

HATCHERY MANAGEMENT OF LOBSTER

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Taxonomy

Kingdom:Animalia

Phylum:Arthropoda

Subphylum:Crustacea

Class:Malacostraca

Order:Decapoda

25 species from **Indian coast**

•Palinuridae(spiny lobster)

•Scyllaridae(slipperlobster)

□ **Four Families:**

Nephropidae {clawed / true lobsters),

Palinuridae {clawless/rock,spiny lobsters),

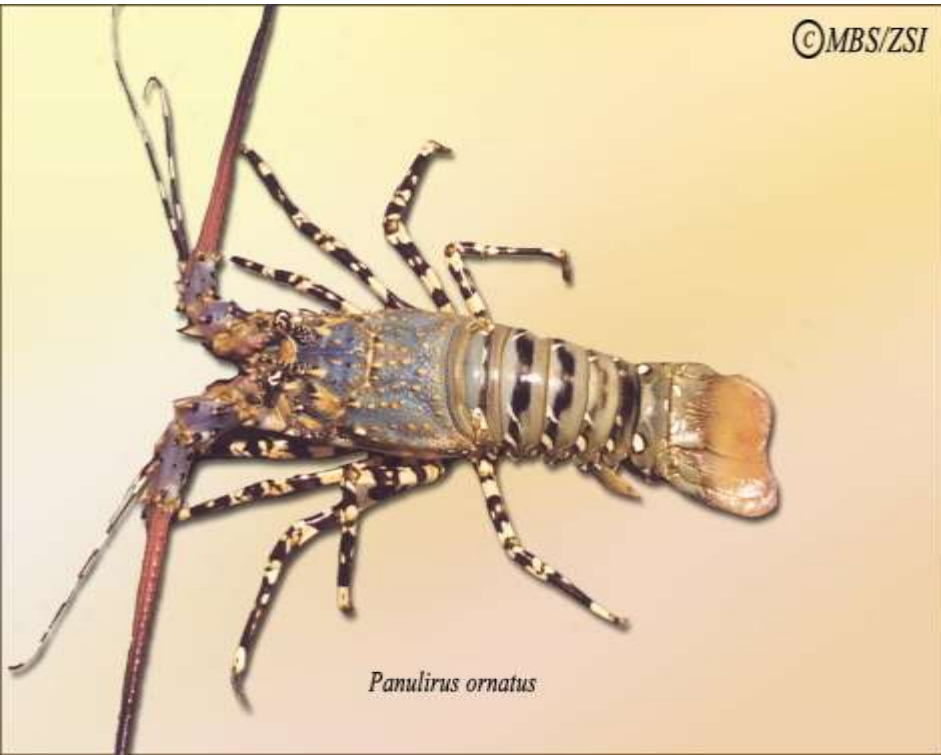
Scyllaridae (Sand /slipper lobsters) and

Synaxidae (Coral lobsters).

Commercially important Species

| Species | Distribution (India) | Availability | Spawning peak season |
|--|---|-------------------------|--------------------------------|
| <i>Panulirus polyphagus</i> Mud spiny lobster | Entire Indian coast esp Gujarat and Maharashtra | Year round | Aug-Oct |
| <i>P. homarus</i> Scalloped spiny lobster | Rich in SWC and kanyakumari coast in SE | Aug-May peak Nov-Jan | SWC-Nov-Dec SEC-Jan-March |
| <i>P. ornatus</i> Ornate spiny lobster | Gujarat, Maharashtra, Kerala & TN | Peak Dec-Jan | Year rounds at deeper water |
| <i>Thennus orientalis</i> Sand lobster | Gujarat, Maharashtra, Kerala and Tamil Nadu | October - December | November - April |

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Panulirus ornatus

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Panulirus polyphagus

Sexual dimorphism

Male

- ❖ Males are usually larger in size
- ❖ Swimmerets nearest to carapace **hard and sharp**
- ❖ Pleopods are **uniramous** (exopods only).
- ❖ Second and third walking legs bigger.
- ❖ Gonopore at **base of fifth walking** leg.
- Sudden lengthening of the 2nd & 3rd walking legs-onset of maturity.

Female

- ❖ Females are smaller
- ❖ Swimmerets **soft and feathery**
- ❖ Pleopods are **biramous**
- ❖ Dactylus of 5th walking leg is chelate.
- ❖ Gonopore at base **of 3rd walking** leg.
- Development of cement glands and sperm receptacle.

Main producers

- Total lobster production in the world-339000 MT (FAO),2014
- United states and Canada are the major producers-37 % of total production
- United states remains the largest importer too after japan
- Viet Nam, Indonesia(Lombok), Malaysia and Philippines
- Ornate lobster - *Southeast Asia*, with the bulk of Production in Vietnam and the Philippines
- **No farmed production of *Panulirus spp.***,has not yet been reported(Clive, 2011),FAO,by the other countries

Current trend & Export potential

- ❑ Catches of American lobster (*Homarus americanus*) and spiny lobster (*Panulirus* spp) accounts for 75% of world lobster production.(FAO Fishstat database,2012)
- ❑ 120000 MT of Homarus species was produced in 2013
- ❑ Global supply of Homarus is increasing
- ❑ US remains the largest market for Canadian lobsters
- ❑ Annual catch between 2000-3000 tonnes (India)
- ❑ Fetches a good price of Rs.600-1500/kg
- ❑ Juvenile lobsters –Rs 250-400/kg when grown to 200 gm it costs –Rs 650-800/kg

World Lobster production (FAO),2010

- Rock lobster =6%
- Spiny lobster =38%
- American Lobster =54%
- European lobster =2%

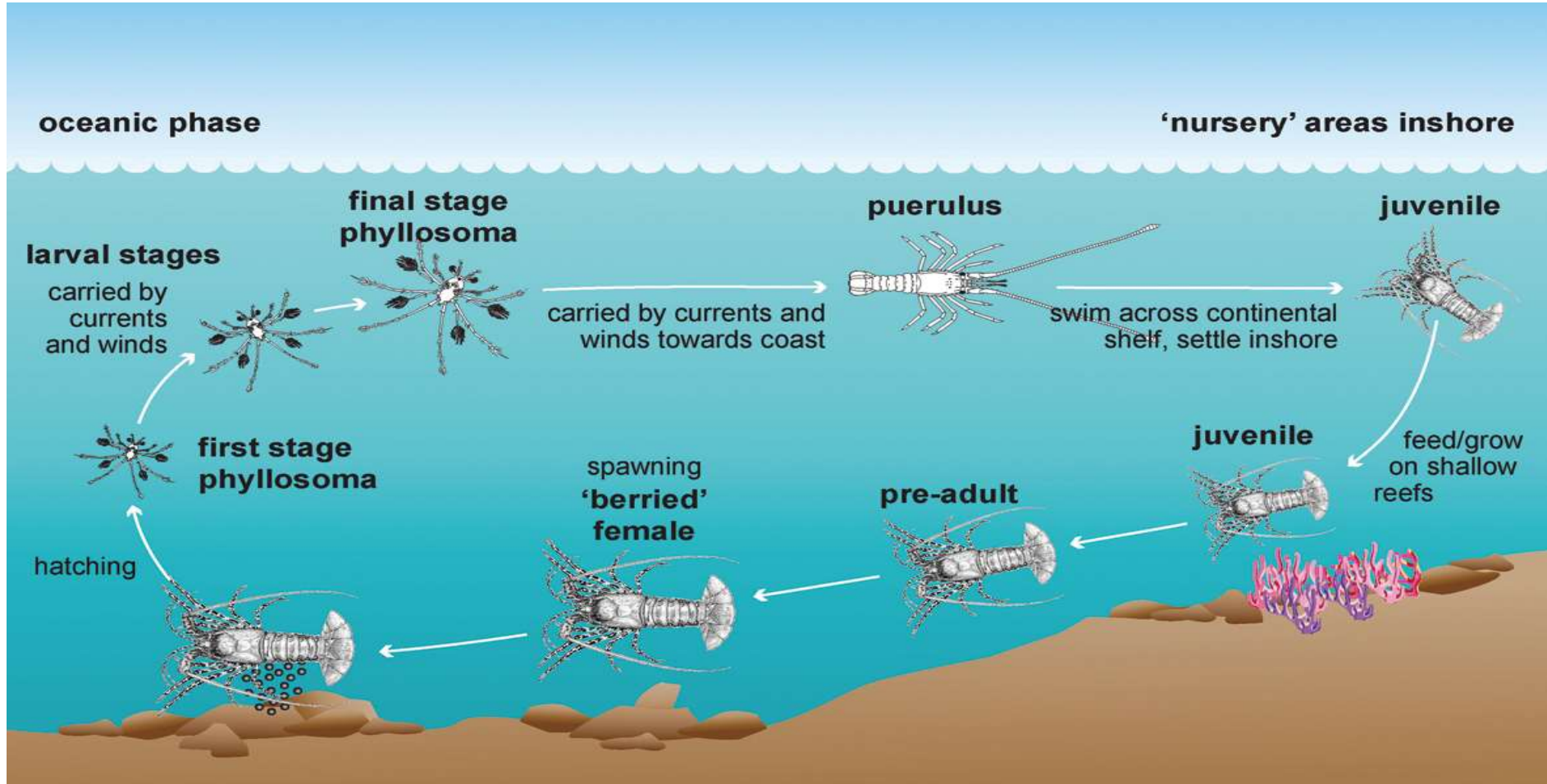
Indian Scenario:-

- In India **Lobster fattening** is popular
- Pond culture of lobsters-**Bhavnagar** in Gujarat
- Indian lobster farm produces 2.5 tons in 2013(Undercurrent NEWS)

Culture potential

- The lobster resource potential of Indian EEZ is 50,000 mt (Vijayakumaran and Radhakrishnan, 2000).
- Both *P.ornatus* and *P. homarus* are **reef dwelling species** of a sedimentary nature with broad **environmental tolerances**
- Highly social, preferring to **congregate in groups** in hollows, caves and crevices within and beneath the reef structures.

Lifecycle of lobster



Breeding

- Tropical lobsters breed throughout the year.
- *Panulirus homarus* - shallow waters
- *Panulirus ornatus* and *Panulirus polyphagus* - deeper areas for breeding.
- India becomes **second country to breed sand lobster** in captivity by Dr. Jeo k.Kizhakudan, CMFRI, kovalam (2007)
- **Olfactory(clawed), visual(spiny), auditory and tactile stimuli** have been known to play a role in the attraction, recognition and choice of mates in different lobster species

Courtship



- ❑ Lobsters can only mate **after the female molts.**
- ❑ mating, egg extrusion and hatching take place during **inter moult period** when the shell is hard
- ❑ Successful mating a female to male **ratio 2: 1** was found to be sufficient.
- ❑ Mating takes place during **night** and the spermatophore is deposited externally on to the sternal plates.
- ❑ The time lag between spermatophore deposition and egg extrusion varies **from 1 to 17 days**
- ❑ If no mating -ovary gets resorbed and the **haemolymph colour changes from light blue to deep red.**

Hatching

- Eggs on the abdominal pleopods change colour from **deep orange to deep brown** before hatching
- Hatching takes place in **batches** only during early morning hours and is usually completed in 1-3 days
- Hatchery phase is of **shorter duration** in **sand lobsters** than spiny lobsters
- 25-30 days in sand lobsters
- 300 days in spiny lobsters
- The mean diameter of the egg is about 0.45 mm

Milestones in larval rearing

- Complete larval development of a spiny lobster was achieved in **1988** when **Kittaka** achieved success in rearing the phyllosoma larvae of the rock lobster *Jasus lalandii*. The larval period of different species ranged from 132-319 days
- The researchers at NIOT succeeded in rearing the larvae of *Panulirus homarus* upto the **7"stage for the first time in India (1993)**
- Complete larval development of *Thenus sp*, was first achieved in Australia by Mikaml and Greenwood (1997).

Phyllosoma

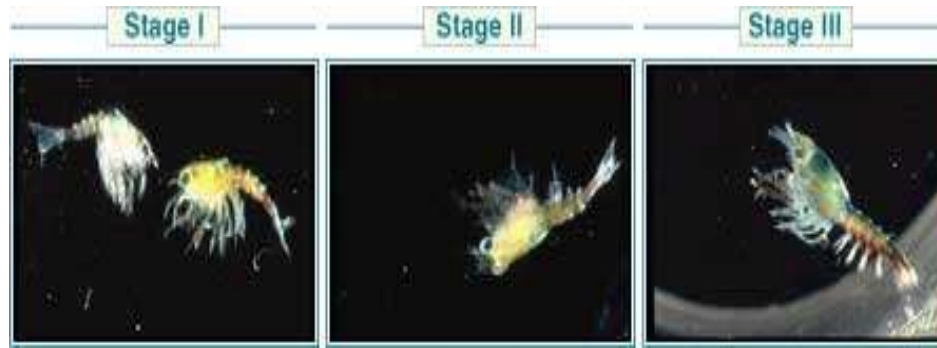
- The eggs hatch into transparent, flat **and leafy shaped larvae** called as **Phyllosoma** larvae.
- Has antennules, antennae, paired eyes and very long jointed setose appendages for **swimming.No pleopods** has been developed
- There are **8-11** Phyllosoma stages(sometimes a pre-Phyllosoma, and pro Phyllosoma)
- They are carried away by the currents even to **oceanic regions** and moults several times before metamorphosing to the postlarva (puerulus).
- Swims vertically and drifted with whim of currents.

- Phyllosoma larvae of *P. homarus* have been reared to stage **6 in 60 days**.
- Recently larvae were reared to **stage 8 in 42 days** on a mixed diet of *Artemia* and plankton



Puerulus

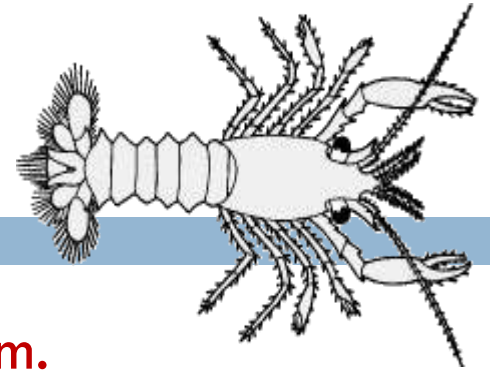
- It is transparent, free swimming, **non feeding post larval stage** that moves inshore where it settles to the bottom
- Puerulus becomes juvenile lobster which leads **a nectonic swimming life** with well developed appendages
- The size of this larvae is **very large, having head, thorax, abdominal regions**, and is transparent as glass
- A large carapace covers the first two thoracic segments and head.



FOOD & FEEDING

- **Larvae**-omnivorous & opportunistic
 - Eat zooplankton (water fleas, copepods, crab larvae, eggs)
&
 - Phytoplankton (Diatom, dinoflagellates, filamentous algae)
- **Post larvae** –
 - larvae of crab & gastropods, copepods, fish eggs (**floating**)
 - small shell fish, marine worms, small sea urchins & a little phytoplankton (**settling**)
- **Juvenile & adult** – Benthic Predators, nocturnal foragers
- Crab, shell fish, echinoderms, marine worms, dead organisms
- Rarely eat algae & aquatic plants

Nursery rearing



- Floating nursery cages dimension **3 m x 3 m x 2 m**.
- Stocking Density - **50-100 pueruli /m²** (submerged cages).
- Finely chopped trash fish, crustaceans and molluscs are used as food.
- The nursery phase lasts for 3-6 months, during which the lobsters grow to **10-30 g**.
- Mortality during the nursery phase may be as high as **40%** but under optimal conditions is usually less than **10 per cent**.

Juvenile rearing

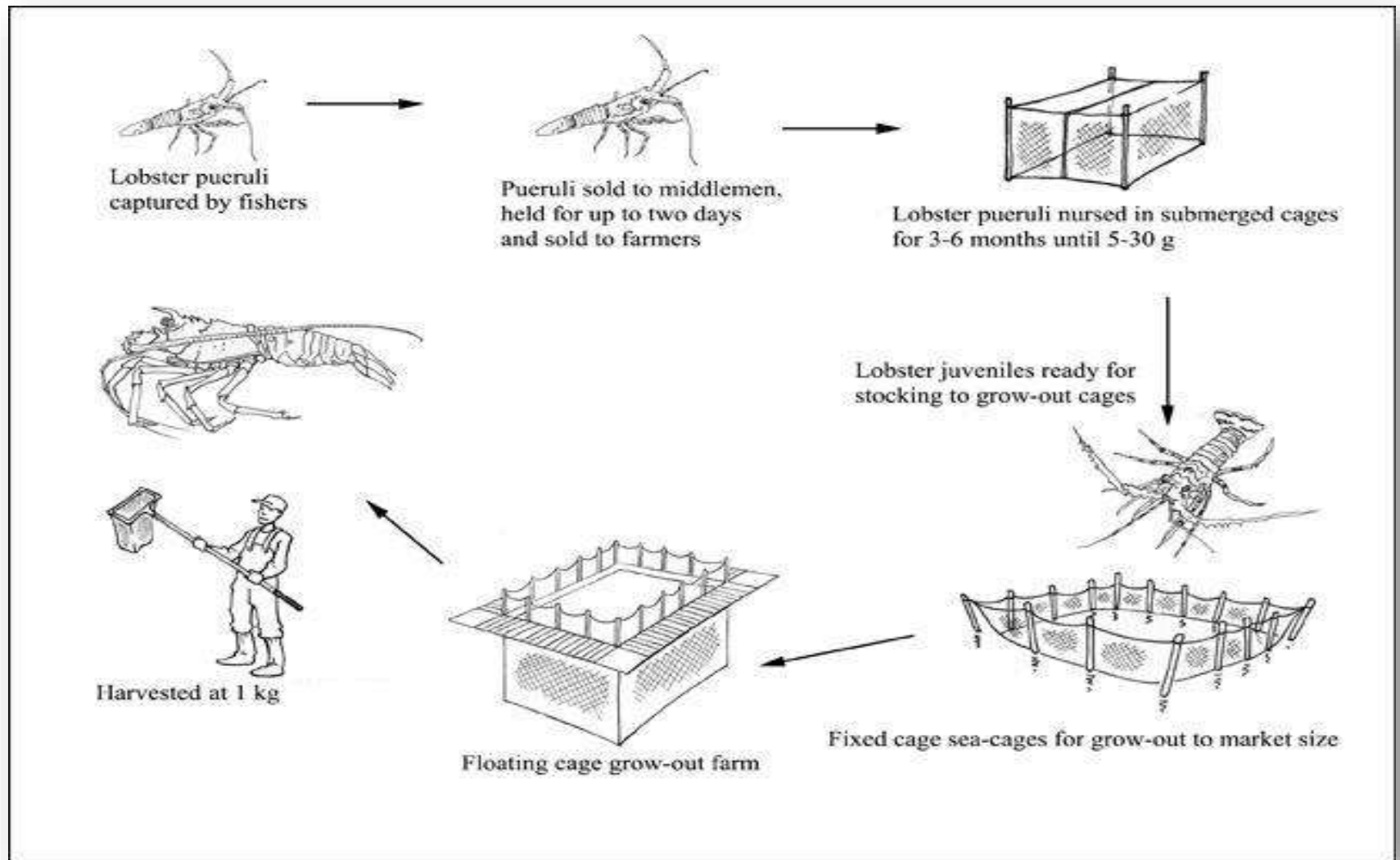
- In nature – juveniles are **benthic**
- In hatchery they are removed & placed in individual on-growing containers
- This is done to avoid cannibalism
- Containers placed in raceways with re-circulating water
- Uneaten food removed in each day
- Juveniles kept in hatchery for 3 months



Moulting

- Within the **first five to seven years** of its life a lobster may shed its shell up to **25 times**
- Flex their bodies back and forth and eventually back out of their old shell
- Lobsters that have just molted are called **“jellies”**
- No definite period the new shell to harden
- As lobster gets bigger, the number of molting events decreases
- Adult lobsters only molt about once a year

Production cycle



Collection of juveniles

- Studies conducted off Kovalam near Chennai show that puerulii of three species *P. homarus*, *P. polyphagus* and *P. ornatus* settle in rocky areas.
- There is no information on settlement density of puerulii anywhere along the Indian coast (Radhakrishnan, 2012).
- Juveniles can be collected from surf ridden and coral areas by handpicking or from by-catches of fishing gears (bottom-setgill nets, trammel nets, traps, trawl nets etc)

Transport of juveniles

- i. **Floating ice blocks** packed in polythene bags should be used for chilling the holding tank in case of high temperature
- ii. Lobsters should be **tied with rubber band** from the spine at the carapace to **abdomen to reduce the movement.**
- bamboo baskets having a layer of straw/ soaked in seawater are used to transport lobsters
- iv. Over this layer of straw, ice blocks packed in polythene bags should be placed and a second layer of seawater soaked-straw should cover this
- V. Such immobilized live lobsters should be placed over the second layer of straw.



- Moist beach sand, bamboo and palmyrah leaf baskets, gunny bag materials, hay, saw dust, wood shavings etc in thermocol boxes, polypropylene bottle, polythene bags are used for live transport of lobsters.
- The "berried" females are captured from the wild, using pots.
- Transport in containers filled with seaweeds to prevent the eggs drying out shows good result



Quarantine

The healthy animals should be given **malachite green bath treatment** (at 0 .25 ppm concentration) for 1 hour on alternate days for three times totally.

- 1) Active swimming behaviour;
- 2) Functioning of appendages;
- 3) Fungal Protozoan infections;
- 4) Tail or pleopod erosion or black spot occurrence;
- 5) Mortality rate, and
- 6) Environmental stress and survival rate.

Acclimatization and stocking

Animals have to be acclimatized for 2 weeks before stocking in fattening tanks.

| S.no | Size group (g) | Stocking density (nos/m ²) |
|------|----------------|--|
| 1 | 50-75 | 25-30 |
| 2 | 75-100 | 20-25 |
| 3 | 100-125 | 8-10 |
| 4 | 125-150 | 6-8 |

Feeding

- The lobsters can be fed with the feeds available near the site like clams, trash fishes and mussels.
- Lobsters were fed with trash fish, small crabs, marine worms and clams @ 10% bodyweight and also on compounded feeds.
- The spiny lobster is a **selective feeder**, preferring shell fish to scale fish .
- Natural food items such as mussels, clams, squids, trash fish etc. could be used as fattening diets .
- Artificial diets could be used as supplementary diet for fattening.
- Lobsters **feed before nightfall**
- **Highest intake** is at the **beginning and end of the moult**
- Maximum feed intake was observed @ 13.1% of bodyweight (Average 5-10%)

Water quality management

| Parameters | Range |
|---|------------|
| Salinity | 30-35 ppt |
| Temperature | 26-33°C |
| pH | 7.5-8.5 |
| Dissolved oxygen | >4.5mg/l |
| Total ammonia | <1 ppm |
| Free ammonia-NH ₄ ⁺ | < 0.25 ppm |
| Nitrate-NO ₂ -N | <0.25 ppm |

Sampling/Monitoring

- Sampling can be done in once in **30 days**.
- animals of small size group (60 - 70g) moult twice within two months
- large size group (150 - 160 g) moult only once within the same period
- Growth can be assessed on their **weight increment**.
- **Record** the weight of freshly moulted animals only after their **exoskeleton hardens** (2-4 days after moulting).
- This will minimize the handling stress to the animals.

Harvesting

- **Ten days before** the date of harvesting the lobsters should be given a quarantine treatment using **0.5ppm malachite green** for a period of one hour in order to remove the algal deposits if any in the carapace of lobsters.
- lobsters can be harvested using a **hand net** without damaging the antennae or other part of the body.

Land based FRP tanks

- In Vizhinjam, Southwest coast of India, growth of Juveniles and sub adults of *P. homarus* was studied in FRP tanks and Cages
- Specific growth rates **0.45%** and **0.50%** of the body weight were obtained per day **in FRP** tanks and **sea cages** respectively.
- **Better survival** was obtained in the **cage** (75%) than in tanks (71%).

Fattening in outdoor cages

- (a) site selection
- (b) cage deployment and stocking
- (c) feeding
- (d) sampling
- (e) cage maintenance

Site selection

- (1) Locality: The site should be preferably free from cyclone and heavy rain.
- (2) Water source and quality: areas of extreme salinity fluctuations should be avoided for the fattening activity, the mean temperature is always within the optimum range of 26-33°C.
- (3) Availability of lobster juveniles;
- (4) Availability of live food organisms
- (5) Infrastructure and communication facilities
- (6) Power supply
- (7) Labour force:
- (8) Technical services and support
- (9) Social, environmental and ecological impacts
- (10) Market

Cost involved

BASIC CONSIDERATIONS

1. Stocking area
2. Stocking size and age
3. Stocking species
4. Stocking density
5. Fecundity & Survival
6. Harvesting size
7. Total breeding period
8. Water resources and treatment

Capital Cost

1. Quarantine / holding tanks 3x3x2m
2. Brooders tanks
3. Breeding tank
4. Hatching tanks
5. Larval rearing tank
6. Bore well /water supply
7. Motor/ Aerator/ Electrical work
8. Bucket, Hand net, roofing

Operational cost

1. Brooders
2. Feeds
3. Electricity charges
4. Communication charges
5. Wages
6. Maintenance and Management cost
7. Marketing and transportation
8. Miscellaneous

Total incurred cost = capital cost + operational cost

Constraints

- **Inability to produce seeds in captivity** due to its long and complex larval life
- Proper **diet for different larval stages** is considered to be a major constraint in the larval culture
- In rearing phyllosoma larvae is maintenance of exceptionally **high water quality** throughout the rearing stage.
- **Collection** of large number of puerulus from nature is **capital intensive and impractical**

Recommendations

- **Protection of egg bearing lobsters** and avoiding them in fishing.
- Strict enforcement of **Minimum Legal Size (MLS)** for fishing by the state governments
- **Ban on operation of destructive fishing gear** (Trammel nets) and fishing by divers. Traps with escape gaps to be promoted
- Establishment of **marine reserves or lobster Sanctuaries** to maintain and protect breeding stock
- Establishment of **Artificial habitats** to provide additional substrate for young lobsters (increase food production and protection from predators)