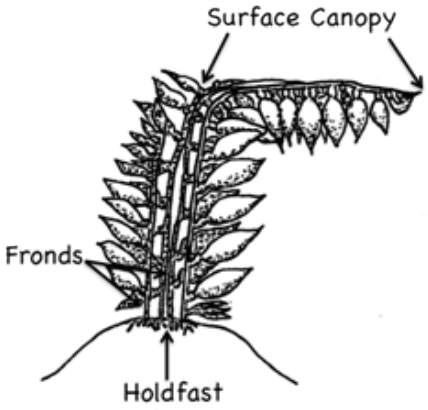
Harvesting Kelp on the Central Coast of BC

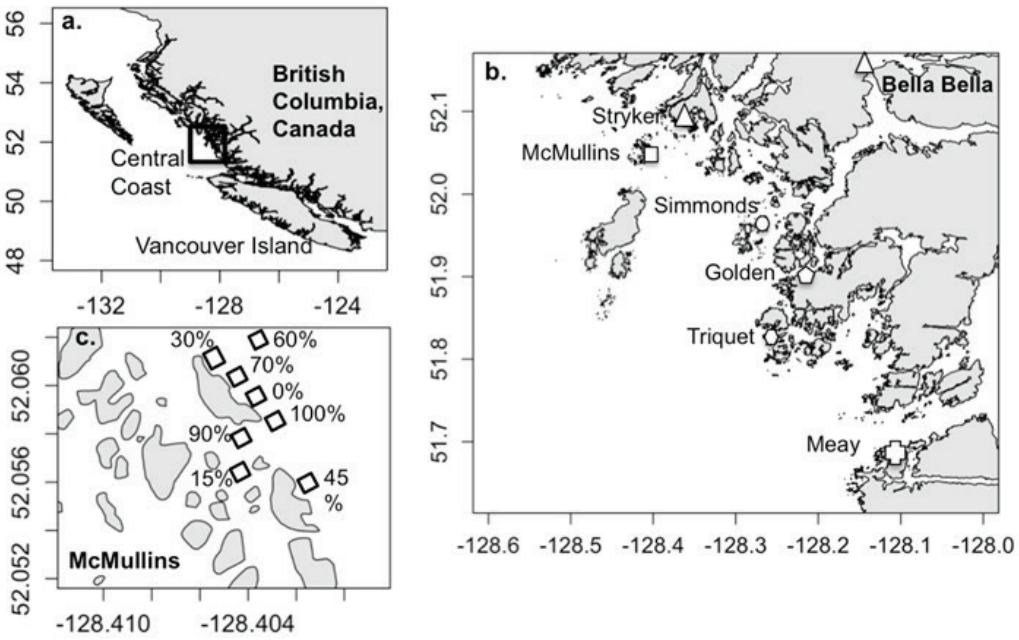
This information and data was submitted by Kira Krumhansl, Postdoctoral Researcher at Simon Fraser University and Hakai Institute. In collaboration with the Heiltsuk First Nation, researchers at Hakai Institute and Simon Fraser University conducted a kelp research project, looking closely at kelp harvesting, to see if kelp can be taken from the ecosystems without having a negative impact on other species in the ecosystem or on the carbon storage abilities of the kelp.

Background: Giant kelp (Macrocystis pyrifera) is the fastest growing primary producer on the planet. This species has been harvested by First Nations on the coast of British Columbia for millennia, and is still being used to collect herring eggs in the spring for subsistence and commercial fisheries (i.e. spawn on kelp fishery). Giant kelp is also being considered for other commercial uses, such as the production of fertilizers, food additives, and cosmetics. Before commercial harvests begin for these purposes, the Heiltsuk First Nation worked in collaboration with researchers at the Hakai Institute and Simon Fraser University to investigate how quickly the kelp recovers from harvest, and what factors influence how quickly kelp recovers. This information helps Heiltsuk Research Managers to determine whether commercial kelp harvesting is a sustainable activity, and if so, how best to manage it.

The basic anatomy of giant kelp is shown in the diagram below. Giant kelps are anchored to the substrate via a root-like structure known as a **holdfast**. Each holdfast has multiple stems or **frond** that grow up through the water column towards the surface of the water. Once the frond reaches the surface, it grows along the surface to form a **surface canopy**. This surface canopy is where most of the kelp's photosynthesis occurs, and is visible from a boat (maybe you've seen one!). Harvesting involves cutting the surface canopy portion of the kelp.



We harvested kelps at 5 sites on the Central Coast of BC near Bella Bella in 2014, where plots that measure 30 by 30 meters were set up as the study area (see the site maps below). We harvested kelp (involves cutting the surface canopy portion of the kelp) and measured how quickly the kelp regrew (meters of canopy growth per day). We were interested in understanding what factors influence how quickly the kelps regrow following harvest such as water temperature and the density of the kelp.



Some of the questions we were interested in were:

Would larger kelp individuals regrow more quickly (compared to smaller kelps)? Would kelps grow back more quickly when they are in sparse kelp beds or dense kelp beds? Does the water temperature influence how quickly kelps regrow?

To answer these questions, we measured the water temperature at each site (°C), the initial size of each harvested kelp before harvest (surface canopy length in meters), and the density of kelps at each site (kelps m^{-2}, i.e. how many kelps there are per meter of ocean bottom). We did an analysis of the data to investigate which factor was most important. What can you see in the data provided? Try to answer these questions for yourself:

Question 1: Did kelps grow back at the same rate at each site? Find the average growth rate at each site. What is the range of average growth rate for each site?

Question 2: Is the water temperature the same at each site? What is the range of average water temperatures? What is the average water temperature at each site?

Question 3: Is the kelp density the same at each site? What is the average kelp density?

Question 4: Does the water temperature influence how quickly kelps regrow?

Question 5: Which factor out of those you considered do you think was most important in determining kelp recovery rates? What implications does this have for harvest?

Table: Kelp Harvest Data

Site	Average Water Temperature (^{0}C)	Kelp Density at Site (m^{-2})	Initial Kelp Size (m)	Kelp Growth Rate (m per day)
Golden	12.4	0.336111111	10.9	0.066666667
Golden	12.4	0.336111111	6.4	0.050520833
Golden	12.4	0.336111111	10.9	0.067708333
Golden	12.4	0.336111111	6.4	0.028125
Golden	12.4	0.336111111	3.8	0.049479167
Meay	12.12	0.147222222	9	0.065306122
Meay	12.12	0.147222222	5.4	0.041836735
Meay	12.12	0.147222222	7	0.051020408
Simonds	11.96	0.233333333	7.6	0.067368421
Simonds	11.96	0.233333333	2.15	0.052631579
Simonds	11.96	0.233333333	4.4	0.043157895
Simonds	11.96	0.233333333	2.05	0.046315789
Simonds	11.96	0.233333333	7.3	0.101052632
Stryker	12.425	0.463888889	4.85	0.012121212
Stryker	12.425	0.463888889	7	0.046969697
Stryker	12.425	0.463888889	3	0.055050505
Stryker	12.425	0.463888889	2.8	0.074242424
Stryker	12.425	0.463888889	2.5	0.034343434
Triquet	12.702	0.486111111	4	0.007368421
Triquet	12.702	0.486111111	4.7	0.004210526
Triquet	12.702	0.486111111	6.05	0.011578947
Triquet	12.702	0.486111111	5.95	0.013684211

NOTE: Permission was granted to use the data in the context of this lesson. The data are not available for publication or use outside of the classroom.