Table S1. Sources of data used in the snapshot analysis. ECCC = Environment and Climate Change Canada. MP = *Macrocystis pyrifera*; NL = *Nereocystis luetkeana.*

Region	Timepoint 1 (T1)	Data source (T1)	Timepoint 1 (T2)	Data source (T2)	Kelp species present
Valdes and Gabriola Islands (i)	July 29, 2004	ShoreZone	August 7, 2021	ShoreZone	NL
Mayne and Saturna Island (ii)	July 29, 2004	ShoreZone	August 7, 2021	ShoreZone	NL
Cowichan Bay (iii)	September 24, 2004	QuickBird Satellite	July 27, 2017	WorldView3 Satellite	NL
Juan de Fuca Entrance (iv)	August, 13-14, 2007	ShoreZone	August 9, 2021	ShoreZone	NL
West Coast Trail (v)	August 14, 2007	ShoreZone	August 8-9, 2021	ShoreZone	MP, NL
Barkley Sound (vi)	August 14, 2007	ShoreZone	August, 2018	In situ survey	MP, NL
Nootka Sound (vii)	June 26, 1994	ShoreZone	July 24, 2021	ShoreZone	MP, NL
Quatsino Sound (viii)	May 17, 1999	ShoreZone	June 17, 2018	ECCC	MP, NL
SouthCentral Coast (ix)	July 21, 1997	ShoreZone	May 18, 2018	ECCC	MP, NL
Laredo Sound (x)	July 24, 1997 and July 12-13, 1998	ShoreZone	July 7, 2019	ECCC	MP, NL
Dundas Island (xi)	July 2, 2000	ShoreZone	July 4, 2019	ShoreZone	MP, NL

Table S2. Accuracy table comparing in situ and remotely sensed (oblique aerial images) classifications collected in Barkley Sound ~2 weeks apart in August, 2021.

	***In situ* classifications**			
Remotely-sensed classifications		**Kelp**	**No kelp**	**Total**
	Kelp	238	6	244
	No kelp	7	206	213
	Total	245	212	457

Table S3. Years and data sources for time series from the Central Strait of Georgia

Site	Year	Number of dives	Source
Eagle Rock, Denman Island	2014	n = 4	Project Watershed and
	2015	n = 4	Hornby Island Divers
	2016	n = 7	
	2017	n = 2	
	2020	n = 2	
	2022	n = 1	
Tyee Cove, Nanoose Bay	2011	n = 1	Mark Bright, Dean
	2012	n = 5	Driver, SCUBA BC,
	2013	n = 4	Rowan Costall, Rayce
	2014	n = 3	Bannon, Tom Hlavac,
	2015	n = 3	Gerald Huppertz, Mike
	2016	n = 4	Holmes, Oceanside,
	2017	n = 2	Mark Heibert
	2019	n = 2	
	2020	n = 3	
	2021	n = 3	
	2022	n = 4	

Table S4. Sources of data used in time series analyses for all regions except the Central Strait of Georgia.

Region	Year	Data type	Source	Methods reference (if applicable)
Mayne Island (iii)	2010, 2011, 2012, 2017, 2018, 2019, 2020, 2021	*In situ*	Kayak surveys (Mayne Island Conservancy)	
Cowichan Bay (iii)	2004	Satellite	QuickBird	Schroeder et al. 2020
	2012	Satellite	WorldView 2	Schroeder et al. 2020
	2015	Satellite	WorldView 2	Schroeder et al. 2020
	2016	Satellite	WorldView3	Schroeder et al. 2020
	2017	Satellite	WorldView3	Schroeder et al. 2020
Barkley Sound (vi)	2007	Oblique aerial imagery	Shorezone	Starko et al. 2022
	2013	Satellite	Google Earth	Starko et al. 2022
	2014	Aerial imagery	Air phot from GeoBC	Starko et al. 2022
	2016	Satellite	Google Earth	Starko et al. 2022
	2018	*In situ*	Boat surveys	Starko et al. 2022
	2021	*In situ*	Boat surveys	Starko et al. 2022
	2022	*In situ*	Boat surveys	
South Central Coast (ix)	1984 -2021 (continuous)	Satellite	LandSat (Google Earth Engine Kelp Tool)	Nijland et al. 2019
Calvert Island (ix- b)	2006 -2021	Aerial imagery	RPAS	
North Beach	2006, 2012, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021. 2022			
Maey Channel	2012, 2016, 2017, 2018, 2019, 2020, 2021, 2022			
Laredo Sound (x)	2007	Aerial imagery	Air photo from GeoBC	
	2013	Satellite	Google Earth	
	2019	Oblique aerial imagery	Environment and Climate Change Canada	

Table S5. Direct comparison of timeseries and snapshot results for inferring changes in kelp coverage or abundance. Provided are summaries of results from each of the seven timeseries datasets alongside patterns inferred from the nearest snapshot subregion.

Region	Timeseries	Timeseries results	Nearest subregion	Snapshot results
Southern	**T1***	Significant decreasing trend (100% decline at both sites)	Nearby Valdes/ Gabriola (subregion i)	Major decrease (74 % of segments)
	T2*	Possibly decreasing trend but not significant	Directly within Mayne Island (subregion ii)	Minor decrease (net loss of 16% of segments)
	T3	No clear trend (variable through time but lowest in latest year). No significance test performed.	Directly within Cowichan Bay (subregion iii)	Minor decrease (22% net loss)
	T4*	Significant decreasing trend	Directly within Barkley Sound (subregion vi)	Major decrease (> 40% of segments)
Northern	**T5***	No significant trend (highly variable through time, recently consistently below average)	Directly within South Central Coast (subregion ix)	Minor increase (16% net)
	T6a	Significant decreasing trend	Nearby South Central Coast (subregion ix)	Minor increase (16% net)
	T6b	Possibly decreasing trend but not significant	Nearby South Central Coast (subregion ix)	Minor increase (16% net)
	T7	Major decrease but no significant	Directly within Laredo Sound (subregion x)	Major decrease

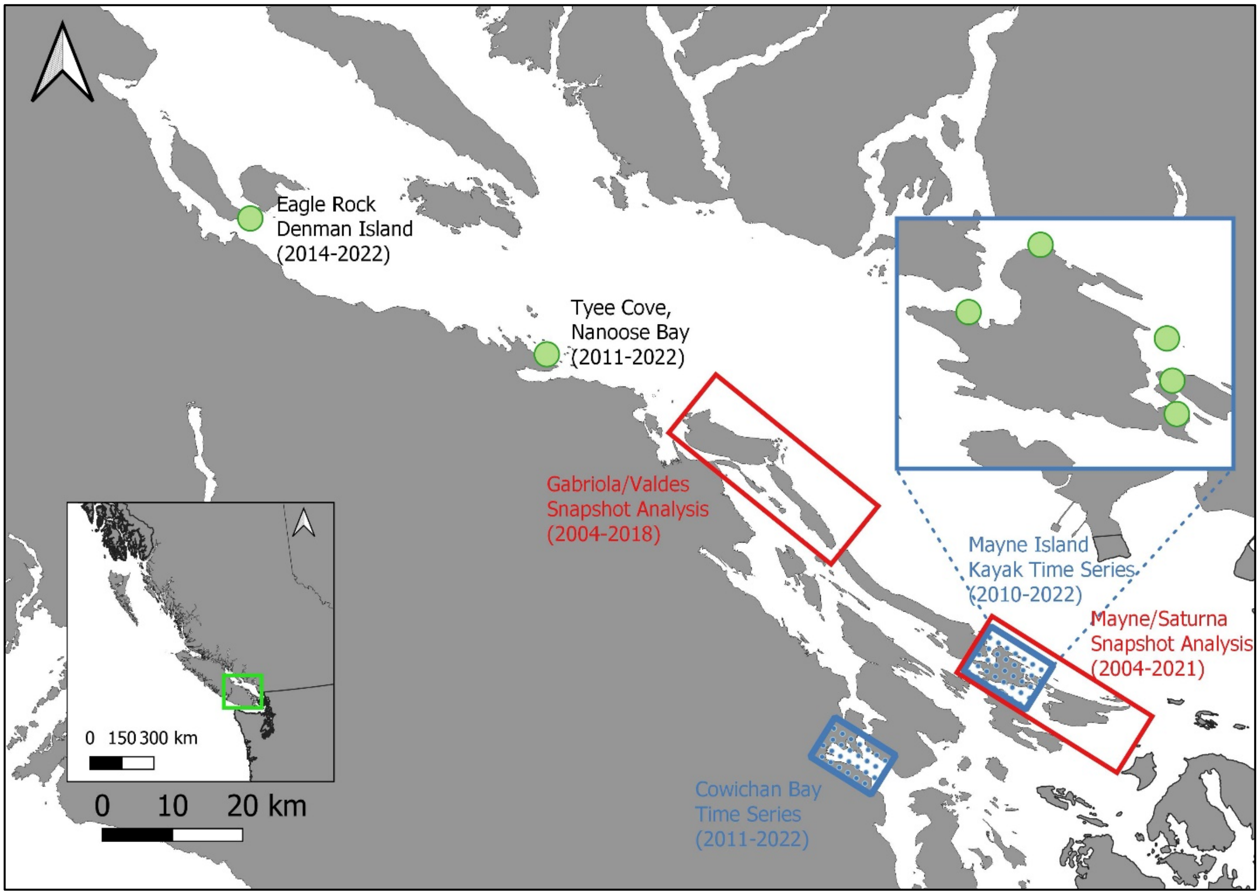

Fig S1. Map showing the locations of time series regions (blue/green) relative to snapshot analysis regions (red) for the Strait of Georgia.

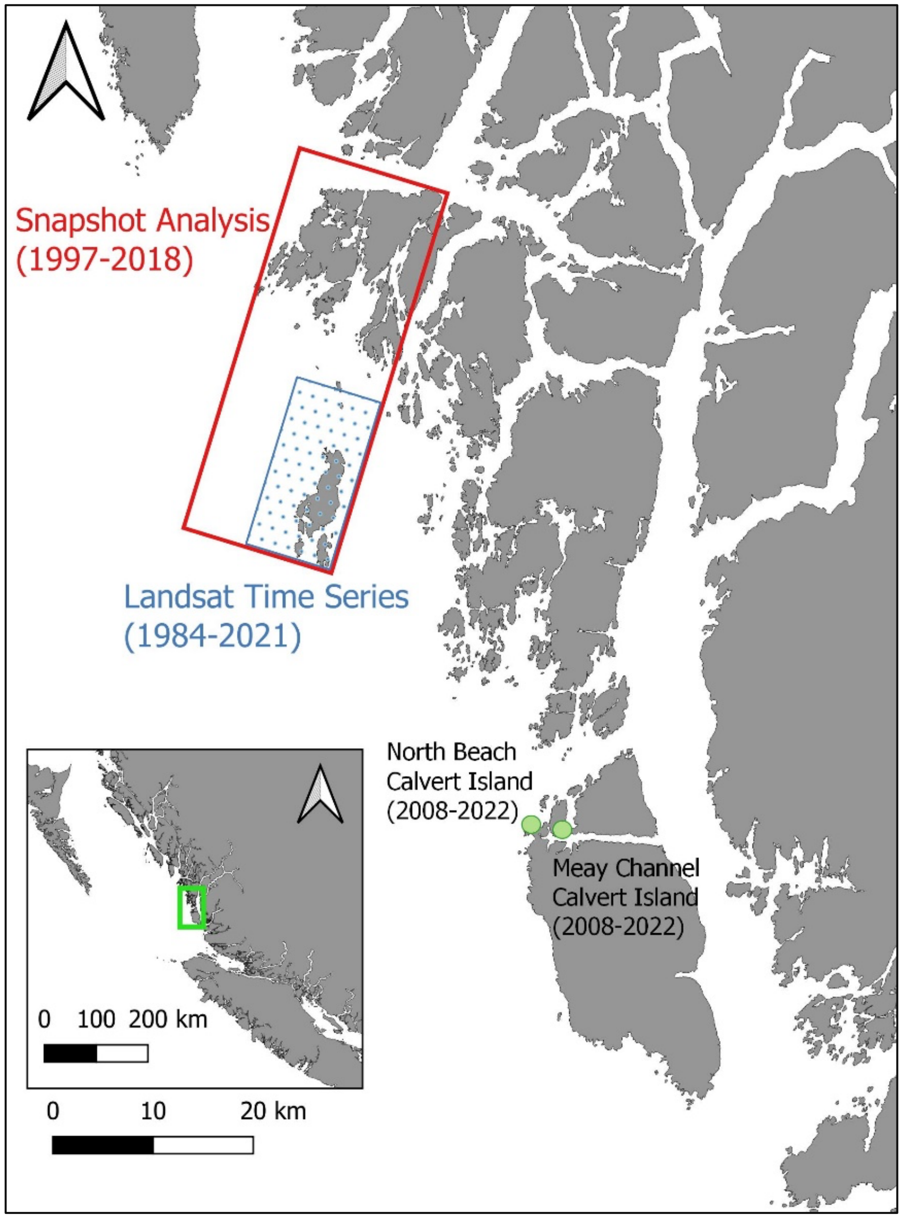

Fig S2. Map showing the locations of satellite (blue) and drone (green) time series regions relative to snapshot analysis regions (red) for the South Central Coast and Calvert Island regions.

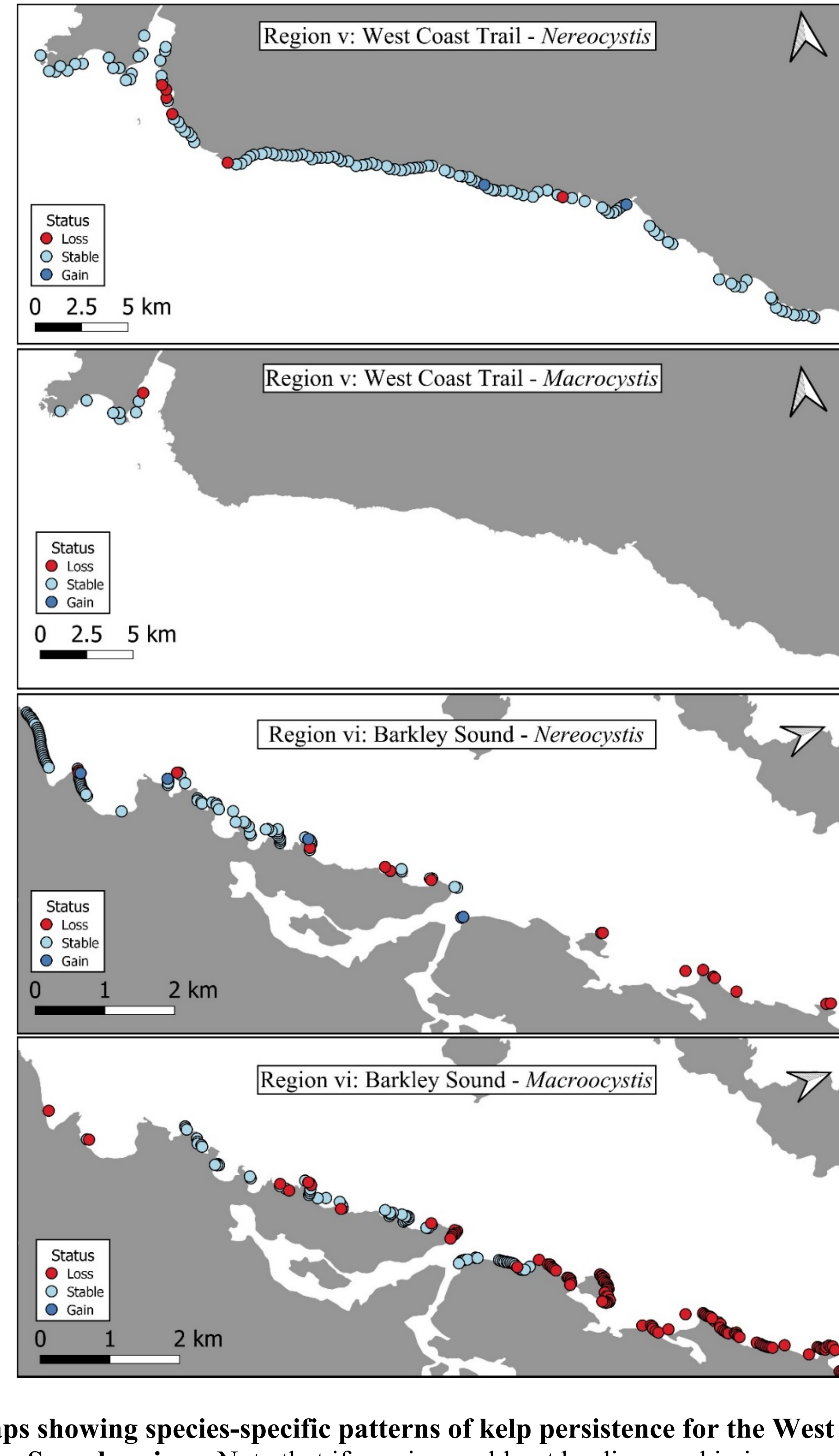

Fig S3. Maps showing species-specific patterns of kelp persistence for the West Coast Trail and Barkley Sound regions. Note that if species could not be discerned in imagery, points were excluded from the maps. Points were ordered by kelp 'Status' so that areas with either 'Loss' or 'Gain' in kelp were overlayed on top of 'Stable' points for improved visibility.

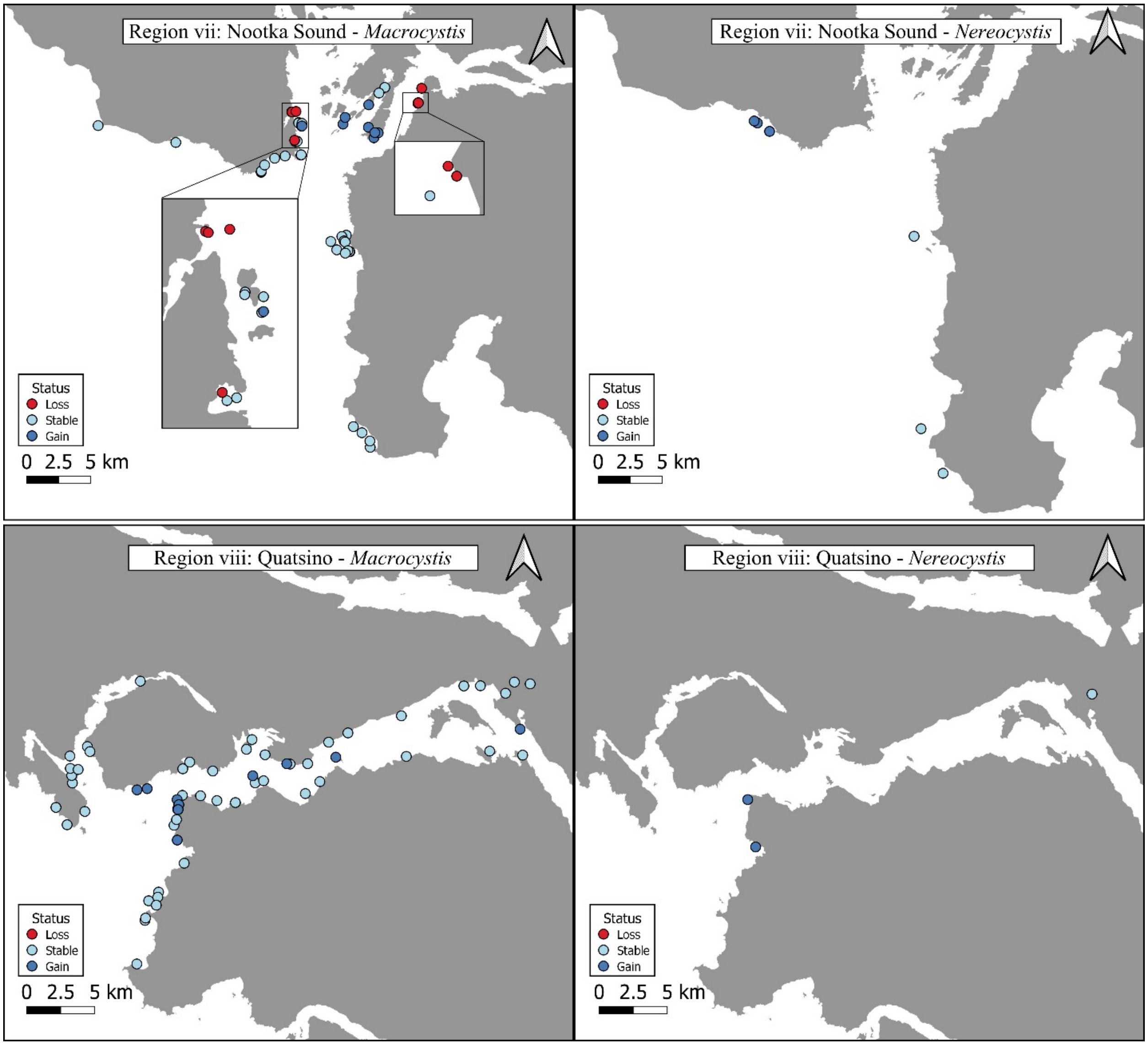

Fig S4. Maps showing species-specific patterns of kelp persistence for the Nootka and Quatsino Sound subregions. Note that if species could not be discerned in imagery, points were excluded from the maps. Points were ordered by kelp 'Status' so that areas with either 'Loss' or 'Gain' in kelp were overlayed on top of 'Stable' points for improved visibility. Insets used where points can not be seen individually due to overlap.

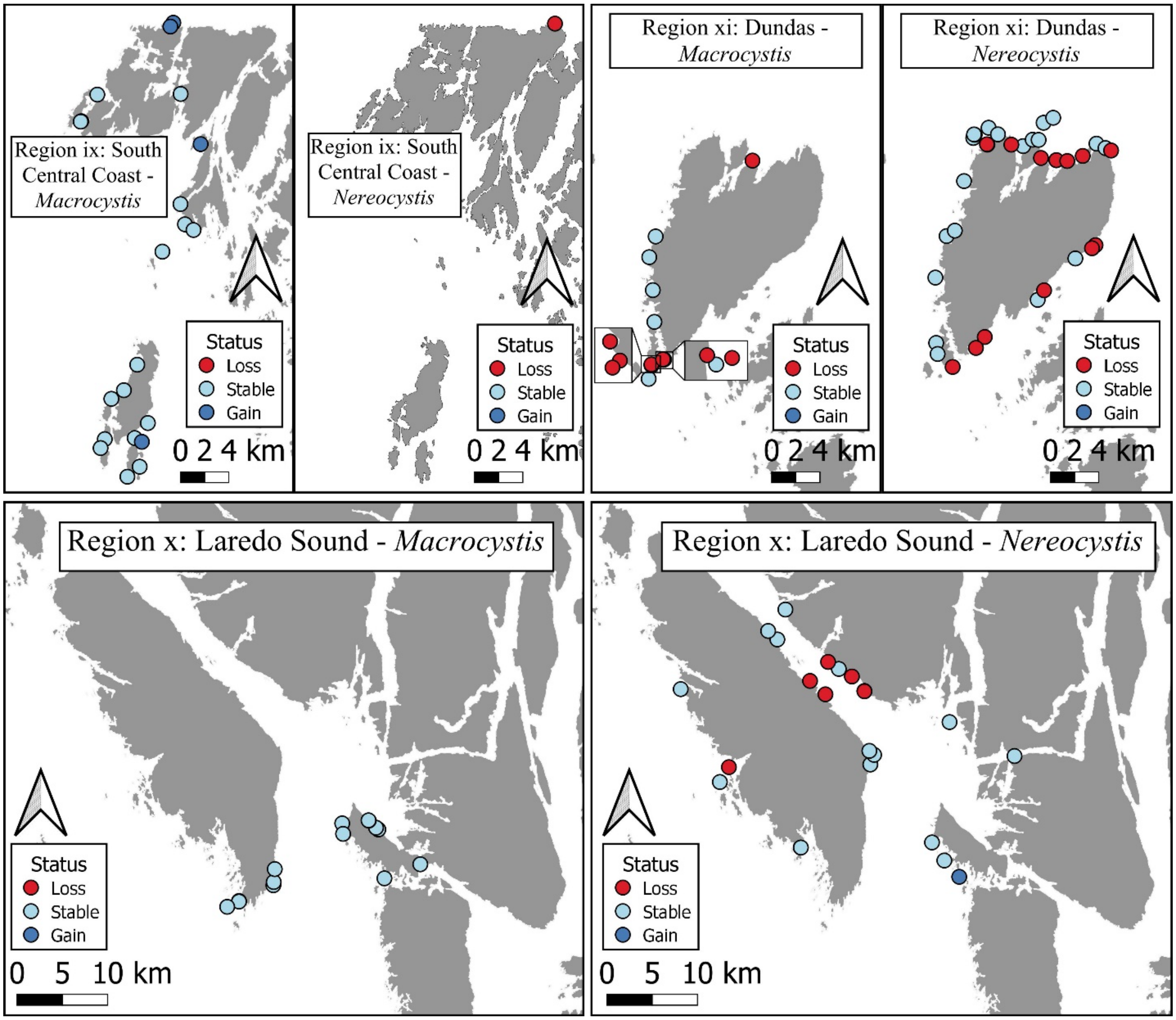

Fig S5. Maps showing species-specific patterns of kelp persistence for the South Central Coast, Dundas Island, and Laredo Sound subregions. Note that if species could not be discerned in imagery, points were excluded from the maps. Points were ordered by kelp 'Status' so that areas with either 'Loss' or 'Gain' in kelp were overlayed on top of 'Stable' points for improved visibility. Insets used where points can not be seen individually due to overlap.

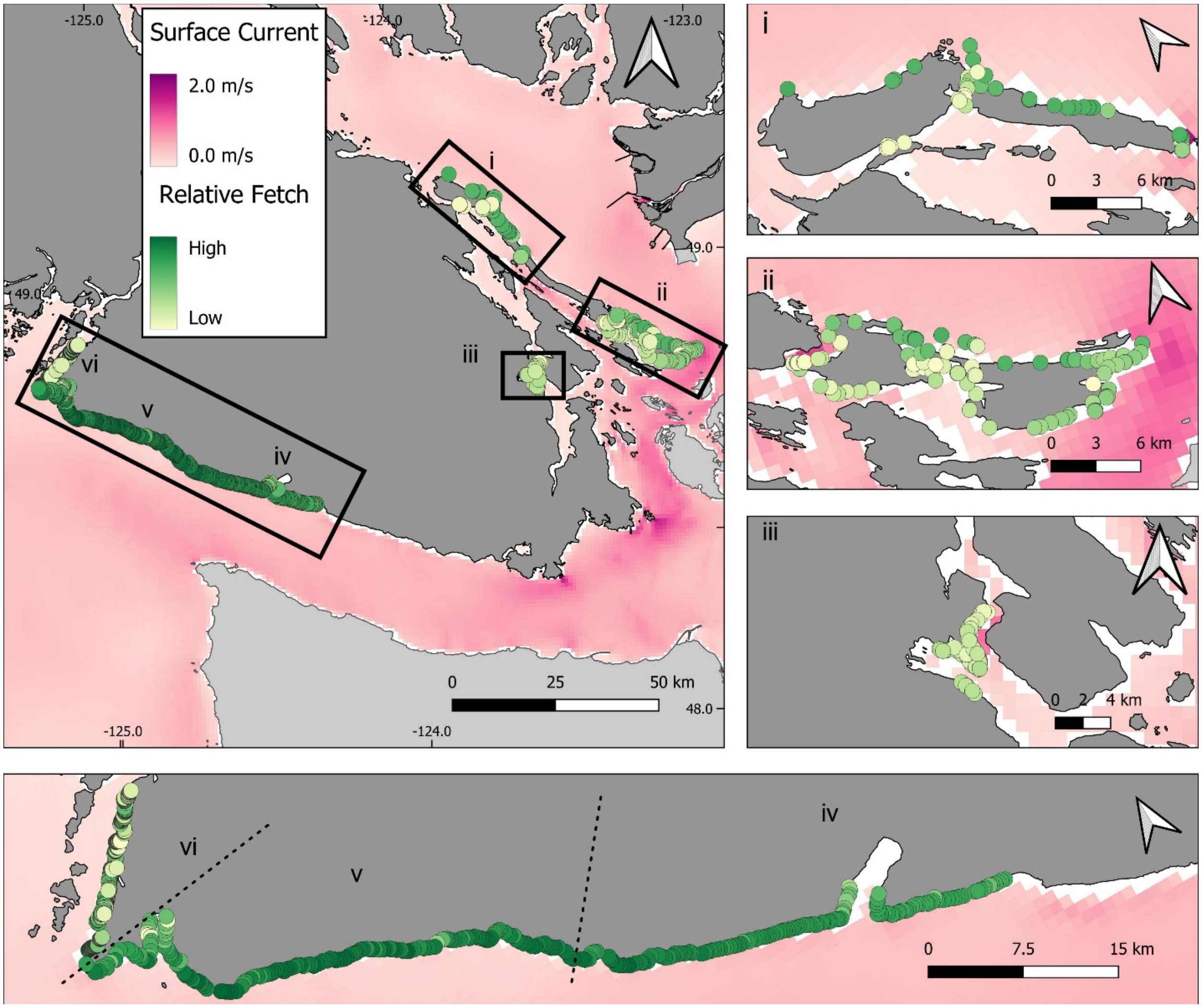

Fig S6. Map of Southern region showing surface current and relative fetch for each segment used in the kelp persistence analysis. Mean surface current data from July – August 2017 (data from LiveOcean Model) are overlaid on the water and segment datapoints are coloured by their relative fetch in green (data from DFO fetch model; see Methods).

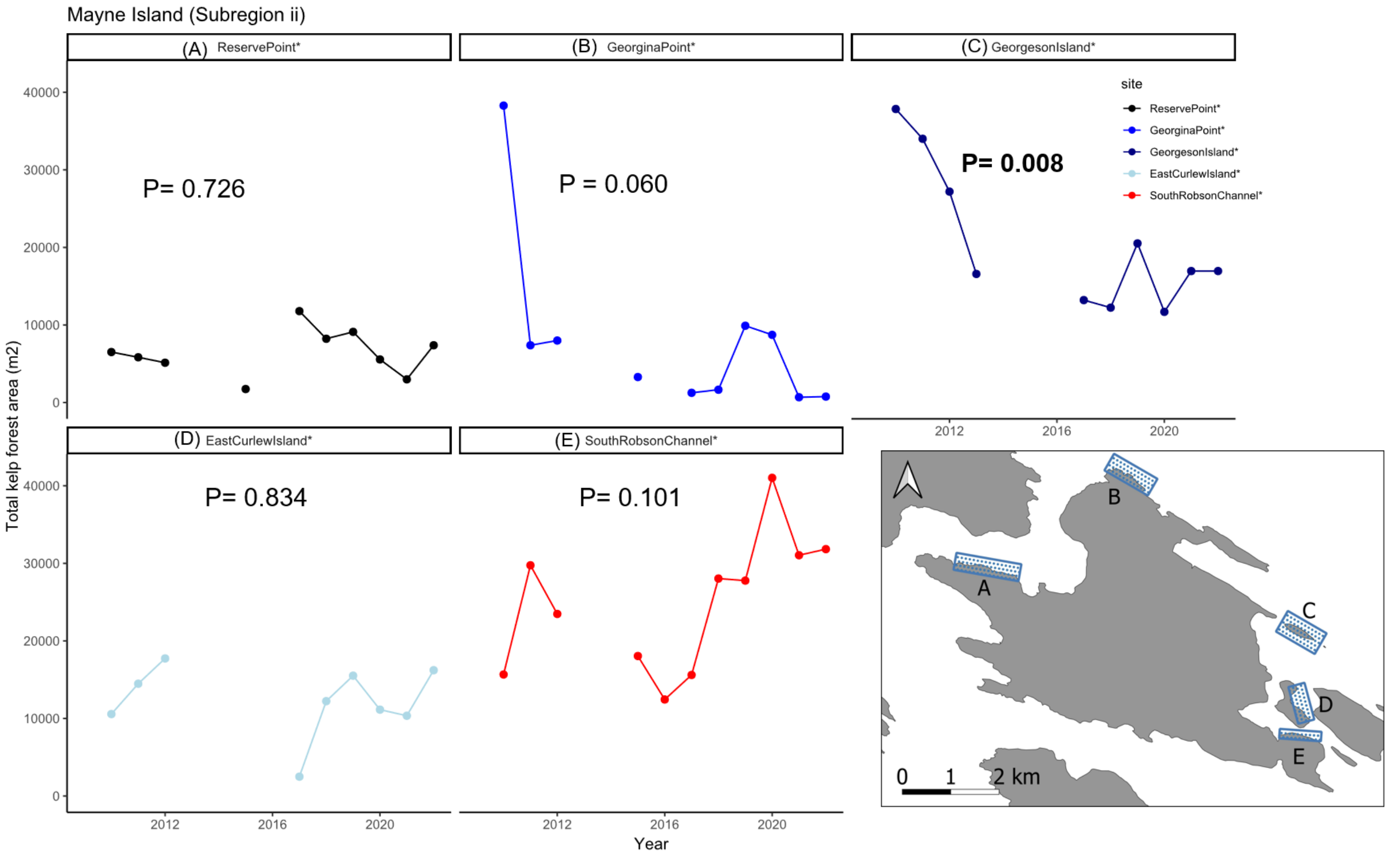

Fig S7. Site level time series of in situ monitoring data collected on Mayne Island (Region ii). Shown is kelp forest area, as inferred from in situ surveys from kayak, for each of five sites. Adjacent years are connected with solid lines. P-values are calculated based on linear models fit to each site separately. Note that only declines in Georgeson Island (site C) are significant.

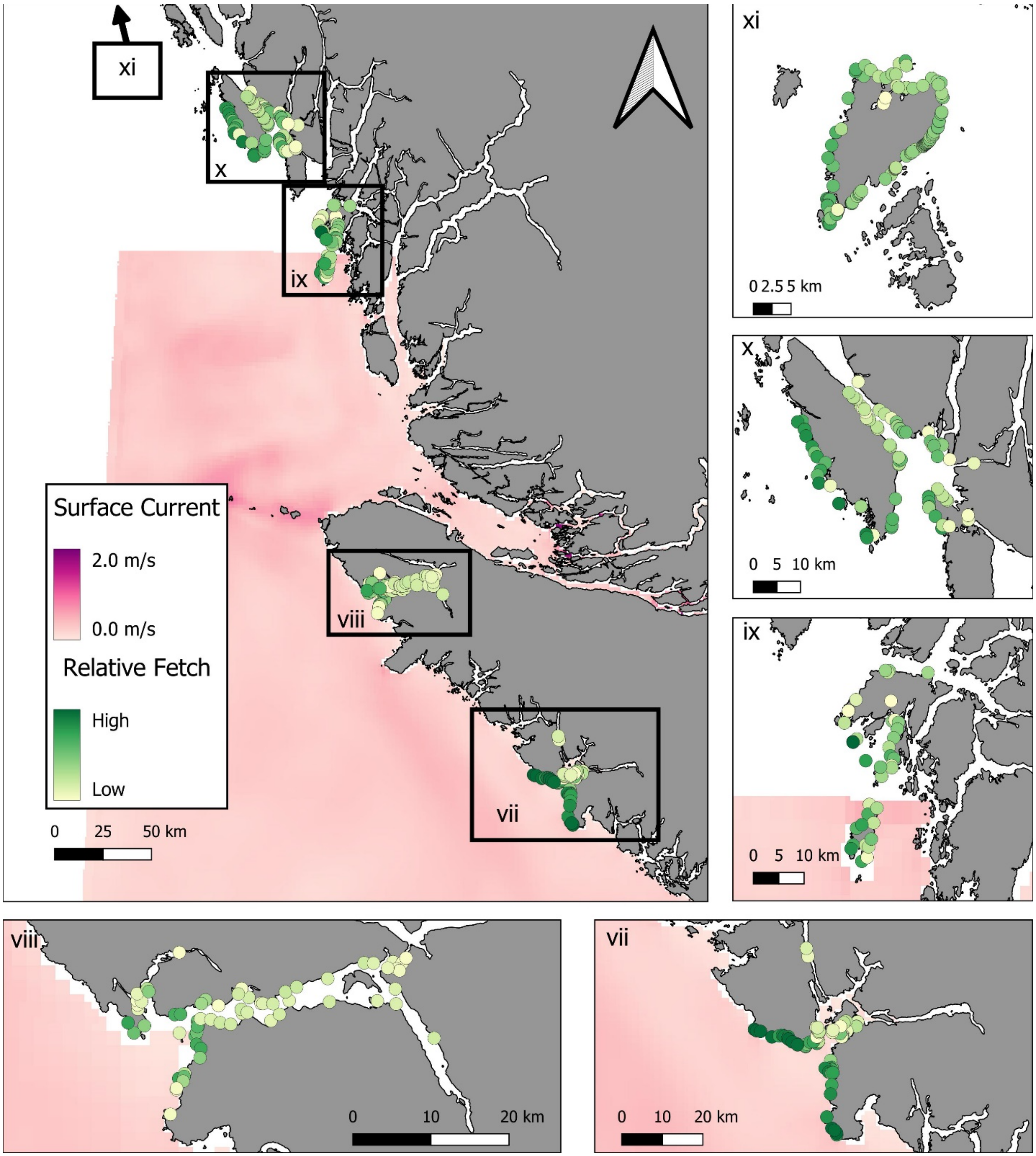

Fig S8. Map of Central and Northern regions showing surface current and relative fetch for each segment used in the kelp persistence analysis. Mean surface current data from July – August 2017 (data from LiveOcean Model) are overlaid on the water and segment datapoints are coloured by their relative fetch in green (data from DFO fetch model; see Methods).

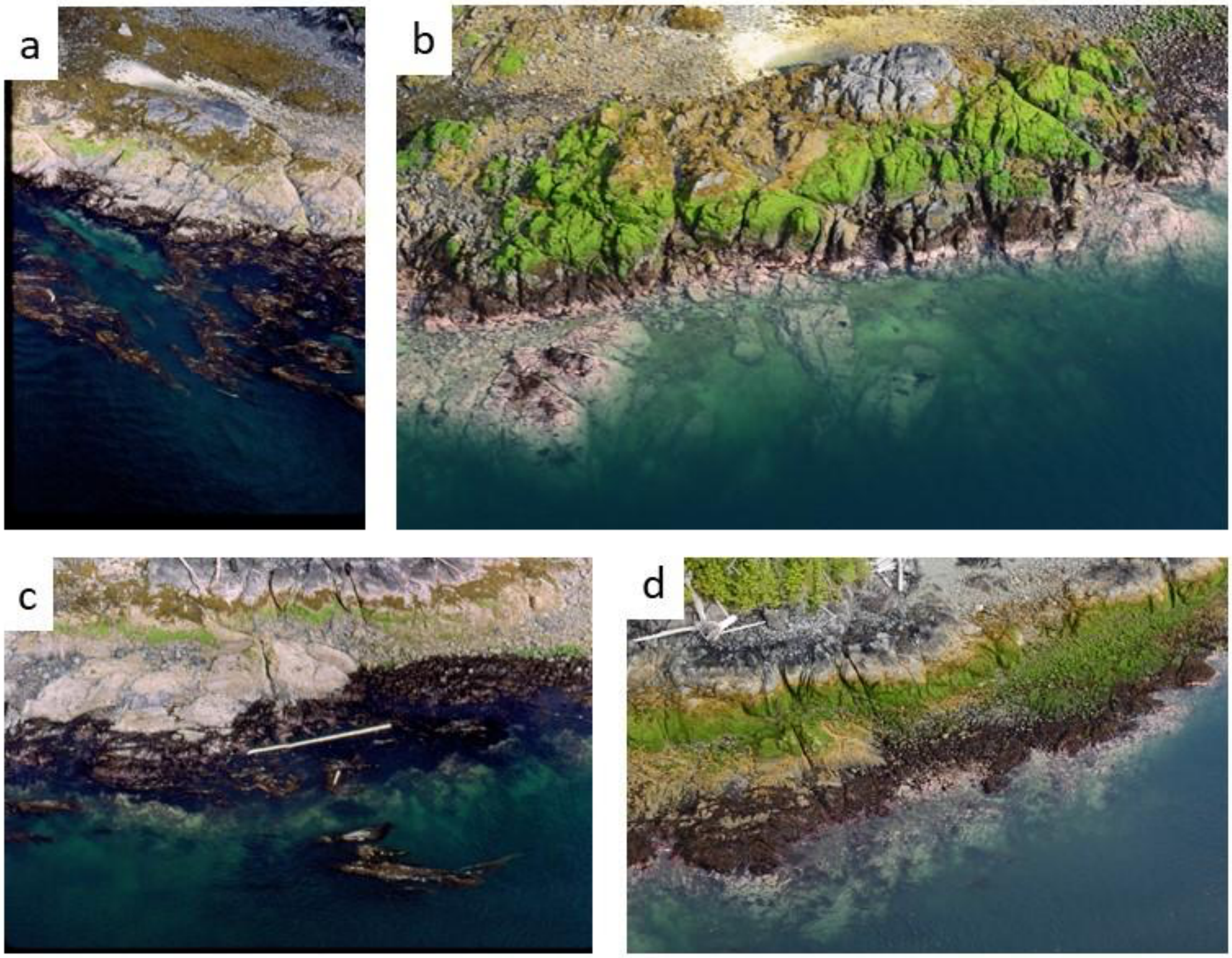

Fig S9. Examples of comparisons between modern and historic imagery from Dundas Island. Panels a and c show kelp forests in 2000 while panel b shows a transition to urchin barren and panel d shows a much reduced sparse forest surrounded by urchin barren. Images from ShoreZone BC.

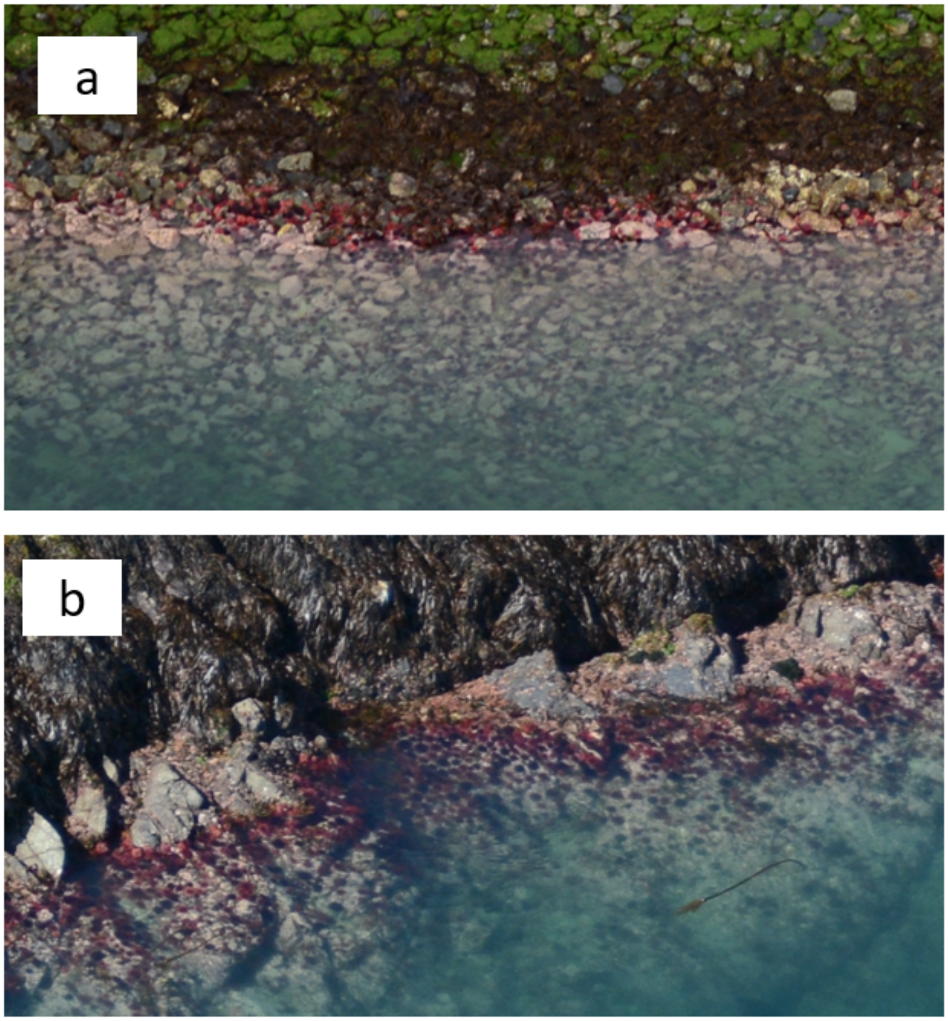

Fig S10. Example of sea urchins grazing up into the intertidal zone on Dundas Island (a) and in Laredo Sound (b) in 2019. Images from ShoreZone BC and Environment and Climate Change Canada.

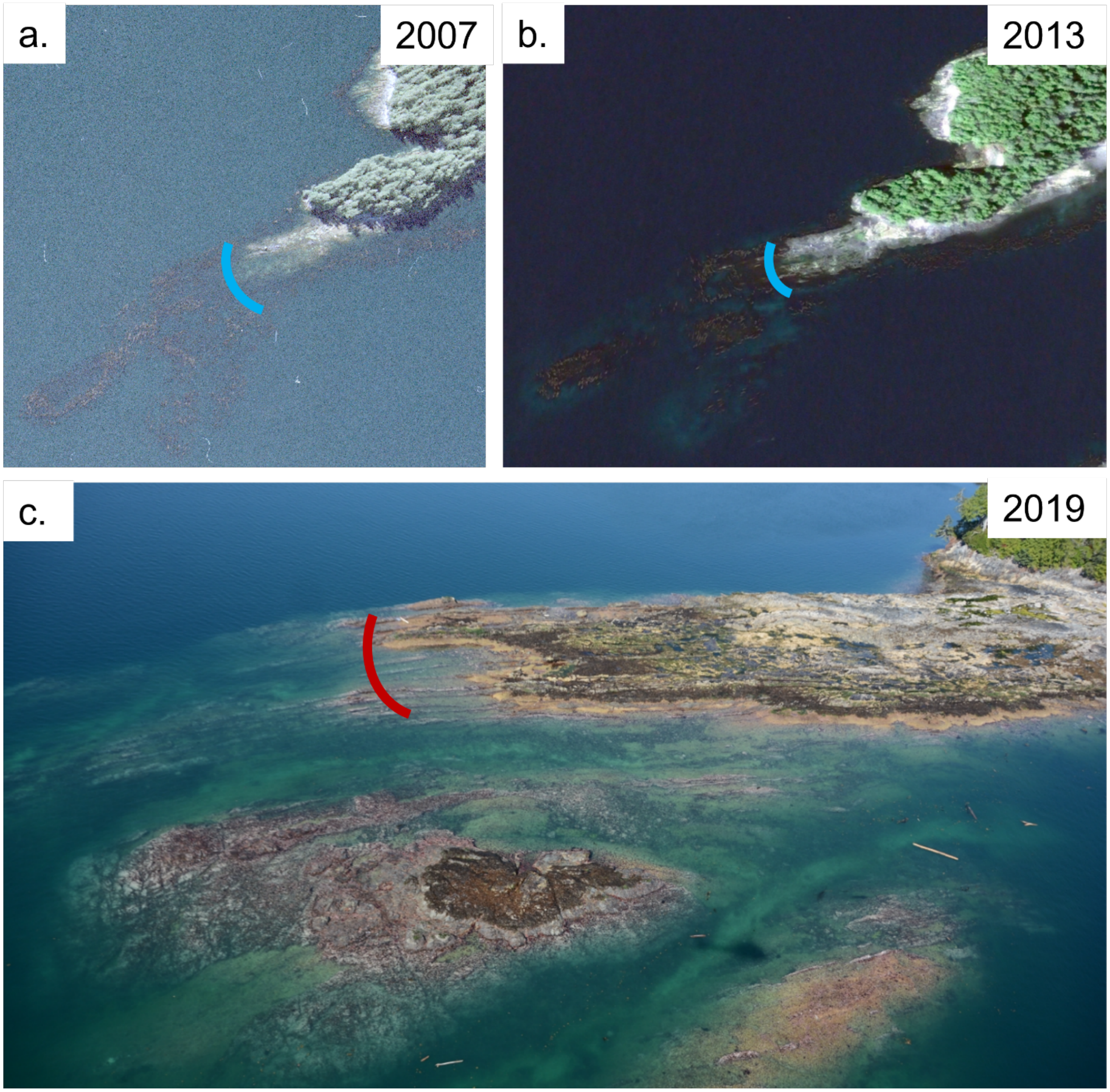

Fig S11. Examples of transitions from kelp forests to urchin barrens in Laredo Sound. Line segments show the same example area compared over time, with blue indicating kelp presence and red indicating kelp absence. Images from GeoBC, Google Earth and Environment and Climate Change Canada.

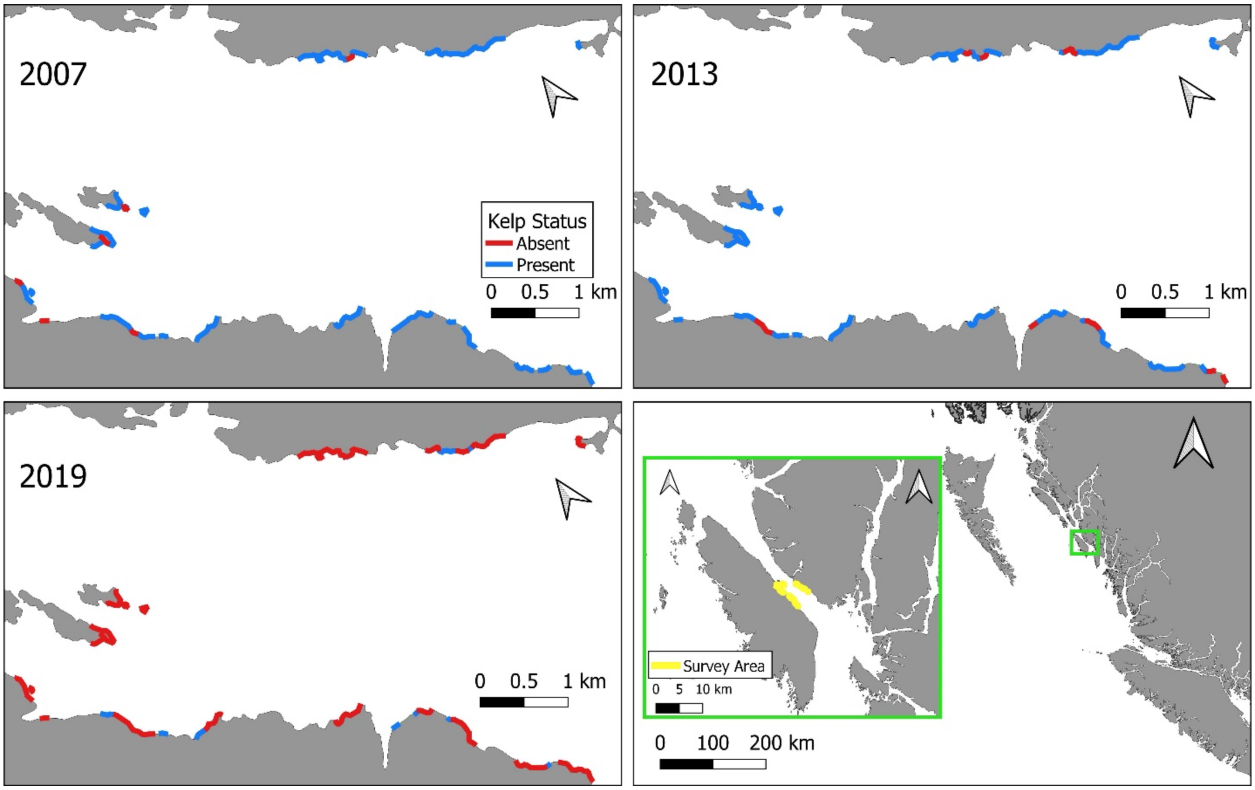

Fig S12. Maps showing the loss of kelp in part of Laredo Sound (Northern region; subregion x) between 2007, 2013, and 2019. Panel with inset map shows the location of survey region within Laredo Sound.

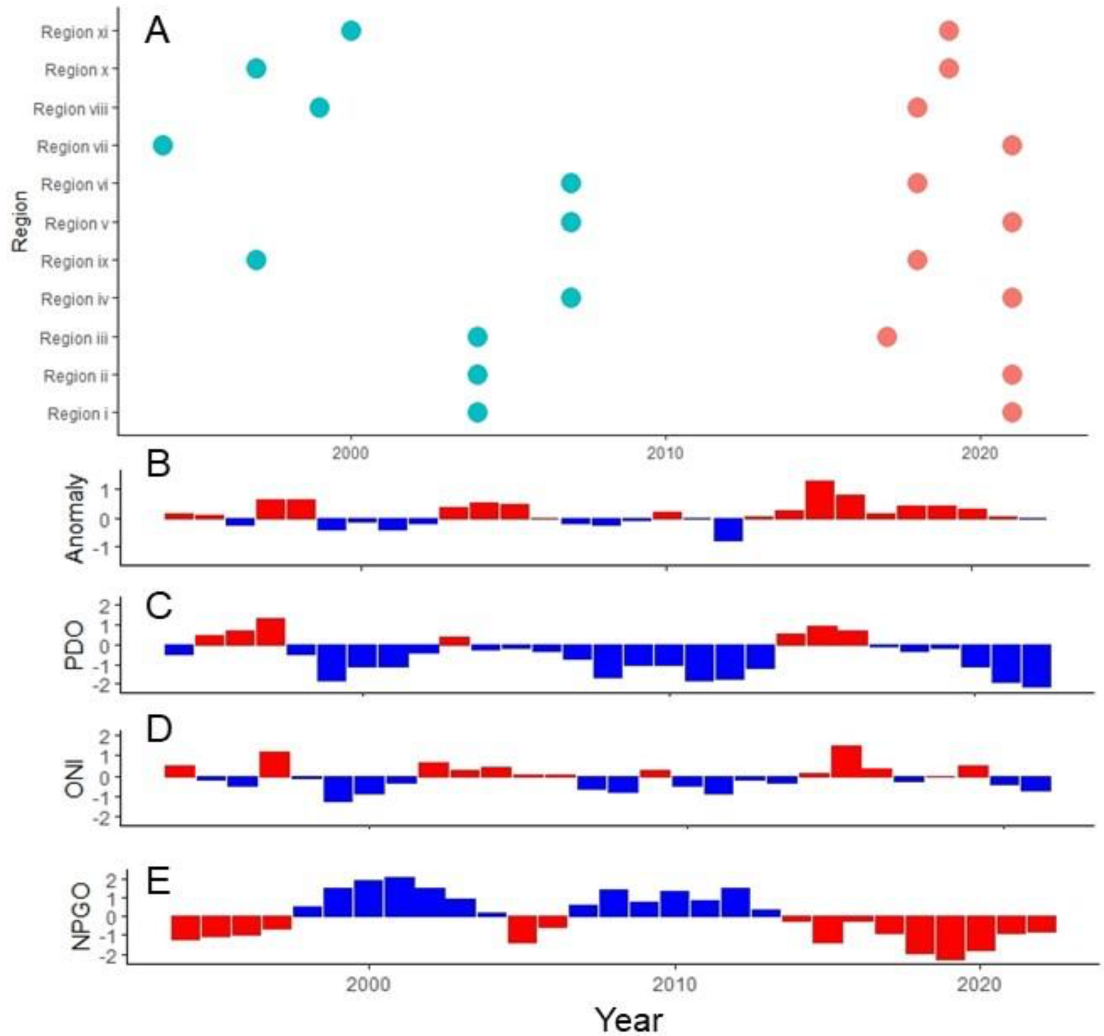

Fig S13. Time points used in snapshot analyses relative to temperature anomalies and climatic oscillators. Shown are the time points from before (teal) and after (red) the heatwave for the snapshot analyses (A). Below are annual mean monthly temperature anomalies (B) and various climate oscillators (C to E). For panels B-E, red colours indicate a warm year and blue represents a cool year. Temperature anomalies represent an average of four lighthouses that span the latitudinal gradient of British Columbia: Amphitrite Point, Chrome Island, McInnes Island and Bonilla Island. Data sources:
PDO: https://www.ncei.noaa.gov/pub/data/cmb/ersst/v5/index/ersst.v5.pdo.dat;
ONI: https://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php;
NPGO: http://www.o3d.org/npgo/npgo.php

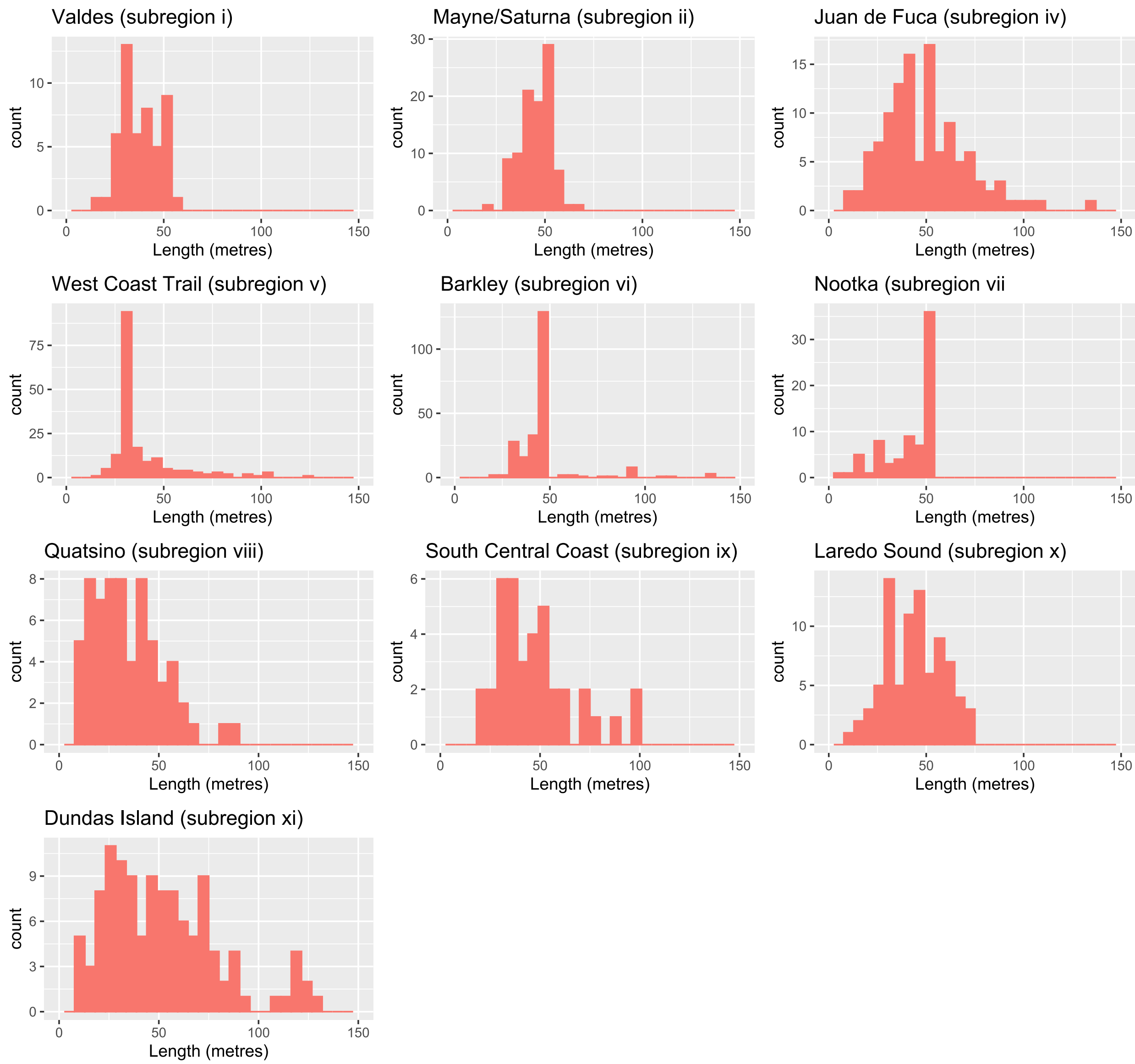

Fig S14. Histograms of segment length for each subregion. Not shown is Cowichan Bay (subregion iii) in which every segment is 100 m.