Advanced Agriculture Technology
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Lecture 25
Maintenance of Optimum Conditions

Hello everyone, welcome to the last lecture material of the module 5, Technology of Larval Rearing.

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I am Professor Gourav Dhar Bhowmick from the Department of Agriculture and Food Engineering of IIT Kharagpur.

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So, in this particular lecture, I will be discussing about the parameters which includes the hatchery operation, the maintenance of hatchery, the basic rules in hatchery operation, the measures that is to be taken before and after filling tank and overall maintenance of the rearing conditions.

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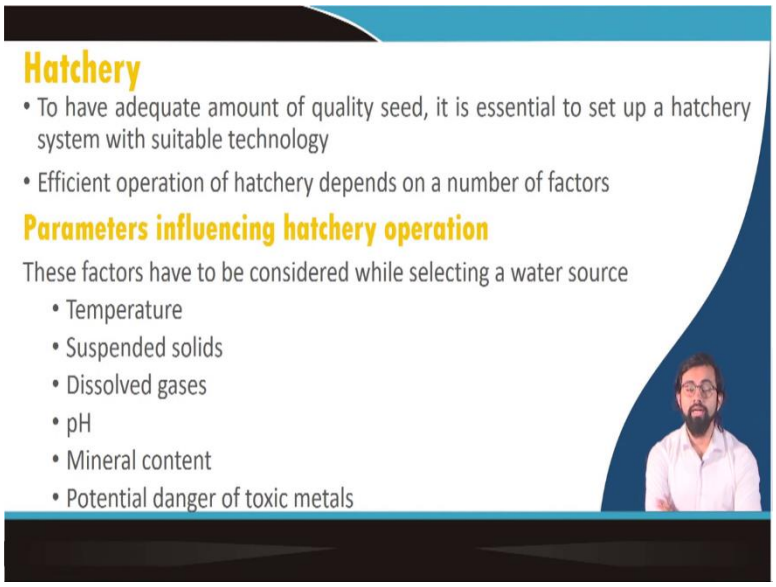

As we know hatchery to have, in order to have a quality amount of seed, it is essential to set up a hatchery system with a suitable technology. So, we discussed about the type of hatcheries how different nodes of hatchery and different parts of hatchery and last two, last couple of lectures.

So, in this particular lecture material I will be discussing about the optimal conditions for each. So, in general the efficient operation of hatchery it depends on a number of factors. So, the factors includes the especially if we talk about the water source, it includes the temperature, suspended solid, dissolved gases, pH, mineral content and the potential danger of toxic chemicals or the toxic metals in general.

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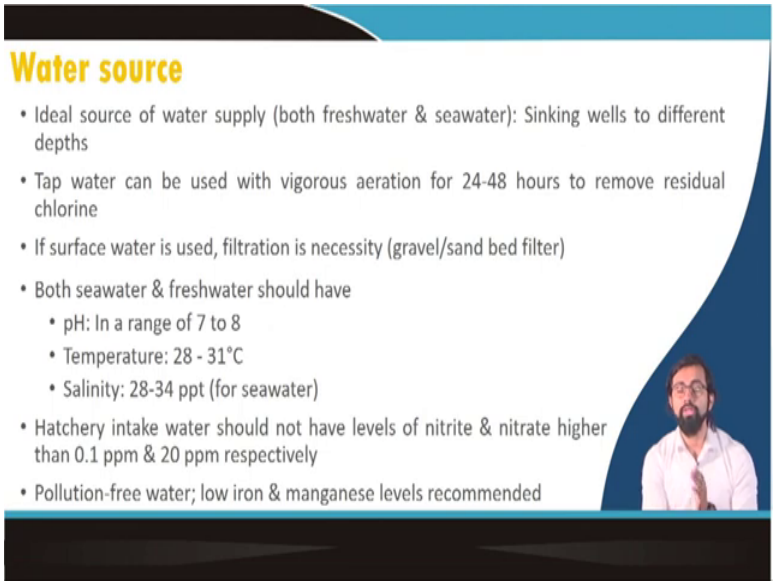

So, how these different parameters are influenced, how these parameter are influencing the our farming product I will tell you in a bit. So in general, if we talk about the ideal source of water quality either it be fresh water, sea water, sinking wells at different depths are the best source to be considered for, like whenever we will be designing your farm it would be better to have can find a sinking well near to your farm area and that will be the best source of collection of water in general.

Tap water can be used, but in general and tap water when we municipality when water treatment system they supply the tap water, they supply the water for like regular purposes. So, they add with the chlorine. So, there is a chances of presence of residual chlorine. So, in order to get rid of the residual chlorine what you need to do. You have to keep on, you have to vigorously aerate it for 24 to 48 hours.

So, then only you will be able to get rid of the residual chlorine concentration chlorine content from the tap water. If the fresh surface water is you say like from any river bodies and all, so in that case gravel or sand mud filters are to be used preferably. For both seawater and the freshwater it should have a pH range of around 7 to 8, temperature of around 28 to 31 and because of sea water, the salinity should be around 28 to 34 ppt.

In general hatchery intake, the water should not have should not have levels of nitrite or nitrate concentrations of higher than 0.1 PPM and 20 PPM respectively. So, in general, the pollution free water like pollutants free water with a low iron and manganese called levels are recommended.

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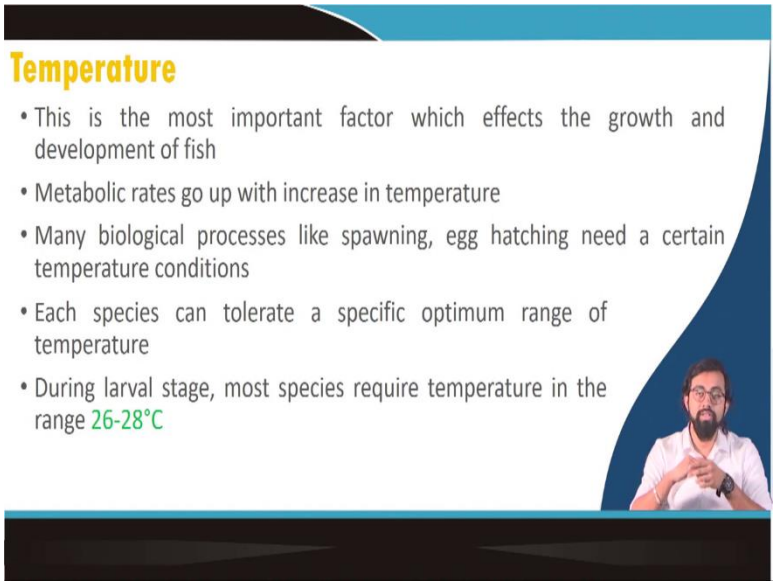

If we talk about the temperature, the most important factor which affects the growth and the development of fish in general, the metabolic rates can go up with increase in temperature. So many biological processes like spawning, egg hatching and egg hatching, etc, they need a certain amount of temp, certain temperature because they in general spawning and hatching in that case, we are dealing with very how to say they are very sensitive, those organisms that we are dealing with, they are very sensitive in nature.

So even if certain amount of because they are in their very early stage of development, because of that certain level, changes in the temperature or any kind of abrupt environmental conditions can highly non beneficial like highly disruptive for the growth of those living beings.

So that is why, that is why temperature is another, is really a important parameter but it actually depends upon the species to species and the place where you are culturing and how we can optimize the temperature in your place like if it is a temperate region, if it equator (())(4:38) regions depending upon the type of place even the altitude also based on the altitude also the temperature varies. So, based on that you have to design your farm to make it in optimal range especially in the larval range better to keep it below 30 degrees Celsius so like around 30 degrees celsius.

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Photoperiod which is another significant factor that induces a sexual, a sexual maturation and the spawning. So, you have to do a properly manipulate the photoperiod which can like to in order to go for the natural spawning and natural spawning of your culture species. The greatest advantage of the alternating altering spawning time is like I will build up the fry throughout the year.

So, in general the availability of prize vary season (())(5:23) specific most of the in case of most of the species. So, what happens so, if you can alter like if you can make it in natural like I mean like artificial environment like say like in a in a polyhouse in a greenhouse in artificial environment you can mimic the natural condition of favorable season.

So, you can get the fry throughout the year. So, that is how we actually go for this artificial propagation methods and artificial this go for this design of different polyhouse with the control environment and all, so to mimic the favorable season for our for proper availability of fry throughout the year.

Maintenance of hatchery in general it involves the intensive care of optimal rearing conditions to, first of all maintain the good quality water which is like the most important factor. Other than that cleaning and disinfection of tanks before utilizing the tank for any purposes you have how to clean it properly, disinfect it properly using different disinfections, disinfecting agents, frequent clearing and cleaning of tank bottom is very important otherwise there is a chances of obnoxious gas and obnoxious parasites or like I would say like different kinds of pathogen concentration can also be generation can also be possible.

Hatchery equipment not to be used outside because if you are preparing it if you are utilizing it outside the equipments which are hatchery equipments, you are utilizing it outside your say like polyhouse or control environment, you it is susceptible to different kind of pathogens or different kind of unwanted microorganisms or foreign microorganisms to be in general.

They can be highly detrimental they can be predited, they can be disease causing, they can be different multifaceted problems that it can it can bring, so that is why it is better to not to put them hatchery equipments outside the hatchery control environment.

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In general the basic rules of hatchery operation we have to use the proper protective clothing and working attire. Drinking and eating should not be allowed. Avoid the contact of equipment unless necessary. And, especially you can wear the gloves and proper preventive measures. It should be operated by the authorized personnel only and always begin with a clean empty tank and equipment. So to so in order to get rid of any possibility of cross contamination.

Disinfection with the chlorine followed by rinsing with the clean water is important and even there is, if there is a chance of having when you clean it with a disinfectants like chlorine, it is better to after you clean it, rinse it with a clean water you put some water and you can add it for like a couple of hours, say like one day or so, in order to make sure that there is no residual chlorine left in your system itself.

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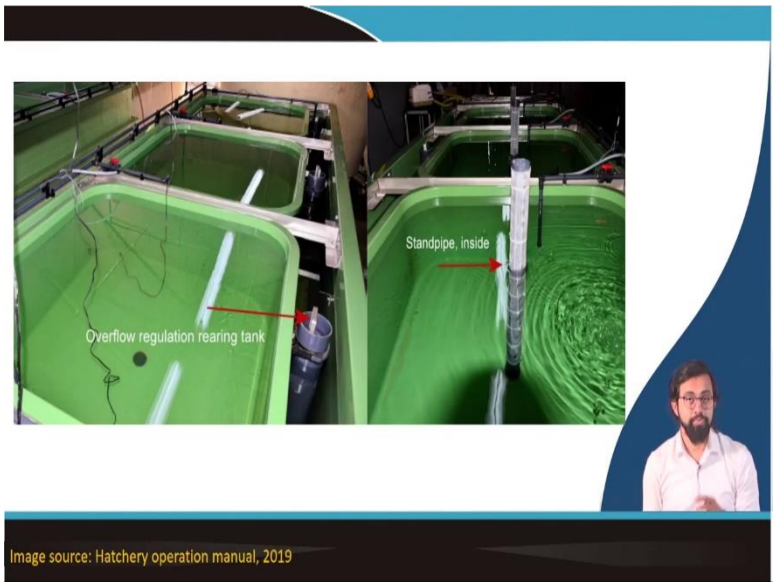

What are the measures while filling the empty tanks? First of all, temporarily remove the standpipes and overflow regulating pipes, you remember like standpipes and overflowing regulating pipeline. So, these are standpipes and this is the you can see the red line, red, the first red, the left side it is indicated showing the overflow regulation or regulating pipes and the right side if you see the standpipes which, how it looks like in a typical tank.

So temporarily you have to, in order to fill the empty tank first you have to remove the standpipes and overflow regulating pipes and water level inside and outside the small tanks should be almost the same and then you can use the, you definitely should use the filtered water depending upon the source of water you can go for different regulations also.

After filling the tank, you switch on all the devices like pumps, aerators, heaters etc and plug in the standpipe and put back the overflow regulating pipes. Check the water flow into the filter box daily and ensure the strong aeration in big tanks, biofilters and in gentle aeration in the rearing tank is always being placed, taking place. Because otherwise dissolvable oxygen if it goes down it can be detrimental for your target species, for your culture species.

Sensor of control unit free floating in a rearing tank separated from a main heater. So, the all the sensor should be in the rearing time that you are installed to go for day wise or like real time monitoring of your system it has to be far away from the main heater line. So, see that is how it looks like this overflow regulating pipe and the standpipe inside as I already showed.

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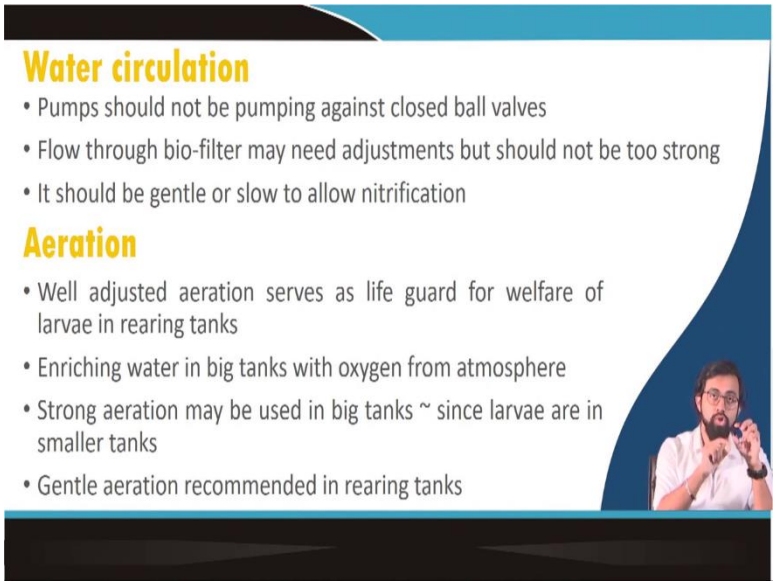

So, water circulation. How the water circulation should be controlled? The pump should be should, the pumps should not be the, should not be pumping against the closed ball, closed ball valves. Definitely you have to make sure that all the valves are open and so that how you can ensure it. So, you can check the arrow sign over the this valves and this all this closed ball valves.

So it, because the pump it will be damage(())(10:19), it is very dangerous it can cause severe damage to your pumping system if the valves are closed and you switch on the pump. So, you have to make sure the valves are open all the time and flow through the bio-filter may need some adjustment with time because bio-filter when you design a bio-filter, it has its own retention time, you have to get, you have to make sure the water which is flowing into the bio filter it will stay there for a certain period of time for the microbial action to take place. You

know the purpose of bio filter, right? Why we need bio-filter? First of all, say like there is aquaculture tank, the wastewater is coming out of aquaculture tank which contains a huge amount of ammonia and all.

Ammonia rich waste water, that ammonia rich waste water it comes to the bio-filter. In the bio-filter what we do in bio-filter we put different kind of medias and for a favorable condition to grow the nitrifying bacteria and also we provide aeration because it needs oxygen.

So, the nitrifying bacteria which is growing inside your bio-filter it will consume the ammonia rich waste water like ammonia and it will convert it to nitrate or nitrite and if it is possible there is like a further anoxic system you can develop that can further utilized this nitrite and nitrate and convert it to di-nitrogen gas by using the denitrifying microorganisms in anoxic conditions.

So, that is how the bio-filter works, but for bio filter, in the bio-filter this nitrifying bacteria need some time to accumulate those ammonia. So, for that it may take couple of hours a couple of days of time. So, there is you have to do the calculation, there is specific design considerations you can google it you can find it out there. And I am also like, go ahead with some further lecture series among specifically for wastewater treatment.

So in there, if you see in bio-filter, so, this time that retention time that we call has to be maintained. So, based on that your water circulation has to be figured out you have to figure out that the water flow should not be more than that particular flow rate that and that flow rate, which is actually maintaining a particular amount of retention time inside the bio-filter.

So, suppose you have a flow rate of say, like 1 liter per hour. So, if you have a flow rate of 1 liter per hour. And, suppose your tank is the size of 1 liter, so what do you think how many, for how long the water will stay inside your tank? 1 hour. But suppose your tank, the bio tank needs at least four hour of retention time.

So what you can do, either you have to reduce the flow rate to at least 0.25 liter per hour. So that in your bio tank, in your bio-filter, which is the 1 liter of size, the water can stay for at least 4 hours so that all the pollutants can be well utilized by the nitrifying organisms, or you can increase the size of the bio-filter like say 4 liters. So, I am just giving you an example just random examples just to make you understand how it how it looks like okay, how the bio-filter actually works here. And so, it should be gentle or slow to allow the nitrification as I already mentioned.

Aeration is very important, well adjusted serves as a life guard for welfare of larvae in rearing tanks. Enriching the water in big tanks with oxygen with atmosphere is very important and strong aeration may be used in big tanks and since the larvae, the larvae or in the small tank and gentle aeration is recommended in the rearing tanks, but aeration is very important at each and every step you have to provide aeration because they are living organisms mostly live in aerobic condition they need oxygen to breathe.

So, it is in that dissolved oxygen, dissolved oxygen, in a form of dissolved oxygen in the water. So you have to provide the dissolved oxygen time to time. And, how we can provide it? By using aerator, so what aerator will do? Aerator will help to dissolve oxygen from atmosphere to water. So, that is that is the basic fundamental, basic fundamentals of aerators like in general, there are different types of aerators, there are different ways of using it. So in general the aerator is used to enrich the oxygen concentration or in the dissolved oxygen concentration in the water by from the air by using the diffusion phenomenon.

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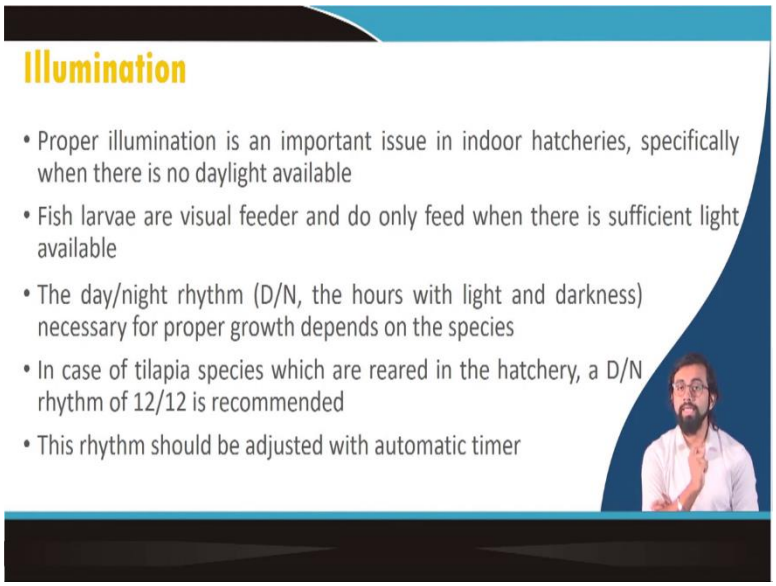

Ilumination is very important as I mentioned already like the proper illumiation is important because indoor hatcheries and specifically there is no daylight available in general we would not be to go for this in house polly, inside pollyhouses and all. Fish larvae are visual feeder do not feed only when there is sufficient light is available. In general, they are the visual feeder, fish larvae. They have all the other sensory parts are not sufficient enough for them to go and catch their target.

So that is why they have to have proper illumination available for their feed to have and also the feed has to be in living condition like we go for live fish, live feed and all. The day night rhythm we call it D N, D N rhythm or like which is like in hours in light and darkness, it is very important. Like saying in case of tilapia fish. If you are hatchering, if you are reared it inside the hatchery, this day night rhythm has to be 12 to 12 which is actually mimicking the natural environment outside the for them to grow and which is actually recommended. And this rhythm should be adjusted using the automated timer so, you do not have to do it by yourself.

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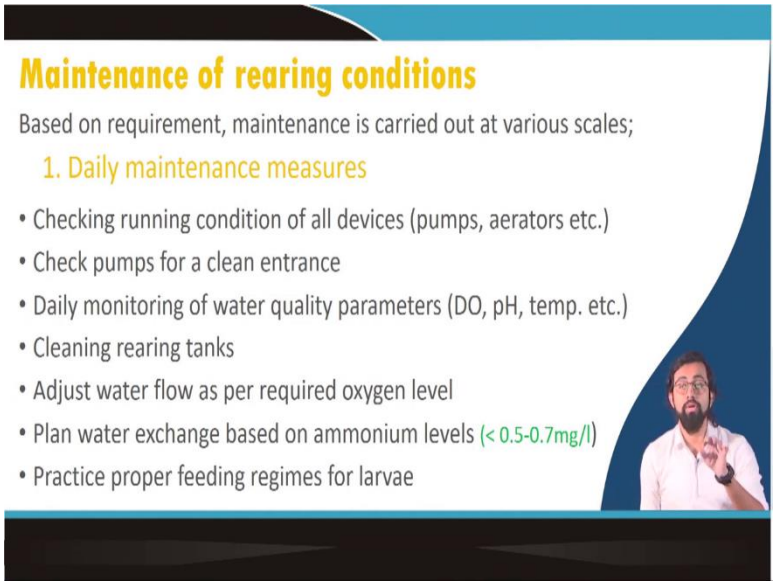

Maintenance of rearing condition based on the requirement maintenance is carried out and various scale, you can go for daily maintenance of your hatchery system, you have to check the running condition of all the devices, pumps, aerators all the running devices and with the moving parts. Check the pumps for clean entrance you can check the filters if they are properly working and or otherwise it can choke if the larger particles can come into the pump and it can choke the pump, it can disrupt the pumping the working mechanism of the pump.

The daily monitoring of the water quality parameter utmost important you have to know that what is the dissolved oxygen concentration, what is the pH, what is the temperature, what is the ammonium nitrogen, what is the nitrite nitrogen, what is the nitrate nitrogen. So, these are a couple of examples that I am just giving you which are very important water quality parameters that you have to monitor it daily basis if possible in real time basis.

What do I mean by real time basis, means every time, each and every time it has to be, there should be a sensor placed in a in a deep in the water and it will give you the real time values every time. So, whenever you want to seek for the information about these parameters, you can go and check the monitors and it will give you the information about the real time data available for those at that particular moment of time.

Cleaning of rearing tanks is very important time to time and it is actually in daily basis you have to do it, adjust the water flow as per the required oxygen level and plan water exchange based on the ammonium level which is very important you can go for either water exchange you can go for either recent recirculatory aquaculture system where you can use the bio filters and all.

However, based on the target ammonium level, you can, up and down this flow rate and daily monitoring. That is why daily monitoring is important. If suppose in particular day ammonium level is very high and you are putting it in the same flow rate in the bio-filter. So bio filter will be in shock, they will not sustain or it may sustain up to a certain level but it will be they will be in shock condition because it is more like all of a sudden if you had like food for like three days you cannot have it.

So your whole system will be in disrupt, system will be disrupted. So that is the same thing. So that is why you have to practice a proper feeding results also because the feeding is also another factor which actually can cause higher level of ammonia in the wastewater because uneaten, uneaten feed is the major source of one of the major source of high nitrogen rich wastewater generated in your farm.

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Frequent maintenance measures you have to clean the blue foam mat inside the filter box, it can be blue, it can be any color in general this filter box has to be cleaned properly, you have to do the partial water exchange depending upon the bio-filter efficiency and the water condition, in this water condition means the outlet water from the bio-filter and the inlet water from the bio-filter both because based on that, you have to go for partial water filtration sometimes because sometimes ammonia level rich say like very high for say like very low.

So, in both of the cases the bio-filter will not solve the purpose. So, you have to, you have to ready with some alternate or some alternate mechanism or alternate funda, so how we can get rid of ammonia, excess ammonia or how we can say it is like it is like very diluted. So, in that case, you can just surpass it through the bio-filter because bio filter will not, it does not make sense.

So, it because in that case, as the ammonia level is very low. So it will increase the retention time or it will decrease the retention time like anything. So, like depending upon the, depending upon the amount of ammonia. So this increment and decrement in the retention time all of a sudden in the system, if it like fluctuate more than a sustain certain threshold level, it is detrimental for your bio-filter because it will wash out, it will wash out the if it is like very fast very.

If you, all of a sudden reduce or reduce the reduction, retention time like anything what will happen, it can because of that the flow rate should have to be increased because the ammonia level is low and because of that what will happen it will because of the higher flow rate it will

just flush out all, flush out all the important nitrifying organisms that was, that is being grown slowly in your bio reactor. So, just give you an example. So, that is how it works. So, you have to make sure that the water condition you have to check the water condition based on that you have to go for this maintenance measures.

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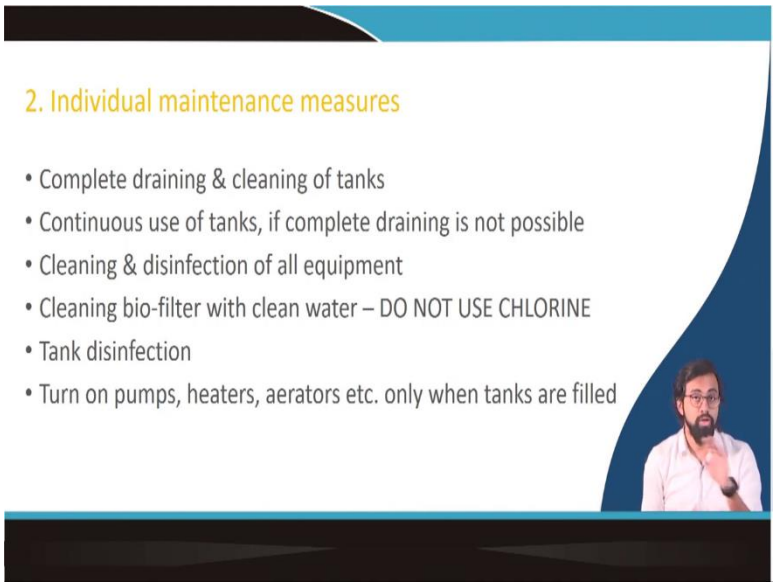

If I talk about the individual maintenance measures, complete draining and cleaning of tank, continuous use of tank if complete draining is not possible. Cleaning and disinfection of all the equipments and better to clean it with the clean water I mean like a bio-filter do not use chlorine because chlorine is a disinfectant, it has a disinfectant capacity, it will cause different reactive oxygen species to generate in the water which is detrimental for your nitrifying organisms or the helpful organisms present. So, do not clean the bio-filter with the chlorine. Tank disinfection is important, turn on, you turn on the pump heater and aerator, etc when tanks are filled.

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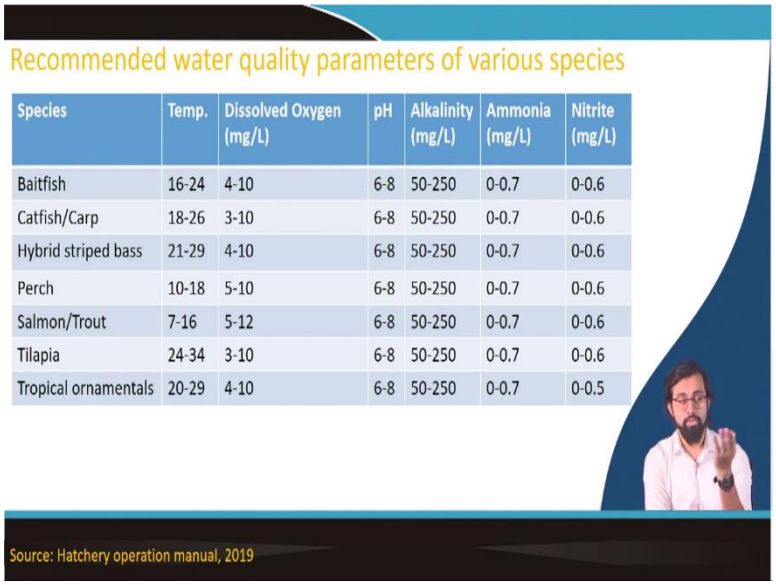

So, this is the recommended water quality parameters of various species, the baitfish, catfish and their temperature range, dissolved oxygen pH you can take a picture of it for your, for your information.

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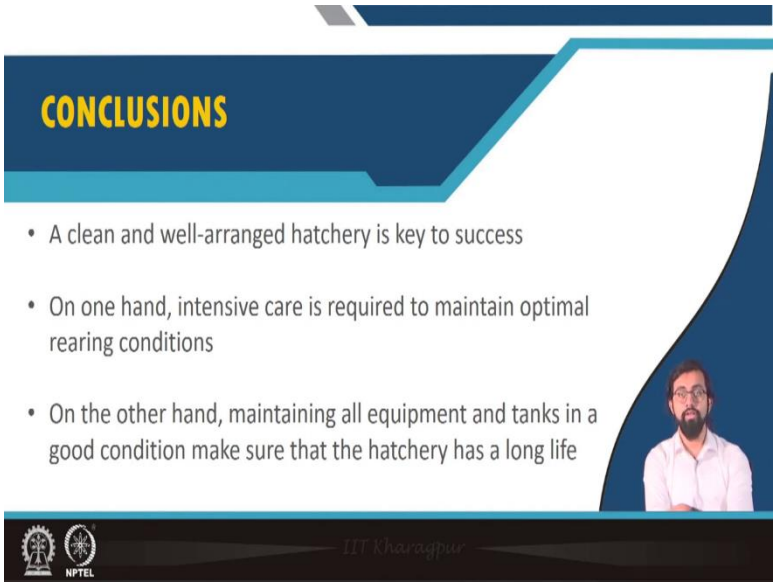

So, in general, when we talk about this hatcheries and all we discussed for the last couple of lectures, how to design a hatchery, what are the site selection criteria, what is the parameters that we need to think, we need to really worry about, what are the engineering considerations are involved here.

So in general, clean and well arranged hatchery is considered as a key to success for your farm and you have to maintain the intensive care you have to maintain a proper optimal rearing condition for intensive care of your product or culture species. And on the other hand, maintaining all the equipment's and tanks in a good condition is like very important for in order to make sure that the hatchery has a long enough life for its survival. Therefore, it is higher benefit and for giving the higher economic benefit plus it will have a higher shelf life as well.

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So the takeaway message, well maintained hatchery ensures a healthy disease free environment for the fry production which is very important and that is why we normally go for designing and developing or the construction of the hatcheries in general. It involves the maintaining of operating condition as well as the equipment used for the larval rearing and all.

So, in general in this couple of lectures we discussed how hatcheries are like how this design of hatchery and the proper engineering concept is mandatory for, it is very much essential when you go for designing of the hatchery. So there is further details that we can go ahead but we can think of it but because of the time constraint I cannot go ahead with the further in detail designing of hatcheries and all if you are interested definitely you can contact me I will definitely can help you out with it and how to design and what are the engineering consideration and what are the, what are the different aspects that involves with design and development of a proper hatchery farm.

So, but we have a good enough knowledge about the carp hatchery, how to design carp hatchery, prawn and shrimp hatchery as till (())(23:41) already and so very good. So we can utilize this and we can think about how we can utilize it for, in future.

Anyway, so in the coming module, I will be discussing about the aquafic technology, how the different kind of aquatic feeds are formulated and how it is being utilized in general for aquaculture purposes.

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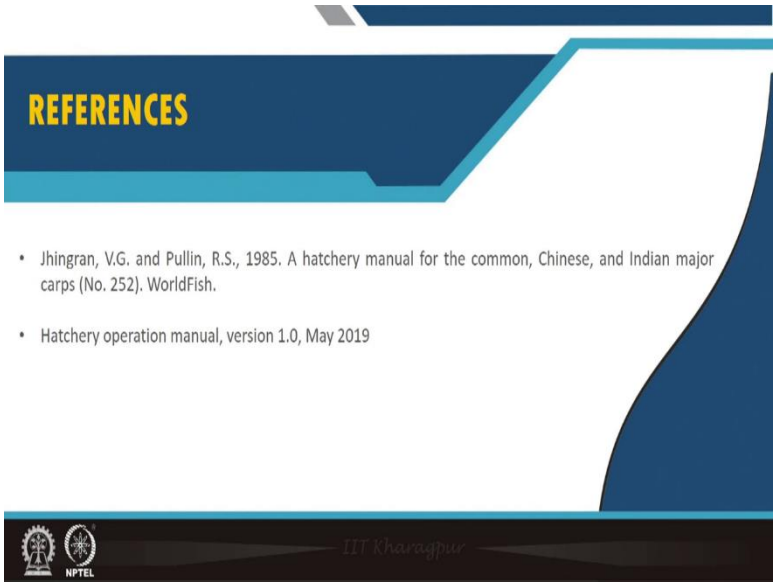

So these are the references that you should, you can take a picture, you can Google it and it will be very much helpful for you to know further about how it works. So that is it for now. So see you in the next module. Thank you.

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