Fig – 4.1

INTRODUCTION

Professional fishermen have usually the greatest experience in catching fish and, as mentioned above, the techniques most often employed for fish sampling are the same as those used in commercial fisheries, but because the purpose is to catch fish according to a programme designed with a certain objective in mind, the use of the gear may differ. Commercial fishermen want to catch as much fish as possible and in the most profitable way, whilst a sampling programme has rather different objectives. Thus, the use of the commercial (as well as sport) fishing gears lies within the scope of this book.

Standardized sampling and data comparison methodologies are used in a wide variety of fields such as medicine, finance, education and agriculture. Standardized sampling methodologies are also extremely important in fisheries and are required to evaluate how a fish population changes over time, or is functioning compared to an "average" in a state or a region. This allows the biologist to identify problem fish populations, discover populations with exceptional angling opportunities, set regulations, or apply various management strategies and monitor their effects.

Effective management of fisheries resources requires knowledge of the fish populations and communities to be managed, and knowledge of the relationships between the populations and communities and their habitats. Information about fish populations and communities is normally acquired through some sort of fish 'sampling'. This sampling usually involves capturing fish, although it may, in some cases, be acquired by simply observing fish in their habitats.

The Sampling Objective

Sampling is undertaken to obtain information about characteristics of fish populations or communities, often in relation to the habitats they occupy. The characteristics that are of interest and the accuracy with which these must be estimated determine the sampling approach that is required.

Many types of fishing gears have been developed worldwide (von Brandt, 1984), although relatively few of these have been adopted for management and research purposes. There has been, and continues to be, research conducted on the efficacy of the sampling methods that have been adopted, as well as on new approaches to sampling. Seven fishing gear types that are commonly used for surveys are reviewed separately below. Gear types include

1. Gill nets
2. Beach seines
3. Hoop, fyke and trap nets
4. Electrofishing
5. Underwater observation
6. Gee or minnow traps
7. Enclosure traps (pop, drop and throw).

TERMINOLOGY DESCRIBING SAMPLING GEAR AND METHODS

Active gear, Passive gear and Point or Quadrant sampling

Fishing gear is often referred to as being either ***active*** or ***passive***.

Active gear is moved in order to capture fish. An example of active gear is the beach seine, which is pulled through the water and encircles fish in its path. Typically, active gear is used to sample fish over a relatively large area during a short period of time.Eg: Pop Net, Drop Net, Electro Fishing, Grid/Drop Net, Throw Trap, Hoop Net, Fyke Net, Trap net.

Passive gear is stationary; fish swim into it. Gill nets are an example of passive gear. Passive gear is used to sample fish at a specific location over a longer period of time.Eg: Gill Net, Pond Net, Block Net, Flume Net, Minnow Trap,

A third approach, referred to as **point sampling** or **quadrant sampling**, samples fish within a small area at a single point in time.

Catchability, Efficiency, Selectivity and Catch-Per-Unit-Effort

There are several key terms that are used to describe the ability of fish sampling gears and methods to capture or observe fish and the susceptibility of fish to various gears and methods.

Catchability is defined as the proportion of the fish that are available to be captured that is caught by a defined unit of fishing effort (Ricker, 1975). The catchability of fish is equal to the *efficiency* of the fishing gear. To clarify, if a single pass through a section of stream with an electrofisher is defined as a unit of effort and half of the brook trout in the section of stream are

removed by a pass, then both the catchability of brook trout and the efficiency of the electrofishing are 0.5 or 50%. Furthermore, assuming equal catchability among individuals, the probability that any individual will be captured by a defined unit of fishing effort is also equal to the catchability which, in the case of the above example, is 0.5.

The number of fish captured by a particular gear with a particular amount of effort is termed **catch-per-unit-effort** (CPUE). Efficiency varies among gears, among habitats, among species, and even among sizes of the same species. Gears for which efficiency is highly variable among species or sizes of fish are termed **selective**. Gears that capture a wide range of species and sizes equally are referred to as **non-selective**. In practice virtually all gears/methods vary to some degree in efficiency among species and sizes of fish.

The number of fish available for capture must be known in order to calculate catchability or gear efficiency. Some studies estimate catchability by releasing a known number of marked fish into the sampling area prior to sampling. If the assumptions are made that catchability is equal for marked and unmarked individuals and that all of the marked individuals are available for capture, then catchability is equal to the proportion of the marked fish that are captured. Other studies employ some means of collecting the remaining fish following the sampling (i.e. poisoning or draining the area). Still others estimate abundance using removal or mark-recapture methods, that use the rate at which the catches decline, or that the proportion of unmarked fish in the catches decline, to estimate the size of the population.

FACTORS TO CONSIDER WHEN DETERMINING WHAT FISH SAMPLING GEARS AND METHODS TO USE

Several factors must be taken into consideration when selecting a method to assess fish communities or populations. Key among these are:

- The question(s) that the investigators wish to answer,
- The habitats that are being investigated,
- The fish species that are being investigated, and
- The time of year when investigations will take place.

It is necessary to understand the capabilities and limitations of various gears and methods in order to determine those that will enable investigators to best answer the questions being posed. In practice, the types of gear available and the amount of time and staff available often play a major role in gear/method selection. In these instances, knowledge of the capabilities and limitations of various gears and methods will allow investigators to recognize the questions that can, or cannot, be answered with the resources available.

Presence/Absence and Species Richness

The simplest question that can be posed is “Are there any fish present?” It often is the first characteristic that investigators need to determine for small waterbodies or streams about which little or nothing is known. Initially, at least, abundance or densities are not of concern, although these may become of interest later. The presence of fish can often be confirmed simply by looking for them, especially in habitats where fish are abundant and visibility is good.

If the question is “Are fish present?” and fish are not readily visible, then methods that are effective at capturing a wide range of species in the type or types of habitats that are present should be utilized. It is important that all habitats be sampled and if the habitat characteristics vary widely it may be necessary to use more than one type of gear. Small fishes are usually more abundant than large fishes and within a species small individuals are usually more abundant that large individuals, so a gear that is effective for small fish are usually preferred. It is important to remember that, unlike presence, **absence can never be proven**. All that can be achieved is to demonstrate that there is a high probability that fish are not present.
Sometimes investigators wish to determine what species or how many species are present (species richness), but require no estimates of abundance. The gear selection criteria are similar to those for determining if any fish are present, bearing in mind, once again, that it is important to sample all of the habitats that are present.

Investigators may wish to determine whether or not a particular species, or even a particular size/age class of a particular species, is present. In those cases it is often desirable to use a highly selective gear that has a high efficiency for the particular target species/size.