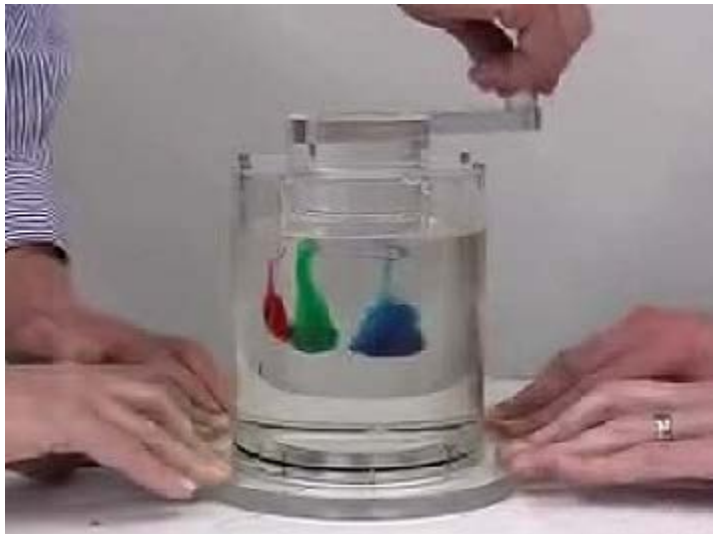
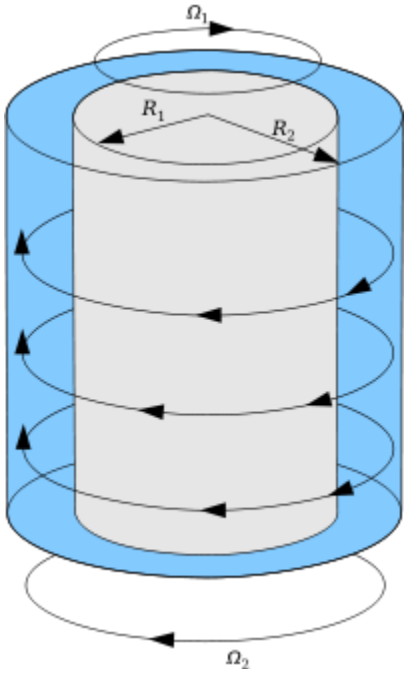
Biological effects of turbulence and shear stress

Dr. Kristina Mead Vetter

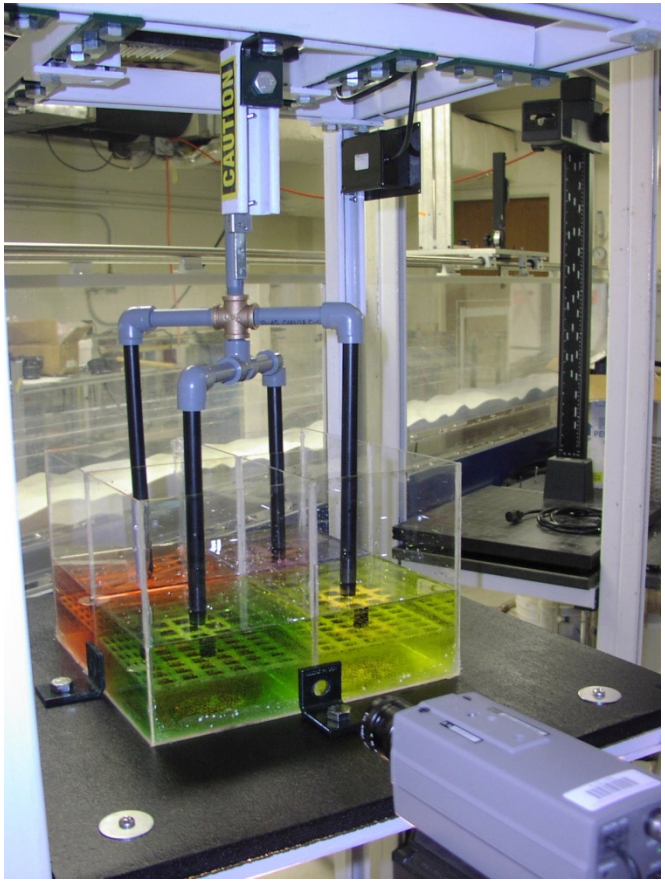
Lab experiments in Couette cell

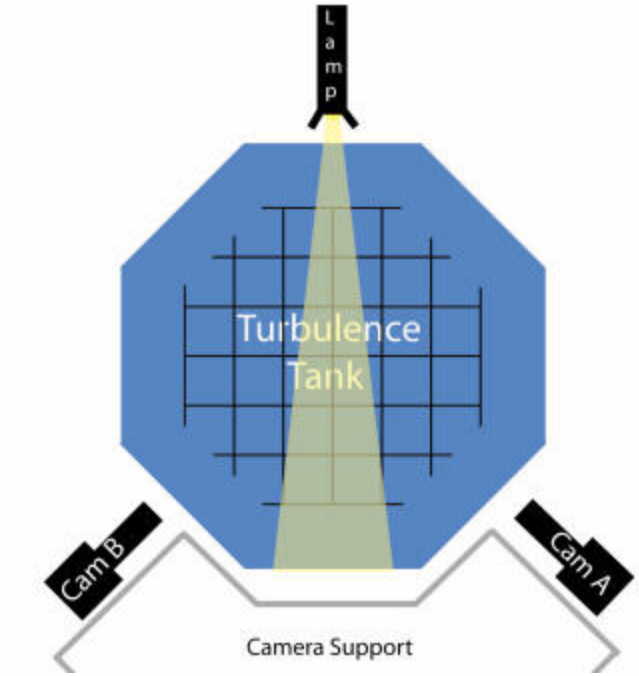




Typically laminar flow

Lab experiments in oscillating grid tank





Typically homogenous turbulence

Turbulence in the field

Turbulence in the lab vs. turbulence in the field

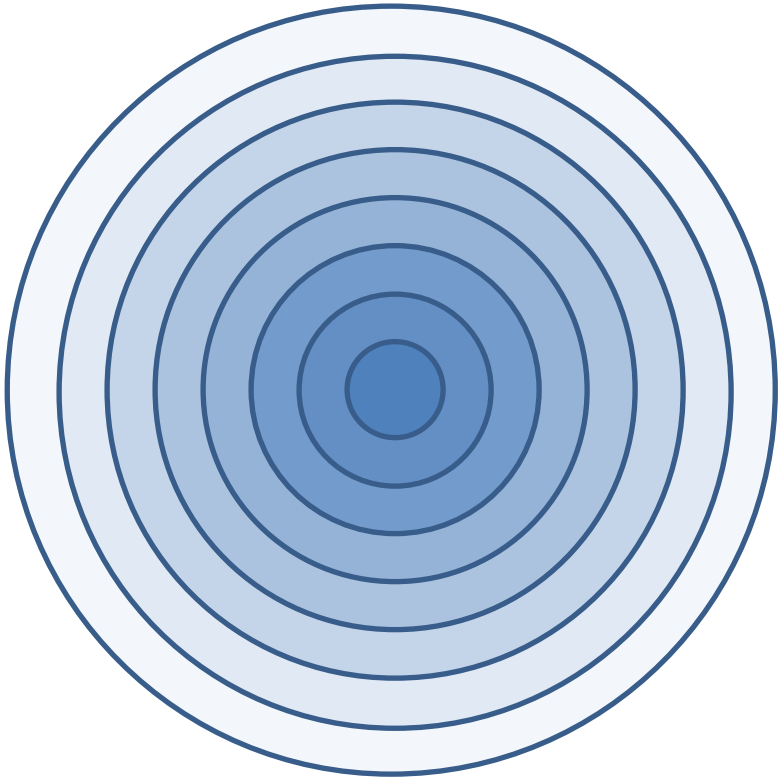
Lab

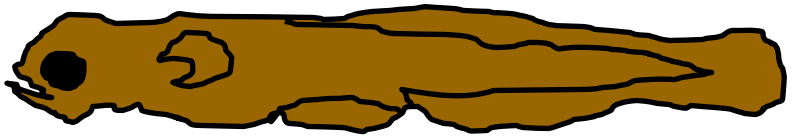
- Either not turbulent (laminar shear) or homogeneous turbulence
- Most experiments over much longer time frames, e.g. 1 hour exposure/day
- Typically no other factors (e.g. temperature, salinity) tested

Field (near diffuser)

- Turbulence not homogeneous
- Shorter exposure
- Potentially other factors: temperature, oxygen, salinity, chemicals, turbidity

How do turbulent eddies affect fish and invertebrate larvae?

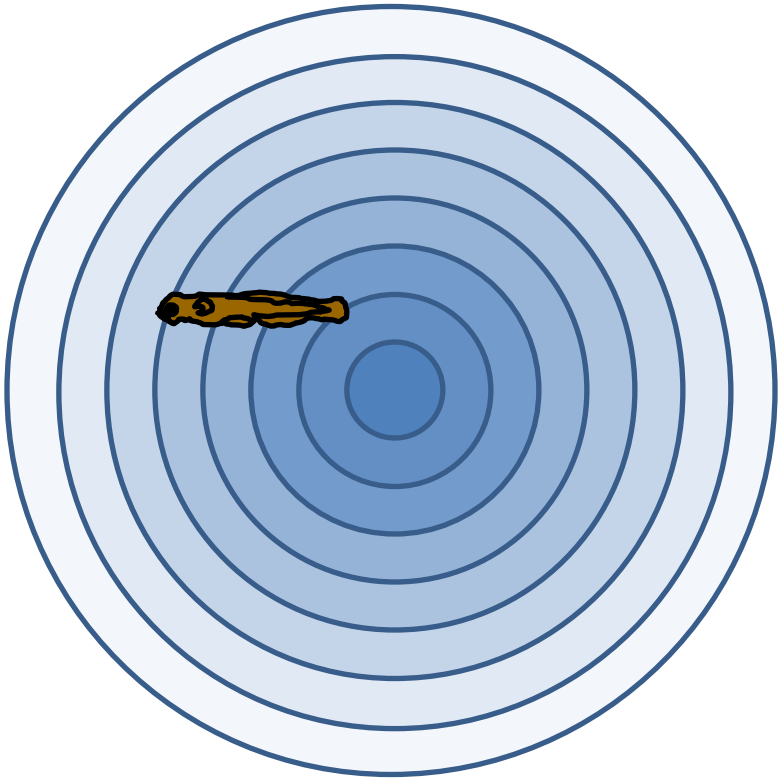




1) It depends on the size of the eddy. Smaller eddies contain more energy, but don't last as long. Bigger eddies persist, but don't contain as much energy

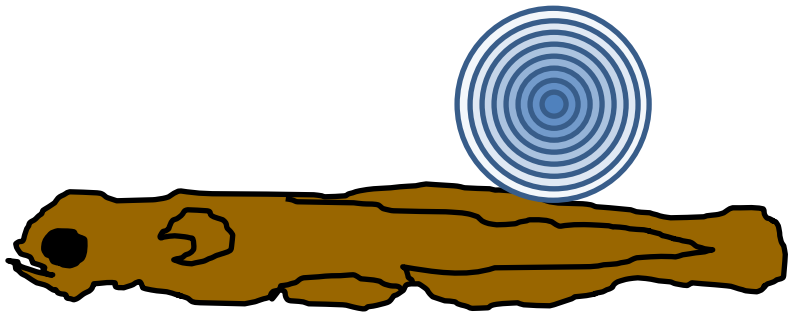
2) It depends on the relative sizes of the larva and the eddy.

Larva much smaller than eddy…



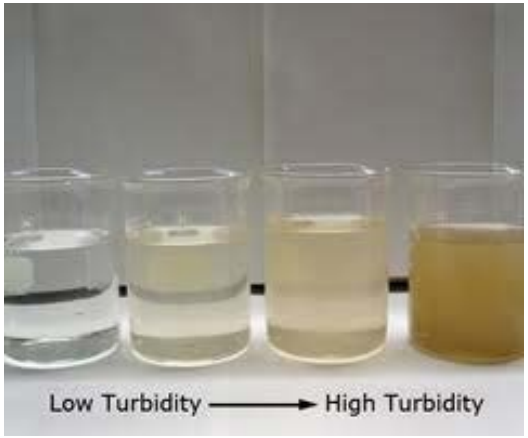
∴ probably not much damage: eddy will move larva along

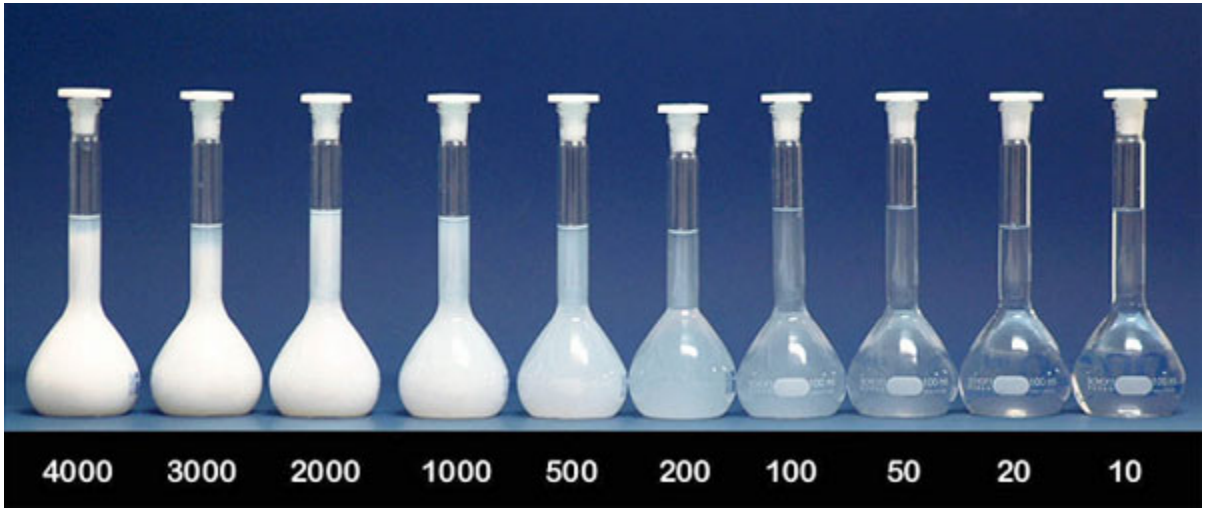
Larva much larger than eddy…



∴ potential for damage

Turbidity





Scale in NTUs