

FEB 21, '95

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Proposal

to

The Japan International Cooperation Agency (JICA)

for

**Research Project to Promote Small Scale Commercial Farming of Lake
Malawi Indigenous Species (ntchila and mpasa)**

Submitted by

The Fisheries Department
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Background

Lake Malawi is one of the most biologically significant freshwater ecosystems in the world. It has the most speciose fish fauna of any lake, with an estimated 500 - 1000 species. This is more species of freshwater fish than are found in all of North America. Most of the species belong to the family Cichlidae and an estimated 99 % are endemic to Lake Malawi, making it the most spectacular example of vertebrate adaptive radiation in the world.

Another important family found in the lake is that of Cyprinidae. About 25 cyprinid species occur in the lake, most of which are also endemic, and riverine or anadromous. Some of these species are : *Opsaridium microlepis*, *O. microcephalus*, *Labeo mesops*, *L. cylindricus*, *Barbus johnstoni*, *B. eurystomus*, and *B. litamba*. Populations of all obligate river - breeders are in decline as a result of overfishing and loss of spawning habitat through siltation and the degradation of perennial streams, consequences of heavy soil erosion on agricultural land. These problems are more severe in Malawi, than in Tanzania or Mozambique, and are especially serious in the Southern and Central Malawi.

As recently as 1950s the *L. mesops* (ntchila) was the most important species landed in Malawi, landing of ntchila from the productive gillnet fishery of the Southeast Arm exceeding the combined catch of all other species. Since the 1950s, catches of ntchila from Lake Malawi have declined from 14.74 % to 8.22 % in 1962 (by number) and 0.33 % in 1989 (by weight) (Mstiska, in press). Consequently, ntchila has been declared endangered species (Department of Agriculture and Fisheries 1963, 1965; Willoughby 1979). The main reason for the decline is increased exposure to fishing pressure during the spawning season as a result of reduced periods of stream flows.

Currently, a lot of efforts are being directed at searching for a suitable candidate species for aquaculture in Malawi, and speculations have centred on some of the endemic cyprinid species in Lake Malawi. A number of reasons have been forwarded in favour of these cyprinid species, including:

(i) **high fecundity:** adult female *O. microlepis* (mpasa) produce between 60,000 and 80,000 eggs; ntchila up to 150,000, and *B. johnstoni* and *B. eurystomus* produce similar number of eggs. Therefore, large numbers of fry can be obtained.

(ii) **ease of artificial fertilization:** experiments have shown that common carp pituitary extract when injected into mpasa induces the final stages of ovary maturation and facilitates the easy stripping of eggs (Msiska in press). Eggs of ntchila and mpasa have been hatched and fry reared in laboratory (Msiska 1986; Msiska in press; Msiska 1993).

(iii) **high growth rates:** ntchila attains total lengths of 22, 31 and 37 cm in the first, second and third year, respectively (Department of Agriculture and Fisheries 1963).

(iv) and marketability of the species.

Objectives

The broad objective of the proposal is to establish a research centre for indigenous Lake Malawi species (mpasa and ntchila), and promote small scale market - oriented aquaculture, using these species. The project will have the following specific objectives:

- 1) to protect the cyprinids species of Lake Malawi, by enhancing their populations in the lake, by releasing into the lake, artificially hatched juveniles;
- 2) to promote culture of these cyprinids in ponds (earthen or concrete) away

- from the lake, or cages in the lake, at a viable cost;
- 3) to facilitate training needs for the Fisheries Department, and University of Malawi (Bunda College).

Project Description

Funding

The project will be funded through the support from the government of Japan through a "Project Type Technical Cooperation Programme" to obtain necessary equipment for the proposed Research Centre. The project will also facilitate bilateral expertise exchange between Malawi and Japan, to reinforce the effectiveness of the centre in its activities of promoting hatchery management and other research activities.

Species

In an efforts to improve fish production from aquaculture in Malawi, the government has in the past resorted to importing such exotic species as common carp. However, environmental pressure has been mounted recently, to restrict importation of exotic species. Consequently, focus is being redirected at indigenous species for search of potential candidates, namely mpasa, and ntchila.

Ntchila is detritus eating species, and attains the lengths of more than 45 cm and weights of 1.5 kg. Being a detritus eating, and mud substratum inhabiting fish, it will easily be raised in earthen pond conditions. However, its preferred food and nutrient requirements are not well known (Msiska 1993). The fact that the fish is a detritus feeder, makes it a potential candidate for smallholder fish farming since ponds in this sector depend on inputs from on-farm by-products.

Mpasa is a predatory species which attains a length of 70 cm, and weight of

4 kg. Due to its predatory nature, there will be a need to develop high protein diet in form of a pellet. This fish is, therefore, a potential candidate for commercial high external input fish farming. Development of a diet will involve a search for protein source, either from other fish or plant source.

Hatchery site

The hatchery will be sited in an area near the lake, to facilitate easy transfer of the broodstock from the lake to the hatchery. Proximity to the lake will also facilitate constant supply of water to the hatchery. Potential sites are Monkey Bay, or Nkhota Kota, near Bua estuary.

Rearing site

Rearing trial will have to be done in earthen ponds, for ntchila, and cages, trials will also be carried out in concrete tanks where possible. For pond culture, the site must have constant supply of water; and suitable soils for pond construction (clay soil); and in an environment more or less similar to those existing on farms. National Aquaculture Centre, at Domasi offers suitable conditions for such trials. Ideal site for cage culture are deep, sheltered, and calm bays and lagoons. Monkey Bay and Chia lagoon have such good conditions. However, Senga Bay does not have well sheltered bay for cages.

Laboratory facilities

Detailed scientific study will have to be done on the biology of these fish species; and this will involve installation of wet and dry laboratories, well equipped to perform a wide range of activities, such as artificial fertilization;

study of early life histories of fish; water quality analysis; just to mention a few. In order to facilitate production of live feed organisms, as well as formulation of artificial diets, live feed culture and feed mixing facilities, and feed analysis equipment will have to be procured.

Data handling facilities

In order to facilitate proper data handling, and analysis, a computer centre has to be installed. A number of research assistants should be put in place to assist in data handling.

Training facility

The project will involve installation of an important facility which will form one of the backbones of future developments in fishery and aquaculture industry. Therefore, it is important to develop local capacity to manage this facility, by training Malawians, on the job, at the level of research scientist as well as technician, in the areas of hatchery management, feed development, and cage culture management.

Staffing

The project will be managed by a Malawian manager, strengthened by a Japanese Project Advisor. Project activities will be coordinated by a Malawian Senior Officer, who will be advised by a Japanese Project Coordinator. Research activities will be executed by Malawian Research Officers in the areas of broodstock management; hatchery operations; and feed development, and these officers will be advised by Japanese experts in these fields.

Three Research Assistants at Technical Officer (TO) or Technical Assistant

(TA) levels will be required for the 3 areas of study. Support staff (a typist; car driver; boat driver; and security guard) will also be recruited for the project.

Project phasing

The first five years of the project will be pilot phase. This phase will undertake research on biological studies of the mpasa and ntchila as well as feasibility study for broodstock management, hatchery operations, feed development and cage culture for the fish. If the pilot phase succeeds, phase 2 will be launched with the help of funds from Grant Aid, to pursue other research topics arising from the Pilot Phase. The second phase will also put a great deal of emphasis on field testing of the culture practices, using potential farmers.

Budget

It is proposed that a total of US\$ 700,000 be obtained from the Japanese Government, for the initial setting up of the infrastructures, and purchase of equipment, in the Pilot Phase. The Malawi Government will have to contribute an equivalent of about US\$ 330,000 over the same period, through maintenance and running cost.

Implementation

The project will be implemented by the Malawi Fisheries Department, through the Aquaculture Section. Construction of the facilities will be undertaken by a contractor as agreed between the Malawi and Japan Governments; under the supervision of the Project Manager and Advisor. Procurement of the equipment from overseas will be taken care of by the Project Advisor.

Various research activities will be undertaken by the research officers and their Japanese Advisors, supervised by the Project Manager and Advisor. Regular advisory meetings will be held, during which the advisory committee, (comprising the Chief Fisheries Officer, and the Monitoring and Evaluation Section of the Fisheries Headquarters), will review the progress of the project activities.

Rationale and justification

One of the reasons for low output from aquaculture in Malawi is because of the lack of a suitable (fast growing; late maturing; easy to culture; high commercial value) species of fish. This project will focus in the right direction in search of a high market value candidate species for aquaculture.

Cyprinid populations of Lake Malawi are almost endangered species, because of deteriorating ecological environment in the catchment areas of the lake, as well as overfishing. Therefore, artificially hatched juveniles for these species will be restocked in the lake and enhance wild populations. Concurrently with the hatchery work, studies will be undertaken to investigate habitat conservation and management for the breeding areas of the fish.

In addition to enhancing the populations of these species in the lake, and boosting aquaculture production, the project will be vital for human resource development through the training component. Management and research components of the project are going to be sustainable because local Malawian personnel are involved. There are a lot of species in the lake whose biology is not known, therefore, experience gained from this project will be vital for the Fisheries Department researchers, in studying other species.

This work undertaken in this project is going to complement those efforts pursued by the World Bank financed Fisheries Development Project (FDP), as well

as the proposed Global Environmental Facility (GEF). The FDP aims at improving the management of the resources through stock management, regulation, and control of fishing; with its extension activities mainly focusing on commercially important species, like Chambo. The GEF is proposed to focus on overall biological diversity of the lake, with its activities covering non-commercial species; whole lake ecosystems; and catchment management.

By working with specific species (mpasa and nchila), and aiming to improve their populations, the proposed hatchery will be a model lake ranching project, the first of its kind in this part of Africa.

Activities

1. Project Management Component

The following activities are going to be carried out under the project management component:

- Construction and procurement of materials
 - Construction of the hatchery facilities;
 - Construction of ponds, tanks and cages;
 - Construction of offices;
- Procurement of materials and equipment
 - Procurement of laboratory equipment;
 - Procurement of vehicles, and boats;
 - Procurement of computers and associated soft ware;
 - Procurement of other materials which are not locally available.
- Project management
 - Organize planning workshops for project management team;

- Organize training for counterpart staff, as specified by research needs.

2. Research Component

The following research activities are going to be undertaken:

- Biological studies
 - Reproductive biology of mpasa and ntchila;
 - Feeding biology of the fish;
 - Early life histories of the fish;
 - Environmental requirements (DO; pH; NH₃; etc) for the fish; and habitat conservation and management studies.
- Broodstock management studies
 - Broodstock handling studies;
 - Broodstock management strategies for better fecundity;
 - Effective population studies, in order to maintain better genetic variability.
- Hatchery operations
 - Induced spawning techniques for better hatchability;
 - Fry rearing techniques for better survival of fry;
 - Effects of environment (temperature and other water quality parameters; feed; broodstock quality; etc) on quality and survival of juveniles.
- Feed development
 - Effects of various live feed organisms on the growth and survival of fry;
 - Test of various techniques in production of live feed organism;
 - Digestibility tests for various live feed organisms.
 - Test various feed formulations for cage culture of the fish;
- Cage culture and restocking in the lake

- Development of cage culture system suitable for Malawi conditions, in terms of local availability of materials and costs;
- Carry out small scale exercises of releasing fingerlings of mpasa and ntchila into the lake, in enclosed bays, and monitor their performance.

3. Training Component

The following will be activities in the training component:

- Coordinate with Bunda College, to have students attached to the hatchery and laboratories to carry out research according to their educational requirements;
- On - the job - training of counterparts, and training in Japan for counterparts, in areas of hatchery, feed development, biology and ecology of migratory fishes.

Assistance Required

It has been proposed that financial assistance for infrastructural development be provided to the Malawi Fisheries Department (through the Government of Malawi) by the Japanese Government's Grant Aid for Increased Food Production (2KR) Funds. The following is the required assistance:

- a) Building of the hatchery and research facility pertaining to the activities proposed above.
- b) Funds to transfer, and adaptation of Japanese advanced technology in fish culture methods to Malawi, via the exchange of expertise and training of Malawi Fisheries staff in Japan.

Annex 1. Proposed Budget

a) Japan Government's contribution (US \$)

Item	US\$
<ul style="list-style-type: none"> • Equipment: <ul style="list-style-type: none"> - Wet and dry laboratory - Hatchery facility - Live feed organism culture set - Pellet machine and feed mill set - Feed analysis machine 	100,000 95,000 5,000 25,000 75,000
Sub - total	300,000
<ul style="list-style-type: none"> • Other equipment <ul style="list-style-type: none"> - Vehicle and boat - Cages and associated materials 	100,000 100,000
Sub - total	200,000
<ul style="list-style-type: none"> • Computer and training <ul style="list-style-type: none"> - Computer network and software - Publication of research findings 	180,000 20,000
Grand total	700,000

b) Malawi Government contribution

Item	US \$
<ul style="list-style-type: none"> • Construction of buildings and maintenance - Construction of buildings - Maintenance of vehicle and boat - Maintenance of hatchery facilities buildings, and office equipment 	<ul style="list-style-type: none"> 180,000 80,000 40,000
10 % contingencies	30,000
Grand total	330,000

Total pilot project cost will be approximately US \$ 1,030,000, over a period of about five years.

ANNEX 2 : Name and speciality of Staff in Aquaculture Section, Fisheries

Department

Position	Expert required*	Counterpart	Local staff qualification
Project Team Leader		Mr. Sloans Chimetiro	B.Sc., M.Sc.
Hatchery operations	To combine with Team Leadership	§	
Broodstock management	Broodstock mgt. expert	Mr. Michael Kapeleta	B.Sc.
Feed development	Nutritionist expert	§	
TA for hatchery		Mr. Presley Kataya	Cert. (trout hatchery)
TA for broodstock		Mr. Tony Mhango	Cert. (mass fry production)
TA feed development		Mr. C. Lipunga	Cert. (Fishery mgt.)

Note : * There is a requirement for only 3 experts. The Team Leader will combine the project management and hatchery operations. It must also be noted that there counterpart to Team Leader will also perform the role of project coordination. This has been done in order to reduce the number of staff required for the project, and also alleviate the constraints of the Fisheries Department to furnish so many counterparts.

§ These counterparts will be identified in due course.

ANNEX 3: List of Equipment Currently Available at Monkey Bay and other
Aquaculture Stations

Equipment	Location	Quantity
Computers	Domasi	1
Computers	Monkey Bay	3
Ponds	Domasi	30
Boats	Monkey Bay	3
Compressors	Monkey Bay	1
Compressors	Domasi	1
Pellet machine	Domasi	1

It must be noted that both Domasi and Monkey Bay have space available, which can be utilized to build offices, concrete tanks, and any other installations.

ANNEX 4 : Project Design Matrix for the Pilot Aquaculture Centre

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<u>Overall Goal</u> Small scale market-oriented aquaculture of mpasa and ntchila promoted			
<u>Project Purpose</u> Aquaculture Production of mpasa and ntchila Species enhanced	At least 1 million fingerlings, and 1 tonne of mpasa and ntchila produced by the end of Pilot phase	Project Reports	
<u>Results/Outputs</u> 01 Research Centre for indigenous fish species set up and functioning effectively.	02 Research activities on mpasa and ntchila implemented		01.1 Construction and procurement made according to plan

<p>02.1 Research carried out according to plan</p> <p>02.2 1 million fingerlings of mpasa and ntchila produced by the</p>	<p>Project Reports</p>	<p>01.1 2KR Funds released by Japan Government, and Fisheries Dept. access them in Treasury</p> <p>01.2 Fisheries Dept. provides Project Manager</p>	<p>03 Training capacity for Malawi in the field of Aquaculture strengthened</p>
	<p>Project Reports</p>	<p>02.1 Fisheries Dept. provides Research Officers, and Technical Assistants</p> <p>02.2 Fisheries</p>	

end of the Pilot phase	scientists and commercial aquaculturists		Dept provides running and maintenance costs
02.3 1 tonne of table size mposa and ntchila produced by end of Pilot phase			
03.1 At least 3 Diplomas majoring in aquaculture, produced by the end of Pilot phase		03.1 Project Reports	03.1 As above
03.2 Fisheries Dept. Research Officers and TO/TAs master hatchery techniques		03.2 Scientific publications	03.2 Malawi training institutions set priority in aquaculture
03.3 Vocational courses for Fisheries Dept.		03.3 Diplomas; training courses; training manuals and booklets	

ANNEX 5 : Tentative Implementation Schedule

Activities	Year 1	Year 2	Year 3	Year 4	Year 5
1 PROJECT MANAGEMENT					
1.1 Construction	<----->				
1.2 Procurement of equipment	<-->				
1.3 Organize planning workshops	<--	<-->	<-->	<-->	<----->
2 RESEARCH					
2.1 Biological studies	<-----	-----	-----	-----	----->
2.2 Broodstock studies	<--	-----	-----	-----	----->
2.3 Hatchery operations	<--	-----	-----	-----	----->
2.4 Feed development	<--	-----	-----	-----	----->
2.5 Cage culture/lake restocking			<-----	-----	----->
3 TRAINING					
3.1 On-job training for counterparts	<-----	-----	-----	-----	----->
3.2 Student training					
3.3 Vocational training for fisheries Dept. scientists, as well as commercial aquaculturists		<-----	-----	-----	----->
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References

- Department of Agriculture and Fisheries. 1963. Annual Report of the Department of Agriculture and Fisheries for the year 1962. Fisheries Research, Part II. Government Printer, Zomba, Malawi.
- Department of Agriculture and Fisheries. 1965. Annual Report of the Department of Agriculture and Fisheries for the year 1964. Fisheries Research, Part II. Government Printer, Zomba, Malawi.
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- Msiska, D.V. 1993. Induced maturation and spawning of ntchilo *Labeo mesops* (Gunther) raised in fish ponds in Malawi. World Aqua. 24 (93) 276-282.
- Willoughby, N.G. 1979. African freshwater fisheries and their management. Fisheries management 10 : 159-168.

HISTORICAL FACTS ABOUT DOMASI

FROM 1920s to 1983
date

HISTORICAL FACTS ABOUT DOMASIACKNOWLEDGEMENTS

I would like to thank the following people for contributing information about Domasi. The last name is of an old villager living just next to Zaone compound. He is nearly 80 years.

MR D.P. CHIPETA

MR W. UTULE

MR NKOROMA ✓

In 1977 to 1979 Mr.D.P. Chipeta was the Principal of Domasi In-service Centre. He has therefore been requested to improve the book for our reference.

P.S. MZUMARA

MALAWI INSTITUTE OF EDUCATION

HISTORICAL FACTS ABOUT DOMASI

In the far past, the year is yet to be found, Domasi became a Sub-District Administration Centre. ✓

The Centre was created because Zomba was the Administrative capital of the then Nyasaland and hence there was inadequate room to administer Zomba District as such.

ESTABLISHMENT OF 3 GOVERNMENT DEPARTMENTS (Refer to Map on page 8)

Sometime in the 1920s there were three Government departments formed. These were: Education, Agriculture (Crop and animal husbandry) and Fisheries. According to the 1951 Domasi Map, Education and the District administrative offices are in block 1 of 189 acres: Fisheries department is in block 2 and has 39 acres of land, and finally Agriculture (animal and crop husbandry) was in block 3 and had 140 acres of land. This block was used for training ordinary people, proper methods of cultivation. Two grainaries were installed for storing grain after harvest. These two grainaries are still standing just next to the Road Supervisors house.

During this period, a number of things were done. The Agriculture department under Mr. Greg planted trees all over Domasi for soil conservation and shade. Mr. Greg also prepared a drain which runs from the foot of Zomba plateau to Domasi to divert water from Domasi river to Domasi and down to the Fisheries.

DISSOLUTION OF THE DEPARTMENTS

In 1953 The British Government declared Federation of Rhodesia and Nyasaland. As a result of this declaration the people in Malawi rose against the Colonial Government to demonstrate their dissatisfaction.

to this time, prisoners help the Institute to slash grass everywhere on the campus.

DEVELOPMENT OF THE PRISON STATION (Refer to Map on page 9.)

The establishment of the prison station has been mentioned already. The population of prisoners grew from time to time, hence it was decided that their activities at Domasi should increase to include farming. After the prison officer consulted the Principal to acquire land, almost all the land along Mpila stream from block 2 to the land along Domasi along the line M121, P28 and P29 was loaned away.

I do remember that some negotiations for more land were made between 1969 and 1970 when I was a member of staff in the Science Curriculum Development Centre. Since the Principal had had no plans for expansion, the prisons took over this land on permanent basis. However the Principal has continued to control the falling down of trees at Domasi. It is also convenient here to point out that the Principal loaned a number of houses at Bekete to the prisons. The loaned houses have been renovated and are well looked after by the prison department.

DEVELOPMENT OF FISHERIES DEPARTMENT

It has been stated before, that soon after the dissolution of the sub district Headquarters, the Fisheries department was weakened. However it revived and came into full force of activities in the 1960s. Since then, it has developed a great deal. Furthermore the Officer-In-Charge has expressed wish to expand fish ponds and staff houses even much further if there was land.

Land Problem for the Fisheries Department

Refer to Map on page 10

Although Fisheries department has 39 acres of land, the officer, has no direct control over it because of the power invested in the Principal. As a result of this control, the Principal gave the prisons all the land along

the Institution for Curriculum Development activities.

PRIVATE PROPERTY WITHIN THE INSTITUTE

Although Domasi revived and developed into an Institute of Education, the people who bought houses and land have been allowed by the Lands Department to maintain ownership. These people owned goats and turkeys which used to go all over the place looking for food. In many cases they destroyed ornamental shrubs and flowers planted around the Institute staff houses. In addition these people owned large maize plots in the Government land. As a result of this awkward situation, in May 1981, the Land Commissioner came at Domasi and convened a meeting of all people who owned land at Domasi. Among many other things which members agreed, the following are worth to remember.

- . The Institute of Education was authorised to utilise Block 3 up to the boundary just before Kanjedza stream.
- . Mr. Kumwembe who leased the land in Block 3 will be requested by the Lands Department to reduce his boundary up to Kanjedza stream.
- . People who own private residential houses within the Institute should keep their activities to the boundaries of their area. It was also pointed out that if their livestock are too many to graze around their houses, they should disappear from the station.
- . Under any circumstances the peace of the Malawi Institute staff should not be jeopardised by private settlers. If it is heard that the settlers are disrupting the peace of the Institute, the Government will think twice about their existence at Domasi.
- . Settlers were discouraged from applying for more additional land in the Institute.

- . If any other Government department at Domasi wants additional land, it should consult the authorities of the Institute who may provide the land.
- . In the case of Fisheries department the Officer-In-Charge was asked to submit his plans of expansion to the Land Commissioner who when he is satisfied, will direct all those departments which have encroached in block 2 to withdraw.

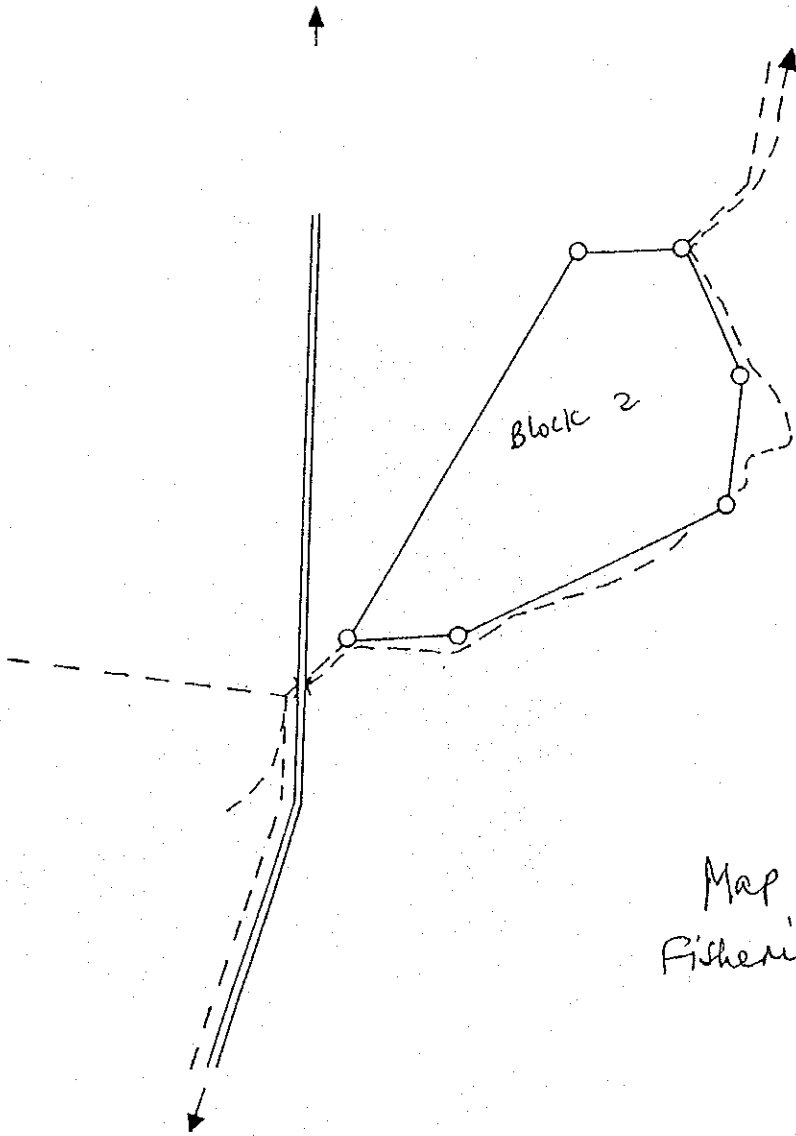
The resolutions stated above have remained in force up this day.

DOMASI RURAL HOSPITAL

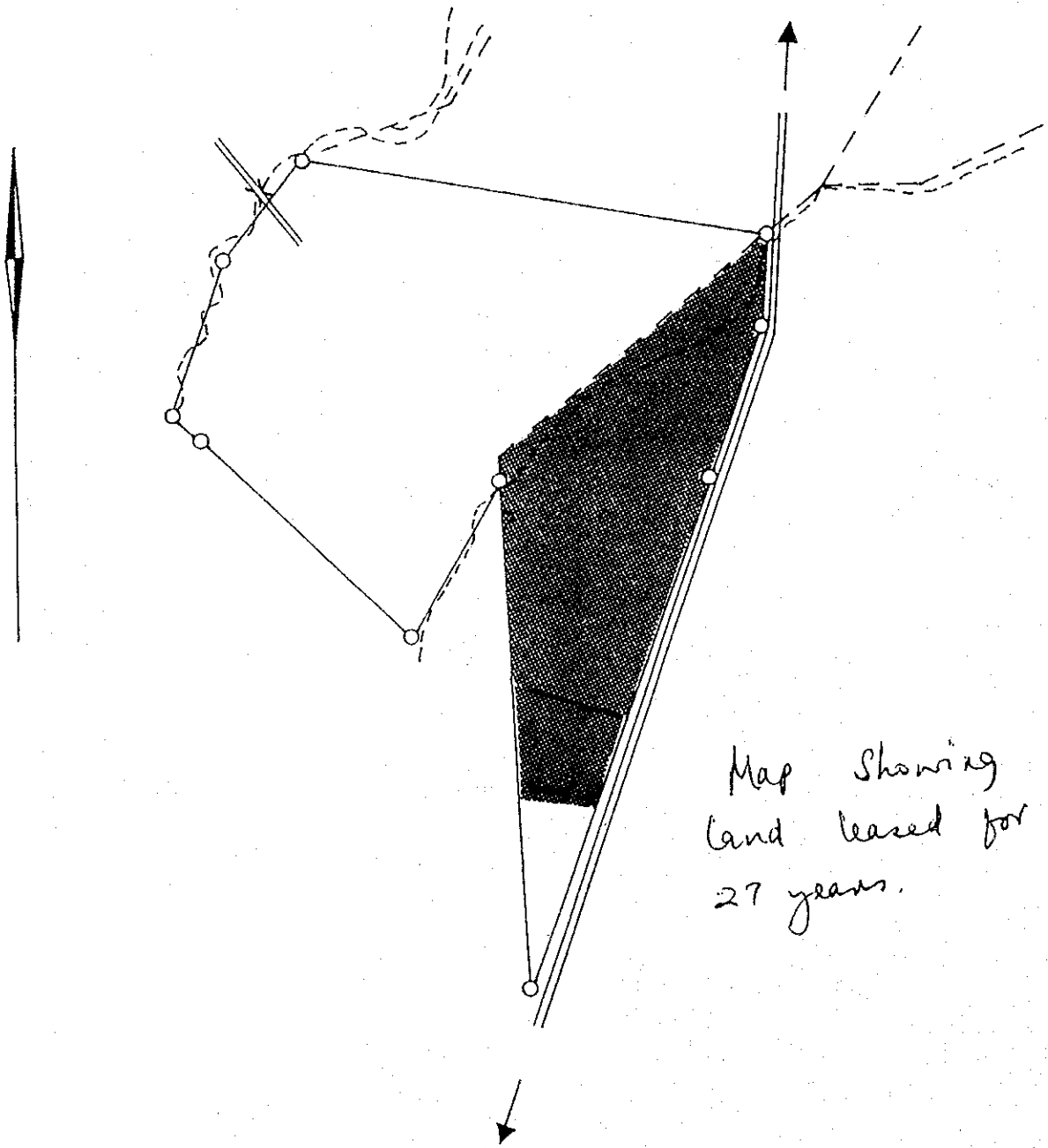
It is a great advantage to have a rural hospital at Domasi. Both the Institute staff and students are treated very well. One of the problems at the hospital is that they have two junior staff houses only and none of them is suitable for senior clinical officer. Since there is a shortage of houses, the Ministry of Health decided to abolish the post of a senior clinical officer at Domasi. Upon realising the importance of having a clinical officer at Domasi, the Institute loaned J14 to the Ministry of Health for Senior Clinical Officer.

Apart from J14, the Institute had found that J23 just next to S11 and two other houses in Bekete location were occupied by hospital staff.

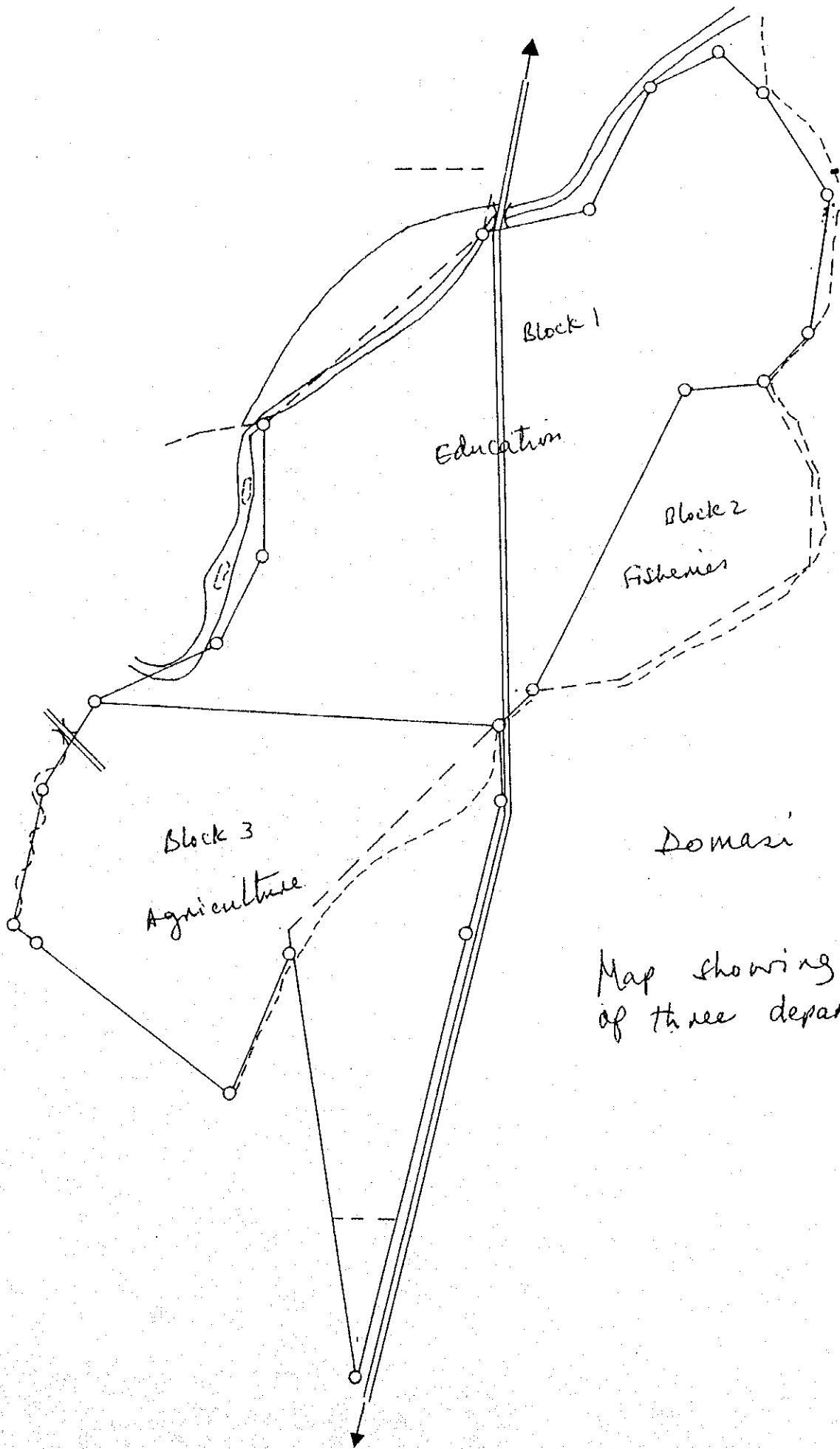
The Ministry of Health has renovated J23 to the point that the Ministry of Education and Culture or the Institute can hardly claim it back. Before, the house was loaned it had a brick floor and was grass thatched.



Map showing
Fisheries department



Map Showing
land leased for
27 years.



Block 1

Education

Block 2

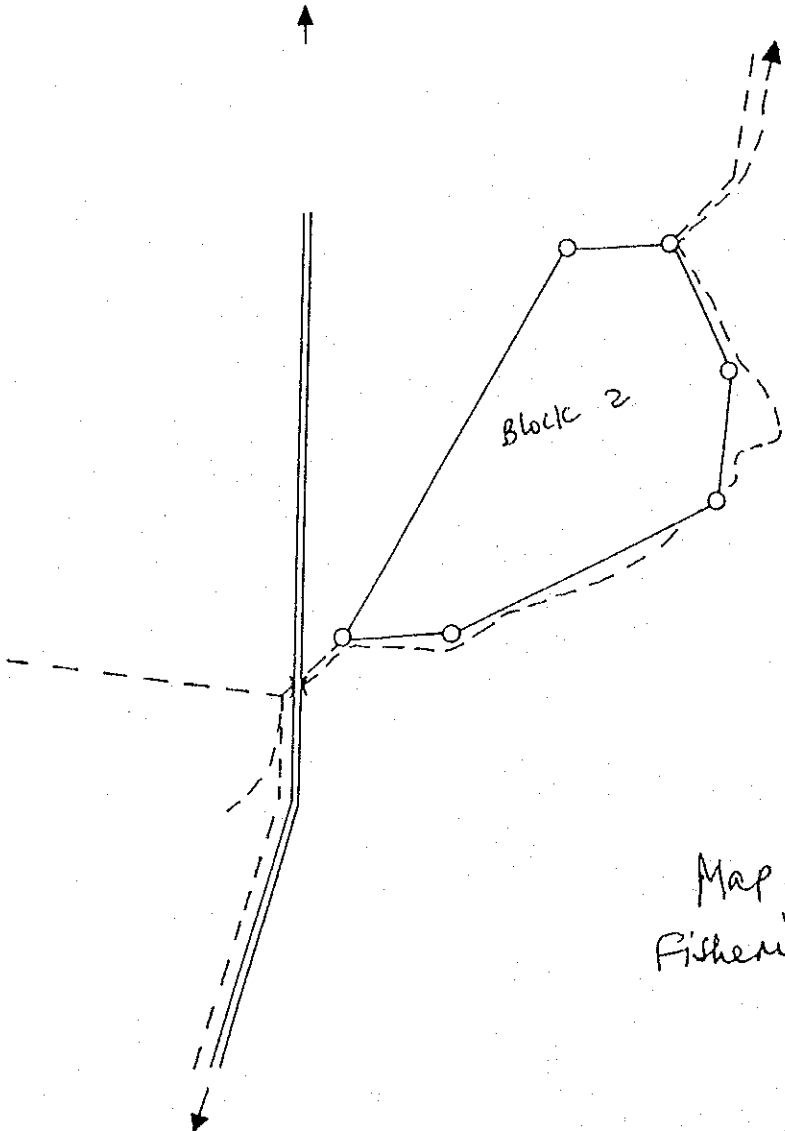
Fishes

Block 3

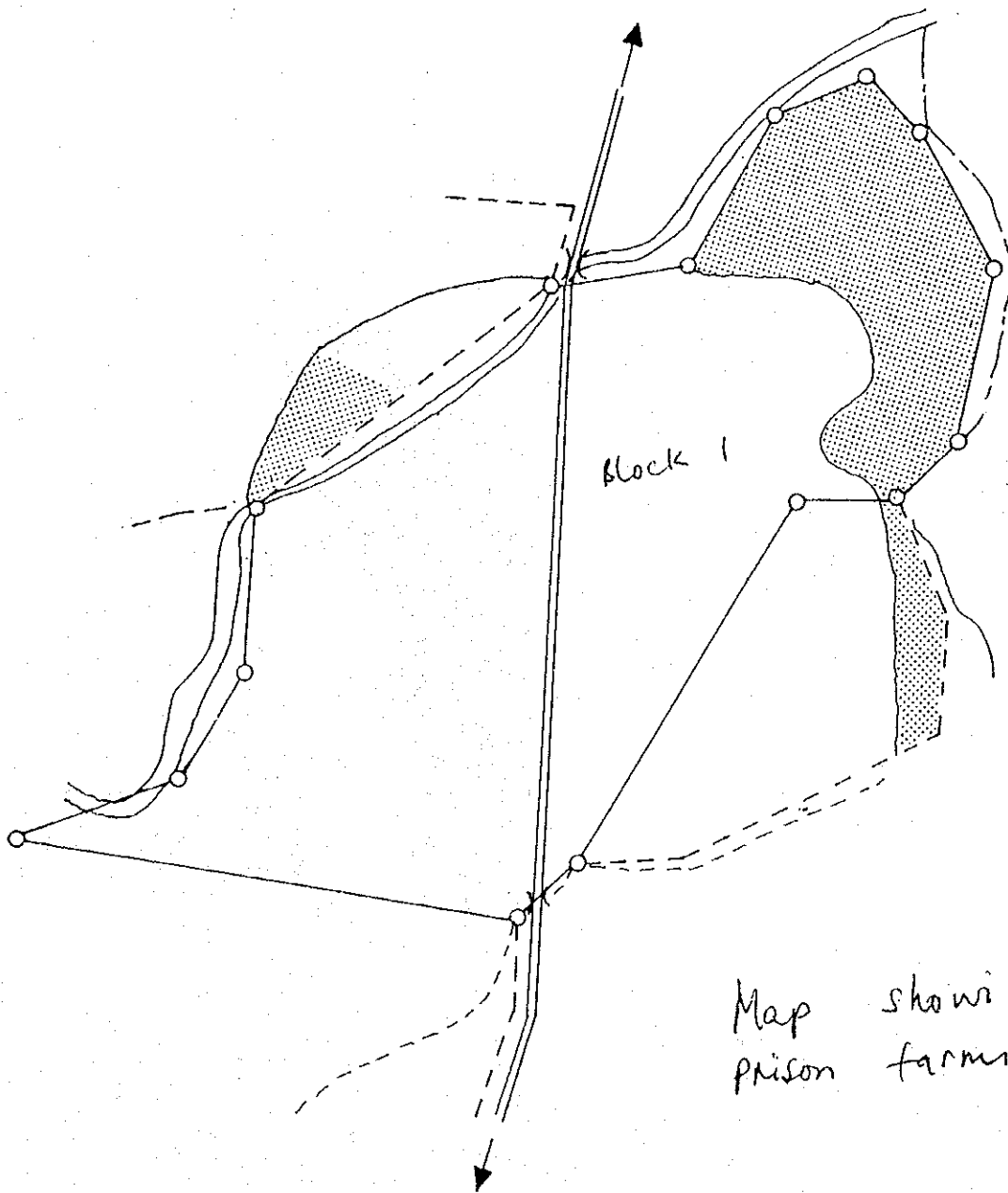
Agriculture

Domasi


Map showing position of three departments

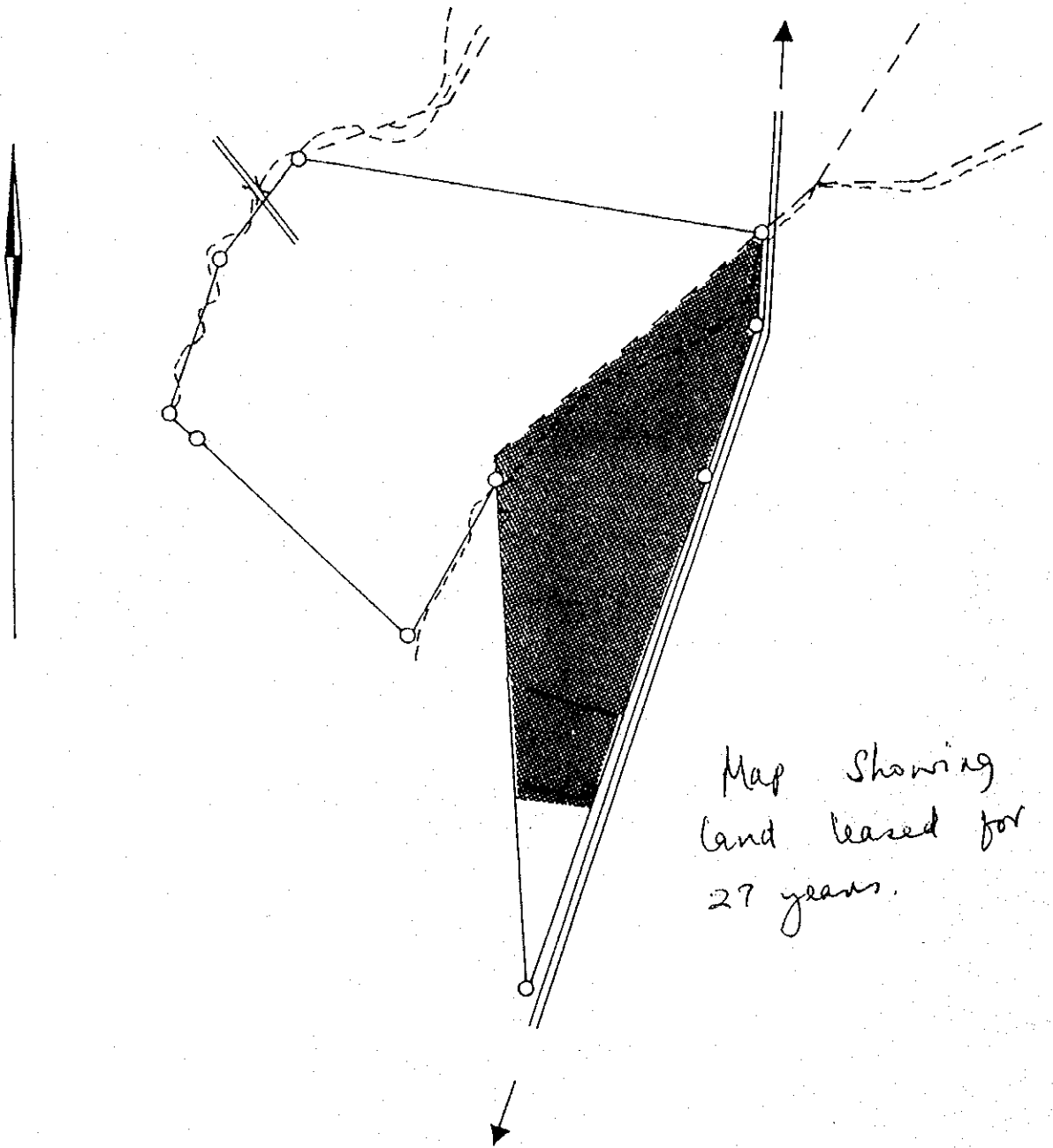


Map showing
Fisheries department



Map showing
prison farms.

 Prison farms



Map Showing
land leased for
27 years.

