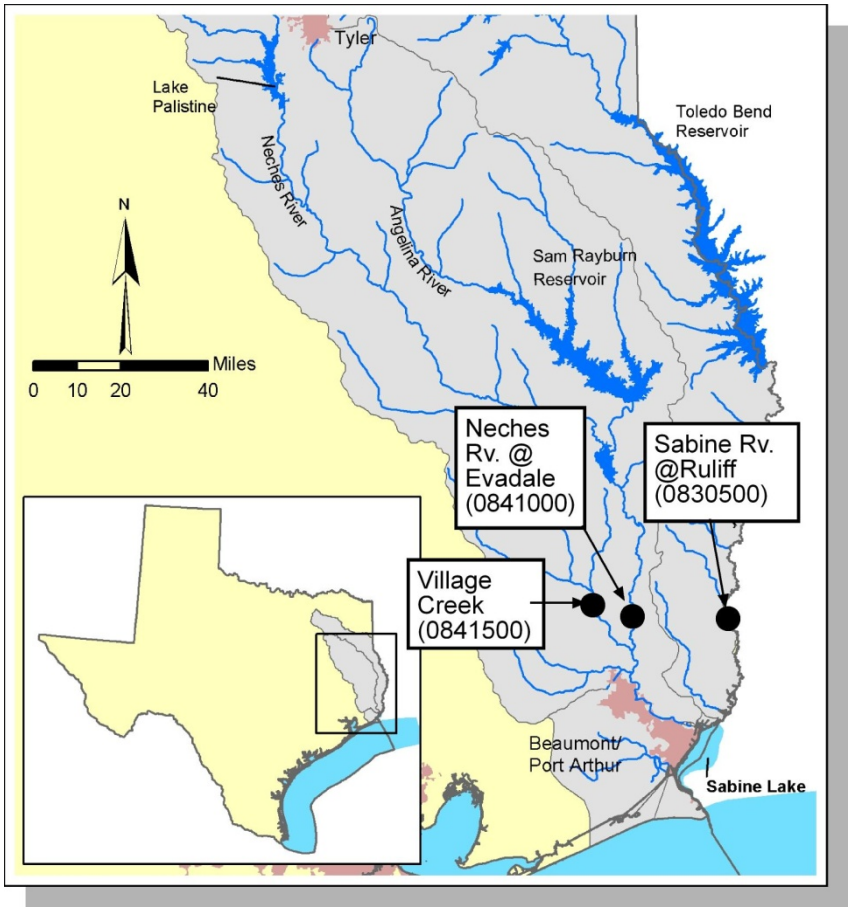
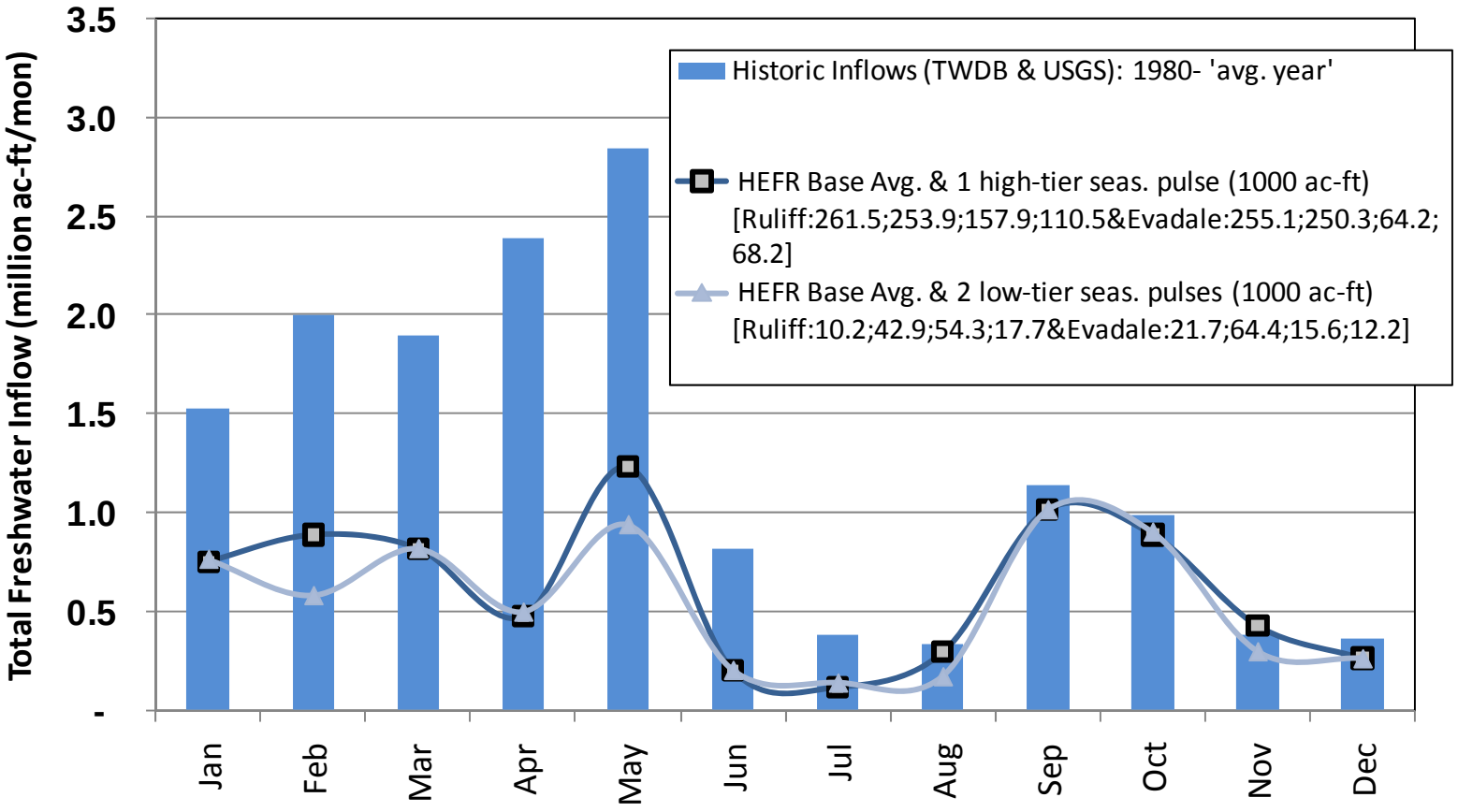
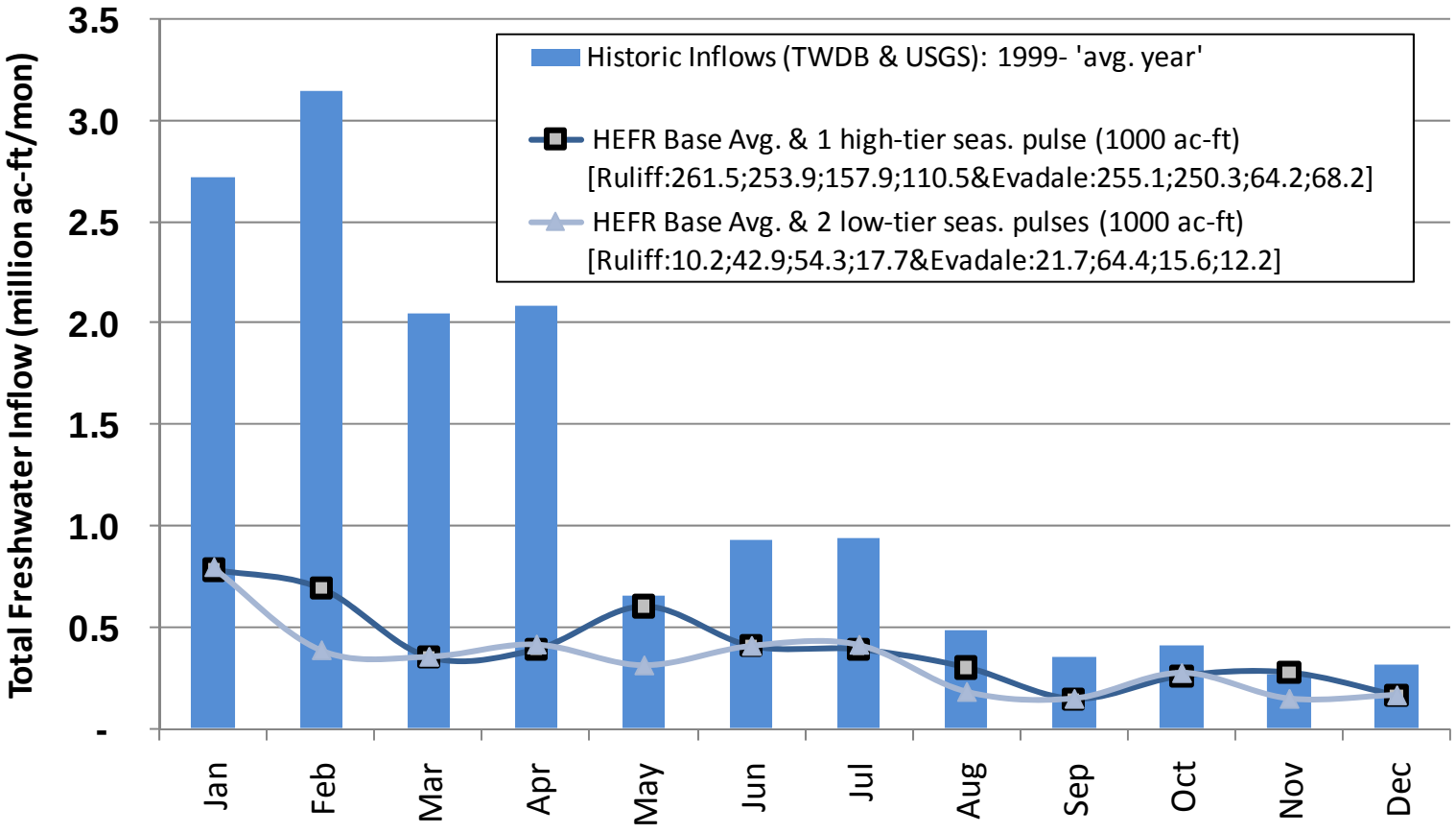
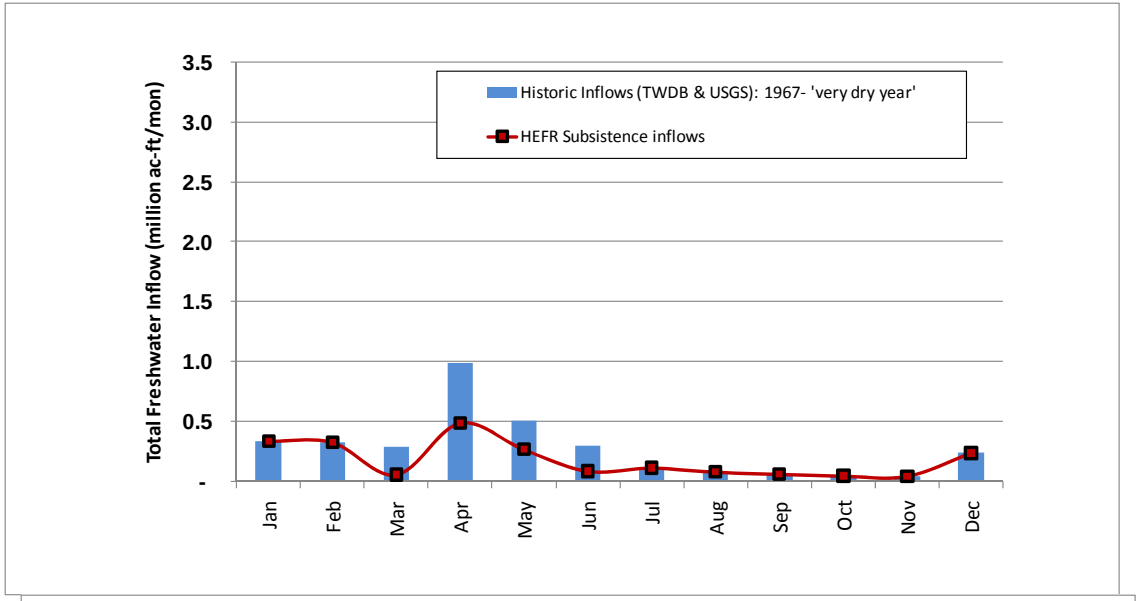
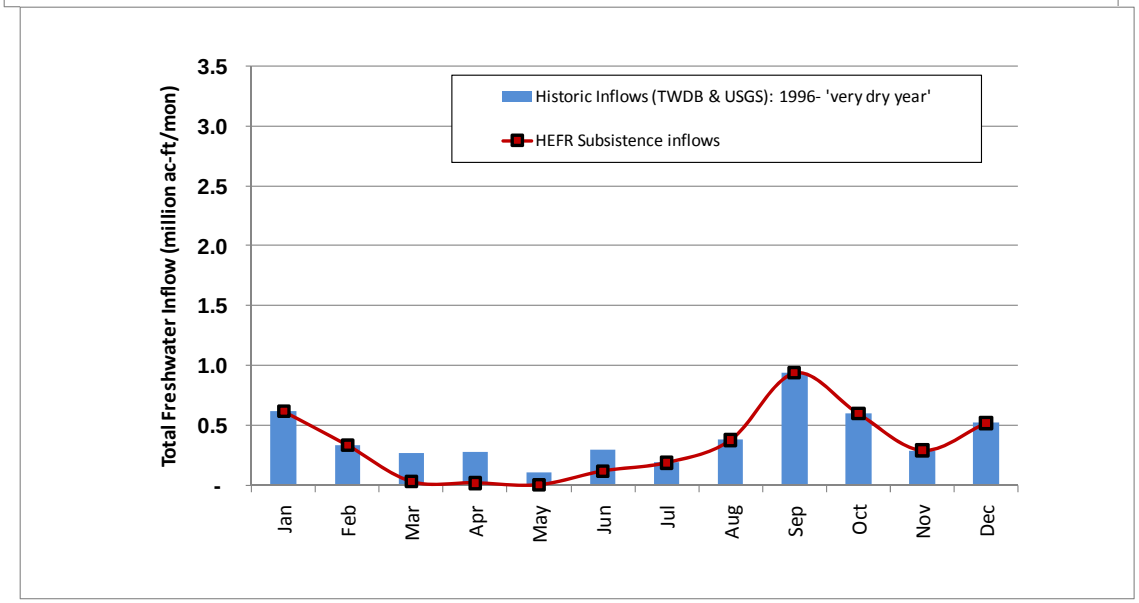
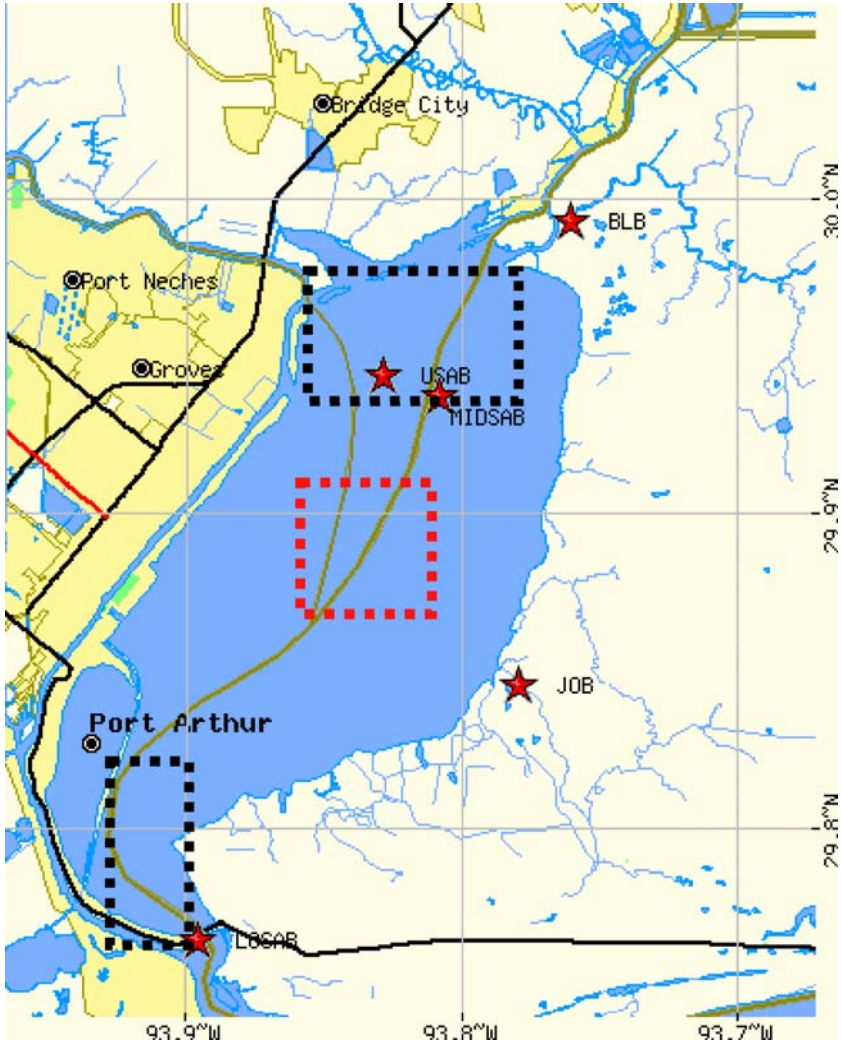

Tyler
Lake Palistine
Neches River
Angelina River
Toledo Bend Reservoir
Sam Rayburn Reservoir
N
Miles
0 10 20 40
Neches Rv. @ Evadale (0841000)
Sabine Rv. @Ruliff (0830500)
Village Creek (0841500)
Beaumont/ Port Arthur
Sabine Lake

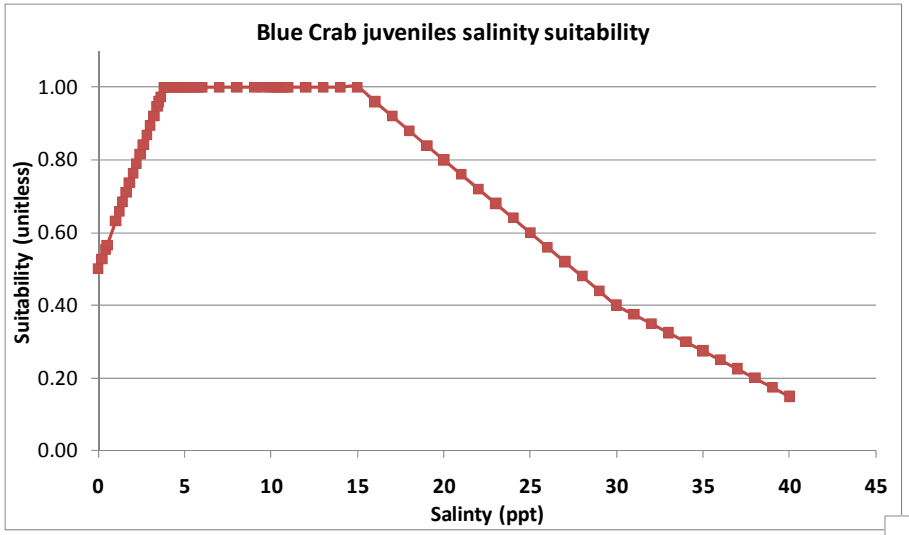

Total Freshwater Inflow (million ac-ft/mon)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
-
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Historic Inflows (TWDB & USGS): 1980- 'avg. year'
HEFR Base Avg. & 1 high-tier seas. pulse (1000 ac-ft) [Ruliff:261.5;253.9;157.9;110.5&Evadale:255.1;250.3;64.2;68.2]
HEFR Base Avg. & 2 low-tier seas. pulses (1000 ac-ft) [Ruliff:10.2;42.9;54.3;17.7&Evadale:21.7;64.4;15.6;12.2]

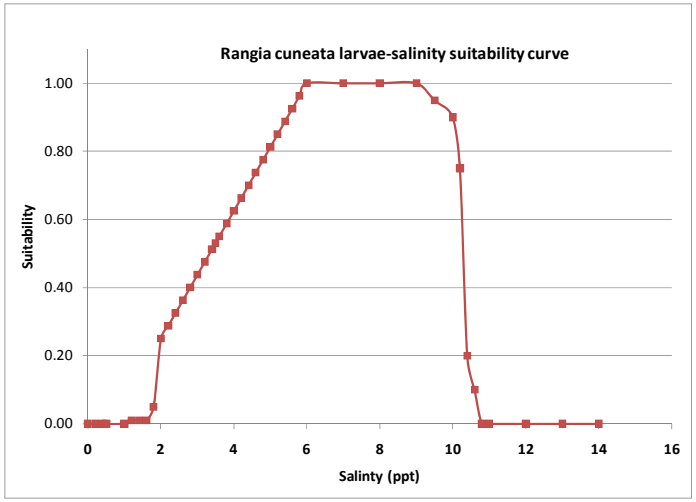

Total Freshwater Inflow (million ac-ft/mon)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
-
Historic Inflows (TWDB & USGS): 1999- 'avg. year'
HEFR Base Avg. & 1 high-tier seas. pulse (1000 ac-ft)
[Ruliff:261.5;253.9;157.9;110.5&Evadale:255.1;250.3;64.2;68.2]
HEFR Base Avg. & 2 low-tier seas. pulses (1000 ac-ft)
[Ruliff:10.2;42.9;54.3;17.7&Evadale:21.7;64.4;15.6;12.2]
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

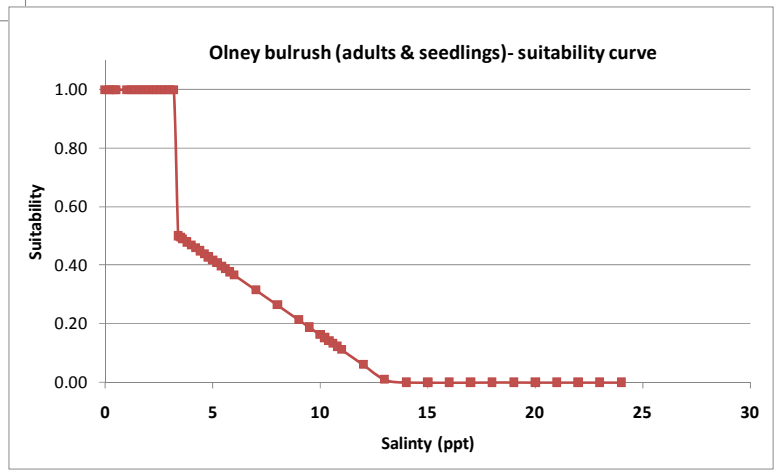

Total Freshwater Inflow (million ac-ft/mon)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
-
Historic Inflows (TWDB & USGS): 1967- 'very dry year'
HEFR Subsistence inflows
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

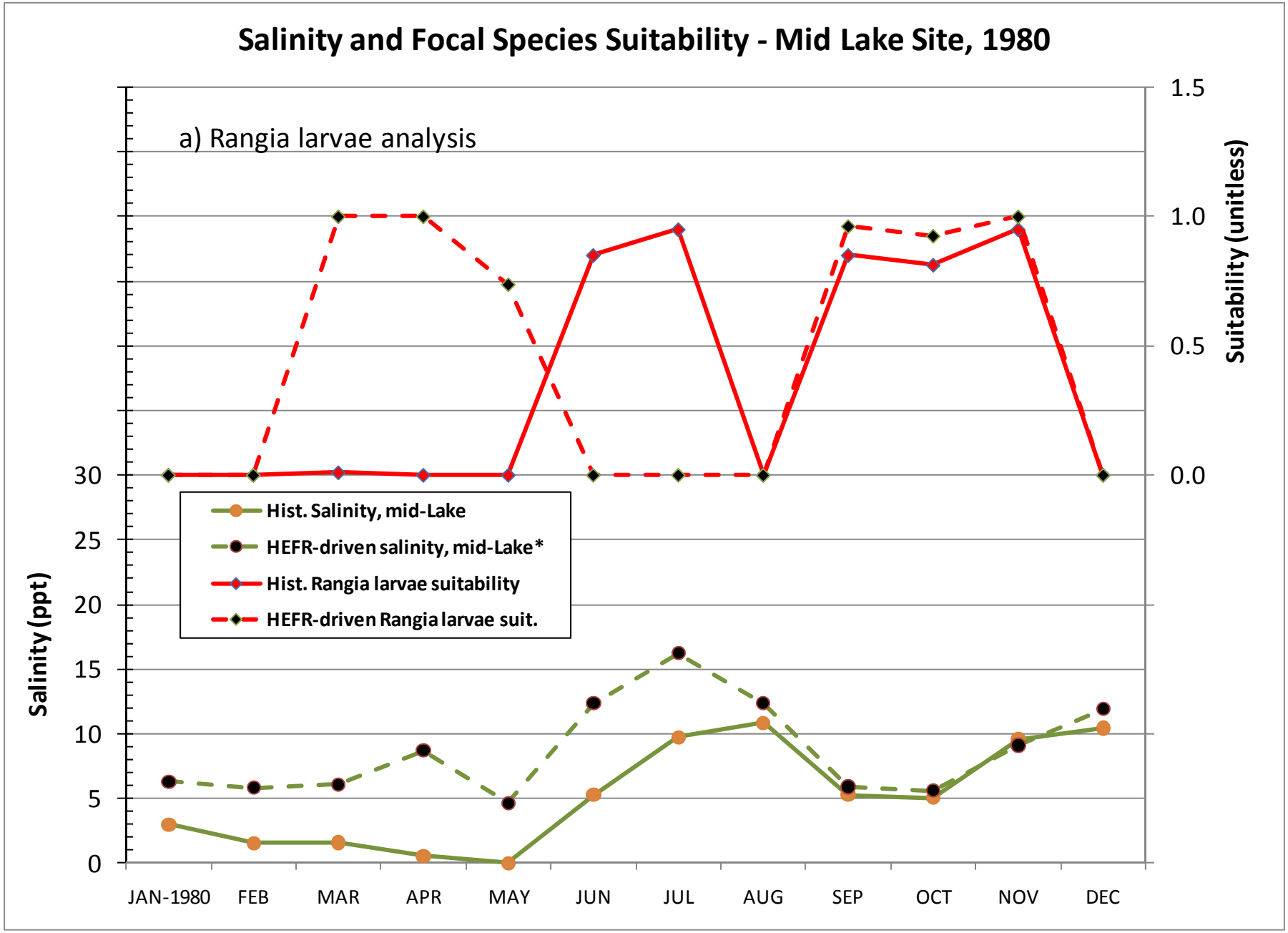

Total Freshwater Inflow (million ac-ft/mon)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
-
Historic Inflows (TWDB & USGS): 1996- 'very dry year'
HEFR Subsistence inflows
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

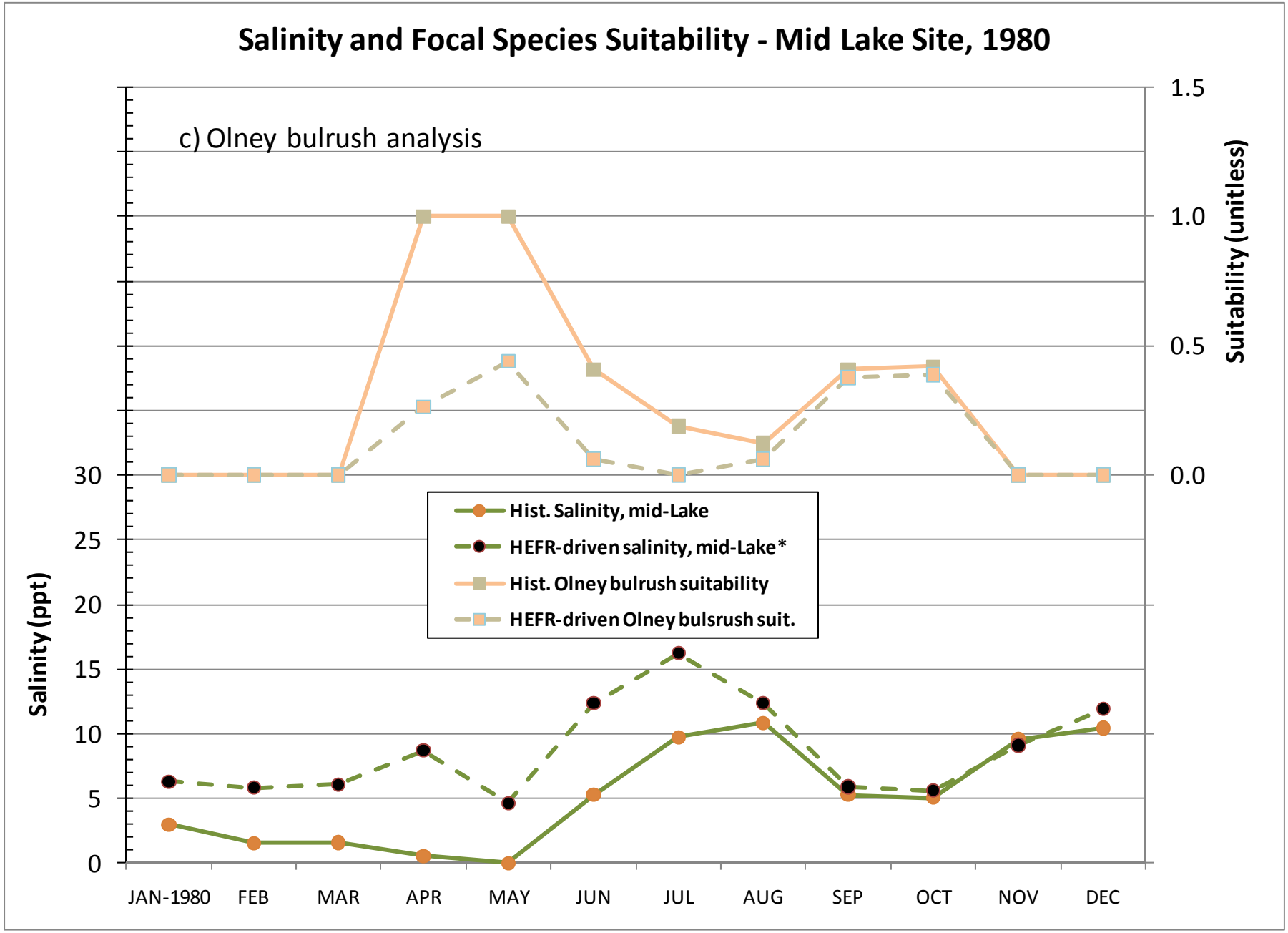

Bridge City
Port Neches
Groves
Port Arthur
BLB
USAB
MIDSAB
JOB
LOSAB
30.0°N
29.9°N
29.8°N
93.9°W
93.8°W
93.7°W

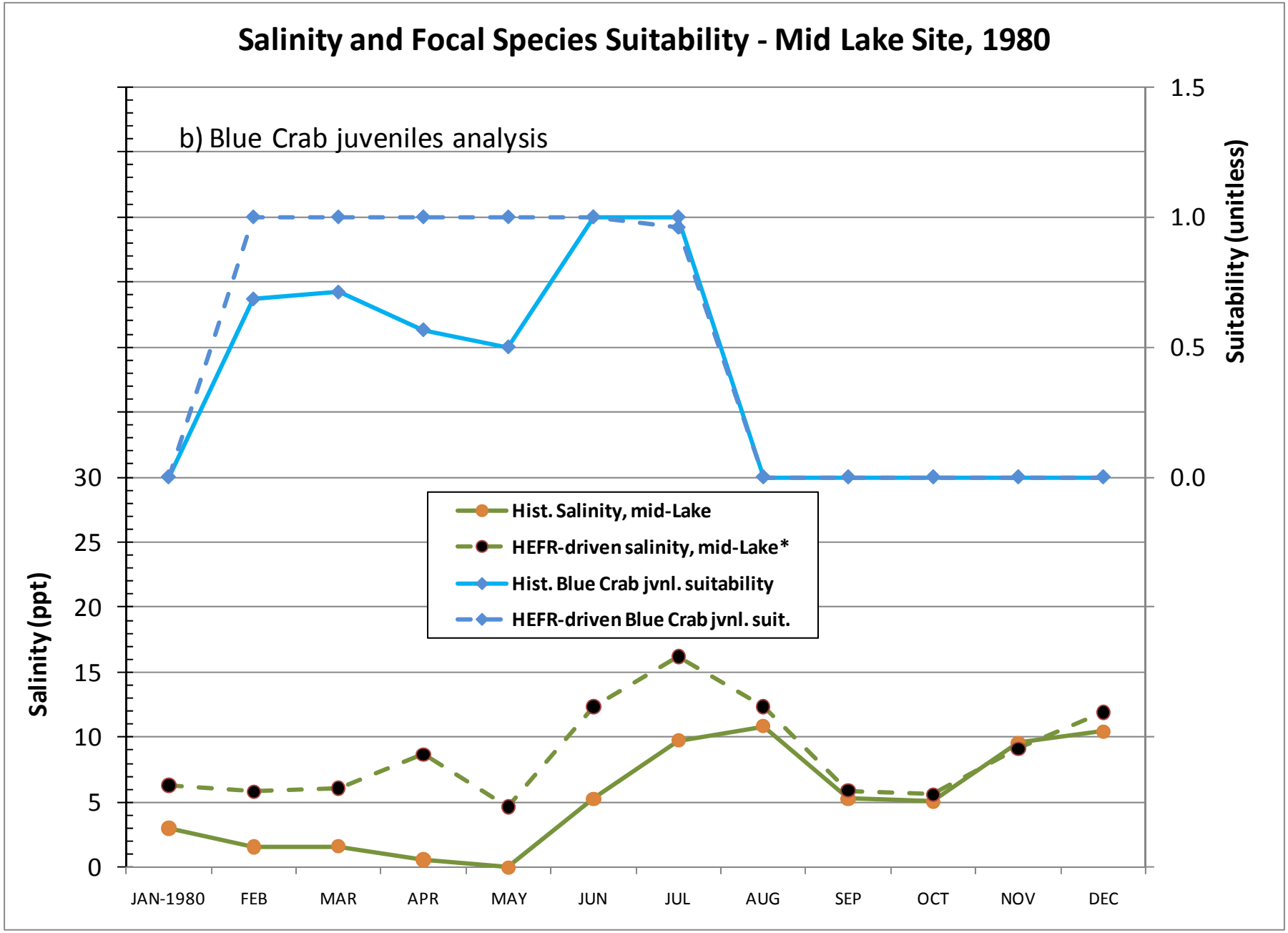

Blue Crab juveniles salinity suitability
Suitability (unitless)
1.00
0.80
0.60
0.40
0.20
0.00
0
5
10
15
20
25
30
35
40
45
Salinity (ppt)

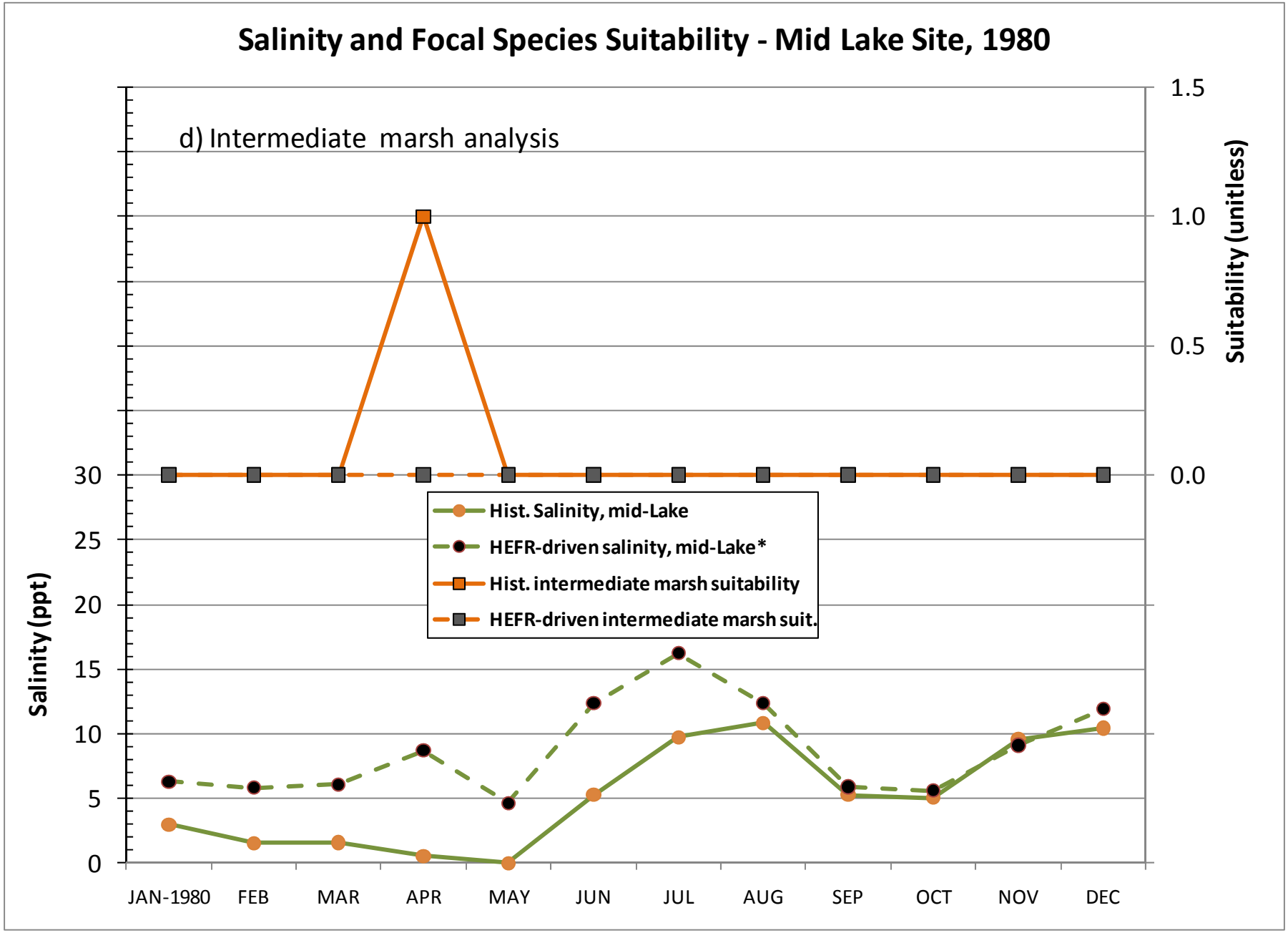

Rangia cuneata larvae-salinity suitability curve
Suitability
1.00
0.80
0.60
0.40
0.20
0.00
0
2
4
6
8
10
12
14
16
Salinity (ppt)


Olney bulrush (adults & seedlings)- suitability curve
Suitability
1.00
0.80
0.60
0.40
0.20
0.00
0
5
10
15
20
25
30
Salinty (ppt)


Salinity and Focal Species Suitability - Mid Lake Site, 1980
a) Rangia larvae analysis
Salinity (ppt)
Suitability (unitless)
0
5
10
15
20
25
30
0.0
0.5
1.0
1.5
JAN-1980
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Hist. Salinity, mid-Lake
HEFR-driven salinity, mid-Lake*
Hist. Rangia larvae suitability
HEFR-driven Rangia larvae suit.


Salinity and Focal Species Suitability - Mid Lake Site, 1980
c) Olney bulrush analysis
Salinity (ppt)
Suitability (unitless)
0
5
10
15
20
25
30
0.0
0.5
1.0
1.5
JAN-1980
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Hist. Salinity, mid-Lake
HEFR-driven salinity, mid-Lake*
Hist. Olney bulrush suitability
HEFR-driven Olney bulsrush suit.


Salinity and Focal Species Suitability - Mid Lake Site, 1980
b) Blue Crab juveniles analysis
Salinity (ppt)
Suitability (unitless)
0
5
10
15
20
25
30
0.0
0.5
1.0
1.5
JAN-1980
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Hist. Salinity, mid-Lake
HEFR-driven salinity, mid-Lake*
Hist. Blue Crab jvnl. suitability
HEFR-driven Blue Crab jvnl. suit.


Salinity and Focal Species Suitability - Mid Lake Site, 1980
d) Intermediate marsh analysis
Salinity (ppt)
Suitability (unitless)
0
5
10
15
20
25
30
0.0
0.5
1.0
1.5
JAN-1980
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Hist. Salinity, mid-Lake
HEFR-driven salinity, mid-Lake*
Hist. intermediate marsh suitability
HEFR-driven intermediate marsh suit.

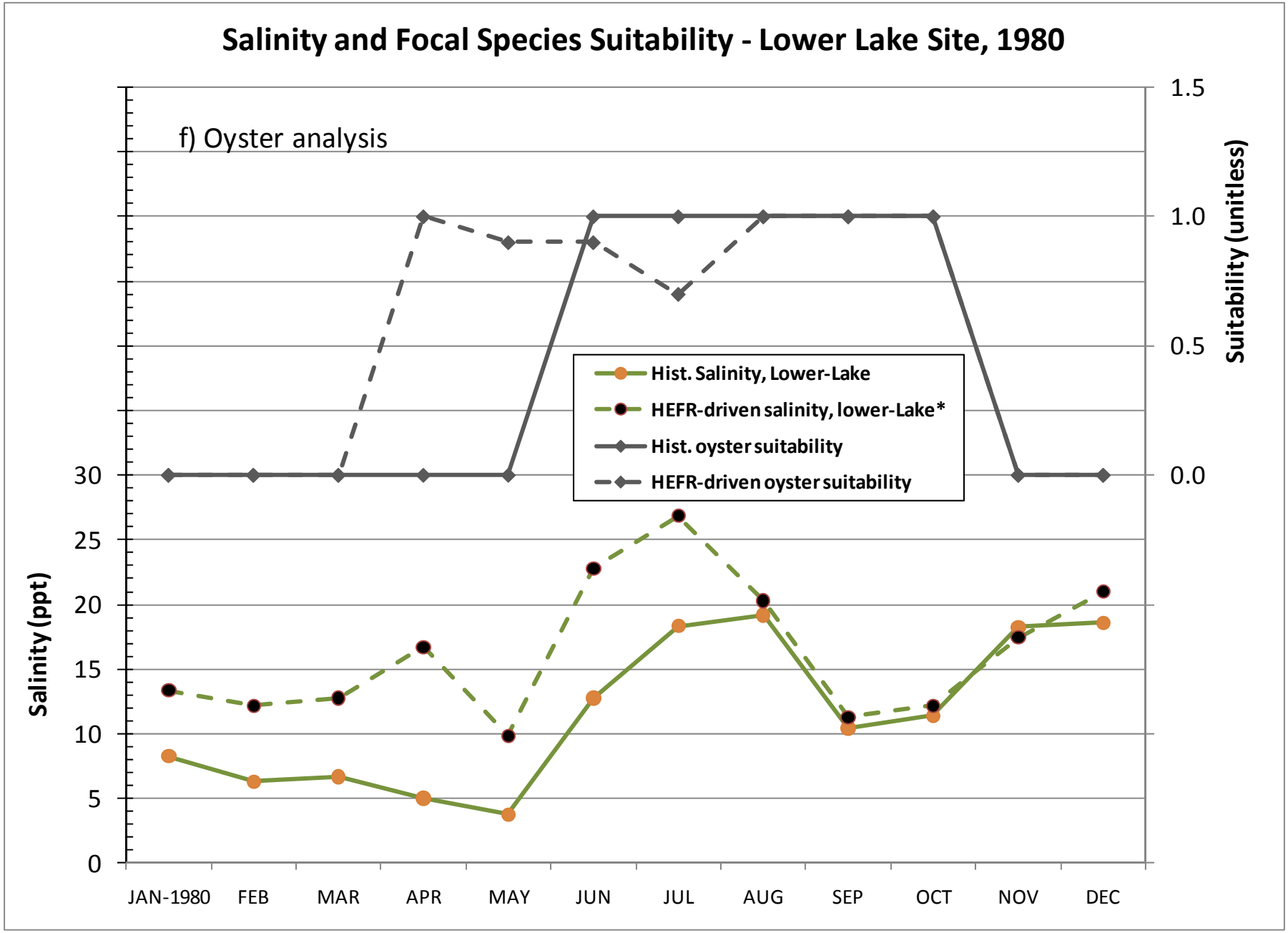

Salinity and Focal Species Suitability - Lower Lake Site, 1980
f) Oyster analysis
Hist. Salinity, Lower-Lake
HEFR-driven salinity, lower-Lake*
Hist. oyster suitability
HEFR-driven oyster suitability
Salinity (ppt)
Suitability (unitless)
0
5
10
15
20
25
30
0.0
0.5
1.0
1.5
JAN-1980
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

Table 3A) Upper-Lake: Substitute HEFR Base Average & High-tier seasonal pulses into all "avg." years.

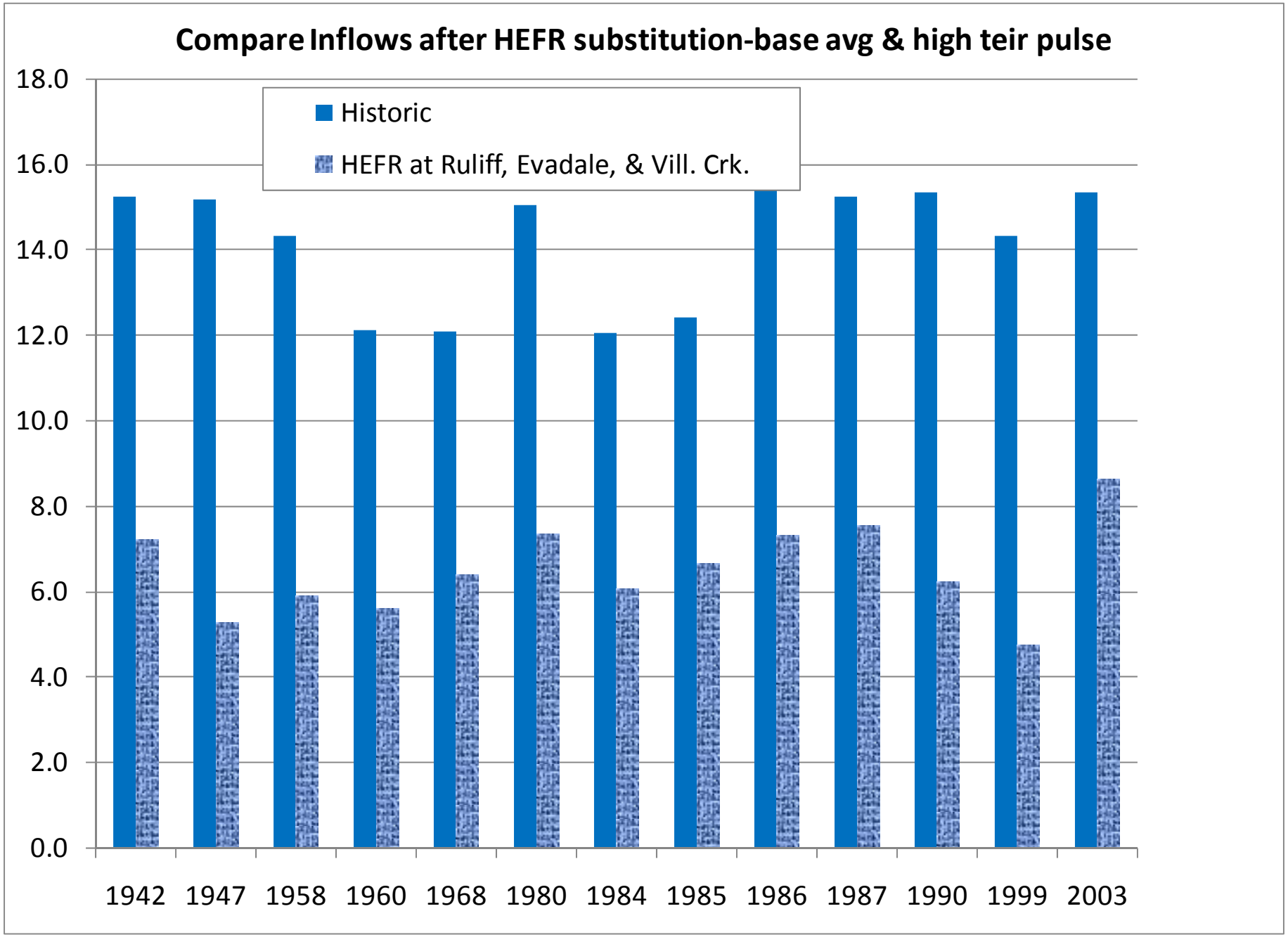
	Rangia larvae average suitability		Blue Crab average suitability		Olney Bulrush average suitability		Intermediate Marsh average suitability		Brackish Marsh average suitability	
Year	Hist.	HEFR	Hist.	HEFR	Hist.	HEFR	Hist.	HEFR	Hist.	HEFR
1942	0.271	0.740	0.743	1.000	0.697	0.308	0.429	0.000	0.286	0.857
1947	0.211	0.417	0.807	1.000	0.370	0.131	0.286	0.000	0.229	0.371
1958	0.564	0.514	0.895	1.000	0.592	0.195	0.429	0.000	0.443	0.521
1960	0.557	0.539	0.899	1.000	0.175	0.154	0.000	0.000	0.564	0.429
1968	0.730	0.517	0.904	1.000	0.531	0.233	0.414	0.000	0.707	0.571
1980	0.501	0.633	0.748	0.993	0.505	0.232	0.143	0.000	0.564	0.571
1984	0.635	0.444	0.884	1.000	0.275	0.147	0.000	0.000	0.729	0.286
1985	0.810	0.663	0.910	1.000	0.318	0.181	0.000	0.000	1.000	0.564
1986	0.719	0.499	0.890	1.000	0.478	0.206	0.143	0.000	0.700	0.421
1987	0.624	0.632	0.875	1.000	0.421	0.210	0.143	0.029	0.714	0.579
1990	0.448	0.515	0.686	1.000	0.573	0.189	0.300	0.000	0.443	0.429
1999	0.551	0.500	0.787	1.000	0.388	0.135	0.143	0.000	0.714	0.493
2003	0.659	0.924	0.873	1.000	0.445	0.383	0.171	0.143	0.800	0.850
avg.	0.560	0.580	0.839	0.999	0.444	0.208	0.200	0.013	0.607	0.534

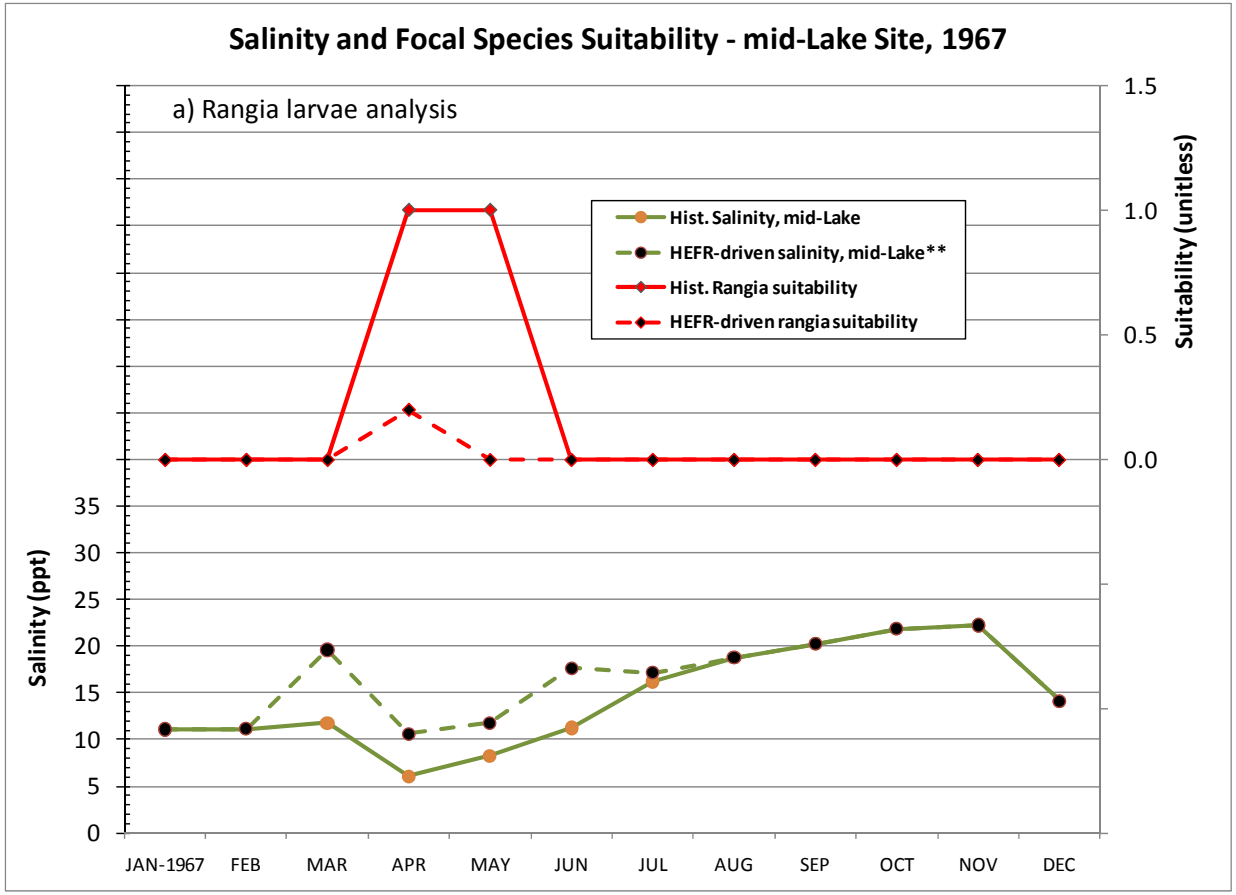
Table 3B) Mid-Lake: Substitute HEFR Base Average & High-tier seasonal pulses into all "avg." years.

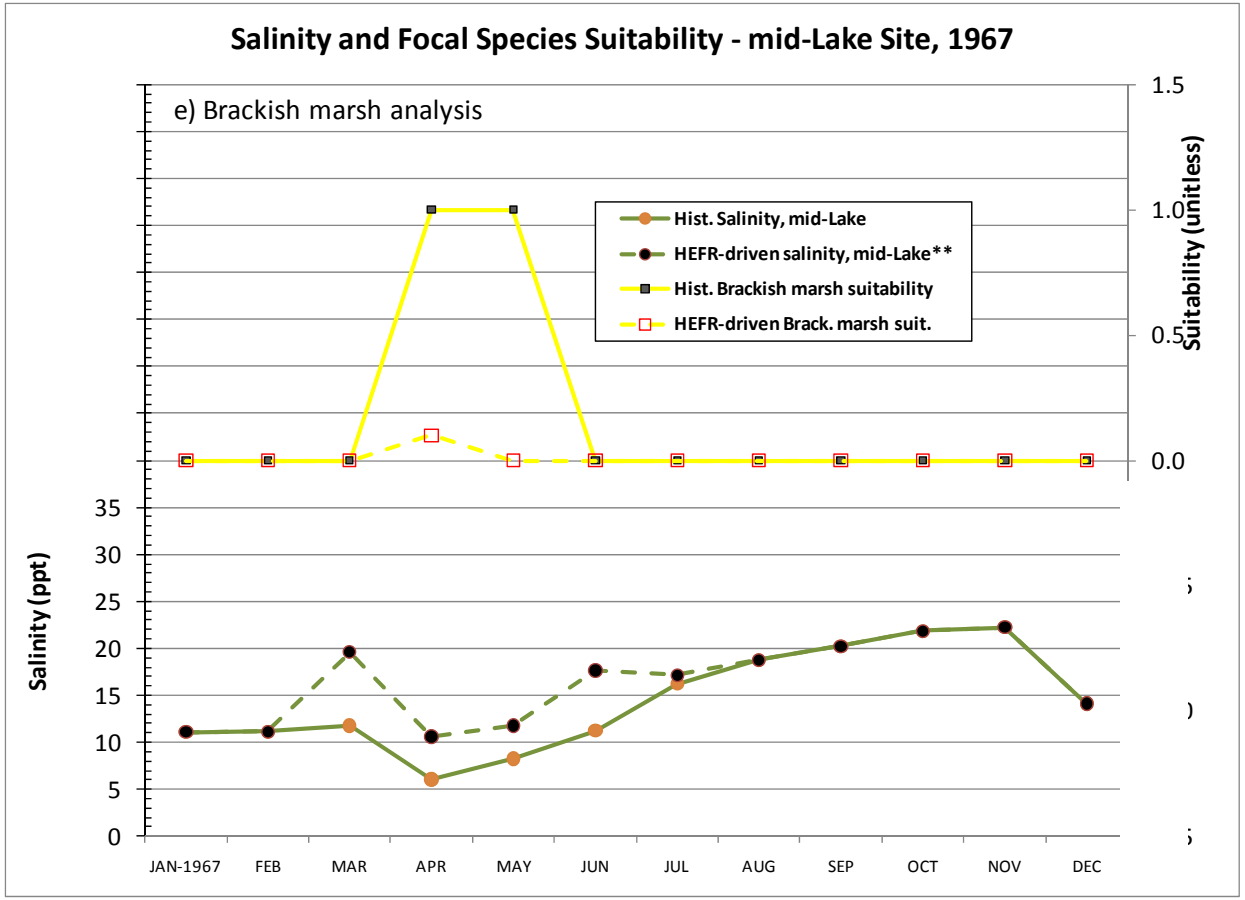
	Rangia larvae average suitability		Blue Crab average suitability		Olney Bulrush average suitability		Intermediate Marsh average suitability		Brackish Marsh average suitability	
Year	Hist.	HEFR	Hist.	HEFR	Hist.	HEFR	Hist.	HEFR	Hist.	HEFR
1942	0.263	0.732	0.739	1.000	0.698	0.309	0.429	0.000	0.286	0.857
1947	0.150	0.417	0.803	1.000	0.369	0.133	0.286	0.000	0.157	0.371
1958	0.533	0.510	0.886	1.000	0.592	0.189	0.429	0.000	0.443	0.521
1960	0.562	0.533	0.890	1.000	0.171	0.154	0.000	0.000	0.571	0.429
1968	0.715	0.513	0.882	1.000	0.610	0.227	0.300	0.000	0.564	0.571
1980	0.491	0.625	0.743	0.993	0.507	0.227	0.143	0.000	0.564	0.571
1984	0.631	0.436	0.879	1.000	0.277	0.150	0.000	0.000	0.729	0.286
1985	0.806	0.663	0.906	1.000	0.319	0.195	0.000	0.000	1.000	0.564
1986	0.689	0.481	0.890	1.000	0.480	0.204	0.143	0.029	0.700	0.414
1987	0.615	0.628	0.860	0.996	0.421	0.219	0.143	0.107	0.714	0.579
1990	0.458	0.528	0.678	1.000	0.571	0.191	0.300	0.000	0.443	0.429
1999	0.546	0.500	0.783	1.000	0.389	0.135	0.143	0.000	0.714	0.493
2003	0.590	0.910	0.873	1.000	0.445	0.380	0.171	0.143	0.729	0.843
avg.	0.542	0.575	0.832	0.999	0.450	0.209	0.191	0.021	0.586	0.533

Table 3C) Lower-Lake: Substitute HEFR Base Average & High-tier seasonal pulses into all "avg." years.

	Oysters average suitability		Blue Crab average suitability		Olney Bulrush average suitability		Intermediate Marsh average suitability		Brackish Marsh average suitability	
Year	Hist.	HEFR	Hist.	HEFR	Hist.	HEFR	Hist.	HEFR	Hist.	HEFR
1942	0.579	0.971	0.991	1.000	0.232	0.041	0.136	0.000	0.557	0.129
1947	0.693	0.936	0.973	0.920	0.099	0.009	0.000	0.000	0.286	0.000
1958	0.714	0.957	0.987	0.907	0.168	0.027	0.000	0.000	0.429	0.136
1960	0.979	0.979	0.940	0.893	0.000	0.000	0.000	0.000	0.000	0.000
1968	0.714	0.964	0.960	0.940	0.166	0.036	0.000	0.000	0.429	0.007
1980	0.714	0.929	0.976	0.873	0.175	0.052	0.107	0.000	0.300	0.136
1984	1.000	0.950	0.973	0.847	0.041	0.020	0.000	0.000	0.129	0.007
1985	1.000	0.993	0.993	0.907	0.033	0.001	0.000	0.000	0.000	0.000
1986	0.800	0.964	0.958	0.920	0.200	0.039	0.143	0.000	0.143	0.143
1987	0.886	0.900	1.000	0.960	0.089	0.039	0.000	0.000	0.150	0.143
1990	0.606	0.986	1.000	0.953	0.175	0.017	0.000	0.000	0.429	0.000
1999	0.880	0.957	0.982	0.927	0.086	0.000	0.000	0.000	0.143	0.000
2003	0.880	0.914	0.969	0.967	0.114	0.061	0.000	0.000	0.279	0.143
avg.	0.803	0.954	0.977	0.924	0.121	0.026	0.030	0.000	0.252	0.065


Compare Inflows after HEFR substitution-base avg & high teir pulse
Historic
HEFR at Ruliff, Evadale, & Vill. Crk.
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
1942
1947
1958
1960
1968
1980
1984
1985
1986
1987
1990
1999
2003


Salinity and Focal Species Suitability - mid-Lake Site, 1967
a) Rangia larvae analysis
Hist. Salinity, mid-Lake
HEFR-driven salinity, mid-Lake**
Hist. Rangia suitability
HEFR-driven rangia suitability
Salinity (ppt)
Suitability (unitless)
0
5
10
15
20
25
30
35
0.0
0.5
1.0
1.5
JAN-1967
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC


Salinity and Focal Species Suitability - mid-Lake Site, 1967
e) Brackish marsh analysis
Hist. Salinity, mid-Lake
HEFR-driven salinity, mid-Lake**
Hist. Brackish marsh suitability
HEFR-driven Brack. marsh suit.
Salinity (ppt)
Suitability (unitless)
0
5
10
15
20
25
30
35
0.0
0.5
1.0
1.5
JAN-1967
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

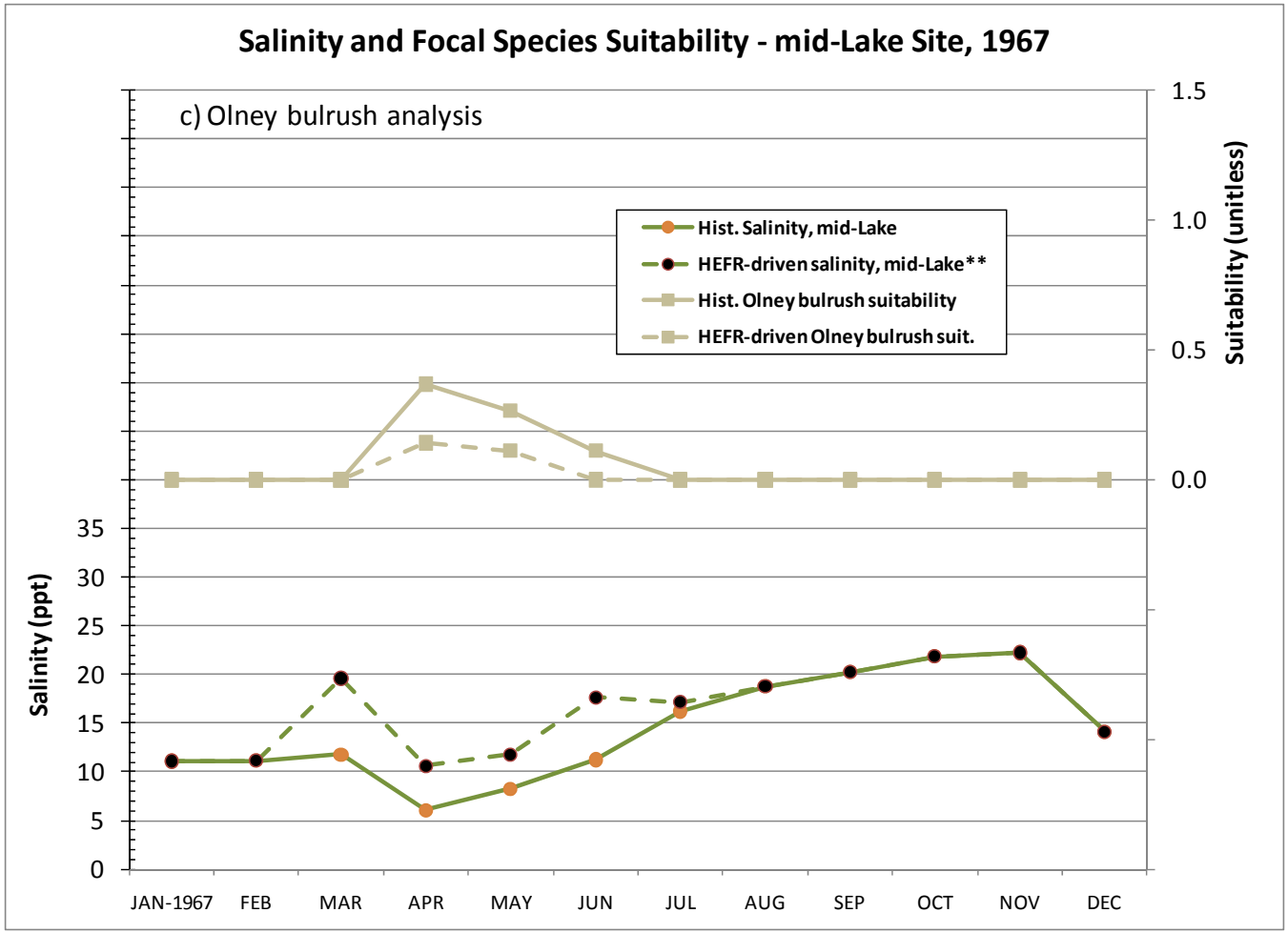

Salinity and Focal Species Suitability - mid-Lake Site, 1967
c) Olney bulrush analysis
Hist. Salinity, mid-Lake
HEFR-driven salinity, mid-Lake**
Hist. Olney bulrush suitability
HEFR-driven Olney bulrush suit.
Salinity (ppt)
Suitability (unitless)
0
5
10
15
20
25
30
35
0.0
0.5
1.0
1.5
JAN-1967
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

Table 4A) Upper-Lake: Substitute HEFR Subsistence values for Mar.-Jun. into all "very dry" years.

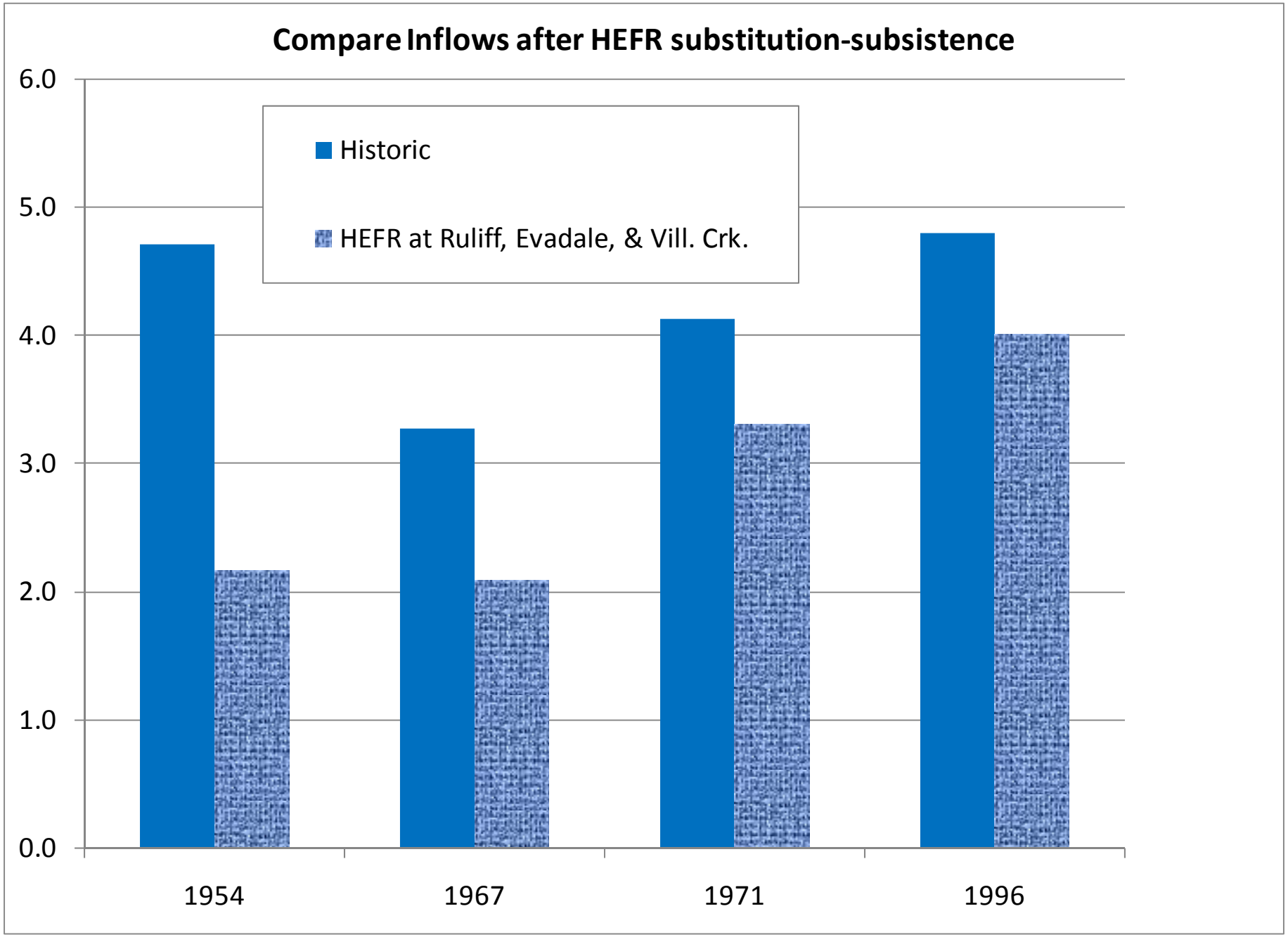
	Rangia larvae average suitability		Blue Crab average suitability		Olney Bulrush average suitability		Intermediate Marsh average suitability		Brackish Marsh average suitability	
Year	Hist.	HEFR	Hist.	HEFR	Hist.	HEFR	Hist.	HEFR	Hist.	HEFR
1954	0.298	0.000	0.993	0.759	0.136	0.000	0.129	0.000	0.421	0.000
1967	0.222	0.000	1.000	0.947	0.106	0.032	0.000	0.000	0.286	0.000
1971	0.106	0.000	1.000	0.813	0.017	0.016	0.000	0.000	0.000	0.000
1996	0.222	0.222	0.993	0.686	0.133	0.114	0.000	0.000	0.286	0.286
avg.	0.212	0.056	0.997	0.801	0.098	0.040	0.032	0.000	0.248	0.071

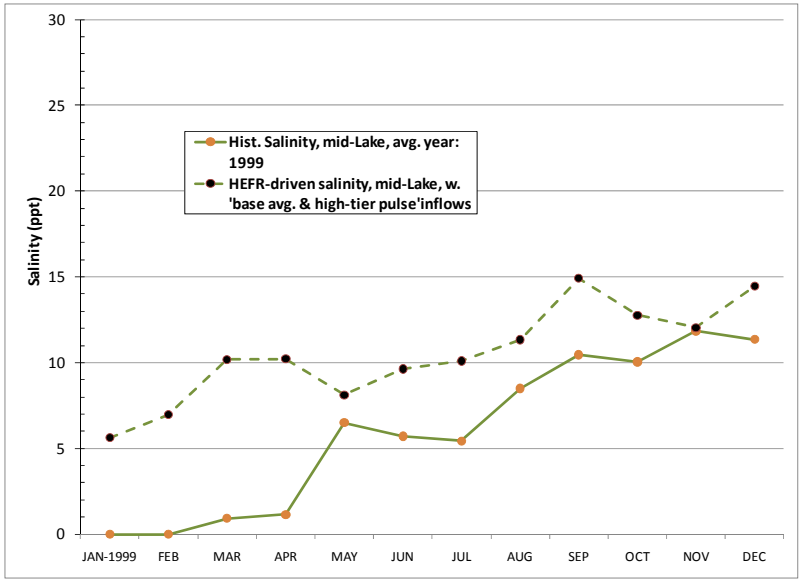
Table 4B) Mid-Lake: Substitute HEFR Subsistence values for Mar.-Jun. into all "very dry" years.

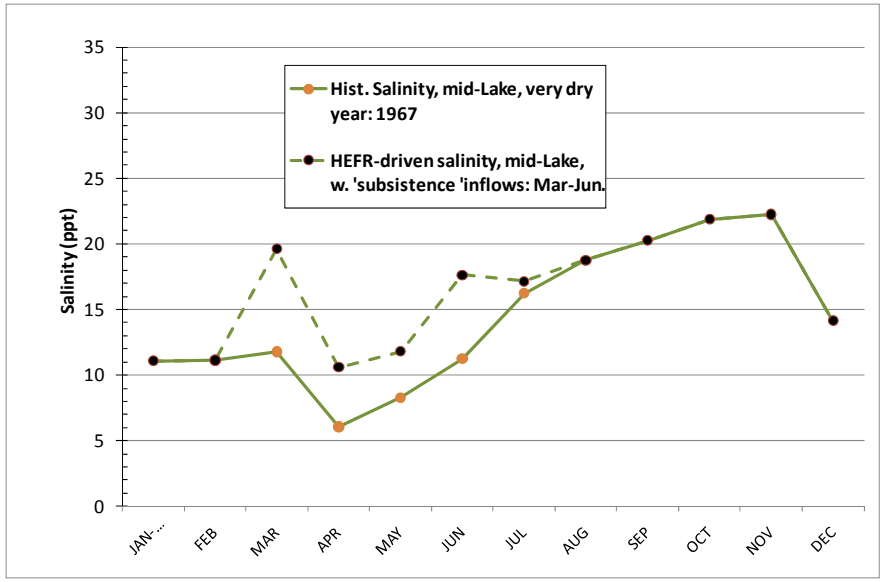
	Rangia larvae average suitability		Blue Crab average suitability		Olney Bulrush average suitability		Intermediate Marsh average suitability		Brackish Marsh average suitability	
Year	Hist.	HEFR	Hist.	HEFR	Hist.	HEFR	Hist.	HEFR	Hist.	HEFR
1954	0.281	0.000	0.987	0.766	0.208	0.000	0.143	0.000	0.293	0.000
1967	0.222	0.022	0.993	0.947	0.106	0.036	0.000	0.000	0.286	0.014
1971	0.111	0.000	1.000	0.813	0.017	0.016	0.000	0.000	0.000	0.000
1996	0.222	0.222	0.993	0.693	0.134	0.115	0.000	0.000	0.286	0.286
avg.	0.209	0.061	0.993	0.805	0.116	0.042	0.036	0.000	0.216	0.075

Table 4C) Lower-Lake: Substitute HEFR Subsistence values for Mar.-Jun. into all "very dry" years.

	Oysters average suitability		Blue Crab average suitability		Olney Bulrush average suitability		Intermediate Marsh average suitability		Brackish Marsh average suitability	
Year	Hist.	HEFR	Hist.	HEFR	Hist.	HEFR	Hist.	HEFR	Hist.	HEFR
1954	0.579	0.457	0.867	0.544	0.045	0.000	0.000	0.000	0.143	0.000
1967	0.693	0.629	0.820	0.652	0.016	0.000	0.000	0.000	0.000	0.000
1971	0.800	0.557	0.727	0.448	0.000	0.000	0.000	0.000	0.000	0.000
1996	0.929	0.714	0.740	0.478	0.016	0.016	0.000	0.000	0.000	0.000
avg.	0.750	0.589	0.788	0.530	0.019	0.004	0.000	0.000	0.036	0.000


Compare Inflows after HEFR substitution-subsistence
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Historic
HEFR at Ruliff, Evadale, & Vill. Crk.
1954
1967
1971
1996


Hist. Salinity, mid-Lake, avg. year: 1999
HEFR-driven salinity, mid-Lake, w. 'base avg. & high-tier pulse'inflows
Salinity (ppt)
30
25
20
15
10
5
0
JAN-1999
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC


Hist. Salinity, mid-Lake, very dry year: 1967
HEFR-driven salinity, mid-Lake, w. 'subsistence 'inflows: Mar-Jun.
Salinity (ppt)
35
30
25
20
15
10
5
0
JAN-...
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC