Task 5.1 Assessment and Potential for Vegetative Remediation of Selected Brown Marsh and Disturbed Sites in the Barataria and Terrebonne Basins Accession Characterization

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Executive Summary

The sudden death of extensive salt marsh populations of *Spartina alterniflora* Loisel (smooth cordgrass) was reported across coastal Louisiana in the spring of 2000. The magnitude and rapidity of the dieback event brought scientists from many disciplines together to study and examine causal factors. The purpose of this study was not to identify factors that contributed to the decline and death of *S. alterniflora* but to advance the information and application technology critical to vegetative restoration. The focus of the study was to establish baseline information on an assembly of surviving *S. alterniflora* ramets collected from marsh dieback sites, and to evaluate their potential for commercial release and use for coastal restoration plantings.

A total of thirty-eight vegetative collections of S. *alterniflora* were made from eighteen marsh dieback sites in Louisiana. Severely impacted marsh dieback study sites established by McKee and Mendelssohn were used for the collection of live vegetative plant materials. Vegetative collections from the marsh dieback sites were planted to three-quarter gallon containers for grow out and plant increase. When suitable numbers of clones representing each collection was established, the plant materials were then transported and planted to three marsh dieback sites and two barrier island restoration sites. The evaluation planting sites included marsh dieback sites at Bayou Lafourche, Lafourche Parish; Felicity Island, Terrebonne Parish; and Grand Pierre Island, Jefferson Parish. Two restored barrier island marsh sites included Queen Bess Island and West Grand Terre Island, Jefferson Parish. Planting period for the installation of the evaluation plantings was conducted from September 6 to December 18, 2001. Evaluation for plant performance and adaptation included survival and visual qualitative ratings for plant vigor and spread from the initial clone. The natural recovery of the marsh dieback sites was observed by the germination of *S. alterniflora* seeds in early January of 2002. Initial data was recorded from Bayou Lafourche and Grand Pierre but *S. alterniflora* seedlings and growth of new plants dominated the Felicity Island site preventing reliable observations for vigor and spread. Excellent survival was recorded across Bayou Lafourche (100%) and Felicity (100%). Queen Bess Island mortality (51%) was attributed to Pelican nesting and trampling. Grand Pierre Island mortality (60.5%) was attributed to tropical storm surges. An additional planting was established on West Grand Terre Island during April, 2003. Plant survival for this planting was 97.7%. The collection identified as 90 (Terrebonne Parish) performed more consistently across planting sites. There were several collections that performed well at each planting site and across all sites. The best performing collections will be vegetatively increased for further testing and potential commercial release.

The potential for the devastating loss of coastal marshes on a massive scale due to such an event as the marsh dieback of 2000 emphasizes the need for readily available sources of suitable (tested and proven) high performing plant materials. We cannot overlook the importance that natural recovery of marsh vegetation played in this event. Because of limitations in the availability of suitable plant materials and planting techniques currently utilized for coastal restoration, the urgent and immediate demand for recovery efforts following the 2000 dieback event could have not been met. Promising collections from this study can be used to advance the application of vegetative restoration and provide alternative plant materials for use in restoration plantings.

Introduction

Louisiana experienced widespread sudden die-off of salt marsh vegetation that was first reported in the spring of 2000. The browning and subsequent dying of *Spartina alterniflora* Loisel (smooth cordgrass) populations occurred over extensive areas of coastal Louisiana. Aerial surveys conducted by the Louisiana Department of Wildlife and Fisheries, and the U.S. Geological Survey National Wetlands Research Center documented die-off across all coastal parishes in Louisiana. The greatest acreage impacted was found in Terrebonne Parish followed by Lafourche Parish. Standing dead vegetation was soon converted to open mud flats devoid of vegetation. The most severely impacted areas were characterized by browning followed by standing dead vegetative stems that was rapidly reduced to short stubble like remnants protruding from denuded exposed mud flats. Though salt marsh dieback has been reported in small isolated occurrences over time, the extent and rapidity of the 2000 die-off was deemed unprecedented and cause for concern and many expressed alarm for good reason. The extensive areas of vibrant emergent marsh now devoid of important sustaining vegetation were extremely vulnerable to soil erosion, and lowering soil elevation. The marsh platform was exposed to environmental effects such as wind, heavy rain, tidal fluctuations, and storms. Such occurrences could make the recovery of natural vegetation or remediation efforts more difficult and greater potential exists for conversion of marsh to open water.

The extensive and sudden die-off of coastal marshlands was attributed mainly to the browning and death of the salt marshgrass *S. alterniflora*. In Louisiana, *S. alterniflora* dominates vast expanses of regularly flooded coastal salt marshes. Of special interest was that the browning and dying of the marsh vegetation appeared to occur in a relatively short period of time. Sampling of vegetative plant materials from the affected areas indicated that not only the above-ground plant material had died but the below-ground portion as well (Proffitt, 2000).

While scientists were attempting to access cause, solutions, and actions, there was a concern that if the die-off continued or natural recovery did not occur in a timely manor or recover at all, then the potential existed for extensive loss of important coastal salt marsh habitat.

Objective

The purpose of this study is not to identify factors that contribute to the marked decline and death of *S. alterniflora* marsh but to advance information critical to vegetative restoration technology and implementation. The focus of this study is to determine the intraspecific demographics of an assembly of surviving brown marsh *S. alterniflora* plant materials and evaluate their potential for 1). inclusion in a seed-based breeding program, and 2). a tested and performance proven clonal plant materials release that can be used for coastal restoration and biodiversity issues.

Assembly and Plant Increase

Assembly of live plant materials from severely impacted brown marsh dieback areas

An assembly of surviving plant materials of *S. alterniflora* was collected from eighteen marsh dieback sites in the fall of 2000. Brown marsh dieback study sites established by McKee and Mendelssohn in the late summer of 2000 were used for the collection of live vegetative plant materials. McKee's and Mendelssohn's study sites were located in the more severely impacted dieback areas of the Mississippi River deltaic plain. Nine sites were established in the Terrebonne Basin and nine sites in the Barataria Basin. McKee and Mendelssohn delineated the dieback sites into three distinct spatial patterns described as a healthy shoreline (< 10 percent mortality), a transition zone (~ 50 percent mortality), and a dead interior (> 90 percent mortality). Our vegetative sampling consisted of using these distinct transitional zones whereby two collections of live plant materials were taken from each brown marsh study site. One collection from each site consisted of taking live ramets found growing within the interior dead area, and a second collection of live ramets found growing in the marginal area between the transitional and dead areas of the same site. Each plant sample was labeled when collected in the field with the brown marsh site identifier followed by D representing dead zone and T representing transitional zone such as 12D and 12T (Table 1) In all thirty-eight live vegetative collections were assembled.

Clonal plant increase

Plant materials from each marsh dieback collection was accessioned and transplanted to three-quarter gallon plastic containers and placed in the greenhouse for grow out. Productive ramets from each containerized accession was further divided and used as propagules for additional plant increase. Other *S. alterniflora* plant materials were added to the assembly to include: 1). five of the most promising accessions representing an assembly of one-hundred and twenty-six Louisiana ecotypes, and 2). *Spartina alterniflora* 'Vermilion', a commercially available cultivar that is used extensively in coastal restoration plantings.

Study Sites and Experimental Design

Field evaluation study plots

Replicated plots established with clonal plant materials representing each of the *S. alterniflora* bieback collections, Louisiana assembly selections, and 'Vermilion' were planted in five field evaluation study sites located in Lafourche, Jefferson, and Terrebonne Parishes (Table 2). The plantings were established within dead zones of degraded marsh dieback sites. A randomized complete block experimental design consisted of single container grown plants spaced on twenty-by-twenty foot centers. The planting period ran from September 6 to December 18, 2001. An additional planting was established April 30, 2003 on a newly created marsh platform formed from dredged sediments.

The planting design consisted of five replicates (clones) each of forty-four accessions selected for this study to be planted to randomized blocks at each test site. Two to three blocks were planted at each selected marsh dieback site based on suitable planting area available. Planting blocks consisted of single plant plots randomly spaced on 20 foot centers. The five replicates from each accession formed a planting block.

Plant performance documentation

Plant performance data was recorded on plant survival, vigor, and spread of ramets. Visual ratings for vigor and spread was used on a 1-9 scale with a rating of 1 best to 9 poorest. Ratings were recorded for each brown marsh study site from June 15-21, 2002 (Table 3). Plant performance on the dedicated sediment site was established April, 2003. Plant performance was recorded on the sediment site August 20, 2003 (Table 4).

Phenotypic measurements

Five mature container grown plants from each accession were selected from the assembly plant increase nursery to gather phenotypic differences. Vegetative culm numbers were recorded from each plant container. Three representative culms from each container were randomly selected for basal stem diameter and leaf with measurements.

Study field planting site descriptions

<u>Bayou Lafourche (Marsh Dieback Site)</u>

The Bayou Lafourche planting site was located on the west side of Bayou Lafourche between Leeville and Port Fourchon, Lafourche Parish. This was one of the more severely impacted marsh dieback areas. The plant community prior to the dieback event was predominately *S. alterniflora* with scattered populations of *Juncus roemerianus* Scheele. (black needle rush). Three planting blocks located approximately 90 meters from the western shoreline of Bayou Lafourche were established within the marsh dieback area. The area at the time of planting appeared as a mudflat with only short dead vegetative stubble remaining. The area fit the dieback site description by McKee and Mendelssohn as having the special pattern of a healthy shoreline, transition, and a dead interior.

Figure 1. Bayou Larourche site 1 planting.

Felicity (Marsh Dieback Site)

The Felicity planting site was located on the east side of Lake Felicity, Terrebonne Parish. Three planting blocks located approximately 30 meters from the shoreline of Lake Felicity were established within the marsh dieback area. The area at the time of planting also appeared as a mudflat with only short dead vegetative stubble remaining. This site also fit McKee and Mendelssohn's special pattern for dieback areas. The area was predominately *S. alterniflora* marsh. *Distichlis spicata* (L.) Greene was found growing along the shoreline in association with *S. alterniflora*.

Figure 2. Felicity Planting Site depicting the typical spatial pattern described by McKee and Mendelssohn with a dead interior with a transition to a healthy marsh in the background.

Grand Pierre (Barrier Island Marsh Dieback Site)

The Grand Pierre Island planting site was located on the marsh backbay area of the barrier island, Jefferson Parish (Table). Two planting blocks were established on the island. *Avicennia germinans* (L.) L. was found growing in association with *S. alterniflora* on this site.

Figure 3. Grand Pierre Island marsh dieback planting site.

Queen Bess Island (Barrier Island Dedicated Sediment Marsh Restoration Site)

One planting block was established on Queen Bess Island. This site was not a marsh dieback site but an area of the island that had been restored using dedicated dredge sediments from the Gulf of Mexico. This island is an important pelican rookery.

Figure 4. Queen Bess Island, restored area of island at high tide.

Figure 5. Planting Queen Bess Island

West Grand Terre Island (Barrier Island Dedicated Sediment Marsh Restoration Site)

One planting block was established on the bay side of West Grand Terre Island. The area of the planting site had been restored using dedicated dredge sediments from the Gulf of Mexico. This planting was established April 30, 2003 with *S. alterniflora* grown in four inch square plastic containers.

Figure 6. West Grand Terre Island restored area

Results

Plant performance for this study was measured on survival, vigor, and vegetative spread outward from the parent plant material. Excellent plant survival was found at the Bayou Lafourche (100%), Felicity (100%), and West Grand Terre (97.7 %) sites. Mortality was high at Queen Bess Island (51%) and Grand Pierre Island (60.5%). Queen Bess mortality was mostly attributed to pressure from Pelican nesting and trampling of plants. Grand Pierre mortality was attributed to spring storm surges. Environmental, ediphic, or biological factors that brought about the die-off of *S. alterniflora* in 2000 did not exhibit the same outcomes on plantings established on the dieback sites in the fall of 2001. Plant survival and growth of planted accessions was excellent on dieback sites of Bayou Lafourche, Felicity, and Grand Pierre. Because of volunteer seedling establishment and subsequent growth of seedlings on Felicity, reliable plant vigor and spread was not recorded for this planting. Though the same outcome was found on Grand Pierre but to a lesser extent, performance data was collected on one of the evaluation blocks (Block A).

Several accessions performed well on each planting block but not across all sites. Accessions 90, 3D and 6T performed more consistently across planting sites on Queen Bess and Bayou Lafourche. Though there are no significant differences among accessions and between sites evaluated, there are several promising accessions that need further testing (Table 1).

Discussion

Specific cause of the marsh dieback has not been conclusive. Scientists have proposed hypotheses of specific biotic, environmental, and ediphic factors. One thing we do know in the case of this specific event, many of the dieback areas recovered naturally. Though natural recovery of *S. alterniflora* did occur, the vegetative recovery of evaluation plots used for this study did not begin until January 2002. This could be a significant period of time considering the fragile and dynamic nature of coastal ecosystems. The potential for severe tropical weather could have proven catastrophic to the recovery in such an event. In as much as it is important to look for cause, it is equally important to develop plant materials solutions for the intervention and recovery of vegetation as an alternative to waiting for natural recovery to occur. The potential exists for greater catastrophe should a tropical weather event further erode the exposed fragile marsh platform before natural recovery can occur. Accessional data gathered for this study shows several promising genetic lines of *S. alterniflora* that may have potential for inclusion and use in coastal restoration plantings.

Conclusion

There is a need for vegetative solutions that have potential to reverse or reduce the catastrophic consequences of such events as the recent marsh dieback in 2000. The scale and complexity of the marsh die-off emphasize the need for readily available sources of suitable high performing plant materials and proven techniques for their successful use.

Though most plant restoration measures are currently conducted using vegetative plant materials or propagules, there is a greater need for seed based production and establishment technology. Vegetative plantings have proven to be successful but on a relatively small scale. Large scale restoration needs that address events such as the marsh dieback in 2000 or coast wide land loss issues need new alternative technologies such as seed based restoration.

Catastrophic events such as the acute *S. alterniflora* dieback emphasize the need for readily available sources of suitable high performing plant materials and techniques for their successful use. Plantings established for this study have proven that successful restoration of vegetative cover can be accomplished successfully after a catastrophic event such as the marsh dieback of 2000. There are several promising accessions selected from this study that can be used to advance *S. alterniflora* plant materials for coastal restoration uses and provide alternative choices for planning restoration plantings. Though it has readily became evident that current plant materials resources and planting technology could not meet the demands necessary to address the massive scale of restoring marsh vegetation on dieback areas exposed in 2000.

Information gathered from this study can be used to further advance tested and performance proven plant materials than are currently available on the commercial market. Plant materials selections from this study will be further tested for performance, adaptation, and potential use in coastal restoration programs.

Table 1. *Spartina alterniflora* vegetative collection locations.

Collection No. ID	Collection Location		No. Plants Collected
2-D	29° 14' 48" N	91° 08' 37.2" W	59
2-T	29° 14' 48" N	91° 08' 37.2" W	19
3-D	29° 11' 50.4" N	91° 05' 21.0" W	73
3-T	29° 11' 50.4" N	91° 05' 21.0" W	12
4-D	29° 10' 40.2" N	90° 59' 25.8" W	75
4-T	29° 10' 40.2" N	90° 59' 25.8" W	25
4A-D	29° 13' 09.6" N	91° 04' 07.8" W	75
4A-T	29° 13' 09.6" N	91° 04' 07.8" W	20
5-D	29° 06' 03.6" N	90° 48' 49.2" W	79
5-T	29° 06' 03.6" N	90° 48' 49.2" W	23
6-D	29° 10' 56.4" N	90° 43' 20.4" W	61
6-T	29° 10' 56.4" N	90° 43' 20.4" W	15
7-D	29° 15' 02.4" N	90° 37' 58.2" W	15
7-T	29° 15' 02.4" N	90° 37' 58.2" W	19
8-D	29° 21' 20.4" N	90° 33' 18.6" W	61
8-T	29° 21' 20.4" N	90° 33' 18.6" W	25
9-D	29° 18' 22.2" N	90° 28' 0.00" W	79
9-T	29° 18' 22.2" N	90° 28' 0.00" W	21
9A-D	29° 19' 20.4" N	90° 29' 27.0" W	75
10-D	29° 16' 21.6" N	90° 18' 57.0" W	64
10-T	29° 16' 21.6" N	90° 18' 57.0" W	25
11-D	29° 11' 10.8" N	90° 14' 20.4" W	71
11-T	29° 11' 10.8" N	90° 14' 20.4" W	26
12-D	29° 13' 23.4" N	90° 07' 36.0" W	78
12-T	29° 13' 23.4" N	90° 07' 36.0" W	44
12A-D	29° 17' 14.4" N	90° 07' 44.9" W	15
13-D	29° 10' 10.8" N	90° 04' 30.0" W	79
14-D	29° 21' 47.4" N	90° 02' 59.4" W	20
14-T	29° 21' 47.4" N	90° 02' 59.4" W	20
15-D	29° 19' 13.2" N	89° 50' 27.0" W	65
15-T	29° 19' 13.2" N	89° 50' 27.0" W	27
16-D	29° 20' 49.8" N	89° 49' 06.0" W	76
16-T	29° 20' 49.8" N	89° 49' 06.0" W	29
17-D	29° 19' 08.8" N	89° 41' 42.6" W	74
17-T	29° 19' 08.8" N	89° 41' 42.6" W	33
18-D	29° 18' 44.4" N	89° 46' 34.8" W	72
18-T	29° 18' 44.4" N	89° 46' 34.8" W	46
21-T			76

Table 2. Evaluation planting locations.

Study Site	A	B	C
Felicity Terrebonne Parish, LA	29° 17’ 46” N 90° 23’ 21” W	29° 17’ 32” N 90° 23’ 42” W	29° 17’ 19” N 90° 3’ 43” W
Grand Pierre Island Jefferson Parish, LA	29° 17’ 9” N 89° 50’ 23” W	29° 19’ 16” N 89° 50’ 6” W	
Queen Bess Island Jefferson Parish, LA	29° 18’ 16” N 89° 57’ 30” W		
Bayou Lafourche Lafourche Parish, LA	29° 11’ 47” N 90° 14’ 13” W	29° 11’ 7” N 90° 14’ 5” W	29° 10’ 47” N 90° 14’ 12” W
West Grand Terre Island Jefferson Parish, LA	29° 17’ 35” N 89° 54’ 47” W		

Table 3.

Accession #	Queen Bess Island Block 1		Bayou Lafourche Block 1		Bayou Lafourche Block 2		Bayou Lafourche Block 3		Grand Pierre Island Block 1		All Average Vigor	All Average Spread
	Vigor	Spread	Vigor	Spread	Vigor	Spread	Vigor	Spread	Vigor	Spread		
10	6.5	6.5	5.4	4.8	4.4	3.8	6.0	5.0	3.7	3.7	5.2	4.8
44	3.0	3.5	5.4	4.0	4.6	4.4	5.3	5.3	4.3	5.0	4.5	4.4
49	3.0	3.0	6.4	5.2	5.0	4.2	5.3	3.7	6.0	4.0	5.1	4.0
75	6.3	5.3	5.2	4.2	5.0	3.8	6.0	4.3	6.0	5.0	5.7	4.5
90	4.4	3.8	5.2	4.2	5.0	3.8	4.7	4.0	6.0	5.0	5.1	4.2
10D	6.0	5.7	5.2	4.0	4.6	4.2	4.3	4.0	5.0	3.5	5.0	4.3
10T	8.0	7.7	5.4	4.0	4.4	4.4	4.7	4.0	5.5	5.0	5.6	5.0
11D	8.0	8.0	5.0	4.0	4.2	4.4	3.3	2.7	3.7	3.3	4.8	4.5
11T	9.0	9.0	5.6	4.6	4.4	3.4	4.0	3.0	5.0	4.0	5.6	4.8
12AD	6.7	6.3	4.6	2.8	4.8	3.6	4.0	3.7	6.0	5.0	5.2	4.3
12D	7.5	7.5	4.8	5.0	4.2	4.4	4.3	3.7	5.3	4.7	5.2	5.0
12T	7.0	6.7	4.8	3.4	4.0	2.8	5.0	4.0	5.0	1.0	5.2	3.6
13D	8.5	8.5	4.8	4.8	4.8	4.2	4.0	3.7	4.0	4.0	5.2	5.0
14D	7.3	7.0	3.8	2.8	4.2	3.4	5.7	4.7	5.0	3.0	5.2	4.2
14T	7.0	6.5	6.4	4.2	5.2	3.8	5.0	4.7	5.0	3.5	5.7	4.5
15D	6.7	6.7	5.8	3.4	4.8	3.8	5.7	3.7	5.5	5.0	5.7	4.5
15T	7.0	7.0	5.2	2.8	4.8	3.0	5.3	3.3			5.6	4.0
16D	6.8	6.3	4.2	3.4	4.6	4.2	4.0	3.7	4.0	4.5	4.7	4.4
16T	8.0	6.5	5.2	4.4	5.2	4.2	4.0	3.3	5.0	4.0	5.5	4.5
17D	9.0	9.0	4.8	3.6	4.6	3.2	4.7	3.3	3.0	2.0	4.3	3.0
17T	9.0	9.0	4.4	4.2	4.4	4.2	4.3	3.0	4.0	4.3	4.3	3.9
18D	9.0	9.0	5.2	2.4	5.0	3.2	4.7	4.0	6.0	3.0	5.2	3.2
18T	7.7	6.0	5.6	4.6	4.6	4.0	3.7	3.7	2.5	2.8	4.8	4.2
21T	6.0	5.5	5.4	4.6	4.8	3.8	5.0	4.3	5.0	3.3	5.2	4.3
2D	5.5	5.0	4.0	4.2	4.6	4.6	3.8	3.0	4.5	4.0	4.5	4.2
2T	8.5	8.5	5.0	5.4	4.2	4.2	5.7	5.3	4.5	4.0	5.6	5.5
3D	7.0	7.0	3.6	2.8	4.6	3.2	4.0	2.0			4.8	3.8
3T	8.3	8.3	5.0	4.8	4.5	4.3			5.0	4.0	5.7	5.3
4AD	6.5	6.3	5.2	3.6	4.2	3.4	3.0	3.3	5.0	4.0	4.8	4.1
4AT	8.0	8.0	4.6	4.4	4.4	4.8	3.3	3.7	4.3	3.7	4.9	4.9
4D	7.5	7.5	4.8	5.2	4.6	4.0	4.3	4.3	4.0	2.5	5.0	4.7
4T	8.0	6.0	4.6	3.2	4.2	2.6	4.3	3.3	4.3	3.3	5.1	3.7
5D	7.5	6.0	5.2	3.6	4.6	3.8	4.3	3.3	4.0	5.0	5.1	4.3

Accession #	Queen Bess Island Block 1		Bayou Lafourche Block 1		Bayou Lafourche Block 2		Bayou Lafourche Block 3		Grand Pierre Island Block 1		All Average Vigor	All Average Spread
	Vigor	Spread	Vigor	Spread	Vigor	Spread	Vigor	Spread	Vigor	Spread		
5T	6.5	5.5	5.2	3.0	4.2	4.0	4.7	2.7	3.0	1.0	4.7	3.2
6D	9.0	9.0	4.6	3.2	4.4	3.4	4.3	2.7	3.5	3.0	4.2	3.1
6T	4.3	3.7	5.0	3.2	4.4	2.8	2.3	1.7	2.0	1.5	3.6	2.6
7D	6.8	6.5	5.2	3.8	4.0	4.0	4.0	2.7	4.7	3.0	4.9	4.0
7T	5.7	4.7	4.5	4.0	4.5	3.3			5.0	4.0	4.9	4.0
8D	6.7	6.3	4.4	4.8	4.4	4.4	5.0	6.0	5.5	5.0	5.2	5.3
8T	5.8	4.7	4.7	4.1	4.7	4.9	4.5	4.3	5.8	5.3	5.1	4.7
9AD	5.5	6.0	4.4	3.2	4.4	4.4	6.0	5.0	4.8	4.0	5.0	4.5
9D	8.0	8.0	4.8	3.2	4.6	4.2	4.3	3.7	4.5	2.0	5.2	4.2
9T	8.0	8.5	4.6	4.4	4.6	3.6	4.7	4.7	3.0	1.0	5.0	4.4
Vermilion	5.3	5.0	6.6	4.4	4.4	4.2	3.7	3.3	5.0	3.0	5.0	4.0
Averages	6.9	6.6	5.0	4.0	4.5	3.9	4.5	3.8	4.6	3.6		

Table 4. West Grand Terre Island plant vigor rating

Plot #	Vigor	Spread	Pest	Disease	Seed Culms
101	3	-	no	no	no
102	2	-	no	no	yes
103	3	-	no	no	yes
104	3	-	no	no	yes
105	2	-	no	no	yes
106	2	-	no	no	yes
107	2	-	no	no	no
108	3	-	no	no	no
109	3	-	no	no	yes
110	2	-	no	no	no
111	2	-	no	no	no
112	2	-	no	no	no
113	3	-	no	no	no
114	4	-	no	no	no
115	5	-	no	no	no
116	5	-	no	no	no
117	7	-	no	no	yes
118	3	-	no	no	yes
119	3	-	no	no	no
120	2	-	no	no	no
121	0	-	-	-	-
122	0	-	-	-	-
123	2	-	no	no	no
124	3	-	no	no	no
125	4	-	no	no	no
126	4	-	no	no	no
127	4	-	no	no	yes
128	9	-	no	no	no
129	3	-	no	no	yes
130	1	-	no	no	no
131	3	-	no	no	no
132	2	-	no	no	no
133	4	-	no	no	no
134	0	-	-	-	-
135	3	-	no	no	yes
136	3	-	no	no	no
137	5	-	no	no	no
138	4	-	no	no	no
139	5	-	no	no	yes
140	6	-	no	no	no
141	4	-	no	no	yes
142	5	-	no	no	yes
143	1	-	no	no	no
144	9	-	no	no	no
201	4	-	no	no	no
202	7	-	no	no	no
203	4	-	no	no	no
204	5	-	no	no	no
205	5	-	no	no	yes
206	4	-	no	no	yes
207	4	-	no	no	yes
208	5	-	no	no	yes
209	4	-	no	no	yes
210	3	-	no	no	yes
211	4	-	no	no	no

212	3	-	no	no	no
213	4	-	no	no	no
214	4	-	no	no	no
215	5	-	no	no	no
216	2	-	no	no	no
217	2	-	no	no	no
218	3	-	no	no	no
219	1	-	no	no	no
220	5	-	no	no	yes
221	3	-	no	no	yes
222	3	-	no	no	yes
223	4	-	no	no	no
224	3	-	no	no	no
225	4	-	no	no	yes
226	4	-	no	no	no
227	6	-	no	no	no
228	7	-	no	no	no
229	4	-	no	no	no
230	2	-	no	no	no
231	2	-	no	no	no
232	7	-	no	no	no
233	4	-	no	no	no
234	4	-	no	no	no
235	5	-	no	no	no
236	4	-	no	no	no
237	1	-	no	no	no
238	5	-	no	no	no
239	4	-	no	no	yes
240	2	-	no	no	no
241	3	-	no	no	yes
242	2	-	no	no	no
243	2	-	no	no	no
244	2	-	no	no	yes
301	7	-	no	no	no
302	0	-	-	-	-
303	4	-	no	no	no
304	4	-	no	no	yes
305	4	-	no	no	yes
306	5	-	no	no	no
307	5	-	no	no	no
308	3	-	no	no	no
309	4	-	no	no	no
310	0	-	-	-	-
311	4	-	no	no	no
312	4	-	no	no	no
313	6	-	no	no	no
314	5	-	no	no	no
315	4	-	no	no	yes
316	5	-	no	no	no
317	4	-	no	no	no
318	5	-	no	no	yes
319	4	-	no	no	no
320	2	-	no	no	no
321	5	-	no	no	yes
322	5	-	no	no	yes
323	4	-	no	no	no
324	4	-	no	no	no
325	4	-	no	no	yes
326	4	-	no	no	no

327	5	-	no	no	no
328	2	-	no	no	yes
329	0	-	-	-	-
330	2	-	no	no	no
331	4	-	no	no	no
332	3	-	no	no	yes
333	4	-	no	no	yes
334	5	-	no	no	no
335	5	-	no	no	yes
336	5	-	no	no	no
337	5	-	no	no	no
338	3	-	no	no	no
339	4	-	no	no	yes
340	5	-	no	no	no
341	4	-	no	no	yes
342	4	-	no	no	no
343	4	-	no	no	no
344	4	-	no	no	no