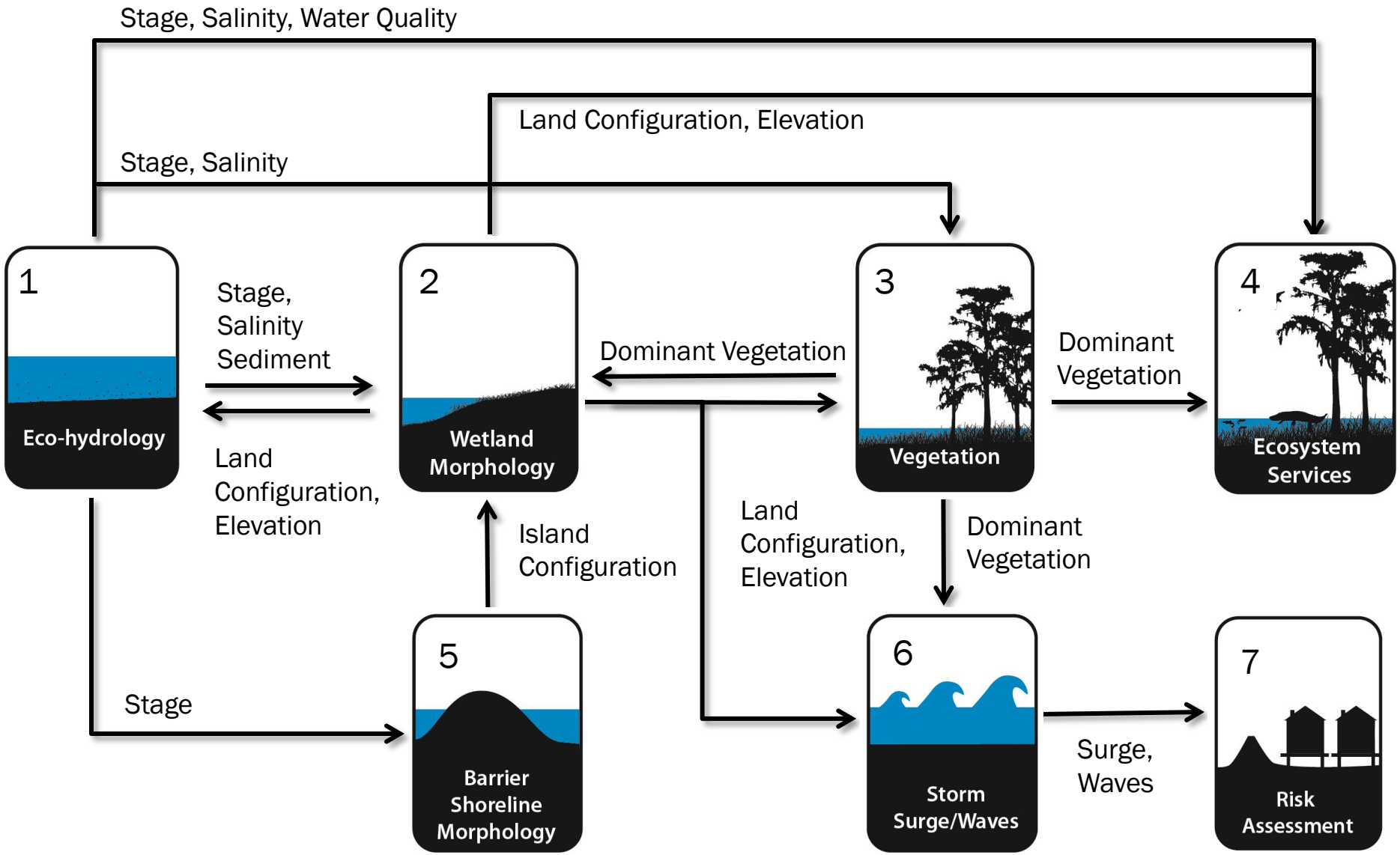
Louisiana's 2012 Coastal Master Plan

UPPER TROPHIC LEVEL MODELING TO SUPPORT PLANNING FLOOD PROTECTION AND WETLAND RESTORATION IN COASTAL LOUISIANA

J. Andrew Nyman, LSU AgCenter

Modeling in a Systems Context



1.	American alligator	Nyman, LSU AgCenter
2.	muskrat	
3.	river otter	
4.	speckled trout	Baltz, LSU
5.	brown shrimp	
6.	white shrimp	
7.	largemouth bass	Kaller, LSU AgCenter
8.	gadwall	Leberg, ULL
9.	green-winged teal	
10.	mottled duck	
11.	neotropical migrants	
12.	roseate spoonbill	
13.	wild-caught crawfish	Romaire, LSU AgCenter
14.	eastern oyster	Soniat, UNO

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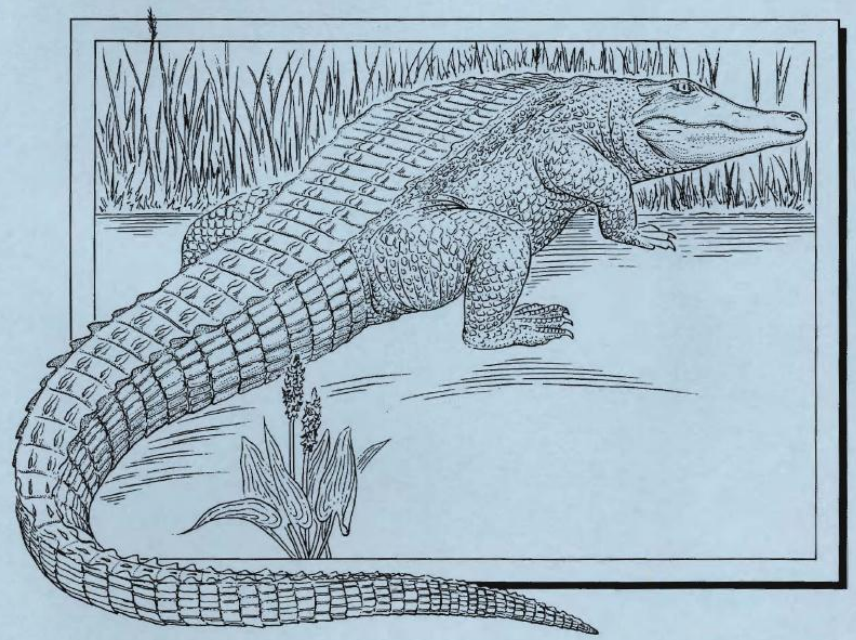
HABITAT SUITABILITY INDEX MODELS: AMERICAN ALLIGATOR



Fish and Wildlife Service
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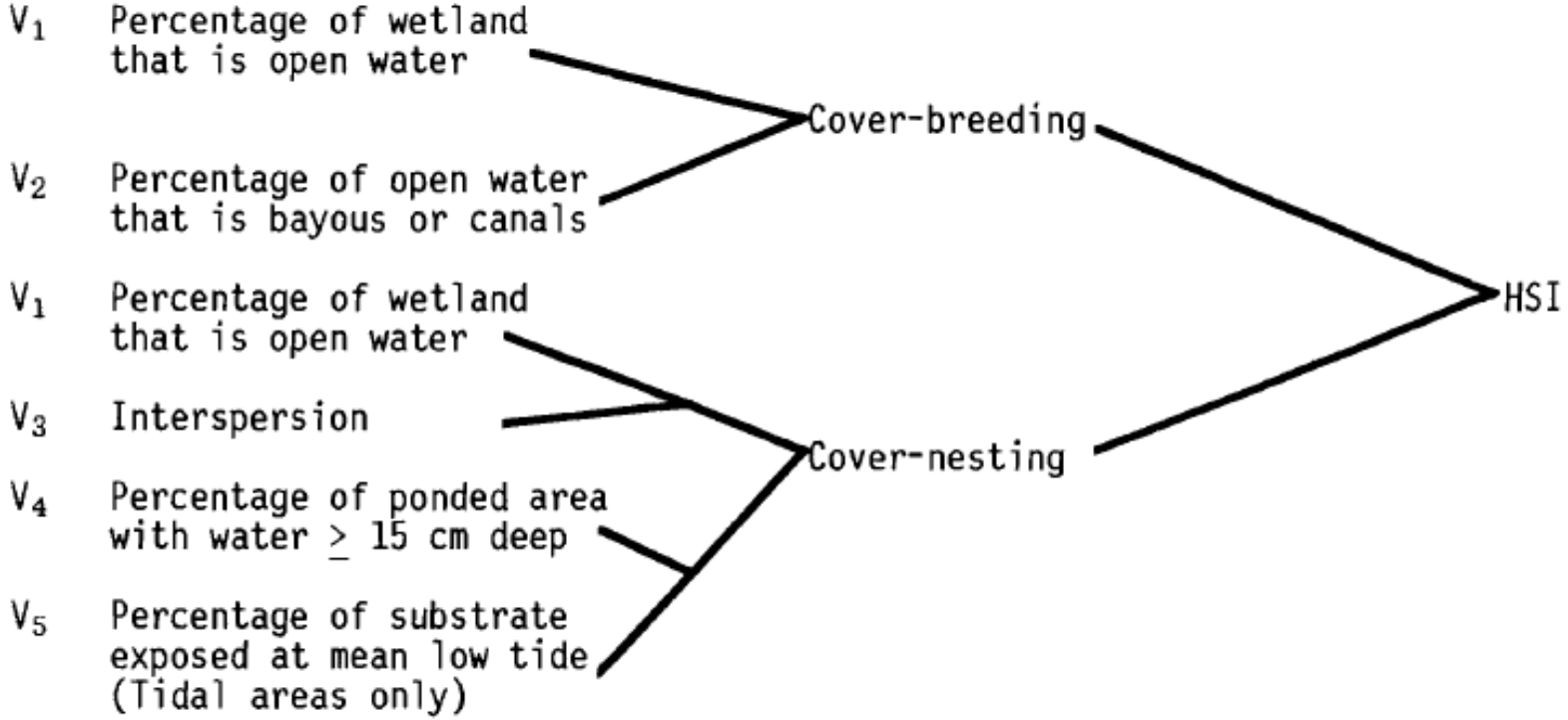

Figure 1. Relationship of habitat variables and the cover life requisite for breeding adults and nesting females in the alligator HSI model.

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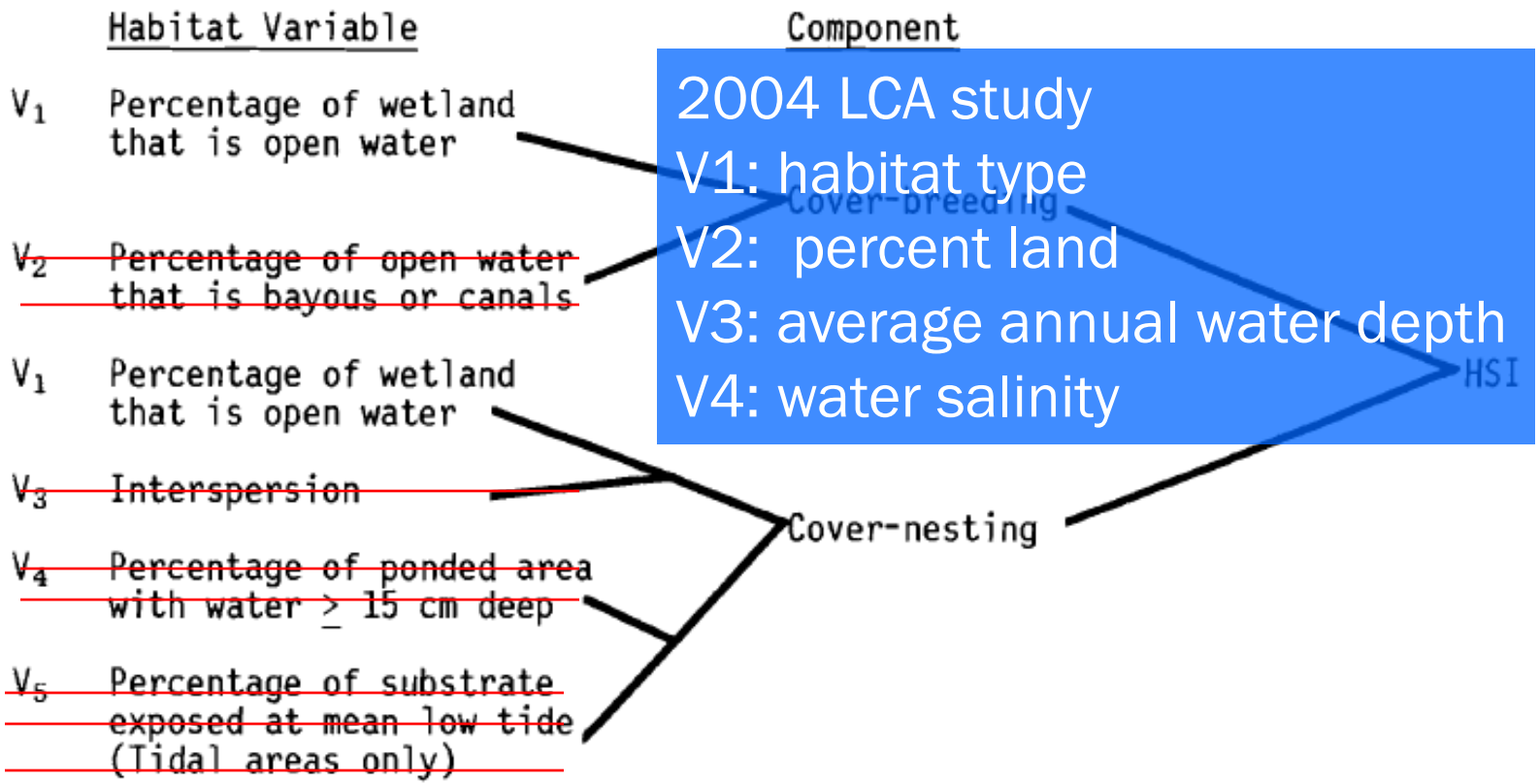

2004 LCA study
V1: habitat type
V2: percent land
V3: average annual water depth
V4: water salinity

Figure 1. Relationship of habitat variables and the cover life requisite for breeding adults and nesting females in the alligator HSI model.

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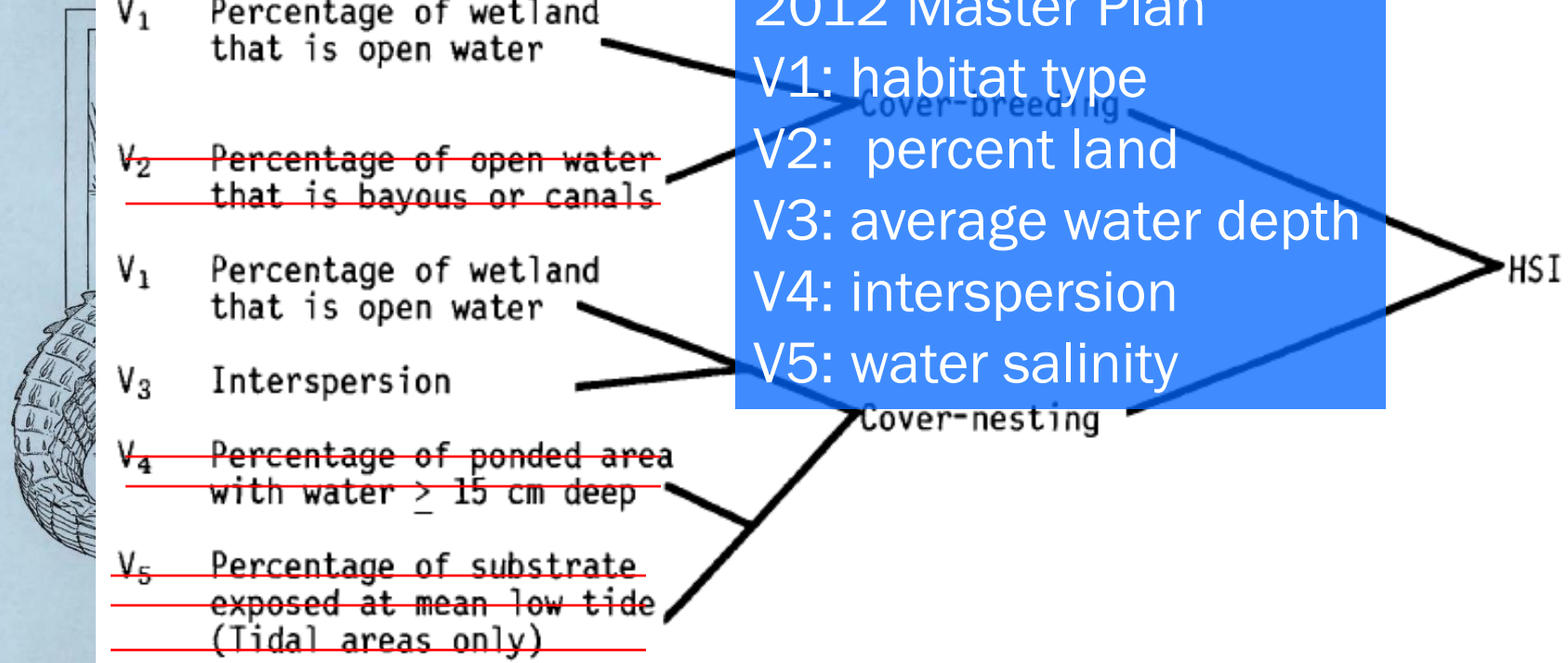

2012 Master Plan
V1: habitat type
V2: percent land
V3: average water depth
V4: interspersion
V5: water salinity

Figure 1. Relationship of habitat variables and the cover life requisite for breeding adults and nesting females in the alligator HSI model.

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alligator: percent land

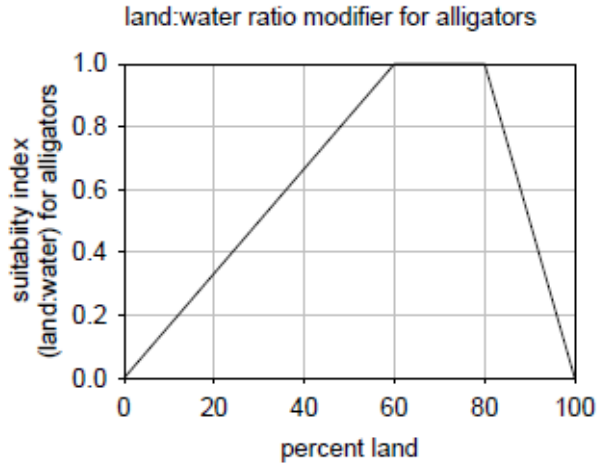
American alligator: land:water; SI_1

A relationship between those percent land; i.e. percent of area with emergent vegetation, and American alligator habitat suitability was previously presented in the HSI model by Newsom et al. (1987) and was therefore used in this model and is represented by:

$SI_1 =$ (percent land)/60 for (percent land) $<$ 60

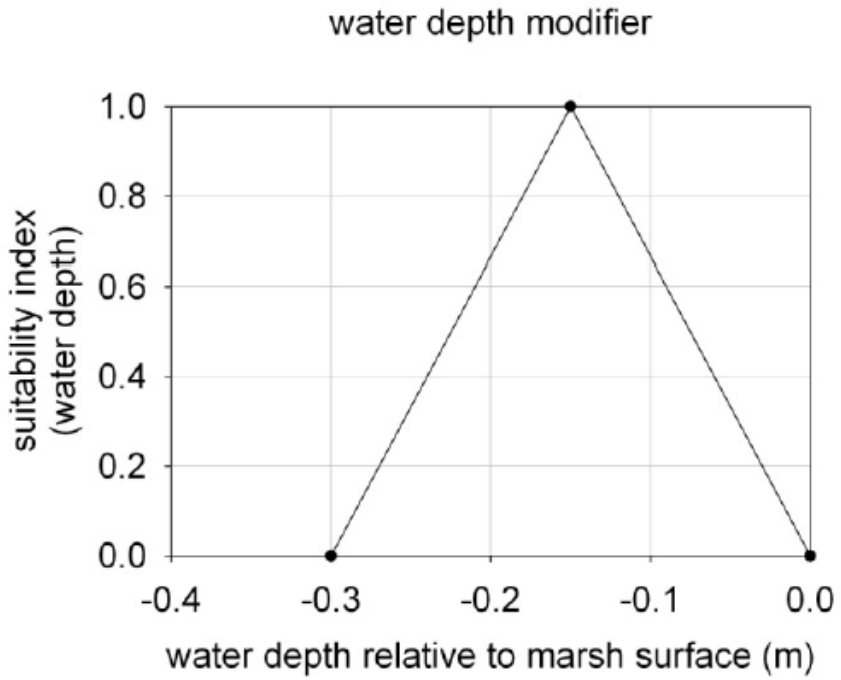
$SI_1 =$ 1 for 60 $\leq$ (percent land) $\leq$ 80

$SI_1 =$ 5 – ((percent land)*0.05)) for 80 $<$ (percent land) $\leq$ 100

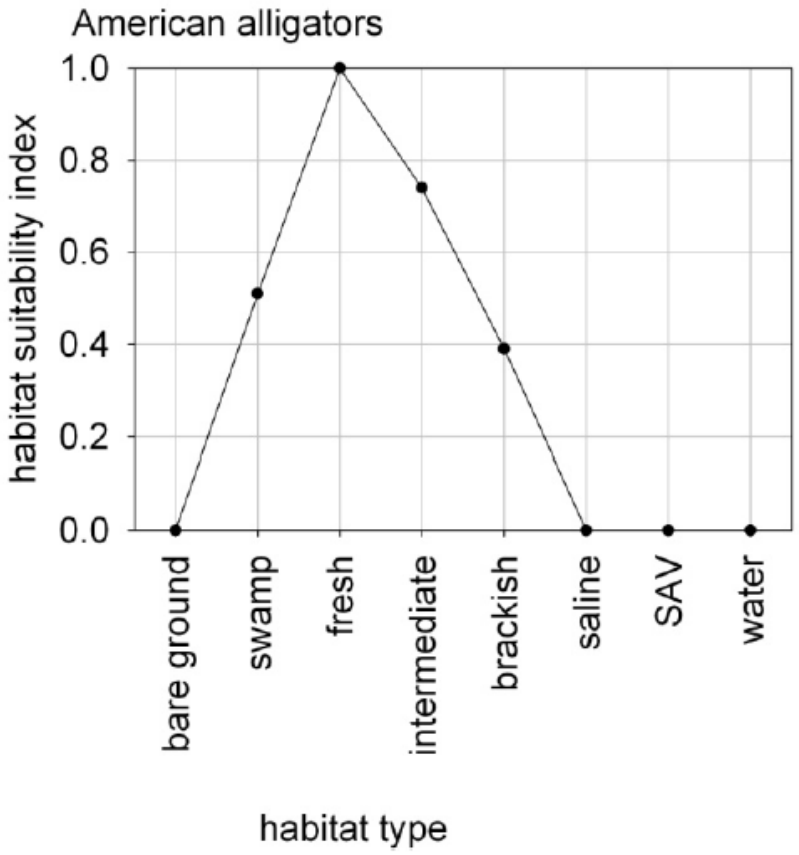


alligator: water depth

$$SI_2 = \begin{cases} 0 & for\ depth\ during\ previous\ 12\ months \le -0.3\ m \\ 2.0 + (depth \bullet 6.7) & for -0.3\ m < depth\ during\ previous\ 12\ months < -0.15\ m \\ 1 & depth\ during\ previous\ 12\ months = -0.15\ m \\ depth \bullet -6.7 & for -0.15\ m < depth\ during\ previous\ 12\ months \le 0.0\ m \\ 0 & for\ depth\ during\ previous\ 12\ months > 0.0\ m \end{cases}$$

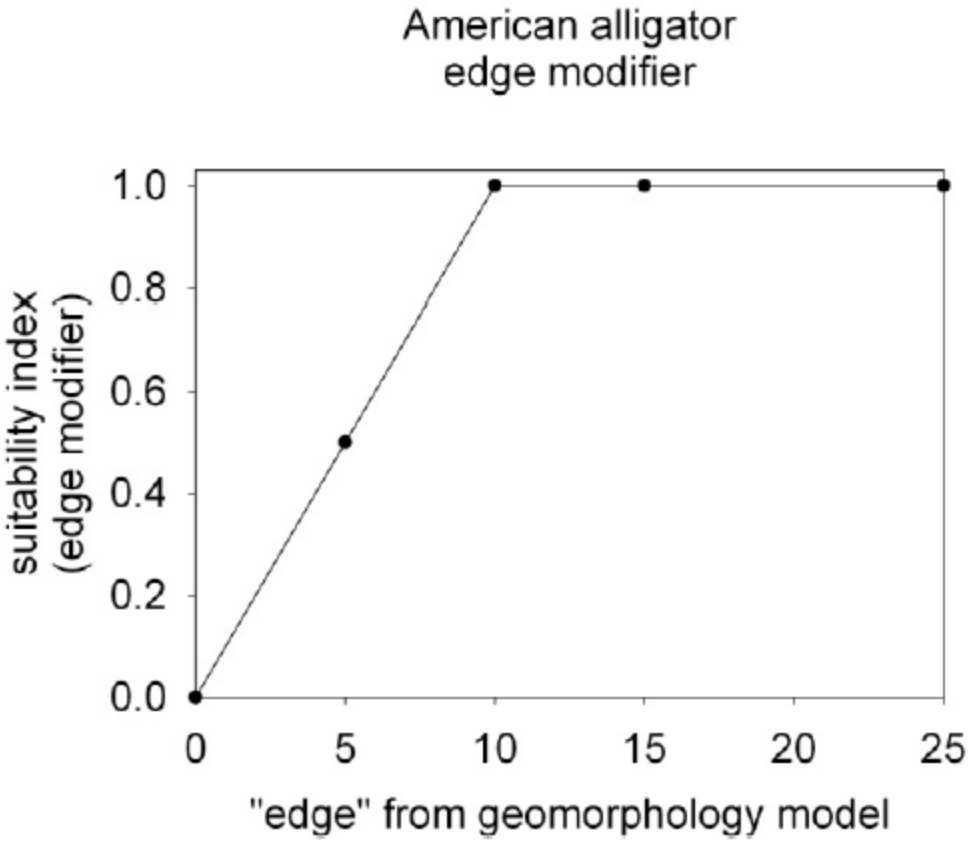


alligator: habitat type



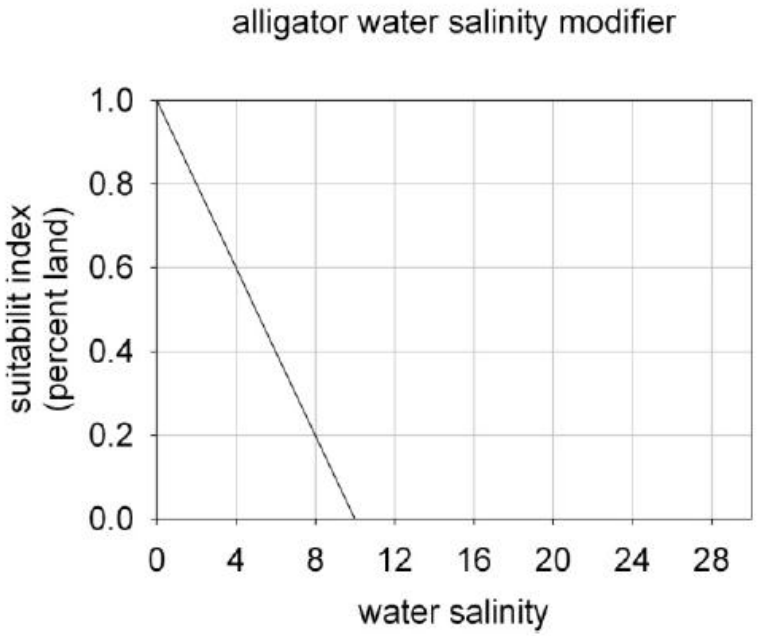
alligator: edge habitat

$$SI_4 = \begin{cases} \text{EDGE}/10 \text{ for } 0 <= \text{EDGE} <= 10.0 \\ 1.0 \text{ for } \text{EDGE} < 0.10 \end{cases}$$



alligator: water salinity

$$SI_5 = \begin{cases} (-0.1 * salinity) + 1.0 & for\ 0 \le salinity < 10 \\ 0 \quad for\ salinity \ge 10 & \end{cases}$$



HSI for alligator is computed as the geometric mean of the 5 factors:

$$HSI = (SI_1 \times SI_2 \times SI_3 \times SI_4 \times SI_5)^{1/5}$$

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V1	V2	V2	V4	V5	5THROOT
1	1	1	1	1	1.00

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V1	V2	V2	V4	V5	5THROOT
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0	1	1	1	1	0.00

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V1	V2	V2	V4	V5	5THROOT
1	1	1	1	1	1.00
0	1	1	1	1	0.00
0.2	1	1	1	1	0.72
0.4	1	1	1	1	0.83
0.6	1	1	1	1	0.90
0.8	1	1	1	1	0.96

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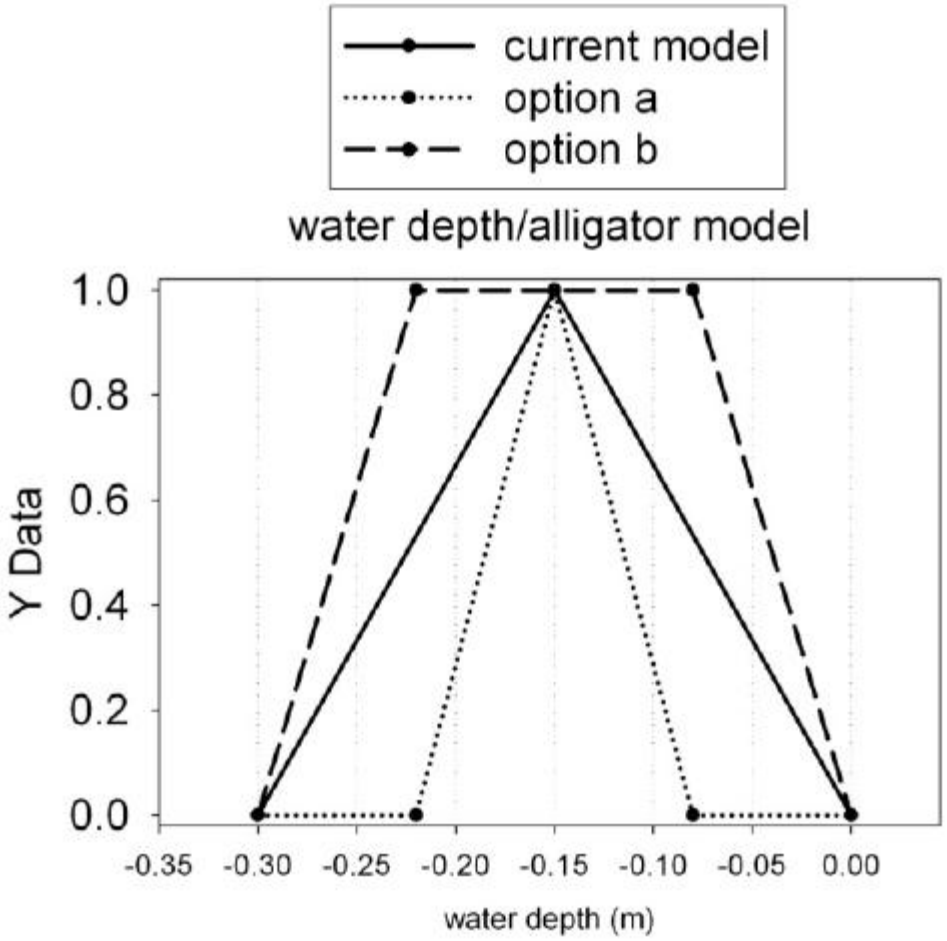
0.8	1	1	1	1	0.96
1	1	1	1	1	1.00
0.2	0.2	1	1	1	0.53

model validation

uncertainty analyses



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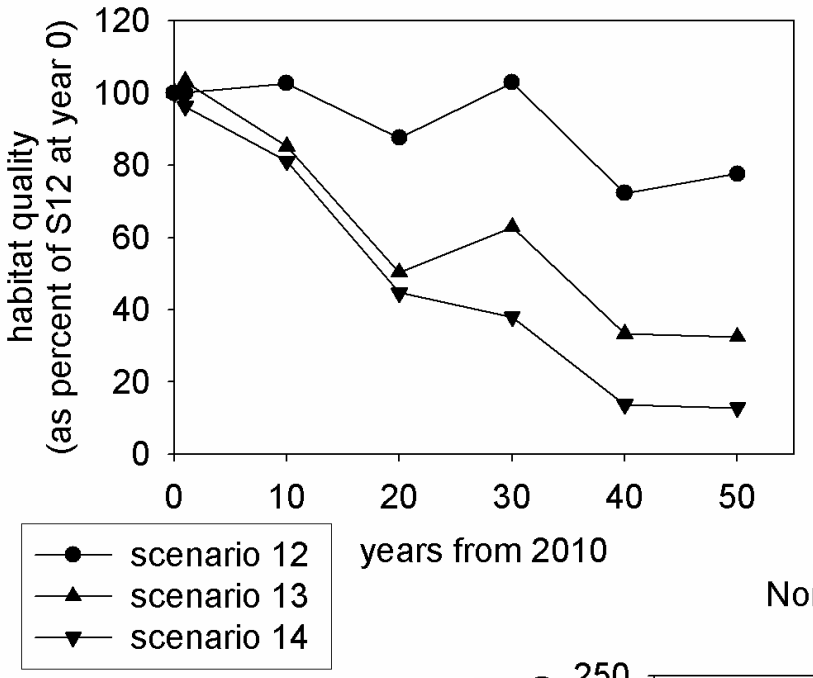
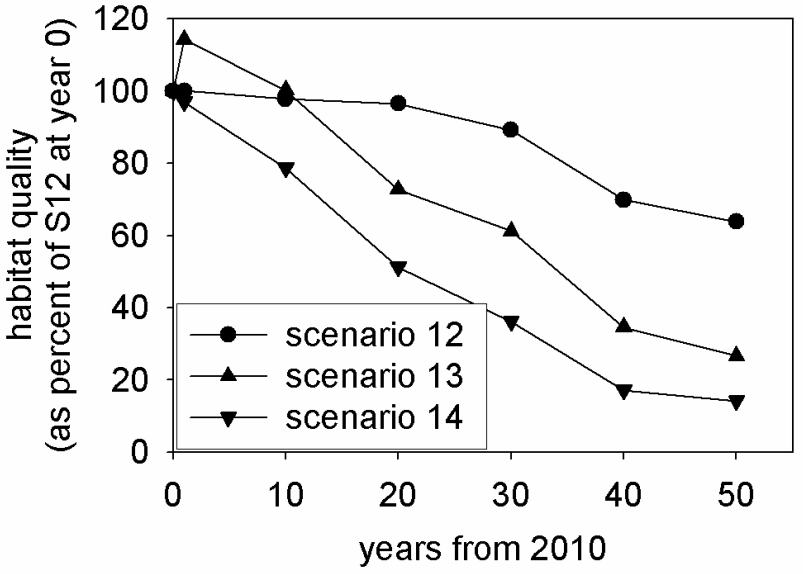
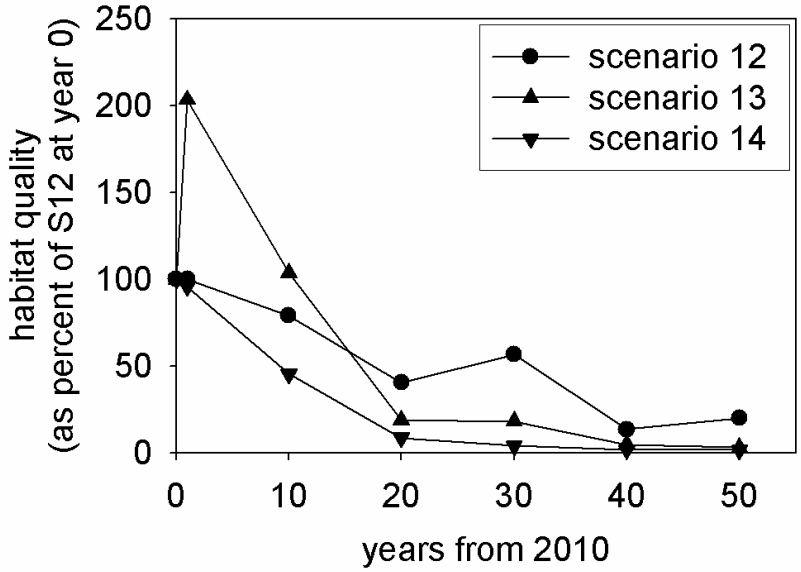
American alligators

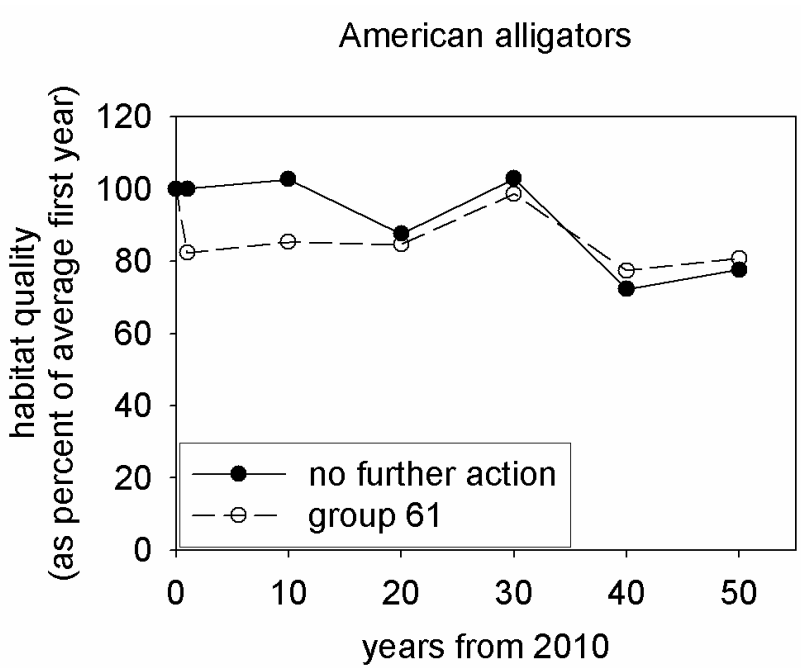


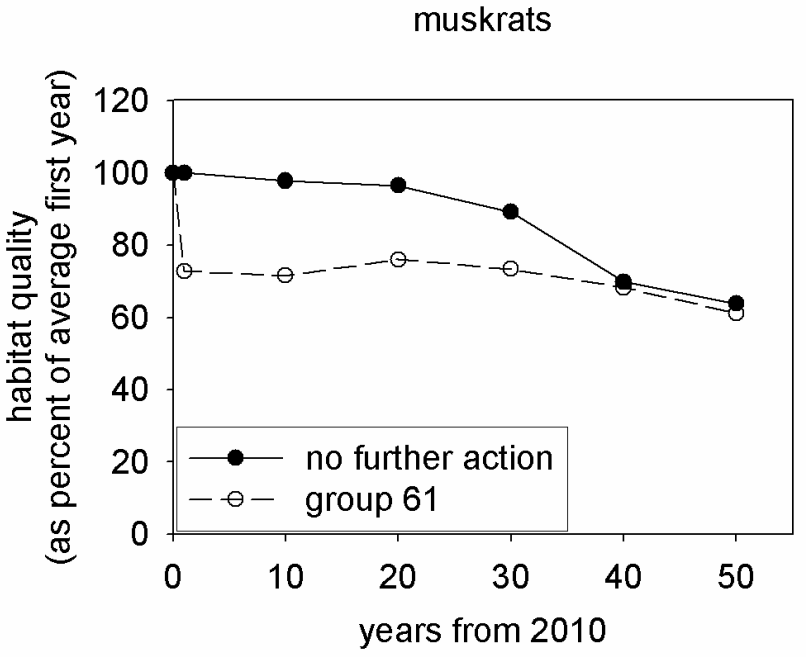
muskrat

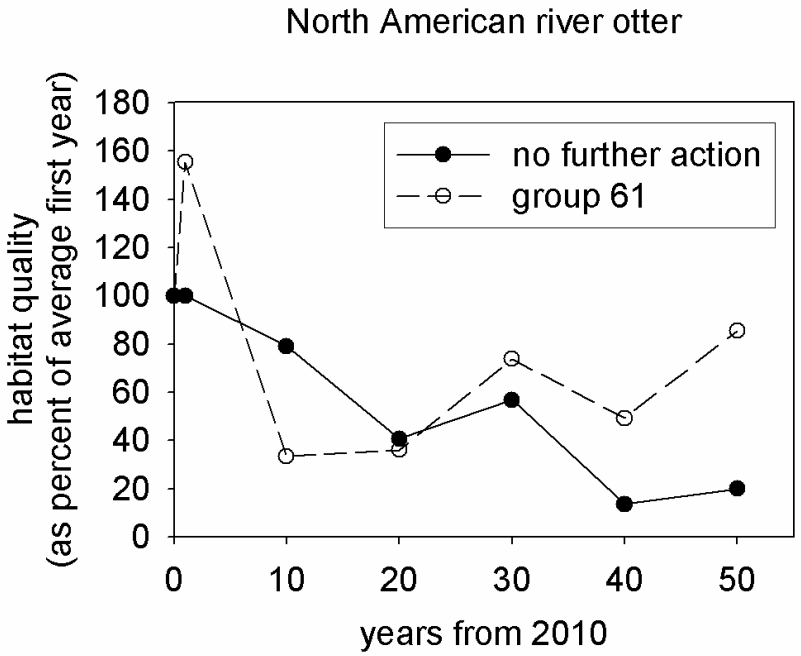


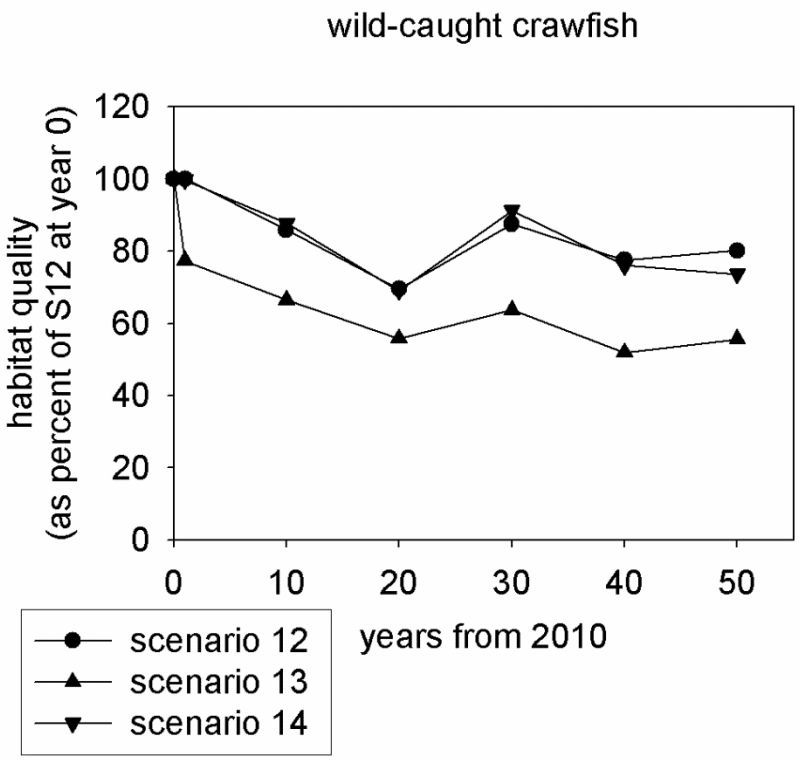
North American river otter

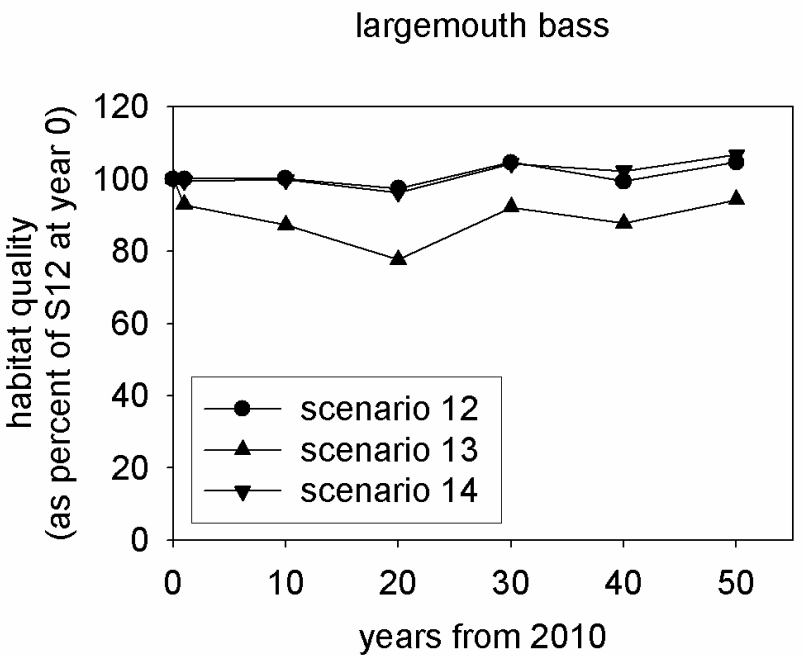


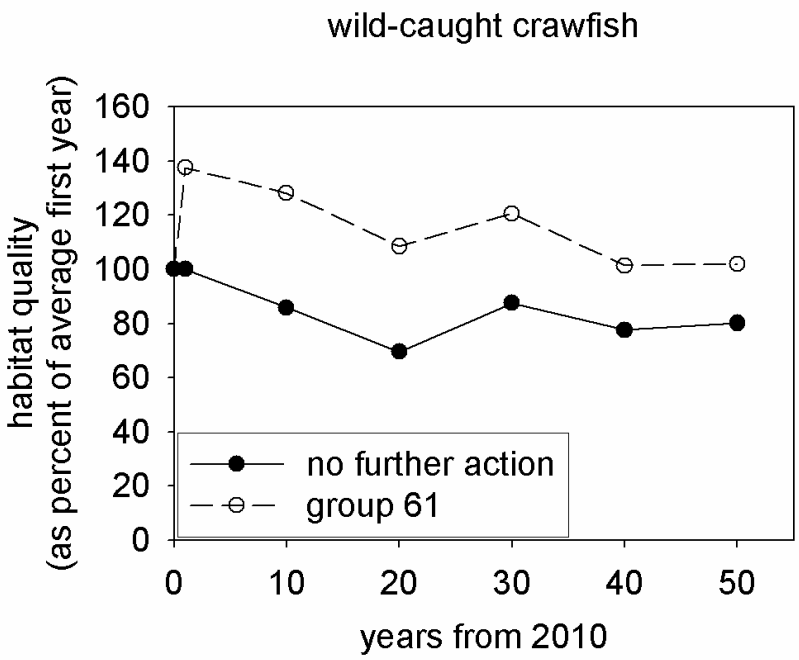

American alligators
habitat quality
(as percent of average first year)
120
100
80
60
40
20
0
0
10
20
30
40
50
years from 2010
no further action
group 61


muskrats
habitat quality
(as percent of average first year)
120
100
80
60
40
20
0
0
10
20
30
40
50
years from 2010
no further action
group 61


North American river otter
habitat quality
(as percent of average first year)
180
160
140
120
100
80
60
40
20
0
0
10
20
30
40
50
years from 2010
no further action
group 61


wild-caught crawfish
habitat quality
(as percent of S12 at year 0)
120
100
80
60
40
20
0
0
10
20
30
40
50
years from 2010
scenario 12
scenario 13
scenario 14


largemouth bass
habitat quality
(as percent of S12 at year 0)
120
100
80
60
40
20
0
0
10
20
30
40
50
years from 2010
scenario 12
scenario 13
scenario 14


wild-caught crawfish
habitat quality
(as percent of average first year)
160
140
120
100
80
60
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20
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0
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20
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years from 2010
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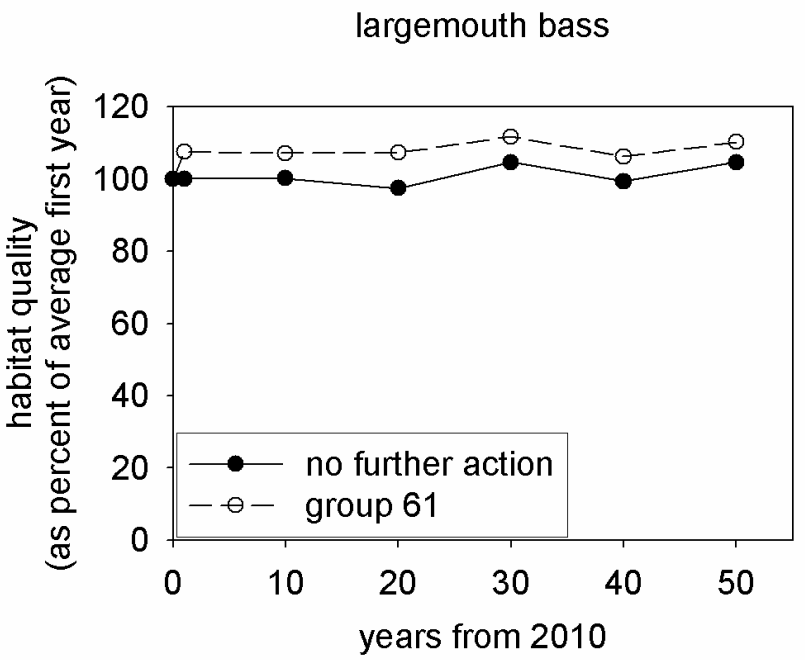
largemouth bass
habitat quality
(as percent of average first year)
120
100
80
60
40
20
0
0
10
20
30
40
50
years from 2010
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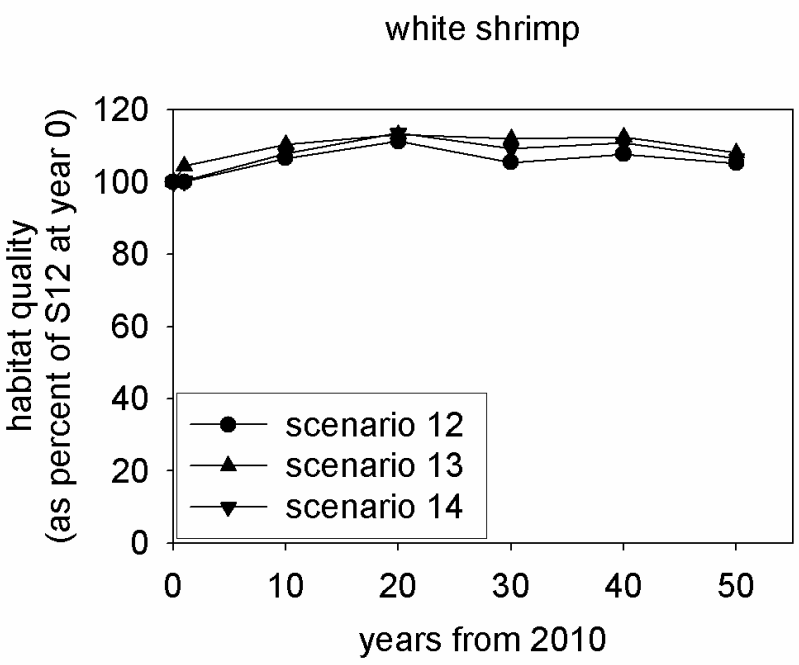
white shrimp
habitat quality
(as percent of S12 at year 0)
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100
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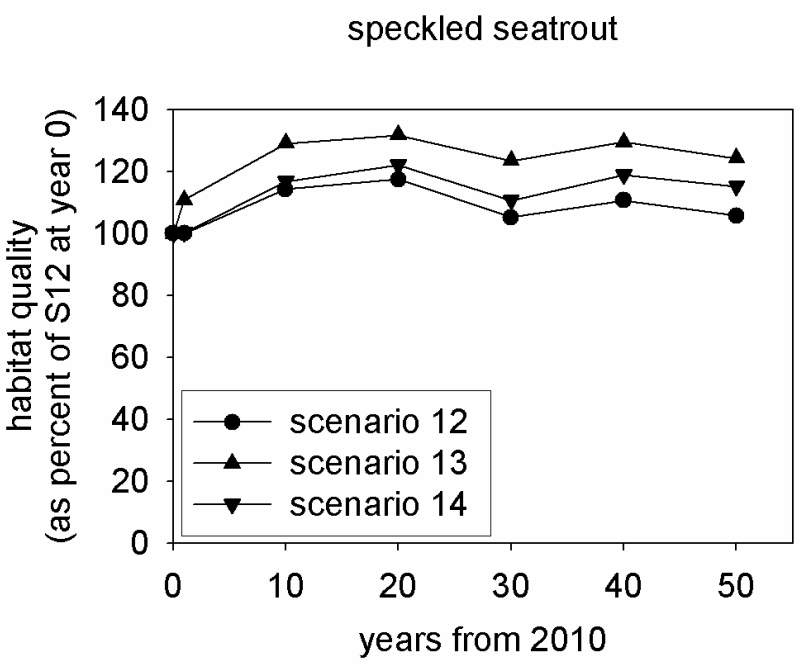
60
40
20
0
0
10
20
30
40
50
years from 2010
scenario 12
scenario 13
scenario 14


speckled seatrout
habitat quality
(as percent of S12 at year 0)
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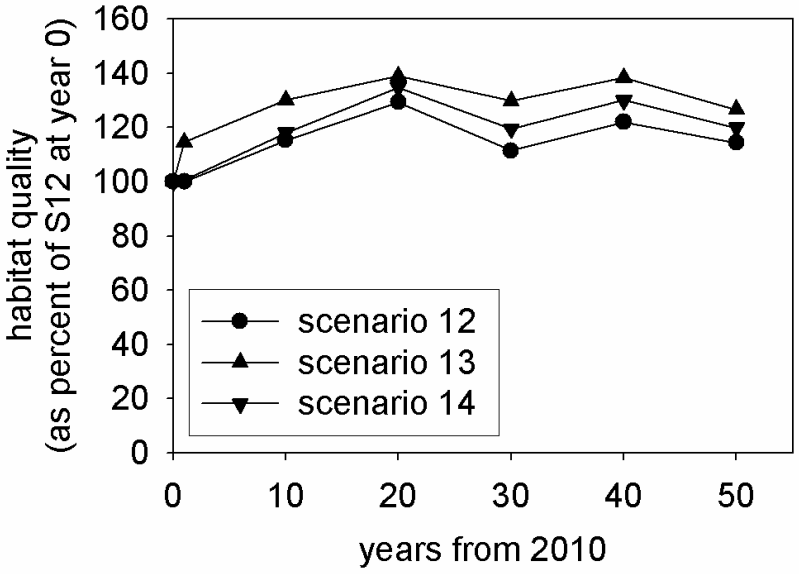
40
50
years from 2010
scenario 12
scenario 13
scenario 14


brown shrimp
habitat quality
(as percent of S12 at year 0)
160
140
120
100
80
60
40
20
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0
10
20
30
40
50
years from 2010
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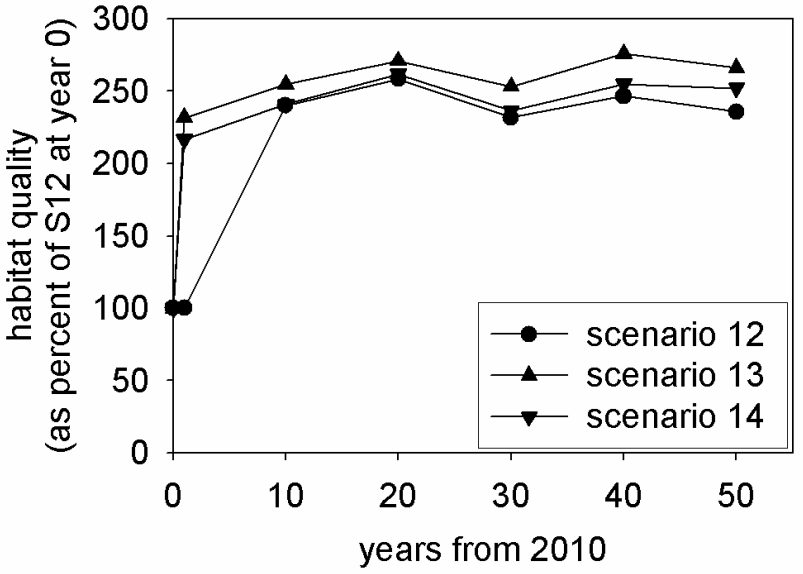
scenario 13
scenario 14


eastern oyster
habitat quality
(as percent of S12 at year 0)
300
250
200
150
100
50
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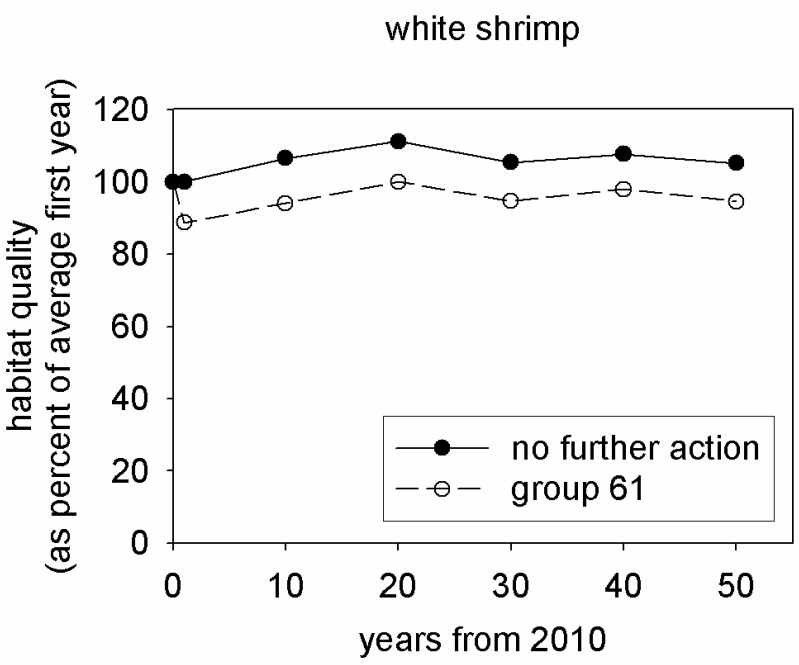
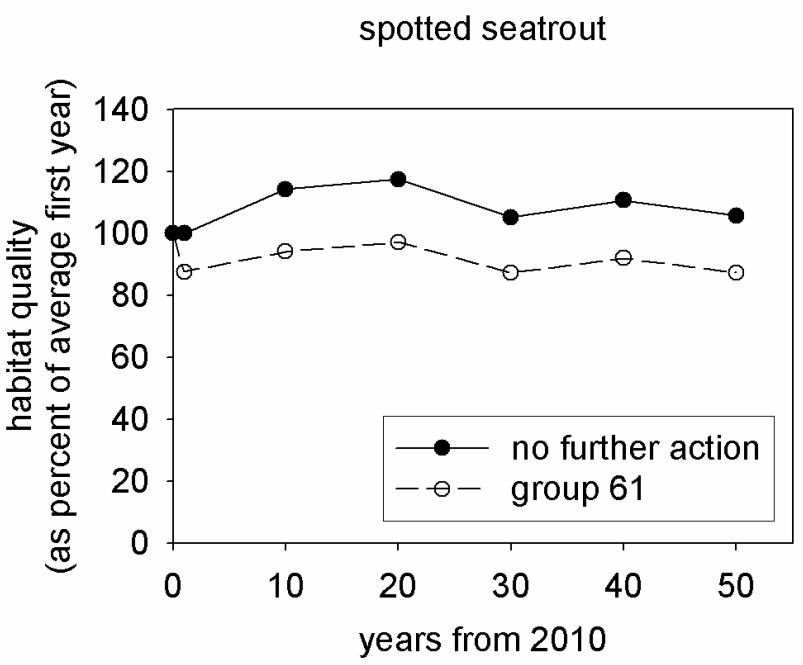
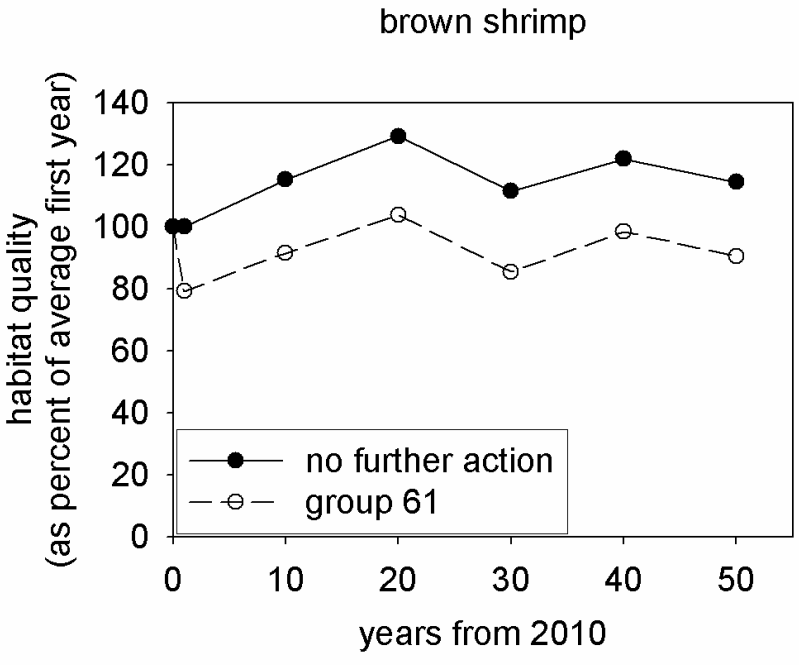
0
10
20
30
40
50
years from 2010
scenario 12
scenario 13
scenario 14


white shrimp
habitat quality
(as percent of average first year)
120
100
80
60
40
20
0
0
10
20
30
40
50
years from 2010
no further action
group 61


spotted seatrout
habitat quality
(as percent of average first year)
140
120
100
80
60
40
20
0
0
10
20
30
40
50
years from 2010
no further action
group 61


brown shrimp
habitat quality
(as percent of average first year)
140
120
100
80
60
40
20
0
0
10
20
30
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years from 2010
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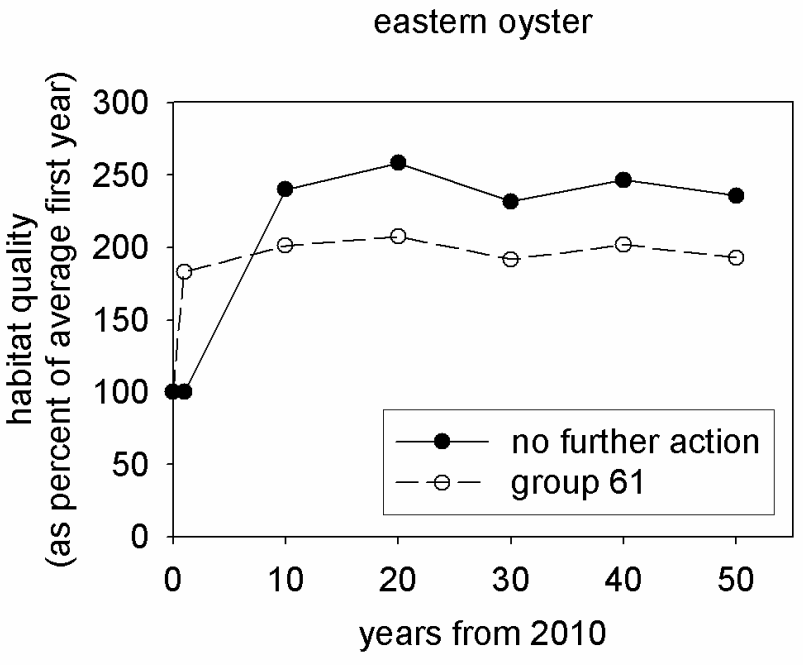
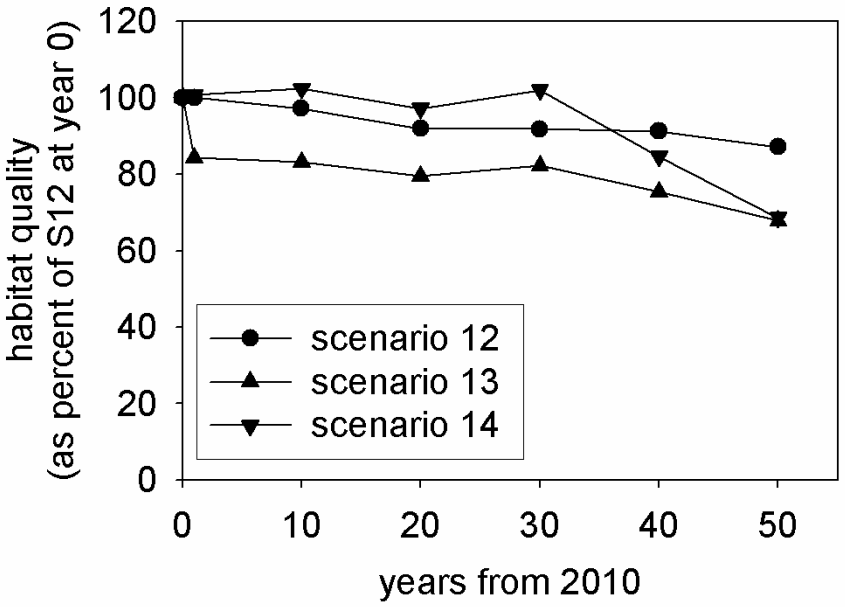
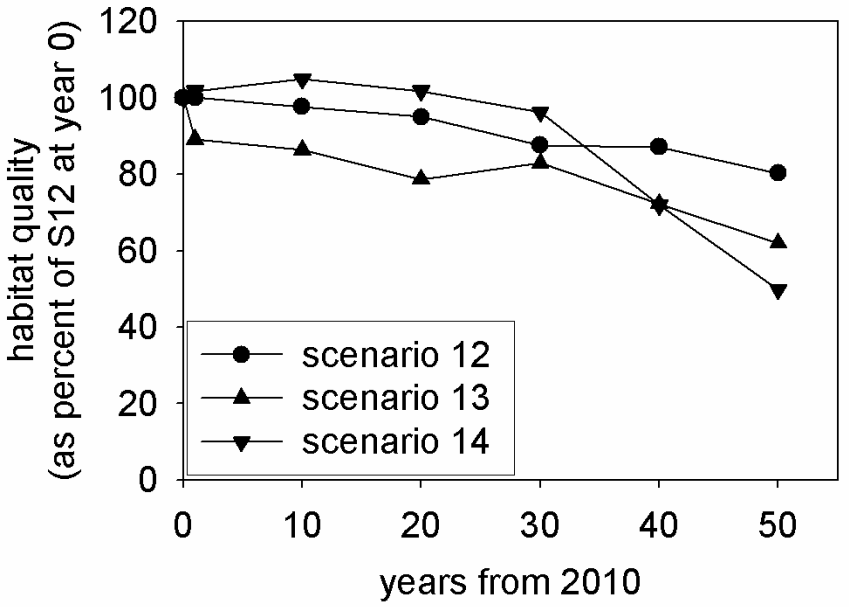

eastern oyster
habitat quality
(as percent of average first year)
300
250
200
150
100
50
0
0
10
20
30
40
50
years from 2010
no further action
group 61

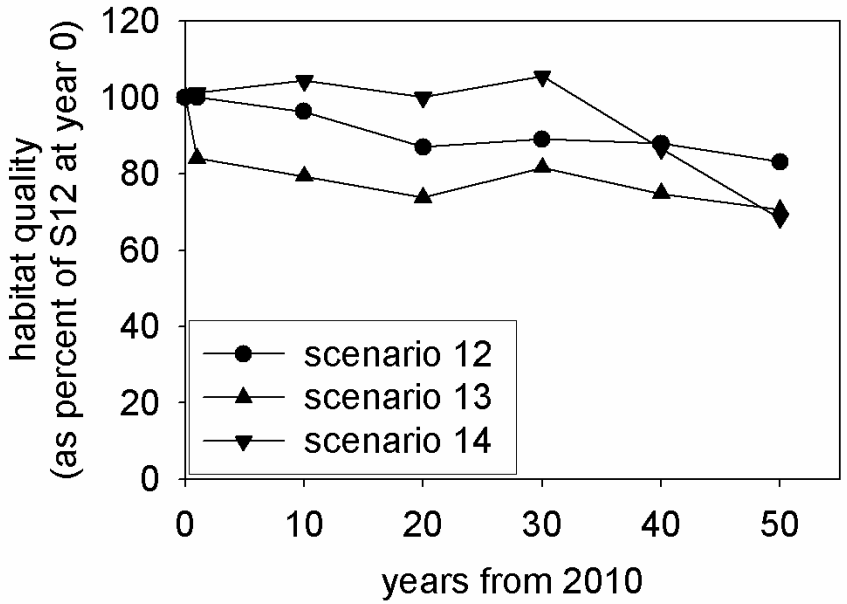
gadwall



green-winged teal



mottled duck



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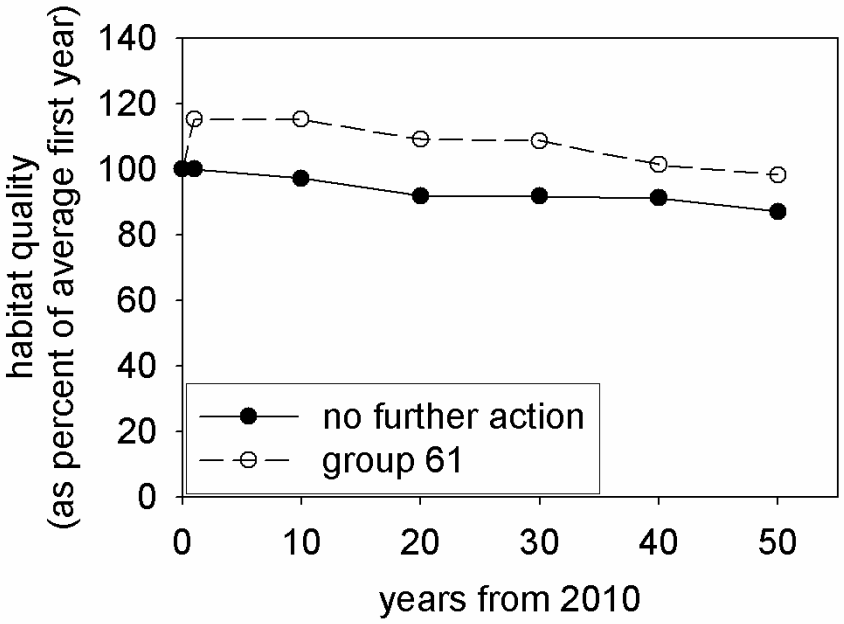

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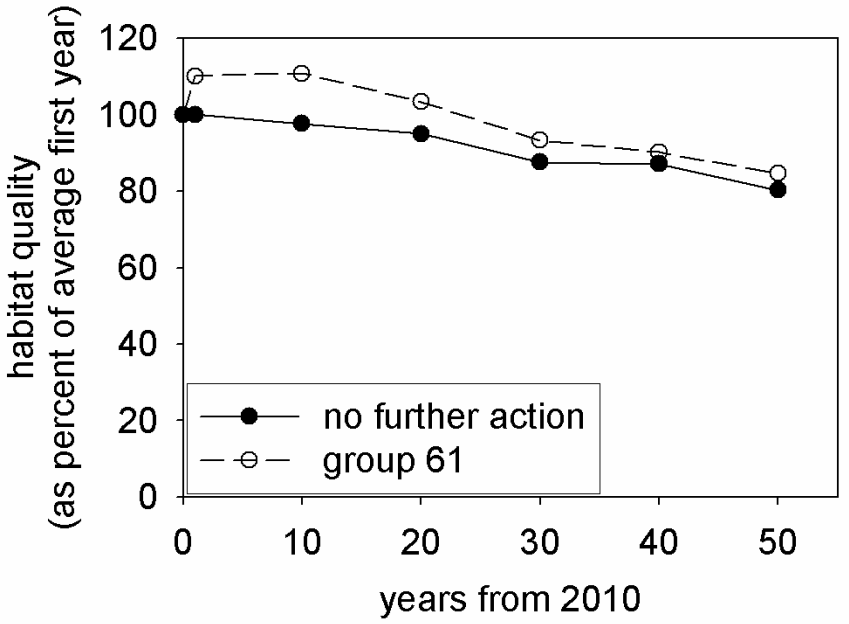
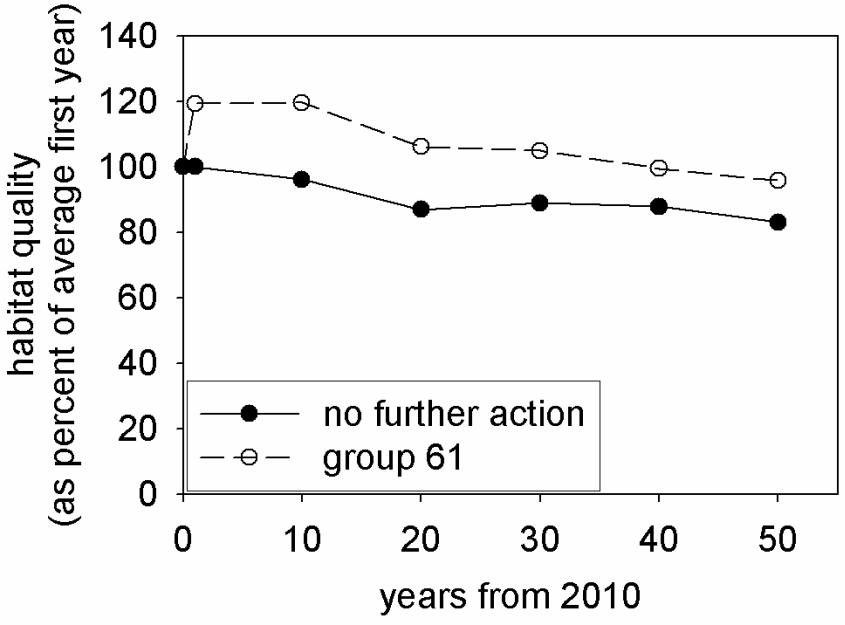
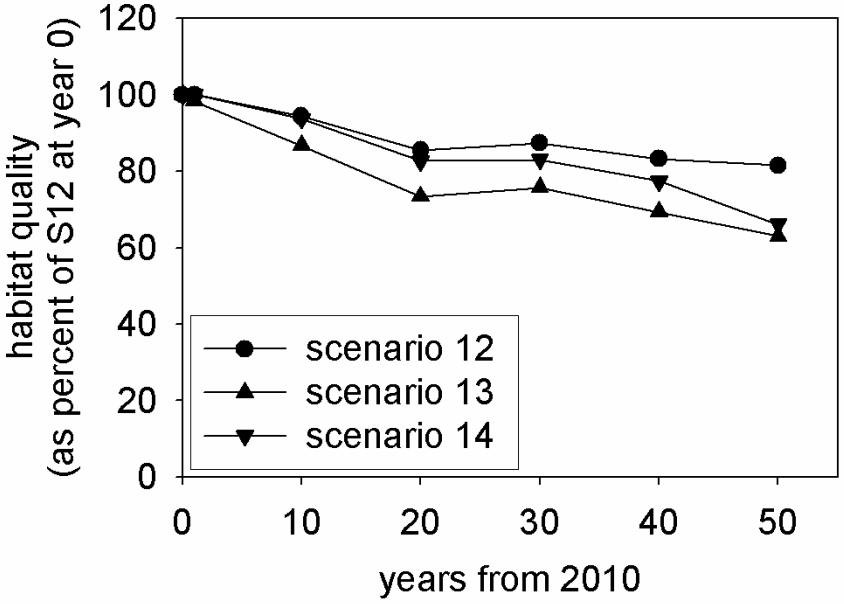


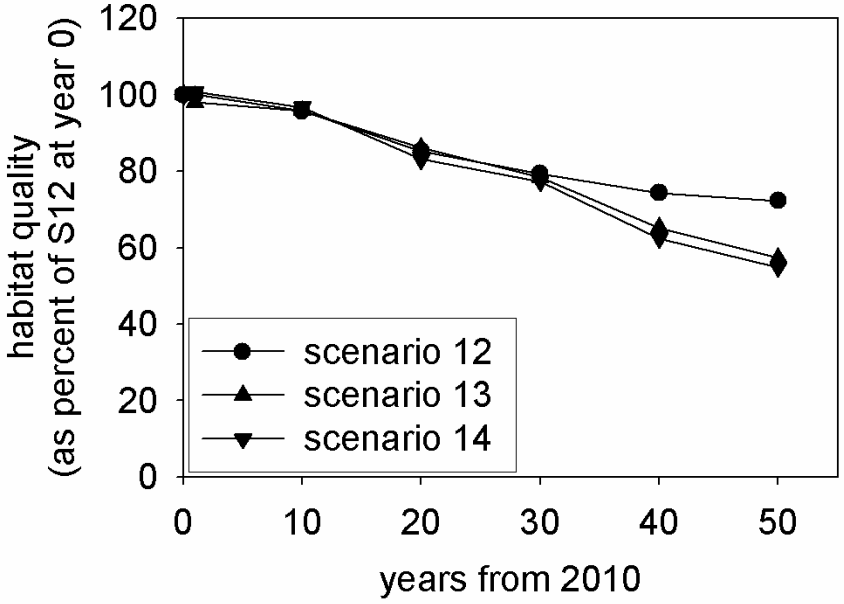
mottled duck

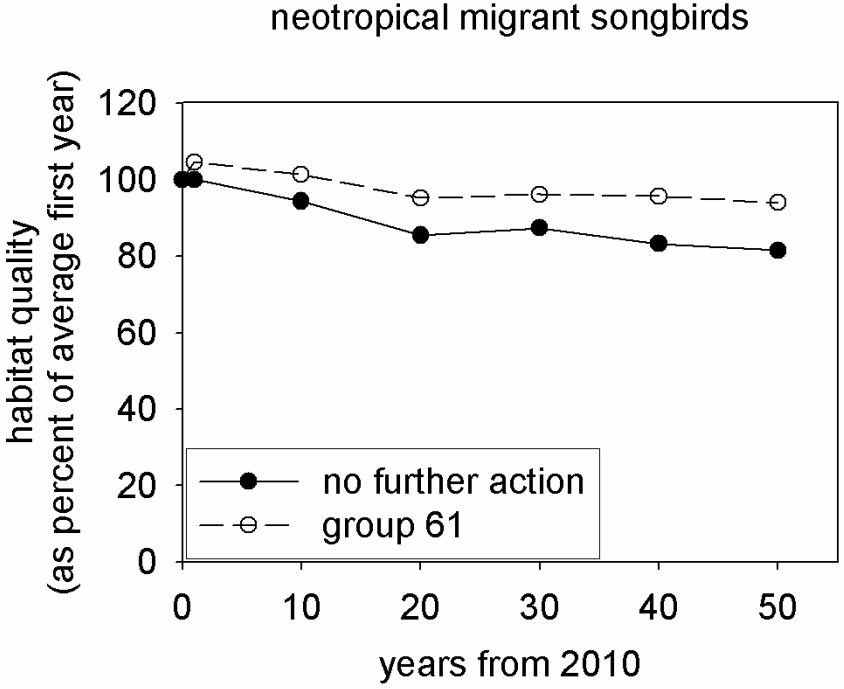


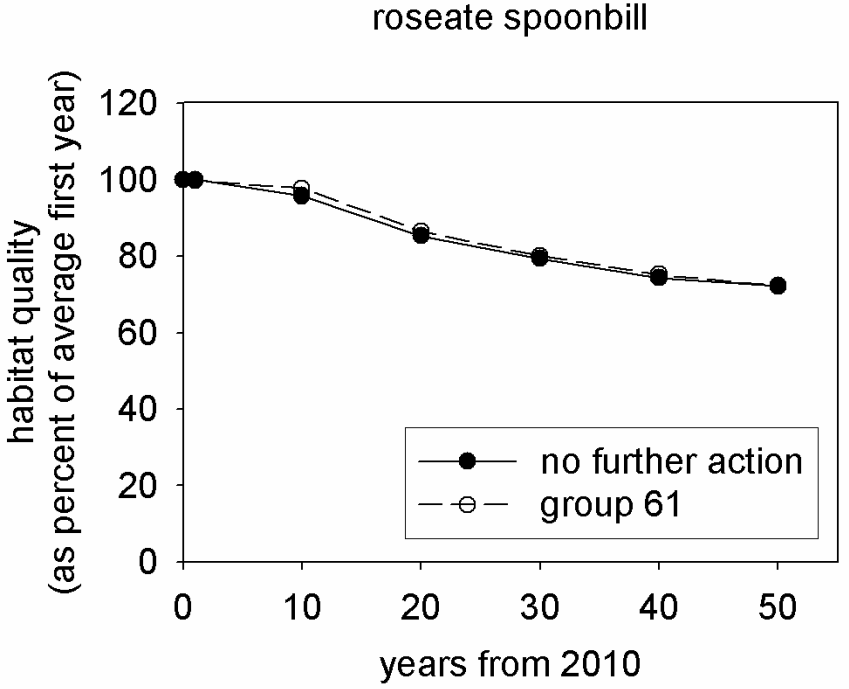
neotropical migrant songbirds



roseate spoonbill




neotropical migrant songbirds
habitat quality
(as percent of average first year)
120
100
80
60
40
20
0
0
10
20
30
40
50
years from 2010
no further action
group 61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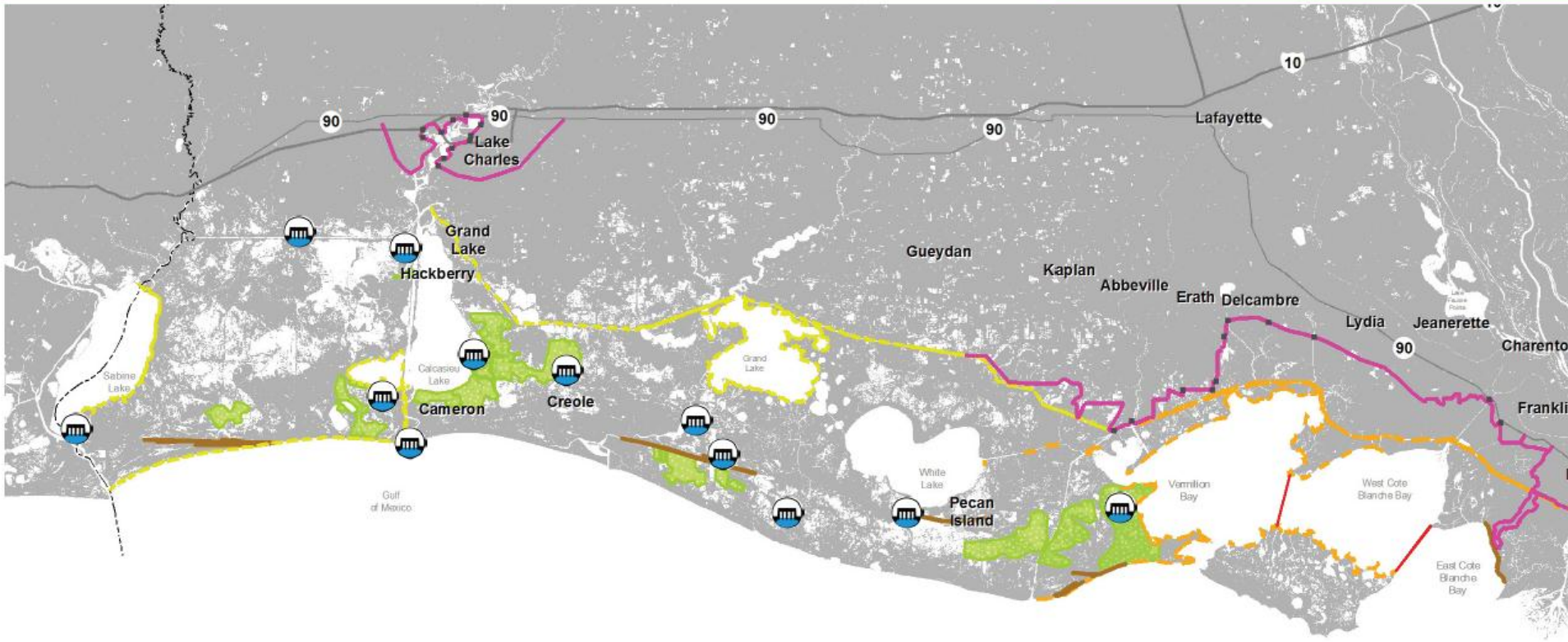
2012 Coastal Master Plan



Protective Levee

Bank Stabilization

Barrier Island Restoration

Channel Realignment

Hydrologic Restoration

Marsh Creation

Oyster Barrier Reef

Ridge Restoration

Sediment Diversion

Shoreline Protection

Multiple Features

Project Types Included: Colors on the icon correspond to color key on map.

Thank You!