

**Name:** David Klein  
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**Location of Interview:** Home of David Klein in Fairbanks, Alaska  
**Interviewer:** Karen Brewster

**Brief Summary of Interview:** In this interview, Mr. Klein is talking about the geology of Pinnacle, St. Matthew, and Hall Islands and how they differ. He also talks about the weather on various trips out to St. Matthew and Pinnacle Island, his experience on the *Tiglax* vessel, polar bears being on St. Matthew and hunted there, the fur seals and the controversy over pelagic hunting, and various publications he wrote for different groups, such as the Explorer's Club.

KAREN BREWSTER: Okay, today is April 24, 2014 and this is Karen Brewster and Dave Klein in Fairbanks. And we are going to keep going with St. Matthew Island. So Dave, did you want to go over your publication stuff, or you want to talk about Pinnacle Island in 2012?

DAVID KLEIN: We can do Pinnacle Island.

KAREN BREWSTER: Okay. Why don't you tell us about Pinnacle Island? Pinnacle Island is an island off of St. Matthew?

DAVID KLEIN: Pinnacle Island is the smallest of the three St. Matthew Island group. So there's St. Matthew, the biggest island about 32 miles long, 4 mile wide. Hall island, which is only perhaps 1/5 the size of St. Matthew, but it's only three miles to the north of northern St. Matthew. And then nine miles from the southern portion of St. Matthew, westward, is Pinnacle Island, which -- it's kind of a mystery island because the fog hangs around all of the islands but much more so around Pinnacle. So sometimes on St. Matthew you get a nice day, and you can see Pinnacle -- and with binoculars you can maybe see a few birds flying, but nine miles away is a little too far. So for me, I've not been real close to it in a boat except in 2012. And the plan was -- I wanted to -- it's sort of a mystery island because the geologists who did this excellent geological map of the St. Matthew Islands, they didn't get to Pinnacle.

KAREN BREWSTER: Okay.

DAVID KLEIN: And so they were able to close -- it's hard to land on Pinnacle because there's very few places where you can land because the steep cliffs coming right down to the sea. And it's a strange -- differential rock forms there than on St. Matthew and Hall. So it's sort of a mystery island. And yet the geologist, Potter and his group that did the -- published this excellent map of the geology of the St. Matthew Islands, they acknowledged that they didn't get ashore on Pinnacle. The best they could do was from shipboard and binoculars looking at the rock forms. And they felt it was similar rocks to

St. Matthew, but -- similar rock types but not in a similar pattern. So the big difference -- one of the big differences was that the strata of rocks were tilted vertical, whereas St. Matthew and Hall are unique in that the volcanism that occurred 60 to 80 million years ago, that during periods of time -- in that period of time -- during volcanic events during that period of time, you can still see the -- had been virtually little erosion from the land's surface. And so you can still see remains of these old calderas or craters. Early craters of small volcanoes of only -- you know, they were -- rims of the craters were only less than 2,000 feet above sea level, which -- but they were significant. And -- and the -- So the land surface and the layering of the different strata, which is a combination of lava flows of basalt and andesite, harder rocks, and then periodic explosive events when would -- followed by ash falls of finer and varying texture ash.

KAREN BREWSTER: Ash falls, you said.

DAVID KLEIN: Ash falls from an explosive or pyroclastic -- what the geologists call pyroclastic events. When instead of lava flowing, it was an explosive event with a lot of ash erupting and much of that falling back down on the land. And so you have these layers of lava and of basalt and andesite from lava, and then layers of the lava, also of different ages, but frequently interrupted by ash events of light -- lighter -- much lighter colored material. Whereas the lava was dark colored, typical basalt and andesite is darker colored rocks. And the light colored ones are generally softer, even though they're made up of ash. They're often formed into rocks over time in their different layers of the strata. Well, the strata is horizontal on St. Matthew and Hall Island, which accounts for these craters still being visible in areas where it's primarily ancient lava flows, but much eroded because 60 million years is a long time ago. Oh, you don't see them as lava fields, but you see them as flows. And you can see at the beach on cliff sides, you can see the different strata with the lighter colored strata representing the lighter ash that has been compressed into rocks, but the rocks aren't as hard as the lava generated. So then when you get to Pinnacle Island, then what we're seeing is the only thing that the rocks all seem to be hard, although there are some of the lighter colored rocks. And the explanation which the geologists were able to make by this stratification and the erosion they saw, partly, and also their knowledge of the sea level or the bottom of the sea at that -- in relation to where major faults lines extending from Pinnacle across to St. Matthew. And with not much evidence of these faults on St. Matthew. But on Pinnacle they were probably the faults that resulted in the tilting of the strata. And the hardness of these rocks verified by our collections, when we got ashore on Pinnacle finally in 2012, were confirmed that they had been under the -- at least under the sea for a period of time, and maybe actually down in the crust, the Earth's crust somewhat. And then were tilted up by some tectonic movement associated with earthquakes and the faults that went across the other islands. So it's -- it's fairly unique in -- but at the same time accounts for their resistance to coastal erosion because upright hard rocks and very little shores -- gravels along the base of these steep cliffs. Because of the hardness of rocks there hasn't been a lot of erosion there. And the rocks are much harder after they've been cooled and undergone pressure down in the sea before they were extruded again through some kind of tectonic movement. It didn't affect St. Matthew Island in the same way.

KAREN BREWSTER: It's interesting that only nine miles apart, they would have been influenced so differently by the tectonics.

DAVID KLEIN: There are some ridges, underwater ridges, that have been mapped by sounding, showing that there's extensions of these ridges to St. Matthew Island. And therefore the rocks, the parent rocks, were comparable. Except the ones on Pinnacle had been hardened by being under the sea.

KAREN BREWSTER: So it's the same rock type, but they've reacted differently?

DAVID KLEIN: Because of their metamorphic change under the sea, and then being extruded again. And so we don't know exactly when they were pushed back up, even though they were probably the same -- their origin. The rocks' origin was probably faults within the same range of the late tertiary, early carbonaceous period, which would be 60 million to 80 million years.

KAREN BREWSTER: Ago?

DAVID KLEIN: Years ago, right. And the -- So from the standpoint of coastal erosion, this Pinnacle Island with these faults turned up, I mean these strata turned up perpendicular and being very resistant rocks, the island looks much younger geologically. And in a sense, it probably is in its reemergence from the sea was probably sometime in the last -- sometime well after the 60 to 80 million year eruption of the -- formation of the parent rocks. But when that occurred, we don't really know. I'm not sure, it might be difficult to age. Do that even with a qualified geologist.

KAREN BREWSTER: I was going to ask, like how does one tell the age of that?

DAVID KLEIN: They can tell. Varying ways to tell the age that are -- some is to look at the polarity of the molecules -- rock crystals. The polarity in the crystals that are tied to the genetics, or to the --not genetics.

KAREN BREWSTER: I was going to say, rocks have genetics?

DAVID KLEIN: No. Tied to the magnetic, not genetic, magnetic poles that can be changed over time. So if they were laying down and if it had been turned through -- from erosion and then reformation again, you can tell whether that -- when that occurred approximately. Whereas it may not be enough and how much -- the cost of doing that, I'm unfamiliar with.

KAREN BREWSTER: Well, that's kind of cool, though, that they can figure that out. So why in 2012 did you decide to go over and venture those nine miles over there?

DAVID KLEIN: Well, I had mentioned when I was sort of taking responsibility for -- my choice, one of the projects I wanted to work with was coastal erosion and how it may affect the nesting -- colonial nesting birds. Presence or absence. And therefore the types

of rocks would be important. So it was -- I knew that hardness, rock hardness would be a -- before I became too familiar, as familiar as I am now, with the geology of the situation after working with the geology/geomorphology lab at the geology department here at UAF. So we did make collections of rocks periodically on St. Matthew, primarily on St. Matthew, to verify that we were interpreting the geological map correctly in terms of rock types. And so I wanted to do the same on Pinnacle Island, if possible to get ashore. We couldn't be sure that that would happen, but the skipper of the *Tiglax* said that he would try to get us there because they had dropped us off and then they came back eventually to pick us up. So they came back with about -- they had about two days for us to break up our camps, the two camps, the Hall Island camp and St. Matthew Island camp and load the boat. And then we had to do one stop at Hall Island for the archaeologist to check out a site there. And so we spent the night there. Then the next day we had a full day, essentially a full day, in which we went with the big boat, the *Tiglax*, down to the southern portion of St. Matthew near Big Lake, where I had -- where we had camped in 1957 and '63, and where I had the vegetation plots. And -- But also it was an area where I felt that the team from the refuge -- there was a team that was doing a fish survey in the fresh water, and they had special traps. We knew that there was char there. We knew that drainages into Big Lake had black fish, which are really unique because they can't exist in salt water. So they are left over from when St. Matthew was part of Beringia.

KAREN BREWSTER: Oh, cool.

DAVID KLEIN: And -- But they had no -- And we knew there were sticklebacks there as well in the lake, but they wanted to catch more blackfish for genetic work. And we -- we didn't get any -- they didn't have any success with catching blackfish in the lake system and drainage near our camp at the north end of St. Matthew, which seemed to me like a good place for blackfish. So when we went down below I was able to direct them to areas where I knew there were blackfish in the past and quickly they caught some in just a matter of a few hours. And we only had about a half a day there. And we had -- some people were a little bit further south doing some -- finishing up some collections of insects. And the rest of us were collecting more information on the distribution in fox. Presence or absence of fox dens and whether they were active or not and whether they were Arctic or red foxes. Which they all turned out, as we suspected, to be red foxes and we did find a couple more dens down by Big Lake. And so then we were finally were picked up at the end of the day, including our travel time, and of course it was convenient because the cook provided meals for us when we were back on the boat and we didn't have to have the usual camp chores. And then the plan was to travel down around the southern tip of St. Matthew and over to Pinnacle Island. And the Skipper said he thought, in view of the weather, they would be able to get me ashore there. So we did this. But it's very late in the day, so we had dinner and the plan was -- and we had to stick to the plan. We had to leave later in order to get back to St. Paul to catch our flights later the next day back to Anchorage. For most of us, not all of us, but most of us. So we went around the -- and we were plagued with a lot more fog in 2012, and it was particularly thick there. 'Cause we couldn't -- When he went around the southern tip, we couldn't see Pinnacle Island. And so, the boat was headed there and they could see it with their radar and knew the route and we -- the fog was so thick that -- we started seeing birds flying

from the island over the ship just checking us out, which was fulmars and kittiwakes, primarily, but occasionally flocks of murre. So -- And they kept increasing in numbers and frequency and curiosity. And it was pretty exciting. And they would come out of the fog and find the boat. They didn't seem to have the problem with fog that we had in the boat. At any rate, by now it's getting late, very late in the evening. It's like 10 o'clock in the evening. And it's in August. It's starting to get a little bit darker, less light, and the fog made conditions even worse. So we weren't able to see the island until we were about a half-mile. And -- and I was, of course, concerned about the safety of the boat, but the Captain said I didn't have to worry about that because the weather was not real rough. You know, there was some waves action, but -- and some wind, but not real strong and he had good navigational equipment and sonar to be aware of the depth and he said it drops off really fast there so we shouldn't have a problem then. So he put us -- He then -- We had to make this decision Well, by -- whether I really wanted to get ashore to collect the rocks. After a long day. The Captain said, well, he could put us ashore if I really wanted to go ashore and I said, "Well, I would like to go, but I only want to do it if it's going to be a safe operation." And he said, "Yes, no problem. It'll be safe. The crew -- the crew member who will operate the Zodiac knows how to land this." And my son-in-law, Rich, would accompany me as an assistant. And then the -- we had one more biologist who was taking over the St. Matthew Island bird work, Mark. And he went along with us. So we put on our splash suits and we went ashore, which was very exciting, because in the fog in a Zodiac, you're out there and these birds we could just -- we could make out the shadow of the island and the cliffs and birds were coming over and swooping over the Zodiac. And it was -- it was very exciting and a terrific experience for me 'cause you really feel like you're part of the bird world, sea bird world. And we had this -- had spotted this little beach where there was a sort of a niche and some gravel beach that was only 30 or so feet wide and then the cliffs were steep beyond that. And so we were able to land on this beach. It's sort of a steep gravel beach, but it was okay for landing with the Zodiac. And then we could jump out and pull the Zodiac up, turn it around and it'd sit there waiting for us to collect rocks. And there was a shoot there where rocks had fallen down from up above, so we could see there was a varying types of rocks that represented what was up above as well as down below. So they were both the rocks from -- originating from -- from lava flows as well as -- including basalt and andesite, and rocks originating from ash falls that had turned into pretty solid rocks that were -- had been under the sea, we had learned subsequently, and that was further hardened. So we were able to get samples of those rocks. A good load of those. And back into the Zodiac. There were some spectacular caves there, sea caves, with some cormorants and a few birds in the entrance to the caves on ledges. And birds were very low, because there's no foxes on Pinnacle Island because there's really no lowland vegetated area that would support the singing vole. And so it'd be hard for foxes to make a living there, except when the birds were there. And -- and nine miles is a bit far for foxes to swim --

KAREN BREWSTER: Yeah.

DAVID KLEIN: -- to get there. And in the wintertime there's not much incentive to go out there, because there's no food out there. So the birds subsequently were nesting just above the splash zone. So there were cormorants and murre and -- particularly, and then

a little bit higher were fulmars and a few other birds. But no small auklets, because there were no -- no earth slumps characteristic to the coastal erosion on the other two -- St. Matthew Island.

KAREN BREWSTER: And the auklet needs that earth slump for their nesting?

DAVID KLEIN: They need the rocky slump areas where they can -- they're crevice nesters underneath these rocks that can't be dug into by foxes. But they -- that's -- And they nest in huge aggregations, so there were no small auklets colony on --

KAREN BREWSTER: Pinnacle.

DAVID KLEIN: -- Pinnacle. So we got the rocks. It was about midnight when we finally got back aboard. And they'd turned the lights on the boat, which was reassuring. And we cruised along a little bit along the coast, but the steep cliffs were coming right down and the wave action was along the cliff face and no -- no place where you could land the Zodiac until we started getting out into more open water with more waves, then we went to the -- went to the *Tiglax*, which had cruised along to give us some cover while we were there, so we wouldn't lose sight of them. We had radio contact, too. So we got back aboard and it was about midnight. And I just could not go to sleep. I was so thrilled to have had this terrific experience and got the rocks. The Captain was super pleased that he was able to get me ashore.

KAREN BREWSTER: Yeah.

DAVID KLEIN: And was sensitive to my limited dexterity and my age, but able to carry out this Zodiac beach landing and collect the rocks successfully and get back. And I had some thirst for some fruit juice, but I wasn't hungry. But I just couldn't -- didn't -- I knew I couldn't sleep so I stayed up for a while until I settled down and then I went to bed and slept well. And the boat was -- by this time, was heading back to -- to St. Paul and the Pribilofs.

KAREN BREWSTER: Well, it sounds like you had a great captain that he was willing to go give it a shot.

DAVID KLEIN: He was terrific, he was terrific.

KAREN BREWSTER: He knew how important -- he understood the importance of what you were doing.

DAVID KLEIN: He's -- I know he was well recommended by the refuge biologists and he has a nice personality, got along well. And the whole crew. The cook was a similar, popular guy, and -- and very friendly and -- and wanting to be sure that the science of the expedition -- that they supported the science in the expedition to the fullest extent possible.

KAREN BREWSTER: Well, the cook's the most important person.

DAVID KLEIN: He was and he did --

KAREN BREWSTER: You know, if you don't make good food.

DAVID KLEIN: -- a lot of nice things with food, so we appreciated that.

KAREN BREWSTER: Yeah, it's always the food is the most important part on some of these.

DAVID KLEIN: Especially when we had come from camping out and it was sort of pretty skimpy when we had kind of miserable weather, rainy weather and were cooking on -- on a little propane one-burner stove. And so we didn't do too much cooking. We got plenty to eat, but it wasn't too spectacular.

KAREN BREWSTER: But, no, it's important to have a good cook, that's for sure.

DAVID KLEIN: Yeah. No, I can't speak highly enough of the *Tiglux* crew and a fine ship. And it's a well-managed and safe operation. They were super conscientious about all that.

KAREN BREWSTER: Well, I think too, it's great that you had Rich along and these other biologist people to work with you. I was gonna say, for you by yourself in a Zodiac, it might not have been possible, but you had a great field team to work together.

DAVID KLEIN: That's definitely the case, yeah, yeah. I really appreciated that. Yeah.

KAREN BREWSTER: And I'm sure they appreciated having you along since you've been going there since 1957. What a great wealth of knowledge you have.

DAVID KLEIN: Well, my excitement and enthusiasm about the -- the coastal erosion and the rock hardness and wanting to get rock specimens, they were -- they built some enthusiasm on their part to be sure that that's part of the reason for being there was successful.

KAREN BREWSTER: Well, isn't that kind of what happens with science and scientists, is you build on each other's enthusiasm?

DAVID KLEIN: Definitely, yeah, definitely, especially in a group like that. I mean I was so impressed, like when we were unloading the field camps and loading up again. We had a lot of boxes and -- and plus our duffels. And the Zodiac could only take some of that stuff with one or two persons at a time, so it would make several trips. So they -- it's like a bucket brigade of passing boxes down the beach so people didn't have to carry them quite so far down to the Zodiacs. And everybody was -- whoever they were, was working in a comparable way. Whether they were crew that were helping us from the

ship, or the grad students, or the biologists, refuge biologists, or the scientists. Everybody chipped in and did more than their share.

KAREN BREWSTER: That's good.

DAVID KLEIN: Yeah.

KAREN BREWSTER: Yeah. I mean, as we all know, that whether it's a field camp situation or a recreational trip, the group dynamics sometimes work and sometimes they don't work. And it's always nicer when it works.

DAVID KLEIN: It is. And then one of the reasons it worked is there was a diversity of interests among the scientists. We had different tasks, and the archaeologists and the refuge biologists, and refuge managers. And so we had our own tasks well-defined and we talked about that and explained, on the way out to St. Matthew, what we were doing and if it was obvious in some cases we might need help from one of the other groups and vice versa. And I was happy to show them areas where I thought it would be worth looking for -- setting the fish traps or for looking for additional archaeological sites or what have you. And so it -- we were all working for the full cause of the expedition, rather than just -- the full objectives of the expedition rather than just the individual ones. But we knew that individuals had their own specific focus.

KAREN BREWSTER: Well, on the other trips you went on out there, were they also so sort of multidisciplinary, or were they mostly it was you just doing your research?

DAVID KLEIN: 1957, the first time I went, it was just my project. And it had become my project, and so I had a field assistant.

KAREN BREWSTER: Right.

DAVID KLEIN: Who's -- he was a student, undergraduate student at the university. Jim Whisenant. And so we worked together on everything. He assisted. And when I was doing the vegetation surveys, as well as hiking all over the island, we always were pretty much together unless someone was taking his responsibility to gather wood for the wood stove or to gather water from the -- hike to get water from the lake or capture a few fish with our net, field net, for our food supply. Then in '63, there were -- it was a larger group, but it was mostly my project on the reindeer. And then there was -- there was one Bureau of Indian Affairs biologist who volunteered to come along as a field assistant to me. And then there was a professor from the university who was Frances Fay, Bud Fay, who was -- he had a project on foxes and the voles, the relationship. And was doing some collections for his -- his supervisor at the time, Public Health Service, on parasites in foxes. Whether there was presence or absence of certain parasites. And also collecting some of the singing voles alive to take back for a colony at the university by Dr. Robert Rausch.

KAREN BREWSTER: I was going to say, is the supervisor Bob Rausch?



DAVID KLEIN: Yeah. And so then there was two people who was a graduate students in fisheries from the University of British Columbia, and their job was to collect more blackfish. They had some Rotenone to collect them for tissue samples to be worked on with -- by a fisheries -- fish specialist that -- Dr. Wilimovsky, who was on the faculty there at the University of British Columbia but he'd also done work in northwest Alaska during --

KAREN BREWSTER: He was Project Chariot, wasn't he? Did he do work during Project Chariot?

DAVID KLEIN: Yes, that's correct. And so then -- and in '66 after the die-off, we went back. There were three of us. It was mainly my own project, but a botanist from the university came along, Vern Harms, and he was interested in collecting plants but also volunteering help if I needed it. And then I had a post-doc Detlef Einfeld from the University of Keele in Germany, who was working with me at the university here. And he came along as the field assistant and helped in the project by doing analysis of the -- of the ovaries of the remaining female that we collected. Of some of the -- a sample of the remaining females. There were like nine that we had taken. So -- But he and I mostly hiked together on the island and did the collecting, while Harms was doing botanical collecting. Sometimes we did the three of us together, but most of the time he was going off in a new direction to find new plants and we were looking for the reindeer. And then in 2005 that was -- no, in 1985 was -- that was an expedition by the refuge (Alaska Maritime National Wildlife Refuge), but they didn't have the *Tiglox* available at that time, so they chartered a crab boat that was not fishing there at the time. And -- So that was -- included enough people to have some on Hall Island to work with the auklet colony there, as well as some to do some of the bird survey work from the ship by going around the island. The population estimate work at different colonies there, while I was mainly focused on visiting the vegetation plots and -- and assessing growth rate and changes of vegetation but primarily the lichens. Was focused on the lichens and their recovery from the heavy grazing pressure by the reindeer before the crash die-off.

KAREN BREWSTER: So that one was a little more interdisciplinary? The birds and then what you were doing?

DAVID KLEIN: Yeah. And then in 2005 it was -- the *Tiglox* was available for supporting that operation. And it was very similar in many ways to the -- there were people doing -- working with the auklet colonies both at Hall Island and northern St. Matthew. And while I was looking at vegetation change. And then we were focused in again on the red foxes that were present there were gradually suppressing and eliminating the Arctic foxes from St. Matthew Island, but not -- they hadn't gotten to --they hadn't started breeding and gotten to Hall Island except for a single individual red fox that was observed there.

KAREN BREWSTER: So you were looking at the foxes or somebody else was doing that?

DAVID KLEIN: We were doing that, although it was primarily Art Sows who -- it was his project primarily. And we were -- I was working closely with him on that one. And he was counting on me to also be -- take that project over in the future.

KAREN BREWSTER: So he was not on the expedition?

DAVID KLEIN: He was on it.

KAREN BREWSTER: Oh, he was on the expedition? Okay.

DAVID KLEIN: Yeah, but he retired then in 2006, I think it was, so he was no longer available as an employee. He would've gone along as a volunteer if it was needed, except that he broke his ankle just before the trip from a fall on his bike.

KAREN BREWSTER: Oh, so -- so okay, and then we're at 2012 after 2005?

DAVID KLEIN: And then 20 --

KAREN BREWSTER: Yeah, no, 2000 --

DAVID KLEIN: We've already discussed, I think, the --

KAREN BREWSTER: Right. Well, yeah, as you say, that interdisciplinary -- having other people along makes it a different kind of experience.

DAVID KLEIN: Right. And my perspective, of course, changed over time. My focus initially was the reindeer and their condition and how they related to the vegetative changes that I could see were taking place, especially the overgrazing of the lichens. And then the follow-up in '63 was when they had peaked at 6,000. And they obviously had really badly overgrazed the lichen, which are primarily present in the southern one-third of the island and -- where lichens were most common because of extensive lowlands there, partly. And that's where the reindeer were released, as well. Then, of course, all the time I was making -- especially the first time out, we were making bird observations, as well, because there wasn't anybody else doing that. When there were bird people along, then I left that bird observation work up to them. But we weren't doing quantitative bird counts, except for the ground-nesting birds, which we could see when we were hiking and disturbed them more. Could get a pretty good idea of their presence. And we made observations on the vole populations all of the times we were there, which was important information because they fluctuate over time about a three- to four- year intervals between peaks. So most of the time populations were moderately high or high, but a couple of times they were low. Out of six, I guess.

KAREN BREWSTER: I had a question, kind of relates to this, about longitudinal studies of a place. That you've been very fortunate that with St. Matthew you've had this chance to keep going back over and over again, and a lot of scientists don't have that

opportunity. So what does that mean to have a place where there's such a longitudinal perspective?

DAVID KLEIN: Well, in this case, it was critically important because you can monitor change. And the change was precipitated, from my perspective, by the introduction of the reindeer to St. Matthew Island, and during the end of the Second World War, or toward the end of the Second World War. And then you could monitor the change of the vegetation, as well as the change in the animals. In their body weight, in their sex and age ratios, etc. So you're looking at this environmental change. Then, at that time, there was little focus on climate change because the significant climate change associated with global climate warming was -- occurred in the Bering Sea area about 1976 when there was a step change in warmer conditions and reflected by a longer period without sea ice each year. So it was mostly in the fall that sea ice would form later into the winter, and often into December before there would be sea ice around the St. Matthew Islands. And then by '85, there still was, you couldn't see -- I wasn't focused -- I was focused on follow-up studies on the vegetation, which was changing. And my focus was there. But, you know, I could see -- I was learning a lot about the island and where the different bird colonies were located, the rock differences that I could perceive myself, and how the vole populations related to how foxes preyed on -- the Arctic foxes then, preyed on birds. That reduced the predation pressure on the birds if the voles were at a peak in their population. Whereas if they're low, then presumably they were more dependent upon. And then with more open sea, we could speculate, especially late in the season, we could speculate on wave action bringing in more food from the sea for the foxes after the birds are gone, but also we knew that sea levels were rising because of the climate warming. And the wave action would be more persistent and more intense in the open water in the early winter, which was normal periods of extreme storms. So severity of the storms were also -- of extreme events like storms, was also tied to global climate change. And so I began to change my focus to things that were changed in the St. Matthew Island situation. Based upon my earlier observations, I was able to see that, yeah, coastal erosion was occurring in some of these rocky beach coastal areas. And it seemed to be related in some ways to the colonial nesting birds, but I wasn't sure in what way. And so my curiosity was stimulated, and I became more cognizant of the coastal erosion in relationship to rocks types. But I didn't have a very good understanding, because mostly when you're on the island you don't see the rocks of the coast unless you're in a -- there's no pronounced bays and unless you're at a point of land or something.

KAREN BREWSTER: Well, and sometimes you don't look at something and you're not paying attention to it --

DAVID KLEIN: It's partly that.

KAREN BREWSTER: -- unless you're interested in it.

DAVID KLEIN: But if you're on the land, then you're hiking from point A to point B, you may walk along the beach if there's a beach below cliffs. And that is interesting

because there's all kinds of carcasses of animals that might -- walrus, for example, skeletons because they get picked clean and get washed by the sea.

KAREN BREWSTER: But you might be going, "Oh, that's an interesting rock cliff" and you wouldn't be looking at it in the same way as once you say your curiosity stimulated and you start thinking, "What does this mean and how does it fit into a different -- ?"

DAVID KLEIN: Well, but you did learn that sometimes cliffs were so steep and there hadn't been much coastal erosion, so if you're walking a beach and if suddenly you're under those kinds of cliffs, the beach ends. And so -- And it's not the greatest walking on a cobble beach with a pack on. So you have to turn around and go back and then go up over the hills and mountains. Frankly, there were times when it was better footing climbing over the hills and less tiring than walking a cobble beach, but the cobble beach - - or at least it seemed less tiring. The cobble beach was interesting because you saw not only the driftwood and maybe remains of dead marine mammals, skeletons and what, but you also could see then the cliffs with the birds nesting just above your head, so you could -- So if the beach was wide enough you could look up with your binoculars and spot different kinds of birds and make notes. We did that when we were doing hiking. And get a feeling for what kind of rock formations were favored by what kind of birds and whether they're ledge-nesting on these big steep cliffs or crevice-nesting like the auklets down where there were these earth slumps and slopes of rocks moving down into the sea. So my interest gradually was more stimulated on to focus on the coastal areas, in what was going on there, and especially because I was getting very involved in climate change research and effect on wildlife throughout the Arctic. And doing research on that here, so that it was -- that helped to stimulate my interest in monitoring the possible effects of coastal erosion on sea birds. And then presence of -- the red fox gaining presence on the island and breeding on St. Matthew Island raises the whole question of differential effect of red foxes versus Arctic's as predators on the nesting birds. And that's a fascinating study in itself. And that was in 2005 was -- had become a major focus of my work then. And it continued into 2012 partly because we had no assurance that the foxes were there -- red foxes were going to be dominant permanently. We didn't know how they would survive the winter compared to the Arctic's, which seemed to be better adapted for winter on an island surrounded by sea ice than red foxes.

KAREN BREWSTER: Well, it is interesting to think about, what if the reindeer had continued to be present on St. Matthew? Would you still have been focusing on them or would you have had these other interests develop if you'd still had reindeer to look at?

DAVID KLEIN: I'm sure the other interests would have developed, but also if they had been -- It was an extreme weather event that coincided with the massive die-off, so there were no viable males that survived. If the weather -- If it hadn't been for that extreme weather event, it had been a relatively normal or mild winter, there would have been a big die-off. But it certainly was -- would be unlikely that all the males would have died out. And all the viable males wouldn't have been killed. And as happened in the Aleutians when reindeer were introduced to some of the islands there like Atka and Umnak Islands, for example, which I'd done some -- was doing some studies there. And where the

winters are milder and the animals did have a big impact on the lichens and reduced the availability. And lichens were not as important where the winters were shorter and green vegetation was usually available at sea level down in the Aleutians throughout most of the winter. Whereas at St. Matthew, further enough north, and also in comparison to reindeer on the Pribilof Islands, which underwent die-offs when they reached a peak and had extreme winters, but they didn't totally eliminate the populations and they would come back gradually. But the lichens didn't come back on those islands as long as they're in the presence of the reindeer. And so that perhaps would have happened on St. Matthew being 250 miles further north than the Pribilofs. And with sea ice around it for a longer portion of the winter than the Pribilofs where they're absent around -- sea ice is usually absent around both of the islands except sometimes reaching the northern one, St. Paul. And, yeah, they do have some difficult winter conditions if they get icing conditions on the snow, but the reindeer would have been able to survive as a population, especially when numbers have been fairly high in recent decades. And so I was able to continue some of this focus on the St. Paul Island and how reindeer affect lichens. And so that -- If it hadn't completely died out, I suspect there would have been a few hundred animals surviving the die-off from 6000 and that they would have been able to increase again in mild winters, but not without the recovery of the lichens. They could never reach such a high peak again in the future as long as there are reindeer preventing the recovery of the lichens. So it's likely they would have only been a few hundred animals that could survive there without abundance of lichens. And they would undergo pronounced die-offs in some winters, extreme winters.

KAREN BREWSTER: Yeah, you know, like if you'd been -- had those reindeer to keep focusing on, your attention would have been focused on them and you wouldn't have had the time to start doing these other projects on the island.

DAVID KLEIN: And this, there was some controversy associated with misunderstanding, since this was part of a national wildlife refuge. Actually, the first one established in Alaska in 1909 by President Theodore Roosevelt. Primarily for the seabirds, but also as stated in the statement establishing it, for the mammals. The marine mammals that would hang out around there like walrus, and the foxes presumably. They were protected along with the other birds that were there. And so one of the questions from the initial study was what -- the reindeer were introduced by the Coast Guard and it was a measure taken during the war to provide an emergency food supply for men manning a Coast Guard navigational station and earlier a weather station by the Army. Which was a very small group of men, but they couldn't count on regular supplies especially during the war. And so -- especially with the Japanese moving into the Aleutian Islands and invading the Aleutian Islands. So it was -- it seemed like it was a wartime effort to provide an emergency food supply, but then when the war was over and the Coast Guard pulled out, they, of course, couldn't remove the reindeer because the reindeer had gone feral and they were increasing. So technically the reindeer were an exotic species and were having an impact -- potential impact on nesting birds and perhaps on the endem -- the endem --

KAREN BREWSTER: Endemic.

DAVID KLEIN: Endemic species there, which included the vole, singing vole, which is an herbivorous vole dependent on plant material. And we didn't know what competition there would be between reindeer and voles, but some. But we don't know whether it could have actually stimulated vascular plants that would benefit the vole, but we didn't know that. And then the question was to maintain a natural environment rather than having exotic species present, but it was unrealistic to think of removal of the reindeer, although that was suggested as a possible solution to the problem. But it was pretty unrealistic in terms of the remoteness, the logistic problems of working on the island, and then, of course, there was always the attitude that these reindeer should be harvested for people to use the meat. Which is unrealistic because the logistic and boating cost with no harbor and no shore facilities, the cost would be three times the price.

KAREN BREWSTER: Yeah, and who were the people, the people of the Pribilofs or St. Paul or -- ? It's not like there are people so close.

DAVID KLEIN: Well, Native interests -- Alaska Native interests were interested in -- a possibility, as was the case in the Aleutian Islands when reindeer were introduced there. But the history of Native interest was that they would hunt them, they wouldn't -- They decided they didn't want to become reindeer herders. They were primarily marine mammal and fish eaters.

KAREN BREWSTER: Well, but it seems like the reindeer on Umnak Island were closer to where there were human populations than St. Matthew.

DAVID KLEIN: Yeah, but even there, I mean, efforts to round up the reindeer by Native corporations after Native Claims Settlement and the reindeer became property of Natives in some areas. Then it was just too costly an operation. They could still hunt them, and might hunt them occasionally, but their interest was focused on hunting marine mammals. And they preferred them and preferred the fish that they could catch around the island. So St. Matthew is not -- had never been settled by Natives. And so it -- And there was no landing field or harbors. It was a primitive wilderness area and it became part of the -- it became wilderness within the wildlife refuge system during the Alaska National Interest Lands Conservation Act. It was established as wilderness.

KAREN BREWSTER: So I asked you the question about the longitudinal study aspects, I'm wondering about -- if you can comment on why it's important in science to have longitudinal studies?

DAVID KLEIN: It's in effect -- if you're doing studies in the laboratory, you can usually have some controls. So if you're manipulating something, say animals in -- say you have rats, laboratory rats, and you're feeding one group a special diet and you have a control group that's standard laboratory chow, you have that control against which to compare the other one. And so you can look at body condition, reproduction, longevity, all of those things. Longitudinal studies in a given area essentially applying the same principle. Your control is the original. Now, in the case of the reindeer introduced, we didn't have

an original. We just had observations of what lichens were by the first people -- sailing people that got there and commented on the lichens, but they didn't do a comprehensive or quantitative assessment. And then when the Rauschs spent -- in 1954, spent time there working with the voles and parasites and the foxes, they made some observations on the effects of the reindeer on the lichens. But it was still good observations and we could use that in seeing the progression of depletion of lichens by the reindeer. And then we used all the other clues that were available that once you're on the island and you can see areas that are more difficult for the animals to reach were less severely impacted by the grazing effects of the animals. But again, well, how far does it go? This is where the comparative studies on St. Paul, and St. George to some extent, were helpful as comparative studies. And I've -- When I worked in southeast Alaska in an island archipelago, it was -- and did my doctoral work there, it was comparing ecological conditions. And in that case, primarily the deer, and they're the Sitka black-tailed deer, and their differential growth and body size and population response on islands with different ecological conditions. And that included the presence or absence of predation by wolves. And also included exposure to the extreme coast maritime climate, which was wet and stormy, but very little snow accumulation in the winter, versus close to the mainland where you get more continental climate and get periodic big snows. And so I could compare growth and the effect of the deer grazing and browsing on vegetation. How it affected the vegetation eliminating some of the more favored plant species. It was an ideal situation comparing different islands, compared to the deer studies that were being done and very popular at that time in the '50's and '60's, 1950's and 1960's, where deer populations were fluctuating in relationship to logging, fire, and hunting and grazing, and agricultural conflicts without any variable controls to work with. So working in southeast Alaska where human impacts were minimized in some of the islands that I chose. And later on, we were also looking at changing -- deliberate manipulation of the environment through logging and what are the consequences there. But I was looking in southeast on differential growth responses of the deer, so it was mainly summer vegetation and its availability that controlled body size, whereas winter vegetation determined a population level that could be reached. So it --

KAREN BREWSTER: So going back to the same place over and over again in those longitudinal projects just helps you understand what's happening in that place and then in the larger environment?

DAVID KLEIN: But in terms of say, wildlife studies or ecological studies in natural environments, it helps to monitor change if you can go back to the same place repeatedly. Ideally, you've got vegetation plots that you can check on, or maybe even exclosures to keep animals from browsing on certain plants that are important seasonally. But it's monitoring change, which is all important. Monitoring change in the habitat of the large mammals, which are usually the focus of why you're employed as a wildlife manager, rather than just counting animals to determine, you know -- and use that as an indicator of how much harvest might be justified of the animals. So what my focus has been throughout much of my professional history in Alaska working with plant/animal interactions is what I call myself. As an ecologist, I focus on plant/animal interaction, so that's herbivores and their relationship to plants. And so I want to know how the plants

are going to respond and how they may have evolved to stay resistant to overgrazing or heavy grazing/browsing. And also how the animals adapt to changes that are going on. Some of those changes are driven by their grazing and browsing pressure. And being able to differentiate those from effects of, say, climate. And climate change adds complexity to it, but then you have to factor in, especially the moving into the high Arctic, where I did, because I wanted to understand the dynamics of these systems. And there the herbivore/plant relationship was much simpler. There were fewer plant species in the high Arctic that were important for the herbivores, the Peary caribou or muskoxen, that were adapted to living in those conditions. And, of course, the other -- the predator relationship was different because the predators couldn't sustain themselves if the prey populations dropped to a certain level, and they would -- Wolves would die out on Greenland, north Greenland, before the muskoxen would die out. So then the limiting factors were food supply in relationship to weather conditions, and the weather conditions are variable. So then you can have these extreme events and sometimes it's related to sea ice. The presence in Greenland, it seemed to be the case in accounting for the extinction of the endemic subspecies of reindeer or caribou that were present in north and northeast Greenland, and died out just around the turn of the late 1800's, completely. And then the wolves died out, and the wolves came back again. An occasional reindeer, probably -- Peary caribou probably came from Ellesmere Island, but they never made it across the top of Greenland. But the muskoxen didn't die out when the caribou did. So it -- And that looked like it was -- could have been a climate warming event that caused this. With the decline in sea ice, then you get more snow falling on the land in the wintertime, the ice free land, and made it difficult, virtually impossible for the caribou, the native subspecies of caribou, which were closely related to Peary caribou, to make a living there. And the muskoxen population went -- presumably, went way down, too. Human populations went down then, too.

KAREN BREWSTER: I was thinking back to St. Matthew. You mentioned 2012, how the fog and getting to Pinnacle Island. I'm wondering on all your years there, I'm sure every year was different, but what was the weather like? And I can imagine rough seas in the boats and trying to land in wet, rainy, foggy weather. I mean, maybe it wasn't all like that?

DAVID KLEIN: Well, it seemed -- the first year in '57, it seemed like it was -- We were there for a longer period of time and we did have a few good days, but, of course, it was all relative what you're used to. I was used to weather in southeast Alaska and also interior Alaska. And in interior Alaska then I was -- fog doesn't exist normally, except rarely. And in southeast, yeah, fog, but it's only during the summer when there's usually -- when fog is more common. And it's warmer then and then you get good weather. Well, it just -- it wasn't -- I didn't remember the fog being as bad in 1957 that -- It was bad, and so we had to use compasses a lot. We didn't have GPS equipment, but we knew how to use the compass and we had some aerial photos to work with and we got by. Sometimes we didn't take the easiest route, we just went over mountains that were -- if it wasn't foggy we could have gone around them. And poor rain gear was one of the things, too. I mean, if you weren't used to the rain and drizzle, not hard rain, but drizzle when the wind is blowing 35 miles an hour in a storm. And used to wear mostly wool clothing with rain



gear that was always coming apart at the seams. And on a long hike, you were going to be pretty wet by the time you came back and especially if you're packing, you're perspiring, too, if it's warm and you've got the raingear. Even if the raingear is doing a good job, you're going to perspire. And you don't notice this if you've got a wood stove and a hut to come back to. If you're camping out in a tent, then you may end up -- and we did this sometimes. Especially that first year. When we did a long hike, we took a small tent and we tried to camp on a beach where there was driftwood and we built a driftwood fire. And some beaches didn't have significant driftwood, and there's no trees and shrubs big enough to produce -- to use for fire, especially if it's pouring down rain with a strong wind blowing. So we'd go until we found driftwood. By this time, we're usually pretty wet. We pitched our tent. Our sleeping bags were usually in plastic bag so they were dry and we'd have inflatable air mattresses, I think that we'd blow up to sleep on, but all effort was in trying to get a fire going. So we had -- usually carried a small axe or a big knife that we could shave -- get shavings -- get the wet wood, outer part of driftwood, and get some shavings and we'd have coils of birch bark that might wash up on the beach. We would save those to start fires, maybe a few stubs of candles and we'd work to get a fire going. And once we got a big fire going, we'd load it with wood and then it would dry out the wood fast enough and you'd get a lot of heat. And then you could take off your rain gear a little bit and get the exposure of the fire. But you had to find a place where you weren't in the full force of the wind, so it's usually on the lee side of the island down at the base of a cliff. It was extremely turbulent. The winds would be circling around and the smoke would be going and you'd end up breathing a lot of smoke because the fire -- you want to get close enough to the fire and the smoke would swing around, but we got by. And we could cook our meals and rake out enough coals to make a small fire for cooking and get relatively dry yourself before you went into your sleeping bag. And hoping that the weather would moderate by the next day, and it often did. And so we survived. And we were prepared and under those conditions you just take pride and wonder and being in such a spectacular environment. And it's always things to see that you -- I remember when we woke up that one morning after the storm had subsided and we got a fire going, we're sitting down -- it had stopped raining and this gray whale -- It was this quick drop off there because it was steep cliffs and a small beach and a gray whale surfaced just a matter of 30 feet away. And that was so exciting and nice experience to see that whale so close. And it was fairly calm water there at that time. That was amazing. Things like that that you see. And sometimes seeing the seabirds and feeding their young and taking off to go to the sea. I mean, it's such a dynamic place. And it's true in the Aleutians, the same way, it's so dynamic. In the Aleutians even more so, because of the volcanic activity that's active sometimes, so you feel the rumble of a slight earthquake and see smoke coming out of a peak of a mountain. And then if you're on solid ground, seeing wave action against -- on the reefs, and seeing eider duck, not eiders, harlequin ducks playing in the waves and sea otters doing the same thing, and seals. It's just amazing.

KAREN BREWSTER: Well, I was wondering listening to that about the cold and the wet and the bad rain gear and the weather and setting up camp, you know, you were doing that for weeks on end out in the field. And what would motivate you to get up every day and keep going? For some people that would be difficult.

DAVID KLEIN: It was such a unique experience, because -- especially on St. Matthew Island where there's no way you could see everything on the island. And we did, you know, went from the south to the north, but four miles wide you favored one side of the island for a while and then you'd work your way over to the other side. And you were seeing different types of rock strata, different types of terrain that you're walking on. Walking was pretty good, usually solid footing. There were very few wetland, soggy, marshy areas that you sometime -- you might have at the bottom of the valley might have that. But mostly you didn't have that. Or you stayed away from that, where you could see long distances and could see that there were no reindeer close in those areas that you wanted to get close to, etc. Or to just to see the vegetation. But we did the systematic studies of the vegetation types to try to cover everything that was existing on the island. It was not only breaking somewhat new ground, it was things I had learned in college and then studied up more and applied this knowledge. But it was training for me. And learning to do things in an efficient way and to record information in a scientific manner with a goal in mind. And so the early reports were different than later on. The early reports included a lot of emphasis on describing, with a lot of photography then when cameras weren't all that efficient. Black and white, usually, photography, but this photography was all important in recording information on vegetation in a systematic way.

KAREN BREWSTER: So is there a way you can explain why St. Matthew is so important to you?

DAVID KLEIN: Not any one way. There's a lot of ways.

KAREN BREWSTER: The reason I -- because it must be important to you because you have kept going back there.

DAVID KLEIN: Well it -- it was such a fascinating study. And having started it, the reindeer part and vegetation, there was nobody else that was ready to step in and take over. And they wouldn't have had the advantage that I had of all the background knowledge that I accumulate. A lot of it was in my head, but, you know, I wrote up reports and published papers, etc. But it's -- over time you accumulate knowledge and it's -- so getting -- and it's such a dynamic, exciting place where everything is relatively new and un -- from my perspective. People have been out there mainly with a focus on the birds, and that's important from the standpoint of the birds. But I'll have to admit that after 2012, and now writing up this seabird colony thing, I've learned so much more about birds, marine birds, which I had an overall perspective on but I didn't really understand and appreciate. These birds -- Most of these marine birds spend their time in the marine environment, away from any land, during most of their annual cycle. They're only coming to a nesting place, which are cliffs frequently in places on islands where there's fewer predators than if they were on the mainland. But they do nest on mainland cliffs along the mainland, as well. So these birds that -- you just can't calculate the amount of miles flown or --

KAREN BREWSTER: Yeah, amazing.

DAVID KLEIN: In a lifetime, these birds. And they're totally at home in the sea, on top of it or above it, and down in the water column. And they know how to take advantage -- their -- and their aerodynamics are just unbelievable. You don't understand how they could do this when we have just difficulty flying long distances over water.

KAREN BREWSTER: Well, it's hard for us. Our arms get tired.

DAVID KLEIN: Pardon?

KAREN BREWSTER: It's hard for us to fly long distances over water. Our arms get tired.

DAVID KLEIN: Yeah, that's right. Yeah, right.

KAREN BREWSTER: Well, also it does sound like partly why St. Matthew is special is because it was your place. There weren't other people doing the work and you were able to build a corpus of scientific work and build a career around it.

DAVID KLEIN: That's true. And the fact that my oldest daughter and her husband-to-be were out there at St. Matthew for two summers. And here both of them -- well, she had grown up here in interior Alaska primarily and loved it. And he was originally from Illinois, but had to come to love interior Alaska when he was working on his master's degree. And when they came back from St. Matthew, they had fallen in love with the sea. And that's part of it, too. I mean, when you're around the sea, don't necessarily have to be aboard ship, but, in fact, there's some advantages of not being aboard ship in stormy weather, but it's so dynamic to be where the sea is and you could see the sea working and the birds and animals that are adapted, the marine mammals, that this is their home. And it's hard to -- we humans find it hard to believe that these cold waters could be such favorable homes for birds and mammals that are adapted to use them. There's that case. But I've always also been fascinated by exploration into polar regions, particularly the Arctic. And so it's a bridging of interests in Arctic flora and fauna and how they are adapted to the Arctic conditions, growth conditions for the flora. And also the herbivores that are dependent upon that vegetation, how they're adapted to utilize the flora. And so in the work I did in Greenland, but also some in Svalbard and in the Taymyr Region of Russia, and a little -- you know, it's mainly in Arctic Alaska. But in the high Arctic was fascinating, because -- partly because it was poorly explored, and it was in terms of -- especially biologically. There had been explorations there, but it was mostly related to understanding the geology or the evidence of early humans.

KAREN BREWSTER: Or just to explore. It wasn't even for science.

DAVID KLEIN: Or being the first getting into those areas, right. And some of it was looking for humans, evidence of humans, and sometimes finding humans still surviving. So all of those, I was exposed to that. And also I've always been interested in how

humans can adapt and have adapted or have not adapted and didn't survive too well where they didn't adapt in the Arctic. So that's been part of it. And it's the dynamics of the Arctic environment, especially the high Arctic where it's mountainous as well as low laying areas and close to the sea. And humans have been there. And animals exist there. And the whole regime of migratory birds. A few of them come into these high Arctic areas and breed successfully. And then there's predator/prey relationships are there with the lemmings and the weasels and foxes that are preying on them. And the birds of prey versus the herbivores, like ptarmigan that are feeding on plant material. So it's amazing to see these. And for me, it makes it easier to understand ecological relationships in whole ecosystems functioning where it's simplified in terms of numbers of species. So to me, it's much easier for me to conceptualize ecosystem dynamics in the high Arctic because of the work I've done there versus when I've gone to the tropics just for vacations or I've had other opportunities there in Central America or Florida. I can see it's much more complex in terms of the plant species, complex. And it's -- it can get -- I'm always interested, but it seems much more complex and harder to get your teeth around the whole system dynamics.

KAREN BREWSTER: And St. Matthew plays into that in the sense that it was an island and was fairly simple?

DAVID KLEIN: Yeah, it was Arctic type vegetation. And so, you know, you can -- this vegetative work, literally, could describe the plant communities and had a pretty good understanding of why there was variation in the plant communities and how they related to, say elevation above sea level, exposure to the wind, exposure to sunlight versus the shady side of mountains, the effects of herbivores, and the water relationships, whether they were well drained or sufficient water for drainage for different kinds of plants growing along stream banks and stuff, and versus marshy, where there's slow movement of water but plenty of water. Water shortages were not significant, but lichens are strange creatures that dry out rapidly and stop growing if it's sunny. So you get a sunny day and if there's any dew from the night, it's -- and in summertime when there's so much light, the dew is evaporated off right away and the lichens go dormant and don't grow. Whereas the vascular plants are thriving in all of this photosynthetic light. The lichens can grow if they're not shaded in foggy weather. It's not a problem. There's plenty of light for their photosynthesis, but they grow much more slowly. But if they're shaded out by taller plants like willows and shrubs that might crowd them out or even sedges might out-compete them for light and it'd be light which they're after. And it's sort of like in a rainforest where lichens growing up in the tops of trees on dead wood, snags and stuff are -- but there's none down on the forest floor because it's -- except the ones that blow down and fall down there, but they don't grow down there.

KAREN BREWSTER: So they want light, but they don't want sun?

DAVID KLEIN: They're happy to have sun if it's sunny and raining, or sunny and --

KAREN BREWSTER: And moist.

DAVID KLEIN: And moist. If they can be moist -- if there's fine mist and lots of sunlight coming through the thin clouds.

KAREN BREWSTER: But if it's cool and shady and still light, then they'll keep growing?

DAVID KLEIN: Yeah.

KAREN BREWSTER: Okay.

DAVID KLEIN: As long as they're not shaded out. And so they grow on trees --you can see where they grow is where they can get plenty of sunlight. And then when there's -- instead of being covered by the evergreen trees, by the branches of the evergreen, that shades them out too much.

KAREN BREWSTER: Right. So you were going to talk a little bit about the publications that have come out of all this St. Matthew Island work.

DAVID KLEIN: Yeah, I talked a little bit about the different kind of publications, because I wrote some articles for general public interest. I was asked to write up that first trip. No, it was after the crash die-off. I was asked to write up an article for the Explorers Club Journal, which I did. And then I was -- And they appreciated it, apparently. And then I had an invitation to join the Explorers Club because of the St. Matthew Island work. But I had also worked some, at that time, in the Arctic. Well, in Alaska, but also a little bit in adjacent Canada. At any rate, I was invited to join the Explorers Club, which I hemmed and hawed about that. At that time, they didn't allow women --

KAREN BREWSTER: Right.

DAVID KLEIN: -- to be in the Explorers Club. And there were no blacks in the Explorers Club, even though Henson was a black man who was --

KAREN BREWSTER: He wasn't in the Club though probably.

DAVID KLEIN: No, but he got to the North Pole.

KAREN BREWSTER: Right.

DAVID KLEIN: So -- Plus another factor was it cost about \$700 a year to join. At that time we were just building a home and financially it was not a realistic thing to do. And so I denied. I said, you know, I didn't think I wanted to join at the present time for those two reasons, financially and then I didn't -- I thought they didn't allow women and black people to be members. So then I did another -- at the request of -- In the '70's, early '70's yeah, after I'd published a technical paper in the *Journal of Wildlife Management* on the introduction, increase, and crash of the reindeer on St. Matthew Island that was published. And that was the whole write-up on the differential survival of females versus

males and all of the work that we did, follow-up work on vegetation and pinning down the time that the die-off had occurred. And I was in Norway on a sabbatical year in 1971/'72 and the editor -- Norwegian editor for a Norwegian journal, Polar something or other. I've a copy right here. Asked me to write an article on it for him for that journal. And they would publish it in English, so I said, "Yeah, okay, I'll do that." So I did that. Subsequently, I got to know this Aud Luno(sp?)[1:39:55], who was the name of the editor. He was a high school teacher who had taught in one of the Norwegian high schools, but when he was younger, he had been a polar bear hunter and fox trapper in Svalbard. And any rate, after I had published there and I'd met him again in Norway on the sabbatical, and then a couple of years later I got this letter from him saying, he just wanted to tell me that my daughter, who was a student in a Norwegian high school taking math from him, was doing quite well. Which I appreciated.

KAREN BREWSTER: Yeah, that's funny.

DAVID KLEIN: And she did, too. He was a nice guy. There were connections. She's the one that -- daughter that spent the time out at St. Matthew's and is similar to me in many ways.

KAREN BREWSTER: So other publications? You must have published a lot of scientific papers?

DAVID KLEIN: I did. There was the --The first paper on St. Matthew was published in a series by the Fish and Wildlife Service. A sort of a special report kind of series that published nationwide on some biological studies. But they were just getting into that period when they were starting to publish stuff, where previously it would end up in the reports in the file cabinet and wouldn't get out. So yeah, I wrote up that first one, which included all the vegetative work. And I had worked with -- I got a lot of the plant identifications done. And when I put together the plant community types from the line transects, I had a senior professor, Harold Hanson, I think was his name, who -- from I forget which university. It might have been Purdue or someplace? Who had done some work in Alaska on grazing lands of caribou. And he volunteered to go over my collections and my write-up, and he provided a lot of help in explaining plant community structure in relationship to my collections and my own interpretations from some limited reading and stuff. So he was very helpful in that. And was -- But that report was comprehensive and included lists of bird species seen, and the status of foxes, and the singing vole, and anything else that we -- of interest. A lot of photography, black and white photography of vegetation plots. And we built exclosures to keep the reindeer away from some of the plots for control. So that was a basic source of early information. And then subsequent publications could use that as a basis for comparison in vegetation, etc., especially for the vegetation plots. And then the follow-up work included a lot of emphasis on the reindeer and changes in body condition. And we looked for parasites and there were no warble or bot flies in the reindeer there. And it was a combination of when they were brought from Nunivak Island, when the reindeer were brought from Nunivak Island, plus one or two were brought in the animals' hides they weren't -- animals that had been infected already. It might have been when they were mostly free of infections.

But even if they had -- with only a few animals in the strong winds, these adults have to fly and mate and free find the reindeer. It's quite likely they would not have survived and reestablished in the new population there, or established.

KAREN BREWSTER: I would say, every time you went back to the island, you were kind of doing a little different kind of research. So I think each time you'd have new information to publish and you published a lot, I'm sure.

DAVID KLEIN: Yeah, that's true. It was. Again, the focus remained mainly on the plant/animal relationship, the reindeer and the vegetation. But there were other things that -- data I collected which passed on to other people like the black fish tissues showing up in the fish samples we sent back. The char samples we sent back to be examined. And then we kept track of the -- as best we could, the identity of whale remains, skeletons or carcasses that were frequently beached there. And we could see other things that had been commented on by earlier explorers, which still remain to be addressed. For example, we could see that there would be extreme storm events must have accounted for -- or even tsunamis, must have accounted for some driftwood being -- well, some early explorers said a hundred feet above sea level, ice level. I don't think I ever found any place where it was quite that high, but maybe seventy feet. But it looked like places where that had happened was not just high tide, or storm tide, it looked like that must have been a tsunami because then there'd be a row -- some places of driftwood at a higher place and then no driftwood except down at a lower place. And it was obvious that that driftwood and some skeletal remains of whales or marine mammals in with the driftwood. And those have never been dated. And they could be dated by someone taking a lot of wood samples, and maybe even using tree rings data, but also Carbon 14 analyses and the bones of the animals would probably be the best, more accurate way to do this to get a feeling for when these might have occurred. So tsunamis could have been generated by volcanic activity in the Aleutian Islands. The Pribilof Islands, there was -- I remember coming across a Russian, the priest Veniaminov, who was good about keeping records on things when he was working in Alaska. And he reported on an earthquake on St. George Island that must've been a really major magnitude earthquake. And it knocked down buildings on St. George Island, rather, but didn't have as strong an influence on St. Paul. So there was some kind -- and one suspects that there must be a major fault close to St. George because there's a big canyon in the sea that comes up close to St. George and accounts for it being -- it's only forty miles south of St. Paul. It has unique gull species that occurs there, the Red-legged Kittiwake. And it has other birds that are more related to the Aleutian Islands. And some of the flora there suggests more of a maritime climate. So probably during -- there were probably quite likely seabirds nesting there even when sea levels were lowered a hundred meters, whereas on St. Paul, they probably were not there, or on St. Matthew.

KAREN BREWSTER: Was it after your 2012 trip or your 2005 trip, you published some article about going there? Wasn't it about polar bears?

DAVID KLEIN: Yeah, that was after the 2005. One of the things that was obvious from the early -- the first time there, was these trails made by polar bears that were not being

used by the reindeer, and polar bears were not there. But polar bears were known to be summer residents on St. Matthew and Hall Island. The first published -- there were probably some Russian reports, yeah, there are some earlier Russian reports, but there's a good write-up on the polar bears in 1874. Elliott, who was a PhD from the Smithsonian, who was assigned to be the responsible scientist for managing the Fur Seals Islands. He was there in 1874 and an assistant who was also a scientist went with him on a sailing ship. They went out on the sailing ship and they got dropped off there. They were able to go ashore with some of the crew onto St. Matthew Island and they were surprised to see, you know, hundreds of polar bears. They estimated 250 to 300 polar bears on St. Matthew and Hall Island. And that included females with young. So these were -- and then they talked about how they seemed to be grazing on sedge hedges. They were probably also going after voles, which might -- gave the impression, that they were -- he described it they were rooting in the soil, but they might have been going after voles. But polar bears sometimes have been known to eat green vegetation just as grizzly bears or brown bears do in the springtime, eat a lot of it. And so at any rate, they shot some and they were in good body condition, but the hides were molting so their skins were of no value. Then during the -- the polar bears had died out. And we thought that they were shot out by the 1890's, sometime in the 1890's. Because the Harriman Expedition, when they got to the St. Matthew Island in 1899 with C. Hart Merriam and the mammologist and glaciologist, which is his name, who's the early environmentalist from California.

KAREN BREWSTER: Oh, John Muir.

DAVID KLEIN: John Muir. The two of them, they were -- the Harriman Expedition actually, Harriman himself, a wealthy businessman, he wanted to go there to hunt polar bears because he heard that there were polar bears there. Whereas Merriam and Muir were more interested in the animal life there and what was unique. And the polar bears, too. But when they got there, there were no live polar bears left and they found some skeletons and skulls with bullet holes in them. And then it turned out -- Well, Art Sowl, who was the biologist there, and that I went there in 1985 with him, as well as in 2005. And he was interested in the polar bears and had picked up a couple of skulls with -- whole skulls with bullet holes in them. And he also had found the skull of a younger polar bear that had been killed in an avalanche on Hall Island. And obviously, it was a more recent one, but it was killed probably by a snow-generated avalanche. So when the sea ice there -- we knew that polar bears are in that region every winter from the Chuckchi population.

KAREN BREWSTER: Okay.

DAVID KLEIN: They come down into the Bering Sea, as long as there's seals and other species available for them to prey on. And the early whalers commented on the islands in the -- there were more than -- Hall Island was originally -- the name the Russians gave to it was translated as Bear Island, and so the bears are known to be there. So then I speculated, you know, oh, who killed off these polar bears because as Elliott had said the hides were not good in the summer. That they were molting and the hides weren't of value. Whereas hides would have been of value to whalers, but if whalers were only there



-- the only time they'd be there was when they could -- when ice free and then that would be in the summer when the bears were molting and the skins are of not much value. But I did go through the Whaling Museum in New Bedford [Massachusetts], in their library, and researched log books of the whaling ships captain's logbooks there, and any of those when they were in the vicinity of St. Matthew, I thought well maybe they did finish them off. Maybe they put crews ashore just for hunting or whatever. Or maybe they were getting -- the skins were of some value. But I came to the conclusion that they didn't go ashore there. They knew about -- had heard about there being bears there. But if they were going north and they were in the vicinity of St. Matthew, they wanted to get to the edge of the sea ice as soon as they could where the whales were. And then these whaling ships were used -- the ships were not owned by the captain, they were owned by the companies.

KAREN BREWSTER: Right.

DAVID KLEIN: And so the captain and crew benefited from coming back with a load of oil and whale bone from the --

KAREN BREWSTER: Baleen.

DAVID KLEIN: -- baleen. If they overwintered up in, off of Barrow, for example, some of them did, they would also harvest -- get -- buy skins from the Natives of other furbearers, foxes primarily, but other skins including polar bears if they could get polar bear skins then. But there was -- I could find no indication that any sailing ships would stop there. And generally, it became obvious that when they were going north -- and it's the big ships which aren't very maneuverable when you get close to the shore. So you'd have to -- if you're gonna go to shore, you'd have to anchor out a ways. If you're there when there was ice, you wanted to -- you didn't want to risk --

KAREN BREWSTER: You didn't want to stick around.

DAVID KLEIN: You didn't want to get stuck in the ice close to the island, which that can happen if the ice was blowing up the island. On there, they were so focused on getting whales that they would be looking for whales and moving north as fast as they could to stay at the broken edge of the ice where they could kill whales. Coming south, they were already filled up with the oil, especially those that had overwintered up there. They were heading back to San Francisco as fast as they could get there because they wanted to get home. They'd been gone for months and months, at least. And they had all this potential wealth to get home. And they wouldn't want to risk again going ashore and taking the time to do that. And they used the favorable wind to get --

KAREN BREWSTER: So did you figure out what happened to the polar bears?

DAVID KLEIN: So then I sort of, kind of ruled out the whalers. And -- So then I went through the reports from the controversy over the fur seal harvest between -- When there was an international tribunal based in The Hague, I think, and -- to determine -- a conflict

between -- a disagreement between Great Britain, the United Kingdom, and the United States over this treaty that when Alaska was purchased from Russia, Russia was managing the fur seals on the Pribilof Islands and there was an international treaty developed which included some of the proceeds of the harvest went to the countries that had -- the fur seals lived in. And so they wintered -- The Pribilof Island fur seals wintered off the coast of California and then they migrated very close to the Vancouver Island where the Native people traditionally hunted them. And then they cut across the Gulf of Alaska to get to the Pribilofs. So the treaty included Great Britain representing Canada, and the U.S., and Russia. And then later Japan got in on it for a short time, the treaty, because they had fur seals over on the Kuril Islands. And then the Russians had fur seals also on the Komandorski Islands. So the controversy was largely over the sealers' pelagic hunting of the fur seals. Hunting them while they were migrating north because they shot then -- the females and younger seals came in groups up the coast, and then across the Gulf of Alaska and then up through the Aleutians and then to the Pribilofs. So the sealers would tend to follow these, and they included -- a majority of the sealers were Canadian, based out of Victoria, but also quite a few from San Francisco. But they were originally, in both cases, they were sealers that were from the Atlantic, north Atlantic, who when they shot out the seals, over harvested the seals there, that was mainly hair seals, they came around to the west coast and started hunting the fur seals. And they didn't -- the population of fur seals -- the United States got the Pribilof Islands when they bought Alaska from Russia in 1867. And they were then responsible for overseeing the management because it was a Russian company, fur company, that was managing the seals. They had made new contracts with American fur companies to do this. And this Elliott -- government had oversight for the biological aspects and population estimates, etc., etc. So there was controversy there about whether pelagic hunting was causing a reduction in the population or whether the population on the Pribilofs was actually going downhill from over harvest in some way. Well, the United States stopped harvesting females, and started harvesting only bachelor males. So the United States claimed that the population was going down, continuing to go down, and they had cut back on their harvest and were not harvesting any females. But the sealers were continuing to harvest females -- mostly females during the migration up to the islands. And then when they got up to the islands, they were being criminals and poaching seals off the beaches around the islands where they could get -- sneak in in the fog, and drop off a team and kill a hundred or two hundred seals, skin them, and then the boat would sneak back in again and pick them up, because frequently they couldn't be seen unless they had guards up on the cliffs all the way around the island. And so then the United States was complaining and they finally created these -- precursor to the Coast Guard, the Revenue Cutters.

KAREN BREWSTER: Right.

DAVID KLEIN: So they sent some of these Revenue Cutter boats out to sort of help guard. And the United States -- the British representing Canada, and the Canadian sealers, they didn't believe that the seal populations were going down, that the counting was screwed up. And this also related to this other paper I did on the lichens, but we won't go there. Let's stick with the polar bears.

KAREN BREWSTER: Did you find whether those fur seal managers and hunters took polar bears?

DAVID KLEIN: Well, I concluded that. It's amazing that during that tribunal both the British and Canadian authorities and Americans gathered information to support their argument when this was going before The Hague tribunal, as to whether harvesting the seals were -- female seals pelagically was detrimental. It was obviously, they were violating the -- they were breaking the law by poaching them. And then the United States wasn't getting any positive response from the British, so then they tried to shut down the whole Bering Sea for foreign ships saying that it was -- when Russia owned Alaska, the Russian government claimed this was an inland sea, the Bering Sea was an inland sea and it belonged -- that Russia had total control over it. And that Alaska, when Alaska was purchased by the United States, they got that right to control the eastern part of the Bering Sea and they could shut down foreign ships. Well, of course, that was in violation of international law of the seas at the time. But any rate, they literally started checking ships and what they -- to see whether they had fur seals that they had poached or taken in violation of this other law. And so then the two sides gathered information. They got sworn statements from the captains of these sealing ships as to how they hunted because the Americans were claiming they were wounding a lot and not recovering them. And these captains made sworn statements. And this is related to polar bears. And they said, "No, our" -- their's were smaller ships. The sealing ships were smaller ships, and they used smaller boats than they used for hunting whales. And they were still small boats, using oars and a small sail and then a bigger boat, but they were sloops. They weren't big multi-masted ships. And so they -- when they would see the group of seals they would put some of these boats over, usually, because they usually couldn't get close necessarily with the bigger ship. And they would shoot them and harpoon them after they shot them. Sometimes they would harpoon them even initially if they had the opportunities. But the question was, you know, did they recover, did they wound a lot or not? And so -- Of course, they would not claim that they wounded a lot, lost a lot. They claimed they -- they didn't -- they said they provided their crews and several of the groups, the captains, said this, both Americans and Canadians, said, "No, no. Our hunters are super good shots. We provide them with all of the ammunition they can possibly use to hunt and shoot anything they can see. Birds or anything else." And so they shoot -- nothing else was protected really, except the fur seals. They were the first to be given some protection. The other marine mammals -- No, the exception was the sea otters. They were -- it was illegal in the United States after the Russians had depleted the sea otters. So the sea otters were protected, and the fur seals on the Pribilofs were protected legally. Polar bears on St. Matthew Island were not protected. And the crews of these Revenue Cutters frequently went ashore when they were -- When the sealers weren't around the Pribilofs, they cruised around looking for sealers to see whether they could board them and find fur seals they had poached. When they were up in the neighborhood of St. Matthew, this was in the log books of these Revenue Cutters, the *Corwin* particularly. They'd put their crew ashore just so they could say they killed a polar bear, or more than one polar bear. There was no limit. The last reported shooting of polar bears on the St. Matthew Island was a Revenue Cutter. And we don't know the exact year. In the 1890's, killed 16 polar bears.

KAREN BREWSTER: 1890's, you said?

DAVID KLEIN: 1890's. And we presume that was the early 1890's, because in 1899 there were no polar bears left. And there was a sailing ship -- a geologist on a British, I think it was a British ship, sailed past Pinnacle Island and doing observations on the geology. Pretty good stuff published in his time. Mostly from shipboard and with a spotting scope, telescope. And he didn't report on any sightings of polar bears on St. Matthew or Hall, but he did report several climbing on Pinnacle Island for sea birds and eggs.

KAREN BREWSTER: They were desperate.

DAVID KLEIN: Which is known to be the case in northern Canada. And so there were still some polar bears then, at least, and they presumably had come from St. Matthew. But the -- So it was sometime probably in the early 1890's, but it could have been later.

KAREN BREWSTER: Well, all of a sudden you became a marine mammal biologist and a historian.

DAVID KLEIN: Right. And so, especially when these -- several of these sealers' captains said, "No, no, our hunters are -- they're trained on anything that's alive that's in the water other than the fur seals." They're trained and they can shoot, and they're excellent shots from a boat. And I think that makes good sense. But then there's one comment made by the -- in the log book of Revenue Cutters or someone on the Revenue Cutters boat wrote that while they were anchored up in the lee side of -- near St. Paul, near the St. Paul harbor there, limited harbor. They frequently would socialize with the -- occasional sealer would come there to sit on the lee side if it was a bit stormy and anchor there off the island. And they would socialize. They were good friends 'cause they were both -- you know, they had respect by the Revenue Cutters.

KAREN BREWSTER: They were all men of the sea.

DAVID KLEIN: Men of the sea, and also hunters.

KAREN BREWSTER: Right.

DAVID KLEIN: And so then they told the sealers that they ought to go -- if they want to hunt polar bears, there.

KAREN BREWSTER: Go to St. Matthew.

DAVID KLEIN: And the only reason, largely, for hunting polar bears is so they could go back and say, "I killed this tremendously dangerous bear that -- the Ice Bear." And that's a macho thing, that's like --

KAREN BREWSTER: Yeah, they weren't doing it for the meat.

DAVID KLEIN: No, they weren't doing it for the meat, and they weren't doing it for the hides. And they frequently weren't even doing it for the skulls. They were just going to say, "I shot a polar bear." And they could go back home and tell their family and their kids and neighbors and everybody else that they were a macho type. And there were some wealthy hunters that were paying big bucks to go on sailing ships up there into -- through Bering Strait to Wrangell Island area, where they could shoot polar bears and just --- and string these up in the rigging and take pictures. I've got pictures from the whaling --

KAREN BREWSTER: Right.

DAVID KLEIN: -- museum of this. So at any rate, the general conclusion was that it was the sealers. It was including Canadian sealers and American sealers that finished off the polar bears. And then, ultimately, the solution from -- as real to this tribunal, the British agreed that they should outlaw pelagic hunting of seals. The U.S made their case that the population was going down and the pelagic hunting should be stopped for conservation. And, of course, then according to the treaty, the proceeds were divided with between the U.S., England representing Canada, and Russia. So this was a major conservation effort and, of course, it was all based on the wealth of these -- of the represented by these fur seals and the money. And, you know, it was -- I think it was within three years, the United States had made more money from the fur seals than they paid for Alaska.

KAREN BREWSTER: Wow.

DAVID KLEIN: 7.2 million, I think.

KAREN BREWSTER: Yeah.

DAVID KLEIN: And so they'd made more money from fur seal harvest.

KAREN BREWSTER: Well, I think that sounds like a good place to stop for the evening, now that we've --

DAVID KLEIN: Yeah. So you can see how these things turn out to be so fascinating. And I'm not much of a historian, but, you know, tracing these things down has been a lot of fun.

KAREN BREWSTER: Yeah, it sounded like, yeah, that's when you really got into the mystery in trying to figure it out.

DAVID KLEIN: Yeah, right.

KAREN BREWSTER: Well, and that's what science is, too, is figuring out a mystery.

DAVID KLEIN: There was amazing stuff, you know, when like, you know, this problem Alaska Maritime Refuge with rats. Getting rid of rats on islands. And one of the -- going through these sailing ship log books, or whaling ship log books, they'd tell -- It's just terrible. You know, they'd load up with all these supplies in San Francisco and by the time they got to the Aleutians, the rats aboard the ship would be so bad they'd eaten up a lot of it and contaminated a lot of their food. And, of course, they ate a lot of whale meat, once they got whales.

KAREN BREWSTER: Once they got -- yeah.

DAVID KLEIN: But -- so what did they do to get rid of the rats? They smoked them out. But they did it when they were laying in the harbor on Unalaska near Dutch Harbor.

KAREN BREWSTER: Oh, yeah.

DAVID KLEIN: And then the rats went overboard.

KAREN BREWSTER: Oh, and they went on the islands?

DAVID KLEIN: Yeah.

KAREN BREWSTER: But so the rats all came from San Francisco originally? Or Seattle?

DAVID KLEIN: No --

KAREN BREWSTER: They came on board ships?

DAVID KLEIN: On board ships. The first rats -- the Rat Islands.

KAREN BREWSTER: Right, in the Aleutians?

DAVID KLEIN: They were named the Rat Islands because the Russians found rats there when they first got there.

KAREN BREWSTER: Oh!

DAVID KLEIN: And how did they get there? Well, it wasn't learned until some Japanese scholar going through old Japanese records told about this fishing boat, Japanese fishing boat, sailing boat, that had wrecked on those islands. And that accounted for the rats. And rats were on virtually every ship.

KAREN BREWSTER: Right. Well, we're getting off topic.

DAVID KLEIN: Yeah.

KAREN BREWSTER: Talking about rats. So we'll stop for tonight.

DAVID KLEIN: Right.

End of interview.