Lexy Dag

Coastal Canaries In Danger

Seagrasses are underwater, flowering plants that have been alive since dinosaurs have existed but for some reason aren't well known to the majority of the human population and are now in danger of extinction. They are known as the "coastal canaries" because of the fact that they detect "harmful changes in the ocean [1]" just like canaries in coal mines would detect harmful gases. Seagrasses live in shallow, salt water coastal areas, where they are anchored to the sand, as seen in Appendix A. Seagrasses live in both temperate and tropical locations as seen in Appendix B. Each seagrass meadow serves as a living environment for a diverse group of marine organisms ranging from, but not limited to conch, shrimp, sea stars, sea cucumbers, lobsters, corals, snapper, parrotfish, sharks, some seabirds to even manatees and dolphins, some seen in Appendix C. Along with serving as a home to a large, diverse group of oceanic organisms, they also control the water flow, "nutrient cycling, and food web structure [2]", control sediment stabilization and increase tourism. Now those services are being threatened by the same source that uses them: people. A large decline in seagrass population has now been noticed because of the pressures human populations are putting on them in coastal areas, along with eutrophication, "fish farming, drastic global climate change, and intensity of storms [3]". Some causes are not related to human interaction but most seem to be. If people continue to overpopulate, overfish and furthermore threaten the population of Seagrasses, they will eventually die out and diminish the many ecosystem services they offer unless a new law is created that strongly puts a restraint on human interaction with Seagrass.

Ecosystem services are usually taken for granted by humans. Some services we often don't even realize as being a service. Conscious about it or not, a single acre of seagrass "provides ecosystem services worth 18,000$ per year[4]". Humans have been using seagrasses for over "10,000 years [4]" and yet most don't even realize they exist. They reduce greenhouse gases, provide food and shelter for fish and organisms we consume and use for tourism, control "organic carbon production and sediment stabilization [2]". These "coastal canaries" are very helpful in determining the health of the sea around them. As shown in Appendix D, the more seagrass there is an a certain area, the better the health of the area. This "better health" refers to the amount of nutrients there are. Seagrass will not be able to survive if the amount of nutrients in the water is over abundant. This exaggeration of nutrients leads to more organisms, like phytoplankton, that fight over oxygen and that depletion of oxygen which adds to the danger of seagrasses going extinct. If there is a limited amount of nutrients in the water, some are able to survive but not many.

Seagrasses are so essential to their ecosystem and habitat that they are noted as to being a 'keystone species'. Keystone species are organisms that "play a critical role in maintaining the structure of an ecological community and whose impact on the community is [5]" greater than most other species among them. In other words, keystone species have a lot of weight on their shoulders and that weight is extremely dependant on the success of their survival. Seeing as they are a major "primary food source for the world's largest marine herbivores [4]" and it is known that decomposing part of seagrasses also "provide nutrients for creatures who have a limited food supply in deep ocean canyons [1]".

According to recent discoveries, the amount of Seagrass decline has "increased

almost tenfold over the last 40 years [3]". This decline is caused by disturbances and a disturbance, "natural or human-induced, is any event that measurable alters resources available to seagrasses…causing degradation or loss [6]". For a major natural disturbance, SeagrassNet monitoring "showed that 96% of the seagrass…was lost…as a consequence of intensive grazing by geese [6]", particularly in Canada. Appendix E shows the comparison of seagrass from the time geese weren't grazing on them to the time that they were. They did this experiment by using "eight quarterly sampling times from October 2001 to July 2003 [6]". For the rest of the geese grazing studies, their site was a 10-ha intertidal meadow, consisting of a shallow "tide pool at low tide [6]". In their site, they studied the change in "percent cover, canopy height and aboveground biomass [6]", along with shoot density to show the seagrass progress or lack thereof. Eutrophication has also been a cause in Tizzard Island (Maryland) that SeagrassNet discovered is killing of seagrass. According to their studies, this over-nutritionalizing of an area where seagrass thrive has increased the algae population and, in turn, "reduced the availability of light to the seagrasses [6]". The shallow areas are especially affected by this overpopulation of algae, as seen in Appendix F, where two different seagrasses are shown to be declining specifically in shallow areas where algae has blocked them off from receiving their means of sunlight. Monitoring for this case study was done by placing their site in Maryland, on the east coast of North America inside of a lagoon that receives nutrients from groundwater. These monitoring tests were done between 2002 and 2001, "particularly near the shore [6]". The same group, SeagrassNet, analyzed seagrass decline in Placencia, Belize where there was a "rapid increase of tourist facilities [6]" and, coincidentally, a "significant decrease in seagrass [6]". Their testing site was purposely placed, of course, adjacent to the shoreline

where the development was heavily increasing. This site was “established to capture the effects of expanding development within the region [6]” and after a short duration of monitoring, a decrease was evident in seagrass percent cover and shoot density.

According to the Seagrass Restoration Now participants, the “rates of change [2]” in seagrass numbers are increasing due to the increased human population and pressure to the coastal zones. Their conclusions are in line with SeagrassNet, seeing as both are pointing the finger at us, humans. Human interactions with seagrass are very negative. The more we add harbors, marinas and groins the more the migration of seagrasses will be prevented which will result in “meadow fragmentation [2]”. As another cause “the introduction of nonnative marine species [2]” is also causing seagrasses to decline. This introduction causes physical disturbances to their ecosystem and since this trend is becoming more popular, seagrasses do not have enough time to adapt to their new changes and are dying out. SRN, Seagrass Restoration Now, has also discovered that because of the “rapid expansion of fish farming [2]” and other human-invested practices, local populations of seagrasses are being disturbed and resulting in their decline. As shown in Appendix G, SRN analyzed how the seagrass populations were handling all the pressure being forced upon them and the levels of decline are shown to be rapidly increasing; meaning the more we, humans, are getting involved the more they, the seagrasses, are decreasing. The “human population expansion is now the most serious cause [8]” of the seagrass loss according to Frederic Short. Short also stated that there are natural disturbances like “hurricanes, earthquakes, disease [8]”, storms, water salinity and droughts but their effects are minor compared to the human-induced effects.

The Florida Marine Research Institute agrees with both SRN and SeagrassNet about the root causes of seagrass decline being linked to human involvement. According to this group of Florida researchers, careless boating, dredging and building are all causing the decline in seagrasses along the coasts, of Florida specifically. They concluded that boats can destroy large amounts of seagrasses to a point where it takes "as long as ten years for recovery [9]". Human pollutants like chemicals and shading created by docks are both causes of the decline in coastal seagrasses as well. Shaded areas don't allow seagrass growth, as shown in Appendix I, because the seagrass require sunlight for their survival so if there is an absence of sunlight "seagrass can not survive and grow [9]". Construction of marinas and docks both take away sunlight and in the end, reduce the amount of seagrass able to live around those areas. These same Florida researchers created a chart analyzing the relationship between Florida's population and the population of seagrass, as shown in Appendix H. As shown in the bar graph, while human "population has been…growing…seagrass meadows have been declining [9]". Seeing how human populations are going to keep growing, especially around coastal areas, seagrasses are going to find themselves in a large predicament where they're existence is tremendously threatened unless a solution is proposed.

The exact number of decline is nearly impossible to estimate but modern technology has helped get an estimate to how much seagrass is being depleted over a period of time. SeagrassNet is a current "monitoring program that investigates…the status of seagrass resources [7]". They are "now monitoring the seagrass habitat four times a year, using the same protocol, in 18 countries at 48 sites worldwide [6]". According to SeagrassNet, it's "too early to draw conclusions [6]" but the cause is seemingly obvious: human

development. Concrete causes are unable to be found because of "lack of comprehensive monitoring and seagrass [8]".

My initial proposed solution was a law that restrains humans from interacting at all with nature, seagrasses included. But that'd be way too easy to propose and not so easy to enact. It'd also cause way too many problems for those that are "dearly" attached to certain ecosystem services they didn't even know existed…until they were threatened to be revoked, of course. Another solution I had in mind was to close off all seagrass ecosystems to any public interaction. In other words, "lock up" seagrass communities so they can flourish on their own without any contact with human life. I then realized that the number of stakeholders that would not be in favor of this proposal (fishermen, tourists, coastal inhabitants), completely outnumbers the ones that would be. Both these proposals are too extreme. I then came up with the idea of making the public "aware" of this dramatic decrease in seagrass and took the "educative approach". This proposal stated that a group or groups would be assigned by environmentalists and ecologists, even specialized biologists to inform the public on the matter. This proposal seemed too passive and realistic results probably wouldn't have resulted.

Those solutions scratched, I came up with a more moderate, active and realistic solution, attempting to avoid as much conflict as I could while still considering bettering the environment as my priority. This solution consists of a law enforcing a restraint on the interaction between humans and, specifically, seagrasses. This law would, obviously, have to be taken up with the lower house, the senate and the president and if all goes well, it would finally be implemented. With the law, come specific restrictions. These restrictions would limit the amount of people that are allowed to live in coastal areas. This amount

would be found by looking at the carrying capacity of certain coastal areas and, for instant results, finding an even smaller amount. Some people currently living in these coastal regions will be upset seeing as a fraction of them will definitely have to be removed and relocated. Realtors would probably be happy seeing as they're going to be in high demand since a number of people will need to find new homes.

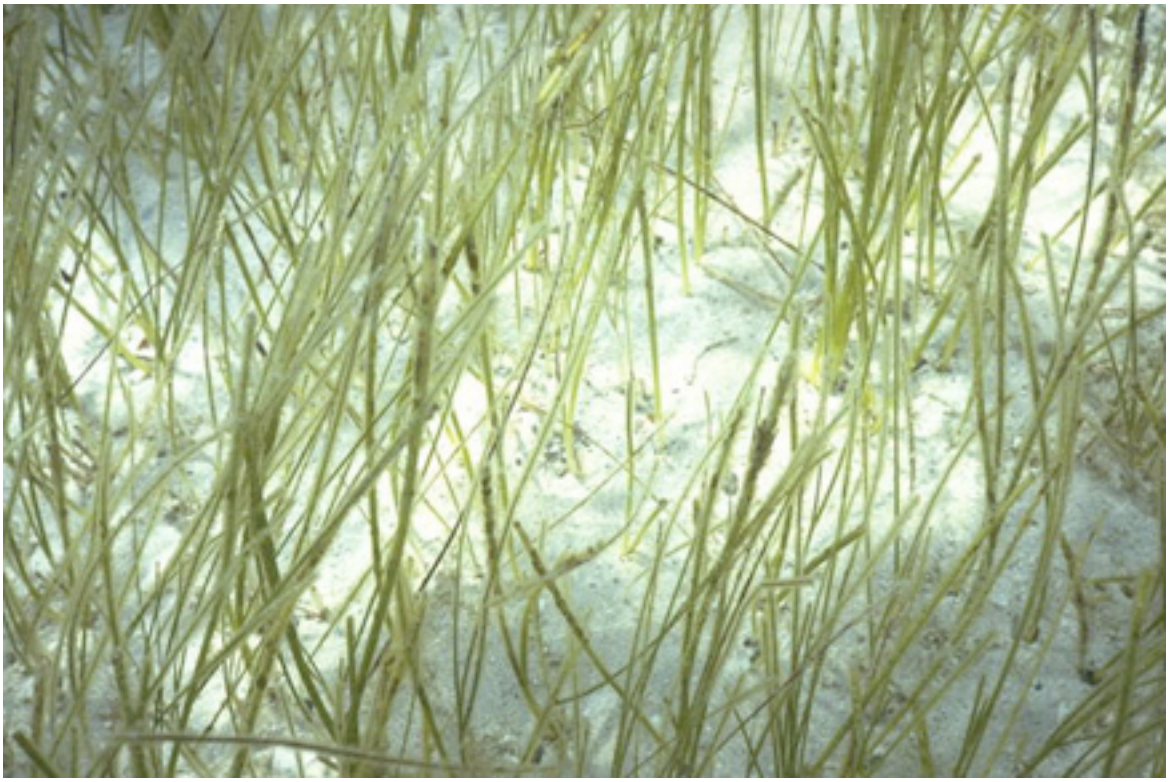
Restrictions involving how much fishing is allowed would also be enforced. This restriction would be found by taking the number of annual fish and/or aquatic organisms fished for in seagrasses and cutting that down by half and making that number the maximum amount of aquatic life these fishermen and companies can attain annually. Fishermen would need to be active in this part of the law. They'd need to be evaluated and interviewed and all their data recorded (data being the amount of fish/organisms they get). They'd have to note down all their counts for fish and organisms each year to be able to find that halved amount. Fishermen wouldn't be too pleased with this seeing as they'd be making less money and companies would be losing a large amount of their income as well.

Even Tourists would be negatively affected seeing as they, too, would have a restraint on how often they can boat around the seagrasses and how close (all to avoid the destruction of seagrasses by the propeller blades). In the long run, tourists would be in favor for this new law because of the increase in seagrass size, which, in turn, would cause the diversity of fish and oceanic life to increase as well. Fertilization of the ocean around seagrass communities would be extremely limited with this law. Farmers would be limited to using fertilizers at only specific times of year instead of whenever they want. This would be to avoid any over-nutritionalizing and eutrophication.

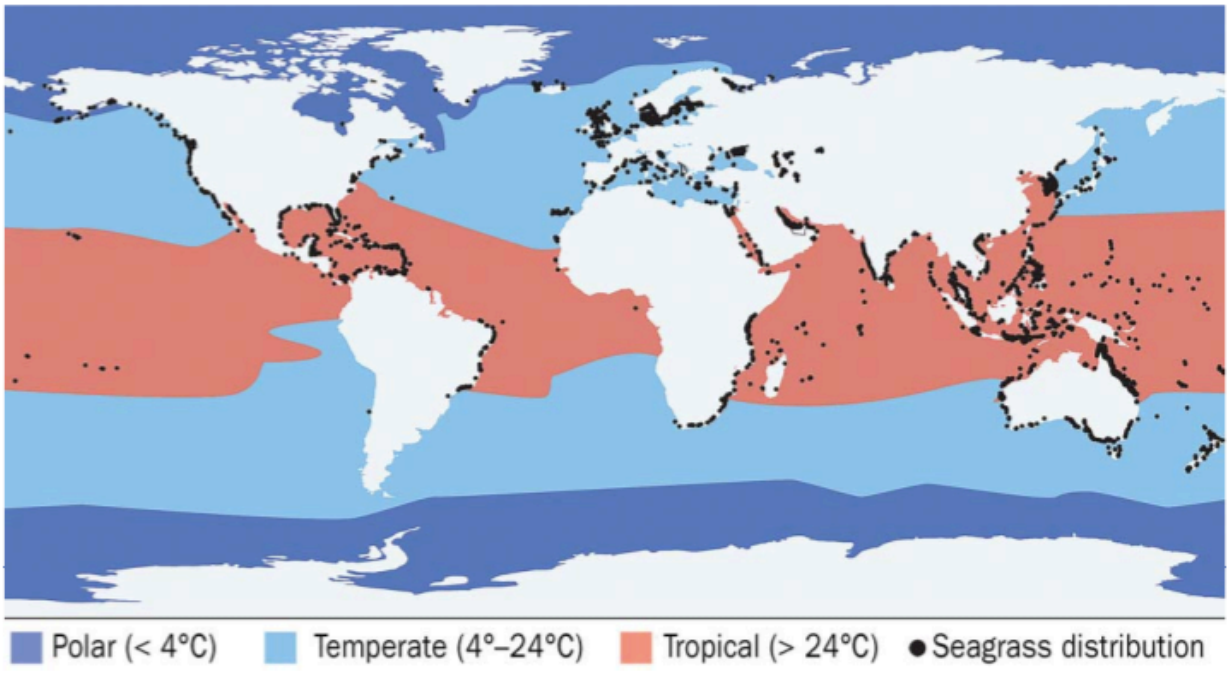
The majority of stakeholders for this proposal would probably lie within the ecologists, biologists and environmentalists. These three stakeholders would see how large of an increase there'd be in seagrass now that there would less boats, docks, construction to limit sunlight. There would also be less eutrophication, which would result, again, in more seagrass. The long-term effects would outmaneuver any temporary cost issues fishermen and other stakeholders would have. These long-term effects include less carbon and greenhouse gases, more diversity in fish and food sources, a controlled oceanic, stable food web along with continue to serve as "coastal canaries" in determining the health of the ocean around said seagrass community. Economically, there's a risk of losing money with the people having to move, temporary less tourism and also less income for business involving fisheries both small-scale and large-scale. This proposal has tried to keep every stakeholder in mind and has attempted to satisfy each adequately.

Appendix

A. http://www.bvidef.org/main/images/stories/seagrass1.jpg

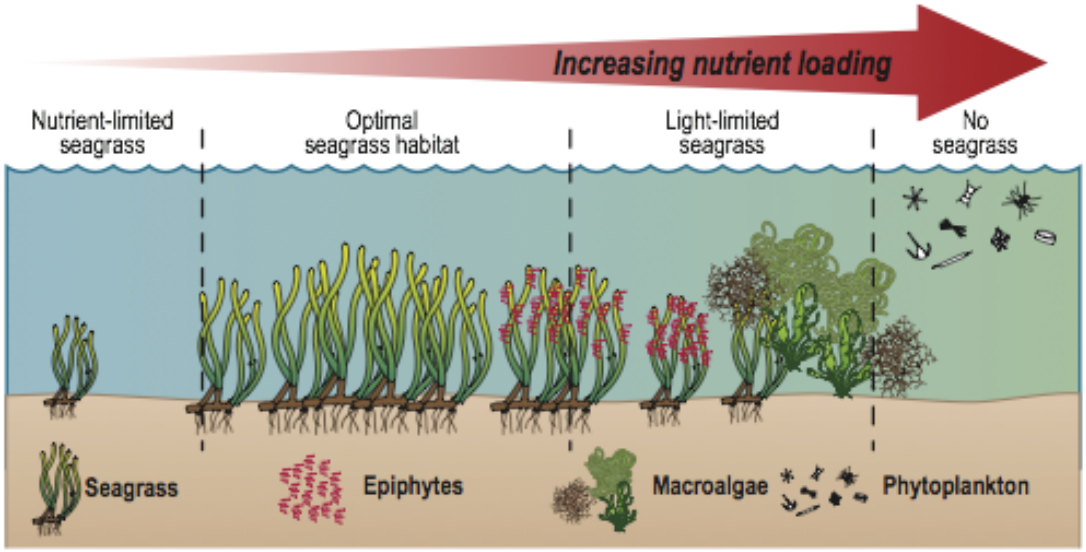


B. source [2]

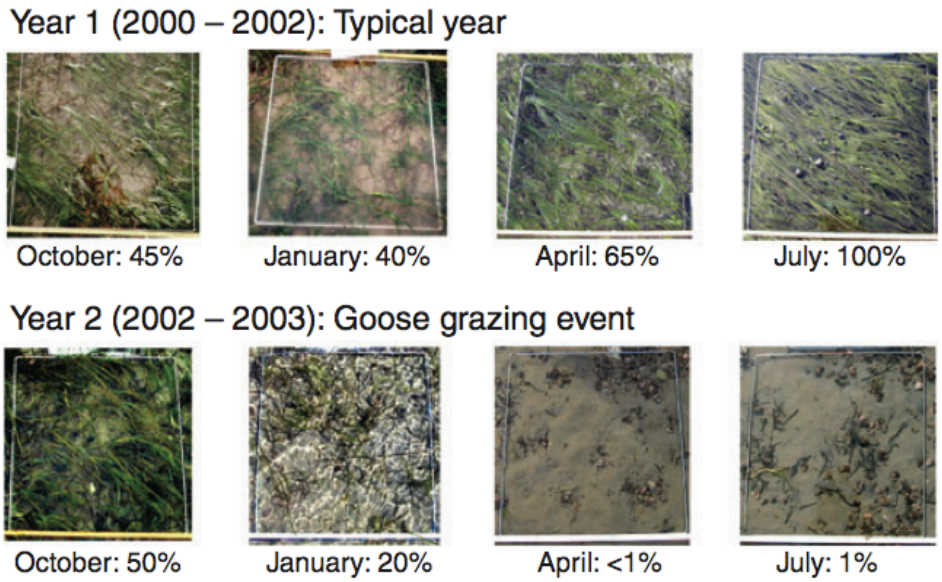


C. http://www.seagrasswatch.org/What_is_Seagrass/images/SG_Habitat.jpg

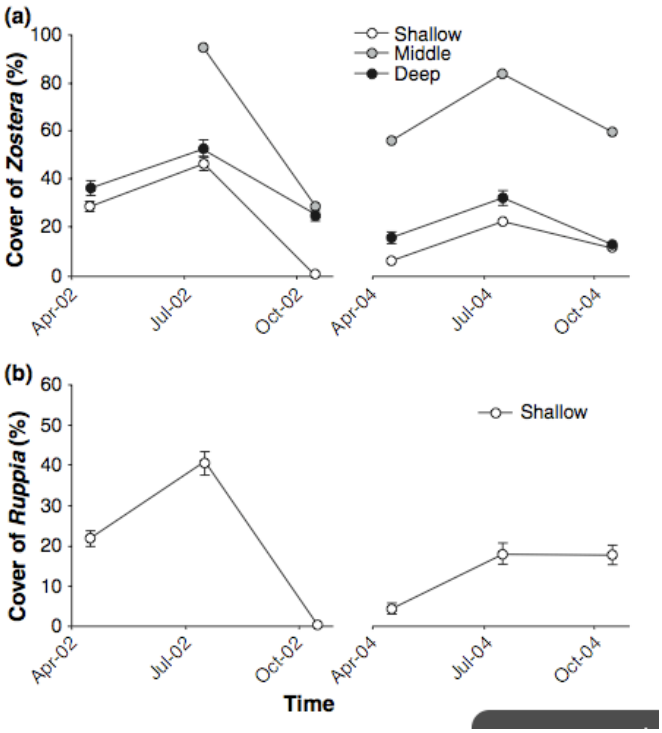
D. source [1]



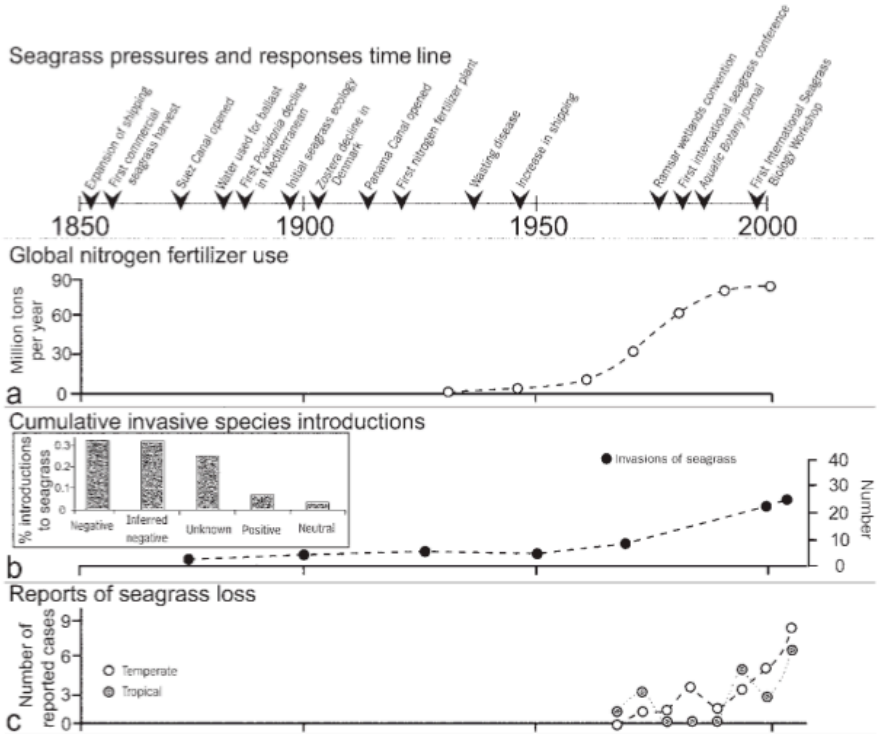
E. source [6]



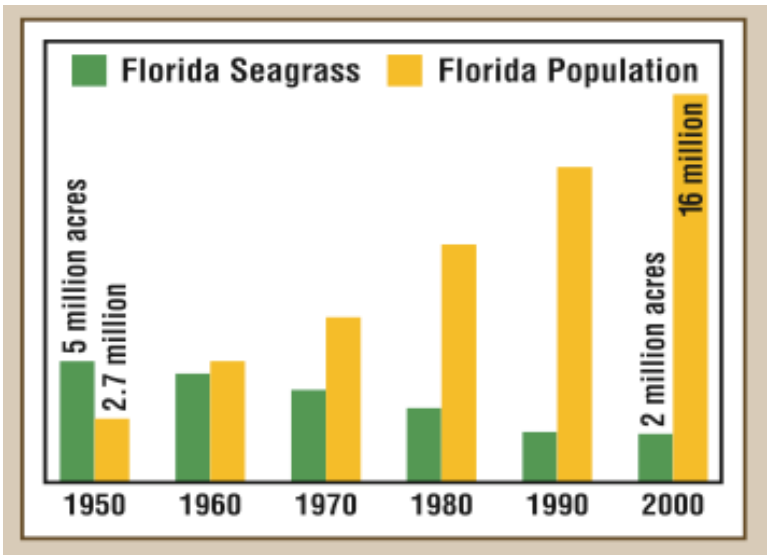
F. source [6]



G. source [2]



H. source [9]



I. source [9]

Above: Effects of residential docks on seagrass include areas under and around docks where seagrass does not grow.

Right: White streaks show damage of boat propellers on seagrass meadows. White patches are where seagrass is completely destroyed.

Bibliography

1. SeaGrass Grow Main Page, http://www.seagrassgrow.org/index.php?ht=a/GetDocumentAction/i/3529 Accessed 13-Oct-2010

2. Orth, Robert J. "A Global Crisis for Seagrass Ecosystems." Bioscience Magazine Dec. 2006. Seagrass Restoration Now. Web. 8 Oct. 2010 <http://seagrassrestorationnow.com/docs/Seagrass%20Orth%20et%20al%20BiosciSeagrassCrisisDec06final.pdf>.

3. "Seagrass Ecosystems Face a Global Crisis." Environment News Alert Service. European Commission, Jan. 2007. Web. 15 Oct. 2010. <http://ec.europa.eu/environ ment/integration/research/newsalert/pdf/49na2.pdf>.

4. SeaGrass Grow Main Page, http://www.seagrassgrow.org/index.php? ht=a/GetDocumentAction/i/3526 Accessed 13-Oct-2010

5. Klappenbach, By Laura. "Keystone Species - What Is a Keystone Species." Animals Wildlife - Animal Facts, Animal Pictures, Habitat Facts, Evolution and Zoology. Web. 16 Oct. 2010.<http://animals.about.com/od/animalswildlife101/f/keystonespe cies.htm>.

6. Short, Frederick T. "SeagrassNet Monitoring across the Americas: Case Studies of Seagrass Decline." Onlinelibrary.wiley.com. Web. 16 Oct. 2010. <http://onlinelibrary.wiley.com/doi/10.1111/j.1439-0485.2006.00095.x/pdf>.

7. SeagrassNet Main Page, http://www.seagrassnet.org Accessed 12-Oct-2010

8. Short, Frederick T., and Evamaria W. Koch. "SeagrassNet Monitoring across the Americas: Case Studies of Seagrass Decline." Journals.Cambridge.org. 28 Nov. 2006. Web. 16 Oct. 2010. < http://journals.cambridge.org/action/displayAbstract?fromPage=online &aid=6328056>.

9. Sarasota Bay Estuary Main Page, http://www.sarasotabay.org/documents/seagrassbrochure.pdf Accessed 16-Oct-2010