



联合国
粮食及
农业组织

FOOD AND
AGRICULTURE
ORGANIZATION
OF THE
UNITED NATIONS

ORGANISATION
DES NATIONS
UNIES POUR
L'ALIMENTATION
ET L'AGRICULTURE

ORGANIZACION
DE LAS NACIONES
UNIDAS PARA
LA AGRICULTURA
Y LA ALIMENTACION

منظمة
الأغذية
والزراعة
للأمم
المتحدة

Via delle Terme di Caracalla, 00100 Rome, Italy

Cables: FOODAGRI ROME

Telex: 610181 FAO I

Telephone: 57971

FIR-IL 2/2 Brazil

Ref.:

8 DEC 1976

Dear Ms Kawakami de Resende,

I enclose herewith my finalized report as promised.

Yours sincerely,

R.L. Welcomme
Senior Fishery Resources Officer
Fishery Resources and Environment Division

Ms Emiko Kawakami de Resende
Chefe Adjunto Técnico
EMBRAPA/CPAP
Rua 21 de Setembro, 1880
Corumba, Mato Grosso do Sul
Brazil

PROPOSAL FOR STUDIES OF THE FISHERIES OF THE PANTANAL

BACKGROUND

Geography

The Pantanal is a low-lying flat area surrounded by the Brazilian Shield and interspersed with occasional masses of hills. It is drained to the south by the Paraguay River and forms part of the La Plata system. It is fed by numerous rivers draining the surrounding plateau the major inflowing rivers being the Cuiaba, Taquari, Aquiduaana, Coxipo and Miranda. The Pantanal has an area of 139 000 km² within Brazil (States of Mato Grosso and Mato Grosso do Sul) and a total area of some 220 000 km² when associated floodlands in the Bolivian and Paraguayan Chaco are added. The basin is itself divided into smaller units characterized by drainage and vegetation.

Hydrology

The Pantanal is subject to an annual cycle of flooding with high water from November–April (maximum January/February) and a minimum during August in Cuiaba. Because of the flatness of the terrain flood peaks and minima tend to be retarded by up to 2 months before their arrival in Corumba. Annual flood cycles are grouped into longer cycles consisting of alternating high water and low water phases of up to 10–11 years duration. Each Pantanal has considerable areas of permanent flooding (Baías) and even more extensive zones of intermittent flooding. Large permanent lake systems, some of which are of considerable depth, are grouped along the main rivers, principally the Paraguay.

The Fishery

Seven main species dominate the fishery: Pseudoplatystoma coruscans, P. fasciatum, Colossoma mitrei, Salminus maxillosus, Paulicea luetkeni, Prochilodus lineatus, Leporinus sp., although many subsidiary species also enter the fishery. These represent only a small percentage of the 400 odd species inhabiting the basin. The main fisheries are located at the periphery of the Pantanal at Cuiaba, Caceres, Rondonopolis, Miranda, Aquiduaana and Coxim. Corumba is the only fishing centre located in the middle of the Pantanal at the present time. Different policies are pursued in the States of Mato Grosso, where a fairly liberal attitude is taken to the fishery, and Mato Grosso do Sul where hard line conservationists seek to deter fishing almost entirely. In this latter fishing is discouraged and most forms of gear are illegal. As a result fishing is largely clandestine and difficult to evaluate. A small traditional fishing sector has been progressively swelled by fishermen arriving from the polluted and depleted Parana River in 1970, but because of the repressive attitudes in the newly formed Mato Grosso do Sul, these moved on to Cuiaba in about 1979. It is very difficult to estimate present levels of catch. Officially about 7 000 t (3 000 t in Mato Grosso and 4 000 t in Mato Grosso do Sul) are landed annually, but real catches may be as much as three times this. Nevertheless, the Pantanal remains one of the least populated and exploited fishery resources anywhere. In addition to the commercial

fishery, there is a heavy recreational/tourist fishery whose offtake must approximate that of the commercial sector.

At Cuiaba there are four major fisheries: (i) a high water fishery for Pimelodid catfishes in the channels connecting the lagoons to the river; (ii) a dispersal fishery "Lufada" for small species concentrated during falling water; (iii) a specialized fishery for Colossoma in the flooded forests and retreating waters, and (iv) a Prochilodus fishery at low water and during the "Piracema".

Environmental Problems

Human occupation of the main body of the floodplain is very low with cattle rearing as the main activity. Farming and settlement are restricted due to the very heavy and persistent floods and to the generally poor soils. However, proposals to enclose areas of the plain within bunds have been made and such activities would greatly alter the character of what is still a virtually unpopulated wilderness. No major dams on tributaries exist as yet, although there have been proposals to erect a high dam across the River Manso, some 80 km above Cuiaba.

While the core of the Pantanal remains largely undisturbed, there are environmental problems around the edges of the basin. Soya bean plantations on the Mato Grosso plateau have denuded the soil through the removal of the "cerado" forest and the mechanizing of agriculture. This has resulted in greatly increased silt loadings in the River Taquari, which has led to that river acquiring a raised bed with occasional break-through leading to severe flooding and channel shifts. Agro-chemicals from the soya bean plantations have also found their way into the aquatic system, here they have been implicated in severe or even catastrophic mortalities early in the rains when the "piracema" species were breeding at upriver sites. At present the major risks to the Pantanal ecosystem must lie in these disturbances rather than the low level of fishing.

RESEARCH NEEDS FOR THE REGION

Research has been discontinuous, recent and confined to a few enthusiastic individuals. However, in view of:

- the initiation of a fishery and the possibility of its rapid expansion, and

- the risks of growing environmental changes, this is insufficient to conserve what must be one of the last unchanged aquatic habitats of the world, there is an urgent need to carry out a full systematic and scientific investigation of the fish stock and the fishery of the Pantanal.

The purposes of such a study should be:

- to establish a scientific description of the situation before further changes occur to serve as a baseline against which to judge future observations, and

- (ii) to provide the information necessary for better management of the Pantanal and its fisheries.

To this end a coordinated programme of research should be established as follows.

GENERAL CONSIDERATION

The programme should be viewed as a collaborative programme in which different institutions, whether Governmental, Statal or Academic, can participate. There should, however, be a Coordinating Committee, preferably composed of those responsible for the different research components, but with an independent Chairman.

A sampling frame should be established at the outset, which includes a number of typical sites representative of the various components of the system. These should form the basis for sampling, although some control studies may also be carried out elsewhere in the system.

To avoid undue stress on financial and manpower resources, it is suggested that sampling frequency be limited at each site to four times a year - peak flood, minimum flood and two intermediate times. More frequent sampling would be needed for some aspects of the programme.

The whole programme should preferably last for five years in order to detect any temporal variations between years and give a data base wide enough for extrapolation. It is, however, realized that, should the theory of 11 years low and high flood cycles be correct, the project would only address one of these cycles. It may be wishful thinking to suggest that this programme could be repeated in its entirety during an alternative cycle, but some control studies at least should be envisaged.

The programme should be divided into four components:

Component 1. HYDROLOGY

Justification: Much information on the hydrology of the Pantanal is already available in government agencies and universities. This information needs to be collected and interpreted in a way useful to managers of the aquatic ecosystem.

Objectives: To provide a scientific basis for understanding the behaviour of fish and their responses to the hydrological regime.

Activities:

- (i) Collection of existing hydrological data to provide a reliable history of flooding in various areas of the basin, and
- (ii) To characterize the Pantanal and its sub-regions in terms of duration and type of flooding.

Means of Action: Either by directly assigning one hydrologist to work with the project or to sub-contract the competent Government Agency to carry out

the work.

Input: One hydrologist, funding for a sub-contract or commitment to participate in the programme by a suitable agency.

Output:

- (i) Charts of flood cycles for all major regions of the basin, and
- (ii) Maps of extent and distribution of flooding.

Component 2. LIMNOLOGY

Justification: Some limnological information is available, but is oriented mainly toward the botany of the region. More data are needed to classify the nutrient status, primary and secondary productivity of the different zones of the Pantanal, to serve as an indication of environmental change and to assist in interpreting fish behaviour.

Objectives: To define the productivity and water quality of the Pantanal and its various sub-regions.

Activities:

- (i) Detailed study of water chemistry in the rivers, permanently flooded plains and seasonal lagoons of the system paying particular attention to current fluxes in sediment loading and toxic contaminants, and
- (ii) Studies of primary (phytoplankton) and secondary (zooplankton and benthos) in the three main habitat types.

Means of Action:

- (i) Collection and synthesis of existing data from all sources, and
- (ii) Sustained sampling at the standard frame sites as established.

Input: 1 Hydrochemist and 1 Limnologist/Biologist; sampling teams, transport and support costs

Output:

- (i) Reports on water quality and pollution, and
- (ii) Reports and maps of zones characterized by their primary and secondary productivity and the identification and distribution of main indicator organisms.

Component 3. ANALYSIS OF THE FISHERY

Justification: Some statistics of the fishery have been collected, but because of restrictive and impractical regulations much of the fishery is clandestine. This means that existing data are misleading. A more detailed study of the fishery is therefore needed in the short term to establish its existing structure. Furthermore, a systematic, long-term

collection of fisheries data should be undertaken aimed at the scientific regulation of the fishery and the assessment of the effects of management practices already in force.

It is realized that there are at present considerable political and practical problems in carrying out this programme. It should be emphasized that without proper knowledge of the fishery, decisions are apt to be arbitrary and frequently erroneous. If some satisfactory compromise cannot be worked out, the whole concept of rational conservation and management of the Pantanal must be called into question.

Objectives: To establish the structure of the fishery and monitor its changes.

Activities:

- (i) Collection of data from the industrial sector (freezer companies), markets, and sport fishery;
- (ii) Census of fishermen and determination of catch and effort by gear, location and season, and
- (iii) Interpretation of statistics for detailed analysis of composition on magnitude of catch by gear, location and season.

Means of Action:

- (i) Regular collection of data to establish effort and catch at the fishermen level;
- (ii) Collection and processing of data from refrigerator companies and markets;
- (iii) Analysis of catch and effort in recreational sector, and
- (iv) Collection of data on type and mean length of species caught

Input: This component of the programme is liable to be the most expensive of staff and support costs and will call for a number of trained monitors, as well as at least one supervising scientist. Transport and support costs for all staff would also be necessary. Costs can be minimized by intelligent framing of the survey, but confidence limits increase in proportion to the economies taken.

Output:

- (i) A series of annual reports on the quantity and type of fish caught in various parts of the basin, and
- (ii) A master report on trends in the fishery over a number of years.

Component 4: FISH BIOLOGY

Justification: A knowledge of the biology and ecology of the most important species is essential particularly with regard to establishing migratory cycles and pathways and determining feeding or spawning areas. These studies have been pursued in general for a few species of present major importance, but should be extended to include others of potential importance. It is also important to measure biomass and species composition of fish communities at different seasons and in different areas of the system.

Objectives: To investigate essential aspects of the biology of fishes of present or potential economic importance in the Pantanal, as an aid to formulation of management strategies for the area.

Activities:

- (i) To study distribution, migration and breeding behaviour of species of commercial or potential commercial importance;
- (ii) To study species composition and biomass of fish communities at various sites in the basin;
- (iii) To study other aspects of the biology of species as necessary - for example, feeding by frugivorous species as related to the impacts of deafforestation, and
- (iv) To study selectivity of various types of fishing gear for important elements of the fish community.

Means of Action:

- (i) Synthesizing existing data on biology of fishes within the basin and incorporation of knowledge on similar species of fish from elsewhere, and
- (ii) Carrying out field studies on the aspects of biology listed above.

Input: This is by far the most flexible element of the programme and can be expanded or contracted according to manpower availability. It can rely in large measure on post-graduate students, but a minimum core group of scientists would be necessary to carry out a basic programme. This number is probably 4: 1 to work on biomass distribution; 1 to work on selectivity and 2 to work on specific species oriented problems. These scientists should be provided with support staff, transport, equipment and operating costs.

Output: A series of reports and scientific papers on fish biology containing information needed to reach management decisions.