

Intermittently Open Estuaries

Science & Management Perspectives

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Science Background

Causes & Consequences of Mouth Closure



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What is an IOE?

Estuary disconnected from ocean when waves build a beach across the mouth ... common in SoCal



Intermittently Open Estuary (IOE)

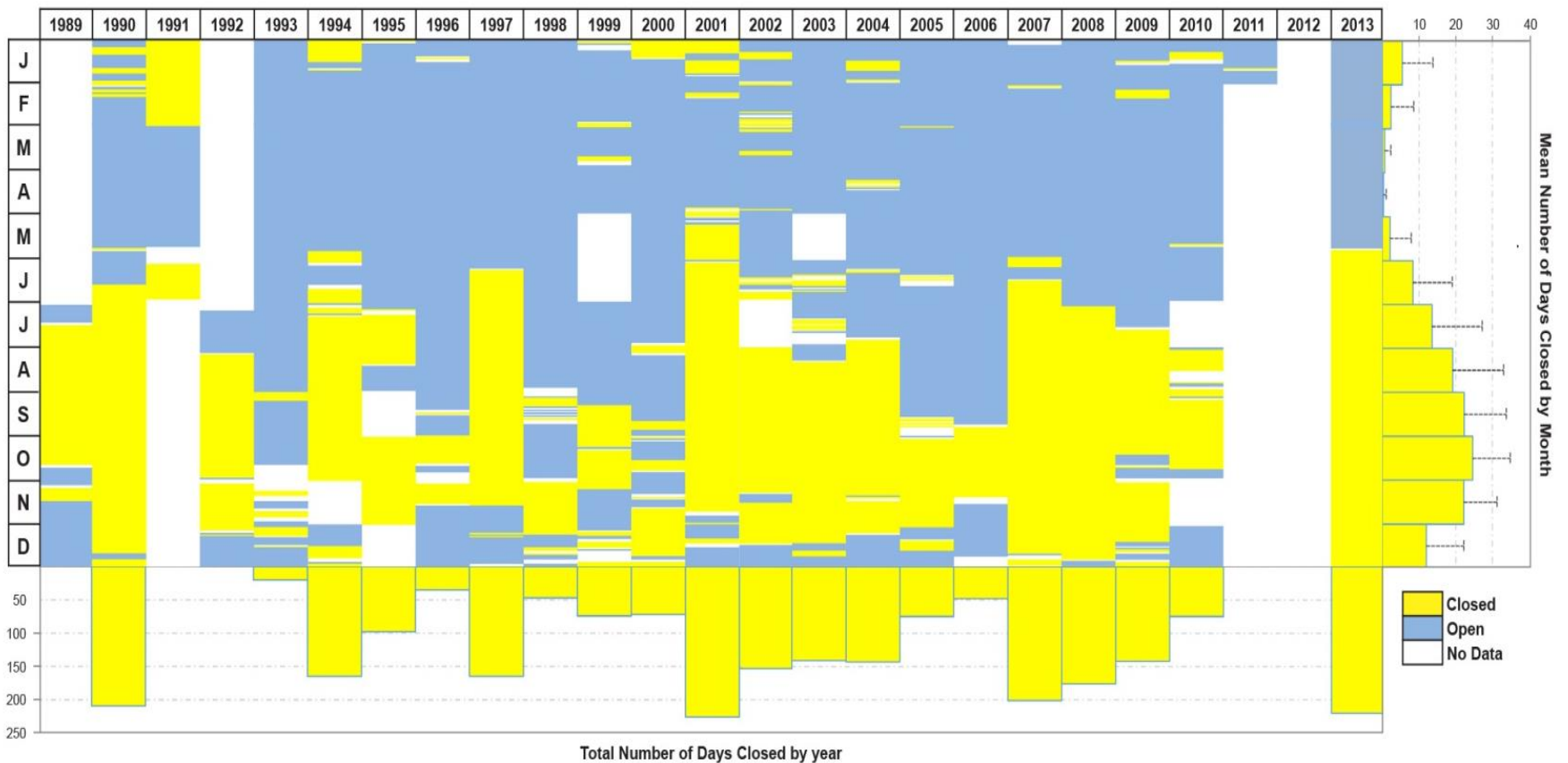
Seasonal Lagoon

Intermittently Closed and Open Lagoon or Lake (ICOLL)

Temporarily Open and Closed Estuary (TOCE)

Bar-Built Estuary (BBE)

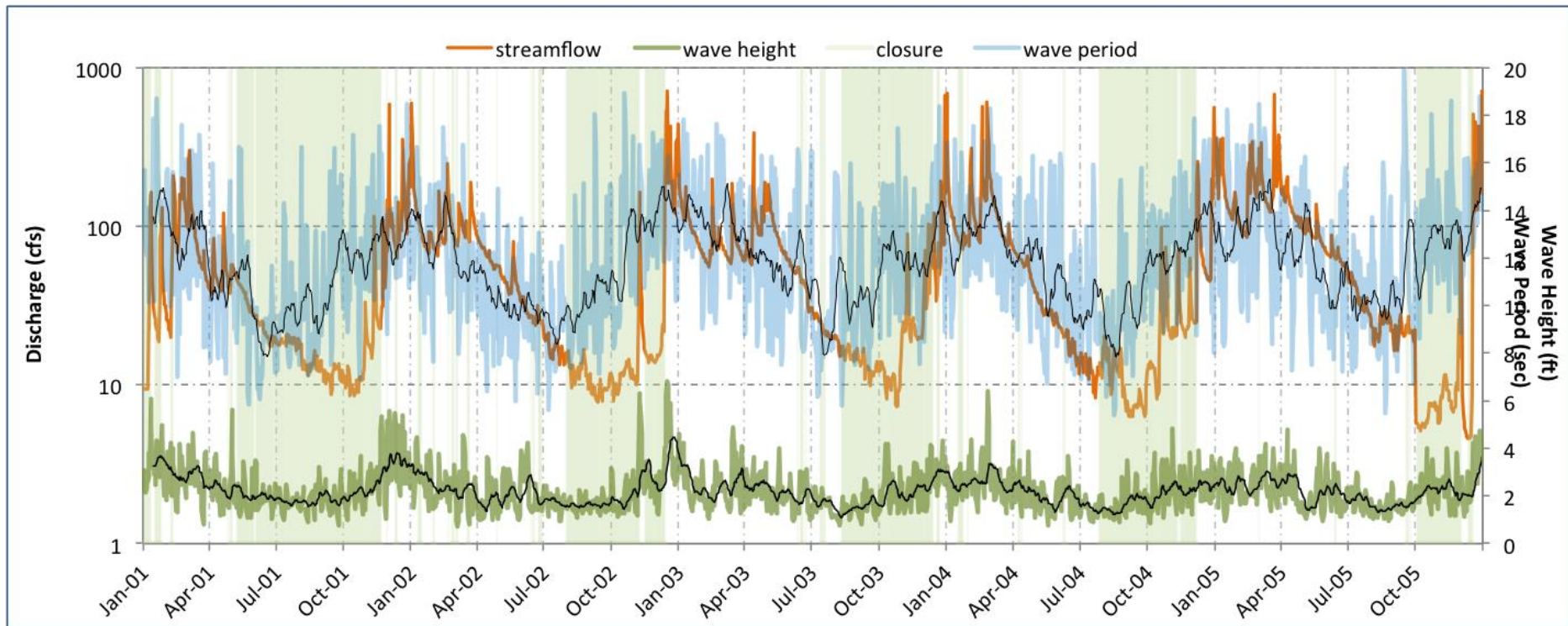
Mouth state 1989-2013 (Nylen, 2014)



Seasonal closures in Scott Creek

Mouth state 2001-2005 follows seasonal changes in river flow and waves.

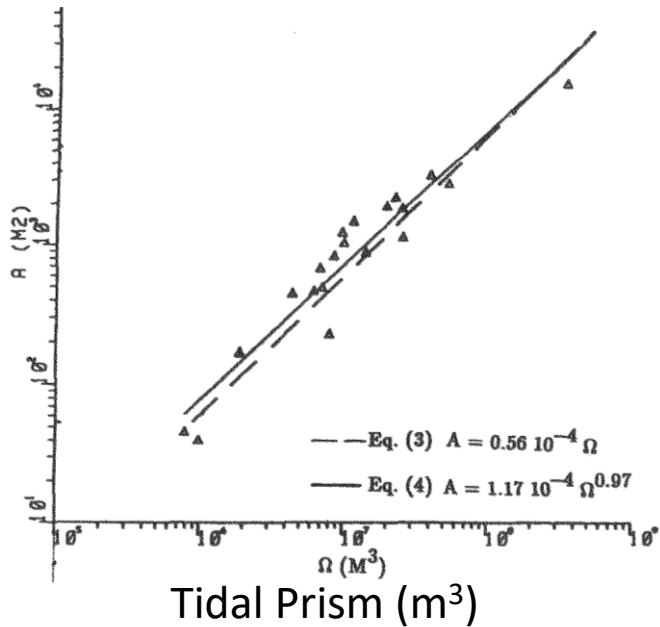
(but mouth may stay open if tidal prism large enough vs waves)



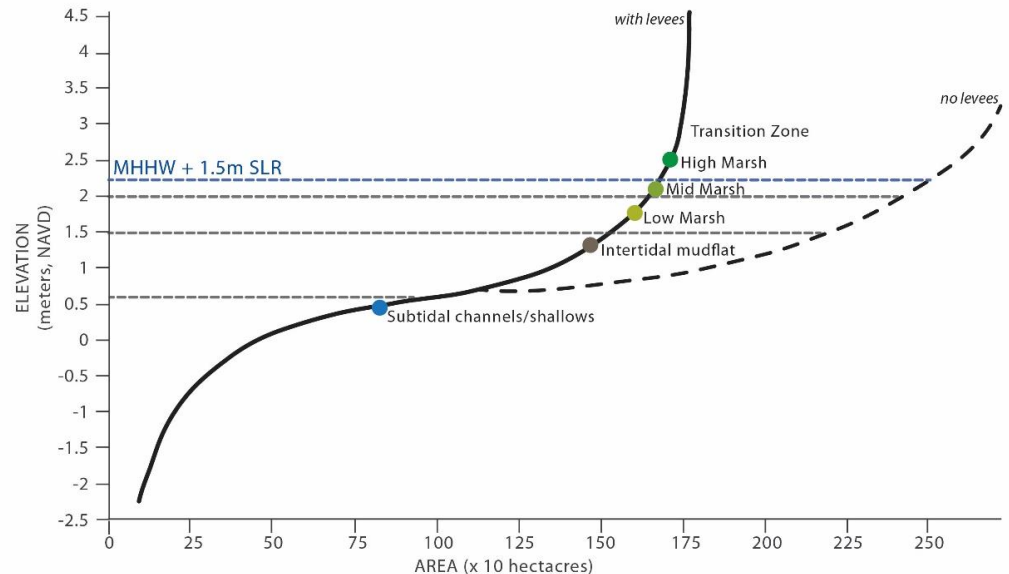
Closure and tidal prism

Cross-sectional area of mouth channel related to volume of water exchanged, i.e., tidal prism (Escoffier 1940).

Area (m²)



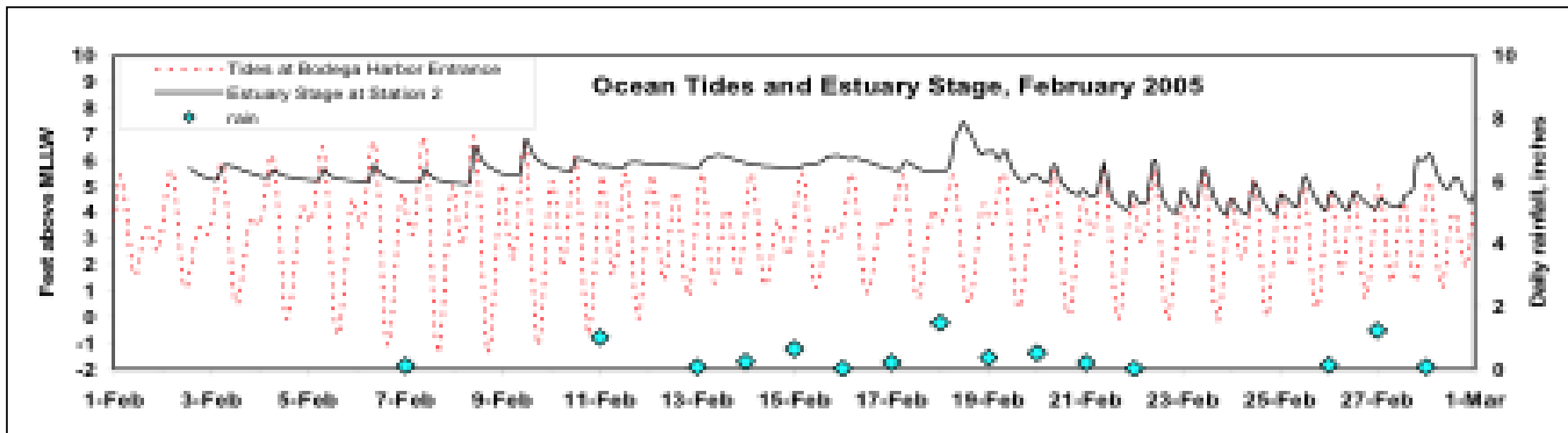
Changes in lagoon area can affect mouth state.



Perched mouth

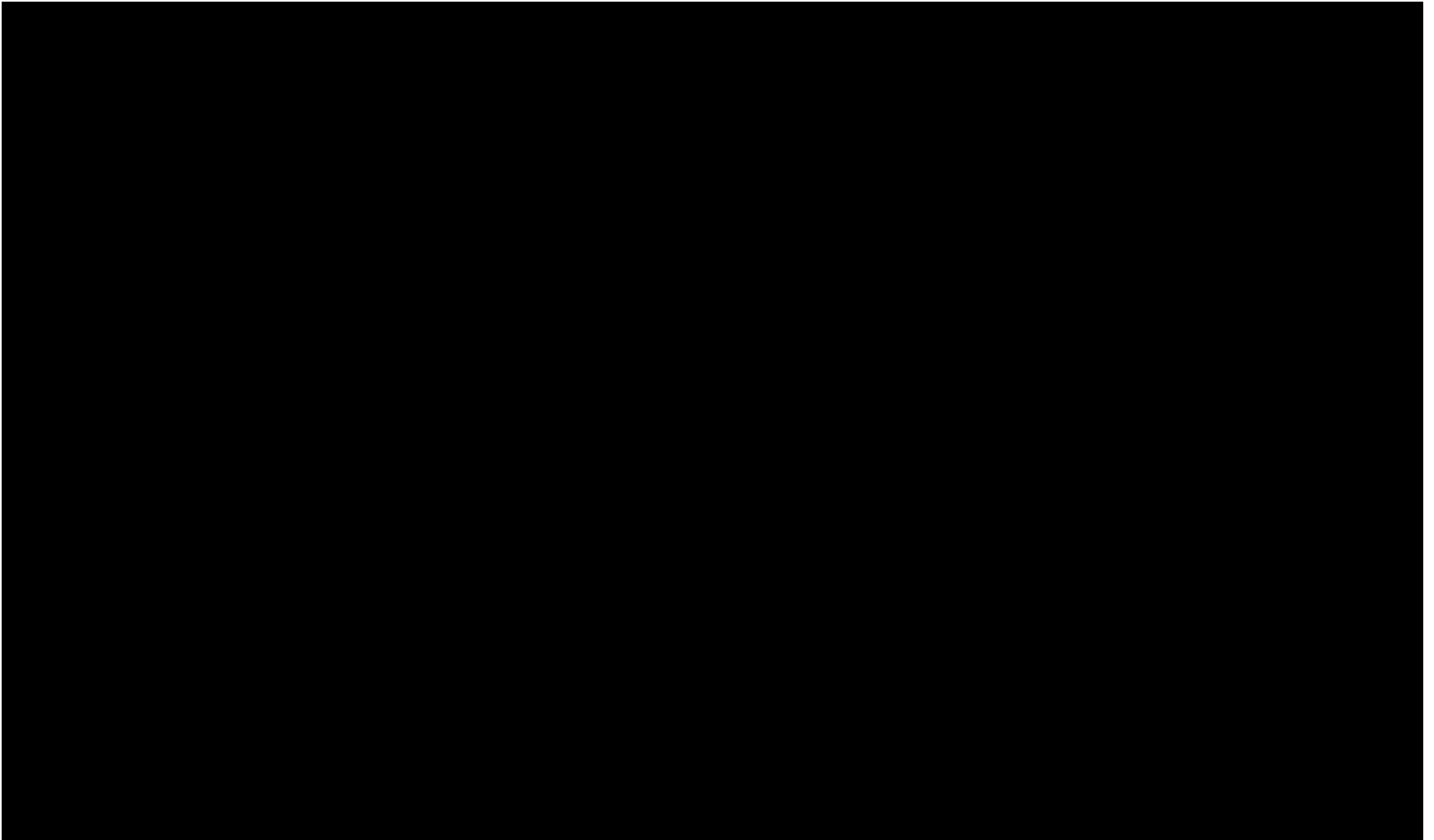
Perched when outflow only (overflow) – Salmon Creek 4 June 2005.

Mouth state not binary ...
degree of tidal damping.



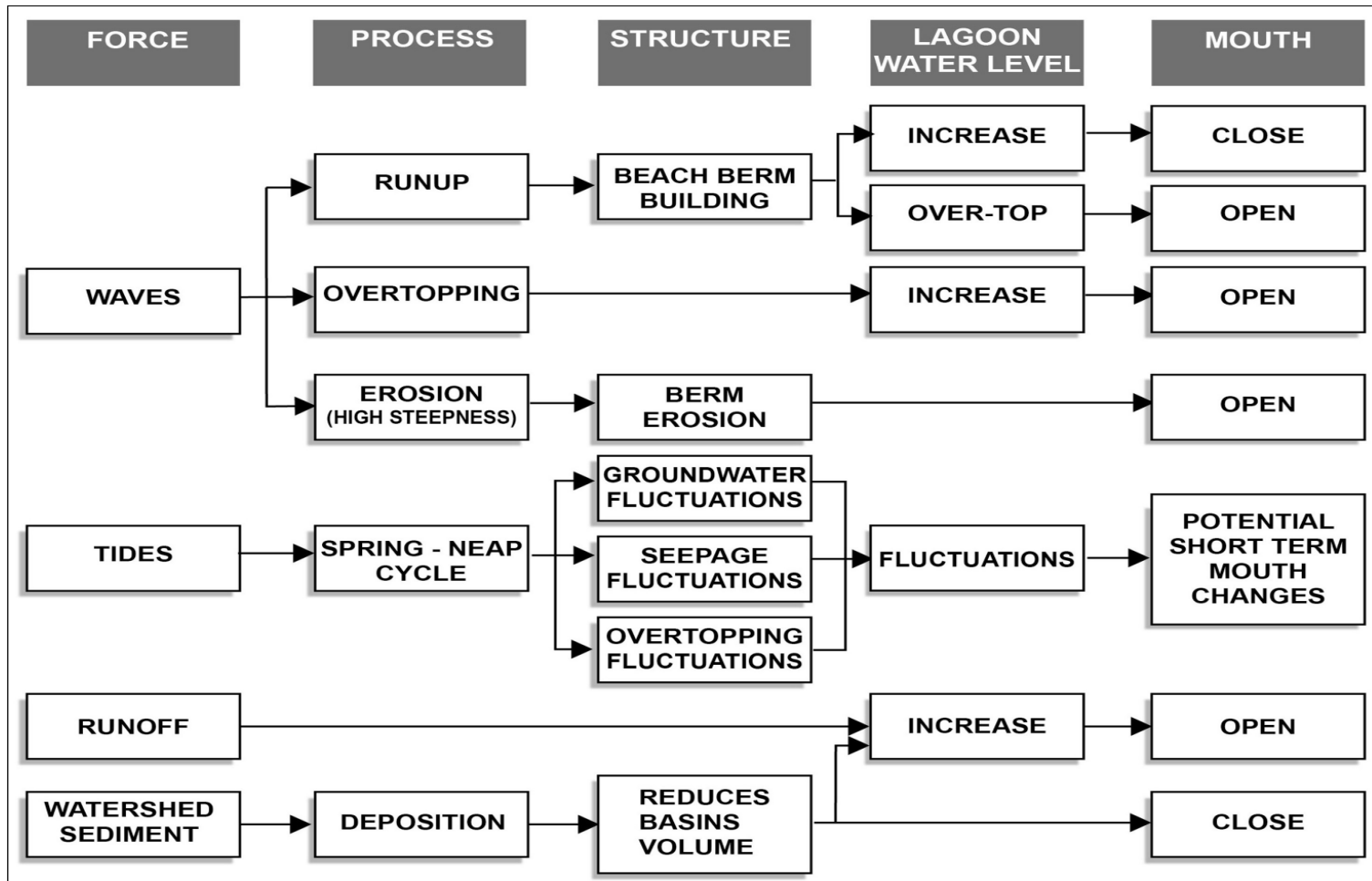
San Gregorio – January to March 2014

Closed lagoon re-opens by overflowing.



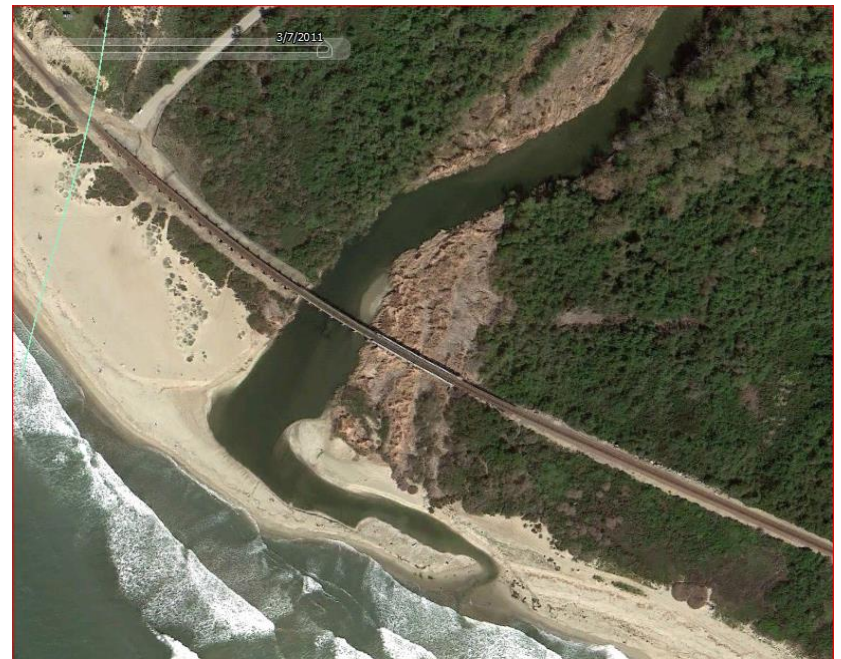
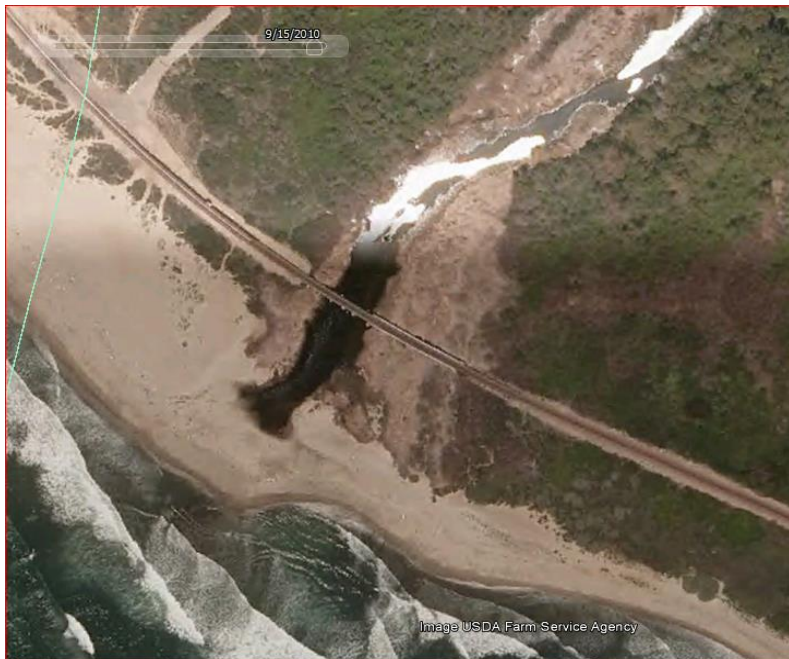
Conceptual model

Dominant physical processes – QCM (Behrens et al 2015)



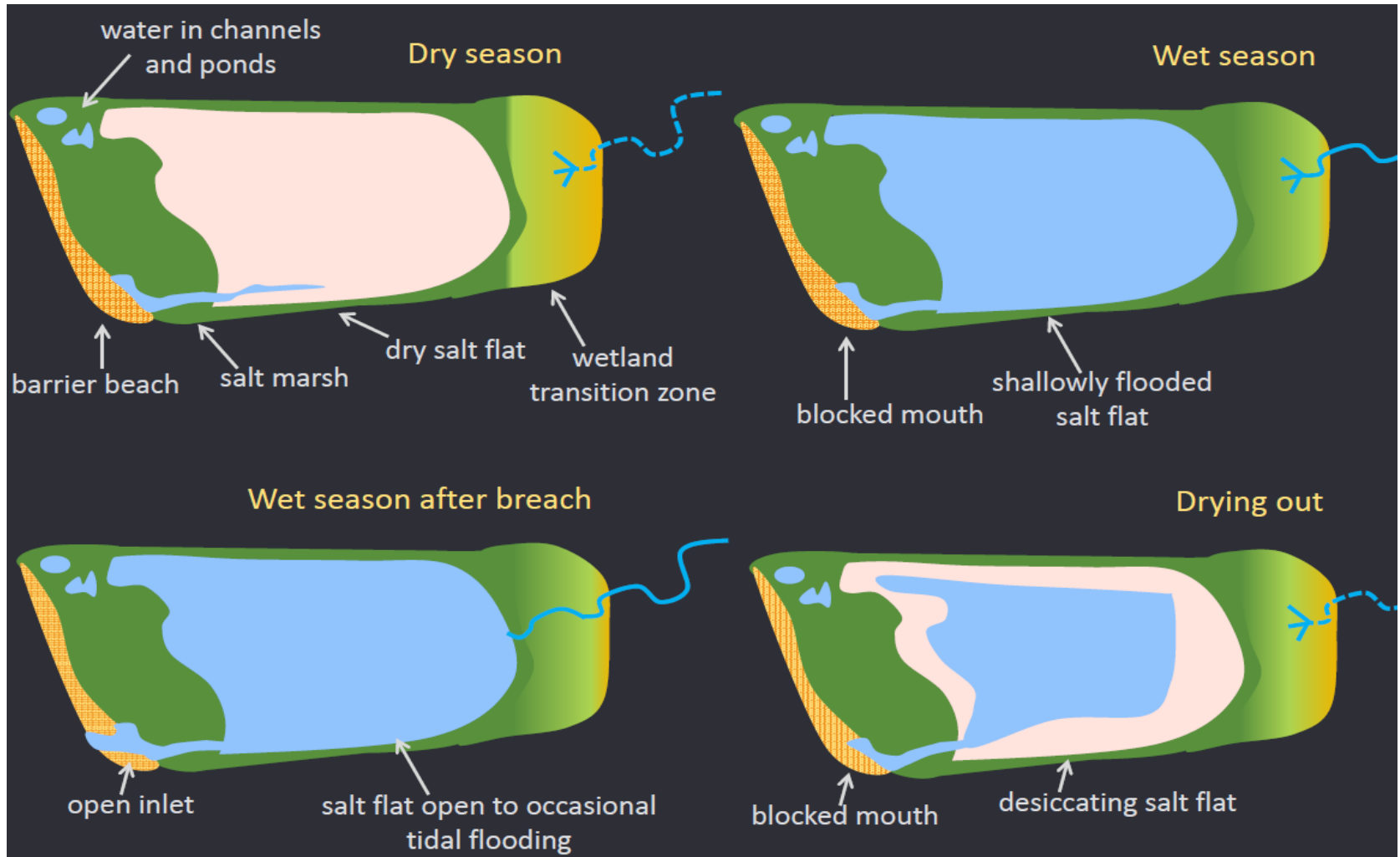
Consequences of closure

- No water exchange – long term retention.
- Water level rises (flooding) or falls (water quality).
- No migration of fish or exchange of plankton.
- Strong salinity stratification impacts WQ.



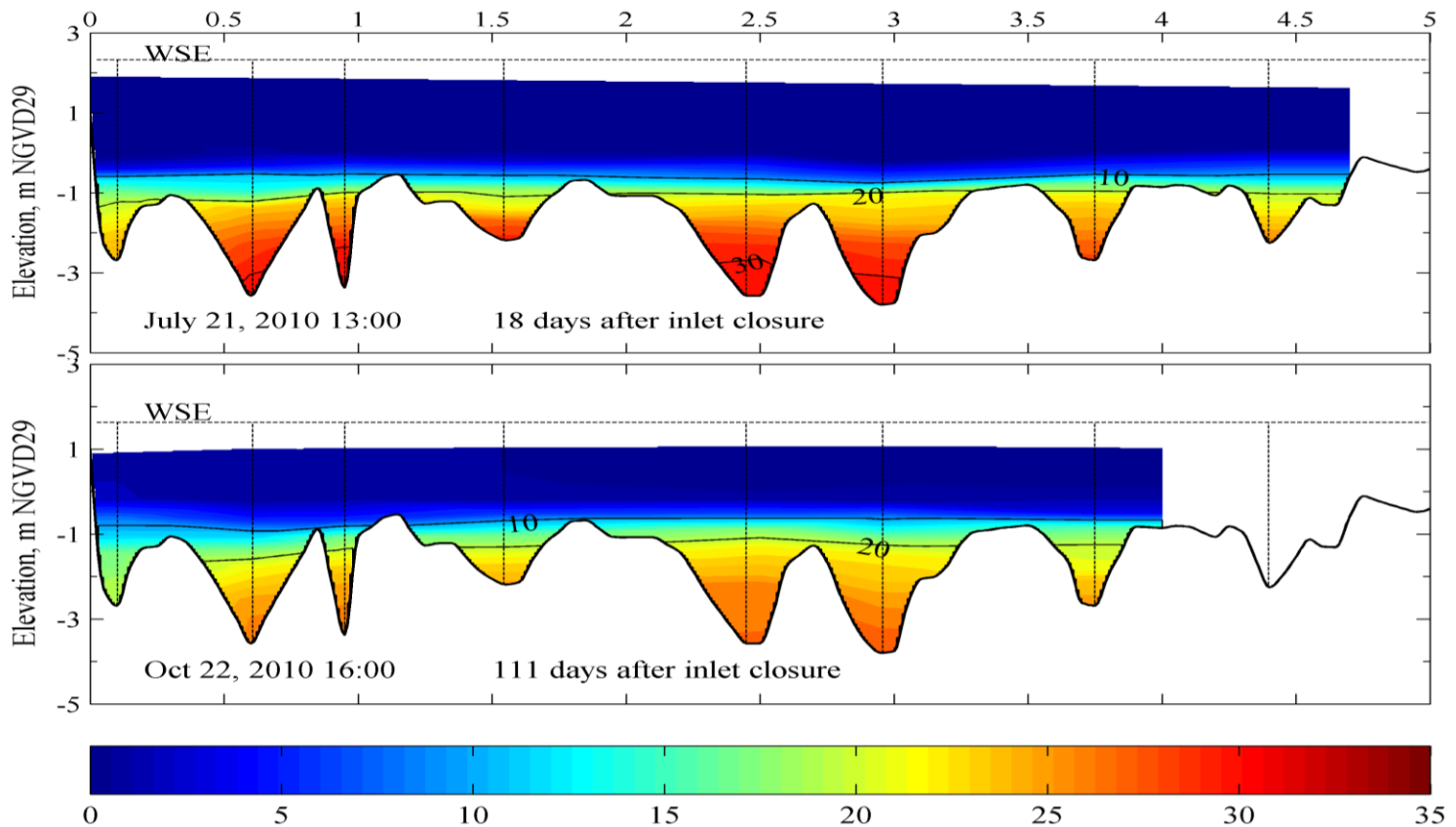
Conceptual model

Seasonal lagoon formation



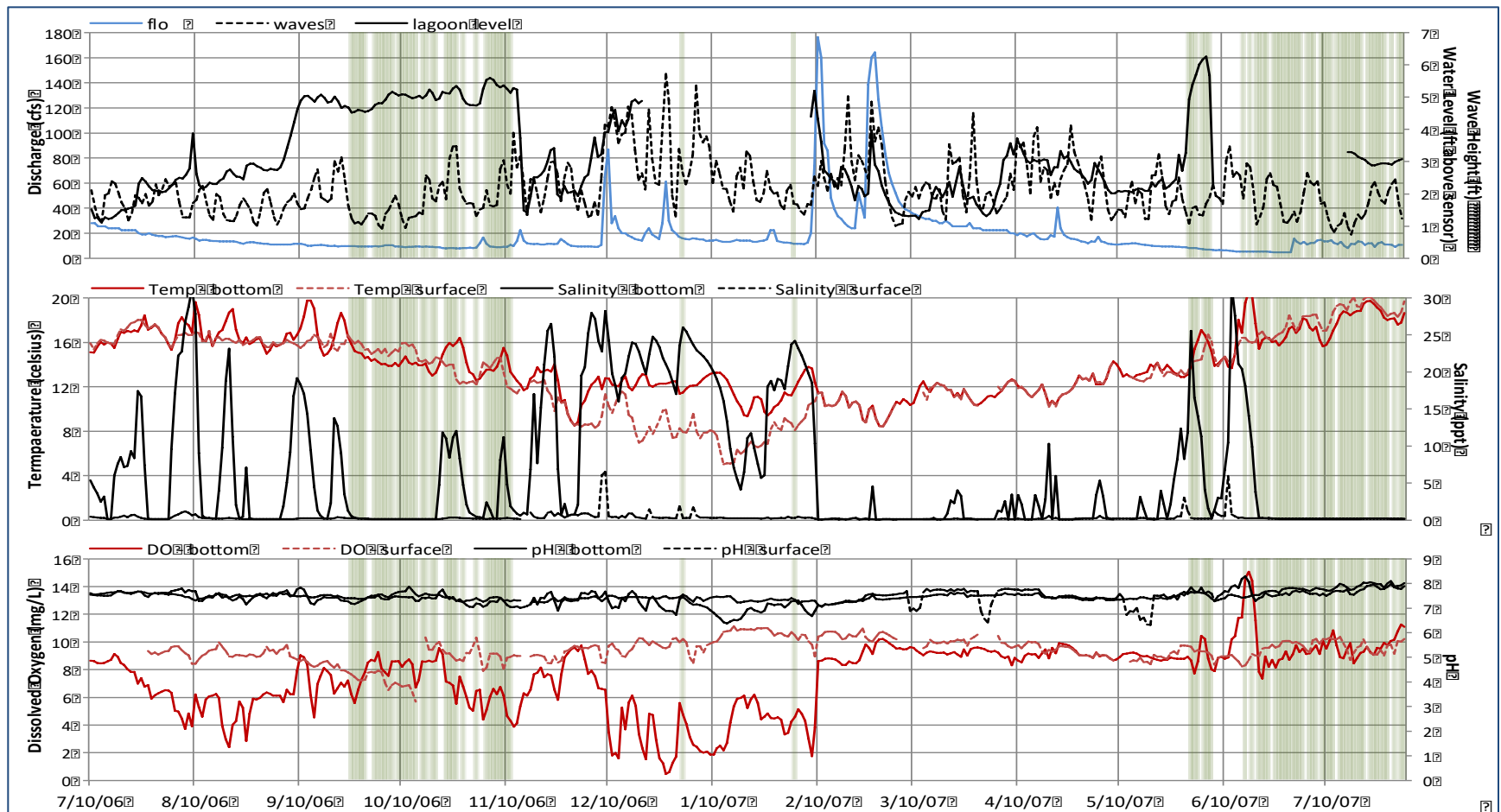
But also salt trapping ...

Trapped salt wedge & intense stratification persist for months in Navarro and other estuaries.



Scott Creek closures

Water level, temperature, salinity, oxygen and pH
July 2006 to July 2007



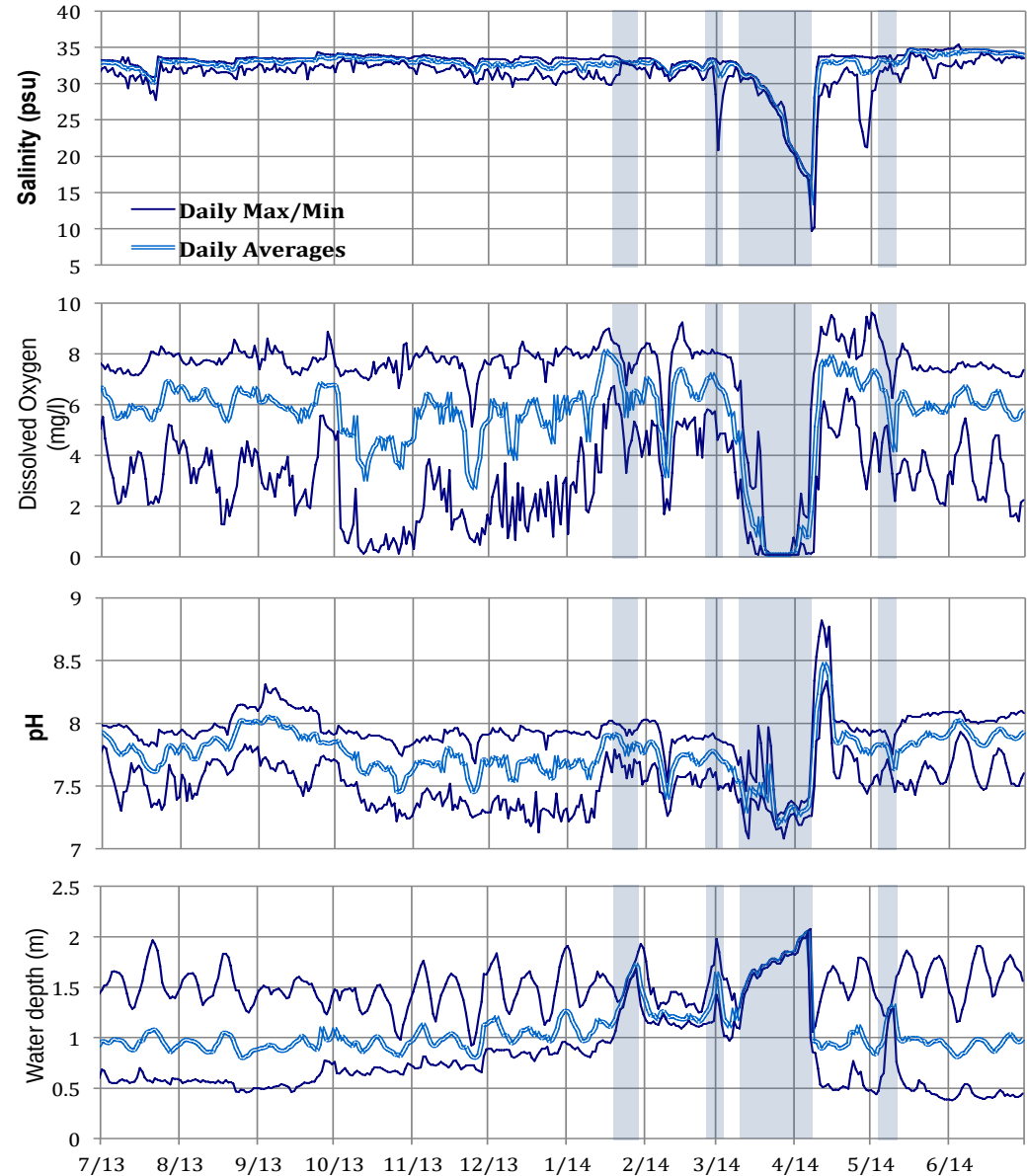
Los Peñasquitos Lagoon

July 2013 to 2014

(Crooks et al 2014)

Taking a closer look
at historical data in
LPL, Tijuana, Otay

(and other historical
data in region)



Changing systems

- What drivers are pushing lagoons into different states?
- How might key drivers change over time?
(physical & socio-economic & regulatory)
- How can systems be best managed to maintain IOE characteristics, functions and benefits?

Highly variable systems (“tough love”).



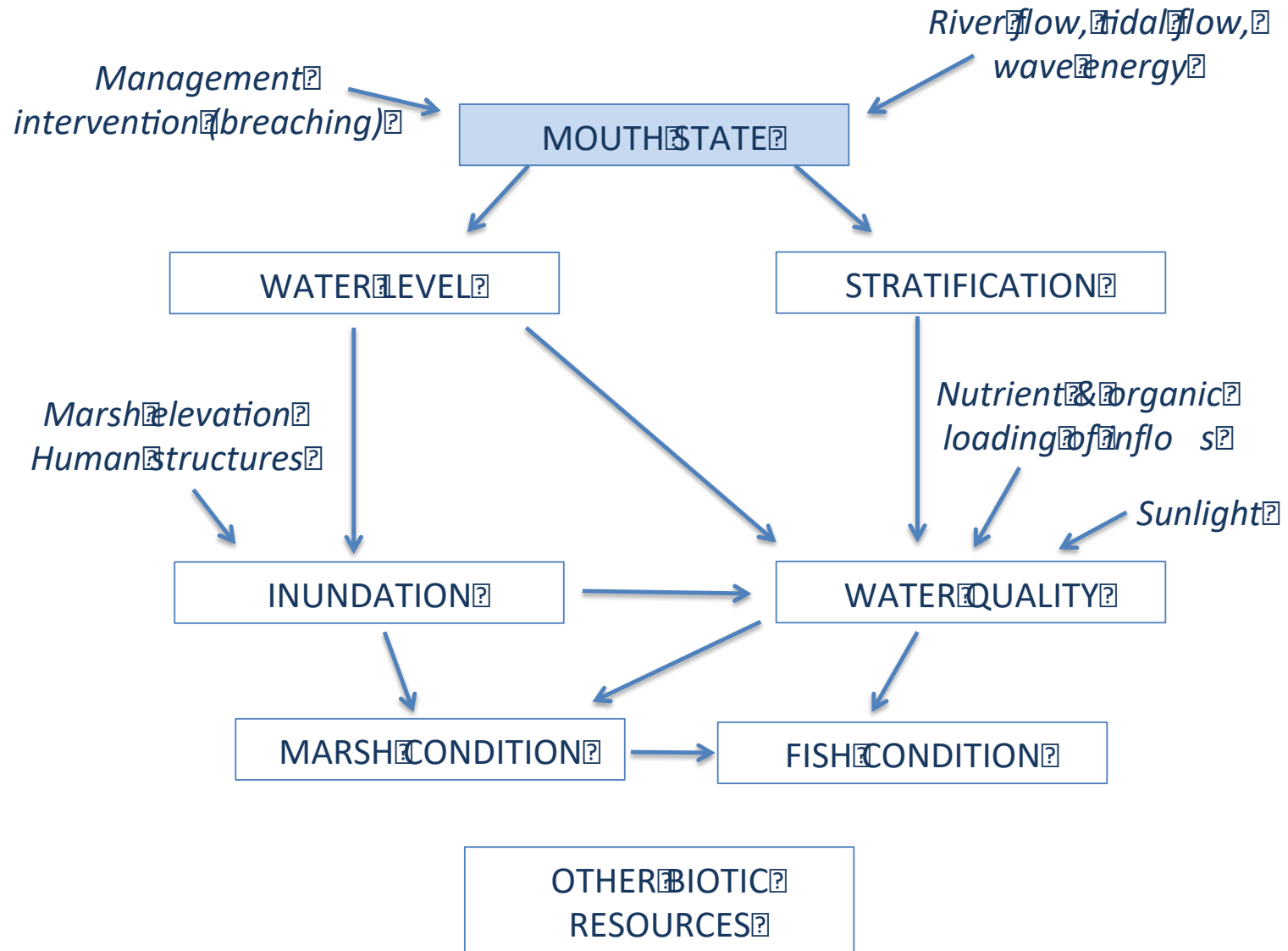
Changing systems

Primary drivers ...

(management need to respond to these issues)

- Water quality
 - Public health (FIB and vectors)
 - Ecosystem & species health (oxygen)
 - “Nuisance” issues
- Flooding
 - Inconvenient (reversible)
 - Infrastructure (lasting damage)
- Fish and other ESA
- Recreation

Mouth state matters



Some questions going forward ...

- What are acceptable conditions?
- Can we allow space for flooding?
- Can we allow for low-energy habitats?
- Are there alternatives to mouth management in addressing specific management challenges (e.g., WQ, flooding)?
- Can we alter regulatory drivers?
- How do we respond to or take advantage of SLR?

Up Next

Presentations that link science and management

- Monitoring
- Fisheries
- Water quality
- San Diego case studies

Discussion to link perspectives and challenges

- Services
- Management issues