

2021 Kelp Monitoring

Introduction

In 2021 Clallam MRC continued the collaboration with the Northwest Straits Commission on the kelp monitoring project. The goal was to monitor the size and density of kelp canopies at three locations during low-tide events between July and September, 2021.

The expected outcomes were 1) to use established methods to produce georeferenced density data to be incorporated into SoundIQ and potentially the Department of Natural Resources database 2) to contribute georeferenced density data which can be used to evaluate longer-term trends, and support environmental decision-making.

Kelp Survey in Clallam Bay August 23, 2021

Two surveyors, Alan Clark and Alisa Taylor, conducted a survey of the kelp bed identified in Clallam Bay during the 2016 land based reconnaissance survey. The survey was conducted one month later than the intended date, due to a lack of available low tide opportunities at the same time as and low enough winds to safely conduct the survey aboard kayaks. The survey was initiated at 9:50 am with a tidal elevation of -0.9 ft. and completed at 10:35 am. The perimeter of the kelp bed was approximately 1.09 miles and the total kelp bed area was approximately 15.32 acres (Figure 1). The bed consisted of a mix of bull and giant kelp with giant kelp more densely present at the center of the bed. The water temperature nearest to shore was 62°F and the water depth was 5 ft; while at the point farthest from shore, the water temperature was 54° F and depth was 24 ft. While the kelp seemed to be relatively healthy with new growth, there was evidence of sun bleaching on both bull and giant kelp. Figures 2 and 3 present photos from the survey. The survey datasheets are provided in Appendix A.

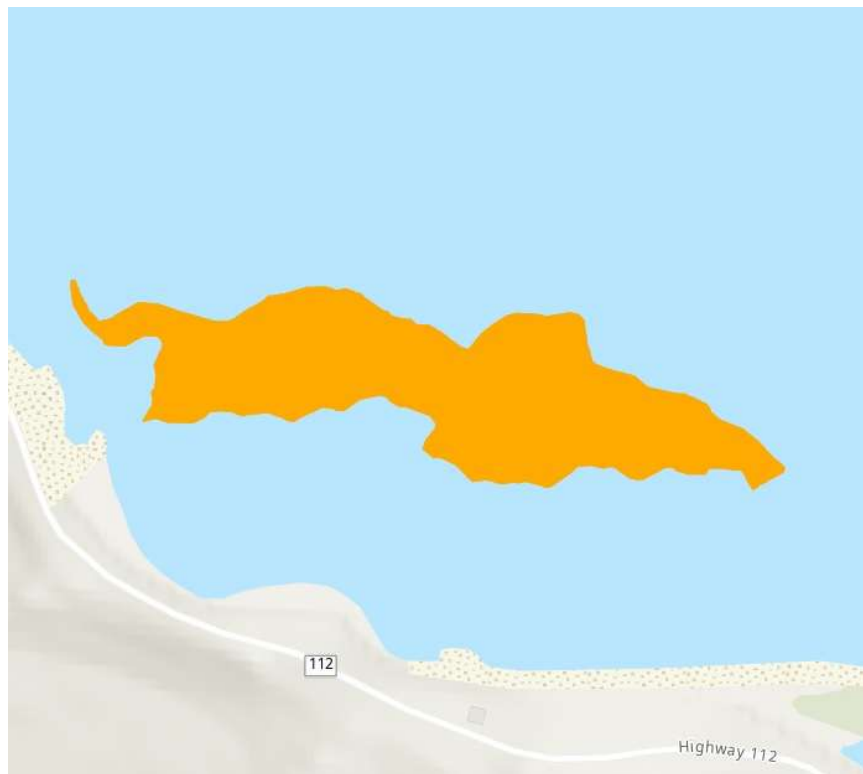


Figure 1. The map of the kelp bed in Clallam Bay based on the field GPS readings taken August 23, 2021.

The kelp bed sizes between 2017 and 2021 are summarized in Table 1.

Table 1. Kelp bed size between 2017 and 2021.

Date	Area (acres)
August 2021	15.32
July 2020	13.14
July 2019	22.3
July 2018	18.8
July 2017	25.1

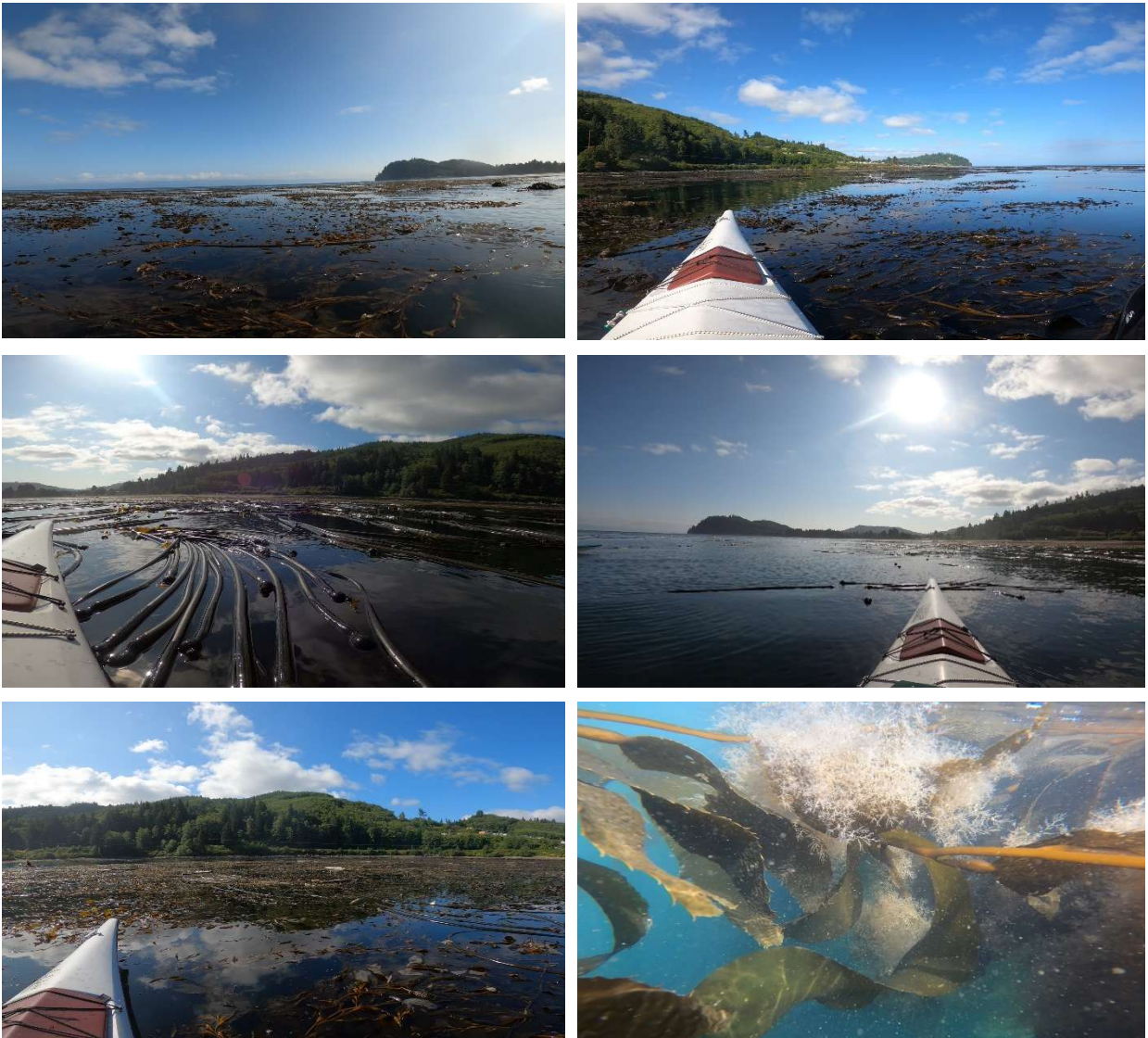


Figure 2. Pictures of the kelp bed in Clallam Bay taken during the 2021 survey.



Figure 3. Pictures of the kelp bed in Clallam Bay taken during the 2021 survey.

Kelp Surveys in Freshwater Bay

Two monitoring surveys were conducted by Alan Clark, Jeff Ward, and Alisa Taylor in Freshwater Bay on July 27, 2021, and September 07, 2021. The following sections provide a brief summary of the two surveys.

Large Kelp Bed

The survey of the large kelp bed east of the boat ramp was initiated at 10:00 am with a tidal elevation of 0.1 ft. and completed at 12:15 pm. The perimeter of the kelp bed was approximately 4.89 miles and the total kelp bed area was approximately 128.52 acres (Figure 3). Most of the area was dominated by bull kelp, with giant kelp distributed throughout the center of the bed, and feather boa kelp mixed in the shallow areas, often extending toward the shore. The water temperature nearest to shore was 56°F and the water depth was 14 ft. Farthest from shore, the water temperature was 52°F, and the depth was 39 ft. Figures 4 and 5 present photos from the survey. Figure 6 represents temperature data gathered over a nearly 2 month period, from July 15 - September 7 2021, from two Hobo temperature monitors deployed at mid-water-column level, and seafloor level. At the mid-water-column level the temperature ranged between 47 and 52°F with a high outlier on August 5 of 55°F; at the bottom the temperature ranged between 48 and 53°F with a high outlier on August 5 of 56°F. While the kelp seemed to be relatively healthy with new growth, there was evidence of sun bleaching on both bull and giant kelp. The survey datasheets are provided in Appendix A.



Figure 3. The map of the large kelp bed at Freshwater Bay based on the field GPS readings taken July 27, 2021.

The kelp bed sizes between 2016 and 2020 are summarized in Table 2.

Table 2. Large kelp bed size between 2016 and 2020.

Date	Area (acres)
July 2021	128.52
August 2020	112.67
July 2019	117.86
July 2018	78.0
August 2017	174.7
July 2016	141.1

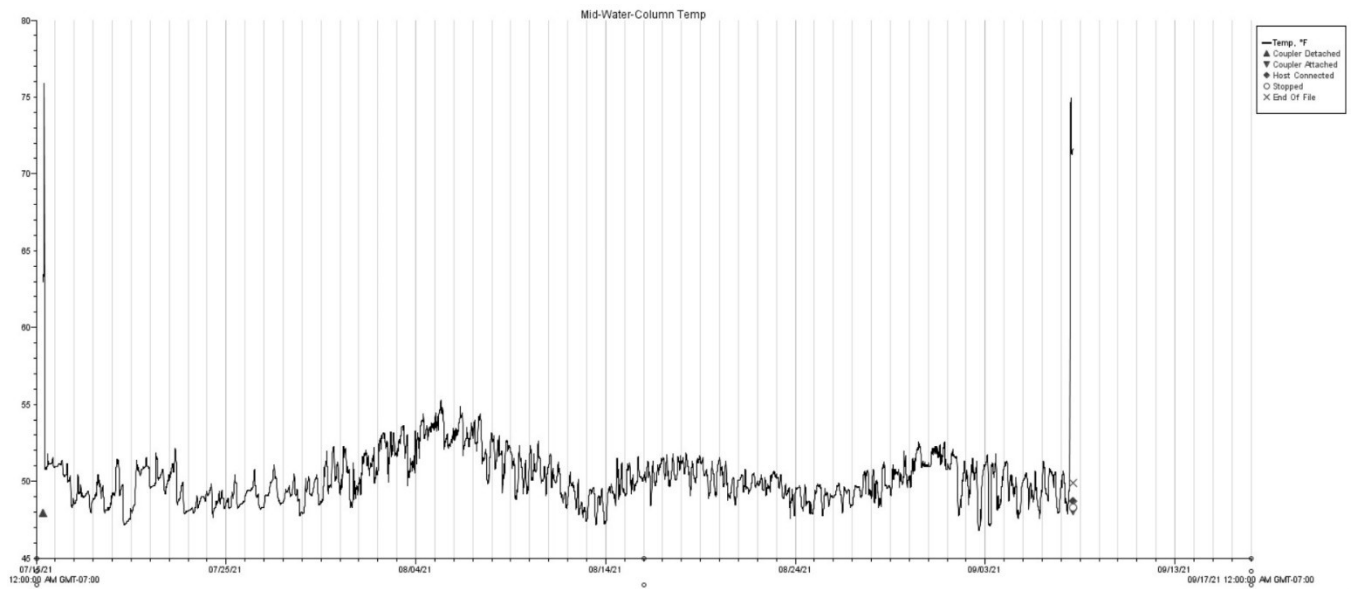


Figure 4. Pictures of the large kelp bed in Freshwater Bay taken during the 2021 survey.



Figure 5. Pictures of the large kelp bed in Freshwater Bay taken during the 2021 survey.

(a)



(b)

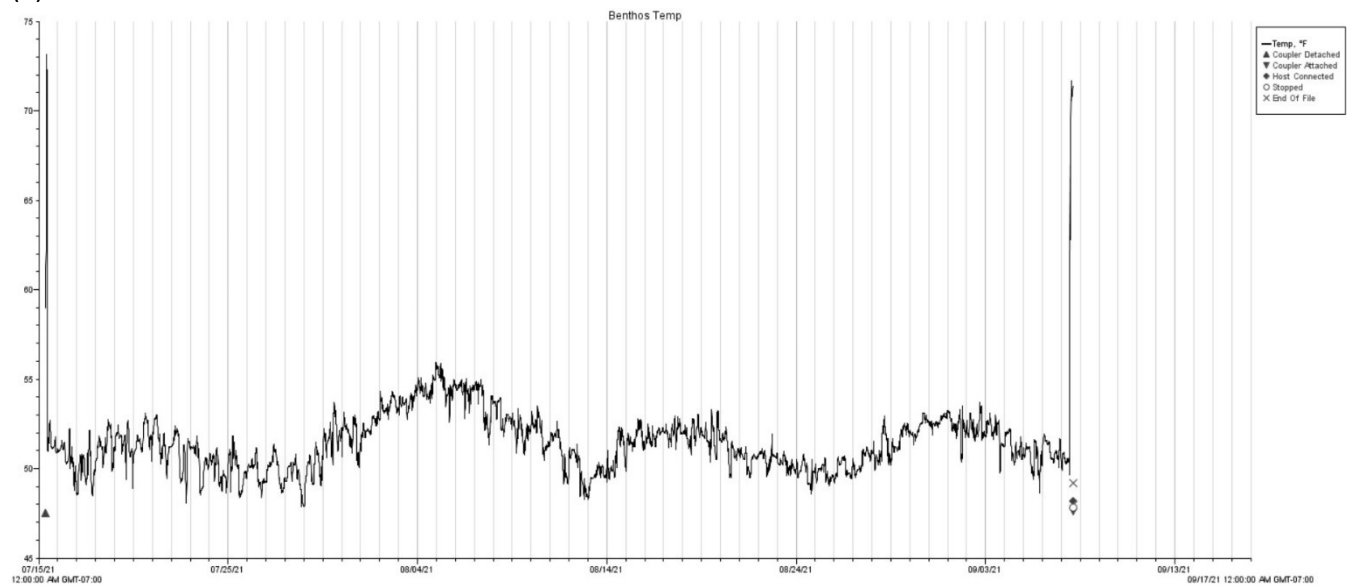


Figure 6. Temperature data recorded via: (a) temperature monitor deployed at mid water-column level; (b) temperature monitor deployed at the seafloor level.

Small Kelp Bed

The survey of the small kelp bed west of the boat ramp was initiated at 9:50 am with a tidal elevation of -0.2 ft. and completed at 10:20 am. The perimeter of the kelp bed was approximately 0.40 miles and the total kelp bed area was approximately 0.93 acres (Figure 7). All of the area was dominated by bull kelp. The water temperature nearest to shore was 50°F and the water depth was 4 ft. Farthest from shore, the water temperature was 52°F, and the depth was 28 ft. While the kelp seemed to be relatively healthy with new growth, there was evidence of sun bleaching on the kelp. Figures 8 and 9 present photos from the survey. The survey datasheets are provided in Appendix A.



Figure 7. The map of the small kelp bed at Freshwater Bay based on the field GPS readings taken September 07, 2021. The kelp bed sizes between 2016 and 2021 are summarized in Table 3.

Table 3. Small kelp bed size between 2016 and 2020.

Date	Area (acres)
September 2021	0.93
August 2020	0.64
July 2019	0.97
August 2018	1.06
September 2017	0.92
July 2016	0.71

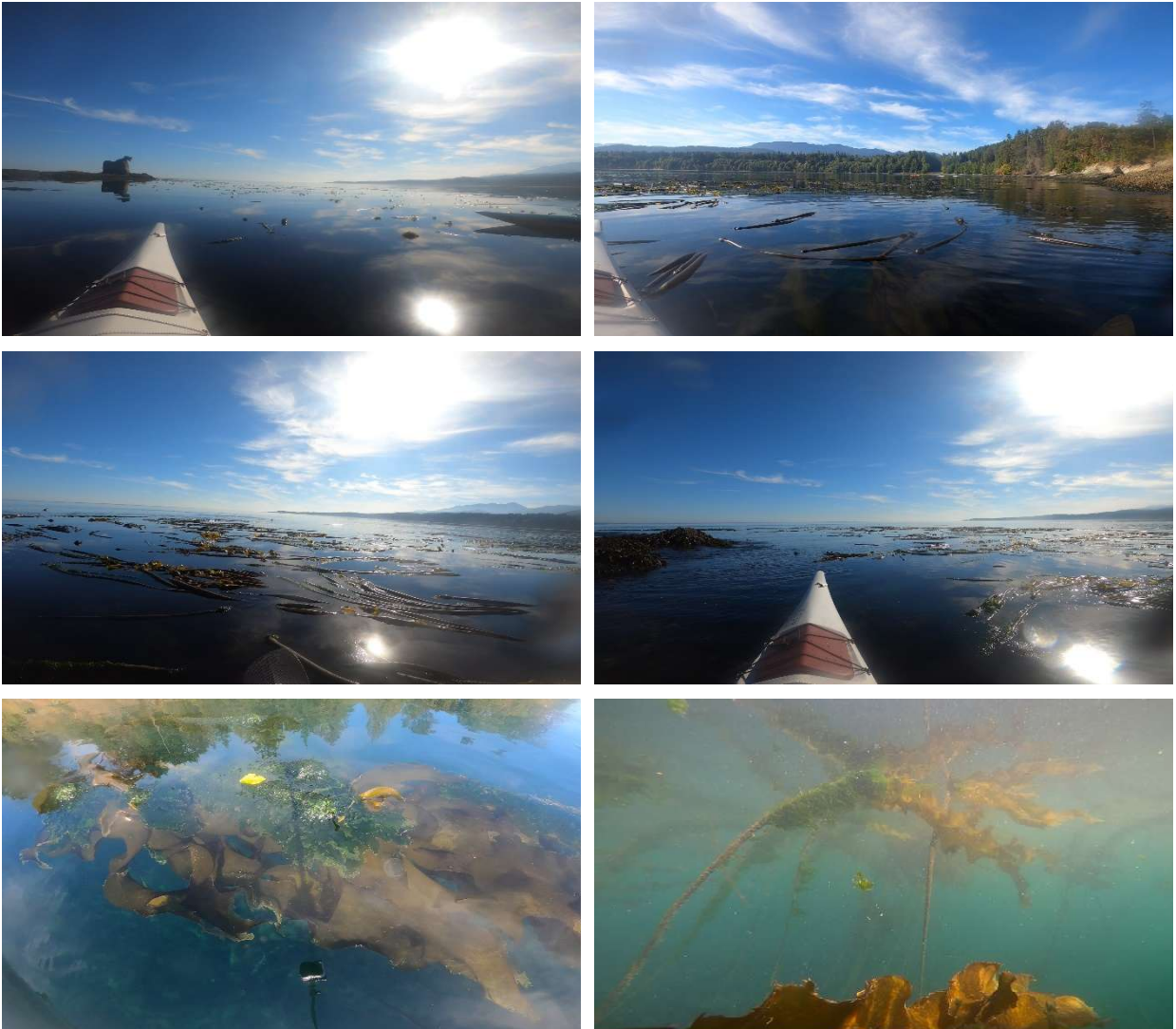


Figure 8. Pictures of the small kelp bed in Freshwater Bay taken during the 2020 survey.



Figure 9. Pictures of the small kelp bed in Freshwater Bay taken during the 2021 survey.

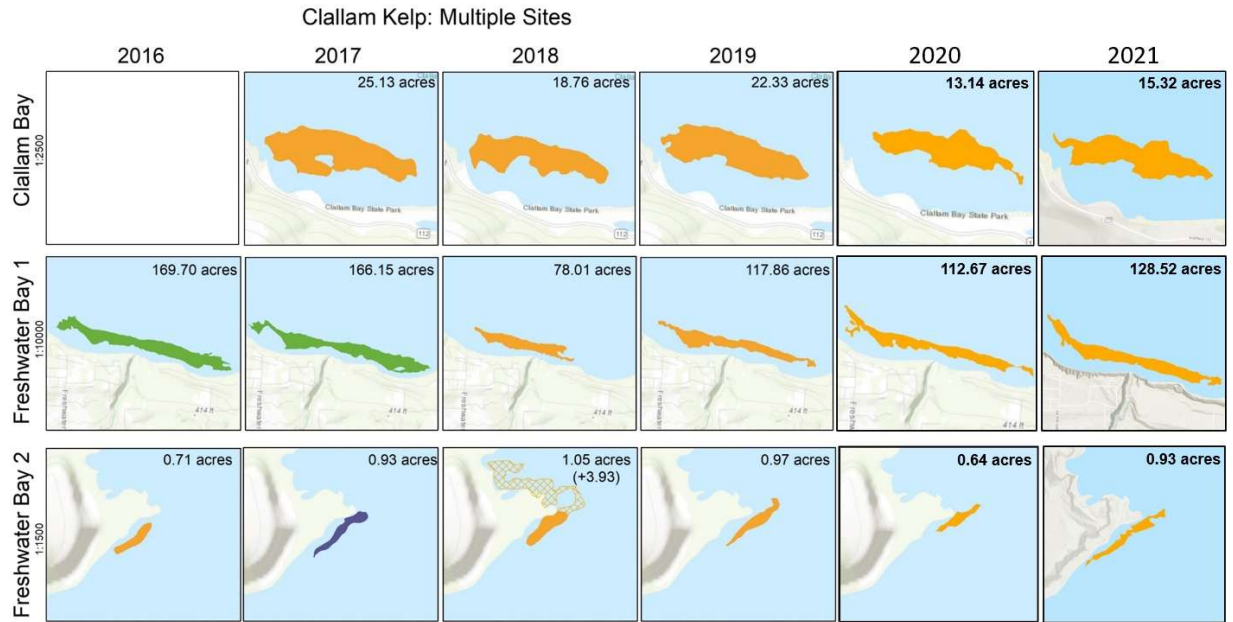


Figure 10. Visual comparison of size, shape, location, and area measurements of the three kelp beds from 2016-2021.

Appendix A – Field Data Sheets



Bull Kelp Survey Data Sheet (on shore)

Pre-Survey Section (on the beach)

Trip Leader: Alan Clark Date: 23 Aug 21

Name of surveyors: Alan Clark, Alisa Taylor

Location (Shoreline Segment): Clallam Bay

Weather conditions (circle one)

Clear

Haze

Clouds

Fog/mist

Light rain

Heavy rain

Tide height (ft): Start -0.9 incoming Tide station: NOAA/Sekiu - Clallam Bay

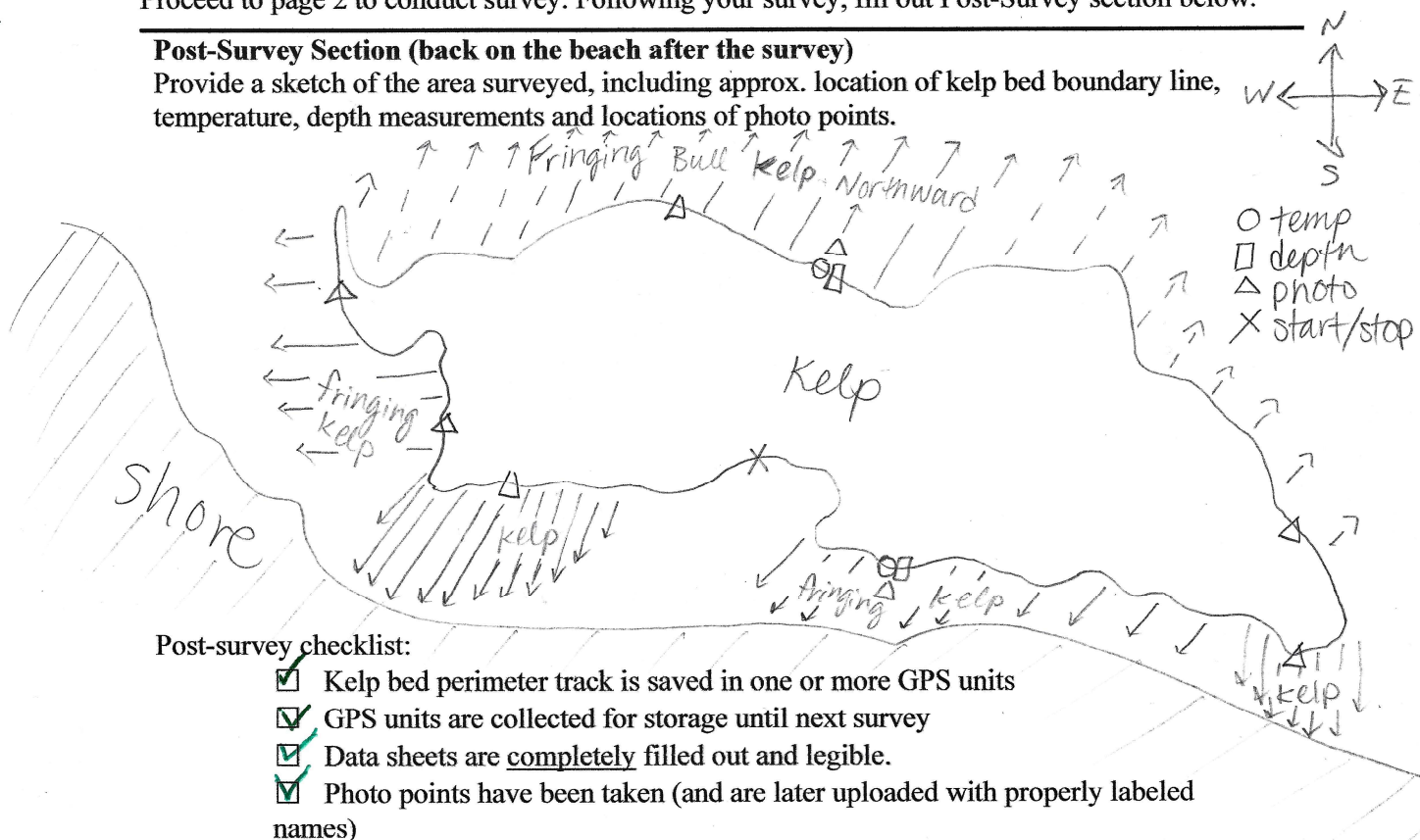
Current (knots): ≤ 1 knot Station/source: Alan's observation

Name of GPS unit or phone app Garmin GPSMAP 78sc Accuracy of GPS: +/- 12 ft

Proceed to page 2 to conduct survey. Following your survey, fill out Post-Survey section below.

Post-Survey Section (back on the beach after the survey)

Provide a sketch of the area surveyed, including approx. location of kelp bed boundary line, temperature, depth measurements and locations of photo points.



Bull Kelp Survey Data Sheet (on the water)

Kelp Bed Number or Name

__Clallam Bay__ Survey start time: __9:50am__

Kelp Bed Water Temperature and Depth (ft):

Edge closest to shore: __5__ ft, GPS Point name: N48°15.345 W124°16.443 Water Temp: __62°F__ Time: __10:30am__

Edge closest to shore: _____ ft, GPS Point name: _____ Water Temp: _____ Time: _____

Edge farthest to shore: __24__ ft, GPS Point name: N48°15.426 W124°16.534 Water Temp: __54°F__ Time: __10:10am__

Edge farthest to shore: _____ ft, GPS Point name: _____ Water Temp: _____ Time: _____

Perimeter: GPS perimeter track name: Track_2021-08-23 Clallam Bay

GPS point name at Start: N48°15.365 W124°16.479 End of paddle around bed: N48°15.376 W124°16.585

Points (Take a waypoint for kelp clusters ≤10 bulbs within shoreline segment):

GPS Point name: N48°15.369 W124°16.693 Depth: _____ Temp: _____ Observations: Bull kelp extends toward shore
apprx. 50 ft.

GPS Point name: N48°15.381 W124°16.729 Depth: _____ Temp: _____ Observations: Bull kelp extending all the way to shore.

GPS Point name: N48°15.387 W124°16.301 Depth: _____ Temp: _____ Observations: Giant kelp dominates the border of
the kelp bed, and is dense into the center of the bed.

GPS Point name: N48°15.347 W124°16.265 Depth: _____ Temp: _____ Observations: Both bull and giant kelp extending
up to the shoreline, among rocks covered with sea palm kelp, and distributed amongst feather boa kelp.

GPS Point name: N48°15.34 W124°16.457 Depth: _____ Temp: _____ Observations: The outline of the kelp bed was cut off
in order to avoid hitting rocks with the kayak. It extends apprx. 100 feet toward shore.

Photo points: (take first photo, then take a photo of this data sheet with the corresponding box checked)

☒ ToBe

☒ ToWa

☒ BeL

☒ BeR

☒ Volunteer photos

Observations (consider density, animals present, overall health of blades, presence of understory kelp, human impacts,

fishing activity, etc.): The kelp bed was dense and overall healthy with new growth, though both bull and giant kelp

showed signs of sun bleaching. There was much epiphytic algae on the kelp, and turbid water. The entire North

boundary, while clear enough to establish, is fringed by bull kelp extending apprx. 200-500 feet toward the Straits.

Animals seen include eagle, great blue heron, surf scoters, harlequin ducks, surf smelt and other forage fish, purple red

and orange ochre stars seen on the rocks to the West of the kelp bed, mussels, harbor seal. The Northern edge of the kelp

consisted mainly of bull kelp, while some Macrocystis was distributed throughout, there were regions of only bull kelp at

Bull Kelp Survey Data Sheet (on the water)**Kelp Bed Number or Name**

the Northern edge, and there was a dense population of *Macrocystis* in the center mass of the bed, with feather boa extending toward shore to the South. _____

End time (time of last measurement or observation before returning to shore): _____ 10:35am _____



Bull Kelp Survey Data Sheet (on shore)

Pre-Survey Section (on the beach)

Trip Leader: Alan Clark Date: 27 July 21

Name of surveyors: Alan Clark, Jeff Ward, Alisa Taylor,

Location (Shoreline Segment): Freshwater Bay Large Bed

Weather conditions (circle one)
 (Clear) Haze Clouds Fog/mist Light rain Heavy rain

Tide height (ft): Start 0.1 ^{outgoing} Tide station: NOAA (Port Angeles)

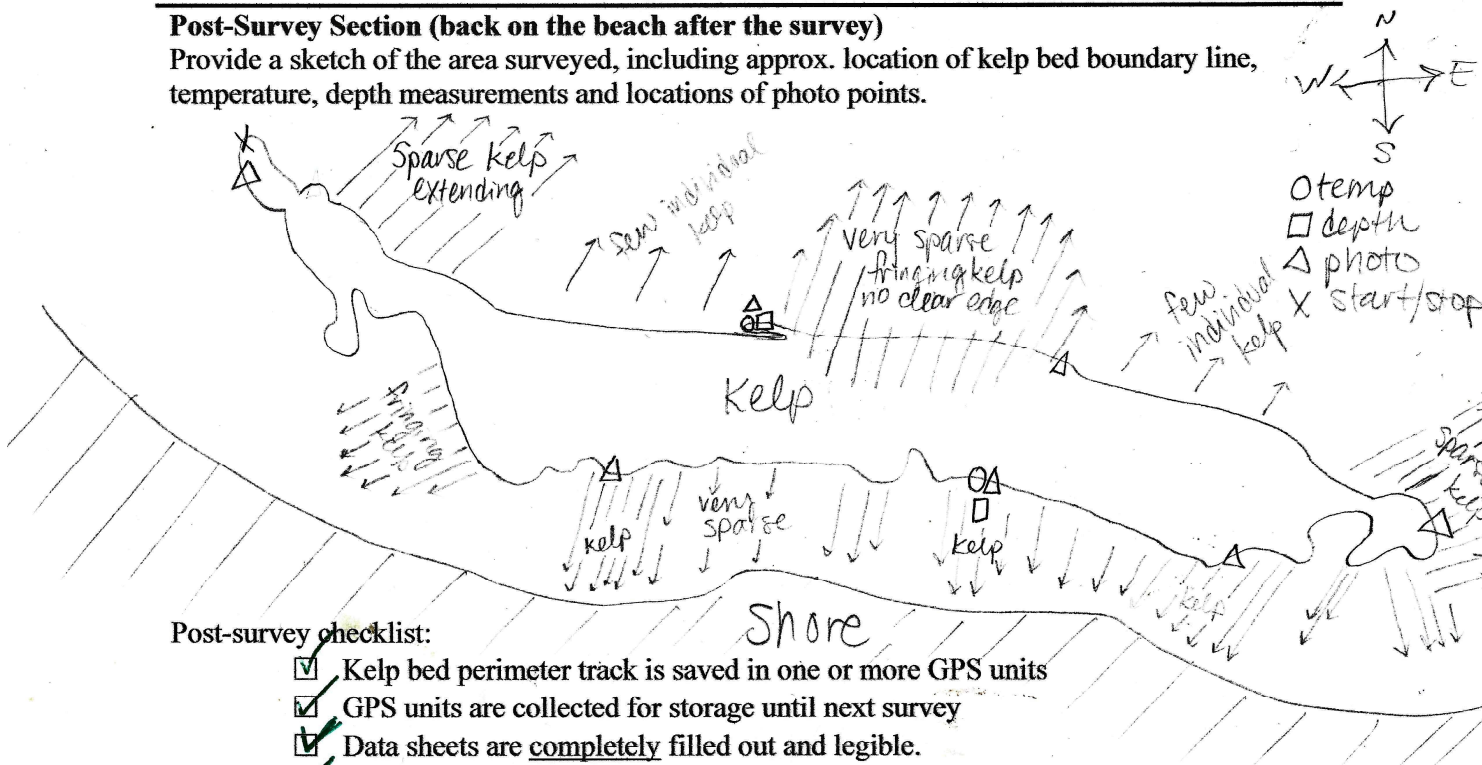
Current (knots): ≤ 1 knot Station/source: Alan's estimation

Name of GPS unit or phone app Garmin GPSMap 78sc Accuracy of GPS: +/- 12 ft

Proceed to page 2 to conduct survey. Following your survey, fill out Post-Survey section below.

Post-Survey Section (back on the beach after the survey)

Provide a sketch of the area surveyed, including approx. location of kelp bed boundary line, temperature, depth measurements and locations of photo points.



Post-survey checklist:

- ☒ Kelp bed perimeter track is saved in one or more GPS units
- ☒ GPS units are collected for storage until next survey
- ☒ Data sheets are completely filled out and legible.
- ☒ Photo points have been taken (and are later uploaded with properly labeled names)

Bull Kelp Survey Data Sheet (on the water)

Kelp Bed Number or Name

Freshwater Bay (Large) Survey start time: 10:00 am

Kelp Bed Water Temperature and Depth (ft):

Edge closest to shore: 14 ft, GPS Point name: N48°08.358 W123°36.594 Water Temp: 56°F Time: 11:36am

Edge closest to shore: _____ ft, GPS Point name: _____ Water Temp: _____ Time: _____

Edge farthest to shore: 39 ft, GPS Point name: N48°08.486 W123°36.951 Water Temp: 52°F Time: 10:27am

Edge farthest to shore: _____ ft, GPS Point name: _____ Water Temp: _____ Time: _____

Perimeter: GPS perimeter track name: Track_2021-07-27 FWB Large

GPS point name at Start: N48°08.773 W123°37.959 End of paddle around bed: N48°08.780 W123°37.946 **Points**

(Take a waypoint for kelp clusters ≤10 bulbs within shoreline segment):

GPS Point name: N48°08.697 W123°37.717 Depth: _____ Temp: _____ Observations: low density bull kelp extends beyond clear boundary of thick kelp bed, approx. 1000 ft north

GPS Point name: N48°08.389 W123°36.190 Depth: _____ Temp: _____ Observations: very low density fringing bull kelp, 10-15 ft apart, extending approx. 1500 feet from center of main bed Northward. No clear boundary path, kayaked through center.

GPS Point name: N48°08.263 W123°35.472 Depth: _____ Temp: _____ Observations: The tip of the bed, while exhibiting a clear boundary line, has a disconnected bit of bull kelp sparsely fringing toward the East along the same zone as the main bed.

GPS Point name: N48°08.210 W123°35.631 Depth: _____ Temp: _____ Observations: Bull kelp (and some giant/feather boa) extend all the way to shore along the South boundary of the bed, everywhere except for a round gap at this exact location. GPS

Point name: N48°08.224 W123°35.767 Depth: _____ Temp: _____ Observations: The gap in the kelp described above ends, and kelp once again extends Southward to shore.

GPS Point name: N48°08.366 W123°36.643 Depth: 7ft Temp: _____ Observations: A sandy substrate round hole disrupts the edge's fringing kelp-- it resumes extending to shore at the second point name. N48°08.374 W123°36.696

GPS Point name: N48°08.426 W123°37.434 Depth: _____ Temp: _____ Observations: Not reaching fully to shore, sparse N48°08.531 W123°37.652 fringing bull kelp out to approx. 200 ft South/West. Clear boundary begins at 2nd point.

Photo points: (take first photo, then take a photo of this data sheet with the corresponding box checked)

☒ **ToBe**
☒ **ToWa**
☒ **BeL**
☒ **BeR**
☒ **Volunteer photos**

Observations (consider density, animals present, overall health of blades, presence of understory kelp, human impacts, fishing activity, etc.): Much evidence is present of kelp sun bleaching, but there is a thick and healthy kelp forest with plenty of new growth. The perimeter is much less "tidy" this year! The outer edge of the kelp bed to the North, and all kelp extending beyond the main bed, are bull kelp. There is Macrocystis distributed throughout the

Bull Kelp Survey Data Sheet (on the water)**Kelp Bed Number or Name**

center of the main bed, and often extending (along with bull, and feather boa kelp) South toward the shoreline. animals seen include river otters, harbor seal, eagle, great blue heron, jellies, forage fish, harlequin duck, gulls, pigeon guillemots, tufted puffin, kingfisher. _____

End time (time of last measurement or observation before returning to shore): 12:15pm _____



Bull Kelp Survey Data Sheet (on shore)

Pre-Survey Section (on the beach)

Trip Leader: Alan Clark Date: 07 Sept 21

Name of surveyors: Alan Clark, Alisa Taylor

Location (Shoreline Segment): Freshwater Bay Small Bed

Weather conditions (circle one)

Clear

Haze

Clouds

Fog/mist

Light rain

Heavy rain

Tide height (ft): Start -0.15 Tide station: NOAA/Port Angeles

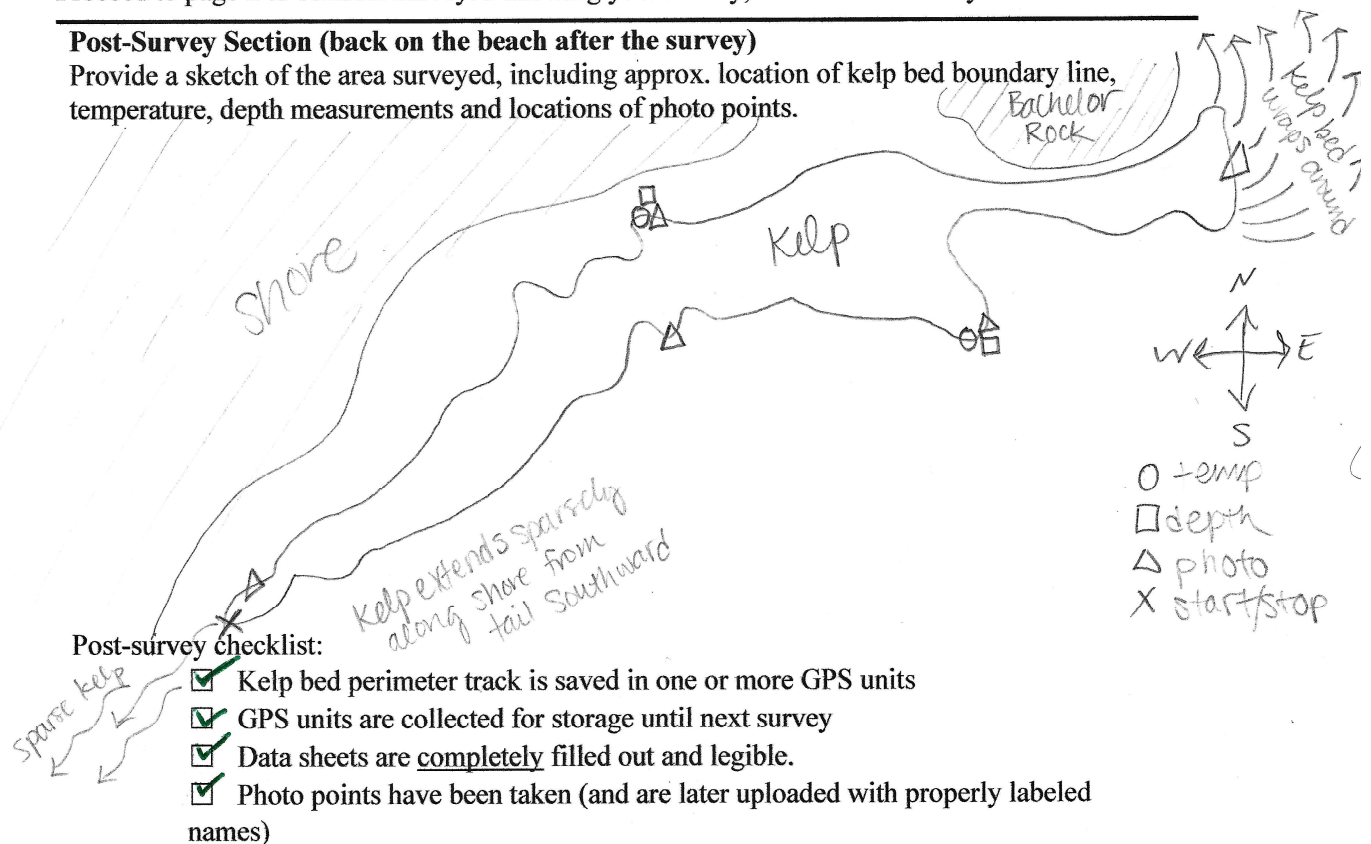
Current (knots): 0 knots Station/source: Alan's Observation

Name of GPS unit or phone app Garmin GPSMAP 78x Accuracy of GPS: +/- 12 ft

Proceed to page 2 to conduct survey. Following your survey, fill out Post-Survey section below.

Post-Survey Section (back on the beach after the survey)

Provide a sketch of the area surveyed, including approx. location of kelp bed boundary line, temperature, depth measurements and locations of photo points.



Bull Kelp Survey Data Sheet (on the water)

Kelp Bed Number or Name

____ Freshwater Bay (Small) ____ Survey start time: ____ 9:50am ____

Kelp Bed Water Temperature and Depth (ft):

Edge closest to shore: ____ 5 ____ ft, GPS Point name: ____ Water Temp: ____ 62°F ____ Time: ____

Edge closest to shore: ____ ft, GPS Point name: ____ Water Temp: ____ Time: ____

Edge farthest to shore: ____ 24 ____ ft, GPS Point name: ____ Water Temp: ____ 54°F ____ Time: ____

Edge farthest to shore: ____ ft, GPS Point name: ____ Water Temp: ____ Time: ____

Perimeter: GPS perimeter track name: Track_2021-09-07 FWB Small

GPS point name at Start: N48°08.948 W123°38.356 End of paddle around bed: N48°08.955 W123°38.329

Points (Take a waypoint for kelp clusters ≤10 bulbs within shoreline segment):

GPS Point name: N48°08.957 W123°38.328 Depth: ____ Temp: ____ Observations: The bull kelp bed extends with a thin fringing strip, toward the Southern shore. It is very sparsely connected to the main bed.

GPS Point name: N48°09.035 W123°38.162 Depth: ____ Temp: ____ Observations: The kelp bed is thickly connected to a long extension which wraps around Bachelor Rock to the North and West. We cut the line off here due to "sporty" waves.

GPS Point name: ____ Depth: ____ Temp: ____ Observations: ____

GPS Point name: ____ Depth: ____ Temp: ____ Observations: ____

GPS Point name: ____ Depth: ____ Temp: ____ Observations: ____

Photo points: (take first photo, then take a photo of this data sheet with the corresponding box checked)

☒ ToBe

☒ ToWa

☒ BeL

☒ BeR

☒ Volunteer photos

Observations (consider density, animals present, overall health of blades, presence of understory kelp, human impacts, fishing activity, etc.): The kelp bed is small but with many dense patches in the center, and consists exclusively of bull kelp, and some low understory kelp. While there is evidence of sun bleaching, there is also much healthy new growth. The floor of the kelp bed, especially near Bachelor Rock, has a lot of purple urchins, as well as some red and green.

Other animals seen included red and purple ochre stars, other species of sea stars, kelp crabs, rock crabs, mussels, green anemones, river otters, surf scoter, great blue heron, harlequin duck, bald eagle, pigeon guillemot, jellies, and forage fish in

Bull Kelp Survey Data Sheet (on the water)**Kelp Bed Number or Name**

great numbers! This kelp bed is slightly larger than in past years, but was surveyed later this season due to weather obstacles in July and August. _____

End time (time of last measurement or observation before returning to shore): _____ 10:20am _____