SECTION III
HYDROLOGY

12. GENERAL.

Waters are divided into two main categories, moving and standing. The main difference between the two types is the current. Waters flowing downhill have currents of varying intensity; lakes and ponds have no current. The strength of a stream's current depends on the gradient of the stream. The greater the incline, the stronger its current. The gradient of a stream determines the character of fauna and flora along its course. The relationship of the length of banks to the surface area of a body of water is more favorable for moving waters than standing waters because the water bank relationship is changing constantly. Moving waters are usually richer in oxygen and are better fish producers.

13. MOVING WATERS

a. **General.** Rivers, streams, and brooks usually start as springs in the mountains or in hilly marshlands. The varying regions along the course of a body of water, from source to mouth,

are particularly significant for the fisherman. These regions are named after the predominant fish species. High mountain streams may not have vegetation or animal life, and melting snow may cause them to swell greatly. High mountain streams have almost dry beds in summer. Fish can be found only in the deeper pools underneath small waterfalls. Living conditions for fish downstream improve considerably. Flatland streams differ from mountain streams basically by their sandy or gravelly bottom and richer vegetation and animal life. Fish find an abundance of food and shelter in these streams because the water temperature is higher than in mountain streams. When moving waters are regulated by straightening their normal course, fish productiveness declines rapidly. Fish that no longer have shelter are exposed to floods and predators and, therefore, migrate to more suitable waters.

b. **Trout Region.** The trout region is immediately downstream from the source of the water. As the name implies, the primary fish species of this region is trout. The water is relatively cold, very rich in oxygen, and well suited for brook and brown trout. Mountain streams flow quickly, while flatland streams have a slower current and are richer in vegetation. The fisherman may find chub and some Cyprinides in the lower and warmer trout regions.

c. **Grayling Region.** The grayling region lies farther downstream where the water is still cool and rich in oxygen. The tributory streams of the Danube, Lech, Isar, and Inn, for example, belong to this category. Although the grayling is predominant, there are also some Trout, Rudd, Chub, Barbel, sucker, and pike in this area. River char usually move into this portion of the stream to spawn.

d. **Barbel Region.** The Barbel is the prevailing fish in this region immediately below the area occupied by grayling. Other species that share this habitat are the Rudd, Nose Carp, Eel, Perch, Pike, and Pike-Perch. In the Barbel Region, the stream gradually becomes a sluggish river with a slightly higher water temperature and a reduces oxygen content. The river banks are frequently covered by heavy vegetation.

e. **Bream Region.** The bream region is the final water division for many German rivers. The river becomes wider, deeper, and slower with the lower gradient. The river forms many pond like habitants with rich vegetation along the banks. The region is very productive. The Bream is the main fish species, but Roach, Rudd, Pike, Pike-Perch, Carp, Eel, Tench, and Sheatfish also inhabit the area. Trout and Grayling are not present because of the relatively high temperature and low oxygen content.

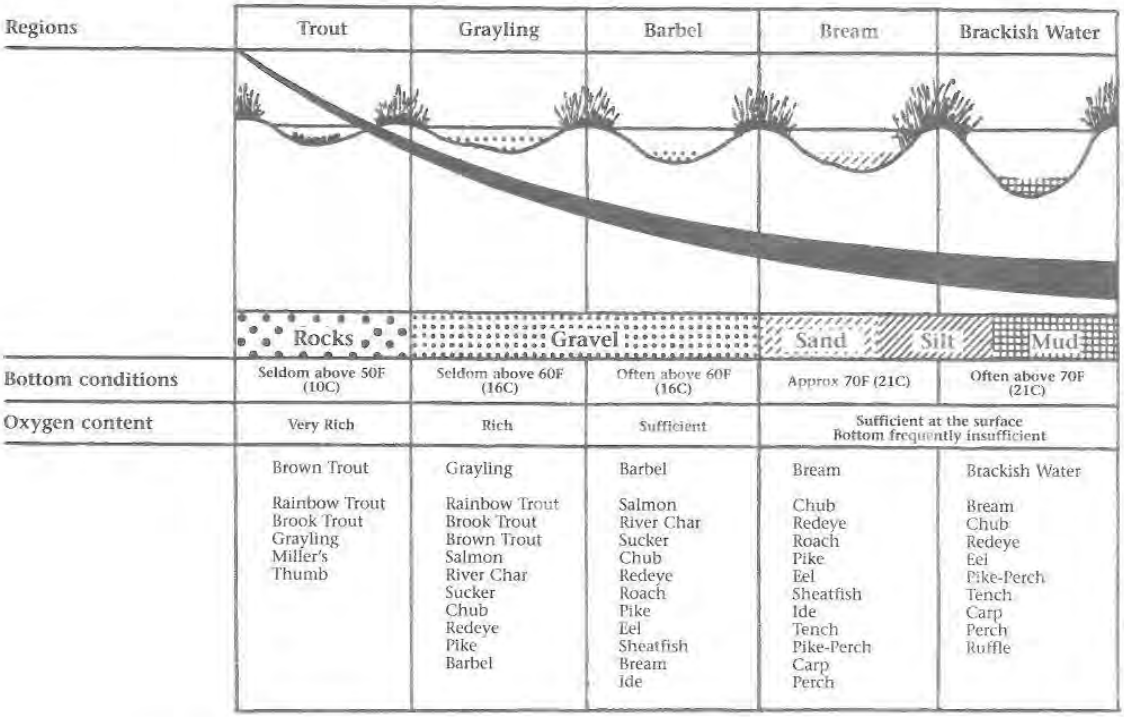
f. **Brackish-Water Region.** Estuary rivers (rivers emptying into the sea) have a brackish-water region that extends from the bream region to the mouth. When the tide turns, salty sea-water enters the river and mixes with the fresh water. Many freshwater organisms killed by this process are valuable food for the brackish-water species. The Ruff (Kaulbarsch), a small member of the perch family, Smelt, and Eel are the most numerous inhabitants. Bream, Roach, and occasionally flounder also are found in this region.

14. STANDING WATERS

a. **General.** Standing waters are characterized by al lack of current and by the productivity of a constant stock of fish species that can adapt to the water composition. Lakes, ponds, and impoundments are in this category. Standing waters may be either natural or manmade. Factors such as depth, water composition, temperature, type of bottom fauna, and food production rate determine the fish stock and classification of a lake.

b. **Lakes.** There are two general types of lakes in Germany with variations in between ((1) and (2) below). Development and circulation of nutritious matter determines lake type. Lakes are further distinguished by their zones and divisions ((3) and (4) below).

(1) Lakes Poor in Nutritious Matter. Lakes poor in nutritious matter are deep, usually with deep rocky shores; they are often blue and transparent with stony or sandy bottoms. Typical representatives of this category, the Bavarian alpine lakes, are usually more than 100 feet deep with some descending to 600 feet. Animals and plants produced in these



lakes are decomposed completely by bacteria during the year. Although these lakes have adequate oxygen in their depths during the summer heat, they are poor in nutritious matter and not very productive. Primary fish species inhabiting these waters are lake trout, lake whitefish, lake char, brook trout, and mountain whitefish. Most of these species live in the lakes' open or free water zone.

(2) Lakes Rich in Nutritious Matter. Lakes rich in nutritious matter (Weedy lakes) are relatively shallow and characterizes by a mucky bottom and plenty of aquatic vegetation. Most flatland lakes belong to this category of waters, which are usually no deeper than 60 feet. The abundance of aquatic vegetation provides a large food supply with adequate shelter, making these lakes far more productive than deeper, clearer ones. Some of the shallow lakes produce water plants and aquatic animals beyond their carrying capacity in summer, increasing the decomposition process. Decomposition depletes the oxygen supply, resulting in stagnation and loss of fish. Fish species that thrive best in these lakes are bream, tench, eel, pike, and perch. They inhabit the bank and bottom areas.

(3) Lake Zones. A lake basin may be divided into distinct natural zones. The littoral zone includes lake areas where water plants grow or where light penetrates to the bottom. This zone is usually a belt around the shore, but may include shoal areas out in the lake. In shallow lakes, this zone may include the entire body of water. A deep lake with an abrupt shoreline drop off or a turbid lake that prevents light penetration needed for plant growth has a limited littoral zone. The open, lakeward area id called the limnetic zone and extends to a depth where small floating plants may flourish. This zone corresponds to the trophogenic (food-producing) zone. Below trophogenic zone is the tropholytic (food-loosening or breakdown) zone, which includes the lake bottom where food is consumed faster than it can be produced. Fish and other organisms living in the tropholytic zone must rely on food dropping from above.

(4) Other Lake Divisions. Each species of fish requires a distinct water composition, average temperature, environmental condition, and food supply. The various lake divisions, therefore, are further identified by the names of the predominant fish species in the waters (for example, Brown Trout, Lake Trout, Roach, Bream, Pike, Pike-Perch, Carp, Perch lakes).

c. **Ponds and Pools.** Ponds are manmade that can be drained and pools are natural, quiet, shallow waters that do not dry our and are not subdivided into bank and deep regions. They generally have the characteristics of a lake littoral or bank zone. Light penetrates through the shallow waters to the bottom, promoting rich vegetation and plenty of food for the fish. Heat from the summer sun can produce high temperatures in these ponds. In winter, the water cools rapidly. These areas frequently contain crucian carp, tench, carp, perch, and white bream.

15. CHEMICAL CHARACTERISTICS OF WATER.

Natural waters are classified as basic, acid, or neutral. The degree of acidity or alkalinity is expressed in pH (pondus Hydrogeni) scale readings. The neutral point, pH7, registers neither acidity nor alkalinity. Sorensen scale readings 1 through 14 indicate the chemical composition of water. Readings 5.5 through 8.5 generally are considered neutral. Readings above 8.5 mean the water is more or less saturated with alkali (alkalisch or basisch); readings below 5.5 mean that the water is more or less saturated with acid (sour (sauer)). Alkaline waters usually produce a higher fish crop. Acid water conditions in lakes or ponds can be corrected to yield better crops by adding lime.

16. IMPROVING PONDS AND LAKES.

a. The hope of improving game fish production may seem futile because of the many known forces destructive to game fish habitant. Proper fish management techniques, however, will set the stage for habitat restoration and improvement. The objective is to manage fishing waters to afford good fishing conditions for the greatest number of fishermen.

b. Lake or pond management should be directed toward eliminating all sources of damaging influences that cause waters with a high game fish population to develop a dominant population of small, less desirable species. Improving such waters requires draining and removing existing fish-stocks, silt, and harmful vegetation. Desirable aquatic vegetation can then be grown on the bottom to provide enrichment when the pond is refilled. This practice is also useful for clearing water in impoudments that have become turbid and low in food production. When these lakes are restocked with the desired species, they provide excellent fishing for many years.

c. Food chain relationships in an ecosystem are important to the community of animals that inhabit lakes and ponds. In a small pond, the primary food producers called zooplankton (microscopic animal life) and phytoplankton (one-celled plant life) determine the overall production capacity of the pond. A simplified version of the food chain may be as follows: phytoplankton is used as food by zooplankton, insects, and other invertebrates; small fish such as whitefish feed on insects and invertebrates; and larger fish such as trout and pike feed on whitefish. Elimination or disappearance of any group in the chain may affect the entire chain adversely. It is important for future planning to remember this when deciding if a small fish or other animal is worth retaining.

17. LEASING; STOCKING AND IMPROVING STREAMS.

a. Rod and gun clubs spend large sums of money to lease and stock streams and lakes throughout Europe so that the maximum number of their fishermen have access to conveniently located fishing areas. Some waters, unfortunately, are not chosen wisely and are so badly polluted that they are incapable of supporting the desires fish life. The result is a waste of both organization funds and fisherman's time. The true condition of the stream often is not discovered until after a long-term lease has been negotiated.

b. The casual observer finds many woodland and mountain streams in GE apparently clean, pure, and fully capable of supporting fish life. Actually, some streams are so polluted that a trout could not live in them for 48 hours. In many cases, local property owners along the stream are not aware that their water is polluted. A stream must be inspected thoroughly and the water tested before signing contracts with property owners and arranging for stocking.

Through testing is especially important if the stream appears to have no fish life in it at all. A few fish will survive from preceding seasons, no matter how heavy the fishing, unless there is something drastically wrong with the water.

c. There are four principal reasons why a stream may be incapable of supporting game fish: high temperature, low mineral content, heavy silting, and lack of oxygen. Club members can make a thorough preliminary survey of a stream considered for lease to determine whether it is good enough for final expert testing. Even a novice can detect and smell many conditions that inhibit successful fish culture. Expert assistance should always be sought, however, to check the following four points:

   (1) Do not stock a stream with trout if the temperature of the stream rises above 75 degrees Fahrenheit during the warm summer months. It is possible, of course, to put legal-sized fish into some streams and fish in early spring, even if the remaining population dies in summer. But it is not wise to contract for part-time recreation if water is available for good sport throughout the season.

   (2) Do not stock sour water or a stream where the mineral content is below that essential to the health if the species being stocked. Mineral deficiency usually results for, low lime content. This deficiency is a matter for experts to determine by analyzing water samples from various parts of the stream.

   (3) Do not stock muddy water or streams where a muddy condition is present as often as 50 percent of the time. This warning is particularly important for trout. While there are a few varieties that tolerate silt to a remarkable degree, no trout can survive in water that is turbid much of the time.

   (4) Do not contract for water with an oxygen deficiency that cannot be corrected. Fish cannot extract enough oxygen from water with a low oxygen content.

d. An experienced fisherman or fishermen should accompany the prospective lessee to substantiate the lessee's observations when making a preliminary study of a stream for subleasing and stocking. The lessee should:

   (1) Cover every foot of a stream or tributary suspected of being polluted.

   (2) Observe the stream bed carefully. Wading into it if necessary to determine if the bottom is rocky, gravel, sandy, or muddy.

   (3) Check the banks of streams near farmhouse, industrial plants, and villages for sewage pipes that dump raw sewage or waste into the stream. Take a sample of the water occasionally and smell it. Polluted water usually has a sour, disagreeable, and distinctive odor. Look for surface scum, which is a sign of pollution. Check the back eddies where scum sometimes accumulates in soapy or foamy mass. Test scum by its odor: if it is highly polluted, it will have a bad smell. Observe reflected light on the surface of quiet pools. An iridescent, rainbow-hued surface indicates floating oil or gasoline, which is deadly to fish life.

   (4) Look closely for indications that property owners along the course of the stream are careless and indifferent to the condition of the water. Old bed springs, automobile tires, abandoned coffee pots, bottles, tin cans, and floating scraps of tissue paper indicate heavy pollution and lack of concern for the environment.

   (5) Observe the reaction of animal life to the water. Do thickets along the bank contain birds' nests or are they completely barren? Do birds drink from the stream? Are crayfish under the rocks or small schools of minnows in the shallows? Are there muskrat holes in the banks? Do heron or kingfishers haunt the stream course? If wild creatures seem to like the stream, it is likely that fish will also. If they do not like it, neither will the fish.

   (6) Before subjecting a body of water to chemical analysis or other scientific tests, obtain permission from the stream owner and fishing authority to do some electrofishing (before signing the contract).

(7) Not abandon the idea of stocking the stream if only a few indications of pollution are present. Some streams can stand a minor amount of pollution and are self-oxygenating by their nature. A mountain stream studded with boulders and with many falls and rapids has a very high oxygen content and is resistant to the bacterial effects of sewage. Slower-moving streams can be made to increase the amounts of oxygen retained by simple measures of stream improvement.

e. A club should not undertake stream improvement involving a considerable amount of work unless the stream is receptive to improvement and unless a sufficiently long lease has been negotiated with the property owners to make the investment of time and money worthwhile. The owner must approve measures planned for improving the stream. The club should obtain written approval before starting any work. Examples of stream improvement are to:

(1) Eliminate or minimize the amount of pollution affecting the stream. Grid chambers installed near sewage outlets can eliminate about 35 percent of sewage pollution. Cooperation from stream-side owners responsible for piping waste into the stream often can be gained by pointing out the harmful effects and explaining how easily the pollution can be corrected. Contact the public authority (Landratsamt).

(2) Place a spawning box in waist-deep shallows to help perpetuate the fish population. The wooden frame with mesh-wire bottom can be submerged by filling it with golfball-sized gravel.

(3) Increase the oxygen content of an otherwise good stream by:

(a) Placing a cylindrical aerator about 10 inches below the water surface, depending on the water depth. Never allow the aerator to protrude out of the water as it will collect debris and become a barrier.

(b) Placing rocks on the stream bed, making certain that the rocks are placed at the water's striking point so that the striking force of the stream is on the rocks and not on the bank. The rocks can be just above or below the water surface (fig 3).

(c) Breaking up the smooth stream bottom by piling rocks across the stream, but below the water surface at the lowest level for a simple method of aeration.

18. VEGETATION CONTROL

There are two effective methods to control or remove undesirable or excessive aquatic vegetation.

a. Rooted plants can be removed by hand or mechanical means (draining and pulling up the roots by hand or with dredging devices). Removal also can be accomplished by leaving the pond drained during May, June, or July, the time of normal flowering and fruiting.

b. Vegetation can be controlled by chemicals. The discovery of new types of chemicals for use with improved materials and techniques makes this kind of plant eradication highly successful. The use of chemicals to control aquatic weeds is subject to the provisions of the Federal Weed Control Act/Federal Plant life Protection Law. Th legal provisions require that only those chemicals specifically approved by competent authorities may be applied to water and that use is made only with the concurrence and under the joint supervision of a chemist and biologist of the appropriate plant life protection agency and water control authority. A chemist and biologist should be present to determine specific requirements and to supervise application because chemicals may affect the fish stock as well as other users of the water. In Germany there is no legalized chemical for plant eradication.

19. ELECTROFISHING

a. Fishing with electric devices is generally forbidden by law. Under certain circumstances, however, German fishing authorities may grant permission for electrofishing. In Bavaria for example, written requests with full justification must be submitted to the district government where the fish waters are located; in Baden-Wuerttemberg, permission may be granted only for conservation purposes, eel fishing, seed-fish fishing, and or research and training purposes.

b. Persons who want to fish with electric devices must possess a certificate (operation license) that shows that they have successfully attended a course on electrofishing recognized by the responsible fishing authority as well as the required liability insurance.

20. PROPER STOCKING

a. **Background.**

(1) Many natural spawning areas are inaccessible, considerably depreciated, or completely destroyed by various corrective actions taken to use and control natural bodies of water. Dams and similar constructions in streams and rivers prevent fish from migration. Heavy ship traffic in navigable waters destroys the spawn of free water spawners. The wake that carries spawn to the shore and hurls them against rocks or other hard objects also damages or destroys eggs of shoal spawners. Boaters and swimmers greatly disturb spawning places in shoal areas, especially those near camp sites. Ducks in small streams and creeks can cause considerable damage to spawning areas. An increase of certain waterfowl (for example, divers, water rails, swallows, swans, wild ducks) significantly depreciates fish spawning areas. Also pollution can cause considerable loss of fish spawn and fry.

(2) The many detrimental influences on fish and increased fishing make the regular restocking of waters with young fish a necessity and, on par with increasing requirements, a must for all conservation-minded fishermen.

b. **Successful Stocking.** Stocking without knowledge of real needs may result in more harm than good. Successful stocking depends on careful selection of suitable species for the waters, attention to the number of additional fish the waters can support, proper and careful release of the fish-stock, and selection of good quality planting material. Stocking more fish than the food and shelter can support is costly and harmful. Great care must be taken to avoid overcrowding and waste by over enthusiastic planting of hatchery fish. The characteristics and carrying capacity of the waters determine the number and types of fish to be planted. To avoid waste or harm to the fish population, stocking should not be done where:

(1) Waters are unsuitable for the fish.

(2) Native fish are not proportionately reduced and their spawning is normal.

(3) Waters are inaccessible and fishermen and natural reproduction is nor fully harvested each year.

21. TRANSPORTING AND STOCKING FISH

a. Hatchery fish must be handled with extreme care. The slime covering and the scales protecting the fish from parasites and chemical substances must not be removed or harmed. When hatchery fish are shipped and stocked, netting must be kept to an absolute minimum to reduce abrasion caused by nets. Hands must be wet before touching or holding fish.

b. Transporting hatchery fish sensitive to high water temperature during hot days requires special shipping containers. Receptacles made of plastic material are in popular use. When the containers are in transit for a prolonged period, the lid should be replaced by conifer branches covered with ice chunks. The melting ice will help keep the water temperature down. Occasional stops are necessary to check that oxygen equipment is functioning properly. Knowledgeable and skilled personnel should accompany fish shipments to ensure delivery of stock in excellent condition.

c. Part of the container water must be drained and replenished slowly by water from where the fish will be stocked, because sudden temperature and water change may injure the slime covering and expose the fish to infection. Even though the water temperatures may be identical, gradual adjustment is necessary because of the difference in chemical composition between the water of the container and that of the fishing stream. Hatchery fish must be released gently into the new water to minimize loss during the planting operation.

WAITING TIME AFTER STOCKING

Waiting time depends on the state fishing laws.

The Fishing Law in Bavaria states: if you stock the water with legal size fish, fishing is not allowed for 14 days after stocking. If you stock the water with legal size fish for a club fishing event – **NO DERBY** – fishing is not allowed for 4 weeks after stocking.

The Fishing Law in Hessen states: if a pond is stocked with legal size fish, fishing is not allowed for three weeks after stocking.