# HEALTHY ENVIRONMENT - HEALTHY SHRIMPS

*(A guide to small-scale shrimp farming)*


A publication of the Aquaculture Foundation of India,
Neelankarai, Chennal, 600 041.
Sponsored by the Netherlands Government & the Bay of Bengal
Programme for Fisheries Management, Chennai, 600 018

BOBP For Fisheries Management
BAY OF BENGAL PROGRAMME

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## Foreword

Shrimp culture in India has gone through drastic ups and downs. The boom of the early 1990s was almost followed by a bust a few years later. Diseases broke out, and shrimp farmers incurred losses. Shrimp farmers were charged with destroying mangroves, fouling agricultural crops, polluting drinking water, degrading the land and soil, creating unemployment. The Supreme Court on 11 December, 1996, ordered the demolition of all shrimp farms with in the Coastal Regulation Zone.

The Court later stayed this order. The Government of India proposes to introduce an aquaculture bill in Parliament to ensure healthy and sustainable development of the shrimp culture industry in harmony with the environment and the public interest.

The history of shrimp culture dramatises the need for knowledge and awareness of the do's and don'ts of shrimp culture practices, particularly among small-scale shrimp farmers and extensionists. Manuals exist on the subject, but they are too technical and abstruse. What is badly needed is a simple pictorial booklet that is easy and even enjoyable to read. Needless to say, it should be in local languages.

This comic book produced by the Aquaculture Foundation of India (AFI) with collaboration from the BOBP meets such a need. It is well-researched, presented imaginatively, in story form, and is attractively illustrated. There is even technical data for those who are interested, but I believe that the essence of shrimp culture can be grasped and followed even without it. What makes the comic book particularly valuable is that it is being published in Telugu and Bengali.

The BOBP mobilized funding from the Netherlands Government for an experimental project on shrimp culture by the AFT, and supported the printing of this comic book. Sincere thanks are due to Mr. Rene Verduijin, who served as Resource Economist (APO) of the BOBP for two years. He contacted the Dutch Embassy in New Delhi and obtained its support for the AFT project. We are especially grateful in this connection to Mr. J.W. Van Beek of the Netherlands Embassy in New Delhi, for his strong support to the endeavour.

Sustainable shrimp culture cannot be achieved overnight. It is a process, and we are very happy to have encouraged it and participated in it. We are also pleased to be associated with the production of this comic book.

Kee-Chai CHONG
Programme Coordinator
Bay of Bengal Programme

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## Introduction

In India about 1.3 lakh of brackish water areas are under culture, with an annual production of 80,000 tonnes of shrimps. By and large, this production comes from the small-scale sector, especially from the States of Andhra Pradesh, West Bengal and Kerala. Though shrimp farming has a great potential for high productivity on a sustainable basis, it is beset with problems. Farmers suffer heavy losses due to disease outbreaks and lack of proper management. Improved farming practices are therefore necessary.

Realising the gravity of the situation, the Royal Netherlands Government readily came forward with a grant to the Aquaculture Foundation of India (AFT) to survey existing shrimp culture practices in West Bengal and Andhra Pradesh, suggest measures to improve them and describe them in a comic book in regional languages for easy understanding by farmers. In this task, the AFT has worked in close collaboration with the FAO/UN's Bay of Bengal Programme (BOBP) in Chennai; the Departments of Fisheries of West Bengal and Andhra Pradesh; the Ramakrishna Ashram Krishi Vigyan Kendra, Nimprith, an NGO in West Bengal; and leading shrimp farmers of the respective States. The AFI is thankful to them for their unstinted cooperation. The AFT is deeply indebted to the Royal Netherlands Government for its generous grant that made this useful project possible. The AFT is also thankful to the FAO and BOBP for technical inputs, and for funding the printing of the cOmic book.

The script for the comic book took into account the suggestions and comments of Tndia's Aquaculture Authourity. The AFT is specially thankful to Dr.Y.S. Yadava, Fisheries Development Commissioner, Government of Tndia; Dr.G.R.M. Rao, Director, CIBA and his team of scientists; and Shri.V. Venkatesan, Director, MPEDA for their help. The tabulated information given in this book is drawn from *Prawn Farming Manual,* Water Base, New Delhi, 1994; *Grow Prawn Grow Richer,* Sampath Kumar *1995;* and *A Manual on Shrimp Farming,* MPEDA, Kochi, 1996.

The AFT thanks Ms.Kamala Chandrakant for visualising and writing the script for the comic book, and Ms.Lalitha Thyagarajan for her evocative illustrations. Both of them patiently and painstakingly modified their draft several times to incorporate the comments offered from time to time before the comic book was finalised. The involvement of Drs. S. Ramamurthy and K.Alagaraaja of AFT in training the State fisheries officials by undertaking field visits, providing the base material and sharing their expertise is greatly appreciated.

We hope that the comic book in the regional languages proves useful to small-scale farmers in their efforts to raise a sustainable shrimp crop.

Place Chennai
Date 01.01.2000

(Dr. M. SAKTHTVEL)
President

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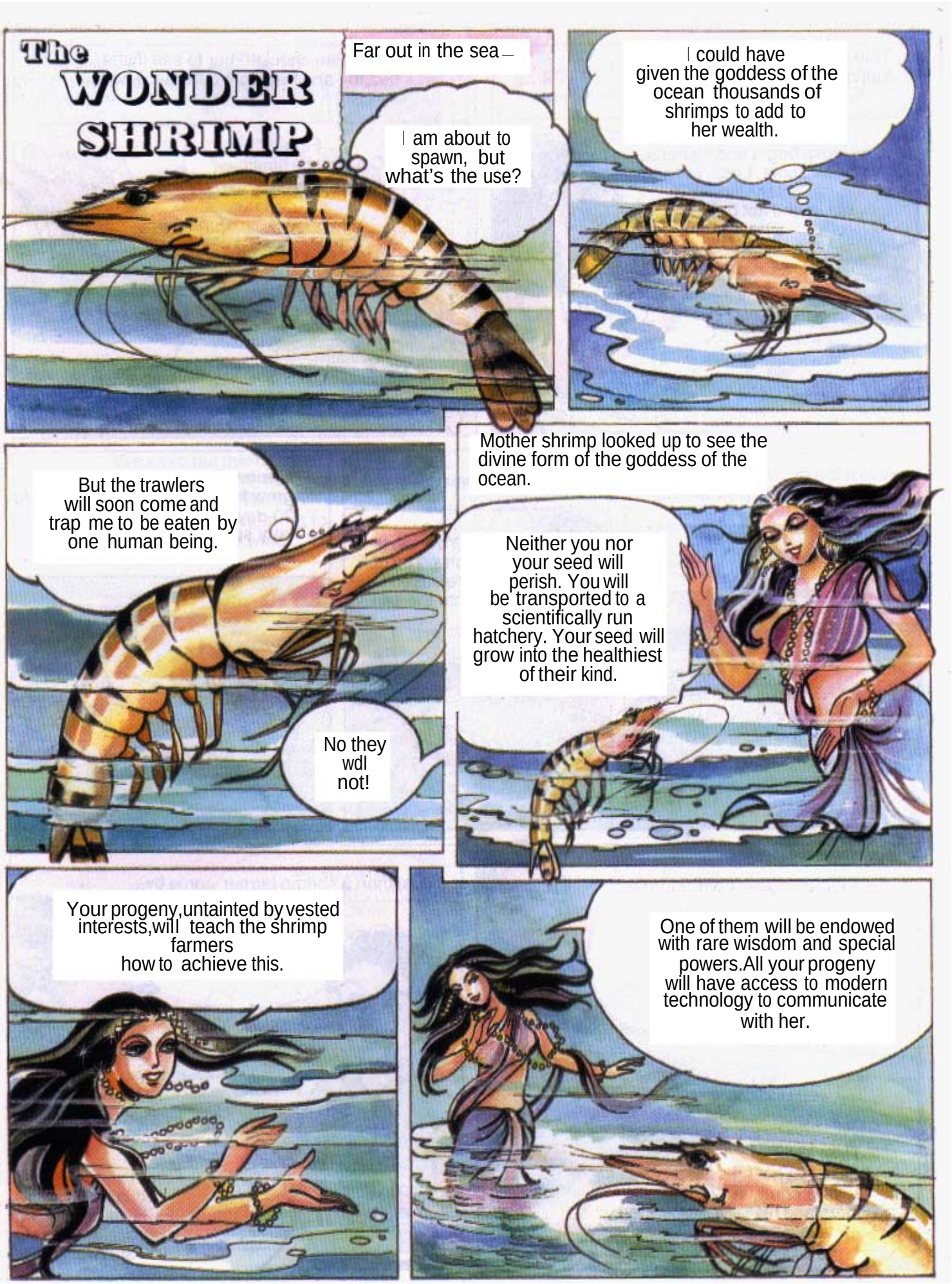
The WONDER SHRIMP
Far out in the sea—
I am about to spawn, but what's the use?
I could have given the goddess of the ocean thousands of shrimps to add to her wealth.
Mother shrimp looked up to see the divine form of the goddess of the ocean.
But the trawlers will soon come and trap me to be eaten by one human being.
No they wdl not!
Neither you nor your seed will perish. You will be transported to a scientifically run hatchery. Your seed will grow into the healthiest of their kind.
Your progeny,untainted by vested interests,will teach the shrimp farmers how to achieve this.
One of them will be endowed with rare wisdom and special powers.All your progeny will have access to modern technology to communicate with her.



<<

True enough Mother Shrimp found herself in a hatchery.

She looks bright and lustrous. No black spots. Legs, tail and antennae clean and not broken.

The technician checked her to see if she was healthy and, free from disease. Then—

Fine! Couldn't be healthier. Extends herself fully.

At last the great night came and Mother Shrimp spawned.

After the spawning—

Your job is done. You can be released back into the sea.

Meanwhile her seed grew from barely visible specks to 20-day-old PLs under very very special care.

The hatchery owner was pleased.

They are now ready for sale. This year the price is fairly good, I hear. Good for us.

Hey! I can hear what he says. I can understand his talk.

Just then a shrimp farmer came by.

Well how's this batch?

Fine! I've put it through the PCR test. No disease and 90% survival.



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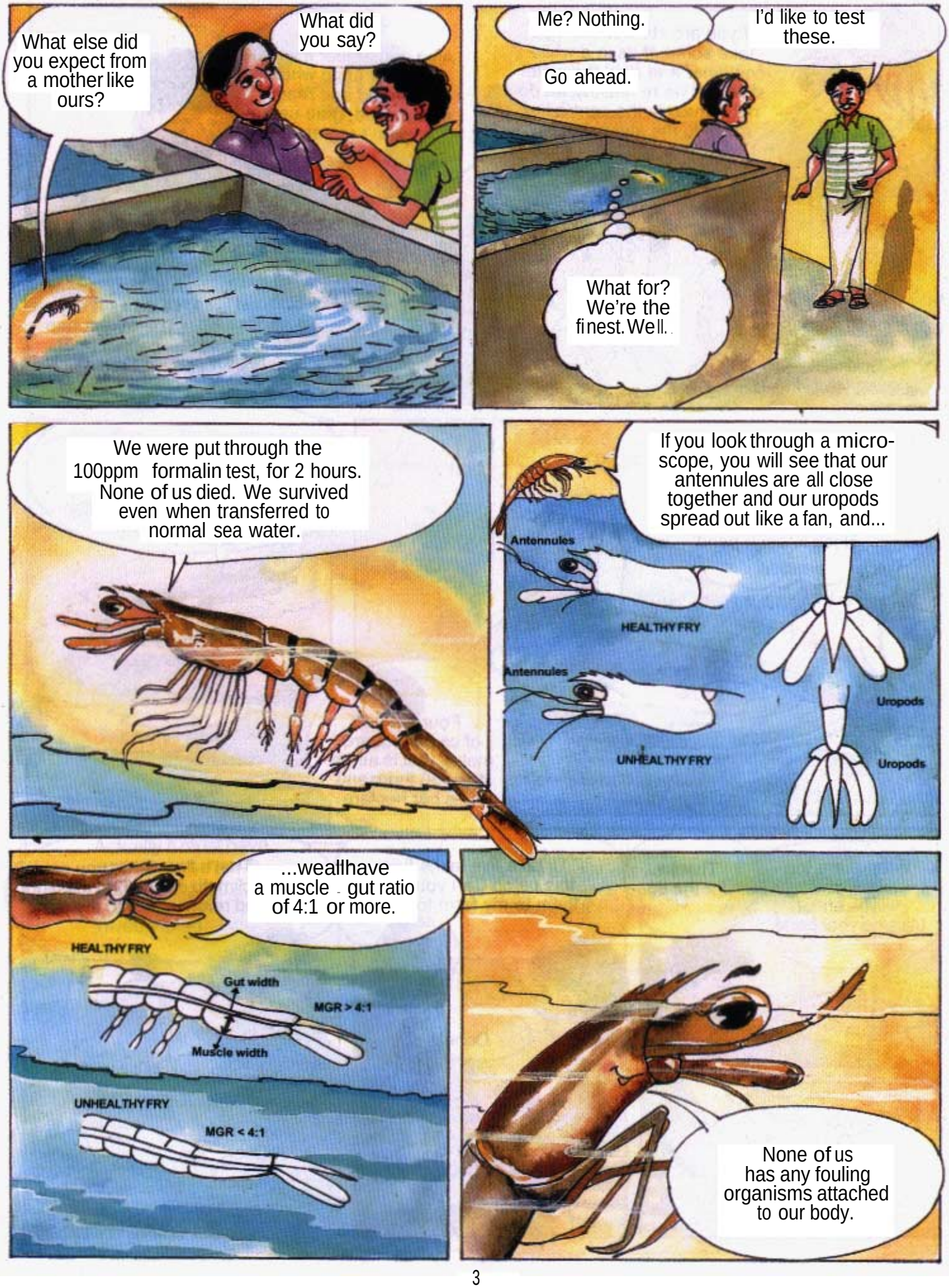
What else did you expect from a mother like ours?
What did you say?
Me? Nothing.
I'd like to test these.
Go ahead.
What for? We're the finest. Well..
We were put through the 100ppm formalin test, for 2 hours. None of us died. We survived even when transferred to normal sea water.
If you look through a microscope, you will see that our antennules are all close together and our uropods spread out like a fan, and...
Antennules
HEALTHY FRY
Antennules
Uropods
UNHEALTHY FRY
Uropods
...weallhave a muscle - gut ratio of 4:1 or more.
HEALTHY FRY
Gut width
MGR > 4:1
Muscle width
UNHEALTHY FRY
MGR < 4:1
None of us has any fouling organisms attached to our body.



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If you are still not satisfied! take some of us in a white container and swirl the water slowly. If we're healthy, we do not remain in the centre but move to the sides against current.
Also, remember, if we are active, jump when disturbed and readily accept feed, grab us. You won't regret it.
Well, well, well! A talking shrimp. I'll do as it says. The other chap cannot hear it Iguess.
The farmer did as he was told.
Perfect responses. I wonder how many I should stock in each pond!
Don't overcrowd us. If there are too many of us, it will affect our health and growth.
Four to five of us per square metre, that is about 40 to 50 thousand of us per hectare.
If there are too few, you will be under-utilising your pond.
Thanks, for the tip.
I'll take five lakhs from this batch. Can you send them to my farm tonight?
Done!
That's fine. Then you can acclimatize us during the night and release us into the pond before dawn.

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Acclimatize?
Yes. There will be a difference in the salinity, temperature and pH of your pond water and the water we're packed in.
If you release us into the pond just like that, most of us will die of shock and stress.
Oh! I see.
By the way, are you a new farmer?
Yes. But my pond site, size and soil condition are perfect.
I looked into a manual and did everything exactly as it said.
Didn't it say anything about acclimatizing us?
Actually it must have escaped my notice.
Never mind. From now on I'll be on the spot to guide you.
What's more, a shrimp will know best about what's good and what's bad for growing shrimps, won't she?
That's true. I'll be off now. Thanks for everything.



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A little later, as the hatchery owner was on his way back to the nursery tank—
TRING! TRING!
Oh! The phone!
Hello! Hello! Who is it?
Never mind who. Hope you remember the rules for packing seeds in polythene bags for transport.
Two thousand per 5 litres of water in one bag. And don't forget to oxygenate the water. It'll help the seeds to survive the journey better.
Oh, really? Hello! Hello!
She's disconnected. Who could that smart aleck have been ? As if I don't know my job! Humph!
Soon—
At night—
Oh ! The seeds have arrived.



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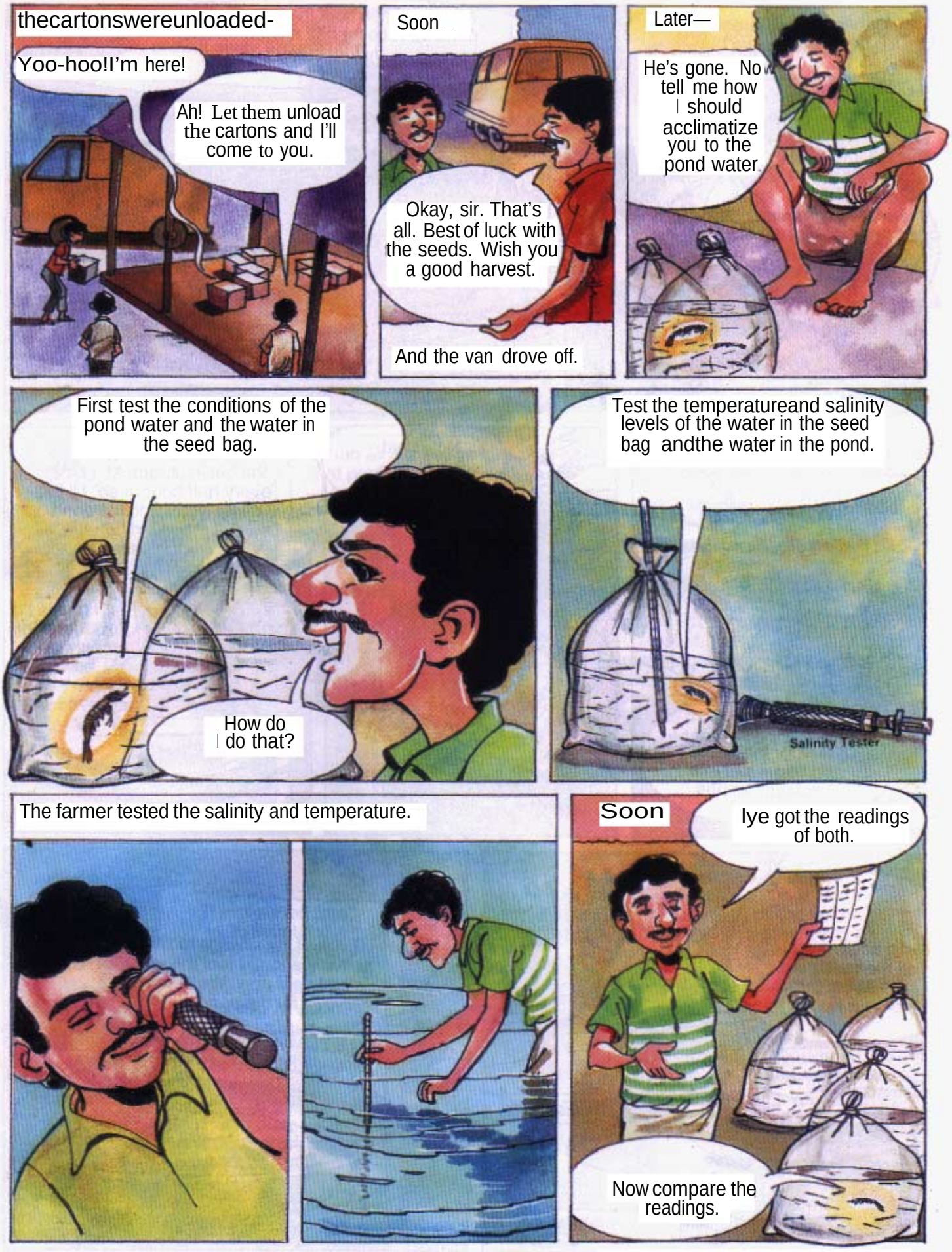
thecartonswereunloaded-
Yoo-hoo!I'm here!
Ah! Let them unload the cartons and I'll come to you.
Soon –
Okay, sir. That's all. Best of luck with the seeds. Wish you a good harvest.
And the van drove off.
Later—
He's gone. Now I tell me how I should acclimatize you to the pond water.
First test the conditions of the pond water and the water in the seed bag.
How do I do that?
Test the temperatureand salinity levels of the water in the seed bag andthe water in the pond.
Salinity Tester
The farmer tested the salinity and temperature.
Soon
Iye got the readings of both.
Now compare the readings.



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Is there any difference between the two?
Yes, there is.
All right. Then float the bags on the pond surface for half an hour. Don't disturb them.
After half an hour—
Now what?
Transfer the seeds and bag water into big plastic basins.
Now float the basins in the pond.
Next pour pond water into the basin, a mug at a time, every half hour or so, till the basin water and the pond water conditions are the same.
I guess I'd better begin right away.
To acclimatize all the seeds will take about three or four hours.
Three hours later—
Look at my siblings moving actively about! I feel the water is just right now. We're ready for the pond.



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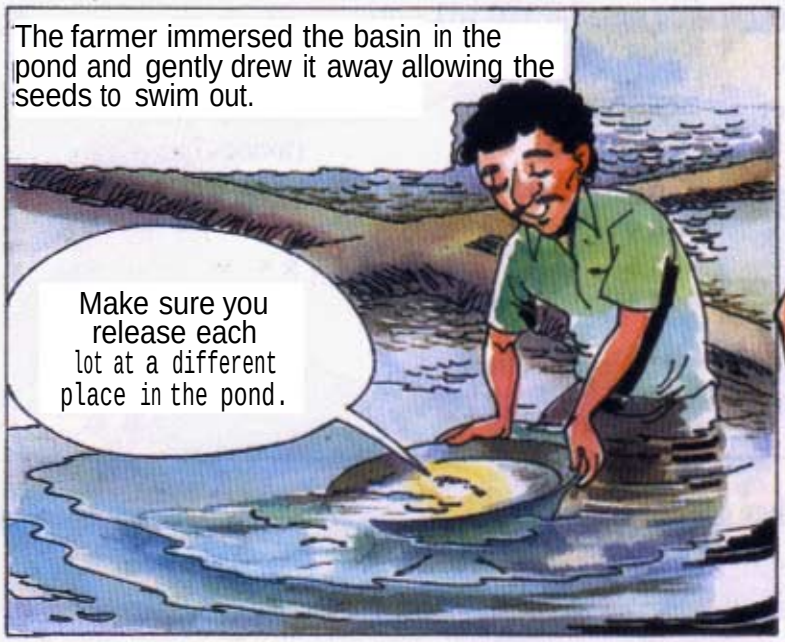


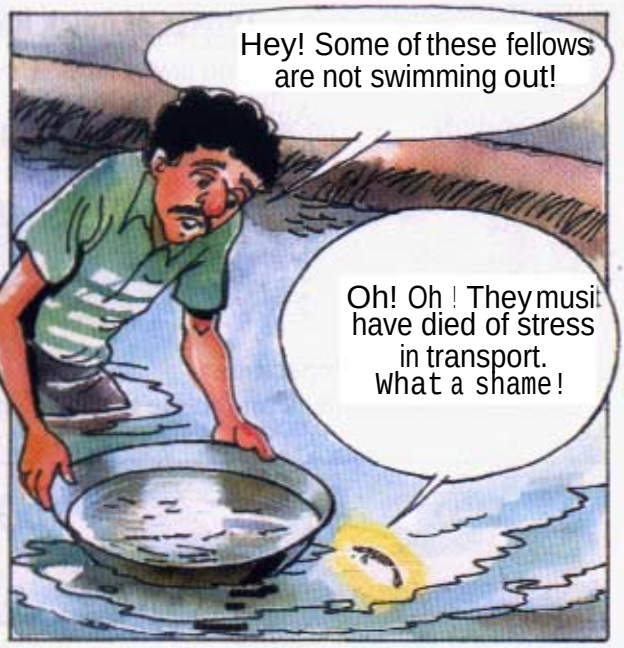


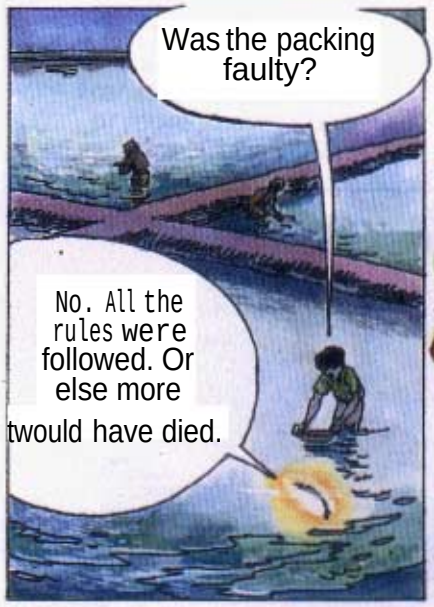


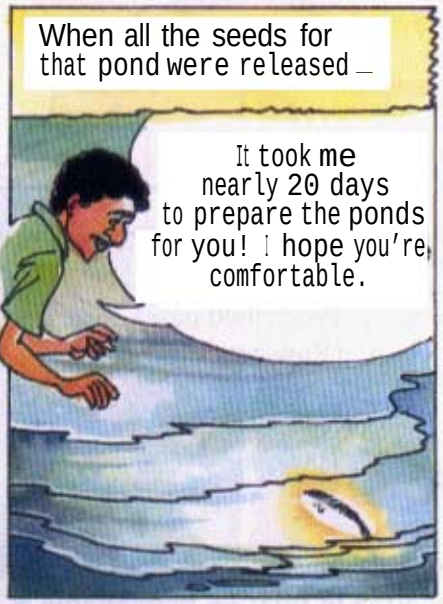


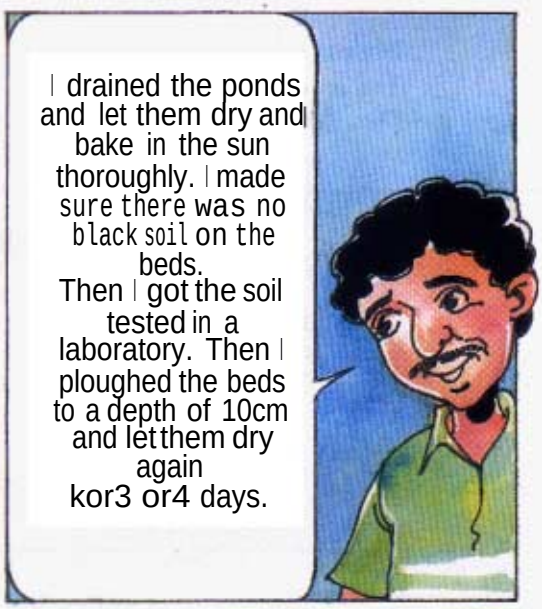


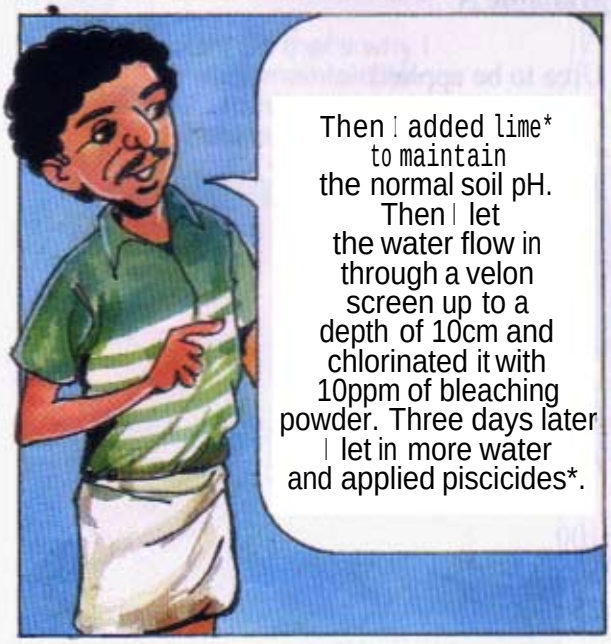


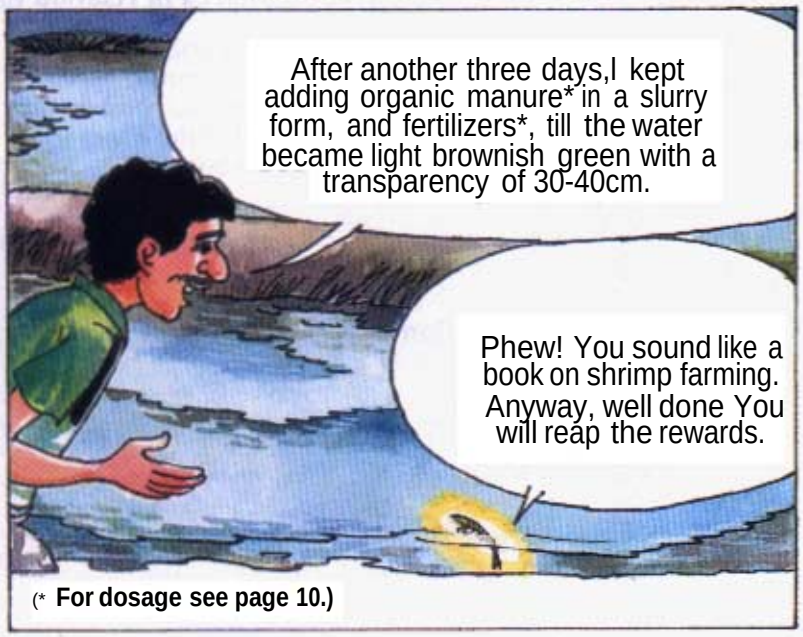


(* **For dosage see page 10.)**



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**Dosage of quick lime / slaked lime for low pH soils**

| Soil pH | Agricultural lime* (tonnes/ha) | or | Quick lime** (tonnes/ha) | Slaked lime** (tonnes/ha) |
|---|---|---|---|---|
| *5.0* | 11.1 | | 9.2 | 17.0 |
| *5.5* | 8.3 | | 6.9 | 12.7 |
| 6.0 | *5.5* | | *4.6* | *8.5* |
| *6.5* | 2.8 | | 2.3 | 4.2 |

*During pond preparation

**During culture

(Agricultural lime is preferable to quick lime)

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**Dosage of piscicides**

| Piscicide | Dose for $100m^3$ of water (10 cm of water in 1 ha area) (kg) |
|---|---|
| Mahua oil cake | 100 - 150 |
| Tea seed cake | 15 - 20 |
| (Tea seed cake is preferable) | |

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**Dosage of manure in relation to organic carbon content of soil.**

| Organic carbon in soil (%) | Prescribed basal dose (Raw cow dung (kg/ha) | Dry chicken manure (kg/ha) |
|---|---|---|
| 1.0 | 500 | 175 |
| *0.5* | 1000 | 350 |
| 0.25 | 2000 | 700 |

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**Application of urea in relation to available N**

| Available N in soil (mg/100g soil) | Urea to be applied (kg/ha) |
|---|---|
| 12.5 | 100 |
| *25.0* | *50* |
| *50.0* | 25 |

**Application of super phosphate in relation to available phosphorus**

| Available P in soil (mg/100g soil) | Super phosphate to be applied (kg/ha) |
|---|---|
| *1.5* | 100 |
| 3.0 | 50 |
| 6.0 | 25 |



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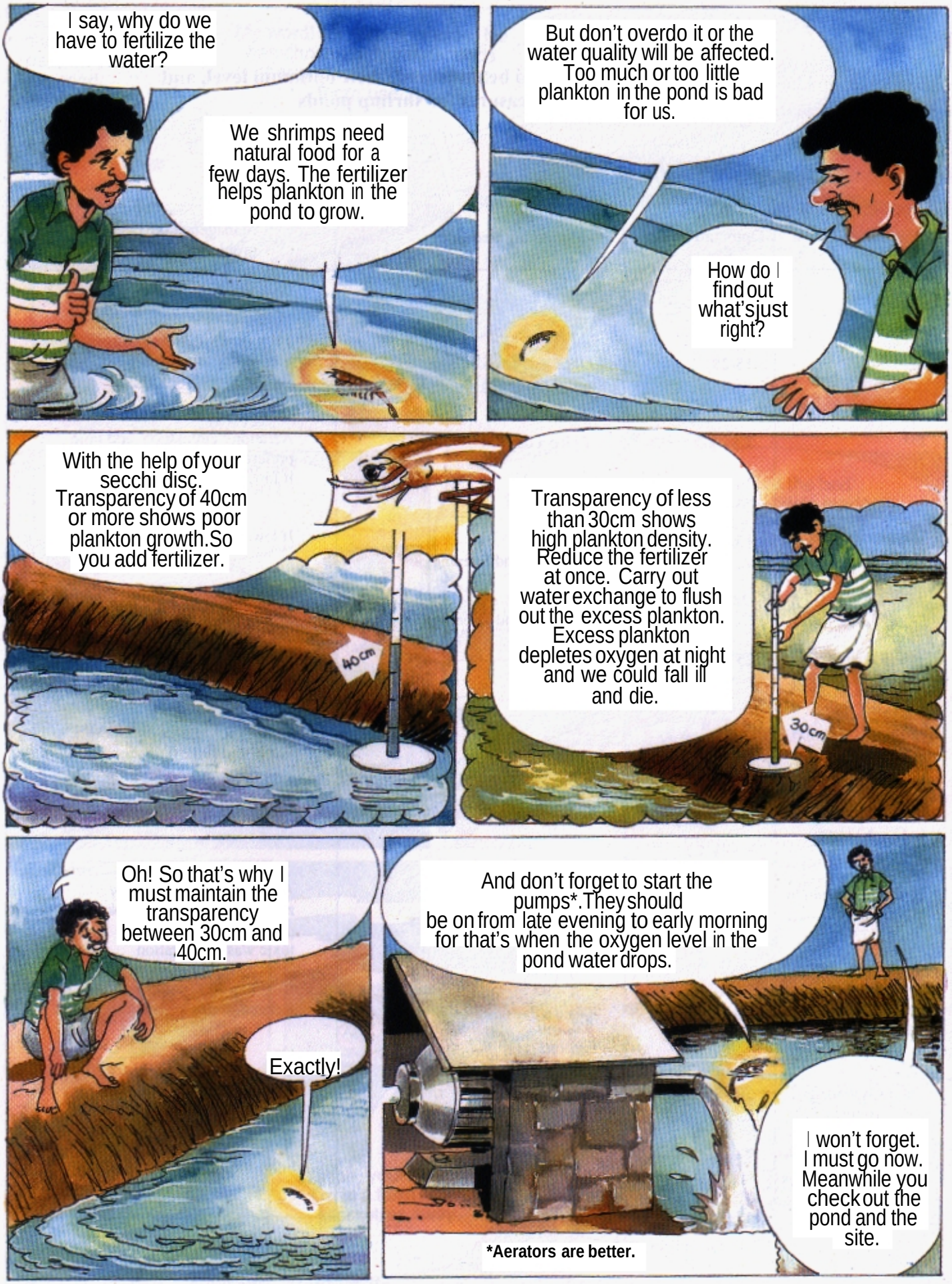
I say, why do we have to fertilize the water?
We shrimps need natural food for a few days. The fertilizer helps plankton in the pond to grow.
But don't overdo it or the water quality will be affected. Too much or too little plankton in the pond is bad for us.
How do I find out what's just right?
With the help of your secchi disc. Transparency of 40cm or more shows poor plankton growth. So you add fertilizer.
40cm
Transparency of less than 30cm shows high plankton density. Reduce the fertilizer at once. Carry out water exchange to flush out the excess plankton. Excess plankton depletes oxygen at night and we could fall ill and die.
30cm
Oh! So that's why I must maintain the transparency between 30cm and 40cm.
Exactly!
And don't forget to start the pumps*. They should be on from late evening to early morning for that's when the oxygen level in the pond water drops.
I won't forget. I must go now. Meanwhile you check out the pond and the site.
*Aerators are better.



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## Water quality parameters to be measured, their optimum level, and management measures for shrimp ponds

| Parameters | Optimum level | Monitoring frequency | Management to overcome problem, if any |
|---|---|---|---|
| Salinity (ppt) | *15-25* | Once a day before and after water exchange | Stop water exchange, if low: Exchange water, if high |
| pH | *7.5 - 8.5* | Twice a day | Aeration / circulation; add lime preferably agricultural 100kg/ha if low, or Gypsum if high |
| Oxygen in water (ppm) | > 3.5 | Twice a day (Morning and Evening) | If low, aeration, water exchange |
| Temperature °C | 28 - 33 | Twice a day (Morning and Evening) | Aeration / water exchange |
| Temperature (cm) (plankton) | *25* -40 | do | Ifhigh, apply urea / phosphate: if low, exchange water 20 - 30%, and aeration |
| Ammonia ($NH_3$ - N) (ppm) | < 1.0 | Once in 3 days | Water exchange / aeration |
| Nitrate ($NO_3$ - N) (ppm) | < 1.1 | do | Water exchange / aeration |
| Hydrogen Sulphide H,S (ppm) | <0.007 | Once a week | Avoid over feeding; apply zeolite (health stone) 250kg/ha/ probiotics to absorb toxic wastes / aeration |
| Water colour | Light brown or light green | Once a day (morning) | Related to transparency |
| Total suspended solids (ppm) | 30 - 190 | Once a week | Remove solids through filter / settlement ponds and aeration |
| | | | |



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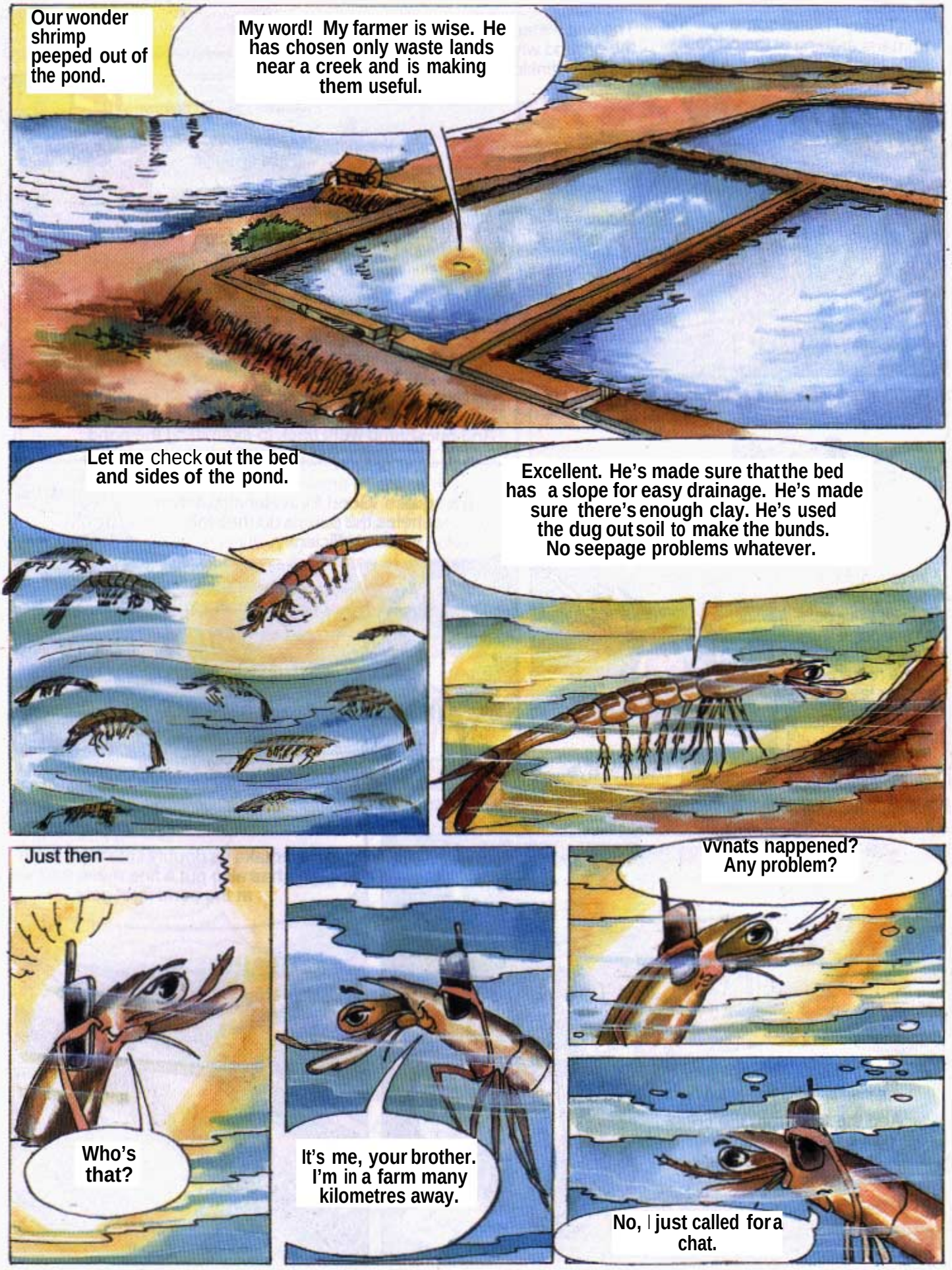
Our wonder shrimp peeped out of the pond.
My word! My farmer is wise. He has chosen only waste lands near a creek and is making them useful.
Let me check out the bed and sides of the pond.
Excellent. He's made sure that the bed has a slope for easy drainage. He's made sure there's enough clay. He's used the dug out soil to make the bunds. No seepage problems whatever.
Just then—
Who's that?
It's me, your brother. I'm in a farm many kilometres away.
Vvnats nappened? Any problem?
No, I just called for a chat.



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Today I heard some humans arguing at the edge of our pond.
The salt water from your ponds seeps into the ground water and affects our crops and drinking water.
Impossible! Our ponds have enough clay to prevent seepage.
He's right. If shrimp farmers do not take care of seepage, they cannot maintain the required water levels in the ponds.
I see. Thanks. Bye.
And our shrimp went back to examining the pond.
It's square. Good for water circulation. It helps the pumps do their job efficiently.
And the inlet from the creek has a velon screen to filter out as many of our enemies as possible.
Velon Screen
To make us doubly safe from them, he has also put a fine mesh bagnet at the pond inlet gate.



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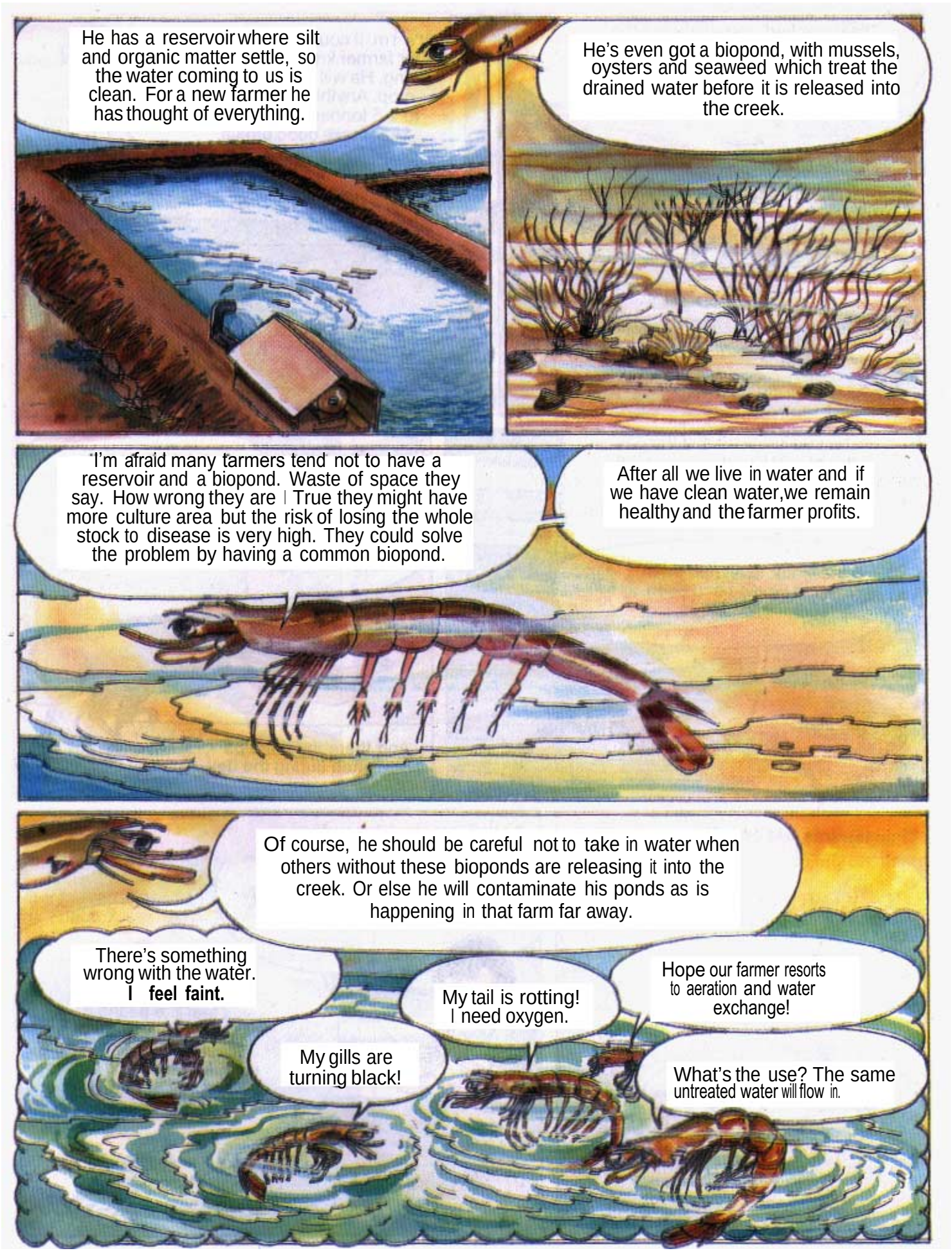
He has a reservoir where silt and organic matter settle, so the water coming to us is clean. For a new farmer he has thought of everything.
He's even got a biopond, with mussels, oysters and seaweed which treat the drained water before it is released into the creek.
I'm afraid many farmers tend not to have a reservoir and a biopond. Waste of space they say. How wrong they are ! True they might have more culture area but the risk of losing the whole stock to disease is very high. They could solve the problem by having a common biopond.
After all we live in water and if we have clean water,we remain healthy and the farmer profits.
Of course, he should be careful not to take in water when others without these bioponds are releasing it into the creek. Or else he will contaminate his ponds as is happening in that farm far away.
There's something wrong with the water. I feel faint.
My tail is rotting! I need oxygen.
Hope our farmer resorts to aeration and water exchange!
My gills are turning black!
What's the use? The same untreated water will flow in.



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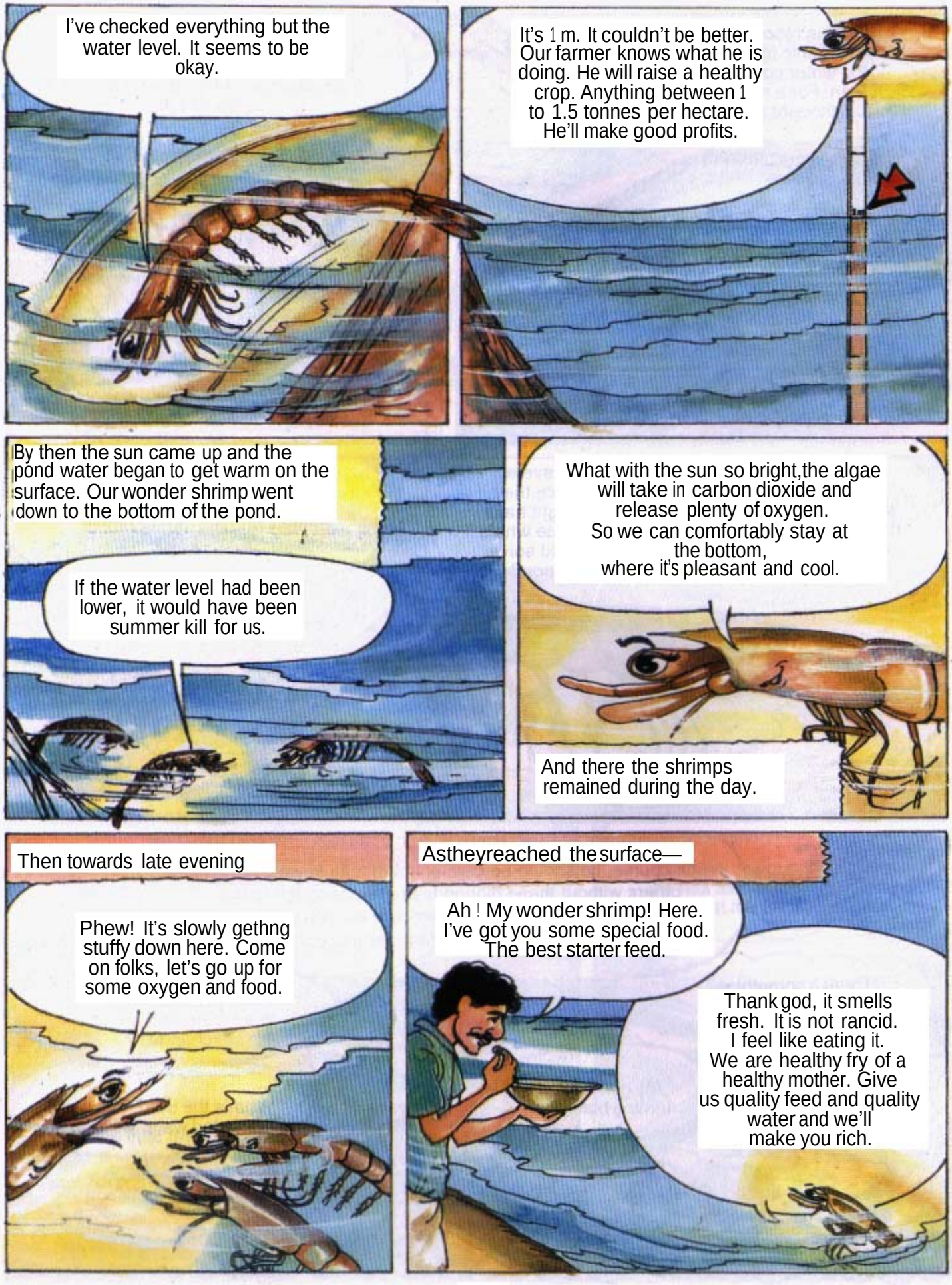
I've checked everything but the water level. It seems to be okay.
It's 1 m. It couldn't be better. Our farmer knows what he is doing. He will raise a healthy crop. Anything between 1 to 1.5 tonnes per hectare. He'll make good profits.
By then the sun came up and the pond water began to get warm on the surface. Our wonder shrimp went down to the bottom of the pond.
If the water level had been lower, it would have been summer kill for us.
What with the sun so bright,the algae will take in carbon dioxide and release plenty of oxygen. So we can comfortably stay at the bottom, where it's pleasant and cool.
And there the shrimps remained during the day.
Then towards late evening
Phew! It's slowly gethng stuffy down here. Come on folks, let's go up for some oxygen and food.
Astheyreached the surface—
Ah ! My wonder shrimp! Here. I've got you some special food. The best starter feed.
Thank god, it smells fresh. It is not rancid. I feel like eating it. We are healthy fry of a healthy mother. Give us quality feed and quality water and we'll make you rich.



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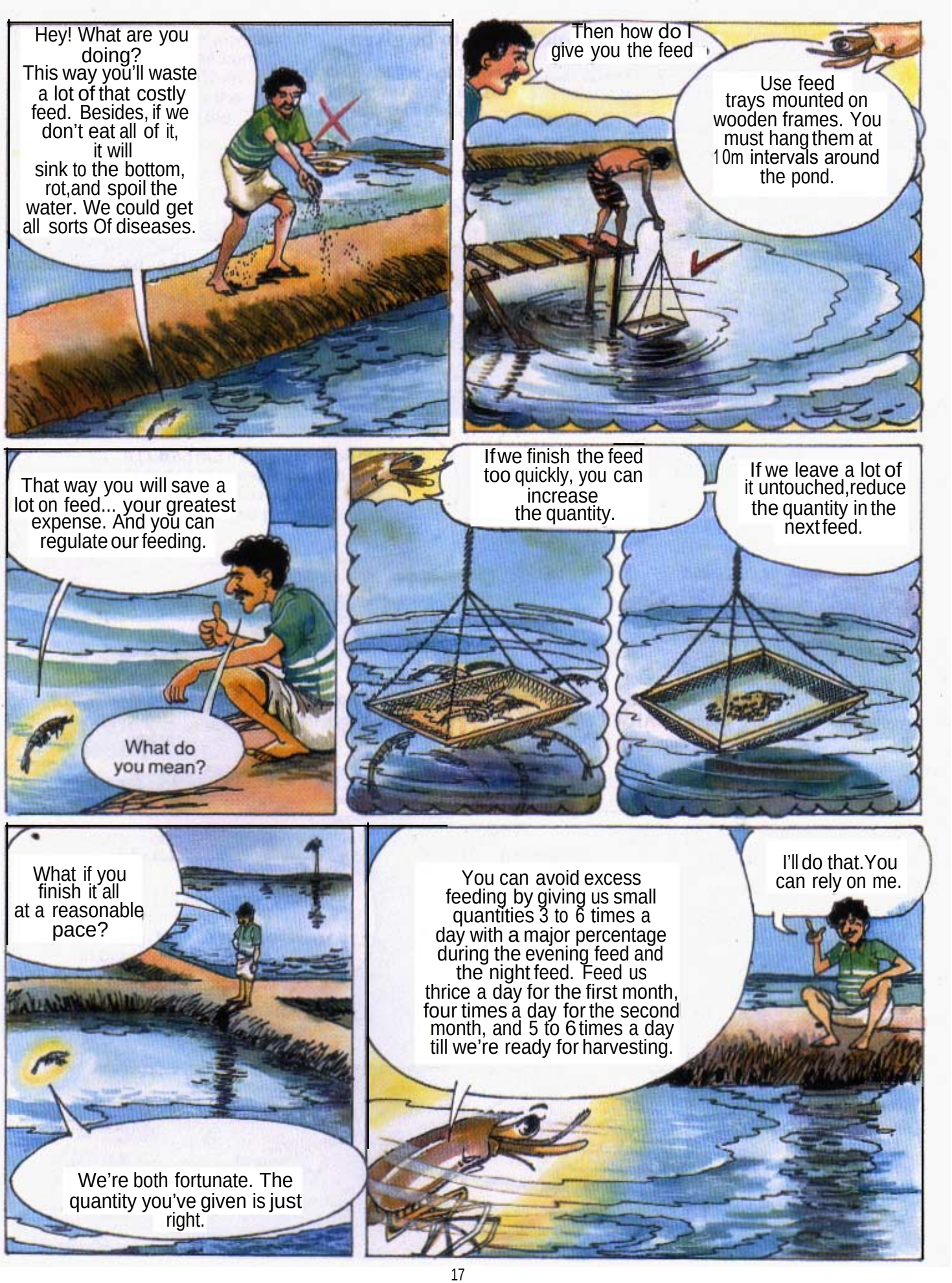
Hey! What are you doing? This way you'll waste a lot of that costly feed. Besides, if we don't eat all of it, it will sink to the bottom, rot,and spoil the water. We could get all sorts Of diseases.
Then how do I give you the feed
Use feed trays mounted on wooden frames. You must hang them at 10m intervals around the pond.
That way you will save a lot on feed... your greatest expense. And you can regulate our feeding.
What do you mean?
If we finish the feed too quickly, you can increase the quantity.
If we leave a lot of it untouched,reduce the quantity in the next feed.
What if you finish it all at a reasonable pace?
We're both fortunate. The quantity you've given is just right.
You can avoid excess feeding by giving us small quantities 3 to 6 times a day with a major percentage during the evening feed and the night feed. Feed us thrice a day for the first month, four times a day for the second month, and 5 to 6 times a day till we're ready for harvesting.
I'll do that.You can rely on me.



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## Type of feed to be given

| Days of culture | Name | Shape | Size (mm) |
|---|---|---|---|
| Upto 20 | PL | crumble | 0.1 - 0.3 |
| 21 -40 | starter 1 | crumble | 0.6 - 0.8 |
| 41 -60 | starter 2 | crumble | 1.0- 1.5 |
| 61 - 100 | Grower 1 to 3 | pellet | 2.0 - *5.0* (dia 1.8 -2.3) |
| 101 - 120 | Finisher | pellet | 5.0-7.0 |

## Feeding schedule

| Days of culture | Average Body Weight - ABW gm | Feeding rate (% OF ABW) | % of feed in check trays | Checking frequency in hrs |
|---|---|---|---|---|
| 15 - 30 | 1.0-3.0 | 10.0- 8.0 | *2.0-2.5* | 3.0- 2½ |
| 31-60 | 3.0- 10.0 | *8.0-5.0* | 2.5-2.7 | 2½ - 2.0 |
| 61 -90 | 10.0-2.0 | 5.0-3.7 | 2.7 - 3.0 | 2.0- 1½ |
| 91 -120 | 20.0 - 33.0 | *3.7-2.5* | 3.5 -4.0 | 1½1.0 |



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The farmer did as our wonder shrimp advised and all went well *for* some days. Then suddenly one night as the farmer was checking the feed trays-—

I gave them the right quantity at the right time, but they've hardly eaten anything of the last feed.

That's because we're about to moult.

During our moulting period our appetite is reduced. We eat much less. Give us less feed in those periods.

**MOULTING FREQUENCY OF SHRIMPS IN CULTURE PONDS.**

| Size (gm) | Moulting interval (days) |
|---|---|
| 2-5 | 7 |
| 6-10 | 7-8 |
| 11-15 | 9-10 |
| 16-25 | 11-13 |
| 26-30 | 14-16 |

next afternoon—

Help! Help! It's me, sister. From the other farm. We're suffocating... the oxygen levels in our pond have fallen

What's wrong?

Our farmer is either ignorant or irresponsible.



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The soil is bad. There are too many of us in the pond, Besides, there's too much algal bloom. The water is a bright green.
Oh!Oh! Never mind.Hang up, I'll take care of this.
The unfortunate shrimp on the other farm had a farmer who was addicted to TV and sat before it when he should have tended his shrimps.
Suddenly —
Then —
Wakeup! Go to your pond at once or you will become a pauper overnight. GO!
Yqur shrimp need oxygen. Operate your pumps at once. Exchange as much wateras possible.
The shaken farmer rushed to his oonds, and started water
Just in time! I'd better do all that that wonder shrimp ordered.



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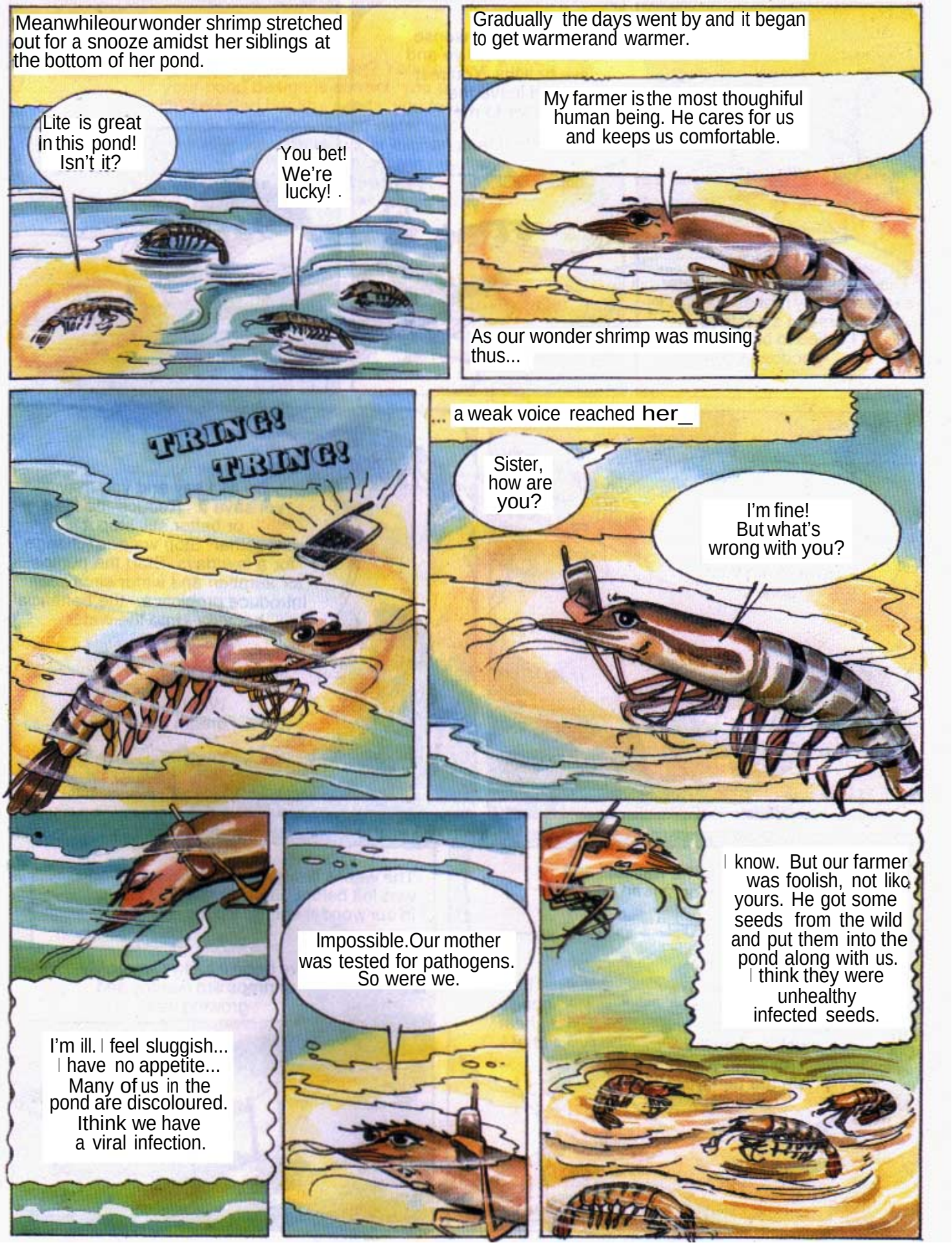
Meanwhileourwonder shrimp stretched out for a snooze amidst her siblings at the bottom of her pond.
Lite is great in this pond! Isn't it?
You bet! We're lucky!
Gradually the days went by and it began to get warmerand warmer.
My farmer is the most thoughiful human being. He cares for us and keeps us comfortable.
As our wonder shrimp was musing thus...
TRING! TRING!
... a weak voice reached her_
Sister, how are you?
I'm fine! But what's wrong with you?
I'm ill. I feel sluggish... I have no appetite... Many of us in the pond are discoloured. Ithink we have a viral infection.
Impossible.Our mother was tested for pathogens. So were we.
I know. But our farmer was foolish, not liko yours. He got some seeds from the wild and put them into the pond along with us. I think they were unhealthy infected seeds.



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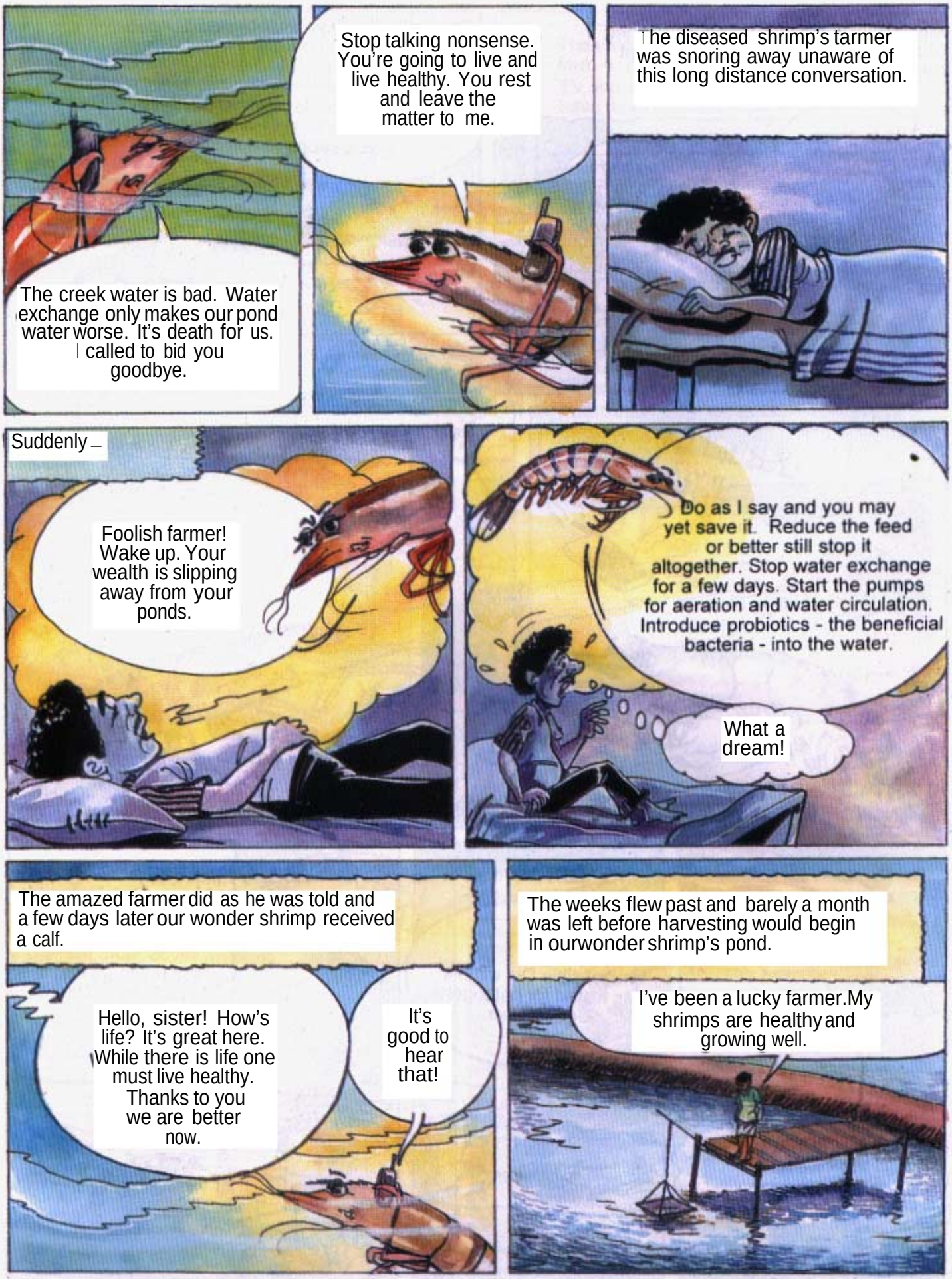
The creek water is bad. Water exchange only makes our pond water worse. It's death for us. I called to bid you goodbye.
Stop talking nonsense. You're going to live and live healthy. You rest and leave the matter to me.
The diseased shrimp's farmer was snoring away unaware of this long distance conversation.
Suddenly...
Foolish farmer! Wake up. Your wealth is slipping away from your ponds.
Do as I say and you may yet save it. Reduce the feed or better still stop it altogether. Stop water exchange for a few days. Start the pumps for aeration and water circulation. Introduce probiotics - the beneficial bacteria - into the water.
What a dream!
The amazed farmer did as he was told and a few days later our wonder shrimp received a calf.
Hello, sister! How's life? It's great here. While there is life one must live healthy. Thanks to you we are better now.
It's good to hear that!
The weeks flew past and barely a month was left before harvesting would begin in ourwonder shrimp's pond.
I've been a lucky farmer.My shrimps are healthy and growing well.



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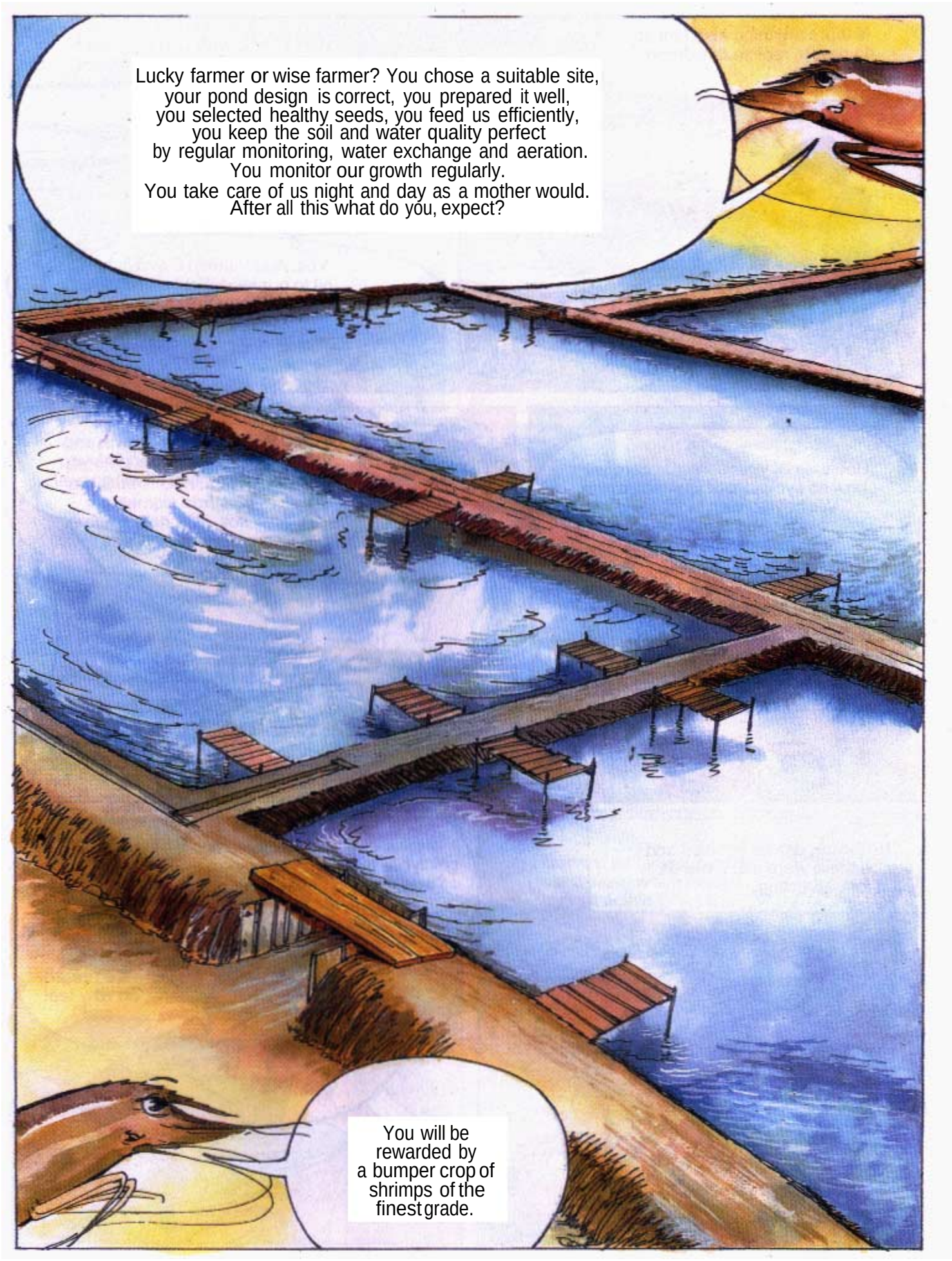
Lucky farmer or wise farmer? You chose a suitable site, your pond design is correct, you prepared it well, you selected healthy seeds, you feed us efficiently, you keep the soil and water quality perfect by regular monitoring, water exchange and aeration. You monitor our growth regularly. You take care of us night and day as a mother would. After all this what do you, expect?
You will be rewarded by a bumper crop of shrimps of the finest grade.



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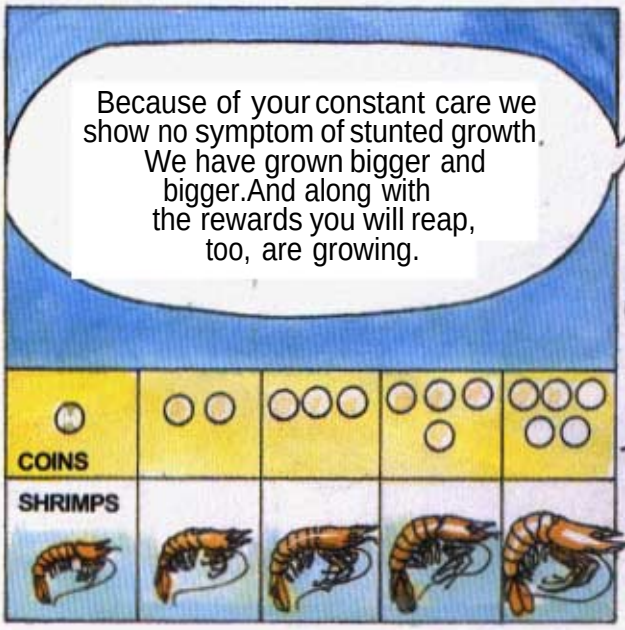
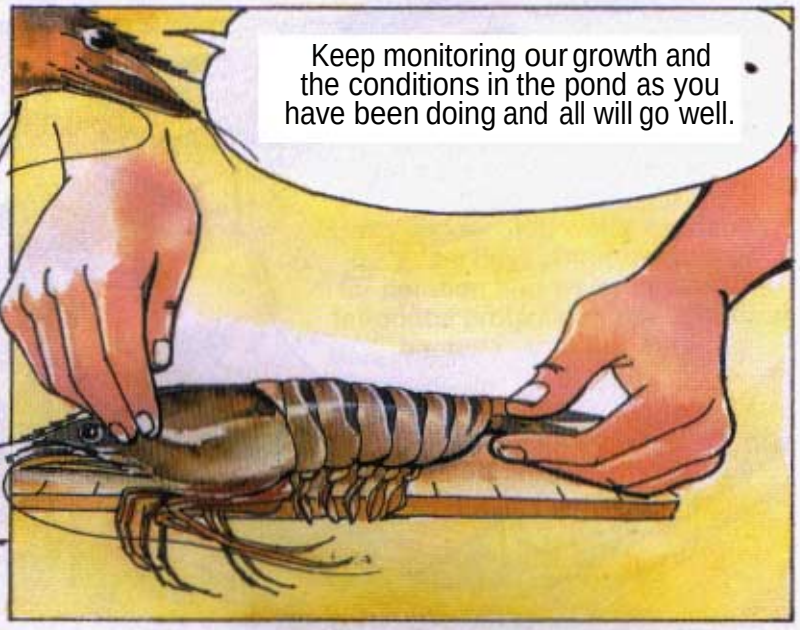
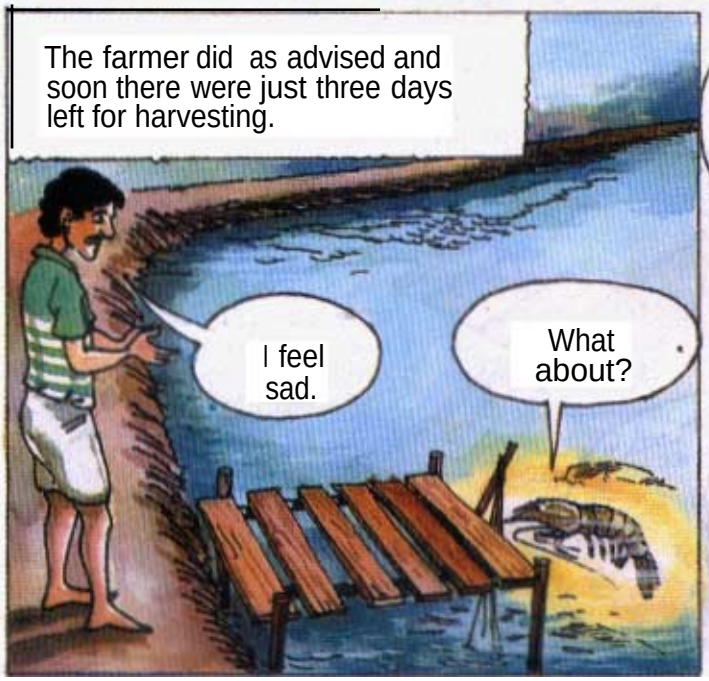
Is there anything else I must do now to realise this dream?
Yes. Add Vitamin C and fish oil to our feed.It will make us grow strong.


Because of your constant care we show no symptom of stunted growth. We have grown bigger and bigger.And along with the rewards you will reap, too, are growing.
COINS
SHRIMPS


Keep monitoring our growth and the conditions in the pond as you have been doing and all will go well.


The farmer did as advised and soon there were just three days left for harvesting.
I feel sad.
What about?


I've grown to love you so, and I will soon lose all of you to people's kitchens all over the world.
But that's the purpose for which we were reared. So why feel sad?



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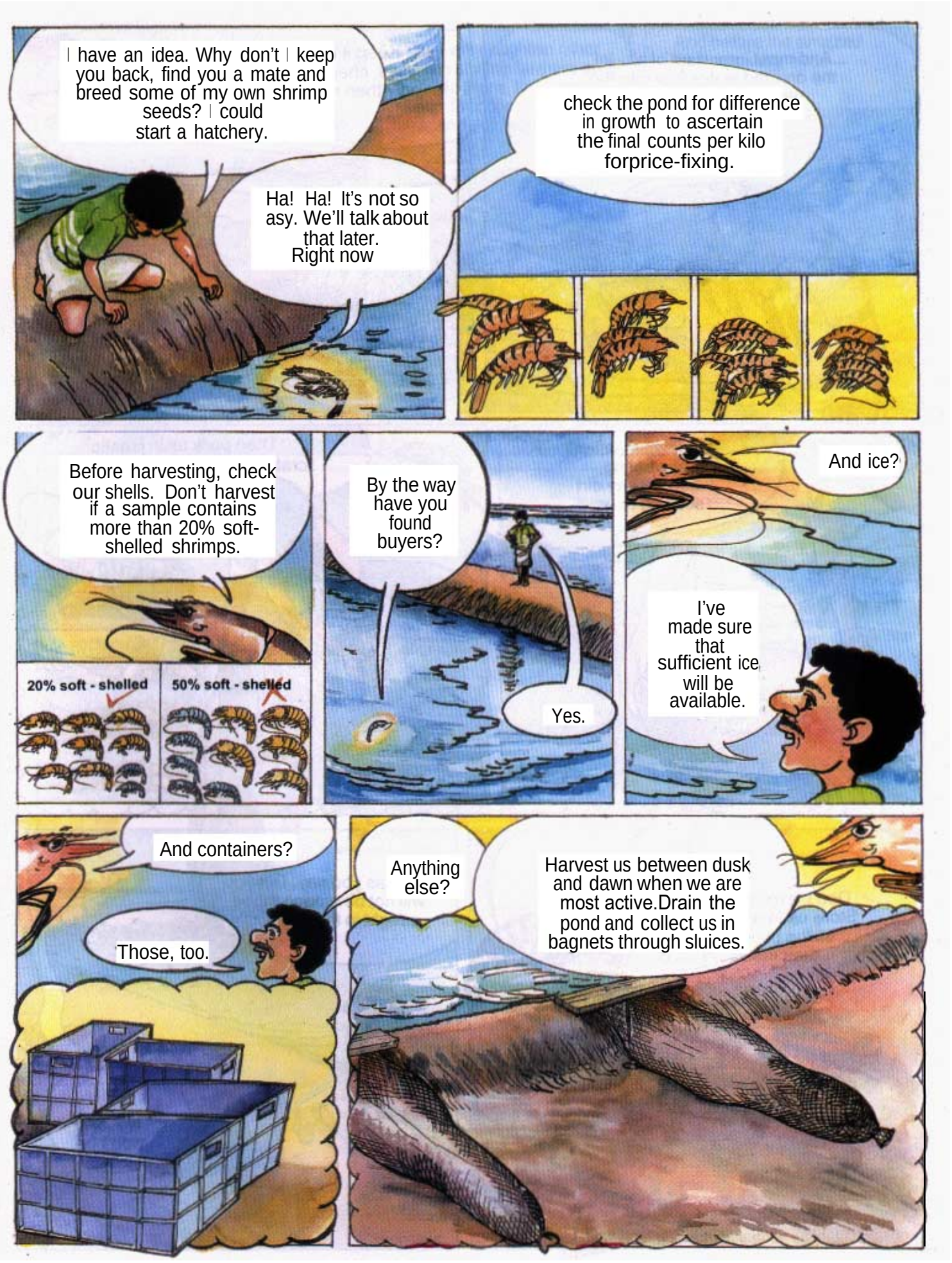
I have an idea. Why don't I keep you back, find you a mate and breed some of my own shrimp seeds? I could start a hatchery.
Ha! Ha! It's not so asy. We'll talk about that later. Right now
check the pond for difference in growth to ascertain the final counts per kilo forprice-fixing.
Before harvesting, check our shells. Don't harvest if a sample contains more than 20% soft-shelled shrimps.
20% soft - shelled
50% soft - shelled
By the way have you found buyers?
Yes.
And ice?
I've made sure that sufficient ice will be available.
And containers?
Those, too.
Anything else?
Harvest us between dusk and dawn when we are most active.Drain the pond and collect us in bagnets through sluices.



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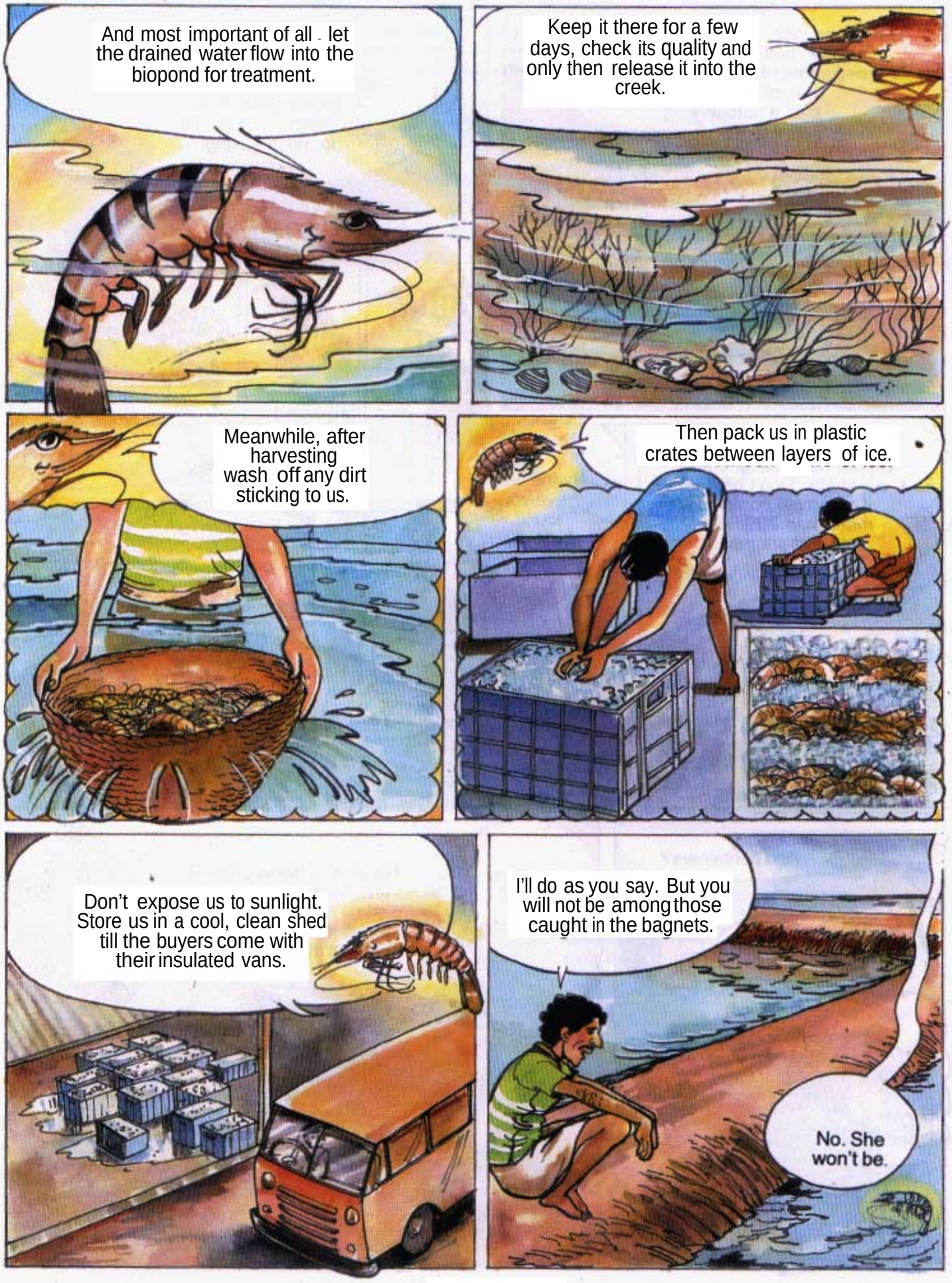
And most important of all - let the drained water flow into the biopond for treatment.
Keep it there for a few days, check its quality and only then release it into the creek.
Meanwhile, after harvesting wash off any dirt sticking to us.
Then pack us in plastic crates between layers of ice.
Don't expose us to sunlight. Store us in a cool, clean shed till the buyers come with their insulated vans.
I'll do as you say. But you will not be among those caught in the bagnets.
No. She won't be.



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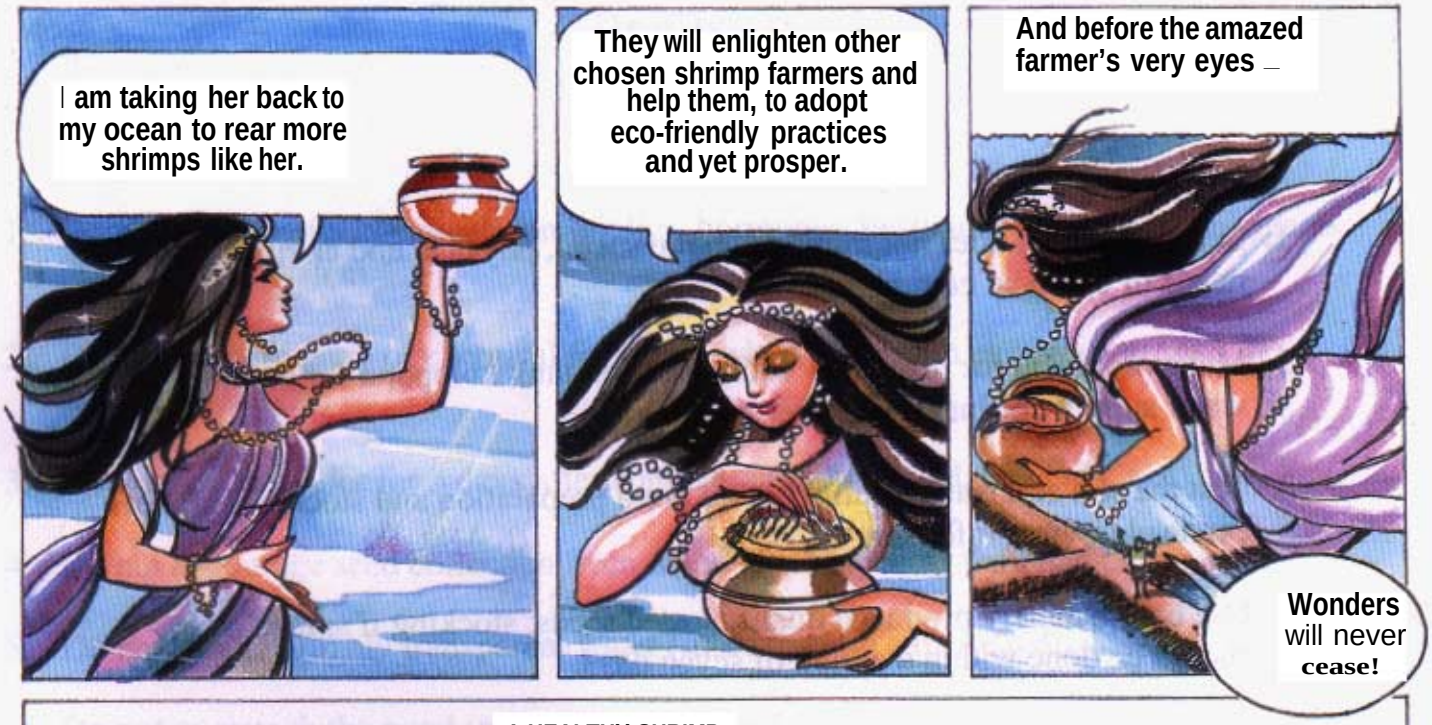
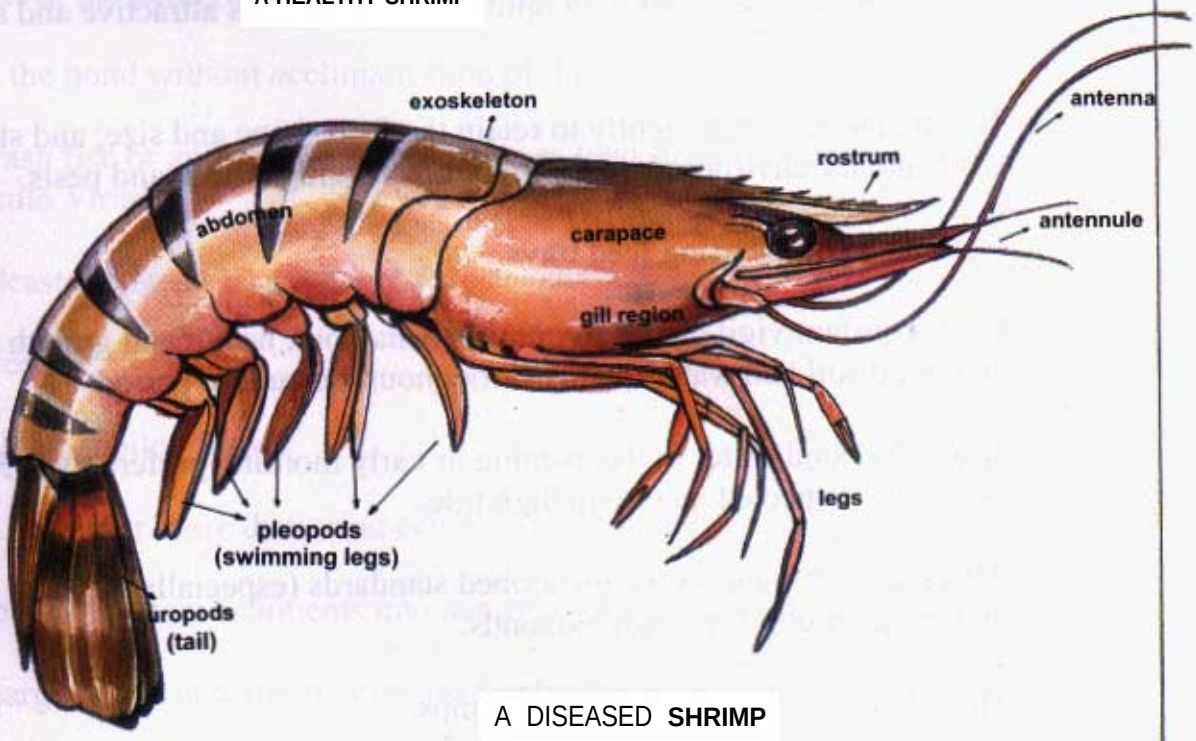



## A HEALTHY SHRIMP




## A DISEASED **SHRIMP**

- Deformities: bent rostrum, twisted antennule: wrinkled or broken antenna: broken legs
- Lesions on exoskeleton: shell soft and thin
- Animals not lustrous: pale bluish gray / dark blue / reddish / pale whitish or bleached
- Fuzzy mat/ cotton-wool like growth on the body and appendages (epibionts)
- Gills brown or black: swollen; blisters in the gill region of the carapace; gas bubbles in gills.
- Gut empty
- White / black / brown patches or spots on the carapace and abdominal region



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# DO's

1. Select land that does not impinge on the social, physical and environmental needs of the local community

2. Make provision for reservoir / sedimentation tank / biopond for treatment of water supply / effluent wherever possible.

3. Test the soil and water quality before pond preparation and stocking; highpH can lead to virus infection.

4. Use only hatchery produced quality tested seeds; stocking if spread over, should be done within a period of seven days.

5. Use dry or semi-dry diet with optimal FCR which is attractive and acceptable to shrimps.

6. Handle the feed bags gently to retain the feed shape and size; and store in a cool and dry environment free from direct sunlight, rain and pests.

7. Feed the shrimps using feed trays.

8. Keep constant vigil on the swimming behaviour, health and growth of shrimps and pond soil and water quality throughout the culture period.

9. Drain the pond water in the evening or early morning preferably 2-3 hours before the expected incoming high tide.

10. Discharge effluents at the prescribed standards (especially the final *25%* of the pond volume) through bioponds.

11. Burn or bury the virus infected shrimps.

12. Disinfect the disease contaminated water before discharge; inform the fellow farmers also.



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# Don’ts

1. Do not use harmful chemicals, antibiotics, hormones, pesticides or any harmful agents in the culture system.
2. Do not apply manure or chemical fertilizers when there is an excessive growth of filamentous algae.
3. Do not release water for 5 days after application of MOC (Mahua Oil Cake).
4. Do not encourage seed collection from the wild for stocking the ponds.
5. Do not stock in highly transparent water (more than 60 cm).
6. Do not overstock the pond (not more than $5/m^2$).
7. Do not stock the pond without acclimatisation of the seeds to the pond water conditions.
8. Do not use trash fish or any estuarine organisms as feed since they are a source of MBV (Mondon Baculo Virus).
9. Do not broadcast the feed.
10. Do not overfeed.
11. Do not use old or spoiled feed.
12. Do not drain the water more than what can be replenished.
13. Do not dump pond bottom sediments into natural open water bodies;
14. Do not discharge brackish water into freshwater bodies or agricultural lands.
15. Do not release diseased shrimps into open water bodies.
16. Do not allow birds or other animals to pick up diseased shrimps since they will spread the disease.
17. Do not use nets, other equipment or even hands without disinfection.



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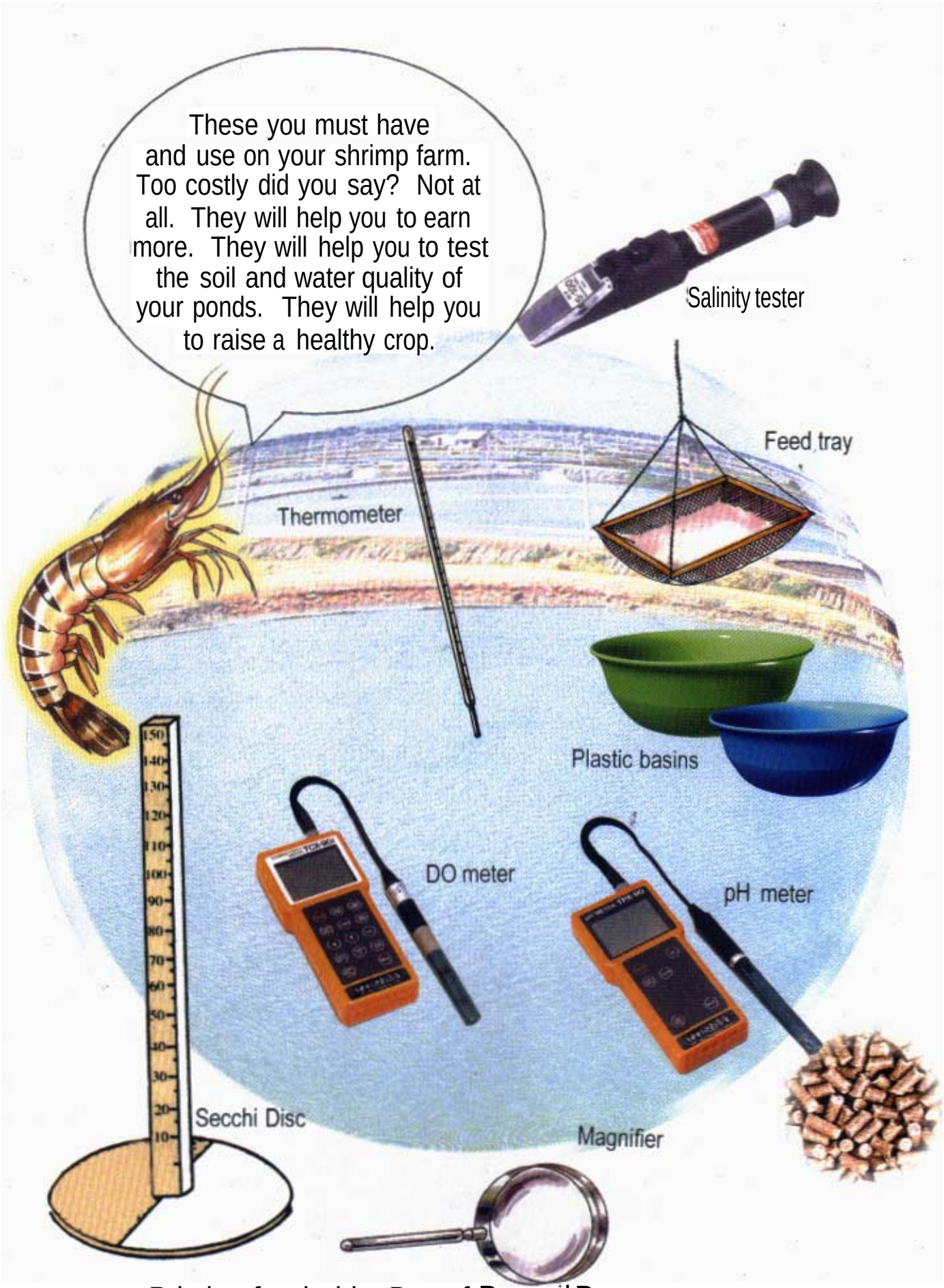


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