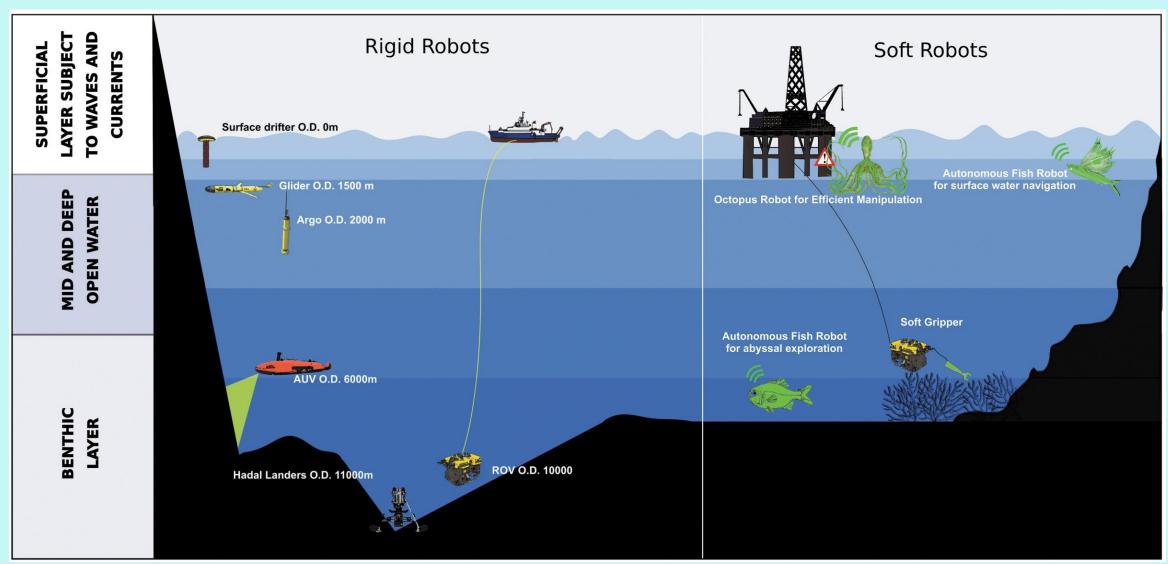


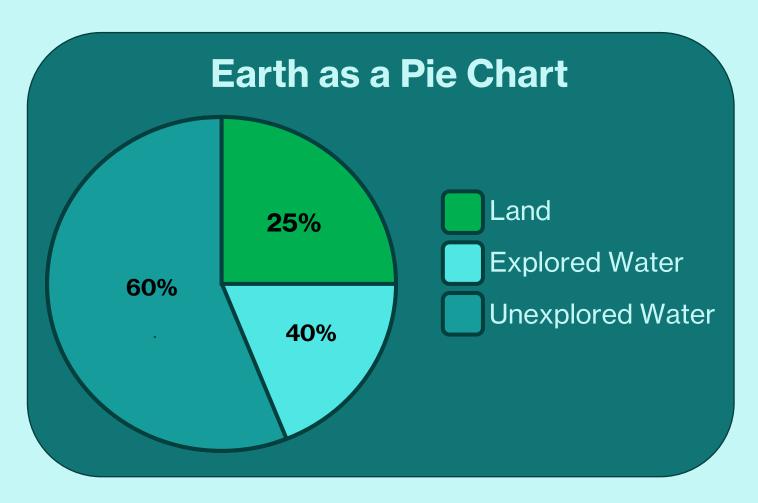
Overview [1]



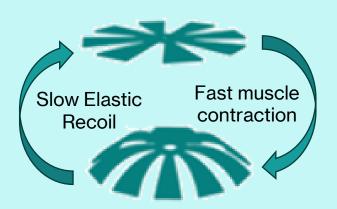
My literature review focuses on various styles of aquatic soft locomotion.

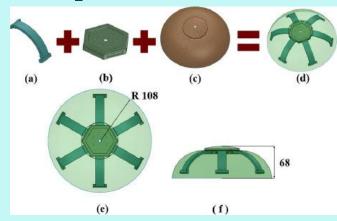
Why Underwater Soft Robots?[2]

- 80% of the ocean is unexplored.
- See animals in their habitat.
- Mimicking organic movement

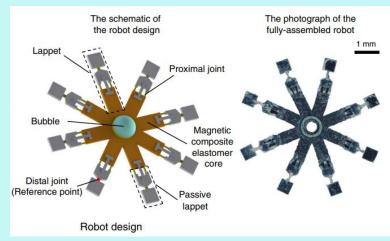


Jellyfish: Jet Propulsion [3], [4], [5], [6]

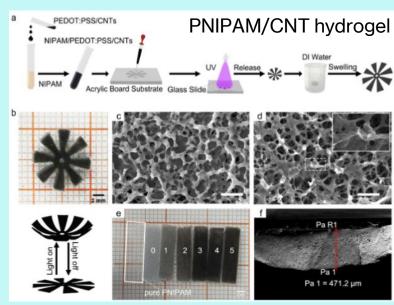




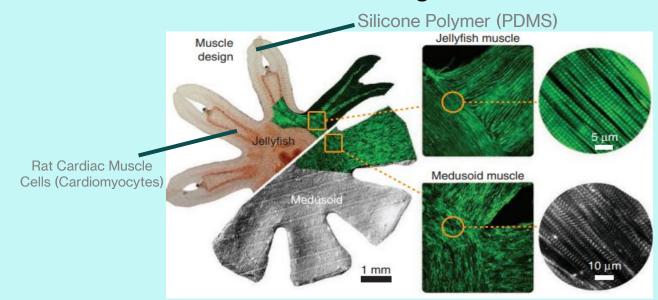
Electro-Deformation Actuation



Magnetic Field Actuation



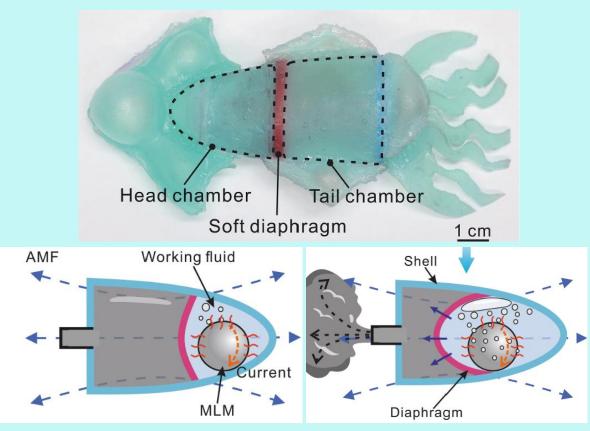
Visible-Light Actuation



Cardiomyocyte Actuation

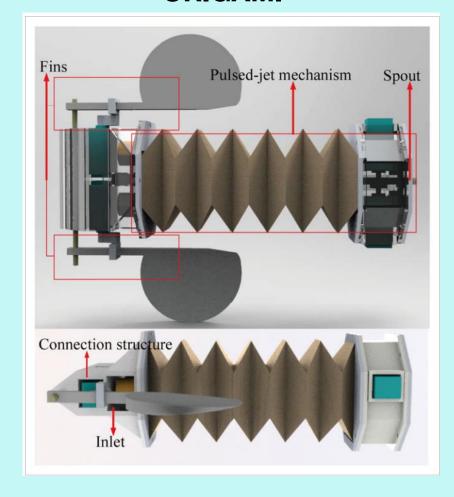
Squids: Jet Propulsion [7],[8]

MAGNETIC



Magnetic Liquid Metal (MLM) - Gallium-based alloy

ORIGAMI



Octopus: String Jet Propulsion and Crawling [9]

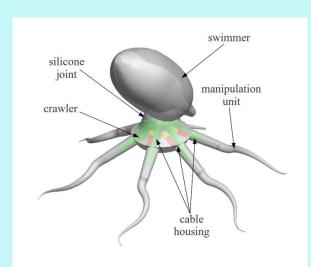


Fig. 7. A concept design of the integrated Soft Unmanned Underwater Vehicle PoseiDRONE in its intended final configuration.

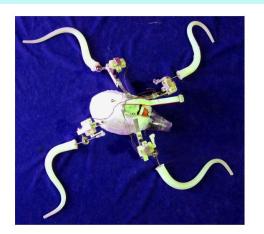


Fig. 8. The first working prototype of the PoseiDRONE, referred to here as the PDR1.

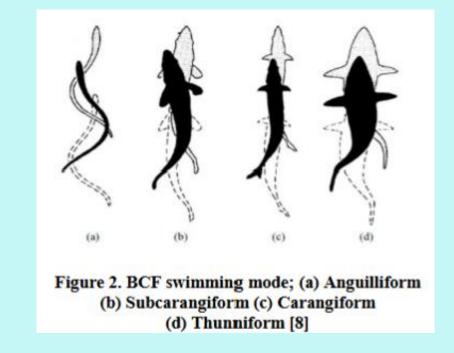


Fishes/ Eels Motion [10]

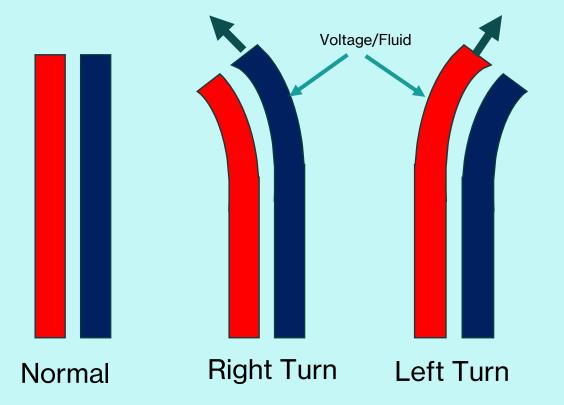
High Control

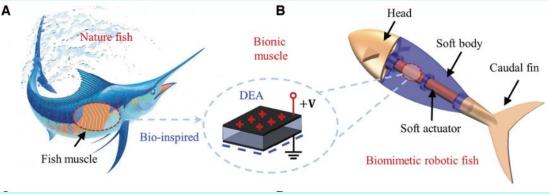
High Speed

- Anguilliform: Almost entire body undulates
- Subcarangiform: Rear half of body undulates
- Carangiform: Rear third of body undulates
- Thunniform: Only the tail moves

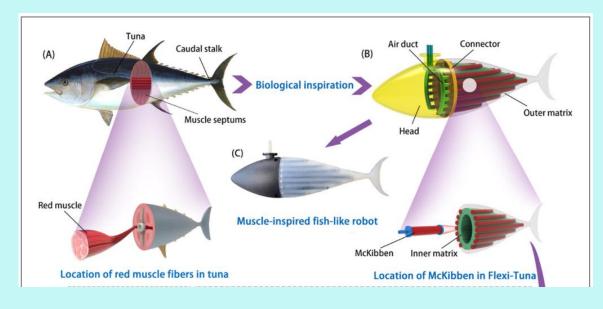


Fishes/ Eels: DEAs, FEAs [11], [12]





Cylindrical DEAs

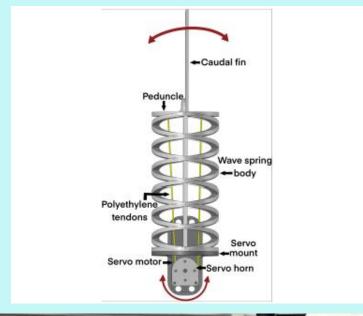


Flexi-Tuna (FEAs)

Fishes/ Eels: DEAs, FEAs [13]



Fishes/ Eels: String actuation [14], [15]



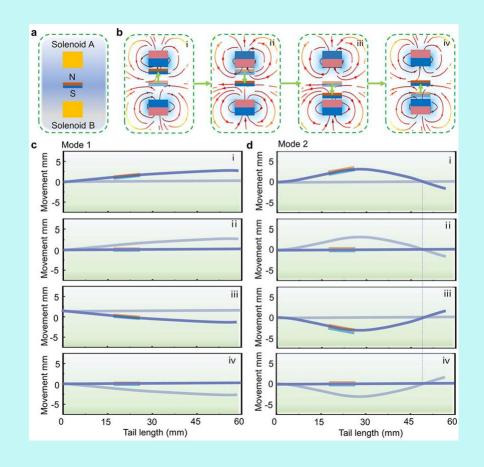


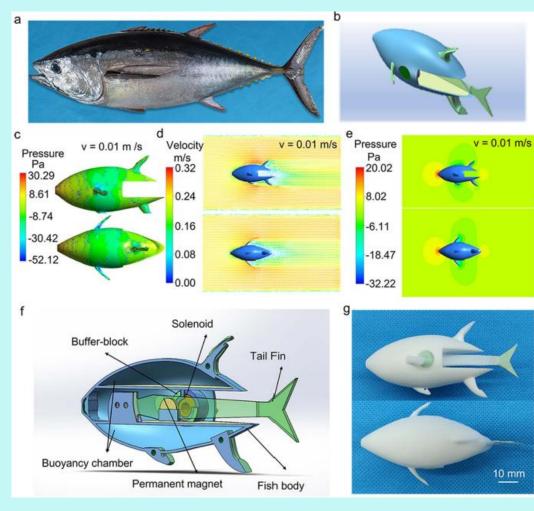




Fishes/ Eels: Magnetic Actuation[16]

Uses 2 solenoids on either side





MAGFLE

Fishes/ Eels: Depth Control [17], [18]

SWIM BLADDERS

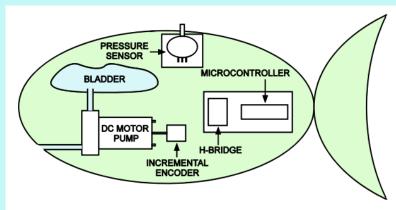
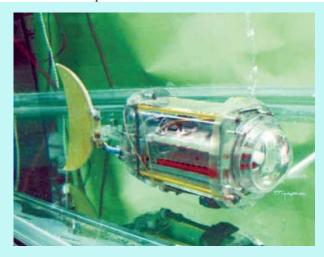


Fig. 6. Hardware setup of robotic fish.



FINS

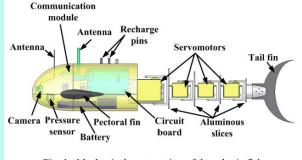
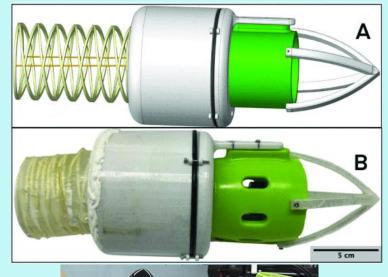


Fig. 1. Mechanical construction of the robotic fish.

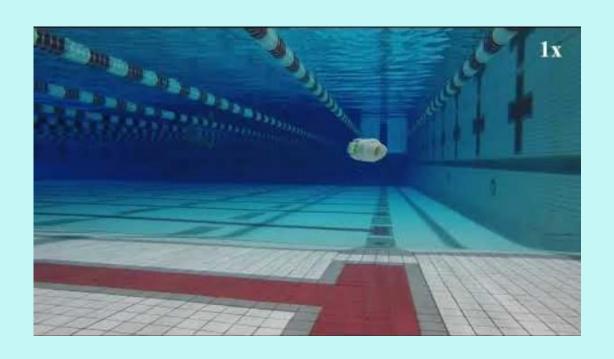




Other: Deformable Robot for Agile Guided Observation and Navigation (DRAGON) [19], [20]

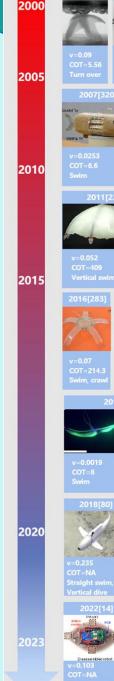






Future Trends

- Rise in anguilliform robot research as they have higher controllability.
- Multimodal locomotion PoseiDRONE
- Tetherless
- Swarm locomotion Fish schools















[14] Flatfishbot: untethered, control localized buoyancy with thermoelectric pneumatic actuators. [327]Light-driven bionic snake soft robot: using a hydrogel Poly (N-isopropylacrylamide) and carbon nanotubes. [91] Copebot: copepod-like combustion-driven high-

> performance robot [8]ART: turtle-inspired, with adaptive morphogenesis. [328]JellyZ: jellyfsh-inspired robot actuated by TCP.

[318]Starfish-shaped gel robot made of electro-active polymer gel (PAMPS gel). [319]Robo-Piketo: actuated by IPMC, capable of very quick turning and fast acceleration from a stop.



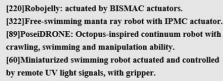


[320]Snake-like swimming robot with IPMC actuator. [321]Robotic fish with two undulating long-fins. [135]Micro manta ray robot fish actuated by SMA wires. [269]G9 serial robotic fish.









[323]Cephalopods-inspired SUUV.

[283]Starfish robot based on SMS.

[19]Turtle-like swimming robot with SMA flippers. [284]Double-caudal-fin robotic fish. [281]2D maneuverable fish propelled by IPMC fins. [324]RobCutt-II with the robotic arm. [62]Robotic fish based on DEAs





[64] Translucent swimming robots driven by frameless fluid electrode DEAs.

[317]Eight-tentacles-jellyfsh-robot actuated by pump. [22]Untethered Jellyfish robot actuated by DEAs. [325]RoboScallop: scallop-inspired robot firstly demonstrated jet propulsion for a robot swimming. [16]Breaststroke-inspired robot actuated by DEA. [316] Walking robot capable of sensing flow.



[80]SoFi: integrated, untethered, remote control. [282]Fish robot with multimodal swimming. [227]PATRICK: brittle-star-inspired robot, actuated by SMA wires.

[53]Biomimetic underwater robot with six MSM-IPMC

[326] Octopus-inspired bipedal walking soft robot.

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Any Questions?

