Casco Bay Estuary Partnership Science and Technical Advisory Committee (STAC)

November 18, 2014

Meeting notes

Curtis Bohlen, CBEP: Introduction

Curtis talked about the loss of key marine species, including mussels, starfish and eelgrass. He is happy that Graham Sherwood of GMRI is putting temperature loggers at several sites.

Temps in Casco Bay probably going up, need to monitor better.

Jellyfish and ctenophores, e.g. lion's mane or *Beroe* appear to be increasing.

Scott Libby is finding more jellies in zooplankton nets in Massachusetts Bay.

The five year plan is not open ended. Try to get most done in 5 years. Divided into campaigns.

What do we need to monitor to see when the system is changing?

Campaigns to address or better manage the bay.

Question: Did we have measureable goals in the previous plan? This plan might have that.

Matt Liebman, EPA Region 1: Nitrogen loadings to Casco Bay

At the last STAC meeting in June 2012, there was interest in better understanding nitrogen loadings to Casco Bay. At EPA we applied a USGS model called SPARROW, for Spatially Referenced Regressions On Watershed attributes to estimate loadings on an annual basis for the early 2000s time frame. These loadings capture non point sources, including atmospheric deposition and runoff in rivers, as well as WWTP discharges to the rivers. The model also include attenuation factors. To these loadings, we added direct discharges to Casco Bay of WWTP discharges, such as the East End Portland Water District discharge.

The results are still preliminary. The results show that the Presumpscot and Royal Rivers are the dominant sources of nitrogen (and flow) to Casco Bay. Watershed loadings are roughly comparable to direct WWTP discharges to the bay. This is just a model, and there are few independent monitoring estimates; this is a major data gap.

Mike Doan, Friends of Casco Bay: Water Quality Monitoring Program

Based on water column measurements, FOCB sees declining pH over the last decade. Annually, pH also appears to decline from April to October.

pH is associated with dissolved oxygen. Higher percent DO saturation is associated with high pH. (I assume that is because higher DO is related to greater production, which involved CO2 uptake, so there is lower CO2, and therefore higher pH in the water column.)

FOCB also measured aragonite saturation state in sediments, and found them associated with pH. Very low aragonite saturation state have been measured, ranging from 0.2 to 1.2.

Angie Brewer, Maine DEP (contributing work by Hilary Neckles, USGS): Casco Bay Eelgrass and Related Surveys, 2013-2014

Based on aerial photos, ME DEP with its partners have documented a 58% loss of eelgrass coverage from 2001/2002 to 2013, mostly in the Middle Bay. At Mackworth Island it is significant in the last year due to green crab predation. This bed thinned considerably over the one year.

Green crab exclusion experiments demonstrate that green crabs destroy eelgrass plants.

Green crab abundance correlated with loss of eelgrass.

Water quality measurements demonstrate favorable conditions for eelgrass growth, suggesting that green crabs are the cause of recent decline in eelgrass coverage.

NOAA is doing a survey on eelgrass and an environmental sensitivity index perhaps doing some water penetration Lidar. Need to check that out.

What are the control methods for green crabs? Fencing.

Curtis Bohlen, CBEP: Salt Marshes, Restoration and Sea Level Rise

Recent research suggests that salt marshes produce less methane, a greenhouse gas, than freshwater marshes. Restoration of salt marshes from tidal restrictions (e..g undersized culverts) would increase salt marsh vegetation at the expense of freshwater vegetation would result in lower greenhouse gas emissions.

Need accretion rates to do modeling of salt marsh response to sea level rise. Need more surface elevation tables or SETs. But, given available data, and using a “Bathtub model”, depending on the accretion rate, low marsh is expected to increase as sea level rises.\

CBEP has evaluated salt marshes for restoration (Return the Tides project). The top 20, out of 120 sites, have been identified. Some of the sites are currently undergoing restoration. CBEP has documented in some sites (Long Marsh) a loss of brackish marshes, e.g. *Typha* (cattails) when salt marsh circulation is restored.

In evaluating salt marshes for restoration, there are many factors to consider, including sediment accretion, habitat value, blue carbon storage potential, etc. These are factors worth researching.

Chris Desorbo, Biodiversity Research Institute: Raptor and contaminants work in Casco Bay

Ospreys are a potentially good bioindicator of availability of contaminants in the marine food web. Based on aerial surveys of nest productivity, BRI finds a stable population of ospreys in the Casco Bay region.

In evaluating contaminants to measure in raptors, there are many factors to consider. One group of contaminants that is emerging and worth future evaluation includes pharmaceuticals and personal care products (PPCPs, e.g. birth control), which are discharged from WWTP (waste water treatment plants) and showing up in birds.

ME DEP looking at PFOS at East End Beach. (PFOS is Perfluorooctanesulfonic acid or perfluorooctane sulfonate (PFOS) is a man-made fluorosurfactant and global pollutant. PFOS was the key ingredient in

Scotchgard, a fabric protector made by 3M, and numerous stain repellents.) It is assumed that it comes out of the wash and WWTP discharges in Portland Harbor going to East End beach.

Graham Sherwood, Gulf of Maine Research Institute: Casco Bay Aquatic System Survey (CBASS)

The CBASS is a synoptic bay wide study focusing on commercial fishes and environmental factors affecting them, including the distribution and abundance of pelagic forage fish. The study is based on the hypothesis that a limitation of forage fish, due to habitat loss and other factors is limiting commercial fisheries. It is a 10 year study, the first year was 2014. They are using many standard fish sampling approaches, including seining, acoustics, jig sampling.

Other complementary studies include oceanographic measurements performed by Jeff Runge, lobster traps deployed to sample Black Sea Bass.

Can compare and complement the Maine DMR inshore trawl surveys.

This is the first time a comprehensive Casco Bay-wide survey has been conducted.

Karen Wilson, University of Southern Maine: Anadromous fisheries in Casco Bay watershed.

Greater than 49,000 alewives returned to spawn in Highland Lake this year.

Discussed the concept mapping exercise.

The purpose of this exercise is to help identify connections and priorities for research and monitoring in Casco Bay. Each group's will develop a concept map of key relationships for understanding (some aspect) of Casco Bay.

Here specifically is what Karen asked the participants:

- What are the key relationships (of policy relevance) for understanding and managing Casco Bay?
- What are our research priorities (or unanswered scientific questions) for the next five years?
- In a changing world, what are our monitoring priorities, with the goal of detecting and predicting change?

Note: this is not about monitoring the effectiveness of CBEP activities. That will be considered in other conversations.

Concept Mapping Exercise

Group 1. Matt Liebman, Steve Jones, Barry Mower and Bob Gerber

We focused on nitrogen loadings, as per suggestions from Bob Gerber.

First question, is Casco Bay nitrogen limited?

Major question asked was – what is the role of dilution and flushing and circulation in modifying the impact of nutrients in Casco Bay?

Considered a sources, transport, fate and effects conceptual model.

DRIVERS

What are the sources of nitrogen to CB? Where are they coming from spatially?

They need to be identified better.

WWTP, septic, agricultural, stormwater, atmospheric deposition.

Can we better identify nitrogen sources using stable isotopes.

Do we have enough gages on river sources to monitor flow and nitrogen loads? Especially on the lower Presumpscot and the Royal Rivers

Is their sufficient modeling to evaluate nitrogen sources?

MODIFIERS of DRIVERS – how nitrogen is delivered to the bay will tell us about interception points

One of the research gaps is figuring out where the interception points are

Can we specifically differentiate the sources of nitrogen? Also called a nitrogen budget or an inventory.

Nitrogen is delivered to the bay.

But, it is modified by many factors. They include:

Terrestrial uptake

Aquatic plant uptake

Dilution/flushing and circulation for example, the fate of nitrogen in the Fore River is different than what happens offshore.

Nitrogen is attenuated by going from NO3 to N2O to N2 through the watershed.

Where are the places that promote this attenuation and denitrification.

In riparian areas.

In impoundments.

For example, Maquoit Bay is a particularly susceptible embayment in Casco Bay.

Within some areas, there is regeneration of ammonia nitrogen in the sediments. Do we have information on that?

Sources of nitrogen from the Gulf of Maine also need to be budgeted.

RESPONSES

Increases in algae, benthic and pelagic. Some algae are nuisance algae.

Other water quality issues, related to dissolved oxygen, water clarity

Loss of eelgrass

CONSEQUENCES (Overlaps with Responses)

Loss of eelgrass is also a consequence

Dissolved oxygen declines influence distribution and abundance of fish, commercial fisheries and shellfisheries

POLICY (Directly relates to interception points in the modifiers flow)

Restore wetlands to promote nitrogen attenuation

Limit nitrogen in WWTP permits

Limit nitrogen in MS4 permits

Install Green Infrastructure projects to control stormwater runoff and promote nitrogen attenuation.

But do we have end of pipe solutions, including stormwater?

There are also national policy implications, e.g. Clean Air Act imposes controls on nitrogen deposition

Group 2. Angie Brewer, Keri Beaulieu and Graham Sherwood

Very well organized. Focuses on global warming in the middle, as the driver.

Shifting species ranges.

Green crabs are the driver, like a keystone species that structures the ecosystem.

Affects habitat for juvenile lobsters and cod.

Eelgrass connected to pelagic ecosystem productivity.

Looking at bottom up effects.

Long term monitoring sites.

Group 3. Scott Libby, Mike Doan and Peter Larsen

Influence of Kennebec.

Better identify circulation patterns.

Seasonality of algal blooms – is it still coupled?

Long term sites should be monitored every 3 to 4 years.

Group 4 Titled Climate Change Pete Slovinsky's group (not sure who else was in this group)

Focus on Habitat

Long term temperature

Vegetation baseline monitoring

Key Gaps

- Water temperature needs to be measured to see if the last decadal trend is a new norm or if part of the longer term cycles.
- Erosion of bluffs and shorelines in Casco Bay of mudflats and wetlands
- Accretion of mudflats, wetlands is a gap that needs to be measured.
- Gap of precipitation data and how to model impacts of increased precipitation in the face of climate change.
- Lack of biological monitoring in the bay
- Lack of bathymetric data in the bay to support circulation modeling and sediment transport
- Land use trends

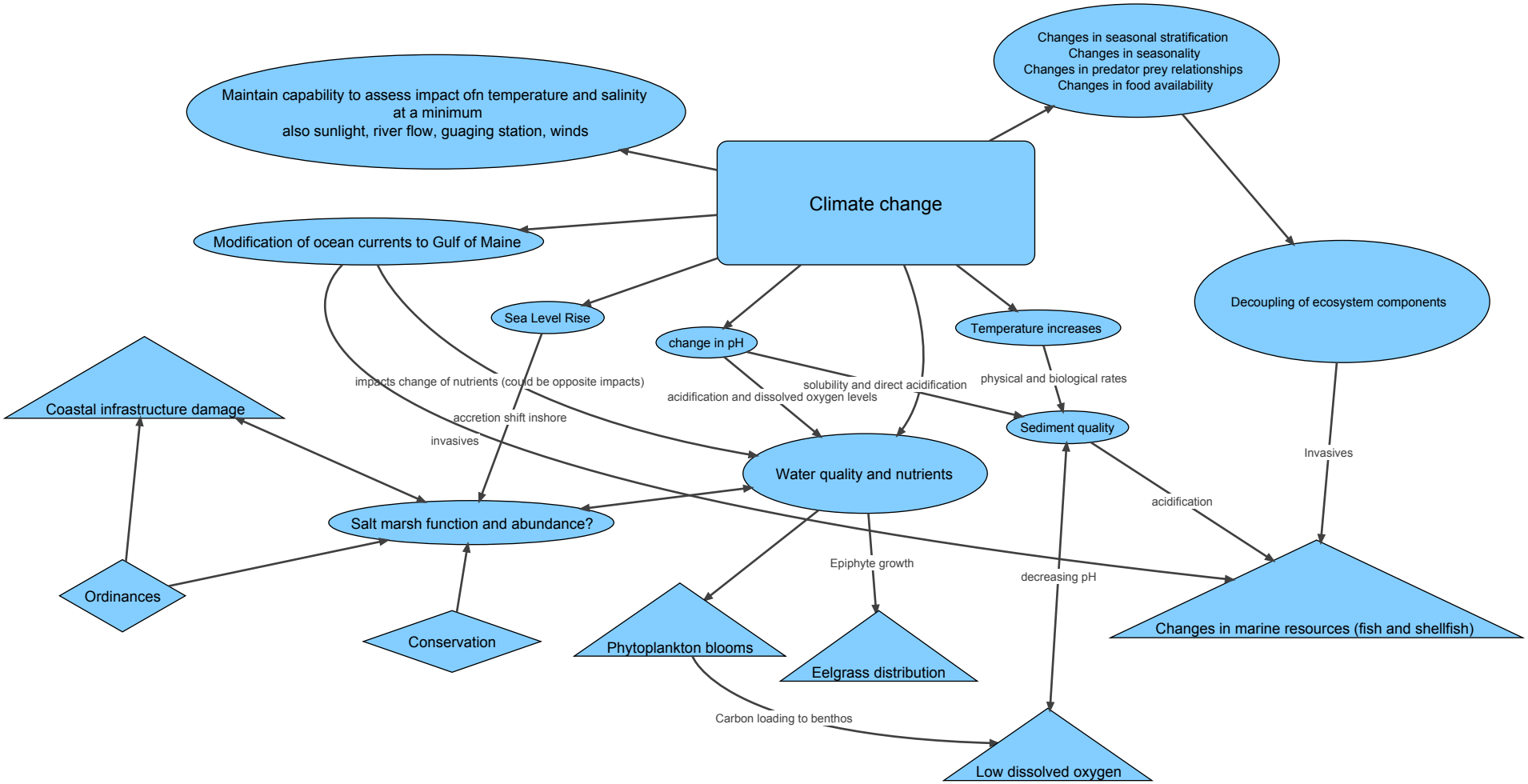
Policies and behaviors

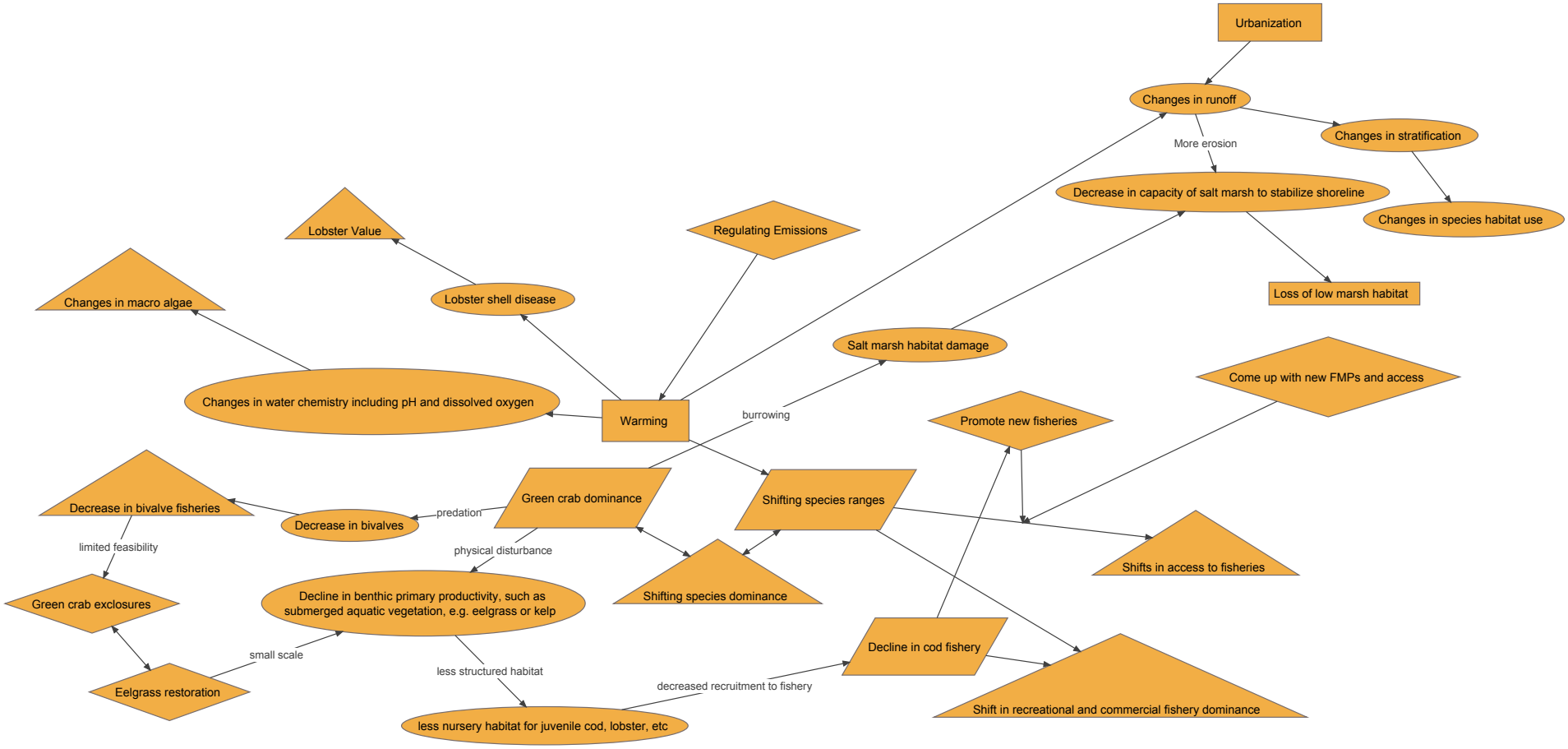
Bacterial monitoring becomes a state run program, not a voluntary program

Bluff management districts

Changes in shoreland zoning/NPRSA regulation to be forward looking in face of climate change

Comprehensive approach to invasive species management


Changes in seasonal stratification
Changes in seasonality
Changes in predator prey relationships
Changes in food availability
Maintain capability to assess impact ofn temperature and salinity
at a minimum
also sunlight, river flow, guaging station, winds
Climate change
Modification of ocean currents to Gulf of Maine
Decoupling of ecosystem components
Sea Level Rise
change in pH
Temperature increases
Coastal infrastructure damage
impacts change of nutrients (could be opposite impacts)
solubility and direct acidification
acidification and dissolved oxygen levels
physical and biological rates
accretion shift inshore
invasives
Sediment quality
Invasives
Water quality and nutrients
acidification
Salt marsh function and abundance?
Epiphyte growth
decreasing pH
Ordinances
Conservation
Phytoplankton blooms
Eelgrass distribution
Changes in marine resources (fish and shellfish)
Carbon loading to benthos
Low dissolved oxygen


Urbanization
Changes in runoff
Changes in stratification
More erosion
Decrease in capacity of salt marsh to stabilize shoreline
Changes in species habitat use
Loss of low marsh habitat
Lobster Value
Regulating Emissions
Changes in macro algae
Lobster shell disease
Salt marsh habitat damage
Come up with new FMPs and access
Changes in water chemistry including pH and dissolved oxygen
Warming
burrowing
Promote new fisheries
Decrease in bivalve fisheries
Decrease in bivalves
predation
Green crab dominance
Shifting species ranges
Shifts in access to fisheries
limited feasibility
physical disturbance
Shifting species dominance
Green crab exclosures
Decline in benthic primary productivity, such as submerged aquatic vegetation, e.g. eelgrass or kelp
Decline in cod fishery
small scale
less structured habitat
decreased recruitment to fishery
Eelgrass restoration
Shift in recreational and commercial fishery dominance
less nursery habitat for juvenile cod, lobster, etc