Additional File 1
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Primed and cued: long-term acoustic telemetry links interannual and seasonal variations in freshwater flows to the spawning migrations of Common Snook in the Florida Everglades

Movement Ecology

Fig. S1: Annual hydrographs for two monitoring stations in the Shark River from 2012 to 2019 illustrating the high degree of interannual variability in flow timing and magnitude. Solid blue lines show water levels at Bottle Creek in the upper river and dotted lines reflect water level in the adjacent freshwater marshes at station MO215 (see Fig. 2b for station locations). Vertical hashed lines indicate the beginning and end of the spawning season (April 1-Nov 15) used in statistical models, and the solid horizontal line shows the 30 cm water depth corresponding to the beginning of the wet/dry transitional period and marsh prey concentration in the river channels.
Table S1: Variables considered and selected for use in GLMMs for hypothesis 1, that interannual differences in hydrologic conditions preceding the spawning season (migratory primers) contribute to the intensity of the Common Snook migratory response at a broad temporal scale. Model variables are organized by hypothesized drivers, and bolded variables indicate those included in our global model, which were selected from collinear variables using lowest AIC.

| Hypothesized Driver               | Model Variable         | Description                                                                 |
|-----------------------------------|------------------------|----------------------------------------------------------------------------|
| Flow Dynamics                     | Maximum Water Level    | Maximum dry season water level in the upper river (cm)                      |
|                                   | Minimum Water Level    | Minimum dry season water level in the upper river (cm)                      |
|                                   | Water Level Range      | Dry season water level range in the upper river (Max - Min)                |
|                                   | Drydown Duration       | Number of days during the spring drydown preceding spawning season where marsh water level at station MO215 was < 30 cm |
| Other Hydrologic/Abiotic Conditions | Maximum Temperature    | Maximum dry season water temperature in the upper river (degrees C)        |
|                                   | Minimum Temperature    | Minimum dry season water temperature in the upper river (degrees C)        |
|                                   | Temperature Range      | Dry season water temperature range (Max - Min)                             |
|                                   | Maximum Salinity       | Maximum dry season salinity in the upper river (PSU)                       |
|                                   | Minimum Salinity       | Minimum dry season salinity in the upper river (PSU)                       |
|                                   | Salinity Range         | Dry season salinity range (Max - Min)                                      |
| Fish Size                         | Fish Size              | Total length (cm) of tagged Common Snook at the beginning of each spawning season |
**Table S2**: Variables selected for use in GLMMs for hypothesis 2, that specific cues trigger Common Snook migration timing during the spawning season. Model variables are organized by hypothesized drivers and evaluate the relative role of flow dynamics, other hydrologic/abiotic factors, seasonality, and interannual variability in migration timing.

| Hypothesized Driver         | Model Variable      | Description                                                                                           |
|-----------------------------|---------------------|-------------------------------------------------------------------------------------------------------|
| **Flow Dynamics**           | Water Level         | Mean daily water level in cm recorded at monitoring station in the upper river at Bottle Creek        |
|                             | Daily Water Level   | Daily rate of change in water level (Current day mean - previous days mean)                           |
|                             | Level Change        |                                                                                                       |
| **Other Hydrologic/Abiotic Conditions** | Temperature          | Mean daily water temperature in the upper river (degrees C)                                          |
|                             | Salinity            | Mean daily salinity in the upper river (PSU)                                                         |
| **Phenology**               | Photoperiod         | Total hours of daylight                                                                                |
|                             | Lunar Period        | Numeric variable indicating the fraction of the lunar period from the full moon on that day           |
| **Interannual Variation**   | Year                | Calendar year of spawning season                                                                       |
**Table S3**: Number of new acoustic tags deployed in the Shark River for each year of the study, the number of individual Common Snook detected during the spawning season, the number of individuals detected making a coastal migration on the acoustic array, and the annual proportion of detected fish that migrated. †Note: a portion of individuals were detected in multiple years, and summed annual detections include repeat observations for some fish.

| Year | # New Tags Deployed | # Snook Detected | # Snook Migrating | Proportion Migrating |
|------|---------------------|------------------|------------------|----------------------|
| 2012 | 44                  | 34               | 18               | 0.53                 |
| 2013 | 17                  | 32               | 8                | 0.25                 |
| 2014 | 20                  | 36               | 12               | 0.33                 |
| 2015 | 21                  | 38               | 20               | 0.53                 |
| 2016 | 55                  | 47               | 5                | 0.11                 |
| 2017 | 14                  | 34               | 15               | 0.44                 |
| 2018 | 21                  | 34               | 6                | 0.18                 |
| 2019 | 14                  | 42               | 19               | 0.45                 |
| Total| 206                 | 297†             | 103              |                      |
Table S4: Number of Common Snook migrations detected by month and year from 2012-2019. Detections reflect individuals making directed movements from the upper river/Tarpon Bay into the lower river during the spawning season (April 1 – Nov. 15). Numbers include individuals that were detected migrating on multiple days, or those making repeat migrations within a spawning season. The proportion of total detected migrations for all years of the study are summarized by month.

| Year | April | May | June | July | Aug | Sept | Oct | Nov |
|------|-------|-----|------|------|-----|------|-----|-----|
| 2012 | 5     | 5   | 4    | 0    | 7   | 1    | 3   | 3   |
| 2013 | 1     | 2   | 4    | 0    | 0   | 1    | 1   | 2   |
| 2014 | 2     | 3   | 5    | 3    | 4   | 3    | 2   | 3   |
| 2015 | 15    | 2   | 3    | 3    | 1   | 1    | 3   | 0   |
| 2016 | 0     | 2   | 3    | 1    | 0   | 0    | 0   | 0   |
| 2017 | 0     | 3   | 4    | 0    | 0   | 12   | 1   | 1   |
| 2018 | 0     | 3   | 2    | 1    | 1   | 0    | 1   | 0   |
| 2019 | 5     | 5   | 9    | 5    | 3   | 2    | 3   | 2   |
| Proportion | 0.17 | 0.16 | 0.21 | 0.08 | 0.1 | 0.12 | 0.09 | 0.07 |