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REPORT ON  
FISHERIES TRAINING IN RESEARCH AND EXTENSION  
AT THE  
FISHERIES STATIONS  
OF  
THAILAND

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USOM/Thailand PIOT 493-180-3-80413

A.I.D. -  
Reference Center  
Room 1656 NS

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September 19, 1969.

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Project: AID/csd-2270. Increasing Fish Production Through Improved  
Fish Cultures.

USOM/Thailand PIOT 493-180-3-80413. Fisheries Development.

1.0 INTRODUCTION

INTRODUCTION : This training trip was made under the general directive to furnish consultant and advisory services and training in freshwater fisheries to the Department of Fisheries, Ministry of Agriculture in Thailand; to advise on freshwater fisheries development in the North-east, in sensitive Changwats in the North, and at the Bangkok Fisheries Research Center at Bangkok.

1.1 Procedures

Training sessions for research and extension personnel were held at four Fisheries Stations including Bangkok, Khon Kaen, Sakol Nakorn and Chiang Rai. Personnel from other Stations traveled to these four locations. The schedule followed is given below.

August 19	Arrived Bangkok 10:15 P.M.
August 20-22	Conferences with USOM and with Department of Fisheries Officials for planning training sessions, discussion of research planning and budgets.
August 25-28	Training sessions at Bangkok Station Meeting with personnel of Kasetsart School of Fisheries.
August 29	Observation of shrimp culture experiments at Kasetsart University.
August 31	Leave for Khon Kaen 8:40 A.M. Trip to Ubol Ratana Reservoir.
September 1-3	Training sessions at Khon Kaen Station.
September 4	Travel by car to Sakol Nakorn.
September 5-7	Training sessions at Sakol Nakorn Station.
September 8	Travel by car to Bangkok.
September 9	Conference with Department of Fisheries, Bangkok.
September 10	Leave by plane for Chiang Rai (Payao) Station.

September 11-13 Training sessions at Chieng Rai Station  
September 14 Travel by car to Chieng Mai  
September 15 Conference at Chieng Mai Station  
September 16 Return to Bangkok  
September 17-19 Reports and Conferences at Bangkok  
September 20 Leave for U.S.A.

### 1.2 Plan of the Report

This report will include the personnel taking part in the training, the content of the training courses, current research at the Stations, and an Appendix to the report.

The Appendix includes a list of the Inland Fisheries Stations. It lists personnel in research, extension and engineering, the ponds and the equipment available for research and extension, and the additional equipment considered desirable by the Head of each Station.

In the Appendix are also given the equipment needed to equip a laboratory for research, and serving of extension in the fields of

- a. Water Chemistry and their suitability for Fish Culture.
- b. Fish parasites and diseases for diagnosis and research
- c. Fish feeds and Nutrition
- d. Limnological Studies of reservoirs

### 2.0 THE TRAINING COURSES

The personnel from Fisheries Stations taking part in the training at the four sessions are as follows:

#### Session 1 - Bangkok

<u>Location</u>	<u>Number of people</u>
Headquarters	2
Inland Fishery Station Section	4
Aquiculture Unit (Bangkok)	8
Fishery Biology Survey	8
Ditch and Dike Area	4
Brackishwater Aquiculture Unit	1
Taxonomy Unit	1
Extension Section	1
Chantaburi Fishery Station	1
Prachuap Khiri Khan Fishery Station	4
Phattalung Fishery Station	1
Total	<u>35</u>

Session 2 - Khon Kaen

<u>Location</u>	<u>Number of people</u>
Khon Kaen Fishery Station	6
Udorn Thani Fishery Station	2
Maha Sarakham Fishery Station	4
Nong Khai Fishery Station	3
Fisheries Research at Khon Kaen Agricultural Research Center	3
Brackishwater Aquiculture Unit	1
Chantaburi Fishery Station	1
Aquiculture Unit (Bangkhen)	1
Total	<u>21</u>

Session 3 - Sakol Nakorn

<u>Location</u>	<u>Number of people</u>
Sakol Nakorn Fishery Station	3
Ubol Rajthani Fishery Station	3
Surin Fishery Station	3
Nakorn Rajsima Fishery Station	3
Extension Section	4
Extension Mobile Unit	3
Headquarters	1
Total	<u>20</u>

Session 4 - Chiang Rai

<u>Location</u>	<u>Number of people</u>
Chiang Rai Fishery Station	4
Chiang Mai Fishery Station	3
Tak Fishery Station	4
Nakorn Sawan Fishery Station	5
Chainat Fishery Station	3
Ditch and Dike (Chainat)	2
Total	<u>21</u>

## 2.1 Content of the Training Courses

Following is a brief summary of the content of the training courses given at the four central meeting centers

### 2.1.1 Water Chemistry

Principles of water chemistry in relation to Fisheries Management

Analysis to be run for extension and research and their interpretation. These included:

pH	Oxygen
Hardness	CO <sub>2</sub>
Alkalinity	Lime requirements
Salinity	

### 2.1.2 Hatchery Management

- Selective breeding
- Hybridization
- Care of brood stock
  - a. Selection and replacement
  - b. Feeds and feeding
  - c. Parasites and disease
- Anesthetics
- Marking
- Hormone injection
- Culture of grass carp
- Culture of catfish
- Preparation of fry and fingerling ponds

### 2.1.3 Management of Village Ponds and Small Reservoirs.

Stocking Methods for temporary and permanent impoundments  
Species of fishes and their feeding habits  
Fertilization  
Weed Control

### 2.1.4 Management of Large Reservoirs

Preimpoundment and post-impoundment Surveys  
Catch statistics  
Species suitable for large reservoirs  
Changes in the fish population following impoundment

### 2.1.5 Intensive Cage Cultures of Fishes

- Principles underlying cage culture
- Stocking densities
- Feeds and feeding programs
- Cage positioning

- Culture environments
- Cage construction
- Culture technique
  - stocking
  - transporting
  - treatments for parasite-disease
  - feeding and feed-rate adjustments
  - sampling
  - harvest
- Cost analysis
- Problems for research

#### 2.1.6 Summary On the Examination and Treatment for Parasites and Bacterial Diseases of Fish

##### Examination:

- Sampling
- Procedure
- Symptoms of Bacterial Disease
- Description of External and Internal Parasites

##### Treatments:

- Bacterial Diseases
- Parasites
  - General External Parasites
    - Protozoans
    - Monogenetic trematodes
    - Crustacean
    - Leeches
  - General Internal Parasites
    - Digenetic trematodes
    - Cestodes
    - Nematodes
    - Acanthocephalans

#### 2.1.7 Research Needs For More Effective Extension

Research on increasing fry and fingerling production

Production of large fingerlings for stocking

Pond-culture research on:

Species and species combinations

Fertilization

Feeds and feeding

Research on management of village ponds and small reservoirs

Research needed on large reservoirs.



### 3.0 CURRENT 1969 RESEARCH AT ALL FISHERIES STATIONS

Following is a list of all current research projects at both the Inland and Coastal Fisheries Stations, Catalogued index subjects:

- Irrigation Tanks
- Reservoirs
- Swamp Fisheries
- River Fisheries
- Hatcheries
- Lakes
- Flood Water
- Fish Feeds
- Freshwater Fishcultures
  - Rice fields
  - Ponds
  - Floating Basket Cultures
- Taxonomy
- Life Histories
- Brackishwater and Marine Cultures

Thailand Research Projects  
1969

<u>Research</u>		<u>By</u>
<u>Irrigation Tanks</u>		
A. Fish Population Surveys on:		
Ubolrat Nam Pung	Klong Prao	Biological Survey Unit
Kaeng Kracharn		" " "
Huey Tucy	Nong Taeveraj	Northeast Center
Kok Muang	Nong Pa Ko	" "
Ta Pra	Soak Rung	" "
Nam Pung		Sakol Nakorn Station
Nong Luang		Tak Station
B. Limnology of Nar. Pung		Sakol Nakorn Station
<u>Reservoir Research</u>		
A. Fish Population Survey of:		
Lam Pao		Biological Survey Unit
Lam Pra Plerng		
Ubolratana		Khon Kaen Station
B. Limnology of Bhumipol		Chiengrai Station
C. Fishing Methods and Fishing Gear:		
Bhumipol		Chiengrai Station
Ubolratana		Khon Kaen Station
<u>Swamp Fisheries Research</u>		
A. Fish Population Survey of Bung Si Fi		Biological Survey Unit
<u>River Fisheries Research</u>		
A. Fishes and Fishing Gear at Mun River		Ubol Station

Research

By

Hatchery Research

A. Production of Fry and Fingerlings of:

Pla Nin (Tilapia nilotica)

Bangkhen Fisheries Sta.

Nilom (Osteochilus hasselti)

Khon Kaen Fishery Sta.

B. Induced Spawning of:  
Chinese Carps

Chiengrai

Pla Sawai (Pangasius sutchi)

Nakorn Sawan Station

C. Fish Transportation in Polyethylene Bags  
With O<sub>2</sub>

Bangkhen

Lake Research

A. Limnology and Fisheries Survey of Nong Harn

Sakol Nakorn Station

Flood Water Research

A. Physical - Chemical Characteristics in  
Province of Surin

Surin Fisheries Station

Fish Feeds

A. Supplemental Feeds for Carp, Cyprinus carpio

Bangkhen

B. Feed Formulation for Carp, Cyprinus carpio

Surin Station

C. Termites as Food for Carp, Cyprinus carpio

Ubol Station

D. Natural Foods of Fishes:

In Bung Bora Pet

Nakorn Sawan Station

Of Morulus chrysophekadion in Ubol Ratana Reservoir Khon Kaen Sta.

Research	By
<u>Freshwater Fish Cultures</u>	
A. In Rice Fields:	
Common Carp Production	Sakol Nakorn Station
Carp culture in fields with different spacing of rice	Chainat Station
Rates of stocking carp	Northeast Center
B. In Ponds:	
Inorganic Fertilizer for production of Pla Salid <u>Trichogaster pectoralis</u>	Chiengrai Station
Production of <u>T. nilotica</u> with or without fertilization, with multiple harvests	Tak Station
Culture of Nile Tilapia with common carp	Chainat Station
C. Floating Basket Cultures:	
Carp ( <u>Cyprinus carpio</u> )	Sakol Nakorn Station
Carp ( <u>Cyprinus carpio</u> )	Surin Station
Pla Sawai ( <u>Pangasius sutchi</u> )	Chainat Station
Durability of basket materials	Surin Station
<u>Taxonomy of:</u>	
Freshwater Fish in Thailand	Taxonomy Unit
Genus <u>Pangasius</u>	" "
<u>Life History Studies of:</u>	
<u>Probarbus jullieni</u>	Biological Survey Unit
Pla Tapak, ( <u>Puntius daruphani</u> )	Tak Station
<u>Miscellaneous</u>	
Sodium cyanide toxicity to fish	Nakorn Rajsim

Research

By

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Brackishwater and Marine Cultures

A. Oysters, Raft Culture of:

Pycnodonta numisma

Prachuap Station

Japanese Oyster (Crassostrea gigas)

Prachuap Station

B. Lates calcarifer, Sea Bass

Chantaburi Station

Culture in ponds

Culture with T. mossambica in ponds

Prachuap Station

Culture in baskets

Songkhla Station

Culture in baskets

Chantaburi Station

C. Milkfish Culture in Ponds and Abundance of Fry in Coastal Waters

Prachuap Station

D. Blue Crab Culture in Ponds With Feeding of Trash Fish

Chantaburi Station

E. Shrimp Culture in Ponds:

Marine Shrimps

Chantaburi Station

Macrobrachium Shrimp Culture

Songkhla Station

Spawning, production of juveniles and commercial production

F. Penacid Shrimps in Songkhla Lake

Songkhla Station

1. Abundance of juvenile shrimp
2. Kinds and abundance of benthos
3. Kinds and abundance of plankton

G. Biology of Mullet

Songkhla Station

#### 4.0 RECOMMENDATIONS

It is recommended that

- A. The Auburn University Contract be modified to include 1 full-time adviser to the Fisheries Department and to USOM/Thailand to be stationed at Bangkok and to work with the Fisheries Department personnel in the Northeast, Sensitive Changwats in the North and at the Bangkhen Fisheries Research Center. His responsibilities would include advisor on research and extension, assisting in the evaluation and reporting of research pertinent to more effective extension activities, and on-the-job training of both research and extension personnel. This would be in addition to the services now rendered by Auburn University.
- B. That construction equipment be made available at three Fisheries Stations in the Northeast to increase the annual rate of construction of village or community ponds that are so urgently needed in many areas. It is suggested that these be located at the Sakol Nakorn, Ubol Rajthani and the Khon Kaen Stations. If the program proceeds satisfactorily, additional equipment should be placed at other Stations in the Northeast.
- C. That equipment be made available over the next 2 years for a Fish Parasite and Disease Laboratory and for a Fish Feed and Feeding Laboratory at the Central Bangkhen Fisheries Research Center. These would service and train personnel for the Northeast, as well as other areas of Thailand.
- D. That research be intensified on the practical problem of increasing fish production and in the training of extension personnel in these procedures so that more effective extension will be possible.
- E. To speed up the development of practical methods of fish culture and management, additional ponds should be constructed at or near the Bangkhen Central Research Center, and at the Sakol Nakorn, and Chiang Rai Stations in the Northeast and North respectively.

5.0 APPENDIX

5.1 PERSONNEL AND EQUIPMENT AVAILABLE FOR RESEARCH AND EXTENSION  
AT THE INLAND FISHERIES STATIONS:

BANGKHEN  
CHAINAT  
NAKORN SAWAN  
CHIENGRAI  
CHIENGMAI  
TAK  
SAKOL NAKORN  
KHON KAEN

MAHA SARAKHAM  
NAKORN RAJSIMA  
UBOL RAJTHANI  
UDORN THANI  
SURIN  
NONG KHAI  
PHATTALUNG

BANGKHEN

<u>STATION</u>	<u>LOCATION</u>	<u>ESTABLISHED</u>
Bangkhen	Amphur: Bangkhen Province: Bangkok	1937

<u>AREA</u>	<u>AVAILABLE FOR EXPANSION</u>
38 rai - Land 14.64 rai - Water	--

<u>PERSONNEL</u>	<u>TRAINING</u>	<u>YEAR</u>
Head:	Mr. Samran Dhamrongrut B.S. Kasetsart Un.	1961
Biologists:	Mr. Manu Potaros M.S. U.S. Auburn Un.	1965
	Mr. Prasit Ketsunchai B.S. Kasetsart Un.	1961
	Miss Kamolporn Thong-uthai B.S. Kasetsart Un.	1965
	Mr. Prasert Sitasit B.S. Kasetsart Un.	1966
	Mr. Kamthorn Pothongkum B.S. Kasetsart Un.	1967
	Mr. Pithaya Pennapaporn B.S. Kasetsart Un.	1967
	Miss Wirut-tada Samuk-kasewee B.S. Kasetsart Un.	1968
Extension:	1 3 years experience	
Laborers:	54 Permanent 9 Temporary	

NUMBER AND SIZE (m<sup>2</sup>) OF PONDS USED TO PRODUCE FINGERLINGS

Earthen

1	345	1	784	2	468
1	560	1	896	1	288
1	520	1	732	1	958
1	224	1	793	1	448
2	200*	1	270	1	1,175
1	483	1	1,404	1	1,323
1	1,888	1	342	2	306
1	1,920	1	1,054	1	187

Cement

12	6.0 (holding)	32	4.5
13	50.0 (spawning and rearing carp fry)	12	6.0
		32	50.0

\* concrete side-earthen bottom

FISH PRODUCTION

<u>Species</u>	<u>Number</u>
Common carp	1,400,000



Sepat Siam	450,000
<u>T. mossambica</u>	310,000
<u>Helostoma</u>	130,000
<u>Osphronemus goramy</u>	26,000
<u>T. nilotica</u>	430,000
Silver carp	143,000

#### RESEARCH PROJECTS

1. Study on the development of silver carp's ovaries.
2. Primary study on induced spawning of Cirrinhus microlepis.
3. The experiments on the transportation of fish in polyethylene bags.
4. Study on the effect of pH of water on fingerlings of pond.
5. Primary study on biology of Anabas testudinus.
6. Study on the production of T. nilotica fry with various ratios of male and female.
7. The experiment on feeding Clarias batrachus with trash fish and Auburn No. 2 pellets and with various rates of stocking.
8. Study on the problems of parasites and disease of pond fishes.
9. Study on the selective breeding of Cyprinus carpio.
10. The experiment on composition of supplementary feeding for fingerling common carp.

#### TRANSPORTATION FACILITIES AVAILABLE

1. Jeep, willy; purchased in 1958; fair.
2. Volkswagon; purchased in 1962; O.K.
3. Nissan; purchased in 1963; O.K.
4. Truck, chevrolet; purchased in 1959; fair.
5. Truck, chevrolet; purchased in 1959; fair.
6. Truck, dodge fargo; purchased in 1962; O.K.

#### EQUIPMENT AVAILABLE FOR RESEARCH

- |   |                                       |
|---|---------------------------------------|
| 1. 1 50 m seine   | 16. 5 plankton nets                   |
| 2. 2 30 m seines  | 17. 1 shadow graph                    |
| 3. 1 25 m seine   | 18. 1 current meter                   |
| 4. 6 net cages  | 19. 1 water distillation machine      |
| 5. 1 dissecting microscope                                | 20. 1 turbidity machine (no batterie) |
| 6. 10 compound microscopes                                | 21. 1 chemical centrifuge             |
| 7. 1 analytical balance<br>(15 years old, fair condition) | 22. 1 drying oven (max. 65°C)         |
| 8. 6 500 gm scales sensitive to 2 gm                      | 23. 1 temperature recorder            |
| 9. 5 1kg scales sensitive to 5 gm                         | 24. 1 oxygen meter                    |
| 10. 1 7 kg scale sensitive to 20 gm                       | 25. 1 magnetic stirrer                |
| 11. 1 10 kg scale sensitive to 5 gm                       | 26. 1 lab pH meter                    |
| 12. 1 15 kg scale sensitive to 100 gm                     | 27. 2 autoclaves                      |
| 13. 1 50 kg scale sensitive to 500 gm                     | 28. 2 calorimeters                    |
| 14. 25 aquaria  | 29. 1 electric calculator             |
| 15. 1 10 cu. ft. refrigerator                             | 30. 1 barometer                       |
|   | 31. 2 1 HP electric pump (2 yrs. old) |

- |     |   |                                |     |   |                                |
|-----|---|--------------------------------|-----|---|--------------------------------|
| 32. | 2 | 3 HP gasoline pump(7 yrs. old) | 36. | 1 | 6 HP gasoline pump(5 yrs. old) |
| 33. | 1 | 4-5 HP diesel pump(1 yr. old)  | 37. | 1 | 9-12 HP diesel pump(1 yr. old) |
| 34. | 1 | 5 HP gasoline pump(7 yrs. old) | 38. | 1 | air pump(3-5 aquaria)          |
| 35. | 1 | 5 HP gasoline pump(6 yrs. old) |     |   |                                |

EQUIPMENT NEEDED<sup>1</sup>

1. 1 muffle oven (650°C)
2. 1 electric steam bath set (6 units)
3. 1 1 ton capacity freezer store room
4. 1 set (6 units) protein distillation and digestion
5. 1 electric calculator (for square root)
6. 1 3'x 4.5' hood
7. 1 analytical balance
8. 1 set (100 units of trough) air pumps
9. 50 plastic pools
10. 100 troughs
11. 1 electric automatic water distiller
12. 1 portable pH meter
13. 1 food mixing machine
14. 3 2" pumps with 3 HP motors
15. 1 nephelometer
16. 2 5 HP diesel pumps
17. 1 emulsion sprayer

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1. Equipment requested by Station Head.

CHAINAT

<u>STATION</u>	<u>LOCATION</u>	<u>ESTABLISHED</u>
Chainat	Amphur: Sunphaya Province: Chainat	1959

<u>AREA</u>	<u>AVAILABLE FOR EXPANSION</u>
-------------	--------------------------------

34 rai - Land	
17 rai - Water	51 rai

<u>PERSONNEL</u>	<u>TRAINING</u>	<u>YEAR</u>
Head: Mr. Prasit Aguru	M.S. U.S. Auburn Un.	1966
Biologists: Mr. Pisan Choangpanich	B.S. Kasetsart Un.	1966
Mr. Manop Tungtrongpiroj	B.S. Kasetsart Un.	1968
Extension: 3	3 years experience	
Laborers: 23 Permanent 2 Temporary		

NUMBER AND SIZE (m<sup>2</sup>) OF PONDS USED TO PRODUCE FINGERLINGS

<u>Earthen</u>		<u>Cement</u>	
1	1 rai	10	50 - not used to produ fingerlins
20	200		
8	400	10	5
8	800		
12	200 - not used to produce fingerlings		
4	400 - not used to produce fingerlings		

EXTENSION AND DEMONSTRATION ACTIVITIES

Equipment Available

1 55 CC. motorcycle

Ponds and Fish Species Used

2 earthen 1 rai

Common carp	3,200
<u>T. nilotica</u>	3,200

6,400 stocked per rai

FISH PRODUCTION

<u>Species</u>	<u>Number</u>
<u>C. carpio</u>	25,300
<u>T. nilotica</u>	78,000
<u>Trichogaster pectoralis</u>	79,000

RESEARCH PROJECTS

1. Pangasius sutchi culture in floating cages.
2. Pangasius sutchi culture in nylon net floating cages.
3. Food habits of Catlacarpio siamensis.
4. Cyprinus carpio culture in combination with Tilapia nilotica.

TRANSPORTATION FACILITIES AVAILABLE

1. Jeep, land-rover; purchased in 1964; fair.
2. Truck, international; purchase date unknown; no good.

EQUIPMENT AVAILABLE FOR RESEARCH

- |    |   |                        |     |    |                         |
|----|---|------------------------|-----|----|-------------------------|
| 1. | 1 | 200 m seine            | 9.  | 1  | compound microscope     |
| 2. | 1 | 100 m seine            | 10. | 1  | dissecting microscope   |
| 3. | 2 | 50 m seines            | 11. | 10 | aquaria                 |
| 4. | 2 | 25 m seines            | 12. | 1  | analytical balance      |
| 5. | 5 | plankton nets          | 13. | 1  | current meter           |
| 6. | 2 | dissecting apparatus   | 14. | 1  | 500 gm capacity balance |
| 7. | 1 | Ekman dredge           | 15. | 1  | 200 gm capacity balance |
| 8. | 1 | Kemmerer water sampler |     |    |                         |

EQUIPMENT NEEDED<sup>1</sup>

1. 1 12 m x 200 m seine
2. 1 barometer
3. 1 Ekman dredge
4. 1 10 cu. ft. (220 volts, 50 cycle) refrigerator
5. 1 nephelometer
6. 1 jeep
7. 1 truck

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1. Equipment requested by Station Head.

NAKORN SAWAN

<u>STATION</u>	<u>LOCATION</u>	<u>ESTABLISHED</u>
Nakorn Sawan	Amphur: Muang Province: Nakorn Sawan	1927

<u>AREA</u>	<u>AVAILABLE FOR EXPANSION</u>
35 rai - Land 17 rai - Water	--

<u>PERSONNEL</u>	<u>TRAINING</u>	<u>YEAR</u>
Head: Mr. Bunlue Luksanabut		
Biologists: Mr. Suchit Bhinyoying	B.S. Kasetsart Un.	1959
Mr. Kumron Potipituk	B.S. Kasetsart Un.	1968
Mr. Khemchat Nimsomboon	B.S. Kasetsart Un.	1964
Extension: 1	5 years experience	
5	3 years experience	
Laborers: 59 Permanent 8 Temporary		

NUMBER AND SIZE (m<sup>2</sup>) OF PONDS USED TO PRODUCE FINGERLINGS

<u>Earthen</u>		<u>Cement</u>	
1	331	1	331
1	396	1	576

Earthen Ponds Not Used to Produce Fingerlings

1	1,400	1	1,040
1	1,081	1	680
1	1,081	1	660
1	268	1	840
1	576	5	396
1	1,064		

RESERVOIRS

Bung Borapet 130,000 rai

EXTENSION AND DEMONSTRATION ACTIVITIES

Ponds and Fish Species Used

1	earthen	331
	<u>T. nilotica</u>	500

FISH PRODUCTION

<u>Species</u>	<u>Number</u>
<u>T. nilotica</u>	11,000
<u>Pangasius sutchi</u>	119,000
<u>Cyclocheilichthys sp.</u>	10,173
<u>Morulus chrysophekadion</u>	4,540
<u>Puntius sp.</u>	1,508
<u>Catlacarpio siamensis</u>	805
<u>Cirrhinus sp.</u>	193

RESEARCH PROJECTS

1. Artificial breeding of Pla Sawai (Pangasius sutchi) by pituitary hormone injection.
2. Study on stomach contents of some species of fishes in Bung Borapet.

TRANSPORTATION FACILITIES AVAILABLE

1. Jeep, land-rover; purchased in 1965; poor.
2. Boat; 7 HP longtail.
3. Boat; 50 HP longtail.
4. Boat; 25 HP outboard motor.
5. Boat; 20 HP inboard motor.

EQUIPMENT AVAILABLE FOR RESEARCH

- |                           |                                |
|---------------------------|--------------------------------|
| 1. 1 200 m seine          | 10. 1 oven                     |
| 2. 4 100 m seines         | 11. 1 refrigerator             |
| 3. 1 50 m seine           | 12. 1 current meter            |
| 4. 3 plankton nets        | 13. 1 5-10 gm capacity balance |
| 5. 10 aquaria             | 14. 1 12 HP pump               |
| 6. 2 Ekman dredges        | 15. 1 9 HP pump                |
| 7. 3 air pumps            | 16. 1 10 KVA generator         |
| 8. 3 dissecting apparatus | 17. 1 binocular                |
| 9. 1 microscope           |                                |

EQUIPMENT NEEDED<sup>1</sup>

1. 1 nephelometer

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1. Equipment requested by Station Head.

CHIENGRAI

<u>STATION</u>	<u>LOCATION</u>	<u>ESTABLISHED</u>
Chiengrai	Amphur: Payao Province: Chiengrai	1941

<u>AREA</u>	<u>AVAILABLE FOR EXPANSION</u>
67 rai - Land 20 rai - Water	--

<u>PERSONNEL</u>	<u>TRAINING</u>	<u>YEAR</u>
Head: Mr. Sawad Boonthai	3 years Kasetsart Un.	1948
Biologists: Mr. Chanintorn Sritongsuk	B.S. Kasetsart Un.	1964
Mr. Panu Tavaratmaneegul	B.S. Kasetsart Un.	1968
Extension: 5	3 years experience	
Laborers: 33 Permanent 3 Temporary		

NUMBER AND SIZE (m<sup>2</sup>) OF PONDS USED TO PRODUCE FINGERLINGS

<u>Earthen</u>				<u>Cement</u>	
1	240	1	730	25	24
6	360	3	1,200	2	12
1	460	2	1,440		

RESERVOIRS

Kwanpayao 10,400 rai

EXTENSION AND DEMONSTRATION ACTIVITIES

Equipment Available

1. 1 motorcycle
2. 1 7-12 HP pump
3. 1 3-5 HP pump

Number and Size (m<sup>2</sup>) of Ponds Available for Research

<u>Cement</u>			<u>Earthen</u>		
3	24 (demonstration)		4	25	1 1,600
5	24		6	120	1 2,200
2	12		2	600	1 4,100
			1	800	

Rice Paddy Fields and Fish Species Used

2. 10 rai

Common carp 3,000

300 stocked per rai

Reservoirs and Fish Species Used

2 400 rai

Common carp 10,000

T. melanopleura 25,000

T. nilotica 25,000

150 stocked per rai

FISH PRODUCTION

<u>Species</u>	<u>Number</u>
<u>Cyprinus carpio</u>	442,005
<u>Hypophthalmichthys molitrix</u>	330,000
<u>T. melanopleura</u>	311,975
<u>T. nilotica</u>	211,135
<u>Trichogaster pectoralis</u>	26,000

RESEARCH PROJECTS

1. Experiments on artificial breeding of chinese carp.
2. Experiments on featherback fish (Notopterus chitala) breeding.

TRANSPORTATION FACILITIES AVAILABLE

1. Jeep, willy; purchased in 1952; no good.
2. Jeep, land-rover; purchased in 1964; O.K.
3. Truck, dodge power wagon; purchased in 1955; no good.
4. Truck, fargo; purchased in 1966; O.K.
5. Boat, longtail; 10 HP; fair.
6. Boat, outboard motor; 25 HP; O.K.



EQUIPMENT AVAILABLE FOR RESEARCH

1. 2 100 m seines
2. 1 25 m seine
3. 1 plankton net
4. 1 Kemmerer water sampler
5. 1 dissecting apparatus
6. 1 profile projector
7. 15 aquaria
8. 1 air pump with filter
9. 1 Ekman dredge
10. 1 analytical balance
11. 1 100 gm capacity balance
12. 1 refrigerator
13. 1 binocular

EQUIPMENT NEEDED<sup>1</sup>

1. Oven
2. 1 laboratory-electric (220 V, 50 cycle) pH meter
3. 1 shadow graph
4. 1 thermometer recorder
5. 1 muffle furnace oven
6. 1 jeep
7. 1 truck

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1. Equipment requested by Station Head.

CHIENGMAI

<u>STATION</u>	<u>LOCATION</u>	<u>ESTABLISHED</u>
Chiengmai	Amphur: San Sai	
	Province: Chiengmai	1953

<u>AREA</u>	<u>AVAILABLE FOR EXPANSION</u>
53 rai - Land	--
13 rai - Water	

<u>PERSONNEL</u>	<u>TRAINING</u>	<u>YEAR</u>
Head: Mr. Boonhai Thongsamui	B.S. Kasetsart Un.	1959
Biologists: Mr. Samrong Powhawn	B.S. Kasetsart Un.	1964
Extension: 4	3 years experience	
Laborers: 14 Permanent		
8 Temporary		

NUMBER AND SIZE (m<sup>2</sup>) OF PONDS USED TO PRODUCE FINGERLINGS

<u>Earthen</u>				<u>Cement</u>	
1	3,900	4	400	1	24
1	3,300	4	375	2	20
1	1,672	1	324	1	12
2	1,260	1	130	10	10
1	1,215	3	112	3	3
4	800	1	68	2	1.5
3	405	1	64		
1	60	1	54		

RICE PADDY FIELDS

15 400 (m<sup>2</sup>)

RESERVOIRS

Nong Bou 163,200 (m<sup>2</sup>)

EXTENSION AND DEMONSTRATION ACTIVITIES

Equipment Available

1. 1 motorcycle
2. 1 12 HP water pump
3. 1 5 HP water pump

Ponds and Fish Species Used

32        13 rai

<u>C. carpio</u>	8,000
<u>P. gonionotus</u>	28,000
<u>T. melanopleura</u>	6,000
<u>T. nilotica</u>	10,000

4,000 stocked per rai

Rice Paddy Fields and Fish Species Used

11        75 rai

C. carpio        30,000

400 stocked per rai

FISH PRODUCTION

<u>Species</u>	<u>Number</u>
<u>P. gonionotus</u>	634,528
<u>T. melanopleura</u>	243,540
<u>T. nilotica</u>	48,700
<u>C. carpio</u>	70,756

RESEARCH PROJECTS

1. Biology of P. gonionotus; method of propagation and its embryonic development.
2. A study on fish population survey in Nong Bou Reservoir.
3. Fish culture in paddy fields.

TRANSPORTATION FACILITIES AVAILABLE

1. Jeep, land-rover; purchased in 1964; fair.
2. Truck, dodge power wagon; purchased in 1955; poor.
3. Truck, chevrolet pickup; purchased in 1953; poor.

EQUIPMENT AVAILABLE FOR RESEARCH

- |                           |                               |
|---------------------------|-------------------------------|
| 1. 1 100 m seine          | 8. 2 Ekman dredges            |
| 2. 2 50 m seines          | 9. 1 Kemmerer water sampler   |
| 3. 2 plankton nets        | 10. 1 refrigerator            |
| 4. 2 compound microscopes | 11. 1 analytical balance      |
| 5. 2 dissecting apparatus | 12. 1 500 gm capacity balance |
| 6. 10 aquaria             | 13. 1 10 gm capacity balance  |
| 7. 1 airpump with filter  | 14. 1 portable pH meter       |

EQUIPMENT NEEDED<sup>1</sup>

1. 1 oven
2. 1 jeep
3. 1 truck
4. 1 electric pH meter
5. 5 5 HP water pumps

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1. Equipment requested by Station Head.

TAK

<u>STATION</u>	<u>LOCATION</u>	<u>ESTABLISHED</u>
Tak	Amphur: Muang Province: Tak	1963

<u>AREA</u>	<u>AVAILABLE FOR EXPANSION</u>
-------------	--------------------------------

150 rai - Land	
500 rai - Water	8.1 rai

<u>PERSONNEL</u>	<u>TRAINING</u>	<u>YEAR</u>
Head: Mr. Montri Muangboon	3 years vocational school	
Biologists: Mr. Chareon Panin	B.S. Kasetsart Un.	1962
Mr. Surajit Parianyarut	B.S. Kasetsart Un.	1966
Mr. Prayot Paosas	B.S. Kasetsart Un.	1968
Extension: 2	5 years experience	
5	3 years experience	
Laborers: 18 Permanent		
14 Temporary		

NUMBER AND SIZE (m<sup>2</sup>) OF PONDS USED TO PRODUCE FINGERLINGS

<u>Earthen</u>	<u>Cement</u>
3 1,300	10 5
5 800	10 10
10 400	

RESERVOIRS

Bhumipol 250,000 rai

FISH PRODUCTION

<u>Species</u>	<u>Number</u>
<u>T. nilotica</u>	316,500
<u>C. carpio</u>	215,000
<u>T. pectoralis</u>	118,000
<u>O. goramy</u>	3,500
<u>C. batrachus</u>	3,000

RESEARCH PROJECTS

1. Study on limnology of the Bhumipol Reservoir.
2. Study on fishing methods in Bhumipol Reservoir.
3. Experiment on pond culture of Sepat siam, Trichogaster pectoralis, applying different formulae of inorganic fertilizer.

TRANSPORTATION FACILITIES AVAILABLE

1. Jeep, willy; purchased in 1963; fair.
2. Jeep, land-rover; purchased in 1966; O.K.
3. Jeep, nissan; purchased in 1967; O.K.
4. Truck, isuzu; purchased in 1964; O.K.
5. 1 125 HP inboard motor boat.
6. 2 50 HP outboard motor boats.
7. 1 13 HP longtail motor boat.

EQUIPMENT AVAILABLE FOR RESEARCH

- |    |    |                        |     |   |                           |
|----|----|------------------------|-----|---|---------------------------|
| 1. | 2  | 100 m seines           | 10. | 2 | refrigerators             |
| 2. | 6  | 25 m seines            | 11. | 1 | analytical balance        |
| 3. | 3  | plankton nets          | 12. | 5 | 500 gm capacity balances  |
| 4. | 35 | aquaria                | 13. | 1 | 2,000 gm capacity balance |
| 5. | 1  | compound microscope    | 14. | 2 | secchi disks              |
| 6. | 2  | air pumps with filters | 15. | 1 | electric pH meter         |
| 7. | 1  | Ekman dredge           | 16. | 2 | sieves                    |
| 8. | 1  | electric centrifuge    | 17. | 1 | 12 HP pump                |
| 9. | 1  | Kemmerer water sampler | 18. | 1 | 5 HP pump                 |

EQUIPMENT NEEDED<sup>1</sup>

1. 1 underwater temperature recorder 100 m depth
2. 1 100 m seine
3. 1 remote control, automatic focus, slide projector
4. 1 35 mm camera
5. 1 oven (220 volts, 50 cycle)
6. 1 colorimeter
7. 1 calculator
8. 1 nephelometer
9. 1 portable pH meter

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1. Equipment requested by Station Head.

SAKOL NAKORN

<u>STATION</u>	<u>LOCATION</u>	<u>ESTABLISHED</u>
Sakol Nakorn	Amphur: Muang Province: Sakol Nakorn	1942
<u>AREA</u>	<u>AVAILABLE FOR EXPANSION</u>	
128.75 rai - Land 18.75 rai - Water	--	

<u>PERSONNEL</u>	<u>TRAINING</u>	<u>YEAR</u>
Head: Mr. Somjet Julapong	B.S. Kasetsart Un.	1962
Biologists: Mr. Phichit Srimookda	B.S. Kasetsart Un.	1966
Mr. Kiri Koanandakul	B.S. Kasetsart Un.	1968
Extension: 5	5 years experience	
10	3 years experience	
Laborers: 40 Permanent		

NUMBER AND SIZE (m<sup>2</sup>) OF PONDS USED TO PRODUCE FINGERLINGS

Earthen

1	338	1	209	1	216	1	336
3	268	1	570	1	144	2	264
2	260	1	273	1	910	2	82.50
1	700	1	5,550	3	600	1	142.50
1	529	1	672	1	966	1	198
1	208	1	540	1	825	1	217
1	180	1	1,140	1	2,072	1	4,410 - demonstration
		1	5,550				

Not used to produce fingerlings

1	902	1	800
1	2,210	1	308
1	667	1	600

Cement

5	50	12	6
6	16.50	6	8
1	28.8	2	24.64
1	6.79		

RESERVOIRS

Nong Harn Lake 48,000 rai (cage culture)

EXTENSION AND DEMONSTRATION ACTIVITIES

Equipment Available

1. 6 motorcycles (4 work; 2 no good)	6. 4 3 HP water pumps
2. 1 land rover jeep	7. 1 12 HP water pump
3. 1 jeep	8. 1 electric water pump
4. 2 movie projectors	9. 3 generators
5. 1 slide projector	10. 1 25 HP outboard motor boat
	11. 1 camera

Rice Paddy Fields and Fish Species Used

16 65 rai

C. carpio 25,800

400 stocked per rai

FISH PRODUCTION

<u>Species</u>	<u>Number</u>
<u>C. carpio</u>	753,453
<u>T. nilotica</u>	299,800
<u>T. mossambica</u>	261,690
<u>Trichogaster pectoralis</u>	500
<u>Helostoma temmincki</u>	26,000

RESEARCH PROJECTS

1. Cyprinus carpio culture in floating baskets.
2. Biological fishery survey of Nam Pung irrigation tank.
3. Biological fishery survey of Nong Harn Lake.

TRANSPORTATION FACILITIES AVAILABLE

1. Jeep, land-rover; purchased in 1965; O.K.
2. Jeep, land-rover; purchased in 1965; O.K.
3. Jeep, pickup; purchased in 1962; poor.
4. Truck, fargo; purchased in 1955; poor.
5. Truck, fargo; purchased in 1966; O.K.
6. Truck, dodge; purchased in 1953; no good.
7. Jeep; purchased in 1953; poor.
8. Jeep, pickup; purchased in 1964; O.K.



EQUIPMENT AVAILABLE FOR RESEARCH

- |    |    |               |     |   |                       |
|----|----|---------------|-----|---|-----------------------|
| 1. | 1  | 100 m seine   | 7.  | 1 | refrigerator          |
| 2. | 2  | 50 m seines   | 8.  | 1 | 500 gm balance        |
| 3. | 6  | 25 m seines   | 9.  | 1 | analytical balance    |
| 4. | 7  | plankton nets | 10. | 1 | electric pH meter     |
| 5. | 15 | aquaria       | 11. | 1 | oxygen meter          |
| 6. | 1  | Ekman dredge  | 12. | 1 | dissecting microscope |

EQUIPMENT NEEDED<sup>1</sup>

1. 1 drying oven
2. 1 nephelometer
3. 1 stereo compound microscope
4. 1 pH standard tablets
5. BOD bottles
6. 1 Kemmerer water sampler
7. batteries for oxygen meter
8. membrane for oxygen meter
9. 1 5 m deep x 1 cm seine and block net
10. 2 longtail motor boats
11. 1 10 HP 6" electric pump

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1. Equipment requested by Station Head.



<u>Pangasius sutchi</u>	3 ponds
<u>Hypophthalmichthys molitrix</u>	2 ponds
<u>C. carpio</u>	1 pond
<u>T. nilotica</u>	1 pond

Rice Paddy Fields and Fish Species Used

32            48.2 rai

<u>C. carpio</u>	13,200 - production per ra
<u>T. nilotica</u>	900

300 stocked per rai

FISH PRODUCTION

<u>Species</u>	<u>Number</u>
<u>Cyprinus carpio</u>	567,020
<u>Trichogaster pectoralis</u>	164,330
<u>Tilapia nilotica</u>	552,830
<u>Tilapia mossambica</u>	36,800

RESEARCH PROJECTS

1. A preliminary study on spawning of nilem, Osteochilus hasseltii.
2. A study on food habit of Morulius chrysophekadion in the Ubol Ratana Reservoir.
3. A study on fish population and efficiency of some kinds of fishing gear in the Ubol Ratana Reservoir.
4. Production of nilem (1968).

TRANSPORTATION FACILITIES AVAILABLE

1. Jeep, wagoner; purchased in 1965; O.K.
2. Jeep, land-rover; purchased in 1965; poor.
3. Jeep, international scout; purchased in 1963; poor.
4. Truck, dodge power wagon; purchased in 1953; very poor.
5. Truck, dodge; purchased in 1953; very poor.
6. Truck, dodge fargo; purchased in 1967; O.K.

EQUIPMENT AVAILABLE FOR RESEARCH

- |                             |                            |
|-----------------------------|----------------------------|
| 1. 1 100 m seine            | 7. 1 dissecting microscope |
| 2. 2 50 m seines            | 8. 20 aquaria              |
| 3. 4 plankton nets          | 9. 1 centrifuge            |
| 4. 1 Kemmerer water sampler | 10. 2 sieves               |
| 5. 1 Ekman dredge           | 11. 1 refrigerator         |
| 6. 1 binocular microscope   | 12. 1 barometer            |

13. 1 max - min thormometer
14. 1 electric thermomoter
15. 1 analytical balance
16. 1 pocket pH meter
17. 1 electric pH meter
18. 2 water analysis lab kits
19. 1 7 kg capacity scale
20. 1 12 HP diesel water pump
21. 1 16 HP diesel water pump

EQUIPMENT NEEDED<sup>1</sup>

1. 1 electric calculator
2. 1 oxygen meter with battery
3. 1 nephelometer
4. 1 colorimeter
5. 3 30 m seines
6. 1 net cage
7. 1 1 kg balance
8. 1 500 gm balance
9. 1 overhead projector
10. 1 automatic focus, remote control slide projector
11. 1 16 mm movie camera
12. 1 5' x 5' lenticular screen
13. 1 35 mm camera
14. 1 amplifier set
15. 1 portable generator
16. 1 5 kg scale
17. 2 jeeps
18. 2 trucks
19. 2 portable 5 HP pumps
20. 1 12 HP diesel pump

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1. Equipment requested by Station Head.

MAHA SARAKHAM

<u>STATION</u>	<u>LOCATION</u>	<u>ESTABLISHED</u>
Maha Sarakham	Amphur: Muang Province: Maha Sarakham	1953

<u>AREA</u>	<u>AVAILABLE FOR EXPANSION</u>
20 rai - Land 4 rai - Water	10 rai - belongs to Irrigation Dept

<u>PERSONNEL</u>	<u>TRAINING</u>	<u>YEAR</u>
Head: Mr. Wai Pinyo	3 years at Kasetsart Un.	1947
Biologists: Mr. Somdet Srikamut	B.S. Kasetsart Un.	1964
Mr. Manus Chantasut	B.S. Kasetsart Un.	1966
Extension: 3	3 years experience	
Laborers: 14 Permanent 6 Temporary		

NUMBER AND SIZE (m<sup>2</sup>) OF PONDS USED TO PRODUCE FINGERLINGS

<u>Earthen</u>	<u>Cement</u>
2 200 - not used to produce fingerlings	5 15
9 200	4 18
1 400	
3 500	
4 600	
1 800	
1 900	

RESERVOIRS

Kaeng Lerng Charn 2,000/rai

EXTENSION AND DEMONSTRATION ACTIVITIES

Equipment Available

1. 1 motorcycle (3 years old)
2. 1 12 HP water pump
3. 1 5 HP water pump
4. 1 35 mm camera
5. 1 13 HP longtail boat (3 years old)

FISH PRODUCTION

<u>Species</u>	<u>Number</u>
<u>C. carpio</u>	158,000
<u>T. nilotica</u>	180,500
<u>Trichogaster pectoralis</u>	71,000

RESEARCH PROJECTS

1. Biological fishery survey in Kaeng Lerng Charn Irrigation tank.
2. Experiment on growth rate of Pla salid, Trichogaster pectoralis (Regan) in ponds.
3. Preliminary studies on life history of Hampala dispar (H.M. Smith).
4. Evaluation on stocking some fishes in irrigation tanks.
5. Study on fecundity and young-produced of various sizes of Tilapia nilotica (Linn.)

TRANSPORTATION FACILITIES AVAILABLE

1. Jeep, land-rover; purchased in 1965; O.K.
2. Truck, dodge; purchased in 1955; poor.
3. Truck, dodge fargo; purchased in 1966; O.K.
4. Truck, dodge power wagon; purchased in 1955; poor.

EQUIPMENT AVAILABLE FOR RESEARCH

- |    |    |                                 |     |   |                        |
|----|----|---------------------------------|-----|---|------------------------|
| 1. | 1  | 100 m seine                     | 10. | 1 | profile projector      |
| 2. | 2  | 50 m seines                     | 11. | 1 | Kemmerer water sampler |
| 3. | 2  | 25 m seines                     | 12. | 1 | centrifuge             |
| 4. | 3  | plankton nets                   | 13. | 1 | refrigerator           |
| 5. | 1  | dissecting binocular microscope | 14. | 1 | analytical balance     |
| 6. | 2  | dissecting apparatus            | 15. | 2 | 500 gm balances        |
| 7. | 10 | aquaria                         | 16. | 2 | thermometers           |
| 8. | 1  | Ekman dredge                    | 17. | 1 | pocket pH meter        |
| 9. | 1  | air pump with filter            | 18. | 1 | water analysis lab kit |
|    |    |                                 | 19. | 1 | 30 kg balance          |

EQUIPMENT NEEDED<sup>1</sup>

- |     |   |                                    |     |   |                                   |
|-----|---|------------------------------------|-----|---|-----------------------------------|
| 1.  | 1 | block net                          | 11. | 1 | portable amplifier                |
| 2.  | 1 | nephelometer                       | 12. | 1 | generator                         |
| 3.  | 1 | 5 kg balance sensitive to 5 gm.    | 13. | 1 | movie projector                   |
| 4.  | 2 | 1 kg balances sensitive to 1 gm.   | 14. | 1 | lenticular projector screen       |
| 5.  | 1 | 10 kg balance sensitive to 5 gm.   | 15. | 1 | tape recorder                     |
| 6.  | 1 | lab-type pH meter                  | 16. | 1 | 5 HP portable gasoline water pump |
| 7.  | 1 | binocular compound microscope      | 17. | 1 | 10 HP electric water pump         |
| 8.  | 1 | drying oven                        | 18. | 1 | jeep                              |
| 9.  | 1 | B.O.D. bottles                     | 19. | 1 | truck                             |
| 10. | 1 | doz. 500 ml plastic sample bottles |     |   |                                   |

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1. Equipment requested by Station Head.

NAKORN RAJSIMA

<u>STATION</u>	<u>LOCATION</u>	<u>ESTABLISHED</u>
Nakorn Rajsima	Amphur: Muang Province: Nakorn Rajsima	1953

<u>AREA</u>	<u>AVAILABLE FOR EXPANSION</u>
24.5 rai - Land 2 rai - Water	--

<u>PERSONNEL</u>	<u>TRAINING</u>	<u>YEAR</u>
Head: Mr. Boonlue Somboonwong	3 years at vocational school	
Biologist: Mr. Pramot Suwanasart	B.S. Kasetsart Un.	1964
Extension: 3	3 years experience	
Laborers: 10 Permanent 3 Temporary		

NUMBER AND SIZE (m<sup>2</sup>) OF PONDS USED TO PRODUCE FINGERLINGS

<u>Earthen</u>		<u>Cement</u>	
4	400	10	10
2	800	4	80
1	200		

EXTENSION AND DEMONSTRATION ACTIVITIES

Equipment Available

1. 1 motorcycle, 13 years old
2. 1 12 HP water pump
3. 1 5 HP water pump

Rice Paddy Fields and Fish Species Used

2 10 rai

Common carp	1,000
<u>T. pectoralis</u>	4,000

500 stocked per rai.

FISH PRODUCTION

<u>Species</u>	<u>Number</u>
Common carp	80,000
<u>T. mossambica</u>	124,500
<u>T. nilotica</u>	100,000
<u>Trichogaster pectoralis</u>	26,200
<u>Helostoma</u>	10,000

RESEARCH PROJECTS

1. Role of sodium cyanide in fish culture.

TRANSPORTATION FACILITIES AVAILABLE

1. Jeep, land-rover; purchased in 1964; O.K.
2. Truck, dodge power wagon; purchased in 1955; no good.
3. Truck, dodge; purchased in 1955; no good.
4. Truck, dodge fargo; purchased in 1967; O.K.

EQUIPMENT AVAILABLE FOR RESEARCH

1. 2 50 m seine
2. 1 dissecting microscope
3. 1 compound binocular microscope
4. 12 aquaria
5. 1 Ekman dredge
6. 1 dissecting apparatus
7. 1 thermometer
8. 1 analytical balance
9. 1 pocket pH meter
10. 1 500 gm capacity balance
11. 1 50 kg - 100 kg scale

EQUIPMENT NEEDED<sup>1</sup>

1. 1 portable pH meter with extra batteries
2. 1 balance
3. 1 5 kg - 10 kg scale
4. 1 dozen BOD bottles
5. 1 Burette - 2 - 25 ml capacity
6. 2 5 HP portable gasoline water pumps

- 
1. Equipment requested by Station Head.



UBOL RAJTHANI

<u>STATION</u>	<u>LOCATION</u>	<u>ESTABLISHED</u>
Ubol Rajthani	Amphur: Muang Province: Ubol Rajthani	1954

<u>AREA</u>	<u>AVAILABLE FOR EXPANSION</u>
57.25 rai - Land 6 rai - Water	--

<u>PERSONNEL</u>	<u>TRAINING</u>	<u>YEAR</u>
Head: Mr. Vinus Boonyaratplin	B.S. Kasetsart Un.	1962
Biologists: Mr. Amnuay Tanthong	B.S. Kasetsart Un.	1964
Mr. Niphon Siribhand	B.S. Kasetsart Un.	1968
Extension: 3	5 years experience	
8	3 years experience	
Civil Engineers: 3		
Laborers: 27 Permanent		
22 Temporary		

NUMBER AND SIZE (m<sup>2</sup>) OF PONDS USED TO PRODUCE FINGERLINGS

Earthen

1	387.50	1	145.60	1	475.20
1	343	1	171	1	375
1	100.44	1	448.20		
1	136	1	304.20		

Cement

13	50		
8	15		
40	130 - these ponds are not used to produce fingerlings		

EXTENSION AND DEMONSTRATION ACTIVITIES

Equipment Available

1. 3 motorcycles	7. 1 16 HP inboard motor boat
2. 1 Bell and Howell projection equipment	8. 1 generator
3. 1 9 HP water pump	9. 1 transistor tape recorder
4. 1 7 HP water pump	10. 1 transistor amplifier
5. 4 5 HP water pumps	11. 1 binocular microscope
6. 1 13 HP longtail boat	12. 1 camera (Canon)

Rice Paddy Fields and Fish Species Used

24 120 rai

Common carp	500
<u>Trichogaster pectoralis</u>	2,000

FISH PRODUCTION

<u>Species</u>	<u>Number</u>
Common carp	790,500
<u>Trichogaster pectoralis</u>	263,500
<u>T. mossambica</u>	149,300
<u>T. nilotica</u>	341,900
<u>Pangasius sp.</u>	970
<u>Puntius gonionotus</u>	
<u>Cyclohyrichthys enoples*</u>	59,650
<u>Pangasianodon gigas</u>	1

\*snail eater

RESEARCH PROJECTS

1. Termites as food for common carp with emphasis on conversion factor.
2. General survey on fishes and fishing gear in Moon River, Ubol Rajthani Province.
3. A preliminary study on the effect of pollution to fishes by soaking jute in irrigation tanks.

TRANSPORTATION FACILITIES AVAILABLE

1. Jeep, land-rover; purchased in 1964; O.K.
2. Jeep, land-rover; purchased in 1965; O.K.
3. Jeep, wagoneer; purchased in 1965; O.K.
4. Truck, dodge power wagon; purchased in 1955; poor.
5. Truck, dodge stake; purchased in 1955; poor.
6. Truck, fargo; purchased in 1967; O.K.

EQUIPMENT AVAILABLE FOR RESEARCH

- |                             |                                  |
|-----------------------------|----------------------------------|
| 1. 2 100 m seines           | 11. 40 aquaria                   |
| 2. 6 50 m seines            | 12. 3 air pumps with filter      |
| 3. 2 25 m seines            | 13. 1 refrigerator               |
| 4. 9 plankton nets          | 14. 1 analytical balance         |
| 5. 1 Kemmerer water sampler | 15. 1 500 gm capacity balance    |
| 6. 7 stereo microscopes     | 16. 11 thermometers              |
| 7. 1 compound microscope    | 17. 1 lab kit for water analysis |
| 8. 2 profile projectors     | 18. 1 electric pH meter          |
| 9. 1 dissecting microscope  | 19. 1 current meter              |
| 10. 2 sieves                |                                  |

EQUIPMENT NEEDED<sup>1</sup>

- |                   |                         |
|-------------------|-------------------------|
| 1. 1 drying oven  | 4. 1 analytical balance |
| 2. 1 centrifuge   | 5. 1 12 x 500 m seine   |
| 3. 1 nephelometer | 6. 1 pelleter           |

- 
1. Equipment requested by Station Head.

UDORN THANI

<u>STATION</u>	<u>LOCATION</u>	<u>ESTABLISHED</u>
Udorn Thani	Amphur: Muang Province: Udorn Thani	1954

<u>AREA</u>	<u>AVAILABLE FOR EXPANSION</u>
27.75 rai - Land 9.5 rai - Water	--

<u>PERSONNEL</u>	<u>TRAINING</u>	<u>YEAR</u>
Head: Mr. Songsilpa Sutjaritkul	3 years Kasetsart Un.	1947
Biologists: Mr. Pipop Kamolrat	B.S. Kasetsart Un.	1964
Mr. Chaichet Laojintanasri	R.S. Kasetsart Un.	1968
Extension: 4	5 years experience	
7	3 years experience	
Civil Engineers: 2		
Laborers: 24 Permanent		
45 Temporary		

NUMBER AND SIZE (m<sup>2</sup>) OF PONDS USED TO PRODUCE FINGERLINGS

Earthen

1	1,350	1	1,230	1	1,080
1	1,092	2	704	2	120
2	726	1	946	2	90
1	400	1	814		
1	360	1	770		
1	660	1	1,032		
1	528	2	480		

Cement

42 10

Rice Paddy Fields

20 160

EXTENSION AND DEMONSTRATION ACTIVITIES

Equipment Available

1. 3 motorcycles
2. 16 mm movie projector with screen
3. 35 mm slide projector

4. 2 transistor tape recorders
5. 2 transistor amplifiers
6. 1 pair of binoculars
7. 1 35 mm camera
8. 2 12 HP water pumps
9. 1 9 HP water pump
10. 1 7 HP water pump
11. 2 5 HP water pump

Rice Paddy Fields and Fish Species Used

24            84 rai

Common carp        53,800

645 stocked per rai. Average production 42 kg/rai.

FISH PRODUCTION

<u>Species</u>	<u>Number</u>
Common carp	478,100
<u>Trichogaster pectoralis</u>	348,200
<u>T. mossambica</u>	few
<u>T. nilotica</u>	113,300
<u>T. melanopleura</u>	few
<u>H. temmincki</u>	few
<u>O. goramy</u>	few

RESEARCH PROJECTS

1. Experiments on common carp culture in rice paddy fields.

TRANSPORTATION FACILITIES AVAILABLE

1. Jeep, land-rover; purchased in 1963; poor.
2. Jeep; purchased in 1965; O.K.
3. Jeep, land-rover; purchased in 1965; O.K.
4. Truck, dodge power wagon; purchased in 1954; no good.
5. Truck, dodge; purchased in 1954; no good.
6. Truck, dodge fargo; purchased in 1967; O.K.

EQUIPMENT AVAILABLE FOR RESEARCH

1. 4 50 m seines
2. 6 25 m seines
3. 9 plankton nets
4. 1 profile projector
5. 20 aquaria

6. 2 airpumps with filter
7. 1 dissecting apparatus
8. 1 refrigerator
9. 1 analytical balance
10. 1 500 gm capacity balance
11. 6 thermometers
12. 1 pocket pH meter
13. 1 water analysis lab kit
14. 1 compound binocular microscope
15. 1 microscope substage lamp
16. 1 7 kg balance

EQUIPMENT NEEDED<sup>1</sup>

1. 1 pH meter unit
2. 1 standard pH tablets
3. 1 drying oven
4. 6 desicators
5. 1 dissecting binocular microscope
6. 1 5 kg accurate to 5 gm balance
7. 1 35 mm camera
8. 1 9 HP water pump
9. 1 5 HP water pump
10. 1 automatic focus, 35 mm slide projector
11. 1 portable lenticular screen
12. 1 jeep
13. 1 truck

---

1. Equipment requested by Station Head;

SURIN

<u>STATION</u>	<u>LOCATION</u>	<u>ESTABLISHED</u>
Surin	Amphur: Muang Province: Surin	1962.

<u>AREA</u>	<u>AVAILABLE FOR EXPANSION</u>
75.45 rai - Land 19.47 rai - Water	15 rai

<u>PERSONNEL</u>	<u>TRAINING</u>	<u>YEAR</u>
Head: Mr. Uthai Promintra	3 years at Kasetsart Un.	1947
Biologists: Mr. Boonchuey Chaopaknam	B.S. Kasetsart Un.	1964
Mr. Sutchu Sukwibul	B.S. Kasetsart Un.	1968
Extension: 2	3 years experience	
Laborers: 23 Permanent 3 Temporary		

NUMBER AND SIZE (m<sup>2</sup>) OF PONDS USED TO PRODUCE FINGERLINGS

<u>Earthen</u>	<u>Cement</u>	
13 200	10 50	
5 800	1 6	
5 1,600	9 6	6 - These ponds not used to produce fingerlings

EXTENSION AND DEMONSTRATION ACTIVITIES

Equipment Available

1. 1 motorcycle
2. 1 12 HP diesel pump
3. 1 5 HP diesel pump

Rice Paddy Fields and Fish Species Used

2 8 rai

Common carp 3,200

400 stocked per rai

FISH PRODUCTION

<u>Species</u>	<u>Number</u>
<u>C. carpio</u>	713,480
<u>T. nilotica</u>	198,435
<u>Trichogaster pectoralis</u>	93,460

RESEARCH PROJECTS

1. Experimental basket culture of common carp aiming at growth rates, stocking rates, and the endurance of basket constructing materials.
2. Comparison of growth rate among three groups of common carp fed on different formulae of feed.
3. Physio-chemical characteristics of inundated waters in and about Surin Province.

TRANSPORTATION FACILITIES AVAILABLE

1. Jeep, land-rover; purchased in 1962; fair.
2. Jeep, willy; purchased in 1962; fair.
3. Truck, dodge power wagon; purchased in 1955; no good.
4. Truck; more than 10 years old; no good.
5. Truck, fargo; purchased in 1966; good.

EQUIPMENT AVAILABLE FOR RESEARCH

- |                            |                          |
|----------------------------|--------------------------|
| 1. 2 50 m seines           | 8. 10 aquaria            |
| 2. 2 25 m seines           | 9. 1 airpump with filter |
| 3. 3 plankton nets         | 10. 1 refrigerator       |
| 4. 2 compound microscopes  | 11. 1 analytical balance |
| 5. 1 profile projector     | 12. 3 spring balances    |
| 6. 1 electrical centrifuge | 13. 1 electric pH meter  |
| 7. 2 sieves                |                          |

EQUIPMENT NEEDED<sup>1</sup>

- |  |                        |
|--|------------------------|
| 1. 1 electric oven (220 volts, 50 cycle)             | 6. 1 amplifier set     |
| 2. 1 100 m seine with 2.5 cm mesh                    | 7. 1 portable generato |
| 3. 1 16 mm movie projector                           | 8. 1 jeep              |
| 4. 1 5' x 5' lenticular screen                       | 9. 1 truck             |
| 5. 1 remote control, automatic focus slide projector | 10. 1 nephelometer     |

---

1. Equipment requested by Station Head.

NONG KHAI

<u>STATION</u>	<u>LOCATION</u>	<u>ESTABLISHED</u>
Nong Khai	Amphur: Srichiengmai Province: Nong Khai	1968

<u>AREA</u>	<u>AVAILABLE FOR EXPANSION</u>
125.5 rai - Land 7 rai - Water	--

<u>PERSONNEL</u>	<u>TRAINING</u>	<u>YEAR</u>
Head: Mr. Nid Koocharoonpaisal	B.S. Kasetsart Un.	1963
Biologists: Mr. Teinthong Yuovechwatana	B.S. Kasetsart Un.	1968
Extension: 2	5 years experience	
5	3 years experience	
Civil Engineers: 2		
Laboreres: 8 Permanent 22 Temporary		

NUMBER AND SIZE OF PONDS USED TO PRODUCE FINGERLINGS

<u>Earthen</u>	<u>Cement</u>
4 1 rai	6 10 (m <sup>2</sup> )
6 0.5 rai	

RESERVOIRS

Nong Rirk 100 (m<sup>2</sup>) basket culture

EXTENSION AND DEMONSTRATION ACTIVITIES

Equipment Available

1. 3 motorcycles
2. 1 movie projector
3. 1 slide projector

Rice Paddy Fields and Fish Species Used

50 250 rai

<u>C. carpio</u>	95,000
<u>T. nilotica</u>	2,000

400 stocked per rai.



FISH PRODUCTION

<u>Species</u>	<u>Number</u>
<u>C. carpio</u>	Brood fish just stocked
<u>T. nilotica</u>	Brood fish just stocked
<u>Trichogaster pectoralis</u>	Brood fish just stocked

RESEARCH PROJECTS

1. Fish collection in Nong Khai province.
2. Experiment on common carp culture in nylon baskets by using two kinds of fish-feed.

TRANSPORTATION FACILITIES AVAILABLE

1. Jeep, land-rover; purchased in 1968; O.K.
2. Jeep, land-rover; purchased in 1963; poor.
3. Boat, 100 HP outboard motor.

EQUIPMENT AVAILABLE FOR RESEARCH

1. 2 100 m seines
2. 2 50 m seines
3. 3 25 m seines
4. 3 plankton nets
5. 10 aquaria
6. 1 Kemmerer water sampler
7. 1 airpump with filter
8. 1 Ekman dredge
9. 1 compound microscope
10. 1 dissecting microscope
11. 2 500 gm capacity balances
12. 2 20-30 kg capacity balances
13. 1 current meter
14. 1 underwater thermometer recorder
15. 1 colorimeter
16. 1 electric pH meter

EQUIPMENT NEEDED<sup>1</sup>

1. 1 analytical balance
2. 1 jeep
3. 1 truck
4. 1 35 mm camera
5. 1 nephelometer
6. 1 portable pH meter

---

1. Equipment requested by Station Head.

PHATTALUNG

<u>STATION</u>	<u>LOCATION</u>	<u>ESTABLISHED</u>
Phattalung	Amphur: Nuang Province: Phattalung	1954

<u>AREA</u>	<u>AVAILABLE FOR EXPANSION</u>
775 rai - Land	--
100 rai - Water	

<u>PERSONNEL</u>	<u>TRAINING</u>	<u>YEAR</u>
Head: Mr. Pramot Wanichagorn	B.S. Kasetsart Un.	1956
Extension: 2	3 years experience	
Laborers: 4 Permanent		
10 Temporary		

NUMBER AND SIZE (m<sup>2</sup>) OF PONDS USED TO PRODUCE FINGERLINGS (Earthen)

1	1,600	2	175
2	112	2	70
2	49	2	140
1	232	1	235
1	225		

EXTENSION AND DEMONSTRATION ACTIVITIES

Earthen Ponds and Fish Species Used

1 247 rai  
Common carp 247

Rice Paddy Fields and Fish Species Used

2 ½ rai

Trichogaster pectoralis 25 pair (brood)

50 pair (brood) stocked per rai.

FISH PRODUCTION

<u>Species</u>	<u>Number</u>
<u>Trichogaster pectoralis</u>	114,900
<u>C. carpio</u>	136,100
<u>T. nilotica</u>	65,300

TRANSPORTATION FACILITIES AVAILABLE

1. Jeep, land-rover; purchased in 1964; O.K.
2. Jeep, willy; no good.
3. Truck, dodge power wagon; purchased in 1955; no good.
4. Truck, chevrolet; no good.

EQUIPMENT AVAILABLE FOR RESEARCH

1. 1 100 m seine
2. 1 50 m seine
3. 2 plankton nets
4. 1 compound microscope
5. 3 dissecting apparatus
6. 10 aquaria
7. 1 airpump with filter
8. 1 analytical balance
9. 2 500 gm capacity balances
10. 1 Kemmerer water sampler

EQUIPMENT NEEDED<sup>1</sup>

1. 2 10 HP portable diesel pumps
2. 1 50 gallon/hour, diesel, deep well pump which will lift water 50 ft.

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1. Equipment requested by Station Head.

5.2 LIST OF EQUIPMENT AND CHEMICAL NEEDED FOR A BASIC WATER  
CHEMISTRY LABORATORY

## Materials for Water Chemistry Lab

I Sampling Equipment

36	BOD bottles 300 ml	\$ 78.23
2	Sampling device - bottle train sampler	
4-6	Field thermometer 0-50°C	16.50
2	Field reagent box	

II Laboratory Hardware

4-6	Ring Stand or Burette Support 60-75 cm high	30.00
4-6	Fisher or Bunsen burner	35.00
12	Wire gauze, 15 cm x 15 cm, asbestos center	4.20
2	Crucible tongs	7.00
2-3	Burette clamps, double	2.40
6	Clamps, single general utility	13.20
4-6	Ring clamps or support rings or tripods, 125 mm diameter	9.00
3-4	Triangular files - glass cutter	3.60
1	Cork borer	5.00
1	Rack for funnels	15.50
1	Rack for Kjeldahl flasks	6.50

III Volumetric glassware - pyrex or corex or kimax

Volumetric flasks		
10	1 liter	38.00
10	500 ml	35.50
10	200 or 250 ml	27.00

Volumetric pipettes

3-4	5 ml	9.60
3-4	10 ml	10.40
1-2	25 ml	5.70
1-2	50 ml	6.06
3-4	100 ml	13.20
1-2	200 ml	7.60

Graduated pipettes

5	1 ml in hundredths of ml	7.50
5	2 ml in tenths of ml	8.00
5	5 ml in tenths of ml	8.00
5	10 ml in tenths of ml	9.50

Graduated cylinders

1	50 ml	3.10
3-4	100 ml	13.80
3-4	200 ml	14.40
3-4	100 ml	27.60

Burettes

2	50 ml in tenths of ml	33.00
2	25 ml in tenths of ml	32.00
4	10 ml in tenths of ml, squeeze bottle, self zeroing	80.00

IV Other Glassware - Pyrex, Kimax

Beakers, Griffin low form with lip

5-6	100 ml	2.70
5-6	250 ml	3.75
3-4	600 ml	5.75
3-4	1000 ml	8.80

	Flasks (Erlenmeyer, narrow mouth)	
12	125 ml	\$ 25.44
24	250 ml	52.32
12	500 ml	27.24
12	1000 ml	31.20

V Miscellaneous Equipment

6	condensers, 300 mm	27.00
24	Funnels, 5-7.5 cm diameter, long stem	15.36
2	Dessicator, 200-300 mm diameter	26.00
	Rubber stoppers, 1 doz of each size to fit each size flask	37.40
30 m	Rubber tubing 5-6 mm inside diameter	54.00
10 m	Glass tubing 5-6 mm diameter	16.00
1	pH meter - Photovolt. battery powered for field use <sup>1</sup>	265.00
1	Spare electrode for pH meter	24.00
24	Nessler tubes, graduated at 50 and 100 ml	60.24
1	Rack for Nessler tubes	9.75
1 pr	Asbestos gloves	6.00
1	Oven - for temp. up to 150-200°C	225.00
1	Still, 4 liter/hr., distilled H <sub>2</sub> O	305.00
1	Storage jug for distilled H <sub>2</sub> O, 40-50 liter	25.52
6	Wash bottles, 500 ml. polyethylene	3.65
1	Analytic balance, sensitivity 0.1 mg, capacity 150-200 gm	795.00
1	Set of weights for balance	15.00
1	Triple beam or torsion balance, sensitivity 0.1 gm, capacity 1-2 kg	185.00
<u>3-4</u>	<u>Reagent bottles, 16 oz. or 500 ml</u>	<u>6.92</u>
1	or laboratory 220 volt model.	

36	Dropping bottles, 60 ml. polyethylene, or glass with pipette	\$ 12.60
3 box	Filter paper 15 cm Whatman No.42	9.36
3 box	Filter paper 15 cm Whatman No.5	5.58
25	Pipets, ungraduated, with rubber bulb (eyedroppers)	1.65
5-6	Evaporating dish, porcelain, 50 or 100 ml	6.75
1 box	Glazed weighing paper, for use with analytic balance	0.45
12	Kjeldahl flasks, 800 ml	158.00
12	Stoppers for Kjeldahl flasks	2.50
1	Hood or suction manifold to exhaust fumes	295.00
2	Thermometer 0-200°C	7.20
12	Brown bottle, 16 oz or 500 ml, for reagent storage	2.75
12	Spatula, assorted sizes	9.60
1000	Labels	2.00
1	Powder funnel 10-15 cm inches diameter	0.78
1	Powder funnel 5-7.5 cm. inches diameter	1.00
500 gm.	Boiling beads	1.50
1	Magnetic Stirrer	37.00
12	Magnetic Stirring bars, 2 to 3 cm.	<u>30.00</u>
TOTAL COST =		\$3,494.00



Chemicals for Water Chemistry Laboratory  
For Determination of Dissolved O<sub>2</sub>, CO<sub>2</sub>, Alkalinity  
Ammonia, Organic Nitrogen, Total Hardness and pH

(All reagents are Reagent Grade except where otherwise stated)

O<sub>2</sub> Det'n

6-4Kg bottles	H <sub>2</sub> SO <sub>4</sub> , conc Sp.Gr. 1.84
500 gm	Sulfamic acid (NH <sub>2</sub> SO <sub>2</sub> OH)
2 Kg	MnSO <sub>4</sub>
5 Kg	NaOH
2 Kg	KI
500 gm	K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
250 gm	Soluble starch powder
2 liter	glycerine
3 - 2.7 Kg bottles	HCL, conc. Sp.Gr. 1.19

CO<sub>2</sub> Det'n

10 gm	phenolphthalein indicator
2 liter	ethyl or methyl alcohol, purified grade
1 Kg	Na <sub>2</sub> CO <sub>3</sub> , or 2 liters, 1-N std. NaOH

Alkalinity Det'n

10 gm	Xylene cyanole indicator
10 gm	Methyl orange indicator

pH Det'n

1 liter each	pH buffers, pH 5, 7, 9, (liquid or tablets)
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Ammonia Det'n

6 liter	Nessler's reagent or 500 gm HgI <sub>2</sub>
500 gm	ZnSO <sub>4</sub>
1 Kg	Rochelle salt

100 gm

100 gm

500 gm	$\text{KH}_2\text{PO}_4$
1 kg	$\text{K}_2\text{HPO}_4$
500 strips	Litmus paper, red
500 gm	$\text{NH}_4\text{Cl}$

Hardness Det'n

10 gm	Calmagite (or Chrome Black T, Eriochrome Black T, or F241)
100 gm	Hydroxylamine HCl
250 gm	$\text{CaCl}_2$
500 gm	E.D.T.A. (Versene)
100 gm	$\text{MgCl}_2$
1.8 Kg bottle	$\text{NH}_4\text{OH}$ Sp.Gr. 0.90

Kjeldahl Digestion for Organic Nitrogen

2 Kg	$\text{Na}_2\text{SO}_4$ or $\text{K}_2\text{SO}_4$ (anhydrous)
------	---

Miscellaneous

2 Kg	Anhydrous $\text{CaCl}_2$ , granular, 4 to 8 mesh, Technical grade
1 Kg	Soda Lime, granular, 4 to 8 mesh, Technical grade

TOTAL COST ..... \$ 193.00

5.3 EQUIPMENT NEEDED FOR A BASIC FISH PARASITE AND DISEASE LABORATORY. (THIS LABORATORY SHOULD BE LOCATED AT THE BANGKHEN CENTRAL RESEARCH STATION).

EQUIPMENT NEEDED TO ESTABLISH A FISH PARASITE AND DISEASE LAB

		<u>Est. Price</u>
Microscope- plus case	Compound, phase-contrast with trinocular head (light and dark field objectives).	1,800.00
Microscope- plus case	Dissecting - cycloptic with camera adaptor 10 x and 15x oculars.	600.00
Camera lucida-	Unitron	40.00
Lamps-	2 gooseneck desk lamps	20.00
Dissecting kit-	Forceps, scalpels, scissors, droppers, probes, needles, bone shearing	30.00
Dissecting pans-	Specimen dishes, petri dishes, embryo dishes, culture dishes	60.00
Aquaria-	40 liter-(about 50 with air; water lines.)	1,500.00
Troughs-	6 with running water.	600.00
Refrigerator	Freczer unit included	350.00
Microtome-	Plus extra blades, paraffin etc.	300.00
Heating table for slides-	Plus parafin oven	350.00
Microscope slides, cover slips, labels, etc.	slide boxes	200.00
Alcohol, permount, Xylene etc. for slide work.		50.00
Glassware-	Beakers, flasks, cylinders.	300.00
Storage vials-	Different sizes.	150.00
Formalin solution	10 gallons.	40.00
Other chemicals-	Bouins, Lugols, Glycerine jelly, Stains (Carminc, Hemitoxylin, fast green) Acetone, Acids (HCl, H <sub>2</sub> SO <sub>4</sub> , Glac. Acetic). NaOH etc.	100.00
Drawing materials-		50.00

Camera-	With microscope adaptor (single lens reflex).	300.00
References-	Books, specimens, reprints, etc.	300.00
Seines, dipnets etc. for collecting fish		200.00

Bacteriological Lab

Incubator, 30°- 65°C		425.00
Incubator; 0° to 50°C (2)		900.00
Autoclave; costle portable		650.00
Oven, sterilizing		325.00
Demineralizer for purifying water		170.00
Glass distillation apparatus		250.00
Magnetic stirring apparatus with rods		80.00
Hot plate		30.00
Spectronic 20 colorimeter		475.00
Torsion prescription balance		200.00
Triple beam balance		25.00
Centrifuge, Micro-hematocrit		210.00
Bunsen burner; Touch-O-Matic (2)		32.00
Centrifuge, clinical		150.00
Timer		6.00
pH Meter		230.00
Liqui-nox detergent		20.00
Pipette Washing apparatus		75.00
Mortar and Pestle (6)		15.00
Bacteriological inoculating loop (6)		12.00
Disposable syringes (2.5, 5 and 10 ml.)		45.00
Pipette can (6)		32.00
Pipettes (1, 5, and 10 ml.)		85.00

	<u>Est. Price</u>
Rubber tubing of assorted sizes	50.00
Rubber stoppers of assorted sizes	10.00
Bacteriological media (TSA, BHI, Pseud. F, sulfide, etc.)	75.00
Bacteriological glassware (Tubes, Petri dish)	150.00
Bacteriological stains	50.00
<u>Tissue Culture Laboratory - Virus Research</u>	
Sterile hood, luminar flow	1,000.00
Tissue culture glassware	250.00
Tissue culture media and antibiotics	100.00
Inverted TC microscope	800.00
Vacuum pump	85.00
Large capacity millipore filter with pressure vessel	230.00
Swinny adapter filters (24)	192.00
Millipore filters of assorted porosity	100.00
Cornwall continuous syringe (2, 5 ml; 2, 10 ml)	75.00
	<hr/>
	\$14,949.00

5.4 LIST OF EQUIPMENT NEEDED FOR A BASIC FISH FEED AND NUTRITION LABORATORY. (THIS LABORATORY SHOULD BE LOCATED AT THE BANGKHEN CENTRAL RESEARCH STATION.).

EQUIPMENT FOR FISH NUTRITION RESEARCH FACILITY

<u>ITEM</u>	<u>QUANTITY</u>	<u>UNIT COST</u>	<u>TOTAL COST</u>
<u>A. Wet Lab:*</u>			
Aquarium , glass, 12 gallon capacity	50	25.00	1250.00
Tanks, fiberglass, 55 gallon capacity, with stand-pipe drain	20	65.00	1300.00
Water pump with pressurized storage tanks, to deliver 900 G.p.m. at 20 ft. elevation	1		235.00
Charcoal	500 lbs.	.50	250.00
Scales, platform type, 10 kg.	1		275.00
Air compressor, to 165 p.s.i., 20 gal. tank or Blower, Sutorbilt 5 HP.	1		155.00
Miscellaneous materials (air stones, tubing, hose, cleaning equipment, containers, etc.)			100.00
<u>B. Feeding in Ponds:</u>			
Hardware cloth for cages 1/4" mesh, 36" wide	300 ft.	42.00	126.00
Scales for field weighing, 10 kg.	1		40.00
Oxygen analyzer, battery operated	1		700.00
<u>C. Feed Preparation Area:</u>			
Scales, 200 kg.	1		150.00
Feed mixer	1		285.00
Pelleting machine with 1/8" die ring	1		3145.00
Hobart mixer, 12 qt.	1		476.00
Grinding head with 1/8" extruding plate			24.00

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\* The following materials can be fabricated locally: racks and tables for tanks; plumbing for supplying water to tanks and for draining tanks; container for charcoal filtration.



<u>ITEM</u>	<u>QUANTITY</u>	<u>UNIT COST</u>	<u>TOTAL COST</u>
Wiley mill with 1/2 h.p. motor, with 3/32, 1/16, and 1/32 inch screens	1		1,020.00
Forced-air drying oven, 36"x36"x60" 45 cu. ft., electric	1		1,500.00
Hammer mill, 66 hammers, 15 inch x 24 inch diameter chamber, with 1/8 inch and 3/32 inch screens, with 15 h.p. electric motor	1		685.00
D. Analysis Lab:**			
Analytical balance, electronic, 160 grams	1		795.00
Kjeldahl digestion and distilling unit, 12 position	1		2,150.00
Fume hood and blower for perchloric acid digestion	1		2,544.00
Magnetic stirrer	1		34.00
Titration lamp	1		30.00
Water bath, thermostatic, 26"x15"x16"	1		297.00
Electric heating plate, thermostatic, 12"x13"	1		77.50
Dissecting kit	1		20.00
Water still, electrically heated, 2 gal. per hr. capacity	1		299.00
Storage freezer, chest type, 17.2 cu.ft.	1		220.00
Goldfish fat extractor, electric, 6-position	1		585.00
Aspirators, 7-inch	3	6.50	16.50

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\*\*Work table, storage cabinets, electricity, gas, and plumbing are assumed to be installed.

<u>ITEM</u>	<u>QUANTITY</u>	<u>UNIT COST</u>	<u>TOTAL COST</u>
Muffle furnace with temp. controls and pyrometer, 5 1/2" x 15" x 4 1/2"	1		347.00
Dessicators, with stopcock covers, 250 mm inside diameter	4	46.00	184.00
Spectronic 20 colorimeter with line voltage regulator, moisture-proof model	1		400.00
pH meter, AC-battery powered	1		330.00
Crude fiber analyzer, 6 position, Labconco model	1		560.00
Fiber filter with 6 metal screens	1		57.25
Glassware, hardware, and miscellaneous equipment (beakers, flasks, pipettes, burettes, crucibles, stands, extraction thimbles, etc.)			<u>1,000.00</u>
	TOTAL		21,765.25

5.5 LIST OF EQUIPMENT NEEDED FOR A BASIC LIMNOLOGICAL RESEARCH  
LABORATORY

LIMNOLOGICAL APPARATUS

MAPPING

- 2 PLANETABLES WITH ALIDADES (LOCAL CONSTRUCTION)  
(Satisfactory for mapping areas up to 10 acres, with reasonable accuracy)
- 1 STEEL TAPE 100 FT OR 50 M
- 2 TRANSITS WITH TRIPODS (Same as for construction of ponds)
- 2 PROTRACTORS
- 1 GRADUATED LINE FOR DEPTHS
- 1 STADIA ROD (For use with transit where high degree of accuracy is not required)
- 1 POLAR PLANIMETER

TEMPERATURE

- 6 to 12 MAXIMUM - MINIMUM THERMOMETERS @15
- 1 ELECTRIC - RESISTANCE THERMOMETER. 100 FT CABLE  
(The thermometer on YSI Oxygen meter may be satisfactory)

VISIBILITY

- 1 SECCHI DISK (Local construction)

LIMNOLOGICAL APPARATUS

CURRENT

- 1 CURRENT METER

BOTTOM MATERIALS SAMPLER

- 1 EKMAN DREDGE WITH MESSENGER \$ 92
- 1 SIEVE FOR SCREENING (Local construction)

WATER SAMPLER

- \* 1 KEMMERER SAMPLER WITH MESSENGER \$ 92  
(Can be operated on ordinary rope)
- \*\*\* 1 VAN DORN WATER SAMPLER \$ 90  
MESSENGER \$ 12.50  
(Can be obtained with transparent cylinder,  
which is desirable for seeing stratification  
of algae. This should be operated on a cable  
because the clamping mechanism tends to  
cut rope.)
- 1 BOTTLE TRAIN APPARATUS (Local construction)  
BOD bottles for train

LIMNOLOGICAL APPARATUS

PLANKTON

*1	PLANKTON NET, WISCONSIN TYPE WITH DETACHABLE "BUCKET", NO.20 BOLTING CLOTH	\$ 80
1	EXTRA BUCKET FOR ABOVE	\$ 50
1	EXTRA BOLTING CLOTH NO.20 FOR REPLACEMENT At least 1 yard (Price approximately \$ 23 per yd. from PAUL O. ABBE', INC. 139 Center Ave., Little Falls, N.J. 07424)	
**1	PLANKTON CENTRIFUGE	\$ 206
*1	HENSEN-STEMPLE PIPET 1 ml.x 2 ml.	\$ 23
1	OVEN, DRYING	200
1	FURNACE, MUFFLE	300
2	DESICCATORS @ 20	

GENERAL

1	COMPOUND MICROSCOPE, With substage condenser, objectives 16 mm., 4 mm. and oil imm. and 10X Ocular. Mechanical Stage.	about \$ 600
1	STAGE MICROMETER 2 mm. 0.1 and 0.01 mm.	\$ 27
1	OCULAR MICROMETER DISC 5 mm. in O.a mm.	10
1	OCULAR MICROMETER DISC , WHIPPLE	18
1	COUNTING CELL, SEDGWICK-RAFTER, PLANKTON	12.25
1	STEREOSCOPIC MICROSCOPE 10X-70X	600

LIMNOLOGICAL APPARATUS

BALANCES

- |   |  |       |
|---|--|-------|
| 1 | TRIPLE BEAM WITH WEIGHTS TO 2610 GRAMS CAPACITY<br>0.1 gr. Approximately | \$ 30 |
| 1 | DIAL-O-GRAM 310 OHAUS (TYPE)<br>311 g.by 0.01 g.                         | \$ 60 |
| 1 | ANALYTICAL   |       |

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\* WILDLIFE SUPPLY CO., 2200 S. Hamilton St., Saginaw, Mich.48602

\*\* FOERST MECHANICAL SPECIALTIES CO. 2407 N. ST. LOUIS AVE.  
CHICAGO, ILL.

\*\*\* HYDRO PRODUCTS. P.O. BOX 10766 SAN DIEGO, CALIF.

LIMNOLOGICAL APPARATUS

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John Wiley and Sons, Inc. New York, London, Sydney.. 1115 pg.
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W<sup>m</sup> C. Brown Company Publishers, Dubuque, Iowa.
- Edmondson, W.T. (Ed.) 1959. Ward and Whipple Fresh-water Biology. 2<sup>nd</sup> Edition. John Wiley and Sons Inc.  
London. 1248 pg.
- Usinger Robert L. 1963. Aquatic Insects of California, Univ. of Calif. Press, Berkeley and Los Angeles, 508 pg.
- American Public Health Association 1955. Standard Methods for the Examination of Water, Sewage, and Industrial Wastes, American Public Health Association. Inc, 1790 Broadway, New York 19 N.Y. 522 pg.
- Welch, Paul S. 1948. Limnological Methods. Blakiston Co. Philadelphia. 381 pg.
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