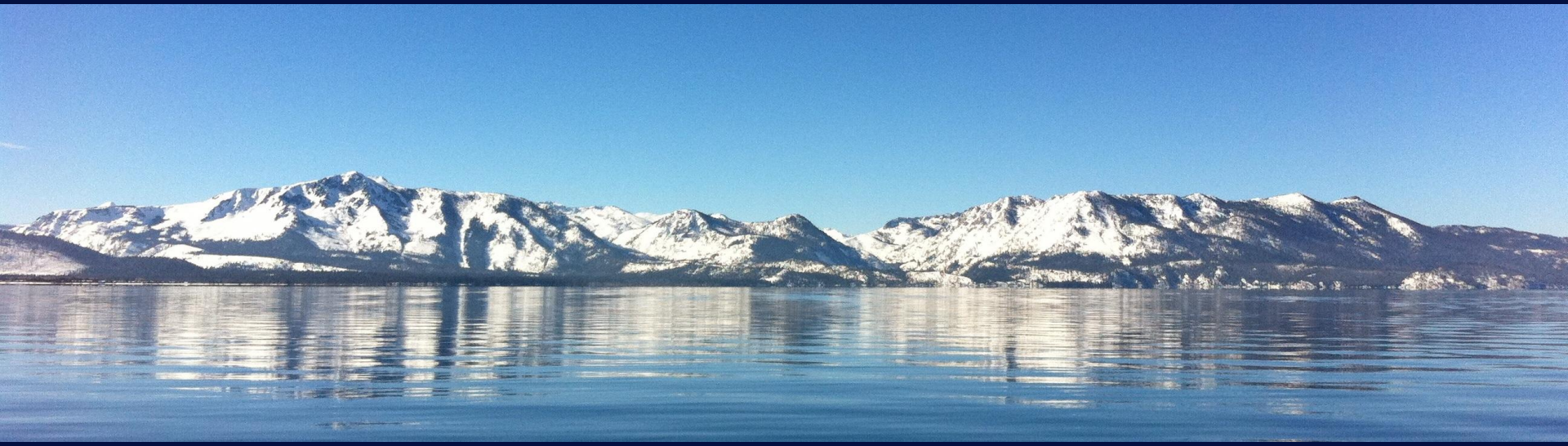
UC DAVIS
TAHOE ENVIRONMENTAL RESEARCH CENTER

# Physical transport of *Corbicula fluminea* in Lake Tahoe, CA-NV USA

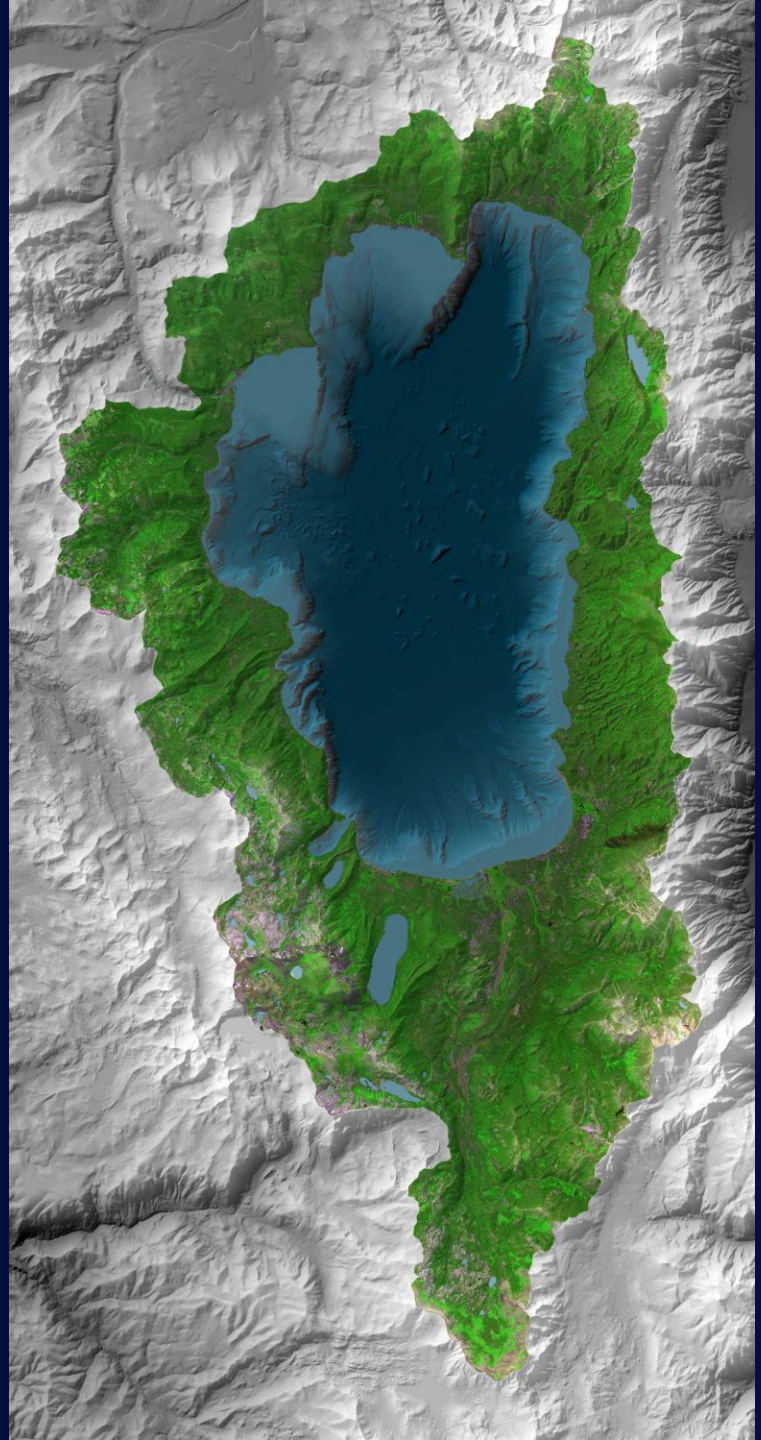
**A.L. Forrest, T. Mathis, A. Hoyer, M.E. Wittmann, and S.G. Schladow**



# Lake Tahoe

- 501 m maximum depth
- 650 year residence time
- 500 $km^2$ surface area
- 116 km of shoreline
- Ultra-oligotrophic


UCDAVIS
TAHOE ENVIRONMENTAL
RESEARCH CENTER



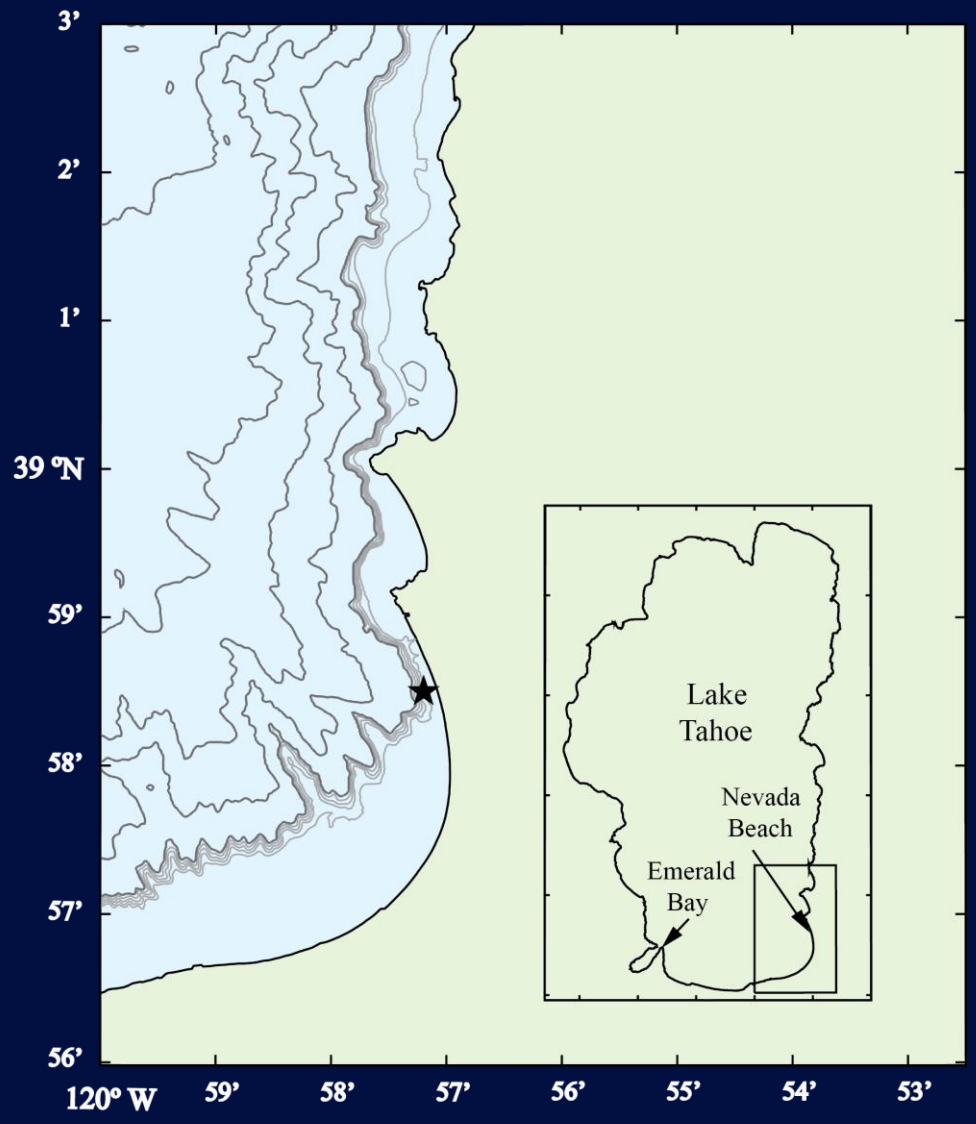
# *Corbicula fluminea*

- **Adults grow up to 2.7 cm in Tahoe**
- **First noted in 2002**
- **Significant populations seen in 2008**


UCDAVIS
TAHOE ENVIRONMENTAL
RESEARCH CENTER

# Nevada Beach

- Majority of clams found in SE part of lake
- Distributed from 2 – 40 m depth
- In Nevada Beach found as deep as 70 m



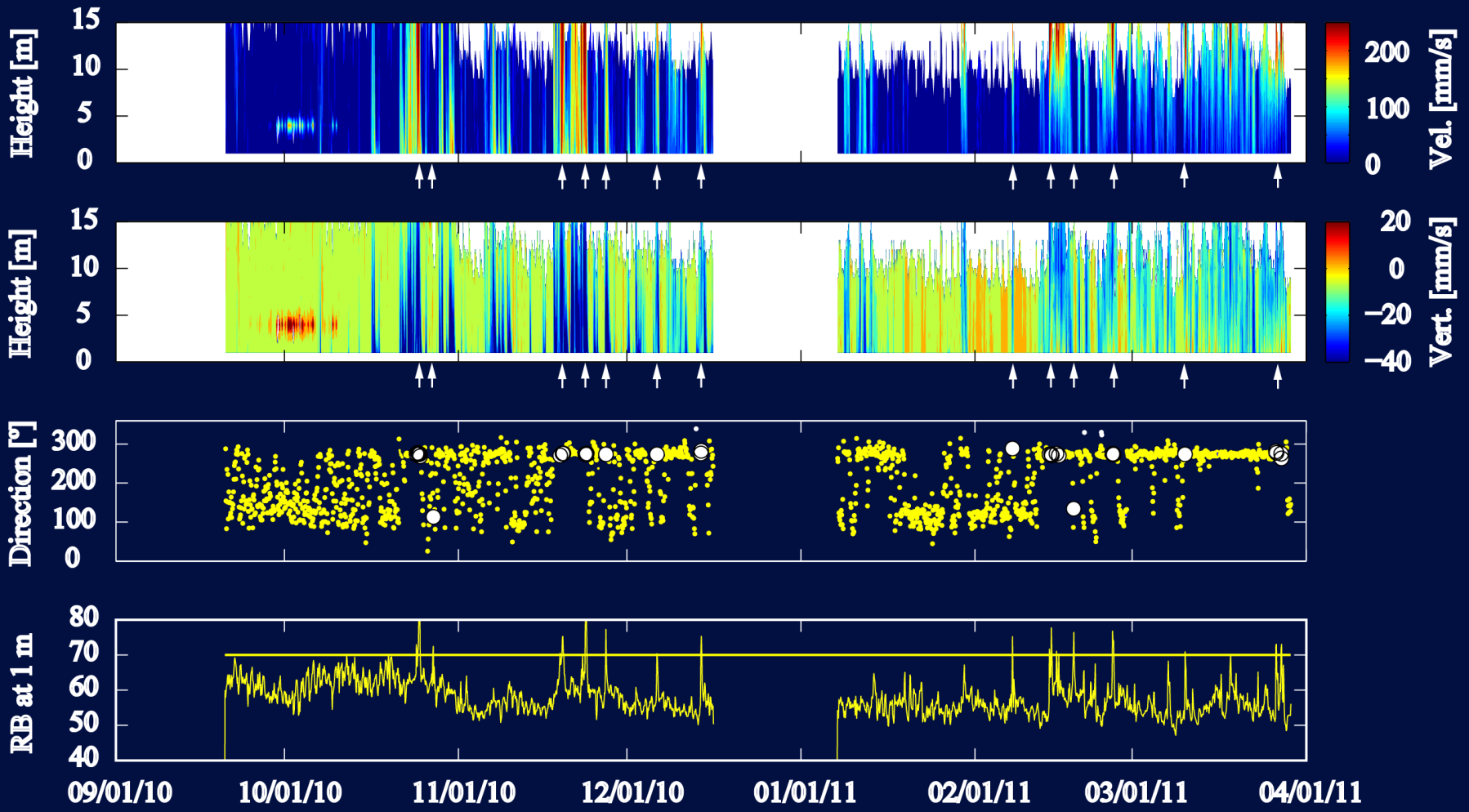

UCDAVIS
TAHOE ENVIRONMENTAL RESEARCH CENTER

*Physical Transport of C. fluminea*

# Experimental Set-up

- 2 observation stations located on the 25 m and 50 m isobaths:
  - 1200 kHz RDI ADCP and 15 T1060 thermistor chain
  - 600 kHz RDI ADCP and 9 T1060 thermistor chain
- Observation periods from September – December, 2010 and January – March, 2011

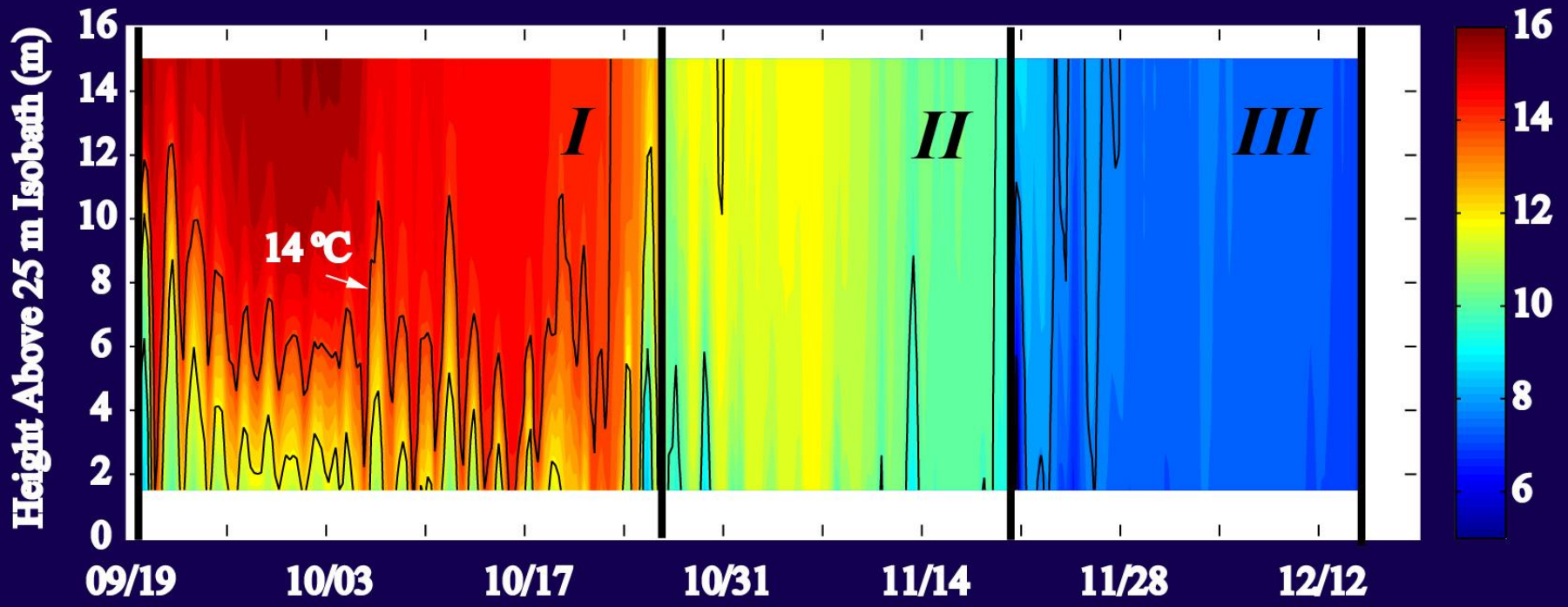
# 25 m Velocity Record




UCDAVIS
TAHOE ENVIRONMENTAL
RESEARCH CENTER

*Physical Transport of C. fluminea*

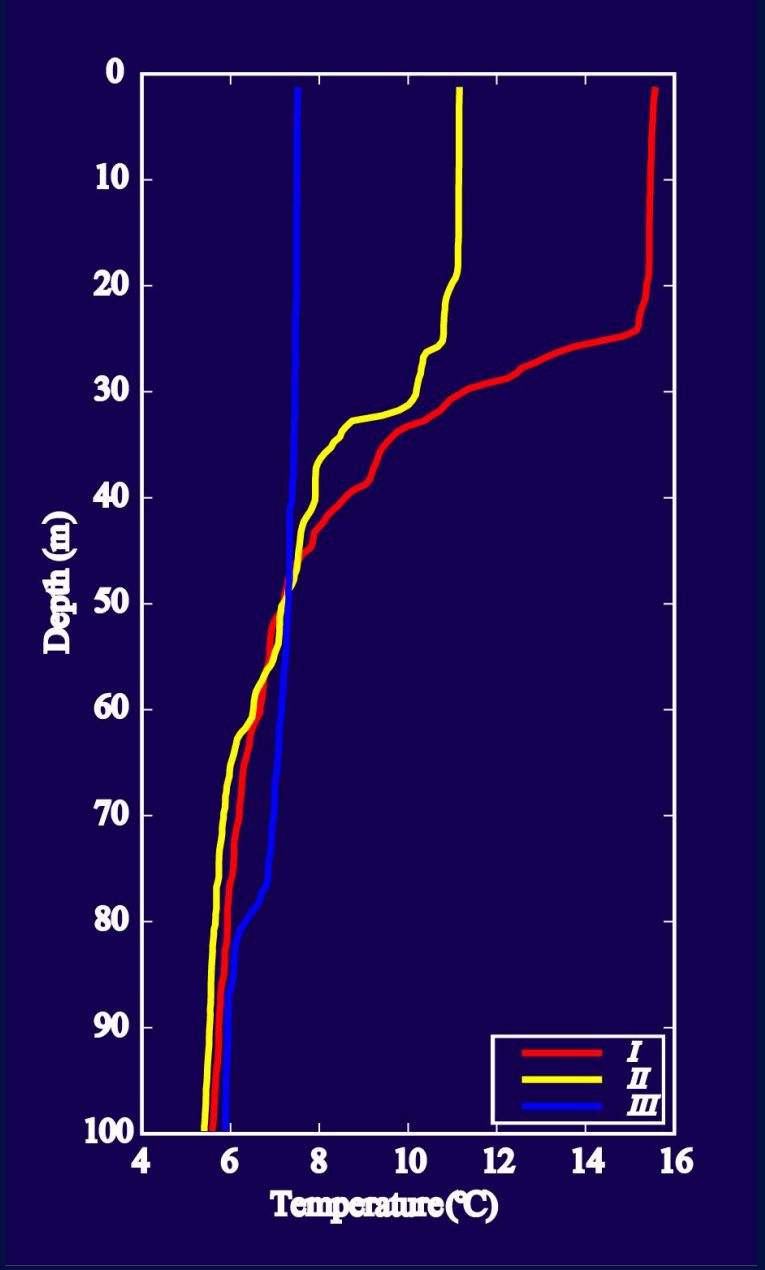
# Fall Stratification




UCDAVIS
TAHOE ENVIRONMENTAL
RESEARCH CENTER

# Weakening Stratification

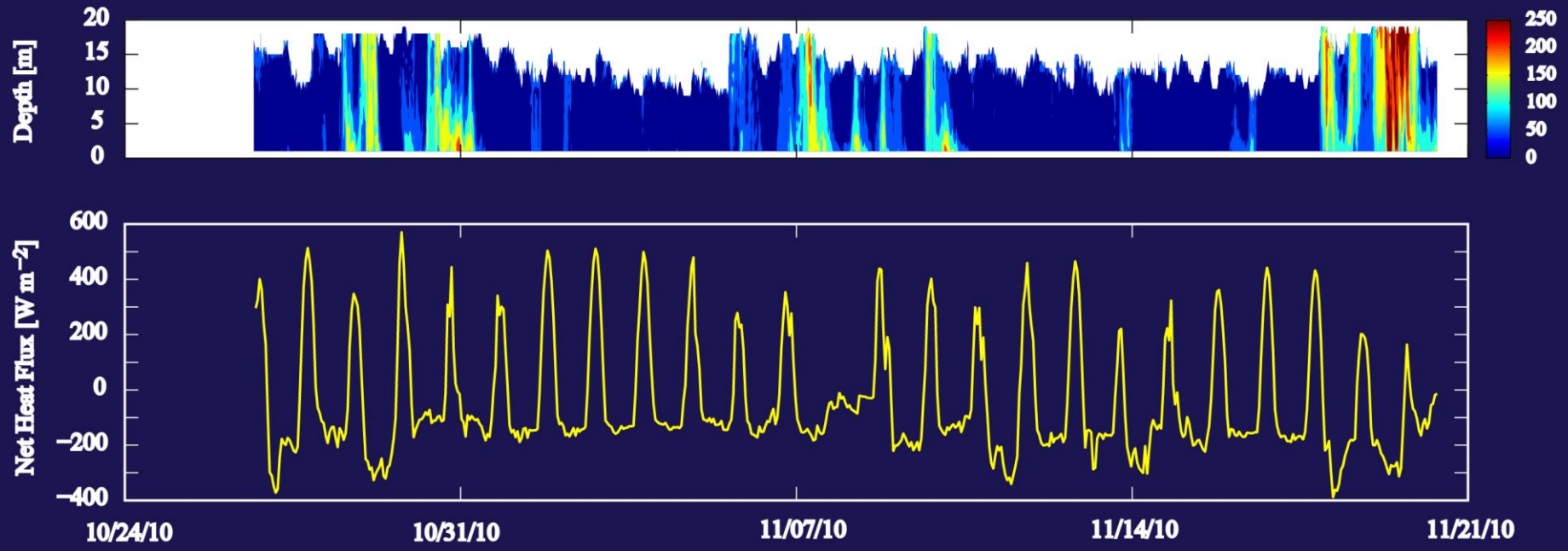
- Seasonal thermocline weakens and deepens over time
- All periods show dominant NW current
- Peak horizontal velocity of 25 cm/s
- Peak vertical velocity of -3 cm/s




*Physical Transport of C. fluminea*

UC DAVIS
TAHOE ENVIRONMENTAL RESEARCH CENTER

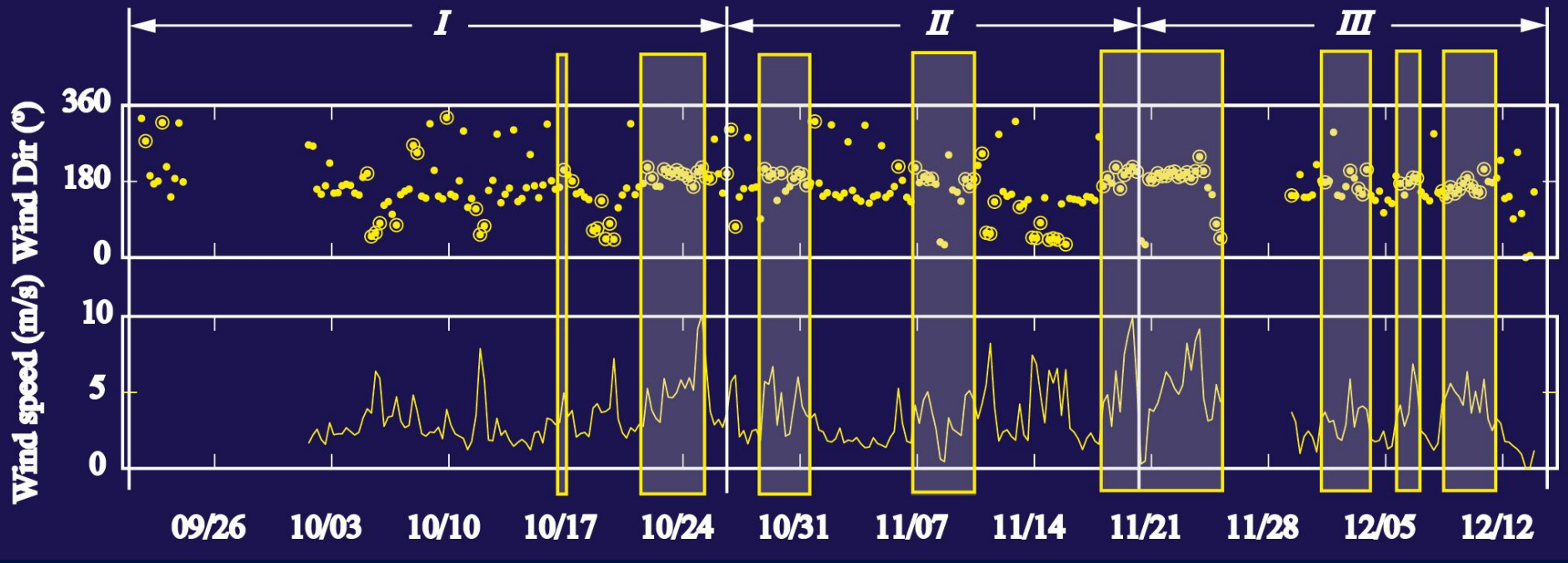
# Density Current Formation?




- Peak heat flux (> 500 W/m$^2$) resulting from large solar radiative input
- Low correlation with observed currents

UC DAVIS
TAHOE ENVIRONMENTAL RESEARCH CENTER

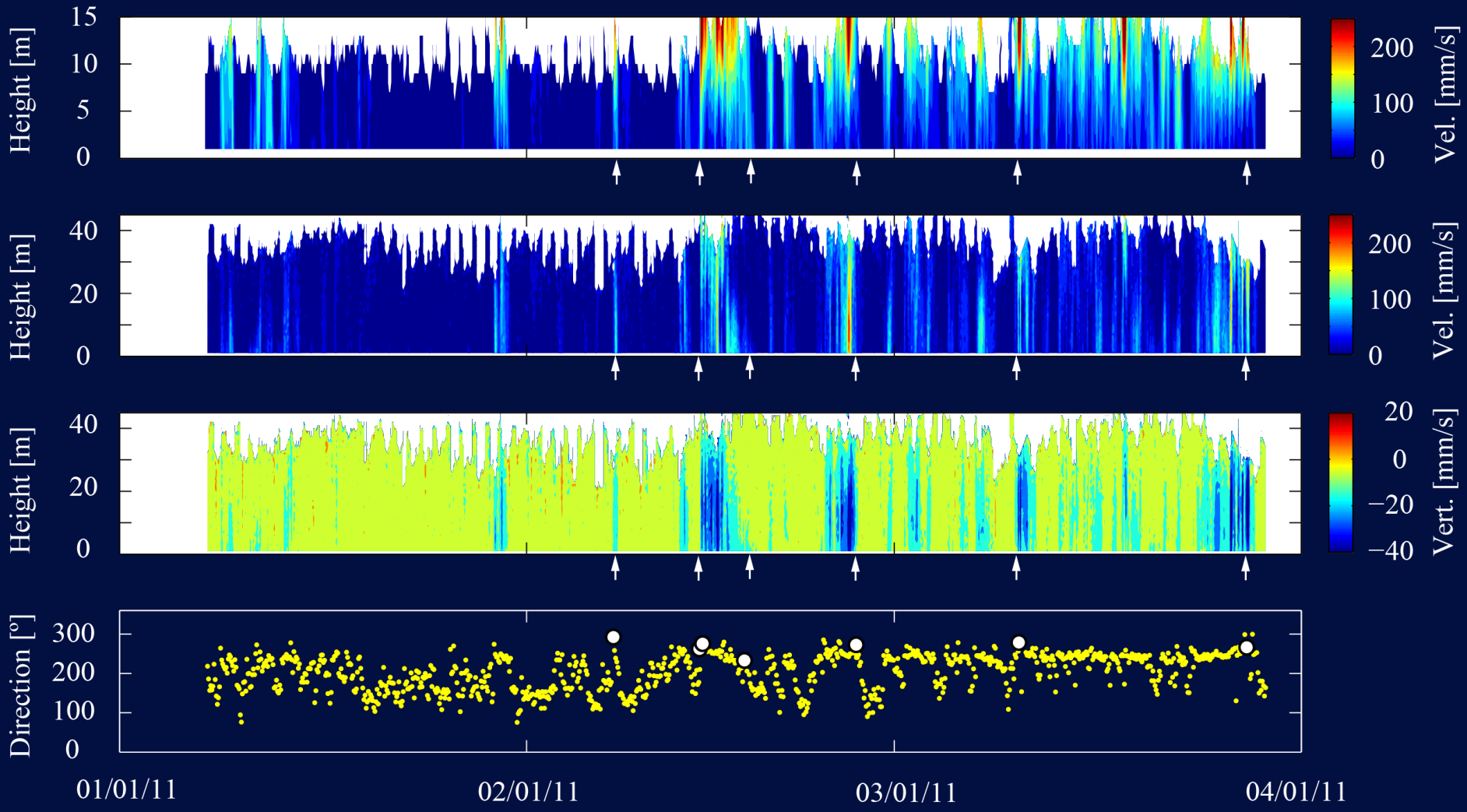
# Weather Data




- Observed currents (> 10 cm / s) were associated with SW winds
- Lasted from 2 – 7 days

UCDAVIS
TAHOE ENVIRONMENTAL RESEARCH CENTER

# Flow to Depth (50 m)

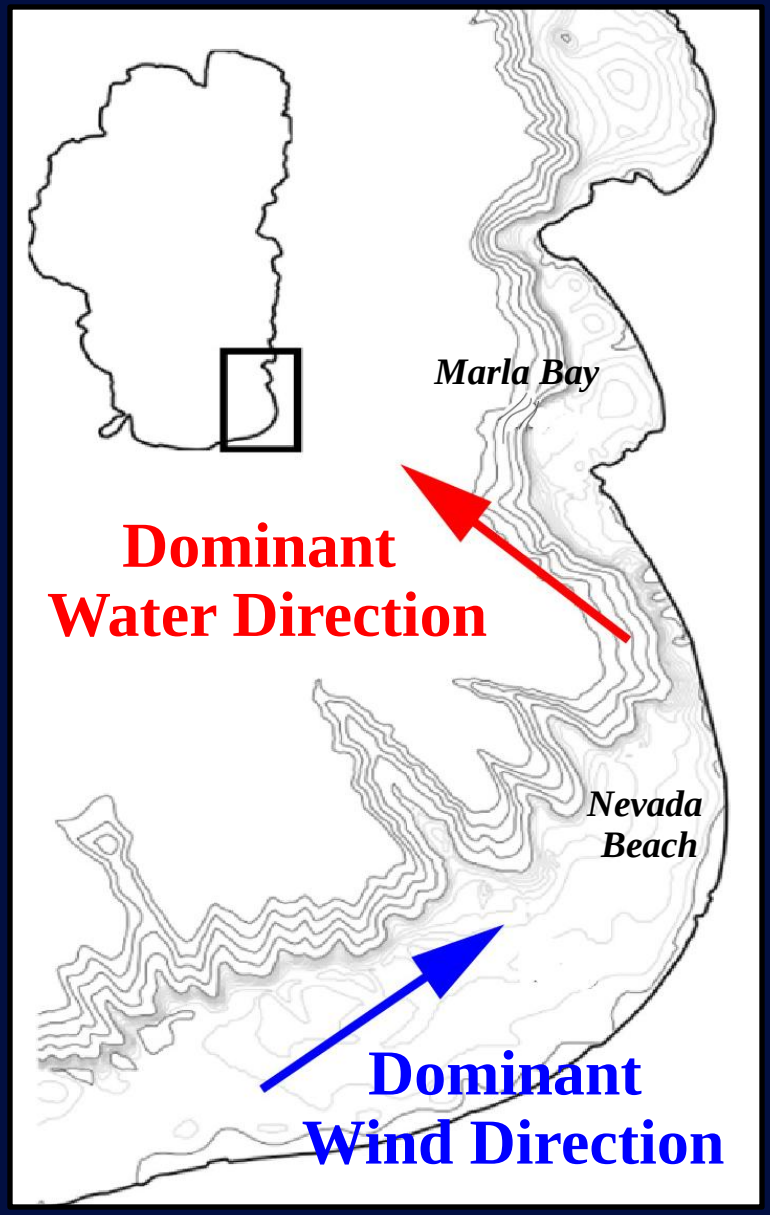



UC DAVIS
TAHOE ENVIRONMENTAL
RESEARCH CENTER

*Physical Transport of C. fluminea*

# Forcing and Response

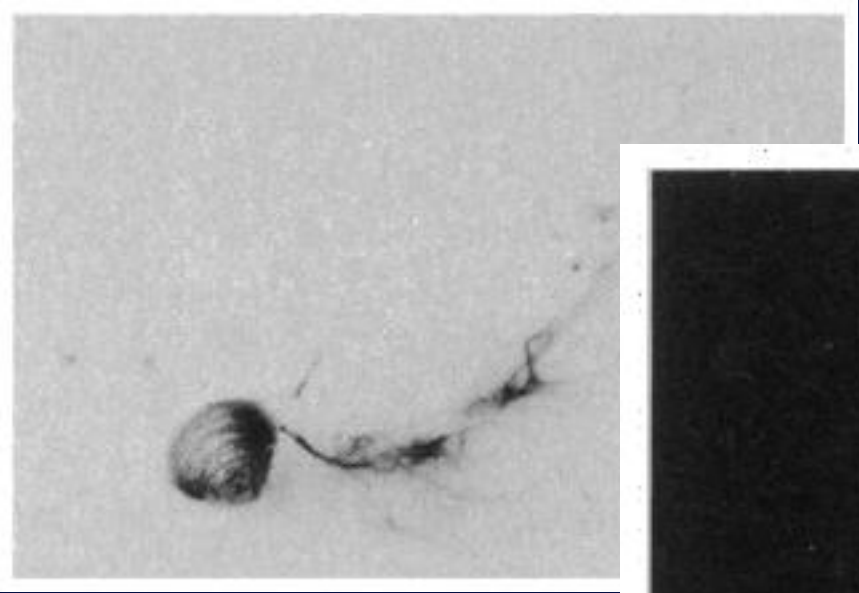
- Forcing generates NW along-shore currents
- Currents result in clam shell matter transport
- Matter collects in the bottom bed form features
- Are *LIVE* clams moved?



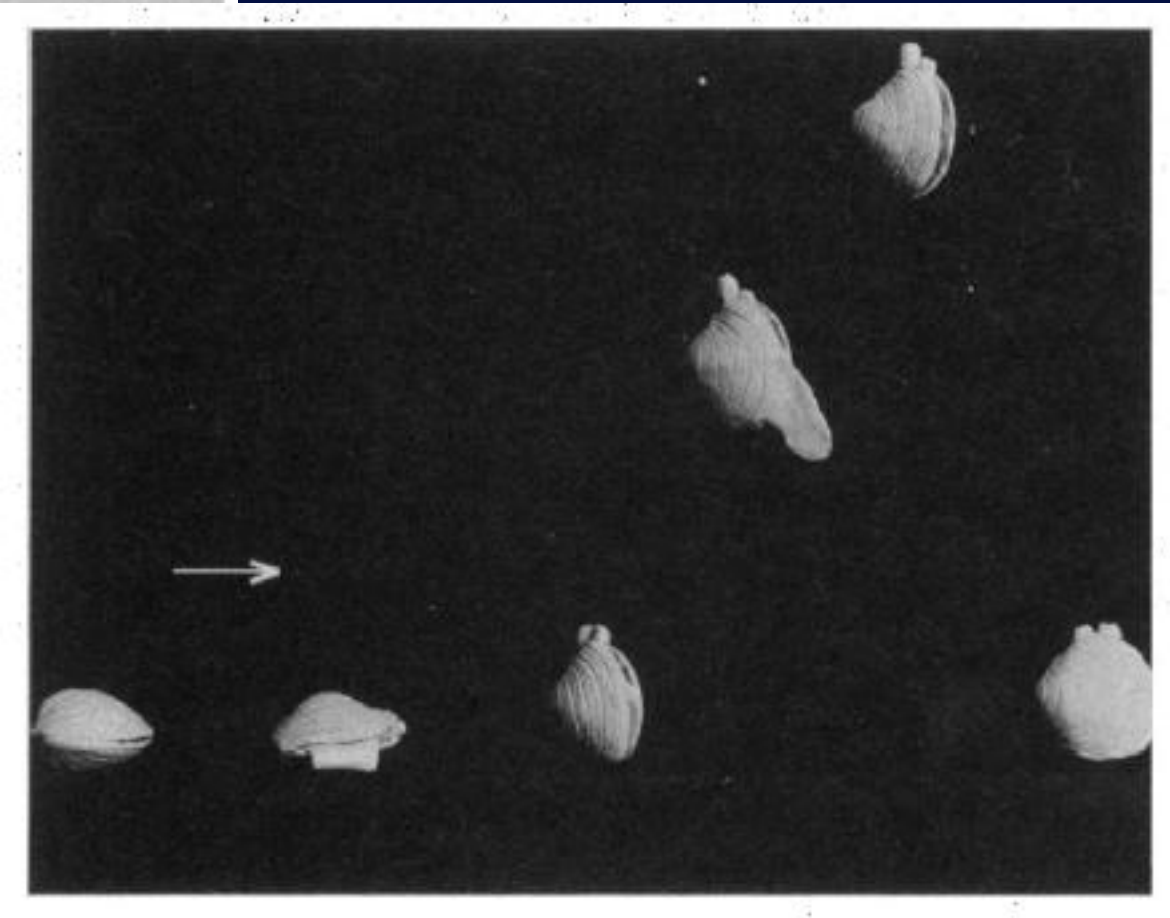

*Physical Transport of C. fluminea*

UCDAVIS
TAHOE ENVIRONMENTAL
RESEARCH CENTER

# Two Modes of Dispersal



*Science*, New Series (1984), 225 (4669): 1491 – 1493



- **Pediveligers can remain pelagic for up to 2 days**
- **Potential dispersal via currents**

UCDAVIS
TAHOE ENVIRONMENTAL RESEARCH CENTER

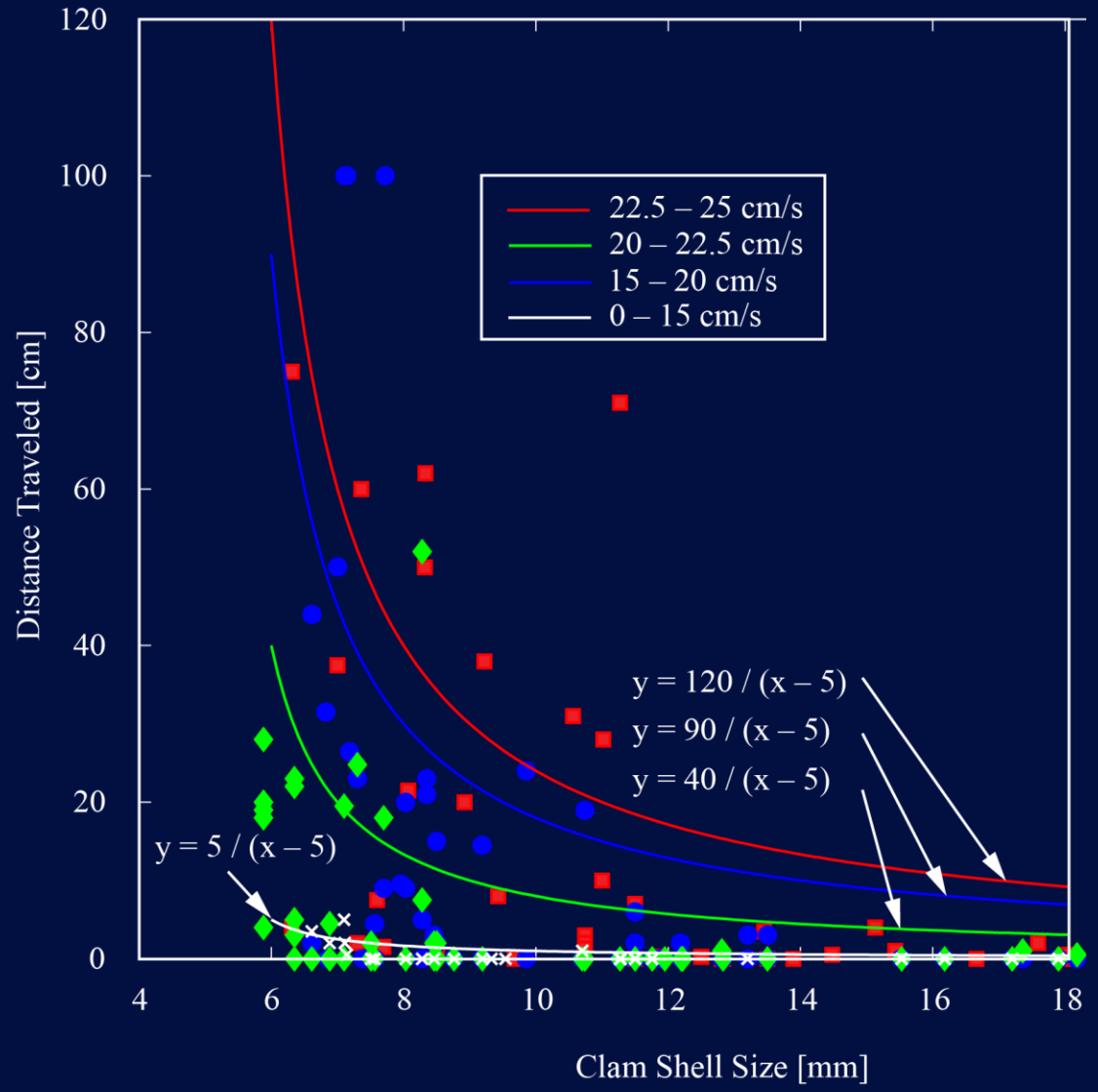
*Physical Transport of C. fluminea*

# Flume Experiment

- Current experimentation is using a flume 0.15 m wide by 1.5 m long
- Velocities ranged from 0 – 25 cm/s
- Clams ranged in size from 5 – 20 mm
- Operating temperature of lake water being recycled through the flume was 15 – 20 ºC

# Flume Results

- Transport observed for most velocities
- Once burrowed clams would cease to be transported
- Requires stressors to drive clams to surface




*Physical Transport of C. fluminea*

UCDAVIS
TAHOE ENVIRONMENTAL
RESEARCH CENTER

# Conclusions

- Study demonstrates strong currents from Sept – April with near-bed currents strongest in the fall
- Strong horizontal component with a downwards vertical component
- Potential mode of transport for clams and shell matter from shallow water to depth

UCDAVIS
TAHOE ENVIRONMENTAL
RESEARCH CENTER

# Acknowledgements

**Funding and support for this project was made possible from the Tahoe Region Planning Agency, Tahoe Resource Conservation District, and the California Tahoe Conservancy**