

And will birds sing? A biography of Julie Savidge

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Abstract. Julie Savidge was among the first small but significant tranche of women field biologists. Her PhD research on the Pacific Island of Guam, published in 1987, stands as a textbook example of ecological problem solving and the first example of the devastating impact of an introduced reptile on an island fauna, the consequences of which continue today. Yet, her findings initially were strongly and publicly challenged. This paper is a brief biography of Julie, as one of the more successful of those pioneer women conservation biologists to work in the Pacific region. It tracks her early life, her influences and career path, and her struggles to balance work and family, particularly in the stressful world of academia.

Keywords: conservation biology, field biologist, invasive species, indigenous knowledge, island management, reptiles, Pacific islands, wildlife research.

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Introduction

Not many people hit a scientific home run as a PhD student, but Julie Savidge did. Her 1986 dissertation (Savidge 1987) convincingly demonstrated why birdlife was disappearing on Guam, the largest island in Micronesia, and the culprit was novel.

By the 1960s, biologists were hearing fewer bird songs in Guam's dense forests, eerily supporting Rachel Carson's compelling environmental degradation metaphor, 'silent spring,' a consequence of the impacts of excessive pesticide use (Carson 1962). Yet pesticides were not the culprit on Guam, even though during and after World War II the US military regularly sprayed the island with dichlorodiphenyltrichloroethane (DDT). After DDT was banned, the military and agricultural producers switched to pesticides that did not persist in the environment (Grue 1985).

The other main suspect was a non-species-specific infectious disease. Avian malaria had decimated many populations of native birds on the Hawaiian Islands and for many endemic Hawaiian forest birds, pox is often crippling or fatal (Warner 1968; van Riper *et al.* 2002). So, when Julie started her PhD, the scientific and management communities were convinced disease was the indiscriminate killer on Guam, even though supporting evidence was lacking.

With Bob Beck, a biologist with Guam's Division of Aquatic and Wildlife Resources (DAWR), hired to lead the conservation effort of saving Guam's rare species, Julie spearheaded one of the most inventive sleuthing projects in conservation biology (for an excellent detailed account of this story see Jaffe 1994).

Early life

Julie is not the daughter of detectives or scientists, nor did she grow up immersed in Nancy Drew mysteries. She is an urban, California girl, born in Long Beach in October 1953. In the 1950s, Long Beach had ~ 250 000 people and was nicknamed 'Iowa by the Sea' or 'Iowa under Palm Trees' for its slow pace compared with neighbouring Los Angeles. Julie's parents, Zona Heggen and Norm Savidge, were part of the sweeping wave of immigration to California after World War II – drawn by the climate, beaches and employment opportunities. They arrived independently from North and South Dakota, respectively, met in Long Beach, and married in 1950.

The couple bought a ranch house in the Long Beach neighbourhood of Naples: three, human-constructed islands in Alamitos Bay, a Pacific Ocean estuary. Zona took a brief maternity leave when Julie was born and gradually returned to her high school teaching job part-time. She hired a nanny to help with childcare and her parents, who moved nearby when they retired, also helped care for the kids. Unusually, Zona had an MA (Master's of Arts) in Education and Norm a BS (Bachelor's of Science) in Civil Engineering – in 1950 only 6.2% of US residents over 25 had earned bachelor's or advanced degrees (7.3% of men and 5.2% of women).¹ Clearly, Julie was expected to attend college.

Once old enough, Julie was at the beach at every opportunity – swimming, fishing, boating, body surfing and sun bathing. She spent her summers exploring the waterways surrounding Naples. Her love of swimming and beaches stimulated a lifelong

Research Front: Women in Conservation

¹US Department of Commerce, Census Bureau, US Census of Population: 1960, Vol. I, Part 1; J.K. Folger and C.B. Nam, Education of the American Population (1960 Census Monograph); Current Population Reports, Series P-20, various years; and Current Population Survey (CPS), March 1970 through March 2013. (This table was prepared February 2014.)

interest in nature, but at this young age she was not considering a career linked to the ocean.

Julie's idyllic childhood ended during her junior year in high school, when Zona was diagnosed with lung cancer and passed away at the age of 51. Her death had a profound effect on the entire family. 'As a defence mechanism I partitioned my Mom's death into another part of my brain to be dealt with in the future. I also became less focused on my social life and started thinking about more existential questions,' Julie says.

Education and early career

Julie was ready for an adventure that would take her away from California. She decided to take flight for the Rocky Mountains. She liked the idea of attending a big university and was torn between the University of Utah, University of Colorado and Colorado State University (CSU). She and Norm went on a college tour in 1969 and CSU, Colorado's more conservative land-grant university, located in Fort Collins, became the school of choice.

During freshman year, Julie vacillated between veterinary medicine and zoology. She ruled out veterinary medicine after volunteering for a veterinarian in Boulder the summer after her sophomore year. She wasn't comfortable with some of the procedures routinely done by vets, e.g. putting animals down, declawing, tail docking. Also, much of the work seemed rather routine. In contrast, she enjoyed her zoology classes particularly the labs and field trips. 'Before Ecology the only birds I knew existed were gulls – these were the only birds I noticed growing up. This class, along with Mammalogy and Herpetology, really expanded my view of the world and its diversity.' By junior year, Julie was a committed Zoology major with a keen interest in vertebrate ecology. In a personality sketch she wrote for a psychology class in her senior year she wrote, 'I am applying to graduate schools and hope to eventually receive a MS [Master of Science] and PhD [Doctor of Philosophy] in wildlife conservation. Ultimately, I want to teach at a university, perhaps write a book concerning wildlife, and travel. My most pleasurable time is spent outdoors observing animals or collecting plants'.

She graduated from CSU with a Bachelor of Science degree in 1975. In her graduating class, 28 of the 83 zoology majors were women. Julie never encountered gender discrimination as an undergraduate. There were never any menial assignments or gofer requests; she shared the classroom with other young women and men and the faculty treated her fairly. Thoughts like 'What am I doing here? Why don't I listen to Dad and switch to Home Economics where I'll have more friends?'² never crossed her mind. Nor did it occur to her to question the highly skewed faculty sex ratio (25 men:1 woman) common globally in science departments at that time. Today the sex ratio is reversed: the fall 2018 enrolment in Zoology was 428 women and 108 men.³

At CSU, Julie met her future husband, Tom Seibert. She and Tom, both freshmen, shared a few classes and developed a typical flirty teenage friendship. They began dating as sophomores and married 6 years later after completing their MS degrees.

The year Julie started university the United States Congress passed the National Environmental Policy Act, creating an entirely new industry – ecological consulting. A pioneering private firm in Fort Collins, Ecology Consultants Inc., hired Julie the summer she graduated. Her job was to collect wildlife data for the Environmental Impact Statement for proposed oil shale developments in northwestern Colorado. She was sent into the field a few days after she was hired. 'Suddenly, I realised with horror I had to drive a standard pick-up 300 miles across Colorado to the field location. I was a city girl – and my driving experiences were restricted to short trips near my home with the family car which had an automatic transmission. I smiled confidently and said, 'No problem!' Then asked if I could pick up the truck the day before I left as I was a bit rusty using a stick shift.' With Tom's help and some gear grinding she got the truck to western Colorado. She and the truck survived her first field season.

Encouraged to continue her education by several CSU professors and graduate students, Julie's top choice was the University of California, Berkeley, CA, USA (hereafter Berkeley), a US epicentre of political and cultural diversity. It would be a radical change from Fort Collins. She would also be within driving distance of Tom who would be ~ 900 km north pursuing an MS in Entomology at Oregon State University, Corvallis, OR, USA.

What about an advisor? She looked at faculty names and recognised A. Starker Leopold, Aldo Leopold's oldest son.⁴ Leopold was an iconic name in US wildlife ecology and management and Starker was a Professor of Zoology and Forestry in the Department of Forestry and Conservation at Berkeley.⁵ Starker's outstanding achievements in scholarship and conservation paralleled those of his eminent father and, like his brother Luna and sister Estella, he was elected to the U.S. National Academy of Sciences (Raitt 1984; McCabe 1990). When Julie called Starker to query him about graduate opportunities, he was close to retirement, but he told her that he might accept one more student. Julie was determined: 'I decided he needed to meet me, so I jumped on the train to San Francisco. Starker was impressed that a young woman took the initiative (and spent her own money) to take a cross-country trip for a graduate school interview. I was really nervous when I arrived at the Department and informed his secretary of my appointment. I controlled my butterflies when I entered his office and saw him sitting at his desk surrounded by floor to ceiling columns of books. He stood to greet me and his commanding presence stunned me'. She didn't remain silent long and Starker accepted

²In 1974 there were 511 seniors enrolled in the College of Home Economics – 498 women and 13 men.

³Unpublished enrolment data by gender in 1974 were provided by Samantha Pilato, External Survey Specialist, Office of Institutional Research at Colorado State University. The 2018 enrolment data was provided by Laura Jensen, Vice-Provost for Planning and Effectiveness, Colorado State University.

⁴Aldo Leopold was an American author, scientist, ecologist, forester, conservationist, and environmentalist. He was a professor at the University of Wisconsin and is best known for his book *A Sand County Almanac* (1949). Leopold is considered the father of North American wildlife management. Wildlife management was first offered as an academic degree in 1939 at the University of Wisconsin, Madison where Leopold was on the faculty. Professor Leopold had only one female graduate student during his career (Trauger and Kennedy 2012).

⁵In 1974 the School of Forestry & Conservation merged with the College of Agriculture to form the College of Natural Resources. Currently the natural resource disciplines are in the Department of Environmental Science, Policy and Management.

her as one of his last graduate students. Under his tutelage, in the fall of 1975 she began her Master's degree in Wildland Resource Science.

Starker's style of guidance fostered graduate student independence. Julie had to design her own project and locate funding (a Teaching Assistantship covered her stipend). She immersed herself in seminars and the scientific literature looking for inspiration. What would she study? Agricultural chemicals and their effects on birds was a hot topic, so she decided to examine effects of herbicides on animal communities and their habitat at Berkeley's Sagehen Creek Field Station.⁶ Part of Sagehen burned in 1960 and was replanted with Jeffrey pine (*Pinus jeffreyi*) to accelerate restoration. In 1970, the area was sprayed with herbicides to discourage brush competition with young trees. An earlier PhD student had found little herbicide effect on birds 2 years after the spray. Julie understood some brush species can persist for years after spraying, thus, the real effect of shrub removal might not be obvious for a long time. She proposed a comparison of the vegetation and animals (birds, deer and small mammals) on two plots – one sprayed 6 years previously with herbicide and one never sprayed. Her advising committee thought it was a useful question that she could examine in one field season and encouraged her to proceed. Her findings supported her hypotheses: herbicides changed the vegetation, substantially reducing resident bird populations both in numbers of individuals and species. The spray area also reflected reduced mule deer (*Odocoileus hemionus*) use. Interestingly, small mammals, particularly chipmunks (*Tamias* spp.), increased.

Even though Starker had back problems and other mobility issues, he made a memorable visit to Julie's field site, located at the top of a fairly steep hill accessed only by a narrow, rock-strewn dirt road. Julie recalls that, 'Berkeley provided me with an old station wagon (with an automatic transmission) for field work. I usually parked at the bottom of the hill and walked to my plots. But this time Dr Leopold was with me and I thought he might not like walking on uneven terrain. I was still uncomfortable driving rough roads. I didn't want to fess up to my insecurities, so I suggested two options: we can stop here and walk up or if I drive *really fast* I can propel this vehicle to the top. Without hesitating he said 'Well, why don't you drive up?' I gulped, backed up the wagon and floored it. He held on for dear life while the car weaved all over the place and ricocheted off rocks. At the top, he turned and said 'That was some driving gal!'. Not surprisingly, Starker spent the rest of the day on foot. Julie showed him her study site while he mesmerised her with his extensive knowledge of the local natural history.

As with most if not all natural resource departments at this time, Berkeley employed no female wildlife faculty members. In spite of the absence of female role models, Julie's experience at the university strengthened her resolve to continue in science. A close scientific network had developed between Julie and her bright and supportive fellow graduate students and Starker, like all effective scientific mentors, didn't micro-manage. Rather, he provided a 360-degree perspective, teaching critical thinking and gently steering students away from dogmatic and untestable

dead-ends. Faculty also supervised the art of scientific writing, which requires years of practice for proficiency. Julie describes Starker as a terrific editor who was instrumental in helping her turn her thesis into a published scientific paper (Savidge 1978). Although most advisors co-author student papers, Starker refused her offer to include him as an author. He graciously declined, saying it was her work. Starker didn't need additional publications to enhance his career, but he may also have been encouraging her talent, aware that few women published, let alone made careers in field biology. Indeed, from 1970 to 1979 only 6.6% of scientific wildlife papers were written by women (Nicholson *et al.* 2008).

For over 2 years Julie and Tom lived apart, putting in lots of hours and kilometres on their cars: they married in 1977 after she graduated. Julie moved to Corvallis, where Tom was still in school. She got a job as a Research Assistant for a pair of Oregon State University zoology professors, taught a wildlife class at a local community college and investigated potential careers. Because Julie liked research and management, working as a federal agency wildlife biologist tempted her. Talking to colleagues about her chances set off alarms. They told her, 'Forget it for now, returning Vietnam vets have federal hiring precedence'. Some even suggested she start as a secretary and climb the internal technical ladder. Julie had no such intention! She turned her attention to academia, but quickly realised universities wanted PhDs. It was time to explore doctoral programs.

Before plunging back into graduate school, she and Tom were ripe for an adventure. Following his mid 1978 graduation, they spent 7 months with backpacks exploring the beautiful wilds, rural outposts and cityscapes of South America. Trekking by way of Columbia, Ecuador, Peru and Bolivia, they journeyed to the southernmost tip of the continent, Argentina's Tierra del Fuego, returning along the Pacific Coast. Julie describes their trip as life-altering, 'I did little travelling as a youngster and was mesmerised by new cultures and landscapes. The diversity in tropical forests inspired a child-like sense of wonder I carried with me my entire life'. The trip helped hone her resourcefulness and heightened her confidence about what she could accomplish.

Landing back in the US invigorated but jobless, the pair found temporary employment. They applied to the same universities as PhD candidates and were both offered teaching assistantships by the University of Illinois. In autumn 1980, they started doctoral programs in the Department of Ecology, Ethology and Evolution.

In January 1980, returning from a visit to Berkeley to see her grandpa, Julie impetuously decided to attend the Joint Conference of the Western Section of the Wildlife Society and the American Fisheries Society. She listened to 20-minute scientific presentations on a wide range of topics, including Mike Wheeler's talk 'Man-Wildlife Relations on Guam'. Mike, a biologist with the DAWR, addressed the status of wildlife on Guam and concluded with a sad tale about unexplained declines in the avifauna. A light bulb went on in Julie's head: this could be her dissertation topic. It was a very serious conservation problem in dire need of focused, scientific inquiry. When Mike had finished, she approached him, explained her search for a PhD

⁶Sagehen Field Station is located 8 miles north of Truckee, CA, USA at 6400 feet in elevation. It was established in 1951 with a Special Use permit between Berkeley (the facility manager) and the USDA Forest Service (the land manager; <http://sagehen.ucnr.org/>).



Fig. 1. Julie Savidge holding a Mariana fruit dove (*Ptilinopus roseicapilla*) on Guam in 1981. Photo Credit: Anne Maben.

project and asked if she could study bird declines on Guam. He referred her to Bob Anderson, his supervisor.

Julie wrote to Anderson expressing her interest in the project and her hope for temporary employment. He replied, 'Nothing is currently available but please keep in touch, something may turn up'. In early 1981, the US Fish and Wildlife Service (USFWS) committed new funds for Guam bird surveys and John Engbring, the project lead, needed assistance. Bob contacted Julie in Illinois and said, 'If you can get to Guam I could probably hire you as a summer research technician'. She arrived in Guam a few weeks later and DAWR hired her (Fig. 1). 'The summer was amazing and I so wanted to solve this crisis; Guam became the center of my universe,' Julie recalls. She returned to Illinois in the fall of 1981 with a dissertation project: she would work for DAWR as a biologist and evaluate the role of avian diseases in the decline of Guam birds. Both the USFWS and DAWR were expecting her to identify a causal pathogen.

Glen Sanderson, at the University of Illinois, agreed to be her PhD supervisor. When the expectations of her PhD advisory committee differed from those of her sponsor and employer, Julie was taken aback. The committee spelled out in no uncertain terms that she was to demonstrate that other likely suspects were not causing the decline. 'One of my committee members, George Batzli, bless his heart, asked me in a meeting 'What if it's not disease? What if the USFWS is wrong? What are alternative hypotheses?' These were perfect questions – directing me to keep my mind open to all possibilities,' Julie says. Berkeley laid the foundations, but Julie credits the University of Illinois with teaching her how to think scientifically.

After 2 years of taking and teaching classes and completing an approved study plan, Julie moved to Guam where she worked for 4.5 years (autumn 1982 to spring 1987). Tom took a break from his dissertation field work to join her and found work with the University of Guam on biocontrol of various pests.

Julie knew she did not have much time to solve this mystery; places she worked in 1981 with John Engbring were now void of bird songs. She explained to Bob Anderson that she had to investigate all possibilities, not just disease. 'OK, but on your own time,' he said, 'The funding is for disease'. She continued to look for diseases and two chapters of her dissertation are on the painstaking and methodical approaches she and her collaborators took. They conducted one of the most elaborate and comprehensive disease monitoring programs imaginable, which demonstrated that Guam birds were free of any population-crippling pathogens (Savidge *et al.* 1992).

As part of her investigations, Julie devised a questionnaire for local Chamorros, Guam's indigenous people, to pinpoint when they last saw native birds and what problems they faced raising poultry and pigeons. The questionnaire focused on disease, but also enquired about predators and pesticides. Julie published the questionnaire in the local paper and Herman Muna, a Chamorro DAWR technician helping Julie, went door to door with the survey. 'I received 300 responses from all over the island and many complained about a snake. The brown treesnake (*Boiga irregularis*), a recent stowaway from the Admiralty Islands, regularly slithered into their chicken and pigeon coops at night, devouring the eggs. Snakes ruined poultry-rearing for many locals,' Julie discovered.

This was anecdotal information about snake predation on bird eggs and there was no case in the annals of zoology of any reptile ever doing such massive ecological damage, yet a little voice haunted Julie about the local peoples' comments. She rarely saw this nocturnal animal, but she knew it was in the forests and it was the only Guam predator not on other Micronesian islands – islands which weren't experiencing bird declines. The idea of excessive predation by an invasive snake began to take shape.

Julie's persistence and lack of evidence supporting disease paid off, 'Bob finally allowed me to spend part of my time on predation'. Her committee and the local community also encouraged her. Tom helped Julie develop testable predictions which, if supported with solid evidence, would lend credence to the predation hypothesis and rule out disease (detailed in Savidge 1987).

After completing approximately half her tests it was time to debut her ideas to the scientific community and the 1983 American Ornithologists' Union Centennial meeting in New York City presented the perfect audience. From the podium at the American Museum of Natural History, she faced a standing-room only crowd that included world-famous ornithologists and other influential and important people in the field. She gulped as she outlined the problem and their fruitless search for a disease. She paused and for the first time presented the mounting evidence supporting snake predation as the casual mechanism. The snake's range expansion correlated with the avian range contractions. Dissections of numerous snake guts by Julie and other Guam biologists revealed native birds had occurred in snake guts before avian populations were functionally extinct,

and after they declined exotic and domestic birds became the snakes' target. She concluded: 'The evidence so far is circumstantial, but currently the data do not support the disease hypothesis but point to predation'.

A preternatural quiet descended as she scanned the audience for questions or comments. After a seeming eternity, resistance flared. Doug Pratt, a Pacific tropical bird expert and one of the authors of the original documentation of the Guam decline (Pratt *et al.* 1979; also see Jenkins 1979) challenged her, 'I have never seen a single snake on Guam'. 'Were you out at night?' she asked. But it wasn't just the visible absence of snakes that bothered Pratt. He thought her hypothesis was deeply flawed and factually inconsistent and took the opportunity to lecture her in this very public arena (see Jaffe 1994 for details of Pratt's concerns).

Struggling to stay grounded as a senior scientist publicly discredited her work, Julie relinquished the podium feeling as though she was falling into a vortex. Nobody approached her to discuss her findings, which left her with a profound sense of intellectual isolation. But Doug's criticism did not erode her confidence in her results – it only heightened her resolve to dig deeper into the 'snake hypothesis'. She invited him to dinner. 'I wanted to know what data I could collect that would convince him snake predation was causing the Guam declines.' But at dinner Doug drew a line in the sand; there were no data that would persuade him it was a snake.

A few days later, the Editor of the *Wilson Bulletin* contacted Julie saying he thought she presented a plausible explanation for the decline. The journal published a Special Conservation Review of Guam (Marshall 1985) and summarised Julie's American Ornithologists' Union talk commenting: '... during the question period some of the audience asked questions or volunteered statements that were unscientific, unchivalrous, and embarrassing to the rest of us. Few could believe that a mere snake was so efficient a predator and could build up the numbers commensurate with such devastation'.

Julie returned to Guam to face another skeptic: Guam's Governor Ricardo Bordallo. He had seen her interviewed on TV and called her at DAWR to tell her, 'It isn't the snake – they are such innocent creatures'. He directed her to investigate pesticides; the call was followed up with a memo to DAWR dictating similar instructions. Although chemicals were likely toxifying parts of the island, Chris Grue, a USFWS Patuxent Scientist, had examined this possibility in great detail and pesticides were not the answer (Grue 1985). Still, the Governor was not swayed by the evidence and Julie could not afford to beat a dead horse. Regardless, the birds were disappearing at an alarming rate, so she zeroed in on the snake hypothesis.

Did being a woman contribute to opposition to the snake predation theory? Julie shakes her head: 'I was just bringing up a situation people didn't want to deal with. It was hard to accept that a snake, that might eat one meal every few days, could destroy an island wildlife community. If I had been a young male student, I would have faced the same resistance'. Nevertheless, the resistance was frustrating and hardened her resolve to find concrete evidence.

To solidly test the 'snake hypothesis' Julie needed to scrutinise other predictions that would support this hypothesis. One of the most challenging predictions was related to snake

abundance: she predicted treesnakes were abundant in forests where birds were declining but hardly present where birds were abundant. To test this, she had to capture these elusive creatures to estimate predation rates. Trapping arboreal snakes was an embryonic art, so she started from scratch. After a year of developing and testing prototypes she (with Tom's help) finally discovered a trap that worked: 'We set up a trap line with ~ 15 of our latest contraption, a funnel trap constructed of tough plastic webbing baited with quail, and immediately caught several snakes. To see a live snake in a trap was mind-boggling. People don't realise how much time biologists spend trying to capture their study animal; no animal means no data.'

Julie accumulated a substantial body of evidence that convinced her committee excessive snake predation had strong support. She successfully defended her dissertation and graduated in 1986. Her 1987 *Ecology* paper is widely cited as a seminal paper on the devastating effects introduced species often have in new habitats where, unchecked by natural enemies, they run rampant. Yet, at first, the scientific accolades didn't dispel the lingering disbelief in some scientific and management sectors. Doug Pratt apologised to Julie and agreed that the snake was a *contributing* factor. Others too conceded that snakes *might* play a role, but were unwilling to abandon the notion that an undocumented pesticide or disease could have influenced bird numbers on Guam. Today, a major thrust of Guam conservation programs is aimed at controlling brown treesnake impacts and preventing their spread to other Micronesian islands. Julie's unprecedented findings withstood decades of scientific scrutiny and hurtled her into conservation fame.

Life as an academic

With Julie's graduate work completed, she and Tom relaxed and began planning a family. The plan didn't take long to implement: Julie fell pregnant immediately. Elated and feeling great, she continued her nocturnal snake searches and her favourite recreation, snorkelling. In 1986, 32-year-old Julie delivered a healthy baby girl, Whitney.

After Whitney was born, Julie took a short maternity leave and gradually returned to full-time work at DAWR. Tom continued in his position at the University of Guam and Whitney went to a university day-care centre where Julie and Tom could visit her during breaks. They agreed the first to graduate would initiate the job search; Julie drew the long straw so she looked to US universities. Two positions fitted her skill set: the University of Nebraska at Lincoln (UNL) and Yale University. She applied and interviewed at both on the same trip; paying the international airfare while the universities covered her domestic travel.

Both universities made attractive offers. Now, Julie faced a tough decision: large Midwestern university or Ivy League? She made umpteen lists all the way to Guam and finally called George Batzli for advice. He told her the decision was obvious. She assumed he meant Yale, but he promoted Nebraska. George advised her that at Yale her early performance would have to be stellar or she would soon be looking for a new position – it would be sink or swim. He told her, 'You'd survive Yale I am sure, but do you want this job stress with a new baby?'. In the autumn of 1987, Julie became the first tenure-track female faculty member in the Forestry, Fisheries and Wildlife Department at the University of Nebraska.

One-year old Whitney went to day-care in Lincoln while Tom completed his dissertation. Several male faculty members had small children and Julie's whole department communicated a family-friendly feeling, encouraging a balanced personal and professional life. She eagerly developed her undergraduate and graduate classes in wildlife management and ecology but phased out her research in Guam. She felt satisfied with her Guam contributions and looked forward to switching gears. Julie was a popular teacher and participated in award-winning research as part of a multi-state effort studying avian use of Conservation Reserve Program lands (King and Savidge 1995; Best *et al.* 1997a, 1997b; Delisle and Savidge 1997). Through her graduate students, she was involved in research on a wide variety of Midwestern US wildlife, including sandhill cranes (*Antigone canadensis*), burrowing owls (*Athene cunicularia*) and ornate box turtles (*Terrapene ornate*) (Converse *et al.* 2005; Converse and Savidge 2003; Desmond *et al.* 1995, 2000; Desmond and Savidge 1996).

Gaining tenure in 1993, Julie was promoted to Associate Professor. Tom finished his dissertation and was involved with part-time research and teaching various science and wildlife courses at UNL until he became the Coordinator for the University of Nebraska's School of Natural Resource Science's Environmental Education Program. Tom and Julie also continued to collaborate on a few wildlife projects.

After a decade in the US Heartland, Julie and Tom began to yearn for open spaces and landscapes not dominated by private land. In 1999, Julie and Tom returned to Fort Collins, where Julie became the second woman hired in a tenure-track position by CSU's Department of Fish and Wildlife. Fort Collins was and is a high cost-of-living community. Julie took a pay cut to move there and Tom gave up his well-paid job in Lincoln altogether. 'In retrospect I wish I had negotiated for Tom's employment at CSU as a condition in my offer letter,' she now says. In 1999 spousal accommodations were not common in US university employment contracts (Wolf-Wendel *et al.* 2000) and Julie had no role models or mentors to help guide her in the process.

In other ways, too, Julie's transition to CSU was not a piece of cake. She replaced a retired Professor who spearheaded the undergraduate wildlife major and taught many pivotal classes. Although she did not begin teaching his classes until her second term she inherited his 67 advisees, which was overwhelming. Enrolment was skyrocketing in the Fish and Wildlife Department and they were being loved to death by an overload of undergraduates. Female faculty were (and still are) particularly susceptible to death by attention; most of the students were women who naturally gravitated to female mentors. Julie's fibromyalgia, first diagnosed in Nebraska, flared into a significant medical problem under the job stress.

Fortunately, Julie and Tom had saved money in Lincoln and could afford a lovely home bordering open space and within walking distance of CSU. Julie found solace in her new garden and her active eighth grader. In 2001, Julie was awarded tenure and promoted to Associate Professor. Tom taught public high school science for 2 years and then, in 2003, got a position with the Fish and Wildlife Department, as an Instructor/Head Advisor.

Once Julie's classes were developed, she returned to the work she loved, exploring new research opportunities with

the Guam brown treesnake program, coincidentally located at the US Geological Survey (USGS) Science Center in Fort Collins. After a 10-year hiatus, she returned to Guam to address numerous questions on brown treesnake impacts and control. With her post-doctoral research fellows, students and federal science colleagues, Julie greatly expanded the information on brown treesnake biology and ecology (e.g. Savidge 1988; Savidge *et al.* 2007; Lardner *et al.* 2009; Mathies *et al.* 2010; Siers *et al.* 2017a), with several projects focusing on brown treesnake movement including movement by juveniles (Lardner *et al.* 2014), and movement in relation to reduction of prey (Christy *et al.* 2017) and roads (Siers *et al.* 2014, 2016).

The ecological and biological information was critical for designing and investigating management approaches to reduce impact of the treesnake on Guam's native wildlife and prevent it from reaching other islands. Highlights of this research were evaluating: (1) invasion risk (Siers *et al.* 2017b); (2) effectiveness and enhancement of traps for catching snakes (Gragg *et al.* 2007; Rodda *et al.* 2007; Boyarski *et al.* 2008; Tyrrell *et al.* 2009; Mason *et al.* 2011; Mathies *et al.* 2013); (3) utility of traps for delivering toxicants to control snake populations (Mathies *et al.* 2011; Lardner *et al.* 2013); and (4) brown treesnake detection by humans (Christy *et al.* 2010) and canines (Savidge *et al.* 2011). She was also involved with projects on other invasive species, including frogs on Guam (Christy *et al.* 2007a, 2007b) and black rats (*Rattus rattus*) in the US Virgin Islands (Savidge *et al.* 2012). In 2007 Julie was promoted, becoming the first female Professor in the Fish and Wildlife Department at CSU and one of the first female Professors of Wildlife Biology in the US.

In recent years, Julie's research efforts have focused more on Guam restoration. With a former PhD student, she co-authored a restoration plan for a 55-ha area of forest surrounded with a snake-proof fence (Siers and Savidge 2017). Julie was also part of a wider effort to understand the importance of lost avian seed-dispersers on Guam and how that critical ecological service might be restored; this involved research on Saipan, an island north of Guam having the full complement of frugivores that historically were on Guam (Rehm *et al.* 2017, 2018).

A few years back, Julie and Tom were awarded funding to study the remnant population of Micronesian starlings (*Aplonis opaca*). Research goals were to assess its nesting success and try to enhance this species' population. Neither of these goals could be accomplished without designing a predator-proof nest box. 'Trying to develop an acceptable bird house reminded me of the old days when we were trying to figure out how to trap brown treesnakes.' After many trials they developed a safe box the birds would adopt where they have very high nest success (Pollock *et al.* 2019). They hope these studies will inform reintroduction efforts for other endangered bird species to Guam, such as the Guam Micronesian Kingfisher (*Todiramphus cinnamominus cinnamomina*), which currently exists only in captivity.

In addition, while testing the predator guards for the nest boxes, they also discovered a novel climbing behaviour of brown treesnakes that allows them to defeat many predator guard designs. They have a paper in review describing this behaviour, which partially explains why this snake is a formidable arboreal predator.



Fig. 2. Julie Savidge hiking the Routeburn Track, New Zealand, 2010. Photo Credit: Tom Seibert.

Conclusions

With Julie's retirement in 2018, she has struggled less with fibromyalgia. Like many professional women of her generation, the prolonged stress of academia can have physical repercussions. Typically, they expected too much of themselves and are continually dissatisfied with their output. Perhaps the younger generation is more realistic?

A few years ago, Julie lectured at the University of Illinois, and later lunched with a group of graduate students. The conversation drifted from conservation biology to their future career goals – not one showed an interest in academia. Julie says: 'Several wanted families and didn't think they could integrate children and the demands of university life. I told them I struggled with this my entire career, always feeling too fragmented and overwhelmed because I wanted to excel at family, teaching, research and professional service. It is very hard to get an A+ on a zillion activities'.

Julie persisted, but many women do not. Females have lower retention rates and research productivity than males in all scientific fields primarily because of their key role in child rearing and lower self-confidence (O'Brien and Hapgood 2012; Cameron *et al.* 2013). Yet, Julie is optimistic that universities can change if we populate them with people with diverse lifestyles and priorities. She is passionate in her belief that 'Change has to occur internally and it won't happen if young

people with a strong interest in the arts and sciences as well as a healthy personal life don't apply for the positions'.

In retirement, Julie and Tom are actively analysing and writing up research they have conducted over the past few years on Guam. Conservation issues in the Pacific remain of utmost importance. 'I hope I've contributed to the future restoration of birds to Guam – that would be a wonderful way to end my career,' she says. What are her additional retirement plans? Exploring other countries with Tom (Fig. 2), visiting Whitney (a Physician's Assistant) in her new home in western Colorado, and working in her garden are at the top of the list. She might eventually approach solving conservation issues from a different perspective – serving as a science advisor to public interest organisations. Like Rachel Carson, she hopes her scientific contributions help ensure that no more Pacific forests lose their avian concertos.

Conflicts of interest

The author declares no conflicts of interest.

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