State of Maine's Beaches in 2013

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Open-File No. 13-18

2013

Financial assistance to initiate this program was provided by the National Oceanic and Atmospheric Administration's Maine Sea Grant Program through a pilot grant *Co-management of Maine's Beaches through Volunteer Monitoring by Homeowners, Technical Evaluation by Scientists, and Annual State-of-Maine's-Beaches Meetings* to J. T. Kelley, S. M. Dickson, and D. F. Belknap from January 1999 - December 2000.

A publication of the Maine Geological Survey for the Maine Coastal Program in the Maine Department of Agriculture, Conservation and Forestry, pursuant to National Oceanic and Atmospheric Administration Award No. NA12NOS4190084.

This analysis was supported in part by the financial assistance provided by the Coastal Zone Management Act of 1972, as amended, administered by the Office of Ocean and Coastal Resources Management, National Oceanic and Atmospheric Administration.

Cover photo by Mark Sladen, Kinney Shores, Saco, Maine.

Acknowledgments

We would like to take this opportunity to thank all the profile volunteers involved in this project. This report would be impossible without your efforts. The scientific understanding of the state of our beaches would be lessened without your diligent and sometimes heroic data collection throughout the year. We thank all of the groups and municipalities that, with Maine Sea Grant and the Maine Coastal Program, have jointly funded the program in the last three years. We greatly appreciate the collaborative efforts of the Maine Sea Grant Program and Wells Estuarine Research Reserve that have coordinated profiling teams, conducted education and outreach programs, provided quality control on the data, and provided the Shore Stewards web site and database. We thank you all for a superb team effort - you have made this report possible.

Contents

Introduction 1
Spatial and Temporal Extent of Data for the 2013 Report: Beach Profile Data 1
Spatial and Temporal Extent of Data for the 2013 Report: MBMAP Data 4

Setting the Stage: Winter Storm Events 5
Winter of 2010-2011 5
Winter of 2011-2012 6
Winter of 2012-2013 6

Review of Beach Responses 9
Willard Beach, South Portland 10
Higgins Beach, Scarborough 11
Scarborough Beach, Scarborough 17
East Grand Beach, Scarborough 24
Kinney Shores, Saco 31
Ferry Beach, Saco 35
Goose Rocks Beach, Kennebunkport 44
Goochs Beach, Kennebunk 51
Laudholm Beach, Wells 57
Wells Beach, Wells 64
Ogunquit Beach, Ogunquit 71
Long Sands Beach, York 74

Beach Grading Summary and Discussion 78
Overview of the Grading System 78
2013 Report Results 78
Comparison with Previous Maine Beaches Reports 79

Discussion of the Maine Beach Mapping Program Results 81

Conclusion 82

References 83

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Introduction

The 2013 State of Maine's Beaches Report is the 4th report in a consecutive series of reports coinciding with the Maine Beaches Conference from 2007, 2009, and 2011. The purpose of the report is to summarize major observed morphologic characteristics and changes of Maine beaches that are monitored as part of the State of Maine Beach Profiling Project (SMBPP, Maine Sea Grant Extension, 2003). The SMBPP utilizes trained volunteers to collect monthly beach profiles which start at a known point or benchmark (usually in the frontal dune or in a seawall) and continue shore-perpendicular to roughly the low water line. Fixed starting locations are used with the Emery Method of beach profiling (Emery, 1961). Data collected is entered by volunteers into an online database, where it is accessible for outside researchers (Maine Shore Stewards, 2007). The SMBPP is funded and managed by combined efforts of the Maine Geological Survey, University of Maine, Maine Sea Grant, and Maine Coastal Program.

This report will build upon the last assessment, which reviewed the changes that occurred through 2010. This report will document additional changes at beaches from 2010 through 2013, during the winter and summer seasons, at each location.

Spatial and Temporal Extent of Data for 2013 Report: Beach Profile Data

The locations of beaches involved in the program as of June 2013 are shown in Figure 1. Generally, there are 2-4 profiling locations along each beach.

Along each collected profile, topographic (elevation) points are generally collected at approximately 3-meter (10-foot) intervals, from the starting point (usually a stake in the dune crest or mark on a seawall) seaward to the low-water line using the Emery Method of profiling.

This report will compare profile data starting in 2010 with profile data from the subsequent closest months from 2010 to 2013, as available. The report will also analyze the changes of the "summer" beach shape from 2010 through the summer of 2012, in order to investigate whether or not the typical recreational beach – usually defined by a wider, sand rich beach profile, was able to recover each year. Summer beach shapes are typically fully developed by August or September, after a season of gentle waves and accretion. Because we have not reached summer shapes for 2013 yet, that data is not being included. Summer beach profiles that were used for this analysis are shown in Table 1. Late spring is typically when the beach profile shape is lean, with little sand on the upper portion of the beach after a season of winter storms. Spring beach profiles that were used for this analysis go through 2013, and are also shown in Table 1.

Locations where profiling has ceased (Fortunes Rocks Beach, Drakes Island Beach), has not been submitted (Willard Beach), or has just been started this past winter (Western/Ferry Beach in Scarborough) have not been included in this report. *New profiling teams are needed at some of these locations!*

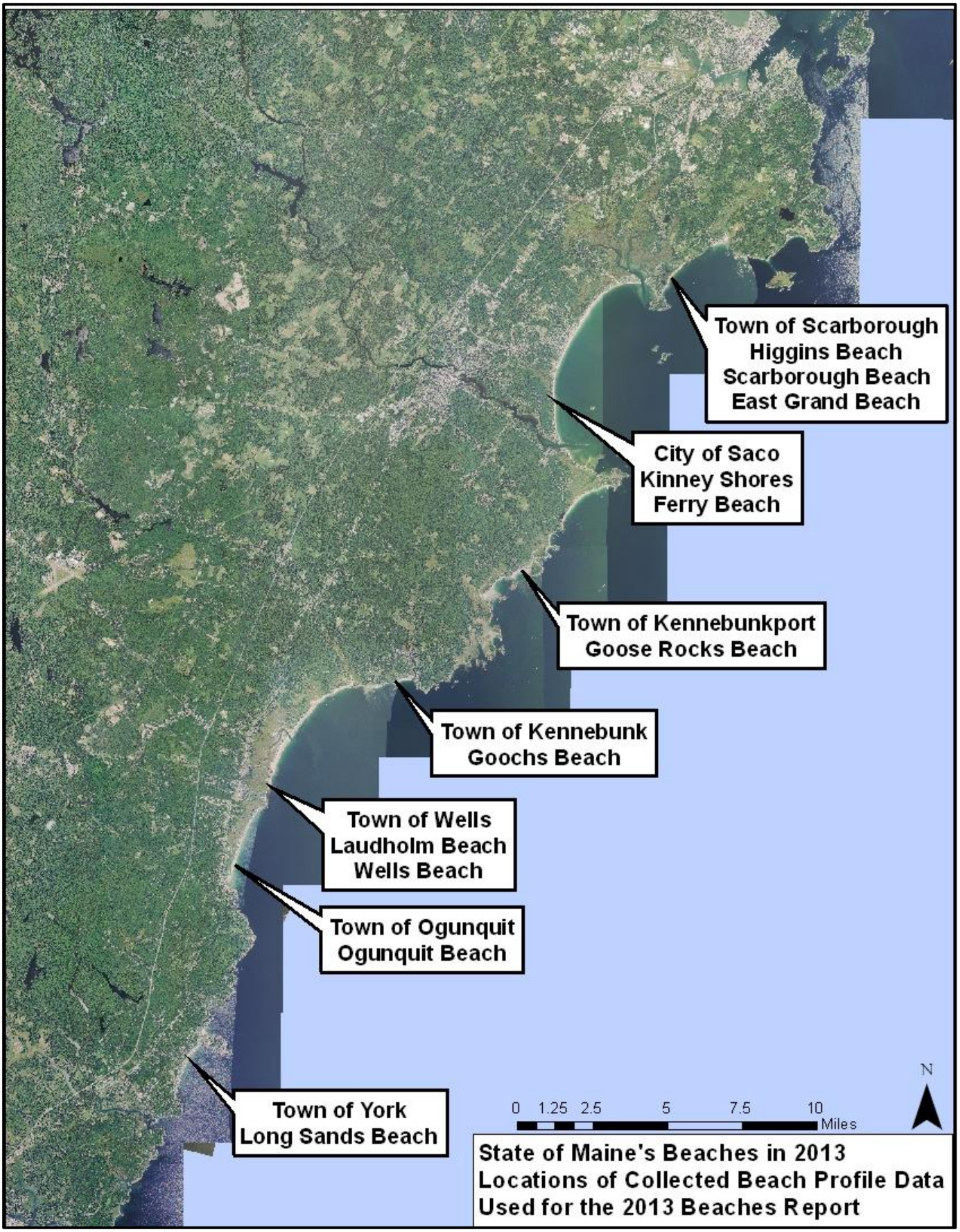

Figure 1. Locations of collected beach profile data that was used for the 2013 Beaches Report. Data courtesy of the State of Maine Beach Profiling Project. Base imagery courtesy of Maine OGIS.

Table 1. Summer and winter beach profile data used for the 2013 Beaches Report.

Beach Name (Acronym)	#	Date		
		2010	2011	2012
Higgins (HI)	01	8/17	8/29	8/27
	02	8/17	8/29	8/27
	03	8/17	8/29	8/27
Scarborough (SC)	01	8/21	8/10	8/31
	02	8/21	8/10	8/31
	03	8/21	8/10	8/31
	04	8/21	8/10	8/31
East Grand (EG)	01	8/18	8/23	N/A
	02	8/18	8/23	N/A
	03	8/18	8/23	N/A
	04	8/18	8/23	N/A
Kinney Shores (KS)	01	9/10	8/8	7/30
	02	9/10	8/8	7/30
Ferry (FE)	01	9/10	9/23	9/13
	02	7/16	9/23	5/7
	03	9/10	10/21	9/13
	04	7/16	10/21	9/13
Goose Rocks (GR)	01	8/14	8/6	8/26
	02	8/14	8/6	8/26
	03	8/14	8/6	8/26
	04	9/10	8/6	8/26
Goochs (GO)	01	8/13	8/6	8/25
	02	8/13	8/6	8/25
	03	8/13	8/6	8/25
	04	8/13	8/6	8/25
Laudholm (LH)	01	8/13	8/5	N/A
	02	8/13	8/5	N/A
	03	8/13	8/5	N/A
	05	8/13	8/5	N/A
Wells (WE)	00	7/16	9/24	8/26
	02	7/16	9/24	8/26
	03	11/13	7/9	8/26
	04	11/13	7/9	8/26
Ogunquit (OG)	02	9/12	8/7	10/12
Long Sands (LS)	01	8/15	8/5	8/24
	03	8/15	8/5	8/24

Beach Name (Acronym)	#	Date			
		2010	2011	2012	2013
Higgins (HI)	01	4/23	4/14	4/10	4/5
	02	4/23	4/14	4/10	4/5
	03	4/23	4/14	4/10	4/5
Scarborough (SC)	01	4/24	4/22	4/11	4/30
	02	4/24	4/22	4/11	4/30
	03	4/24	4/22	4/11	4/30
	04	4/24	4/22	4/11	4/30
East Grand (EG)	01	4/21	3/30	4/12	N/A
	02	4/21	3/30	4/12	N/A
	03	4/21	3/30	4/12	N/A
	04	4/21	3/30	4/12	N/A
Kinney Shores (KS)	01	3/8	2/25	3/7	3/16
	02	3/8	2/25	3/7	4/5
Ferry (FE)	01	4/23	4/15	5/7	4/5
	02	4/23	4/15	5/7	4/5
	03	7/16	4/15	5/7	4/5
	04	2/5	4/15	5/7	4/5
Goose Rocks (GR)	01	4/24	4/15	4/12	4/6
	02	4/24	2/26	4/12	4/6
	03	4/25	4/16	4/12	4/6
	04	5/22	4/16	4/12	4/6
Goochs (GO)	01	4/25	4/15	4/24	4/5
	02	4/25	4/15	4/24	4/5
	03	4/25	4/15	4/24	4/5
	04	4/25	4/15	4/24	4/5
Laudholm (LH)	01	4/23	4/22	3/23	N/A
	02	4/23	4/22	3/23	3/14
	03	4/23	4/22	3/23	3/14
	05	4/23	4/22	3/23	3/14
Wells (WE)	00	4/24	3/5	3/17	4/6
	02	4/24	3/5	3/17	4/6
	03	11/13	3/27	4/14	4/6
	04	11/13	3/27	4/14	4/6
Ogunquit (OG)	02	4/23	4/16	12/9	2/2
Long Sands (LS)	01	4/25	4/15	4/15	4/6
	03	4/25	4/15	4/15	4/6

Spatial and Temporal Extent of Data for 2013 Report: MBMAP Data

In order to supplement the efforts by profiling volunteers, MGS has implemented the Maine Beach MAPping (MBMAP) program. This conducts annual surveys of several shore parallel beach features, including the wrack line or high water mark (after the last high tide), in addition to the seaward edge of the dune vegetation line. This data is captured using a highly precise Real Time Kinematic Global Positioning System (RTKGPS), which is capable of horizontal and vertical accuracies of several centimeters (Abousalem and others, 2001).

For this report, we will compare the horizontal positions of the **vegetation line only** for surveyed beaches from 2007 through 2012, as data is available. For this report, the vegetation line is defined as the seaward-most extent of dominant dune vegetation, as measured in the field using the MGSRTK-GPS.

Some additional data has been collected thus far for the 2013 season at select beaches, but will not be included in calculations of shoreline change for this report except for a few select areas.

The MBMAP shorelines will follow the color scheme used for the profile data: 2010 (purple), 2011 (red), 2012 (green), and 2013 (blue). Also, the **linear regression rate (LRR) for shoreline change,** which is the shoreline change rate computed using a linear regression fit between available data, will be calculated using the United States Geological Survey (USGS) Digital Shoreline Analysis System (DSAS) tool (Thieler and others, 2008), and shown for each beach. Available MBMAP data is shown below in Table 2. Highlighted green indicate those beaches which will have MBMAP data for 2013 included in this report.

Table 2. Maine Beach Mapping (MBMAP) data collected since 2007. Data that is included in this report is highlighted in green.

Beach	Town	2007	2008	2009	2010	2011	2012	2013
Western/Ferry	Scarborough	4/25	6/6	6/5	6/4	6/3	5/15	5/30
Higgins	Scarborough	6/12	7/23	7/31	6/4	6/6	5/25	6/3
Crescent/Kettle	Cape Elizabeth	5/29	7/22	6/8	6/4	6/6	6/1	6/10
Willard	South Portland	4/19	6/9	6/25	6/11	6/7	6/6	6/6
Scarborough	Scarborough	4/20	7/24	6/16	-	6/8	6/8, 6/14	6/13
Saco	Saco	5/2	7/15	7/15	5/26	6/17	6/5, 6/12	6/19
Old Orchard	Old Orchard	-	6/11	7/21	5/27	6/20	6/11	TBD
Pine Point	Scarborough	5/4	6/11	7/14	5/27	6/20	6/11	TBD
Ogunquit	Ogunquit	7/10	8/8	7/28	6/15	6/23	6/27	TBD
Ocean Park	Old Orchard	5/7	7/30	7/27	6/2	6/27	6/16	TBD
Fortunes Rocks	Biddeford	8/1	7/31	7/2	6/11	6/28	6/26	TBD
Hills	Biddeford	-	-	-	6/23	7/1	7/2	TBD
Goose Rocks	Kennebunkport	6/15	-	8/4	6/22	7/7	7/11	TBD
Goochs	Kennebunk	-	-	-	7/2	7/11	7/13	TBD
Reid	Georgetown	-	-	-	7/19	7/13	7/23	TBD
Popham	Phippsburg	6/7	7/1	7/22	6/30	7/21	8/3,8/6	TBD
Drakes	Wells	6/28	8/5	8/3	6/18	7/27	8/8	TBD
Laudholm	Wells	6/28	8/5	8/3	6/18	7/27	8/8	TBD
Wells	Wells	6/29	8/13	8/4	6/21	7/28	8/14	TBD
Long Sands	York	-	-	-	8/4	8/3	8/27	TBD
Short Sands	York	-	-	-	8/4	8/3	8/27	TBD
Seapoint	Kittery	-	-	-	-	8/12	8/29	TBD
Crescent	Kittery					8/12	8/29	TBD
Seawall	Phippsburg	-	-	-	-	9/14	9/18	TBD

Setting the Stage: Winter Storm Events

Winter of 2010-2011

Late summer and fall of 2010 had a mix of downgraded hurricanes and northeasters over several months. The first "fall" northeaster occurred on August 24 and it produced two days of surf peaking with a wave height of 2.6 m (8 feet) at the Casco Bay Buoy (44007). On August 31 Tropical Storm Earl, with a pressure of 980 millibars (mb), tracked up the East Coast across the outer Gulf of Maine; waves of 1.6 m (5 feet) were recorded at the Western Maine Shelf Buoy (B01; 44030). September 17-20 Tropical Storm Igor sent in moderate long-period swells for 4 days. September 30 Tropical Storm Nicole passed inland through New England, much like a southeaster. On October 15, a northeaster with a low pressure of 980 mb produced a 3-foot storm surge but the tides were neap so the storm tide only reached 10 feet above mean lower low water (MLLW) and did not result in coastal flooding. An extended period of rough seas occurred in early November culminating with a northeaster that had 6 m (20 feet) waves. A December 2nd southeaster with a low of 1004 mb produced waves to 4.6 m (15 feet) at the Casco Bay Buoy.

Another southeaster followed on December 12th and 13th with 5.2 m (17 foot) waves and a pressure down to 986 mb. Calendar year 2010 ended with a Blizzard on December 27. The barometric pressure dropped to 962 mb as it entered the Gulf of Maine and produced waves over 7 m (23 feet; Figure 2).

A classic northeaster (985 mb) passed quickly through the central Gulf of Maine on January 12, 2011. Waves from this storm briefly topped 6 m (20 feet). A storm surge of 2.5 feet came on another neap tide so the storm tide only reached 9 feet MLLW. January 27 saw another northeaster pass up the East Coast. A February 2, Ground Hog Day storm produced a storm tide of 11 feet MLLW with 3.3 m (11 feet) waves at the Casco Bay Buoy. On March 7, a southeaster (996 mb) tracked north through New England and waves remained in the 2-3 m (6-10 feet) range for 4 days. Another southeaster followed on March 11th with 3.3 m (11 feet) waves and a pressure of 1011 mb. An April Fools' Day northeaster produced a brief period of 3.6 m (12 feet) waves and had a central pressure of 987 mb. The last major winter storm of the 2010-2011 season was a strong southeaster (995 mb) in mid-April with seas that topped 6.6 m (21 feet; Figure 3).

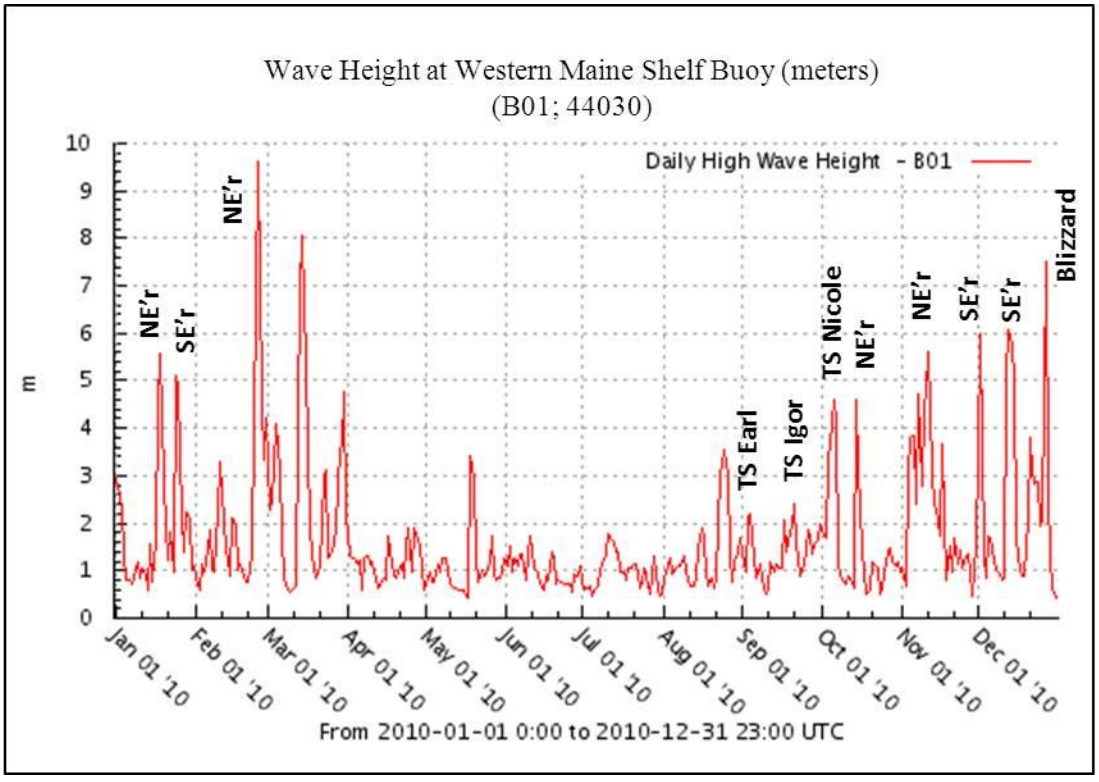

Figure 2. Buoy data from the Western Maine Shelf Buoy (B01; 44030) for 2010. Data courtesy of NERACOOS.

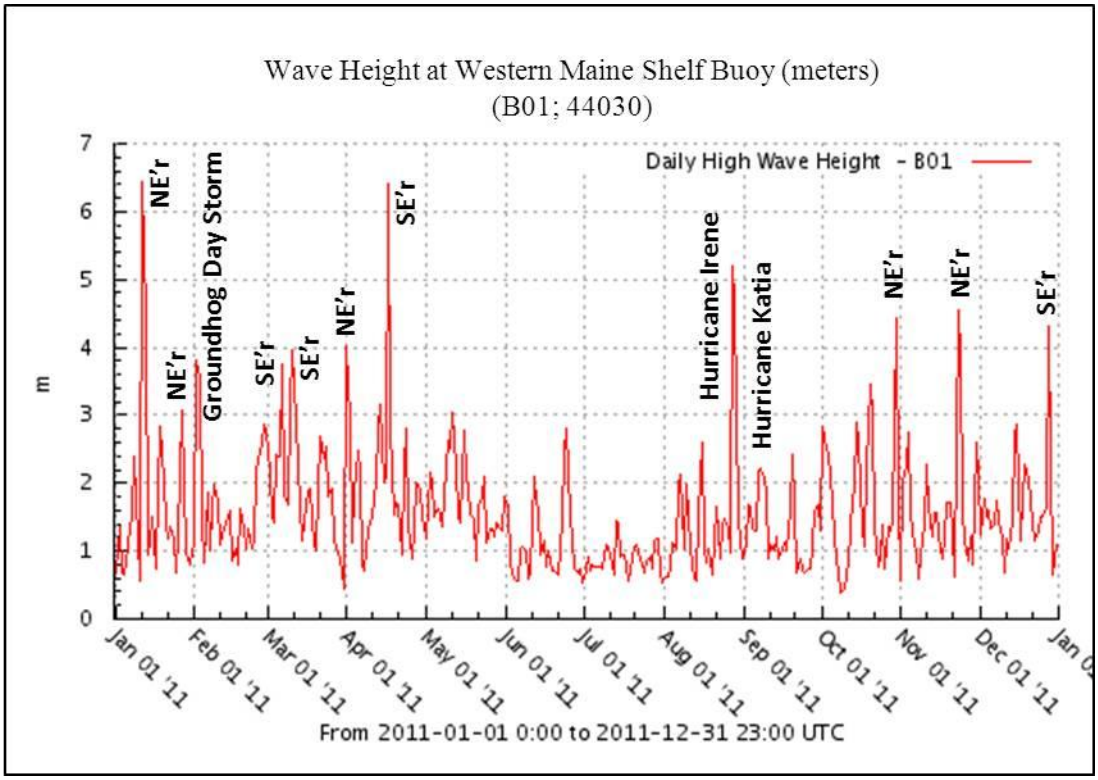

Figure 3. Buoy data from the Western Maine Shelf Buoy (B01; 44030) for 2011. Data courtesy of NERACOOS.

Winter of 2011-2012

After about four months or relative calm, the storm season began with a tropical influence. August 2011 is remembered from Hurricane Irene's track through interior New England on the 29th. Coastal state park campgrounds were evacuated due to the combination of high wind and surf. Waves at the Casco Bay Buoy reached 4.6 m (15 feet) where the pressure dropped to 989 mb. The maximum storm tide reached 11.96 feet MLLW in Portland from a surge of 1.08 feet (NOAA, 2011).

Hurricane Katia passed offshore September 9 with waves under 2 m. On October 30 a northeaster (984 mb) passed through the Gulf of Maine and left 5 inches of snow in Portland for Halloween. November 23rd a northeaster (1000 mb) produced 4.5 m (15 feet) waves. Calendar year 2011 closed out with a southeaster (988 mb) on December 28th that produced 4.1 m (13 feet) waves (Figure 3).

January 12 was the start of the 2012 storm season with a northeaster that produced a storm tide to 12 feet MLLW driven up by a 2-foot surge. Waves were up to 6.3 m (21 feet) and the pressure fell to 992 mb. March 1st a 1012 mb northeaster generated 4.6 m (15 feet) waves at the Casco Bay Buoy. By March 3rd the storm became a southeaster with 3.0 (10 feet) m waves. After a quiet spell, another northeaster arrived April 23rd with a low pressure of 997 mb that produced 3.8 m (12 feet) waves at the Casco Bay Buoy.

A rare June northeaster (1003 mb) hit the beaches hard from June 4-6th. This storm could be considered a late spring storm that finally ended the winter storm season. Each day storm tides topped 12 feet and reached as high as 13 feet MLLW. This storm's 3.7 m (12 foot) waves ran up to and eroded the dune edge. Because of the unusual time of year for such a powerful storm, *many piping plover nests were washed out along the dune edge and berm* (Figure 4).

Winter of 2012-2013

With only a 3-month respite, the next storm season began. September 8th and 9th long-period swells (15 seconds) with heights up to 2.1 m (7 feet) from Hurricane Leslie came ashore on the beaches. On September 18th there was a southerly gale in Maine. Waves 3.3 m (11 feet) with a long period over 16 seconds hit the beaches with an 11-foot storm tide.

Hurricane Sandy was the highlight of the storm season in New York and southern New England on October 29th and 30th. Maine experienced the remnants of the "superstorm" (a post-tropical cyclone) with an impact similar to a strong winter easterly storm. Tides were near average (10 feet) and the storm surge ranged from 2 to 3 feet over two days. The highest storm tide occurred on the morning of the 29th and it reached the 12-foot level (about 2 feet below the

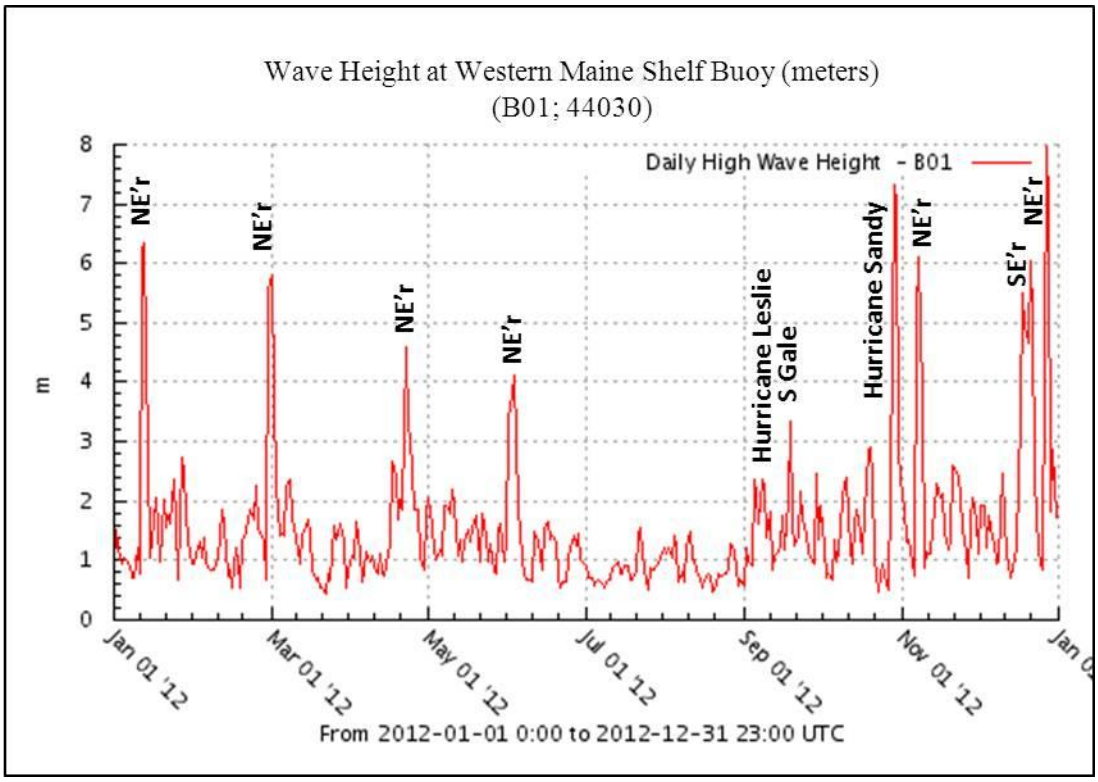

Figure 4. Buoy data from the Western Maine Shelf Buoy (B01; 44030) for 2012. Data courtesy of NERACOOS.

Blizzard of 1978). Waves at the Casco Bay Buoy topped 7.1 m (23 feet) and 11 second swells ran up against seawalls, caused splashover, and some beach and dune erosion. The storm also drove sand into Wells Harbor and caused immediate shoaling in the anchorage.

On November 8th, a very strong storm passed offshore in the wake of Hurricane Sandy. This storm produced NE gale-force winds along the coast but received little notice since it was offshore and the media was focused on damage from Hurricane Sandy. Nevertheless, waves at the Casco Bay Buoy reached 6.1 m (20 feet) with a period of 12 seconds with a pressure of 1000 mb. Farther south, the Western Maine Shelf Buoy had remarkable 8.5 m (28 feet) waves. A 2-foot surge on a neap tide resulted in only a 10-foot storm tide. Had this offshore storm tracked closer to the Maine coast there would likely have been very significant beach and dune erosion from even higher waves and storm surge.

On December 18th a southeaster resulted in a storm tide of 12 feet driven up from a 2-foot surge. Waves ran in the 4.9 to 5.5 m (16 to 18 foot range). Barometric pressure at the Casco Bay Buoy fell to 993 mb. The final storm of calendar year 2012 arrived on December 27th as a northeaster. This 999 mb low produced 11 second waves that reached 6.4 m (21 feet) at the Casco Bay Buoy and up to 8 m (26 feet) at the Western Maine Shelf Buoy to the south (Figure 4).

The first remarkable storm of 2013 was the Blizzard of February 9 (also nicknamed Nemo in the media). This storm came 35 years after the record-setting Blizzard of 1978. The blizzard tracked up the East Coast and out across Georges Bank. This storm had a large surge of up to 3.5 feet but coincided with an average tide instead of an exceptionally high tide as in 1978. In addition, the highest surge occurred at low tide, reducing the erosion impact to the upper beach and dunes. Consequently, the highest storm tide was just below the 12 foot MLLW level in Portland.

An easterly gale (999 mb) arrived February 28th. Storm tides ran in the 11 foot MLLW due to a persistent 1- to 2-foot storm surge. Waves at the Western Maine Shelf Buoy reached 6.4 m (21 feet) with a period of 11 seconds.

An early March northeaster (1014 mb) on the 8th caused rough conditions for several days with wave periods up to 12 seconds. This storm track came out to sea off the mid-Atlantic coast and then headed east of Cape Cod. Despite the more distant track, storm tides ran above normal from March 5th through 9th, exceeding the 11-foot level 6 of 9 times, but never topped the 12-foot level. The maximum storm surge was about 3 feet but arrived at low tide. Waves were very high, peaking around 8.5 m (28 feet) at the Western Maine Shelf Buoy. *Large amounts of beach and dune erosion as well as exposure of substrates underlying the beach profiles were reported after this storm. Some of these effects were noted at Drakes Island Beach, Goochs Beach, Higgins Beach, Ogunquit Beach, Scarborough Beach, and York Beaches (Short and Long Sands).*

Yet another northeaster (1003 mb) arrived March 19th with a low pressure centered over Cape Cod. This storm had lower water levels due to neap tides. The storm tide only reached 9 feet MLLW with the assistance of a 1.5-foot storm surge. Waves peaked at 6 m at the Western Maine Shelf Buoy and ran 3 m (10 feet) or more for two days.

The winter of 2012-2013 was a season with 6 major storms that impacted Maine beaches (Figure 5). There were no exceptionally high storm tides, but on many occasions water l levels approached the coastal flood threshold of 12 feet MLLW. Storm tracks were dominated by northeasters and only one major southeaster. Superstorm Sandy was less severe than a late December northeaster or the Blizzard of February 9th (Nemo). Despite the strong surf, coastal flooding - beyond the effects of splashover - was not significant due to storms passing farther offshore in the Gulf of Maine.

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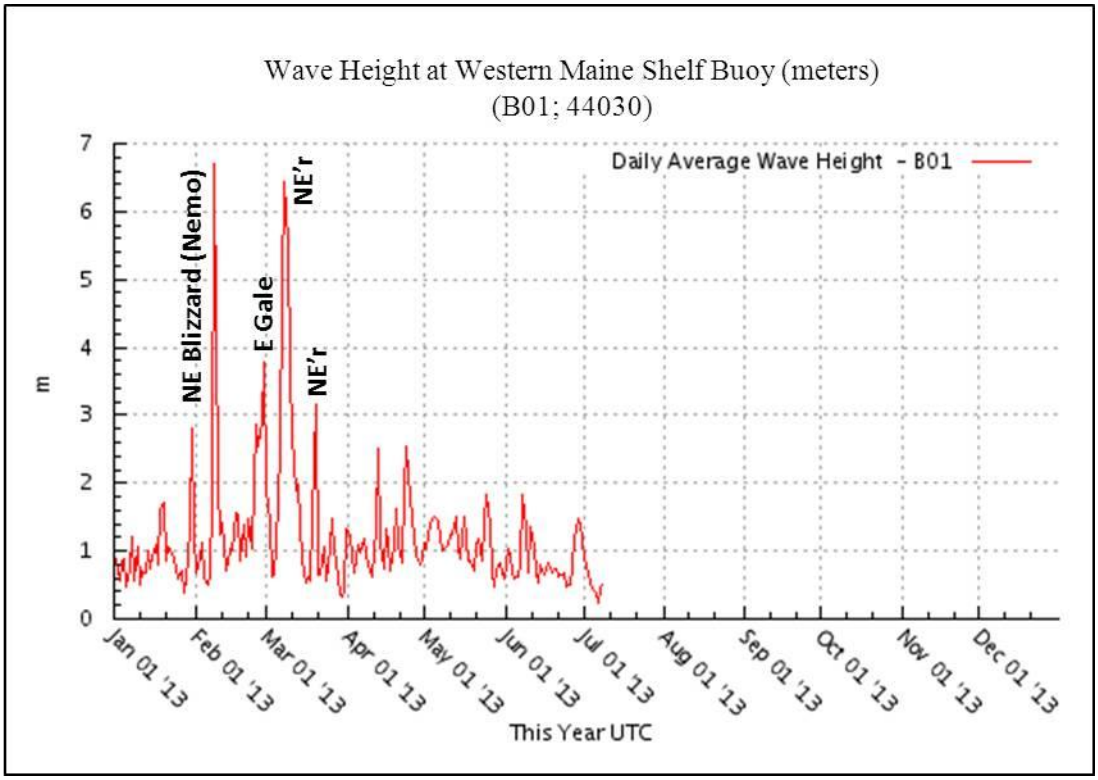

Figure 5. Buoy data from the Western Maine Shelf Buoy (B01; 44030) for 2013. Data courtesy of NERACOOS.

Review of Beach Responses

This portion of the report will progress in a north-to-south format, starting with the northernmost monitored beach, Higgins Beach in Scarborough, and ending with Long Sands Beach in York.

First, we will review profile changes using the winter 2010 beach profile shapes as a starting point for comparison with subsequent years from roughly the same months, through April or May 2013, as data is available. Review of the "winter" beach profile shapes will allow us to detail whether or not the beaches have continued to recover (or erode, or switch their recovery) from a relatively lean 2010 winter season. For winter profile graphs, purple represents 2010, green 2011, red 2012, and blue 2013.

We will also review profile changes and recovery from 2010 through the summer of 2012 for the "summer beach" profile shapes at each profiling location. This will include, as data is available, profile data from July, August or September of each year from 2010 through 2012. For summer profile graphs, purple represents 2010, green 2011, and red 2012. Unfortunately, we are unable to include 2013 summer beach data since it has not been collected yet.

It is generally not sound to compare May or June profiles with August or September profiles, since in Maine, beaches are typically still recovering from the winter in May and June, and fully developed by August or September.

Note that each beach profile is described first in terms of its winter shape first, then its summer shape (e.g., Winter HI01, Summer HI01). Each profile is assigned a "grade," based on the amount of stability, growth, or erosion exhibited for both summer and winter beach profile shapes. Then, for each beach, an averaged grade for the "winter" beach changes (2010 to 2013) and the "summer" beach changes (2010 to 2012) was created. Finally, an overall beach grade was assigned, as an average of all the summer and winter profile scores. Note that this grading system is qualitative, and described in Table 3.

Note that in this ranking system, we consider a score of an A or B to indicate excellent or very good recovery or growth, a C to be considered a cautionary stability or recovery, and a D and F to be an unsatisfactory outcome for the beach recovery, signifying an ongoing erosion or instability problem.

Finally, each location that has MBMAP data collected will review the status of the vegetation line changes for when data has been collected.

Table 3. Beach grading system employed as part of the State of Maine's Beaches in 2013 report.

Grade	Numerical Score	Beach Status Description
A	95	**Excellent** (profile shows continued accretion and growth)
B	85	**Very Good** (profile shows very good stability or slight growth)
C	75	**Satisfactory but Cautionary** (profile shows some stability but may be undergoing erosion)
D	65	**Very Cautionary** (profile shows continued signs of erosion or massive erosion for a short period of time)
F	55	**Fail** (profile shows extensive, continued erosion over a long period)

Willard Beach, South Portland

No beach profile data was collected for Willard Beach for this report so no analysis was completed.

Willard Beach MBMAP Results

MBMAP data was available from 2007 to 2012. Previous results from 2007 to 2011 showed that the vegetation line had a slightly positive mean change value of +0.20 m/yr. (Figure 6). This trend has continued into 2012. The largest accretion (between +0.5 m/yr. to +0.8 m/yr.) occurred just to the north of the beach restrooms and snack shack. The remainder of the dune system to the north had relatively good dune growth, with several pockets of increased erosion at the northernmost end of the beach. The dunes along the central portion of the beach appear to be most stable, with increased erosion at the southern and northern ends of the beach. **Willard Beach is proving to have one of the most stable dune systems, and much of this has to do with the restoration and management efforts undertaken by the community.**

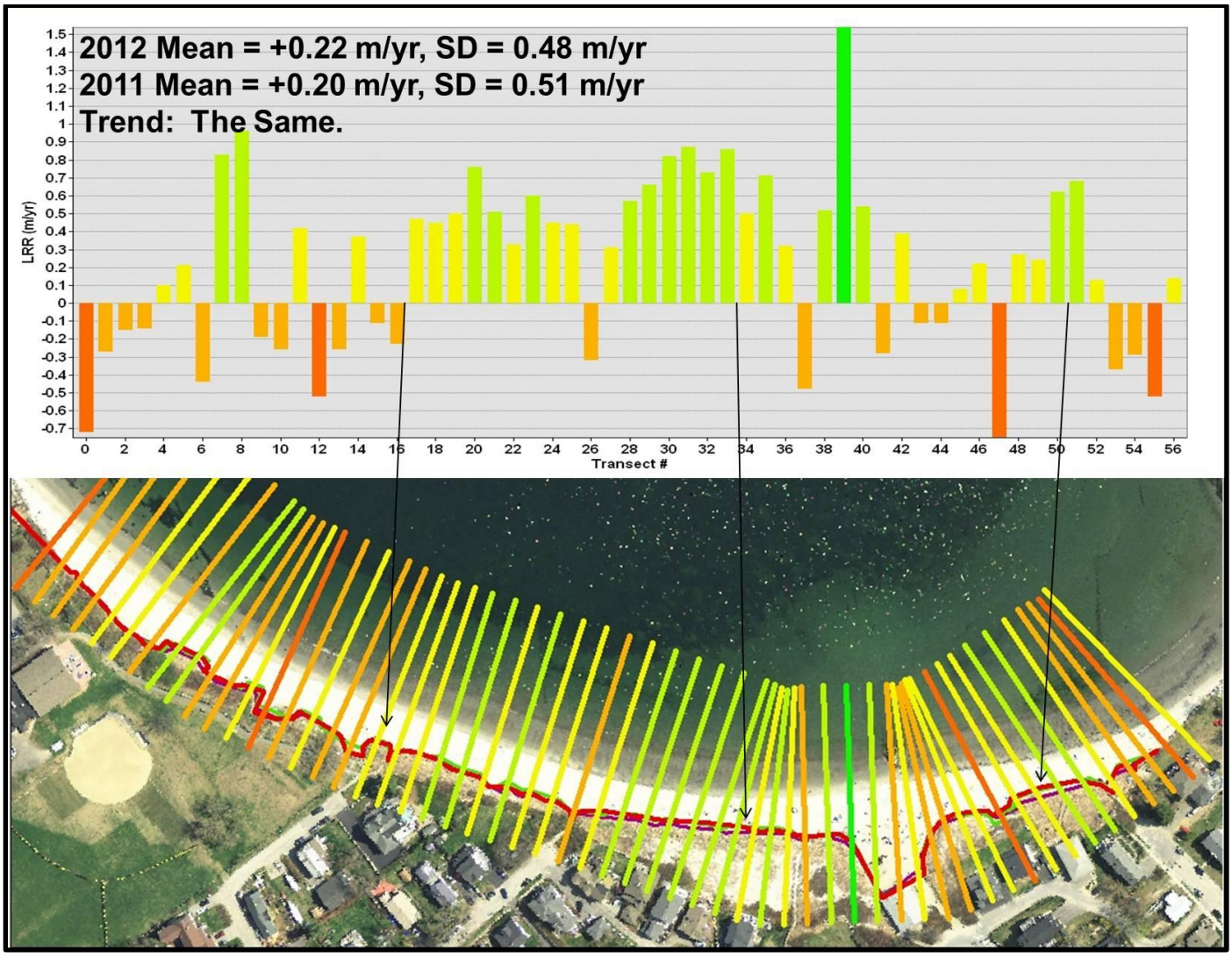

Figure 6. MBMAP data showing shoreline changes along Willard Beach, South Portland. 2012 base imagery from Maine OGIS.

Higgins Beach, Scarborough

A total of three beach profiles (HI01, HI02, and HI03, Figure 7) were available for comparison.

Winter HI01 = D (65). 2011 grade: C-. Trend: Worse. This profile, located at the main seawall, received an A and a C- previously. Its winter profile exhibited its lowest, most erosive, shape in 2010 (Figure 8). By 2011, it gained about 100 cm of sand vertically along its length. This trend continued, with additional growth on the order of 20-40 cm along most of the profile; however, nearest the wall, the beach scoured and lowered. In 2013, it eroded to within about 40-50 cm of the 2010 shape, and was steeper nearest the wall. Although it showed good recovery to 2012, in 2013 it saw severe erosion, to near 2010 erosive depths - on the order of 1-2 meters vertically (i.e., between 2010 and 2012 profiles). It appeared to be influenced by winter seasonal storms and the adjacent seawall, which caused scouring adjacent to the wall and lowering of the profile during more winter energetic seasons (2010 and 2013). Thus, this profile continues to warrant extreme caution.

Summer HI01 = B (85). 2011 grade: C. Trend: Better. The 2010 profile had a concave, erosive shape, with a steep slope at the seawall. In 2011, it had minimal recovery, with slight elevation gains along the profile (Figure 9). However, the 2012 shape showed a large gain of sand nearest the wall (the largest recorded in the last 3 seasons), which steepened to a well-defined trough which formed just past the 40 m mark (this trough reaches down to 2010 and 2011 elevations, and is probably to the historical erosion surface, the old marsh surface). An offshore bar has also formed, indicating sediment has been gained in the offshore. The profile underwent very good recovery through the summer of 2012. It will be interesting to see how the profile recovered from the relatively severe winter of 2012-2013. Aside from 2012, the summer shapes at HI01 did not vary much.

Winter HI02 = C (75). 2011 grade: F. Trend: Better. The profile, located at a smaller seawall east of HI01, received a B and an F previously. The profile was at its lowest in 2010 (Figure 10). Slight recovery occurred in 2011. In 2012, it lost sand at the seawall, but had a shallower slope with higher elevations, showing that sand moved back onto lower portions. In 2013, it had a higher starting elevation, indicating that sand levels along the wall increased; however, it eroded to near the 2010 shape out to about 40 meters. From here seaward, it gained sand and fell between 2011 and 2012 shapes, indicating stability. Over the past 4 years, this profile underwent less vertical change (about 20-50 cm) during the winters, and was more stable. We remain cautionary about this profile.

Summer HI02 = C (75). 2011 grade: F. Trend: Better. The summer 2010 profile showed a steep shorefront, low berm, and a steep profile into the offshore (Figure 11). By 2011, the profile recovered well, with substantial amounts of sand gain. By 2012, it eroded at the wall, lowering back to the 2010 level out to about 30 m. Seaward of this, out to about 80 m, a large bar formed, indicating a gain in sand; however, seaward of this bar, it lost elevation. Although the profile showed some recovery in 2011, the 2012 shape had loss along the wall, but a large sand bar with sediment moving up the profile. Because the winter shape of 2013 had some stability in relation to 2011 and 2012, we are cautiously optimistic that this section of the beach is showing some stability after a previous period of extensive erosion.

Winter HI03 = F (55). 2011 grade: B. Trend: Worse. This profile, located in a natural dune system close to the Spurwink River, received a C and B previously. It displayed influences of the Spurwink River and entered an erosive phase (Figure 12). The 2010 profile had several dune crests, and large volumes of sand seaward of the 40 m mark. By 2011, the dunes grew farther seaward – indicating accretion, but the profile lost elevation seaward of 40 m. By 2012, it showed extensive erosion. The entire dune was eroded to the seawall. The 2013 profile had a lower starting elevation – indicating more dune loss, but a substantial gain in sediment at 10 m seaward. This profile showed significant dune and beach erosion from 2010 through 2013. This profile was highly variable; we do expect recovery to occur as dynamics associated with the river channel change. The MBMAP data (discussed below) showed the changes from HI03 very well.

Summer HI03 = F (55). 2011 grade: A+. Trend: Worse. This profile underwent extreme accretion through 2010. However, using the 2010 profile as a starting point, this section of the beach has now entered a phase of extreme erosion (Figure 13). The 2011 profile shape shows landward migration of the entire dune, and lowering of the dune crest, indicating erosion. The 2012 summer shape showed more extensive erosion, with loss of the entire dune system, and lowering of the profile in some areas of about 2 meters.

Winter Summary: The profiles varied greatly at HI01 to lesser changes at HI02. These profiles had generally concave shapes, while HI03 remained variable due to its proximity to the Spurwink River, and underwent erosion (it was previously accreting). Erosion occurred at HI01 and HI03, with stability at HI02. **Winter Beach Grade: D (65). 2011 Grade: C- (71). Trend: Worse.**

Summer Summary: HI01 and HI02 are showing some signs of stability; HI01 showed recovery from 2010, but may not have recovered as well as indicated by the 2012 summer shape due to the winter of 2013. HI02, which eroded in the last assessment, showed signs of stability. Some of the apparent stability at HI01 and HI02 profiles may relate to emergence of the historical erosion surface (peat deposits). HI03, which previously underwent large amounts of accretion, has now entered a period of massive erosion. **Summer Beach Grade: C- (72). 2011 grade: D+. Trend: Slightly better.**

Overall Summary: Unfortunately, it appears that overall, the beach continued to undergo erosion. Winter erosion hampers HI01, but it showed some ability to recover in terms of its summer shapes. It appears that seawall reflectivity during series of winter storms may be the cause of continued winter erosion at HI01. HI02 showed some stability over the past few years. Changes in inlet dynamics at the Spurwink River have eroded large sections of beach and dune in the vicinity of HI03; however, a large, emergent bar is now present. We do expect that bar to hopefully move onto the beach in the summer months, bringing back a pattern of accretion at HI03. **Higgins Beach Overall Grade: D+ (68). 2011 grade: C-. Trend: Slightly worse.**

Figure 7. Higgins Beach, Scarborough profiling locations.

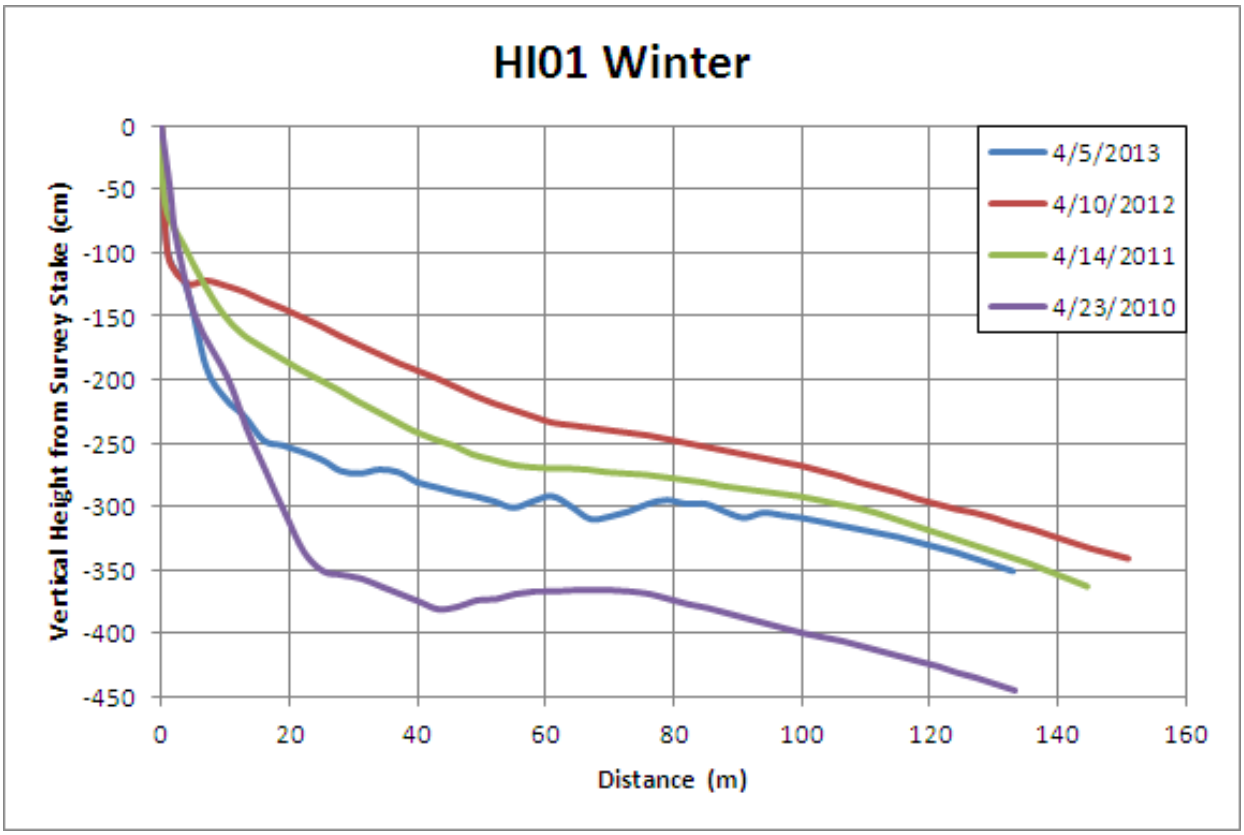

Figure 8. Winter beach profiles for HI01 from 2010, 2011, 2012, and 2013.

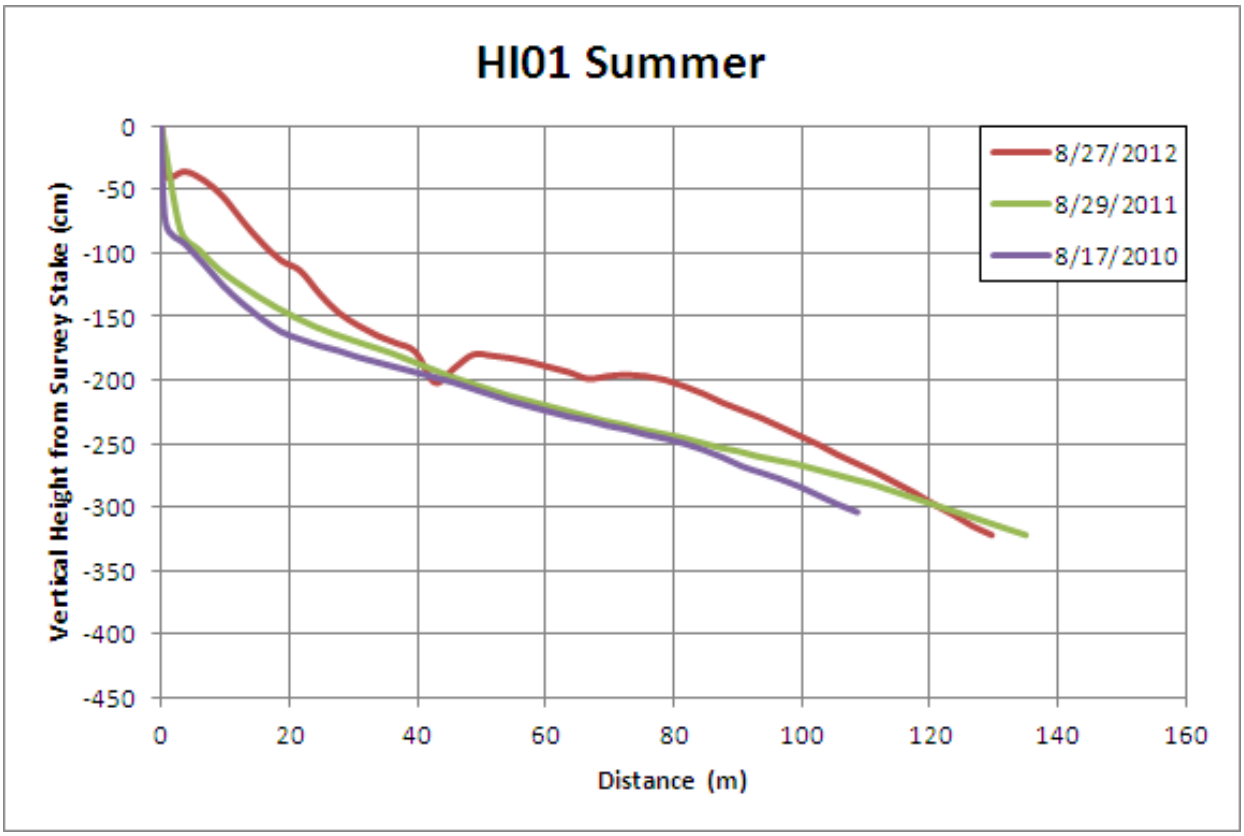

Figure 9. Summer beach profiles for HI01 from 2010, 2011, and 2012.

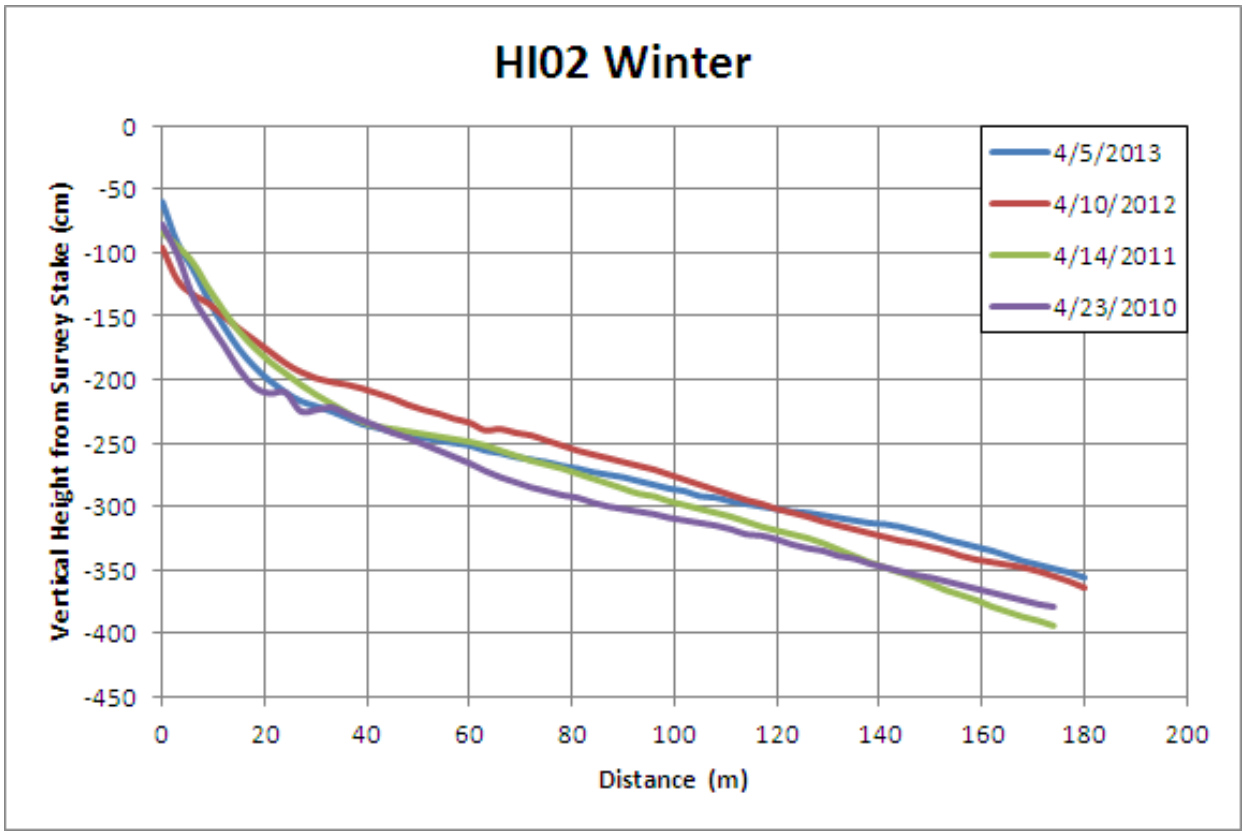

Figure 10. Winter beach profiles for HI02 from 2010, 2011, 2012, and 2013.

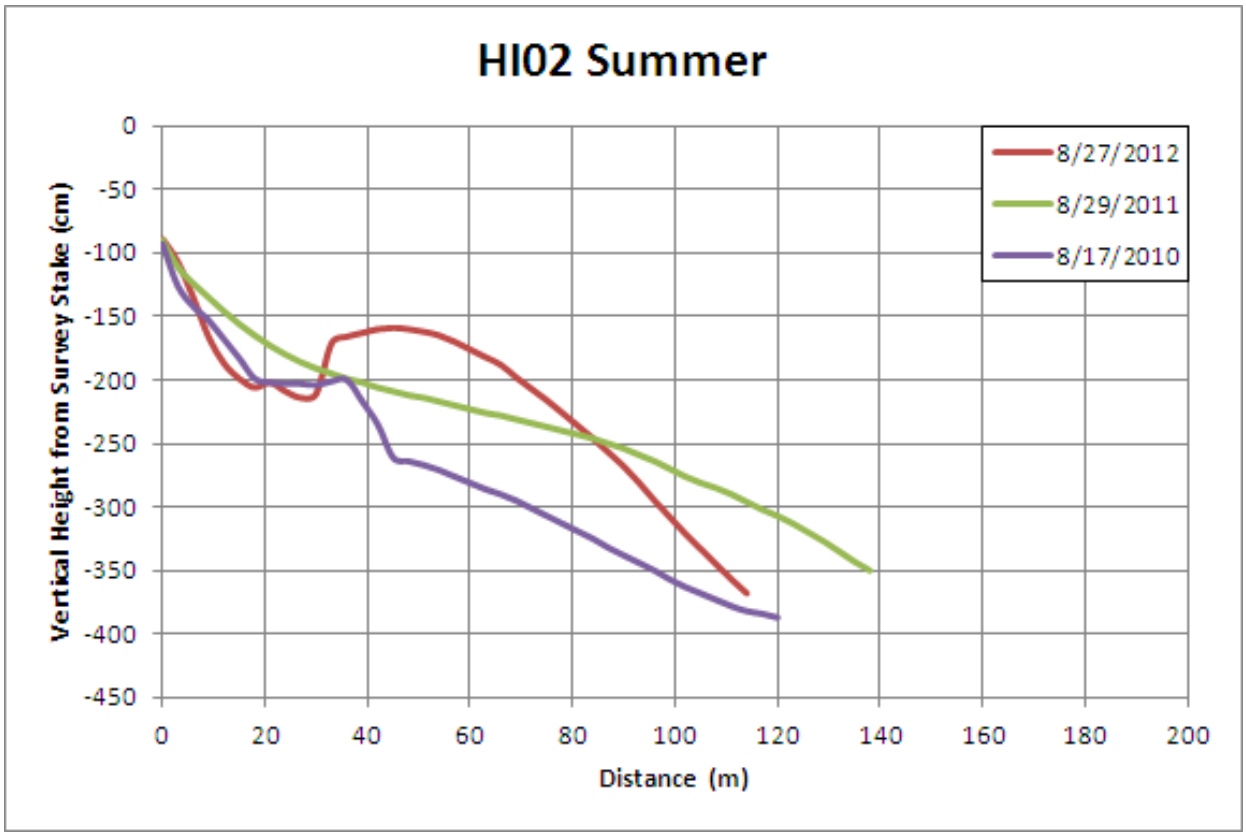

Figure 11. Summer beach profiles for HI02 from 2010, 2011, and 2012.

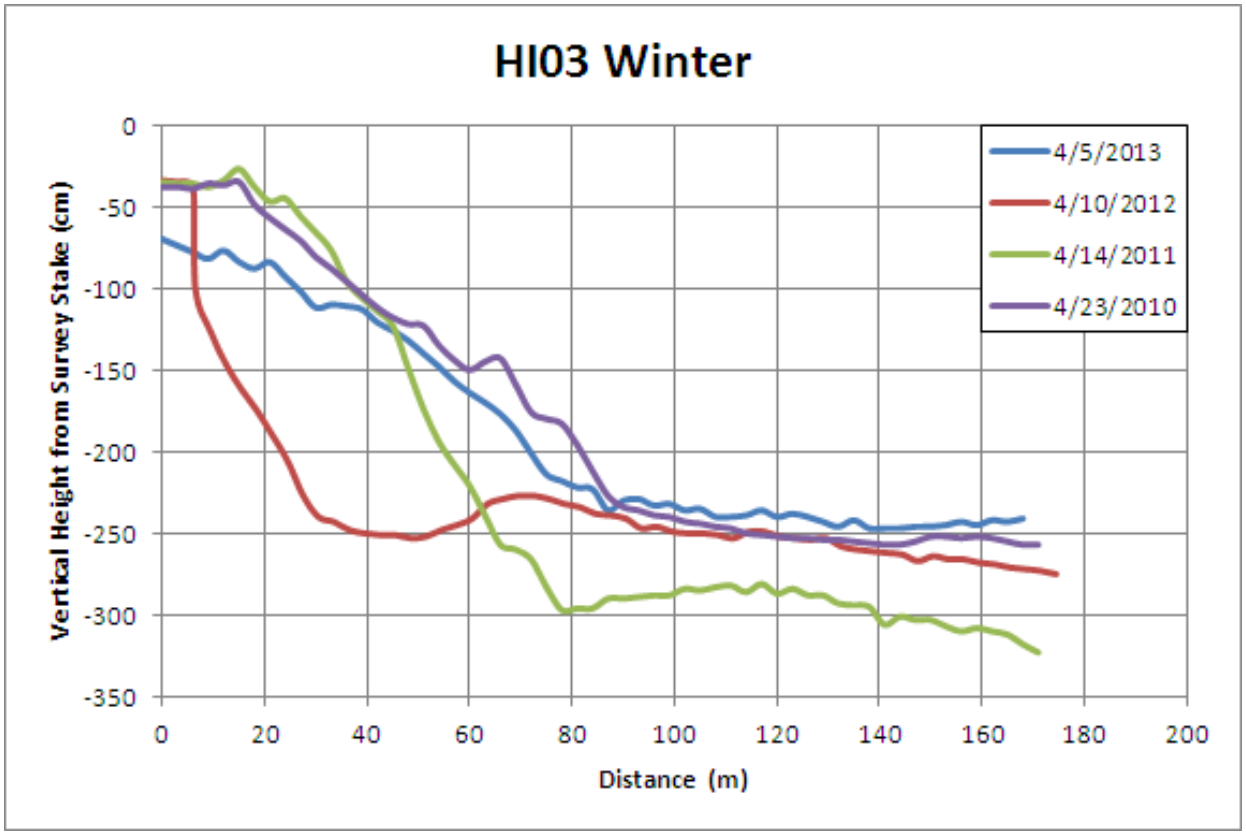

Figure 12. Winter beach profiles for HI03 from 2010, 2011, 2012, and 2013.

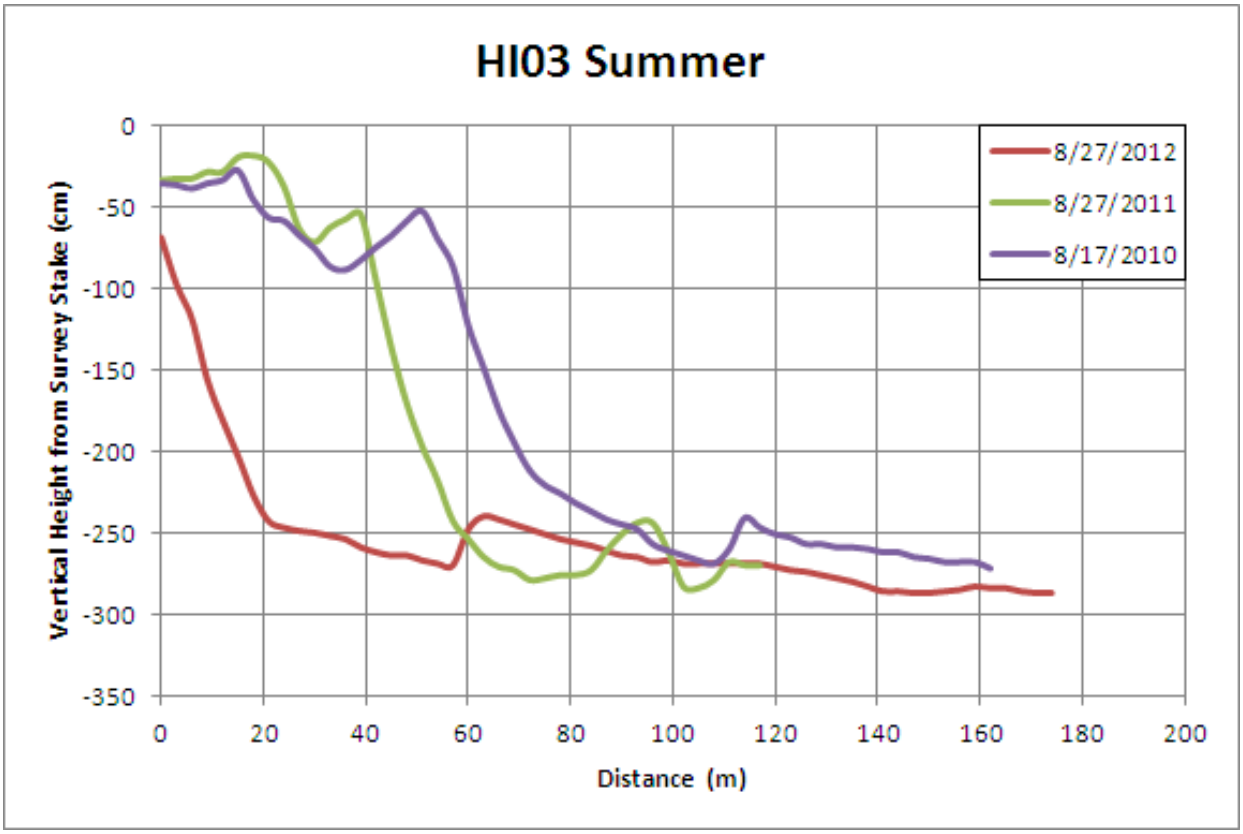

Figure 13. Summer beach profiles for HI03 from 2010, 2011, and 2012.

Higgins Beach MBMAP results

MBMAP vegetation line data was collected from 2007 through 2013 in the vicinity of HI03, from the seawall eastward to the Spurwink River inlet (Figure 13). The edge of the dune stayed relatively constant from 2007-2009, building seaward slightly. From 2009-2010, slight dune recession occurred, but that changed in 2011, with the edge of vegetation building even farther seaward. In 2012, the dune started to recede near the seawall where HI03 is located, but continued to build seaward nearest the inlet. However, by 2013, the dune line had receded dramatically along the majority of the beach, and especially just east of the seawall. Dune recession averaged 2 m/yr. for this stretch, but had pockets of erosion that averaged 5-6 m/yr. Previously (through 2011), this portion of Higgins Beach had a positive growth rate of 0.4 m/yr. **The general trend is extensive erosion of the dune in this area**.

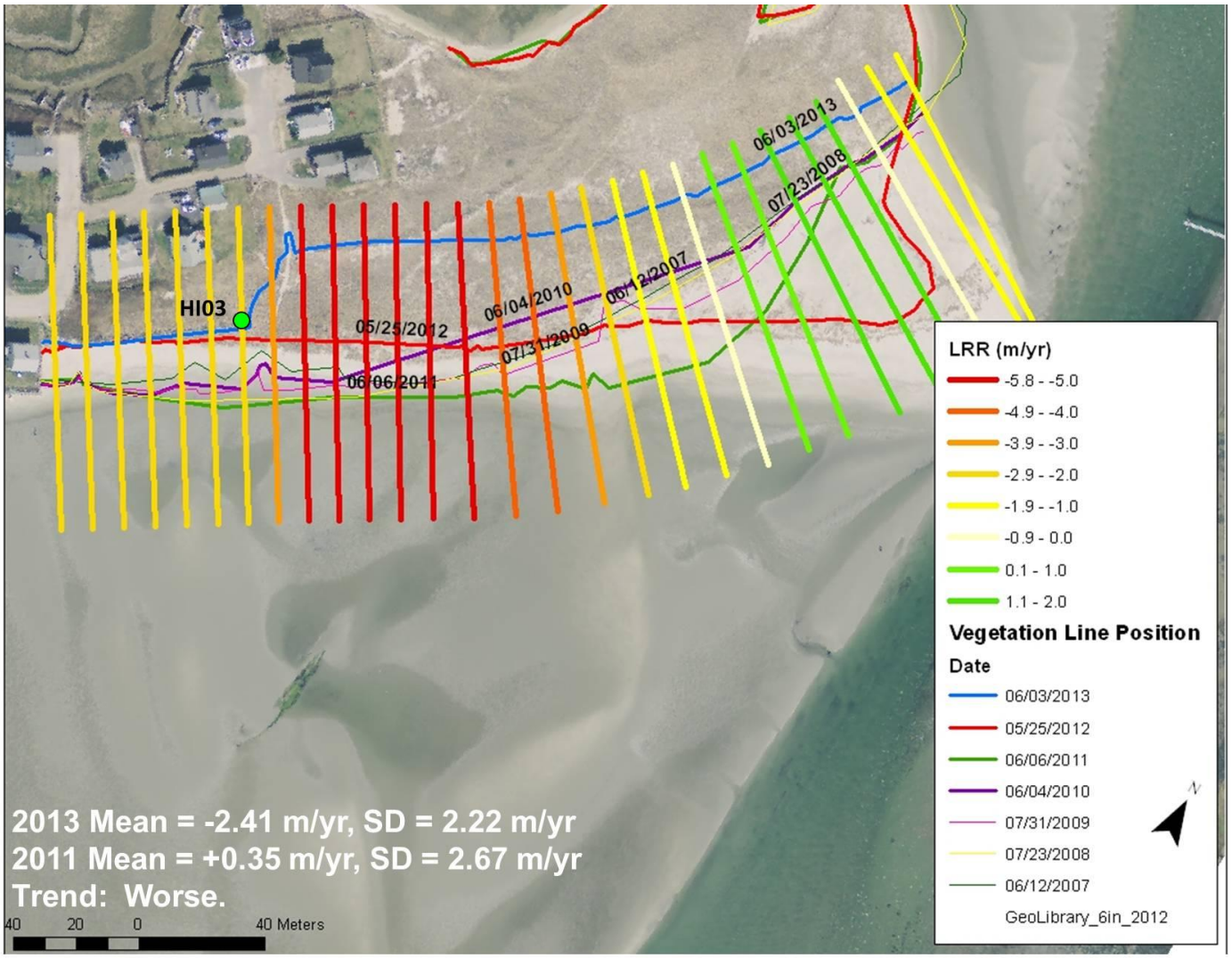

Figure 14. MBMAP data showing shoreline changes along the eastern end of Higgins Beach, Scarborough, nearest the Spurwink River. 2012 base imagery from Maine OGIS.

Scarborough Beach, Scarborough

A total of four beach profiles (SC01 to SC04, Figure 15) were available for comparison.

Winter SC01 = B (85). 2011 grade: C. Trend: Better. SC01, located north of the beach access path, received a C+ and C previously. It had a concave shape with few features (Figure 16). In 2011, it gained elevation and had good recovery. Sand came back to the profile in 2012, and it reached its fullest extent, gaining over 1 m of elevation (over the 2010 shape). It underwent erosion in 2013, resulting in lowering, but still above 2010 and 2011. This profile demonstrated positive net changes since reaching an erosive shape in 2010, even though it lost sediment from 2012-2013.

Summer SC01 = B (85). 2011 grade: B+. Trend: Worse. In 2010, a berm was clearly present at the 20-30 m mark (Figure 17). In 2011, the berm was lost and the profile lowered seaward (this was the most erosive year). In 2012, it had a large, well defined berm, which was slightly lower in elevation and farther seaward than the 2010 shape. This could be indicative of beach recovery and seaward growth of the berm. All years showed good dune stability.

Winter SC02 = B+ (88). 2011 grade: C. Trend: Better. Profile SC02, located just south of SC02 but north of the access path, received a B and C previously. In 2010, it had a steep slope from the dune, and a well-defined berm (Figure 18). By 2011, the steep slope flattened, and the berm was eroded, though its elevation in the offshore increased. 2012 had additional sand gains along the profile; this shape was maintained through 2013, indicating good stability. This profile gained sediment and was stable over the past 2 winters.

Summer SC02 = B (85). 2011 grade: B. Trend: Same. In 2010, the profile had the highest, best defined berm (Figure 19). In 2011, the berm flattened, but the profile gained sand at the base of the dunes – 2011 was the most erosive. Similar to SC01, the 2012 shape had a prominent berm, located slightly more seaward, indicating potential beach growth. The profiles from 2010 and 2012 were quite similar, with the berm migrating slightly seaward, marking beach growth.

Winter SC03 = C (75). 2011 grade: F. Trend: Better. Profile SC03, located just south of the access path, received a C and an F previously. In 2010, it had a well-defined berm between 30-45 m (Figure 20). It eroded in 2011 to its most erosive shape. It showed recovery in 2012, with the highest elevations and a well-defined berm. In 2013, it eroded and the berm moved landward but stayed above 2011. Comparing 2010 and 2013, the berm was more landward (at 20 m instead of 30-45 m), and higher. The profile showed stability but landward berm movement, indicating slight erosion.

Summer SC03 =C+ (78). 2011 grade: D. Trend: Better. In 2010, the profile had a prominent berm at 30 m (Figure 21). In 2011 it had its lowest elevations, with berm loss and flattening of the profile to 60 m. In 2012, it recovered, with berm reestablishment, and elevation gains. The 2012 berm doesn't reach that of 2010, but had more sand offshore. This profile showed seaward growth, but a marked loss in the berm's elevation.

Winter SC04 = C- (72). 2011 grade: C. Trend: Slightly worse. SC04 received a C previously. In 2010, it had a well-defined berm near 40 m (Figure 22). This eroded in 2011, and the berm narrowed and lost elevation. In 2012, the beach recovered, with berm reforming higher and more landward than 2011. In 2013, the profile eroded – it lost its berm, and eroded down to or below 2011 elevations. Comparing 2010 and 2013 profiles showed some landward sand movement, and berm loss. This profile remained slightly erosive.

Summer SC04 = C (75). 2011 grade: B+. Trend: Worse. In 2010, a large, well defined berm was near the 30 m mark - this is the highest berm of all profiles (Figure 23). In 2011, the berm lost elevation while flattening and remaining in roughly the same place. Its seaward portion gained elevation while some erosion occurred between the dune and the berm. By 2012, it showed landward migration of the berm at the same elevation as the 2011 profile. This profile is showing slight erosion in the 2011-2012 season, but has not grown seaward, nor has it reached or exceeded the well-defined 2010 shape.

Winter Summary: Winter 2012 had the most sediment rich profiles, with either winter 2010 or winter 2011 being the most erosive. Profiles recovered from these low points through 2012, but showed signs of erosion in the winter of 2013. In this assessment, the profiles north of the access path (SC01 and SC02) showed more stability or accretion than those south of the path. **Winter Beach Grade: B- (80). 2011 grade: C- (70). Trend: Better**

Summer Summary: Generally, the summer of 2010 had the highest and best defined summer berms at each beach, while summer 2011 was generally most erosive. Last summer's 2012 berms never achieved the same elevations as 2010, but showed seaward growth, indicating seaward beach growth, albeit at a lower elevation than the 2010 beach. Berm growth mostly took place north of the access path. **Summer Beach Grade: B- (81). 2011 grade: B- (82). Trend: Same.**

Overall Summary: Profiles were relatively stable to slightly erosive, with the largest erosion near SC04. This profile is furthest south, and impacted by cobble migration associated with a salient stretching offshore. SC01 had the most "winter" shape (concave), while the others had winter and summer berms. The beach maintained good summer shapes, with some seaward growth of the berms, especially north of the access path. **Overall Scarborough Beach Grade: B- (80). 2011 grade: C (76). Trend: Better.**

Figure 15. Locations of Scarborough Beach profiles. 2012 base imagery from Maine OGIS.

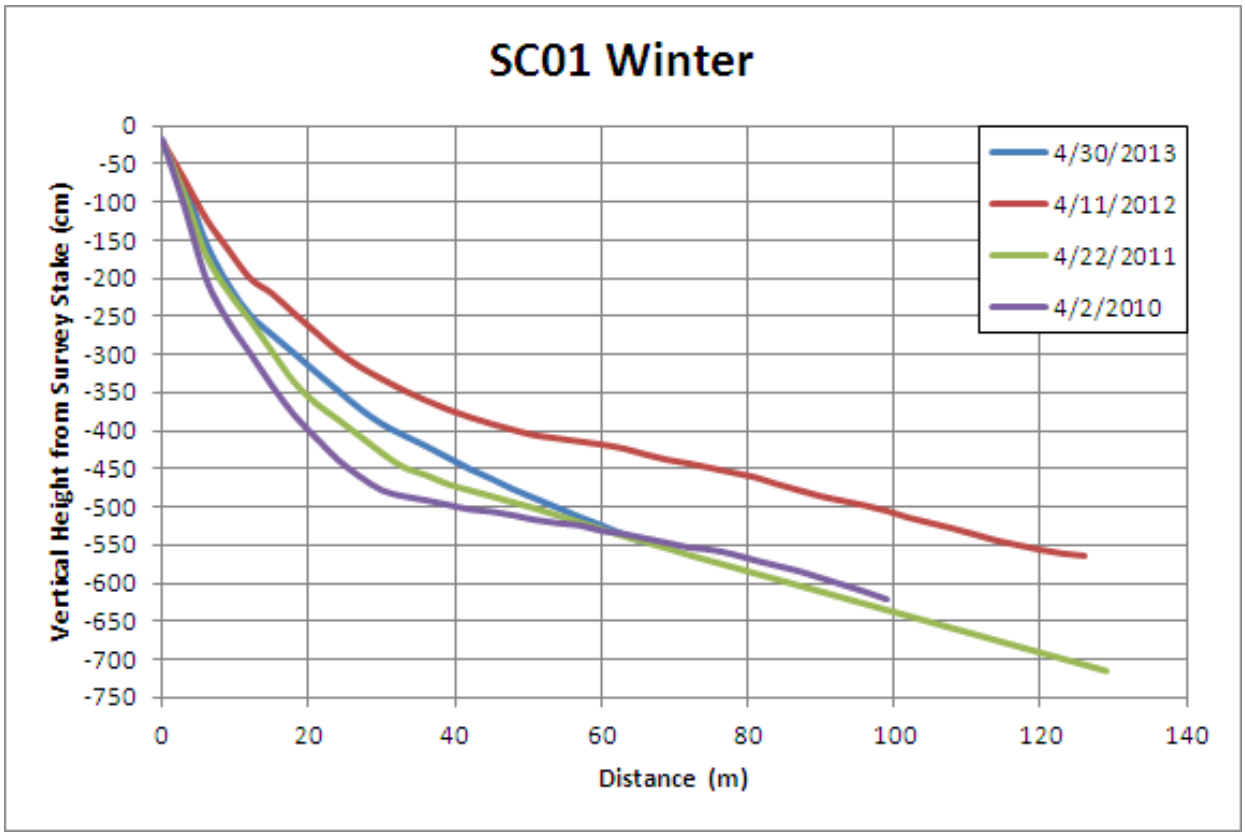

Figure 16. Winter beach profiles for SC01 from 2010, 2011, 2012, and 2013.

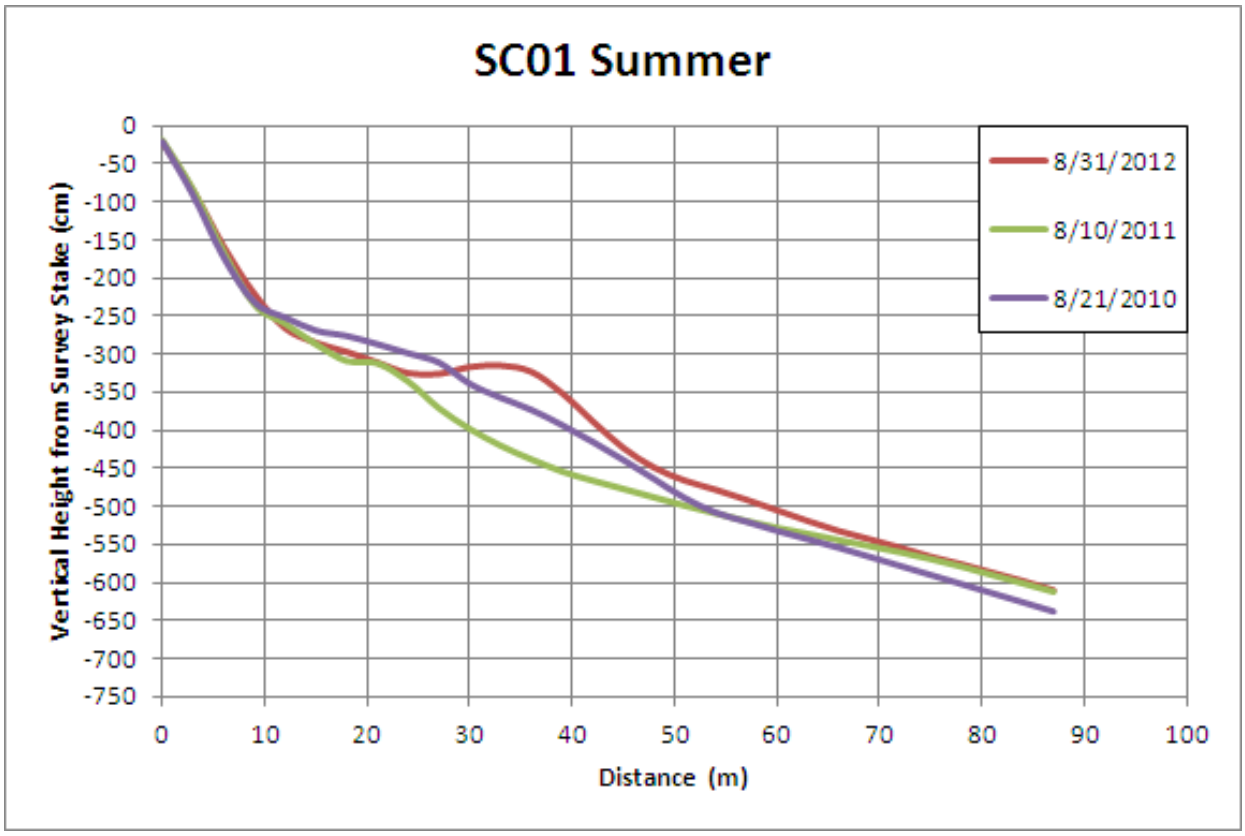

Figure 17. Summer beach profiles for SC01 from 2010, 2011, and 2012.

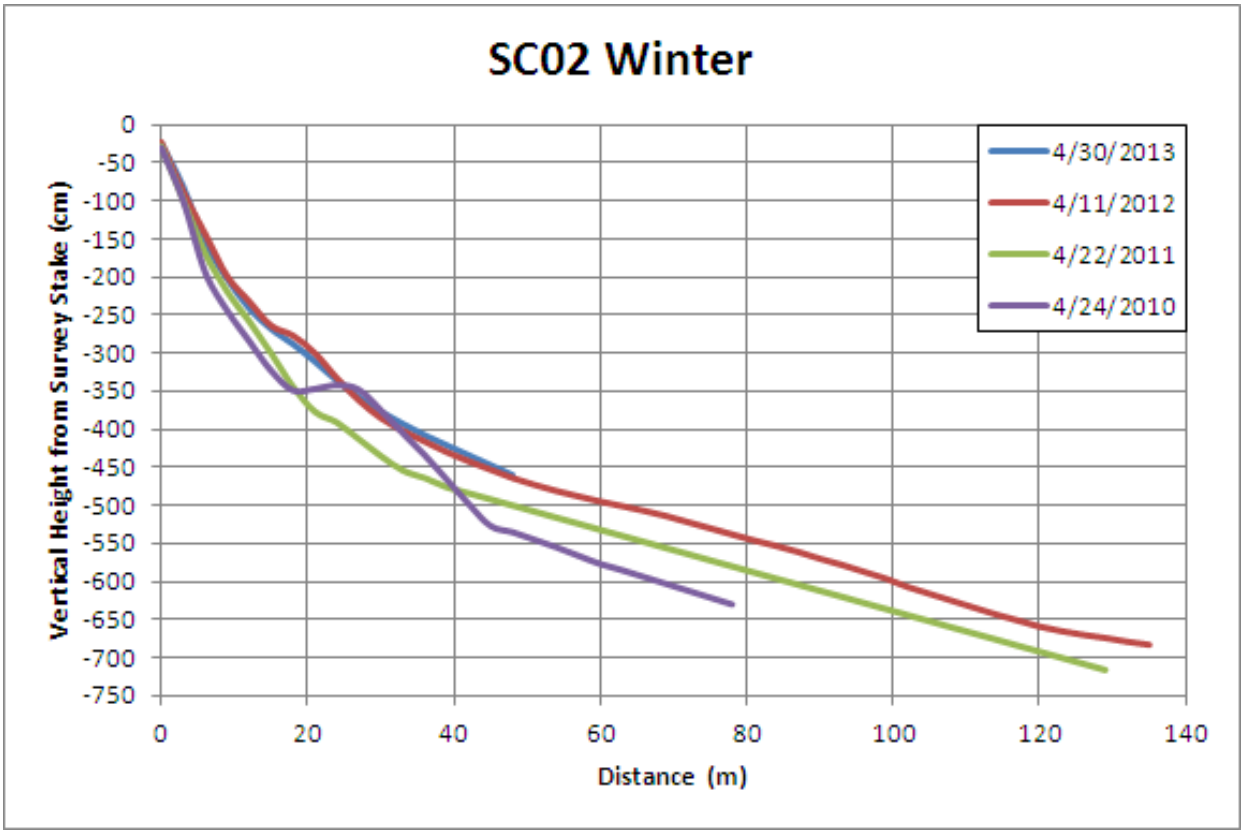

Figure 18. Winter beach profiles for SC02 from 2010, 2011, 2012, and 2013.

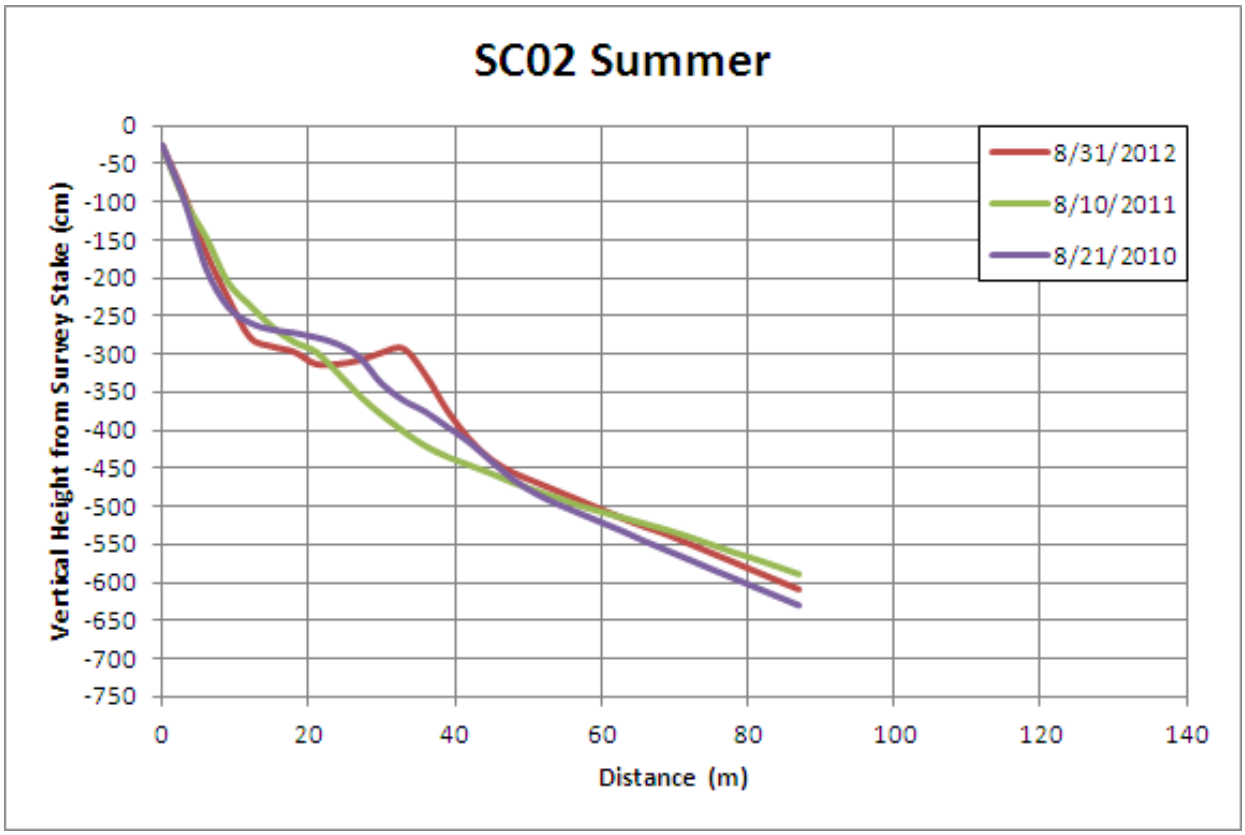

Figure 19. Summer beach profiles for SC02 from 2010, 2011, and 2012.

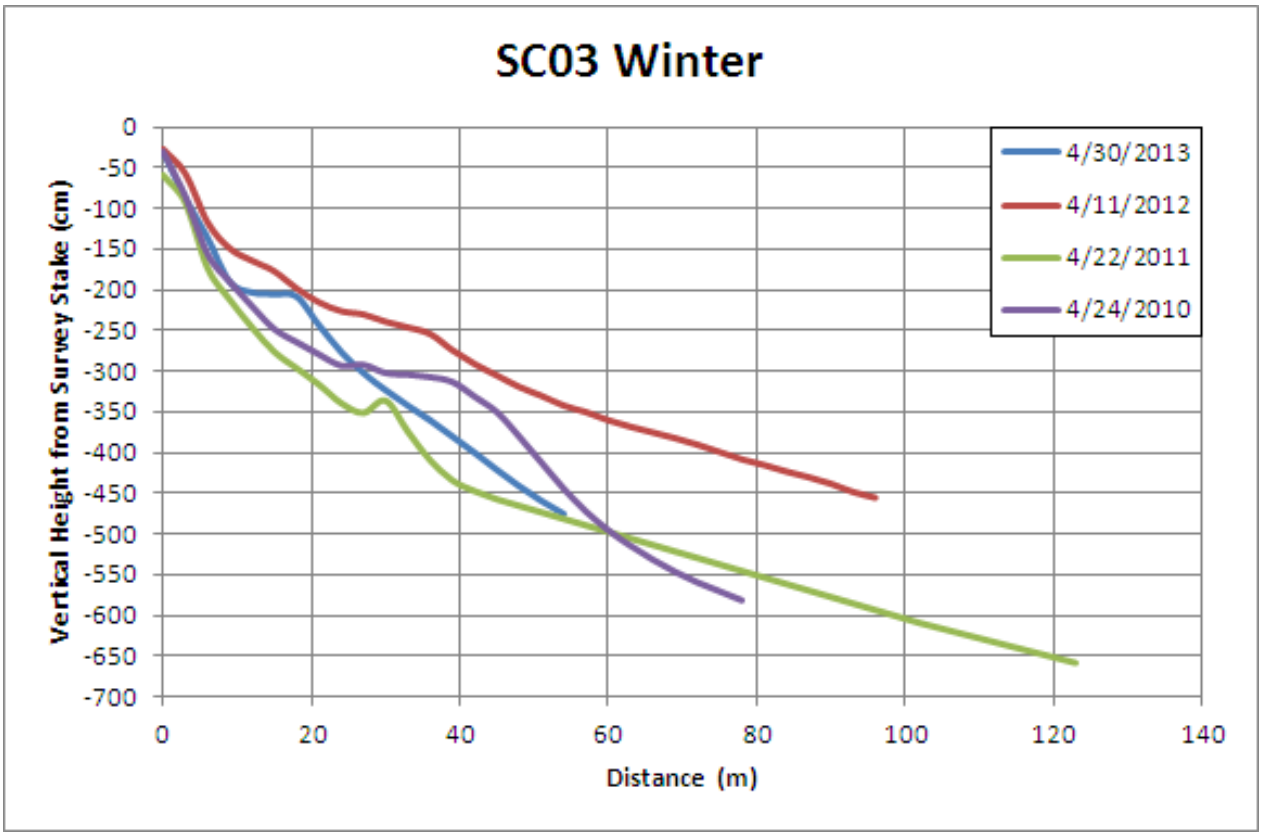

Figure 20. Winter beach profiles for SC03 from 2010, 2011, 2012, and 2013.

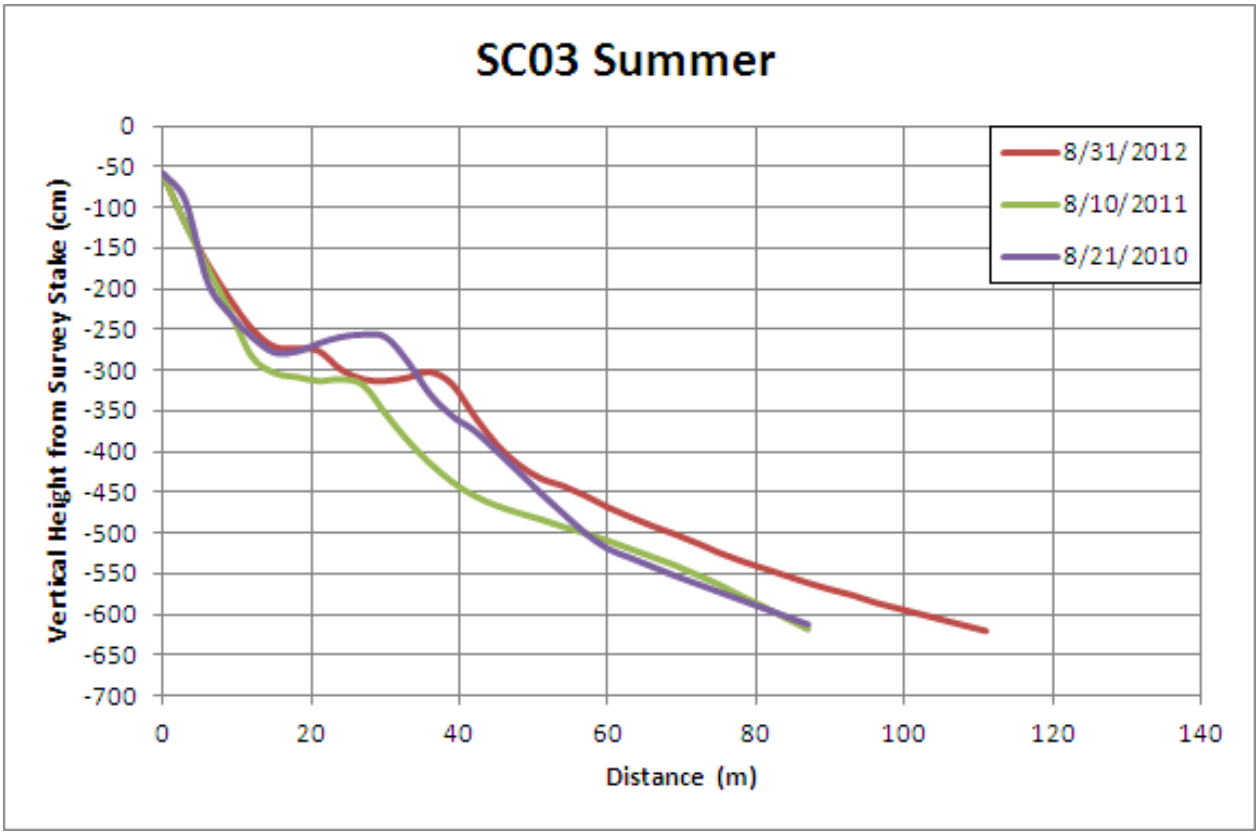

Figure 21. Summer beach profiles for SC03 from 2010, 2011, and 2012.

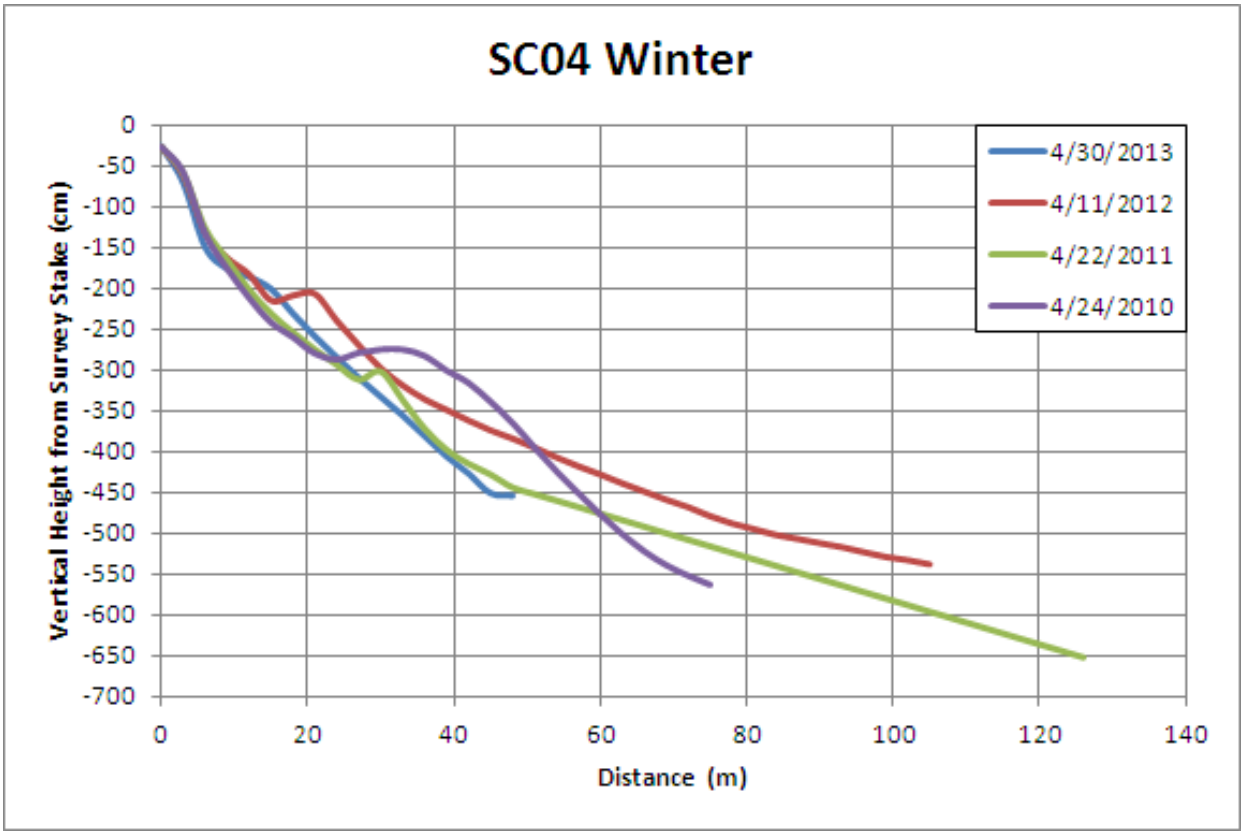

Figure 22. Winter beach profiles for SC04 from 2010, 2011, 2012, and 2013.

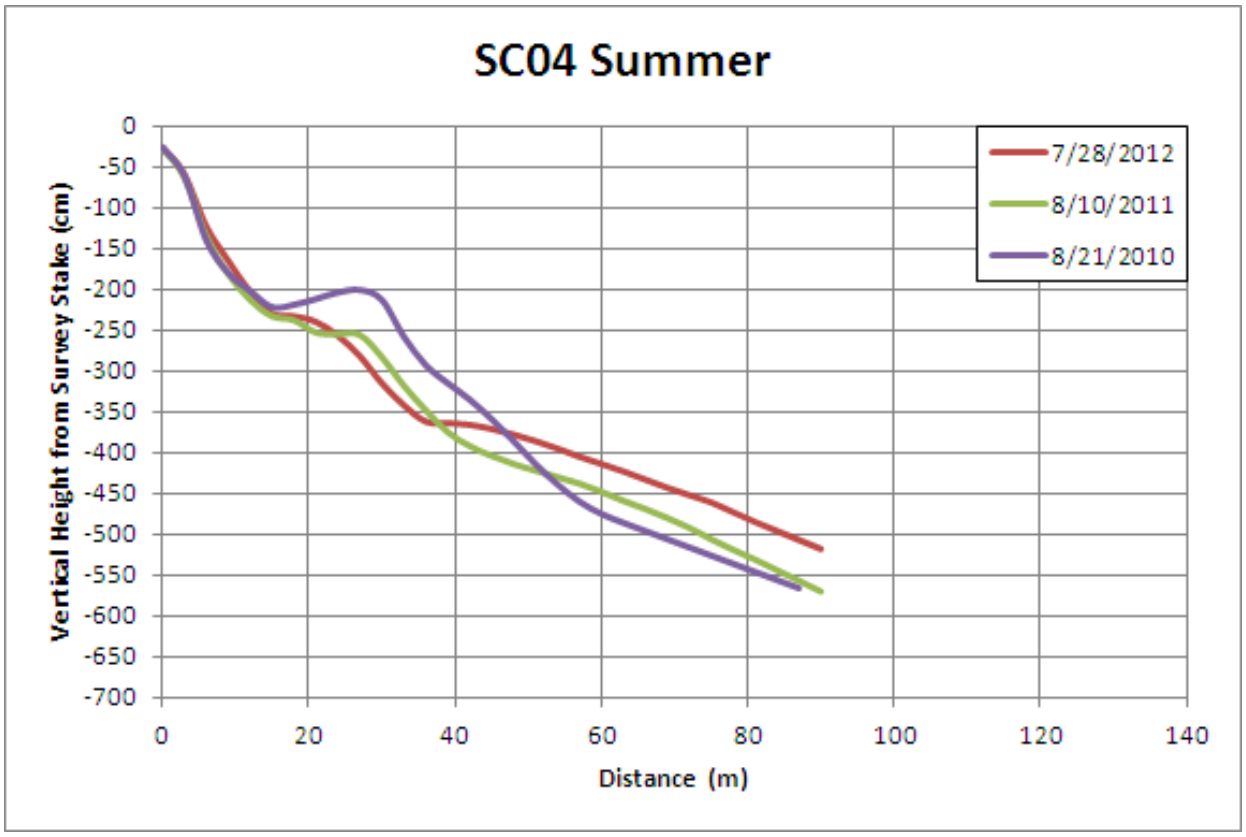

Figure 23. Summer beach profiles for SC04 from 2010, 2011, and 2012.

Scarborough Beach MBMAP Results

The overall 2007-2011 vegetation shoreline change rate was -0.52 m/yr. By 2012, the shoreline change rate was -0.18 m/yr. Although this is within the variability of the data, this **signified a better trend** (Figure 24). A close up view of the data (Figure 25) indicated that north (to the right, circled in green) of the access path, erosion was not nearly has high as south (to the left, circled in red) of the access path. These overall trends were also reflected by the profile data analyzed.

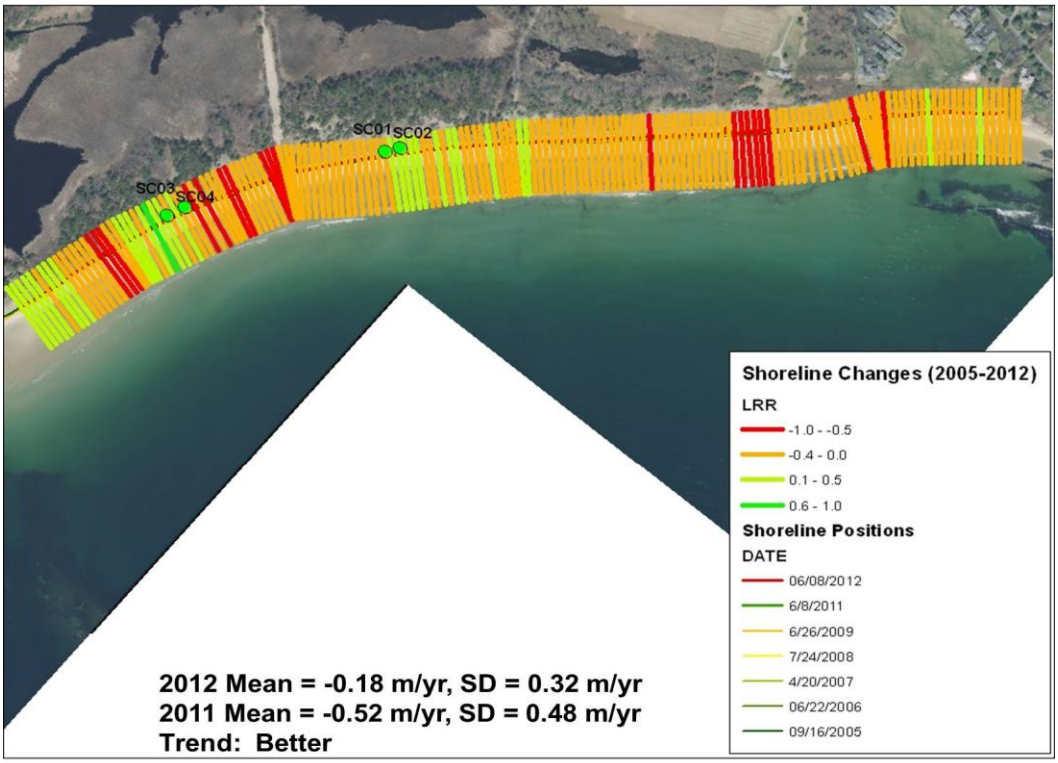

Figure 24. MBMAP results for Scarborough Beach. Base imagery from Maine OGIS.

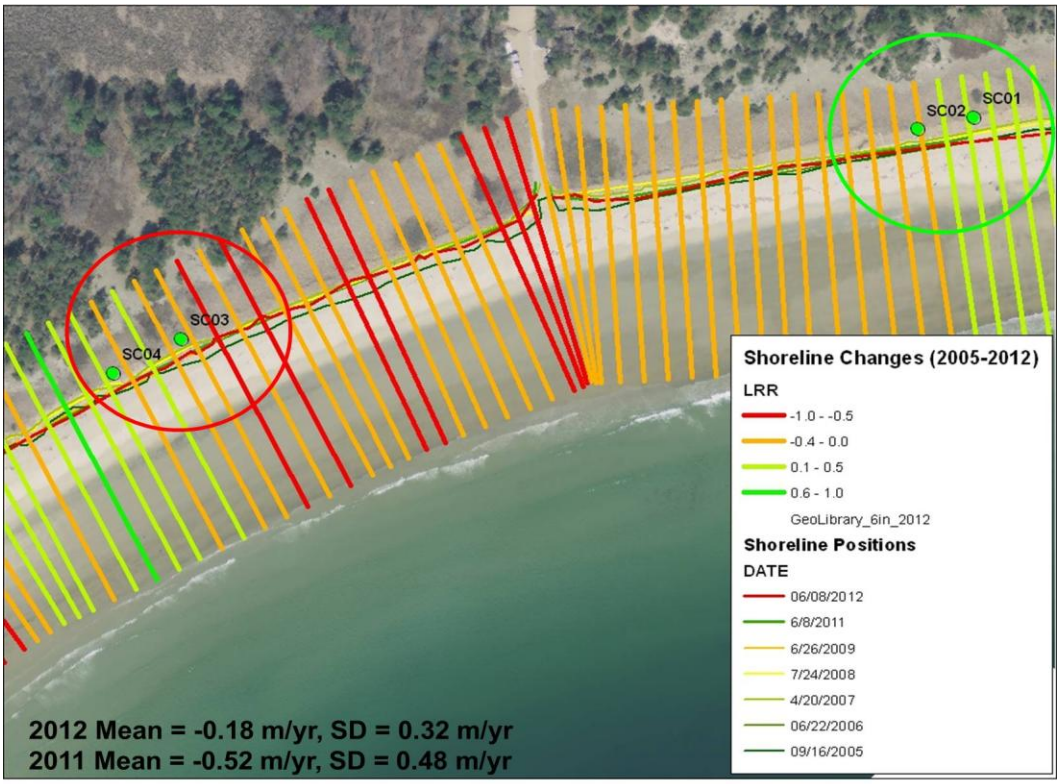

Figure 25. MBMAP results for Scarborough Beach. Base imagery from Maine OGIS.

East Grand Beach, Scarborough

Four profiles (EG01-EG04, Figure 26) were available. No data was collected in summer 2012 or winter 2013.

Winter EG01 = D (65). 2011 grade: A. Trend: Worse. This profile received a C and an A previously. In 2010, the profile exhibited a well-defined dune and relatively steep slope to the 80 m mark, where it flattened seaward along a low berm and flat beach (Figure 27). In 2011, the dune grew slightly farther seaward, and the berm/beach developed a gentle slope, gaining elevation above all other years. The 2012 shape showed significant erosion and landward movement of the entire profile, including the dune, beach face and berm.

Summer EG01 = C+ (78). 2011 grade: B. Trend: Worse. From 2010 to 2011, the profile showed loss of the berm but landward growth of the dune and offshore (Figure 28). This is a reversal of a long standing trend of continuous dune growth, punctuated by anomalous accretion between 2009 and 2010. However, there is ample sediment supply at this profile, indicating that although the dune is migrating landward, it may be readjusting to the accretion that occurred in 2010. We have no 2012 data for comparison, so we give this a cautionary C+ since there is evidence of ample sediment, but the switch from dune growth to landward migration is troubling.

Winter EG02 = A (95). 2011 grade: A. Trend: Same. The profile received an A previously. From 2010 to 2011 (Figure 29), the profile showed growth of the dune and the beach elevation. This trend continued, with dune crest growth (but slight landward translation) on the order of 1.2 m. The foreshore slope stayed in roughly the same location, and the beach berm gained about 1.2 m in elevation. This profile showed ample sediment supply and continued growth but slight landward movement.

Summer EG02 = C+ (78). 2011 grade: B . Trend: Worse. Similar to EG01, this profile showed loss of the berm and landward migration between 2010 and 2011 (Figure 30). Although we have no 2012 data for comparison, we give this a cautionary C+ since there is evidence of ample sediment, but the switch from seaward dune growth to landward migration is troubling.

Winter EG03 = C- (72). 2011 grade: A. Trend: Worse. The profile received an A previously. In 2010 it had a defined dune and steep slope to flat berm (Figure 31). By 2011, the dune gained height, the slope lessened, and a well-defined berm formed. By 2012, the dune crest moved landward and the entire profile lowered. This profile is in an erosive trend.

Summer EG03 = C+ (78). 2011 grade: A. Trend: Worse. Similar to the other East Grand summer profiles, this profile showed loss of the berm and landward migration between 2010 and 2011 (Figure 32).

Winter EG04 = D (65). 2011 grade: A-. Trend: Worse. The profile received a B- and an A- previously. EG04 showed nice growth of the dune and berm from 2010 to 2011 (Figure 33). The 2012 profile showed lowering of the dune and landward movement of the whole profile to below 2010 shapes, indicating erosion. This profile is in an erosive trend.

Summer EG04 = C+ (78). 2011 grade: A. Trend: Worse. Again, similar to the other summer profiles, the dune crest moved inland, but gained in elevation, while the berm was lost (Figure 34).

Winter Summary: Unlike the last few assessments, the profiles generally showed erosion over the past few years (excluding 2013 data), especially of the dune areas, which historically have been growing seaward. Except for EG02, the dunes showed signs of landward migration. **Winter Beach Grade: C (74). 2011 grade: A (94). Trend: Worse.**

Summer Summary: Unlike the last assessment which showed seaward growth of dunes and berms, the summer beach shapes along East Grand Beach all indicated inland migration of the dune landward, but vertical growth, and ample sediment supply offshore. Each profile generally showed loss of the berm. It appears that these profiles underwent transgression (landward migration), but there is ample sediment supply to allow overwash to build up the dune in a landward direction. However, this trend is somewhat troubling since the last two assessments saw almost continuous seaward dune growth. **Summer Beach Grade: C+ (78). 2011 grade: A- (90). Trend: Worse.**

Overall Summary: East Grand Beach has reversed a long trend of marked seaward growth of the dune and berms from the previous assessments. The winter profiles –which include data through winter 2012 – all showed landward movement and dune erosion. The summer profiles – which only include data through summer 2011 – showed landward movement of dune crests, and berm losses. However, the profiles also showed vertical growth of the dunes, indicating an ample sediment supply to allow natural transgression to occur.
Overall Beach Grade: C (76). 2011 grade: A- (92). Trend: Worse.

Figure 26. Locations of East Grand Beach volunteer monitoring profiles. Base imagery from Maine OGIS.

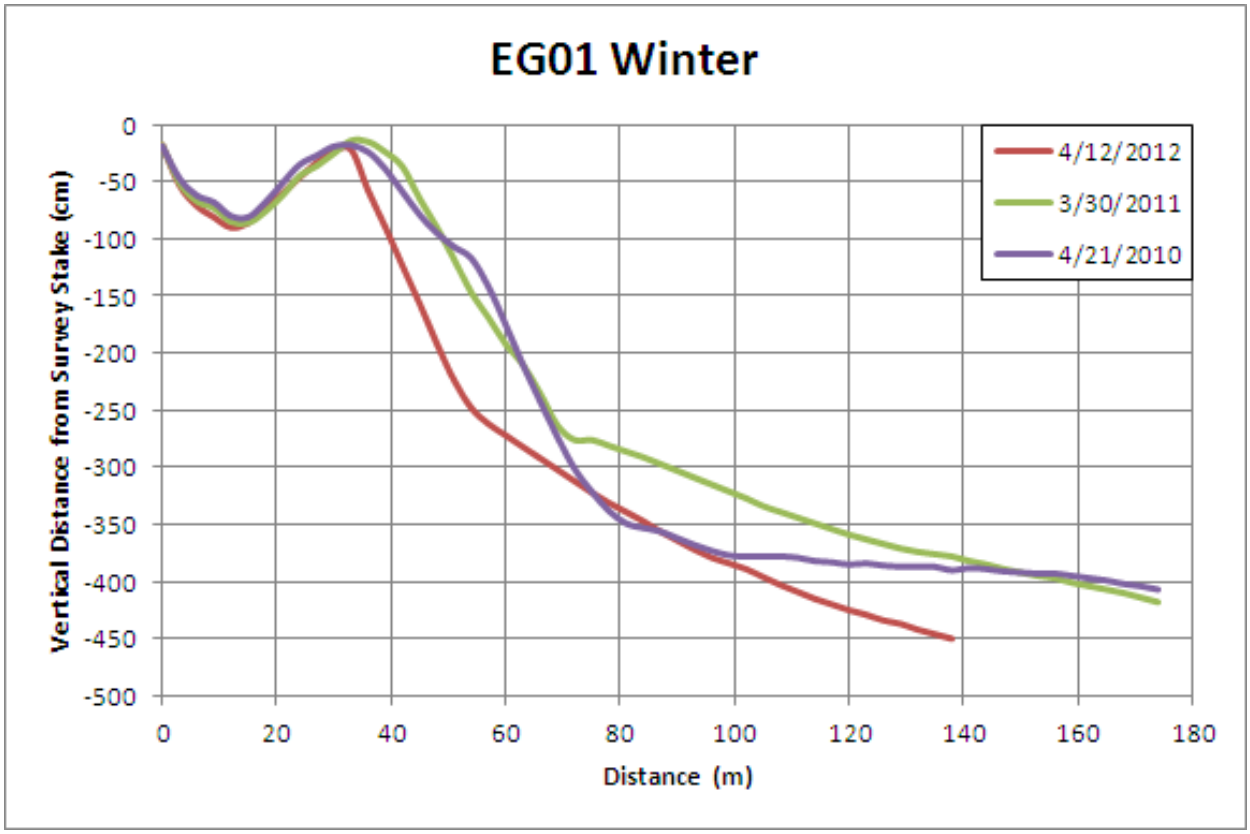

Figure 27. Winter beach profiles for EG01 from 2010, 2011, and 2012.

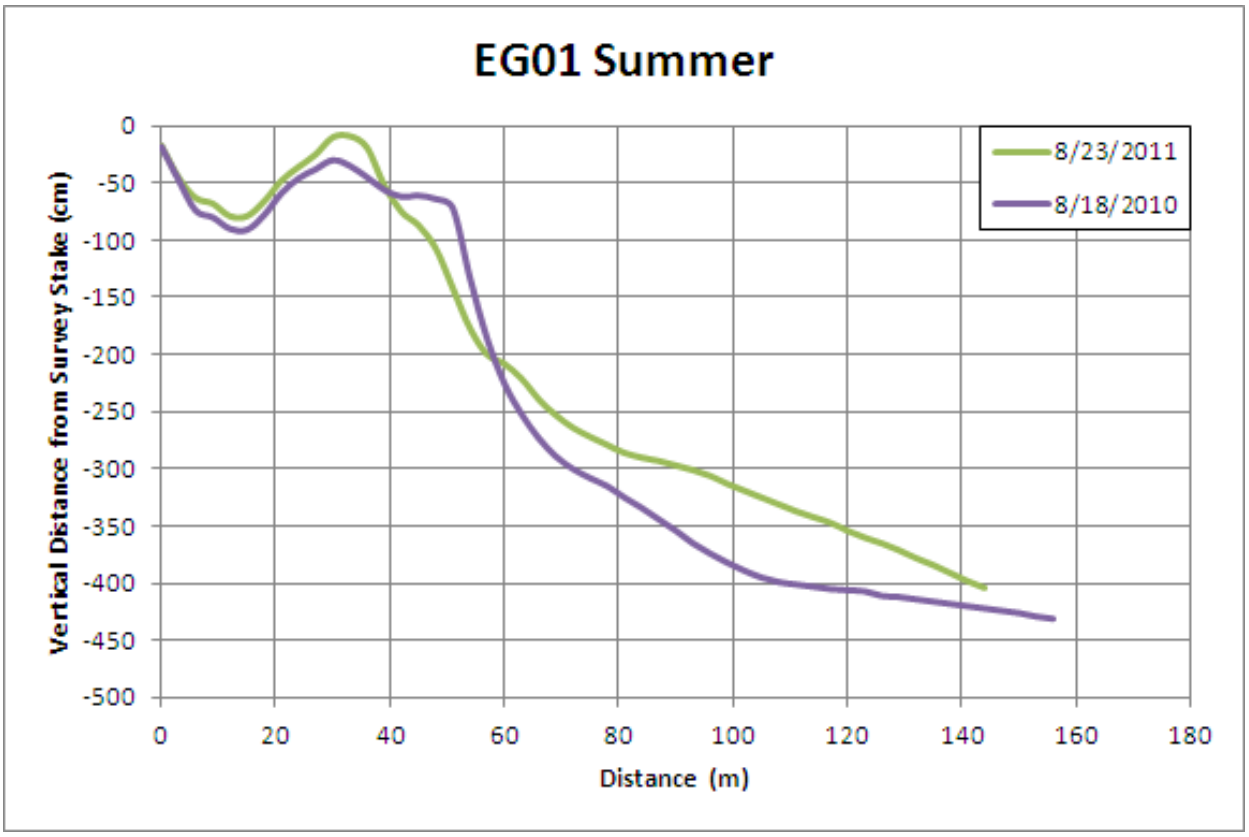

Figure 28. Summer beach profiles for EG01 from 2010 and 2011.

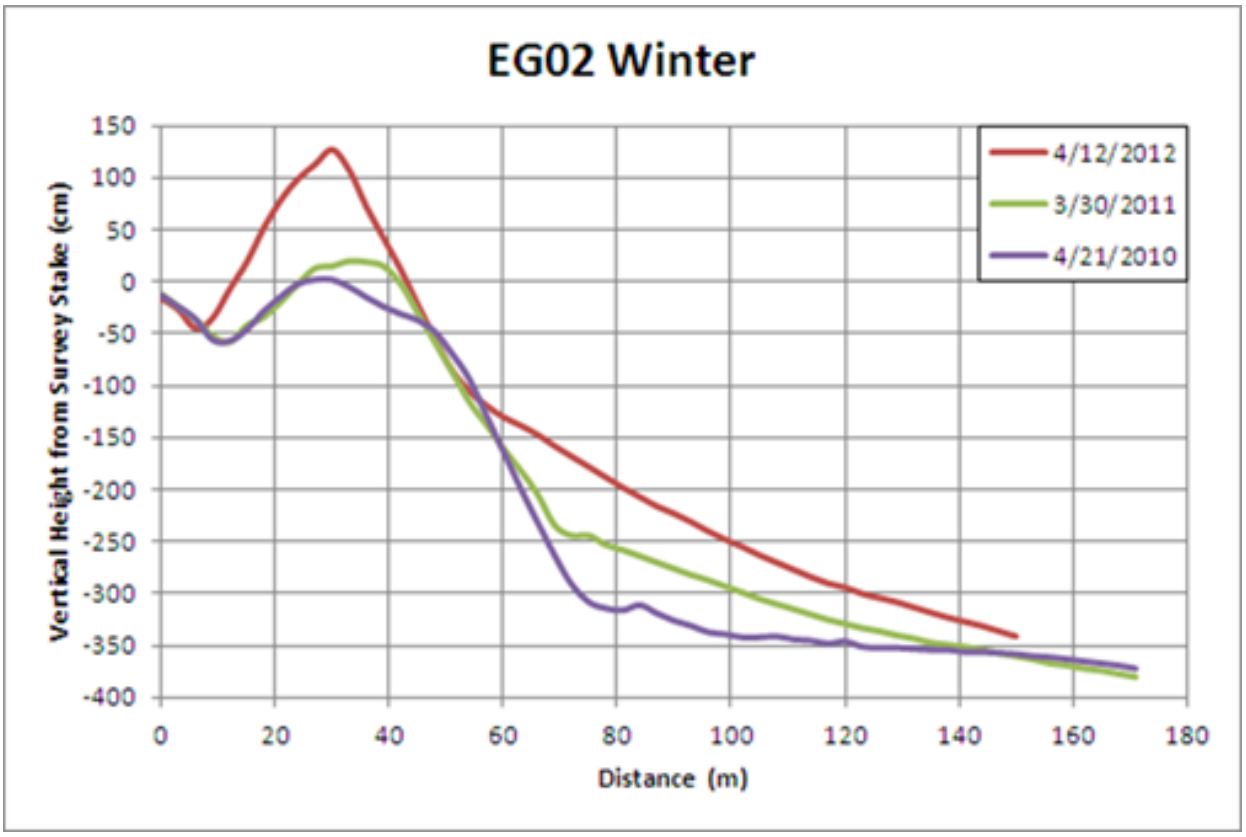

Figure 29. Winter beach profiles for EG02 from 2010, 2011, and 2012.

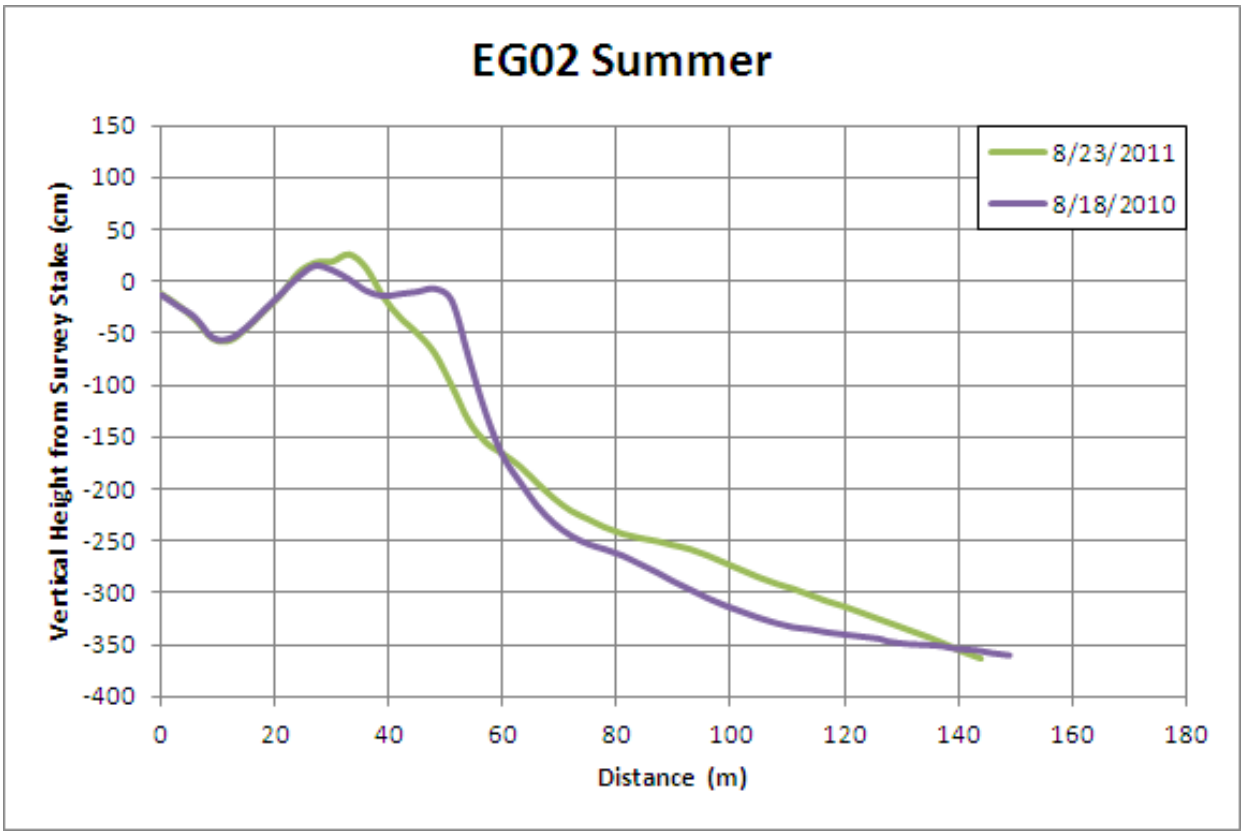

Figure 30. Summer beach profiles for EG02 from 2010 and 2011.

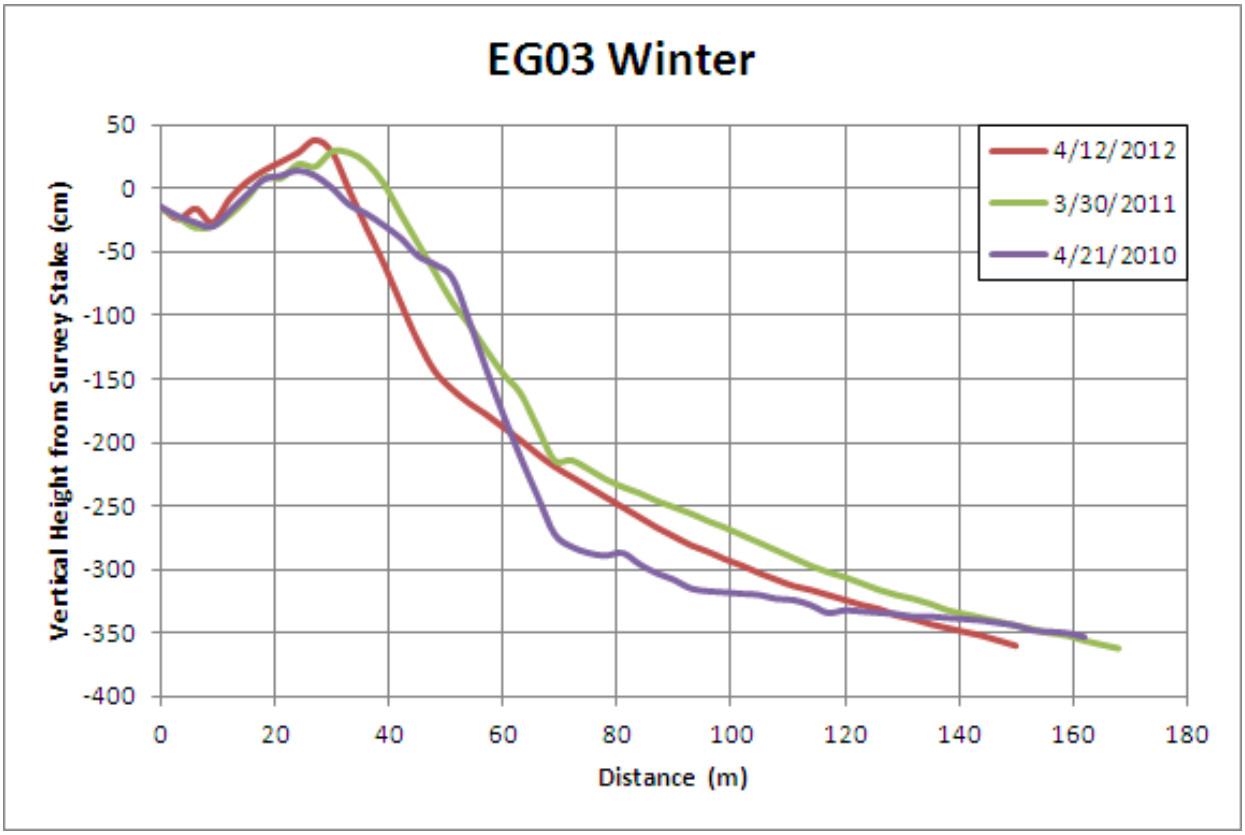

Figure 31. Winter beach profiles for EG03 from 2010, 2011, and 2012.

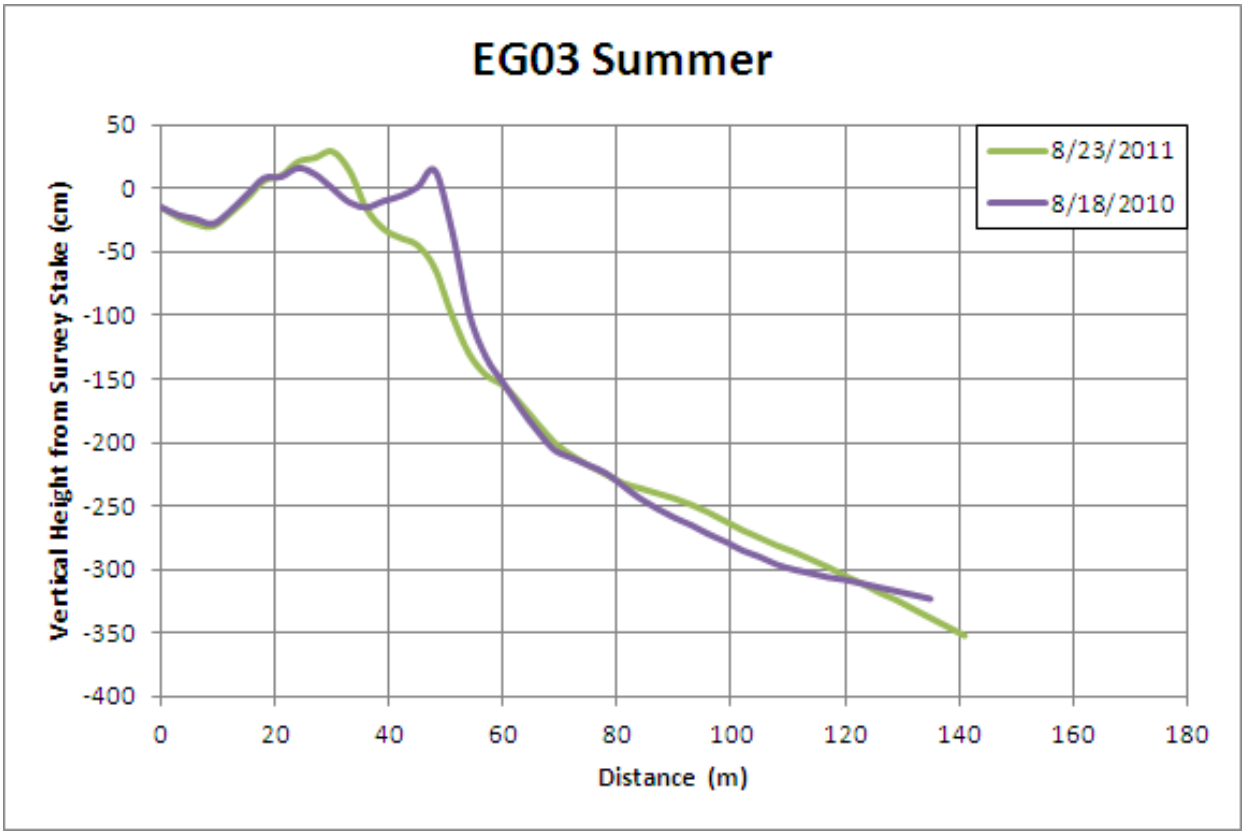

Figure 32. Summer beach profiles for EG03 from 2010 and 2011.

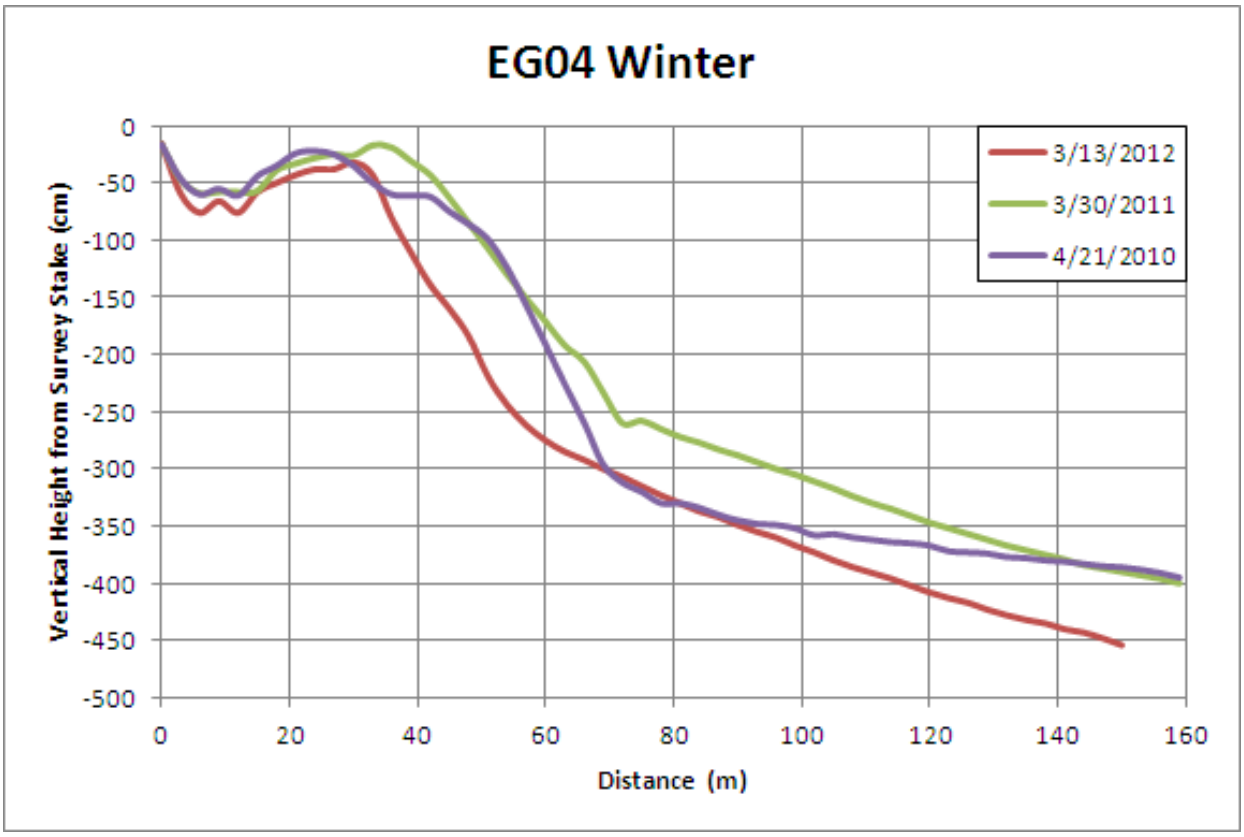

Figure 33. Winter beach profiles for EG04 from 2010, 2011, and 2012.

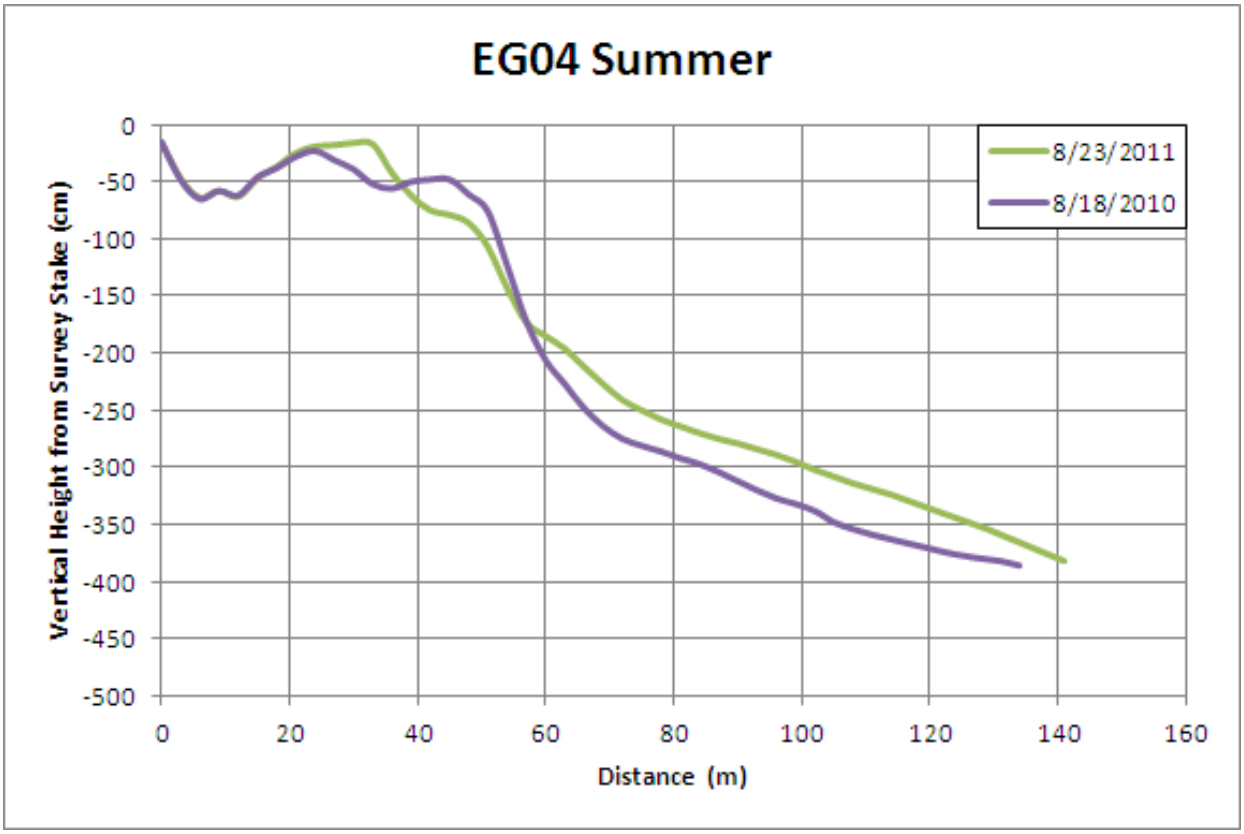

Figure 34. Summer beach profiles for EG04 from 2010 and 2011.

East Grand Beach MBMAP Results

Vegetation line changes from 2007 through 2012 were available for comparison for the entire Pine Point area. The overall calculated rate from the last report had a mean rate of +0.63 m/yr.; in 2012, that number dropped by half, to +0.30 m/yr. (but within the standard deviation) (Figure 35).

Analysis of shoreline changes near the profiles themselves showed that between 2007 and 2011, the area saw accretion of the dune around +1.0 m/yr. Including 2012 data, that number fell slightly to between +0.4 m/yr. and +0.8 m/yr. – still positive, but **showing a decreased trend.**

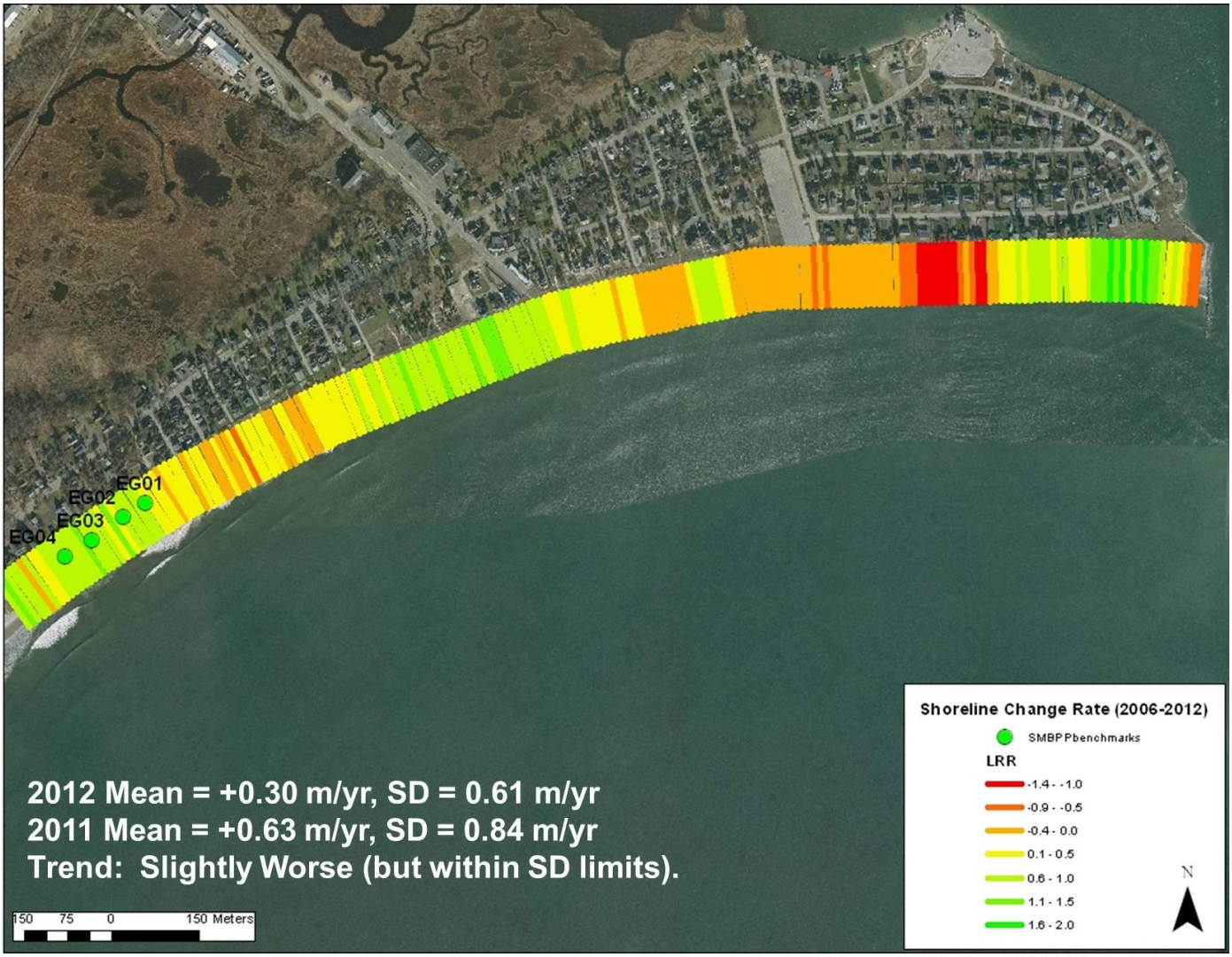

Figure 35. MBMAP shoreline change analysis results for the Pine Point/East Grand Beach area. Base imagery from Maine OGIS.

Kinney Shores, Saco

A total of two beach profiles (KS01, KS02, Figure 36) were available for comparison.

Winter KS01 = D (65). 2011 grade: A. Trend: Worse. Profile KS01, located at the southern end of Kinney Shores in a natural dune, received a C and an A previously, and showed good recovery from the Patriots' Day event to 2011. In 2010, it showed a steep foreshore, with a berm around 30 m (Figure 37). In 2011, the profile underwent recovery, with gains in elevation along its length and a well-defined, higher berm near 20 m. However, by 2012, the profile lowered along its entire length, exhibiting a more erosive shape. Unfortunately, this trend continued into 2013, with a steep and very short reflective shape, indicating substantial beach loss. Profile data for 2013 was taken from March instead of April because profiling was moved to the back stake in April due to erosion; thus, for ease of comparison with other previously collected front stake data, the March 2013 data was used.

Summer KS01 = C- (72). 2011 grade: B. Trend: Worse. The 2010 profile exhibited a nicely defined berm right at the 20 m mark. This year had the highest berm (Figure 38). By 2011, the profile gained some sand at the base of the seawall, and the berm lowered in elevation and moved slightly landward. The profile also gained elevation offshore. However, by the summer of 2012, the berm lowered (by about 80 cm below the 2010 maximum), but maintained its location at the 20 m mark. At its landward edge and in the offshore, the profile showed good stability between 2011 and 2012. The profile showed major loss in the summer berm, but some stability along its landward and seaward extents. However, we remain very concerned about the elevation loss in the summer berm.

Winter KS02 = C (75). 2011 grade: C. Trend: Same. KS02, located at the northern end of Kinney Shores in a seawall with a dune, received an A- and C previously. The 2010 profile had a berm feature at around the 20-25 m (Figure 39). In 2011, the lower portion of the profile eroded, and although the berm gained in elevation, it migrated landward, indicating erosion of the beach and landward retreat. By March 2012, the profile showed good recovery, with a well-defined berm out at the 40 m mark, and elevation gains offshore. In 2013, the profile showed some stability out to 40 m, but lost some elevation offshore. This profile is showing stability to slight erosion, and remains with a cautious rating.

Summer KS02 = B (85). 2011 grade: C. Trend: Better. The 2010 shape showed a small scarp in the dune, and a berm at around 20 m from the pin (figure 40). The 2011 profile shows the berm growing seaward, albeit slightly less in height, and steepening to a concave shape. Conversely, by 2012, the summer shape gained more sand at its landward end, at the berm, which built farther seaward, and gained elevation offshore, indicating accretion along the entire profile over the past several years.

Winter Summary: KS01 had its highest profile in the winter of 2011, while KS02 had its lowest. As KS02 showed some stability and recovery, KS01 (slightly farther south), showed erosion in 2012 and 2013. It appears that erosion along the shoreline is negatively impacting KS01 at this time. **Winter Beach Grade: C- (70). 2011 grade: B (85). Trend: Worse**

Summer Summary: The summer profiles both exhibited seasonal summer berms. Trends in the summer shapes are opposite that of 2011; Profile KS02 showed growth, while KS01 showed some erosion. It appears that these two profiles undergo opposite changes every few years. **Summer Beach Grade: C+ (79). 2011 grade: B- (80). Trend: About the same.**

Overall Summary: The beach profiles appear to have shifted in terms of their recovery patterns, whereas KS02 underwent good recovery in the last assessment, it appears KS01 is showing much better recovery in both summer and winter shapes in this assessment, while KS02 appears to be undergoing a slightly more erosive trend, with landward migration of its features. **Overall Kinney Shores Beach Grade: C (74). 2011 grade: B (83). Trend: Worse.**

Kinney Shores MBMAP Results

Results for the Kinney Shores MBMAP results will be presented in the next few sections in the context of the larger Saco area and will be discussed after Ferry Beach.

Figure 36. Locations of Kinney Shores volunteer beach profiling locations. Base imagery from Maine OGIS.

Figure 37. Winter beach profiles for KS01 from 2010, 2011, 2012, and 2013.

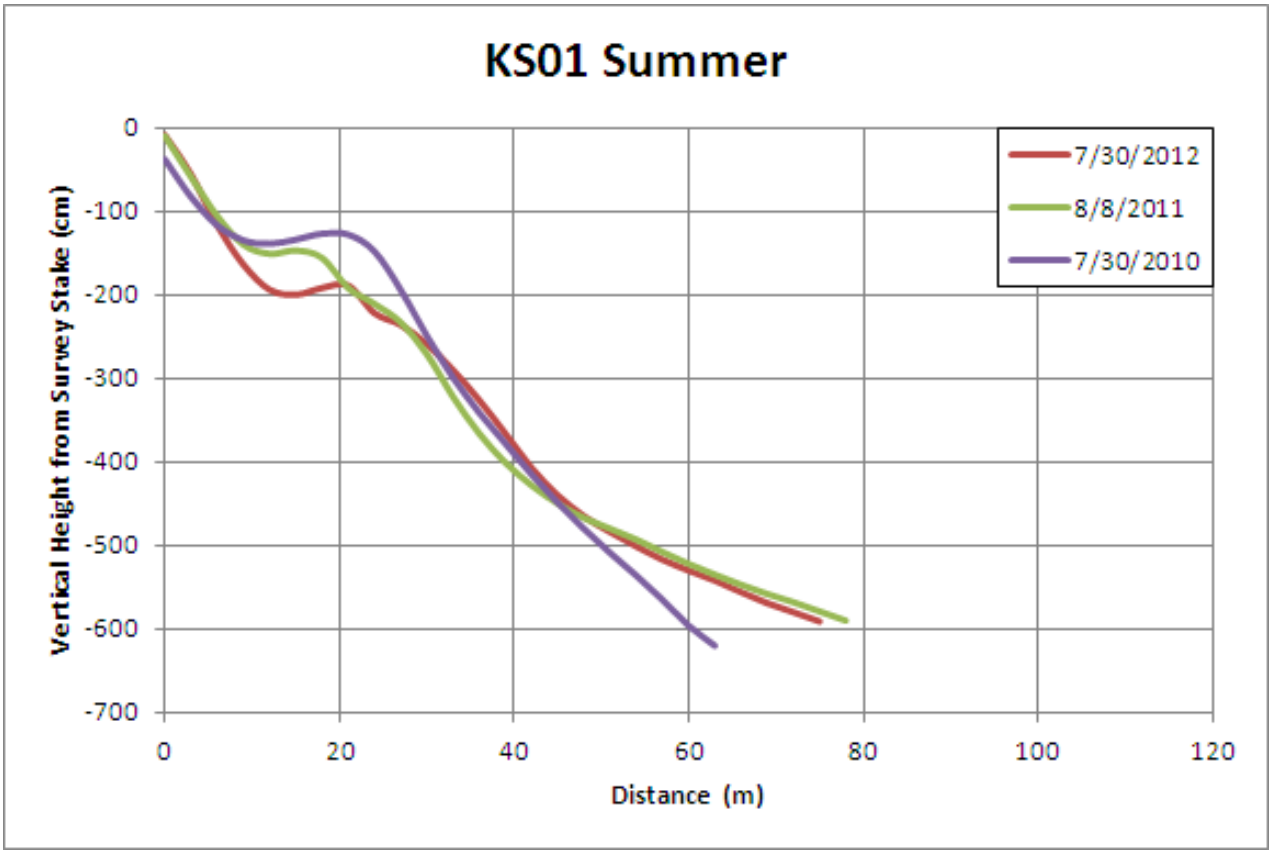

Figure 38. Summer beach profiles for KS01 from 2010, 2011, and 2012.

Figure 39. Winter beach profiles for KS02 from 2010, 2011, 2012, and 2013.

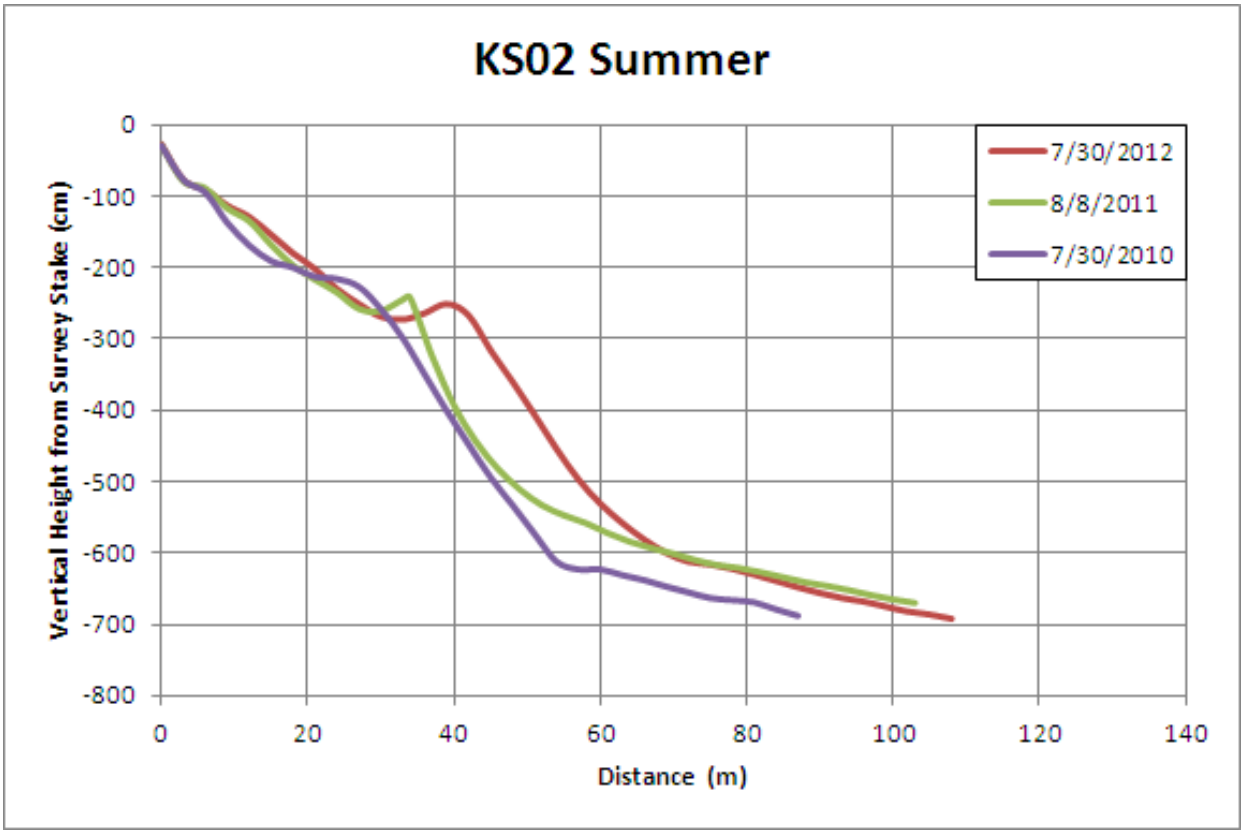

Figure 40. Summer beach profiles for KS02 from 2010, 2011, and 2012.

Ferry Beach, Saco

A total of four beach profiles (FE01 to FE04, Figure 41) were available for comparison.

Winter FE01 = D (65). 2011 grade: D. Trend: Same. The profile received a D previously. From 2010 to 2011 (Figure 42), it showed scarping along the dune, but gains along the lower berm and low tide portions. In 2012, it showed a similar shape to 2010, but had more sand between the berm and the dune (out to 20 m); seaward of this, the profiles looked similar. Sand was lost along the profile from 2011 from 20 m seaward. The winter 2013 profile had a shape similar to 2012 from about 20 m seaward, but landward of this, had additional berm and dune loss.

Summer FE01 = D (65). 2011 grade: D+. Trend: Worse. The summer 2010 profile had a dune and a well-defined berm at 20 m (Figure 43). In 2011, it had some dune and berm retreat, and steepening out to low water. In 2013, it had the same steep profile but additional dune loss at the start of the profile. This profile continued to show erosion at the dune, and though it has remained somewhat stable over the past few summers, is below the 2010 starting profile shape.

Winter FE02 = C- (72). 2011 grade: C. Trend: Worse. The profile received a D and C previously. From 2010 to 2011 (Figure 44), the dune receded slightly, but the berm and lower portion built seaward. It returned to a very similar shape to 2010 in the 2012 winter season, except for the dune showing more recession. The starting pin for the profile was moved in November 2012, so subsequent surveys in 2013 were unavailable. The profile showed some stability along its berm and outer reaches, but also dune recession.

Summer FE02 = D (65). 2011 grade: F. Trend: Better. In 2010, it had a small, scarped dune, and a rounded profile out to the low water mark (Figure 45). In 2011, it lost elevation and migrated landward along its length. By summer 2012, the profile was stable, maintaining a shape very similar to 2011. The profile was below 2010 shapes in all aspects, though did show some stability over the 2011-2012 season.

Winter FE03 = C (75). 2011 grade: D. Trend: Better. Profile FE03 received an F and D previously. The 2010 profile used a July date because the starting pin was lost, reset in May (Figure 46). The 2010 profile showed a dune, and a slight berm around 20 m, and a steep slope to low water. The 2011 profile also showed a well-defined dune, which grew slightly seaward. The 2012 shape showed dune recession and slight landward migration, but overall, good profile stability. The 2013 winter shape showed dune growth landward (likely caused by overwash) and an otherwise stable profile shape. This is the most stable this profile has been over the past 2 reports, which is a good sign.

Summer FE03 = D (65). 2011 grade: C. Trend: Worse. A new starting pin was placed in May of 2010; thus, we will compare starting with the September 2010 profile. It showed landward movement of the dune crest by 2011, and landward movement (erosion) of the entire profile (Figure 47). In summer 2012, it maintained its 2011 shape relatively well. Although it eroded from 2010-2011, it has been somewhat stable in 2011-2012, lending itself to a D instead of F.

Winter FE04 = D (65). 2011 grade: C. Trend: Worse. Profile FE04 received an A and a C previously. The July 2010 profile was used since the starting pin was lost and changed in May 2010 (Figure 48). From 2010 to 2011, it lost sand in the berm (15-20 m from the pin). Below this, the profile gained sand slightly. From 2011 to 2012, it was stable, with only slight lowering in the offshore (back to 2010 levels). By 2013, it had significant dune loss, but reappearance of a berm, similar to but slightly higher than the 2010 shape. Although it showed some stability, this profile clearly underwent significant dune erosion in 2013.

Summer FE04 = D (65). 2011 grade: C. Trend: Worse. The profile showed landward migration of the entire profile from 2010 to 2011, and some recovery along its lower portions in 2012. However, the berm disappeared and the dune appeared to have continued eroding landward in 2012.

Winter Summary: The winter profiles are quite steep, undergoing around 6 meters (or more) of vertical change in about 80 meters horizontally from dune crest to low water line. Scores were better than previous years, but the profiles are not remaining stable in the longer term
period. Erosion of the dune restoration project appears to still be helping maintain some resemblance of stability and reappearance of the berm. **Winter Beach Grade: D+ (69). 2011 grade: C- (70). Trend: Slightly worse.**

Summer Summary: The summer profiles at Ferry Beach have clearly undergone erosion the past few seasons, although they appeared to be somewhat stable between 2011 and 2012. We have no 2013 profile data for comparison, but based on observed trends along the beach, the profiles will likely show much more erosion this summer. **Summer Beach Grade: D (65). 2011 grade: D+ (68). Trend: Worse.**

Overall Summary: Consistent with the previous assessment, the beach and dunes (especially the dunes) along Ferry Beach continued to erode into winter of 2013.
Overall Ferry Beach Grade: D (67). 2011 grade: D+ (69). Trend: Worse.

MBMAP Results for Ferry Beach, Saco will be discussed in the context of the entire Saco shoreline, after the profile images.

Figure 41. Locations of volunteer monitoring profiles at Ferry Beach, Saco. Base imagery from Maine OGIS.

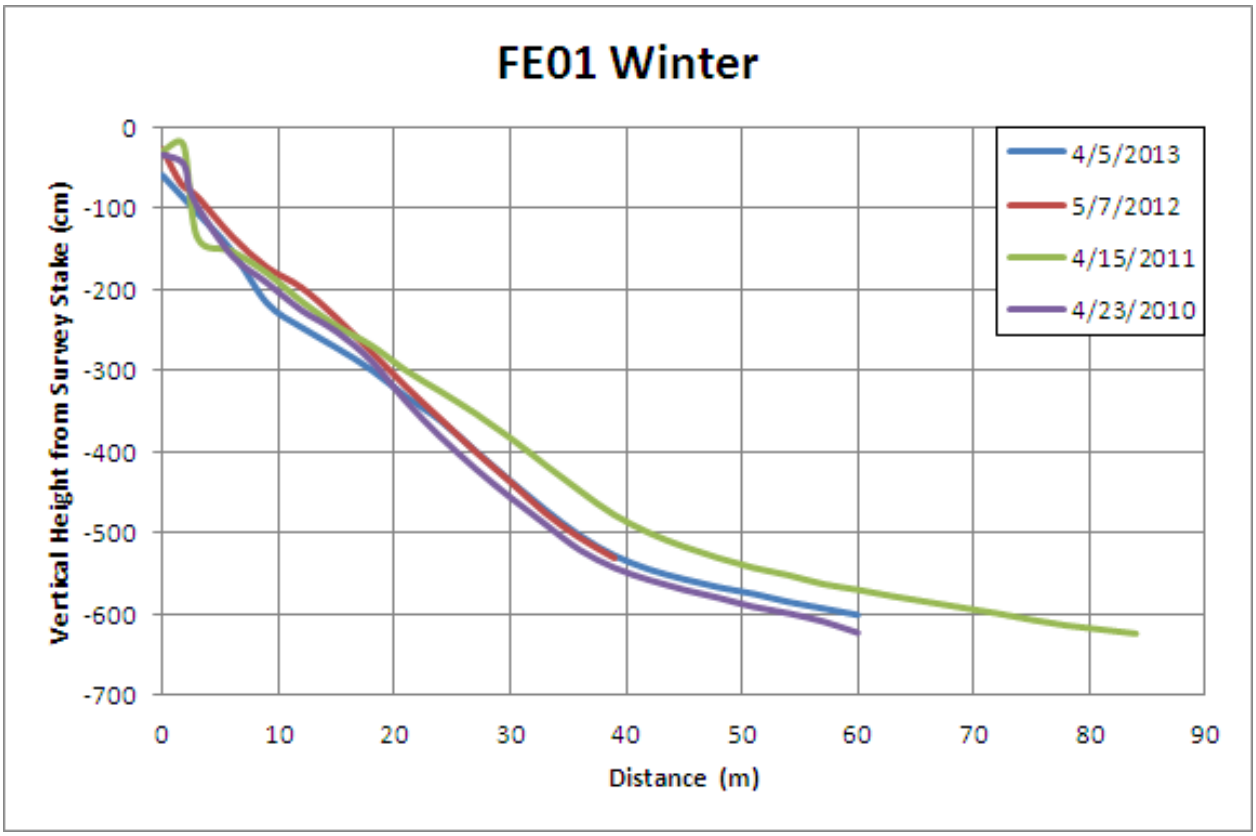

Figure 42. Winter beach profiles for FE01 from 2010, 2011, 2012, and 2013.

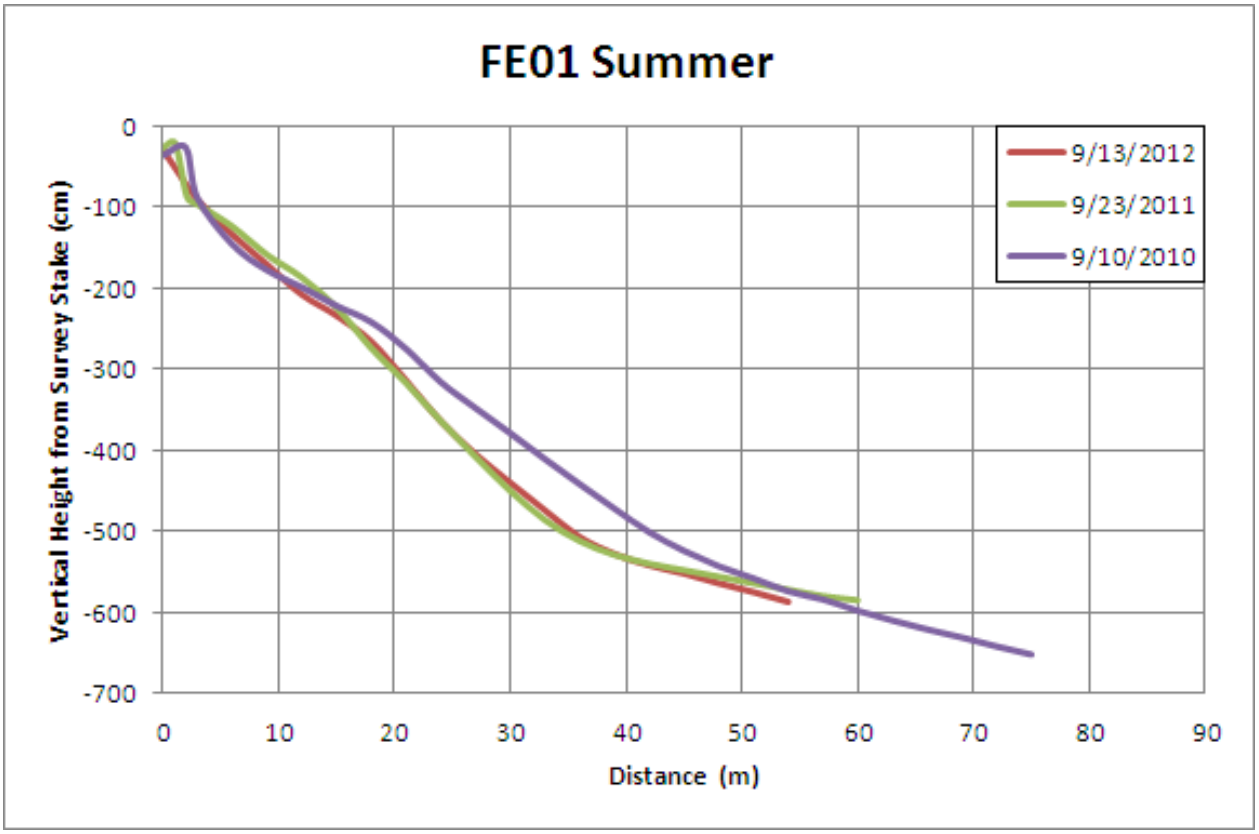

Figure 43. Summer beach profiles for FE01 from 2010, 2011, and 2012.

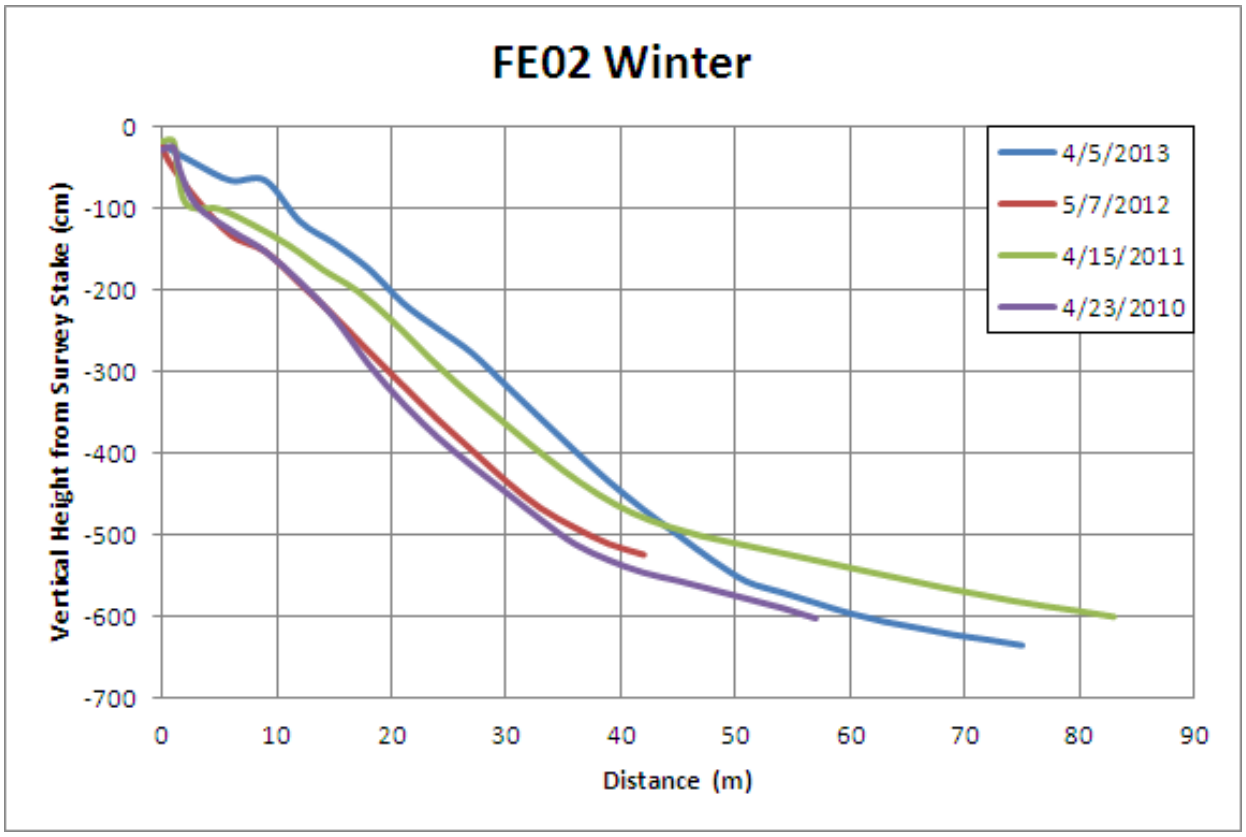

Figure 44. Winter beach profiles for FE02 from 2010, 2011, 2012, and 2013.

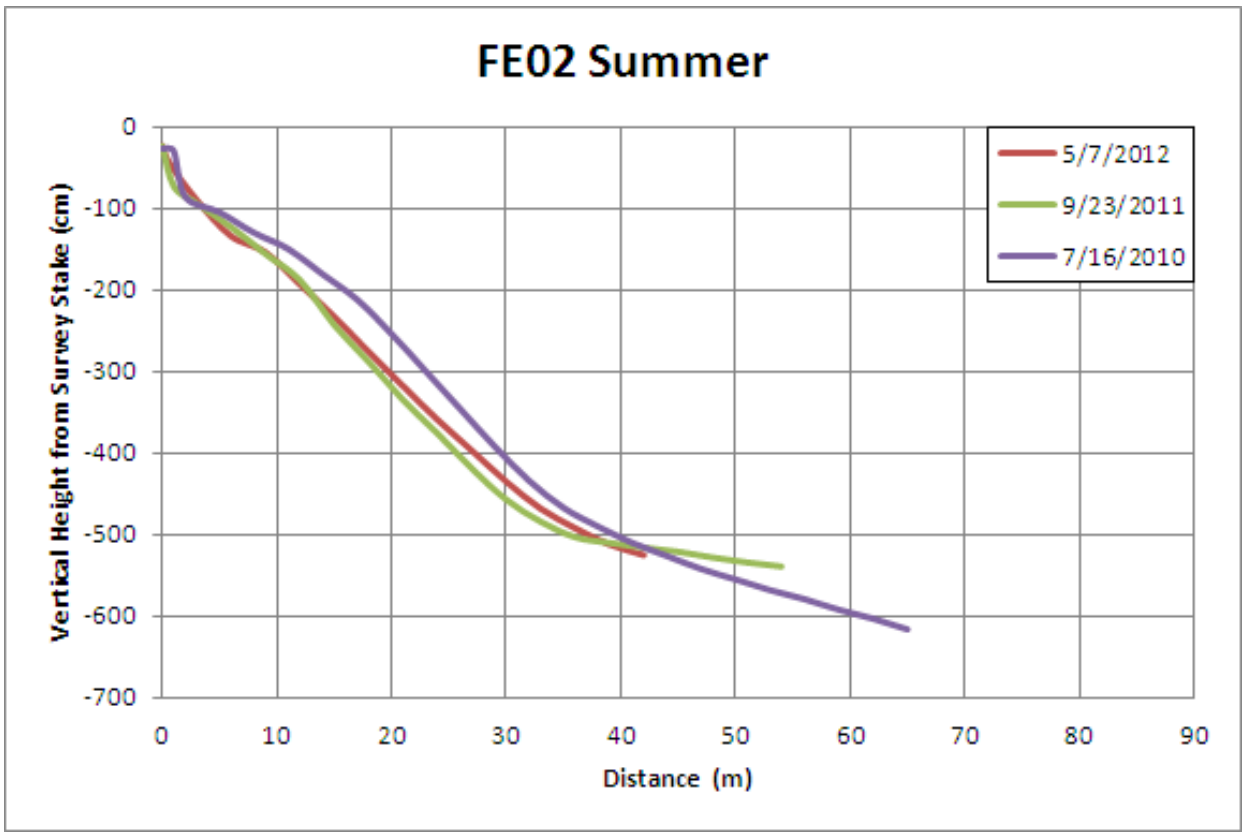

Figure 45. Summer beach profiles for FE02 from 2010, 2011, and 2012.

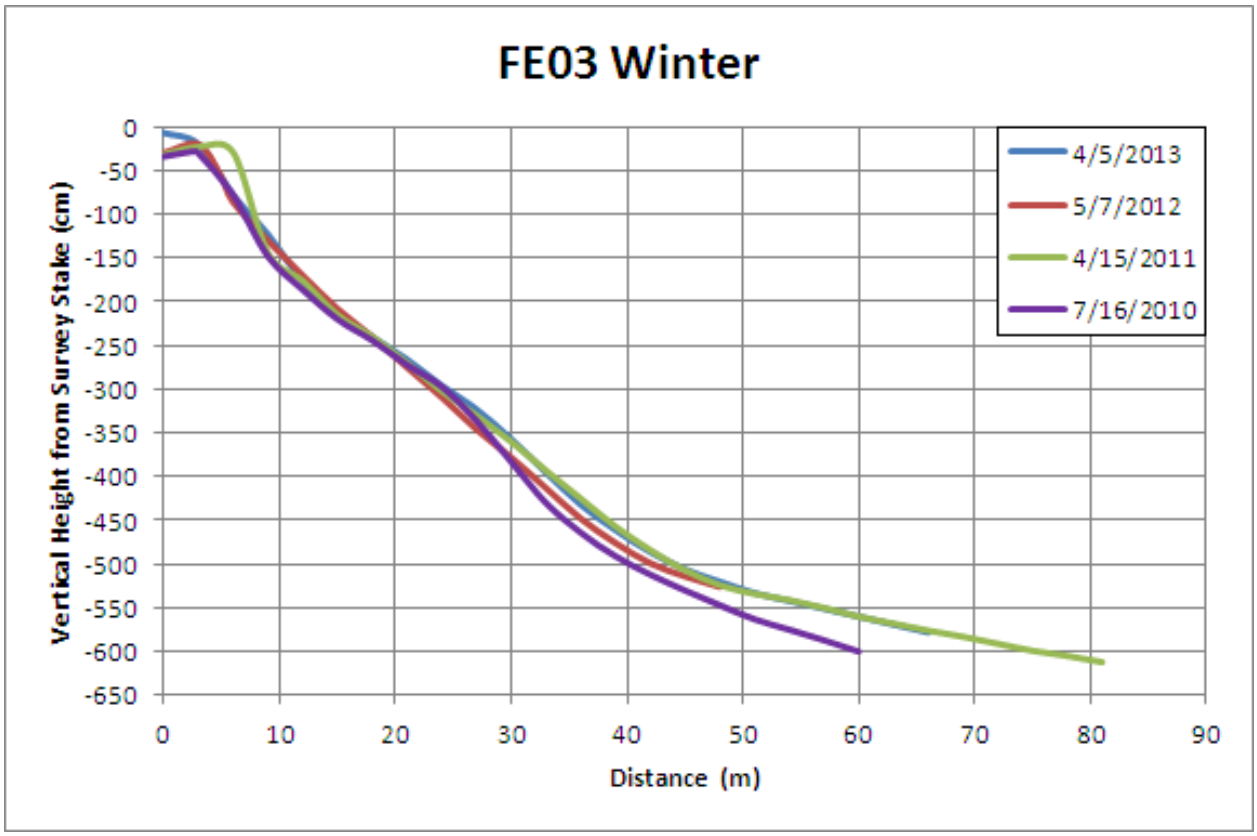

Figure 46. Winter beach profiles for FE03 from 2010, 2011, 2012, and 2013.

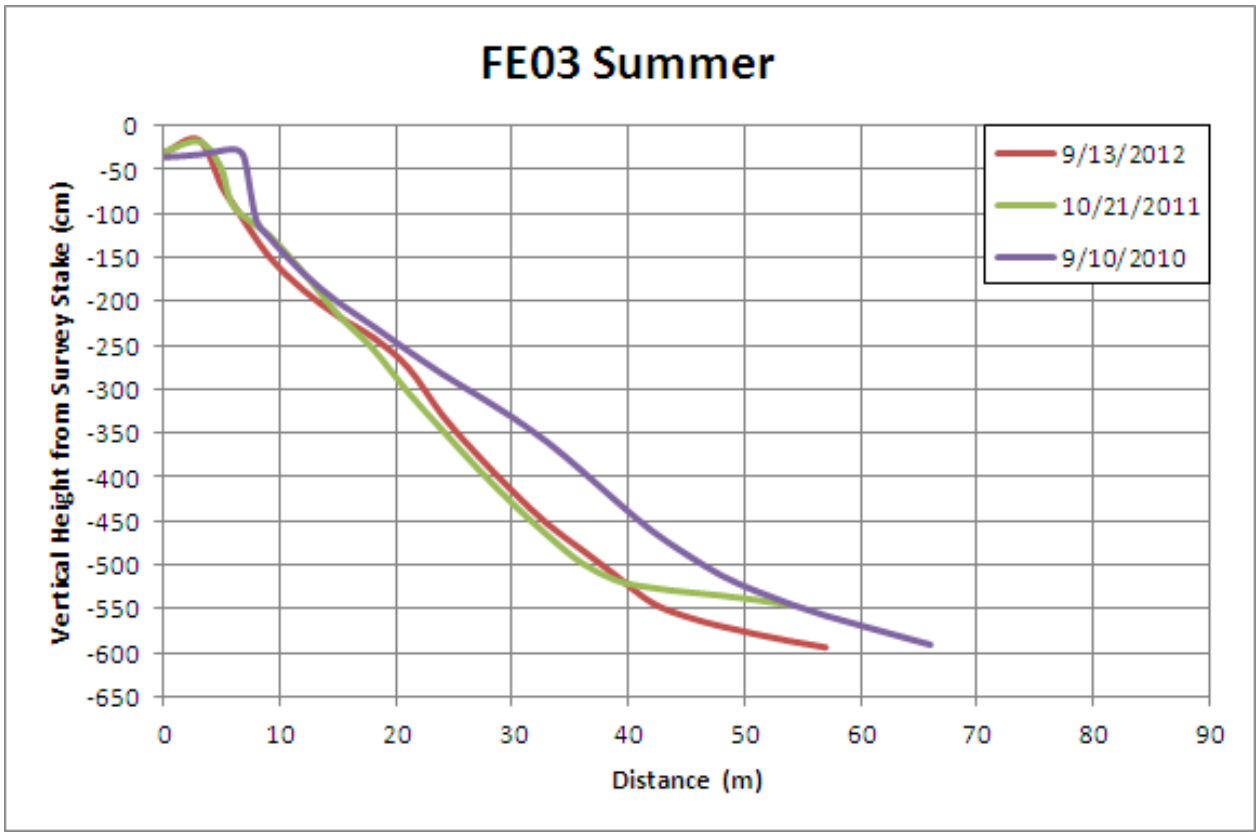

Figure 47. Summer beach profiles for FE03 from 2010, 2011, and 2012.

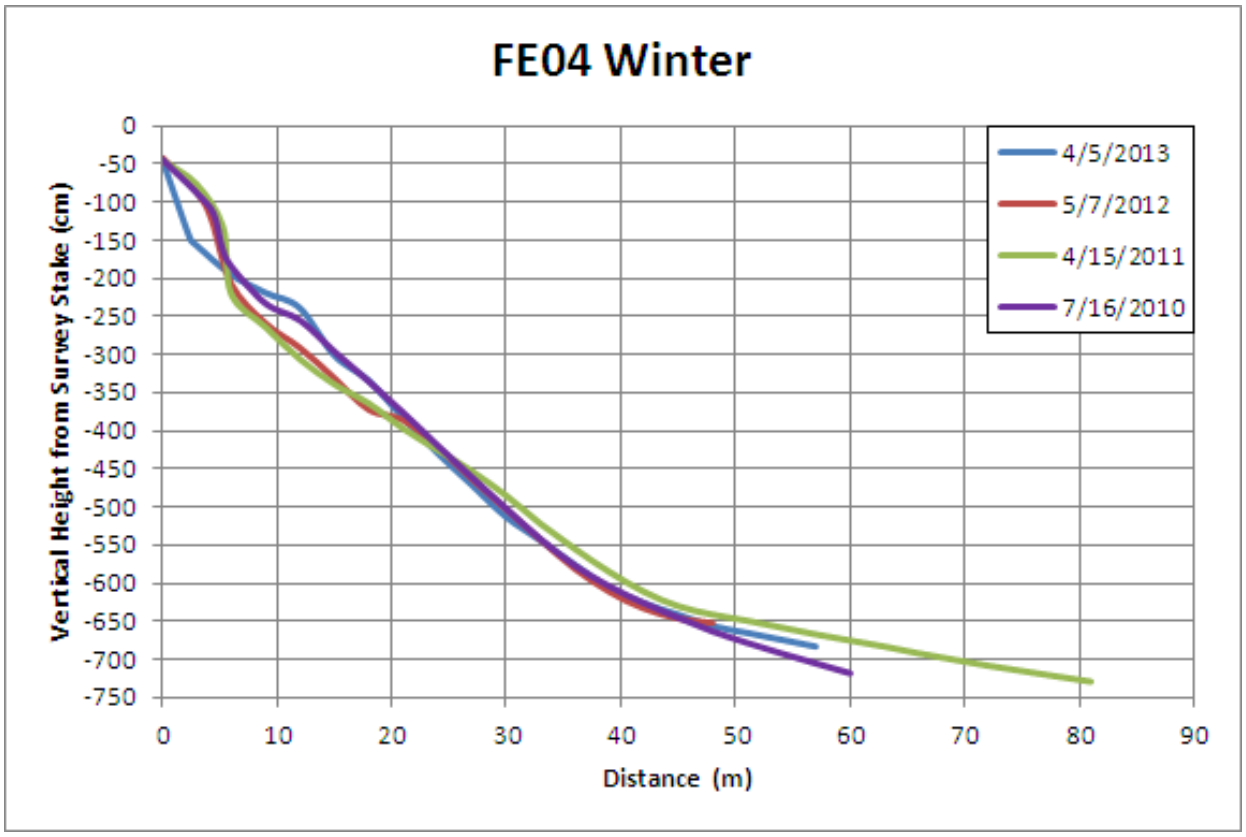

Figure 48. Winter beach profiles for FE04 from 2010, 2011, 2012, and 2013.

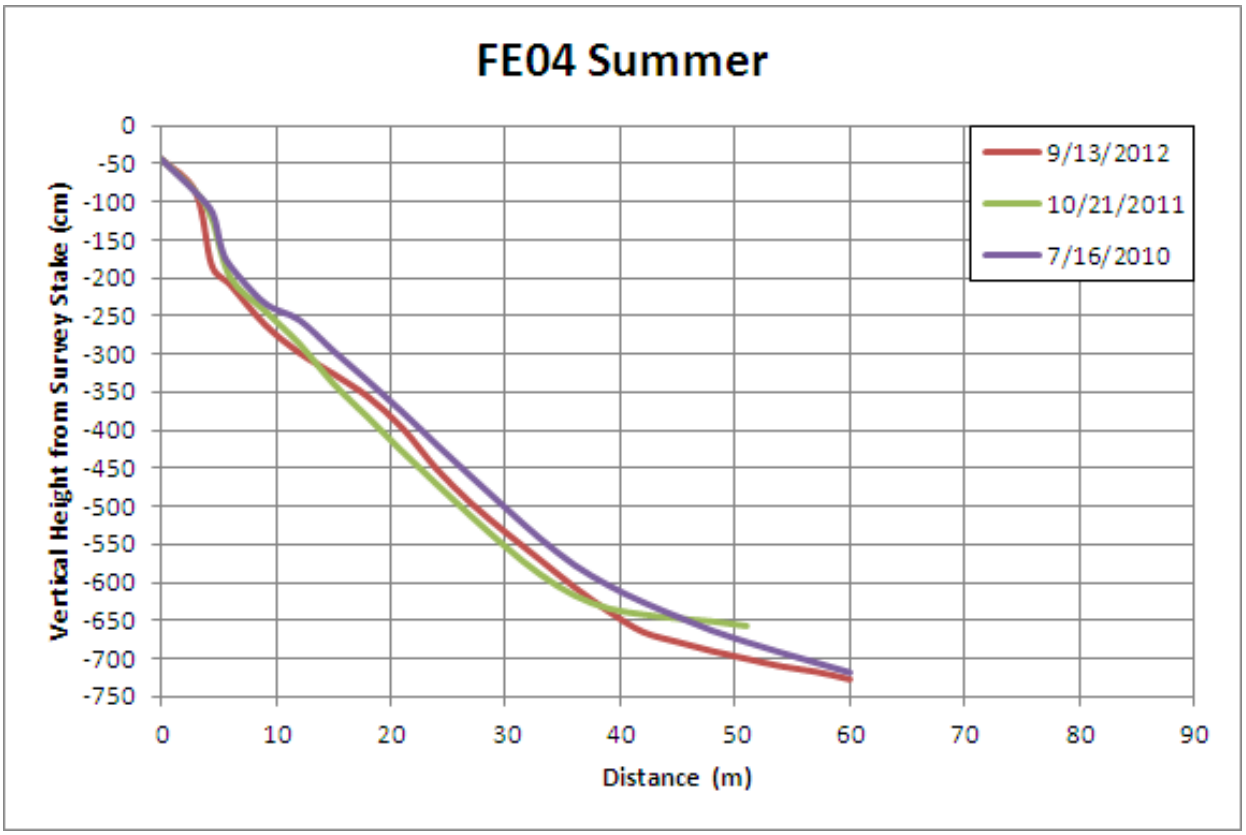

Figure 49. Summer beach profiles for FE04 from 2010, 2011, and 2012.

Saco MBMAP Results

MBMAP data is presented for the entire Saco area, Kinney Shores, then Ferry Beach, respectively. For the entire City of Saco beaches, shoreline positions between 2007 and 2013 were available (Figure 50). **The overall trend when comparing with the 2011 report was worse (erosive), but within the variability of the data. The overall trend went from slightly positive, to slightly negative.** In 2011, the erosion along the southern portion of the shoreline – from near Ferry Beach State Park south to the Ecology School – averaged around -0.2 to -0.4 m/yr., with pockets around -0.6 to -1m/yr. **Erosion has clearly worsened in the area north of Ferry Beach Ecology School by the 2013 report.** However, an area of the shoreline just north of the Park that was eroding previously (marked on the image, above, underwent accretion, gaining sand dune.

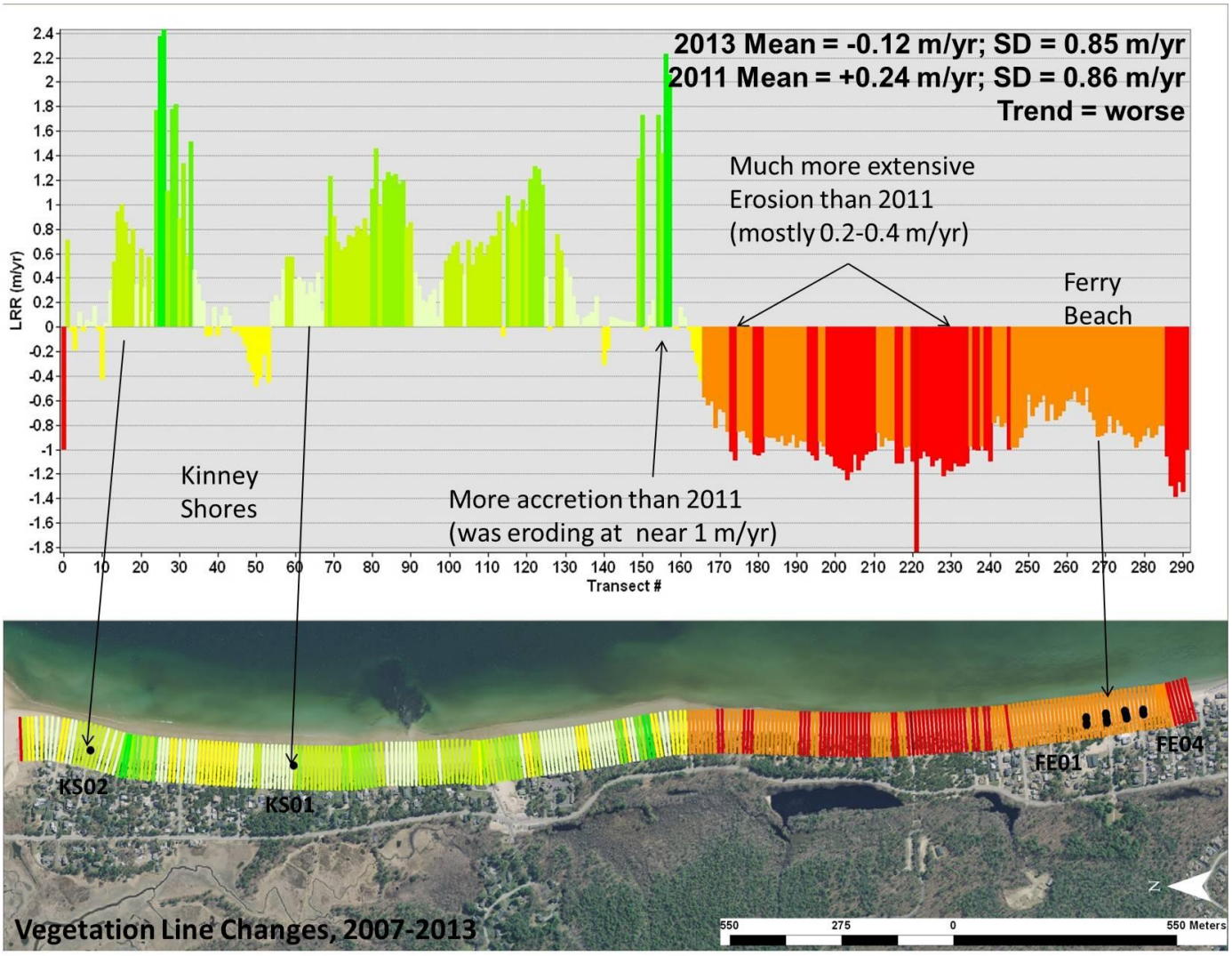

Figure 50. MBMAP shoreline change results for Saco beaches. Base imagery from Maine OGIS.

Kinney Shores MBMAP results

In the northern end of the bay, in the vicinity of the Kinney Shores Profiles, Figure 51 shows MBMAP results. The MBMAP data supports the trends observed at the profiles; that KS01 is undergoing a more erosive phase than KS02.

KS01 is located right where the trend of accretion decreases to about +0.2 to +0.4 m/yr. (in the previous assessment, KS01 was along a stretch of shoreline that had a trend of about +0.6 to +0.8 m/yr.). KS02, on the other hand, has remained at a location where the sand dune has been building, on average, about +0.8 to +1.0 m/yr.

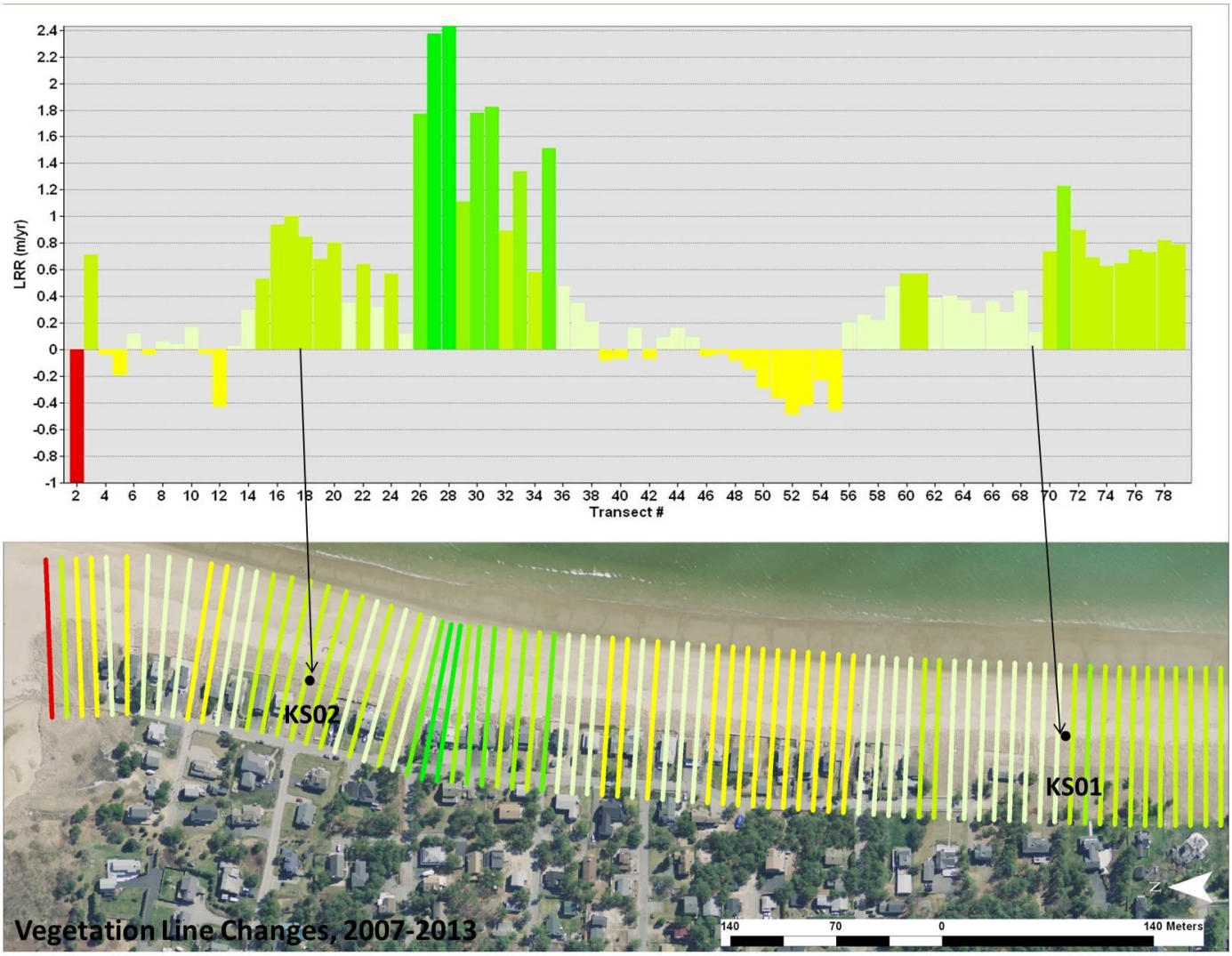

Figure 51. MBMAP shoreline change results for the Kinney Shores area of Saco beaches. Base imagery from Maine OGIS.

Ferry Beach MBMAP Results

Near the Ferry Beach profiles, MBMAP data (Figure 52) showed that the vegetation line has receded between 0.6 m/yr. and 1.0 m/yr., including 2013 data. Just north of this – closer to the State Park, the shoreline erosion has clearly increased, as changes are over -1 m/yr., when in 2011, the shoreline changes in this area were much lower, between -0.2 m/yr. and -0.4 m/yr.

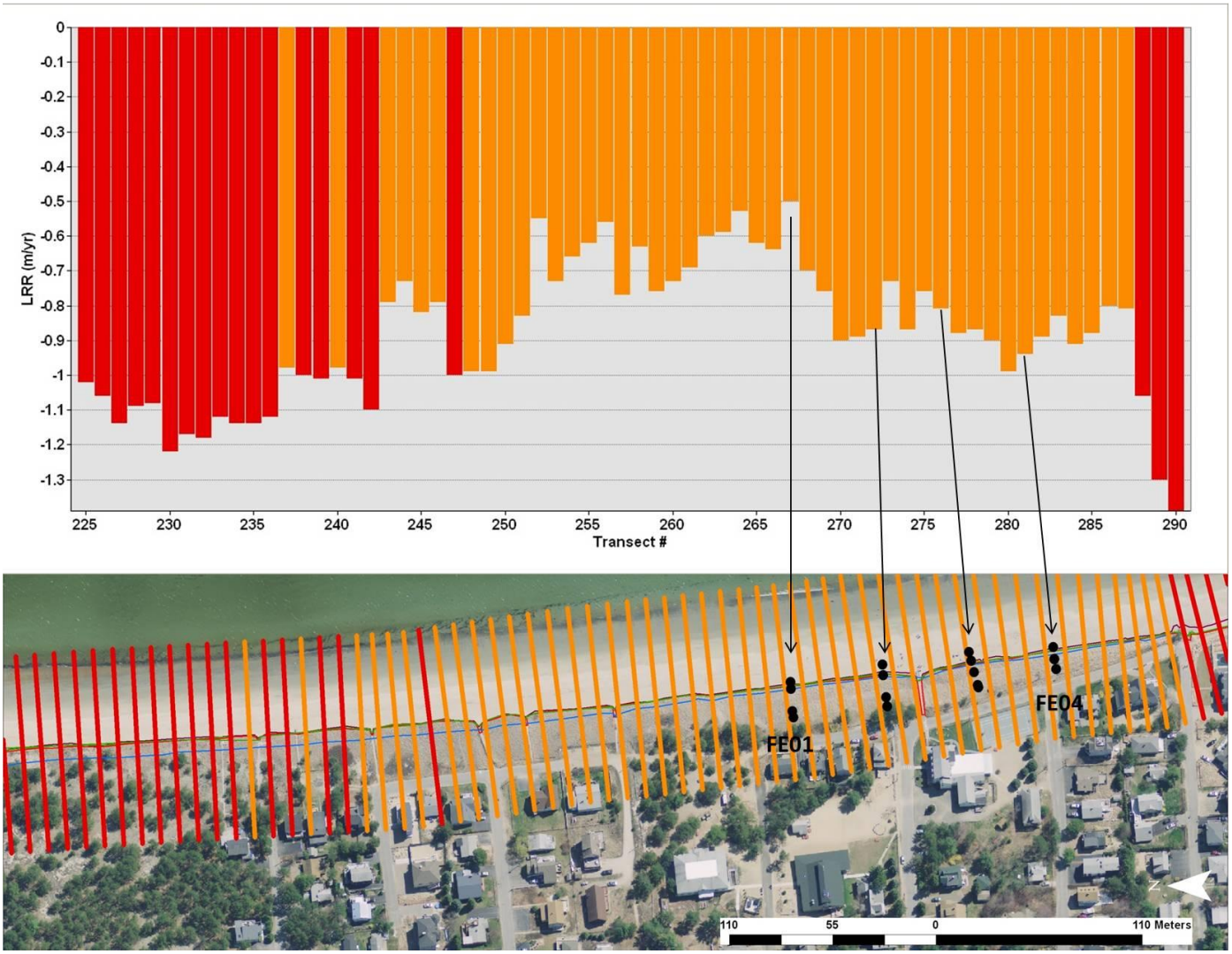

Figure 52. MBMAP shoreline change results for the Ferry Beach area of Saco beaches. Base imagery from Maine OGIS.

Goose Rocks Beach, Kennebunkport

A total of four beach profiles (GR01 to GR04, Figure 53) were available for comparison.

Winter GR01 = A (95). 2011 grade: A. Trend: Same. GR01 is located at the southern end of the beach, at the Batson River. It received an A previously. In 2010, it had a defined dune and numerous swash bars out to 350 m (Figure 54). In 2011, it gained in elevation. In 2012, it showed dune growth, fore-shore steepening, and elevation loss along the low tide terrace. In 2013, it showed dune growth, and landward movement of swash bars on the low tide terrace. This profile continued to be variable but showed vertical growth.

Summer GR01 = B (85). 2011 grade: C. Trend: Better. In 2010, it had a defined dune and steep slope to a low tide terrace out to 350 m (Figure 55). In 2011, it gained elevation at the dune and 100 and 300 m from the pin due to swash bars. In 2012, it gained sand at the dune, but maintained a shape similar to 2010 offshore. It showed landward migration of the dune (indicating erosion but ample sediment supply since the crest is growing) and a stable low tide terrace.

Winter GR02 = D (65). 2011 grade: B. Trend: Worse. GR02 is located at the central portion of the beach, in the southern cell along Goose Rocks Beach. It received an A and B previously. In 2011, it gained elevation in the berm out to 30 m, then lost seaward of this (Figure 56). In 2012, there was additional berm growth while it lost elevation at the low tide area. By 2013, it underwent severe erosion along its landward portion (up to 1 m) out to 50 m. This is the most erosive profile, and is below the 2010 shape. This profile received a D instead of F because it has shown severe erosion in the last year, not a continual trend.

Summer GR02 = A- (92). 2011 grade: A. Trend: Slightly worse. In summer 2010, the profile had a trough landward of a well-defined berm (at 30 m, Figure 57). By 2011, it gained elevation while the berm moved seaward and flattened, indicating accretion. By 2012, it gained dune elevation and the berm migrated landward. This profile continued to maintain a stationary berm over the past few years and is showing stability, but not additional growth. This may be due to sheltering by offshore outcrops.

Winter GR03 = D (65). 2011 grade: C-. Trend: Worse. GR03 is located in the northern third of the beach, within a cove between the Little River and a salient formed by offshore outcrops. It received a C- in the last two assessments. From 2010 to 2011 (Figure 58), it changed very little with slight gains at the upper end of the profile. From 2011 to 2012, it gained a large berm at the 50 m mark. The 2013 profile lost sand at the dune and berm, but was about equal to the 2010 profile shape from about 100 m seaward. This was lower than the 2010 shape along the upper portion of the profile.

Summer GR03 = C (75). 2011 grade: D. Trend: Better. This profile received a D previously because of extensive erosion in 2010. 2010 resulted in the most erosive shape. By 2011, it gained elevation (about 50cm over 2010 elevations) at the 40m mark, and a berm formed (Figure 59). Sand bars formed around 110m and 210m. In 2012, the profile lowered, indicating erosion. However it never reached 2010 depths, indicating some stability. We remain cautious about this profile shape given its past performance.

Winter GR04 = D (65). 2011 grade: A. Trend: Worse. GR04, adjacent to the Little River at the northeast end of the beach, received a B and an A previously. In 2010, it had sand at the base of the wall and a concave shape, flattening into the offshore (Figure 60). By 2011, sand adjacent to the wall eroded by around 60 cm, and the entire profile flattened but gained sand along its middle portion. By 2012, the sand at the wall returned, but the profile was steeper and more erosive than 2010. 2013 showed some elevation recovery, but it remained below the 2010 shape. This profile showed signs of erosion. The variability of this profile is due to the dynamic low tide swash platform, which receives bars of sediment periodically resulting in accretion, and erosion.

Summer GR04 = F (55). 2011 grade: D. Trend: Worse. This profile received a D previously. It had a steep area below the wall, a berm near 50 m, and a wide low tide terrace with several swash bars (Figure 61). By 2011, it had large elevation gains (up to 1 meter), with a berm at 50 m. It eroded and steepened in 2012 to below 2010 along most its length. The profile is highly variable in nature due to its proximity to the river and dynamic low tide swash platforms. We expect this profile to undergo highly variable changes in the future.

Winter Summary: Aside from GR01, winter profiles showed progressive erosion since 2010, a reversal of the previous trend. It is clear that the proximity to the river of GR01 aids in profile stability and growth through shoals. This was not the case for GR04 in this assessment. **Winter Beach Grade: C- (73). 2011 grade: B (87). Trend: Worse.**

Summer Summary: Summer profiles at GR01 and GR02 did well, while GR03 underwent erosion in 2012, but remained above 2010 profile limits. GR04 underwent continued erosion. **Summer Beach Grade: C+ (78). 2011 grade: C (75). Trend: Better.**

Overall Summary: Dramatic variations in profile shape at the end members (GR01 and GR04) due to influence of the rivers continued, especially during the summer months. GR01 and GRO4 have massive swings in terms of profile shapes from year to year. The most stable profile was GR02, which is quite protected by offshore outcrops. **Overall Goose Rocks Beach Grade: C (74). 2011 grade: B- (81). Trend: Worse.**

Figure 53. Volunteer beach profile locations for Goose Rocks Beach, Kennebunkport. Base imagery from Maine OGIS.

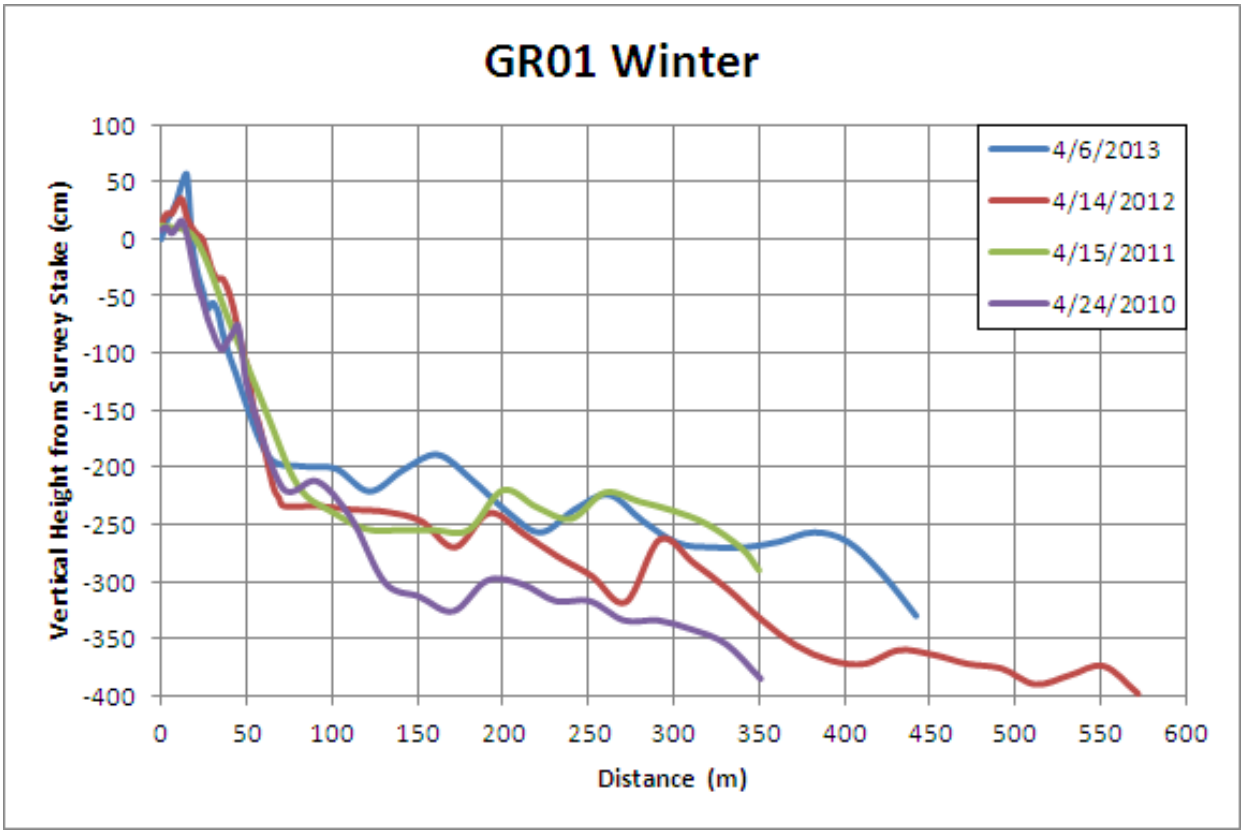

Figure 54. Winter beach profiles for GR01 from 2010, 2011, 2012, and 2013.

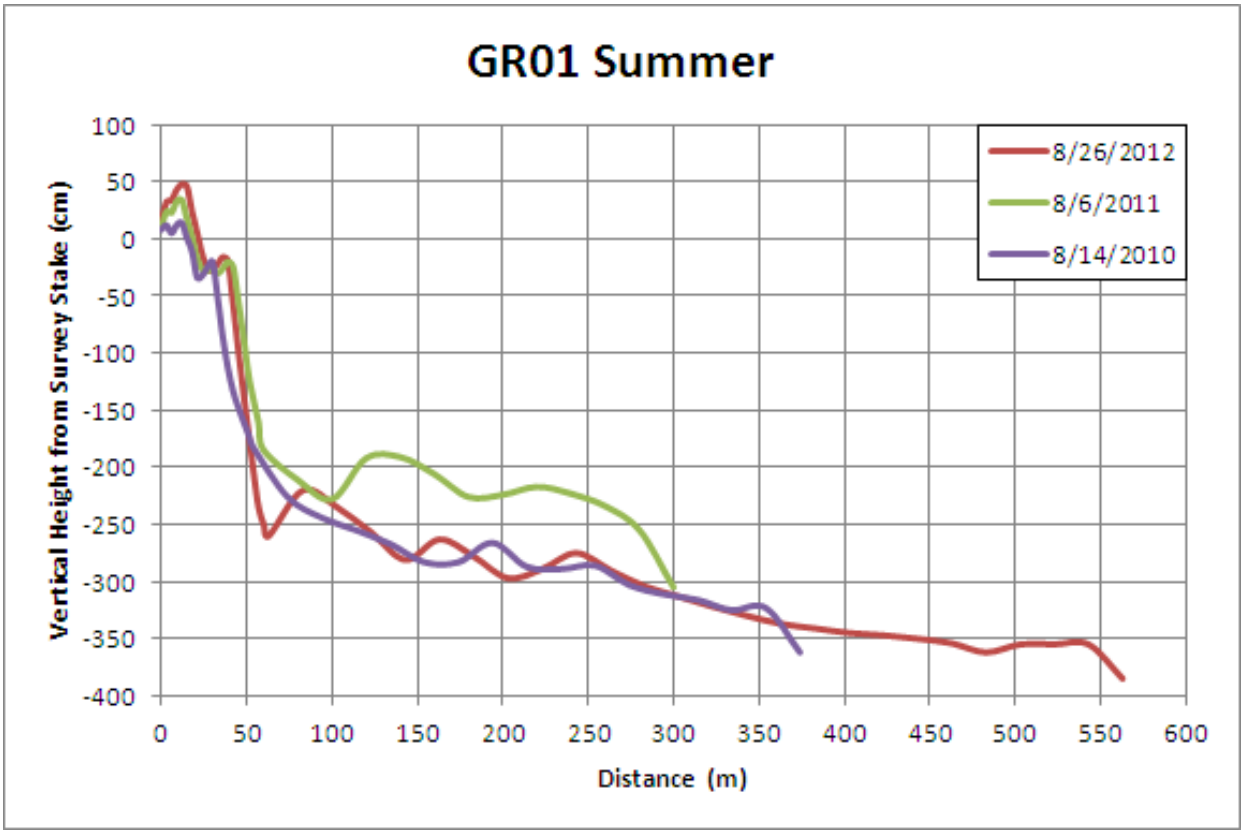

Figure 55. Summer beach profiles for GR01 from 2010, 2011, and 2012.

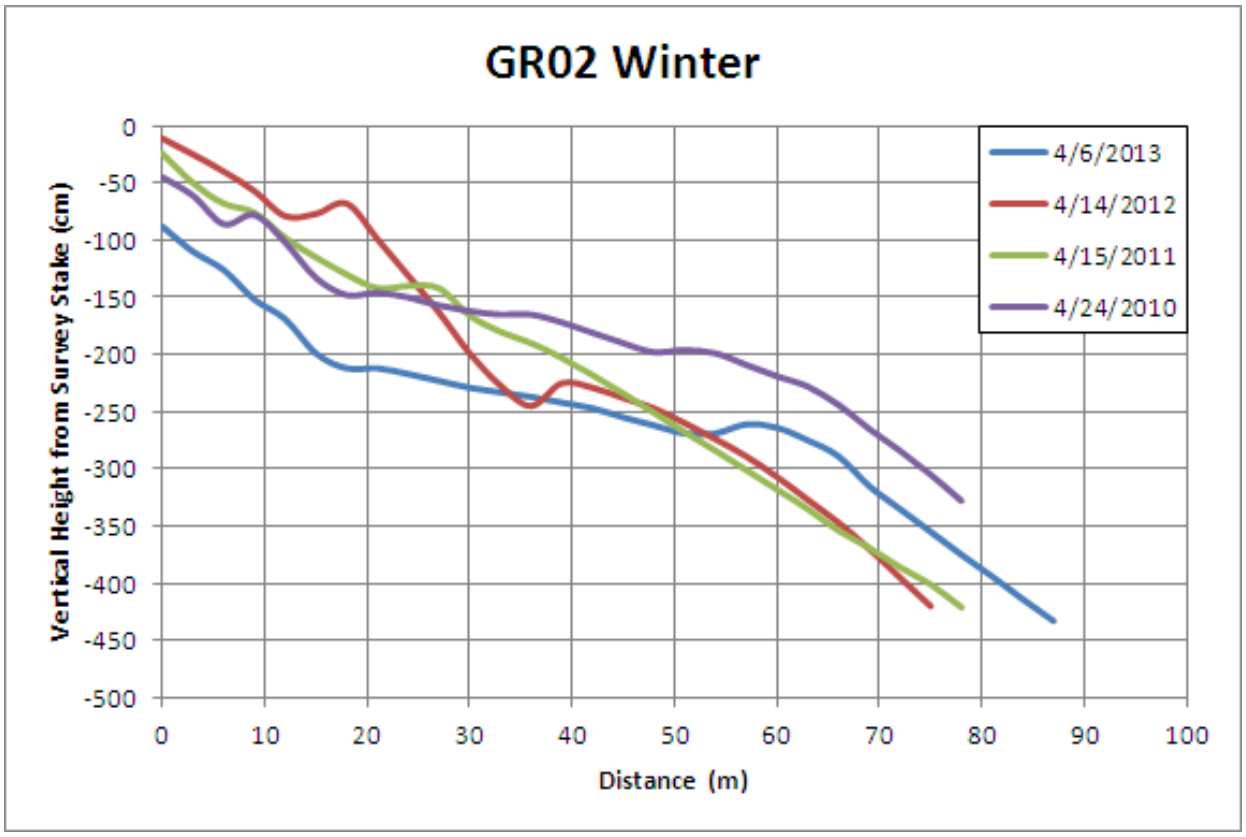

Figure 56. Winter beach profiles for GR02 from 2010, 2011, 2012, and 2013.

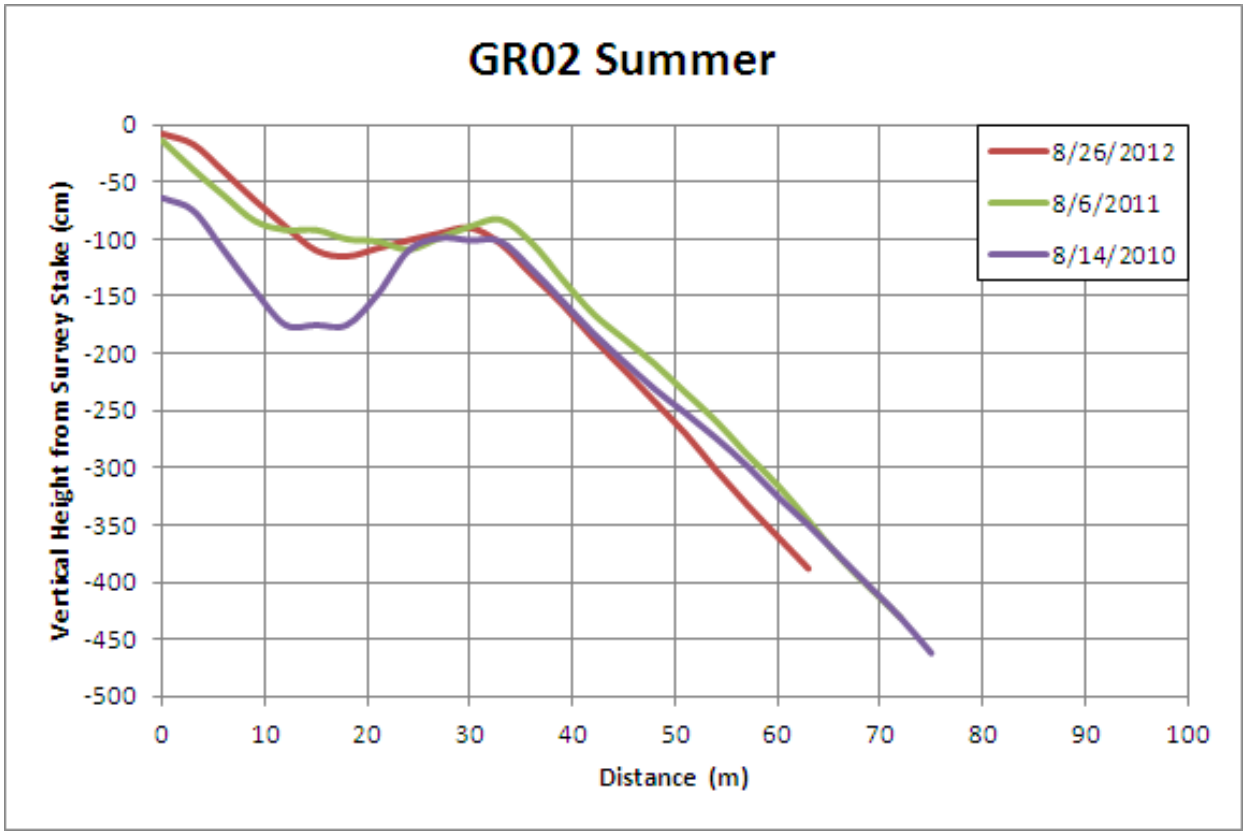

Figure 57. Summer beach profiles for GR02 from 2010, 2011, and 2012.

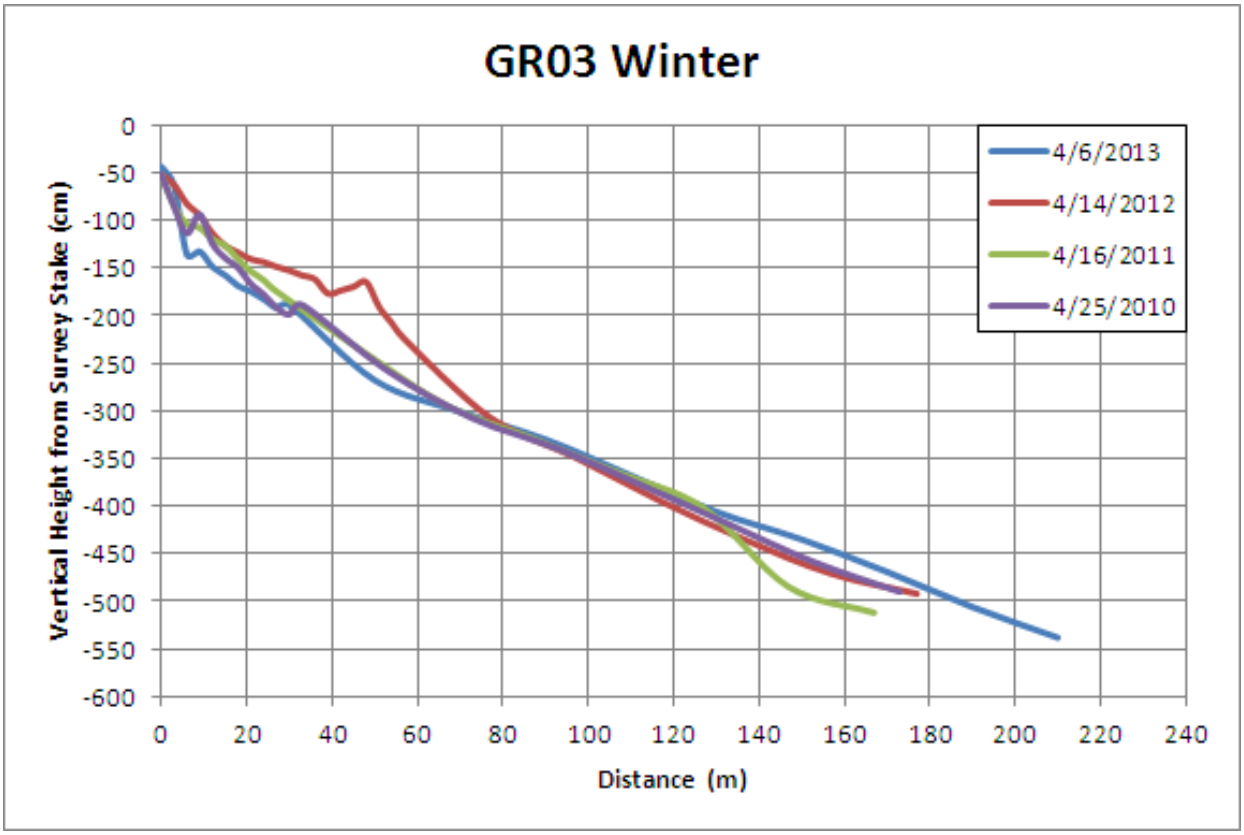

Figure 58. Winter beach profiles for GR03 from 2010, 2011, 2012, and 2013.

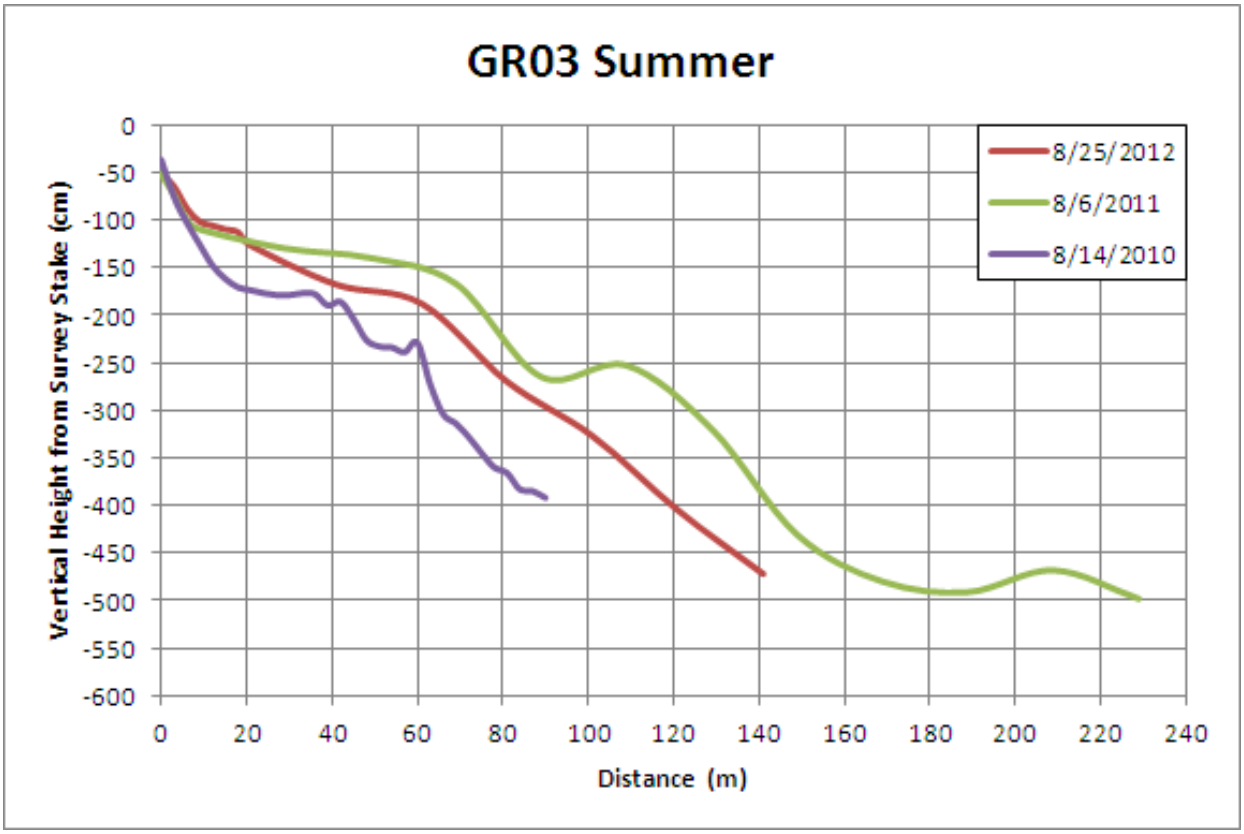

Figure 59. Summer beach profiles for GR03 from 2010, 2011, and 2012.

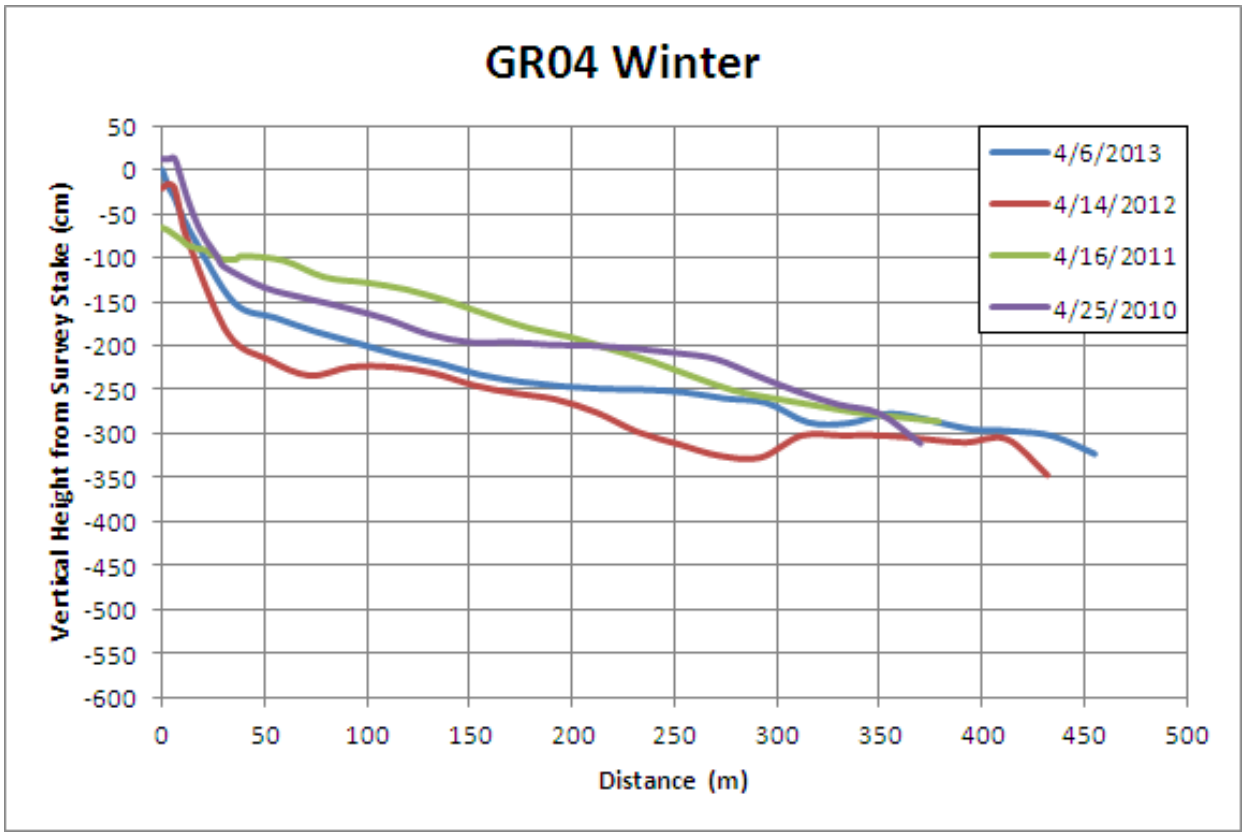

Figure 60. Winter beach profiles for GR04 from 2010, 2011, 2012, and 2013.

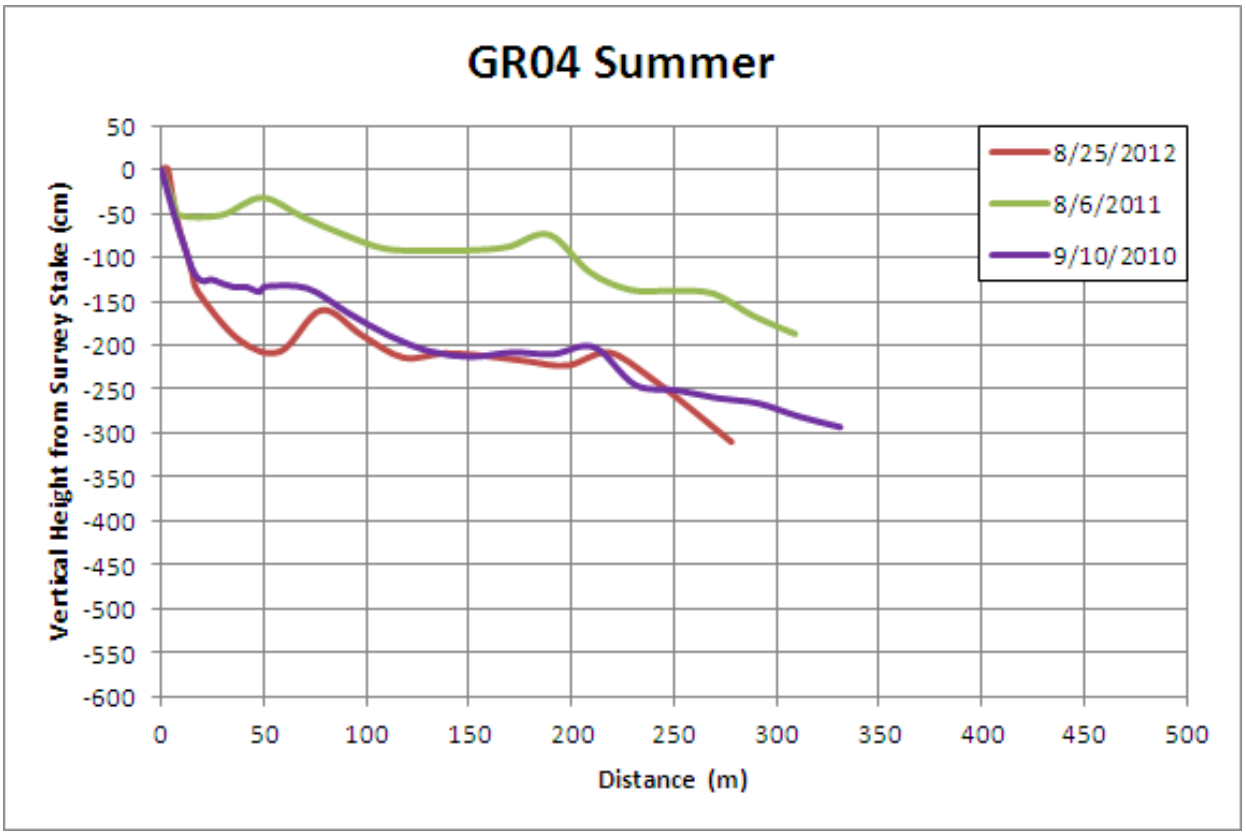

Figure 61. Summer beach profiles for GR04 from 2010, 2011, and 2012.

Goose Rocks MBMAP Results

Previously, MBMAP data for the vegetation line from 2009 to 2011 showed an overall trend of -3.66 m/yr., indicative of extensive erosion of the dune system. Note that this data was derived using an end point method, not linear regression rate, since the shoreline underwent extensive erosion from 2009 to 2010 and the vegetation in many locations was completely removed. Subsequently, large areas of previously vegetated areas were not surveyed. Thus no more than 2 shorelines were available for calculating rates along much of the shoreline, which does not allow a LRR calculation. Data updated through the summer of 2012 showed that the overall trend got slightly better (Figure 62). There was appreciable continued accretion near the Batson River (reflected by the good scores at GR01), at the salient near the middle of the beach, but mostly erosion at GR02, GR03, and GR04.

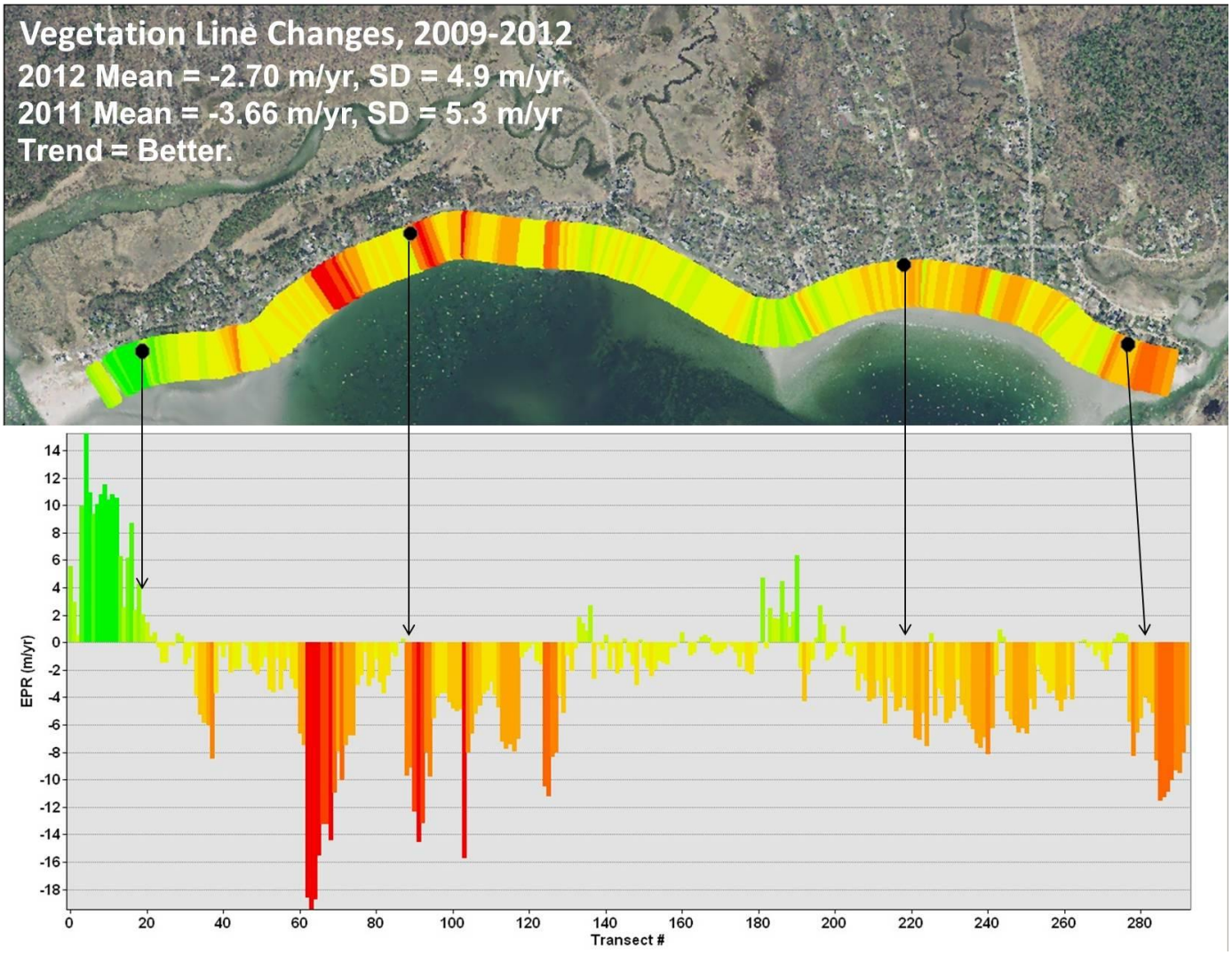

Figure 62. MBMAP shoreline change results for Goose Rocks Beach, Kennebunkport. Base imagery from Maine OGIS.

Goochs Beach, Kennebunk

Four profiles (GO01 to GO04, Figure 63) were available.

Winter GO01 = F (55). 2011 grade: D. Trend: Worse. The profile is located at the southwestern end of the beach. It received an A and D previously, with erosion in 2011 to below 2007 levels (Figure 64). By 2011, it retreated landward to 15 m, where it remained similar to 2010. In 2012, the sand adjacent to the wall lowered, but the profile built in elevation out to about the 40 m mark. In 2013, it eroded, steepened, and lost around 60 cm in elevation compared with 2012. The winter of 2013 caused extensive erosion of the profile.

Summer GO01 = B+ (88). 2011 grade: D. Trend: Better. The profile received a D previously. 2010 had sand elevation at -50 cm at the starting point and a slightly convex shape (Figure 65). By 2011, it gained elevation, including at the berm. By summer 2012, it had gained sand within about 40 m of the seawall. The profile showed stability to growth over the past few years. The 2013 profile was about 30 cm – about 1 foot – higher in elevation than the summer 2010 shape.

Winter GO02 = C- (72). 2011 grade: B. Trend: Worse. The profile is central along the seawall. It scored an A and B previously. In 2010, it was steep, concave, and flattened to a berm at -250 cm at 20-50 m (Figure 66). In 2011, it lowered at the wall, but gained elsewhere. In 2012, the sand at the wall dropped to -50 cm, but the berm raised up to -175 cm below the pin. In 2013, it gained sand at the wall out to 25 m, but lost elevation seaward of this; the berm lowered to between 300 to -350 cm. *This is about 1 meter below 2010*. Between 2010 and 2013, it gained sand at the wall, but lowered along the rest of the profile, likely exposing peat surfaces.

Summer GO02 = D (65). 2011 grade: A. Trend: Worse. The profile received an A previously. In 2010, it had a starting elevation of 20 cm, indicating sand was above the starting pin (Figure 67). It had a steep slope, which flattened seaward of 20 m. By 2011, it lost 50 cm at its starting point, and fell along its entire length, indicating erosion. In 2012, it lost more sand at the wall – down to -70 cm – indicating more erosion. Seaward of 30 m, it had the same shape as 2010. This profile showed stability along its lower portion (likely the historic erosion surface), but lost its summer berm at the seawall. We are concerned about the continuous berm loss.

Winter GO03 = C (75). 2011 grade: C+. Trend: Worse. The profile, at the northeastern end of the beach, received a B and C+ previously. In 2010, it had the highest sand level at the wall, with a steep, concave slope that flattened at 20 m (Figure 68). In 2011, sand was lost at the wall (about 50 cm), but the lower portion of the profile gained. In 2012, the profile had the highest berm at 30-40 m. In 2013, it gained slightly at the wall, but deepened seaward of 40 m, indicating sand loss. In 2013 it was lower than 2010 in all locations but for a narrow berm just seaward of the seawall.

Summer GO03 = C (75). 2011 grade: B. Trend: Worse. The profile showed stability to slight growth in the last report. In 2010, it had a starting pin near 0 and sloped sharply offshore until seaward of 15 m (Figure 69). In 2011, it lost 50 cm at the starting pin, but gained a berm between 10-20 m and between 60-100 m. In 2012, it gained slightly in elevation (10 m seaward), but lost elevation at the wall. It showed some stability in its berm and nearshore area, but is lower in elevation at the wall than 2010.

Winter GO04 = C (75). 2011 grade: B. Trend: Worse. GO04, along Middle Beach, received a C and a B previously. The profile is made of cobble and extended only 40 m in length and dropped 4-5 m vertically (Figure 70). In 2010, it was flat, with a slight berm around 18 m. In 2011, it gained at the wall, and formed a well-defined berm at 10 m. The berm moved up the profile in 2012, but lost around 50 cm of elevation at the seawall and slightly steepened offshore. The berm maintained its position in 2013, but lost elevation at the wall. There appeared to be scour at the wall, but the berm remained in about the same location, giving this profile a C.

Summer GO04 = C+ (78). 2011 grade: B. Trend: Worse. 2010 had a starting point of -35 cm, and a well-defined berm. In 2011, it lost sand at the wall, and the berm migrated slightly landward (Figure 71). By 2012, the profile's starting point moved back up to the 2010 location, but a significant trough feature formed landward of the berm (at the 4 m mark). The berm is in the same location as the 2010 profile, and the rest of the profile is consistent with the 2010 shape. This profile showed general berm stability, but changes adjacent to the wall.

Winter Summary: The winter shapes showed typical signs of landward migration – loss of berms, steepening and deepening of the profiles in the offshore. **Winter Beach Grade: D+ (69). 2011 grade: C+ (78). Trend: Worse.**

Summer Summary: Aside from GO01, which underwent accretion, the remaining profiles showed some signs of stability (GO04 and GO03) to erosion (GO02). Sand seemed to be moved from the eastern side of the beach to the western side (opposite trend of last report). **Summer Beach Grade: C+ (77). 2011 grade: B (83). Trend: Worse.**

Overall Summary: Generally, the profiles are showing worse trends for both winter and summer seasons. The profiles here are flat (except for GO04) to concave in shape, and have difficulty maintaining a berm in either the winter, or the summer. **Overall Goochs Beach Grade: C (73). 2011 grade: B- (81). Trend: Worse.**

Goochs Beach MBMAP Results

No MBMAP data will be presented since Goochs Beach is entirely seawalled with no vegetation line.

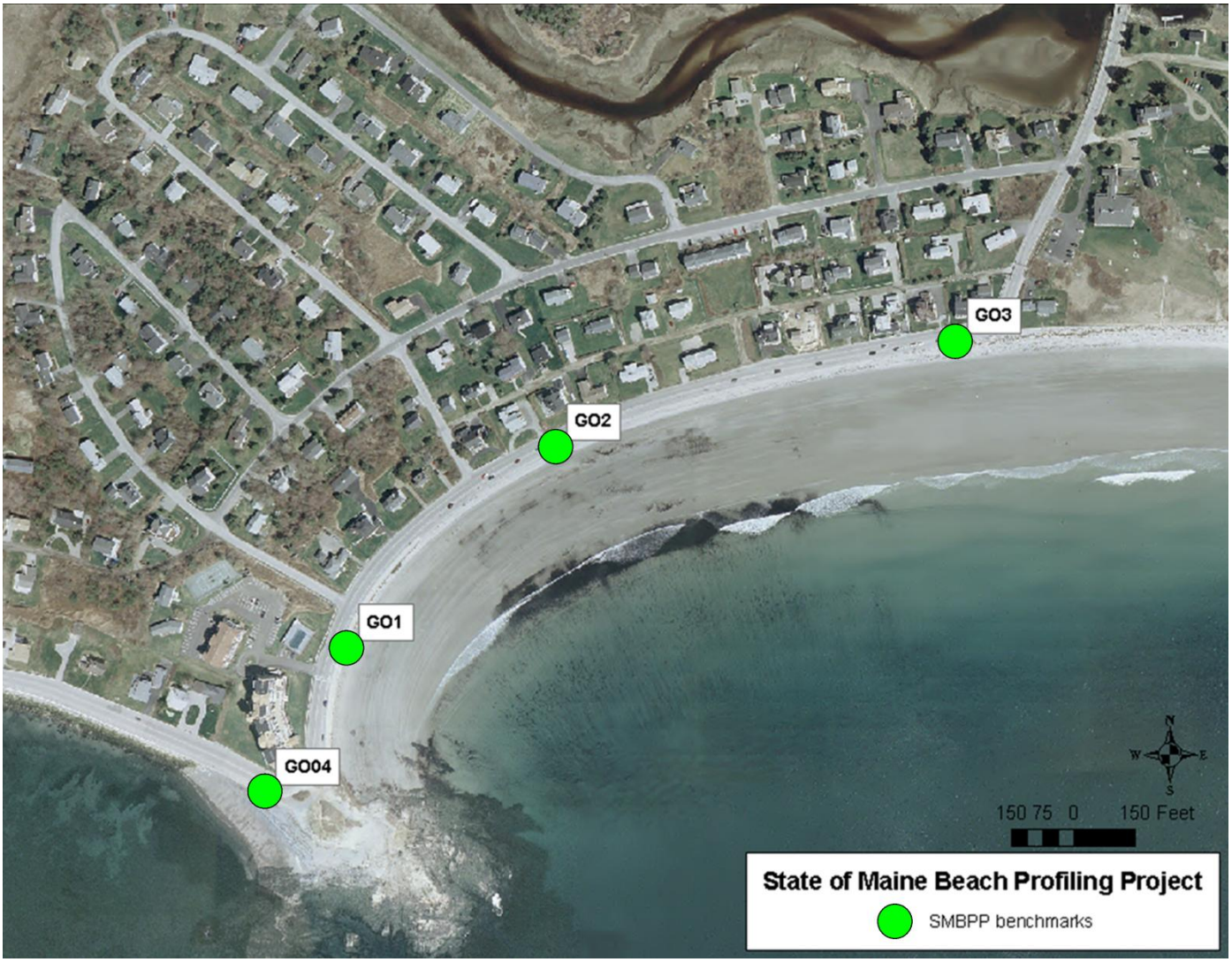

Figure 63. Volunteer beach profile locations at Goochs Beach, Kennebunk. Base imagery from Maine OGIS.

Figure 64. Winter beach profiles for GO01 from 2010, 2011, 2012, and 2013.

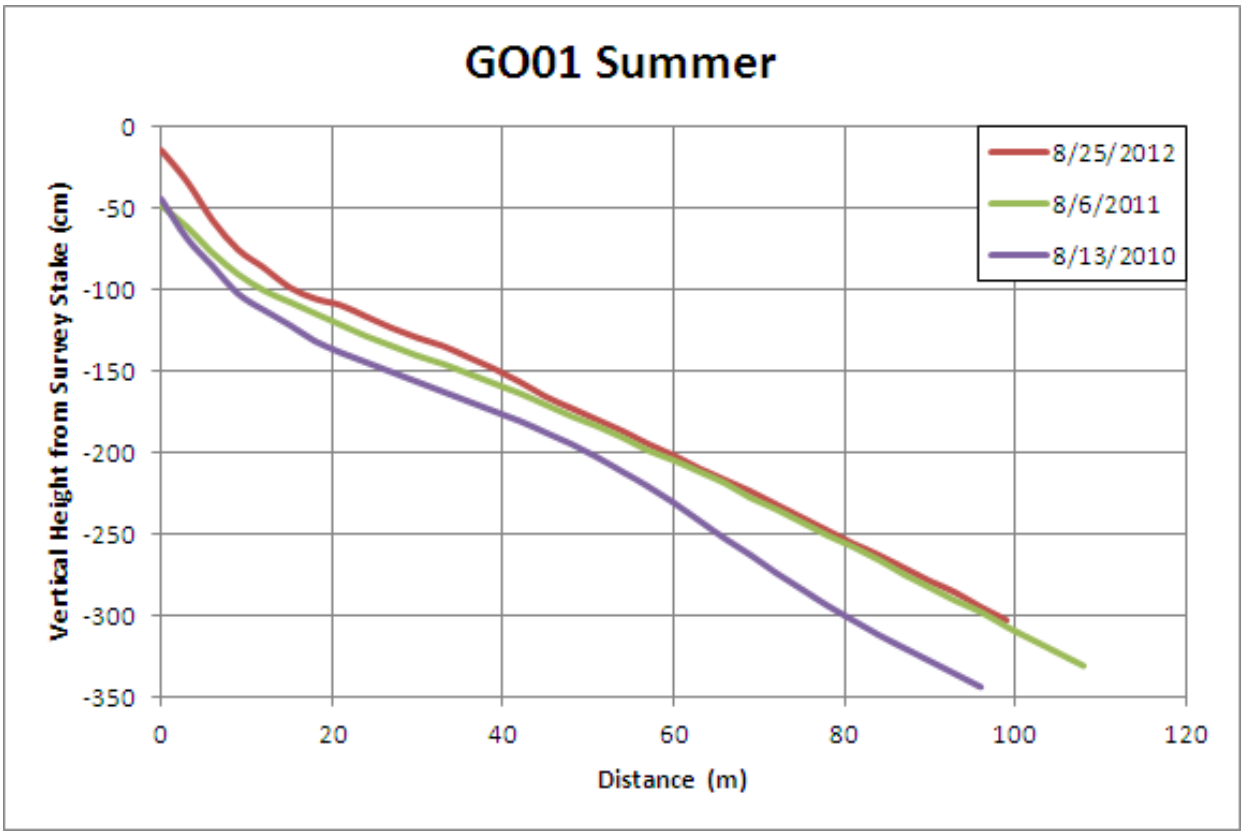

Figure 65. Summer beach profiles for GO01 from 2010, 2011, and 2012.

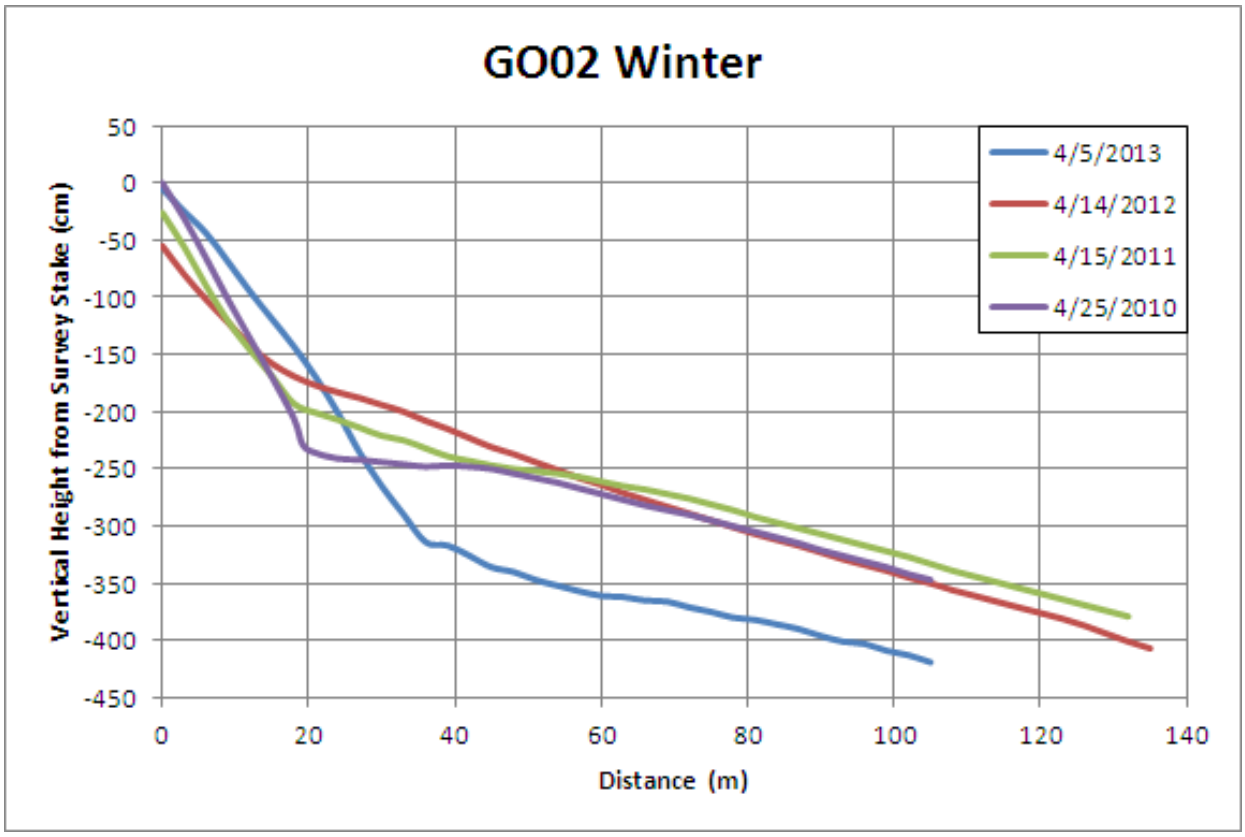

Figure 66. Winter beach profiles for GO02 from 2010, 2011, 2012, and 2013.

Figure 67. Summer beach profiles for GO02 from 2010, 2011, and 2012.

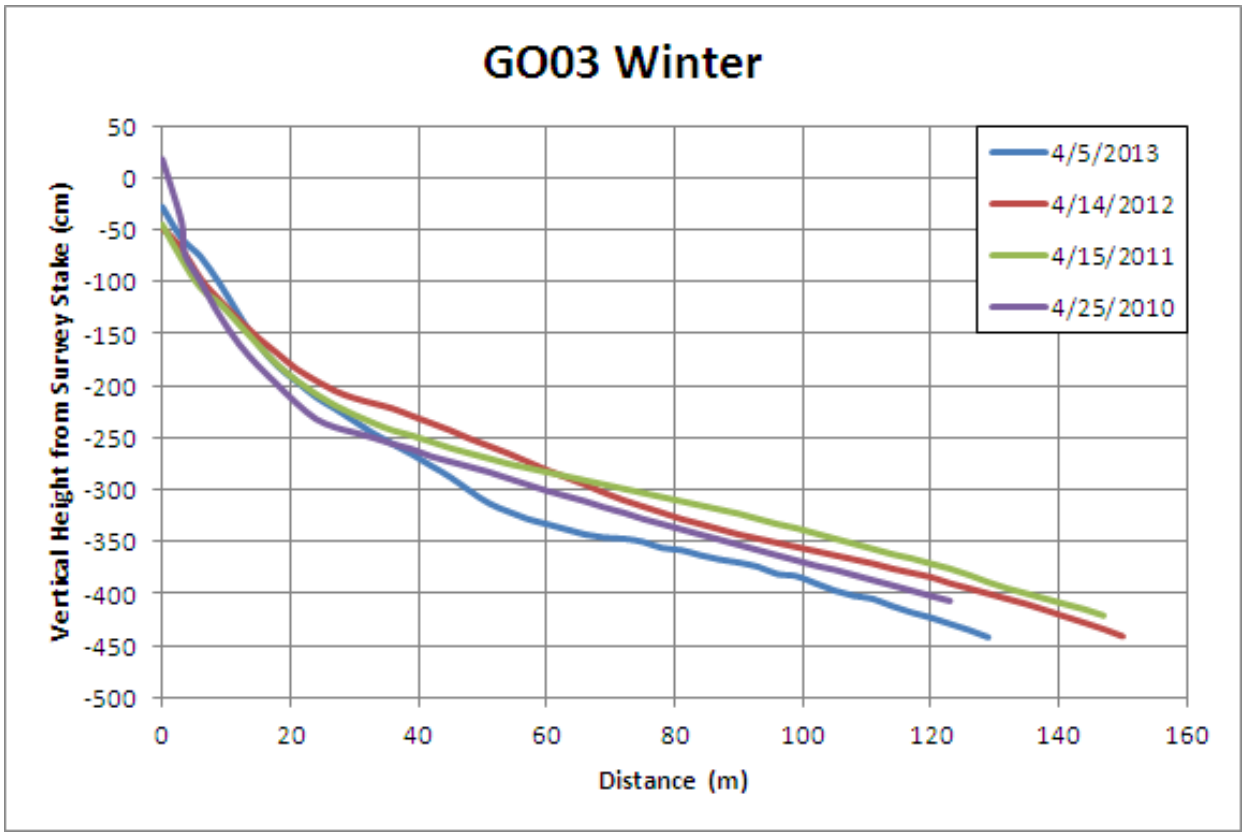

Figure 68. Winter beach profiles for GO03 from 2010, 2011, 2012, and 2013.

Figure 69. Summer beach profiles for GO03 from 2010, 2011, and 2012.

Figure 70. Winter beach profiles for GO04 from 2010, 2011, 2012, and 2013.

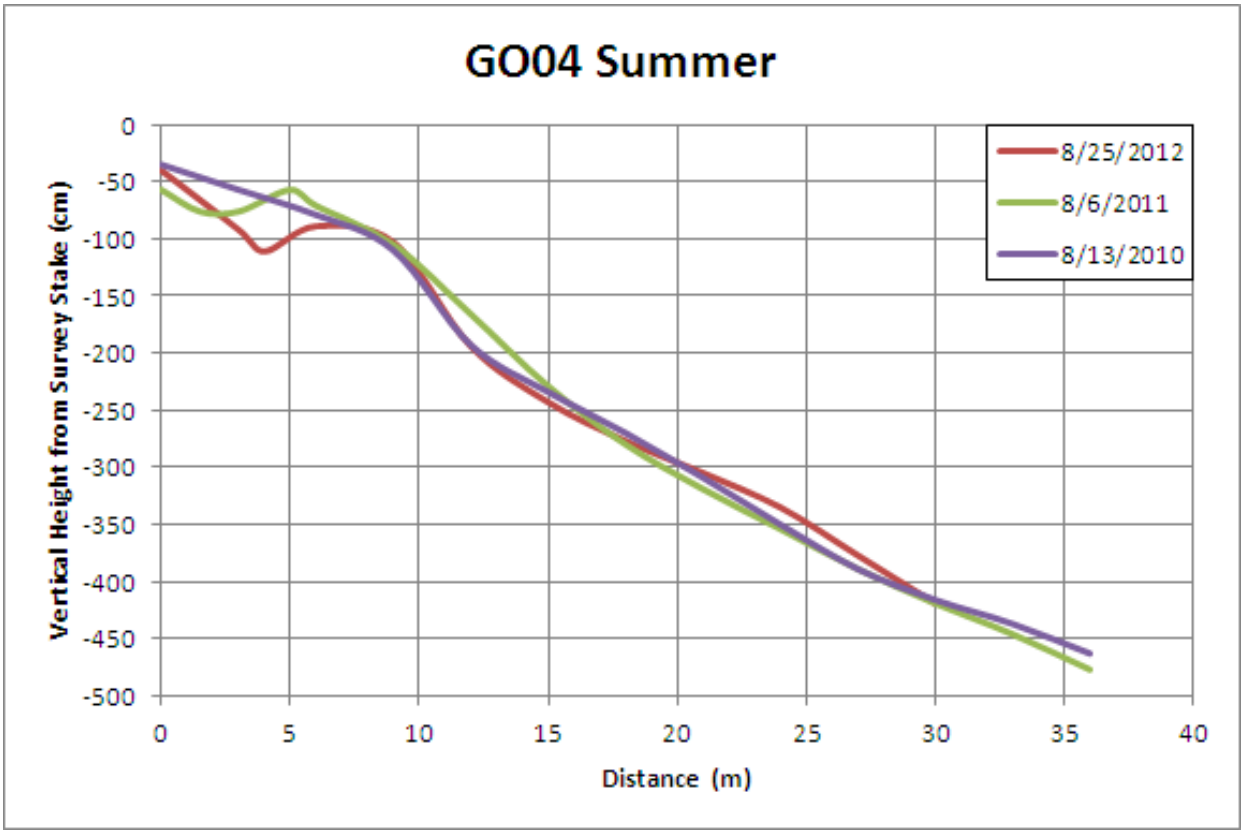

Figure 71. Summer beach profiles for GO04 from 2010, 2011, and 2012.

Laudholm Beach, Wells

Four profiles (LH01-03, LH05, Figure 72) were available.

Winter LH01 = C (75). 2011 grade: C. Trend: Same. Profile LH01, located in the middle of Laudholm Beach, received a B- and a C previously. The starting point has been stable. The 2010 profile (which was the most erosive) had a well-defined dune crest, and a berm at 20 m which sloped steeply and flattened seawards starting at 40 m (Figure 73). In 2011, it had elevation gains at the base of the dune, slight berm loss, and gains along the profile seaward of 30 m. In 2012, it showed berm loss and recession (below 2010 levels) but some elevation gains seaward of 50 m. Data entry stopped in May 2012, so no 2013 data is available for comparison. This profile showed stability of the dune and gains in the lower tide areas, but some berm loss.

Summer LH01 = D (65). 2011 grade: C. Trend: Worse. In 2010, it had a well-developed dune, small berm, and a relatively steep slope out to 30 m and then a series of swash bars (Figure 74). By 2011, its profile migrated landwards, including loss of the berm and part of the dune. The 2012 profile (from May), showed additional landward migration of the berm, but slight recovery of the dune. However, it underwent steady erosion over the past few summers.

Winter LH02 = D (65). 2011 grade: D. Trend: Same. LH02, slightly closer to the Little River than LH01, received a B and D previously due to steepening and landward migration. In 2010, it was eroded to its deepest point of the 3 previous years (Figure 75). In 2011, it had berm loss at 30 m, but seaward of this, showed recovery to 80 m. By 2012, it showed berm recovery back to 2010 levels, and some continued elevation gains in its seaward portions. In 2013, it exhibited landward movement of the dune, a steeper slope from the dune, and loss of the berm within 40 m, indicating erosion. The 2013 profile was more erosive than the 2010 profile. It showed recovery to 2012, then extensive erosion in 2013.

Summer LH02 = C (75). 2011 grade: D. Trend: Better. In the last report, LH02 had consistent berm loss and landward migration. In 2010, it had a well-defined dune, a break in slope at 30 m to a relatively flat profile (Figure 76). In 2011, it had slight dune and beach erosion, but elevation gains from 30 m seaward, indicating the availability of sand. In 2012, it showed additional beach and berm loss at 20 m, but gains in the offshore portion of the profile (30 m seaward). Comparing 2010 and 2013 profiles showed landward berm movement, but growth offshore. This profile showed loss along its upper portions, but ample sand supply offshore.

Winter LH03 =F (55). 2011 grade: C-. Trend: Worse. LH03, located closer to the Little River, received a B and C- previously. In 2011, the dune eroded slightly, the profile steepened, and the elevation decreased along the profile (Figure 77). Some recovery happened in 2012, but 2013 had more dune erosion and significant profile steepening. This profile underwent significant dune erosion and landward migration.

Summer LH03 =C- (72). 2011 grade: C-. Trend: Same. The profile showed landward migration of the berm near the dune (10-15 m) from 2010 to 2011 (Figure 78), but gained in the offshore, seaward of 40 m. The upper portion of the profile remained stable in 2012 out to 40 m, and gained sand seaward of this, indicating sand is available to the profile. We hope to see recovery in summer 2013.

Winter LH05 = D (65). 2011 grade: C. Trend: Worse. LH05 is positioned closer to Drakes Island Beach, and received a C previously. In 2010, it had a scarped dune, a defined berm at 18 m, and a steep slope to low tide terrace at 40 m (Figure 79). In 2011, it had landward dune migration (but an increase in elevation), a slight gain in sand along the beach, but slight lowering at the berm. In 2012, it had considerable dune and beach erosion, with loss of sand between 10-25 m, but slight gains offshore. By 2013 (it is unclear if this is the same starting location; we assume it is), it showed more dune loss, landward berm migration, but an increase in sand elevation in the berm. This profile showed significant dune erosion, and landward migration of the berm.

Summer LH05 = C- (72). 2011 grade: C. Trend: Worse. From 2010 to 2011 (Figure 80), it showed good stability in the dune, and some minimal growth along the profile. However, in 2012 (the only profile available was from May), it showed dune and beach erosion to 40 m, where there was an elevation gain seaward along the profile over the 2011 shape. The profile showed erosion of the beach and dune, but some seaward growth in the lower profile elevations over the past few years. We remain cautious about its summer shape, especially with the extensive loss of berm.

Winter Summary: The profiles are indicating landward migration of berm and dunes (especially at LH03 and LH05). **Winter Beach Grade: D (65). 2011 grade: C- (72). Trend: Worse.**

Summer Summary: Aside from LH01, profiles maintained dune crests well. Profiles showed signs of berm retreat, signifying erosion. The positive note is that there does appear to be sediment available in the lower portions of the profiles. **Summer Beach Grade: C- (71); 2011 grade: C- (72). Trend: Same.**

Overall Summary: Beach profiles showed worse winter trends, with exacerbated berm and dune erosion. The summer profiles fared slightly better, but showed evidence of continued erosion and landward migration. **Overall Laudholm Beach Grade: D+ (68). 2011 grade: C- (70). Trend: Worse.**

Figure 72. Volunteer beach profile locations along Laudholm Beach, Wells. Base imagery from Maine OGIS.

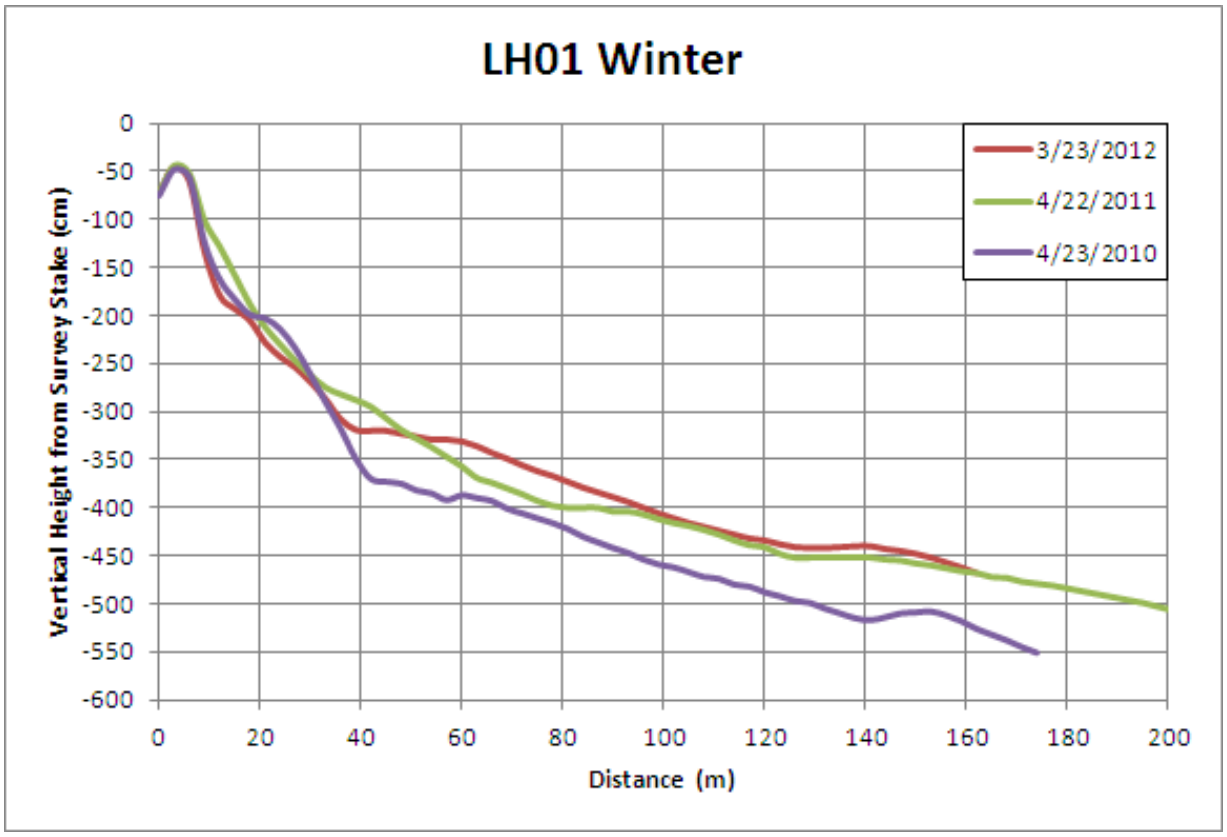

Figure 73. Winter beach profiles for LH01 from 2010, 2011, and 2012.

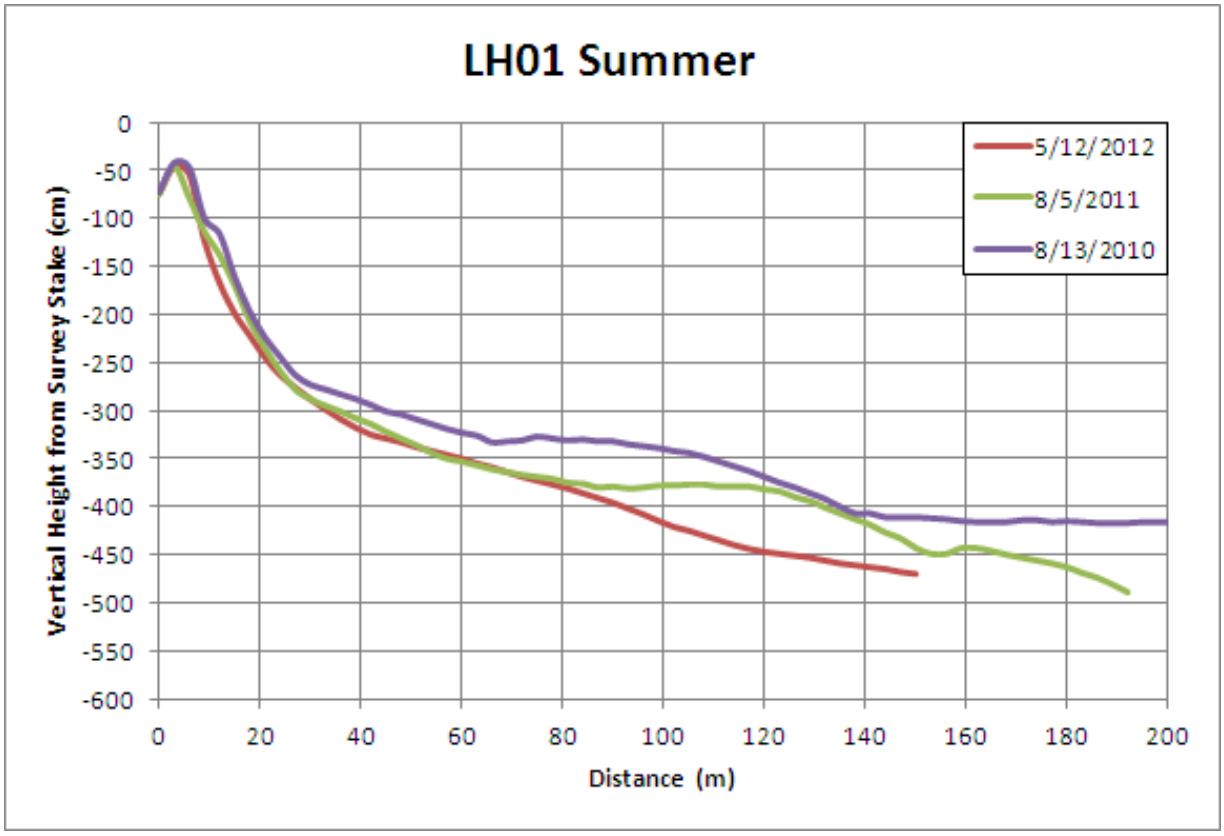

Figure 74. Summer beach profiles for LH01 from 2010, 2011, and 2012.

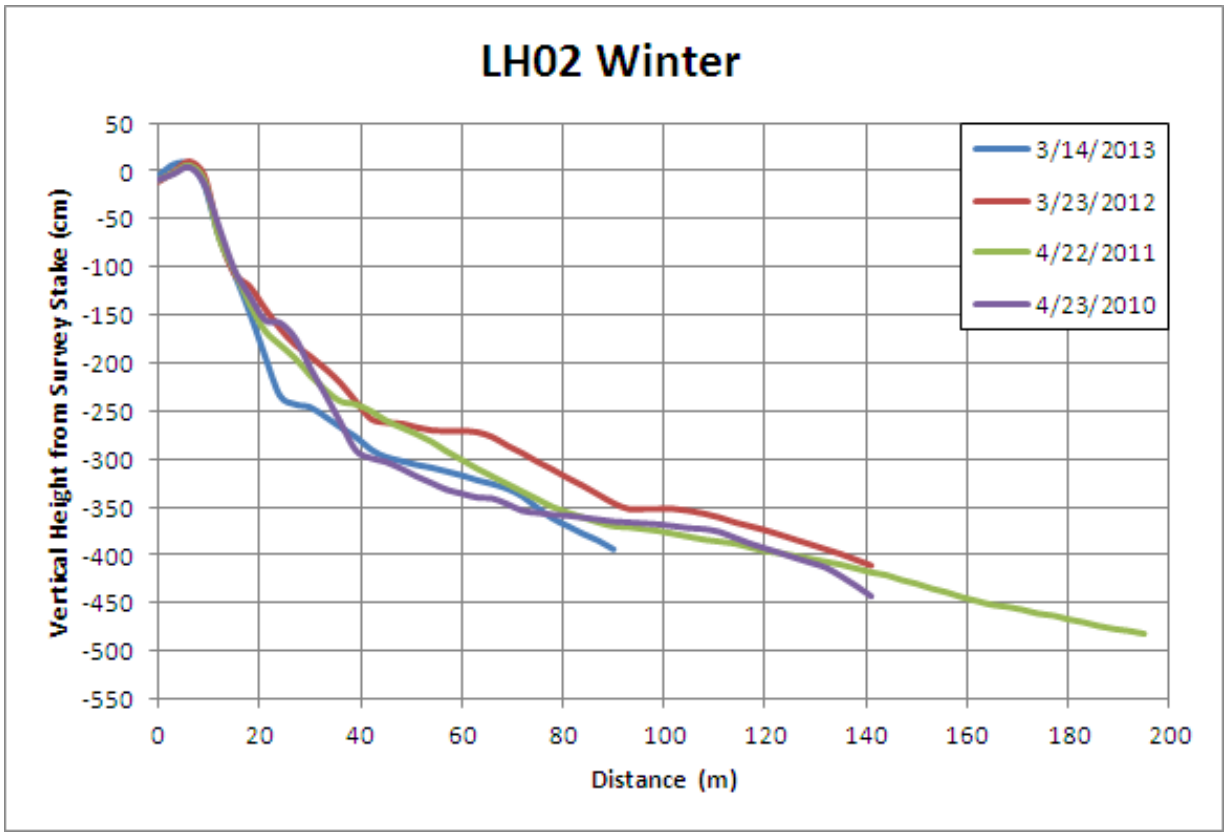

Figure 75. Winter beach profiles for LH02 from 2010, 2011, and 2012.

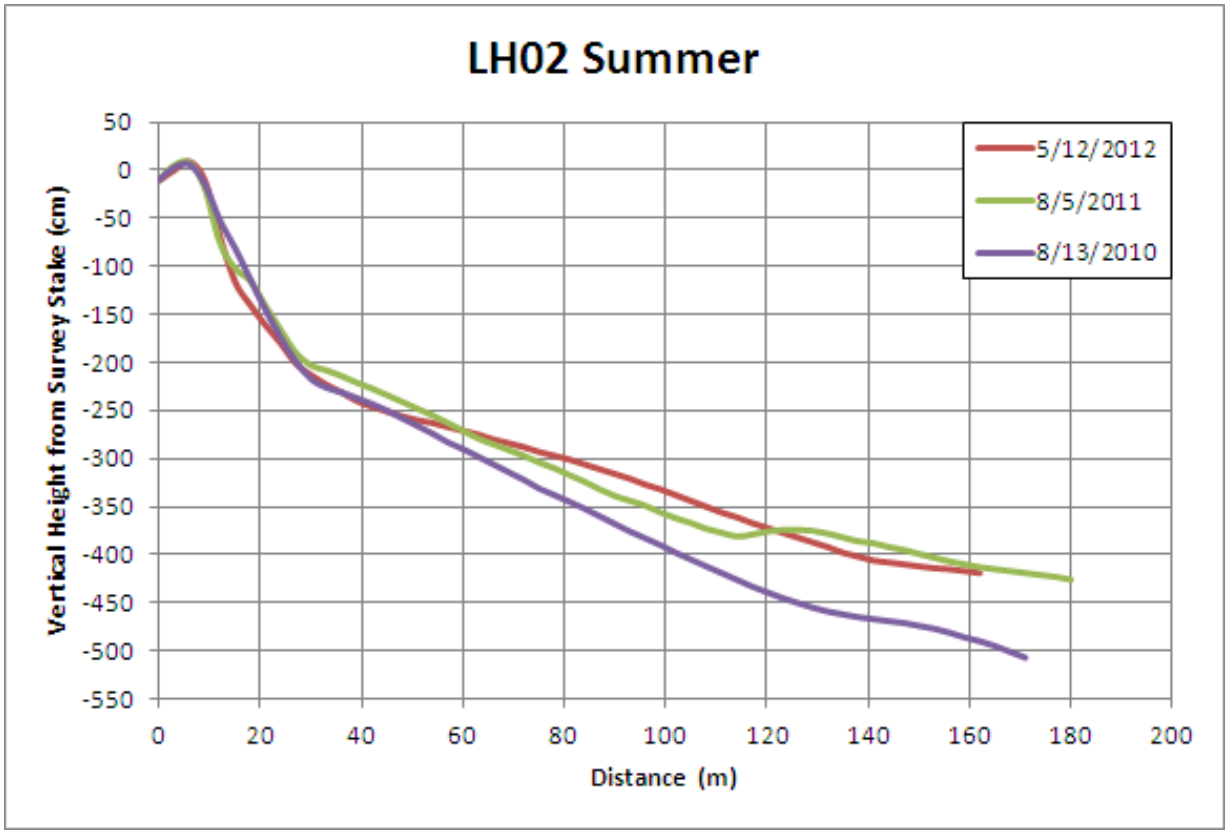

Figure 76. Summer beach profiles for LH02 from 2010, 2011, and 2012.

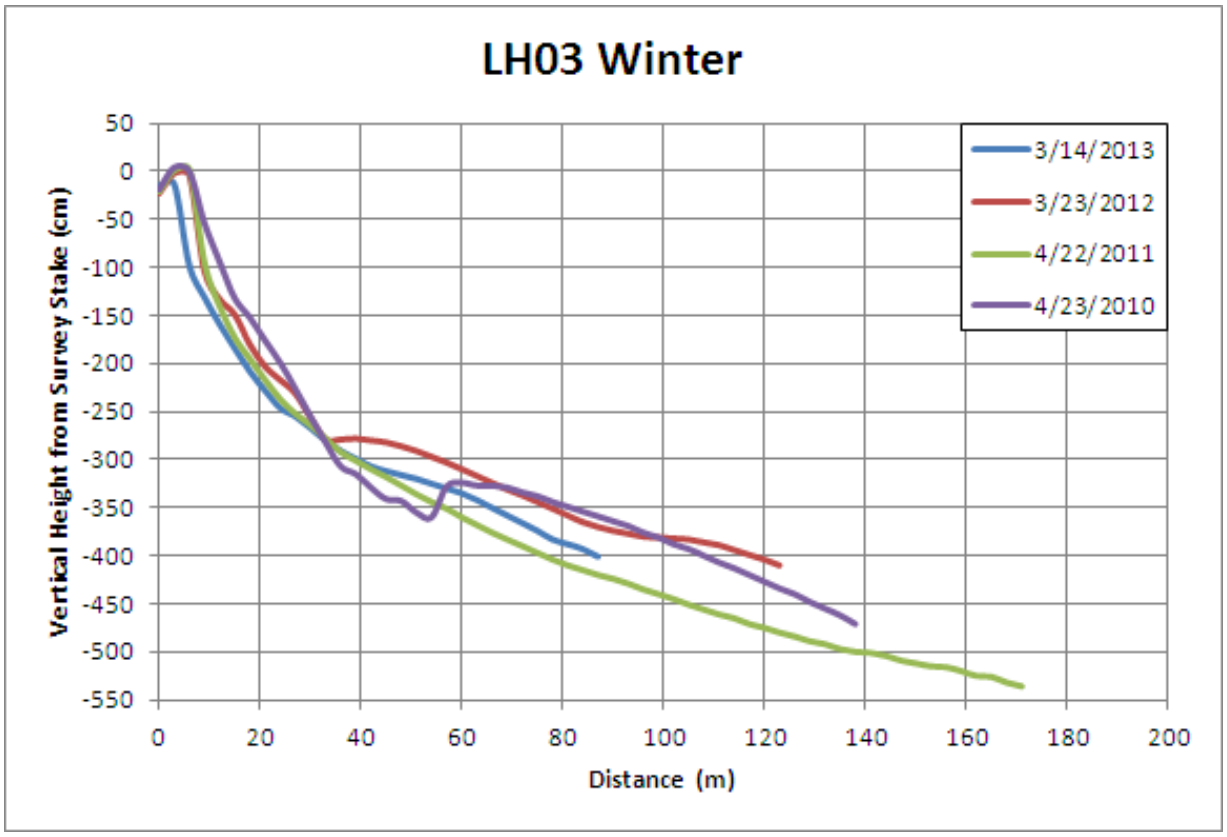

Figure 77. Winter beach profiles for LH03 from 2010, 2011, and 2012.

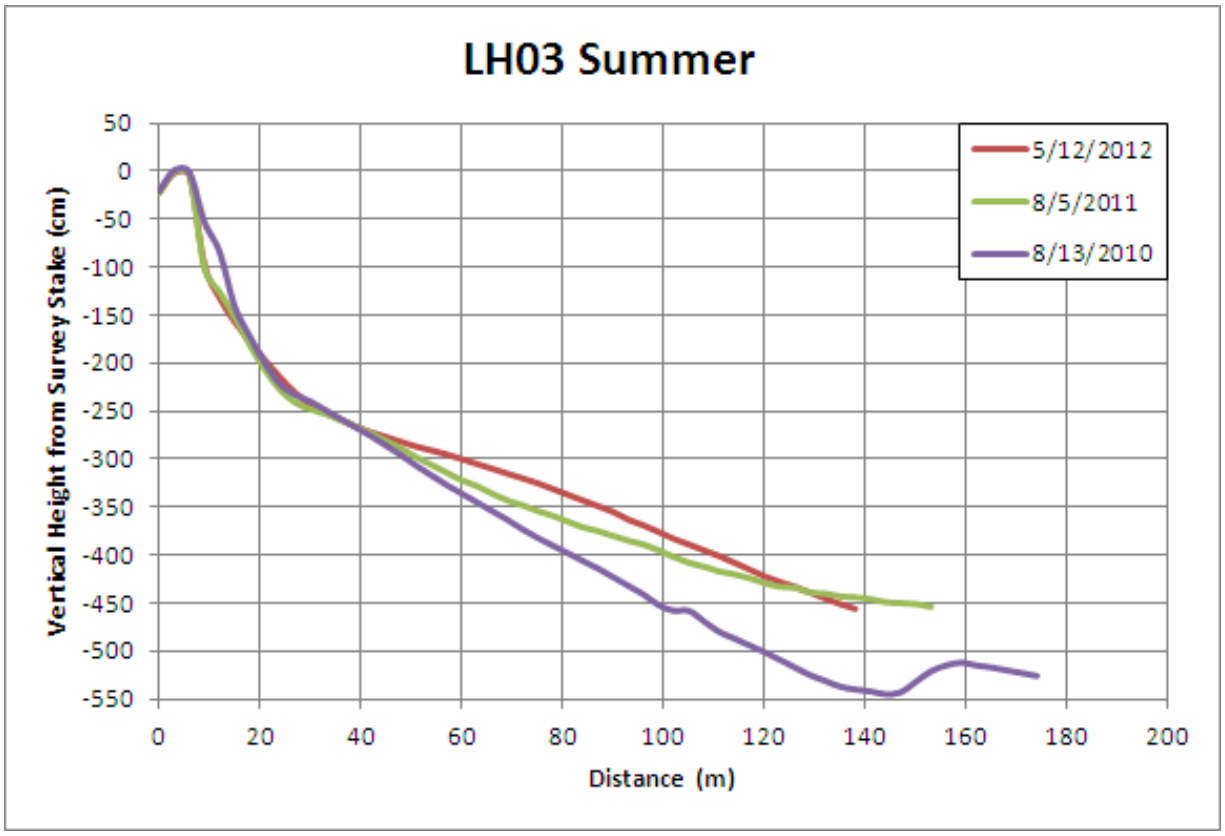

Figure 78. Summer beach profiles for LH03 from 2010, 2011, and 2012.

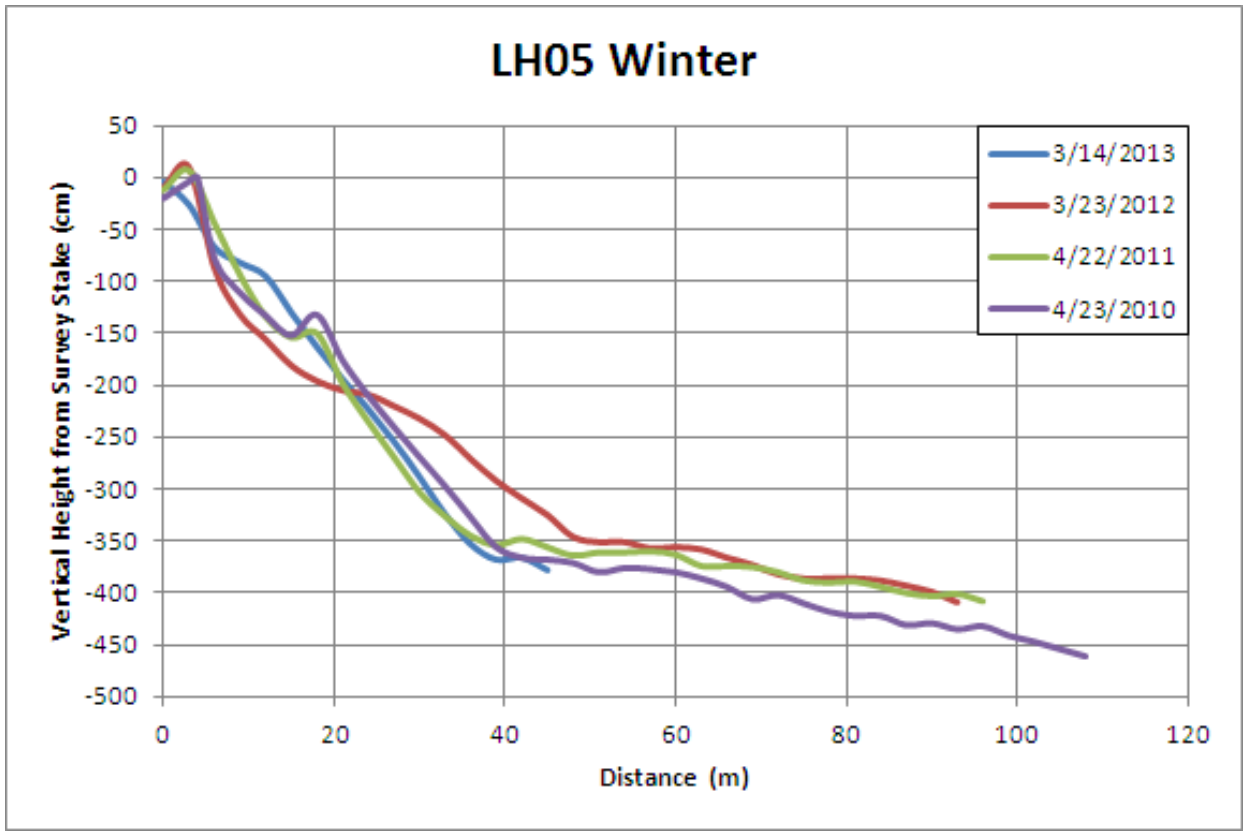

Figure 79. Winter beach profiles for LH05 from 2010, 2011, and 2012.

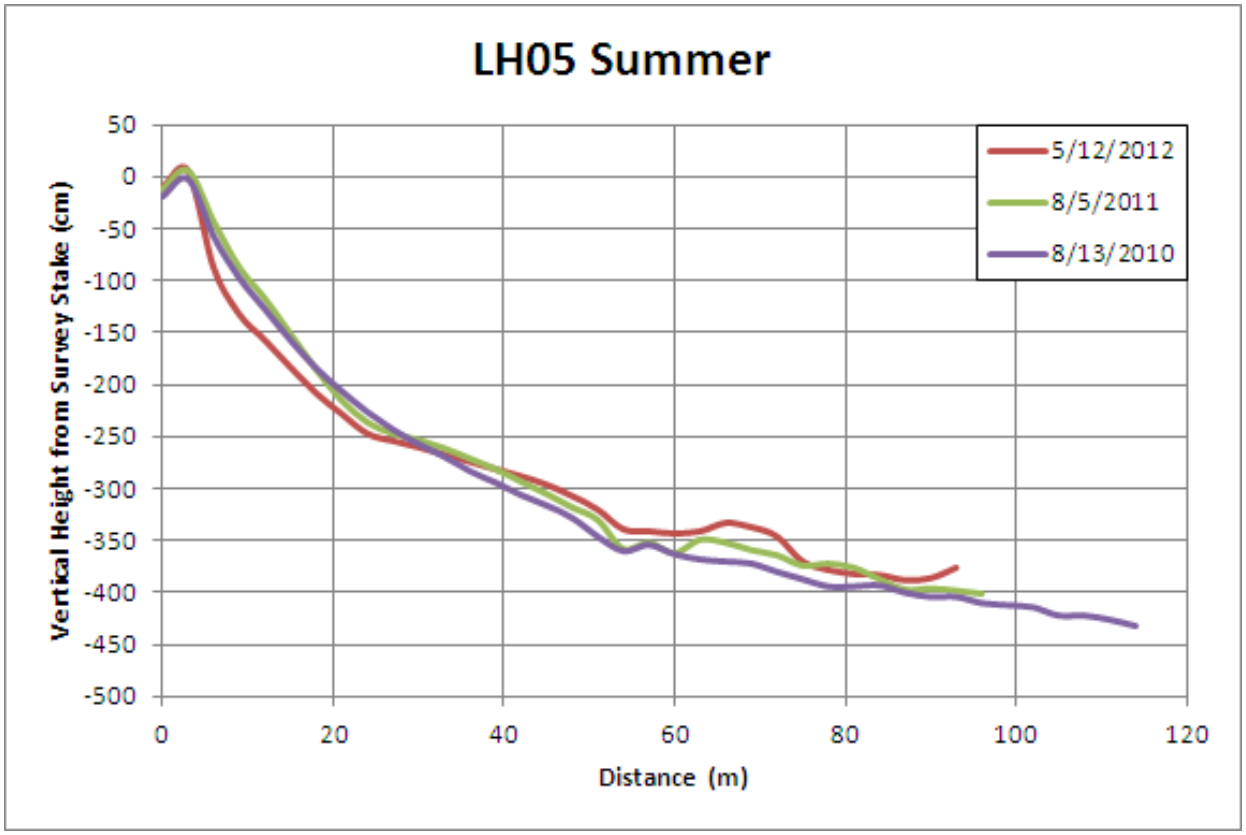

Figure 80. Summer beach profiles for LH05 from 2010, 2011, and 2012.

Laudholm Beach MBMAP Results

The previous assessment, which included data from 2007 through 2011, showed a LRR of -2.73 m/yr. When 2012 data is included (Figure 81), the vegetation shoreline change LRR decreased to -1.19 m/yr. (but within the variance of the data). Shoreline erosion nearest the inlet, which was on the order of -10 m/yr. or more in the 2011 report, decreased to a rate of between -4 m/yr. and -6 m/yr., indicating that the dunes nearest the inlet are undergoing recovery. This heavily influenced the overall recession rates for the Laudholm Beach section of shoreline. The majority of the profile locations according to MBMAP data were slightly erosive, averaging around -0.5 m/yr. or less (aside from LH03). This trend appears to be reflected by the summer profile shapes at Laudholm Beach, which showed maintenance of the dune positions and not high erosion.

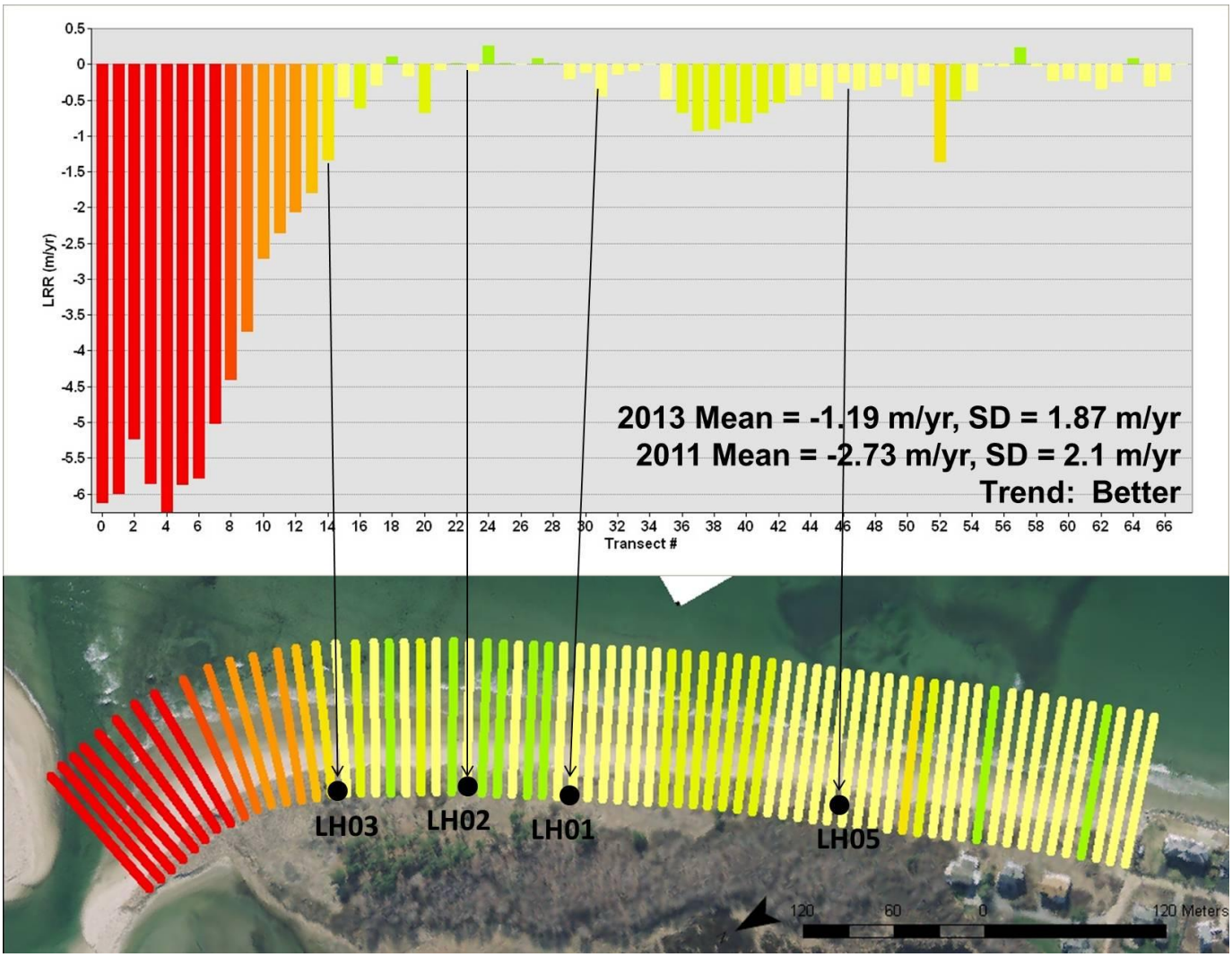

Figure 81. MBMAP shoreline change results for Laudholm Beach, Wells. Base imagery from Maine OGIS.

Wells Beach, Wells

Four beach profiles (WE00, WE02-WE04, Figure 82) were available for analysis.

Winter WE00 = D+ (68). 2011 grade: C. Trend: Worse. Located just south of Casino Point, WE00 received an A and C previously. In 2010, the profile was highly erosive, with a steep shorefront to likely a cobble-dominated, flat beach (Figure 83). It showed good recovery by 2011, gaining elevation along its entirety. Recovery continued into 2012, with more elevation gains, and swash bars from 10-25 m. However, it underwent massive erosion in 2013, with losses to almost 2010 levels. The 2010 profile likely represents erosion to the historical geologic surface. Although 2013 is above the 2010 shape, it lost almost 100 cm of vertical elevation from 2012 to 2013.

Summer WE00 = D (65). 2011 grade: A. Trend: Worse. In the previous report, WE00 had excellent summer profile shapes, and increased in elevation. However, over the last 3 summers, that appears to have changed (Figure 84). The 2010 profile had the highest elevations of all, and showed a defined berm, and convex (sediment rich) shape. By 2011, it had eroded dramatically, and had a much more concave, erosive shape, with no berm. In 2012, the profile gained some at its berm (out to about 30 m), but then eroded below 2011 elevations. The profile has undergone clear erosion since 2010.

Winter WE02 = D (65). 2011 grade: B+. Trend: Worse. Located north of Casino Point, WE02 received an A and B+ previously (Figure 85). The 2010 profile had a large, anomalous, well developed berm (likely comprised of cobbles) at about 20 m. This was the highest, best developed profile. In 2011, the cobble berm disappeared, and the profile lost elevation at the dune and the berm, but remained the same as the 2010 shape from 35 m seaward. Erosion continued into 2012, as the profile steepened out to about 40 m, then flattened to near the 2010 shape. By 2013, it lost sand at the dune/wall edge, gained in the berm area (remained below 2010), and steepened dramatically at around 40 m indicating large amounts of scour. The profile was well below its 2010 shape, and the amount of scour that occurred near 80 m is concerning.

Summer WE02 = C+ (78). 2011 grade: C-. Trend: Better. 2010 showed a defined berm and steep slope to a deep trough (about 150 cm below any of the other profiles) near 70 m. The summer 2010 shape looks very similar to the winter 2013 shape, indicating that both of these years likely eroded to the historical erosion surface (Figure 86). By 2011, it recovered well along its seaward end (seaward of 20 m), but lost berm elevation. In 2012, it showed elevation gains in the berm, then a deep trough near the 30 m mark, and elevation gains offshore. The summer of 2010 was a low point for this profile, and the profile is showing some recovery and stability since that time, though between 20-30 m was eroded below the 2010 shape.

Winter WE03 = F (55). 2011 grade: C. Trend: Worse. WE03, located south of the Webhannet River jetties, received an A- and a C previously. The 2010 profile is from November as no other data was collected in that year; thus, this may be more of a "fall" profile shape (Figure 87). It had a defined berm near 15 m, and a gradual slope offshore. In 2011, it flattened and eroded, but maintained its elevation from about 125 m seaward. In 2012, it showed some recovery, with a berm returning, but seaward of about 50 m, the profile lost elevation. The 2013 profile showed the steepest, most concave profile shape, and was the most erosive. This profile underwent continued erosion over the past 3 years.

Summer WE03 = B (85). 2011 grade: D. Trend: Better. WE03 received a D in the previous report, showing evidence of continued erosion since 2008. The 2010 shape (taken from November 2010) had a well-defined berm and gentle slope into the offshore (Figure 88). By 2011, it lost its berm, and lost elevation along its length – 2011 was the most eroded profile. In summer 2012, the profile showed dune growth, gained back its berm and showed elevation gains along the profile. This profile showed good summer recovery.

Winter WE04 = D (65). 2011 grade: D. Trend: Same. WE04, directly adjacent to the Webhannet River jetties, received an A and D previously. It showed some recovery, but underwent erosion in 2011 (Figure 89). In 2010 (from November), the profile had a high, well defined frontal dune that sloped to a small berm near 10 m, with a gradual slope offshore. In 2011, the frontal dune lowered, the berm disappeared, and the profile steepened. 2012 showed some stability and recovery, with the dune maintaining its position, a return of a berm, and the highest elevations along the profile occurring. However, winter 2013 showed significant dune elevation loss and landward movement, in addition to profile steepening, and berm loss. This profile underwent landward movement.

Summer WE04 = B+ (88). 2011 grade: B. Trend: Better. The November 2010 profile showed a well-defined dune ridge, small berm, and gradual slope offshore (Figure 90). By 2011, it showed slight landward migration of the dune, but a higher, better defined berm, and more sand offshore. This trend continued into 2012, with dune landward movement (but growth), and a well-defined berm and sand rich nearshore. Although it showed landward dune migration, this profile appears to be sand rich, and is the best performing of the Wells Beach profiles in terms of summer shapes.

Winter Summary: Winter profiles along Wells Beach clearly underwent an erosive phase from 2010 to 2013, with all profiles scoring poorly in this assessment. **Winter Beach Grade: D (63). 2011 grade: C (76). Trend: Worse.**

Summer Summary: Similar to the last two assessments, summer profiles at Wells Beach appeared to do *much* better than winter profiles, with some signs of stability to growth at WE03 and WE04 at the northern end of the beach. The southern and central portions appear to be eroding, or somewhat stable. **Summer Beach Grade: C+ (79). 2011 grade: B (83). Trend: Worse.**

Overall Summary: Wells Beach appears to be undergoing erosion at the dune at its northern end – especially during winter. This appeared to have recovered by summer. Winter months were mostly erosive for all four profiles over the past few years. Luckily, the summer profile shapes at the northern end of the beach (WE03 and WE04) show seasonal recovery, while WE00 and WE02 struggled to maintain good summer shapes in this assessment. **Overall Wells Beach Grade: C- (71). 2011 grade: C+ (78). Trend: Worse.**

Figure 82. Locations of volunteer profiles along Wells Beach, Wells. Base imagery from Maine OGIS.

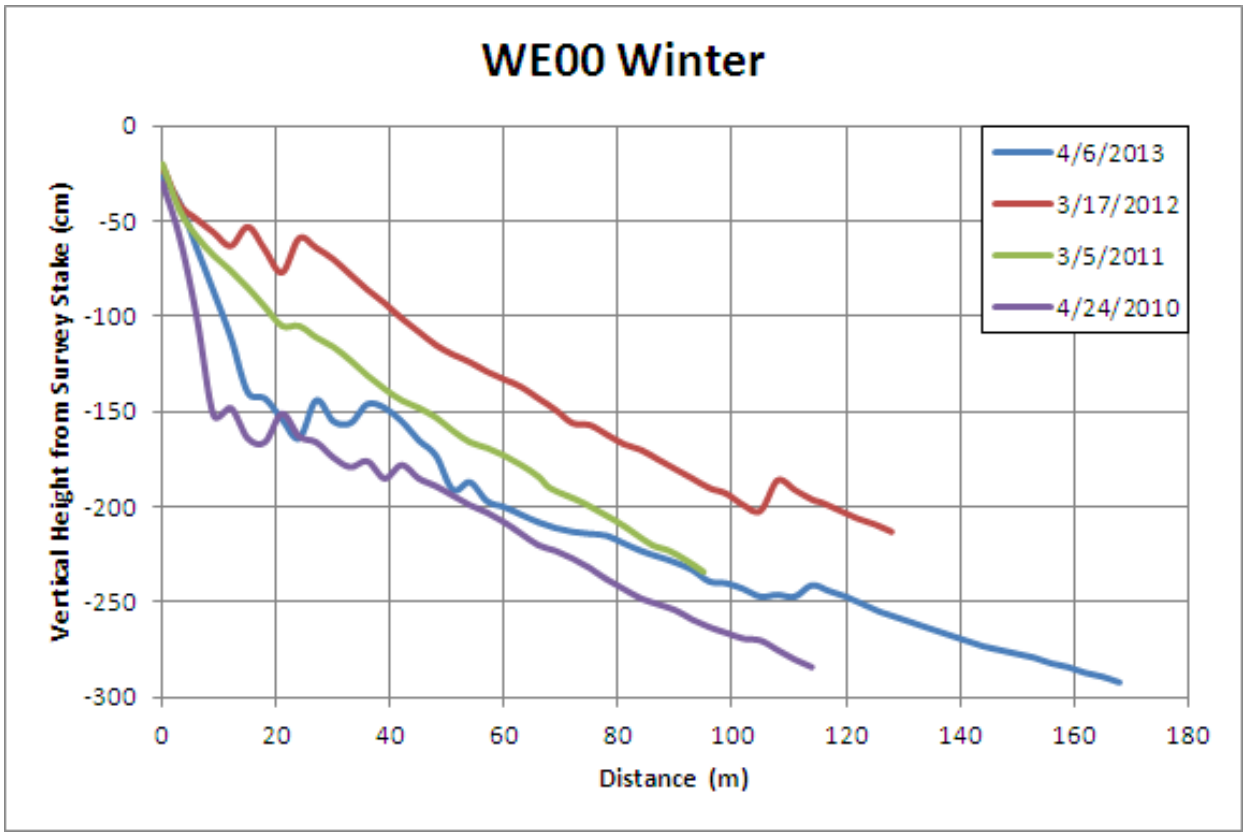

Figure 83. Winter beach profiles for WE00 from 2010, 2011, 2012, and 2013.

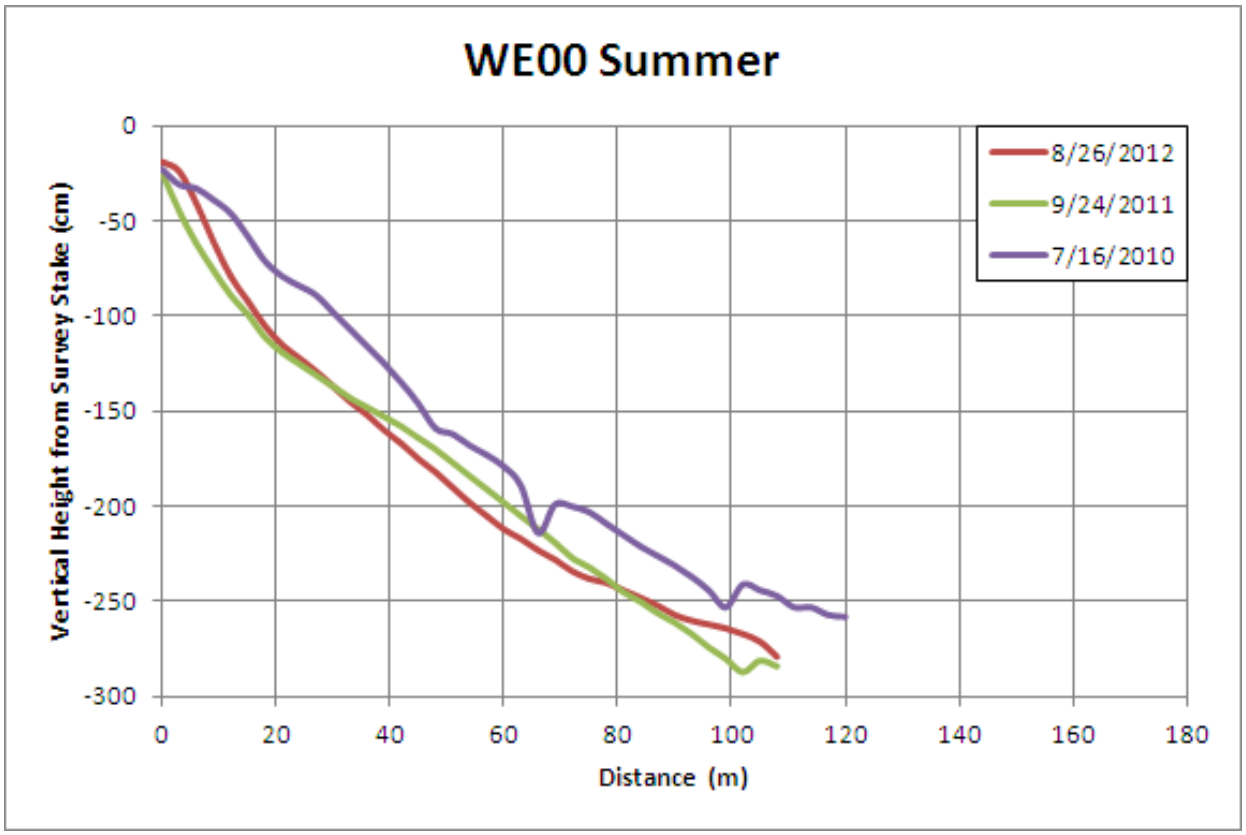

Figure 84. Summer beach profiles for WE00 from 2010, 2011, and 2012.

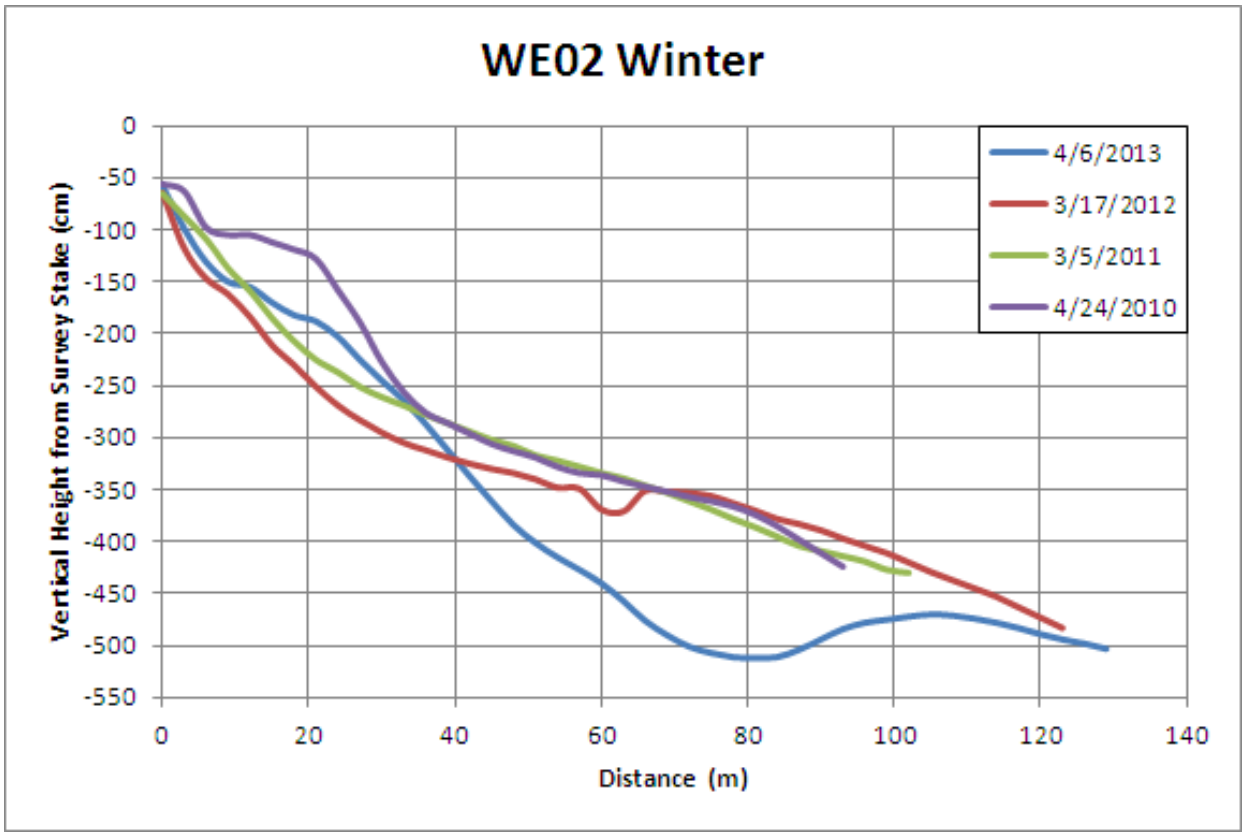

Figure 85. Winter beach profiles for WE02 from 2010, 2011, 2012, and 2013.

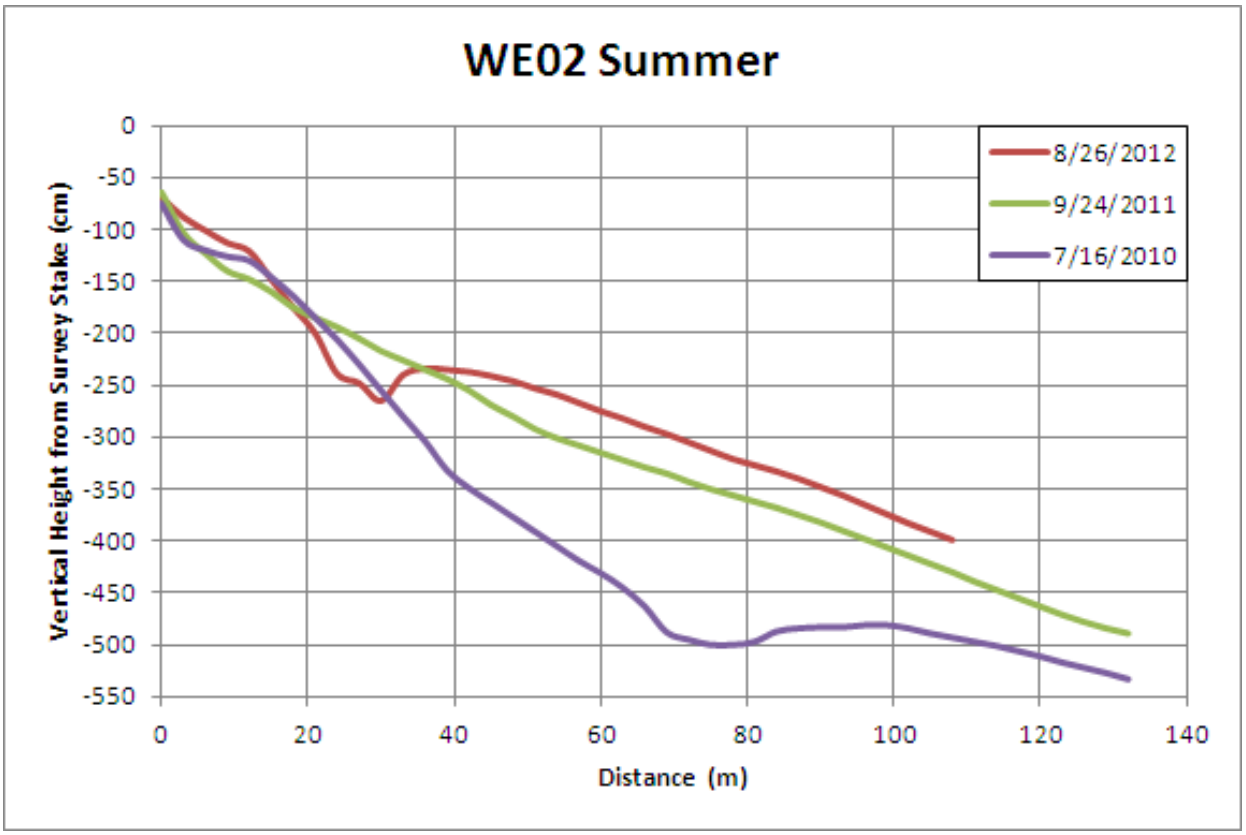

Figure 86. Summer beach profiles for WE02 from 2010, 2011, and 2012.

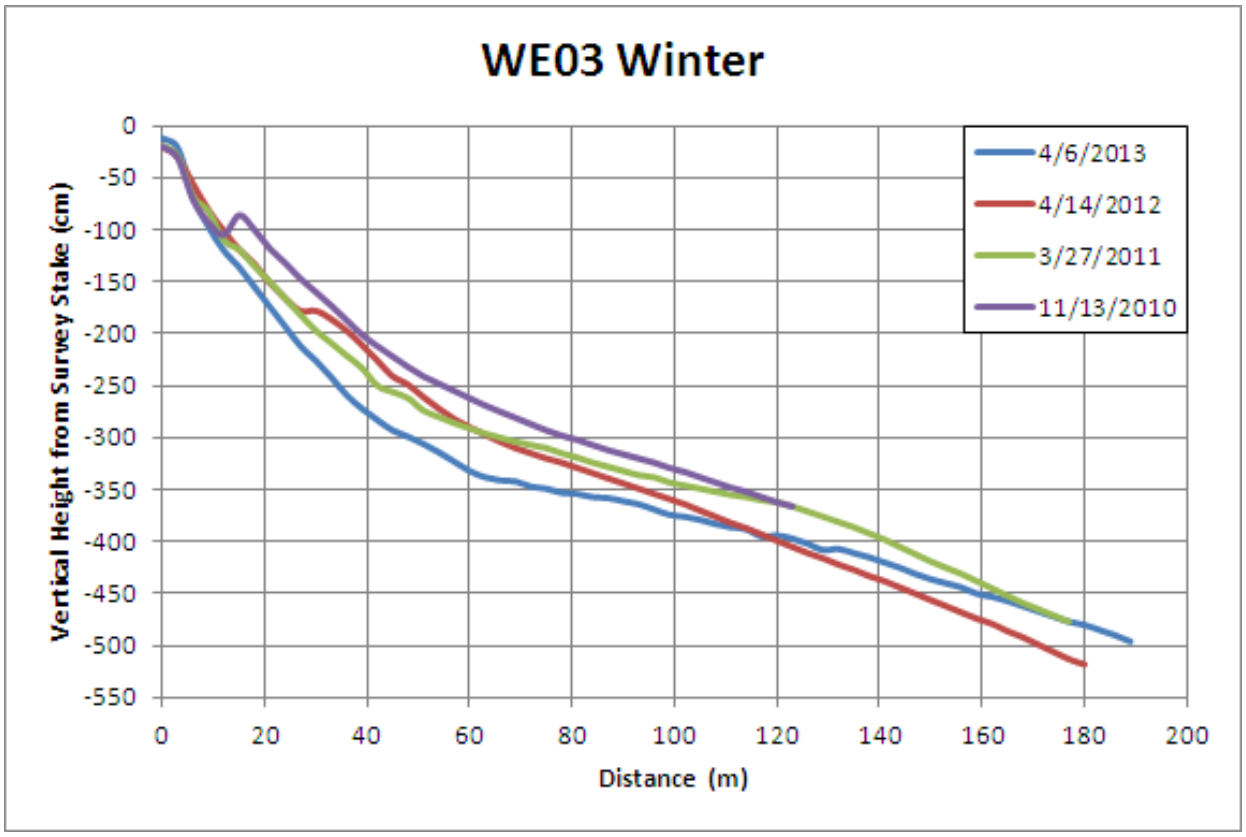

Figure 87. Winter beach profiles for WE03 from 2010, 2011, 2012, and 2013.

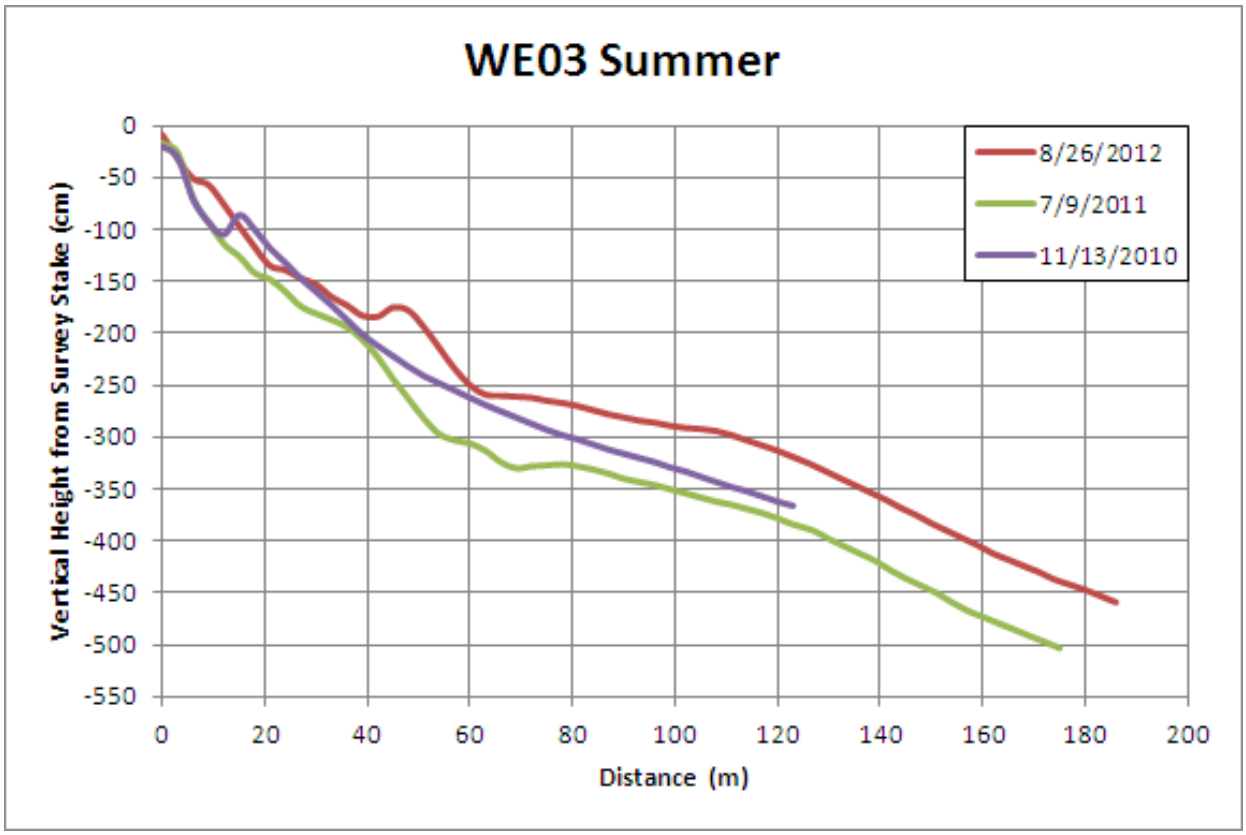

Figure 88. Summer beach profiles for WE03 from 2010, 2011, and 2012.

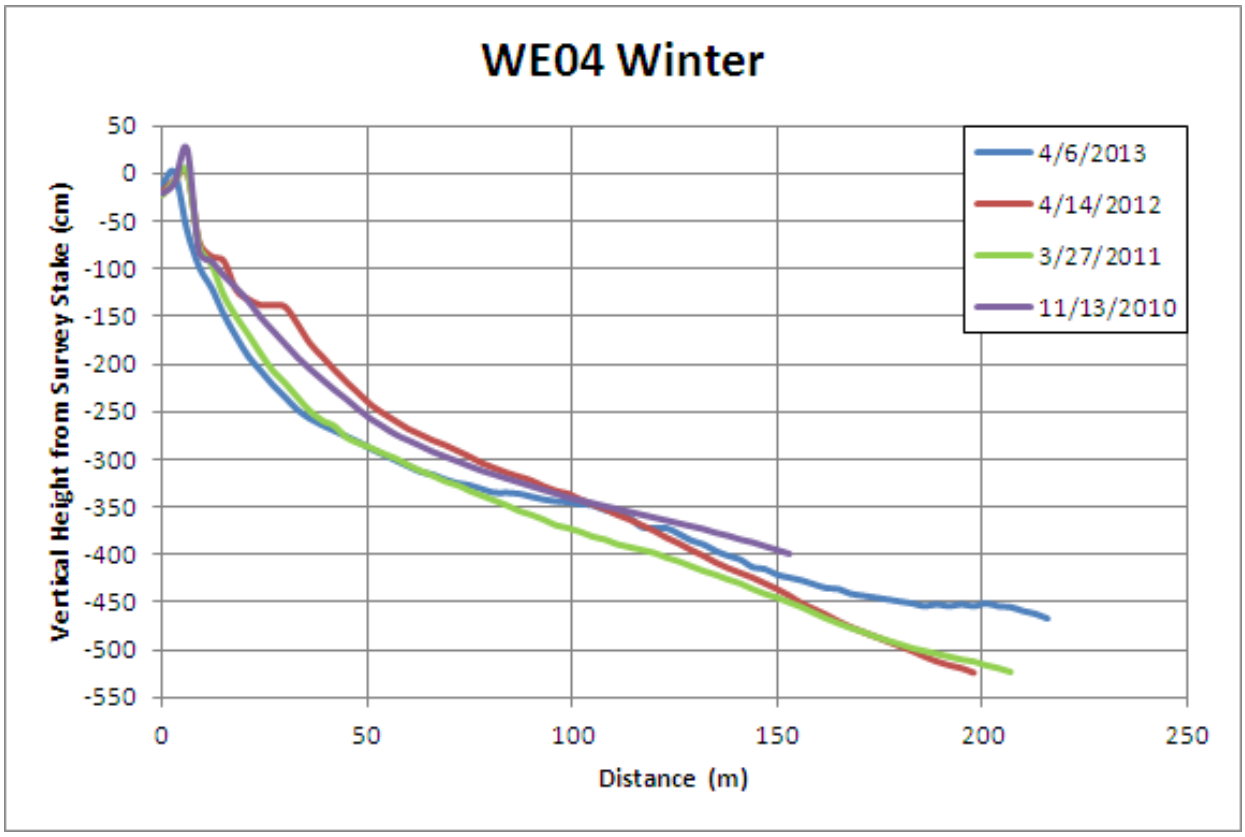

Figure 89. Winter beach profiles for WE04 from 2010, 2011, 2012, and 2013.

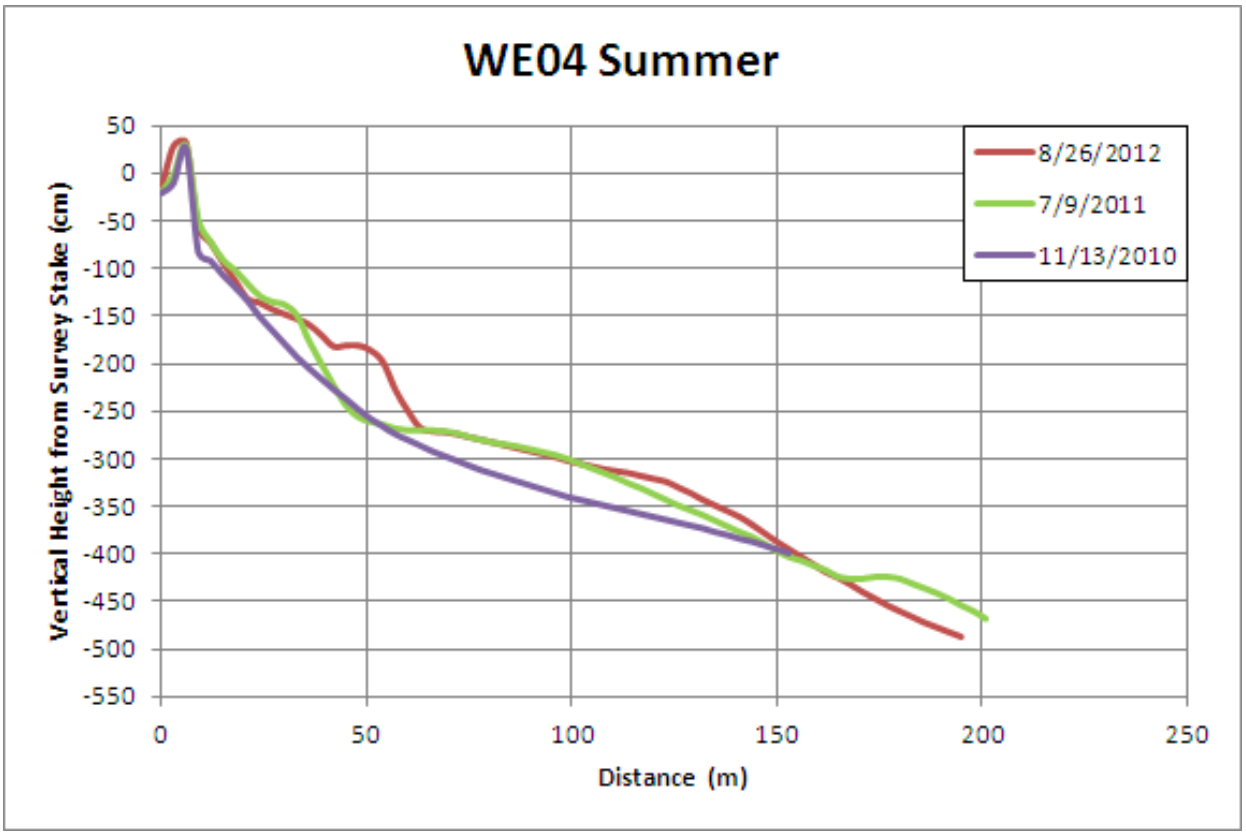

Figure 90. Summer beach profiles for WE04 from 2010, 2011, and 2012.

Wells Beach MBMAP Results

The previous MBMAP results, which covered data from 2009 to 2010 only, showed that the vegetation line had gained (grown seaward) on average about +0.6 m/yr. over that time period for the entire Wells Beach area. Results for inclusion of 2011 and 2012 shoreline position data indicate that the north-central portions of the beach underwent dune growth (Figure 91). Nearest the jetty, MBMAP data still showed an overall erosive trend, but decreased values from the previous report (which showed erosion rates on the order of -0.5 m/yr. to -1.0 m/yr.). This is consistent with the beach profile data at WE03 and WE04, which showed dune erosion continuing, but good summer recovery. It appears that erosion in this area may be moving sediment along the north-central portion of the beach, resulting in increased dune accretion.

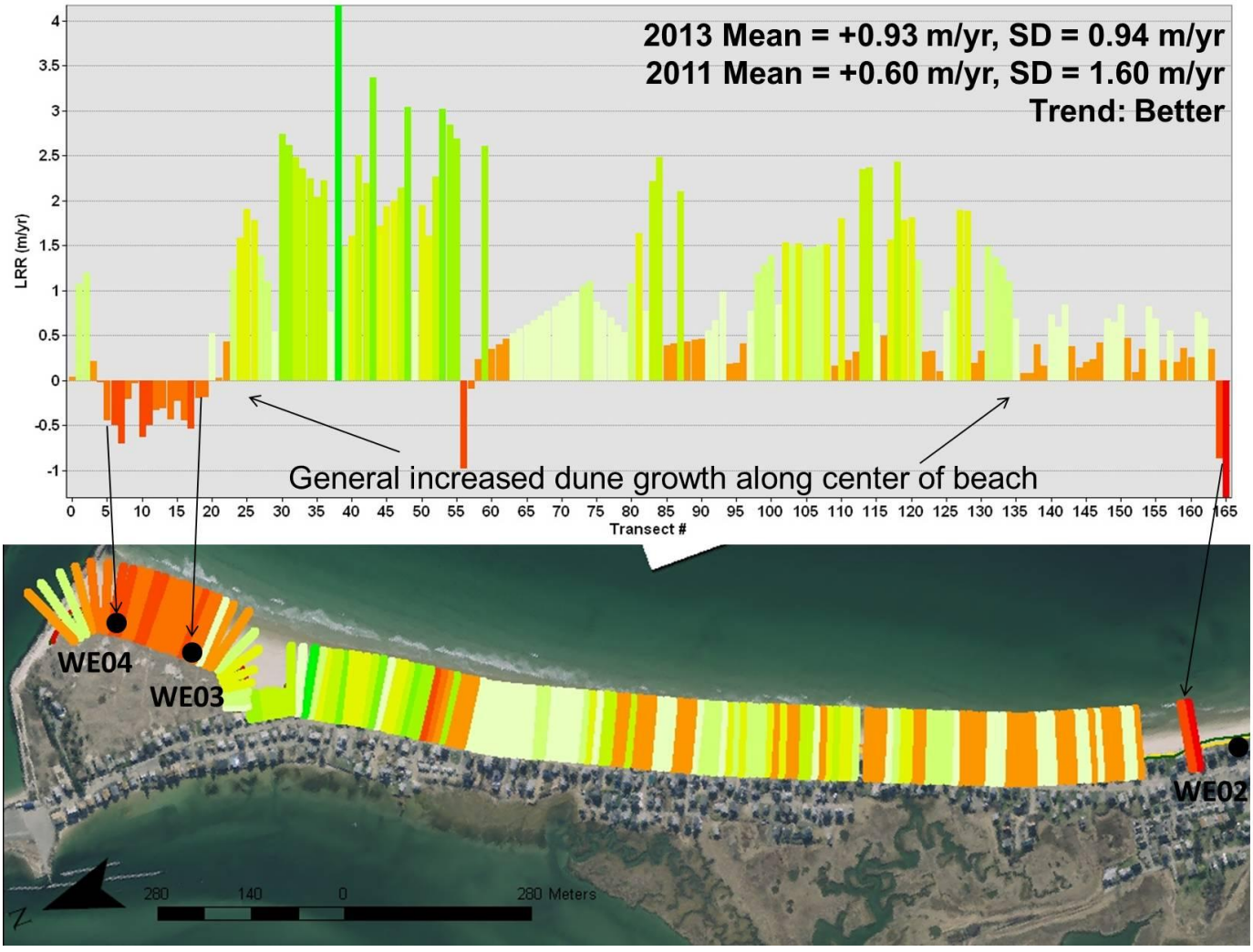

Figure 91. MBMAP shoreline change results along Wells Beach, Wells. Base imagery from Maine OGIS.

Ogunquit Beach, Ogunquit

At Ogunquit Beach, only one profile was available for comparison – OG02 (Figure 92). OG06 and OG07 do not have enough data for seasonal comparison. More profiling is required at this site to monitor changes.

Winter OG02 = B+ (88). 2011 grade: D. Trend: Better. Profile OG02, located near the sewer pump station at the northern end of the beach, received a C and D in the last two assessments. In the last assessment, it showed continuous erosion through 2010. However, it appears that this trend may have reversed (Figure 93). The 2010 winter profile showed a well-defined dune, but had the lowest profile elevations of the last 4 years. By 2011, the profile showed recovery from the 2010 low profile, with the dune crest moving seaward, and the profile gaining in elevation along its length. This trend continued in 2012 (note, the profile is from December due to lack of early winter 2012 data), with additional gains in the dune and berm. By February 2013 (the latest available data), seaward growth of the dune continued, and the berm and the beach remained quite stable. This is a marked switch in the profile action; OG02 appears to be showing very good stability and growth over the past 4 winters.

Summer OG02 = B+(88). 2011 grade: D. Trend: Better. The profile received a D in the previous assessment, showing erosion of the dune, berm, and profile. The September 2010 profile exhibited a well-defined dune and a prominent berm at the 30 m mark (Figure 94). In 2011, the profile showed growth at the dune and in the berm, but a slight landward movement of the berm. By summer 2012, the beach appeared to have prograded more, building seaward at the dune (but losing slightly in elevation), and markedly at the berm. This indicates a phase of accretion for this profile.

Overall Summary: At Ogunquit Beach, based on analysis of profile OG02, the previous trend of erosion has reversed, with good beach and berm stability and growth in the winter and summer beaches. Side-by-side comparison of the profile at this location shows the summer berm, which appeared each summer season, and the steeper, concave shape of the winter profile. *More profiling is required at the Ogunquit Beach area to understand spatial beach changes*. **Overall Ogunquit Beach Grade: B+ (88). 2011 grade: D (65). Trend: Better.**

Figure 92. Location of volunteer monitoring profile at Ogunquit Beach, Ogunquit. Base imagery from Maine OGIS.

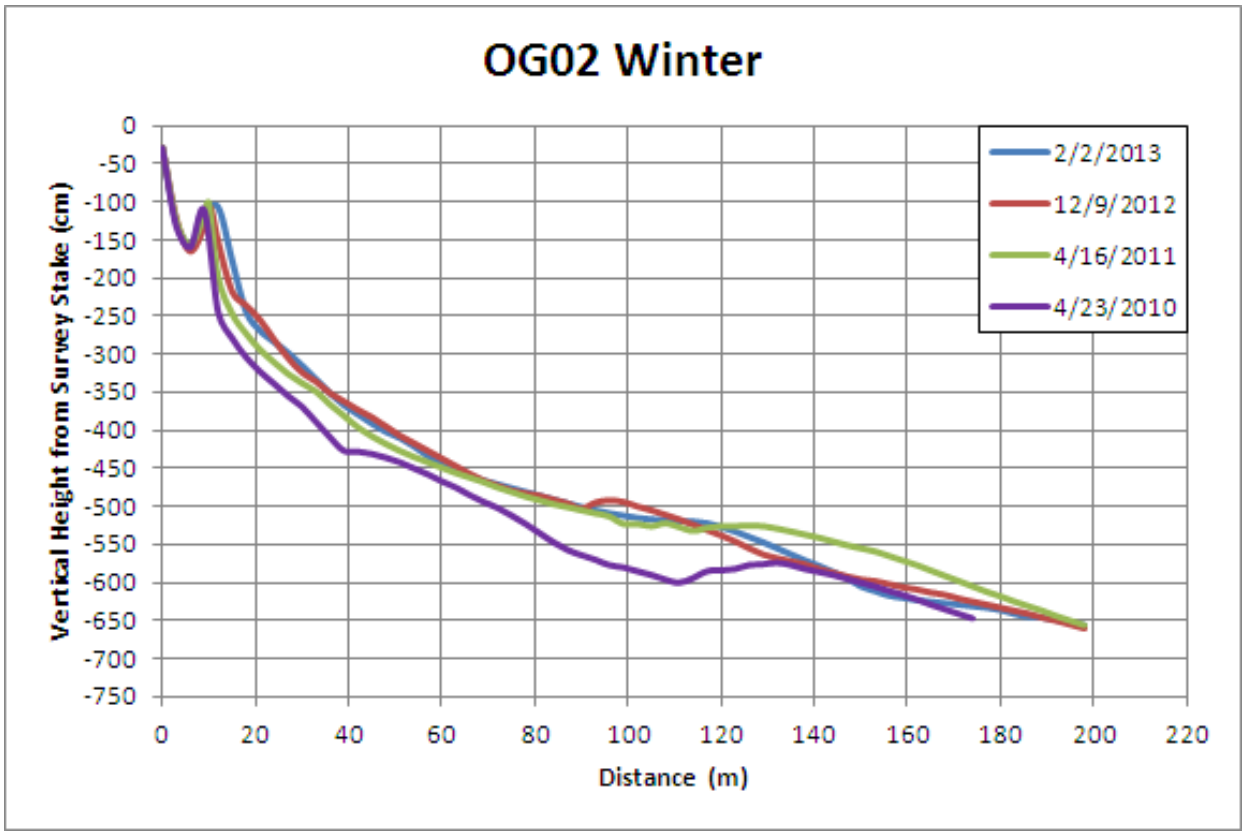

Figure 93. Winter beach profiles for OG02 from 2010, 2011, 2012, and 2013.

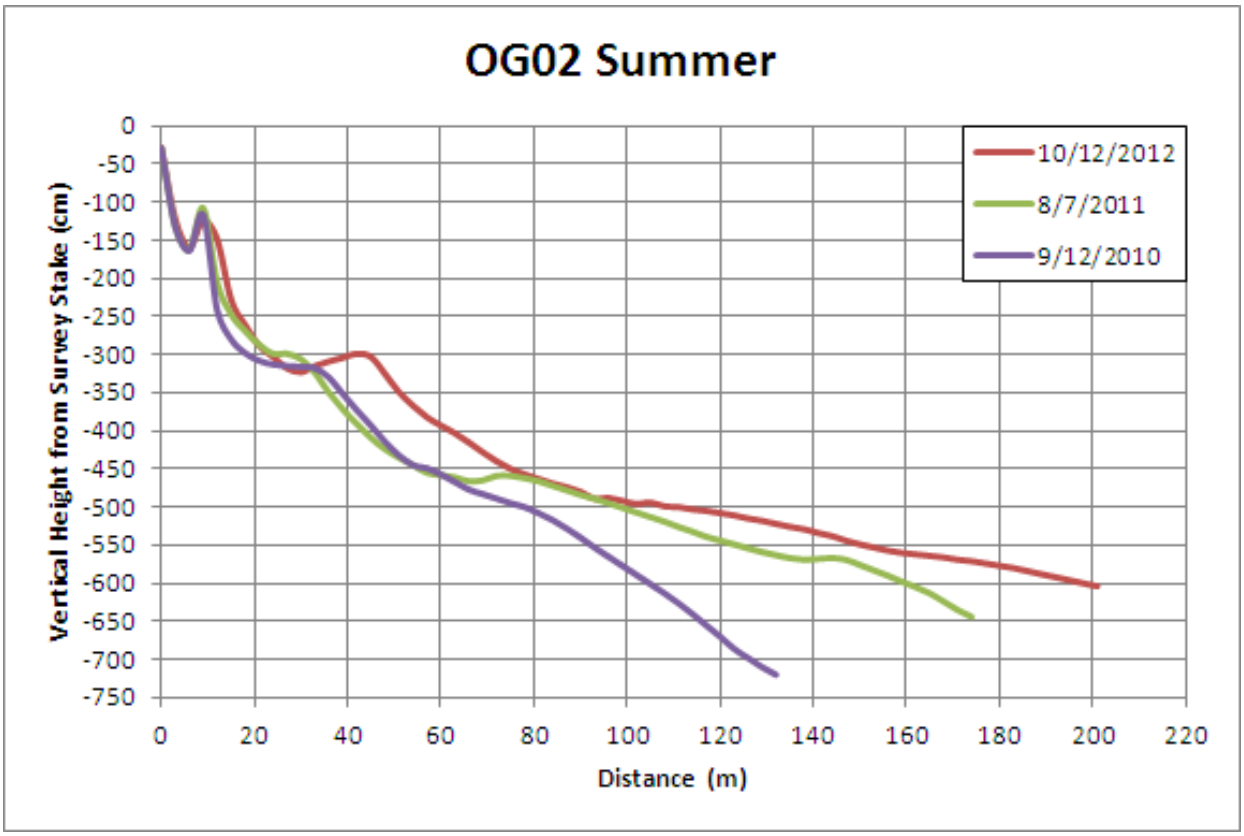

Figure 94. Summer beach profiles for OG02 from 2010, 2011, and 2012.

Ogunquit Beach MBMAP Results

Previous MBMAP data showed an overall slightly positive trend in terms of dune changes of +0.20 m/yr., with loss in the central portion of the beach, and growth at the northern and south-central portions of the coastline. Including 2012 data, this general trend continued, and the shoreline showed an overall trend of +0.10 m/yr., with a much lower standard deviation indicating that variability of the data had decreased (Figure 95). It appears that the dune north of the sewer treatment plant (where OG02 is located) underwent growth in 2012, and this was reflected well in the profile data. **The overall shoreline trends, in terms of the vegetation line, are about the same.**

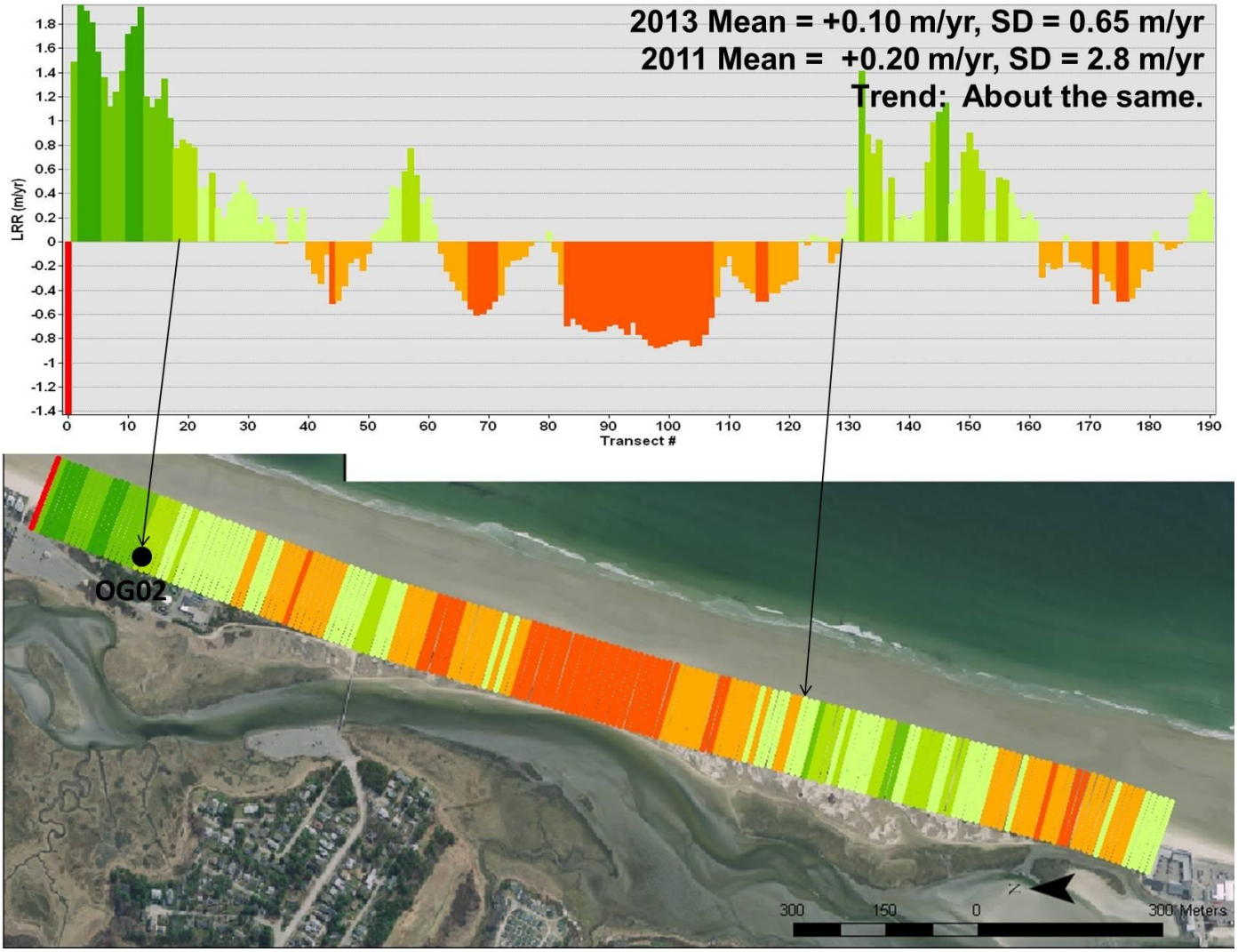

Figure 95. MBMAP shoreline change results for Ogunquit Beach, Ogunquit. Base imagery from Maine OGIS.

Long Sands Beach, York

Two beach profiles (LS01 and LS03, Figure 96) were available for comparison.

Winter LS01 = D (65). 2011 grade: A. Trend: Worse. Profile LS01, which is located in the northern half of Long Sands Beach and starts in the seawall, received a B and an A in the last two assessments. The 2010 profile had an erosive, very steep foreshore to a low, small berm at 15 m, and a flat, relatively featureless slope out to the low tide area (Figure 97). By 2011, the profile rebounded, and gained sand at the berm and migrated seaward (to the 30 m mark), indicating accretion. The entire profile gained in elevation. This trend continued into winter 2012, with the berm gaining elevation and migrating upslope. However, by winter 2013, the profile was eroded back to, and in areas, below the 2010 erosive shape. Although the profile showed good recovery and growth from 2010 to 2012, the 2013 profile indicated a highly erosive trend, likely in response to the winter 2013 storms.

Summer LS01 = A (95). 2011 grade: D. Trend: Better. The 2010 shape, which was one of the lowest recorded since 2007, was relatively featureless and concave in shape (figure 98). The 2011 profile showed signs of recovery, with an increase in sand elevation at the wall (over 2010), the development of a berm at the 15 m mark, and general increases along the profile offshore. By 2012, this trend continued, with additional increases in elevation along the entire profile. The 2012 profile gained 30 cm (about 1 foot) over the 2010 profile at the starting point. The summer profile at this location showed good growth since 2010.

Winter LS03 = C (75). 2011 grade: C. Trend: Same. Profile LS03, which is located at a natural cobble dune and beach area south of the bath house, received a B and C in the last two assessments. The 2010 profile had a berm at the 10 m mark, and a relatively steep slope to the low tide area (Figure 99). By 2011, the profile showed good stability, with maintenance of the 2010 shape in the berm area, and gains in elevation in the low tide area of the beach. This general trend of berm stability – with some slight growth seaward of the 30 m mark, continued into winter 2012. However, similar to LS01, LS03 underwent erosion by the winter of 2013; the profile gained some sediment on its dune (due to overwash), lost some adjacent to the dune, and the berm lowered. LS03 did not seem to be eroded to or below 2010 elevations. Therefore, this profile is showing some signs of stability.

Summer LS03 = C (75). 2011 grade: D. Trend: Better. LS03 received a D in the last assessment. The 2010 profile was one of the lower ones recorded since 2007 (Figure 100). Through 2012, the summer profiles generally show marked stability. From 2010 to 2011, the profile lost elevation slightly near the berm at the 20 m mark, but gained in elevation seaward of this. By 2012, the profile showed additional growth at the berm, and elevation gains into the offshore. The summer profile appears to be relatively stable currently; however, because the 2010 profile is one of the lowest recorded since 2007, we remain cautious about the long-term viability of the berm here.

Winter Summary: Unlike the previous assessment, which showed good stability to growth, the winter profiles at Long Sands Beach appear to have been negatively impacted by the winter storms of 2013. At LS01, the profile was eroded down to 2010 levels, while LS03 (a cobble dominated beach) fared better in terms of stability. **Winter Beach Grade: C- (70). 2011 grade: B+ (87). Trend: Worse**

Summer Summary: Summer beach recovery at Long Sands Beach was good at LS01, with the profile gaining sediment from 2010 through 2012. At LS03, the profile showed general stability; however, it did not show marked growth. **Summer Beach Grade: B (85). 2011 grade: D (65). Trend: Better**

Overall Summary: Comparison of winter and summer profiles at Long Sands Beach indicates that there is a notable difference – albeit small, on the order of 10-20 cm, in the overall shapes from winter to summer at LS01 (adjacent to the seawall), while the profiles at LS03 appear to remain much more stable through the seasons, potentially due to the beach being dominated by cobble. **Overall Long Sands Beach Grade: C+ (78). 2011 grade: C (75). Trend: Better.**

Long Sands Beach MBMAP Results

Since there is little to no vegetation along the seawalled stretch of Long Sands Beach, we did not include an analysis of the vegetation line changes along Long Sands Beach.

Figure 96. Locations of volunteer monitoring profiles along Long Sands Beach, York. Base imagery from Maine OGIS.

Figure 97. Winter beach profiles for LS01 from 2010, 2011, 2012, and 2013.

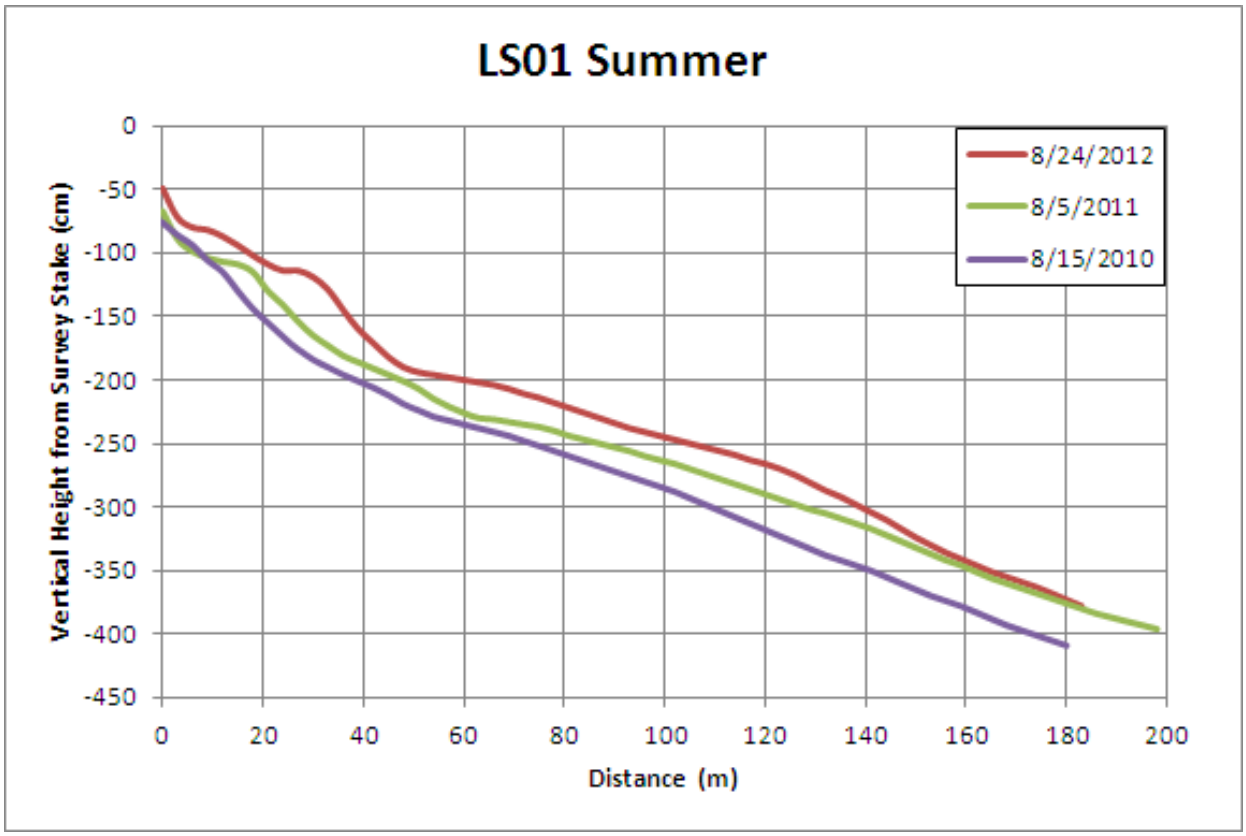

Figure 98. Summer beach profiles for LS01 from 2010, 2011, and 2012.

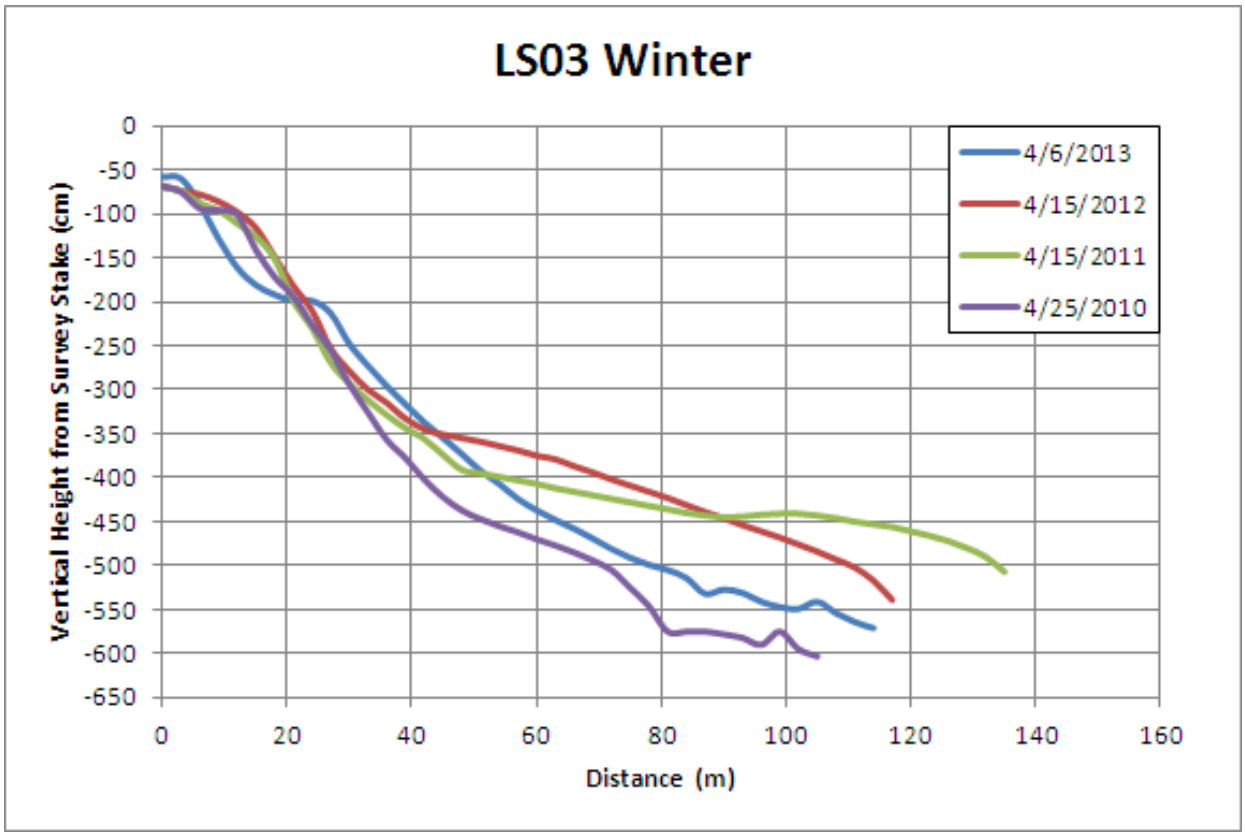

Figure 99. Winter beach profiles for LS03 from 2010, 2011, 2012, and 2013.

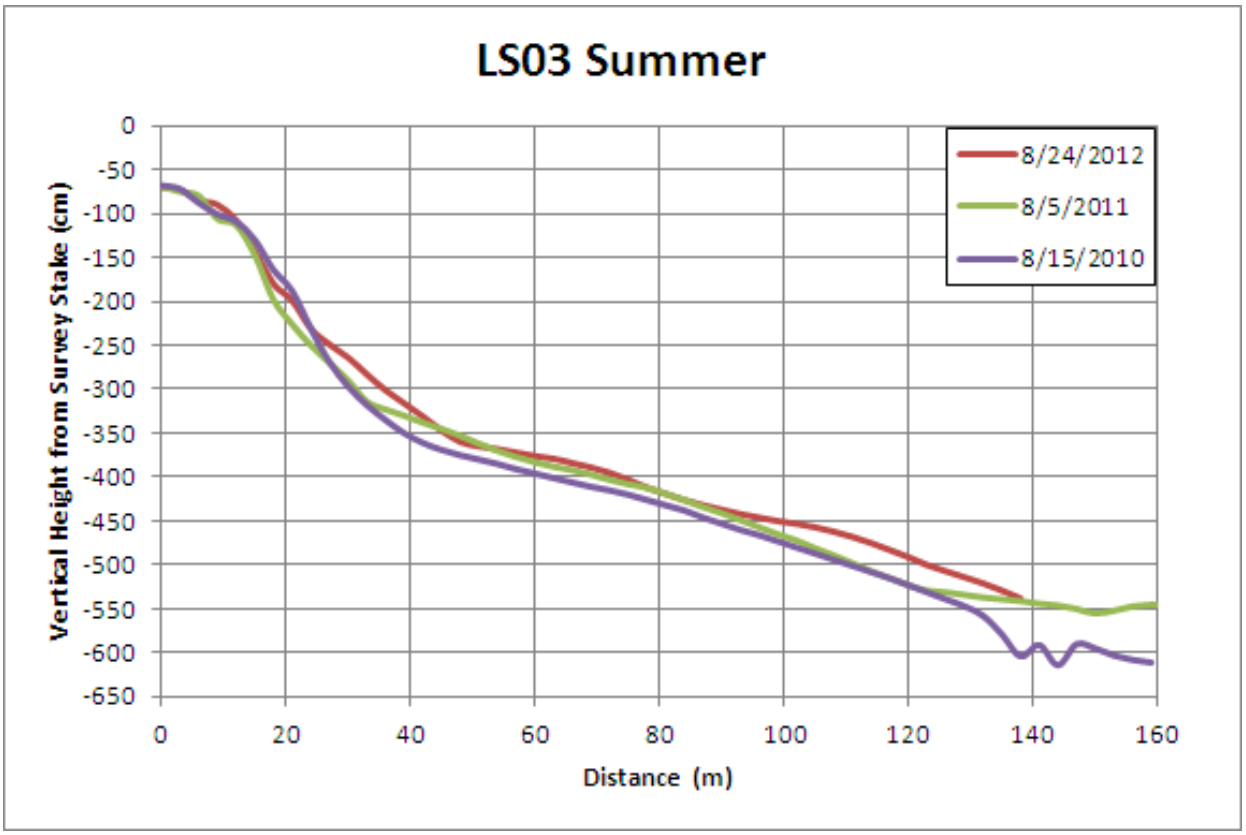

Figure 100. Summer beach profiles for LS03 from 2010, 2011, and 2012.

Beach Grading Summary and Discussion

Overview of the Grading System

The first edition of the Maine Beaches Report in 2007 (Slovinsky and Dickson, 2007) characterized beach profiles in terms of morphologic characteristics and changes observed from 2000 through 2007 using quantitative, statistical techniques. Since then, the 2009 Beaches Report (Slovinsky and Dickson, 2009) introduced a lettered grading system and matching color coded system to provide a more *qualitative* overview of the overall status of the beaches in terms of their recovery from the Patriots' Day storm of 2007. Each beach was "scored" using a numbered system outlined in the beginning of this report, then color-coded to represent the corresponding grading system: green, A or B; yellow, C; red, D or F. Based on feedback from volunteers and conference attendees, this type of system was found to be a better way of communicating beach changes than quantitative statistical methods, and was also used in the subsequent 2011 report (Slovinsky and Dickson, 2011).

The 2013 report used a similar system, and used 2010 beach profiles from April (for winter) and August (for summer) as the "starting point" for comparison with subsequent data from 2011, 2012, and 2013. Based on observations from the field, the winter (April) 2010 profiles were some of the most erosive shapes since the 2007 Patriots' Day storm, with many spots showing erosion down to historic erosional surfaces. For example, large peat deposits were exposed at Higgins Beach, Laudholm Beach, and Ogunquit Beach. Using this as the starting point for comparison made good sense to see how the beaches have been faring since that point.

One of the limitations of using "snapshot" points in time (such as the same month through consecutive years, as is the case in this report) is that the analysis may miss, or overly weigh, a certain profile shape that was influenced by an event immediately preceding the recording of the beach profile, when a month later, the profile may show full recovery.

2013 Report Results

The results of the 2013 report are presented below, in Table 4, which shows the ranked results (highest to lowest scores) based on overall score. The table also shows the relationship between the winter and summer scores.

Based on overall scores, the beaches had an overall grade of a C (74). However, only 2 of 11 beaches (18%) had green (A or B) scores, while 6 beaches (55% had yellow (C) scores, and 3 beaches (27%) had red (D or F) scores. For winter beach profile scores, only 2 of 11 beaches (18%) had green scores, 4 beaches (36%) had yellow scores, and 5 beaches (46%) had red or poor scores. **Overall, the winter profiles scored a C- (71).** Summer profile scores fared slightly better, with 3 beaches (27%) having green scores, 7 beaches (64%) having yellow scores, and only 1 beach (9%) having a red score. **Overall, summer profiles scored a C+ (77).**

More beaches appear to have poor scoring profiles during the winter than the summer. This tells us that the winter storms that we have been seeing are likely negatively impacting beaches more, but the beaches have been showing an ability to recover during the summer to still have somewhat stable (but "cautionary") shapes and scores. This will be explored more in comparing trends with other years, below.

On a positive note, Ogunquit Beach (which only had one profile available, so it is important to note that its changes may not represent the entire beach) clearly came out on top in terms of recovery since 2010, with the best winter, summer, and overall scores. The profile at OG02 showed good growth of the dune and berm through both seasons over the past few years. Scarborough Beach's profiles showed good shapes in both winter and summer as well. These profiles, although they clearly undergo seasonal changes, have been keeping enough sediment within the system to maintain good profile shapes through the seasons.

Beach Name	Winter 2013	Summer 2013	Overall 2013
Ogunquit (OG)	88	88	88
Scarborough (SC)	80	81	80
Long Sands (LS)	70	85	78
East Grand (EG)	74	78	76
Kinney Shores (KS)	70	79	74
Goose Rocks (GR)	73	77	74
Goochs (GO)	69	77	73
Wells (WE)	63	79	71
Higgins (HI)	65	72	68
Laudholm (LH)	65	71	68
Ferry (FE)	69	65	67
Overall Grade	71	77	74

Table 4. Numerical and corresponding "grade" and color results from the winter, summer, and overall beach profile scores.

LEGEND	
Color	Letter Grade
	A or B
	C
	D or F

Comparison with Previous Maine Beaches Reports

It is difficult to come to conclusions on how the beaches are faring until comparison is made with the results from the previous beaches reports.

Based on data from the 2009 report, the beaches in southern Maine showed relatively good recovery from the Patriots' Day Storm of 2007, scoring an overall grade of a **B- (81)**. The 2011 report resulted in an overall beach score of a **C (77)**, slightly lower than the 2009 assessment. Based on beach profile data reviewed for the 2013 assessment, the overall grade for the beaches was once again a **C (74)**, but slightly lower numerically. Most beaches appear to have undergone additional erosion since 2010, unfortunately, and thus received lower scores, especially for their winter shapes.

Table 5 below, shows a comparison of the 2009, 2011, and 2013 assessment results, and the overall trends of each beach (using up or down arrows) from the 2009 to 2011 report, and the 2011 to 2013 report. This table doesn't rank beaches by their scores, but uses the overall geographic framework of north to south for displaying the results and presents the overall trends between each assessment.

Using this table, we can observe the trends in the context of the different time periods of the assessment**. In 2009, the majority of beaches scored in the green range** (11 of 13 or 85%) – that is, an A or a B. The remaining 2 beaches scored in the yellow range (C). There was no D or F (red) scores in 2009. However, by the **2011 report, only one-third of the beaches scored in the green range** (4 of 12 or 33%), while 5 beaches (42%) scored in the yellow range, and 3 beaches (25%) in the red range. In **the 2013 report, only eighteen percent of the beaches had green scores** (2 of 11), while 6 beaches (55%) had yellow scores, and 3 (27%) had red scores.

This trend unto itself is significant; since the 2009 assessment, there has been a decrease in the good (A or B scores), and an increase in the cautionary (C) and very cautionary (D) overall scores. Between 2011 and 2013, of all the beaches, only three (Ogunquit, Scarborough, and Long Sands) had increases in their overall scores. ***The rest of the beaches had scores in 2013 that were lower than in 2011. These two trends are showing that our overall beach health, especially during the winter, has been degrading over the past four years; this has generally been reflected by field observations at most locations.***

Table 5. Comparison of 2009, 2011, and 2013 Maine Beaches Report trends.

Beach Name	2009	2011	2009-2011 Trend	2013	2011-2013 Trend
Willard (WI)	A-	N/A	N/A	N/A	N/A
Higgins (HI)	B	C-	▼	D+	▼
Scarborough (SC)	C+	C	▼	B-	▲
East Grand (EG)	B	A	▲	C	▼
Kinney Shores (KS)	B	B	—	C	▼
Ferry (FE)	C-	D+	▼	D	▼
Goose Rocks (GR)	B-	B-	▼	C	▼
Goochs (GO)	B	B-	▼	C	▼
Laudholm (LH)	B	C-	▼	D+	▼
Drakes Island (DI)	B-	D	▼	N/A	N/A
Wells (WE)	A	C+	▼	C-	▼
Ogunquit (OG)	B-	D	▼	B+	▲
Long Sands (LS)	B	C	▼	C+	▲
Overall Grade	B- (81)	C (77)	▼	C (74)	▼

We were also interested in inspecting the trends regarding seasonality in comparing the 2011 and 2013 results. This is shown below in Table 6 which provide each beach ranked by their 2013 scores for winter and summer profiles, and the related trends since the 2011 report.

In 2011, winter profiles had an overall grade of a C (76). There were 4 beaches (36%) that had had A or B scores (green), and 6 beaches (55%) with cautionary (C, yellow) scores, and only 1 beach (9%) with poor scores. However, in winter 2013, only 2 beaches (18%) had green scores, and the number of poor scoring beaches (receiving a D or F) increased from only 1 to 5, accounting for 46% of the beaches. So between the two assessments, the percentage of poor scoring beaches increased by fivefold, while the number of good scoring beaches was halved**. This trend was reflected by the overall winter grade decreasing to a 71 (C-) in 2013**.

For summer profiles, in 2011, there were 5 beaches (46%) that had good scores, and only 3 (27%) with cautionary, and 3 (27%) with poor scores. In the 2013 report, only 3 beaches (27%) had good scores, while the majority (7 beaches, or 54%) had cautionary scores, and only one a failing score. This showed a doubling in the number of beaches that scored "cautionary". Because fewer beaches received poor scores, the overall summer score was slightly higher than the 2011 report. *However, although not so many beaches are failing in this last assessment, an increasing number are showing signs of erosion when previously, they were showing signs of stability or accretion.* A good example of this is East Grand Beach in Scarborough, which underwent some of the largest grade changes of all (from an A to a C in terms of winter shapes, and from an A to a C+ in the summer shapes).

These results show the general trend that we have been observing over the past five years in the field, and what has been reported in the news. ***That is, winter storms seem to be eroding more of the beaches during the winter season (both geographically, and spatially along the beach profile), and although they appear to be recovering the following summer season to an extent (and in some cases, well), more of those beaches are not recovering as well as they used to.***

Table 6. Comparison of Winter and Summer 2011 and 2013 scores and general trends.

Beach Name	Winter 2011	Winter 2013	Trend	Beach Name	Summer 2011	Summer 2013	Trend
Ogunquit (OG)	65	88	▲	Ogunquit (OG)	65	88	▲
Scarborough (SC)	70	80	▲	Long Sands (LS)	65	85	▲
East Grand (EG)	94	74	▼	Scarborough (SC)	82	81	▼
Goose Rocks (GR)	87	73	▼	Kinney Shores (KS)	80	79	▼
Kinney Shores (KS)	85	70	▼	Wells (WE)	83	79	▼
Long Sands (LS)	85	70	▼	East Grand (EG)	90	78	▼
Ferry (FE)	70	69	▼	Goose Rocks (GR)	75	77	▲
Goochs (GO)	78	69	▼	Goochs (GO)	83	77	▼
Laudholm (LH)	70	65	▼	Higgins (HI)	76	72	▼
Higgins (HI)	71	65	▼	Laudholm (LH)	72	71	▼
Wells (WE)	76	63	▼	Ferry (FE)	68	65	▼
Overall Grade	76	71	▼	Overall Grade	76	77	▲

Discussion of Maine Beach Mapping Program (MBMAP) Results

Although the State of Maine's Beaches in 2011 report did not include specific analyses of beach shoreline changes using MBMAP, results were shared with the public in presentation format at the 2011 State of Maine's Beaches Conference (Slovinsky, 2011). That presentation summarized beach changes, as measured using the vegetation line as an indicator of the "shoreline" from 2007 through 2011 (as available – in some locations, only MBMAP data through 2010 was available), in order to supplement volunteer profiling data in terms of observing overall trends.

The 2013 report included shoreline change rate analyses through the summer of 2012, and in some cases such as Higgins Beach in Scarborough and the Saco shorelines, 2013. For each beach, these were compared with previously calculated shoreline change values from the 2011 dataset.

Based on the previous analysis in 2011, the overall general shoreline change rate (based on the vegetation line for only beaches that were profiled as part of the volunteer beach profiling program) was -0.52 m/yr., or about -1.7 ft/yr. (with a standard deviation of 1.6 m, or 5.2 ft/yr.). That trend, when 2012 and 2013 vegetation line data is included, remained about the same to slightly worse with an overall value of -0.56 m/yr. (or about -1.8 ft/yr.). This change is not statistically significant, and falls within the standard deviation of the data. This data is summarized in Table 7 below.

However, there was a statistically significant change observed at Higgins Beach, Scarborough. This went from an overall positive change of +0.40 m/yr. (about +1.3 ft/yr.) for data from 2007 to 2011, to a very negative rate of -2.41 m/yr. (about -7.9 ft/yr.). This was mainly due to the reversal in the shoreline accretion trends near the spit at the Spurwink River, where profile HI03 is located. The dunes in this area underwent large amounts of accretion from 2007 through 2011, but that trend changed in 2012 and the dunes continued to erode into 2013.

Although none of the other changes are statistically significant, it is important to note some of the other trends. Scarborough Beach's data showed an upward trend (becoming slightly less negative). This was supported by data seen at the beach profiles, where dunes grew slightly. The same can be said for Goose Rocks Beach, and Laudholm Beach, both of which had improving, but still negative, trends in terms of dune growth.

At Willard Beach, no notable overall change in the shoreline change rates was seen. The dunes in this area continued to remain generally stable to growing through the summer of 2012.

Along Saco beaches (as a whole), the general trend turned negative. Previously, high erosion at the southern end of Saco beaches (where the Ferry Beach profiles are located) were offset by high amounts of accretion at the mid-to-northern end of the beaches (i.e., where Kinney Shores profiles are located). *In 2012 and 2013, the amount of erosion in the southern to middle portions of the Saco beach shoreline increased, resulting in a negative overall shoreline change rate.*

At Wells Beach, the general trend showed a positive increase in the overall shoreline change rate through 2012 over 2011. This may be due to slightly lower erosion of the dune at the northern end of the beach (near the jetties), and higher amounts of accretion of the dune in the north-central (just farther south of the jetties) and central portions of the beach.

Continued MBMAP shoreline change monitoring will help put the changes seen at individual beach profiles into the larger geomorphic context of beach changes.

Beach	2011 Δ(m/yr)	2012/2013 Δ(m/yr)	Trend
Willard	0.20	0.22	—
Higgins	0.40	-2.41	▼
Scarborough	-0.52	-0.18	▲
Pine Point	0.60	0.30	▼
Saco	0.24	-0.12	▼
Goose Rocks	-3.66	-2.7	▲
Laudholm	-2.73	-1.19	▲
Wells	0.60	0.93	▲
Ogunquit	0.20	0.10	▼
Average	-0.52	-0.56	—

Table 7. Comparison of the overall shoreline change rates, based on vegetation line surveys, from the 2011 and 2012/2013 MBMAP results. The general trend has remained the same; erosion of dunes on the order of about 0.5 to 0.6 meters per year.

Conclusion

The State of Maine's Beaches Report series is meant to provide our volunteer monitors, general public, and local, regional, and state decision-makers and managers with a better sense of the status of southern Maine's beaches. The beach profile data used for analysis in this report comes from the State of Maine Beach Profiling Project, which in many locations, has collected beach profile data for over a decade now. The data, collected by volunteer beach monitors, is vital to better understanding the monthly, seasonal, and yearly patterns of beach change. The data provided by the program is helping us understand the longer term trends of beach changes along the southern Maine coast, and how the beaches respond to storm events.

The Maine Geological Survey, which conducts annual and sometimes biannual shoreline surveys on its own as part of the Maine Beach Mapping Program (MBMAP), does not have the personnel or funding to support monthly beach profiling efforts. With the availability of the profiling data from the efforts of the volunteers and funded from local sources, we are able to utilize data, that would simply not exist if not for the SMBPP program, to better understand the patterns of changes we have been observing at our beaches.

Analysis of the most recent (2010 to 2013 winter, and 2010 to 2012 summer) profile data has shown that:

- The majority of southern Maine's beaches were eroded heavily in the winter of 2009-2010 due to a series of large northeast storms. This resulted in very low, erosive profiles from early 2010.

- The majority of southern Maine's beaches showed at least some levels of recovery by winter and summer 2012 from the winter 2010 storm events.

- The winter of 2012-2013, similar to the 2009-2010 winter, had a series of northeast storm events that negatively impacted beach profile shapes. Many were eroded near to, or below winter 2010 elevations.

- Based on comparison with previous reports, there is a general trend of more profiles scoring **poorly in the winter, and more profiles scoring cautiously in the summer**. ***Winter storms seem to be eroding more of the beaches during the winter season (both geographically, and spatially along the beach profile), and although they appear to be recovering the following summer season to an extent, more of those beaches are not recovering as well as they used to*****.*** Whether this trend is due solely to the relatively stormy winter of 2012-2013 (like the winter of 2009-2010) is unclear at this point.

- Maine Beach Mapping (MBMAP) data showed that for the beaches monitored through 2012, and at some locations into 2013, **vegetated shorelines continued to erode at an average rate of about -0.5 m/yr. to -0.6 m/yr. (between -1.6 ft/yr. and -2.0 ft/yr.)**

- For this report, the southern Maine beaches scored an overall mean **Cautionary C (74)**. This is several points below the 2011 overall score of a C+ (77).

As usual, analysis of summer 2013 profile data, from July or August, would definitely help determine if many of the beaches that have undergone erosion in the winter of 2012-2013 and in the spring and early summer 2013, continued to recede, or underwent recovery. Unfortunately, due to the timing of the beaches conference in July, we are unable to analyze summer 2013 profiles. We may want to consider trying to hold future Maine Beaches Conferences in the month of September, or later, in an attempt to capture this vital data for subsequent reports.

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