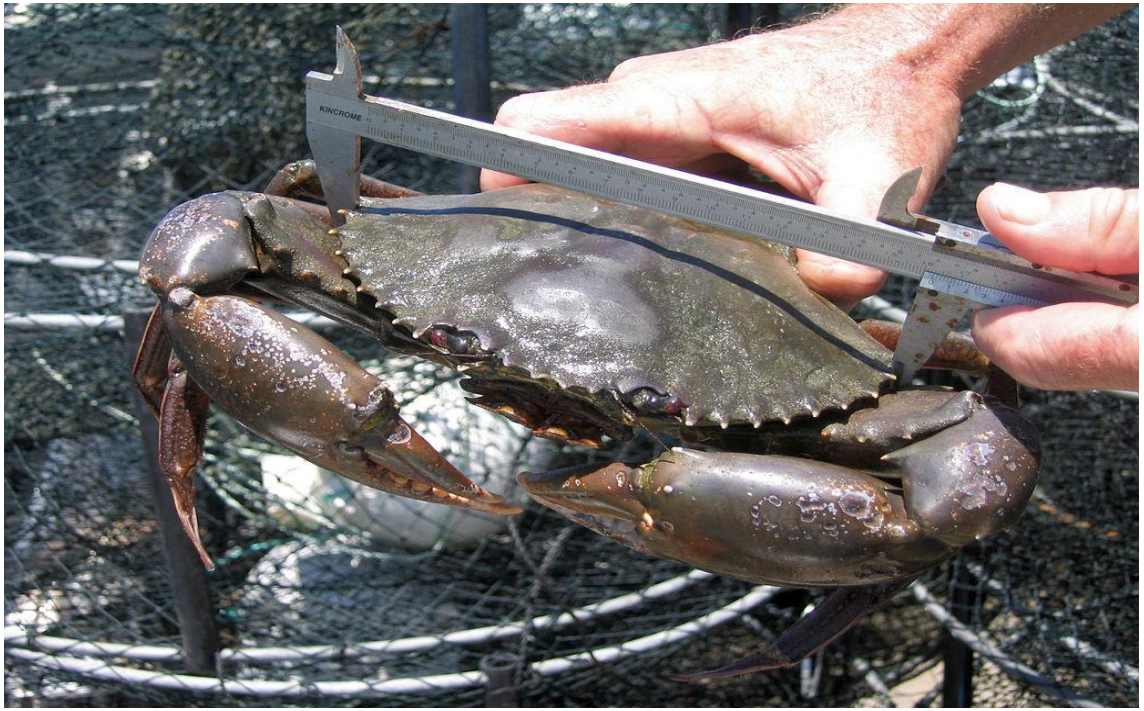
Breeding and Seed production of *Scylla serrata*

Gulshan Kumar
School of Fisheries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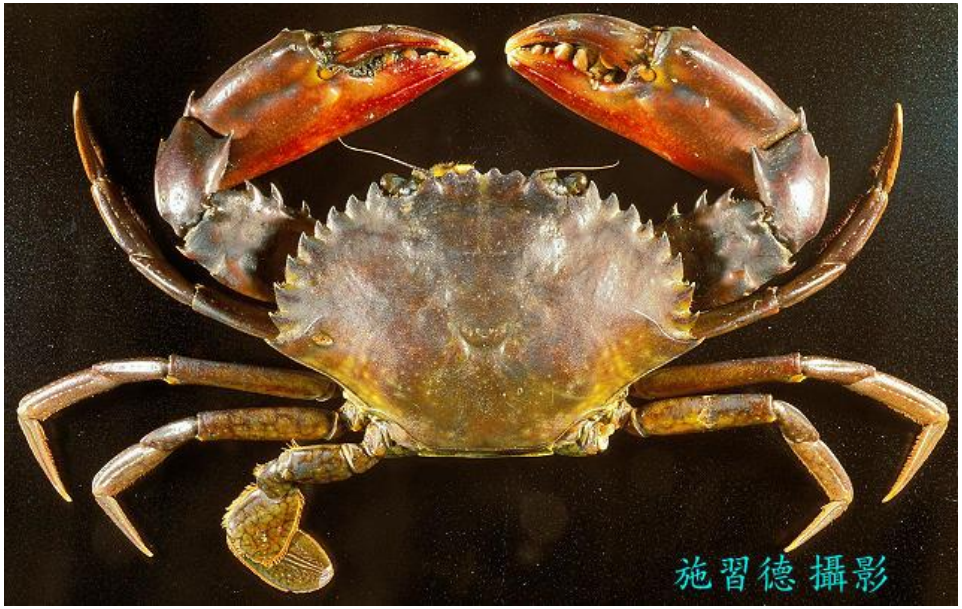
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Systematic position

ORDER: Decapoda.

FAMILY: Portunidae.

GENUS :Scylla

SPEIES: Scylla tranquebarica.

Scylla serrata

Scylla olivacea (orange mud crab)

Scylla paramamsain (green mud crab)

Introduction

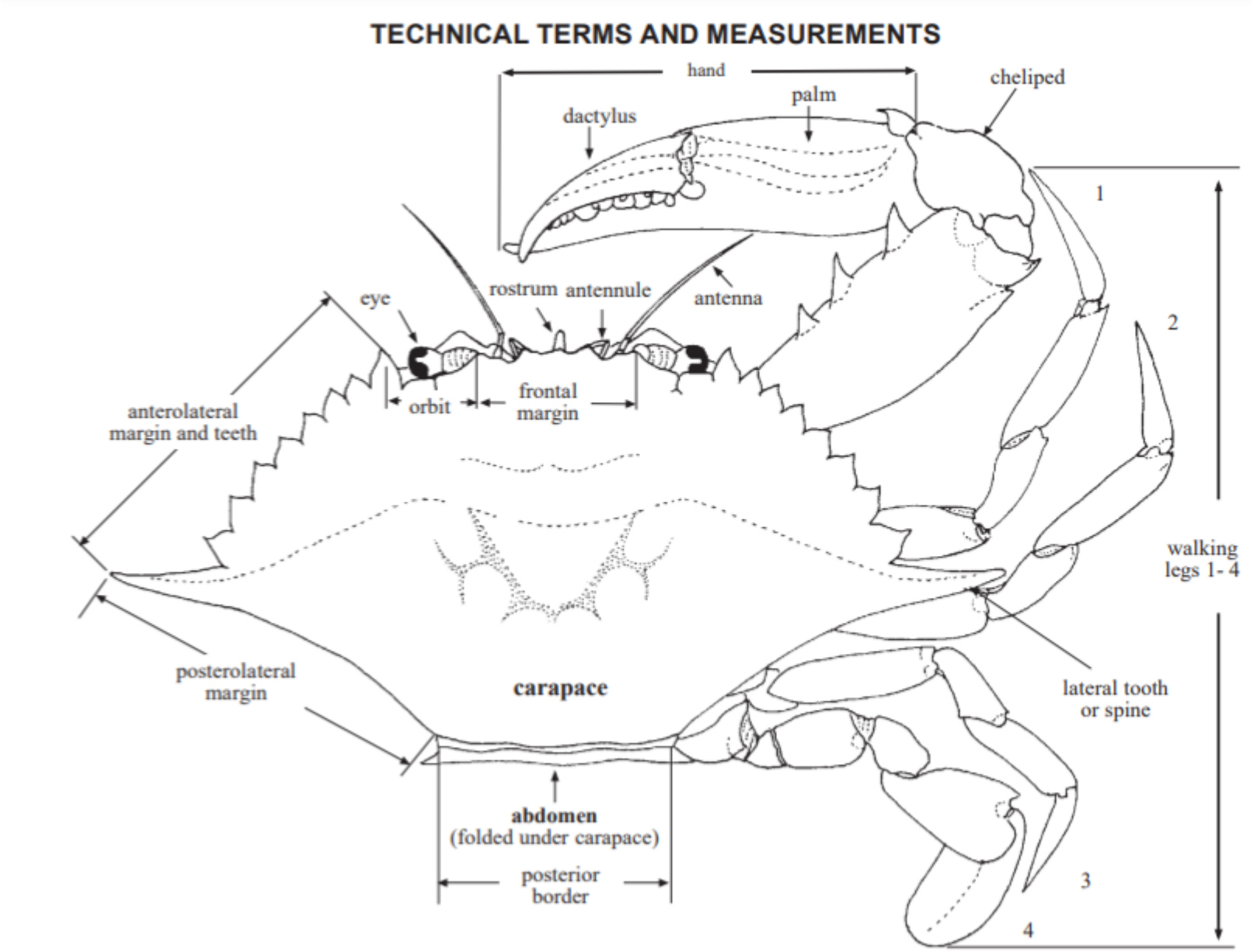
- **Edible crabs of commercial importance are *Scylla serrata, Scylla tranquebarica, Neptunus pelagicus and Neptunus sanguinolentus.***
- *Neptunus pelagicus* and *Neptunus sanguinolentus* are **entirely marine** where as the *Scylla serrata* and *Scylla tranquebarica* are commonly called as **mud crabs migrate to brackish** water for growth while they are juvenile and the **adults migrate from brackish water to the ocean** for breeding and spawning.

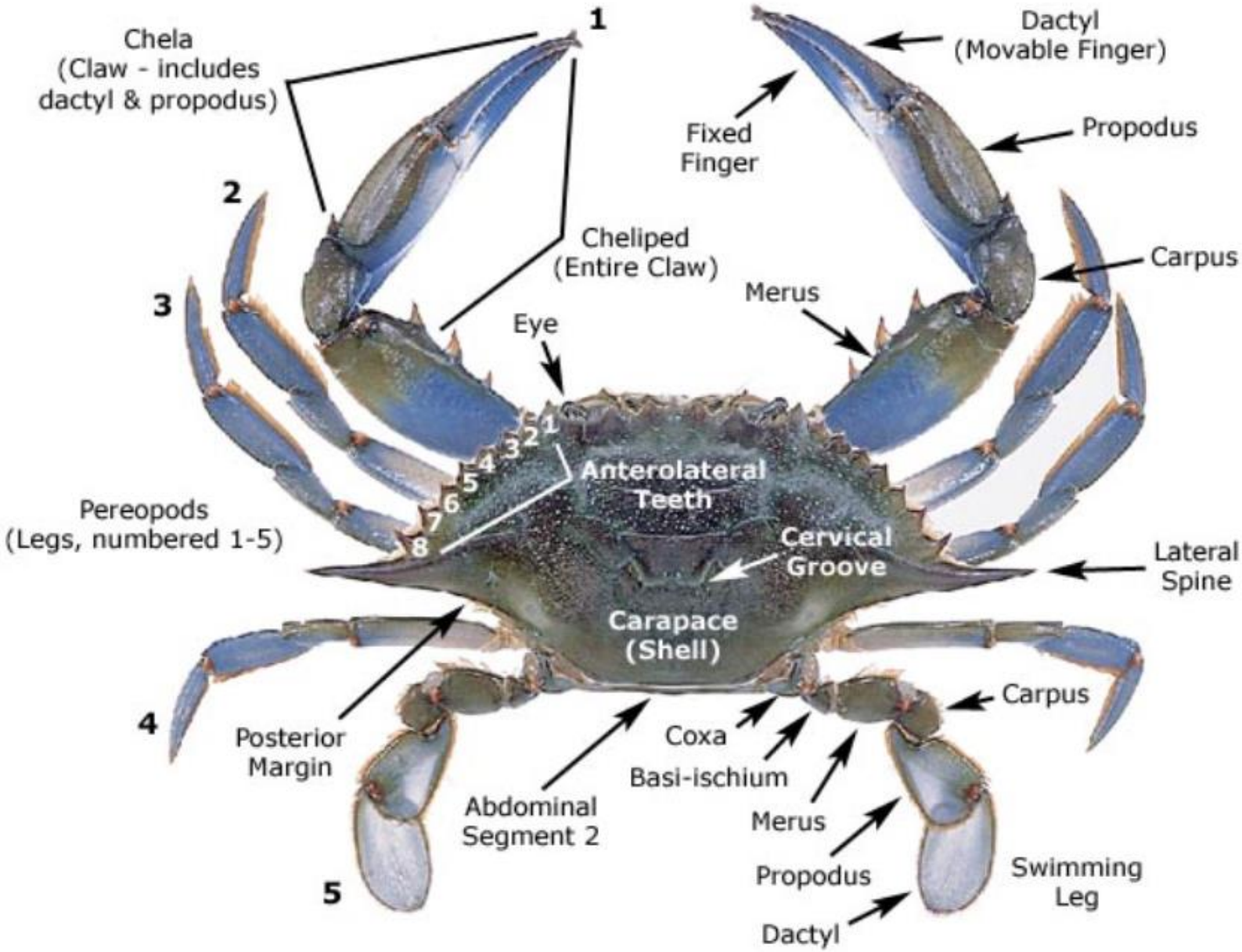
- Among the commercial important brachyuran crab, the species of the genus Scylla, know as **mud crabs, green crabs or mangrove crab** are widely used for aquaculture purpose in the Indo west pacific region.
- In their most common form, the shell colour varies from a deep, mottled green to very dark brown.

- In India species of mud crabs namely
- 1. *Scylla tranquebarica*
- 2. *Scylla serrata;* are extensively exploited from both the shore marine & adjoining brackish water area.
- Mud crab also preferred for their **medicinal value.**
- **Crab are acknowledged to be low in fat ,high in protein, & are excellent source of minerals & vitamins.**

- **Mud crab can tolerate wide range of salinities & migrate estuaries areas during post larval stage, grow fast & attain maturity.**
- **Among the marine crabs, mud crab the only species which can remain alive out of water for a considerable time.**

Morphology of crabs




Chela
(Claw - includes
dactyl & propodus)
1
Dactyl
(Movable Finger)
Fixed
Finger
Propodus
2
Cheliped
(Entire Claw)
Carpus
3
Merus
Eye
1
2
3
4
5
6
7
8
Anterolateral
Teeth
Pereopods
(Legs, numbered 1-5)
Cervical
Groove
Lateral
Spine
Carapace
(Shell)
4
Posterior
Margin
Carpus
Coxa
Basi-ischium
Abdominal
Segment 2
Merus
Propodus
Swimming
Leg
5
Dactyl

Dorsal View

- Crabs can be **classified into 2 main groups, brachyuran crabs (infraorder Brachyura) and anomuran crabs (infraorder Anomura).**
- Most species of Brachyura, or true crabs, can easily be separated from the so-called “false crabs” belonging to the infraorder Anomura by having 4 and one cheliped pairs of well-developed walking legs.
- Anomuran crabs always have only 3 pairs of walking legs clearly visible, while the fourth (last) pair is very small, normally tucked under the body and hardly noticeable.

- The 5 pairs of locomotory appendages of a crab (the pereiopods) are made up of a pair of usually powerful chelipeds (legs carrying a chela or pincer) and normally of 4 pairs of walking (or ambulatory) legs. For the present contribution, the first appendage is referred to as the cheliped and the last 4 appendages (walking legs) as legs.
- The claw (or chela) itself consists of a palm (or merus) and 2 fingers, one of which is movable (the dactylus or movable finger), whereas the other one (pollex) is fixed.
- 5th pareopod is modified for swimming and burrowing.
- Most crabs have 7 abdomenal segments, last one is called as telson. Some of them can be fused with each other.

Identifying characters

- In **Scylla serrta**
- Outer margin of wrist (carpus) or cheliped with one blunt spine,
- color of upper surface of body (carapace)greenish brown.
- lower surface of cheliped dark to pinkish red in color.
- Found in the region of mangrove, estuaries and creek.

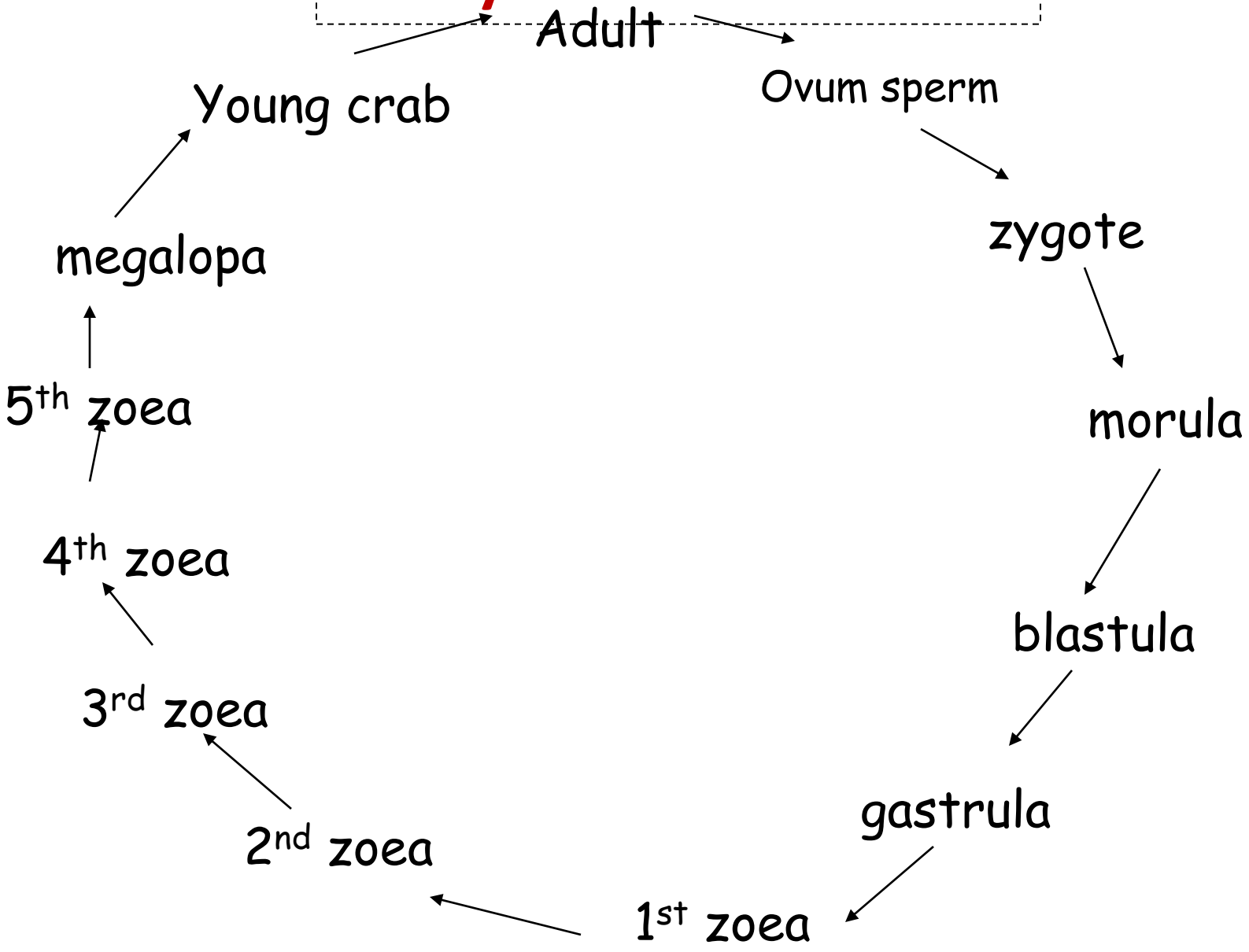
Habitat

- Adult crab are found in the shore seas & estuarine system.
- Being a member of family portunidae crabs the mud crabs possess a paddle shaped swimming leg ,which help them for fast swimming in columnar waters.
- Their megalopa stage (post larva) migrate into the estuaries, coastal lagoons & backwaters, grow fast, attain maturity & the female become berried.
- For hatching the larvae, the berried female of mud crab migrate to inshore sea.
- They are nocturnal feeder feeding mainly on bottom dwelling animals such bivalve, small crabs and dead decayed animals matter.

Growth

- Males grows larger in size than female.
- The size frequency studies have indicated male & female mud crabs grow at a rate of 9 & 10 mm in carapace width (cw) per month respectively.
- *Scylla serrata* 140 mm/0.7kg in the wild.

Life cycle of mud crab



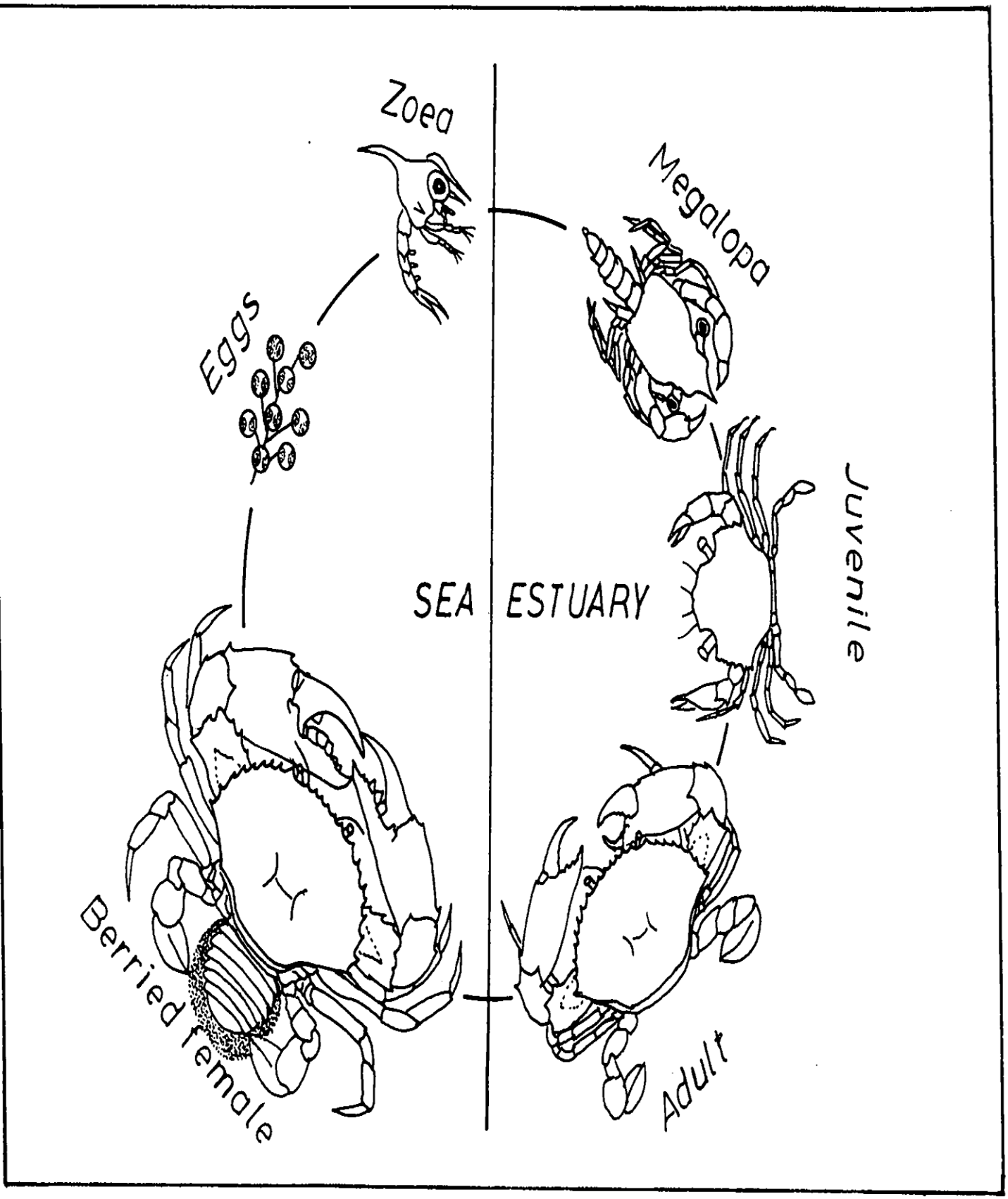
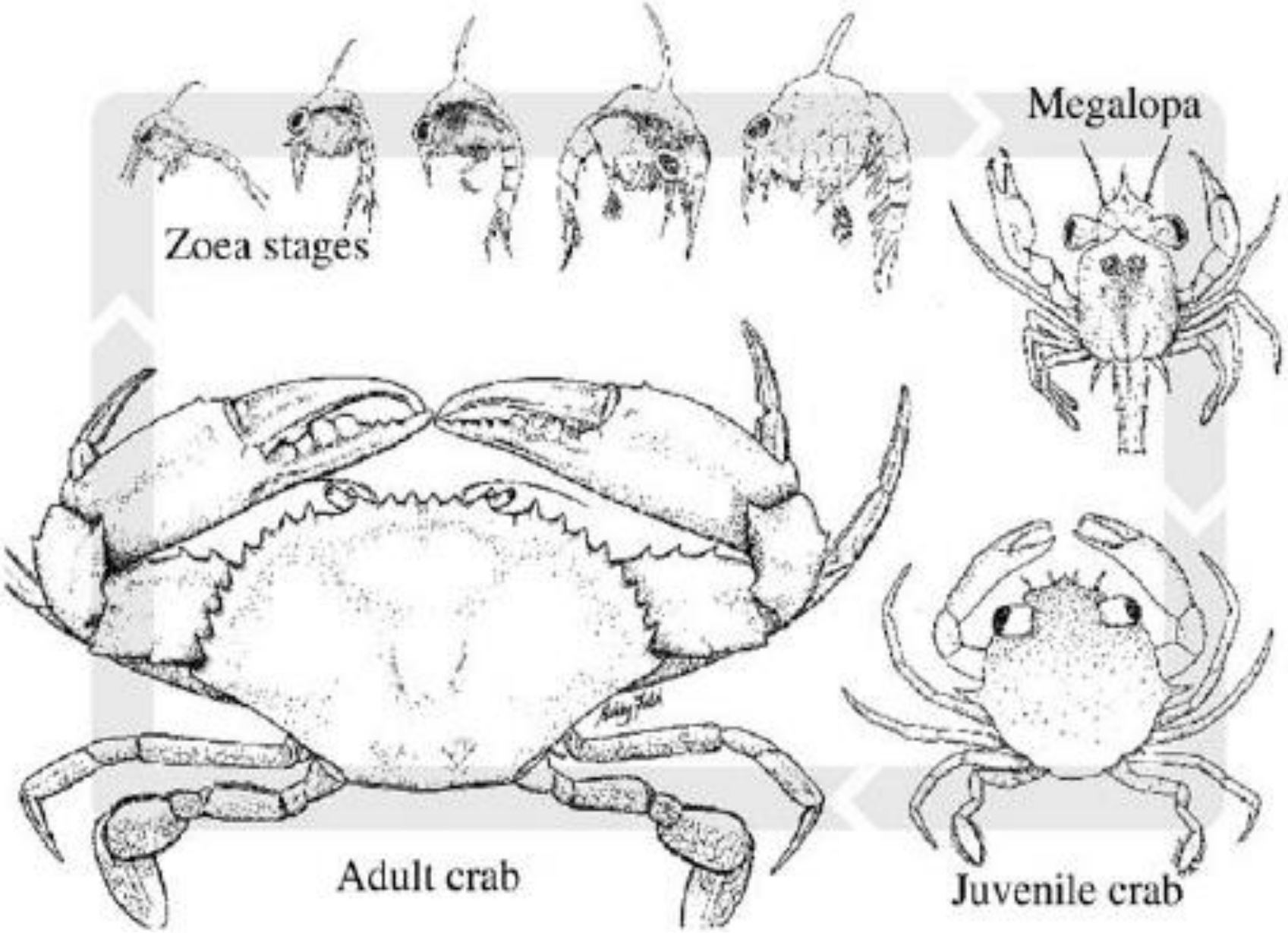
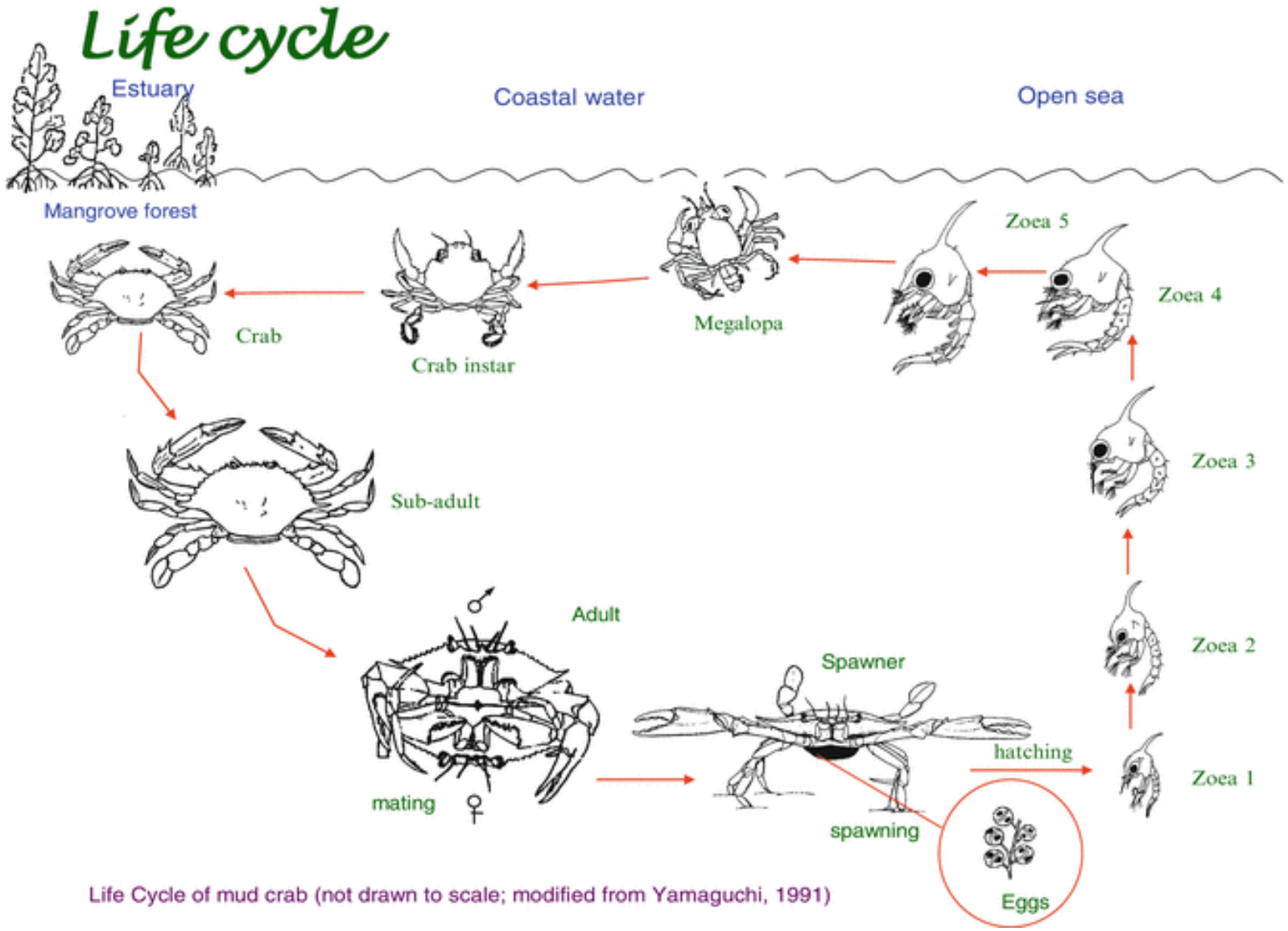


Fig. 1. Life history of a mud crab.


Zoea stages
Megalopa
Adult crab
Juvenile crab

Life cycle



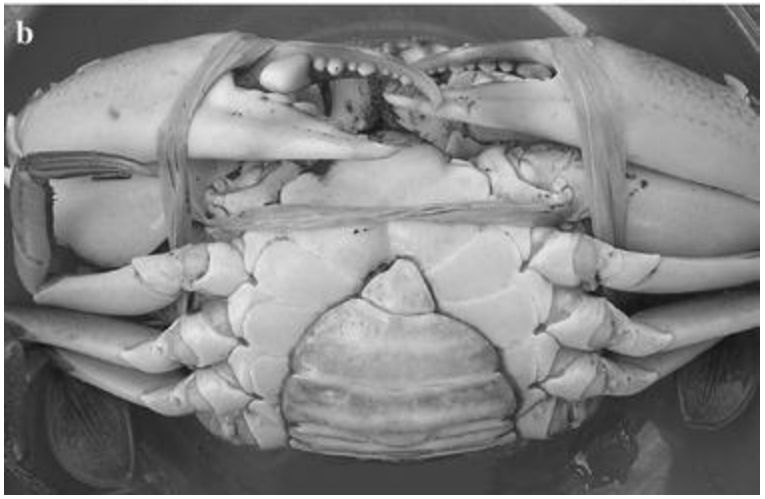
Life Cycle of mud crab (not drawn to scale; modified from Yamaguchi, 1991)

Breeding biology

Sexual dimorphism

	MALE		FEMALE
1.	Abdominal flap which is folded firmly against the ventral side of cephalothorax is slender & triangular.	1.	Abdominal flap folded against the ventral side of the body is broad & triangular /semicircular in berried female
2.	Appendages are present only on 1st & 2nd abdominal segments & the same are modified to copulatory organ.	2.	There are 4 pairs of abdominal appendages present from 2nd to 5th segment & the same are used for carrying the eggs.
3.	The claws are comparatively larger.	3.	The claws are smaller.


a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Size at first maturity

The size at first sexual maturity is 83 mm(CW) for S. serrata. The early maturing ovary is bright orange where as in mature ready to spawn female it is deep yellow.

Maturity stages

STAGE	TESTES	OVARY
IMMATURE	Transparent/creamy in color; occupying 1/6th of body cavity, without a prominent vas deferens.	Transparent/ yellowish in color. occupying 1/6th body cavity, without a prominent seminal receptacle.
MATURING	Creamy white in color; occupying 1/4th of body cavity.	Pink in color ;occupying 1/4th or 1/3rd of body cavity.
MATURE	Milky white in color ;with a thick vas deferens, occupying full body cavity.	Orange in color; with a prominent seminal receptacle, occupying full body cavity.

Fecundity

- The no. of egg found attached to the pleopod of female mud crab.
- 1-3 million for Scylla serrata.
- 2-5 million for Scylla tranquebarica.

- 2.5 to 7 million for Scylla oceanica.

Breeding season

REGION	PEAK BREEDING SEASON	PEAK JUVENILE IN ABUNDANCE
1.Kerala coast	Sept-Feb	May to oct in vembanad back water
2.Tamilnadu coast	Sept-April	December to may in pulicatlake
3.Andrapradesh coast	Oct-Feb & May – June	Dec to April & July to Aug in kakinada.
4.Orissa coast	November- January	March to June in chilka lake
5.West Bengal coast	May- Aug	Nov to feb in hoogly Malta estuaries system.

Mating behavior

Copulation take place between a hard shell male & freshly moulted soft bodied female.

The courtship is initiated by a premating embrace between the hard shell male & hard shell female which lasts for 2-3 days.

Premating embrace is accomplished by the male clibing over the female and holding her by his cheliped & 1st two pair of walking legs.

When the female is about to moult, the male leave the riding position & helps the female in casting off the old cuting.

A few hour after the precopulatory moulting ,actual process of copulation start.

This embrace lasts for 6-8 hour during which time male deposits the spermatophore, in the seminal reptacle of the female.

After that male & female separated.

Female Snow Crab

Mating behavior of mud crab

Spawning

The ova are extruded by the female & fertilized by sperm stored in the spermatophores.

The fertilize egg are attached to the ovigerous setae of the abdominal appendages.

Incubation & hatching

The berried female carry the egg for 2 weeks during which period the embryo develops in the egg.

The egg change the color from orange to brown.

Just before releasing the larva the egg become black.

At the end of incubation zoea larva hatch out.

Larval development

- There 5 zoeal stages and one megalopa stage.
- Zoea takes 15 – 20 days to become megalopa and megalopa takes 8 – 11 days to become juvenile.
- Newly hatched larva measures 1.2 mm in size and consists of cephalothorax, 5 segmented abdomen and a telson.
- As it passes through 5 zoeal stages, body and appendages grow.
- Megalopa larvae has a crab like appearance.

Larval stage	Distinguishing feature
Zoea1	Eyes are sessile. Abdominal segments are 5. telson with 3+3 spine.
Zoea2	Eyes are stalked. abdominal segments are 5. telson with 4+4 spine.
Zoea3	There are 5 abdominal segments.
Zoea4	Pleopod buds appears in abdominal segments & rudiments of remaining thoracic appendages also appear.
Zoea5	Setae are present in pleopods. telson with 5+5spines.rest of thoracic appendages develop.
Megalopa	Carapace length is more than the width, abdomen with 5 pairs of pleopods. a pair of cheliped & 4 pair of legs are seen.
Crab1	Carapace length 9 anterior lateral spines on either side.1st pair of cheliped & three pair walking legs, fifth pairs of legs has paddle shaped dactylus.

Hatchery technology

Components of crab hatchery

- For the operation of a hatchery for seed production of crab, the following are the component required.
- 1.Brood stock development unit.
- 2.Hatching unit.
- 3.Larval rearing unit.
- 4.Live feed culture unit.

Broodstock rearing

- The berried females can be either collected from the nature ground or raised in a pond.
- If the berried female are available from natural ground, only a holding tank shall be required in the hatchery for maintaining the brooders.
- Berried female with yellowish/orange eggs mature to grey/blackish eggs within 5-7days & can be fed on squid meat twice daily.
- If brood stock has be raised, tanks are to be excavated to stocks young crabs (crablings) collected from wild. The size of the tanks may be 0.1-0.4ha.

The central portion of the pond can be kept shallow or slightly exposed which will stimulate the natural habited of *Scylla serrata* to burrow & live inside the burrow.

It may also serve as a feeding place.

Surrounding the pond ,along the inner edge or on the top of bundh fencing is made to prevent the escape of crawling crab.

Fencing of 1 meter height. Inside the pond pipes, PVC pipes or wornout tyres are kept , help in hiding and shelter, reduce fighting among hard shelled crabs and prevent mortality of soft crabs.

- Young crab of 80-100 gm can be stocked @2-5no.per sq m.
- Feeding can be done within trash fish /bivalve/gastropods meat at the rate of 5% of body weight initially which can be increase to 10% towards the part of rearing period of 4 month.
- Temp: 28c.
- Do :5-7ppm.
- Depth: 0.5-1m.
- ph: 7.5-8.5
- From the cultured pond either berried females are collected or to induced gonadal maturation eyestalk ablation of female can be obtained , within 15 days berried females can be obtained for the hatchery used.

Hatching and larval rearing

The berried females are dipped in 10 ppm malachite green /methylene blue for 5 min as a prophylactic measure & released into 500 litre capacity FRP tanks /cement covered with black cloth to prevent the passage of light.

The zoea larva that are hatch out are attracted toward the light.

The incubation period of crab is 8-15 days.

The firstly hatched zoea are stocked @200-400 numbers per litre in fibre glass/cement rearing tank of 2 ton capacity.

- The filtered sea water having salinity 30-35ppt.
- Temp: 27-28(below 26 is not suitable).
- 80% water has to exchanged daily.
- Each zoea stage of 3-4 days duration, at the end of which they moult to enter into next stage.
- Zoea1: 2-4 days.
- Zoea2: 3-4 days.
- Zoea3: 3-5 days.
- Zoea4: 6-7 days.
- Zoea5: 5-8 days.

- After 5 moult the larva become megalopa.
- The megalopa moult several time.
- Thus it takes 27-30 days for the 1st zoea to become 1st crab instar.
- Megalopa grows to juvenile crab within 8-11 days.
- During the zoea 1 to zoea 5 heavy mortality (50%-70%).
- Zoea 5 to megalopa ,less mortality (10-20%)
- During the growth of megalopa to crab 1 stage, cannibalism is serious. cannibalism can be as high as 60% mortality.

Hatchery & nursery for mud crab

Feeding the larva

- Rotifers and artemia nauplii have been the shown to be suitable feed for larvae.
- Rotifers given at early stages and artemia nauplii given for megalopa to crab stages.
- During the early zoea stages (z2-z4) artemia nauplii swim faster than the zoea and hence larvae can’t catch the prey. So, 1 days old frozen artemia nauplii has recommended foe zoea stages.

- Zoea stage 1 to 3:

a. algal cultures chlorella sp @ 20000 cells/ml, chaetoceros@1-2 lakh cells/ml ,tetraselmis @ 1000cells, Skeletonema costatum/isochrysis@5000 cells/ml.

b. Rotifer (Brachionus plicatilis) @30-60nos/ml.

c. Artificial feed shrimp larval feed @0.5g/ ton of water.

❑For zoeal stage 4-5:

- a: Algal culture :chlorella @20000 cells per ml , chaetoceres 1-2 lakh cells /ml .tetraselmis @1000 cells /ml.
- b: Artemia nauplii 5-50 nos.per ml.
- c: Artificial feed @ 0.5g /ton of water.

- For Megalopa:

  a: Two days old live artemia @50 nos. per ml

  b. Bits of flesh of prawn ,bivalve, mollusks, squid & fish @150-200g/ton of water.

  c. Artificial feed @0.5 g per ton of water.

- 1st crab instar to tenth & further instars:

  a: Flesh of prawn ,bivalve mollusks & fish @ 3-5% of biomass.

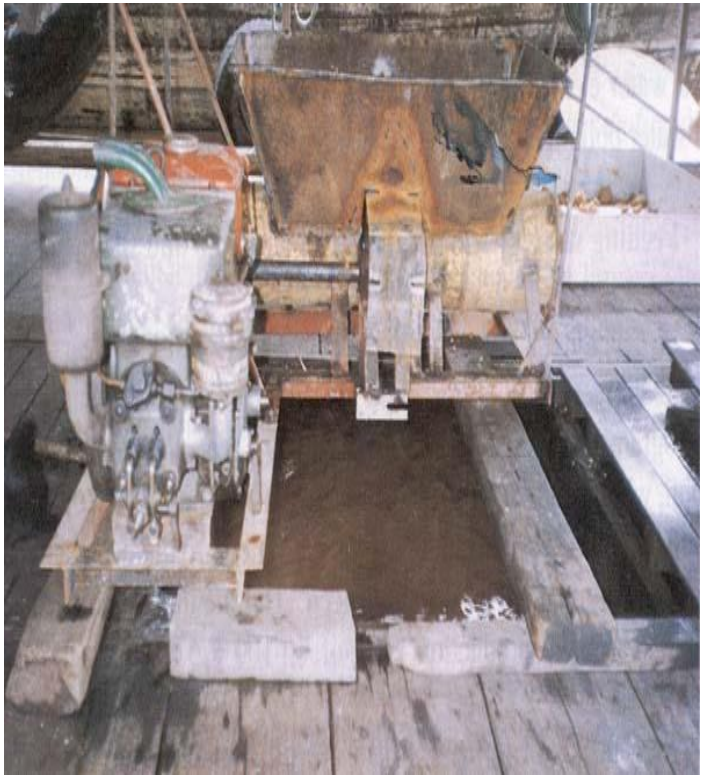
  b:Artificial feed @ 0.5g /ton of water.

  c:During larval rearing high mortality or poor survival rate has been reported by all workers. survival rate may be as low as 5-15%.

Post larvae rearing

- Fine sand should be spread on the bottom of the post larvae tanks to a depth of 5cm to facilitate the burying habit of small crabs. The stocking rate should be 5-10 crabs /sqm. Meat of molluscan, gastropod etc were given @ 1-2%.

feeding trial in indoor tank



Locally manufactured feeding machine