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LOCAL DEVELOPMENT II
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NATIONAL CONFERENCE
ON
THE ENVIRONMENT OF LAKE MANZALA

October 27 - 29, 1991

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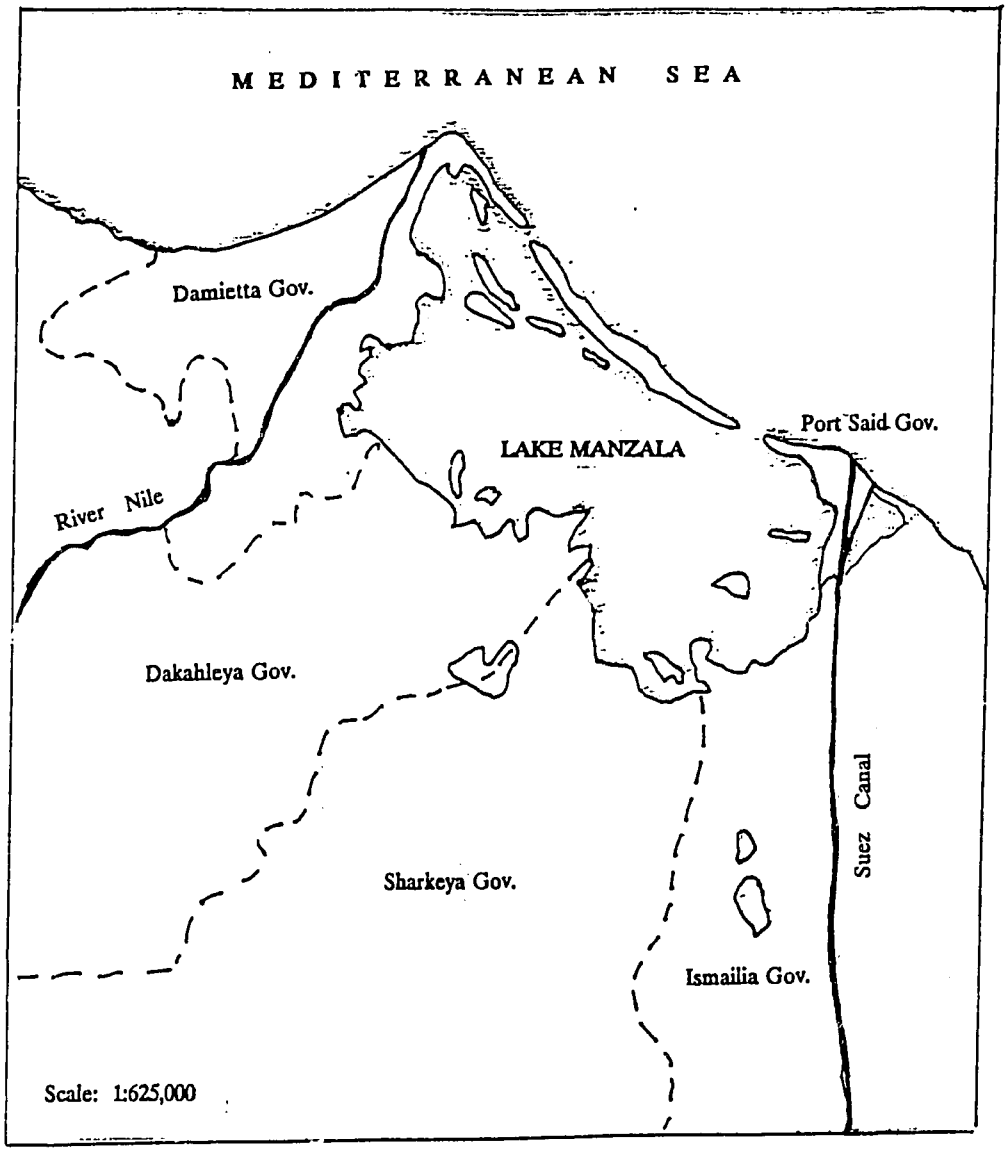

LAKE MANZALA & THE SURROUNDING GOVERNORATES

1. INTRODUCTION

Awareness of the continuous deterioration of the environment of Manzala Lake led the Governorate of Port Said to adopt the idea of organizing a conference which would collect representatives from all involved agencies as well as from all governorates abutting Manzala Lake in order to present the problems affecting the environment of this important natural resource and to formulate recommendations to preserve and develop it.

USAID and TAC were invited to observe the conference.

1.1 Conference Agenda

The First Day: 10/27/91	Morning Session: Official opening ceremonies including opening of the Manzala Lake Exhibition.
	Evening Session: Presentation of the first technical papers.
The Second Day: 10/28/91	Morning Session: a long boat tour of the Lake to demonstrate the size of the Lake and to point out problem areas.
	Evening Session: Presentation of technical papers.
The Third Day: 10/29/91	Morning Session: Completion of presentation of technical papers, followed by final session for conference recommendations.

2. SCOPE OF REPORT

The purpose of this report is to record, in an English language account, the proceedings of an important national conference (in Arabic) addressing a major ecological problem in Egypt. Lake Manzala, a large, shallow, saline water body adjacent to the city of Port Said, has long been the recipient of vast quantities of untreated municipal sewage and industrial wastes flowing in daily from Cairo and other governorates. Eutrophication is the term commonly used when a water body, as a result of a heavy input of nutrients (phosphates and nitrates), suffers from decreased dissolved oxygen and a profusion of algae, all of which deplete the fish population. The quantities of sewage in Lake Manzala, however , are so large that hundreds of acres of this water body have effectively been converted into a giant anaerobic lagoon. This, in turn, has an obvious adverse effect on a fishing industry which supports thousands of families living adjacent to the Lake.

Unfortunately, there are many facts which are unknown at this time. Do the fish caught in this lake constitute a health hazard because of liver flukes or buildup of heavy metals in their tissues? How long will it take for the lake to be "brought back to life" when the secondary sewage treatment plants in Cairo go on the line, thus eliminating 70-90 percent of the nutrients and decaying solids now entering the lake? The conference was meant to discuss these issues and develop a long range plan for improvement of the lake.

This report will include the following:

- Brief recap of the opening addresses.
- The Lake Manzala exhibition.
- The field trip through Lake Manzala.
- Composite analysis of the technical papers presented in the conference.
- The recommendations issued by the conference.

3. BRIEF RECAP OF THE OPENING ADDRESSES

3.1 Dr. Fikry Khalaf, the Rapporteur of the Conference, stated that the purpose of the conference was to discuss the recent condition of the environment of Manzala Lake, and to prepare an Executive Plan as a first step toward stopping the pollution and fostering economic and ecological improvements in the Lake. He stated that:

a. The area of the lake was 700,000 feddans in the eighteenth century but it has now shrunk to only 190,000 feddans.

b. There are serious problems with the current management situation in the Lake. The management of the Lake should be conducted in a scientific way, integrating the needs of all the users.

3.2 Dr. Ahmed Dwedar, the Deputy Director of Suez Canal University, noted that Port Said Governorate asked the University some three years ago to undertake a pollution study of the Lake. It is clear, he stated, that the need for this study is now even more urgent. Moreover, the academic and executive people must co-operate to develop a comprehensive study which will have positive results.

3.3 H.E. Sami Khodier, the Governor of Port Said, provided a number of facts:

a. The Lake receives one million m^3 of raw sewage from Cairo daily plus another one quarter million m^3 from other governorates.

b. L.E. 669 millions is the budget of the wastewater treatment plant (WWTP)in Yellow Mountain outside Cairo.

c. L.E. one million has been allocated to upgrade the old W.W.T.P. in Port Said.

d. L.E. 3 millions had also been allocated to upgrade the Lake inlets.

3.4 Mr. Salah Hafez, Chief of the Environmental Authority, expressed the hope that a meaningful action plan could be developed as an output of the conference.

3.5 Eng. Essam Rady, Minister of Water Resources noted that the Ministry of Re-Construction has many studies on this specific topic and should have been invited to the conference. He also stated that augmenting the Manzala Lake by Nile residue water is not included in his Ministry's plans because of the large quantity of water needed.,

4. THE LAKE MANZALA CONFERENCE EXHIBITION

The Suez Canal University used an empty meeting area on the first floor of the hotel to present an interesting exhibition for the attendees, to include: pictures of the various areas of Manzala Lake; the locations of several archaeological monuments; pictures of the many species of plants, fishes, and birds found around the Lake; and some preserved flora /fauna samples in glass cubes.

5. BRIEF DESCRIPTION OF THE FIELD TRIP THROUGH LAKE MANZALA.

The Governorate arranged a four hour field trip for the conference attendees so that they could get a close look at the flora and fauna of the Lake and also obtain an impression of the size of this vital water resource. The people were carried on a flat-bottomed ferry boat which moved slowly through the navigation channel which extends to El Mataria town in Dakahlia Governorate. The boat crossed an opening in the Ring Road which is being constructed

around Port Said, and which is scheduled to be a part of the international highway passing along the North Coast of Egypt. Scattered fishing was observed. At one location, the marine police were seen chasing fishermen who were engaged in illegal catching of fingerlings. Also several archeological sites on islands in the lake were pointed out. The most important observations were those in the southeastern part of the Lake, close to the outlets of the agricultural drains where every day approximately 1.25 million m^3 of raw sewage arrives from Cairo and other governorates. The odor of decaying organic matter was intense and all of the lake water over a large region was black, oily and foul. In fact, this area is serving as a raw sewage lagoon and the numerous bubbles coming to the surface indicate the anaerobic activity below. Increasing quantities of the water hyacinth plant, an indicator of eutrophication, were also observed.

6. COMPOSITE REVIEW OF THE PAPERS PRESENTED IN THE CONFERENCE:

The following is a composite review of all the papers submitted and discussed throughout the three days of the conference. This approach is considered appropriate as a large part of the information was repeated in most of the presentations with the exception of the paper entitled "An Action Plan for the Rehabilitation of Lake Manzala and Development of its Fisheries Resources". This comprehensive report, which was prepared by Prof. Dewedar of the Suez Canal University and Dr. Fikry Khalaf , Conference Rapporteur, made a number of feasible recommendations to be handled as an "action plan". This paper is attached as an Appendix.

6.1 Background Information On Lake Manzala

a. Located in the Northeast Zone of the Nile Delta on the Mediterranean, Lake Manzala is a large, shallow, saline water body.

b. It was said that a big earthquake during an earlier era resulted in the formation of a depression which, in time, filled with sea water thus forming Lake Manzala.

c. Five governorates have shores on the Lake: Port Said and Damietta on the North; Dakahieya, Sharkeya, and Ismailia on the South .

d. The area of Lake Manzala is now 190,000 feddans (about 800 square kilometers) with an average depth of about only 1.5 meters.

e. The salt concentration is considered very high (3.25-4.5%) as reported in the Dameitta Governorate Paper.

6.2 Economic Importance of Lake Manzala

a. Fish production is about 60,000 tonnes/ year and this constitutes the major source of income for about 68,000 fishermen.

b. Wild birds (an estimated 300,000) use the Lake as an intermediate stopover shelter during their yearly migrations between Europe and Africa.

c. The Lake contains important archaeological monuments (Tennis and Ibn Salam).

6.3 The Main Problems Effecting The Environment of Manzala Lake

There are three major problems: pollution, reclamation, and poorly organized or illegal fishing.

a. Pollution

- The Sources of Pollution are Concentrated in Three Inflows.

- Untreated sewage comes from Cairo and other Governorates through several drains including the main surface drain, Bahr El Baker, which discharge about 1.25 million cubic meters of sewage daily into the Lake.

- Industrial wastes, which are either mixed with the untreated sewage and come through the cited surface drains, or which flow directly from the factories established on the shores of the Lake.

- Agricultural wastes flowing into the Lake from numerous agricultural drains.

Table (1) shows the estimated monthly inflows to the Lake. The annual total is 6.657 billion m^3. This quantity is reported to be almost equal to the annual loss by evaporation from the Lake.

The Effect of the Pollution of Lake Manzala

- Spreading of epidemic diseases between the fishermen (it was noted also that the incidence of kidney failure of the inhabitants around the Lake is much higher than the national averages).

- Infection of the immunity system of fishes (some studies observed high concentrations of harmful heavy metals in the fish tissues).

- Most of the wild birds have abandoned the Lake.

- Visible pollution of the North Coast.

- The decrease of fish resources has resulted in rises in unemployment, and criminal activities among the fishermen as well as a continuing loss of population by emigration.

Pollution Assessment

- Since the Canadian report of MacLaren (1979) no comprehensive studies have been conducted on Lake Manzala because of lack of funding and scientific capabilities. It was reported that the National Center for Research (NCR) is about to start a detailed study on Lake Manzala Pollution in cooperation with the British Institution of Marine Science. This study will focus on the distribution patterns of various kinds of pollution in the fish, water and soil of the Lake.

Suggestions to Eliminate the Pollution of Lake Manzala

- Preventing the entry of industrial and municipal sewage from Cairo and other governorates by accelerating the construction of wastewater treatment plants. (Current plans are that Cairo sewage treatment plants will be operational by late 1994).

- Providing the facilities around the lake with septic tanks so as to keep the nutrients out of the Lake.

- Restricting the use of fertilizers ,especially the nitrates, which are a troublesome pollutant as they foster eutrophication of water bodies.

- Improving the water circulation between the Lake and the Mediterranean Sea should remain as a priority. The Authority for Shore Protection is now working on several projects to clear the

TABLE 1

ESTIMATED MONTHLY INFLOW TO LAKE MANZALA
UNDER EXISTING CONDITIONS

MONTH	AVERAGE INFLOW TO LAKE MANZALA IN 10^6 M^3	PERCENTAGE OF THE YEARLY TOTAL
January	464.263	7.0
February	343.739	5.2
March	523.828	7.9
April	500.031	7.5
May	520.098	7.8
June	565.220	8.5
July	657.107	9.9
August	666.194	10.0
September	672.011	10.1
October	647.998	9.7
November	549.471	8.2
December	546.537	8.2
Year Total	6656.493	100%

Lake inlets and to prevent either erosion or sedimentation near these openings. Moreover, the Lake is now artificially divided into 27 zones which form 27 small ponds for fish farming purposes. This situation should be evaluated to determine how it effects circulation. Also the widespread growth of the water hyacinth in recent years obstructs the lake water circulation.

b. Reclamation

The filling in of areas within the lake for agriculture or other purposes is threatening the marine ecology of the Lake (there are more than 400 islands with a total area of 3000 feddans and the land areas are continuously increasing). This reclamation work, besides shrinking the water area, often prevents good water circulation.

c. Non-Organized and Illegal Fishing

- Lake Manzala is suffering from unorganized and illegal fishing because of the lack of firm control and coordination among the multiple concerned Authorities and Governorates supervising the Lake. This has resulted in many serious problems effecting the environment and efficiency of the Lake, for example:

  - The fishermen are using illegal, (small opening) fishing nets.
  - The divisions which were constructed for fish farming are being used for illegal fishing.
  - Widespread collection and smuggling of the fingerlings (before they can achieve any growth) is taking place due to the inadequate budgets of the Marine Police (The police are reported to be using motor boats with only half the power of the ones operated by the smugglers so they are unable to successfully chase and catch them.)

  - Updated maps, statistics and economic data are not available to monitor the fishing operations in the Lake.
  - The numbers of fishermen and boats are greatly in excess of the numbers licenced.

7. THE RECOMMENDATIONS OF THE CONFERENCE

7.1 In the final session on October 29, 1991, the following recommendations were issued:

a. Coordination must take place between executive and legislative groups within a framework of an efficient administrative organization to insure good management of Lake Manzala. This administrative organization should be provided with necessary and technical capabilities to guarantee that it will play its role efficiently.

b. The aquatic balance of the Lake must be maintained by preserving its water resources. No action that may lead to disorder of the Lake's balance should be allowed in order to prevent any decrease in the lake's area. Such a decrease may consequently result in a higher salt concentration or a higher pollution rate that may ruin fish resources and adversely impinge on relevant developing activities.

c. Support must be provided so as to give high priority to projects of construction and rehabilitation of wastewater treatment plants in the East Delta and Cairo.

d. Industrial facilities must be strongly encouraged to treat their wastes before draining or dumping them into the drainage canals which in turn drain into Lake Manzala.

e. Concerned authorities must be urged to provide needed subsidies and incentives for the marine police departments in those governorates that abutt the Lake. These are essential if these police are to effectively fulfill their assigned duties.

f. Continuous attention must be paid to the Lake's archeological sites as they constitute an important factor in preserving national heritage as well as the social and economic development of the area.

g. The Research Program drafted by the Suez Canal University should be approved in order that a self-contained, comprehensive implementation plan, based on sound scientific foundations, can be initiated. Suez Canal University is expected to cooperate with all concerned scientific bodies to prepare the time table and the estimated cost of the program within two months. Likewise, they will recommend that the Environmental Affairs Authority, as well as other concerned bodies, sponsor this program and finance its execution. This program should be implemented in a framework of cooperation and coordination between concerned scientific and executive bodies on a national level. This approach will lead to the best use of expertise and available national potentials in order to avoid duplicate efforts and to cut down on costs.

h. A Supreme Committee should be formed to follow-up the implementation of these recommendations by the concerned bodies. The committee will be chaired by H.E. the Port Said Governor, who will issue its formation decree in coordination with Dr. Atef Ebeid, the Minster of Cabinet Affairs, the Minister of Administrative Development, and the Supervisor of Environmental Affairs Authority.

i. The conference recommendations will be submitted to their excellencies, the Prime Minster, the Parliament Chairman, and the Shoura Council Chairman, as well as to their excellencies, the concerned ministers and governors.

APPENDIX A

APPENDIX A

LIST OF THE PAPERS PRESENTED AT THE CONFERENCE

1.	Port Said Paper	Port Said Governorate staff
2	Damietta Paper	Mr. Kaled Montaser, Director Environmental Affairs Dept.
3.	Paper About Problems Facing Dakahlia Gov. Concerning the Pollution of Lake Manzala, & Suggestions for Solving.	Brig. Ibrahaim El Zomor
4.	Fish Resources Federal Authority	Dr. Eng. Sany Sadek
5.	National Environmental Authority's Role in Preventing the Pollution.	Eng. Mohammd Abdel Halim
6.	National Authority For Protection of The Coast	Eng. Kotb Nasr
7.	Paper from Wetland Police Dept.	
8.	National Institution for Marine Science	Dr. Khamis Abdel Hamid
9.	Study Proposed from Water Pollution Research, National Research Center	Dr. Fatma El Gohar
10.	Study by El Mansoura University on Lake Manzala	Dr. Amin Abdulla
11.	Upgrading of Geological Knowledge of Lake Manzala	D. El Sayed Abbas Zaghloul
12.	Strategic Basis for Developing Fish Resources	Dr. Samir Ghoneim
13.	Fish Farming Project in Lake Manzala	Dr. Magda Zaki
14.	Pollution Abatement System Using Gravel Sinks in Egypt,Ismailia & Aboua Atwa	Dr. Atef Diab
15.	Allergy Caused by some Fish	Dr. Ekram Amin
16.	The Pollution of Lake Manzala from a Social Perspective	Dr. Nabil El Zahar
17.	Same as 16	Dr. Mohamed Hussein
18.	National Authority for Industry	Dr.Mohamed Monagy
19.	A Study on Lake Manzala Pollution	Dr. Ozoris Aly
20.	The Importance of Lake Manzala as a Shelter for Wild Birds	Dr. Gamil Abdel Mawla

APPENDIX B

DRAFT PROPOSAL

AN ACTION PLAN FOR THE REHABILITATION OF LAKE MANZALA AND DEVELOPMENT OF ITS FISHERIES RESOURCES

PREPARED BY

Prof. Dr. A. DEWEDAR
Prof. Dr. F. KHALAF

SUEZ CANAL UNIVERESITY

SEPTEMPER 1991

ABSTRACT

Lake Manazala is one of the largest Egyptian coastal lakes. Itis located along the Mediterranean Sea to the east of Damiatta branch of the Nile , Lake Manzala is characterized by its fisheries resources, its fish production estimated at 69000 tons in I988 which represents about 30% of Egypts total fisheries production. The lake ecosystem suffers from impacts of the various developments activities which are mainly represented by the disposal of agricultural, industrial and municipal waste water, land reclaimation, and irrational exploitation of the fisheries resources. Such impacts are manifested by the deterioration of the lake environmental quality and the qualitative decline of its fish stock.

Concerned government agencies exerting great efforts to maintain the lake environment and its fisheries resources. However, these efforts are not properly coordinated and therefore progress is not assured.

The present proposed research programe aims at the design of an integrated and comprehensive action plan for the improvment of the lake environmental quality and rational development of its fisheries resources. Specific objectives, research approach, detailed description of the scope of work are out lined.

The proposed Programme will make use of the extensive survey that was carriedout by MacLaren (1982) and which provided a very comprehensive environmental baseline data for lake Manzala. It is also suggested that the proposed research programe will be excuted in a cooperative manner between the various concerned national scientific and excutive agencies. Relevant ongoing and planned research activities should be coordinated within the proposed research programe to avoid duplication of efforts and to direct all available national capabilities to achieve the programe st goals.

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OBJECTIVES

The main goal of the proposed study program is to design an integrated action plan for the protection of Lake Manzala from pollution, The rehabilitation of its environment and the development of its fisheries resources. This plan will address both short and long term actions and will clearly and thoroughly define :

* Suitable technologies for pollution abatement.
* Environmentally Sound and economically feasible remedial measures for improvement the Lake's environmental quality.
* An integrated and comprehensive program for rational development of fisheries resources.
* Legislations and organization for rational management of the Lake and maintenance of its environmental quality .
* Time Schedule for the implementation of the various components of the action plan.

To actualize the program goal, the following specified objectives should be achieved :

1) To assess and evaluate the quality of the various environmental components, i.e. water, sediments and biota.
2) To carryout a comprehensive assessment of the water circulation pattern.
3) To establish a computerized environmental data bank.

4) To assess the impacts of current and planned activities on the quality of the various environmental components.

5) To assess qualitatively and quantitatively the discharged waste water into the Lake form all detectable sources.

6) To identify and quantify activities and factors responsible for the deterioration of the Lake ecosystem.

7) To review and assess the institutional organizations and management functions of all concerned agencies.

8) To review and assess legislations related to the protection of the Lake environment and management of its resources.

9) To identify suitable and feasible remedial measures and resource management programs consistent and coordinated with the national socio-economic development plans.

APPROACH

The proposed study program is intended to develop an action plan specifies and describes an environmentally sound and economically feasible executive measures that will lead to the improvement of Lake Manzala environmental quality and to the rational development of its resources. For the development of such action plan in a practical and feasible manner; Three issues should be clearly defined, namely; a) The present status of the Lake environmental quality and its resources, b) The desired environmental quality and pattern of resources development, and c) The national capabilities that can be devoted for making the desired changes.

It has to be noted that the sound design of the targeted action plan and the success of its implementation will entirely depend on comprehensive understanding and thorough assessment of these three issues. There for; the proposed study program is designed to include the following six main consecutive phases :

* Phase One : Mobilization

This phase will include all preparatory activities that are required for a sound and effective start of the proposed study program.

* Phase two : Survey of Current Lake Conditions

This phase will be devoted to identify, quantify, delineate and characterize the current conditions of the various natural

environmental components of the Lake (Soil, Water, Biota and climate), pattern and magnitude of man made activities, and the living conditions of the inhabitants.

* **Phase three** : Evaluation of Lake conditions

Upon the completion of the survey of the Lake current conditions, Detailed and thorough evaluation of the collected data will be performed. Use will be made of previous data and information to determine trends and magnitude of changes occurred to the various environmental parameters of the Lake.

* **Phase four** : Determination of controlling factors

Detailed evaluation of the Lake conditions would facilitate the determination of the factors and causes responsible for the ecological deterioration of the Lake. the output of this phase would provide an essential input for the identification of the environmentally sound and economically feasible remedial measures and outlining the main strategic element for rational resources development.

* **Phase five** : Recommended remedial measures

This phase is considered the first step in designing the executive and comprehensive action plan for the rehabilitation of the Lake environment and the development of its resources.The performance of this phase will mainly depend on the output, of phase three in addition to the results of the review and assessment of the institutional organization, current

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legistations and the desired environmental quality of the Lake.

* **Phase six** : Design of the action plan

Activities within this phase will be devoted to the preparation of the recommended executive programs within the suggested action plan. This will be the final and the main output of the proposed study program. Several scenarios and options will be defined and will be discussed with concerned agencies in order to come up with the most feasible and acceptable options. The various components of the action plan will be described and specified in detail and in such a manner that can be easily implemented by the concerned executive agencies.

MANAGEMENT ASPECTS

The proposed study will be organized and managed in such away to ensure the following :

- Formulation of a competent, coordinated and devoted working team. Members of this team will be selected from the national scientific organizations.The team will be supported by specialized and experienced personnel for concerned executive agencies.

- Full utilization of all relevant information and experience available within concerned national scientific and executive agencies.

- consideration of relevant ongoing or committed research activities within the various scientific and executive agencies. Such activities will be coordinated with the proposed study program to avoid duplication of efforts and to strengthen the proposed national study program.

- Coordinated cooperation among the various concerned national research organization should be organized to avoid the present national technical capabilities for the program implementation. This will maximize the utilization of available capabilities in order to rationalize the program budget.

- The assigned national working team should continue its activities after the completion of the study program to provide the required services and support to the executive agencies during the implementation of the action plan.

- Use should be made form the technical support and consultation that can be provided by recognized and specialized international agencies and institutions as required and in accordance with the proposed scope of work.

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SCOPE OF WORK

In order to achieve the set goal of the proposed study program, the scope of work is organized to include nineteen tasks within the six phases of the study. The following is a brief description of each task.

PHASE ONE : *MOBILIZATION*

This phase comprises the following three tasks :

Task I : LITERATURE REVIEW

All available information relevant to the project scope will be be collected. These information will include but not limited to published articles, technical reports, thesis, and maps. Collected information will be reviewed and a comprehensive literature review report identifying previously collected sound environmental data will be prepared. Such report will be available to all project team to avoid repetition and to make full use of the available information.

Task II : Project organization

The main activities of this task include :

- Preparation of a detailed work plan to include thorough description of each activity, its time schedule, its expected outputs, and interrelation with other activities. It also includes responsibilities of each one of the project key staff, detailed presentation of the project budget and expenditure

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schedule

- Recruitment of the required key staff such as task leaders and principle investigators. The success of the project depends mostly on the efficiency of its team, there for great attention should be paid to the criteria and procedures of selection of the project staff.
- Based on the detailed work plan all equipment and facilities required for the program will be identified. Agreements will be made with the concerned authorities to allow the use of available facilities for the program. Equipment and facilities that are not available will be purchased.
- Securing support and approvals from all concerned government agencies to ensure accessibility of information and smooth transportation within the study area.

Task III : Development of Data Bank

During the mobilization stage of the project, detailed specifications of a computerized data bank system will be prepared. It is suggested that this data bank will be based in the Faculty of Engineering and Technology of Suze Canal University at Port-Said. The hardware components should be capable of filing, processing and retrieval of voluminous amount of data and should have the capabilities for graphical presentation. The system will be supported with software that include statistical packages and geographical information system (GIS).

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PHASE TWO : *SURVEY OF CURRENT LAKE CONDITIONS*

The main objectives of this phase is to collect Data and information that can identify, delineate and characterize the current Lake conditions. A comprehensive base line data of the various environmental components was collected by J.MacLaren (1982). The methodologies and sampling locations used by J.Maclaren (1982) will be considered in the planning of the proposed study. Activities within this phase of the study are organized in eight tasks; which can be grouped into three groups, namely; A) tasks IV, V, VI, VII, deal with the characterization of the natural environmental components, B) task VIII deal with the natural resources, and C) tasks IX, X deal with the social and economic development pattern of the Lake.

Task IV : SURVEY OF PHYSIOGRAPHIC FEATURES

The main purpose of this task is to identify and delineate the various physiographic features of the Lake area. These features include, but not limited to, land areas such as coastal sand bars, vegetated islands, barren islands; and water bathymetric zones The land use pattern will be also surveyed in detail, such as reclaimed areas, fish farms, closed fishing areas (housha), open Lake water,cultivated areas, urban sites, mineral exploitation areas, roads, inlets, navigational canals,etc.

Satellite data, aerial photographs and available geographic maps will be used for the preparation of a detailed physiographic and land use map of 1:50,000scale. Geographically and

rediometrically corrected satellite images will be insupervisly classified to prepare a preliminary map. This will be followed by intensive field investigations where aerial photographs and topographic maps will be used for ground truthing.

The output of this task will include :

- Detailed and an uptodate physiographic map of the Lake area scale 1:50,000.
- An up to date land use map of the Lake area scale 1 : 50,000.
- Preliminary bathmorphic map scale 1:50,000, that will display the relative depth of the water area.
- pattern of drainage water flow within the Lake water.

The various types of maps that will be prepared within the scope of this task as well as those available and represent historical data will be digitized and stored in the computerized data bank using the GIS software packages.

Task V : HYDROGRAPHIC SURVEY

The main objective of this task is to perform field measurements required for the charactorization of the hydrographic regime of the Lake. Also, meteorological data related to the lake hydropgraphy will be collected from the various stations located within the area (Port-Said, Damietta, Sirw, Mansura and Ismailia).

1) *Hydrographic parameters :*

The following hydrographic parameters will be measured :

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* Bathymetry (depth).
* Water current (speed & direction).
* Water level fluctuation.
* Temperature.
* Salinity.
* Turbidity.

2) *Sampling and measurement sites :*

The hydrographic sampling and field measurement program will be planned in such a manner to ensure appropriate statistical analysis, to recognize possible spatial and temporal variations and to represent different hydrographic regions. Use will be made of available previous hydrographic measurements for the planning of the sampling and field measurements program.

The hydrographic zonation of Lake Manzala suggested by Maclaren (1982) will be used as a guide for the estimation of numbers of sampling and measurement sites. This zonation divides Lake Manzala into 5 main zones (Fig.1) namely Southern, Eastern, Middle, Western and northern. For budget estimation it is suggested that about 5 sites will be selected within each zone. In addition, two sites will be selected within each of the four main drainage inflow areas (Bahr al Baqar, Hadous, Ramsis, and Faraskor) and the six inlets (El-Gamel east, El-Gamil west, Sheikh Ali, Sofara, El-Boghdadi,and El-Ratama).This will make the total sampling sites about 45 sites (Fig.2). Collected data will be stored in the data bank.

Task VI : ECOLOGICAL SURVEY

The main purpose of the ecological survey is to determine the present abundance and distribution pattern of the Lake biota for the [illegible] comparison with the previous ecological baseline data established by Maclaren in 1980. Such comparison will indicate the magnitude and trends in the ecological changes during the last 10 years. This information is of vital importance in assessing the impacts of development activities and waste discharges on the Lake environment, and therefore contribute to the identification and specification of the remedial measures.

Biota that will be surveyed includes both aquatic and terrestrial communities. Aquatic communities will include Plankton, Benthic, Fauna, and Macrophytic vegetation, while terrestrial survey will concentrate on birds and vegetation. The methodology used by Maclaren will be followed in the proposed study.

A- Plankton

Phytoplankton samples will be taken from about 20 station (ten of them will be taken from the same stations sampled by Maclaren in 1982), (Fig.3), at monthly intervals. Primary productivity experiments will be performed at 8 stations on monthly basis. Phytoplankton will be collected from the top 50 cm of the water column. Samples will be fixed and enumerated by binocular microscope. Primary productivity will be performed using C14 method.

Zooplankton sampling will be carried out at 20 station

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(Fig.4) on monthly basis. A two minute horizontal-water tow will be performed at each sampling station using a net of opening [illegible] mm in diameter. Small current meter suspended in the opening will be used to determine the volume of the water filtered. Samples will be fixed and enumerated. Dry weight will be determined by [illegible]ing the samples at 100 C.

B- Benthic fauna

Sampling will be performed along 5 transects on quarterly basis (Fig 5) using Ekman dredge. The bottom mud samples will be screened through No. 30 mesh and benthic Fauna will be picked and preserved in 90 % ethyalcohl. Organism will be enumerated and weighted after drying. The abundance, distribution and species composition will be determined. Emphasis will be given to pelecypods, gastropods, annelids and arthropods.

C- Aquatic macophytes

Both emergent and submergent aquatic plants will be surveyed in about 30 selected sites. At each site type and abundance of vegetation will be surveyed in an area of about $4m^2$.

Task VII : ENVIRONMENTAL QUALITY

This task will be devoted to the survey of the quality of the Lake environmental components, i.e. Water, Sediments, and Biota.

A- Water Quality

1) *Sampling :*

Maclaren surveyed the lake water quality in ten stations distributed among the Lake five regions. The same locations will be also sampled for water quality survey in the proposed study to allow comparison with previous baseline data. In addition, 10 more stations will be selected to ensure appropriate coverage of the lake water body (Fig.6). Samples will be collected on quarterly basis.Sample size and the sampling technique should be thoroughly planned to ensure that collected samples are representative, are sufficient for the various analysis and to avoid contamination.

2) *Water quality parameters :*

Collected samples will be analyzed for both bacteriological and chemical quality. Analyzed parameters will include the following :

(i) Major Constitutes :

* Total suspended solids mg/L
* PH
* Calcium mg/L Ca
* Magnesium mg/L Mg

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* Sodium	mg/L Na
* Potassium	mg/L K
* Carbonate	mg/L CO_3
* Bicarbonate	mg/L HCO_3
* Sulphate	mg/L SO_4
* Chloride	mg/L Cl
* Ammonia	mg/L NH_4
* Nitrite	mg/L NO_2
* Nitrate	mg/L NO_3
* Orthophosphate	mg/L PO_4
* Total Phosphate	mg/L PO_4
* Silica	mg/L SiO_2
* C.O.D.	mg/L
* B.O.D.	mg/L
* Dissolved Oxygen	mg/L
* Alkaliaity	mg/L $CaCO_3$
* Salinity	mg/L

(ii) Heavy metals :

* Arsenic	µg/L As
* Cadmium	µg/L Cd
* Chromium	µg/L Cr
*Copper	µg/L Cu
* Lead	µg/L Pb
* Nickel	µg/L Ni
* Zinc	µg/L Zn
* Mercury	µg/L Hg

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(iii) Pesticides

* Lindane
* DDT
* DDE
* DDD
* Mirex
* PCB

B) Sediment quality

Sediments samples will be collected from the same water sampling sites. The Lake bottom sediments will be analyzed for the following parameters :

* Grain size distribution.
* Total Organic Carbon.
* Mineralogy of the mineral grains.
* Heavy metals and pesticides.

C) Pollutants levels in the lake organisms

Based on the ecological survey, types of the Lake organisms to be analyzed for pollutant levels will be selected. These organisms should include economic fishes and crustaceans, benthic Fauna and Submergent plants. This activity is of vital importance since it will address a very sensitive and a public concern issue, i.e., is the lake fish polluted or not. Therefore, a very thorough sampling plan will be designed to ensure the following :

* Representation of the common economic fish and crustaceans species as well as other aquatic fauna and flora that are

significant in the food chain.

- Appropriate spatial distribution.
- Consideration of the age, size, sex and organs for the fish samples.

Collected samples will be analyzed for heavy metals and Pesticides (Same listed in the water quality survey).

D- Survey of fish associated parasites

Fish and crustacean samples that will be collected for pollutant analysis, will also be investigated to determine nature and occurrence of parasites.

E- Quality control

The environmental quality data is the most important part of the current Lake conditions survey, since it will be the basis for assessment and evaluation of the pollutant levels and eventually design of remedial actions for pollution control. Therefore, quality control program for the chemical analysis of the Lake environmental samples should be performed. The main components of this program include :

- The assigned laboratories have to discuss and agree on the sampling, sample preparation and sample analysis procedures
- Standard samples will be analyzed and results will be compared
- Intercalibration exercise will be performed using natural environmental samples (Water, sediments and Biota).

The quality control program can be implemented with the support of an international laboratory such as IAEE laboratories at Monaco-France

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Task VIII : Survey of Drainage System

The main objective of this task is to determine the quality and quantity of drain water flow into Lake Manzala. To achieve this objective the following three activities will be performed.

A- Physical Setting of Drainage Net Work :

This activity aims at the preparation of a map presenting the present pattern of the drainage net work that flow into the lake. The physical parameters of the various components of this net work will be determined . These parameters will include length, width and depth as well as the boundaries and area of the agricultural lands drained in each canal. Pattern of crops cultivated in each area as well as the type and amount of fertilizers and pesticides used will be determined.

B- Sources of Waste Water

The sources of industrial and municipal waste water discharged into the various canal of the drainage net work system will be identified and located on a map. each source will be described. In the case of industrial sites the following main information will be collected :

- Type of industry.
- Type and amount of products.
- Type and amount of raw material.
- Industrial products,
- Quantity and quality of waste water.
- Treatment technologies, if any.

In the case of municipal waste the following information will be collected :

- Population.
- Methods used for waste water disposal.
- Collection net work.
- Characteristics of the treatment plant.
- Quality and quantity of sanitary waste water disposed into the drainage canal.

C- Drainage waste assessment

This activity will be devoted to measure :

1) The amount and flow rate of drainage water inflow to the Lake.

2) The quality of drainage water.

The same bacteriological and chemical parameters that will be determined for the Lake water will be determined for the drainage water.

TASK IX : FISHERIES AND AQUACULTURE ASSESSMENT

Lake Manzala is characterized by its fisheries resources and fishing activities. Exploitation of the Lake fisheries resources can be grouped into two categories, namely; Open fisheries and Closed fisheries. The open water area along with marsh and reed beds supports fisheries industry of most of the fishermen population within the Lake. Closed fishing encompasses a variety of fishing systems, ranging from rather sophisticated fish farming operations (aquaculture) where stocking, feeding, and rearing takes place, to a simple in lake trapping system called Hosha.

MacLaren (1982) has carried out an extensive survey of both open fisheries and Closed fisheries, which has provided a comprehensive base line data.

A- Open Fisheries Survey

The specific objective of this subtaske is to determine the present status of the fishing activities within the open area of Lake Manzala. To achieve this objective field survey will be carried out to systematically collect data using the same schemes adopted by MacLaren (1982). Such survey will provide an inventory of a number of characteristics required for the assessment of size and pattern of fishing activities (frame survey (Fig.7).The surveyed parameter at each landing site will include :

- Number of fishing boats.
- Type and size of fishing boats.
- Numbers of fishermen.

- Seasonal variation in fishing activities.
  - Migratory pattern of fishermen.
  - Types of fishing gear used.
  - Size and composition of catch.
  - Methods used for processing the catch.
  - Marketing of the catch.

For catch assessment a special survey will be performed using the same format used by MacLaren (1982) (see Fig.8) . All fishing ports will be visited, where the survey will be performed for at least two days per quarter for each port. The parameter that will be surveyed include :

- Catch by landing site.
- Catch by Lake region.
- Catch by fishing method.

B- Fish Stock Assessment

Information on the standing fish stock within a water body is an important measure for the nature (type and size) of its fisheries resources. Catch data are normally not an accurate reflection of the fish species composition or population structure of the stock. This is due to several factors that may result in size and species bias. Among these factors are fishing gear selectivity, selective areas, habitats and seasons, and active fishery selection.

The objective of this subtask is to survey the present status of fish stock of lake Manzala. The same method used by MacLaren

(10/2) will be adopted for the propo[illegible] study. [illegible] of 30 stock assessment sampling experiments will be performed. Sampling sites will be randomly distributed, but will fairly cover the various lake regions. Each sampling experiment will cover an area of 400m^2 which will be enclosed with a fine mesh blocking seine (0.5 cm stretch mesh). An attempt will be than made to remove all the fish inside the sampling quadrant and abundance of each fish type will be determined. Data will tabulated and fish stock maps will be preparated.

C- Closed Survey

Closed fishing operation encircle most of the lake islands surround the lake perimeter, and are found in a muddy marshes, intermittent wet lands and partially reclaimed areas.

The main purpose of this subtask is to delineate and characterize the closed fishing activities within the Lake. The following activities will be performed :

1) *Delineation of the Closed Fishing Areas :*

The physiographic and land use maps that will be prepared within Task IV will be used to delineate the closed fishing areas. Detailed maps (Scale 1:25000) will be prepared using aerial photographs for accurate delineation of the various types closed fishing areas. These maps will be verified through intensive field investigation.

2) *Characterization of Closed Fishing Areas :*

The same regional classification of closed fishing activities established by Maclaren (1982) will be adopted. The following parameters will be surveyed within each region.

- Gross closed fishing areas. (feddan).
- Type (hosha or farm).
- Average size of hosha or farm.(feddan).
- Total employment (man/year).
- Area yield (Kg/net feddan).
- Total yield (t).
- Yield composition.
- Fish prices.
- Total value.
- Net economic return per unit area.

TASK X : ARCHAEOLOGICAL SITE AND TOURISM POTENTIALITIES

Several important archaeological sites are scattered within the Lake area and its surroundings. Most of these sites and their historical background are documented by the Egyptian Archaeological Agency. However, few sites only are excavated. The main purpose of this task is to assess these archaeological sites along with other sites of potential touristic development.

TASK XI : SOCIOECONOMIC SURVEY

The availability of accurate and up-to-date information on the Socio-economic status of the human communities inhabiting an ecosystem is an essential prerequisite for appropriate and sound

planning for measure aimed at improving [illegible]s envi[illegible] [illegible] quality and rational exploitation of its natural resources. s[illegible]omic surveys are usually performed to determine the type [illegible]ial groups, the pattern of interaction between them, the [illegible]re of their activities, their needs and aspirations and their a[illegible]ituc[illegible] towards development.

MacLaren (1982) has carried out a social survey of the inhabitant of the Lake Manzala area using informal open-ended interviews with about 533 heads of house holds in June 1979. The questioner used for these interviews include about 175 items. This survey provided a baseline data for the sociological setting of the lake population.

The main purpose of the present task is to conduct a similar survey to update the information and to determine the changes occurred during the last ten years. The task will include the following activities :

A- Demographic Features

The different communities that accommodate the human population of the Lake Manzala area will be identified and the most recent population census will be used to retrieve the Demographic information on / hese communitities. Demographic features that will be determined include population and house hold for each community, annual rate of increase, Age, Sex, etc...

B) Housing and Community Standards

This activity will deal with the type o housing, the ratio of people to rooms, their attitudes towards the housing they have and

the basic social characteristics of house hold composition. the various community services will also be surveyed. These will include communications, energy, education, sanitation and recreation.

C) Health Conditions

Survey of health conditions of the selected communities inside the Lake Manzala and on its periphery will be carried out.An attempt will be made to identify the most common health problems and their distribution pattern, public health services will also be assessed.

D) Employment and work Structure.

This activity will be devoted to the understanding of the work organization and its relation to production as well as the social factors controlling such organization.

E) Attitudes Towards Development

The main aim of this activity is to elicit people's attitudes and feeling about the problems they face and how they think those could be solved, as well as their opinions on specific type of development projects.

F) Development Activities

The purpose of this part of the survey is to identify the current development activities with the Lake area as well as the projected development project.

PHASE THREE : EVALUATION OF LAKE CONDIT NS

This phase of the study will be commenced after thorough survey of the current conditions of the environmental ents of the Lake its fisheries resources and the various velopment activities. The main objectives of this phase are :

(1) To perform a systematic analysis of the collected survey data for a rational evaluation of the current environmental quality of Lake Manzala and fisheries resources.

(2) To predict future status of the Lake environment and its resources in case of no corrective measures will be implemented.

Phase three will include two tasks.

TASK XII : EVALUATION OF THE ENVIRONMENTAL QUALITY

The main concern in lake Manzala is the deterioration of the quality of its ecosystem due to possible increase of pollution. pollution is defined as the process or processes responsible for changes in the physical, chemical or biological characteristics of the ecosystem due to introduction of material or energy by man-made activities, to the extent that these changes will adversely impact the environmental quality of the ecosystem and would eventually threat the human health and people well fair.

Pollution would vary in causes and magnitude. For any pollution assessment that would aim at designing pollution control measure, the type, source, occurrence and levels of pollutants within the various environmental components, and the direct and indirect impact of these pollutants on the quality of the

environmental components as well as on the human inhabitants interacting with these components should be properly determined. Therefore the main objectives of this task are :

- To Assess the present physical, chemical and biological characteristics of the various environmental components of Lake MAnzala (Water, Sediments, Biota).

- To Determine the management and pattern of changes occurred to the environmental quality of the various component of the Lake.

- To Define sources of pollutants and the contribution of each source to the pollutant loads received by the Lake.
- To Determine the pathway and fate of the various pollutants within the environmental component of the lake with emphasis on the food chain.
- To Determine direct and indirect impact of man-made activities in general, and pollutant inflow in particular on the environmental quality of the Lake and on the human health and socioeconomic potentialities.

The following activities will be performed within this task.

A- Assessment of Current Lake Condition :

The survey results will be studied and analyzed to provide the present status of the Lake environment. This will include :

-Pattern of land use in and around the Lake.

-Pattern of current development activities.

- Physical and chemical characteristics of the lake water and their spatial and seasonal fluctuation.
- Level of pollutants in the Lake water.
- Level of pollutants in fish and benthic fauna.
- Spatial and seasonal distribution of the Lake biota.
- Types, nature, and distribution of Lake bottom sediments.
- Levels of pollutants in the Lake bottom sediments.

B- Determination of Environmental Changes :

The pattern and magnitude of changes occurred to the Lake environmental quality will be determined by the compansaion between the current environmental qualities and those documented in previous studies such as MacLaren (1982). Emphasis will be given to those changes occurred to :

Physiographic features and pattern of land use.

Physical and chemical characteristics of water and sediments.

Level of pollutants in water, sediments and biota.

Spatial and temporal distribution of benthic fauna and vegetation.

Socioeconomic pattern and development activities.

C- Determination of Pollution Sources

From the survey result performed in phase two the pollutant contribution from the various sources will be qualitatively and quantitatively assessed. Resources will be compared with previous

data to determine changes occurred in the type and [illegible] of pollutant loads inflow to the Lake.

D- Pollutant Fate and Pathway

Since most of the pollutant loads are carried t[illegible] Lake by the inflow water, a thorough investigation of the hydrological regime of the Lake should be performed.

Mathematical modeling technique will be used for the determination of the pollutant fate and flux within the Lake hydrographic regime. On the other hand fate and pathways of pollutants within the Lake food chain will be determined using conceptual biological models. An attempt will be made for the determination of the pollutant pathway at least semi-quantitatively.

1) *Modeling of Lake Water Circulation*

Field data collected within the hydrographic survey of phase two will be used for the establishment and calibration of a computerized mathematical model that will present the current circulation pattern of the Lake water.

2) *Modeling of pollution pathway*

: the information and data collected within the drainage survey task of phase two, and the water circulation model, a computerized mathematical model of pollution dispersion will be developed. Water environmental quality data will be used for the calibration and validation of this model. This activity will provide very useful information that facilitate understanding of the dispersion pattern, pathway and fate of water pollutants.

3) *Conceptual Modeling for Biological Pollutant Fate.*

This activity will attempt to establish a conceptual model that identify and quantify the interaction between the physical parameter of the Lake environment and its biological communities on one hand, and the interaction between the various fauna and flora communities on the other hand. Such a model will be the basis for the determination of pollutant pathway in the food chain within the Lake and, therefore, will exhibit how the pollutants could reach the edible fish within the Lake.

4) *Assessment of Pollutants Accumulation within Fish*

The accumulation rate and pattern of the various pollutant by different fish species will be assessed. This will be mainly based on the understanding of the fish biology, their feeding habits and the availability of pollutants within the various segments of the Lake food chain.

E- Waste Assessment Capacity

Lake Manzala has an important existing and future role as a stabilization pond for waste and nutrients originating from domestic sewage and agricultural runoff. The Lake has certain capacity for assimilation of such organic and nutrient loads. An attempt will be made to determine the amount of wastes that can be assimilated by the Lake and does not cause eutriphication of the Lake water.

F- Environmental Impact Assessment

This activity will deal with the assessment of the impacts of all current man-made activities on the environmental quality of Lake Manzala. A matrix system will be developed for such assessment. One axis of this matrix will encounter in detail the components of the Lake environment, while the other axis will list the various development activities. The impacts of each activity within the current developments project on the environmental components will be assessted (negative, positive or no impact).

The impacts will also be weighted (slight, moderate, significant, sever). The results of this activity will provide an important input for the determination of factors controlling the environmental quality of the Lake. The following activities will be performed :

(a) Listing and characterization of development activities . Development activities will be categorized on the basis of their regional occurrence and their nature (industrial, agricultural, etc..).

(b) Listing of the environmental components.

(c) Developing of a computerized environmental impact assessment system.

(d) Determination of the type and magnitude of the impacts.

(e) Categorization of the development activities into three groups, namely; activities that have negative impacts, activities that have positive impacts, and activities that have no impacts.

(f) Determination the course of the ucts and measures for enhancing the positive impacts and mitigating the regional impacts.

G- Prediction of Future Status

Results provided by activities (1) to (5) will be used to predict the future environmental quality on the assumption that the current pattern of development and social behavior will continue. The result of this activity will provide the rational and justification for the implementation of the proposed action plan. It will also facilitate the process of planning that will aim at making the change from the projected status to the desired conditions.

TASK XIII : EVALUATION OF FISHERIES RESOURCES DEVELOPMENT

This task will be devoted to evaluate the fisheries resources development and determination of the trends and magnitude of changes and developments occurred in the Lake fishing and agricultural activities.

(A) Assessment of Open Fisheries.

The objective of the subtask is to evaluate the present status of open fisheries and to determine trends and magnitude of changes occurred to the open fisheries activities. This objective will be achieved through performing comparative analysis of the 1979 data documented by MacLaren (1982) and the results of the present study (TASK VII-A). Evaluation will be carried out for

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the fisheries characteristics and catch - ıtistics in the light of the various physical and environmental co..._tions.

(B) Evaluation of Fish Stock.

A comparision between the current fish stock and that measured in 1979 by MacLaren (1982) will be performed. Such comparision will provide valuable information on the trands and magnitude of changes occurred to the Lake fish stock. The interrelation between the changes in the fish stock and the physical and environmental conditions will be investigated.

(C) Evaluation of Closed Fishing Activities.

Using the 1979 survey that was carried out by MacLaren (1982) results of the present closed fishing survey (TASK VII-C) will be assessed and changes occurred to this sector will be determined. The results will also be evaluated with respect to its interrelationship with the pattern of development and physical and environmental conditions.

TASK XIV : EVALUATION OF INSTITUTIONAL ORGANIZATIONS AND LEGISLATIONS

Institutional organizations and legisllation are the main tools for the management of an ecosystem and its natural resources. These tools are usually designed and organized in such a way to ensure the implementation of the national strategy. Achievement of the strategic goals set for environmental

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protection depends mainly on the soundness, and effectiveness of these management elements.

In case of Lake Manzala, several national and local organizations are entrusted, in a way or another, by the protection of the Lake environment and management of its resources. Several legislations were issued to enable these organizations to perform their function with regard to the protection of Lake Manzala and its resources.

The deterioration occurred to Lake Manzala ecosystem reflects difficulties in the application of these environmental rules and regulations. Therefore, need arises for the investigation of the institutional organizations and the legistelation concerned with the Lake environment and the exploitation and development of its national resources. This task will be devoted to answer such need. Activities that will be performed to achieve the task objective include:

- Identification of all concerned agencies and legistelation.
- Review and assessment the organization structure of there agencies .
- Investigation of the coordination and cooperation procedures between these agencies.
- Review and assessment of the planning and follow up activities.
- Review of relevant legistlation and their enforcement procedures.
- Final assessment and evaluation of the present institutional organizational and legistelations.

PHASE FOUR : DETERMINATION OF CONTROLLING FACTORS

Task XV : FACTORS CONTROLLING FACTORS

This task will aim at the identification of factors controlling the quality of the lake environment. Such factors can be grouped into three groups, namely: (a) Socio-economic, (b) physical and (c) organizational.

The outputs of the previously described tasks will provide the required information for the identification of these factors and determination of their role and magnitude in controlling the environmental quality of the lake.

A- Socio-economic factors

Factors controlling or impacting the environmental quality of the lake and related to the social setting and economic activities may include :

- Demographic pattern.
- Pattern and magnitude of industrial development.
- Irrigation and pest control practices.
- Disposal of domestic sewage.
- Disposal of industrial wastes.
- Pattern of landuse.

B- Physical Factors

These are factors related to the physiographic setting of the lake area, which may include :

- Pattern of Drainage net-work and location of drainage inflow to the lake.
- Sedimentation rate and pattern within the lake.
- Distribution patterns of islands and hosha.

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- Location and morophology of tidal lets.
- Water Budget.
- Dispersion pattern of organic and nutrient loads.

C- Organizational Factors

- These are factors related to the management of the lake environment, and may include :
- Objectives and functions of the national and regional concerned government agencies.
- Planning and follow up practices.
- Monitoring activities.
- Euforcement of rules and regulation.

Task VXI : FACTORS CONTROLLING FISHERIES DEVELOPMENT

This task will be devoted to identify factors impacting the pattern and rate of fisheries development and the determination of their role and magnitude. These factors may include the following:

(A) Environmental factors.

- Water quality.
- Ecological Changes.

(B) Management related factors

- Pattern of fisheries development planning.
- Follow up and monitoring practices.
- Enforcement of legistelation.

(C) Socio-economic factors

- Demographic and social patterns.
- Open and closed fishing activities.
- pattern of aquaculture development.
- Processing and marketing

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PHASE FIVE - REMEDIAL MEASURES

Task VIX : Environmental quality remedial measures

The main objective of this task is to identify economically feasible and environmentally sound remedial measures for the improvement of the lake Manzala environmental quality To achieve this objective the following activities will be performed.

A- Determination of the desired environmental quality

Based on the survey of current environmental conditions and the projected trends and magnitude of changes in the quality of the various environmental components of the lake, Detailed description of the desired environmental quality will be performed. Such desired quality may be defined by the waste assimilation capacity of the lake and maintaining a balanced ecological system that may provide a health habitat for fisheries resources and human communities.

B- Options for Remedial Measures

Knowing the desired environmental quality, and using output of previous tasks, various options of measures capable of changing the current environmental quality to the desired one will be identified. Remedial measure may address the following issues :

1) Reduction in the organic and nutrient loads and pollutant levels carred to the lake by the various drainage canals

2) The removal of polluted bottom sediments.

3) Optimum dispersion of organic and nutriant loads within the lake area.

4) Lake water buuget and salinity control

5) Rehabilitation o the biological components of the lake eco-system with emphasis and fi. benthic fauna, vegetation and birds.

C- Selection of Remedial Measures

Possible options and scenarios for remedial measures will be thoroughly discussed with concerned government age. cies, privet sectors and local communities. Selection criteria will be designed on the basis of the outputs of these discussions as will as the national and regional on going activities and the socio-economic

development plane. Selection criteria will be then reviewed with the concerned agencies the ensure its feasibility.

D- Validation of the selected remedial measures

The choesen remedial measures will be described and their effectiveness will be examined. Mathematical modeling will be used for the validation of certain control measures, specially those related to the optimization of the dispersion of organic and nutrient loads, salinity control and removal of polluted bottom sediments.

E- Conceptional Design of The Remedial Measures

The selected and validated remedial measures will be conceptually designed. Conceptual designs will define the main action required for the implementation of such remedial measures and specification of these actions

TASK XVIII : FISHERIES RESOURCES DEVELOPMENT.

The aim of this task is to define actions required for the enhancement of fisheries resources and its rational exploitation. Recommended actions should fulfill the following national and regional socioeconomic development goals.

(a) Economic

- To promote economic development through optimal use of resources.
- To maximize opportunities for employment.
- To promote food security by encouraging a balanced development of agriculture and fisheries resources.
- To put forward development schemes that will attract foreign investment.

(b) Social and environmental

- To improve the quality of life.
- To make wise and efficient use of the environment.
- To minimize adverse environmental impact.
- To conserve natural resources.

Activities of this task will include.

A- Design A Strategic Framework The Development of Fisheries Resources

This activity will be devoted to outlining a strategic framework for the overall development of the Lake fisheries resources. Such strategic framework should consider the following:

- Present status of open and closed fisheries as well as agricultural activities.

- Factors responsible for adverse impact on fisheries activities.
- Current socioeconomic conditions.
- National and regional socioeconomic development goals.

The general framework of the fisheries development strategy will be discussed with concerned government and local agencies.

B- Determination of Corrective Actions

On the approval of the strategic framework for the fisheries development, corrective action required to reorient the set strategic goals will be identified. These recommended action will be also reviewed and discussed with concerned agencies, local authorities and representatives of fishermen communities.

(C) *CONCEPTUAL DESIGN OF RECOMMENDED PROJECTS.*

Agreed upon recommended action will be translated to development projects. The main components of these projects will be conceptually specified.

PHASE SIX : *ACTION PLANE*

TASK XIX : DETAILED DESIGN OF THE ACTION PLAN.

This task will provide in detail the technical specification of the recommended projects within an integrated action plan aimed at improvement the environmental quality of Lake Manzala and rational development and exploitation of its fisheries resources.

This task will include the following activities:

(A) Technical specification of the recommended projects.

(B) Detailed breakdown of the estimated budget for each project.

(C) Duration and time schedule for the execution of each project.

(D) Recommended framework for the institutional organization and feasible legislations.