APPENDIX E.1

COMBINED OPERATIONAL PLAN

ECOLOGICAL EVALUATION OF ROUND 1, ROUND 2 AND ROUND 3 ALTERNATIVES

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E.1 INTRODUCTION

The purpose of the Combined Operational Plan (COP) is to define water management operations for the Water Conservation Area (WCA) 3A and WCA 3B outlets, structures in the L-31N and the C-111 Basins constructed as part of the Central and Southern Florida (C&SF) Project and the recently constructed components of the Modified Water Deliveries (MWD) and C-111 South Dade Projects. In order to achieve the action objective, the U.S. Army Corps of Engineers (USACE) in conjunction with the project team, identified a list of performance measures for purposes of evaluating the systems response to alternative plans. Project performance measures were identified as being able to evaluate a project objective(s) and are quantitative tools that have numerical targets related to restoration objectives. Several of the project performance measures for the planning effort were derived from those performance measures approved for use in the Comprehensive Everglades Restoration Plan (CERP) by Restoration, Coordination and Verification (RECOVER). RECOVER is an interagency and interdisciplinary scientific and technical team that provides essential support to the CERP. RECOVER performance measures identify hydrologic and ecological indicators expected to respond to implementation of CERP and were developed from Conceptual Ecological Models that identify the major anthropogenic drivers and stressors on natural systems, the ecological effects of these stressors, and the best biological attributes or indicators of these ecological responses. Performance indicators were also identified to be used. Performance indicators were used as a check against ecosystem harm (in some instances) and to evaluate potential impacts to the current system by evaluating a given alternative relative to the existing condition baseline (ECB19R/ECB19RR). Ecological planning tools developed by the Joint Ecosystem Modeling group (JEM) were also identified to be used for purposes of evaluating habitat suitability for fish and wildlife resources (https://www.jem.gov) in addition to indicators developed under Endangered Species Act consultation from the 2016 Everglades Restoration Transition Plan (ERTP) Biological Opinion (BO). Regional hydrologic models included the South Florida Regional Simulation Model Glades-LECSA Implementation (RSMGL).

Appendix E.1 provides a summary of how this information was utilized to evaluate Round 1, Round 2, and Round 3 alternatives and documents trends in alternative performance. This appendix supports the environmental effects analysis within the main document of the COP EIS. Reference **Section 4** (**Alternatives**).

E.1.1 Ecological Evaluation: Round 1 Alternatives

A methodology was developed to evaluate alternatives based on the set of project objectives, which must largely be either met or accomplished in order for the implementation of the project to be considered a success. A set of subject-specific performance measures were used to help connect the relationship between simulated water surfaces to expectations of ecological performance. All alternatives were compared to the No Action Alternative/Existing Condition Baseline (ECB19R). The methodology also considered the use of performance indicators.

E.1.1.1 Summary of Round 1 Model Results: Performance Measures

Table E.1-1 presents a cross-walk between the project objectives and project performance measures. Project performance measures were identified as being able to evaluate a project objective, if a score from the regional hydrologic model was available for a given area (i.e. indicator region (IR) or transect). **Table E.1-2** provides a brief description of each performance measure. More detailed information is provided in the associated performance measure documentation sheets available upon request. Results are summarized in bullet form below for each alternative. Reference **Figure E.1-1** for the location of IRs within the project area.

To Note - when the evaluation methodology for the COP was developed, the project team identified the use of a performance measure to evaluate the timing, distribution and continuity of sheetflow across the landscape. The performance measure was evaluated for Round 1 alternatives, however results were not sensitive. This performance measure had been used in prior CERP planning efforts to evaluate structural modifications to existing water management features (i.e. backfilling of canals, degrading of levees etc.) and how those modifications influence sheetflow within the greater Everglades. After a review of the Round 1 modeling results, the project team decided to remove the sheetflow performance measure from the COP evaluation methodology.

Table E.1-1. Cross walk of project performance measures and project objectives.

Performance Measures	1i. Improve water deliveries – timing	1ii. Improve water deliveries – location	1iii. Improve water deliveries – volume	2i. Restore hydrologic conditions in Taylor Slough	2ii. Restore hydrologic conditions in Rocky Glades	2iii. Restore hydrologic conditions in eastern panhandle of ENP	3. Protect the intrinsic ecological values associated with WCA 3A and ENP	4. Minimize damaging flows to Manatee Bay/Barnes sound and increase flows through Taylor Slough and coastal
Inundation Duration in the Ridge and Slough Landscape	X	X	X	X	X		X	X
Number and Duration of Dry Events in Shark Slough	X	X	X				X	
Slough Vegetation Suitability	X	X	X	X			X	X
Soil Oxidation	X	X	X	X			X	X
Florida Bay Salinity	X	X	X				X	X

Table E.1-2. Performance measures for the COP.

Area	Performance Measure	Description
WCA 3 & ENP	**Inundation Patterns** • Percent Period of Record (PPOR) of Inundation	**Above Ground Water Levels** - Measure of the duration of inundation over the period of record within WCA 3 and ENP. Desired

		restoration condition is to restore pre-drainage patterns of multi-year hydroperiods. Target: based on Natural System Model (NSM)*.
WCA 3 & ENP	**Hydrologic Surrogate for Soil Oxidation** • Drought Intensity Index	**Below Ground Water Levels** - Measure of cumulative drought intensity below ground to reduce exposure to peat within WCA 3 and ENP. Desired restoration condition is to restore processes that result in soil accretion. Target: based on NSM.
ENP (Northeast Shark River Slough)	**Dry Events in Shark River Slough** • Number of Dry Events • Duration of dry Events • Percent Period of Record (PPOR) of Dry Events	**Below Ground Water Levels** - Measure of number of times and mean duration in weeks that water drops below ground in NESRS. Desired restoration condition is to restore pre-drainage patterns of multi-year hydroperiods. Target: based on NSM.
WCA 3 & ENP	**Slough Vegetation Suitability** • Hydroperiod • Drydown • Dry Season Average Depth • Wet Season Average Depth	**Above & Below Ground Water Levels** - Measure to evaluate the hydrologic suitability for vegetation communities within WCA 3A and ENP. Desired restoration condition is to restore pre-drainage water patterns suitable for white water lily and slim spikerush. Target: based on NSM.
Florida Bay	**Southern Coastal Systems** • Dry Season Regime Overlap • Wet Season Regime Overlap • Dry Season High Salinity • Wet Season High Salinity	**Salinity** - Measure to evaluate suitability for flora and fauna in Florida Bay based on salinity envelopes. Target: paleo-adjusted NSM.

* Several of the performance measure targets listed within this table are based on output from the NSM which simulates the response of a pre-drained Everglades. Additional documentation of the Natural Systems Model (NSM) is available at the following web location: https://www.sfwmd.gov/science-data/NSM-model#level7.

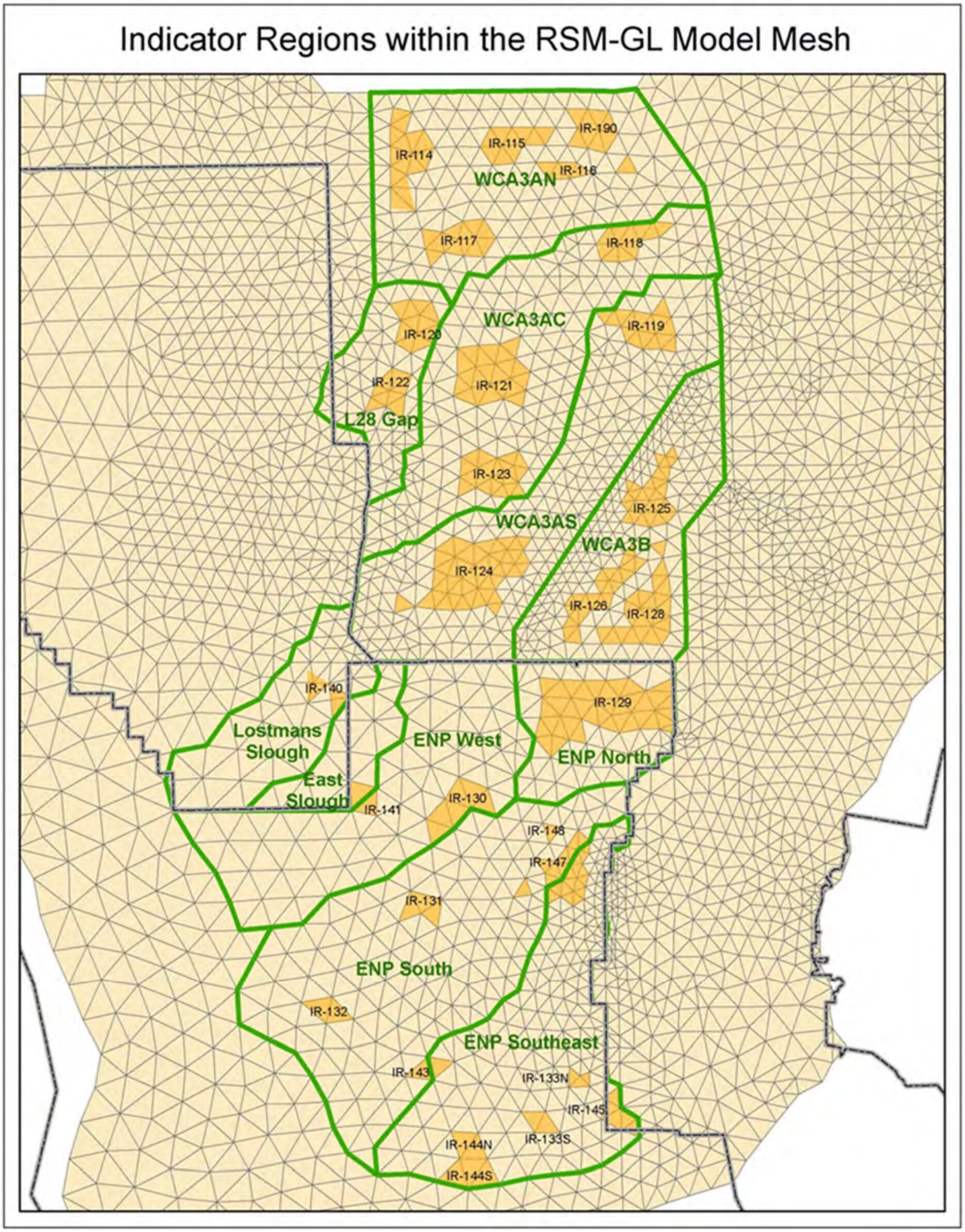


Figure E.1-1. Indicator regions (yellow) in the RSM-GL model mesh to be utilized in portions of the study area. Zones depicted in green to determine how benefits are spatially distributed throughout the area.

Inundation Duration in the Ridge and Slough Landscape

Observed similar performance of alternatives (ALTS) K, L and N. Each ALT provides increased risk of decreasing inundation duration in portions of central and southern WCA 3A and WCA 3B; additional risks are marginal. ALTS N and L increase stages relative to ALTK and ECB19R. Reference **Table E.1-4**, **Figure E.1-2,** and **Figure E.1-3**.

- ALTS perform virtually identically in northern WCA 3A (IR114, IR115, IR117).
- Each ALT increased inundation durations within NESRS and central SRS (IR129, IR130, and IR131 IR132) relative to ECB19R.
- ALTK increased inundation duration within NESRS and central SRS (IR129, IR130, IR131) followed by ALTN and ALTL; however difference between ALTS are minimal. ALTN increased inundation duration within southern SRS (IR132) followed by ALTL and ALTK. ALTN performed better in portions of Taylor Slough (IR133N, IR133S, IR144N, IR144S). ALTS K and L both decreased inundation duration at IR133N and IR133S relative to ECB19R.
- Observed, minimal decreases in inundation duration over the period of record in portions of central (IR118, IR121) and southern WCA 3A (IR119, IR124) and WCA 3B (IR125, IR126, IR128) with each ALT relative to ECB19R. Greatest magnitude of potential affect was observed under ALTN followed by ALTL and ALTK. In general, the ALTS converged as depths reaching 0.0 ft. are observed. It should be noted that IR119 and IR124 are perennially over-ponded, so above-ground decreases in this area are seen as positive.
- Observed differences between ALTS were slight. Changes in PPOR ranged from +/-4%. 1% equates to ~ 150 days over the period of record.
- Across WCA 3 and ENP, the target (NSM) is often not met under either the base condition (ECB19R) or under each ALT. This was expected as the COP is not introducing new water; only redistributing the existing water budget.
- While observed differences in the PPOR of inundation were slight, ALTN and ALTL increase stages 40% of the time within ENP on average. Reference normalized stage duration curves (IR129, IR130).

Number and Duration of Dry Events in Shark Slough

Observed similar performance of ALTS K, L and N. ALTS L and N performed slightly better than ALTK for percent duration of dry events. Reference **Figure E.1-4** and **Figure E.1-5**.

- Each ALT decreased the number and average duration of dry events in NESRS relative to ECB19R. Observed differences between ALTS were slight.
- Number of Dry Events (Order- Greatest Decrease to Least)
  - IR129 ALTK, ALTL, ALTN
  - IR130 ALTL, ALTK = ALTN
  - IR131: ALTK, ALTN, ALTL = ECB19R
  - IR132: ALTN, ALTK = ALTL
- Average Duration of Dry Events (Weeks) (Order – Greatest Decrease to Least)

  - IR129 ALTN, ALTK = ALTL
  - IR130 ALTL, ALTK = ALTN
  - IR131: ALTL, ALTN, ALTK = ECB19R
  - IR132: ALTK = ALTL = ALTN
- No ALT met the target (NSM).

Soil Oxidation

Observed mixed performance of ALTS in ENP; generally ALTK performed better in IRs 129, 130 and 131 (NE, Mid and West Shark Slough) while ALTN performed better in IRs 132, and 133N and 133S (South Shark Slough and Taylor Slough). Each ALT provides increased risk of cumulative drought intensity in portions of central and southern WCA 3A and WCA 3B; additional risks are marginal. Reference **Table E.1-5**, **Figure E.1-6**, and **Figure E.1-7**.

- Maximum amount of soil loss has been observed within northern portions of WCA 3A and northern ENP.
- Each ALT decreased the risk for soil oxidation within NESRS and central SRS (IR129, IR130, IR131, IR132) relative to ECB19R.
- ALTK decreased cumulative drought intensity within NESRS and central SRS (IR129, IR130, IR131) followed by ALTN and ALTL; ALTN decreased cumulative drought intensity duration within southern SRS (IR132) followed by ALTL and ALTK.
- ALTK, ALTL, and ALTN increased cumulative drought intensity in portions of Taylor Slough (IR133N). The same pattern was observed for ALTK and ALTL at IR133S; however ALTN at this location decreased the risk for soil oxidation.
- Observed minimal increases in cumulative drought intensity in portions of central WCA 3A (IR118, IR121) and southern WCA 3A (IR119, IR124) and WCA 3B (IR125, IR126, IR128) with each ALT relative to ECB19R. Greatest magnitude of potential affect was observed under ALTN followed by ALTL and ALTK.
- Across WCA 3 and ENP, the target (NSM) is often not met under either the base condition (ECB19R) or under each ALT. Exceptions occur in portions of central and southern WCA 3A where the target is exceeded.

Slough Vegetation Suitability

Observed better performance of ALTN relative to ALTS L and K in ENP. Generally alternatives demonstrated improvement relative to ECB19R, but this was not always true, particularly in southern Taylor Slough. There are clear operational effects for WCA3B, NESRS, and southern Taylor Slough.

- Water lily dominated sloughs are common features across the landscape of central and southern portion of WCA 3, but have been severely reduced in ENP for decades.
- All alternatives demonstrate similar performance for sloughs in northern WCA 3A, so no large scale landscape level tradeoff between ENP and WCA 3A is observable in the alternatives.
- WCA 3A central region shows slight dry season depth reduction and modest increase in dry down frequency for ALTL and K.

- The ponded area of WCA 3A (IR119) is too wet during wet years in ECB19R and ALTK. ALTS L and N enhance these areas by reducing average water depths during the wettest of years. All alternatives perform similarly in this area during the driest years.
- WCA 3B shows a modest depth reduction in wet years for ALTN. ALTL performs best in WCA 3B due to the elimination of wet season flows through S-335 and S-331 into southern Dade. Moving water through S-335 and S-331 during the wet season enhances southern Taylor Slough in ALTN.
- Major improvements to NESRS in ALTN and ALTL. A 0.25 depth enhancement is consistently shown for the wetter half (21 years) of the 41 year period of record.
- ALTN and ECB19R performed better for southern Taylor Slough (IR133N and IR133S). Difference was larger in IR133S – the southernmost portion of Taylor Slough, and this is likely caused by hydrologic deliveries through the eastern boundary canal system. Only ALTN enhances slough conditions in southern Taylor Slough compared to the baseline.
- Clear evidence of operational tradeoff between WCA3B and Eastern panhandle of ENP (southeast corner of ENP) in ALTN and L.

Florida Bay Salinity

ALTN performance in Florida Bay consistently (if only slightly) provided lower salinities in the bay, followed by ALTL and then ALTK, when compared to ECB19R. Reference **Table E.1-6**.

- Transect flows across T-23 (Craighead Basin, Taylor Slough and Eastern Panhandle) increased most in ALTN (258 thousand acre feet per year (KAC-FT per year)) from the ECB19R (227 KAC-FT /yr.). ALTL was essentially the same as ECB19R while ALTK decreased flows by 23 KAC-FT /yr.
- Notably, ALTN increased flows by 31% in the dry season from ECB19R.
- Increases in flows (ALTL and ALTN) came through the Eastern Panhandle portion of the transect (T-23C).
- Wet and dry season mean salinity in North, East, E Central, Central South and West Florida Bay saw a dip in practical salinity units (psu) of 0.96 to 0.39 psu in ALTN, from the ECB19R, quite small differences but trending in the right direction. This performance was followed by ALTL (.74 to .23) and ALTK (0.73 to .05).
- Larger differences were estimated for dry season 25th percentile levels (dry season salinity during relatively wet years), with Florida Bay sub-regions' salinity dropping the most from ECB19R with ALTN (decrease of 1.27 to 0.69 psu) then ALTL (0.83 to 0.60) then ALTK (0.61 to 0.46).

E.1.1.2 Summary of Round 1 Model Results: Performance Indicators

Performance indicators were used to evaluate potential affects to the current system by evaluating a given alternative relative to ECB19R. Results are summarized in bullet form below and in **Table E.1-3**. For supporting information on performance indicators refer to **Appendix E.2**.

2016 ERTP Biological Opinion Metrics

Observed similar performance of ALTS K, L and N. Reference **Figure E.1-10** and **Figure E.1-14**.

- Wood Stork and Wading Birds: ALTS K, L, and N do not exceed the identified thresholds more frequently than ECB19R.
- Cape Sable Seaside Sparrow (CSSS) Dry Nesting Days: ALTS K, L, and N meet the identified threshold of 40% of each subpopulation (CSSS-Ax through CSSS-F) obtaining 90 consecutive dry nesting days between March 1 and July 15 on average over the period of record.
- CSSS Discontinuous Hydroperiod: ALTS K, L, and N do not consistently meet the identified threshold of 40% of each subpopulation (CSSS-Ax through CSSS-F) obtaining a discontinuous hydroperiod range of 90-210 days on average over the period of record. Exceptions occur for CSSS-B for ALTS K, L and N; CSSS-D for ALTK and ALTL, and CSSS-E for ALTK and L. In instances in which the identified threshold of 40% is not met, the percentage is close to this value. Across the CSSS subpopulations ALTS K, L, and N are farthest from the identified threshold of 40% for CSSS-Ax; however in this instance ECB19R does not meet the identified target as well.
- Snail Kites (Dry Season High Water; Wet Season High Water; Recession Dry Season Amplitude): ALTS K, L, and N do not significantly exceed the identified thresholds more frequently than ECB19R.

Tree Islands

- Tree island decline across WCA 3A, WCA 3B, and ENP has been extensively documented. There has been a ~10% reduction in the number of tree islands larger than 1 acre each decade beginning 1952-2004.
- The rate of tree island loss is different in different portions of the landscape.
- The central portion of WCA 3A has the largest number of tree islands per square mile. This portion of the landscape also exhibits tree islands occurring adjacent to each other which have very different tendency to be inundated. Between May 1, 2016 and April 30, 2017 there were many examples of adjacent tree islands where the highest elevation portion of one tree island was never below the water surface while a tree island next to it had over 300 days of inundation.
- When inundation duration of 387 of the largest tree islands in WCA 3 and ENP is summarized and then the number of tree islands inundated is counted among 40 categories of inundation duration, it is observed that the WCA 3C region has 43 large tree islands which are inundated less than 10% of the time since 1991 (this translates to an average of inundation less than 37 days per year). These 43 islands represent 33% of the large tree islands mapped in this region.
- ALTN consistently produces the most tree islands that are inundated less than 10% of the total time period in all portions of WCA3A and WCA3B. None of the mapped tree islands are ever inundated in ENP. ALTL and N have more tree islands inundated less than 10% of the time than ECB19R. ALTK has fewer tree islands inundated less than 10% of the time.
- Reference **Figure E.1-16** through **Figure E.1-20.**

Flows to ENP Eastern Panhandle and at S-197

Observed better performance of ALTN relative to ALTS K and L. Reference **Figure E.1-21** and **Figure E.1-22**.

- ALTN increased average annual overland flow (KAC-FT per year) across ENP's Panhandle relative to ALTL, ALTK, and ECB19R over the period of record. ALTL performed better than ALTK.

- ALTN decreased average annual structure flow (KAC-FT per year) through S-197 relative to ALTL, ALTK, and ECB19R over the period of record. ALTL performed better than ALTK.
- ALTL increased the average number of days per year of no flow through S-197 relative to ALTN, ALTK, and ECB19R. ALTN performs similarly to ALTL and better than ALTK.
- Each ALT minimizes the average number of days per year of flow > 0 to 400 cfs through S-197 relative to ECB19R. ALTL decreased the number of days to the greatest extent relative to ECB19R.
- Each ALT minimizes the average number of days per year of flow > 400 and up to 800 cfs through S-197 relative to ECB19R. ALTN decreased the number of days to the greatest extent relative to ECB19R.
- Each ALT minimizes the average number of days per year of flow > 800 through S-197 relative to ECB19R. ALTN decreased the number of days to the greatest extent relative to ECB19R.

Minimum Levels

Observed better performance of ALTN relative to ALTS K and L.

- The total count of exceedances in ENP (peat and marl) was decreased under each ALT relative to ECB19R. ALTN had the fewest number of exceedances, followed by ALTL and ALTK.

Biscayne Bay Critical Flows Report

Observed better performance of ALTN relative to ALTS K and L.

- Observed differences in the volume of flow to Biscayne Bay and the distribution of flow with each ALT. The area of Biscayne Bay in need of additional water the most is the South Bay.
- ALTK increased flow to Biscayne Bay relative to ECB19R across North, Central and South Bays.
- ALTL increased flows to Biscayne Bay relative to ECB19R across North and Central Bays with a decrease for South Bay.
- ALTN decreased flows to Biscayne Bay relative to ECB19R across North Bay and increased flows to South Bay.

High-Low Closure Criteria for Everglades Wildlife Management Areas (WMAs)

- Compared to ECB19R, ALTK results in a 6% increase in days closed due to high water, and a 13% increase in days closed due to low water.
- Compared to ECB19R, ALTL results in a 4% decrease in days closed due to high water, and an 18% increase in days closed due to low water.
- Compared to ECB19R, ALTN results in a 14% decrease in days closed due to high water, and a 23% increase in days closed due to low water.

Table E.1-3. Performance indicators evaluation table Round 1 alternatives. NA indicates performance indicator information was not available.

2016 ERTP Biological Opinion Metrics	Metric Relative to the ECB19R	ECB19R		ALTK		ALTL		ALTN	
Wood Stork and Wading Birds: Water depths greater than 16 inches (41 cm) from March 1 through May 31 throughout WCA 3A for two consecutive years as measured by the two gauge average 3A-3 and 3A4 (based upon a ground surface elevation of 8.4 feet NGVD).	Does the ALT exceed the threshold relative to the ECB19R and if so what is the number of times the threshold is exceeded in two consecutive years over the period of record?	Number of Times Not Met = 12		No: = 9		No: =7		No: = 5	
*CSSS: Dry nesting days - To produce multiple broods each year, the CSSS requires at least 90 consecutive dry days (water below ground surface) during the nesting season (March 1 – July 15) . Manage water levels in a manner aimed at meeting the following: a. Subpopulation A - At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-Ax	51.2%	CSSS-Ax	48.2%	CSSS-Ax	50.1%	CSSS-Ax	49.8%
*CSSS: Dry nesting days - To produce multiple broods each year, the CSSS requires at least 90 consecutive dry days (water below ground surface) during the nesting season (March 1 – July 15) . Manage water levels in a manner aimed at meeting the following: a. Subpopulation A - At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-B	79.3%	CSSS-B	79.0%	CSSS-B	78.7%	CSSS-B	78.5%
*CSSS: Dry nesting days - To produce multiple broods each year, the CSSS requires at least 90 consecutive dry days (water below ground surface) during the nesting season (March 1 – July 15) . Manage water levels in a manner aimed at meeting the following: a. Subpopulation A - At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-C	85.0%	CSSS-C	93.0%	CSSS-C	87.7%	CSSS-C	86.4%

2016 ERTP Biological Opinion Metrics	Metric Relative to the ECB19R	ECB19R		ALTK		ALTL		ALTN	
*CSSS: Dry nesting days - To produce multiple broods each year, the CSSS requires at least 90 consecutive dry days (water below ground surface) during the nesting season (March 1 – July 15) . Manage water levels in a manner aimed at meeting the following: a. Subpopulation A - At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-D	43.1%	CSSS-D	48.3%	CSSS-D	42.9%	CSSS-D	39.7%
*CSSS: Dry nesting days - To produce multiple broods each year, the CSSS requires at least 90 consecutive dry days (water below ground surface) during the nesting season (March 1 – July 15) . Manage water levels in a manner aimed at meeting the following: a. Subpopulation A - At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-E	60.3%	CSSS-E	61.9%	CSSS-E	57.8%	CSSS-E	55.0%
*CSSS: Dry nesting days - To produce multiple broods each year, the CSSS requires at least 90 consecutive dry days (water below ground surface) during the nesting season (March 1 – July 15) . Manage water levels in a manner aimed at meeting the following: a. Subpopulation A - At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-F	71.5%	CSSS-F	82.6%	CSSS-F	73.6%	CSSS-F	69.0%
**CSSS: Discontinuous hydroperiod - The marl prairie habitat that the CSSS requires for its survival and recovery persists under a hydrologic regime of 90 – 210 wet days (water above ground; discontinuous). Manage water levels in a manner aimed at meeting the following: a. Western Marl Prairie – At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-Ax	32.3%	CSSS-Ax	30.8%	CSSS-Ax	32.1%	CSSS-Ax	32.0%

2016 ERTP Biological Opinion Metrics	Metric Relative to the ECB19R	ECB19R		ALTK		ALTL		ALTN	
**CSSS: Discontinuous hydroperiod - The marl prairie habitat that the CSSS requires for its survival and recovery persists under a hydrologic regime of 90 – 210 wet days (water above ground; discontinuous). Manage water levels in a manner aimed at meeting the following: a. Western Marl Prairie – At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-B	41.2%	CSSS-B	40.8%	CSSS-B	41.0%	CSSS-B	40.8%
**CSSS: Discontinuous hydroperiod - The marl prairie habitat that the CSSS requires for its survival and recovery persists under a hydrologic regime of 90 – 210 wet days (water above ground; discontinuous). Manage water levels in a manner aimed at meeting the following: a. Western Marl Prairie – At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-C	42.2%	CSSS-C	29.5%	CSSS-C	38.1%	CSSS-C	38.1%
**CSSS: Discontinuous hydroperiod - The marl prairie habitat that the CSSS requires for its survival and recovery persists under a hydrologic regime of 90 – 210 wet days (water above ground; discontinuous). Manage water levels in a manner aimed at meeting the following: a. Western Marl Prairie – At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-D	42.0%	CSSS-D	48.3%	CSSS-D	43.5%	CSSS-D	36.8%
**CSSS: Discontinuous hydroperiod - The marl prairie habitat that the CSSS requires for its survival and recovery persists under a hydrologic regime of 90 – 210 wet days (water above ground; discontinuous). Manage water levels in a manner aimed at meeting the following: a. Western Marl Prairie – At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-E	41.9%	CSSS-E	41.9%	CSSS-E	39.9%	CSSS-E	37.9%
**CSSS: Discontinuous hydroperiod - The marl prairie habitat that the CSSS requires for its survival and recovery persists under a hydrologic regime of 90 – 210 wet days (water above ground; discontinuous). Manage water levels in a manner aimed at meeting the following:	What is the % of CSSS subpopulation area that meets the target? A higher	CSSS-F	38.9%	CSSS-F	38.2%	CSSS-F	38.4%	CSSS-F	35.2%

2016 ERTP Biological Opinion Metrics	Metric Relative to the ECB19R	ECB19R	ALTK	ALTL	ALTN
a. Western Marl Prairie – At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target.	percentage is better for this metric.				
Everglade Snail Kite: a. Dry Season High Water - Timing: by April 15; Trigger Value: stage > 9.2 ft. NGVD at gauge 3AS3W1; Frequency: 2 consecutive years.	Does the ALT exceed the threshold relative to the ECB19R and if so what is the number of times the threshold is exceeded in two consecutive years over the period of record?	Number of Times Not Met = 7	No: = 7	No: = 7	No: = 4
Everglade Snail Kite: b. Wet Season High Water - Timing: June 1 – December 31; Trigger: stage > 10.5 ft. at gauge 3AS3W1 for 60 days; Frequency: 2 consecutive years.	Does the ALT exceed the threshold relative to the ECB19R and if so what is the number of times the threshold is exceeded in two consecutive years over the period of record?	Number of Times Not Met = 2	No: = 2	No: = 2	No: = 1
Everglade Snail Kite: c. Recession/Dry Season Amplitude - Timing: January 1 – May 31 (or onset of wet season, whichever is sooner); Trigger: stage difference > 1.7 ft. as measured at gauge(s) closest to kite nesting, as determined by the Service.	Does the ALT exceed the threshold relative to the ECB19R and if so what is the number of times the threshold is over the period of record?	Number of Times Not Met Gauge 3AS3W1 = 6	No: = 5	No: = 3	No: = 3
Everglade Snail Kite: c. Recession/Dry Season Amplitude - Timing: January 1 – May 31 (or onset of wet season, whichever is sooner); Trigger: stage difference > 1.7 ft. as measured at gauge(s) closest to kite nesting, as determined by the Service.	Does the ALT exceed the threshold relative to the ECB19R and if so what is the number of times the threshold is over the period of record?	Number of Times Not Met Gauge W2 = 7	No: = 6	No: = 4	No: = 4
Everglade Snail Kite: c. Recession/Dry Season Amplitude - Timing: January 1 – May 31 (or onset of wet season, whichever is sooner); Trigger: stage difference > 1.7 ft. as measured at gauge(s) closest to kite nesting, as determined by the Service.	Does the ALT exceed the threshold relative to the ECB19R and if so what is the number of times the threshold is over the period of record?	Number of Times Not Met Gauge 3A28 = 8	No: = 6	No: = 5	No: = 5
Everglade Snail Kite: c. Recession/Dry Season Amplitude - Timing: January 1 – May 31 (or onset of wet season, whichever is sooner); Trigger: stage difference > 1.7 ft. as measured at gauge(s) closest to kite nesting, as determined by the Service.	Does the ALT exceed the threshold relative to the ECB19R and if so what is the number of times the threshold is over the period of record?	Number of Times Not Met Gauge 3A-4 = 4	No: = 4	No: = 3	No: = 3

2016 ERTP Biological Opinion Metrics	Metric Relative to the ECB19R	ECB19R	ALTK	ALTL	ALTN
Tree Islands	-	145 (= 37% of mapped tree islands inundated less than 10% of period of record)	127 (= 33% of mapped tree islands inundated less than 10% of period of record	151 (= 39% of mapped tree islands inundated less than 10% of period of record	161 (= 42% of mapped tree islands inundated less than 10% of period of record
Outflow from C-111 Canal between S-18C and S-197	Does the ALT exceed ECB19R?	S-197: 60.6 KAC-FT	No: S-197: 27.6 KAC-FT	No: S-197: 10.9 KAC-FT	No: S-197: 8.1 KAC-FT
Outflow from C-111 Canal between S-18C and S-197	Does the ALT exceed ECB19R?	Overbank: 77.6 KAC-FT	Yes: Overbank: 78.2 KAC-FT	Yes: Overbank: 85.3 KAC-FT	Yes: Overbank: 107.0 KAC-FT
S-197 Daily Flow Distribution in cfs	Does the ALT exceed ECB19R?	No Flow: 141.1 Days	Yes: No Flow: 217.1 Days	Yes: No Flow: 356.6	Yes: No Flow: 353.7
S-197 Daily Flow Distribution in cfs	Does the ALT exceed ECB19R?	> 0 to 400 CFS: 217.2 Days	No: > 0 to 400 CFS: 87.9	No: > 0 to 400 CFS: 3.5	No: > 0 to 400 CFS: 11.5
S-197 Daily Flow Distribution in cfs	Does the ALT exceed ECB19R?	> 400 to 800 CFS: 3.0 Days	No: > 400 to 800 CFS: 2.3	No: > 400 to 800 CFS: 2.4	No: > 400 to 800 CFS: 0.0
S-197 Daily Flow Distribution in cfs	Does the ALT exceed ECB19R?	> 800 CFS: 3.9 Days	No: > 800 CFS: 3.0	No: > 800 CFS: 2.8	No: > 800 CFS: 0.0
Minimum Levels Peat in ENP (Count of Exceeding Criteria)	Does the ALT exceed the criteria?	10	6	6	6
Minimum Levels Marl in ENP (Count of Exceeding Criteria)	Does the ALT exceed the criteria?	53	56	52	50
Minimum Levels Peat in WCA 3	Does the ALT exceed the criteria?	NA	NA	NA	NA
Biscayne Bay – North (S-25+S-25B+S-26+S-27+S-28+S-29)	Does the ALT increase flows relative to ECB19R?	512.4 KAC-FT	Yes: 529.4 KAC-FT	Yes: 543.7 KAC-FT	No: 500 KAC-FT
Biscayne Bay – Central (G-93+S-22+S-123)	Does the ALT increase flows relative to ECB19R?	106.7 KAC-FT	Yes: 113.1 KAC-FT	Yes: 110.9 KAC-FT	No: 106.4 KAC-FT
Biscayne Bay – South (S-20F+S-20G+S-21+S-21A)	Does the ALT exceed the ECB19R?	251.1 KAC-FT	Yes: 253.2 KAC-FT	No: 233 KAC-FT	Yes: 264.9 KAC-FT
High-Low Closure Criteria for Everglades Wildlife Management Areas. Criteria Used: 1. A closure was counted as soon as the closure criteria was exceeded 2. If there were up to 2 consecutive weeks that did not violate the criteria in between closures, that was counted as one closure (i.e., the area did not open and close) 3. Closures are based on calendar years The total number of days does not include the days that did not violate the closure criteria in between closures (i.e., the day count does not include the days referred to in number 2 above).	Days High Water Criteria Exceeded (Percent Change from ECB19R)	498	528 (6%)	476 (-4%)	427 (-14%)
High-Low Closure Criteria for Everglades Wildlife Management Areas. Criteria Used: 1. A closure was counted as soon as the closure criteria was exceeded 2. If there were up to 2 consecutive weeks that did not violate the criteria in between closures, that was counted as one closure (i.e., the area did not open and close)	Days Low Water Criteria Exceeded (Percent Change from ECB19R)	756	854 (13%)	895 (18%)	933 (23%)

2016 ERTP Biological Opinion Metrics	Metric Relative to the ECB19R	ECB19R	ALTK	ALTL	ALTN
3. Closures are based on calendar years The total number of days does not include the days that did not violate the closure criteria in between closures (i.e., the day count does not include the days referred to in number 2 above).					
High-Low Closure Criteria for Everglades Wildlife Management Areas. Criteria Used: 1. A closure was counted as soon as the closure criteria was exceeded 2. If there were up to 2 consecutive weeks that did not violate the criteria in between closures, that was counted as one closure (i.e., the area did not open and close) 3. Closures are based on calendar years The total number of days does not include the days that did not violate the closure criteria in between closures (i.e., the day count does not include the days referred to in number 2 above).	Number of High Water Closures	10	10	9	9
High-Low Closure Criteria for Everglades Wildlife Management Areas. Criteria Used: 1. A closure was counted as soon as the closure criteria was exceeded 2. If there were up to 2 consecutive weeks that did not violate the criteria in between closures, that was counted as one closure (i.e., the area did not open and close) 3. Closures are based on calendar years The total number of days does not include the days that did not violate the closure criteria in between closures (i.e., the day count does not include the days referred to in number 2 above).	Damaging High Water Closures (> 60 Days)	3	3	3	3
High-Low Closure Criteria for Everglades Wildlife Management Areas. Criteria Used: 1. A closure was counted as soon as the closure criteria was exceeded 2. If there were up to 2 consecutive weeks that did not violate the criteria in between closures, that was counted as one closure (i.e., the area did not open and close) 3. Closures are based on calendar years The total number of days does not include the days that did not violate the closure criteria in between closures (i.e., the day count does not include the days referred to in number 2 above).	Number of Low Water Closures	16	15	15	16

* Results generated produced from the Interagency Modeling Center's (IMC's) post-processing spreadsheet. Information not generated from CSSS Viewer.
** Results produced from IMC's post-processing spreadsheet. Information not generated from CSSS Viewer. Note % therefore does not reflect a four year running average discontinuous hydroperiod range; represents average over the period of record.
***There are 2132 weeks in the period of record (1965-2005).

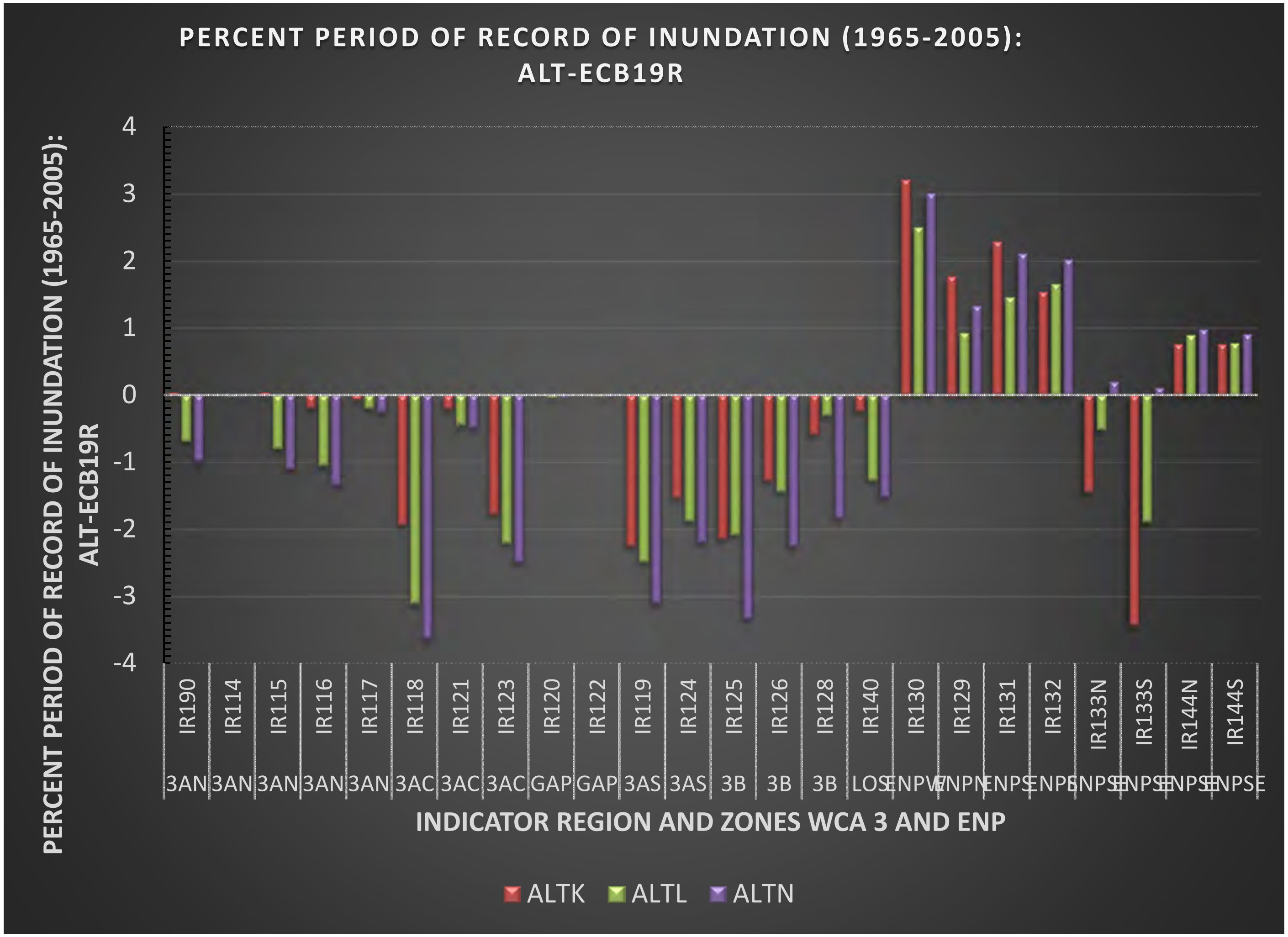


Figure E.1-2. Percent period of record of inundation (1965-2005) in WCA 3 and ENP for ALTK, ALTL, and ALTN relative to ECB19R. Values above the line indicate an alternative exceeds ECB19R. Values below the line indicate an alternative does not exceed ECB19R.

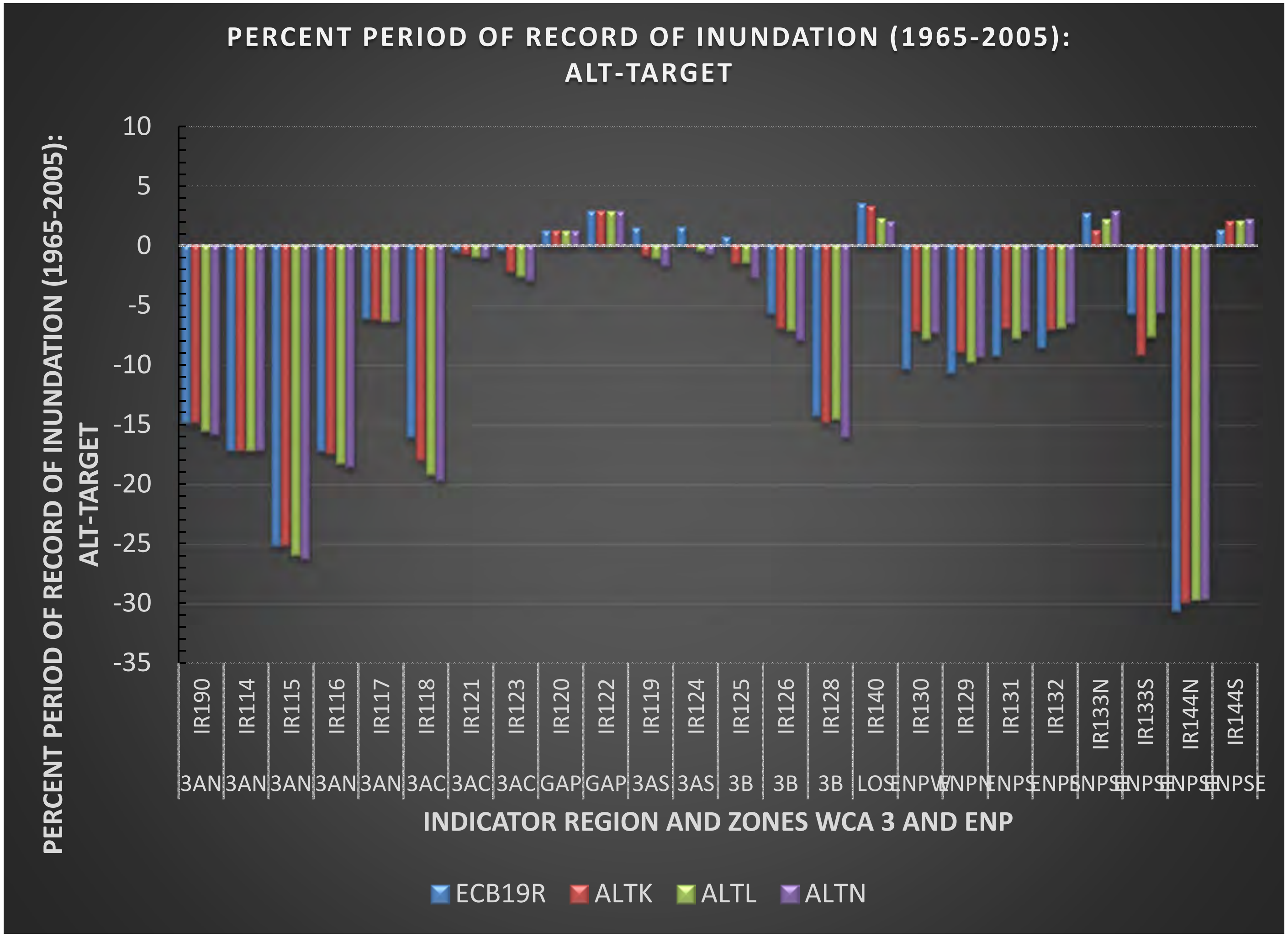


Figure E.1-3. Percent period of record of inundation (1965-2005) in WCA 3 and ENP for ECB19R, ALTK, ALTL, and ALTN relative to the target (NSM). Values above the line indicate an alternative exceeds the target. Values below the line indicate an alternative does not meet the target. Values below axis are not deemed detrimental.

Table E.1-4. Percent period of record of inundation (1965-2005). Scores are illustrated by zone and indicator region for the target (NSM), ECB19R and Alt K, ALTL, and ALTN.

Zone	Indicator Region	ECB19R	ALTK	ALTL	ALTN	TARGET
3AN	IR190	74	74	73	73	89
3AN	IR114	78	78	78	78	95
3AN	IR115	68	68	67	67	93
3AN	IR116	71	71	70	70	88
3AN	IR117	90	90	89	89	96
3AC	IR118	77	75	74	73	93
3AC	IR121	93	93	92	92	93
3AC	IR123	91	90	89	89	92
GAP	IR120	95	95	95	95	94
GAP	IR122	95	95	95	95	93
3AS	IR119	94	92	92	91	93
3AS	IR124	95	94	93	93	94
3B	IR125	89	87	87	86	88
3B	IR126	92	90	90	89	97
3B	IR128	84	83	83	82	98
LOS	IR140	78	78	77	77	75
ENPW	IR130	88	91	91	91	98
ENPN	IR129	89	90	89	90	99
ENPS	IR131	87	89	88	89	96
ENPS	IR132	87	88	88	89	95
ENPSE	IR133N	91	90	91	92	89
ENPSE	IR133S	83	80	81	83	89
ENPSE	IR144N	58	59	59	59	89
ENPSE	IR144S	90	91	91	91	89

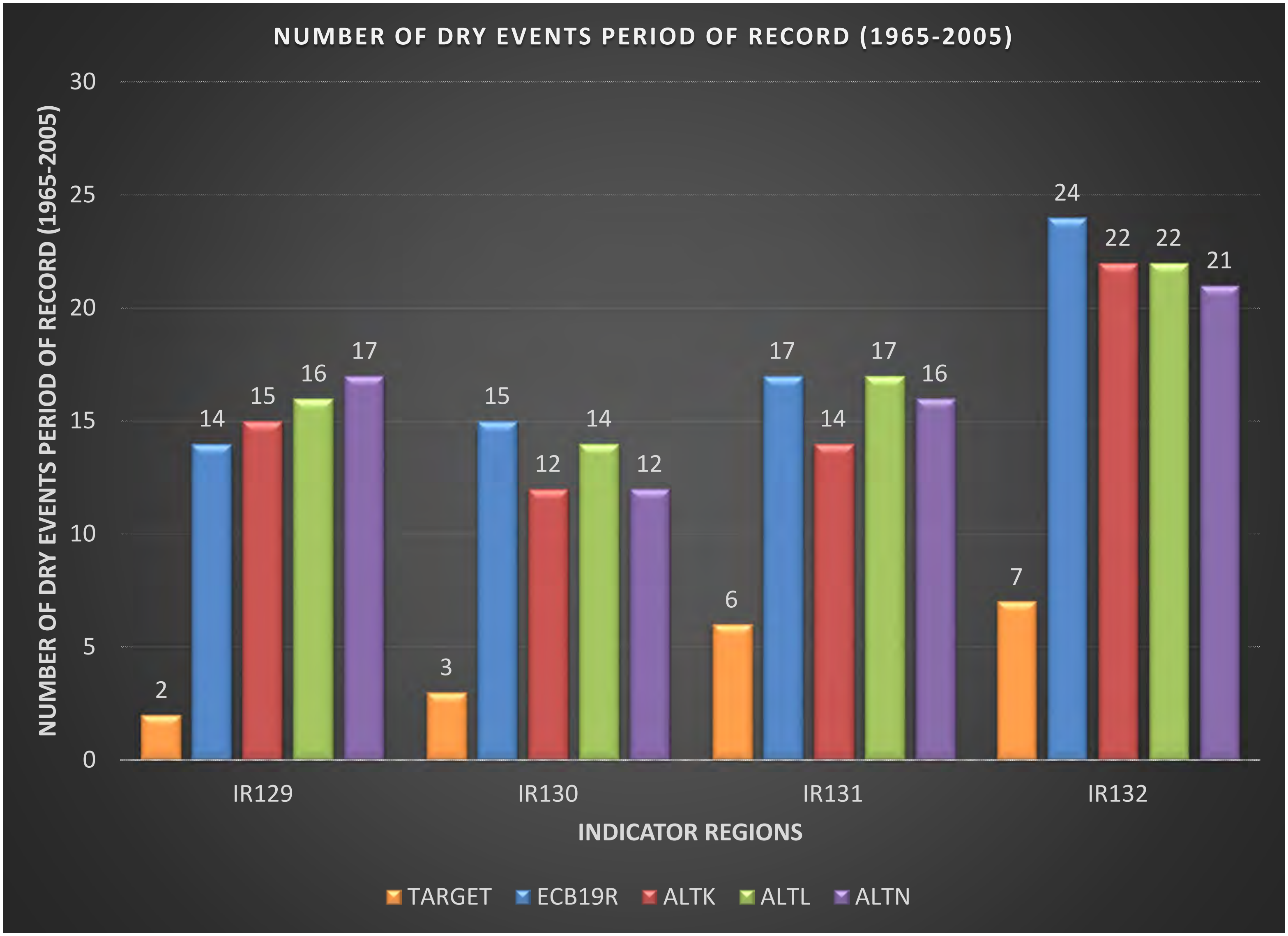


Figure E.1-4. Number of dry events in NESRS over the period of record (1965-2005) for the target, ECB19R, ALTK, ALTL, and ALTN.

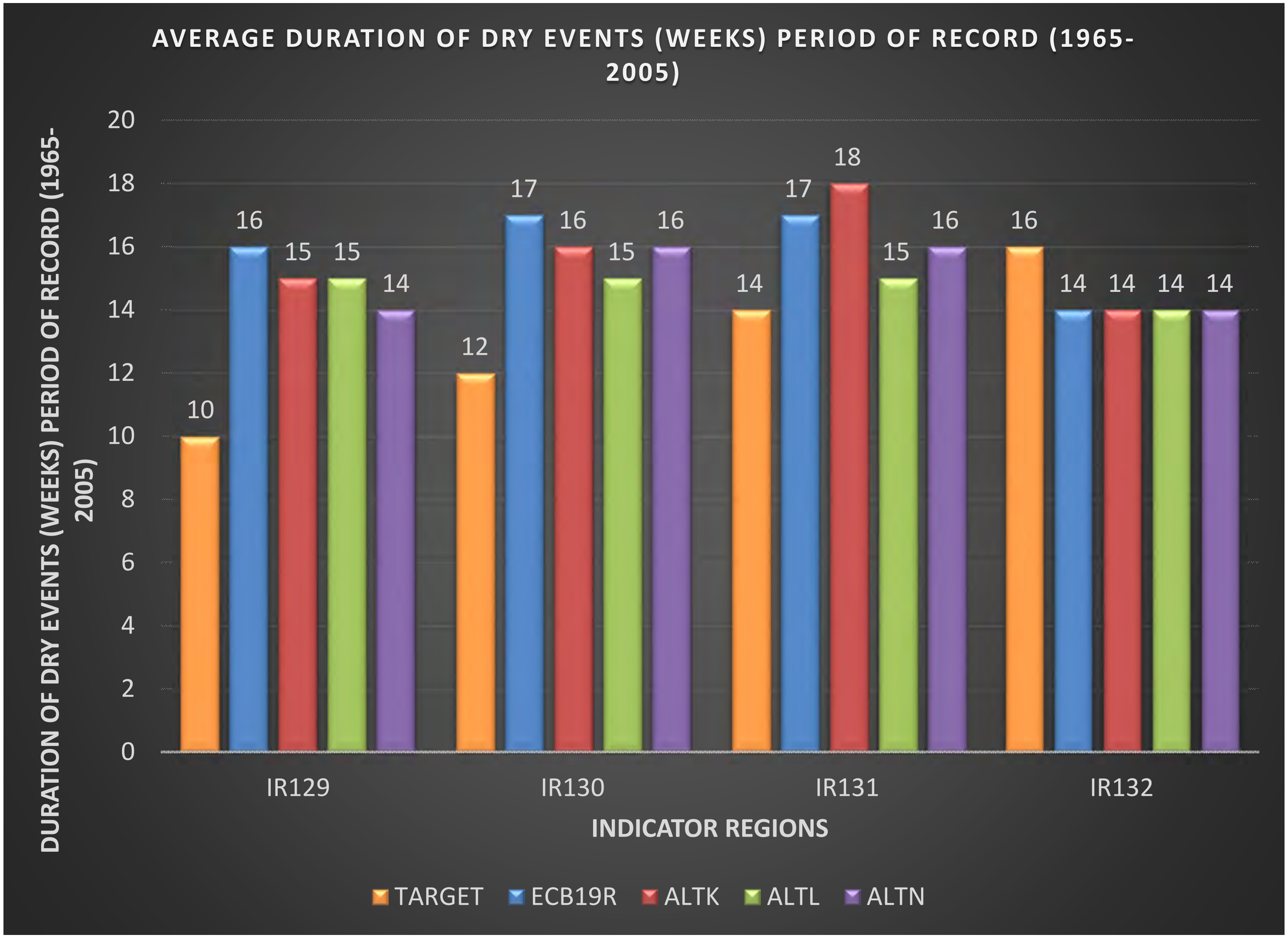


Figure E.1-5. Average duration of dry events (weeks) in NESRS over the period of record (1965-2005) for the target, ECB19R, ALTK, ALTL, and ALTN.

Table E.1-5. Hydrologic surrogate for soil oxidation (water depth relative to land surface elevation ft.-days below ground). Scores are illustrated by zone and indicator region for the target (NSM), ECB19R, ALTK, ALTL, and ALTN. * Denotes missing score. Lower values represents reduced cumulative drought intensity.

Zone	Indicator Region	ECB19R	ALTK	ALTL	ALTN	TARGET
3AN	IR190	1403	1403	1436	1447	1252
3AN	IR114	1238	1238	1238	1238	318
3AN	IR115	1889	1899	1941	1958	513
3AN	IR116	1736	1758	1811	1828	921
3AN	IR117	546	552	557	560	282
3AC	IR118	1637	1880	1981	2046	487
3AC	IR121	270	280	287	289	495
3AC	IR123	337	429	454	471	666
GAP	IR120	153	154	154	154	487
GAP	IR122	146	145	146	146	664
3AS	IR119	232	352	367	417	443
3AS	IR124	174	256	273	295	492
3B	IR125	728	928	907	1044	919
3B	IR126	435	511	504	574	115
3B	IR128	1257	1329	1281	1452	87
ENPW	IR130	665	450	495	457	114
ENPN	IR129	1060	893	985	943	37
ENPS	IR131	746	574	626	588	317
ENPS	IR132	1162	1008	1001	964	370
ENPSE	IR133N	695	833	768	724	*
ENPSE	IR133S	2808	3371	3112	2775	*

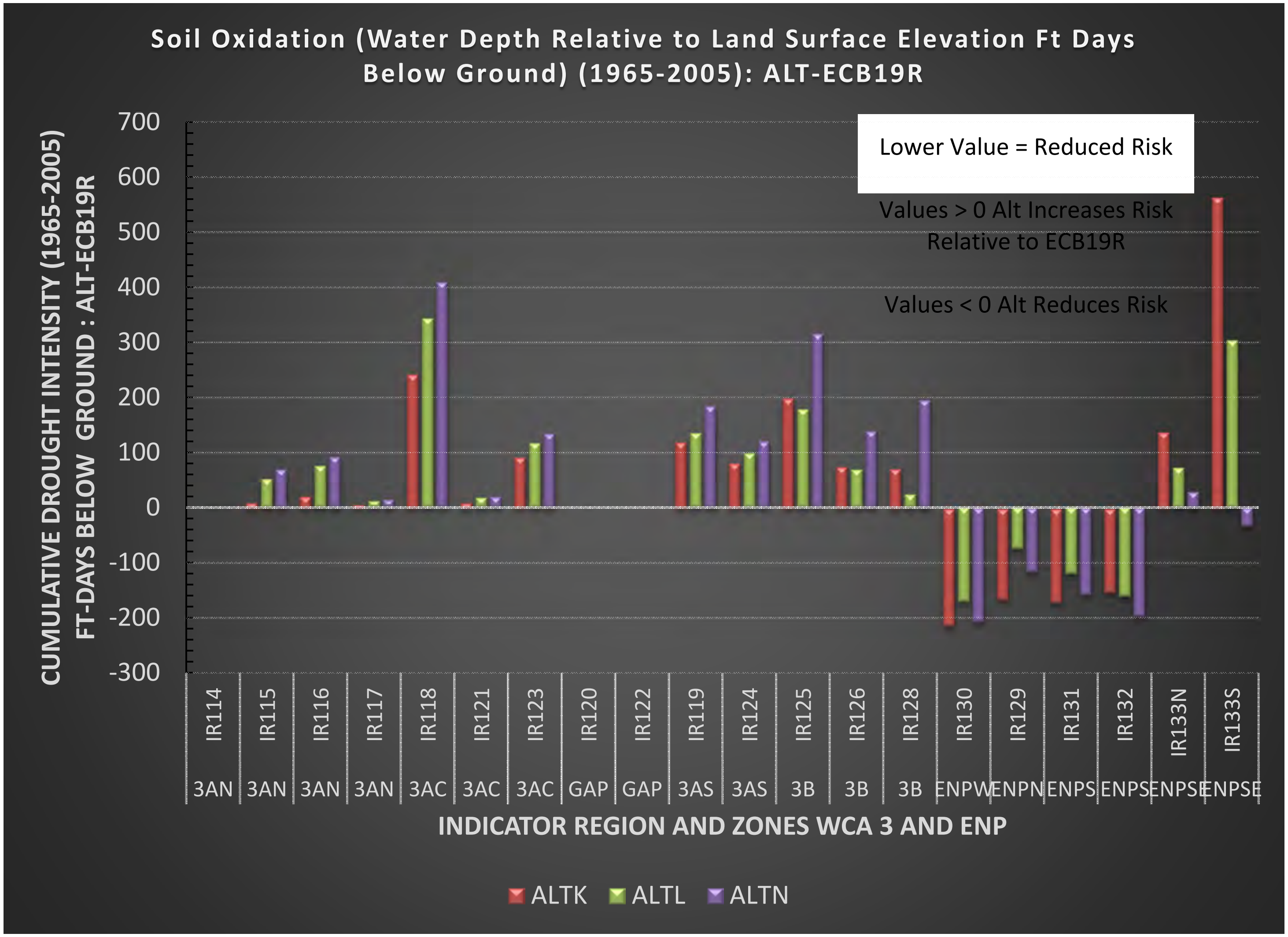


Figure E.1-6. Difference in hydrologic surrogate for soil oxidation (water depth relative to land surface elevation ft.-days below ground). Scores are illustrated by zone and indicator region for ALTK, ALTL, and ALTN relative to ECB19R.

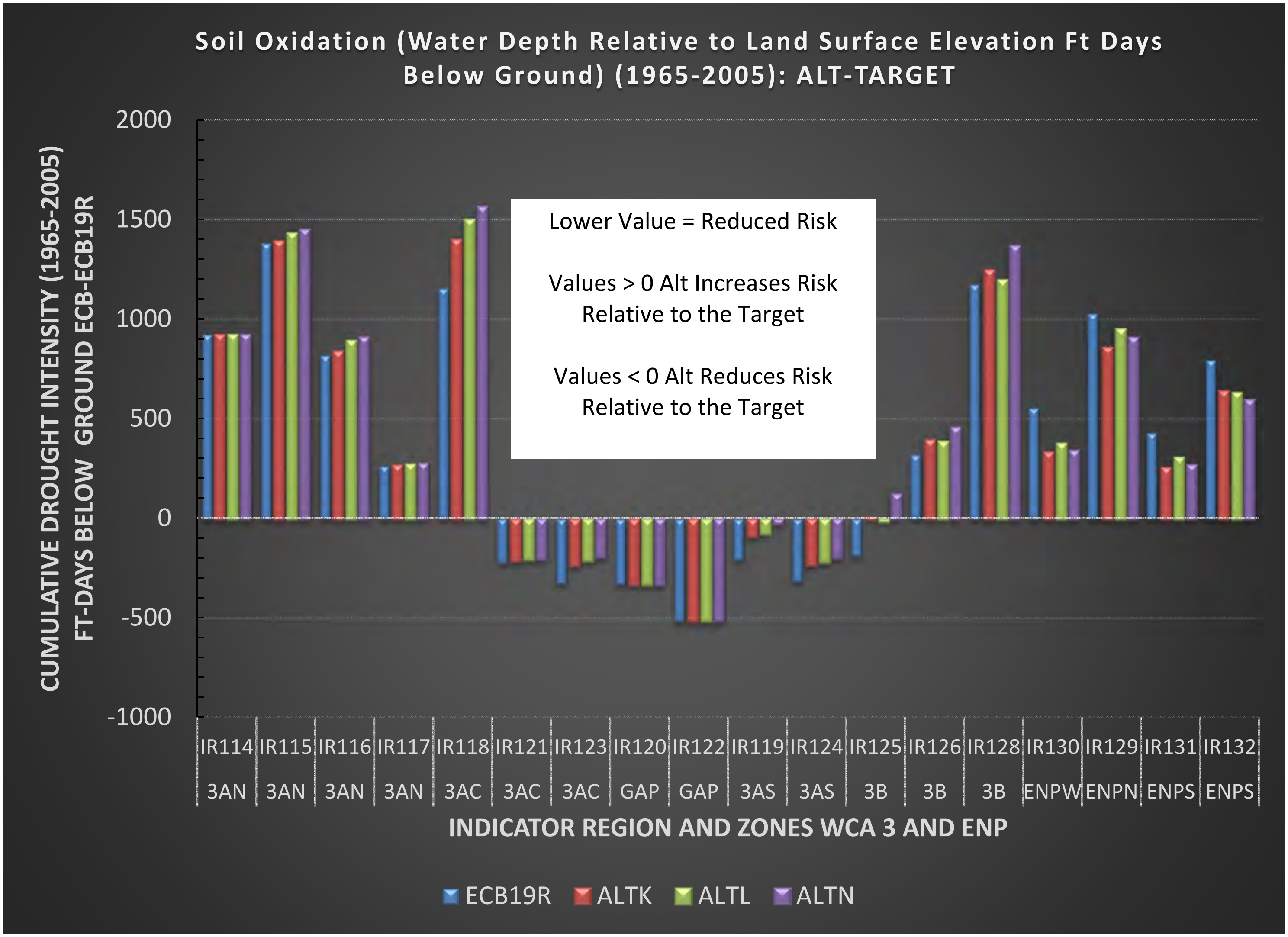


Figure E.1-7. Difference in hydrologic surrogate for soil oxidation (water depth relative to land surface elevation ft.-days below ground). Scores are illustrated by zone and indicator region for ECB19R and ALTK, ALTL, and ALTN relative to the target (NSM).

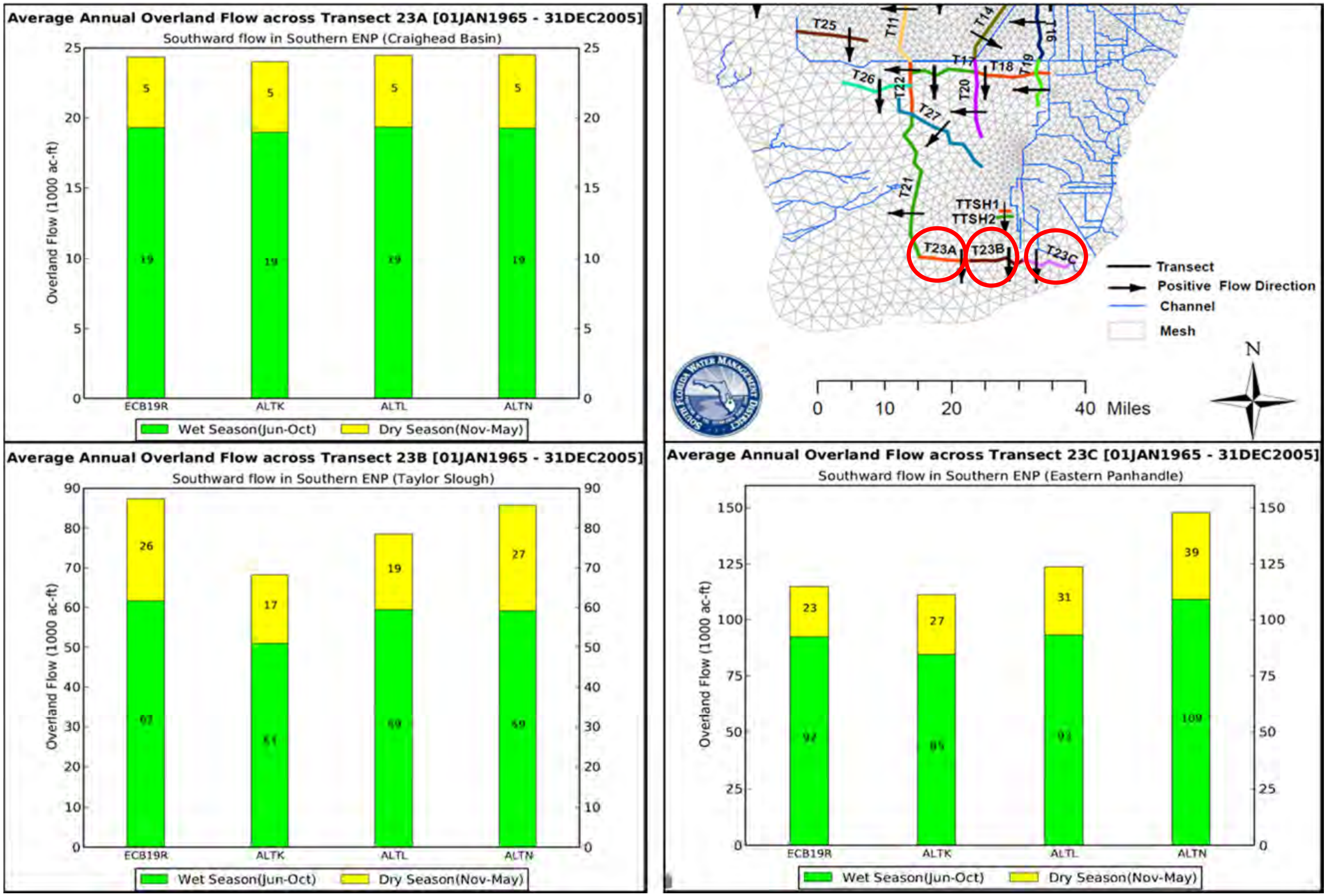


Figure E.1-8. Average annual overland flow across transects (T23A, T23B, T23C) in thousand acre feet across the period of record (1965-2005) for ECB19R, ALTK, ALTL, and ALTN. Red circles denote location of referenced transects.

Table E.1-6. Dry season and wet season mean salinity. Difference from ECB19R in Florida Bay.

Florida Bay Zone	Dry Season Mean Salinity ECB19R (PSU)	Dry Season Mean Salinity ALTK (Difference from ECB19R)	Dry Season Mean Salinity ALTL (Difference from ECB19R)	Dry Season Mean Salinity ALTN (Difference from ECB19R)
North Bay	25.1	0.42	0.49	0.92
East Bay	29.9	0.28	0.39	0.72
E Central Bay	29.0	0.55	0.49	0.62
Central Bay	35.5	0.73	0.74	0.96
South Bay	34.7	0.56	0.51	0.65
West Bay	36.1	0.51	0.48	0.62
Florida Bay Zone	**Wet Season Mean Salinity ECB19R (PSU)**	**Wet Season Mean Salinity ALTK (Difference from ECB19R)**	**Wet Season Mean Salinity ALTL (Difference from ECB19R)**	**Wet Season Mean Salinity ALTN (Difference from ECB19R)**
North Bay	18.3	0.13	0.40	0.59
East Bay	24.7	0.05	0.23	0.43
E Central Bay	27.6	0.22	0.37	0.43
Central Bay	32.6	0.27	0.51	0.61
South Bay	33.8	0.22	0.38	0.44
West Bay	34.8	0.19	0.34	0.39

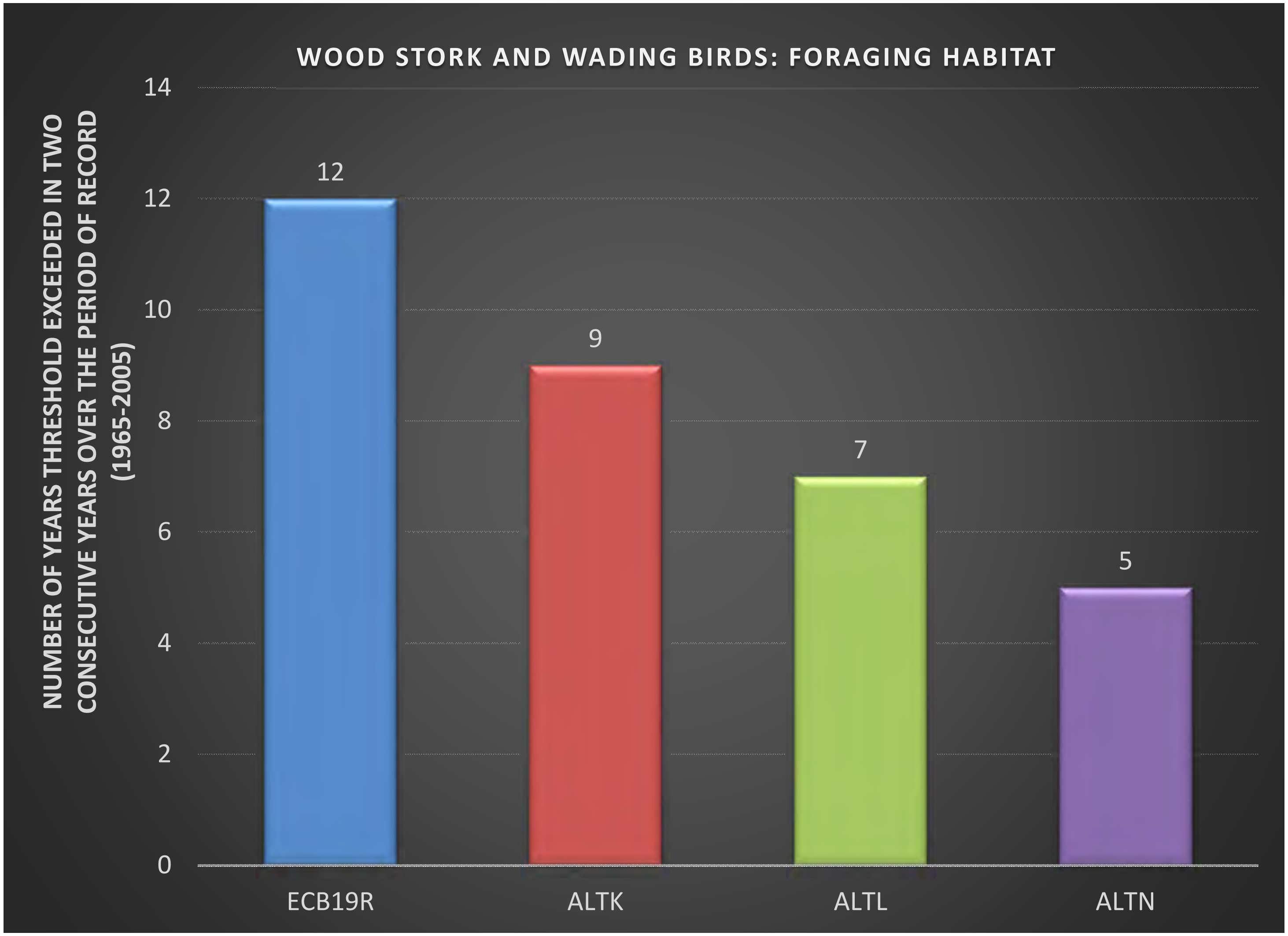
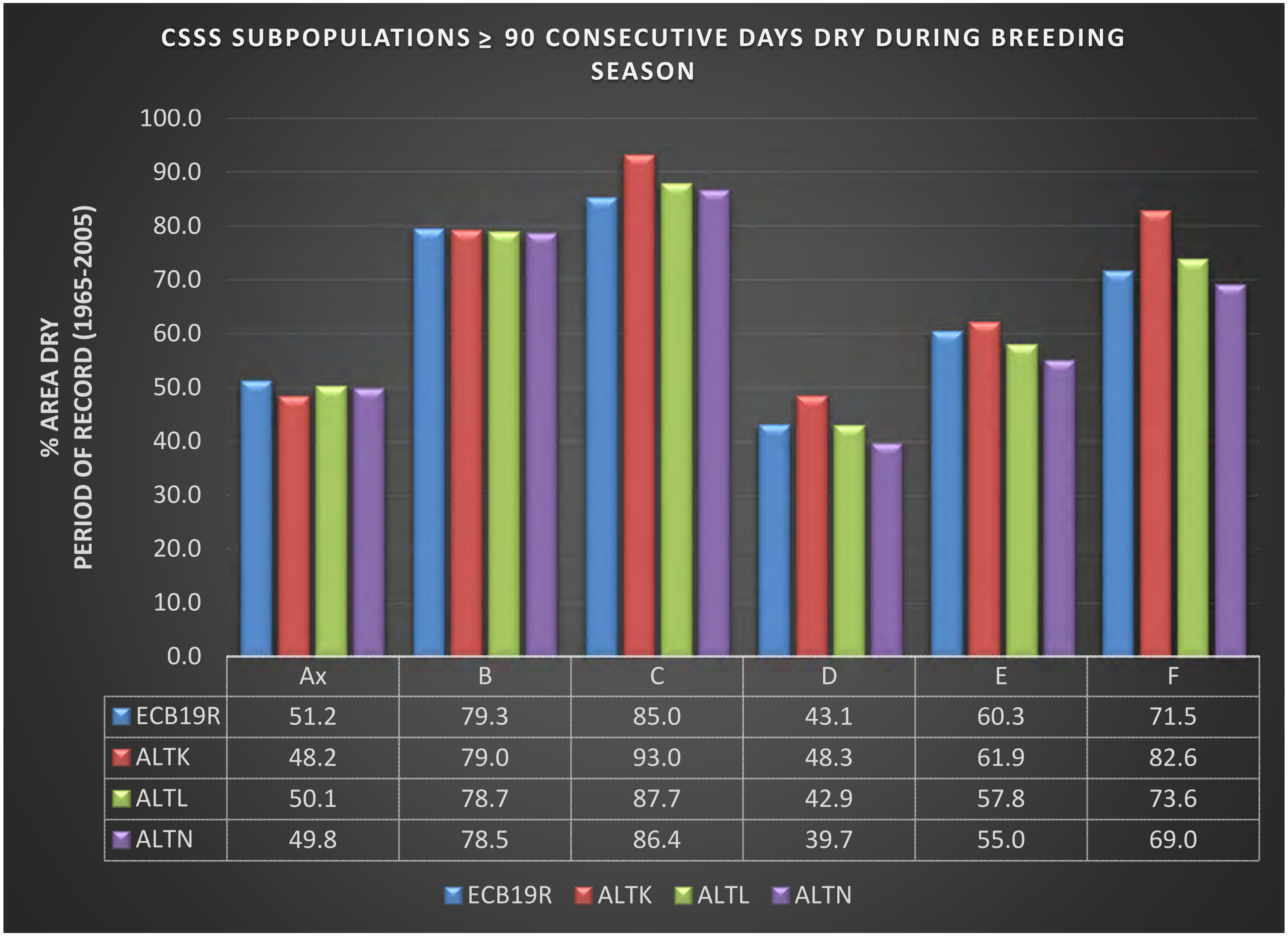
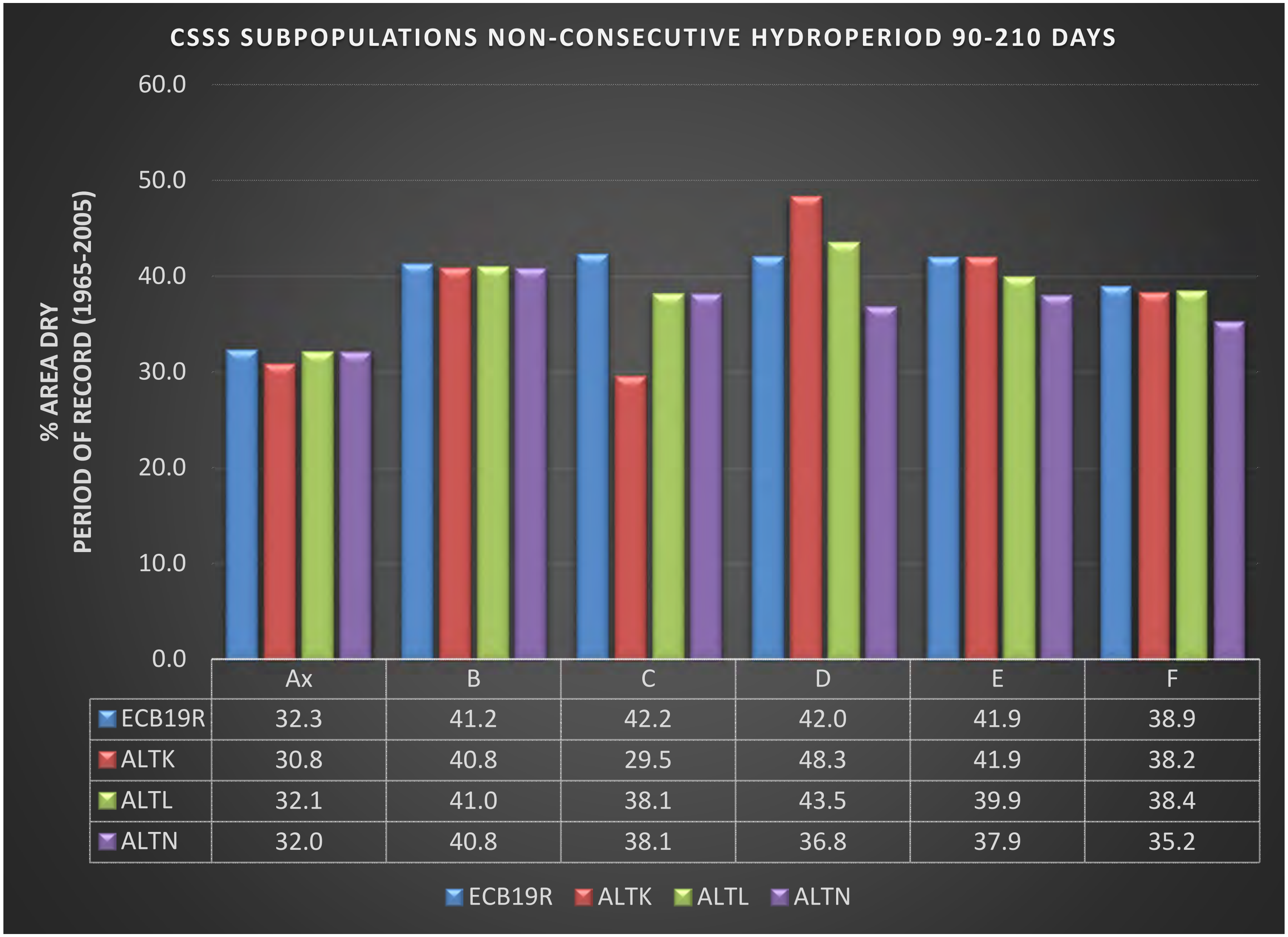


Figure E.1-9. Wood storks and wading birds Round 1: Number of times in the period of record (1965-2005) when water depths exceeds 16 inches (41 cm) from March 1 through May 31 throughout WCA 3A in two consecutive years as measured by the two gauge average (based upon a ground surface elevation of 8.4 feet NGVD at gages 3A-3 and 3A-4).



	Ax	B	C	D	E	F
ECB19R	51.2	79.3	85.0	43.1	60.3	71.5
ALTK	48.2	79.0	93.0	48.3	61.9	82.6
ALTL	50.1	78.7	87.7	42.9	57.8	73.6
ALTN	49.8	78.5	86.4	39.7	55.0	69.0

Figure E.1-10. CSSS nesting season statistics (dry nesting days) Round 1: Percent of habitat within CSSS subpopulations that met ≥ 90 consecutive dry days during March 1 through July 15 over the period of record (1965-2005).



	Ax	B	C	D	E	F
ECB19R	32.3	41.2	42.2	42.0	41.9	38.9
ALTK	30.8	40.8	29.5	48.3	41.9	38.2
ALTL	32.1	41.0	38.1	43.5	39.9	38.4
ALTN	32.0	40.8	38.1	36.8	37.9	35.2

Figure E.1-11. CSSS nesting season statistics (discontinuous hydroperiod) Round 1: Percent of habitat within CSSS subpopulations that met a discontinuous hydroperiod range of 90-210 days over the period of record (1965-2005).

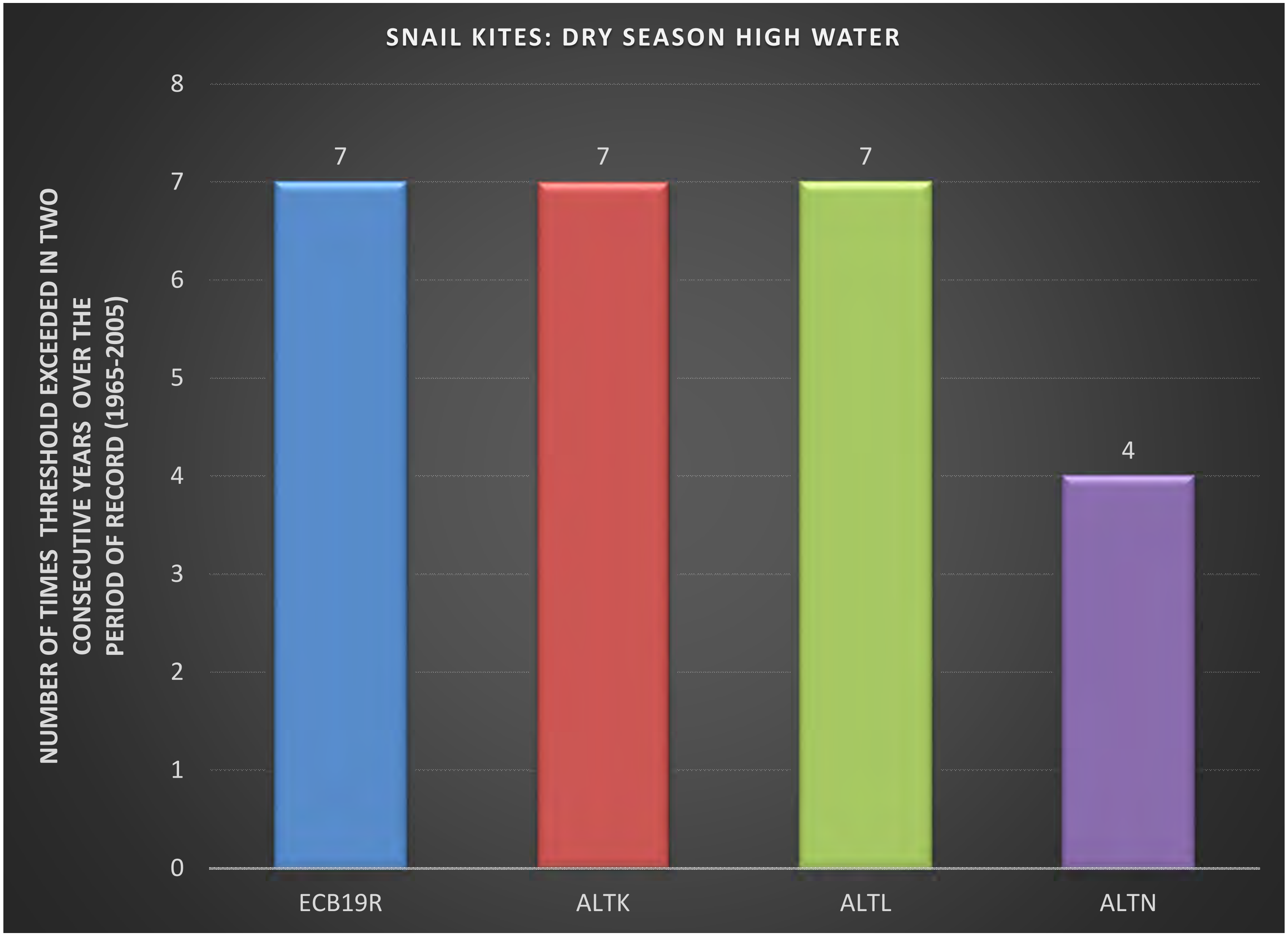


Figure E.1-12. Snail kites (dry season high water) Round 1: Number of times in the period of record (1965-2005) when maximum water levels exceed 9.2 feet, NGVD at gage 3AS3W1 on or after April 15 in two consecutive years.

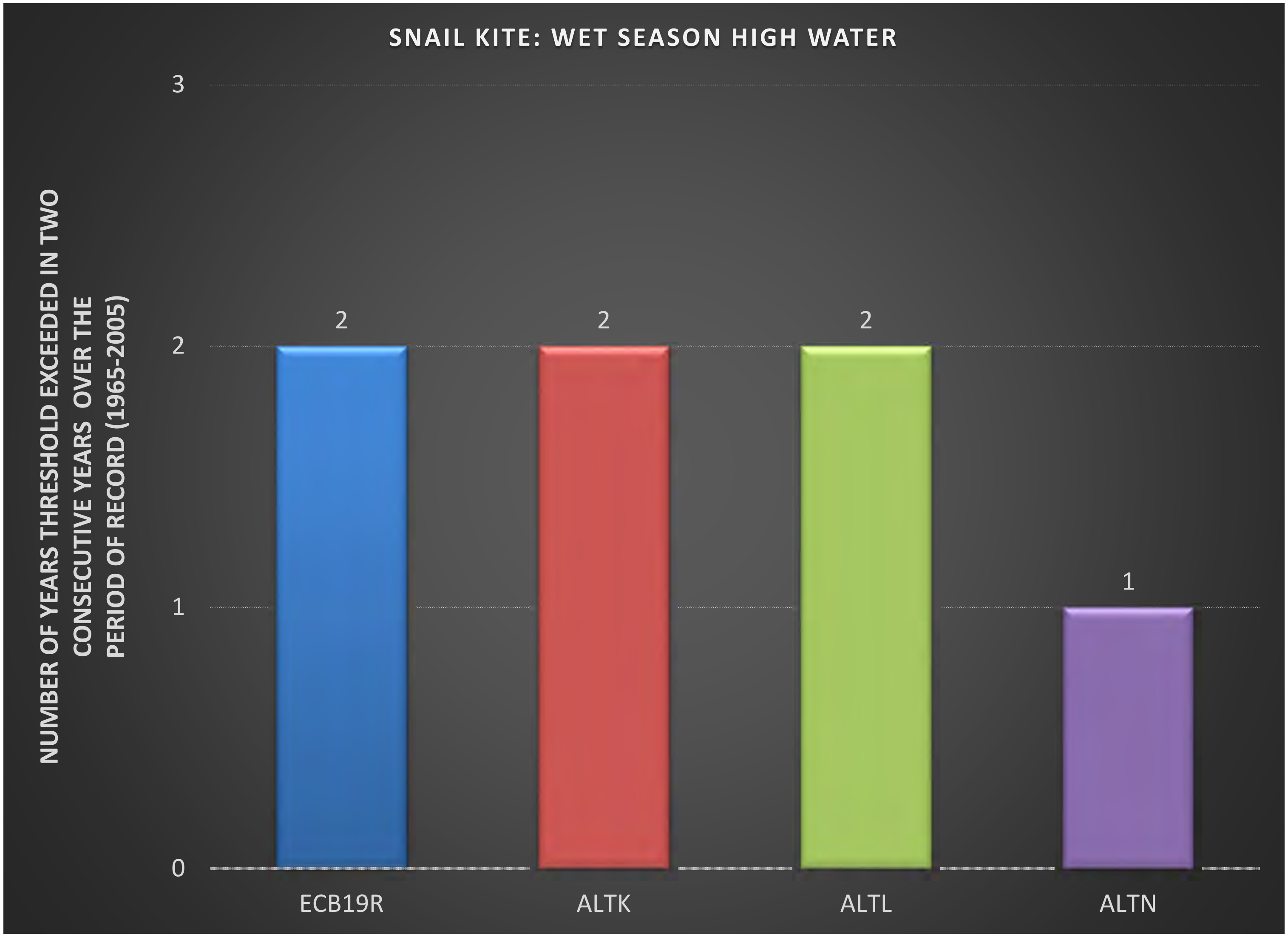


Figure E.1-13. Snail kites (wet season high water) Round 1: Number of times in the period of record (1965-2005) when maximum water levels exceed 10.5 feet, NGVD at gage 3AS3W1 for 60 days (June 1-December 31) in two consecutive years.

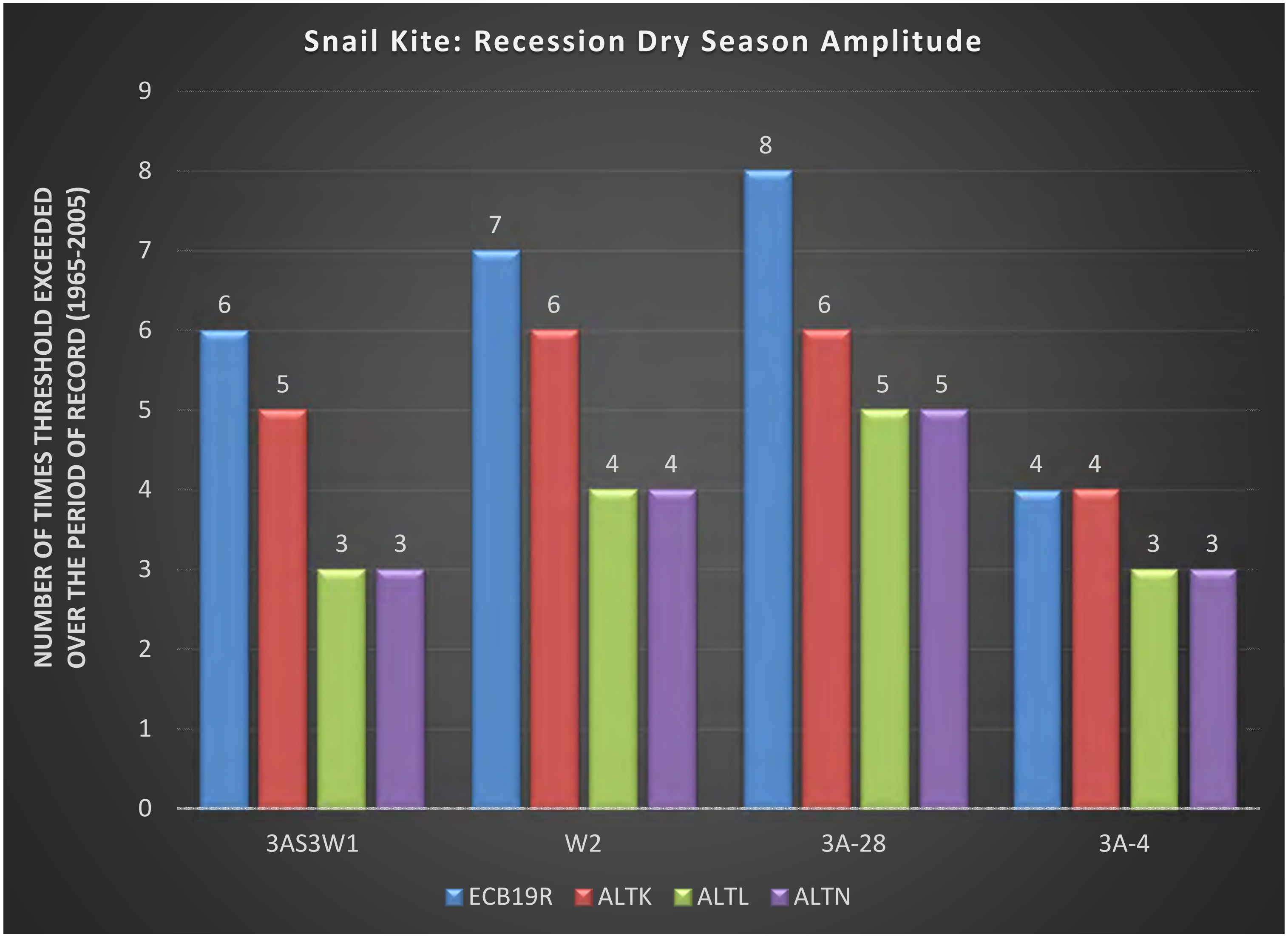


Figure E.1-14. Snail kites (recession: dry season amplitude) Round 1: number of years over the period of record (1965-2005) the WCA 3A stage difference as measured at gages 3AS3W1, W2, 3A-28, and 3A-4 recedes by more than 1.7 feet, NGVD from January 1 through May 31 in a given year.

Table E.1-7. Total number of tree islands inundated less than 10% of time period for Round 1. For observed this = 950 days over 26 years, for alts this = 1461 days over 41 years.

Alternative	WCA 3AC	WCA 3AN	WCA 3AS	WCA 3B	ENPN	ENPS	ENPW	Gap	Sum
Observed	16	3	19	11	4	14	18	6	91
ECB19R	47	1	26	11	4	14	18	24	145
Alt K	41	1	20	7	4	14	18	22	127
Alt L	51	1	27	12	4	14	18	24	151
Alt N	57	1	29	14	4	14	18	24	161

Table E.1-8. Percent of mapped tree islands inundated less than 10% of time period for Round 1. For observed this = 950 days over 26 years, for alts this = 1461 days over 41 years.

Alternative	WCA 3AC	WCA 3AN	WCA 3AS	WCA 3B	ENPN	ENPS	ENPW	Gap	Total
Observed	12%	50%	17%	38%	100%	100%	100%	9%	24%
ECB19R	36%	17%	24%	38%	100%	100%	100%	36%	37%
Alt K	32%	17%	18%	24%	100%	100%	100%	33%	33%
Alt L	39%	17%	25%	41%	100%	100%	100%	36%	39%
Alt N	44%	17%	26%	48%	100%	100%	100%	36%	42%

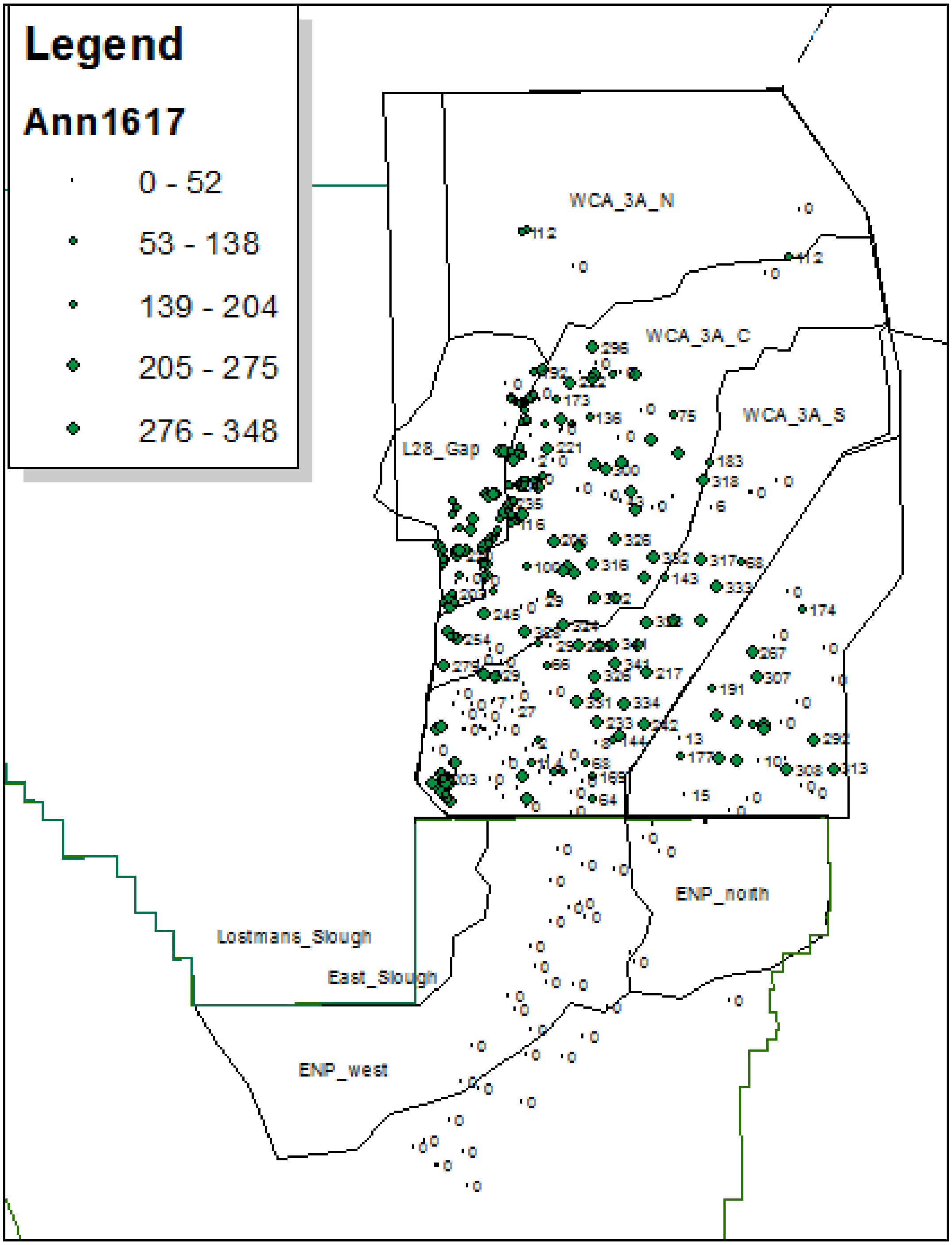


Figure E.1-15. Location of mapped tree islands with estimate of number of days inundated during April May 1, 2016 and April 30, 2017.

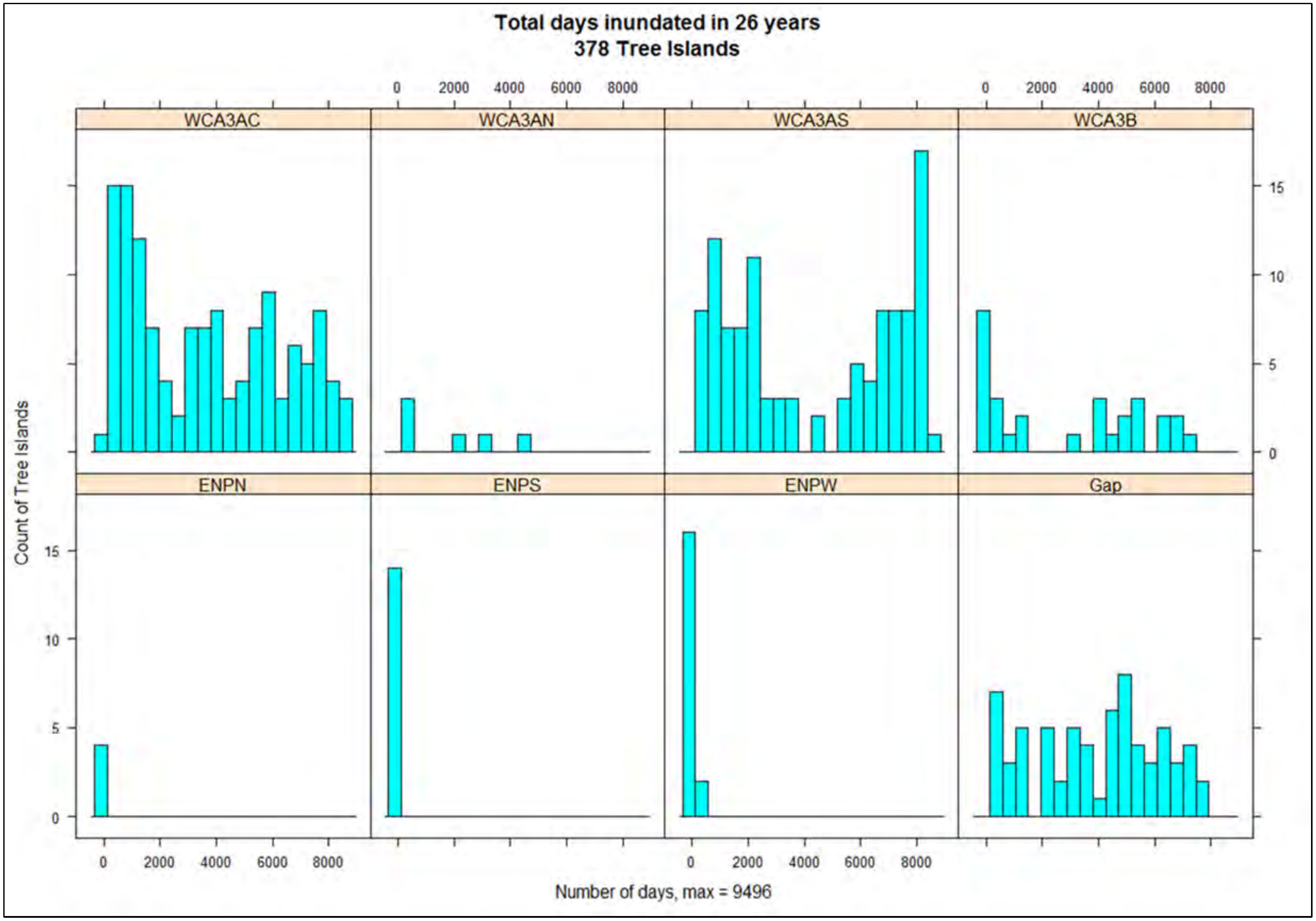


Figure E.1-16. Histogram of mapped tree islands across the regions of interest in WCA 3A, WCA 3B, and ENP. These are observed counts of inundation over a 25 year period.

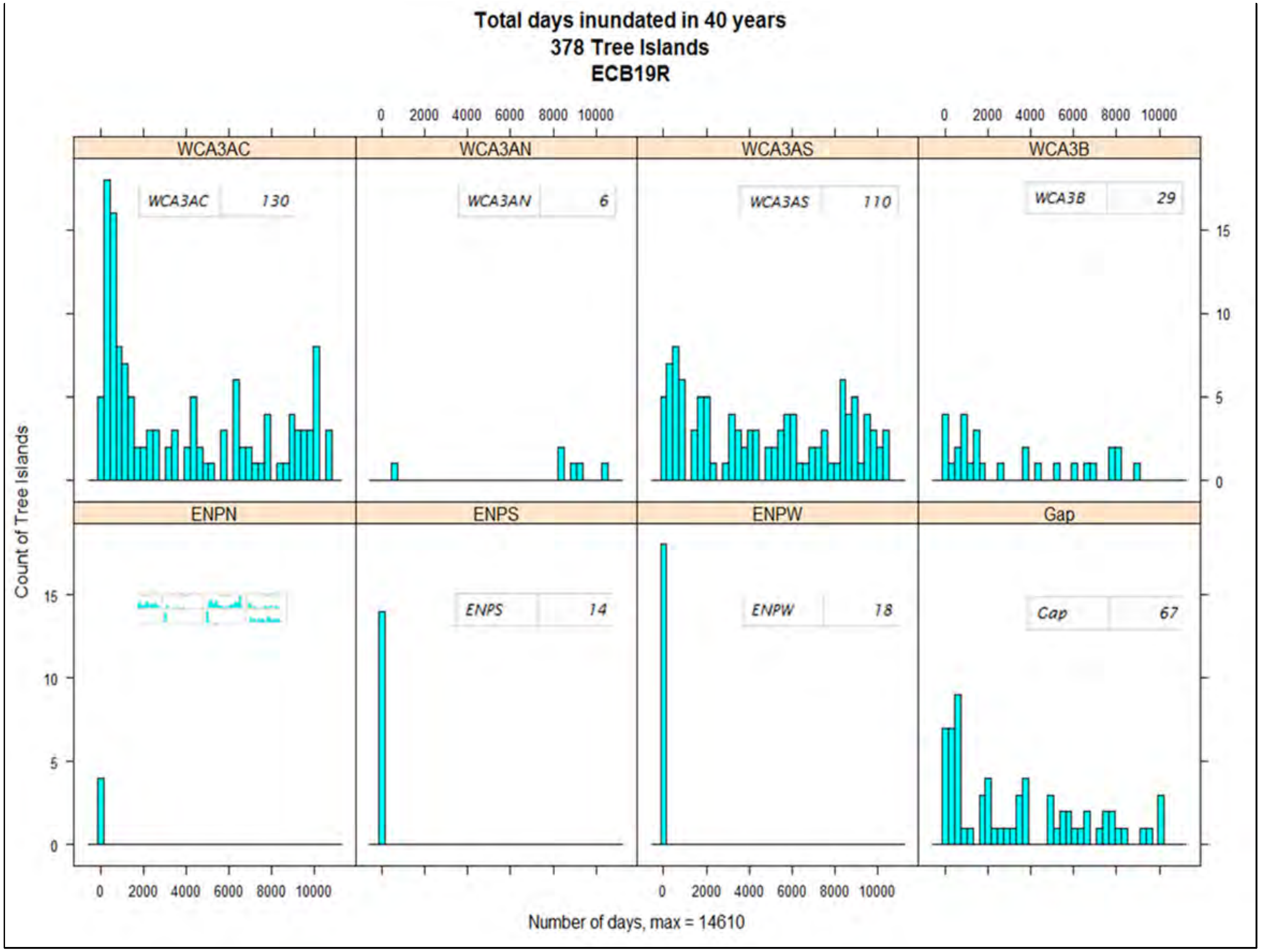


Figure E.1-17. Histogram of mapped tree islands across the regions of interest in WCA 3A, WCA 3B, and ENP. These are counts of inundation over a 41 year period of simulating the operations of ECB19R.

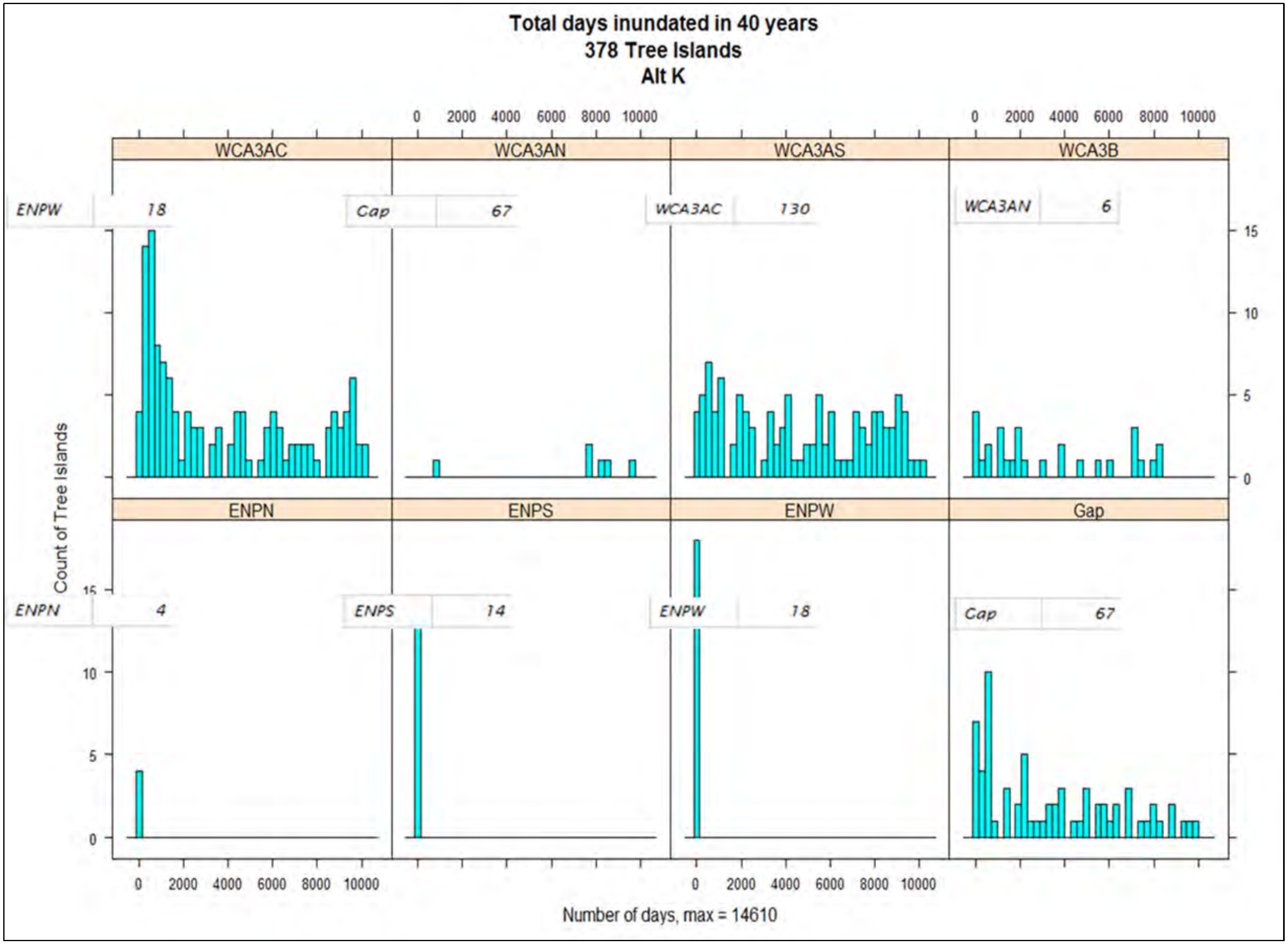


Figure E.1-18. Histogram of mapped tree islands across the regions of interest in WCA 3A, WCA 3B, and ENP. These are counts of inundation over a 41 year period of simulating the operations of ALTK.

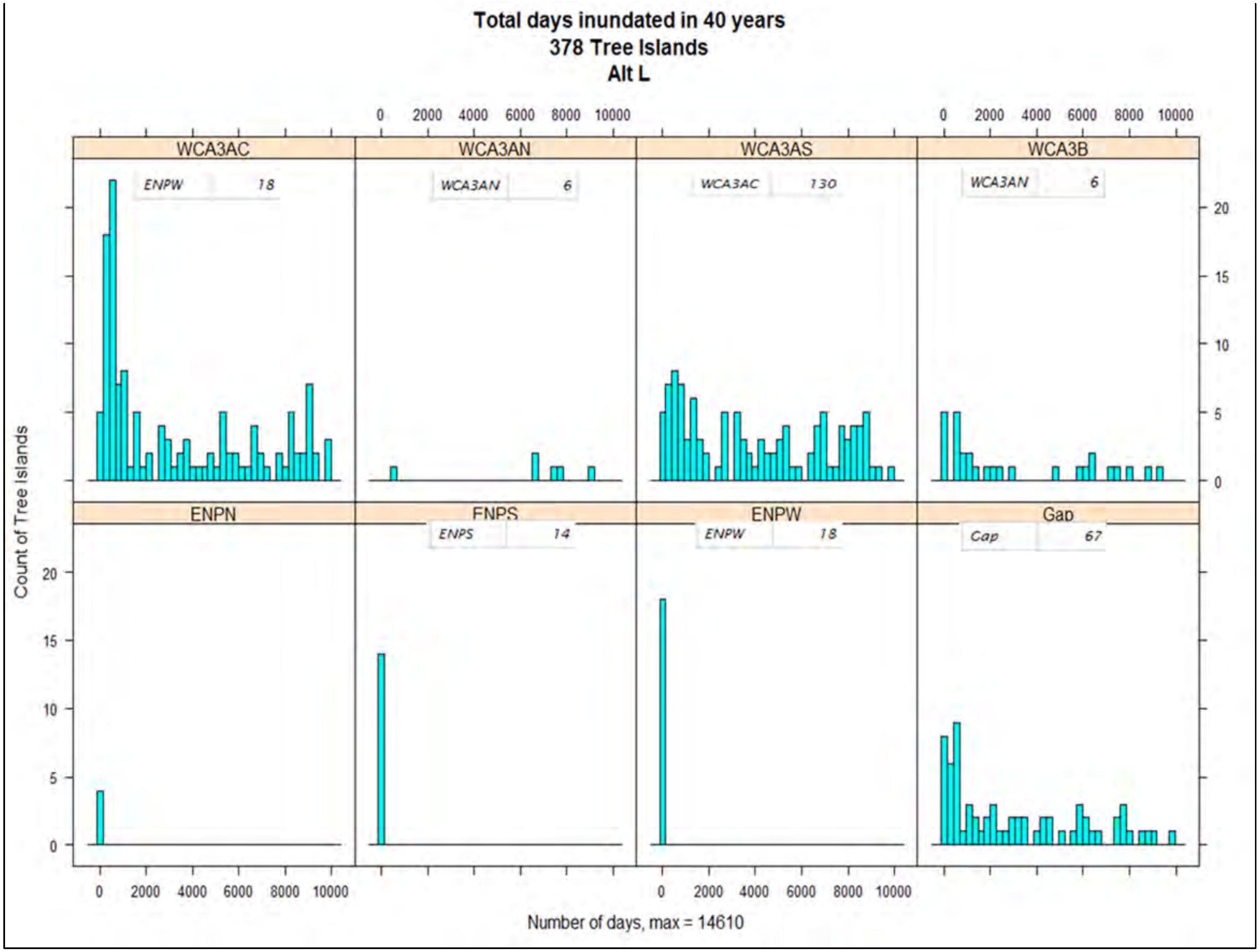


Figure E.1-19. Histogram of mapped tree islands across the regions of interest in WCA 3A, WCA 3B, and ENP. These are counts of inundation over a 41 year period of simulating the operations of ALTL.

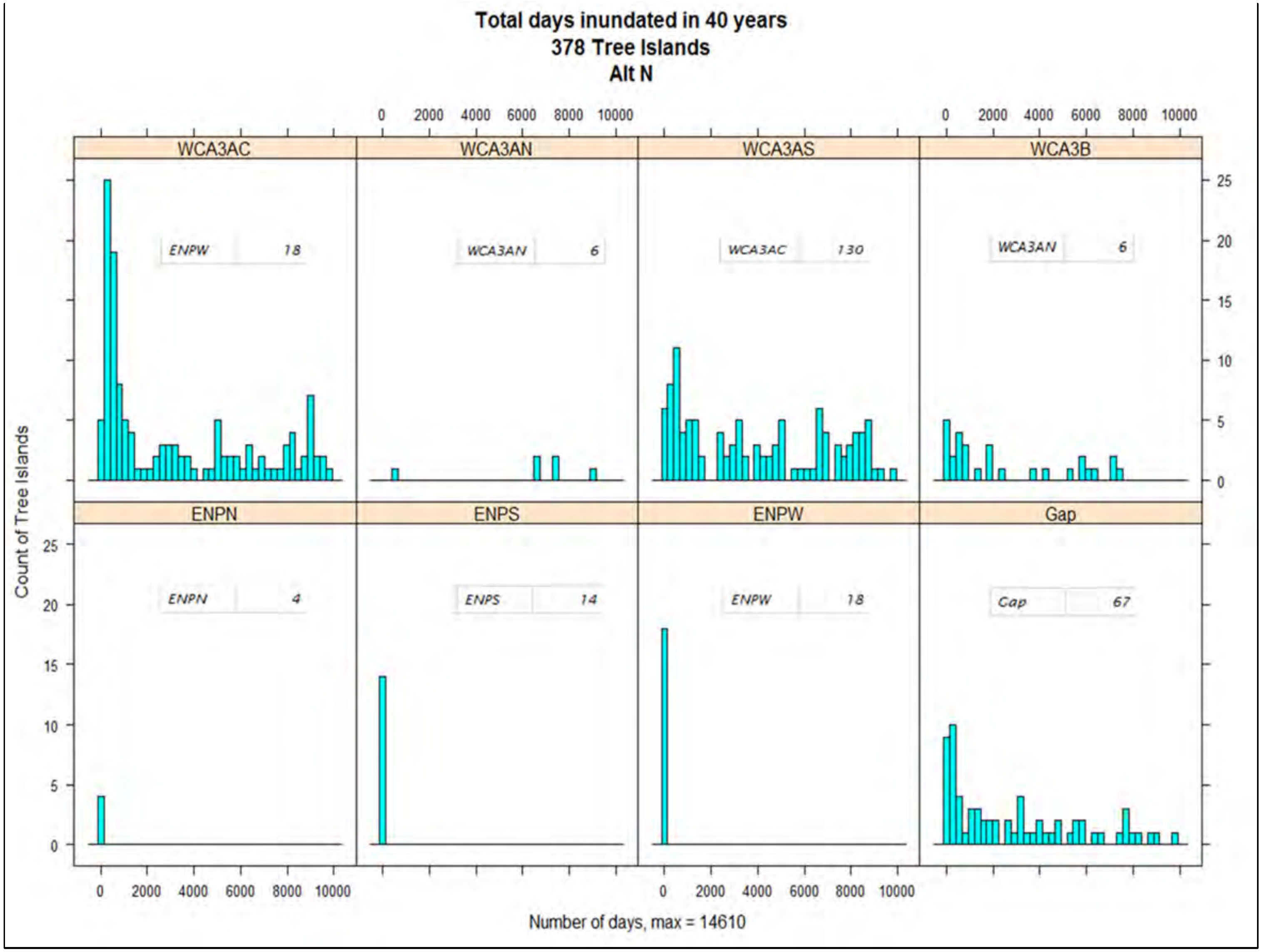


Figure E.1-20. Histogram of mapped tree islands across the regions of interest in WCA 3A, WCA 3B, and ENP. These are counts of inundation over a 41 year period of simulating the operations of ALTN.

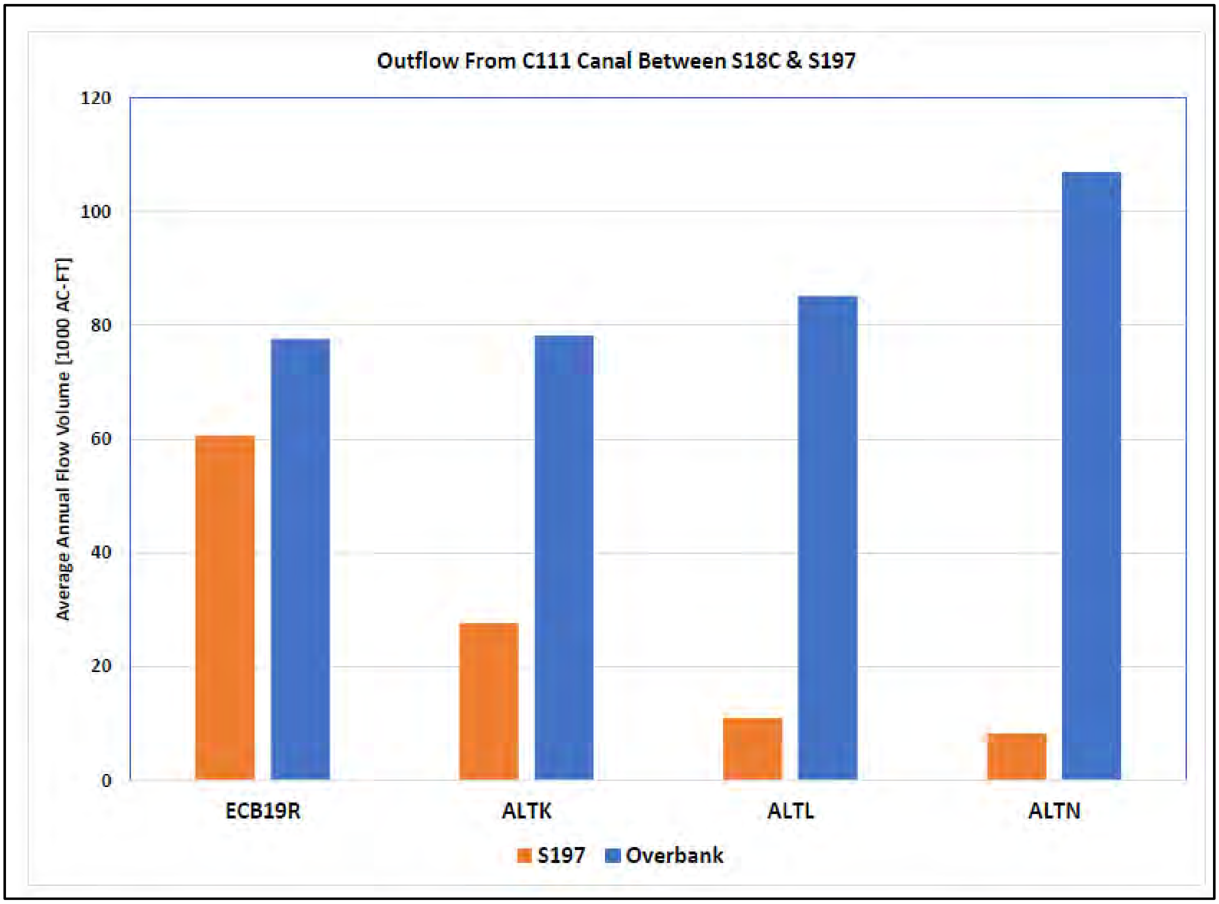


Figure E.1-21. Outflow from C-111 canal between S-18c and S-197 over the period of record (1965-2005)

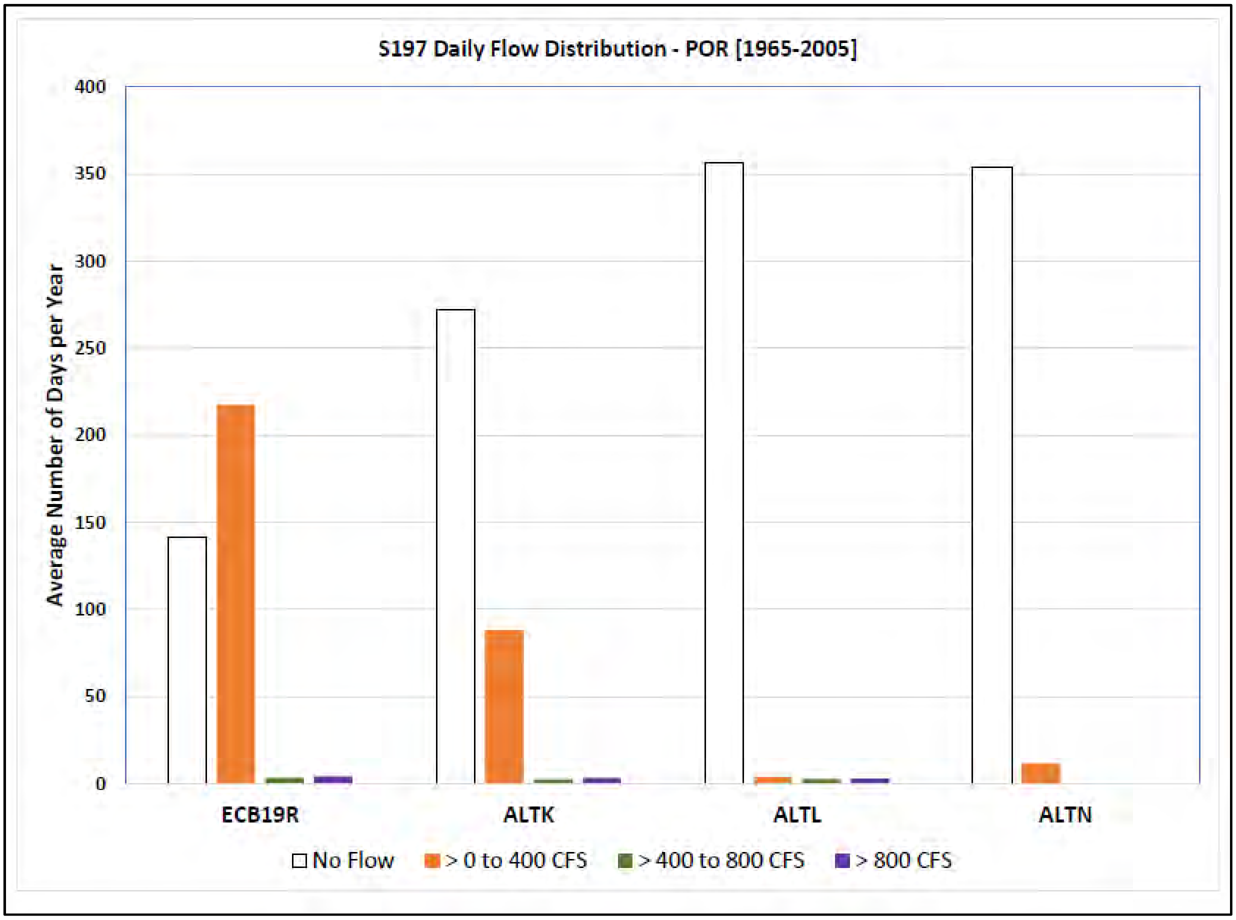


Figure E.1-22. S-197 daily flow distribution over the period of record (1965-2005) for Round 1.

E.1.2 Ecological Evaluation: Round 2 and 3 Alternatives

Alternatives for Round 2 (ALTN2, ALTO) and Round 3 (ALTQ) were evaluated consistent with the methodology described in **Section E.1.1**. The No Action Alternative/Existing Condition Baseline was updated between plan formulation efforts for Round 1 and Round 2. Alternatives for Round 2 and Round 3 were compared to the revised No Action Alternative/Existing Condition Baseline known as ECB19RR. Round 2 and Round 3 also included the evaluation of several sensitivity runs. Four RSM-GL sensitivity runs were jointly requested by the Cooperating Agencies (USACE, SFWMD, and ENP), for completion along with the Round 2 alternatives (SR1, SR2, SR3, and SR4). Six sensitivity runs were requested for completion with ALTQ in Round 3 (SRQ1, SRQ2, SRQ3, SRQ4, SRQ5, and SRQ6). Results for ALTN2, ALTO, and ALTQ are summarized below in addition to a summary of the sensitivity runs completed in Round 2s and 3.

Round 2 (ALTN2 and ALTO) Sensitivity Runs: SR1, SR2, SR3, and SR4

SR1: Conditional Closures for the S-12s (Apply to both Round 2 Alternatives: SR1 for ALTN, SR2 for ALTO)*

- Targets from iModel versus prescribed seasonal closure dates at S-12A/B, S-343A/B, and S-344 currently required through the 2016 ERTP BO*

SR3: Lower Canal Levels in South Dade (Apply to ALTN2 only: SR3);

- Operational criteria were revised to match lower canal levels included in ALTO for South Dade Canal reaches between S-331 and S-177

SR4: Refinement of operational criteria for coastal divide structures to opportunistically provide improved timing and spatial distribution of flows to Biscayne Bay (Apply to ALTO only: SR4).

- Ensure COP operations maintain the “do no harm” standard for Biscayne Bay while aiming to prioritize spatial location of inflows to the South Bay

*ALTS N2 and O use time series targets for the iModel referred to as “Rnd2_Base”. SR3 and SR4 sensitivity runs also use the same.

*SR1 and SR2 sensitivity runs use targets for the iModel that relax the seasonal closures and capacity constraints for S12A, S12B, S343AB and S332D and are referred to as “Rnd2_MarlSens”.

* Reference **Appendix E.2** for further information on time series targets used for the iModel and Round 2 sensitivity runs.

Round 3 (ALTQ) Sensitivity Runs: SRQ1, SRQ2, SRQ3, SRQ4, SR Q5, and SRQ6

SRQ1: Relax FDOT Constraint

- Based on the USACE Increment 2 Operational Strategy limit of 90 days per water year with stages above 8.3 feet NGVD, the Round 1 and Round 2 alternatives limit the L-29 Canal maximum operating limit to 8.5 feet NGVD during October through February and 8.25 feet NGVD for the remaining 8 months of each year
- Maximum L-29 stage constraint is limited to 8.5 feet NGVD, consistent with the pre-scribed COP constraints

SRQ2 and SRQ3: Timing of Inflows to NESRS

- Two operational scenarios were developed by the COP Water Quality Sub Team to improve timing for water quality to NESRS.

SRQ4: Conditional opening of S-344 and removal of seasonal CSSS constraints at S-332D

- No seasonal closures at S-344 (ALTQ seasonal closure dates 01 October through 14 July)
- No seasonal closures at S-332D. (ALTQ seasonal constraints: 01 December – 31 January: Limited to 325 cfs (Note: for Round 2 and Round 3 COP modeling, if S-332DX1 is able to direct 75 cfs to the SDA, the effective S-332D discharge limit is raised to 375 cfs); 01 February – 14 July: Limited to 250 cfs (Note: for Round 2 and Round 3 COP modeling, if S-332DX1 is able to direct 75 cfs to the SDA, the effective S-332D discharge limit is raised to 325 cfs): 15 July – 31 January: No capacity limit (up to 575 cfs))

SRQ5 and SRQ6: Low Water Action Line

- Two operational scenarios were developed by the COP Water Supply Sub Team to ad-dress potential concerns with ALTQ and waters supply.

SRQ2, SRQ3, SRQ5 and SRQ6 were evaluated by the COP Water Quality and Water Supply sub-teams. Hydrologic modeling output was limited for the sensitivity runs. Performance measures were not available. Furthermore, only a subset of the performance indicators were available. The project team therefore relied on regional hydrologic modeling output which included hydroperiod distribution maps, stage maps, ponding depth maps, and overland flow volumes.

E.1.2.1 Summary of Round 2 and Round 3 Model Results: Performance Measures

Results of performance measures for Round 2 and Round 3 are described below for ECB19RR, ALTN2, ALTO, and ALTQ.

Inundation Duration in the Ridge and Slough Landscape

Each ALT increased inundation duration in NESRS. Each ALT decreased inundation duration in portions of central and southern WCA 3A and WCA 3B; additional risks are marginal. ALTO decreased the risk relative to ALTN2 and ALTQ. Reference **Table E**.1-11 and **Figure E.1-23** through **Figure E.1-24**.

- ALTS perform virtually identically in northern WCA 3A (IR114, IR115, IR117).
- Each ALT increased inundation durations within NESRS and central SRS (IR129, IR130, and IR131 IR132) relative to ECB19RR. ALTN2 and ALTO performed better than ALTQ at IR130, IR131, and IR132 with respect to this metric except at IR129 where performance was more similar.
- ALTO and ALTQ performed better in Taylor Slough at IR133N and IR133S; performance at IR144N and IR144S varied across the alternatives.
- Observed, minimal decreases in inundation duration over the period of record in portions of central (IR118, IR121) and southern WCA 3A (IR119, IR124) and WCA 3B (IR125, IR126, IR128) with each ALT relative to ECB19RR. Greatest magnitude of potential effect was observed under ALTN2 and ALTQ in WCA 3A. ALTQ minimized decreases in WCA 3B. Decreases in inundation duration in central WCA 3A and WCA 3B are undesirable.
- Observed differences between ALTS were slight. Changes in PPOR ranged from +/-5%. 1% equates to ~ 150 days over the period of record.
- Across WCA 3 and ENP, the target (NSM) was often not met under either the base condition (ECB19RR) or under each ALT. This was expected as COP is not introducing new water; only redistributing the existing water budget.

Number and Duration of Dry Events in Shark Slough

Observed similar performance of ALTS N2, O, and Q. Reference **Figure E.1-25** and **Figure E.1-26**.

- Each ALT decreased the number and average duration of dry events in NESRS relative to ECB19RR.
- Number of Dry Events (Least = Best Performer):
  - IR129 ALTQ < ALTN2 < ALTO < ECB19RR
  - IR130 ALTN2 = ALTO = ALTQ < ECB19RR
  - R131: ALTQ < ALTN2 = ALTO < ECB19RR
  - IR132: ALTN2 = ALTO < ALTQ = ECB19RR

- Average Duration of Dry Events (Weeks) (Least = Best Performer):
    - IR129 ALTO = ECB19RR < ALTN2 < ALTQ
    - IR130 ALTN2 = ALTO < ECB19RR < ALTQ
    - IR131: ALTO < ALTN2 < ECB19RR = ALTQ
    - IR132: ALTN2 = ALTO = ALTQ < ECB19RR
- No ALT met the target (NSM).

Soil Oxidation

Each ALT decreased the risk for soil oxidation within NESRS. ALTO and ALTQ performed better than ALTN2 in Taylor Slough. Each ALT provides increased risk of cumulative drought intensity in portions of central and southern WCA 3A and WCA 3B; additional risks are marginal. Reference **Table E.1-12** and **Figure E.1-27** through **Figure E.1-28**.

- Each ALT decreased the risk for soil oxidation within NESRS and central SRS (IR129, IR130, IR131, and IR132) relative to ECB19RR; ALTO and ALTQ decreased drought intensity to a greater extent than ALTN2 at IR129; however at IR131 and IR132 in central SRS, ALTN2 and ALTO decreased drought intensity to a slightly greater extent than ALTQ. ALTO and ALTQ decreased drought intensity to a greater extent than ALTN2 in Taylor Slough.
- Observed minimal increases in cumulative drought intensity in portions of central WCA 3A (IR118, IR121) and southern WCA 3A (IR119, IR124) and WCA 3B (IR125, IR126, IR128) with each ALT relative to ECB19RR. Greatest magnitude of potential affect was observed under ALTN2. ALTO performed better in WCA 3A overall. ALTQ performed better in WCA 3B overall
- Across WCA 3 and ENP, the target (NSM) is often not met under either the base condition (ECB19RR) or under each ALT. Exceptions occur in portions of central and southern WCA 3A where the target is exceeded (IR120, IR121, IR122, IR123, IR124). These locations are free from oxidation risks.

Slough Vegetation Suitability

ALTN2 performed better in NESRS while ALTO and ALT Q performed better in southern Taylor Slough. ALTO performs better in WCA 3 overall.

- All alternatives demonstrate similar performance for sloughs in northern WCA 3A at select IRs (IR114 andIR117). Alternatives also demonstrate similar performance in southwest Taylor Slough (IR144N and IR144S).
- Slight differences in alternative performance were observed within other portions of the system. ALTO performed slightly better in northern WCA 3A at IR115, IR 116, and IR118 and in portions of WCA 3A adjacent to the L-28 Gap (IR120 and IR122). ALTO also performed slightly better in central WCA 3A (IR118, IR121, IR123, IR124). ALTO is preferred within WCA 3B; however, ECB19RR performs the best relative to the target.
- Major improvements to NESRS under each ALT.
- ALTQ performed slightly better in NESRS (IR129); ALTN2 in central SRS (IR130, IR131, and IR132). ALTO and ALT Q performed slightly better within southern Taylor Slough (IR133N and IR 133S).

Florida Bay Salinity

ALTO provided slightly lower salinities in Florida Bay, followed by ALTQ and ALTN2 when compared to ECB19RR. Reference **Table E.1-13**.

- ALTO increased average annual overland flow to Florida Bay relative to ALTQ, ALTN2, and ECB19RR. The greatest observed increases in flow came through the Eastern Panhandle portion of the transect (T-23C).
- Wet and dry season mean salinity in North, East, East Central, Central, South and West Florida Bay decreased (< 1 psu) for each ALT relative to ECB19RR. Dry season differences were observed to be greater than wet season differences. Percent differences shown in FIGURE 31 and FIGURE 32 are the decrease in salinity from ECB19RR to the ALT as a % of ECB19RR absolute salinity. Larger differences were observed for ALTO during the dry season across each region relative to ALTN2 and ALTQ. During the wet season, larger differences were observed under ALTN2 in East-Central, Central, South, and West Florida Bay while ALTQ was observed to perform slightly better in North Florida Bay and ALTO was observed to perform better in East Florida Bay. Overall the differences in salinity between each ALT were less than 5% compared to ECB19RR.

E.1.2.2 Summary of Round 2 and Round 3 Modeling Results: Performance Indicators

Results of performance indicators for Round 2 are described below for ECB19RR, ALTN2, ALTO, and ALT Q. Sensitivity runs for Round 2 and Round 3 are also described where hydrologic model output was available.

2016 ERTP Biological Opinion Metrics:

Observed similar performance of ALTN2, ALTO, and ALTQ. Thresholds identified to be protective of wood storks, CSSS's, and Everglade snail kites were not significantly exceeded. Reference **Figure E.1-30** through **Figure E.1-41**.

- Wood Stork and Wading Birds: ALTN2, ALTO, and ALTQ do not exceed the identified thresholds more frequently than ECB19RR.
- CSSS Dry Nesting Days: ALTN2, ALTO and ALTQ met the identified threshold of 40% of each subpopulation (CSSS-Ax through CSSS-F) obtaining 90 consecutive dry nesting days between March 1 and July 15. Exceptions occurred in CSSS-D under ALTO and ALTQ, however each ALT was close to the identified threshold. Each ALT performed slightly lower than ECB19RR in CSSS-C, CSSS-D, and CSSS-E.
- CSSS Discontinuous Hydroperiod: ALTN2, ALTO, and ALTQ do not consistently meet the identified threshold of 40% of each subpopulation (CSSS-Ax through CSSS-F) obtaining a discontinuous hydroperiod range of 90-210 days; however observed values were not significantly below the identified threshold. Each ALT performed slightly lower than ECB19RR in CSSS-D, and CSSS-E.
- Snail Kites (Dry Season High Water; Wet Season High Water; Recession Dry Season Amplitude): ALTN2, ALTO, and ALTQ do not exceed the identified thresholds more frequently than ECB19RR for the Dry Season High Water and Wet Season High Water indicators. Exceedances were observed under ALTO and ALTQ at a subset of gages for the Dry Season Amplitude metric; however the observed exceedance in each case increased by only one event.

Round 2 Sensitivity Runs (SR1, SR2, SR3, and SR4)

- Observed similar performance for SR1, SR2, SR3, and SR4; except for SR1 and SR2 in which performance within CSSS-Ax was decreased relative to ALTN2 and ALTO.

Round 3 Sensitivity Runs (SRQ1 and SRQ4)

- SRQ1 and SRQ4 performed similarly to ALTQ.

Tree Islands Reference

- Tree island decline across WCA 3A, WCA 3B, and ENP has been extensively documented. There has been a ~10% reduction in the number of tree islands larger than 1 acre each decade beginning 1952-2004. The rate of tree island loss is different in different portions of the landscape.
- ALTN2 consistently produced the most tree islands that were inundated less than 10% of the total time period in all portions of WCA 3A and WCA 3B. None of the mapped tree islands were ever inundated in ENP. ALTN2, ALTO, and ALQ were observed to have more tree islands inundated less than 10% of the time than ECB19RR.
- Reference **Table E.1-14** through **Table E.1-15** and **Figure E.1-42** through **Figure E.1-46**.

Flows to ENP Eastern Panhandle and at S-197

Each ALT decreased structure flow through S-197 and improved overbank flow into ENP's eastern Panhandle relative to ECB19RR. Observed better performance of ALTO, followed by ALTQ and ALTN2. Reference **Figure E.1-47** and **Figure E.1-48**.

- ALTO increased average annual overland flow (KAC-FT per year) across ENP's eastern Panhandle relative to ALTQ, ALTN2, and ECB19RR.
- ALTO decreased structure flow (KAC-FT per year) through S-197 relative to ALTQ, ALTN2, and ECB19RR. ALTQ and ALTN2 performed similarly.
- Each ALT increased the average number of days per year no flow was observed through S-197 relative to ECB19RR. ALTO performed better than ALTN2 and ALTQ. ALTN2 and ALTQ performed similarity.
- Each ALT minimized the average number of days per year flow > 0 cfs to 400 cfs was observed through S-197 relative to ECB19RR. ALTO performed better than ALTN2 and ALTQ. ALTN2 and ALTQ performed similarly.
- Each ALT performed similarly to ECB19RR for the average number of days per year S-197 structure flow was observed to be > 400 cfs and up to 800 cfs and/or structure flow was > 800 cfs.

Round 2 Sensitivity Runs (SR1, SR2, SR3, and SR4)

- SR1, SR2, SR3, and SR4 decreased structure flow (KAC-FT per year) through S-197 relative to ECB19RR. SR1 and SR3 performed similarly to ALTN2. SR2 and SR4 performed similarly to ALTO.

Round 3 Sensitivity Runs (SRQ1 and SRQ4)

- SRQ1 AND SRQ4 decreased structure flow (KAC-FT per year) through S-197 relative to ECB19RR. SRQ1 and SRQ4 performed similarly to ALTQ. SRQ4 decreased structure flow to a greater degree (1 KAC-FT per year less than ALTQ AND SR1.

Minimum Levels

Observed similar performance of ALTN2 and ALTO. This performance indicator was not evaluated for ALTQ.

- The total count of both exceedances and violations in ENP (peat and marl) was decreased under each ALT relative to ECB19RR. ALTO had the fewest number of exceedances; however the difference between ALTN2 and ALTO was a difference of 1 count for both peat and marl.
- The total count of both exceedances and violations in the peat soils of WCA 3 was increased under each ALT relative to ECB19RR. ALTN2 exceeded the ECB19RR count by 7 events while ALTO exceeded the number of events by 5.

Biscayne Bay Critical Flows Report

Under ECB19RR, flows to Biscayne Bay are predominantly focused on the northern part of the Bay. The vast majority of flows to northern Biscayne Bay occur during storm events when large volumes of water from WCA 3 are routed down the Miami Canal to reduce flooding risks. The Biscayne Bay Coastal Wetlands project is conceptualized to enhance water storage within the naturally formed basins of coastal Miami-Dade County so that a higher proportion of flows can occur outside of storm events. Increasing the capacitance (ability to store excess water during storms and deliver low-volume flows of water for more days of the year) is needed to enhance the ecological condition of Biscayne Bay. So while COP cannot achieve these ecological goals without installing significant portions of the Biscayne Bay Coastal Wetlands Project, the COP team has identified the opportunity to better balance flows across Biscayne Bay, by setting a goal to increase the volumes delivered to the southern portion of the Bay while decreasing the volumes delivered to the northern portion of the Bay. Overall it appears that the system can be operated to modestly shift flows to the southern portion of Biscayne Bay, providing a modest ecological benefit to the Bay as a whole. The remainder of this section quantifies the amount of water that is shifted to southern Biscayne Bay.

Each ALT decreased the average annual volume of flow to Biscayne Bay relative to ECB19RR. Observed better performance of ALTQ relative to ALTN2 and ALTO.

- The area of Biscayne Bay in need of additional water the most is South Bay. ALTN2 and ALTO decreased flows to North Bay relative to ECB19RR by approximately 10 KAC-FT per year on average. ALTQ decreased flows by approximately 21 KAC-FT per year on average. Flows to Central Bay were essentially maintained under each ALT (less than 2 KAC-FT (=0.3%) change in any ALT, probably within the range of certainty of the hydrologic model). It is important to note that while ALTQ reduces overall flows to Biscayne Bay, the reduction is accounted for entirely by changes to flow in the northern portion of the Bay which is receiving too much flow during storm events. So overall the reduction in flows observed in ALTQ are perceived as a benefit to this area that is stressed by high volume deliveries that are concentrated around storm events. ALTQ and ALTN2 performed better than ALTO in South Bay by increasing flows to this area relative to ECB19RR. ALTQ and ALTN2 increased flows by approximately 10 KAC-FT and 9 KAC-FT per year on average. Flows to South Bay under ALTO were equivalent to ECB19RR.

Round 2 Sensitivity Runs (SR1, SR2, SR3, and SR4):

- Observed better performance of SR4 relative to ALTN2, ALTO, SR1, SR2, and SR3.
- Each of the sensitivity runs decreased flows to Biscayne Bay relative to ECB19RR across North Bay. SR1, SR2, SR3, and SR4 decreased flows to a greater degree relative to ALTN2 and ALTO. SR1, SR2, SR3, and SR4 decreased flows by approximately 14 KAC-FT, 15 KAC-FT, 11 KAC-FT, and 17 KAC-FT per year on average, respectively. Flows to Central Bay were essentially maintained under each sensitivity run with SR1, SR2, SR3, and SR4 demonstrating decreased flows (compared to ECB19RR) by approximately 1 KAC-FT, 2 KAC-FT, 1 KAC-FT, and 1 KAC-FT per year on average, respectively. SR1, SR3, and SR4 increased flows to South Bay by approximately 5 KAC-FT, 2 KAC-FT, and 11 KAC-FT per year on average, respectively. SR2 decreased flows to this portion of Biscayne Bay by approximately 3 KAC-FT per year. SR4 performed better relative to ALTN2 and ALTO, as well as SR1, SR2, and SR3 in the South Bay. The result of the sensitivity runs was that the operations of SR4 were combined with the operations of ALTO to produce ALTQ in Round 3 of the simulation process.

Round 3 Sensitivity Runs (SRQ1 and SRQ4):

- Observed better performance of SRQ1 relative to ALTQ and SRQ4.
- SRQ1 and SRQ4 decreased flows to North Bay relative to ECB19RR by approximately 23 KAC-FT and 22 KAC-FT per year on average. Flows to Central Bay were relatively maintained under each sensitivity run. SRQ1 and SRQ4 decreased flows by approximately 2 KAC-FT per year on average. SRQ1 and SRQ4 increased flows to South Bay by approximately 11 KAC-FT and 9 KAC-FT per year on average relative to ECB19RR. SRQ1 performed better relative to ALTQ and SRQ4.

High-Low Closure Criteria for Everglades WMAs

Under ALTO maintained the number of days the Everglades WMAs were closed due to high water relative to ECB19RR. ALTN2 and ALTQ performed better than ECB19RR for the high closure criteria, with ALTN2 reducing the number of days the area was closed due to high water relative to ECB19RR to a greater extent. Each ALT increased the number of days the Everglades WMAs were closed due to low water relative to ECB19RR. ALTQ minimized this risk to a greater extent followed by ALTO and ALTN2.

- Compared to ECB19RR, ALTN2 resulted in a 0.49% decrease in percent period of record the Everglades WMA were closed due to high water and a 1.23% increase closed due to low water. The number of high water and low water closures under ALTN2 were reduced by one event each.
- Compared to ECB19RR, ALTO did not differ in days closed due to high water but was predicted to result in a 0.89% increase in days closed due to low water. The number of high water or low water closures did not differ from ECB19RR.
- Compared to ECB19RR, ALTQ resulted in a 0.17% decrease in days closed due to high water and a 0.82% increase in days closed due to low water. The number of high water and low water closures under ALTQ were reduced by one event each.
- ALTN2 and ALTO resulted in the same number (3) of damaging high-water closures (>60 days) over the period of record, consistent with that observed under ECB19RR. ALTQ reduced the number of events by one relative to ECB19RR.

Additional Regional Hydrologic Model Output (Sensitivity Runs SR1, SR2, SR3, and SR4)

SR 1 and SR 3 were evaluated against ALTN2. SR2 and SR4 were evaluated against ALTO. SR1 and SR2 increased the risk of reduced hydroperiods and stages within portions of central WCA 3A and northern WCA 3B, while increasing hydroperiods and stages within the vicinity of CSSS-Ax. Observed similar performance of SR 3 relative to ALTO. SR4 increased flows to the South Bay of Biscayne Bay; however flows to NESRS and Taylor Slough were slightly decreased relative to ALTO. Reference **Figure E.1-49** through **Figure E.1-57**.

- SR1 and SR3 were evaluated against ALTN2. Average annual hydroperiod distribution maps showed a decrease in hydroperiod within portions of central and southern WCA 3A and northern WCA 3B under SR1 relative to ALTN2. On average over the period of record, hydroperiods were decreased by 14-30 days. Increases in hydroperiod were observed south of Tamiami Trail and west of the L-67 Extension near the vicinity of CSSS-Ax. On average over the period of record, hydroperiods increased by 14-30, 30-45, and 45-90 days depending on location within the vicinity of CSSS-Ax. Observed decreases in hydroperiods were intensified during a typical dry year (1989). Average annual stage distribution maps showed similar patterns. Decreases in stage were also observed within portions of central and southern WCA 3A and northern WCA 3B. On average over the period of record, stages were decreased by 0.10-0.25 and 0.25-0.5 feet depending on location. Increases in stage were observed within the vicinity of CSSS-Ax. On average over the period of record, stages were increased by 0.10-0.25 feet. Decreases in hydroperiod and stage in northern WCA 3A and WCA 3B is undesirable. Increases in hydroperiod and stage in areas adjacent to CSSS-Ax is also undesirable. Differences in hydroperiod distribution and stage were observed within areas adjacent to 8.5 Square Mile Area (8.5 SMA). SR1 decreased hydroperiods and stages within this area to a greater extent relative to ALTN2. SR3 performed similarly to ALTN2; however the spatial extent in which hydroperiods and stages were observed to decrease adjacent to 8.5 SMA was slightly less under SR3 relative to ALTN2.
- SR2 and SR4 were evaluated against ALTO. Average annual hydroperiod distribution maps showed a decrease in hydroperiod within portions of central and southern WCA 3A and northern WCA 3B under SR2 relative to ALT 0. On average over the period of record, hydroperiods were decreased by 14-30 days. Increases in hydroperiod were observed south of Tamiami Trail and west of the L-67 Extension near the vicinity of CSSS-Ax. On average over the period of record, hydroperiods increased by 14-30, 30-45, and 45-90 days depending on location. Observed decreases in hydroperiods were intensified during a typical dry year (1989). Average annual stage distribution maps showed similar patterns. Decreases in stage were also observed within portions of central and southern WCA 3A and northern WCA 3B. On average over the period of record, stages were decreased by 0.10-0.25 and 0.25-0.5 feet depending on location. Increases in stage were observed within the vicinity of CSSS-Ax. Decreases in hydroperiod and stage in northern WCA 3A and WCA 3B is undesirable. Increases in hydroperiod and stage in areas adjacent to CSSS-Ax is also undesirable. SR4 performed similarly to ALTO.
- SR1 and SR2 decreased flows to NESRS across T-18 relative to ALTN2 and ALTO by approximately, 9 KAC-FT and 7 KAC-FT per year, respectively. SR 3 decreased flows to NESRS by approximately 1 KAC-FT per year relative to ALTN2. SR 4 decreased flows relative to ALTO by 2 KAC-FT per year on average. Differences in overland flow to Taylor Slough were observed at T-23C; however observed changes were not as large and/or remained the same. SR1 decreased flows to Taylor Slough across T-23C relative to ALTN2 by approximately 1 KAC-FT per year while SR2 maintained flows consistent with ALTO. SR 3 increased flows to Taylor Slough by approximately 1 KAC-FT per year relative to ALTN2 and SR 4 decreased flows by 2 KAC-FT per year relative to ALTO. SR4 was

observed however to increase flow to South Biscayne Bay relative to ECB19RR by approximately 11 KAC-FT per year on average.

Additional Regional Hydrologic Model Output (Sensitivity Runs SRQ1 and SRQ4):

SRQ1 and SRQ4 were evaluated against ALTQ. SRQ1 provided additional hydrologic benefit to portions of ENP, including NESRS and Taylor Slough by removing the L-29 Canal constraint that limits the duration at which the maximum operating limit can be held at 8.5 feet NGVD. SRQ4 provided additional hydrologic benefit to portions of Taylor Slough by removing the S-3332D constraint that currently restricts pumping capacity during the CSSS nesting season. Reference **Figure E.1-58** through **Figure E.1-60**.

- SRQ1 removed the FDOT constraint, allowing the opportunity to increase the L-29 Canal maximum operating limit to 8.5 feet NGVD for a longer duration relative to ALTQ. Increases in average annual overland flow were observed consistently across transects in ENP (T-18, T-27, T-23B, T-23C, TSH1, TSH2) with observed increases ranging from 1KAC-ft to 43 KAC-ft. at Tamiami Trail (Figure 63). Average annual hydroperiod distribution maps showed an increase in hydroperiod within portions of ENP adjacent to the C-111 SD Detention Areas; and Taylor Slough. On average over the period of record, hydroperiods increased by 14-30, 30-45, and 45-90 days depending on location (Figure 61). S-333/S-333N discharged 588.3 KAC-FT per year on average under SRQ1 while ALTQ discharged 539.5 KAC-FT per year on average; a significant increase relative to ECB19RR (262.9 KAC-FT). Decreases in hydroperiod of 14-30 days were observed in portions of WCA 3B under SRQ1.
- SRQ4 modified operations of S-344 and S-332D. Areas potentially affected include portions of ENP south of WCA 3A and west of the L-67 Extension and in Taylor Slough located south of the C-111 SD Detention Areas. SRQ4 decreased flows in central WCA 3A at T-12 (located directly east of S-344) by 4 KAC-FT. SRQ4 increased flows to Lostmans Slough across T-26 by 3 KAC-FT relative to ALTQ. S-344 discharged 6 KAC-FT per year on average. ALTQ discharged 2.1 KAC-FT per year on average. Reference Figure 63. Under SRQ4, S-344 was utilized more often relative to ALTQ due to the relaxation of the closure constraints; however, when compared to ECB19RR, both ALTQ and SRQ4 decreased the average annual flow volume discharged at this structure relative to ECB19RR (7.0 KAC-FT) as the pool in WCA 3A is lowered under COP. Average annual hydroperiod distribution maps showed an increase in hydroperiod within portions of ENP adjacent to the L-28S and north of CSSS-A; however this was only observed during portions of the period of record that are deemed to be wet years. On average over the period of record, hydroperiods increased by 14-30, 30-45, and 45-90 days depending on location. Reference Figure 62.
- Increases in overland flow to Taylor Slough were observed at TSH1/TSH2 and at T-23B and T-23C under SRQ4. SRQ4 increased flows to Taylor Slough at each of these transects relative to ALTQ by 1 to 2 KAC-FT (Figure 63). S-332D discharged 38 KAC-FT per year on average. ALTQ discharged 30.9 KAC-FT per year on average. Average annual hydroperiod distribution maps showed an increase in hydroperiod within portions of ENP adjacent to the C-111 SD Detention Areas; however this was only observed during portions of the period of record that are deemed to be wet years. On average over the period of record, hydroperiods increased by 14-30 and 30-45 depending on location in areas around CSSS-C and CSSS-D. Decreases in hydroperiod were observed north of CSSS-C, with hydroperiods potentially reduced by 14-30 days. Reference Figure 62.
- SRQ4 decreased flows to NESRS across T-18 relative to ALTQ by approximately 1 KAC-FT per year and in central SRS across T-27 by 2 KAC-FT.

Table E.1-9. Performance indicators evaluation Round 2 alternatives and sensitivity runs. NA indicates performance indicator information was not available.

2016 ERTP Biological Opinion Metrics	Metric Relative to the ECB19RR	ECB19RR		ALTN2		ALTO		SR1		SR2		SR3		SR4	
Wood Stork and Wading Birds: Water depths greater than 16 inches (41 cm) from March 1 through May 31 throughout WCA 3A for two consecutive years as measured by the two gauge average 3A-3 and 3A4 (based upon a ground surface elevation of 8.4 feet NGVD)	Does the ALT exceed the threshold relative to the ECB19RR and if so what is the number of times the threshold is exceeded in two consecutive years over the period of record?	Number of Times Not Met = 12		No: = 7		No: = 9		No: = 7		No: = 9		No: = 7		No: = 10	
*CSSS: Dry nesting days - To produce multiple broods each year, the CSSS requires at least 90 consecutive dry days (water below ground surface) during the nesting season (March 1 – July 15) . Manage water levels in a manner aimed at meeting the following: a. Subpopulation A - At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-Ax	51.3%	CSSS-Ax	50.5%	CSSS-Ax	50.0%	CSSS-Ax	40.9%	CSSS-Ax	40.8%	CSSS-Ax	50.5%	CSSS-Ax	49.9%
*CSSS: Dry nesting days - To produce multiple broods each year, the CSSS requires at least 90 consecutive dry days (water below ground surface) during the nesting season (March 1 – July 15) . Manage water levels in a manner aimed at meeting the following: a. Subpopulation A - At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-B	79.2%	CSSS-B	78.7%	CSSS-B	78.7%	CSSS-B	78.6%	CSSS-B	78.7%	CSSS-B	78.6%	CSSS-B	78.7%
*CSSS: Dry nesting days - To produce multiple broods each year, the CSSS requires at least 90 consecutive dry days (water below ground surface) during the nesting season (March 1 – July 15) . Manage water levels in a manner aimed at meeting the following: a. Subpopulation A - At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must have 90	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-C	85.3%	CSSS-C	86.6%	CSSS-C	89.5%	CSSS-C	82.8%	CSSS-C	85.6%	CSSS-C	87.3%	CSSS-C	89.8%

2016 ERTP Biological Opinion Metrics	Metric Relative to the ECB19RR	ECB19RR		ALTN2		ALTO		SR1		SR2		SR3		SR4	
consecutive dry days between March 1 and July 15 (CSSS breeding season) every year. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year.															
*CSSS: Dry nesting days - To produce multiple broods each year, the CSSS requires at least 90 consecutive dry days (water below ground surface) during the nesting season (March 1 – July 15) . Manage water levels in a manner aimed at meeting the following: a. Subpopulation A - At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-D	43.7%	CSSS-D	39.6%	CSSS-D	39.3%	CSSS-D	39.6%	CSSS-D	39.4%	CSSS-D	40.0%	CSSS-D	39.9%
*CSSS: Dry nesting days - To produce multiple broods each year, the CSSS requires at least 90 consecutive dry days (water below ground surface) during the nesting season (March 1 – July 15) . Manage water levels in a manner aimed at meeting the following: a. Subpopulation A - At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-E	60.5%	CSSS-E	56.3%	CSSS-E	55.7%	CSSS-E	57.1%	CSSS-E	56.3%	CSSS-E	56.1%	CSSS-E	56.0%
*CSSS: Dry nesting days - To produce multiple broods each year, the CSSS requires at least 90 consecutive dry days (water below ground surface) during the nesting season (March 1 – July 15) . Manage water levels in a manner aimed at meeting the following: a. Subpopulation A - At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must have 90 consecutive	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-F	71.8%	CSSS-F	71.6%	CSSS-F	72.1%	CSSS-F	73.7%	CSSS-F	73.3%	CSSS-F	70.7%	CSSS-F	72.9%

2016 ERTP Biological Opinion Metrics	Metric Relative to the ECB19RR	ECB19RR		ALTN2		ALTO		SR1		SR2		SR3		SR4	
dry days between March 1 and July 15 (CSSS breeding season) every year.															
**CSSS: Discontinuous hydroperiod - The marl prairie habitat that the CSSS requires for its survival and recovery persists under a hydrologic regime of 90 – 210 wet days (water above ground; discontinuous). Manage water levels in a manner aimed at meeting the following: a. Western Marl Prairie – At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-Ax	32.3%	CSSS-Ax	32.7%	CSSS-Ax	32.5%	CSSS-Ax	25.7%	CSSS-Ax	25.9%	CSSS-Ax	32.7%	CSSS-Ax	32.5%
**CSSS: Discontinuous hydroperiod - The marl prairie habitat that the CSSS requires for its survival and recovery persists under a hydrologic regime of 90 – 210 wet days (water above ground; discontinuous). Manage water levels in a manner aimed at meeting the following: a. Western Marl Prairie – At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-B	41.2%	CSSS-B	40.9%	CSSS-B	40.9%	CSSS-B	40.8%	CSSS-B	40.8%	CSSS-B	40.9%	CSSS-B	40.9%
**CSSS: Discontinuous hydroperiod - The marl prairie habitat that the CSSS requires for its survival and recovery persists under a hydrologic regime of 90 – 210 wet days (water above ground; discontinuous). Manage water levels in a manner aimed at meeting the following: a. Western Marl Prairie – At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-C	41.5%	CSSS-C	39.2%	CSSS-C	43.2%	CSSS-C	39.6%	CSSS-C	40.4%	CSSS-C	40.6%	CSSS-C	41.7%

2016 ERTP Biological Opinion Metrics	Metric Relative to the ECB19RR	ECB19RR		ALTN2		ALTO		SR1		SR2		SR3		SR4	
**CSSS: Discontinuous hydroperiod - The marl prairie habitat that the CSSS requires for its survival and recovery persists under a hydrologic regime of 90 – 210 wet days (water above ground; discontinuous). Manage water levels in a manner aimed at meeting the following: a. Western Marl Prairie – At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-D	43.6%	CSSS-D	37.9%	CSSS-D	32.8%	CSSS-D	38.2%	CSSS-D	33.2%	CSSS-D	37.8%	CSSS-D	33.4%
**CSSS: Discontinuous hydroperiod - The marl prairie habitat that the CSSS requires for its survival and recovery persists under a hydrologic regime of 90 – 210 wet days (water above ground; discontinuous). Manage water levels in a manner aimed at meeting the following: a. Western Marl Prairie – At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-E	41.6%	CSSS-E	39.5%	CSSS-E	39.4%	CSSS-E	39.9%	CSSS-E	39.7%	CSSS-E	39.5%	CSSS-E	39.4%
**CSSS: Discontinuous hydroperiod - The marl prairie habitat that the CSSS requires for its survival and recovery persists under a hydrologic regime of 90 – 210 wet days (water above ground; discontinuous). Manage water levels in a manner aimed at meeting the following: a. Western Marl Prairie – At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-F	39.4%	CSSS-F	35.0%	CSSS-F	33.7%	CSSS-F	35.3%	CSSS-F	34.4%	CSSS-F	35.4%	CSSS-F	33.7%

2016 ERTP Biological Opinion Metrics	Metric Relative to the ECB19RR	ECB19RR	ALTN2	ALTO	SR1	SR2	SR3	SR4
Everglade Snail Kite: a. Dry Season High Water - Timing: by April 15; Trigger Value: stage > 9.2 ft. NGVD at gauge 3AS3W1; Frequency: 2 consecutive years.	Does the ALT exceed the threshold relative to the ECB19RR and if so what is the number of times the threshold is exceeded in two consecutive years over the period of record?	Number of Times Not Met = 7	No: = 4	No: = 5	No: = 4	No: = 4	No: = 4	No: = 6
Everglade Snail Kite: b. Wet Season High Water - Timing: June 1 – December 31; Trigger: stage > 10.5 ft. at gauge 3AS3W1 for 60 days; Frequency: 2 consecutive years.	Does the ALT exceed the threshold relative to the ECB19RR and if so what is the number of times the threshold is exceeded in two consecutive years over the period of record?	Number of Times Not Met = 2	No: = 1	No: = 2	No: = 1	No: = 2	No: = 1	No: = 2
Everglade Snail Kite: c. Recession/Dry Season Amplitude - Timing: January 1 – May 31 (or onset of wet season, whichever is sooner); Trigger: stage difference > 1.7 ft. as measured at gauge(s) closest to kite nesting, as determined by the Service.	Does the ALT exceed the threshold relative to the ECB19RR and if so what is the number of times the threshold is over the period of record?	Number of Times Not Met Gauge 3AS3W1 = 8	No: = 7	Yes: = 9	No: = 7	No: = 7	No: = 7	Yes: = 9
Everglade Snail Kite: c. Recession/Dry Season Amplitude - Timing: January 1 – May 31 (or onset of wet season, whichever is sooner); Trigger: stage difference > 1.7 ft. as measured at gauge(s) closest to kite nesting, as determined by the Service.	Does the ALT exceed the threshold relative to the ECB19RR and if so what is the number of times the threshold is over the period of record?	Number of Times Not Met Gauge W2 = 4	No: = 3	Yes: = 5	No: = 3	No: = 4	No: = 3	Yes: = 5
Everglade Snail Kite: c. Recession/Dry Season Amplitude - Timing: January 1 – May 31 (or onset of wet season, whichever is sooner); Trigger: stage difference > 1.7 ft. as measured at gauge(s) closest to kite nesting, as determined by the Service.	Does the ALT exceed the threshold relative to the ECB19RR and if so what is the number of times the threshold is over the period of record?	Number of Times Not Met Gauge 3A28 = 6	No: = 5	No: = 6	No = 4	No: = 6	No: = 5	No: = 6

2016 ERTP Biological Opinion Metrics	Metric Relative to the ECB19RR	ECB19RR	ALTN2	ALTO	SR1	SR2	SR3	SR4
Everglade Snail Kite: c. Recession/Dry Season Amplitude - Timing: January 1 – May 31 (or onset of wet season, whichever is sooner); Trigger: stage difference > 1.7 ft. as measured at gauge(s) closest to kite nesting, as determined by the Service.	Does the ALT exceed the threshold relative to the ECB19RR and if so what is the number of times the threshold is over the period of record?	Number of Times Not Met Gauge 3A-4 = 7	No: = 6	No: = 6	No: = 6	No: = 7	No: = 6	No: = 6
Tree Islands		138 (= 36% of mapped tree islands inundated less than 10% of period of record)	174 (= 45% of mapped tree islands inundated less than 10% of period of record	153 (= 40% of mapped tree islands inundated less than 10% of period of record	NA	NA	NA	NA
Outflow from C-111 Canal between S-18C and S-197	Does the ALT exceed ECB19RR?	S-197: 60 KAC-FT	No: S-197: 20 KAC-FT	No: S-197: 13 KAC-FT	No: S-197: 20 KAC-FT	No: S-197: 13 KAC-FT	No: S-197: 21 KAC-FT	No: S-197: 13 KAC-FT
Outflow from C-111 Canal between S-18C and S-197	Does the ALT exceed ECB19RR?	Overbank: 76 KAC-FT	Yes: Overbank: 97 KAC-FT	Yes: Overbank: 110 KAC-FT	NA	NA	NA	NA
S-197 Daily Flow Distribution in cfs	Does the ALT exceed ECB19RR?	No Flow: 143 Days	Yes: No Flow: 319 Days	Yes: No Flow: 338 Days	NA	NA	NA	NA
S-197 Daily Flow Distribution in cfs	Does the ALT exceed ECB19RR?	> 0 to 400 CFS: 216 Days	No: > 0 to 400 CFS: 44 Days	No: > 0 to 400 CFS: 23 Days	NA	NA	NA	NA
S-197 Daily Flow Distribution in cfs	Does the ALT exceed ECB19RR?	> 400 to 800 CFS: 3 Days	No: > 400 to 800 CFS: 0 Days	No: > 400 to 800 CFS: 2 Days	NA	NA	NA	NA
S-197 Daily Flow Distribution in cfs	Does the ALT exceed ECB19RR?	> 800 CFS: 4 Days	No: > 800 CFS: 1 Day	No: > 800 CFS: 1 Day	NA	NA	NA	NA
Minimum Levels Peat in ENP (Count of Exceeding Criteria)	Does the ALT exceed the criteria?	10	5	4	NA	NA	NA	NA
Minimum Levels Marl in ENP (Count of Exceeding Criteria)	Does the ALT exceed the criteria?	55	48	47	NA	NA	NA	NA
Minimum Levels Peat in WCA 3	Does the ALT exceed the criteria?	28	35	33	NA	NA	NA	NA
Biscayne Bay – North (S-25+S-25B+S-26+S-27+S-28+S-29)	Does the ALT increase flows relative to ECB19RR?	509.3 KAC-FT	No: 498.8 KAC-FT	No: 498.7 KAC-FT	No: 494.7 KAC-FT	No: 494.1 KAC-FT	No: 498.3 KAC-FT	No: 492.0 KAC-FT
Biscayne Bay – Central (G-93+S-22+S-123)	Does the ALT increase flows relative to ECB19RR?	106.9 KAC-FT	No: 106.5 KAC-FT	No: 105.3 KAC-FT	No: 105.7 KAC-FT	No: 104.6 KAC-FT	No: 106.3 KAC-FT	No: 104.9 KAC-FT
Biscayne Bay – South (S-20F+S-20G+S-21+S-21A)	Does the ALT exceed the ECB19RR?	248.9 KAC-FT	Yes: 257.5 KAC-FT	No: 248.7 KAC-FT	Yes: 253.9 KAC-FT	No: 245.7 KAC-FT	Yes: 250.9 KAC-FT	Yes: 259.9 KAC-FT
High-Low Closure Criteria for Everglades Wildlife Management Areas.	Days High Water Criteria Exceeded	506	434	507	NA	NA	NA	NA

2016 ERTP Biological Opinion Metrics	Metric Relative to the ECB19RR	ECB19RR	ALTN2	ALTO	SR1	SR2	SR3	SR4
Criteria Used: 1. A closure was counted as soon as the closure criteria was exceeded 2. If there were up to 2 consecutive weeks that did not violate the criteria in between closures, that was counted as one closure (i.e., the area did not open and close) 3. Closures are based on calendar years The total number of days does not include the days that did not violate the closure criteria in between closures (i.e., the day count does not include the days referred to in number 2 above).not include the days referred to in number 2 above).	(Percent Change from ECB19RR)							
High-Low Closure Criteria for Everglades Wildlife Management Areas. Criteria Used: 1. A closure was counted as soon as the closure criteria was exceeded 2. If there were up to 2 consecutive weeks that did not violate the criteria in between closures, that was counted as one closure (i.e., the area did not open and close) 3. Closures are based on calendar years The total number of days does not include the days that did not violate the closure criteria in between closures (i.e., the day count does not include the days referred to in number 2 above).	Days Low Water Criteria Exceeded (Percent Change from ECB19RR)	750	930	880	NA	NA	NA	NA
High-Low Closure Criteria for Everglades Wildlife Management Areas. Criteria Used: 1. A closure was counted as soon as the closure criteria was exceeded 2. If there were up to 2 consecutive weeks that did not violate the criteria in between closures, that was counted as one closure (i.e., the area did not open and close) 3. Closures are based on calendar years The total number of days does not include the days that did not violate the closure criteria in between closures (i.e., the day count does not include the days referred to in number 2 above).	Number of High Water Closures	10	9	10	NA	NA	NA	NA
High-Low Closure Criteria for Everglades Wildlife Management Areas. Criteria Used: 1. A closure was counted as soon as the closure criteria was exceeded 2. If there were up to 2 consecutive weeks that did not violate the criteria in between closures, that was counted as one closure (i.e., the area did not open and close) 3. Closures are based on calendar years The total number of days does not include the days that did not violate the closure criteria in between closures (i.e., the day count does not include the days referred to in number 2 above).	Damaging High Water Closures (> 60 Days)	3	3	3	NA	NA	NA	NA
High-Low Closure Criteria for Everglades Wildlife Management Areas. Criteria Used: 1. A closure was counted as soon as the closure criteria was exceeded 2. If there were up to 2 consecutive weeks that did not violate the criteria in between closures, that was counted as one closure (i.e., the area did not open and close) 3. Closures are based on calendar years	Number of Low Water Closures	16	15	16	NA	NA	NA	NA

2016 ERTP Biological Opinion Metrics	Metric Relative to the ECB19RR	ECB19RR	ALTN2	ALTO	SR1	SR2	SR3	SR4
The total number of days does not include the days that did not violate the closure criteria in between closures (i.e., the day count does not include the days referred to in number 2 above).								

* Results generated produced from the Interagency Modeling Center's (IMC's) post-processing spreadsheet. Information not generated from USGS CSSS Viewer. For purposes of relative comparisons, the post-processing spreadsheet was used to maintain consistency when comparing ECB19RR, ALTN2, ALTO2 and SR1, SR2, SR3 and SR4.
** Results produced from IMC's post-processing spreadsheet. Information not generated from USGS CSSS Viewer. Note % therefore does not reflect a four year running average discontinuous hydroperiod range; represents average over the period of record. For purposes of relative comparisons, the post-processing spreadsheet was used to maintain consistency when comparing ECB19RR, ALTN2, ALTO2 and SR1, SR2, SR3 and SR4.

Table E.1-10. Performance indicators evaluation Round 3 alternatives and sensitivity runs. NA indicates performance indicator information was not available.

2016 ERTP Biological Opinion Metrics	Metric Relative to the ECB19RR	ECB19RR		ALTQ		SRQ1		SRQ4	
Wood Stork and Wading Birds: Water depths greater than 16 inches (41 cm) from March 1 through May 31 throughout WCA 3A for two consecutive years as measured by the two gauge average 3A-3 and 3A4 (based upon a ground surface elevation of 8.4 feet NGVD).	Does the ALT exceed the threshold relative to the ECB19RR and if so what is the number of times the threshold is exceeded in two consecutive years over the period of record?	Number of Times Not Met = 12		No: = 6		No: = 6		No: = 5	
*CSSS: Dry nesting days - To produce multiple broods each year, the CSSS requires at least 90 consecutive dry days (water below ground surface) during the nesting season (March 1 – July 15) . Manage water levels in a manner aimed at meeting the following: a. Subpopulation A - At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-Ax	50.8%	CSSS-Ax	48.1%	CSSS-Ax	48.5%	CSSS-Ax	47.8%
*CSSS: Dry nesting days - To produce multiple broods each year, the CSSS requires at least 90 consecutive dry days (water below ground surface) during the nesting season (March 1 – July 15) . Manage water levels in a manner aimed at meeting the following: a. Subpopulation A - At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-B	79.2%	CSSS-B	78.3%	CSSS-B	78.3%	CSSS-B	78.3%
*CSSS: Dry nesting days - To produce multiple broods each year, the CSSS requires at least 90 consecutive dry days (water below ground surface) during the nesting season (March 1 – July 15) . Manage water levels in a manner aimed at meeting the following: a. Subpopulation A - At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must have 90 consecutive dry days between March 1 and July 15 (CSSS	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-C	85.3%	CSSS-C	87.6%	CSSS-C	87.0%	CSSS-C	84.8%

2016 ERTP Biological Opinion Metrics	Metric Relative to the ECB19RR	ECB19RR		ALTQ		SRQ1		SRQ4	
breeding season) every year. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year.									
*CSSS: Dry nesting days - To produce multiple broods each year, the CSSS requires at least 90 consecutive dry days (water below ground surface) during the nesting season (March 1 – July 15) . Manage water levels in a manner aimed at meeting the following: a. Subpopulation A - At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-D	43.7%	CSSS-D	38.8%	CSSS-D	38.5%	CSSS-D	38.8%
*CSSS: Dry nesting days - To produce multiple broods each year, the CSSS requires at least 90 consecutive dry days (water below ground surface) during the nesting season (March 1 – July 15) . Manage water levels in a manner aimed at meeting the following: a. Subpopulation A - At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-E	60.6%	CSSS-E	52.8%	CSSS-E	52.5%	CSSS-E	52.9%
*CSSS: Dry nesting days - To produce multiple broods each year, the CSSS requires at least 90 consecutive dry days (water below ground surface) during the nesting season (March 1 – July 15) . Manage water levels in a manner aimed at meeting the following: a. Subpopulation A - At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-F	71.8%	CSSS-F	70.0%	CSSS-F	68.7%	CSSS-F	70.7%
**CSSS: Discontinuous hydroperiod - The marl prairie habitat that the CSSS requires for its survival and recovery persists under a hydrologic regime of 90 – 210 wet days (water above ground; discontinuous). Manage water levels in a manner aimed at meeting the following: a. Western Marl Prairie – At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-Ax	32.0%	CSSS-Ax	31.9%	CSSS-Ax	32.2%	CSSS-Ax	31.7%

2016 ERTP Biological Opinion Metrics	Metric Relative to the ECB19RR	ECB19RR		ALTQ		SRQ1		SRQ4	
**CSSS: Discontinuous hydroperiod - The marl prairie habitat that the CSSS requires for its survival and recovery persists under a hydrologic regime of 90 – 210 wet days (water above ground; discontinuous). Manage water levels in a manner aimed at meeting the following: a. Western Marl Prairie – At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-B	41.2%	CSSS-B	40.8%	CSSS-B	40.8%	CSSS-B	40.8%
**CSSS: Discontinuous hydroperiod - The marl prairie habitat that the CSSS requires for its survival and recovery persists under a hydrologic regime of 90 – 210 wet days (water above ground; discontinuous). Manage water levels in a manner aimed at meeting the following: a. Western Marl Prairie – At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-C	41.5%	CSSS-C	41.4%	CSSS-C	41.6%	CSSS-C	40.5%
**CSSS: Discontinuous hydroperiod - The marl prairie habitat that the CSSS requires for its survival and recovery persists under a hydrologic regime of 90 – 210 wet days (water above ground; discontinuous). Manage water levels in a manner aimed at meeting the following: a. Western Marl Prairie – At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-D	43.6%	CSSS-D	33.8%	CSSS-D	33.6%	CSSS-D	33.7%
**CSSS: Discontinuous hydroperiod - The marl prairie habitat that the CSSS requires for its survival and recovery persists under a hydrologic regime of 90 – 210 wet days (water above ground; discontinuous). Manage water levels in a manner aimed at meeting the following: a. Western Marl Prairie – At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target.	What is the % of CSSS subpopulation area that meets the target? A higher percentage is better for this metric.	CSSS-E	41.6%	CSSS-E	38.7%	CSSS-E	39.1%	CSSS-E	38.8%
**CSSS: Discontinuous hydroperiod - The marl prairie habitat that the CSSS requires for its survival and recovery persists under a hydrologic regime of 90 – 210 wet days (water	What is the % of CSSS subpopulation area that meets the target? A higher	CSSS-F	39.4%	CSSS-F	32.3%	CSSS-F	32.4%	CSSS-F	32.7%

2016 ERTP Biological Opinion Metrics	Metric Relative to the ECB19RR	ECB19RR	ALTQ	SRQ1	SRQ4
above ground; discontinuous). Manage water levels in a manner aimed at meeting the following: a. Western Marl Prairie – At least 24,000 acres of suitable habitat within and adjacent to CSSS subpopulation A must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target. 24,000 acres of CSSS-A equates to roughly 40% of CSSS-A and CSSS-Ax. b. Subpopulation B through F – At least 40 percent of each designated CSSS critical habitat unit must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this target.	percentage is better for this metric.				
Everglade Snail Kite: a. Dry Season High Water - Timing: by April 15; Trigger Value: stage > 9.2 ft. NGVD at gauge 3AS3W1; Frequency: 2 consecutive years.	Does the ALT exceed the threshold relative to the ECB19RR and if so what is the number of times the threshold is exceeded in two consecutive years over the period of record?	Number of Times Not Met = 7	No: = 4	No: = 4	No: = 2
Everglade Snail Kite: b. Wet Season High Water - Timing: June 1 – December 31; Trigger: stage > 10.5 ft. at gauge 3AS3W1 for 60 days; Frequency: 2 consecutive years.	Does the ALT exceed the threshold relative to the ECB19RR and if so what is the number of times the threshold is exceeded in two consecutive years over the period of record?	Number of Times Not Met = 2	No: = 2	No: = 2	No: = 2
Everglade Snail Kite: c. Recession/Dry Season Amplitude - Timing: January 1 – May 31 (or onset of wet season, whichever is sooner); Trigger: stage difference > 1.7 ft. as measured at gauge(s) closest to kite nesting, as determined by the Service.	Does the ALT exceed the threshold relative to the ECB19RR and if so what is the number of times the threshold is over the period of record?	Number of Times Not Met Gauge 3AS3W1 = 8	Yes: = 10	Yes: = 10	Yes: = 10
Everglade Snail Kite: c. Recession/Dry Season Amplitude - Timing: January 1 – May 31 (or onset of wet season, whichever is sooner); Trigger: stage difference > 1.7 ft. as measured at gauge(s) closest to kite nesting, as determined by the Service.	Does the ALT exceed the threshold relative to the ECB19RR and if so what is the number of times the threshold is over the period of record?	Number of Times Not Met Gauge W2 = 4	No: = 4	No: = 4	No: = 4
Everglade Snail Kite: c. Recession/Dry Season Amplitude - Timing: January 1 – May 31 (or onset of wet season, whichever is sooner); Trigger: stage difference > 1.7 ft. as measured at gauge(s) closest to kite nesting, as determined by the Service.	Does the ALT exceed the threshold relative to the ECB19RR and if so what is the number of times the threshold is over the period of record?	Number of Times Not Met Gauge 3A28 = 6	No: = 5	No: = 4	No: = 5
Everglade Snail Kite: c. Recession/Dry Season Amplitude - Timing: January 1 – May 31 (or onset of wet season, whichever is sooner); Trigger: stage difference > 1.7 ft. as measured at gauge(s) closest to kite nesting, as determined by the Service.	Does the ALT exceed the threshold relative to the ECB19RR and if so what is the number of times the threshold is over the period of record?	Number of Times Not Met Gauge 3A-4 = 7	Yes: = 8	No: 7	Yes: 8

2016 ERTP Biological Opinion Metrics	Metric Relative to the ECB19RR	ECB19RR	ALTQ	SRQ1	SRQ4
Tree Islands	-	138 (= 36% of mapped tree islands inundated less than 10% of period of record)	171 (=45% of mapped tree islands inundated less than 10% of period of record)	NA	NA
Outflow from C-111 Canal between S-18C and S-197	Does the ALT exceed ECB19RR?	S-197: 60 KAC-FT	No: S-197: 19 KAC-FT	NA	NA
Outflow from C-111 Canal between S-18C and S-197	Does the ALT exceed ECB19RR?	Overbank: 76 KAC-FT	Yes: Overbank: 101 KAC-FT	NA	NA
S-197 Daily Flow Distribution in cfs	Does the ALT exceed ECB19RR?	No Flow: 143 Days	Yes: No Flow: 318 Days	NA	NA
S-197 Daily Flow Distribution in cfs	Does the ALT exceed ECB19RR?	> 0 to 400 CFS: 216 Days	No: > 0 to 400 CFS: 42 Days	NA	NA
S-197 Daily Flow Distribution in cfs	Does the ALT exceed ECB19RR?	> 400 to 800 CFS: 3 Days	No: > 400 to 800 CFS: 4 Days	NA	NA
S-197 Daily Flow Distribution in cfs	Does the ALT exceed ECB19RR?	> 800 CFS: 4 Days	No: > 800 CFS: 2 Days	NA	NA
Minimum Levels Peat in ENP (Count of Exceeding Criteria)	Does the ALT exceed the criteria?	10	NA	NA	NA
Minimum Levels Marl in ENP (Count of Exceeding Criteria)	Does the ALT exceed the criteria?	55	NA	NA	NA
Minimum Levels Peat in WCA 3	Does the ALT exceed the criteria?	28	NA	NA	NA
Biscayne Bay – North (S-25+S-25B+S-26+S-27+S-28+S-29)	Does the ALT increase flows relative to ECB19RR?	509.3 KAC-FT	487.7 KAC-FT	486.2 KAC-FT	487.2 KAC-FT
Biscayne Bay – Central (G-93+S-22+S-123)	Does the ALT increase flows relative to ECB19RR?	106.9 KAC-FT	104.7 KAC-FT	104.6 KAC-FT	104.7 KAC-FT
Biscayne Bay – South (S-20F+S-20G+S-21+S-21A)	Does the ALT exceed the ECB19RR?	248.9 KAC-FT	259.2 KAC-FT	260.4 KAC-FT	258.0 KAC-FT
High-Low Closure Criteria for Everglades Wildlife Management Areas. Criteria Used: 1. A closure was counted as soon as the closure criteria was exceeded 2. If there were up to 2 consecutive weeks that did not violate the criteria in between closures, that was counted as one closure (i.e., the area did not open and close) 3. Closures are based on calendar years The total number of days does not include the days that did not violate the closure criteria in between closures (i.e., the day count does not include the days referred to in number 2 above).not include the days referred to in number 2 above).	Days High Water Criteria Exceeded (Percent Change from ECB19RR)	506	481	NA	NA
High-Low Closure Criteria for Everglades Wildlife Management Areas. Criteria Used: 1. A closure was counted as soon as the closure criteria was exceeded 2. If there were up to 2 consecutive weeks that did not violate the criteria in between closures, that was counted as one closure (i.e., the area did not open and close) 3. Closures are based on calendar years The total number of days does not include the days that did not violate the closure criteria in between closures (i.e., the day count does not include the days referred to in number 2 above).	Days Low Water Criteria Exceeded (Percent Change from ECB19RR)	750	870	NA	NA

2016 ERTP Biological Opinion Metrics	Metric Relative to the ECB19RR	ECB19RR	ALTQ	SRQ1	SRQ4
High-Low Closure Criteria for Everglades Wildlife Management Areas. Criteria Used: 1. A closure was counted as soon as the closure criteria was exceeded 2. If there were up to 2 consecutive weeks that did not violate the criteria in between closures, that was counted as one closure (i.e., the area did not open and close) 3. Closures are based on calendar years The total number of days does not include the days that did not violate the closure criteria in between closures (i.e., the day count does not include the days referred to in number 2 above).	Number of High Water Closures	10	9	NA	NA
High-Low Closure Criteria for Everglades Wildlife Management Areas. Criteria Used: 1. A closure was counted as soon as the closure criteria was exceeded 2. If there were up to 2 consecutive weeks that did not violate the criteria in between closures, that was counted as one closure (i.e., the area did not open and close) 3. Closures are based on calendar years The total number of days does not include the days that did not violate the closure criteria in between closures (i.e., the day count does not include the days referred to in number 2 above).	Damaging High Water Closures (> 60 Days)	3	2	NA	NA
High-Low Closure Criteria for Everglades Wildlife Management Areas. Criteria Used: 1. A closure was counted as soon as the closure criteria was exceeded 2. If there were up to 2 consecutive weeks that did not violate the criteria in between closures, that was counted as one closure (i.e., the area did not open and close) 3. Closures are based on calendar years The total number of days does not include the days that did not violate the closure criteria in between closures (i.e., the day count does not include the days referred to in number 2 above).	Number of Low Water Closures	16	15	NA	NA

* Results generated produced from the Interagency Modeling Center's (IMC's) post-processing spreadsheet. Information not generated from USGS CSSS Viewer. For purposes of relative comparisons, the post-processing spreadsheet was used to maintain consistency when comparing ECB19RR, ALTQ SRQ1 AND SRQ4.

** Results produced from IMC's post-processing spreadsheet. Information not generated from USGS CSSS Viewer. Note % therefore does not reflect a four year running average discontinuous hydroperiod range; represents average over the period of record. For purposes of relative comparisons, the post-processing spreadsheet was used to maintain consistency when comparing ECB19RR, ALTQ SRQ1 AND SRQ4.

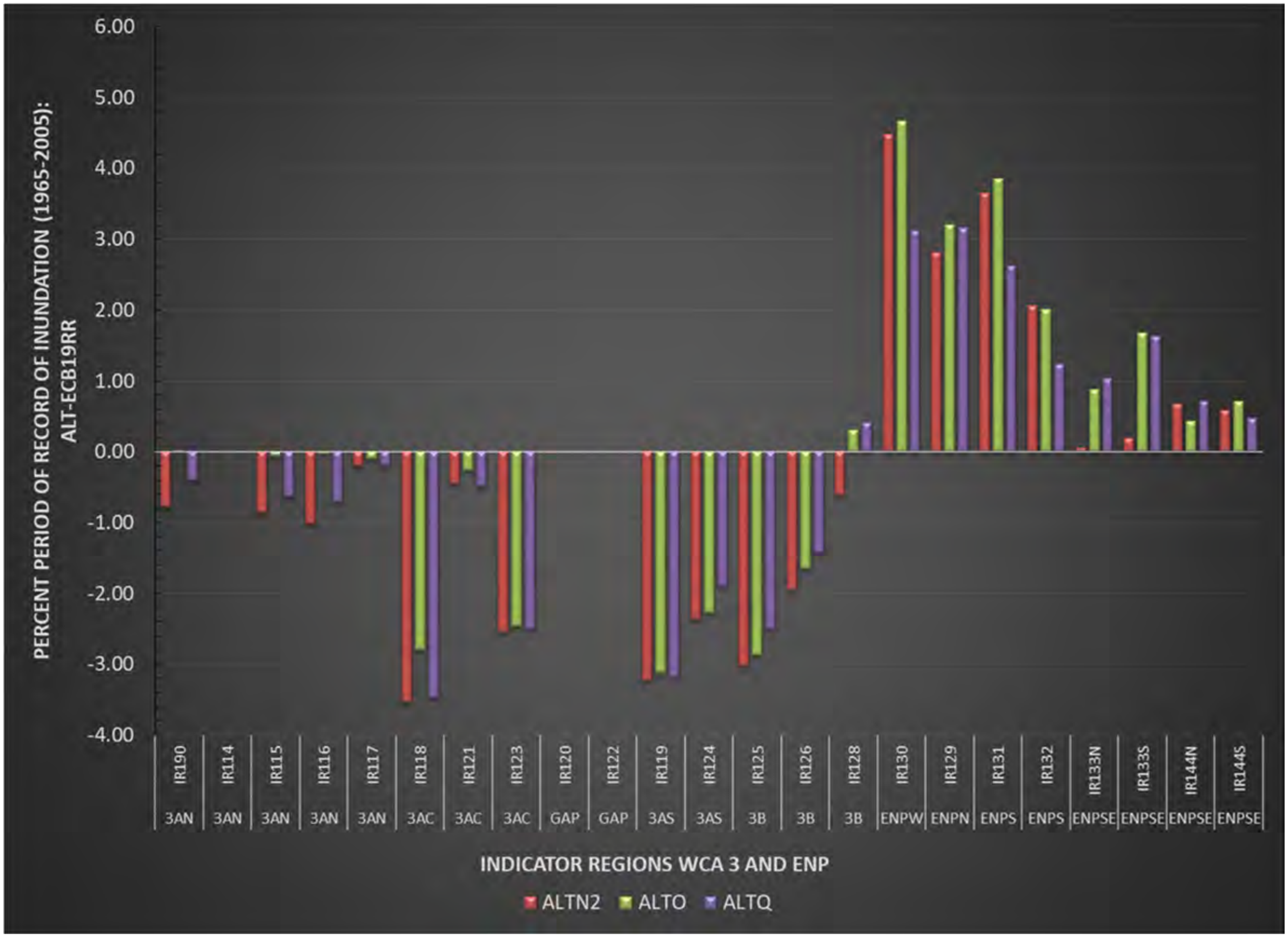


Figure E.1-23. Percent period of record of inundation (1965-2005) in WCA 3 and ENP for ALTN2, ALTO, and ALTQ relative to ECB19RR. Values above the line indicate an alternative exceeds the base condition.

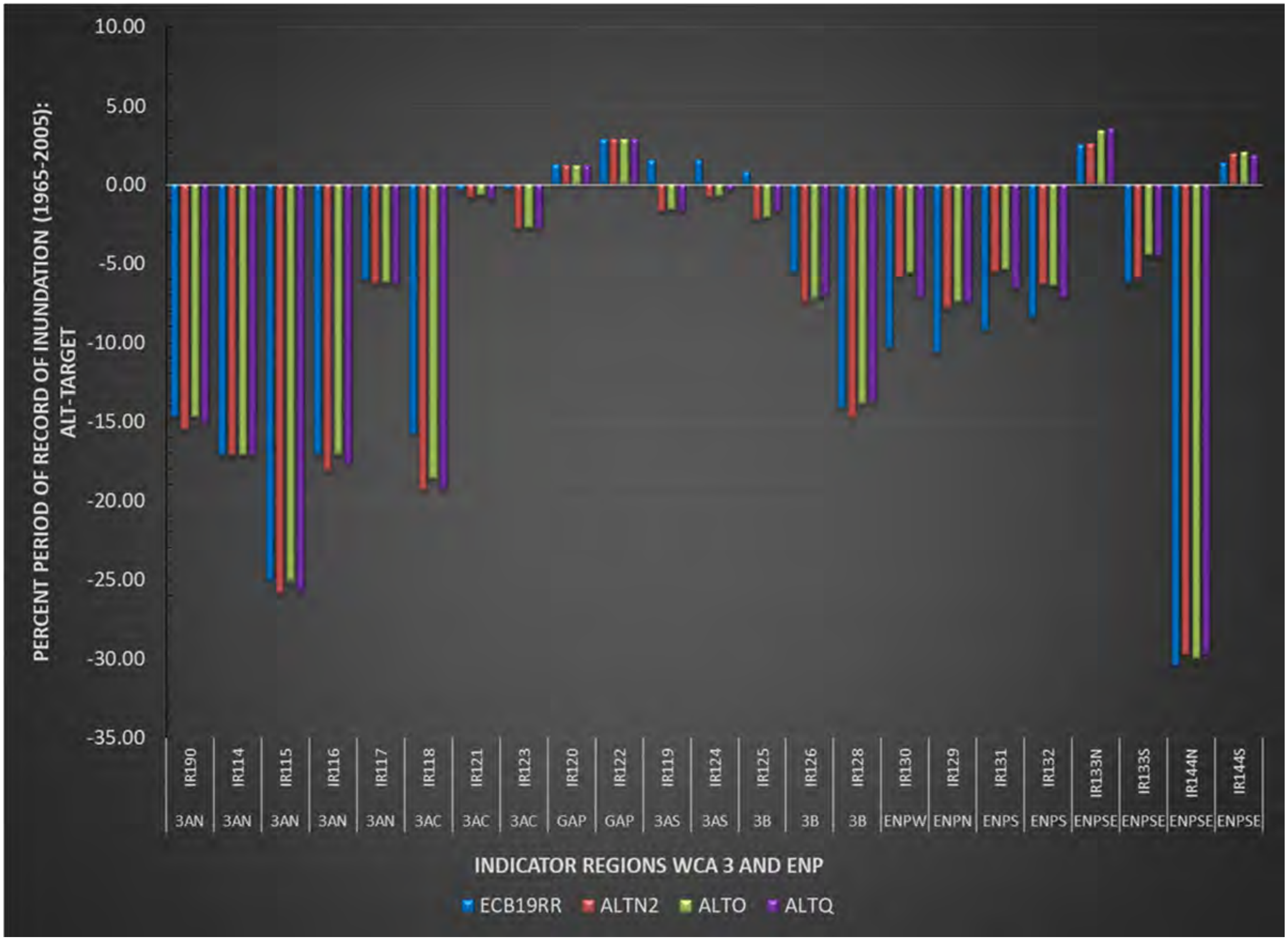


Figure E.1-24. Percent period of record of inundation (1965-2005) in WCA 3 and ENP for ECB19RR, ALTN2, ALTO, and ALTQ relative to the target (NSM). Values above the line indicate an alternative exceeds the target condition.

Table E.1-11. Percent period of record of inundation (1965-2005). Scores are illustrated by zone and indicator region for the target (NSM), ECB19RR, ALTN2 ALTO, and ALTQ.

Zone	Indicator Region	ECB19RR	ALTN2	ALTO	ALTQ	TARGET
3AN	IR190	74	73	74	74	89
3AN	IR114	78	78	78	78	95
3AN	IR115	68	67	68	67	93
3AN	IR116	71	70	71	70	88
3AN	IR117	90	89	90	89	96
3AC	IR118	77	74	74	74	93
3AC	IR121	93	92	93	92	93
3AC	IR123	91	89	89	89	92
GAP	IR120	95	95	95	95	94
GAP	IR122	95	95	95	95	93
3AS	IR119	94	91	91	91	93
3AS	IR124	95	93	93	93	94
3B	IR125	89	86	86	87	88
3B	IR126	92	90	90	90	97
3B	IR128	84	83	84	84	98
LOS	IR140	88	93	93	91	98
ENPW	IR130	89	91	92	92	99
ENPN	IR129	87	91	91	90	96
ENPS	IR131	87	89	89	88	95
ENPS	IR132	91	91	92	92	89
ENPSE	IR133N	83	83	84	84	89
ENPSE	IR133S	58	59	59	59	89
ENPSE	IR144N	90	91	91	91	89
ENPSE	IR144S	74	73	74	74	89

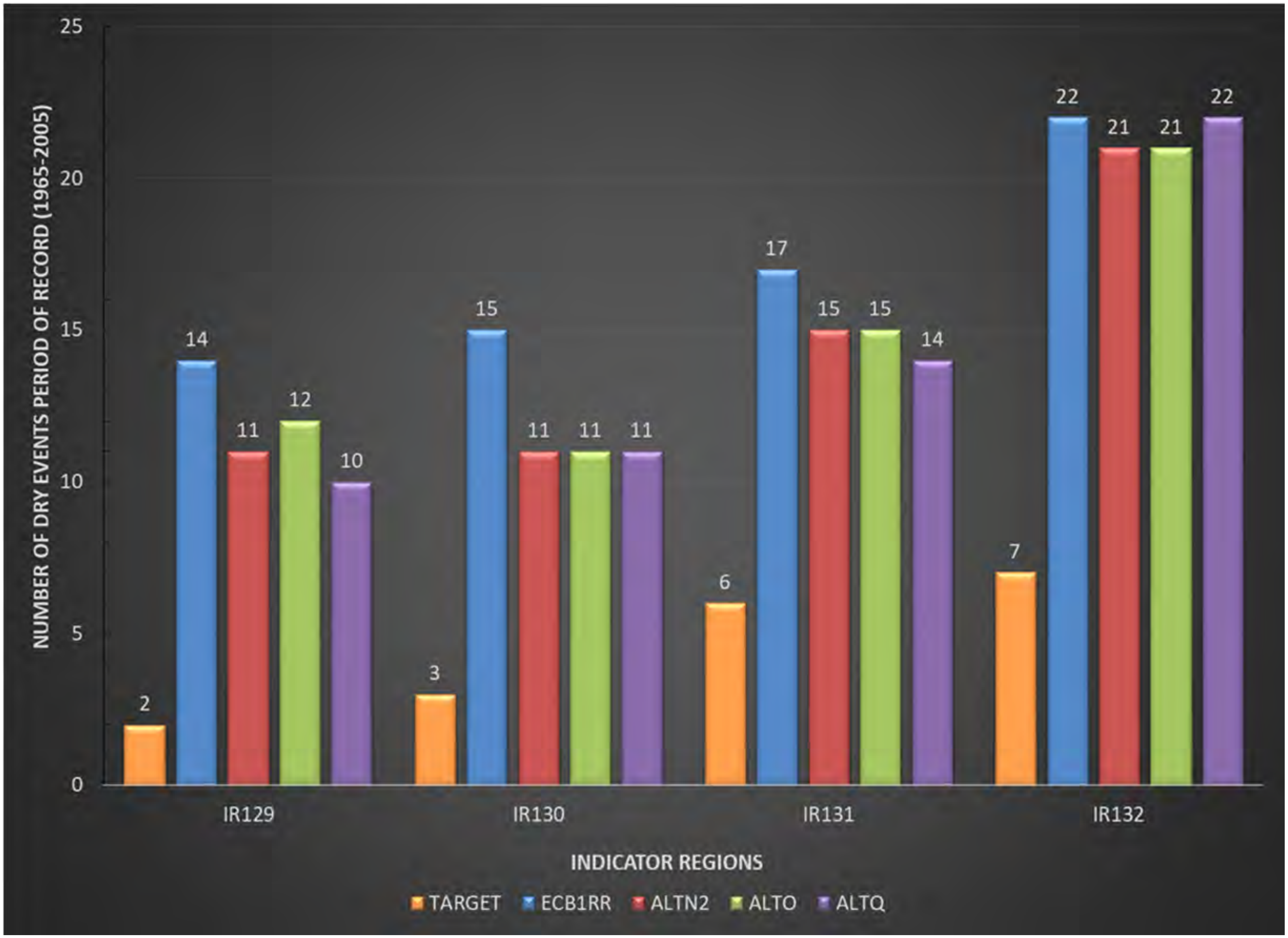


Figure E.1-25. Number of dry events in NESRS over the period of record (1965-2005) for the target, ECB19RR, ALTN2 ALTO, and ALTQ.

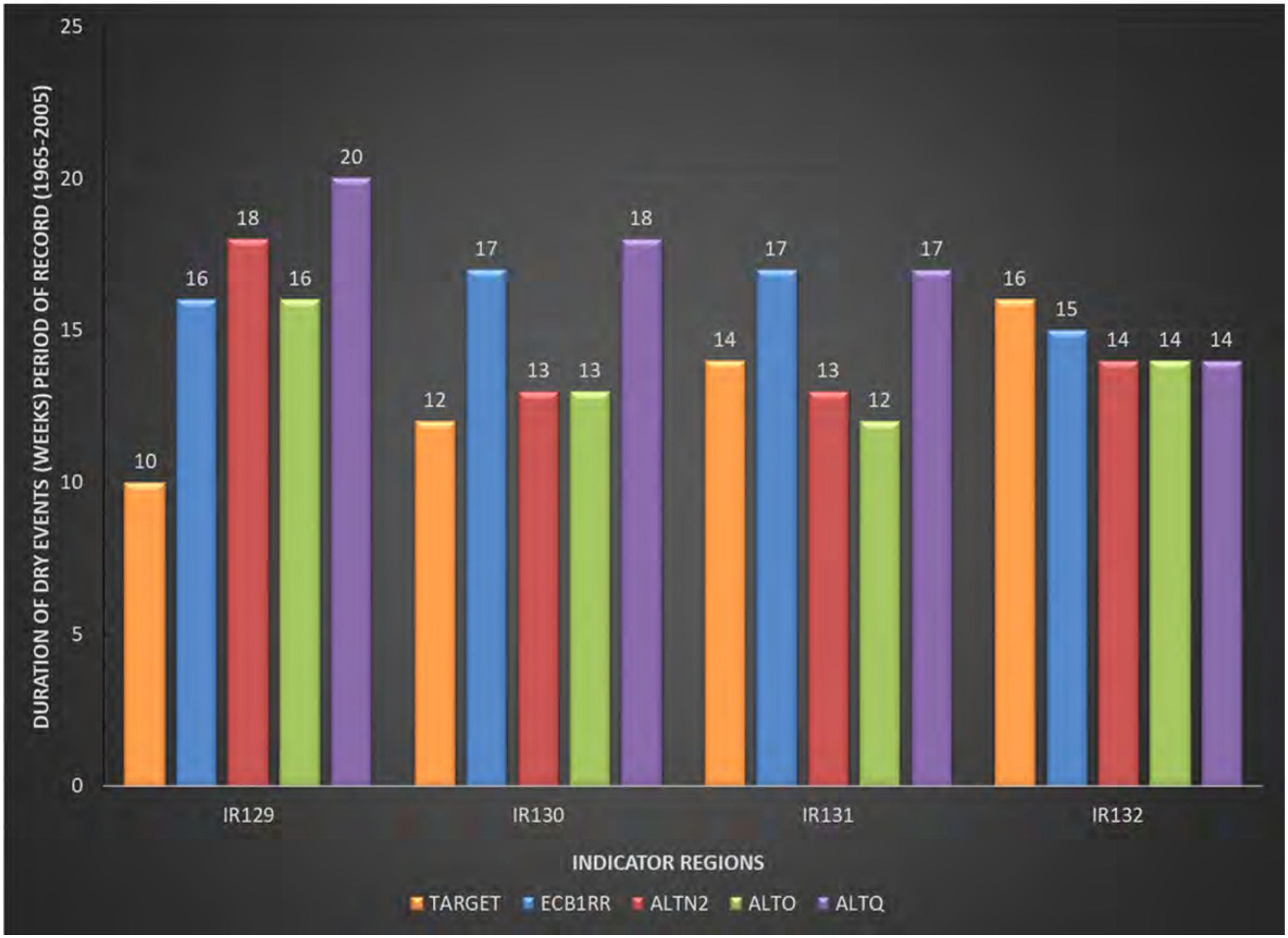


Figure E.1-26. Average duration of dry events (weeks) in NESRS over the period of record (1965-2005) for the target, ECB19RR, ALTN2, ALTO, and ALTQ.

Table E.1-12. Hydrologic surrogate for soil oxidation (water depth relative to land surface elevation ft.-days below ground). Scores are illustrated by zone and indicator region for the target (NSM), ECB19RR, ALTN2, ALTO, and ALTQ. * Denotes missing score. Lower value represents reduced cumulative drought intensity.

Zone	Indicator Region	ECB19RR	ALTN2	ALTO	ALTQ	TARGET
3AN	IR190	1398	1238	1238	1238	1252
3AN	IR114	1238	1238	1238	1238	318
3AN	IR115	1884	1942	1903	1928	513
3AN	IR116	1729	1797	1733	1769	921
3AN	IR117	545	558	553	557	282
3AC	IR118	1622	1998	1912	1950	487
3AC	IR121	268	287	280	287	495
3AC	IR123	334	480	470	450	666
GAP	IR120	153	154	153	154	487
GAP	IR122	146	146	145	146	664
3AS	IR119	229	457	464	445	443
3AS	IR124	173	319	316	284	492
3B	IR125	722	1034	1001	912	919
3B	IR126	432	565	544	492	115
3B	IR128	1253	1344	1226	1135	87
ENPW	IR130	666	359	346	479	114
ENPN	IR129	1060	785	749	754	37
ENPS	IR131	746	467	446	579	317
ENPS	IR132	1149	959	956	1032	370
ENPSE	IR133N	704	737	660	617	*
ENPSE	IR133S	2880	2858	2546	2558	*

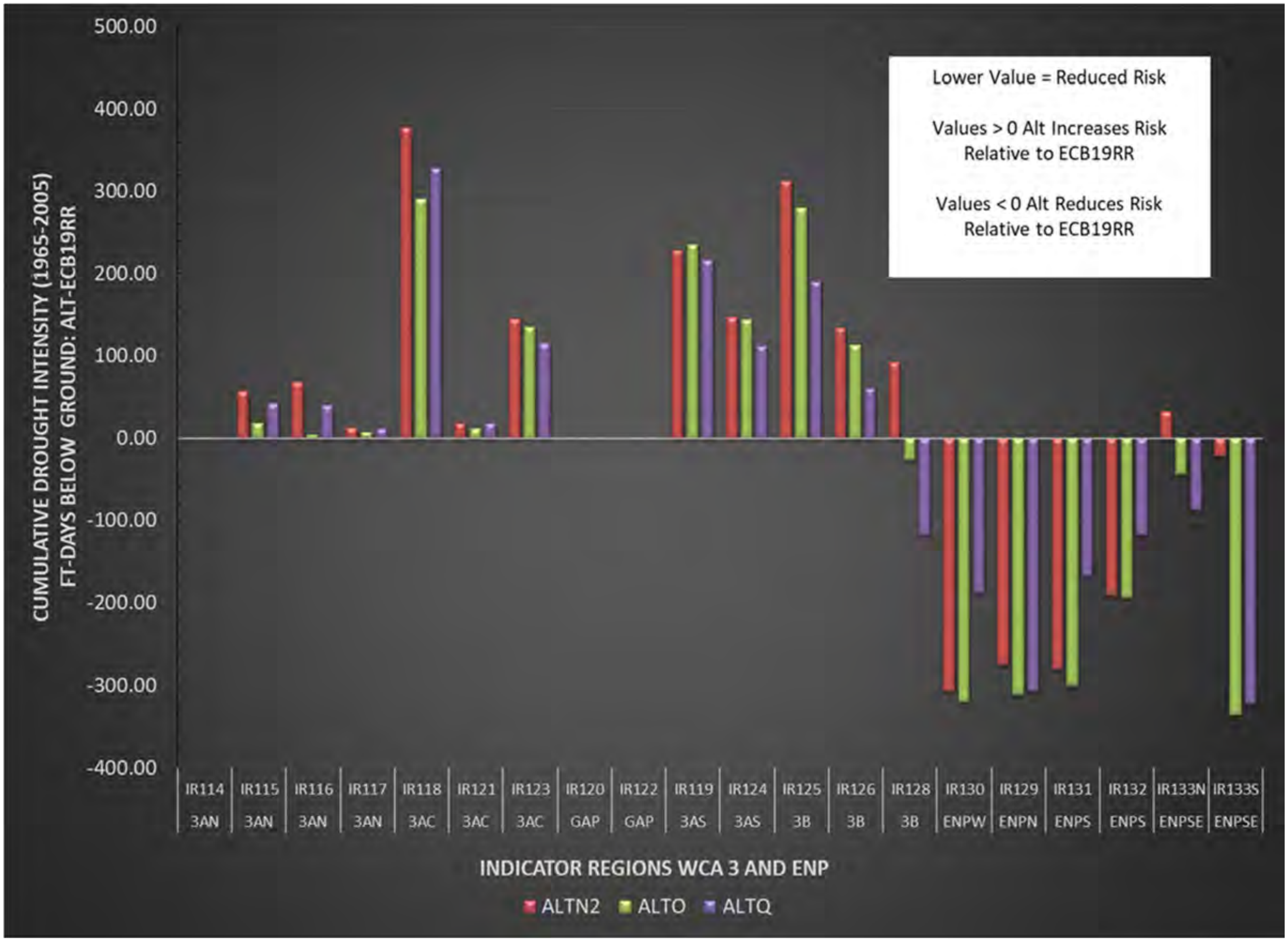


Figure E.1-27. Difference in hydrologic surrogate for soil oxidation (water depth relative to land surface elevation ft.-days below ground). Scores are illustrated by zone and indicator region for ALTN2, ALTO, and ALTQ relative to ECB19RR.

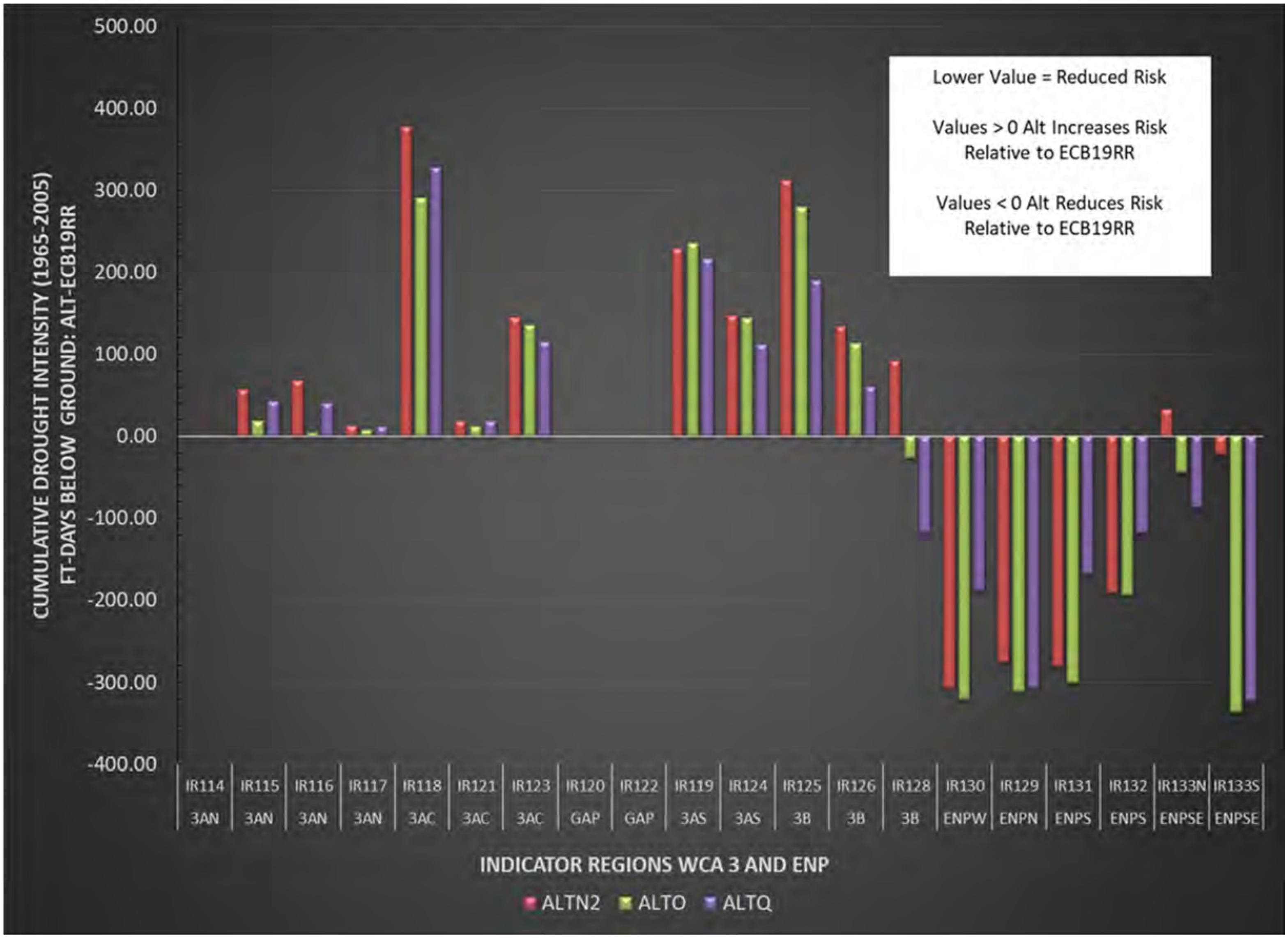


Figure E.1-28. Difference in hydrologic surrogate for soil oxidation (water depth relative to land surface elevation ft.-days below ground). Scores are illustrated by zone and indicator region for ECB19RR, ALTN2, ALTO, and ALTQ relative to the target (NSM).

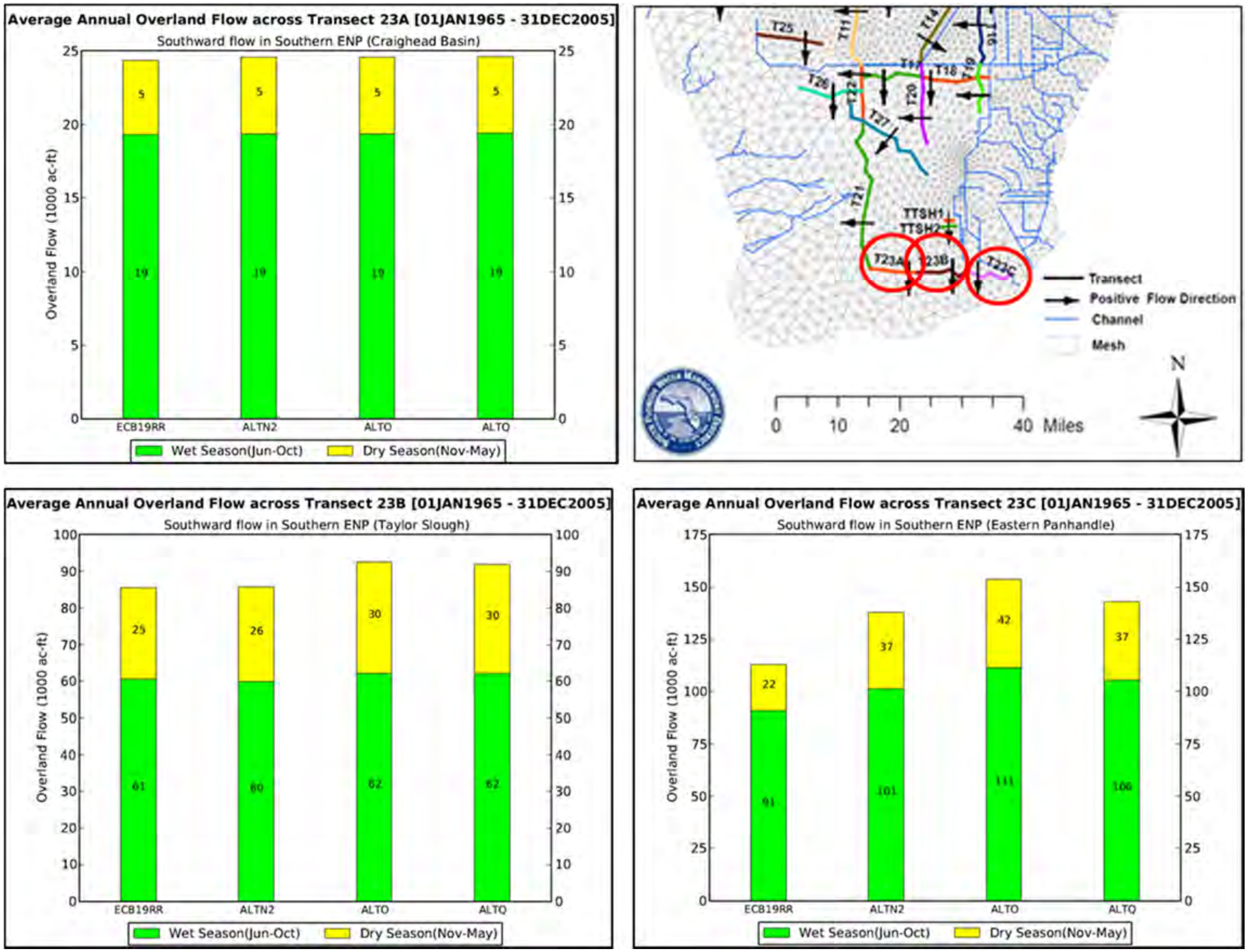
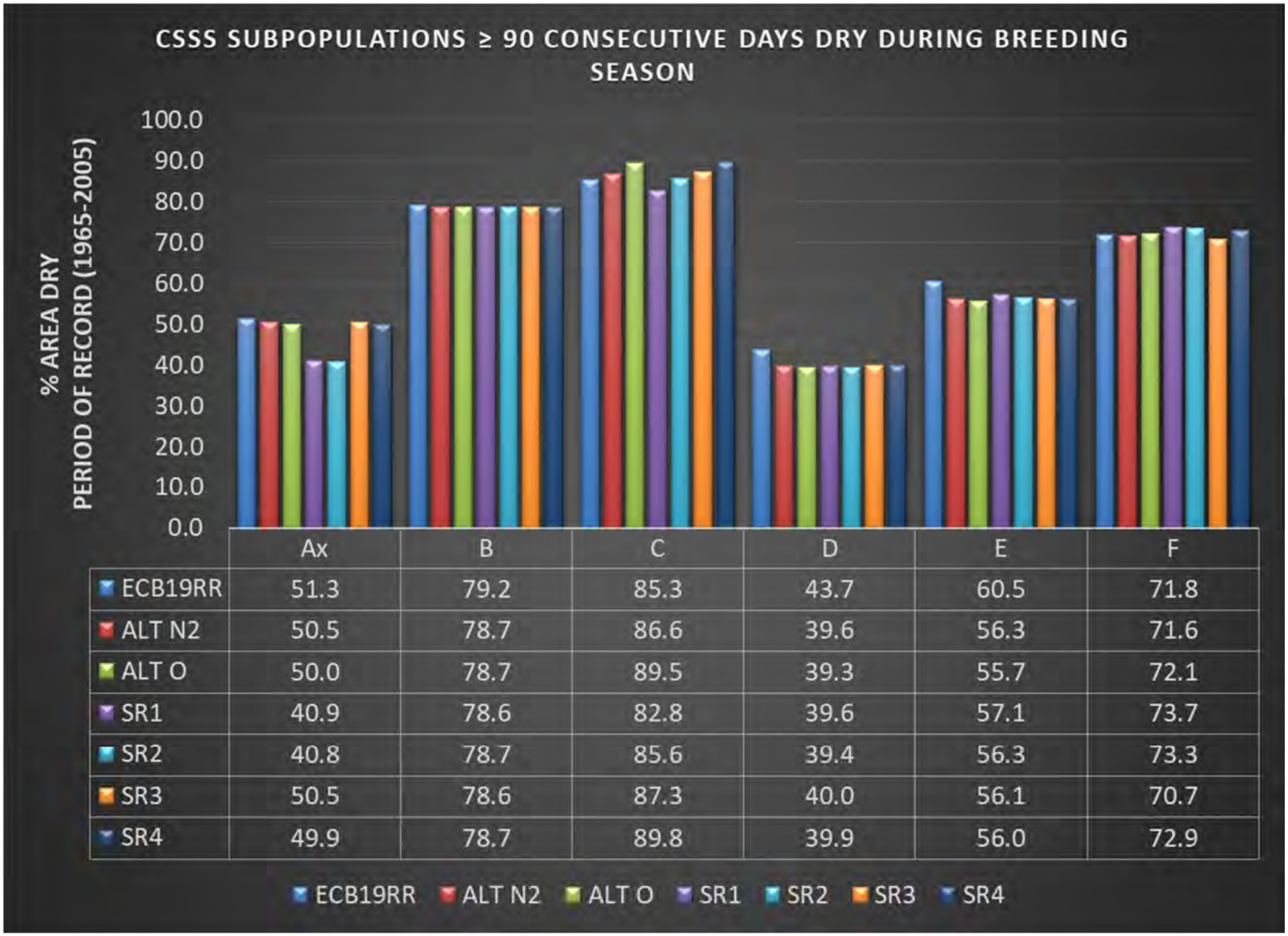


Figure E.1-29. Average annual overland flow across transects (T23A, T23B, T23C) in thousand acre feet across the period of record (1965-2005) for ECB19RR, ALTN2, ALTO, and ALTQ. Red circles denote the location of the referenced transects.

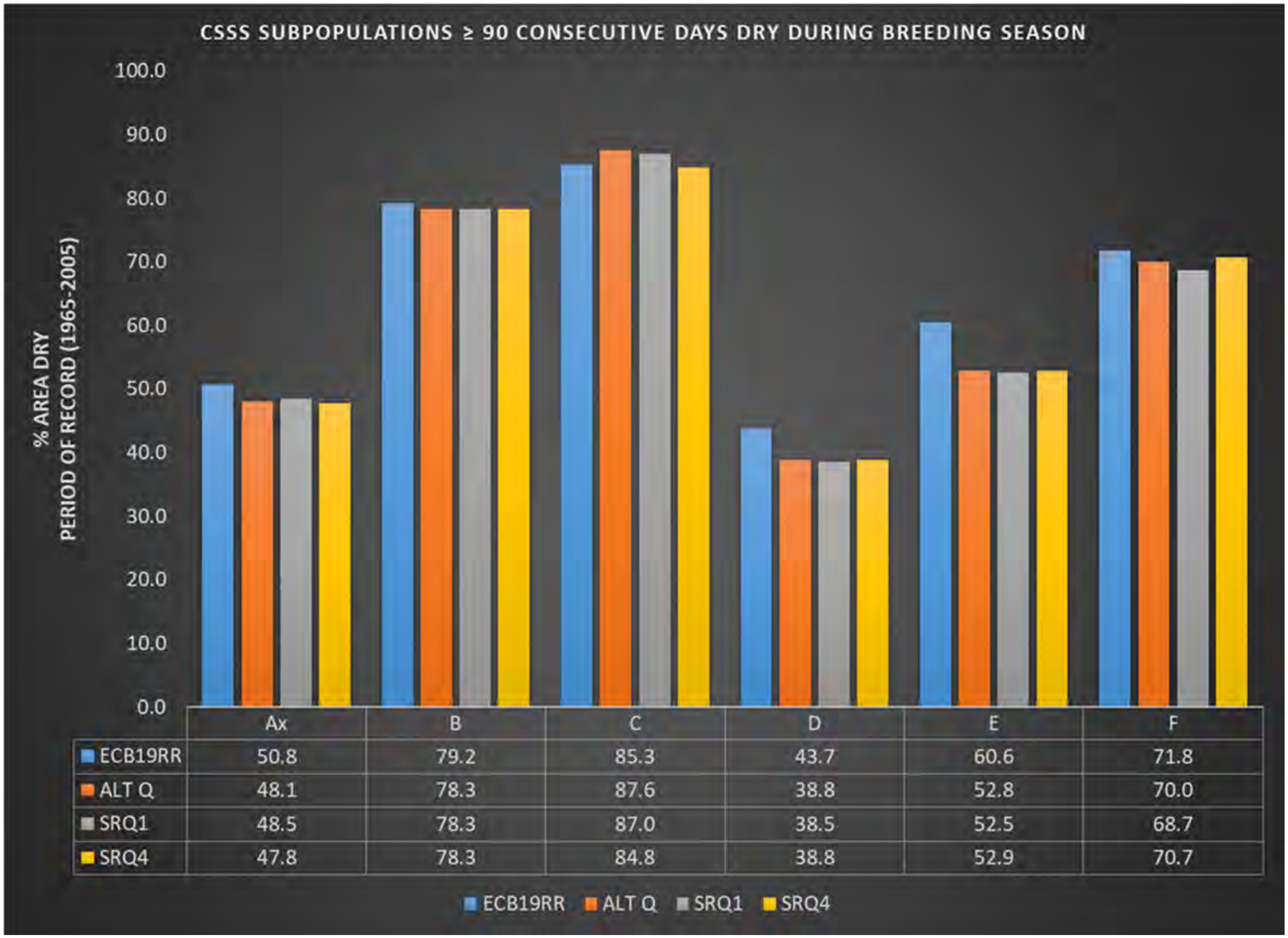
Table E.1-13. Dry season and wet season mean salinity difference from ECB19RR in Florida Bay for ALTN2, ALTO, and ALTQ.

Florida Bay Zone	Dry Season Mean Salinity ECB19RR (PSU)	Dry Season Mean Salinity ALTN2 (% Difference from ECB19RR)	Dry Season Mean Salinity ALTO (% Difference from ECB19RR)	Dry Season Mean Salinity ALTQ (% Difference from ECB19RR)
North Bay	25.1	3.8%	5.1%	4.7%
East Bay	29.9	2.2%	2.9%	2.8%
E Central Bay	29.0	2.8%	3.0%	2.6%
Central Bay	35.5	3.1%	3.4%	3.0%
South Bay	34.7	2.4%	2.6%	2.2%
West Bay	36.1	2.2%	2.4%	2.1%
Florida Bay Zone	**Wet Season Mean Salinity ECB19RR (PSU)**	**Wet Season Mean Salinity ALTN2 (% Difference from ECB19RR)**	**Wet Season Mean Salinity ALTO (% Difference from ECB19RR)**	**Wet Season Mean Salinity ALTQ (% Difference from ECB19RR)**
North Bay	18.3	3.2%	3.1%	3.3%
East Bay	24.7	1.7%	2.2%	2.0%
E Central Bay	27.6	1.6%	0.9%	1.2%
Central Bay	32.6	1.8%	1.1%	1.4%
South Bay	33.8	1.4%	0.8%	1.0%
West Bay	34.8	1.1%	0.6%	0.8%



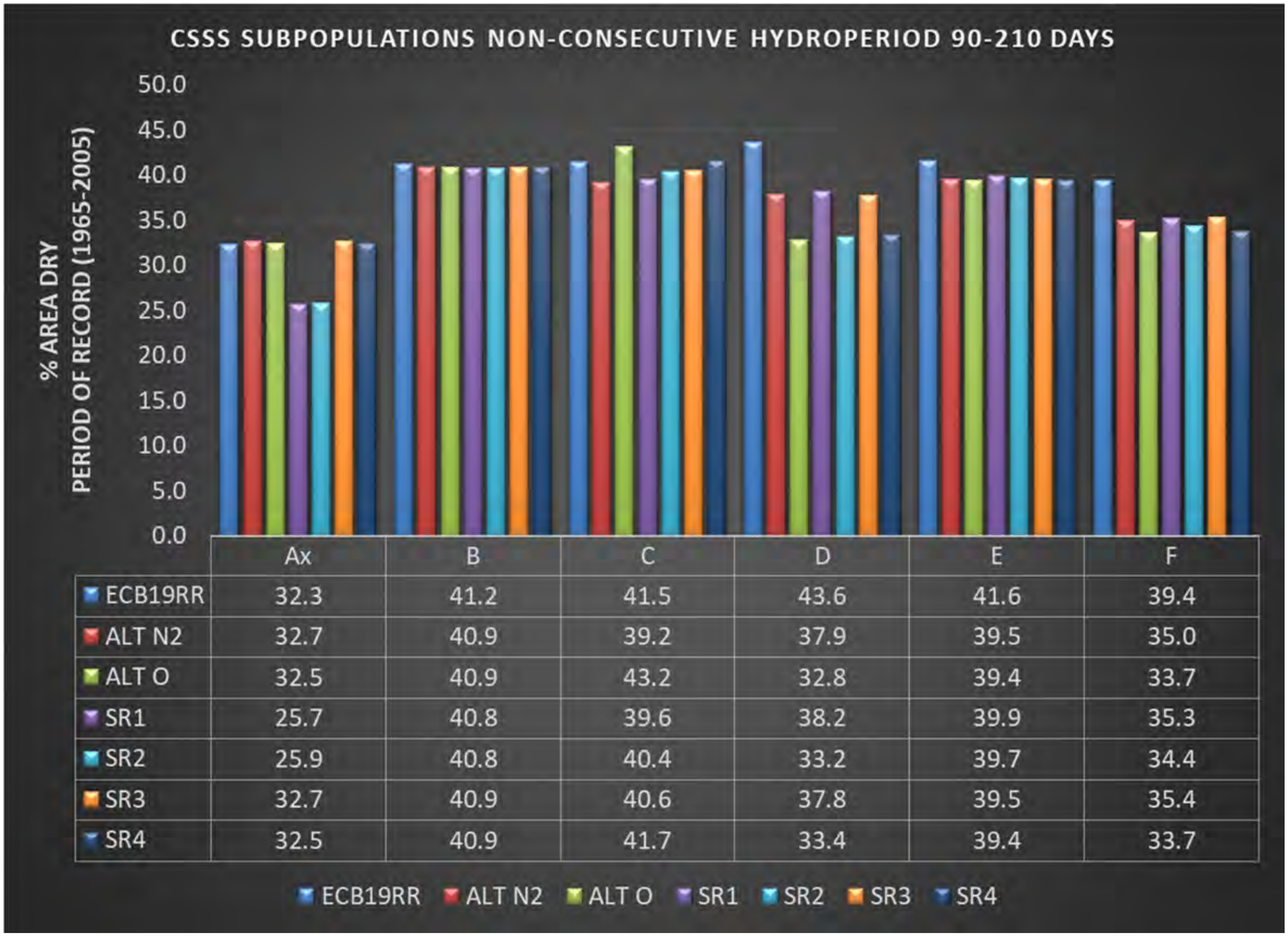
	Ax	B	C	D	E	F
ECB19RR	51.3	79.2	85.3	43.7	60.5	71.8
ALT N2	50.5	78.7	86.6	39.6	56.3	71.6
ALT O	50.0	78.7	89.5	39.3	55.7	72.1
SR1	40.9	78.6	82.8	39.6	57.1	73.7
SR2	40.8	78.7	85.6	39.4	56.3	73.3
SR3	50.5	78.6	87.3	40.0	56.1	70.7
SR4	49.9	78.7	89.8	39.9	56.0	72.9

Figure E.1-30. CSSS nesting season statistics (dry nesting days) Round 2 (ALTN2, ALTO, SR1, SR2, SR3, and SR4): Percent of habitat within CSSS subpopulations that met ≥ 90 consecutive dry days during March 1 through July 15 over the period of record (1965-2005).



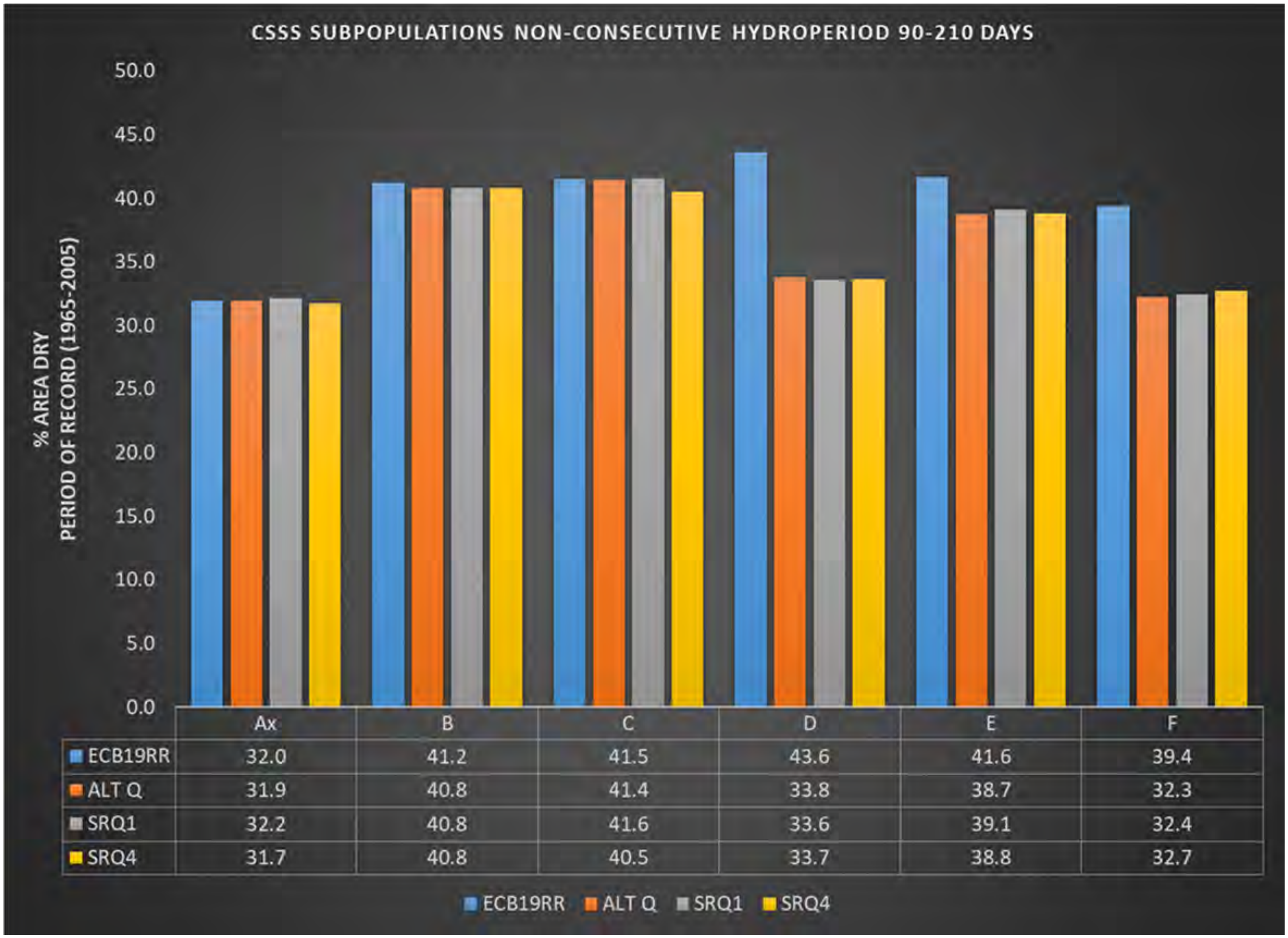
	Ax	B	C	D	E	F
ECB19RR	50.8	79.2	85.3	43.7	60.6	71.8
ALT Q	48.1	78.3	87.6	38.8	52.8	70.0
SRQ1	48.5	78.3	87.0	38.5	52.5	68.7
SRQ4	47.8	78.3	84.8	38.8	52.9	70.7

Figure E.1-31. CSSS nesting season statistics (dry nesting days) Round 3 (ALTQ, SRQ1, and SRQ4): Percent of habitat within CSSS subpopulations that met ≥ 90 consecutive dry days during March 1 through July 15 over the period of record (1965-2005).



	Ax	B	C	D	E	F
ECB19RR	32.3	41.2	41.5	43.6	41.6	39.4
ALT N2	32.7	40.9	39.2	37.9	39.5	35.0
ALT O	32.5	40.9	43.2	32.8	39.4	33.7
SR1	25.7	40.8	39.6	38.2	39.9	35.3
SR2	25.9	40.8	40.4	33.2	39.7	34.4
SR3	32.7	40.9	40.6	37.8	39.5	35.4
SR4	32.5	40.9	41.7	33.4	39.4	33.7

Figure E.1-32. CSSS nesting season statistics (discontinuous hydroperiod) Round 2 (ALTN2, ALTO, SR1, SR2, SR3, and SR4): percent of habitat within CSSS subpopulations that met a discontinuous hydroperiod range of 90-210 days over the period of record (1965-2005).



	Ax	B	C	D	E	F
ECB19RR	32.0	41.2	41.5	43.6	41.6	39.4
ALT Q	31.9	40.8	41.4	33.8	38.7	32.3
SRQ1	32.2	40.8	41.6	33.6	39.1	32.4
SRQ4	31.7	40.8	40.5	33.7	38.8	32.7

Figure E.1-33. CSSS nesting season statistics (discontinuous hydroperiod) round 3 (ALTQ, SRQ1, SRQ4): percent of habitat within CSSS subpopulations that met a discontinuous hydroperiod range of 90-210 days over the period of record (1965-2005).

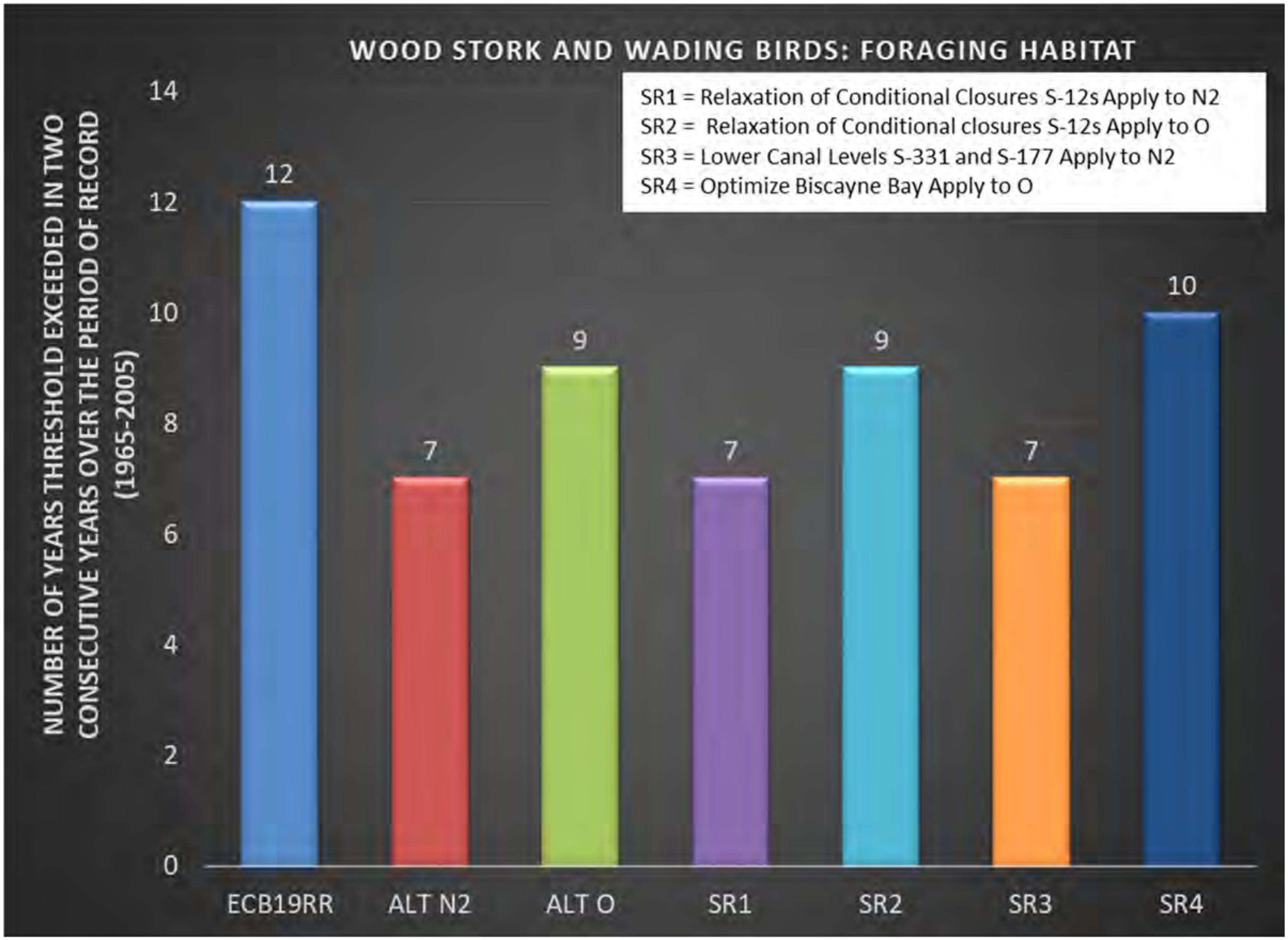


Figure E.1-34. Wood storks and wading birds Round 2 (ALTN2, ALTO, SR1, SR2, SR3, SR4): Number of times in the period of record (1965-2005) when water depths exceeds 16 inches (41 cm) from March 1 through May 31 throughout WCA 3A in two consecutive years as measured by the two gauge average (based upon a ground surface elevation of 8.4 feet NGVD at gages 3A-3 and 3A-4.)

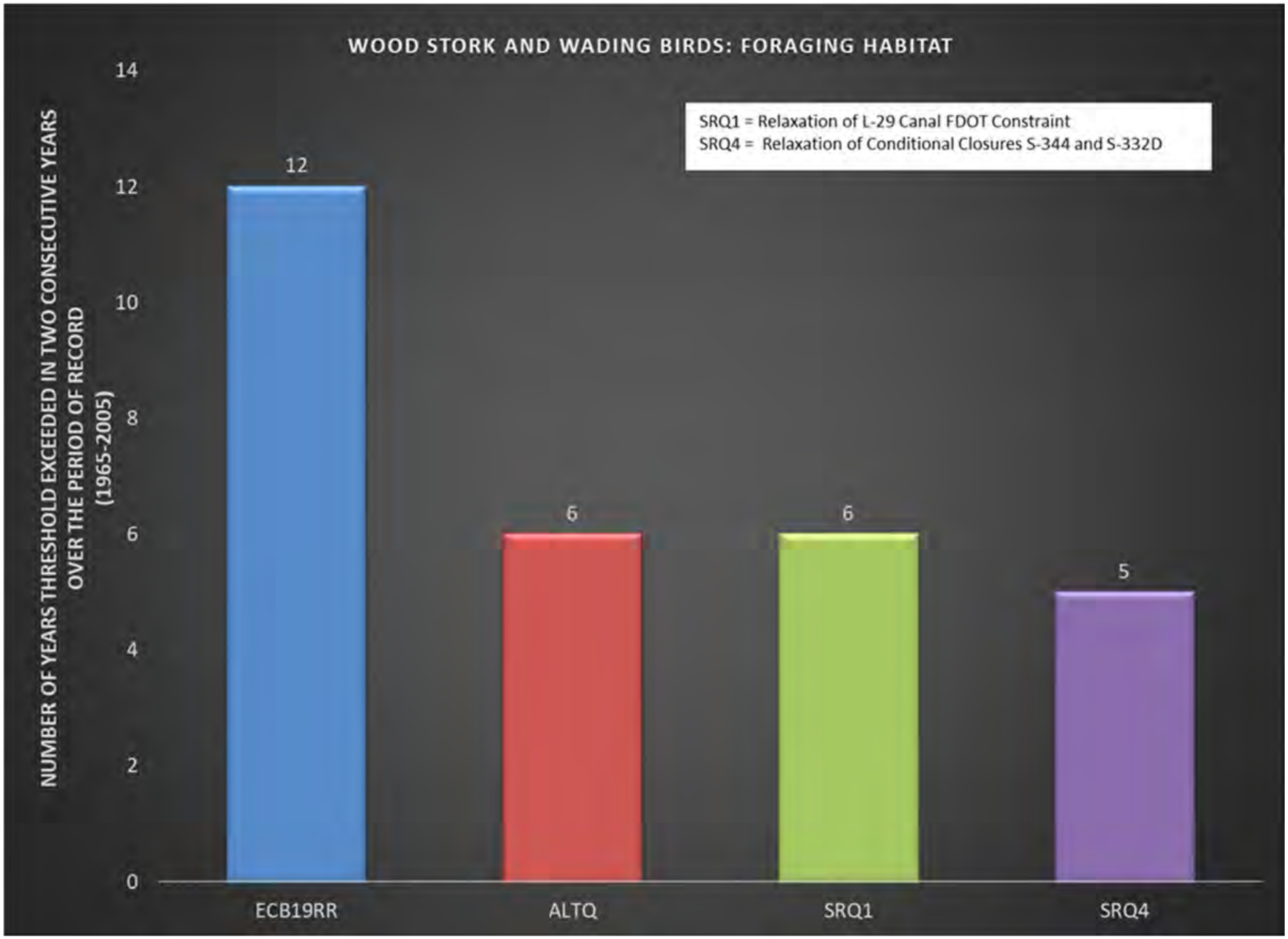


Figure E.1-35. Wood storks and wading birds Round 3 (ALTQ, SRQ1, SRQ4): Number of times in the period of record (1965-2005) when water depths exceeds 16 inches (41 cm) from March 1 through May 31 throughout WCA 3A in two consecutive years as measured by the two gage average (based upon a ground surface elevation of 8.4 feet NGVD at gages 3A-3 and 3A-4.

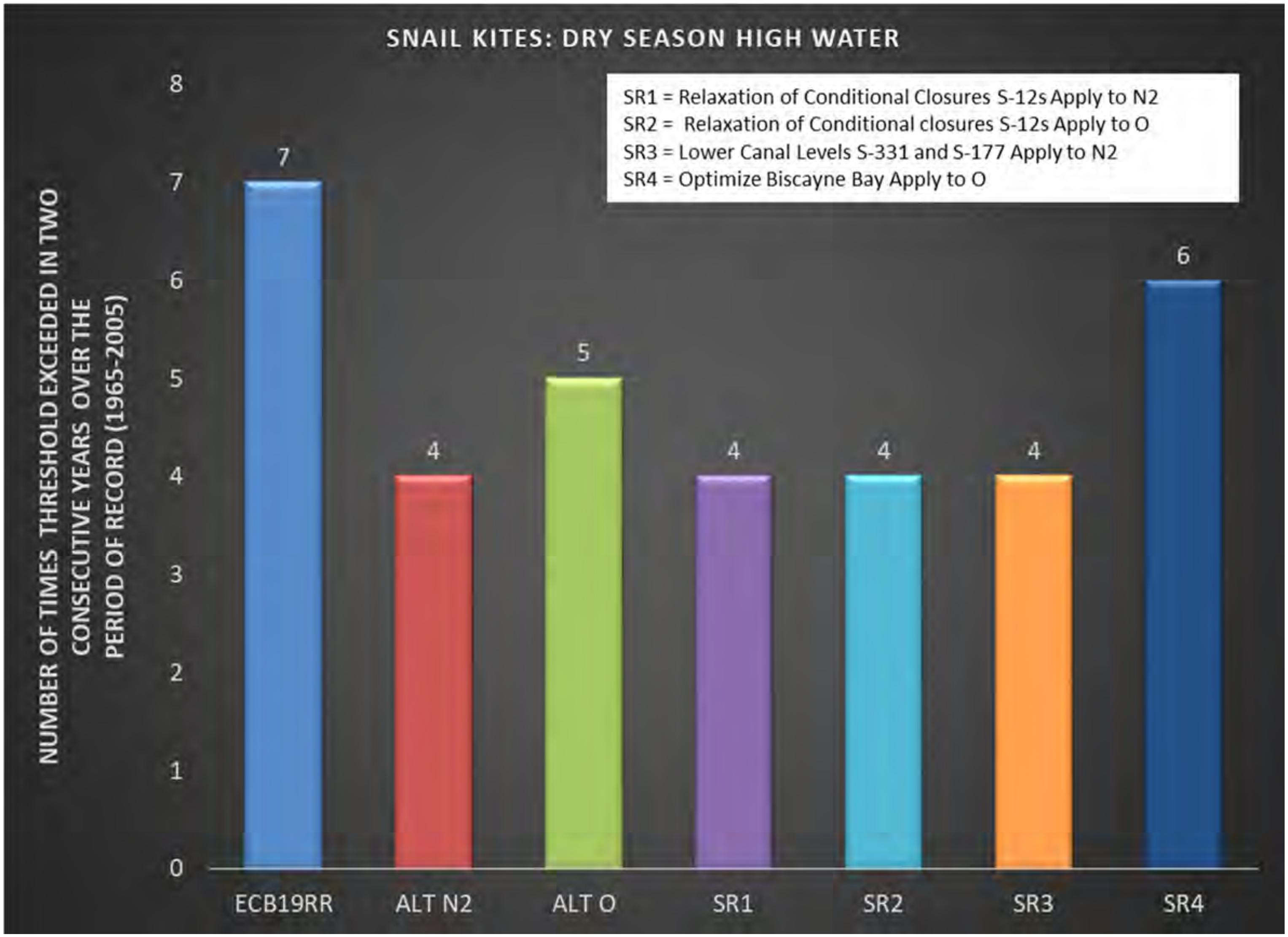


Figure E.1-36. Snail kites (dry season high water) Round 2 (ALTN2, ALTO, SR1, SR2, SR3, SR4): number of times in the period of record (1965-2005) when maximum water levels exceed 9.2 feet, NGVD at gauge 3AS3W1 on or after April 15 in two consecutive years.

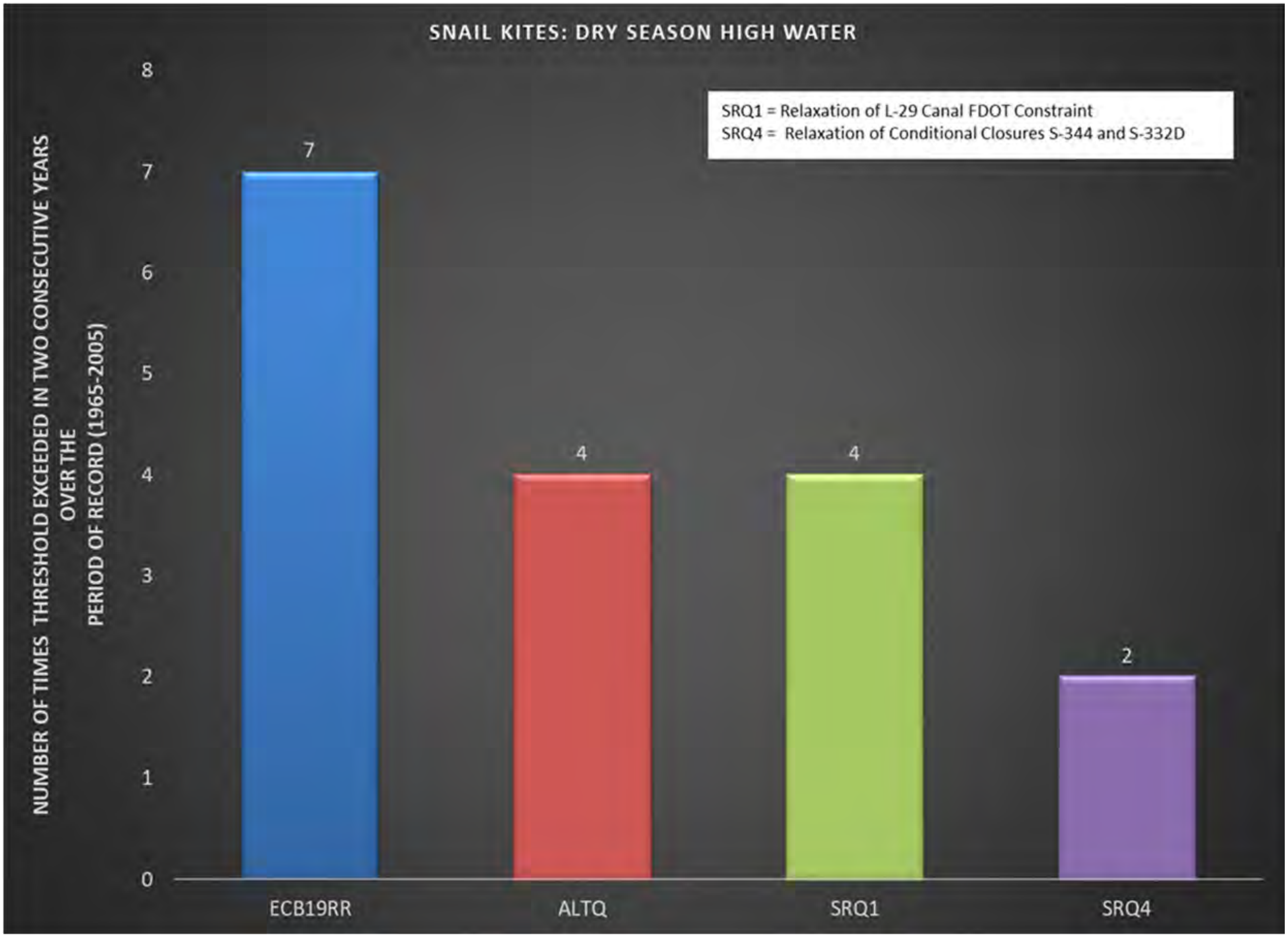


Figure E.1-37. Snail kites (dry season high water) Round 3 (ALTQ, srq1, srq4): number of times in the period of record (1965-2005) when maximum water levels exceed 9.2 feet, NGVD at gauge 3AS3W1 on or after April 15 in two consecutive years.

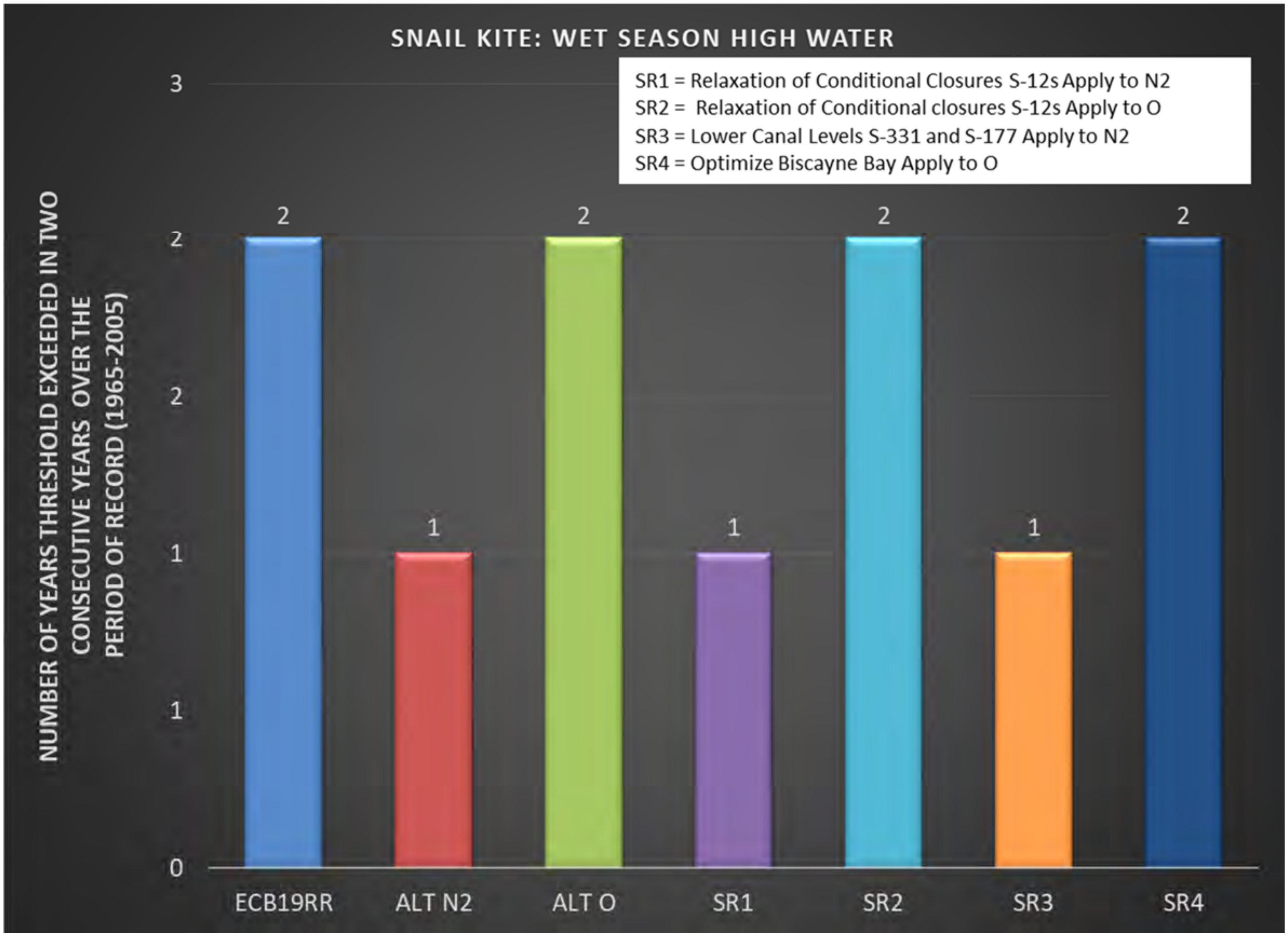


Figure E.1-38. Snail kites (wet season high water) Round 2 (ALTN2, ALTO, SR1, SR2, SR3, SR4): Number of times in the period of record (1965-2005) when maximum water levels exceed 10.5 feet, NGVD at gage 3AS3W1 for 60 days (June 1-December 31) in two consecutive years.

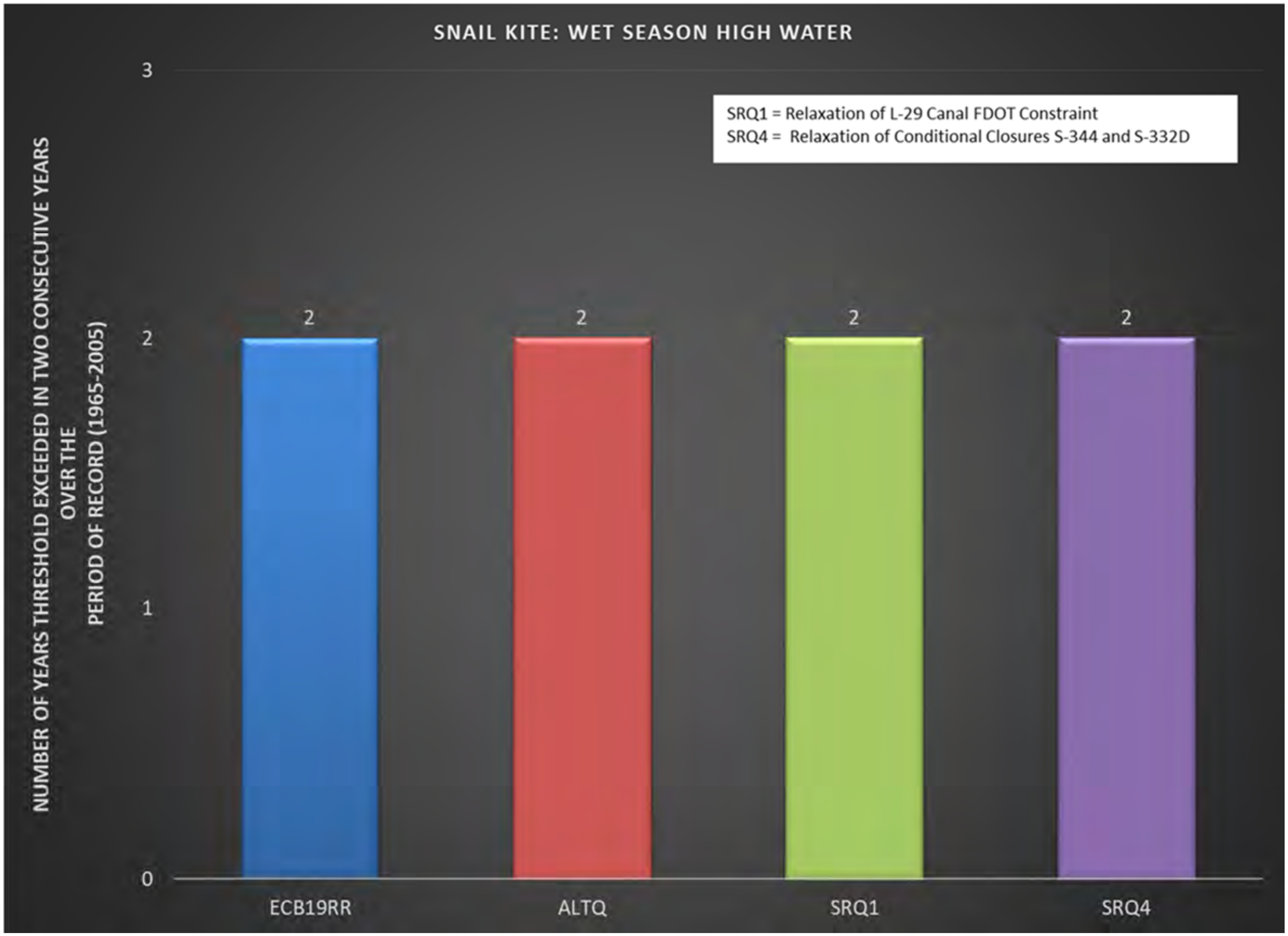


Figure E.1-39. Snail kites (wet season high water) Round 3 (ALTQ, SRQ1, SRQ4): Number of times in the period of record (1965-2005) when maximum water levels exceed 10.5 feet, NGVD at gage 3AS3W1 for 60 days (June 1-December 31) in two consecutive years.

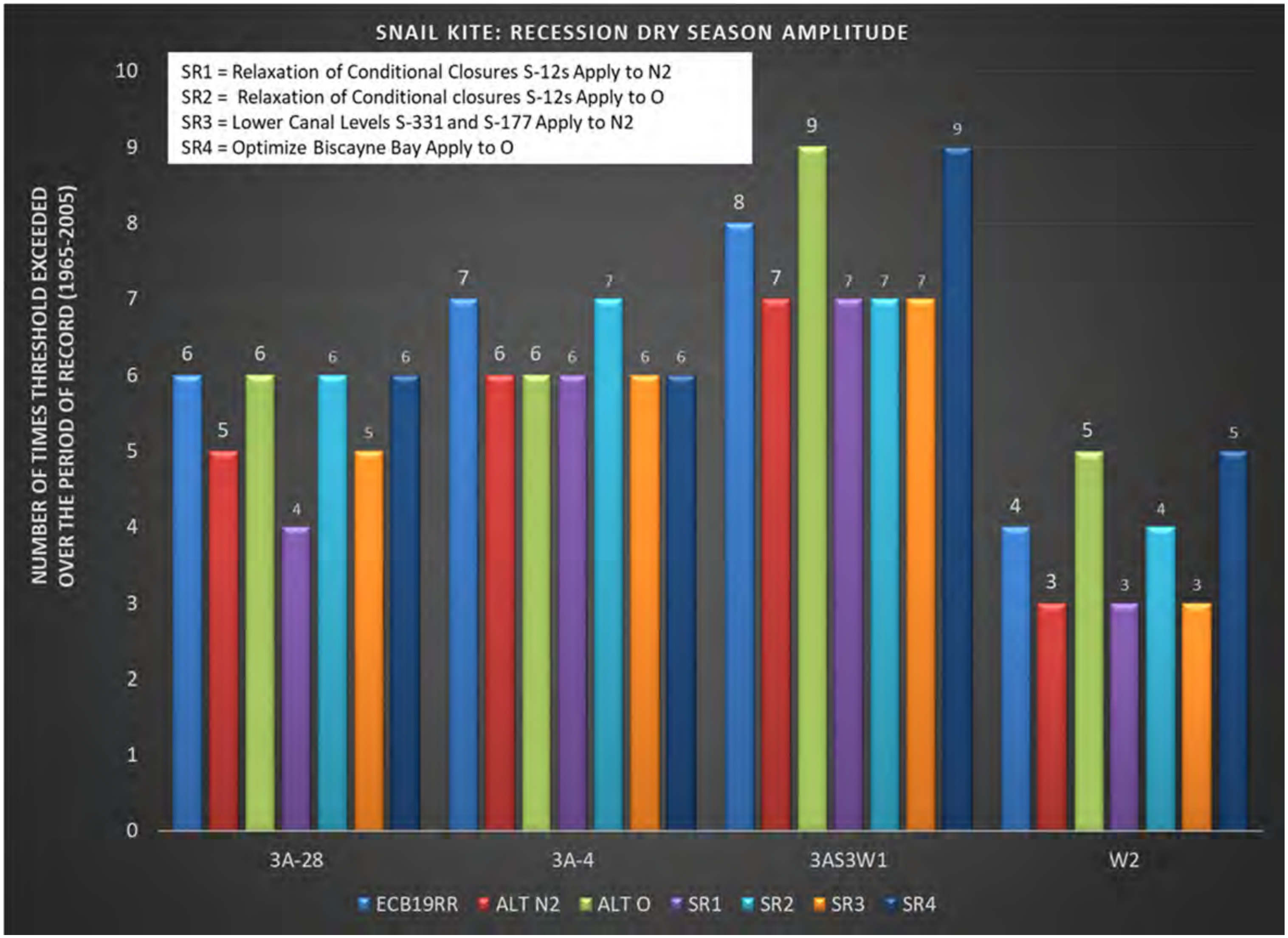


Figure E.1-40. Snail kites (recession: dry season amplitude) Round 2 (ALTN2, ALTO, SR1, SR2, SR3, SR4): Number of years over the period of record (1965-2005) the WCA 3A stage difference as measured at gages 3AS3W1, W2, 3A-28, and 3A4 recedes by more than 1.7 feet.

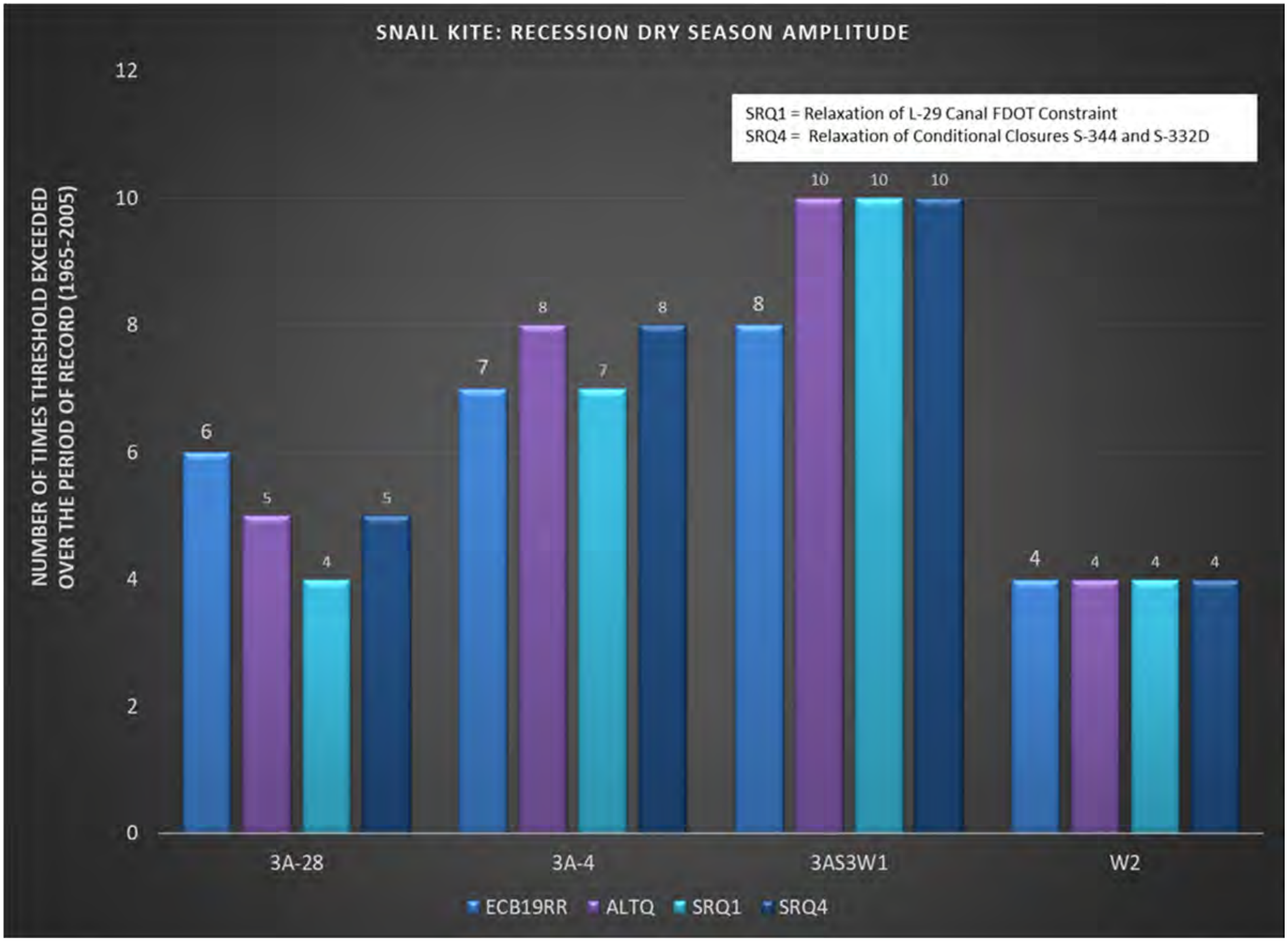


Figure E.1-41. Snail kites (recession: dry season amplitude) Round 3 (ALTQ, srq1, srq4): number of years over the period of record (1965-2005) the WCA 3A stage difference as measured at gages 3AS3W1, W2, 3A-28, and 3A-4 recedes by more than 1.7 feet, NGVD from January 1 through May 31 in a given year.

Table E.1-14. Total number of tree islands inundated less than 10% of time period for Round 2 (ALTN2, ALTO, SR1, SR2, SR3, and SR4). For observed this = 950 days over 26 years (1991-2017), for alts this = 1461 days over 41 years (1965-2005).

Alternative	WCA3AC	WCA3AN	WCA3AS	WCA3B	ENPN	ENPS	ENPW	Gap	Sum
Observed	16	3	19	11	4	14	18	6	91
ECB19RR	45	1	24	9	4	14	18	23	138
ALTN2	61	1	34	15	4	14	18	27	174
ALTO	52	4	30	12	4	14	18	19	153
ALTQ	56	4	41	13	4	14	18	21	171

Table E.1-15. Percent of mapped tree islands inundated less than 10% of time period for round 2 (ALTN2, ALTO, SR1, SR2, SR3, SR4). For observed this = 950 days over 26 years (1991-2017), for ALTS this = 1461 days over 40 years (1965-2005).

Alternative	WCA3AC	WCA3AN	WCA3AS	WCA3B	ENPN	ENPS	ENPW	Gap	Total
Observed	12%	50%	17%	38%	100%	100%	100%	9%	24%
ECB19RR	35%	17%	22%	31%	100%	100%	100%	34%	37%
ALTN2	47%	17%	31%	52%	100%	100%	100%	40%	46%
ALTO	40%	67%	27%	41%	100%	100%	100%	28%	40%
ALTQ	43%	67%	37%	45%	100%	100%	100%	31%	45%

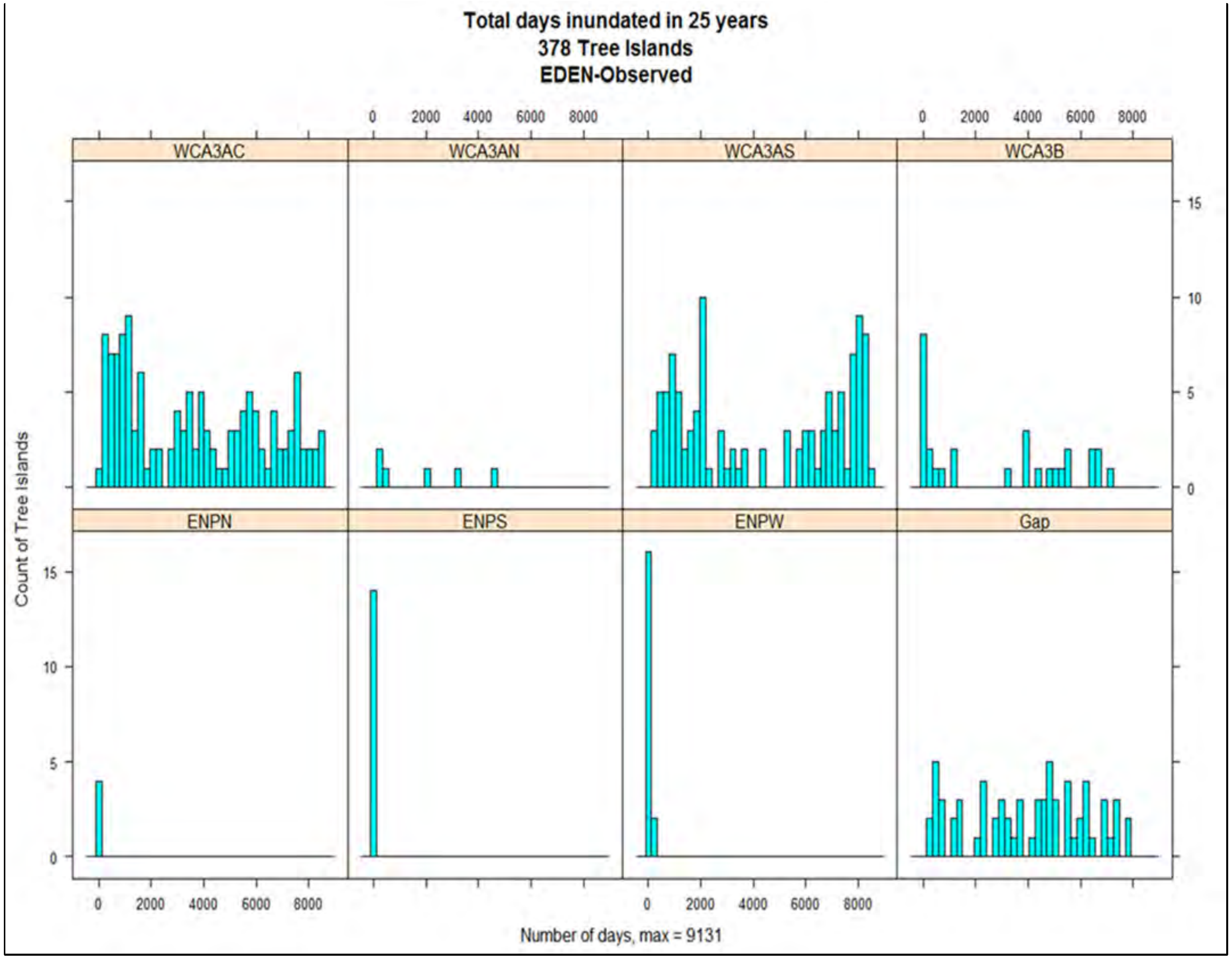


Figure E.1-42. Histogram of mapped tree islands across the regions of interest in WCA 3A, WCA 3B, and ENP. These are observed counts of inundation over a 25 year period.

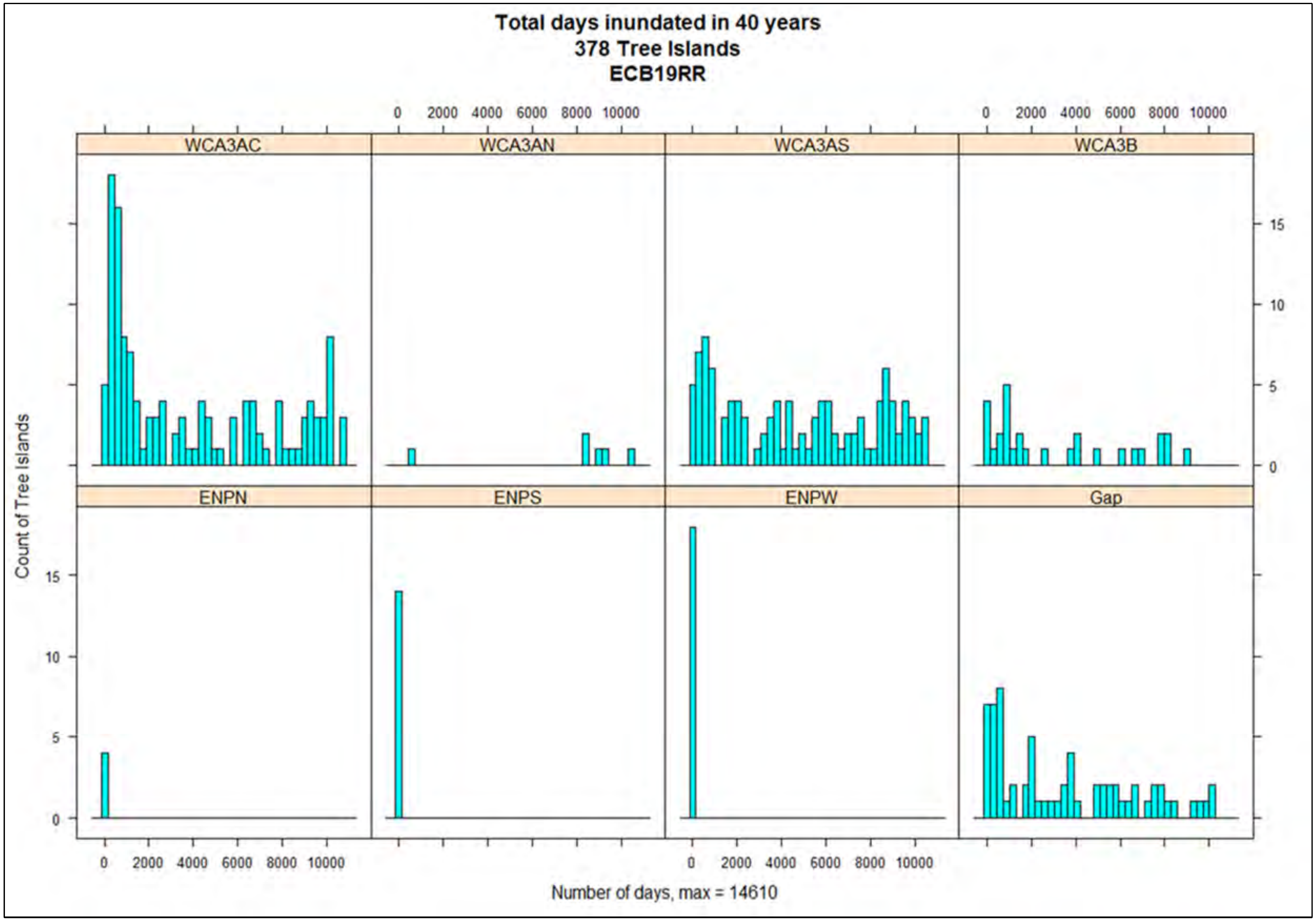


Figure E.1-43. Histogram of mapped tree islands across the regions of interest in WCA 3A, WCA 3B, and ENP. These are counts of inundation over a 25 year period of simulating the operations of ECB19RR.

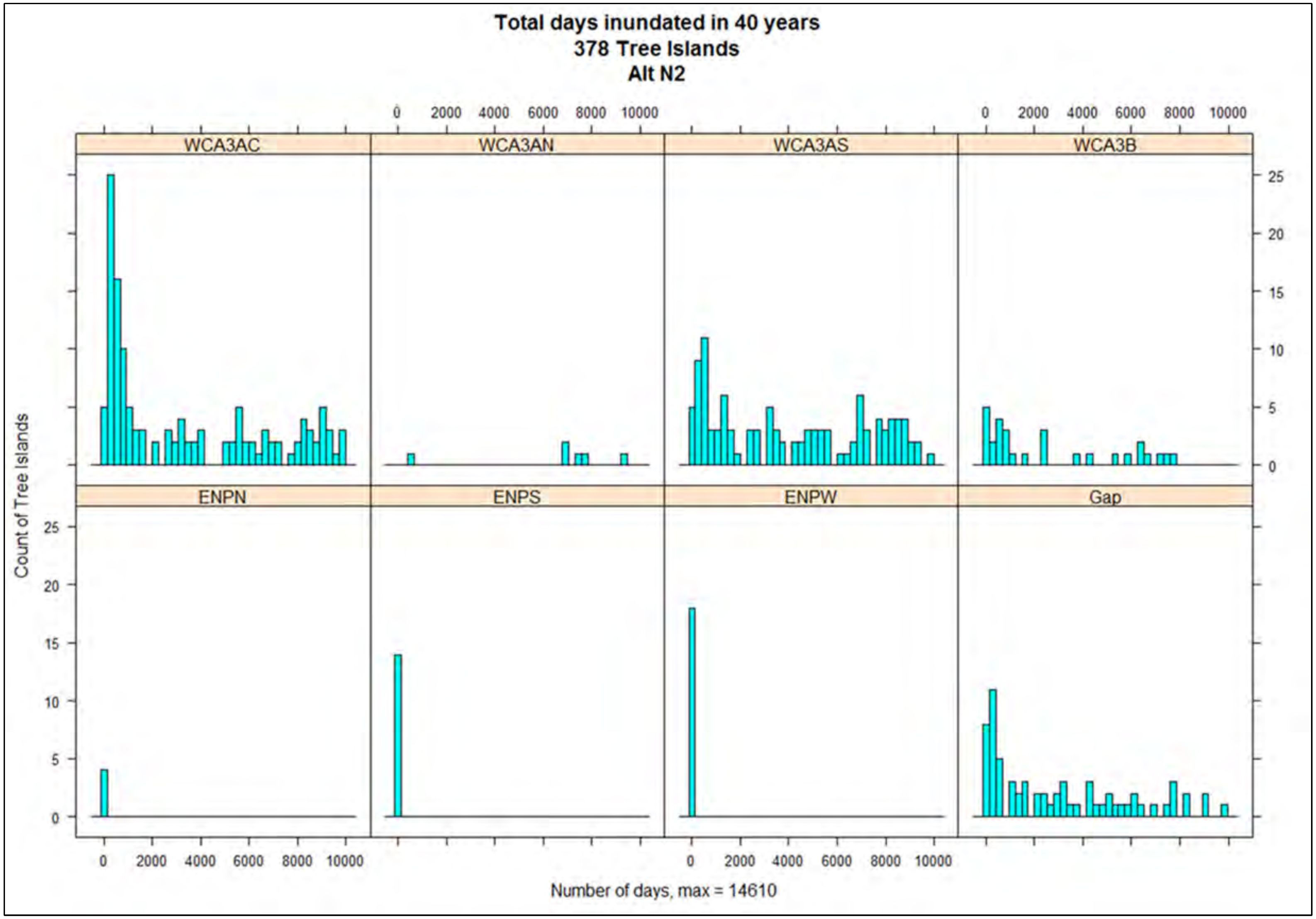


Figure E.1-44. Histogram of mapped tree islands across the regions of interest in WCA 3A, WCA 3B, and ENP. These are counts of inundation over a 41 year period of simulating the operations of ALTN2.

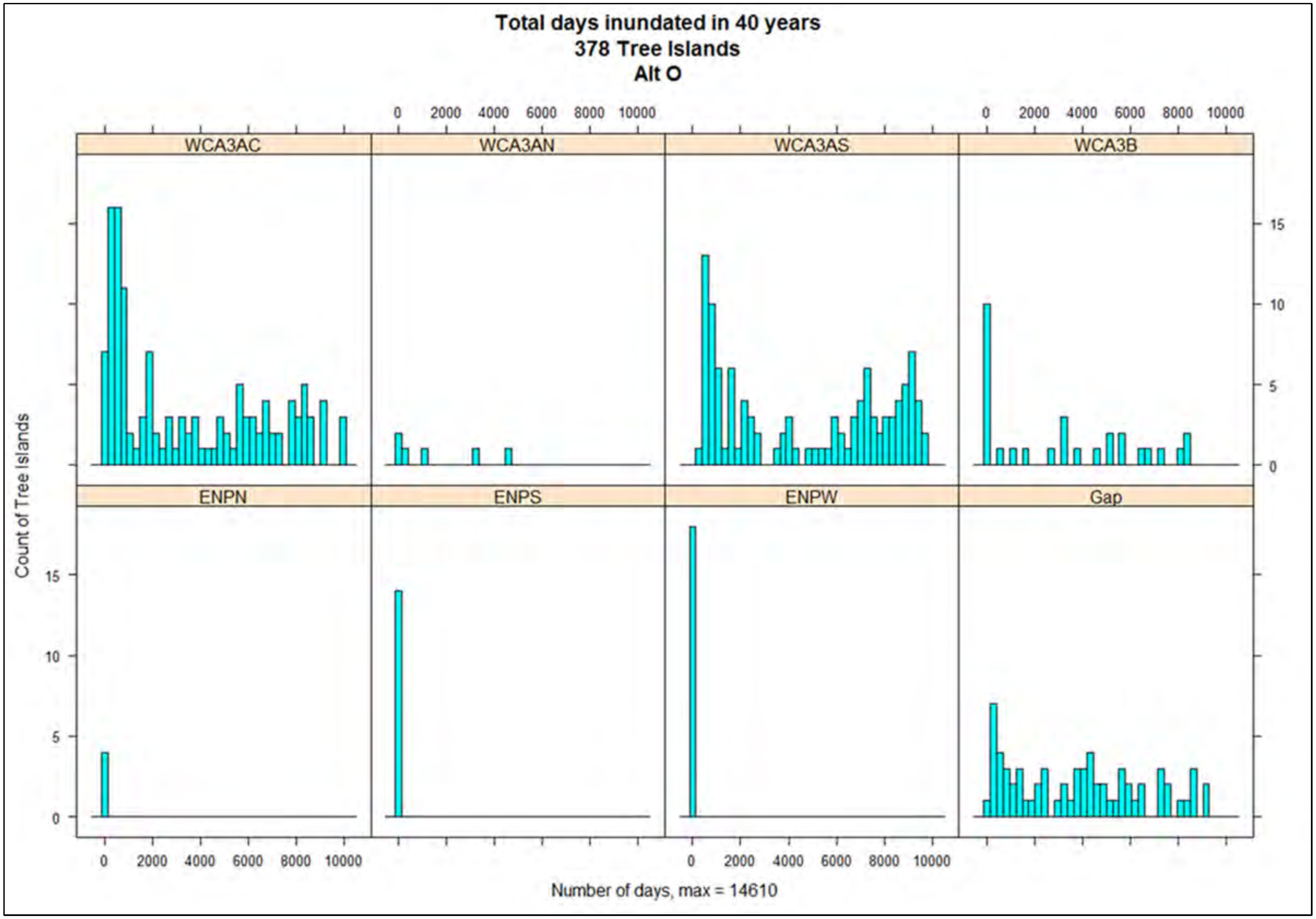


Figure E.1-45. Histogram of mapped tree islands across the regions of interest in WCA 3A, WCA 3B, and ENP. These are counts of inundation over a 41 year period of simulating the operations of ALTO.

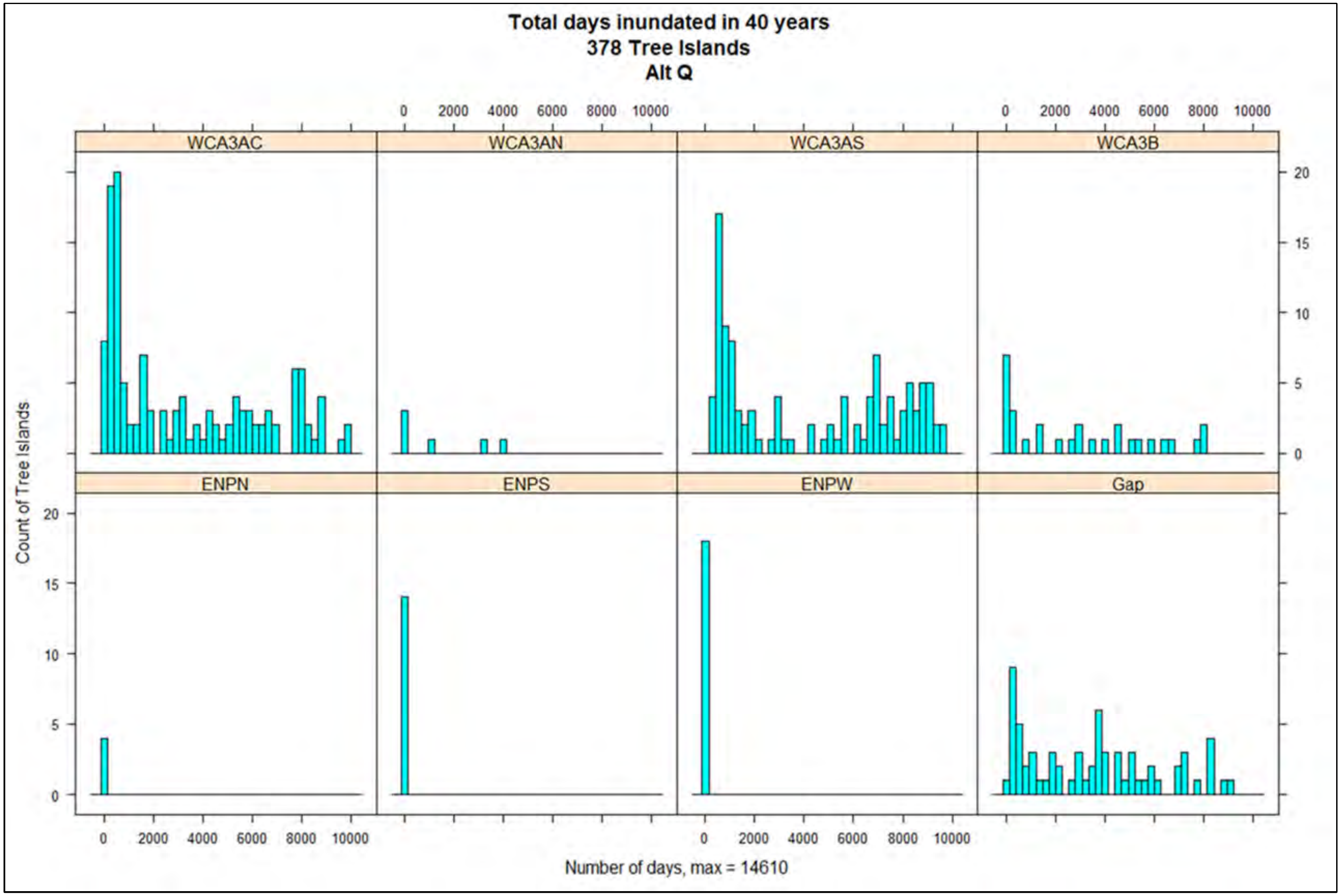


Figure E.1-46. Histogram of mapped tree islands across the regions of interest in WCA 3A, WCA 3B, and ENP. These are counts of inundation over a 41 year period of simulating the operations of ALTQ.

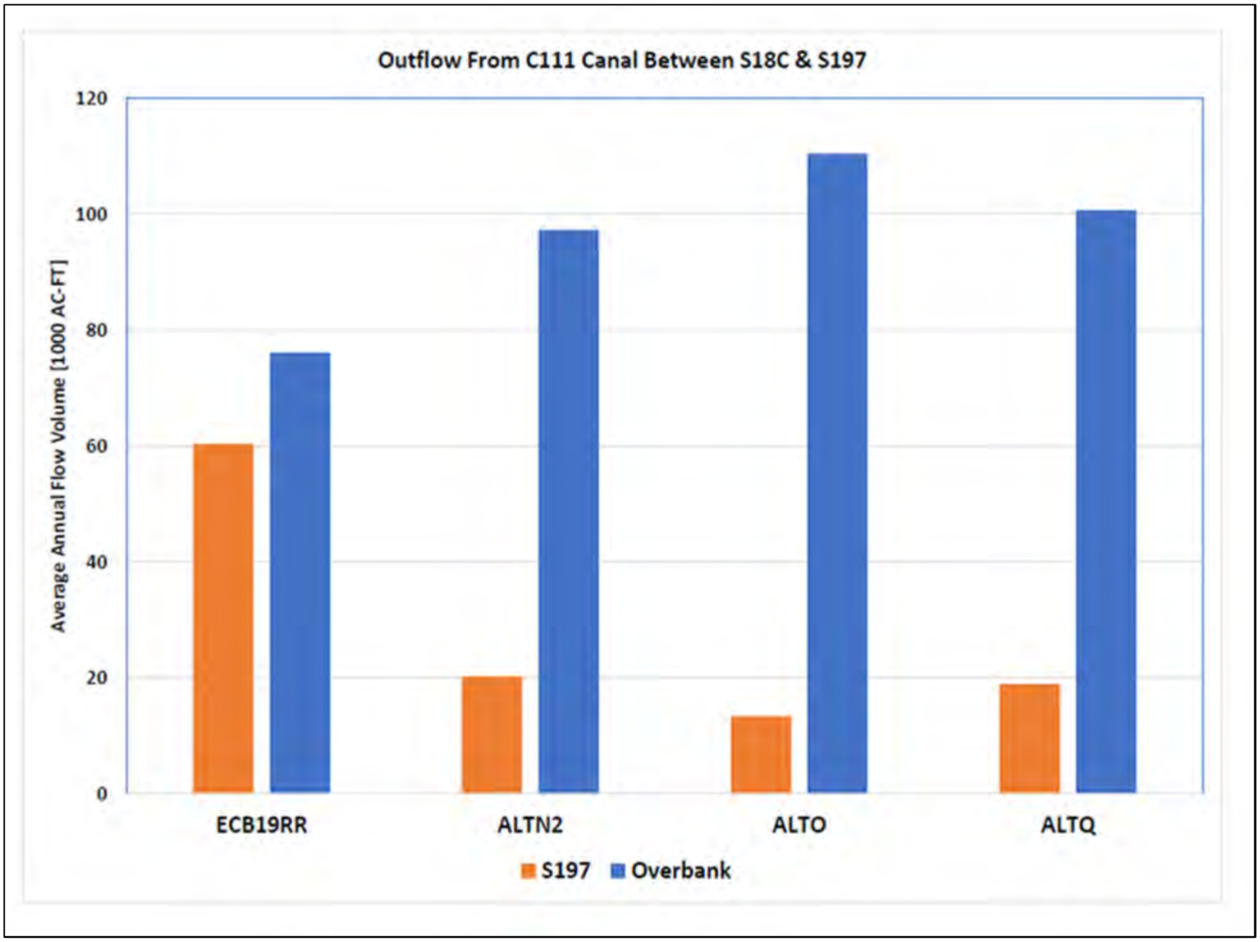


Figure E.1-47. Outflow from C-111 canal between S-18c and S-197 over the period of record (1965-2005) for Round 2 evaluation.

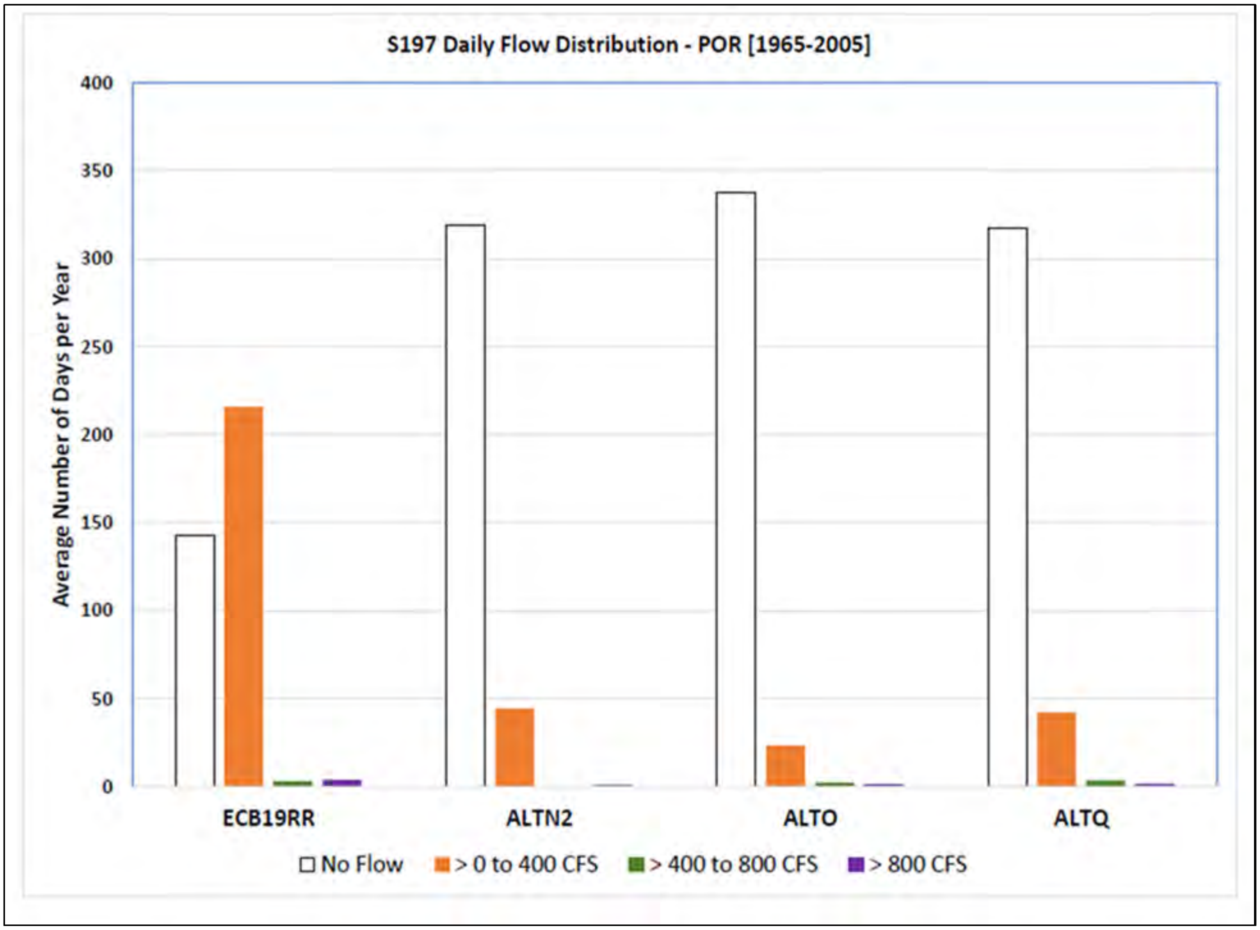


Figure E.1-48. S-197 daily flow distribution over the period of record (1965-2005) for Round 2 evaluation.

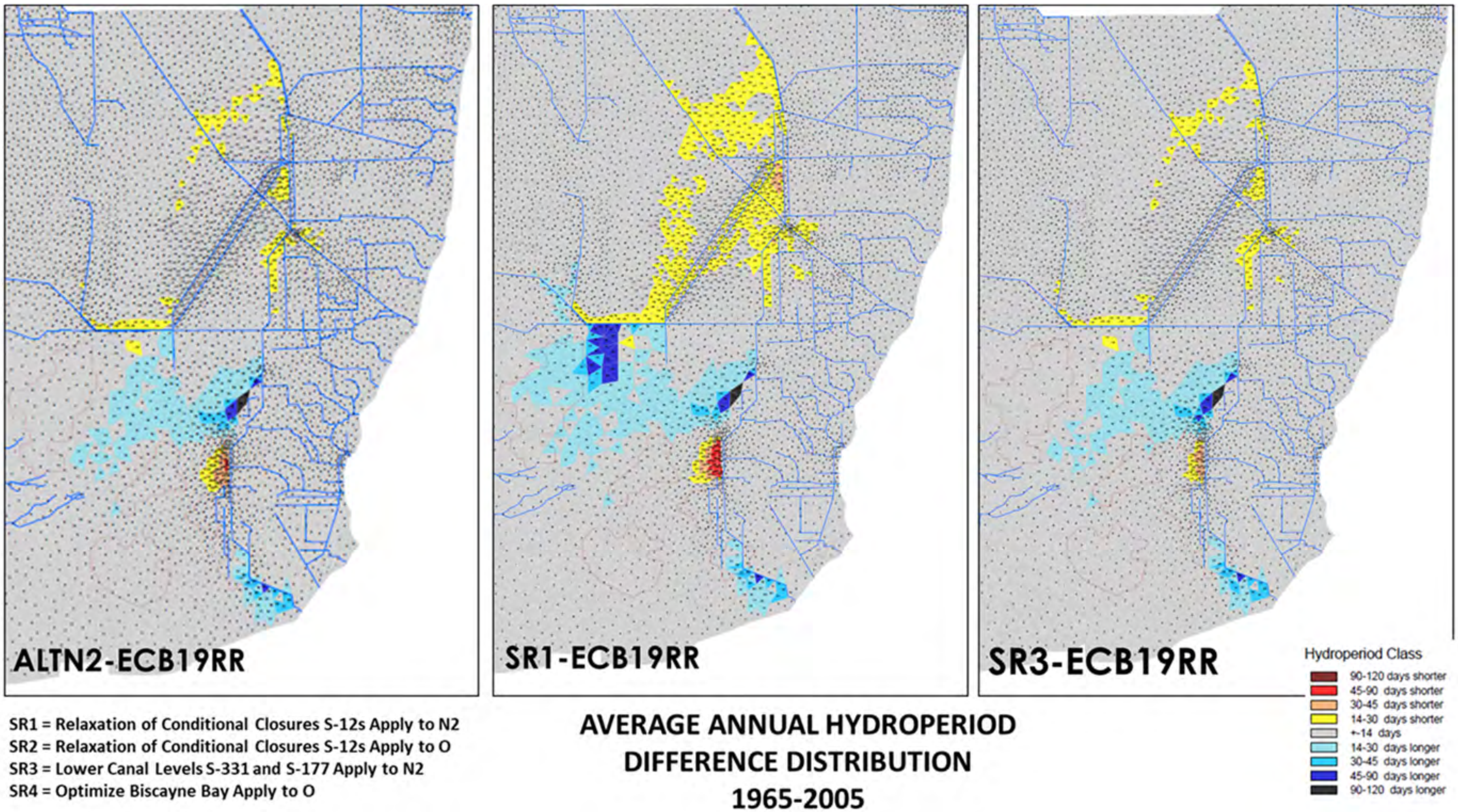


Figure E.1-49. Average annual hydroperiod difference distribution maps for the period of record (1965-2005) for ALTN2, SR1, and SR3.

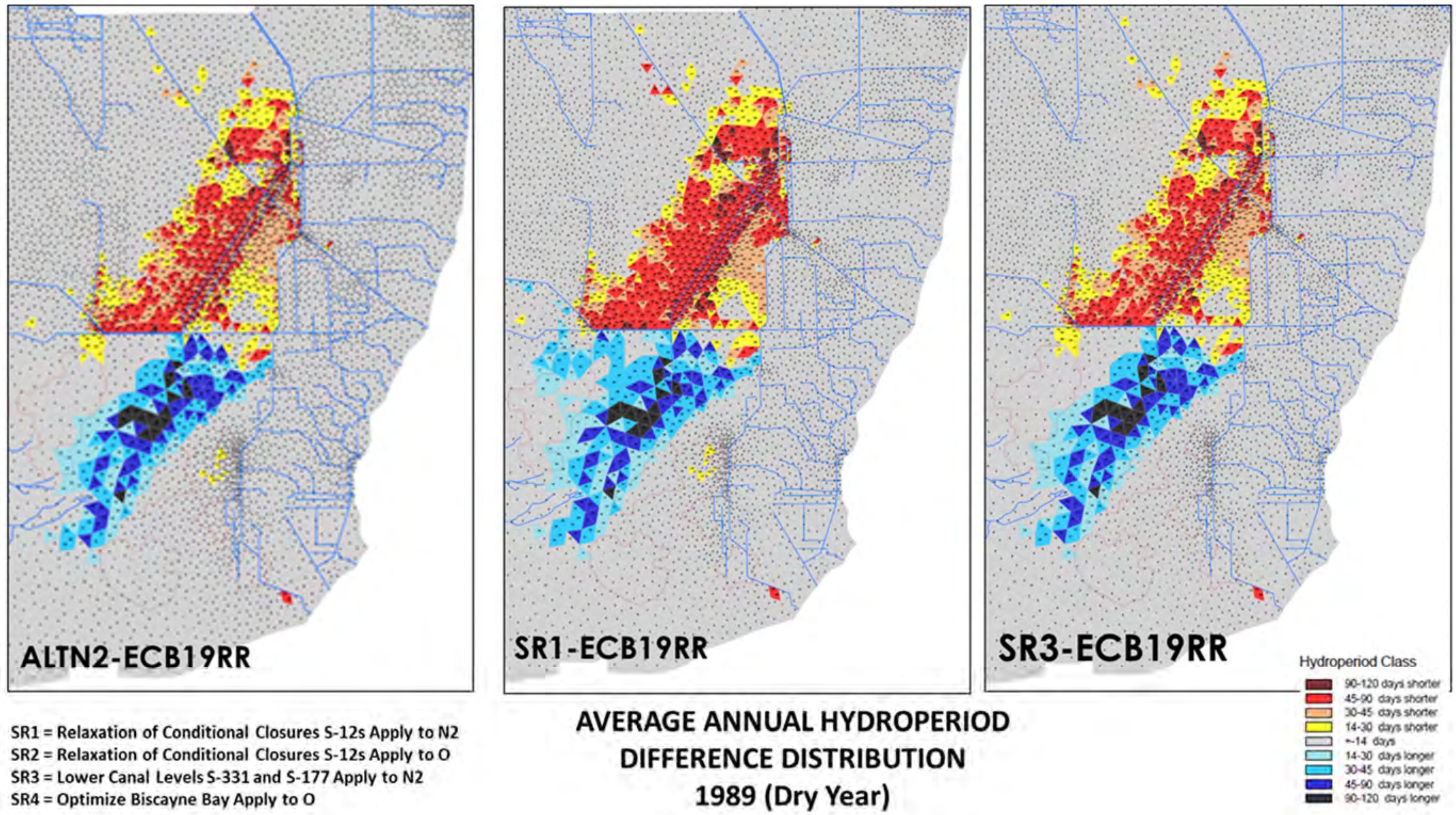


Figure E.1-50. Average annual hydroperiod difference distribution maps for a typical dry year in the period of record (1989) for ALTN2, SR1 and SR3.

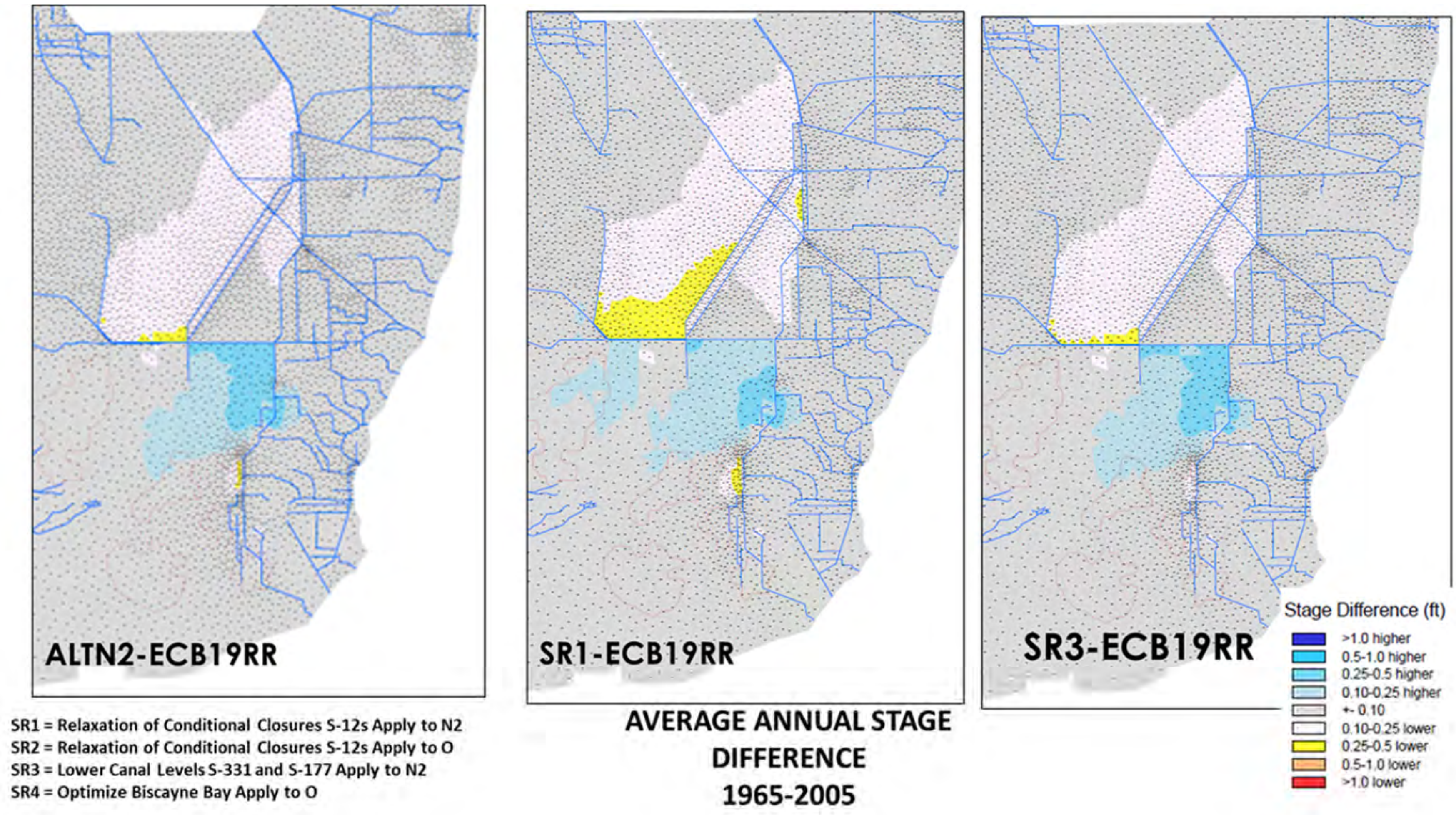


Figure E.1-51. Average annual stage difference maps for the period of record (1965-2005) for ALTN2, SR1, and SR3.

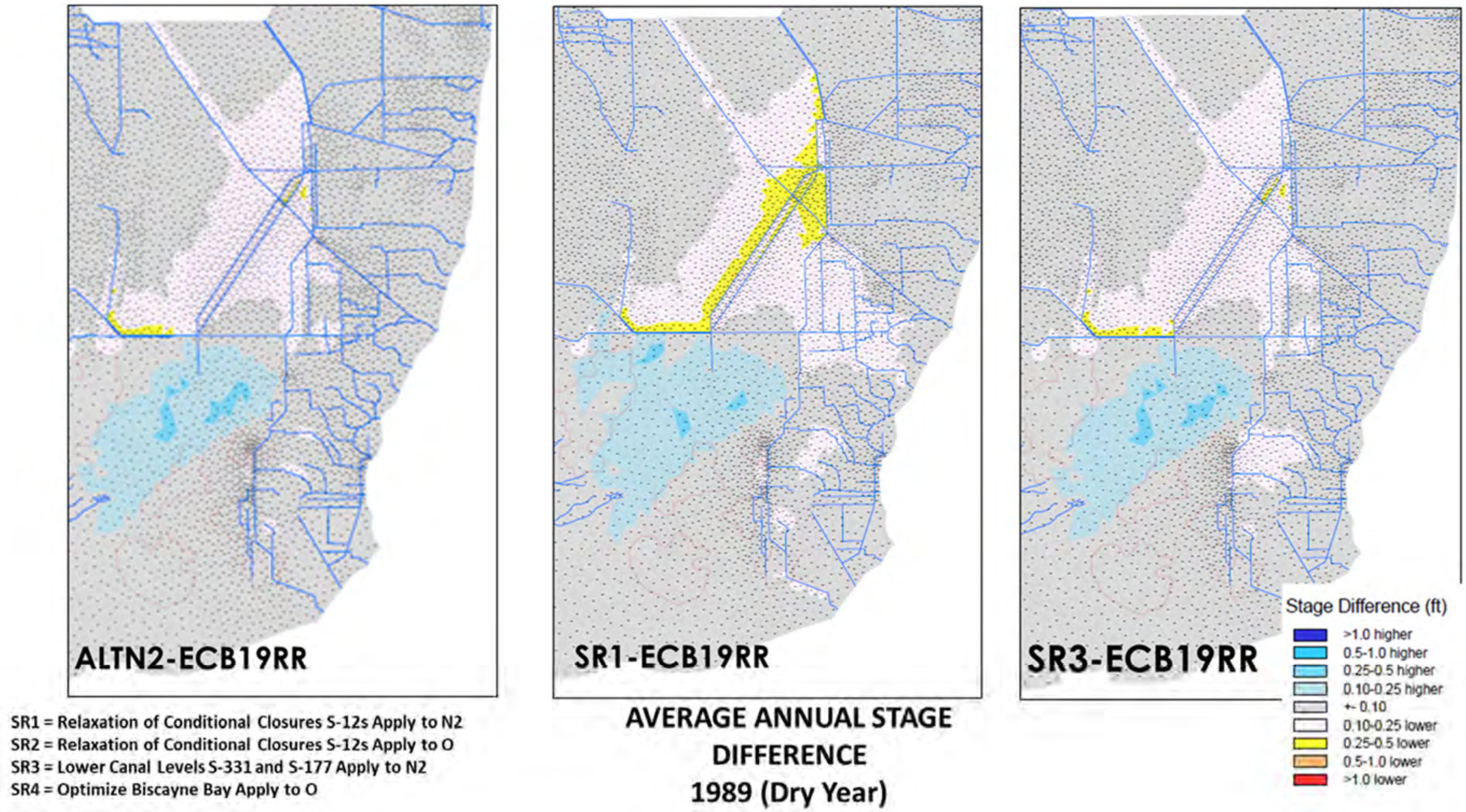


Figure E.1-52. Average annual stage difference maps for a typical dry year in the period of record (1989) for ALTN2, SR1 and SR3.

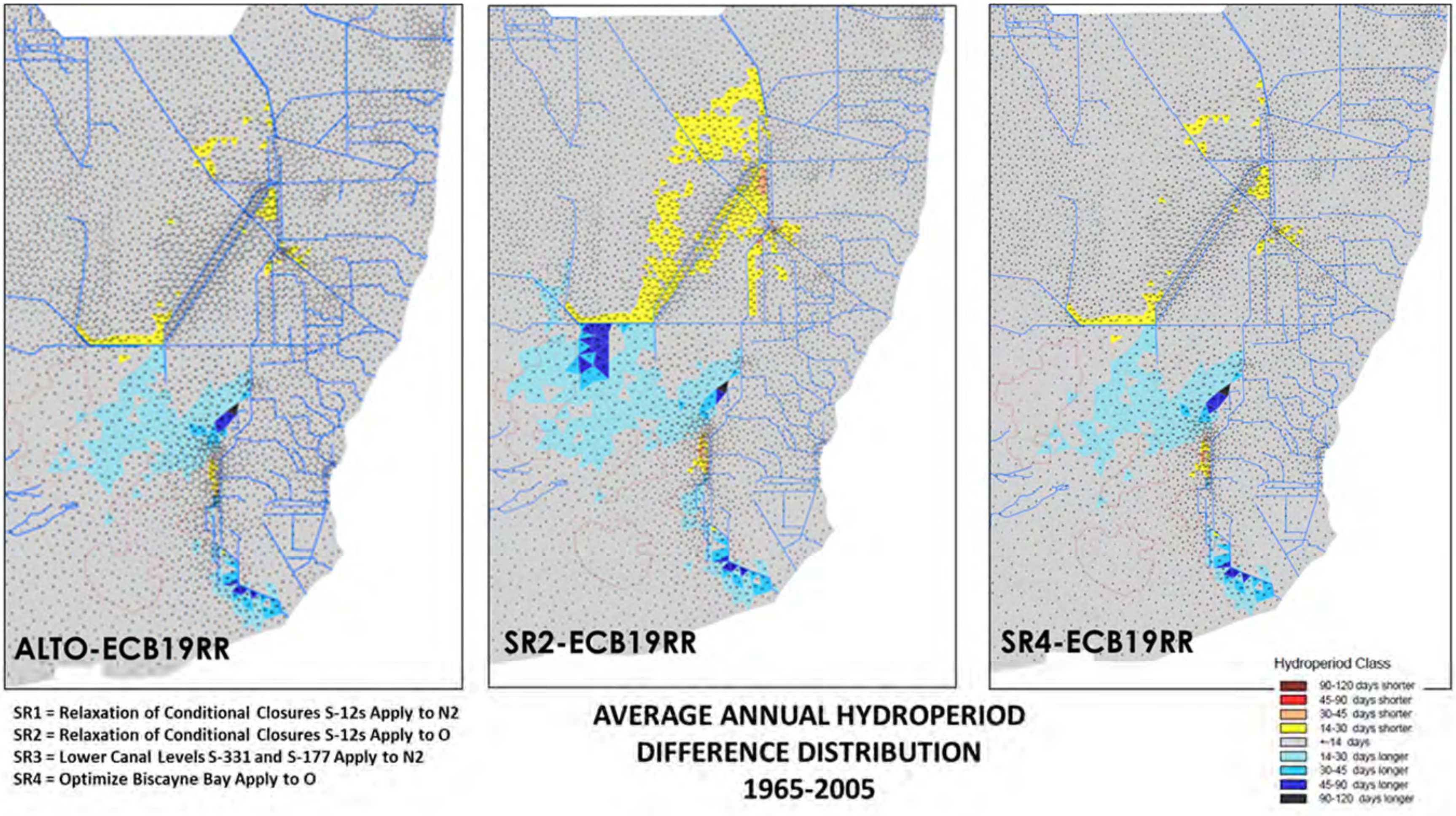


Figure E.1-53. Average annual hydroperiod difference distribution maps for the period of record (1965-2005) for ALTO, SR2, and SR4.

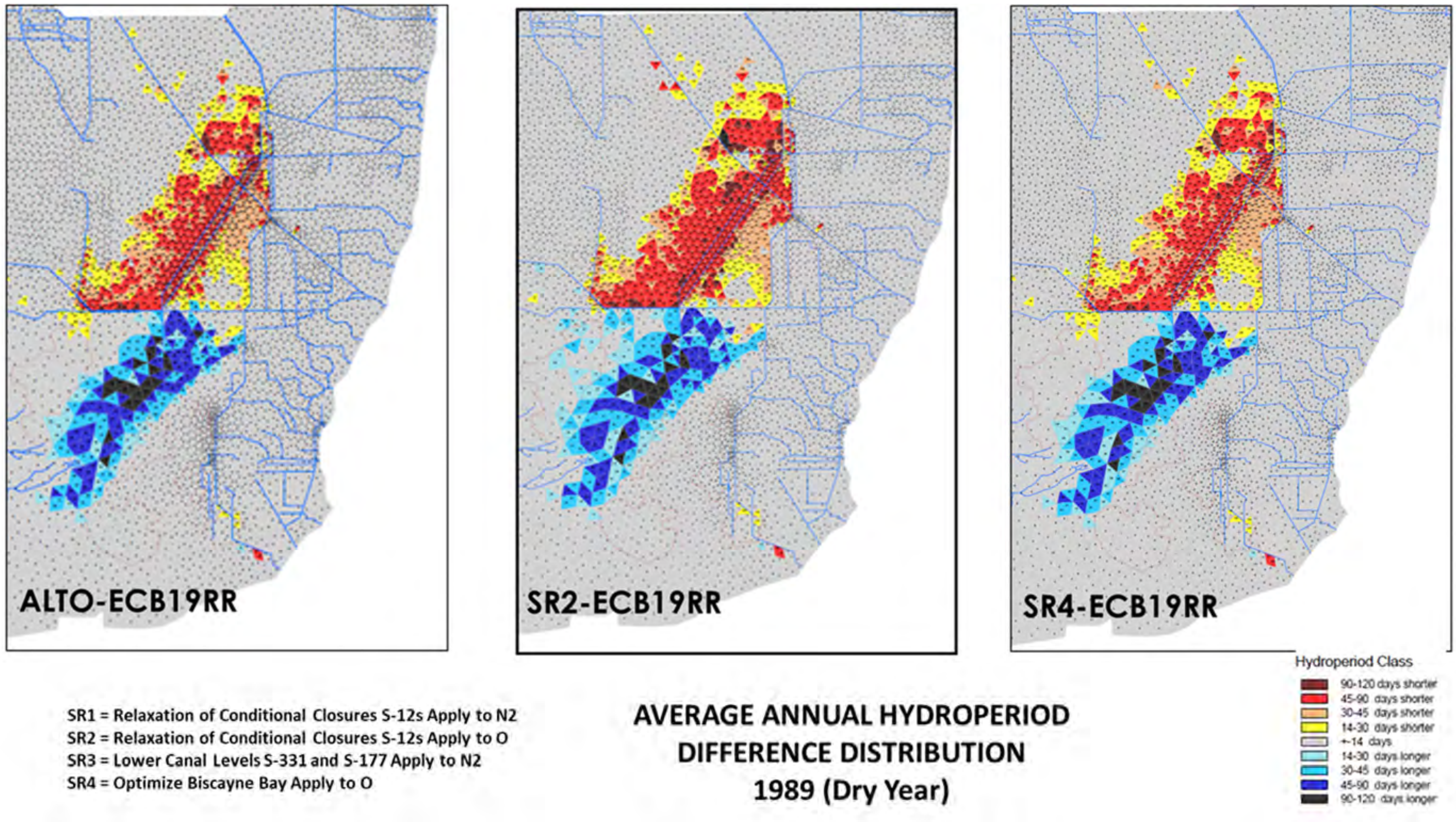


Figure E.1-54. Average annual hydroperiod difference distribution maps for a typical dry year in the period of record (1989) for ALTO, SR2 and SR4.

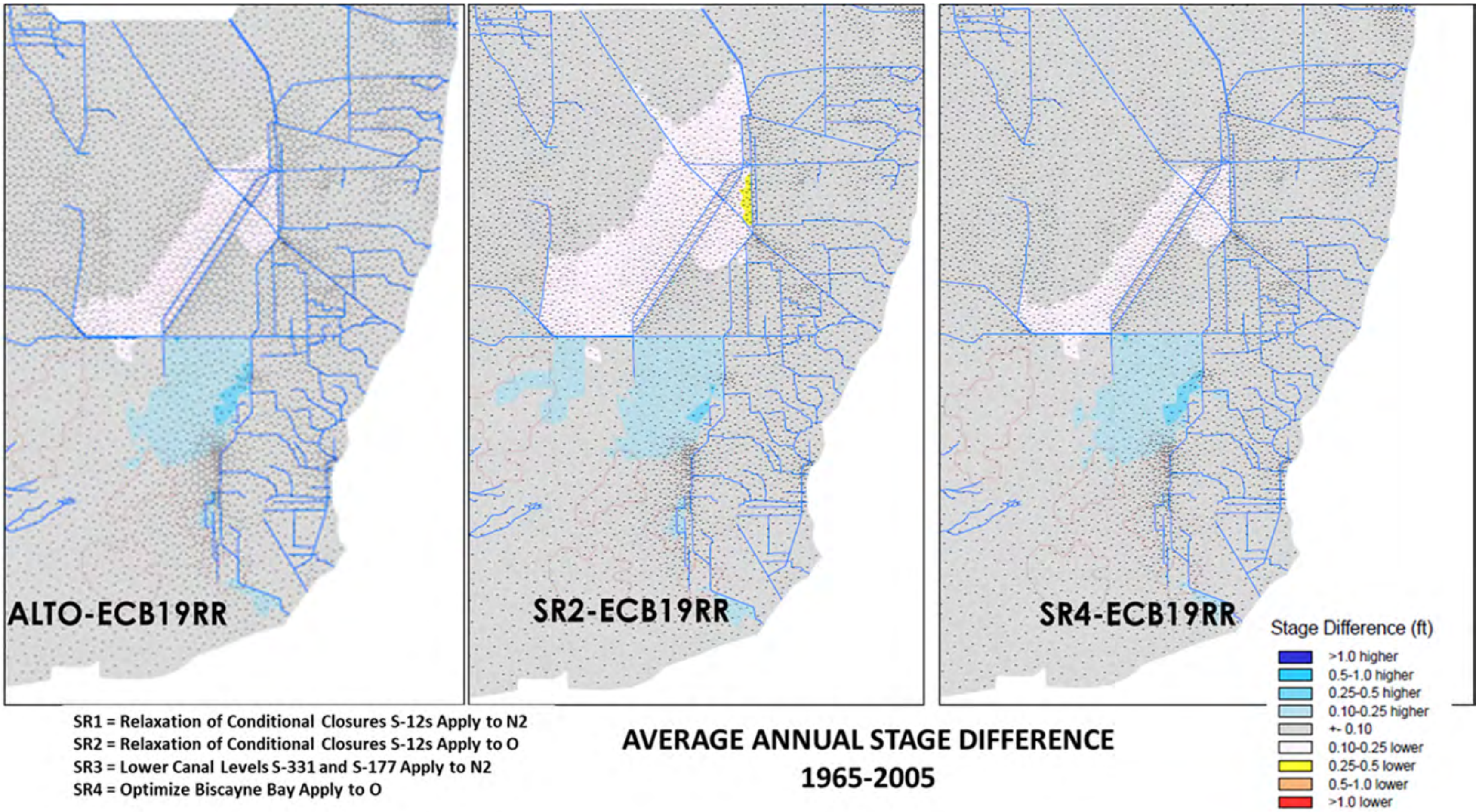


Figure E.1-55. Average annual stage difference maps for the period of record (1965-2005) for ALTO, SR2, and SR4.

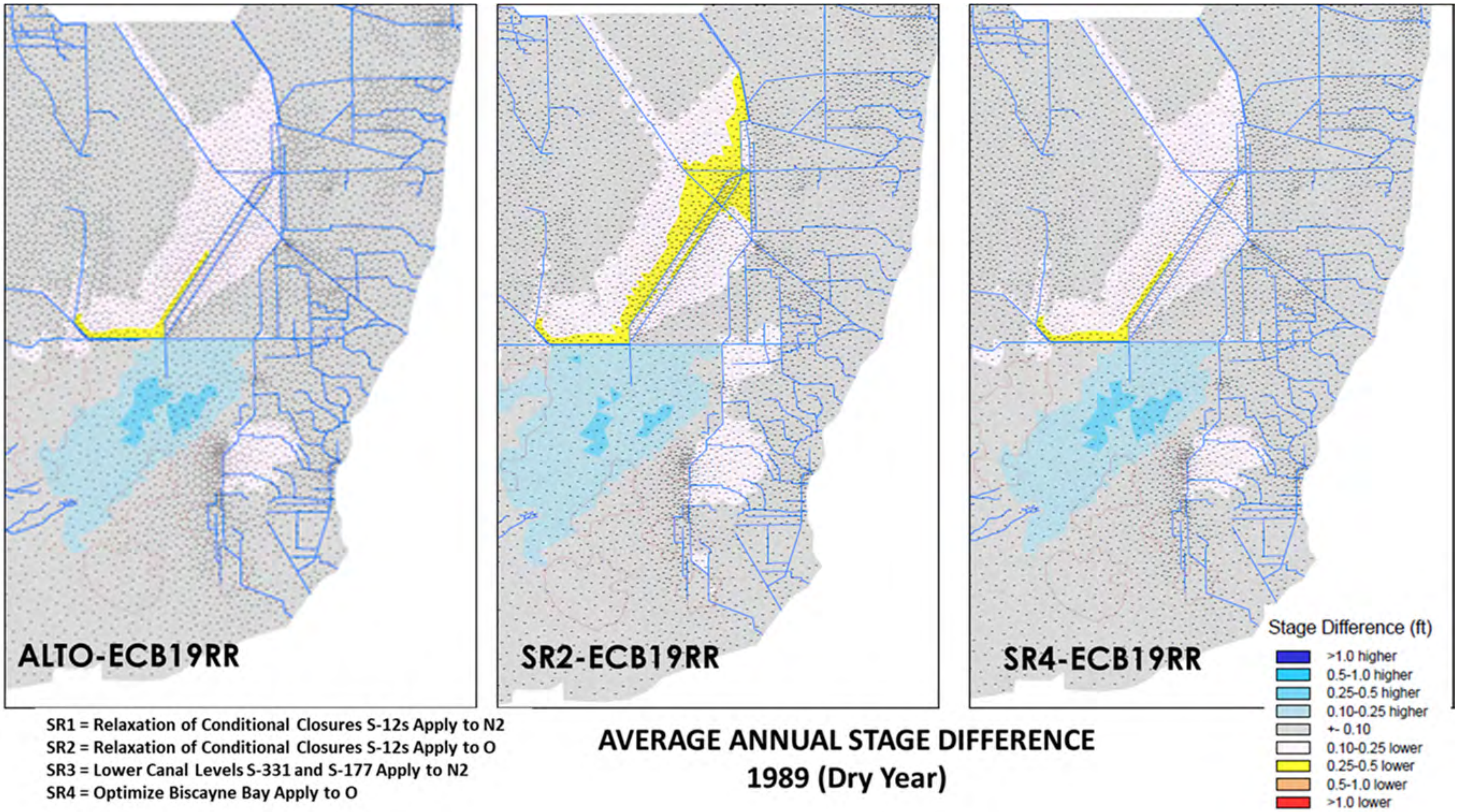
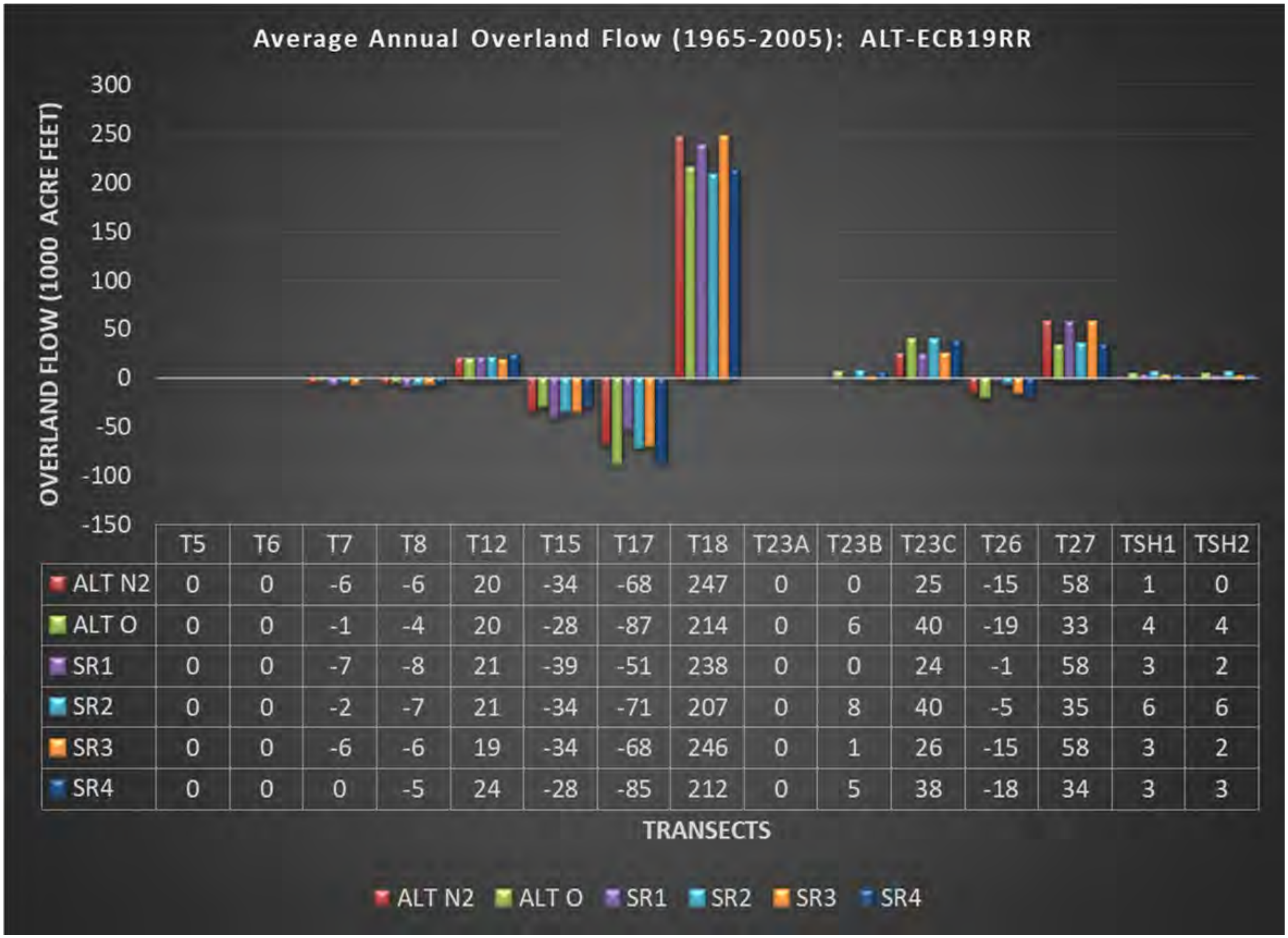


Figure E.1-56. Average annual stage difference maps for a typical dry year in the period of record (1989) for ALTO, SR2 and SR4



	T5	T6	T7	T8	T12	T15	T17	T18	T23A	T23B	T23C	T26	T27	TSH1	TSH2
ALT N2	0	0	-6	-6	20	-34	-68	247	0	0	25	-15	58	1	0
ALT O	0	0	-1	-4	20	-28	-87	214	0	6	40	-19	33	4	4
SR1	0	0	-7	-8	21	-39	-51	238	0	0	24	-1	58	3	2
SR2	0	0	-2	-7	21	-34	-71	207	0	8	40	-5	35	6	6
SR3	0	0	-6	-6	19	-34	-68	246	0	1	26	-15	58	3	2
SR4	0	0	0	-5	24	-28	-85	212	0	5	38	-18	34	3	3

Figure E.1-57. Average annual overland flow across the period of record (1965-2005) relative to ECB19RR for round 2 (ALTN2, ALTO, SR1, SR2, SR3, SR4).

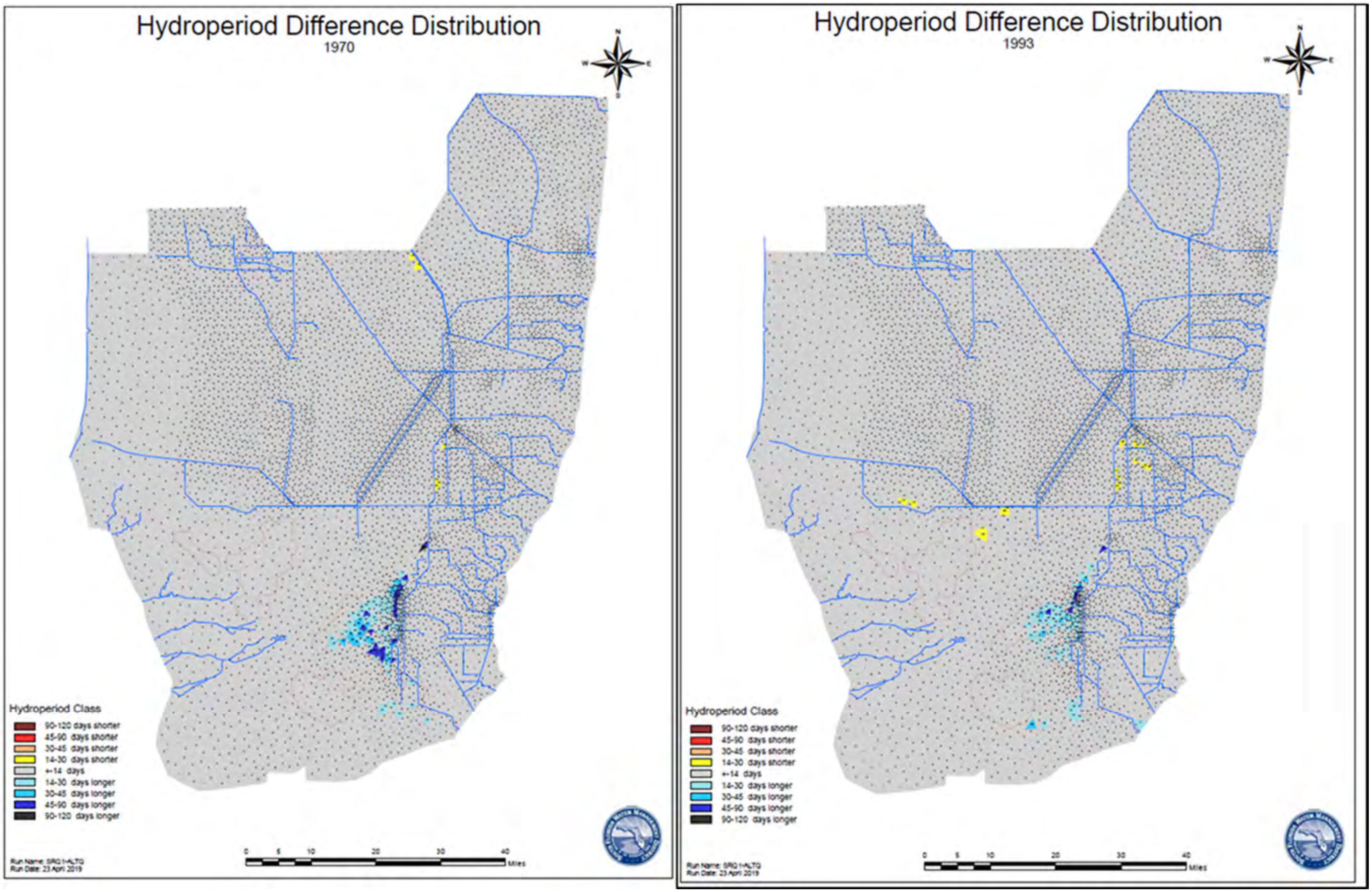


Figure E.1-58. Average annual hydroperiod difference distribution maps for the period of record (1965-2005) for SRQ1 relative to ALTQ for the year 1970 and 1993.

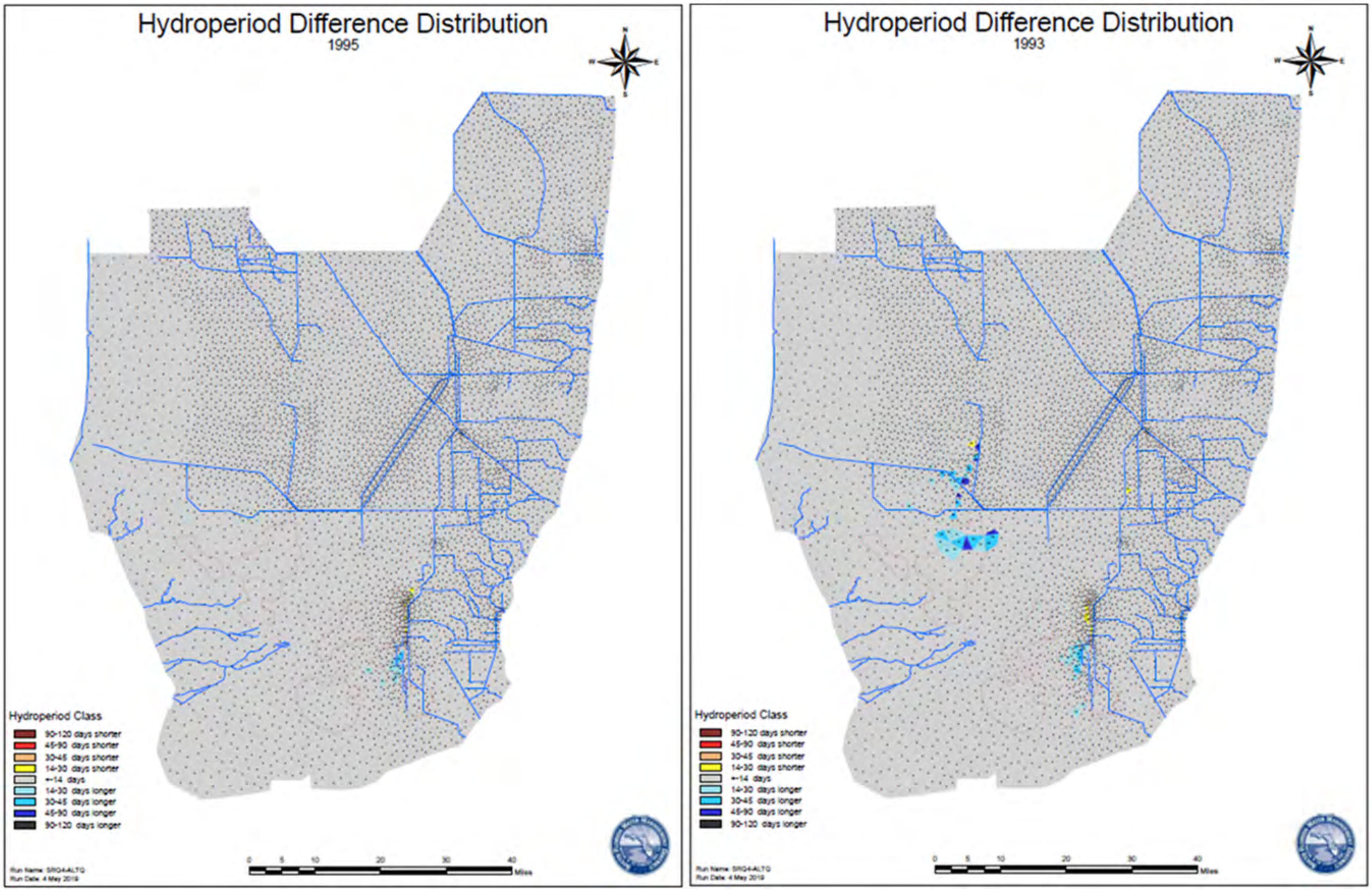
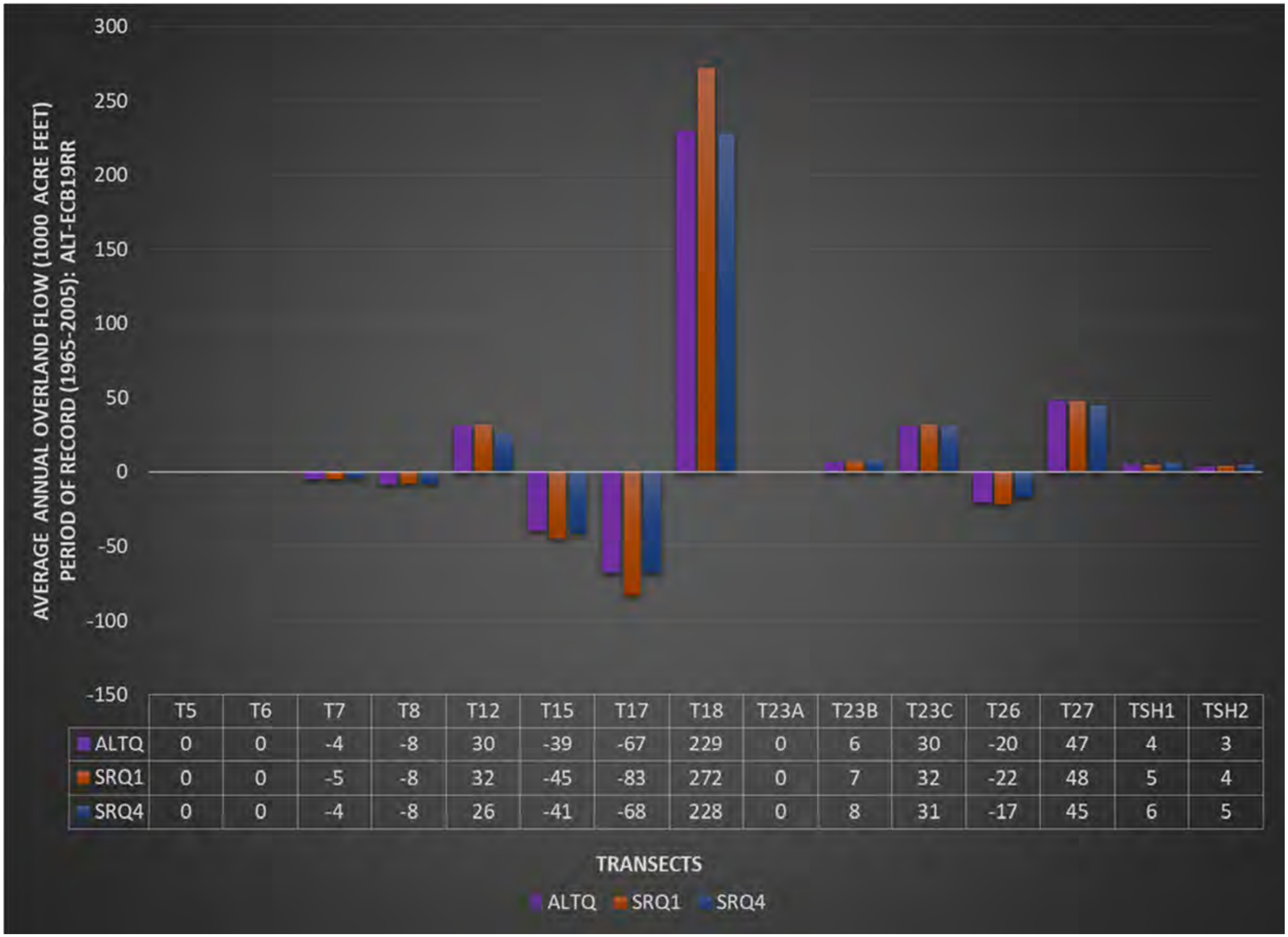


Figure E.1-59. Average annual hydroperiod difference distribution maps for the period of record (1965-2005) for SRQ4 relative to ALTQ for the year 1995 and 1993.



	T5	T6	T7	T8	T12	T15	T17	T18	T23A	T23B	T23C	T26	T27	TSH1	TSH2
ALTQ	0	0	-4	-8	30	-39	-67	229	0	6	30	-20	47	4	3
SRQ1	0	0	-5	-8	32	-45	-83	272	0	7	32	-22	48	5	4
SRQ4	0	0	-4	-8	26	-41	-68	228	0	8	31	-17	45	6	5

Figure E.1-60. Average annual overland flow across the period of record (1965-2005) relative to ECB19RR for round 3 (ALTQ, SRQ1, and SRQ4)