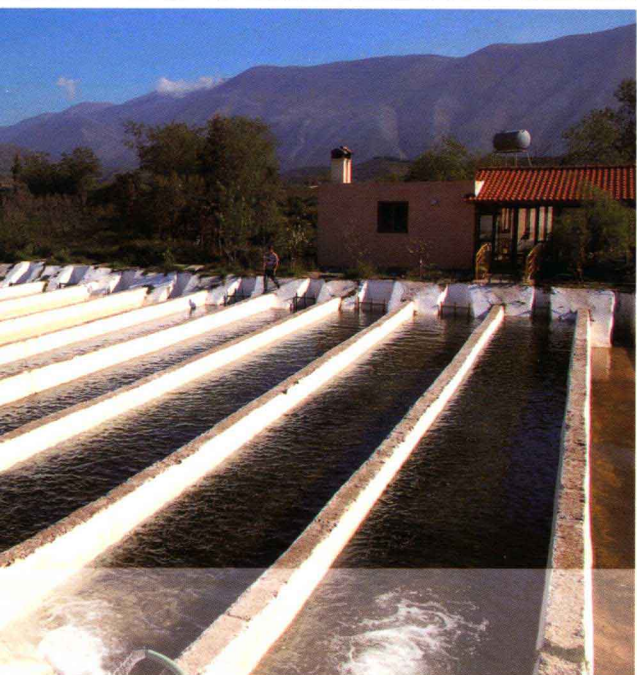
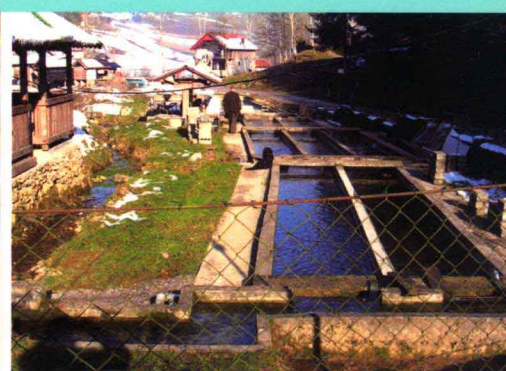
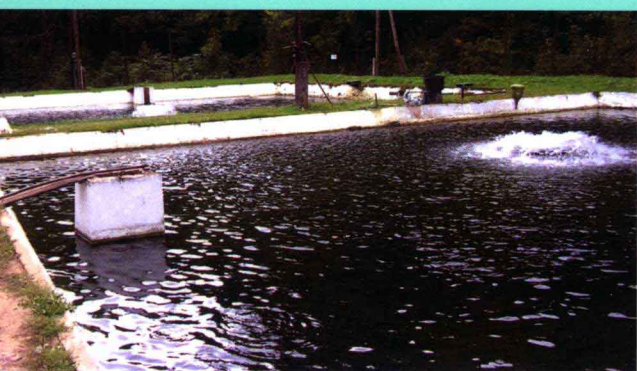


# Small-scale rainbow trout farming



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PAPER

561

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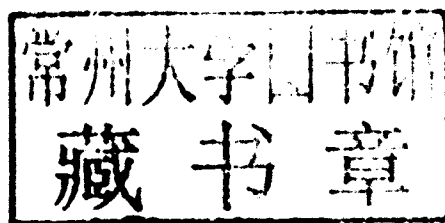
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# Preparation of this document

Unemployment-generated poverty in the mountainous regions of the countries of Central and Eastern Europe and of the Caucasus and Central Asia is a considerable problem. The problem exists in spite of the fact that natural resources could provide both income generation and employment in these regions.

Among the available natural resources, water excellent for trout farming is abundant in the mountainous regions. However, instead of being produced locally, the highly valued trout is often imported. Therefore, the utilization of available water resources for trout production is an obvious possibility for both increasing employment opportunities and generating income.

Because of the reasons mentioned above, the present practical reference publication has been designed and elaborated along with three other related trout farming publications. These are the guides to *Small-scale Propagation of Rainbow Trout*, *Small-scale Trout Processing Methods* and *Trout Farming-based Angling Tourism*.

It is hoped that the publications will support initiatives and the creativity of individuals, families and communities in the successful start-up and practice of trout farming and associated activities.

It is envisaged that interested farmers and families will learn the art of trout farming through this general example of rainbow trout farming. It is also hoped that the knowledge gained will help and support the start-up of the production of local trout species that need similar conditions and care.

We thank Jacob Bregnballe, Sales Director of AKVA Group, Denmark, for his valuable comments. We also wish to acknowledge the professional support received from Annamaria Hajduk (FAO Subregional Office for Central and Eastern Europe), Maksim Mikaric, FAO volunteer, Tina Farmer, Marianne Guyonnet and Maria Giannini (FAO Fisheries and Aquaculture Department), and José-Luis Castilla Civit in the finalization of this publication.



# Abstract

This technical paper is a basic guide to the starting and successful practice of small-scale trout farming. It summarizes all the technical information that it is important to know for small-scale trout production.

In mountainous regions, where water resources could support profitable trout farming, protection of the environment is also important. Therefore, this technical paper contains sections with information about the basics of efficient treatment of trout farm effluents.

The concept of this technical paper is to guide the reader through the necessary technical information, related practical solutions and the steps of preparation of both investment in and day-to-day operation of a small-scale rainbow trout farm.

In order to satisfy interest for specific details, a glossary has been compiled and tables and annexes attached. Explanations are short but together with their illustrations they should be informative. Hence, it is hoped that this combination will facilitate easy understanding and learning of rainbow trout farming.

**Woynarovich, A.; Hoitsy, G.; Moth-Poulsen, T.**

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# 1. Introduction

Trout farming is an ideal option for sustainable use of water resources in mountainous regions because here both surface and underground waters are suitable for this purpose. In regions where income-generating and employment opportunities are scarce, trout farming could help to ensure employment and steady incomes (Figure 1).

In addition to the production, trout farming could also ensure increased income and employment through angling tourism (Figure 2), restaurants (Figure 3) and related services.

The concept of this technical paper is to guide the reader through the necessary basic information of both investment in and day-to-day operation of a small-scale rainbow trout farm.

To satisfy the interest for specific details, a glossary has been compiled and tables and annexes are attached. For the sake of easy identification and finding additional information, a term in *italics* and followed by an asterisk (\*) indicates a term that is explained in the glossary.

The combination of short explanations together with illustrations is aimed for easy understanding. However, it is suggested that users of this publication consult subject specialists, who will help to avoid unnecessary failures and their financial consequences.

FIGURE 1  
Direct income generation through trout production

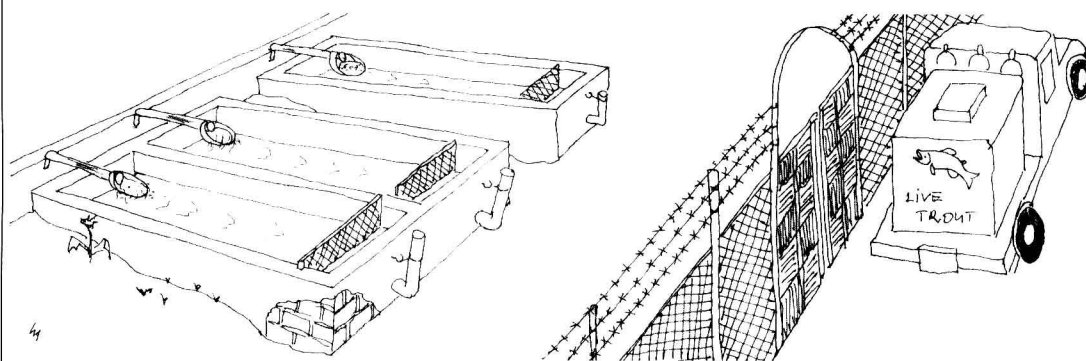


FIGURE 2  
Trout farming can support angling tourism

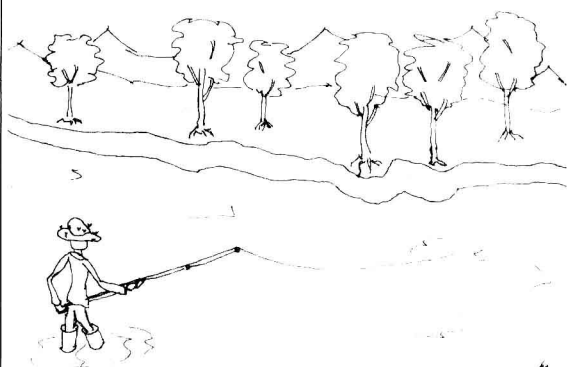


FIGURE 3  
Supplying trout to local restaurants generates tourism





## 2. Important trout species

There are 206 species in the *family*<sup>\*</sup> of Salmonidae. Salmonids (*salmon*<sup>\*</sup>, *trout*<sup>\*</sup>, char and whitefish) are found in practically all continents, partly because they are indigenous there and partly because they have been *introduced*<sup>\*</sup>.

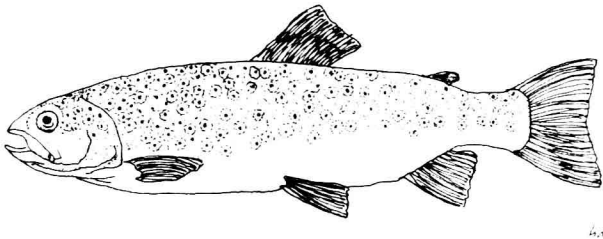
Among trout, brook trout, brown trout, lake trout, sea trout and rainbow trout are the most widely known species.

**Brown trout** is native to Europe and West Asia (Figure 4). An important market and sport fish, it has been introduced to many different countries all over the world.

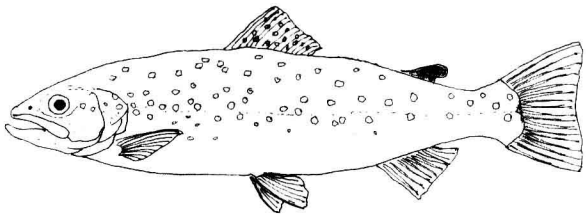
According to their *habitat*<sup>\*</sup>, taxonomists distinguish three forms of brown trout. They are the actual brown trout (*Salmo trutta m. fario*), lake trout (*Salmo trutta m. lacustris*) and sea trout (*Salmo trutta m. trutta*) (Figure 4).

FIGURE 4  
Brown, lake and sea trout

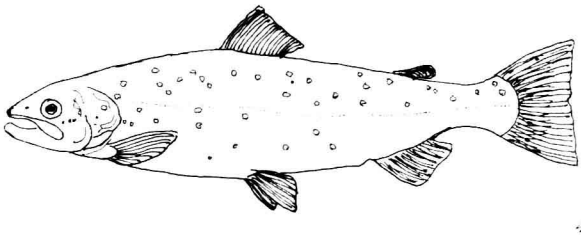
**Brown trout** (*Salmo trutta m. fario*)  
Normal adult size in the wild: 1–2 kg  
Maximum size and weight: 100 cm TL\*, 20 kg  
Maximum age: 8 years  
Water temperature of production: 2–16 °C



**Lake trout** (*Salmo trutta m. lacustris*)  
Normal adult size: 1–2 kg  
Maximum size and weight: 140 cm SL\*, 50 kg  
Maximum age: 7 years  
Water temperature of production: 2–16 °C



**Sea trout** (*Salmo trutta m. trutta*)  
Maximum size and weight: 140 cm TL, 50 kg  
Maximum age: 38 years  
Water temperature of production: 18–24 °C  
Distribution: Europe and Asia, northwest coast of Europe



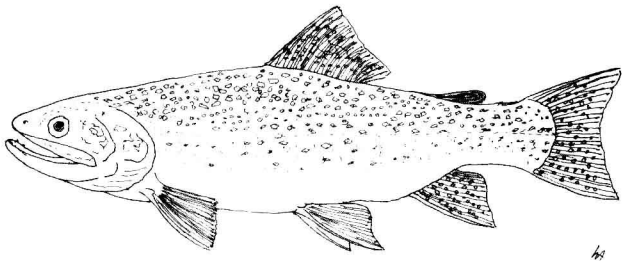
Source: Froese and Pauly (2009).

**Brook trout**, together with *lake trout*\* (*Salvelinus namaycush*), belongs to the “char” subgroup of salmonids, which distinguishes it from trout and salmon (Froese and Pauly, 2009).

The brook trout is one of the most well-known sport fish (Figure 5) and is native to the northeast of the United States of America and the east region of Canada. It has been introduced to many countries of South America, Oceania and Asia, and to practically all of the countries of Europe and the former Soviet Union.

FIGURE 5  
**Brook trout (*Salvelinus fontinalis*)**

Normal adult size in the wild: 1–2 kg  
Maximum size and weight: 86 cm TL, 9.39 kg  
Maximum age: 24 years



Source: Froese and Pauly (2009).

### 3. The rainbow trout

Rainbow trout (*Oncorhynchus mykiss*) is a highly commercial sport and market fish (Figure 6).

A normal adult rainbow trout weighs about 2–3 kg, while its maximum size, weight and age are 120 cm total length (TL), 25.4 kg and 11 years, respectively (Froese and Pauly, 2009). Rainbow trout live in the upper, cold water sections of rivers and seas.

As in the case of other trout, the habitat and food of rainbow trout determine both their actual colour and shape.

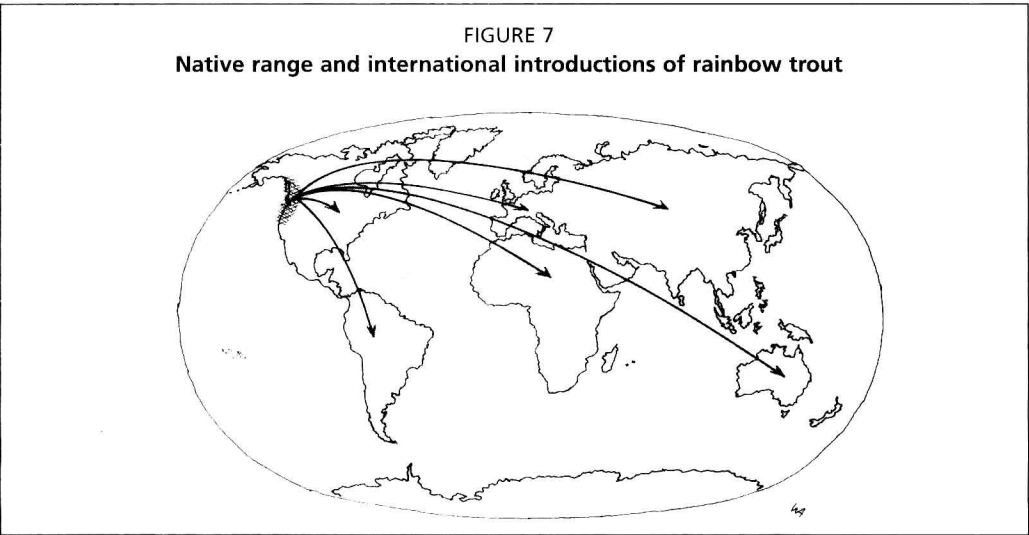
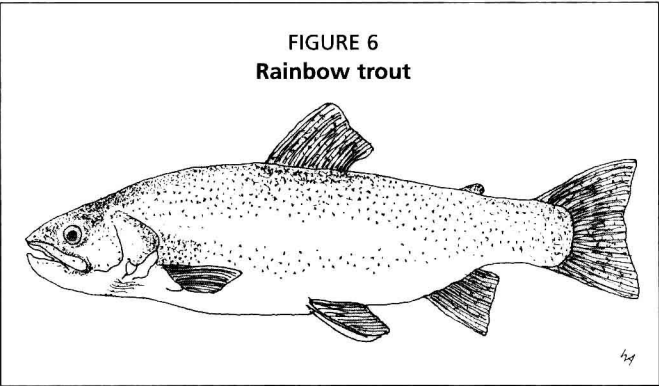
The rainbow trout has many local strains, which have developed in the different river systems. Out of these, numerous improved commercial **strains\*** have been bred. The widely cultured commercial strains have been improved from those original rainbow trout populations that possessed advantageous qualities, such as hardiness, fast growth, resistance to diseases and reliable reproduction under farm conditions.

In the wild, there are rainbow trout populations that spawn in autumn and there are other populations that spawn in spring. From these populations, two different commercial strains have been bred. Their qualities are similar, only their spawning seasons differ from each other. This enables the **production capacities\*** of a rainbow trout farm to be increased.

In many countries, the albino form of rainbow trout is cultured and is often, but mistakenly, called golden trout. This form is a popular ornamental and “put-and-take” fish, even if it is very sensitive to unfavourable environmental and production conditions.

#### 3.1 NATIVE RANGE AND INTERNATIONAL INTRODUCTIONS

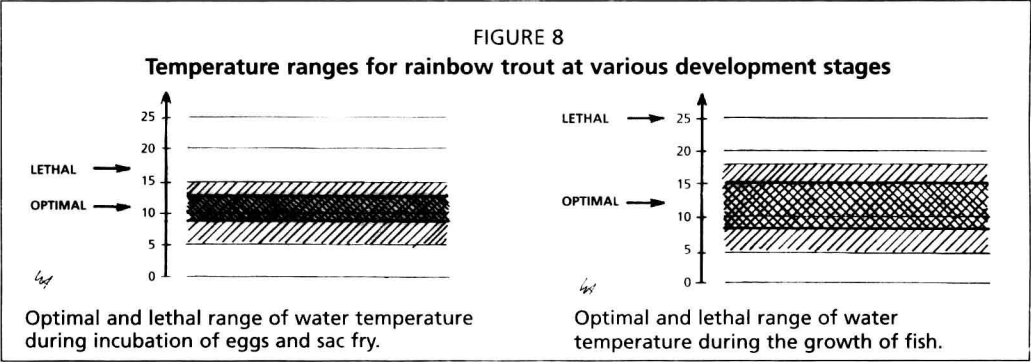
Rainbow trout is native to the cold water rivers and lakes of the Pacific coasts of North America and Asia. It has been **introduced\*** to about 82 countries (Figure 7), practically everywhere the conditions are favourable for its culture, because rainbow trout tolerates a wide range of environmental and production conditions better than other trout species.



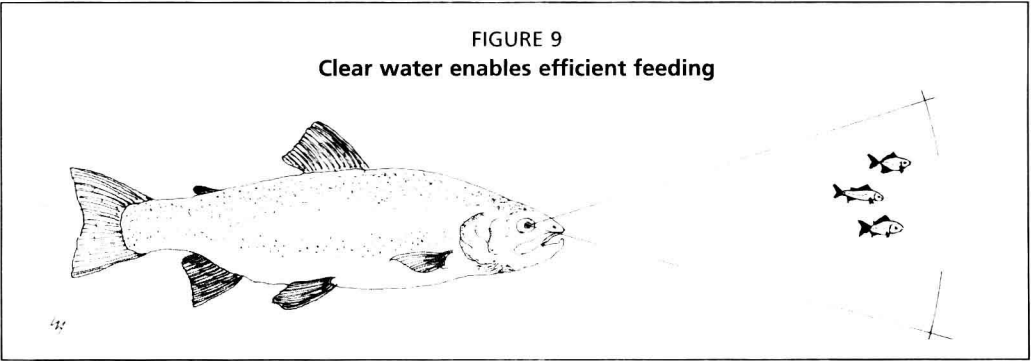
3.2 HABITAT FACTORS

There are four vital habitat factors that basically influence the growth of rainbow trout. These include basic water qualities and the abundance of *natural food*\*.

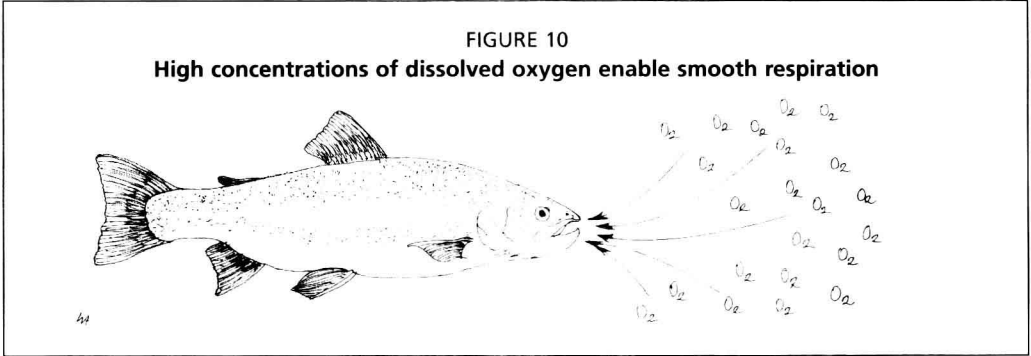
**Cold water:** Rainbow trout is a typical *cold water fish*\* (Figure 8).



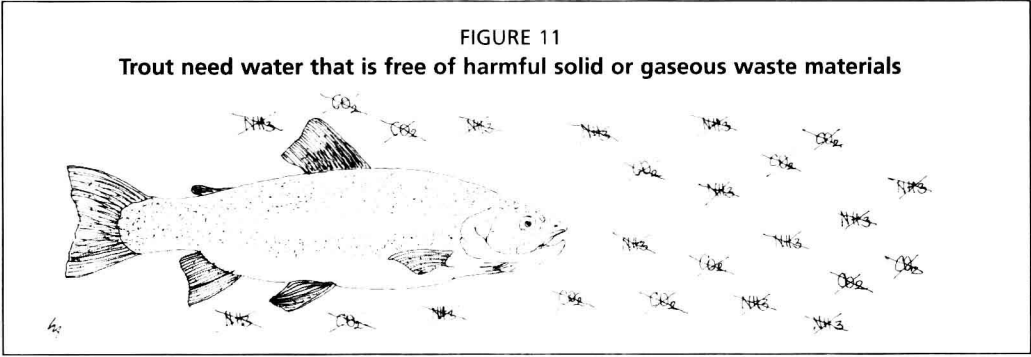
**Clear water:** Keen eyesight is crucial for the efficient feeding of trout (Figure 9).



**Dissolved oxygen:** Water should sustain *DO*\* in high concentrations, in order to ensure smooth respiration (Figure 10).



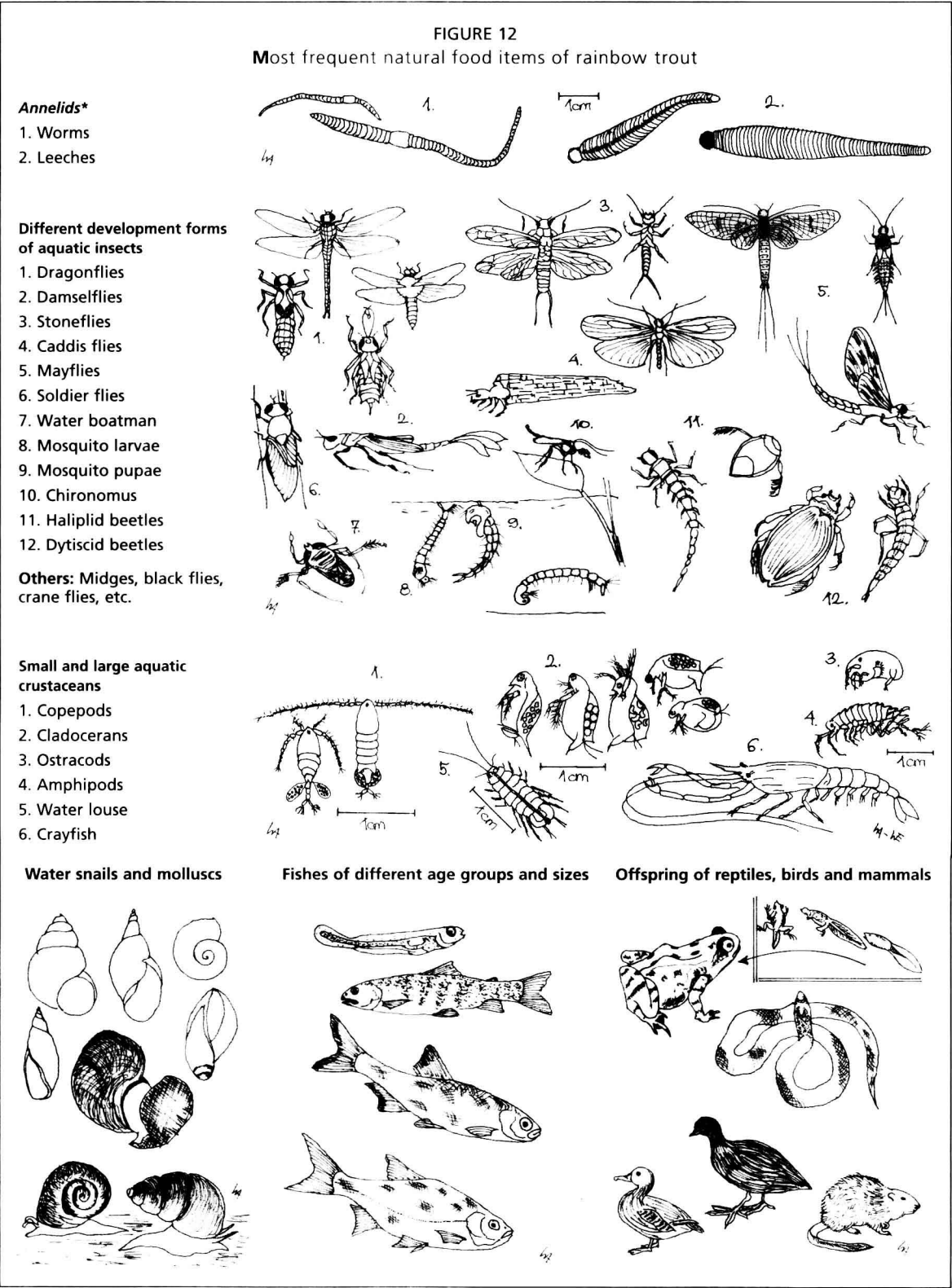
**Clean water:** Water should be free of *harmful solid*\* and *harmful gaseous*\* waste materials produced during metabolism and respiration (Figure 11).





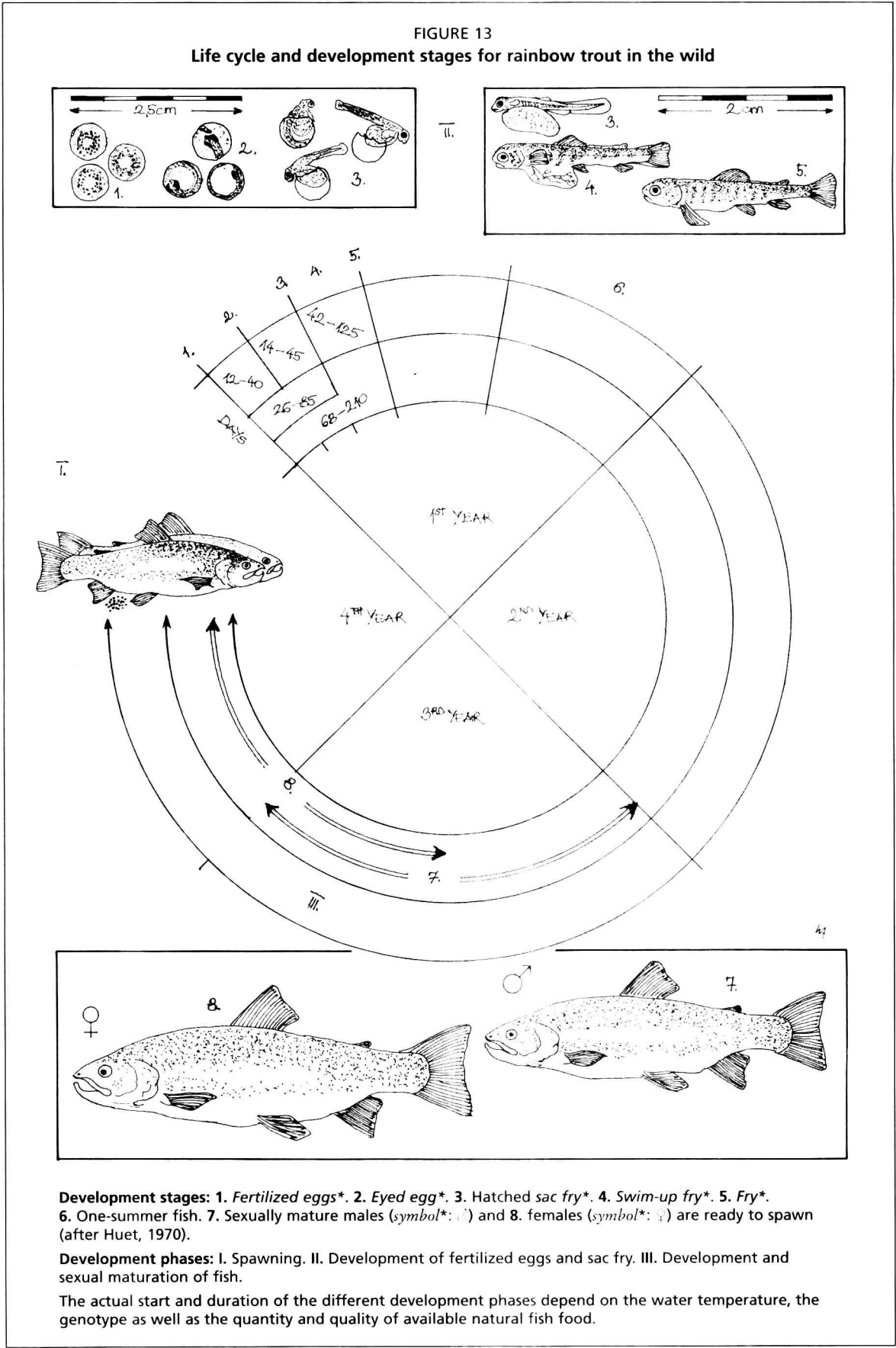
**Natural food:** The actual natural food of rainbow trout depends on the age and size of fish, on the size of food item and on the habitat occupied. Rainbow trout are aggressive and greedy in feeding (Hoitsy, 2002). They are opportunistic feeders that grab and eat almost anything. Figure 12 summarizes the most frequent natural food items of rainbow trout.

Terrestrial insects are also consumed when they fall into the water. These insects are adult beetles (Coleoptera), flies (Diptera), ants (Formicidae) and larvae of Lepidoptera (moths and butterflies) (Montgomery and Bernstein, 2008).



3.3 LIFE CYCLE AND DEVELOPMENT STAGES IN THE WILD

Figure 13 shows the life cycle and development stages for rainbow trout in the wild.



3.4 MEASUREMENTS, BODY PARTS, ORGANS AND CORRELATIONS  
BETWEEN LENGTH AND WEIGHT

Figure 14 shows the standard measurements and body parts of a rainbow trout, while Figure 15 shows the correlation between its total length and weight.

