SOME OBSERVATIONS ON THE SPOTTED SANDPIPER

ACTITIS MACULARIA

by

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A report of an original field study conducted
as a requirement for Advanced Ornithology
(Zoology 209), University of Michigan
Biological Station

Submitted August 15, 1941

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INTRODUCTION

From July 20 until August 30, 1955, a study of a nesting Spotted Sandpiper (Actitis macularia)was undertaken to learn about the reproductive phase of the bird's life history. The opprotunity and time available allowed the study to cover only the period from the last day of incubation through the twelfth day after the eggs hatched. The nest with four eggs was discovered by Michael Valentine of Lincoln, Nebraska on July 15, but observations were not begun until July 20. Seven trips were made to the nest area, and a total of 17 hours were utilized for field observations. The study dates and the number of hours spent are as follows: July 2o five hours, July 22 four hours, July 23 two hours, July 24 two hours, July 29 two hours, July 31 one hour, and August 3 two hours. After the chicks left the nest, which they did on July 22, the observation periods were shortened, since it was extremely difficult to keep the birds under surveillance and at the same time have them behave in a normal manner.

The study area was located on the north shore of Burt Lake, Cheboygan County, Michigan, 50 yards west of the end of the road which runs so th to the lake from the University of Michigan Biological Station.

Concentration was made on one nest only, but other Spotted Sandpipers along the beach in this area ~~had no effect on~~ affected the study's subject, and observations on one adjacent territory were especially pertinent.

The study was made openly, without the aid of concealment. On the first day of observation, a Bausch and Lomb 20 power telescope was mounted about 30 feet north of the nest and slightly above it. I merely sat on a camp stool behind the telescope

and had complete freedom of movement in making observations of the bird. On the following days I used a camp stool in the same spot, but had 7x35 binoculars instead of the telescope. Of course after the chicks hatched and the precocial young left the nest, observations became a non-sedentary endeavor.

I caught all three chicks on July 23 and color-banded them to aid in later identification. I used red, blue, and gold aluminum bands, giving each chick one of the colors.

I am indebted to Dr. Theodora Nelson of Hunter College for permission to use her doctoral thesis on the Spotted Sandpiper as a reference.

ENVIRONMENT

The study area included the shallows of Burt Lake and some 300 yards of the beach along the north shore. At this point the sand beach is about 30 yards wide, sloping from the lake to several dunes which lie 10 yards back from the water. It was on the crest of one of these shallow dunes that the nest was located. The beach is rather heavily vegetated with grasses (Agrostis scabra), milkweed (Asclepias syrica), and rushes (Scirpus); poison ivy (Rhus radicans) was especially prevalent. A few elms (Ulmus americana) and alders (Alnus) were scattered over the dunes to the rear of the beach, the landward border of which was formed by the coniferous forest of Reese's Bog. There was a great deal of driftwood on the beach.

The trees of Reese's Bog shelter the beach in such a manner that on hot sunny days in the summer when the wind is from any but a southerly direction, the heat on the beach is stifling.

The road down to the beach makes the study area easily accessible to man, and there are several cottages to the west

of the study area, so that human visitors are not infrequent. However, in this particular study, man, with the exception of myself, did not appear as an affecting force on the birds. Dogs were present in the area although I saw none on the beach during the study. Coyotes (Canis latrans) are known to frequent the woods behind the beach, as are the Cooper's and Sharp-shinned Hawks (Accipiter cooperii and A. striatus). These are potential predators on the Spotted Sandpiper, but no such relationships were observed. Ring-billed Gulls (Larus delawarensis) were present on the beach on days when the wind blew onshore, and I considered that they would be a source of danger to both eggs and chicks. However, except for once when the adult gave the danger call as a gull flew over, the sandpiper apparently was not alarmed by them. Mourning Doves (Macroura zenaidura) flying over the beach caused no reaction in the sandpiper; not so in the case of the American Crow (Corvus brachyrynchos). Upon hearing the calls of several crows approaching the beach from the north, the adult sandpiper, which was then incubating, cocked its head and watched the skyline in that direction. As soon as the crows appeared over the trees, the bird lay very low in the nest, depressed its head somewhat, and appeared to compress the feathers of the body as well. It remained very still in this position until the crows were several hundred yards out over the water, at which time it resumed normal incubating posture and began again to pant violently as it had been doing previously.

No other ecological animal relationships were observed.

Temperatures were generally exceptionally high throughout the study period, accompanied by high humidities. The maximum

daytime temperatures for the study days are as follows, expressed in degrees Fahrenheit: July 20 93. July 22 88, July 23 82, July 24 84, July 31 93, and August 3 93. Since the nest was on an exposed portion of the beach and received little shade from the small plants about it, there was some question in my mind during the incubation period as to whether the embryoes might be killed by overheating. As will be pointed out later, the adult bird took active measures to combat the heat, and the interesting question of whether it did so for its own comfort or to cool the eggs was posed. An excellent problem in the physiology of incubation was hereby presented, but neither time nor opprotunity availed themselves to such a study. The exposure of this nest to the sun was ~~somewhat unusual~~ in ~~its~~ contrast to the 39 Spotted Sandpiper nests observed by Miller and Miller (1948:556-567), all of which were well shaded.

TERRITORY

Although Nelson (1939) has records of females incubating, it is usual among Spotted Sandpipers for the male to incubate and care for the young alone, as demonstrated by van Rossem (1925: 232). I believe that this was the case in the bird I observed, because during the entire period of the study only one adult, a lightly spotted bird which was assumed to be a male, had any contact with the eggs and young, and no other bird on the beach gave indications apparent to me that it was mated to this bird. This situation caused territorial behavior, if there was any at all, to be very slight. Miller and Miller (1948:561) found no territorialism exhibited in 39 nesting pairs on 17.5 acres of land near Detroit, Michigan, and indeed two of these nests were only 12 feet apart. However, Nelson (1939:56) says this on territorial behavior: "Distinct nesting territories have been

observed in a number of cases. These territories are not defended, but they seem to have definite boundaries within which the parent keeps the young until they are able to fly, when the size of the territory is increased, but its boundaries are none the less distinct. Several territories may overlap, but I have never witnessed quarrelling." For the following reasons I feel that the bird observed did have such a loosely organized territory on the beach: no other Spotted Sandpiper ever fed or landed on the beach closer than 40 yards east and 80 to 100 yards west from the nest, although they often fed ~~to the east and west of~~ beyond these limits. In flying by the nest, other birds on two occasions deviated from their line of flight and passed by some 10 yards out over the water. I do not know what caused them to do this, as there was no warning call or threat posturing on the part of the incubating bird. It is possible that some conflict which took place before I began observations had taught the other birds to ~~avoid~~ avoid the area. In addition, the subject bird never ranged farther than 40 yards east of the nest nor more than 100 yards to the west along the beach. On the stretch of the beach to the west of this limit there was almost always another adult Spotted Sandpiper feeding and calling; after several days of observing this deliniation I began to think that this was either the mate of the subject bird which had established a feeding territory nearby, or else another breeding bird on its territory. The latter proved to be the case when, on July 29, I discovered two chicks about three weeks old feeding along the edge of the woods in this area while the adult fed along the beach. These birds were about 150 yards west of the subject nest at the time, and were never seen any closer to it than that.

No actual threat displays or pursuit flights were observed, with the possible exception of an occurrence on July 22, shortly after the oldest chicks had hatched. The subject bird was feeding along the water's edge in front of the nest, while another of the species fed 50 yards to the east. The subject then flew down the beach calling peet-tweet, landed near the other bird and remained there for a few seconds until the other bird flew away to the east. The subject then returned directly to the area near the nest whence it had come. At no time during this episode was there any display, attack, or evidence of intimidating practices, yet the strange bird, which was then closer to the nest than any other was seen during the study, left the area at once. Another incident occurred in the same area, but in this case I could not be certain that the subject bird was involved. An hour after the aforementioned occurrence the subject was feeding along the beach to the west of the nest, out of my sight. I then saw a Spotted Sandpiper fly eastward along the beach, followed closely by another. They flew 50 yards beyond the nest and then alighted. Almost immediately the pursuing bird flew back to the beach near the nest and commenced feeding. I could see only one bird in the area then, and assumed that the pursuing bird had been the subject.

These two incidents are, of course, open to wide interpretation, and it may well have been that the second bird involved in each case was the mate of the subject. However, there seems to be enough suggestion of territorialism in these activities that, together with the apparent feeding areas established, the bird may well be thought of as having a territory, although not so strictly delineated and defended as the territory we are accustomed to think of in connection with passerine birds. Study of many pairs of birds from the time of their arrival on the

breeding grounds would be necessary to establish the condition of the situation prevailing.

NEST AND EGGS

The nest was located on the beach, about 24 feet from the water's edge and 60 feet from the edge of the forest, atop the flat crest of a small sand dune. It was a semi-spherical hole in the sand about one and one-half inches deep and six inches in diameter. It was lined with pieces of grasses and sedges and some driftwood; a few pebbles which jutted into the bottom of the nest cavity were probably not scraped out when the hole was dug. The interior diameter of the nest was four inches, and the depth one and one-quarter inches; the edge of the nest was flush with the ground. The nest was placed between a milkweed plant to the east and a clump of grass 18 inches high to the west. Both these plants were immediately adjacent to the rim of the nest, and provided the nest with the only shade that it received. The milkweed was surprisingly effective as a shading agent during the morning hours, as the incubating bird had about eight-tenths of its body shaded while sitting in certain positions during this time of day. The dead grass lining and bits of included driftwood made the nest very difficult to see against the background of the beach, even when viewed from almost directly above.

The nest contained four eggs, which is typical for most birds. Their background color was a pale buff, and this was irregularly and rather heavily splotched with black. I neither weighed nor measured the eggs, but they appeared to be consistent in size and appearance with Spotted Sandpiper eggs in the University of Michigan Biological Station collection.

INCUBATION

The incubation period for the Spotted Sandpiper has been determined to be 21 days (Nelson 1939:70). On the basis of this period I think that the eggs were laid on or about July 1. Observations were then begun on the twentieth day of incubation, if Miller and Miller's (1948:565) information that incubation is begun with the laying of the first egg is accurate.

As already stated, only one adult, thought to be a male, participated in incubation during my study. Upon my original approach to the nest at 8:50 am on July 20, the incubating bird left the nest when I was 45 feet away, walked a few feet toward the lake, and then flew the remaining yards over the grasses and rushes to the water's edge, where it commenced feeding. No call was given while doing this, and only two subdued calls of peet-tweet were given while the bird was on the beach. On this first occasion the bird was hesitant to return as I was then set up with the telescope nearby. When it did return, it came up from the water walking very quickly and silently through the grasses on a somewhat indirect route, and then settled on the eggs. These methods of leaving and returning to the nest proved to be the bird's standard procedure while I was in the area; only once did the bird fly directly from the nest. This silent and secretive action contrasts sharply with the descriptions of other incubating Spotted Sandpipers given by Knowles (1942:583) and others which state that injury-feigning by the incubating bird was especially prevalent during the latter stages of incubation when humans were near the nest. I witnessed no distraction display of any sort, and all the bird's actions were discreet until there were chicks in the nest,

The subject had no apparent incubating rythm, and I have found no references in the literature which indicate that any such rythm for the species exists. Table 1, Appendix A, gives the attentive and inattentive periods of incubation during the observation period on July 20. The exact timings of the attentive periods are given in the first column, the total time of each period in the second, the exact timing of the inattentive periods in the third column, and the total time of each of these periods in the fourth. The shortest attentive period was two minutes, the longest one hour and 15 minutes; The longest inattentive period was 11 minutes, the shortest were six which lasted from 30 to 60 seconds.

Regarding incubating rythm, these figures show only that there was none. However they do point out a physiologic problem of sorts. At 11:00 am on July 20, the air temperature on the study area was 93 degrees Fahrenheit, and the temperature of the sand was estimated to be well over 100 degrees, since it was very painful to walk barefooted on the beach. From about 9:30 on, the incubating bird panted almost constantly. At times the panting, which is a body temperature control method in birds, was so violent that the bird's entire body shook. With reference to the figures of Table 1, I find it interesting that the bird could be attentive for an hour and 15 minutes (10:13 to 11:28) in the severe heat on the beach, even though it was partially shaded. The second and more interesting point lies in the bird's activities after 12:29 pm, when the attentive periods become much shorter and the inattentive periods last for no more than 60 seconds. In these short inattentive periods the bird would go to the water directly before the nest, and while feeding a little, wade out into the water until its

belly was touching the surface. Twice it bathed, but the rest of the times contact with the water seemed to suffice. It would then return by running back to the nest much faster than was its usual manner. This speed may have been an effort to avoid getting a hot-foot from the sand. A logical solution to the problem, if indeed the hot sand was the stimulus for the bird's actions and traversing the beach could then be considered a problem for the bird, was to fly back to the nest from the beach. However, the habit of returning through the grasses in a secretive manner was apparently so firmly entrenched in the bird's behavior pattern that it precluded a substitute response to a secondary stimulus such as that of the heat underfoot, and the subject eventually reacted simply by traversing the beach by foot, but much more rapidly than it did under normal circumstances.

All this is conjecture based on a few scattered observations; no experimental data support the idea. It may be that the sandpiper's feet were not sensitive to the heat of the sand, since I know that ducks can stand for long periods on the ice without apparent affect. However, no other explanation of the bird's unusual behavior has come to mind as yet.

The fact that the eggs were very near hatching (two hatched the following day) might be thought of as the reason for the pronounced decrease in the amount of time spent away from the eggs, and the bird's apparent hurry to return to its nest each time it left them. However, while photographing this bird on July 17, only the seventeenth day of incubation and one equally as hot as July 20, Dr. O. S. Pettingill Jr. saw much the same behavior. I think that the reason for this extreme attentiveness at the nest was that if the embryoes were exposed to the sun for more than a few

minutes they would have perished from the heat. The adult's reaction in this case was probably adaptive behavior. After several of these quick trips on which the bird went deeper into the water than is its usual habit, it became obvious that the bird was using the water as a means of temperature control. Upon seeing the sandpiper bathe on the first of these trips, I immediately presumed that it was doing so to cool itself. This may be so, but as I have already said, on four of the six trips made the bird walked into the water only far enough to wet the breast feathers, and did not bathe. Upon examining the nest when I ended observations that day, I noticed that all the eggs had droplets of water on them. This raised the question of whether the cooling of the eggs by the water on the breast feathers was incidental to the bird's cooling itself, or whether the real purpose of going into the water was to cool the eggs. It is likely that the cooling of the eggs is coincidental. I took no temperatures, but feel certain ~~feel certain~~ that the temperature of the sand was higher than the bird's body, and as a consequence the bird was incubating in order to cool the eggs. If this were so, then I think the possibility warrants attention that the wetting of the breast feathers was an instinctive action designed, if I may use the term, to cool the eggs and not the bird. ~~The two need purposes may not be coincidental~~.

As one more facet of this situation possibly worth investigating, I refer to the work of Mayhew (1955:45) in which it was established that few Mallard (Anas platyrynchos) eggs hatched unless they received sprinklings of water, either from rainfall or from the breast feathers of the adult during incubation. Possibly a similar situation exists in the Spotted Sandpiper.

In settling on the eggs the incubating bird usually rocked from sise to side , presumably to bring the brood patches in comfortable contact with the eggs. Occasionally, upon coming to the nest, or while incubating, the adult would stand in the nest and shuffle the feet very rapidly, as if digging in the nest. The nest never was disarrayed in this process, and I decided that perhaps the bird was shifting its eggs about with its feet. At no time did I see the adult move the eggs with its bill.

Apparently there were no regular positions on the nest, and the subject faced nearly every direction at some time or another while incubating. The milkweed plant near the nest affected the subject's position however, because on hot days the bird faced east a large share of the time, as this position allowed maximum advantage of the little shade available to be taken.

HATCHING

When the eggs were last examined at 1:45 on July 20, they were unpipped. I could not return to the area on the next day; when I did so at 8:50 on July 22 the nest contained two dry chicks which I am sure hatched the previous day, a wet chick which had apparently hatched within an hour of my arrival, the empty shell whence it had come, and the fourth egg which was only slightly pipped near the large end. Upon my approach the adult bird ran off the nest into the grass and called loudly and persistently <u>Peet-peet</u>, <u>peet-peet</u>,<u>peet-peet</u>, from 10 yards away. This action around the nest contrasts with that of the bird during incubation. The two dry chicks huddled very still in the nest, with the wet chick and the egg beneath them. When I touched the dry chicks in order to see the egg, they ran from the nest and hid in the grass nearby. This occurrence upset observations on the hatching period

because the parent then called the two chicks away from the nest and deserted the other young and the egg. I feel that this was a complete and final desertion of the nest, because when observation was ended at 1:00 pm the adult had not returned, although I tried to induce it to do so by capturing one of the older chicks and placing it back in the nest. The parent merely called the chick away and moved west again on the beach without coming near the nest. At 12:20 pm I placed the chick which had hatched that day, which was by that time dry and active, with the rest of the brood. At 7:00 pm that day, Mary Whelan of Muskegeon, Michigan visited the nest and found the egg partially hatched. The adult and chicks were 80 yards down the beach to the west, and there was no evidence that the adult had been incubating the egg since I had left earlier in the day. Whelan took the chick from the shell, banded it, and placed it with the rest of the brood. I never saw this chick, and feel certain that it did not survive that first night.

Thus it was that two eggs hatched on July 21, one the next day, and the fourth egg, had events gone undisturbed, would have hatched the same evening or the next day, giving a two to three day hatching period.

The eggshells of the two older chicks were not seen on the day after their hatching, and because the parent deserted the nest after the hatching of the third chick, I was not able to determine how the sandpiper disposed of the empty shells.

YOUNG AND THEIR DEVELOPMENT

I wish first to describe the calls used by the adult and young, as they played a big part in the brood life observed. The common call, or song, of the Spotted Sandpiper was a series of Peet-tweet

Peet-tweet, Peet-tweet, given either while flying or standing. The danger call, given after the chicks hatched whenever there was foreign activity on the beach, was a Peet, Peet, Peet, louder and more insistent than the syllables of the common song. This call was usually given during a distraction display which consisted of running about, flying about the intruder and then up and down the beach, or in one case, when I had captured a chick, injury feigning. In this display the bird squatted on the ground five yards away with its tail spread and wings dragging on the ground. It called loudly and frantically, but did not flop about much. This performance lasted about two minutes, and then the bird resumed flying about me. The chicks reaction to the danger call was to run to the nearest cover if they were not already near some, and then freeze until the danger seemed past or the assembly call was given by the adult. The assembly call consisted of several peet peet peet peet series, of more subdued tone than the danger call, followed by a quick rolling call of turrweet turrweet turrweet, given with rising inflection at the end of each note. This call was usually given by the adult from a spot where the cover was heavy and to which it wanted the chicks to come. They usually responded in a matter of minutes, and the brood assembled in the chosen cover. The adult also made soft conversational notes while brooding the chicks, and these may be described as a soft peep, peep, peep-tweet.

The chicks made brood, or contact, calls which were notes of peep-peep, peep-peep, peep-peep, given in a small voice. These were given intermittently at all times when the brood was moving about, and ceased only when the chicks froze in the presence of danger or while they were being brooded. These calls apparently served to keep the brood together and let the adult know the location of the chicks

The chicks peeped loudly in a distress call when caught and handled.

The chicks are well covered with down on hatching, and have a prominent egg-tooth. The eyes are open at this time, but the chicks are helpless, lying with their heads down on the floor of the nest and moving only feebly. The one chick which I was able to watch through this stage was not tended by the adult at all, so that the first hours of its development may not have been typical. However, over the course of four hours from the time that it hatched (about 8:00 am) the bird dried off progressively and steadily increased in vigor. It began to stand and move about a little at 10:20 am, and also began to peep softly then, so that the call was audible from 30 feet away. At 12:20 pm it was entirely dry, peeped constantly, and left the nest of its own accord although it was still very weak and unsteady. At this time I placed the chick with the rest of the brood 70 yards away on the beach to the west. Miller and Miller (1948:565) cite the nest life of the Spotted Sandpiper chick as lasting from one to three days. In my study, the two older chicks had been in the nest a day when I disturbed them and caused desertion. At one day of age all the chicks had lost their egg tooth.

The chicks' natal plumage was like that described by Bent (1929:84): "The young Spotted Sandpiper in the natal down is quite uniformly grizzled or mottled on the upper parts, from crown to rump with buffy brown, wood brown, greyish buff, and black. The forehead is greyish buff, and the entire underparts are white; a narrow black stripe extends from the bill through the eye to the nape; a black patch in the center of the crown extends as an indistinct median stripe down the nape and broadens to a black band along the back of the rump".

The chicks ran well when one day old, although they often stumbled and fell, but were not so fast as to be difficult to catch. They began to teeter in the characteristic Spotted Sandpiper fashion as soon as they could stand. When they were nine to twelve days old, their ability to run had developed so as to make them very difficult to capture. At this age one of the chicks ran iinto the lake and swam for several yards in an effort to escape from me. I have also seen such behavior in another chick of about the same age in Jasper National Park, Alberta, Canada. In this time the plumage changed but little, perhaps most notably in a lightening of the brown color on the back, and an increase in the length of the tail feathers. The two young birds which I saw on the territory to the west of the subject nest on July 29 had teleoptiles well developed on the dorsal regions of the body, and on the wings and rectrices as well, though the latter were not so advanced as the others. The rest of the plumage was still natal down, so far as could be determined through the binoculars, although it is likely that closer examination would have revealed teleoptiles well developed on the ventral tract.. I estimated these birds to be about two and one-half to three weeks old.

Immediately after leaving the nest, the chicks were able to pick up their own food. I never saw the adult bird feed any of the chicks, nor did I ever see it call the youngs' attention to any food. The usual feeding procedure observed was for the adult to feed along the water's edge, while the young worked parallel to it, a little higher up on the beach closer to cover; they would come down to work along the water occasionally. At no time was I able to determine exactly on what the birds were feeding. The two young birds on the territory to the west appeared to be catching Tiger Beetles (Cicindellidae) when I

encountered them.

On July 23 the adult led the chicks 20 to 30 yards back into the woods, where they fed along the mud of a dried creek bottom. This occasion was the last time I saw the adult brood the chicks, which it had done twice before on the beach during cool weather. The brood was one and two days old at this time; brooding periods lasted about five minutes each.

At no time did I see the chicks fighting or playing with one another, nor did I ever see them preen. At the close of observations on August 3, all three chicks were alive and engaging in normal behavior, as was the adult.

SUMMARY

From July 15 to August 3, 1955, a life history study of the nesting Spotted Sandpiper was undertaken on the north shore of Burt Lake, Cheboygan County, Michigan. The study covered only that period from the day before hatching of the eggs to the twelfth day of the chicks' lives. Seven trips were made to the study area, for a total of 17 hours of observation.

The nest, with four eggs, was discovered on July 15 and the study begun on July 20. It was located on an open beach 24 feet from the water in an unshaded spot. Temperatures ranged from 82 to 93 degrees Fahrenheit on the study days.

Only one adult, thought to be a male on the basis of appearance, was present with the eggs and young during the study, and it appeared to maintain a loosely defined territory. No actual pursuit flights or threat displays toward other birds were seen, although several questionable possibilities of these activities occurred.

The adult's habits in leaving and going to the nest during in-

cubation were silent and generally secretive. No incubating rythm was apparent, but the heat had a decided affect on the length of attentive and inattentive periods.

I examined the possibility that the great heat of the beach's surface caused the adult sandpiper to run much faster than was its normal habit.

The incubating bird frequently went to the water during one very hot afternoon, in order to cool itself or perhaps to wet its breast feathers in order to cool the eggs.

Hatching of the eggs extended over two days; the fourth egg was only pipped when the adult deserted it and a newly hatched chick while coaxing the two older chicks along with it. After the third chick dried I placed it with the others and it survived.

The adult had a regular call, or song, and in addition to this gave a number of calls directed to the brood. These were a danger call, a call given while feigning injury, an assembly call, and a brooding or conversational call. The chicks made a contact call constantly, and gave a distress call when handled.

The natal plumage of the subject chicks was described, and the development of the plumage traced roughly through an age span of three weeks.

The chicks ran well on the first day of life, and by the ninth day were fleet enough so as to be difficult to catch. At this time one of the chicks swam in the lake attempting to escape capture.

The parent was not seen to feed the young, which were able to pick up food as soon as they left the nest. Feeding was done largely along the beach, though once they fed in the forest.

Brooding was observed three times for periods of about five minutes each during the first few days of the chicks' lives.

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APPENDIX A

Table 1

Periods of Incubation on July 20

Attentive Period	Total Time	Inattentive Period	Total Time
9:20 - 9:26	6 minutes	8:50 - 9:20	30 minutes
9:37 - 10:10	33	9:26 - 9:37	11
10:13- 11:28	1:15	10:10 -10:13	3
11:31- 12:29	58	11:28- 11:31	3
12:29 -12:38	9	12:29- 12:29	30 seconds
12:39- 12:57	18	12:38- 12:39	60
12:58- 1:20	22	12:57- 12:58	60
1:20 - 1:36	16	1:20 - 1:20	30
1:36 - 1:38	2	1:36 - 1:36	30
1:38 - 1:45	observation ended	1:38 - 1:38	30