The Southwestern Association of Naturalists extends a cordial invitation to all those interested in participating in the SWAN 67th Annual Meeting, held 23-26 April 2020, in Huntsville, Texas, USA. The Department of Biological Sciences and Office of Research and Sponsored Programs is hosting the meeting, which will take place at the Lowman Student Center on the Sam Houston State University main campus. Join us for presentations relating to taxonomy, systematics, morphology, ecology, behavior, evolution, and physiology of plants, fungi, invertebrates, and vertebrates, with plenary speakers, poster and oral presentations, and special workshops for students. The Local Committee and the community of Sam Houston State University extends a warm welcome to all naturalists.

LOCAL COMMITTEE CO-CHAIRS
Justin K. Williams (bio_jkw@shsu.edu)
Chad W. Hargrave (cwhargrave@shsu.edu)
REGISTRATION AND PAYMENT INSTRUCTIONS

To become a member of SWAN visit this URL https://saon.wildapricot.org/join-us

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<thead>
<tr>
<th>Category</th>
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<th>Late payment date: after 1 March 2020</th>
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*Note: If you are not already a member, you may join SWAN at https://saon.wildapricot.org/join-us and use the discount code SWAN20 to apply $35 USD of your meeting registration to a SWAN Regular Membership for 2020. If you are a student, you can use the discount code SWANSTUDENT20 to apply $15 USD of your meeting registration to a SWAN Student Membership for 2020.

Optional costs
- Banquet: $45.00 USD
- Picnic: $25.00 USD
- T-shirt: $15.00 USD

ON-LINE REGISTRATION:
An on-line registration form in English and Spanish is available at: Registration Form

Payment by Credit/Debit Card (Visa, MasterCard, Discover only): Once you have entered the registration site, you will be able to pay on-line using the secure on-line forms.
HOTEL INFORMATION

Huntsville has several lodging options. For this event we have established agreements with several hotels. The reservation must be made by 20 February 2020 to receive the SWAN discount. Mention in your reservation the keyword 2004BIO or Biology Conference to receive the discount offered to our event.

Our conference hotel is the University Hotel (http://www.shsuhotel.org; (936) 291-2151), located on the Sam Houston State University campus. Mention in your reservation the keyword '2004BIO' or 'Biology Conference' to receive the discount offered to our event.

Other lodging options

<table>
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<tr>
<th>Hotel Name</th>
<th>Approximate Price (USD) per night for a standard room</th>
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<th>Web page</th>
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<td>$100</td>
<td>1610 Bobby K Marks Drive, Huntsville, TX 77341</td>
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<td>(936) 439-5228</td>
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<td>631 I-45 South, Huntsville, TX</td>
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Hotel Quality: 2.5 Stars
* Conference hotel
INSTRUCTIONS TO SUBMIT ABSTRACTS
Deadline to submit abstracts: 1 March 2020

ON-LINE ABSTRACT SUBMISSION:
An abstract submission form is available at: Abstract Submission Form

Deadline to submit abstract and apply for Wilks Award, Student Field Natural History Award, and Clark Hubbs Student Poster Award: 1 March 2020. A complete application for the Wilks and Student Natural History Awards must also be sent to the President-Elect by 1 March 2020. For more information see Student Awards section below.

Abstract preparation: Abstracts must be in English and Spanish, in Times New Roman 12 pt with a 400-word maximum for both languages combined. The 400-word limit does not include the title, authors or institutional addresses. Authors are responsible for providing the necessary translation.

The abstract should include:
- Presentation type (oral or poster) followed by a request for consideration for award competition (Wilks, Student Field Natural History, or Hubbs), if applicable.
- The general topic that best describes your presentation (Behavior, Ecology, Evolution, Morphology, Physiology, Systematics) - Taxonomic group of study (Plants, Fungi, Invertebrates, Fishes, Amphibians, Reptiles, Birds, Mammals).
- Title in all CAPITAL LETTERS in English and Spanish with a slash between them.
- Author(s) and affiliation(s). Use full names in normal order: first name(s), then last name(s). If there are multiple authors, indicate the presenting author with an asterisk. Use superscript numbers to identify institutional affiliations.
DESCRIPTION OF LATE EMBRYONIC DEVELOPMENT OF THE BAT *LEPTONYCERIS YERBABUENAE* MARTÍNEZ Y VILLA, 1940 (CHIROPTERA: PHYLLOSTOMIDAE)/DESCRIPCIÓN DEL DESARROLLO EMBRIONARIO TARDÍO DEL MURCIÉLAGO *LEPTONYCERIS YERBABUENAE* MARTÍNEZ Y VILLA, 1940 (CHIROPTERA: PHYLLOSTOMIDAE)

Noemí Juárez-Sánchez¹*, Cornelio Sánchez-Hernández¹, María de Lourdes Romero-Almaraz², Leobardo Sánchez-Vázquez¹ y Oscar Fernández-Barrera¹.

¹Departamento de Zoología, Instituto de Biología, Universidad Nacional Autónoma de México, A. P. 70-153, Coyoacán, C. P. 04510, México. ²Escuinapa No. 92 bis. Col. Pedregal de Santo Domingo, México, D.F.

In bats’ embryonic development, at least 24 stages may be recognized; the first nine correspond to the early development of the embryo, while the remaining ones to the late development. Late embryonic development in bats has been studied in less than 15 species. The embryonic development aspects of *Leptonycteris yerbabuenae* are completely unknown, so the objective of this work was to define and describe late stages of embryonic development of *L. yerbabuenae*. We collected 18 embryos from 18 pregnant females in three roosts in the Mezcala region, in the municipality of Eduardo Neri, state of Guerrero, Mexico. The classification and description of each embryonic stage was performed by comparing the embryonic staging system for *Carollia perspicillata* embryos. We determined six stages of late embryonic development and found that the development of morphological structures in *L. yerbabuenae* generally follows the embryonic development pattern for Chiroptera.

En el desarrollo embrionario de los murciélagos se pueden reconocer al menos 24 etapas, de las cuales las primeras 9 corresponden al desarrollo temprano del embrión y las restantes al desarrollo tardío. El desarrollo embrionario tardío de los murciélagos se ha estudiado para menos de 15 especies. Para *Leptonycteris yerbabuenae* se desconoce por completo los aspectos de su desarrollo embrionario, por lo que el objetivo de este trabajo fue definir y describir las etapas de su desarrollo embrionario tardío. Se recolectaron 18 embriones de hembras preñadas de tres refugios de la región de Mezcala, en el municipio Eduardo Neri del estado de Guerrero, México. La clasificación y descripción de los embriones de cada etapa embrionaria se realizó mediante la comparación con el sistema de estadificación establecido para los embriones de *Carollia perspicillata*. En total se determinaron seis etapas del desarrollo embrionario tardío y se observó que el desarrollo de las
estructuras morfológicas de *L. yerbabuenae* corresponde en general con el patrón de desarrollo embrionario de las especies conocidas para el orden Chiroptera.

Oral - Wilks
Ecology – Mammals

**DESERT BATS AND WATER: THE IMPORTANCE OF FLIGHT MANEUVERABILITY IN A CHANGING CLIMATE/LOS MURCIÉLAGOS DEL DESIERTO Y DEL AGUA: LA IMPORTANCIA DE MANIOBRABILIDAD DE VUELO EN UN CLIMA CAMBIANTE**

Lucas K. Hall\(^1\)*, Connor T. Lambert\(^2\), Randy T. Larsen\(^1\), Robert N. Knight\(^3\), and Brock R. McMillan\(^1\)

\(^1\)Department of Plant & Wildlife Sciences, Brigham Young University, Provo, UT 84602.  
\(^2\)Department of Biology, Miami University, 700 East High Street, Oxford, OH 45056.  
\(^3\)Environmental Programs, U.S. Army Dugway Proving Ground, 5330 Valdez Circle, Dugway, UT 84022.

Global climate change will decrease the availability and sizes of water sources in arid environments, particularly in the Southwest as forecasted mega-droughts occur. Loss of water will likely impact water-dependent species, but mechanisms predicting how these species will be affected are largely unknown. Desert bats are reliant on drinking water, yet the ability to access water varies by species. Because bats drink during flight, reduced sizes of water sources will likely affect less maneuverable bats more than maneuverable bats. During May to August 2010-11, we acoustically monitored 60 water sources of varying size in two Utah deserts and experimentally reduced surface area at two water sources. Less maneuverable bats experienced a 3.5 fold reduction in drinking and increased competition with maneuverable bats when surface area was reduced. These effects explain the observed absence of less maneuverable bats at smaller water sources from our study areas. Reduced size of water sources due to climate change will impact less maneuverable bats more than maneuverable bats. The morphological differences that evolved for niche partitioning among ecologically-similar bats may now be maladaptive in a changing climate.

El cambio climático global disminuirá la disponibilidad y tamaños de las fuentes de agua en ambientes áridos, particularmente en el suroeste cuando mega-sequías pronosticadas ocurran. La pérdida de agua probablemente impactará las especies que dependen del agua, pero los mecanismos que predicen cómo se verán afectadas estas especies son mayormente desconocidos. Los murciélagos del desierto dependen del agua, sin embargo, la capacidad de obtener acceso al agua varía según especies. Debido a que los murciélagos beben mientras vuelan, la reducción de tamaños de las fuentes de agua probablemente afectará a murciélagos menos maniobrables más que a murciélagos maniobrables. Durante mayo-agosto 2010-11, monitoremamos acústicamente 60
fuentes de agua de tamaños diferentes en dos desiertos de Utah y experimentalmente redujimos el área de la superficie en dos fuentes de agua. Los murciélagos menos maniobrables tuvieron una reducción de beber de 3.5 veces más y enfrentaron competencia aumentada con los murciélagos maniobrables cuando redujimos el área de la superficie. Estos efectos explican la ausencia observada de murciélagos menos maniobrables en las fuentes de agua más pequeñas de nuestras áreas de estudio. El tamaño reducido de las fuentes de agua debido al cambio climático impactará a murciélagos menos maniobrables más que murciélagos maniobrables. Las diferencias morfológicas que evolucionaron para la partición de nichos entre murciélagos ecológicamente similares pueden ser ahora de mala adaptación en un clima cambiante.

RECOMMENDATIONS FOR PREPARATION OF PRESENTATIONS

We ask that the winners of the Bruce Stewart Student Travel Award and the SAC Student Travel Award mention the award and SWAN in the acknowledgements of their presentations.

Poster Presentations: Posters must be in horizontal orientation and no larger than 36 inches (92 cm) tall (vertical) and 48 inches (122 cm) wide (horizontal). All posters presented at the annual meeting should at least include the title and abstract in English and Spanish. The local committee will provide necessary supplies for mounting and exhibiting the poster. Authors will hang their posters on Friday morning (12 April). The poster session will take place on Friday afternoon. The primary author should be present at their poster during the whole scheduled poster session.

Oral Presentations: Each presentation will last 15 minutes, 12 minutes for presentation and 3 minutes for questions. We strongly encourage presentations in PDF saved to a USB flash drive. A room designated for presentation practice will be available during the meeting. Presenters will be required to load their presentation on the computer prior to the start of their assigned session (see the session chair). For oral presentations, we recommend to authors to make their presentation friendly to a bilingual audience where possible (e.g., title, labels on figures, and conclusions).
STUDENT AWARDS

Instructions to apply for awards can be found at the SWAN web page:
https://saon.wildapricot.org/Instructions-for-Student-Awards

SAC STUDENT TRAVEL AWARD: The Student Advisory Committee together with SWAN’s Membership Committee have created a travel award, the "SAC Student Travel Award." The award will help defray travel and meeting expenses of new or returning student members. The SAC Travel Award is open to all undergraduate and graduate students only from the host country (i.e., from the country where the Annual Meeting is being held this year). The award is limited to ten recipients who will be randomly drawn from the pool of eligible applicants and would receive $175 cash at the Meeting.

The Applicant:
- Must be a student living/working in the host country,
- At the time of applying, must be a current SWAN student member,
- At the time of applying, must be registered to attend the current SWAN meeting,
- Must be first author on either a talk or a poster at the current SWAN meeting,
- Cannot receive the award two years in a row.

To apply:
- **Deadline 15 February 2020,**
- Apply for the award on Google Forms at https://forms.gle/BnbbrWnaFFYxGu1e7, then email electronic copies of meeting registration receipt and proof of membership payment to sacaward@gmail.com

BRUCE STEWART STUDENT TRAVEL AWARD
The Southwestern Association of Naturalists is granting student travel awards to help defray travel and meeting expenses for students attending the 67th Annual Meeting to be held on 23-26 April 2020 at Sam Houston State University, Huntsville, Texas. These awards will be given to students currently enrolled in an institution of higher education outside of the USA who are presenting papers or posters. Students must be current SWAN members, registered for the 67th Annual Meeting, and first author on a paper or poster. Those who have received two travel awards previously are ineligible. **Deadline for application is 15 February 2020.** To help you with the proposed budget, here are estimates of some of the costs:
- Student Registration $75 US
- Picnic $25 US
- Banquet $45 US
- Lodging variable and depends on your choice of hotel and if the room is shared (preferred). For budgeting purposes, use $40 US/night/person.
- Airfare is variable, depending upon your departure city.
Ground transportation is also variable, but may include travel to and from the George Bush Intercontinental Airport (IAH) in Houston.

Visa costs can be included in budget.

Go to on-line application form for [Bruce Stewart Student Travel Application Form](#)

**WILKS AWARD**

The Wilks Award is presented to the student giving the best oral presentation in the Plenary Session at the Annual Meeting of the Association. Research must be primarily the work of the student, not of the major professor, and the student must be both a member of SWAN and first author. From those submitting written summaries, a judging panel will select up to approximately three students to make oral presentations (15 minutes in length) in a special plenary session consisting of approximately six students competing for the Wilks and Student Field Natural History Awards at the beginning of the Annual Meeting. A winner for each award will be selected from this group based on the quality of the oral presentation and the significance of the results. Finalists will receive a $250 honorarium to cover the costs of attending the meeting. The Wilks Award recipient receives an additional cash award of $1000, a certificate, and a set of all available back issues of *The Southwestern Naturalist*. The winner will be announced at the Annual Banquet.

**APPLICATION DEADLINE: 1 March 2020.**

**STUDENT FIELD NATURAL HISTORY AWARD**

The Student Field Natural History (SFNH) Award is presented to the student giving the outstanding oral presentation with a substantial field component at the Annual Meeting of the Association. Like the Wilks Award, the presented research must be primarily the work of the student, not of the major professor, and the student must be both a member of SWAN and first author. From those submitting written summaries, a judging panel will select up to approximately three students to make oral presentations (15 minutes in length) in a special plenary session consisting of approximately six students competing for the Wilks and Student Field Natural History Awards at the beginning of the Annual Meeting. A winner for each award will be selected from this group based on the quality of the oral presentation and the significance of the results. Finalists will receive a $250 honorarium to cover the costs of attending the meeting. The SFNH Award recipient receives an additional cash award of $1000, a certificate, and a set of all available back issues of *The Southwestern Naturalist*. The winner will be announced at the Annual Banquet.

**APPLICATION DEADLINE: 1 March 2020.**

**CLARK HUBBS STUDENT POSTER AWARDS**

The Clark Hubbs Student Poster Awards are presented to students displaying the three best posters at the Annual Meeting of the Association. The first place award provides a certificate, a cash award of $600, and a set of all available back issues of *The Southwestern Naturalist*. The second and third place awards will receive $400 and $300, respectively. Although posters may be coauthored with the major professor, the work presented must be primarily that of the student and the student must
be the first author and a member of SWAN. A panel of judges will select the winners based on the quality of the visual presentation and the significance of the results. **APPLICATION DEADLINE: 1 March 2020.**

**HOWARD McCARLEY STUDENT RESEARCH AWARDS**
The Howard McCarley Student Research Fund provides as many as eight awards annually, up to $1000 each, to support student research. Applicants must be students (undergraduate or graduate) currently enrolled in an institution of higher education, a SWAN member, and be sponsored by a faculty member. Awards will be made in support of any aspect of research on biota of the southwestern United States, Mexico, and Central America except for travel to meetings. Individuals may receive a maximum of two grants from the Association. All qualified students are encouraged to apply, especially those in developing countries. Grant applications may be in either English or Spanish. Two letters of recommendation must be submitted in support of the application. One must be from the research advisor and the second from someone familiar with the student’s academic career and proposed research project. Awards will be announced at the banquet of the Annual Meeting of the Association. **APPLICATION DEADLINE: 1 March 2020.**
SCIENTIFIC PROGRAM
The scientific portion of the program will be held in Lowman Student Center at Sam Houston State University. The Welcome and Plenary Session will be held on Friday morning (24 April 2020) in the Orange Ballroom of the Lowman Student Center. The Business Meeting will follow the plenary session in the Orange Ballroom. Concurrent oral paper sessions will be held on Friday afternoon and all day Saturday (24 and 25 April, respectively) in the Lowman Student Center. The poster session will be held on Friday afternoon (24 April, from 3 - 5 pm.) in the Lowman Student Center. The Board of Governors lunch and meeting will be held at noon on Thursday (April 23) in the Lowman Student Center.

FOOD SERVICE
Coffee, tea, water, and light snacks will be provided for breaks on Friday and Saturday. There are a variety of restaurants within walking distance of campus as options for lunches. The Friday night picnic will be held at the Sam Houston State University Center for Biological Field Studies. There will be busses to transport participants. The Saturday night banquet will be held in the Orange Ballroom of the Lowman Student Center at Sam Houston State University. Vegetarian meals will be available at the picnic and banquet on Friday and Saturday nights. If you prefer a vegetarian option, please indicate so on the registration form.

PICK-UP OF REGISTRATION PACKETS
You will be able to pick up your meeting packet at the Lowman Student Center, beginning Thursday, 23 April 2020, between 1:00 pm and 5:00 pm. Meeting packets will also be available for pick up at the Thursday evening reception at KAT Lounge between 6:00 pm and 10:00 pm, and at the Registration Desk on Friday and Saturday at the Lowman Student Center.

MEETING REGISTRATION
On-site meeting registration will be available, but we encourage you to pre-register on-line by 1 March 2020 to take advantage of the lower cost. On-site registration will be available between 11:00 am and 5:00 pm on Thursday (23 April) at the Lowman Student Center. You will also be able to register on-site on Friday and Saturday (24-25 April) at the Lowman Student Center, between 8:00 am to 5:00 pm.

SOCIAL ACTIVITIES
A welcome reception will be held at the KAT Lounge in the Lowman Student Center between 6:00-10:00 pm on Thursday, April 23. On Friday (24 April), the picnic will be held at the Center for Biological Field Studies from 6:30 to 9:30 pm. We will conclude our program with the Annual Banquet on Saturday (25 April) in the Orange Ballroom of the Lowman Student Center where we will all enjoy the SWANSong by Past-President Dr. Susana Perea-Fox entitled “Mapuche Myths that Explain Animal Behavior,” and recognition of student and distinguished award recipients.
TICKETS FOR THE PICNIC AND BANQUET
The Friday picnic and Saturday banquet are ticketed events. You must purchase picnic and banquet tickets during pre-registration. Tickets also will be available for purchase on-site at the meeting registration table until Thursday 23 April.

STUDENT WORKSHOP AND ACTIVITIES
The Student Advisory Committee will offer a “Using Social Media in the Sciences” workshop. Participants will be shown potential uses of social media and will offer strategies to using social media in their research. The workshop will take place during lunch on Friday (lunch and soft drinks will be provided). Lunch with a Scientist will continue this year and be held during lunchtime on Saturday. Come have lunch on us and chat with one of SWAN’s scientists! The Student Advisory Committee will give $10 to each student who signs up and $10 to the scientist to pay for the lunch. There will also be a student-only social hosted by the Student Advisory Committee an hour prior to the picnic. If you want to participate in the “Using Social Media in the Sciences” workshop, Lunch with a Scientist, and/or student-only social, please check the appropriate checkboxes on the registration form to indicate your interest.

TRAVELING TO HUNTSVILLE, TEXAS
Huntsville is located on Interstate 45 about 70 miles north of Houston. If flying to the region for the meeting, George Bush Intercontinental Airport/Houston Airport (IAH) is the best location to for air travel. IAH is about 60 miles (1 hr) drive from Huntsville, Texas. Participants arriving by plane can rent vehicles or take taxis from the airport to Huntsville. Alternatively, the Local Committee will arrange an airport pick up for participants on Thursday afternoon (~4:00 pm) and an airport drop-off on Sunday morning (~8:00am). Participants wishing to use the Local Committee shuttle should make flight arrangements according to these designated times. Details of this pickup and drop-off will be posted on the meeting website.

FIELD TRIPS IN HUNTSVILLE, TEXAS
Rather than arranging guided field trips following the annual meeting, we will provide information on a number of recreational options near Huntsville in your conference packet.