Advance Aquaculture Technology
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Lecture 03
Important Species in Aquaculture

Hello everyone, welcome to the third lecture series of the module 1. My name is Professor Gaurav Dhar Bhowmick, I am from the Department of Agriculture and Food Engineering Department from IIT Kharagpur. So, in this particular module, in this particular lecture series where I will be discussing about the Important Species in Aquaculture under the module of Introduction to Aquaculture.

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So, the basic concepts that I will be covering here the classification of fish, basic classification of the aquatic species, important cultivable fishes and shellfish, characteristics of major fishes, selection criteria and the broodstock management.

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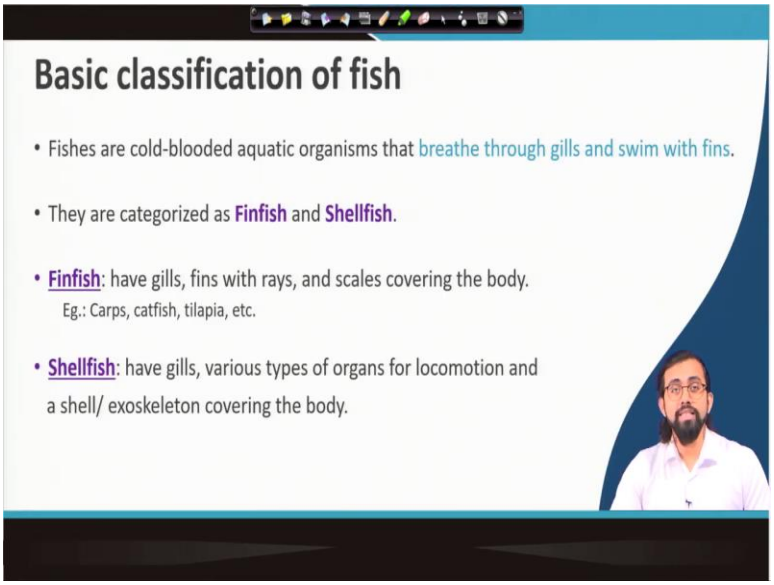

In case of basic, when we go for the basic classification of fish, we know that they are normally, they are generally the cold-blooded aquatic species that breathe through their gills and swim with fins. So, they are categorized as either fin fish or the shellfish. So, in case of fin fish, they have a fins with a ray and also they have the skills covering their whole body normally the carps, catfish, tilapia, etcetera. In case of shellfish, they have the various types of organs for locomotion and a shell or the exoskeleton, additional exoskeleton covering their body like shrimp and all. All right

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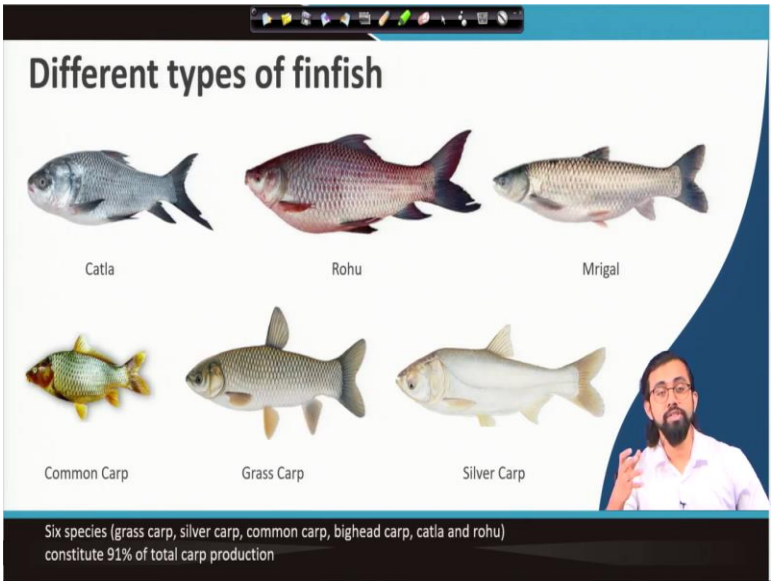

Different type of finfish you already know, I think most of them the Catla, Rohu, Mrigal, Common Carp, Grass Carp, Silver Carp, in general these six species itself they constitutes more than 91 percent of the total carp production in the world.

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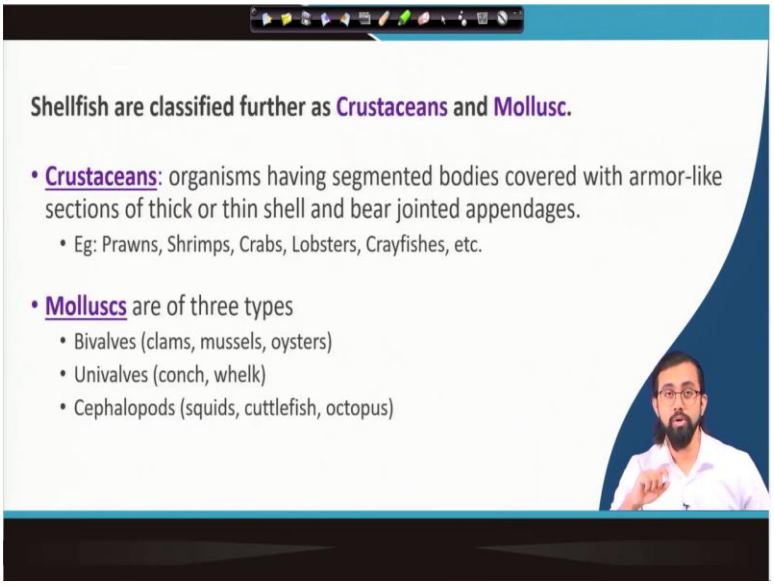

The Shellfish they actually classified further as the Crustaceans and the Mollusc. The Crustaceans, they normally, as I already told you like they normally have a segmented bodies covered with the armored like sections of thick or thin shell and the beard jointed appendages. So, you know about prawn, shrimps, crabs, lobsters, crayfishes, etcetera.

This Mollusc they normally have, like, they are normally three types there is Bivalves, the Univalves and the Cephalopods. The Bivalves are, the examples of Bivalves you know the clams, you know the mussels, the oysters. The Univalves, though, like conch, the conch is the one that we normally use it for religious purposes as well to make some specific type of sound, whelk etcetera. The Cephalopods like squids, cuttlefish and the octopus.

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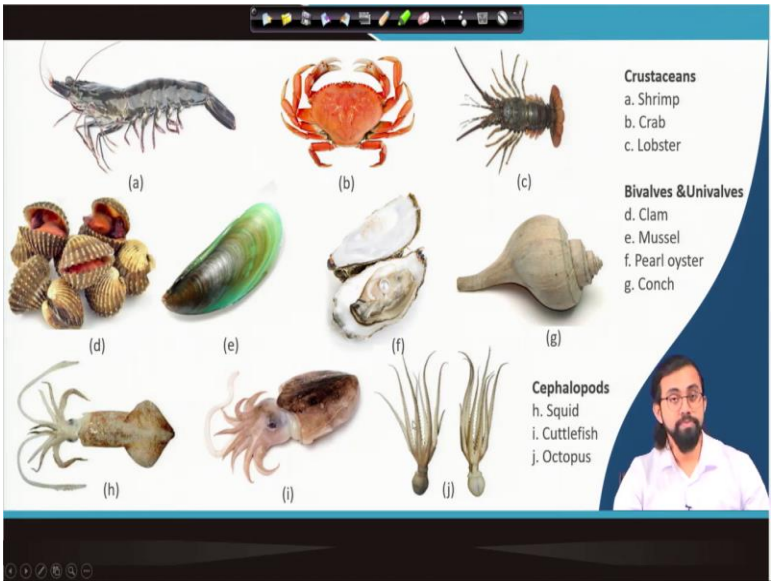

In case of crustaceans, you see the pictures the shrimps, this one is the shrimp, the crab, the lobster, this is how it looks like the clams, the mussels, the pearl oyster, the conch, this is the one that we normally use it for the religious purpose as I mentioned. Different types of cephalopods like the squid, cuttlefish, and the octopus.

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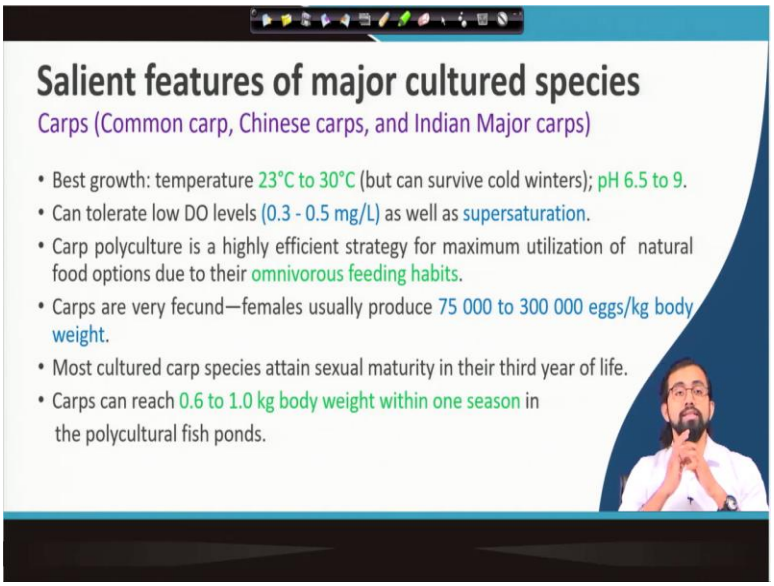

What are the salient features of this major cultural species like especially the common carp, chinese carp, the grass carp, or most of the IMCs like the Indian Major carps, Rohu, Catla and Mrigal. So, they are the best growth condition for them to have a temperature of around 23

degrees Celsius to 30 degrees Celsius, but it can survive in cold winters sometimes, like some of the species.

Their pH variability should have range of 6.5 to 9 for their dwelling water bodies. It can tolerate low DO levels, 0.3-0.5 milligram per liter, as well as supersaturation. Though we say it a supersaturation, but like it is better not to have them in a super saturated oxygen condition, dissolved oxygen condition. So, when I talk about saturation, they, I mean say like in 20 degrees Celsius, suppose if I am talking about 20 degrees Celsius in a normal water body in a tropical region, in 20 degrees Celsius the in STP conditions, the saturation concentration for dissolved oxygen is 9.1 milligram per liter. So, if it is more than 9.1 milligram per liter at a particular moment of time, I mean like the dissolved oxygen concentration, we call it super saturation level.

It happens because of certain activities, natural activities and anthropogenic activity as well. I am not discussing about all those things. So, anyway, it can sustain, the carps can sustain this whole range. This carp polyculture, it is a very efficient strategy as we discussed in the earlier lectures that ~~is~~ this polyculture, why we should go for polyculture and all.

This carp polyculture it has a very, it is a very efficient strategy which we use to maximize the utilization of natural food options due to their omnivorous feeding habitats and all. Carps are very frequent, the females usually produce more than 75,000 to 300,000 eggs per kg of their bodyweight.

The most culture carp species attain the, most of culture carp species, they attain their sexual maturity in their third year of their life, so which is pretty low. And so, in that, because of that, our whole production system goes well, it can reach 0.6 to 1 kg of body weight in one season and in this kind of polyculture fish pond and which also gives us a very high fish, a very high production, economical benefits as well.

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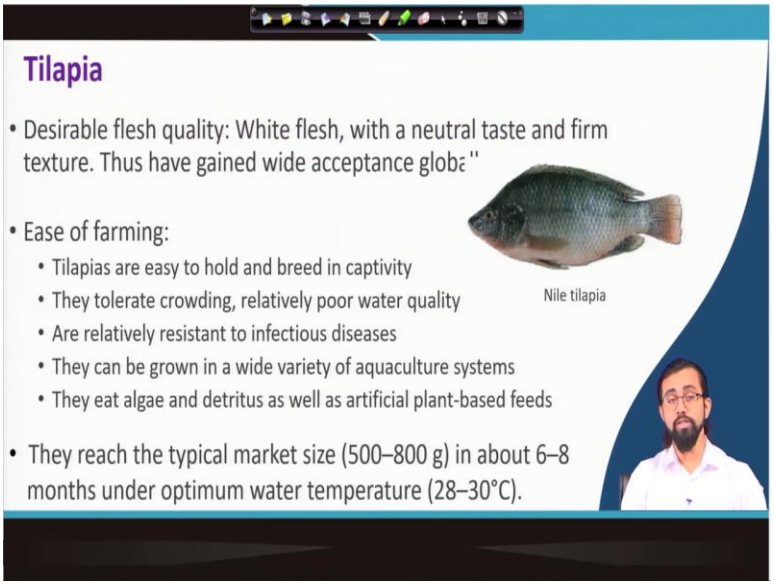

Tilapia, tilapia is one of the very major fish species that we normally try to culture in the aquaculture's tanks in like in no matter what in even in the tropical regions, subtropical, even in temperate region also a specific type of tilapia's market is very high. So, they have a very desirable flesh quality, they have white flesh and with a neutral taste and a firm texture and because of these regions, they have gained wide acceptance global demand all over the world.

The ease of farming, tilapias are easy to hold and breed in captivity, they can tolerate a little bit of crowding, I mean like you know, like the density the stocking density, they can even sustain in poor water quality which makes it a very like sought after fish farming culture species, because of you know, sometimes the water quality may change a little bit and some other species they cannot sustain even minor change in the environmental quality or the water quality.

So, they have this susceptibility, they this tilapia and they can sustain even relatively poor water quality also. They are relatively resistant to the infectious diseases. They can be grown in a wide variety of aquaculture systems, it can be open systems, it can be closed systems, it can be anything, they eat algae and detritus as well, as well as additional artificial plant-based feed. So, when you have the option, you can feed them; if you have option, you do not have to feed them because it can sustain in the natural feed system as well.

In case of they can reach a typical market size of around 500 to 800 gram in about 6 to 8 months under optimum water temperature and which is very like which is that is one of the major reason

why this kind of tilapia culture is very much sought after all over the world. And also, because of the demand market demand market fish demand, tilapia can supply a huge amount of food.

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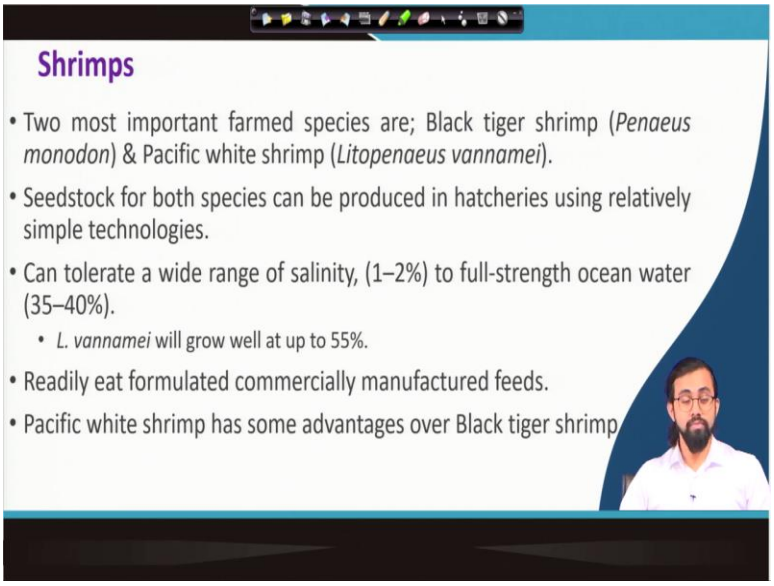

This is one of the futuristic, not futuristic, it is still it is going nowadays also even in future also, consumption of tilapia will keep on increasing. Second thing is the shrimp. The amount of, the shrimp culture, its the most important farmed species in shrimp culture are the black tiger shrimps, the *Penaeus monodon* and the pacific white shrimps *Litopenaeus vannamei*.

So, these two species, these two particular species are very much sought after all over the world and people are people want to have them because of their specific tastes because of their availability because of their market demand and all. The seed stock for both of these pieces can be produced in hatcheries using relatively very simple technologies. It can tolerate a high range of salinity, 1.2 percent is the full strength ocean waters, 35 to 40 percent or shall I say 35 PPT to 40 PPT.

And this vannamei can grow as well up to 55 PPT so which is like why quite saline water for other species to survive. Readily eat formulated commercially manufactured feeds are available for culturing this kind of shrimps in land and in water bodies as well. Pacific white shrimps has some advantages over the black white shrimps.

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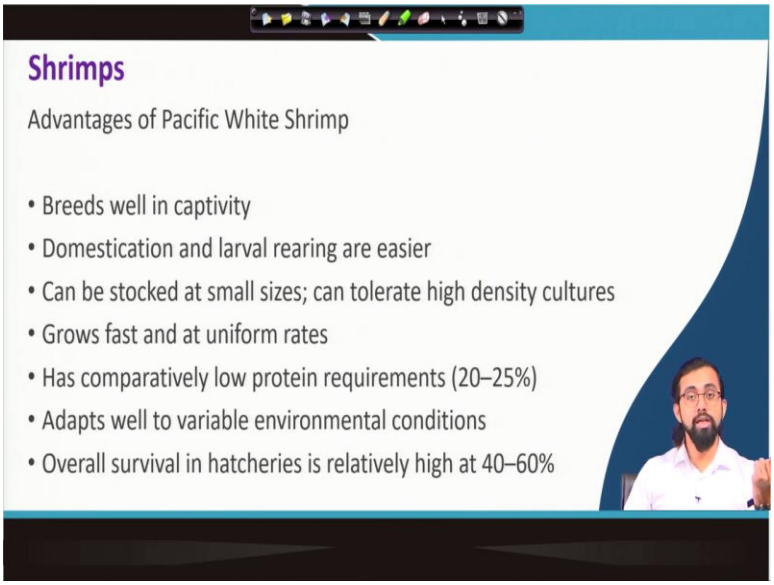

And what are the advantages of it because it can breeds very well in captivity. So, in aquaculture systems when you want to have a better yield and also you want to have a breed which can sustain minor changes in the water quality it can sustain some minor changes in the product disputes and all.

So, in that case, these shrimps product disputants, I mean like you know somehow suppose the aeration system has some issue for a couple of minutes and it stops and because of that DO level goes down but still, this kind of shrimps can somehow survive. So, I mean, like this is just an example that I am giving you.

So, this type of situations this kind of breed can easily sustain and because of that, they are considered as they have major advantages over the other shrimp's species. The domestication and the larval rearing is easier, these systems are easier for this species, it can be stocked at small sizes and it can tolerate very high density culture.

So, which gives us a very high economic benefit. So, it grows first and it grows at a uniform rate in general whenever it replicates and produce and it like grows. And has comparatively very low protein requirement in general, so the fish feed that you are providing. In general protein content, you want to supply the protein content that is one of the major costs associated with the fish breed.

So, that also can be minimized with this kind of pacific white shrimps. It can advert well in the variable environmental condition as I already mentioned, it can survive in the hatcheries in relatively high, overall survival for this kind of shrimps are relatively high or around 40 to 60 percentage.

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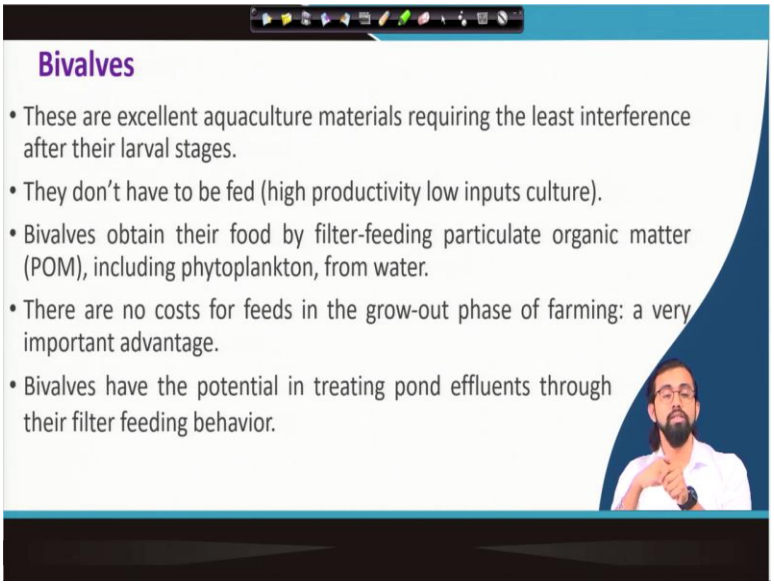

Second thing is bivalves. They are excellent aquaculture material, which requires the very least interference human interference I would say after only after the larval stage, because you do not have to feed them because they are okay with that, they have a very high productivity at a very low input culture. The bivalves obtain their food by a filter feeding particulate organic matter, including the phytoplankton etcetera from the water.

So, they are no cost for feeds in the grow out phases of farming is required and which is a very important advantage for this particular type of bivalves culture. It has a potential of treating pond effluent so their filter feeding behavior as well, what does that mean? It does mean that these bivalves are not only having the food from the natural habitat, but also, they are kind of treating the environment, how they are treating the environment, they are utilizing the nutrients available in the water and even in the wastewater and this the water which has a certain amount of obnoxious pollutants, which means certain pollutants which are not desirable, those pollutants are being fed by the bivalves.

So, I am not going to details there are a lot of in depth discussion that we can have in later lectures. So, these bivalves are helping us in that way as well, so to help us in environmental, it can give us some environmental benefit as well by this means.

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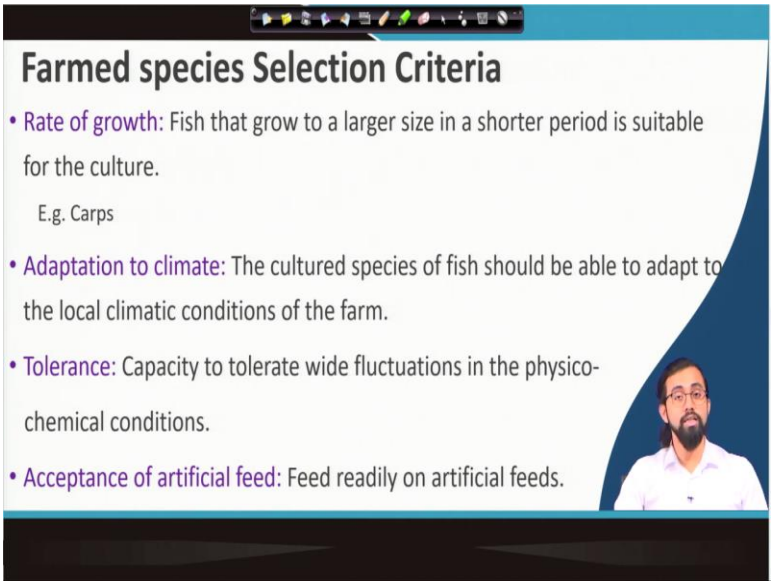

So, next thing that we want to discuss is the selection criteria of farmed species. What are the criteria that you need to think of or you need to prepare by yourself before choosing any farmed species, any species for your farm, for your aquaculture farm? It is very easy, you can say by yourself only. So, you know, the rate of growth, definitely, it involves, if the rate of growth is like it is very high.

So, it can grow to a larger size in a very smaller period and which gives us a very good like, it can easily solve the market demand and all. It has to have a capacity to adapt to the climate. What does that mean, because most of the fishes are very much susceptible, as I mentioned, they are very much susceptible to the minor changes in the environment, minor changes in the water quality, whereas this we have to find out the species which can sustain even at some sudden changes in the climate conditions, the local climate conditions and somehow it can add up to the local climatic conditions of the farm easily.

It should have a tolerance to the wide fluctuations of the physico-chemical conditions. So, also almost the same as the earlier discussion that we had. It should accept the artificial feed. There are features which like, you know, it is like more like you once you are well, suppose you are

coming from a different part of the India and you know, that this particular food is what you normally used to have and then you go to the other part of the India where that food is not available.

So, you have to have unless until you survive, you know to survive in that particular place, you have to accept to the artificial feed accept to the feed that is available in that particular zone. So, you have to have this readiness, that fish that your targeting, it has to have that readiness to survive in that artificial feeds.

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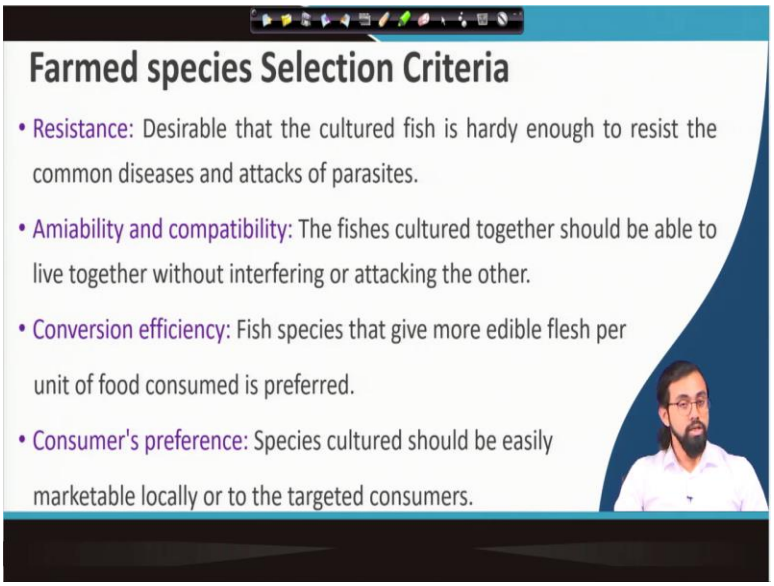

Other criteria's are like the resistance, it has a desirability and it has to resist the common disease and the attacks by the parasites. It should be amiable and comfortable in nature so that it can grow together with the other cultural species and without interfering or attacking the others. Some species are you know, no no it is my zone so you just keep away from this place, so it should not be like this.

So, it has to be, it should be amiable and compatible in nature for your target for the target species has to has this characteristic so that you can grow them in your system in your farm. The conversion efficiency fish species that give more edible flesh per unit of food that it consumes is obviously preferred. Because you do not want to have fish or you do not want a culture something which requires a huge amount of feed but the ultimate production produces very less.

So, this conversion efficiency is another very important selection criteria for these farmed species and one of the most important the consumers preference. You do not go for culturing you know keep on culturing tilapia once you see the end local customer is not happy with the, local consumers is not happy with the tilapia they want to have a shrimp in that particular season. So, like some other species, but you keep on supply them with a tilapia they were like No, no, I am not going to have it and let us have something else, some alternative food.

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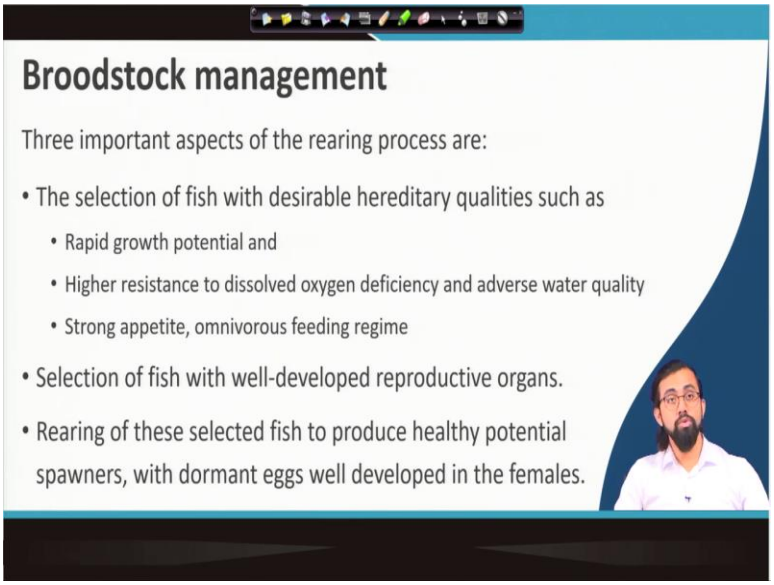

So, the consumer preference is very important, which we have to take care of before selecting a particular species for our farm. Next thing that we will be discussing about is the broodstock management. There are a couple of important aspects that we need to take care of it like during the rearing process.

The selection of fish, the selection of fish, with the desirable hereditary qualities like rapid growth potential, it should have a higher resistance to the dissolved oxygen deficiency and adverse water quality, it should have a strong appetite and omnivorous feeding regime. So, once you have these particular qualities, then you just go for choosing that patient, you just go for you know go for the broodstock management.

So, selection of fish with well developed reproductive organs are very much important, that is another important criteria. Rearing of these selected fish to produce healthy potential spawners

with dormant eggs well developed in the females are actually very much needed. So, which is another aspects of this kind of rearing processes.

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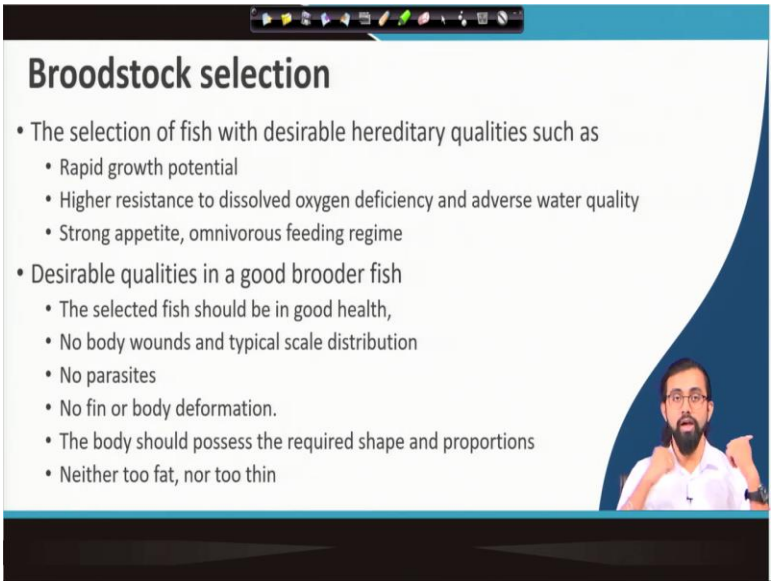

The selection of fish with desirable hereditary qualities like rapid growth potential as I already discussed, like it has to have a very strong appetite omnivorous feeding regime. The desirable qualities in a good brooder fish, the fish, the selected fish, it has the brooder fish that you are selecting for the broodstock management.

It has to have a very in a very healthy condition it should have a very good health, no body wounds, typically no scale like or no typical scale distribution should be there, there should be no parasites attacked, like you know the environment with it, no fin or body deformations, the body should process the required shape and proportions neither too fat neither too thin. So, it is just perfect for your production, you can choose this kind of brooder fish.

So, once these are the very important criterias that we have to understand, we need to know once we talk about the, once we talk about the target species or when we start our aquaculture farm. So, whatever we have discussed in this particular lecture, we will try to understand we will try to remember these fundamentals when we go for developing our own farm or when we try to consult, say like suppose you will become a consultant or you will become an engineer, aquaculture engineer or aquaculture technologist.

So, what you need to do? Once your customer or once buyer will come to you that I need to, can you please design me a farm for my practice for my economic benefit? So, what are the sectors, what are the factors that I need that I need to abide by? What are the sectors that I need to think of before developing my own farm?

So, then you have to show them you have to tell him or her that Okay, so see once you go for farming once you go for developing your own aquaculture farm, what you need to do you need to choose proper species, what species you are targeting and what is the reason for choosing that specie is that you have to make sure, that you have to let him or her understand that come on if you want to choose an exotic species, which are not actually have any demand in your local market or suppose even in distance local market.

So, you do not want to produce that culture species in your farm. The farm that you are developing in a particular area, if it does not have any proper brooder fish available for you so you do not want to go for you just need to find out different stages of development for your farm and at different stages of day development what are the necessary factors that you have to think that you have to think upon that it is very important being an aquaculture technologist or an aquaculture engineer or even aqua culturist.

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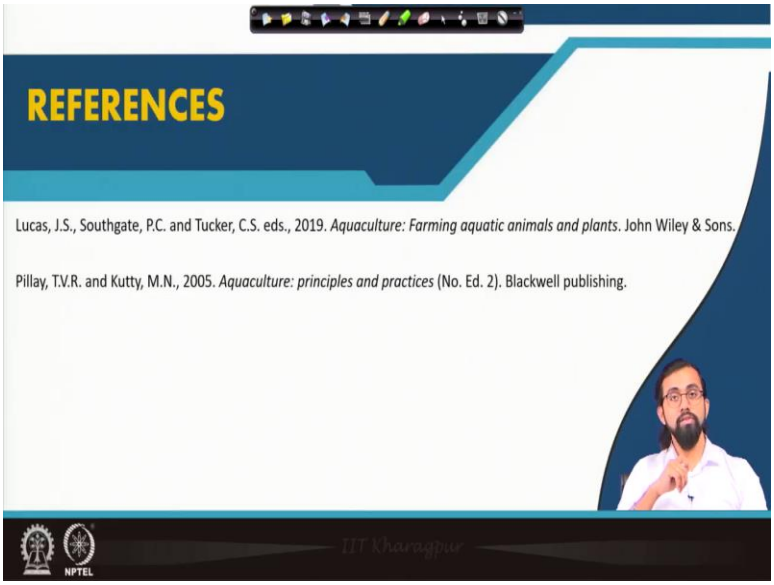

So, these are the references from which I have taken some of the information so you can go ahead with these literatures to have a better understanding about the stuff that I have already just

now discussed. And we will go ahead with like this. And in the later lectures, we will be discussing more on this technology aquaculture technology and how what are the way forwards and what are the changes that is happening nowadays all over the world, what are the technologies that the researchers are putting forward and how they can be used, you know to help your development of your farm.

Or suppose your knowledge base on this aquaculture subject, so that once you will become an Aquaculture Specialist, you can give these suggestions to your client that, so, ok go ahead with this and this is the thing, these are the things necessary for developing your farm and this is the very, this has a very high like very high demand in the very near future, as I already discussed in like previous lectures and just this is this is it. So, I think in the next lecture and coming lectures, I will be discussing about these things in more in details. Till then, thank you.