

# GUIDE TO TROUT FARMING BASED ANGLING TOURISM

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## PREFACE

*Intension of this book is to inspire initiatives of local governments, communities and entrepreneurs regarding development of angling tourism in general, and trout angling tourism in particular. One of the most important aims of this book is to initiate and support the combined utilization of local socio-economic and natural resources of mountainous regions in countries where angling tourism is none existent, or minimal.*

## ACKNOWLEDGEMENT

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## 1 ▸ INTRODUCTION

Changes in touristic habits and the characteristics of most countries, abundant in water resources, would give reason for the growth of angling tourism, an area of tourism which has been rather forgotten over the past years.

With the help of angling tourism a great number of visitors could be attracted to beautiful but less developed regions. In spite of this, tourist schemes rarely focus, or even deal with angling tourism. They concentrate on hunting tourism instead, which may well be a better spending branch, but it also has a smaller tourist base. Above this, it is often difficult to decide whether angling tourism is a form of ecotourism or active tourism.

Though there are debates where to class angling tourism, the sustainable use of water resources in mountainous regions calls for development. Hence, these regions, abundant in water resources, could ensure income growth and employment opportunities from fish farming supported angling tourism.

Angling tourism is a complex industry. Therefore, in addition to fishing services, income could also be expected from shops, restaurants and accommodation. Above the income generated through fishing and supplementary services, social and financial benefits can also be expected from conservation and management of fish and their habitat, and maintenance of biodiversity (Brainerd, 2010).

The objective of this reference book is to support fish and trout farmers and decision makers of local communities with the necessary basic information and details regarding angling tourism in general, and trout angling tourism in particular.

To satisfy interest for specific details a glossary has been compiled. Furthermore, tables and an appendix have been attached. For the sake of easier identification and finding additional information, italics and asterisk symbols (\*) are used at words clarified in the glossary.

## 2 ▸ ANGLING TOURISM

All over the world the economic value of angling activities is steadily increasing. Effect of this growth can be summarised as the following.

The most significant change affects the market of angling tackle. Anglers typically buy more and more expensive tackle, so, for example they own a different tackle for different angling methods. In recent years the purchase of manufactured feeds and lures, or baits has increased.

In most countries angling tackles are imported, whereas lures, live baits and feeds are manufactured locally, within the given country.

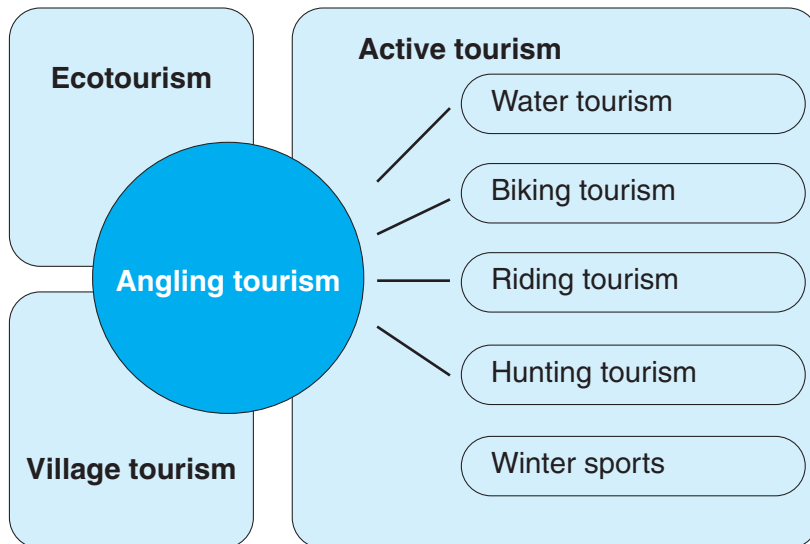
Other important effect of angling is that it provides fish farmers with a stable and continually expanding market. This is due to the fact that the natural restock of fish is steadily decreasing, because nature is unable to compete with the catch demand of the raising number of anglers. Missing fish, both predator and peaceful species, are recovered from stocks bred in hatcheries and reared on fish farms.

Angling tourism generates additional income and the use of natural water resources for commercial and recreational fishing creates numerous workplaces.

**Box 1**

### The most popular freshwater fish species of anglers

<b>Family Acipenseridae</b>	– Sturgeon
<b>Family Salmonidae</b>	– Trout, salmon, Danube salmon, white fish
<b>Family Esocidae</b>	– Pike
<b>Family Characidae</b>	– Tambaqui, pacu
<b>Family Cyprinidae</b>	– Common carp, asp, bream
<b>Families Siluridae, Ictaluridae, Bagridae, Pangasiidae and Clariidae</b>	– Catfish
<b>Family Centrarchidae</b>	– Black bass
<b>Family Latidae</b>	– Nile perch
<b>Family Percidae</b>	– Pikeperch
<b>Family Cichlidae</b>	– Tilapia



**Figure 1:**  
**Angling tourism**  
within the tourist  
industry

*Angling tourism can be well connected to many different types of active tourism. The lines aim to indicate the duplex relation between the different branches. The lines also demonstrate that they may utilize the same resources. Hence, they can weaken or strengthen each other, depending on whether they compete or cooperate.*

## 2.1 ▶ PARTICIPANTS OF ANGLING TOURISM AND THEIR EFFECTS

According to a survey, visitors of fishing ponds and natural waters can be divided into two types: anglers staying for one day, or anglers staying for a longer period of time. Within both groups there are two subgroups: anglers coming alone and anglers coming with their families. However, whereas one day anglers can belong to both subgroups, those arriving with their families are nearly always from the second type.

While examining the effects of angling tourism the following should be kept in mind. Anglers arriving for one day stay mostly in the immediate vicinity of the angling facility, so they only affect that particular area. Not angling family members tend to move away from the immediate vicinity of a given angling area. Hence, they may affect the whole region. Anglers arriving with their families often take part in excursions themselves.

## 2.2 ▶ SEASONS OF ANGLING TOURISM

Seasons of angling tourism differ in several points from seasons of mass tourism. The period between March and May is usually considered to be low-season, but the registered number of anglers in this period matches the number of anglers during the summer months. For natural waters this is not so common, but apart from the July-August high-season of water tourism, angling tourism is common during spring and autumn as well.

Drastic regression of visitors only occurs during winter months, and continues until the middle of March. Where ice fishing is possible, and where it is traditional, the decline is less pronounced

## 3 ▶ TROUT ANGLING BASED TOURISM

In regions where trout farms or other fisheries are located, angling should be developed according to conditions of the region. Extensive or intensive fish production and water systems connected to the region insure this development.

Two basic factors of angling tourism must be guaranteed; fish abundance and infrastructure of hospitality elements (e.g. accommodation, food, activities, travel etc.)

### 3.1 ▶ ENSURING FISH ABUNDANCE

Anglers will only visit an area if they can catch fish there on regular basis, or if in the given area the catch of a specific fish species is possible. Fish abundance can only be achieved if natural resources are used and not abused. If the fishery's management or the lease holder of a water body does not ensure the replacement of caught fish, then after some time anglers will abandon the given area. This is why fish has to be stocked on a regular basis, regulations set by law only provide a legal base for that.

### 3.1.1 ▸ Waters suitable for trout angling

Utilization value of commercial and recreational fishing of natural waters is determined by several factors, of which the most important ones are as follows.

- Composition of fish stock, meaning the ratio of favoured or game fish to disfavoured and uncatchable fishes.
- Ecological state of the region which determines water quality and stocking conditions.
- Accessibility and guarding capability of the water body.

### ▸ Streams, rivers

It is widely known that trout inhabits cold, highly oxygenated, swift flowing streams and rivers. Trout thrives in cold waters which contain 5–12 mg/l dissolved oxygen.

Trout grows best in streams and rivers with a temperature between 14–17 °C. If the water is highly saturated with oxygen, they are able to tolerate 20–24 °C temporarily, but 25–56 °C is already fatal for them. With the increase of water temperature the *dissolved oxygen (DO)*\* level proportionately decreases. However, oxygen consumption of fish rises. This is due to the fact that the metabolism of fish increases with the rising of water temperature.



**Figure 2:**  
**Typical trout waters**

Trout, if possible, avoids swift flowing sections/reaches, and rarely stays there for a longer period of time. Although its body is perfectly adjusted to swiftly flowing waters (it can move remarkably well in such a medium), trout can withstand the flowing current only with high energy usage. As a result, trout is never found in flowing currents, but behind partly or totally submerged rocks, tree trunks where the flow of current is broken. Trout likes to lurk in the dead spaces of whirlpools, under hollowed out banks, in front of dykes and dams, or under the still parts of rapids.

Trout tolerates murkiness only up to a certain point, because above this level it can directly damage its gills. If concentrations of floating organic and inorganic particles, which create murkiness, are less only the feeding of fish is disturbed. It is because visibility is reduced in such waters.

### ► Reservoirs

Although trout is a *rheophilous fish*<sup>\*</sup>, the flow of water is not an important factor in its development. If the temperature is suitable and water contains enough food, trout develops just the same in still waters of mountain lakes or aquifers/reservoirs, than in swift waters of mountain streams and rivers.

#### Box 2

### Creation of spawning grounds in quarry lakes

If stocking is done with sexually mature fish, spawning places/grounds must be provided for them, because new quarry lakes lack these sites. As a result, in shallower parts – for pike, pike perch, bream and common carp – it is advisable to make artificial substrate and nests from willow roots, pine branches and juniper. Nests can either be sunk to the bottom by rocks or bricks, or they can be strung up between two poles. Nests should be placed with a minimum of one meter between them. In case of pike perch the nest should be placed out in March. After the spawning of pike perch, breams will also use the nests, sometimes more than once. Mortality rate of fry hatched in lakes is always higher than of those hatched in fish farms and stocked as fingerling/parr.

### ► Quarry lakes

A new or only 2–3 year old quarry lake's capacity to produce organic materials is low, so in this stage it is an *oligotrophic lake*<sup>\*</sup>. Inflowing water comes from underground and it oozes in, either through the bottom of the lake or the embankment. Therefore, water supply is filtered through a layer of pebbles and arrives to the lake clean. So it does not contain any plant nutrition. Inorganic nutrition only dissolves through the subsoil, or is washed in from the soil around the lake.

As a result of deep quarry mining the depth of these lakes, compared to their surface, is relatively big. The fluctuation of water level is small. Depending on groundwater recharge and surface runoff it does not exceed half or one meter. Due to this the water amount of quarry lakes is approximately permanent. Their temperature, owing to their depth, is lower. The natural *thermal circulation of water*<sup>\*</sup> in quarry lakes is slower or only seasonal. It is because deeper and cooler water layers and the layer of surface water are sharply separated and waves are uncommon. Natural water circulation only occurs during spring and autumn when as the effect of temperature changes the 4 °C densest layer begins to move. The water of quarry lakes is clean and transparent, the *epipelagic or photic zone*<sup>\*</sup> is wide.

Because their nutrient content is low, these lakes are not rich in *plankton*<sup>\*</sup>. Due to this reason, and because of the bank vegetation, water depth and unproductiveness of the lake bed, it does not have macro-vegetation. As a result, their organic matter production is low, thus they are deprived of nourishment. Rearing fish in such waters is nearly impossible. However, quarry lakes are suitable for trout.

If quarry lakes are intended to be used as angling sites, it is advisable to stock them with fully grown fish. These could be common carp, pike perch, pike, trout, breams and other smaller fish species for predator fish to prey on. For sexually mature specimens artificial nests can be placed out, in order to allow them to spawn (see Box 2).

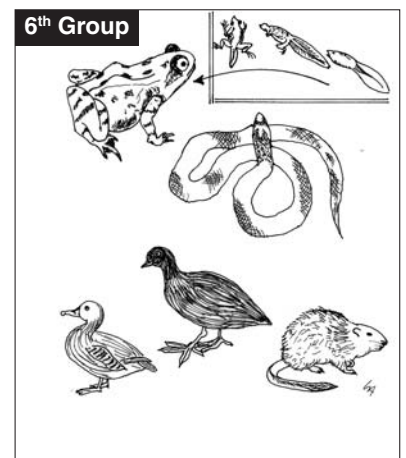
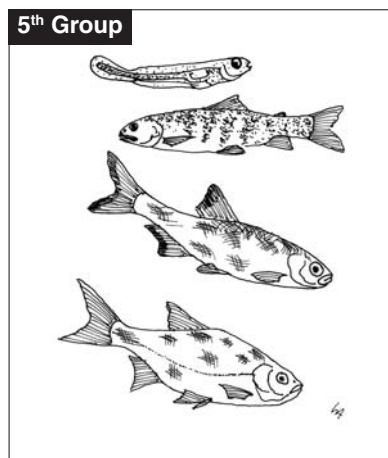
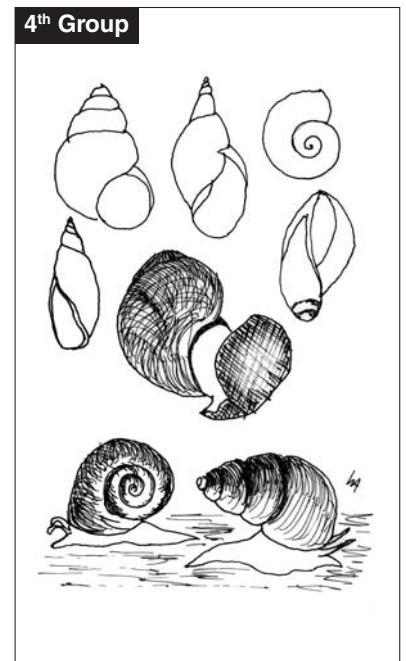
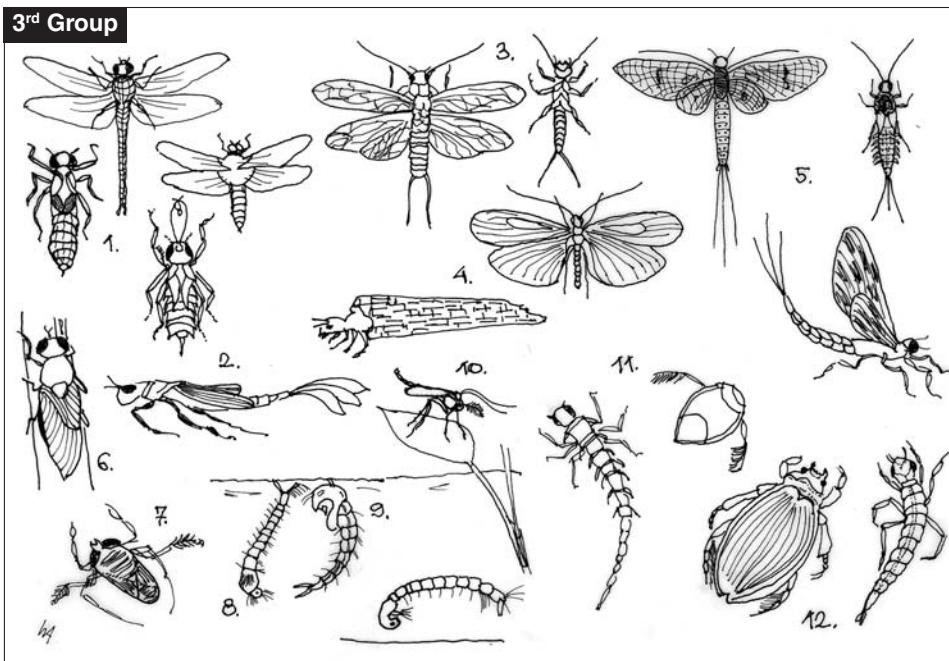
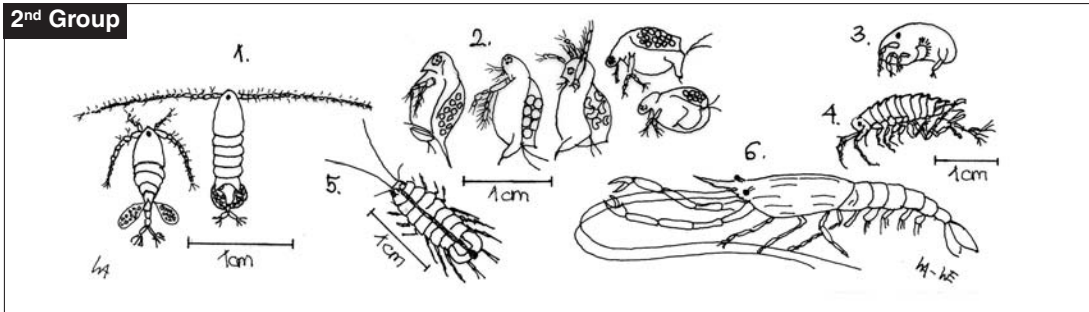
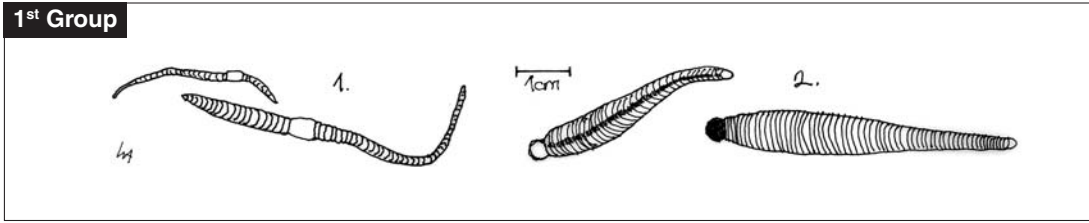


Figure 3:  
Natural food of trout

**1st Group:** Nematodes and Annelids: 1.1 Worms, 1.2 Leeches,  
**2nd Group:** Small and large aquatic crustaceans: 2.1 Copepods, 2.2 Cladocerans, 2.3 Ostracods, 2.4 Amphipods, 2.5 Water louse, 2.6 Crayfish,  
**3rd Group:** Different development forms of aquatic insects: 3.1 Dragonflies, 3.2 Damselflies, 3.3 Stoneflies, 3.4 Caddis flies, 3.5 Mayflies, 3.6 Soldier flies, 3.7 Water boatman, 3.8 Mosquito larvae, 3.9 Mosquito pupae, 3.10 Chironomus, 3.11 Haliplid beetles, 3.12 Dytiscid beetles,  
**4th Group:** Water snails and molluscs,  
**5th Group:** Fishes of different age/size,  
**6th Group:** Reptiles, birds and mammals (after Woynarovich, Hoitsy and Moth-Poulsen 2011).

### 3.1.2 ▸ Stocking trout in angling waters

In recent years trout angling is once again gaining popularity, so both fishing associations and private people are stocking waters with trout.

Of course, stocking of mountain streams and reservoirs is completely different from stocking of quarry lakes. Again, stocking trout in common carp wintering ponds of lowlands and plains for autumn and spring fishing seasons, is also different.

#### ▸ Stocking eyed eggs

In the 1940s and 1950s modern equipments of fish transport (plastic bags, oxygen etc.) did not yet exist. Due to this, eyed eggs were stocked just before hatching. The reason for this was mostly the convenience of transport, since in this stage of development under the right circumstances – in small boxes, linen covered wooden frames, with small amount of ice – eyed eggs can survive up to 2 days of transport.

Another advantage was its cheapness. However, mortality rate became too high if the river section where they were stocked was not protected, or if there was too many one- or two-summer old trout, because those inevitably prey on the young fish. Larvae of caddiflies and dipper (*Cinclus cinclus* spp.) also endangered the stocked eggs.

#### ▸ Stocking swim-up fry

Swim-up fry is the young fish which has just started to swim and feed from the environment. Stocking should be done in springs and upper headwater zones of streams, or in branches of streams. These locations are good stocking sites for more than one reason. Firstly, no larger trout can commonly be found here, so they would not feed on the fries. Secondly, they are rich in natural food (see Figure 3), and thirdly, swim-up fry can find sufficient hiding places, such as larger rocks, submerged tree trunks, braches

and aquatic mosses (*Fontinalis* spp.).

In a stream which has about 10–15 l/sec water flow about 1 000–2 000 swim-up fry/km, or in other words, about 4–6 swim-up fry/m<sup>2</sup> can be stocked. Under optimal circumstances survival rate of stocked fry will be about 30 percent.

Swim-up fry should be stocked after the spring thawing and floods when the alluvium has cleared. They should be stocked in small groups of 10–50 fish in 20–50 meter distances. As a result birds and frogs feeding on fry will not notice them and natural food supply will not run low. If swim-up fry are all stocked in one place their food supply will eventually run out and they will start eating each other.

When stocking, it is extremely important to remember that the temperature difference between the receiving water and the water of the transporting tank must never exceed ~3 °C. One of the best solutions is to add some stream water to the transporting water. This way the two temperatures will equalize. After stocking, fry first stay pressed together at the bottom of the stream. Then while shoaling they are seeking hiding places and after a couple of days they spread out.

#### ▸ Stocking advanced fry

Advanced fry is about 4–5 cm long and 1–2 months old. This age group is already stronger, and compared to swim-up fry their survival rate is better by about 50–60 percent (Hoitsy 2002). As for the way of stocking, the previously described method is the guideline. Per kilometre about 100–300 advanced fry should be stocked.

#### ▸ Stocking one-summer-old trout

A one-summer-old brown trout weighs 30–100 grams and is 12–20 cm long. Bigger specimens of this age group are of angling size in some countries (22 cm *TL*\*). A stream rich in natural food can be stocked during autumn and by spring these fish will reach angling size. Mortality rate of one-summer-old trout is about 10 percent.



Bigger specimens instantly start looking for hiding places. If the stream has plenty of bank cover (fallen trees), washed under bank sections, rapids and common butterbur (*Petasites hybridus*), about 1–2 fish can be stocked per 15–20 meters.

In small mountain lakes or cold water reservoirs annually 100 kilograms of trout can be stocked per hectare (Hoitsy 2002).

If possible, trout should be habituated to natural food which means before they are released they should be fed with smaller live fishes. These waters are usually rich in bleak (*Alburnus sps.*) and roach (*Rutilus sps.*) so directly after stocking trout will start preying immediately.

### ► Stocking two-summer-old trout

One, one and a half year old trouts are about 25–30 cm long and weigh approximately 200–500 grams. It is advised to stock them in waters where there is a demand for angling-size fish, and more than one annual stocking can be carried out. Due to the hunger and greed of trout (it will grab anything, even corn), within a short period of time the whole water body can be fished out if stocking is done in one round. Usually there are no fishing prohibitions after stocking.

When stocking is done in streams 1–3 specimens per rapids or, according to the stream bed, 1–2 specimens per 20–50 meters can be released. In case of lakes it is advised to stock 100–150 specimens per hectares (Hoitsy 2002).

Many times leaseholders stock the

same amount of fish in every year. However, they should take into consideration factors such as natural reproduction and the number of anglers visiting the area. After such assessments they should adjust the stock size accordingly. These assessments and proper adjustments in stocking plans could ensure a trout population of advocate density and age. This way the survival of the fish stock could also be guaranteed.

### ► Seasonal stocking of small ponds and wintering ponds

Stocking of carp ponds and 100–1000 m<sup>2</sup> large wintering ponds mentioned at the beginning of the chapter should be assessed and treated in a different manner as done at natural waters. This type of angling, which is popular everywhere from Japan to the USA, should be judged from a different standpoint than the angling of trout in streams and natural waters. Angling for trout in overpopulated fish ponds and wintering ponds where fish grab nearly anything can not and should not be compared with the complexity of fishing in nature (see Annex 1).

These lakes should be stocked according to their oxygen-content, temperature, the number of daily water exchange and the number of visiting anglers. If water temperature does not exceed 14 °C and the water is exchanged about 1–1.5 times per day, up to 500 kilograms of trout can be stocked per 100–200 m<sup>2</sup>.

Water temperature should be closely monitored, because if it exceeds 18–22 °C

**Figure 4:**  
**Stocking of trout of different sizes**

and the stock has not been completely fished out trout can easily die. This is an important issue, since even the most popular fee fishing resorts cannot afford to let dead fishes floating around on the surface of their waters.

### 3.1.3 Management and maintenance of trout streams

Fish carrying capacity of natural rivers and streams depends mainly on natural factors. However, with proper approach, persistence and human intervention the size of fish populations can be increased. Every angler knows that the development of trout is determined by several factors of the *habitat*<sup>\*</sup>, such as the amount of food, rate of and pace of water flow, conditions of stream bed and number of rapids and pools. The more food and hiding places a stream has, the more trout it can feed and hide.

Trout is said to be a predator fish, but like pike and pike perch, most of the time it does not prey on fish. The explanation of this is that if it did, it would die in streams where there are no other fish species, or it would start eating its own kind. Therefore, trout mainly feeds on small animals. Trout swim-up fry, just like any other fry, chiefly feeds on insects, worms and larvae living on stream banks and in slow flowing stream sections (see Figure 3). As long as they can find water crustaceans and other insects, they will not feed on fish. Trout notices and grabs every small moving creature or objects. They even jump out of the water to catch insects flying near to the water surface.

In trout streams it is the top consumer. As a result, the structure of food chain should be examined and species of the primary (natural food of peaceful fishes) and secondary levels (peaceful fishes) should be determined (see Figure 3). The result will show what to do in order to boost natural food supply. If the necessary steps are taken, trout population will steadily increase.

Natural food production capacity of streams is defined by factors that determine the amount of living organisms on which trout feed found in a given water

body. Gammariade (order: Amphipoda) is the main food of trout. They consume fallen leaves and branches found in streams. Therefore, if the flow of a given stream is too swift, it will wash away these leaves and branches and the food capacity of the water body will be low. Crustaceans, Chironomus larvae and other aquatic insects, presented in Figure 3, dwell in shallow puddles near the banks, waterlogged marshes and seepages. If, with a ditch, these are connected to a stream, insects and larvae will be able to get across and so a sufficient food supply can be provided for trout. Of course, while digging the ditch, it is important not to disturb or alter natural circumstances, i.e. the stream should not wash through these puddles, marshes and seepages. Plants found in streams, such as aquatic mosses, can also function as food production mediums, because for many insects and insect larvae it can be a habitat on the one hand, and its decaying parts can serve as food on the other hand.

Vegetation along the stream banks, e.g. common butterbur (*Petasites hybridus*), willow or alder also contributes to the nourishing of trout, because small insects, snails and slugs can fall into the water from them. Where vegetation is absent or scarce on stream banks, it is advisable to plant some artificially. Later, when shadows and roots already stretch into the water, plants can enhance fish carrying and preserving capability of a stream. In such places the water is also suitable for hiding.

When dealing with stream maintenance, based on the characteristics of trout, two things should be kept in mind. Firstly, trout is light avoiding fish, and secondly, it sticks to one place. It tries to hide behind or under inward leaning trees, bigger rocks, cavities in river banks or washed under sections. Once a trout finds an appropriate place, it will guard it and not leave it. At the edge of the chosen spot it hovers in position, facing upstream, preying on passing animals. In open water, or near the surface, trout preying on food is only found at dusk. Trout feeds two times a day, once during the morning between 5 and 7, and once during the evening between 5 and 9.

Trout has a very good eyesight and based on surface reflections it accurately catches insects flying above the water. Its velocity also helps its efficiency. With one stroke trout can reach the speed of 60 km/h.

Sometimes there are too few hiding places in a stream. If this problem occurs, boulders or large rocks can be rolled into the stream bed<sup>1</sup>. This way the monotonous water flow will be broken, that is, it will be split into two and trout will be able to hover behind it. This is especially good for smaller fish which have been chased away by larger specimens.

With building rapids bigger spaces can be created for trout to hover in. The easiest spots to build these rapids are at the narrowest parts of the stream bed. Dams of new rapids must be constructed in a way that the swelling of water, mainly during heavy rains and thawing, does not flood the surrounding forests. Ends of the used logs, both upper and lower sides, should be fastened by rocks or sticks. Above and under the rapids, in a two meter stripe, stream bank should be protected by wicker-work. The water of the rapids quickly washes out a pit where after a few days trout starts to hover. In case of faster flowing streams rapids should be built in such distances that they do not allow alluvium to settle.

In maintained streams trout population can quickly multiply. In bigger *biotopes*<sup>1</sup> fish also grow to a bigger size, and because these water bodies are rich in food, trout will rapidly reach a catchable size.

### 3.2 ▸ INFRASTRUCTURE OF ANGLING TOURISM AND ITS DEVELOPMENT

In each stage of angling tourism it is required to introduce newer and newer products and programmes connected to these products. In order to put each development into action the following preconditions must be existent: sufficient amount of anglers and their demands in a region and capital to carry out developments.

<sup>1</sup> Before improving angling sites on this way consequences of such an action should be considered, among others sizes of changed cross sections, freeness of water flow and the probability of other negative effects.

#### 3.2.1 ▸ Fishing on natural waters

In many countries angling is done mostly on natural waters such as rivers, lakes and backwaters. Permits for these areas are distributed by leaseholders. Despite of their large size, a really good management regularly restocks and guards the area. Typically, angling is done from river and lake banks, but sometimes the use of boats is allowed as well. This can be beneficial, because it facilitates other services, for example boat renting, boat storage, harbouring services etc.

In regions which are streaked by rivers and canals there may also exist a slightly different type of boat angling. In this case anglers go to fishing sites that could not be easily accessed by other means of transport. A guide could also accompany anglers both to help them with the catch and also to give a kind of training.

The most popular fishing sites of natural waters are smaller lakes, because if they are regularly stocked their fish density is high. These areas can be well guarded and anglers, especially less skilled ones, can expect better catches (see Figure 2).

Usually for streams and quarry lakes one day permits are more expensive, but anglers do not have to pay an extra fee for caught fish. In these areas waterside parcelling, weekend house building and appearance of hospitality services are more and more common.

**Box 3**

#### Angling licences and tickets, and what they license

In countries where angling is a well-organised tourist industry fishing licences and one day permits not only allow the purchaser to catch a fish, but also define terms of the catch.

**Fishing licences:** In most countries a state issued licence is required for angling. This can be acquired after a successful examination where applicants have to demonstrate their knowledge of fish species, size restrictions, open and closed seasons etc.

**Permits:** Permits are valid for one given water body and are distributed by leaseholders. A permit may hold for one or more days, a week, or even a year. These permits also include restrictions of a given area.

## Recommended equipments and services of angling campsites

1. A place to clean fish
2. A deep freezer for fish intended to be taken away, but not yet cleaned
3. Open air grilling spots
4. A place to lock away fishing tackle
5. Family friendly services:
  - playground
  - roofed area with toys and games
  - swimming pool or pond
  - sunbathing area with deck-chairs
  - pony lunging (possibly in association with a local stable)

### Box 4

### 3.2.2 ▶ Fee fishing

Popularity of fee fishing on lakes and fish-ponds has radically increased in the past few years. The reason for this is that these water bodies are regularly stocked, usually once, but sometimes more than once a week, so catch is almost always certain. This service also developed many sub variants with various products connected to them (see Box 4). Best operating areas are the ones with drainable fishponds and pond systems, because fee fishing can be best realized here.

Angling is usually done on more pond types with different species of fish. Ponds can range from the traditionally large ones to small ones overstocked with trout. Fees of one day permits are usually different for each pond. Anglers are usually obliged to take their catch with them, but some places allow or even demand visitors to release hooked fishes, such as common carp or catfish. However, smaller species must be taken.

Anglers must pay for fish which are not released and the price contains a profit margin. If the fish is produced on the spot, this margin can be significant. About 2–3 kilos of annual fish catch per angler can be calculated. However, during summer, on Fridays and Saturdays, this can go up to 5–6 kilos, because summer is the season of barbeque parties.

In a part of many fish farms fish for catch are also produced to sustain the

level of fish population. If fish are purchased they can also be stored on the spot.

Around these ponds everything is provided for the comfort of anglers; they can reach the ponds via clean, mud free roads, they can use roofed fishing sites and can fish from boats or jetties. In developed areas other services, such as restaurants and various types of accommodations (camping sites, chalets, apartments) are at the disposal of visitors.

One of the most important traits of fee fishing is that a family friendly aspect of angling tourism was developed here. The importance of it is that while one family member is fishing the others can find activities to their interest. Most common family friendly services are listed in Box 4. With the help of these services the angler, who is usually the head of the family, can convince the whole family to spend a mini-break or a summer holiday at fee fishing ponds. Non-angler family members can be the target of other services of the region.

A chance of constant catch and the infrastructure of fish ponds can attain longer fishing seasons and a higher number of visitors than other natural waters. Above this, the annual spreading of visitors will become less fragmented.

### 3.2.3 ▶ Hospitality services connected to angling tourism

Today buffets are essential parts of fishing resorts where not only drinks and light snacks, but baits, lures and basic fishing tackle can also be bought. On most fee-fishing pond resorts the income of buffets are equal to the income from one day permits and fish sales.

As far as accommodation goes, anglers prefer camping and 'rough camping' in particular, due to the freedom it gives. Where safety is an issue closed campsites or other forms of accommodation (caravans, chalets and 4–5 roomed houses) should be provided. With the increase of visitors and wealthier anglers, the need for guest-houses and pensions will also increase.



One-day anglers rarely stop at restaurants. Such services are more commonly used by those who come for a longer period of time. The need for restaurants can be enhanced with the right types of services. If, for example, a restaurant specialised in fish dishes made from cleaned and quickly prepared fish caught by anglers, more one day visitors would start using the services of it.

Recently more and more people are becoming interested in the operation of fisheries and fish farms. Many anglers and 'civilians' want to know what happens up until the fish is caught or delivered on a plate. Many small things can be connected to this notion from which the fish farmer will profit. These can be guided tours around the fishery, purchase of fresh or processed (smoked, soured) fish on the spot, etc. The best is if there is a small restaurant in the immediate vicinity of the fishery, so that visitors can taste the offered fish (see Figure 5).

Holiday-makers often want to take a small souvenir with them which can also be a steady source of income.



### 3.2.4 Match angling

By organizing angling competitions or tournaments the number of visitors of a region can be increased. The success of competitions and tournaments can be raised if beforehand sufficient amount and sized fish is stocked. It is wise to organise competitions with more categories, because this way whole families can be attracted to the area. These categories can be the following: children, women, men.

**Figure 5:**  
**Farm restaurant and shop**  
Farm restaurants and fish shops are often parts of a trout farm. Outdoor and indoor restaurants are built together with the production unit. Fried fish and a large variety of fish products attract tourists.

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<sup>2</sup> Norwegian Institute for Nature Research

<sup>3</sup> European Sustainable Use Specialist Group

°C	DO (mg/l)	°C	DO (mg/l)	°C	DO (mg/l)	°C	DO (mg/l)	°C	DO (mg/l)
1	13.92	6	12.21	11	10.83	16	9.75	21	8.82
2	13.52	7	11.91	12	10.61	17	9.55	22	8.67
3	13.20	8	11.62	13	10.38	18	9.35	23	8.41
4	12.88	9	11.33	14	10.15	19	9.16	24	8.36
5	12.52	10	10.10	15	9.96	20	9.00	25	8.22

## ► GLOSSARY

### **Biotope**

An environmental region characterised by certain conditions and populated by a characteristic biota, plants and animals occupying the place together (Allaby, 1994).

### **Dissolved oxygen (DO)**

DO is the abbreviation of **dissolved oxygen** which ensures the respiration of fish. The actual oxygen content of the water depends on some important physical and chemical characteristics of it.

Water can dissolve only a certain quantity of oxygen at a certain temperature. The possible maximum dissolved oxygen content of water (100 percent saturation) depends on the actual water temperature and the partial pressure of oxygen in the atmosphere. Dissolved oxygen content changes slightly with the quality and quantity of other materials dissolved in water. The altitude also modifies the oxygen content of water.

### **Epipelagic or photic zone**

The upper layer of a water body into which the light can penetrate.

### **Habitat**

It is the living place of an organism or community, characterized by its physical or biotic properties (Allaby, 1994).

### **Oligotrophic lake**

A lake is oligotrophic when its water is poor in plant nutrients and its dissolved oxygen content is high.

### **Phytoplankton**

It is the collective name of floating microscopic plants.

### **Plankton**

It is the collective name of microscopic plants, animals and bacteria which float or drift in the water column. Accordingly, the plankton consists of bacterioplankton, *phytoplankton*\* and *zooplankton*\*.

### **Rheophilous fish**

The fish which thrives in running water.

### **Thermal circulation of water**

Daily changes of water temperature ensure the circulation between the surface and the bottom of a pond. The water is warmer at the surface than at pond bottom during sunny days. At night when the air is cooler, the water at the surface also cools down while temperature remains higher at the bottom. Since the specific weight of cooler water is higher than of warmer water, it sinks down to the bottom, pushing the lighter warm water up toward the surface. As the water gets to the surface it starts to cool down, so it sinks again. This process maintains water circulation and prevents pond water from permanent stratification.

### **TL**

It is the abbreviation of the total length of fish. This measurement also includes the caudal fin of a fish.

### **Zooplankton**

It is the collective name of tiny worms and insects swimming passively or actively in the water. In other words it is the animal members of plankton (Thain and Hickman, 1980).

*Table of dissolved oxygen content of fully saturated water at different temperatures*

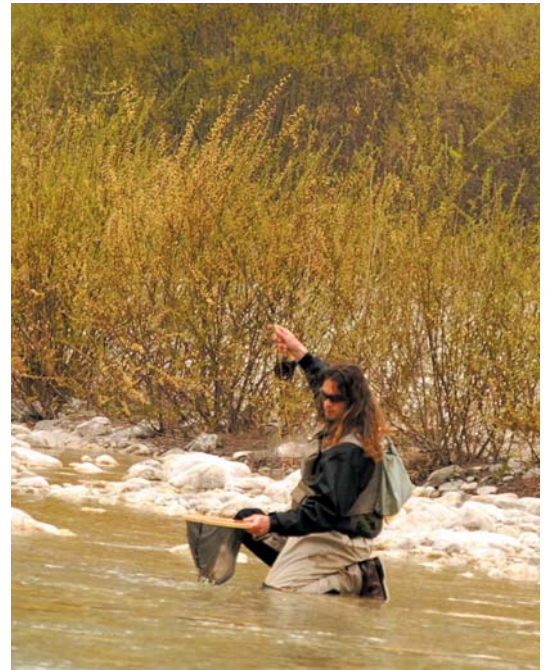
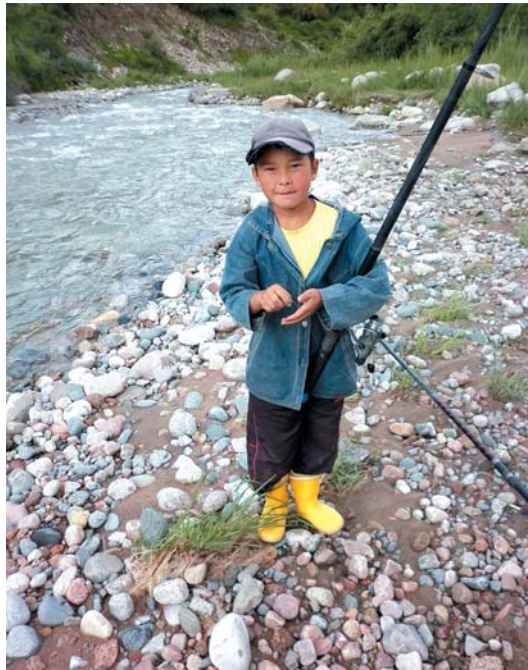
## ▸ APPENDIX

### ▸ ANGLING TECHNIQUES OF TROUT

Though anglers have a deep knowledge of different techniques for catching trout decision makers and entrepreneurs who develop and maintain angling tourism in a region should also know some basics regarding the actual options of trout angling.

Trout angling is the most athletic, natural and environmental friendly form of recreational fishing. Trout anglers love, respect and know nature. They are aware of trout habitats and diet. They are familiar with the fish, the insects on which they feed and pray, and waters where they live.

Trout anglers practice this noble sport alone in the forest, away from noise and in unity with nature. A clattering angler will most certainly scare away trout. Since trout has perfect eyesight if anglers do not



**Figure 6:**  
**Trout angling and its award**  
*It is one of the most challenging ways of catching fish*



take cover behind bushes or camouflage themselves, trout will be frightened away. Regardless of the best efforts to lure them out with the finest baits, they will not appear again for hours.



## ARTIFICIAL FLY FISHING

Artificial fly fishing is the most difficult form of angling, because ranging uphill through mountains, crawling and climbing along rivers and streams searching for trout calls for flexible joints and athletic muscles.

It is fantastic to watch artificial fly fishing, but many feel intimidated by its mystique and do not dare to try it. Many people believe that it can only be taught by veteran anglers. Of course, it is always good to have a more experienced angler at hand to pick up small tricks, but many have become masters of fly fishing on their own. As always, practice makes perfect (see Box 5). So, after a couple of hours' practice anglers can pick up the basics of this technique; the harmony of the rod and line, how to pass our energy to the rod and by moving the rod back and forth how to keep the line in the air.

It is very difficult to describe the sequence of fly fishing and probably it is more effective to demonstrate it in action.

### Box 5

#### Practicing motions of fly fishing

Technically, if there is an open space of 20 – 40 meters, casting can be practiced anywhere from meadows, gardens to river and lake banks.

1. The rod should be set up. Attach the reel and the line to the rod, then slip the line through the rings and fasten the leader. Finally attach the fly.
2. Reel down 2-6 meters of line and lay it on the water surface or grass. In the casting hand the rod is in line with the horizontal forearm. The other hand holds the line.
3. With a stronger lift the rod is moved from horizontal to vertical position. The line first follows the motion of the rod, then passes it and straightens out backwards. After this, with a forward swing, steer the rod into its original place, but not into complete horizontal position.
4. During the next backswing an arm length of line is reeled down. Although, when the rod is swung forward the line is released, the index finger and the thumb form a kind of ring, and that is where the line runs through. The line is let to move forward until it straightens out in midair.
5. The backward and forward swing is done until the desired distance is reached. At that point the line is released and the rod is slightly lifted. The leader straightens in the air and the fly gently drops onto the water surface.

However, in the following section an attempt will be made to portray the standard cast, the over-head cast and other cast types.

The motion cycle must always be firm and dynamic. The distance between line and rod holding hands should always be the same. The tip of the rod must be directed as if there were imaginary parallel wires in front of, behind and above us. There are more than one style of swinging. According to one, the upper arm must stick to the torso and the actual motion is done by the elbow. According to another one, the angle between the swinging fore- and upper arm must be unchanged, and the motion itself is done by the shoulder-blades.

Beyond the above described over head cast (Figure 9) there are other casting techniques, such as roll cast (Figure 10), side cast (Figure 11) and catapult cast (Figure 12). The usage of each technique is determined by the conditions of a given angling spot.

A classical variant of the over-head cast is the parachute cast. When the rod is pointing upward, the line is at the same height as the tip of the rod and the leader is straight. The tip of the rod is dropped to the surface of the water. As a result, instead of the fly, the line reaches the water first.

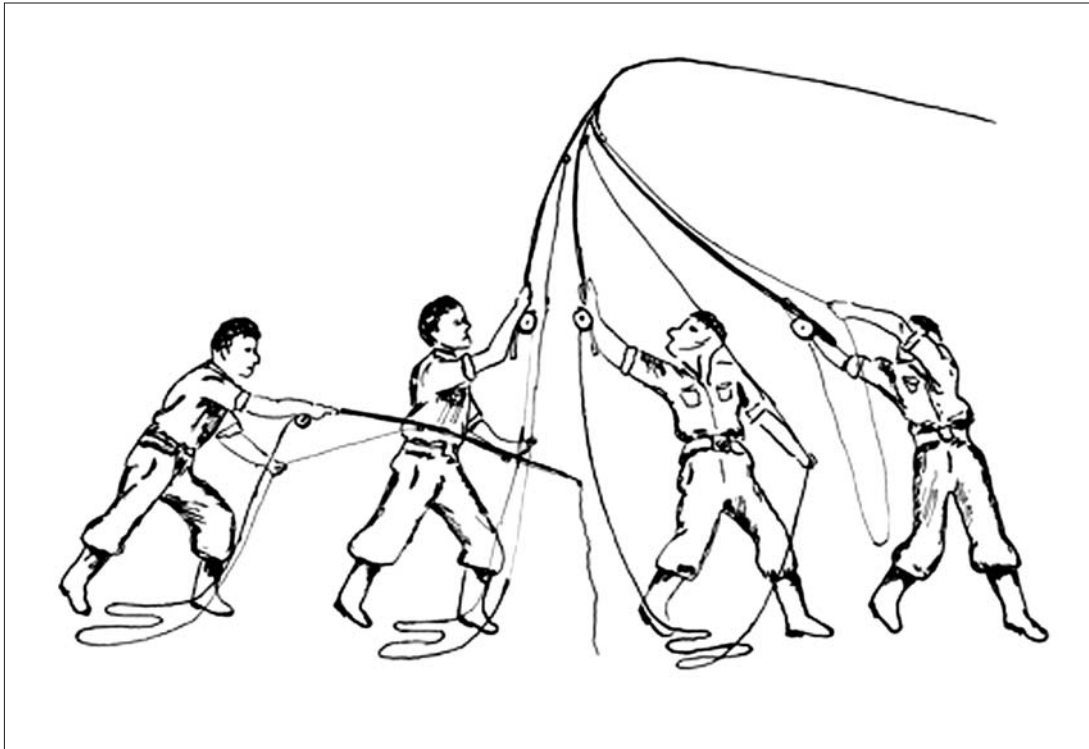
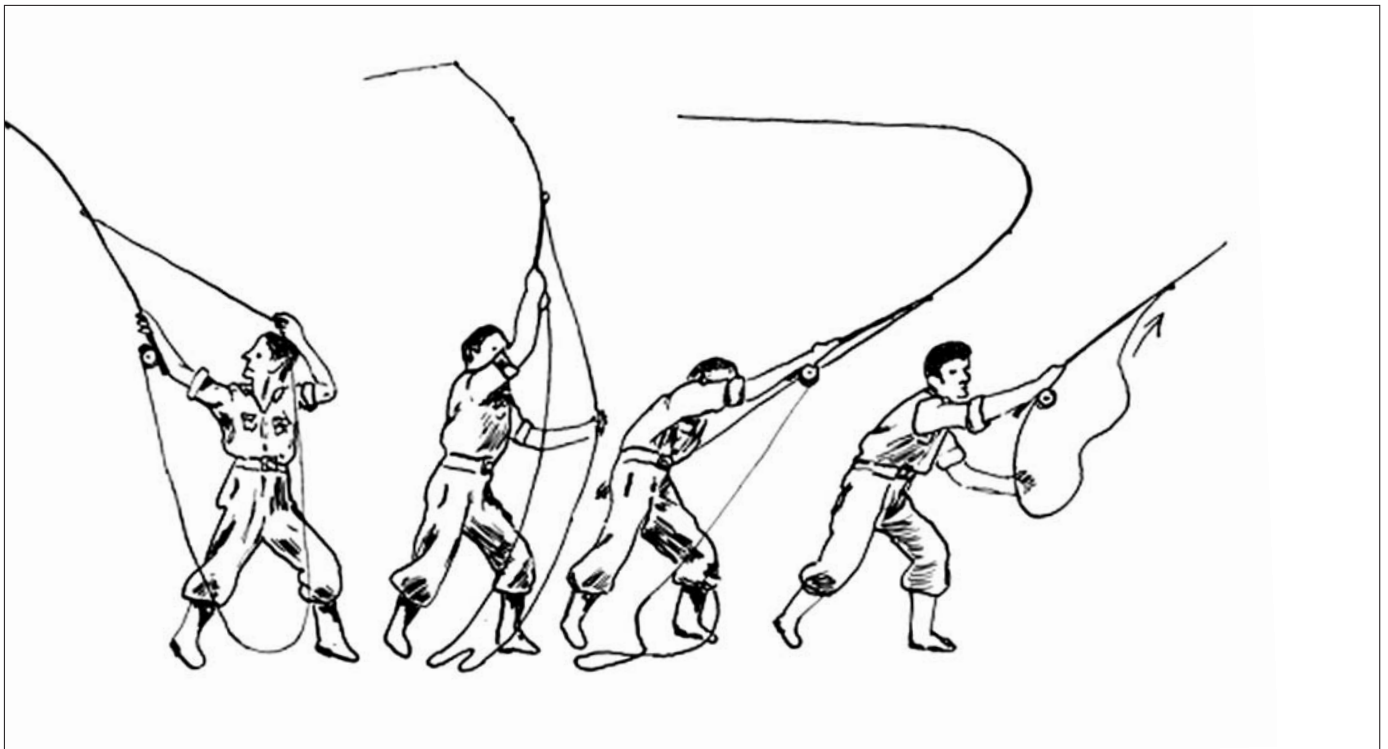
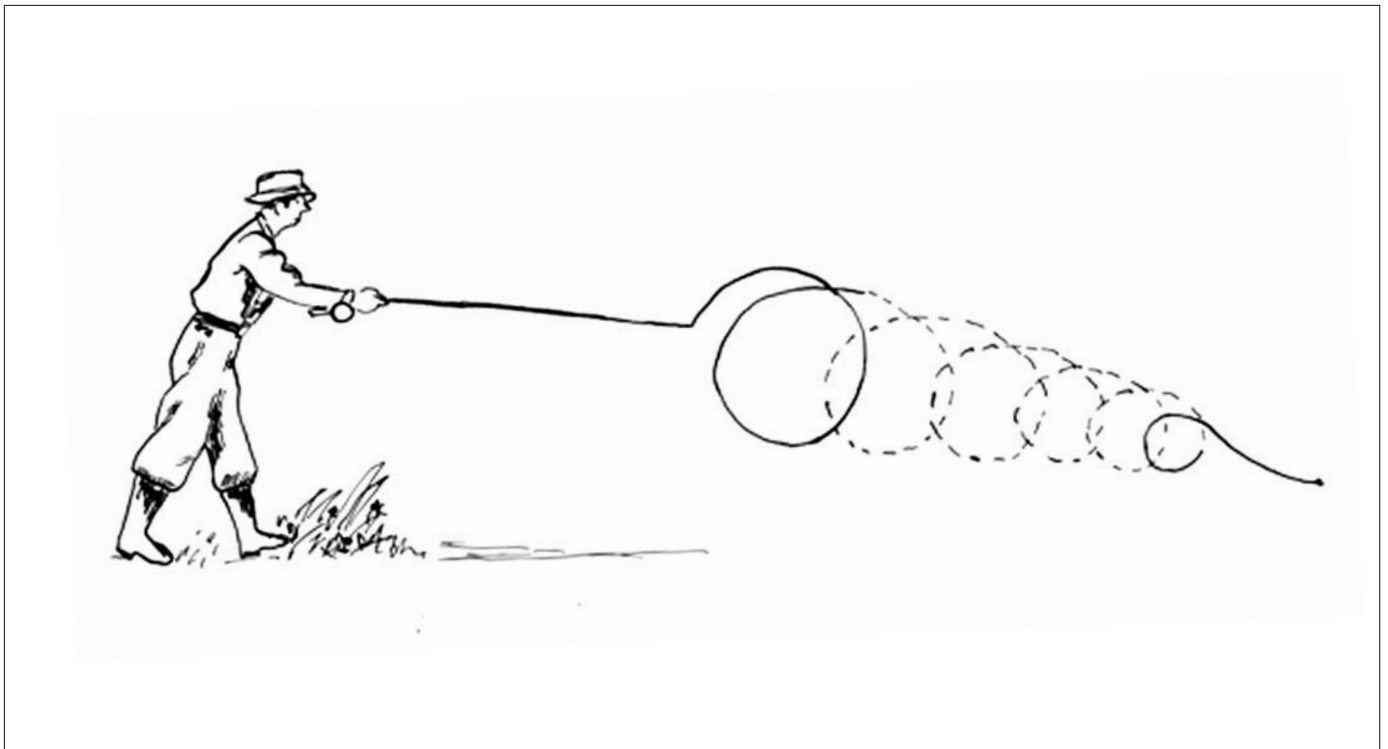
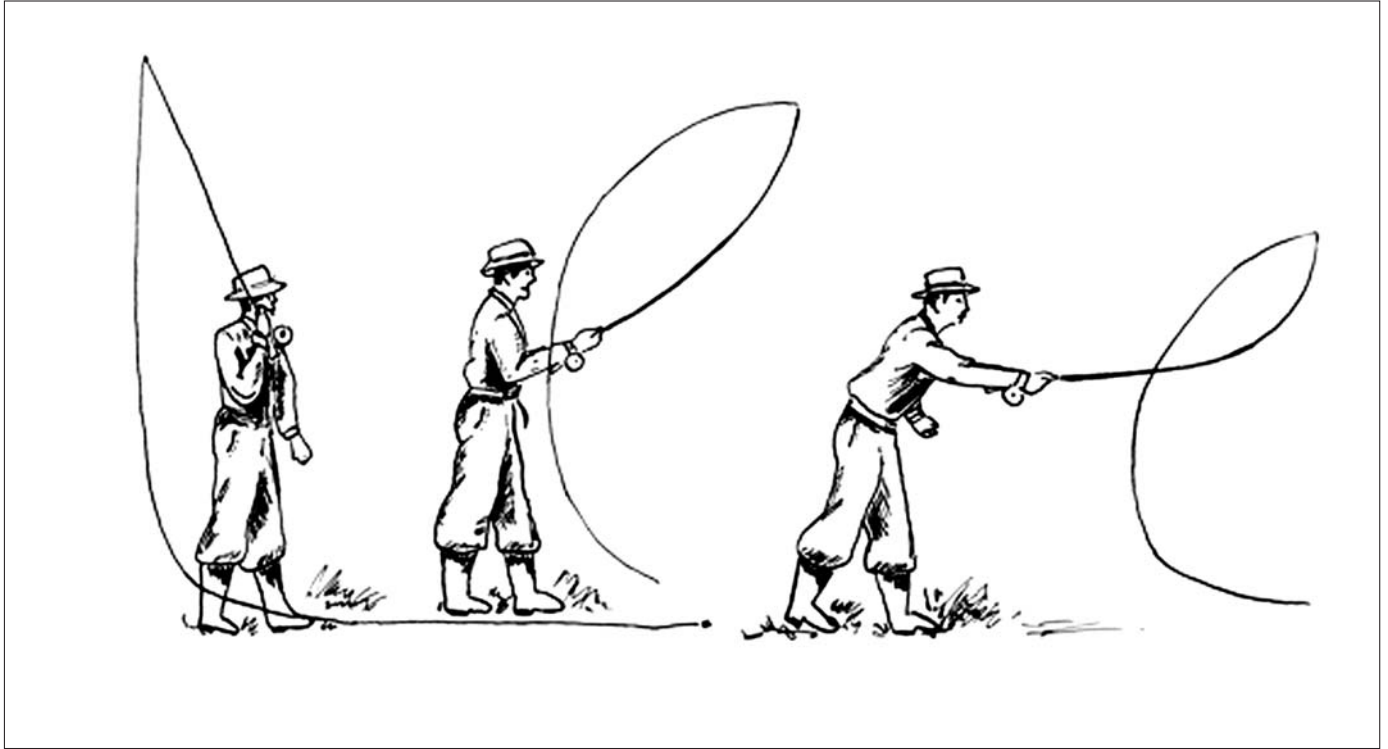


Figure 8:  
Motions of over-head  
cast

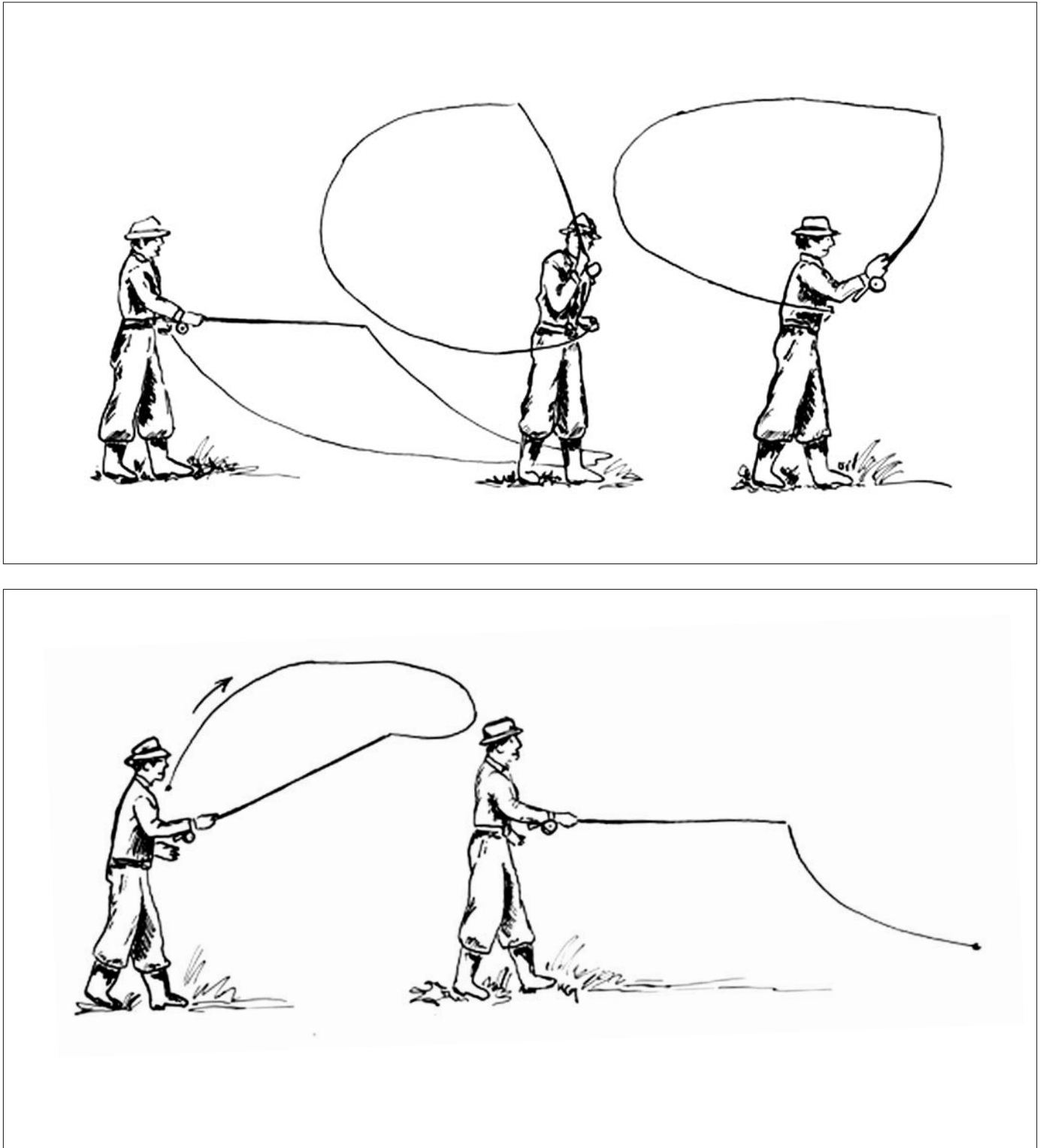




**Figure 9:**  
**Motions of roll cast**

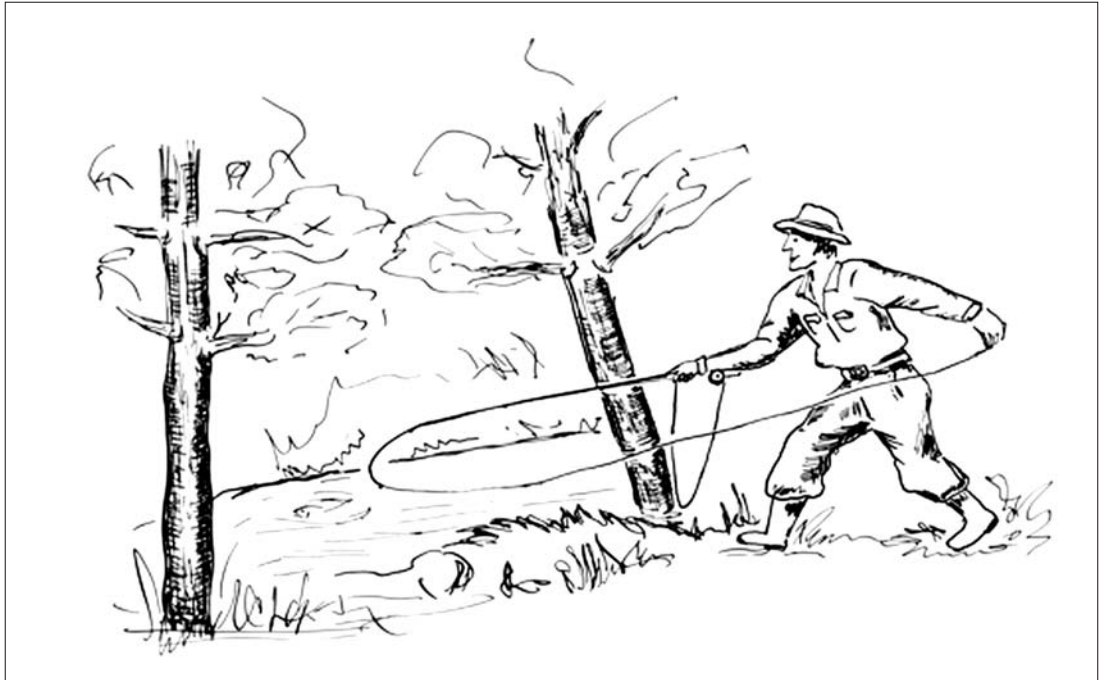
Roll cast is used when there is no available room for back-casting due to high bushes or other circumstances. When performing the cast reel down two times longer line than the rod and start out as if doing a side cast, but in mid movement bring the rod into a vertical position and cast it forward from that position. The line will follow the movement of the rod, thus creating a spiral which ripples through the whole line.

At dry fly fishing the serpent cast is often used. In the course of this cast the line reaches the water in a series of curves. In other words, the casting hand performs a series of small whipping movements.



*Side cast is used when there is no or little room for back casting. It is very similar to the over-head cast. The only difference is that the rod is brought back horizontally, not vertically.*

**Figure 10:**  
**Motions of side cast**



**Figure 11:**  
**Motion of**  
**catapult cast**

*This cast is used when there is little space due to bushes and branches. Resilience of the rod is used to shoot the fly to the target area.*

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