Advanced Aquaculture Technology
Professor Gourav Dhar Bhowmick
Department of Agriculture and Food Engineering
Indian Institute of Technology, Kharagpur
Lecture 20
Introduction to Crab Culture (Continued)

Hello, welcome everyone my name Gourav Dhar Bhowmick from the agriculture and food engineering department of IIT Kharagpur. Today I will be discussing about the introduction of crab culture which is like continuation of the last lecture only and this is the last lecture from this module technology of crustacea farming for this course advanced aquaculture technology.

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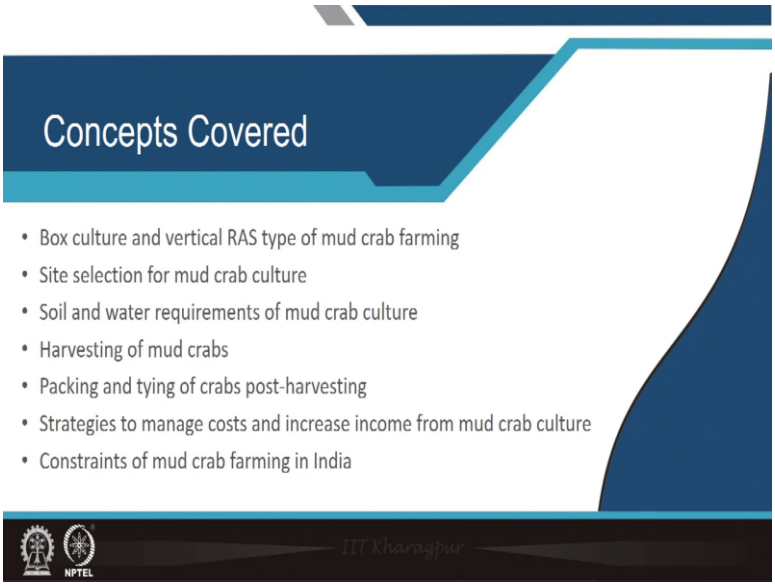

The concepts that I will be covering in this particular lecture would be like the box culture and the vertical recirculated aquaculture system type of mud crab farming, remember earlier we have already discussed two of them and this is the third and the fourth type of farming systems that we will be discussing today.

The site selection for the mud crab culture, what will be the optimum site what the optimum criteria for selecting a site for aquaculture for a mud trap culture, soil and water requirement, harvesting of mud crab, packing and tying of crabs after the harvesting is done, strategies to manage the cost and the increase income from mud crab culture. Other than that, the constraints of mud crab farming in India and how to troubleshoot them.

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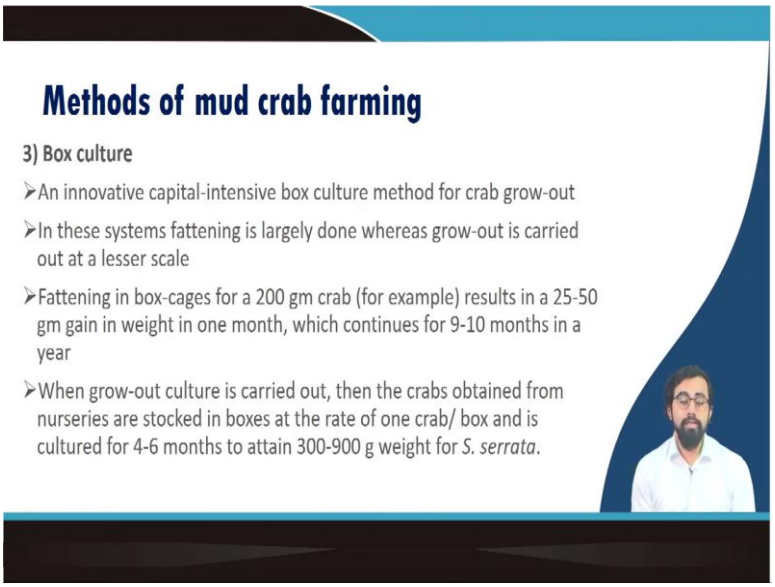

In general, you remember we already discussed two of the mud crab farming techniques and so this is the third one the box culture that we will be discussing today. It is an innovative and it is actually a very standard methods now even in India also people are going for it this kind of culture systems where an innovative capital-intensive box culture method are shown instead of in for the crab grow out and it is like much better than the grow out techniques that we normally follow that are there for this crab culture. In this kind of systems the fattening is largely done whereas the growout is carried out in a lesser scale. So, mainly it is like a mixture of grow out techniques and the fattening techniques but mostly in the fattening techniques.

So, fattening techniques is mostly done like largely done and and a grow out is done in a lesser scale, so fattening in box cages for a 200 gram crab just for example results in a 25 to 50 gram weight in a single month, so which continues for 9 to 10 months in a year. Just imagine it will give you a large amount of economic benefit or for this kind of culture systems and when growout culture is carried out then the crabs obtained from the nurseries are stocked in boxes at a rate of like one crab per box and is culture for 4 to 6 months to attain around 300 to 900 gram of weight for this species.

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So, what are the advantages and the disadvantages of this kind of systems? First of all, box culture it involves very low maintenance, ease of assessment and the predictability. It can be carried out indoors using the flow through or the recirculated aquaculture systems where there is a scarcity of land and water, because it is in the box and you can just have a proper system, proper conduit line available for it and you can have a flow through system, you can utilize the flow through systems or you can utilize some additional bio filter to treat the water and put it back again. So, that is called that is under the recirculated aquaculture system that we call, so that way also you can go ahead and you can utilize the water more as much as possible.

By this way you can reduce the overall water demand of the systems and also you can reduce the environmental impact. What are the disadvantages of this kind of system is like it requires a high capital investment in general because of you need some equipment some box in general for each crab you have to have a single box for it.

Lower activity of crab culture it reduces their metabolism and subsequent feed intake because they have a very limited space to dwell and their metabolism rate goes down and the subsequent feed intake also becomes down and which definitely have a proper impact on their meat on their biomass. So, other than that the lower activity of the cultured crab along with the constant exposure to the sunlight it results in an algae infestation sometimes.

That is a major issue sometimes we have to worry about it and sometimes people put a proper kind of what we call it like proper you can do this painting anti-foulent and all, you can paint the boxes so that it will be very difficult for the bar to attach to its surface, so because of that

we can go for different techniques there are like thousands of techniques for this antibiofoulent and painting. So, not only the antibiofoulent but also like this algae also they can also be infested, so how to get rid of it there are thousands of technique available with it but still it needs some capital cost so it does not make sense and that is why sometimes it is one of the disadvantages part of this box culture.

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It looks like this if you see this box single crab is there are in the same box and hanging from a bamboo structure, they will be almost half dipped or like full dipped inside the water or sometimes even a little bit of the above the water is also if the water level goes down for one or two days because like they can survive with it.

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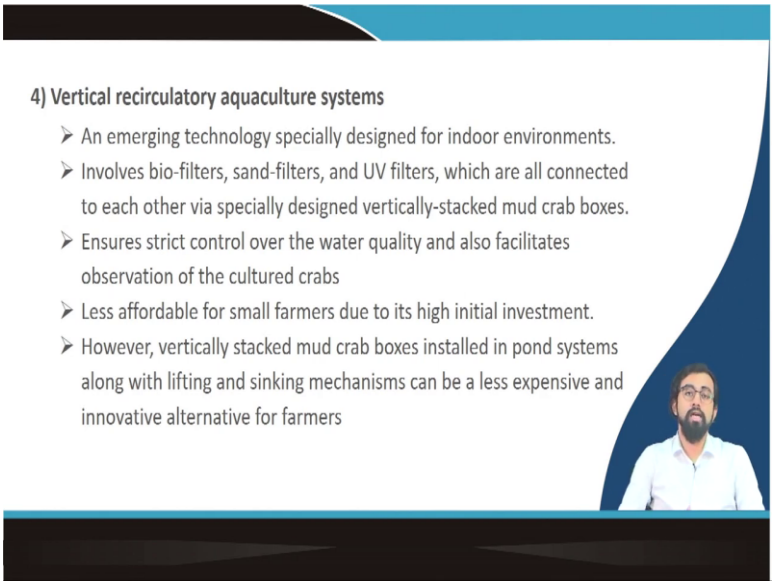

In case of vertical recirculatory aquaculture systems it is actually emerging technology that is coming out where it involves the bio filters, sand filters, UV filters which all are connected to each other via specially designed vertically stacked mud crab boxes. What they do they treat the water so that it will get rid of the, once that water is utilized then the water is it is like a waste water, after the crab is purchase, it is like waste water that wastewater is again treated using all this filter mechanism, biofilters, sand filter, UV filter it all has its definite properties or definite functionality.

The biofilter why the bio filters are used, bio filters are mainly used to get rid of all the carbonacious and the nitrogenous compound in general, which is a very high in case of this cultural procedures and farming techniques. In order to get rid of the carbonacious and the nitrogenous species we go for biofilters where the microorganisms are artificially grown which will consume this nitrogen and carbon from the wastewater for and they will develop their biomass and the water which is coming out of this bio filter are free of those nitrogen. It is not completely free they can reduce the load, pollutant load. Then if you talk about the sand filters in general we can put it before actually, so sand filters are for what purpose?

It will get rid of all the suspended solid present in your, so because of the high turbide water because it is a brackish water it generally has a very high repeatability. So, these sand filters what they do they will reduce the suspended solid level of this kind of water and at the end is why we we go for UV filter, just an example do not go for it like it is only UV filter that you need to use you can use ozonator and all these things also there are advanced oxidation techniques there are like lot of techniques, technology available in this field where those are mainly being used to reduce the microbial content what does that mean it will reduce the pathogenic concentration, pathogenic microorganism content in the water.

So, the water which is after the treatment is done in this different treatment units then that water is again thrown back to the pond or the cultural system or so that what will happen you are reducing the overall water intake, because water comes with a price no matter if it is like a pumping system, it is a conveyance systems it comes with the price.

So you are reducing the water intake by all utilizing the same water over and over again, so that is why it is called the recirculatory aquaculture systems. Why it is called vertical, because you can design it vertically by some different filters at different stage put the water once it is done, once the water is utilized then you put the water, use the pump to the reservoir from reservoir through gravity it will go through the different system different

filters and it will again come to the pond itself, come to the the culture pond itself or the culture tank itself.

It ensures very strict control over the water quality as I already mentioned and also facilitates the observation of the cultured crabs. It is less affordable for the small farmers because of its high initial investment or the capital investment, however there are a lot of policies that is available right now, the bank loans are available right now, government policies as I told like it is available right now for which you can go ahead with it. It will take x amount of money you just have to pay like 0.1 x or 0.2 x by yourself.

As a farmer you just have to make sure you have that much of amount then the rest of it will be covered by the banking system, by the government grants, because these are the techniques that government is trying to promote, the banks are very much ready to give you loan for this kind of systems and they are having with a very low interest loan or sometimes interest free loans also you will get it.

So, you can use those opportunity and you can go ahead with it, so there are a business strategy that you can develop if you want to go for this kind of crab culture in the in your village, in your like coastal region, in wherever you are, so you just want to go for that there are opportunities available.

So, do not just lose the hope that just because it is a high initial involvement involved with it you cannot do anything with it, you cannot do anything because of that. There are a lot of opportunities lies with it. In general, the vertically stacked mud crab boxes installed in pond systems along with the lifting and sinking mechanisms can be less expensive and innovative alternatives for the farmers.

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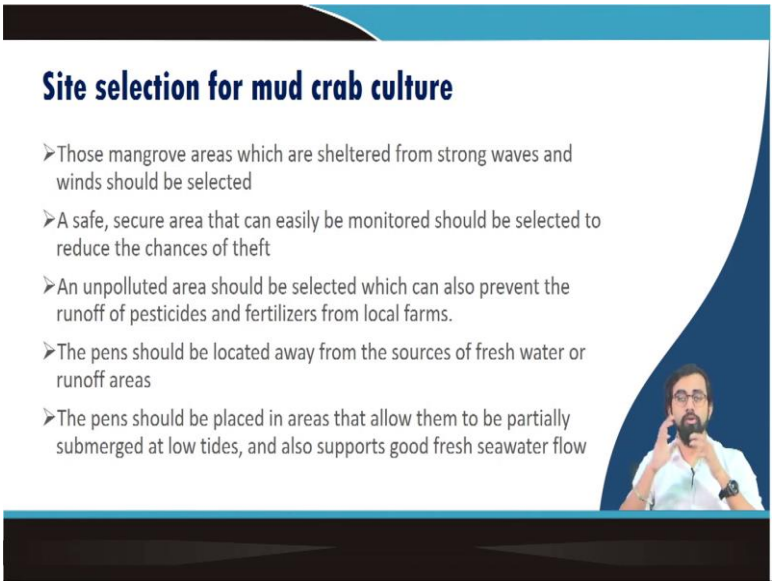

This is vertical recirculatory aquaculture system type of mud crab box culture if you see, so all this box are actually contains the crops and there we have either vertical or maybe horizontal systems which are involved with it. In general, the site selection if you ask me before starting a mud crab culture what are the basic things very important parameters that you have to look for before going forward designing your firm. The first thing will come into your mind is like the site selection; definitely we go for that thing first like where are we going to build our farm. For this mud crab culture those like mangrove areas which are sheltered from the strong waves and the winds should be selected.

Why I say so, if you go to Sunderban, it has a very nice mangrove belt in its southern part the moment it reaches its like where the land in the coastal regions, so this mangrove areas are

actually very enriched and they enriched with the proper site available, proper quality of soil, proper quality of the sea water, proper quality of saline water available for the mud crab culture. What you need to do, you need to select the site properly, so you have this proper mangrove region what they are doing, they are reducing they are kind of energy dissipating structure.

When the sea waves are coming it will disable it will reduce the wave energy by crashing on them, so what will happen, these mangroves are actually helping to this reduce the land erosion not only that it will help to grow like the other side of the mangrove area you can utilize it for your site for growing your mud crab along.

In general, you just go for a safe and secure area so that there are a less chances of stealing your product or farm products. Mainly you should go for the unpopulated area why it is to be selected because it can prevent the runoff or the past pesticides or the fertilizers from the local firms. The pens should be located away from the sources of fresh water or the runoff radius, the pens should also be placed in areas that allow them to be partially submerged at low tides and also support a good fresh sea water flow all the time.

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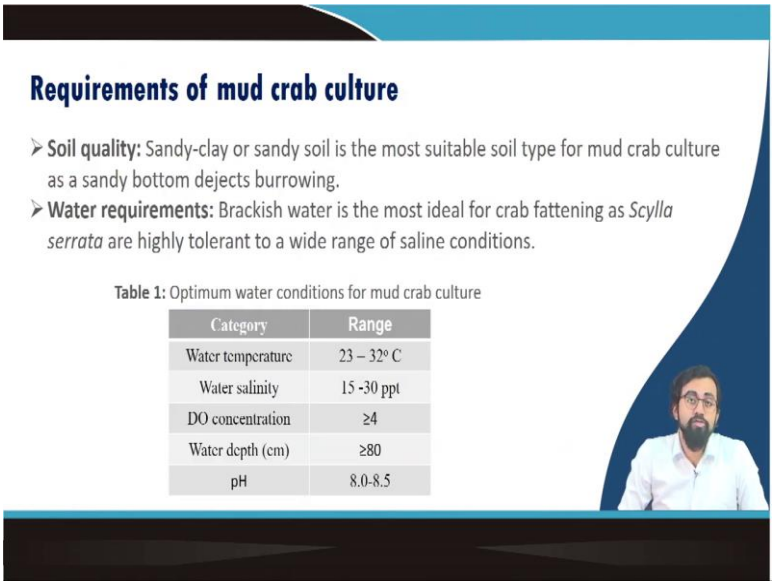

The requirement of the mud crab culture, the soil quality if I talk about the soil quality definitely you should go for the Sandy-clay or the sandy soil it is the most suitable soil type for the mud crab culture the reason because sandy bottom they dejects the borrowing, so that is what they do this mud crab, so we have to have a proper sandy clay or the proper sandy soil in your system.

The water requirement the brackish water is the most ideal for crab fattening as scylla serrata has it is very much tolerant they can be easily tolerable to, they are actually tolerant to the wide range of saline conditions and you see like optimum range can be a from 15 to 30 ppt which is like very high. So, it can be as low as the like normal brackish water to even standard seawater also it can easily sustain, it can easily survive.

Other than that, the water temperature has to be around 23 to 32 degrees Celsius, water depth has to be more than 80 centimeter in general, the DO concentration which is like dissolve oxygen concentration has to be more than 4 PPM for sure or the 4 milligram per liter for sure, pH slightly basic range 8 to 8.5 is perfect for them to grow.

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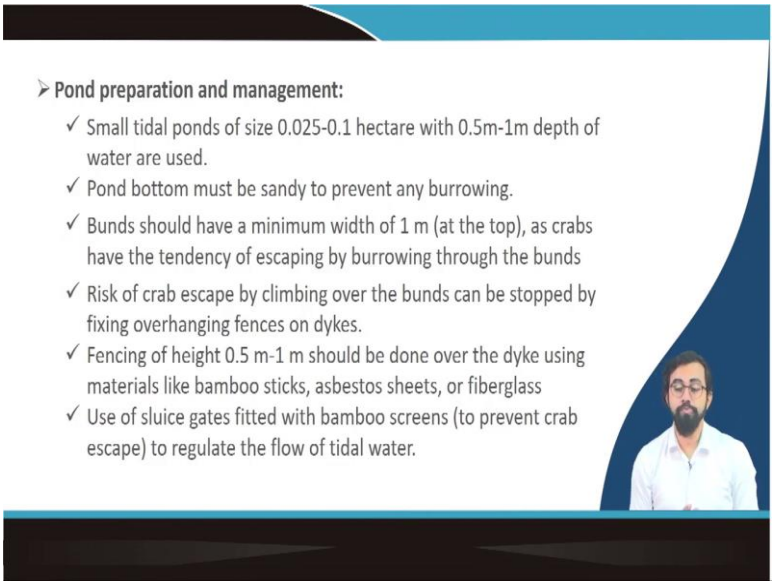

Pond preparation on the management, if we talk about the small tidal ponds of around like 0.025 to 0.1 hectare you have to choose with the 0.5 to 1-meter depth of water should be there at least. The pond bottom must be sandy to prevent any borrowing, the bunds should have a minimum width of one meter at the top and also as crabs have a tendency to escaping by borrowing through the bunds so you have to have as thick bound as possible so they cannot escape very easily.

The risk of crab escape by climbing over the bunds can be stopped by fixing the overhanging fins incline towards the pond. Fencing of height around 0.5 meter to one meter should be done over the dyke using the materials like bamboo sticks, fiberglass, asbestos sheets, etc. So, if you are rich enough go for asbestos seeds and fiberglass, definitely it is not possible for them to for your culture crab to escape from your system.

So, use of this sluice gets fitted with the bamboo screens to prevent the crab escape and to regulate the flow of tidal water, so the sluice gate when it opens at the end it touch with the bamboo screens, so the bamboo screens are always there, so moment the sluice gate will open still the bamboo screens are there, because of bamboo screens water will come in or water will go out in the drainage channel or incoming sea water but the crabs which is there in your farming it cannot escape through it.

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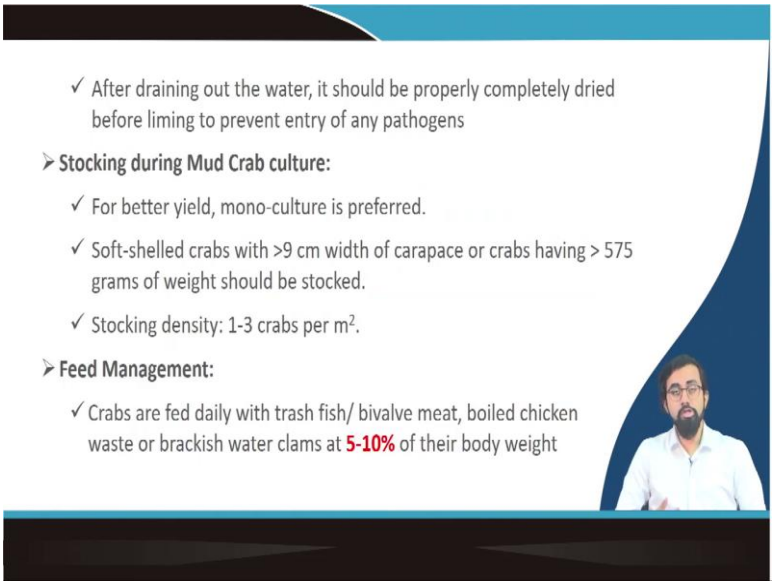

Also, after draining out the water it should be properly dried before liming to prevent the entry of any pathogen or pathogenic microorganisms and just remember for pathogens is the one like which is harmful microorganisms for that particular type of species. So, which is pathogen, the pathogenic mechanisms for us may not be pathogen for other kind of culture species alone, so it depends upon the species to species.

The stocking during the mud crab culture for better yield, monoculture is preferred in general but you can go for a poly culture as well it will give you higher return. Soft shell crab with like more than 9-centimeter width of carapace or crabs having more than 575 gram of weight should be stocked and stock intensity can be in between 1 to 3 crabs per square meter.

Well it depends upon the what type of culture if you go for cage culture it can be as high as 10 grams per square meter which will definitely increase your productivity like anything, so that is why people are started going for the cage culture nowadays for crab farming. In terms of feed management the crabs are fed daily with the trash fish or the bivalve meat, boiled chicken waste, brackish water clams at 5 to 10 percent of their body weight, so they are really non-vegetarian mostly, but they are actually okay with the vegetarians I mean the plants as

well so if you can provide them with the proper plant materials which they normally prefer to have they will definitely have it.

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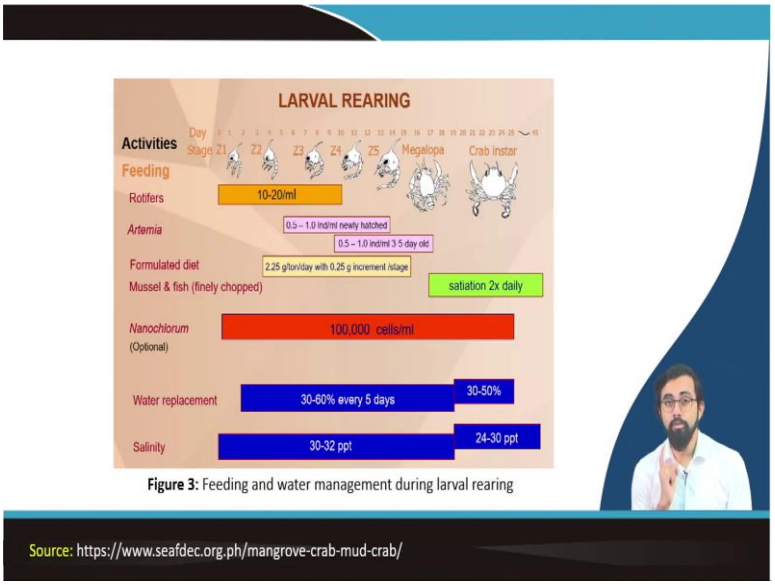

Figure 3: Feeding and water management during larval rearing

So, but make sure that it is at least 5 to 10 percent of the body weight of feed is always available for them to have for their normal growth and physical benefits. So, in general if you see the the stage of their rearing from this zoea stage from Z1 stage or we call it zoea 1, zoea 2, zoea 3, zoea 4, zoea 5 to Megalopa to crab instruct to the maturation stage.

So, all these stages at different stages their feeding habits can be different you just do not go for fishes on the very first day they cannot just have it. They can have it they can grow very easily if there is like rotifiers available; they have the artemias available at a certain stage after couple of days. This artemia seeds they can have it, these Branch shrimps and all they can have it and they can grow very fast because of this animal protein. Then you can have the formulated diet with a proper depending upon the size of the your like farming species, you can go for this nanochlorum and all you can water replacement is also important based on their maturation stage.

So, in general 30 to 60 percent every 5 days is recorded the initial days but it can be reduced down to up to 50 percent at the later stage because they do not create much of a pollutants at the end because well theoretically they should but actually the area which we normally provide them with is also very high, the volume which provide them with is also high at the later stress so because of that the volume requirement for the fresh water exchanges becomes reduced a little bit. The salientary requirement is also around 30 to 32 ppt at the max and it can be 24 to 30 ppt in the later stage as well.

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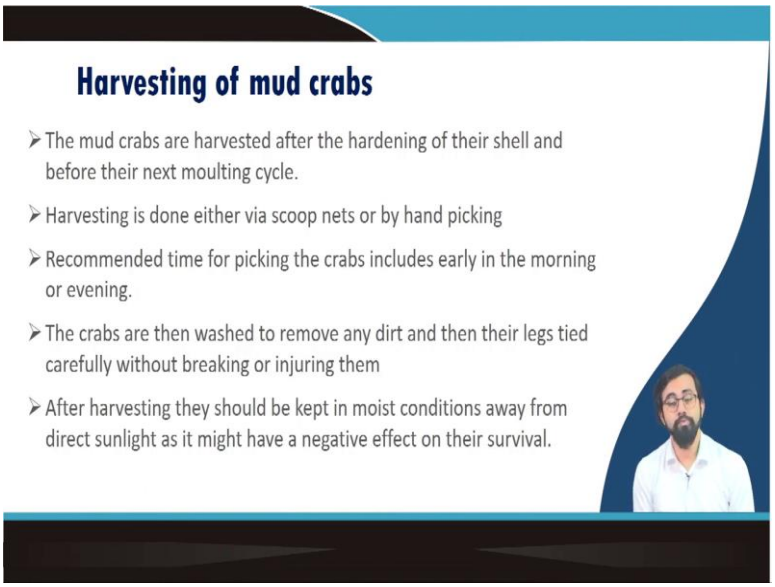

So, once everything is done the crab breaches its mature stage, how to harvest it? You need to harvest it from the system. So, there are different methods available for harvesting of mud crabs. The mud crabs are normally harvested by hardening their shell and just before their next maulting season. It is done by using the scooping nets or by simply hand picking if you have a small farm. It is recommended to pick the crabs includes like in general the early in the morning or evening where they are less active. The crabs are then washed to remove any dirt particles then their legs are tied carefully without breaking and injuring them I will show you how to tie it in later slides. After harvesting they should be kept in a moist condition away from the direct sunlight so it might have a negative effect on their survival.

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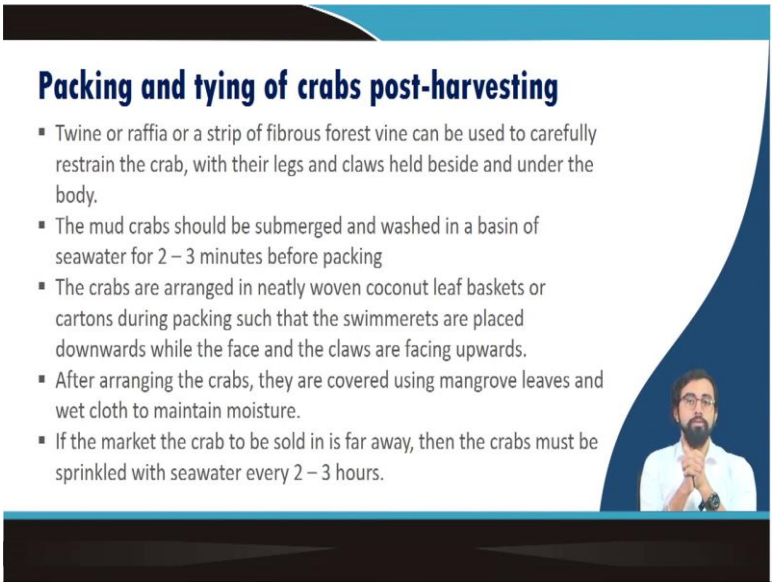

So, in general, we use the twine or raffia or a strip of fibrous forest vines used for to restrain the crab with their leg and claws held beside and under the body. The mud crabs should be submerged and washed in basin sea water for say two to three minutes before the packing. Then it is arranged, the crabs are arranged neatly in a woven coconut leaf baskets or the cartons during the packing of such that the swimmerets are placed downwards with the face and the claws are facing upwards.

So, after arranging the crabs, they are covered using the mangrove leaves and wet cloths to maintain the moisture and if you want to sold it far far away it will go for more than a week of transportation then the crabs must be sprinkled with sea water after every 2 to 3 hour or at least you have a provision to drop the sea water from the above after every 2 to three 3 or it will keep on dropping at a regular manner. So, you have to arrange that situation, arrange that mechanism or system.

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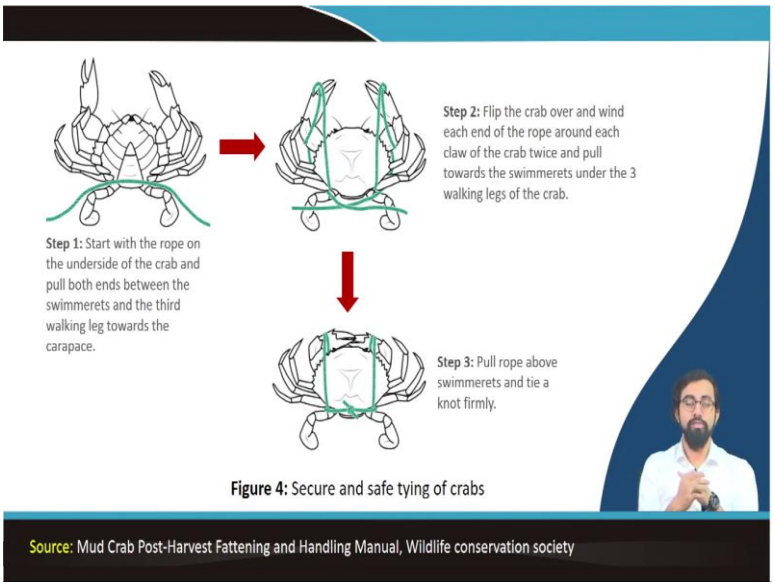

So, in general the secure and the safe tying of crabs how it is done? You see the pictures very carefully like how we tie the crabs so that it will not be having any negative impact on their livelihood, on their life during the transportation. So, we will start with the rope on the underside of the crab and we will put both of its swimmerets, both ends between the swimmeretes and the third walking leg towards the carapace.

Next, we will flip the crab over on the other side now, we will wind each end of the rope around each claw of the crab twice, one or two times both of its claws and then we will pull it towards the swimmerets under the third walking leg of the crab. Just look at the third picture now, so now we will pull the rope above the swimmerets and tie the knot firmly at the

bottom. So, by this way we normally go for the secure tying of crabs. Once the secure tying of crabs are like we tie the crabs properly then it is ready to transport very easily forl transportation purpose even for the long duration as well.

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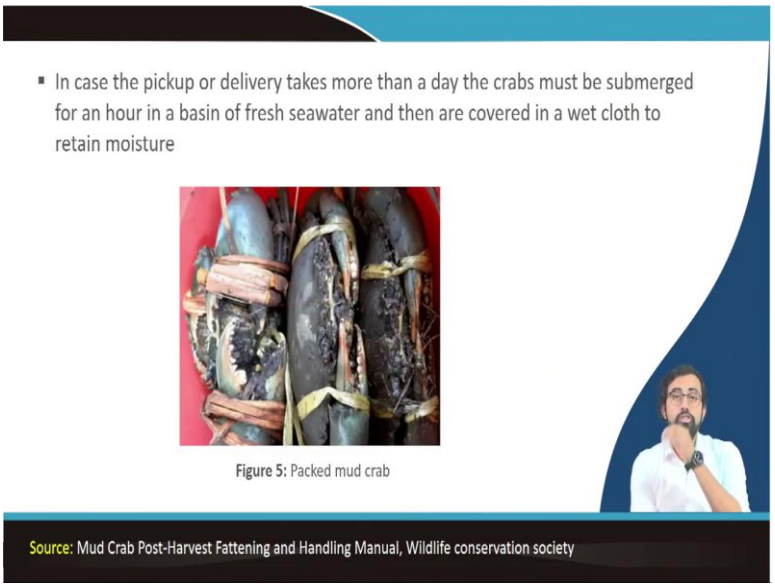

In case of pickup or delivery takes more than a day the crabs must be submerged for an hour in a basin of fresh sea water and then are covered in a wet cloth to retain the moisture. So, it looks like this if you see it clearly, so it looks like this from the picture the figure 5 that you can see the packed mud crabs how it looks like.

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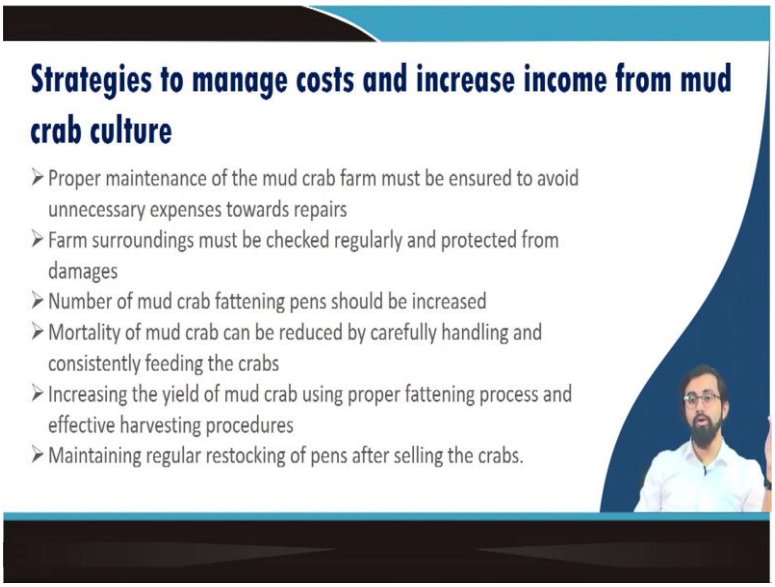

There are the strategies to manage the cost and increase the income from mud crab culture. This is very important for whoever is very much interested and maybe you are in the bachelor

stage or master stage but you are interested in future to go and becoming an entrepreneur by yourself, so you have to abide by some strategies to manage the cost for your farm.

So, proper maintenance of the mud crab farm must be ensured to avoid any unnecessary expenses towards repairs, you have to design the dykes accordingly, the pond bottom accordingly so that the type of soil that you are providing them with like it has to be proper culture system, the proper fencing, the width, the water salinity, the quality of water, all these things has to be properly maintained.

The farm surrounding must be checked very regularly and protected from the damages. Number of mud crabs fattening the pens should be increased. The mortality of the mud crab can be reduced by carefully handling and consistently feeding the crabs, you can increase the yield of mud crab using proper fattening process and effective harvesting procedures.

You can maintain the regular restocking of pens by selling the crabs. So, what you can do you can just develop a procedure in such a way so that you will have a production year wise round. Suppose you are introducing the crabs in your system and you know that after 3 months or after 4 months it will reach the maturation stage.

So, after every week you start structuring the system, so after every weeks if you start structuring the system from the beginning of the from the commencement of your farm after four months you will get the first return after, one week you will get the second return the moment you will get the first return you will replace it with the zoea crabs again. So, you will keep on getting the benefits year long because it depends upon the structure and especially in the pen culture it is doable because you do not have to worry about much of water, no water exchange, it is done automatically.

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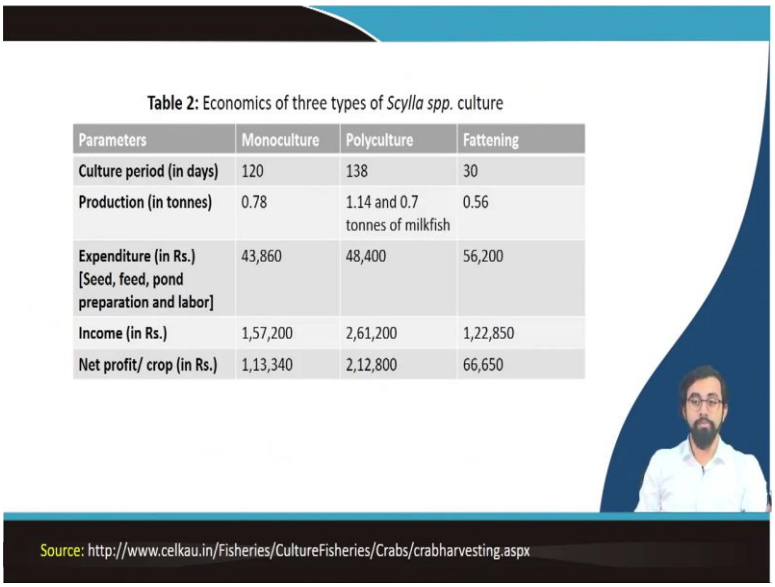

You just need to provide them with the feed if it requires and definitely it requires because you are sometimes we go for a semi-intensive or even intensive also definitely to require so you just provide them with the proper food so to have a higher higher economic benefit and that is it. In general, if you see the Scylla species there are three types of parameters that we discussed here about like the three types of cultural species culture we discuss monoculture, polyculture and the fattening.

If we go for monoculture it can go like culture period is like around 120 days, polyculture 138 days, fattening is around 30 days, the production around maximum is around in case of polyculture definitely because you are also getting some milkfish out of it in it is for this particular study but if you are gonna go for this kind of polyculture you will get a lot of benefit because utilizing the same pond, same farm you will get two or three species together.

So, why not to go for that it will definitely increase your income and it will provide you with the higher net profit as you can see from the last row, the net profit per crab it is like in rupees which is around 2,12,800. This is just a symbolic figure, this is just an example from a particular study, this is not representing the actual values I am again saying this is not representing the actual values this is just to give you an idea about why to go for this polyculture systems. If you go for this polyculture systems you can have a milkfish, you can have a prawn in the same system same unit and you can double your income.

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So, what are the constraints of mud crab farming in India, largely depends on the collection of wild seeds thus posing a threat to the wild population that is a major problem, a lack of commercial feed mills along with the absence of dedicated mud crab feed manufacture compel to the farmers to use the low-cost fresh feed.

So, in India there should be a proper crab fish crab feed manufacturing units, so you can easily imagine the demand of this kind of system, this kind of technologies in near future so you just need to find out what is the correct composition of the feed that mud crab would like to have and based on that you just make a proper arrangement and just make the feed and just make it as a business model and then you can go ahead with it.

There is a lot of future in the research and also in the entrepreneurship point of view in case of mud crab farming in India. The one of the disadvantages of low-cost fresh feed is includes it is like very fast spoilage and their need to over storage facilities and because of that it is not a good choice sometimes in it can cause a lot of harm for the local farmers and a lot of in terms of economic return.

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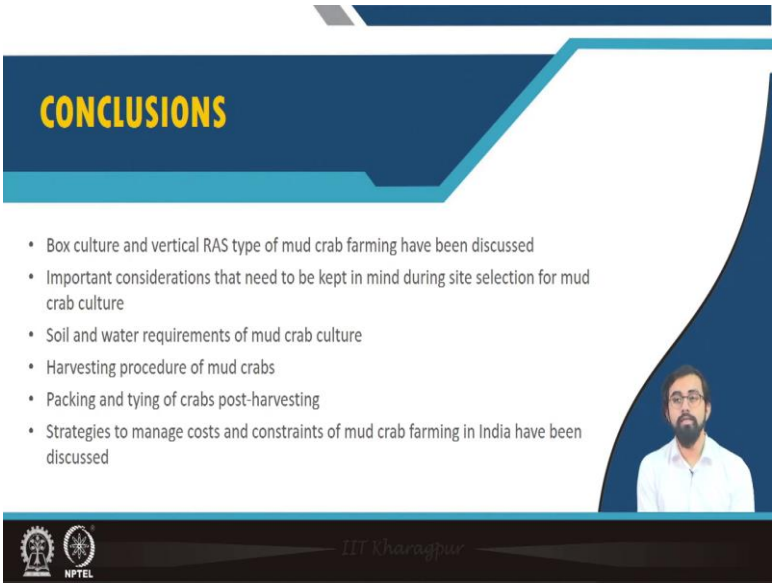

So, what we have discussed in this lecture in general we discussed about the methods like box culture and the vertical RAS systems for crab farming, we discussed about the important consideration for the site selection, soil and water requirements, what is the harvesting procedures, packing and tying of crabs after the harvesting is done, what are the strategies to manage the cost and the constraints of farming in India and what are the troubleshooting measure that we can adapt for this kind of techniques.

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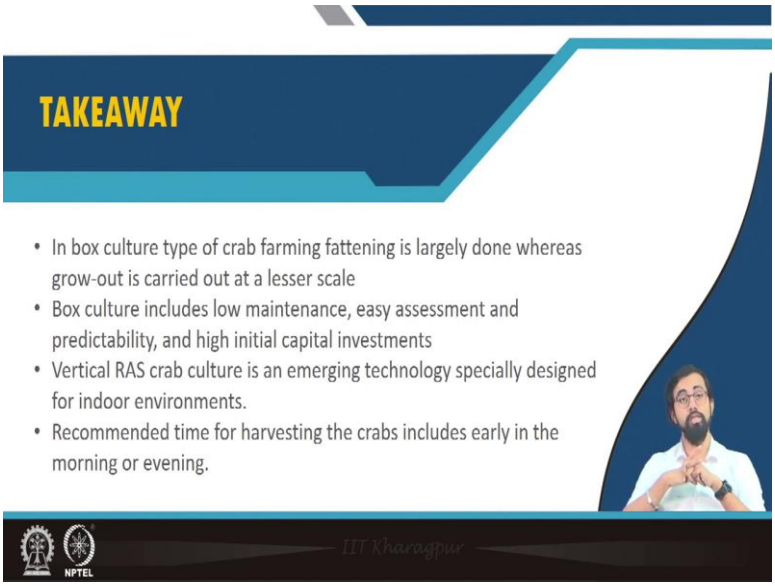

So, if you ask me what are the takeaways for today's lecture it is like the box culture methods which is a type of farming where the fattening is largely done whereas the grow out is carried out in a lesser scale. Box culture includes the low maintenance, easy assessment,

predictability and the high initial capital investment, but this high capital investment can be somehow neutralized by higher economic return as well. Vertical RAS crab culture is emerging technology specially designed for the indoor environment.

So, to increase the productivity you do not have to depend upon the oceanic environment or depend upon the coastal region. It is recommended for the harvesting of the crabs includes early in the morning or the evening and it is very important and also what are the techniques and strategies that we can go ahead in this particular field in Indian context and how to troubleshoot them.

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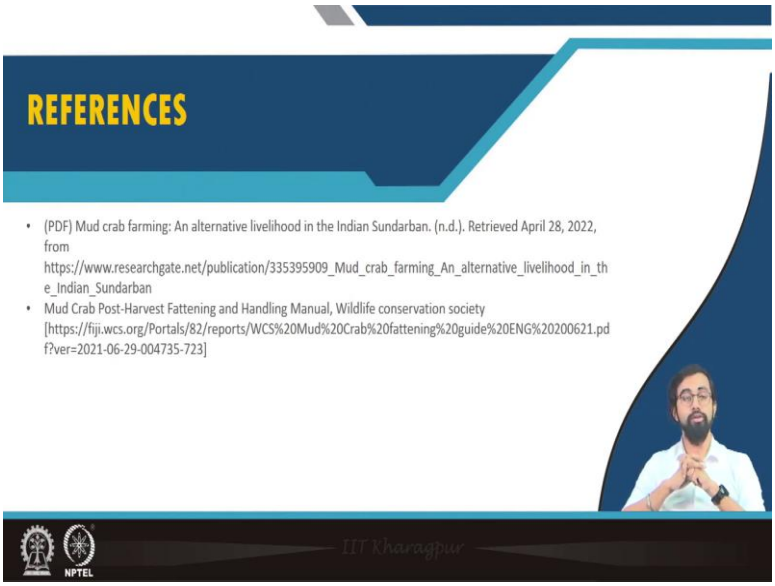

So, these are the references that it is very important literatures that you can go ahead and you can search for it and so to get some more information about it. So, that is, it for this module; see you again, thank you.