Jim Woodruff Dam

Section 7 Consultation

Hydrological Modeling Technical Workshop II

12 July 2006

Endangered Species Act of 1973 Section 7 Consultation

- "All Federal agencies shall, in consultation with and with the assistance of the Secretary of the Interior/Commerce, insure that any actions authorized, funded, or carried out by them do not jeopardize the continued existence of any endangered species or threatened species, or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary (Interior/Commerce) to be critical, unless an exception has been granted by the Endangered Species Committee."

Federally Listed Species and Critical Habitat on Apalachicola River

- Gulf sturgeon – listed as threatened in Sep 1991
- Gulf sturgeon critical habitat listed Mar 2003
- Fat threeridge mussel – listed as endangered in Mar 1998
- Purple bankclimber mussel – listed as threatened in Mar 1998
- USFWS also proposed critical habitat for listed mussels on 6 June 2006 – includes Apalachicola River

ESA-listed species on Apalachicola River

Gulf sturgeon

Fat threeridge

Purple bankclimber

Section 7 Consultation

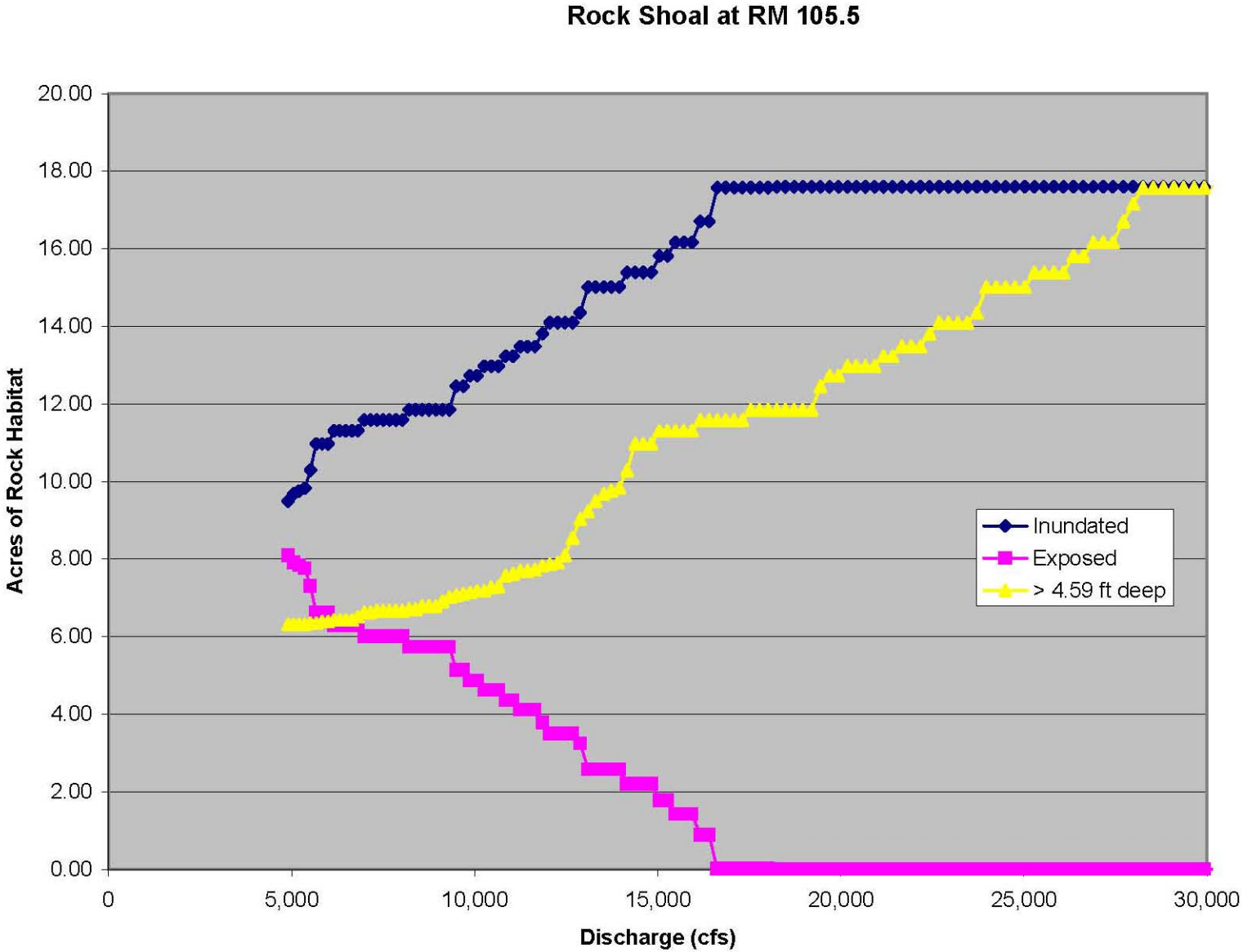
- Mobile District has been informally consulting with USFWS since 2000 on potential for impact of existing water management operations to Gulf sturgeon and mussels
  - Impact of navigation window in Spring 2000 on fish spawning in Apalachicola River
  - Impact of drought operations on mussels in summer of 2000
  - Impact of reservoir fish spawn management on Apalachicola River/Gulf sturgeon spawning in 2002
  - Impact of low flow operations on Gulf sturgeon and mussels in 2004

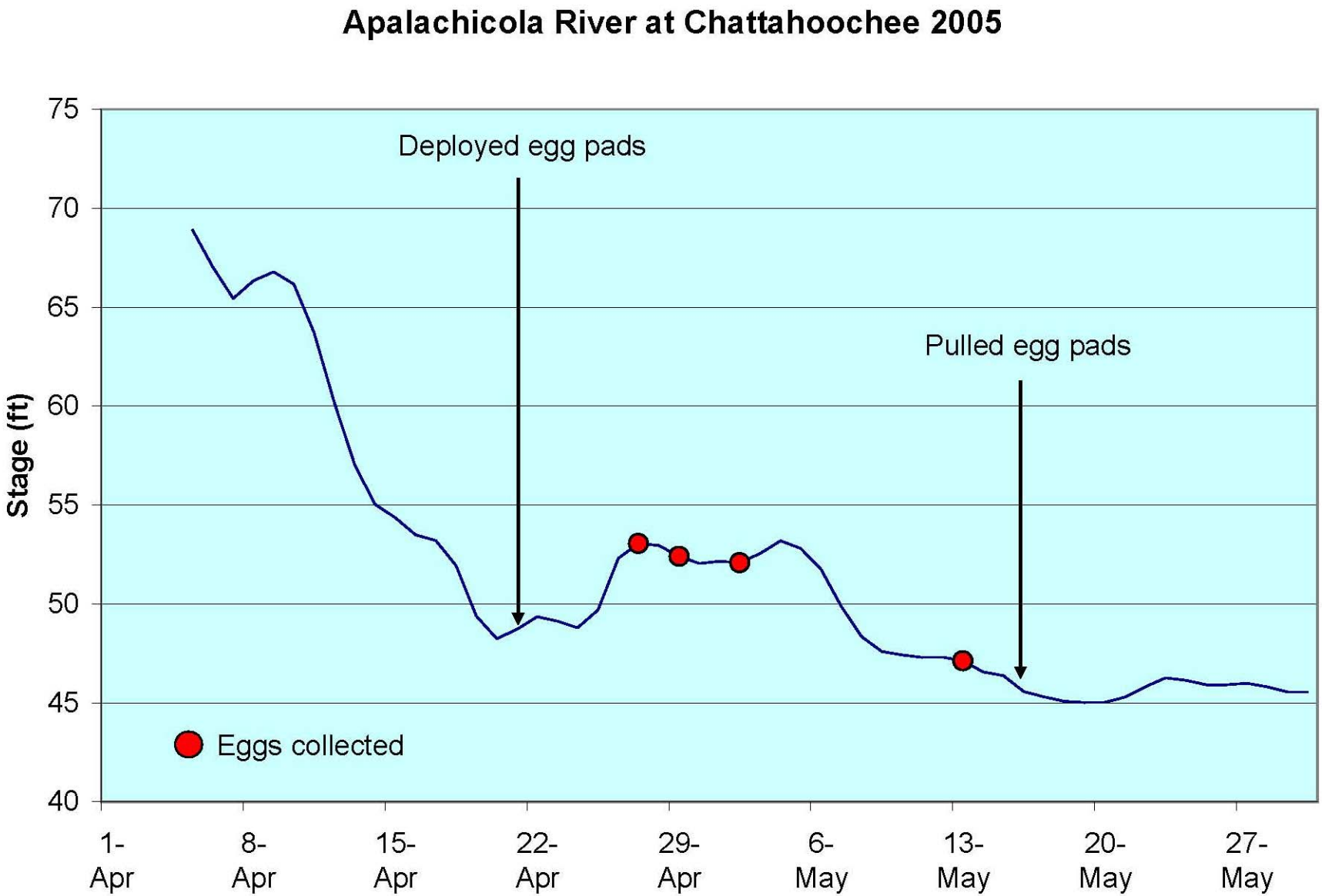
Informal Consultation

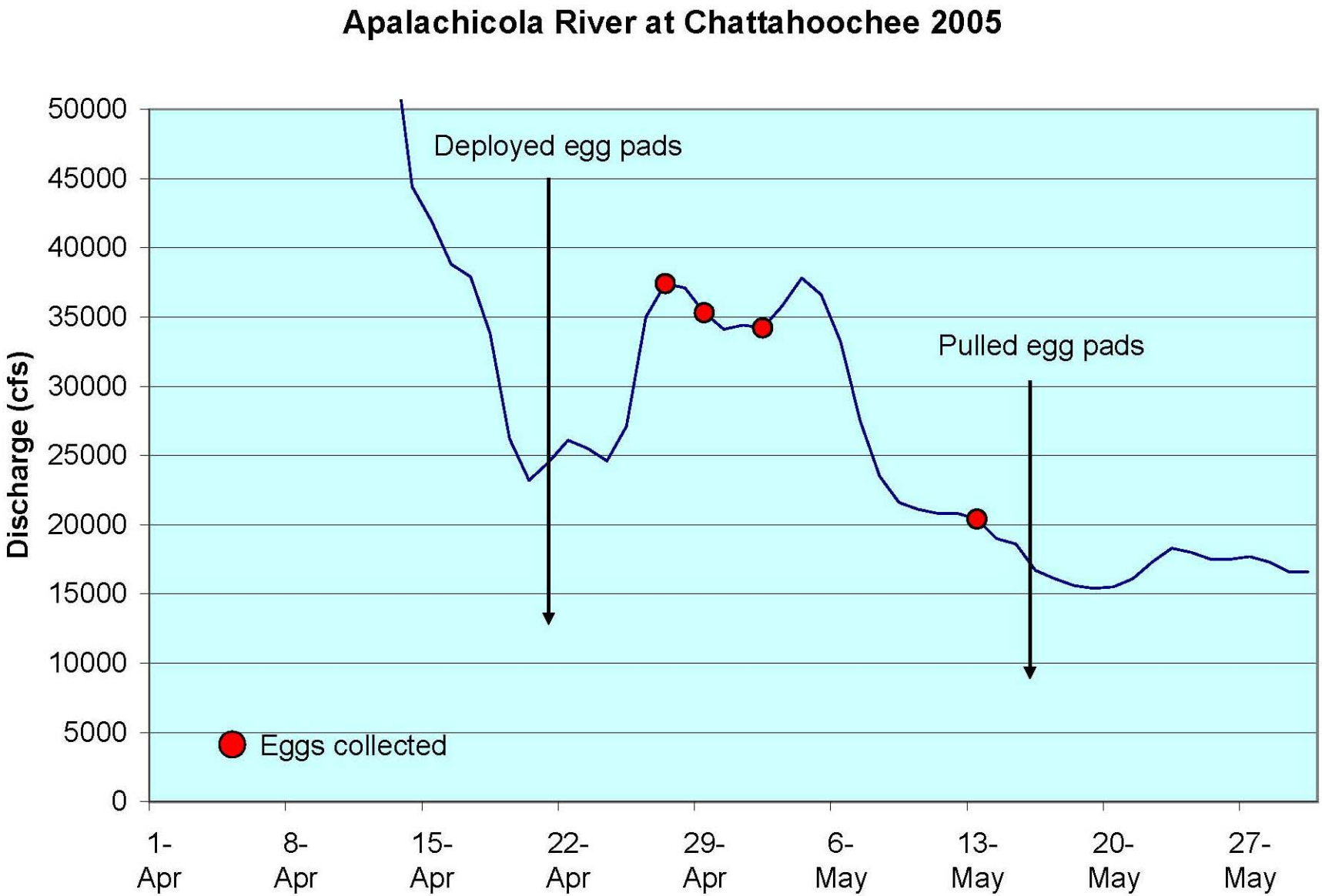
- Potential for impact to Gulf Sturgeon or critical habitat for Gulf sturgeon
- Potential for impact to listed mussel species
- Surveys of Gulf sturgeon spawning habitat and flow/depth study
- Mussel surveys and flow/depth distribution study
- Draft SOP for fish spawn operations to include management for Apalachicola River species in addition to reservoir fish spawn management – annual meetings
- Development of low flow operations protocol for Gulf sturgeon and mussels in 2004 (i.e., match releases to basin inflows; therefore impacts due to declining basin inflows rather than discretionary water management actions)

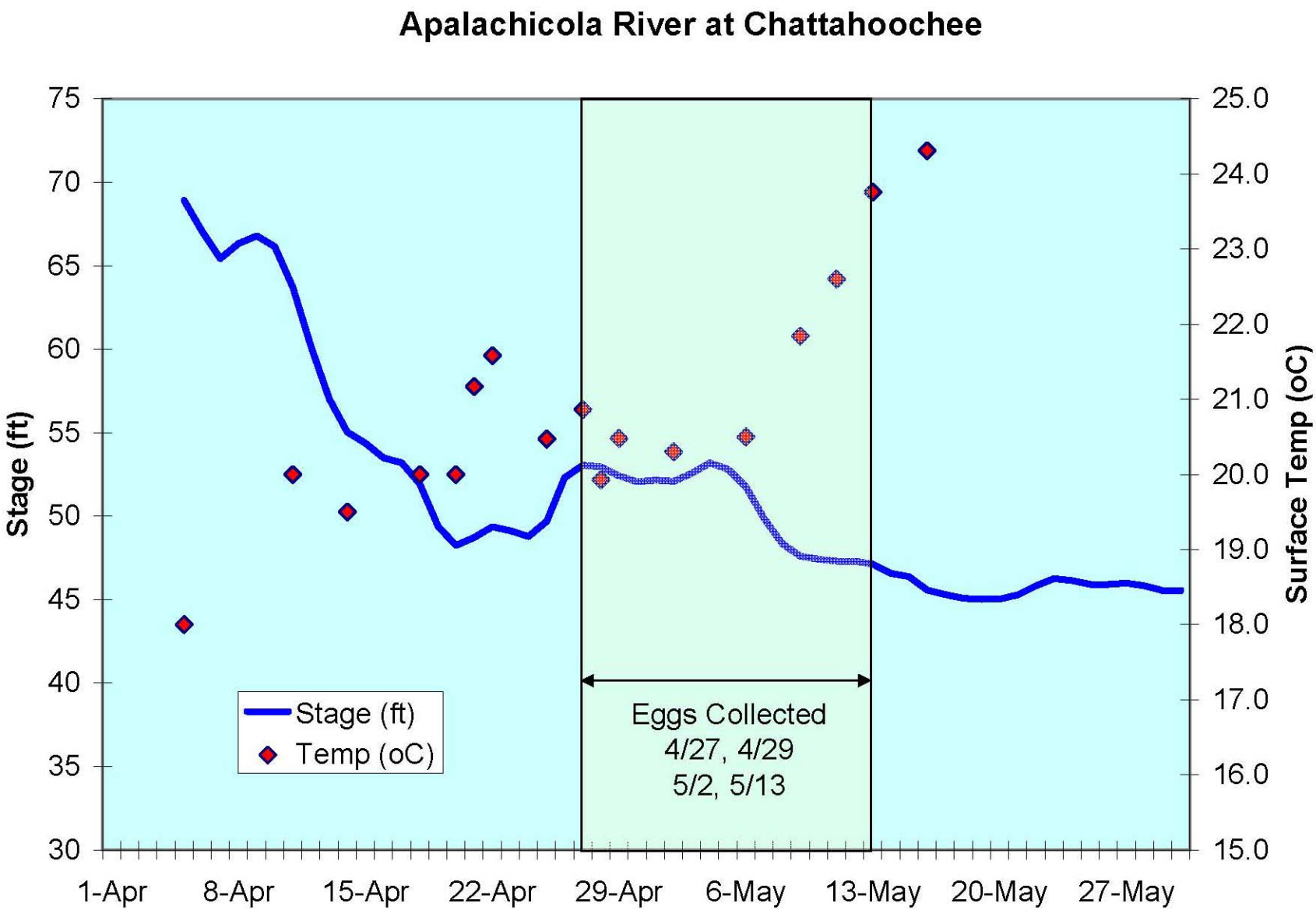
Gulf Sturgeon Spawning Flow Requirements

- Sampling in 2005 collected sturgeon eggs on rock ledge at NM 105 at flows between 37,400 cfs and 20,400 cfs
- 20 eggs collected at depths ranging from 7.5 ft to 20.1 ft. from 17 samples on 4 dates
- Rock ledge at NM 105 is completely inundated to depth of 4.5 ft. at flows of 30,000 cfs
- At flows of 20,400 cfs approx. 75% of rock ledge is inundated to depth of 4.5 ft.
- Rock ledge at NM 105 becomes exposed at flows of 16,000 to 18,000 cfs
- Spawning habitat and adequate flow regime are primary constituent elements of critical habitat


Rock Shoal at RM 105.5
Acres of Rock Habitat
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0
5,000
10,000
15,000
20,000
25,000
30,000
Discharge (cfs)
Inundated
Exposed
> 4.59 ft deep


Apalachicola River at Chattahoochee 2005
Stage (ft)
75
70
65
60
55
50
45
40
Deployed egg pads
Pulled egg pads
Eggs collected
1-Apr
8-Apr
15-Apr
22-Apr
29-Apr
6-May
13-May
20-May
27-May


Apalachicola River at Chattahoochee 2005
Discharge (cfs)
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Deployed egg pads
Pulled egg pads
Eggs collected
1-Apr
8-Apr
15-Apr
22-Apr
29-Apr
6-May
13-May
20-May
27-May


Apalachicola River at Chattahoochee
Stage (ft)
Surface Temp (oC)
75
70
65
60
55
50
45
40
35
30
25.0
24.0
23.0
22.0
21.0
20.0
19.0
18.0
17.0
16.0
15.0
1-Apr
8-Apr
15-Apr
22-Apr
29-Apr
6-May
13-May
20-May
27-May
Stage (ft)
Temp (oC)
Eggs Collected
4/27, 4/29
5/2, 5/13

Flow Requirements for Protected Mussels

- Endangered fat threeridge mussel and threatened purple bankclimber mussel occur on the Apalachicola River
- Mussel surveys completed in the mid-1990s through 2003
- Mussel population locations and relative depth distribution have been correlated to flows
- Mussels begin to become exposed at flows of 8,000 cfs or less
- FWS has stated that continued existence of mussels could be jeopardized at flows less than 5,000 cfs
- Additional flows also required to support needs of host fish for mussels (spawning, nursery and feeding areas)

Table 6. An estimate of the percentage of *A. neislerii* that would be exposed to the atmosphere at three locations at discharges of 3,000-10,000 cfs, Apalachicola River, Florida, 2003.

Location	NM	Estimated Mussels	Discharge, cfs 3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
A	30.0	11.0	6.1	5.2	2.1	0.0	0.0	0.0	0.0	0.0
B	41.5	42.6	42.6	36.3	32.8	25.5	6.6	0.0	0.0	0.0
B	41.5	3.0	3.0	2.6	2.3	1.8	0.5	0.0	0.0	0.0
B	46.8	3.8	3.8	3.2	2.9	2.3	0.6	0.0	0.0	0.0
B	48.4	5.3	5.3	4.5	4.1	3.2	0.8	0.0	0.0	0.0
B	48.4	1.5	1.5	1.3	1.2	0.9	0.2	0.0	0.0	0.0
B	49.0	3.0	3.0	2.6	2.3	1.8	0.5	0.0	0.0	0.0
C	73.3	10.5	8.8	7.0	4.9	3.6	1.6	0.8	0.0	0.0
C	73.3	1.0	0.8	0.7	0.5	0.4	0.1	0.1	0.0	0.0
C	73.3	34.7	29.2	23.1	16.1	13.5	5.1	2.6	0.0	0.0

An estimate of the percentage of *A. neislerii* that would be exposed to the atmosphere at three locations at discharges of 3,000 –10,000 cfs, Apalachicola River, Florida, 2003.

			3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
A			55.0	47.0	19.1	0.0	0.0	0.0	0.0	0.0
B			100.0	85.1	77.0	59.8	15.4	0.0	0.0	0.0
C			84.1	66.5	46.3	33.9	14.8	7.4	0.0	0.0

Locations A, B, and C, include sites at the following Navigation Miles:

A	30.0
B	41.5, 46.8, 48.4, 49.0
C	73.3

Informal Consultation Ramping Rates

- Attempt to mimic "natural flows"
- Minimize impacts on downstream habitat
- Minimize trapping of fish in out-of-bank or floodplain pools after high flows
- Reduce exposure/mortality of mussels
- Reduce bank sloughing
- Rates: 0.5 to 1.0 ft per day when flows are less than 20,000 cfs; Goal of 0.5 ft per day or less during fish spawning and for mussels during low flow operations

Formal Section 7 Consultation

- Interim Operations Plan for releases from Jim Woodruff Dam to the Apalachicola River
  - Incorporates elements developed or agreed to during informal consultation
  - Based on basin inflow and incorporates new information collected during informal consultation
- Formal Section 7 consultation requested on 7 March 2006
- FWS letter dated 9 March 2006 – intent to complete Formal Consultation by 21 July 2006

Intent of Interim Operations Plan

- Provide year-round operations to support flow needs for sturgeon spawning, young sturgeon, mussels, and host fish for mussels
- Minimize or avoid impacts of low flow operations on listed species or critical habitat
- Provide for storage when water is more plentiful to allow for future augmentation during low flows in support of mussels
- Minimize conflicts with management for other fish and wildlife species (e.g., reservoir fish management)
- Minimize impact to other project purposes

Interim Plan for March - May

Based on Basin Inflows (BI)

- If BI $\geq$ 37,400 cfs, Woodruff outflow $\geq$ 37,400 cfs
- If BI >20,400 and < 37,400 cfs, outflow $\geq$ 20,400 cfs and at least 70% of BI
- If BI $\leq$ 20,400 cfs, outflow = BI
- Outflow $\geq$ 5,000 cfs

Interim Plan for June - February

- If BI $\geq$ 37,400 cfs, Woodruff outflow $\geq$ 37,400 cfs
- If BI >8,000 and < 37,400 cfs, outflow > 8,000 cfs and at least 70% of BI
- If BI $\leq$ 8,000 cfs, outflow = BI
- Outflow $\geq$ 5,000 cfs

Interim Plan Ramping Rates

- Exceeds Powerhouse Capacity (18,000 cfs)

  0.5 to 1.0 ft/ day*
- Within Powerhouse Capacity and >8,000 cfs

  0.25 to 0.5 ft/day*
- Within Powerhouse Capacity and ≤8,000 cfs

  0.25 ft/day or less*

*Consistent with safety requirements, flood control operations, and equipment constraints

U.S Army Corps of Engineers, Mobile District
Interim Operations at Jim Woodruff Dam
and Releases to the Apalachicola River
In Support of Listed Mussels and Gulf Sturgeon

Minimum Releases

Months	Basin Inflow (BI) (cfs)	Releases from JWLD (cfs)	Justification
March - May	>= 37,400	not less than 37,400	Max. known flow of sturgeon spawning in the Apalachicola. All of rock shoal inundated by more than 4.59 ft. Majority of floodplain aquatic habitat (61%) in which mussel fish hosts may spawn is connected to the main channel. Peak flows of this magnitude or greater have occurred in all but 5 out of 85 years of record. No evidence of adverse effects to listed species if Corps stores BI above this level in these months while observing down ramping rates.
	>= 20,400 and < 37,400	>= 70% to 90% BI; not less than 20,400	In 2005 successful sturgeon spawning was documented to occur between 20,400 cfs and 37,400 cfs. All of rock shoal habitat at NM 105 is inundated in this range, and most (>73%) innundated with > 4.59 ft (the min. reported depth of Gulf sturgeon spawning in any river). Storing up to 10% of BI (i.e., releasing >= 90% BI) in this flow range would insignificantly affect the area of the rock shoal inundated or other characteristics that may influence its suitability as spawning habitat. During normal to wet periods releases would equal or exceed 90% BI. During extended dry or drought periods, if composite storage is less than full, it may be prudent to release less than 90% in order to all some refill for future augmentation flows. Releases between 70% and 90% of basin inflow would still provide access for spawning to between 74% and 100% of the rock ledge habitat at NM 105.
	< 20,400	>= BI; not less than 5,000	No discretionary action except flow augmentation and ramping rates. 5000 cfs is the minimum condition to ensure using water stored during discretionary actions in other flow ranges and time periods.

Months	Basin Inflow (BI) (cfs)	Releases from JWLD (cfs)	Justification
June - February	>= 37,400	not less than 37,400	Majority of floodplain aquatic habitat (61 %) in which mussel fish hosts may spawn and rear is connected to the main channel. Peak flows of this magnitude or greater have occurred in all but 5 out of 85 years of record. No evidence of adverse effects to listed species if Corps stores BI above this level in these months while observing down ramping rates.
	>= 8,000 and < 37,400	> 70% to 90% BI; not less than 8,000	Max. known stage of listed mussels on the river bed (8000 cfs). Storing up to 10% of BI (i.e., releasing >= 90% BI) in this flow range would insignificantly effect habitat features relevant to sturgeon and mussel conservation in these months while observing down ramping rates. No mussels would be exposed. During normal to wet periods releases would equal or exceed 90% BI. During extended dry or drought periods, if composite storage is less than full, it may be prudent to release less than 90% (store some water from rain events) in order to allow some refill for future augmentation flows. Water stored during these conditions would be available for future augmentation to maintain flows above BI when 8000 cfs >BI >= 5000 cfs, and above 5000 cfs when BI < 5000 cfs.
	< 8,000	>= BI; not less than 5,000	No discretionary action except flow augmentation and ramping rates. 5000 cfs is the minimum condition to ensure using water stored during discretionary actions in other flow ranges and time periods.

Down Ramping Rates

Release Range	Maximum Fall Rate (ft/day), measured at Chattahoochee gage	Justification
Exceeds Powerhouse Capacity* (~18,000 cfs)	0.5 to 1.0 ft/day	Apalachicola River fall rates of greater than 0.5 ft/day were extremely rare prior to construction of the Corps ACF projects (analysis of gage records from the 1920s to present), except during flood pulses. Mussels and early sturgeon life stages have limited mobility to avoid stranding. The Corps ability to control fall rates at less than 0.5 ft/day when releases exceed the powerhouse capacity is very limited, but the stranding risk to listed species at these high flows is also limited (e.g., all of the known sturgeon spawning rock shoal is inundated by flows greater than 18,000 cfs). Previous operations have attempted to produce a fall rate of 0.5 ft/day or less whenever flows are less than 20,000 cfs, and less than 1.0 ft/day at flows greater than 20,000 cfs. These rates represent the best attempt within current capabilities to limit stranding risks of other species in the floodplain, such as potential mussel host fishes. Rates will approximate 0.5 ft/day, but not more than 1 ft/day except in emergency conditions.
Within Powerhouse Capacity and > 8,000 cfs*	0.25 to 0.5 ft/day	More gradual (lesser) fall rates become a greater conservation concern at flows that approach the stages at which the mussels are found and are achievable when releases are from the powerhouse instead of the spillway gates. 8,000 cfs is the highest stage at which the listed mussels are found. Fall rates of approximately 0.25 ft/day in advance of this stage gives mussels several days to move to lower bed elevations. 9,000 cfs provides approximately 0.5 ft or greater above the highest-stage listed mussels.
Within Powerhouse Capacity and <=8,000 cfs*	0.25 ft/day or less	8,000 cfs is the highest stage at which the listed mussels are found and when the most gradual rates are required if flows decline further. Fall rates of approximately 0.25 ft/day give the mussels several days to move to lower elevations. Rates of less than 0.25 ft/day may be possible when making releases from the powerhouse, but are more difficult to achieve (incremental reduction in releases of 500 cfs/day approximates 0.25 ft/day). Previous operations have been in range of 0.25 and 0.5 ft/day during sustained low flow periods. These rates appear to be within the tolerance of the two species ability to move to lower stages. It is supported mainly by the fact that they are present at stages above 5000 cfs after several years of flows hovering around 5,000 cfs for extended periods during the drought of 1998-2002.

*Consistent with safety requirements, flood control purposes, equipment cababilities.

Note: These operations are considered sufficient to minimize adverse effects on the listed species to the maximum extent practicable or feasible based on equipment constraints, and safety concerns. Consideration is also given to the need to balance releases to the river with the need to refill or conserve storage in upstream reservoirs in the interest of having adequate storage in later months when augmentation flows may be necessary to protect listed mussel species. Any of the numbers in this table are subject to revision based on better information that may be developed during the Section 7 consultation process. FWS recommends the release of 90% of BI as the degree to which the Corps could store water during intermediate flow ranges (i.e., March through May when BI is between 37,400 cfs and 20,400 cfs; and June through February when BI is less than 37,400 cfs and greater than 8,000 cfs) such that the amount of flow depletion would not measurably alter habitat quality features in those flow ranges (e.g., temperature, DO, channel area inundated, etc.). Although this requirement can be met during normal to wet periods, it may not be reasonable or prudent during extended dry or drought periods. Therefore, the Corps proposes a sliding percentage between 90% and 70% BI that would be released during extended dry or drought periods. The goal would be to release 90% BI. In the event this was not feasible or prudent (i.e. would prevent sufficient refill or conservation of storage to guarantee future augmentation flows for mussels or to meet other critical project purpose needs), then informal consultation discussions would be conducted with FWS to determine the appropriate percentage release and the justification for the reduced percentage release. The release to the Apalachicola River would be at least 70% BI. The 70% to 90% BI release would assure that at least 74% of the rock ledge spawning habitat at NM 105 would be submerged to a depth of 4.59 ft or greater during spawning periods during these intermediate flows during this discretionary action. No mussels would be exposed during these intermediate flows due to discretionary action. Any reduction in releases would represent a trade-off of minimal impact on other habitat or host species requirements in order to provide future augmentation flows as required to prevent or minimize mussel mortality due to exposure.

Interim Operations Plan

- Numbers in Plan subject to change based on new information
  - E.g., Powerhouse capacity = 16,000 cfs
  - Results of 2006 sturgeon spawning monitoring and habitat mapping efforts?
  - How to calculate basin inflows?
  - How to account for ramping rates?
  - What is appropriate threshold for flood control operations?

Adjustments to IOP Submitted to USFWS on 12 June 2006

- Based on "Lessons Learned"
- Use Chattahoochee gage, 7-day average and volume computations to measure basin inflow and releases to smooth releases and minimize over-releases
- Include "mini-peaking" operations at JWD
- Adjust upper flow threshold Jun-Feb to provide for more opportunities for storage
- Clarify flood control flows and ramping rates

Proposed Adjustment to Jun-Feb Upper Threshold

- Intent to provide sufficient flows when available for access to the adjacent floodplain by host fish for mussels
- Average monthly flows for Jun – Aug approximately 16,000 cfs
  - Approximately 7,000 acres of adjacent floodplain connected at 16,000 cfs
  - Approximately 3,000 acres of adjacent floodplain connected at 14,000 cfs
  - Only a few hundred acres of adjacent floodplain connected at 8,000 cfs flow
- Provides some restriction on storage when basin inflows are 23,000 cfs or less to provide for gradual reductions for flows on the river of 16,000 cfs or less

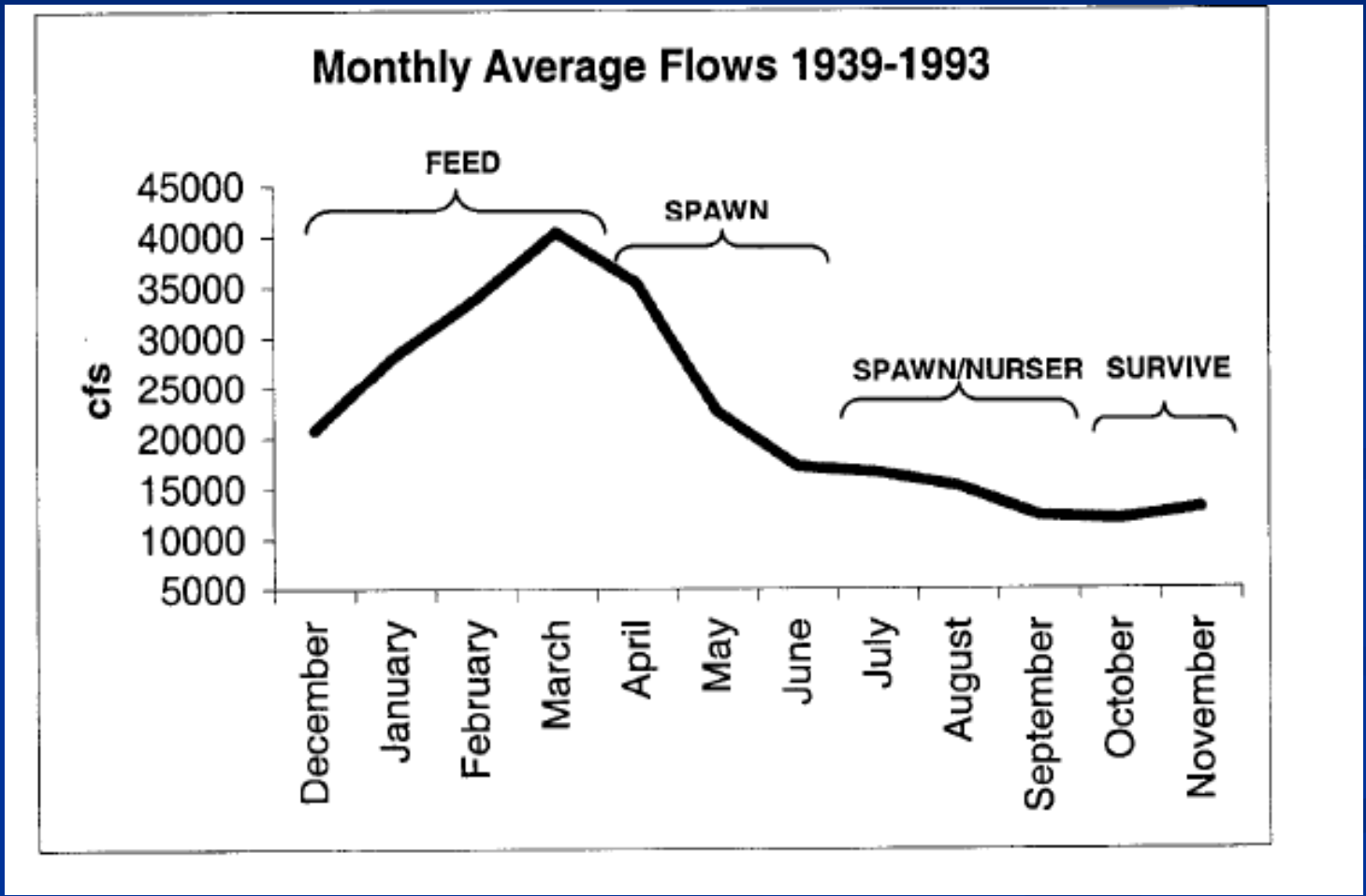
	January	February	March	April	May	June	July	August	September	October	November	December	Totals
Average	27213	33238	40638	34143	21680	16637	17316	15115	12327	12416	13343	20083	
Minimum	5980	8280	8260	7010	5210	4540	4530	4430	4530	5010	3900	5150	
Maximum	165000	127000	291000	158000	126000	71300	203000	60800	65900	86800	102000	137000	
99.9% exceedence	6163	8378	8298	7082	5404	4580	4578	4498	4671	5080	4160	5393	
99% exceedence	6785	8980	11386	9661	6939	5076	5367	4689	5461	5290	5280	6252	
95% exceedence	9700	11600	13600	12200	8883	7470	7205	5953	6120	5690	5730	7350	
90% exceedence	11600	13700	16500	14400	10400	8660	8620	7900	6910	6307	6460	8800	
80% exceedence	13600	17800	20300	17700	12600	10500	10100	9542	8480	7604	8110	9952	
75% exceedence	15000	19700	22000	18700	13400	11500	11000	10500	9000	8300	8688	10700	
50% exceedence	22200	28400	33400	27800	18000	14600	14000	13500	11350	10800	11200	14900	
25% exceedence	34275	43575	50400	41300	25100	19300	18900	17400	14000	13500	15200	23900	
10% exceedence	51300	58390	69900	64400	37280	27200	26800	24240	18500	19300	21400	40330	
1% exceedence	78532	94219	160280	124000	72914	47682	79328	43428	31800	44847	44744	73856	

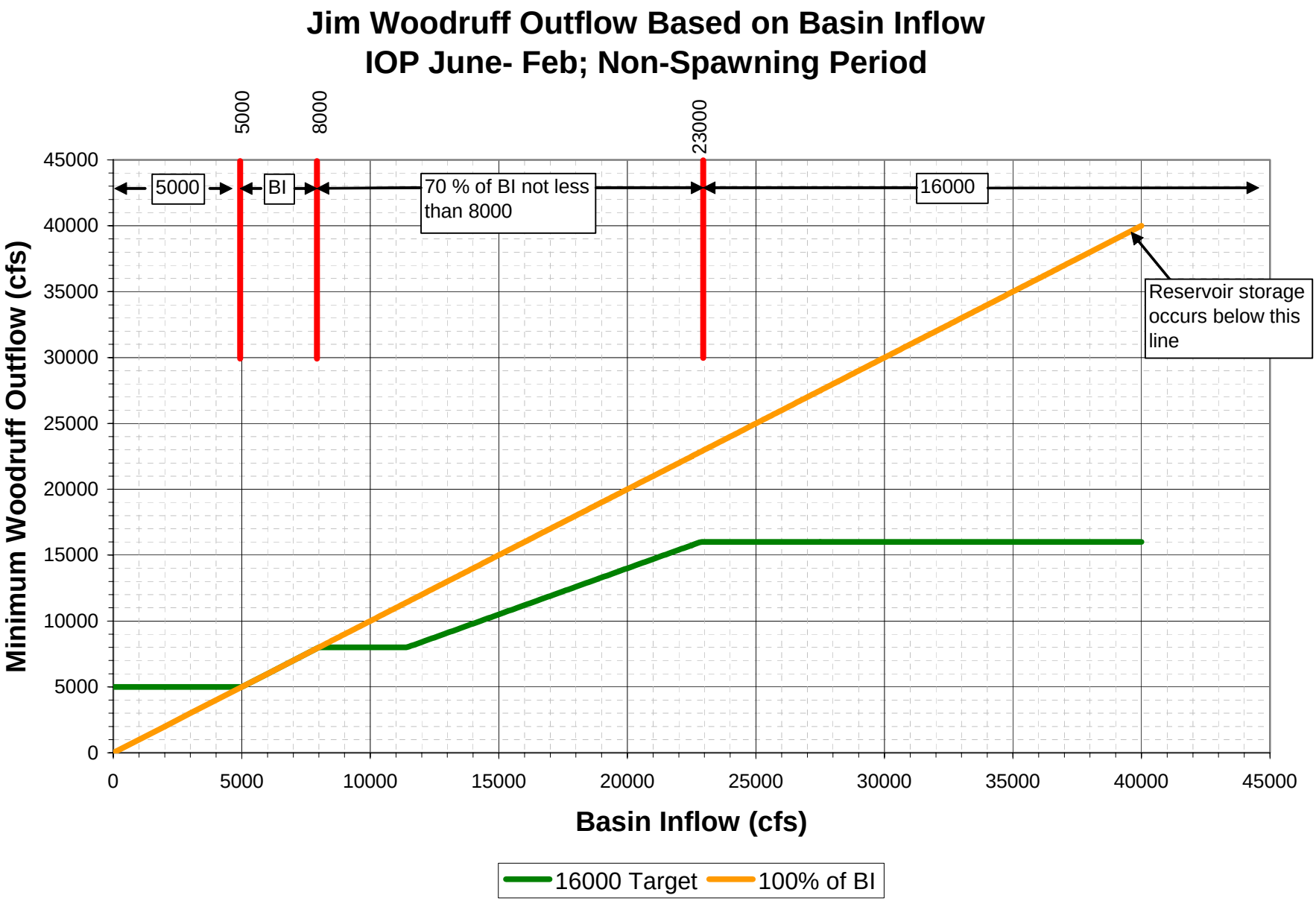
			MARCH DAYS	%	APRIL DAYS	%	MAY DAYS	%							
Less than 4000	0	0	0	0%	0	0%	0	0%	0	0	0	0	0	3	0	
Less than 5000	0	0	0	0%	0	0%	0	0%	23	11	33	6	0	7	0	80
Less than 14000	527	240	134	6%	201	9%	668	28%	1013	1188	1301	1731	1895	1651	1077	11626
Less than 14970	600	304	184	8%	257	11%	791	33%	1207	1326	1496	1851	1978	1740	1214	12949
Less than 16000	684	347	210	9%	315	14%	899	38%	1353	1488	1648	1943	2043	1807	1330	14068
Less than 17000	790	387	259	11%	400	17%	1034	43%	1472	1603	1756	1999	2091	1893	1421	15106
Less than 18000	894	450	310	13%	491	21%	1188	50%	1599	1705	1833	2041	2133	1948	1499	16092
Less than 21000	1137	645	533	22%	778	34%	1529	64%	1865	1939	2029	2173	2225	2086	1676	18616
Total Days	2418	2182	2387		2310		2387		2310	2387	2387	2310	2418	2340	2418	

Volatility

1928-1952 Average Day	1515.544264
1953-2006 Average Day	1923.89668

Average Monthly Flows for Jun-Aug are approximately 16,000 cfs




Jim Woodruff Outflow Based on Basin Inflow
IOP June- Feb; Non-Spawning Period
5000
8000
23000
5000
BI
70 % of BI not less than 8000
16000
Reservoir storage occurs below this line
Minimum Woodruff Outflow (cfs)
Basin Inflow (cfs)
0
5000
10000
15000
20000
25000
30000
35000
40000
45000
16000 Target
100% of BI

Interim Plan for March - May

Based on Basin Inflows (BI)

- If BI $\geq$ 37,400 cfs, Woodruff outflow $\geq$ 37,400 cfs
- If BI >20,400 and < 37,400 cfs, outflow $\geq$ 20,400 cfs and at least 70% of BI
- If BI $\leq$ 20,400 cfs, outflow = BI
- Outflow $\geq$ 5,000 cfs

Original Interim Plan for Jun – Feb*

- If BI ≥ 37,400 cfs, Woodruff outflow ≥ 37,400 cfs
- If BI >8,000 and < 37,400 cfs, outflow > 8,000 cfs and at least 70% of BI
- If BI ≤ 8,000 cfs, outflow = BI
- Outflow ≥ 5,000 cfs

*The Interim Plan was Modified in 12 Jun 06 letter to USFWS

Adjusted Interim Plan Jun – Feb*

- If BI ≥ 23,000 cfs, Woodruff outflow ≥ 16,000 cfs
- If BI >8,000 and < 23,000 cfs, outflow > 8,000 cfs and at least 70% of BI
- If BI ≤ 8,000 cfs, outflow = BI
- Outflow ≥ 5,000 cfs

*The Adjusted Interim Plan was submitted in 12 Jun 06 letter to USFWS; Allows for more opportunities for storage during significant rain events while still providing for mussel and host fish needs

Original Interim Plan Ramping Rates

- Exceeds Powerhouse Capacity (18,000 cfs)

  0.5 to 1.0 ft/ day*
- Within Powerhouse Capacity and >8,000 cfs

  0.25 to 0.5 ft/day*
- Within Powerhouse Capacity and ≤8,000 cfs

  0.25 ft/day or less*

*Consistent with safety requirements, flood control operations, and equipment constraints – Ramping rates for flood control purposes were clarified in the 12 June 2006 letter to USFWS

Adjusted Ramping Rates*

- No ramping when flows are 30,000 cfs or higher
- Ramp down between 1.0 and 2.0 ft/day when flows are between 20,000 cfs and 30,000 cfs
- Ramp down between 0.5 and 1.0 ft/day when flows are between 16,000 cfs and 20,000 cfs
- Ramp down between 0.25 and 0.5 ft/day when flows are between 8,000 cfs and 16,000 cfs
- Ramp down at 0.25 ft/day or less when flows are less than 8,000 cfs

*Adjusted rates submitted in 12 Jun 06 letter to USFWS

Revised 12 Jun 2006

U.S Army Corps of Engineers, Mobile District
Interim Operations at Jim Woodruff Dam
and Releases to the Apalachicola River
In Support of Listed Mussels and Gulf Sturgeon

Minimum Releases

Months	Basin Inflow (BI) (cfs)	Releases from JWLD (cfs)	Justification
March - May	>= 37,400	not less than 37,400	Max. known flow of sturgeon spawning in the Apalachicola, as documented in 2005. All of rock shoal inundated by more than 4.59 ft. Majority of floodplain aquatic habitat (61%) in which mussel fish hosts may spawn is connected to the main channel. Peak flows of this magnitude or greater have occurred in all but 5 out of 85 years of record. No evidence of adverse effects to listed species if Corps stores BI above this level in these months while observing down ramping rates.
	>= 20,400 and < 37,400	>= 70% BI; not less than 20,400	In 2005 successful sturgeon spawning was documented to occur between 20,400 cfs and 37,400 cfs. All of rock shoal habitat at NM 105 is inundated in this range, and most (>73%) innundated with > 4.59 ft (the min. reported depth of Gulf sturgeon spawning in any river). Storing up to 30% of BI (i.e., releasing >= 70% BI) in this flow range would insignificantly affect the area of the rock shoal inundated or other characteristics that may influence its suitability as spawning habitat. During normal to wet periods releases would likely equal or exceed 90% BI. During extended dry or drought periods, if composite storage is less than full, it may be prudent to release less than 90% in order to all some refill for future augmentation flows. Releases of at least 70% BI would still provide inundation of at least approximately 87% of the rock ledge habitat and access for spawning (>4.59 ft depth) would be available to approximately 60% of the rock ledge habitat at NM 105.
	< 20,400	>= BI; not less than 5,000	No discretionary action except flow augmentation and ramping rates. 5000 cfs is the minimum condition to ensure using water stored during discretionary actions in other flow ranges and time periods.

Months	Basin Inflow (BI) (cfs)	Releases from JWLD (cfs)	Justification
June - February	>= 23,000	not less than 16,000	A flow of 16,000 cfs is equivalent to the approximate average monthly flow levels for June – August. The 16,000 cfs flow is important because data indicate that it will provide sufficient flow for host fish necessary for mussel reproduction, as well as provide connectivity between the main channel of the Apalachicola River and back channel and floodplain habitat areas used by mussel host fish as well as young Gulf Sturgeon. At this flow level there are still approximately 7,000 acres of floodplain habitat connected to the river channel. The 16,000 cfs release is equivalent to 70 percent of a basin inflow of 23,000 cfs. There is no flow restriction for excess BI above 23,000 cfs, which allows for storage of the excess flow. This additional storage could be used for other project purposes or as future augmentation flows in support of listed mussels. No evidence of adverse effects to listed species if Corps stores BI above this level in these months while observing down ramping rates.
	>= 8,000 and < 23,000	>= 70% BI; not less than 8,000	Max. known stage of listed mussels on the river bed (8000 cfs). Storing up to 30% of BI (i.e., releasing >= 70% BI) in this flow range would not significantly effect habitat features relevant to sturgeon and mussel conservation in these months while observing down ramping rates. No mussels would be exposed. During normal to wet periods releases would likely equal or exceed 90% BI. During extended dry or drought periods, if composite storage is less than full, it may be prudent to release less than 90% (in order to store some water from rain events) in order to allow some refill for future augmentation flows. Releases of at least 70% BI and gradual ramping rates would minimize impacts to host fish necessary for mussel reproduction, by maintaining access to remaining off channel habitat areas. Water stored during these conditions would potentially be available for future augmentation to maintain flows above BI when 8000 cfs >BI >= 5000 cfs, and above 5000 cfs when BI < 5000 cfs.
	< 8,000	>= BI; not less than 5,000	No discretionary action except flow augmentation and ramping rates. 5000 cfs is the minimum condition to ensure using water stored during discretionary actions in other flow ranges and time periods.

Down Ramping Rates

Release Range	Maximum Fall Rate (ft/day), measured at Chattahoochee gage	Justification
Exceeds Powerhouse Capacity* (~16,000 cfs)	0.5 to 1.0 ft/day	Apalachicola River fall rates of greater than 0.5 ft/day were extremely rare prior to construction of the Corps ACF projects (analysis of gage records from the 1920s to present), except during flood pulses. Mussels and early sturgeon life stages have limited mobility to avoid stranding. The Corps ability to control fall rates at less than 0.5 ft/day when releases exceed the powerhouse capacity is very limited, but the stranding risk to listed species at these high flows is also limited (e.g., all of the known sturgeon spawning rock shoal is inundated by flows greater than 18,000 cfs). Previous operations have attempted to produce a fall rate of 0.5 ft/day or less, but not greater than 1.0 ft/day whenever flows are less than 20,000 cfs. These rates represent the best attempt within current capabilities to limit stranding risks of other species in the floodplain, such as potential mussel host fishes. Rates will approximate 0.5 ft/day, but not more than 1 ft/day except in emergency conditions. For flows between 20,000 cfs and 30,000 cfs, ramping down from flood peaks for flood control purposes would likely be within a range of 1.0 to 2.0 ft/day.**
Within Powerhouse Capacity and > 8,000 cfs*	0.25 to 0.5 ft/day	More gradual (lesser) fall rates become a greater conservation concern at flows that approach the stages at which the mussels are found and are achievable when releases are from the powerhouse instead of the spillway gates. 8,000 cfs is the highest stage at which the listed mussels are found. Fall rates of approximately 0.25 ft/day in advance of this stage gives mussels several days to move to lower bed elevations. 9,000 cfs provides approximately 0.5 ft or greater above the highest-stage listed mussels.
Within Powerhouse Capacity and <=8,000 cfs*	0.25 ft/day or less	8,000 cfs is the highest stage at which the listed mussels are found and when the most gradual rates are required if flows decline further. Fall rates of approximately 0.25 ft/day give the mussels several days to move to lower elevations. Rates of less than 0.25 ft/day may be possible when making releases from the powerhouse, but are more difficult to achieve (incremental reduction in releases of 500 cfs/day approximates 0.25 ft/day). Previous operations have been in range of 0.25 and 0.5 ft/day during sustained low flow periods. These rates appear to be within the tolerance of the two species ability to move to lower stages. It is supported mainly by the fact that they are present at stages above 5000 cfs after several years of flows hovering around 5,000 cfs for extended periods during the drought of 1998-2002.

*Consistent with safety requirements, flood control purposes, equipment cabability.
**For flows greater than 30,000 cfs, it is not reasonable or prudent to attempt to control down ramping rate, and no ramping rate is required.

Note: These operations are considered sufficient to minimize adverse effects on the listed species to the maximum extent practicable or feasible based on equipment constraints, and safety concerns. Consideration is also given to the need to balance releases to the river with the need to refill or conserve storage in upstream reservoirs in the interest of having adequate storage in later months when augmentation flows may be necessary to protect listed mussel species. Any of the numbers in this table are subject to revision based on better information that may be developed during the Section 7 consultation process. FWS has recommended the release of 90% of BI as the degree to which the Corps could store water during intermediate flow ranges (i.e., March through May when BI is between 37,400 cfs and 20,400 cfs; and June through February when BI is less than 16,000 cfs and greater than 8,000 cfs) such that the amount of flow depletion would not measurably alter habitat quality features in those flow ranges (e.g., temperature, DO, channel area inundated, etc.). Although this requirement can be met during normal to wet periods, it may not be reasonable or prudent during extended dry or drought periods. Therefore, the Corps proposes a minimum percentage of 70 BI that would be released during extended dry or drought periods. The goal would be to release 90% BI. In the event this was not feasible or prudent (i.e. would prevent sufficient refill or conservation of storage to guarantee future augmentation flows for mussels or to meet other critical project purpose needs), then informal consultation discussions would be conducted with FWS to determine the appropriate percentage release and the justification for the reduced percentage release. The release to the Apalachicola River would be at least 70% BI. The 70% BI release would assure that at least approximately 60% of the rock ledge spawning habitat at NM 105 would be submerged to a depth of 4.59 ft or greater during spawning periods during these intermediate flows during this discretionary action. No mussels would be exposed during these intermediate flows due to discretionary action. Any reduction in releases would represent a trade-off of minimal impact on spawning habitat or host fish habitat requirements in order to provide future augmentation flows as required to prevent or minimize mussel mortality due to exposure.

Status – 12 July 06

- 13 June 06 - USFWS requested 45-day extension to complete BO
- 21 June 06 - Georgia filed TRO requesting no more than 5,000 cfs release
- 21 June 06 - Florida filed TRO requesting 8,000 cfs min. flow
- 22 June 06 - Court granted FL TRO requiring 8,000 cfs release
- 23 June, 26 June, 27 June, 29 June 06 - Court revised FL TRO to ramp down to 7,000 cfs, 6750 cfs, 6250 cfs and 6,000 cfs respectively
  - ramping rate of no more than 0.25 ft/day;
  - pending further modification if agreement can be reached between States

Status – 12 July 06

- 30 June 06 – Interim agreement reached between AL, FL, GA and Dept of Army until 24 July 06
  - 5,000 cfs min. flow with augmentation from "Environmental Storage Pool" as requested by FL
  - Environmental Storage Pool equivalent to 5 percent composite storage in ACF basin
  - Cumulative withdrawals/deposits to the Environmental Storage Pool posted on Mobile District Water Management Web Page
- FWS and Corps continue to consult on impacts of the Adjusted IOP on Gulf sturgeon and mussels
- Corps agreed to 45-day Extension of Consultation Period - Biological Opinion due by 5 September 2006