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### Rainbow trout culture in Thailand

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#### Abstract

This study was carried out to determine the biological feasibility of rainbow trout culture at high altitude in Thailand. Four groups of trout eggs obtained from America, Germany, Nepal and Finland were donated to the Royal Project from February 1998 to June 1999. All eggs were transported to the trout farm at 6°C in controlled temperature boxes. Trout eggs were incubated in incubation troughs at 10-12°C water temperature with 6 L/min water flow-rate. The incubation period of eyed eggs was 8-10 days and hatching percentages of 86-100 were obtained. After hatching, yolk-sac fry were moved to nursing troughs and fry were fed on 52 % protein trout starter feed 12 times daily. After one month of age, fingerlings were stocked in 30 x 2 x 1.2 m concrete raceways. These were supplied with water at the rate of 250-500 L/min. Stocking density of fingerlings was 3 000-5 000 fish per pond. The fingerlings were fed daily with 40 % protein floating pellets at 1-3 % of body weight per day. Average water temperature during the culture period was 18°C. Despite varying on-growing regimes at 6-8 months of age, on average the fish had attained the marketable weight size (250-300 g). The survival rate was higher than 80 % and average food conversion rate of 1.5. This study shows that rainbow trout can be successfully reared in the Highland region of Thailand and there is therefore scope for farmers in this region to go into large scale rainbow trout production.

#### Introduction

Rainbow trout is a fish of temperate zone which do not occur naturally in Thailand where water temperature in the low lands is too high for their survival. In the mountain area of the northern part of Thailand, however, temperature is much lower which may make this region suitable for trout survival and growth. Rainbow trout were chosen as an experimental fish because its upper lethal temperature is higher than for other Salmon species. This experiment was designed to determine the biological feasibility of trout culture at high elevation (>1200 m asl) at different times of the year. The aim of this project is to introduce the rainbow trout farming in the northern highlands as a cash income source for the hill-tribe people. This project was supported

by the Department of Fisheries, The Royal Project Foundation, University of Goettingen, Chiang Mai University and DAAD.

## **Material and Methods**

### *Experimental trout farm*

The farm site is located at a height about 1 300 m asl on a small tributary stream of the River Klang near the base of Siriphum Waterfall on Doi Inthanon National Park which is the highest mountain of Thailand with 2 567 m asl. A small Meo village is located about 300 m from the experimental site.

### *Seed fish*

American, Nepalese, German and Finn trout eggs from Troutlodge Inc. USA, Nepal Agriculture Research Council, Relliehausen Farm of Goettingen University, and Finnish Game and Fisheries Research Institute were donated to the Royal Project Foundation and transported to the trout farm on 26 February 1998, 10 January 1999, 2 February 1999 and 16 June 1999 respectively. All eggs were transported to the trout farm in boxes with controlled temperature. Transportation temperatures were 6°C and 9°C.

### *Eggs incubation and nursing fry*

Eyed eggs were incubated in troughs at water temperature of 10-12 °C with 6 l/min water flow rate. After hatching, yolk sac fry were removed from hatching troughs to nursery trough. Water temperature in the nursing troughs would slowly increase from 12 °C to 15 °C at the end of nursing period. Fry were hand-fed 12 times daily with a 52 % protein trout fry starter feed. Green eggs were incubated and nursed in high water temperature (15-18 °C) only.

### *Grow out phase to marketable size*

The four concrete raceways (2.5x30x1 m deep) (Fig.2) were used for growing from fingerling until marketable size (250-300 g). These raceways were supplied with water from the waterfall at the rate of 250 l/min in the summer season and 500 l/min in the rainy season. At one month of age, fingerling were removed from hatching troughs into the concrete raceways. Details of the growing period for the different populations are given in Table 2. Water temperature and dissolved oxygen concentrations were monitored daily before feeding time. The fingerlings were fed 2-3 times daily with 40 % protein floating pellets at 1-3 % body weight per day and feeding rates were adjusted every two weeks after sampling. The fish were harvested when they reached marketable size of 250-300 g.

## **Results**

### *Eggs incubation and nursing fry*

The incubation periods for eyed eggs of all four populations were 8-10 days with average hatching percentage from 86-100 % and 21-30 days with hatching rate of 24-59 % for green eggs (Table 1). The survival rate of American, Nepalese, German and Finn populations at nursing period (30 days) were 92 %, 90 %, 95 % and 94 % respectively. The survival of fry from green eggs was as expected low but indicated that embryo development and survival was possible even under high incubation temperature (15-

18°C). Incubation times, hatching percentage and survival of fry from eyed eggs from four populations were satisfactory.

**Table 1.** Hatching percentage of eyed and green eggs of rainbow trout from different populations during 1998-1999

Population	Time	Water temp.	% hatch out	Eggs stage	Remark
USA	26/02/98	10 - 12	99.84	eyed eggs	USA female eggs
G1	02/02/99	10 - 12	93.08	eyed eggs	Germany population 1
G2	02/02/99	10 - 12	93.43	eyed eggs	Germany population 2
GB	02/02/99	10 - 12	87.36	eyed eggs	Germany population B
G12	02/02/99	10 - 12	58.86	green eggs	Germany population 1+2+B
G12	02/02/99	15 - 18	23.81	green eggs	Germany population 1+2+B
Nepalese 1	10/01/99	10 - 12	95.61	eyed eggs	Nepal normal egg 1
Nepalese 2	10/01/99	10 - 12	89.86	eyed eggs	Nepal normal egg 2
Finn	16/06/99	10 - 12	86.07	eyed eggs	Finn female eggs

### *Growth*

Despite varying on-growing regimes growth of all sizes of fish was satisfactory and trout from all four populations reached marketable size within 6-8 months with feed conversion ratios of 1.3-1.5 (Table 2). On the average the survival rate was about 80 %

**Table 2.** On growing period of the different trout populations.

Populations	Stocking density	Duration	Season/water temperature course	Harvest size
USA	3 000 fish	213 days	May, 1998 – Nov, 1998 21°C - 18°C - 16°C	350 g/fish
Nepalese	3 500 fish	316 days	Mar, 1999 – Jan, 2000 16°C - 19°C - 12°C	413 g/fish
Germany	4 000 fish	293 days	Apr, 1999 – Jan, 2000 19°C - 19°C - 12°C	351 g/fish
Finn	5 000 fish	250 days	Aug, 1999 – Apr, 2000 18°C - 12°C - 18°C	276 g/fish

### **Conclusion**

Growth of fish of all populations was satisfactory under a wide water temperature range. Thus water temperature at Doi Inthanon site was proven suitable all year round and close to ideal from October to March for trout. Therefore there does not seem to be any serious constraints for on growing of trout in the mountain area of Northern Thailand.