

Supplement

Bertram DF, Janssen MH, Cragg JL, Macdonald CA, McAdie M, Wilson A, Woo K, Gross E, Maftei M, O'Hara PD, Davis SE, Greene R, Vincent P (2022) Data from: Study “Marbled Murrelet satellite tracking data from British Columbia, Canada 2014-2016”. Movebank Data Repository.

<https://doi.org/10.5441/001/1.j0d889f0>

1.1: Marbled Murrelet satellite tracking data from British Columbia, Canada 2014-2016: Attribute Table

The following table provides attribute details for each bird in this study. Please note the “isotopes-id” field is related to a separate table that provides isotope data (obtain for bird’s breast feather) from Keith Hobson (ECCC at Western University). This table is provided in the Movebank study as additional data download.

Sat tag-id	animal-id	isotopes-id	animal-taxon	deploy-on-date	deploy-off-date	new-deploy-off-date	total-days-moving	total-distance-km	total-reports	animal-mass	animal-ring-id
135748	KT14_135748	16170	Brachyramphus marmoratus	2014-04-17 0:00	2014-04-17 23:59	2014-04-17 23:59	0	0	0	235	131389850
135750	KT14_135750	16169	Brachyramphus marmoratus	2014-04-18 0:00	2014-04-20 23:59	2014-04-20 23:59	2	12.62090348	2	220	131389849
135756	KT14_135756	16167	Brachyramphus marmoratus	2014-04-19 0:00	2014-04-24 6:21	2014-04-24 6:21	5	105.6991834	37	225	131389835
135755	KT14_135755	16168	Brachyramphus marmoratus	2014-04-19 0:00	2014-04-29 23:59	2014-04-29 23:59	10	208.4875558	40	235	131389836
135752	KT14_135752	16166	Brachyramphus marmoratus	2014-04-19 0:00	2014-09-19 22:12	2014-09-19 22:12	153	3463.341608	202	225	131389834
135751	KT14_135751	16165	Brachyramphus marmoratus	2014-04-19 0:00	2014-04-24 23:59	2014-04-24 23:59	5	144.3000364	38	225	131389833
135753	DS15_135753	16171	Brachyramphus marmoratus	2015-05-06 0:00	2015-07-17 23:59	2015-05-19 0:00	13	1153.905659	12	252	131389837
135747	DS15_135747	16172	Brachyramphus marmoratus	2015-05-07 0:00	2015-06-21 23:59	2015-05-27 0:00	20	1065.425043	49	205	131389838
146875	DS15_146875	16174	Brachyramphus marmoratus	2015-05-08 0:00	2015-07-03 23:59	2015-06-05 0:00	28	125.2952258	11	190	131389840
146874	DS15_146874	16173	Brachyramphus marmoratus	2015-05-08 0:00	2015-07-16 23:59	2015-07-16 23:59	69	7205.07519	670	266	131389839
146872	DS15_146872		Brachyramphus marmoratus	2015-05-08 0:00	2015-07-19 23:59	2015-05-20 0:00	12	1301.954416	15	250	131389844
135754	DS15_135754	16177	Brachyramphus marmoratus	2015-05-08 0:00	2015-05-20 23:59	2015-05-20 23:59	12	9697.749875	8	186	131389843
135749	DS15_135749	16175	Brachyramphus marmoratus	2015-05-08 0:00	2015-06-24 23:59	2015-06-07 0:00	30	599.0080374	47	205	131389841
146873	DS15_146873	16178	Brachyramphus marmoratus	2015-05-09 0:00	2015-05-18 23:59	2015-05-18 23:59	9	193.3986868	26	218	131389845
146871	DS15_146871	16179	Brachyramphus marmoratus	2015-05-09 0:00	2015-07-16 23:59	2015-05-31 0:00	22	2887.466957	472	201	131389846
159050	DS16_159050	16190	Brachyramphus marmoratus	2016-05-02 0:00	2016-05-07 23:48	2016-05-07 23:48	5	86.21919443	14	200	131389847
159047	DS16_159047	16191	Brachyramphus marmoratus	2016-05-02 0:00	2016-09-03 23:59	2016-09-03 23:59	124	2551.98925	249	227	131389848
159046	DS16_159046	16181	Brachyramphus marmoratus	2016-05-02 0:00	2016-05-10 23:59	2016-05-10 23:59	8	86.71053569	21	195	131386969
159044	DS16_159044	16180	Brachyramphus marmoratus	2016-05-02 0:00	2016-06-09 23:59	2016-06-09 23:59	38	600.4556066	92	223	131386968
159049	DS16_159049	16182	Brachyramphus marmoratus	2016-05-03 0:00	2016-05-17 3:43	2016-05-17 3:43	14	355.2410715	43	200	131386970
159048	DS16_159048	16184	Brachyramphus marmoratus	2016-05-03 0:00	2016-05-07 23:58	2016-05-07 23:58	4	38.60126871	9	268	131386972
159045	DS16_159045	16183	Brachyramphus marmoratus	2016-05-03 0:00	2016-05-10 23:59	2016-05-10 23:59	7	14.90376362	4	245	131386971
159051	CS16_159051	16185	Brachyramphus marmoratus	2016-05-21 0:00	2016-07-14 23:59	2016-06-11 12:00	21	946.6513921	205	225	131386973
159055	CS16_159055	16187	Brachyramphus marmoratus	2016-05-22 0:00	2016-07-18 23:59	2016-07-18 23:59	57	1346.133871	110	260	131386975
159054	CS16_159054	16186	Brachyramphus marmoratus	2016-05-22 0:00	2016-07-10 14:39	2016-07-10 14:39	49	1216.796583	169	250	131386974
159053	CS16_159053	16189	Brachyramphus marmoratus	2016-05-22 0:00	2016-06-29 23:59	2016-06-11 12:00	20	870.0877123	74	250	131386977
159052	CS16_159052	16188	Brachyramphus marmoratus	2016-05-22 0:00	2016-09-06 23:59	2016-09-06 23:59	107	3115.272754	96	195	131386976
N/A	N/A	16176	Brachyramphus marmoratus							235	131389842

Sat tag-id	animal-sex	Wing Chord (mm)	Culmen (mm)	Bill Depth (mm)	Tarsus (mm)	Measurer	Brood Patch	Paired	Paired with	Comment	deployment-year	deployment-latitude	deployment-longitude	deployment-comments
135748	f	137	13.2	6.3	17.8	DFB	N			Brown and white	2014	53.5876667	-129.4681667	NorthernBC
135750	m	130	13.7	5.2	17.6	MJ					2014	53.3339833	-129.1825	NorthernBC
135756	f	128	13.9	5	18.7	MJ		Y	135755		2014	53.3518333	-129.2623833	NorthernBC
135755	m	134	14.5	5.3	18.2	MJ		Y	135756		2014	53.3518333	-129.2623833	NorthernBC
135752	f	124	14	5.1	17.5	MJ		Y	135751		2014	53.3589667	-129.1968667	NorthernBC
135751	m	134	14.9	5.2	17	MJ		Y	135752		2014	53.3589667	-129.1968667	NorthernBC
135753	f	129	17.5	5.6	15	CM					2015	50.058	-124.685	SouthernBC
135747	m	121	17.7	5.4	15.8	KW					2015	50.058	-124.685	SouthernBC
146875	m	122	17.3	5.5	16	KW				RF web defect	2015	50.053	-124.935	SouthernBC
146874	f	128	17.5	5.6	17.1	KW					2015	50.053	-124.933	SouthernBC
146872	f	125	16.9	5.7	17.3	KW					2015	50.052	-124.928	SouthernBC
135754	m	119	16.9	5.6	16.3	KW					2015	50.094	-124.788	SouthernBC
135749	f	121	18.3	5.4	17	KW		N			2015	50.066	-124.817	SouthernBC
146873	f	126	17.6	4.8	17.5	KW		Y			2015	50.083	-124.835	SouthernBC
146871	m	119	20	4.8	17	KW		N			2015	50.087	-124.808	SouthernBC
159050	m	117	17	5.6	17.2	KW	N				2016	50.0863667	-124.1486333	SouthernBC
159047	f	125	16.2	5.5	17.7	KW	N				2016	50.0957	-124.1463667	SouthernBC
159046	f	116	16.1	5.2	16.3	KW	N	Y	PTT 159044		2016	50.0880833	-124.15225	SouthernBC
159044	f	125.0	18.3	5.8	17.3	KW	Y	Y	PTT 159046		2016	50.0880833	-124.15225	SouthernBC
159049	m	127	18.4	5.8	17.4	KW	N				2016	50.0788333	-124.1518167	SouthernBC
159048	f	126	17.6	6.3	18.1	KW	Y				2016	50.0721167	-124.1644833	SouthernBC
159045	f	125	17.5	5.5	18.2	KW	Y				2016	50.0779	-124.16405	SouthernBC
159051	f	130	17.9	6	17	KW	Y				2016	49.06545	-126.0991833	SouthernBC
159055	m	125	17.6	5.3	17.6	KW	Y				2016	49.0669	-126.0385333	SouthernBC
159054	f	124	17.6	5.3	16.6	KW	Y				2016	49.0675833	-126.1143833	SouthernBC
159053	m	124	16	5.4	16.9	KW	Y				2016	49.07285	-126.0642167	SouthernBC
159052	f	128	18.6	5.5	18.1	KW	n/a				2016	49.0773167	-126.0642167	SouthernBC
N/A		124	19	5.5	16.8	KW				Mortality				

Sat tag-id	new-end-type	deployment-end-type-Shanti	deployment-end-comments-Shanti
135748	equipment failure	equipment-failure	tag failure, no transmissions
135750	unknown	unknown	not enough data to conclude anything, unknown stop
135756	tag stopped moving	dead	drop in temp at same time that locations cluster in one area (from April 24 - May 1 in same location with low temp)
135755	unknown	unknown	Volt, Temp, Location all ok. A few blimps of data come in in 2015 and 2016!
135752	tag temp drop	dead	temp drop corresponds to tight cluster of locations from Sept 19 until last transmission on Nov 17, temps very low, sometimes negative
135751	unknown	unknown	temp, volt, locations all ok, unknown stop
135753	unknown	unknown	volt and temp ok, unknown stop
135747	unknown	unknown	volt and temp ok
146875	unknown	unknown	unknown, tag gets last fix in July 2015, but then comes back on for a bunch of invalid transmissions in July 2016! Bird alive? Unknown
146874	tag voltage drop	unknown	not 100% but drop in volt before trasmission stops. Location and temp both ok.
146872	tag temp drop	unknown	last valid fix July, then one invalid loc (with negative temp) in oct 2016
135754	invalid locations	unknown	unknown stop, last valid fix in may, tag keeps trasmitting invalid locs until July?.OR dead and washed up but temp seems too high
135749	tag voltage drop	unknown	drop in volt before tag stopped, not 100% on battery failure but does drop below cut off
146873	unknown	unknown	temp and volt ok
146871	tag stopped moving	unknown	breeding starting May 11? In same location (within error) until tag stopped on 07/16, temp fairly high during that whole period
159050	tag temp drop	dead	temp drop
159047	tag temp drop	dead	same location from 05/24-07/09 - foraging? then returns to area a bit through july. Temp goes whacky end of aug and same loc until late Sept - DEAD
159046	tag temp drop	unknown	sudden temp drop but no cluster of locations, suspected dead but not certain
159044	tag temp drop	dead	temp drop and bird in same location from June until Oct when tag stops
159049	tag temp drop	dead	temp drop sudden on May 17 - same location until June when tag dies.
159048	tag temp drop	dead	sudden drop in temp, combined with tight cluster of locations (examined best of day high quality locs), however temp drops down to 10 for many days, but then goes back up over 20 so breaks the rule, but decided still dead
159045	tag temp drop	unknown	sudden temp drop but no cluster in locations, unknown stop, etither tag fell off or bird died?
159051	unknown	unknown	Volt, Temp, Location all ok
159055	tag stopped moving	dead	bird moves around until July 20, then points until Aug 28 all in same spot - dead bird washed up on beach
159054	tag stopped moving	dead	bird moves around until July 15, then points until Nov 10 all in same area, seems like either bird died (and washed up on to beach)
159053	tag temp drop	dead	drop in temp, location on beach from early July until tag stops trasmitting in Novemeber - dead bird
159052	tag temp drop	dead	unknown, last location fix on Aug 15, then a bunch of invalid locs (no lat/lon), then comes back on in Oct with low temp and locs all in same place
N/A			

Sat tag-id	study-site	tag-manufacturer-name	tag-mass	tag-model	tag-production-date
135748	Kitimat	Microwave Technology	5	Solar PTT-100	2014
135750	Kitimat	Microwave Technology	5	Solar PTT-100	2014
135756	Kitimat	Microwave Technology	5	Solar PTT-100	2014
135755	Kitimat	Microwave Technology	5	Solar PTT-100	2014
135752	Kitimat	Microwave Technology	5	Solar PTT-100	2014
135751	Kitimat	Microwave Technology	5	Solar PTT-100	2014
135753	Desolation	Microwave Technology	5	Solar PTT-100	2014
135747	Desolation	Microwave Technology	5	Solar PTT-100	2014
146875	Desolation	Microwave Technology	5	Solar PTT-100	2015
146874	Desolation	Microwave Technology	5	Solar PTT-100	2015
146872	Desolation	Microwave Technology	5	Solar PTT-100	2015
135754	Desolation	Microwave Technology	5	Solar PTT-100	2014
135749	Desolation	Microwave Technology	5	Solar PTT-100	2014
146873	Desolation	Microwave Technology	5	Solar PTT-100	2015
146871	Desolation	Microwave Technology	5	Solar PTT-100	2015
159050	Desolation	Microwave Technology	5	Solar PTT-100	2016
159047	Desolation	Microwave Technology	5	Solar PTT-100	2016
159046	Desolation	Microwave Technology	5	Solar PTT-100	2016
159044	Desolation	Microwave Technology	5	Solar PTT-100	2016
159049	Desolation	Microwave Technology	5	Solar PTT-100	2016
159048	Desolation	Microwave Technology	5	Solar PTT-100	2016
159045	Desolation	Microwave Technology	5	Solar PTT-100	2016
159051	Clayoquot	Microwave Technology	5	Solar PTT-100	2016
159055	Clayoquot	Microwave Technology	5	Solar PTT-100	2016
159054	Clayoquot	Microwave Technology	5	Solar PTT-100	2016
159053	Clayoquot	Microwave Technology	5	Solar PTT-100	2016
159052	Clayoquot	Microwave Technology	5	Solar PTT-100	2016
N/A					

1.2: Time-Partitioned Kernel Density Estimates for Individual Marbled Murrelets

Summary

The original 2014–2016 marbled murrelet dataset used for this study was downloaded through Movebank. This dataset used to create the figures below have undergone a cleaning process that removed invalid locations and truncated bird movements based on a sudden drop in temperature or voltage from the Argos sensor data. The workflow involved in truncating movement was performed by Shanti Davis based on the document Migration Patterns of Pacific Sea Ducks, created by Jennifer Barrett, March 28th, 2015, which was a part of the Pacific Barrow’s Goldeneye tracking project. R code accompanied this document which processed the sensor output to yield appropriate temperature, voltage, and mortality values and create corresponding graphs. This analysis resulted in 12 of the 27 bird time ranges being truncated due to suspected death or equipment failure. After discussions on how to further challenge some of the determinations (e.g., unknown should be dead and at an earlier date), it was decided that an additional analysis may provide further insight into more accurate movement patterns and timeframes of these birds. For example, a bird might have died on land and maintained the impression of being alive and active due to summer temperatures and the error radius of the sensors. Kernel Density Estimates (KDE) were performed on birds based on 2-week intervals (where possible) and Argos location classes using the ArcGIS Kernel Density geoprocessing tool. The output maps were used along with expert knowledge in further interpretation of the number of days moving rather than the number of days transmitting. If a sequence of KDE maps for a bird showed very little size or geographical change in the high density use cores, the bird’s movement was truncated at the midpoint of the first map that appeared to have no movement. An example of this truncation can be seen in bird 146871, where it was determined that the high density use cores do not appear to move across any of the time-partitioned KDE maps.

The following is the workflow used to create KDEs for each bird based on ~2-week intervals and the Argos location classes

- Split the locations for the bird based on ~2-week intervals (sometimes these time frames are more than 2 weeks due to needing enough location points to run a KDE). It should be noted that the binning of weeks must be somewhat subjective to make sure there are enough records to do a KDE.
- Split each “2 week” intervals further into the Argos LC values (3, 2, 1, 0, A, B) using the split by attribute tool.
- Each of the above layers had a KDE run based on the 95th percentile error radius for each LC value for the KDE search radius parameter. The Douglas et al. 2016 paper provides a summary of their process used in the Douglas et al. 2012 paper:
 - “we grouped Argos location data (points) by their assigned location classes (LC = 3, 2, 1, 0, A, B) and assigned an error radius (in kilometres) to each set of points. Douglas et al. (2012) estimated the average location error by comparing >20 000 locations estimated by Argos with temporally paired locations derived by the global positioning system (GPS) for tracked free-ranging birds. We assigned the 95 percentile error radii calculated by Douglas et al. (2012) for each LC, which ranged from 1.5 km for LC = 3 to 20.9 km for LC = B (see Table 2 in Douglas et al. 2012). The assigned error radii were used as the input parameter “Search Radius” for the KD analyses performed on each set of data.”
- Each KDE layer was then summed to provide a final KDE layer for its “2 week” time period of bird movement.
- Symbolology was applied using 10 classes with quantile (10–100th percentiles) to allow for consistent symbolizing of data.

It should be noted that 3 birds did not have enough location points to perform KDEs; bird 135748 has no records, 135750 has 2 locations and 159045 has 4 locations. Note too that some birds have long time ranges but very few location records. All raw data points are mapped and provided for each bird in this

supplement to aid in the interpretation of the number of days moving rather than the number of days transmitting. Supplement 1.1 Attribute Table reflects the new deployment off date for all the birds that had movement truncated as a result of interpretation of the KDEs.

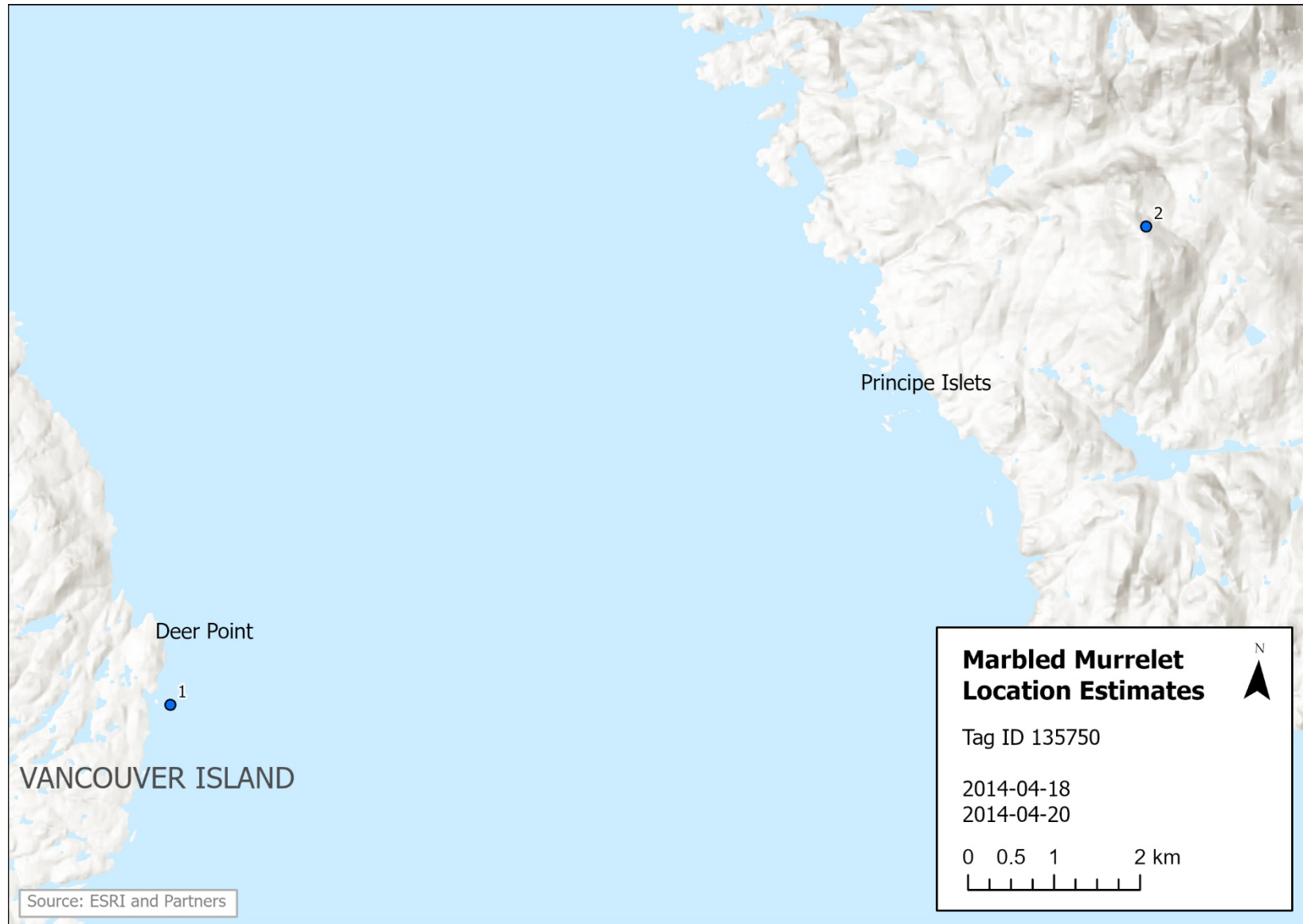
Reference

Bertram DF, MacDonald CA, O’Hara PD, Cragg JL, Janssen MH, McAdie M, Boyd WS (2016) Marbled murrelet *Brachyramphus marmoratus* movements and marine habitat use near proposed tanker routes to Kitimat, BC, Canada. *Mar Ornithol* 44: 3–9

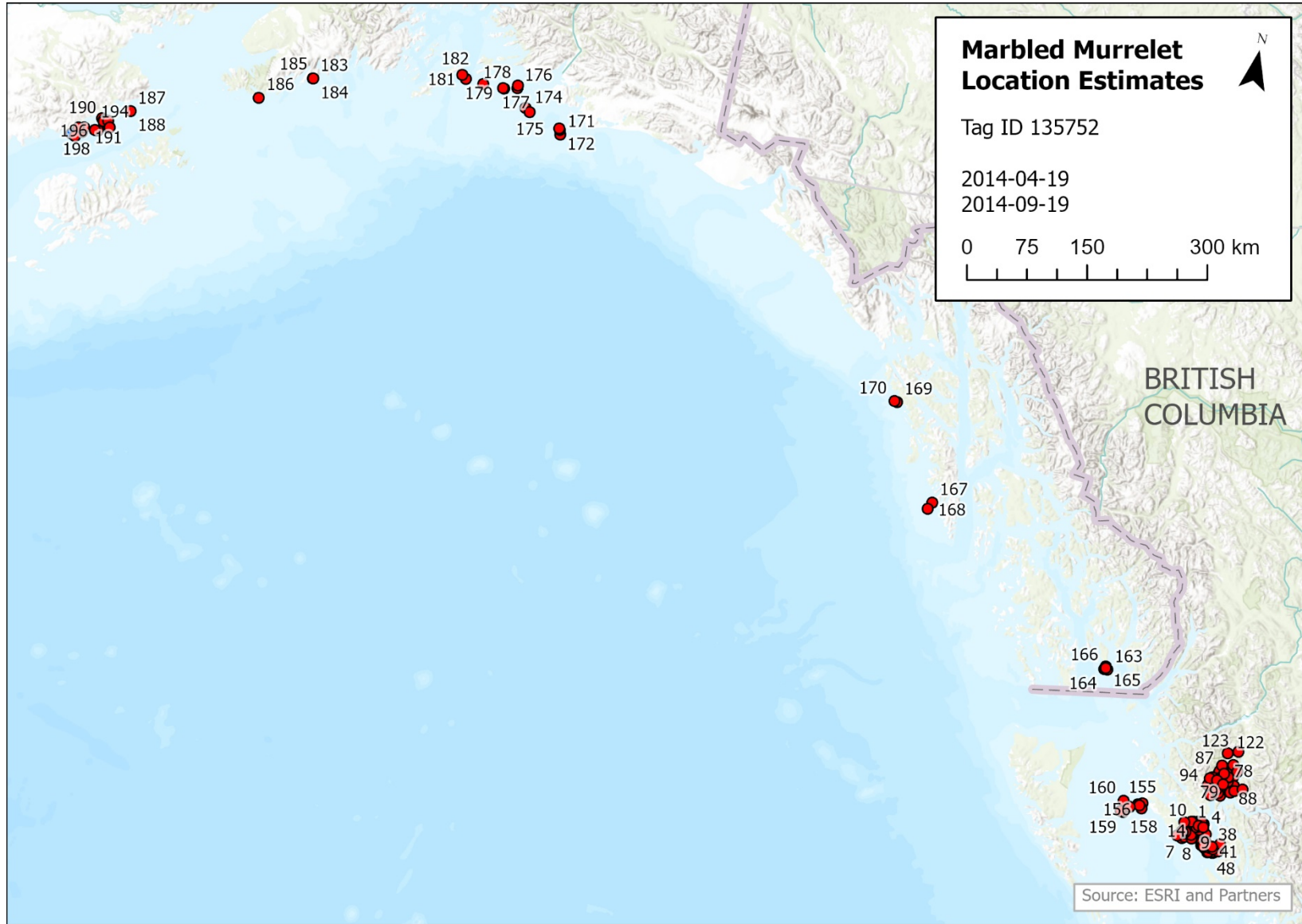
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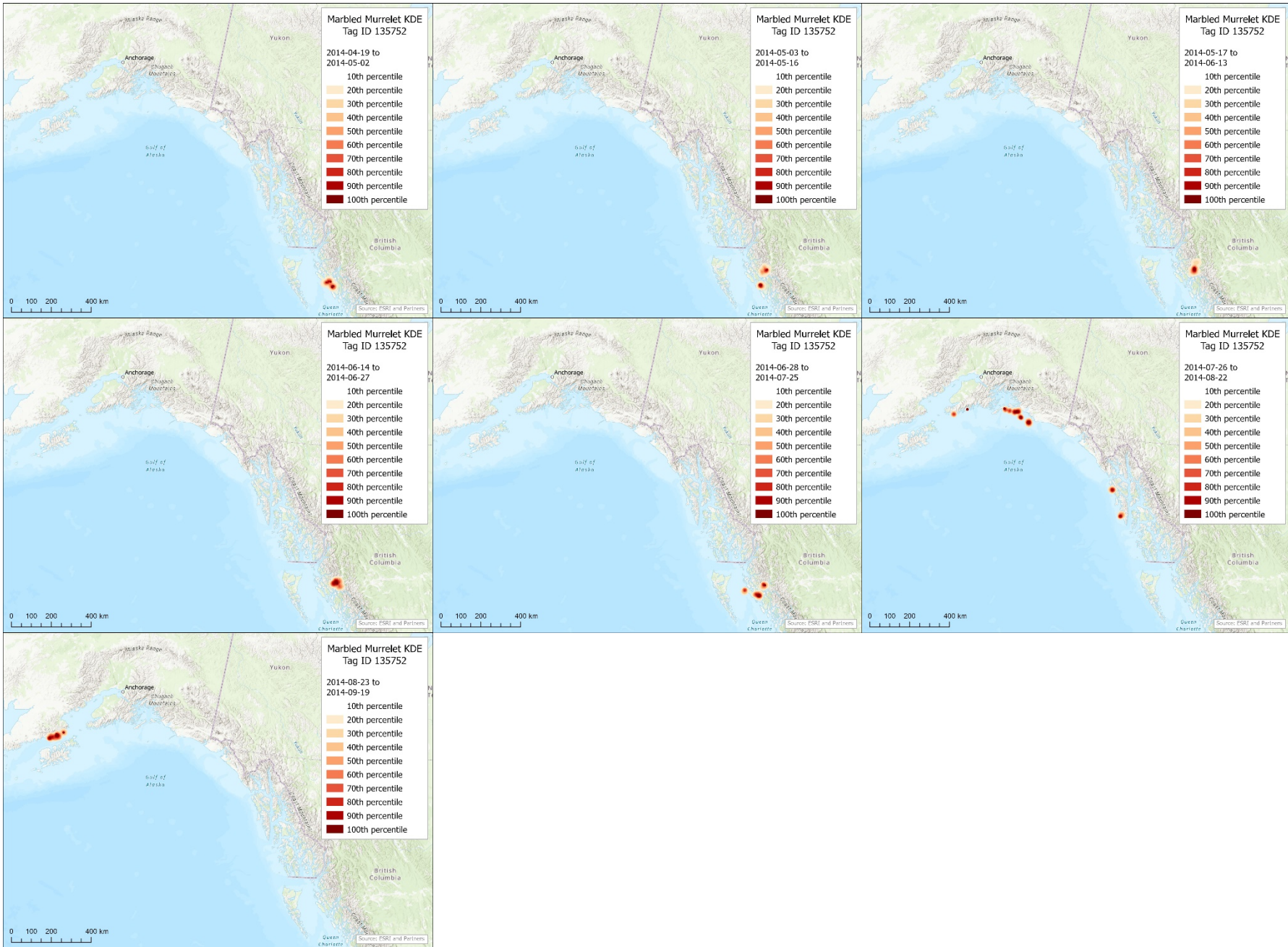
Douglas DC, Weinzierl R, Davidson SC, Kays R, Wikelski M, Bohrer G (2012) Moderating Argos location error in ani-mal tracking data. *Methods Ecol Evol* 3: 999–1007

Tag 135750, 2014, Kitimat

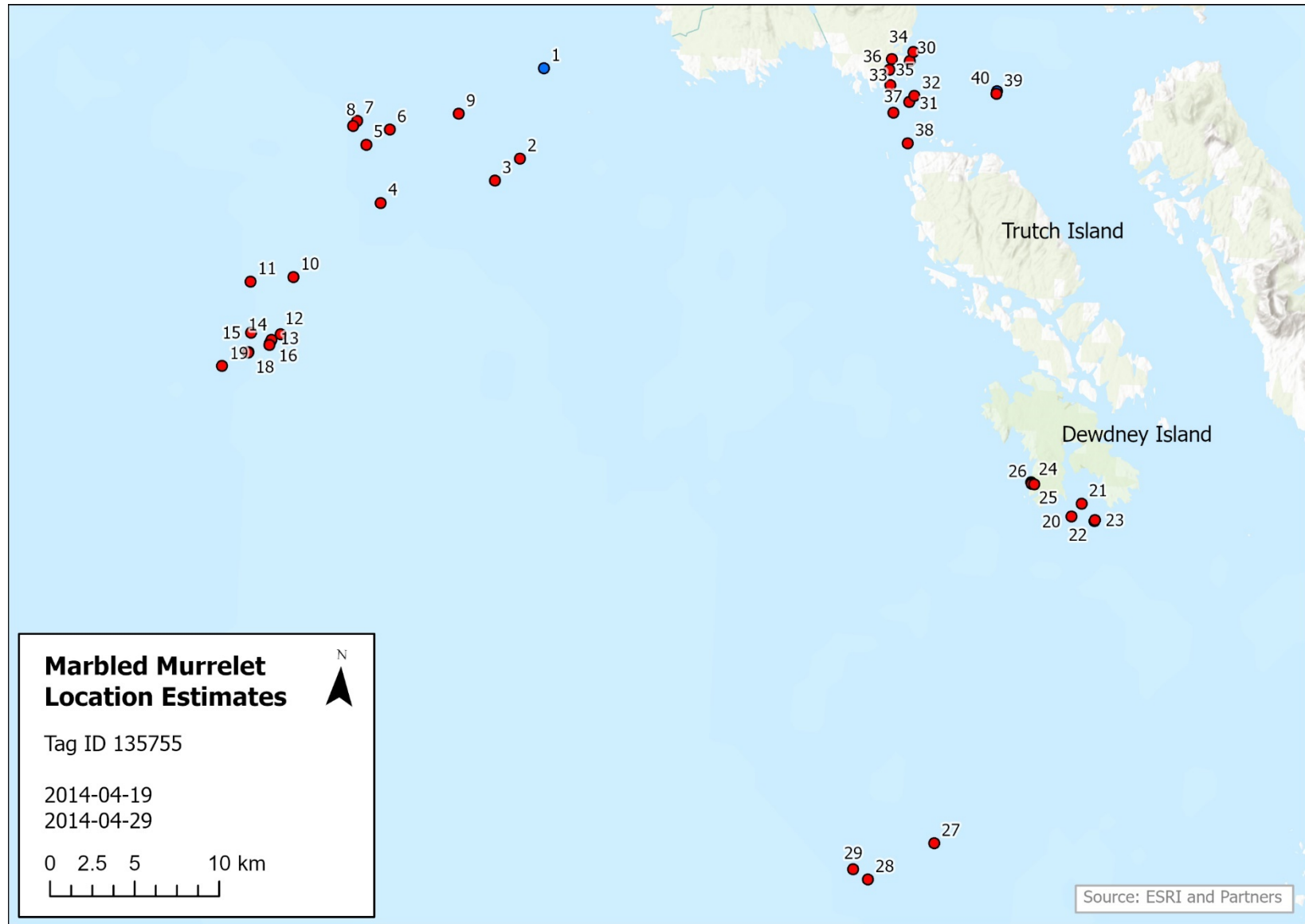


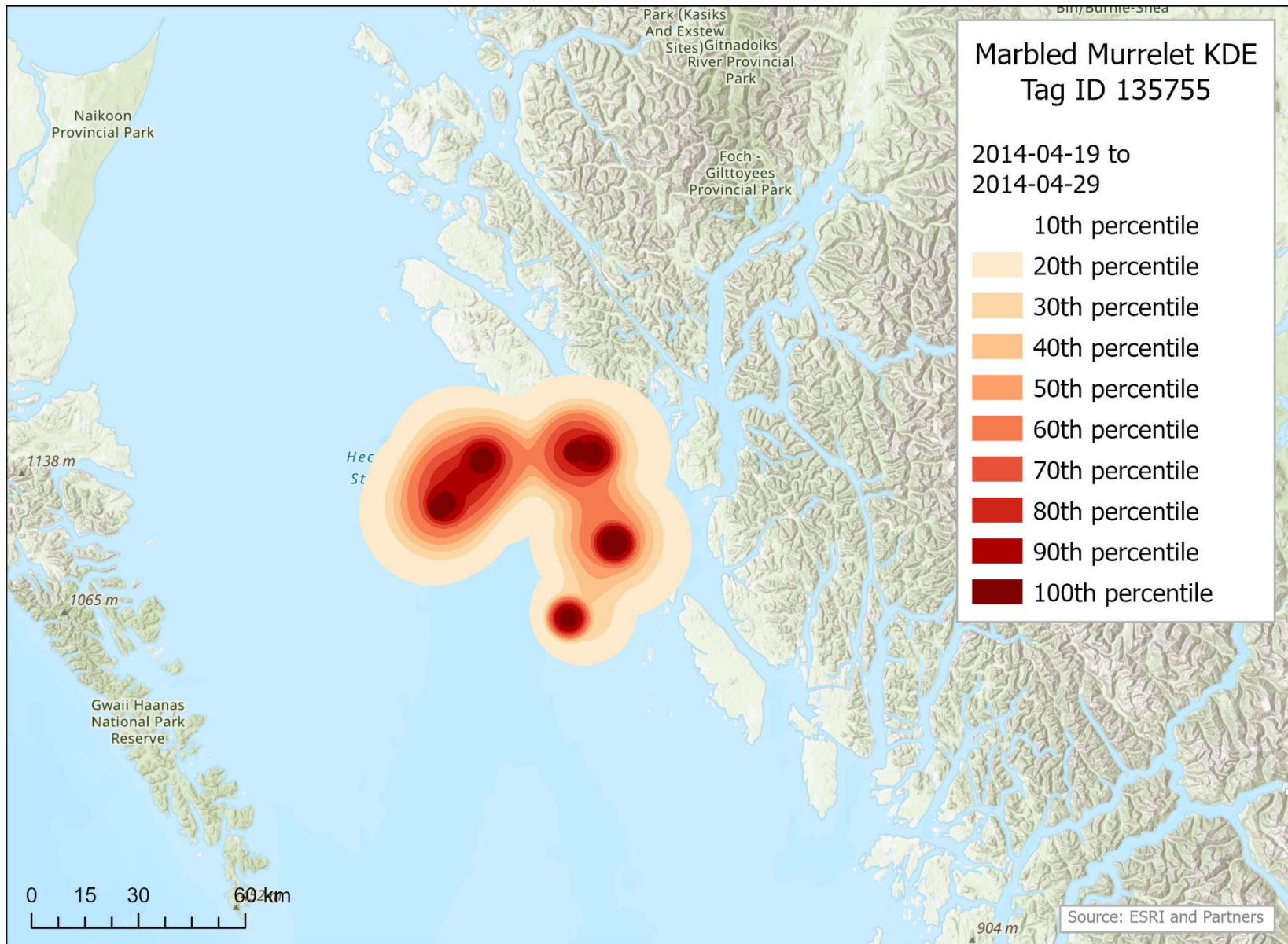
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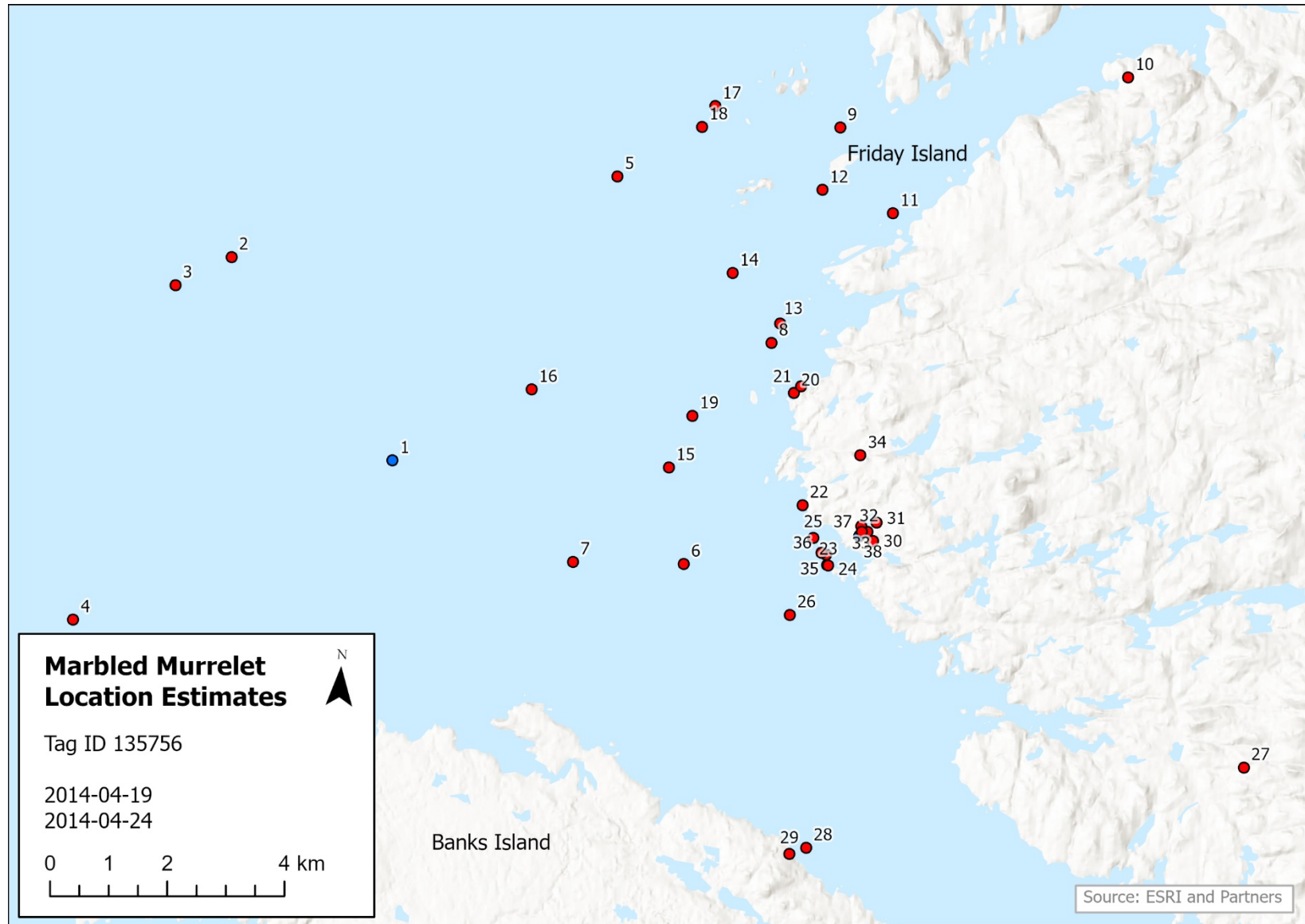


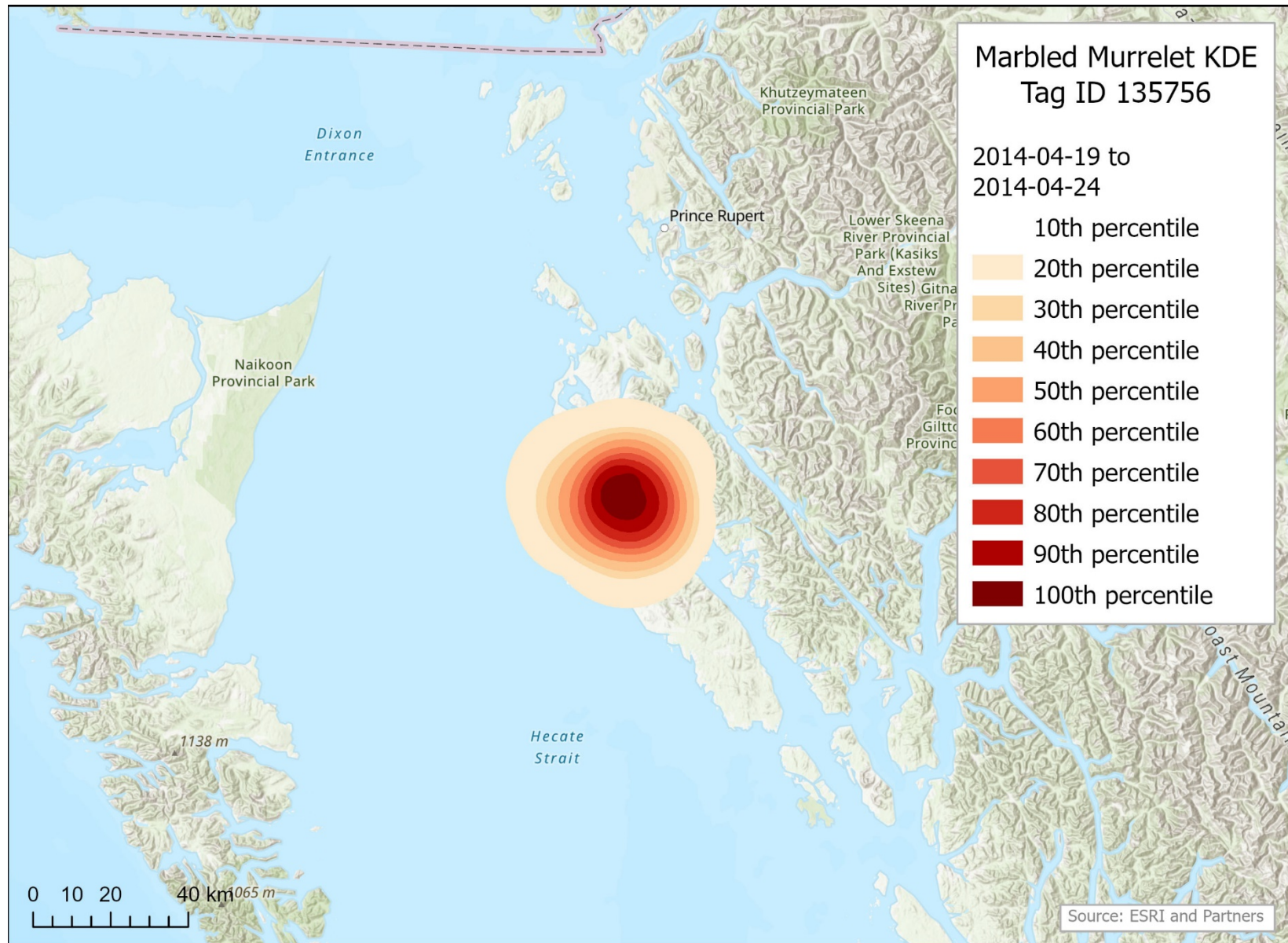
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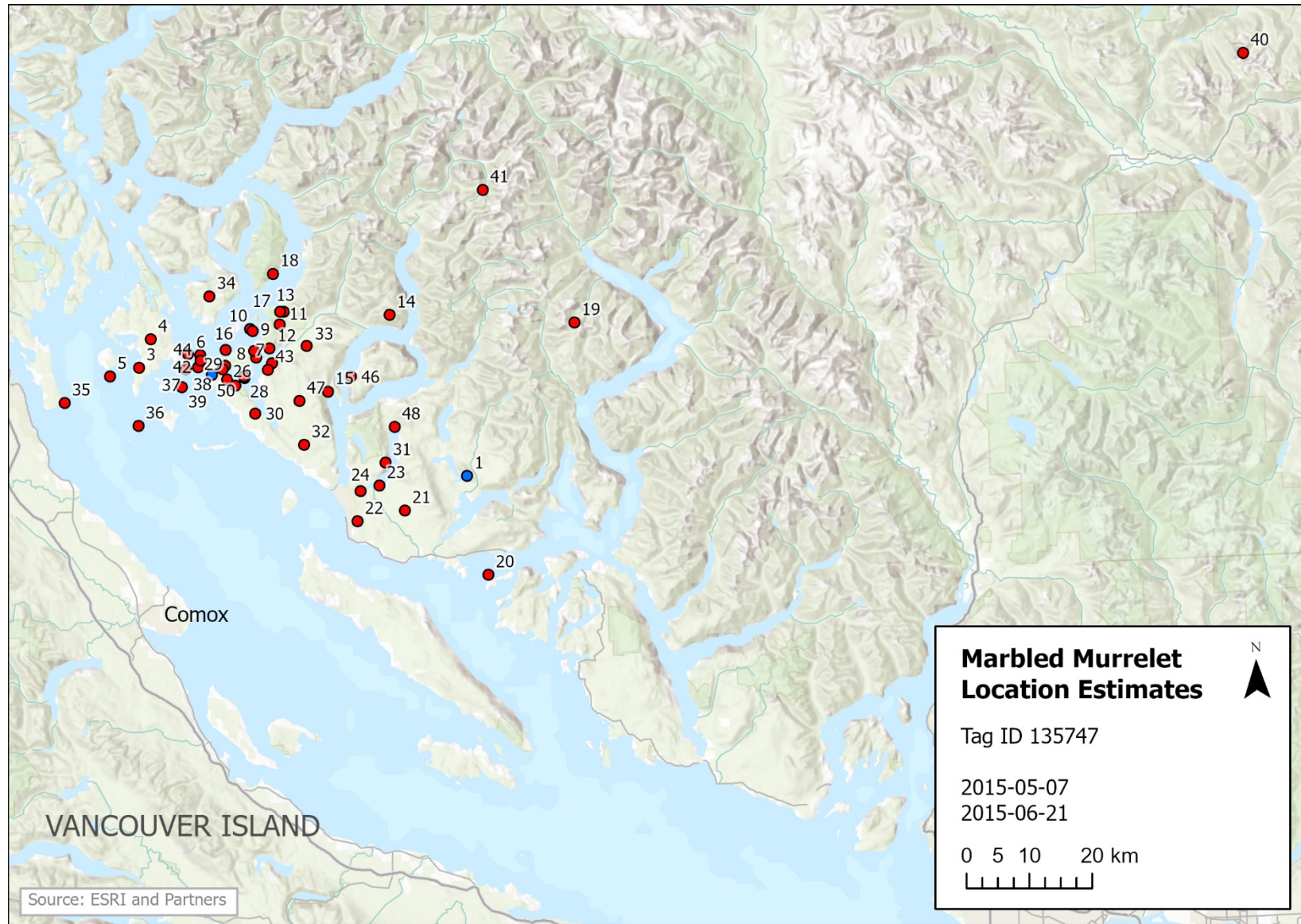


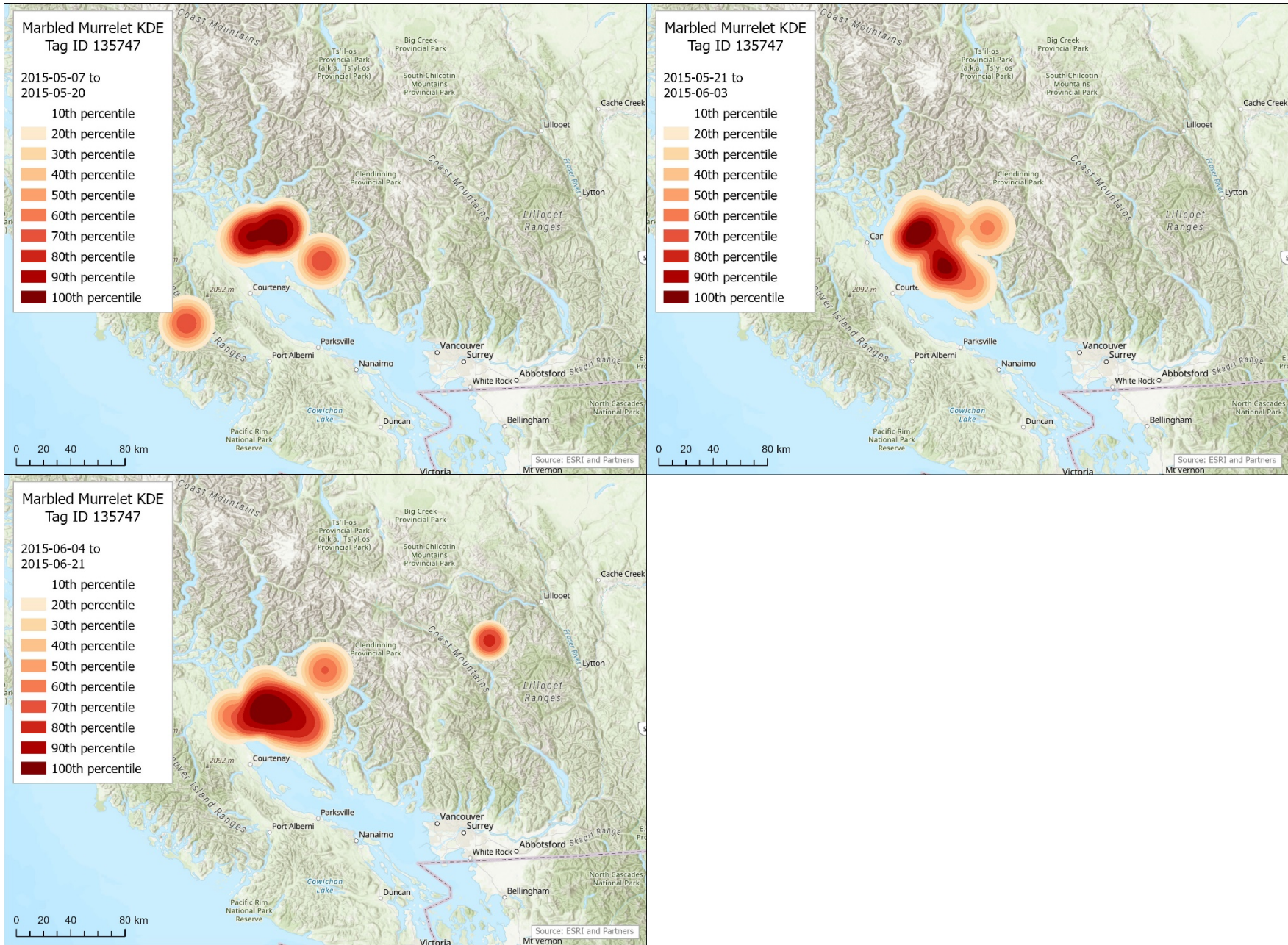
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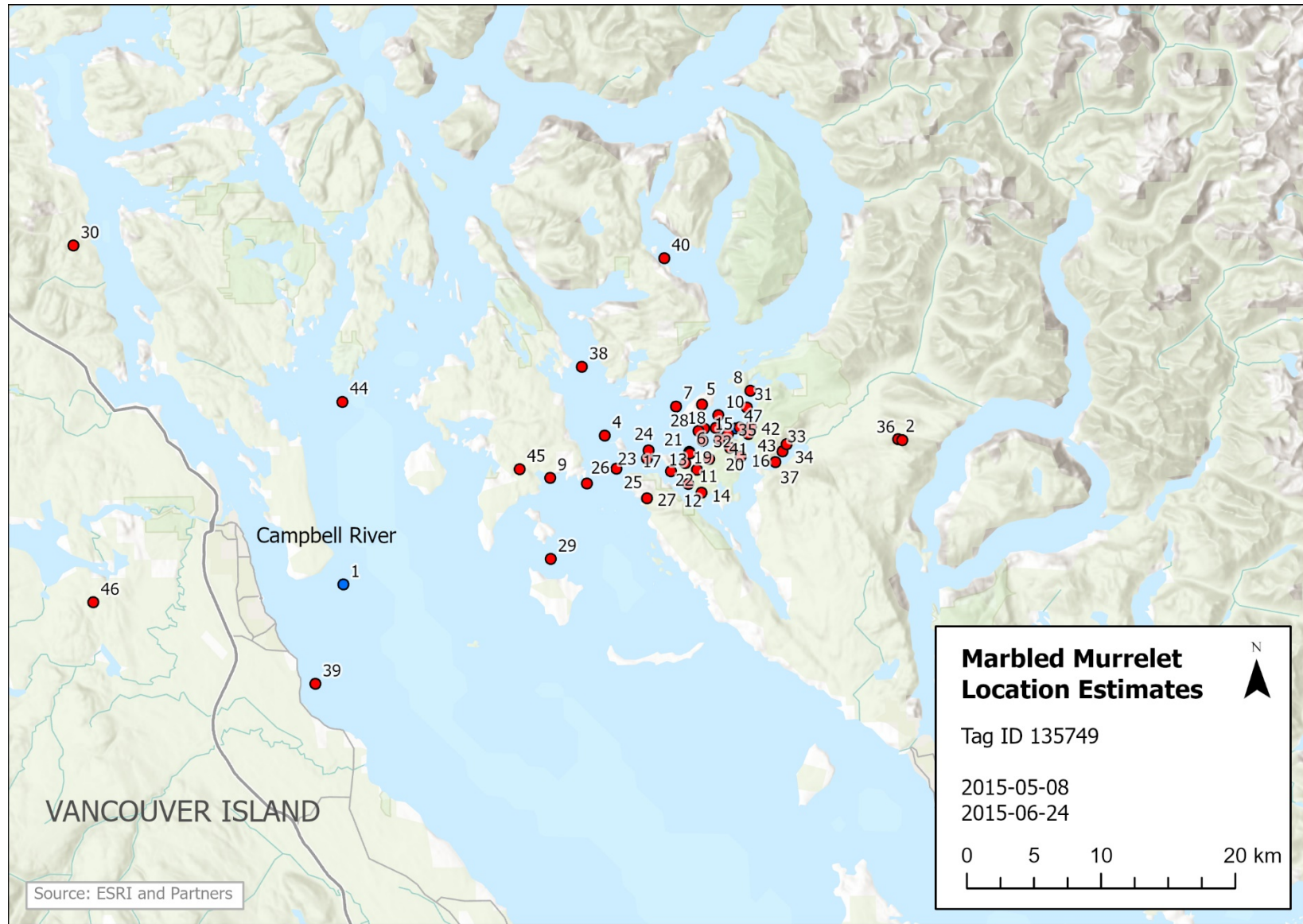


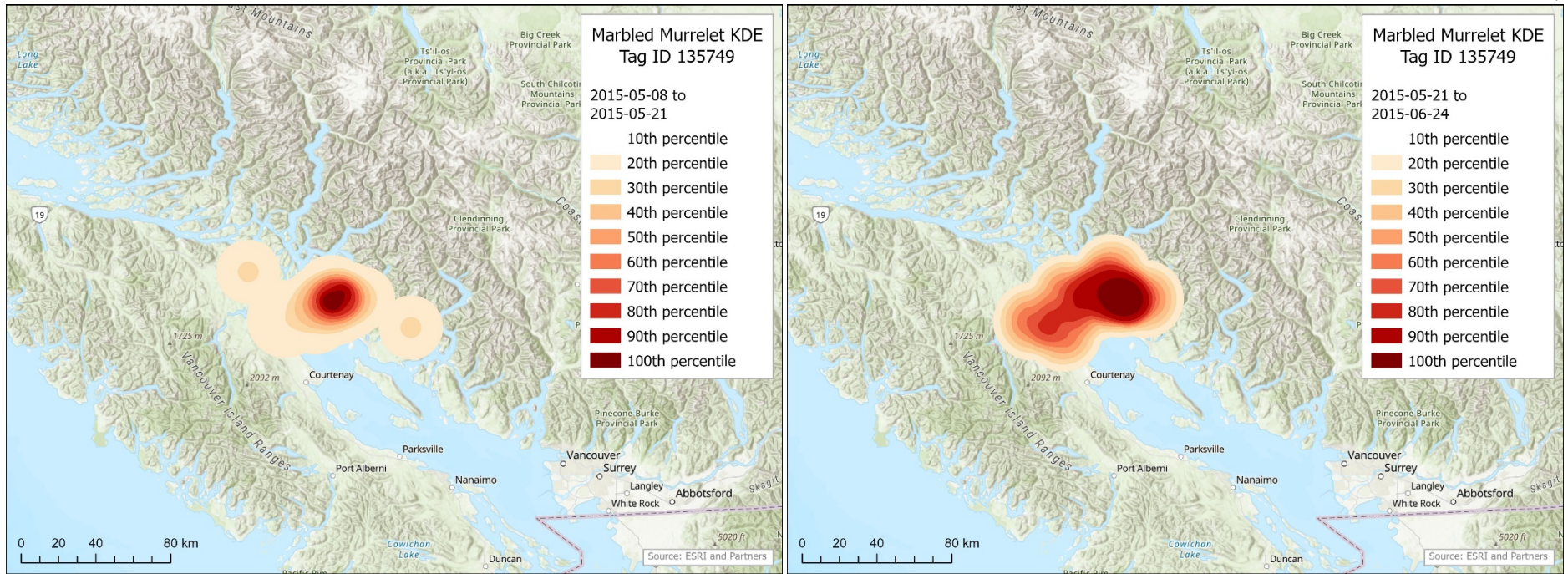
Tag 135747, 2015, Desolation Sound



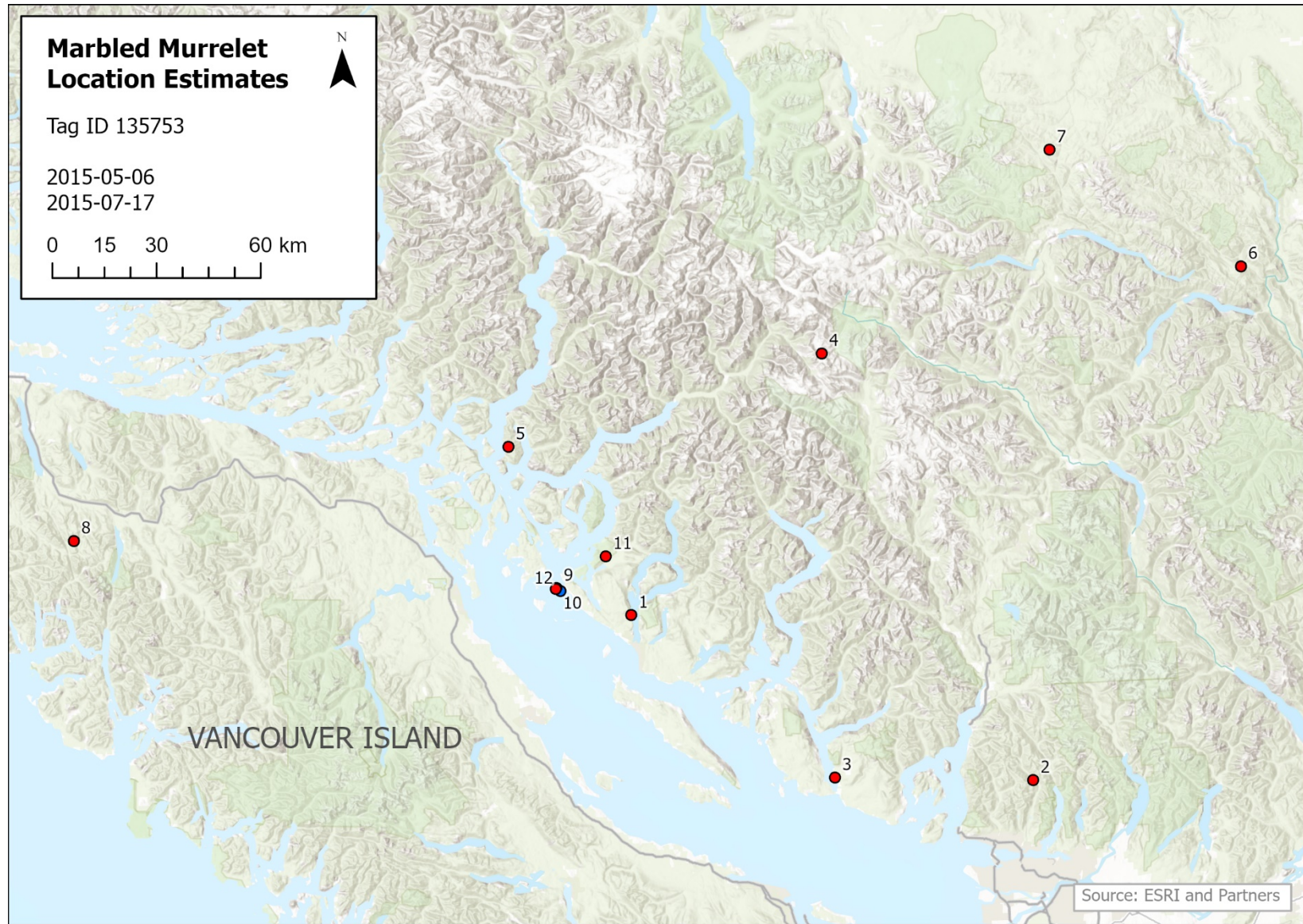


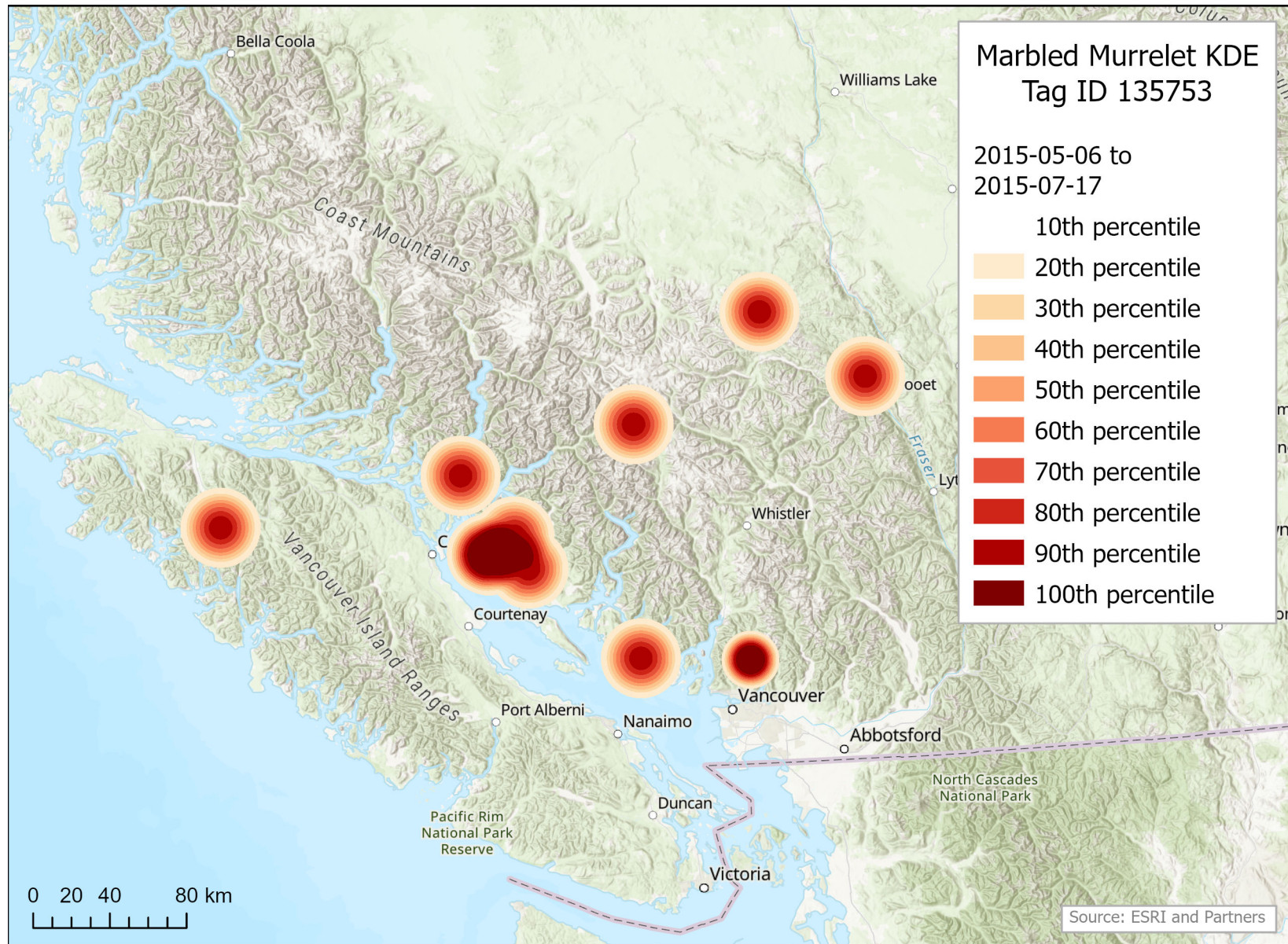
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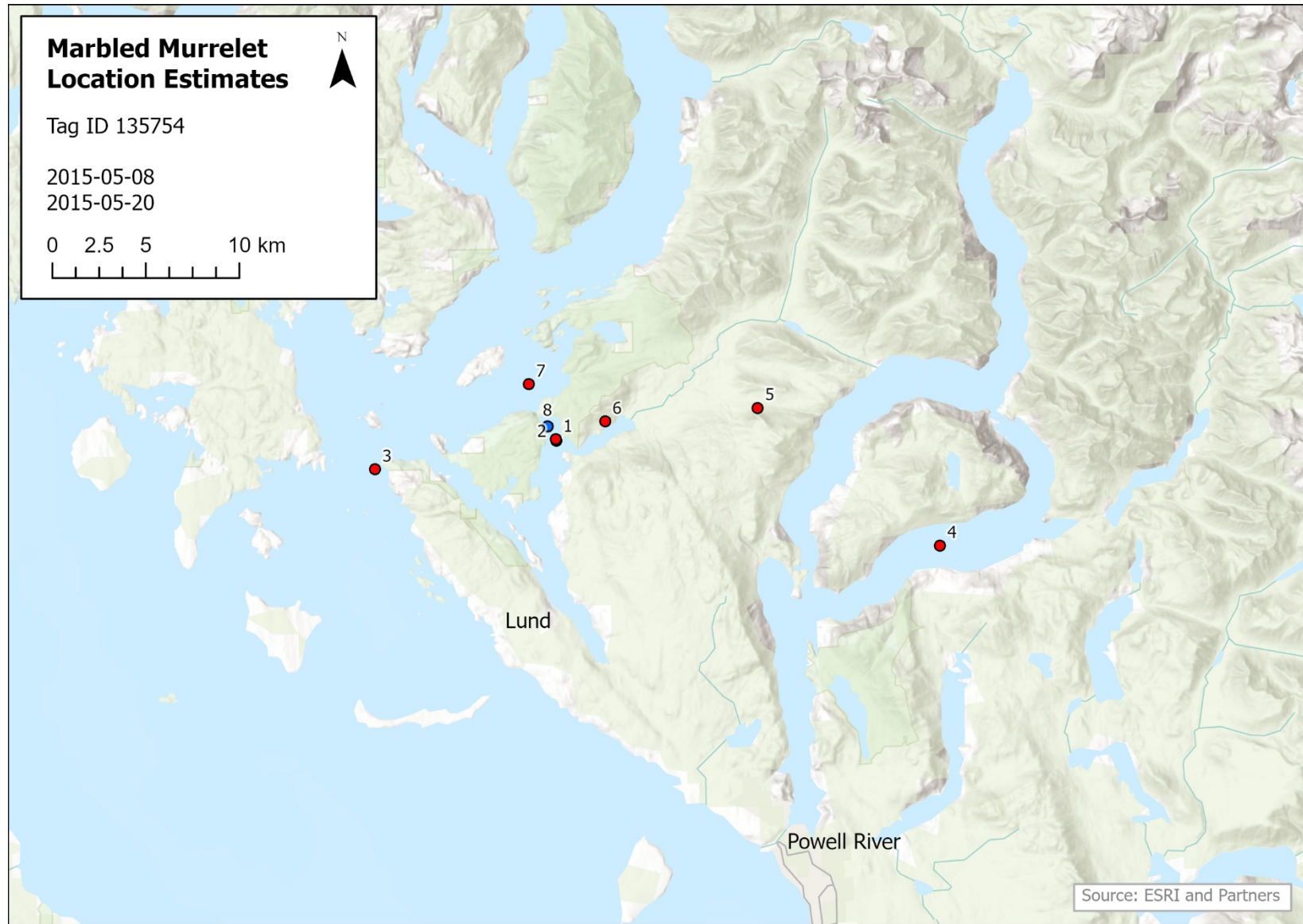


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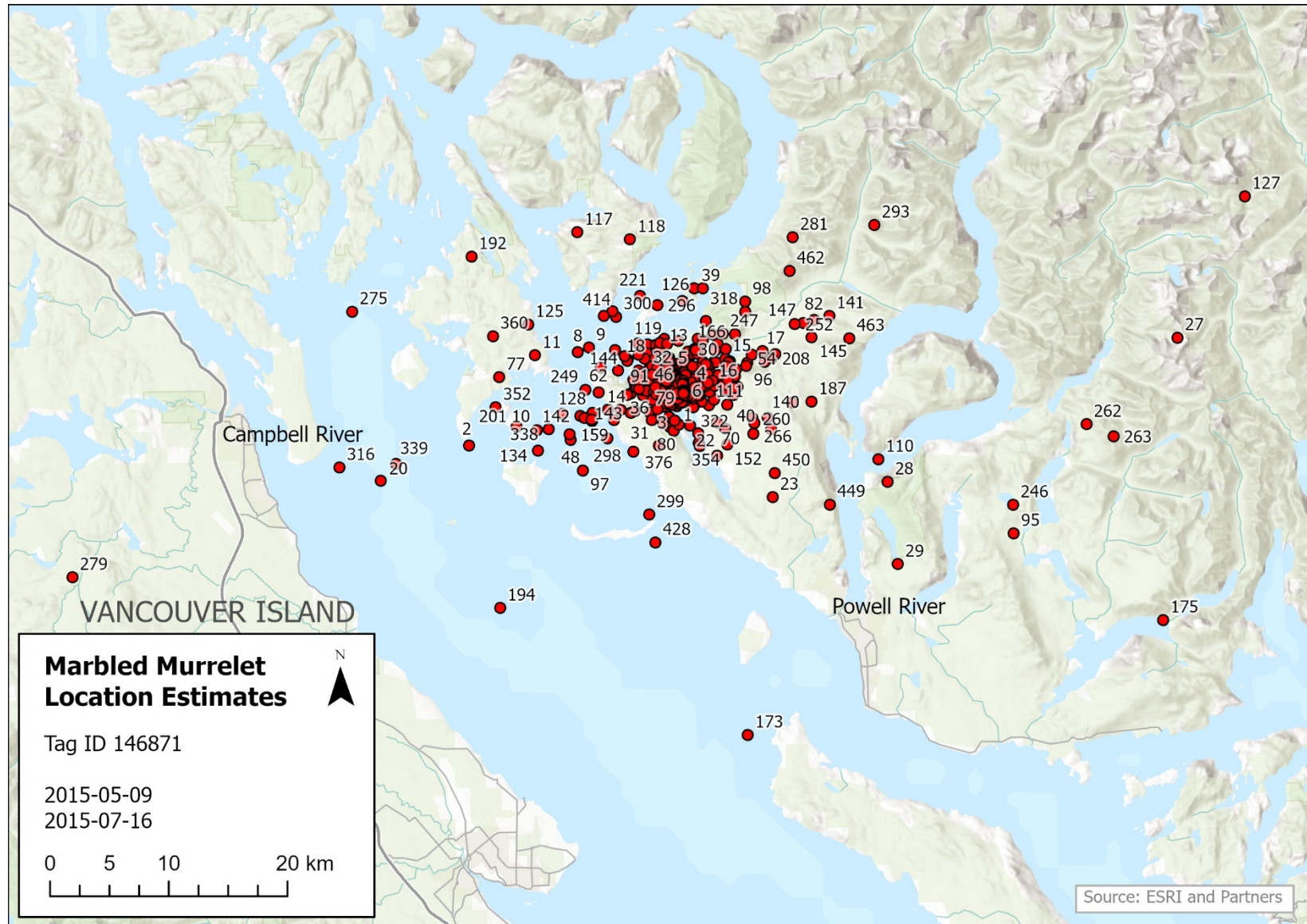


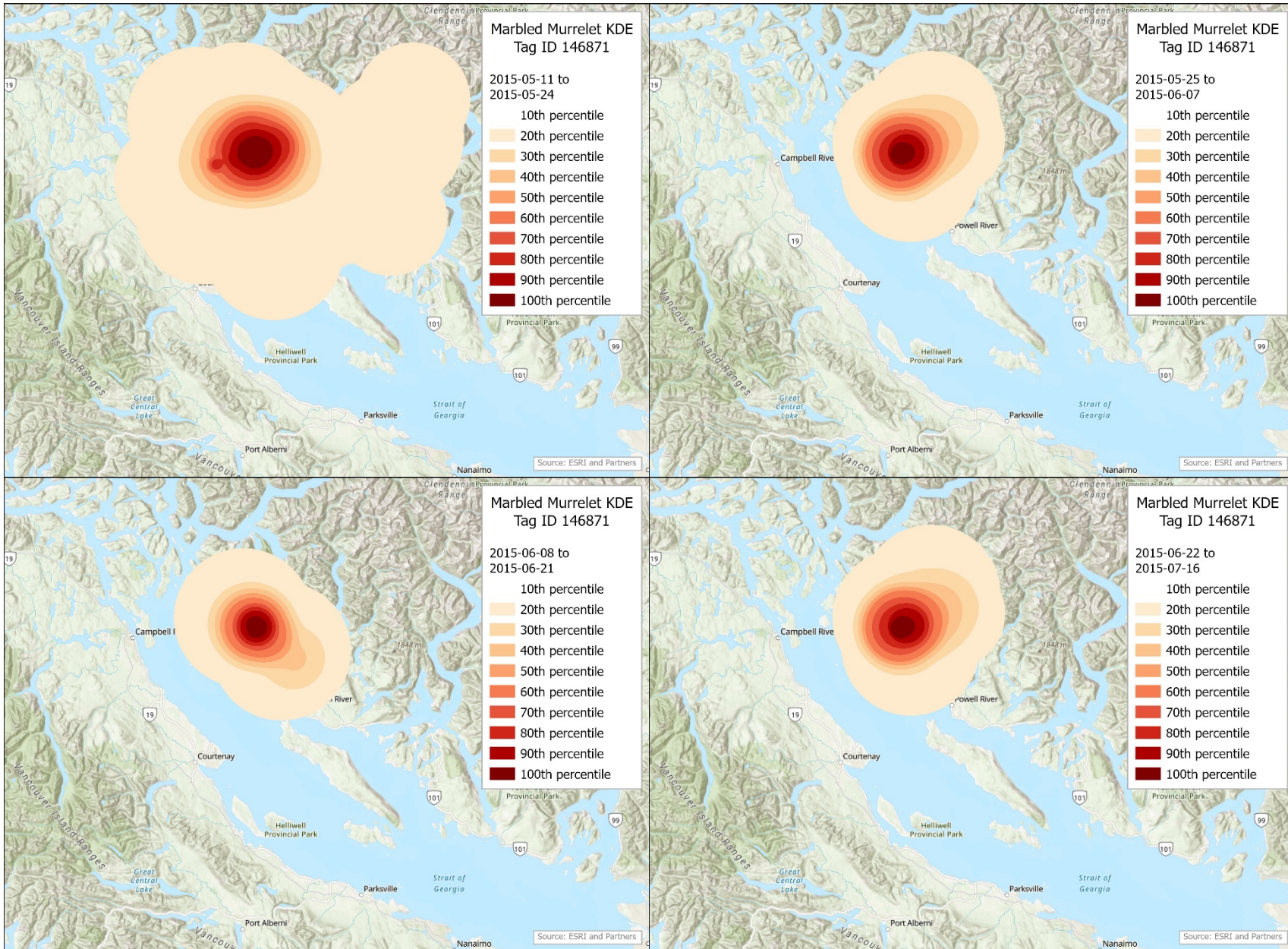


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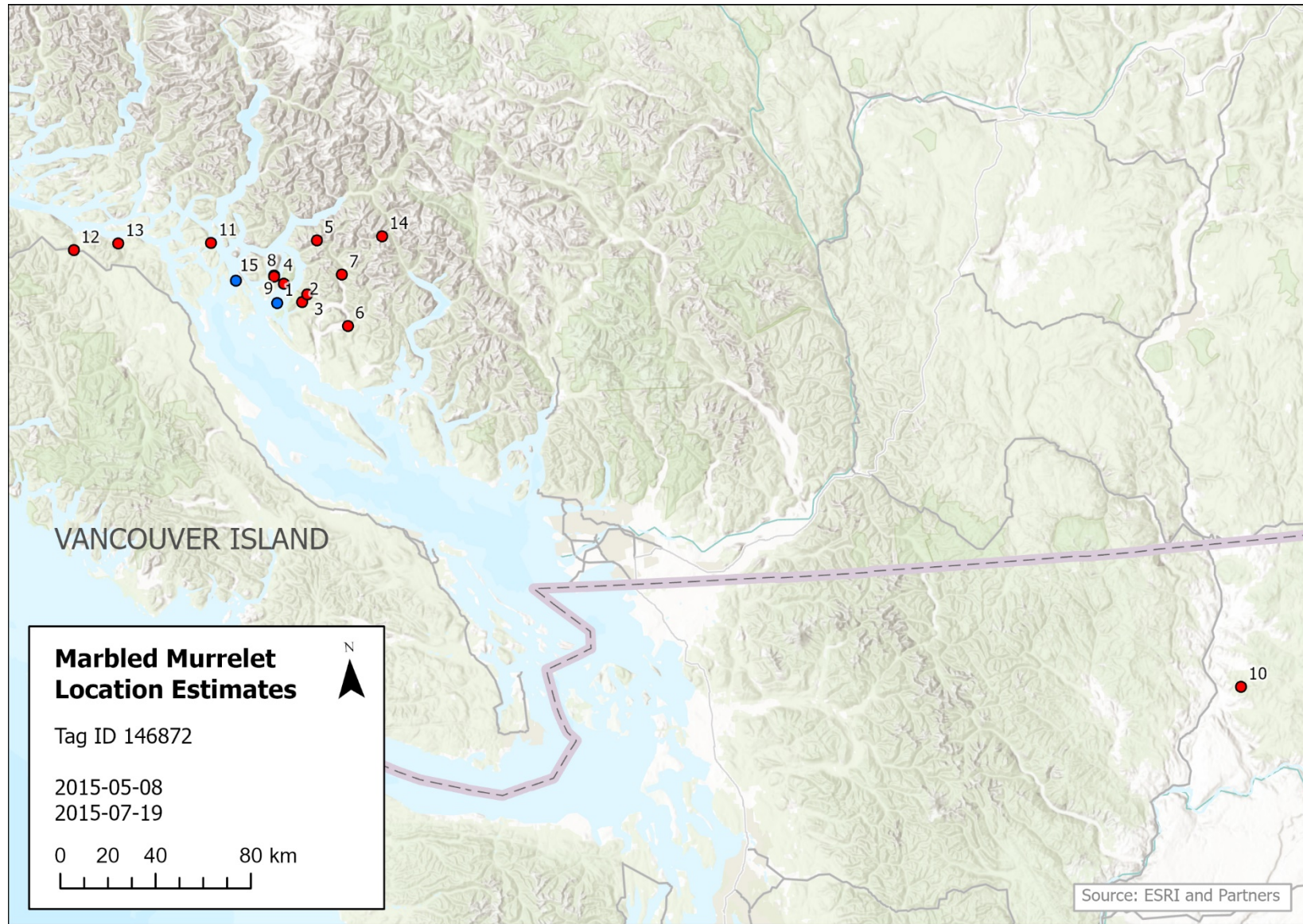


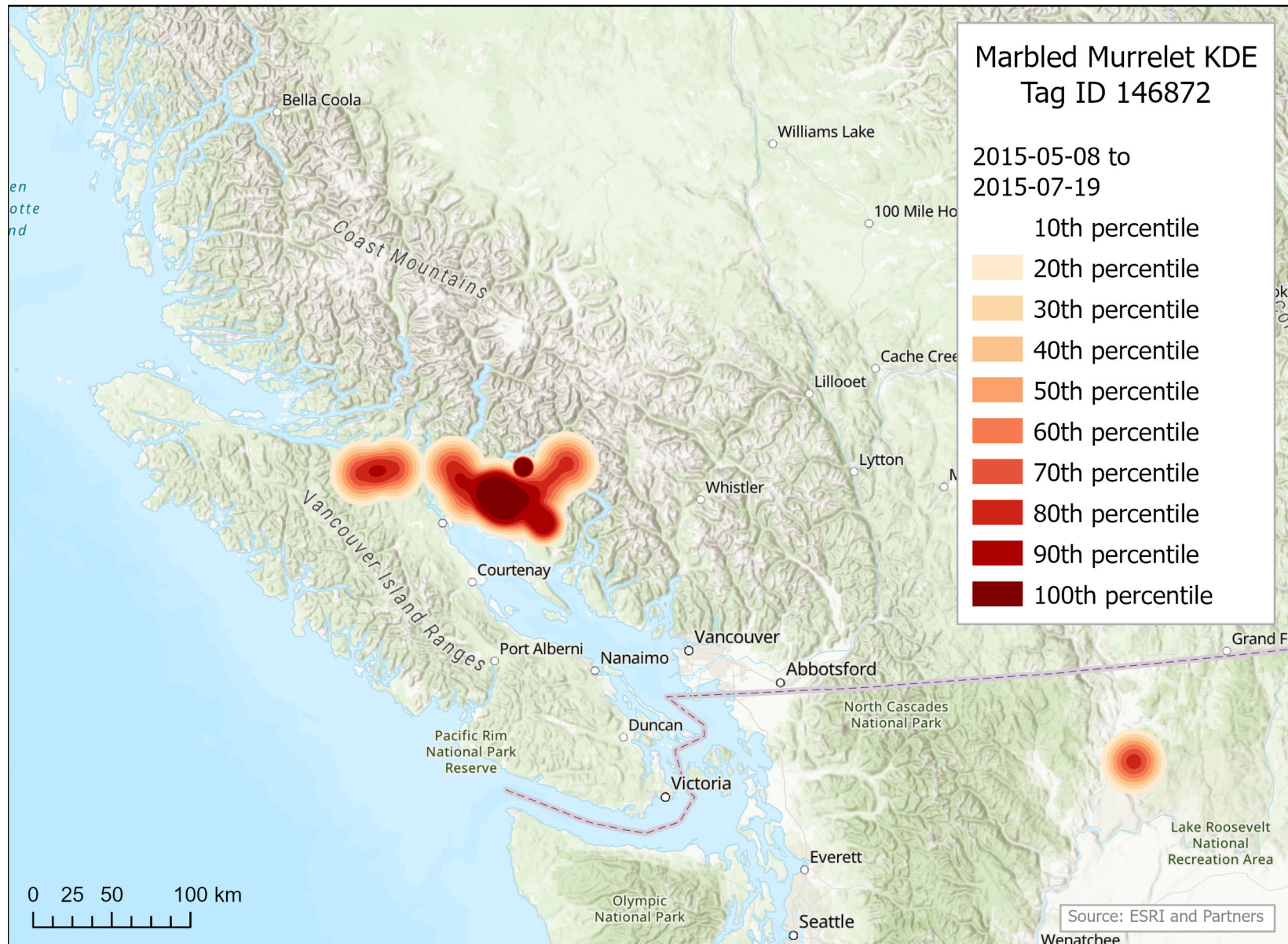
Tag 146871, 2015, Desolation Sound



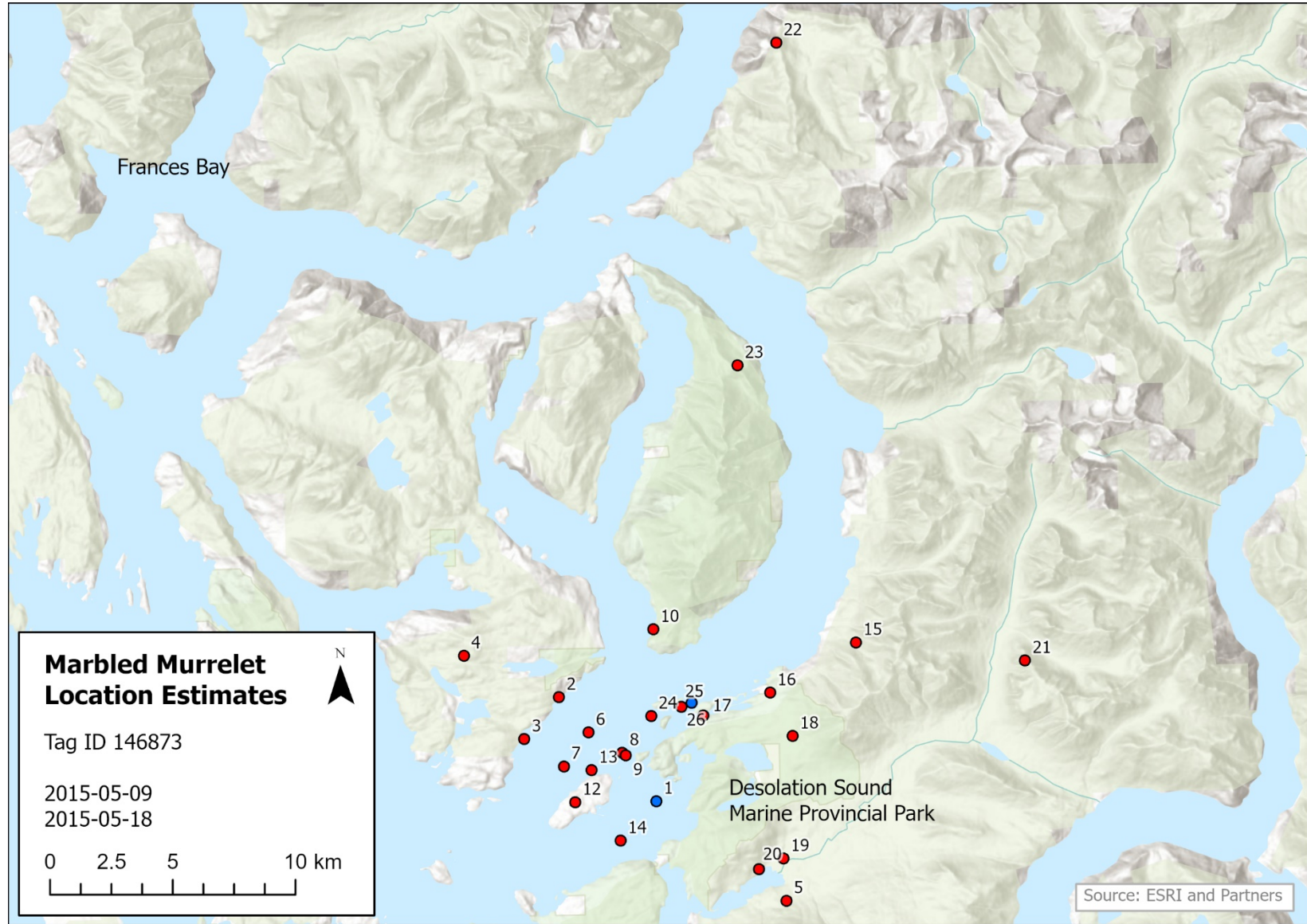


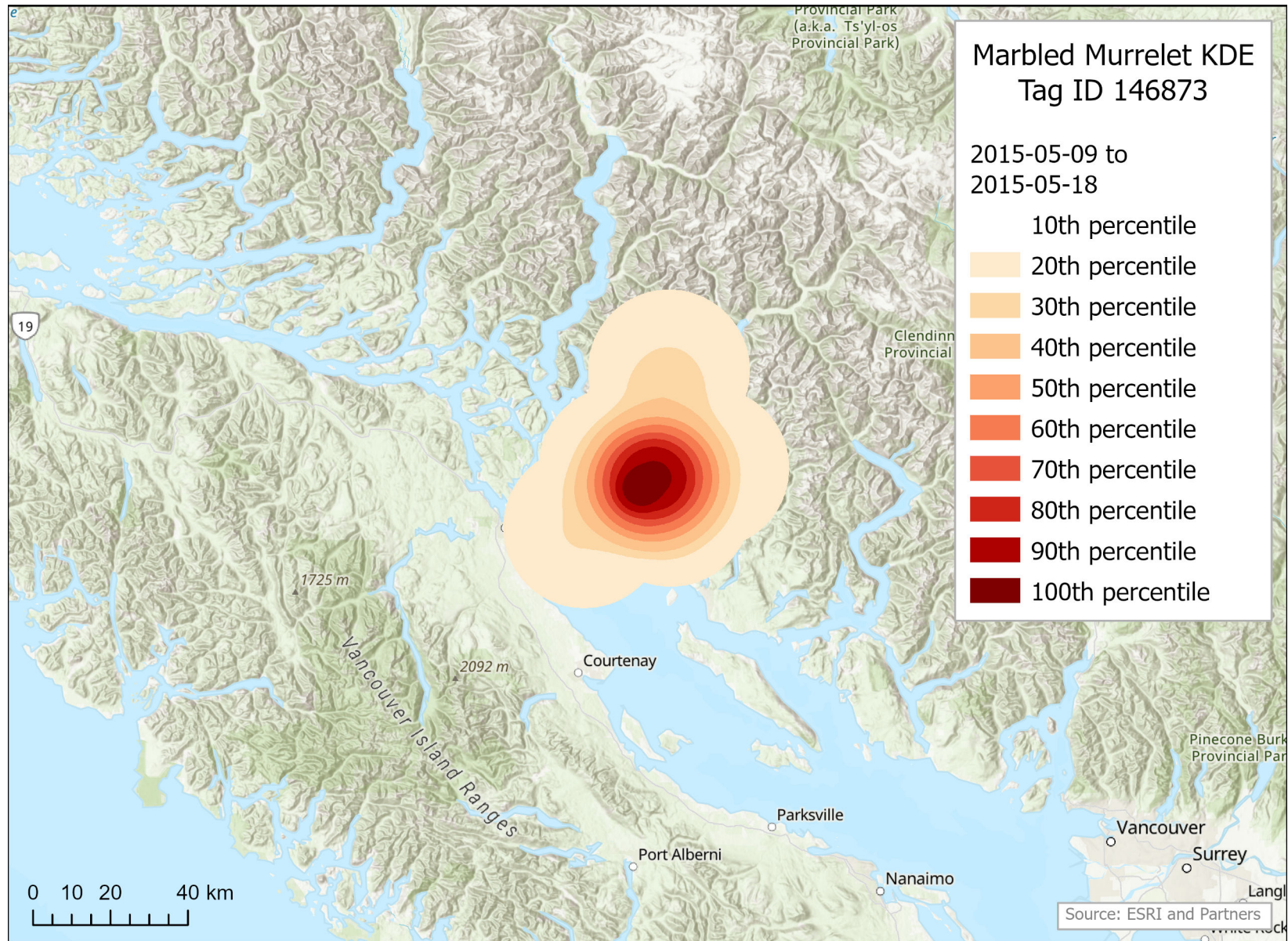
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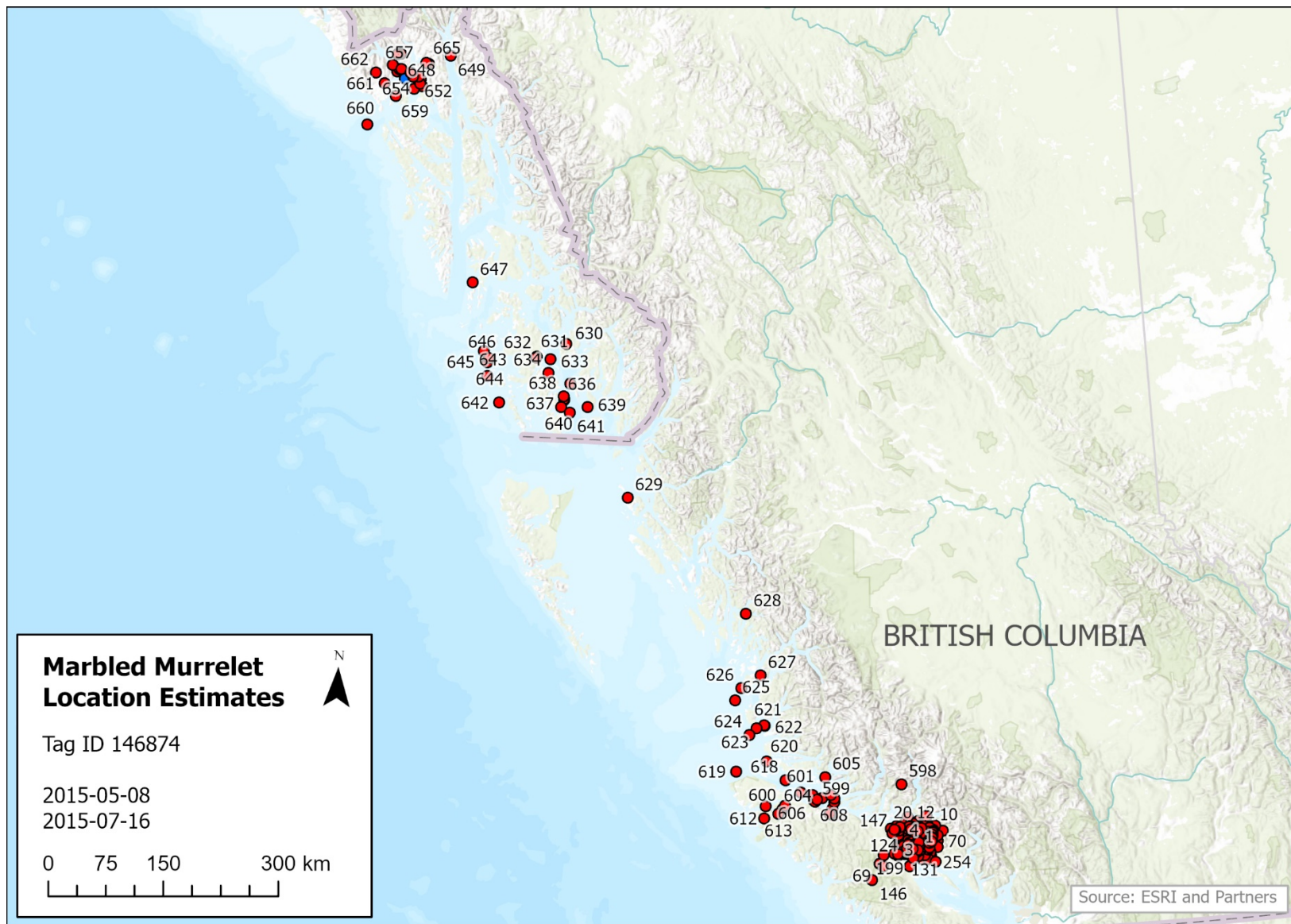


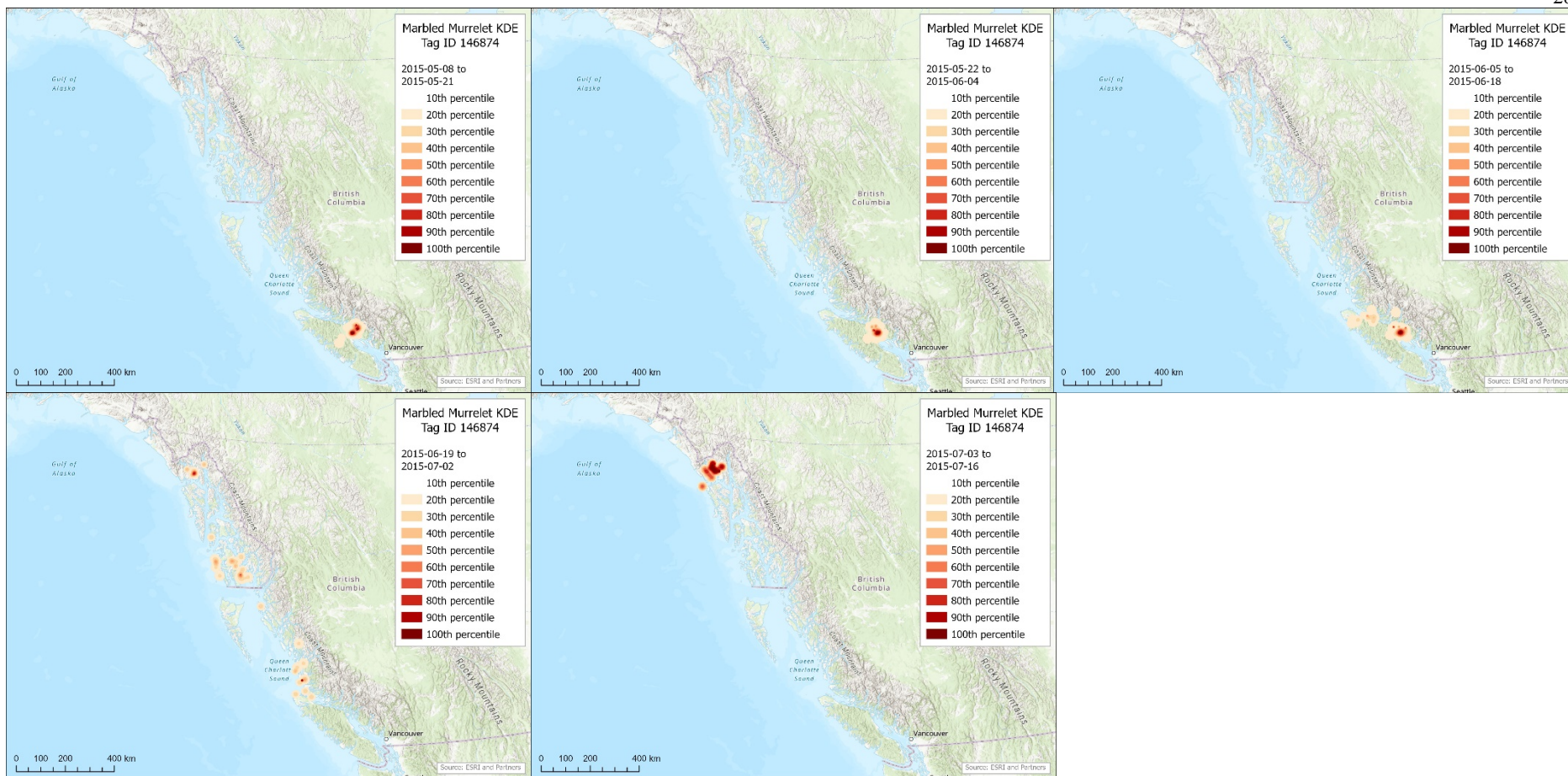
Tag 146873, 2015, Desolation Sound



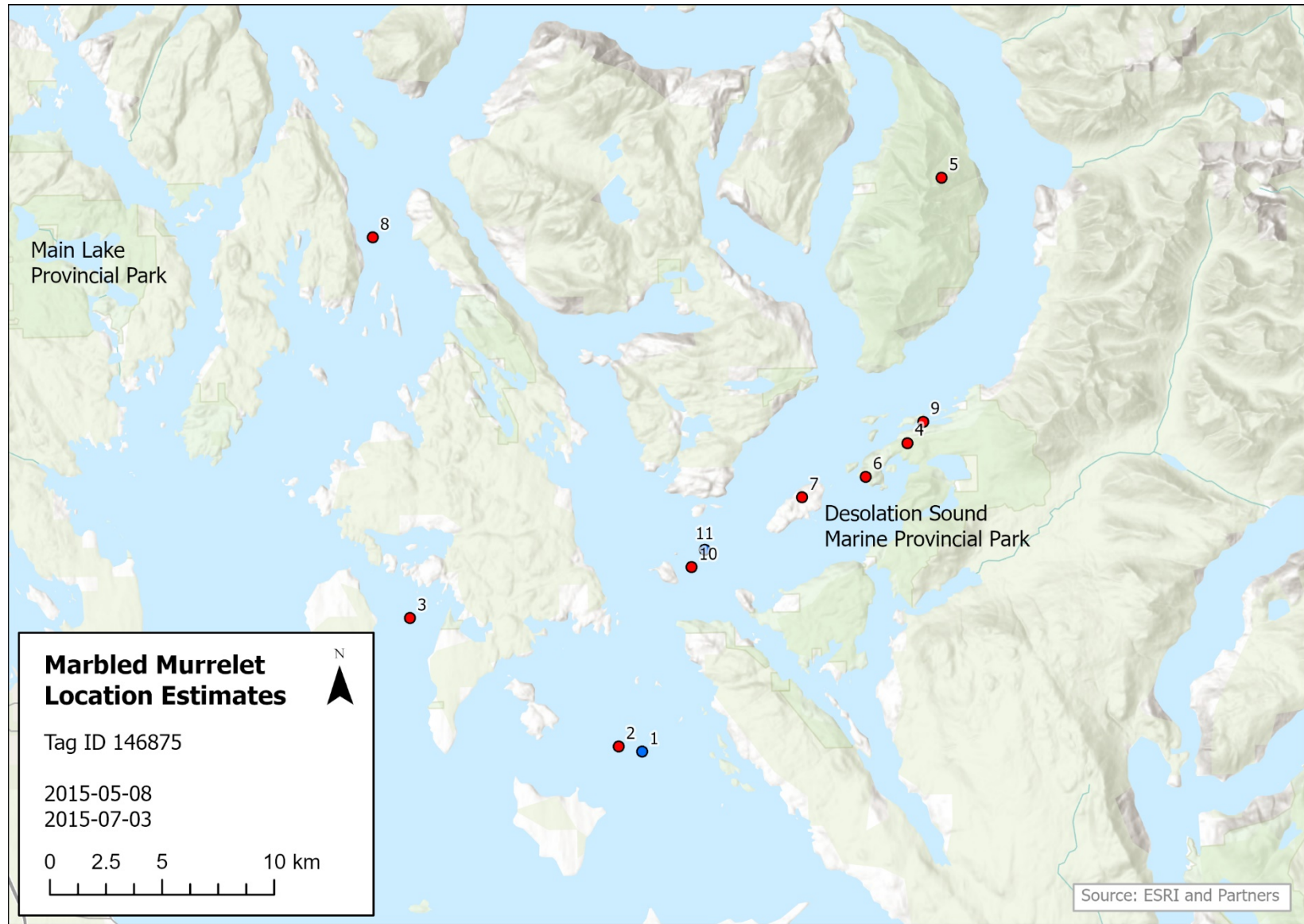


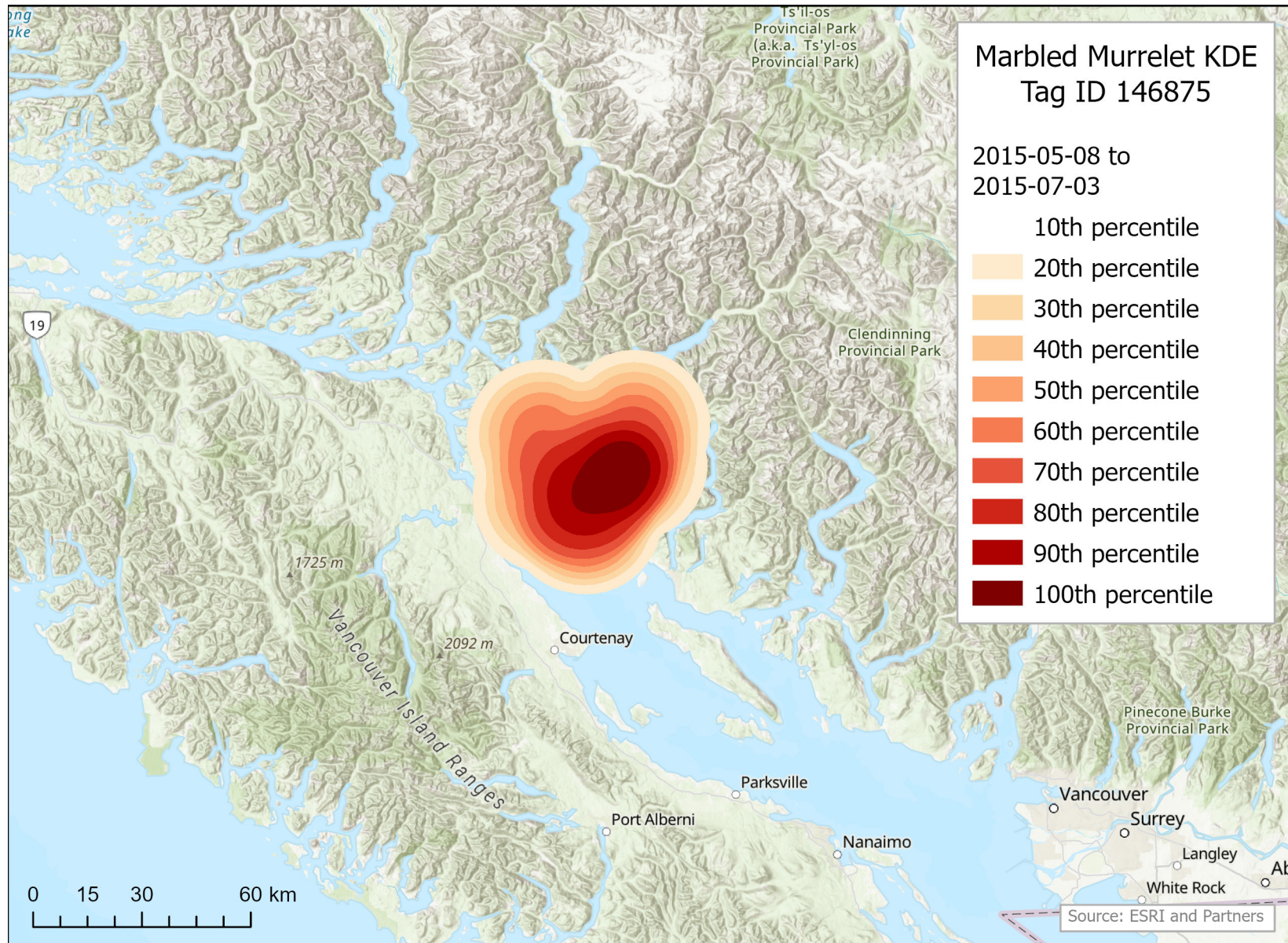
Tag 146874, 2015, Desolation Sound



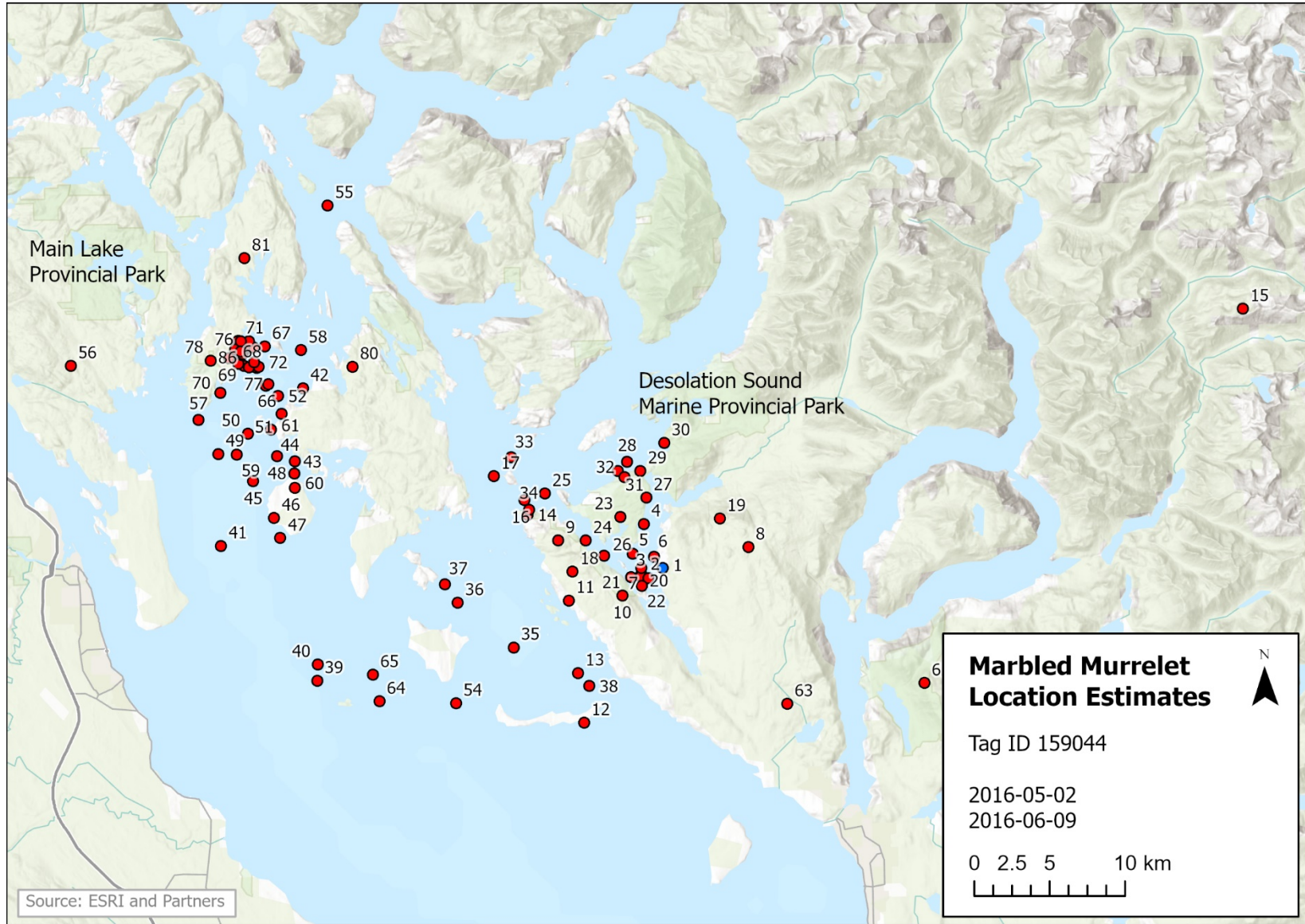


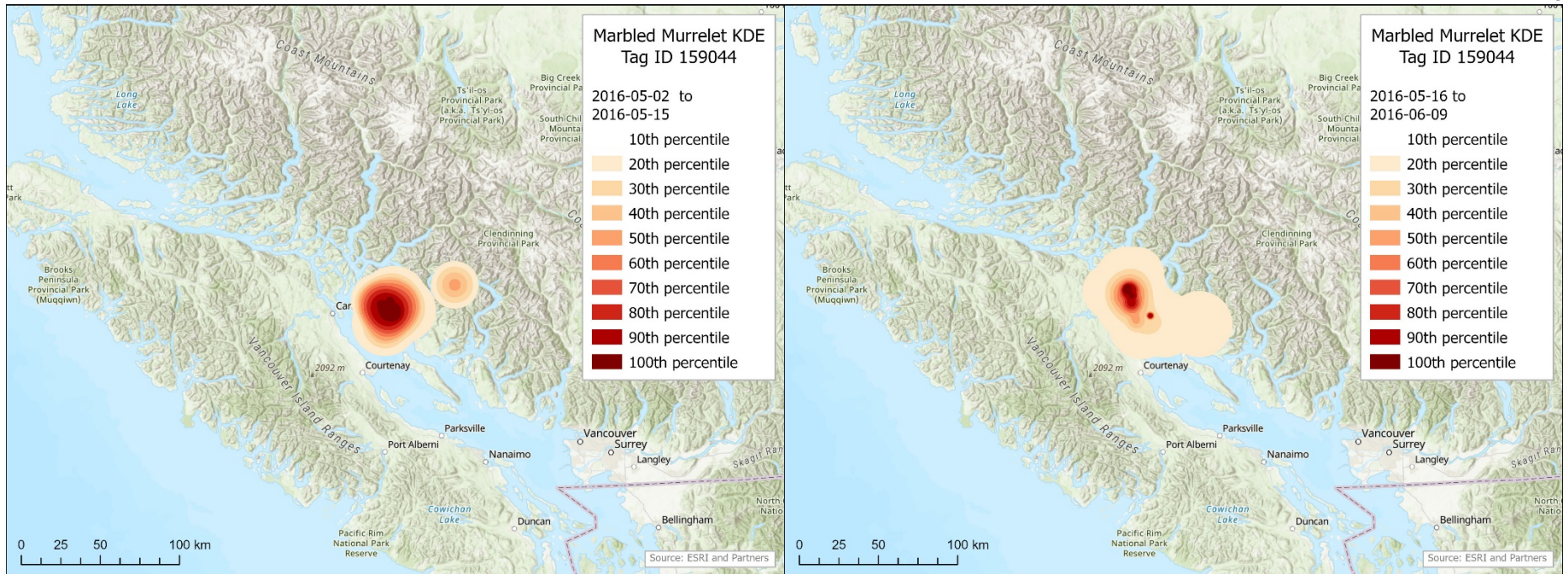
Tag 146875, 2015, Desolation Sound



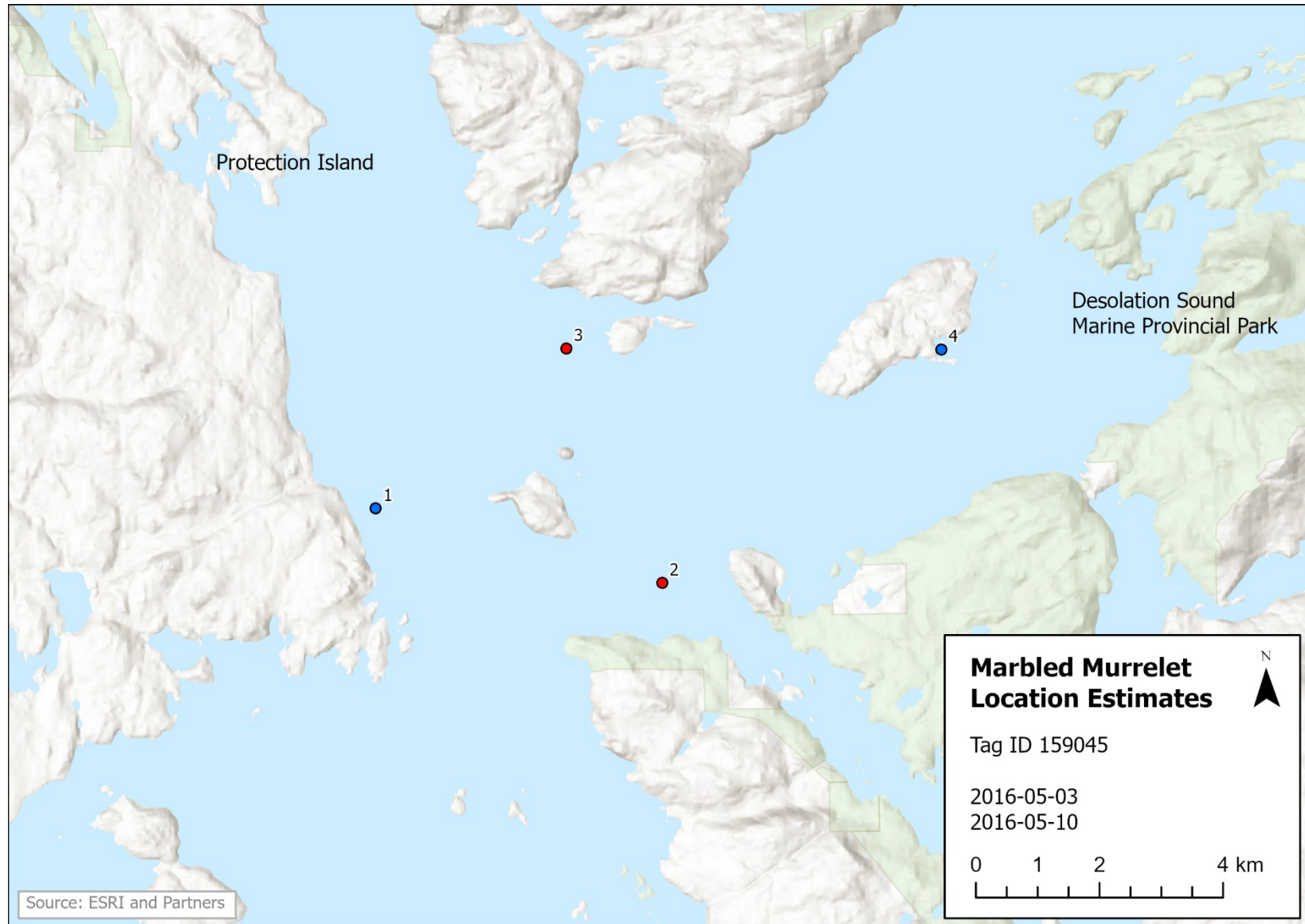


Tag 159044, 2016 Desolation Sound

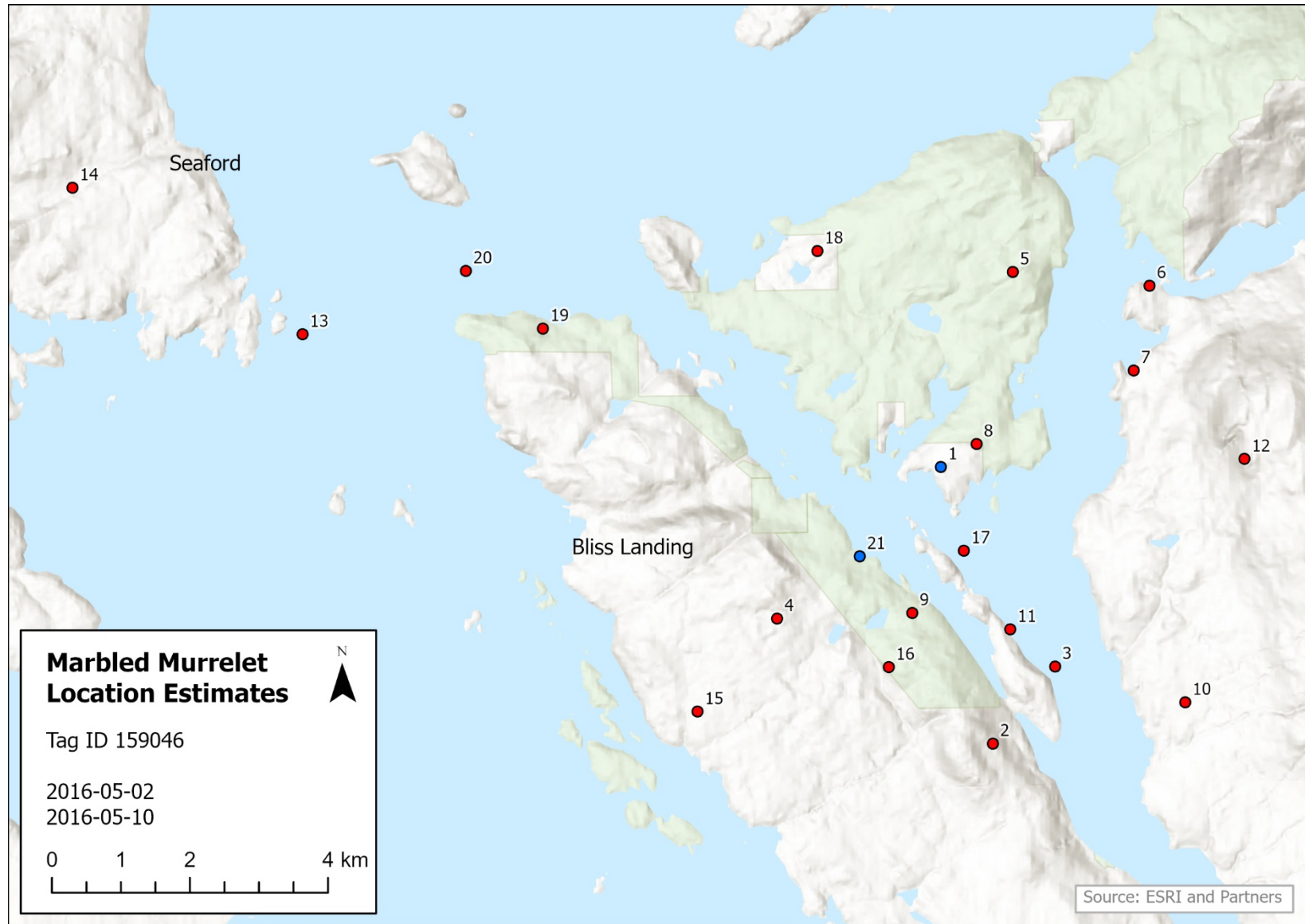


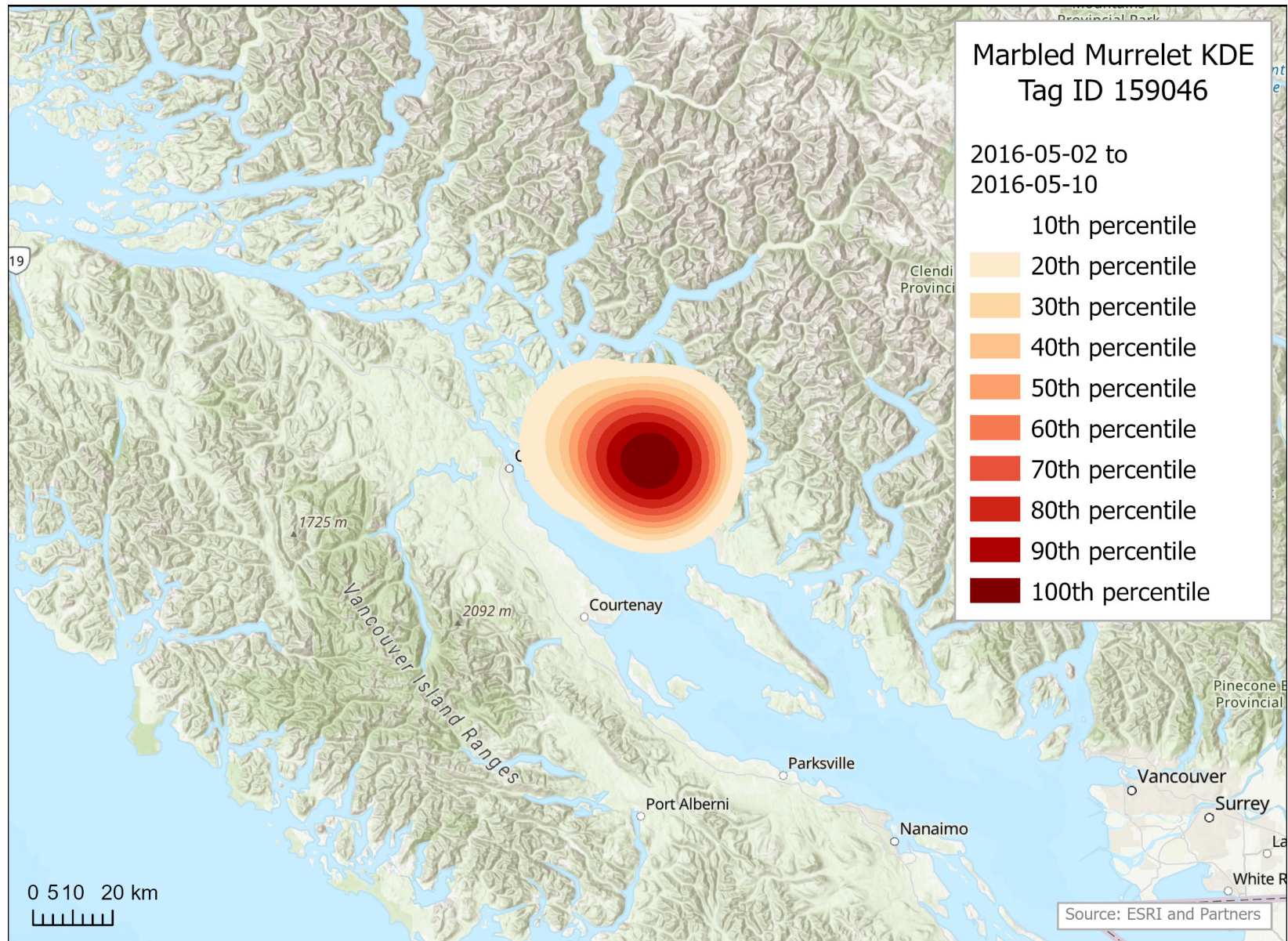


Tag 159045, 2016 Desolation Sound

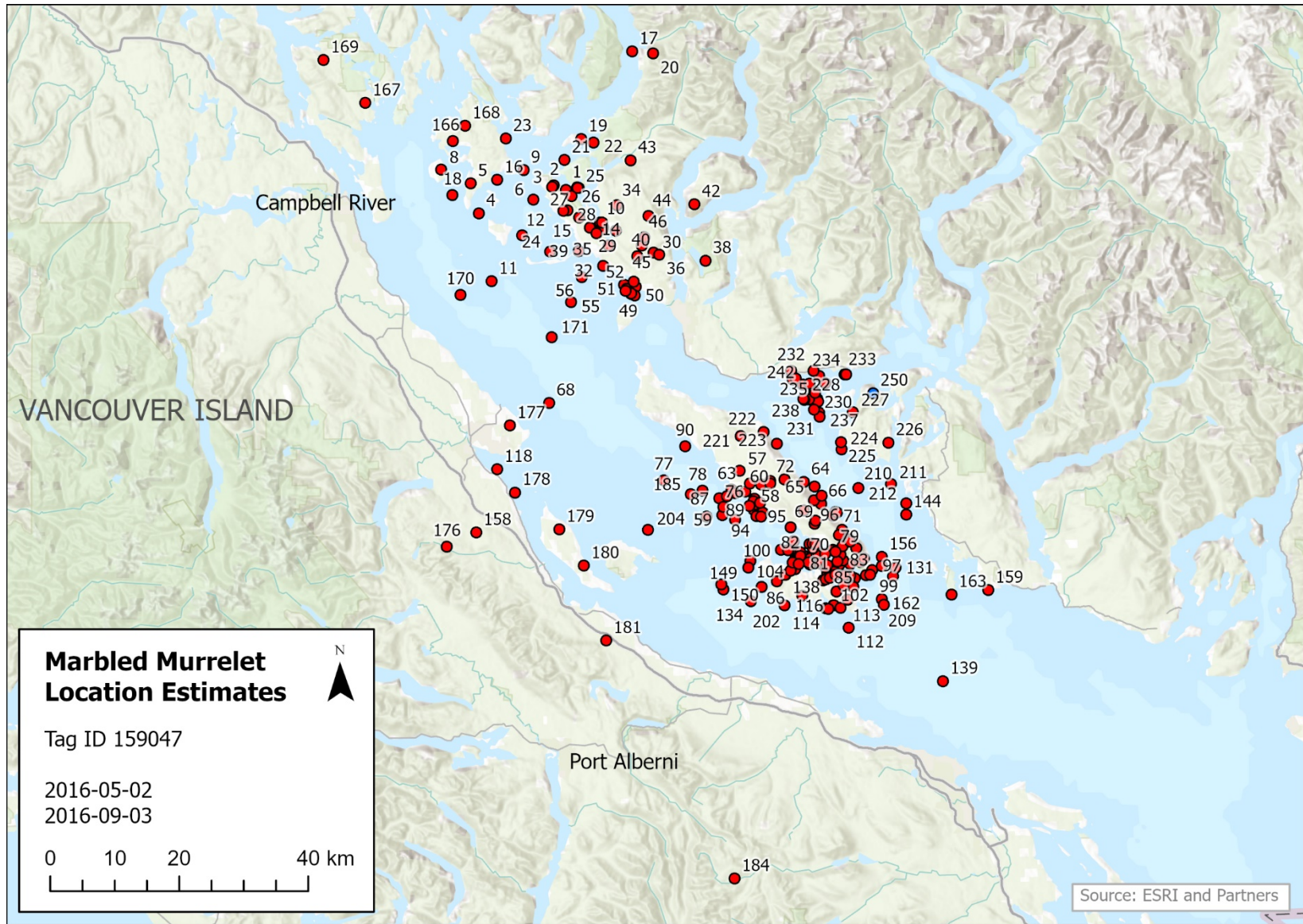


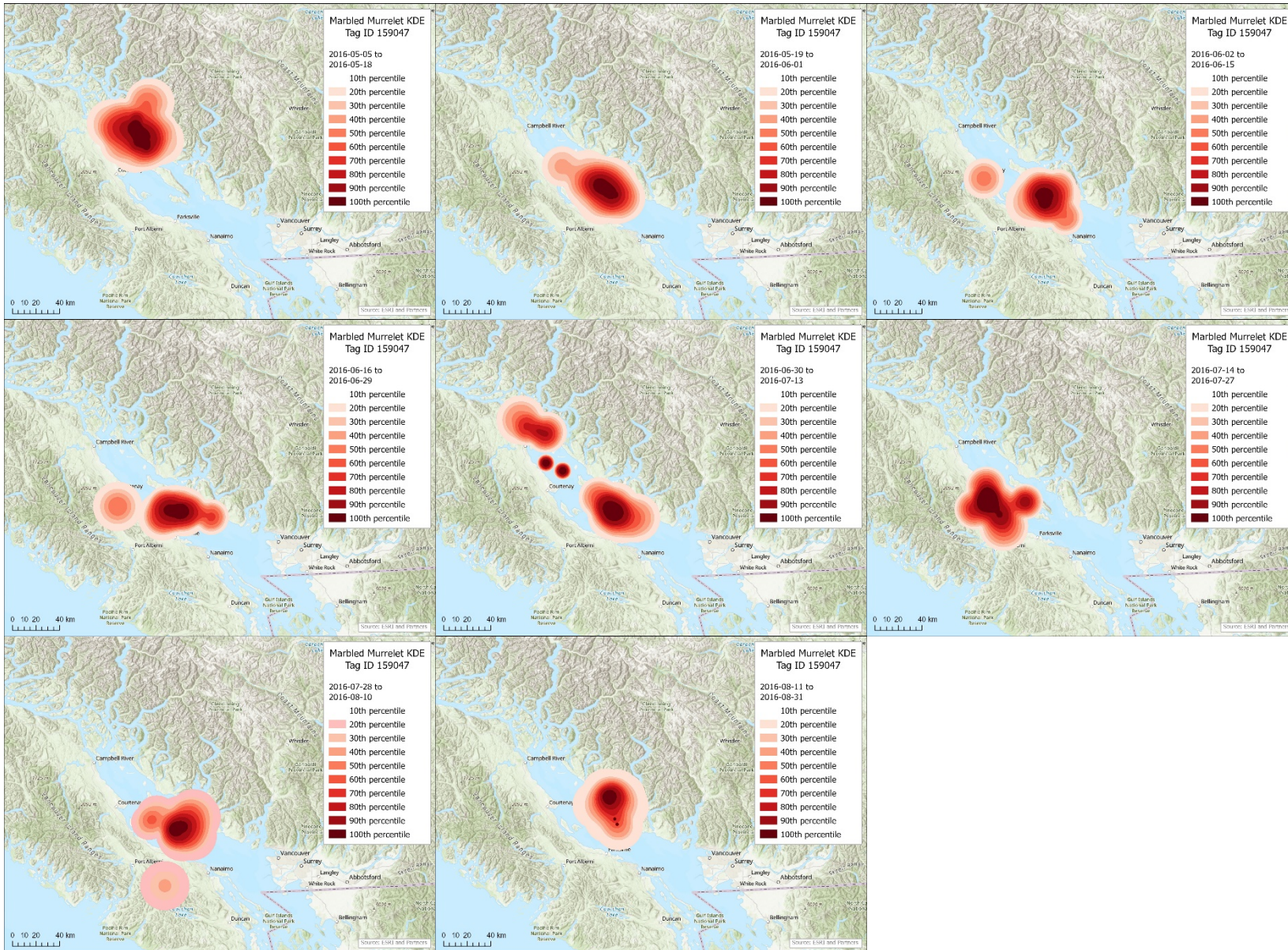
Tag 159046, 2016 Desolation Sound



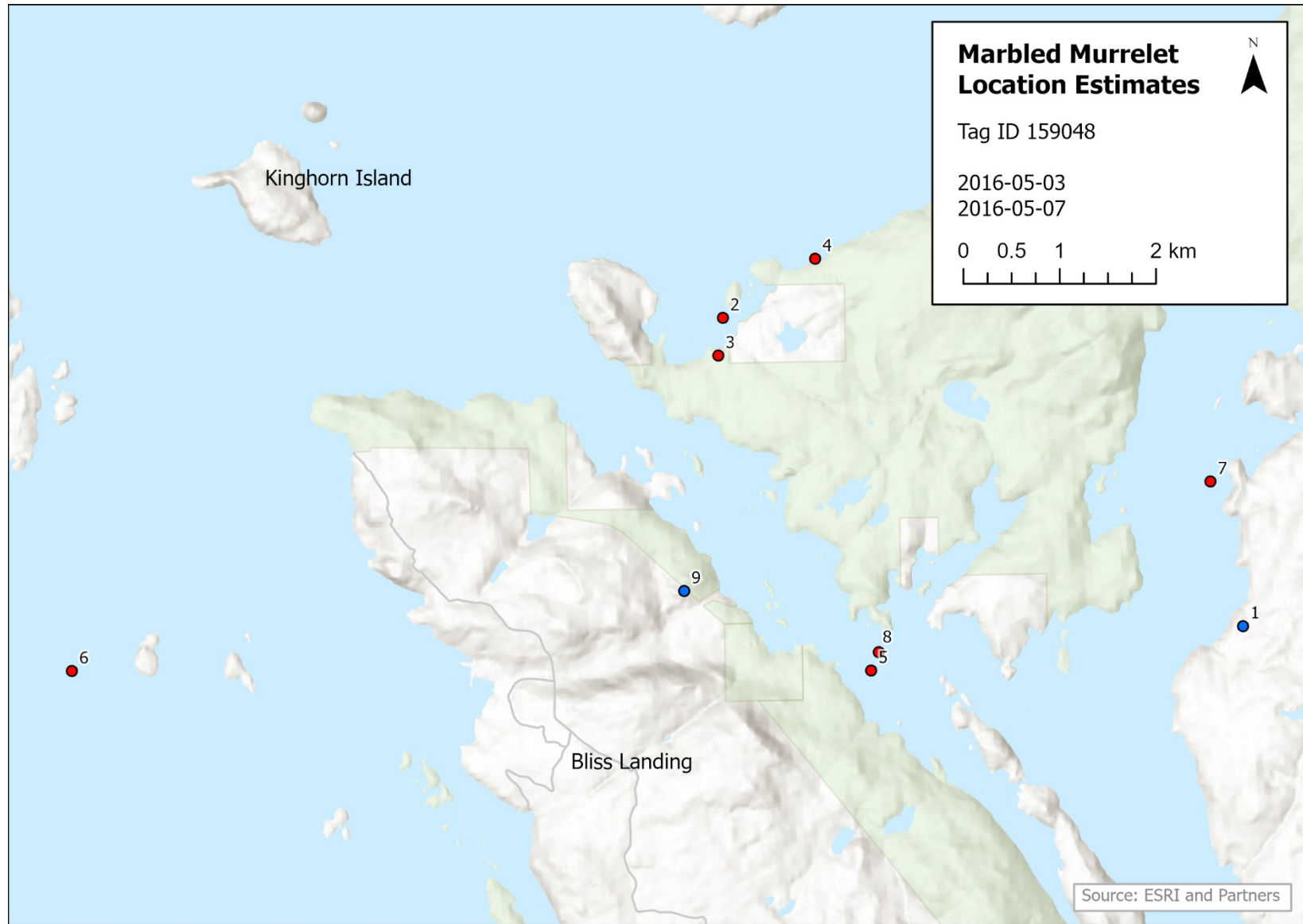


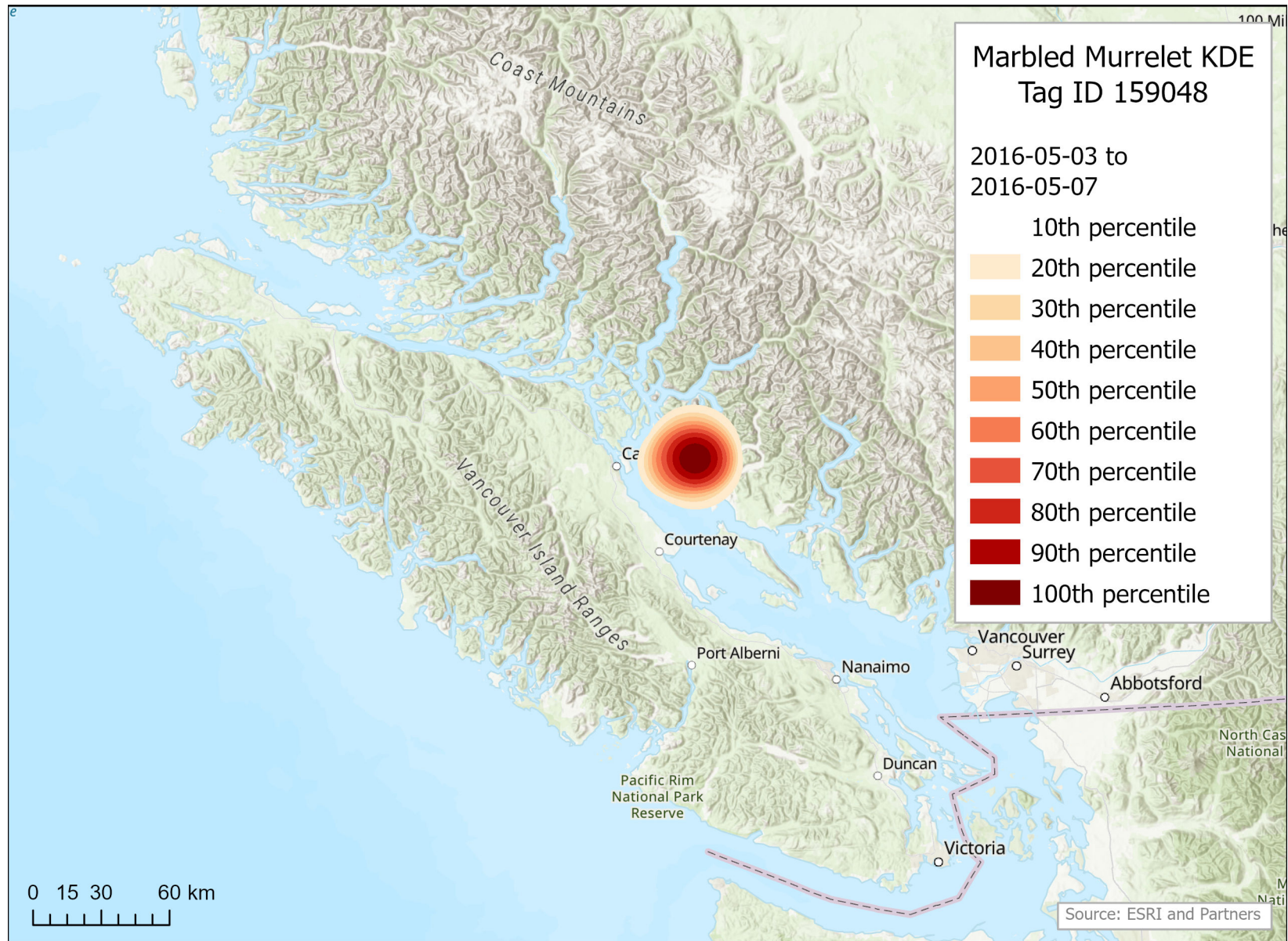
Tag 159047, 2016 Desolation Sound



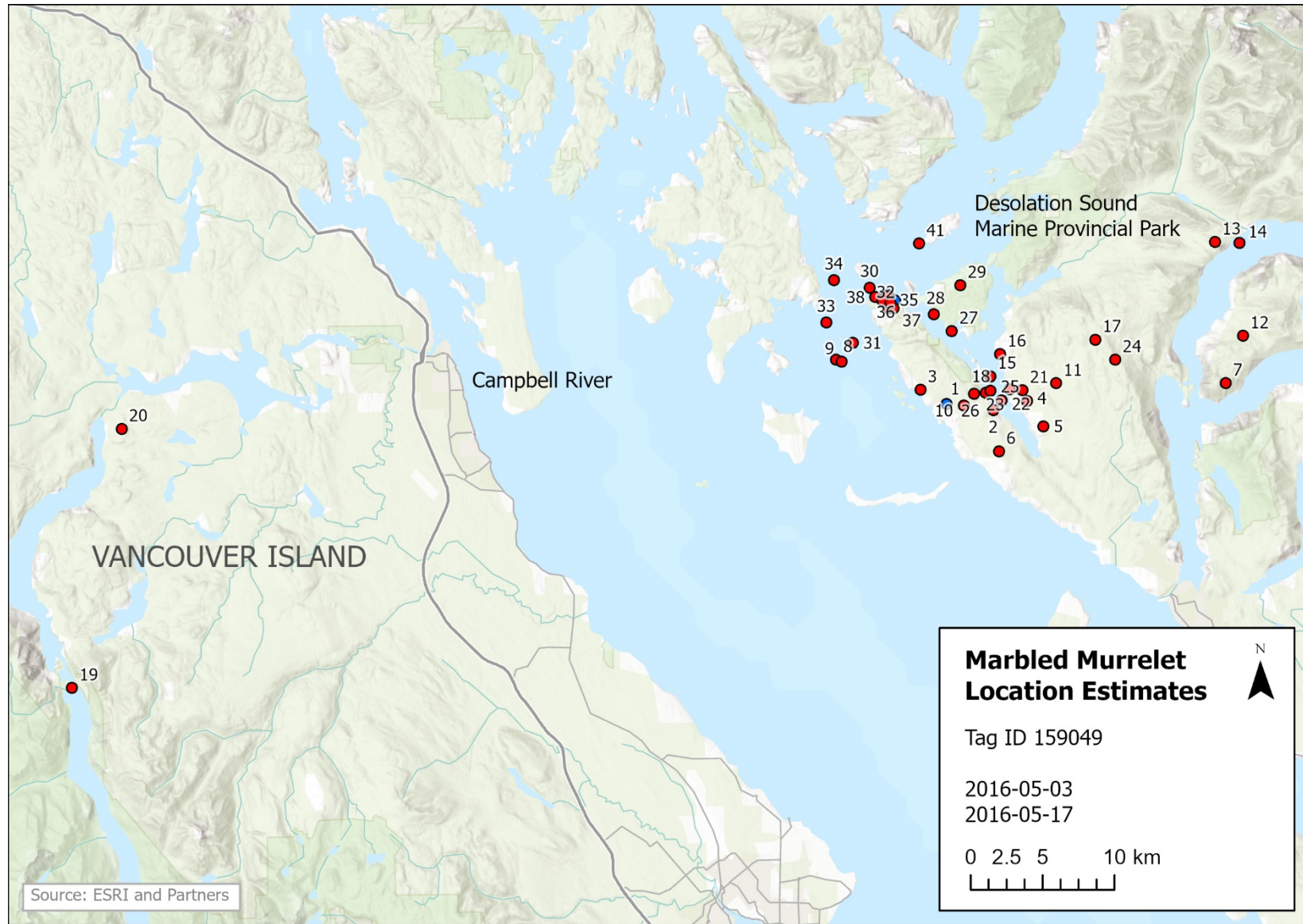


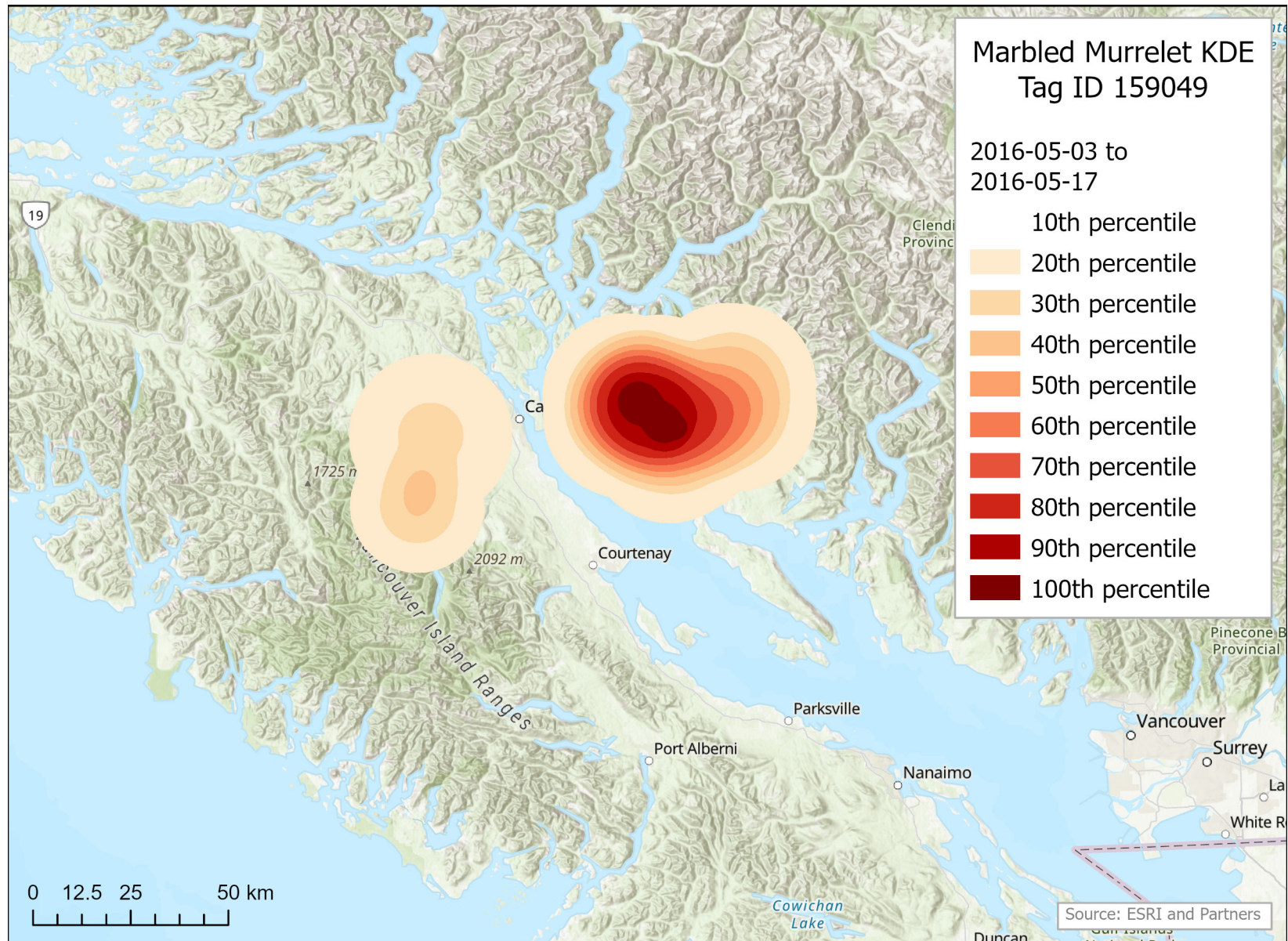
Tag 159048, 2016 Desolation Sound



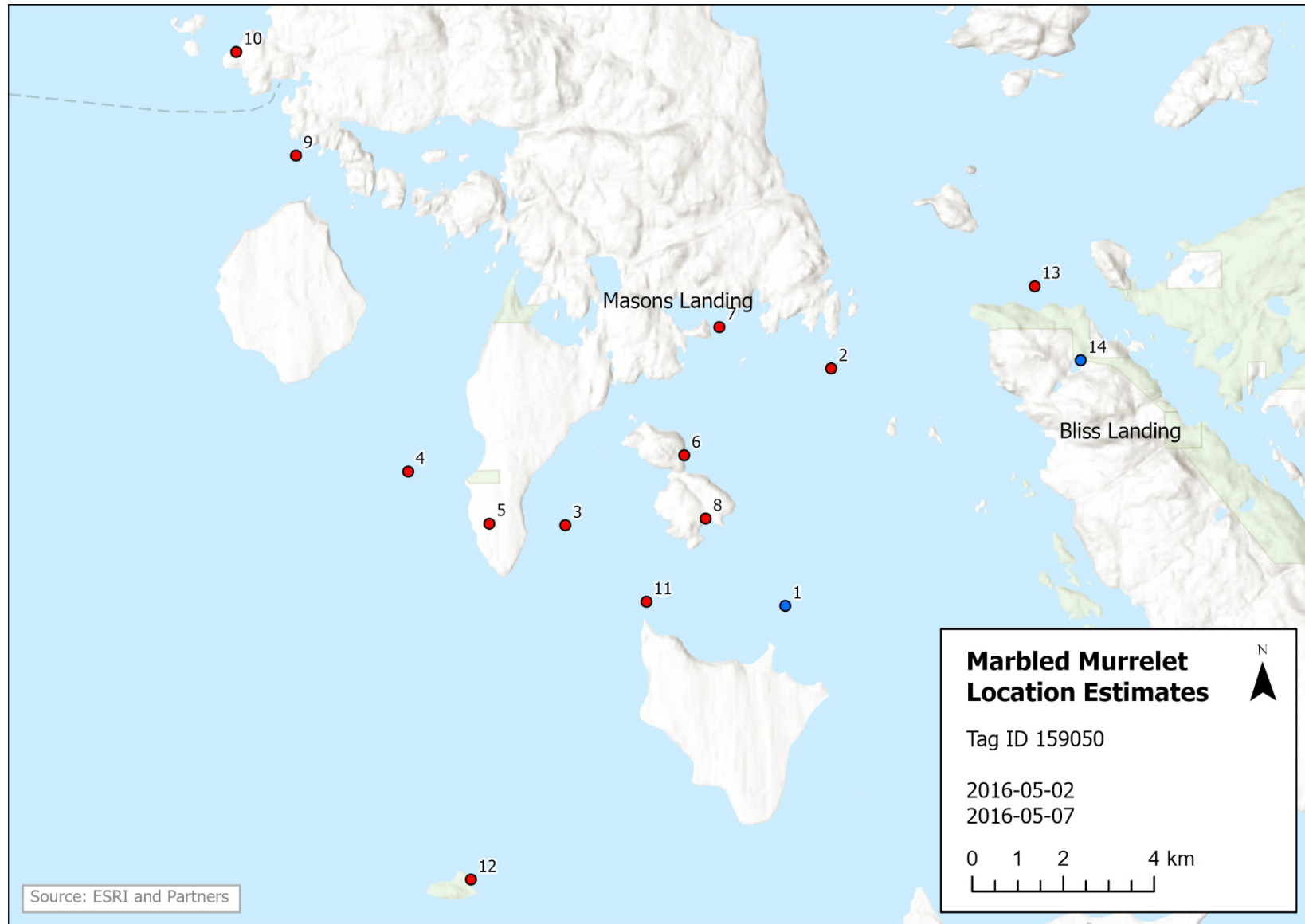


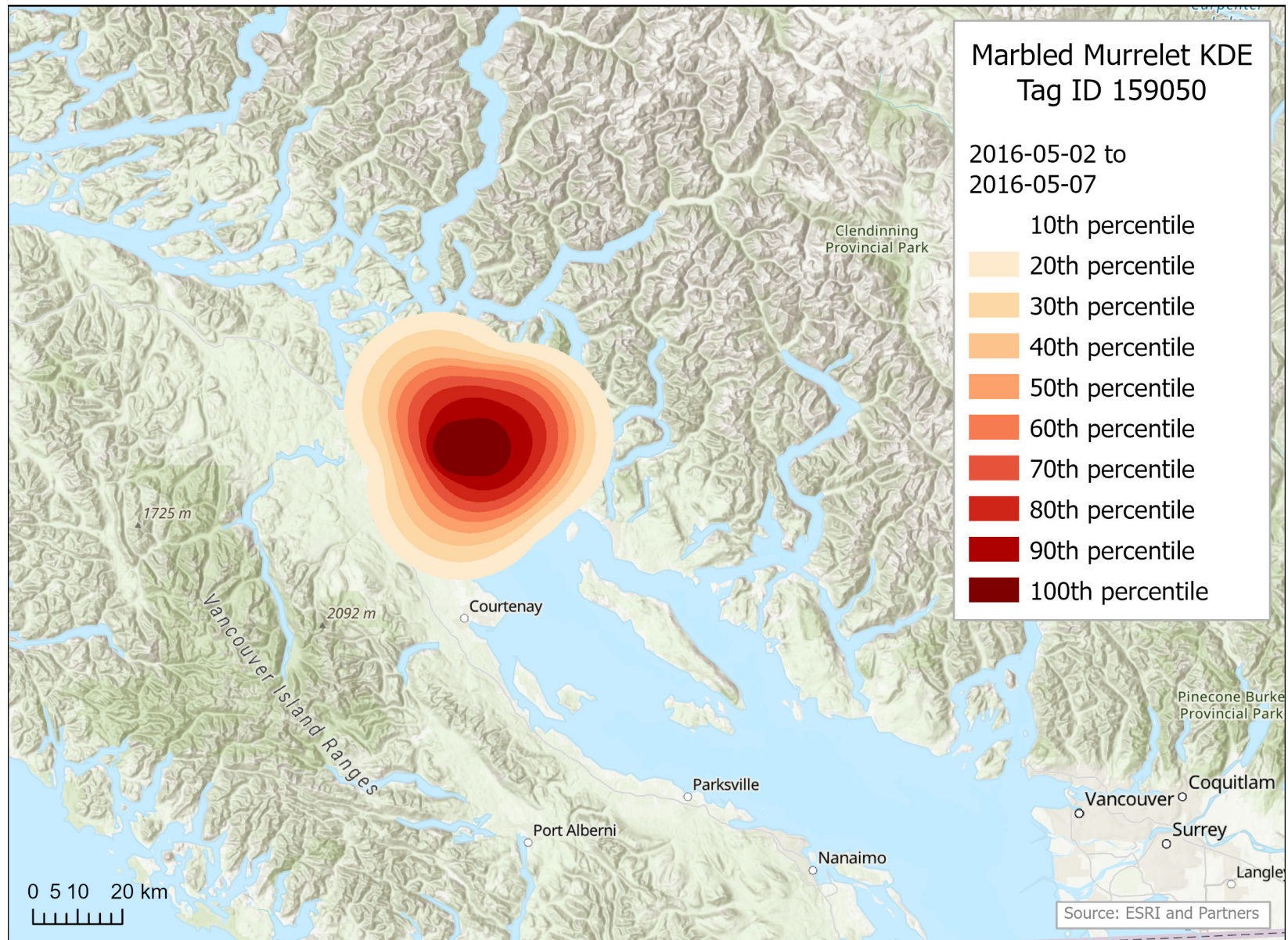
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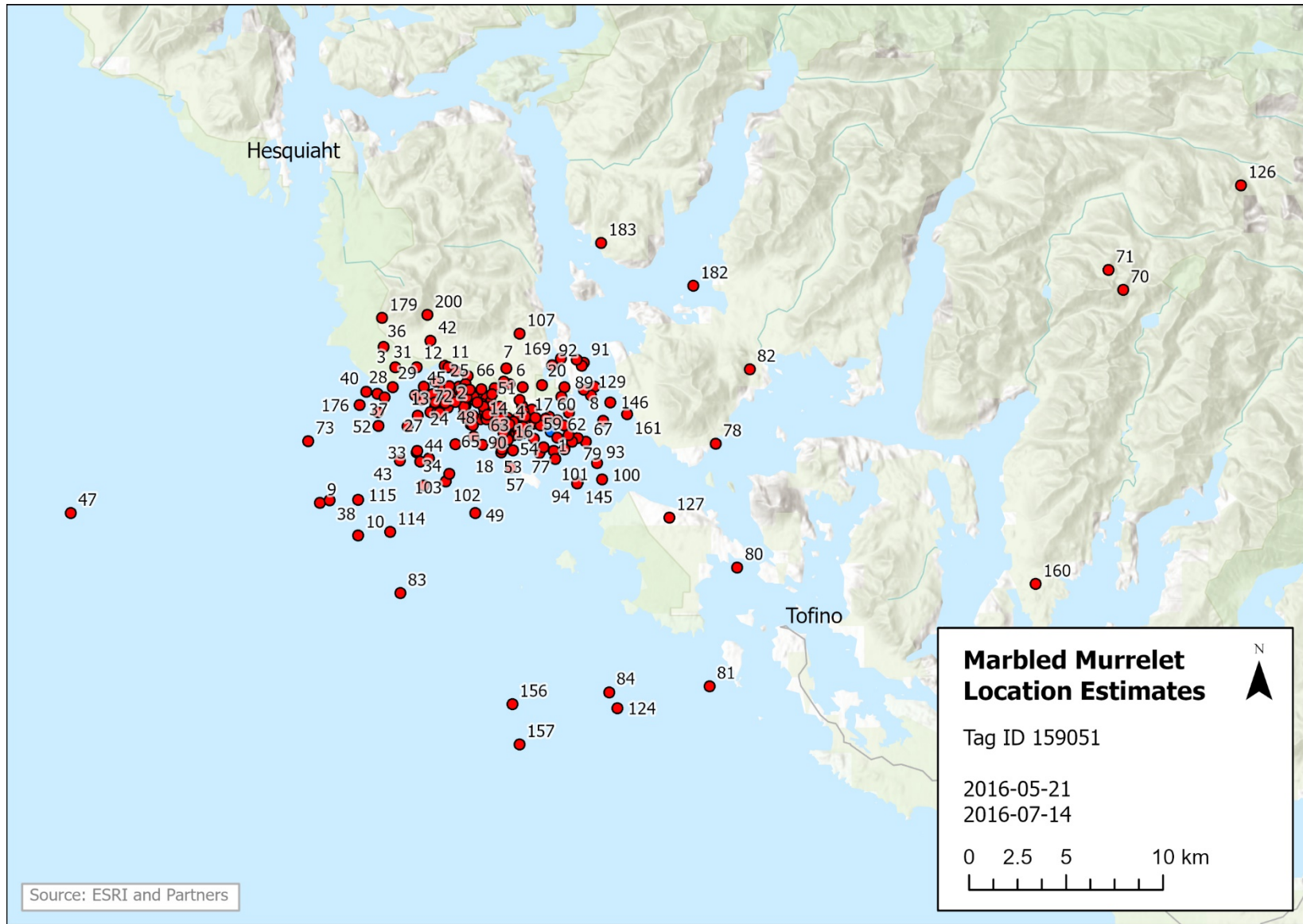


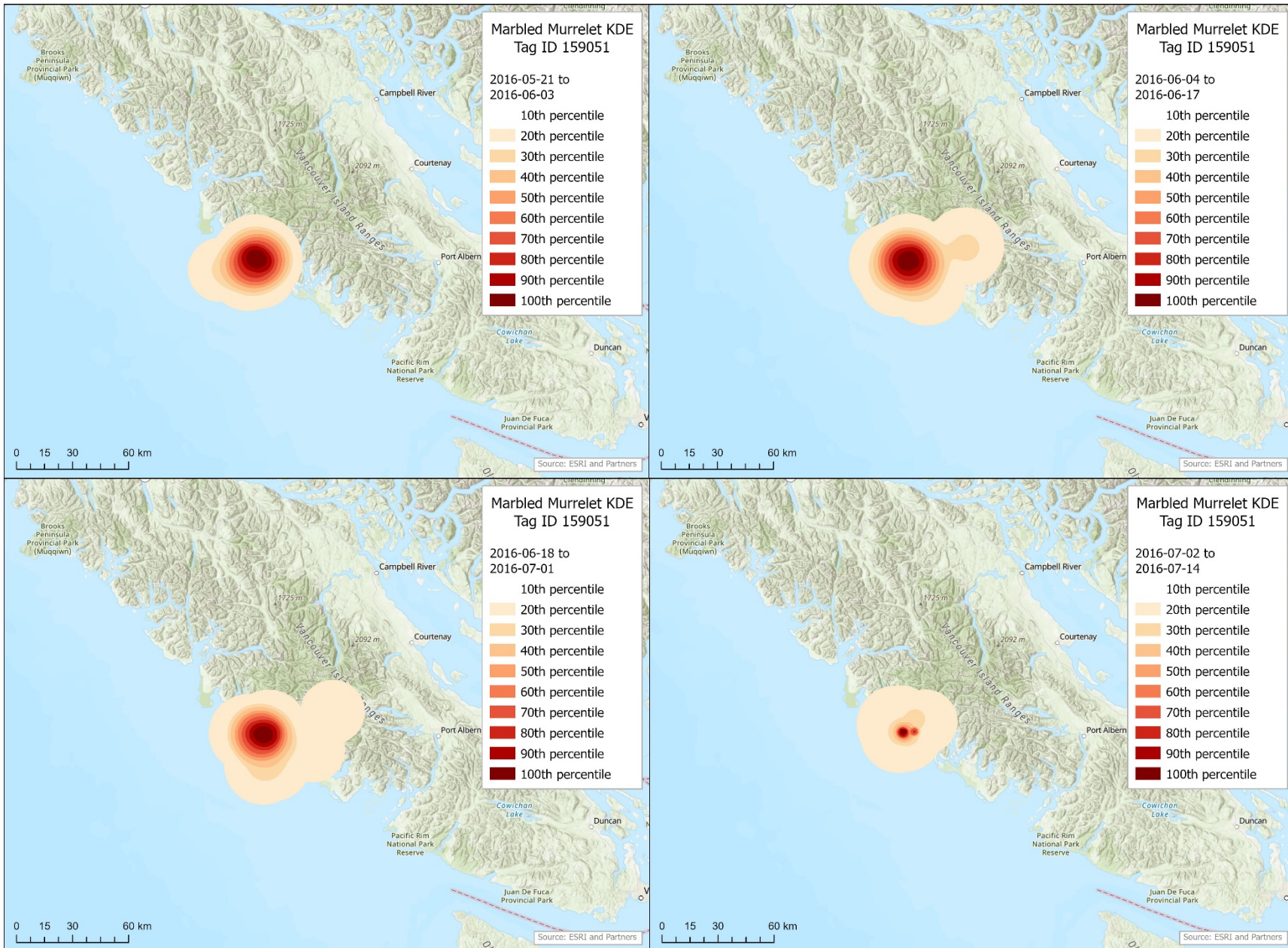
Tag 159050, 2016 Desolation Sound



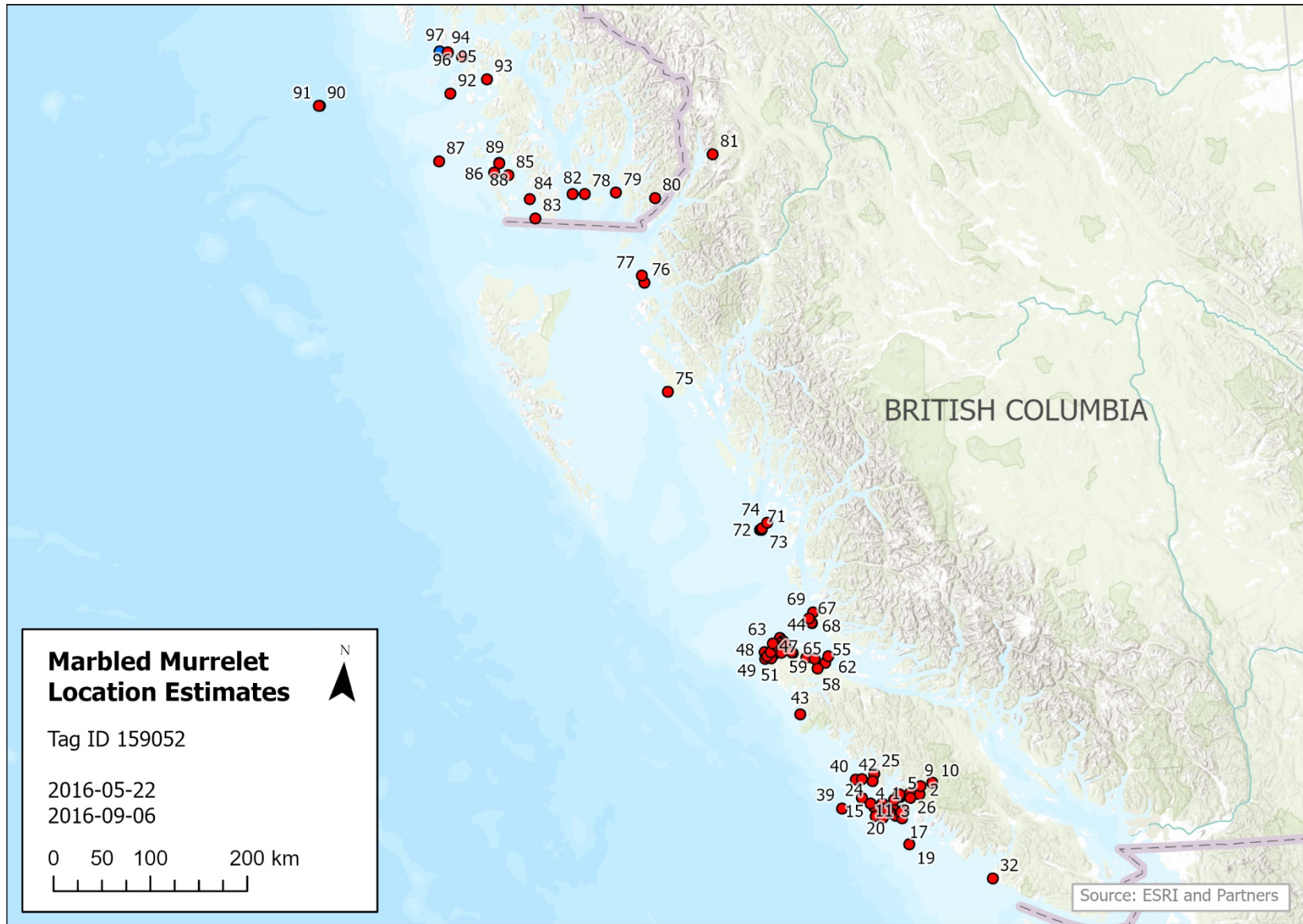


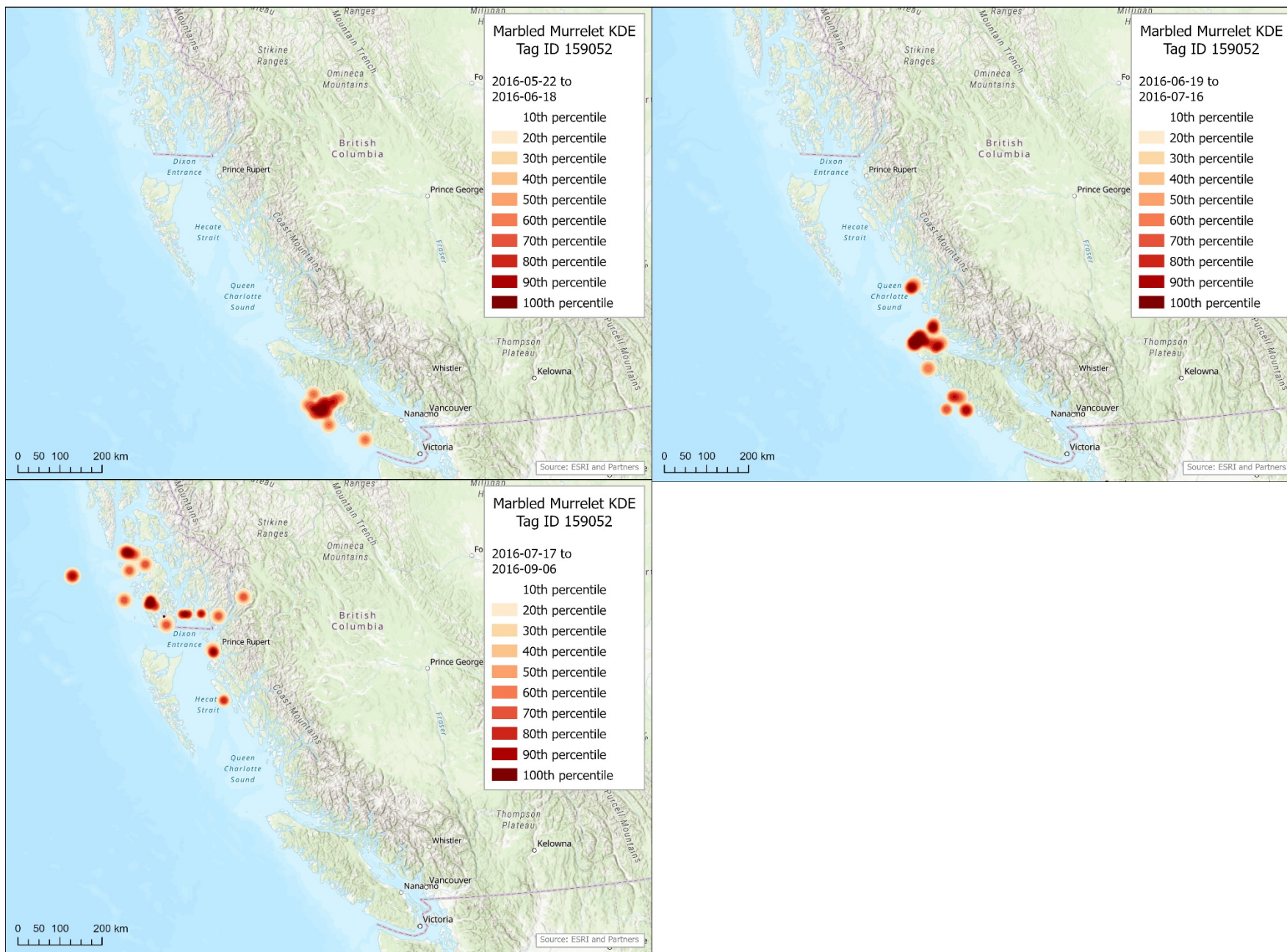
Tag 159051, 2016 Clayoquot Sound



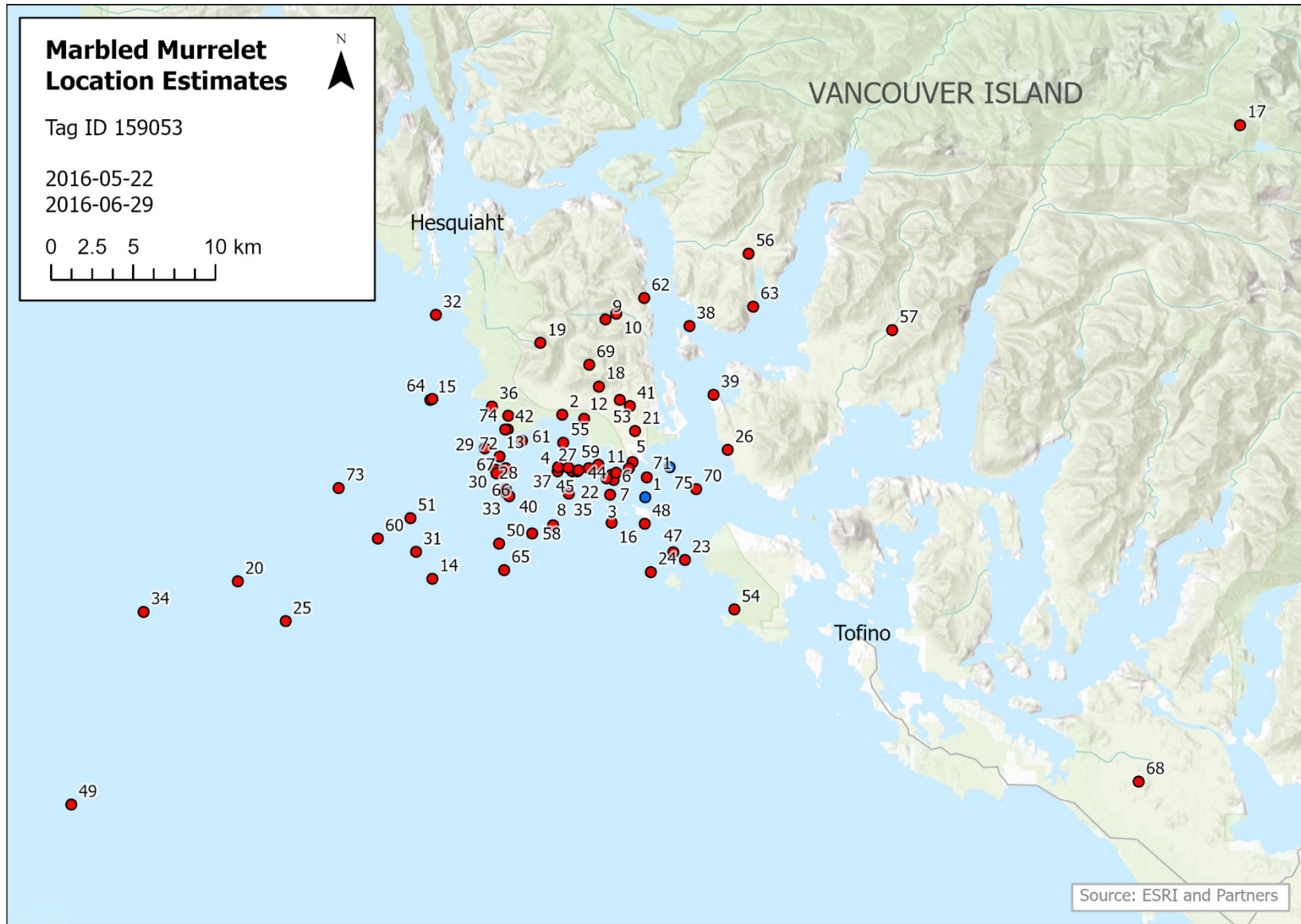


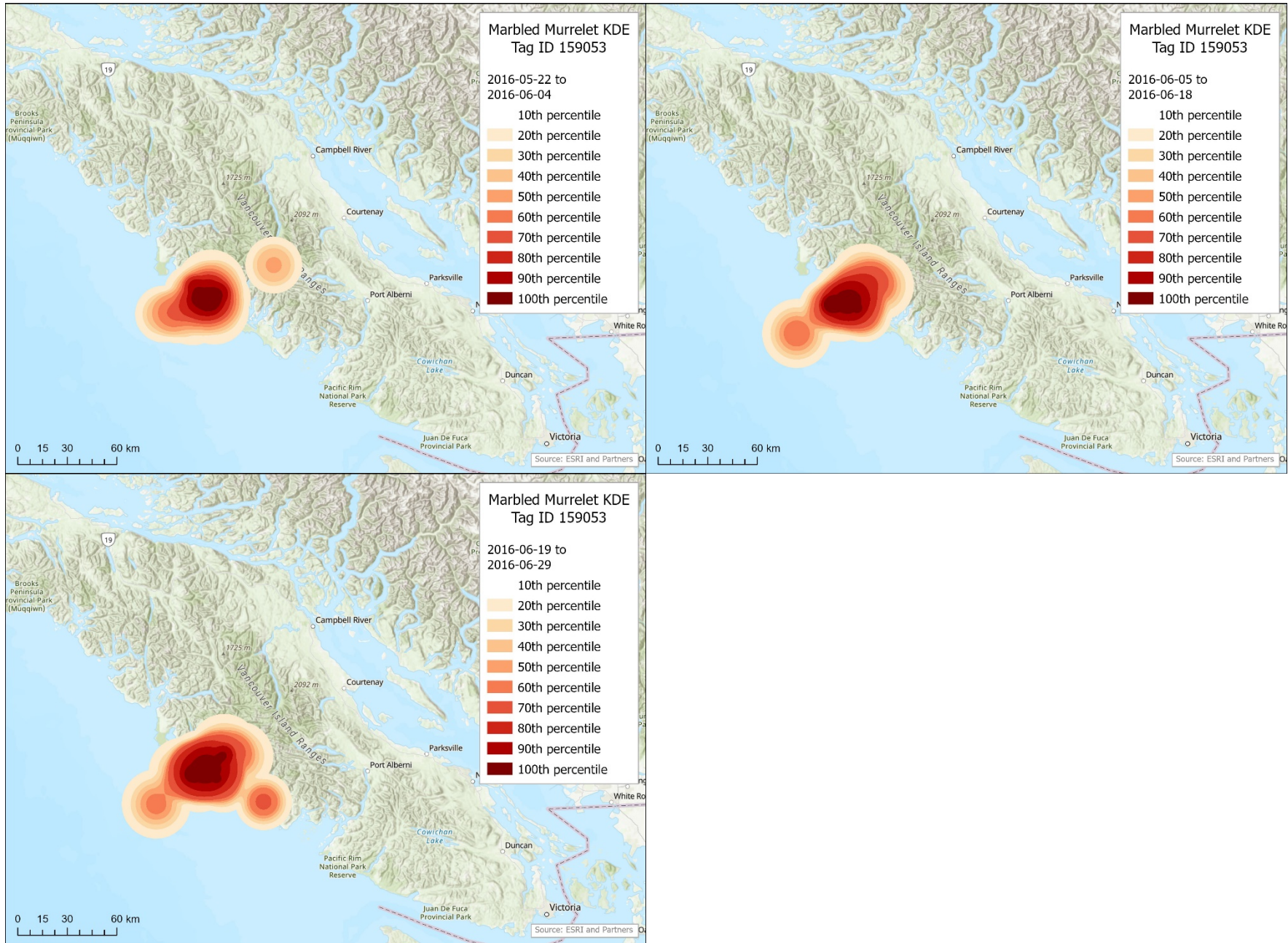
Tag 159052, 2016 Clayoquot Sound



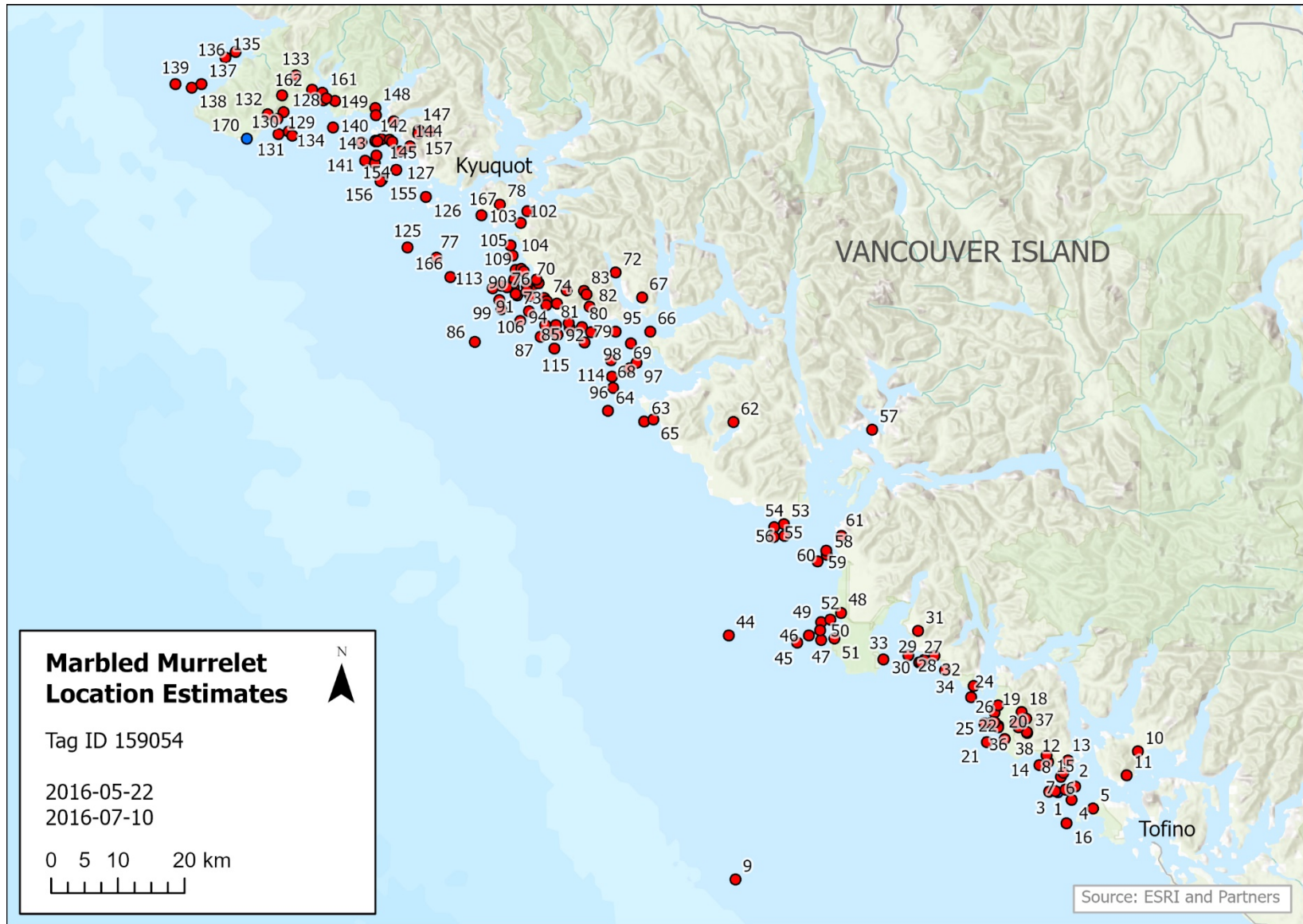


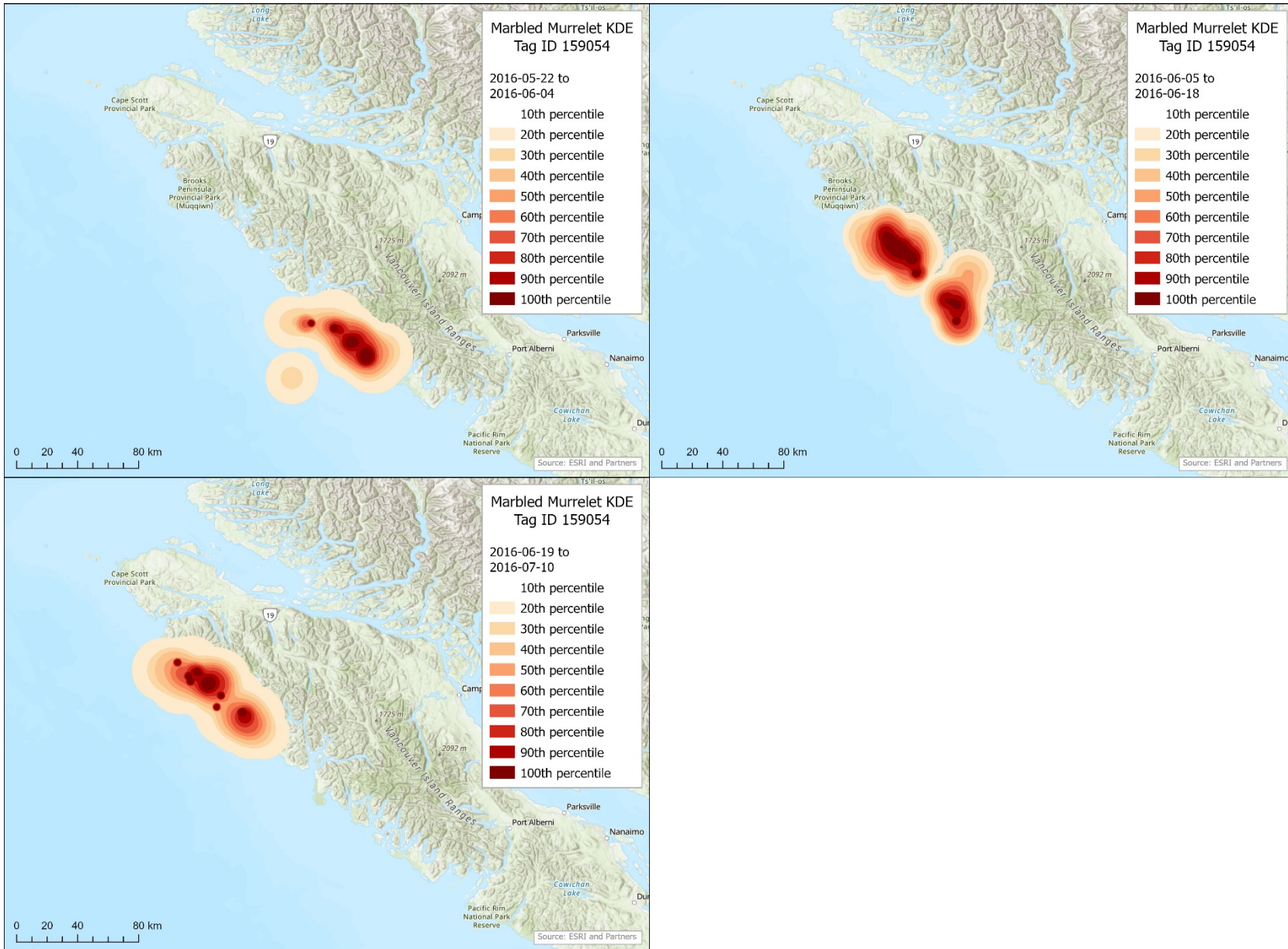
Tag 159053, 2016 Clayoquot Sound



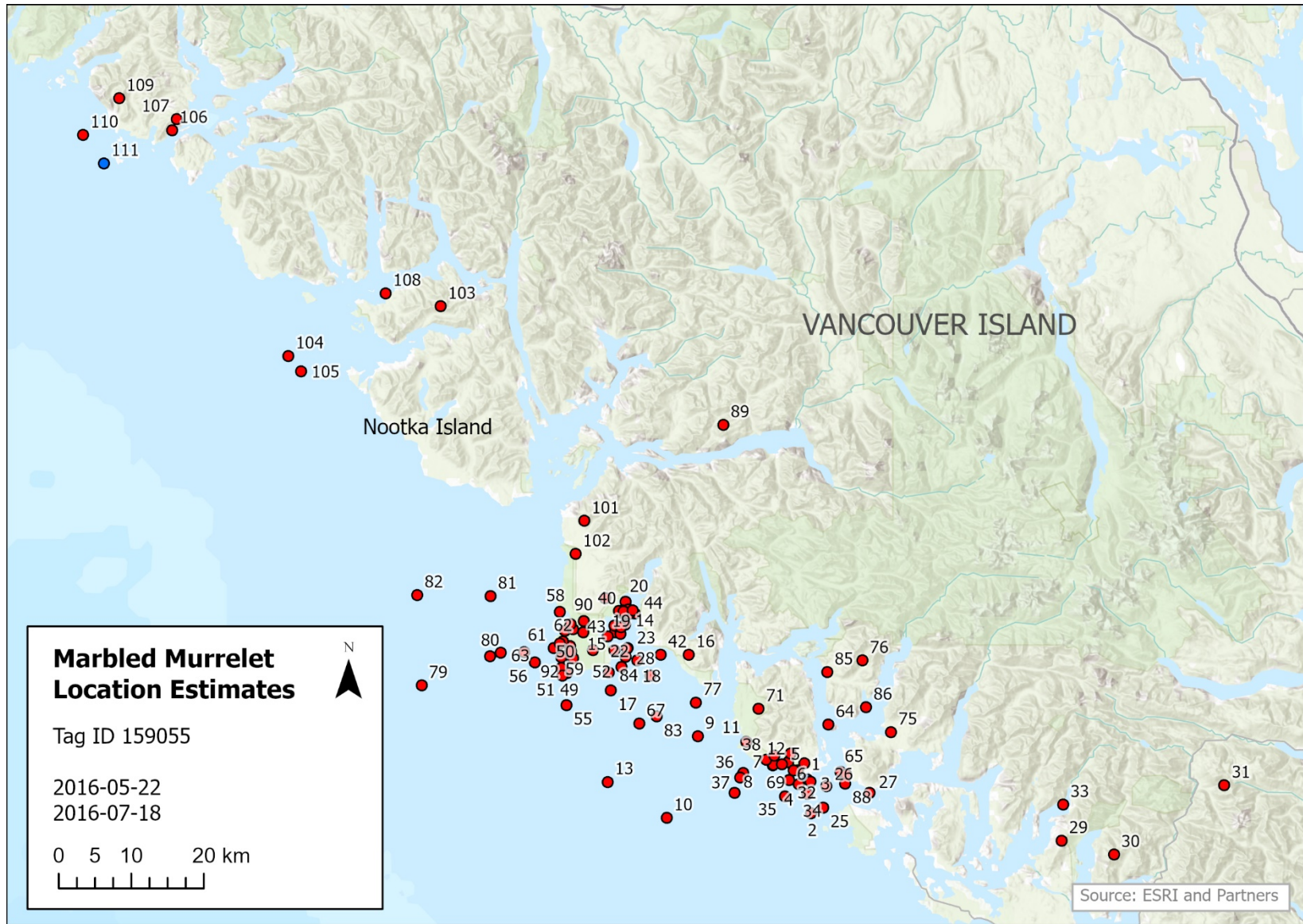


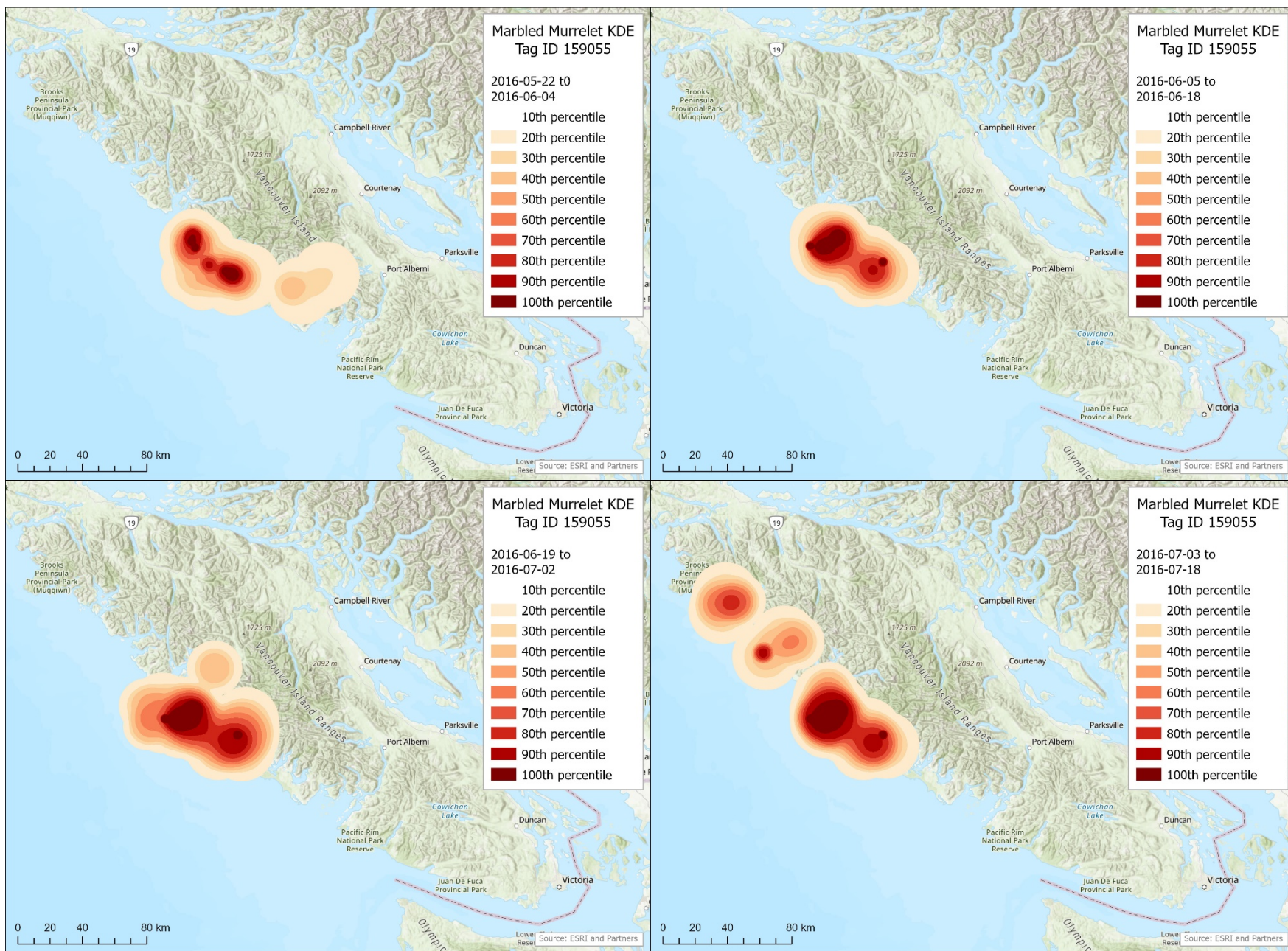
Tag 159054, 2016 Clayoquot Sound





Tag 159055, 2016 Clayoquot Sound





1.3: Locations of places named in Bertram et al. (2023) ‘Summer movements of marbled murrelets from Canada to Alaska’

