Asking Some Reasonable Questions
(and some that don't seem quite so reasonable --- yet!)

Exactly what is Fisheries Biology anyway?

What do you think?

Sounds good to me!

Literally "Fisheries Biology" means the biological study of fisheries - but you already knew that!

In its shorter scope it is the study of the many life features of the organisms which comprise a fishery.

In its longer scope it includes the social, economic and management aspects as well.
Sometimes this broader field, which includes all the aspects related to Fisheries Biology, is called 'Fisheries Science.' For the most part these two terms have the same meaning.

(Note: Although there may be a difference between the terms, Fishery + Fisheries, no one really knows or cares what the difference is, so they are often used interchangeably – both here and everywhere.)

When we talk about a 'Fishery' we mean a group of aquatic organisms (things that live in the water) that are, will be, or have been used for commercial and/or recreational purposes. The uses include not only those for human consumption but also things like industrial (cat food + fish meal) and tourism (decorative shells, etc.)
The aquatic organisms themselves include a wide variety of groups. The cold blooded vertebrates (can't regulate their body temperature but they do have backbones) like fish, sharks, rays, skates, and sea turtles.

I thought I was protected!

Warm blooded vertebrates (they can control their body temperature quite nicely—like you and me) such as whales and seals.
Lastly, they include a wide variety of invertebrates (no backbones) such as shrimp, crabs, crayfish & lobster, squid & octopus, and clams & oysters.

Last, but not least, not to leave out any group, we might also include corals (used in making jewelry) and some plants such as seaweed (used in making ice cream!).

All the above groups have fisheries attributed to them. The terms fish & fishes will be used when referring to the organisms comprising a fishery. I won't always mean "fish," of course, but it will make reading (and writing) a whole lot simpler (and hopefully clearer). As you have probably already gathered, the general principles of fisheries biology can be applied to any fishery.
Why should we want to know something about Fisheries Biology?

The above question roughly translates to:

What are the objectives of Fisheries Biology?

The reason is: if we have an idea what the field is trying to do then it follows that we will have the answer to both questions.

The main objective of Fisheries Biology should be to:

"Create and maintain the best possible fishing experience for everyone."

Did you notice...?

Ya, he said "should be" not "is"!
Robert Lackey wrote the previous quote in his book "Introduction to Fisheries Science."

It's important for us to examine this statement, especially to understand the terms "best" and "everyone." We all know that what is best for someone may not necessarily be what's best for someone else. Moreover, we also need to recognize that the "everyone" refers not just to everyone present here and now, but also to the everyones who will be here in the future as well.

This becomes quite an objective then when you consider the hundreds of fisheries (some of which haven't even been developed or discovered yet), each with its own very special features, and the multitudes of participants each with their own idea of what's "best" for them (and everyone else!).

Let's examine the nuts and bolts of this objective even further -- -- --
The diversity of fishing participants as well as those closely or even remotely associated with fisheries all have a vested interest in deriving the "--- best possible fishing experience ---." The value of this experience is obviously in the eye of the beholder and includes more (or bigger) fish if you are a commercial fisherman, more lost lures and tackle if you own a bait & tackle shop, stranger and more picturesque fish if you're a sport diver, or lower prices if you are a consumer.
Then there is, of course, a major conflict that arises under the term "best". What is best for some (lower prices for example) is not necessarily the best for others (if you happen to be a commercial fisherman). Once a conflict occurs most of us prefer to divorce ourselves from the nice, harmonious group. As soon as that happens it's "everyone for themself".

I caught it first!

No, me!

Agh!

Let it go or I'll call my congressman.

In essence what fisheries biology is all about is providing the best possible fishing experience for everyone while minimizing the conflicts between everybody.
THOSE OF US INTERESTED IN OUR FISHERIES RESOURCES NEED TO LEARN HOW TO MAINTAIN, IMPROVE, AND DEVELOP THEIR QUALITY AND QUANTITY. THIS IMPLIES THAT WE OUGHT TO KNOW, OR AT LEAST UNDERSTAND, HOW TO ACHIEVE THE OBJECTIVES OF FISHERIES BIOLOGY. EVEN MORE IMPORTANTLY, WE NEED TO KNOW WHEN OUR OBJECTIVES HAVE BEEN MET SO THAT WE'LL KNOW IF OUR MANAGEMENT STRATEGY HAS BEEN SUCCESSFUL. SO--- THE MAIN EMPHASIS IN THE NEXT FEW SECTIONS WILL BE ON DISCOVERING:

WHAT A FISHERIES BIOLOGIST DOES,

HOW HE OR SHE DOES IT,

AND---

WHY ALL THIS ACTIVITY AND RESEARCH IS NECESSARY.

LATER ON WE'LL EXAMINE HOW THE SPECIFIC OBJECTIVES FOR EACH FISHERY ARE DETERMINED. BUT FIRST ---
The question also arises:

What yardstick do we use to measure what is "best" and do we know when "best" has been attained?

In the recent past and even to the present day, one of the major objectives of fisheries biologists was to maintain a fishery at its maximum sustainable yield (or MSY for short).

MSY is defined purely on a biological basis. Briefly, MSY means...the highest yield or catch of fish which can be taken without causing a decline in future catches. In other words, the catch we can take from a fishery without depleting the number in the group or stock.
As stated previously the MSY for any fishery is established purely as a biological problem. Calculating MSY requires no information of any of the economic or social factors which we know can greatly affect the fishing industry and its participants. If the goal of fisheries biology were merely to determine and maintain the MSY for each species or kind of fish in the various fisheries then there would certainly be many problems. These problems would occur because the level of catch taken from the pool or stock would be made without any reference or consideration for the personal lives of the people involved with it.

The Fishery Conservation Management Act (abbreviated to FCMA, of course) of 1976 was passed by the U.S. Congress with one of its purposes being to get away from a strictly biological goal of fisheries management.

It always seems to take an Act of Congress ...
A new goal for fisheries managers was adopted as part of the FCMA called Optimum Yield. Optimum Yield (or OY) is based on the Maximum Sustainable Yield but as it (the MSY) is "... modified by relevant social, economic, or ecological factors."

We'll get to just exactly how this puzzle is put together later. But the important point to realize is that fisheries biologists must no longer be only concerned with being able to manage a fishery from a biological point of view. They must now learn to manage it from a people point of view. That should make everybody happy! Yeah, even us.
Figure 1. The relationship between MSY, OY, and Stock
A Fisheries Biologist must be able to assess and determine the impact the major environmental and biological factors have on a fishery. That may sound like a difficult, if not impossible, task, but it sounds even more difficult once you realize that often even the factors themselves may interact with each other. For example, temperature may influence a fishery, not only by acting directly on the fish in a fishery, but also by affecting the availability of a food item essential to their growth or survival. Studying and determining the importance of these factors, their interaction, and how they each, in turn, affect the fishery is the responsibility of fishery biologists. It is through a careful and correct understanding of these relationships that he or she is able to calculate MSY and subsequently examine the social and economic factors to determine OY.
In order to set the goals for fisheries management and to determine if and when these goals have been met we must be able to view the fishery in its total perspective.

Aquatic organisms are not isolated from themselves or anything else. The fact is that fisheries are affected by just about everything. In Figure 2, the major factors which influence fisheries have been broken down into two groups. There is a group of environmental or physical factors which influence fisheries such as temperature, salinity, oxygen, or bottom type or substrate. In addition, there is a group of other factors which are biological such as competition, food, parasites, diseases, and predators (in a way you might think of fishermen as predators on the fish in a fishery).
Figure 2. Factors which may influence a fishery and the concept that a fishery is composed of individuals which are each, in turn, influenced by these factors.
In Figure 3, a diagram is presented which indicates the general procedures used in Fisheries Biology (at least in an ideal situation). This general procedure is no different than that used in any other field oriented toward problem solving. It requires an input of information, an analysis of the information, an appropriate response to the situation, and an assessment of the response.

Above all, however, we should begin with a question. This usually means that some inquiry has been made into the current status of a "stock" (we'll define this term later). For example, it may be noted that a fishery seems to be declining in the past few years (sounds familiar !!!). The question then is raised:

Has the stock really declined?
Figure 3. Flow chart of the general procedure used in Fisheries Biology.
We would begin by examining the available data. If the data indicate that the answer to our question is a 'yes' (or a probable 'yes') as opposed to a 'no' (or probable 'no') then a second question must be asked:

What is the cause of the decline in the fishery?

Answering this second question lets us jump into the procedure cycle already seen in Figure 3. The information required to answer this second question may already be available from previous studies. In general, however, the answer usually requires gathering new or additional data on individuals within the fishery.
While it is true that a fishery is composed of many individual organisms, we need to realize before we go out and gather data on them that not all individuals in the fishery have exactly the same characteristics. For example, some members of the fishery may be longer or produce more eggs than others of the same age. Some may differ in what they eat or where they occur.

In order to account for these differences (which could have a major impact on the final answer to a question) it is essential to describe a fishery on a statistical basis.

Don't get put off. What is meant by a statistical description is really quite easy to understand. In its simplest form we mean using an average length or weight to represent that characteristic of the members of a fishery (the average then is the value for a "typical" member of the group).
Also - it is important to realize that the answers to our questions may require that not only will a lot of fish have to be measured for a single character -- (like body size)

--- but most answers will require that we study (sometimes in elaborate statistical detail) many different body characters of the organisms as well as many different factors or features of the environment which pertain to the fishery.

For example, to know what may have caused the decline of a fishery we may have to know the

1. Fishing pressure in the area
2. Migration pattern of the fish
3. Their growth rates.
We might even need to know the amount of food that's available because that can certainly influence growth rates.

FISH GOTTA EAT TOO!

RULE #12

A lot of different characters from a lot of different fish must be examined in order to accurately answer questions in fisheries.

Oh yeah, well just how many? - Wise guy

"As many as it takes, you little clam!"

This response may seem a bit silly but there is a lot of truth to it. Generally, fishery biologists gather data of the type and in amounts that their experience, equipment, and funds allow.
Upon further study it may be determined that too much of one type of data were collected, not enough of another, or some useless data were gathered. Perhaps some really important information was not collected at all.

**Rule #2**

Only by collecting data, analyzing it, and assessing it, can we ever refine the data to the point where our question can be correctly answered.
Once enough of the 'right' kind of data are gathered an analysis is conducted to determine the status of the fishery.

Note: the word 'data' is plural and refers to more than one number or piece of information. The word 'datum' is the singular form.

Another note: hardly anybody uses it correctly.

... The analysis might indicate that the fishery is declining, increasing, or stabilizing and (depending on the kind of analysis) indicate the probable cause (or causes) for the current status of the fishery.
Sometimes by using the same data, it is possible to examine the effects that various management options (management options are essentially the same thing as potential solutions) might have on a fishery. For example, if our analysis indicates that low reproductive effort is the reason suspected as causing the decline of a fishery, one suggestion for its improvement might be to stop or reduce fishing pressure during the peak reproductive season. There are numerous other options or strategies that could be applied as well but by using the data from the fishery and some analytical techniques it is possible to develop management strategies that will lead to improvement of the fishery while causing the least inconvenience to the fishing community.
Once a strategy for a fishery is adopted and implemented it is absolutely necessary to reassess the status of the fishery to determine if the management technique has been effective. This, of course, requires that additional data on the fishery be gathered and reanalyzed. Subsequent to a reanalysis several questions should be asked:

"Was the management strategy effective?"

"Do we need to substitute or add another management strategy?"

"Is further management necessary?"

The process of gathering data, analyzing it, offering management options, and evaluating the status of the fishery is what fisheries biology is all about. In the next few sections we will examine some of the life history data that are often needed. Later we'll see what these will be able to tell us.