Honours Project Proposal.

Jesse Smith

3868892

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[3868892@myuct.ac.za](mailto:3868892@myuct.ac.za)

Project Supervisor: Prof AJ Smit

Assistant Supervisor: Ross Coppin

**Morphometric properties of shallow water kelp, *Ecklonia maxima*, along thermal and wave exposure gradients.**

**Background info:**

Ecklonia maxima is a large brown kelp from the order Laminariales, one of four kelp species found along the south-west coast of Southern Africa, along with Laminaria pallida, Macrocystis pyrifera and Ecklonia radiata.

E.maxima and L.pallida are the only two species that are both ecological and economically beneficial.

E.maxima occurs in areas of warm to cold temperate waters in the sub- and intertidal rocky substrate (Stenek and Johnson 2013, Rothman 2015). E.maxima and L.pallida form extensive kelp beds along the South African west coast. With E.maxima forming the floating canopy up to depths of 10m and L.pallida forming the sub-canopy at depths of 20m or greater.

Many environmental factors influence the kelp bed communities, where temperature generally controls the geographical distribution of marine organisms (Luning 1990, Rothman 2015) kelp beds are controlled by factors such as wave action, nutrient levels, photoperiod, tides, topography of substrata and depth among others. Previous studies show that …

Bolton and Anderson have shown a strong relationship between seawater temperature and the geographical distribution of kelp species. Because of South Africa`s unique location and it being bordered by two large intense currents, the warm tropical Agulhas current on the east coast, and the cold nutrient rich Benguela on the west coast, the interaction of these two currents have profound effects.

In the Benguela Marine Province, seawater temperature serves as a proxy for nutrients, with an inverse relationship (Diekmann 1980). The order Laminariales has a general ability to translocate stored nutrients for survival in conditions where light availability in unpredictable (Luning 1990). Both L.pallida and E.maxima can store nutrients, but they don’t store it seasonally.

Depth is directly related to light attenuation (Luning 1990), which makes it a major controlling factor of the vertical distribution of kelps.

Studies show that morphological factors of seaweed can be a function of environmental factors, especially wave action. Kelps need to be flexible, to resist hydrostatic bending forces, and have strong thalli (Norton et al 1982). Generally kelp growing in exposed areas is tougher, sturdier, and more strongly attached than those in sheltered areas. The way nutrients are stored can also influence kelps morphology.

* The bigger the organism the bigger the drag force.

Temperature and irradiance are the two most important factors influencing early stage of development (luning 1990). Heteromorphic life histories are beneficial in that organisms can survive in different environmental conditions seeing that the different stages have different environmental requirements. E.maxima gametophytes have a broader temperature range for growth and survival than sporophytes (Bolton and Levitt 1985). Rothman 2006, generalise that once sporophytes are established and reach a certain size (stipe > 25mm), they have a good chance (75%) of maturing and forming part of the canopy.

Adult E.maxima is characterised by a long hollow stipe, spear-shaped primary blade, with secondary blades grow bilaterally.

Morphological plasticity in kelps induced by environmental conditions, Hurd and Pilditch 2011, blade width and thickness varies with wave exposure, but adaptations help reduce drag and maximise nutrient uptake.

* Sheltered: thin blades with ruffled margins,
* Exposed: flat and smooth blades

E.maxima historically never occurred further than Cape Agulhas, increasing in abundance within False Bay between 1966 – 2007, possibly due to the lower temperatures in that region.

**Intention of study/ Rational:**

To determine if environmental factors such as temperature and wave intensity have an effect on the morphology of shallow water sporophytes of Ecklonia maxima.

**Justification:**

Why is kelp so important? (Two Oceans Aquarium)

1. Kelp is classified as a keystone species, which means it plays a vital part in forming a thriving ecosystem
2. Kelp forests are among the most productive ecosystems in the world
3. Due to climate change and elevated sea temperatures, the environment for kelp to successfully grow in is at risk. This poses a huge threat to biodiversity within the ocean
4. Kelp purifies water and removes waste products produced by the animals living within the forests
5. Underwater forests provide shelter, food and the ideal habitat for various species
6. Commercially, kelp is used in a wide variety of products, from salad dressings, cosmetics, food, vitamin supplements, skin care products, paint, etc.

**Proposed methodology:**

Thirteen *Ecklonia maxima* individuals will be collected by snorkel in an area of kelp bed ~1m deep. After collection of kelp has been completed, various morphological and biomass measurements will be recorded. Measuring tape will be used to measure the various morphological features, and biomass will be measured by cutting the kelp into sections and placing the material in a net bag which will be weighed using scientific scales.

The morphological factors going to be measured are: primary blade length, primary blade width, frond length, stipe length, stipe circumference, number of tufts and epiphyte length. The biomass will be divided into frond mass and stipe mass.

**Expected outcome:**

**Timeline:**

February – April 2018

* Sampling

May – July 2018

* Analysis of results

August – October

* Write up

October

* First draft

November 19th 2018

* Submission

December 3rd 2018

* Presentation