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A PROPOSAL TO MONITOR ANURAN ABUNDANCES
ON
CUMBERLAND ISLAND, GEORGIA

To: National Park Service
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INTRODUCTION

Since anurans have moist, relatively permeable skins, they are always in intimate contact with their chemical environment and are sensitive to many environmental changes. Worldwide, amphibians have gained notoriety as key indicators of environmental degradation (Heyer et al, 1994); consequently, it is important to monitor these animals in a biological reserve lacking direct environmental insults that are so common in many locations. Long-term changes in frog abundances or distributions on Cumberland Island could signal local or regional environmental problems.

We propose to initiate and maintain an anuran monitoring program to provide indices of normal variability which will allow assessment of changes in relative abundances and distributions of a series of island frogs. While absolute abundances would be a preferable measurement, different behaviors and environmental variability make such assessments unlikely, so that indices are of greater value in tracking amphibian success. The problems of such monitoring have been recently addressed in the amphibian monitoring handbook edited by Heyer et al. (op cit.). The great variation in island weather patterns and thus annual reproductive success, requires long-term measurements for reliable indices, and this proposal includes several sampling techniques to provide the indices.

The protocols and techniques addressed herein are designed to be executed by specialists in

amphibian biology and are based on our experience of amphibian monitoring elsewhere and from examining the vertebrate fauna of the island. Choices of sampling areas are based on known faunas and likelihood of convenient sampling. While some island sites might provide more data for certain species, the remoteness or difficulty in reaching those sites increase the likelihood that they will not be monitored regularly in the future. For example, vehicle access to South Point ponds is sometimes impeded by spring or storm tides inundating the road. Some sampling techniques, while productive, may not be appropriate in a National Park or Wilderness Area. Transect sampling for aquatic species along roads running east-west across the island is not particularly useful because the animals are mainly limited to one habitat; hence, our emphasis is on site specific sampling. Halliday (in Sutherland, 1996) discussed this issue in detail.

Some amphibian species are extremely abundant and found in most freshwater habitats of the island. Because of their abilities to occupy so many habitats, they are relatively insensitive to all but the most destructive ecological insults. They do not provide a basis for assessing subtle ecological changes, and their disappearance from a given habitat is unlikely; consequently, simple checks on occurrence would provide adequate information to assess gross ecological change. Other species have more restricted distributions and habitat requirements, and would provide a more fine-scaled measure of ecological change, at least for the specific habitat involved. Such species, especially if common in the restricted habitat, are important to monitor both for abundance and reproductive success. It is important to combine call censuses and larval sampling to adequately survey island anurans.

Based on our recorded observations of the past 24 years on Cumberland Island, the month of June provides for assessment of occurrence and reproductive success of the greatest number of frog species either through breeding call surveys or larval sampling. Some winter-breeding species such as

Pseudacris crucifer and Pseudacris ocularis may be missed, as may the explosive breeder Scaphiopus holbrookii which is dependent on torrential rains. Those species can be assessed on an ad hoc basis during other excursions around the island or a call survey in winter. Timing or need of additional surveys will be better determined after two years of specific observations.

FROG SPECIES ON CUMBERLAND ISLAND

Of the species occurring on Cumberland Island (Table 1), most are widespread in island distribution except Hyla gratiosa and Rana grylio. Gastrophryne carolinensis has a spotty distribution, while Scaphiopus holbrookii is an explosive breeder in specialized island sites during and following torrential rains. Acris gryllus and Rana utricularia (= sphenocephala) are ubiquitous, while Pseudacris crucifer is most common from Stafford northward. The remainder of the species are relatively common, especially north of Stafford.

Except for Bufo terrestris and Rana grylio, breeding sites for the frogs are limited to relatively fish-free waters, or waters with only mosquito fish (Gambusia holbrooki), especially temporary ponds and seeps. Consequently, monitoring may be limited to temporary ponds with presently known anuran faunas, with ad hoc visits to permanent water sites. Occasionally, mixed species choruses of breeders are encountered, but usually there is some temporal separation of maximum reproductive activity. Following breeding, treefrogs return to terrestrial sites as do toads, narrow-mouthed frogs, and spadefoots. Cricket frogs and ranid frogs tend to remain in or near aquatic sites. Aquatic sites are fewer on the southern portion of the island.

MONITORING LOCATIONS

Since the greatest variety and maximum abundances of anurans are on the northern half of the island, we propose to center monitoring studies in that area, with additional call and dip net surveys along road transects proposed by NPS on South Fraser (South Cut), Davisville, and South Point roads in suitable sites when accessible. While surveys will be needed to confirm standard locations, we anticipate aquatic larval sampling in Willow Hole, Ponds 1, 2, and 3, Borrow Pit A, Bunkley Pond, Brickhill Pond, and Sweetwater Sloughs (see map for locations). Standard call surveys will cover the same sites. Terrestrial sites will be sampled for tree frogs and will include oak scrub, oak-pine scrub, pine flatwoods, and live oak hammock along the North Cut (N. Fraser) and Old Dungeness (Bunkley Trail) roads. Island-wide call surveys on proposed NPS survey transects should provide the bases for increasing or changing the scope of the proposed monitoring.

PROTOCOLS

1. Purpose. To establish baseline data on anuran abundance and reproductive success at selected sites for long-term assessment of status.
2. Schedule. Most sampling will take place in June of each year. Call surveys during or following heavy rains may be accomplished at any time of the year, but at least once in winter and in early spring.
3. Personnel. Sampling, identifications, and call surveys are to be made by C. R. Shoop and C. Ruckdeschel with the occasional assistance of Cumberland Island Museum interns.

4. Equipment. Dip nets; 3 mm mesh, 1 x 3 m seines; .5 x .5 x .2 m amphibian traps; and .036 x .5 m PVC pipe refuges; notebooks; flashlights and batteries; containers for specimen transport for identification; map.

5. Procedures. Aquatic surveys will involve 10, 1 m dips and 3, 10 m seine hauls per site. Seining may not be possible at all sites in all years. Amphibian live-traps will be set for two nights at each call site location with counts and species recorded. All larvae will be tabulated by species and returned to the water. If necessary, larvae will be identified in the laboratory and returned to the collection site.

Night call surveys will be made along North Cut Road (N. Fraser) at the established monitoring locations and along Duckhouse Road at Sweetwater Sloughs at the westernmost dune. Additional call surveys may be established at aquatic sites on proposed NPS transects if larval sampling shows any breeding activity. Based on 5 minute listening samples, counts or estimates of chorus sizes will be recorded. Regardless of precipitation, a night call survey will be made at established locations once each week in June.

Treefrog use of PVC pipe refuges on trees (out of visitor sight) will be monitored for a two-week period each June. The pipes are hung on trees 1.2 m above the ground. Four lines of 10 refuges each will be established in scrub, pine flatwoods and oak hammock near breeding sites. Selection of the sites has not yet been made. Counts and species composition will be recorded.

DATA MANAGEMENT

1. Software. Lotus spreadsheet software will be adequate to record the data.
2. Data entry. Data entry will follow sampling and tabulation within 5 days.
3. Data analysis. Analyses will include total counts, relative abundance indices and distribution maps.
4. Reporting. Reports of results will be delivered by 31 December each year.
5. Field data forms. Special forms have not been developed. We anticipate simple counts by species, hence form style is not a critical factor for this study. Our standard field note form is attached as Appendix A. We could use the USFWS amphibian survey form (Appendix B) if requested.
6. Report format. Counts and species composition at each locality presented in table form with comparisons to previous year(s) data will be provided in duplicate in addition to ad hoc observations. Preparation of a set of reference materials for identification of larvae is an ongoing project and will be included as developed.
7. Product delivery date. 31 December each year.

LITERATURE CITED

- Heyer, W. R., M. A. Donnelly, R. W. McDiarmid, L.C. Hayek, and M. S. Foster [eds]. 1994. Measuring and monitoring biological diversity. Standard methods for amphibians. Smithsonian Institution Press, Washington, DC.
- Sutherland, W. J. [ed]. 1996. Ecological census techniques: a handbook. Cambridge University Press, Cambridge.

Table 1. Frog species present on Cumberland Island, Georgia.

Gastrophryne carolinensis (eastern narrow-mouthed frog)

Scaphiopus holbrookii (eastern spadefoot)

Acris gryllus (southern cricket frog)

Pseudacris ocularis (little grass frog)

Pseudacris crucifer (spring peeper)

Hyla cinerea (green tree frog)

Hyla femoralis (pine woods treefrog)

Hyla gratiosa (barking treefrog)

Hyla squirella (squirrel treefrog)

Bufo terrestris (southern toad)

Rana utricularia (= *sphenocephala*) (southern leopard frog)

Rana grylio (pig frog)

YEARLY BUDGET

PERSONNEL:

Activity	Person Days	Cost (\$)
4 call surveys	4	1600
4 larval surveys	4	1600
trap surveys	4	1600
refuge construction	1	400
lab identifications	1	400
report preparation	2	800
other call surveys	1	400
Subtotal	17	7000

SUPPLIES:

PVC pipe and caps	100
netting, traps	100
fuel	50
transportation maintenance	250
Subtotal	500

TOTAL DIRECT COSTS	7500
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COST SHARING:

Cumberland Island Museum	7500
National Park Service	0

Survey _____

Coll. No. _____ Date _____

State _____ County _____

Locality _____

Elevation _____ Drainage _____

Weather _____ Air temp. _____ H₂O temp. _____ Time _____

Previous Weather _____

Water: Color _____ Flow _____ Width _____

Depth _____ Bottom _____ Shore _____

General Region _____

_____ Cover _____

Vegetation: _____

Capture method _____ Orig. pres. _____

Collected by: _____

_____ Time span _____

General notes:

DATE		BEGIN TIME		END TIME		OBSERVERS	
LOCALITY							
STATE		COUNTY		MAP NAME		OWNER	
						ELEVATION (circle scale) M FT	
T	R	S	SECTION DESCRIPTION		UTM ZONE	NORTHING (or LAT)	EASTING (or LONG)
AMPHIBIAN AND/OR GARTER SNAKE SPECIES PRESENT (INDICATE NUMBERS IN CATEGORIES IF POSSIBLE)				CIRCLE METHOD AND INDICATE IF VOUCHER SPECIMEN WAS COLLECTED:			
SPECIES		ADULTS/JUVENILES		CALLING?	TADPOLES/LARVAE	EGG MASSES	METHOD:
				Y N			VISUAL/AURAL ID DIP NET/SEINE HAND COLLECTED TRAPPED VOUCHER COLLECTED? YES NO
				Y N			VISUAL/AURAL ID DIP NET/SEINE HAND COLLECTED TRAPPED VOUCHER COLLECTED? YES NO
				Y N			VISUAL/AURAL ID DIP NET/SEINE HAND COLLECTED TRAPPED VOUCHER COLLECTED? YES NO
				Y N			VISUAL/AURAL ID DIP NET/SEINE HAND COLLECTED TRAPPED VOUCHER COLLECTED? YES NO
				Y N			VISUAL/AURAL ID DIP NET/SEINE HAND COLLECTED TRAPPED VOUCHER COLLECTED? YES NO
FISH PRESENT? YES ??? NO				FISH SPECIES:			
ENTIRE SITE SEARCHED? YES NO				IF NO, INDICATE AREA		METERS OF SHORELINE M' OF HABITAT	
PHYSICAL AND CHEMICAL ENVIRONMENT (CHEMISTRY VARIABLES OPTIONAL - USE EXTRA SPACES FOR ADDITIONAL MEASUREMENTS)							
WEATHER:		CLEAR	OVERCAST	RAIN	SNOW	WIND:	CALM LIGHT STRONG
AIR TEMP (circle scale)	*C *F	WATER TEMP (circle scale)		*C *F	COLOR:	CLEAR STAINED	TURBIDITY: CLEAR CLOUDY
pH		ANC					
SITE DESCRIPTIONS - (SKETCH SITE AND PUT ADDITIONAL COMMENTS ON BACK OF SHEET) OMIT THIS SECTION IF DATA HAVE BEEN COLLECTED ON A PREVIOUS VISIT							
ORIGIN:		NATURAL	MAN-MADE	DRAINAGE:		PERMANENT OCCASIONAL NONE	
DESCRIPTION:		PERMANENT LAKE/POND	TEMPORARY LAKE/POND	MARSH/BOG	STREAM	SPRING/SEEP	ACTIVE BEAVER POND INACTIVE BEAVER POND
SITE LENGTH (M)		SITE WIDTH (M)		MAXIMUM DEPTH:		< 1 M 1 - 2 M > 2 M	
STREAM ORDER		1		2		3 4 5 +	
PRIMARY SUBSTRATE:		SILT/MUD		SAND/GRAVEL	COBBLE	BOULDER/BEDROCK	OTHER
% OF POND LAKE MARGIN WITH EMERGENT VEGETATION:				0		1 - 25 25 - 50 > 50	
EMERGENT VEGETATION SPECIES (LIST IN ORDER OF ABUNDANCE)							
NORTH SHORELINE CHARACTERS:				SHALLOWS PRESENT		SHALLOWS ABSENT	EMERGENT VEG PRESENT EMERGENT VEG ABSENT
DISTANCE (M) TO FOREST EDGE				FOREST TREE SPECIES:			