National guidelines for metrics used for monitoring oyster restoration projects

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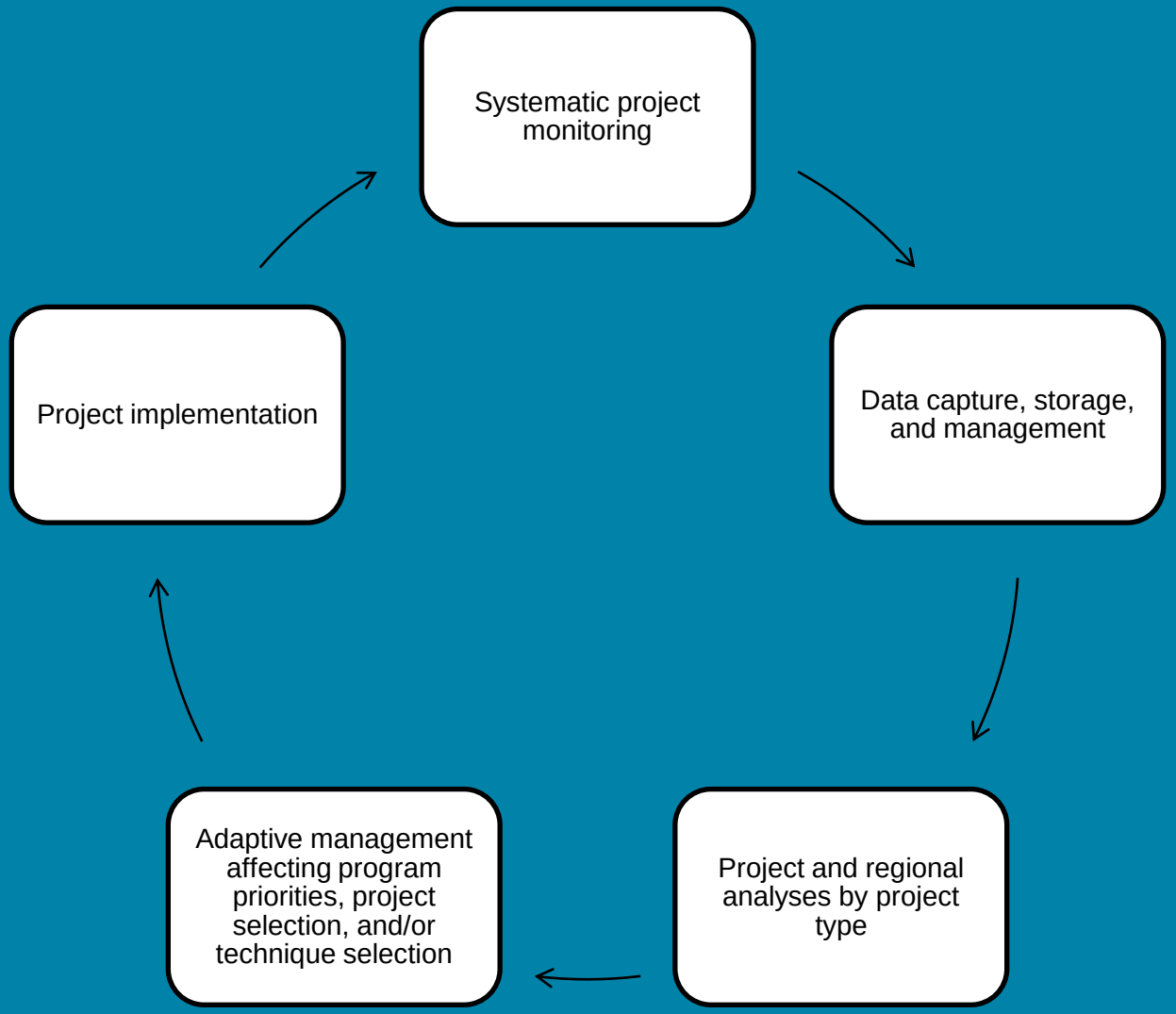
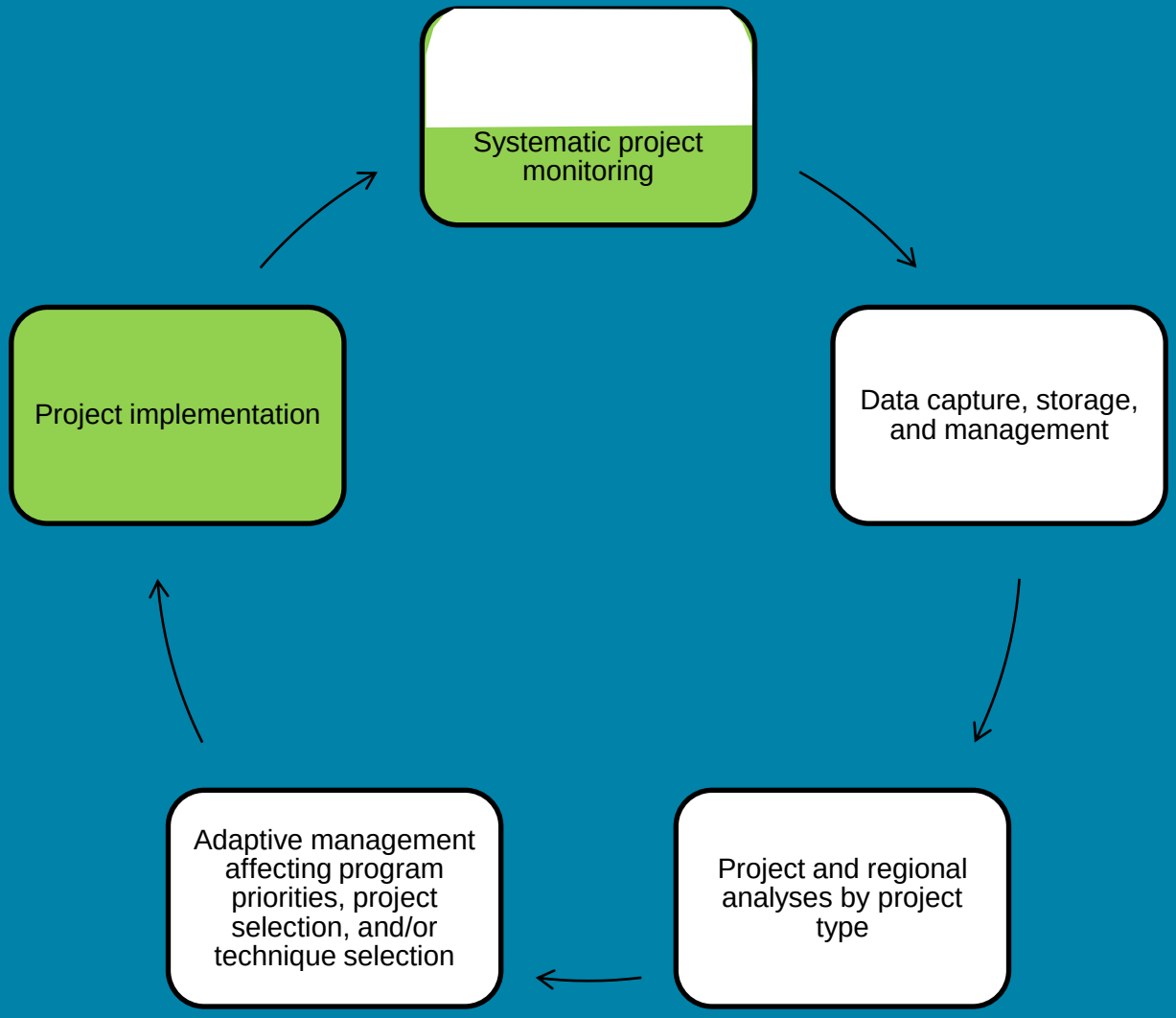
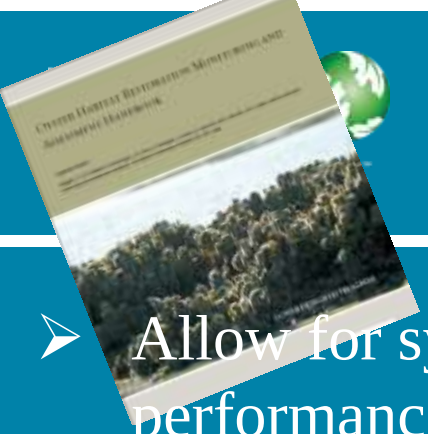
Integrated Monitoring



Where are “we” in this process now?





Universal Metrics – the minimum – for ***every*** project

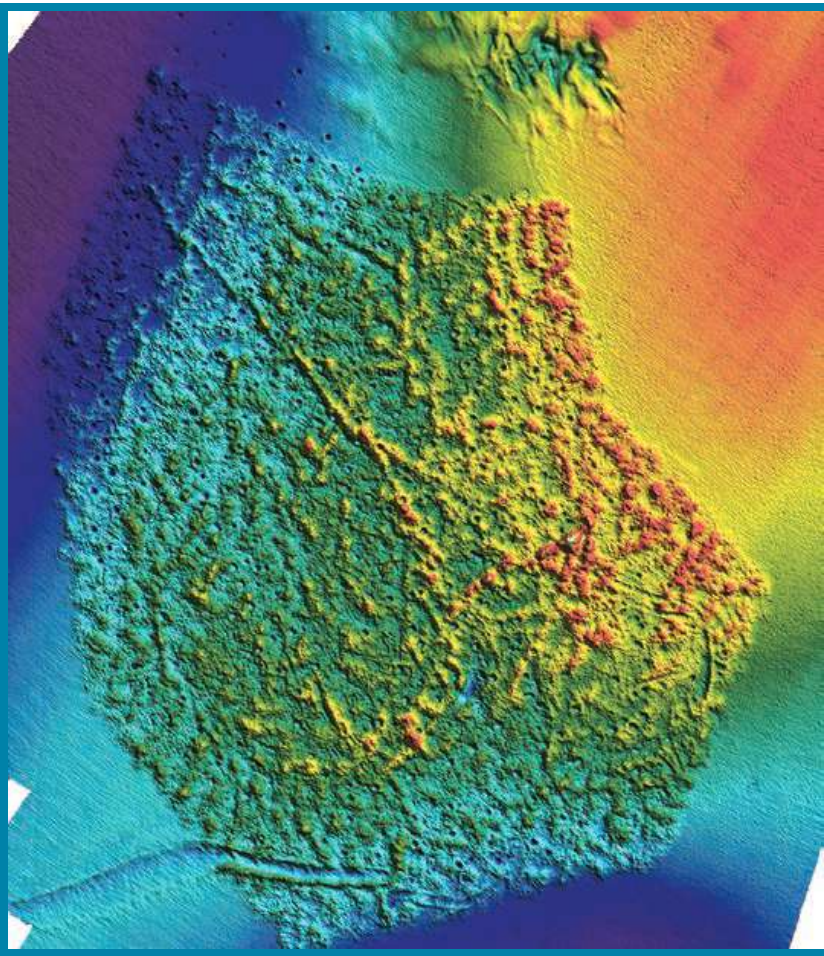
- Allow for systematic comparison among restored sites; basic performance of each reef to be assessed through time, while also allowing for comparisons of Universal Metrics with other projects across the US
- Can be used to develop performance criteria
- Developed for **ALL** projects is complicated
  - Scale; Funding; Capacity; Expertise; Type of project; Landscape….

Standardization

- For each metric, information is provided re:
  1. required units for data collected,
  2. suggested methodologies*
  3. frequencies of sampling.

*Methodologies listed for each metric are noted as 'suggested'

- include low and high-tech alternatives, alternatives for various reef construction approaches and tidal elevations.
- alternative methodologies that have equal rigor and provide data in the specified units for that metric should be used.



It is imperative that data are recorded using the required units and with a mean and variance so that data may be compared among projects.

Baseline Data and Control and Reference Sites

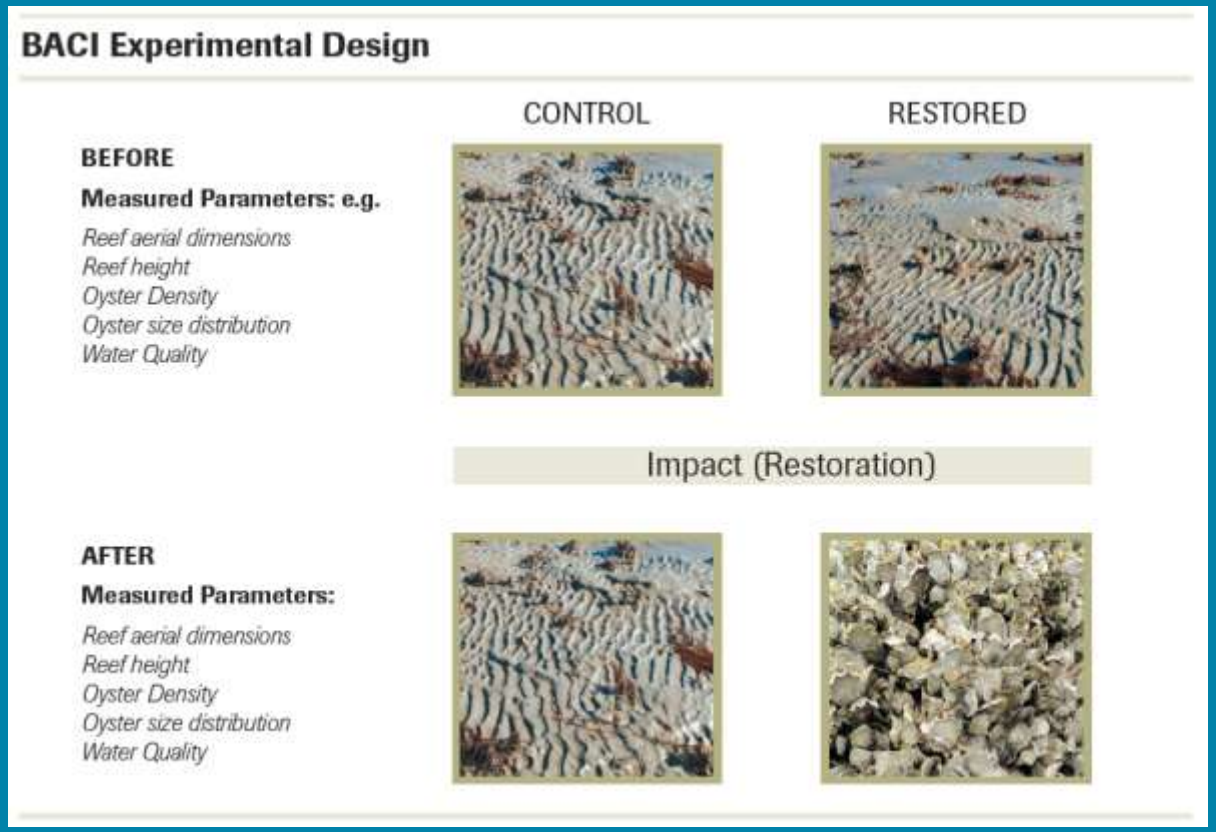
For all metrics, sampling should be performed at the restoration site and a control and/or natural reference site

- 1 year pre

Guidance provided for:

- Sampling design
- Sample size

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50



Monitoring Time Frame

The **short-term** timeframe is the minimum monitoring period of 1-2 yrs post-construction

- should include at least two recruitment phases
- often dictated by the funding period of the project
- May be the only monitoring feasible

The **mid-term** timeframe is the ***preferred*** period; 4 – 6yrs post-constructionthe

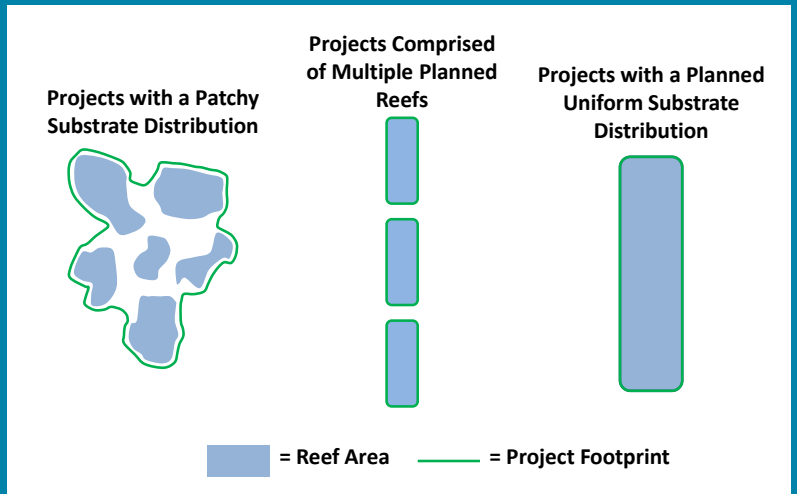
- The mid-term timeframe is more of an ecologically meaningful period in which to assess performance.

Universal Metric #1: Reef Areal Dimensions

The reef areal dimension metric consists of two separate measurements

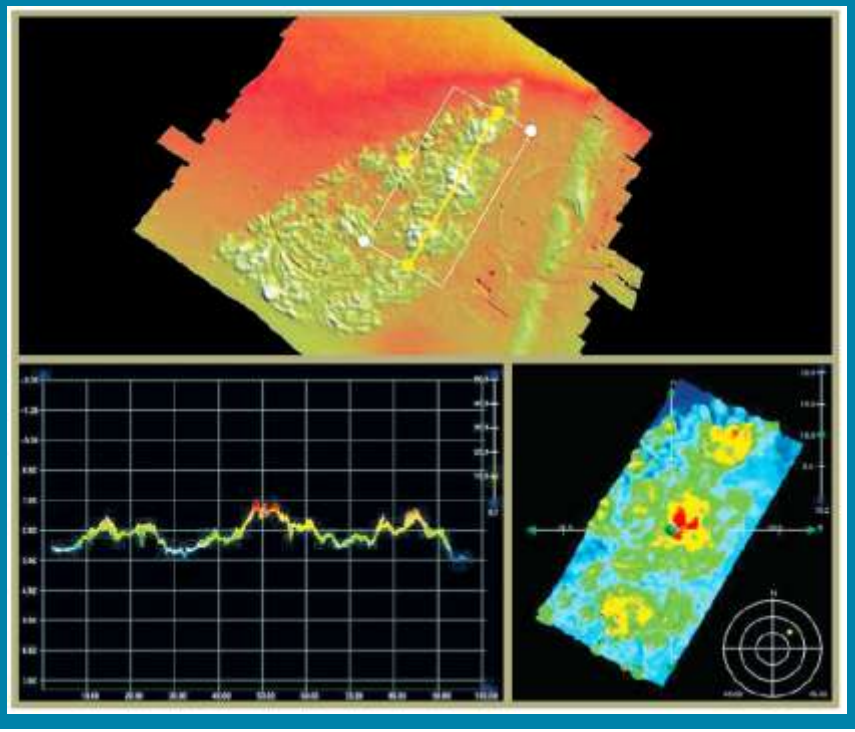
1. **Project footprint** is *the maximum areal extent of the footprint of the reef.*
   - Ignores the patchiness of multiple smaller reefs that may be located within the 'reef complex' .
2. **Reef area** is *the actual area (summed) of patches* of living and non-living oyster shell (or other construction material with and without live oysters) within the project footprint

Units = m^2
Sampling Frequency = 1x prior; As-built survey (3mos.); 1-2yrs; Preferably 4-6yrs and after reef altering events
Performance Criteria = none



Universal Metric #2: Reef Height

Reef height is a measure of the *mean* reef height



Units = m/cm (note accuracy of device in cm)

Sampling Frequency = 1x prior; As-built survey (3mos.); 1-2yrs; Preferably 4-6yrs and after reef altering events

Performance Criteria =neutral or positive change

Universal Metric #3: Oyster Density

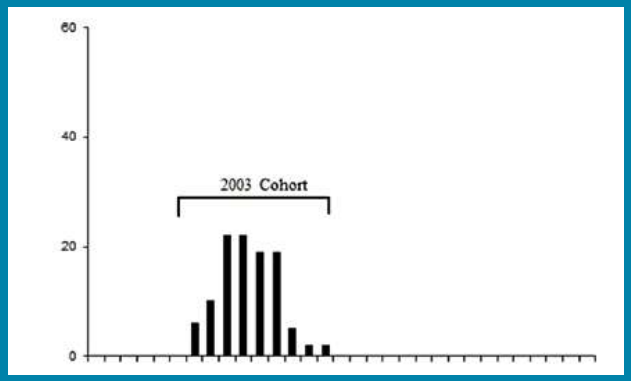
Live oyster density is the *number of live oysters, including recruits*, per m2.*

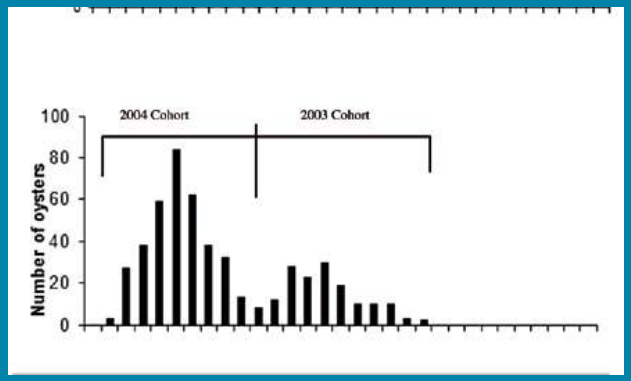
***Settlement *vs.* Recruitment**

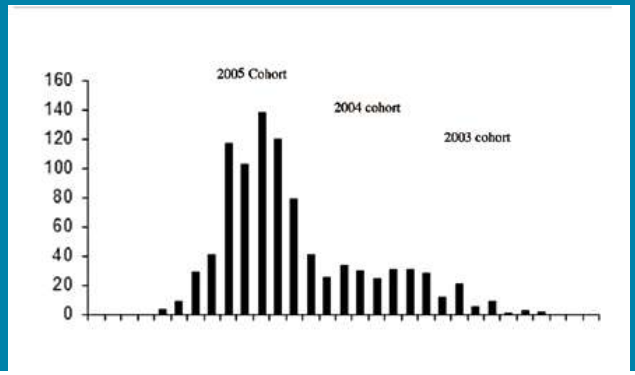
Units = Mean density of live oysters, including recruits (individuals/m^2 $\pm$ S.E.)
Sampling Frequency = annually at the end of the oyster growing season
Performance Criteria = number live oysters/m^2

Projects with seed oysters

Units = seed oysters/m^2 $\pm$ S.E.
Sampling Frequency = immediately post deployment; With density thereafter
Performance Criteria = number live seed oysters/m^2

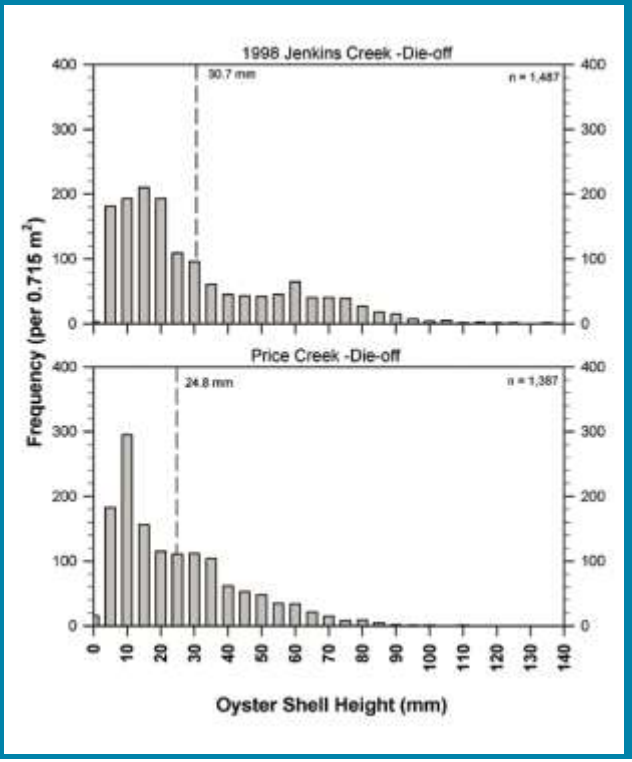






Universal Metric #4: Oyster Size-Frequency Distribution

Oyster size-frequency distribution is a measure of how the oyster population is distributed across various size classes



Units = Mean shell height of live oysters (mm); Mean % of measured oysters per size class (%)

Sampling Frequency = annually at the end of the oyster growing season; recruits

Performance Criteria =none

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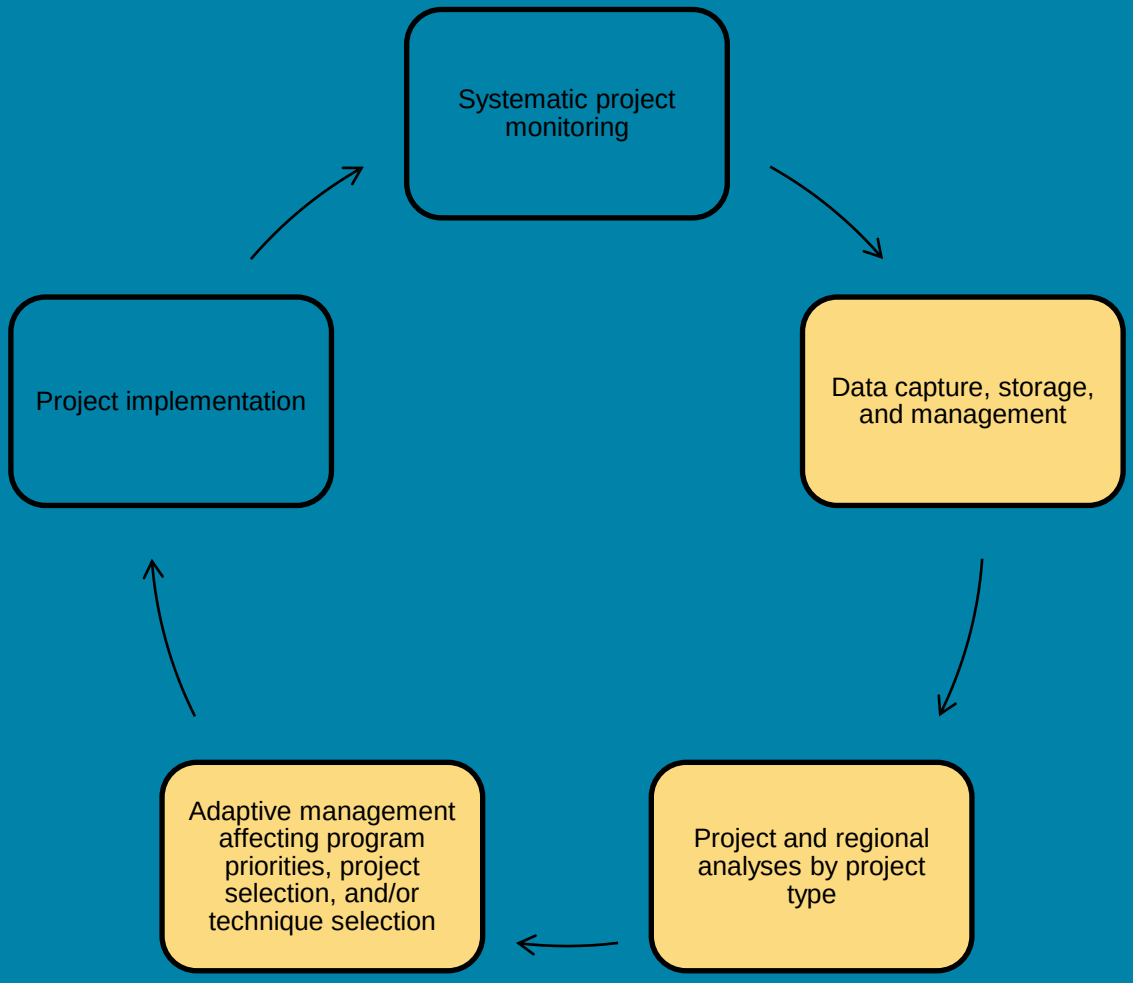
These components still absent!



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Questions ?