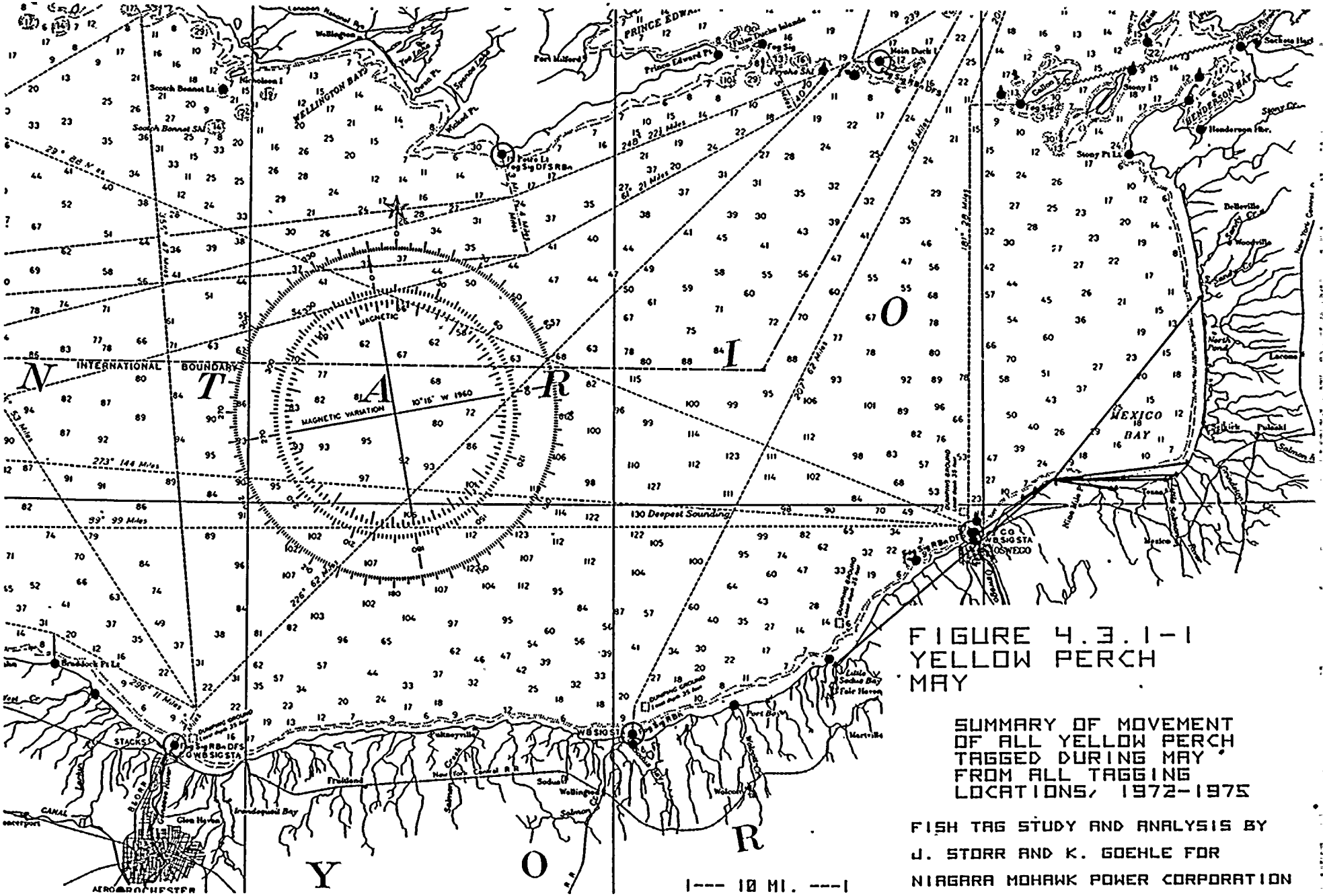


FIGURE 4.3.1-1
YELLOW PERCH
MAY

SUMMARY OF MOVEMENT OF ALL YELLOW PERCH TAGGED DURING MAY FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION

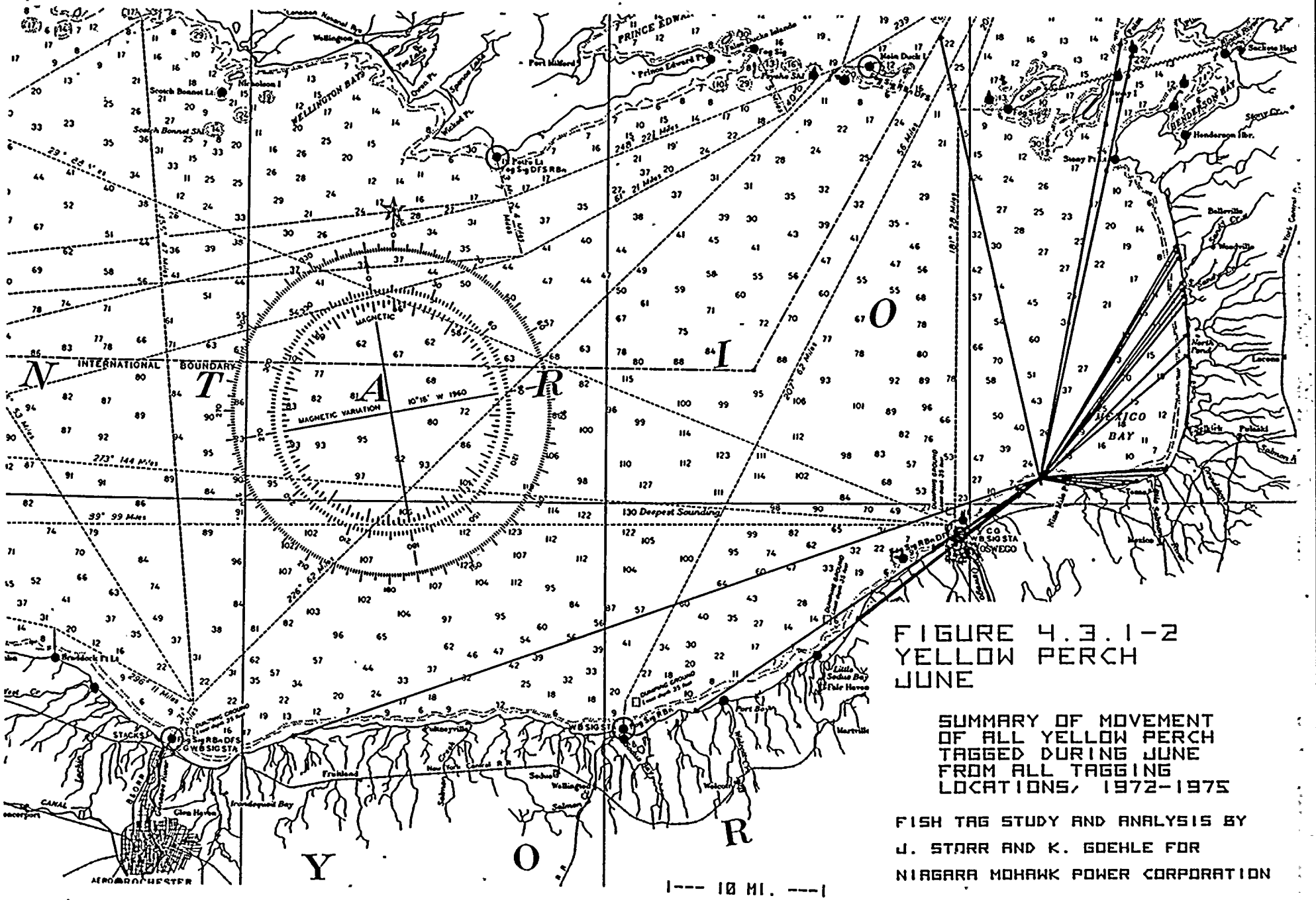


FIGURE 4.3.1-2
YELLOW PERCH
JUNE

SUMMARY OF MOVEMENT OF ALL YELLOW PERCH TAGGED DURING JUNE FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY
J. STARR AND K. GOEHLE FOR
NIAGARA MOHAWK POWER CORPORATION

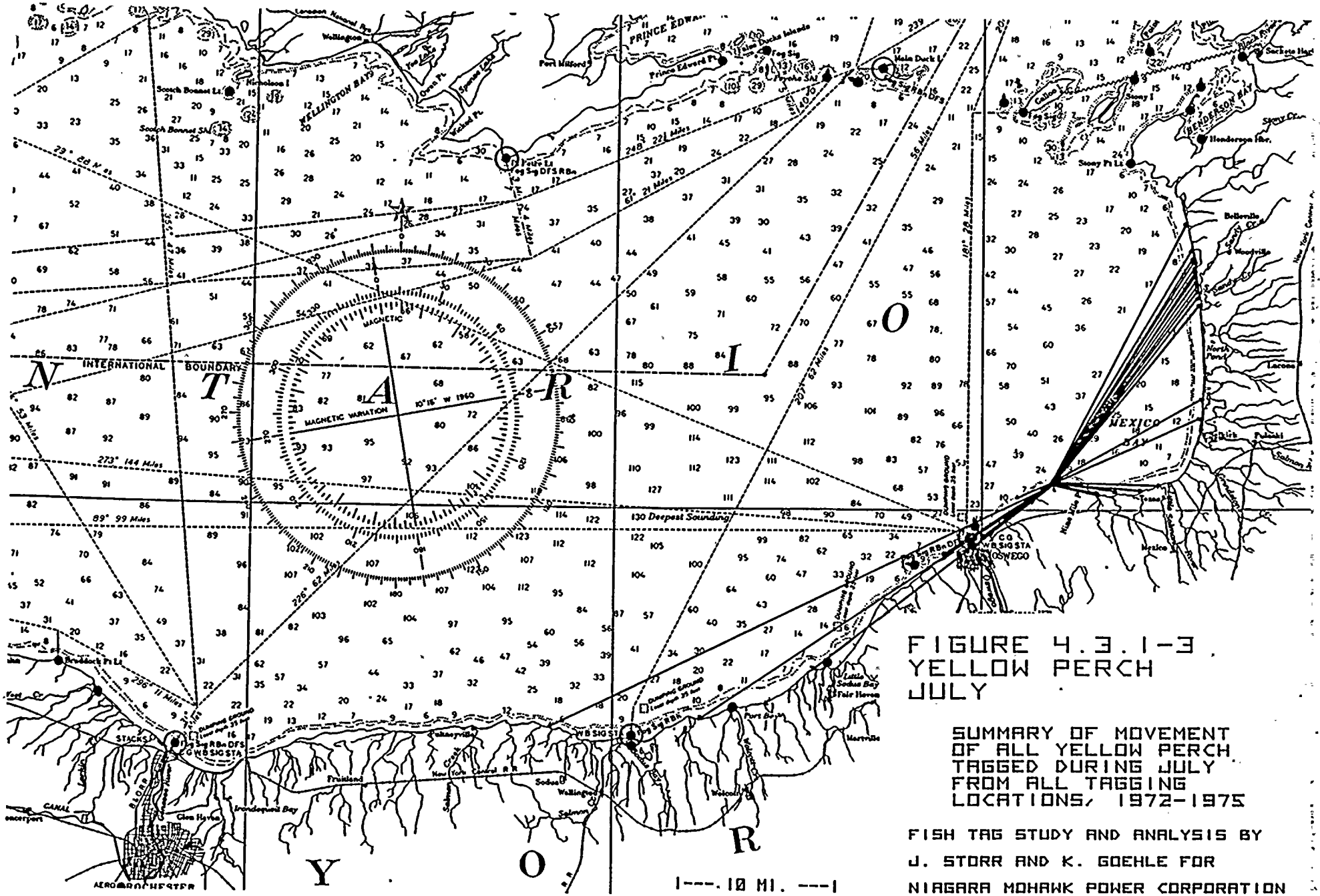


FIGURE 4.3.1-3
YELLOW PERCH
JULY

SUMMARY OF MOVEMENT
OF ALL YELLOW PERCH
TAGGED DURING JULY
FROM ALL TAGGING
LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY
J. STORR AND K. GOEHLE FOR
NIAGARA MOHAWK POWER CORPORATION

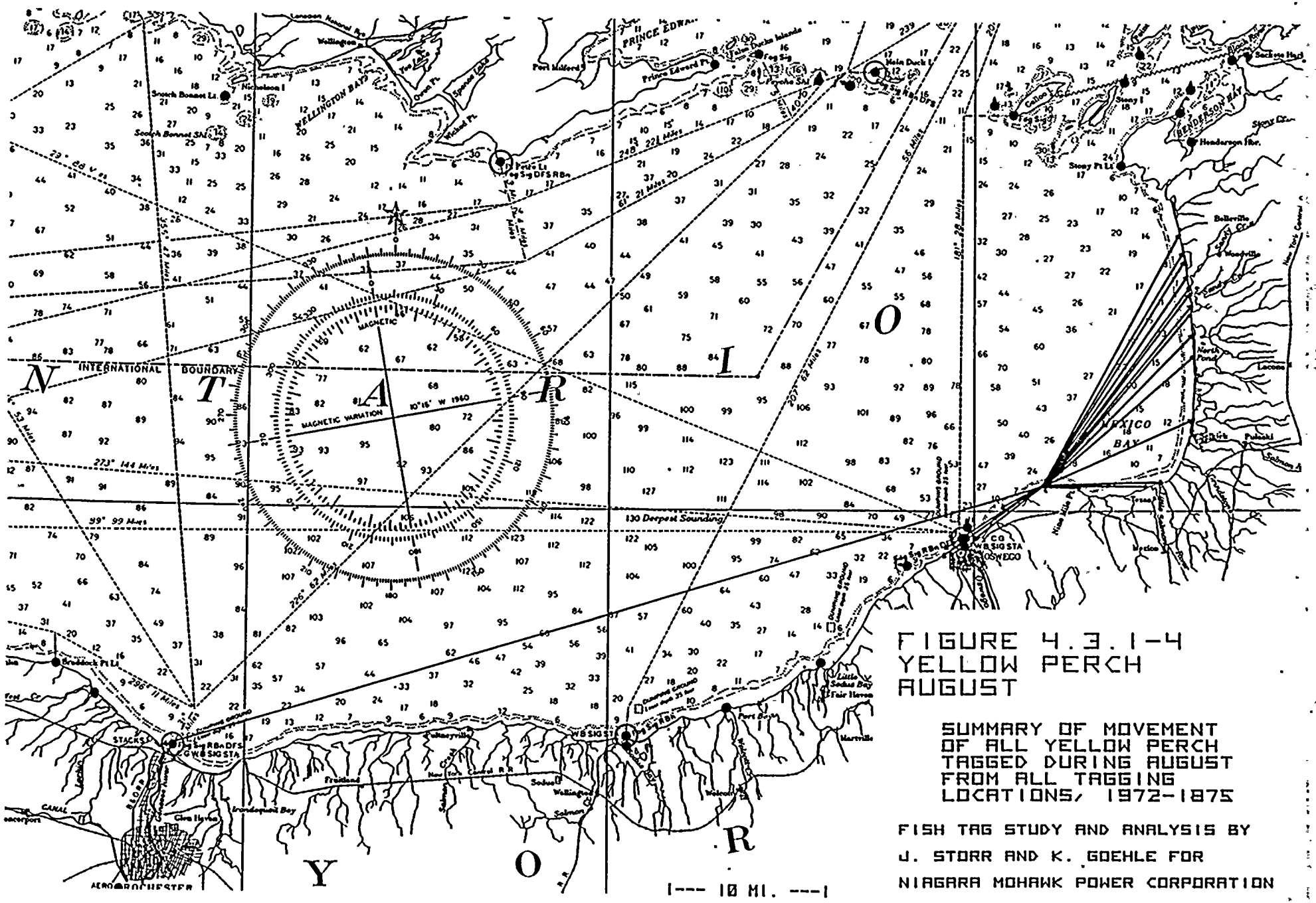


FIGURE 4.3.1-4
YELLOW PERCH
AUGUST

SUMMARY OF MOVEMENT OF ALL YELLOW PERCH TAGGED DURING AUGUST FROM ALL TAGGING LOCATIONS, 1972-1875

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION

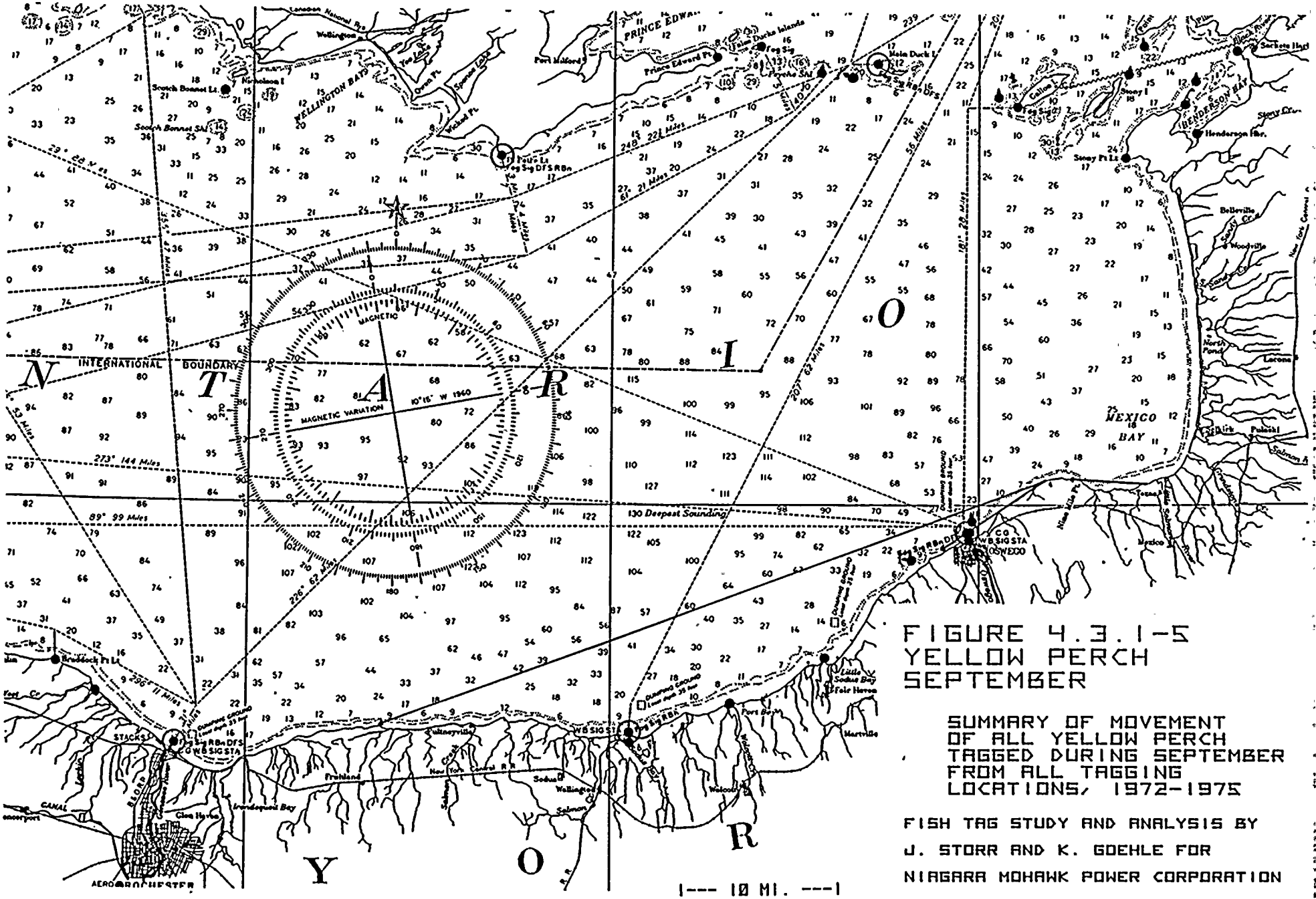


FIGURE 4.3.1-5
YELLOW PERCH
SEPTEMBER

SUMMARY OF MOVEMENT OF ALL YELLOW PERCH TAGGED DURING SEPTEMBER FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION

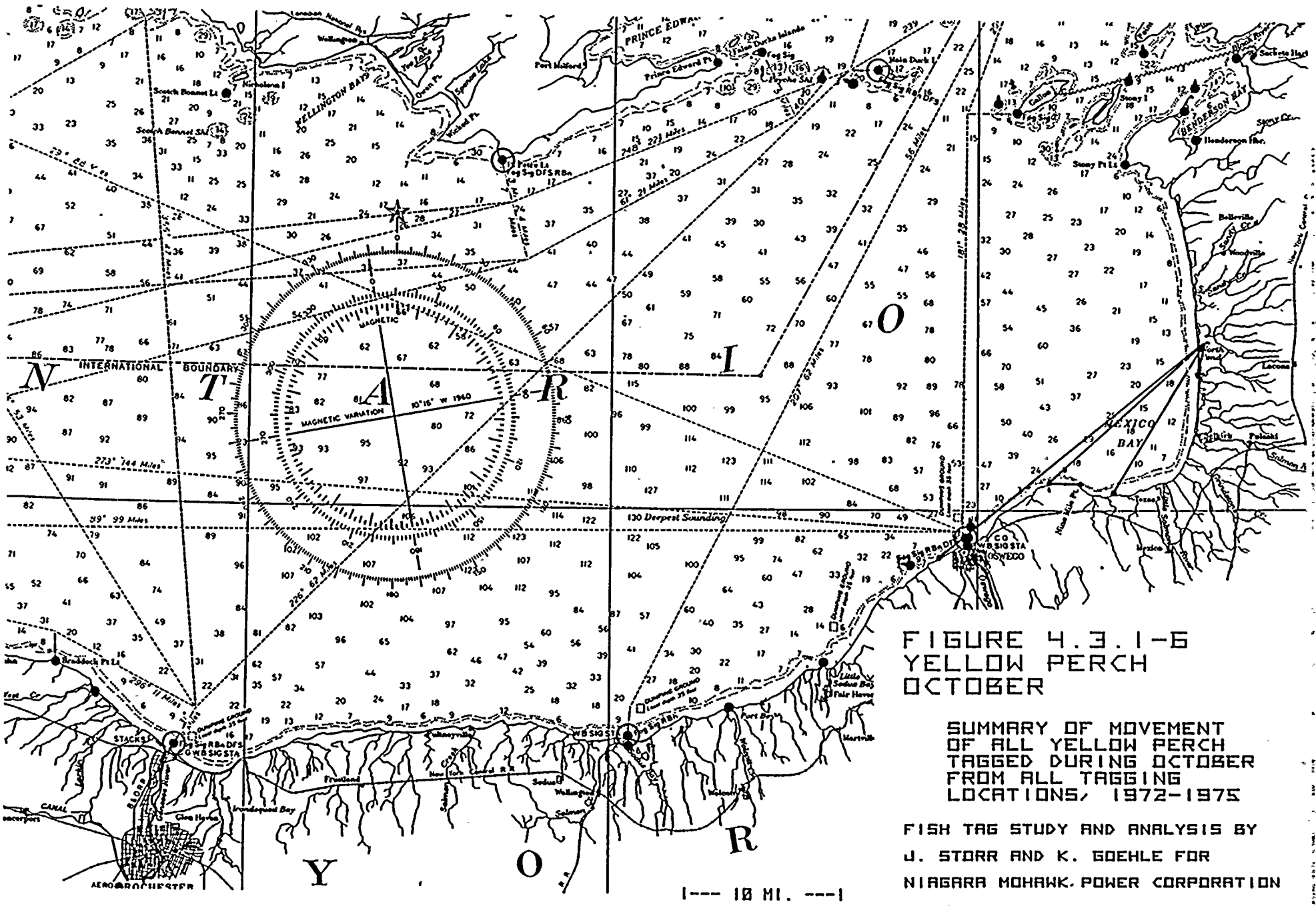


FIGURE 4.3.1-6
YELLOW PERCH
OCTOBER

SUMMARY OF MOVEMENT OF ALL YELLOW PERCH TAGGED DURING OCTOBER FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION

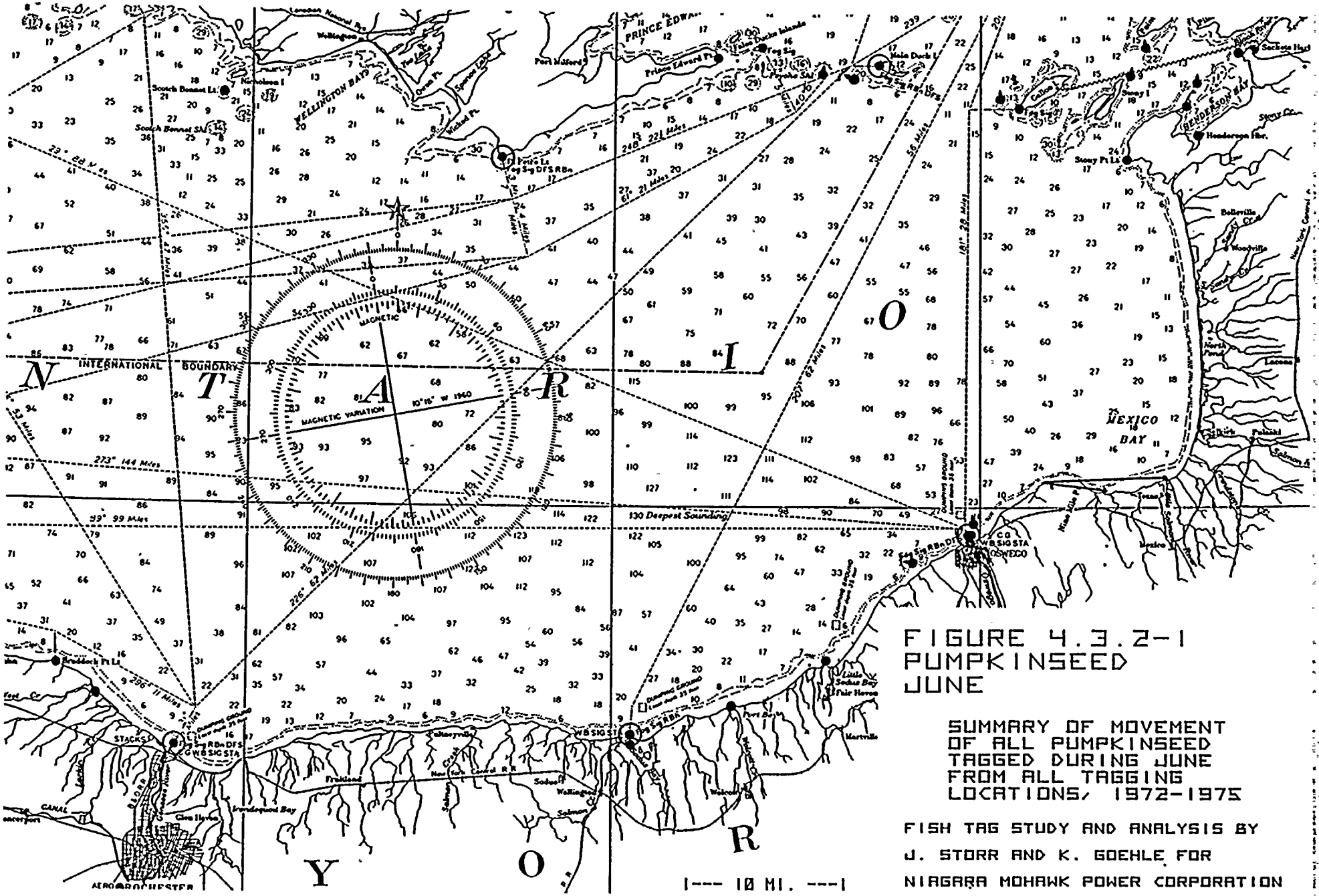


FIGURE 4.3.2-1
PUMPKINSEED
JUNE

SUMMARY OF MOVEMENT OF ALL PUMPKINSEED TAGGED DURING JUNE FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION

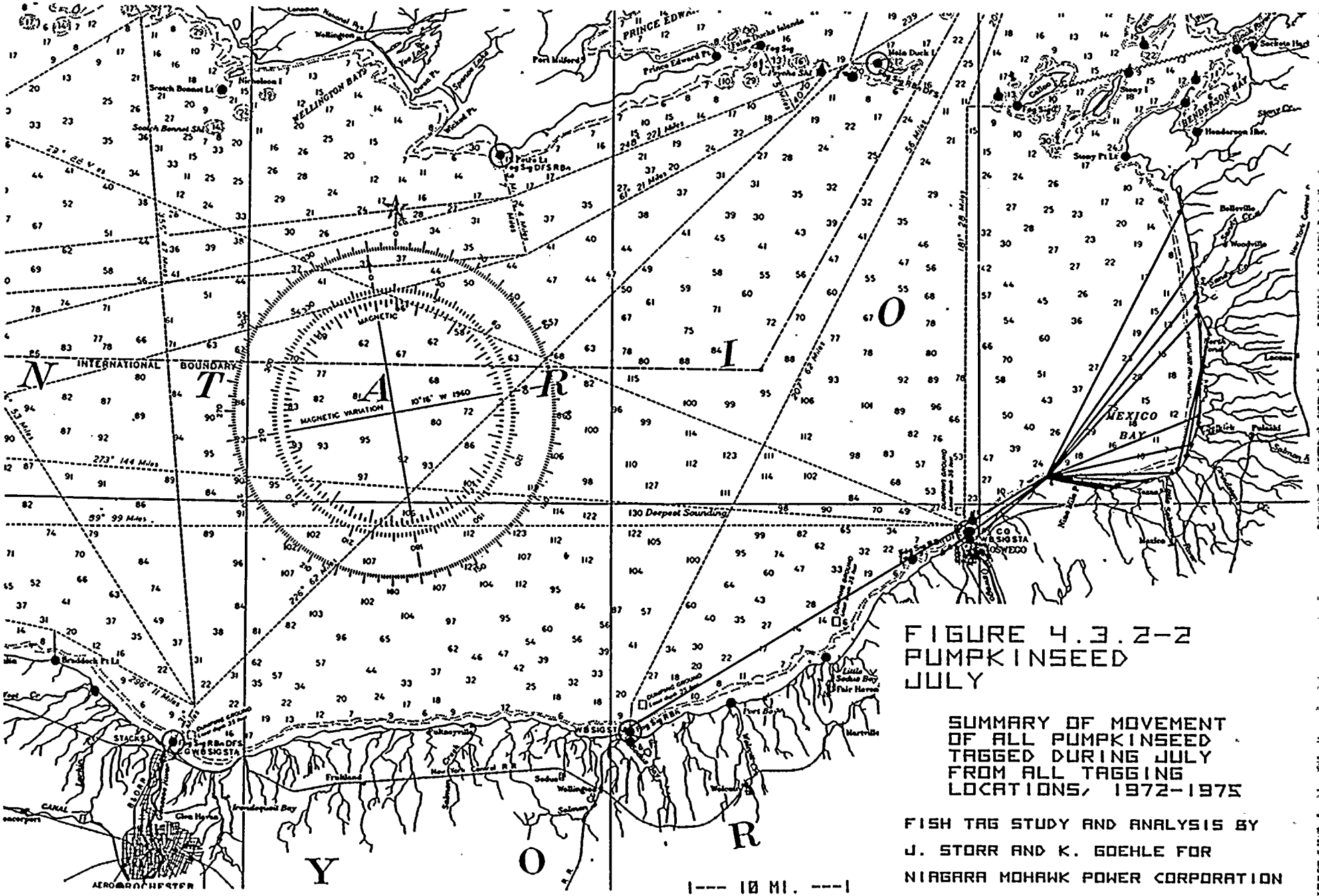


FIGURE 4.3.2-2
PUMPKINSEED
JULY

SUMMARY OF MOVEMENT OF ALL PUMPKINSEED TAGGED DURING JULY FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION

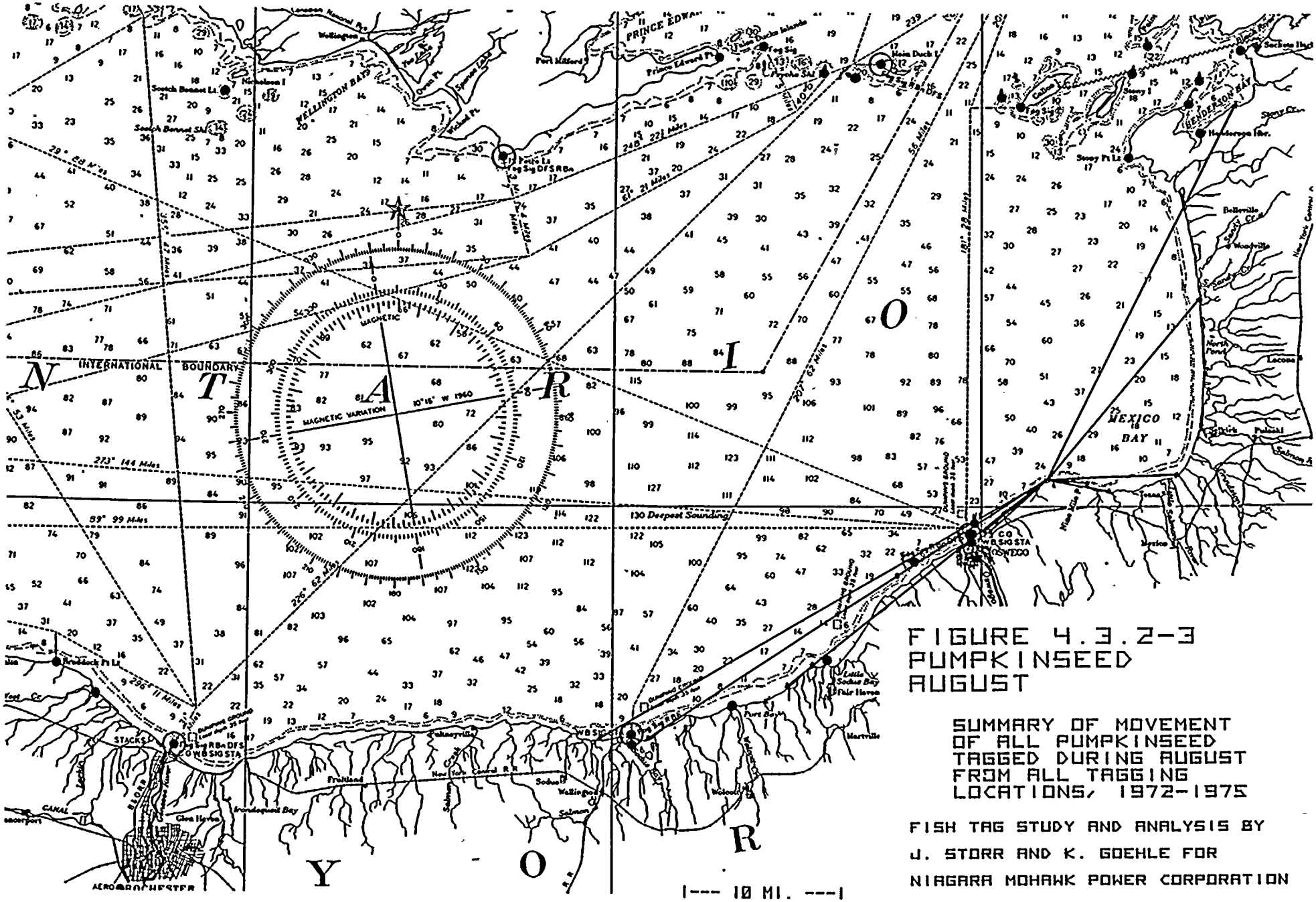


FIGURE 4.3.2-3
PUMPKINSEED
AUGUST

SUMMARY OF MOVEMENT OF ALL PUMPKINSEED TAGGED DURING AUGUST FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION

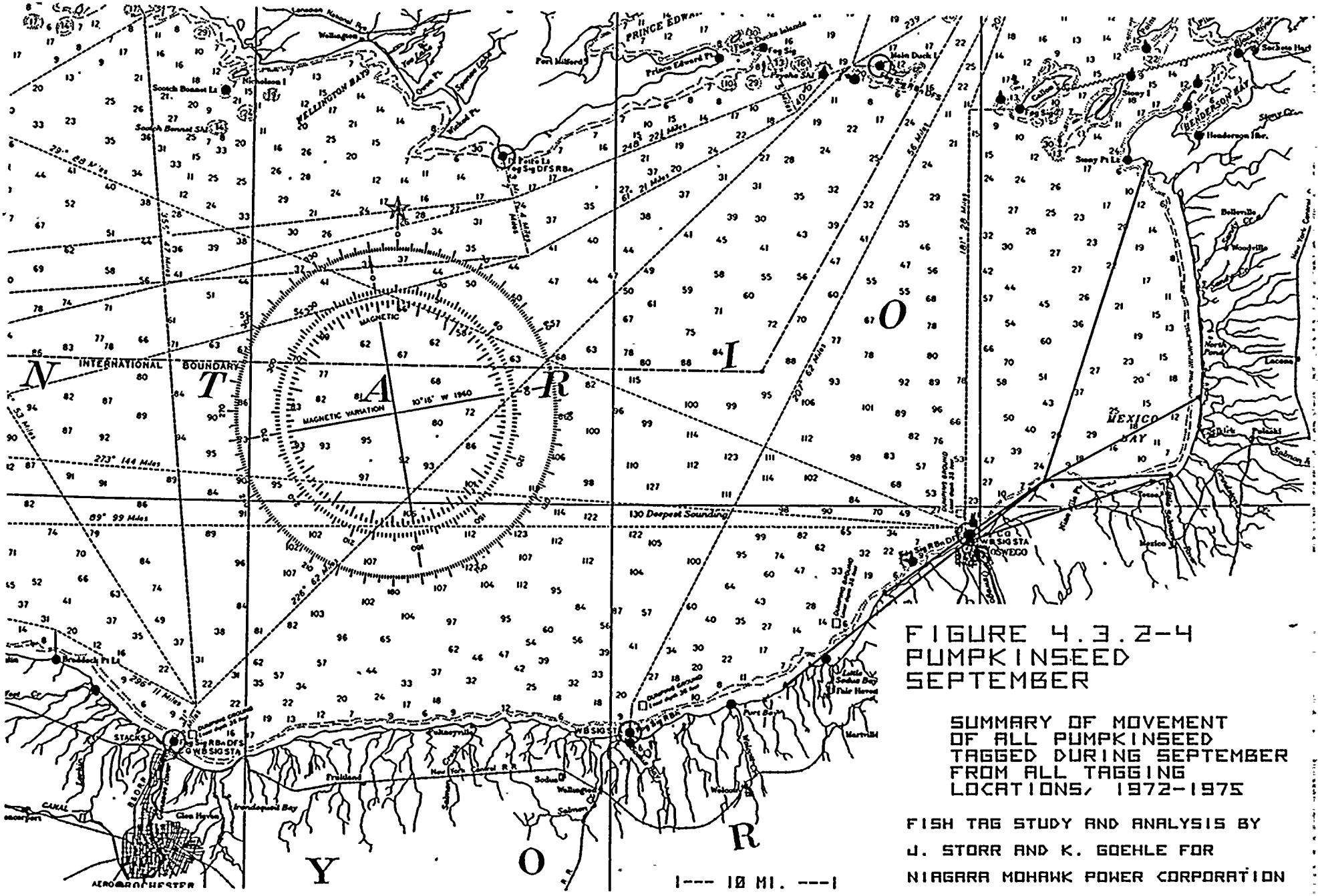


FIGURE 4.3.2-4
PUMPKINSEED
SEPTEMBER

SUMMARY OF MOVEMENT OF ALL PUMPKINSEED TAGGED DURING SEPTEMBER FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION

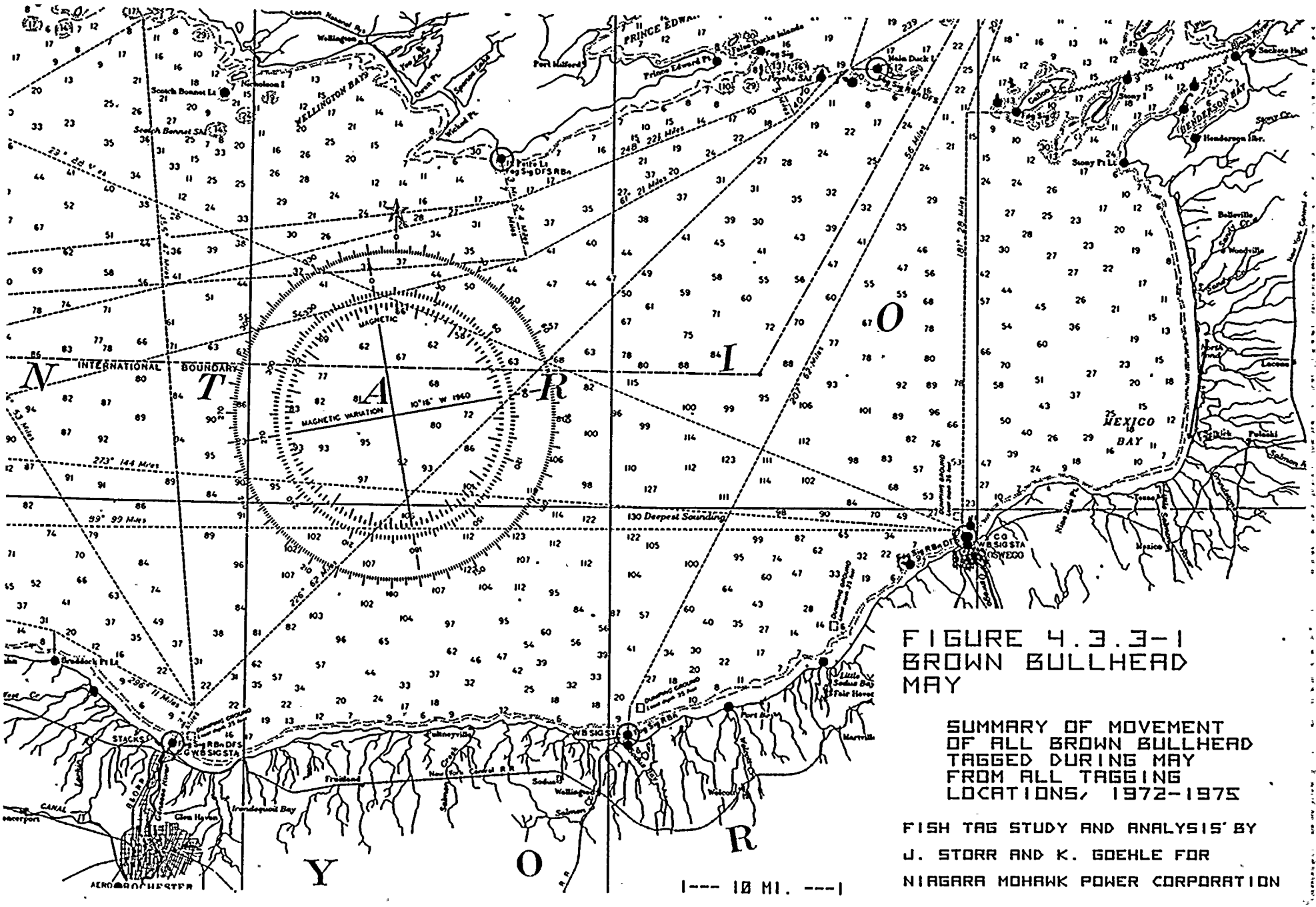


FIGURE 4.3.3-1
BROWN BULLHEAD
MAY

SUMMARY OF MOVEMENT OF ALL BROWN BULLHEAD TAGGED DURING MAY FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION

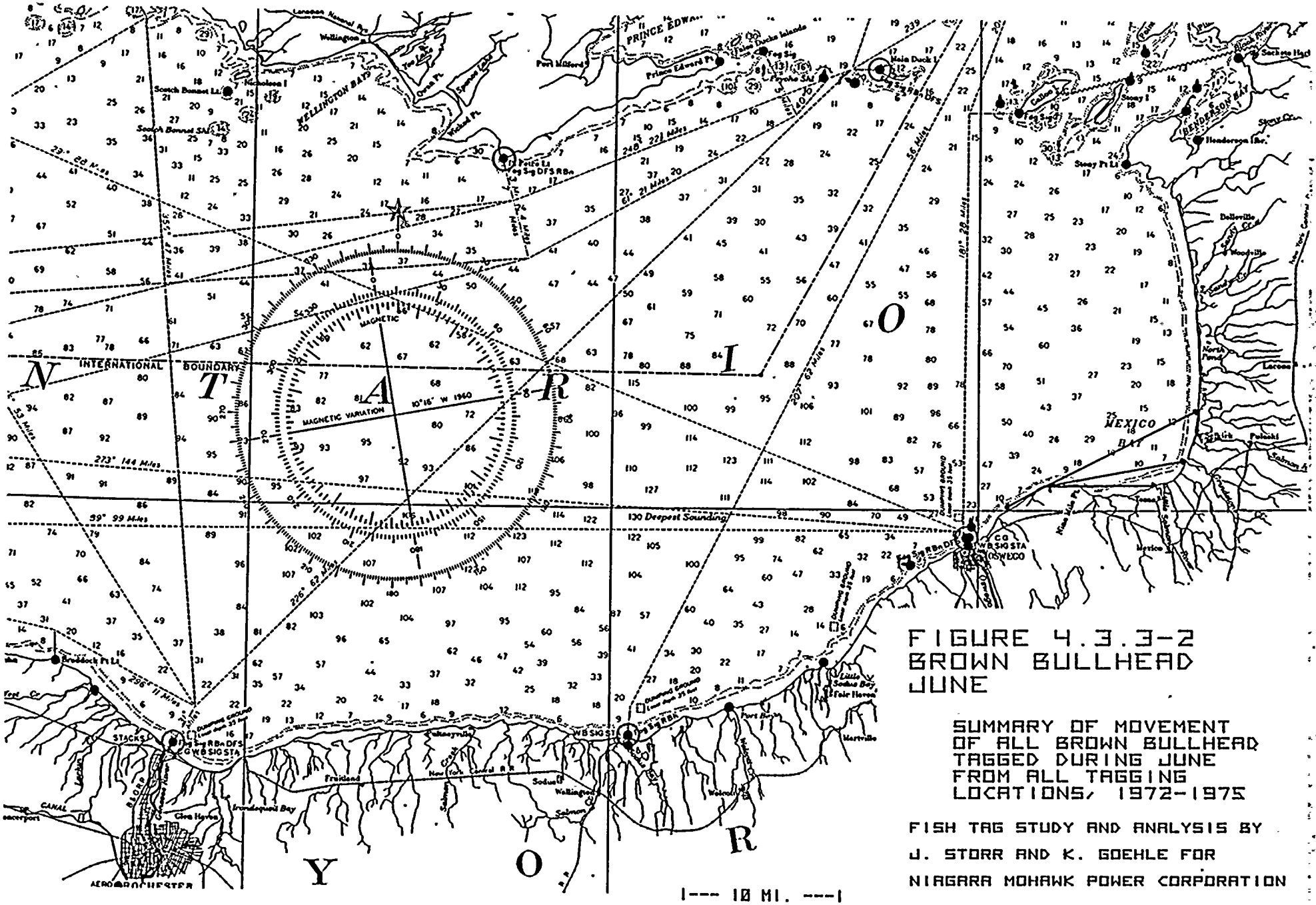


FIGURE 4.3.3-2
BROWN BULLHEAD
JUNE

SUMMARY OF MOVEMENT OF ALL BROWN BULLHEAD TAGGED DURING JUNE FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION

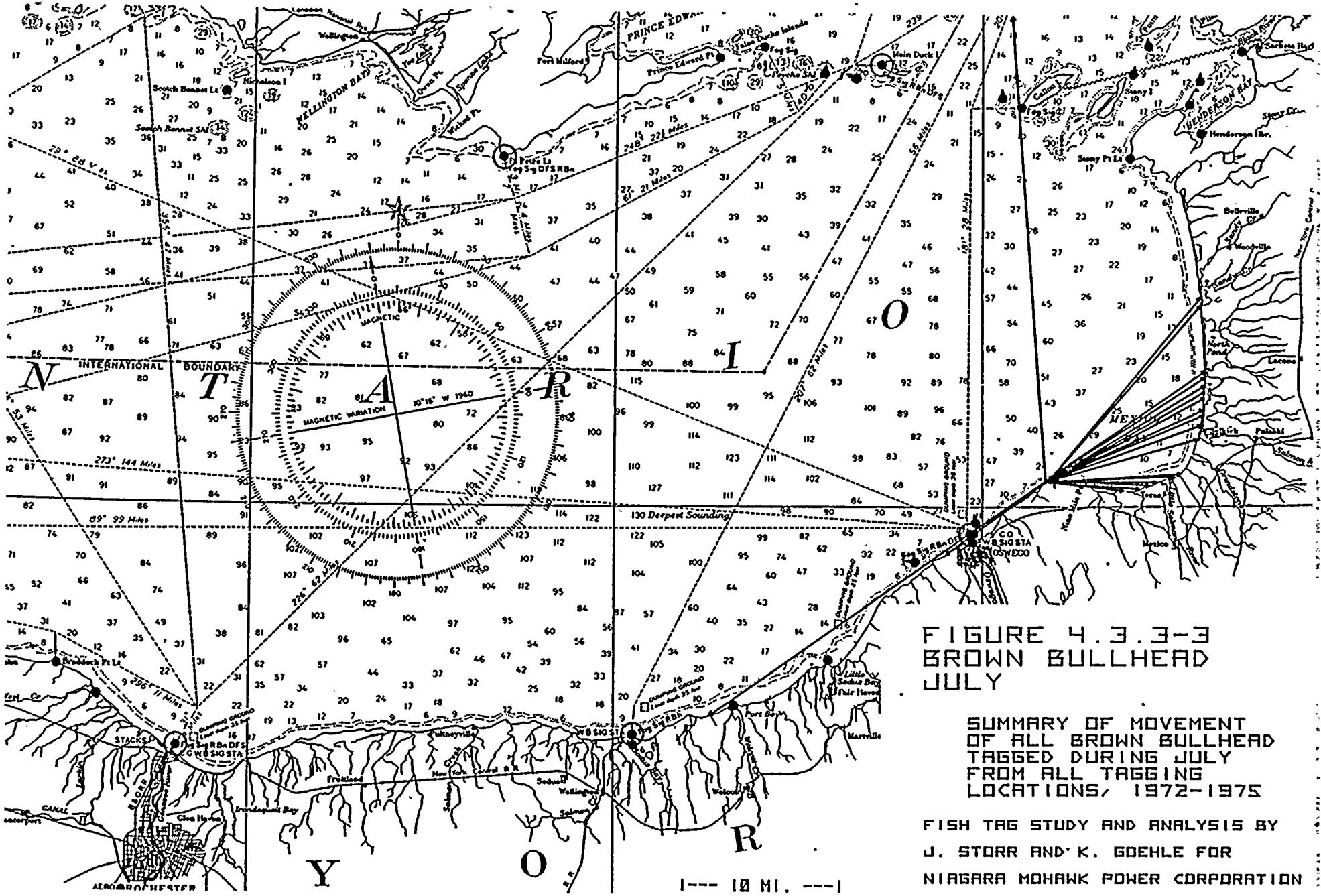


FIGURE 4.3.3-3
BROWN BULLHEAD
JULY

SUMMARY OF MOVEMENT OF ALL BROWN BULLHEAD TAGGED DURING JULY FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION

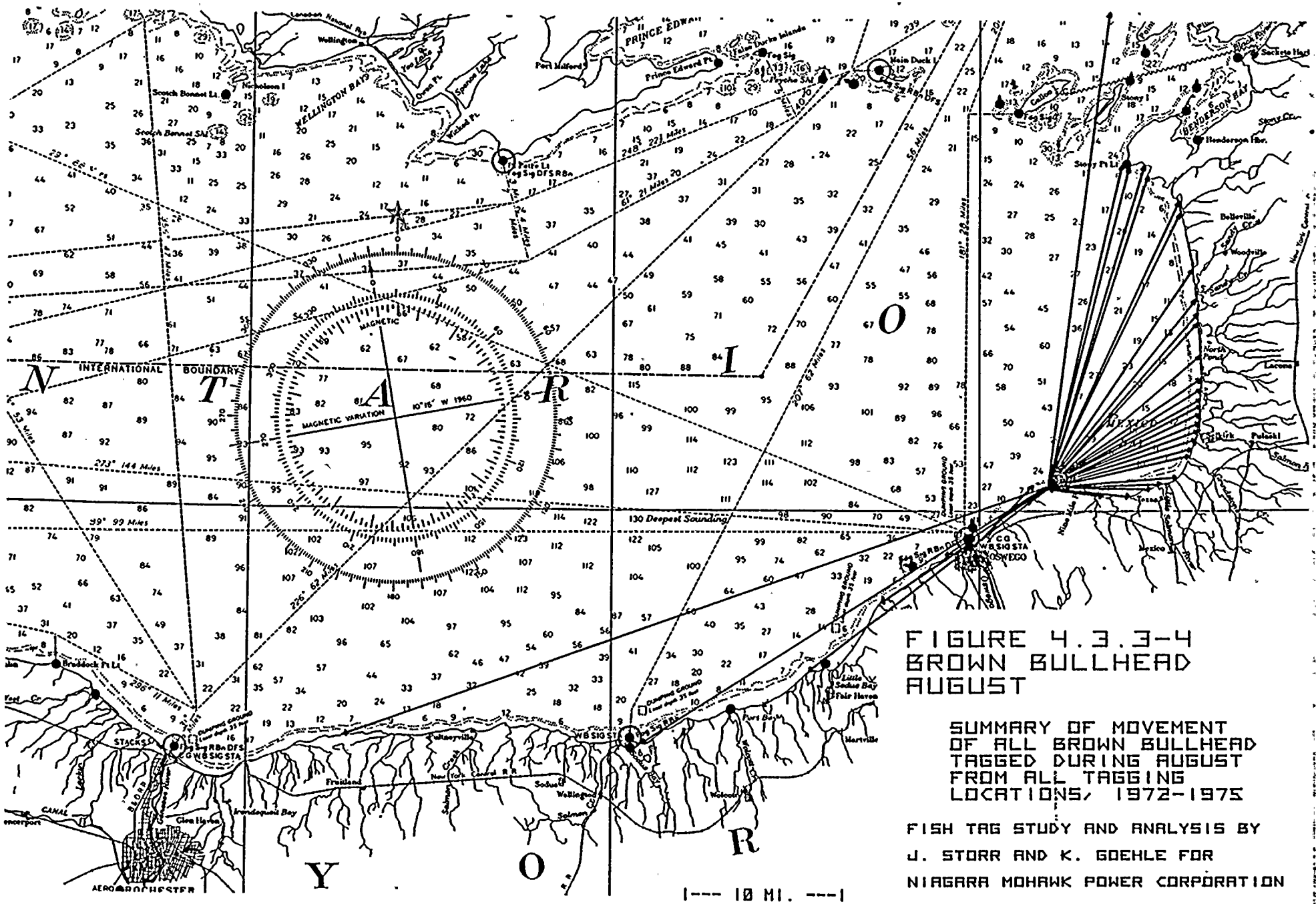


FIGURE 4.3.3-4
BROWN BULLHEAD
AUGUST

SUMMARY OF MOVEMENT OF ALL BROWN BULLHEAD TAGGED DURING AUGUST FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY
J. STORR AND K. GOEHLE FOR
NIAGARA MOHAWK POWER CORPORATION

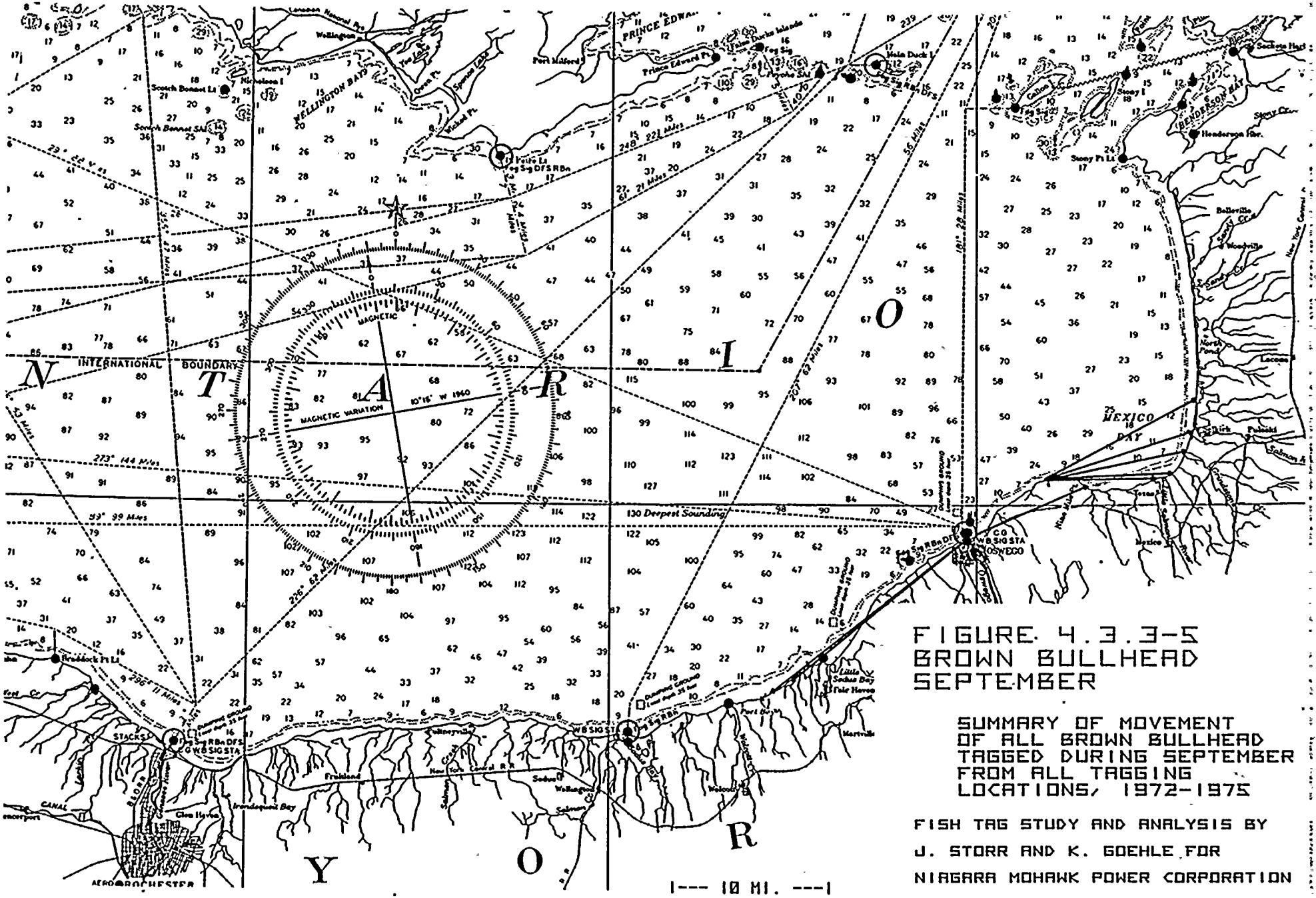


FIGURE 4.3.3-5
BROWN BULLHEAD
SEPTEMBER

SUMMARY OF MOVEMENT
OF ALL BROWN BULLHEAD
TAGGED DURING SEPTEMBER
FROM ALL TAGGING
LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY
J. STORR AND K. GOEHLE FOR
NIAGARA MOHAWK POWER CORPORATION

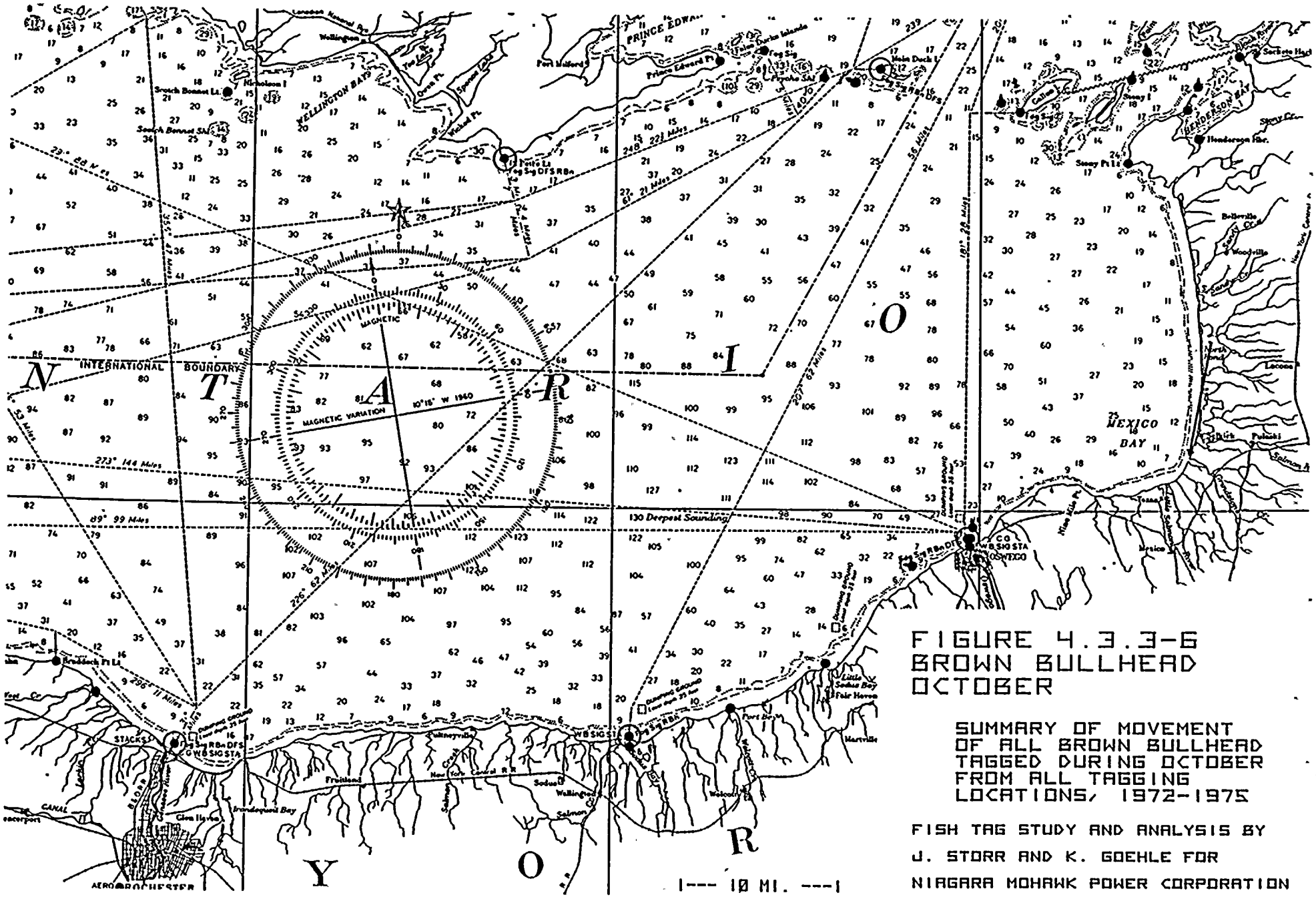


FIGURE 4.3.3-6
BROWN BULLHEAD
OCTOBER

SUMMARY OF MOVEMENT OF ALL BROWN BULLHEAD TAGGED DURING OCTOBER FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION

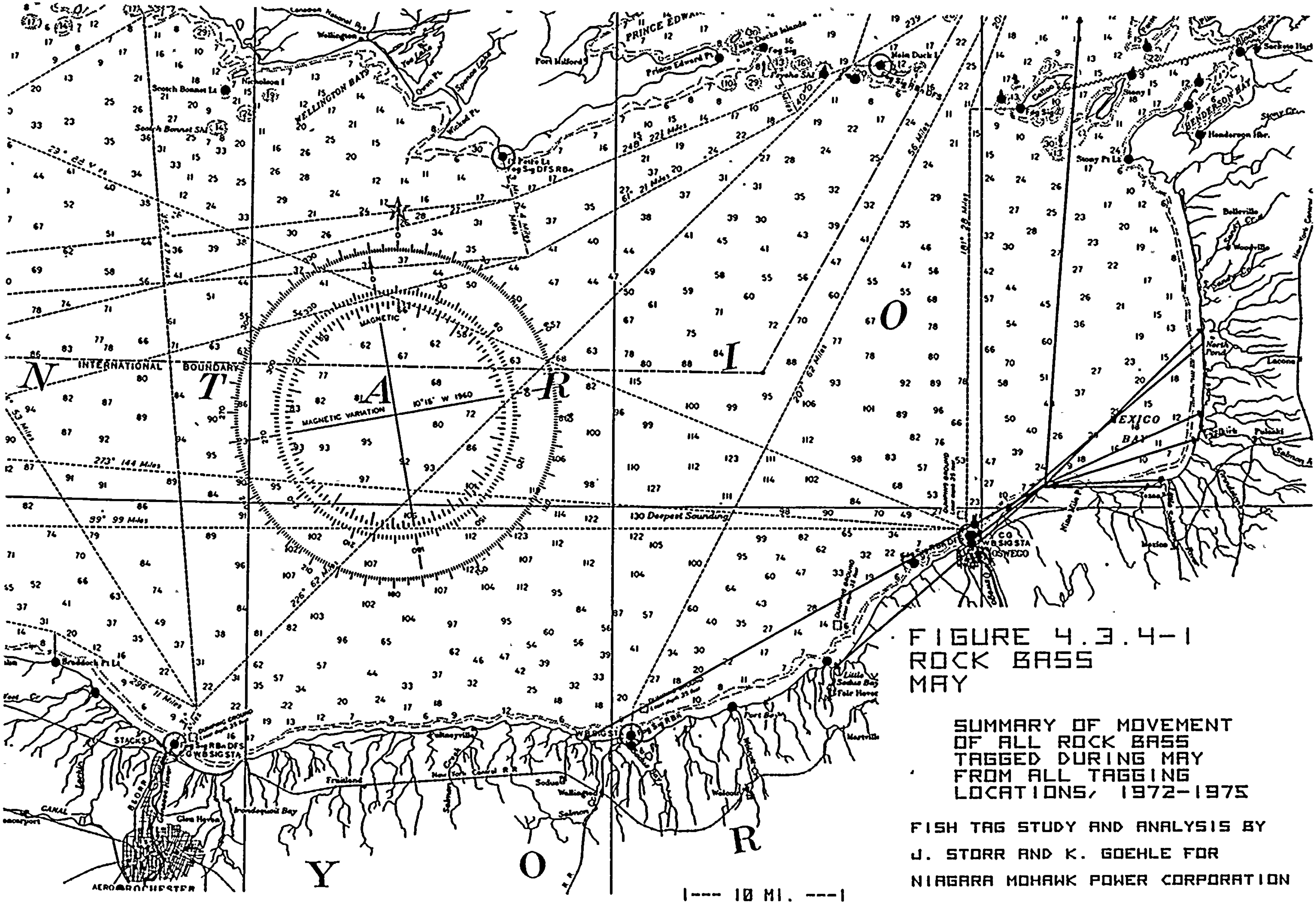


FIGURE 4.3.4-1
ROCK BASS
MAY

SUMMARY OF MOVEMENT
OF ALL ROCK BASS
TAGGED DURING MAY
FROM ALL TAGGING
LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY
J. STORR AND K. GOEHLE FOR
NIAGARA MOHAWK POWER CORPORATION

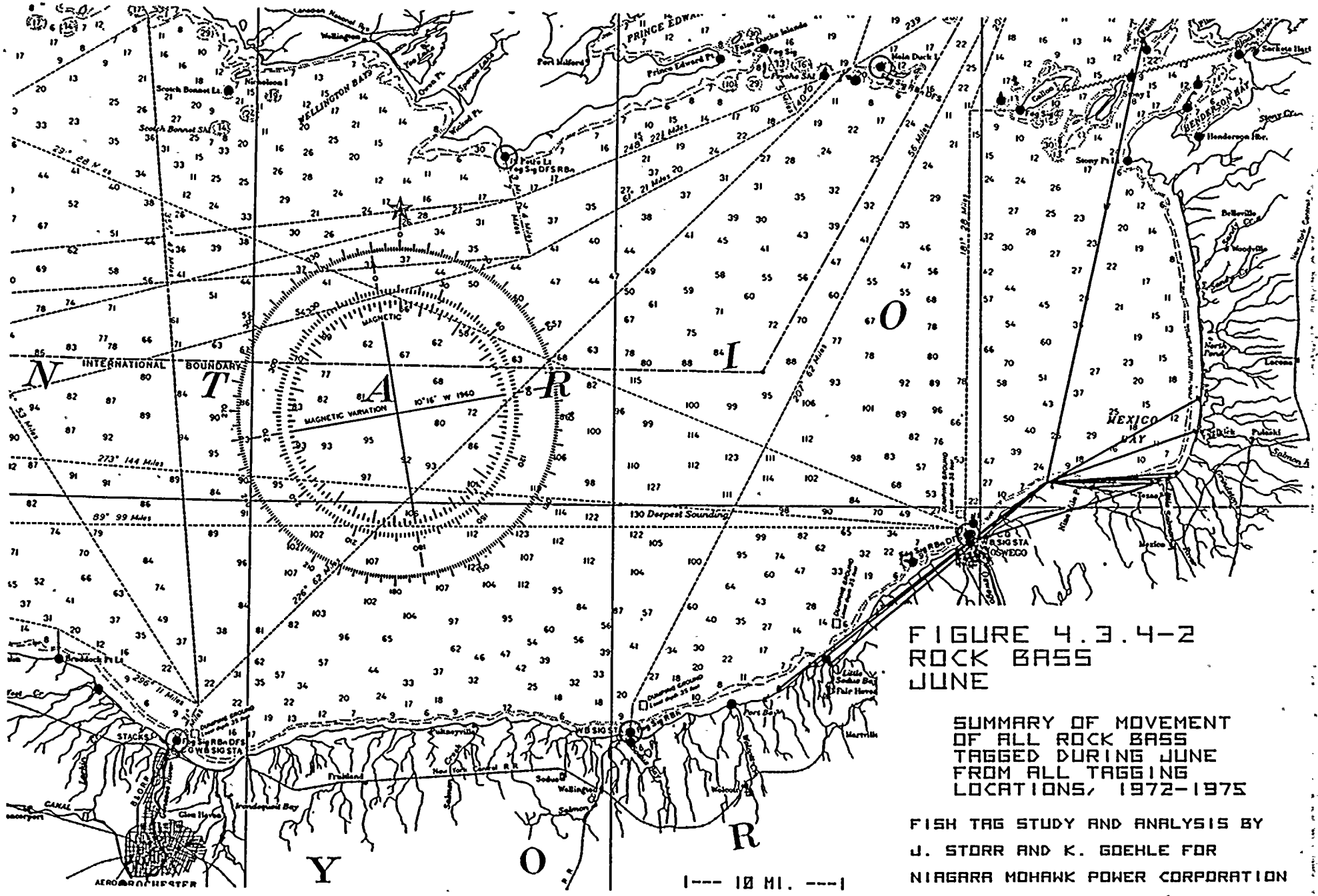


FIGURE 4.3.4-2
ROCK BASS
JUNE

SUMMARY OF MOVEMENT OF ALL ROCK BASS TAGGED DURING JUNE FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION

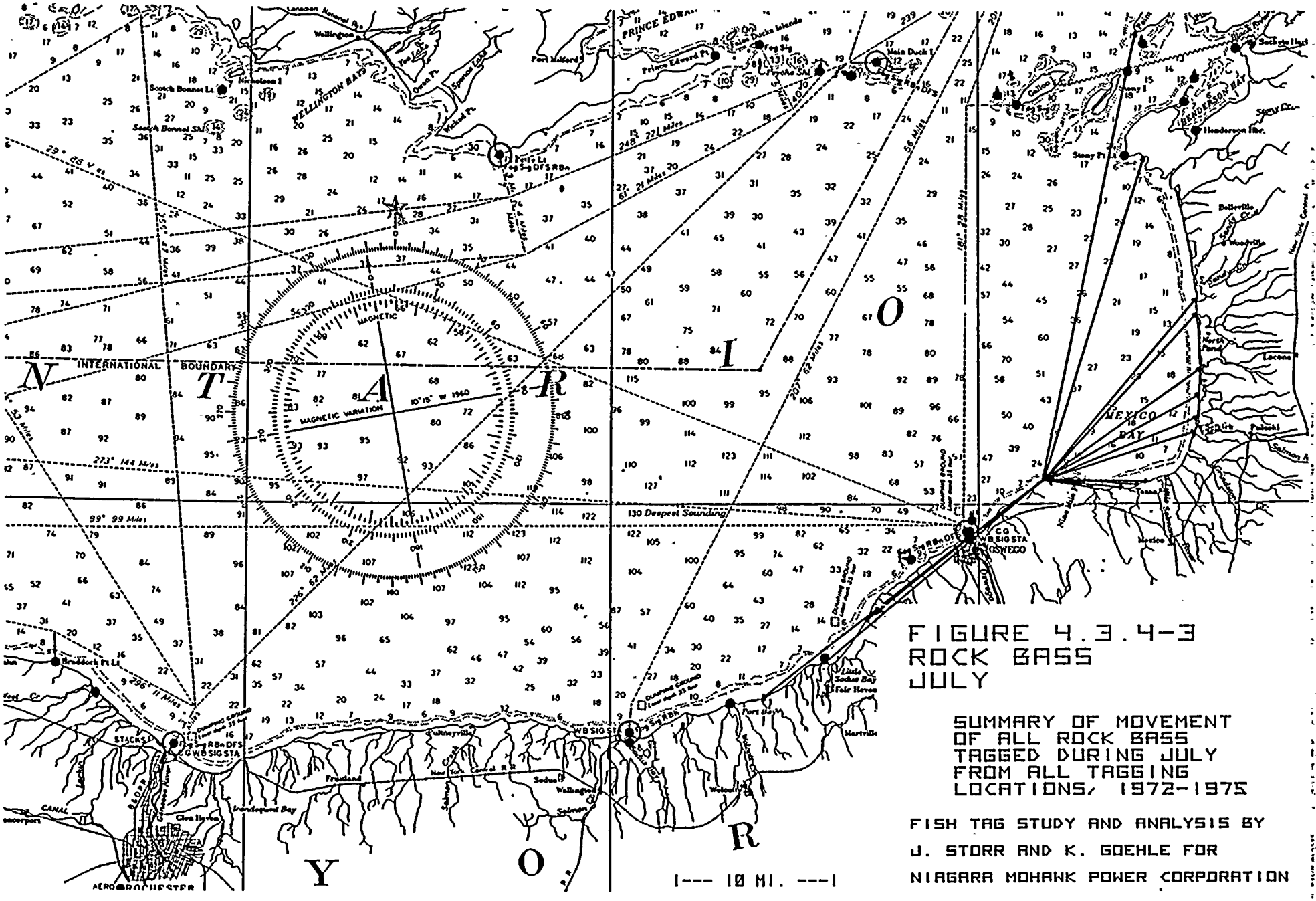


FIGURE 4.3.4-3
ROCK BASS
JULY

SUMMARY OF MOVEMENT
OF ALL ROCK BASS
TAGGED DURING JULY
FROM ALL TAGGING
LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY
J. STORR AND K. GOEHLE FOR
NIAGARA MOHAWK POWER CORPORATION

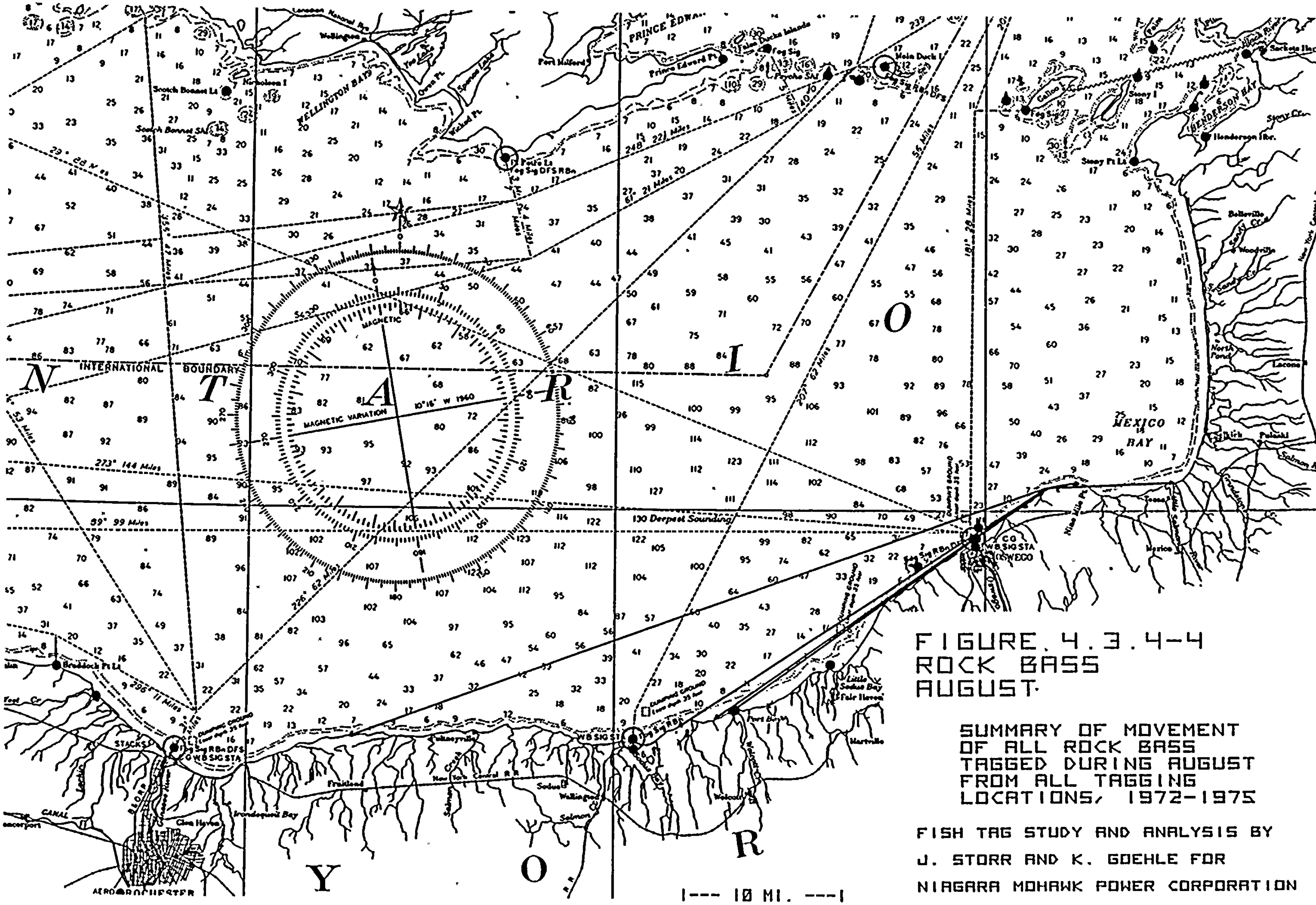


FIGURE 4.3.4-4
ROCK BASS
AUGUST

SUMMARY OF MOVEMENT OF ALL ROCK BASS TAGGED DURING AUGUST FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION

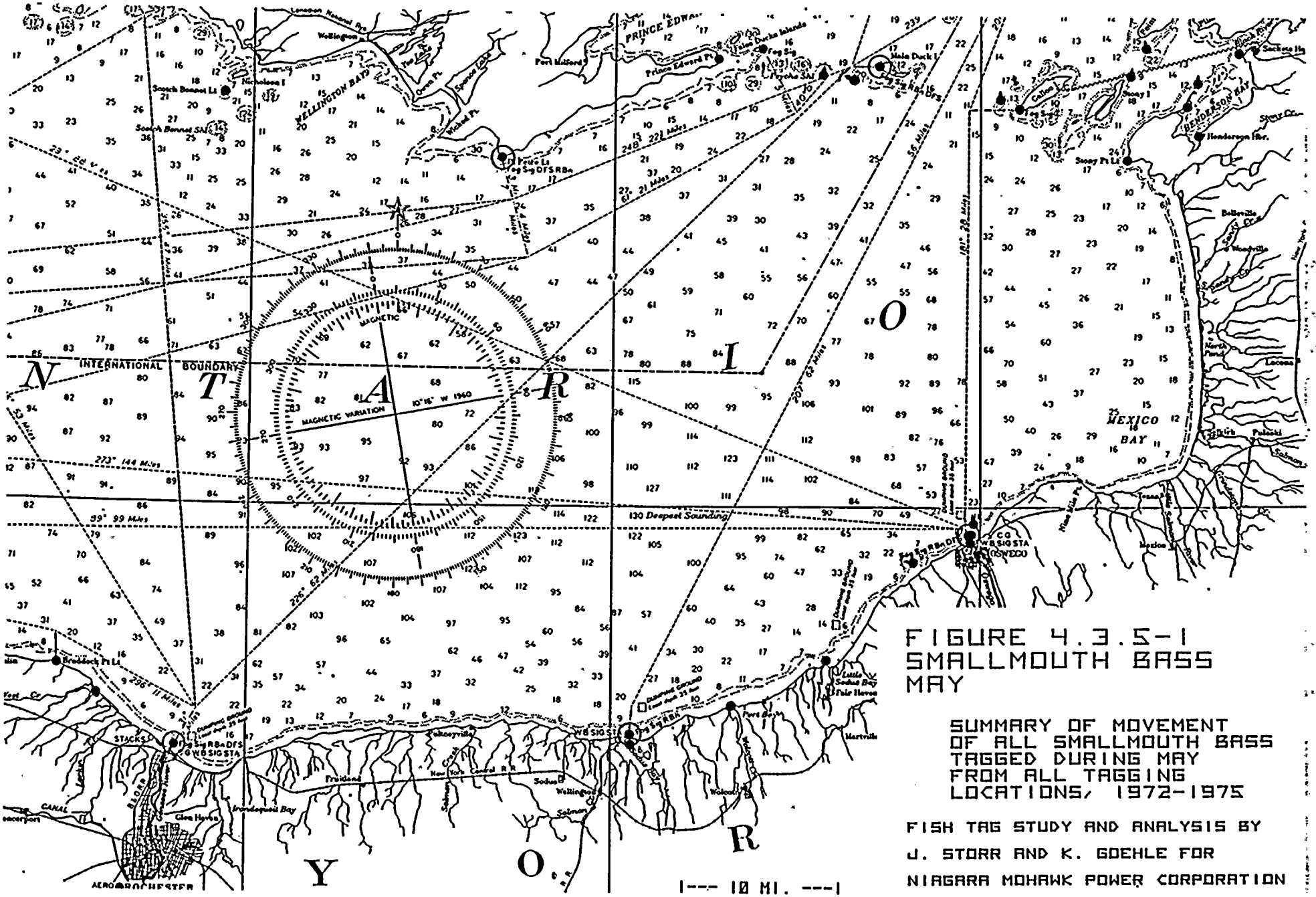


FIGURE 4.3.5-1
SMALLMOUTH BASS
MAY

SUMMARY OF MOVEMENT OF ALL SMALLMOUTH BASS TAGGED DURING MAY FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION

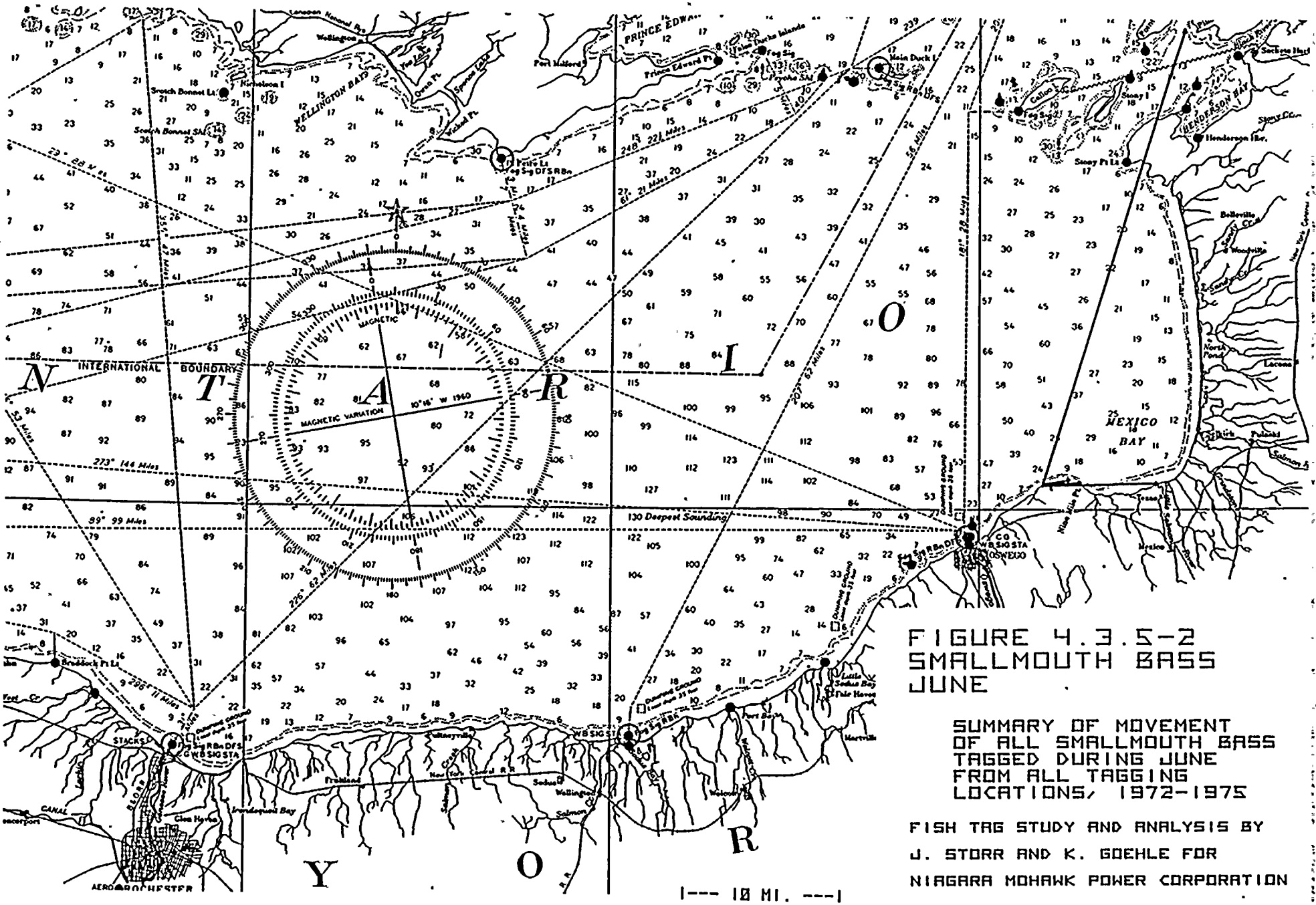


FIGURE 4.3.5-2
SMALLMOUTH BASS
JUNE

SUMMARY OF MOVEMENT OF ALL SMALLMOUTH BASS TAGGED DURING JUNE FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY
J. STORR AND K. GOEHLE FOR
NIAGARA MOHAWK POWER CORPORATION

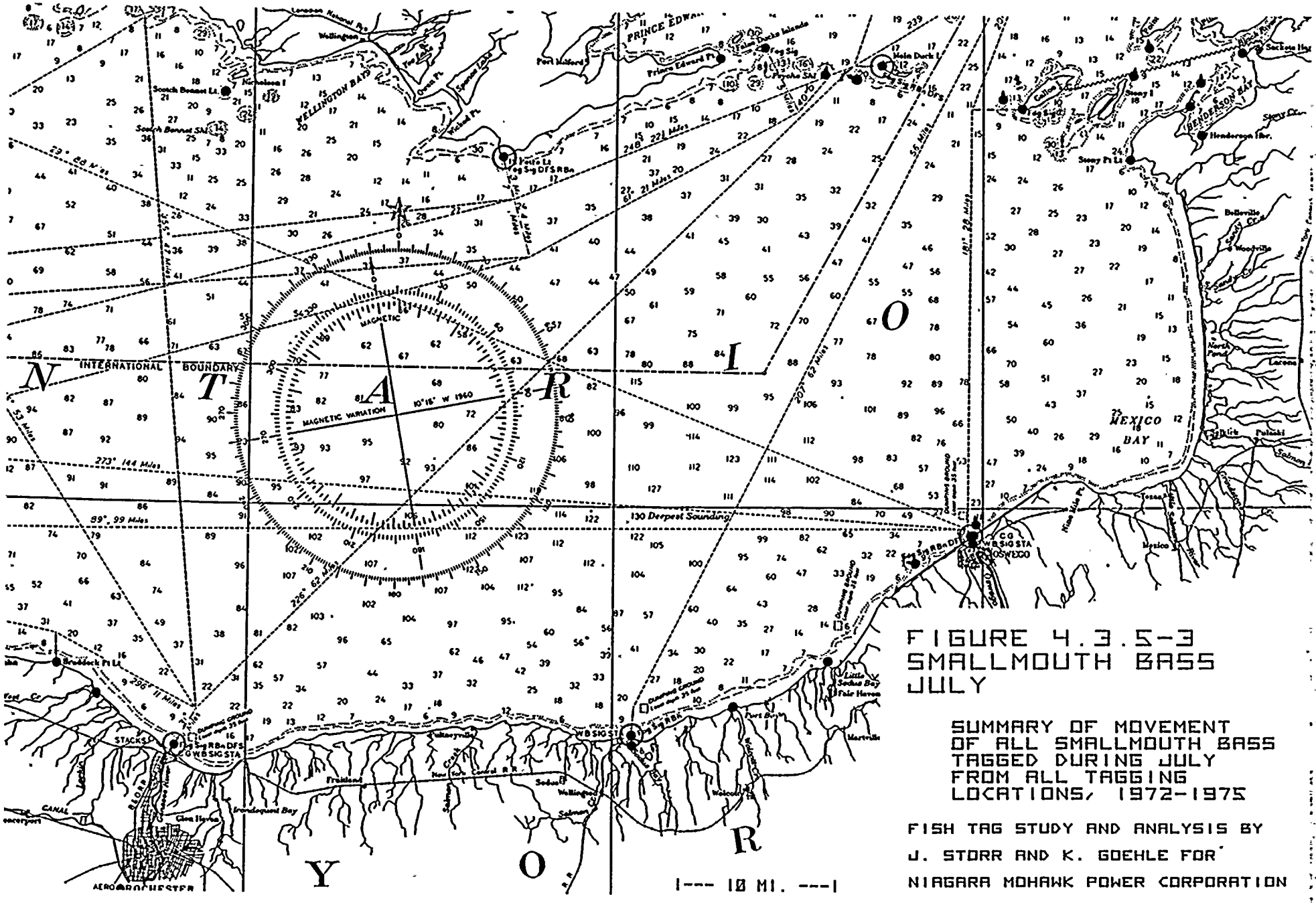


FIGURE 4.3.5-3
SMALLMOUTH BASS
JULY

SUMMARY OF MOVEMENT OF ALL SMALLMOUTH BASS TAGGED DURING JULY FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION

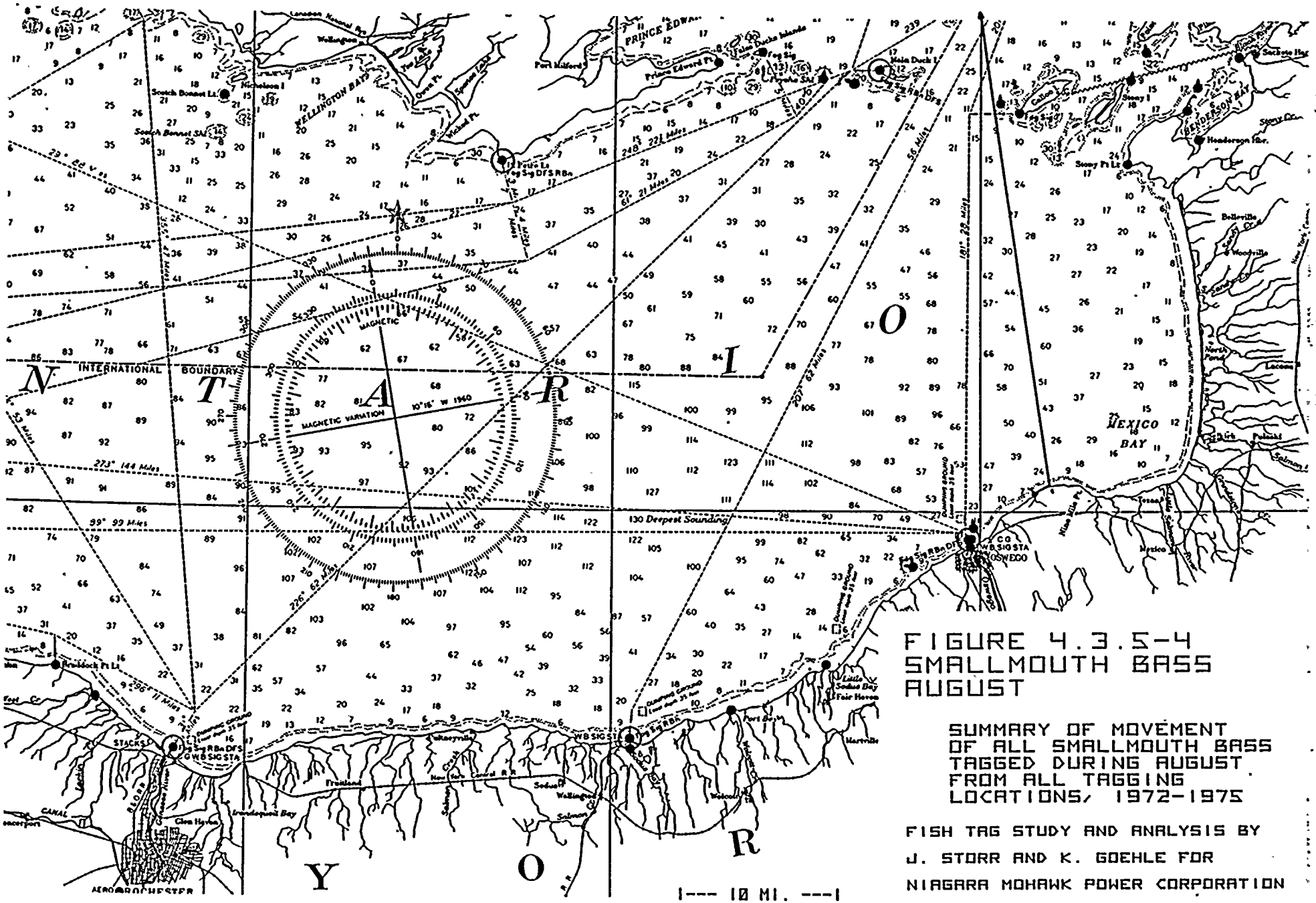


FIGURE 4.3.5-4
SMALLMOUTH BASS
AUGUST

SUMMARY OF MOVEMENT OF ALL SMALLMOUTH BASS TAGGED DURING AUGUST FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION

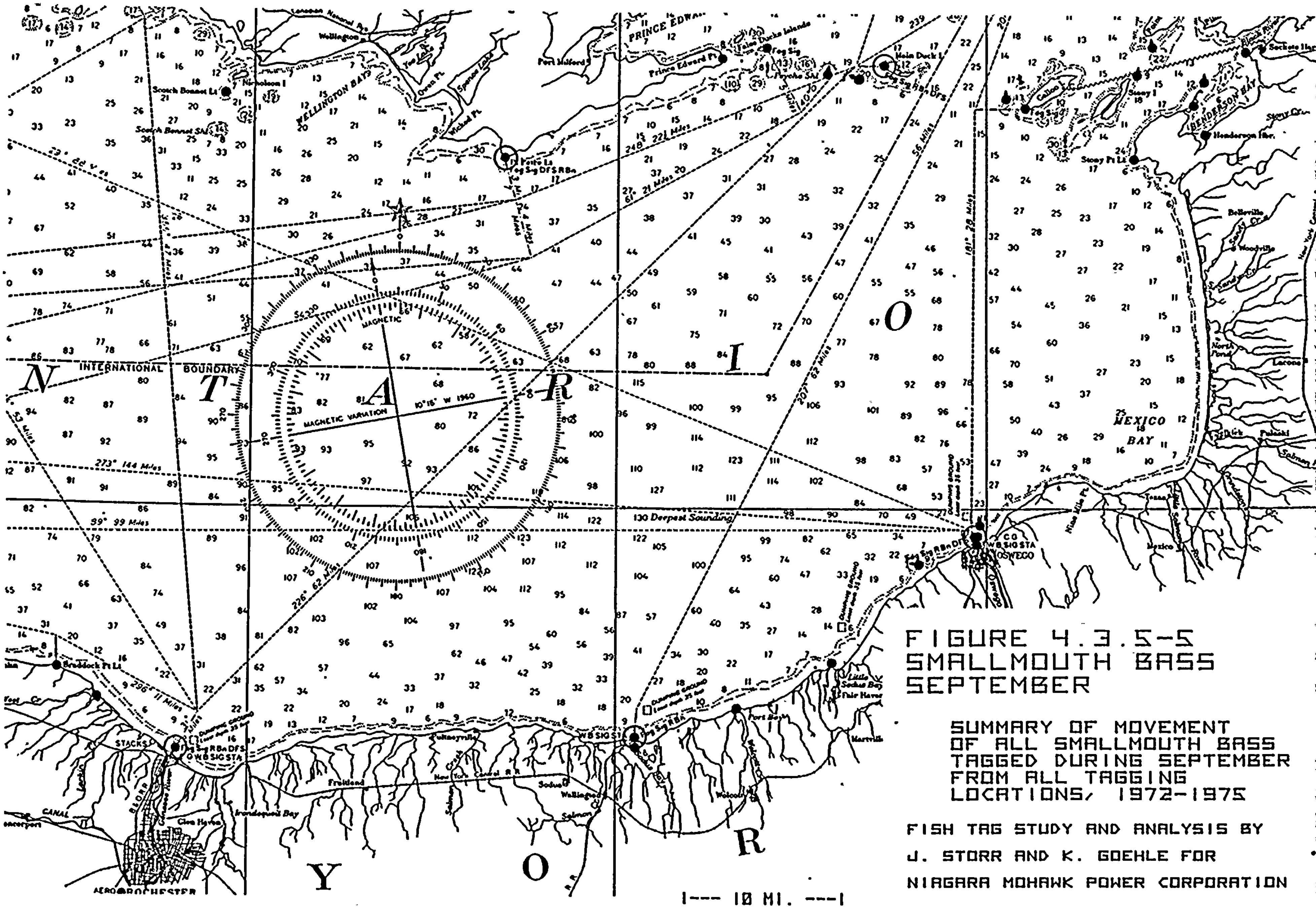


FIGURE 4.3.5-5
SMALLMOUTH BASS
SEPTEMBER

SUMMARY OF MOVEMENT
OF ALL SMALLMOUTH BASS
TAGGED DURING SEPTEMBER
FROM ALL TAGGING
LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY
J. STORR AND K. GOEHLE FOR
NIAGARA MOHAWK POWER CORPORATION

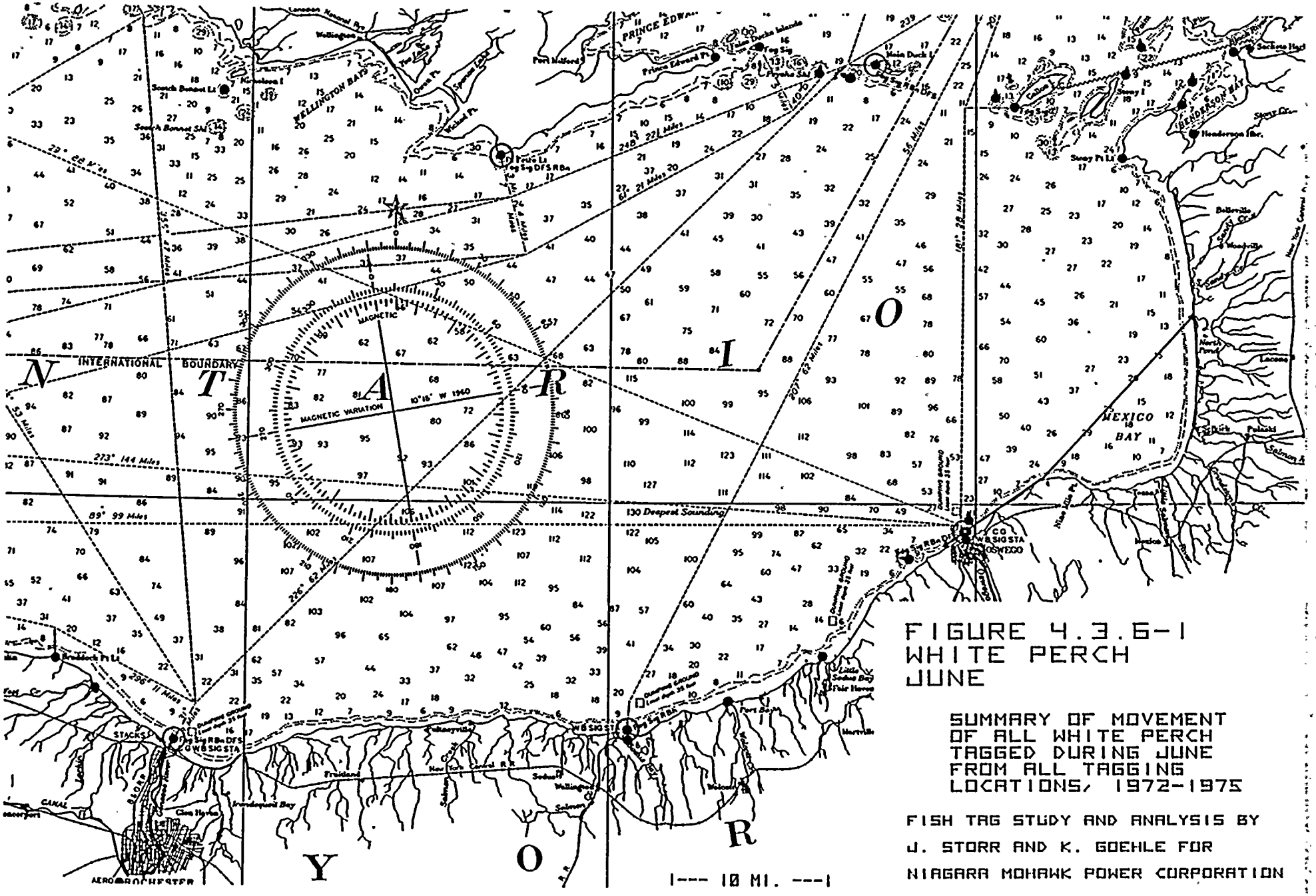


FIGURE 4.3.6-1
WHITE PERCH
JUNE

SUMMARY OF MOVEMENT OF ALL WHITE PERCH TAGGED DURING JUNE FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION

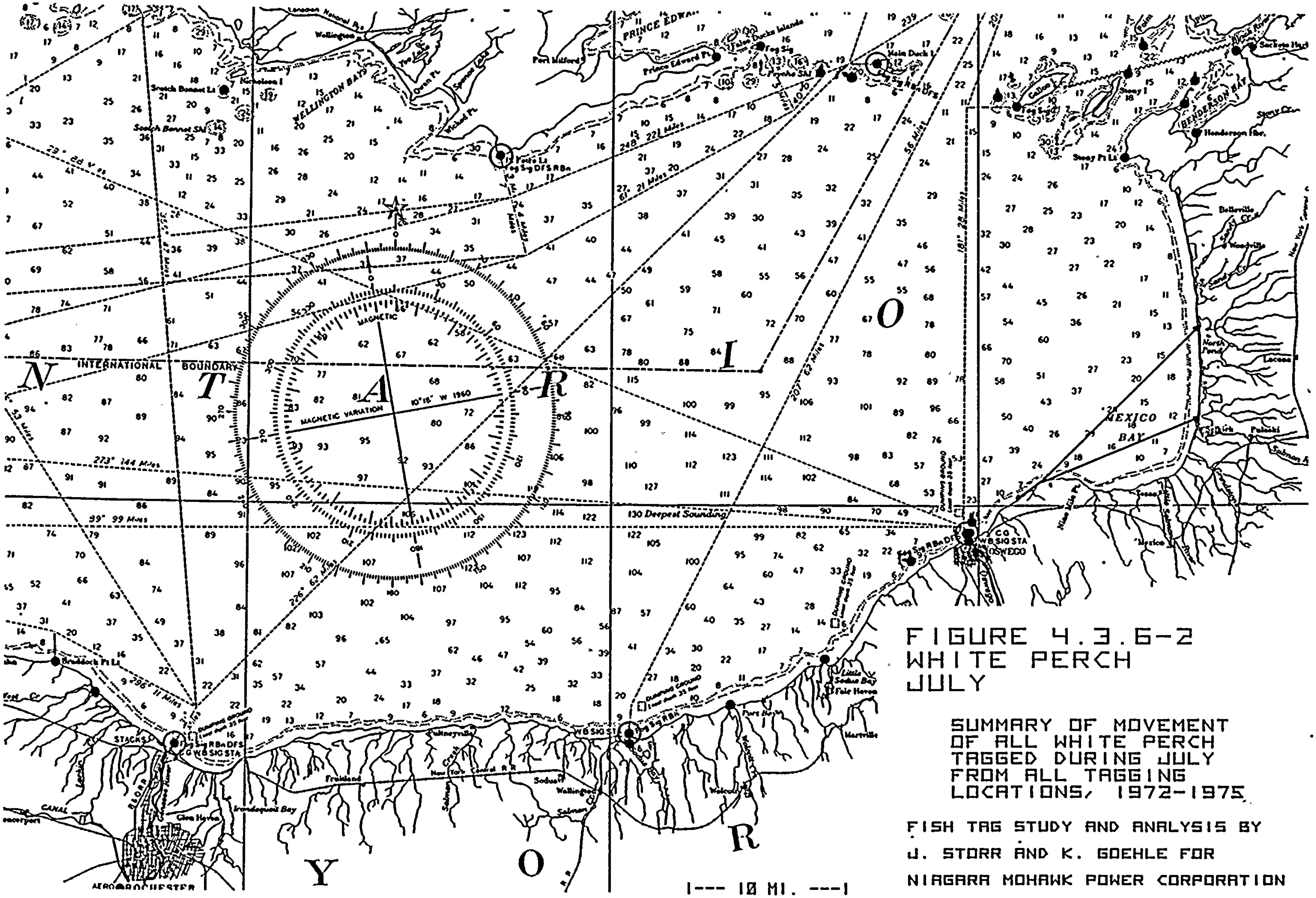


FIGURE 4.3.6-2
WHITE PERCH
JULY

SUMMARY OF MOVEMENT
OF ALL WHITE PERCH
TAGGED DURING JULY
FROM ALL TAGGING
LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY
J. STORR AND K. GOEHLE FOR
NIAGARA MOHAWK POWER CORPORATION

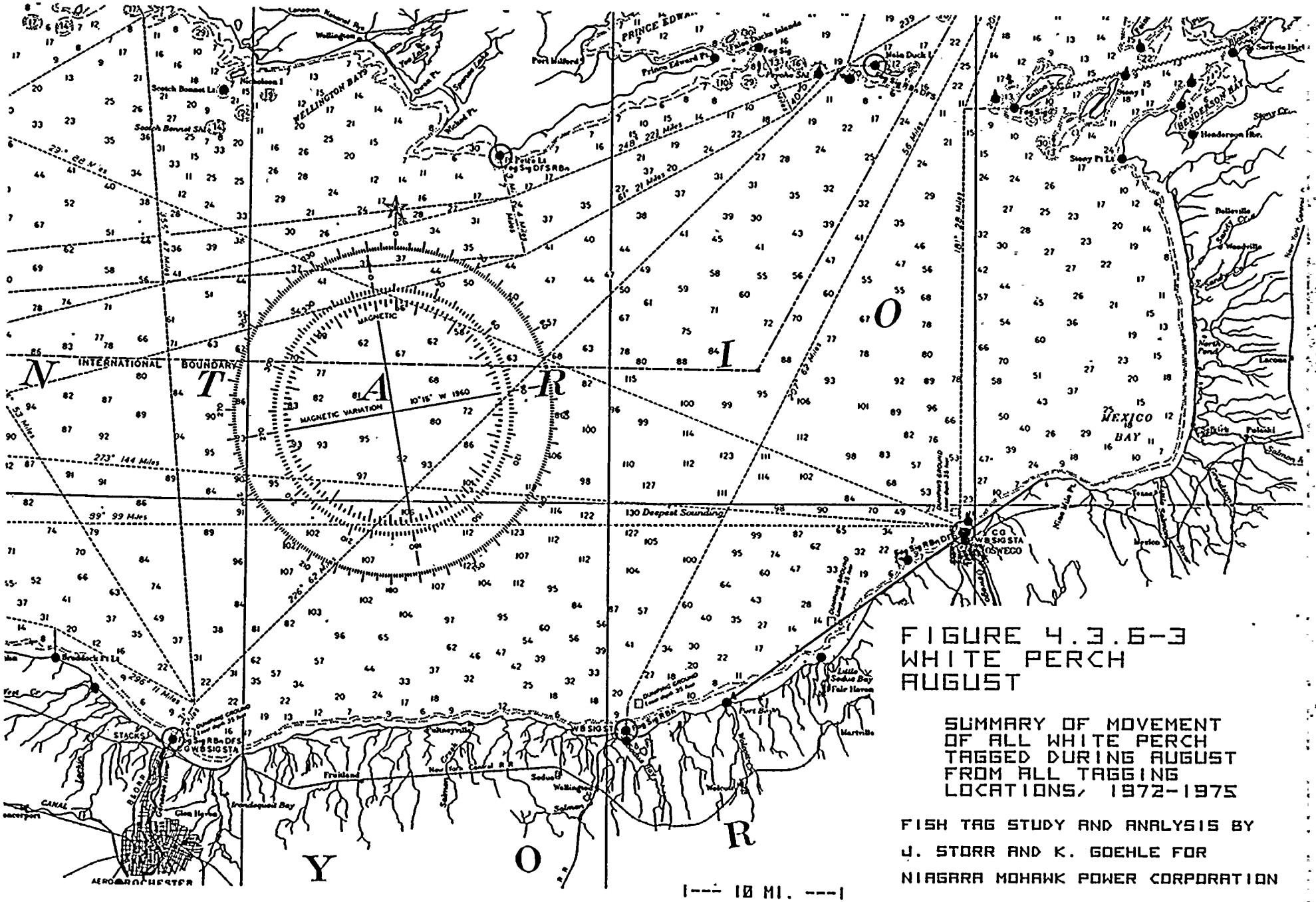


FIGURE 4.3.6-3
WHITE PERCH
AUGUST

SUMMARY OF MOVEMENT OF ALL WHITE PERCH TAGGED DURING AUGUST FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY
J. STORR AND K. GOEHLE FOR
NIAGARA MOHAWK POWER CORPORATION

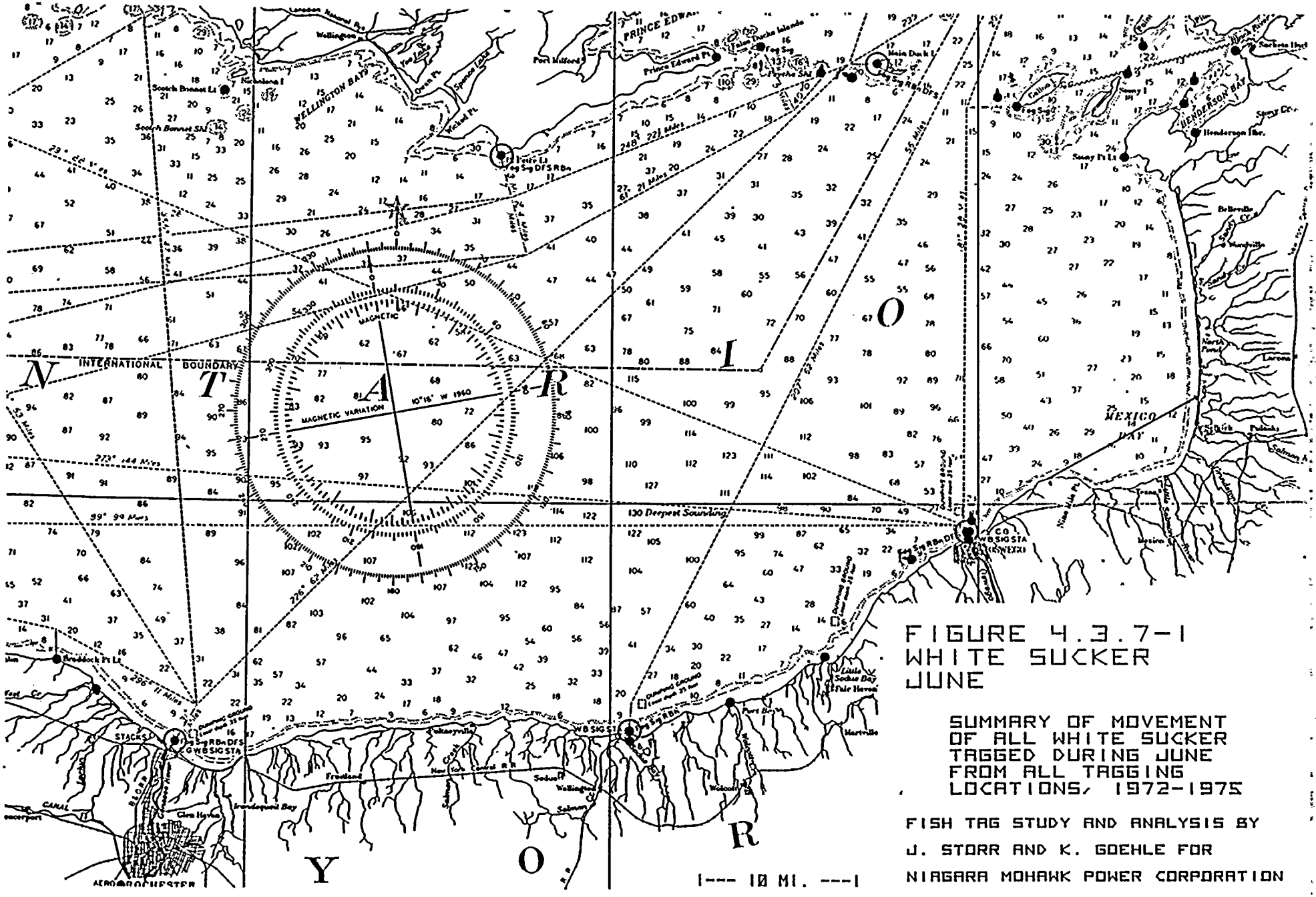


FIGURE 4.3.7-1
WHITE SUCKER
JUNE

SUMMARY OF MOVEMENT OF ALL WHITE SUCKER TAGGED DURING JUNE FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY
J. STORR AND K. GOEHLE FOR
NIAGARA MOHAWK POWER CORPORATION

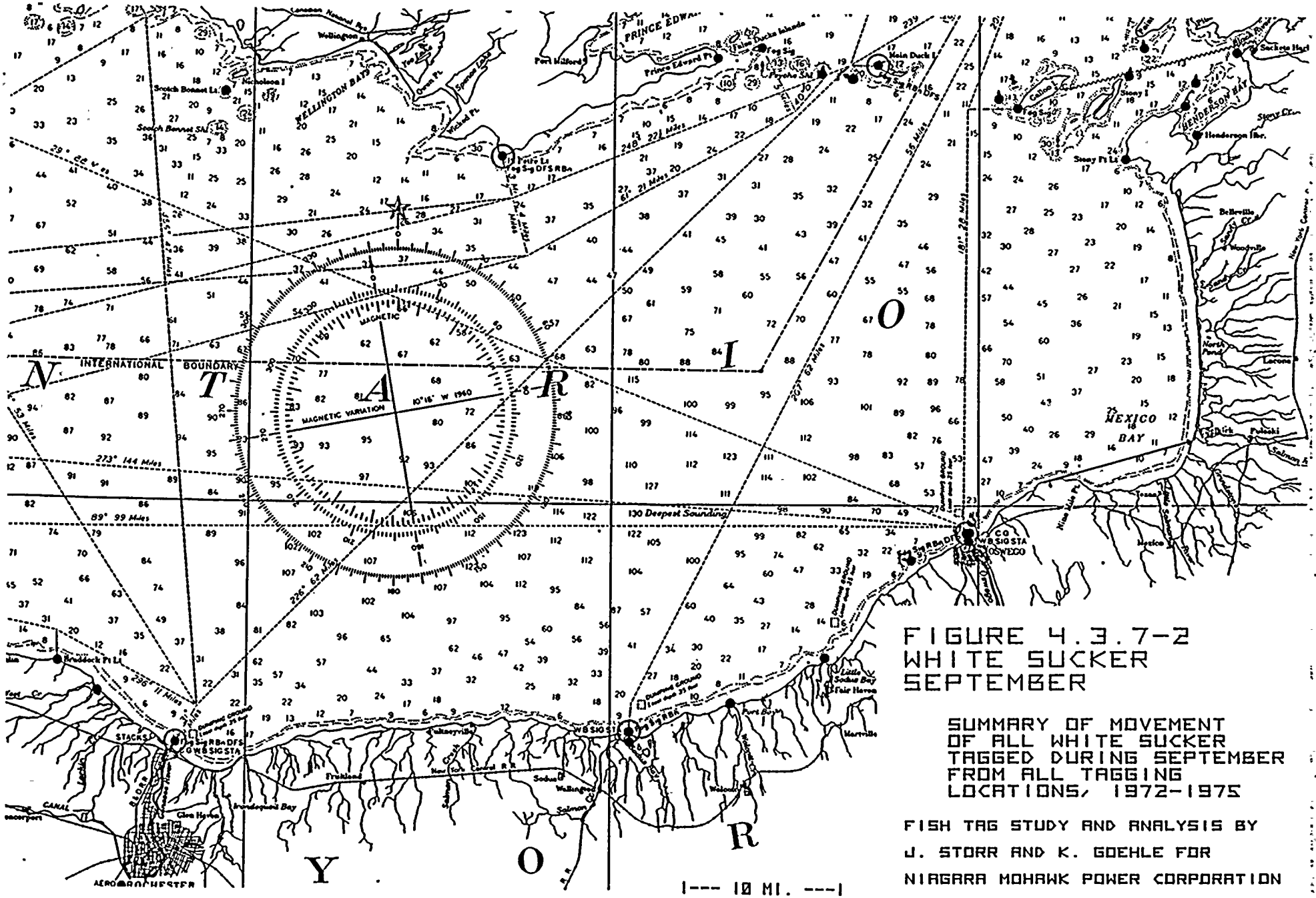
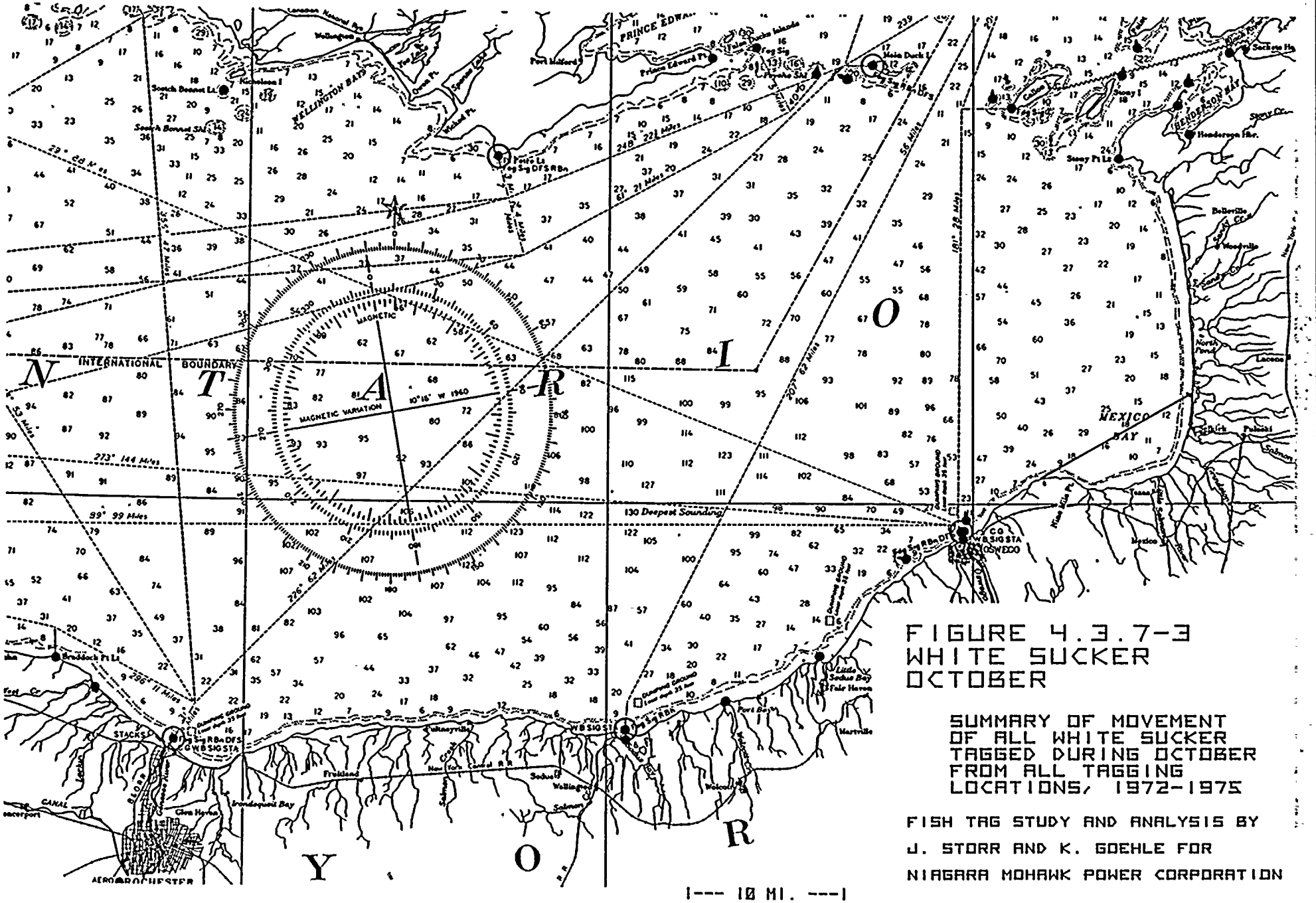


FIGURE 4.3.7-2
WHITE SUCKER
SEPTEMBER

SUMMARY OF MOVEMENT OF ALL WHITE SUCKER TAGGED DURING SEPTEMBER FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION



I--- 10 MI. ---I

FIGURE 4.3.7-3
WHITE SUCKER
OCTOBER

SUMMARY OF MOVEMENT OF ALL WHITE SUCKER TAGGED DURING OCTOBER FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY
J. STORR AND K. GOEHLE FOR
NIAGARA MOHAWK POWER CORPORATION

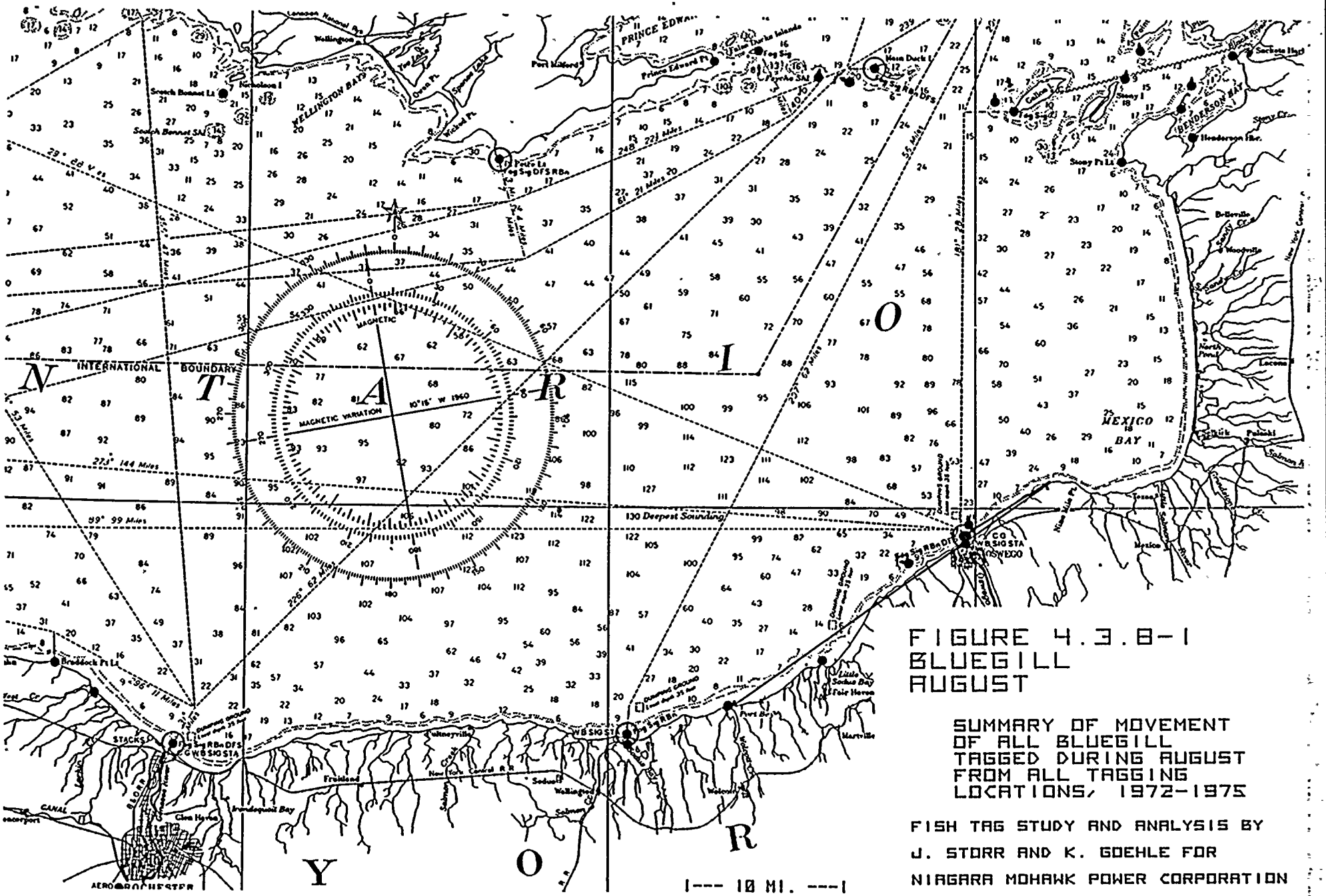
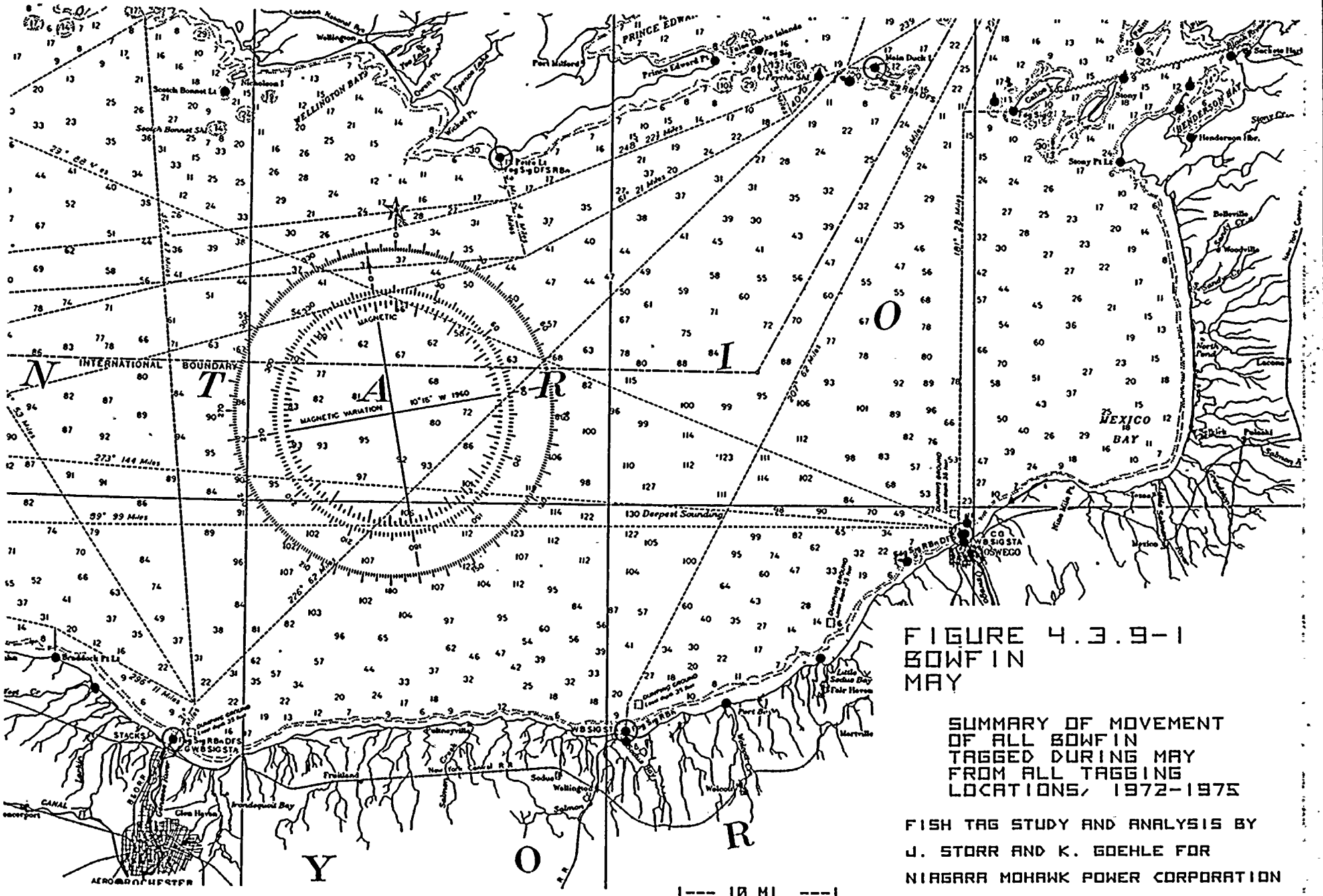


FIGURE 4.3.8-1
BLUEGILL
AUGUST

SUMMARY OF MOVEMENT OF ALL BLUEGILL TAGGED DURING AUGUST FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION



1--- 10 MI. ---1

FIGURE 4.3.9-1
BOWFIN
MAY

SUMMARY OF MOVEMENT OF ALL BOWFIN TAGGED DURING MAY FROM ALL TAGGING LOCATIONS, 1972-1975

FISH TAG STUDY AND ANALYSIS BY J. STORR AND K. GOEHLE FOR NIAGARA MOHAWK POWER CORPORATION