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Originally founded by Gerald Keown in 2007, SWCHR is a 501(c)(3) non-profit association, governed by a board of directors and dedicated to promoting education of the Association’s members and the general public relating to the natural history, biology, taxonomy, conservation and preservation needs, field studies, and captive propagation of the herpetofauna indigenous to the American Southwest.

THE SWCHR LOGO

There are several versions of the SWCHR logo, all featuring the Gray-Banded Kingsnake (Lampropeltis alterna), a widely-recognized reptile native to the Trans-Pecos region of Texas as well as adjacent Mexico and New Mexico.

ON THE COVER: Balcones Barking Frog (Craugastor augusti latrans), Val Verde County, Texas (Kyle Elmore). With this photograph, Kyle won the SWCHR 2015 Award for Excellence in Herpetological Photography.

BACKGROUND IMAGE: Gates’ Pass, Tucson Mountains, AZ (Bill White)

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A CALL FOR PAPERS

Are you a field herpetologist or a herpetoculturist (amateur or professional) working with species native to the American Southwest? Do you have a paper or an article you have written for which you would like to find a permanent repository? Want to be assured you will always be able to share it with the world? Submit it to the SWCHR Bulletin for possible publication. Submitted manuscripts from SWCHR members, as well as non-members, will be considered. There are NO page charges to have your articles appear in the SWCHR Bulletin, as some other publications are now requiring.

To be accepted for publication, submissions must deal with herpetological species native to the American Southwest. Such topics as field notes, county checklists, range extensions, taxonomy, reproduction and breeding, diseases, snake bite and venom research, captive breeding and maintenance, conservation issues, legal issues, etc. are all acceptable. For assistance with formatting manuscripts, contact us at the email address below.

Previously published articles or papers are acceptable, provided you still hold the copyright to the work and have the right to re-publish it. If we accept your paper or article for publication, you will still continue to be the copyright holder. If your submission has been previously published, please provide the name of the publication in which it appeared along with the date of publication. All submissions should be manually proofed in addition to being spell checked and should be submitted by email as either Microsoft Word or text documents.

Send submissions to swchr@mountainboomer.com.
A Message from the President

This issue has a diverse selection of articles, with something for everyone!

We start with a report by Dr. Sam Sweet of the University of California—Santa Barbara on a recent habitat restoration he, his doctoral student, and a team of conservation-minded individuals completed on private property in the mountains of California. This was a great solution to increase numbers by protecting the amphibians from natural predators and providing better habitat for metamorphosing amphibians to egress. Step by step details along with the photographs make this an interesting and informative article. I especially liked the discussion on collecting methods and tools used to make this project a success.

Next, Bulletin Associate Editor Tom Lott again regales us with an in-depth investigation of historical herpetological records—you may recall his previous sleuthing of Smooth Green Snake (Ophiodrys vernalis) records in Texas from a previous issue. We have all seen range extensions published over the years, with some of them seeming plausible but others seeming to be a little farther out than what we expect to be normal. Researching these can certainly be a chore. Tom has done an excellent job of sifting through records and literature to explain the anomalous Texas locality records for the Mexican Tree Frog (Smilisca baudinii).

Our Editor Chris McMartin then introduces us to the idea of using “dash cam” video recorders for road cruising. Its’ a cool idea to document sightings and wildlife interactions that may otherwise go unrecorded due to those spontaneous moments not giving you time to record with a phone or camera. Being able to save pics/clips from the video is a handy tool. It’s hard to beat the feeling of coming up on a cool sighting and to hear the excitement in our voices at the moment. I experienced this quite a bit on my West Texas trip last month, with a night of 17 mammal species; a Black Bear (Ursus americanus), Badger (Taxidea taxus), Bobcat (Lynx rufus), and Elk (Cervus canadensis) being the highlights. I was able to video the bear but none of the others. If I had a dash cam I would have been able to record all of them. It’s an idea worth checking out.

Contributor Diego Ortiz provides a good overview of herping-related regulations in Arizona, the first of what we hope is a series of articles detailing regulations in each of the six states in our SWCHR region of interest. I have always been in awe of the herps in Arizona. It really bothers me when I see pictures on Facebook and elsewhere on the internet of Arizona herps that have been caught to be sold (which is illegal). Understanding what the regulations for herps are in each state can be challenging. Something as simple as going out to photograph a herp can require a license, depending on the state. Researching these regulations takes a lot of time, so it’s nice to have this article along with additional references for those of us wanting to enjoy Arizona herps!

Our friend Juan C. Lopez-Johnston provides a primer on using natural and artificial light to enhance the quality of your reptile and amphibian (and basically any other!) photography. Juan is a biologist specializing in animal toxins and learned photography to document his primary study animals: snakes. A Venezuela native, Juan now calls San Antonio, Texas home and offers photography classes there. His blog is listed on his article’s byline.

We round out this issue with Tom Lott’s review of Texas Turtles & Crocodilians: A Field Guide. This continuation of the University of Texas Press Natural History Guides is a handy reference to complete your Texas field guide collection. There really has been a wealth of new reptile and amphibian books for the SWCHR region in the last several years. This book is no exception; it’s a great read and Tom provides excellent critiques of the books he reviews.

With fall upon us, the traditional herping season is winding down. That being said, it appears late-season herping has been very good for many of our members and friends. You never know when you’ll make a surprising observation, so don’t let the date on the calendar keep you from getting out in the field!
Habitat restoration projects and opportunities come in all sizes and scales. As a general rule more complex ventures on larger scales begin to involve trading advantages for some species for losses to others, and even for the target species begin to include enough assumptions that pure successes are rare. On the other hand, it is sometimes possible to make small and temporary alterations that really do matter. For example, individual Ambystoma salamanders may spend several months as larvae, then 3-6 years as juveniles, growing, maturing and avoiding predators. One night a 6-year-old female full of her first clutch of eggs sets out to migrate to a breeding pond and gets run over a minute before she enters the water. Yes, close a quarter mile of the road that night.

Lots of populations face bottlenecks, and if we are observant enough to detect them we may actually do some good. For many amphibians, metamorphosis is a bottleneck event— not only are new genes being expressed, but the animals can be dramatically less able to flee or otherwise respond to challenges, and a mortality peak is a standard feature of this brief interval. The account here describes a situation where a pronounced mortality peak was likely, but possibly averted by relatively minor intervention. The specific circumstances are unique, but the general principle might be applied widely.

The “Trout Farm” is a property owned by retired Cal Poly faculty architects and sustainability pioneers Ken Haggard and Polly Cooper in the mountains north of San Luis Obispo. It was built as a trout fishing business, with a series of six concrete-lined ponds of increasing size and depth stepped down a hillside from a large spring that provides significant throughflow year-round, the water returning to the creek below. All structures on the property were lost in a 1993 wildfire, now replaced by beautifully-designed houses that work with the landscape. Ken and Polly have carefully maintained the ponds free of exotics and welcome class and research visits.

Each of the ponds has a large breeding population of California Newts (Taricha torosa), which normally breed only in streams in southern California, and the three larger ponds support a large population of California Red-legged Frogs (Rana draytonii, federally listed as Threatened), with a few Western Toads (Anaxyrus boreas), many Pacific Treefrogs (Pseudacris regilla) a few Pacific Pond Turtles (Actinemys marmorata) and occasional garter snakes (Thamnophis hammondii and T. sirtalis) thrown in. Slender Salamanders (Batrachoseps nigrovittatus) and Ensatinas (Ensatina eschscholtzii) are common in the wet ravines bordering the ponds. Bullfrogs (Lithobates catesbeiana) occasionally colonize the site but are quickly removed.

My doctoral student Juliet Knowles is using the Trout Farm as a core site in her studies of newt population dynamics, and it is one of a network of sites where we regularly monitor the prevalence of chytrid fungal infections among the native amphibians. On July 20, 2016, we stopped by to sample larval newts, and on this occasion wanted to check the two largest lower ponds (each ca. 60x90 ft, 5-6 ft deep), requiring something more than a dip net. I brought along a ski net (Fig. 2; Herpetological Review, in review). This is a rectangular metal frame mounted on short plastic skis, holding a tapered net bag, which can be towed across any pond lacking obstacles on the bottom. It rides on top of even very loose mud, and is just the ticket when...
you don’t want to mess up a pond by wading around in it with dip nets or seines. In this case, the ponds are deep, and we aren’t sure how strong the old concrete bottoms are.

We did a couple of tows across the number 5 pond and got a hundred or so newt larvae, all about the same size (40-45 mm TL), very few showing signs of metamorphosis yet. We went down to the largest (#6) pond and made a single tow, and the net came up with more larval newts, but it was also packed with large Red-legged Frog tadpoles (10-12 cm TL), all with large hindlimbs and a few with one forelimb emerged. My federal permit allows me to capture redlegs (adults and tadpoles) for chytrid sampling, but incidental captures have to be released promptly. We estimated there were between 200 and 250 tadpoles in the net, so if the one haul was representative there might be over 6000 tadpoles nearing metamorphosis in the pond.

Inspection of this pond revealed an immediate problem – it has open, sloping bare concrete edges and bottom that provide no cover at all for metamorphosing tadpoles (Figs. 3, 4). Larvae of the size we found should already be in shallow water (and probably are there, after dark), because deep water is likely anoxic and their gill functions are being lost. Predation risk is great on an open shoreline, and we saw two pairs of green herons working the ponds all day. Mr. Haggard said that a great blue heron often shows up at dusk and remains for some time. The artificial pond is thus creating a problem by being hugely successful for redleg breeding and larval growth, but lousy for metamorphosis and recruitment. I recalled that Mr. Haggard had once asked whether it would be bad to partly clear out pond #4, a shallow basin upslope that had become choked with cattails and tall sedges on the sunlit end. I took a closer look at this and found that the root mat surface was raised above water level, and was solid enough to walk on, though the soil was completely saturated. We knew from prior visits that redlegs do not breed in this pond (which is only about 18” deep at best), and a look through the vegetated part on 20 July turned up no metamorphosed frogs (Fig. 5).

The plan thus arose to pull most of the vegetation out of pond 4, leaving an edge as a buffer, and building two strips of submerged roottmat along the east and west sides of the lower pond where I think the largest numbers of metamorphs will try to go (towards the lowest skyline as seen from the pond). Ken and Polly agreed to this, so I asked Michaela Koenig (current president of the Central Coast chapter, The Wildlife Society) to try to round up some muscle on short notice. USFWS expressed support while pointing out that no redlegs could be displaced or harassed since my permit does not include habitat enhancement or restoration for redlegs. We thus had 11 people on hand at 0830 on July 30th.
It turned out to be quite easy to lift the rootmat away from the concrete bottom of pond #4, and to section the mat up into liftable pieces using a relatively fine-toothed pruning saw (Figs. 6, 7). Chunks were then transported by wheelbarrow and aligned along the edges of pond #6 (Figs. 8, 9).

The entire project, including cleaning up at the donor pond (Figs. 10, 11), took only about four hours, thanks to the hard work of the crew. All environmental consultants and project managers in the central part of California, they are: Rhett Blanton, Jackie Hancock, Michaela Koenig, Andrew Loveall, Halden Petersen, Kristina Olsen, Sara Snyder, Bill Vanherweg and Cherie Yang.

Biologist Wendy Knight and I made a follow-up visit in the afternoon and after dark on 11 August, and noted that the transplanted vegetation has begun to sprout new growth, with the separated sections beginning to mesh together with new roots. No amphibians other than aquatic adult newts were evident by day, but after dark there were hundreds of larval newts in shallow water, with a few newly-metamorphosed individuals visible in the cattail mats.

The red-legged from tadpoles were holding back on metamorphosis, but dozens could be seen in water 18” to 2 feet deep, concentrated along the outer edges of the vegetation mats. The mats themselves had been adopted by subadult and adult red-legged frogs (Figs. 12-15).

Many artificial ponds have limited shoreline cover and are heavily visited by predators such as herons (Ardeidae) and Raccoons (Procyon lotor). Even temporary placement of larval cover or of obstacles to predator access can make a big difference in recruitment.
Fig. 10. Installation completed. Photo by the author.

Fig. 11. The donor pond was left with a thinned border. Photo by the author.

Fig. 12. Adult male California red-legged frog (*Rana draytonii*). Photo by the author.

Fig. 13. Adult female California red-legged frog (*Rana draytonii*). Photo by the author.

Fig. 14. Subadult male California red-legged frog (*Rana draytonii*). Photo by the author.

Fig. 15. A night visit on 17 September showed large numbers of metamorphs using the vegetation. They aren’t completely safe since adults are cannibalistic (see arrow in top center photo), but the project seems to have been a big success for relatively little effort. Photo by the author.
A Possible Historical Explanation for Anomalous Texas Locality Records for the Mexican Tree Frog (*Smilisca baudinii*) (Amphibia: Anura: Hylidae)

by Tom Lott
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The presence of the Mexican Tree Frog (*Smilisca baudinii*) in the extreme lower Rio Grande Valley of Texas has been long-known and uncontroversial. Many similarly distributed neotropical vertebrates reach their northern limits in that area. However, two long-standing disparate Texas county records (Bexar and Refugio) for this frog considerably to the north of its expected range have been problematic. Most authorities have since regarded these extraneous localities to be accidental but unexplained introductions (e.g., Tipton et al. 2012, Dodd 2013).

Some authors, however, (e.g., Malone 2005, Dodd *op. cit*) continue to depict these counties on distribution maps for this species, even though there is sufficient reason to believe these populations were short-lived and are no longer extant.

Nevertheless, Murphy and Drewes (1976) used the existence of an accurately identified specimen of *S. baudinii* in the collection of the California Academy of Sciences (CAS 74068) to declare the "validity" of the Bexar County records of this species as a "200-mile range extension." The specimen in question was among a shipment of amphibians and reptiles said to have been collected at Helotes, Bexar County, Texas by Gabriel W. Marnoch (1838-1920). This shipment was received at CAS in 1923 but it included no collecting date(s) nor did Murphy and Drewes (*op. cit*) provide information concerning from whom or where this delivery originated.

Consequently, it may be assumed the consignment was part of the dispersal of Marnoch's personal collection upon his death, which may have contained specimens obtained many years earlier and/or from localities other than Helotes. Most, if not all Bexar County records for this species are attributed to Marnoch, who seems to have been somewhat cavalier about labeling his specimens with collecting data. Cope (1880) merely mentions that Marnoch had "found" this species at the problematic San Miguel Creek locality (see below), but does not refer to the Helotes locality nor his having actually received any specimens from Marnoch. When John K. Strecker (1922) purchased the remainder of Marnoch's collection for Baylor University, shortly after the latter's death, he noted that it contained four specimens of *Smilisca baudinii*, and that Marnoch had sent one specimen from Helotes to the United States National Museum. It appears, however, that no one other than Marnoch has ever claimed to have seen, heard, or collected this species at the Helotes locality, despite it having long been a popular destination for herpetologists [e.g., Strecker (*op. cit.*, 1933), Wright and Wright (1949), etc.].

Malone (*op. cit*) suggested that perhaps specimens were imported from areas within the natural range of the species via the potted plant trade (in a manner similar to that presumed for the recent and widespread introduction of the Rio Grande Chirping Frog (*Eleutherodactylus cystignathoides*). Given the age of the records, however—prior to 1880 (Cope) for Bexar County and 1908 (Strecker) for Refugio County—coupled with the apparent lack of more modern introductions of *S. baudinii* despite an exponential increase in the horticulture of potted plants, this seems doubtful as a source of these old records.

Conversely, the diaspora of *E. cystignathoides* appears to have begun sometime during the 1960s (Lott 2012). It should be
noted, however, that more recent introductions of *S. baudinii*, even if they were occurring, would be unlikely to be detected absent the serendipitous presence of alert frog enthusiasts; Gabriel W. Marnoch served that function at Helotes (and the even more puzzling "San Miguel Creek" locality cited by Cope *op. cit.*), while John K. Strecker served it in Refugio County.

A recent historical work, *Death of a Texas Ranger* by Cynthia Leal Massey (2014), coincidentally sheds some light on the likely provenance of at least the Bexar County specimens. With the commencement of the American Civil War in 1861, Union naval forces quickly established blockades on Confederate ports, effectively shutting down the export of the South's primary source of income: cotton. Texas, however, bordering Mexico as it does, was able to circumvent the blockade to some extent by transporting its cotton overland to Mexican ports for shipment, as ships departing from Mexican ports were not subject to the Union naval inspection. Massey provides ample evidence that Gabriel Marnoch routinely traveled from San Antonio to ports on the Mexican Gulf Coast during the Civil War as an agent of his father's cotton exporting business.

As recounted by Massey, this cotton trans-shipment business consisted of caravans of horse or mule-drawn wagons laden with bales of the valuable fiber from San Antonio to ports on the Gulf Coast in northeastern Mexico. Apparently, Gabriel and his younger brother John accompanied and supervised these caravans through the wilds of south Texas and adjacent Mexico, occasionally subject to the depredations of various bandits and renegade tribes en route. The trade was lucrative for the Marnochs, and their war profiteering further served to defer Gabriel and John from the pervasive Confederate military conscription, as such enterprises were considered vital to the economic interests of the Confederacy.

The main point of herpetological interest in Gabriel Marnoch's travels during this period, however, was that these endeavors placed him within the natural range of *Smilisca baudinii*, where he could have collected or inadvertently acquired specimens concealed on his wagons or within his gear that were then transported back to Helotes (and possibly San Miguel Creek) on the return trip—lylid frogs seem especially disposed to this sort of "stowaway" behavior on or within vehicles, as has been speculated to be the source of the introduced population of the Green Tree Frog (*Hyla cinerea*) at Big Bend National Park's Rio Grande Village Campground (e.g., Dayton et al. 2007). Marnoch, unfortunately, did not appear to keep a field journal nor label specimens he collected.

The "San Miguel Creek" locality, given by Cope *op. cit.* as a "tributary of the Medina River" and another locality from which Marnoch had obtained specimens of *S. baudinii*, is problematical due to the fact that no such named tributary to that stream is currently recognized nor depicted on maps from that era. A long-known San Miguel Creek does exist in the "low country southwest of San Antonio" (Cope *op. cit.* [actually southwest of San Antonio], but it feeds into the Frio River [now Choke Canyon Reservoir], rather than the Medina River. The location of the actual San Miguel Creek, however, places it on a likely route between San Antonio and northeastern Mexican ports where the logistically necessary requirements to rest, feed, and water draft animals could be accomplished. It is thus conceivable that Marnoch observed and collected stowaway *S. baudinii* from his equipment at San Miguel Creek on the return trip to San Antonio from Mexico.

Moreover, this species does not tolerate sub-freezing temperatures (Dodd *op. cit.*), and has apparently developed no behavioral adjustments to deal with such. Almost certainly this is the primary limiting factor on its northerly distribution, ensuring that any populations introduced into more temperate zones are ephemeral. Thus, even if Marnoch had inadvertently introduced specimens of *S. baudinii* into the Helotes area, it is doubtful they could have survived for more than one or two years, given that the area routinely experiences several events of sub-freezing weather each winter. The San Miguel Creek locality, while slightly milder in winter than Helotes, still generally has some freezes each year.

The provenance of the Refugio County specimens is a bit more difficult to surmise. They were apparently collected by Strecker himself in the spring or summer of 1904: "Three specimens from Mr. Barber's farm near Refugio. One of these was found hanging to the side of a frame building, the others were captured on the ground, in the woods" (Strecker 1908). Presumably, these were deposited in the Baylor University collection (then curated by Strecker), although the paper makes no reference to their ultimate disposition.

As any casual visitor to south Texas and particularly along the Gulf coast will undoubtedly note, there is (and long has been) a marked tendency to landscape with imported, mostly non-native palm trees and banana plants. Such landscaping applications typically involve nearly full-sized, root-balled specimens, which provide generous accommodations for stowaway fauna. The Refugio County specimens found by Strecker could have resulted coincidentally from the importation of such plants from Mexico, which was done with few restrictions at the time. It would appear that much of this imported tropical vegetation, as suggested by Dixon (1987), likely originated from areas within the natural range of *S. baudinii*. The milder coastal climate of Refugio County would also tend to extend the viability of any introduced populations of this species, although no one seems to have duplicated Strecker's discoveries at that location during the intervening 112 years.
In summation, it is doubtful that any of these three anomalous localities for *S. baudinii* has ever represented a viable, reproducing population. In the absence of additional extralimital records in the intervening period of more than a century, the conventional wisdom that Marnoch's and Strecker's specimens are merely indicative of ephemeral and presumably accidental introductions is affirmed. Further, in the absence of any collecting data for the Marnoch specimens, the possibility that they were obtained inadvertently or intentionally by the collector during his documented visits to the natural range of the species cannot be discounted.

**Literature Cited**


**Use of “Dash Cams” for Field Observations of Reptiles and Amphibians**

by Chris McMartin

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In 2012 I began using the citizen-science database NAHerp (www.naherp.com) to record my reptile and amphibian observations in the field. When I upgraded to a “smart” cell phone, I installed the NAHerp application to the phone, which allowed real-time logging of latitude and longitude for each entry. Since I carried my phone with me in my car, I started thinking about how I could accurately document animals I encountered on roadways when I was not actively herping (e.g. traveling for other reasons when I had no time to stop, or traveling on interstate highways where it is generally illegal to stop). Often these “incidental herping” encounters occurred when I did not have the NAHerp app running. I use a dashboard GPS unit for navigation, but by the time my passenger could pull up the phone app to document the observation, at highway speeds the coordinates would be far behind us. I therefore developed a protocol wherein I would note the time upon sighting the dead-on-road (DOR) turtle or other animal, then get the phone app pulled up while maintaining speed. In the “notes” section of the data entry, I would note the observation occurred, say, 30 seconds prior at 70 mph. Later that day, when synchronizing the accumulated observations, I would manually calculate the distance traveled those 30 seconds and derive the resulting coordinates using Google Earth. The coordinates would be within 50 feet of the actual animal's location. It was a tedious process, and even worse, I had no way of photographing the animals, meaning the observations were unvouchered.

To streamline this process, I started thinking about designing a phone app of my own which would run continuously, and a press anywhere on the touch screen would instantaneously log latitude, longitude, and elevation, while simultaneously activating the voice recorder for ten seconds so the user could comment on the observation (species name, weather conditions, etc.) without the need for typing the information into the phone.
while driving (thereby providing a safer alternative to the previous method, if traveling alone). However, this solution still did not allow for photography of the animal in question.

Then one day I had an epiphany, probably after watching YouTube videos shared by friends of the hazards of driving in Russia, where dashboard cameras are ubiquitous. The “dash cams” are invaluable there in determining fault after vehicle accidents, as they run continuously and users can save footage of interest. I thought perhaps one of these dash cams could be handy for recording herp observations, and set about researching various attributes of cameras offered in the United States. There is a wide range of features and specifications available, and after comparing several brands I settled on the KDLINKS X1 as my choice ($169.95 at press time). Since I am not a professional reviewer, I do not have access to manufacturer-provided products, nor the funds to spend on purchasing my own fleet of dash cams, so while the following information can in many cases be generalized to many makes and models of dash cam, other brands’ offerings may be better or worse in some aspects of performance.

The KDLINKS X1 dash cam, shown with its GPS antenna and windshield mount. Photo by the author.

The KDLINKS X1, like most dash cams, is a small unit with a wide field of view (in this case, 165 degrees horizontally, and though not listed in product information, approximately 90 degrees vertically), in keeping with its intended primary use as an “eye witness” to vehicular accidents. It attaches to a vehicle’s windshield via a suction cup mount which incorporates a GPS receiver external to the camera and connected with a short cable. The camera plugs into the vehicle’s cigarette lighter outlet (or similar accessory outlet) and automatically powers up/shuts down when the vehicle’s ignition system is turned on. The power cord jack is a mini USB port, so the same jack is used to connect to a computer for download and review of recorded footage. The video resolution can be set to a small choice of resolutions, up to full HD (1920 × 1080). Both audio and video are recorded, and the date/time and GPS-provided location and speed are embedded into the video files, which are recorded onto a micro SD memory card.

The camera accepts micro SD cards up to 32 GB in capacity, which at full HD equates to more than 5 hours of recording time. Once the camera has filled the memory card, it continues recording but erases previously-recorded video by looping back to the earliest recorded file and overwriting in sequential order. However, the user can prevent a particular video file from being overwritten by pressing a button on the camera when something of interest occurs (in my case, a wildlife sighting). The camera shows elapsed time into each video file real-time as it records—for example, if you have it set to record in 2-minute intervals, an on-screen digital “stopwatch” resets to 0:00 every 2 minutes. When the user presses the “lock” button, a key symbol shows up on the screen, and it disappears at the end of the video file at the camera saves the file and begins a new file. What’s nice is that when you or a passenger exclaims, “Wow! Did you see that?” a few seconds after an observation, you can hit the “lock” button and be reasonably assured you’re preserving the moment of interest, provided the observation did not occur at the precise moment the camera began a new video file (meaning the observation was recorded on the previous file which you didn’t lock)—the camera records such that there are a few seconds of overlap between files. Even so, as long as you don’t record another 5 hours of video such that the file of interest gets overwritten, you can still access the file upon downloading to your computer. In such cases (and they have been rare), I lock the file AFTER the observation of interest, and dictate a note to myself to check the previous file—the software which ships with the dash cam allows the user to view all recorded video files on the camera, or just the locked ones to eliminate the necessity of reviewing up to 5 hours of footage when you’re really only interested in 20 minutes.

The user can set the desired length of each video file (2, 3, or 5 minutes). I set mine to 2 minutes so even if I save several video files, it doesn’t take up as much capacity as if I saved them in 5-minute increments with only 30 seconds of interest on each file. An added benefit is that whenever I download the files to my computer, I can spend less time watching shorter files to find the footage of interest.

When the dash cam first arrived, I was apprehensive about how difficult it would be to operate, but it has a pretty easy learning curve. Once you initially configure the settings for such things as resolution, video file size, etc. how you want them, the only thing you really need to do is to remember to press the “lock” button when you want to save a particular file, and that button is conveniently located on the lower-left side of the device—the
closest button to the driver. As long as the unit is plugged into a power source, everything else is automatic. The dash cam begins recording as soon as it powers up, and GPS lock-on takes approximately 3 minutes from a cold start.

Upon completion of a driving session, the user merely connects the dash cam to a computer, at which time the camera gives the option of functioning as a web cam or just a media storage device (to download the files). The software is easy to use, and in addition to the video playback also displays the recorded coordinates, instantaneous speed, maximum speed logged during the current video file, and distance traveled during the file (again, useful for the intended vehicular-accident-recording purpose). A separate window can be opened to display instantaneous position on a Google Map which updates while the video file plays…more on this later. The software has a “screen capture” feature which, when clicked, saves a series of individual stills from the fraction of time immediately before and after the point at which you clicked, so you can cycle through them and select the exact frame you want—a nice feature.

After reviewing both the instructions accompanying the X1 and customer reviews, I began using my dash cam in May 2016. Many users warned that leaving the dash cam mounted on a vehicle’s windshield on a hot day caused problems up to and including unit failure. Obviously, in the sunny SWCHR region of interest that could be a problem, but I wonder which dash cams (or other electronics) wouldn’t experience similar problems. I run the air conditioning in my car when using the dash cam, and when I stop for food, gas, etc. I either park in the shade or place my sunshade such that it covers the dash cam. After a summer of use, the camera has suffered no damage.

I was worried about video quality (I have it set to the highest—1080p), especially considering the wide field of view. On the positive side, you can capture a lot of great scenery so it’s enjoyable to relive memories of driving in prime herp habitat. Review of footage indicates it is sufficient for animals down to at least the size of Red-eared Sliders (Trachemys scripta elegans) and larger snakes, such as the Coachwhip (Masticophis flagellum). However, if the user does not positively identify the animals real-time, it can be very difficult to do so when reviewing the footage later. Additionally, these animals are diurnal and the camera functions with a higher shutter speed during the daytime. The real test would come during night road-cruising sessions.

A Bullsnake/Gopher Snake (Pituophis catenifer) on the right shoulder of Highway 385, Brewster County, Texas. This specimen was approximately 4 feet long. Photo by the author.

Using the dash cam’s included software to view footage on a computer. In the lower left of the screen are instantaneous latitude/longitude; speed information and distance traveled are on the right of the same window. A Google Maps-derived visualization of position (selectable between map and satellite view) are in the adjacent window to the right. Photo by the author.

A cropped view of the same snake, from the same video frame. Photo by the author.

To gauge the dash cam’s effectiveness at night, I drove around my local area to see what I could find. As expected, video quality is not quite as good using default settings. Experimenting with the various exposure compensations available may help. There is noticeable blurring, especially when traveling at higher speeds, which makes freeze-frame screen grabs less useful as photo vouchers. The picture quality is still decent for objects larger than herps, as long as you know what you were seeing (for example, a black cat on the grass near the road looked somewhat like a black cat, but I probably wouldn’t have been able to identify it as such had I not noticed it other
than through the camera’s lens). Using high beams on the car seems to help a little bit. There is some “light bloom” from oncoming cars on a two-lane road, but my lane was still discernible in the video (i.e. an oncoming car isn’t going to “blind” the camera).

After that night drive, I noticed on file playback I could hear choruses of Gray Treefrogs (Hyla versicolor), Rio Grande Chirping Frogs (Eleutherodactylus cyanophlyctis), and Cricket Frogs (Acris crepitans) calling as I drove past with the windows down, thanks to a surprisingly-sensitive microphone on the dash cam. At that point I realized a solution to the species-identification problem would be to verbalize what each animal/object is as you see them, and the dash cam’s microphone will essentially “take dictation” which you can review during playback on your computer. This concept also streamlines the post-excursion workflow, as I can play back a file, work on other things on my computer or in the house, and listen for my excited commentary to know when to watch the video, take a screen capture, and log date/time/coordinates. I also discovered it was possible to extract the audio from the file, filter out the car noise using audio-editing software, and have audio vouchers (complete with coordinates) for uploading to databases.

I didn’t plot the resulting coordinates from those initial tests, but I figured the dash cam would be an easy way to record them without having to log them separately from a stand-alone GPS receiver or smart phone. I first employed the dash cam seriously during the fifth annual Snake Days event in Sanderson, Texas in June. I used it during the day as well as at night. I didn’t download any of the video files until returning home. When I did, I simply chose the option in the computer software to “view only protected files” so I would only need to peruse about 200 minutes of footage of interest versus 300—a significant time-saver, but still a lot of material to review. I started pulling times, dates, and coordinates from observations on those files to compile in a database matched with higher-quality photos I had taken after stopping for some of the animals seen. I didn’t notice anything was amiss until I plotted a set of coordinates from the footage in Google Earth.

For a Yellow Mud Turtle (Kinosternon flavescens) found in Val Verde County, I noticed the resulting coordinates plotted nowhere near the road on which the animal was found. I was confused and it took several more sets of coordinates before I realized the dash cam’s GPS receiver was accurate in latitude, but not longitude. However, the map feature on the dash cam’s software itself accurately portrays both the true latitude and longitude. Upon this discovery, I was able to simply follow along a line of latitude east or west until matching up Google Earth’s imagery with the imagery displayed on the dash cam software’s map plot. The software’s map allows you to zoom in to a corresponding Google Earth “eye altitude” of approximately 10,000 feet. This is sufficient to match up the location in Google Earth and then use Google Earth to further zoom in, matching features with those visible in the dash cam video file (such as bridges, tree lines, and signs) for greater fidelity in documenting the coordinates.

I initially thought perhaps it was a simple matter of the dash cam using a different datum than Google Earth (such as NAD 1983 versus WGS 84), but generally such errors amount to only a few hundred yards. I started tracking how much the error was for each observation, to see if there was a pattern—there wasn’t. Sometimes the longitude would be nearly spot-on; sometimes it would be 48 miles west of the actual position; sometimes it would be 58 miles east of actual. There seemed to be no correlation between length of time the camera had been running and cumulative error. I started dictating my Garmin GPS receiver coordinates while recording (stopped on the shoulder, so the coordinates were “frozen”) during a subsequent trip to the Trans-Pecos region, and they matched perfectly to the actual coordinates, thus eliminating the possibility of poor satellite visibility/signal reception for a given area. I reasoned it must be some sort of error in the computer software, since the map display in the software is correct while the wrong coordinates are displayed (no coordinates are displayed on the video itself for comparison).

I contacted the manufacturer about this defect (software and camera firmware updates are periodically available on their website), but in the meantime I manually corrected the coordinates using Google Earth to match the dash cam software’s map as described above. The manufacturer responded that the software had been updated; upon installing
the update it appears the problem has been remedied, though I have only tested it with a few of my archived video files. In their correspondence, they were not as concerned with the discrepancy as I was, since most users do not care so much about coordinate accuracy as they do about the footage itself, since they’re using it for accident reporting and not citizen science. At any rate, it’s good to see the problem resolved.

If one desires to share their footage for aesthetic rather than mere documentary value, take care when mounting the dash cam to the windshield. It is challenging to get it level, and the resulting footage with tilted horizons can be frustrating. Another consideration is to ensure your windshield is as clean as possible. Depending on time of day and amount of road grime, insect collisions, etc. you encounter, there is significant glare/glint from these obscurants if the sun is at the right angle. Most of the time this merely constitutes a distraction, but it could potentially mask your object of interest if the spot on the windshield is sufficiently large or in the exact wrong spot. Bright sunlight can also mean reflections on your windshield from your dashboard (and whatever objects you choose to “store” there) which will show up on your video footage. There are a number of user web sites detailing how to make polarizing filters for dash cams which may help with this problem.

Also noteworthy is the intentionally low capacity of the dash cam’s onboard battery. It is intended to auto-save files in an emergency (the built-in acceleration sensor automatically protects the file currently being recorded in event of an accident, and the battery is sufficient to ensure the save process completes before the unit powers down). This is important because if you pull off the road to get a closer look at an animal or to shine a road cut, you must leave your vehicle key in the “on” position even if you turn off the ignition or else the unit will shut down shortly afterward. Furthermore, if the dash cam has not been used in a while, the onboard battery may discharge to the point the date/time must be reset the next time it is used. I didn’t realize this and was happily saving video files while driving, assuming the date and time were correct, until after a few observations I noticed the error and had to make myself an audio note on the next saved file of how far off the time was.

It was not until returning from Sanderson that I discovered the dash cam has a zoom feature (up to 4x). I hypothesized this might be a way to get better resolution on those roadside turtles, and I would not miss the loss of field of view since a herper’s eyes are more attuned to areas along the right-of-way than past the fence line. Unfortunately (but not unexpectedly), the zoom is digital, rather than optical, so there is no appreciable gain in resolution; at maximum zoom the resultant imagery is noticeably pixelated. In my further testing on subsequent trips, I found a 2x zoom setting to be a reasonable compromise for image quality. The dash cam did freeze up once when I pressed the “lock” button to save the moment an errant domestic sheep ran alongside, then in front of, my car. I simply turned off the camera and then turn it back on; it functioned normally from that point forward, and the video file in question was preserved as well.

In my experience, the use of a dash cam has been a greatly beneficial enhancement to my observational capabilities while traveling. Its best function has been to serve as a real-time dictation device, with a visual backup for pinpointing locality for more-precise still-camera shots (when possible) and as a source of crude yet useable photo vouchers when stopping for higher-quality photography is not possible or practical. The simultaneous automatic position and date/time recording are a great help when later reviewing the observation and creating a database entry.
Along with attempting to identify species visually and verbalizing this information after pressing the “lock” button, I also verbalize the temperature reading from my vehicle (accurate within a few degrees) and information on cloud cover, rainfall, etc. and condition of the animal (DOR or alive). Not only do I do this for animal observations, I press the “lock” button and dictate general notes for myself, much more easily than attempting to either write them down or input them to my phone. It is also enjoyable to hear what was playing on the radio at the time of an observation (e.g. Peter Frampton’s “Do You Feel Like I Do” was the background to finding a New Mexico Milksnake [Lampropeltis Triangulum celaenops] this summer), or to hear the conversation in the vehicle before and after an exciting find.

For readers still skeptical about the utility of dash cams for herping, there is an alternative solution—several smart-phone apps exist which replicate dash cam functionality to varying degrees. However, there are several drawbacks: the field of view of a smart phone’s camera is narrower (not necessarily a drawback but it means you may miss sightings of interest); recording video requires a lot of power and therefore drains your phone’s battery more quickly unless you keep it plugged in (and even then, current draw may exceed your particular car charger’s capabilities to replenish it); the phone can get very hot while recording video, even without the added burden of sitting in direct sunlight on your windshield; you have to start the app every time you wish to use it, rather than have it start automatically upon engine start; and probably most importantly, you can’t use your phone for anything else (including as a phone!) while using it as a dash cam. A dedicated dash cam device is much more practical.

A comparison of an un-zoomed cell phone photo (LG Stylo; top), an un-zoomed dash cam photo (middle), and a 4x zoom dash cam photo (bottom). Most dash cams employ a digital zoom; for this model a 2x setting seems to offer the best compromise between zoom and image quality. Photos by the author.

Another familiar sight when driving in west Texas, though not often photographed. This Turkey Vulture (Cathartes aura) sprung from its roadkill meal into the air to avoid the oncoming vehicle. Photo by the author.

Even though the dash cam is somewhat less advantageous for deliberate road cruising than I had hoped, it has come in handy for those “unexpected” encounters, such as a family of Black Bears (Ursus americanus) in the Chisos Mountains of Big Bend National Park, which initially blocked the road as we rounded the bend and moved into the brush before bringing my still camera to bear (pardon the pun). In situations like this, the KDLINKS X1 dash cam saved the day! As more herpers begin purchasing and using them, two things will likely happen: first, the technology will continue to improve and higher-quality footage capability will become available; and second, the reptile and amphibian enthusiast community will share their experiences with various camera models and we will start seeing both amazing stills and video of animals which otherwise would have “got off the road” before they could be photographed. I look forward to both these developments!
Herping Regulations for States in the Southwestern Region
Part 1: Arizona
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Arizona has long been regarded as a must-visit destination by amateur and professional herpetologists alike. Chapters from Kauffeld’s *Snakes and Snake Hunting* (1957) and *Snakes, the Keeper and the Kept* (1969) titled “Huachuca Heaven,” “The Ajo Road,” and “Trail of the Tiger” have long fascinated and tempted snake hunters to try their luck in the mystical Sonoran Desert. Today, the internet has gone much further in reaching out to more reptile and amphibian enthusiasts than Kauffeld could have ever dreamed of. Consequently, more and more people flock to Arizona every year in order to try their luck at observing, photographing, and collecting some of the more desirable reptiles and amphibians that occur there. As an Arizona native, it always amuses me how much research and preparation most visitors to my state perform before heading out of their homes, yet there is usually one thing that gets overlooked throughout this staging process – the legalities surrounding the activities they are about to undertake. As such, it is my intention in this article to offer some insight and also some resources that will allow the reader to look into the regulations that are in place to protect the reptiles and amphibians of Arizona.

The Basics

The Arizona Game & Fish Commission establishes the guidelines and regulations for the management of all Arizona native wildlife, under authority granted by Arizona Revised Statutes 17-231. The Arizona Game & Fish Department (AZGF) is then authorized to implement said management, including the enforcement of bag limits and illegal take. Anyone who wishes to conduct any field herping within the state would be wise to understand the term “take,” as defined in A.R.S. 17-101. The legal definition, as it pertains to wildlife is the “pursuing, shooting, hunting, fishing, trapping, killing, capturing, snaring or netting wildlife or the placing or using any net or other device or trap in a manner that may result in the capturing or killing of wildlife.” This very broad interpretation means that in order to lawfully engage in any of these activities, one must possess a hunting or combination license for most reptiles and a fishing or combination license for amphibians and softshell turtles – even if there is no collection of the animals occurring. At this time, The Department offers yearly Fishing Licenses ($37/resident, $55/non-resident), General Hunting Licenses ($37/resident, N/A for nonresidents), and Hunt/Fish Combination Licenses ($57/resident, $160/nonresident). Yearly licenses are valid for 365 days from the day of purchase. The department also offers a Short-term Combo Hunt & Fish License with a daily fee ($15/day for residents, $20/day for nonresidents).

An Arizona icon—Gila Monster (*Heloderma suspectum*), Pima County. As a state-protected species, it may not be legally taken (full definition of “take” given in article text). Photo by the author.

Means of take allowable for reptiles and amphibians are by hand, catch-pole, snake hook, snake tongs, pit traps (if checked daily and dismantled properly after use) and dip nets. Contrary to popular belief, road cruising at night, a popular method of searching for reptiles, is not a legal means of take in Arizona. Arizona Game & Fish Commission R12-4-318 clearly states that a person may “use artificial light while taking reptiles if the light is not attached to or operated from a motor vehicle, motorized watercraft, watercraft under sail, or floating object towed by a motorized watercraft or a watercraft under sail.” With that said, I have personally never heard of this particular regulation being enforced before and has never caused any problems for me even after having had many interactions with AZGF law enforcement officers in the field. During a personal communication with AZGF Region VI Supervisor Jay Cook some years back, I asked about the legality of road cruising using headlights and he replied that the main concern behind that particular regulation was that
AZGF does not want people to spotlight or use firearms from their vehicles as a means of take. He also went on to explain that the manner in which it is written certainly does, in essence, outlaw road cruising at night but that it is up to the individual law enforcement officer’s discretion as to how to interpret the regulation.

The Details

Commission Orders 41, for amphibians, and 43, for reptiles state that the season for hunting reptiles and amphibians in Arizona is open from January 1st through December 31st in all open areas, except for protected species and certain areas with specific restrictions. Rather than go into the minutiae here, I’ve decided to provide a basic overview of how to read the regulations, which can be viewed here: https://www.azgfd.com/PortalImages/files/regs/ReptileAmphibian.pdf. Please keep in mind these regulations are for 2015-2016, but any subsequent regulations publications can easily be obtained at https://azgfd.com/. In the following paragraphs, I will only focus on Commission Order 43, but Commission Order 41 can be deciphered in the same manner.

Commission Order 43: Under the General Reptiles regulations chart, Subsections A-D detail the Open Season Dates, Notes applicable, designated Open Areas, types of Legal Reptiles, and Bag and Possession Limits. Subsection E details the reptiles that are protected in Arizona and may not be legally taken (it is imperative to remember the broad definition of “take” at this point). This list includes Phrynosoma mcallii (Flat-tailed Horned Lizard), Heloderma suspectum (Gila Monster), Crotalus lepidus (Rock Rattlesnake), Crotalus pricei (Twin-spotted Rattlesnake), Crotalus willardi (Ridge-nosed Rattlesnake), Sistrurus catenatus (Massasauga), Thamnophis eques (Mexican Garter-snake), Thamnophis radixpunatus (Narrow-headed Gartersnake), Gopherus agassizii (Mojave Desert Tortoise), Gopherus monticola (Sonoran Desert Tortoise) and Terrapene ornata (Ornate Box Turtle). Lampropeltis triangulum (Milksnake) is protected only in Cochise County.

As an example, if I want to know what regulations apply to Sonora semiannulata (Groundsnake), I would first look to see where they are listed under the Legal Reptiles column. After seeing that they fall under Subsection C, I now know the Open Season Dates are from January 1st – December 31st, that Notes 1, 3, 8 11, 12, 13, 23, 27, 31, 32, & 33 apply to them, that they may be taken Statewide, except Open Areas restrictions listed in Notes 12, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, and 30, and that I can take 20 per day or have up to 20 in my possession, alive or dead. It is important to pay careful attention to the given Notes and Open Area restrictions, which are listed directly underneath the charts.

Now let’s try the same for Crotalus cerastes cerobombus (Sonoran Sidewinder). A cursory glance reveals that C. c. cerobombus is not specifically mentioned under the Legal Reptiles column or Box E. Therefore, it falls under the “All reptiles, except those mentioned in Subsections B, C, D, and E.” We now know that
C. c. cerobombus belongs in Subsection A and can glean the necessary info through the Notes, Open Areas designations, and Possession and Bag Limits.

The Limited Weapon chart of Commission Order 43 refers to the regulations and guidelines of using weapons to take reptiles. Since that is not the focus of field herping, I will not focus on it other than to say it can be read exactly in the same manner as described above.

Sonora Mud Turtle (Kinosternon sonoriense sonoriense), Maricopa County. Photo by the author.

Conclusion

I hope this brief introduction to Arizona’s reptiles and amphibian regulations serves to help the reader better understand them and I encourage anyone interested in the subject to delve further into the AZGF publications to learn more. It should go without saying, however, that neither I nor any members of the SWCHR are offering this article as a substitute for individual research and understanding of the regulations. In fact, it is up to the individual field herper to perform their due diligence in understanding the laws, as well as their own ethical and moral obligations, before they partake in any activities that are governed by AZGF. With that said, the rugged beauty of Arizona and its unique and rich diversity of herpetofauna certainly make it a worthwhile endeavor to experience it first-hand. I hope all responsible herpers are able to do so safely, and legally.

Balancing Ambient and Artificial Lighting: A Powerful Technique to Improve Your Field Photography

by Juan C. Lopez-Johnston
http://lopezjohnston-photography-instructor.blogspot.com

How many times have you experienced deep frustration because you were in the field taking pictures of your favorite reptile, and the images did not come out as expected? It happens a lot, more than what we may want. As reptile enthusiasts, we face a unique double challenge. On one side, the need to learn how to properly handle reptiles to minimize their stress (and our stress too!) in order to get the best possible pose of the animal (if we are stressed, the animal does not respond well to our manipulation); and on the other side we need to learn basic photographic principles and special techniques to fully capture the essence of these amazing creatures. In this article I want to share with you some technical photographic aspects for capturing the images. But do not worry! These are easy-to-understand techniques requiring minimum equipment (which could even be made yourself if you understand what it’s all about.

This article follows a step-by-step, informal conversation-like structure. I will introduce a topic and then the concepts (highlighted in bold) supporting the topic. Why do you need all this technical foundation? Simply put, in order to move forward in the quality of your images there is no such thing as merely “taking a picture.” In photography you make your image, so you need a good conceptual foundation to construct your final product. I am starting with basic concepts of photography to allow novices to build up a foundation and be able to take advantage of this information. Those with technical knowledge, please be patient, view this as a refresher of the concepts, and I hope you can get something new from this article.

Let’s start with basic definitions. The first term I want to talk about is photography. The word photography means “to paint (graph) with light (photo).” Why is this important? Because it is light which physically imprints the image on a light-sensitive material (negative film and papers in the past, and light-sensitive electronic devices today). From now on, light and its behavior becomes the main subject of our attention. I have found a very common belief among my photography students that relates the equipment and gadgets with the quality of the images. This is only true under certain circumstances. Let me be straightforward with you: even though equipment is clearly important, it is also true that all the most expensive and technically advanced equipment in the world means nothing if we, as photographers, are unable to properly “read and use the
light.” On the other hand, the most inexpensive, apparently trivial, and quotidian gadgets may become most useful tools if you understand the light. Learn to see the light, feel its force all around you—become one with it! Free your mind! Then, your pictures will get better!

Understanding light is the critical component to quality photographs. Here, the photographer takes advantage of natural light. Photo by the author.

I mentioned above that photography is about light, so how many kinds of light are used in photography? There are four basic types of light: a) natural light, b) artificial light, c) continuous light, and d) intermittent light. Natural light (Fig. 1) comes from the sun, while artificial light comes from any man-made artifact. In general, natural light changes throughout the day, from one minute to the next (here we start to see where technical photographic challenges come from). It changes in color, direction, and intensity from morning to afternoon. The natural light “is what it is” at the time of creating our image—we cannot decide its color, direction, or intensity. Nevertheless, we can learn to use and modify what is available for our benefit.

The light and its behavior: Natural light

![Fig. 1. Properties of natural light. Illustration by the author.](image)

Artificial light (Fig. 2) is another story. Its emission is stable and does not change its properties unless the source changes. When using artificial light for photography, we can customize color by changing the bulb or by using filters; we can change intensity by moving it closer to or farther from the subject, or by using diffusers to make it soft; and we can change the direction by moving the lamp/source to another place around the subject.

The light and its behavior: Artificial light

<table>
<thead>
<tr>
<th>&gt; Direction: Where the light comes from relative to the front of the subject.</th>
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<tbody>
<tr>
<td>&gt; No modifiable.</td>
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<td>&gt; Temperature depends on the time of the day.</td>
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<td>&gt; Require perfect plan in advance.</td>
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<td>&gt; Know the magic hours.</td>
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![Fig. 2. Artificial light. Illustration by the author.](image)

Light is continuous when it is emitted as a constant stream (no pulses), such as from the sun or a tungsten light bulb. Conversely, light is intermittent when it is emitted as pulses, such as from camera flash or a fluorescent light bulb. The available light as can be inferred by its name, is the continuous light present at the time of creating our image. The available light can be natural (as in the field or indoors through a window), artificial (from light bulbs), or a combination of both.

I briefly mentioned above three other concepts: a) color, b) direction, and c) intensity. These concepts are known as the basic qualities of the light (Fig. 3) and apply to both natural and artificial light. I will only elaborate on the concepts of direction and intensity as the most relevant qualities for the purpose of this article. The direction of the light is defined by where the light comes from—where the source of the light is located in relation to the subject of the image. (See Fig. 4).

![Fig. 3. Basic qualities of light. Illustration by the author.](image)

As an example of how the direction of the light changes the appearance of the subject, pay attention to the image series in Fig. 4. I used a speed light, moving it to different positions in order to change the direction in relation to the subject and the camera. Note how the overall appearance of the same subject changes significantly just by changing the direction of the light! The yellow arrows indicate the direction of the light beam from the flash.
Fig. 4. From what direction does the light originate? Photos by the author.

The light in the upper left frame is coming from the right side. The light in the upper right frame is coming from the front of the subject, almost parallel to the camera. Observe how the direction of the light makes the snake’s eye look different. In the case of the lower left frame, I used a combination of two lights from the previous examples, where one flash is positioned in front of the subject as in the upper left frame, and the other flash is positioned as in the upper right frame. Here you see how the “mood” of the image changed again. Finally, the lower right frame shows how light from above the subject again changes the mood of the image. As you can see, the direction where the light originates defines the mood of the subject in the image.

Continuing with the properties of the light, **intensity** describes the strength of the light beam falling over the subject. The light is “hard” when it produces harsh shadows on the subject, and it is “soft” when it produces soft shadows on the subject. The intensity of the light changes from being hard, when the light directly hits the subject, to soft, when the light is scattered by clouds in the case of natural light, or a diffuser in the case of artificial light (Fig. 5).

Fig. 5. Diffusion is the scattering of direct light by making it pass through a non-transparent material of bouncing it off a semi-reflective surface, as shown with this homemade diffuser. Photo by Dwight Sipler; used under Creative Commons license 2.0.

The following images illustrate this concept in a more visual way. The first is a studio image (Fig. 6) made using a speed light. As you can see, the shadows produced by the intense and directional light are “hard.” The difference between the lit side of the subject and the darker areas is evident.

Fig. 6. *Porthidium lansbergii*, Guajira Peninsula, Zulia State, Venezuela. Photo by the author.

The second image (Fig. 7) was made in the field, under the shade of a forested area. The intensity of the light falling all over the area is “soft” and uniform, with no virtual difference between the lit side of the subject and the darker areas of the image.

Fig. 7. *Bothrops isabelae*, Burro Negro Recreational Park, Zulia State, Venezuela. Photo by the author.

The importance of gaining awareness about the light falling over the subject and its surrounding areas, and how it affects the image, is to learn to see the patterns of light and shadows produced. The camera does not think; it only reads the light and calculates the right combination of what we call the camera settings. **You** are the one analyzing the composition and pressing the shutter release button, which is the last instance to make decisions to create your image.
A last group of fundamental definitions I want to introduce concern the three settings we need to learn to control basic functions of the camera, the aforementioned camera settings. Here I refer to a) the **shutter speed**, b) the **aperture**, and c) the **ISO**. Remember, photography is about the amount of light that reaches the light-sensitive device in the camera (the sensor) to imprint an image. Imagine light as a stream of liquid (water) filling a bucket (sensor). You may fill right to the top, overfill, or underfill the bucket. If the amount of light exactly “fills” the sensor, you produce a “well exposed image”—the amount of light produces proper colors, tones, and shadows. If the amount of light reaching the sensor is lower than the optimum amount, the image produced is dark and the image is underexposed. On the other hand, if the amount of light reaching the sensor is more than the optimum (overfilling the bucket), the image produced is excessively bright; color and shadows are washed; and the image is overexposed. See how I purposely italicized the word *amount*. I did this because the amount of light needed to produce a well-exposed image is always the same—regardless of the camera, lens, brand, and technology. In other words, the camera settings I mentioned above are universal to any kind of photographic device, and all three settings work together in a delicate balance to control the amount of light that reaches the sensor.

I previously asked you to think of the light as a stream of fluid filling a bucket (the sensor). Now, I want you to think of the mechanisms of the camera settings as gates that open and close to allow the light to pass into the camera. Two of the settings, the **shutter speed** and the **aperture**, work as independent gates that open and close in a synchronized fashion to allow the light to pass. The **shutter speed** is the speed (in fractions of a second) at which a tiny curtain system opens and closes to allow the light to pass to the sensor when you press the shutter release button. This curtain system is called the [shutter or obturator](Fig. 8). In general, it simply works by opening to allow light to reach the sensor, and closing to cut the light passing to the sensor. As the time the shutter remains open increases, the **shutter speed** is slower, and the greater the amount of light reaching the sensor. The faster the shutter opens and closes, smaller the amount of light that reaches the sensor. Summarizing, the shutter controls the amount of time a certain amount of light is passing to the sensor. This will become clearer when we discuss the concept of **aperture**. The image below is of a film camera, but the configuration is exactly the same as in a digital one; the only difference is the use of a sensor instead of film. Note how the shutter is located just in front of the film. The light enters to the camera through the lens, passes the mirror, and reaches the film (sensor) when the shutter opens.

The shutter speed is measured in seconds, from 30 seconds or more, to 1/8000 of a second or less, depending on the camera model. (Fig. 9)

**Shutter speed:**

*Effective time length a camera’s shutter is open*.

**Fractions of one second:**
- Fractions of half of a second.
- Fractions of a third of a second.

**Two synchronized curtains:**
- Front curtain.
- Rear curtain.

<table>
<thead>
<tr>
<th>Most common shutter speeds</th>
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*Fig. 9: The shutter speed.*

The second setting to control the amount of light entering to the sensor is the **aperture**. The **aperture** (expressed as “f number” or “f stop”) is a numerical value with units relative to the diameter of the opening of the “iris-like” gate located as part of the mechanism of the lenses in single-lens-reflex cameras, as part of the body of the camera in other models, in front of the shutter. The mechanism that opens and closes to control the light is called the **diaphragm** (Fig. 10). As you can see in the image, the iris-like shape of the opening of the diaphragm allows the light to pass as a narrower or broader beam.

**Diaphragm:**
- Group of circular iris-like blades that controls the amount of light entering to the camera.

**Aperture:**
- Relative diameter of the opening of the diaphragm.

**f number:**
- Units of measurement of the aperture.
- Ratio between the diameter of the opening diaphragm and the focal length of the lens.

<table>
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<tr>
<th>f number</th>
<th>1</th>
<th>1.4</th>
<th>2</th>
<th>2.8</th>
<th>4</th>
<th>5.6</th>
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<th>11</th>
<th>16</th>
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<td>1</td>
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*Fig. 10: The diaphragm, the aperture value and the “f number” (or “f stop”).* Illustration by the author.
The narrower the diameter of the diaphragm, the narrower the beam of light and the lower the amount of light reaching the sensor (Fig. 11). Conversely, the wider the diameter of the diaphragm, the wider the beam of light and the greater the amount of light reaching the sensor. Recall the idea of thinking of light as a stream of water. In this case, the diameter of the opening of the diaphragm allows more or less “water” to pass, depending on width of the iris.

**Speed of a lens:**

![Image](image.png)

Fig. 11. The “f number” or “f stop.” Illustration by the author.

If the shutter controls the amount of time that the light reaches the sensor, the diaphragm controls the amount of light that passes to the sensor. Be aware that we are discussing two different “amounts”—until now, we discussed the amount of light that passes through the diaphragm and also the amount of time the shutter allows light to pass from the diaphragm to the sensor. Both the aperture and the shutter speed work coordinated as a single joint mechanism to allow a certain amount of light to pass during a certain amount of time to produce a well-exposed image. Remember that the right amount of light needed to produce a well-exposed image is always the same; what changes is the combination of values of aperture and shutter speed.

Light → Diaphragm (amount of light) → Shutter (amount of time) → Sensor

How do shutter speed, aperture, and ISO work together to produce a well-exposed image? The ISO establishes how sensitive the sensor is to the light. The diaphragm closes up to a certain aperture, allowing a certain amount of light to pass through. Finally, the shutter speed determines how long (in fractions of seconds) the light is allowed to reach the sensor. Shutter speed, aperture, and ISO work together in a very close relationship known as the “exposure triangle.” Each one of the three values is linked to the other two.

If one value changes, at least one of the other two must also change to keep the same exposure value. For example, if I change the ISO value from 50 to 100, I need to change either aperture or shutter speed to keep the same exposure value. Now, in what order should you set your camera parameters? I personally first set ISO, because this value depends on the amount of light available. If it is dark, I choose a high ISO, but if it is a very bright day then I choose a low ISO. NOTE: The actual phenomenon about how the exposure triangle works would require an entire article itself in order to provide a thorough and more understandable explanation.

Until now, I have described these fundamental concepts as separate pieces of a puzzle. Now, let’s begin to put them together. Among the main challenges we all face in the field (among others beyond the scope of this article) is how the direction and intensity of the light affects the final image. How many times we have taken a picture and the subject is overexposed (too dark) or underexposed (too bright), but the landscape of the image is well-exposed? This is where learning to balance the natural and artificial light comes into play.

The light meter is an internal photosensitive sensor that measures the amount of light coming through the lens into the camera, and in turn can set a range of proportional combinations of shutter speed (time the shutter is opened) and aperture (diameter of the diaphragm) to produce a well-exposed image. When we work in Manual Exposure mode, we need to set the proper combination of aperture and shutter speed ourselves to produce a well-exposed image based on the information provided by the light meter. The optimum combination of aperture and shutter speed values depends on the direction of the source of light relative to the camera (Recall Fig. 5). In the field, we have the sun. But it is also possible to add one or more lights to the composition to create different effects as if we were in a photography studio (Fig. 12). Here we will introduce the use of the automatic flash.

Most of our cameras have a built-in flash. We use flash when the light conditions are poor and we need more general lighting on our subject. What would you think if I tell you professionals also use the flash under sunny conditions? Yes, that sounds
strange but it is very common. The light of the flash is used to lighten the shaded areas on the subject produced by the sun. It is important that the flash matches the ambient light, meaning the ambient light and the flash have the same intensity.

In order to produce a good quality image in terms of lighting using more than one source of illumination, it is necessary to set the right intensity proportions for each source (natural and artificial). The process of setting the output of the artificial lights (flash, or speed lights) to match the intensity of natural light to produce a natural-looking effect is called balance of lights. In general, the natural light is our reference point to adjust aperture and shutter speed. Then, we adjust the power output of the flash until the intensities of the natural light and the flash match each other. This way the overall composition of the image gains a more natural appeal. Of course, as we cannot intentionally change the intensity of the sun; we must set the output of the flash and the camera settings (aperture, shutter speed, and ISO) to match the intensity of the sunlight (Fig. 13). In this case, the snake in the foreground and its habitat in the background are displayed at the same light intensity because the snake was illuminated with a flash.

The most convenient position for a light source is behind the photographer, facing the subject (frontal light). Under this situation, the subject and the background are equally exposed—we set the proper aperture and shutter speed and press the shutter release; no flash is needed. On the other hand, when the natural light comes from behind the subject, toward the camera, the image is backlit—the background may seem well-lit, but the subject is dark. Under these conditions, we take advantage of the flash to light the subject. In Fig. 14, the snake is in a darker area than the background (the background is more illuminated). The camera was adjusted to the light of the background; the image was created with no use of flash, resulting in an underexposed snake.

How do we deal with this challenging lighting situation? I will give you some straightforward instructions as reference. They are not universal to every situation, but in order to master the “balance of lighting” technique it is very important to do your best to understand the fundamental concepts discussed above. The step-by-step reference instructions are as follows:

1) Analyze the lighting situation of your subject. Is the subject evenly lit? Is it lit from the front, side, back, and/or top? Each situation is different, and opens opportunities for different outcomes. The easiest approach to challenging lighting situations is to move to another angle that favors your picture whenever possible. For example, you can change to another
angle to where the light hits the subject from the front (Recall Fig. 4).

2) Analyze the lighting situation over your entire area of framing. This is important to provide guidance to define your aperture and shutter speed settings. It is also important because it can help you define which areas to include and what to leave out of the framing of the final image. Are your subject and the areas in the foreground, middle, and background all evenly illuminated? If “yes,” then chances are your image will look good. After taking the photograph, are you going to frame all three areas, only two areas (e.g. foreground and mid-range), or are you going to crop tightly to the subject? This is your compositional call; just make sure to choose the appropriate camera settings for what you want as your result. Of course, a simple solution is that whenever possible, move your subject to an evenly illuminated area; but we know that cannot always happen.

3) If the subject is darker than the surrounding areas, set your exposure (aperture and shutter speed) to the brightest area, set the flash to automatic function or “always on,” re-frame to your subject, and press shutter release button.

Let me share some examples. In Fig. 15, the image is cropped tightly, but there is space in the background that is underexposed in relation to the plane of the subject. I set the aperture and shutter speed to the background, and let the flash add enough light to fill in the snake.

The next example used Abronia lythrochila as the subject (Fig. 16). Again, the flash was used after adjusting aperture and shutter speed, exposing for the background. This technique is very versatile as it allows for different creative scenarios under the same natural lighting conditions.

Fig. 15. Cerrophidion tzotzilorum (Mexico). In this image, the snake is originally in a less-well-lit area in relation to the amount of natural light illuminating the background. In order to appropriately illuminate the snake light, I added a frontal light (using flash) to balance the lighting of the snake with the background. Photo by the author.

Fig. 16. Abronia lythrochila. In this image, the camera settings were adjusted for the well-lit background, and the subject was filled with flash. Photo by the author.

The following image (Fig.17) of Cerrophidion tzotzilorum features the same animal and staging as Fig. 15. As we can see, the background is very dark when compared with the background of Fig. 15. Changing the camera settings and adjusting the flash output makes it possible to modify the final result, producing a different “mood.”

This covers the fundamental concepts of photography, light, and camera settings. As you can see, photography is far more than just pressing the shutter release button and expecting a good image. Photography is a blend of technical details that, when brought together using the right combination of each, produce great results. Each basic concept I have shared here is part of that final blend, but I cannot cover all the technicalities in just a short article. Read, read, read and study; practice, practice and practice until you are capable of getting the images you dream of your favorite reptile.
Some final thoughts: always respect your reptiles; no picture is worth unnecessary stress for the animals. Remember to especially respect all venomous critters, as one of my students quoted once: “you may think you are in control, but they still have the power.” No picture is worth an unnecessary bite. Finally, “keep away from the fangs but not from the fun!”

In what is the fifth and presumably the final herpetologically-oriented volume of the University of Texas Press’ “Texas Natural History Guides,” Troy and Terry Hibbitts undertake to cover the thirty-one species of turtles and the single species of crocodilian native to the state. The style and layout of this newest book is identical to that of the previous volumes in the series, especially the two in which the Hibbitts family have been involved as authors. Its physical dimensions are consistent with the other entries in this series (7.5” x 4.8” [19 cm x 12.2 cm]), allowing it to be comfortably carried into the field, especially in the spacious pockets of cargo pants. The durable-appearing cover and binding also contribute to its field-worthiness. In short, anyone acquainted with the earlier offerings in this series will feel immediately familiar with this newest one.

In content, the reduced number of species included allows for an expanded introductory section (91 pp.), which includes, in addition to the usual preliminary topics, an extensive description (including photos) of eight major river drainage systems in Texas. This is particularly useful since the vast majority of the species covered in this book are aquatic or semi-aquatic and their distributions and habits are significantly affected by the drainage systems they inhabit. The extensive introduction also provides detailed information for those who might wish to collect, photograph, or simply observe these animals in the wild. The labyrinthine state regulations for collecting and possessing turtles and alligators within the state are effectively discussed in what is an eminently readable preamble that would benefit many enthusiasts to thoroughly peruse.

Most of the species accounts are at least three pages in length and contain three to five large, clear photographs. The photography in this volume is exceptional, which should not be surprising considering that both authors—who provided almost all of the photos themselves—are accomplished photographers. The shots selected generally provide examples of the most common variations in phenotype encountered, and most feature specimens originating from Texas.

Each species account includes, in addition to the photos, a range map of the shaded outline type superimposed over a county map of the state as in the two preceding volumes in this series. These maps appear to be the most accurate range depictions currently available in a non-technical publication, particularly so with regard to those species restricted to specific drainage systems.

The range maps are followed by brief sections on size, general description, similar species, natural history, reproduction, and comments and conservation. While it is, of course, beyond the scope of a field guide to provide detailed natural history information, this guide does an admirable job of presenting a concise digest of salient natural history facts for each species.
In the “Comments and Conservation” segment of each species account the state and federal endangered or threatened status of the animal is listed, along with the authors’ personal observations on population trends within the state.

Considering the outstanding photographic resources provided in this book, the average user should seldom feel the need to resort to the provided dichotomous identification keys, which, in my experience, most novices find somewhat intimidating anyway. The keys, however, if navigated successfully, will take one to the appropriate species (but not the particular subspecies).

In keeping with the trends established early-on in this series, the taxonomy used in this volume remains refreshingly conservative, with the authors declining to adopt two recent taxonomic proposals that they consider unsupported or controversial. Thankfully, they thoroughly explain their decisions to deviate from these proposed “standards” (i.e., Crother et al. 2012) in their introduction. Those deviations are as follows:

1) They retain Texas populations of the Eastern Box Turtle (Terrapene carolina) within that species, rather than accepting the recently proposed elevation of the Texas subspecies tringuis to full species status. This is due to that proposal being based primarily upon mitochondrial DNA sequencing, as well as their own observations that specimens from southeastern Louisiana and Mississippi appear to be morphologically intermediate between the purported eastern and western “mitochondrial species” (this actually conforms with the opinion expressed in the latest entry in the SSAR database). Unfortunately, for readers who might want to consider the evidence for themselves, the authors did not cite the paper in which those proposals appeared (Martin et al. 2013, but see also Fritz and Havaš 2014).

2) The recently proposed elevation of the southern populations of the Painted Turtle (Chrysemys picta) to full species status (as “C. dorsalis”) is considered unwarranted since, again, phenotypic intermediates exist between the two populations in question, suggesting that ample gene flow between them is present. However, in the species accounts the two widely separated Texas populations of this species are all treated as C. picta, with no mention that they have traditionally been considered to belong to different subspecies, the Southern (C. p. dorsalis) and the critically endangered (in extreme west Texas) Western (C. p. bellii). Again, the actual paper proposing the Painted Turtle split is not cited (Starkey et al. 2003), although this detail seems relevant, even in a field guide context, when that field guide is pointedly differing from the current version of taxonomic orthodoxy.

The Hibbitts also advise the reader that the taxonomy of the river cooter complex (Pseudemys spp.) is currently in disarray and that revisions should be expected in the near future.

This new guide also deviates from two newly proposed “standard” common names (Crother et al. op. cit.), especially where they replace names that have long been in use and/or where the newly proposed names are more confusing than existing ones:

1) The long-recognized common name “Stinkpot” is retained for Sternotherus odoratus over the newly-proposed “Eastern Musk Turtle,” which the authors maintain is too easily confused with the Eastern Mud Turtle (Kinosternon subrubrum).

2) The traditional name “Ouachita Map Turtle” is retained for Graptemys ouachitensis on the grounds that even though this species is much more widely distributed than the Ouachita River drainage system, the proposed replacement name, “Southern Map Turtle,” could also apply equally well to almost any species of the largely austroriparian map turtle complex.

Separate indices are provided for common and scientific names only, but other general topics must be located within the contents section of the extensive introduction. There is a four-page glossary at the end of the book and a very short bibliography is provided, which curiously includes Lindeman’s (2013) monograph on the map turtles, but omits a reference to similar works by Rose and Judd (2014) on the Texas Tortoise and Dodd (2001) on box turtles.

This book also includes five appendices. Appendix A provides an account of the relictual Boslon Tortoise (Gopherus flavomarginatus), which occurred in Texas during the Pleistocene and early Holocene epochs. Appendix B deals with two Nonestablished Exotic Species, the African Spurred Tortoise (Geochelone sulcata) and the Spectacled Caiman (Caiman crocodilus), that occasionally show up as escaped or released pets. Appendix C is a table of the turtles and the alligator and the river drainages they inhabit. Appendix D is a partial list of additional resources that can be contacted for additional information on these animals. Presumably, most of these organizations are to be contacted via the internet, although the urls of the state, national, and international societies, as well as the three listed museums, are not provided. A search engine inquiry for several of the state organizations listed yielded links that were either deceased or had not been updated for several years. Among increasingly popular citizen science resources, only the iNaturalist “Herps of Texas” site is mentioned, although the equally useful H.E.R.P. database (http://www.naherp.com/) is not. Appendix E consists of a large county outline map of the state, which will prove invaluable for users unfamiliar with the geography of the state.

In conclusion, Texas Turtles and Crocodilians: A Field Guide, by Troy and Terry Hibbitts provides a fitting completion to an exceptional series of guides to the herpetofauna of Texas, one that is unequaled by any other sequence of field guides for any
other state in the country. This particular volume substantially eclipses its nearest competitor, the out of print field guide by R. D. and Patricia Bartlett (1999, which also included lizards) in every category: text, photos, range maps, and even physical construction. Consequently, congratulations are extended to the University of Texas Press for undertaking the publication of this excellent series and especially to the talented and eclectic collection of authors (professional and avocational) who assembled these outstanding guides. They will be cherished by serious Texas herpers and will long stand as tributes to those four authors who are no longer with us: Andrew H. Price, John E. Werler, James R. Dixon, and Bob L. Tipton.

Literature Cited


SWCHR CODE OF ETHICS

As a member of the Southwestern Center for Herpetological Research, I subscribe to the Association’s Code of Ethics.

Field activities should limit the impact on natural habitats, replacing all cover objects, not tearing apart rocks or logs and refraining from the use of gasoline or other toxic materials.

Catch and release coupled with photography and the limited take of non-protected species for personal study or breeding use is permitted. The commercial take and sale of wild-caught animals is not acceptable.

Collecting practices should respect landowner rights, including but not limited to securing permission for land entry and the packing out of all personal trash.

Captive-breeding efforts are recognized as a valid means of potentially reducing collection pressures on wild populations and are encouraged.

The release of captive animals including captive-bred animals into the wild is discouraged except under the supervision of trained professionals and in accordance with an accepted species preservation or restocking plan.

The disclosure of exact locality information on public internet forums is discouraged in most circumstances. Locality information posted on public internet forums usually should be restricted to providing the name of the county where the animal was found. When specific locality data is provided to one in confidence, it should be kept in confidence and should not be abused or shared with others without explicit permission.

Other members of the Association are always to be treated cordially and in a respectful manner.