MISSISSIPPI RIVER AND TRIBUTARIES
MISSISSIPPI DELTA REGION, LOUISIANA
SALINITY CONTROL STRUCTURES

CAERNARVON FRESHWATER DIVERSION STRUCTURE

DRAFT BIOLOGICAL MONITORING PROGRAM REPORT

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BIOLOGICAL MONITORING PROGRAM

Draft Report

INTRODUCTION

The proposed project would divert fresh water from the Mississippi River into the Breton Sound Estuary. Water would be diverted via a controlled structure installed in the mainline Mississippi River levee near Caernarvon, Louisiana, at river mile 81.5 (Figure 1). The primary purpose of the project is to establish favorable salinity conditions in the area. Salinities would be managed to reduce saltwater intrusion, enhance growth of vegetation, reduce land loss, and increase production of commercial and recreational fish and wildlife.

Throughout the period of study leading to the recommendation of this project, there was extensive interagency and public involvement. During this period, numerous individuals and agencies recommended that the project be carefully monitored. At first, the driving force behind a monitoring program was concern over the relatively poor water quality of the Mississippi River and the potential for adverse impacts on organisms in the estuary.

However, it soon became apparent that it would be wise to develop a comprehensive monitoring program to include biological, water quality, and hydrological data collection. The overall monitoring program would provide information which could be used to guide structure operation including timing, magnitude, and duration of flow. The biological, water quality, and hydrological monitoring programs are being developed concurrently. Close coordination is being maintained during the development of these programs to avoid unnecessary duplication.

FIGURE 1. Location of proposed freshwater diversion site near Caernarvon, Louisiana.

This report deals specifically with the biological monitoring program, although certain water quality parameters which are routinely sampled in conjunction with biological sampling in aquatic environments are also discussed. The water quality and hydrological monitoring programs are covered in a separate report.

The biological monitoring program would be carried out in three distinct phases: an intensive, 3-year preconstruction program; an intensive, 4-year postconstruction program; and a long-term program which would continue for 46 years, the remainder of the 50-year project life. The objectives of each phase of the program are described below.

Preconstruction Monitoring Program - 3 years

The overall objective of the intensive, 3-year preconstruction biological monitoring program is to establish baseline conditions for the important biological resources in the study area. Data collected in this program will be compared with data from the postconstruction biological monitoring program in order to assess project effects. Specific objectives include:

- Describe prediversion conditions of emergent and submergent vegetation.
- Estimate prediversion populations and areas of concentration for wildlife including furbearers, alligators, and waterfowl.
- Determine preferred habitat and areas of concentration of important finfish and shellfish species prior to diversion.
- Determine as accurately as possible commercial landings of important finfish and shellfish species prior to diversion.
- Determine prediversion contaminant levels for selected parameters in resident finfish and shellfish species.

Postconstruction Monitoring Program - 4 years

The overall objective of the intensive, 4-year postconstruction biological monitoring program is to assess the immediate and "short-term" effects of the diversion on the important biological resources in the study area. This will be accomplished by collecting similar information on the same parameters sampled in the preconstruction program and comparing the two sets of data. Specific objectives include:

- o Describe postdiversion conditions of emergent and submergent vegetation.
- o Estimate postdiversion populations and areas of concentration for wildlife including furbearers, alligators, and waterfowl.
- o Determine preferred habitat and areas of concentration of important finfish and shellfish species following diversion.
- o Determine as accurately as possible commercial landings of important finfish and shellfish species following diversion.
- o Determine postdiversion contaminant levels for selected parameters in resident finfish and shellfish species to determine whether or not unacceptable levels of contaminants are resulting from the diversion.

Long-Term Monitoring Program - 46 years

The long-term monitoring program would continue for 46 years. The overall objective of this program is to assess the long-term effects of the diversion on the biological resources in the study area. The specific objectives and the types of sampling for the long-term program would be similar to the intensive pre- and postconstruction programs discussed above; however, the sampling effort would be scaled down. The intensity of the long-term monitoring program would be determined primarily based on experience gained during the pre- and postconstruction programs.

METHODOLOGY USED TO DEVELOP THE MONITORING PROGRAM

Monitoring effects of the diversion on biological resources is a topic that was discussed on numerous occasions throughout the development of the project. The concept of using an interagency, multidisciplinary approach to develop the monitoring program evolved in the early stages. It is a logical approach for several reasons.

Since the diversion would have a direct effect on the biological resources which several natural resource agencies are mandated to manage, it stands to reason that individuals from these agencies should be involved. These people have expertise in monitoring and management of biological resources and are familiar with the Breton Sound Basin. Several of the agencies have existing monitoring programs in the basin, and it makes sense to take advantage, to the maximum extent practicable, of these programs. Using this approach, the monitoring program could be developed by establishing sampling stations at key locations in relation to the diversion site and by modifying parameters sampled and sampling frequencies as necessary.

Additional support for the interagency approach stems from the fact that many of the agencies and individuals have been involved with this project since the early planning stages. They have a thorough understanding of the proposed project, its anticipated effects, and the types of monitoring that would provide meaningful information that would allow us to assess project effects. They have been very cooperative and supportive of the project since its inception and have formally requested that they participate in the development and implementation of the monitoring program.

The first formal, large-scale meeting to discuss development of the program was held on August 7, 1984 at the New Orleans District (NOD). Representatives from appropriate Federal, state, and local agencies were invited to attend as well as members of the academic community. A Memorandum of Meeting is presented in Attachment 1.

At that meeting, NOD personnel presented a brief history of the project and emphasized that because Caernarvon would be the first of our proposed freshwater diversion projects to come to fruition, it is essential that it be monitored and operated to the best advantage so that the full potential of freshwater diversions in preserving and enhancing estuarine areas be demonstrated. Corps personnel then provided a general overview of the proposed monitoring program and presented ideas on how the program could be developed and implemented. It was noted that the program could be developed most efficiently through a series of meetings/workshops.

Following the presentations by NOD personnel, participants were requested to comment on the sampling schemes and discuss what role their organization would play in development and implementation of the program. After statements from the meeting participants, the group established dates for a 3-day technical workshop to further discuss monitoring needs. Participants were requested to prepare detailed informational packets concerning their existing monitoring programs for presentations at the workshop.

The technical workshop to discuss development of the monitoring program was held on October 9-11, 1984. The primary purpose of the meeting was to assemble a group of multidisciplined individuals representing numerous Federal, state, and local agencies and other interested groups to gather information on existing monitoring programs. Based on this information, they could identify data gaps and recommend sampling programs to collect additional required information. A Memorandum of Meeting for the workshop is presented in Attachment 2.

At the August 7, 1984 meeting, NOD personnel had requested that the various agencies or groups having sampling programs in the Breton Sound Basin prepare information concerning their respective monitoring programs for presentation at this workshop. Representatives from the various groups were asked to present an overview of their sampling programs to the entire working group so everyone would have an idea of the overall extent of sampling efforts in the area. Presentations were made by the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), U.S. Geological Survey (USGS), Louisiana Department of Wildlife and Fisheries (LDWF), Louisiana Department of Health and Human Resources (LDHHR), Plaquemines Parish Environmental Services Laboratory (PPESL), and Coastal Environments, Inc.

Following the presentations, participants divided into two subgroups to discuss existing sampling programs in more detail, identify data gaps, and recommend additional sampling efforts as deemed necessary to monitor effects of the diversion.

The biological subgroup discussed sampling of important fishery resources including oysters, shrimp, blue crab, menhaden, groundfish, red drum, and spotted seatrout. The group determined that LDWF has adequate sampling programs to monitor fishery resources and manage fisheries under existing conditions. However, the proposed diversion would cause changes in distribution and abundance of aquatic organisms and, in order to document project effects, sampling efforts would be required in areas which presently receive little attention. Increased monitoring would be required in the upper basin to document changes and potential adverse impacts, and some monitoring would be required gulfward of existing stations to determine effects of salinity changes in the area.

As far as monitoring of vegetation and wildlife is concerned, LDWF currently flies a series of transects in the Breton Sound Basin to assess marsh types and marsh condition. They also conduct periodic aerial surveys of muskrats, alligators, and waterfowl. Several transects would have to be added to fully assess impacts of the diversion.

The workshop was very successful. Participants demonstrated a sincere interest in the monitoring program, and nearly all of the important parameters to be monitored were discussed. Perhaps one of the most significant accomplishments of the workshop was selection of tentative sites in the basin where the Corps would locate several in situ instrumentation packages to gather hydrological, climatological, and physical water quality parameters. Several individuals at the workshop were familiar enough with the hydrology of the basin to choose these tentative sampling locations (Figure 2). Although these in situ monitors will not collect biological data, they warrant discussion here because many of the biological sampling stations were strategically located in relation to these monitors to allow us to correlate changes in populations of aquatic organisms with hydrology/water quality parameters.

It was determined that the most efficient way to arrive at detailed designs for various types of monitoring would be by working in small subgroups comprised primarily of individuals from the large working group who provided input to development of the overall monitoring program. A list of individuals involved in development of the overall monitoring program, including the biological program, is provided in Attachment 3.

Large-scale meetings/workshops provide an excellent forum for exchange of ideas, discussion of philosophies, and providing the framework for more detailed studies. However, technical details can be worked out more efficiently by small groups of individuals with expertise key to particular areas of interest. The various monitoring programs described in this draft report were designed using the small group approach.

This draft report will be distributed for review by all of the people who have been involved with development of the monitoring program. Based on comments received on the draft report, a final biological monitoring program report will be prepared. Additional meetings to further discuss the monitoring program will be held as deemed necessary.

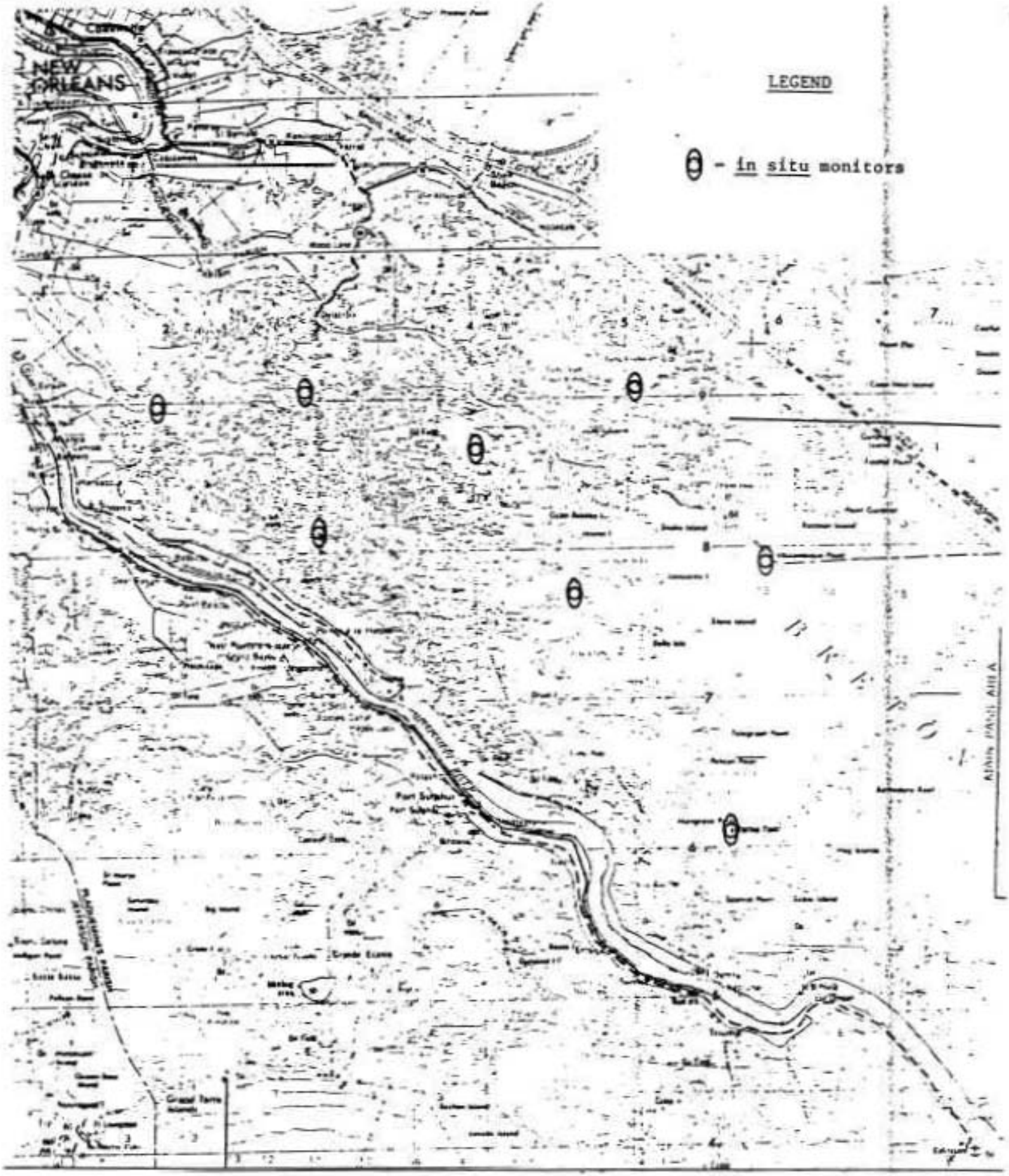

FIGURE 2. Tentative locations of in situ monitoring stations.

The remainder of this draft report discusses the various biological monitoring programs individually. Topics discussed include the reason for monitoring the particular resource, objectives of the monitoring, description of sampling procedures, location of sampling stations, sampling frequencies, time of year the monitoring is conducted, who proposes to conduct the monitoring, preliminary cost esimates, and other pertinent information.

The station and transect locations described in this report are referred to as tentative; however, in most cases, the locations closely approximate where the exact locations will be. Since it is not yet known whether construction funds will be appropriated in 1986, it was not prudent to expend the time and funds necessary to conduct extensive field surveys to precisely position sampling sites. However, before any sampling efforts begin, the coordinates of all new stations will be established. The sampling schemes and station locations described in this report will be identical for both the pre-and postconstruction monitoring program.

It should be emphasized that the monitoring efforts proposed in this report do not necessarily include all of the types of monitoring deemed desirable for a project with such far-reaching potential effects. However, as always, there are certain budgetary constraints which had to be considered. The total annual cost of the proposed program is nearly double the estimate ~~in the Final Feasibility Report~~ originally developed in interim studies (September 1984). Additional funds for monitoring were made available from within the amount currently available for the project. All factors considered, it is felt that the sampling proposed herein represents a reasonable monitoring program.

MONITORING PROGRAM DESIGNS

MARSH VEGETATION

The Breton Sound Estuary has experienced marsh loss and dramatic changes in marsh types due to saltwater intrusion into the area. Historically, fresh/intermediate marshes occupied a large area in the upper portion of the estuary. Due to a variety of factors, salt water has penetrated into these fresher marshes and brackish marshes are now present as far north as Big Mar.

The primary effect of the proposed diversion would be lowered salinities in the marshes. Increased nutrient and sediment input into the marshes would also occur. It has been projected that the rate of marsh loss would be reduced and that some areas of brackish marsh would revert to fresh/intermediate marsh over time.

In order to assess changes in the marsh, it will be necessary to monitor marsh vegetation. Because of the size of the area to be sampled and the limited access, a helicopter is the only practical means of transportation for the marsh monitoring. Sampling would be conducted along predetermined north-south transect lines established from original transects used by Chabreck (1968) and Chabreck and Linscombe (1978) in making Louisiana coastal vegetative type maps. A total of 100 miles of transects would be flown in the study area. The sampling stations would be located at 0.25 or 0.50 mile intervals along these transects, depending on sampling intensity needed. The transects to be used for this monitoring would be selected from among the transects already established by Chabreck and Linscombe. However, it is proposed that two additional transects be established to properly assess the effects of the diversion. The established and proposed transects are shown in Figure 3. A Loran C unit would be utilized in the helicopter to maintain a true line, making it possible to repeat this line from year to year. At each sampling station an ocular estimate would be made with the helicopter landing or hovering.

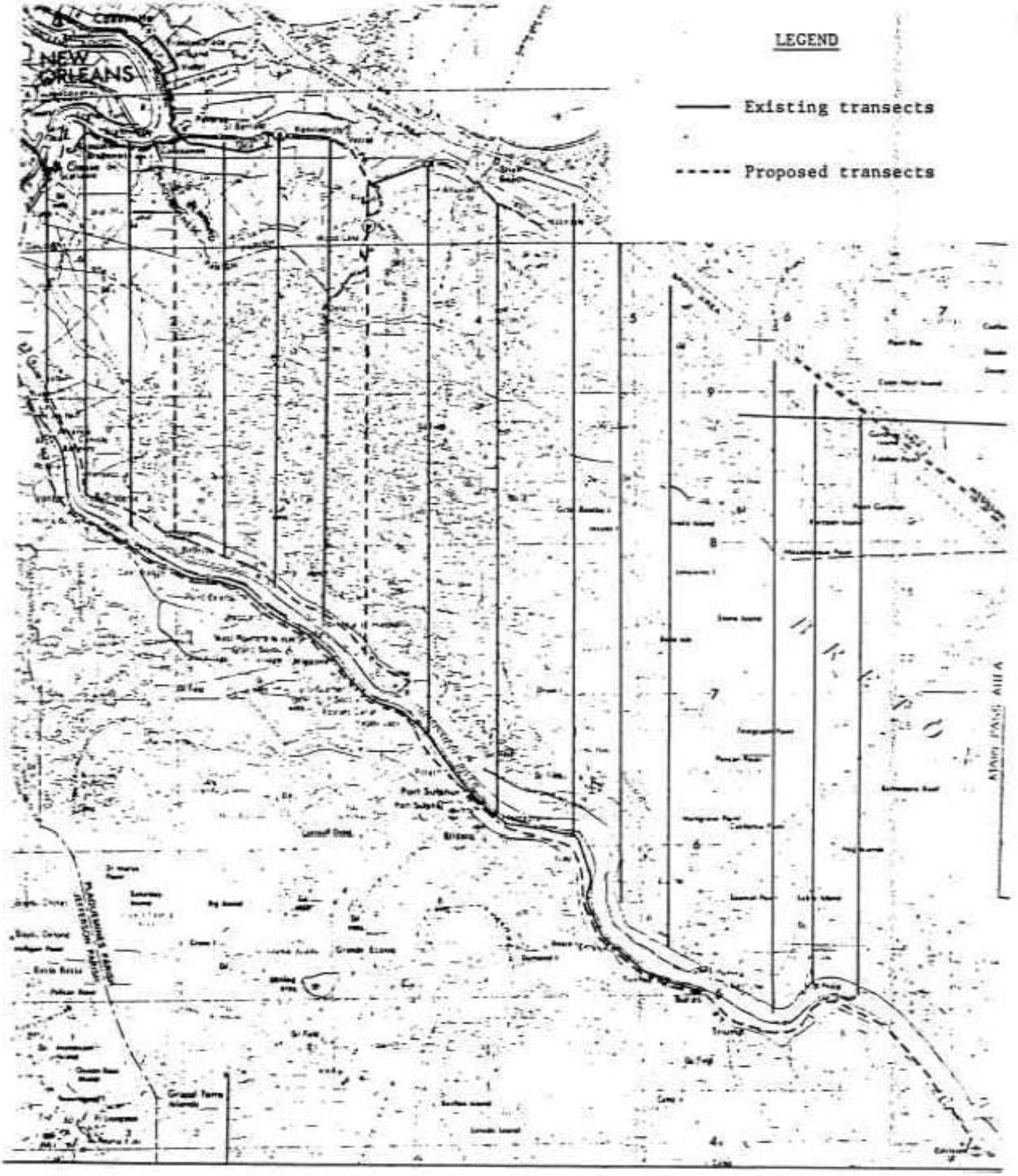

FIGURE 3. Existing and proposed transects for monitoring vegetation, muskrats, and alligators.

All marsh species present and percent composition would be recorded at each station. Observations concerning submerged aquatic vegetation would also be recorded. Sampling would be conducted in late July or early August when most species are mature and easier to identify. The vegetation monitoring would be conducted with a 206B jet ranger helicopter, pilot, one biologist to navigate, and one biologist to identify vegetation and record. The data would be compiled and compared from year to year and between or along transect lines to measure changes related to environmental conditions associated with the freshwater introduction.

It is proposed that vegetation monitoring be conducted by LDWF. It is currently estimated that the monitoring would cost about $12,000 per year. This cost is largely attributable to helicopter flight time. The cost of monitoring muskrat and alligator populations, the next two topics of discussion, are included in the $12,000 per year estimate.

The vegetation monitoring proposed above would provide information primarily concerning qualitative changes in marsh vegetation. It would not provide information which would allow quantification of changes in marsh acreage. However, it is highly probable that aerial photography and habitat mapping of the study area will be conducted by Federal and/or state agencies within the next few years. This would make it possible to express the anticipated habitat changes in quantitative terms.

WILDLIFE

Muskrats

Muskrat population density in coastal brackish marsh is related to a number of environmental parameters including vegetation, salinity, and nutrients. Muskrat populations appear to obtain high densities in brackish marsh dominated by three-cornered grass (Scirpus olneyi), a preferred food of the muskrat. It has been observed in the past that muskrat populations often demonstrate a dramatic increase during high water years when marsh salinities are reduced in some areas. Three-cornered grass is more abundant in low-salinity brackish marshes. The proposed project would expand the area of these marshes.

A count of muskrat houses can be used as an index to muskrat numbers. However, it is necessary to know the past history of the population in order to correctly interpret aerial house counts. Aerial counts would be made using the same north-south transects chosen for the vegetation monitoring (Figure 3). Counts would be made from a helicopter flying at an altitude of approximately 100 feet and a speed of 80 mph. The strip counted would be 300 feet wide. This survey would be conducted in late February after green-up has begun. Muskrat houses at this time are still dry and highly visible because of the contrast with green vegetation. A total of 100 miles of transect line would be flown. This survey would be conducted with a 206B jet ranger helicopter, pilot, one biologist to navigate and record, and one biologist to act as observer (counting houses). Data would be compiled by line and/or marsh type and compared annually to detect trends.

It is proposed that monitoring of muskrat populations be conducted by LDWF. The cost is included in the estimate for vegetation monitoring.

Alligators

Alligators are most abundant in fresh/intermediate marshes. Their numbers are reduced as marsh salinities increase; however, they do occur in brackish marsh situations. The LDWF currently surveys alligator populations across the state out to the 10 ppt isohaline.

The marsh alligator population in the Breton Sound Estuary would be censured by aerial nest inventory. Such an inventory would index population levels and measure population variation by marsh or habitat type and through time. The aerial nest censuses would be conducted in late June or early July after nesting is complete. The alligator nests would be counted along permanently established north-south transects using the same lines used for vegetation monitoring and muskrat population surveys (Figure 3). A flight speed of approximately 80 mph and an altitude of 200 feet are considered optimum. An observer would count nests within a transect line width of 350 feet. Data would be recorded by marsh type and transect line.

This survey would also utilize a 206B jet ranger helicopter, pilot, one biologist to observe, and one to navigate and maintain records. A total of 100 miles of transect line would be flown.

It is proposed that the monitoring of alligator populations be conducted by LDWF. The cost is included in the estimate for vegetation monitoring.

Waterfowl

Historically, the Breton Sound Estuary provided habitat for large concentrations of waterfowl. The conversion of fresh/intermediate marshes to more saline habitat types has resulted in a significant decline in waterfowl populations in the area. It is expected that the proposed diversion would enhance the suitability of waterfowl habitat in the area. It is important that waterfowl populations be monitored to assess these changes.

The LDWF began using periodic aerial surveys to estimate migration chronology, size, and distribution of coastal waterfowl populations in 1951. In 1968, the Department altered the original survey and began using the present inventory procedure in the coastal region. The present methods were adapted from a sampling technique designed by Chabreck, Palmisano and Joanen (1968) to type map the Louisiana coastal marshes. The survey consists of 27 north-south transect lines which cover the entire Louisiana coastal zone. The sampling rate is greater in the western half of the state since duck populations there are normally twice as large as those observed in the east.

Figure 4 shows the transects which would be used to monitor waterfowl populations in the study area. Two transects are already flown under their current monitoring program. It is proposed that an additional transect be added in the upper part of the estuary to better assess effects of reduced salinities an waterfowl use in the area.

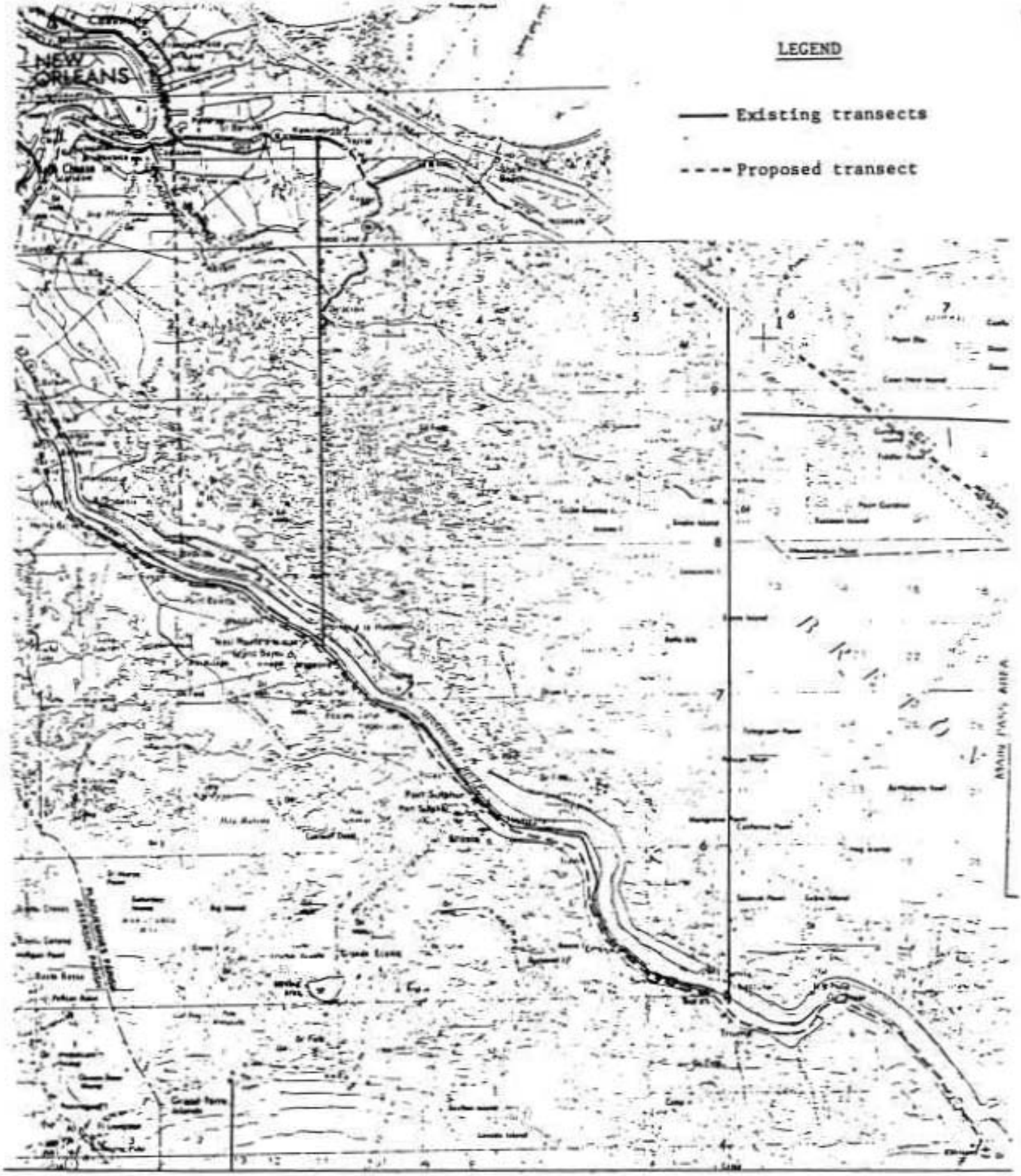

FIGURE 4. Existing and proposed transects for waterfowl monitoring.

Aerial surveys would be conducted using a twin-engined Partenavia 68C aircraft, a high wing monoplane with an unobstructed downward view owned and operated by the LDWF. The aircraft is equipped with a LORAN-C navigation system to ensure accurate repeatability of aerial transects throughout the duration of the study. Aerial transects would be flown at approximately 90 mph and 150 feet altitude.

Numbers of each species observed from both sides of the aircraft would be estimated and recorded as the aircraft moves across the vegetation types along each transect line. A detailed vegetation type map overlaid with the transect lines would allow observers to record bird numbers in each of the major habitat types. Species to be included in the survey are listed below.

Mallard	Pintail
Mottled duck	Coots
Gadwall	Scaup
Wigeon	Ring-necked duck
Green-winged teal	Canvasback
Blue-winged teal	Hooded merganser
Shoveler	Geese

LDWF has indicated that the additional monitoring required to assess the impacts of the diversion on waterfowl could be accomplished at no significant additional cost.

FISHERIES

The proposed diversion would, of course, alter the distribution of aquatic resources in the Breton Sound Estuary. It is essential that these resources be monitored.

Oyster, brown and white shrimp, crab, and finfish populations would be surveyed during the pre-and postconstruction monitoring phases. The Seafood Division of LDWF has in place extensive management-oriented monitoring programs for these resources. The objectives of the proposed diversion monitoring program can be met with relatively minor additions to the existing monitoring effort. Discussions of existing monitoring efforts for each resource, along with suggested additions, are presented below.

Oysters

At present, weekly deployments are made from March through November of spat collecting plates (Butler Plates) at five stations on the Public Oyster Seed Grounds and one station on the Bay Gardene Seed Oyster Reservation (Figure 5). Spat set intensities are expressed in spat/cm^2/week. Bottom salinity and temperature are measured weekly at all six stations year round. The information gathered is used in the selection of cultch plant sites and in the prediction of the ensuing year's seed production.

Yearly seed and sack oyster density estimates on the seed grounds and reservation are made by means of meter square (M^2) sampling with SCUBA. Three replicate M^2 samples are taken at each of 23 stations in June of each year (Figure 6). Total seed and sack oyster availability on the seed grounds is determined by extrapolating from the sample results.

Harvest estimates are made from daily boarding surveys (weather permitting) of boats fishing on the Public Oyster Seed Grounds or Reservation. Observations recorded include location, method of harvest (one dredge, two dredges, tong, etc.), the number of sacks or barrels of oysters taken, and size of the vessel.

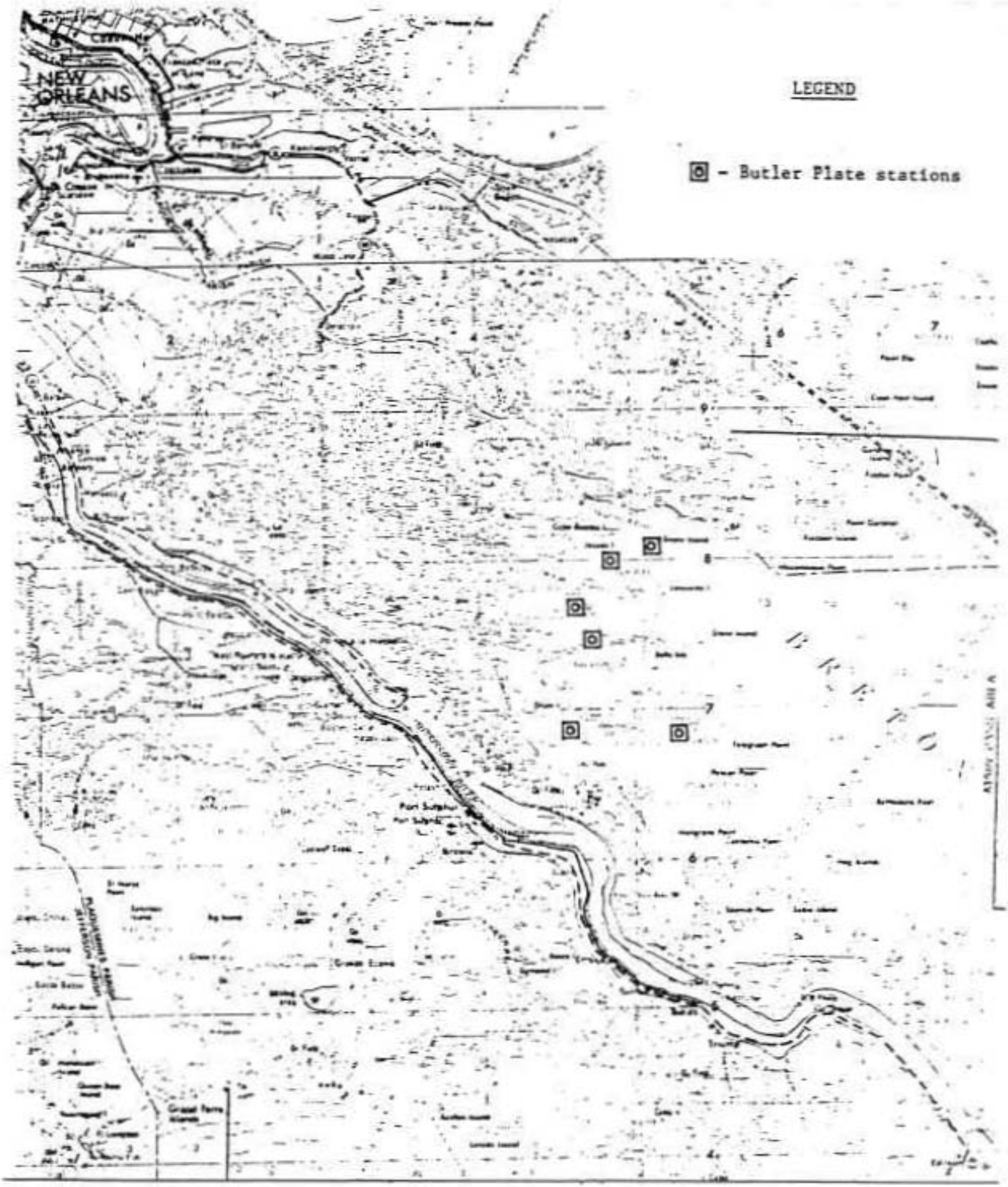

FIGURE 5. Existing Butler Plate stations for monitoring spat set intensities.

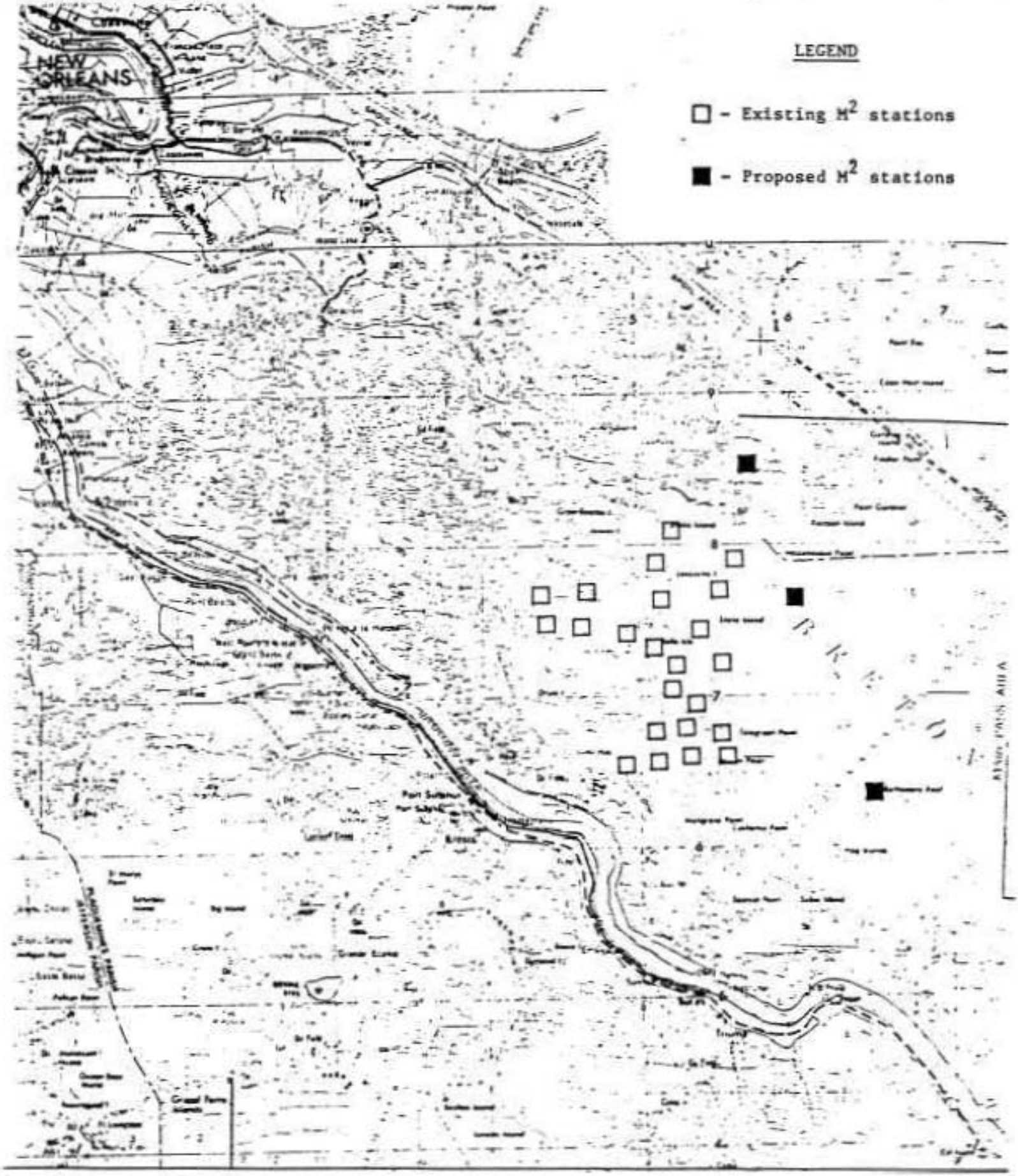

FIGURE 6. Existing and proposed M^2 stations for determining seed and sack oyster density estimates.

For purposes of the proposed monitoring program, the above procedures for measuring spat set intensities, seed and sack oyster density, and harvest would be continued in full with the addition of three M^2 sampling sites on the seaward portions of the seed grounds (Figure 6).

Currently, there is no consistent sampling of oyster populations on the privately leased water bottoms in the Breton Sound Basin. For this reason, and since the leased waterbottoms would be affected by the proposed diversion, it was necessary to design a monitoring scheme that would yield information as to the productivity of leased waterbottoms. The information generated should enable identification of the geographical limits of the productive oyster zone pre- and postdiversion. The design for this program is discussed below.

Fourteen stations were chosen within the Breton Sound Basin to represent the complete range of currently productive and potentially productive oyster growing areas (Figure 7). Sampling devices would consist of Nestier grow-out trays. These trays are constructed of heavy-duty plastic and are 70 cm by 70 cm in dimension. Each tray would contain 25 oysters 50 to 75 mm in height. The 25 oysters would be arranged in five rows of five oysters each and attached to the trays so that growth and survival records can be maintained for each individual oyster. Two such trays would be placed on the bottom at each of the 14 stations during the last two weeks in January of each year.

During the last week of every ensuing month, all sampling stations would be visited. Bottom salinity and temperature would be recorded and the oysters measured. Oyster mortalities and kinds and numbers of oyster predators and fouling organisms would also be noted. As an index of recruitment, the number of oyster spat which sat and survived on the sample oysters during the year of deployment would be counted and measured.

All trays would be removed from the field during the first two weeks in January, approximately one year after deployment. These procedures would be carried out in full for each year of the monitoring program. These trays have been used very successfully by the LDWF in similar growth and survival studies in Barataria Bay.

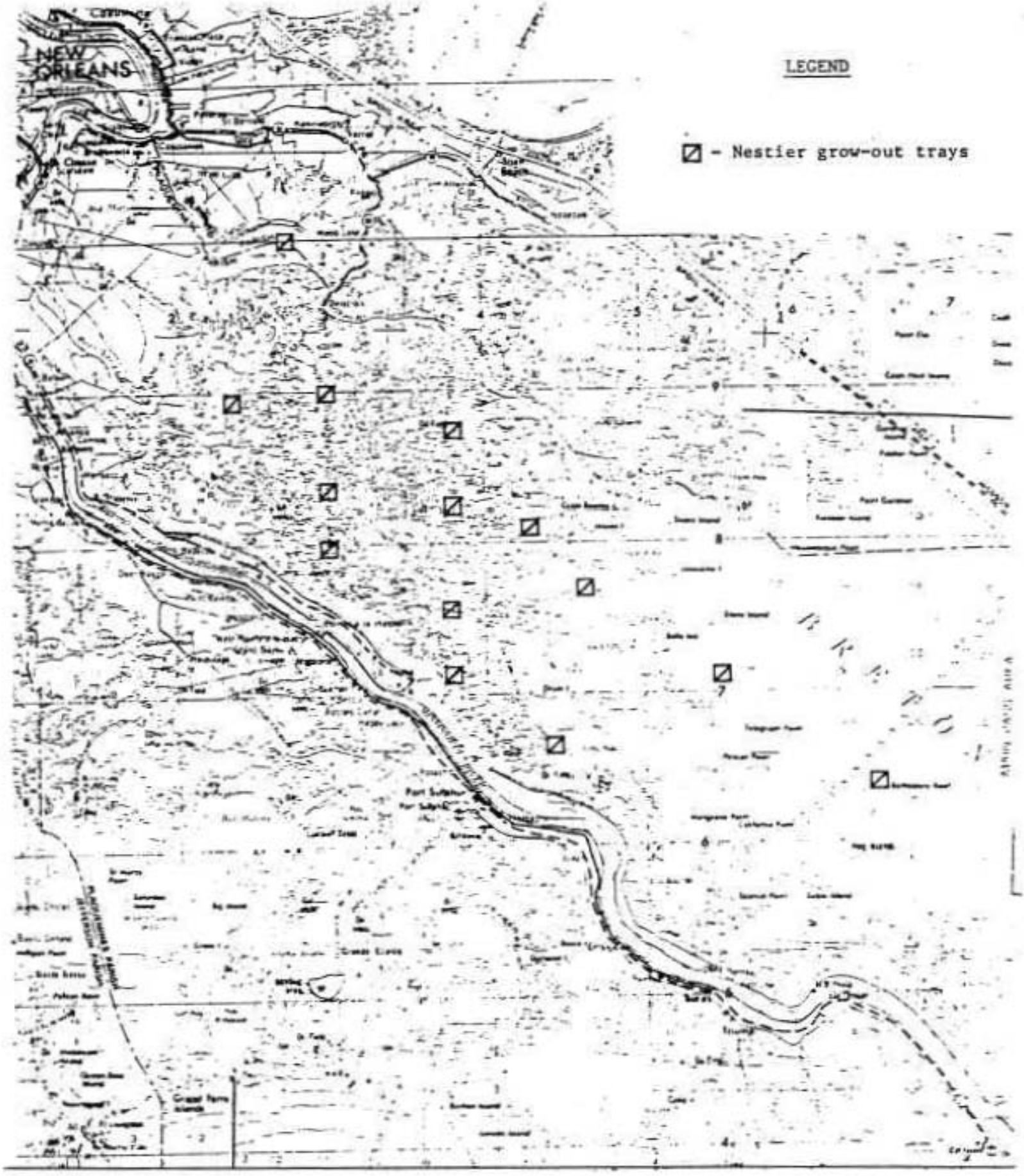

FIGURE 7. Tentative locations of Nestier grow-out trays for oyster growth and survival studies.

Shrimp

The Seafood Division of LDWF uses 6-foot and 16-foot flat otter trawls to monitor brown and white shrimp populations in the Breton Sound Basin. The 6-foot trawls with 5/8" bar wings and 1/4" bar tail are used to sample shallow bayous and bays. In the deeper inshore areas, 16-foot trawls with 3/4" bar wings and 1/4" bar tail are used. All trawl samples are of 10-minute duration. All shrimp collected are identified, counted, and a random sample of 50 of each species is measured in 5 mm groups.

Five stations are sampled weekly with a 6-foot trawl from March through October and five additional stations (crash stations) are sampled with a 6-foot trawl during the last two weeks of April for purposes of setting the brown shrimp season (Figure 8).

Two inshore stations are sampled weekly with a 16-foot trawl from March through October and bi-weekly from November through February. Each time a sample is taken, salinity, water temperature, sea state, cloud cover, and wind speed and direction are recorded.

For purposes of the diversion monitoring program the above efforts should be continued with the additions discussed below.

Four of the five 6-foot crash stations that are currently sampled only during the last two weeks of April should be sampled every week from March through October. In order to ensure adequate sampling of presently unsampled areas, three additional 6-foot trawl stations and two additional 16-foot trawl stations should be established and sampled weekly from March through October. The two additional 16-foot trawl stations should also be sampled bi-weekly from November through February. The additional proposed shrimp sampling stations are shown in Figure 9.

FIGURE 8. Existing 6-foot and 16-foot trawl stations.

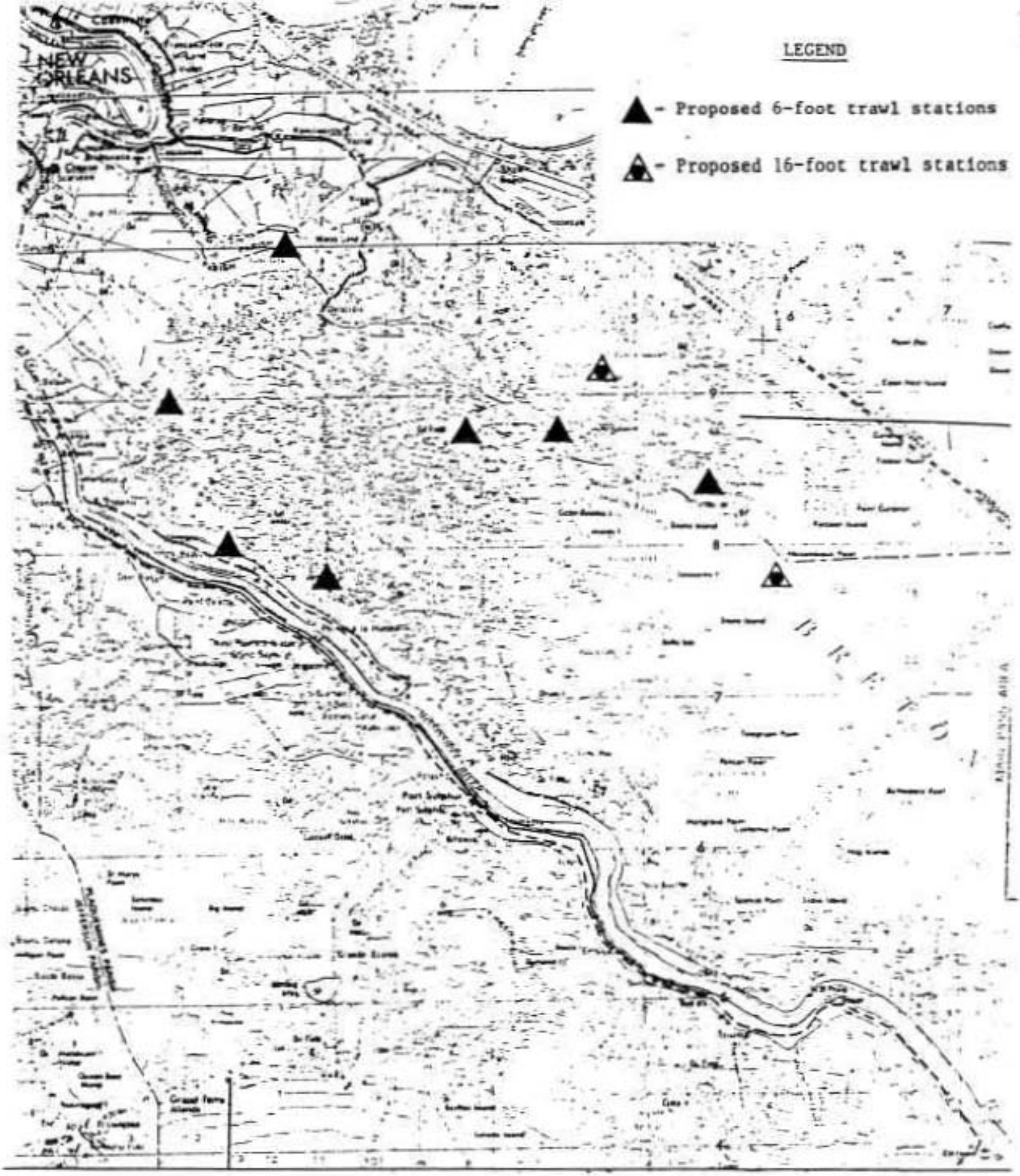

FIGURE 9. Locations of proposed 6-foot and 16-foot trawl stations.

Blue Crab

Monitoring the blue crab resource in the Breton Sound Basin is done in conjunction with the existing shrimp monitoring program. In all 16-foot trawl samples, blue crabs are counted and a random sample of 50 are measured, sexed, and berried females noted.

It is proposed that these procedures be continued for the diversion monitoring program. Additionally, crab data would be obtained whenever a 6-foot or 16-foot trawl sample is taken. This includes existing as well as all proposed trawl stations (Figures 8 and 9).

Finfish

Finfish monitoring in the Breton Sound Basin is also currently conducted in conjunction with the existing shrimp monitoring program. In the 16-foot trawl samples, all fish are identified to species, counted, and a random sample of 50 measured. These procedures would be continued for the diversion monitoring program. Additionally, data on all fish would be obtained whenever a 6-foot or 16-foot trawl sample is taken. This includes existing as well as all proposed trawl stations.

The Department of Wildlife and Fisheries has recently created a special Finfish Section within the Seafood Division. The Section has plans to sample commercially and recreationally important finfish in the Breton Sound Basin, with special emphasis on spotted seatrout and red drum.

At this time, it is envisioned that sampling gear would include 50-foot nylon bag seines with 1/4" bar mesh, 750-foot monofilament gill nets composed of five panels of varying mesh size (1" bar to 3" bar), and 750-foot nylon trammel nets with a 2:1 sag and 1 5/8" bar inner wall and 6" outer wall.

All fishes collected would be identified to species, counted, and a random sample of 50 measured in 5 mm groups. For certain species, additional information on sex, gonadal condition, and stomach contents would be recorded.

Several meetings have been held with personnel from the new Finfish Section. Although the station locations, number of stations, and sampling frequencies have not been finitely determined, it is believed that the finfish sampling to be conducted by LDWF would satisfy our finfish monitoring needs. Efforts are being made to choose sampling stations that would satisfy the requirements of both the LDWF and the proposed freshwater diversion monitoring program.

Personnel from the Plaquemines Parish Environmental Services Laboratory have provided a list of 13 potential sampling sites for finfish monitoring (Figure 10). Most of these sites appear to be very good. It is unlikely that all of the suggested sites would be utilized; however, some of the sites could certainly be integrated into the program.

It is proposed that the LDWF conduct the fisheries monitoring including oysters, shrimp, blue crabs, and finfish. It is currently estimated that the annual cost for the 7 years of intensive fisheries monitoring would be about $45,000 per year. The funds would be used to hire a biologist and a marine resources specialist to conduct the additional sampling, and to purchase additional sampling equipment.

ISOHALINES

In addition to salinity data gathered at the various biological sampling stations, the LDWF monitors salinities in the Breton Sound Basin at 15 separate isohaline stations (Figure 11). These stations are visited weekly and have been monitored an a regular basis since 1974. In addition to salinity, water temperature (^{o}C) and conductivity (mmhos/cm) are also measured. The Department uses the data to plot isohalines which provide valuable information concerning the effects of salinity an fishery resources, particularly oysters.

FIGURE 10. Potential sites for finfish sampling.

FIGURE 11. Existing and proposed isohaline stations.

The salinity data collected at these isohaline stations would complement the salinity data gathered under the water quality monitoring program for the proposed diversion. It is proposed that an additional isohaline station be established in Lake Fortuna (Figure 11). Since the proposed diversion would likely exert some secondary effects on the salinity regime on that side of the estuary, additional salinity data from that area would be useful. In addition, as discussed under oyster monitoring, it is proposed that a M^2 station be established in the Lake Fortuna area for oyster monitoring (Figure 6). The year round salinity data from the new isohaline station would be valuable in assessing the oyster data from the new M^2 station.

CONTAMINANT UPTAKE ANALYSIS

One of the greatest concerns related to the proposed diversion of Mississippi River water is the potential adverse impacts due to high levels of pollutants in the River. The River often contains high levels of heavy metals, phenolic compounds, pesticides, PCBs, and other compounds. Monitoring of contaminants in the water column and sediments would be conducted under the water quality/hydrology monitoring programs. However, in order to determine the effects of contaminants on fishery resources, it is proposed that tissue analyses be performed for selected aquatic resources.

In any contaminant uptake study, it is important to monitor the same species at the same locations throughout. Otherwise, if any changes in analyses results occurs, one does not know if the levels are different due to switching sites or species, or to an actual change in contamination. Thus, selection of animals for contaminant uptake monitoring presents a problem in that most estuarine-dependent animals are highly migratory due to seasonal salinity changes and varying habitat requirements at different life stages. It is essential that resident species be chosen that would be available under both pre-and postdiversion conditions. The oyster is an ideal candidate for analysis since it is sessile, in contact with the sediments, a filter feeder, and is the commercial species expected to be most greatly affected by the diversion project.

Blue catfish, an important freshwater commercial fish that also enters low salinity estuaries, would be selected as a representative bottom feeding fish for analysis. Since some contaminants are also known to biomagnify in predator species, a predator such as spotted gar would also be collected. Spotted gar are known to occur over a wide range in the estuary.

In order to ensure that the analysis is statistically meaningful, three composite samples consisting of five individual fish per sample would be collected at each sampling station. These numbers are based on experience gained from the National Pesticide Monitoring Program. Three composite samples consisting of 200 grams of oyster meats from each station would also be collected. The oysters would probably be collected in conjunction with the Louisiana Department of Wildlife and Fisheries studies on oyster survival, growth, and abundance.

Four contaminant monitoring areas have been tentatively chosen (Figure 12). Samples would be collected in the Mississippi River just upriver from the diversion site, the Upper Basin area near Big Mar, the expected northernmost area of oyster production after diversion (perhaps the Grand Lake area), and an open bay area close to the diversion structure. Oysters, of course, would be lacking at the first two stations, and freshwater fish may not be present at the lower most station prior to diversion.

Animals would be collected in the late fall (probably October). This would allow five to ten months for any contaminants introduced into the estuarine ecosystem to be accumulated in the tissues. Since it is not known what contaminants may be found in the diverted waters, it is recommended that chlorinated hydrocarbons; phenolic compounds; aliphatic, aromatic, and polynuclear aromatic hydrocarbons; selenium; and heavy metals be monitored. It is estimated that this analysis would cost about $1,000 per sample and that the results of the contaminant analysis would be available about 90 to 120 days after collection.

FIGURE 12. Tentative areas for contaminant uptake monitoring.

The U.S. Fish and Wildlife Service proposes to conduct the contaminant uptake monitoring including collection of the organisms and the analytical laboratory analysis. The current estimated costs for this monitoring are presented below.

Estimated Cost Summary

Analytical Laboratory Analysis

Oysters-2 sites x 3 composites/site @ $1,000/sample	= $ 6,000
Bottom feeding fish-4 sites x 3 composites/site @ $1,000/sample	= $12,000
Predatory fish-4 sites x 3 composites/site @ $1,000 sample	= $12,000
Analysis subtotal	= $30,000

Annual Field Office Sampling Costs

Collecting, shipping, data analysis, and reporting	= $ 6,000
Annual Grand Total	= $36,000

FISHERY HARVEST (LANDINGS)

The overall objective of the proposed diversion is to produce a healthy estuarine ecosystem in the Breton Sound Basin. Marsh productivity and concomitant fish and wildlife production would increase. Since the benefits of the project are primarily attributable to increased production of oysters and other commercially and recreationally important finfish and shellfish species, it is important that the harvest of these resources be carefully monitored. Additionally, some changes could occur in the fisheries harvested in the Basin. For example, in years of large diversions, there may commercially harvestable catfish populations in the Upper Basin, as well as a shad fishery in the tailwaters of the diversion.

The National Marine Fisheries Service (NMFS) gathers harvest information in the area. However, their fishery reporting specialists are assigned to rather large geographical areas, and it is often difficult for them to obtain detailed coverage for localized areas. In addition, it is sometimes difficult for them to obtain accurate information from fishermen, seafood dealers, and processors because these people often harbor an innate distrust of anyone gathering statistics which concern their livelihood.

In order to improve upon the harvest data collected in the area affected by the diversion, it is proposed that a fishery reporting specialist be hired to concentrate efforts on the Breton Sound Basin. In several discussions with NMFS personnel, this was the recommended approach. NMFS has indicated that the additional information would be helpful to them and they are willing to provide guidance to the program based on their extensive data gathering experience. It is believed that by assigning an individual to concentrate full time on the Breton Sound Basin, that individual would develop a rapport with members of the fishing industry, thereby enabling collection of more accurate data.

The proposed fishery reporting specialist would concentrate an commercial harvest. However, data could also be gathered on recreational harvest of important species in the area. The major duties of the reporting specialist would include the following:

- collects commercial and/or recreational catch, effort, biological, environmental, and socioeconomic data on important species of marine organisms.
- collects and compiles landings and value of fishery products from dealers in assigned area, including the collection of economic data.
- performs continuing survey of ports, number and types of gear and craft used, number of fishermen employed, products manufactured, lists of wholesale dealers, and employment in shore-based plant facilities.
- prepares a monthly report of fisheries in assigned area.
- obtains data from fishermen at dockside, aboard fishing vessels, or at fish processing plants.

- o keeps detailed records of work accomplished and reports data.
- o assists in developing summary reports.

The individual hired for the position would have a knowledge of fisheries to include:

- o ability to identify various types of fish and shellfish.
- o ability to identify various types of equipment used on commercial and recreational fishing boats and vessels.
- o knowledge of seafood harvesting and processing.
- o skill in making measurements and recording data accurately for marine organisms.
- o ability to express technical fishery data information in a written format clearly and concisely.
- o ability to make computations and compile and tabulate numerical and/or statistical data.
- o skill in developing and maintaining personal contacts.

It is proposed that the fishery reporting specialist would be hired by the LDWF. The current estimated cost is $22,000 per year.

DATA MANAGEMENT

The proposed monitoring program would generate a large amount of data. The value of the data would be dependent upon the quality of data management practices. It is essential that a logical, integrated data management program be implemented. Data management would constitute a large-scale effort and would justify a full-time position to oversee the program.

It is proposed that the LDWF hire an individual for this task. The Department proposes to conduct all of the biological sampling except the tissue analysis. For all practical purposes, the additional biological monitoring recommended for the proposed diversion is merely an extension of existing monitoring conducted by the LDWF. The Department already has a data management program in effect. All of their important data is stored on magnetic tapes and their hardware capability is sufficient to accommodate the additional data. They currently use a Sperry Univac 1100 computer. Additionally, the LDWF has arrangements which allow them to interface with Louisiana State University's Department of Experimental Statistics for both computer capability and assistance with statistical analyses.

The individual hired for the position would preferably have an understanding of both biology and data management, including computer programming and basic statistics. The current cost estimate for this position is $28,000 per year.

MONITORING PROGRAM COSTS

Costs for the various types of monitoring have been discussed throughout the report. The following table provides a summary of the current cost estimates on a year by year basis.

Biological Monitoring Program

Current Cost Estimate

Preconstruction Monitoring Program

Items	Year 1	Year 2	Year 3
Biologist II	$ 22,000	$ 22,000	$ 22,000
Marine Resource Specialist	15,000	15,000	15,000
Sampling Equipment	30,000	5,000	5,000
Fishery Reporting Specialist	22,000	22,000	22,000
Data Manager	28,000	28,000	28,000
Flight Time (Helicopter)	12,000	12,000	12,000
Tissue Analysis (Fish & Shellfish)	36,000	36,000	36,000
Totals	$ 165,000	$ 140,000	$ 140,000

Postconstruction Monitoring Program

Items	Year 1	Year 2	Year 3	Year 4
Biologist II	$ 22,000	$ 22,000	$ 22,000	$ 22,000
Marine Resource Specialist	15,000	15,000	15,000	15,000
Sampling Equipment	5,000	5,000	5,000	5,000
Fishery Reporting Specialist	22,000	22,000	22,000	22,000
Data Manager	28,000	28,000	28,000	28,000
Flight Time (Helicopter)	12,000	12,000	12,000	12,000
Tissue Analysis (Fish & Shellfish)	36,000	36,000	36,000	36,000
Totals	$ 140,000	$ 140,000	$ 140,000	$ 140,000