ON THE TRAIL OF THE CALIFORNIA PINE

Brother Alfred Brousseau
St. Mary's College, Calif.

The statements in books about pine cones, sunflowers, pineapples and other natural objects manifesting Fibonacci numbers in their structure are interesting, but they are bloodless and academic when compared to the actual experience of seeking out and examining these things. The present account concerns a series of events which began in the summer of 1966 when the author started collecting cones of the California pines with a view to observing and verifying Fibonacci relations.

Being located at Huntington Lake in the Sierra Nevada with a number of pine species in the near vicinity, there was a good opportunity to begin the work of collection. With pine trees of several species all about and with cones in profusion lying on the ground, there seemed to be no problem. However, all these fallen cones were open and here was the first big surprise: it is difficult, if not impossible, in many cases to follow the spirals on open cones. There is a notable element of uncertainty involved which could lead one to using his imagination rather than examining the spirals objectively!

It seemed that the only thing to do was to go about looking for fresh closed cones. This was not too difficult for the lodgepole pine (Pinus Murrayana) but provided a problem with the yellow (Pinus ponderosa) and Jeffrey (Pinus Jefferyi) pines. These are large trees and in our area the cones few in number were very high. However, it was possible to collect a fresh cone of each of these species as well as samples of immature closed cones that were found on the ground.

Then followed a hike in the Kaweah Mountains during which many fine specimens of what was taken to be the limber pine (Pinus flexilis) were observed. However, only one fresh cone was collected, though a number of good open specimens were gathered.

On returning to base camp, it was found that the rodents had taken advantage of my absence to upset the boxes in which the fresh cones were stored and of course they had one or more sumptuous meals at my expense. This meant starting all over again with greater security measures against these predators.

A large cardboard box with a substantial board and heavy rock on top of it seemed to provide ample protection.

A special trip was made to the vicinity of Cow Creek (near Mt. Tom) to collect sugar pine (Pinus Lambertiana) cones. There were many immature fallen cones on the ground and these were procured in quantity. Such cones apparently do not come open subsequently, so that with their fine symmetry and large size they furnish an ideal means of bringing out Fibonacci relations.

The white bark pine (Pinus albicaulis) grows at an altitude of from 8,000 to 12,000 ft. Specimens were found on Kaiser Ridge. However, another hazard for the pine cone collector was highlighted at this point. In this area there were not too many trees with cones. But more disappointing, those that had them in quantity had been visited by the Clark nutcracker (or Clark crow) which pecks away at the cones on the trees and gets at the nuts inside. Thus it was not possible to find one good cone. Furthermore, those cones that are on the ground deteriorate so that even here, the one or two open cones collected were very fragile.

At the end of the season in the mountains, therefore, the following species had been obtained either in the form of fresh cones or open cones; lodgepole pine, yellow pine, Jeffrey pine, silver pine (Pinus monticola), what was believed to be limber pine, sugar pine, and white bark pine. On the way down to the valley, there were many digger pines (Pinus Sabiniana) and some fine open specimens were gathered from the ground.

Thus eight species in all had been obtained with the following still awaiting collection:

One-needled pinon (Pinus monophylla)
Pinus edulis (edible pinon pine)
Four-needled pinon (Pinus quadrifolia)
Bristlecone pine (Pinus aristata)
Foxtail pine (Pinus Balfouriana)
Bishop pine (Pinus muricata)
Santa Cruz Island pine (Pinus remorata)
Beach pine (Pinus contorta)
Torrey pine (Pinus Torreyana)
Monterey pine (Pinus radiata)
Knobcone pine (Pinus attenuata)
Coulter pine (Pinus Coulteri)

The work of collecting was continued at St. Mary's College in September, 1966, this institution being located in Contra Costa County about twenty-five miles from San Francisco. The Monterey pine was found on the property. The knobcone pine was located on what is known as Moraga Ridge in the vicinity of a small settlement named Canyon. In the Mt. Diablo area, a fresh digger pine cone was found as well as a green Coulter pine cone. This latter pine is not too easy to identify especially in the Mt. Diablo area as the tree grows there along with digger pines from which it is difficult for the amateur to distinguish it. One certain means of identification is the longer wing on the seed of the Coulter as compared to the digger. The Coulter pine cone is a magnificent large specimen ranging in length from eight to twelve inches.

A special trip was made to Tioga Pass to collect the one-needled pinion pine cone. Not knowing exactly where these trees were to be found, it was necessary to grope around. However, about eight miles beyond the pass on the East side, a prominent group of bushy looking trees was observed on the left side of the road. These were indeed one-needled pinions. After scrambling up steep cliffs to gether specimens, it was found that the Clark nutcracker had again been doing his work. There were quite a few cones on the ground but these dry cones are badly out of shape though not without their artistic aspect. They would render tracing spirals impossible. A number of intact fresh green cones was obtained as well as samples of the needles. These latter are most interesting. As the name implies, the needles come individually and are not in groups of 2, 3, or 5 as with most pines. They are round and sharply pointed!

Bishop pine cones had been found earlier in the spring on the Point Reyes Peninsula. A special trip was made up the coast to Sonoma, Mendocino and Humboldt Counties to look for the beach pine. A friend indicated that trees were located just above Fort Ross. These were found and cones collected. However, on returning home, comparison seemed to indicate that what was in hand was the bishop pine! It was only later on another occasion that the beach pine was found. This tree is similar in some respects (especially in its cone) to the lodgepole pine. A couple of specimens were located along the road going up the coast, but since according to the guide book there were specimens in the vicinity of Albion, this area was explored. In the neighborhood of this settlement there seemed to be none of these trees. However, a road leading inland was followed for a few miles. This led to a plateau area with strange

looking soil and here an abundance of these beach pines was found. They appeared to be somewhat stunted in their growth due no doubt to the poor nature of the soil in which they grow. There is also a dwarf variety of this species (Bolanderi) one example of which was apparently found. A forest of these dwarf trees is located according to information just south of Fort Bragg.

A trip to San Diego provided an opportunity to study the Torrey pine. This is a species endemic to California growing naturally only at Del Mar (north of San Diego) and on Santa Rosa Island (one of the Channel Islands). There are only about 3,000 trees of this species in existence. As a result, they are protected to a large extent in Torrey Pines State Park. It was possible to find some trees outside the limits of this park and collect one or two of these very interesting and distinctive cones.

On this same trip an excursion was made to the East with the hope of discovering some pinon pines, but these were not in evidence. As a compensation, however, some interesting Fibonacci specimens (cholla cactus and ocotillo, e. g.), were picked up in the Anza Borrego Desert.

On still another trip to Redding, it was possible to secure two fresh digger pine cones. This was something of an effort as it was necessary to climb to the top of a tree fifteen or twenty feet high, to wrestle with these cones and drop them to the ground. The result was a pair of bruised and badly gummed-up hands.

It was reported that the foxtail pine was located in the Yollo Bolly Mountains and in particular on Mt. Scott (just over 6,000 ft.). Following directions that had been received, this location was found after a trip into the back country amid none too good weather conditions. Various rugged looking trees with cones closed by recent rains were located near the crest and cones and branchlets collected. On returning and submitting these specimens for identification to Dr. Thomas Howell of the Academy of Sciences in San Francisco, it was found that there were no cones of the foxtail pine among them but only cones of the silver pine!

On this same trip some very fine specimens of knobcone pine were obtained West of Redding.

Later in the year, a correspondent in Santa Fe, New Mexico, was contacted and in this way cones of Pinus edulis were obtained.

Thus at the end of this first season there were just four holdouts of the twenty specimens of pine in California, namely; the four-needled pinon, the

bristlecone, the foxtail (so it was thought) and the Santa Cruz Island pine. Specimens were studied at the Academy of Sciences in San Francisco where it was noted, for example, that the Santa Cruz Island pine is very close to the bishop pine with which it used to be identified.

The point of collecting all these cones was to use them as part of an exhibit exemplifying Fibonacci relations in nature. The following lessons of experience show how different the book approach to these matters is from actual contact.

In the first place, it was possible to take open cones and close them by soaking them in water. This would take care of a particular exhibit that one would want to make. However, it was found that if such cones were slightly dried and then covered with white glue, one or more coats would be sufficient to keep them closed!

In the second place, most of the fresh cones that were collected dried and in due time opened so that all the effort involved in gathering them was misplaced. There are cones (such as those of the Monterey pine and the bishop pine) which normally remain closed; but if a cone opens on drying, there is not much point in having a fresh cone because sooner or later it will open anyhow.

In examining pine cones, it was found that there are two principal ways of noting the Fibonacci relations. One is to take a particular set of spirals and count their number: this should be a Fibonacci number. The other is to start at some particular bract and follow two spirals proceeding from it until they meet again. Then the number of bracts along each spiral required to go from one intersection to the next should be a Fibonacci number.

It was noted likewise that in many cones there are more than two spirals going through each bract. If there are spirals one, two, and three, for example, any two of these spirals can be related and in each case there will be Fibonacci numbers.

For exhibit purposes the following means of bringing out these relations can be used. In accord with the first system each spiral can be painted a given color, so that the number of colors automatically shows the number of spirals. Following the second system, the spirals issuing from one bract can be colored differently or map pins of different colors, one for each spiral, can be used.

Part two of the pine cone project was completed in the summer and fall of 1967. Once again the mountains were visited, but this time the idea was to

find cones and collect them before the birds had done their work. As a result, it was possible to secure some excellent specimens of the cones of the white bark pine. These are things of beauty, roundish in shape and purple in color! Furthermore, they were immediately covered with white glue so that they would hold their appearance and not fall apart or deteriorate. Similarly, fine specimens of silver and yellow pine were obtained in their fresh state and glued.

It must be reported that this gluing of fresh specimens seems to work well for small cones such as the white bark pine cone and the foxtail cone. But the larger cones, such as those of the yellow and Jeffrey pine, opened in spite of the glue. Better results were obtained for these latter cones by taking an older cone, soaking it in water and then gluing. Presumably, the answer may be that the once open cone on being closed has small cracks between the bracts which are filled with glue and thus the bracts are held more strongly together.

The crowning achievement of the summer was a quick trip to the Alta Peak area near Sequoia National Park. It was reported that the foxtail pine could be found there at high altitudes. In this whirlwind trip, the issue was long in doubt: there seemed to be nothing along the slopes but very rugged looking silver pines. As the tree line was approached, however, two somewhat smaller specimens were observed which raised hope. Closer examination showed all the characteristics of the foxtail pine: needles of about an inch length, cones that were definitely different from those of the silver pine and open cones on the ground that corresponded to what had been observed at the Academy of Sciences in San Francisco. There were only two scraggly trees but they represented the end of a long search.

SEQUEL

The final act of the pine cone search came in the fall. In conjunction with a mathematics conference in Squaw Valley at the end of September, it was decided to go to the Bishop area and proceed to Onion Valley west of Independence to collect the limber pine. The reader may recall that the author thought he had this specimen in the summer of 1966 when hiking in the Kaweak area. However, these cones turned out to belong to the foxtail pine, so that all the effort in Yollo Bolly Mountains and the dash to Alta Peak was superflous!

Onion Valley is a very interesting area about nine thousand plus feet, reached by a good mountain road from Independence. According to an article

read after the trip, there are eight species of pine within a few miles of this point, the author claiming this to be the greatest density of distinct pine species in the world. Some very interesting trees and cones were found and specimens collected. However, on being brought to Dr. Howell at the Academy of Sciences, it was found that they were excellent specimens of foxtail pine!

Likewise on this trip it was possible to collect some specimens of the bristlecone pine, a unique tree growing at an altitude of over 10,000 ft. in poor dolomite soil. These trees are the oldest living thing in the world, ages of 3,000 years being common and some trees being over 4,000 years old.

In a subsequent trip to the Southern part of the State, a day was taken to do some collecting in the neighborhood of Aguanga (south of San Bernardino) and on Mt. San Gorgonio. The first location is a very small settlement on the road with no pine trees in sight. However, inquiry led to information regarding what the local people call Pine Flat. There, the four-needled pinon was found in quantity and specimens procured.

Not too far beyond this point, what must be literally known as a windfall came to hand. Cresting a gentle pass, trees with very large cones were noted. Investigation showed that they were Coulter pines. However, the cones on the ground were old and broken, while those on the trees were so high it was very difficult to get at them. Continued search revealed a tree with its top broken off: there on the ground was about eight feet of a twenty-five to thirty foot tree with two very large cones on it! Apparently, these cones were sufficiently heavy to snap off the top of the tree in a wind!

About four-thirty in the afternoon after considerable motoring, Poopout Hill parking lot on Mt. San Gorgonio was reached. After about an hour and a half of brisk walking up the trail, the elusive limber pine was found. Specimens were collected for about half an hour and the return trip begin. However, darkness set in at seven o'clock so that there was a full hour of hiking in the dark, though the moon made the going somewhat less difficult!

At the end of this trip, there was a certain feeling of satisfaction: all cones of all California pine species except the Santa Cruz Island pine which is located on this particular Channel Island had been collected.

SPIRAL PATTERNS ON CALIFORNIA PINES

The following designations of spiral patterns do not make any pretense of completeness. Actually bracts can be lined up into sequences in many ways. The following are simply some of the more obvious patterns which have been observed.

As for notation, 8-5, for example, means that starting from a given bract and proceeding along two spirals, 8 bracts will be found on one spiral and 5 on the other when going to the next intersection of the spirals.

Pinus albicaulis (Whitebark pine) 5-3, 8-3, 8-5
Pinus flexilis (Limber pine) 8-5, 5-3, 8-3
Pinus Lambertiana (Sugar pine) . . . 8-5, 13-5, 13-8, 3-5, 3-8, 3-13, 3-21
Pinus monticola (Western white pine, Silver pine) . . 3-5
Pinus monophylla (One-leaved pinon) 3-5, 3-8
Pinus edulis 5-3
Pinus quadrifolia (Four-leaved pinon) 5-3
Pinus aristata (Bristlecone pine) 8-5, 5-3, 8-3
Pinus Balfouriana (Foxtail pine) 8-5, 5-3, 8-3
Pinus muricata (Bishop pine) 8-13, 5-8
Pinus remorata (Santa Cruz Island pine) 5-8
Pinus contorta (Beach pine) 8-13
Pinus Murrayana (Lodgepole pine, Tamarack pine) . . 8-5, 13-5, 13-8
Pinus Torreyana (Torrey pine) 8-5, 13-5
Pinus ponderosa (Yellow pine) 13-8, 13-5, 8-5
Pinus Jeffreyi (Jeffrey pine) 13-5, 13-8, 5-8
Pinus radiata (Monterey pine) 13-8, 8-5, 13-5
Pinus attenuata (Knobcone pine) 8-5, 13-5, 3-5, 3-8
Pinus Sabiniana (Digger pine) 13-8
Pinus Coulteri (Coulter pine) 13-8

★ ★ ★ ★ ★