**SEAGRASS PROGRAM OBJECTIVES**

Objectives of phase 1 (2011-2014):

1. Identify key species and important species interactions in the grazer / epiphyte system
2. Estimate grazer biodiversity and the scale of spatial and temporal variation in seagrass biodiversity
3. Determine whether seagrass meadow systems function as metacommunities

Objectives of phase 2:

1. Identify drivers of variation in biodiversity
2. Continue to identify important species interactions
3. Link species composition and diversity with ecosystem function in seagrass meadows
4. Consider this work on conservation contexts (MPA, etc)
5. Consider seagrass habitats in the seascape – what is their role?

**Expanding on how we met objectives in phase 1**.

**1. Key species and important species interactions in the grazer / epiphyte system**

Between 2011 and 2014, we conducted more than 7 projects centered on grazer-epiphyte species interactions in BC seagrass meadows. Through experiments and observations, we have identified important species interactions including facilitation, competition and predation that structure eelgrass-associated faunal communities. We have documented a trophic cascade from Great Blue Herons to invertebrate grazers, suggesting that predation by wading birds on fish can influence the abundance and distribution of eelgrass-associated invertebrates. Predation by small fish living in seagrass meadows maintains diversity of grazers, possibly because in the absence of predation invertebrates can outcompete or displace each other at the scale of the seagrass plant. We have also documented differences in feeding rates and feeding preferences by grazers on epiphytes, suggesting that the taxonomic diversity in eelgrass meadows is related to functional diversity at the grazer – epiphyte interface.

**2. Quantifying grazer biodiversity and the spatial and temporal scale of variation**

We have identified over 100 species living on and among seagrass blades in BC coastal waters (link to species list). Many are common, found in most meadows, but many species are found only occasionally. We have compiled a database on grazer and epiphyte composition and abundance through time since 2011 at Tsawassen, White Rock and Bamfield, in a time-series that demonstrate seasonal change in grazer communities.

We found typically X-Y species are found on a patch of seagrass growing within a meadow, though this species diversity can vary widely among meadows. Meadow-scale diversity ranges from X – Y species, and is similar among regions (Barkley Sound vs Tsawwassen vs Calvert Island). Through participation in ZEN, we have learned that our grazer diversity and grazer impacts on epiphytes are relatively high compared to other sites.

We have found substantial variation in grazer biodiversity among eelgrass meadows and regions (map). Some species are common and found everywhere, while other species are rare and only appear in a few places at some times (RAD curves). Exploring the causes and consequences of these biodiversity patterns is one of our next objectives.

**3. Seagrass faunal systems as metacommunities.**

Seagrass meadows form distinct habitats. Some are vast, covering many hectares, while others are small fringing meadows only a few square meters in size. The animal biodiversity living in seagrass are likely influenced not only by the temperature, salinity or depth of a meadow, but also by a meadow’s size and isolation from other meadows. We are working to determine the relative importance of animal movement among meadows as a factor that is important to maintaining biodiversity and trophic structure within seagrass meadows.

To determine whether a system is a metacommunity, we need to establish the extent to which populations in meadows are dispersal limited (Objective 2.1). We are doing this by quantifying dispersal potential by comparing life histories among grazer species (Objective 2.1), and working in a system with extensive landscape maps available (Objective 2.x).

**ACCOMPLISHMENTS (2011-2014):**

1. Publications: Knight et al 2015, Huang et al 2015, Amundrud et al 2015; Duffy et al in review, Whippo et al in prep
2. Projects that could be written up: ZEN Predator? Prentice honours project?
3. Databases: Species ID database (Nicole), spatial biodiversity database (Ross, Coreen), phenology database (Sarah, Coreen, Robyn)
4. Networking initiated:

HBI connection (M2M project)

CHONE2 proposal

Massa and Masahiro connection

Fred Short – WA DNR panel

Sandy Wyllie-Ecchevaria et al – seagrasses and climate workshop at FHL

**FUNDING:**

NSERC Discovery grant (O’Connor) 2011, 2013-

UBC work learn (Prentice, Yogendran, Cheung)

NSERC USRA (Amundrud) 2011

UBC Deans award (Knight) 2013

M2M (Parfrey, Harley, O’Connor) 2015-

HBI Seagrass Project (Hessing-Lewis) – 2014-

BMSC research scholarship (Whippo, O’Connor) 2012

CHONE2 (O’Connor, in progress) 2015-?

**FUTURE DIRECTIONS - Objectives, Phase 2:**

***2.1. What drives variation in grazer biodiversity within and among seagrass meadows?***

* Quantify dispersal of eelgrass-associated grazers, and their use of other habitats (Coreen / hakai)
* Metacommunity dynamics (Coreen)
* Estimate biodiversity across gradients: human impacts? (Chone2?)

***2.2. How does seagrass-associated biodiversity affect the function of seagrass ecosystems?***

* Are grazers equivalent in function? What is the function (grazing? Productivity? Some kind of facilitation of seagrass?). This could be done through field and lab experiments to quantify grazing rates, feeding preferences, productivity in the field (shoot growth, flowering timing and density, etc).
* How does function vary spatially and how is it maintained?
* How are important species and species interactions in seagrass affected by human impacts and climate conditions (temp, oa)? [microbes to macrophytes; Chone2]

***2.3 Are they functionally different than other macrophyte assemblages from the perspective of grazers, and fish food?*** [M2M?]

***2.4 How does this seagrass ecology and its landscape context affect the success of conservation objectives?*** [maybe developing under Chone2; could review this sooner as a blog or review article?]

* What are relevant conservation objectives, and how can we integrate seagrass ecological information? [literature review and talking to people]
* What are the specifics in BC – known information needs, unknown needs? [collect and collate information]

***2.5 What outreach and citizen science efforts could we lead or contribute to that would help achieve our goals of better understanding seagrass animal ecology, and including this information in conservation plans?***

* Set up a sign to have people take photos and upload them as a way to document spread of invasive species. A project would make a nice sign; figure out where to put it. ibird, leaf, etc.
* Write up these questions and ideas: get to know communities, reach out to them, discuss collaboration and coordination about eelgrass. Step 1. Write up what this would look like, what the project would be. Consider even a BRITE internship.
* Website: Nicole partner with David?
* Protocols for noting where there is not eelgrass

**TASKS AND NEXT STEPS:**

1. Finish species guide (Nicole)
2. Look at species ids, issues and clean it up.
3. Analyze data together and address questions like those outlined above (how many species have we found where, which are common, which are rare, etc) (Mary? Coreen?)
4. Draft a summary of progress to date (fill in data above)
5. Update the web page with the objective summaries as above, + key figures. (Coreen? Nicole?)
6. Identify major goals for the next 1, 3 and 5 years, and outline how these might be done and by whom (new PHD student, honours student, etc).
7. Develop protocol for sampling and get that up and running; work out details for who does it. (mary and coreen, and gwen); Nicole will help with inverts. Have it ready for classes (402?). Resurrect Sarah’s protocol, describe the position, how much does it require, who would do it.
8. Draft a few project ideas and get them up on our website.
9. Develop a BRITE internship that would help us.
10. Outline opportunities for mapping, data collation of existing data. Collect and aggregate mapping and data that exists (Gwen has leads) on current maps, but also historical trends. Parcs Canada has monitoring data.
11. Create a contact list
12. Budget: lab space and time for mesocosm experiments (BMSC, FHL?) for projects.

**Suggestions for things we’d want to know:**

Environmental variables: temperature, salinity, nutrients; context, data, etc.

Nicole’s idea: MTE biodiversity hypotheses could be tested in seagrass fauna.