special project

Design of human powered bionic boat

Guided by Prof V P Bapat

By
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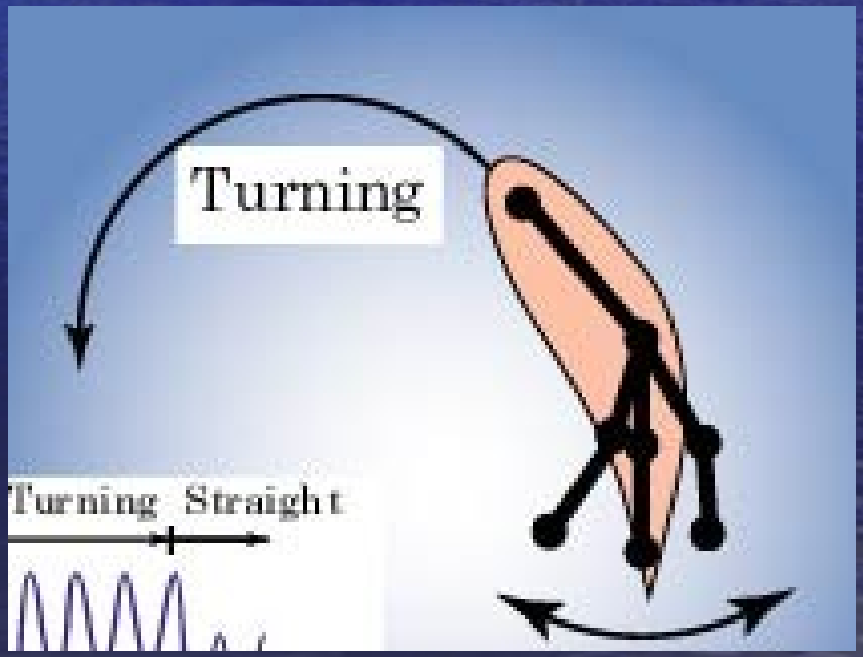
Need for such a project ?

Higher efficiency then propeller powered boats

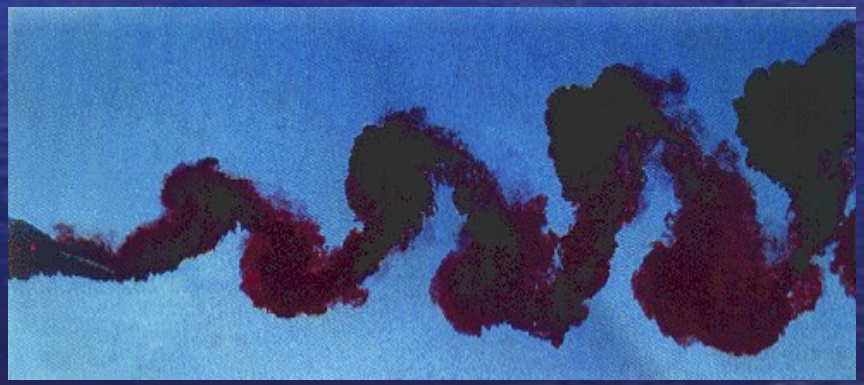
quiet operation

low consumption of fuel

Better turning qualities



Less bothersome to marine life due to low propulsive turbulence

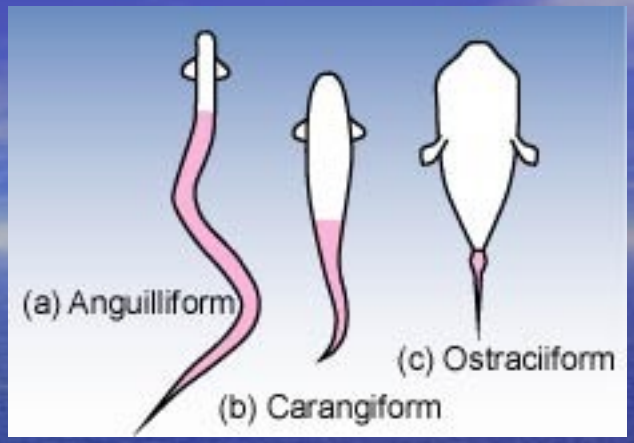


Brief

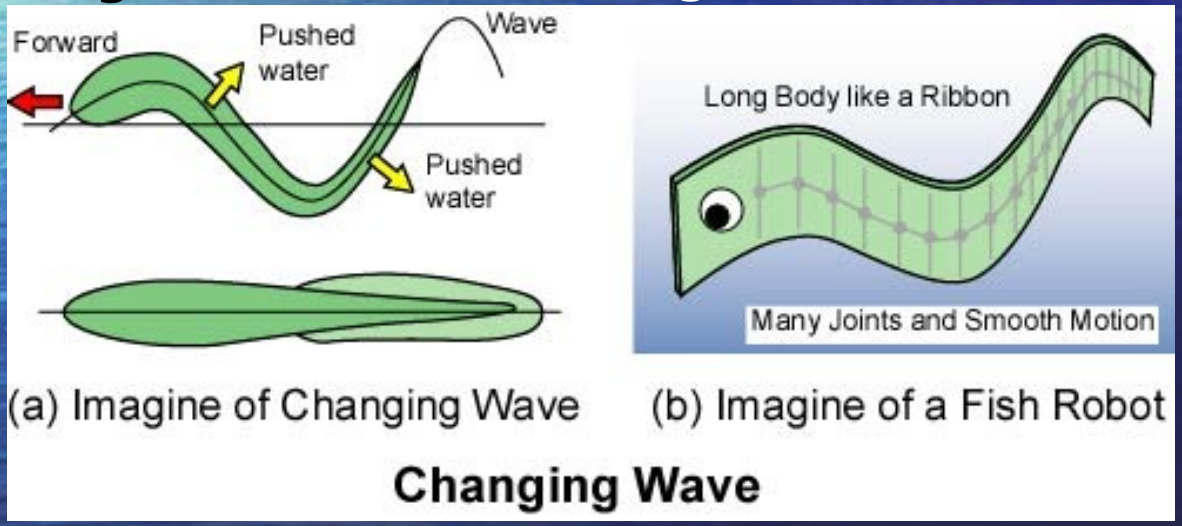
utilize the motor qualities of fishes to conceptualize a human powered boat

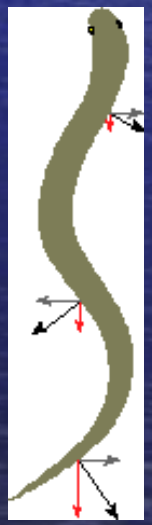
- Studying various types of fish motions and facts related to them
- Study the work done in human powered boats
- Selecting and simulating a fish motion which can propel a single seater boat

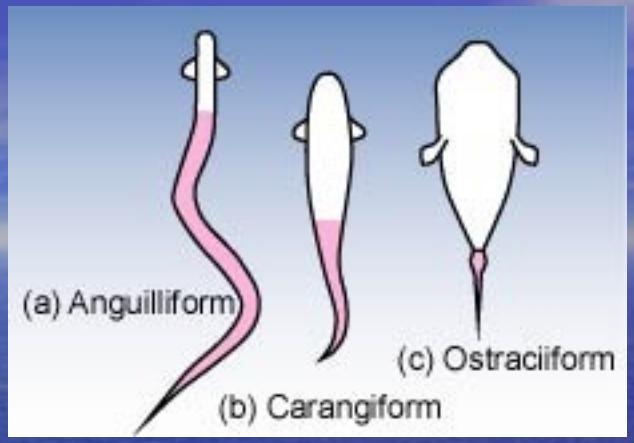
Three basic types of fish locomotion



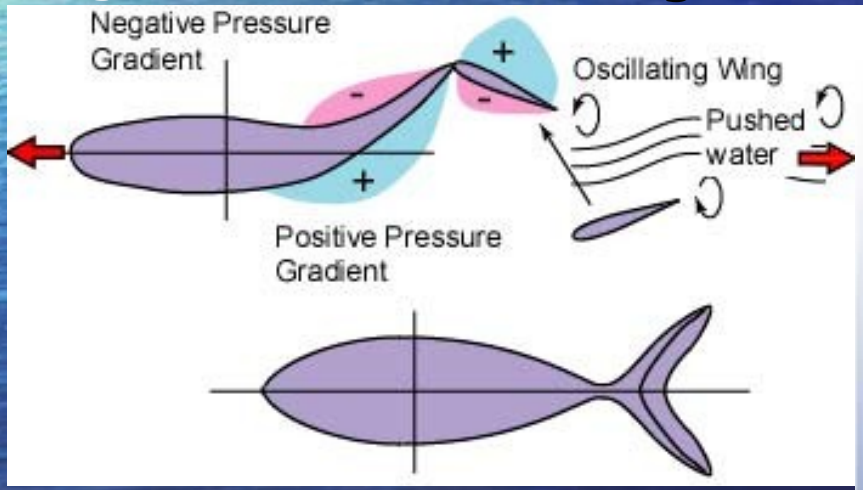
Anguiliform **Carangiform** **Ostraciiform**





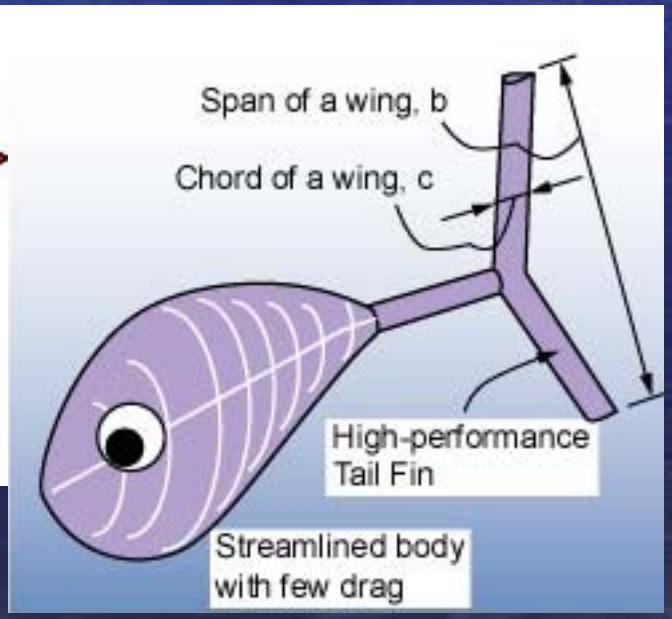


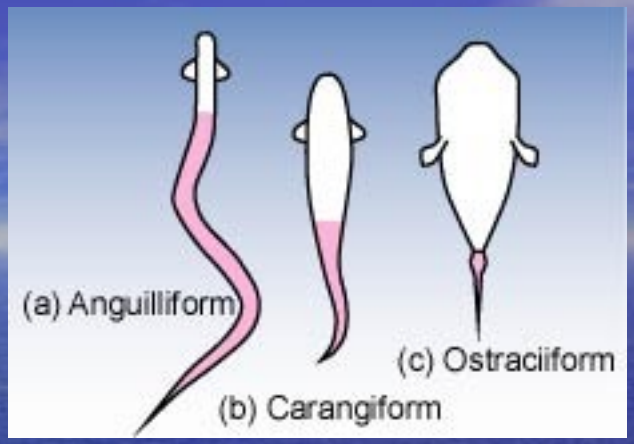
Anguiliform



Carangiform

Ostraciiform





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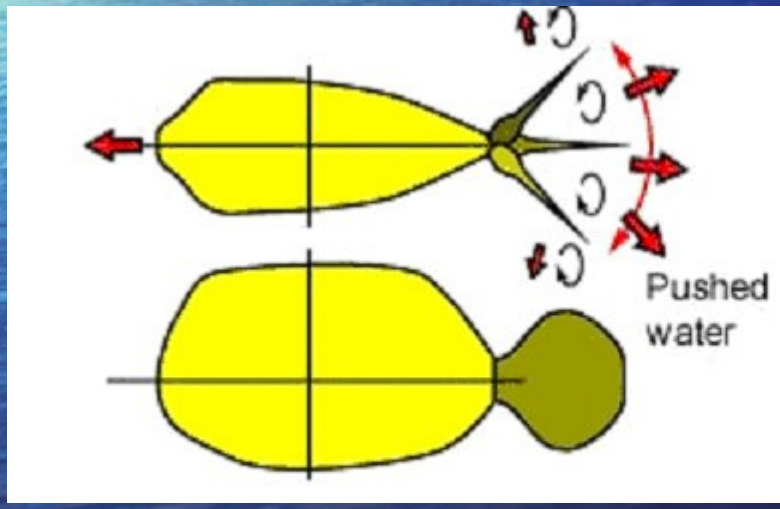
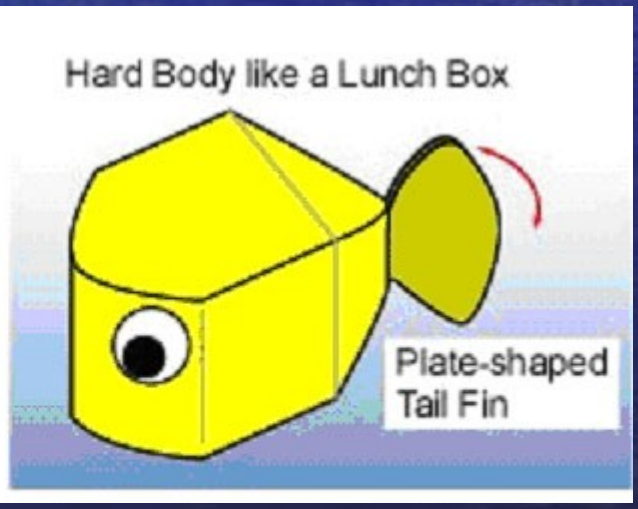
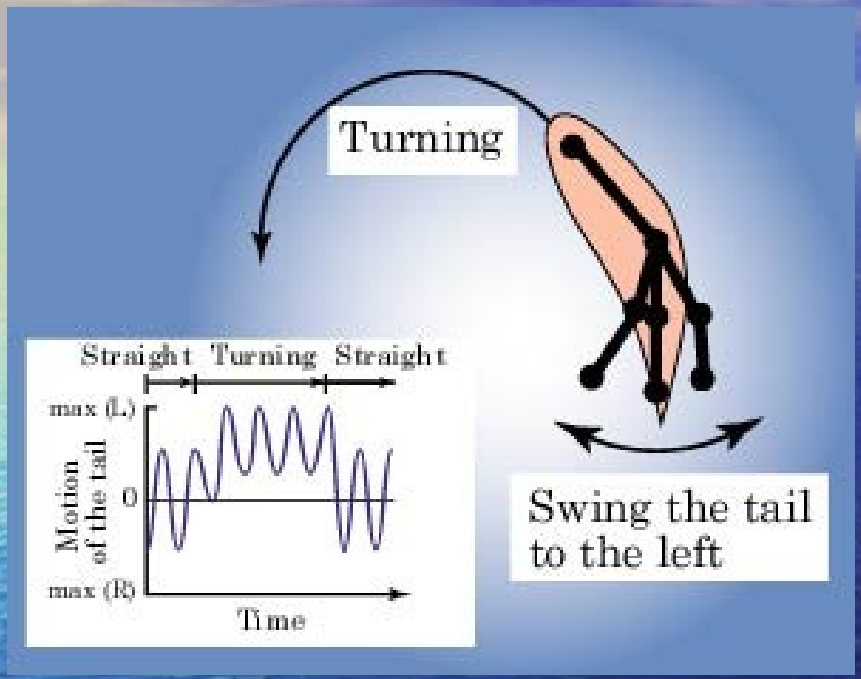


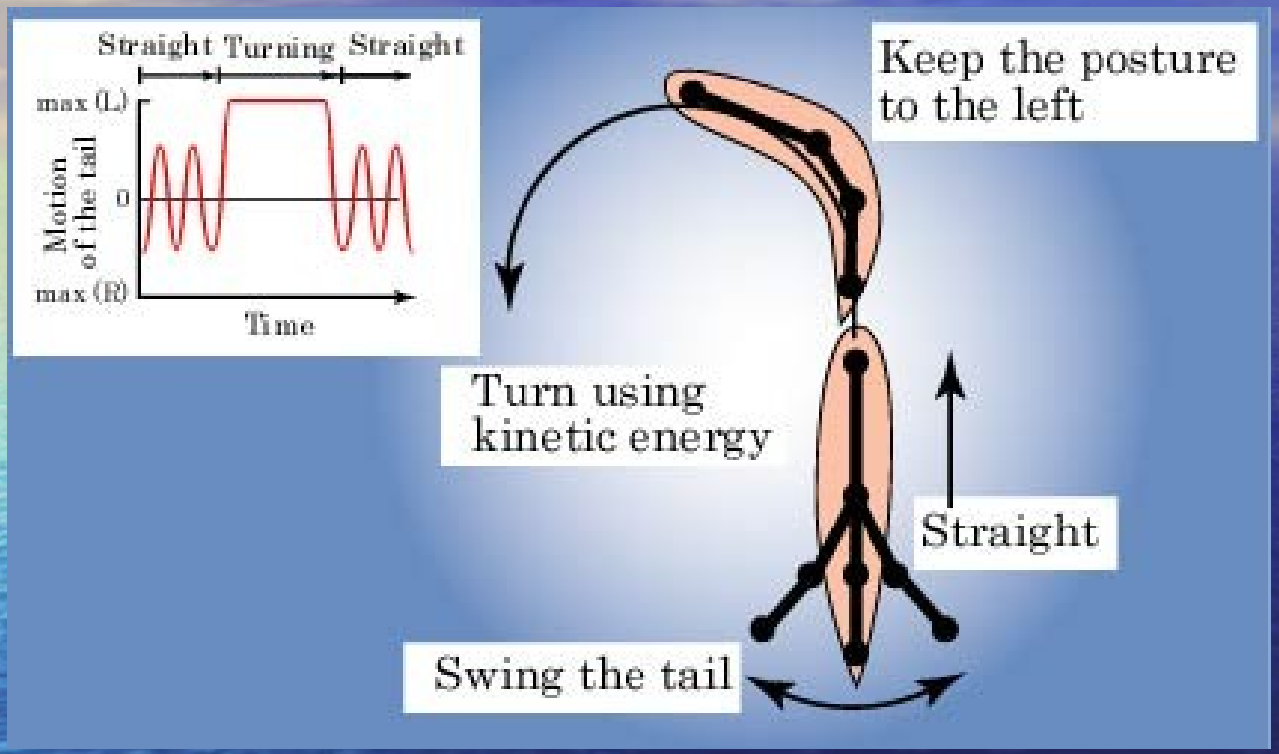


How do fish turn ?



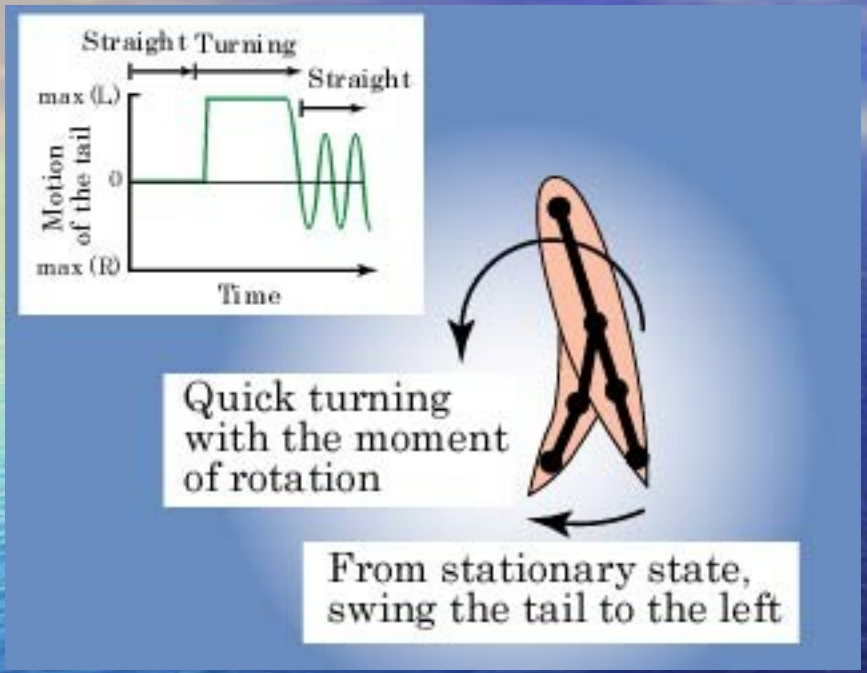
Turning while on the move by using the tail fin

How do fish turn ?



Turning on the move by twisting the body about peduncle

How do fish turn ?

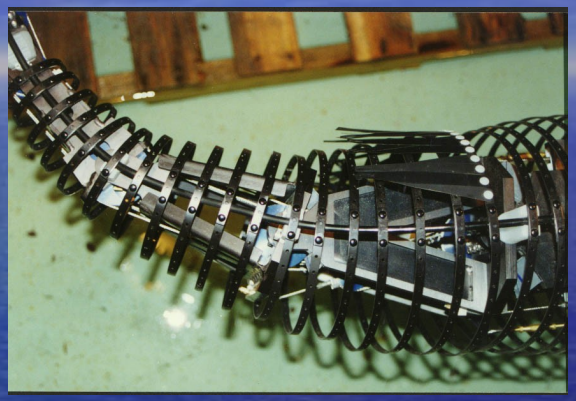


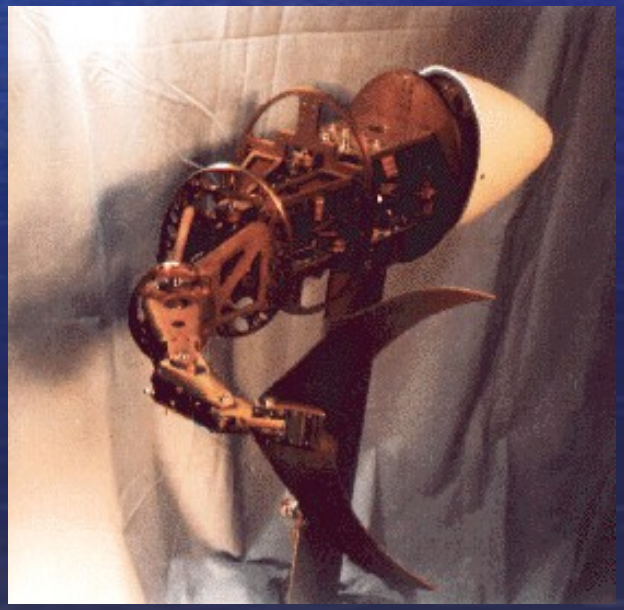
Turning from static position

Other general guidelines from studies on fish

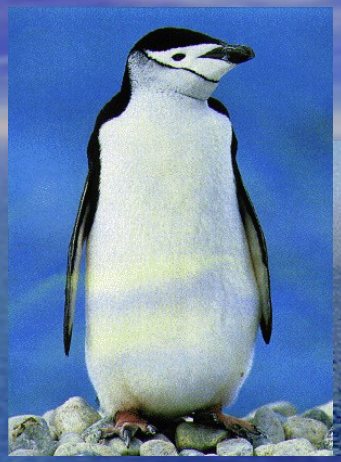
- longer and faster the fish, the more frictional resistance is encountered
- Mucus added to water can cause a substantial reduction in frictional drag
- Flexibility to bend the body into a strong arc provides a power thrust from a standstill
- A short, rounded body with sculling or undulating fins maximizes maneuverability Pectoral fins are handy for braking or steering
- an undulating wave traveling the length if some fishes allow body to stay rigid to improve sensory systems such as electrical detection

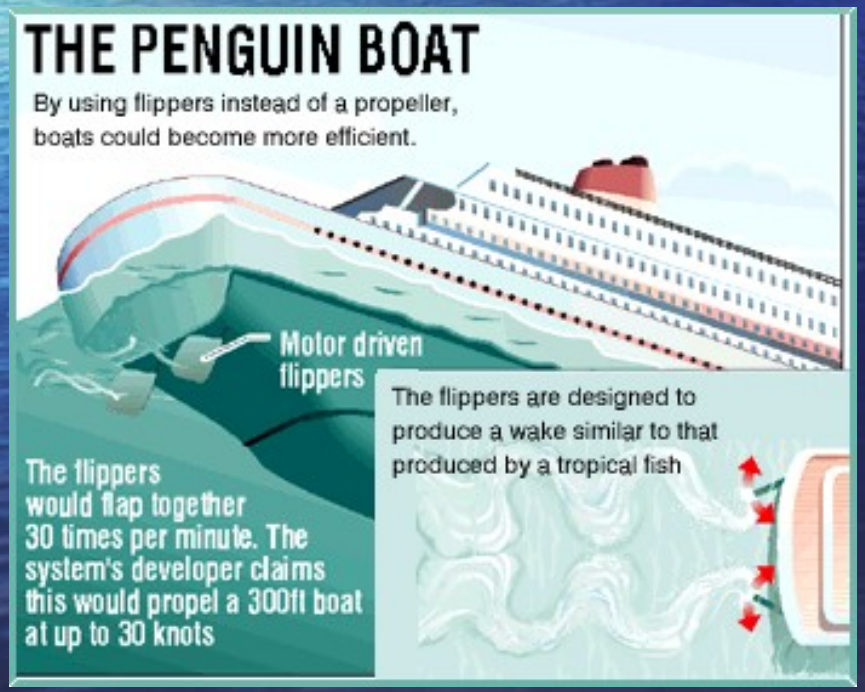
The MIT Robo Tuna project





PROTEUS THE PENGUIN BOAT





Some of existing human powered boats.

Single-seater boat construction strategies

Geometry

Airfoil effect is used to reduce drag

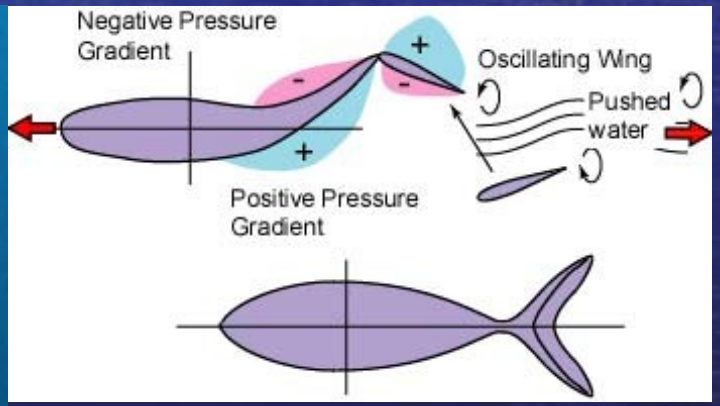
Hydro bike

Modular also

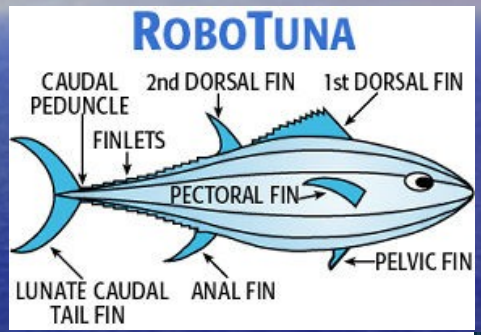
The wavebike

Which fish to copy ?

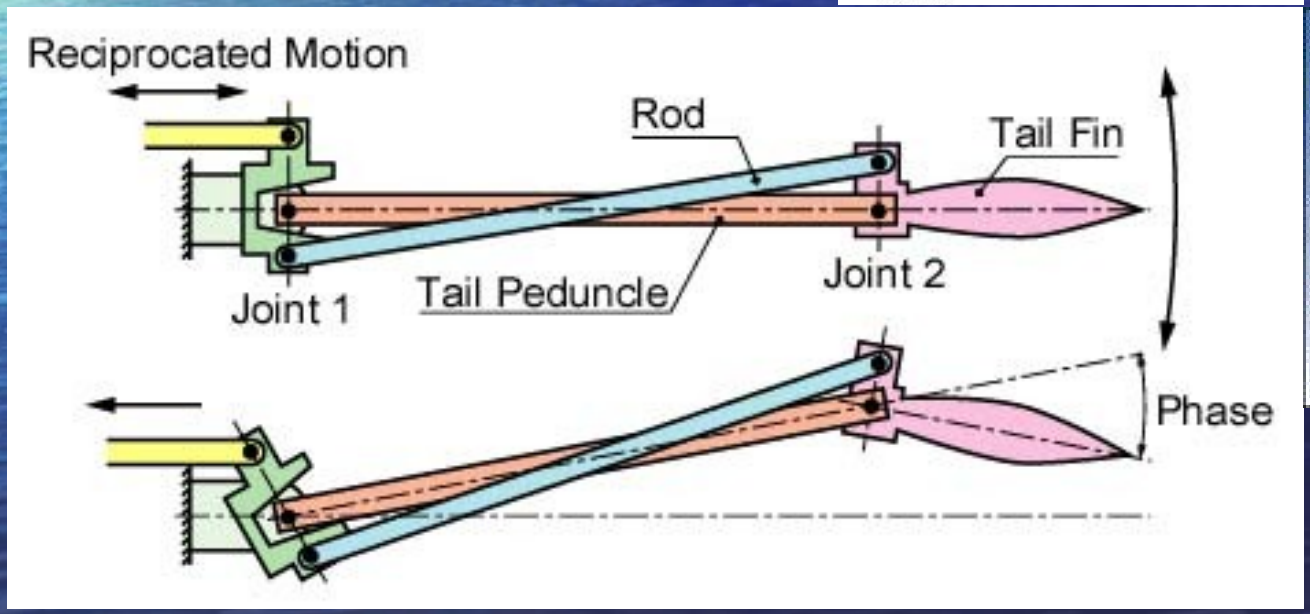
Tuna is among the fastest swimmers in the aquatic kingdom with maximum speeds of
Speed = 80 km/h = 22.2 m/s = 50 MPH
Length = 3.0 m

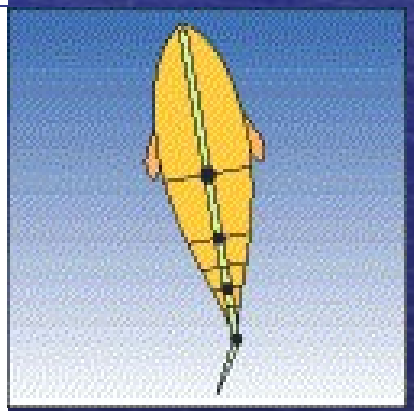


Mechanism

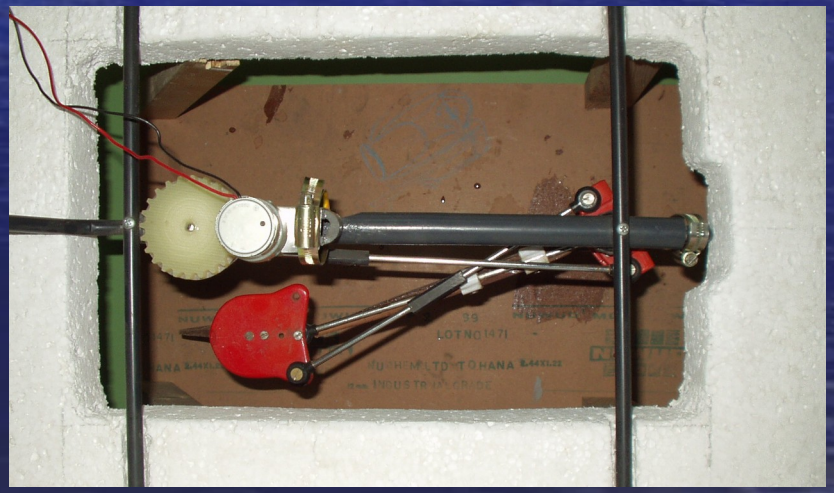


Inverted pantograph mechanism





The model



Airfoil profile for the fins

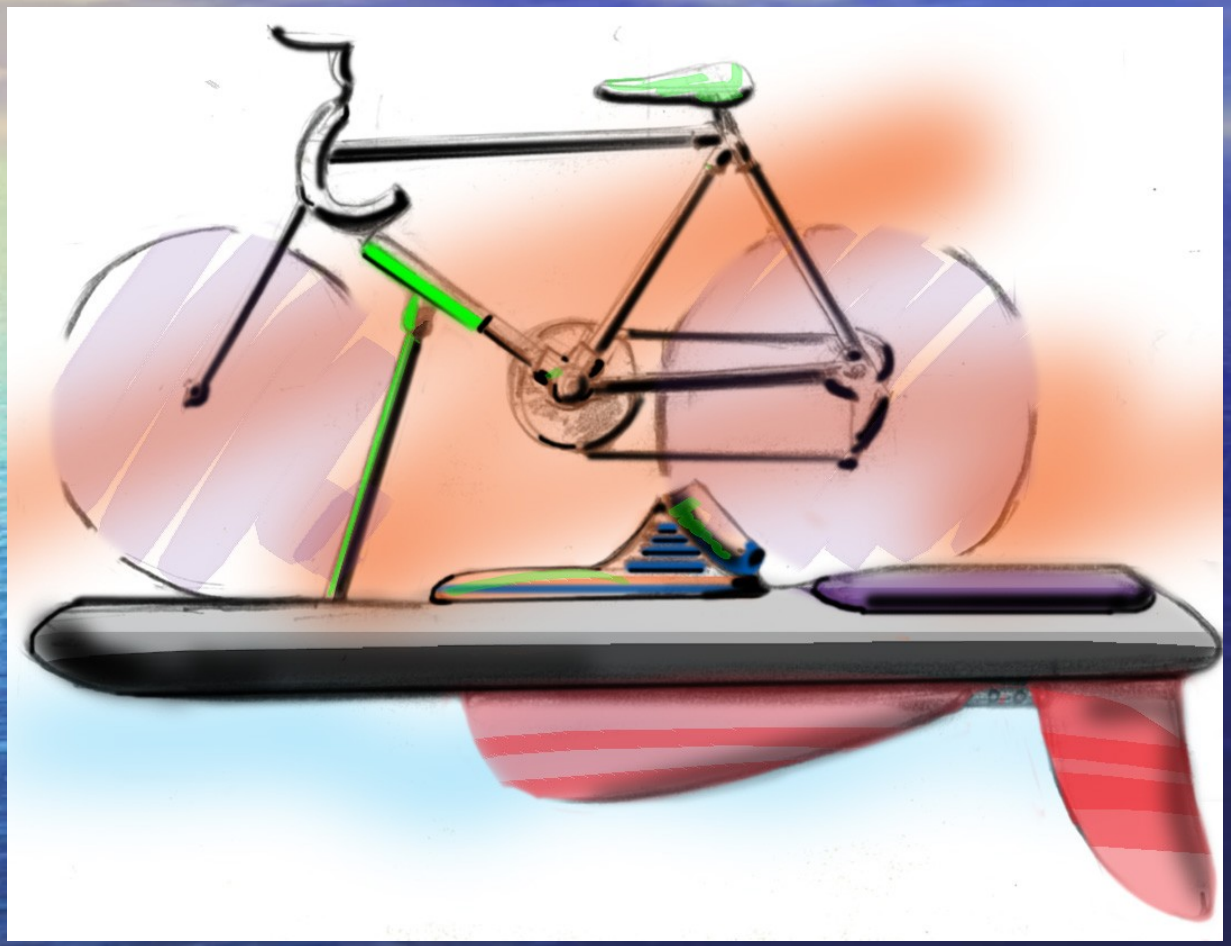
Trials

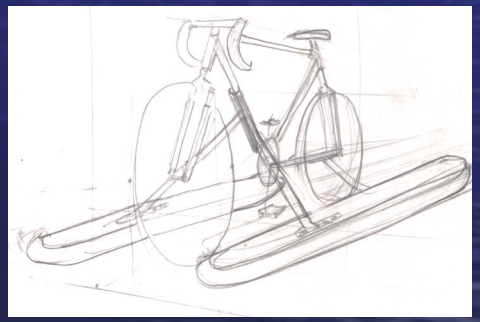
Observations

- Too much transverse sway which needs to be arrested because it is dissipating the power developed
- The model is fairly balanced by provision of floats along the front and rear and on the sides.
- The sailor should be preferably situated above or close to the pivot of fins.
- The dead centers occurs on the ends of amplitude of the fins. More torque is required at these ends

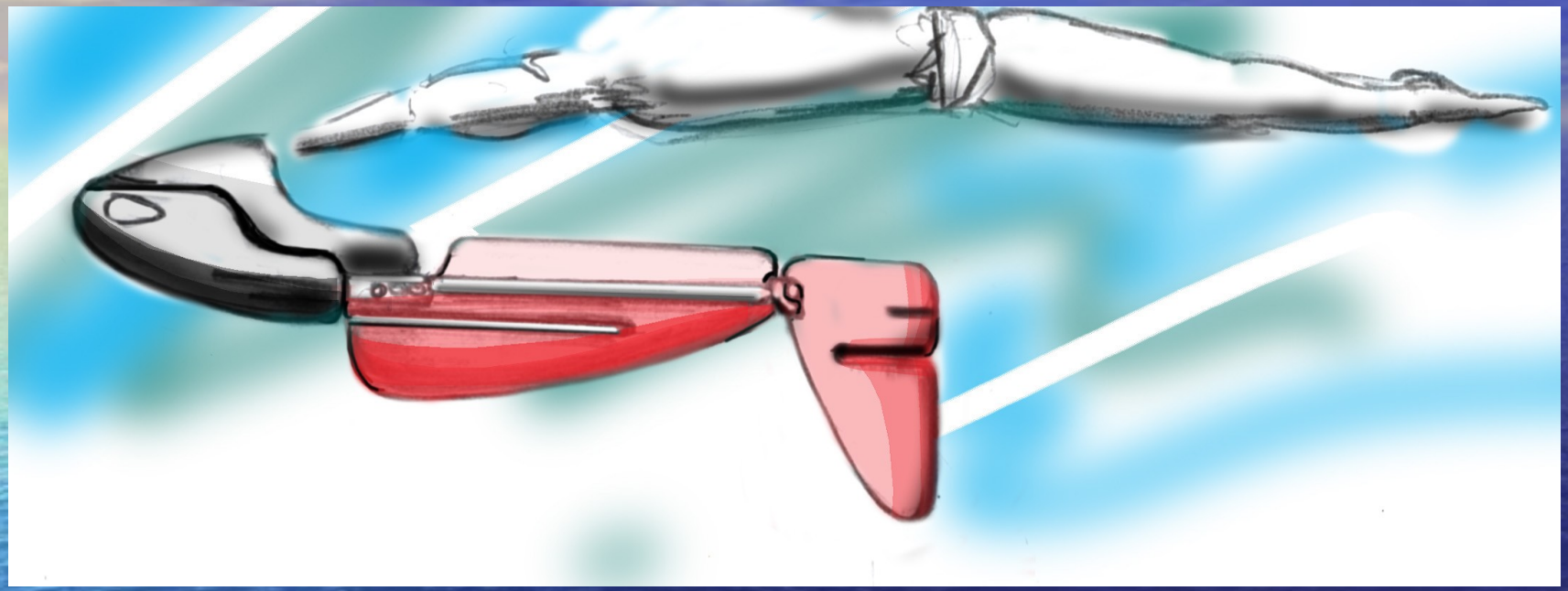
Product proposals

fish platforms

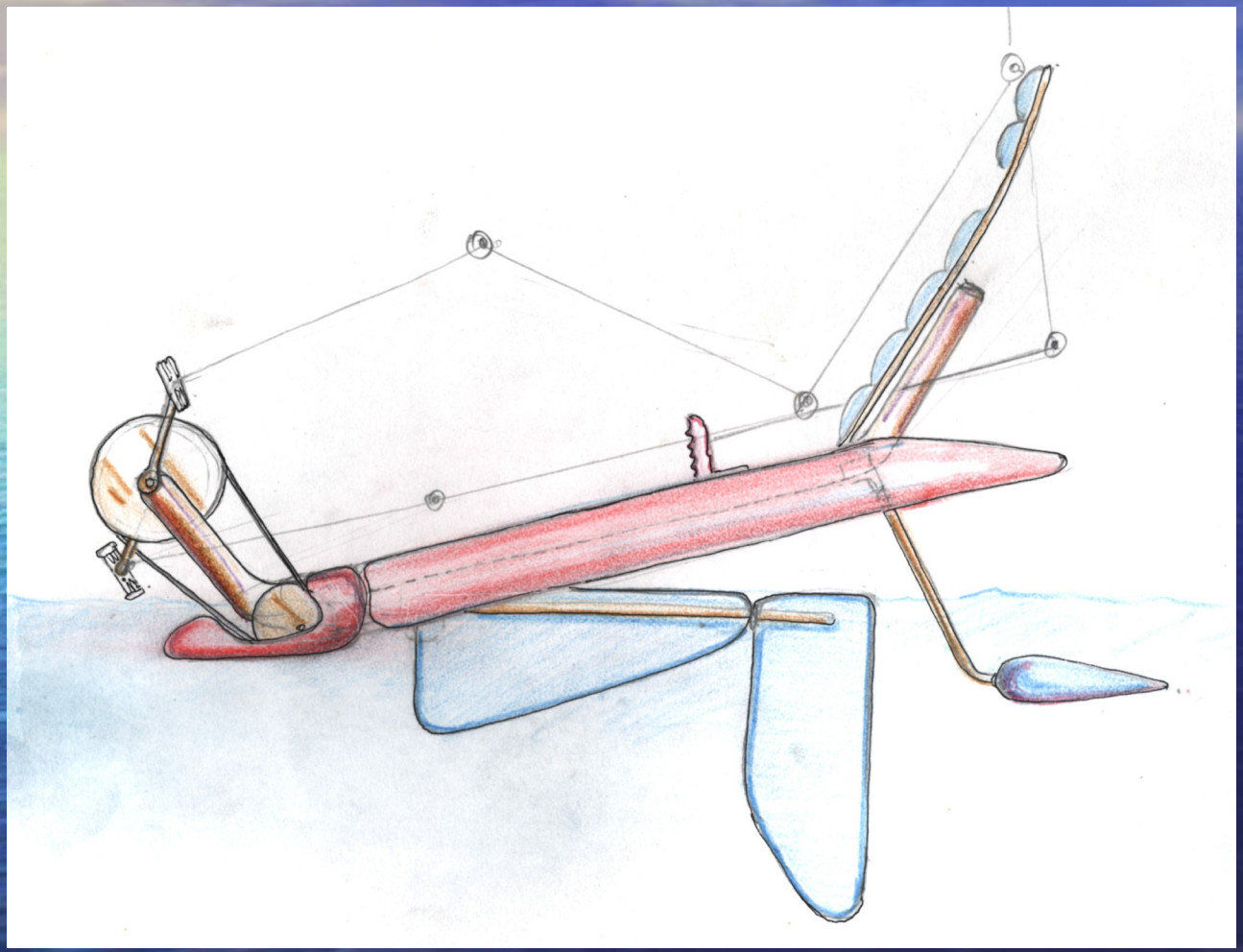




Product proposals underwater craft



Product proposals surface crafts for higher speeds



Product proposals

surface crafts