



Florida Department of Environmental Protection
Division of Water Resource Management

Regulation and Evaluation of Hardbottom Monitoring

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Beaches, Inlets and Ports Program





Nourishment & Hardbottom





Beach Nourishment

Benefits:

Restores and widens recreational beach area

Increases protection for upland structures

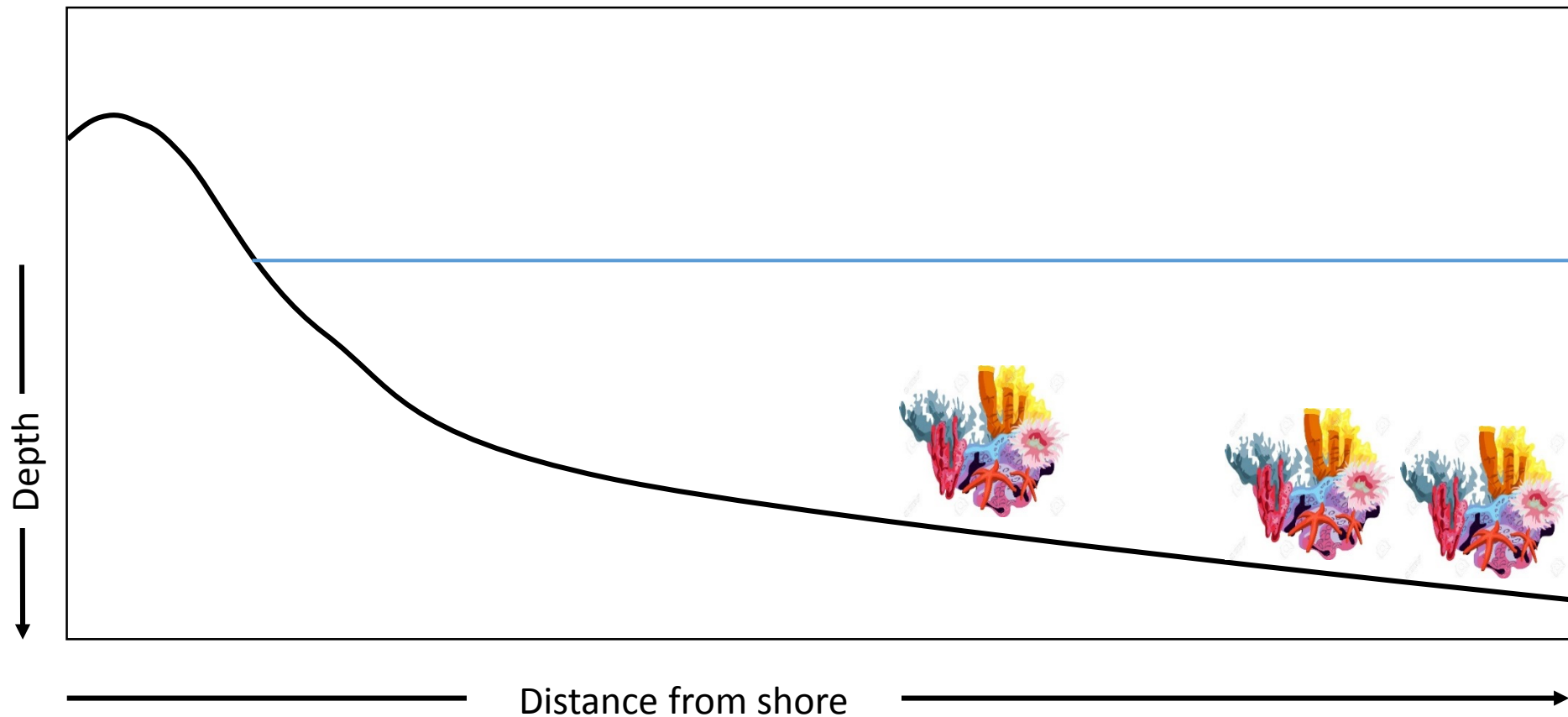
Maintains habitat for organisms (e.g., sea turtles, shorebirds)





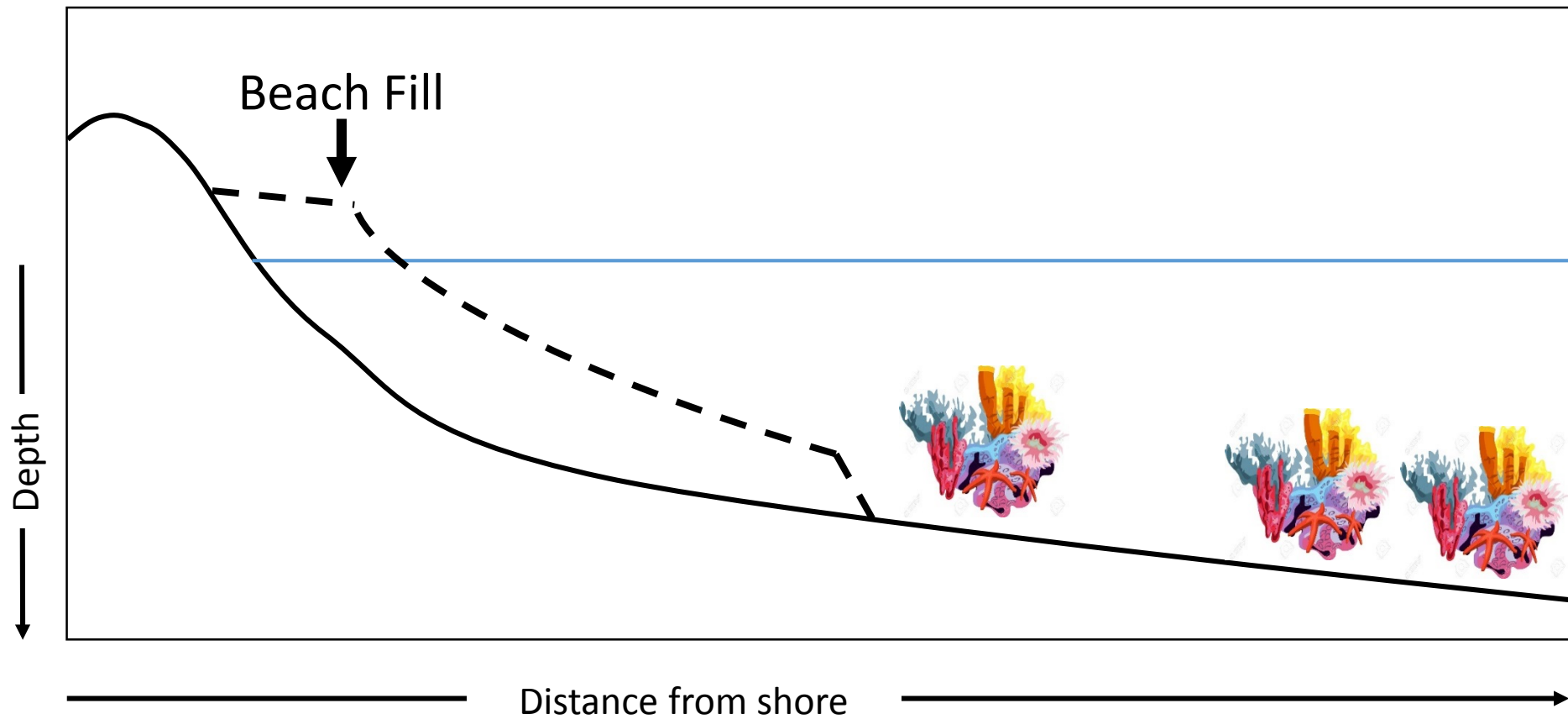
Nourishment & Hardbottom

Potential consequences





Nourishment & Hardbottom

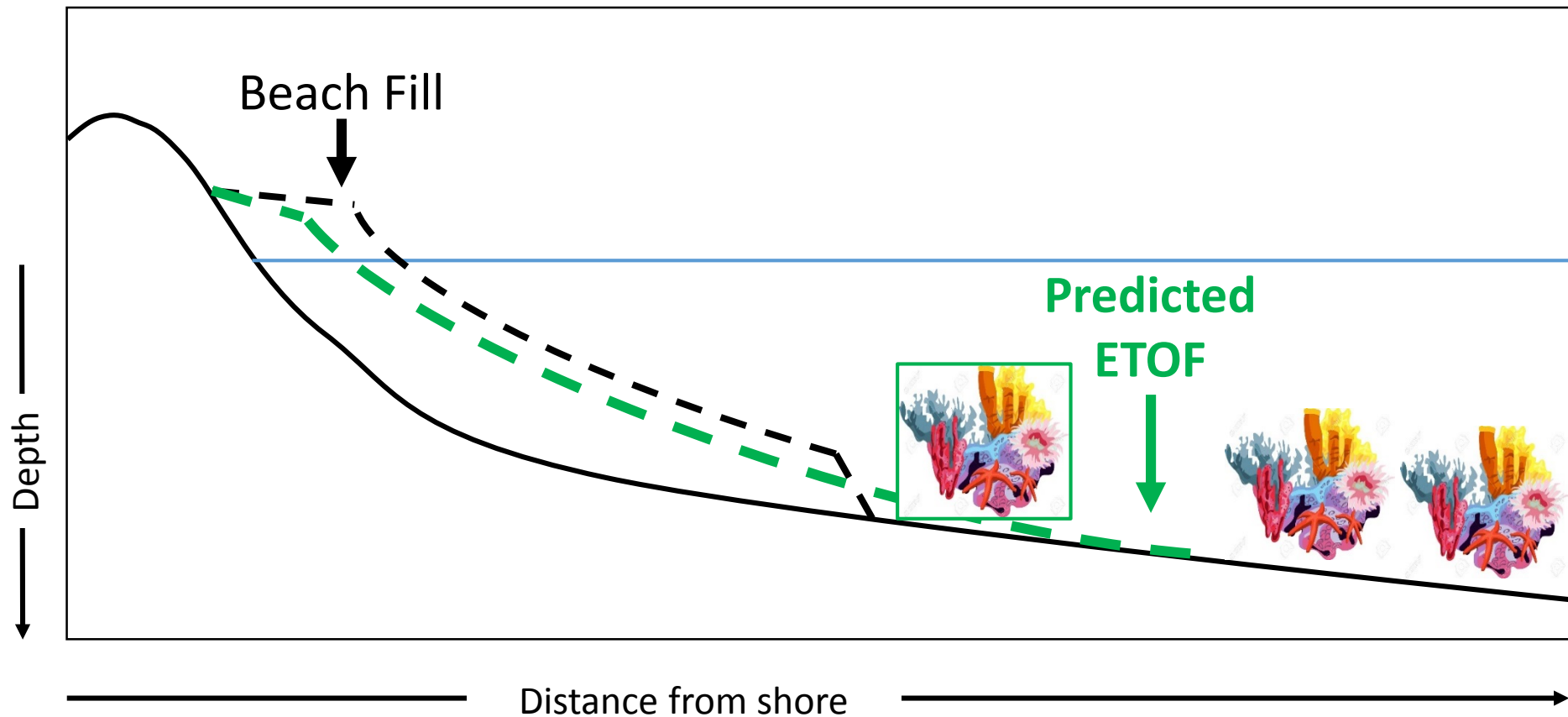




Nourishment & Hardbottom

Predicted/Permitted Impacts –

Within the predicted Equilibrium Toe of Fill (ETOF)

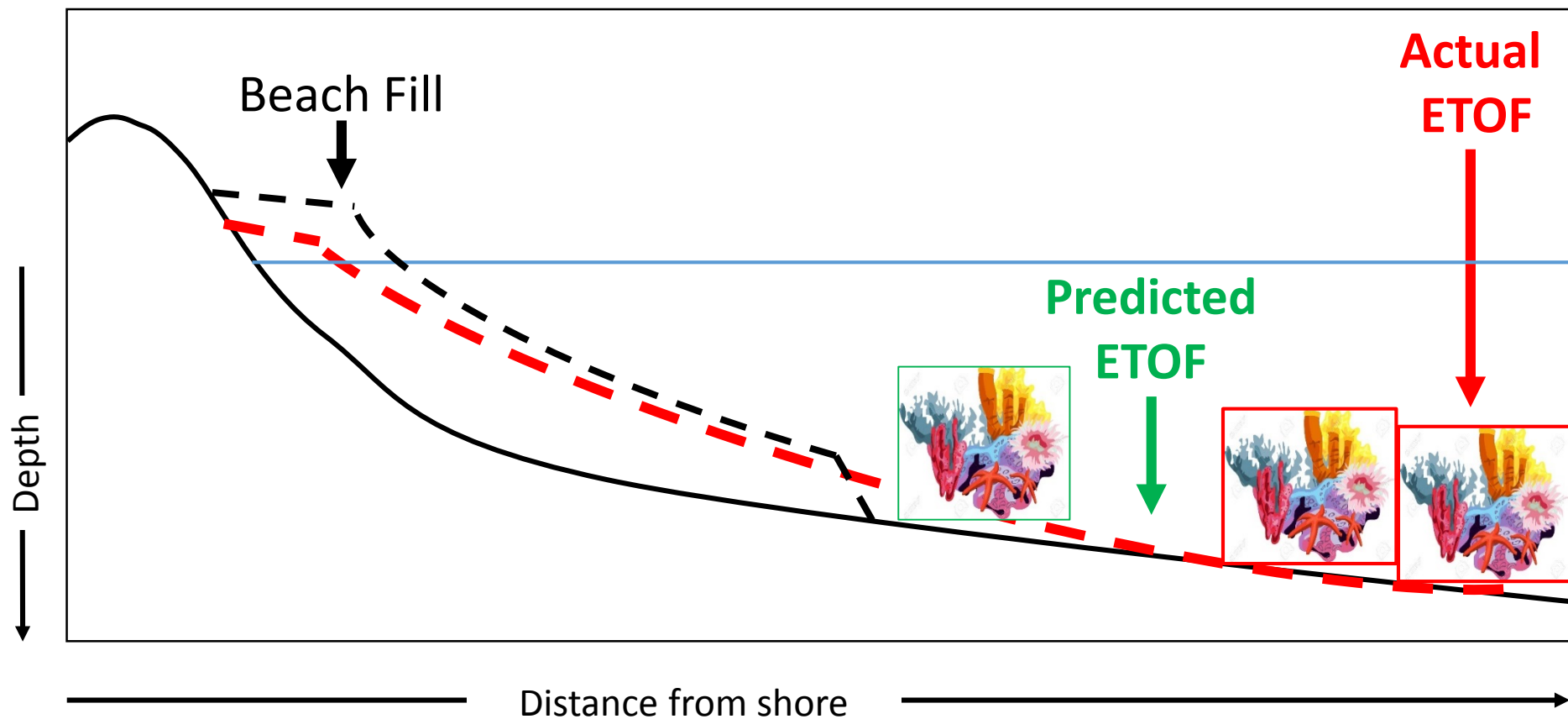




Nourishment & Hardbottom

Unpredicted/Unpermitted Impacts –

Outside the predicted ETOF





Hardbottom Habitats





Biological Monitoring

Monitoring required for reasonable assurance

- Rule Chapter 62B-41 005 (16) (17) F.A.C., Section 161.041 (4) F.S.

Aim: To determine whether project-related impacts to nearshore hardbottom communities exceed permitted (predicted) impacts

Indicators of potential project related impacts:

- Increases in sediment (depth, cover)
- Declines in abundance of organisms and/or deleterious shifts in community composition





Standard Operating Procedures (SOP)

Hardbottom Monitoring SOP

- Guidance document
- Details Department-approved methodology
- Standardizes procedures for increased consistency

Current version of SOP located on FDEP Beaches web page

<http://www.dep.state.fl.us/beaches/publications/pdf/SOPNearshoreHardbottomBioMonitoring.pdf>

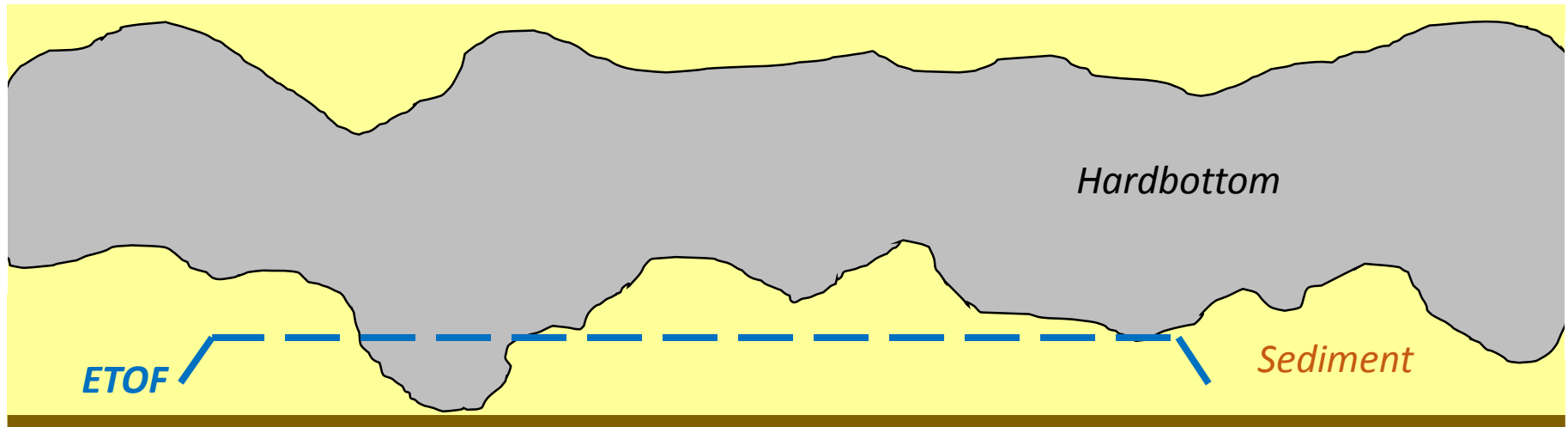


Biological Monitoring

Surveys – pre- and post- construction

Sampling units – permanent

Methods:

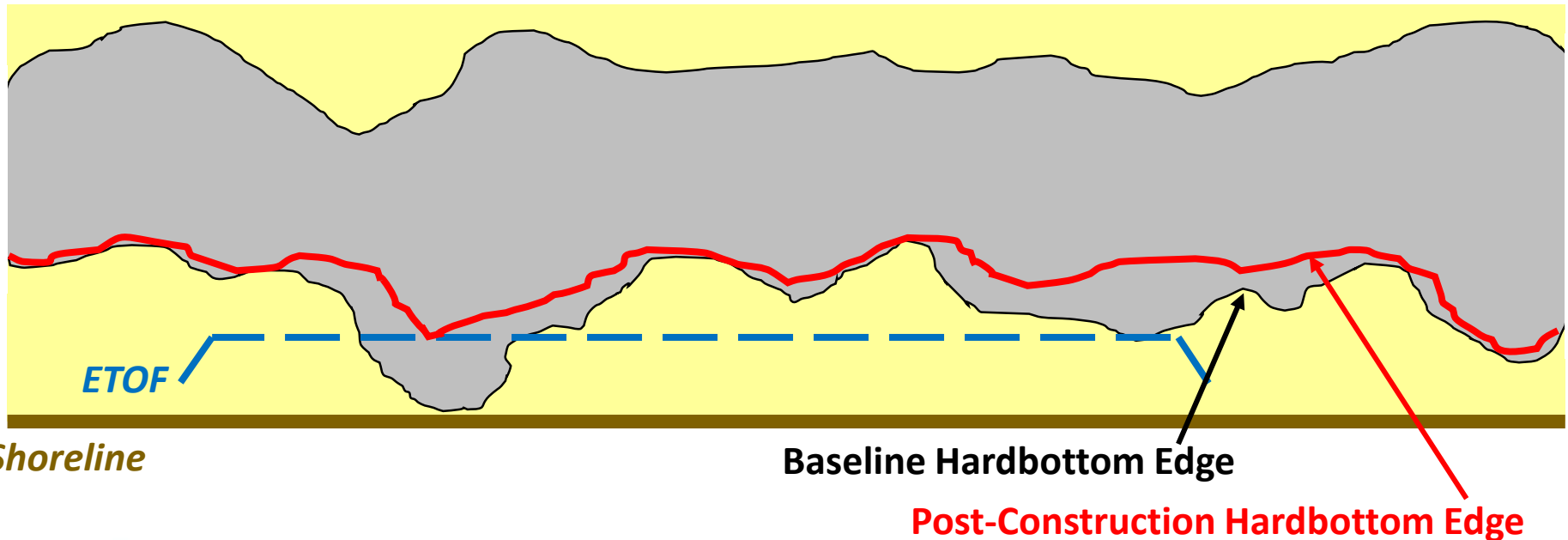


Shoreline



Biological Monitoring

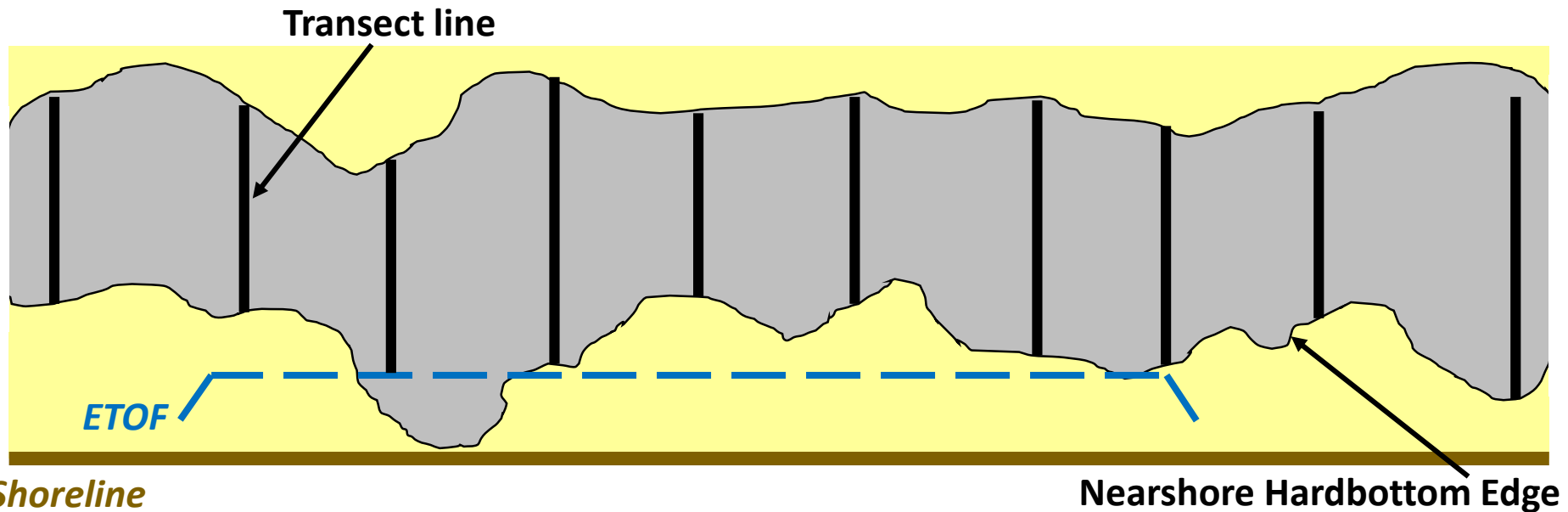
Nearshore hardbottom edge mapping





Biological Monitoring

Surveys of permanent transects

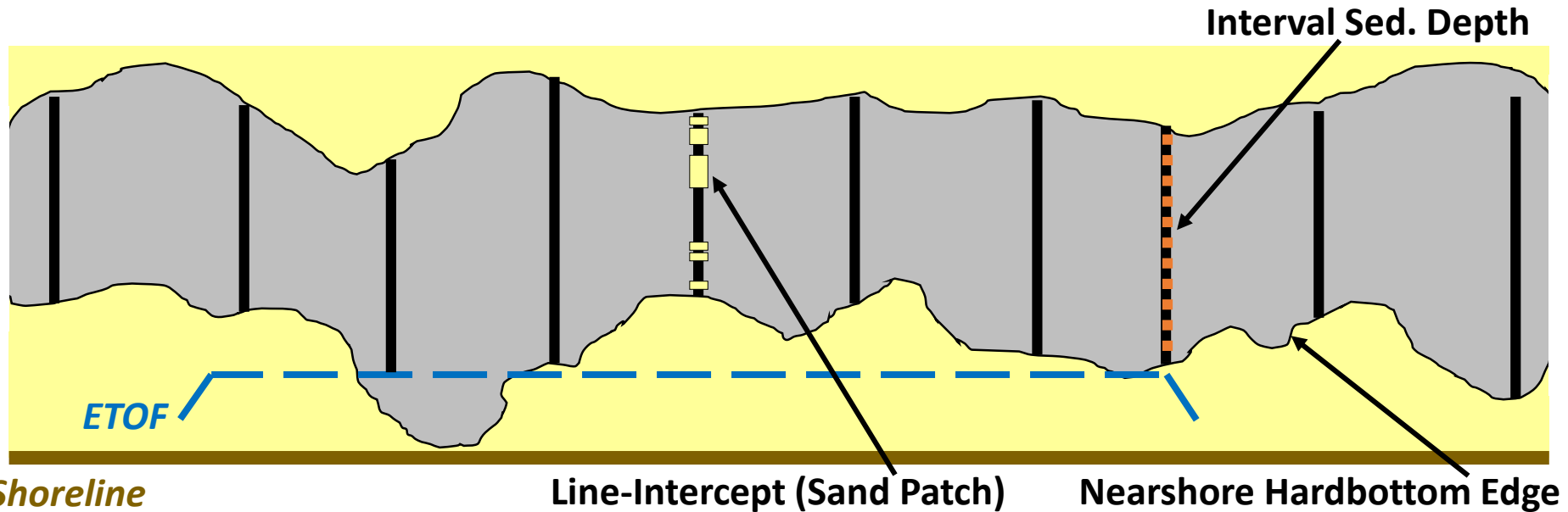




Biological Monitoring

Surveys of permanent transects

- Line-Intercept for sand and hardbottom
- Interval sediment depth measurements



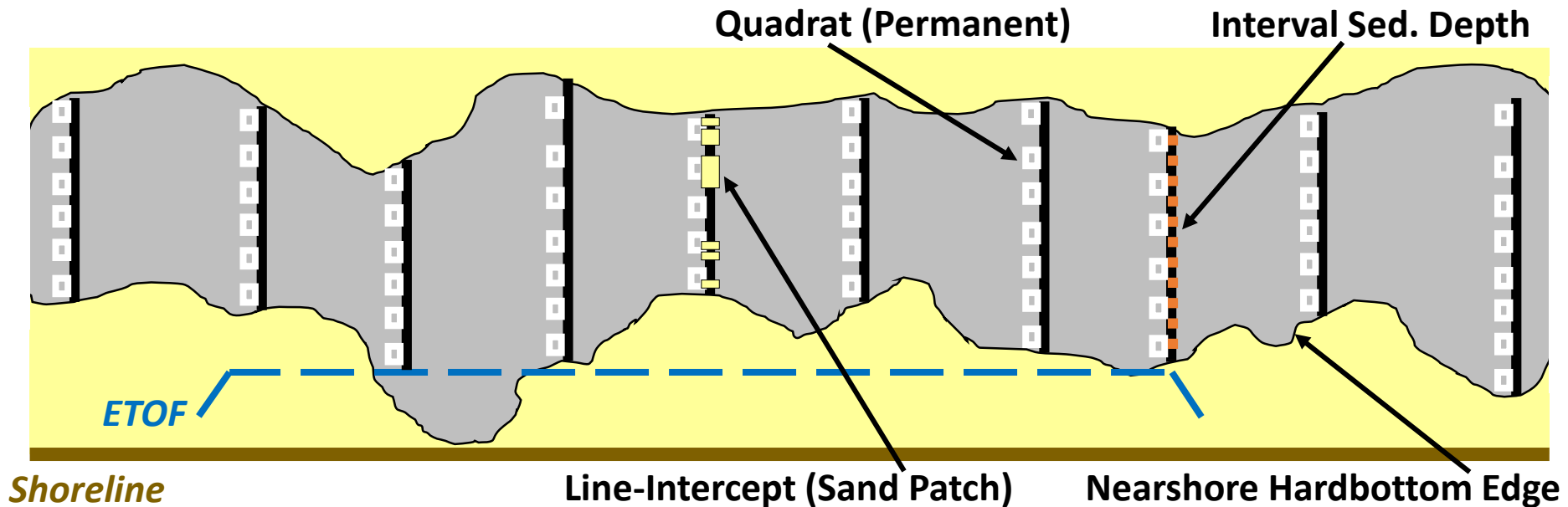


Biological Monitoring

Surveys of permanent transects

- **Quadrat (permanent) surveys**

- Physical: Sediment depth, hardbottom relief
- Abiotic: Substratum cover (sand, rubble, etc.)
- Biotic: Functional group cover



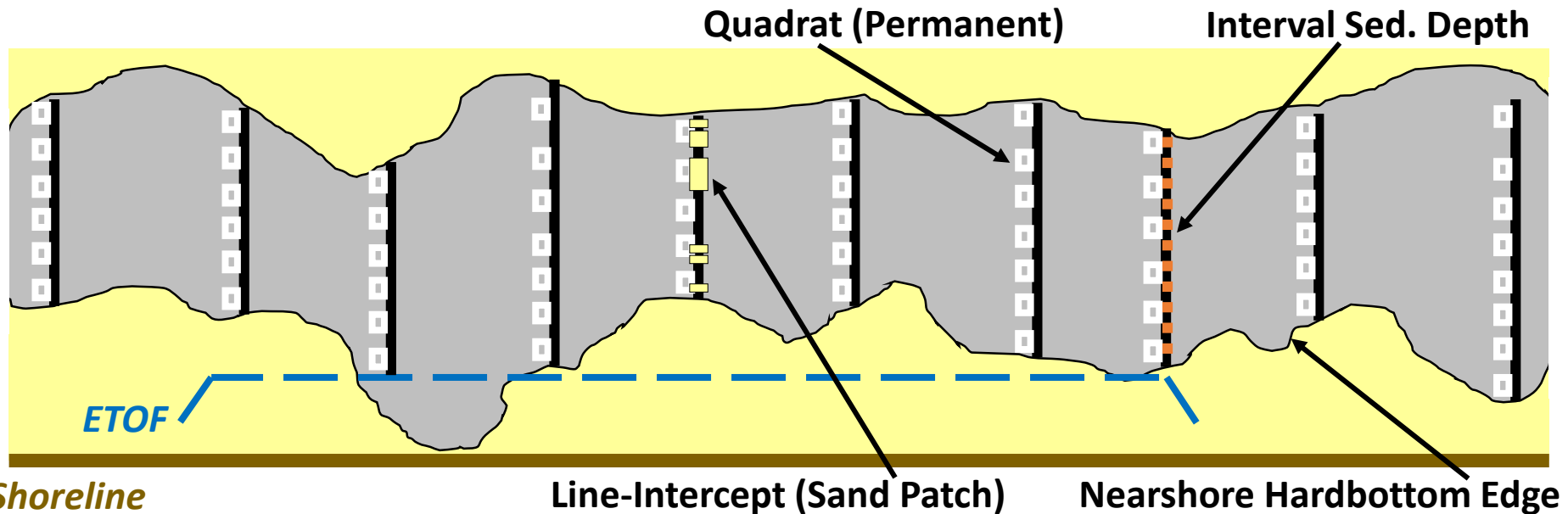


Physical Monitoring

Biological Monitoring

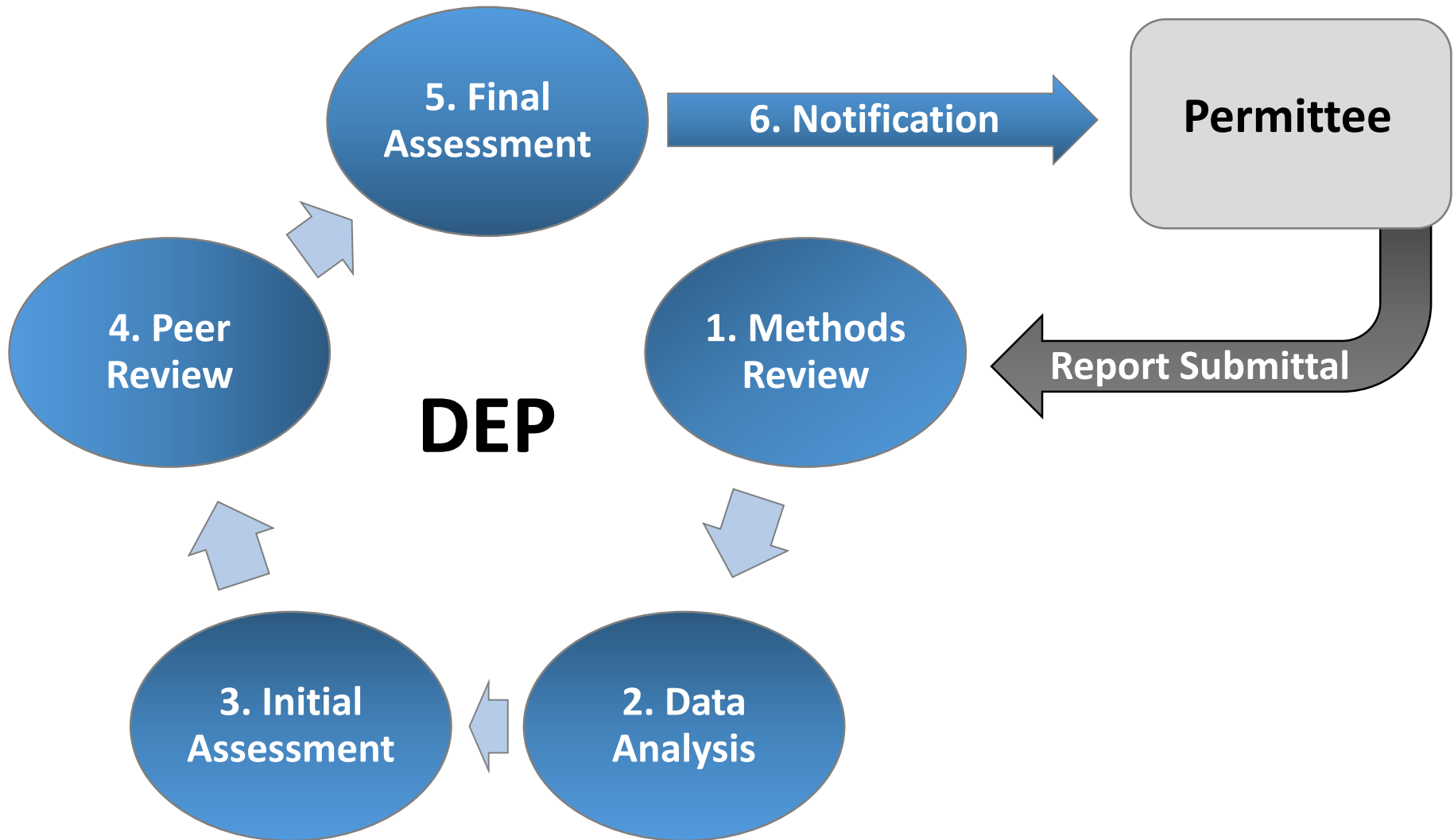
Physical Monitoring:

- Shoreline position
- Beach volume





Evaluation Process





Methods Review

Do methods match Permit and Plan requirements?

- Check Biological Monitoring Report
- Check Data
 - Locations/positions and numbers
for transects, quadrats, and video segments



Data Analysis

Steps:

1. Organize

E.g., Master species list

2. Visualize

Graph summary statistics

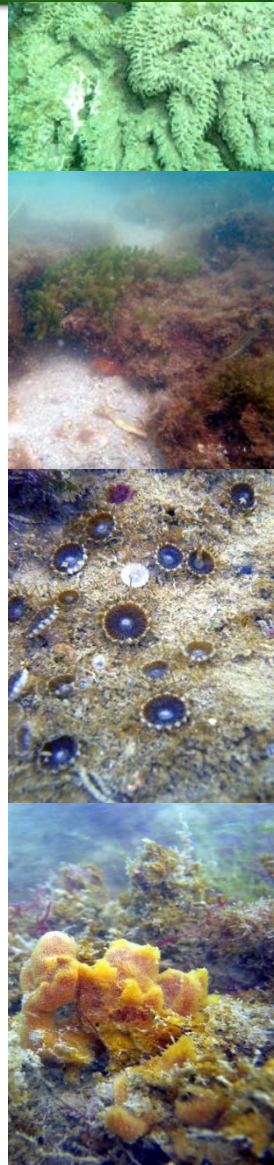
At multiple scale for each metric

Cluster and NMDS for community data

3. Analyze

Univariate tests

Multivariate tests

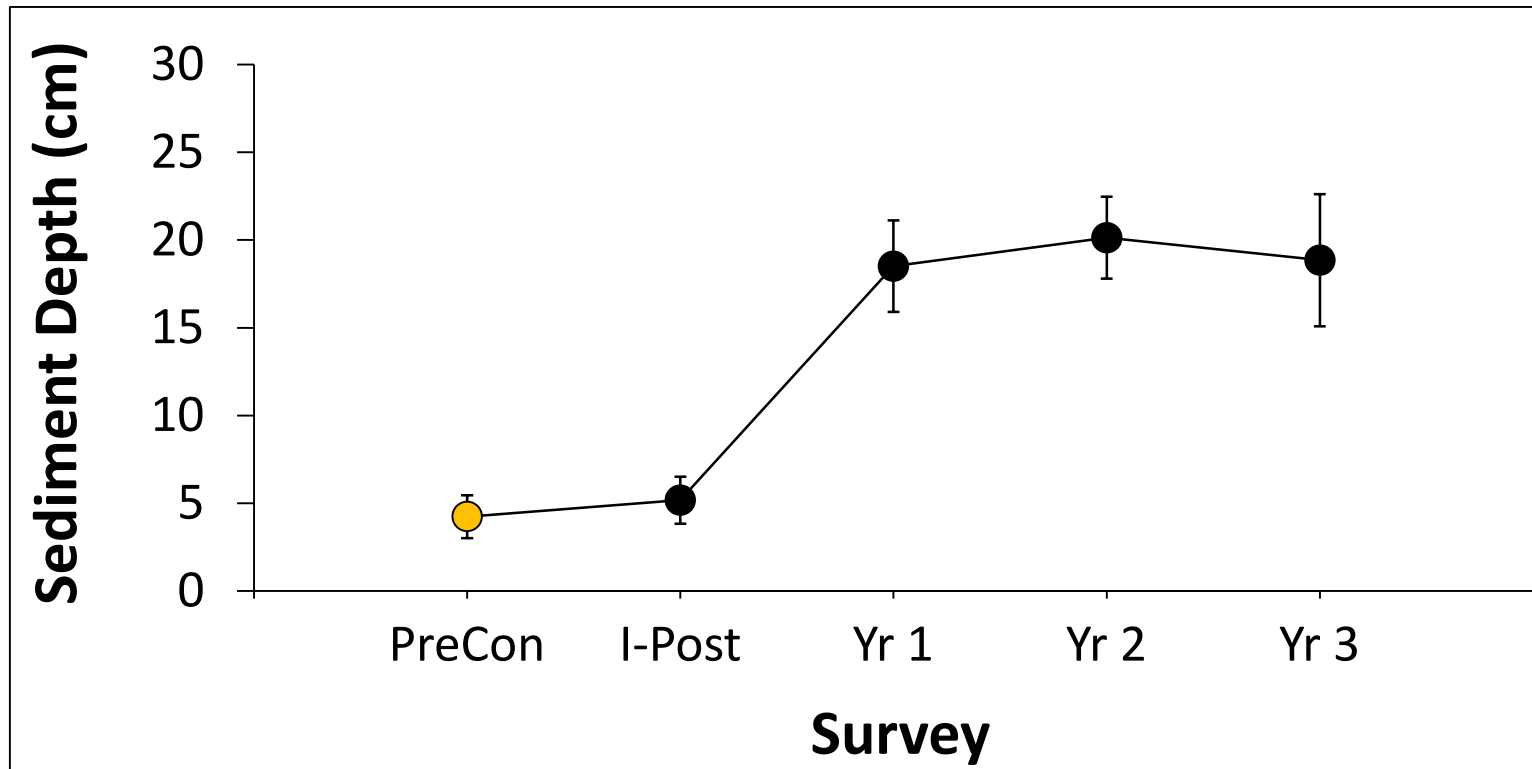




Data Analysis

Step 2. Visualization – Interval Sediment Depth

A. Project level

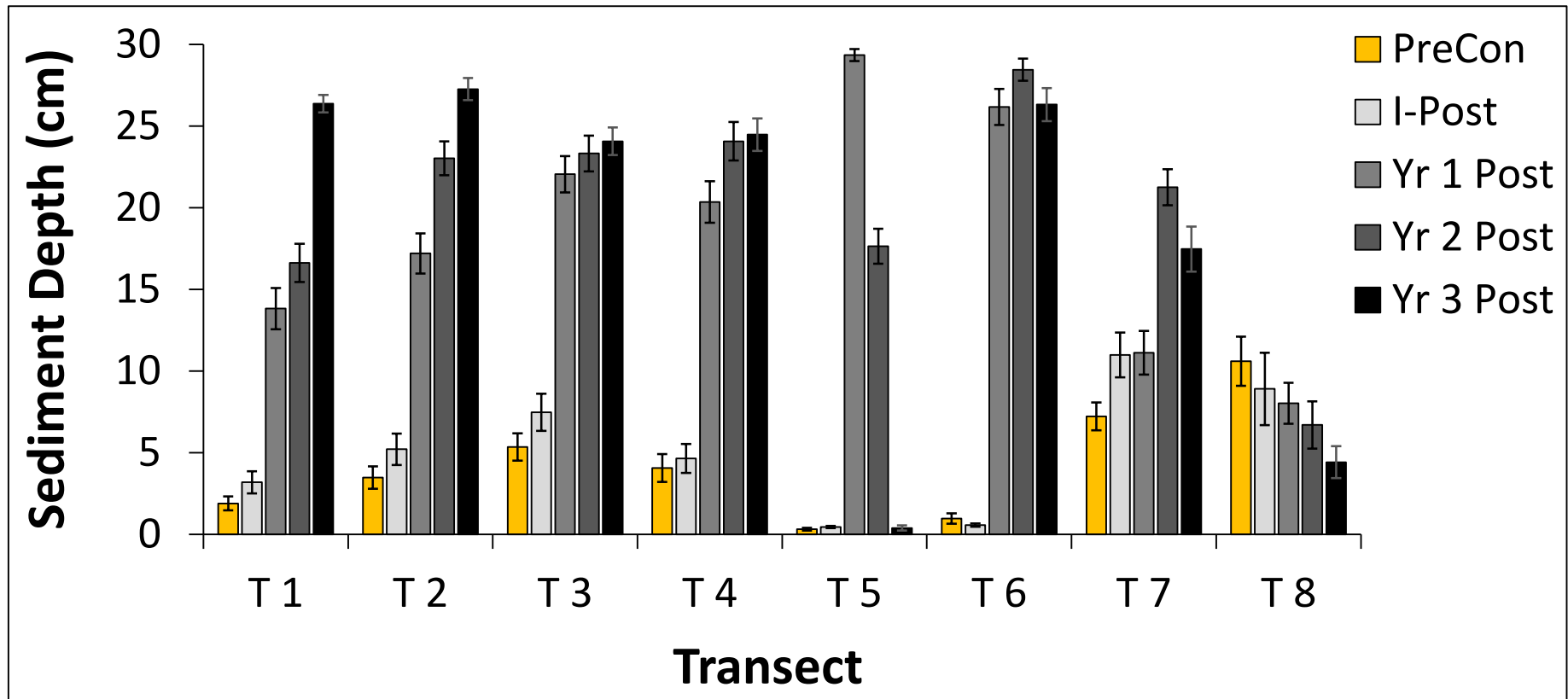




Data Analysis

Step 2. Visualization – Interval Sediment Depth

B. Transect level

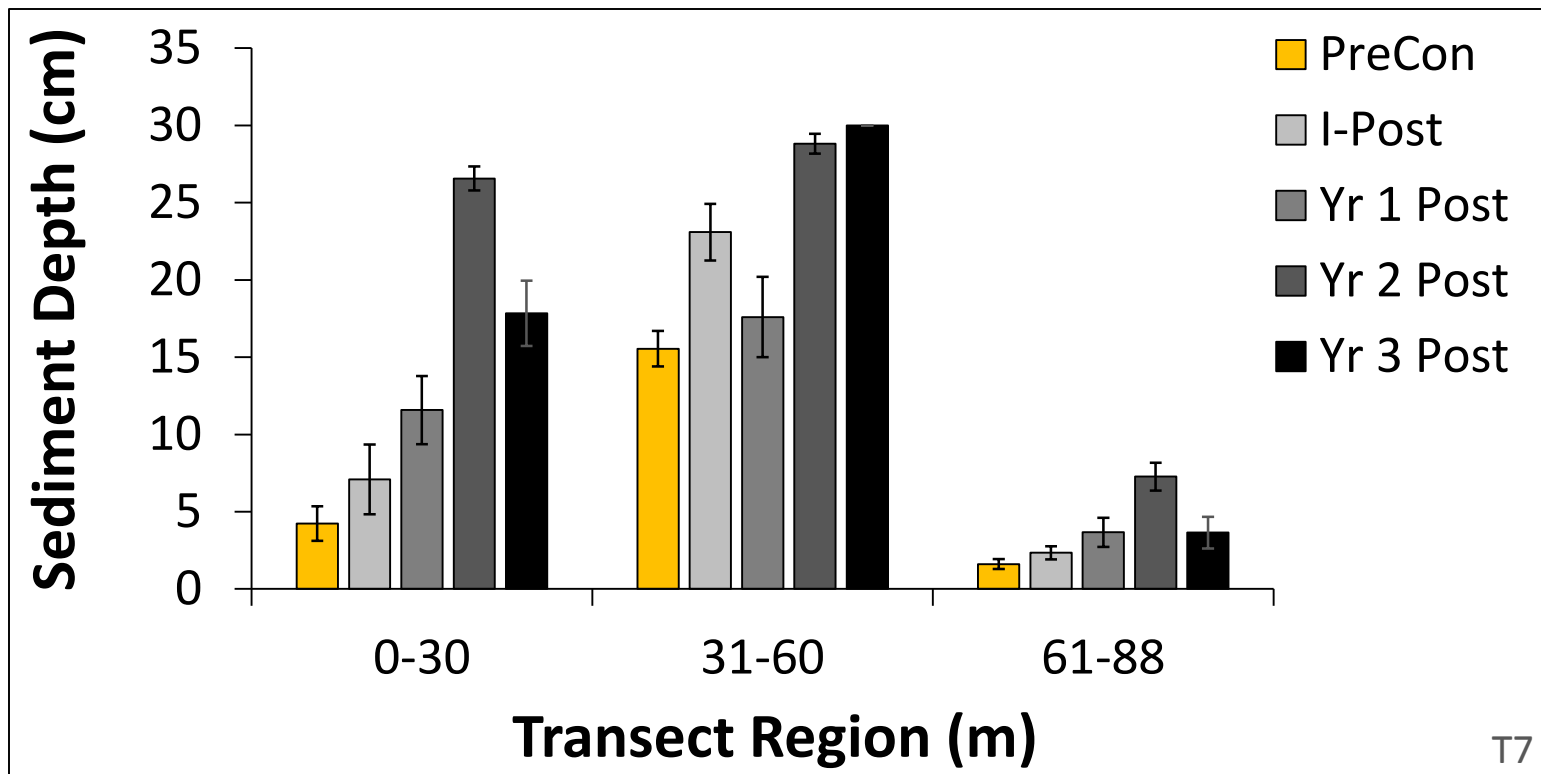




Data Analysis

Step 2. Visualization – Interval Sediment Depth

C. Regions within a Transect level



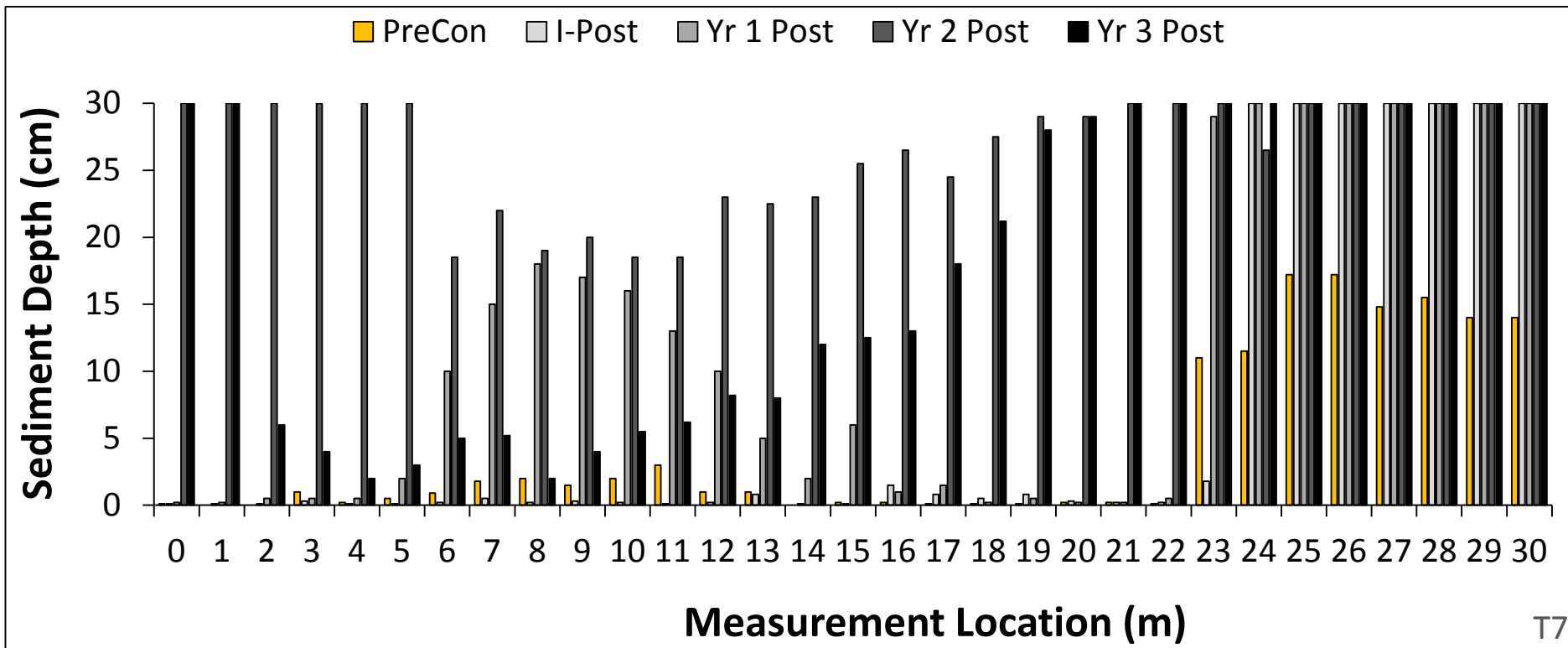
T7



Data Analysis

Step 2. Visualization – Interval Sediment Depth

D. Region (nearshore) within a Transect level



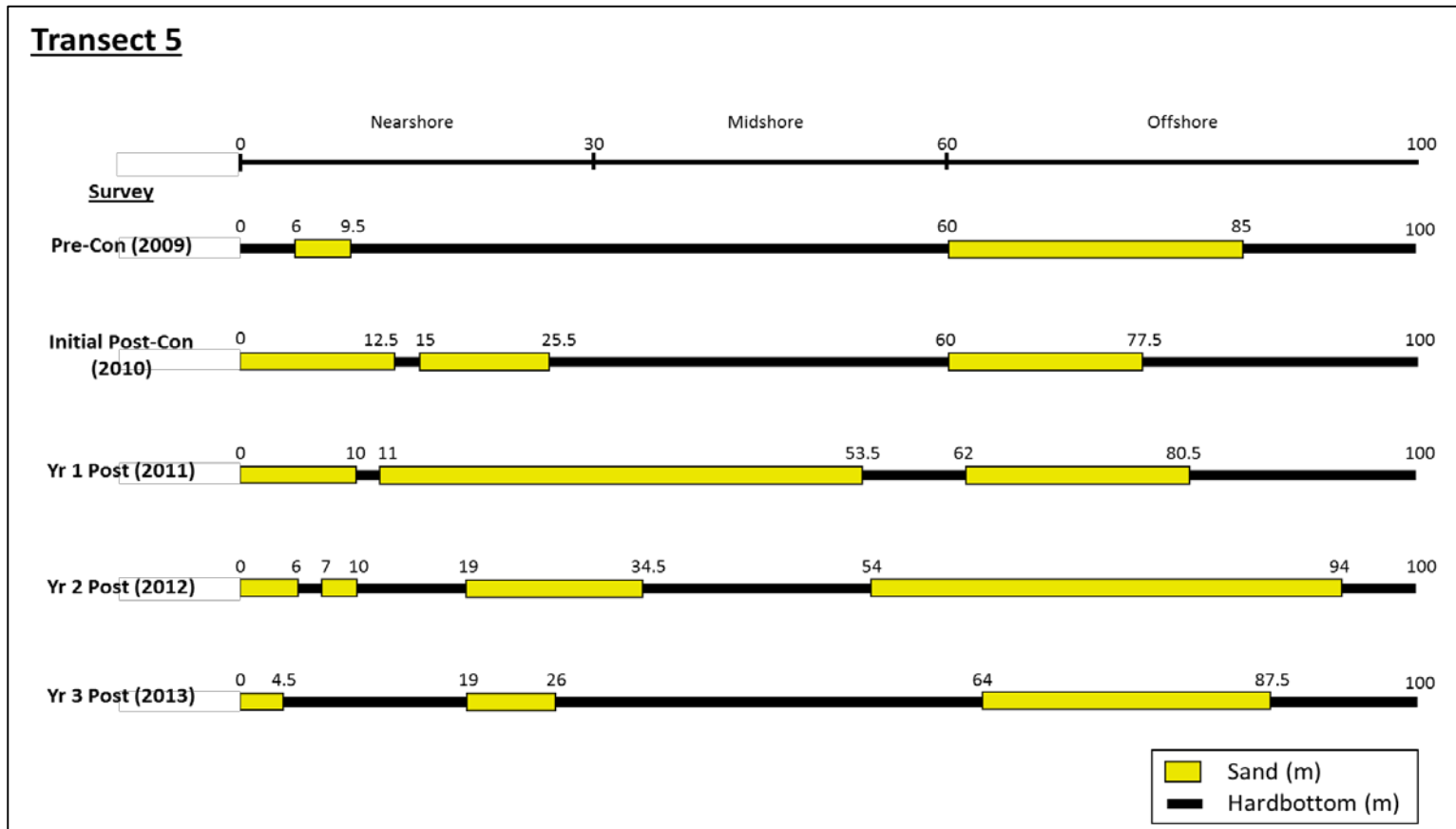
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Data Analysis

Step 2. Visualization – Line-Intercept

B. Transect level

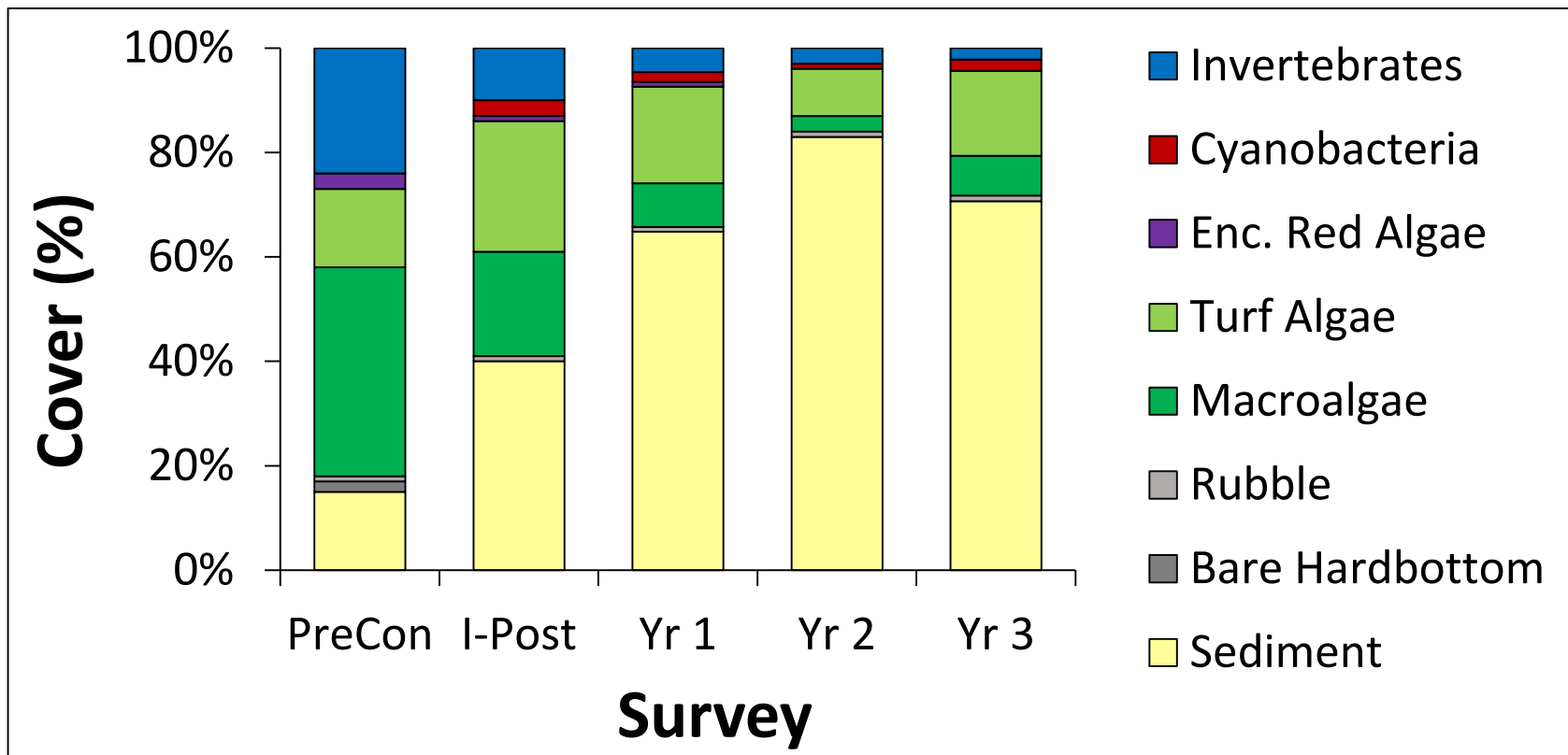




Data Analysis

Step 2. Visualization – BEAMR Functional Group Data

A. Project level





Data Analysis

Step 3: Statistical Analysis

Univariate tests

- t-tests, ANOVA, ANCOVA
- Mixed-effects models (LME, GLMM)

Multivariate tests

- MANOVA
- Primer routines (ANOSIM), PERMANOVA

Repeated measures designs

Comparison to Baseline

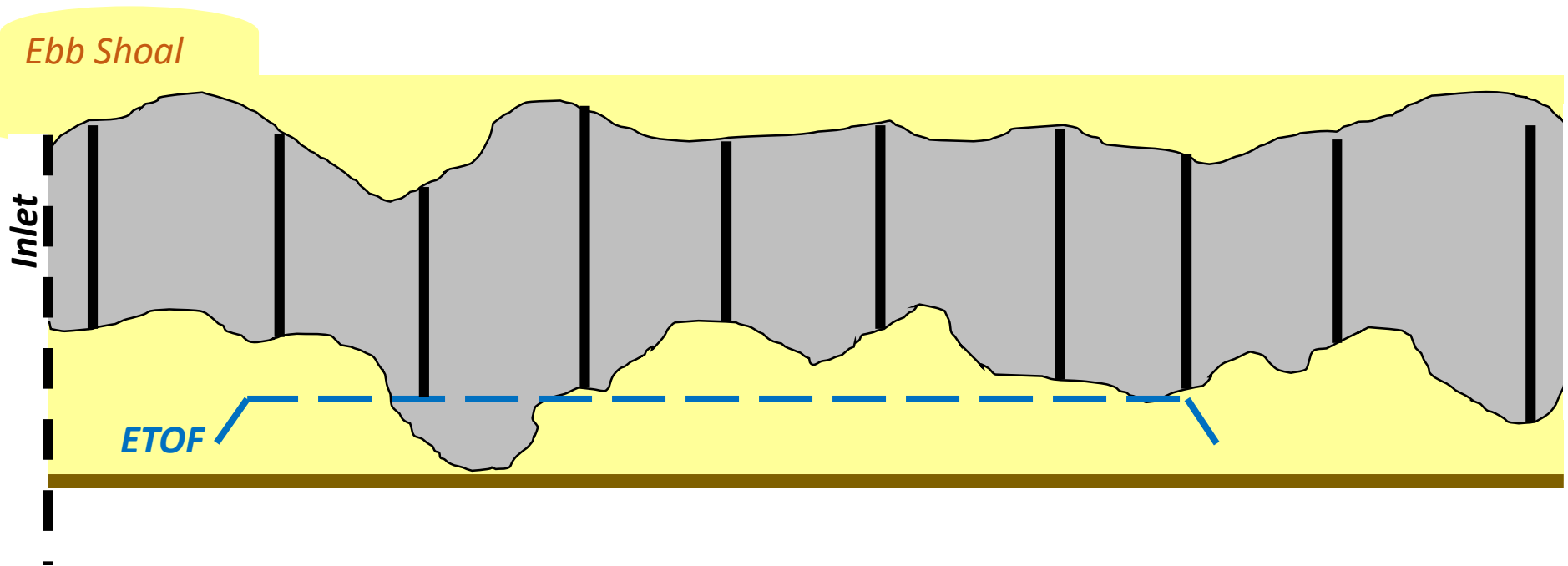
Biological relevance



Initial Assessment

Holistic Approach - bring together data from all aspects

Fictional Example



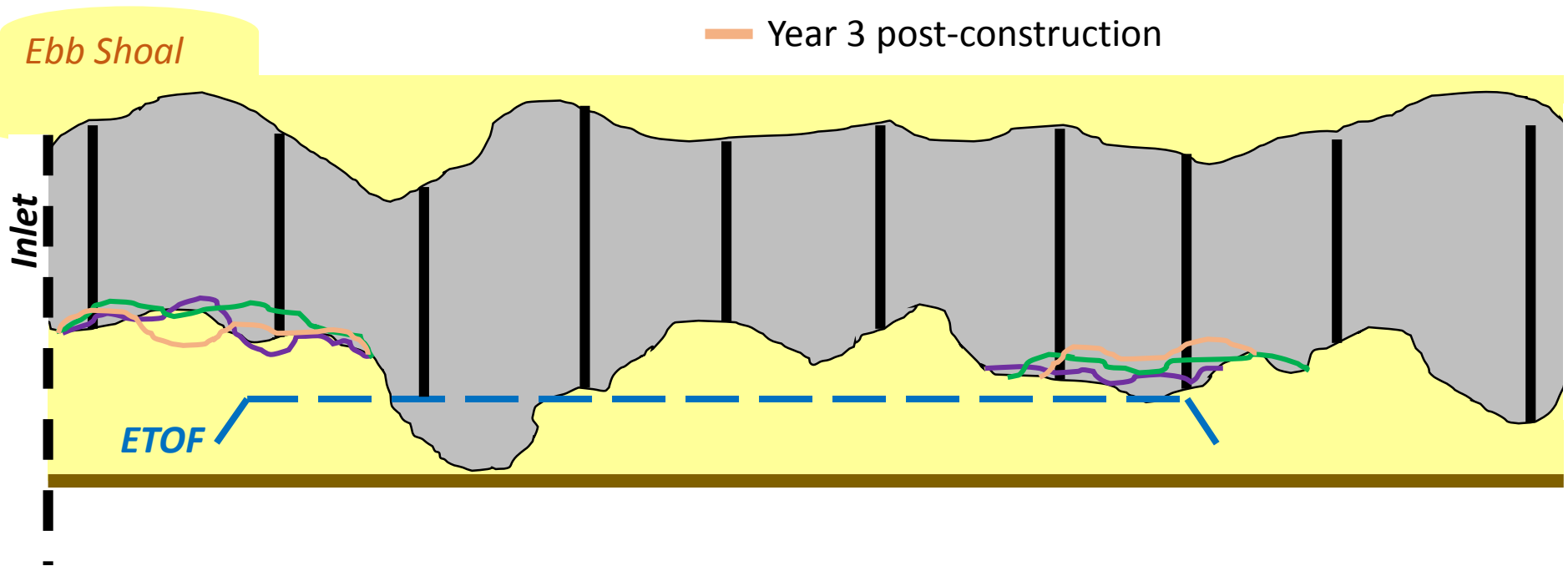


Initial Assessment

Macro Scale:

- **Hardbottom Edge:** variation over time

- Baseline (pre-construction)
- Year 1 post-construction
- Year 2 post-construction
- Year 3 post-construction

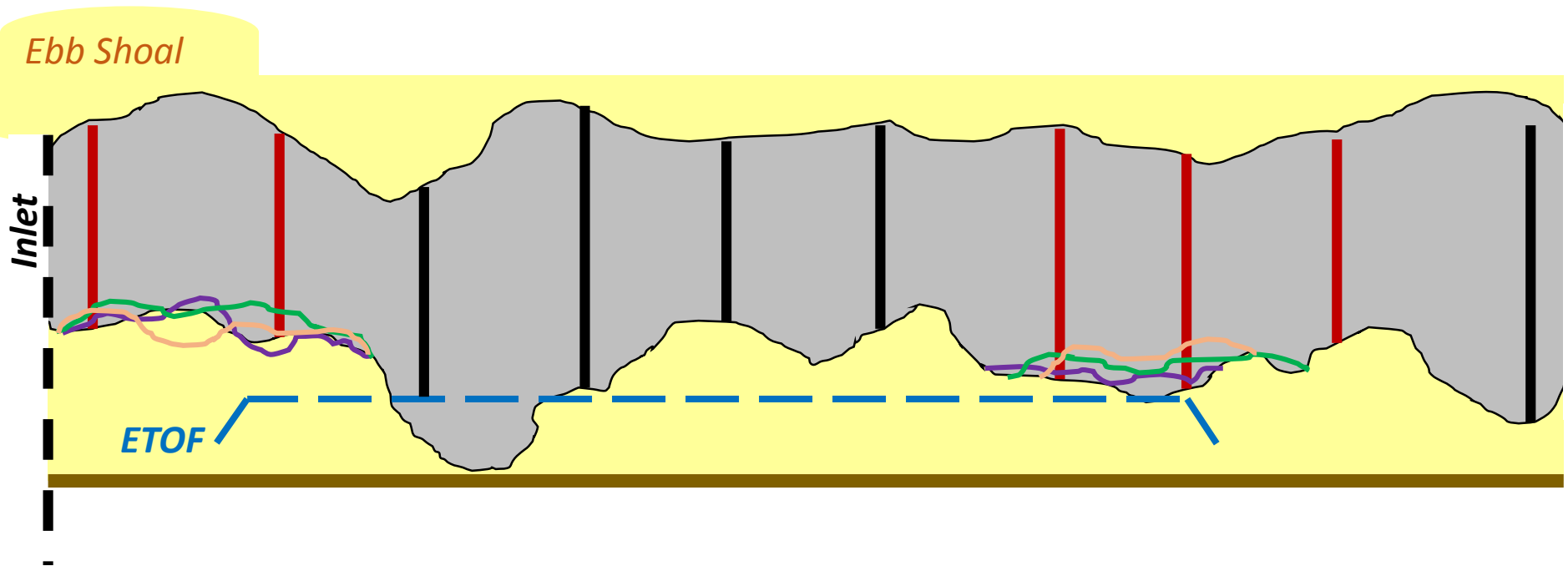




Initial Assessment

Macro Scale:

- **Hardbottom Edge:** variation over time
- **Line-Intercept:** Loss of hardbottom to sand over time

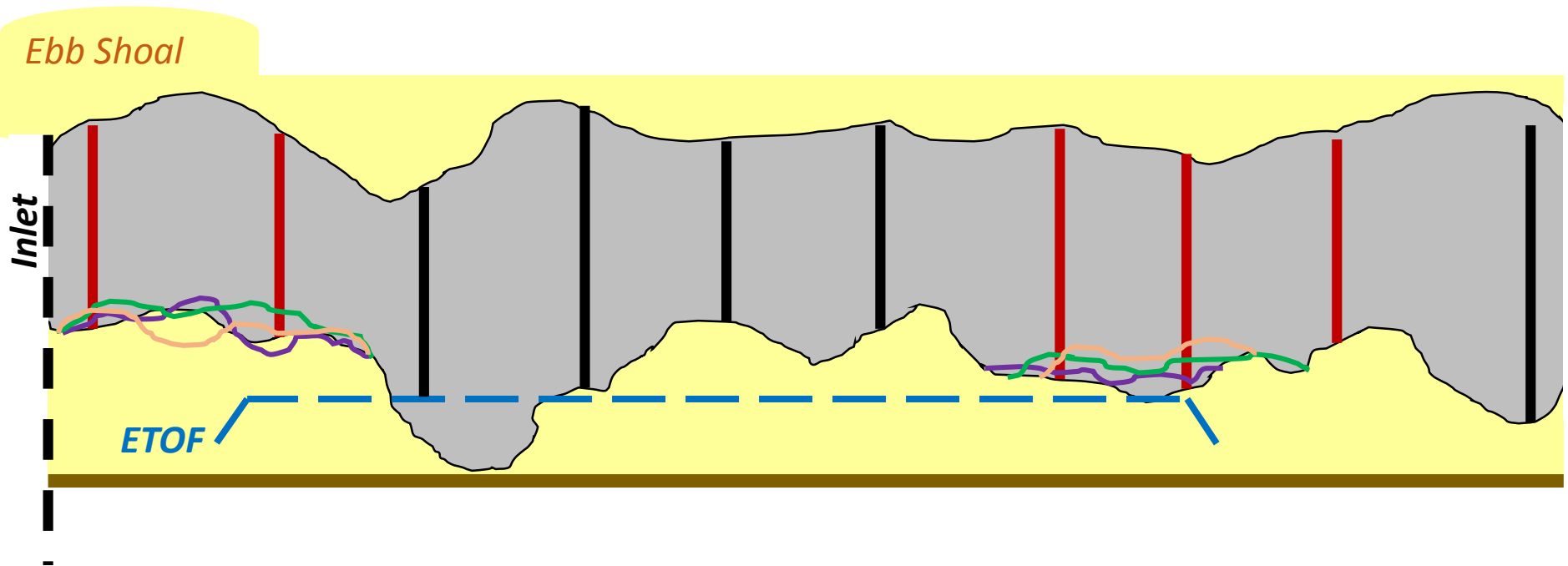




Initial Assessment

Macro Scale:

- **Hardbottom Edge:** variation over time
- **Line-Intercept:** Loss of hardbottom to sand over time
- **Sediment Depth (Interval and Quadrat):** Increase over time

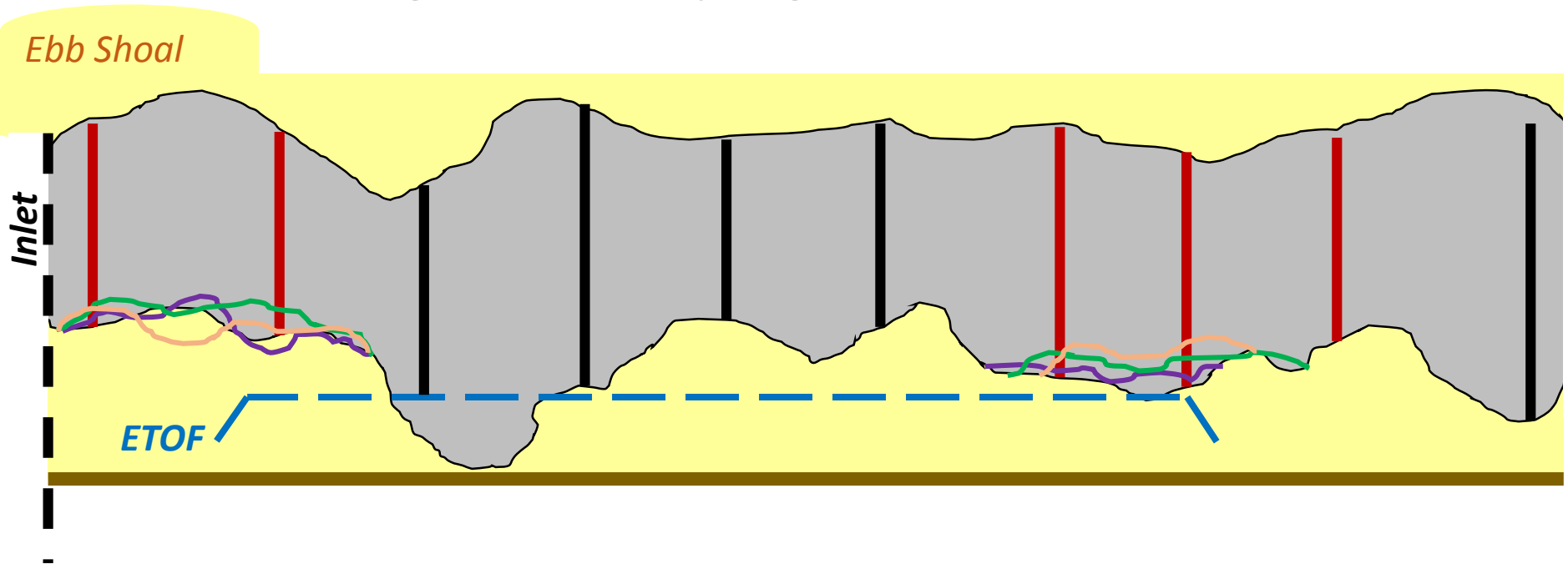




Initial Assessment

Macro Scale:

- **Hardbottom Edge:** variation over time
- **Line-Intercept:** Loss of hardbottom to sand over time
- **Sediment Depth (Interval and Quadrat):** Increase over time
- **Biological Community:** Degradation over time

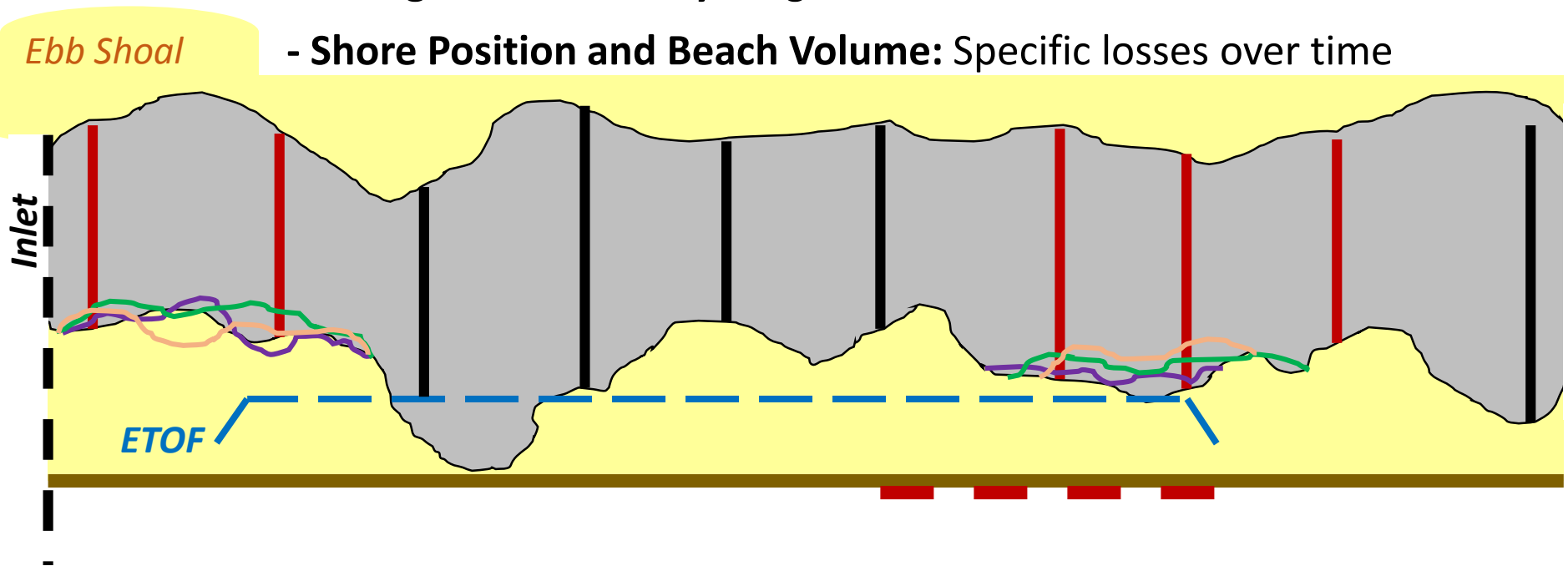




Initial Assessment

Macro Scale:

- **Hardbottom Edge:** variation over time
- **Line-Intercept:** Loss of hardbottom to sand over time
- **Sediment Depth (Interval and Quadrat):** Increase over time
- **Biological Community:** Degradation over time
- **Shore Position and Beach Volume:** Specific losses over time





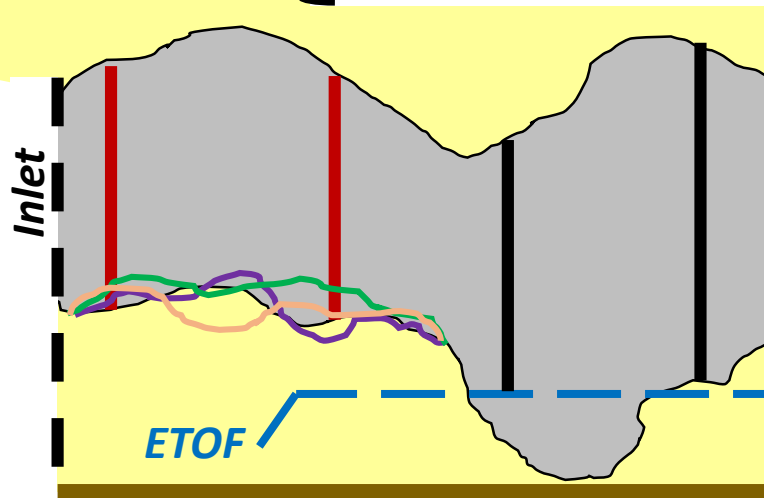
Initial Assessment

Intermediate Scale:

Int. Scale
Analysis

- **Hardbottom Edge:** variation over time
- **Line-Intercept:** Loss of hardbottom to sand widespread and erratic
- **Sediment Depth:** Increase first offshore, then midshore & nearshore
- **Biological Community:** Low diversity. Degradation follows sediment.
- **Shore Position and Beach Volume:** No large losses over time

Ebb Shoal



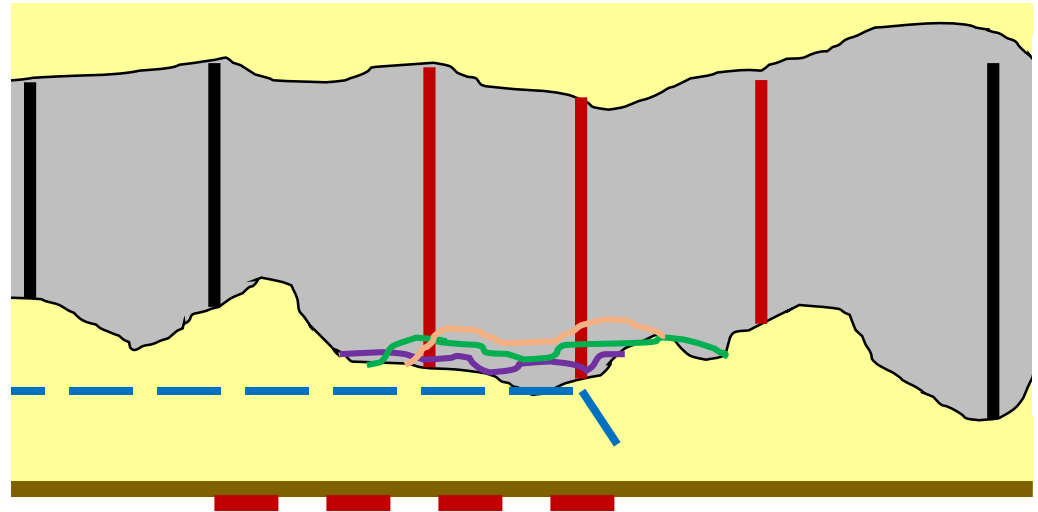


Initial Assessment

Intermediate Scale:

Int. Scale Analysis

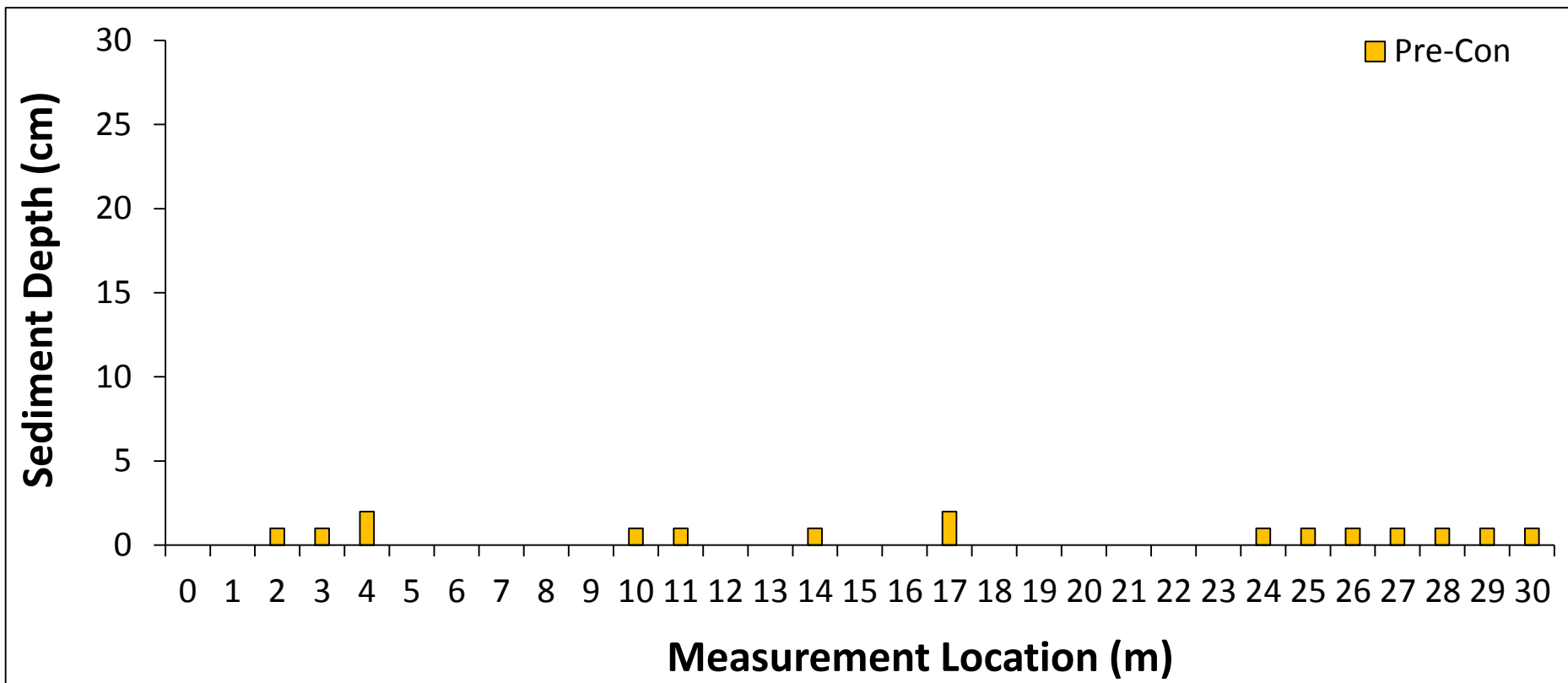
- **Hardbottom Edge:** variation over time
- **Line-Intercept:** Loss of HB to sand in nearshore
- **Sediment Depth:** Increase in nearshore
- **Biological Community:** High diversity. Degradation follows sediment
- **Shore Position and Beach Volume:** Substantial losses over time





Initial Assessment

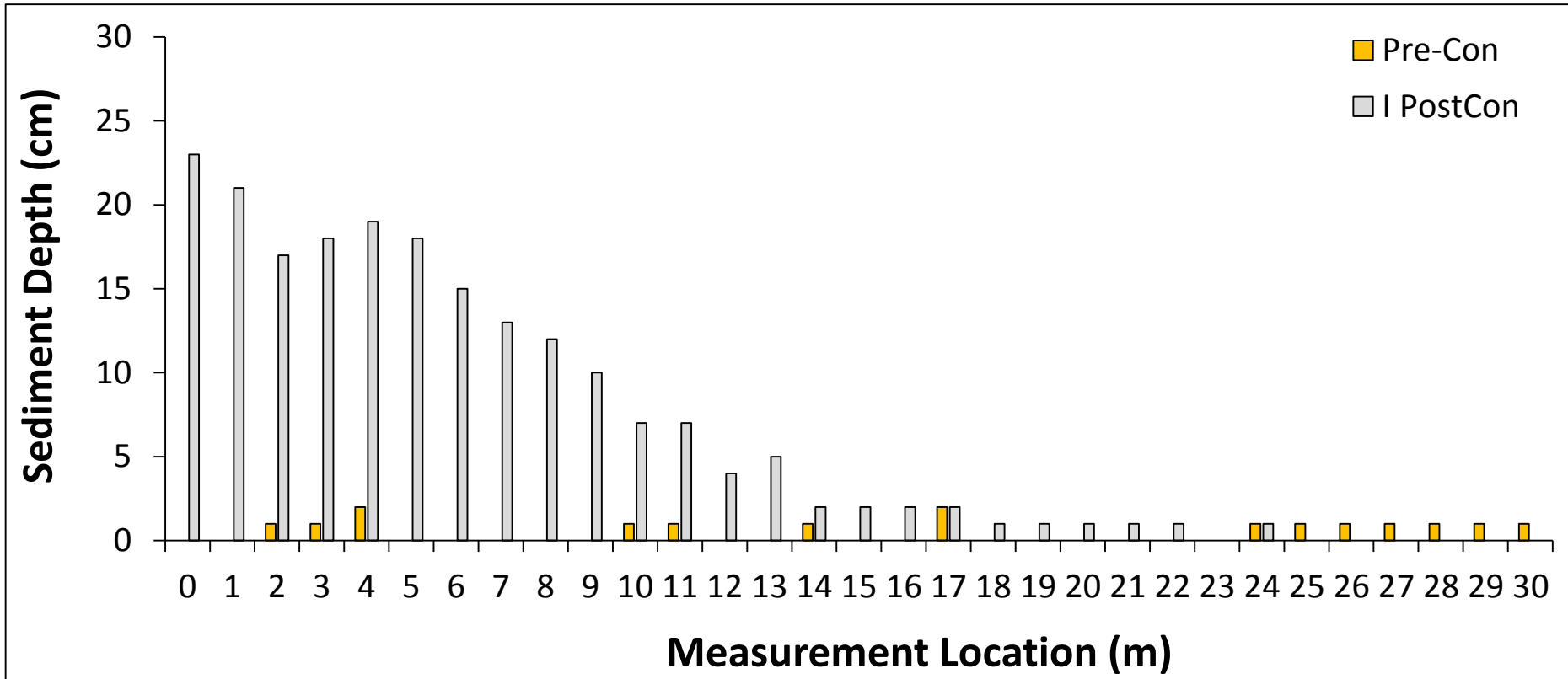
Interval Sediment Depth





Initial Assessment

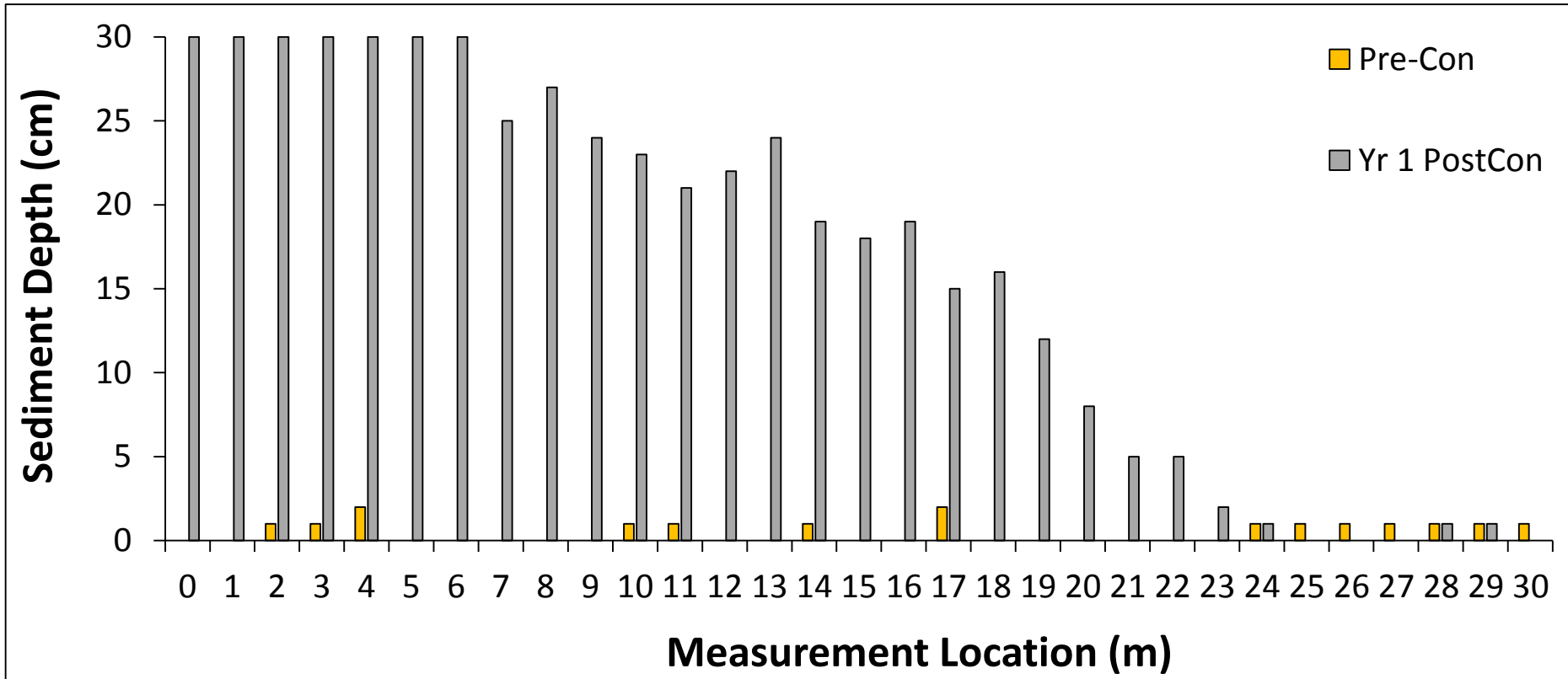
Interval Sediment Depth





Initial Assessment

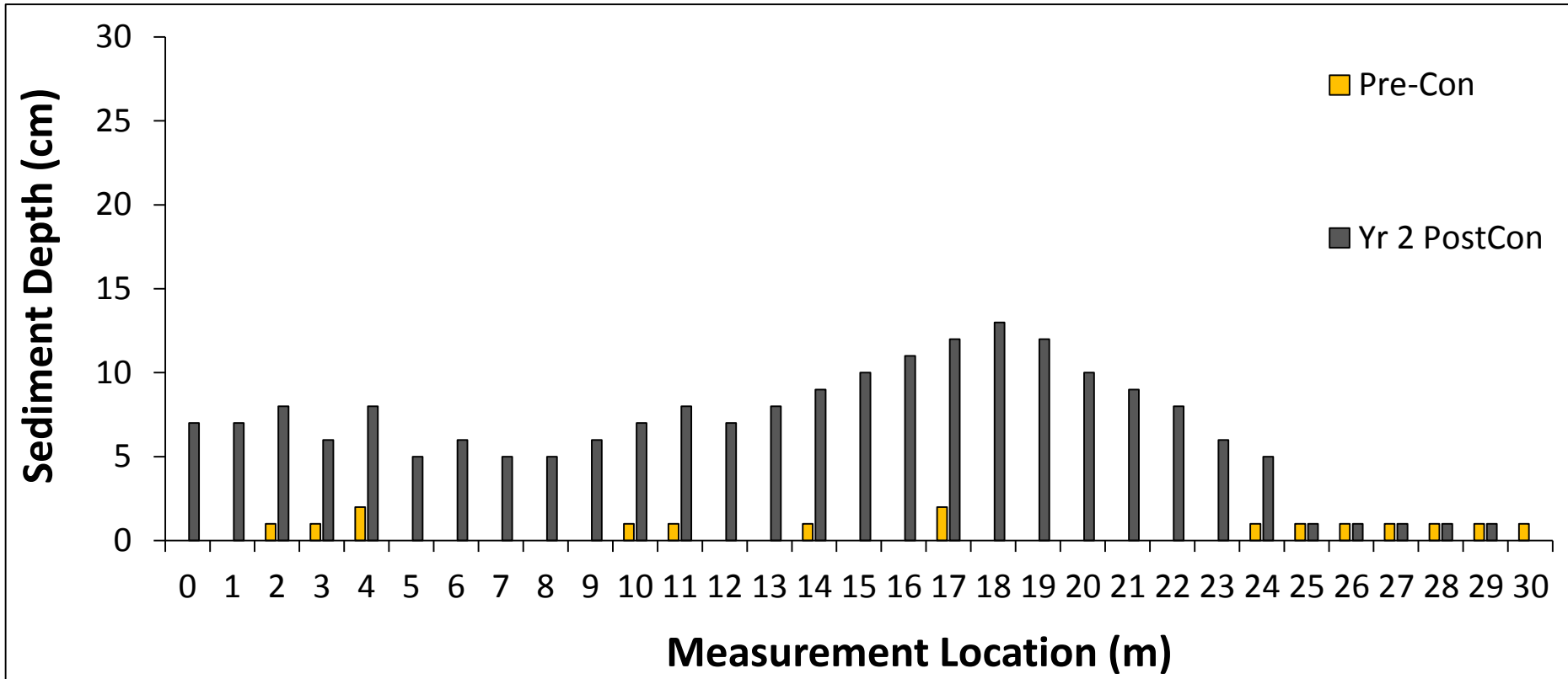
Interval Sediment Depth





Initial Assessment

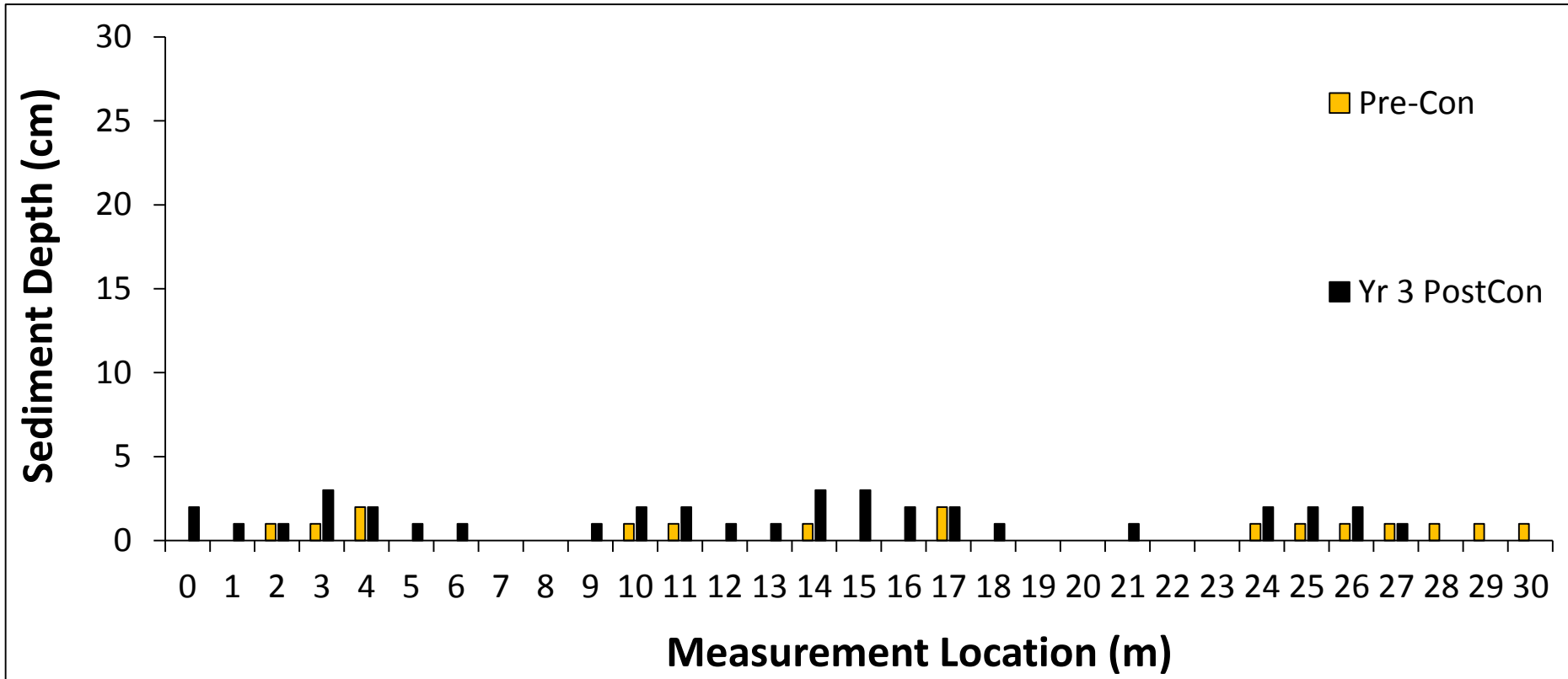
Interval Sediment Depth





Initial Assessment

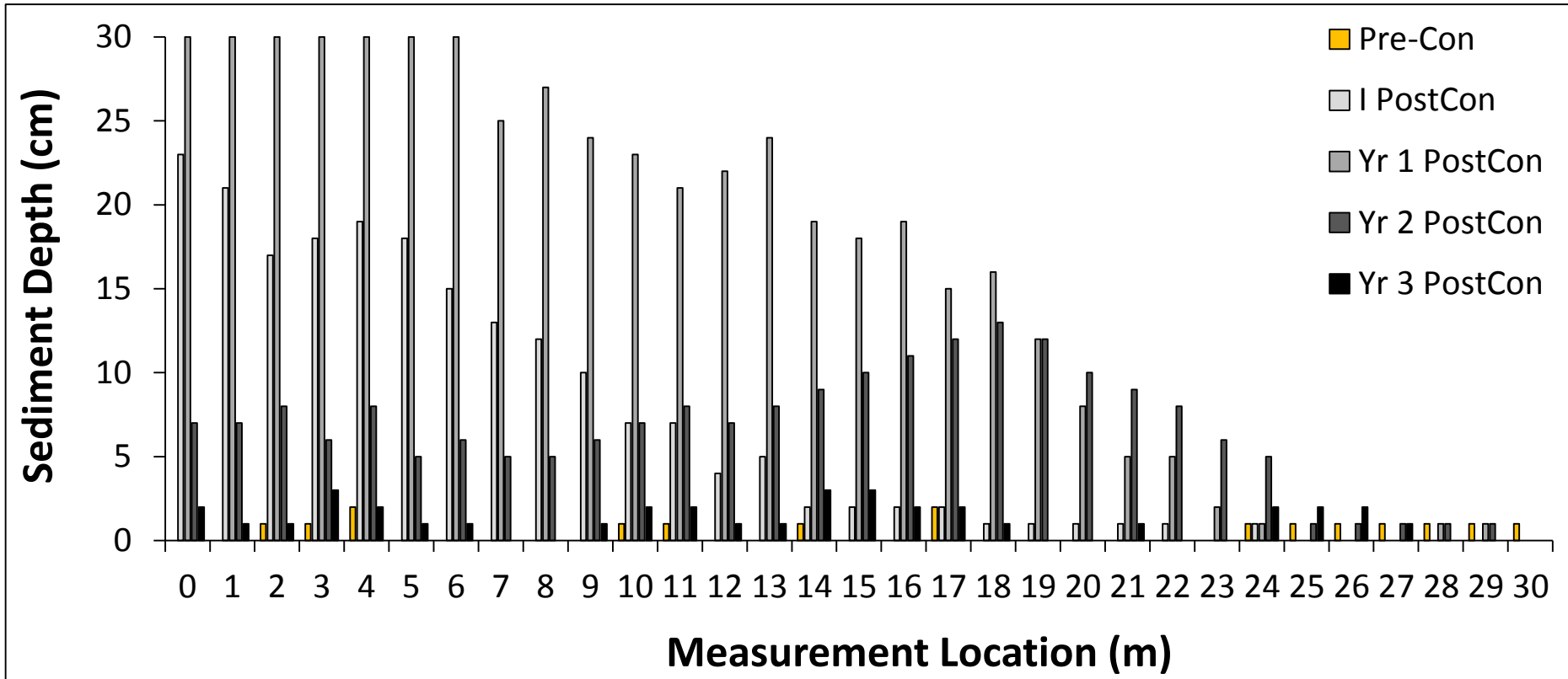
Interval Sediment Depth





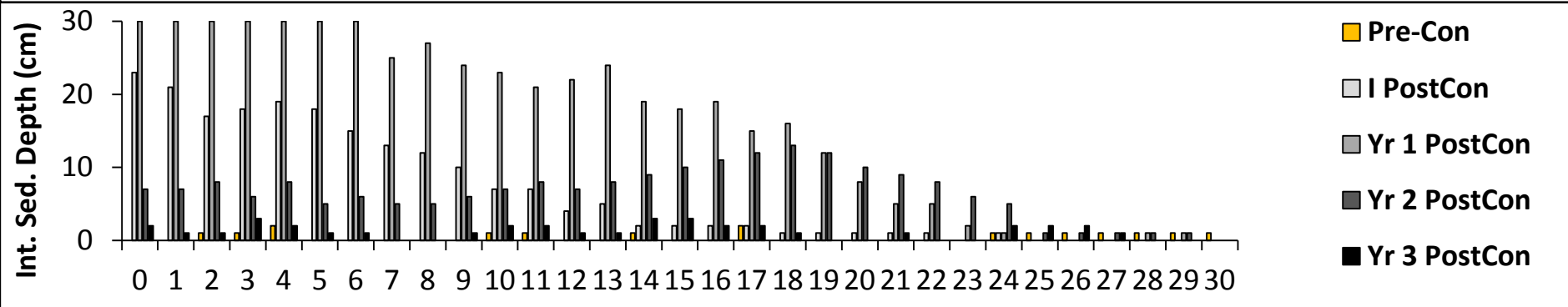
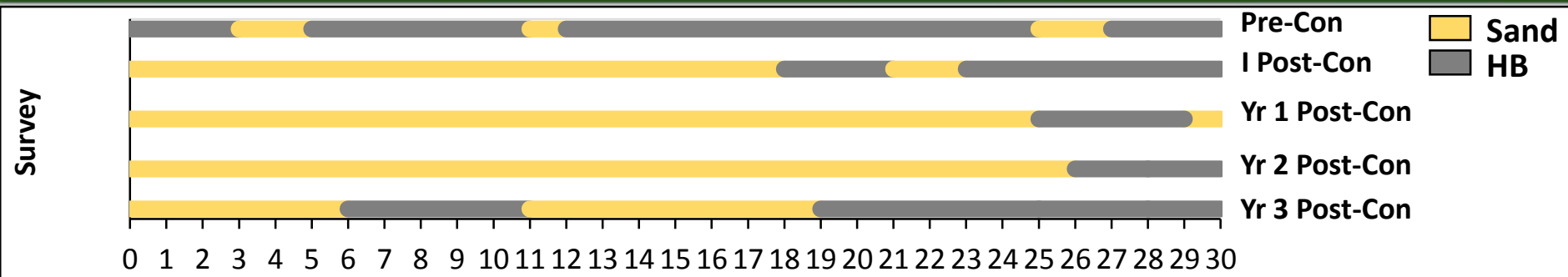
Initial Assessment

Interval Sediment Depth





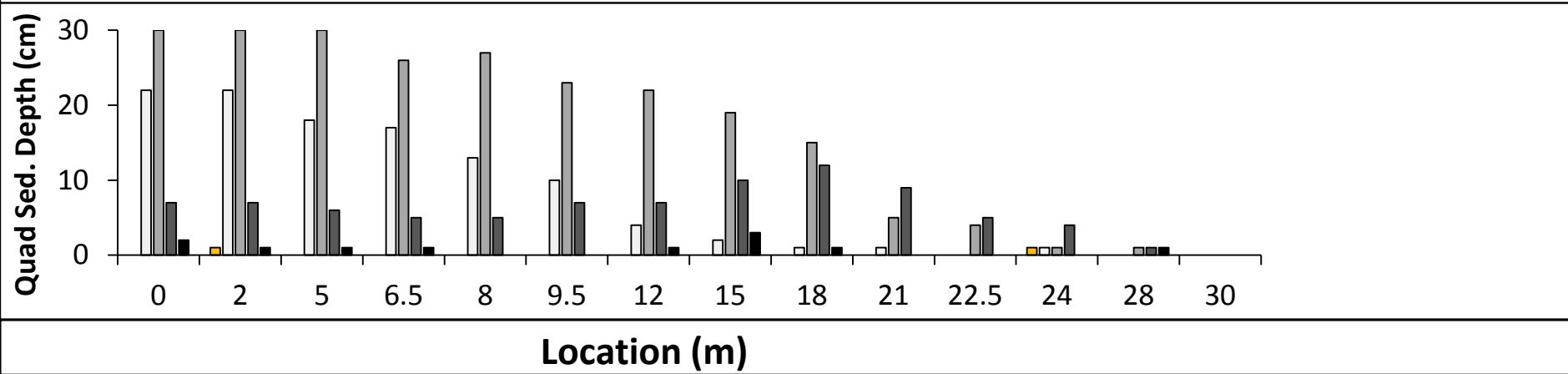
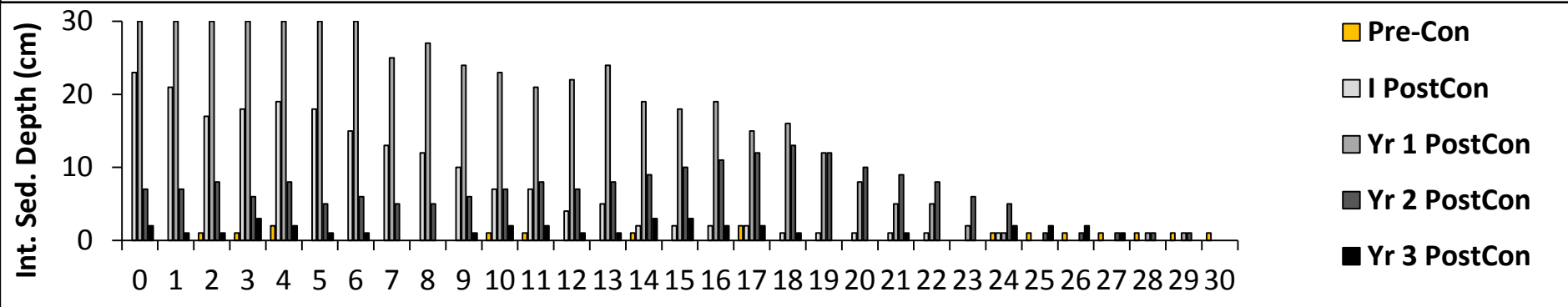
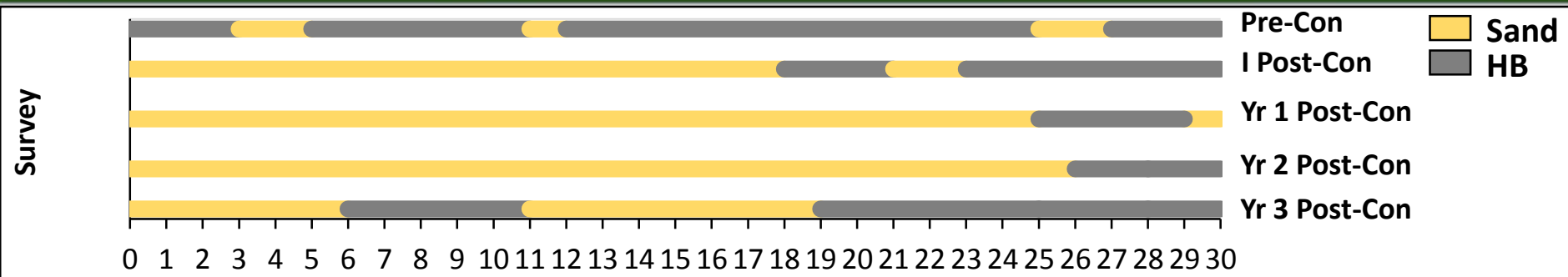
Initial Assessment



Location (m)

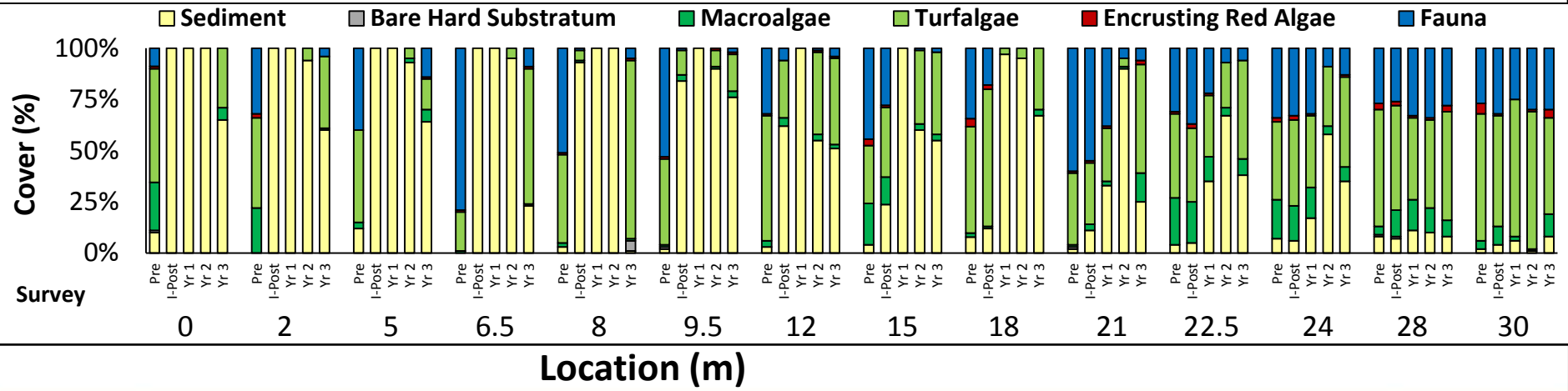
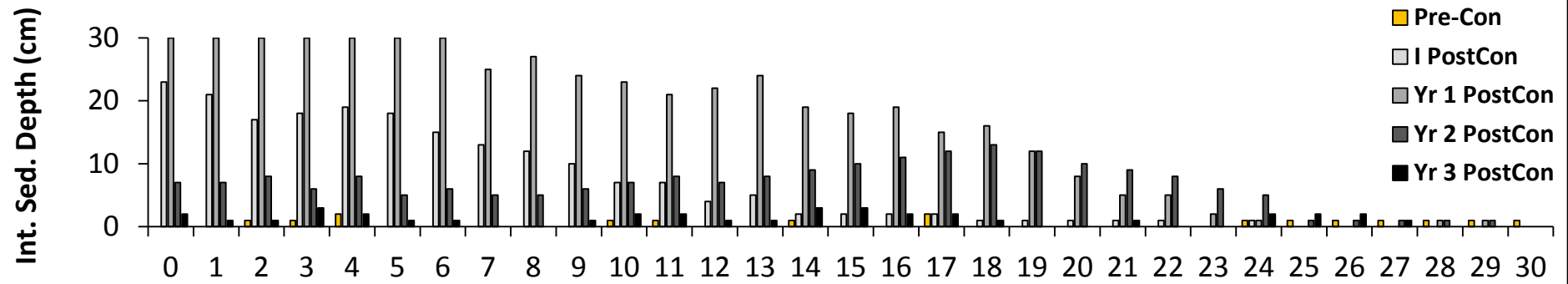
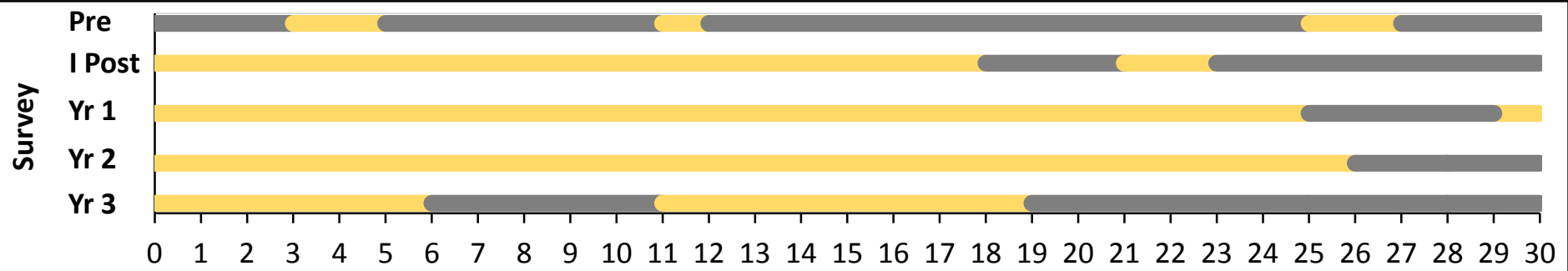


Initial Assessment



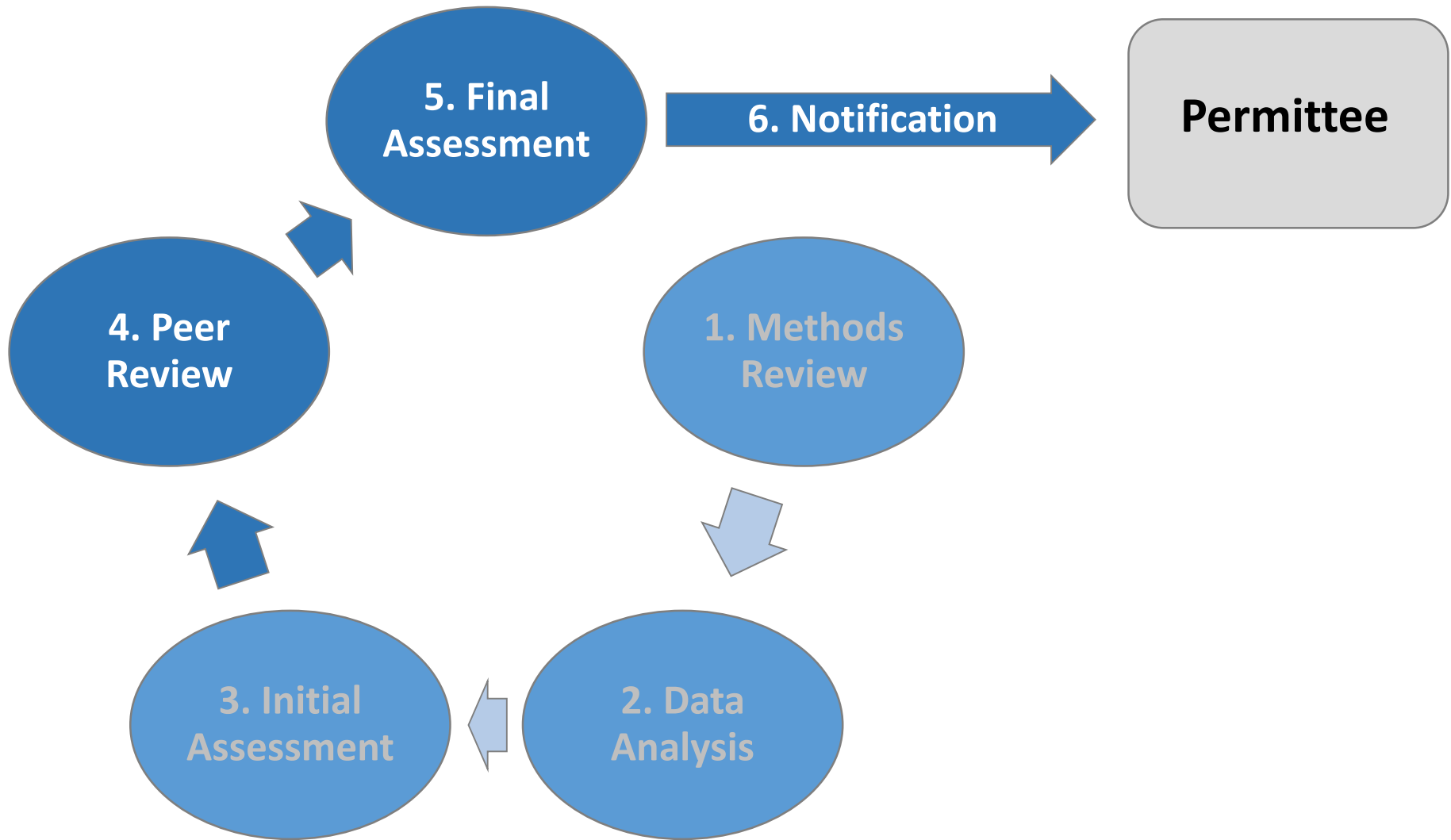


Initial Assessment





Evaluation Process





Healthy Hardbottom

Collaborative Effort to Maintain Beaches and Protect Hardbottom Resources





Questions?

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