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Session E5: What Should We Know About Behavior of Sturgeons to Provide Their Efficient Passage?

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What should we know about behavior of sturgeons to provide their efficient passage?

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Main issues:

- **Behavior of sturgeons migrating upstream**
- **Fish passage facilities: structure and biological basis of operation**
- **Examples of sturgeon passage in the Volga, Don and Kuban rivers. Contemporary state.**

Behavioral patterns of pelagic and bottom fish migrating in rivers



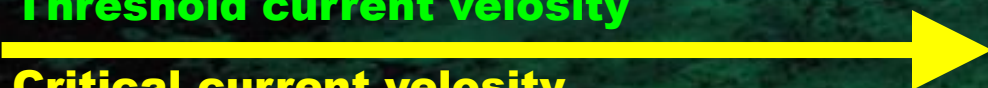
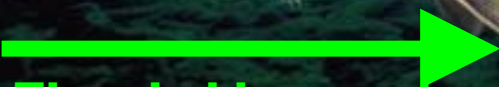
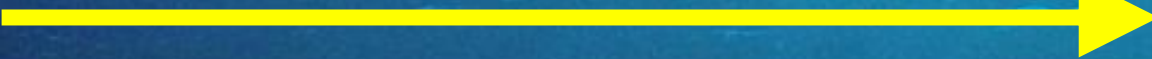
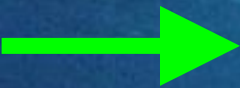
Pelagic fish

- Visual orientation
- Low threshold velocity
- High critical velocity
- Diurnal migrations
- Swimming near the surface or mid-water



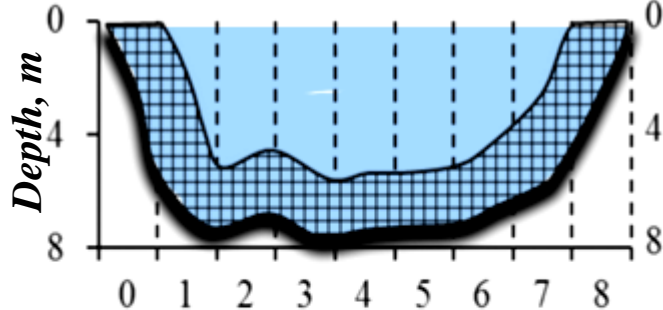
Bottom fish

- Tactile orientation
- High threshold velocity
- Low critical velocity
- Nocturnal or round-the-clock migration
- Swimming near the bottom

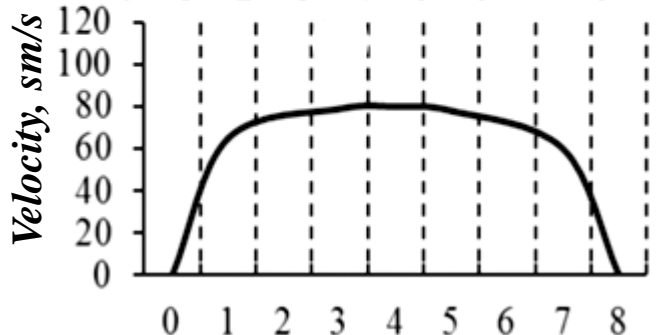


Threshold current velocity

Critical current velocity

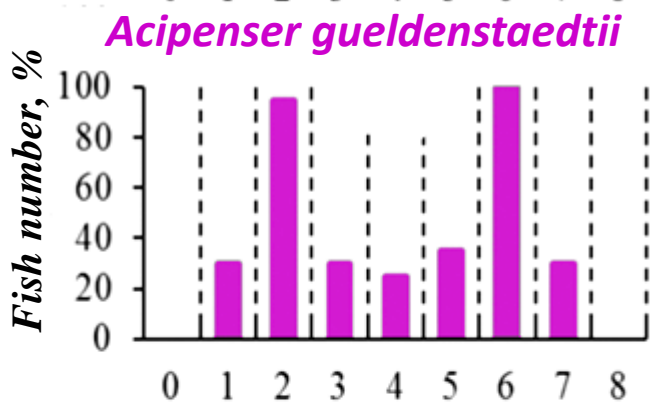


Location of drift net
(cross-section of
the river)

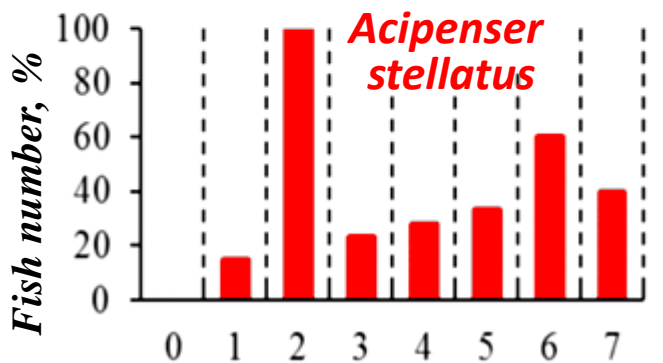


Flow velocity at
the zone of
sampling

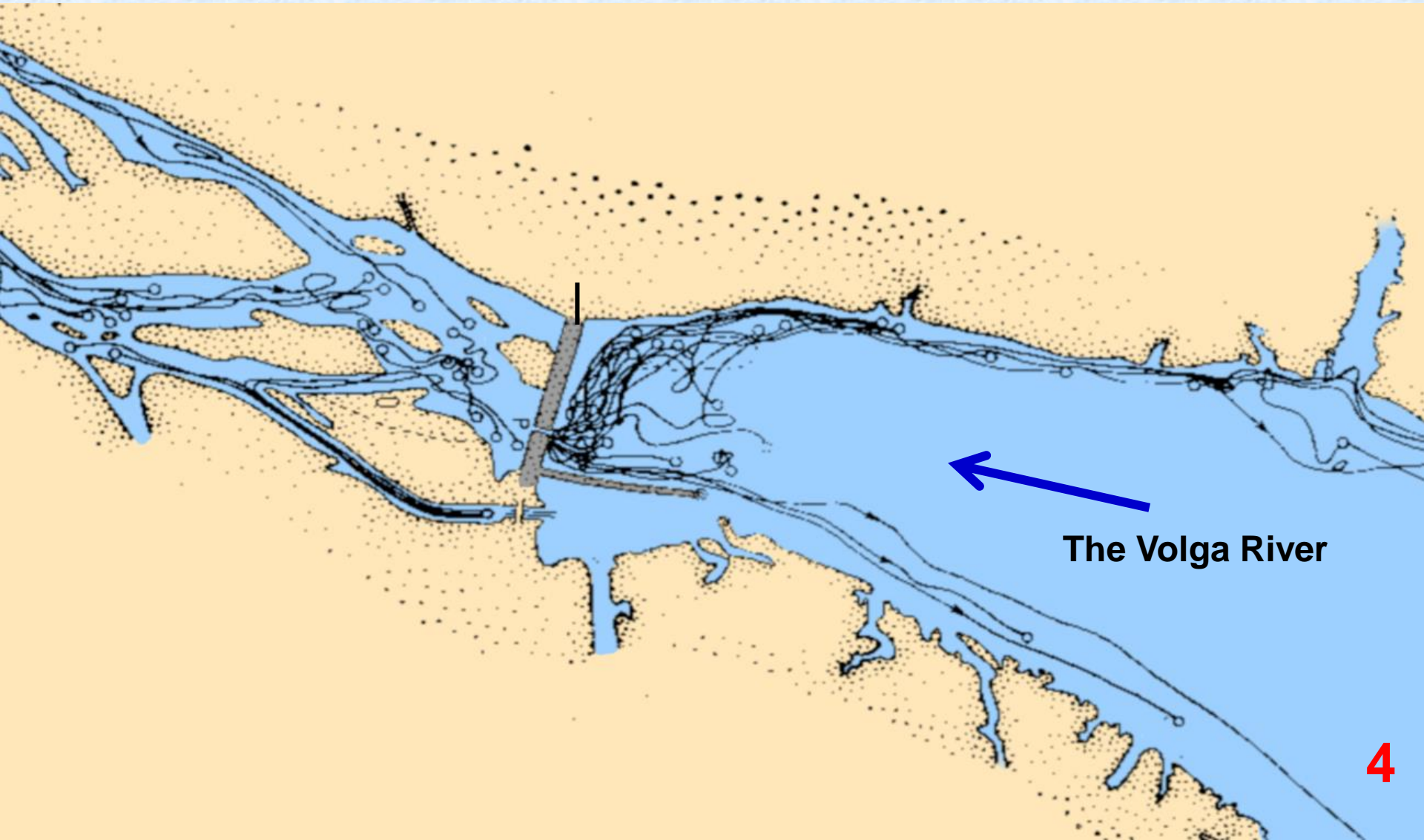
Cross-river distribution of fish in the Lower Volga during spawning migrations



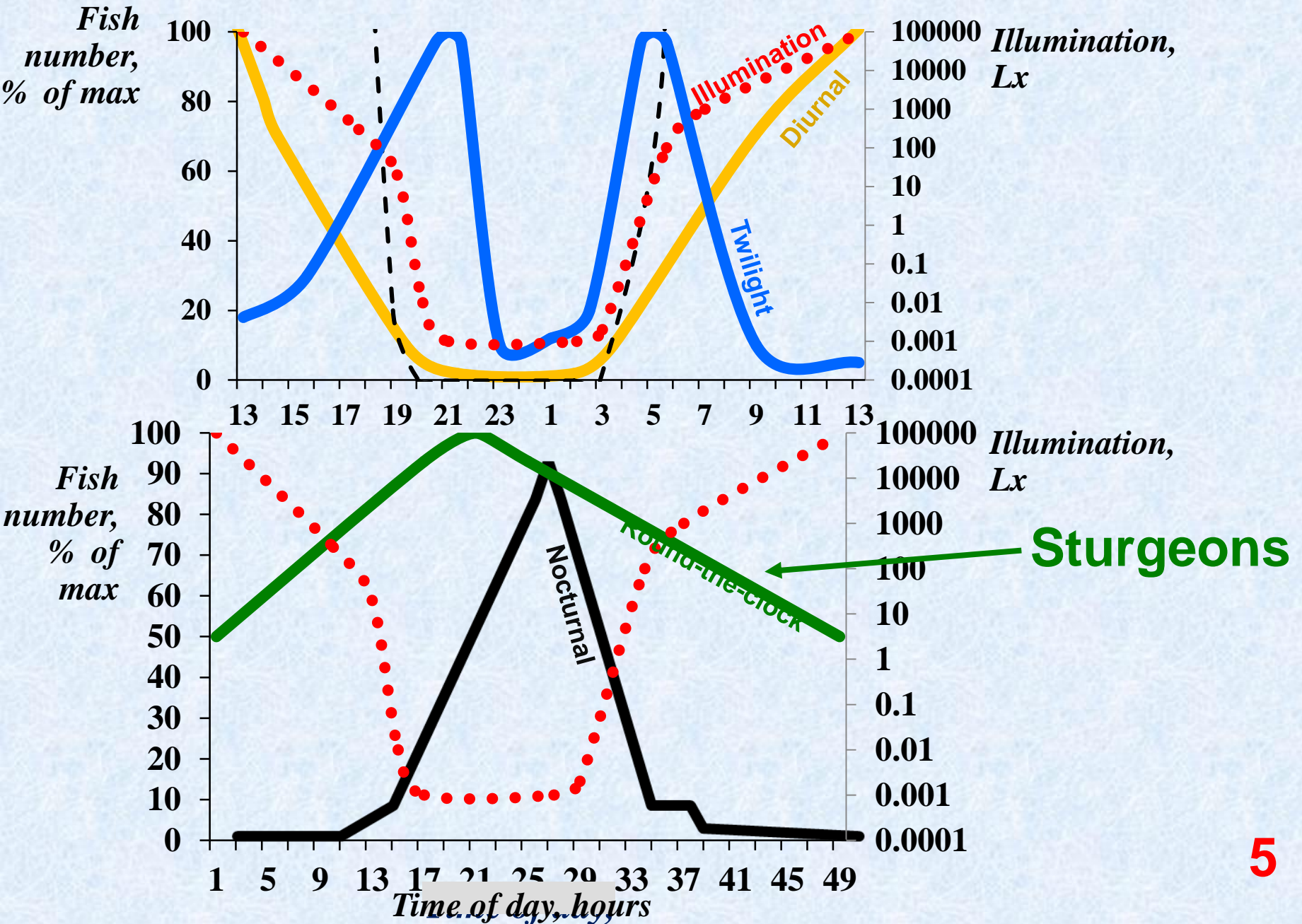
Distribution of
migrating fish



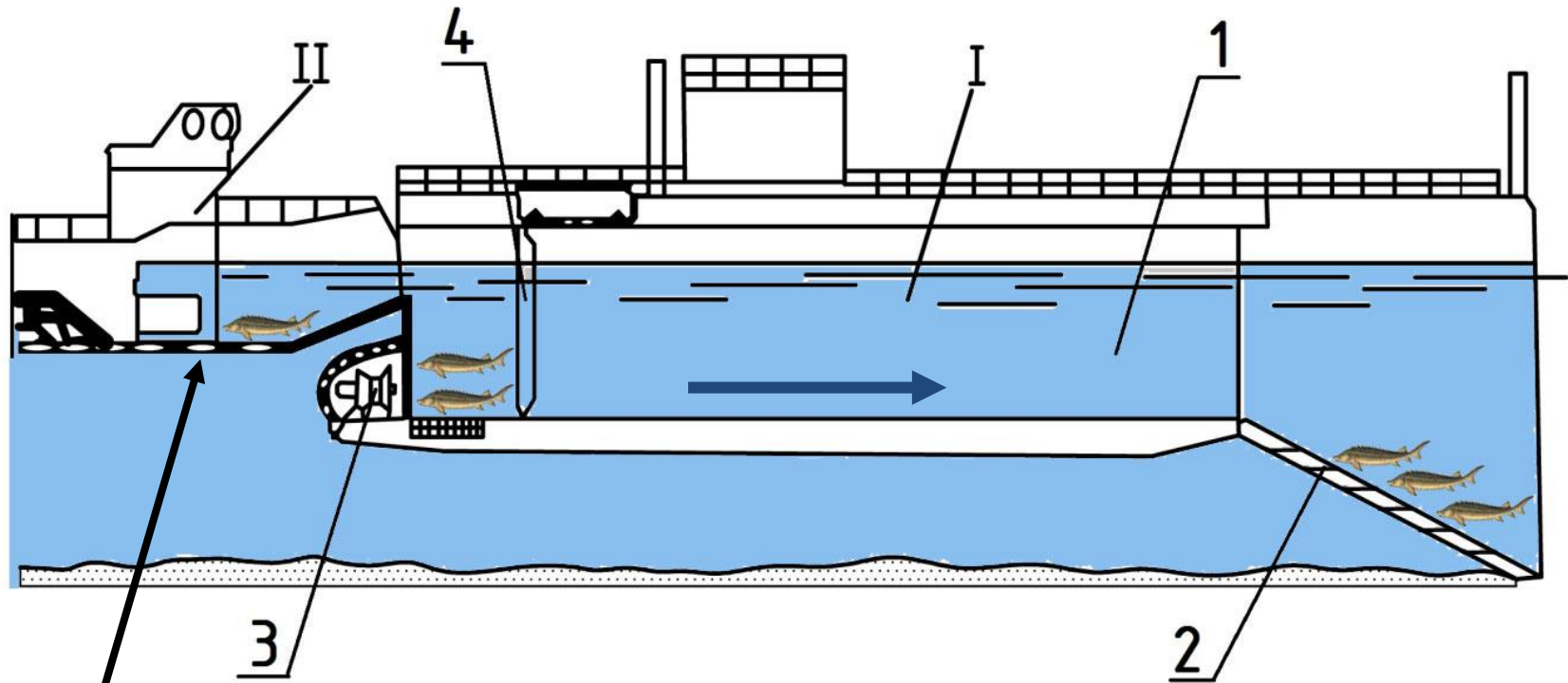
Tracks of *Acipenser gueldenstaedtii*
in tail water and head water of the Volgograd dam
(from Poddubnyi & Malinin, 1988)



Patterns of dial changes in fish spawning migrations



Experimental movable fish collector



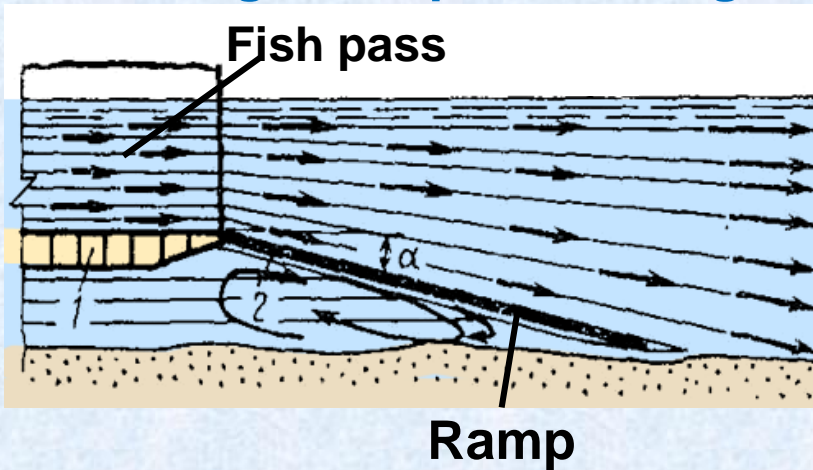
**Transportation
mean**

1 – fish collector, 2 – ramp, 3 – pumps, 4 – movable screen (*to concentrate fish*)

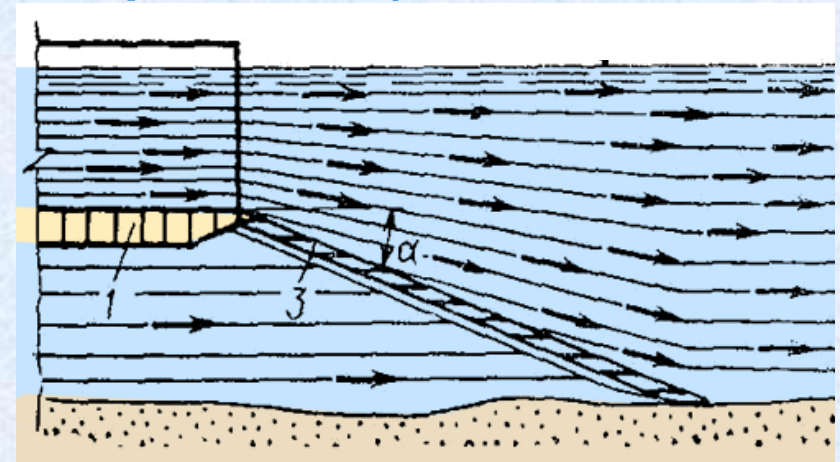
Modifications of the water flow in front of the movable fish collector

7

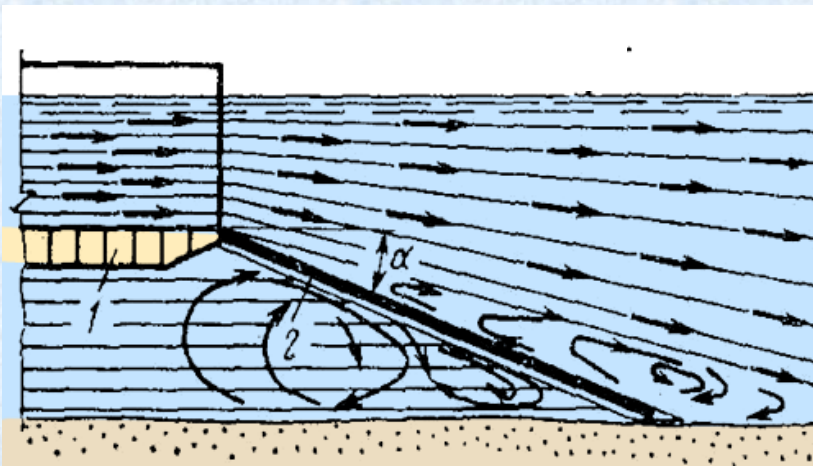
Watertight ramp. Small angle



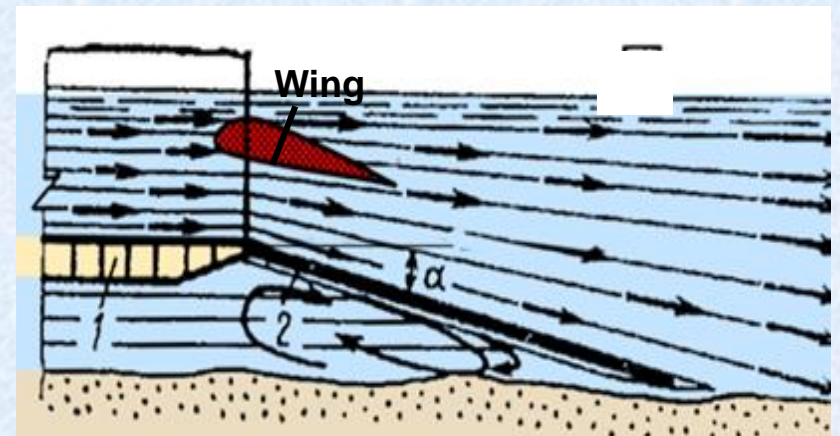
Ramp with slots (water-permeable). No vortices.



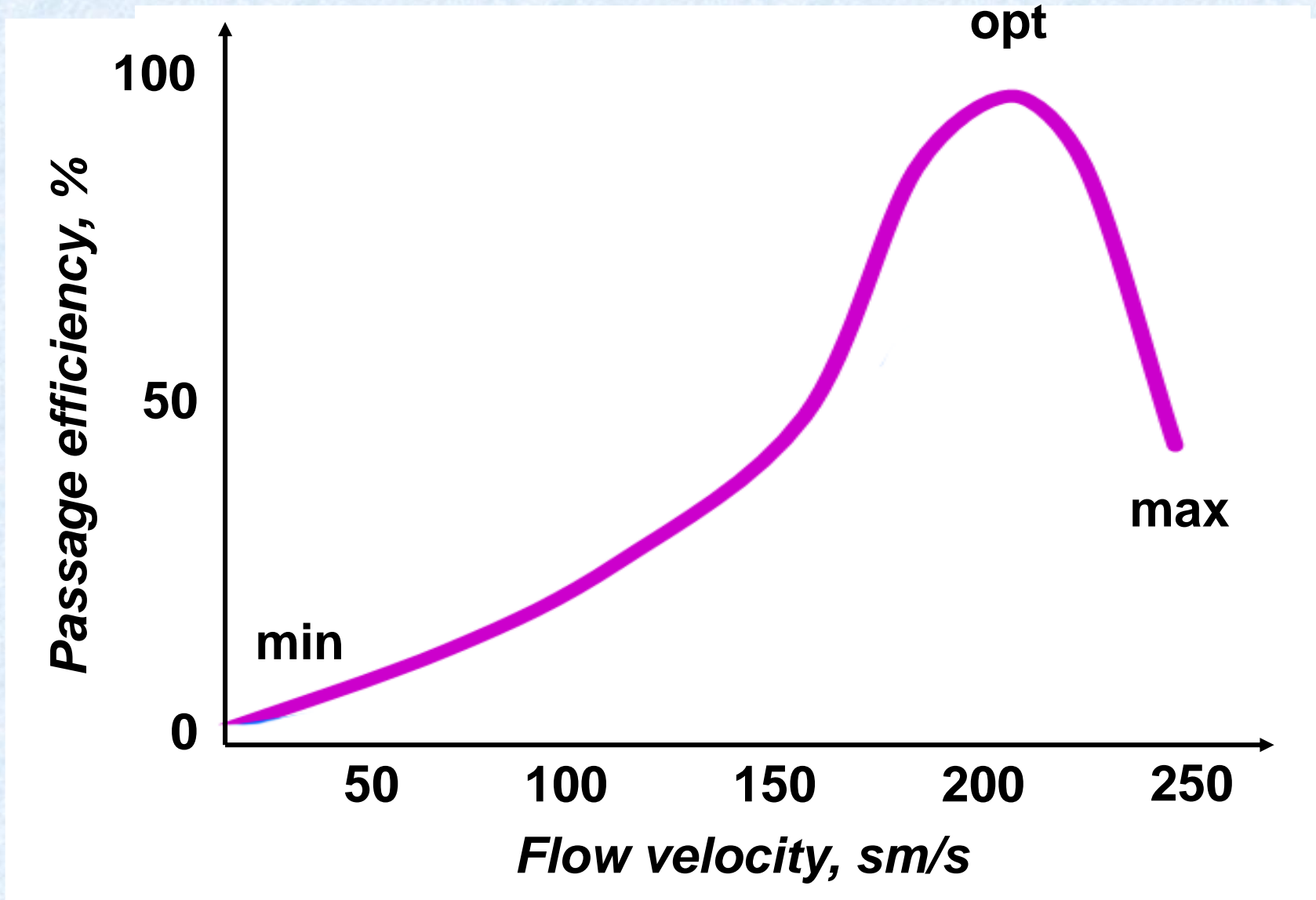
Watertight ramp. Large angle



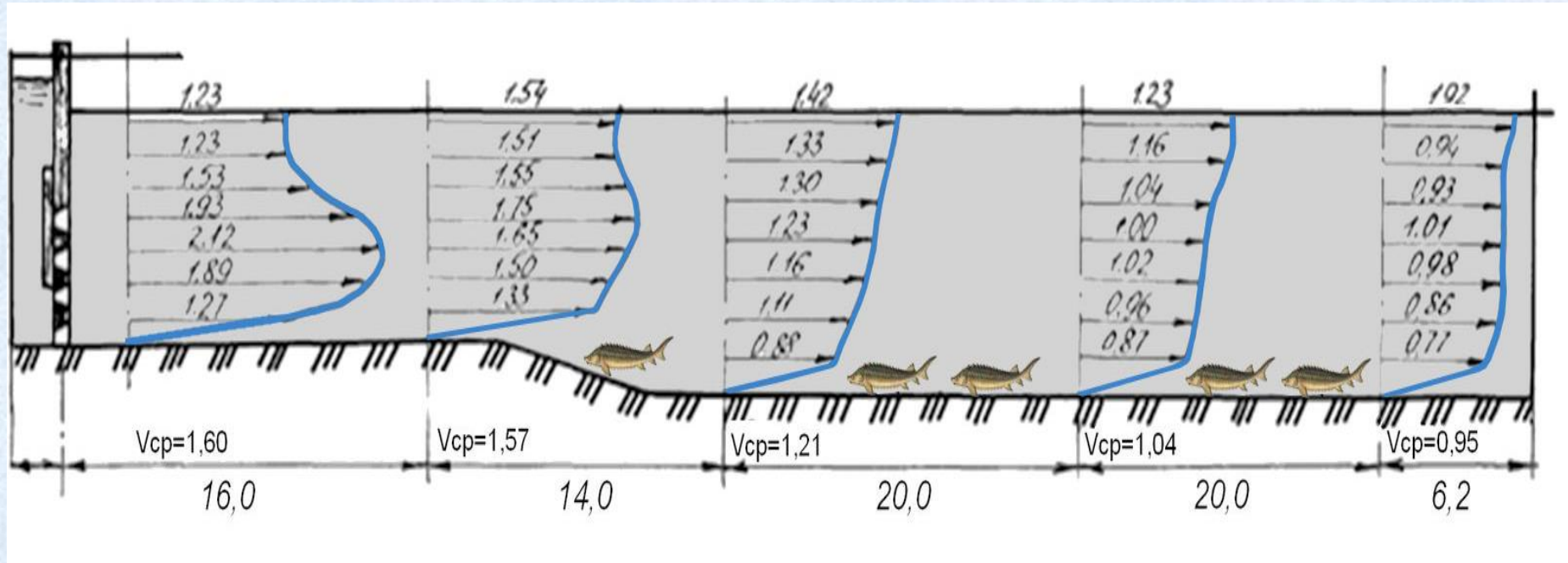
Watertight ramp, "hydraulic wing"



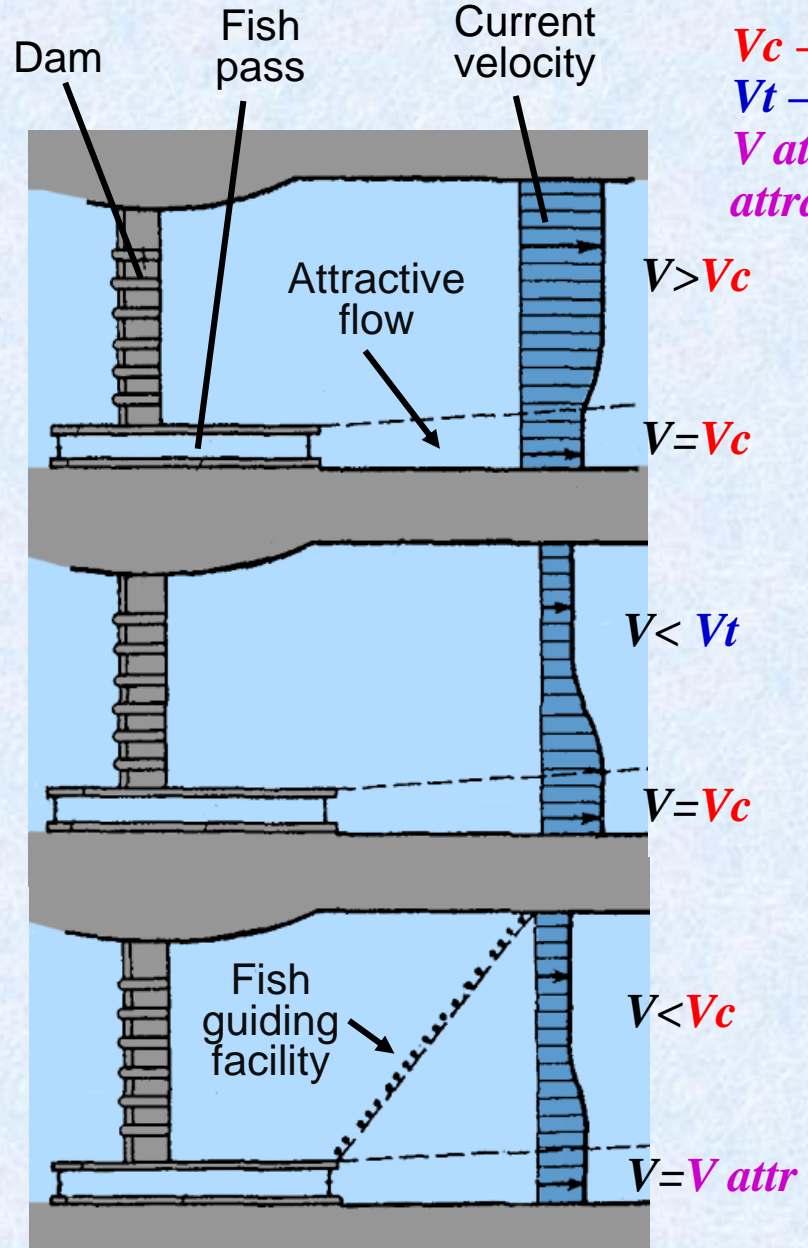
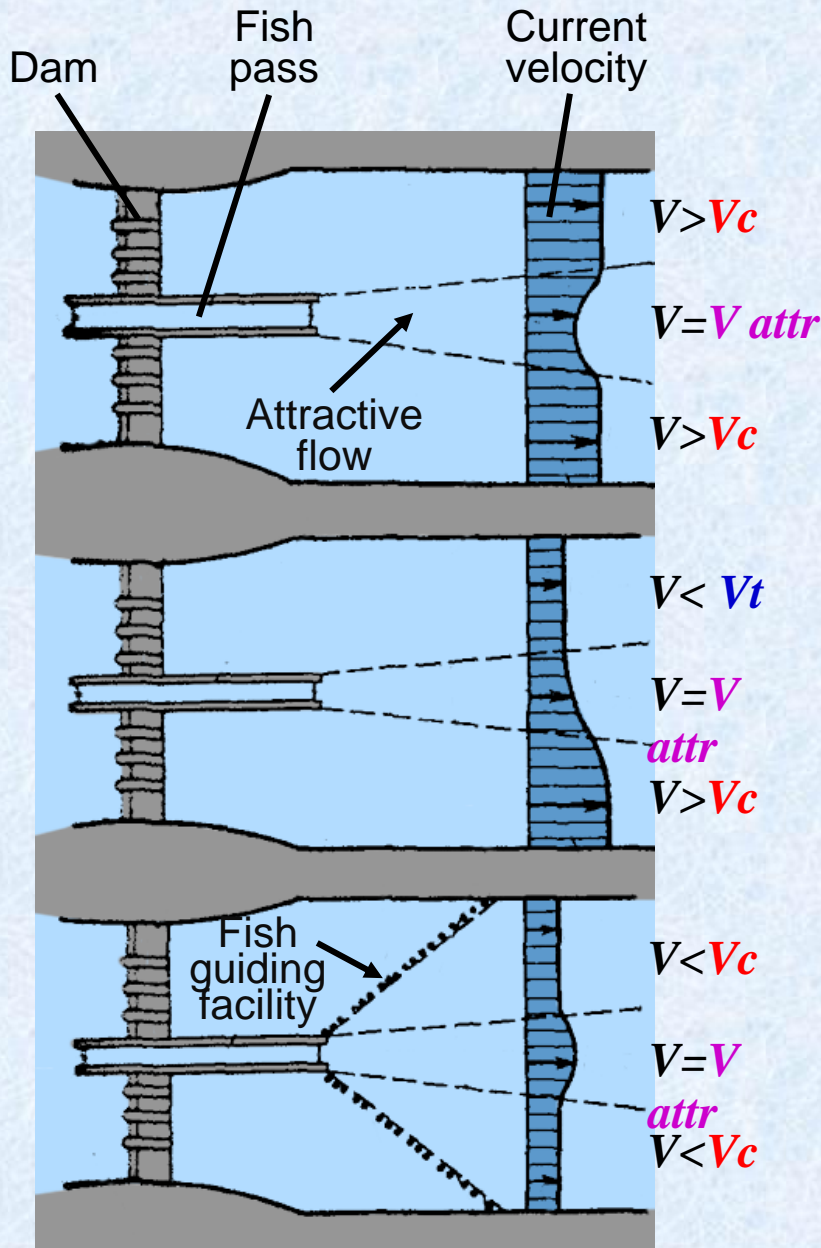
Velocity of attractive flow influences number of passed fish



Flow velocity profiles within the fish collector



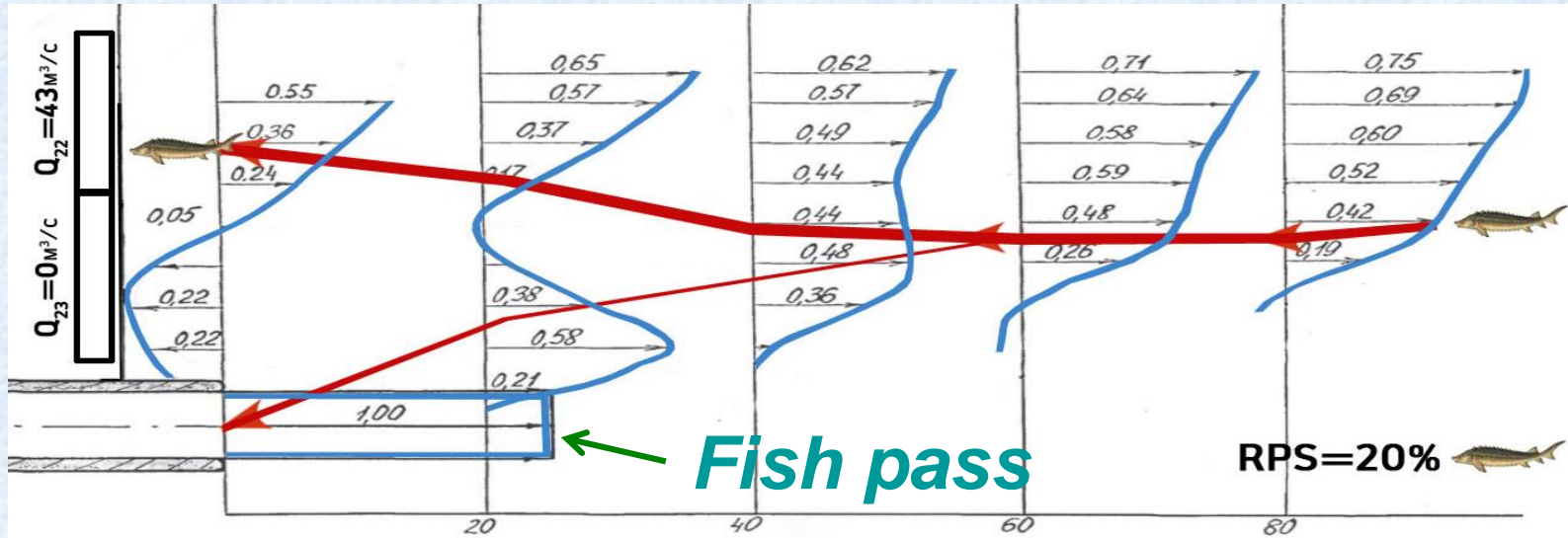
Hydraulic schemes of fish attraction



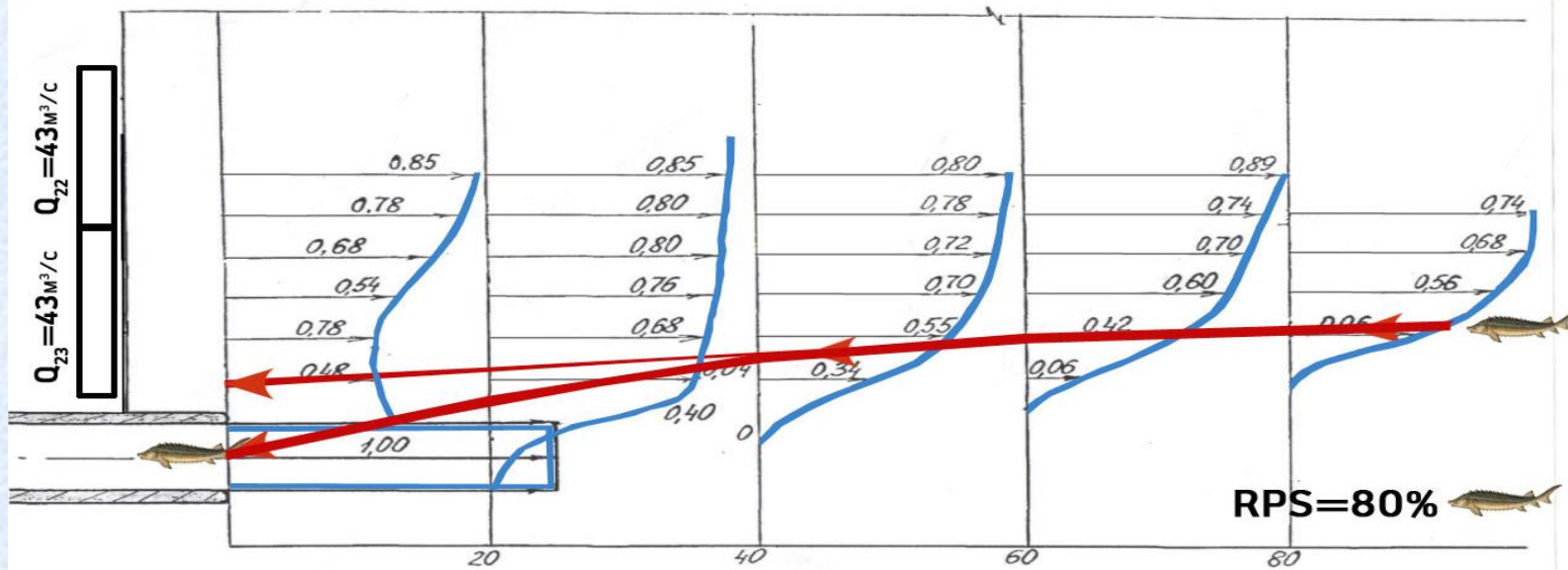
V_c – critical
 V_t – threshold
 V_{attr} – attractive

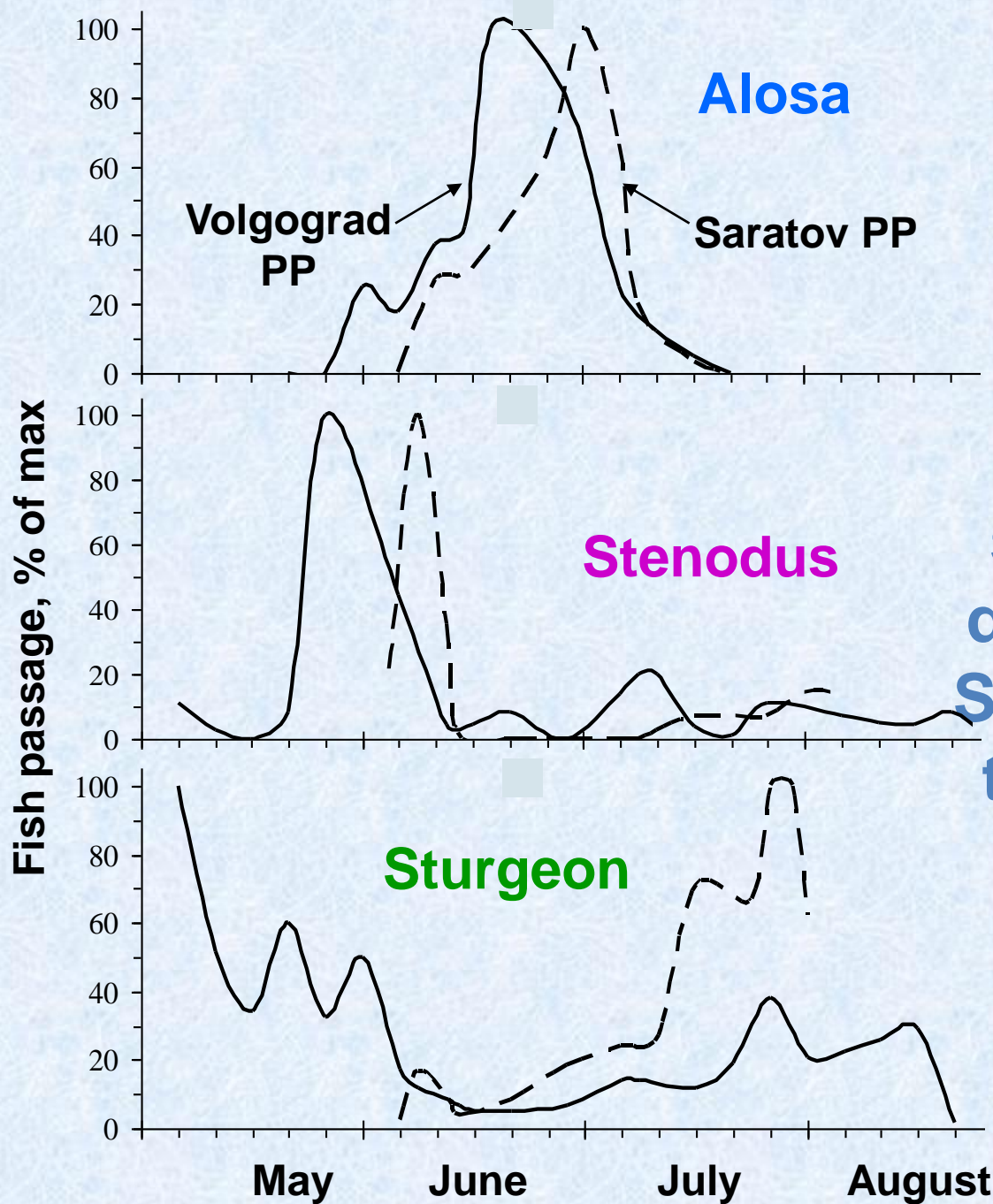
Flow velocity patterns in the tail race of Saratov power plant near the fish pass

One turbine works



Two turbines work





Sturgeons move slower between two dams (Volgograd and Saratov Power Plants) than other migrants.

Kuban River. Tikhovskii Power Plant equipped with fish passage locks (2) to pass sturgeons



Kuban River. Fedorovskii (A) and Krasnodarskii (B) Power Plants equipped with fish passage facilities to pass sturgeons

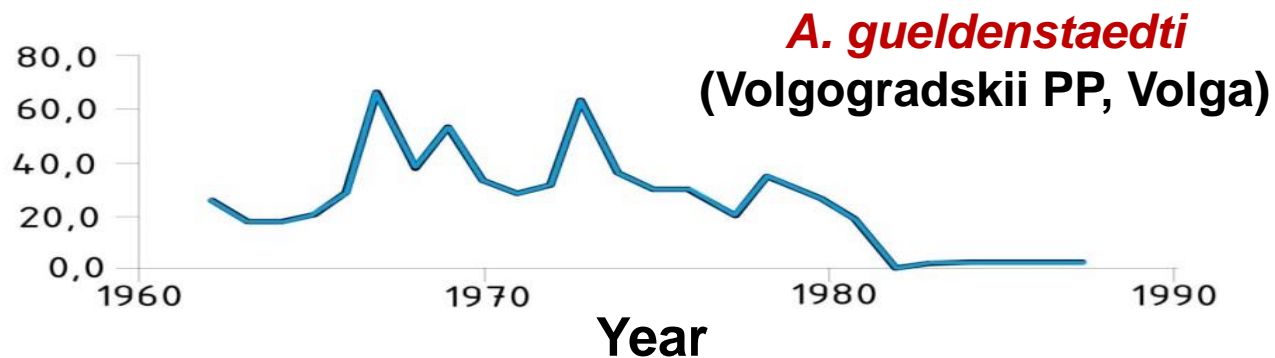
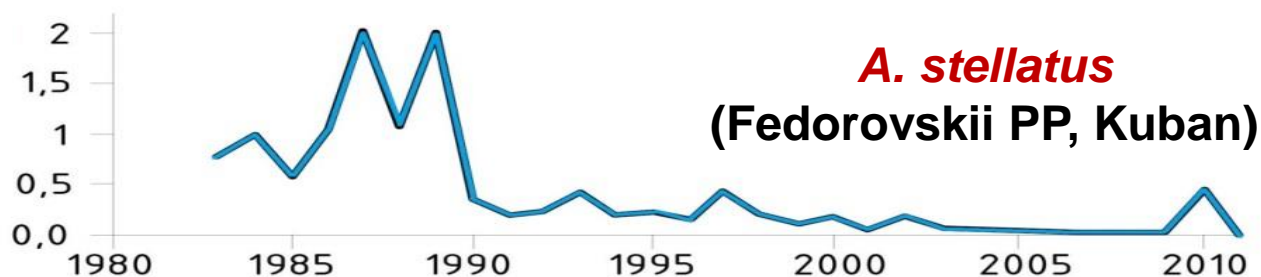
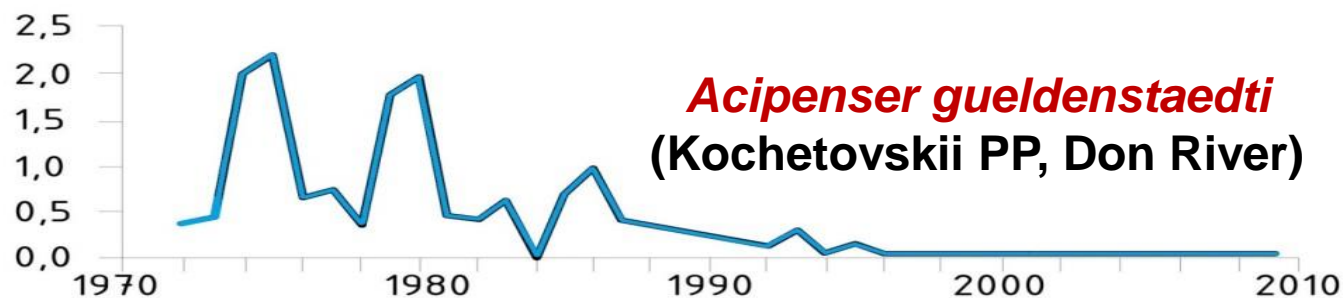
A)



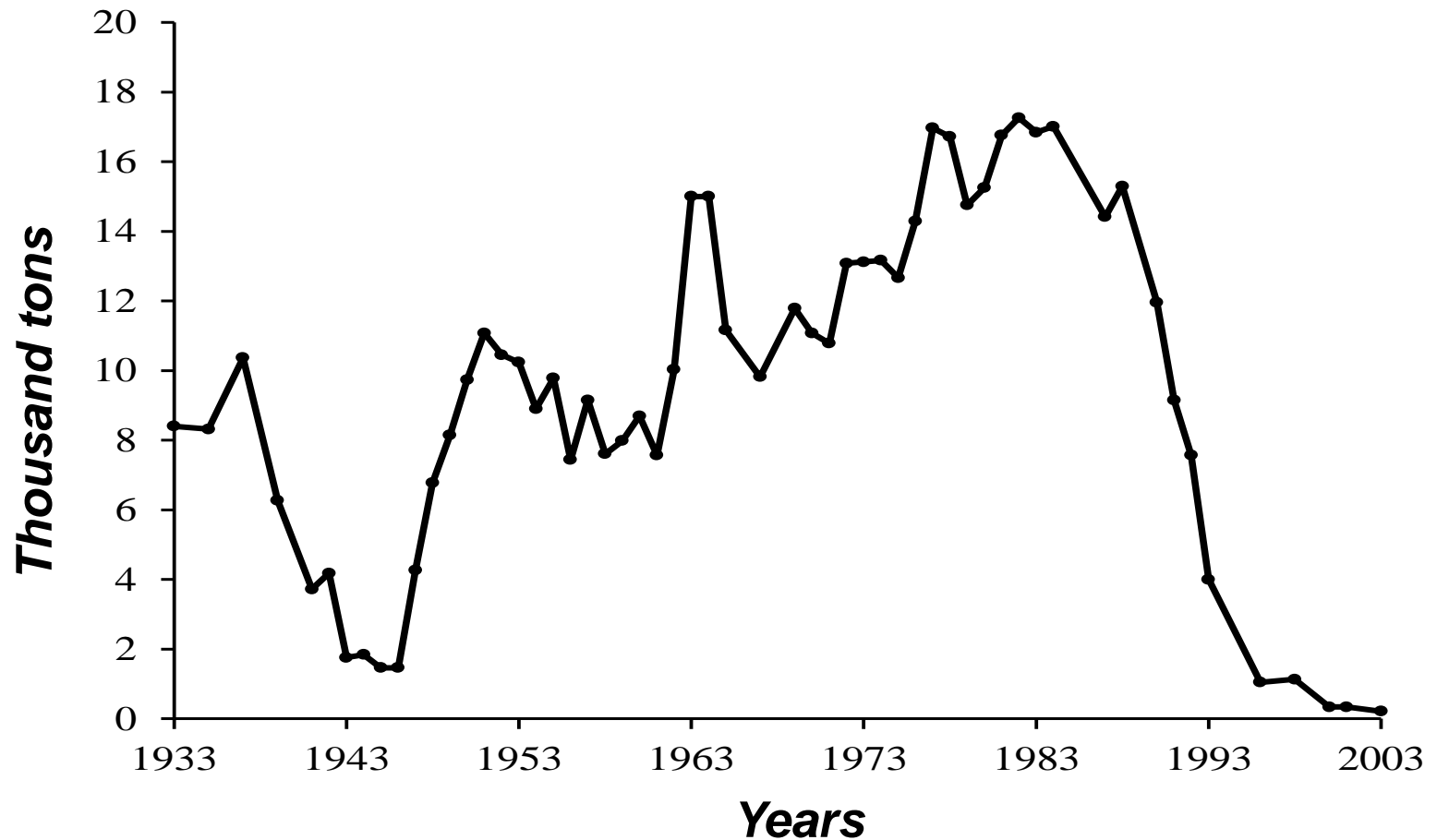
B)



Annual number of passed sturgeons (thousand fish)



Annual commercial catch of sturgeons in the Russian part of Caspian basin





THANK YOU!