



### Evolution of the Bering Sea Shelf's Mixed Layer and Photic Zone: Ice to Summer

E. D. Cokelet<sup>1</sup>, C. W. Mordy<sup>1</sup>, P. J. Stabeno<sup>1</sup>, N. Kachel<sup>2</sup>, P. Proctor<sup>2</sup> & D. Righi<sup>2</sup>

<sup>1</sup>EcoFOCI, NOAA/PMEL Seattle, WA

<sup>2</sup>EcoFOCI, University of Washington/JISAO, Seattle, WA



Season

Line

Temperature

Salinity & Density

Nitrate

Chlorophyll & Oxygen Saturation

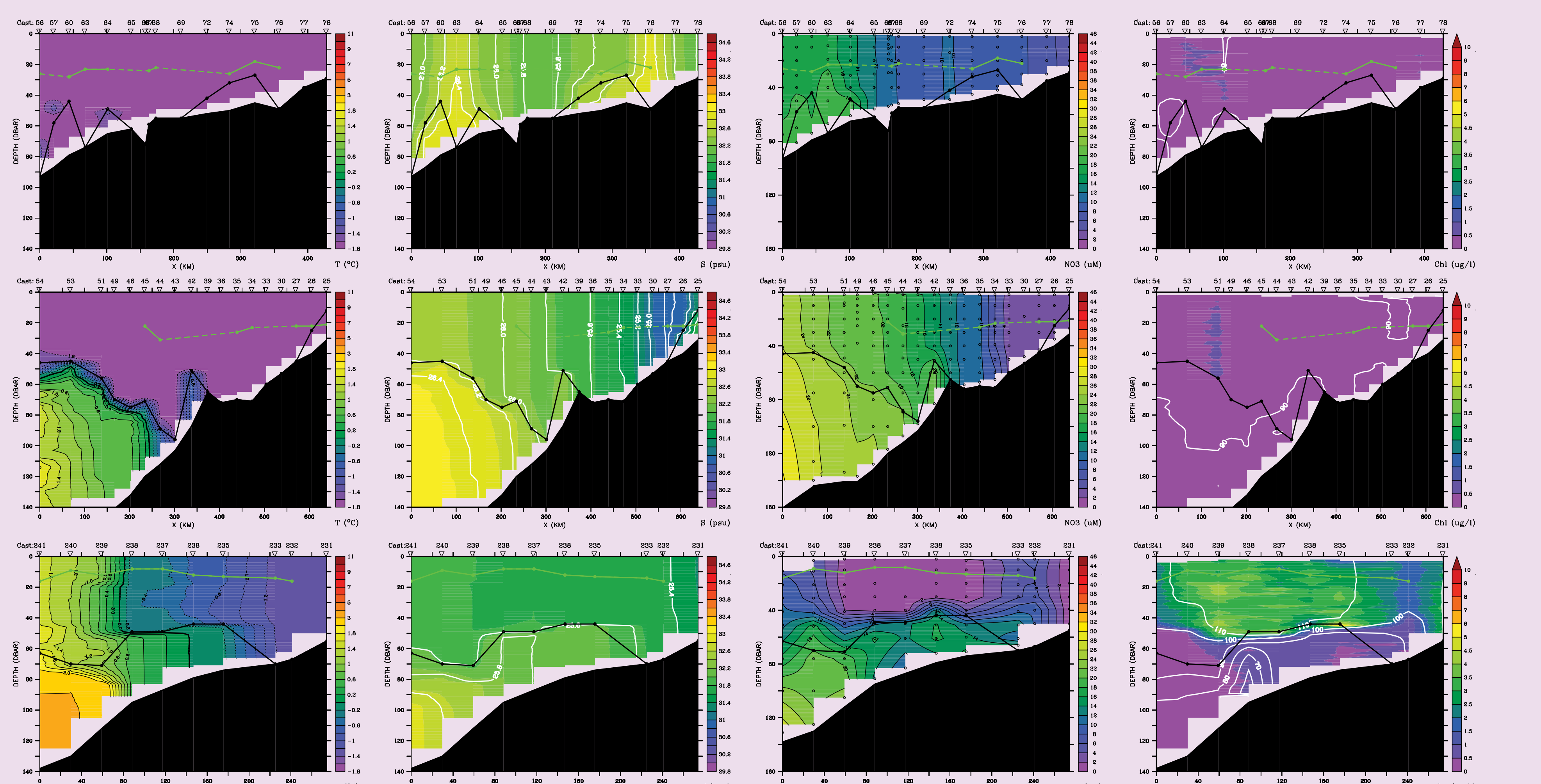
Spring

SL

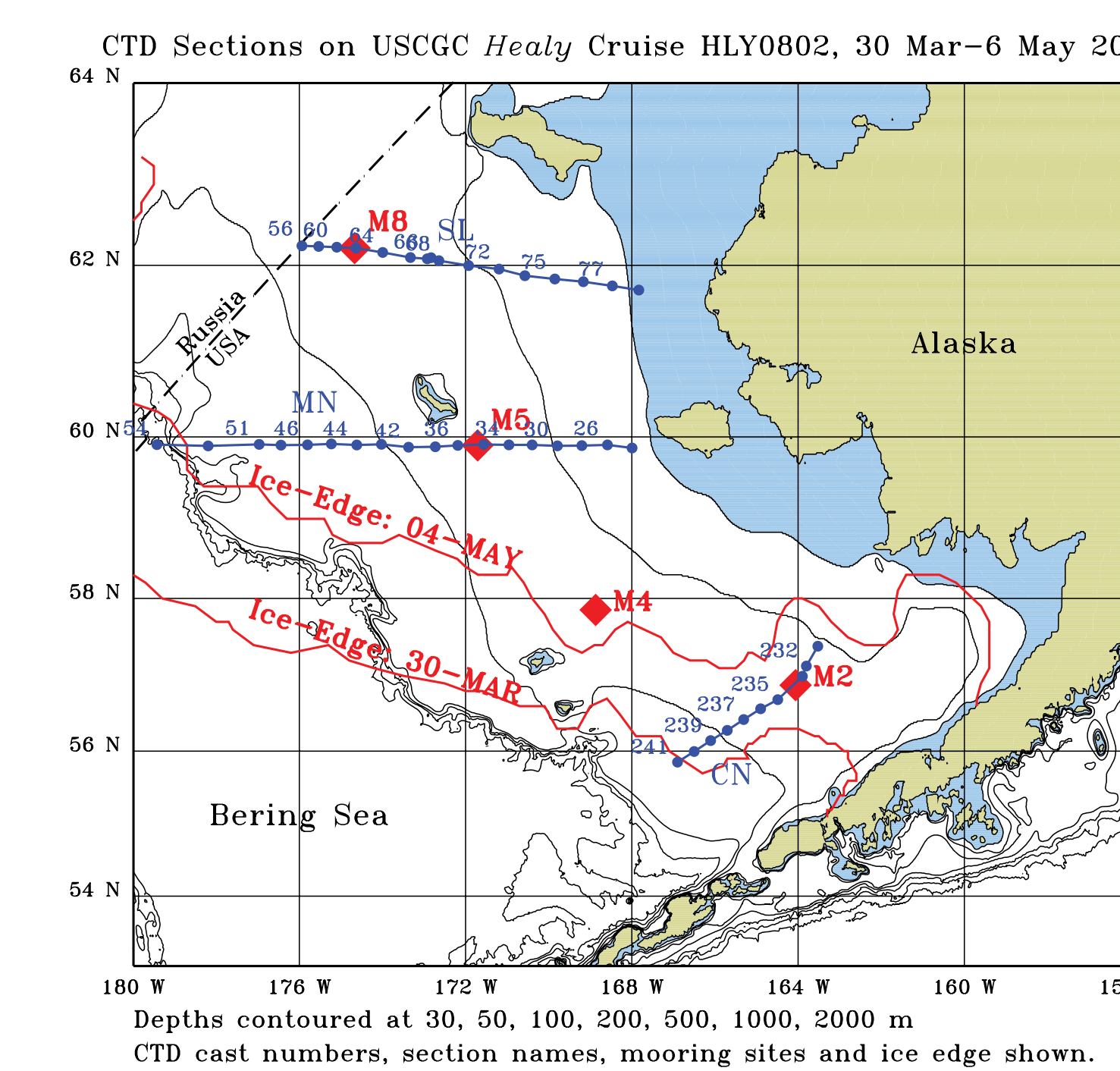
MN

CN

Depth (dbar)



Sampled 3 cross-shelf lines (SL, MN & CN) from north to south in the Bering Sea over 3 periods (Spring, Summer & Late Summer 2008)



#### Spring (30 Mar-6 May 2008, Healy Cruise HLY0802)

##### Prolonged ice cover on SL and MN Lines

- Cold and well-mixed to 50-60 m
- Mixed-layer salinity highest beneath oldest ice cover
- Prior to spring bloom
  - Euphotic Depth above Mixed Layer Depth, therefore light limited
  - Plentiful nitrate on middle and outer shelf
  - Low chlorophyll and under-saturated oxygen
- MN Line inner shelf anomalous: lower salinity and nutrients

##### Abbreviated ice cover on CN Line

- Ice melt prior to sampling
- Warmer and weakly stratified on middle shelf
- Bloom conditions: depleted nitrate, high chlorophyll, super-saturated oxygen

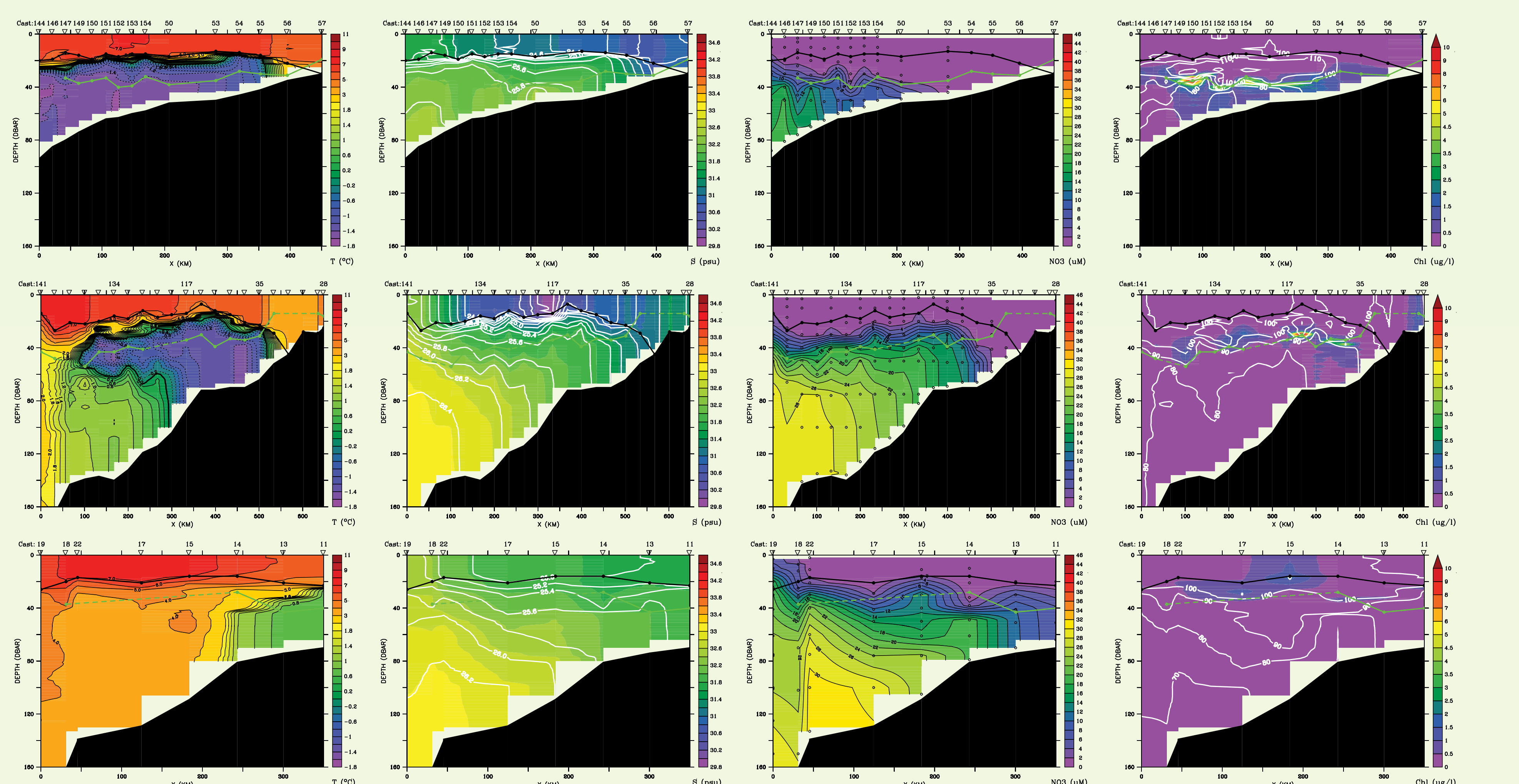
Summer

SL

MN

CN

Depth (dbar)



#### Summer (4-30 July 2008, Healy Cruise HLY0803)

##### Strong ice-melt influence on SL and MN Lines

- Stratified by ice melt (salinity controls density)
- Cold Pool ( $T < 2^{\circ}\text{C}$ )
  - Capped by fresher, warmer water
  - Tongue ( $T < 0^{\circ}\text{C}$ ) formed by surface warming on MN Line
  - Warming on inner shelf bounds Cold Pool
- Post-bloom conditions in upper layer
  - Euphotic Depth below Mixed Layer Depth, therefore light available
  - Nitrate depleted in upper layer and on inner shelf
- Phytoplankton below pycnocline at Euphotic Depth
  - Light and nutrients available
  - Subsurface chlorophyll maximum & oxygen super-saturation

##### Weak ice-melt influence CN Line

- Cold Pool narrower and warmer
- Stratification due to salinity and temperature
- Salt and nitrate intrude shoreward at depth
- Low chlorophyll in upper layer with slight oxygen super saturation
- No chlorophyll or super saturation below weak pycnocline

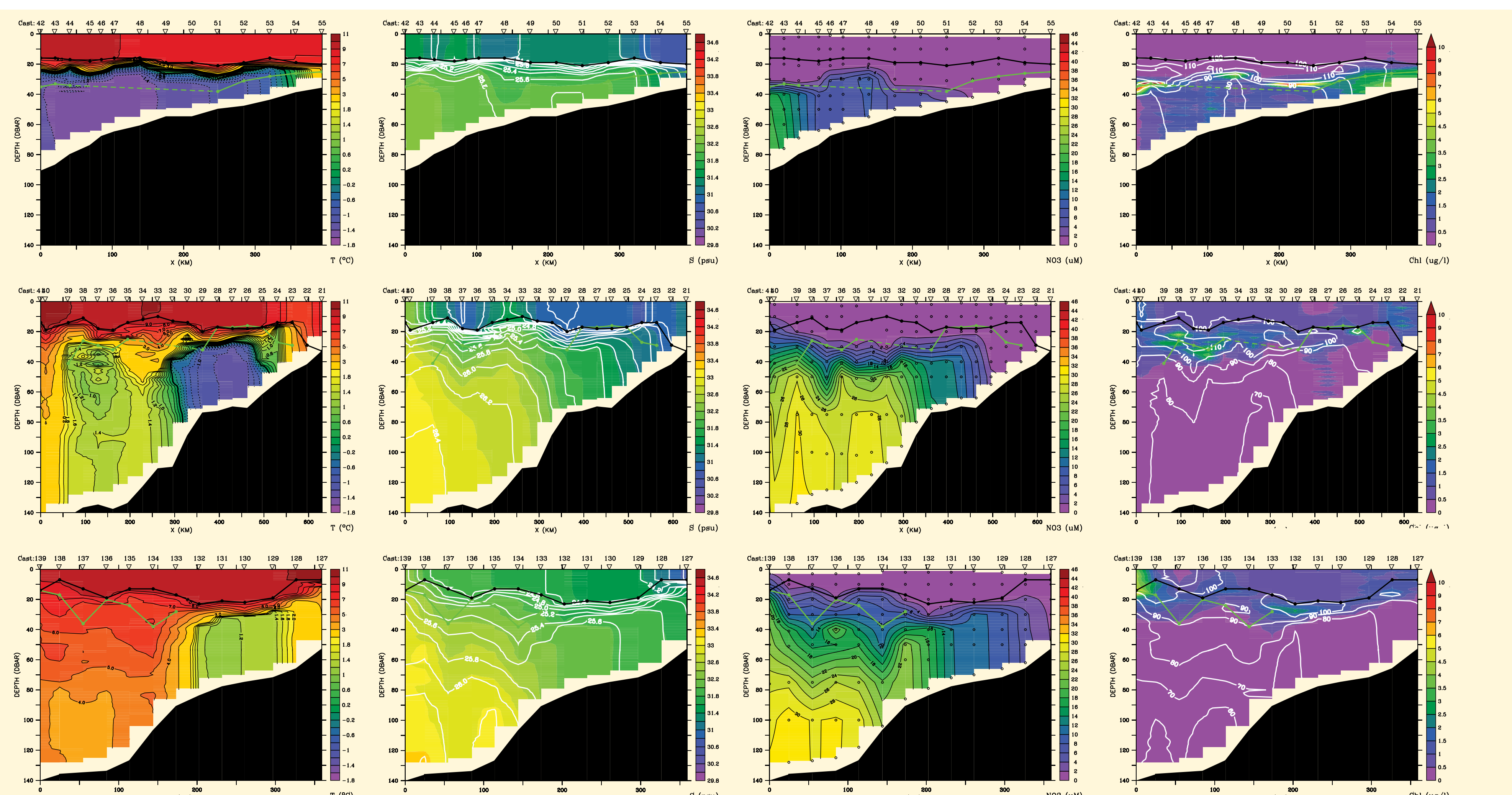
Late Summer

SL

MN

CN

Depth (dbar)



#### Late Summer (24 Aug-11 Sep 2008, Melville Cruise 8M0823)

##### Dwindling ice influence as Summer progresses

- Surface warming enhancing stratification especially on CN Line
- Cold Pool tongue disappears on MN Line
- Freshening on the inner shelf of the MN and CN Lines (from runoff and Alaska Coastal Current)
- Post-bloom conditions in upper layer
  - Euphotic Depth below Mixed Layer Depth implies adequate light for phytoplankton
  - Nitrate depleted in upper layer and on inner shelf
- Production below the pycnocline where nutrients available
  - Light available shown by Euphotic Depth below pycnocline
  - Subsurface chlorophyll maximum
  - Subsurface oxygen super saturation

Distance (km)