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REPORT OF FISHCULTURAL INVESTIGATIONS  
IN THAILAND

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by Improved Fishcultures

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REPORT OF FISHCULTURAL INVESTIGATIONS  
IN THAILAND

USAID-Auburn University Project (AID/csd-1581) Increasing  
Fish Production by Improved Fishcultures - Phase I

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January 15, 1968

Introduction

The total area of Thailand is 128,094,720 acres with a population of 35,000,000 people. At present rates of increase, the population may be expected to double within approximately 20 to 25 years.

The freshwater areas,<sup>2</sup> both temporarily and permanently flooded are:

<u>Water Areas</u>	<u>Number</u>	<u>Hectares</u>
Large Impoundments	8	214,741
Irrigation Tanks	161	30,724
Rivers and Canals	47	119,199
Lakes and Swamps	11,030	215,833
Ponds	16,000	<u>3,500</u>
Total		583,997

In addition during the rainy period, 1,760,000 hectares are flooded on the Central Plain 3 to 5 months, giving rise to an

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1. This report is based on a survey made from October 9, through November 12, 1969.
  2. Data from Thailand Department of Fisheries.

extensive flood fisheries, where fish are harvested as the flood waters recede. Also, there are 4,000,000 hectares of irrigated rice lands, over 200,000 hectares of which are suitable for combined rice-fish culture.

Intertidal areas suitable for brackishwater fishculture are estimated at 166,000 hectares.

T. Backiel (FAO unpublished report) estimated total water area of rivers and canals as 220,000 hectares, or double the area listed above. He reports that the total annual catch of fish was estimated as follows by Lobell in 1955:

Marine	151,000 metric tons
Freshwater Commercial	62,000
Freshwater subsistence	<u>257,000</u>
Total	470,000

Official estimates on consumption vary from 8.7 kilos to 77 kilos per capita per year in various areas of Thailand, with highest consumption in the central plain area, where the Chao Phrya river system produces over 60 percent of the annual catch of freshwater fish. The average consumption of fish per capita per year is approximately 22.5 kg. (49.5 pounds). When subsistence catch of freshwater fish is omitted, average consumption per capita is estimated at approximately half the above figure.

Of the total freshwater catch, flood fisheries supply approximately 50 percent and the rivers an additional 15 percent.

Backiel (unpublished report) estimates fish production for various aquatic areas as follows:

<u>Source</u>	<u>Average kg./ha.</u>
Flood Fisheries	125
Reservoirs	50
Lakes	200
Ponds	400
Rice Fields	265

The average figure for fish consumption of 22.5 kg/capita/annum, indicates that 47 percent of the animal protein requirement or 15.6 percent of total protein requirement was derived from fish in Thailand. However, average figures are misleading as in the Central Plains, fish consumption furnished 54 percent of total protein requirements, while in Northeastern villages it furnished an average of only 6 percent.

#### Changes Affecting Future Inland Fish Production

The greatest change from the fisheries and agricultural standpoint occurring in Thailand is the rapid increase in impoundment of floodwaters in reservoirs for use in irrigation.

In the Central Plains, approximately 2,000,000 hectares of land is annually flooded sufficiently long to produce a crop of fish, which yields approximately 50 percent of the freshwater catch. Several reservoirs are presently constructed and many others are planned on all major and minor rivers to provide water for irrigation. This will have the effect of reducing the area normally

flooded and will reduce the fish crop from this source.

Compensating measures can be taken by constructing low dams to maintain water on important overflow swamp areas and these managed for fish and food production on a more intensive basis than at present.

In the North and Northeast, there are no flood fisheries and the impoundment of water on major and minor creeks and rivers will greatly increase fish production at these locations as a result of the great increase in areas of water in the reservoirs over those originally present in the creeks and rivers. An example of this can be seen at Ubol Ratana Reservoir on the Nam Pong River in the Northeast. An earthen dam impounds 41,000 hectares in an area where agriculture was practically impossible because of poor soils and inadequate water. A vigorous fishery has developed and just below the dam a new small town was established to service fishermen and fish dealers. At this landing 2.5 tons fresh fish are sold daily by fishermen, a total of 912 tons annually. There are 4 other landings on this reservoir that handle sizeable amounts of fish. The demand for fish still exceeds the supply and wholesalers promptly buy all the fish caught as the fishermen dock their boats. In addition, this reservoir will furnish, through a network of canals, water for irrigation of 47,000 hectares of land. It will then be possible to develop pondculture of fish on many farms by passing the irrigation water through a pond on its way to the paddy field. Also, a considerable

additional area may be suitable for raising rice and fish together in the paddy fields. To activate such a program will require research and extensive demonstration to farmers.

#### Program for the Northeast

This area of Thailand is a problem area because of poor soils and low rainfall. The dry period begins in late October or November and continues until the following April. During the period November-December, the rate of potential evaporation is approximately 100 mm per month, gradually rising to about 140 mm in January and February and increasing to approximately 175 mm in March (Figure 1). Records on rainfall and evaporation for Khon Kaen are given in Table 1. This type of information plus information on runoff and seepage rates of soils and subsoils is the basic data from which watershed-pond ratios can be calculated. However, no information is available in the Northeast on the latter factor. The low clay content and variability of Northeastern soils makes any general statement of the possibilities of constructing ponds that will retain a reasonable volume of water throughout the dry period difficult.

#### Soils of the Northeast

The underlying base to the entire area is conglomerate and sandstone rock, the permeability of which is unknown (Figure 2). Overlying this is a deep alluvial deposit, consisting of ancient alluvial deposits on the upper terraces and more recent deposits

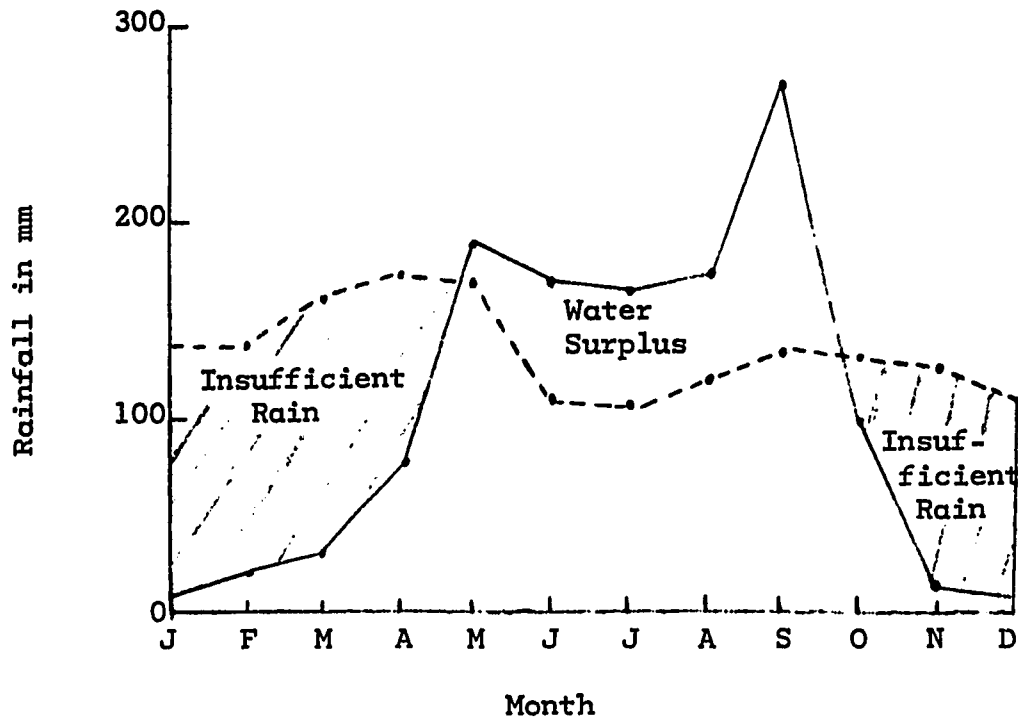


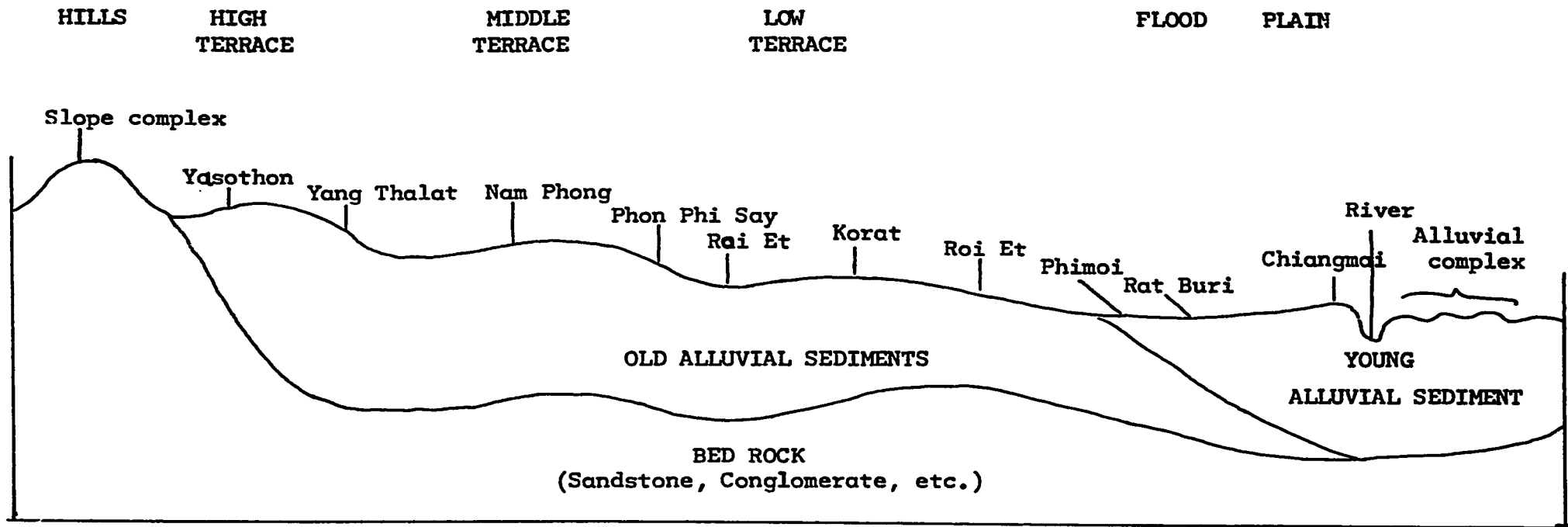
Figure 1. Average Rainfall and Potential Evapo-Transpiration, Khon Kaen, from Report SSR-51-1966, Soil Survey Division of the Land Development Department.



Table 1. Weather Data for Khon Kaen, Thailand, for 1966.

<u>Month</u>	<u>Total Rainfall (mm)</u>	<u>Mean rainfall per rainy day (mm)</u>	<u>Number of rainy days</u>	<u>Average Temp. (°C)</u>	<u>Average relative humidity (%)</u>	<u>Evaporation (mm)</u>
Jan.	Trace	0.0	0	25.39	63.08	188.0
Feb.	76.5	8.56	9	27.24	66.80	161.9
Mar.	56.1	5.10	11	29.91	62.42	247.7
April	58.0	5.80	10	30.77	65.83	235.5
May	354.6	11.4	25	28.67	78.10	172.6
June	137.1	4.57	15	28.73	76.02	178.7
July	152.5	4.92	20	28.68	77.18	186.9
Aug.	188.5	6.08	28	27.60	82.78	133.6
Sept.	167.0	5.57	16	26.72	80.79	132.5
Oct.	106.2	3.43	14	27.26	81.11	131.2
Nov.	11.3	3.80	3	25.61	70.41	180.4
Dec.	18.4	4.60	4	25.00	70.84	180.0
	<u>1326.2</u>		<u>155</u>			<u>2129.0</u>

SCHEMATIC CROSS SECTION OF LANDSCAPE IN N. E. THAILAND



Simplified from M S R 9, Soils of Northeast Thailand, Land Development Dept., Bangkok, 1964

Figure 2. Schematic Cross-Section of Landscape in N.E. Thailand.

on the lower terrace. Erosion has reshifted most of the upland materials until little of the uppermost terrace is left. In general, the topsoil is a sandy loam or sandy clay, with relatively little clay. The subsoils are generally sandy varying from 10 percent or less of clay to 60 or 70 percent. At depths of 1 to 2 meters, the presence of rounded pebbles indicate deposition by water.

In certain areas nests of pebbles made the subsoil quite permeable to water. The soils in general vary from highly permeable to slowly permeable. USOM soil specialists have listed the soils as to their suitability for pond construction, while admitting that there were no good criteria by which suitability for ponds could be predicted (Table 2).

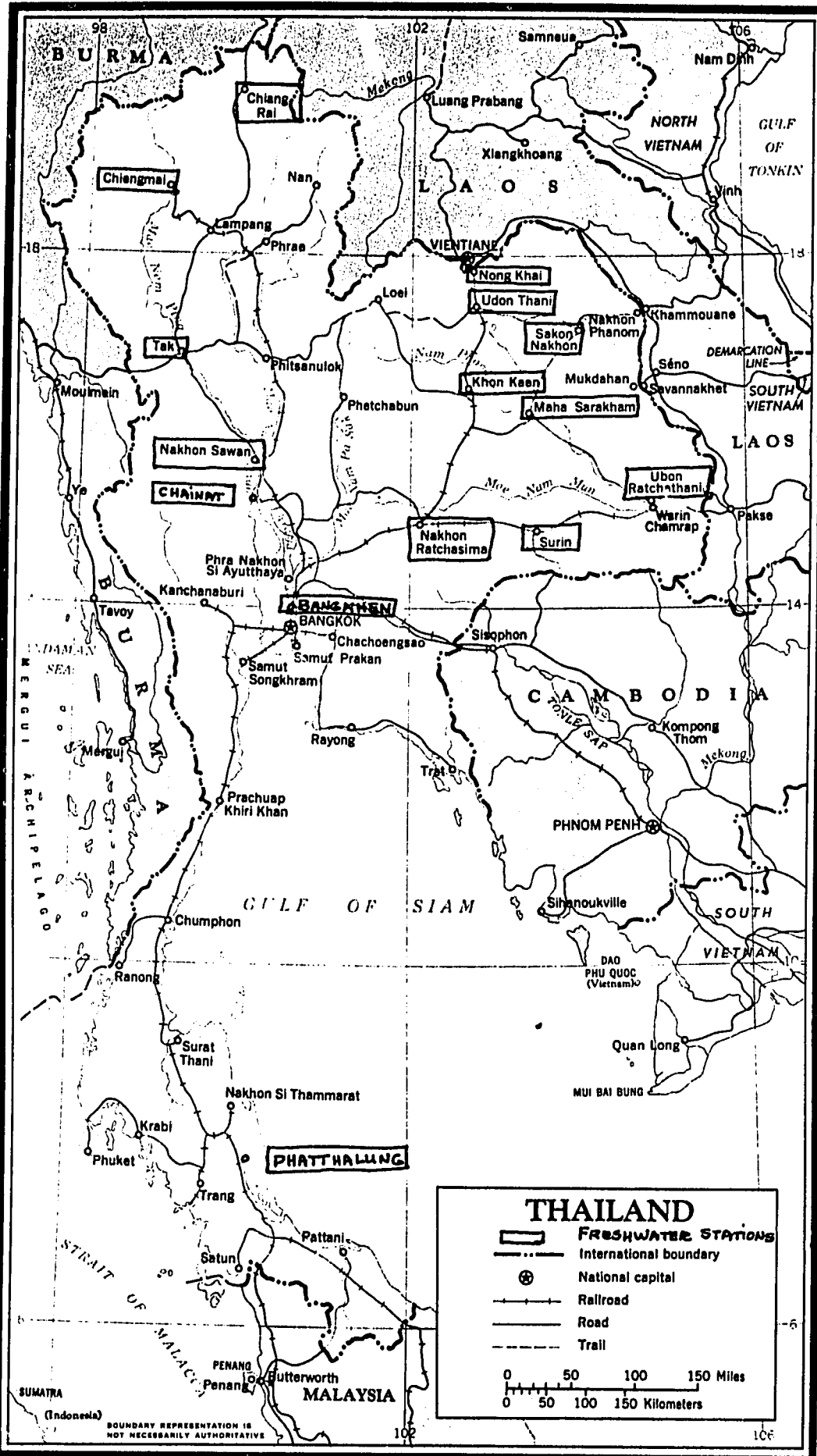
The prediction of suitability is principally based upon the clay content of the subsoil. A similar field criterion is used in the Southeastern U. S. by examining samples of subsoil at various depths as removed from a soil auger. The moist sample is compressed by hand into a tight ball; if sufficient clay is present to form a hard, firm ball, then the soil is suitable. However, if so little clay is present that the ball cracks open after release of pressure, it is not suitable because of too little clay or the presence of too much mica or other unsuitable materials.

Table 2. Suitability of Soils for Ponds.

Soils Series	Top Soil	Subsoil	Suitability for Ponds
Chiengmai	Alluvial	Brown loam	Poor; permeable
Ratburi	Alluvial	Clay loam	OK, except in driest season
Ubon	Gley, sandy	Loam-sand. Dries deeply, sandy-loam	No
Udon	Saline, gley	Sandy-loam	No
Korat	Podzolic	Moderately-permeable	Temporary ponds
Sakorn	Alluvial, variable	Variable, slowly permeable	Poor
Tha Muong	Alluvial variable	Variable, slowly permeable, silt-clay	Poor - Temporary ponds
Chainat	Alluvial	Slowly permeable silt clay	Good
Nakhon Phanon	Gley	Silt-clay	Good
Ta Thun	Grey-brown loam	Brown to light grey clay	Good

If the subsoil is suitable for pond construction, then the rate of seepage will be regulated by the depth of this subsoil and the permeability of the underlying formations. Unfortunately no research-tested data are available to allow more than an educated guess on the part of the soil analyst or by persons making field examinations with the soil auger as to the rate of seepage to be expected. Considering the importance of prediction of seepage losses for ponds, reservoirs and irrigation canals in various developing countries, it is recommended that research be set up to develop this information together with research on methods of reducing seepage permeability in various soils by compaction, puddling, chemical treatment, asphalt sprays and other methods. This could readily be done in conjunction with the fifteen Department of Fisheries Stations in Thailand which are well distributed over the country (Figure 3). Figures on loss to seepage over a wide range of soils during the dry period can be readily measured in these ponds by measuring total drawdown, subtracting loss by evaporation and adding rainfall upon the pond surface.

During the Phase I investigation on this Project, soils and subsoils were examined by soil borings at Chiangmai in the North, at Bang Poo below Bangkok along the Gulf of Thailand, and in the Northeast in the vicinity of Khon Kaen, Udon Thani, Nong Kai, Surin and Ubon. Borings were made at ponds holding



Base 55533 1-67

Figure 3. Location of Freshwater Fisheries Stations.

water, at ponds that dried up, along roadside ditches that did and did not hold water, in good rice fields and marginal rice fields. The soils were quite variable near any one location throughout the North and Northeast, while practically all were suitable heavy clays in the Central and South.

In the Northeast, in general, soils producing good rice all appeared more or less suitable for pond construction. Marginal riceland areas proved to have so little clay in the subsoil that they appeared suitable only for temporary ponds that could not be expected to retain water throughout dry periods unless techniques could be developed to reduce the rate of seepage as suggested above. Near Surin, areas with sufficient clay at depths below 30 to 50 cm. were found at the Fisheries Station, and in other nearby sites tested. From Surin to Nong Waeng, roadside ditches and railroad borrow ditches in mid-November were generally holding water indicating a considerable amount of clay and low permeability.

At Ubon, however, the Fisheries Station was found to be built on sands extending down to at least 4 meters below the surface, although less than one hundred meters away was a permanent reservoir operated by the Irrigation Department. The Station ponds could be kept full only by constant pumping from the reservoir. Below the reservoir, mixed soils were found, some with heavy clays on the surface underlain by sands and others with a reverse situation. Where clays were present in either location, no reliable criterion was available as to how deep a clay deposit was necessary

over more permeable underlying formation for construction of reservoirs that would retain adequate water throughout the dry period. From past experience, a depth of 2 meters of slowly permeable soils would appear a minimum requirement.

Most locations near Ubon were found to have deep sands with slight clay content, apparently useless for pond construction, and the district name Warin Chamrat meaning "Full of Water", appeared a misnomer. However, it was found that the water table in many areas was quite high, making the name more meaningful. East of Ubon, the water table was 110 cm. below the surface even on slight slopes. The depth of the sand-bearing strata could not be determined by the soil auger. At Ban Tart, the water table was above the surface, making possible permanent ponds by use of low dams and excavation in an area of deep sands. Several of these were commercial ponds producing carp with artificial feeding with rice bran, broken rice and termites. At distances of 15 kilometers from Ubon, areas were found with suitable clay soils within 40 cm. of the surface. In fact the names of some of the small villages were indicative of this fact; for example Ban Pa Warin, meaning "Houses Near Water" indicated where a swamp lake used to exist.

The conclusion reached was that ponds could be successfully constructed in many areas of the Northeast. Also even temporary ponds that dried up before the end of the dry period would be



quite useful as water is deficient in the area and a crop of fish could be produced if the pond held water for at least 5 months. In fact a crop could be raised in 3 months under proper conditions in this climate.

Another reason why even temporary impoundments would be desirable is because kanaf is raised in the Northeast for the production of jute fibre. At the beginning of the dry season, this crop is cut, tied in bundles and immersed in streams, puddles, roadside ditches or any available water for retting. The resulting decay pollutes the water to such an extent that it is not usable for fish, watering livestock or for any other purpose. Excavated earthen vats could be constructed, and supplied water by gravity from either temporary or permanent reservoirs and thus keep pollution out of other water supplies.

Because of the necessity for water, it would be desirable to set up a program of experimental pond construction to more fully explore the possibilities in the area. If this is done, a survey team should first examine the subsoils by boring down to depths of approximately 3 meters, retain samples of soils for analysis and make an educated guess as to the suitability of the site for pond construction. Test ponds should be constructed on sites considered barely possible, fair and excellent. Measurements should then be made on loss of water by seepage during the dry season for several years. Methods of compacting the bottom

soils, puddling, and other treatments to reduce seepage should be tried and evaluated. This information would be widely useful in very many developing as well as "developed" nations.

#### Coastal areas

The coastal areas along the Bay of Thailand are also problem areas due to low income and penetration of communist groups from Cambodia and Malaya. In this area there are approximately 200,000 hectares of intertidal zone that could be largely developed into brackishwater and seawater ponds for culture of shrimp, fish, oysters and other seafoods. Individuals have already developed part of the area into private ponds for culture of shrimp. They harvest from 50 to 200 kg. shrimp per hectare with a culture that consists only of letting the small shrimp into the ponds while the ponds are being filled, closing the gates and harvesting the shrimp as they grow to a desirable size. Some species of fish gain entrance as fry and also are harvested. However, no research is being conducted to increase both production and income, through development of improved culture techniques, fertilization and feeding. Results of fertilization and feeding elsewhere indicate that productions of 1000 kg. shrimp or more per hectare per year are possible. For development of this food-producing potential and improved standards of living in the area, it is proposed that a brackishwater-seawater fishculture research station be established on the Gulf of Thailand

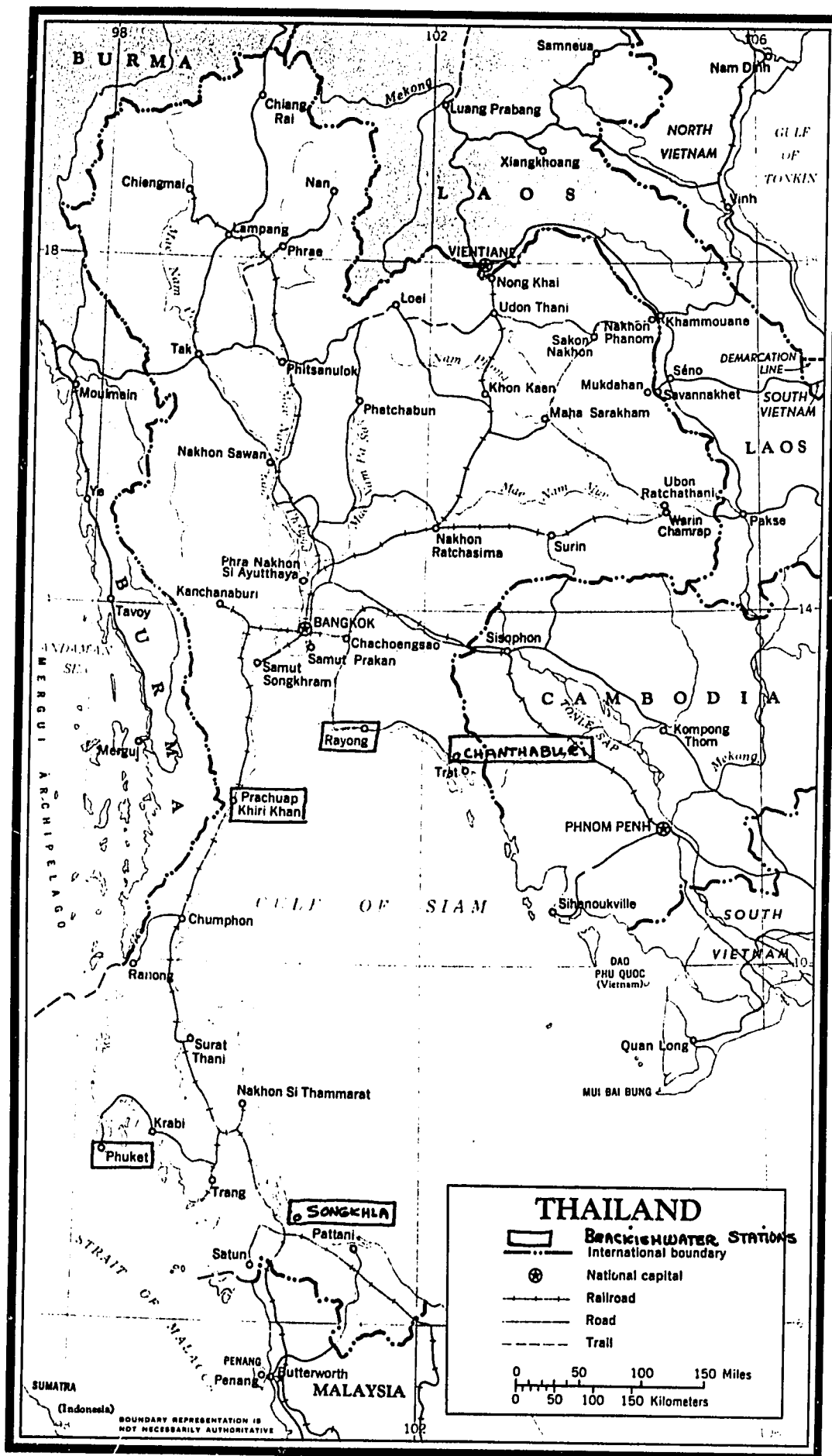
at a site to be selected. There was not sufficient time on this survey to select and plan such a station.

The Department of Fisheries of the Ministry of Agriculture

Thailand Department of Fisheries under the Ministry of Agriculture is well administered and is carrying out a good program for increase in fish production. We would rate it as one of the best in Asia. It is divided into a Marine Section and an Inland Fisheries Section. The latter has research and management dealing with fishcultures in fresh and brackish-water, flood fisheries, reservoirs and large impoundments and riverine fisheries. The Department operates a main Research Station at Bangkok on the campus of Kasetsart University, 14 additional Freshwater Stations and 2 Brackishwater Stations.<sup>1</sup> These are well distributed throughout the country (Figures 3,4). Their function is to conduct research on various phases of fishery management and to rear fish for stocking public and private waters. Within the Department at Bangkok and located at the Fisheries Stations are construction engineers who plan and supervise construction of ponds and reservoirs for public and private usage and also construction of hatchery and research facilities. They assist in the Department of Fisheries programs for construction and renovation of village multi-purpose reservoirs supplying water for fish production, domestic usage, livestock watering, and other purposes including retting of kanaf. Under this program, the engineers plan the reservoir with the village

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<sup>1</sup>These Brackishwater Stations have no research facilities for the development of seafood cultures.



Base 55533 1-67

Figure 4. Location of Brackishwater and Marine Fisheries Stations.

leaders, the Department of Fisheries supplies cement, pipe and other materials and the village furnishes the labor.

At the various Fisheries Stations, but especially in the Northeast, the Department has placed many extension fisheries specialists whose task is to help farmers learn to raise fish to supplement their protein-poor diet and for profit. The Department explained that the extension specialists lived at and worked out of the Fisheries Stations so that they would know intimately new fisheries developments and so that they and the research biologists would work together as a team. This would appear to us also as the best possible procedure to get effective extension of fishery knowledge. At the Udon Fisheries Station, for example, there is stationed 2 fisheries biologists, 1 fish propagation officer, 4 engineers and 13 extension specialists.

The heavy staffing of extension specialists and engineers was to serve several provinces along the Mekong River in the Northeast where communists had infiltrated from Laos and started a program of harassment. The farmers in this area of poor soils are quite poor. The program being carried to these farmers is principally that of raising rice and fish together in the same paddy. This program was selected because the farmers already have rice fields, but do not have ponds. They are furnishing the farmers with the fish for stocking and teaching them the

techniques of rice-fish culture by demonstration. In central locations the extension personnel select privately owned paddy fields, then stock and manage these themselves, bringing farmers in to see the results. In most instances, the paddy fields are owned and operated by farmers with advice from the extension specialists. The farmers obtained from 10 kg. to 500 kg. carp per rai (55 to 1250 pounds per acre) along with rice. The higher figure was produced where farmers fertilized the paddy with manure and fed the fish supplementally with termites, broken rice and rice bran. The program has not been going long enough to evaluate the results, but they have now gained the confidence of the farmers in the area because they work with and visit them in their homes. This they have accomplished at some personal risk to themselves. These extension workers stated that it would help them in their task if they could get more training in advanced methods of fish-culture. Their training in fisheries consists of a short period of training by the Fisheries Department and what they learn from the fisheries biologists at the Station.

While considerable research is being carried on in the main Fisheries Station at Bangkhen, little research on improving fishculture is being conducted presently at the outlying stations. Their principal function has been that of spawning fish and raising fingerling fish for stocking. Consequently, the extension

specialists at these stations learn how to raise small fish, but have no experience with raising fish commercially to harvestable size. They gradually learn through the success and failure of their demonstrations. They could work more effectively if research on increasing fish production was being carried on at their Station and if each of them could raise one or more crops of fish at the Station before he had to demonstrate to farmers just how to do this.

While little research has been done in the past at the outlying Stations, some is presently being carried on with respect to rice-fish culture and with pelleted feeds for fish. The personnel at all the Stations were quite eager to find what they could do in research and to get the training necessary to do it. Most Stations were staffed with energetic young men who wanted to do their best.

In all the Freshwater Fisheries Stations, there is a total (Table 3) of 308 earthen ponds with a total area of 34.2 hectares of water and 217 concrete ponds. While most of the ponds are currently used for fish breeding and raising fingerlings for stocking, the survey indicated that with improved cultural methods and wiser use of fish for stocking, almost half the ponds could be devoted to research on how to increase fish production. Consequently, the best plan for rapid progress appears to be to develop the Central Bangkok Research Station as the main "Research Station" by more than doubling its size,

Table 3. Freshwater and Brackishwater  
Fisheries Stations of the Thailand  
Department of Fisheries

Station	Area (Acres)		Number of Ponds		Personnel			Expansion Possible (Acres)
	Land	Water	Cement	Earthen	Technical	Extension	Laborers	
<u>Freshwater</u>								
Bangkhen	7.4	4.6	24	30	7	6	58	5**
Chainat	17.0	3.7	15	13	2	1	21	2***
Chiangmai	25.0	8.4	9	30	2	3	10	---
Chiang Rai	14.8	11.9	20	41	3	3	30	---
Khon Kaen	33.6	14.0	38	52	3	2	12	---
Maha Sara-kham	2.2	1.9	13	19	2	1	11	---
Nakhon Ratchasima	9.2	6.8	1	9	2	1	9	---
Nakhon Sawan	7.2	6.8	---	19	3	3	52	---
Nong Khai	51.2	---	20*	10*	1	4	8	---
Phatthalung	326.8	41.2	2	18	2	1	3	---
Sakon Nakhon	33.0	8.4	33	47	2	11	37	---
Surin	29.2	8.4	20	16	2	2	20	4.8***
Tak	60.0	3.2	---	---	3	2	17	---
Ubon Ratchathani	23.4	1.9	21	9	2	7	27	---
Udon Thani	4.2	3.6	24	22	2	13	18	5***
<u>Brackishwater</u>								
Chanthaburi	76.0	64.0	---	9	2	1	8	---
Prachuap Khiri Khan	55.6	15.6	---	17	2	1	8	---

\*To be constructed in 1968

\*\*Acreage may be obtained from Kasetsart University

\*\*\*Acreage for expansion now owned by Fisheries Department



number of ponds and research facilities and to add ponds and facilities for research to selected outlying Stations. Coordinated plans of research should then be developed assigning portions of the research to those Stations where it can best be done, and using all the Stations to test under local conditions advanced fishcultural techniques developed at the main Station or elsewhere.

Since the main Station would be at Bangkhen on the campus of Kasetsart University, it could serve the multiple purpose of providing training for students in the School of Fisheries, involving the professors in research on fish production and processing, and providing the techniques for improved fishcultures through research. Since the Station belongs to the Department of Fisheries, this would serve also a very useful purpose of leading professors and Fisheries Department personnel into cooperative research and mutual understanding. It would be helpful if money were available in the Department to hire both professors and students to conduct part-time research, thus keeping direction of the research under their leadership. This was discussed with the Dean of the College of Fisheries and with the Director-General of the Department of Fisheries, each of whom agreed that this would be desirable.

Expansion of the Main Station at Bangkhen

This is in the edge of Bangkok at Bangkhen where Kasetsart University is also located. In fact, when the University was established it took over part of the lands and some of the ponds previously operated by the Fisheries Department. At present there are 38 ponds, which are being subdivided into 59 ponds to allow more replications for research. This was necessary as the Station had no more land to expand into. The total numbers and sizes of ponds after the renovation will be:

<u>Area of ponds, m<sup>2</sup></u>	<u>Number of ponds</u>
50	24
200	18
300	12
900	2
<u>1,125</u>	<u>3</u>
Total 13,575	59

The 300 m<sup>2</sup> ponds are being constructed with concrete sides to save space. However, even with this renovation, there will not be enough ponds for adequate research. There is the possibility of acquiring some adjoining land from the University that would enable construction of an additional 50 ponds. If possible additional lands nearby should be acquired to make possible expansion to 200 experimental ponds and adequate laboratory research facilities. If this is not possible, then moving the main research Station to another location must be considered.

It is suggested that under these conditions, an area south of Bangkok on the eastern side of the Gulf of Thailand below Bang Poo be considered where a brackishwater station could be built on the west side of the road and a freshwater station on the east side with common laboratories serving both. Such a combined station would be possible in that area. Brackish-water ponds could be constructed to fill at high tide and drain at low tide. Freshwater ponds could be constructed to drain by gravity, but filling would require pumping with a lift of not over 2 meters.

Expansion of Outlying Inland Stations

The following table gives the number of ponds, their area and building construction for needed expansion for all the Inland Stations.

<u>Station</u>	<u>Added No.</u>	<u>Pond Size (m<sup>2</sup>)</u>	<u>Cost of Ponds</u>	<u>Buildings</u>
NORTH				
Chiengmai	20	500	\$ 20,000	
Chieng Rai	20	500	20,000	
Chainat	20	500	20,000	
NORTHEAST				
Khon Kaen	50	500	50,000	
Surin	34	500	34,000	\$10,000
Udon	28	500	28,000	20,000
Nong Khai	40	500	40,000	
			<u>\$212,000</u>	<u>\$30,000</u>
				\$212,000
				<u>30,000</u>
				Total---- <u>\$242,000</u>

Financing of Proposed Expansion:

Of the above suggested expansion, the Department of Fisheries indicated that this probably could be done from their funds at Bangkok, Chiangmai, Chiang Rai, Chainat and Nong Khai over a period of 2 to 3 years, leaving principally Khon Kaen, Surin and Udon in the Northeast where additional help would be necessary.

Additional funds would also be necessary for the development of the proposed Brackishwater Station. No plans have been prepared for this Station as a suitable site has not been located. Sites are being investigated by the Department of Fisheries and the final selection and planning will require a subsequent trip for a period of approximately 3 weeks.

Assistance Considered Most Desirable by the  
Department of Fisheries

The Director-General of the Department of Fisheries and the Chief of the Inland Fisheries Division both stressed that the principal way in which this project could be of great assistance to them was to provide from Auburn University periodic visits every 6 months of 2 or more experts in various fisheries fields to help them in planning their research for the Central Main Station and the outlying Stations, and to take part in training programs. This would require approximately 6 weeks per year for the visiting team of experts.

An alternate proposal was to supply one specialist in pondculture full-time in Bangkok to assist in research planning, with one to two shorter visits per year by research specialists from Auburn for special problems (e.g. such as fish disease, fish nutrition) when assistance was needed, and for assistance in inservice training.

They also needed additional advanced training for their research personnel. In recent years no fellowships were available to them except for training of personnel in extension and in these programs too much of the trainees time was spent abroad in courses dealing with extension, with very little training in fisheries. Several fellowships were available if an employee would quit his position with the Department and work at the Khon Kaen Agricultural Research Center. Certainly this is an undesirable situation. For example, the Head of the Fisheries Station at Ubon in the Northeast made the best grades of all candidates for the fellowships, but to receive it he would be required to quit his job as head of a Fisheries Department Station in the Northeast to work in fisheries at the Agricultural Research Center. Since he is a good man in his present post, such a change would have been unfortunate. Fellowships should be made available for training of selected personnel within the Fisheries Department.

Another field in which they hoped this Project could be of assistance was to provide facilities at Auburn for statistical evaluation of research data and assistance in preparation of research publications, especially where the report must be in English for international usage. The Department has many very valuable data on the composition of fish populations in reservoirs, swamps, and rivers that would contribute greatly toward understanding fish population dynamics in this area. This Project should set up personnel and procedures whereby such services can be provided for the various host countries to speed up exchange of research information.

Kasetsart University College of Fisheries

This University must provide the basic college training for the personnel who will make effective use of research facilities to devise improved fishcultural techniques, as well as for those who will perform the difficult task of persuading fishfarmers and fishermen to put these new techniques into practice. The outline of courses to be followed is good, but quality of training is a function of the excellence of teaching, not of outlines. There are 22 staff members, 1 with the Ph.D. degree, 7 with M.S. degrees, and 14 with the B.S. degree.

The College has 4 departments: Aquaculture, Fisheries, Fishery Products and Fishery Biology. The enrollment is approximately 200, with 28 students graduating annually.

The staff does little research. Six of the staff members were on educational leave.

Since the staff members are not actively engaged in research in the fields they teach, nor have they had previous experience by working in these fields, they principally can pass on to students only a portion of what they themselves learned as students. The only exceptions to this are the very few staff members who continue to learn over their lifetime by continuous study and reflection. Without research or practical experience in the field, even this group will find evaluation of the great masses of words masquerading as scientific papers difficult-almost impossible. An effective teaching staff must have both physical and mental competence in the subjects taught which can best be obtained by actively working on research problems in these fields.

The staff at Kasetsart University greatly needs the stimulus to continue to learn that opportunities to engage in research related to increasing fish production and utilization would supply. This plus more advanced training abroad for selected personnel is needed to upgrade the training students will receive.

Further upgrading of student training will be attained if facilities are available to involve the students themselves in some research before graduation. Experience such as this has often transformed a poor student into an excellent one.

It is for these reasons that the Bangkok Station of the Department of Fisheries should be expanded so that students and professors may engage in meaningful research in cooperation with the Department of Fisheries. If this expansion is not possible, then consideration should be given to establishment of a new Central Fisheries Station elsewhere by the Department, allowing use of the present research facilities by the University College of Fisheries for research and teaching. However, if this were contemplated, it would only be useful if the College of Fisheries were allotted sufficient money for proper operation of the Bangkok Station.

The Khon Kaen Agricultural Research Center

This Research Center was set up outside the regular departmental divisions of the Ministry of Agriculture to rapidly solve agricultural problems of the Northeast, except for livestock which is in a separate division at the same location. Active research on the 300-acre farm deals in varying degrees with crops, forestry, entomology, fisheries, plant pathology, and animal husbandry as related to crops. The Center is in its third year of operation.

The Center is not connected with any University and its work is equivalent to that of an Experiment Station in the States. Its general directive is to assist the Ministry of Agriculture,



to conduct research and to coordinate research activities in the Northeast. At a later date, an Extension Service is contemplated. The Center, under the USAID-University of Kentucky Contract, is also to employ a Fisheries Expert, which will be outside the Fisheries Department. The Fisheries Department has had some pressures to establish a research unit there, although they already have a Fisheries Station at the city of Khon Kaen about 5 miles away. Present research at the Agricultural Center deals with rice-fish culture conducted by an employee of the Fisheries Department in cooperation with the Center. The soils at the Center do not appear suitable for a fisheries research center and water supplies there are limited.

We considered the possibility of establishing fisheries research under the Center, but do not believe this is either feasible or desirable. The Department of Fisheries has Fisheries Stations already established throughout the Northeast as well as in other parts of Thailand (Figures 3 and 4) and the trained personnel to operate them. It will be less costly to expand certain of these stations and help organize all the stations into a research and training organization within the Department of Fisheries. They are already doing in a very creditable way the things that need to be done within the limits of their present resources and training. If the program herein recommended is approved, then under this Project we will endeavor to set up cooperation with fisheries personnel located at the Center.

Recommendations for Fishculture Project  
in Thailand

Integration of the 15 Freshwater Fisheries Stations of the Thai Department of Fisheries into an effective research organization to develop advanced fishcultural and management methods by:

- a. Expanding the Fisheries Department's Bangkok Station located at Kasetsart University into the Main Research Station to provide the necessary research data and to involve the Fisheries Staff and students in research in cooperation with the Department.
- b. Expanding the number of ponds available at selected field stations in the Northeast and North where supplementary research may be carried out, and where extension personnel may be trained.

To train research and extension personnel by periodic short courses in which the Auburn Staff will participate at one or more of the Stations yearly.

To make available fellowships for advanced training of research, extension and teaching personnel.

To locate and establish a Brackishwater Research Station for development of management methods for seafoods culture in the 500,000-acre intertidal zone along the Gulf of Thailand.

To coordinate and facilitate the work by providing from the Auburn Staff a group of specialists several times yearly as advisors to the Department of Fisheries to assist in organization and planning of research and to advise on various phases of the work.

To make available at Auburn assistance in research data processing, editing and preparation of research and extension publications for the host country.

Estimated Costs

WITHIN THAILAND

Capital costs (Preliminary Estimates)

Freshwater Stations

Pond and building construction \$242,000

Brackishwater Station 200,000

Total \$442,000

Annual operating costs \$200,000

Annual, fellowships for training at  
M.S. and Ph.D. levels (4 annually) 20,000<sup>1</sup>

Total \$220,000

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<sup>1</sup>This would increase to \$40,000 during second and succeeding years as 2 years would be required for training each participant.

EXPENDITURES AT AUBURN

Staff participation	\$30,000
2 staff members to Thailand 2 weeks	
3 staff members to Thailand 3 weeks	
Travel	<u>15,000</u>
	\$45,000
Consultant from 3rd country or U.S. to assist in training	\$ 5,000
Data Processing, Research and Extension Editing <sup>1</sup>	
Staff participation	\$30,000
Typist	4,000
Data Processing	2,000
Other	<u>5,000</u>
	\$41,000
Total	<u>\$91,000</u>

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<sup>1</sup>This would include costs for the three host countries - Thailand, Philippines and East Pakistan, but does not include costs of publication.

RESEARCH ON SEEPAGE RATES IN VARIOUS SOILS AND  
METHODS FOR ITS REDUCTION

Basic research on methods of reducing permeability would be conducted at Auburn and studies on seepage rates and effect of various treatments for its reduction will be measured in ponds on soils in Thailand and East Pakistan. (See page 5 to 15 of this report.)

Cost at Auburn University<sup>1</sup>

	<u>Initial</u>	<u>Annual</u>
Research equipment	\$50,000	
Staff		\$ 45,000
Non-expendable equipment		15,000
Expendable supplies		20,000
Travel		20,000
Overhead		<u>18,000</u>
Total	\$50,000	\$118,000

Cost in Each Host Country

Travel		\$ 5,000
Non-expendable	\$80,000	20,000
Expendable		20,000
Staff		<u>15,000</u>
Total	\$80,000	\$ 60,000

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<sup>1</sup> Watershed areas, tractors and other pond construction equipment for the research at Auburn is presently available at the Fisheries Research Unit of Auburn University Agricultural Experiment Station.