

Appendix F1: Life History Parameter Values Used to Evaluate I&E in the Gulf of Mexico Region

The tables in this appendix are those life history parameter values used by EPA to calculate age 1 equivalents, fishery yield, and production foregone from I&E data for the Gulf of Mexico region. Because of differences in the number of life stages represented in the loss data, there are cases where more than one life stage sequence was needed for a given species or species group. Alternative parameter sets were developed for this purpose and are indicated with a number following the species or species group name (i.e., Anchovies 1, Anchovies 2).

Table F1-1: Atlantic Croaker Life History Parameters				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	0.817	0	0	0.0000000128
Larvae	8.10	0	0	0.000000145
Juvenile	3.38	0	0	0.0000624
Age 1+	1.09	0.30	0.50	0.220
Age 2+	0.300	0.30	1.0	0.672
Age 3+	0.300	0.30	1.0	1.24
Age 4+	0.300	0.30	1.0	1.88
Age 5+	0.300	0.30	1.0	2.43
Age 6+	0.300	0.30	1.0	3.26
Age 7+	0.300	0.30	1.0	3.26
Age 8+	0.300	0.30	1.0	3.26

Source: PSE&G, 1999.

Table F1-2: Anchovies Parameters 1^{a,b}

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	1.94	0	0	0.0000000186
Polarvae	1.57	0	0	0.0000000441
Post larvae	6.12	0	0	0.00000235
Juvenile	1.29	0	0	0.000481
Age 1+	1.62	0	0	0.00381
Age 2+	1.62	0	0	0.00496
Age 3+	1.62	0	0	0.00505

^a Includes bay anchovy, striped anchovy, and other anchovies not identified to species.

^b Life history parameters applied to losses from Big Bend, Crystal River, Robinson, and Webster.

Sources: Derickson and Price, 1973; Leak and Houde, 1987; NMFS, 2003a; and PSE&G, 1999.

Table F1-3: Anchovies Parameters 2^{a,b}

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	1.94	0	0	0.0000000186
Larvae	7.70	0	0	0.00000158
Juvenile 1	0.0822	0	0	0.0000495
Juvenile 2	0.0861	0	0	0.000199
Juvenile 3	0.129	0	0	0.000532
Juvenile 4	0.994	0	0	0.00114
Age 1+	1.62	0	0	0.00381
Age 2+	1.62	0	0	0.00496
Age 3+	1.62	0	0	0.00505

^a Includes bay anchovy.

^b Life history parameters applied to losses from Big Bend and Webster.

Sources: Derickson and Price, 1973; Leak and Houde, 1987; NMFS, 2003a; and PSE&G, 1999.

Table F1-4: Black Drum Life History Parameters 1 ^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Egg	2.27	0	0	0.000000842
Prolarvae	3.06	0	0	0.000000926
Postlarvae	3.06	0	0	0.0000176
Juvenile	1.15	0.15	0.50	0.0327
Age 1+	0.0977	0.15	1.0	0.671
Age 2+	0.0977	0.15	1.0	1.70
Age 3+	0.0977	0.15	1.0	3.21
Age 4+	0.0977	0.15	1.0	5.15
Age 5+	0.0977	0.15	1.0	7.43
Age 6+	0.0977	0.15	1.0	9.93
Age 7+	0.0977	0.15	1.0	12.6
Age 8+	0.0977	0.15	1.0	15.3
Age 9+	0.0977	0.15	1.0	18.0
Age 10+	0.0977	0.15	1.0	20.7
Age 11+	0.0977	0.15	1.0	23.3
Age 12+	0.0977	0.15	1.0	25.7
Age 13+	0.0977	0.15	1.0	28.1
Age 14+	0.0977	0.15	1.0	30.2
Age 15+	0.0977	0.15	1.0	32.3
Age 16+	0.0977	0.15	1.0	34.1
Age 17+	0.0977	0.15	1.0	35.8
Age 18+	0.0977	0.15	1.0	37.4
Age 19+	0.0977	0.15	1.0	38.8
Age 20+	0.0977	0.15	1.0	40.1
Age 21+	0.0977	0.15	1.0	41.3
Age 22+	0.0977	0.15	1.0	42.4
Age 23+	0.0977	0.15	1.0	43.3
Age 24+	0.0977	0.15	1.0	44.2
Age 25+	0.0977	0.15	1.0	45.0
Age 26+	0.0977	0.15	1.0	45.7
Age 27+	0.0977	0.15	1.0	46.3
Age 28+	0.0977	0.15	1.0	46.8
Age 29+	0.0977	0.15	1.0	47.3
Age 30+	0.0977	0.15	1.0	47.8
Age 31+	0.0977	0.15	1.0	48.2
Age 32+	0.0977	0.15	1.0	48.5
Age 33+	0.0977	0.15	1.0	48.8
Age 34+	0.0977	0.15	1.0	49.1
Age 35+	0.0977	0.15	1.0	49.4
Age 36+	0.0977	0.15	1.0	49.6
Age 37+	0.0977	0.15	1.0	49.8
Age 38+	0.0977	0.15	1.0	50.0
Age 39+	0.0977	0.15	1.0	50.1
Age 40+	0.0977	0.15	1.0	50.3

^a Life history parameters applied to losses from Big Bend, Crystal River, and Robinson.

Sources: Bartell and Campbell, 2000; Froese and Pauly, 2001; Leard et al., 1993; Murphy and Taylor, 1989; Scott and Scott, 1988; Sutter et al., 1986; and personal communication with Michael D. Murphy, Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, January 23, 2002.

Table F1-5: Black Drum Life History Parameters 2^a

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Egg	2.27	0	0	0.000000842
Larvae	6.13	0	0	0.00000453
Juvenile	1.15	0.15	0.50	0.0327
Age 1+	0.0977	0.15	1.0	0.671
Age 2+	0.0977	0.15	1.0	1.70
Age 3+	0.0977	0.15	1.0	3.21
Age 4+	0.0977	0.15	1.0	5.15
Age 5+	0.0977	0.15	1.0	7.43
Age 6+	0.0977	0.15	1.0	9.93
Age 7+	0.0977	0.15	1.0	12.6
Age 8+	0.0977	0.15	1.0	15.3
Age 9+	0.0977	0.15	1.0	18.0
Age 10+	0.0977	0.15	1.0	20.7
Age 11+	0.0977	0.15	1.0	23.3
Age 12+	0.0977	0.15	1.0	25.7
Age 13+	0.0977	0.15	1.0	28.1
Age 14+	0.0977	0.15	1.0	30.2
Age 15+	0.0977	0.15	1.0	32.3
Age 16+	0.0977	0.15	1.0	34.1
Age 17+	0.0977	0.15	1.0	35.8
Age 18+	0.0977	0.15	1.0	37.4
Age 19+	0.0977	0.15	1.0	38.8
Age 20+	0.0977	0.15	1.0	40.1
Age 21+	0.0977	0.15	1.0	41.3
Age 22+	0.0977	0.15	1.0	42.4
Age 23+	0.0977	0.15	1.0	43.3
Age 24+	0.0977	0.15	1.0	44.2
Age 25+	0.0977	0.15	1.0	45.0
Age 26+	0.0977	0.15	1.0	45.7
Age 27+	0.0977	0.15	1.0	46.3
Age 28+	0.0977	0.15	1.0	46.8
Age 29+	0.0977	0.15	1.0	47.3
Age 30+	0.0977	0.15	1.0	47.8
Age 31+	0.0977	0.15	1.0	48.2
Age 32+	0.0977	0.15	1.0	48.5
Age 33+	0.0977	0.15	1.0	48.8
Age 34+	0.0977	0.15	1.0	49.1
Age 35+	0.0977	0.15	1.0	49.4
Age 36+	0.0977	0.15	1.0	49.6
Age 37+	0.0977	0.15	1.0	49.8
Age 38+	0.0977	0.15	1.0	50.0
Age 39+	0.0977	0.15	1.0	50.1
Age 40+	0.0977	0.15	1.0	50.3

^a Life history parameters applied to losses from Big Bend and Webster.

Sources: Able and Fahay, 1998; Bartell and Campbell, 2000; Froese and Pauly, 2001; Leard et al., 1993; Murphy and Taylor, 1989; Scott and Scott, 1988; Sutter et al., 1986; and personal communication with Michael D. Murphy, Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, January 23, 2002.

Table F1-6: Blue Crab Life History Parameters				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Zoeae	13.8	0	0	0.000000211
Megalops	1.30	0	0	0.00000291
Juvenile	1.73	0.48	0.50	0.00000293
Age 1+	1.00	1.0	1.0	0.00719
Age 2+	1.00	1.0	1.0	0.113
Age 3+	1.00	1.0	1.0	0.326

Sources: Hartman, 1993; Murphy and Nelson, 2000; and PSE&G, 1999.

Table F1-7: Commercial Shrimp Life History Parameters 1^{a,b}				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	3.22	0	0	0.0000000253
Prolarvae	1.70	0	0	0.00000274
Postlarvae	1.70	0	0	0.0000268
Juvenile	0.140	0.14	1.0	0.0473
Age 1+	0.140	0.14	1.0	0.0770

^a Includes pink shrimp, brown shrimp, white shrimp, and other commercial shrimp not identified to species.

^b Life history parameters applied to losses from Big Bend, Crystal River, Robinson, and Webster.

Sources: Bielsa et al., 1983; Costello and Allen, 1970; TBNEP, 1992b; and Stone & Webster Engineering Corporation, 1980.

Table F1-8: Commercial Shrimp Life History Parameters 2^{a,b}				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	3.22	0	0	0.0000000253
Larvae	3.40	0	0	0.00000274
Juvenile	0.140	0.14	1.0	0.0473
Age 1+	0.140	0.14	1.0	0.0770

^a Includes pink shrimp.

^b Life history parameters applied to losses from Big Bend.

Sources: Bielsa et al., 1983; Costello and Allen, 1970; TBNEP, 1992b; and Stone & Webster Engineering Corporation, 1980.

Table F1-9: Goby Life History Parameters^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	0.288	0	0	0.00000200
Larvae	4.09	0	0	0.00000219
Juvenile	2.30	0	0	0.00049
Age 1+	2.55	0	0	0.00205

^a Includes clown goby, code goby, frillfin goby, green goby, naked goby, sharptail goby, skilletfish, violet goby, and other goby species not identified to species.

Sources: Froese and Pauly, 2003; NMFS, 2003a; and PSE&G, 1999.

Table F1-10: Hogchoker Life History Parameters				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.24	0	0	0.000000487
Larvae	6.73	0	0	0.00110
Juvenile	0.916	0	0	0.00207
Age 1+	0.250	0	0	0.0113
Age 2+	0.250	0	0	0.0313
Age 3+	0.250	0	0	0.0610
Age 4+	0.250	0	0	0.0976
Age 5+	0.250	0	0	0.138
Age 6+	0.250	0	0	0.178

Sources: Able and Fahay, 1998; New England Power Company and Marine Research Inc., 1995; NMFS, 2003a; and PG&E National Energy Group, 2001.

Table F1-11: Jack/Pompano Species Life History Parameters^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	0.817	0	0	0.00000115
Larvae	8.61	0	0	0.00000127
Juvenile	0.916	0	0	0.0222
Age 1+	0.340	0.25	0.50	0.168
Age 2+	0.340	0.25	1.0	0.460
Age 3+	0.340	0.25	1.0	0.511
Age 4+	0.340	0.25	1.0	0.565

^a Includes Atlantic bumper, Atlantic moonfish, bluntnose jack, crevalle jack, leatherjacket, lookdown, and permit.

Sources: Florida Fish and Wildlife Conservation Commission, 2001; Froese and Pauly, 2003; Overholtz, 2002b; and PSE&G, 1999.

Table F1-12: Killifish Life History Parameters ^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.30	0	0	0.0000180
Larvae	3.00	0	0	0.0000182
Juvenile	0.916	0	0	0.000157
Age 1+	0.777	0	0	0.0121
Age 2+	0.777	0	0	0.0327
Age 3+	0.777	0	0	0.0551
Age 4+	0.777	0	0	0.0778
Age 5+	0.777	0	0	0.0967
Age 6+	0.777	0	0	0.113
Age 7+	0.777	0	0	0.158

^a Includes gulf killifish, longnose killifish, bayou killifish, and other killifish species not identified to species.

Sources: Able and Fahay, 1998; Carlander, 1969; Meredith and Lortich, 1979; NMFS, 2003a; and Stone & Webster Engineering Corporation, 1977.

Table F1-13: Mackerel Species Life History Parameters ^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.39	0	0	0.00000176
Larvae	10.6	0	0	0.00000193
Juvenile	0.916	0	0	0.0000368
Age 1+	0.520	0	0	0.309
Age 2+	0.370	0.25	0.50	0.510
Age 3+	0.370	0.25	1.0	0.639
Age 4+	0.370	0.25	1.0	0.752
Age 5+	0.370	0.25	1.0	0.825
Age 6+	0.370	0.25	1.0	0.918
Age 7+	0.370	0.25	1.0	1.02
Age 8+	0.370	0.25	1.0	1.10
Age 9+	0.370	0.25	1.0	1.13
Age 10+	0.370	0.25	1.0	1.15
Age 11+	0.370	0.25	1.0	1.22
Age 12+	0.370	0.25	1.0	1.22
Age 13+	0.370	0.25	1.0	1.22
Age 14+	0.370	0.25	1.0	1.22

^a Includes Spanish mackerel.

Sources: Entergy Nuclear Company, 2000; Froese and Pauly, 2001, 2003; Overholtz, 1991; Scott and Scott, 1988; and Studholme et al., 1999.

Table F1-14: Menhaden Life History Parameters^a

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.08	0	0	0.000000716
Larvae	5.71	0	0	0.00000203
Juvenile	2.85	0	0	0.000746
Age 1+	0.450	0	0	0.0937
Age 2+	0.450	0.8	0.50	0.356
Age 3+	0.450	0.8	1.0	0.679
Age 4+	0.450	0.8	1.0	0.974
Age 5+	0.450	0.8	1.0	1.21
Age 6+	0.450	0.8	1.0	1.38

^a Includes Alabama shad, Atlantic thread herring, finescale menhaden, gizzard shad, gulf menhaden, skipjack herring, yellowfin menhaden, and other closely related herrings not identified to species.

Sources: Able and Fahay, 1998; ASMFC, 2001b; Durbin et al., 1983; Entergy Nuclear Generation Company, 2000; Froese and Pauly, 2001; Ruppert et al., 1985; and U.S. Fish and Wildlife Service, 1978.

Table F1-15: Pinfish Life History Parameters^a

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.30	0	0	0.00000107
Larvae	7.39	0	0	0.0000238
Juvenile	1.91	0	0	0.00669
Age 1+	0.340	0.34	0.50	0.0791
Age 2+	0.340	0.34	1.0	0.218

^a Includes pinfish, spottail pinfish, and other porgies not identified to species.

Sources: Froese and Pauly, 2001; Muncy, 1984; and Nelson, 1998.

Table F1-16: Pipefish Life History Parameters^a

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.30	0	0	0.000000842
Larvae	2.40	0	0	0.0000122
Juvenile	0.916	0	0	0.00785
Age 1+	0.750	0	0	0.0195
Age 2+	0.750	0	0	0.0384
Age 3+	0.750	0	0	0.0658
Age 4+	0.750	0	0	0.103
Age 5+	0.750	0	0	0.151

^a Includes chain pipefish, dusky pipefish, gulf pipefish, and other pipefish not identified to species.

Sources: Able and Fahay, 1998; Froese and Pauly, 2001, 2003; NMFS, 2003a; Scott and Scott, 1988; and Stone & Webster Engineering Corporation, 1977.

Table F1-17: Red Drum Life History Parameters

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Egg	2.27	0	0	0.000000842
Prolarvae	3.06	0	0	0.000000926
Postlarvae	3.06	0	0	0.0000176
Juvenile	1.15	0.15	0.50	0.0327
Age 1+	0.0977	0.15	1.0	0.671
Age 2+	0.0977	0.15	1.0	1.70
Age 3+	0.0977	0.15	1.0	3.21
Age 4+	0.0977	0.15	1.0	5.15
Age 5+	0.0977	0.15	1.0	7.43
Age 6+	0.0977	0.15	1.0	9.93
Age 7+	0.0977	0.15	1.0	12.6
Age 8+	0.0977	0.15	1.0	15.3
Age 9+	0.0977	0.15	1.0	18.0
Age 10+	0.0977	0.15	1.0	20.7
Age 11+	0.0977	0.15	1.0	23.3
Age 12+	0.0977	0.15	1.0	25.7
Age 13+	0.0977	0.15	1.0	28.1
Age 14+	0.0977	0.15	1.0	30.2
Age 15+	0.0977	0.15	1.0	32.3
Age 16+	0.0977	0.15	1.0	34.1
Age 17+	0.0977	0.15	1.0	35.8
Age 18+	0.0977	0.15	1.0	37.4
Age 19+	0.0977	0.15	1.0	38.8
Age 20+	0.0977	0.15	1.0	40.1
Age 21+	0.0977	0.15	1.0	41.3
Age 22+	0.0977	0.15	1.0	42.4
Age 23+	0.0977	0.15	1.0	43.3
Age 24+	0.0977	0.15	1.0	44.2
Age 25+	0.0977	0.15	1.0	45.0
Age 26+	0.0977	0.15	1.0	45.7
Age 27+	0.0977	0.15	1.0	46.3
Age 28+	0.0977	0.15	1.0	46.8
Age 29+	0.0977	0.15	1.0	47.3
Age 30+	0.0977	0.15	1.0	47.8
Age 31+	0.0977	0.15	1.0	48.2
Age 32+	0.0977	0.15	1.0	48.5
Age 33+	0.0977	0.15	1.0	48.8
Age 34+	0.0977	0.15	1.0	49.1
Age 35+	0.0977	0.15	1.0	49.4
Age 36+	0.0977	0.15	1.0	49.6
Age 37+	0.0977	0.15	1.0	49.8
Age 38+	0.0977	0.15	1.0	50.0
Age 39+	0.0977	0.15	1.0	50.1
Age 40+	0.0977	0.15	1.0	50.3

Sources: Bartell and Campbell, 2000; Froese and Pauly, 2001; Leard et al., 1993; Murphy and Taylor, 1989; Scott and Scott, 1988; Sutter et al., 1986; and personal communication with Michael D. Murphy, Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, January 23, 2002.

Table F1-18: Scaled Sardine Life History Parameters ^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.12	0	0	0.00000533
Prolarvae	0.560	0	0	0.00000586
Postlarvae	6.53	0	0	0.0000247
Juvenile	0.916	0	0	0.000483
Age 1+	1.02	0	0	0.275

^a Includes Brazilian sardinella, scaled sardine, threadfin shad, and other clupeids not identified to species.

Sources: Froese and Pauly, 2003; Houde et al., 1974; NMFS, 2003a; Pierce et al., 2001; and Stone & Webster Engineering Corporation, 1980.

Table F1-19: Sea Bass Species Life History Parameters ^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lb)
Egg	0.288	0	0	0.00000101
Larvae	6.00	0	0	0.00000111
Juvenile	0.190	0	0	0.000581
Age 1+	0.190	0	0	0.0313
Age 2+	0.190	0	0	0.0625
Age 3+	0.190	0	0	0.125
Age 4+	0.190	0	0	0.312
Age 5+	0.190	0.26	0.50	0.531
Age 6+	0.190	0.26	1.0	0.813
Age 7+	0.287	0.26	1.0	1.13
Age 8+	0.287	0.26	1.0	1.50
Age 9+	0.287	0.26	1.0	1.88
Age 10+	0.287	0.26	1.0	2.19

^a Includes black sea bass.

Sources: Cailliet, 2000; California Department of Fish and Game, 2000b; Froese and Pauly, 2002; and Leet et al., 2001.

Table F1-20: Searobin Life History Parameters ^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.30	0	0	0.00000132
Larvae	3.66	0	0	0.00000145
Juvenile	0.916	0	0	0.000341
Age 1+	0.420	0.10	0.50	0.0602
Age 2+	0.420	0.10	1.0	0.176
Age 3+	0.420	0.10	1.0	0.267
Age 4+	0.420	0.10	1.0	0.386
Age 5+	0.420	0.10	1.0	0.537
Age 6+	0.420	0.10	1.0	0.721
Age 7+	0.420	0.10	1.0	0.944
Age 8+	0.420	0.10	1.0	1.21

^a Includes bighead searobin, leopard searobin, and other searobins not identified to species.

Sources: Froese and Pauly, 2001, 2003; Saila et al., 1997; and Virginia Tech, 1998.

Table F1-21: Sheepshead Seabream Life History Parameters				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.30	0	0	0.000000591
Larvae	7.39	0	0	0.0000241
Juvenile	1.91	0	0	0.00167
Age 1+	1.98	0	0	0.981
Age 2+	1.98	0	0	1.22
Age 3+	1.98	0.45	0.50	1.56
Age 4+	1.98	0.45	1.0	2.33
Age 5+	1.98	0.45	1.0	2.43
Age 6+	1.98	0.45	1.0	2.45
Age 7+	1.98	0.45	1.0	2.47
Age 8+	1.98	0.45	1.0	2.49
Age 9+	1.98	0.45	1.0	2.51
Age 10+	1.98	0.45	1.0	2.53
Age 11+	1.98	0.45	1.0	2.55
Age 12+	1.98	0.45	1.0	2.57
Age 13+	1.98	0.45	1.0	2.59
Age 14+	1.98	0.45	1.0	2.61
Age 15+	1.98	0.45	1.0	2.63
Age 16+	1.98	0.45	1.0	2.65

Sources: Froese and Pauly, 2002; Murphy and MacDonald, 2000; Murphy et al., 2000; Nelson, 1998; Pattillo et al., 1997; and personal communication with Michael D. Murphy, Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, January 23, 2002.

Table F1-22: Silver Perch Life History Parameters 1 ^{a,b}				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.75	0	0	0.000000527
Prolarvae	2.10	0	0	0.000000580
Postlarvae	3.27	0	0	0.0000379
Juvenile	1.71	0	0	0.0445
Age 1+	3.84	0	0	0.273
Age 2+	3.84	0.10	0.50	4.15
Age 3+	3.84	0.10	1.0	0.607

^a Includes banded drum, silver perch, silver seatrout, southern kingfish, and star drum.

^b Life history parameters applied to losses from Crystal River, Robinson, and Webster.

Sources: Able and Fahay, 1998; Florida Fish and Wildlife Conservation Commission, 2001; Froese and Pauly, 2001, 2003; PSE&G, 1999; and personal communication with Michael D. Murphy, Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, January 23, 2002.

Table F1-23: Silver Perch Life History Parameters 2 ^{a,b}				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.75	0	0	0.000000527
Larvae	5.37	0	0	0.00000771
Juvenile	1.71	0	0	0.0445
Age 1+	3.84	0	0	0.273
Age 2+	3.84	0.10	0.50	0.415
Age 3+	3.84	0.10	1.0	0.607

^a Includes silver perch, northern kingfish, and southern kingfish.

^b Life history parameters applied to losses from Big Bend.

Sources: Able and Fahay, 1998; Florida Fish and Wildlife Conservation Commission, 2001; Froese and Pauly, 2001, 2003; PSE&G, 1999; and personal communication with Michael D. Murphy, Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, January 23, 2002.

Table F1-24: Silverside Life History Parameters ^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.30	0	0	0.000000487
Prolarvae	1.45	0	0	0.000000554
Postlarvae	1.45	0	0	0.000000554
Juvenile	0.916	0	0	0.0000292
Age 1+	2.10	0	0	0.0119
Age 2+	2.10	0	0	0.0224

^a Includes California grunion, inland silverside, rough silverside, tidewater silverside, and other silversides not identified to the species.

Sources: Froese and Pauly, 2001; Garwood, 1968; Hildebrand, 1922; NMFS, 2003a; Scott and Scott, 1988; Stone & Webster Engineering Corporation, 1977, 1980.

Table F1-25: Spot Life History Parameters 1^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	0.825	0	0	0.000000131
Prolarvae	3.30	0	0	0.000000154
Postlarvae	4.12	0	0	0.000000854
Juvenile	2.57	0	0	0.000121
Age 1+	0.463	0.4	1.0	0.0791
Age 2+	0.400	0.4	1.0	0.299
Age 3+	0.400	0.4	1.0	0.507
Age 4+	0.400	0.4	1.0	0.648
Age 5+	0.400	0.4	1.0	0.732
Age 6+	0.400	0.4	1.0	0.779
Age 7+	0.400	0.4	1.0	0.779
Age 8+	0.400	0.4	1.0	0.779
Age 9+	0.400	0.4	1.0	0.779
Age 10+	0.400	0.4	1.0	0.779
Age 11+	0.400	0.4	1.0	0.779
Age 12+	0.400	0.4	1.0	0.779
Age 13+	0.400	0.4	1.0	0.779
Age 14+	0.400	0.4	1.0	0.779
Age 15+	0.400	0.4	1.0	0.779

^a Life history parameters applied to losses from Crystal River and Robinson.

Sources: PSE&G, 1984b, 1999; and Warlen et al., 1980.

Table F1-26: Spot Life History Parameters 2^a

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	0.825	0	0	0.000000131
Larvae	7.42	0	0	0.000000504
Juvenile	2.57	0	0	0.000121
Age 1+	0.463	0.4	1.0	0.0791
Age 2+	0.400	0.4	1.0	0.299
Age 3+	0.400	0.4	1.0	0.507
Age 4+	0.400	0.4	1.0	0.648
Age 5+	0.400	0.4	1.0	0.732
Age 6+	0.400	0.4	1.0	0.779
Age 7+	0.400	0.4	1.0	0.779
Age 8+	0.400	0.4	1.0	0.779
Age 9+	0.400	0.4	1.0	0.779
Age 10+	0.400	0.4	1.0	0.779
Age 11+	0.400	0.4	1.0	0.779
Age 12+	0.400	0.4	1.0	0.779
Age 13+	0.400	0.4	1.0	0.779
Age 14+	0.400	0.4	1.0	0.779
Age 15+	0.400	0.4	1.0	0.779

^a Life history parameters applied to losses from Webster.

Sources: PSE&G, 1984b, 1999; and Warlen et al., 1980.

Table F1-27: Spotted Seatrout Life History Parameters 1^{a,b}

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.30	0	0	0.000000842
Prolarvae	1.50	0	0	0.000000926
Postlarvae	6.92	0	0	0.00000568
Juvenile	0.272	0.27	0.50	0.571
Age 1+	0.272	0.27	1.0	0.914
Age 2+	0.272	0.27	1.0	1.55
Age 3+	0.272	0.27	1.0	2.50
Age 4+	0.272	0.27	1.0	3.15
Age 5+	0.272	0.27	1.0	3.54
Age 6+	0.272	0.27	1.0	4.41
Age 7+	0.272	0.27	1.0	4.97
Age 8+	0.272	0.27	1.0	4.99

^a Includes sand seatrout, sand weakfish, spotted seatrout, and other drums not identified to species.

^b Life history parameters applied to losses from Big Bend, Crystal River, and Robinson.

Sources: Johnson and Seaman, 1986; Murphy and Taylor, 1994; Stone & Webster Engineering Corporation, 1980; and Sutter et al., 1986.

Table F1-28: Spotted Seatrout Life History Parameters 2^{a,b}				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.30	0	0	0.000000842
Larvae	8.42	0	0	0.000000926
Juvenile	0.272	0.27	0.50	0.571
Age 1+	0.272	0.27	1.0	0.914
Age 2+	0.272	0.27	1.0	1.55
Age 3+	0.272	0.27	1.0	2.50
Age 4+	0.272	0.27	1.0	3.15
Age 5+	0.272	0.27	1.0	3.54
Age 6+	0.272	0.27	1.0	4.41
Age 7+	0.272	0.27	1.0	4.97
Age 8+	0.272	0.27	1.0	4.99

^a Includes sand seatrout and spotted seatrout.

^b Life history parameters applied to losses from Webster.

Sources: Johnson and Seaman, 1986; Murphy and Taylor, 1994; Stone & Webster Engineering Corporation, 1980; and Sutter et al., 1986.

Table F1-29: Stone Crab Life History Parameters				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Stage 1	1.97	0	0	0.000000101
Stage 2	1.97	0	0	0.000000417
Stage 3	1.97	0	0	0.00000109
Stage 4	1.97	0	0	0.00000226
Stage 5	1.97	0	0	0.00000405
Megalops	1.97	0	0	0.00000662
Juvenile	1.97	0	0	0.0000182
Age 1+	0.939	0.75	0.50	1.02
Age 2+	0.939	0.75	1.0	3.63
Age 3+	0.939	0.75	1.0	7.12
Age 4+	0.939	0.75	1.0	10.0

Sources: Bert et al., 1978; Ehrhardt et al., 1990; Lindberg and Marshall, 1984; Sullivan, 1979; and Van Den Avyle and Fowler, 1984.

Table F1-30: Striped Mullet Life History Parameters				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	1.90	0	0	0.000000537
Larvae	4.61	0	0	0.0000110
Juvenile	0.916	0	0	0.131
Age 1+	0.230	0.30	0.50	0.187
Age 2+	0.230	0.30	1.0	0.379
Age 3+	0.230	0.30	1.0	0.774
Age 4+	0.230	0.30	1.0	1.58
Age 5+	0.230	0.30	1.0	3.21
Age 6+	0.230	0.30	1.0	6.53

Sources: Collins, 1985; Froese and Pauly, 2003; PSE&G, 1999; and Wang, 1986.

Table F1-31: Other Commercial Species Life History Parameters^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.08	0	0	0.000000716
Larvae	5.71	0	0	0.00000204
Juvenile	2.85	0	0	0.000746
Age 1+	0.450	0	0	0.0937
Age 2+	0.450	0.80	0.50	0.356
Age 3+	0.450	0.80	1.0	0.679
Age 4+	0.450	0.80	1.0	0.974
Age 5+	0.450	0.80	1.0	1.21
Age 6+	0.450	0.80	1.0	1.38

^a Includes Atlantic cutlassfish, black bullhead, cobia, grey snapper, gulf butterfish, ladyfish, largehead hairtail, mojarra spp., silver jenny, spotfin mojarra, tripletail, and yellow bullhead.

Sources: Able and Fahay, 1998; ASMFC, 2001b; Durbin et al., 1983; Entergy Nuclear Generation Company, 2000; PSE&G, 1999; Ruppert et al., 1985; and U.S. Fish and Wildlife Service, 1978.

Table F1-32: Other Recreational Species Life History Parameters^a

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.08	0	0	0.000000716
Larvae	5.71	0	0	0.00000204
Juvenile	2.85	0	0	0.000746
Age 1+	0.450	0	0	0.0937
Age 2+	0.450	0.80	0.50	0.356
Age 3+	0.450	0.80	1.0	0.679
Age 4+	0.450	0.80	1.0	0.974
Age 5+	0.450	0.80	1.0	1.21
Age 6+	0.450	0.80	1.0	1.38

^a See Table F1-34 for a list of species.

Sources: Able and Fahay, 1998; ASMFC, 2001b; Durbin et al., 1983; Entergy Nuclear Generation Company, 2000; PSE&G, 1999; Ruppert et al., 1985; and U.S. Fish and Wildlife Service, 1978.

Table F1-33: Other Forage Species Life History Parameters^a

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	1.04	0	0	0.0000000186
Larvae	7.70	0	0	0.00000158
Juvenile	1.29	0	0	0.000481
Age 1+	1.62	0	0	0.00381
Age 2+	1.62	0	0	0.00496
Age 3+	1.62	0	0	0.00505

^a See Table F1-35 for a list of species.

Sources: Derickson and Price, 1973; and PSE&G, 1999.

Table F1-34: Other Recreational Species^a

Atlantic sharpnose shark	Bonnethead	Hardhead sea catfish	Smooth butterfly ray
Atlantic stingray	Channel catfish	Least puffer	Smooth puffer
Bandtail puffer	Dwarf sandperch	Pigfish	Southern flounder
Belted sandfish	Gafftopsail catfish	Rock sea bass	Southern puffer
Blackear bass	Gag grouper	Sand perch	Tomate
Bluefish	Gulf toadfish	Sea catfish	

^a Includes other organisms not identified to species.

Table F1-35: Other Forage Species^a

Atlantic midshipman	Dwarf seahorse	Jawfish	Seahorse
Atlantic needlefish	Fat sleeper	Lined seahorse	Sheepshead minnow
Atlantic spadefish	Feather blenny	Live sharksucker	Snakefish
Atlantic threadfin	Florida blenny	Longear sunfish	Southern codling
Barbfish	Freckled blenny	Mottled jawfish	Southern hake
Bay whiff	Fringed filefish	Needlefish	Southern stargazer
Blackcheek tonguefish	Fringed flounder	Orange filefish	Spotted whiff
Blackwing flyingfish	Golden shiner	Planehead filefish	Striped blenny
Bluegill	Green sunfish	Polka dot batfish	Striped burrfish
Bridle cardinalfish	Gulf of Mexico ocellated flounder	Redfin needlefish	Warmouth
Carp	Halfbeak	Roughback batfish	Yellowhead jawfish
Common halfbeak	Harvestfish	Sailfin molly	
Diamond lizardfish	Inshore lizardfish	Scrawled cowfish	

^a Includes other organisms not identified to species.