T. E. Angela L Quiros
N-Gen summary report
2017-2018 reporting period

Title of project: Effects of coastal development on *Zostera marina* and *Phyllospadix* sp. along the Pacific coast of northern Baja California, México

Summary of Project

The purpose of this project was to continue research in seagrass habitat in northern BC, Mexico that asked the question, "*are we able to monitor and assess the effects of coastal development on seagrass habitat in an under-studied arid region*"? First, we compared the condition of *Zostera marina* beds in two estuaries in northern BC, Mexico in the summer during an El Nino year (2016 under a previous grant) and in the summer after an El Nino year (on this current grant in 2018). To assess seagrass condition in the Punta Banda and San Quintin estuaries, we collected *Zostera marina* core samples to quantify and identify invertebrates, and tested water samples for nitrates and phosphates. We took aerial photographs using a drone to begin mapping the extent of the *Zostera marina* in selected locations around these estuaries. Second, we continued to monitor effects of coastal development on the rocky coast by collecting seagrass tissue samples and water samples in *Phyllospadix spp.* beds along the coast during rain events in the winter (2018 on this current grant).

Drs. Julio Lorda and Rodrigo Beas and I had productive meetings with Autonomous University of Baja California (UABC) and Ensenada Center for Scientific Research and Higher Education (CICESE) professors about present research and future collaborations for seagrass research in northern BC, Mexico.

1) We held a collaborative workshop in March 2018 with UABC professors Alejandro Cabello Passini and Racquel Muniz Salazar about research directions and potential projects for seagrasses in northern BC, Mexico. At this meeting, University of Arizona (UA) students Misty Mehalek and Todd Nicholas Stone presented results of their year of laboratory processing of invertebrates from the 2016 *Zostera marina* cores.
2) I held a meeting in July 2018 with Elena Solana of CICESE about synergies between this current project and data sharing with her long-term monitoring of *Zostera marina* beds in Punta Banda and her current students' projects.
3) In turn, CICESE (Solana) and UABC (Lorda and Beas) provided myself and my UA and UABC team of interns with laboratory space to process *Zostera marina* cores and water samples.

Through this project, Drs. Lorda, Beas and I mentored 7 undergraduate and graduate students in seagrass research across two countries.

1) University of Arizona undergraduate students who assisted in fieldwork include Misty Mehalek and Todd Nicholas Stone in the February/ March fieldtrip and Kara Marie

Lachappelle in the July fieltrip. University of Arizona students who are currently doing labwork to process the *Zostera marina* cores for invertebrates include Purvi Patel (started in the summer of 2018) and Claire Sterling (started in the fall 2018).

2) Misty Mehalek and Todd Nicholas Stone, who had worked as laboratory assistants on previous phases of this project for a year, applied for a Nex-Gen student grant in 2017, which unfortunately was never reviewed. Instead I brought them to northern BC under the Nex-Gen grant to do their own investigations in *Phyllospadix* beds. They conducted rapid assessments in two *Phyllospadix* beds and their initial findings are reported in the attached blogs.
3) Two UABC master's students of Lorda and Beas assisted in the laboratory processing of *Zostera marina* cores included Carolina Felix and Eliot Edd.
4) I presented a seminar on my work on seagrasses for UABC students.

To conclude, the work completed under the budget from Nex-Gen, augmented by matching in kind funds from UABC and CICESE, and funds external to this program enabled us to complete an additional phase in this research program.

Next steps

The next steps in this project are to finish counting and identifying the invertebrates found in the *Zostera marina* cores collected in 2018, process the final batch of water samples collected in 2018, and to begin the comparison of the 2016 dataset with the 2018 dataset. Of note, it took two UA students almost 7 months to process the 2016 cores, so I expect the team of two UA students (Purvi Patel and Claire Sterling) would be able to finish photographing and counting the invertebrates during the Spring 2019 semester, since they started at the end of the summer 2018. If these students wish, I could work with them to use this dataset as their undergraduate thesis.

We partially meet objectives set out in the original proposal (9/1/2017).

Objective 1: Seagrass monitoring in 3 estuaries for seagrass biomass, cover, invertebrates from sediment cores, nutrient content in seagrass tissue, nitrates and phosphates in water samples and fish surveys

Status: Seagrass monitoring in 2 estuaries for all variables except nutrient content in seagrass tissue (no current funding for nutrient analysis but the samples have been collected), and invertebrates from sediment cores are still being processed by UA students.

Objective 2: Characterize watersheds, take aerial photographs and videos

Status: Watersheds observed using Google Earth, drone aerial photographs obtained, no videos taken (turns out videos are not useful to quantify seagrass cover).

Objective 3: Develop protocols to monitor *Phyllospadix* sp. and start their long-term monitoring

Status: UABC undergraduate and graduate students supervised by Beas and Lorda have theses in the *Phyllospadix* sp. around Ensenada. UA students, Misty Mehalek and Todd Nicholas Stone conducted a rapid assessment of Aplysia sp. (sea hares) in *Phyllospadix* sp. beds. However, long-term monitoring protocols have not yet been developed.

Objective 4: Enlist UA and UABC students to develop their own research questions related to this Project

Status: UA students Misty Mehalek and Todd Nicholas Stone developed their own Aplysia rapid assessment in *Phyllospadix* sp. beds.

Objective 5: Peer reviewed publication

Status: In progress since invertebrates are still being counted and identified, and nutrient content of seagrass samples not yet analyzed.

Objective 6: Present results in UABC and in the US.

Status: In progress.

Photos with captions:

File name: Quiros,Mehalek,Stone_processing seagrass in Baja
Caption: T E Angela L Quiros and Misty Mehalek and Todd Nicholas Stone at processing seagrass from Baja California Mexico

File name: Quiros flying drone

Caption: T E Angela L Quiros uses a drone to take aerial photographs of seagrass beds along the coast of Baja California Mexico

File name: Collaborative fieldwork UA UABC students
Caption: Collaborative fieldwork UA UABC students include surveys during negative low tides in Phyllospadix sp. beds

File name: Zostera marina Punta Banda, July, 2018
Caption: A drone flies over *Zostera marina (eelgrass)* exposed at spring low tides in Punta Banda Estuary

File name: UA students surveying Aplysia in Ensenada eelgrass
Caption: UA students Misty Mehalek and Todd Nicholas stone surveying *Aplysia* (sea hares) in the *Phyllospadix* (surfgrass) beds in Ensenada

File name: Aplysia in eelgrass bed Ensenada
Caption: Aplysia, or sea hares were found in abundance February-March 2018 on the rocky shores of Ensenada, here they are nestled in a surf grass (*Phyllospadix* sp) bed