



Coastal Topography Change at Gulf Islands National Seashore, Texas

2018–2021 Data Summary

Natural Resource Data Series NPS/GULN/NRDS—2022/1355



ON THE COVER

Photo of dunes near the western tip of Horn Island taken in April 2021 at Gulf Islands National Seashore. NPS photo / GULN staff.

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Summary and Key Findings

In the spring of 2018 and 2021, the Gulf Coast Network collected coastal topography data at Gulf Islands National Seashore as a part of the NPS Vital Signs Monitoring Program. Monitoring was conducted following methods detailed in *Monitoring Coastal Topography at Gulf Coast Network Parks: Protocol Implementation Plan* (PIP; Bracewell 2017).

Key findings from this effort are as follows:

- In Florida, the Perdido Key unit showed higher losses in profile area as well as retreat in dune crest and shoreline position than in the Fort Pickens unit.
- Because of unfavorable weather conditions and a compressed survey window, six of 16 transects in Mississippi were not surveyed in 2021.

- The highest rates of loss in profile area on Horn Island were at the western end.
- Three pilot monitoring transects were added in 2021 at Fort Pickens area, updrift, or east of the Gulf Coast Network's established effort. This expands survey coverage about 3 kilometers (1.9 miles [mi]) and incorporates a portion of the narrower, washover-prone section of the unit.

This project is in the early phases of implementation and will benefit from future surveys to better understand the influence of slight changes in survey timing and other environmental variations.

Introduction

As stated by Psuty et al. (2010)

Changes in coastal topography, whether caused by erosion or accretion, vary both spatially and temporally. Understanding these variations is key to early recognition of potential problems affecting natural resources and cultural resources in coastal parks. For managers, an understanding of the spatial and temporal patterns of geomorphologic change is basic to optimal management of any coastal park because the interface of marine and land systems: (1) is highly dynamic and driven by multiple forcing mechanisms; (2) results in alterations to resource patterns and dynamics at habitat and ecosystem levels; and (3) can eventually result in the loss of static resources. The establishment of local, long-term monitoring programs provides metrics . . . to help understand the processes that are driving coastal change of beaches, dunes, and bluffs within the parks.

Methods for monitoring coastal topographic change were developed by the Northeast Coastal and Barrier Network in Psuty et al. (2010) and adapted for use by the Gulf Coast Network (GULN) in Bracewell (2017). Following this guidance, the Gulf Coast Network has created a network of permanently established reference points that allow for the collection of highly accurate elevation data along beach and dune transects at Gulf Islands National Seashore (GUIS) and Padre Island National Seashore (PAIS). Profiles created from these elevation data are tracked through space and time to better understand geomorphic processes and spatial patterns as they relate to park resources.

This report provides a summary of changes in coastal topography at Gulf Islands National Seashore between 2018 and 2021.

Study Area

Gulf Islands National Seashore (GUIS) consists of several units in Florida and Mississippi. The Mississippi section (GUIS-MS) consists of five islands and a small mainland headquarters area. The authorized boundary includes not only the barrier islands themselves, but also portions of the Gulf of Mexico and Mississippi Sound. From the west to east, the islands of GUIS-MS are: Cat, Ship, Horn, West Petit Bois, and Petit Bois Islands and are only accessible by boat. Horn Island is the largest and Cat the most recently acquired of the GUIS-MS islands. Davis Bayou is the only mainland area in the GUIS-MS park section.

The Florida section (GUIS-FL) consists of portions of two islands, Santa Rosa Island and Perdido Key, and two small mainland areas. Three park units are located on Santa Rosa Island: Fort Pickens, Santa Rosa Area, and Okaloosa Area. The Naval Live Oaks Reservation is on a peninsula forming part of the eastern mouth of Pensacola Bay. Unlike GUIS-MS, all areas of GUIS-FL, including the islands, are accessible to vehicles. The water bodies surrounding GUIS-FL include Santa Rosa Sound, Big Lagoon, Pensacola Bay, Choctawhatchee Bay, and the Gulf of Mexico (Cooper et al. 2005).

There are a number of aquatic and terrestrial ecosystems in Gulf Islands National Seashore, including Gulf, bay, dunes, salt marsh, maritime forest, barrier islands, seagrass beds, and other marine systems. Hydrology and water-related

issues are of central importance because 80% of the park is submerged land (Anderson et al. 2005). The mainland portion of GUIS-FL consists of live oak, sandhill, and marsh communities; the mainland portion of GUIS-MS consists of pine/palmetto flatwoods, mixed pine/hardwood, lowland hardwood, and tidal marsh.

Hurricanes are one of the biggest concerns for the park, as they can have devastating effects on biological communities as well as park structures and facilities and cause rapid morphological shoreline changes through erosion and overwash of the islands. Hydrologic alternations (e.g., jetties and navigation channels) alter sediment input and transport, limiting the ability of these systems to recover on their own between storms. To combat erosion, the beaches of Gulf Islands National Seashore have been regularly nourished with sand, which generally comes from the dredging of navigation channels. Although these nourishment projects are beneficial for the reduction of erosion, there is concern regarding the rates of revegetation, adverse effects on macroinvertebrates, and reduction of the vegetative seed bank (Cooper et al. 2005).

The purpose of this document is to report the most recently collected data from within the park as part of an ongoing long-term topographic-change monitoring program. Other data collected during this survey are available at the [Gulf Coast Network Coastal Topography Monitoring Project](#).

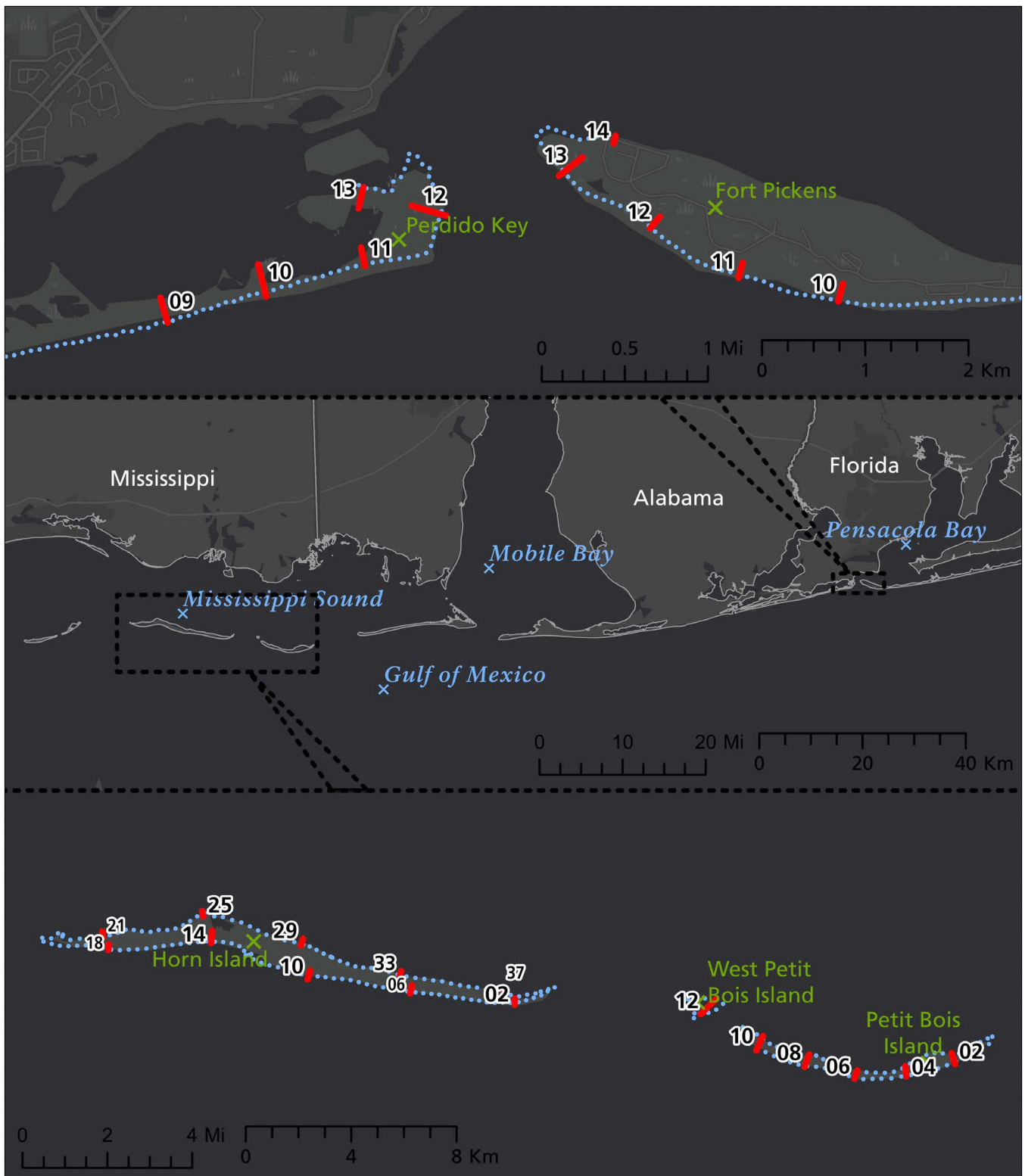


Figure 1. Gulf Coast Network's set of 26 coastal topography survey transects at Gulf Islands National Seashore. Numbered monitoring transects are shown in red. Dotted lines in the detail maps represent the recent shoreline position.

Methods

The Gulf Coast Network (GULN) has established a framework of equally spaced cross-shore transects in a Geographic Information System (GIS) along the entire shoreline of Gulf Islands National Seashore. From this framework, a set of monitoring sites was selected to support high-priority park resource management decisions and other GULN vital signs monitoring projects. The Gulf Coast Network monitors topographic change at Fort Pickens, Perdido Key, Petit Bois Island, West Petit Bois Island, and Horn Island (Figure 1). To collect monitoring data, a crew member records elevation using precision GPS equipment at the topographic inflections in the beach and primary dune complex along the transect (Figure 2).



Figure 2. Surveyor measuring beach/dune topography taken in April 2021 at Fort Pickens, Gulf Islands National Seashore. NPS photo / GULN staff.

Standard Operating Procedures

Table 1 presents the standard operating procedures (SOPs) that are critical to maintaining continuity between data sets across many surveys so results are comparable. No significant changes were made to SOPs between 2019 and 2021, and version numbers in the table apply to both efforts.

Timing of the Topographic Survey

Topographic surveys are timed to be concurrent with GULN shoreline position surveys, which are conducted during neap tides in April and May of every other year. Neap tides are the two periods per month when high

and low tides are least different. Due to COVID 19 related travel restrictions, the Gulf Coast Network was not able to survey Gulf Islands National Seashore in 2020 as prescribed in the protocol implementation plan. As an adaptive measure, the network surveyed the Seashore in 2021 and will resume the normal even-year schedule with a survey in 2022. The dates and transects surveyed for 2018 and 2021 are listed in Table 2. Although lower water levels make surveying lower beach elevations easier and safer, the topographic survey is not dependent on neap tides to complete the work and to produce comparable results.

Table 1. Standard operating procedures used for topographic data collection, processing and reporting.

SOP number	SOP title	SOP version
CT03	Survey Timing and Mission Planning	1.0
CT04	Settings for Collection of Topography	1.0
CT05	Conducting the Survey	1.0
CT06	Initial Post Survey Processing	1.0
CT07	Data Analysis and Reporting	1.0

Table 2. List of survey collection days and transects surveyed.

Season	Survey Collection Date	Surveyed Transects
Spring 2018	4/27/2018	Perdido Key: 10, 11, 12, 13, 9
Spring 2018	4/28/2018	Fort Pickens: 10, 11, 12, 13, 14
Spring 2018	5/22/2018	Horn Island: 10, 2, 25, 29, 33
Spring 2018	5/23/2018	Horn Island: 14, 18, 21, 6; Petit Bois: 10
Spring 2018	5/24/2018	Petit Bois: 12, 2, 4, 6, 8
Spring 2021	4/10/2021	Fort Pickens: 10, 11, 12, 13, 14
Spring 2021	4/11/2021	Perdido Key: 10, 11, 12, 13, 9
Spring 2021	4/12/2021	Fort Pickens: 7, 8, 9
Spring 2021	4/26/2021	Petit Bois: 4, 6
Spring 2021	4/27/2021	Horn Island: 18, 2, 21, 25, 29, 33, 37, 6

Natural and Anthropogenic Events affecting Coastal Geomorphology

Table 3 lists tropical storms that have made landfall near GUIs from January 2017 to May 2021 with the associated water levels recorded at nearby NOAA tide stations (NOAA 2022). Figure 3 shows storm tracks for these and other storms in the northern Gulf of Mexico for the same period.

Some of these storms caused island overwash and breaching in parts of the surveyed areas. Table 4 summarizes dredging activities since 2017 at Pensacola Pass, Florida and Horn Island Pass, Mississippi [email correspondence with Bullock, H (Army Corp of Engineers), December 2021]. Figure 4 shows a dredge boat in operation at Horn Island Pass, Mississippi in May 2021.

Table 3. Tropical storms making landfall near GUIs from January 2017 through May 2021.

Storm	Water Level (Meters NAVD88)	Water Level Date	Tide Station	Proximity of Landfall to Park
Nate	2.159	Oct 8	Pascagoula NOAA Lab, Mississippi	About 12mi west of the Davis Bayou Unit
Gordon	0.942	Sept 5	Pensacola, Florida	About 20mi east of the Davis Bayou Unit
Sally	1.972	Sept 16	Pensacola, Florida	About 23mi west of the Naval Live Oaks Unit

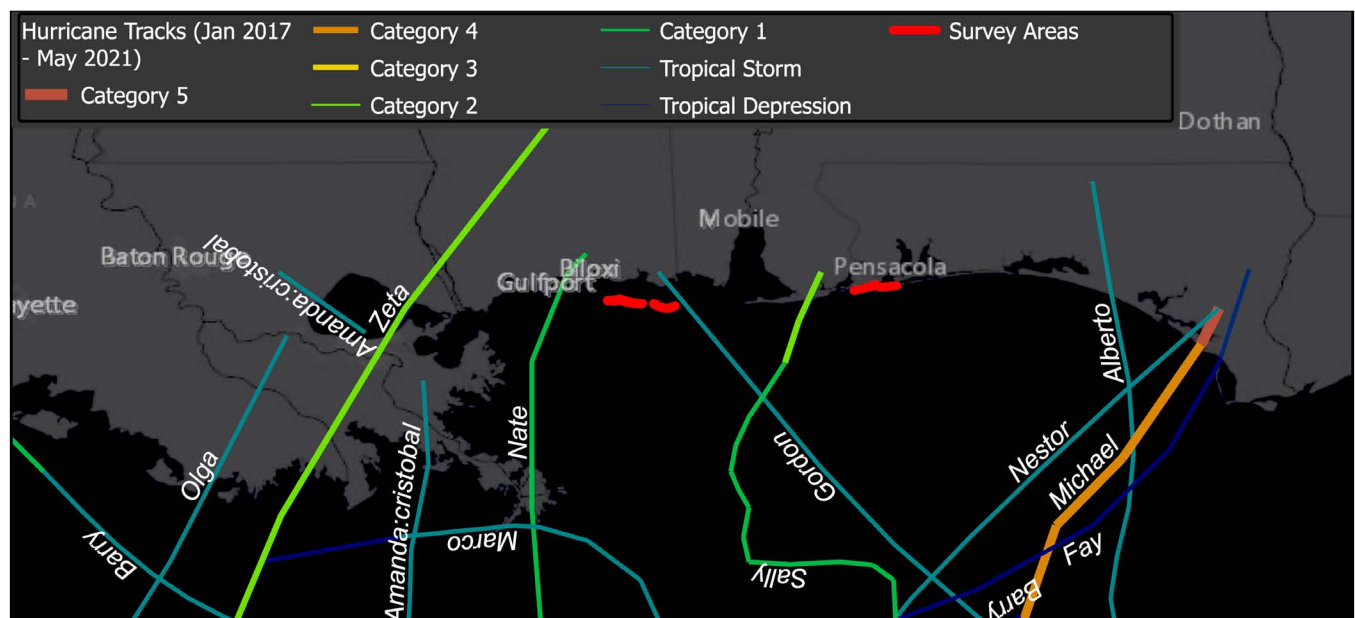


Figure 3. Map showing tropical storms making landfall near Gulf Islands National Seashore from January 2017 through May 2021.

Table 4. Recent dredging history at Pensacola Pass and Horn Island Pass.

Location	COE Project Code	Dredging Period	Dredge Amount (Cubic Yards)	Disposal Site
Pensacola Pass	W9127817D0092	2018 (May 10 - 26)	194,625	Within channel placement
	W9127819D0019	2020 (October - November)	186,073	Within channel placement
	W9127821D0083	2022 (scheduled February)	160,000	Beach placement
Horn Island Pass	W9127817F0243	2018 (January 2018 & May)	116,031	West Petit Bois
	W9127818C0022	2019 (May-September)	639,330	Ship Island
	W9127821F0004	2021 (March-April)	159,233	West Petit Bois



Figure 4. NPS boat anchored on Petit Bois Island near a dredging operation at Horn Island Pass, April 2021.

Results

Topographic Positional Data Quality

Topographic elevations were recorded in April through May 2018 and April 2021. All 26 established transects were surveyed in 2018. Because high winds limited field access in Mississippi in 2021, the GULN crew was unable to survey Horn Island transects - 10, 14; and Petit Bois

transect - 2, 8, 10, 12. Pre- and post-survey check-ins on geodetic benchmarks were all within the 0.05 meter (0.16 feet [ft]) horizontal and vertical tolerance as outlined in the protocol implementation plan (Bracewell 2017). The average horizontal and vertical positional precisions remained near 0.026 meters (0.09 ft; Table 5).

Table 5. Table listing the average horizontal and vertical Global Navigation Satellite System (GNSS) positional precision of the topographic features collected during 2018 and 2021.

Survey Date	Average of Horizontal Precision (meters)	Average of Vertical Precision (meters)
4/27/2018	0.035	0.049
4/28/2018	0.036	0.046
5/22/2018	0.020	0.026
5/23/2018	0.024	0.032
5/24/2018	0.029	0.038
4/10/2021	0.008	0.004
4/11/2021	0.010	0.008
4/12/2021	0.010	0.008
4/26/2021	0.011	0.002
4/27/2021	0.012	0.005
Total Average	0.022	0.026

Topographic Measurements

Figure 5 presents the key dimensions for an example profile. Throughout this document, ‘dune crest’ refers to the foredune crest. Each profile distance measurement originates at a physical or virtual benchmark (0.0 meters horizontal). Measurements are taken in the active part of the beach/dune system and may not extend to the origin. All elevation measurements are referenced to NAVD 88, Geoid 12B.

Profile area is the two-dimensional area under the profile measured to 0.0 NAVD 88. Profile area is discussed in the next section. Three pilot monitoring transects were added at the Fort Pickens area, updrift, or east of the GULN’s already established effort. This expands survey coverage about 3km and incorporates a portion of the narrower, washover-prone section of the unit (Figure 6).

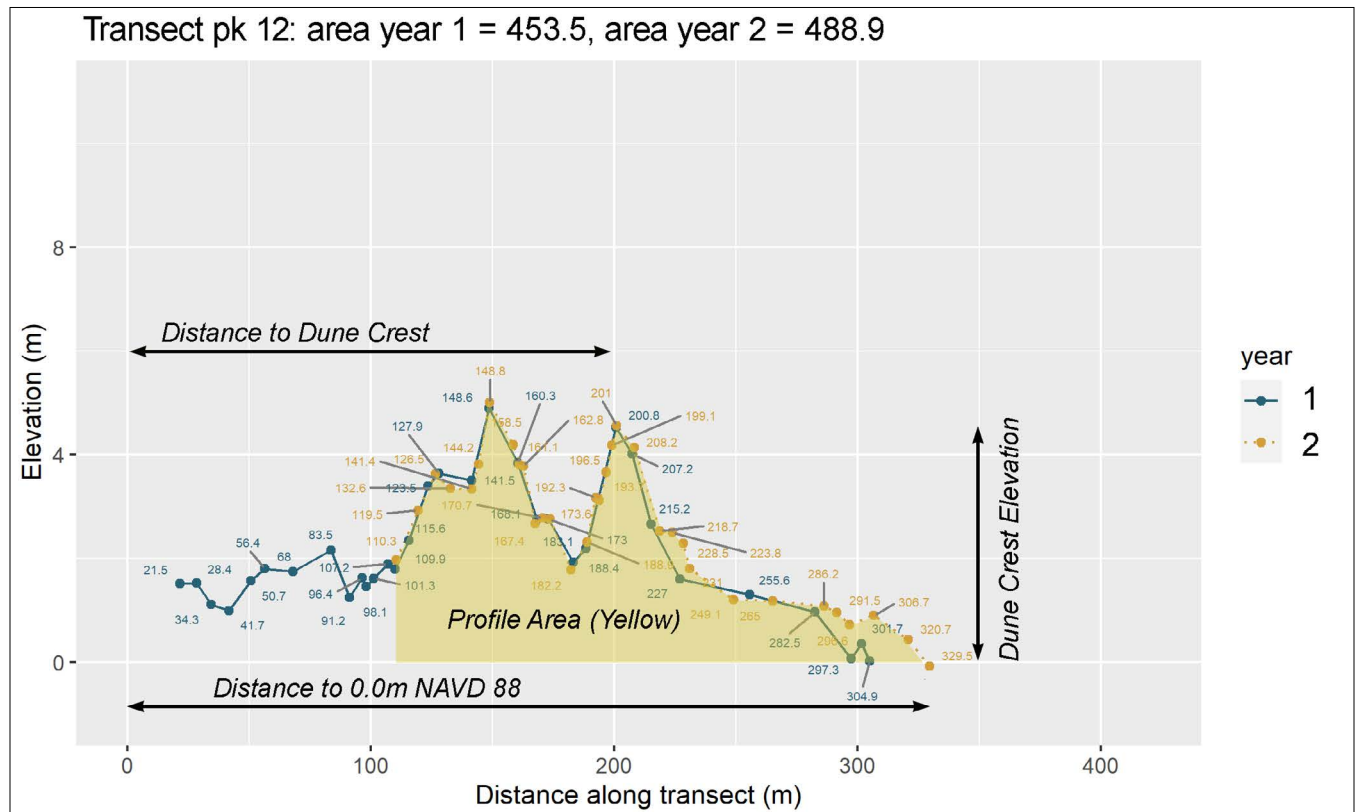


Figure 5. Example graph showing key profile dimensions. Arrows indicate: Distance to dune crest, Dune crest elevation, and Distance to 0.0 meters NAVD 88. The shaded portion under the ‘year 2’ profile represents the area calculated for profile area dimension. Only the overlapping parts of the profile are compared in profile area change. Each topographic measurement point is labeled with ‘distance from benchmark’ for each year. In cases where a transect crosses the entire island, Distance to 0.0 meters NAVD 88 is replaced with shore width. Shore width measures from sound-side 0.0 NAVD 88 to gulf-side 0.0 NAVD 88.



Figure 6. Pilot transect added at Fort Pickens includes FP07, FP08 and FP09.

Table 6 provides the key distance and elevation measurements that describe the topographic profiles for each surveyed transect in 2018 and 2021 and the amount of change that occurred over that period. Negative numbers

in the change columns represent landward retreat or lower elevations. See Appendix A for graphical depictions of each profile in each year.

Table 6. Topographic profile dimensions for 2018 and 2021 surveys at Gulf Islands National Seashore [m—meters]. Alongside the Transect ID are notes to indicate: (1) transects that were new to the project in 2021, and (2) where no data were collected in 2021. The ‘Width Type’ column notes whether the distance to 0.0 NAVD 88 is measured from shore to shore (A) or from benchmark to shore (B).

Transect ID	Dune Crest Elevation (DCE) 2018	Dune Crest Elevation (DCE) 2021	Dune Crest Elevation (DCE) Change	Dune Crest Distance (DCD) 2018	Dune Crest Distance (DCD) 2021	Dune Crest Distance (DCD) Change	Distance to NAVD88 (0) 2018	Distance to NAVD88 (0) 2021	Distance to NAVD88 (0) Change W	Distance to NAVD88 (0) Width Type
fp07 (1)	No Data	1.64	–	No Data	150.63	–	No Data	244.52	–	A
fp08 (1)	No Data	3.55	–	No Data	125.08	–	No Data	240.80	–	B
fp09 (1)	No Data	5.23	–	No Data	163.98	–	No Data	232.05	–	B
fp10	4.06	4.18	0.12	107.06	107.10	0.04	172.29	165.05	-7.25	B
fp11	3.60	3.60	0.00	67.96	67.48	-0.48	122.28	136.14	13.86	B
fp12	6.36	6.36	-0.01	98.11	98.13	0.02	136.76	125.01	-11.75	B
fp13	4.21	4.29	0.07	143.21	143.57	0.36	227.78	280.44	52.65	B
fp14	3.26	3.25	-0.01	0.00	0.03	0.03	70.11	70.37	0.26	B
pk09	4.50	4.71	0.21	174.21	174.38	0.17	231.25	203.25	-28.00	A
pk10	3.87	2.85	-1.02	237.79	113.11	-124.68	260.23	236.48	-23.74	B
pk11	1.73	1.42	-0.31	121.17	130.77	9.61	120.30	121.80	1.50	A
pk12	4.52	4.56	0.04	200.77	201.01	0.24	305.21	328.09	22.88	A
pk13	2.35	2.40	0.05	78.80	77.44	-1.36	191.50	194.48	2.98	A
pb02 (2)	2.68	No Data	–	161.32	No Data	–	233.43	No Data	–	B
pb02s (2)	1.22	No Data	–	87.25	No Data	–	117.70	No Data	–	B
pb04	2.15	2.23	0.08	147.92	138.92	-9.00	277.93	254.99	-22.95	B
pb04s	1.70	1.58	-0.12	31.84	32.24	0.41	59.12	60.93	1.81	B
pb06	2.50	2.69	0.18	105.75	107.24	1.48	209.87	159.13	-50.74	B
pb06s	0.89	1.05	0.16	38.21	32.64	-5.57	56.09	48.55	-7.54	B
pb08 (2)	3.15	No Data	–	195.70	No Data	–	341.52	No Data	–	B
pb08s (2)	1.11	No Data	–	64.48	No Data	–	76.63	No Data	–	B
pb10 (2)	3.21	No Data	–	195.27	No Data	–	339.45	No Data	–	B
pb10s (2)	1.28	No Data	–	87.22	No Data	–	106.24	No Data	–	B
pb12 (2)	5.56	No Data	–	61.38	No Data	–	370.84	No Data	–	B
pb12s (2)	6.16	No Data	–	94.88	No Data	–	297.92	No Data	–	B
hi02	2.04	1.18	-0.86	79.83	67.49	-12.34	141.46	84.37	-57.09	B

Table 6 (continued). Topographic profile dimensions for 2018 and 2021 surveys at Gulf Islands National Seashore [m—meters]. Alongside the Transect ID are notes to indicate: (1) transects that were new to the project in 2021, and (2) where no data were collected in 2021. The ‘Width Type’ column notes whether the distance to 0.0 NAVD 88 is measured from shore to shore (A) or from benchmark to shore (B).

Transect ID	Dune Crest Elevation (DCE) 2018	Dune Crest Elevation (DCE) 2021	Dune Crest Elevation (DCE) Change	Dune Crest Distance (DCD) 2018	Dune Crest Distance (DCD) 2021	Dune Crest Distance (DCD) Change	Distance to NAVD88 (0) 2018	Distance to NAVD88 (0) 2021	Distance to NAVD88 (0) Change W	Distance to NAVD88 (0) Width Type
hi06	4.00	3.83	-0.17	23.77	22.70	-1.07	257.80	263.21	5.41	B
hi10 (2)	3.82	No Data	–	102.55	No Data	–	190.00	No Data	–	B
hi14 (2)	3.81	No Data	–	222.63	No Data	–	414.96	No Data	–	B
hi18	1.89	2.11	0.22	33.26	36.04	2.78	197.68	161.29	-36.39	B
hi21	1.19	0.91	-0.29	12.64	2.96	-9.68	22.03	18.37	-3.66	B
hi25	3.10	3.61	0.51	28.28	27.20	-1.08	80.81	67.31	-13.50	B
hi29	1.25	1.36	0.11	72.64	65.42	-7.22	111.83	89.95	-21.87	B
hi33	3.02	2.64	-0.38	28.95	26.11	-2.84	56.93	49.27	-7.67	B
hi37	5.75	4.10	-1.64	88.83	96.74	7.90	138.42	113.12	-25.30	B

Across all survey areas, dune crest height was reduced slightly, while dune crest distance retreated substantially (Table 7). In Florida, dune crest height and distance were strongly influenced by change at transect PK 10, situated near an island washover which was breached by Hurricane Sally (Figure 7). When PK10 is removed from the group

averages, the net change shifts from dune-crest-elevation loss to a slight gain, and from dune-crest-distance retreat to a slight seaward advance (Tables 7, 8). In Mississippi, there was a -19.93 meter (-65.39 ft) change in distance to 0.0 NAVD 88, indicating sizable shoreline retreat (Table 7).

Table 7. Summary of changes in Dune Crest Elevation, Distance to Dune Crest and Distance to 0.0 NAVD 88.

Group	Dune Crest Elevation Average	Dune Crest Elevation Standard Deviation	Dune Crest Distance Average	Dune Crest Distance Standard Deviation	Distance to 0.0 NAVD88 Average	Distance to 0.0 NAVD88 Standard Deviation
Fort Pickens	0.04	0.06	0.00	0.30	9.55	25.97
Perido Key	-0.21	0.49	-23.21	56.89	-4.88	21.00
FL Summary	-0.08	0.28	-11.60	28.60	2.34	23.48
Petit Bois	0.08	0.14	-3.17	4.97	-19.85	22.98
Horn Island	-0.31	0.68	-2.94	6.65	-20.01	19.94
MS Summary	-0.12	0.41	-3.06	5.81	-19.93	21.46



Figure 7. Image courtesy of NOAA Remote Sensing Division, taken soon after Hurricane Sally in September 2021, shows breaching in the overwash zones between transects PK 10 and PK 11.

Table 8. Metrics presented Table 7 for the Florida units, but without transect PK10 included.

Group	Dune Crest Elevation Average	Dune Crest Elevation Standard Deviation	Dune Crest Distance Average	Dune Crest Distance Standard Deviation	Width Average	Width Standard Deviation
Fort Pickens	0.04	0.06	0.00	0.30	9.55	25.97
Perido Key	0.00	0.22	2.16	5.02	-0.16	20.96
FL Summary	0.02	0.14	1.08	2.66	4.70	23.47

Profile Area

Profile area metrics produce what may be the most comprehensive assessment of change in this report. Change can be measured as raw changes in area or as percent change [(final value-initial value)/initial value] as presented in Table

9. Grouped change is shown in Table 10. Negative values in the change column represent a loss of profile area and positive numbers indicate gain. Figure 8 shows change in area as a graph.

Table 9. Profile area by transect. Percent change addresses change from 2018 to 2021. Percent change is calculated as '(final value – initial value) / initial value'. Area is reported in square meters.

Transect ID	2018	2021	Change	Percent Change
fp07	No Data	286.3	No Data	No Data
fp08	No Data	421.7	No Data	No Data
fp09	No Data	191.1	No Data	No Data
fp10	430.3	430.7	0.4	0%
fp11	211.9	243.9	32.0	15%
fp12	390.9	351.1	-39.8	-10%
fp13	692.4	772.0	79.6	11%
fp14	162.1	131.0	-31.1	-19%
pk09	523.7	460.5	-63.2	-12%
pk10	434.2	377.4	-56.8	-13%
pk11	154.6	110.9	-43.7	-28%
pk12	453.5	488.9	35.4	8%
pk13	311.8	318.1	6.3	2%
pb02	234.7	No Data	No Data	No Data
pb02s	33.0	No Data	No Data	No Data
pb04	279.2	247.1	-32.1	-11%
pb04s	25.7	26.4	0.7	3%
pb06	240.3	185.9	-54.4	-23%
pb06s	19.7	13.4	-6.3	-32%
pb08	395.6	No Data	No Data	No Data
pb08s	7.7	No Data	No Data	No Data
pb10	365.2	No Data	No Data	No Data
pb10s	23.6	No Data	No Data	No Data
pb12	908.6	No Data	No Data	No Data
pb12s	864.0	No Data	No Data	No Data
hi02	128.9	44.6	-84.3	-65%
hi06	408.2	381.0	-27.2	-7%
hi10	312.8	No Data	No Data	No Data
hi14	650.4	No Data	No Data	No Data
hi18	195.0	200.3	5.3	3%
hi21	6.5	3.5	-3.0	-46%
hi25	120.5	108.1	-12.4	-10%
hi29	28.8	19.7	-9.1	-32%
hi33	67.7	53.9	-13.8	-20%
hi37	332.1	241.2	-90.9	-27%

Table 10. Grouped profile area averages and standard deviations (StdDev).

Group	StdDev of Percent Change in Area	Average of Change in Area	Average of Percent Change in Area	StdDev of Change in Area
Fort Pickens	14.4%	8.2	-0.5%	48.9
Perdido Key	14.1%	-24.4	-8.7%	43.1
FL Summary	14.3%	-8.1	-4.6%	46.0
Petit Bois	14.9%	-23.0	-15.8%	25.2
Horn Island	22.3%	-29.4	-25.6%	37.1
MS Summary	18.6%	-26.2	-20.7%	31.2

There are conspicuous losses in profile area at Perdido Key transects PK 9, 10 and 11, while PK 12 and 13, at the east end of the unit, gained in area (Figure 8). Fort Pickens was mixed in terms of spatial distribution of profile area gains and losses but showed overall gain. The highest losses in profile area at Horn Island were on the western end, at

transects HI 02 and 37. Two Gulf side transects on the western half of Horn Island were not surveyed in 2021. Four of six transects at Petit Bois Island, including one at West Petit Bois, were not surveyed in 2021. The limited survey data from Petit Bois show both a general loss in profile area as well as retreating shorelines and dune crest distances.

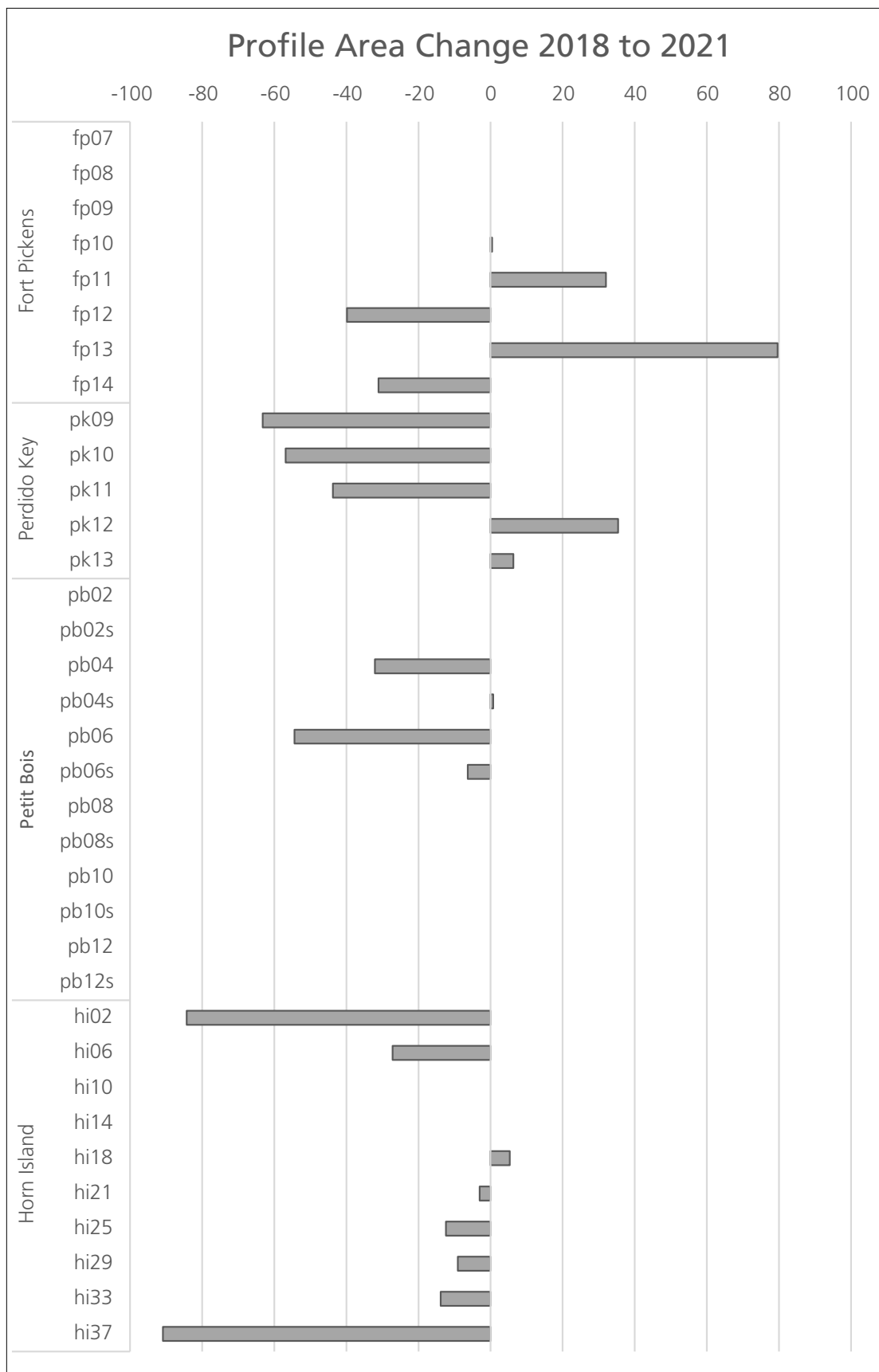


Figure 8. Profile area percent change from 2017 to 2021 and 2019 to 2021.

Areas of Special Interest

During scoping meetings for this project, GUIS Resource Management staff expressed special interest in the areas adjacent to Pensacola Pass. Table 7 reports an average 8.2 square meter (88.3 square feet [ft²]) gain in profile area at Fort Pickens, while Perdido Key experienced a 24.4 square meter (262.6 ft²) loss. An 8-mile-(12.9-kilometer [km])long extent of Pensacola Beach, just east of the Fort Pickens Unit, was nourished in 2003, 2006 and 2016 with volumes of sand ranging from 185 million CY (cubic yards) to 420 million CY. The amount of sand recently replaced at Perdido Key was substantially less, with 520,000 CY placed near Pensacola Pass in 2012 and 238,000 CY placed in the nearshore, along the unit's extent in 2016 (Florida DEP 2020). The difference in the amount of sediment placed at or near each of these two units likely helps to explain the difference in profile area change.

Problems and Concerns

The 2021 survey period in Mississippi overlapped with challenging boating conditions. Wind gusts were routinely 15 to 20 knots out of the east/ southeast which made safely dropping surveyors off on the islands difficult. Meanwhile, because of COVID 19 travel restrictions in 2020, both Gulf Island National Seashore and Padre Island National Seashore were surveyed in 2021. Typically, only one GULN seashore park is surveyed per year. To fit both parks into the limited

survey window, the GULN crew was obligated to conclude surveying at Gulf Islands National Seashore at the end of April. The weather challenges, combined with a limited survey window, meant that the Gulf Coast Network was not able to survey six of the 16 transects in Mississippi.

This is the first in a continuous series of every-other-year reports related to monitoring topographic change at Gulf Islands National Seashore. It is expected that future reports will benefit from the accumulation of data sets, allowing for better interpretation of the measurement variation attributed to geomorphic differences (e.g., slope), as well as weather, seasonal and tidal differences.

Protocol Changes

No major changes occurred to the GULN protocol implementation plan (Bracewell 2017) between its initial publication in 2017 and composition of this report (August, 2019).

Additional Information

For data and information related to this report please visit the [Gulf Coast Network Coastal Topography Monitoring Project](#). For information about the GULN's complementary coastal dynamics project mapping changes in shoreline position, see the [Gulf Coast Network Shoreline Monitoring Project](#).

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Appendix A. Graphs Comparing Transect Profiles

Graphical depiction of topographic profiles with dimensional measurements for the years surveyed.

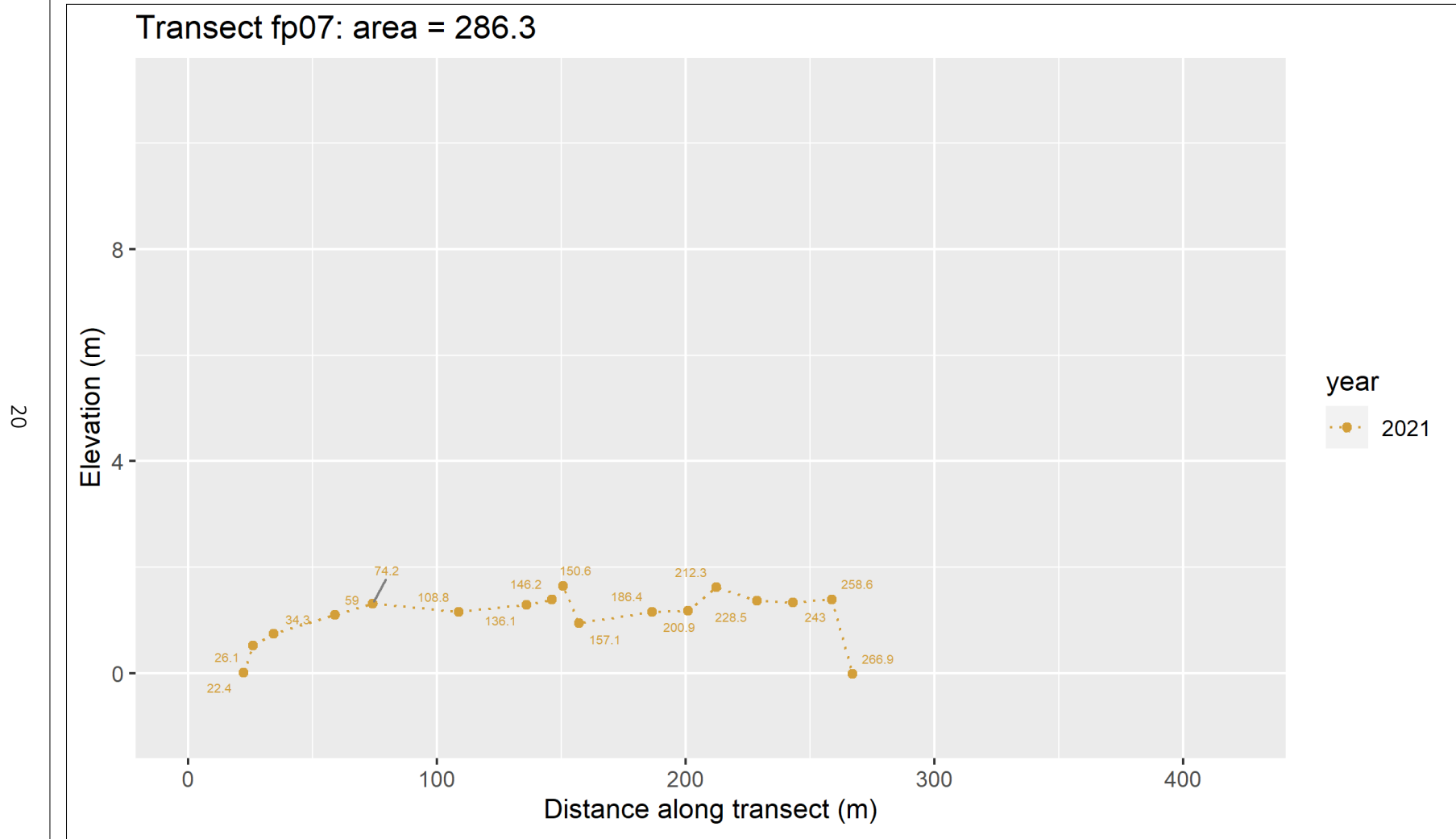


Figure A-1. Transect profile(s) for fp07 at Gulf Islands National Seashore.

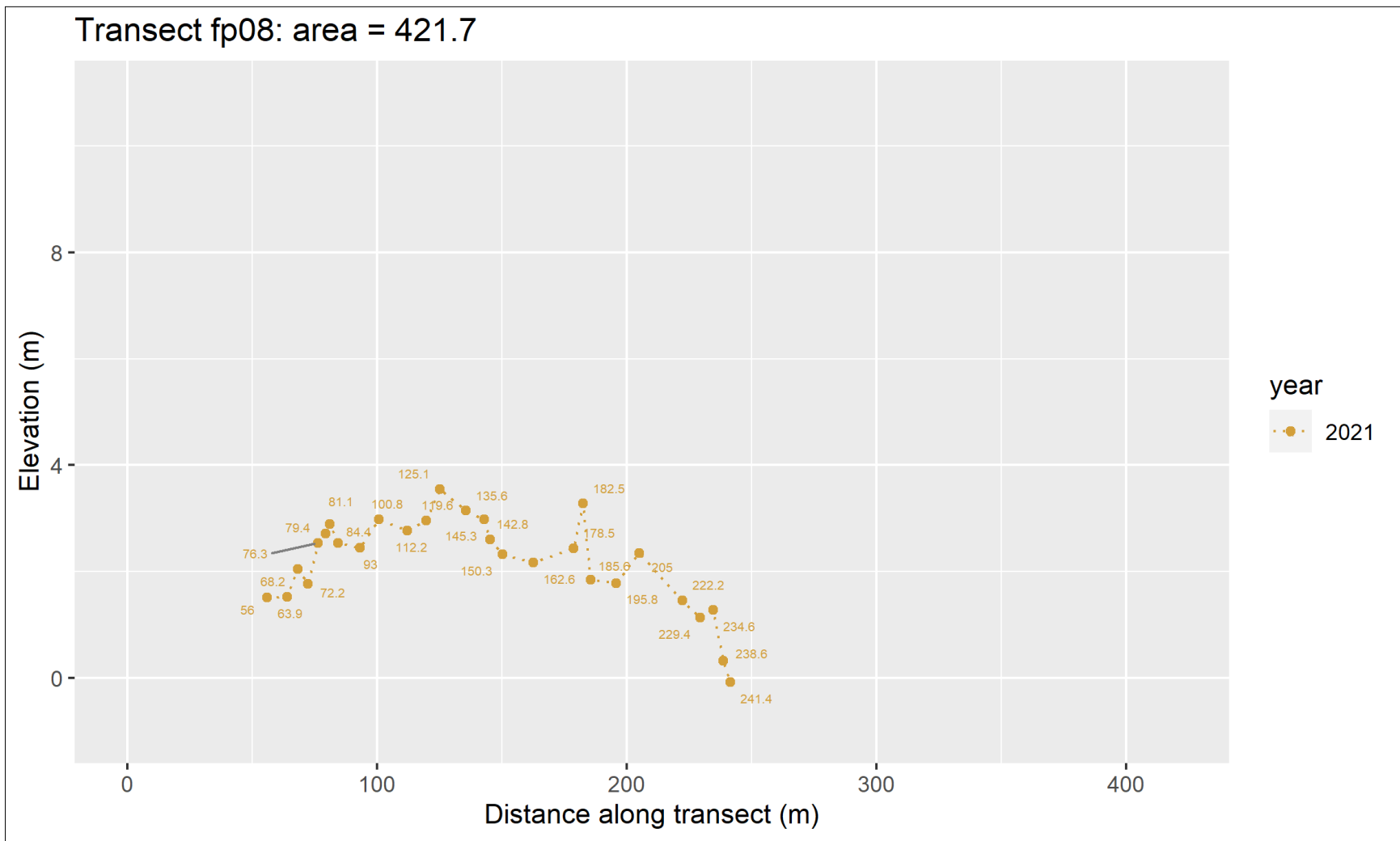


Figure A-2. Transect profile(s) for fp08 at Gulf Islands National Seashore.

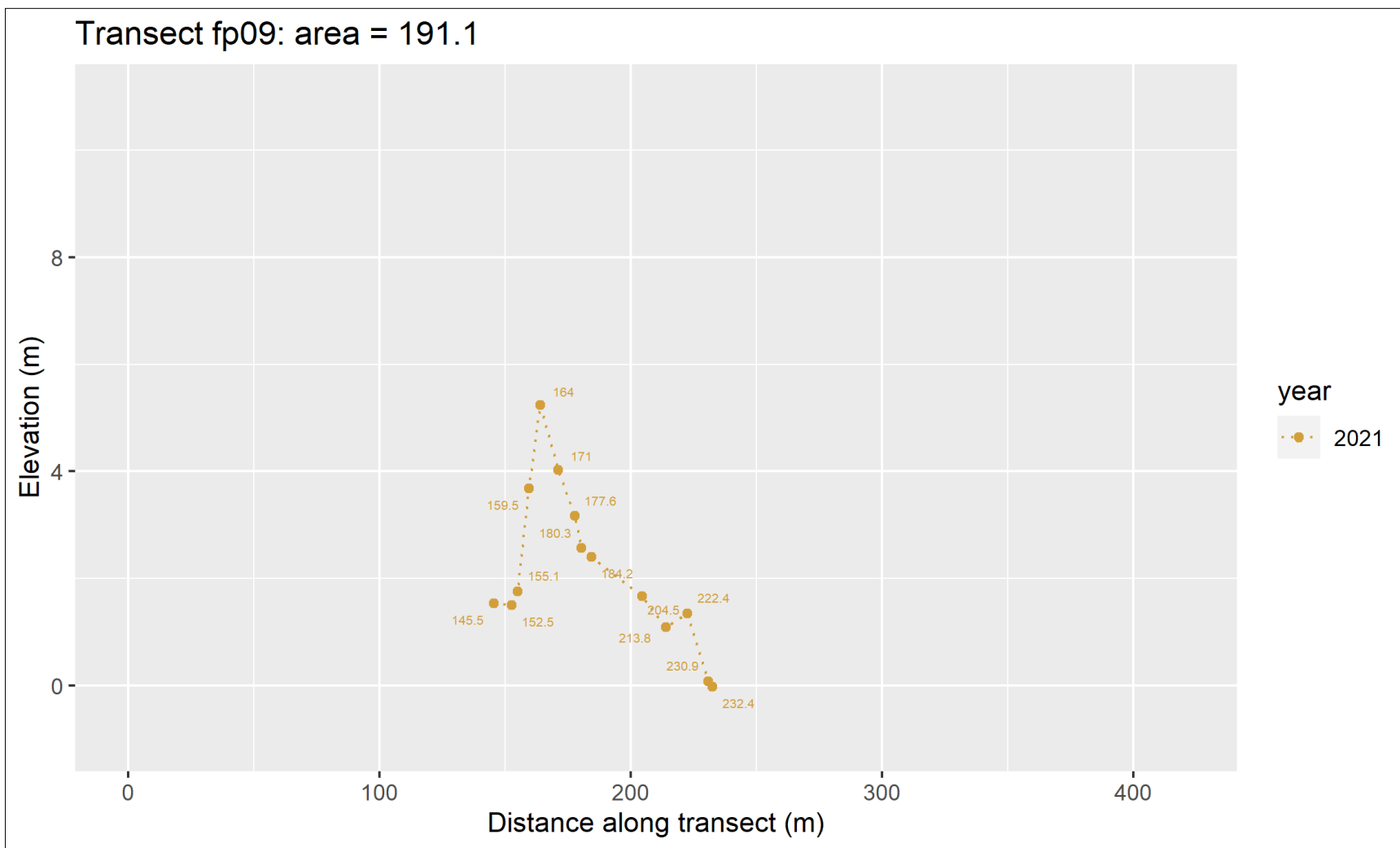


Figure A-3. Transect profile(s) for fp09 at Gulf Islands National Seashore.

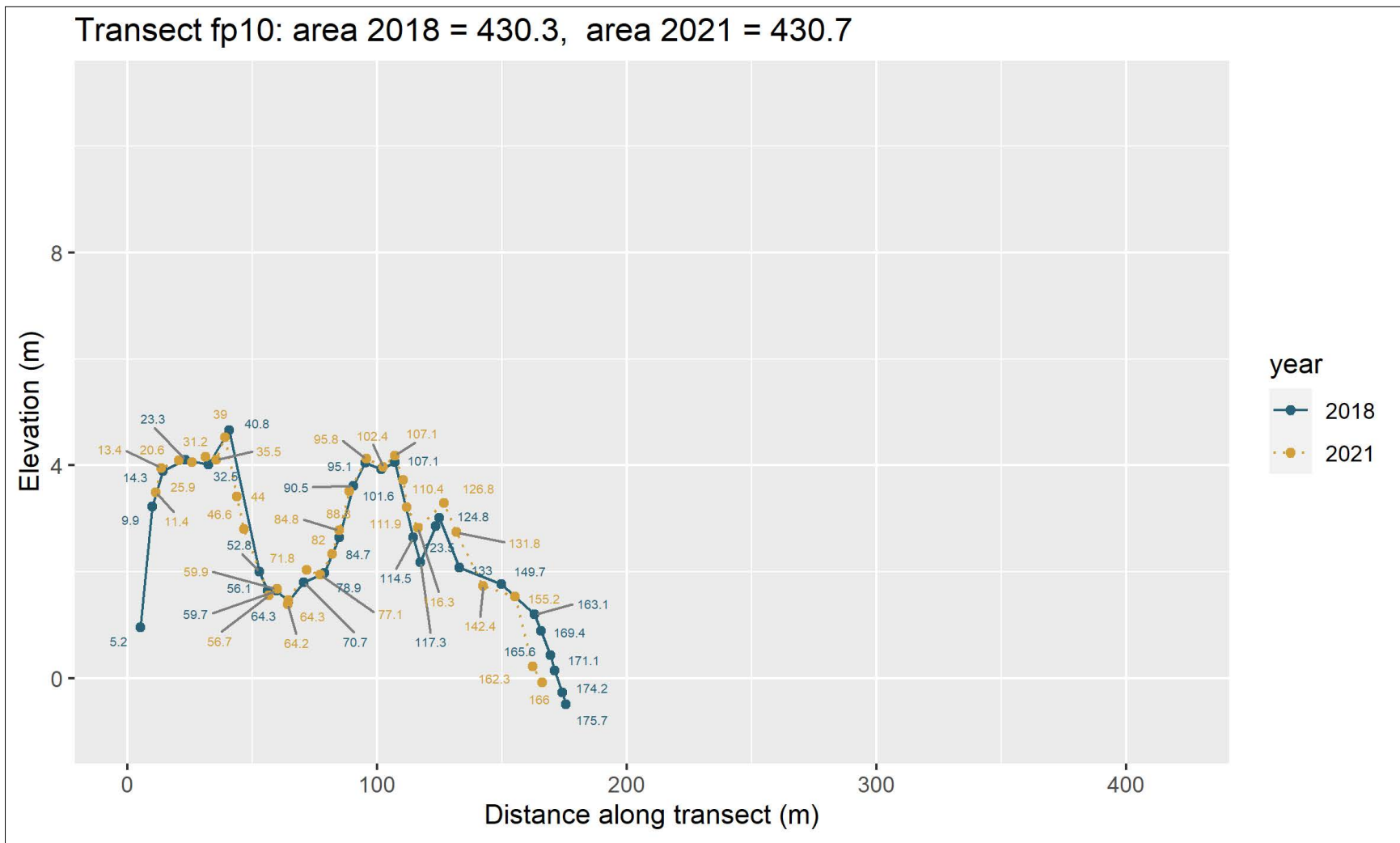


Figure A-4. Transect profile(s) for fp10 at Gulf Islands National Seashore.

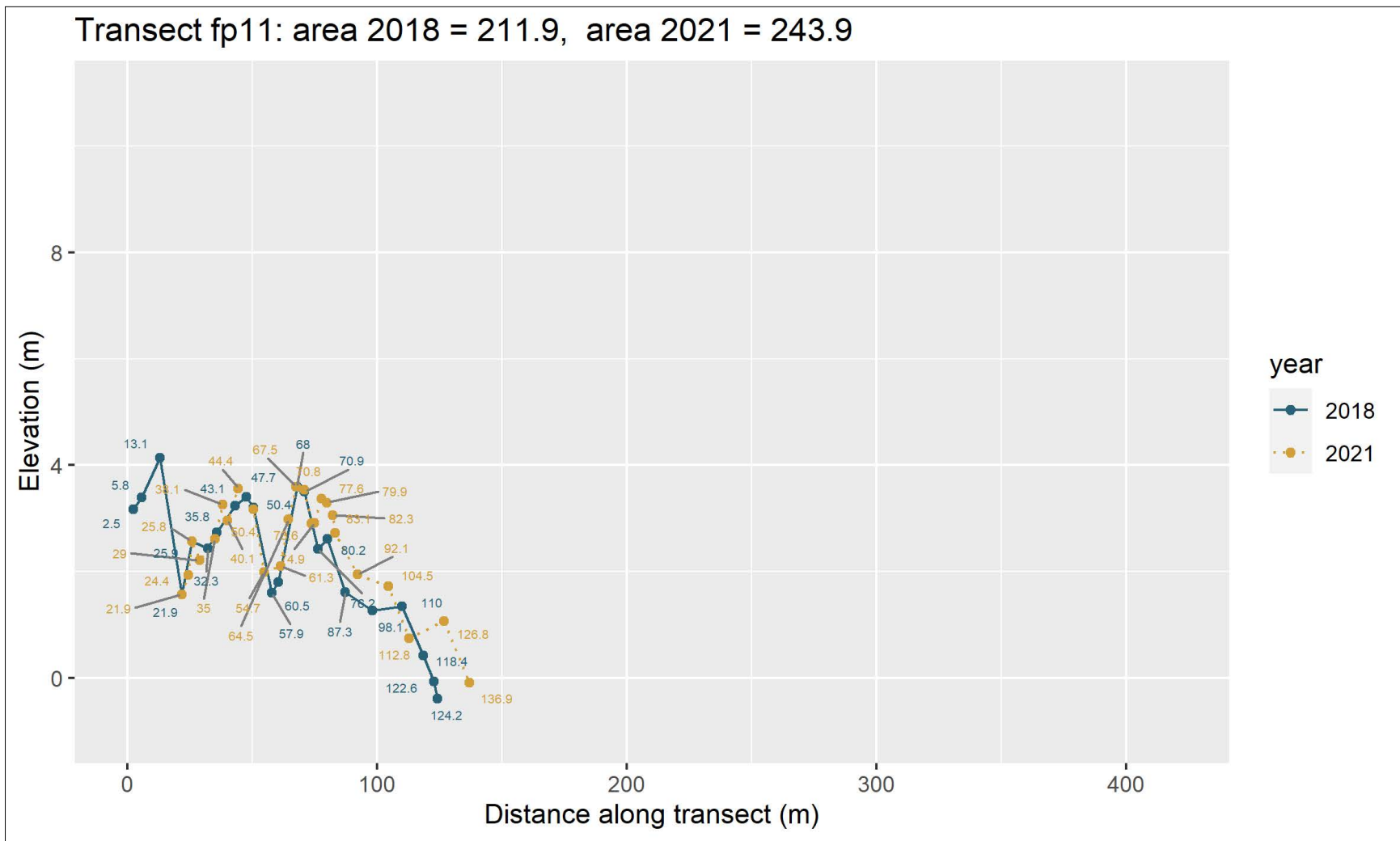


Figure A-5. Transect profile(s) for fp11 at Gulf Islands National Seashore.

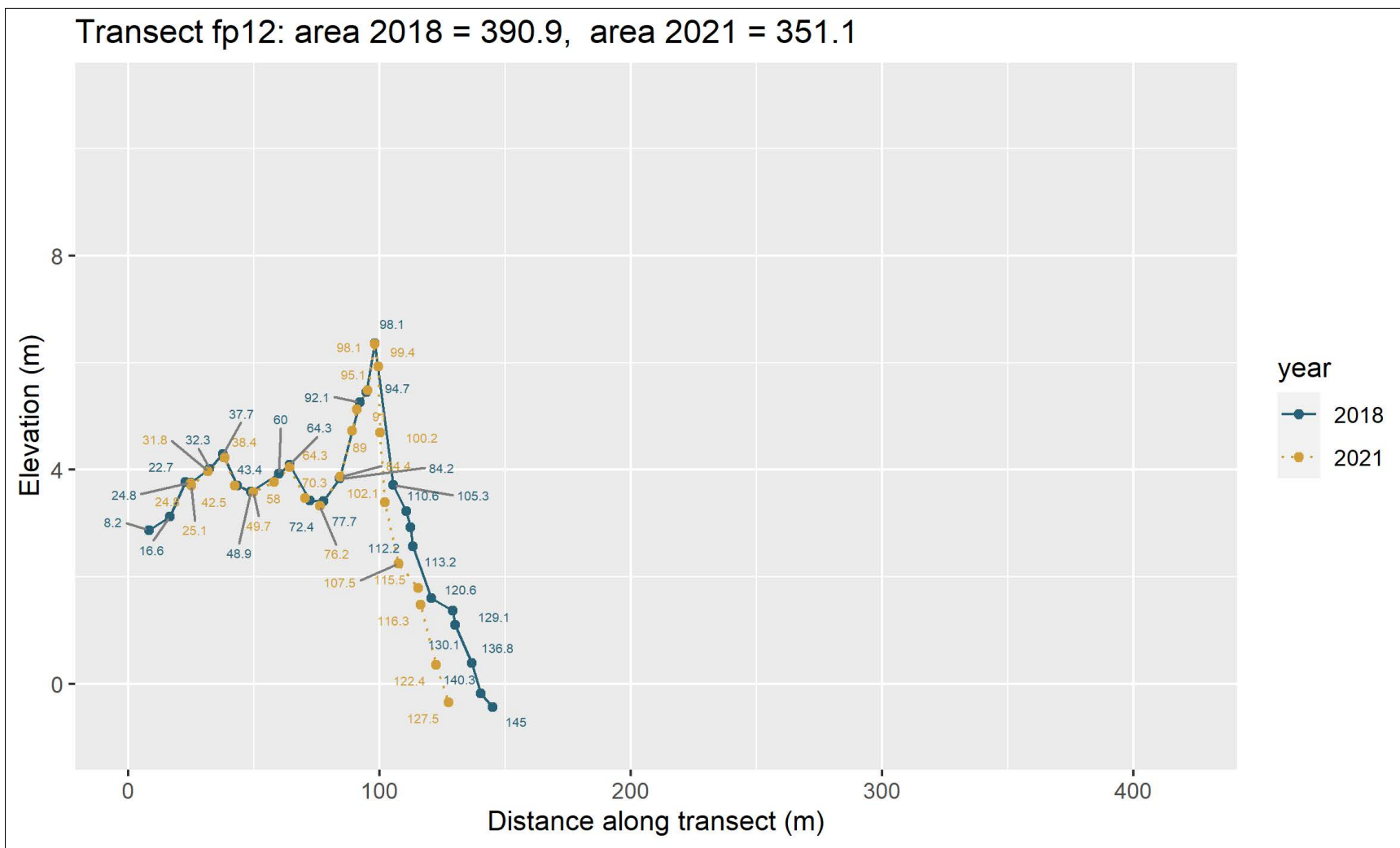


Figure A-6. Transect profile(s) for fp12 at Gulf Islands National Seashore.

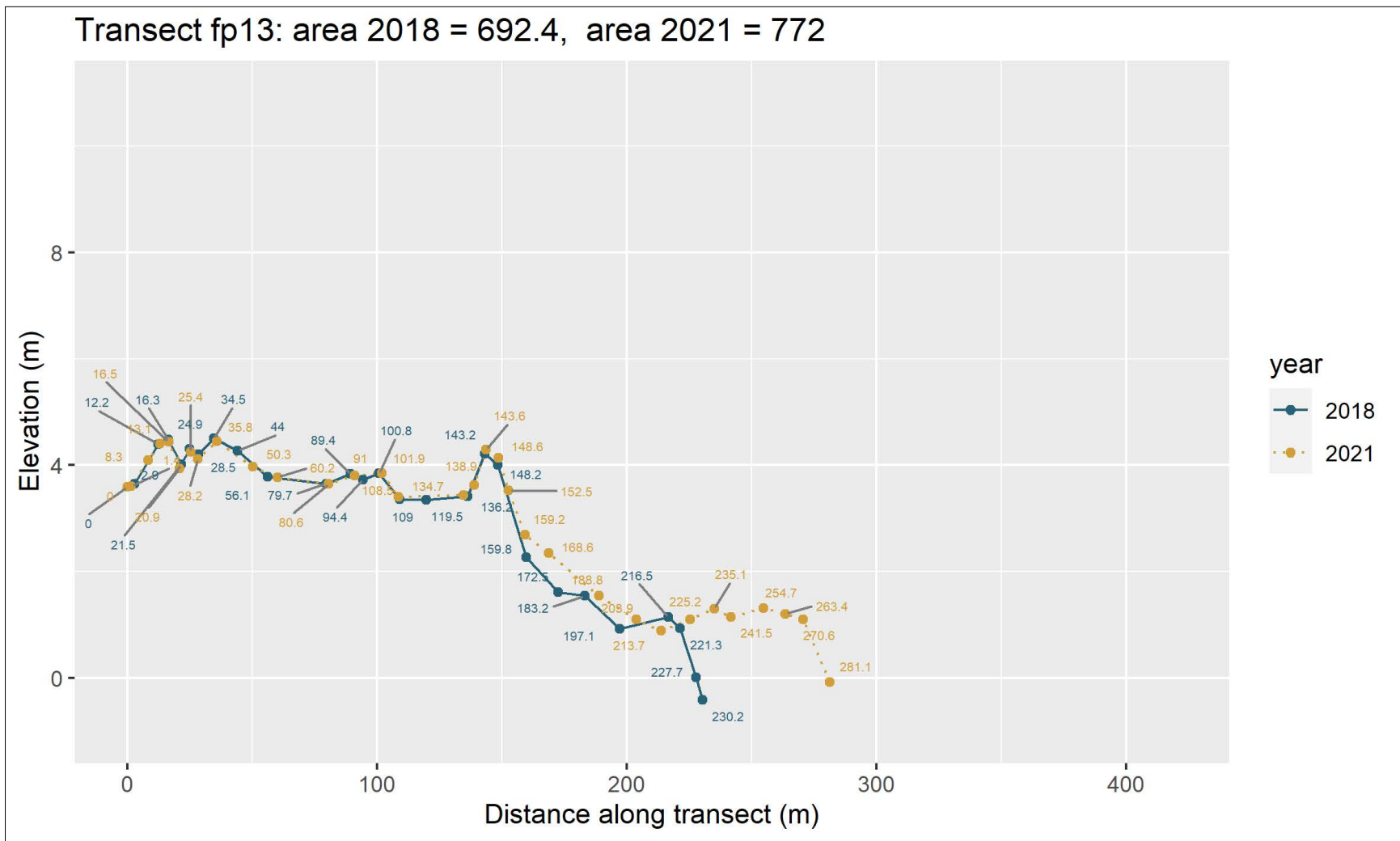


Figure A-7. Transect profile(s) for fp13 at Gulf Islands National Seashore.

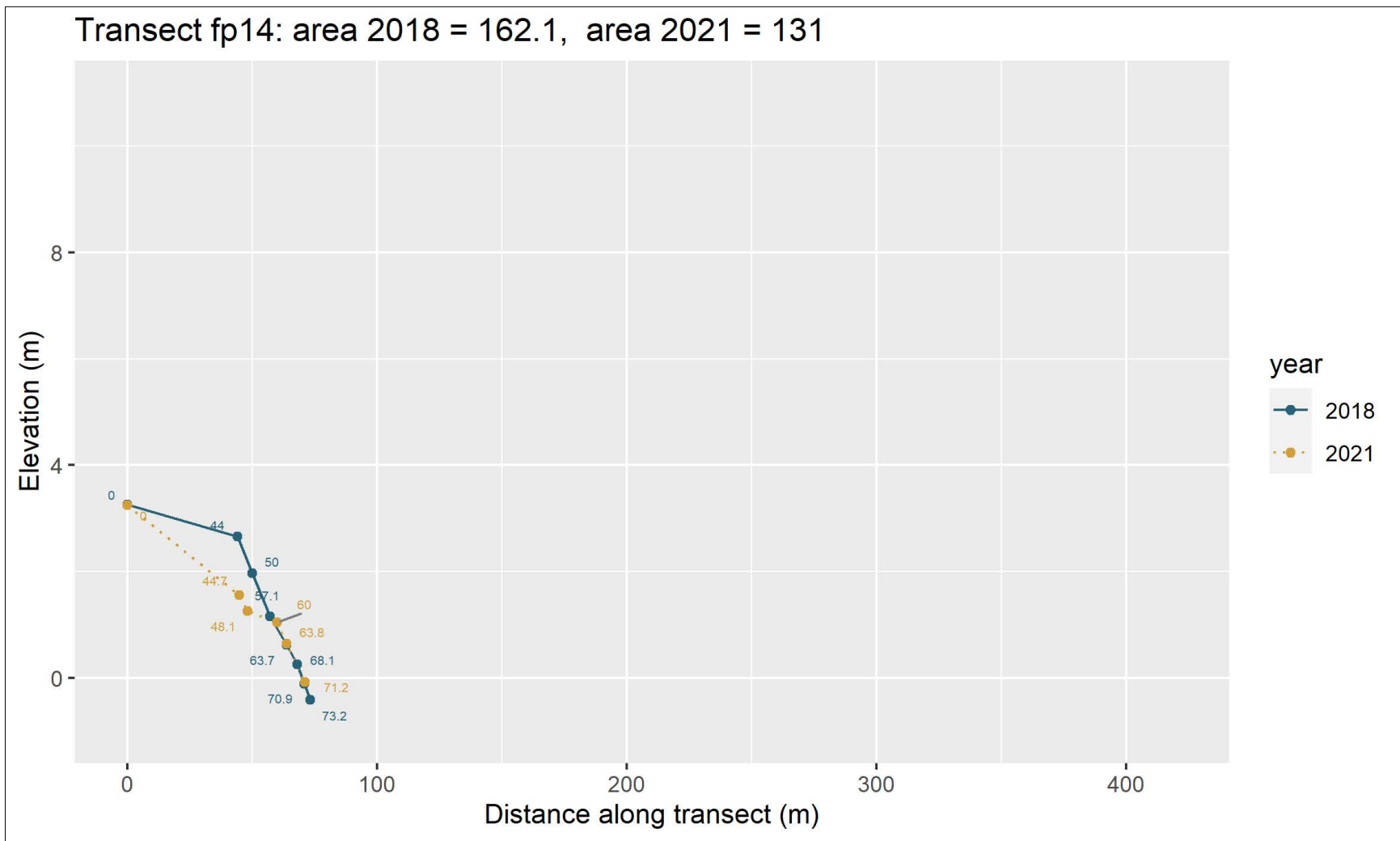


Figure A-8. Transect profile(s) for fp14 at Gulf Islands National Seashore.

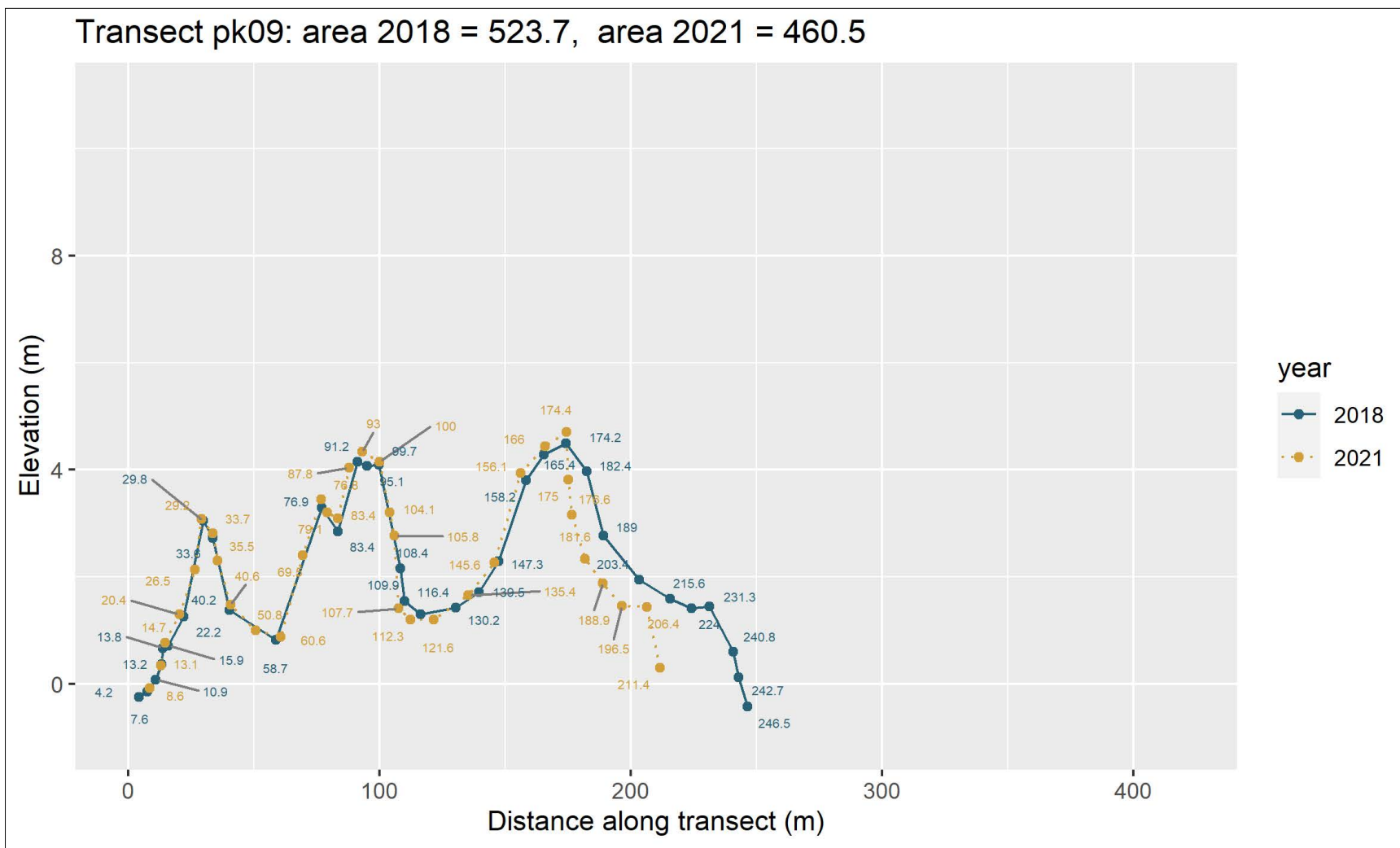


Figure A-9. Transect profile(s) for pk09 at Gulf Islands National Seashore.

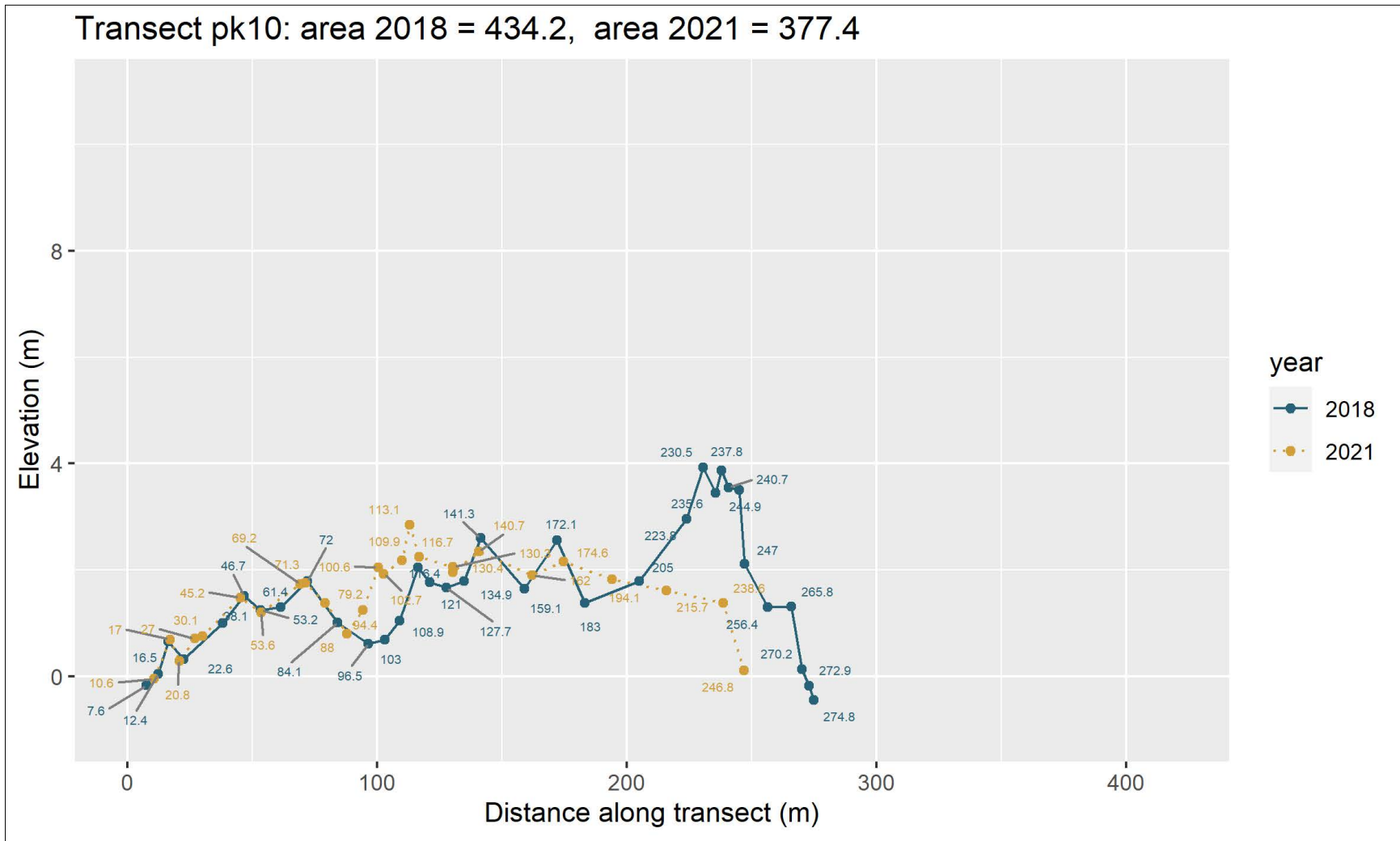


Figure A-10. Transect profile(s) for pk10 at Gulf Islands National Seashore.

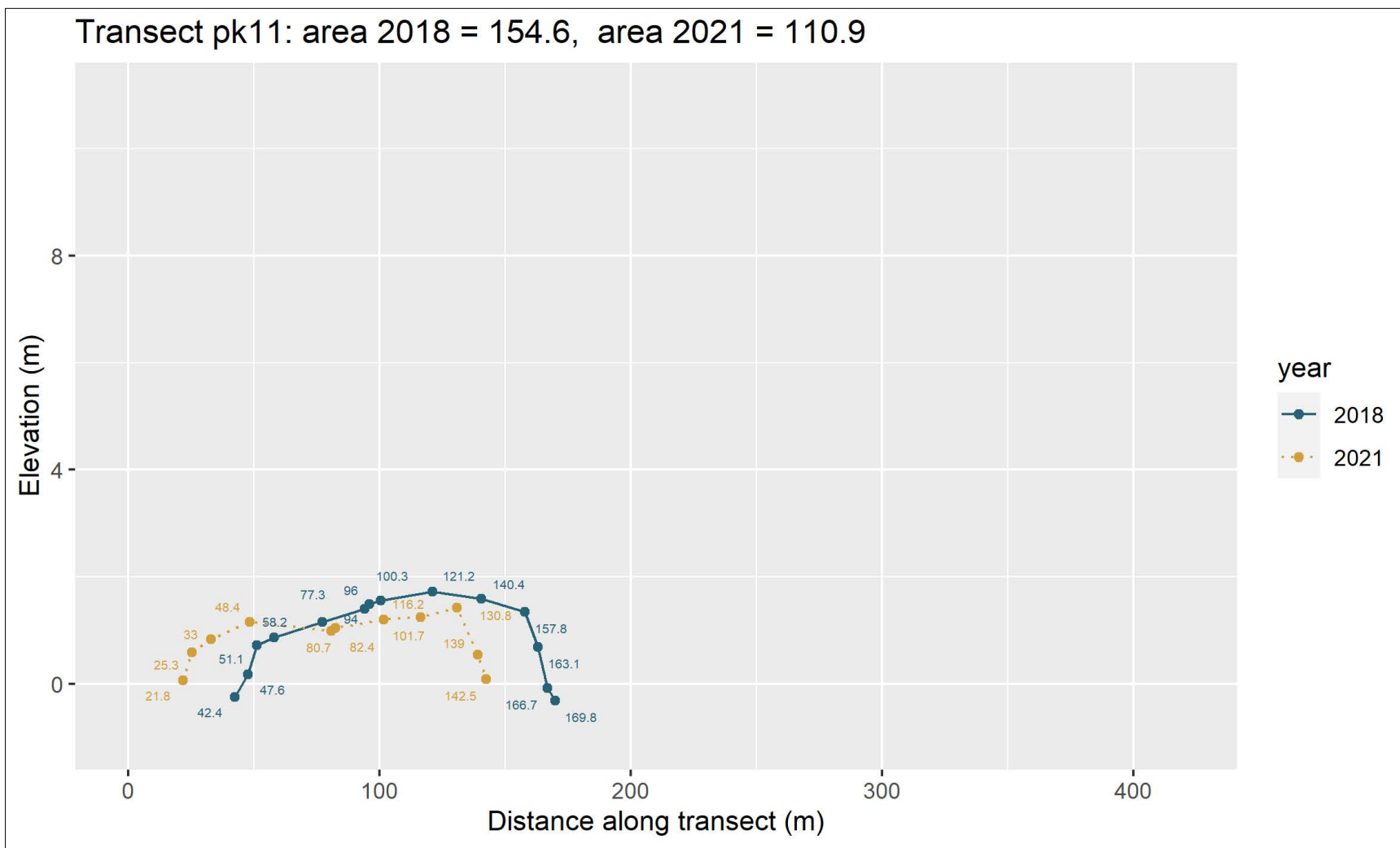


Figure A-11. Transect profile(s) for pk11 at Gulf Islands National Seashore.

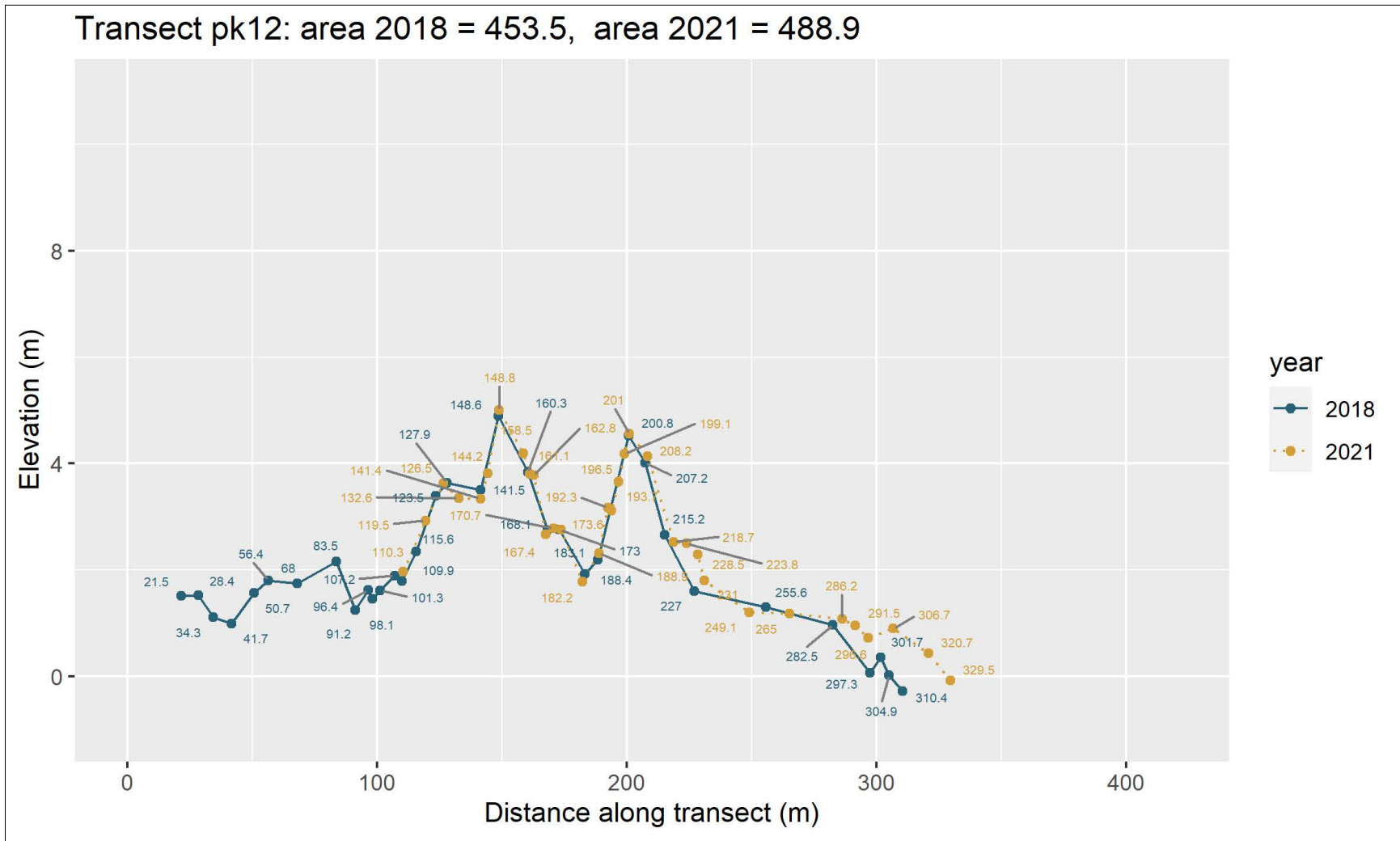


Figure A-12. Transect profile(s) for pk12 at Gulf Islands National Seashore.

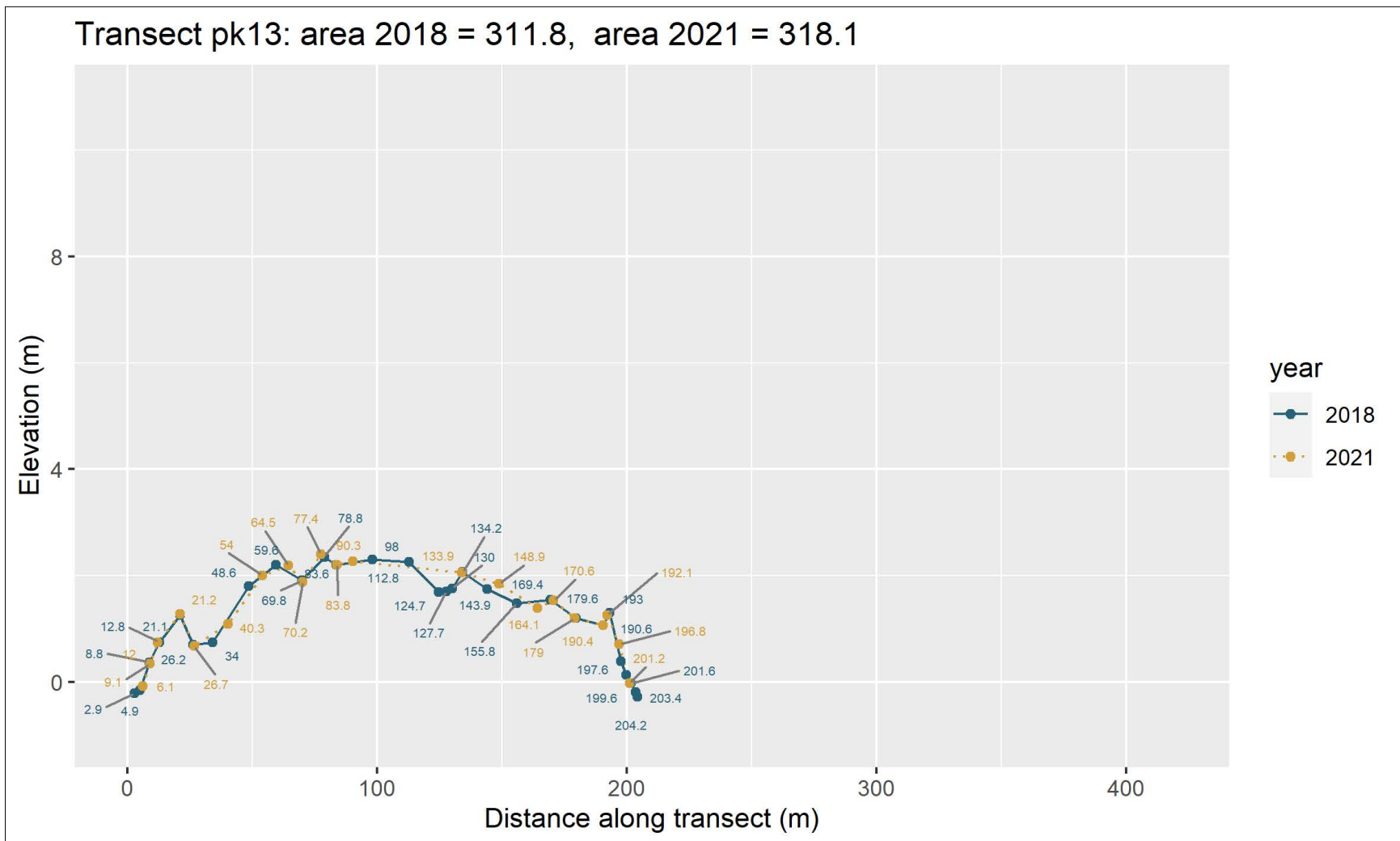


Figure A-13. Transect profile(s) for pk13 at Gulf Islands National Seashore.

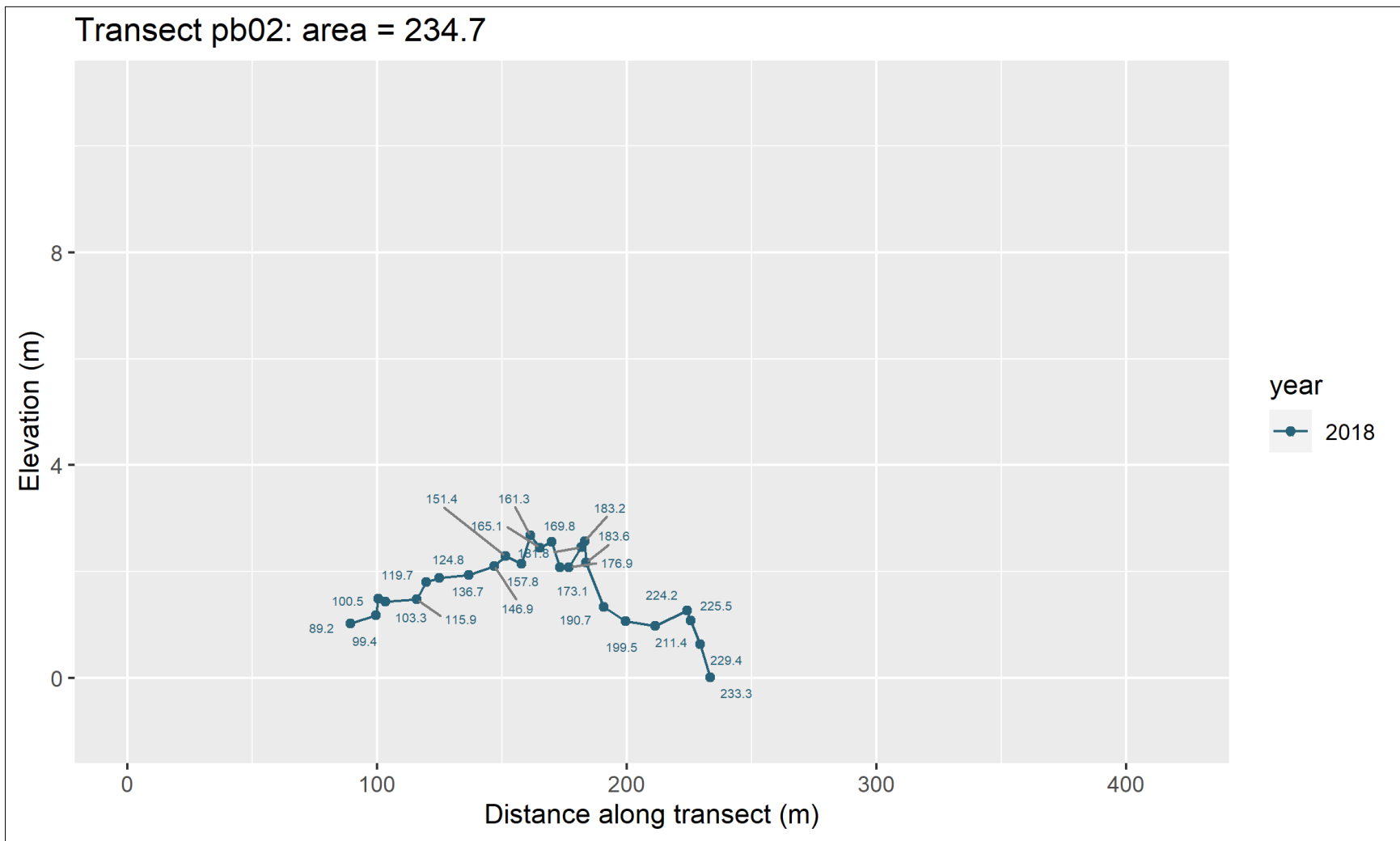


Figure A-14. Transect profile(s) for pb02 at Gulf Islands National Seashore.

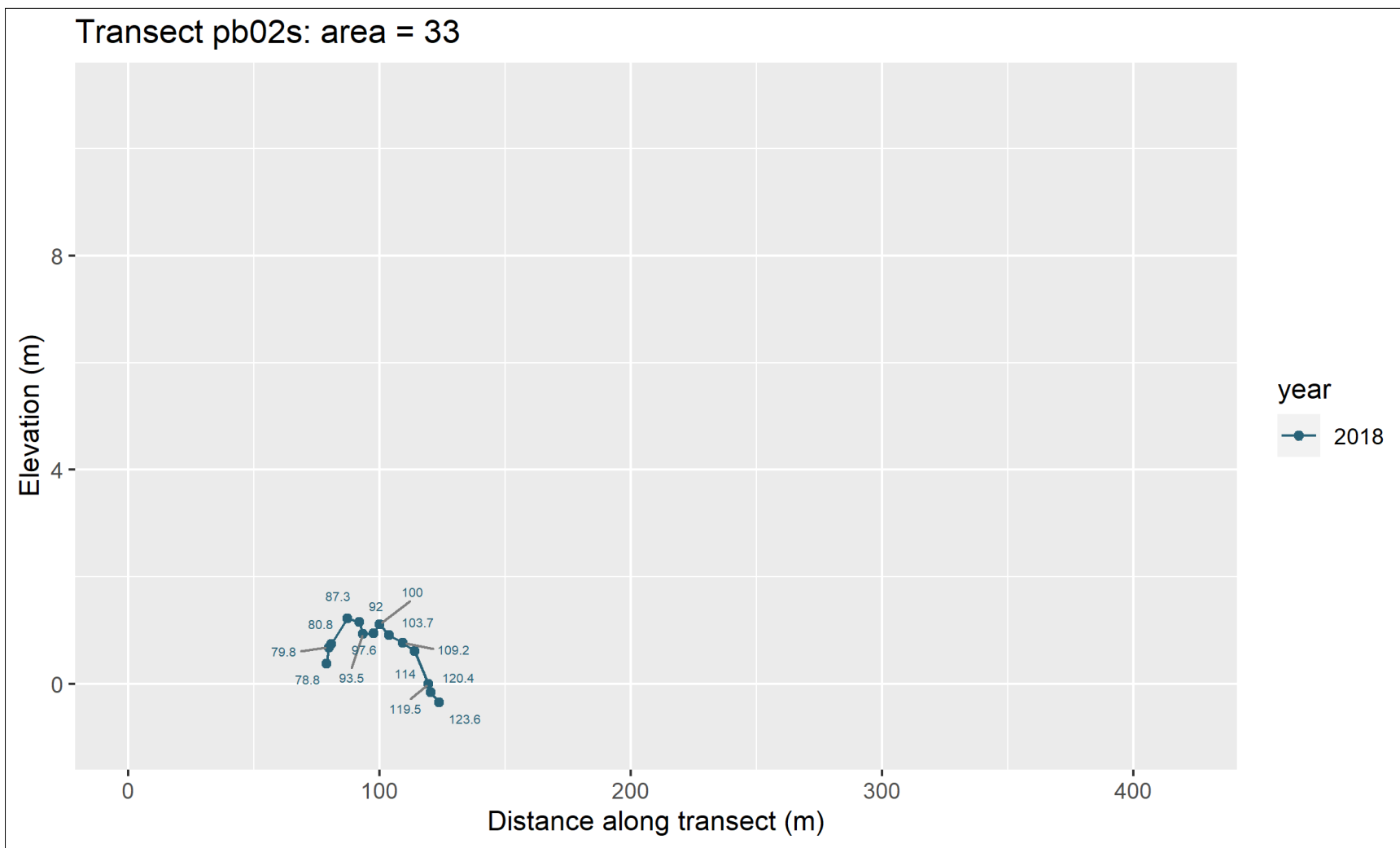


Figure A-15. Transect profile(s) for pb02s at Gulf Islands National Seashore.

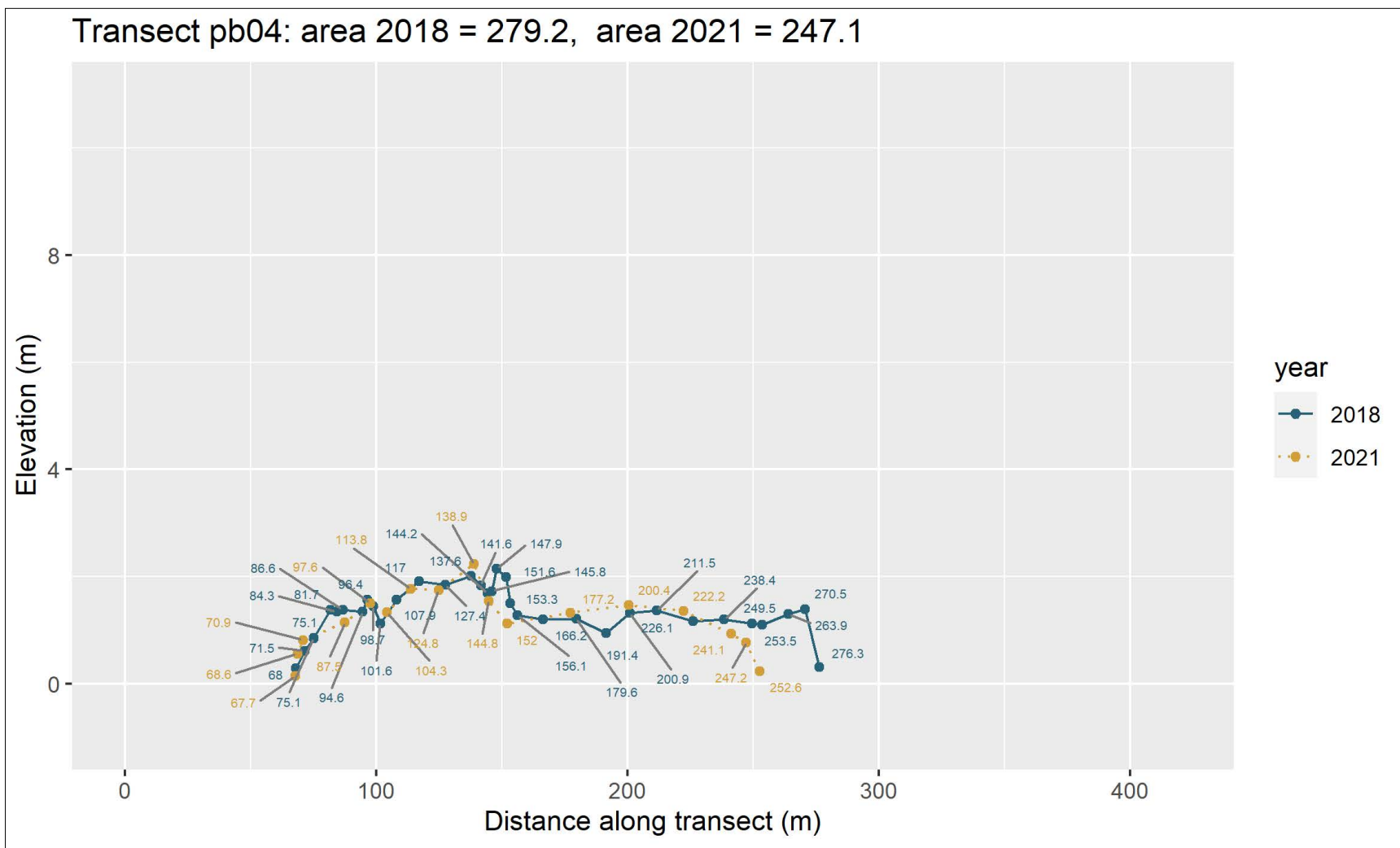


Figure A-16. Transect profile(s) for pb04 at Gulf Islands National Seashore.

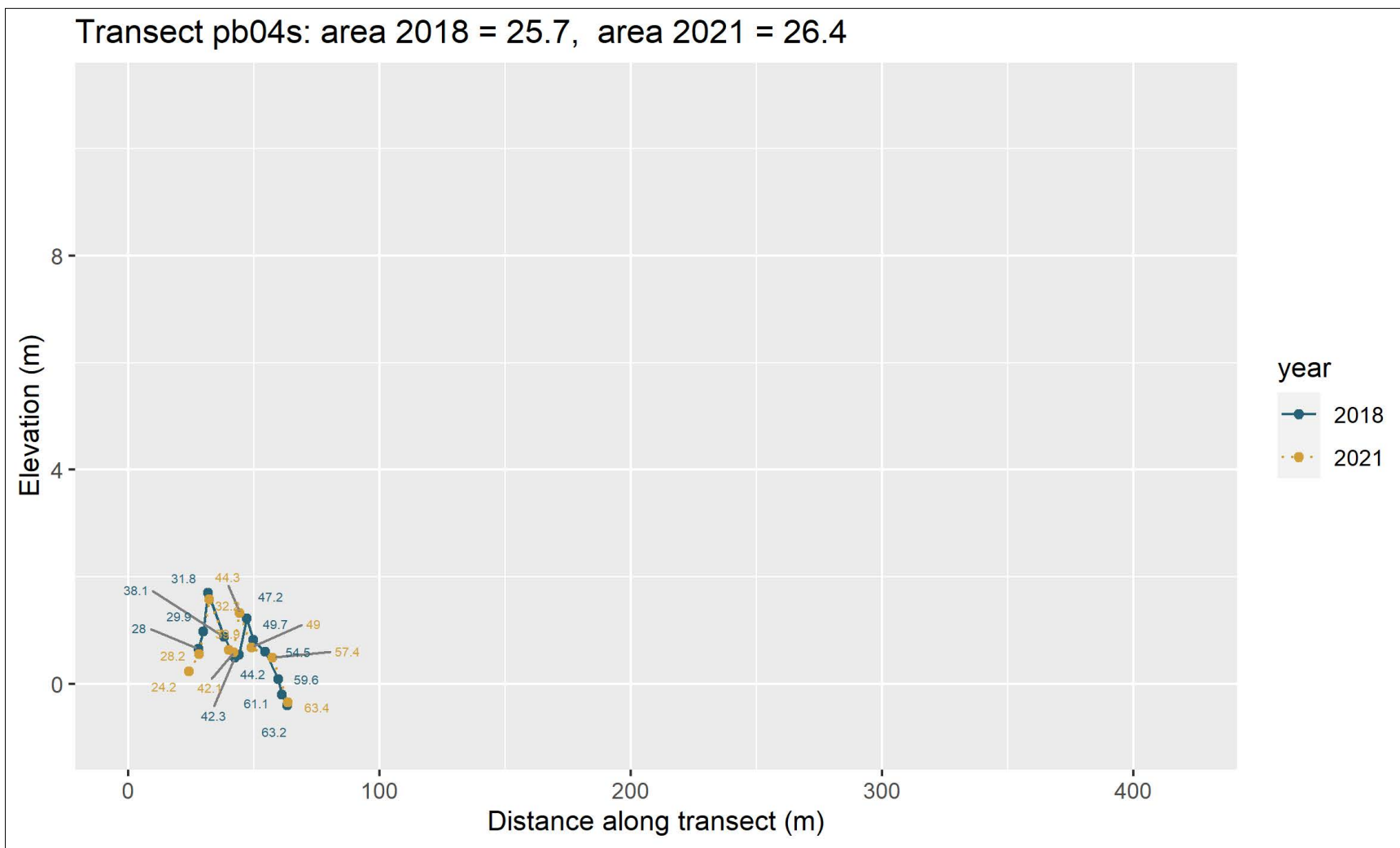


Figure A-17. Transect profile(s) for pb04s at Gulf Islands National Seashore.

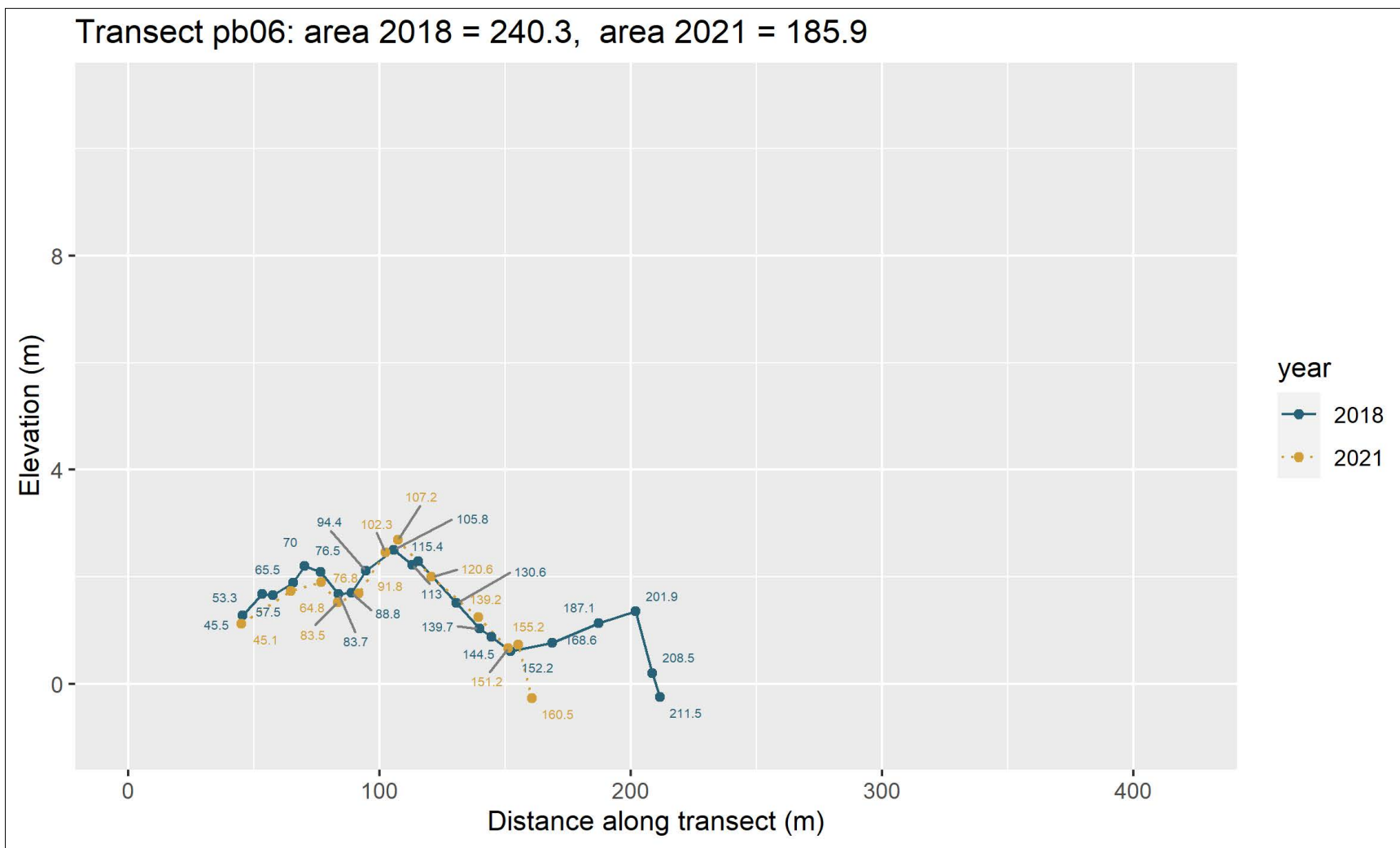


Figure A-18. Transect profile(s) for pb06 at Gulf Islands National Seashore.

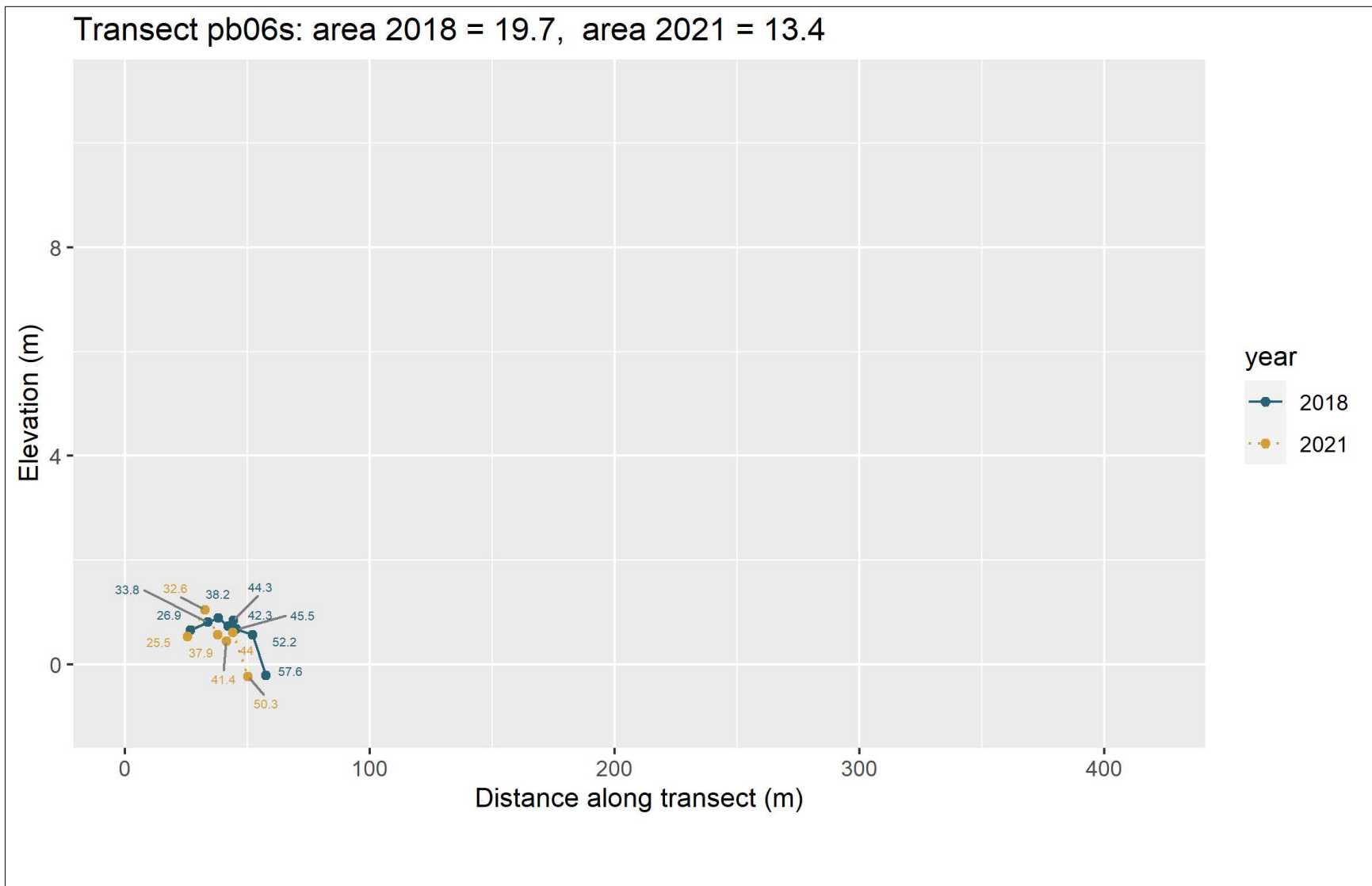


Figure A-19. Transect profile(s) for pb06s at Gulf Islands National Seashore.

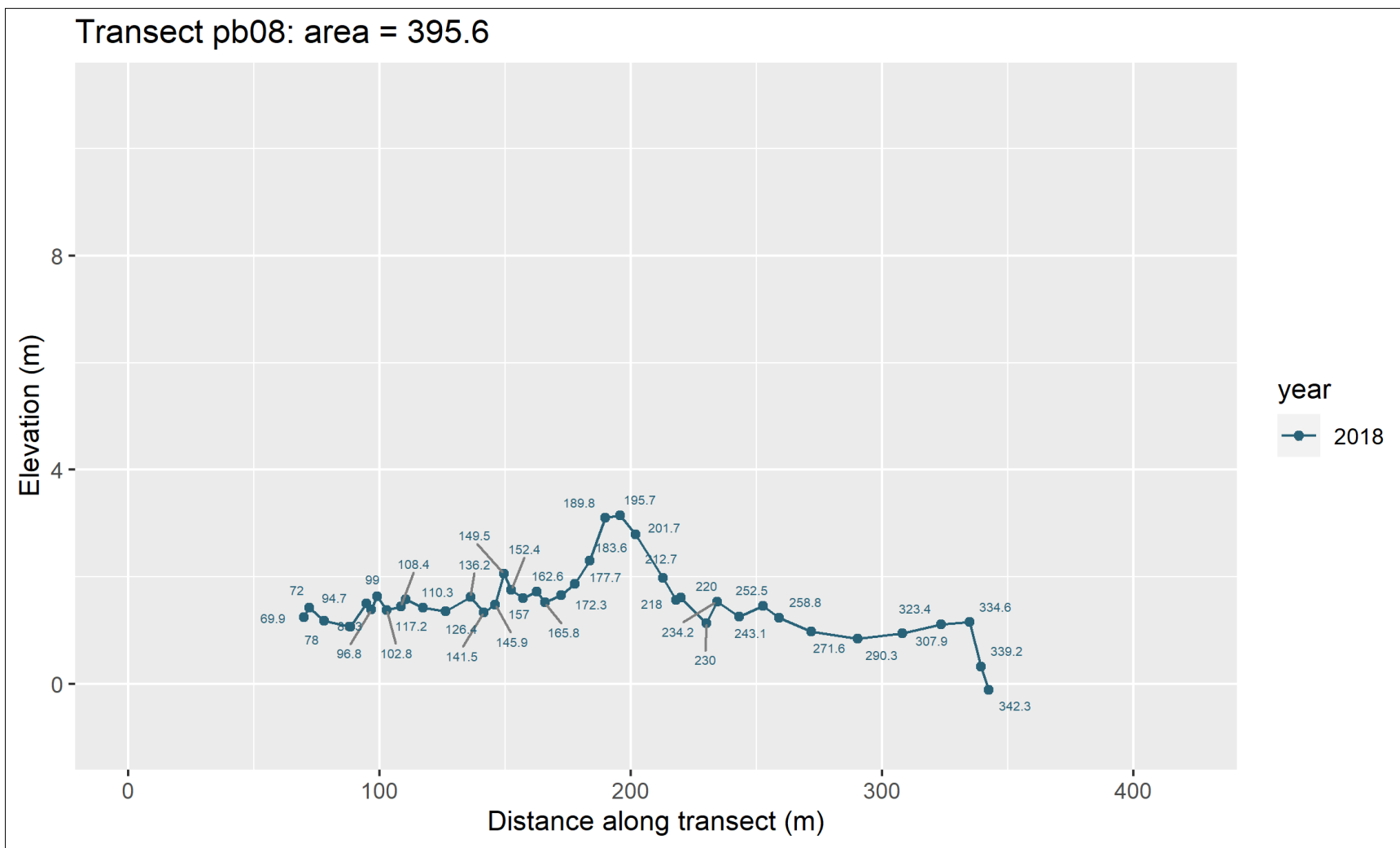


Figure A-20. Transect profile(s) for pb08 at Gulf Islands National Seashore.

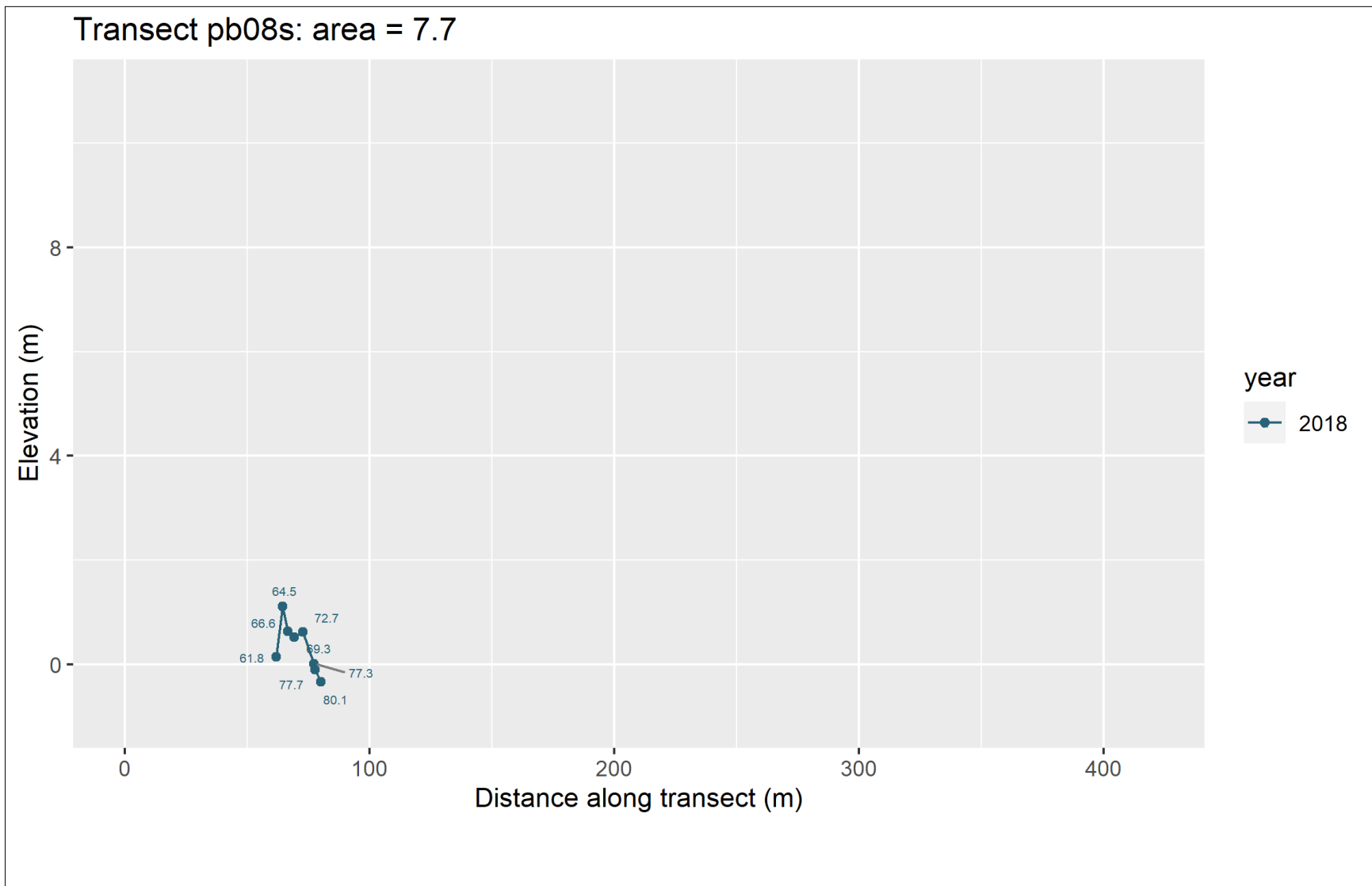


Figure A-21. Transect profile(s) for pb08s at Gulf Islands National Seashore.

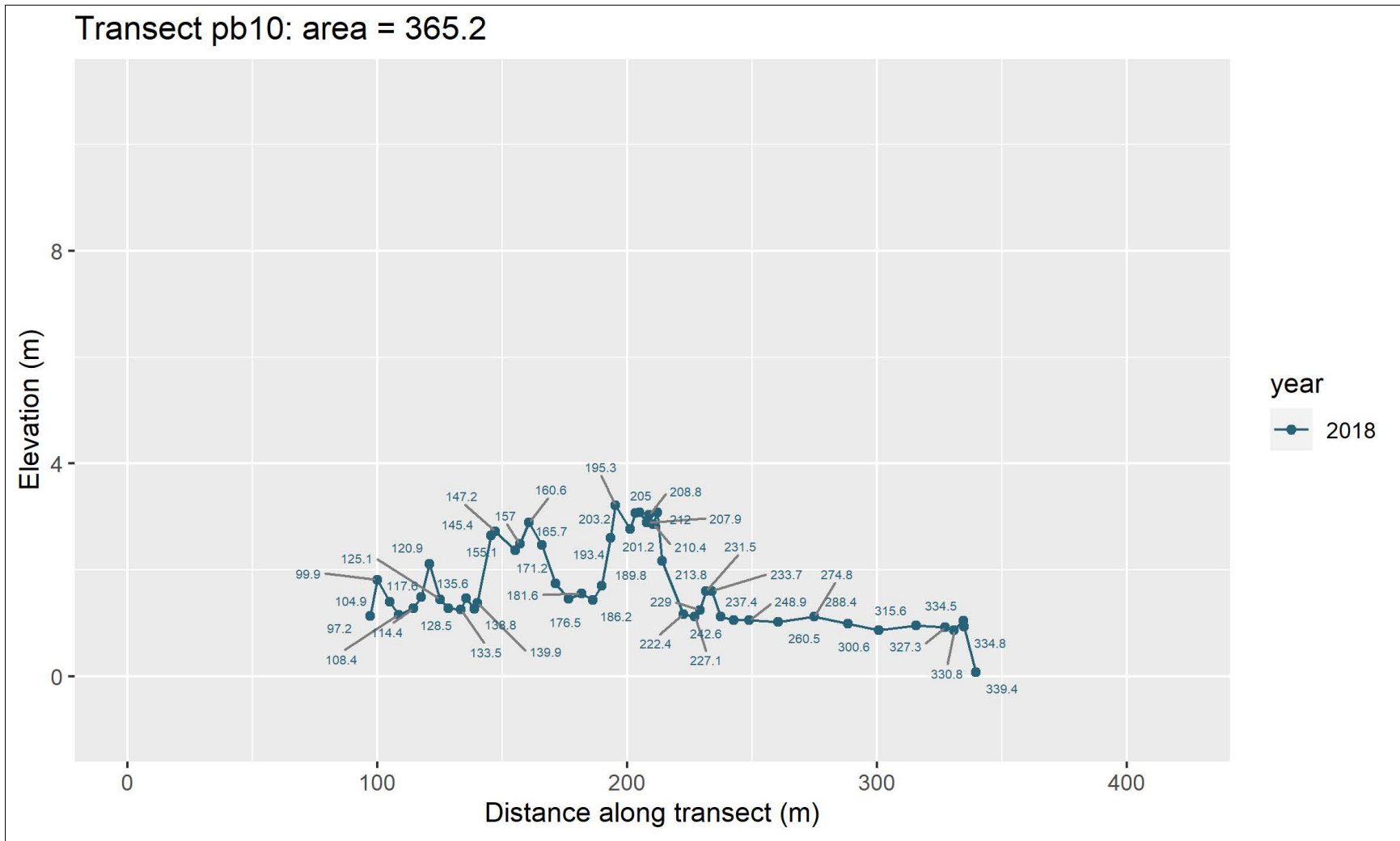


Figure A-22. Transect profile(s) for pb10 at Gulf Islands National Seashore.

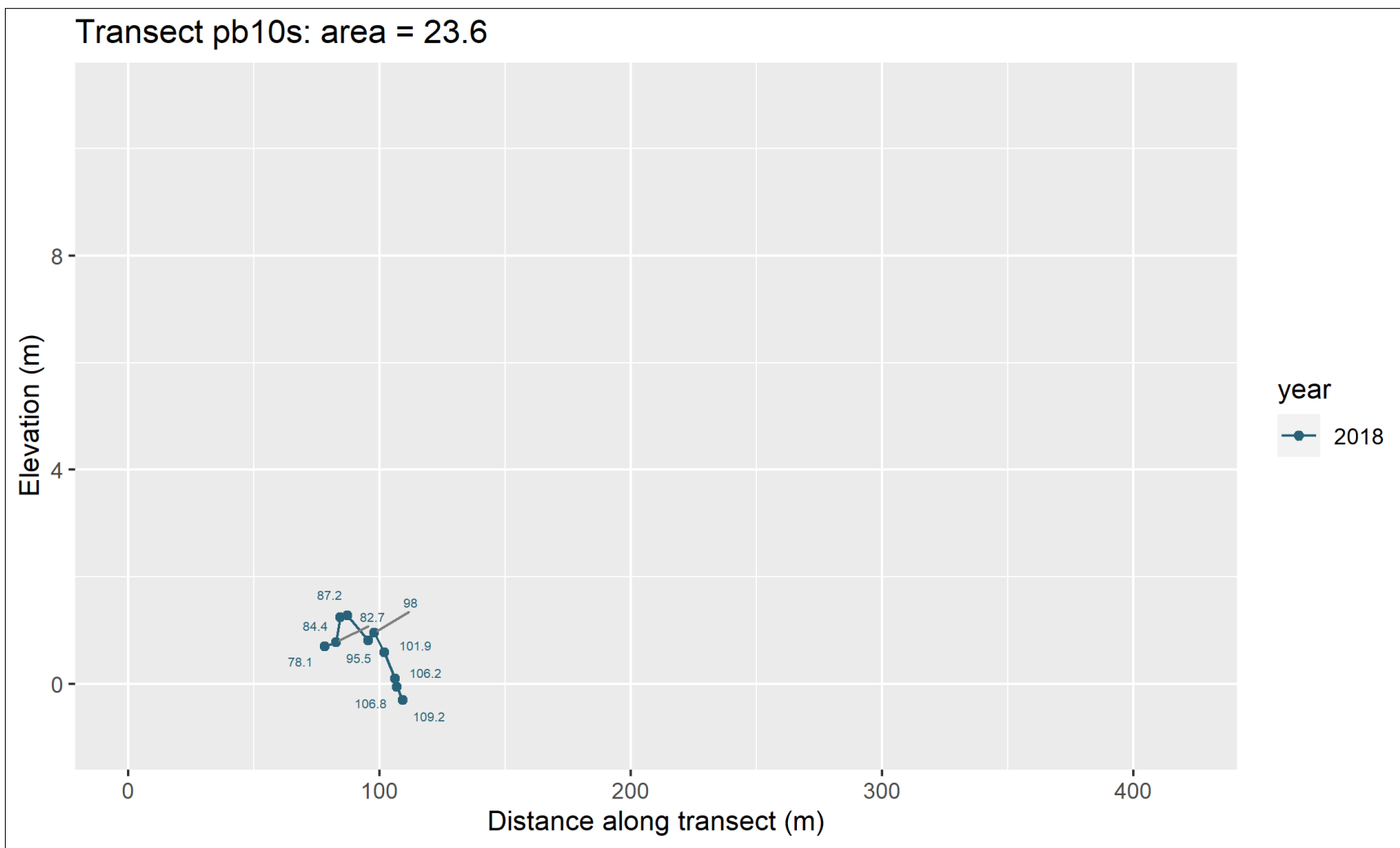


Figure A-23. Transect profile(s) for pb10s at Gulf Islands National Seashore.

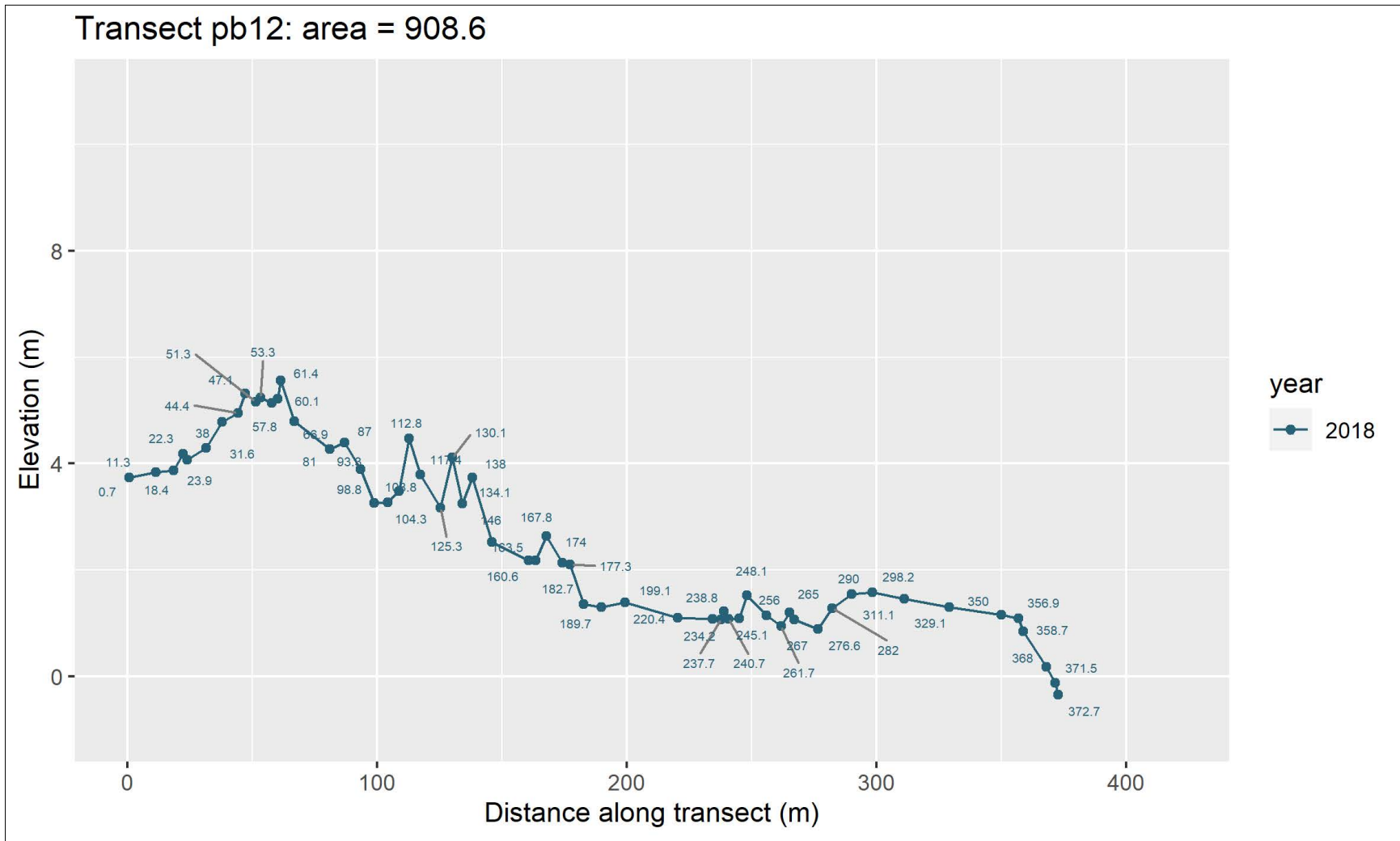


Figure A-24. Transect profile(s) for pb12 at Gulf Islands National Seashore.

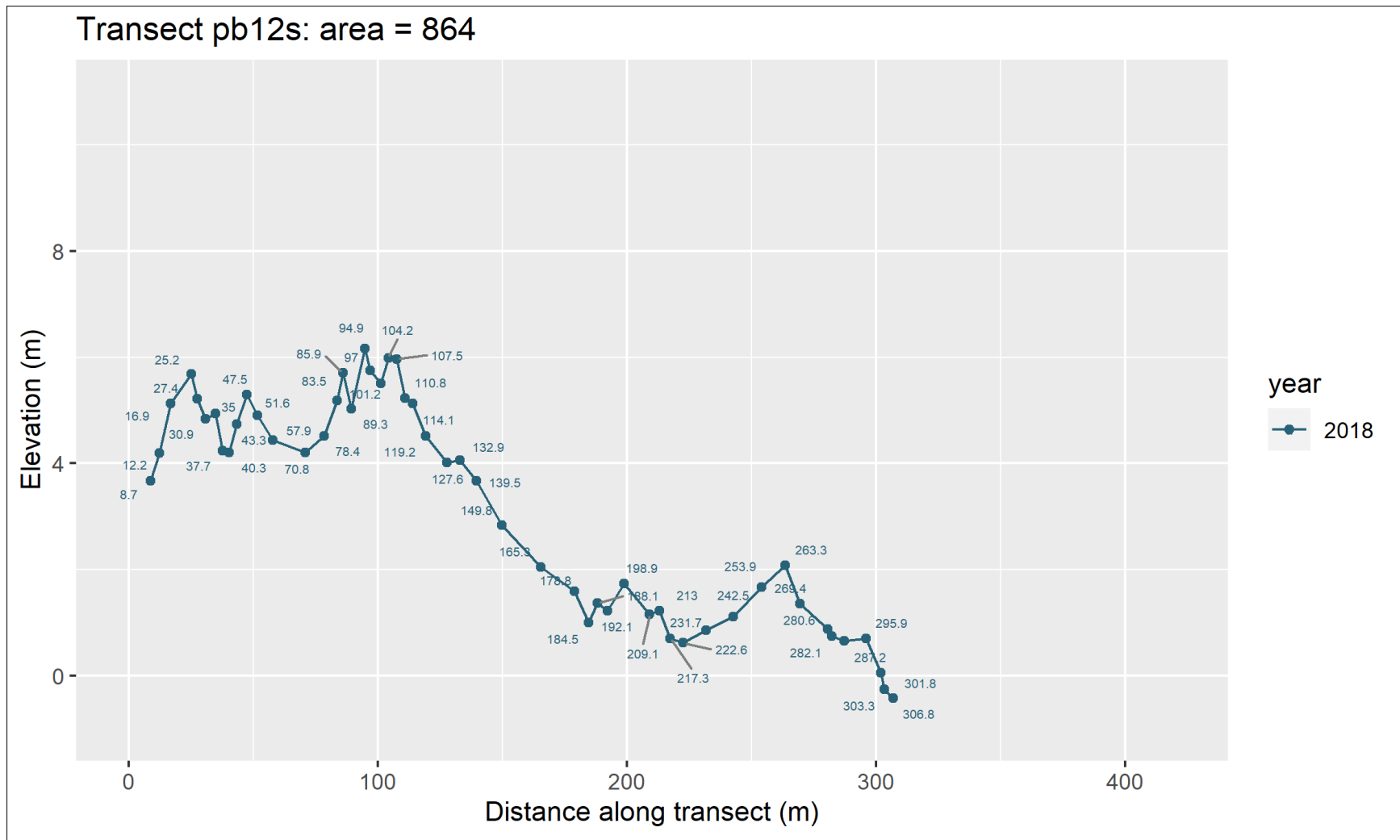


Figure A-25. Transect profile(s) for pb12s at Gulf Islands National Seashore.

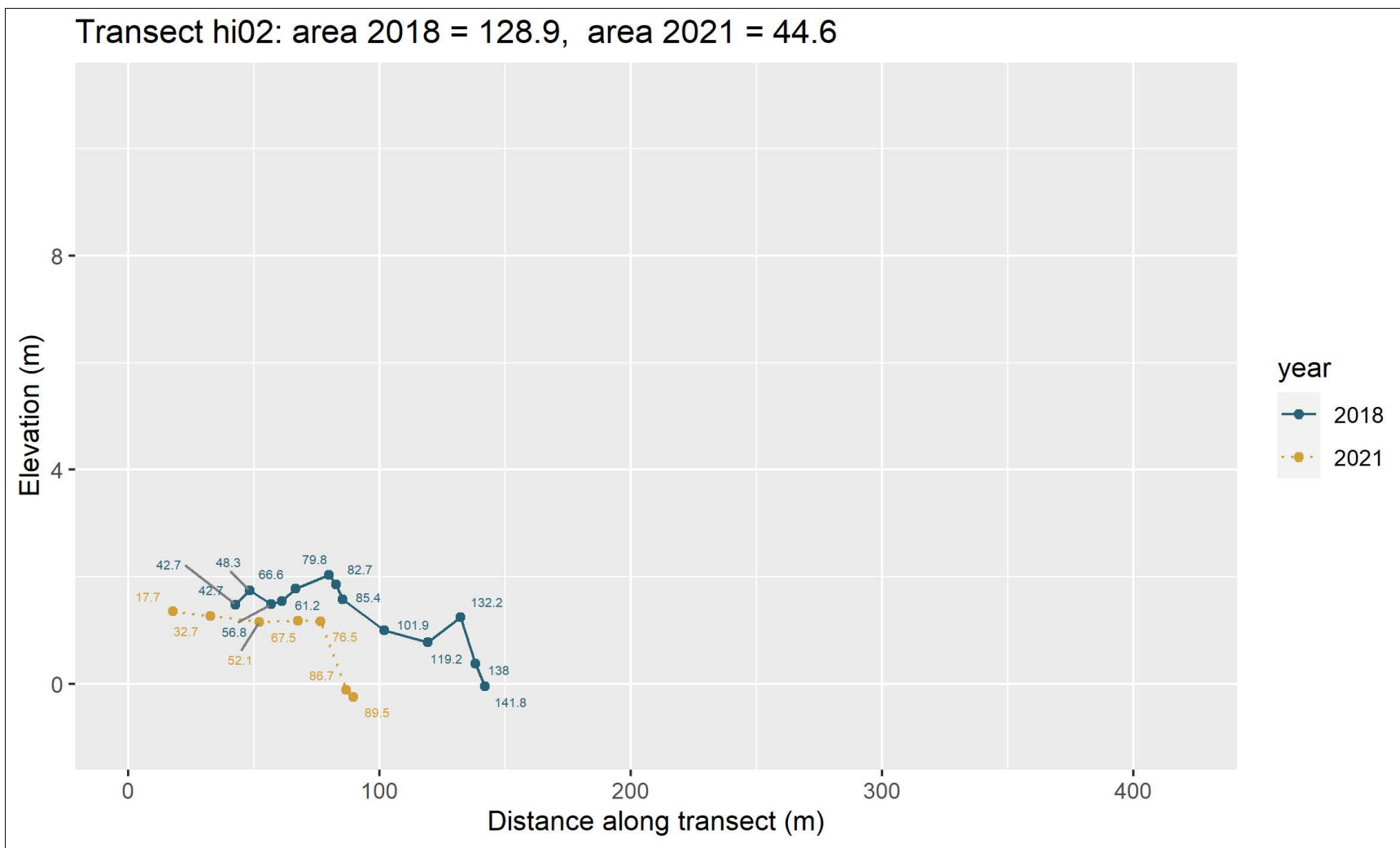


Figure A-26. Transect profile(s) for hi02 at Gulf Islands National Seashore.

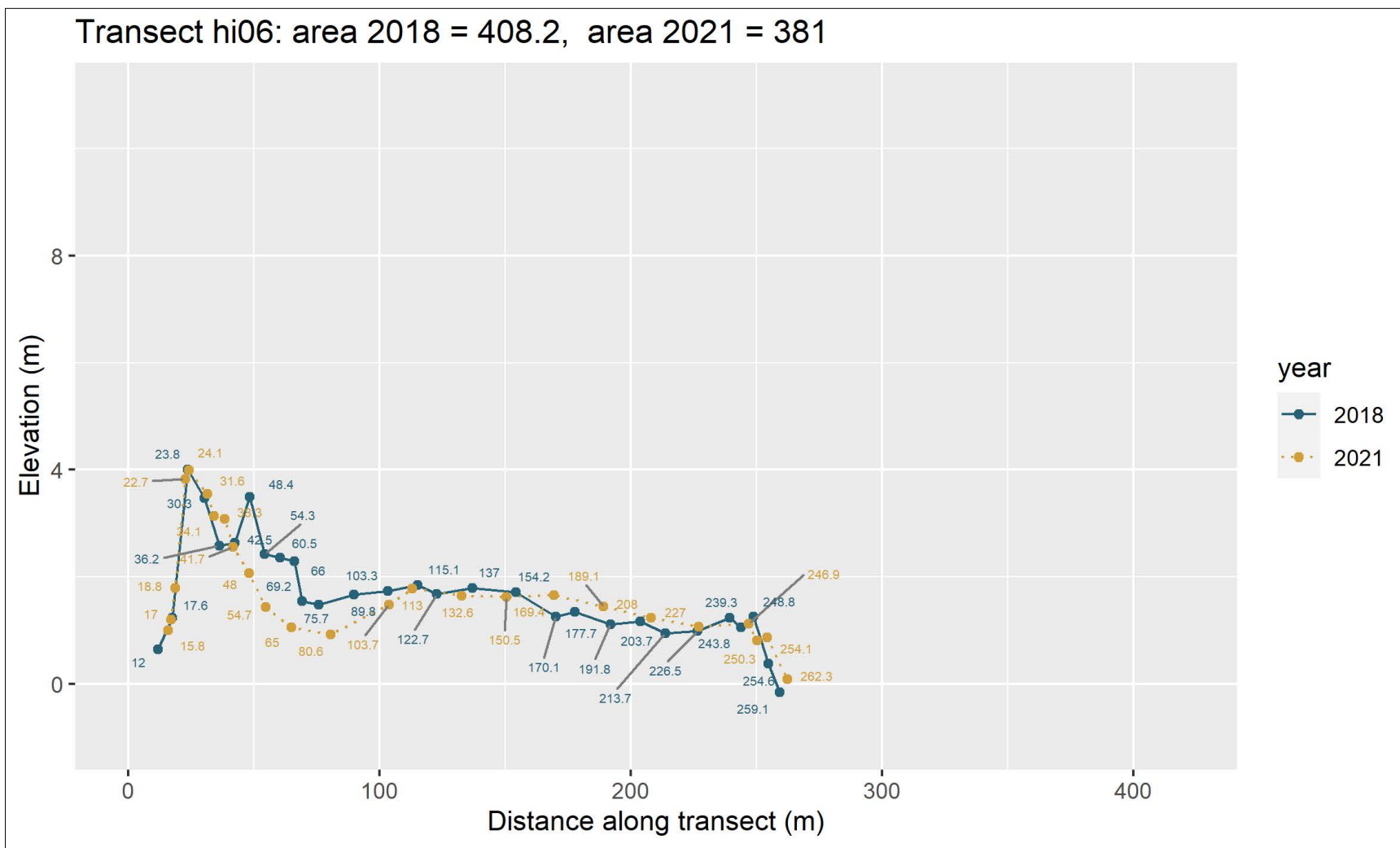


Figure A-27. Transect profile(s) for hi06 at Gulf Islands National Seashore.

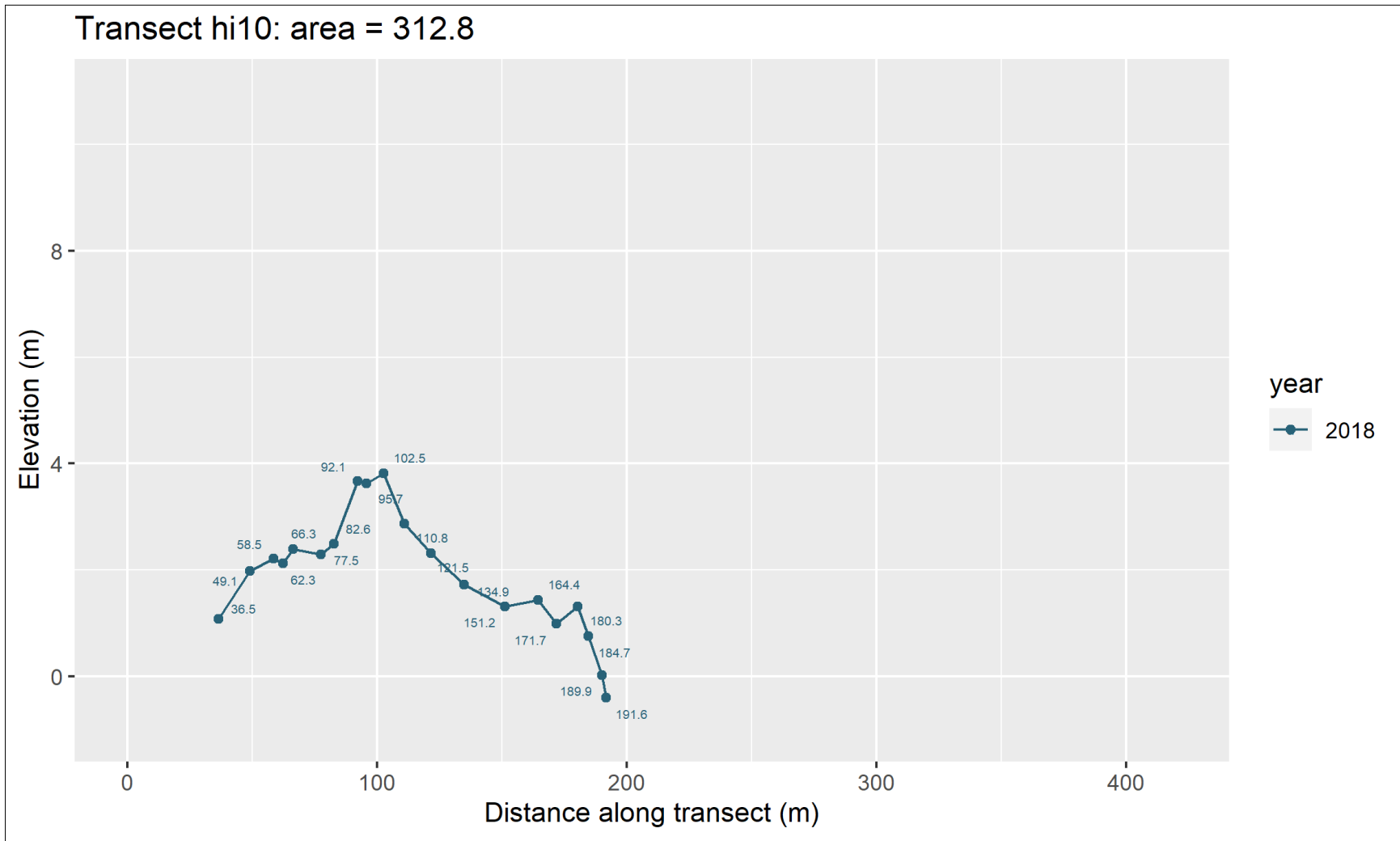


Figure A-28. Transect profile(s) for hi10 at Gulf Islands National Seashore.

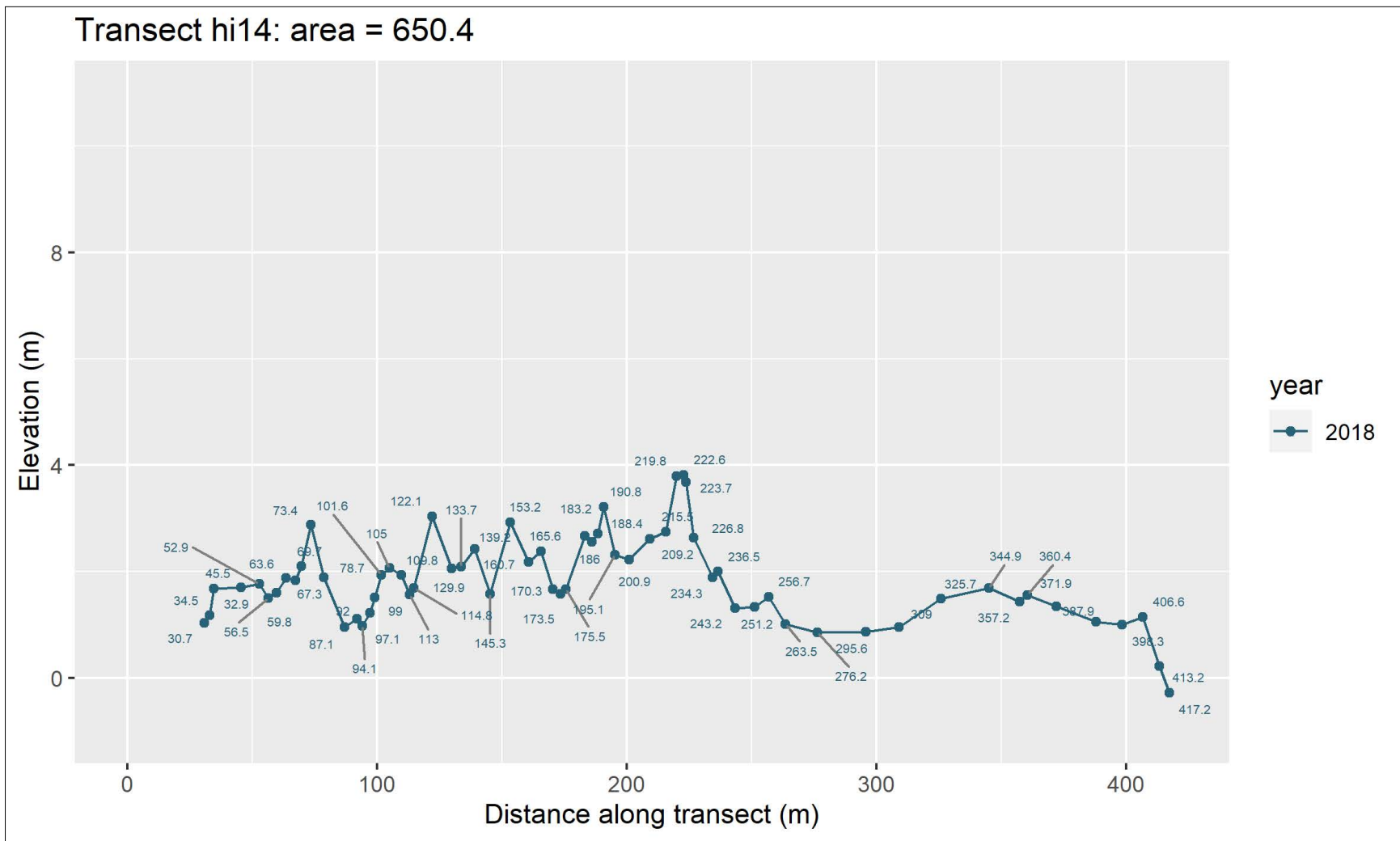


Figure A-29. Transect profile(s) for hi14 at Gulf Islands National Seashore.

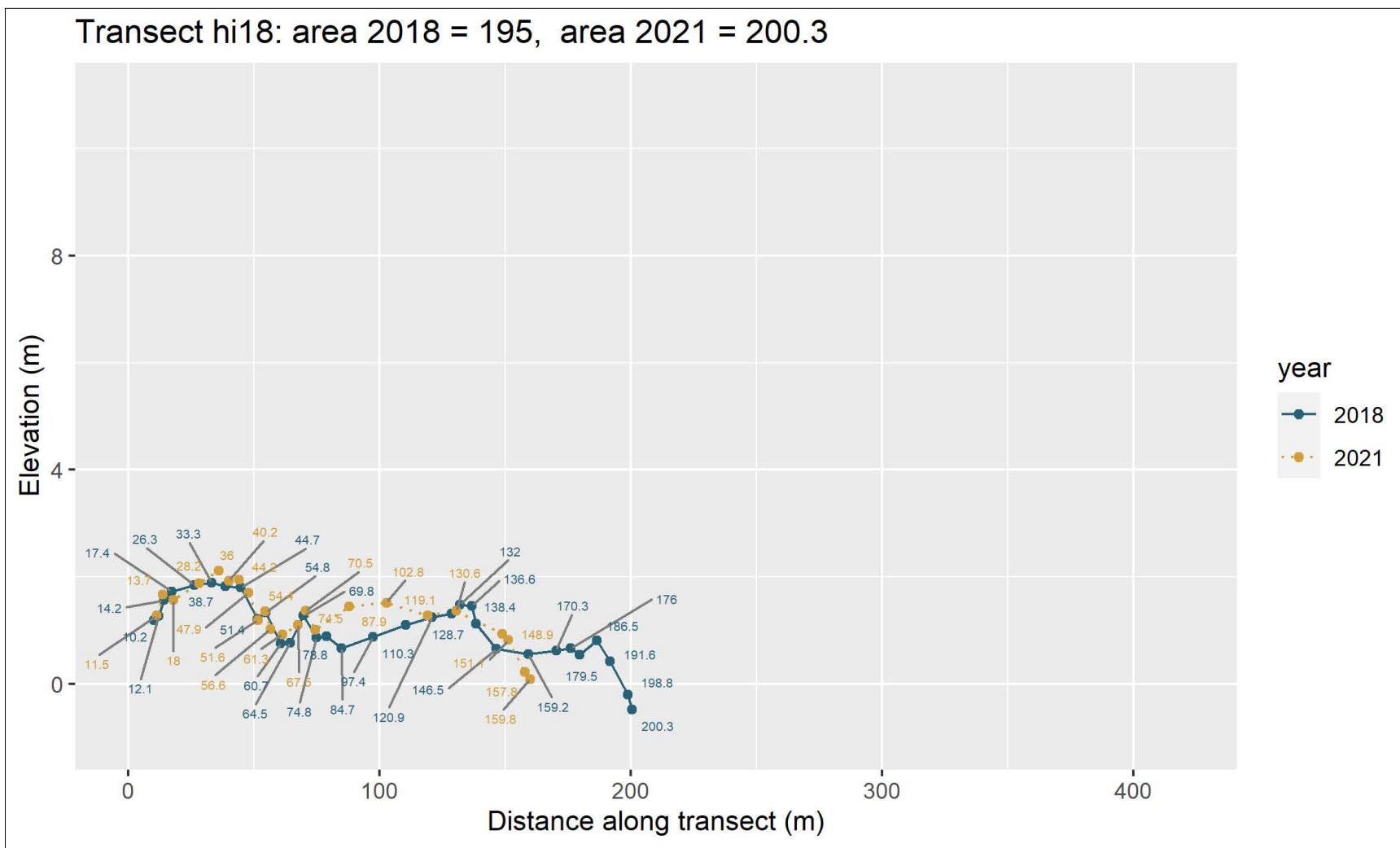


Figure A-30. Transect profile(s) for hi18 at Gulf Islands National Seashore.

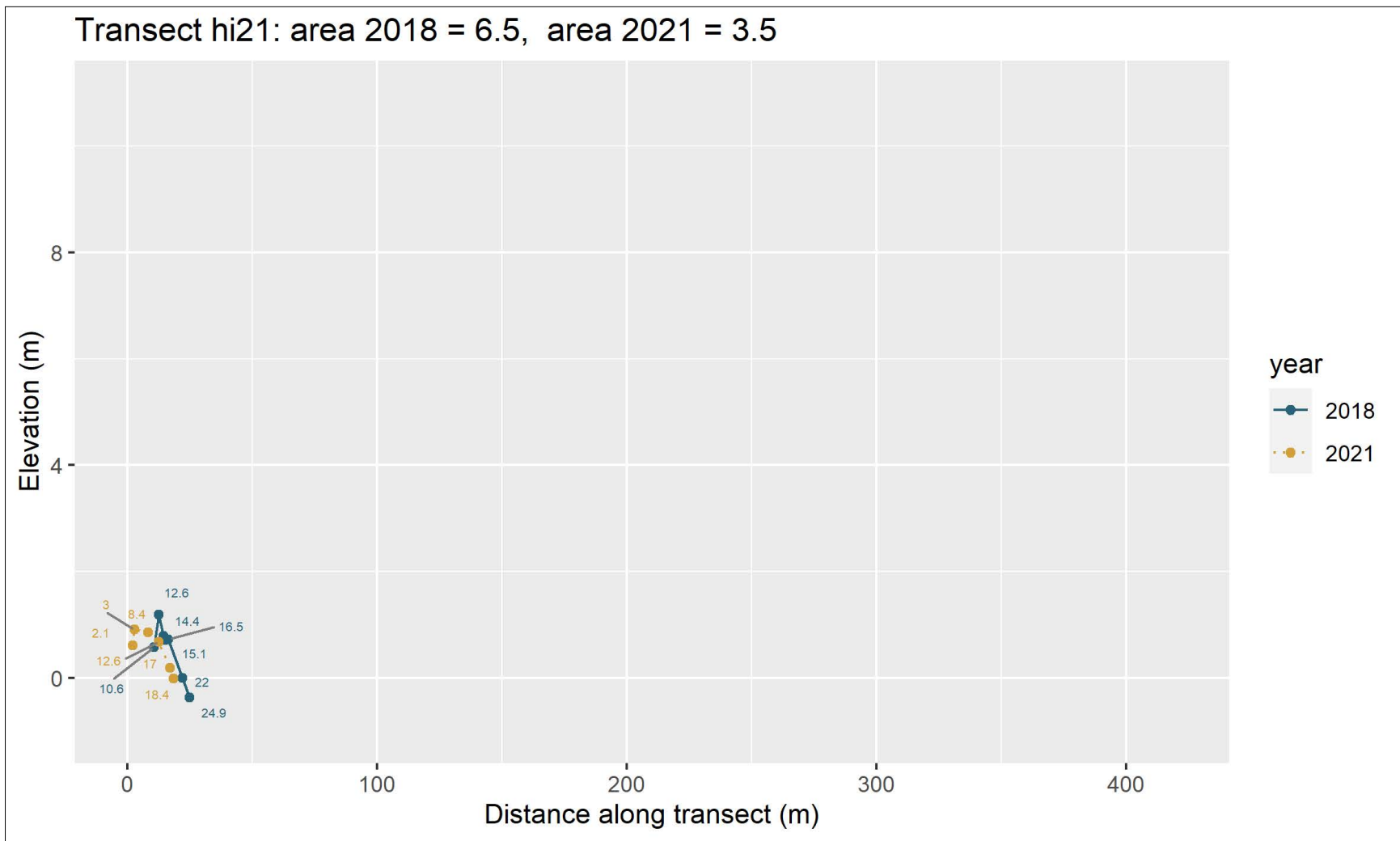


Figure A-31. Transect profile(s) for hi21 at Gulf Islands National Seashore.

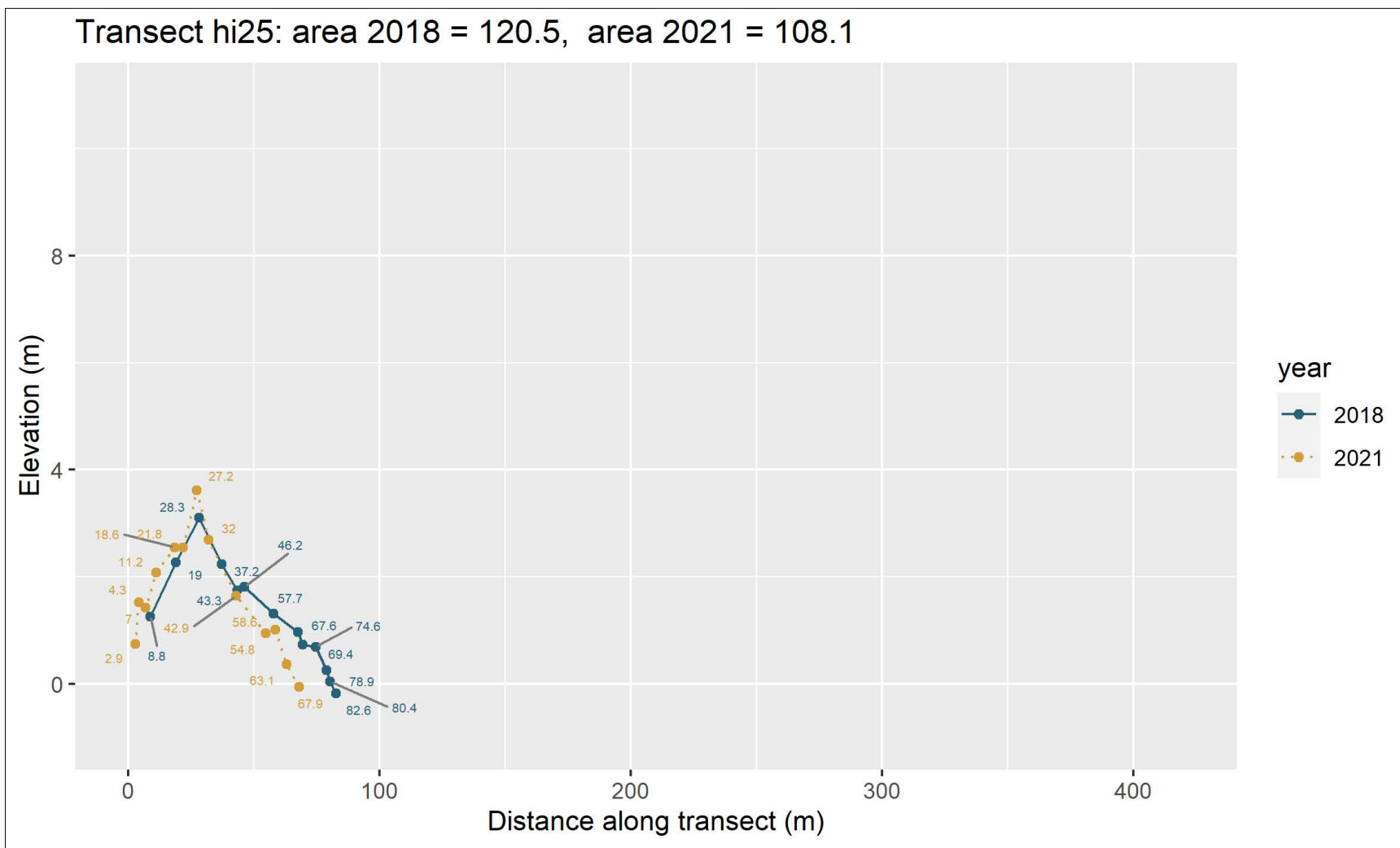


Figure A-32. Transect profile(s) for hi25 at Gulf Islands National Seashore.

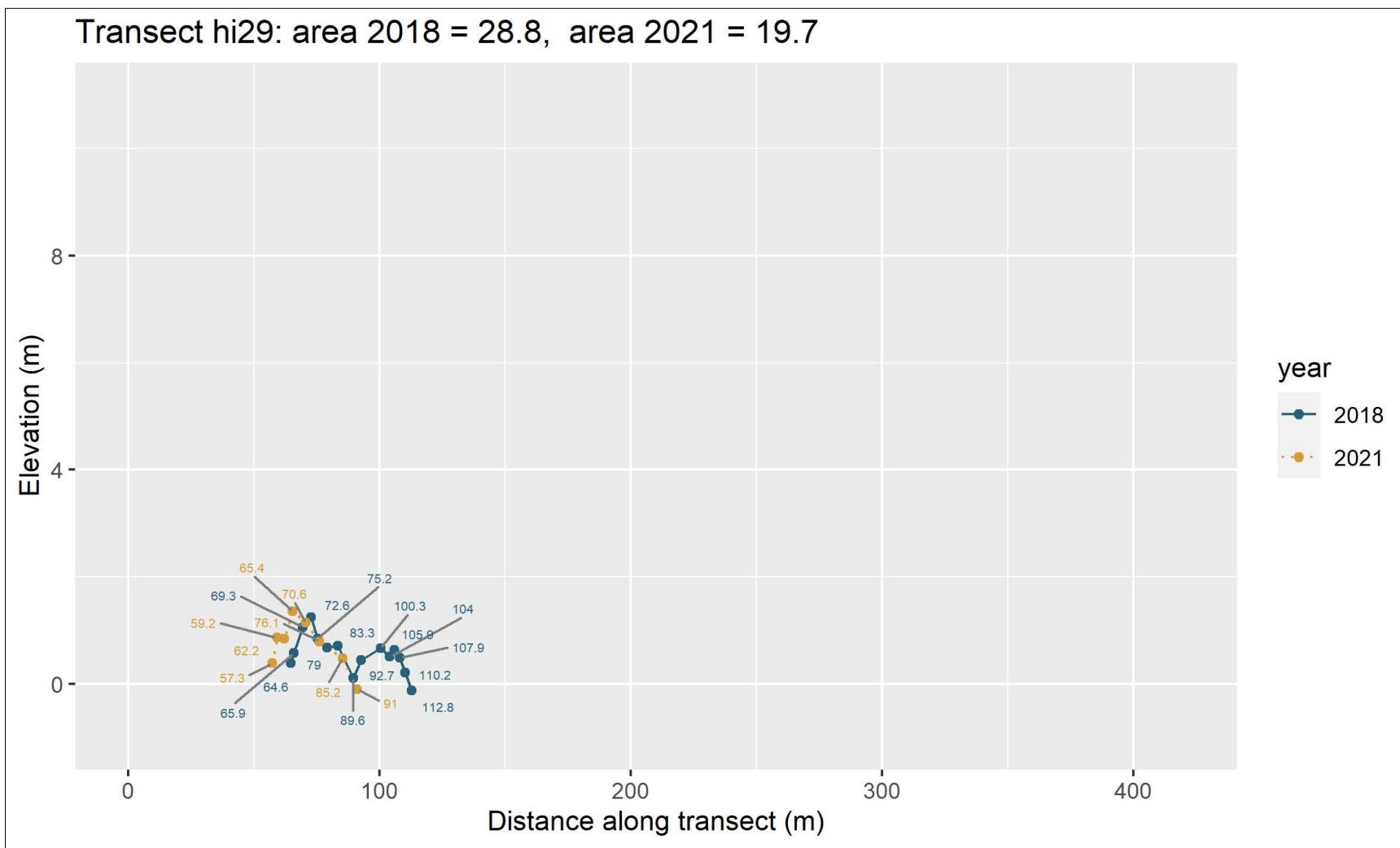


Figure A-33. Transect profile(s) for hi29 at Gulf Islands National Seashore.

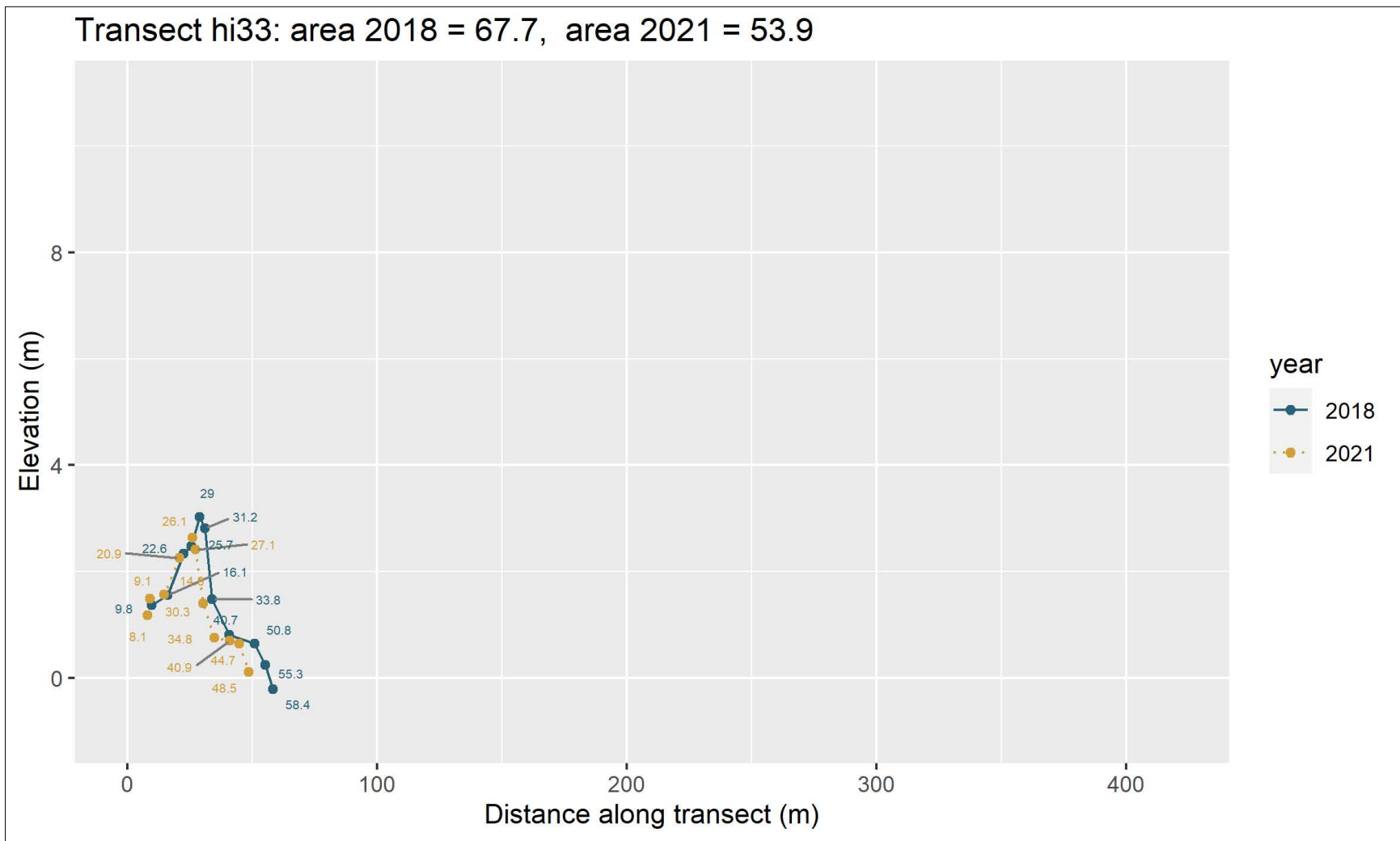


Figure A-34. Transect profile(s) for hi33 at Gulf Islands National Seashore.

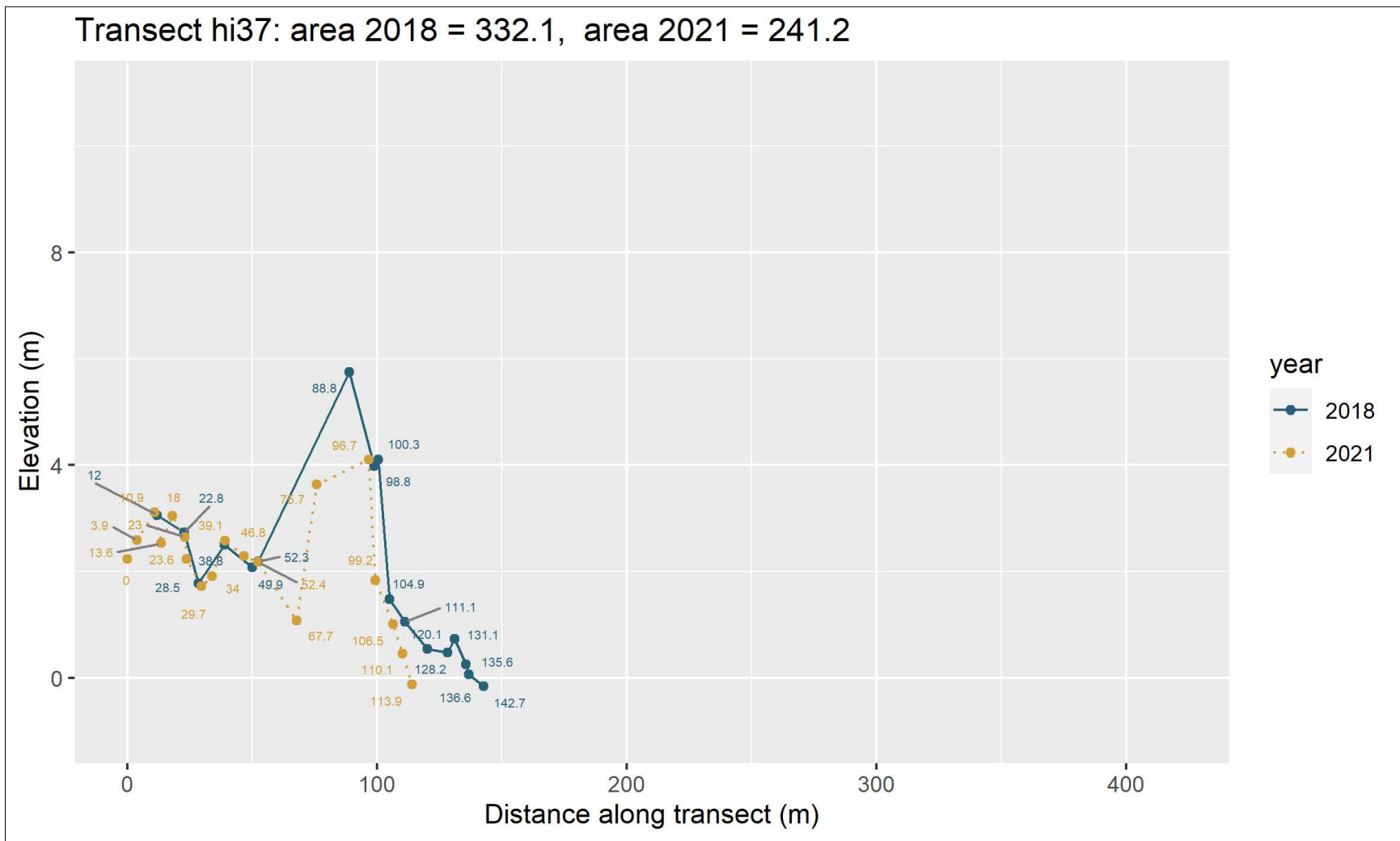


Figure A-35. Transect profile(s) for hi37 at Gulf Islands National Seashore.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

National Park Service
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Natural Resource Stewardship and Science

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