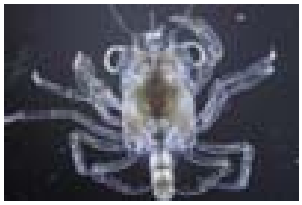
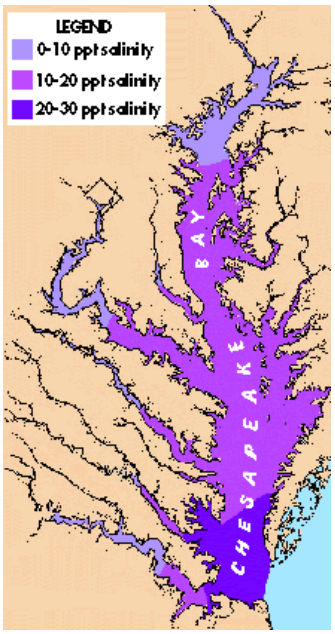
Blue Crab



spawns in the ocean
matures in the estuary
how does it get where it needs to be?

http://www.esva.net/~tomthumbworkshps/emailtrav.htm
http://www.naturalvisions.co.uk/pictures/

Chesapeake Bay



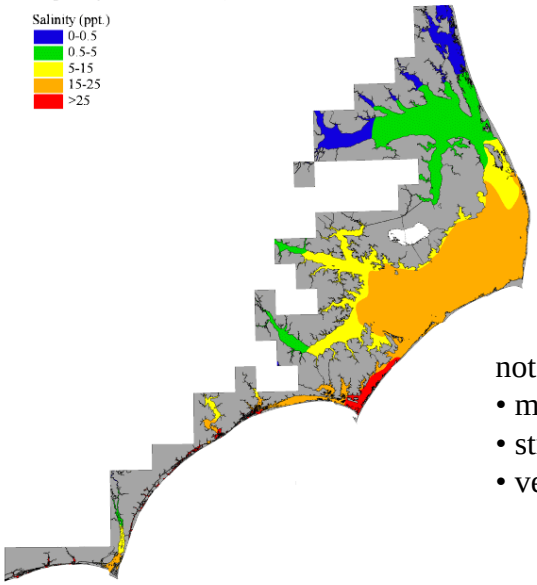
Flood Tide Transport (FTT)

- surface on flood, bottom on ebb
- net motion up-estuary

Assumptions

- significant tides
- along-estuary salinity gradient
- flood strongest at surface

http://www.mdsg.umd.edu/CBEEC/toxicsrpt/workshop.html



Albemarle Sound

Pamlico Sound

not a normal estuary!
- microtidal except at inlets
- strange salinity gradient
- vertical shear unknown

http://biogeo.nos.noaa.gov

Blue Crab Larvae, Prior Studies

Lab studies of vertical migration (fast)
(Tankersley et al, '94, '95, '98, '02)
- negative phototaxis
- swim when salinity increases
- swim when pressure increase >> tidal

Field studies of settlement at Beaufort (slow)
(Forward et al, '04)
- high during neap tide
- high when flood ends after midnight

Nathalie Reyns, PhD thesis

Observations:
- counted crabs over large part of Pamlico Sound
- very good spatial coverage
- temporal resolution day/night, not flood/ebb
- found postlarvae at surface at night
- found postlarvae in western part of Sound

... not a demonstration of FTT ...

Nathalie Reyns, PhD thesis, Part II

Model:
- hindcast using R. Luettich wind-driven model
- assume crabs swam < 5 days
- wind model: start crabs at inlets
- wind/tide model: start crabs 1 tidal excursion landward

Results:
- wind alone:crabs along eastern sound
- wind/tide: crabs to western sound

... suggests importance of FTT

New Biological Questions

Do blue crab postlarvae in Pamlico Sound ...

- swim more on flood than ebb?
- swim at the depth of maximum current?
- respond to increasing salinity on flood?

To Answer ...

- need temporal and vertical resolution
- focus on one location

New Physical Questions

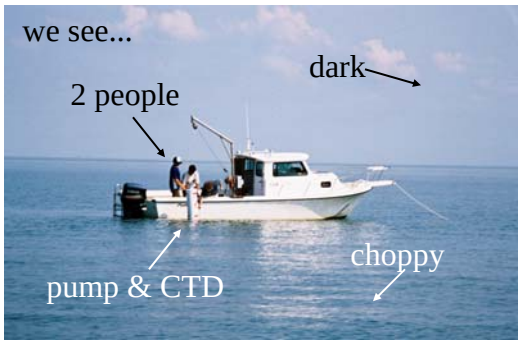
Currents in Pamlico sound

- actually stronger at the surface on flood?
- more night floods on spring or neap?

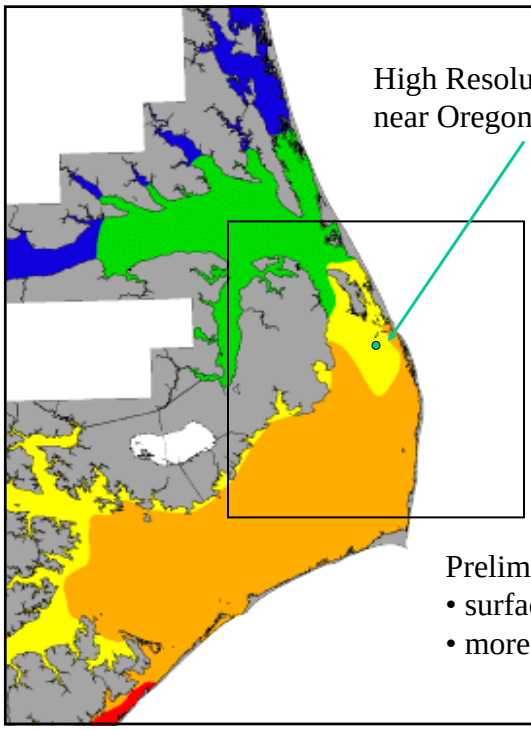
Salinity in Pamlico Sound

- actually increase on flood?
- respond to currents or wind?

ADCP
- bottom mounted
- upward looking
- currents all depths
- 3 month timeseries
- CTD attached



Dave and Gayle
- 7 nights in September
- hourly crab counts, 4 depths
- 1/2 hourly CTD profiles



Preliminary Crab Count
- surface and bottom, not middepth
- more on flood

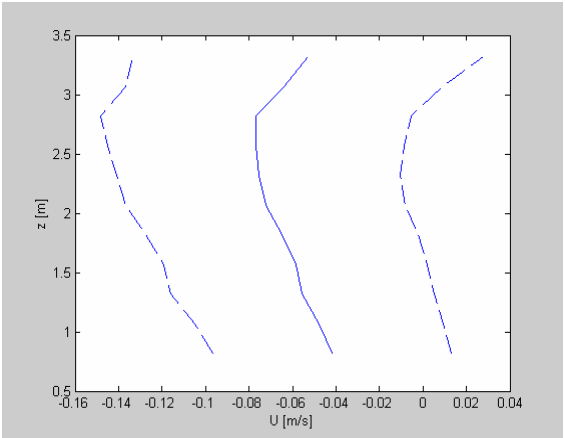
Flood Currents: 2 Models

friction dominated
•fast at surface
•shallow, unstratified

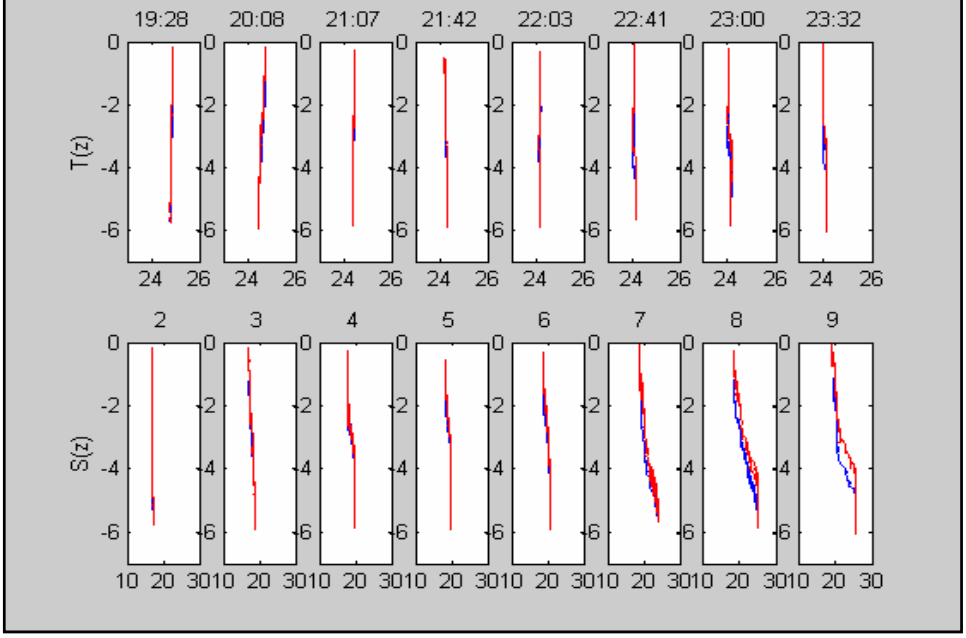
baroclinic
•fast at bottom
•deep, stratified

landward ← → seaward

- find U along principal axis of variability (SW-NE)
- bandpass for tidal periods (4-40h)
- average profile for <U> < 0 (flood)
- strongest current slightly below surface

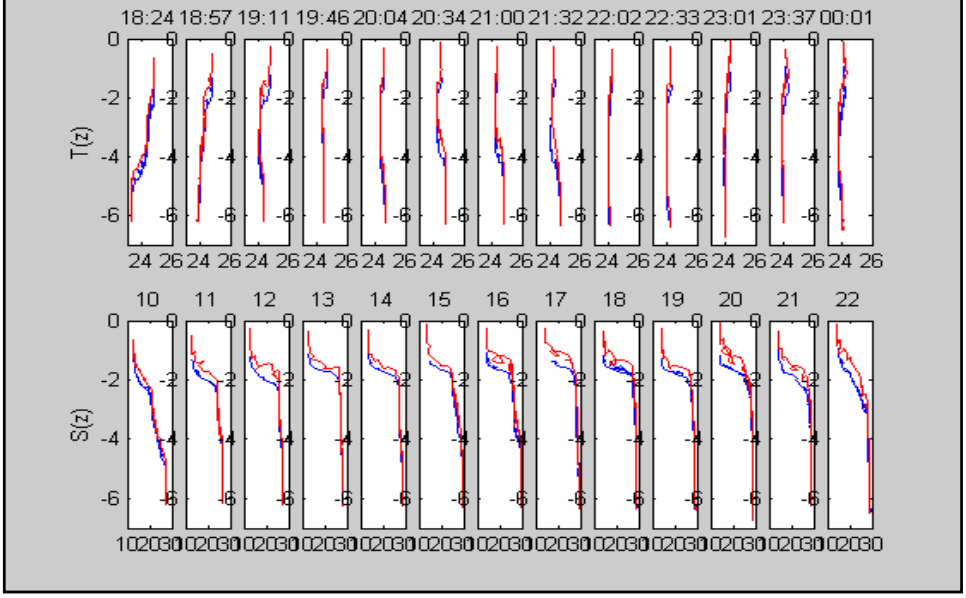


flood CTD profiles: Sept 11, 2004 ebb



strong northeasterly winds

flood Sept 12, 2004 ebb



Preliminary Results

Salinity Profiles

- three sources (Albemarle, Pamlico, Ocean)
- wind and tidal forcing
- thermocline may respond to tide
- bottom salinity may *not* increase on flood

Summary most recent work:

- crabs at surface on night floods
- flood currents strongest below surface
- salinity cue unlikely

Future directions:

- critter flux (concentration x speed)
- analyze 3-month salinity time series
- statistics on night floods
- ... ideas ...??