

मत्स्य FISH मछली & मात्सियकी FISHERIES मछली- पालन

F - **Far Abundant** [about 35, 315; 50% of all vertebrates]

I - **Inhabiting**

S - **Solely**

H - **Hydrosphere**
- [Fresh, Brackish & Marine]



PROC. NAT. ACAD. SCI., INDIA, 47(B), IV, 1977
FISH AND FISHERIES OF BANDA DISTRICT (U. P.)

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ABSTRACT

A detailed account of status of fishing industry, resources, fishing methods, fishermen and the status of fish fauna of Banda district is assessed. A classified list of 44 sp. of fishes have been given. The Indian major carp, Mahaseer and few cat fishes are commercially most important. General aspect of fishery development in the river stretches and tanks or reservoirs is explained.

INTRODUCTION

Being one of the backward and undeveloped districts of the Bundelkhand region of U. P., the records of the fishing industry and fish fauna of Banda within the main rivers, their tributaries and reservoirs etc. are still inadequately understood and the exploitable potentialities largely unassessed. The record available mainly refers to the fish fauna of the river Ken given by Srivastava Chandra and Vishard (1970). A classified list of 58 sp. along with a few field notes on fishes is given by



मत्स्य FISH मछली

- *“a poikilothermic, aquatic chordate with appendages (when present) developed as fins, whose chief respiratory organs are gills and whose body is usually covered with scales”.* [TM Berra, 2001, *Freshwater fish distribution.*]
- *‘aquatic vertebrates that have gills throughout life and limbs if any in the shape of fins’.* [Nelson, 2006]
- **ICHTHYOLOGY = The Study of fishes.**
- **ICHTHYOLOGIST = A student of fish systematics or dealing with the dimensions of Ichthyology.**

FISHES

VS

FISH

• **FISHES** = Individuals of more than one species.



• **FISH** = One or more individuals of one species e.g., 100 individuals of *Labeo rohita*.

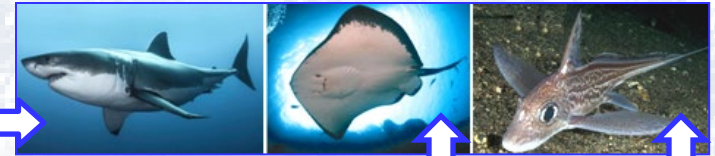
NUMBER

DIVERSITY

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About 27, 977 valid sp.



• **JAWLESS 108** : 70 Hagfishes and 38 Lampreys

• **CARTILAGINOUS FISHES: 970**

Sharks **403**

Skates and Rays **534**

Chimaeras **33**

• **BONY FISHES**

26, 000+



FROM TROPICS
TO
POLAR REGIONS

HABITAT

FRESH
BRACKISH
MARINE



• **FRESHWATER** - 11,952 species (43%).

• **MARINE** -15,800 species.

• **UP TO AN ELEVATION** of 5,200 m in hot Springs of Tibet .

• **IN THE WORLD'S HIGHEST (3,812 m) LAKE:** Titicaca (South America).



HABITAT

DIVERSITY

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- In the world's **DEEPEST BAIKAL LAKE** (at least 1,000 m).
- In **HOT SODA LAKE** Magadi (Kenya) at temp. up to **42.5°C**.
- Under the **ANTARCTIC ICE SHEET**: At **about -2°C** (= cryopelagic)[e.g., Cod ice fish *Trematomus*].
- **AIR-BREATHING** in the SWAMPS.
- **LAKE-DWELLING**: Deep, cold, Oligotrophic , Mesotrophic and Eutrophic.



DIVERSITY

MARINE

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- **VAST MAJORITY: Tropical.**
- **RICHEST: Indo-West Pacific** (Red Sea and Indian Ocean to Northern Australia and Polynesia).
- **LARGEST NUMBER OF SHORE FISH: Southeastern Africa** and **Queensland.**
- **DEPAUPERATE :Arctic and Antarctic fauna.**

DIVERSITY

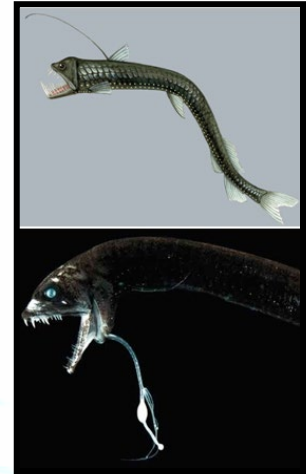
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MARINE
(DEEP SEA FISHES)

- **MAJORITY:** Coastal or Littoral.
- **In THERMAL VENTS:** Eastern Pacific Ocean.



DEEP SEA
Beyond the 200 m.



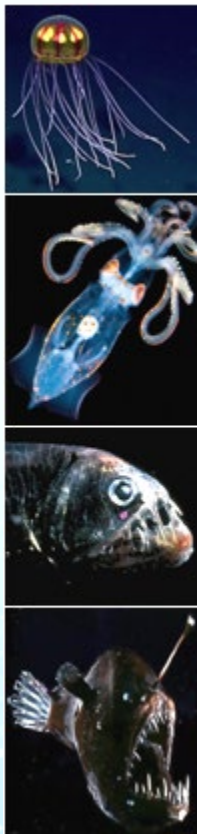
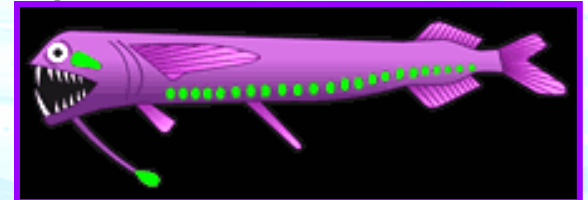
ZONATION:

EPIPELAGIC [open water zone]: up to **200 m**

MESOPELAGIC: 200 – 1000m

BATHYPELAGIC: 1000– 4000 m

ABYSSOPELAGIC or BENTHIC: Beyond 4000 m.





DISTRIBUTIONAL

DIVERSITY

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- **LARGEST NUMBER:** In the Tropics

[large number of freshwater fishes in tropical Africa, southeastern Asia and the Amazon River].

- **GREATEST DIVERSITY OF NON-OSTARIOPHYSAN:** Africa.

- **ABSENCE OF INDIGENOUS FISHES CONFINED TO FRESHWATER:**

Most oceanic islands and continental areas recently exposed from the last ice age (*e.g.*, northern regions of North America, Western Europe and Asia).



DIVERSITY

BIOGEOGRAPHICAL

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GEOGRAPHIC DISTRIBUTIONAL PATTERNS

or

INTERPRETIVE BIOGEOGRAPHY

TWO APPROACHES

- **ECOLOGICAL BIOGEOGRAPHY** - Environmental factors limiting the distribution.
- **HISTORICAL BIOGEOGRAPHY** - Origin of distributional patterns (*i.e.*, paleontological studies).

MODES OF DISTRIBUTION

- **DISPERSAL:** Active or Passive
- **VICARIANT EVENTS :** Geographical range is split into **DISCONTINUOUS** regions.

MORPHOLOGICAL

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SMALLEST : About 6 sp.
maturing at about 7.0 – 8.0 mm

WORLD'S SMALLEST 
[Recorded in 2006]

Translucent fish (max. 10.3 mm; males 9.8 mm,
smallest is Female of 7.9 mm)

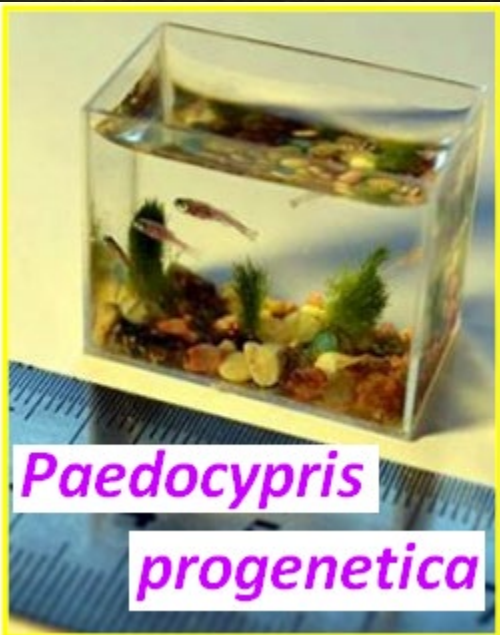
from
Peat swamps
of

Indonesian Islands (Sumatra & Bintan).

[was the smallest vertebrate, before the description of the smallest
(7.7 mm) frog,

Paedophryne amauensis
Reported in 2012
from Papua New Guinea].

Paedocypris
progenetica



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Rhincodon typus (Whale shark)

- **The LARGEST / LONGEST:** 12 – 18 m, 34000 kg.
- Slow moving, filter feeding.
- Open waters of Tropical Oceans.
- Life span: 70 years

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THE LONGEST BONY FISH



Found worldwide in the open ocean



[Epipelagic to dimly lit Mesopelagic;
up to 1000 m]

LEGENDARY SEA MONSTER

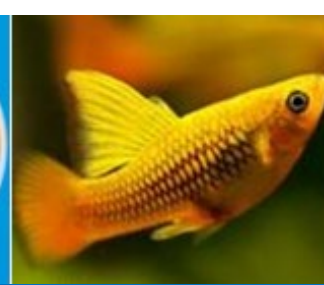
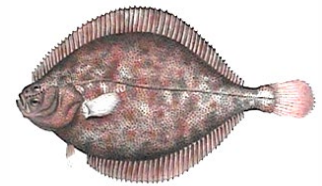
Regalecus glesne [Oarfish]

Up to 11.0 m.

OCEANODROMOUS

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- D**• **FORM:** Spindle-shaped, snake-like (Eels), dorso-ventrally flattened, laterally compressed or globular.
- I**
- V**• Brilliantly coloured to drab.
- E**• Absence of eyes: 50 Teleosts [Cave dwellers].
- R**• **FINS:** absence, holdfast organs, lures, copulatory structures.
- S**• **RESPIRATORY DIVERSITY:** Gills to accessory structures like air bladders or even lungs.
- I**
- T**• **EXOSKELETON:** Body naked or covered with scales [Cycloid, Ctenoid or Ganoid].
- Y**• **ENDOSKELETON:** Cartilaginous or Bony.

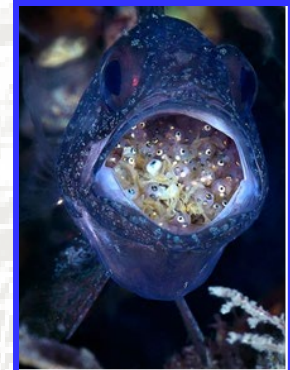




BEHAVIOURAL

- **Schooling** or **Territorial**
- **Migrating:** Anadromous,
- Catadromous or Diadromous,
- Oceanodromous, Potamodromous.
- **Poisonous, venomous.**
- Electricity and Luminescent.
- **Parasitic** or **commensal.**
- Herbivorous to Carnivorous.
- **Eurythermal** to **Stenothermal.**
- **Euryhaline** to **Stenohaline.**
- Gonochoristic to hermaphroditic.
- **Semelparous** or **Iteroparous.**
- **Oviparous** to **Viviparous.**
- **Parental care.**

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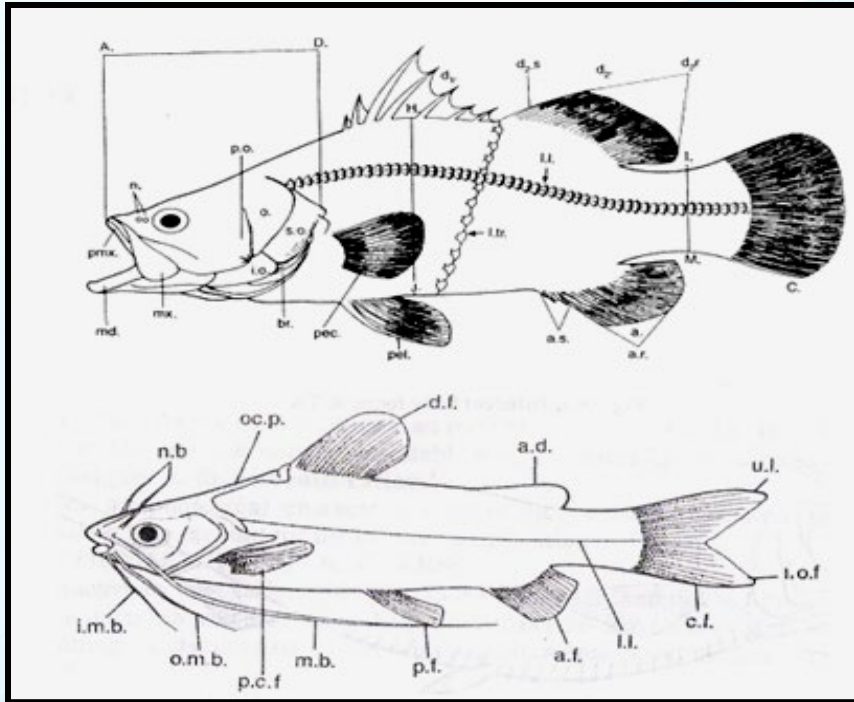


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TAXONOMIC CHARACTERS

- **CHARACTERS:** Like **GOLD** – they are where you find them. (Stanford Ichthyologist *George Myers*)
- **CHARACTERS:** Needed to differentiate taxa and assess their interrelationships.
- **CHARACTERS:** Variations of a homologous structure.
- **CHARACTERS:** To be useful, must show some variation in the taxon under study.
- **CHARACTERS:** Meristic, Morphometric, Anatomical, Osteological, Colour, Sexual dimorphism, Cytological, Molecular (*N* DNA, *Mt* DNA).

TECHNIQUES IN FISH IDENTIFICATION

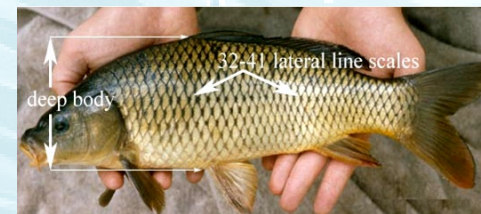
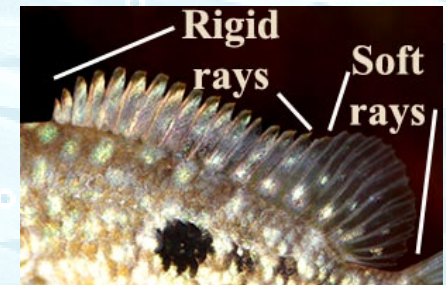
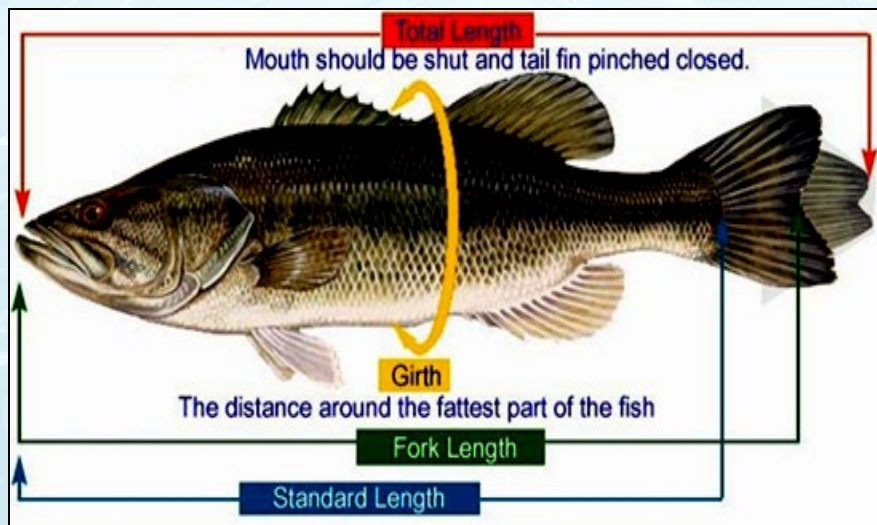


MORPHOMETRY = Various body measurements and calculation of RATIOS.

MERISTICS = Various counts.

Fin Formula:

*Biii D16(III/13) P17(I/16)
V9(I/8) A7(II/5) C19 L.l. 40 –
42 Ltr. 6.5 – 7.5 / 9*





FISH COLLECTIONS

COLLECTIONS = LIBRARIES

- **VOUCHER SPECIMENS** : Serve as a basis of study and are retained as a reference.
- **CURATORS** = Caring for collections and conducting observations.
- **PRESERVATION**: In Formalin (40%) and then transferred to alcohol.
- **CLEARED** and **STAINED SPECIMENS**: To study Osteology.
- **TISSUE COLLECTIONS**: In Ethyl Alcohol or Frozen at -2°C .





FISHERIES

(Sing. FISHERY)

मात्स्यिकी



• **COLLECTIVE TERM:** *Cultivation and capture of Fish(s), Molluscs, Crustaceans, any other aquatic animal and even Sea weeds.*

• *‘the people (fishermen) involved, species or type of fish, area of water or seabed, method of fishing, class of boats, purpose of the activities or a combination of the foregoing features’.* [FAO, US]



FISHERIES

BASED ON ECONOMIC RETURNS AND PRODUCTION

- **CAPTURE FISHERY:** CATCHING AND HAULING FROM NATURAL RESOURCES (RIVERS, LAKES, ESTUARIES, SEA).
- **CULTURE FISHERY:** PRUDUCING ECONOMICALLY IMPORTANT EDIBLE FISH (OR OTHER AQUATIC ORGANISMS) IN MAN MADE AQUATIC ENVIRONMENT (**FISH FARMS**), ADOPTING SCIENTIFIC TECHNIQUES.

BASED ON AQUATIC ENVIRONMENT

- **FRESHWATER** (= Inland Fisheries)
- **BRACKISHWATER** (= Estuarine Fisheries)
- **MARINE**

मात्सियकी





AQUACULTURE = "Blue Revolution"
[vs **Green Revolution**]

“the **FARMING** of aquatic organisms, including fish, Molluscs, crustaceans and aquatic plants *i.e.*, **Fish farming**, **Shrimp farming**, **Oyster farming**, **Mariculture**, **Algalculture** and the cultivation of **Ornamental fish**”. [FAO, US]

- **Being practiced in China since 2500 BC**
- **MOST COMMON FORM OF AQUACULTURE: Fish Farming.**
- **AQUAPONICS = Conventional Aquaculture + Hydroponics** [Cultivation of plants in water] in a symbiotic environment *i.e.*, Rice in Paddy fields in combination of fish



CULTIVABLE FISH

संवर्धन योग्य मछलीयाँ

CHARACTERISTICS

- Adaptability to pond environment.
- **Faster growth rate.**
- Efficient utilization of natural food resources of the pond.
- **Non-predaceous and planktiophagous, preferably herbivorous and detritus feeder.**
- Efficiently accepting artificial feed.
- **Hardy, not easily susceptible to disease.**
- Easy to breed and rear the seed.
- **Prolonged breeding period or multiple breeding frequency.**
- Compatible with other cultivable species.
- **Palatable with high nutritive value.**
- High market demand and high price.





FISH CULTURE SYSTEMS IN ASIA

TWO MAJOR SYSTEMS

1. **CHINESE PLOYCULTURE SYSTEM-** INVOLVING **'6'** CHINESE CARPS:

Silver carp (*Hypophthalmichthys molitrix*)

Grass carp (*Ctenopharyngodon idella*)

Bighead carp (*Aristichthys nobilis*)

Mud carp (*Cirrhinus molitorella*)

Black carp (*Mylopharyngodon piceus*)

Common carp (*Cyprinus carpio*)

'4' FAMOUS as
'DOMESTIC FISHES'

=

BLACK CARP +
BIGHEAD + **SILVER** +
GRASS CARP

2. **INDIAN COMPOSITE FISH CULTURE SYSTEM:**

Indian major carps (*Labeo rohita*, *Catla catla* and *Cirrhinus mrigala*) + **Chinese carps**

INDIAN MAJOR CARPS



Labeo rohita (Rohu): Max. 1.0 m ; 18.5 kg



INDIAN MAJOR CARPS



Catla catla

Max. 1.8 m

36.8 kg



Cirrhinus mrigala

Max. 1.0 m

6.0 kg

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Silver Carp: *Hypophthalmichthys molitrix*,

Max. 1.4 m , 50.0 kg

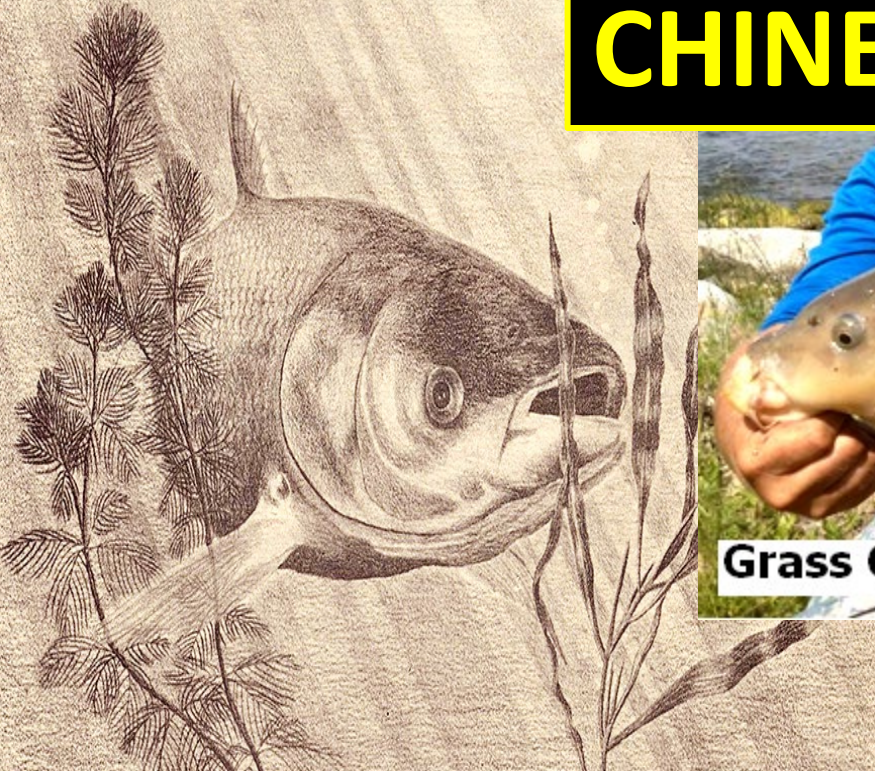
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Bighead Carp: *Aristichthys nobilis* (= *H. nobilis*)

Max. 1.4 m, 40.0 kg

CHINESE CARPS



Grass Carp

Ctenopharyngodon idella

Max. 2.0 m , 100 kg



Mud Carp

Cirrhinus molitorella

Max. 55.0 cm, 500 g



Mylopharyngodon piceus

Black Carp

**Max. 1.8 m
35.0 kg**



CHINESE CARPPS

COMMON CARP

Cyprinus carpio

THE NUMBER ONE FISH FOR AQUACULTURE.

40–80 cm, 2–14 kg
(World record 46.10 kg)



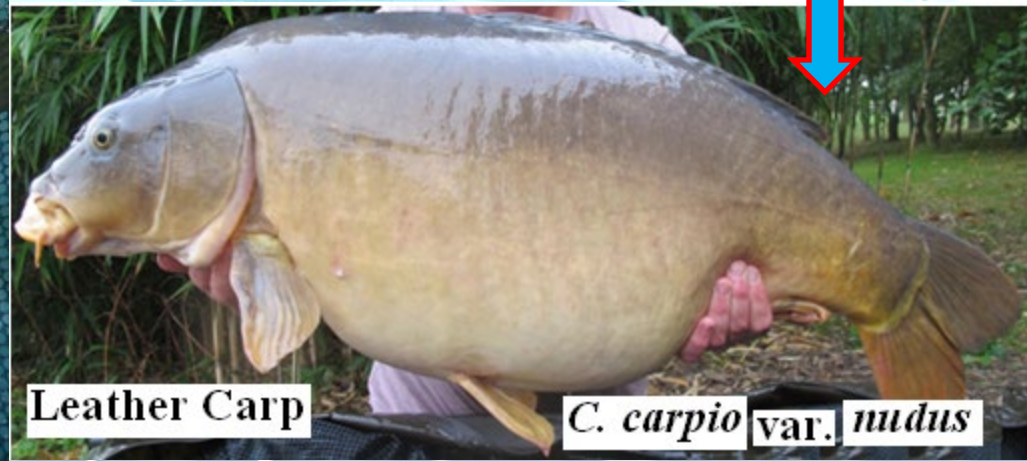
Scale Carp: *C. carpio* var. *communis*

VARIANTS

due to

MUTATION

Mirror Carp: *C. carpio* var. *specularis*



Leather Carp

C. carpio var. *nudus*

ORNAMENTAL CARP

KOI

EAST ASIAN AMUR CARP

Cyprinus rubrofuscus

English, *Koi* = Carp; or Japanese, *nishikigoi* = 'brocaded carp'

- **Cold-water fish**: Being kept at 15–25 °C.
- **Common size**: 30.0 – 37.0 cm; Japanese *koi* 55.0 – 65.0 cm; Jumbo size: 85.0 – 90.0 cm
- **As many as 22 varieties** distinguished by **colouration**: white, black, **red**, yellow, **blue** and cream.
- Kept for decorative purposes in outdoor koi ponds and aquaria.

MOST COMMON VARIETIES

- **Kohaku**: white-skinned with large red markings on the top (Red and white); first ornamental variety to be established in Japan
- **Taisho Sanshoku**: similar to the *kohaku*, but with small black markings.
- **Showa Sanshoku**: black koi with red and white markings.





SUSTAINABLE FISHERIERS

INDIA: Xth Plan (2002 – 2007) and XI Plan (2007 – 2012)

The ‘Sustainable development of Fisheries’ requires:

- *“Strengthening of Database and Information Networking for Fisheries Sector”*
- **Involvement of components like: Remote Sensing (RS), Information Technology, GIS, GPS, Inland and Marine Fisheries Census.**
- **FishBase** [a global species database]
- **Fish-barcoding** [=FISH-BOL campaign]
- **Fishery Extension Services**
- **Welfare Schemes, Fishery Policies, Laws / Acts / Regulations**

Thank You

