Reproduction and Development in Fishes

Anatomy

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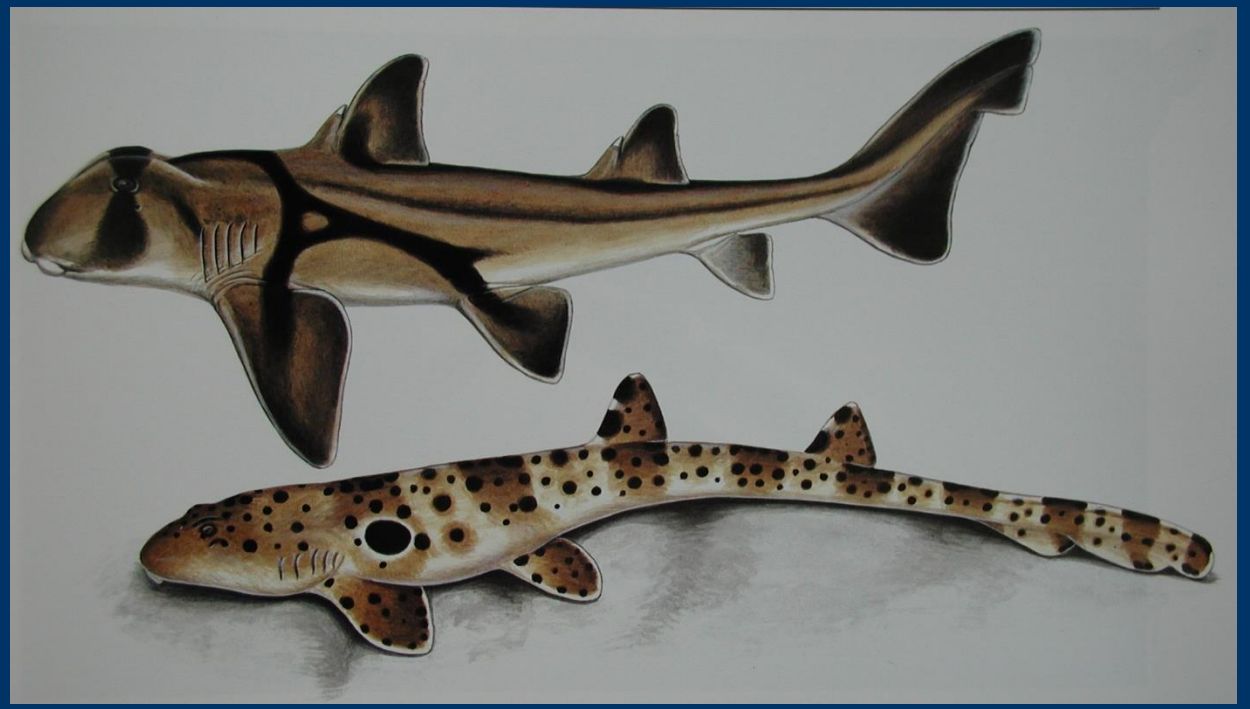
internal fertilization

sperm emitted through cloaca, along grooves in claspers



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chimaeras, bony fishes: paired gonads

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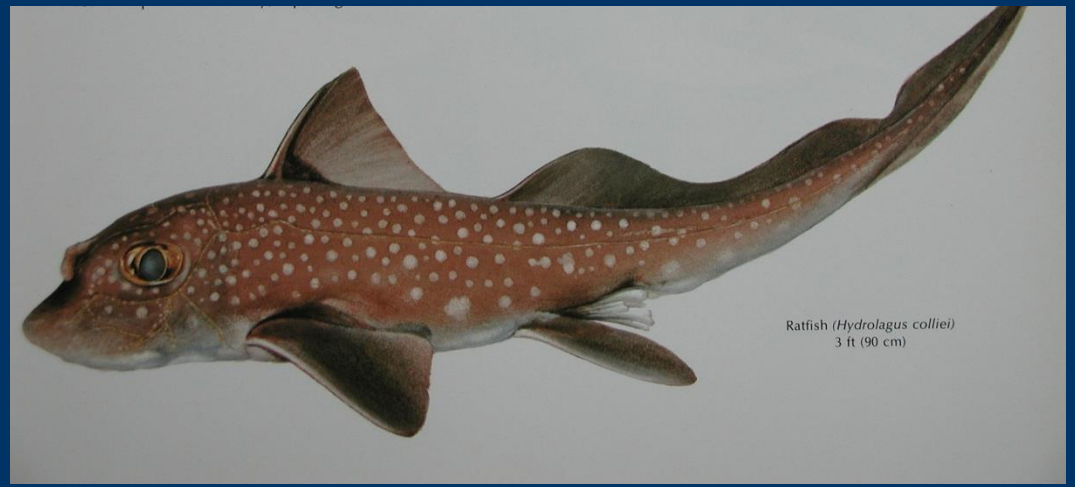
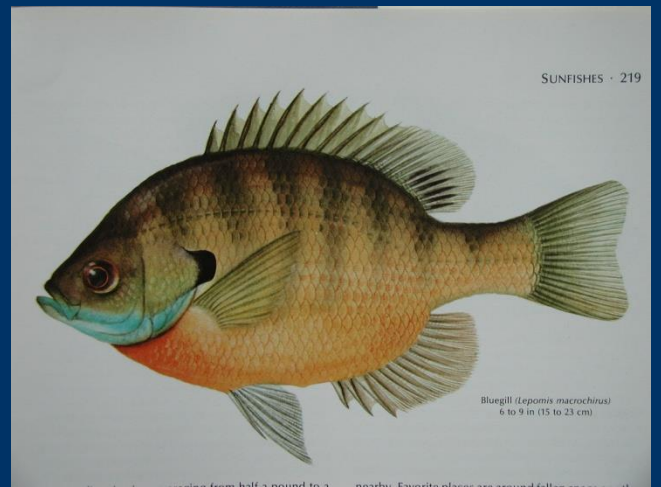
sperm released through separate opening





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most teleosts:
ova maintained in continuous sac from ovary to oviduct
exceptions: Salmonidae, Anguillidae, Galaxidae, non-teleosts
- these release eggs into body cavity when ripe

Anatomy

in general:

gametes produced only during spawning season
gonads reduced during non-reproductive season

Timing and location of spawning

strategy:

avoid competition for spawning habitat
maximize access to food for offspring
minimize access to offspring by predators

example: Lake Champlain

anadromous – salmon
catadromous – eels
fall spawners – lake trout, whitefish
spring spawners – smelt
littoral spawners – sculpins, sunfishes, basses
stream spawners – suckers, darters, minnows, sturgeon
pelagic eggs – burbot

Reproduction

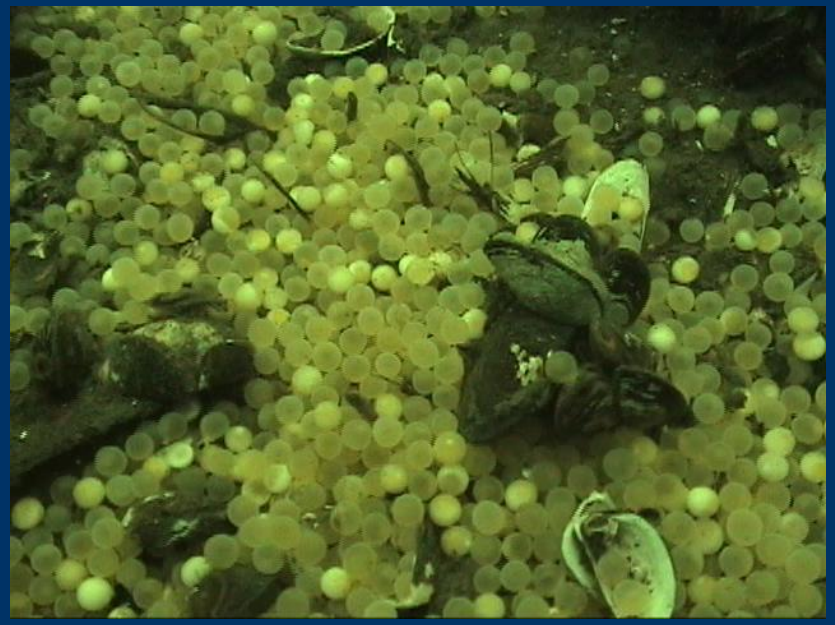
fecundity

egg size and number inversely related

egg number directly related to female size (within species)

related to food supply, competition

= population-regulating mechanism



Sexual maturity-I

- Fishes can become sexually mature at various ages, depending on species. Several factors influence sexual maturity, including age, gender, and size.
- Spawn immediately after birth. Although female dwarf perch receive sperm soon after they're born.
- Some bony fishes become sexually mature shortly after birth. The western mosquito fish (Gambusia affinis) becomes sexually mature within a year.

Sexual maturity-II

- Most bony fishes become sexually mature between one and five years. Most bony fishes are in excess of 8 cm (3 in.) before reproducing.
- It may take ten years or more for some bony fishes to become sexually mature. The eels (family Anguillidae) become sexually mature at 10 to 14 years of age, and the sturgeons (family Acipenseridae) may take up to 15 years to mature.
- . In general, species of a small maximum size begin reproducing at an earlier age than those with a large maximum size. Age and associated size are major factors in determination of adulthood.

DIVERSITY IN SEXES

- The vast majority of fish are 'Dioecious' (a species that possesses both males and females in separate bodies
- 'Hermaphrodism', the alternative to dioecism eg; in Myxins.

Modes of Sexual Reproduction

- There are three primary ways that fish reproduce
- **Ovopartity**-- Lay undeveloped eggs, External fertilization (90% of bony fish), Internal fertilization (some sharks and rays)
- **Ovoviviparity**- Internal development- without direct maternal nourishment-Advanced at birth (most sharks + rays)-Larval birth (some scorpeaniforms-rockfish)
- **Viviparity-** Internal development- direct nourishment from mother-Fully advanced at birth (some sharks, surf perches)

SOME MORE DETAILES

Three more important terms in the science of fish reproductive biology are Oviparous, Ovoviviparous and Viviparous. A species is Oviparous if the eggs are fertilized internally and then laid by the female , they are Ovoviviparous if the eggs are fertilized internally and then carried in the females body until they hatch, then they are born alive, not laid as an egg. Still all the nutrients the young embyro needs are in the egg before it is fertilized. Finally a fish species is Viviparous if the eggs are fertilized internally, and the embryos kept within the females body until they are born alive, but these embryos receive nutrients directly from the mother while they are developing, in addition to those in the egg at the time of fertilization. Internal fertilization is possible for fish via modification of the anal fin of the male into a copulatory organ. Viviparity is rare in fish (but common amongst mammals), a very successful example is the common Mosquito fish, Gambusia affinis, which produces about 30 young with a gestation period of 24 days.

CLUTCH SIZE IN VIVIPAROUS

- The Black-spotted Shark (Carcharhinus sealei) 1-2 young
- Bristly Catshark (Halaelurus hispidus) 2 young
- Brown Catshark (Apristurus brunneus) 2 young
- Caribbean Sharpnose Shark (Rhizoprionodon porosus) 2-6 young

PROTECTION OF YOUNG ONES

Fish have evolved a diverse selection of strategies to protect their eggs after fertilization. Apart from live bearing, these strategies include a variety of methods of external incubation (not inside the females body cavity) as well as many different ways of hiding or protecting the eggs from casual predators such as building a nest or using the topography of the land under, or even above, the water.

PROTECTION OF YOUNG ONES

One of the most common and most well know methods is mouth brooding such as that carried out by Cardinal Fish and many Cichlids. In these cases one member of a pair collects the eggs in his of her mouth after fertilization and keeps them safe there until they hatch. This can often mean the adult not eating for several days, or even weeks.

PROTECTION OF YOUNG ONES

A second well known method is external brooding in a pouch, or with the eggs stuck to the males body. This method has the benefit of not requiring the brooding adult to fast. Sea Horses and Pipefish are the most famous examples of this method

PROTECTION OF YOUNG ONES

A third fascinating method of external brooding used by a few species is gill brooding. Here, as the name suggests, the eggs are brooded in the gill cavity of the adult

PROTECTION OF YOUNG ONES

- Other ways in which try to protect their eggs include building a nest, Sticklebacks ; burying them in sand, Trout Oncorhynchus mykiss and Salmon Salmo salar; sticking them to rocks, Cornish Suckerfish Lepadogaster lepadogaster; tangling them in plants, Armed Bulheads ; laying them inside empty shells Gunnels and some Gobies, Gobiidae; or even laying them inside the a living bivalve such as is the practice of the Bitterling with Swan Mussels