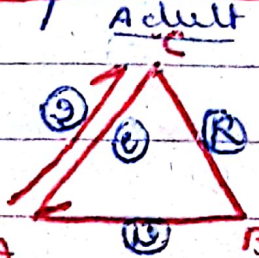
Migration

"The periodic & directed movements from one place to other for specific natural regions like feeding, breeding or for overcomming adverse environmental condition is known as migration."

(IX) Type of migration →

Acc. to Heape "- A type of movements that impels the migrants to return to the region from which they have migrated is called migration". The impelling cause of migration may be various such as alimental (i.e. in search of food), climatic (to secure suitable climatic conditions) Gametic (for spawning) or the osmoregulatory (for water balance).

(X) Acc. to Harden & Jones → Migration is a movement from ~~spawning~~ spawning to nursery ground, from nursery ground to feeding ground & from feeding to spawning ground" Thus he mal- included climatic & osmoregulatory migrations.



R = Recruitment
D = Denatant (with water current)
C = Contranatant (against the water

Type of migration or migratory fishes → (M) (P) Acc to Myers

① Diadromous fishes or (M) (between river & sea)
- (a) Anadromous (P) or (M) → Sea → River to lay egg. (P) eg- Salmon, lamprey, Hilsa.
- (b) Catadromous → River to sea
  eg- Freshwater eels or European eel (~~Conger~~ Anguilla anguilla)

② Amphidromous → fresh sea ⟷ fresh water but the purpose of migration is some other regions but not breeding. (Not true migration)

③ Potamodromous (P) / (M) → Migration within freshwater. Carps & trouts travel long distances in large rivers to spawn & then return to their feeding grounds.

④ Oceanodromous → migration within sea.
eg- Atlantic herring, Sardines, mackerels, & tunnas. These fishes migrate seasonally from the hot to cold water for the purpose of spawning after which they return to the point of departure.

Methods of Migration Studies → Marking & tagging
- Biochemical tests like serum analysis & amino acid composition.
- Physical - By tracing route & direction through ship, aircraft, Submarines & recent echo technique.

(4) Anguilla Anguilla → European eel → 110-119 vertebrae
ii rostrata → (Eastern coast) American eel → 102-111 vertebrae (West)

Influencing factors →

Physical → bottom material, water depth, pressure, oceanic current, tides, transparency, temp, light intensity, photoperiod etc.

Chemical → H^+ ion conc., alkalinity, salinity, dissolved gases, presence of pollutants.

Biological → B.P., sexual maturity, phototaxis, social response, presence of predators, hunger, food, memory, endocrine secretion

Migration of eel →

Some RIDDLE about the migration of eel.

(X) Eel are the major part of european diet & were reared by tanks. Because of their irregular habitat no body knew where they lay their eggs & how their young one looked.

(X) ARISTOTLE → Because eel have no genrative organs & so they do not lay egg. He postulate that they came from the bowels of the earth.

(X) PLINY → Each eel have no sex cells & when they grew old they rubbed themselves against rock & the pieces thus scraped off their bodies came to life.

(X) Some speculated that eels came from the dews of May mornings.

⊗ The aforesaid riddle come to be end when two Italian scientists accidentally found certain leaf shaped transparent fish like animal called as Leptocephali. & they found that when it reaches to size 76 - 101 mm they change to elver.

⊗ For knowing the life history of eel a team under the direction of Dr. Johann Schmidt formed by International council for the study of the sea. This team is done a great work until the death of Dr. Johann in 1939

⊗ During their work they found two kind of Leptocephali one have 7½ more vertebrae than the other. The former was belong to European eel (Anguilla anguilla) & latter to the American eel (Anguilla rostrata). & both species used the Atlantic as their breeding place.

Life history of European eel (Anguilla anguilla).

European eel are found in inland water of the countries situated along the east coast of Atlantic Ocean. They are found from Murmon coast of North Africa, Madeira etc.

The life cycle of europiean eel studied under the following heads →

Transformation into silvery eel →

(x) The feeding & growing stage of EE is called as yellow eel. At the onset of autumn the Y.E. transformed to a sexually mature & breeding phase called as silver eel. Following change occure at this stage →

(i) The eye become enlarged like deep sea fish
(ii) The retinal pigment (chrysopsin) appear
(iii) The yellow-green colour of body changes to silvery white at the side & black along the back.
(iv) The skin thickness increases
(v) The lip become thinner & snout sharper.
(vi) The osmoregulatory mech. change to sea habit & no of chloride cells (ch secretary of gills increase.
(vii) Reproductive organ become well developed
(viii) Fish stop feeding & alimentary canal become reduced in size or shrink.
(ix) Pectral fin become pointed & darker in colour.
(x) Rete mirabilia of swim bladder become enlarged.

Movement to sea →

Pelagic → Now silvery eel make them for a long journey (3830 km) to the SARGASSO sea in the Atlantic near the Bermuda.

They move down from isolated ponds, lost lakes, river even crawling over grass land & mud meadows in the cool of the nights in the direction of the east and at last plunge to sea. & start journey.

- The question why eel covers this long distance to reach atlantic for breed. Ans. is that they finds suitable conditions such as temp, depth, salinity for spawining.
- During journey some die, some eat up by predators & those which entered the spawining ground die after spawning.

Pelagic eggs & Spawning →

- Eel spawn the egg at a depth of 400-700m below the surface at temp of 10-12°C.
- The eggs are pelagic like marine fishes.
- As eggs rise above the surface the process of development completes & hatching occure. during this the ~~year~~ temp change from 10-12°C (700m depth) to 20-25°C (at 80 m depth).

Lepto cephali & Larval Drift →

- The larva hatching out from egg is called PROTOCEPHALINE larva. It bears yelk sac & confined to a depth of 200-500m
- As yelk sac absorbed the protocephaline larva change to LEPTOCEPHALUS larva having following chs.
  - 1- It is divoid of yelk sac & confine to a depth of ~~500~~ 50-100m.
  - 2- Body have glassy transparency but eyes have silvery transperency.
  - 3- Presence of large size eye, head & brain
  - 4- Skeleton unossified
  - 5- Teeth are long & needle like.
  - 6- Gut become as a straight tube.
  - 7- RBCs, Spleen, & air bladder absent.
  - 8- Kidneys are aglomerular.
- The lepto cephali migrati passively by north Atlantic drift from their spawining ground (Sargesa sea) to nursery grounds (coastal water of europe). This is completed in about 2-2½ years. (At the end of Ist year they become 25 mm in size & at the " " IInd " " " 50-75 " ") & ~~the~~ attain a size of 70-80 mm. It is estemated they reach to Europe by their IIIrd Summer.

Elvers →

(x) In autmen & winter of IIIrd year they change shape & become pencil-shaped elvers (or miniature eel) generally called as Glass-eel.

(x) The leptocephlia metamorphosis to elvers is a time of one year during which following change occure —

(1) Larva stop feeding at the one set of metamorphosis

(2) The middle like teeth lost & replaced by others.

(3) The body become cylendrical in shape

(4) The length of larvae also decreases.

(5) Pigmentation occure in skin layer.

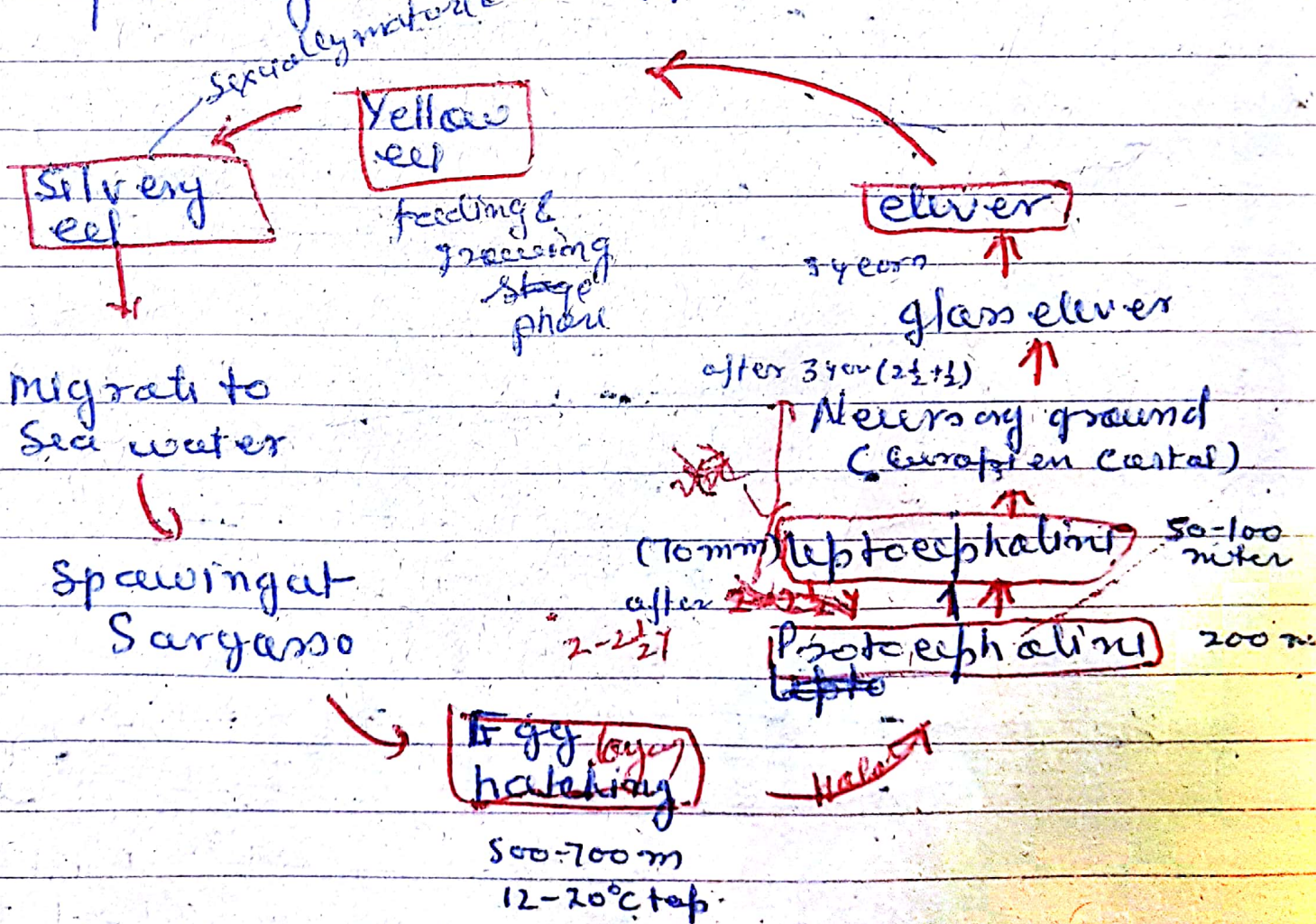
Return to parental home →

(x) Elvers continue to develop in coastal water for about 3 years As they become stronger they start swimming & reach to mouth of river & entre fresh water.

(x) The male prefer to stay in estuarine & brakish water of river mouth while the females ascend the rivers as far as the headwaters.

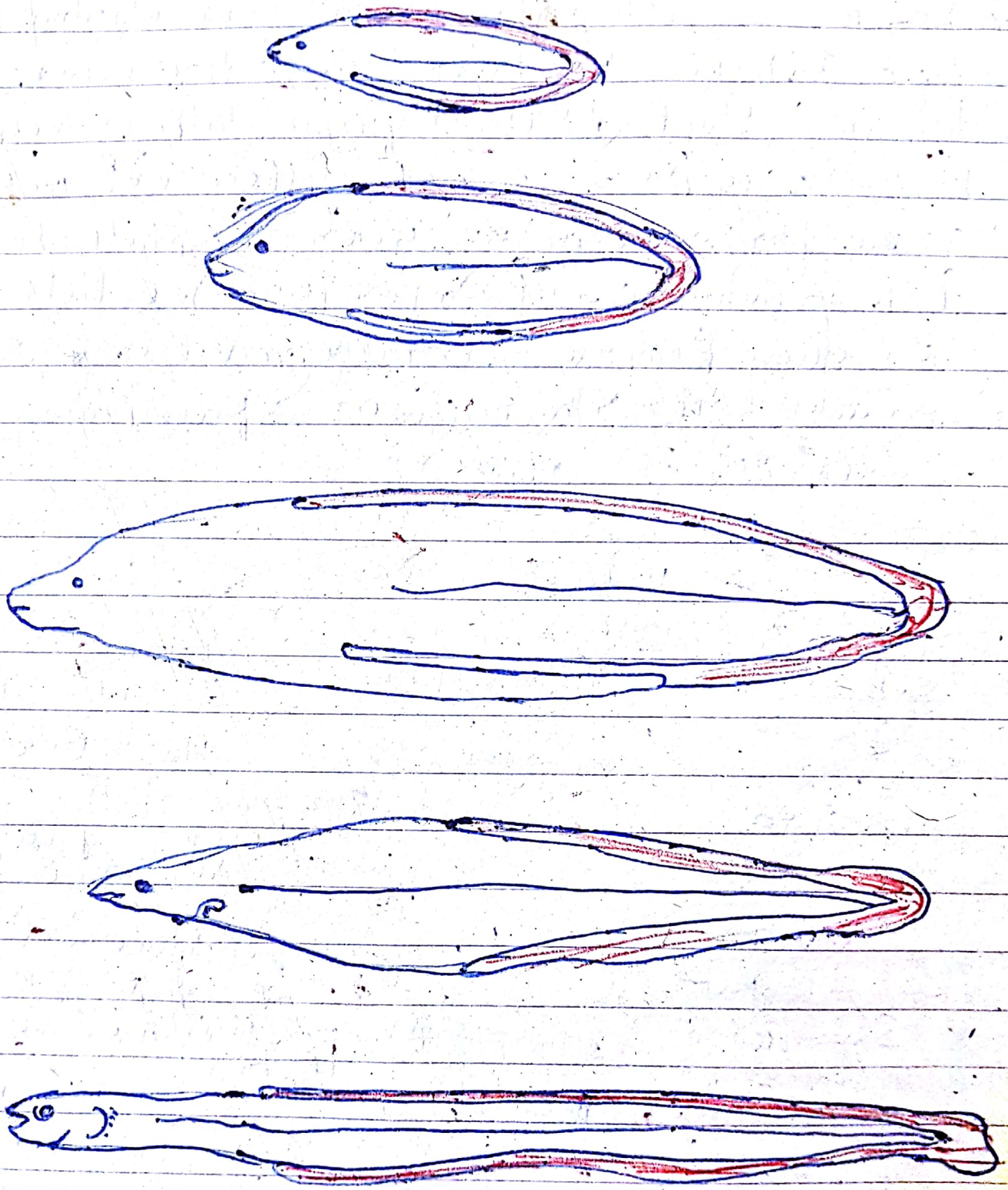
(x) In river these fish measure about 15-20cm in length & are as thick as a pencil.

(X) In stronger fishes the larval teeth are completly lost & their shortened intestine have become short & total pigmentation occurs in body. They transform into yellow eel which grow for several ~~eel~~ years. (Male life - 8-10 y while ♀-life → 10-18 year) & later on they become sexually matere & ready to start new spawning journey.



Migration of eel (Anguilla anguilla)

Catadromous



Stage of life history of European eel.

Salmon (Anadromous) King Salman.

① Adult in sea → ascend to river for spawn

② It travels about 1610-3220 km

③ migrate to Yukon river in ~~State~~ Alaska (North america)

④ In frest water —

— they stop feeding; the store fat used up & weight of fish reduced.

— The front teeth of the upper jaw become enlarged.

→ Select a shallow place, where copulate discharge egg which fertilize externally

→

Hilsa (Anadromous)

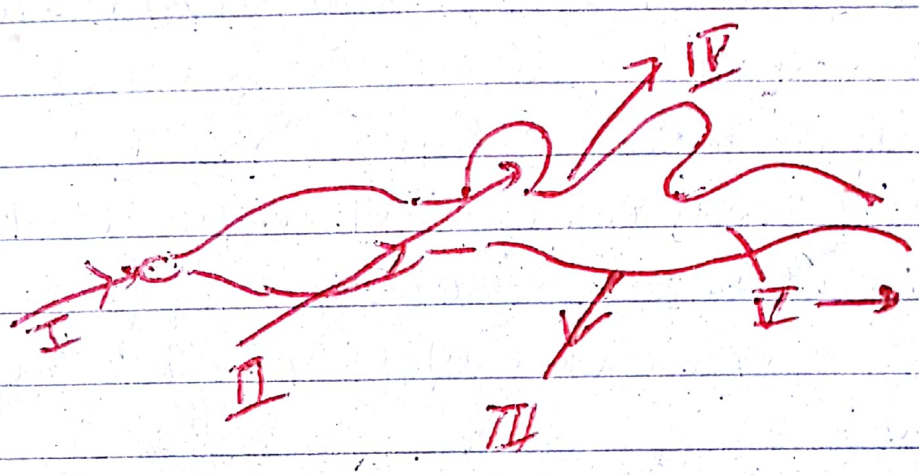
Bay of Bangal ⟶ Ganga
Adult for spawn

Doctrine of Nerve components →

Introduction → STRAN, Ewart etc.

⑧ About nerve, Mixed, Sensory & Motor nerves?

⑨ The peripheral N.S → 4 chief components — SS, SM, VS, VM



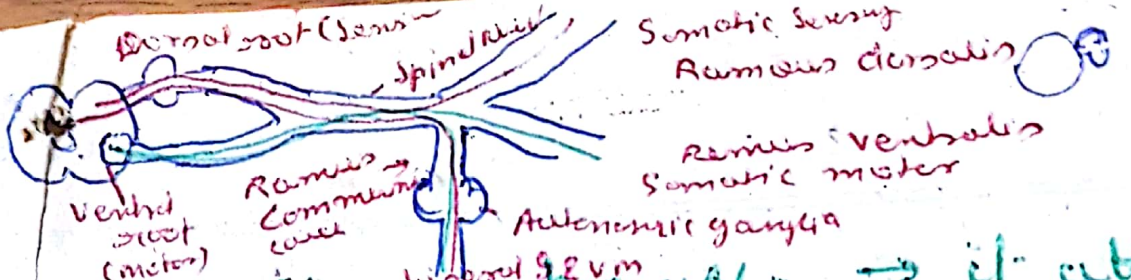
also called as oculomotor nerves

III, IV VI → eye muscles.

ant Rectus — III
post " — VI
Superior " — III
Inferior " — III
Superior oblique — IV
Superior oblique — III

⑤ Ramus ophthalmicus
Superficials →
→ eye (SSS)
• Ramus maxillaris
→ upper jaw
(SSS)
• Ramus mandibularis —
→ lower jaw
(Mixed)

VS ① • Palatinus → palato quadrate bar
• Praespiracularis or pretremitic — upper jaw
Post Tremitic — lower jaw



① except Electric fibres → it attached with by connective tissue it is nerve

Somatic Sensory System →

ⓐ General cutaneous – 1 2 3 7 9 10 → Dorsal root of spinal

ⓑ from special visceral organ, eye, pinna,

ⓒ Special cutaneous or Acoustico lateral System. – 7 8 9 10

ⓓ muscular sense, proprioceptive field, tissue, bone, tendon, ligament.

Visceral Sensory System →

(9) General visceral → Afferent fibres – alim. canal, interoceptive field, – 7, 9, 10

ⓑ special paired olfactory organs.

② Special Visceral → Afferent – Taste bud, (nucleus Solitarius) Buccal cavity pharynx)

7 9 10

ⓓ Gland sup to smooth muscle glands by sympathetic system.

③ Somatic motor → Efferent → ventral root, All skeletal muscles, origin from ventral horn of Spinal cord 3, 4, 6, (12). → action, in under control of will

④ Visceral motor →

ⓐ Special visceral motor → efferent, smooth muscle,

ⓑ Effect → Sympathetic or Autonomic ex to motor Synapse

Effect → glands, muscle, ventral root

→ All 10 Nerves