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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



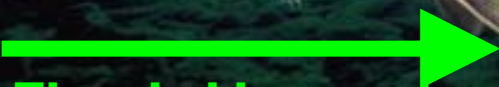
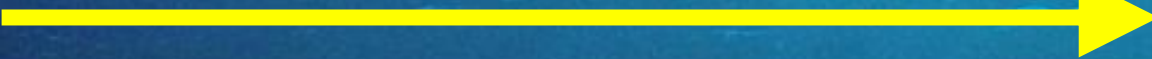
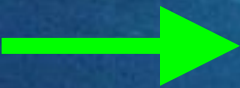
## Pelagic fish

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



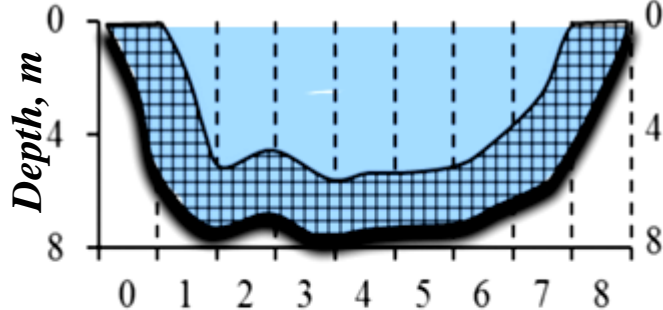
## Bottom fish

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

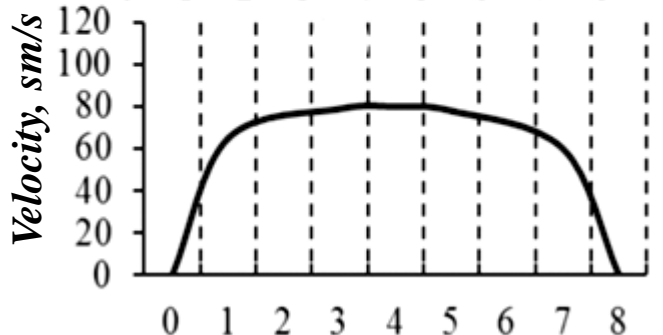


**Threshold current velocity**

**Critical current velocity**

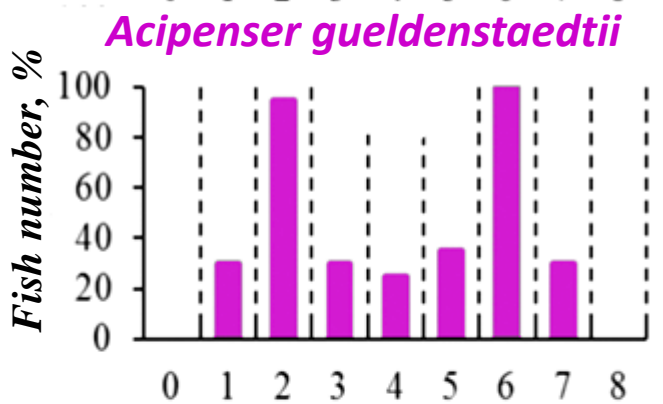


Location of drift net  
(cross-section of  
the river)

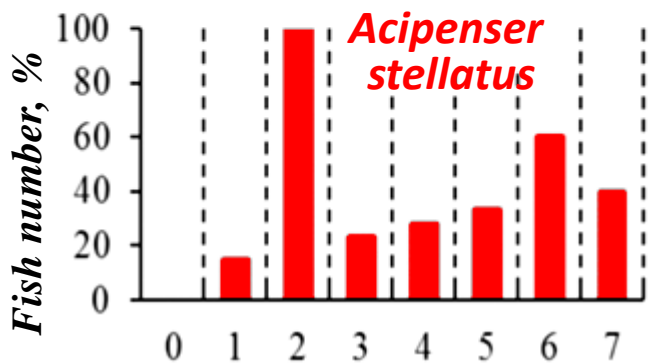


Flow velocity at  
the zone of  
sampling

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

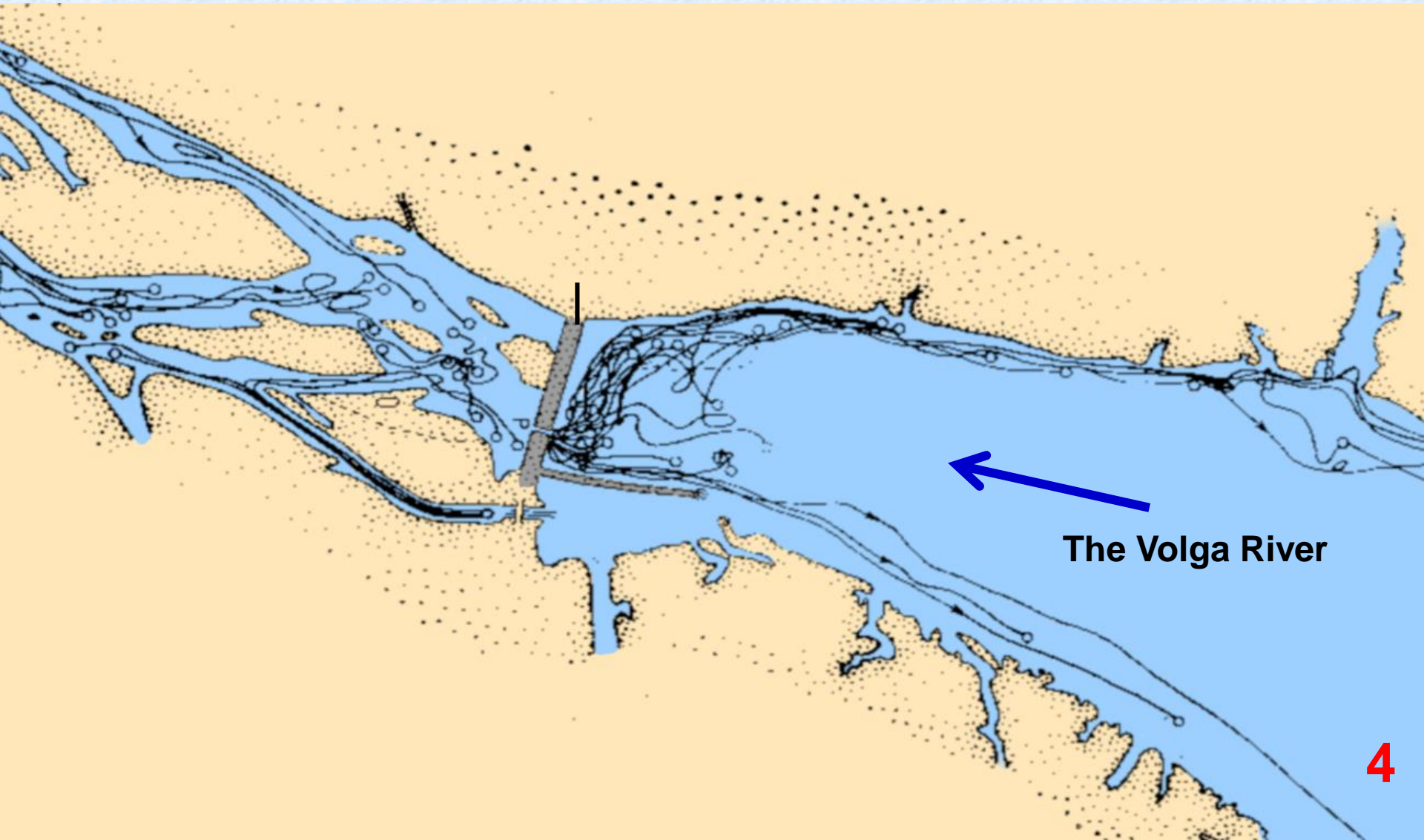


Distribution of  
migrating fish

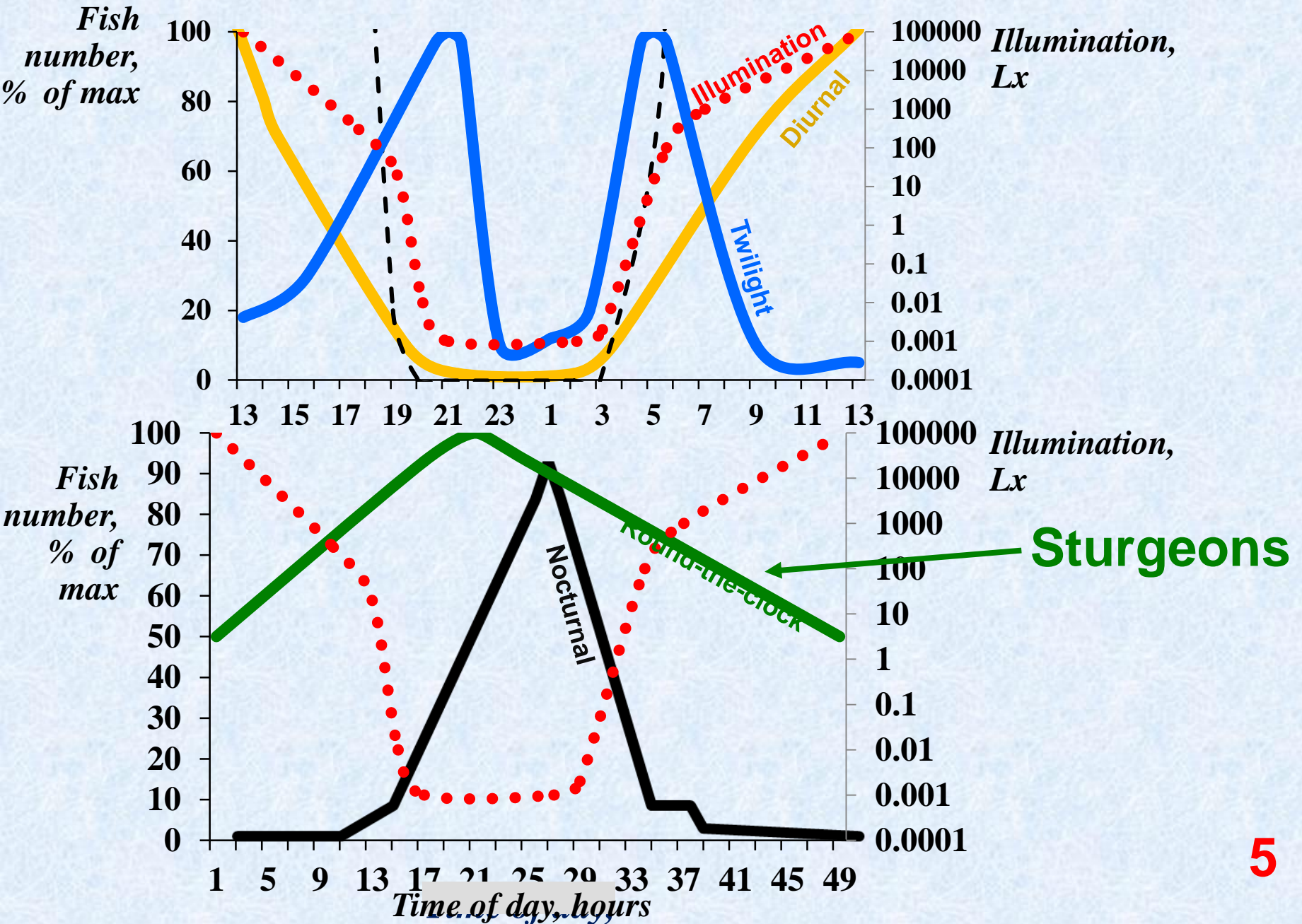




Tracks of *Acipenser gueldenstaedtii*  
in tail water and head water of the Volgograd dam  
(from Poddubnyi & Malinin, 1988)

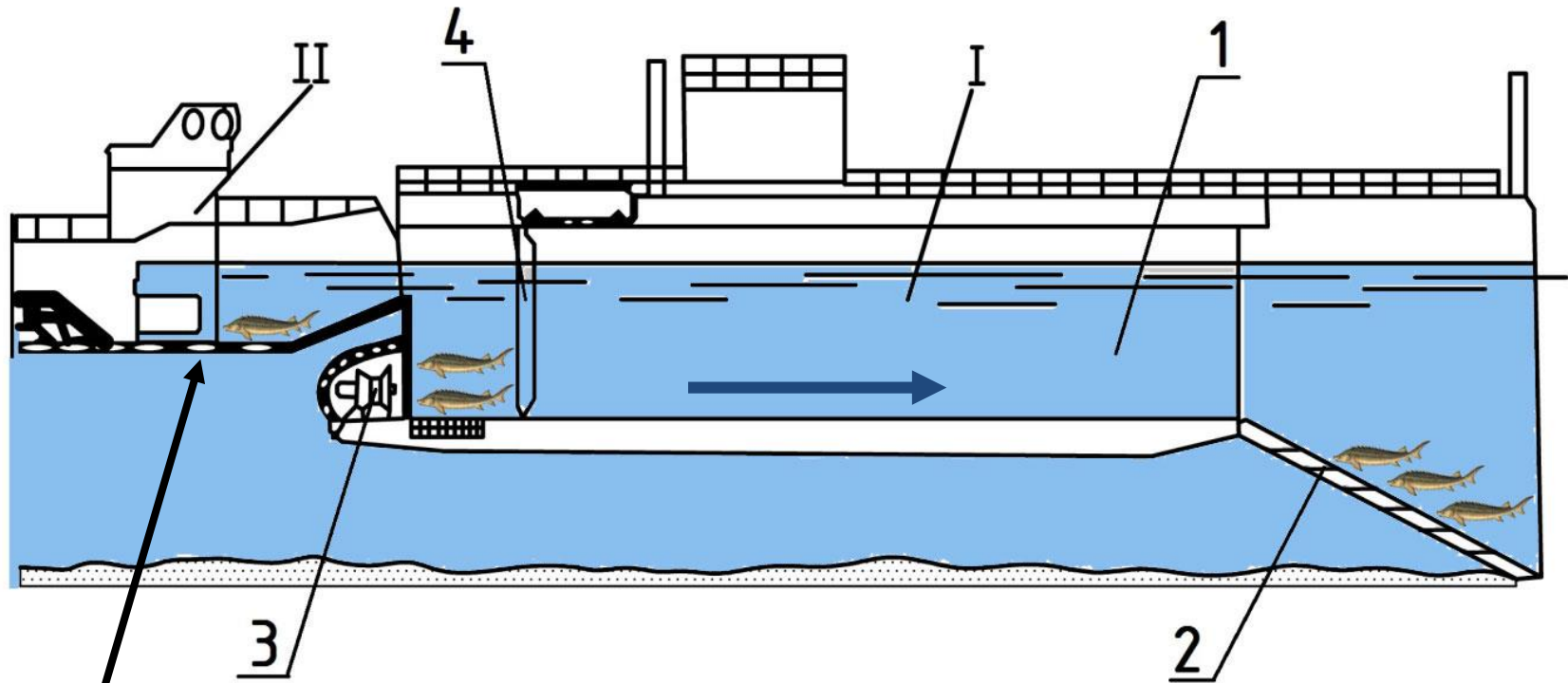


# Patterns of dial changes in fish spawning migrations





# Experimental movable fish collector



**Transportation  
mean**

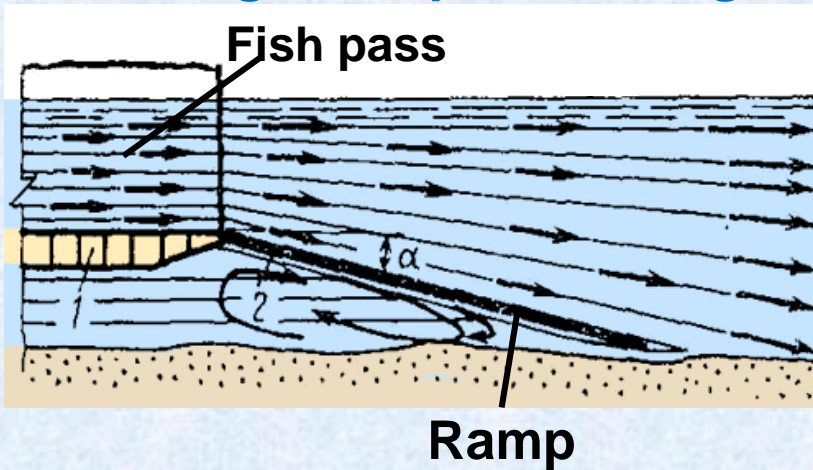
1 – fish collector, 2 – ramp, 3 – pumps, 4 – movable screen (*to concentrate fish*)



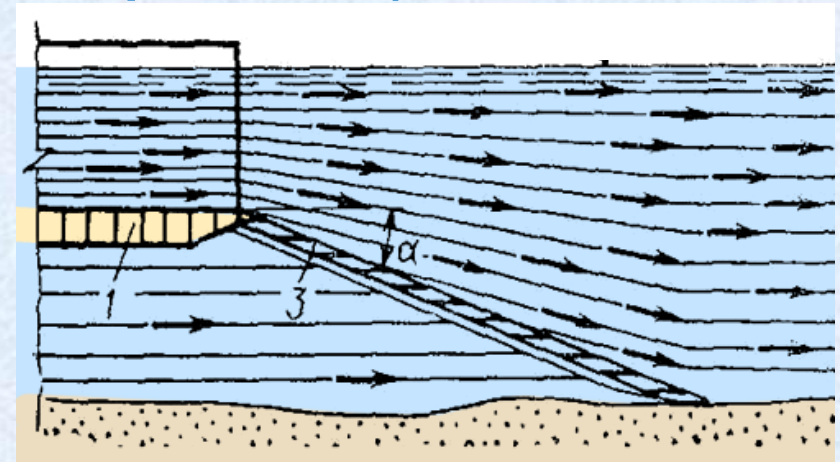
# Modifications of the water flow in front of the movable fish collector

7

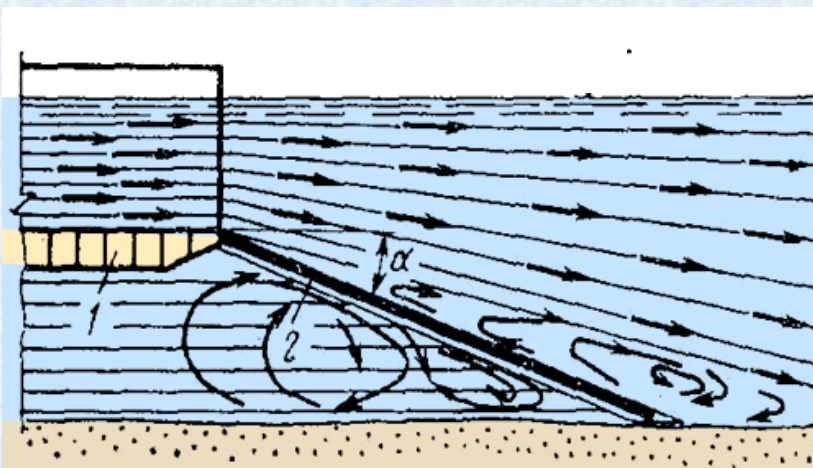
Watertight ramp. Small angle



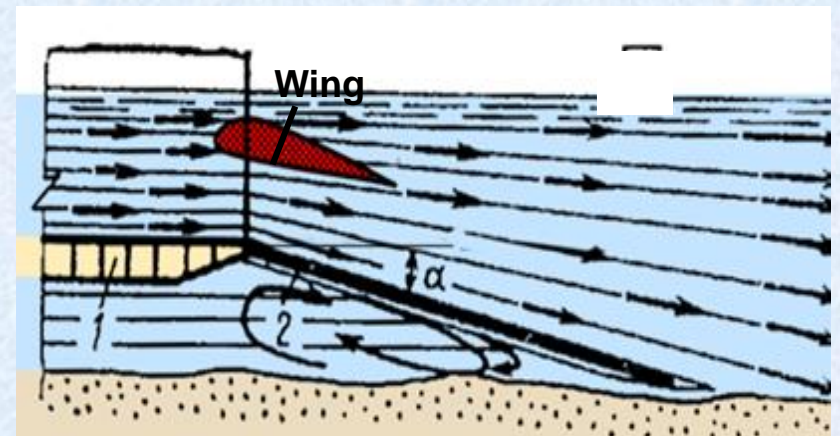
Ramp with slots (water-permeable). No vortices.



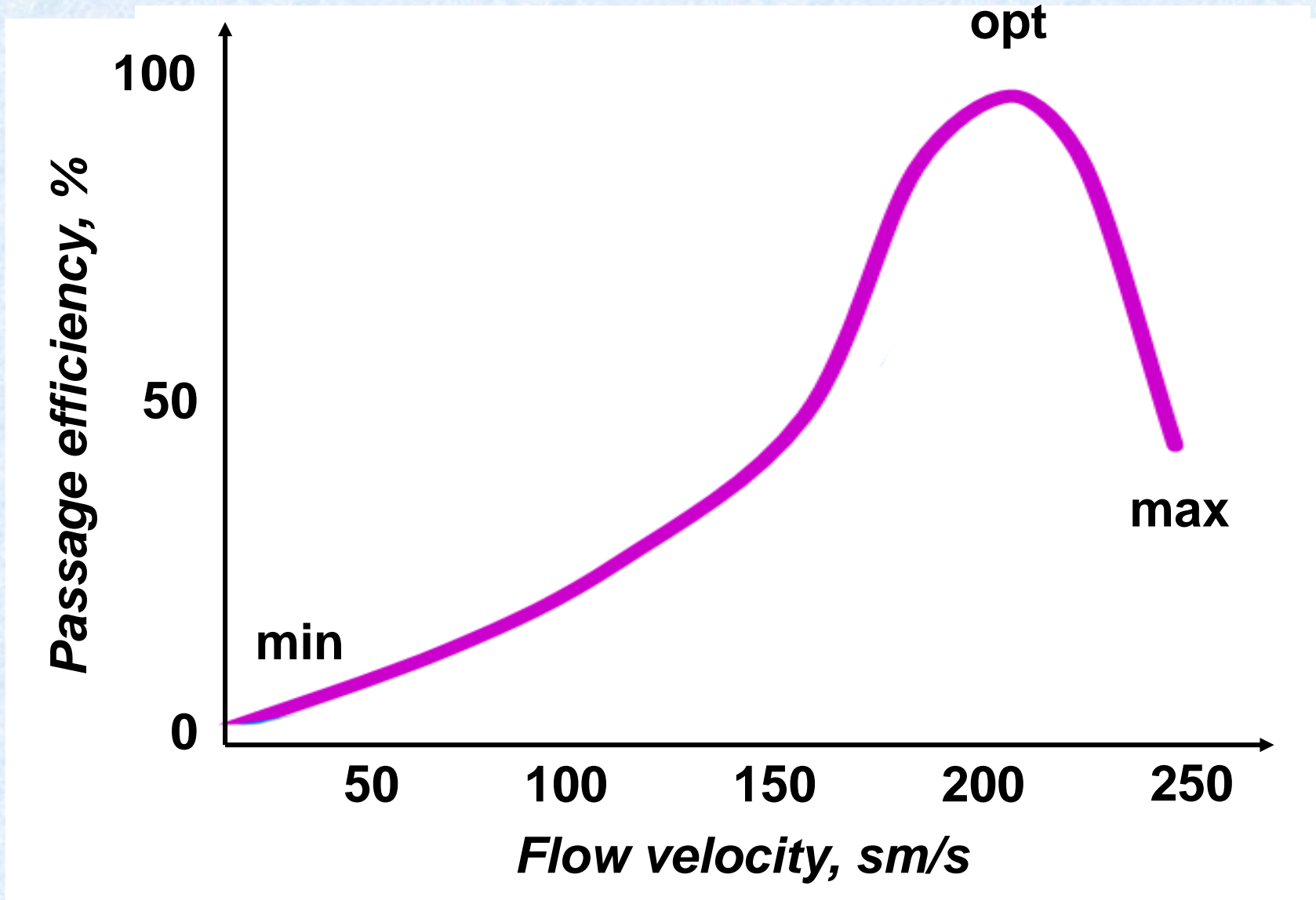
Watertight ramp. Large angle



Watertight ramp, "hydraulic wing"

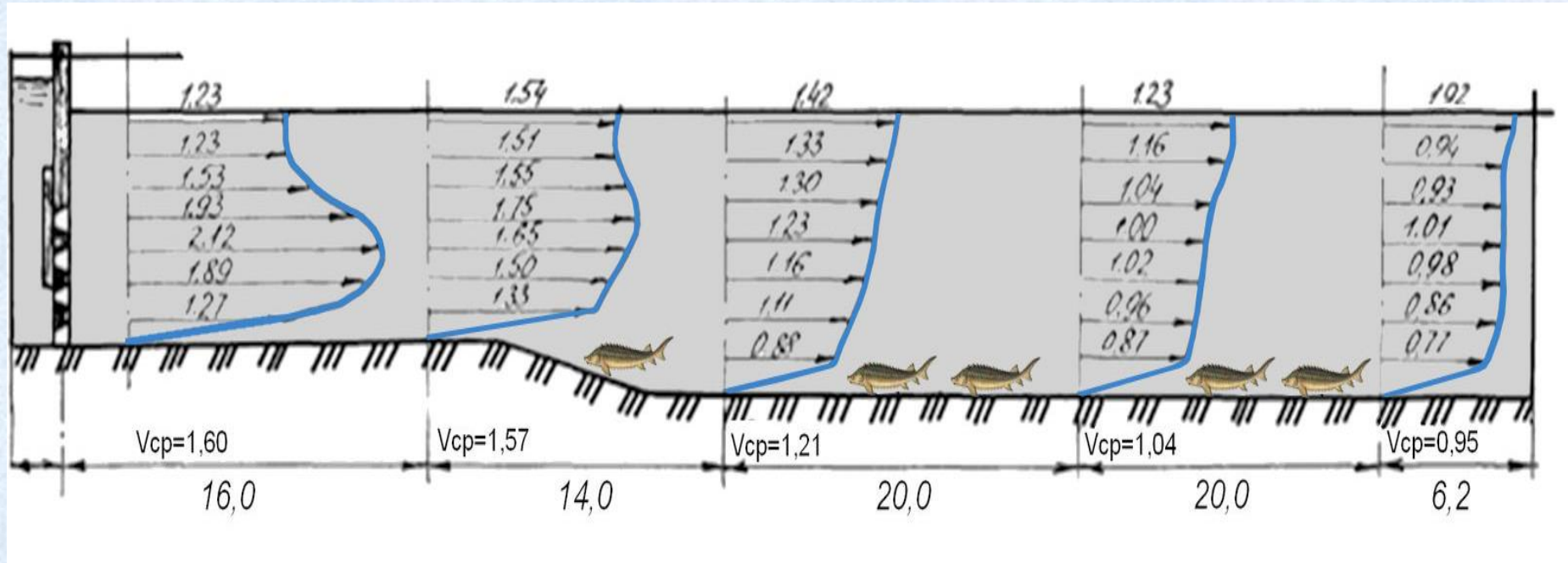


# Velocity of attractive flow influences number of passed fish

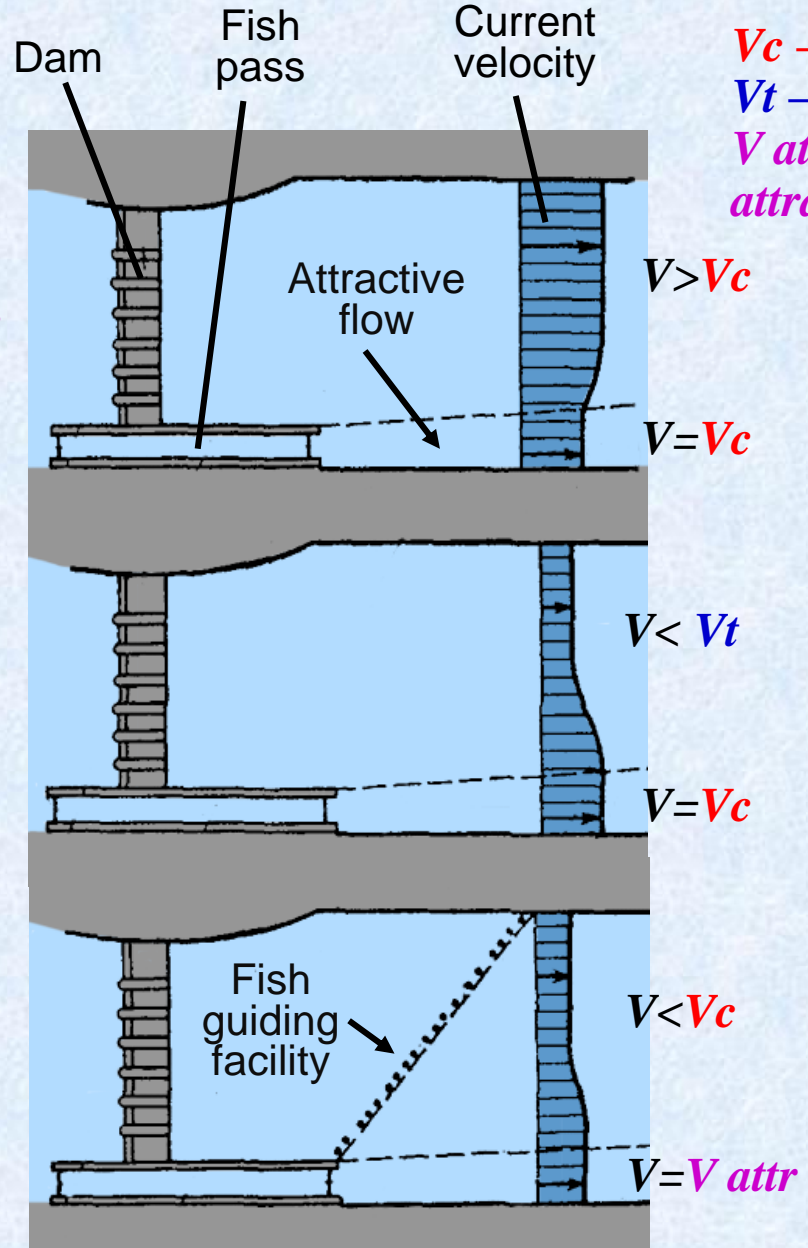
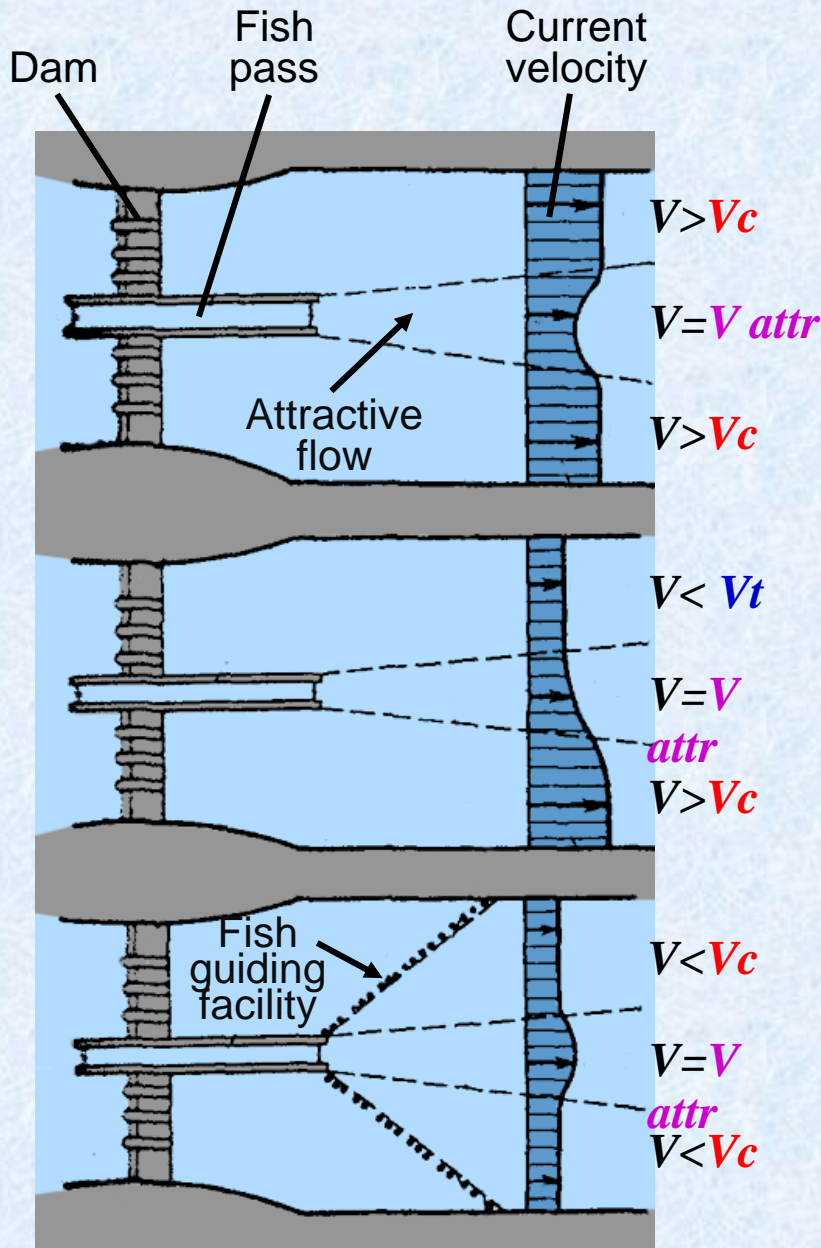




# Flow velocity profiles within the fish collector



# Hydraulic schemes of fish attraction

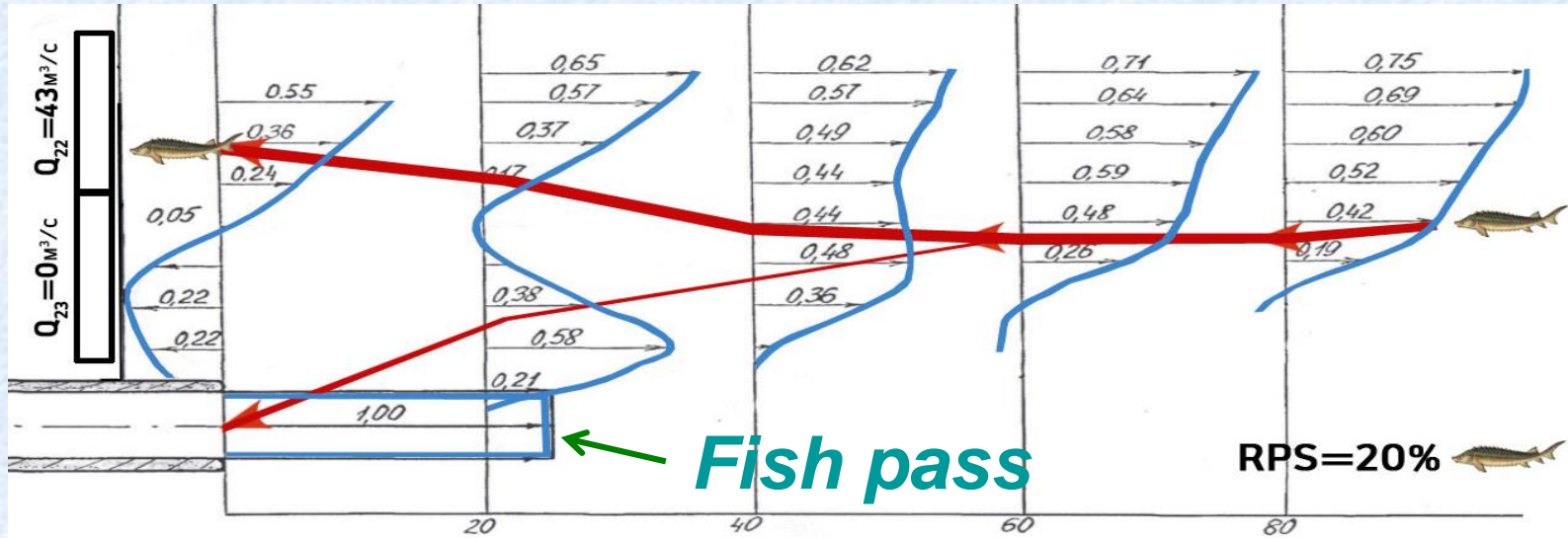


$V_c$  – critical  
 $V_t$  – threshold  
 $V_{attr}$  – attractive

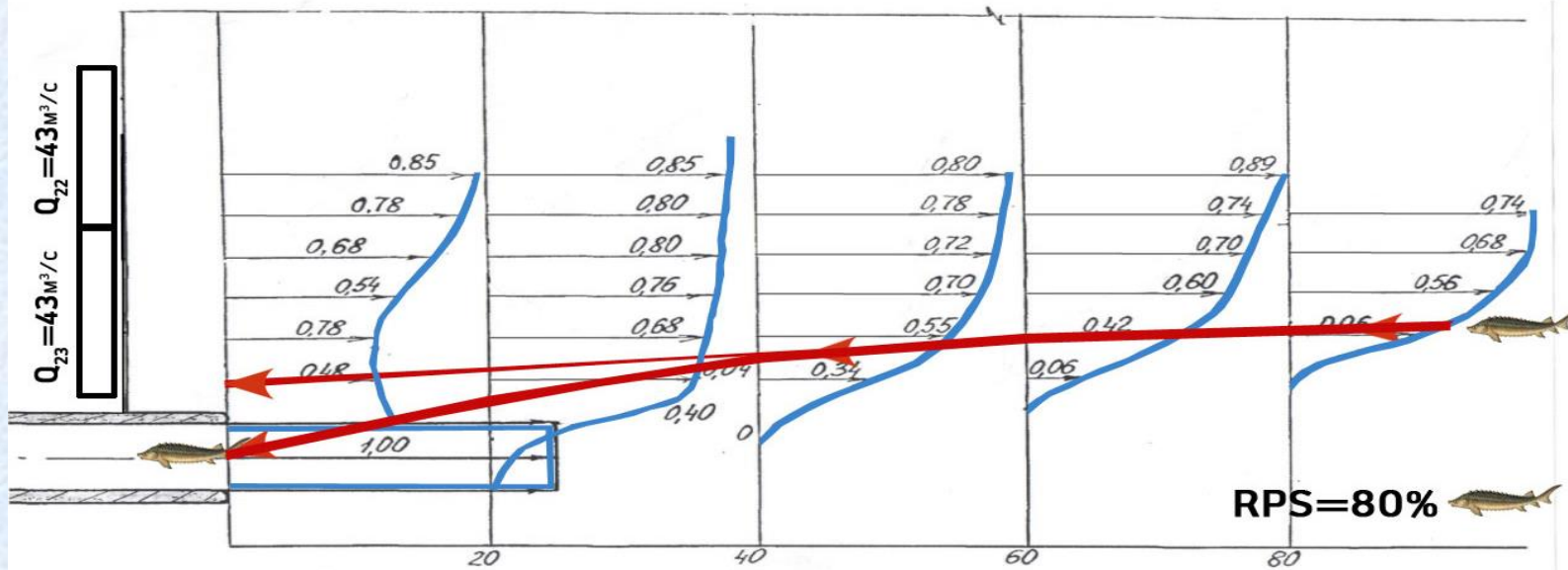


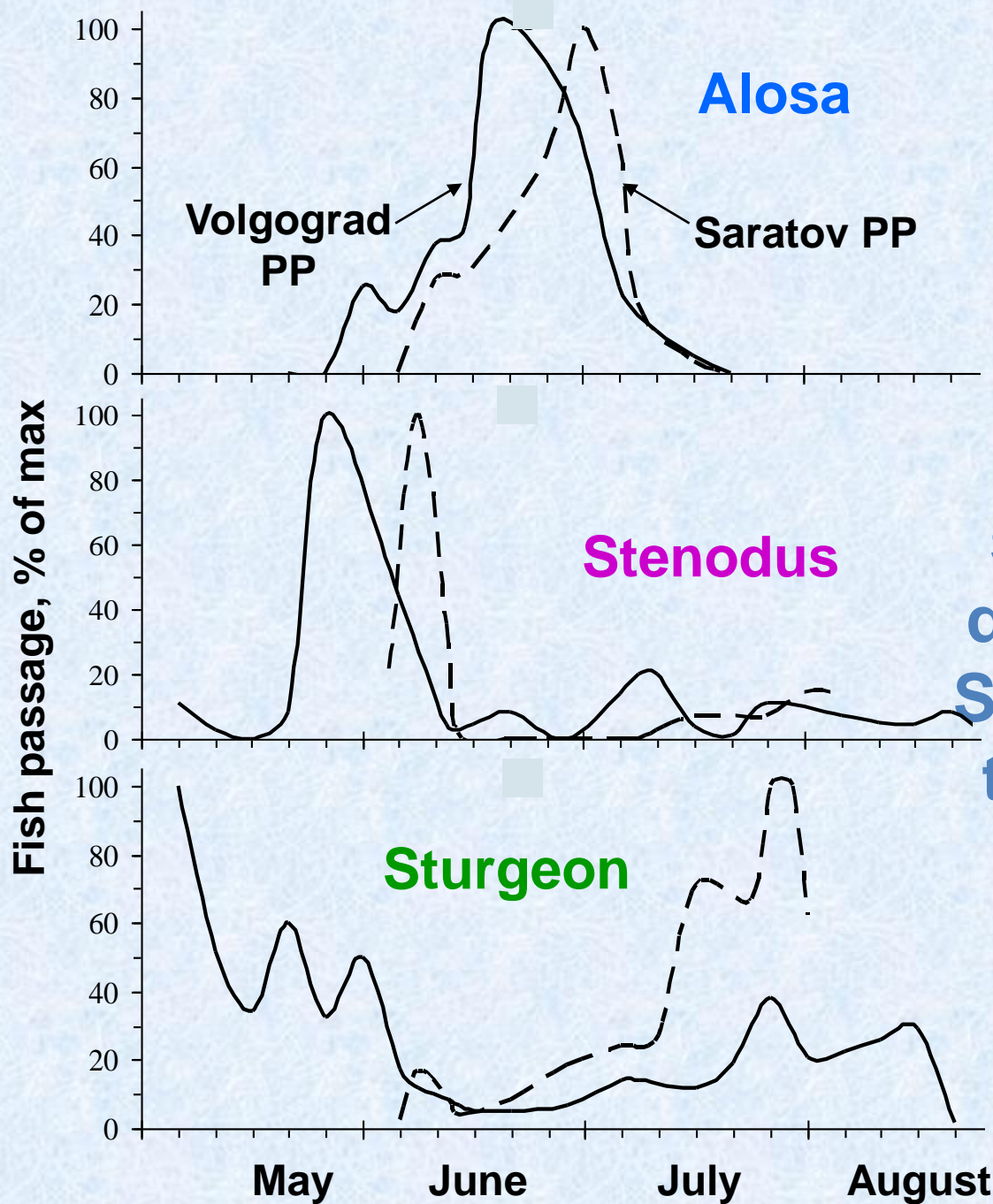
# Flow velocity patterns in the tail race of Saratov power plant near the fish pass

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)

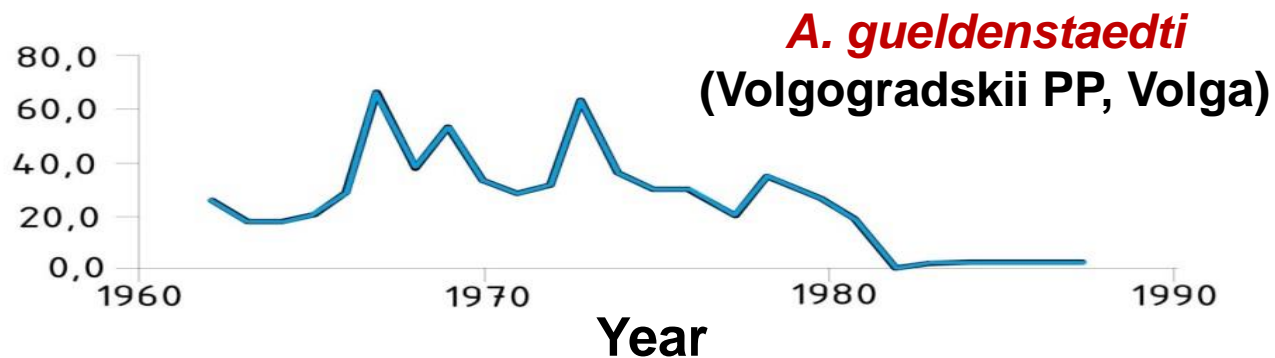
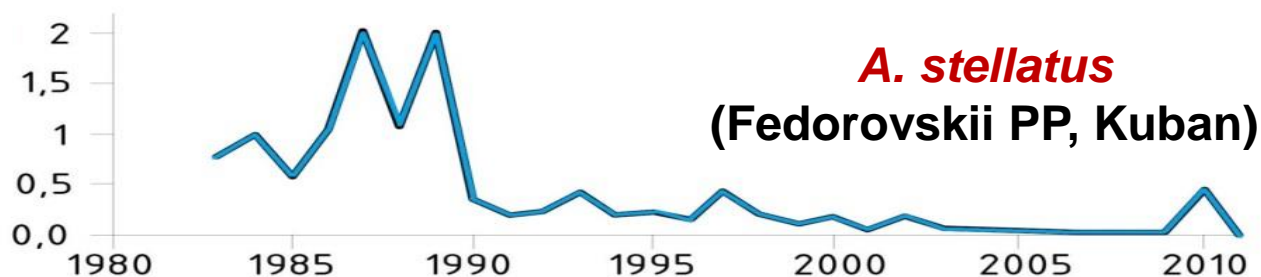
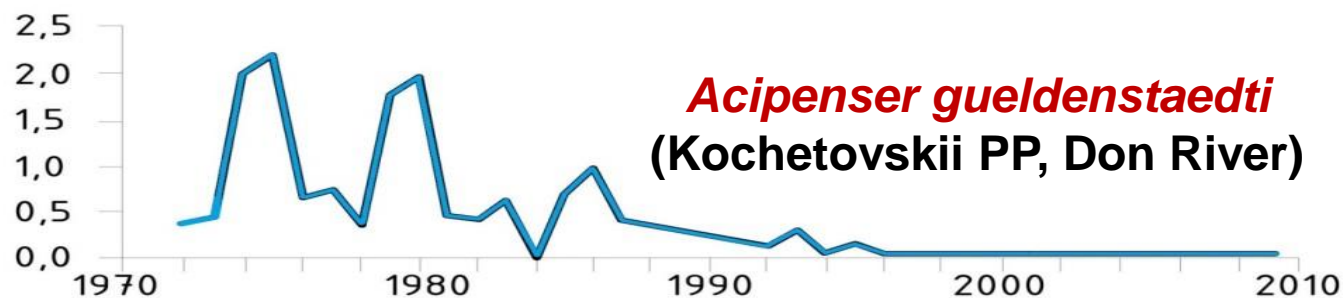


B)

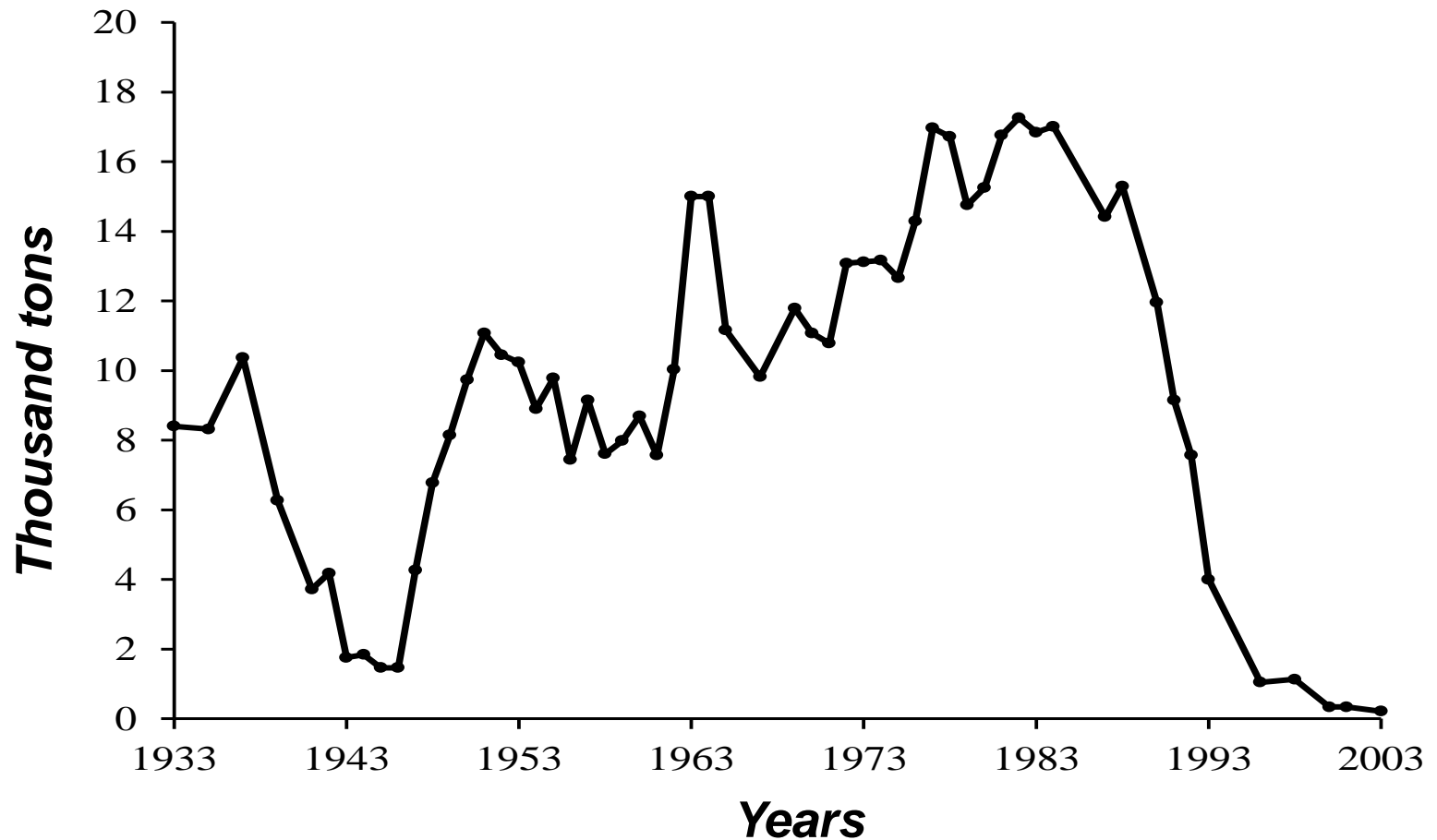




# Annual number of passed sturgeons (thousand fish)



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







**THANK YOU!**