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IN HONOR OF HIS 85 BIRTHDAY: RECOLLECTIONS OF
HAWAIIAN NATURAL HISTORY AND CONSERVATION,
WITH FRANCIS G. HOWARTH, PIONEER OF HAWAIIAN
CAVE BIOLOGY

MATTHEW J. MEDEIROS



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Cover: Frank Howarth in a cave on Moloka'i. Photo: Fred D. Stone..

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In Honor of his 85 birthday: Recollections of Hawaiian Natural History and Conservation, with Francis G. Howarth, Pioneer of Hawaiian Cave Biology

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On 23 October 2025, Francis [“Frank”] Gard Howarth III turns 85. Over his long career, with over 50 of them spent at the Bernice Pauahi Bishop Museum in Honolulu, Frank has contributed hugely to our understanding of Hawaiian entomology and natural history, including both terrestrial and subterranean ecosystems. His pioneering work on the biota of Hawaiian lava tube caves is perhaps his greatest achievement: from his discovery of this fauna in the early 1970s to his decades of research on new cave species to his subsequent work on fossil birds and bats known from caves to his publications focusing on insect conservation and biological control, Frank’s success is a testament to his curiosity and passion. I was fortunate enough to meet Frank early on in my studies and I owe my first research directions to his advice. I interviewed Frank on 14 October 2024, via Zoom; Frank was at his home in Portland, Oregon. The following interview has been lightly edited for clarity. Following the interview are additional thoughts about Frank by his colleagues and a gallery of photos.

MJM: Where were you raised, Frank? And how would you describe your childhood before you entered college?

FGH: I developed an early interest in entomology – I just loved to watch insects in the yard. I grew up in southeastern Massachusetts in a little town called Upton, halfway between Worcester and Boston, on a 180 acre farm-turned-woodland. My sister was eleven years my senior and she was taking agriculture in high school – they taught it back then – and in the spring of 1945 she came home and announced that she had to make an insect collection for her class, and she didn’t know how to begin. So, I volunteered at age 4, to help her collect. And so during the day, I took canning jars out in the front yard and collected insects individually into the jars and brought them in, so each evening I had a bunch of jars with bugs in them. She mounted them and labeled them and then we tried to identify them together using the few books we had. And so she was successful with her insect collection and I just decided that I wanted to be an entomologist. I entered first

grade the next year being able to spell my name and the word “entomologist,” and I told people all through my childhood and education when they asked that I wanted to be an entomologist, and I never looked back. So that was really exciting to grow up on an abandoned farm that had all sorts of habitats from bogs and marshes to ponds and forests and a huge milkweed patch with just every conceivable insect in the region. So I was hooked. I entered the University of Massachusetts wanting to major in entomology.

MJM: Did your sister go on in entomology, or just you?

FGH: Just me. She went on to technical school and studied chicken farming, which was big in southeastern Massachusetts and Rhode Island at the time. In fact, the farm I grew up in, we had 1,500 head of egg laying chickens, and that was our side business.

MJM: Were your parents supportive of your pursuit of entomology?

FGH: My mother was dreadfully frightened of insects but she turned around and finally encouraged me a great deal.

MJM: I know you did your undergrad at UMass and your master’s at Cornell, and then your PhD at University of Hawai’i Mānoa. Would you tell me some of your recollections of those three experiences?

FGH: At UMass, I was C.P. Alexander’s last student, in his last class, which was really a privilege. He was just amazing. He described 1% of the known insect fauna at the time. I had many good mentors there in entomology. I had summer jobs in entomology each of my years there, exploring different aspects of entomology. I decided that to earn a living I would go into insect biochemistry and physiology and that’s how I entered Cornell, with a fellowship, but I only lasted one year in that because I decided early on that with my hand tremor and anxiety and the fact that I just loved field work and looking at insects in the field, that I wouldn’t enjoy staying in the lab on beautiful sunny days. So I switched and studied medical entomology because that was an opening field, and Ceratopogonidae or biting midges, were an orphan group at the time, it was an open niche for me to try and fill. That’s what I pursued and at Cornell, I married my wonderful wife Nancy. I wanted to get to the tropics, and I had a roommate who was back from a field tour with International Voluntary Services, a volunteer group that was the precursor and the inspiration for the Peace Corps. We both got stationed in Laos in 1966, essentially behind enemy lines, armed with a butterfly net and a smile, which was really eye-opening and really an exciting experience. In my spare time advising local agricultural agents, I collected my biting midges, and that was my PhD at Mānoa - on the biting midges of Laos.

Knowing that I wanted to do field work in entomology, I joined the Outing Club at UMass early on, and developed strong friendships there, and learned the skills of

wilderness camping and wilderness survival. I quickly discovered the sport of cave exploration and I fell in love with it, so my hobby was cave exploration, and part of my reason for going to the tropics, and to Laos, was to see the caves there, but I didn't get much opportunity because of the war. Although I did do some in the neighboring countries. And at Cornell, I serendipitously rubbed shoulders with Fred Stone, who studied agricultural engineering at Cornell for his undergraduate, and then switched to entomology for his graduate work, surprisingly. He was an avid cave explorer, and together we explored caves and that friendship lasted for 60 years of cave exploration in Asia, Australia, Hawai'i, and all across the US. He and I were great partners and supported each other in our research.

So I arrived at Mānoa and Fred, who was still in Thailand at the time, joked to me that Hawai'i didn't have many caves and wouldn't be expected to have any cave fauna so I could devote my full time to getting my PhD - little did he know! (laughs) To support myself in graduate school, I accepted a position at the Bishop Museum, curating the Hawaiian insect collection as part of the International Biological Program. That program created a renaissance in Hawaiian natural history, putting field researchers in the field, rediscovering the Hawaiian fauna and its evolutionary significance and discovering so many new things. Part of my responsibilities at the museum were handling the insect collections that were being made by the IBP scientists, but also I was the alternate manager for the field research station in Kīlauea Forest Reserve, just outside Hawai'i Volcanoes National Park. One of my first trips to the station in July of 1971, I guess, I was managing the station and collaborating with the visiting scientists who were there at the time, and I got the phone call from my wife that she had just received a letter from the museum that my contract with them had been renewed and I was getting a pay raise. So, to celebrate, I took the afternoon off and went on a solo cave exploration at a cave in the park and I discovered the Hawaiian cave fauna. Which, by all accounts by cave biologists, was considered totally impossible for half a dozen reasons, and I broke all of those reasons. So suddenly my hobby became my career and I just had a remarkable time pursuing my passion in discovering new insects and understanding the ecosystems.

MJM: Were your ideas surrounding the evolution of Hawai'i's cave fauna, in particular the adaptive-shift hypothesis, were these things that jumped out to you pretty quickly, would you say, or did they take you a long time to come to?

FGH: With Fred, starting at Cornell, starting in the lab and rubbing shoulders, we discussed evolution of insects and the seed for the adaptive-shift hypothesis was planted then. In terms of the research on Hawaiian *Drosophila* and other Hawaiian groups and on islands and on the surface fauna around the world, the adaptive-shift was pretty well accepted, but it was totally foreign to cave biologists. They had this relic hypothesis that the cave fauna was trapped in caves – the ancestors of the cave fauna were trapped in caves by the glaciers or changing climate, so they were restricted to the temperate zones

where the climate would trap animals in caves, and it was impossible for them to evolve in the tropics because, they thought falsely, that the environment in the caves was similar to the environment of the tropical rain forest, so there was no resulting isolation. My discovery turned that on its head and there had to be another explanation since I was also showing at the time that many of the Hawaiian cave species still had close surface relatives living nearby in surface environments. And so the idea of adaptive-shift essentially brought cave biology, cave evolution, into the mainstream understanding. So, I think it's a pretty strong hypothesis.

If it wasn't changing environment that isolated them, what was the driving force for the adaptive shift toward isolation in caves, if it wasn't climatic shift? And unlike tropical biologists looking at caves in previous times, I visited caves essentially 24 hours a day. It would take me half the day to find a cave, and then I'd enter and I'd stay in until I was either exhausted or ran out of cave, because it was so much effort to get in that I might as well stay in and finish. And so I was sitting some thousand feet in, in a Big Island cave, and eating a snack at dinnertime, roughly sunset, and I realized that the wind completely changed! I was dripping with sweat because of the 100% humidity and I could see my breath even though it was 21 °C or so in the cave, which is pretty extreme, and then all of a sudden I was chilled and there was a strong downslope breeze, and I no longer could see my breath. I thought, "what in the world is happening"? The explanation was that the sun had recently set, and that the outside temperature was falling below cave temperature. The dense colder air was sinking into the cave and warming to the cave temperature thereby drying the cave. From my experience in South East Asia and the literature, I knew that, in the tropics, the surface temperature falls below the average annual temperature nearly every night. Thus, in the tropics, nighttime is analogous to winter in temperate regions. I kept the observation in the back of my head as I continued my studies and subsequently recognized the phenomenon in many other caves. Also, recalling my training in insect biochemistry and physiology, I realized this might explain the inability to find obligatory terrestrial cave animals by previous surveys in the tropics. With collaborators, I conducted physiological studies on water balance and cave climate that showed that this was indeed a major factor in understanding cave ecology.

The other myth that I still have trouble convincing mainland cave biologists about, but I'm sure that I'm right, is that food resources are the driving force - they have this feeling that caves, because they can't see any food when they go in - it's all barren rock - that the habitat must be food limited. But it isn't! For a cave bug, the cave has boundless food energy if you can find it and eat it. So, I've been trying - I must have put that in 20 different papers - trying to convince people that food is not limiting in caves. Animals that can exploit food in surface environments would have difficulty finding food underground, because all the cues that they use to find food on the surface are useless underground. You can't see it, and even if you can smell it, you can't walk a straight line or fly a straight line to your food because of obstructions that you can't see, so you sometimes have to walk away from the scent plume in order to find the food, so it's much more difficult. And cave

animals have adapted this random walk to find food resources, or they wait for the food to come to them, like the spiders. So, that's one of my missions.

MJM: Do you have a story about you and longtime friend and colleague Fred Stone doing field work together?

FGH: We had incredible experiences together, including near-death experiences where we each rescued each other from almost impossible situations. There was one time, caving in upstate New York with him during my Cornell days when he dropped a refrigerator-sized rock on me and I managed to get out of the way just in time. We then had to re-rig the pit so that we could get out, which was really, really frightening and tough. For years, I could hear the ringing of the rock in my ears.

Once, we came out of a cave on a towerkarst, which is a tropical limestone formation in which the erosion relatively rapidly dissolves away some of the limestone and the erosion carries away the sediment around these limestone deposits and you end up with these towers that can be a kilometer in diameter and a kilometer high, in the extreme, or a few hundred meters in diameter and 200 meters high, so really spectacular and photogenic, just marvelous geological formations, and they're riddled with caves, essentially stacks of Swiss cheese. So we had gone into a cave near the base of a limestone tower in North Queensland, Australia, and climbed within the cave and exited quite high up on the tower and we didn't want to go back through the cave - it was tough. We could see that our way down was a ridge off of the towerkarst, so we proceeded down and I was 100 feet ahead of Fred, or so, on this knife edge ridge. I came upon a beautiful spherical boulder resting on the ridge, completely blocking my way going down. It was a meter or so in diameter. And so I sat on it and rotated myself around to bypass it and it broke free, and essentially I went over the cliff with the boulder on my shoulder, like Atlas. (laughs) And instinctively I pushed myself off the boulder, increasing my downward speed, but separating me from the boulder, and when I hit the rock talus below, I did a parachute roll out of the way and the boulder smashed into a million pieces right behind me, and I ended up on the grass below the talus slope, cut up badly by the sharp limestone. Tropical limestone dissolves into absolutely sharp *makatea*-type formations caused by case hardening of bare limestone surfaces by alternate wetting and drying, which dissolves then recrystallizes the surface. This process results in a hard surface often with razor sharp ridges, which is very difficult to walk and negotiate, and that's what I fell on.

I was alive, but Fred thought I was gone – he came over, looked over the edge, and there I was, laughing at the bottom of the pile. That was pretty amazing! We discovered so many things together – the fossil birds, numerous insects, and other arthropods, which always inspired each of us.

MJM: What are some of your recollections about being involved in the Hawai'i Biological Survey, and the Bishop Museum in general?

FGH: I started with the International Biological Program (IBP), which as I said was a renaissance, and I shared a portion of the collection room with Wayne Gagné. After I discovered the cave fauna, he joined me and we had some good explorations together, and I joined him and his hiking companion, Steve Montgomery, who was a classmate of mine at Mānoa and in fact we shared an office for a while. So the three of us would go into the field and generally collect insects on the surface, and occasionally they joined me in the caves. Wayne cultivated a relationship with local nature photographer William Mull – Bill Mull. Bill started photographing Wayne's insects and then Steve discovered the incredible predatory caterpillars and the happy-face spider, which really were just a marvelous PR discoveries, and Bill started enthusiastically photographing the caterpillars in action and as many varieties of happy-face spiders as Steve and Wayne could find, and it was just – well, the collection of literally 100 different patterns on the happy-face spiders, which was beyond the variability of any other animal in the world, that inspired Hamp Carson to question whether island faunas were really all that depauperate and lacking variability. And of course the rest is history, when (professor and arachnologist) Rosemary Gillespie arrived to study the variation patterns. And so after Steve made those discoveries, and Wayne discovered a few new insects that were really striking, as part of the IBP surveys, we started an informal or friendly camaraderie or competition to find the most bizarre Hawaiian arthropod between the three of us. So each of us would come back from our field work and show off our discoveries and brag about who won that expedition's competition. So those were exciting times, and I think we discovered more things because we had that friendly competition where we encouraged each other not to try and outdo one another but to try and encourage them to do their best to find everything. So that was inspiring and an exciting time. And we developed a really close camaraderie and relationship which lasted until Wayne's untimely death and my leaving the islands, but I'm sure Steve agrees that we had a remarkable run while we were at it. And Bill, of course, went on to become famous as a nature photographer in Hawai'i and we published a book together.

MJM: Yes, *Hawaiian Insects and their Kin*. How did that originate?

FGH: Wayne had a hand in initiating it and I'm not sure how the details came about. But at the time, a publishing house in Singapore was publishing natural history books in various regions as part of a series, and Sy Sohmer, the botanist at the museum, got a contract to write a book on the Hawaiian flora, Hawaiian plants, which you probably have a copy of, and so Wayne approached Bill and me to coauthor a book on Hawaiian insects. Then Wayne unfortunately passed away, but we eventually get the contract to do it between the two of us, Bill and I. That was fun – I learned more – Bill's career had been as a linguist with Army intelligence and he spoke fluent Japanese and fluent Chinese, he would shock people by talking in such absolute correct tones and intonations that they couldn't even tell he was an American speaker. And so when we got together, he selected

the photos and I wrote up drafts, captions, for each. We got together for one week at his house and massaged the captions to say what we wanted to say in the minimum and correct and accurate language. Bill's linguistic background was just marvelous – I learned more English than all my college studies and other endeavors. He could massage the language to be perfect, to fit the mood and tone. In my view, he was pleased with the results. We occasionally argued over words but he usually won.

MJM: Do you have a favorite arthropod that you've ever worked with or published on?

FGH: They pretty much all are, for different reasons. The no-eyed big-eyed hunting spider is probably the most famous that I – when I put that name in my papers, I had a dozen editors come back at me and ask me to correct or explain how could something be called a no-eyed big-eyed hunting spider – it must be a typographical error to fix. So there's that one, and of course it's appeared in humor books, science humor books, as in "how many eyes does a no-eyed big-eyed hunting spider have?" They could count as a favorite. But there are many many others. There's a blind centipede from North Queensland, Australia, that still hasn't been described, but is the largest terrestrial cave-adapted animal anywhere, and that was a pretty spectacular and totally off the wall, unexpected discovery. But there are just dozens and dozens of others. Each one has a story, so how can you separate them out into a favorite?

MJM: How about – any maybe you'll say the same thing – how about a favorite cave or a favorite place you've done field work?

FGH: It's the same question!

MJM: Fair.

FGH: For better or for worse, because of the IBP mission, I focused on a single cave for ecological studies, rather than trying to find as many different caves and different environments as possible, so I missed a lot of other spots because I didn't get to other areas on the Big Island. I did a little and made a few discoveries, but there are still big blanks in the map, which [UH professor] Megan [Porter] is now trying to fill. The cave I focused on was Kazamura Cave on the Kīlauea slopes, which turns out to be the longest lava tube in the world, and also the deepest, although it doesn't get more than 30 m below ground level, it's 1,000 m deep from Kīlauea to the seacoast, which makes it the deepest cave in the United States, technically speaking. So that ranks up there. Also ranking up there is the cave where Fred dropped the "refrigerator" on me – McFail's cave in upstate New York, which is the longest cave in New York. Fred and I and several members of the caving club at Cornell purchased and donated it to the National Speleological Society (NSS), the national cave exploration society, and it was the first cave that they had ever

owned. It took quite a bit of lobbying to get them to accept the cave, even after we bought it and gave it to them for free. But they were worried, of course, about liability, and what to do with it and how to manage it. But we solved those problems and they accepted it and that broke the logjam and other groups started donating caves to the National Speleological Society, and now it's part of their mission to save caves, which puts Fred and I in sort of a pioneering position in cave conservation, which I'm pretty proud of.

MJM: That's a great story! Do you happen to know your NSS number off the top of your head?

FGH: The NSS is one of the organizations where you keep your number for your entire membership term. Did you know that?

MJM: Yes, I have my own number.

FGH: Ah yes, so, mine is #6344.

MJM: Pretty good, that's much lower than mine, mine is a much larger number than that! [It's #56834, in fact. —MJM.]

FGH: I've been a member for 60+ years.

MJM: I've been a member since around the time I met you, so not quite that long.

FGH: My membership in the Entomological Society of America is longer – 66 years, now, that I've been a member. So I guess that makes me an entomologist, finally! (laughs)

MJM: Is there anything else about your career that you would like to share here today?

FGH: Well, what I've hidden for most of my career was my hand tremor. I've learned to live with it, but it's gotten much worse in recent years so it's hard to hide. But that was a difficulty that I had to overcome right from grammar school through college through my whole career. Handling insects, when you have a hand tremor, are you kidding me! I've pinned microlepidoptera, for crying out loud, but my hand would be all over the place. You probably saw that?

MJM: Yeah... you know, Frank, I didn't know if it was something you preferred not to talk about, but I did of course notice it when I first met you and was amazed that you were able to do what you were able to do given it. I didn't know you had it since you were a little kid. What sorts of things did you do to compensate for it, say, to be able to pin microleps despite the tremor?

FGH: Well, I'd brace one hand against the other, to sort of cancel out the hand tremor with two hands, and I did that successfully for a while, but now it's too difficult. I had a medical procedure earlier this year to correct the hand tremor in my right hand, and it was spectacularly successful but still I have problems, it still twitches when I don't want it to. The other thing I learned – particularly by high school – because of my hand tremor, I wrote exceedingly slowly, which was a nemesis in grammar school and high school. Teachers back then did not recognize handicaps of any kind so I was considered lazy and unproductive and mentally behind because I couldn't finish tasks. So what I learned was to read a question and answer it as concisely and accurately as I possibly could, which turned out to be a tremendous advantage for college and career. Except for English, where, English teachers –even in college – tended to grade by volume rather than content. But that said, I got by, and that's one of my coping mechanisms – being able to answer a question in precisely the fewest words possible so that I can get through the test in time.

MJM: Thank you for talking about that, for sharing that.

FGH: That latter point was probably worth mentioning for other people with this problem, for inspiration. The hand tremor and associated problems with it – throughout my career, I get terribly anxious, because I know it takes me twice as much effort, at least, to finish a project than other people because I have to think about how I'm going to do it, how am I going to get around this problem, and some of the high intensity projects that I've had, the anxiousness has been overpowering. I remember [lepidopterist] Scott Miller telling me he wanted a report done, he said "this will only take you an hour to write," and I had to tell him, "it'll take me an hour just to copy an already-written page. One page!"

MJM: Last question, Frank. What advice, if any, would you give to young entomologists working in Hawai'i?

FGH: Get out in the field and observe things. We need more warm bodies looking for things, and discovering new things, and rediscovering lost species. More and more it's coming down to management and conservation biology, as we're losing things faster than we discover them. You also have to write up what you find – I'm still trying to finish writing up projects that I did twenty years ago, because I was told in graduate school, research not published is research not done, it remains forever, it gets buried with me and that's the end of it, no one ever knows.

So, keep your eyes open, look for new things, look for unexpected things. One of the things that Wayne was keen on, and I agree with him, was, in order to find new things in Hawai'i, you had to know what was already known. In the field, you had to recognize that something was new or unusual, that you hadn't seen before, that possibly wasn't known. He was very good at that, and I of course did it without realizing it, that I had the same skill. A number of people, I mean I've taken keen entomologists into lava tubes, and they

will waste so much time collecting the super obvious common things, that alien millipede for example, *Oxidus gracilis*, they'll think it's something bizarre, something new. They don't know the fauna, so they waste all their time looking at the wrong things. I think I pointed that out to you when you were starting out. I could wax poetic on this question for another hour.

To add to that, one of my abilities, it's not unique, but it's pretty common amongst scientists, is I can transfer information I've learned from one field to another, almost automatically. I read *Science* magazine almost cover to cover every week, when it comes out, and I will find an article, in physics, that suddenly explains some question I've had in entomology. For example, that winter effect in cave physiology, that goes back to transferring what I learned as an insect biochemist and insect physiologist, back at Cornell. I had the background to read the literature, to understand the parameters that I needed to understand the cave adaptation. That's a skill set that's really important, to integrate different fields, multidisciplinary approach to answer questions.

MJM: Thank you for all that, Frank. On a personal level, the time you spent with me in the field, and the advice you gave me as a new student, certainly shaped my life in fantastic ways, and although I've bounced all over, research-wise, the one common thread has been a passion for Hawaiian entomology, and I am really so grateful for having met you and to have been able to spend the time with you that I have, and I really want to thank you for that.

FGH: Take cave!

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REMINISCENCES BY COLLEAGUES

Frank's office at the Bishop Museum was next to mine for about 10 years. He was my go-to guy for virtually any question concerning Hawaiian natural history (his favorite quote [I'm paraphrasing] "anything possible can happen in Hawaiian natural history (e.g., stink-less stink bugs, nettle-less nettles, no-eyed big-eyed spiders, carnivorous caterpillars, aquatic moths, flightless flies), so nothing in Hawaiian natural history should surprise you"); and was great for feedback on various hypotheses I had. A couple of examples on the latter: (1) the Hawaii Biological Survey did a contract survey in 2001 in a relatively inaccessible (only by chopper) spot upslope along the Hamakua coast of the Big Island and a new species of *Campsicnemus* was found and described by me. I had done collecting near there and places between there and Volcano Village before and soon after and this was the only spot for that new species. Then in 2004, the same species was collected in pan traps in the Saddle Road area (kīpuka 9), although it had never been collected there previously; and a few years later (2006) it finally showed up in pan traps I set out in our back yard in Volcano every year since 1993; first a few, then in successive years more and more. I told Frank about this and he said it reminded him of a tabanid that his major prof. at Cornell, LaVerne Pechuman, had found in an area in upstate New York (I think) closed off on all sides by tall trees. Only when the trees were cut down, did the tabanid "escape" and expand its distribution outward. He suspected the same might have happened in this case (a good assumption!). So, we had witnessed a new species expanding its range in a matter of 5 years (much the same as an introduced species might – an interesting phenomenon). (2) In 1971, some flightless dolichopodids were collected in the Saddle Road kīpuka area (around milepost 18). I had visited the spot yearly for many years starting in 1994 but with no luck in finding them. Frank's thought: "Maybe they only come out based on the sun-spot cycle [= ca. 11 years]". I still have to test that one. Happy Birthday, Frank! — *Neal Evenhuis*

Frank is fun to work with, with many aphorisms and stories. But he also works tirelessly. Our first day with him for the Kahului Airport Arthropod Survey he had us show up at 10am, and we thought "wow, these guys get a late start." Well, after much collecting and sorting it starts getting dark, we're ready to go home for the day, and Frank says "You didn't bring a headlamp?" After a long night light trapping at the sheet, we got to bed around midnight. We woke up the next day all groggy and thought, "10am already?"

But after light trapping, Frank didn't just crash like us. He felt compelled to keep going and pin the moths we caught that evening. Some of that was done in the lab, the rest he did in his hotel room bathroom. He has these hand tremors that make you think he's going to just shred the moths, but he does his magic, pulls away his hands, and reveals nicely pinned moths. Of course, we can only imagine what the hotel maid service thought of his moth torture scene in the bathroom.

It doesn't take long for those working with native Hawaiian insects to find an undescribed species. But Frank can lay claim to discovering a new ecosystem: the caves that no one thought had any life in them. "I wouldn't have seen it if I hadn't believed it," he relayed. We took that lesson to heart, and kept our eyes and minds open to otherwise overlooked creatures hidden in plain view. But Frank could take it to another level, as he proved in a lava tube exposed during road construction in Haleakala National Park. We had previously looked in the tube and didn't see anything, but Frank crawls in there and a few minutes later triumphantly emerges with a cricket in a vial.

Other lessons we are grateful to have learned from Frank were to treat our collections as "a label with an attached specimen." And to have fun. Not sure if it was a gag, or just convenient, but we'd do a double take every time we saw Frank drinking water from used isopropyl alcohol bottles. Indeed, "Time is fun when having flies," especially with Frank. Happy Birthday, Frank! — *Kim & Forest Starr*

We first met Frank in 1987 when we were post-docs at the J. Linsley Gressitt Center at Bishop Museum. Our focus then was on collection-based research relating to the phylogeny of planthoppers (Hemiptera: Fulgoromorpha). One day Frank (whom we hadn't met before) – just coming back from an extended field trip to Australia - dropped a vial on my desk with a note saying "More planthoppers for your study". It only needed a glance at the vial to recognize that it contained a fantastic troglobiont species new to science, which we later described as *Solonaima baylissa* from Bayliss Cave, in the Undara lava tube system, Queensland. The rest is history: Frank and I started talking about caves and cave fauna, and he got me hooked on the topic within a short few days. We did fieldwork together in Australia and in Hawaii, and we were the first people ever to listen to the vibrational courtship songs of the white, eye- and flightless *Oliarus polyphemus* from lava tubes on the Big Island. Over the past 40 years, Frank has proven to be a model collaborator.

Field work with Frank – how can I describe it? It is certainly unique, inspiring, exciting, surprising, sometimes nerve-wracking (but never for long), exhilarating, and fun, fun, fun.

I have learned so much from time spent with Frank in the field and in the lab, in and outside of science, and I admire his ability to improvise technical solutions for just about any problem, as much as his brilliant mind. When in the field, Frank always comes top-notch prepared – the size and weight of his suitcases are legendary – and no matter what you may find necessary for some sort of experiment while in the outback – Frank has it all: rubber bands, selection of metal wire, duct tape, even Plaster of Paris!

From crawling together in the mud in search for new hoppers to co-authoring scientific publications Frank has always been a wonderful companion and a very dear friend. I shall look very much forward to continuing our collaboration. Happy Birthday, Frank! — *Hannelore Hoch and Manfred Asche*

One of my favorite recollections of time in the field with Frank is when we took a trip down to Big Island with a new intern, whom I will call Chris. He was a nice young man from Connecticut who had come out to Hawaii to assist with insect survey and conservation work. Frank had some funds to get live spiders for an exhibit, and the plan was to go catch them in unusual habitats, so as to highlight adaptive radiation in Hawaii.

Our first stop was Kazamura Cave, where we donned hard hats and head lamps and headed underground into the stygian darkness of a lava tube. There were cave spiders here, but catching them was challenging because there were lots of places for them to hide, and one had to watch for overhead projections in the cave, and the hard hats took a fair number of hits. But after banging around for an hour or two we finally obtained some specimens, and emerged back into the bright light of the Puna rain forest.

After a late lunch, Frank then took us to a set of recent lava flows near the coast at Kalapana. He explained that after darkness fell there would be spiders which came out and hunted on the dark, bare rock surface. At the proper angle the light from our headlamps would reflect off the tapetum lucidum layer in the backs of their eyes, which helped give them good night vision, and we would see a green flash. We then had to run over the rough, black lava flow in the dark to catch the spider before it ran away. This turned out to be even less easy than it sounded, and we ended up getting a bit scraped up for not so many spiders captured. As we were taking a break, someone looked back and said “Check it out, there is a lava breakout upslope.” This was at a time when Kilauea was going through a fairly active phase, with lava occasionally forming surface flows in the area above of where we were working. We all took a few minutes to admire Pele’s show, with lava fingers moving downhill through burning trees, and then Frank indicated it was time to get back to work, since we still needed a few more spiders.

At this point Chris started to realize that he was in company with obsessed and deranged people, since in Connecticut if lava had just emerged nearby everyone would be running for the next state over. He said something like “But...uh...lava” to which we reassured him that stuff like this happened all the time on Big Island, and that we could easily get away before the lava got too close. He did not seem at all convinced, and was clearly quite relieved when we finally caught a few more spiders and got the heck out of there.

The next day the objective was to obtain spiders that occur in the alpine zone of Mauna Kea. After breakfast we drove up to Hale Pohaku, where Frank made sure that everyone had warm clothes, since we would be working above 12,000 feet. Since he was coming to the tropics, Chris had not thought to pack a lot of warm clothes, since face it, who needs them in the rain forest? But he layered up with what he had, and we went on up. The Mauna Kea spiders were under rocks and in crevices, and it took a bit of running around to get them. Suddenly we looked over as Chris gave a dull groan and sank down on a rock. Having grown up at sea level, he had never been this high up in his life, and one could almost see the little cartoon spiral in the air above his head as he completely succumbed to the thin air.

Having come to Hawaii expecting to work in a place of rain forests and gentle beaches, our unsuspecting intern had for his first exposure to Hawaiian field work instead been hauled by Frank into a savage world of stygian caves, across black rock deserts at night with an active lava eruption coursing down from above, and into a bleak alpine wasteland devoid of oxygen, all in search of spiders. And the rest of us accompanying Frank all saw this as totally normal. It was clearly not the Hawaiian paradise that Chris had conceived

of in his mind, and I am not sure he ever got over it, because if I recall he went back to the East Coast not long thereafter, where life was more rational, orderly and sedate. But Frank got his spiders. — *Dan Polhemus*

While doing a postdoc (surveying birds) with the International Biological Program in the early to mid 1970s, I met a cohort of other young (we were then, anyway) biologists working on plants, invertebrates and communities of all sorts. I met and got to know Frank and Wayne Gagné by traveling with them when the opportunity arose to gather data on the species and communities in which we were interested. Those were the days!

Frank has reminisced in detail about his work on and in cave (lava tube) ecosystems in Hawai'i. As it turns out, my fondest recollection of time spent with Frank, was an exploratory trip to a lava tube that Frank was mapping. Wayne Gagné was along to look for interesting invertebrates, I came along for fun. I remember being extremely impressed by the helmets with the little gas powered (I think) flames that provided us with light. They were a bit heavy, but, I thought, quite fashionable. We parked our jeep near a skylight that provided entry into the then mostly unmapped lava tube. I had no clue that he wasn't really sure we'd end up anywhere near where the car was.

I don't remember how long we were in the cave or what cave invertebrates we saw. What I remember was how strange and wonderful it was to crawl (I was often able to walk upright—I'm sure that made Wayne, and especially Frank, terribly jealous!) through this enchanting ecosystem for hours on end. Frank and Wayne busied themselves looking for interesting cave fauna, which they showed to me when they encountered them. I hoped, but failed, to find bones of extinct birds. I remember there were several places where Frank could barely squeeze through narrow parts of the lava tube that I found "roomy".

With Wayne's help, Frank was meticulously mapping the lava tube, recording every change in the angle of our trajectory as well as the distances between each change in direction. The goal, of course, was to literally map the lava tube so that it could be drawn onto a Geological Survey quad map of the surface. That, of course, would allow biologists to map the plant communities under which the lava tube went. In turn, that information would facilitate characterization of the plant communities whose roots formed the basis of the food chain in the lava tube.

When we emerged from a skylight at dusk, Frank rolled out his geological survey quad map, and his field notebook record of our trajectories (distances and angles) throughout the day. Using those field notes he led us back to the spot where he had parked the jeep with ease and we drove home very satisfied with ourselves.

I have many good memories of those good ole' IBP days, but that one is uniquely memorable. — *Sheila Conant*.

PHOTO GALLERY

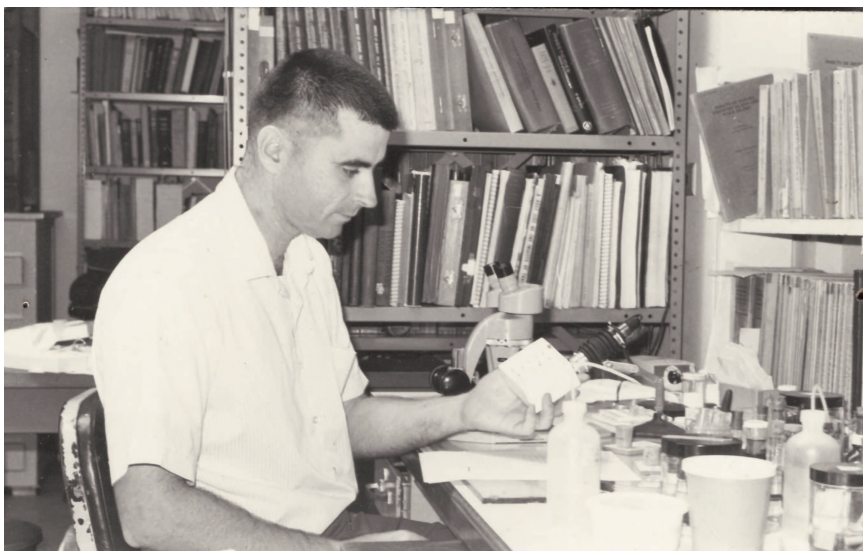


Figure 1. Frank Howarth at his desk at the Bishop Museum in the early 1970s. Photo courtesy Neal Evenhuis.



Figure 2. Staff and Associates of the Entomology Department, Bishop Museum, in 1985. Frank far right, back row, wearing a black arm band made out of a garbage bag to protest the massive layoffs of research staff that had just taken place there. Photo courtesy Neal Evenhuis.



Figure 3. Frank climbing karst tower at Chillagoe, far North Queensland, Australia, 1986. Photo by Fred D. Stone.



Figure 4. Getting ready for caving in Pahoa Cave, Puna, Hawaii Island, 1986. From left to right: Frank Howarth, Hannelore Hoch, Fred Stone. Photo courtesy Hannelore Hoch and Manfred Asche.



Figure 5. Getting ready for caving in Pahoa Cave, Puna, Hawaii Island, 1986. From left to right: Frank Howarth, Hannelore Hoch, Manfred Asche. Photo courtesy Hannelore Hoch and Manfred Asche.



Figure 6. Frank walking on hot lava. Pu'u O'o eruption, 1986. Photo courtesy Hannelore Hoch and Manfred Asche.



Figure 7. Frank and Fred Stone looking for cave arthropods in Kaumana Cave, Hilo, Hawaii Island, 1986. Photo courtesy Hannelore Hoch and Manfred Asche.



Figure 8. Frank searching for cave arthropods on roots in Crocodile Pot Cave, Chillagoe, Queensland, 1989. Photo courtesy Hannelore Hoch and Manfred Asche.



Figure 9. Breakfast before caving at Long Shot Cave, Undara, Queensland, 1989. From left to right: Frank Howarth, Manfred Asche, Hannelore Hoch, Douglas Irvin. Photo courtesy Hannelore Hoch and Manfred Asche.



Figure10. Chillagoe caving party with the Explorer's Club, N.Y., Queensland, 1989. From left to right: Frank Howarth, [unknown], Hannelore Hoch, Manfred Asche, Nickolas O'Sullivan, Don Matts, Fred Stone, Grace Matts, Terry Matts, [unknown]. Photo courtesy Hannelore Hoch and Manfred Asche.



Figure 11. Frank squeezing through a tight passage in an East Maui lava tube, 1989. Photo courtesy Hannelore Hoch and Manfred Asche.

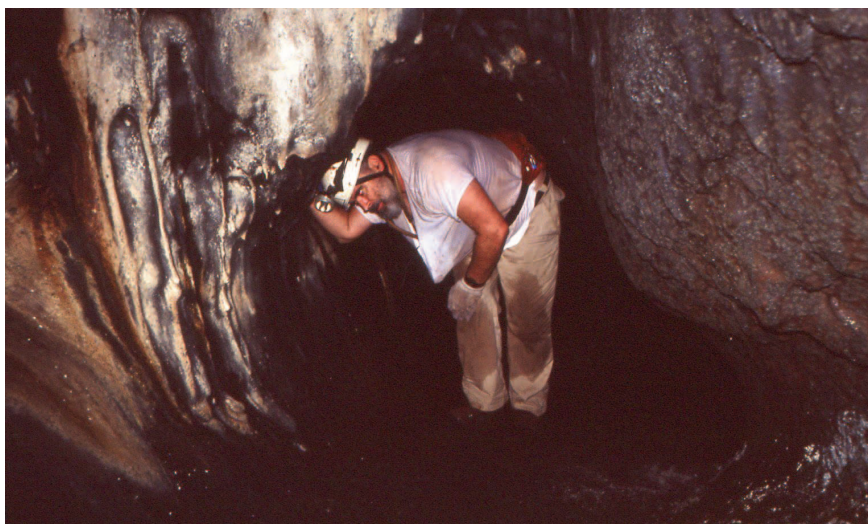


Figure 12. Frank searching for cave arthropods in an East Maui lava tube, 1989. Photo courtesy Hannelore Hoch and Manfred Asche.



Figure 13. Frank in a cave on Moloka'i, 2010. Photo Fred D. Stone.