Advanced Agriculture Technology
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Lecture 24
Design of Shrimp Hatchery

Hello everyone, welcome to the fourth lecture of the module 5.

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So I am Professor Gourav Dhar Bhomick. I am from the Department of Agricultural Food Engineering from IIT Kharagpur.

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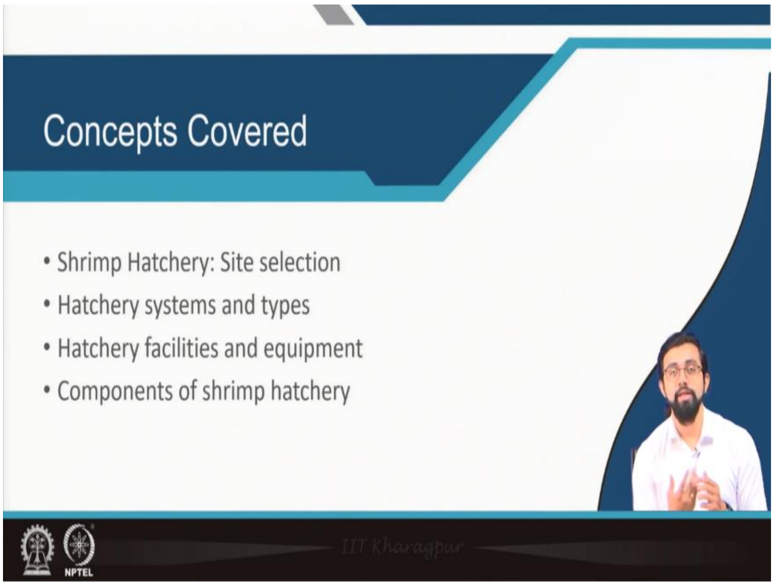

So, in this particular lecture material we will be discussing the concepts that I will be covering is the site selection for shrimp hatchery. We have already, we have already understood what are the criteria of site selection for carp, prawns. Now we were discussing about the shrimp hatchery. What are the hatchery systems and types that involves with the shrimp hatchery. What are the facilities and equipment that it involves and what are the components of shrimp hatchery.

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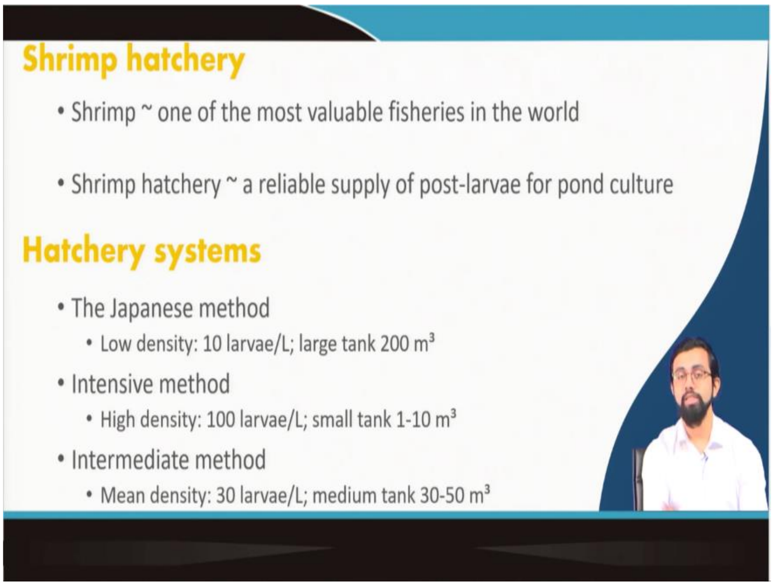

When we talk about the shrimp hatchery, it is that shrimp is one of the most valued valuable fisheries product or aquacultural product in the world. It is a reliable supply of and the shrimp hatchery is the only source and like say I would say like one of the reliable supply of post larvae for pond culture even. But also for your even for your farm any kind of farm.

So, when we go for the different types of hatchery systems if we talk about the types of hatchery systems generally we follow these three types of hatchery systems key methods. The Japanese method where the very low density of hatchery unit are available like 10 larvae per liter with a large tank of around say like 200 meter cube which is like very high be like the size is very huge.

Intensive once with a high density of around 100 larvae per liter with a small tank around like 1 to 10 meter cube, which is nowadays becoming more how to select sustainable because in terms of landmass use, in terms of the electricity use and all we have to compromise with some stuff maybe we compromise with the amount of energy requirement, we sometimes compromise with the amount of water requirement because of its intensive uses, we have to increase the water exchange, but that can also be minimized by using other troubleshooting measures and all, anyway.

So, the other than that the intermediate method is also famous which takes around like around mean density of around 30 larvae per liter with a medium tank size of around 30 to 50 meter cube.

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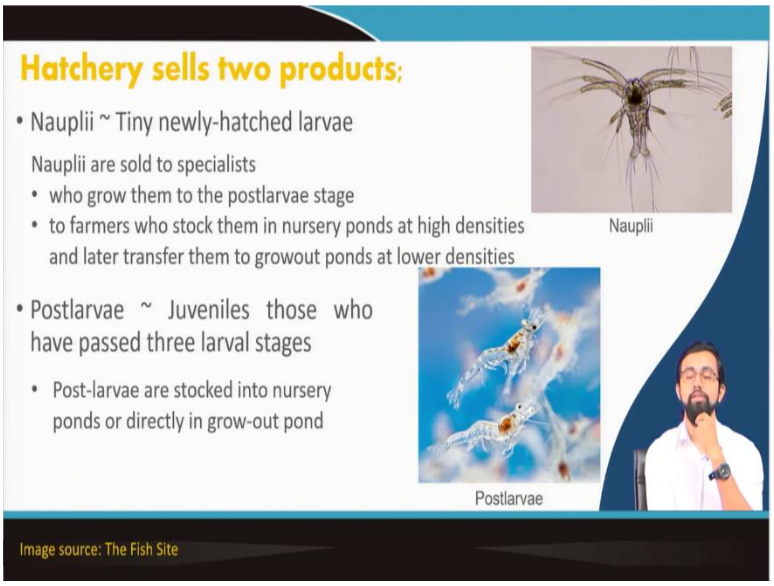

In general hatchery they sell two products mainly. First is the Naulpii or the Nauplii. The second is the Postlarve. So, the Nauplii are the tiny newly hatched larvae is the one which is very famous which is sold which is actually sold to the specialists who grow them to the post-larval stage or to the farmers who stock them into the nursery pond at high density and later transfer them into the grow-out pond at lower densities. So, this is one of the major product of hatchery.

Another product is like post-larvae, definitely if you go for the further stage and at the end you will get the post-larvae and that you go throw into that you directly stock it into your grow-out pond or maybe the nursery pond like it depending on the size and the culture, anyway. So, we go to the grow-out pond.

In the grow-out pond, it will reach from post-larval stage I mean like from the stay stage to the say like mature adult stage and ready for you once it reaches the marketable size it will transport it to the market or will sell it to the market. So, that is that this is that this is the very two products that is available that is the main products of any hatchery especially the shrimp hatchery.

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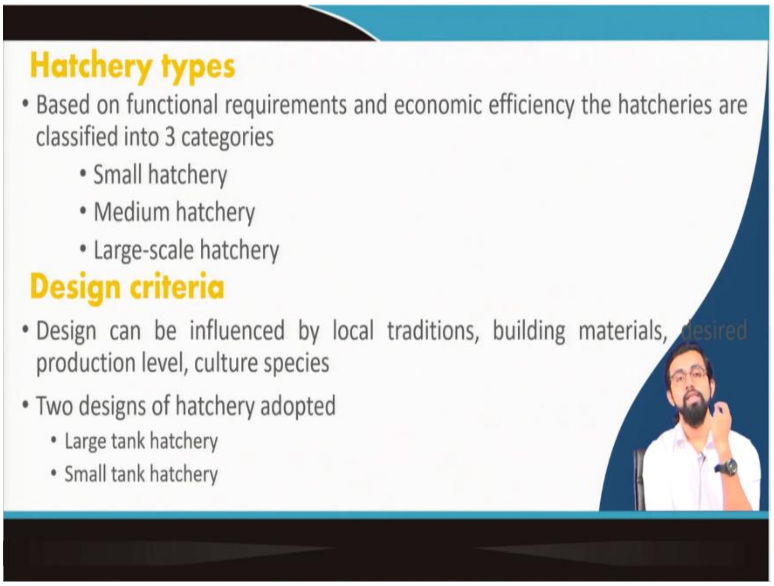

In general the shrimp hatchery types it is of small, medium or large scale and the criteria is like as I told you the local influenced by the local tradition, building materials, designed production level, culture species and based on all these things we go for the designing of hatchery, two designs are of hatchery mostly we adopt like the large, large tank ones and the small tank ones.

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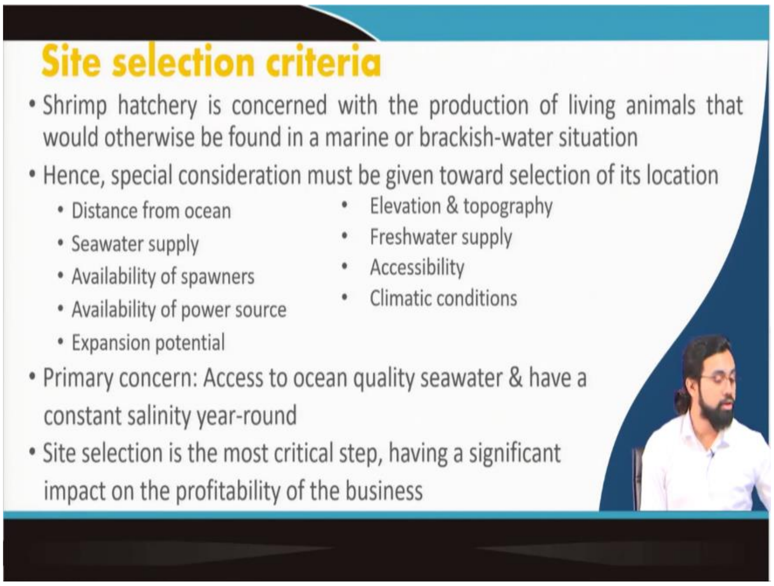

I do not want to go in details about this slide because I have again I have discussed about it in details in last lecture even last to last lecture also to remember for carp hatchery, for prawn hatchery also, these are almost the same in case of shrimp hatchery also it also almost shows the same parameters or almost shows the same concerns like the other two with some additional, additional points.

Let me go through it like very fast. Shrimp hatchery is like it is concerned with the production of living animals that would otherwise be found in their marine and brackish water situation definitely. And its special consideration that must be given towards the selection of his location is like the distance from ocean. How does it matter? Because you have a distance if you have, like, the more the distance from the ocean, it will cost you more the convenience, convince charge, the more the convince charge more the pump that it needs to be used. So, depending on that you have this issues. So, distance it does matter.

What is the second thing is the sea water supply. So, how you are supplying your sea water, I know remember we discussed about the supply mechanism in the last lecture. It is like the same. Availability of the spawners, availability of the power source, expansion potential. Expansion potential is why it is important?

When you suppose design a farm and you choose a site suppose you know that you only have like say like 10 acre of site, 10 acre of land available with you and all the land that is surrounding to it is already been taken and already been utilized by some high product, crop utilization or say high product, high residency building and all the things are there. So, you cannot expand it.

But however, suppose your product has a very high market value and at the end you need to have it expanded, expanded vertically or horizontally. So, you need to think about the probability or the like the possibilities of vertical or at least horizontal extension of your expansion of your project site. Other than that the elevation and the topography, freshwater supply, accessibility, climatic condition, definitely these are the very important parameters. I am not going into details you already know how does it matter when we design a hatchery site.

Primary concerns, access to the ocean quality sea water and have a constant salinity year-round, year-round is very important. If it fluctuates, it will put a stress on the on your target species. Site selection is the most critical step having a significant impact in the profitability of the business that you are doing.

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Ample space has to be provided for rearing and the support facilities as well it is not that only you think about the designing of your major components because the support facilities like the office, lab, the other utilities are very important, then then only the actual tank design of different designing of say like larval tank, post-larval tank, broodstock pond, etc, etc, spawning incubators and etc.

So, what are the essential components of a shrimp hatchery, maturation tank, spawning tank, larval rearing tank, live food culture tank, water storage and filtration tank, aeration, sea water supply and marine pumps.

Do we need to discuss about it (())(8:04)? You already know like maturation stage, maturation tanks are the one where we normally suppose like kept the broodstocks we keep the mature adults which are capable enough for further off spring production. Then we when they reach the spawning stage we let them rearing the spawning tanks and where they spawn and we after the spawning is done the eggs are hatched we collect those hatchlings for this in the larvae to the larval rearing tank from there we wait for it to be grow to the or this to the actual maturation stage.

Live food culture tanks what is algal culture tanks or the Artemia or rotifers culture tanks and all, so these are used for, these are what we considered as live food culture tank. Water storage or filtration tanks is very important where we stored the seawater because it is not possible for us to go for 24, 7 pumping water, you need to store the seawater in a certain up to a certain volume for emergency purposes as well. So, that is very important when we design a system you cannot just simply rely on your pumps you have to have backup always ready for you.

First backup is like an additional pump system, pumping system. Second backup is like additional storing system. You just store the water when the pump is in running condition you store as much as possible in your farming area. So that in case of any emergency you can use that backup water for your for farming your tank, for farming in your tank. Then this aeration is very important sea water supply and pumping systems we already discussed what is marine pump, we already know.

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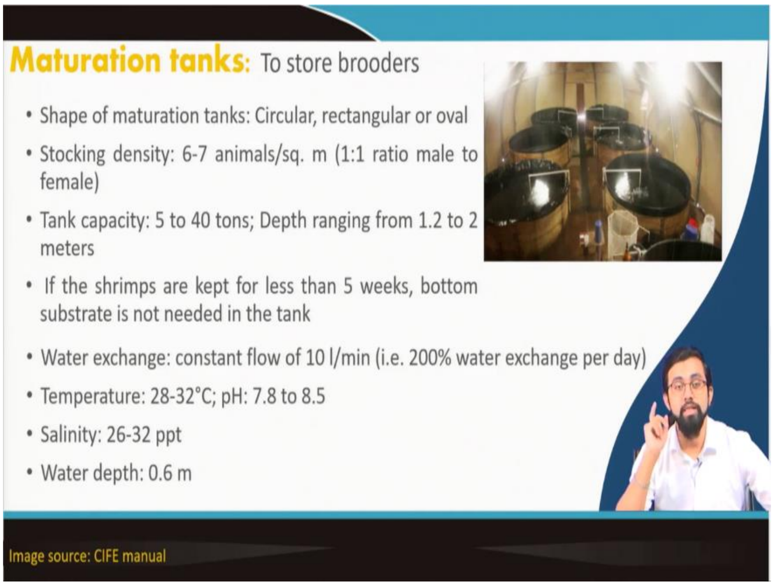

So, in case of maturation tank, which is used for storing the brooders, the shape can be circular, rectangular or oval in shape and most famous one is circular ones or the rectangular one. Stocking density around 6 to 7 brooder per square meter of 1 is to 1 ratio of male and female. Tank capacity about, of about like say 5 to 40 tons of depth ranging from 1.2 to 2 meter.

If the shrimps are kept for less than 5 weeks, bottom substrate are not need, bottom substrate are not needed in a tank. Water exchange, constant flow of 10 liter per minute is required. So, around 200 percent is water exchange per day, can you imagine 200 percentage of water exchange per day. So, which is like say like if you are having like 2 meter cube of small tanks for each tank you have to exchange 4 meter cube of water each day.

So, which is a huge amount of water. So, that is what is a major concern you need to really worry about in how to treat that water and when you put it back into the system rather than throwing it away to surface water which will cause environmental harm as well. The temperature 20 to 30 degrees Celsius with a pH of around 7.8 to 8.5, salinity, sea water range 26 to 32 and water depth of around 0.6 meter is expected to be in the in maturation pond.

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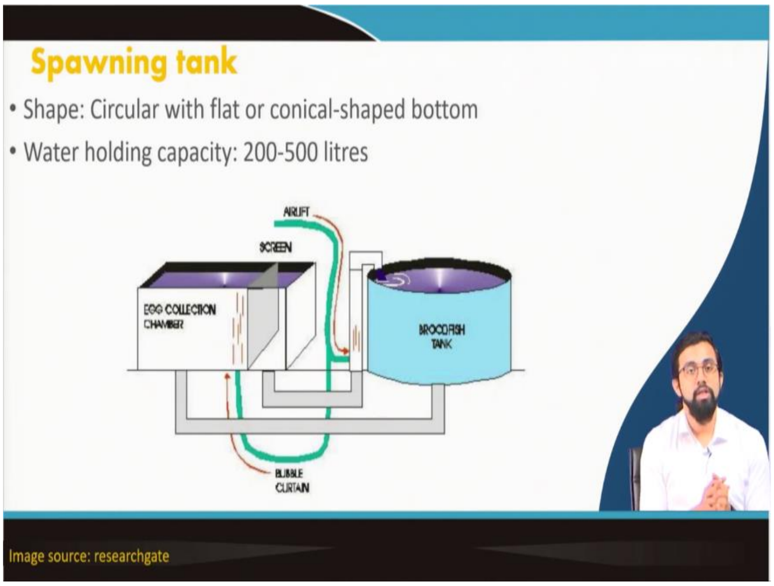

Then there comes a spawning tank. So, from broodfish tank or the spawning tank, you have a collection to the a collection chamber you see the airlift pump, we can provide the bubble curtain we can provide, the shape should be circular with flat or conical size. So, in general spawning tank. So, it is not necessary it can be circular as well, then you take the brooder fishes and just let them spawn there, and after spawning is almost it is evident. So, you just collect the egg from through the skin the water will be taken out and you can collect the egg from the from the spawning tank.

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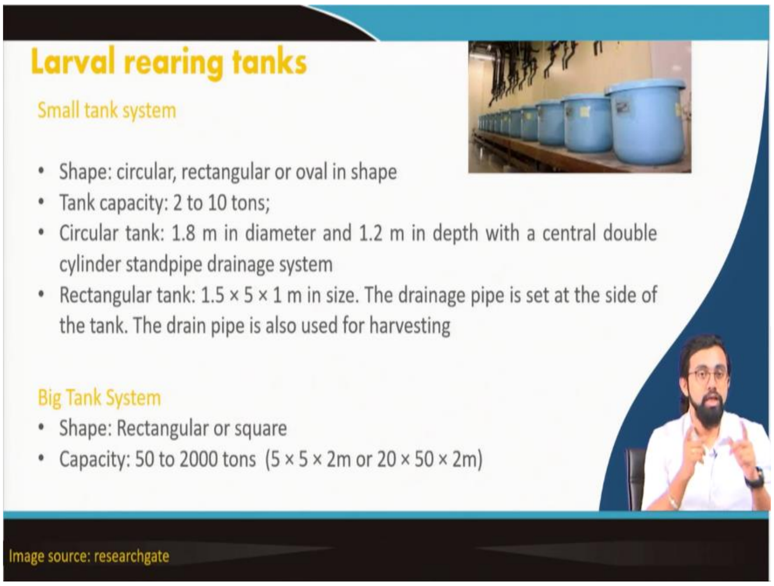

So, often I mean like egg is (())(11:53), when it has those as larvaes can be easily corrected from this spawning this tank and then you put it in the small tank systems with like size of around like 2 to 10 tons with a circular or rectangular or oval in shape. With a diameter of 1.8 meter and 1.2 meter in depth with a central double cylinder standpipe drainage system. So it will be like water will be coming from outside and then once it reaches a certain level from inside there is a drainage system. So it will come in the inside cylinder it will go down, and it will collect like this. So, it will be like this double cylinder standpipe drainage system.

Rectangular tank of around tank of around 1.5 by 5 by 1 meter in size can be used with a drainage pipe is set at the side of the tank and drain pipe is used while harvesting. In case of big tank systems it can go as high as 2000 tons of capacity.

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The live food culture system, it is generally of around 1 to 20 ton of tank capacity like food tank capacity of 20 percent of total tank capacity is the larval rearing is used for the larval rearing. In general light is very important because your culturing algae here, in general. So, other than that, you can go for Artemia culture tank also but in general when we go for algae, so it is better to provide it with at least 1000 to 800 lux with a temperature of around 24 to 26 degrees Celsius. Water storage and filtration as I already told at least, tank capacity of at least 20 percent of total tank capacity larval rearing has to be there, has to be stored as a water storage for emergency purposes.

The treatment before use of seawater you can settlement of how we can how we can treat it the sea water first of all, you can use a settlement of suspended particles. How we can do that? We can provide it with different kinds of grid chambers. We can provide with some this filtering mechanism by sand filtration and all.

Then the chlorination with around 5 ppm for like 6 hours, which is very important to provide the chlorination because of suspended, further suspension of suspended particles like, sedimentation of suspended particles kind of how to say to cleansing or for to get rid of all the foreign micro flora and fauna and then follow up filtration and then a dechlorination and all because any chlorine based product or the residual chlorine that is present there is no, is actually harmful. So, that also dechlorination process has also been followed. So, to clean the all the residual chlorine concentration and all the residue chlorine byproducts.

Then the sea water can be utilized or sea water can be used again back to the your for in the storage tank. So once the storage tank is filled, once the storage tank is available with the amount of seawater that it requires, then it can be easily utilized for your how to say your tank again with time.

So, with, so this is a very important para, these are the very important units or the how to say the chambers or the design parameters, design considerations that we need to have. And when all these things like almost they are equal because they are like not equal, almost they are similar carp hatchery, prawn hatchery or the shrimp hatchery, but it all has its own specificness.

Specificness is, specificness means, what do I mean by that? I mean like, suppose you are culturing a particular type of carp, you culturing a particular type of shrimp? Or suppose you are culturing particular type of prawn or say macrobrachium Rosenberg, or like we call them scampi. So, if you go for this hatchery of macrobrachium Rosenberg, which is very famous in actually Indian context, Indian, I mean, like coastal region if you go, so there what they do. They design it accordingly.

According to the target species, they design it according to their requirement, it is not always fixed, there are certain changes and certain manipulations that we do, depending upon the species and after then we design the farm. The major information that we need to think about at this moment of time is the environmental impact. So, before going for any design, before going for any finalization of the farming product and all, you need to think about the environmental impact and based on that you have to do it.

If you do not do that, you simply do not get the official permission or the how to say to go ahead with the business to go ahead with your farm, the official permission where you can get the environmental consideration in terms of environmental point of view, you can get it from the central pollution control board CPCB, you can get it from the clean Ganga mission. So clean Ganga mission, the government of India, it is a new regulatory body.

So, namami Ganga, under the namami Ganga project. So, what they do, they have fixed the criteria of wastewater discharge into the Ganga, into the river Ganga. And the parameters are actually differs from species to species. But in general, when you are designing a farm, the size of the farm and the amount of discharge that you are actually supplying to your surface water body has to be well within the limit.

So this limit has to be maintained. And not only the water discharge that here I am talking about, I am discussing about the water discharge causing harm to the surface water as well as the ground water. So, these are the parameters that you have to really think about it before going for any designing.

So, these are the things that we normally do not care about much, even 10 years back also, but now, these are very important parameters that we have to look after, while we design any kind, any forming, any farms, any of these kinds of farms.

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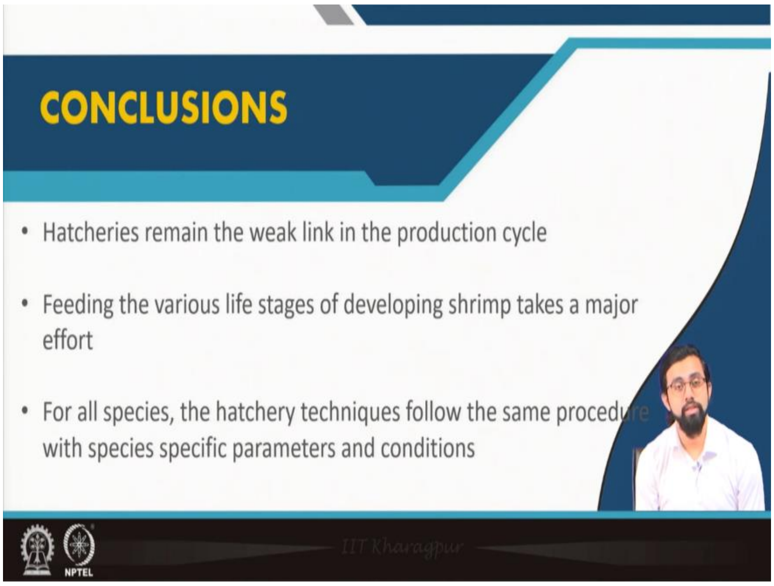

In general, the hatcheries, in conclusion, hatcheries remain the weak link in the production cycle. And like, feeding of, the feeding, the various life stages, life stages of developing shrimp takes a major effort. So, all these parameters can be well adjusted well troubleshooted in case of, in case of proper designing of hatchery. For all species, the hatchery technique follows the same procedure with specific, species specific parameter and the conditions.

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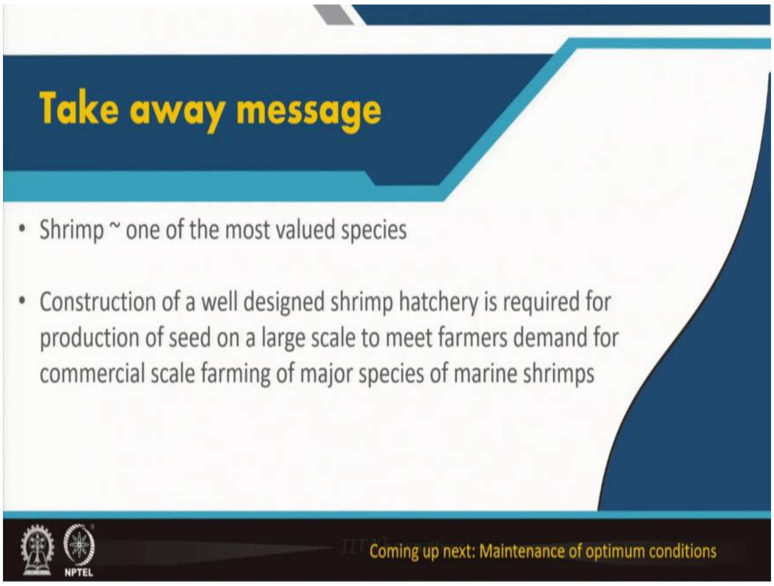

So, we will discuss more about the optimum conditions or optimum parameters, which it requires to maintain in a how to say in a proper shrimp hatcheries or proper prawn hatchery or proper carp hatchery that will be discussed more in details in the coming lecture.

So the one of the takeaway message that I can give you in this lecture material is the construction of a well designed shrimp hatchery is very much needed for the production of seed on a large scale manner to meet the farmers demand for commercial scale farming of major species of marine shrimps.

Because in general, the collection of seed from the wild stock is not a feasible idea and nowadays, it causes a huge harm, it not only causes the huge harm to the ecosystem, but also it becomes impossible to collect because nowadays the wild population of this kind of marine shrimps are also dropping like anything.

So when we design a proper hatchery it can helps us, help us not only helping the complete revival of the natural wild population of the shrimps. But, also it helps the equal or, to balance the ecological, eco ecosystem of the nearby vicinity.

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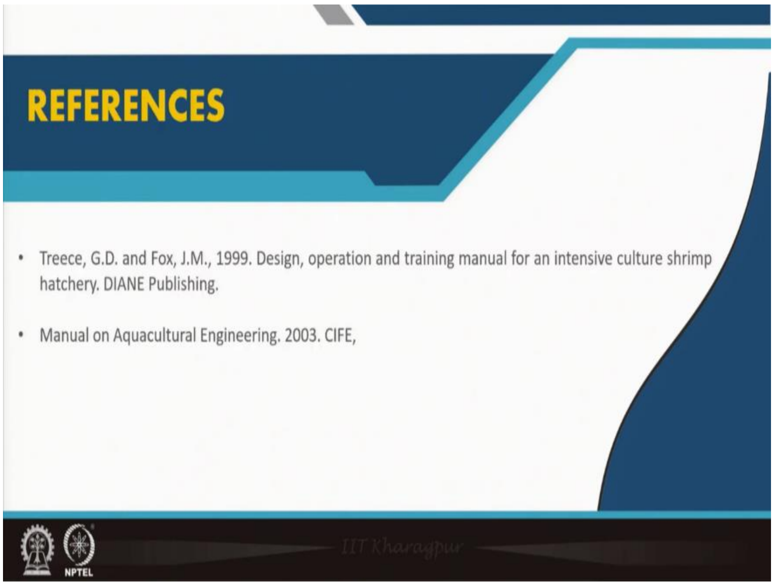

So, these are the references from which I have taken the informations from and it is not only the only information sectors, we can Google it and you can get to know a lot of other informations about the design of a proper shrimp farming and all. You can take the pictures in a in like, simply you can search it and you can see the pictures and the images, you can have a better idea how it looks like and how when you will be designing it will give you a better idea that what are the parameters that you need to follow and how to design it accordingly.

And I would really ask you to do proper brainstorming about the way of collecting the sea water, how we can collect the seawater better from the coastal region and not only that, how we can find out the alternate procedures for using the, mimicking the sea-water. Suppose sea water source is not available in your sources.

So, I will just want you to brainstorm about it and think about it and Google it and try to learn about it more in details. It will definitely give you more insight information about this hatcher design. So, thank you so much. So in the next lecture, we will discuss about the optimal conditions for Hatcher design in more detail. Thank you.