

CAGE CULTURE OF FISH



**Central Inland Fisheries
Research Institute**

BARRACKPORE, KOLKATA 700 120
WEST BENGAL

Cage culture of fish

(A Handbook)

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Bull No. 132 • May 2004

Central Inland Fisheries Research Institute

(Indian Council of Agricultural Research)

Barrackpore – 700 120

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ISSN 0970-616X

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Produced at : **The Project Monitoring & Documentation Section**
CIFRI, Barrackpore

Published by: **The Director**
Central Inland Fisheries Research Institute
Barrackpore, Kolkata - 700 120

Printed at : **Classic Printers**
93, Dakshindary Road, Kolkata - 700 048

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The genesis of this handbook begins while ten fishermen with two boats surfaced the underwater cruel fact of their daily life despite their hard toil.....



Ooh! Such a meagre catch!



So much dense macrophyte! How will we catch fish?



Yes, Yes. Macrophyte is the main culprit. So much of hard labour but so little catch! Again, Fisheries Department has imposed ban on fishing from May till July. What will we do in those 3 months?

It seems we have to starve with all our family members. Oh God! Help us. Is there no solution to our problem? Is there nobody to help us?



See, some scientists of CIFRI are coming. Let us ask them if they can be of any help to us.



Sir, Would you listen to our problems and suggest us something, so that we do not die of starvation.



Oh, sure. We are here to hear you. First tell us what all your problems are.

Sir, we have several problems. First, we are getting very little catch despite our hard labour, as the fishes hide below thick mat of aquatic weeds. Besides, there seems to be very poor stock of fishes. Second, Government has declared closed season from May to July and we will become almost jobless and just have to starve with our family members.





Well, I understand your problems but you can very well overcome them. You see, this region is blessed with high rainfall and large amount of water cover, particularly *beels* (wetlands), even then fish production is highly irregular and pitiable. There are several causes of your pathetic condition; otherwise wetlands of Assam could prove to be a golden goose, provided you manage them. These beels need regular stocking because they are no more naturally stocked. If you do so, surely you will get more fish.

Sir, we are afraid that we will not get back the stocked fish as you know during flood our beel becomes an open system and looks one sheet of water making the escape of fishes very easy. So, fishes can escape. Fishes also hide inside weed and we are unable to catch them again. Also, you know, many carnivores are there to make a good meal out of the small stocked fry.



Yes, to avoid this, you stock with bigger sized (8-10 cm) advanced fingerlings. You can grow advanced fingerling in secured captivity through pen or cage culture and then release them in the beel. And, if you are really worried about their retrieval from weed-infested beel, you can also grow them up to table size in the same cage itself. Floating cage is best suited to these types of beels, which can sustain flood and ensure full retrieval. In addition, during closed season, you all can be busy with cage culture. In this manner you will get more fish and employment round the year.



Cage culture of fishes! What is it, sir?



Cage culture of fish is nothing but rearing of fish in an enclosure, which permits water exchange and waste removal into the surrounding water. It is closed on all sides and bottom. Here you can grow fish, as you desire.

Can we adopt the technique in our beel?

Certainly yes! It is applicable to all water bodies including non-drainable, non-seinable and flood-prone, otherwise not suitable for aquaculture.



Well! Sir, in what way cage culture is advantageous?



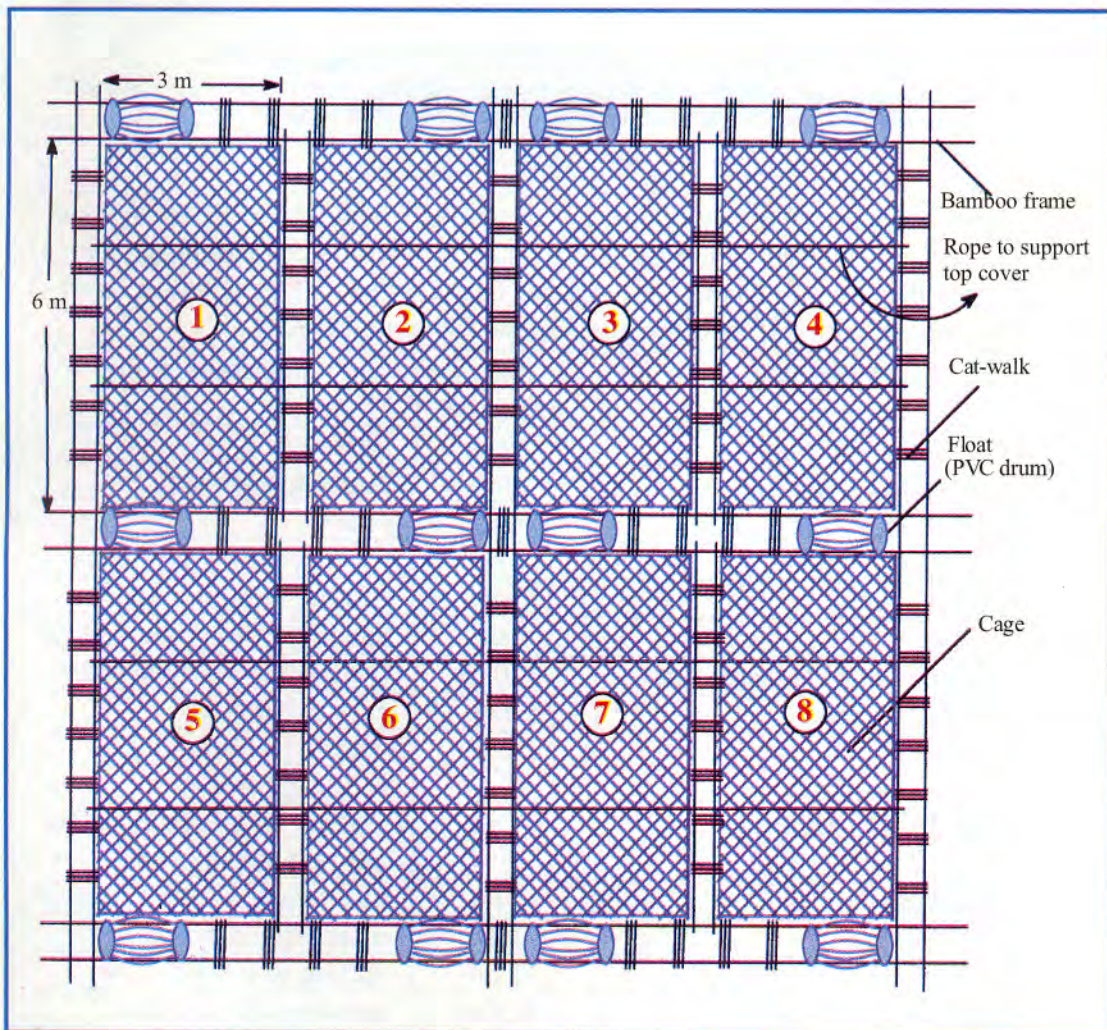
There are many advantages of cage culture, like (1) it is under your own control ensuring maximum retrieval of reared fishes, (2) easy monitoring, (3) no predation from predatory fishes, birds or reptiles and thereby less mortality, (4) less competition i.e. more survival, (5) high stocking density i.e. high yield of fish, (6) less requirement of manpower and so, more profit, and (7) efficient use of feed.



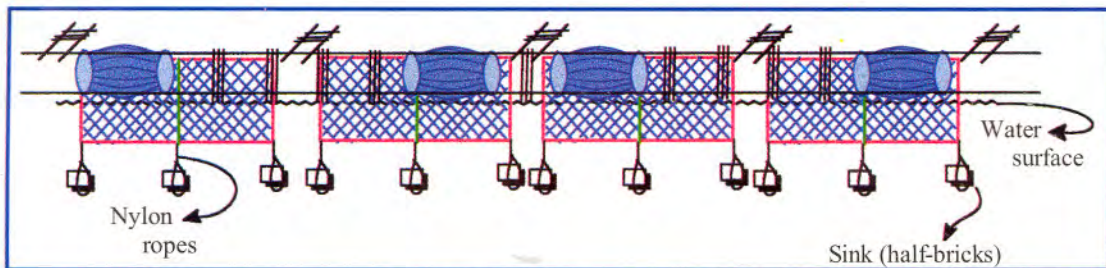
Very good! But sir, we don't know anything about cage culture. How to start and how to proceed? This is something very strange and new, at the same time it's interesting too.



Well, first thing is site selection, then fabrication of cage and finally rearing of fish. Make a floating frame using bamboo. Few nylon net cages are then hanged from this frame in water. Then, fishes are stocked inside those cages. Look at the following design to get an idea.



A birds eye view of a battery of cages



Design of cages (side view)



It's very good, sir. Please tell about the materials required and how to fabricate this cage?



This is very simple and you can make it yourselves. All the materials are available in local market or neighbouring areas. The basic raw materials and tools required to construct the floating frame are bamboo, floats (used PVC or metallic drums) and some nut and bolts. Details are given in the following table -

	Materials	Nos. required	Required for
1.	Floats (PVC drums)	12 nos.	float
2.	Bamboo (~14 m/9 m)	15/30 nos.	frame & walk-way
3.	Nut-bolt (5 / 6 / 7)	60 nos.	joints
4.	Coir rope	7 kg	holding walk-way steps
5.	Nails (2)	32 nos.	making bottom frame
6.	Bricks	16 nos.	hanging from bottom frame
7.	Iron wire (10 m for each float)	120 m	tying floats with top frame
8.	Saw cutter frame	1 nos.	cutting bamboo
9.	Saw blade	2 nos.	cutting bamboo
10.	Bamboo chopper	1 no	splitting bamboo
11.	Hand drilling machine	1 no	making hole in bamboo for nut-bolt attachment
12.	Measuring tape	1 no	measuring bamboo, rope etc.
13.	Hammer	1 no	inserting nut-bolt etc.
14.	Cutting pliers	1 no	cutting iron wire
15.	Coal tar	0.5 kg	painting all iron parts
16.	Small sign boards (tin made)	8 nos.	marking individual cages

Oh! That's good. You have rightly said that all things are available here. Sir, there are several varieties of bamboos available in our locality. Which one should we choose?





Yes, there are various types of bamboos available in your area. The variety, which is durable and strong but lightweight, is best suited for the frame e.g. *Bhaluka* variety will be the right choice.

Well, Sir. Now tell us how to make the frame?

Before making frame, we have to decide about the shape and size of the cage.



Which shape and size will be suitable for our beel?



Frame can be rectangular, square or circular in shape. You can choose any shape, as beel is almost a static water body except during rainy season when little flow and wave action is seen. Small sized cages are easier to manage than the large ones. From our experience, we can tell you that you can go for 6 m x 3 m x 1.5 m or 6 m x 6 m x 1.5 m size cages. They can be made as a single unit or a battery of several units.

Sir, what would you suggest for making it float on water surface?



Well, you can use empty drums to keep the frame afloat. Twelve numbers of floats are sufficient to hold the bamboo frame for hanging a battery of 8 cages of 6 m x 3 m x 1.5 m size.



All right! Can you tell us about the fabrication of cage in a simple and step-by-step manner so that we can proceed easily?

Oh! Sure. Suppose we are planning to prepare a battery of 8 cages of 6 m x 3 m x 1.5 m size as shown in the previous design.



From the design, it appears that the total length of each side of the frame measures around 14 m. That means the bamboos have to be joined end to end because bamboos available here are generally 10-11 m in length.



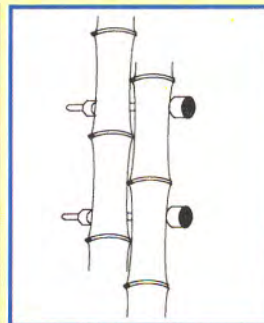
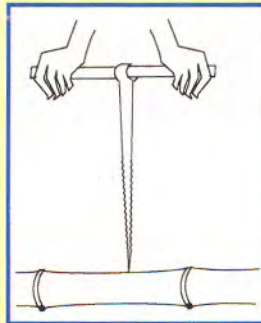
Yes, you are right. But, in some areas in Assam, you can get even more than 14-15 m long bamboo and need not to be joined. But, in case of 10-11 m long bamboo, take approximately 9 m length from the base and remove the weak, narrow tip portion of bamboo. Later, join them end to end by iron nail. Now, you please note down the following steps.

- Arrange 12 floats (empty PVC drums) longitudinally ~3 m apart in 3 rows having 4 floats in a row on a vacant field of ~150 sq m area near the bank of the water body.

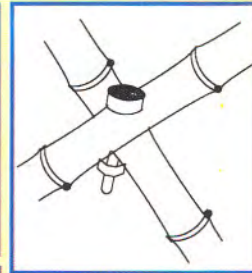
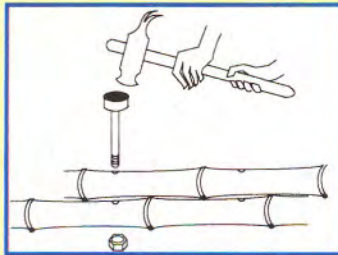


- Now place 13 m long bamboo poles in parallel manner, 15 apart over the drum and tie them temporarily with coir rope.
- Place another 3 pairs of same size bamboo with same gap of 1'5 transversely above the previously laid bamboos, keeping a distance of 6 m to make a square shaped frame.

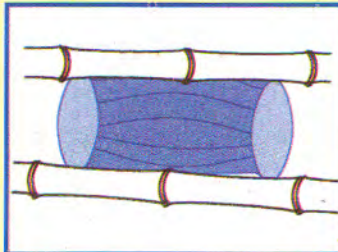
- Mark the position of bamboo to be drilled for joining. Try to join proximal end (base) of one bamboo with distal end of the other. Drill bamboos, arrange them one upon another and join with nut and bolt.



- Corner joints and Middle joints will appear as shown in figure.



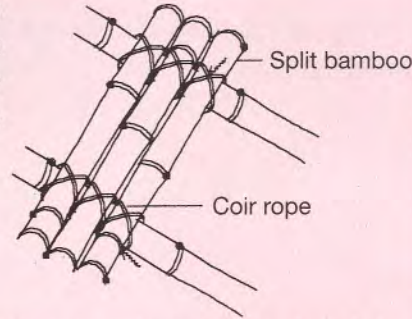
- Bamboos are placed above the float in such a manner that they tightly hold the float in the gap (as shown in the picture).



- The floats in the four corners are placed just interior to the side arms of the frame.



Now, make walkways using half-split bamboos tied with coir rope across the frame as shown.



Walk-way made of split bamboo tied with coir rope

Very nice! Sir, now tell us which should be the suitable place in our beel for that frame to be installed.



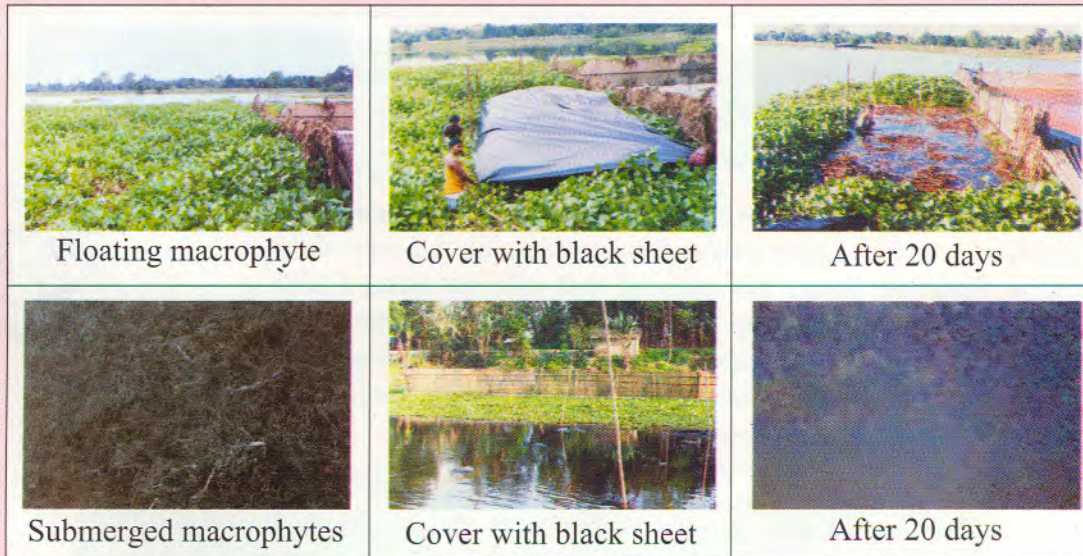
Yes, this is very important aspect. The site should have a (1) depth of at least 2-3 m, (2) good supply of oxygen, (3) least prone to winds and waves, (4) easy accessibility from land, (5) less anthropogenic pressure, (6) away from macrophyte-choked area to avoid high fluctuation in oxygen level.



But, our beel is mostly covered with macrophyte. That means little area is available for cage culture.



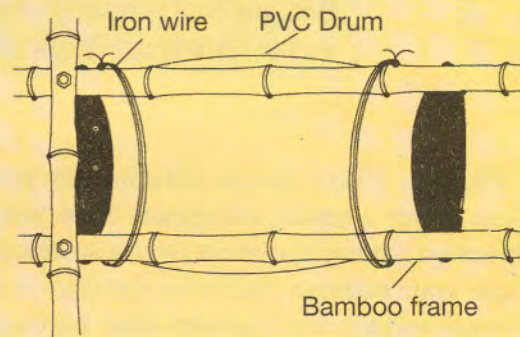
Yes. There is a very simple solution for your problem. Buy a black polythene sheet that can cover a space little more than your cage area. Before initiating your cage construction, spread the sheet over a selected area choked with macrophyte, so that by the time your bamboo frame for the cage is ready, the macrophyte will die as seen in the picture and the site becomes clear for cage installation.



Excellent sir. What an idea! So far, we have thoroughly understood the steps of frame construction and site selection. Now, we would be able to do it ourselves. Well, sir, once the frame is ready, what should we do next?



- Well, having done this part of the work, you will now have to install the cage in water. Gently drag the frame into water. On the ground, floats act as wheel and facilitate movement while dragging.
- After dragging the frame into water, floats are tightly fastened with bamboo frame using iron wire as seen in the figure.
- Hang half bricks with the loops present in cage bottom. This will give perfect rectangular shape of the cage and help to maintain upright posture. During monitoring or harvesting, untie those bricks from the cage.



Okay, one question, sir. When cage can be tied simply with four bamboo poles in water, what is the need of costly PVC float, bamboo frame etc?

In weed-infested beels, weeds especially water hyacinth grow very fast which can give tremendous pressure on the cage without frame. Bamboo frame can prevent that side pressure. Floating frame is necessary not only for easy monitoring and harvesting; it can overcome frequent change in water level throughout the year as observed in the beels of Assam. Again, during summer, you can easily drag your cages in deeper zone.



Well, sir, till now you have talked only about fabrication of frame, but where to rear the fishes?



Exactly, so far, we have only talked about frame construction and site selection! Now, look at the following list of items, which will be required to fabricate the cage where you can rear your fish.

	Materials	Nos. required	Required for
1	Nylon net (50 m x 1.37 m as available in the market)	6 rolls (good quality) 3 rolls (cheaper priced)	Body of the Cage Cover of the Cage
2	Nylon thread	1 roll	Cage stitching
3	Nylon ribbon (1.5_), made of fresh plastic beads	7 kg	Border stitching in cage fabrication
4	Parachute cord (popularly known as <i>Don</i> thread)	1 kg	Tying cages with top frame and also to support top cover
5	Nylon rope	1 kg	Tying cages with bricks at bottom

Sir, may I know, why have you mentioned about two types of rope?

You should not use nylon rope for tying the cages with frame. Because, the nylon ropes become weak and brittle very soon when constantly exposed to sun and rain but they last long under water. On the other hand, *don* thread does not get easily withered in the sun, lasts long; so, they can be used above water.



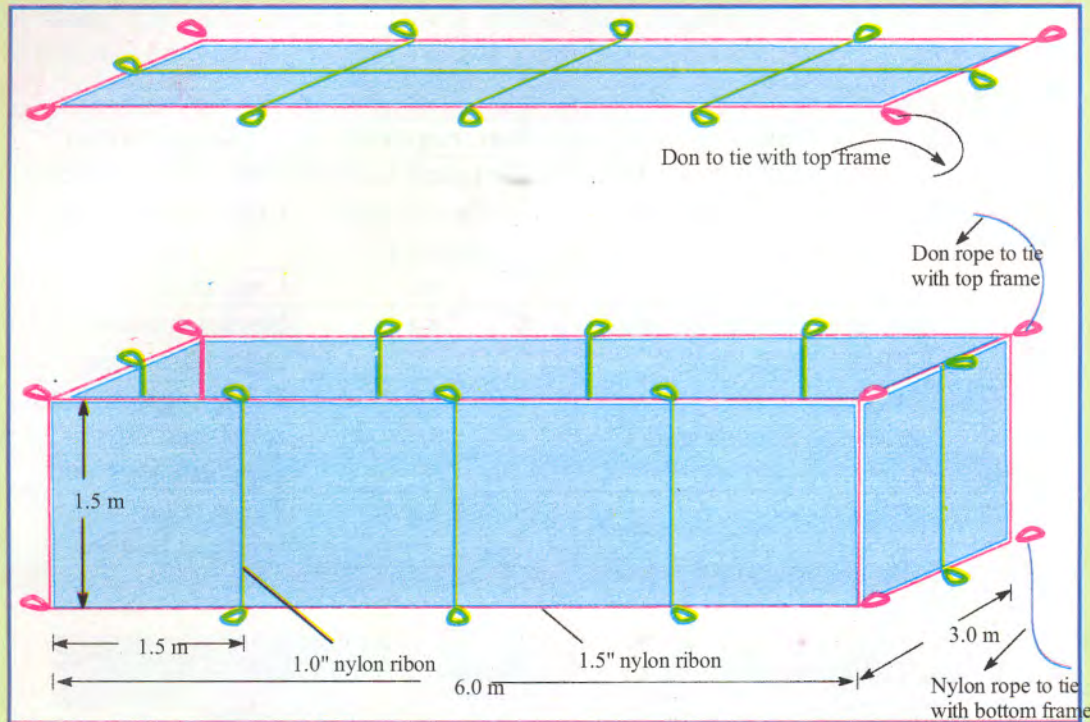
What should be the mesh size of the net?

You see, this will depend upon the rearing size of fish. If it is fry to fingerling, then select 1 mm mesh size and for fingerling to table size, you can go for bigger mesh size i.e. 1-1.5 cm. Buy good quality fishing net and other items as mentioned in the above box.

What would be the fabrication design of the cage?



Generally nets are available in a roll of 50 m having a width of 1.37 m. For a dimension of 6 x 3 x 1.5 m size cage, first cut 9 m long pieces, then join them laterally and use 1" wide ribbon at the joints and try to give the shape as shown in the picture. Use 1.5" wide ribbon at the corner joints. Bigger mesh or cheaper priced net may be used as top cover.



Sir, now tell us how to stitch the cages?

- Stitch the cages with the help of a tailor. Give loops at every corner of the cage as shown in above design for fastening it with top and bottom frame. Make a cover with cheaper nets.



- Look at the full view of a cage, ready to be installed in bamboo frame.





Sir, is there any other point to be taken care of?



Yes. Take care of following things before installation -

- Carry all the cages on the main frame floated near shore.
- In beels with wind, wave and flow, you have to give a rectangular split bamboo frame at bottom as seen in the picture.
- Drag the cage to the pre-determined site.
- Hang the cages one by one with parachute chord (*don*) tied with loops present at the cage top from the bamboo frame. This will help in easy lifting of the cage for monitoring, in addition to giving perfect shape to the cage.
- Tie half-bricks to the loops at cage bottom and release the cages slowly along with bricks (bottom frames with bricks, if necessary) in water.
- Anchor the cage with bamboo poles.
- The cage is now ready for fish stocking. But, stock after a week as periphyton growth on cage wall prevents scratching of young fish's tender body, otherwise fishes may die due to infection in the scars inflicted from rough surface of the net.
- It has been observed that the young fishes generally congregate at the corner of the cages and get rubbed. Hang a bundle of hydrilla in every corner of the cage. This will keep the young fishes busy in nibbling the tiny tender leaves of hydrilla and thus protect them from getting rubbed against cage wall



Sir, what are the species we should rear in cages?

Yes. This is a good question. You can go for IMC (catla, mrigal, rohu), bata, gonius, calbasu in addition to grass carp, common carp, Java punti etc. In addition, you can try some other fishes like kawai, shingi, magur and even freshwater prawn, provided their seeds are available in your area.





What should be the size of fish for stocking?



We have fabricated the cage with fine mesh net; so, fry (size 1 cm – 1.5 cm.) can be stocked and reared up to advanced fingerling stage (10-15 cm).

Sir, can fishes be stocked at any season and time of the day?

Yes, you can stock fish at any season if seeds are available. But, it's better to avoid peak winter season when water temperature is very low. Small fishes are unable to withstand the transportation and handling stress at low temperature. Morning is the best time for stocking, as temperature is quite favourable and chances of mortality are less.



What should be the stocking density of fish?

In such cages, you can rear fish with very high stocking density ranging between 30-50 fry per cubic meter since you are providing improvised supplementary feed. The area of the cage described here is 18 square meter (6 m x 3 m). Therefore, the stocking density estimated to be 550-900 fry per cage.

Sir, in this high stocking density, whether natural food available in beel is sufficient or we have to provide food from outside?



That is a very important aspect in post-stocking management. To make cage culture a profitable venture we have to resort to very high stocking density, and you know, generally, in such beel with dense macrophyte, natural food of fishes (plankton) is scanty. As a result, fishes reared in cages receive no or little natural food. Therefore, it is advisable to supplement with as much possible nutritionally balanced diet in sufficient quantity.



Sir, can you explain us about feeding of fishes with simple example, so that fishes get nutritionally rich diet in sufficient quantity?



Yes, why not. It's better if you can afford highly nutritive balanced formulated feed, but it may not be available here. In such situation, you can utilize the agricultural by-products like rice polish and mustard oil cake, which is cheaper and locally available. To improvise its food value, you can fortify with some essential nutrients like vitamins, minerals, amino acids and some probiotics, which are readily available in the market. This will make your food little costlier, but it will help in enhancing fish growth.



Sir, what do you mean by improvisation and what would be the cost?



Well, to achieve faster growth and healthy fish, we should add certain very essential food components to the traditional rice polish and oil cake mixture. You need not to worry about them. They are available in any veterinary medicine shop. As you are adding these essential components, it is better to use a binder like wheat flour to prevent their leaching loss. For your easy understanding, you can follow the chart given below to prepare 10 kg of feed –

	Materials	Nos./amount	Unit price (Rs./kg)	Approx. cost (Rs.)
1.	Rice polish	4.700 kg	5.00	23.50
2.	Mustard oil cake	4.700 kg	7.00	32.90
3.	Wheat flour (<i>moida</i>)	0.500 kg	11.00	5.50
4.	Vitamins + Minerals (premix)	0.020 kg	130.00	2.60
5.	Probiotics	0.015 kg	170.00	2.55
6.	Hen egg (for amino acids)	2 pc (70g)	2.00	4.00
	Total			71.05
	Cost per kg			7.10

Sir, should we directly feed the fish with the above mixture or some processing is required?





Yes, it is better if you process the mixture like cooking, pelleting etc. This will make the feed more digestible and prevent nutrient loss. Follow the steps given below to prepare the improvised supplementary feed with above-mentioned ingredients and quantity:

1. Grind mustard oil cake (MOC) to make fine powder, or soak it in 2 litre water overnight in a bucket.
2. Boil 3 litre water in a bowl.
3. Pour 500 g *moida* in the boiling water and dissolve it thoroughly by continuous stirring with a bamboo stick.
4. Add powdered/soaked MOC followed by rice polish (RP) with continuous stirring, make dough, remove from heat and allow to cool to 70°C (tolerable to your finger).
5. In a separate small bowl, heat 1 litre water to 70°C and add contents of two raw eggs by breaking and stir for 2 mins. Remove the bowl from heat, and then add vitamin-mineral premix followed by probiotics, when the mixture cools down.
6. Add mixture number 5 to previously cooked mixture of MOC, RP and *moida* and mix thoroughly.
7. Make pellets with hand pelletizer or make small balls.
8. Sun dry the pellets/balls before packing in polythene bags and store in dry and cool place before use.



Feed ball preparation



When and how much feed should we give to the fishes?



- Well, it is better to use two feeding trays being hanged from two opposite corners of the cage for feeding purpose.
- Feed the fishes @ 4% of body weight or work out the ration level by observing their consumption 1 hr after giving the feed.
- Calculate the ration level and feed half of the total daily ration in the morning (~ 8 O' clock) and rest half in the afternoon (~ 4 O' clock) when oxygen levels are high. Distribute each times' ration into two trays being hanged in each cage.
- Avoid over-feeding, otherwise this may lead to wastage of feed and money, and will also deteriorate water quality leading to stress and disease.
- Under-feeding will reduce growth-rate.
- Initially, fishes may be shy to feed, but within 2-3 days, they would adjust to feeding.
- Do not feed your newly stocked fish for first 2 days as they are



Feeding tray



After stocking, what should be our daily routine for cage maintenances?



- First prepare a few record-keeping charts for feeding, mortality, arvesting etc. as shown below for your day-to-day recording of the cage culture.

Feeding chart of Cage culture in beel

Date of start.....

Average wt on (date) Average wt on..... (date)
 Catla..... Catla.....
 Rohu..... Rohu.....
 Mrigal..... Mrigal.....

Sl. No.	Date	Cage 1	Cage 2	Cage 3	Cage 4	Cage 5	Cage 6	Cage 7	Cage 8	Comment
1
...

- Similarly, you can prepare mortality chart to keep records of fish deaths and harvesting charts to know your returns.

Mortality table of Cage culture in beel

Date of start.....

Sl. No.	Date	Cage 1	Cage 2	Cage 3	Cage 4	Cage 5	Cage 6	Cage 7	Cage 8	Comment
1
...

Harvesting table of Cage culture in beel

Date of start.....

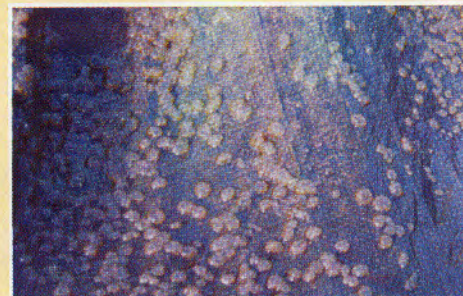
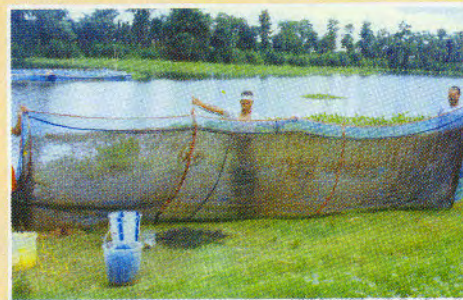
Date of harvest.....

	Number stocked				Number harvested				Comment
	Catla	Rohu	Mrigal	Catla	Rohu	Mrigal	
Cage 1
Cage



Some important management tips are given below as a daily routine for cage culture.

- Check whether fishes are finishing food within 1 hr, it is an indication of their good health.
- Reduce or stop feeding until fishes respond actively to feed.
- Catch few fishes every 15 days to monitor their growth by weighing in a top-pan balance and subsequently adjust the ration.
- Place the broader side of the cage-wall facing wind direction to facilitate better water exchange.
- Close any opening between cage and cover with plastic-coated wires, which can be easily opened during monitoring and harvesting.
- In the event of reduction in water level, drag the cage frame to a deeper place where at least 30-50 cm gap between cage bottom and beel bottom is available.
- Choking of cage wall due to bio-fouling caused by the growth of attached algae can prevent water exchange. To avoid this, 4-5 common carp can be stocked in each cage to graze on interior wall of the cage.
- If the problem persists, then exchange the cage sequentially every 2 weeks with a new cage for sun-drying the fouled cages in the sun and after drying, rub one portion of the cage with other portion by hand to remove the fouling material.
- The exterior of the cage may be scrapped with the help of a coir-made broom.
- Remove floating dead fishes, if any, immediately from the cage.



Bio-fouling

When should we harvest the fishes from cages?





- This will depend upon your choice of whether the harvest is for stocking in the beel or for selling in market as table fish.
- For stocking in the beel, fishes will grow to advanced fingerlings size within 2 months and ideal for stocking in your beel.
- But, for table size fish production, rear them for additional 2-3 months.
- You can have an idea of fish growth in cages demonstrated in Samaguri beel, Nagaon, Assam during July-September from the following table.



Growth monitoring of fishes

Fish Species	Initial length (cm)	Length (cm) after 61 days	Length (cm) after 112 days	Initial weight (g)	Weight (g) after 61 days	Weight (g) after 112 days
<i>C. catla</i>	2.5 ± 0.5	10.1 ± 0.9	12.7 ± 2.1	0.3 ± 0.1	12.7 ± 3.8	31.6 ± 17.3
<i>L. rohita</i>	2.7 ± 0.5	11.0 ± 0.7	16.6 ± 1.0	0.3 ± 0.1	16.0 ± 3.1	59.7 ± 9.0
<i>C. mrigala</i>	3.0 ± 0.4	13.4 ± 1.7	20.2 ± 1.0	0.3 ± 0.1	27.8 ± 10.3	89.0 ± 11.0
<i>L. calbasu</i>	3.0 ± 0.4	12.2 ± 0.8	16.0 ± 0.1	0.3 ± 0.1	23.2 ± 5.1	54.8 ± 6.5
<i>L. gonius</i>	3.0 ± 0.4	13.0 ± 0.7	19.3 ± 2.1	0.3 ± 0.1	26.7 ± 9.5	92.5 ± 26.0



It appears that except for catla, all fishes are performing well in cages. Isn't it, sir?



- Yes, you are right. Growth of fish in cages depends on many factors like species, stocking density, fish size at stocking, culture period, cage size, water quality, feeds used etc. However, minor carps and detritivores like, mrigal, gonius, reba, bata, calbasu etc are growing well in cages.
- Catla didn't grow well because of their feeding habit. They couldn't eat properly from the feeding tray. The anatomy of their mouth is unsuitable for collecting food from feeding tray. Besides, their natural foods, particularly zooplankton were very poor inside cages. As a result, they suffered from malnutrition and growth was affected. We have observed many catla specimens with bent tail (lordosis), a symptom of malnourishment. To avoid this, catla has to be fed with floating pellets or by broadcasting the feed mixture.

Well, sir. Now please tell us, how to harvest the fish from cages.



- For harvesting, start lifting the cage from three corners, thereby accumulating the fishes to the fourth corner of the cage.
- Remove the fishes with beg mesh scoop net, keep them in a plastic bucket, count and release in the beel.



Sir, now please tell us about the expenditure involved with this cage culture?



Well, the expenditure can be divided into three sub-heads for your easy understanding viz. frame construction, cage fabrication, fish seed stocking and their rearing. See the following tables for details:



	Materials	Nos./amount	Unit price (Rs.)	Approx. cost (Rs.)
A. Detail expenditure for frame making				
1.	Floats (PVC drums)	12 nos.	500.00	6000.00
2.	Bamboo (15 m each)	15 nos.	50.00	750.00
3.	Nut-bolt (5_/6_/7_)	60 nos. (8 kg)	35.00	280.00
4.	Coir rope	7 kg	35.00	245.00
5.	Nails (2_)	32 nos. (150 g)	35.00	5.00
6.	Half bricks	32 nos.	~ 1.00	30.00
7.	Iron wire (10 m for each cage)	3.0 kg	40.00	120.00
8.	Saw cutter frame	1 nos.	25.00	25.00
9.	Saw blade	2 nos.	10.00	20.00
10.	Bamboo chopper	1 no	30.00	30.00
11.	Hand-drilling machine	1 no	20.00	20.00
12.	Measuring tape (3 m)	1 no	10.00	10.00
13.	Hammer	1 no	30.00	30.00
14.	Cutting pliers	1 no	30.00	30.00
15.	Coal tar	0.5 kg	10.00	5.00
16.	Labour charges	10 nos.	70.00	700.00
Sub-total (A)				8300.00
B. Expenditure for cage fabrication:				
17.	Nylon net (50 m x 1.37 m)	6 rolls 3 rolls (for cover)	375.00 210.00	2,880.00
18.	Nylon thread	1 roll	40.00	40.00
19.	Nylon ribbon (1.0_ & 1.5_) Prepared from fresh plastic beads	5 kg	85.00	425.00
20.	Parachute cord (<i>Don</i>)	1 kg	200.00	200.00
21.	Nylon rope	1 kg	70.00	70.00
22.	Stitching charges	8 cages	250.00	1800.00
Sub-total (B)				5,415.00
C. Fish seed, feed and harvest:				
23.	Feeding tray (burnt clay)	16 nos.	2.50	40.00
24.	Scoop net for harvesting	1 nos.	30.00	30.00
25.	Weighing balance (500 g capacity)	1 nos.	350.00	350.00
26.	Thermometer	1 nos.	35.00	35.00
27.	Miscellaneous	-	100.00	100.00
27.	Seed (fry for stocking)	5000 nos	140.00	700.00
28.	Improvised feed (home made)	40 kg	7.00	280.00
29.	Maintenance charges	-	-	200.00
Sub-total (C)				
Grand total (A + B + C)				15,450.00

Well, sir. The cost appears to be quite reasonable. But, sir, in the total expenditure, the major amount goes towards PVC float. Is there any means to reduce the cost towards float?



Yes, you can try by making bundle of small pieces of bamboo. But, their durability needs to be tested.



After spending so much of money, how much can we get as return?



Well, the advanced fingerlings will be ready after 2 months of rearing. The sales proceed of these fingerlings from first crop equals only 60% of the investment. However, in the subsequent crops, in addition to recovery of your investment, there will be earning as well. The economics of the whole operation is given below:

		Year					
a	Sale of fingerlings (per cycle)	1st	2nd	3rd	4th	5th	6th
	5000 X 75% @ Rs. 2.50 per no.	18750	28125	28125	28125	28125	28125
b	Sale of table fish (100 to 300 gm)						
	5000 X 70% @ Rs. 5.0 per no.	17500	17500	17500	17500	17500	17500
	Total income	36250	45625	45625	45625	45625	45625
	Net Benefit	18160	40625	31026	40125	29569	32975

What will be the total benefit for 2 years out of these 8 cages?

Total benefit from 2 years (total 8 crops)

It will be around Rs. 18160.00 + Rs. 40,625.00 = Rs. 58,785.00



But, sir, as you know, we are poor fishers. Where from will we get this initial investment of about Rs. 16,000/-?



For that you can try for a loan from any bank like a Commercial Bank or a Gramin Bank. Submit your cage culture project plan to any bank in the format as given in next few pages, because, the project is financially viable.

MODEL SCHEME FOR SEED REARING IN CAGES

ECONOMICS OF CAGE CULTURE - CASH FLOW ANALYSIS

Assumptions

1. No. of cycles - 2 cycles for seed production (2 months each) and one cycle of table fish production (5 months) in first year. During subsequent years, 3 cycles of seed production and one cycle of table fish production.
2. Life of assets - 5 years for floats and 2 years for all other items.
3. Escalation of cost of assets at the rate of 10% on every replacement.
4. Benefits calculated at the same rate throughout the project.
5. Survival rate for advanced fingerlings is 75 % and for table fish is 70 %.
6. Stocking density for fingerlings and fish is 5000 per unit (~ @ 300,000 per hectare).

Sr. No	Particulars	Unit cost/ value	Year					
			1st	2nd	3rd	4th	5th	6th
I	Costs							
	1. Capital Costs							
1.	Floats (PVC drums)	6000	6000					6600
2.	Bamboo (15 m each)	750	750		825		908	
3.	Nut & Bolt (5"/ 6"/ 7")	280	280		308		339	
4.	Coir rope	245	245		270		296	
5.	Nails (2")	5	5		7		8	
6.	Half bricks	30	30		33		33	
7.	Iron wire (10 m for each cage)	120	120		132		145	
8.	Saw cutter frame	25	25		28		31	
9.	Saw blade	20	20		22		24	
10.	Bamboo chopper	30	30		33		36	
11.	Hand drilling machine	20	20		22		24	
12.	Measuring tape	10	10		11		12	
13.	Hammer	30	30		33		36	
14.	Cutting pliers	30	30		33		36	
15.	Coal tar	5	5		6		7	
16.	Labour charges	700	700		770		847	
17.	Nylon net (50 m X 1.37 m)	2880	2880		3168		3485	
18.	Nylon thread	40	40		44		49	
19.	Nylon ribbon (1.5")	425	425		468		514	
20.	Parachute cord (<i>Don</i>)	200	200		220		242	
21.	Nylon rope	70	70		77		85	
22.	Stitching charges	1800	1800		1980		2178	
23.	Feeding tray (burnt clay make)	40	40		44		48	
24.	Scoop net (for harvesting)	30	30		33		36	
25.	Weighing balance	350	350		385		424	
26.	Thermometer	20	20		22		24	
27.	Miscellaneous	100	100		110		121	
	Sub Total		14270	0	9100	0	10006	6600
	2. Recurring costs							
1.	Seed (fry for stocking)	700	2100	2800	3080	3080	3388	3388
2.	Improvised feed	Rs 7 / kg	960	1280	1408	1408	1549	1549
	a) For fingerlings @ 40 kg per crop		560	840	924	924	1016	1016
	b) For table fish @ 80 kg per crop		560	560	616	616	678	678
	Total		1120	1400	1540	1540	1694	1694
3.	Maintenance charges	Rs. 200/ crop	600	800	880	880	968	968
	Sub Total		3820	5000	5500	5500	6050	6050
	Total Costs		18090	5000	14600	5500	16056	12650

II. Benefits

		Year					
		1st	2nd	3rd	4th	5th	6th
a	Sale of fingerlings (per cycle)						
	5000 X 75% @ Rs. 2.50 per no.	18750	28125	28125	28125	28125	28125
b	Sale of table fish (100 to 300 gm)						
	5000 X 70% @ Rs. 5.0 per no.	17500	17500	17500	17500	17500	17500
	Total benefit	36250	45625	45625	45625	45625	45625
	Net Benefit	18160	40625	31026	40125	29569	32975

Discount Factor	0.15
Net Present Value (NPV) of Costs	45707
Net Present Value (NPV) of Benefits	164515
Benefit Cost Ratio (BCR)	3.6
Internal Rate of Return (IRR)	More than 50

The benefit cost ratio indicates that the scheme is productive and is financially viable.

Net Surplus from project (Bankability)

	Year			
	1st	2nd	3rd	4th
Gross benefit	36250	45625	45625	45625
Capital/ Rec cost of next year	5000	14600	5500	16056
Gross surplus	31250	31026	40125	29569
Loan installment	5844	5345	4845	4345
Net surplus	25406	25681	35280	25224
DSCR	5.35	5.80	8.28	6.80

Loan Repayment Schedule

Year	Loan amt	Prin. inst	Prin. o/s	Interest	Total Rep
1	15380	3845	15380	1999.40	5844
2		3845	11535	1499.55	5345
3		3845	7690	999.70	4845
4		3845	3845	499.85	4345
TOTAL	15380	15380		4998.5	20378.5

Great, excellent sir, we can start our cage culture right from the time when IMC seeds are available during April. That means we can take 3 crops of advanced fingerlings every 2 months till September. With this method, we can earn sufficient profit after recovering our investment. After that, as you said, we can grow table size fish by rearing them for a longer period. But, sir, can we do it in the same cage?

Yes, you have rightly understood the production system. You can earn additional profit in the same year by rearing table size fish in little modified cage of bigger mesh size (1 cm) to facilitate waste removal.



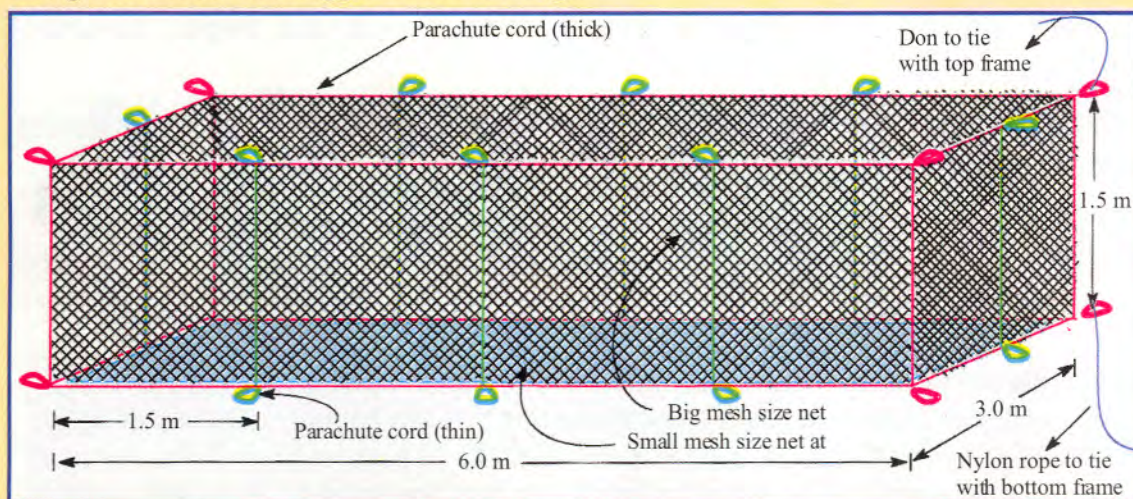
Sir, approximately how much additional investment will be required in case of new set of cage fabrication?

Yes. In the previous design, for each cage, replace fine mesh net cage-walls with bigger nets, which costs around Rs. 22/- per sq m. For a new set of 8 modified cages, total expenditure will be approximately around Rs. 8,152/-.

Details of expenditure of big-mesh net cage fabrication

	Materials	Quantity	Unit price	Cost
1.	Nylon net (50 m X 1.37 m)	3 rolls (good quality) 3 rolls (cheaper quality)	3 0 00 210.00	680 00
2.	Nylon net (big mesh 1 cm)	216 sq m	22.00	4752.00
3.	Nylon thread	1 roll	40.00	40.00
4.	Nylon ribbon (1.5") for bottom	2 kg	85.00	170.00
5.	Nylon ribbon (1.0") for top cover	2 kg	85.00	170.00
6.	Nylon rope	2 kg	70.00	140.00
7.	Parachute chord (<i>don</i>)	2 kg	200.00	400.00
8.	Stitching charges	8 cages	100.00	800.00
Sub-total (B)				8152.00

Design of a modified bigger-mesh net cage



Sidewalls made of big mesh net facilitate better water exchange. On the other hand, cage-bottom made of fine mesh net helps in accumulation of unconsumed food, which in course of time turns into detritus for further consumption by bottom feeders like mrigal, calbasu to grow better. Previously made cover can be used in this cage.



Sir, can you give us the addresses of the shops where from we can get all the required materials?



Materials like nut-bolt, iron wire, nylon rope, nails etc. you can get from any hardware shop of your locality and rest of the material you can purchase from the following shops -

PVC float	<ul style="list-style-type: none"> • Shree Vijay Hardwares, Mahabir Market, Paltan Bazar, Solapara Rd. Opp. Capital Towers, Guwahati-1. Phone – 2603788. • Dipak Banik, C/o Hardware Stores, S. S. Rd., Lakhtokia, Guwahati – 1. Phone – 2520766. • Mahesh Hardwares, Haibargaon, Nagaon, Assam – 782007, Phone – 234554.
Nylon net	<ul style="list-style-type: none"> • Sonu Stores, 43-A, New Market, Fancy Bazar, Guwahati-1, Phone – 2633578. • Kothari Brothers, Haibargaon, Nagaon, Assam –782007, Nagaon, Phone – 231926.
Big mesh net & parachute cord	<ul style="list-style-type: none"> • M/s Guwahati Fishing Nets, Fancy Bazar, Guwahati – 1; Phone – 0361-2606369. • Siraj net shop, Nagaon, Assam, Phone – 03672-236637.
Nylon ribbon & stitching thread	<ul style="list-style-type: none"> • Tirpal House, Jail Road, Fancy Bazar, Guwahati – 1, Phone – 2545168. • Tirpal Enterprises, Jail Road, fancy Bazar, Guwahati –1, Phone – 2544334.
Vit.mineral premix & probiotics	<ul style="list-style-type: none"> • M/s Kay & Kay Enterprises, Tarun Ram Phukan Rd (Opp. Pani Tanki), Machkhowa, Guwahati – 9.
Tailor for Cage stitching	<ul style="list-style-type: none"> • Qayyum Khan, Ganesh Market, Ganesh Guri, Dispur, Guwahati – 6. • Nikhil Biswas, Samaguri Market, Samaguri, Nagaon, Assam.



Sir, you have successfully demonstrated rearing of fingerlings through pen culture in some beels. Which one is better among pen and cage culture?



Pen culture has some limitations, like it is site-specific (marginal) and stationary, so, unable to overcome water level fluctuation and can be done only in particular seasons. On the other hand, cage is mobile and can be practiced round the year; it's monitoring and retrieval is very easy; it can bear the brunt of flood and can be dragged to new location in case of bad water quality; it's harvesting requires no gear and a very few labour. So, in many ways, cage culture is advantageous.

Sir, as we know fish grows better if the space is more. Then, why eight cages instead of one, two or four big cages?



Yes, you can, but it is difficult to manage bigger sized cage.



After discussing with you, we can see a silver lining in our uncertain profession and hope that, if we adopt cage culture, we would be benefited and relieved of our worries.

Yes, we are confident of that. However, cage culture was tried earlier in other parts of India, but not adopted by people due to involvement of heavy expenditure. While demonstrating cage culture in many beels of Assam, we have used locally available bamboo and feed, which are cheap, thereby, making the whole operation economically viable. Good survival, growth and retrieval give you the guarantee of profit.



That's right, your words have enormously inspired us and given us sufficient confidence to start cage culture.



If so, why to delay? Get into the job immediately. Hope for the best. In case of any problem at any step, don't hesitate to contact us. We would always extend our best possible help. Our address is:

**The Officer-in-charge
Northeastern Regional Centre
Central Inland Fisheries Research Institute (ICAR),
Housefed Complex, Beltala Basistha Road, Dispur,
Guwahati – 781006. Phone & Fax – 0361-2228486/2224893.
E-mail: nerccifri@sancharnet.in**



Thank you, all.

We have learnt a lot. Thank you, sir.





Cage culture demonstration in Samaguri beel, Nagaon



Frame construction



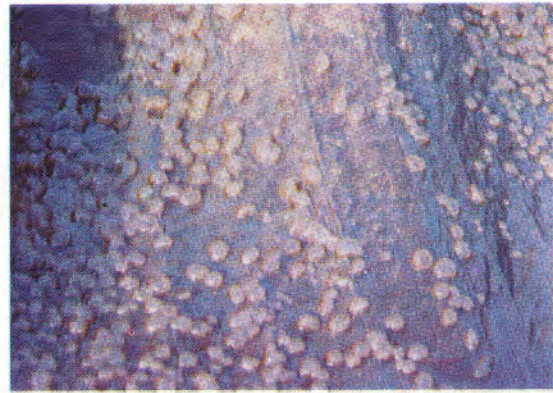
Frame installation



Full view of a cage



Close view of a battery of cages



Bio-fouling in cage wall



Harvesting from a cage



Harvested fish