

# **Conawapa Generating Station Nelson River Physical Environment**

## **Conawapa Project Environmental Impact Study**

### **Physical oceanography studies**

Hydro Power Planning Department  
Power Projects Development Division  
Power Supply

May 28, 2012



# Objectives and goals

- **EIA context:**
  - Define physical characteristics of study area
  - Define present influence of river flow
  - Determine future influence of river flow
- **Minimum requirement to characterize**
  - Open water conditions
  - Ice cover conditions
- **Determine river area of influence**
  - Plume delineation (salinity)
  - Water masses characteristics
  - Sediment transport
- **Define physical setting of habitats**
  - Salinity
  - Temperature
  - Turbidity
  - Others



## Available data 2005-2007, 2009

### •2005:

- Early July to Early September:
- 9 weeks near shore
- 3-4 weeks offshore (Sept. 11)
  - CT-Tu, wave, TSS, hydrological, bathymetry

### •2006:

- Early September to Mid-October
- 4-6 weeks near and offshore (Oct. 11)
  - Limited ADCP
  - CT-Tu, wave, TSS, hydrological, sediment



### •2007:

- Near-shore only
- Month of August

### •2009:

- Winter survey (March)
- Combined MH-ArcticNet

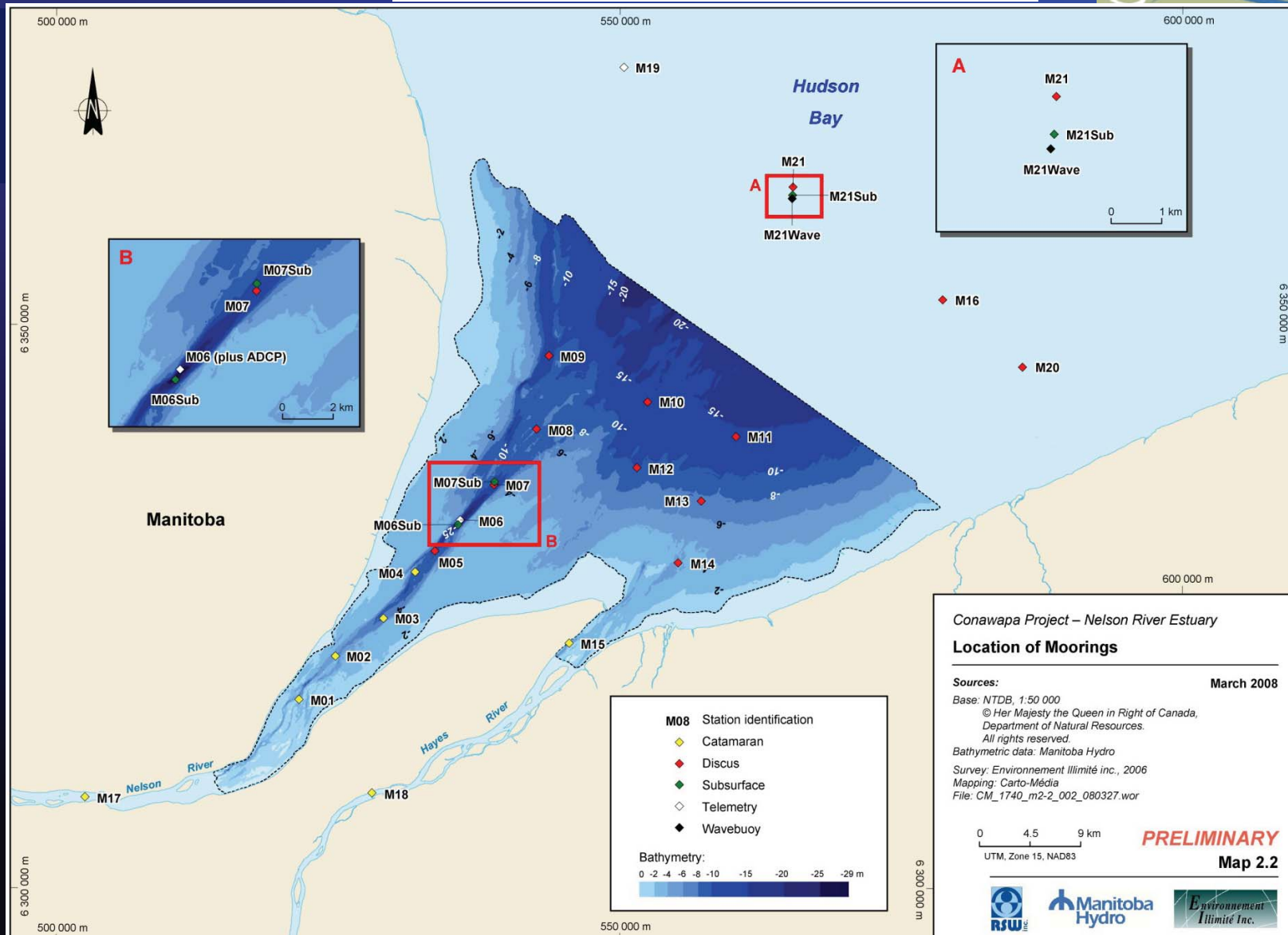


<p><b>LEGEND</b></p> <ul style="list-style-type: none"> <li>□ INITIAL MOORING LOCATION</li> <li>● FINAL MOORING LOCATION (PHASE 1)</li> <li>▲ FINAL MOORING LOCATION (PHASE 2)</li> </ul>	
<p><b>NELSON RIVER ESTUARY</b></p>	
<p><b>2005 MONITORING PROGRAM INITIAL AND FINAL MOORING LOCATION</b></p>	
 <p>engineering consultants</p>	 <p>Manitoba Hydro</p>
<p>Scale: 1:300000</p>	<p>Figure 3.3</p>

# Available data 2006

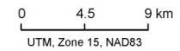


CONAWAPA

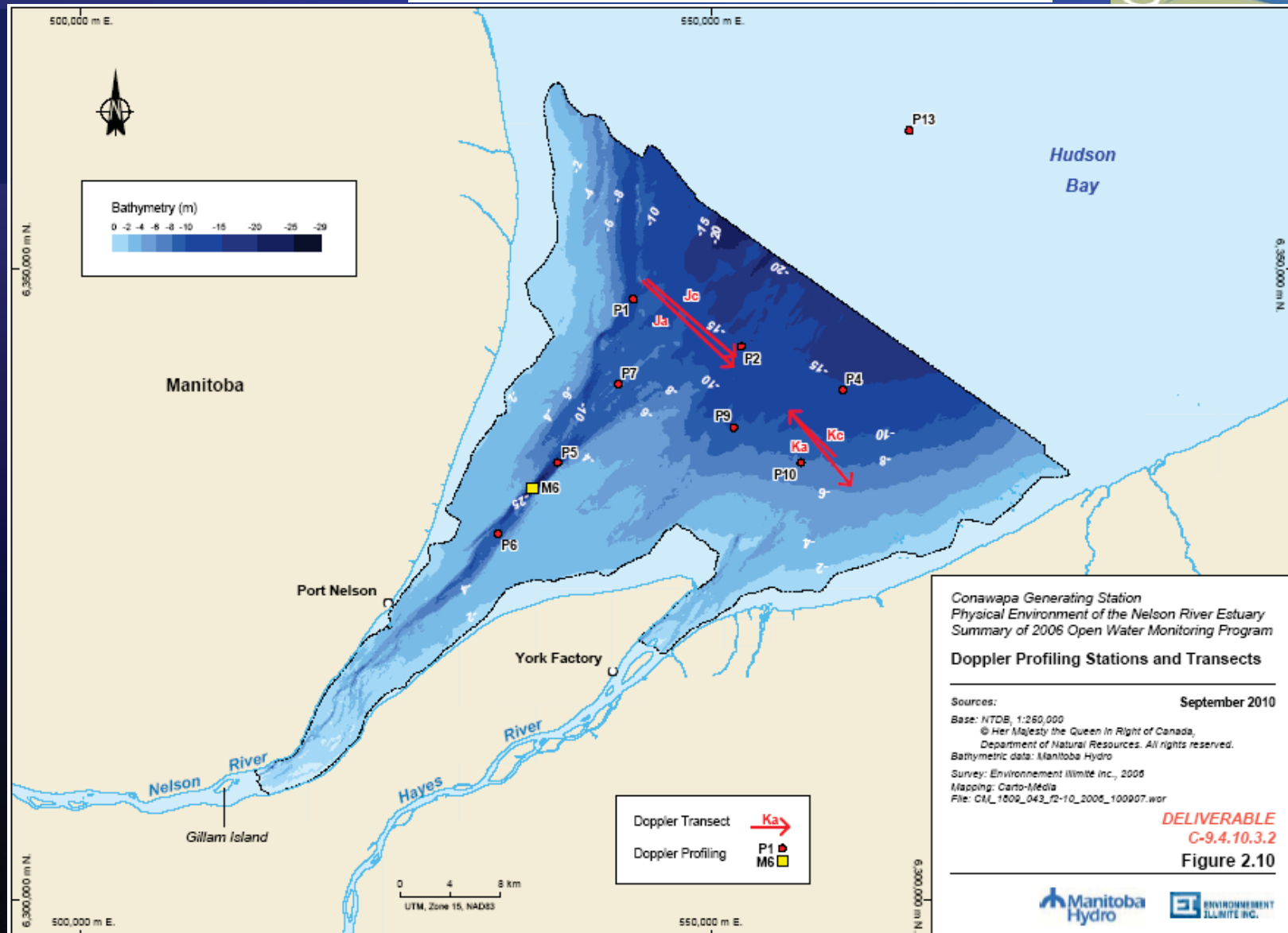


**Conawapa Project – Nelson River Estuary**  
**Location of Moorings**

**Sources:** March 2008  
 Base: NTDB, 1:50 000  
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 Department of Natural Resources.  
 All rights reserved.  
 Bathymetric data: Manitoba Hydro  
 Survey: Environnement Illimité inc., 2006  
 Mapping: Carto-Média  
 File: CM\_1740\_m2-2\_002\_080327.wor



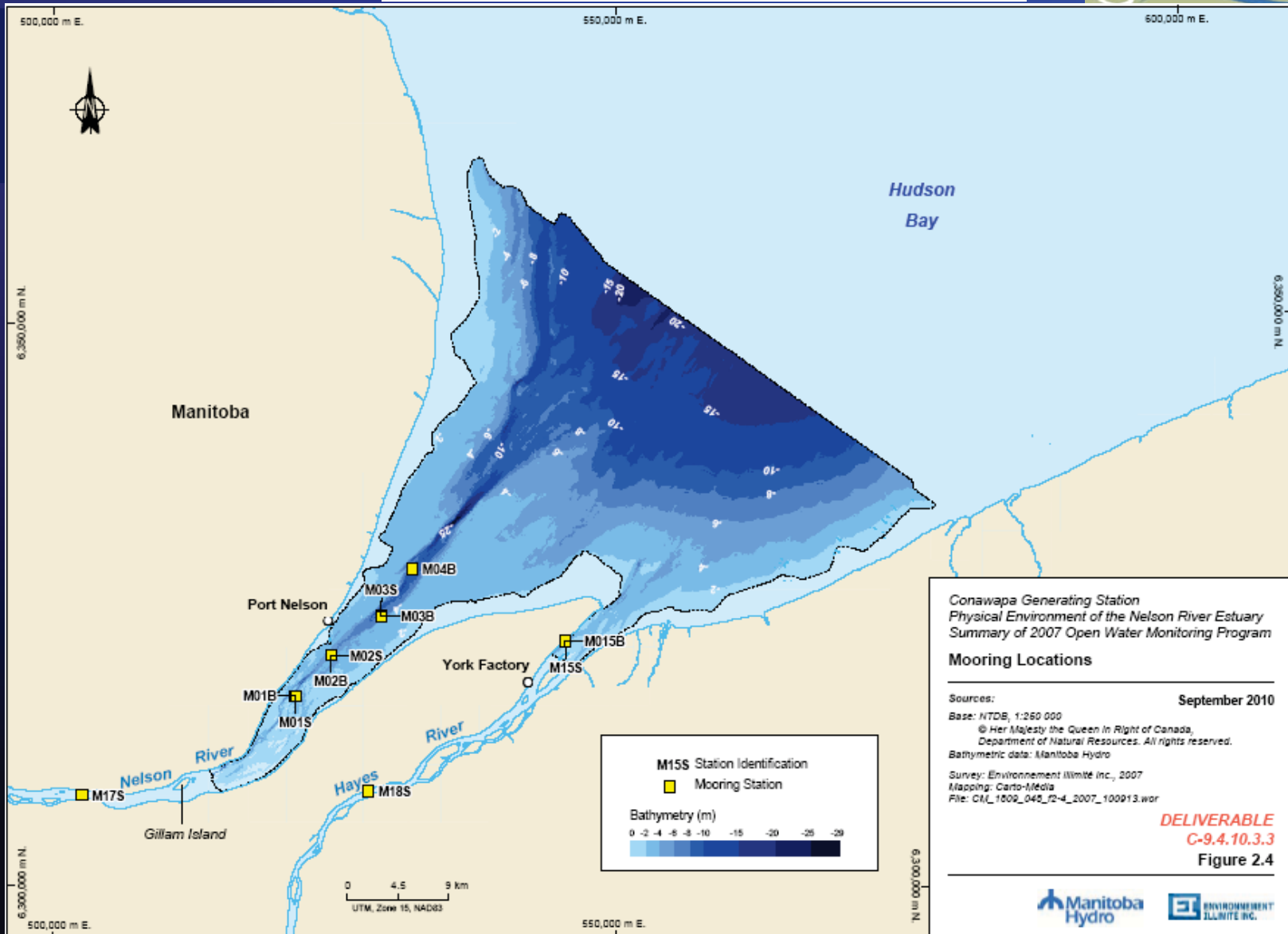
**PRELIMINARY**  
**Map 2.2**



# Available data 2007

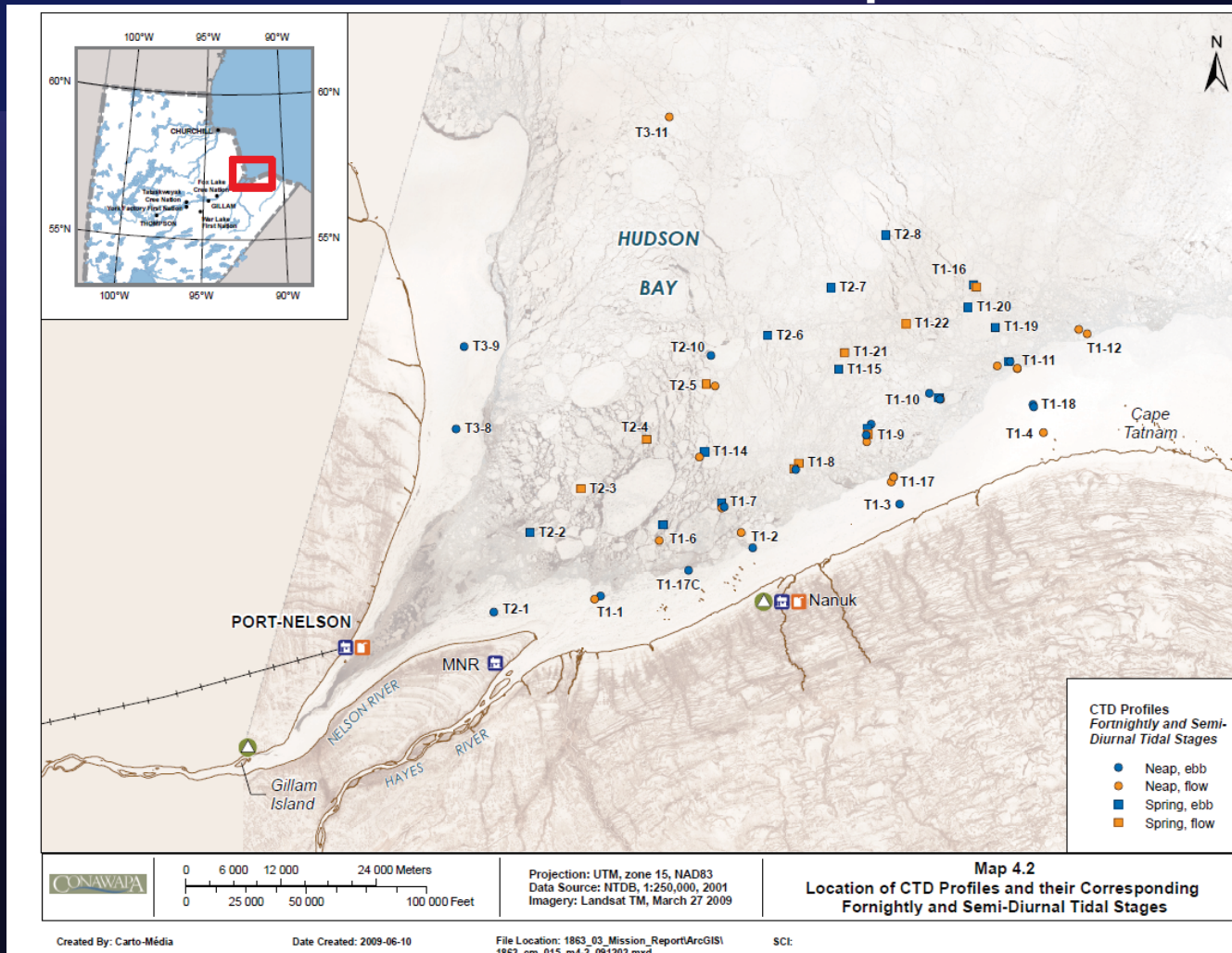


CONAWAPA





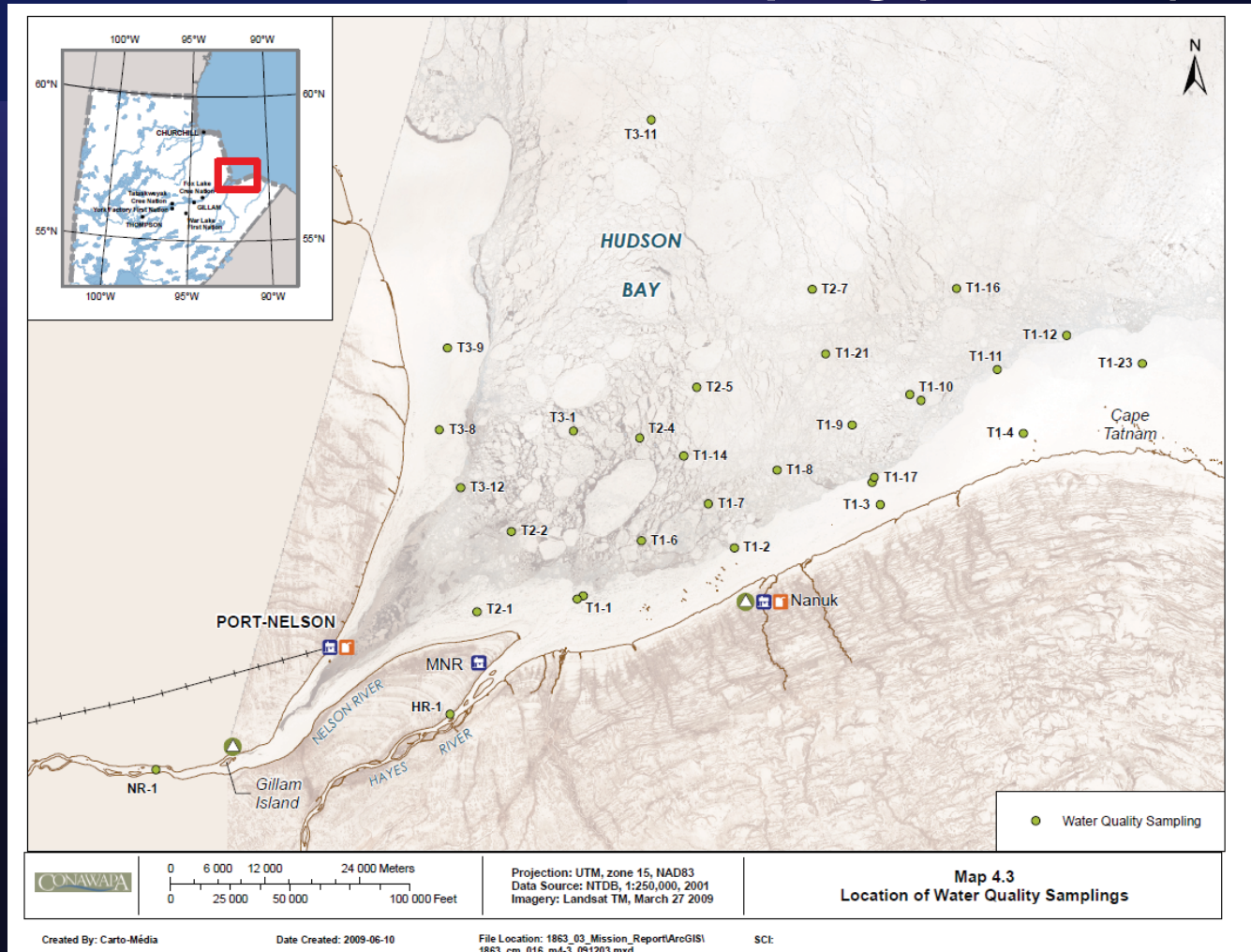
- Location of CTD – Ice profiles





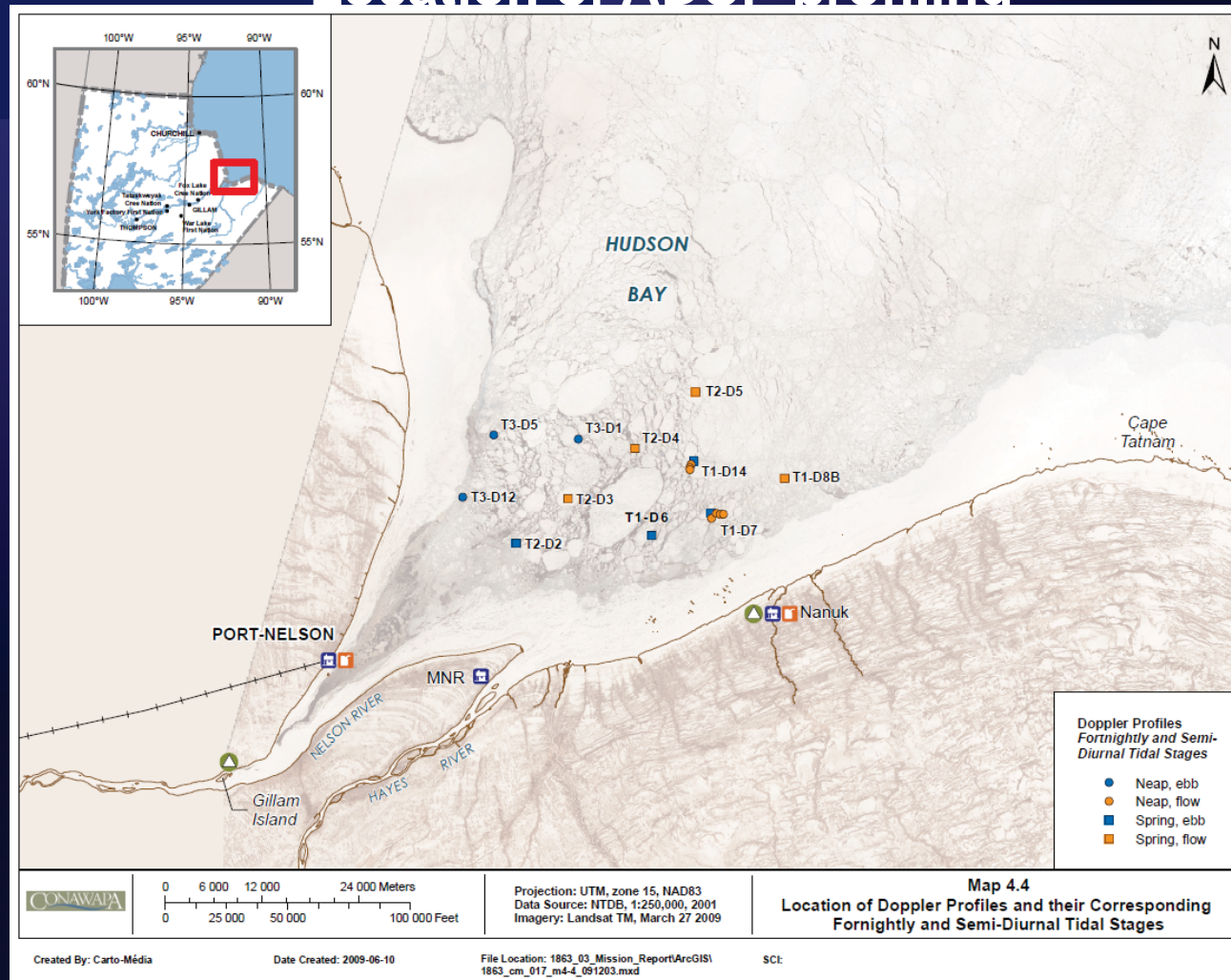


- Location of water sampling (ArcticNet)



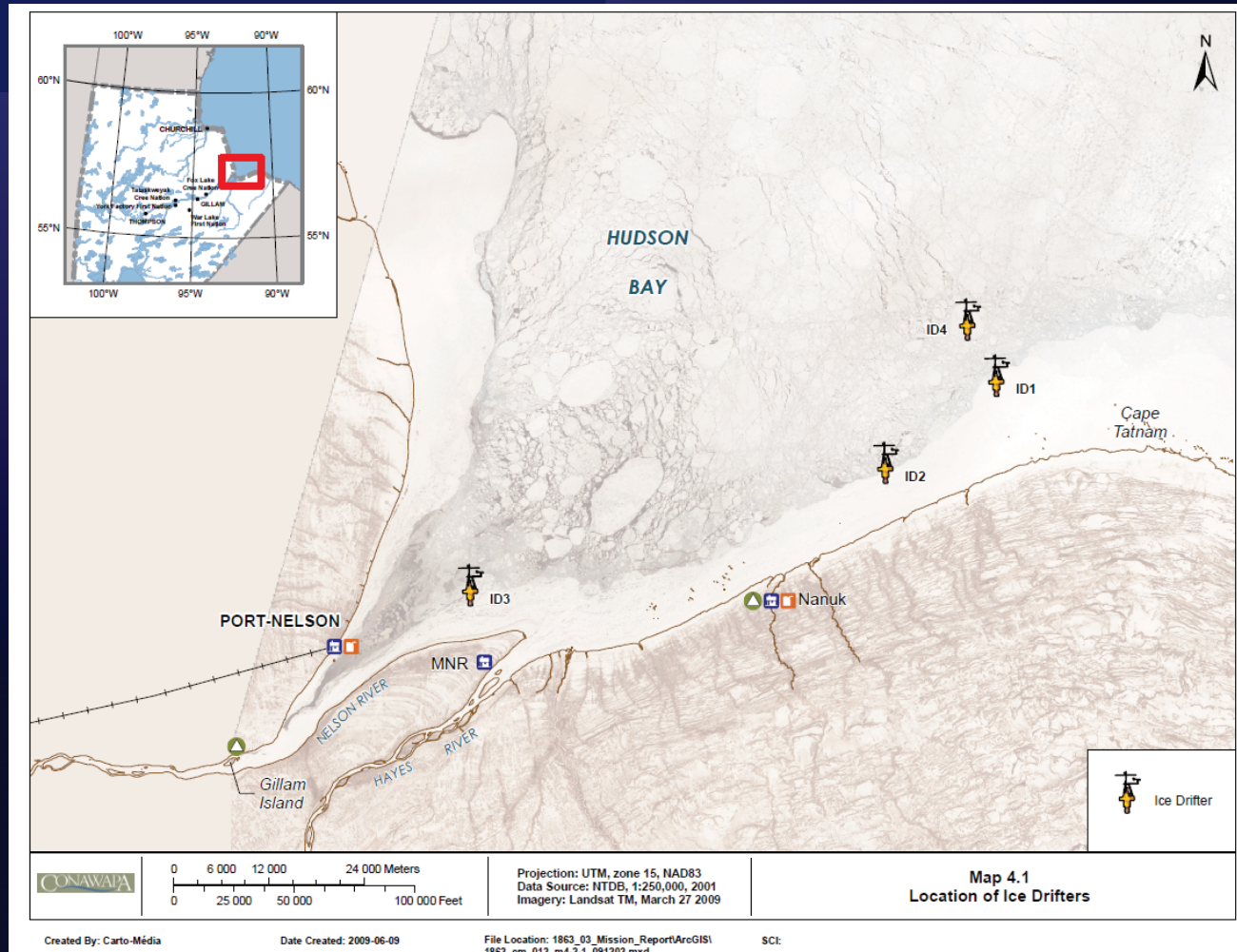


- Location of ADCP profiling



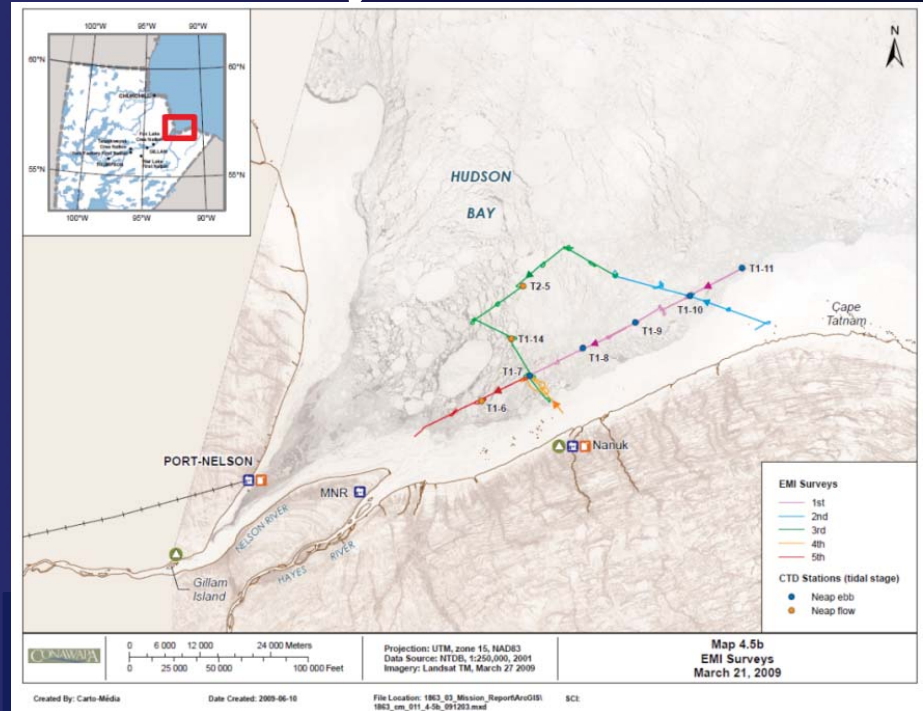
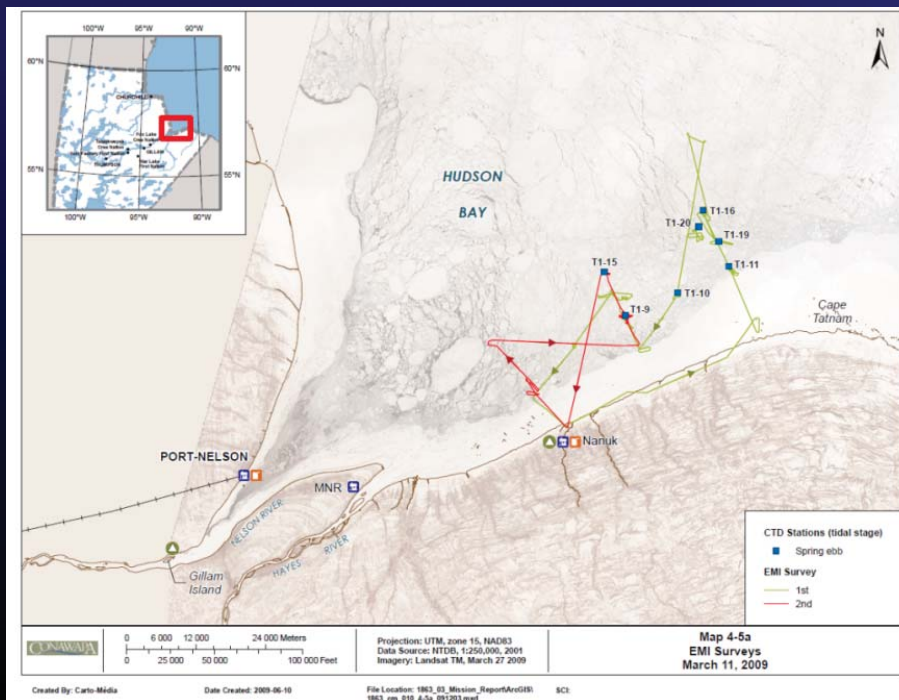


- Location of Ice Drifter



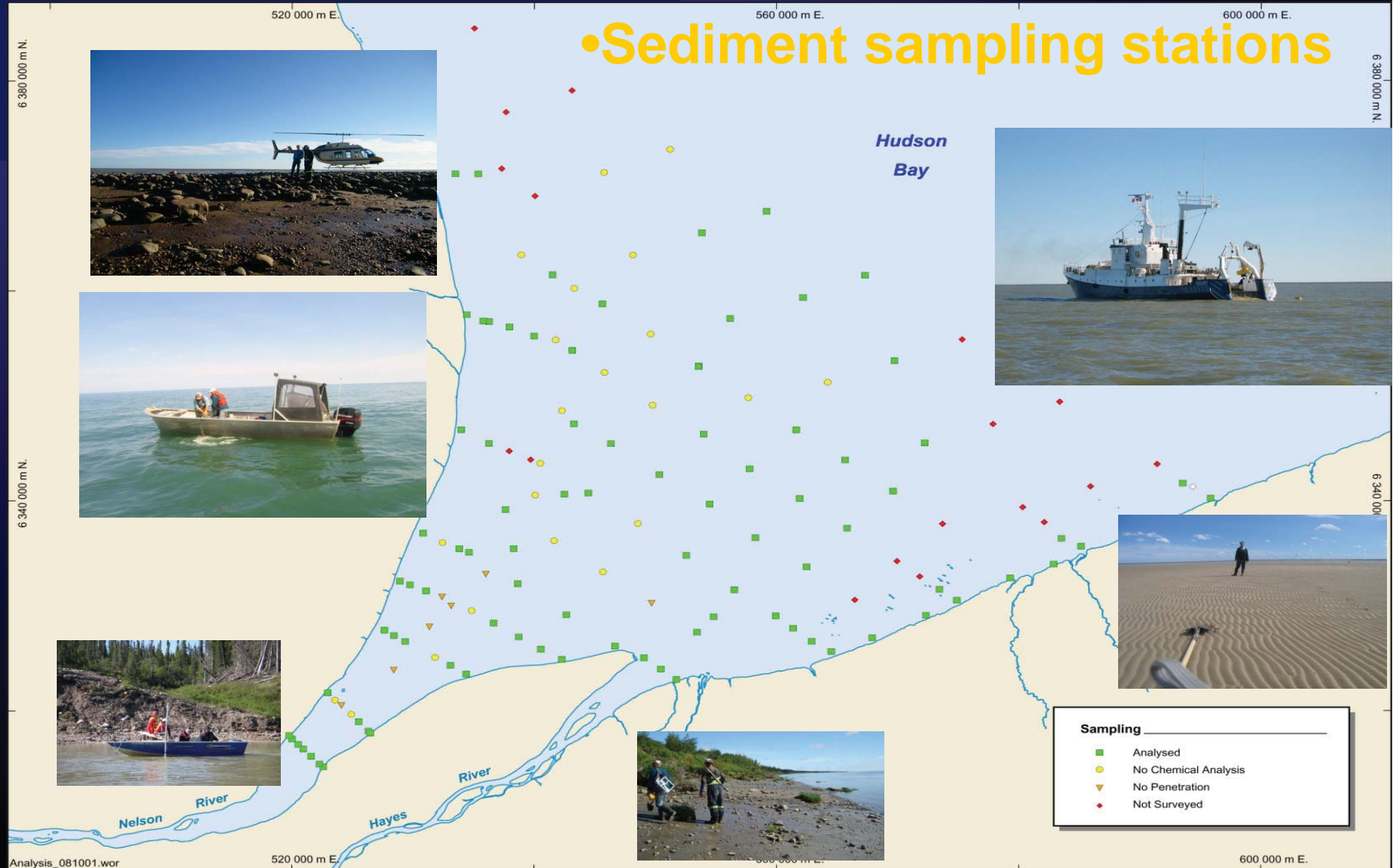


- Location of EMI survey





## • Sediment sampling stations

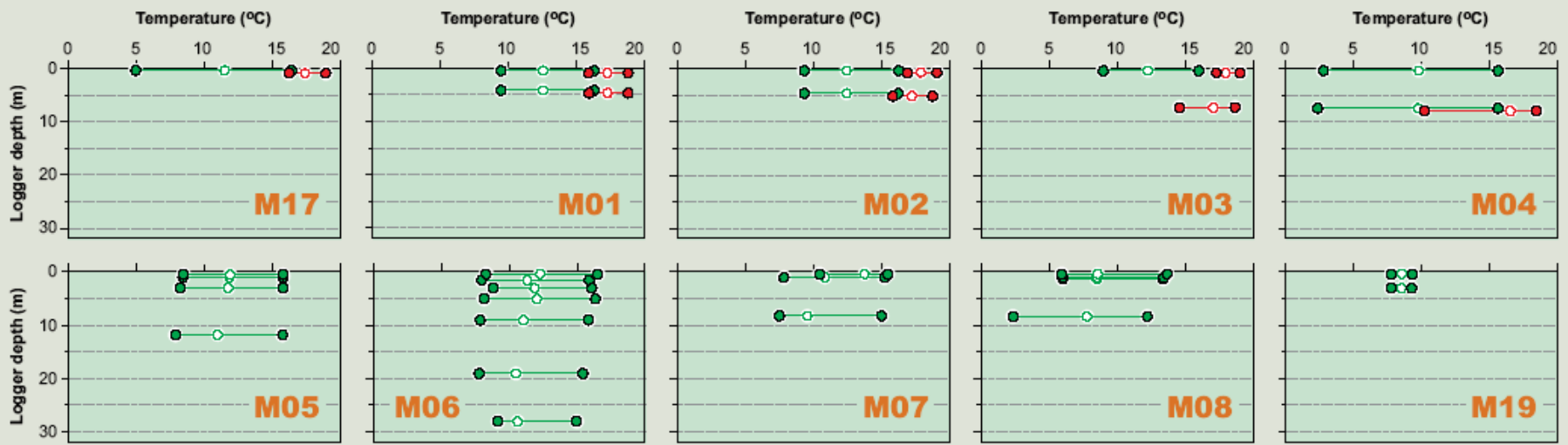
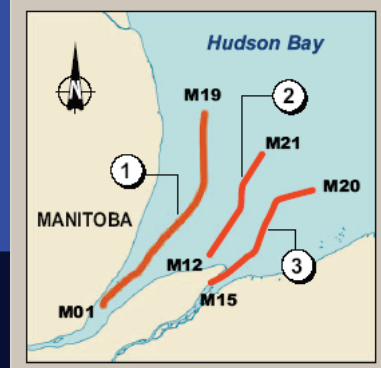




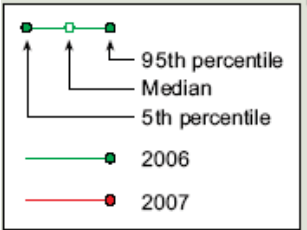
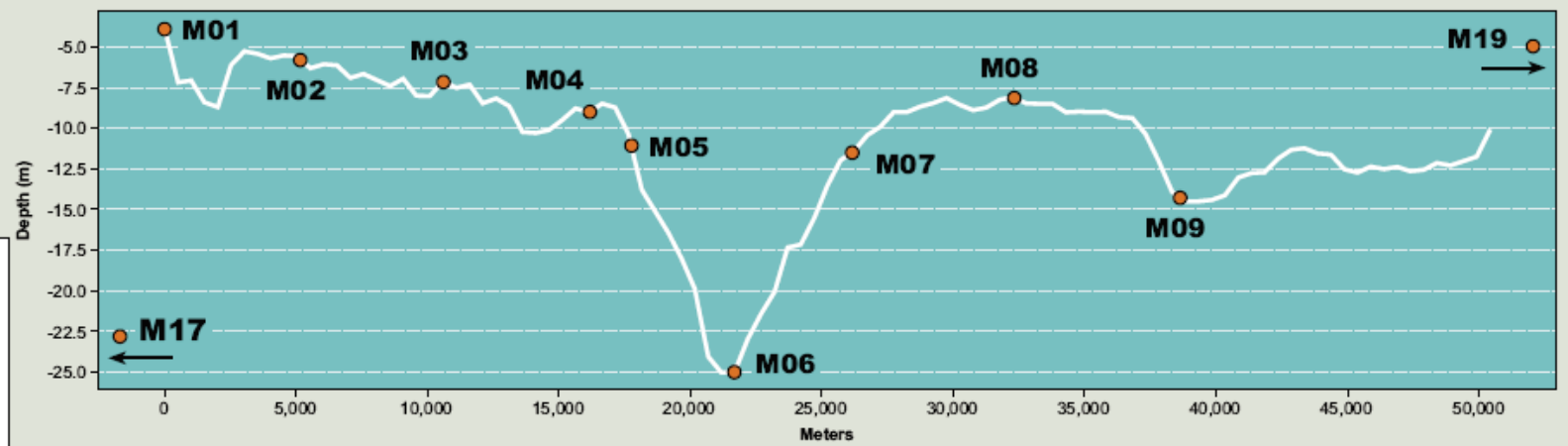
- **Results**

- **Time series CT-Tu**
  - Overall descriptive statistics
  - Tidal stages descriptive statistics
- **Relative influence of tide and river flow**

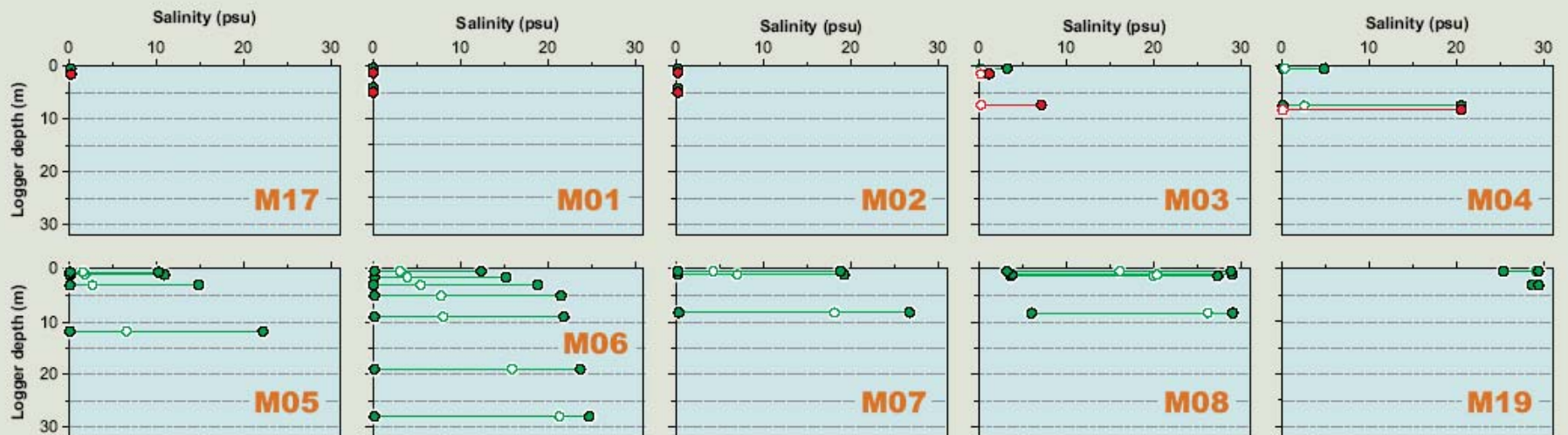
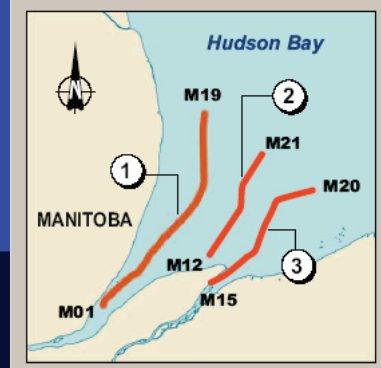
# Descriptive statistics Median temperature



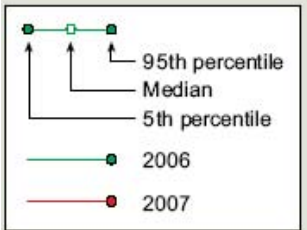
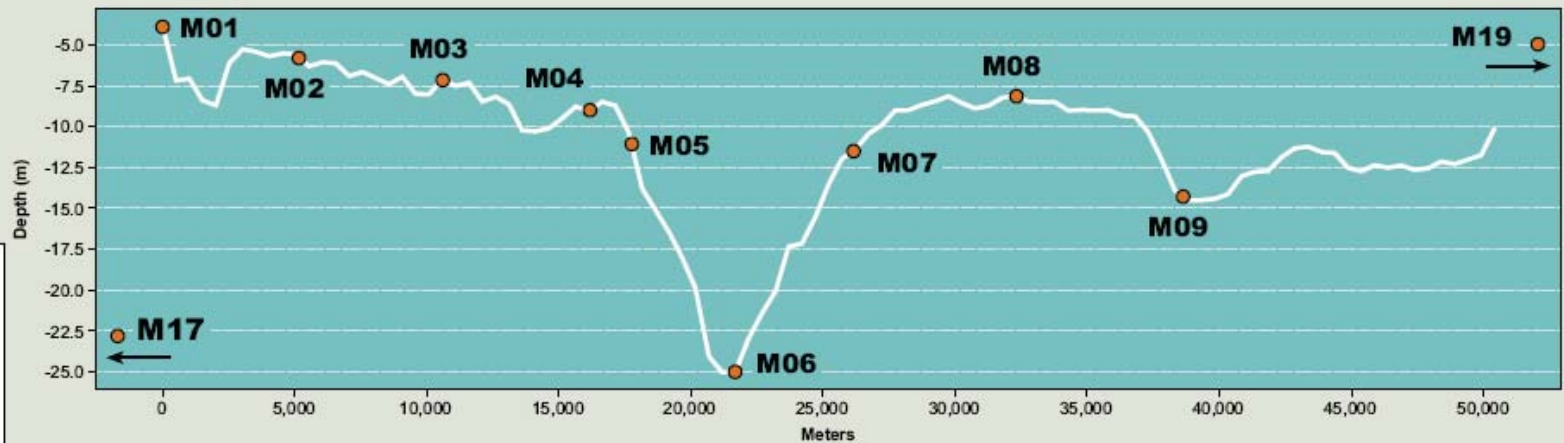
1



# Descriptive statistics Median salinity



1





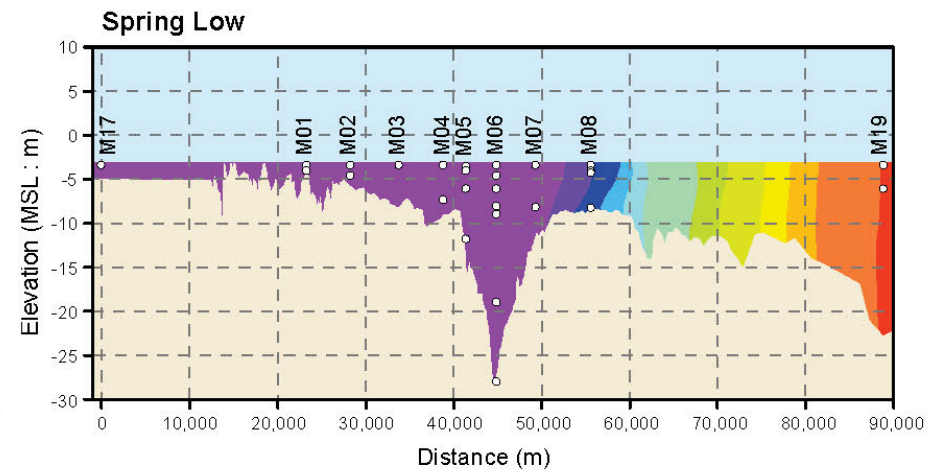
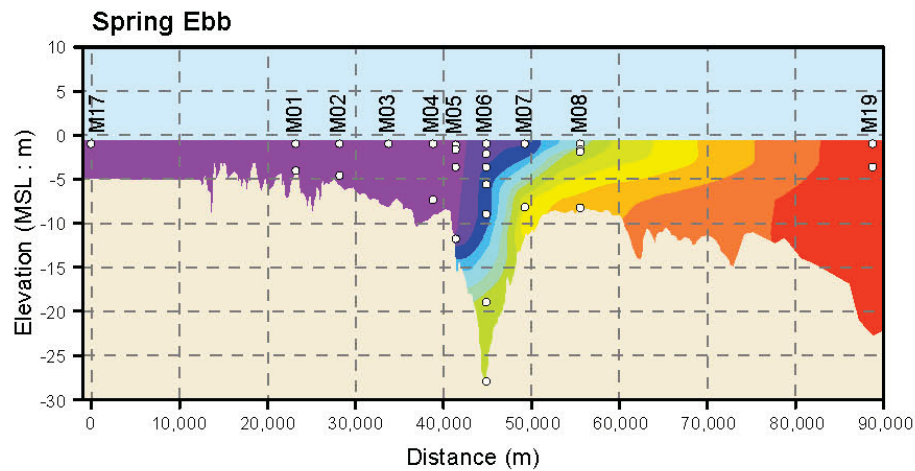
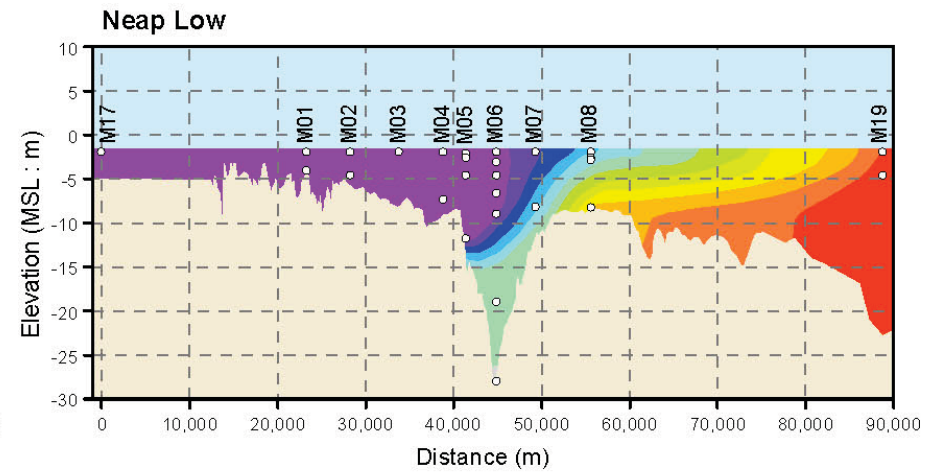
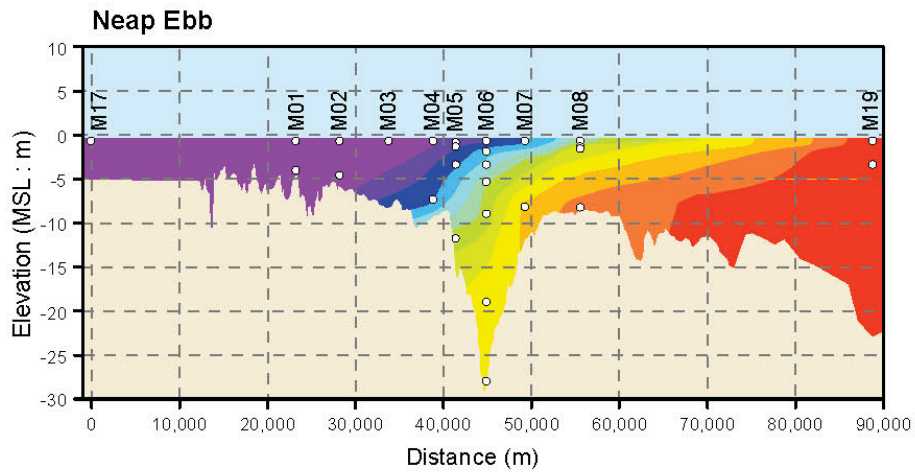


# Mixing processes

Range of water levels observed in 2005-2006

Station	Spring tides			Neap tides		
	Minimum (m)	Maximum (m)	Amplitude (m)	Minimum (m)	Maximum (m)	Amplitude (m)
Outer estuary (M13) (MSL)	-3.10	2.85	5.95	-1.64	1.10	2.74
Port Nelson (05UH737) (MSL)	-1.17	2.92	4.09	-1.13	1.43	2.56
Port Nelson (Fisheries and Oceans Canada) (MSL)	-1.86	2.86	4.72	-1.68	2.04	3.72

Note: High and low tide elevations on the cross-sections are referenced to M13 tide date



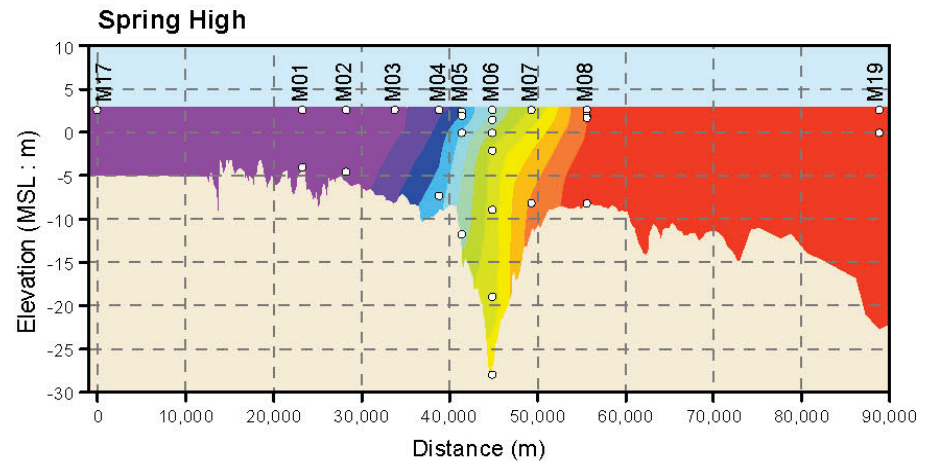
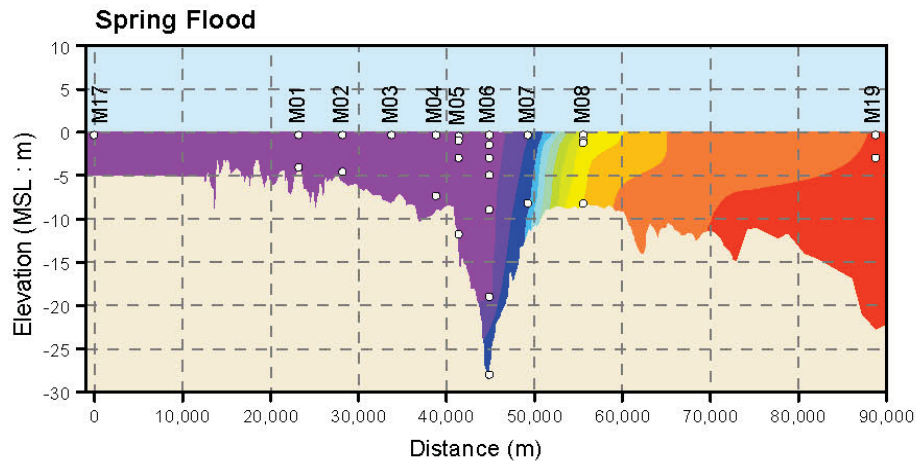
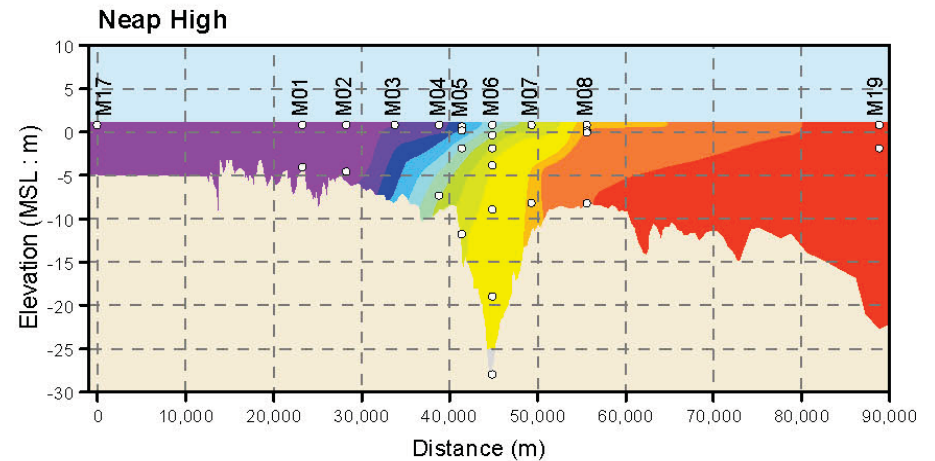
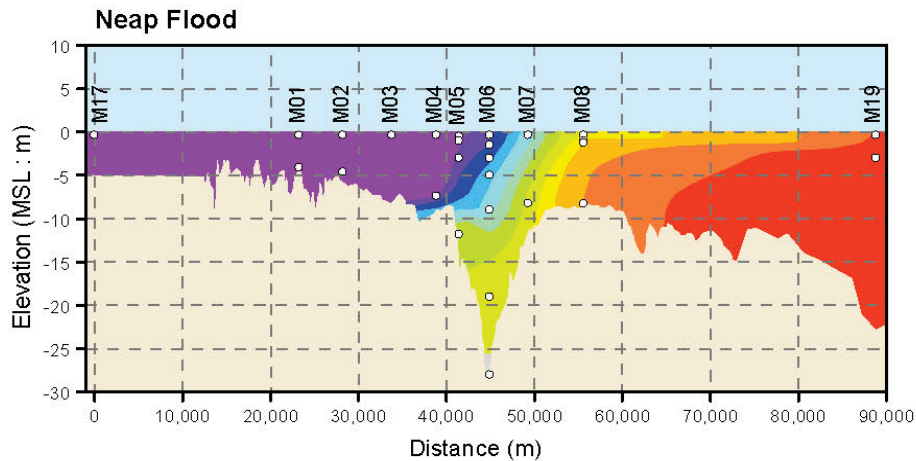


# Mixing processes

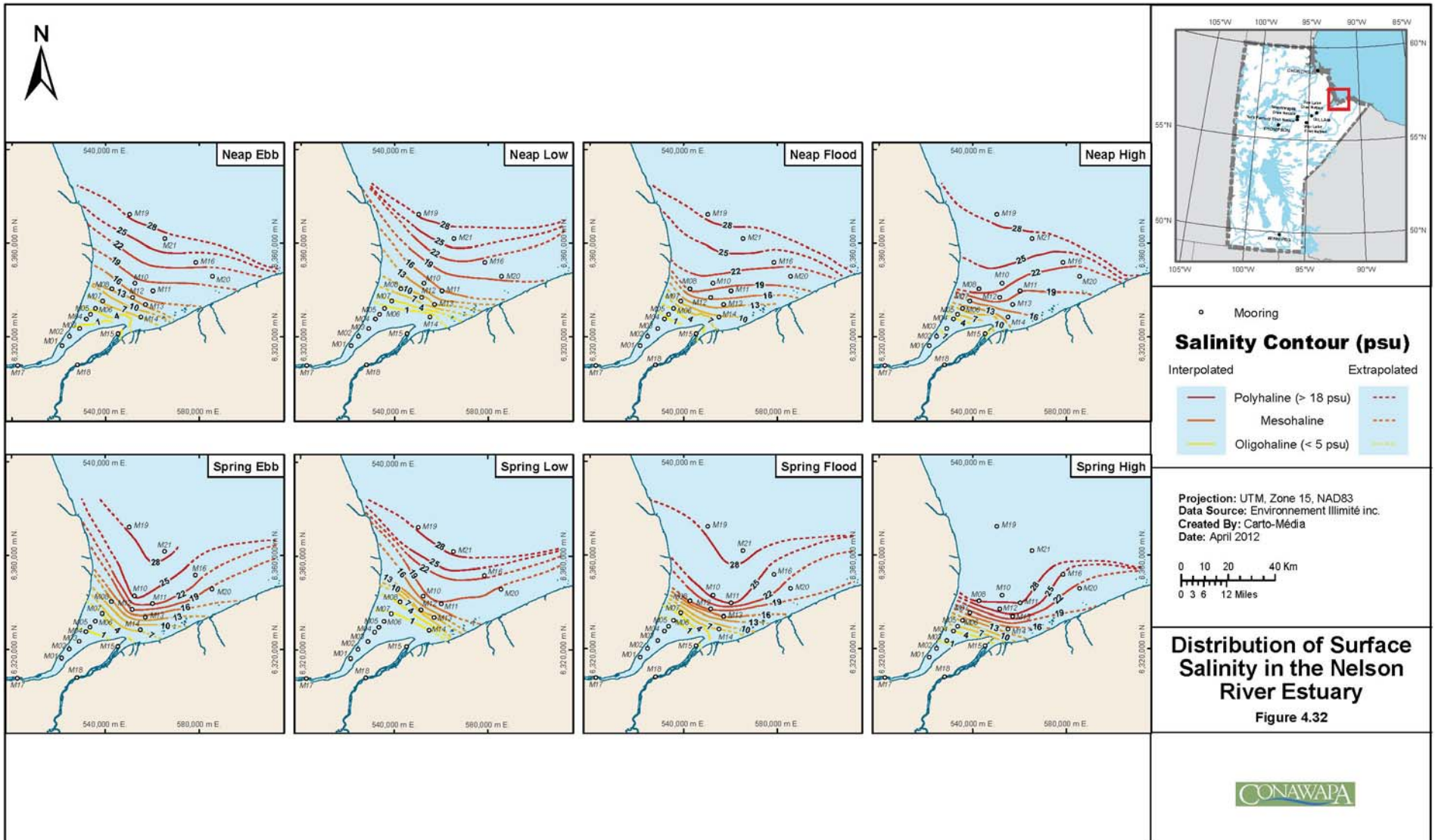
Range of water levels observed in 2005-2006

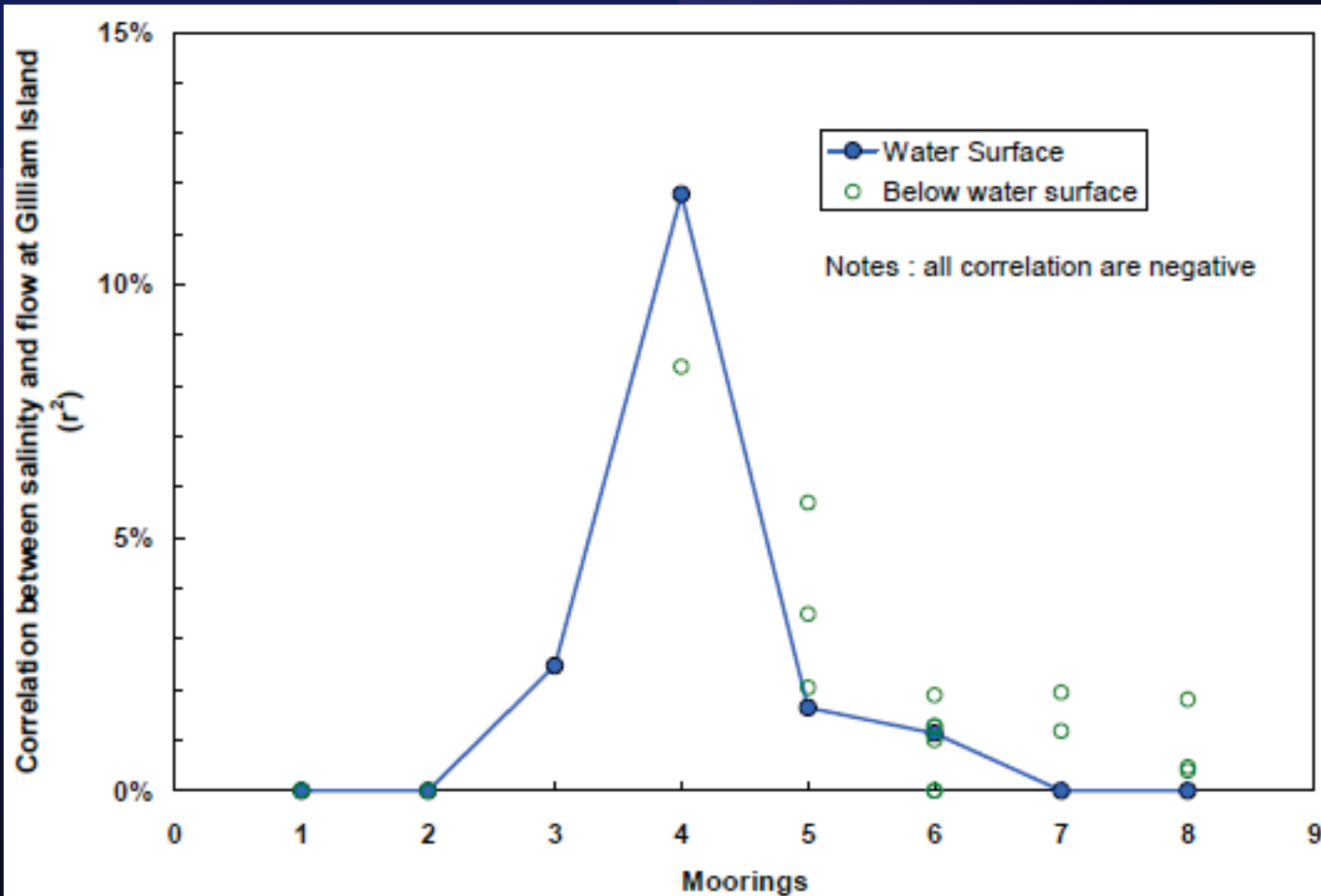
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Note: High and low tide elevations on the cross-sections are referenced to M13 tide data



# Surface salinity



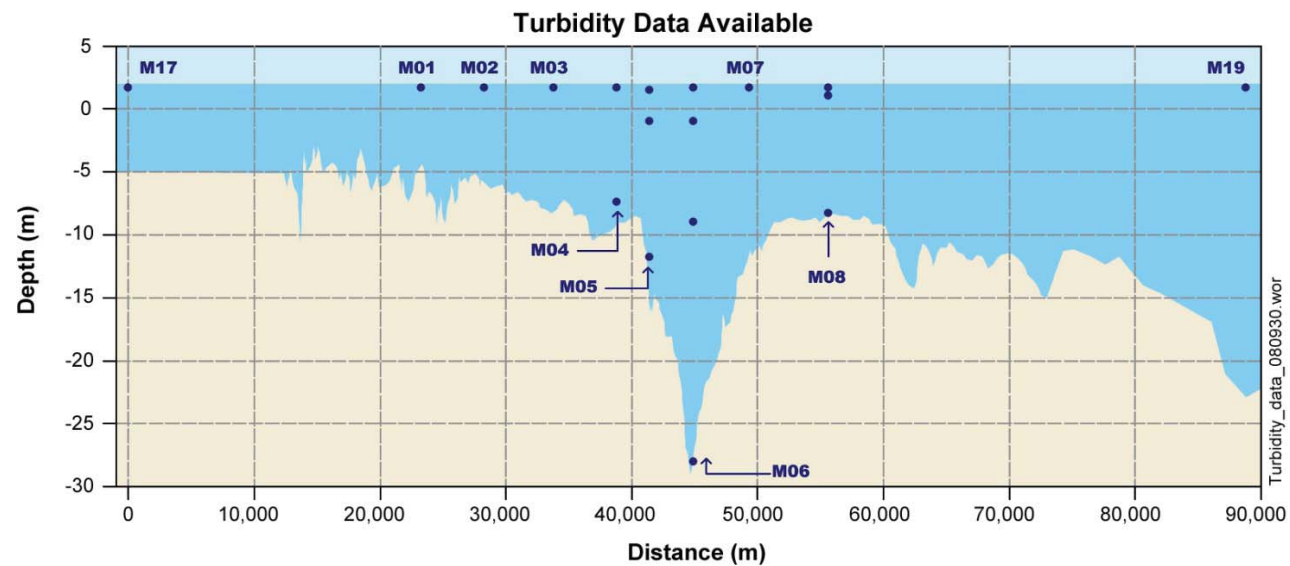


**Figure 4.28**

Correlation between flow routed at Gillam and 2006 salinity data.



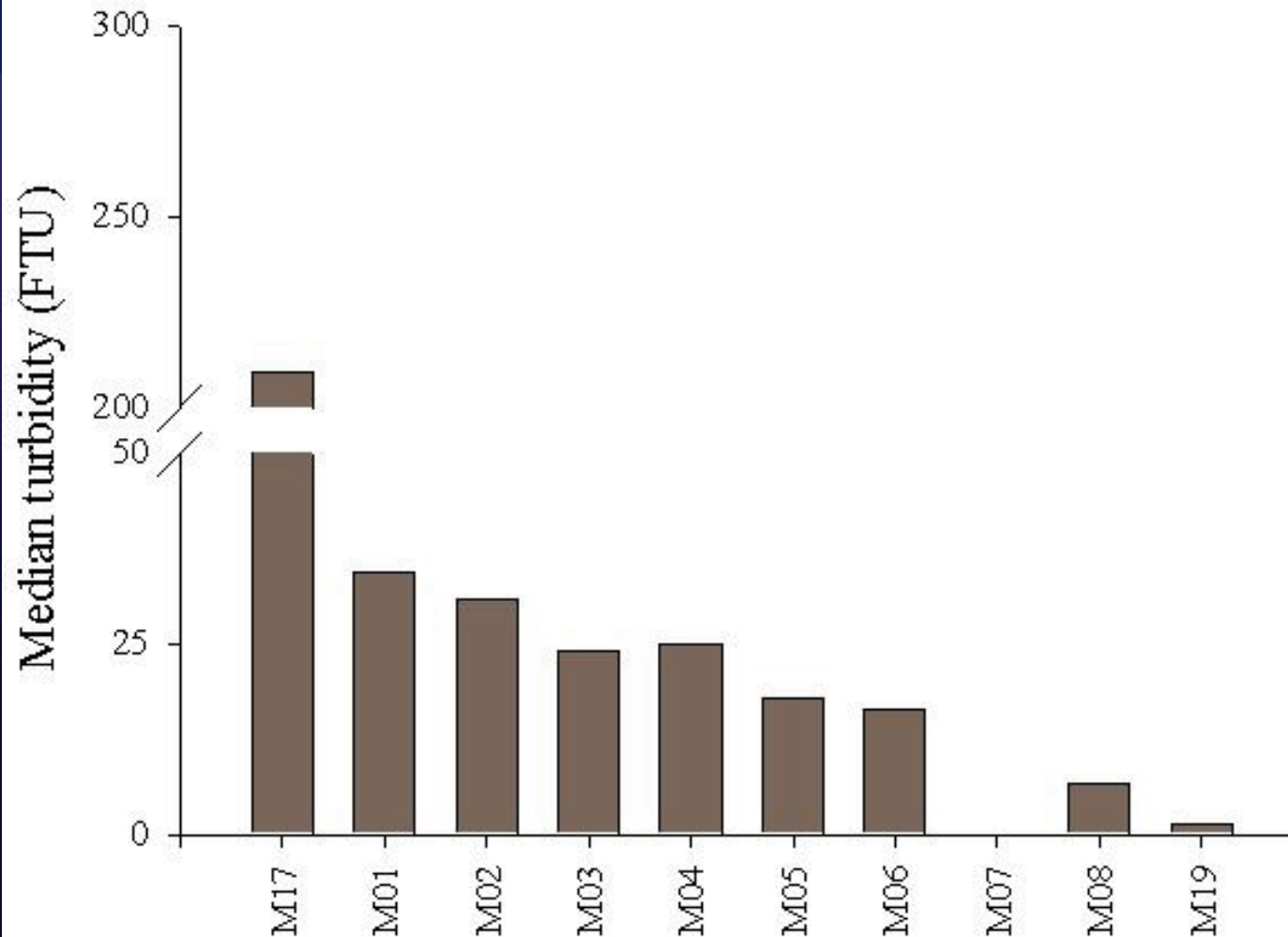
- **Cross-section of Turbidity**
  - Data gaps
  - Missing data



# Transect 1: Surface turbidity



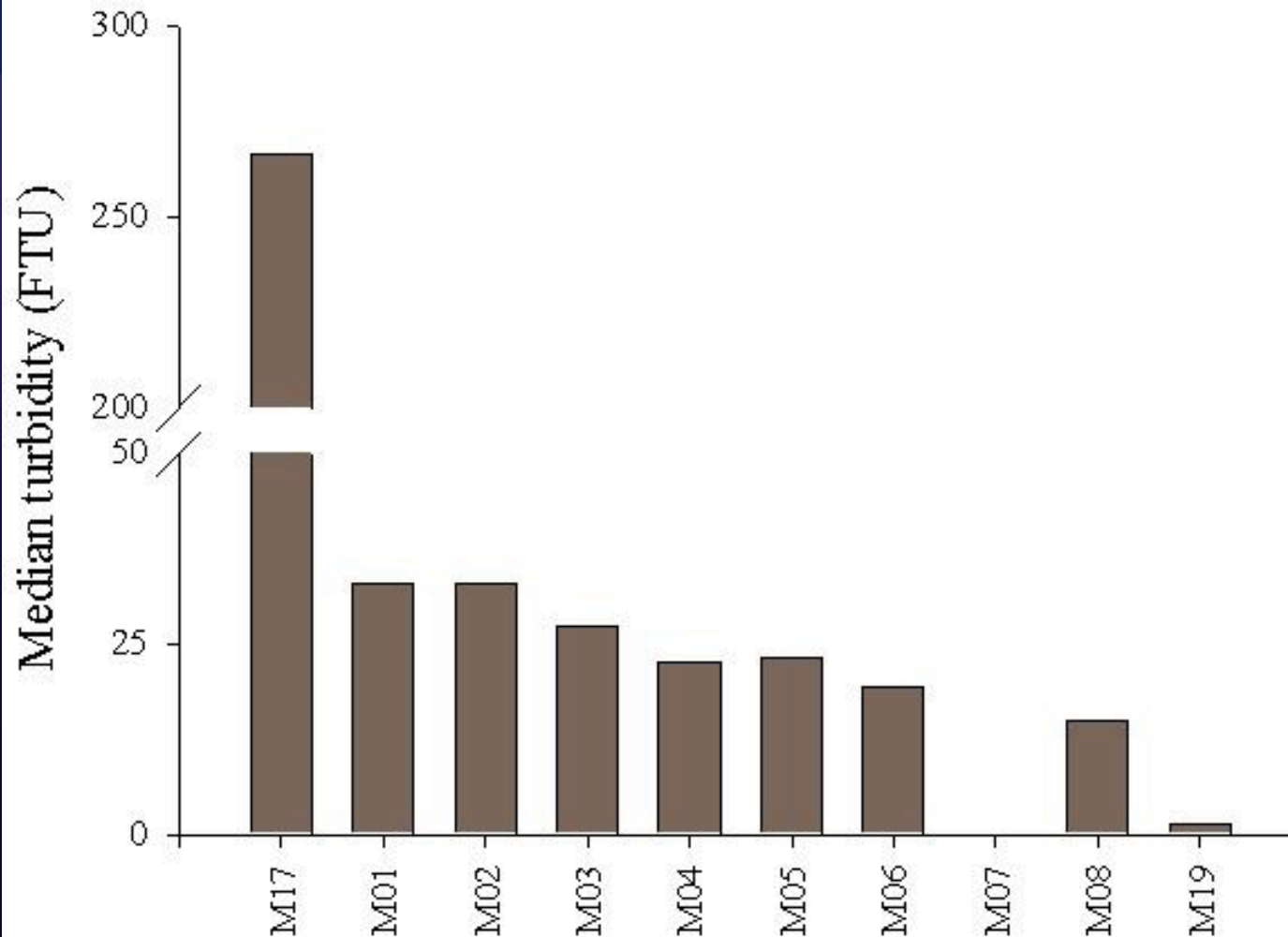
Neap High Tide



# Transect 1: Surface turbidity



Neap Ebb Tide

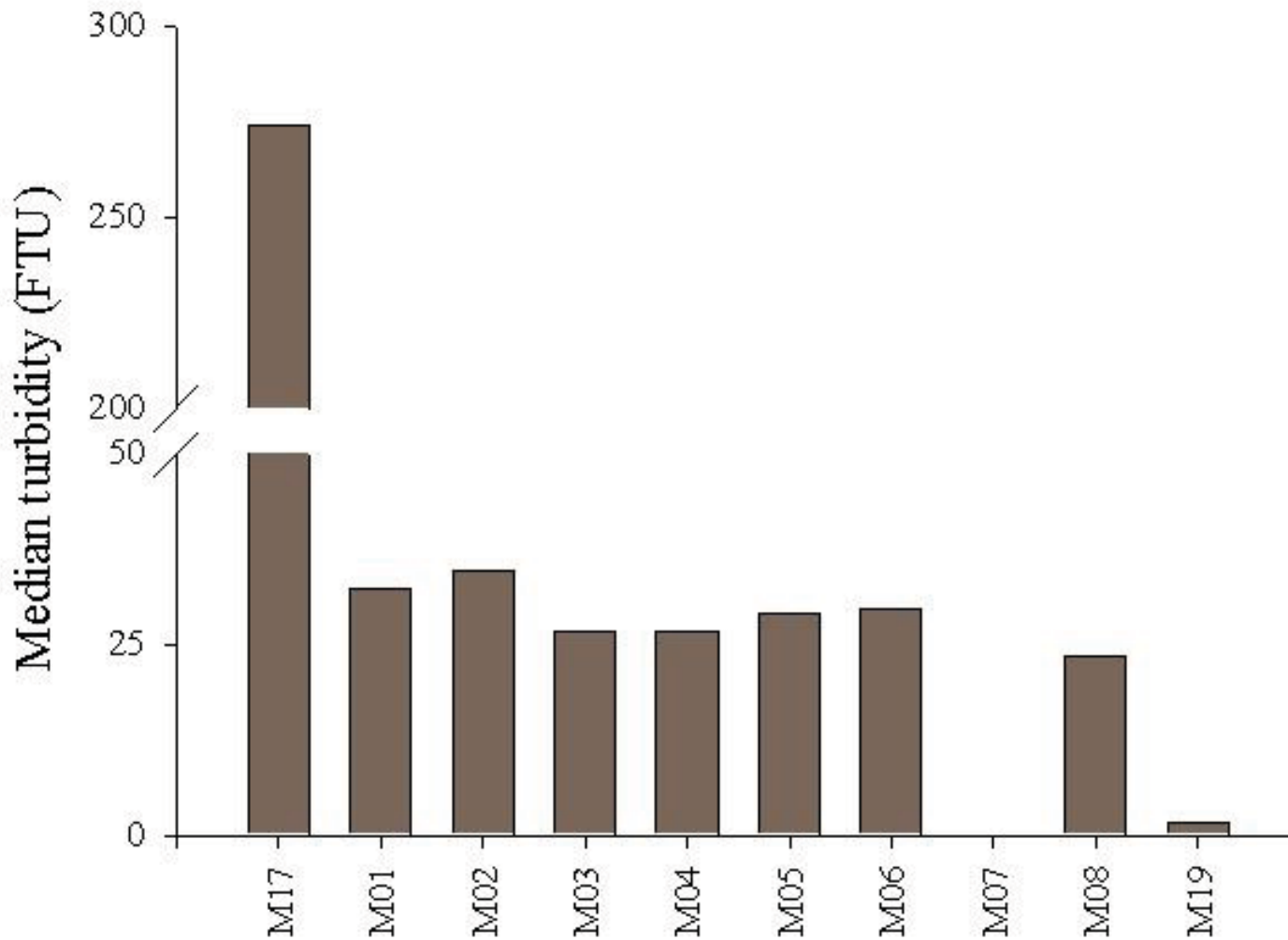


# Transect 1: Surface turbidity



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Neap Low Tide

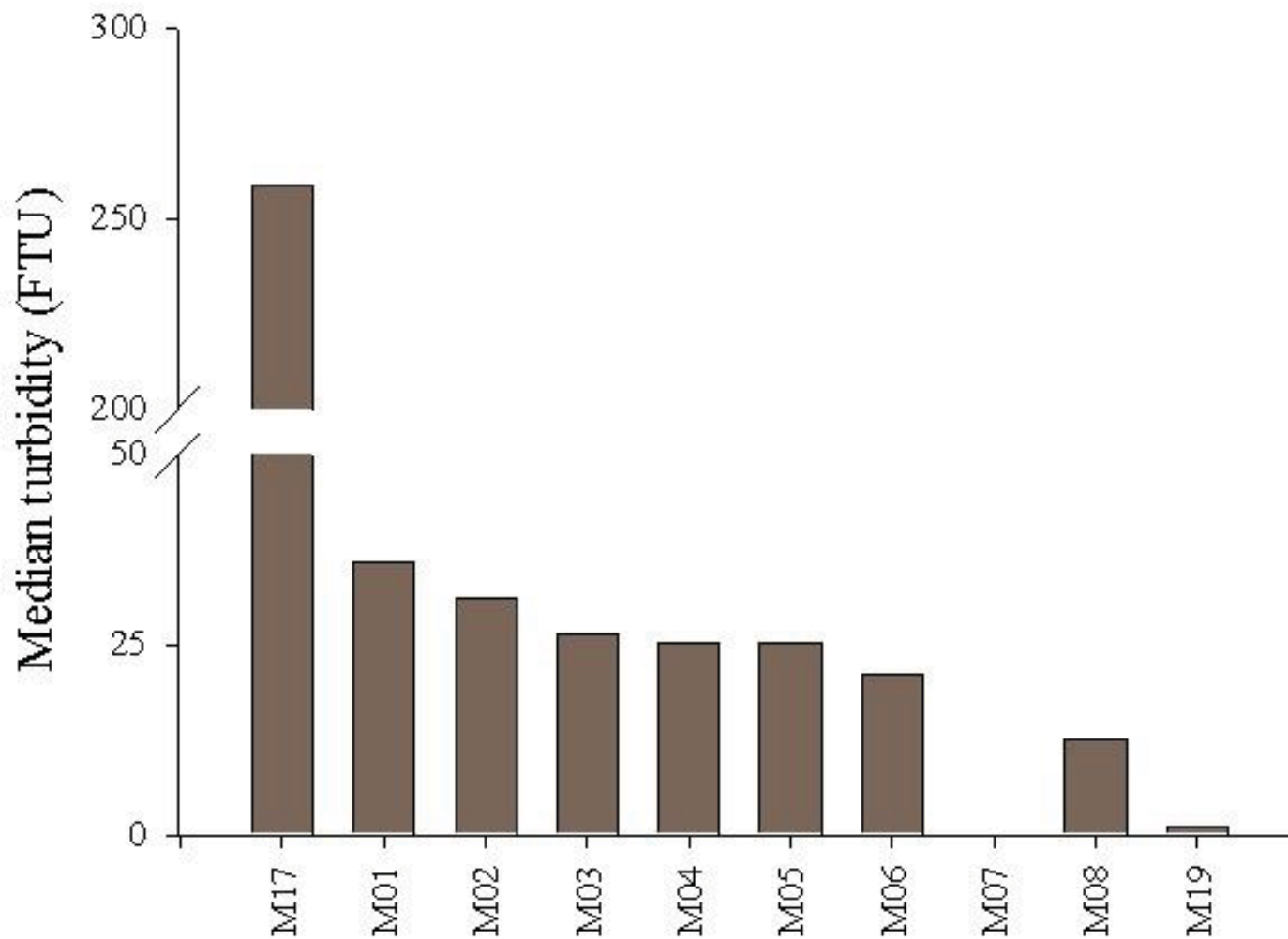




# Transect 1: Surface turbidity



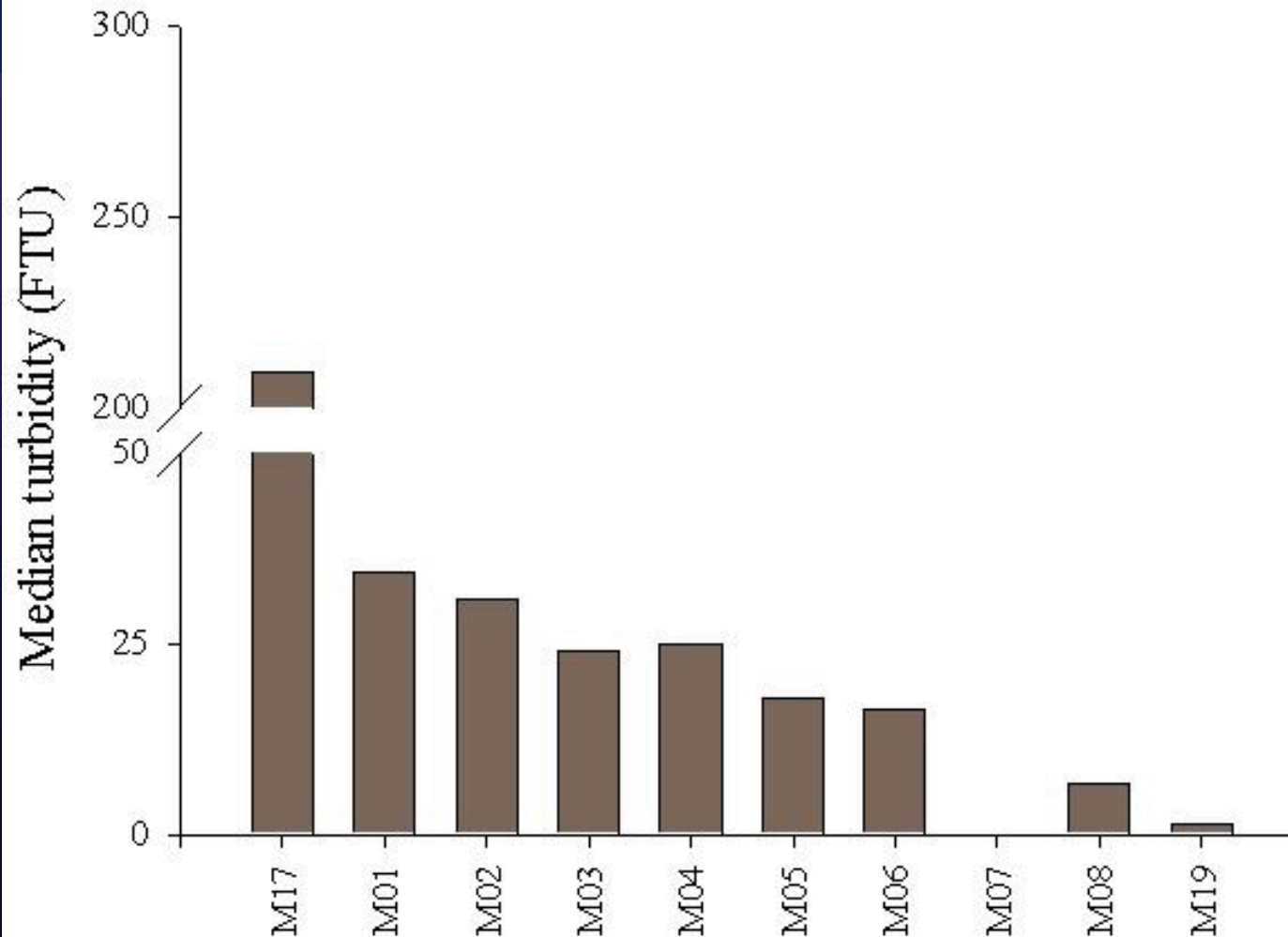
Neap Flood Tide



# Transect 1: Surface turbidity



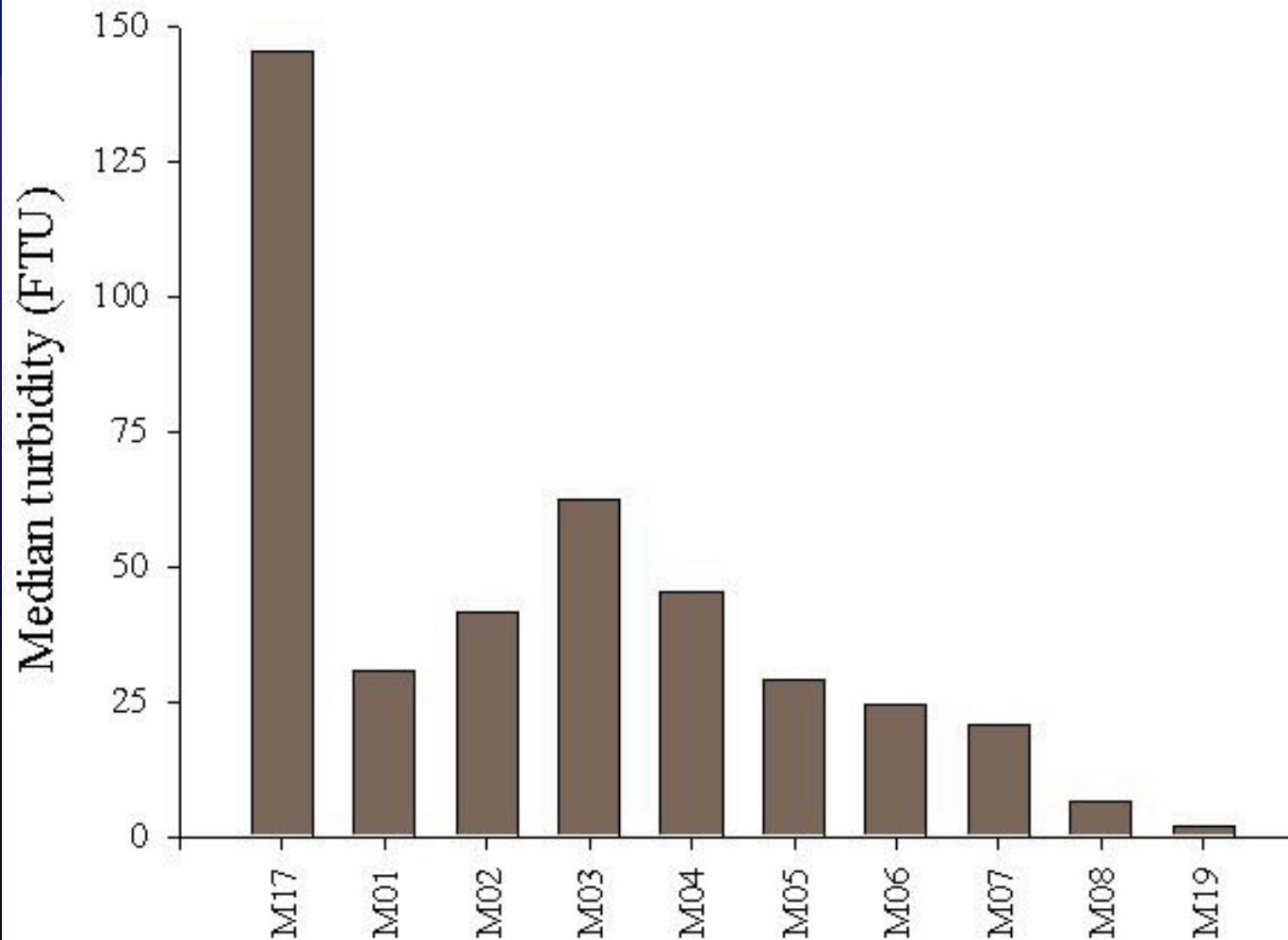
Neap High Tide



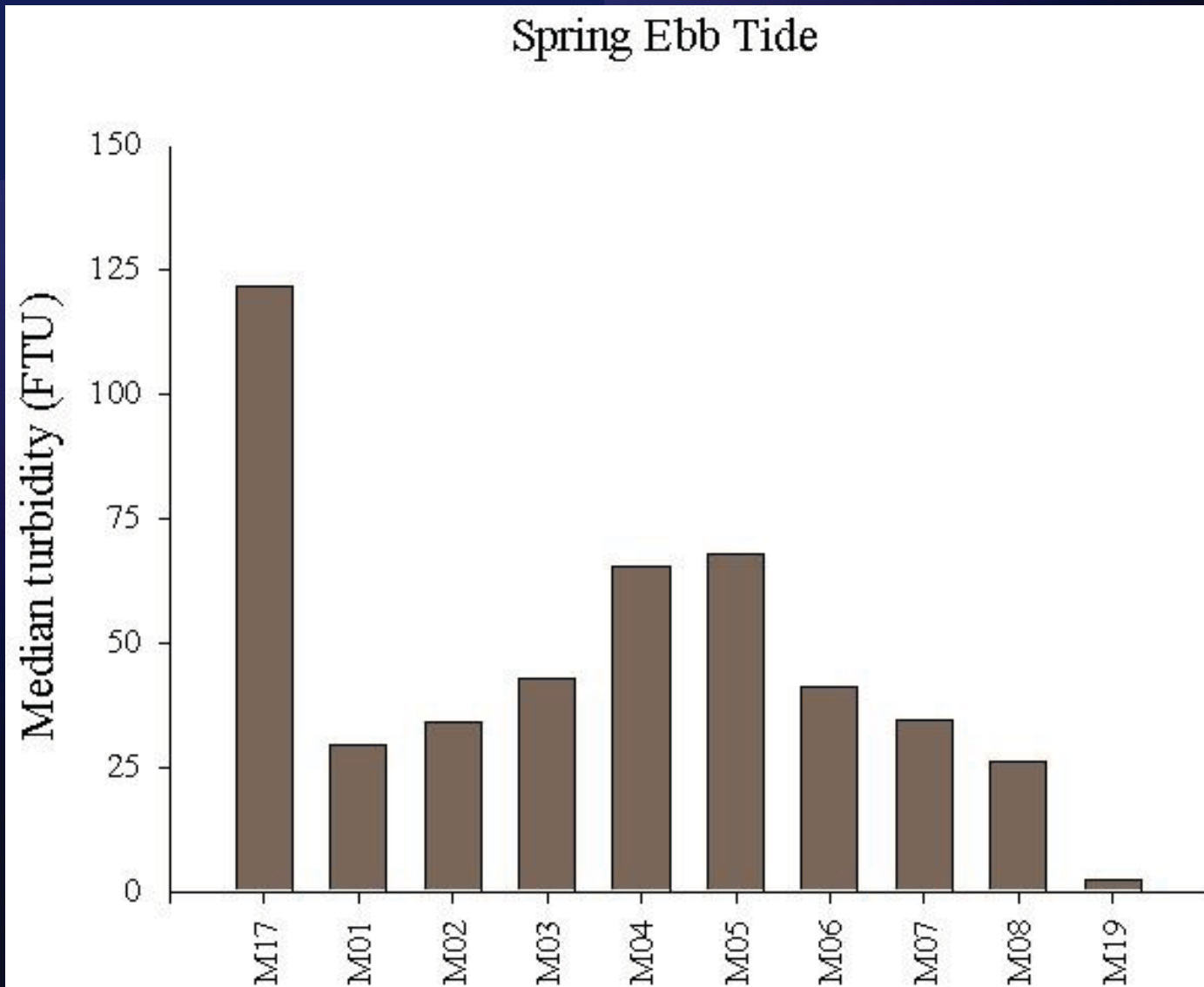
# Transect 1: Surface turbidity



Spring High Tide



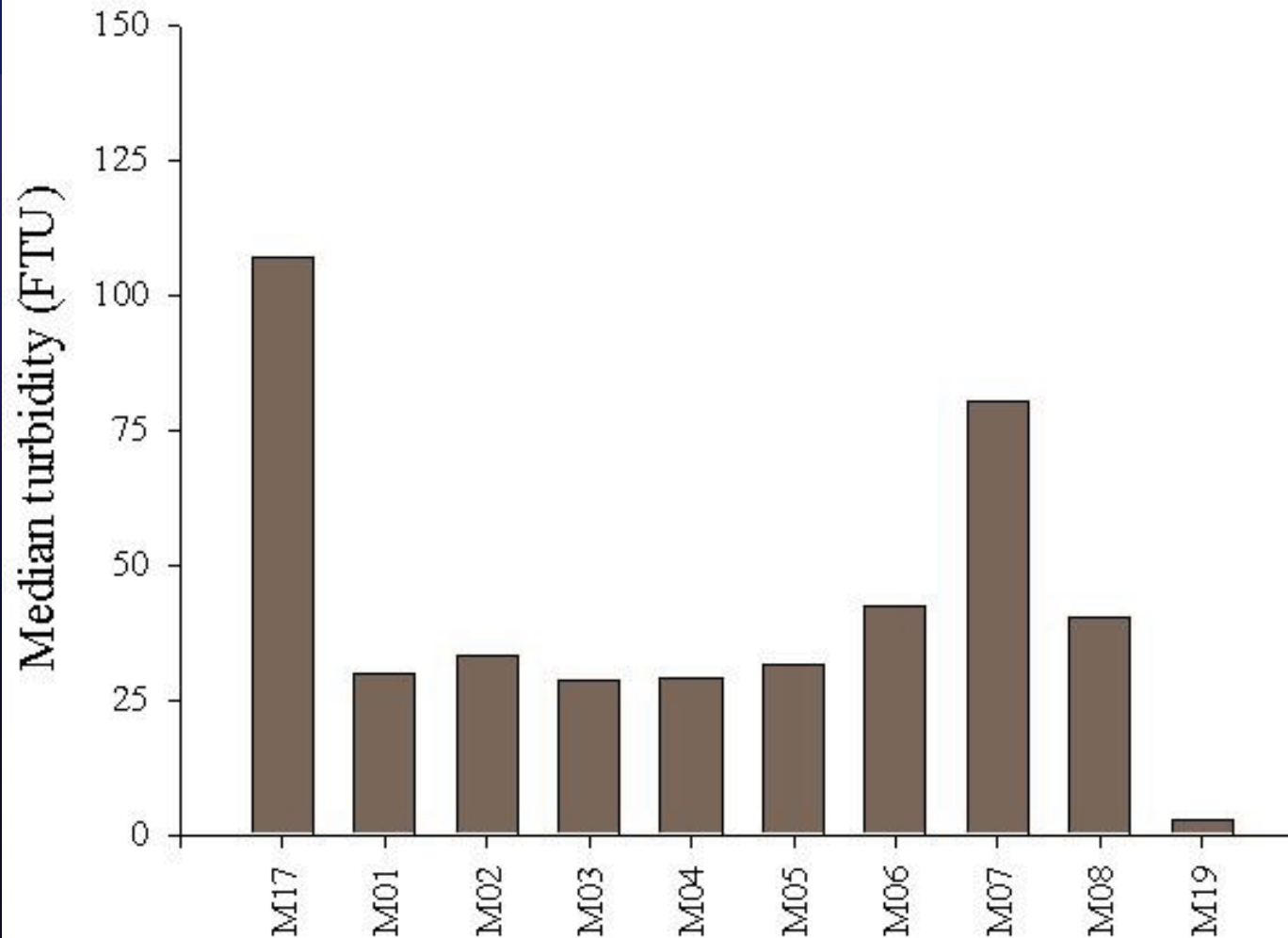
# Transect 1: Surface turbidity



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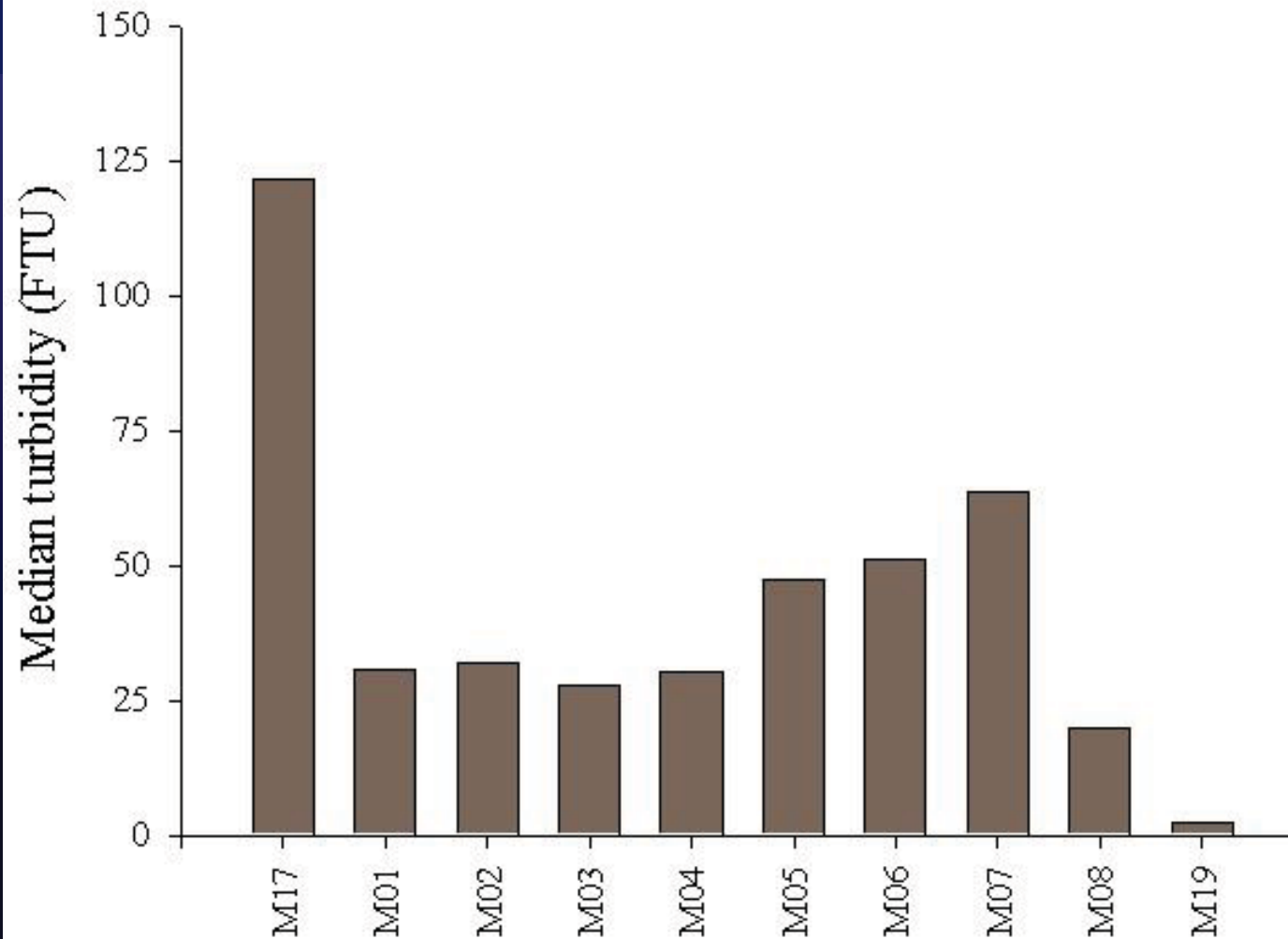
Spring Low Tide



# Transect 1: Surface turbidity



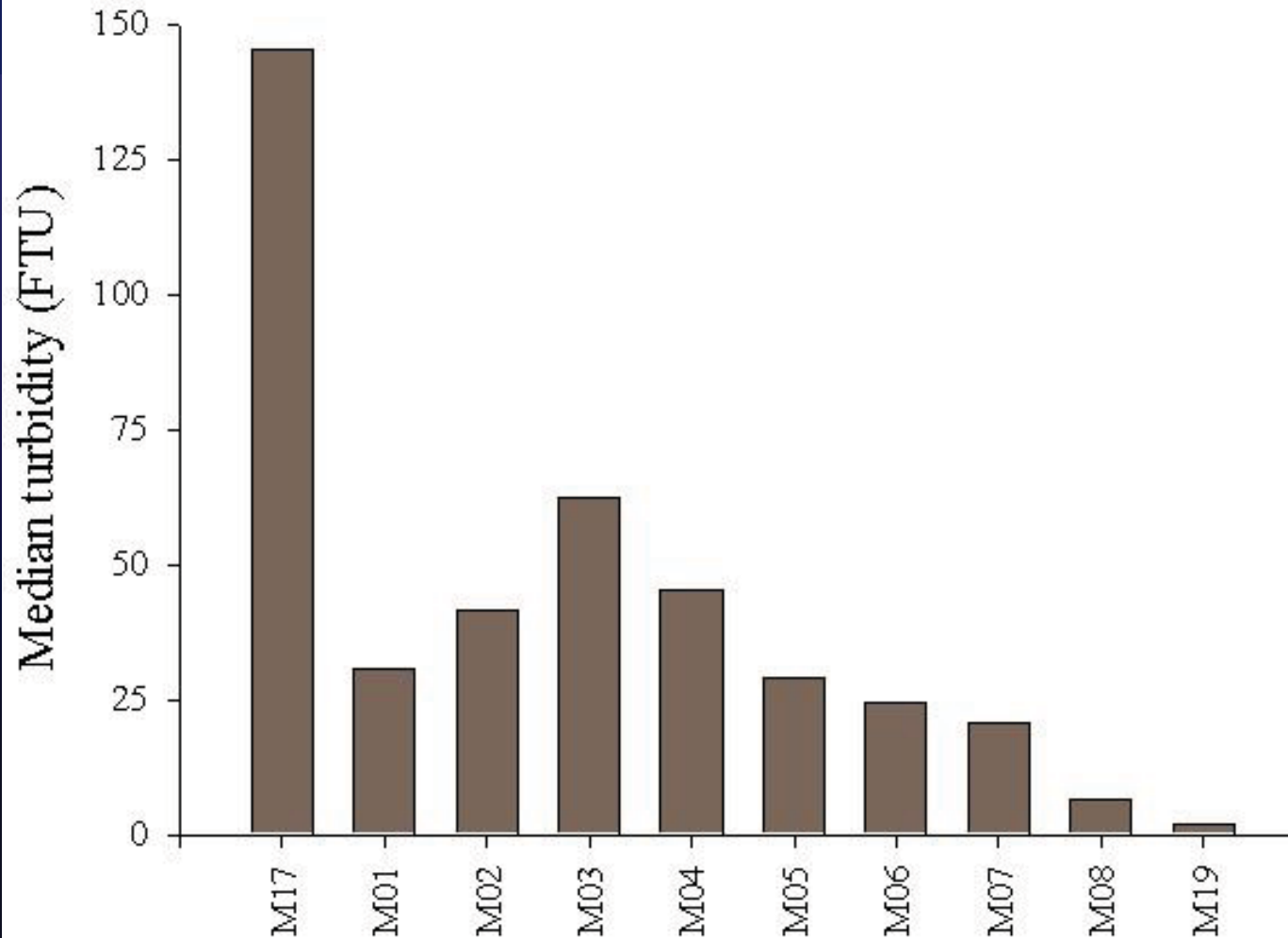
Spring Flood Tide



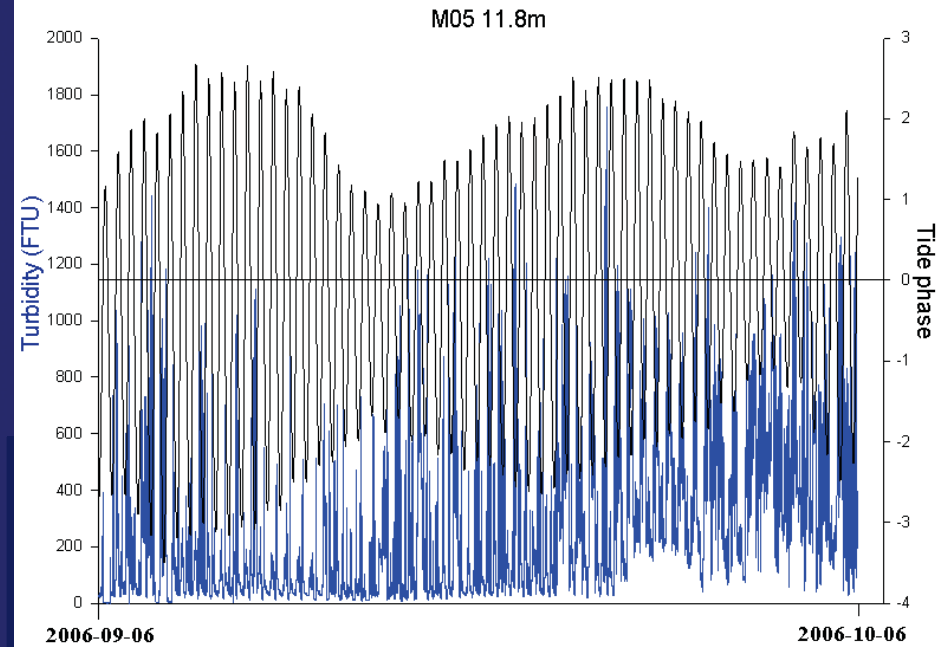
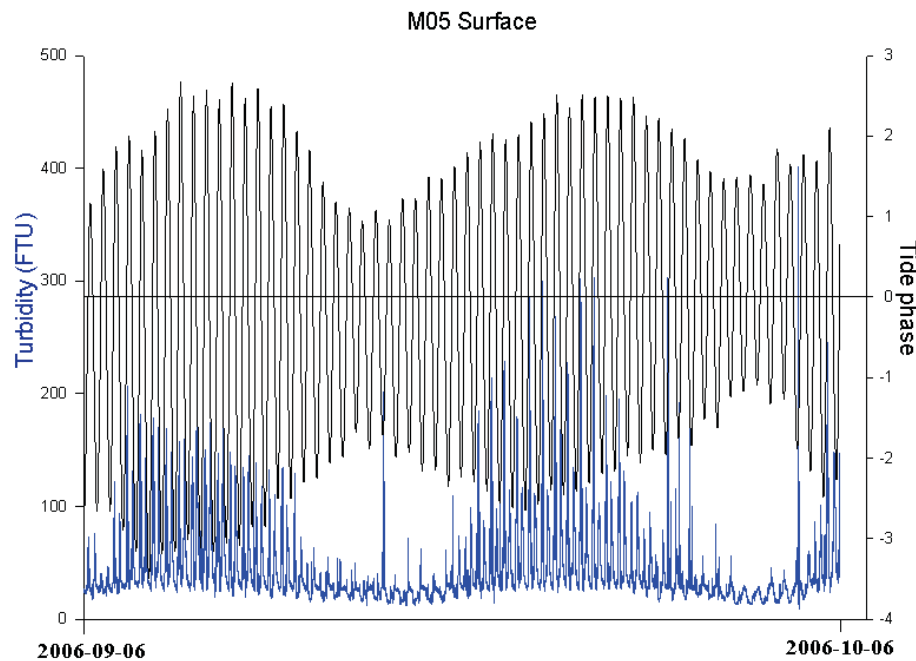
# Transect 1: Surface turbidity



Spring High Tide

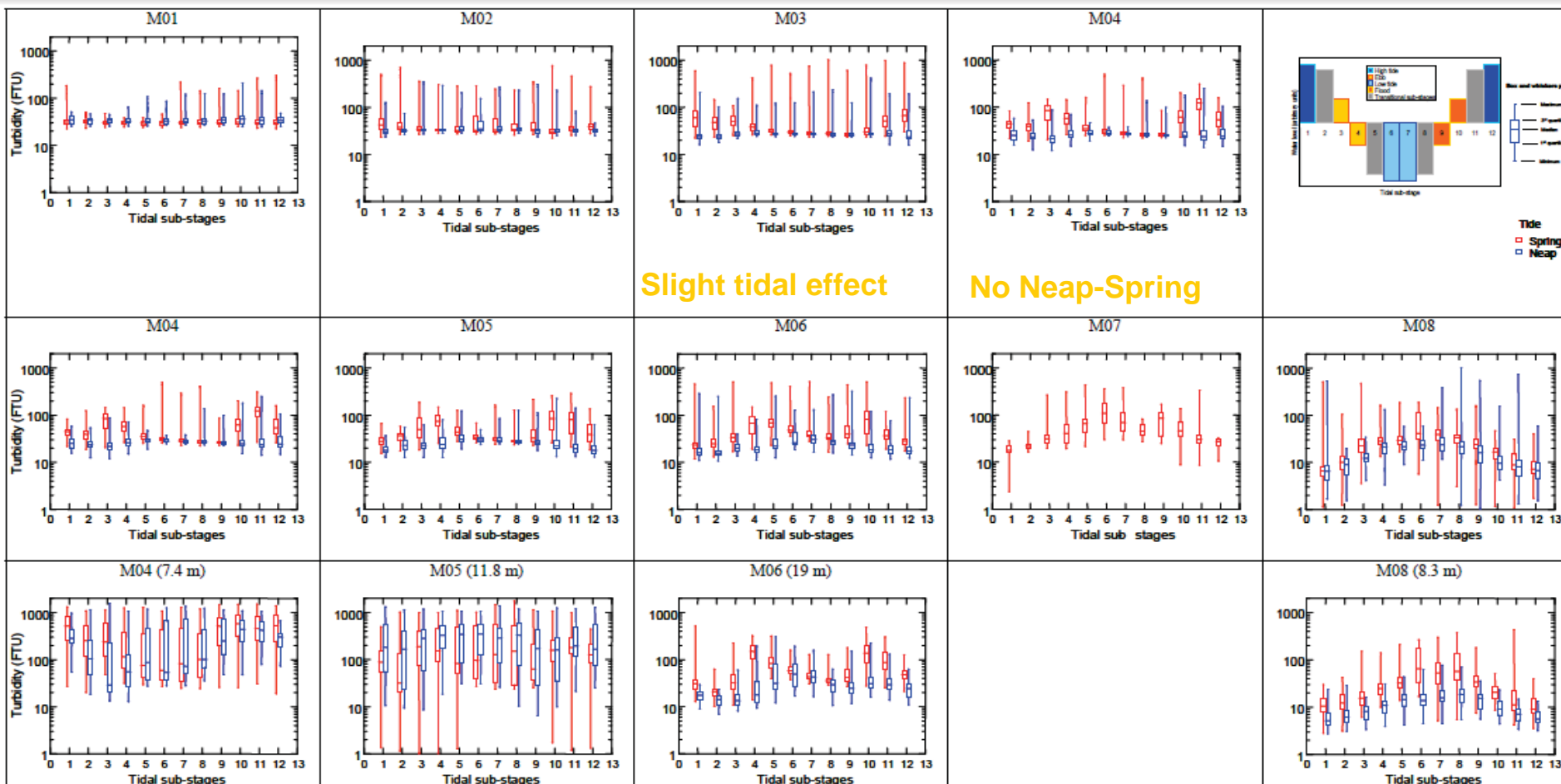
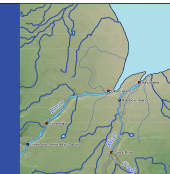


# Transect 1: Tidal variation of turbidity





# Turbidity variations



Slight tidal effect

No Neap-Spring

Figure 4.41

Variation of turbidity with tidal sub-stages for Neap and Spring tides along the Nelson River Estuary.

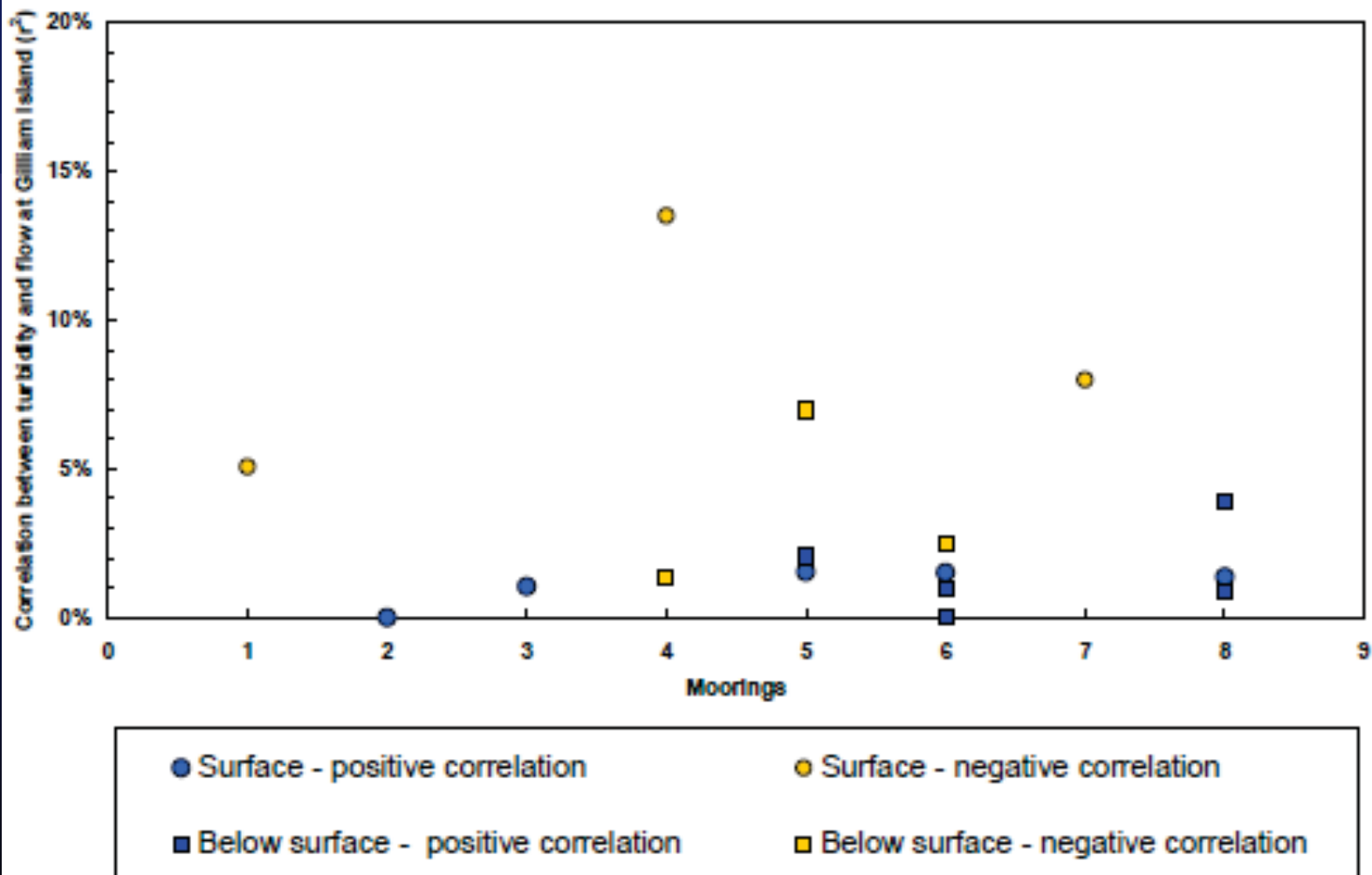
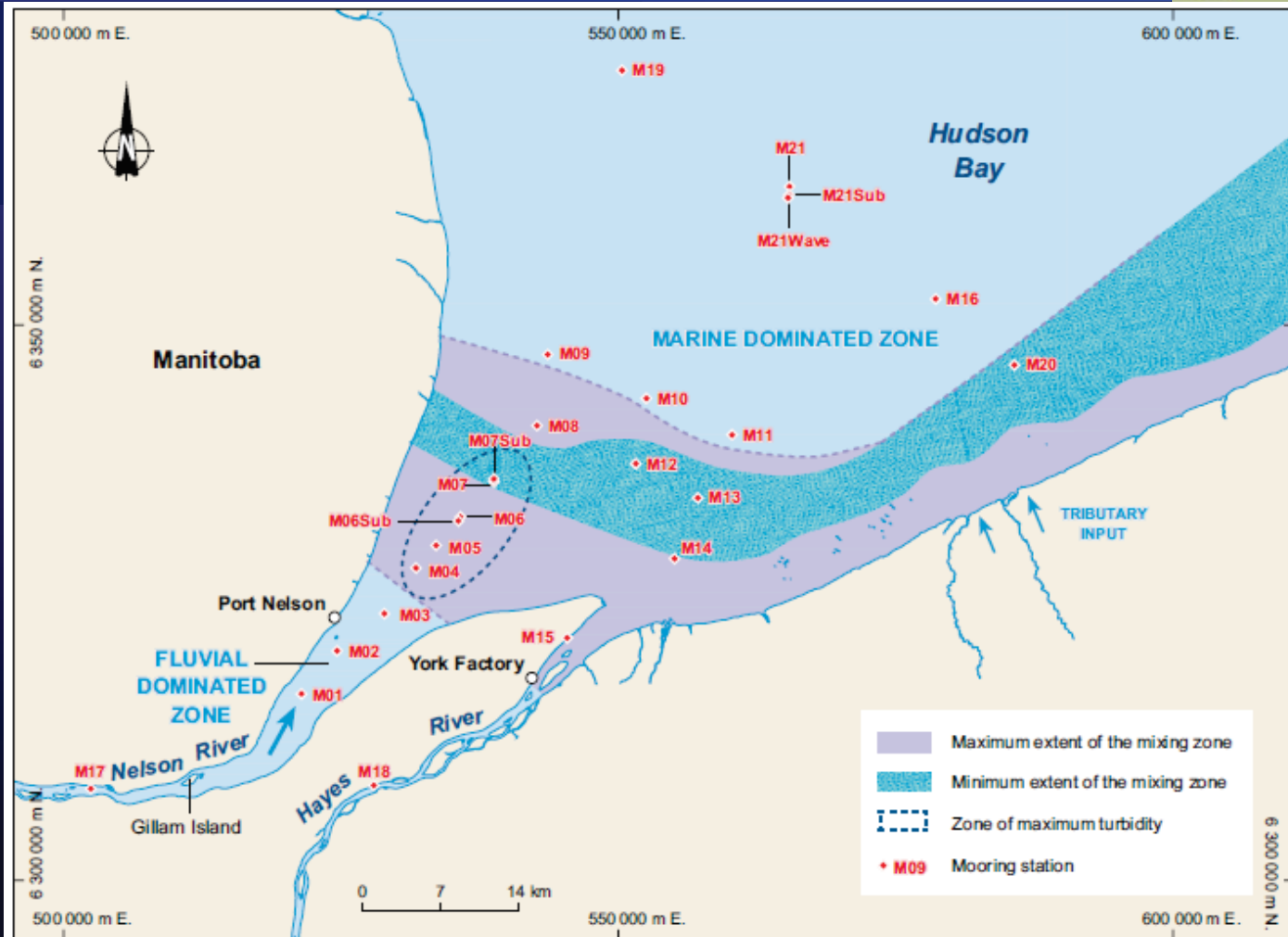


Figure 4.29

Correlation between flows routed at Gillam and 2006 turbidity data.

# Tide related limits of fluvial or marine dominated zones



**Figure 4.45**

Tide-related limits of fluvial- or marine-dominated zones of the Nelson River estuary, and their control on the extent of the mixing zone.



## •Contrasting North and South Shores

### •North

•Muddy

•Narrow and Sinuous Streams

•Vegetation close to shore

### •South

•Sandy

•Braided or Unchanneled Streams

•Remnant Beach Deposits

•Vegetation far from shore