Advanced Agriculture Technology
Professor Gourav Dhar Bhowmick
Department of Agriculture and Food Engineering
Indian Institute of Technology, Kharagpur
Lecture - 18
Topic - Introduction to Shrimp Culture (Contd.)

Hello everyone, my name is Professor Gourav Dhar Bhowmick, I am from the Agricultural and Food department of IIT, Kharagpur.

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So, welcome to the Advanced Agriculture Technology course, for the lecture 3 of module 4, in this lecture also I will be continuing the introduction to the shrimp culture lecture only. So, there I will be covering the introduction to the stocking density during the shrimp farming, the nutrient requirement, the how to harvest the shrimp, what are the advantages of several important commercial shrimp species culture, what are the problems which are associated with this culture and how to kind of troubleshoot them.

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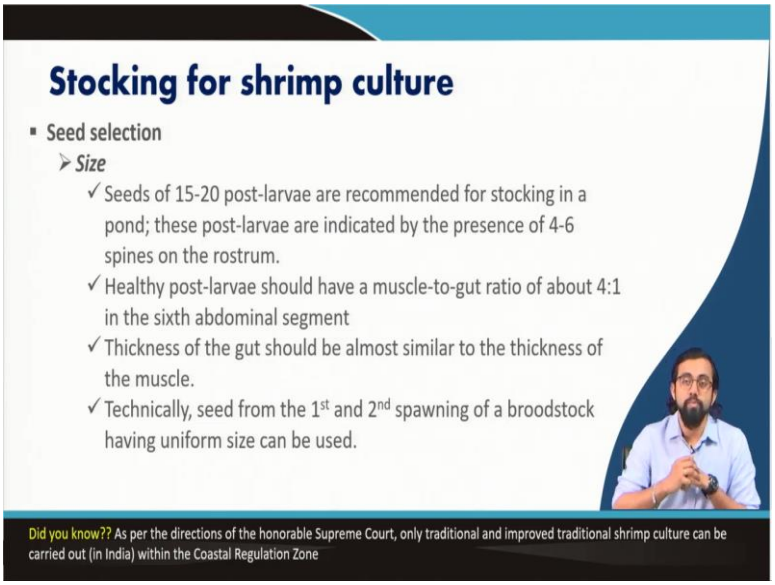

So, when we discuss about the stocking of shrimp culture especially the seed selection and all, in general size of around say like seeds of around 15 to 20 post larva are recommended. So, I recommended for stocking in pond though it based upon the type of culture definitely, remember we discussed in the last lecture, what type of culture that we are doing culturing system it is an extensive, semi intensive or intensive even in intensive there are like open culture, there are a recirculation, recirculatory and so on, so forth, minimum waste utilization and minimum water utilization etc.

So, based on the type of culturing systems, the stocking density actually it varies. So, in general the 15 to 20 post larva recommended for stocking in pond and with this post larva indicated by the presence of 4 to 6 spine in the rostrum. In case of healthy post larva it should have a muscle to gut ratio of around 4 is to 1 in the sixth abdominal segment and the thickness of the gut should be almost similar to the thickness of the muscle. So, then only it will be considered as proper it reaches the post larval situation, post larval condition. Technically see it from first and the second spawning of a brood stock having uniform size can be used.

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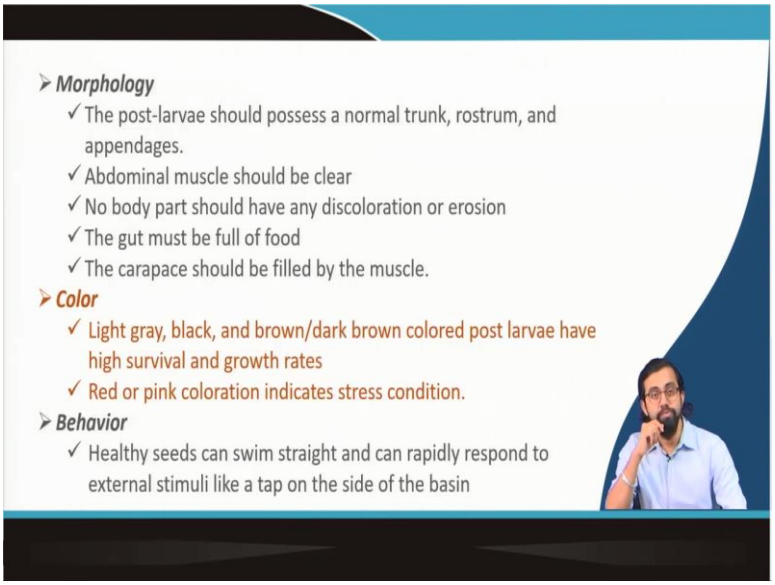

In terms of morphology, the post larva should possess a normal trunk, rostrum and the appendages, abdominal muscles should be clear and no body parts should have any kind of discoloration or erosion or in disorientation. The guard must be full of food and carapace should be filled with the muscle.

The color in general the if it is a light grey, black or brown or dark brown colored, it has a high survival of the growth rate but in case of red or pink coloration, it indicates that it is under the stress condition. So, when we talk about the its behavior, in general the healthy seeds can swim straight and it rapidly respond to the external stimuli like a tap on the side of the basin or any kind of external stimuli are likely to refer stuck them they will just they will like kind of they will sense and they will get back to the change that their direction.

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When healthy, the seeds can actively swim against the current if you make a kind of wielding motion it will make a steering in the water so, it can directly swim against the current and click to the site. So, to not to blow away like when we will be doing swelling or manually or in a natural situation.

External fouling seeds should not be contaminated with external parasites, bacteria or any other fouling organisms it has to be pathogen free, any case of viral occlusion bodies should be checked in the seeds, a large number of occlusions in the seed indicates a stress situation. So, you have to worry about these factors as well when we will be choosing a particular seeds for your system.

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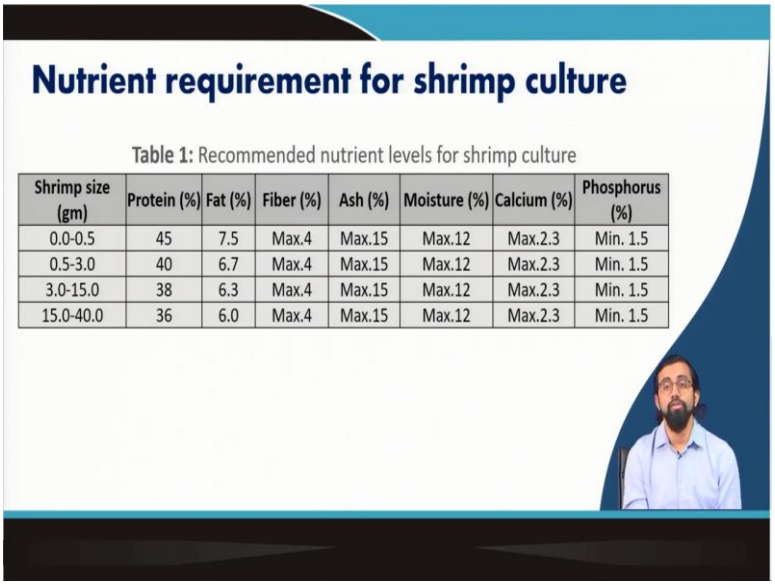

In general, the nutrient requirement for shrimp culture it depends on the size. If you see this particular table, when it reaches around 0.5 gram up to 0.5 gram when it is like the size of around 0.0 like 0.5 when there is no zero like from its birth to the 0.5 it has a requirement of around 45 percent of protein, 7.5 percent of fat, no more than 4 percent fiber, no more than 15 percent ash content, no more than 12 percent moisture and like minimum 1.5 percent phosphorus content. Again, the calcium content has to also be limited to 2.3 percent.

This percentages are almost equal other than the amount of protein and fat that requires, so in case of the along with the when its keep on increase in the size the shrimp size the protein requirements is literally goes a little bit down and as well as the fat requirement but others can be as a as it is of.

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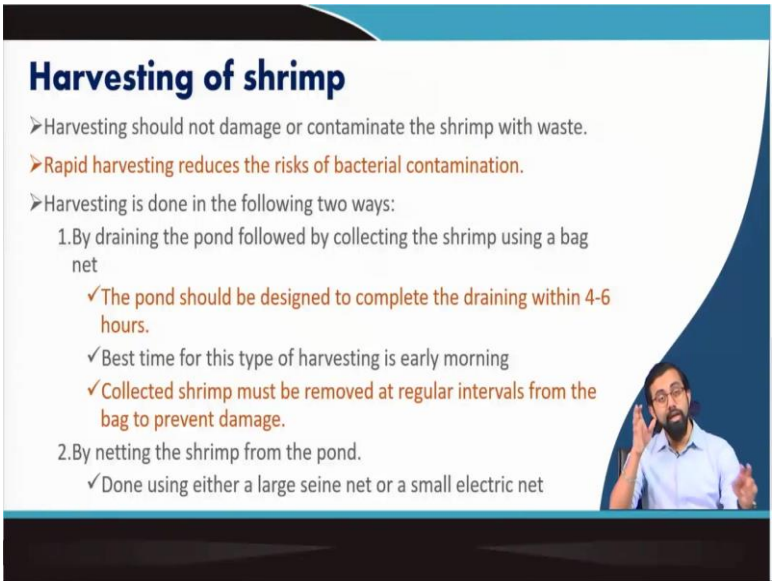

Harvesting of shrimp, so how you will harvest the shrimp, so now you have you are providing the feed now you are culturing your species in a particular very proper way everything is done. Now, your culture species has reached to his maturation stage. When it comes to his maturation stage now we have to harvest it. So, harvesting should not damage or contaminate the shrimp with waste that is the very important thing again and rapid harvesting sometimes it is helpful because rapid harvesting if you do it reduces the any chances of bacterial contamination in your stock.

Also harvesting is done in general the two ways first by draining the pond followed by collecting the shrimp using a bag net. So, suppose you just kind a get it on one side of the

dyke and open the sluice gate and it goes to the drainage canal the water is going to the drainage canal you put a bag net there.

So, what will happen, all the shrimps can easily be collected as the easiest way, one of the easiest way. The pond should be designed to complete the draining within 4 to 5 hours and the flow has to be designed in that way also, the base time for this kind of harvesting is early morning and the collected shrimp must be removed the collector shrimp must be removed at regular intervals, so, to prevent the any kind of damage to their body.

Another method is by netting the shrimp from the pond. In general, we do it for the extensive systems because in extensive systems, we do not want to collect all the culture species at the same goal, so in that kind of cases, it is better to provide them with a large seine net or the small electric net also to collect the shrimps from the pond.

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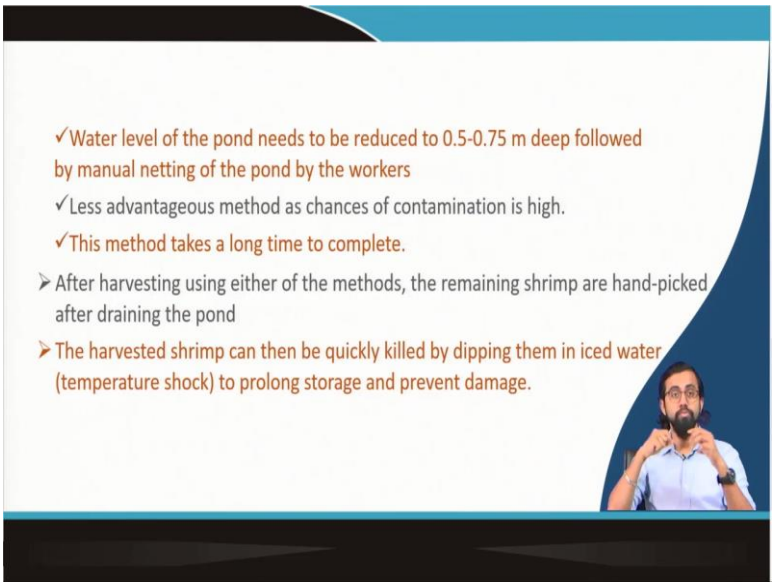

In case of collection of in case of this netting the pond, the water level of the pond needs to be reduced to at least 0.5 to 0.75-meter-deep, less advantageous method as chances of there is a problem with this because it is a less advantageous method as a chance of contamination is very high. This method takes a long time to complete also so that is why it is better to go for the method by when we use the completely open the drainage canal, open the sluice get to pass the water through the drainage canal and have to put the bag net on it. After harvesting either of these methods, the remaining shrimps are handpicked after draining the pond. And if it is like extensive culture systems, we do not do it at all.

The harvested shrimp can be quickly killed by dipping them into the iced water, we call it temperature shock. That is the most famous way of doing that. So, to remain its taste and its or like odor as it is and to prolong this also to prolong the storage and to prevent any kind of damage that this culture species.

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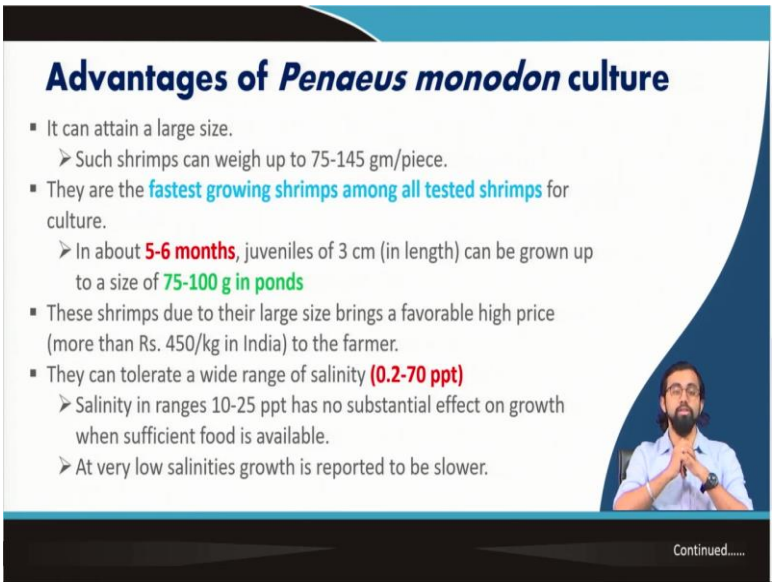

What are the advantages of the Penaeus monodon culture it can attain a very large size. So, the shrimps can weigh up to 40, 75 to 145 gram per piece and they are the fastest growing shrimps among all the tested shrimps for the culture. In about 5 to 6 months that juveniles have around 3 centimeter in length can be grown up to 75 to 100 gram in ponds within 5 to 6 months. So, that is a reason why it is a favorable pond practices in Indian coastal regions and there is a chances of growing it further there is a chances of further extension of this kind of market in Indian scenario because of considering the amount of large coastal region that we have in India.

They can tolerate a wide range of salinity 0.2 to 70 ppt. Salinity in range of ranges from 10 to 25 ppt has no substantial effect on growth when sufficient food is available. At very low salinity the growth is reported to be slower as remember I told you like the salinity is a very important factor though it can tolerate but it does not make their life easier when the salinity level is less than 10 or more than 25 their growth can be affected.

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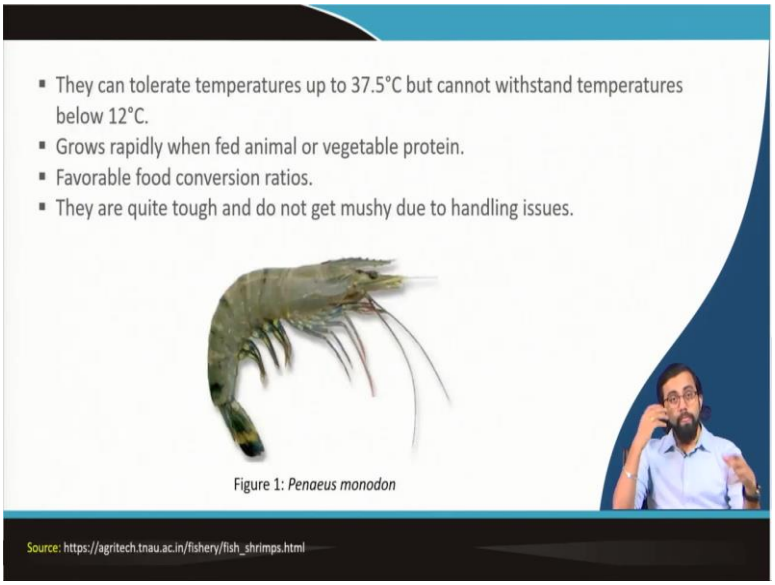

So, they can tolerate a temperature of around up to 37.5 degrees Celsius and as low as 12 degrees Celsius. It grows rapidly when it is fed with animal or the vegetable proteins and all and favorable food conversion ratios are seen in this kind of species. And they are quite tough and do not get mushy when due to the handling issues and all.

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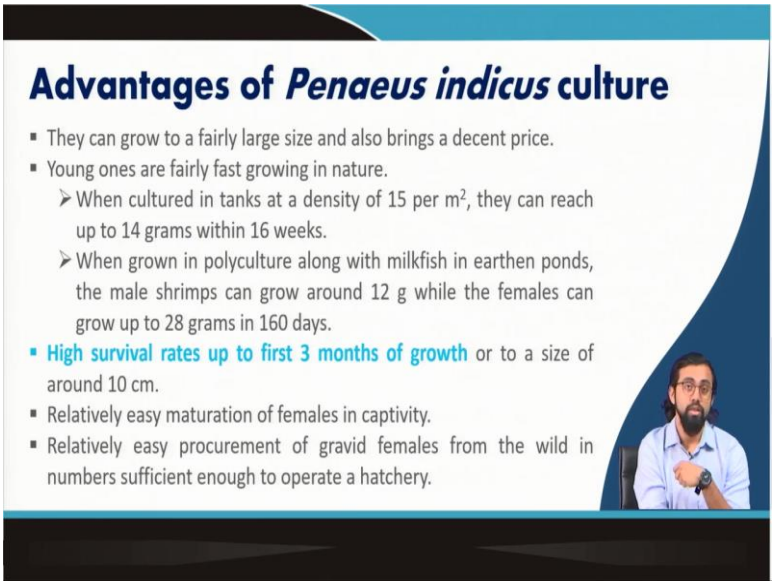

Second type of species is the advantages of Penaeus indicus culture is like they can grow fairly large size also brings a decent price also for their farmers, for the farmers or for culturing the farm owners. Young ones are fairly fast growing in nature when culturing tanks at a density of around 15 per square meter and they can reach up to 14 grams within 16 weeks. When growing polyculture along with milk fish in earthen ponds, the male shrimps

can grow around 12 gram while the females can grow up to 28 grams in 160 days, so, almost twice as the size of the male. T

They have a very high survival rate up to the first 3 months of growth and it can reach to a size up around 10 centimeter and relatively easy maturation of females in captivity can be witnessed. Relatively easy procurement of gravid females is possible in case of Penaeus indicus from the wild because in numbers because of sufficient enough to operate in hatchery.

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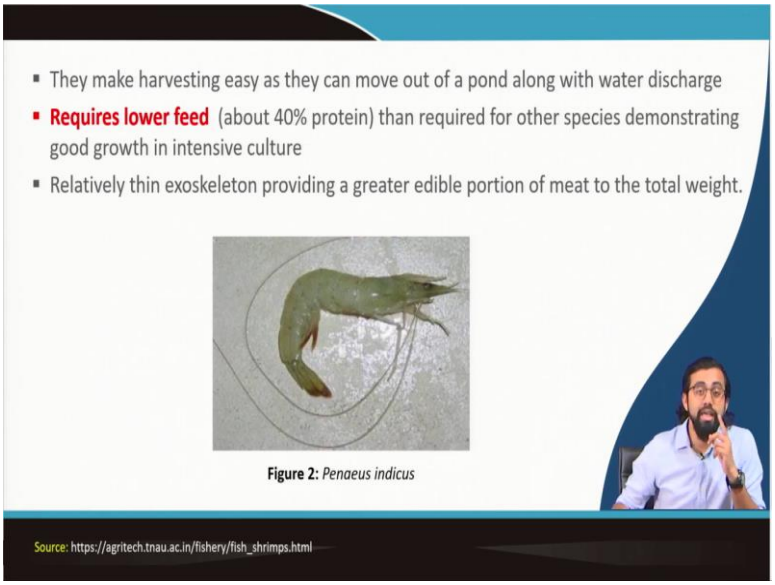

Because of that they make the harvesting easy as they can move out of pond along with the water discharge. It requires a very low amount of food surprisingly and also only around 40 percent of the protein that requires then the other species demonstrating good growth in the much better growth in the intensive culture. However, they relatively have a very thin exoskeleton providing greater edible portions of the meat to the total weight than any other kinds of shrimp species.

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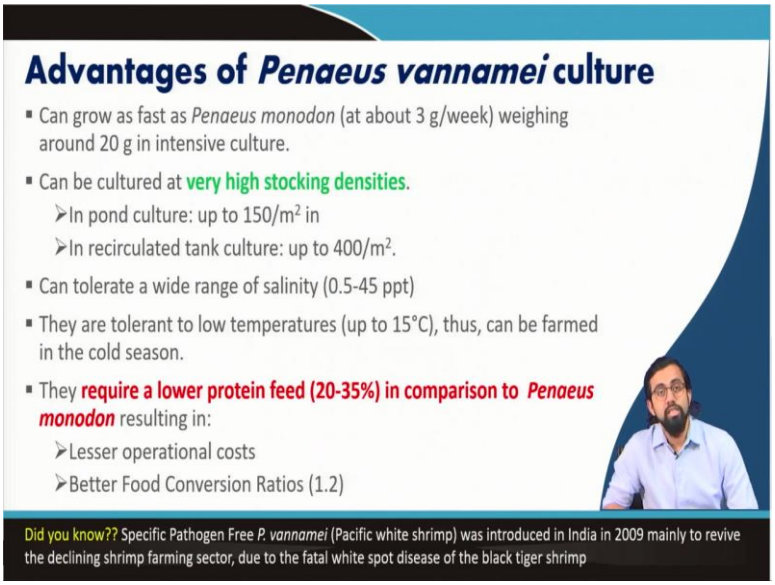

So, what is the third one, let us discuss about the advantages of Penaeus vannamei culture, why am discussing about all this specific species because these are the species that we normally in Indian context, we culture and there is a possibility of culturing this kind of species because of the enough like how to say just profit environmental conditions prevailing in the Indian scenario. So, and also, they can give you a pretty high economic return if you can culture it properly scientifically.

What are the advantages of this vannamei culture so, they can grow as fast as monodon, Penaeus monodon but weighing up around 20 gram in intensive culture and with a very high stocking density can be prevailed in pond culture it can go up to 150 per square meter. In case of recirculating tank culture, it can go up to 400 per square meter, can we imagine it is a huge amount. But it is doable and because of that, it gives you a very high economic return and very well definitely with the proper design and also it can tolerate a very wide range of salinity as low as 0.5 ppt to 45 ppt, but again the proper salinity range if you can provide it will grow faster.

So, it will not be in stress condition, though it will not get killed or it will not be like it will not get killed at least when the salinity level goes below because of certain reason or it goes up because of certain situation or certain reason. In general, they are tolerant to low temperatures up to 15 degrees Celsius thus can be found in the cold season.

And also, it is a type of species that we can think about growing in the temperate regions in like European and North American context as well. It requires a very low animal protein feed

only 20 to 35 person in comparison to the other Penaeus species resulting in a lesser operational costs and also a better food conversion ratio around 1.2.

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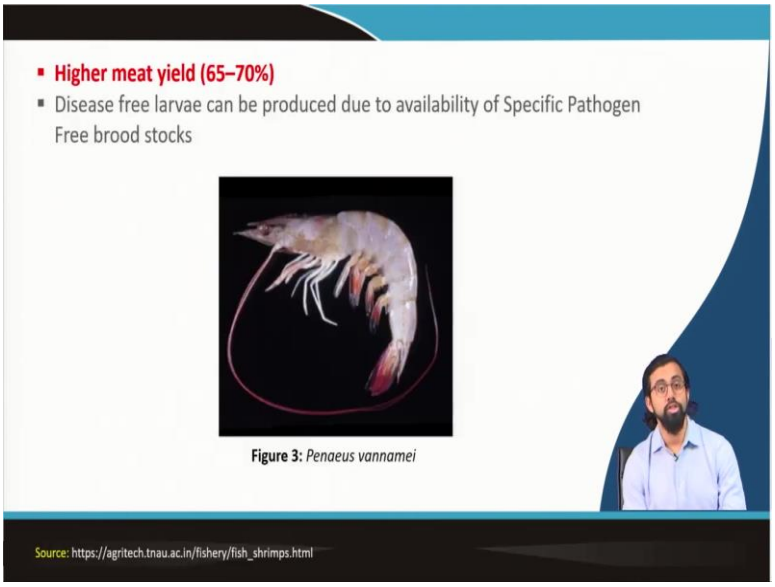

It has a very high meat yield as like the monodon and disease-free larva can be produced due to availability of specific pathogen free brood stock that is available with the experts and available with the collection of different authorities in India.

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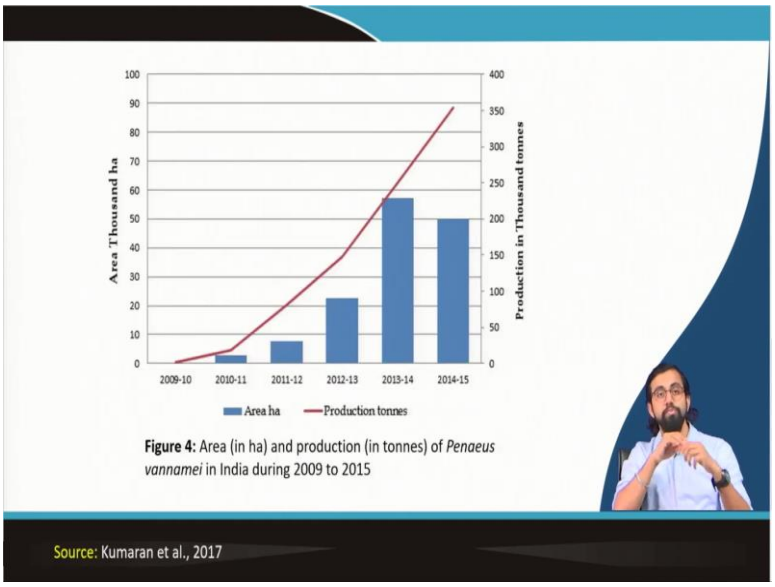

If you see the area and the production of Penaeus vannamei in India during the 2009 to 2015 it keeps on increasing, 2014-15 it drops a little bit but at around like if you say in terms of area, it is almost 200,000 hectare of area is now well utilized in Indian context and the

production in turns is around it goes up to 350,000 tons as of now in 2015 the production of the shrimps

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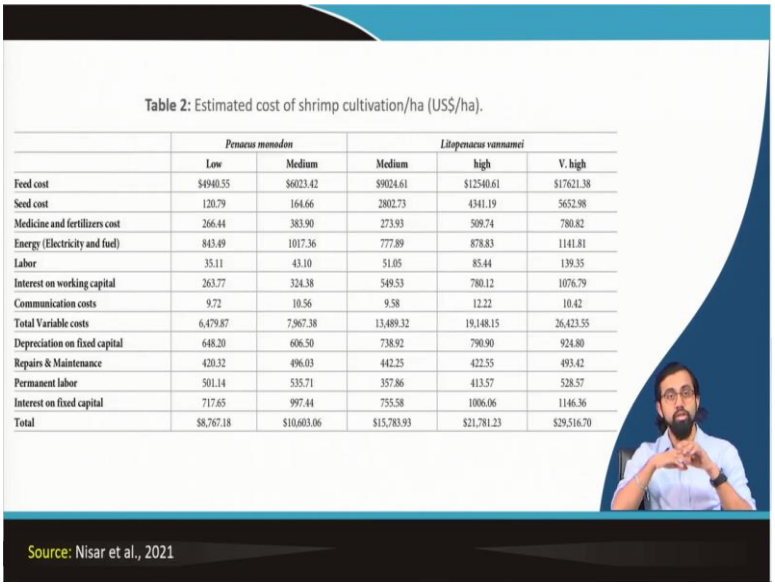

	Penaeus monodon		*Litopenacus vannamei*		
	Low	Medium	Medium	high	V. high
Feed cost	$4940.55	$6023.42	$9024.61	$12540.61	$17621.38
Seed cost	120.79	164.66	2802.73	4341.19	5652.98
Medicine and fertilizers cost	266.44	383.90	273.93	509.74	780.82
Energy (Electricity and fuel)	843.49	1017.36	777.89	878.83	1141.81
Labor	35.11	43.10	51.05	85.44	139.35
Interest on working capital	263.77	324.38	549.53	780.12	1076.79
Communication costs	9.72	10.56	9.58	12.22	10.42
Total Variable costs	6,479.87	7,967.38	13,489.32	19,148.15	26,423.55
Depreciation on fixed capital	648.20	606.50	738.92	790.90	924.80
Repairs & Maintenance	420.32	496.03	442.25	422.55	493.42
Permanent labor	501.14	535.71	357.86	413.57	528.57
Interest on fixed capital	717.65	997.44	755.58	1006.06	1146.36
Total	$8,767.18	$10,603.06	$15,783.93	$21,781.23	$29,516.70

This is a very standard estimation of shrimp cultivation per hectare with USD and this conversion was used around 70 rupees, 1 USD to 70 rupees, 70 rupees and when the discussion is done with only for the Penaeus monodon and for the vannamei species. For the feet cost seed the medicine and fertilizer energy labor these are the variable cost and the fixed cost, the interest the total the depreciation on the fixed capital, the repairs on the maintenance, permanent labor, interest on the fixed capital considering all those parameters we have in the research paper by Nisar et al, 2021.

If you go I will show you the reference. So, you can go ahead and study by yourself, and to get much detailed idea about how this cost estimation of farming is done, because of the time constraint, I cannot go in details about those things. But I really suggest you to go and study this paper where you can get much more details about how to do these kind of calculations and how to design a farm and what are the cost estimations that involves with it.

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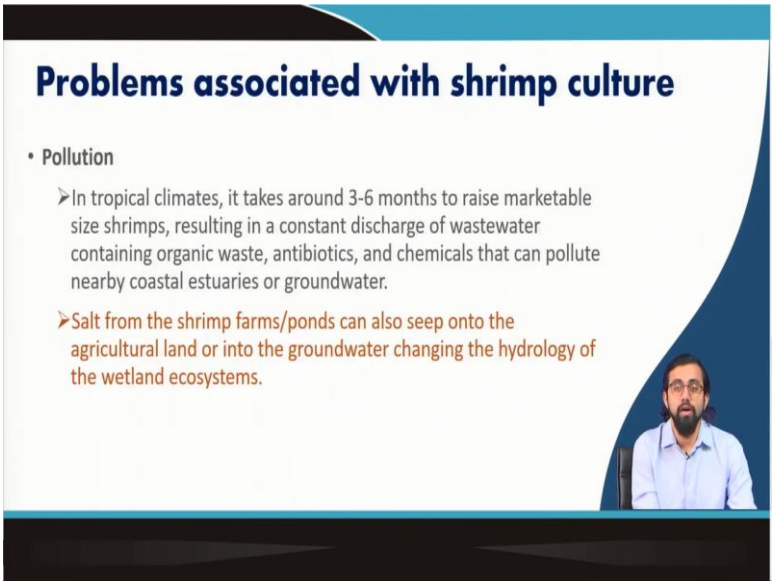

What are the problems associated with the shrimp culture, definitely the first thing is the pollution in the tropical climate, it takes around 3 to 6 months to raise the marketable size change resulting in a constant discharge of wastewater containing organic waste, antibiotic chemicals that can pollute the nearby coastal estuaries and the groundwater.

What we need to do to get rid of this kind of situations or the problems, go ahead with the recirculating type of treatment units. So, recycling type of culture systems, what it does, it cleans the water which is the for during this 6 months of culture period, and provide its back to the to your farm. Though it is not possible all the time and also, it requires a huge amount of scientific involvement, experts involvement and all but believe me it is very good for the ecosystem because the environment, it is good for your economic higher economic return as well.

Salt from the economy shrimp farms and ponds can also seep into the agricultural land and into the groundwater changing the hydrology of the wetland ecosystems completely sometimes what it happens though I already mentioned you it is better to have a proper at least more than 90 percent of the clay soil on the bottom of your farm, but still sometimes what happened because of some cracks and the default features the water can seep through and it can go and charge the groundwater. When it charged the groundwater especially suppose there is a aquifer there, when it reaches the aquifer where it contains the fresh water of like with almost no salinity, but that saline water comes in contact with them and it comes with different kinds of other ions as well.

So, it will kinds of kind of completely pollute that aquifer and because of that, it somehow the suppose you are using that aquifer water for your irrigation purposes in here by aquaculture agricultural land, so definitely that you will not get it anymore. So, that is the kind of environmental hazard that it can create.

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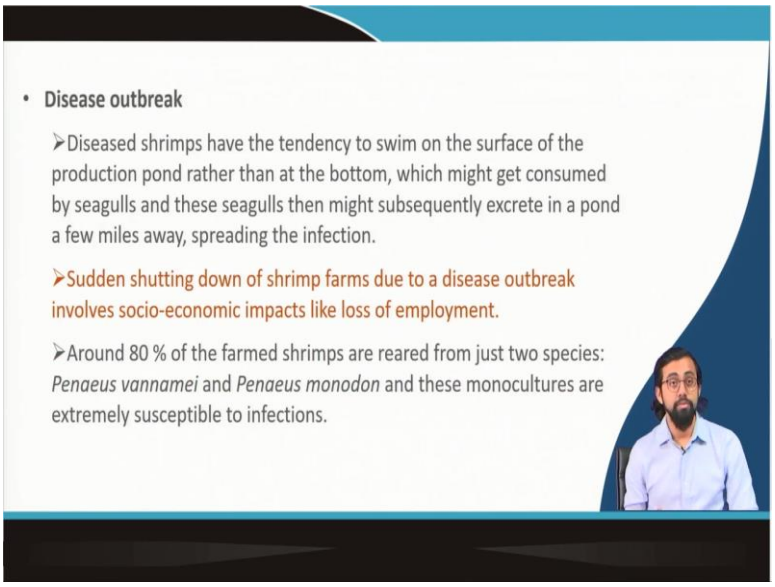

So, do not worry about it, there are lot of troubleshooting measures that we can do and we designed the we know we can design the dyke in such a way. So, we designed the bottom in such a way there are proper consolidation methods and technology which are already available. So, to reduce the seepage loss, reduces any kind of possibility of groundwater recharge by your farming water and also the dyke also it can be the embankment design is also standard enough now, if you design it properly, it will not let you seep the water through any either to any direction.

So, these are available. The technologies are already available, what we need to do, we just need to go and read a little bit and also consult with the experts before designing your farms. The second thing is that the like is the disease outbreak. So, the disease shrimps have the tendency to swim to the surface of the production pond rather at the bottom, which might get consumed by the seagulls and thus, the seagulls then might subsequently excrete in a pond a few miles away and spreading the infection. So, it is like kind a way of spreading diseases. So, you understand like first suppose you have a diseased shrimp or which because they have a tendency, they cannot breathe properly.

So, they go and they have because of the irritation that they are feeling, they go on the surface of the pond, and when they go to the surface of the pond or different type of predators, they captured them they literally consume them. Once they consumed them then they go say like miles and miles away and then they extend in a different pond. So, what will happen this is the way of spreading of infection from one pond to the one farming system to the other farms to the other farm. So, this is how the disease outbreak is in generally, it happens.

Sudden shutting down of the shrimp farms due to that disease outbreak it also not possible because of the socio economical impact like say like loss of employment, loss of high amount of economic like the loss of revenue and all. So, that is also sometimes not possible and even if you do so, it comes with a lot of consequences. In general, in Indian context, the almost around 80 percent of the farmed species shrimps are reared from just two types of species Penaeus vannamei and Penaeus monodon and these monocultures are extremely susceptible to infections and all.

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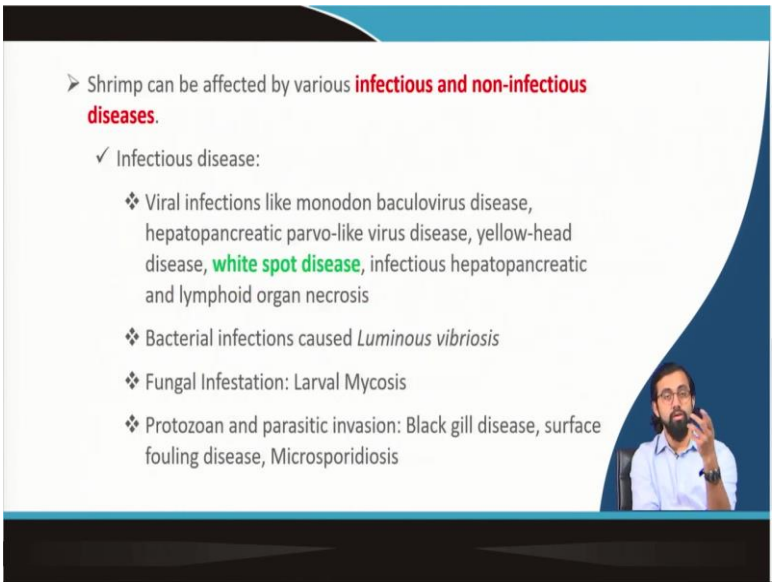

Shrimps can be affected by various infectious and non-infectious diseases, infectious diseases like the white spot disease, which is most common. Other than that, they have this yellow-head disease, infectious hepatopancreatic and lymphoid organ necrosis etc, they can have the bacterial infections caused by this luminous vibriosis and etc.

Fungal infestation, protozoan and the parasitic invasions like black gill disease, surface fouling disease, microsporidiosis, etc. So, if you want to know more about all these things, you can just simply Google it and you will get a more much better about better idea about

what all are these diseases and what can be the troubleshooting measure that we should follow we should kind of follow in our system in our farm, so, to get rid of this kind of disease or infection possible.

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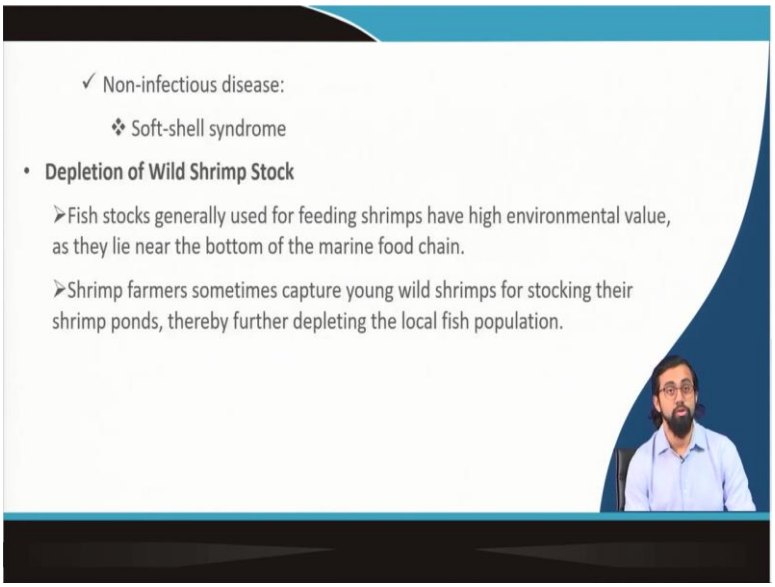

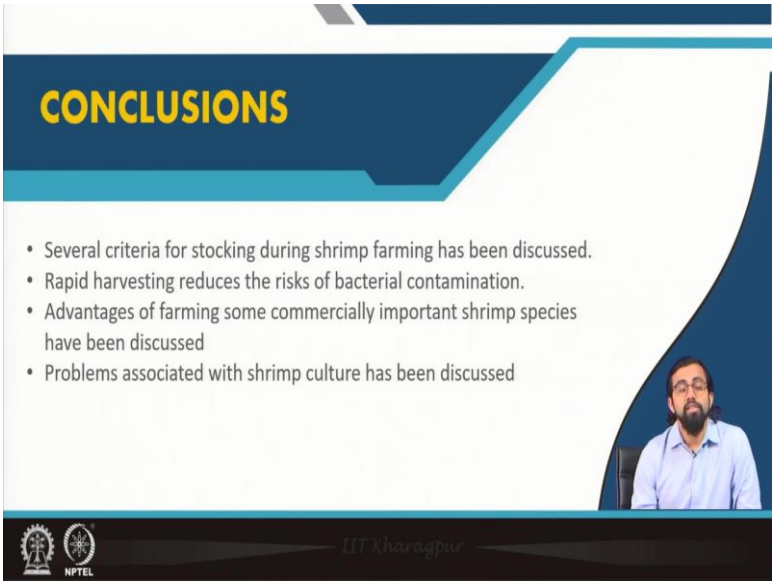

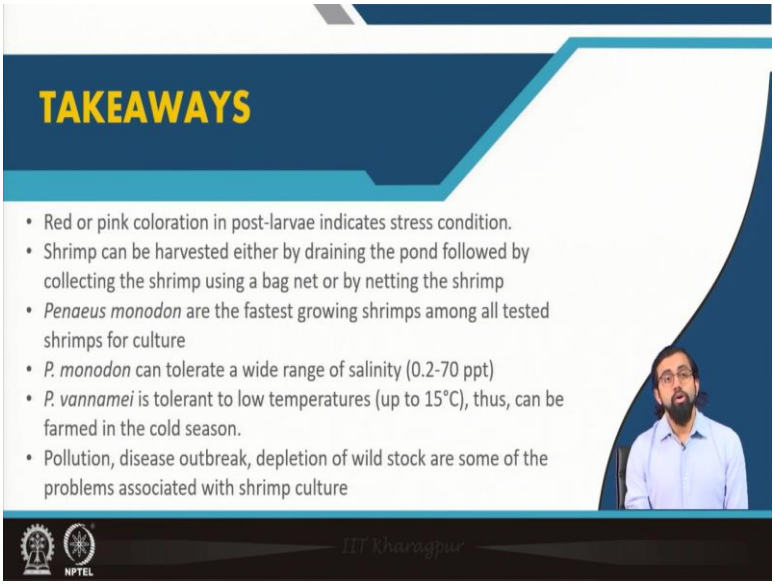

Non-infectious diseases like soft-shell syndrome, because some maybe because of the unavailability of specific type of elements like that shell are made up normally calcium magnesium compounds and also. There is a chance of decrementing these elements and it can cause different kinds of diseases, different types of diseases like soft-shell syndrome etc. Depletion of wild shrimp stop, the fish stocks generally used for feeding the shrimps have very high environmental value as the line near to the bottom of the marine food chain.

Shrimp farmers sometimes capture these young wild shrimps for stocking their shrimp pond and there by further depleting the local fish population. So, that is the reason why this depletion of wild shrimp stocks are like we experienced or we kind of witnessed in all over the world right now.

Several criteria for stocking, in conclusion, we can say like we discussed about several criteria for stalking during the shrimp farming, we discuss about the rapid harvesting, how it can reduce the risks of bacterial contamination, which is very important information for us, advantages of farming some commercial importance shrimp species has been discussed and what are the advantages and what can be the possible outcome that we can get out of culturing this particular type of shrimp species.

What are the problems data that is associated with the shrimp culture that also we discussed and we also discussed about the troubleshooting measures that what will be the troubleshooting measures that we need to follow in order to get rid of those problems. We know that the red or what are the major takeaways from today's discussion from this lecture is first like the red or the pink coloration of the post larva it indicates the stress condition.

So, you need to think about the you need to find out the reason, you need to think about what is the cause behind what is and how to you have to think about the troubleshooting measure as soon as possible otherwise, it can cause drastic situation in your farm, it can be harvested either by draining the pond followed by collecting the shrimps using a bag net or by simply netting the shrimp from the pond itself using the bag shrimps and the net shrimps and all.

Penaeus monodon is the fastest growing shrimps among all tested shrimps for culture in Indian context than this they can tolerate a wide range of salinity they whereas the Penaeus vannamei can tolerate to low temperature very low temperature and can be found in the cold season as well. Pollution, disease outbreak, depletion on wild stock are some of the problems associated with the shrimp culture and it can be definitely troubleshooted very easily once we know the reason behind it and once we can contact with the specific experts and who can give us an idea about like how to kind of solve these kinds of situations.

And the specific in terms of pollutions we already discussed that is the very important solution for pollution outbreak is just go further recirculating aquaculture recirculating aquaculture systems. So, you can by this means you can easily reduce the amount of wastewater inclusion in the surface water bodies, how we can get rid of the groundwater recharge by your farm, just simply put a proper consolidation measure for your what is it called those clay soil that you will be using for your pond or you can properly design your embankment or the dyke in proper way. So, the water will not seep and also from the other way like from outside also water cannot enter to your pond.

So, to dilute your water or to introduce the predatory species or unwanted infectious diseases or in altogether. So, this is the problems that we this is the troubleshooting measure that we can think of. Disease outbreak definitely you can go ahead, get the proper vaccination and proper culturing species and try to go ahead with the maintain the pond in proper way like right from the beginning the liming to the end you can provide it with the proper type of chemicals. So, to have to reduce the amount of bacterial load, harmful bacterial load from your system. The another important thing is the depletion of the wild stock and all this problems that we associated with the shrimp culture we already discussed.

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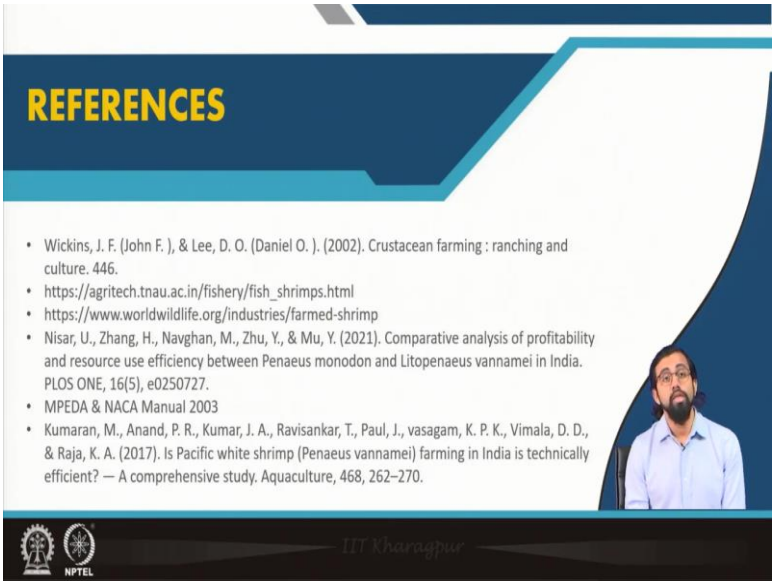

So, these are the references as I told you like these are the references, you should really you can take a picture of it and then you can search it in Google. And I will really appreciate if you go and study these papers or this information's given in this particular year. So, it will enlarge your idea or more knowledge about this particular field. So, that is it for today for this lecture. So, we will meet again in the for the next lecture. Thank you so much.