THE ARRIVAL OF CONTINENTAL MIGRANTS IN WESTERN JAPAN

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IN the fall of 1955 we had an opportunity to study migration along the coast of western Japan by analysis of the daily take of two commercial bird netters. The apparent effects of weather and the position of the netting sites upon the daily take are reported here.

The "wave action" of bird migration has long been recognized and referred to by many authors. Cooke (1915) and Lincoln (1939) both call attention to the fact that migrating birds appear in waves. Ornithological literature of recent years records many studies of the action of weather in producing waves of bird movements. Since 1950 the rôle of weather in migration has been under study as a joint project between the Departments of Zoology and Entomology and of Physics and Astronomy at Ohio State University (Miskimen, 1955).

Bennett (1952) in a five-year study at Chicago found that "as a general rule the big migration waves of a given species occur during a cold front period." Devlin (1954) concludes from observations over a period of several years at Philadelphia that "the hour just before nightfall was the critical time in nocturnal migration." He continues, "If at that hour the winds were calm or southerly (spring) migration could be expected. It did not seem to matter if the skies were overcast as long as it was not raining." Both Lowery (1945, 1946) and Williams (1945, 1947, 1950a, 1950b) in their discussions of Trans-Gulf of Mexico migration relate the movements of birds to weather. The effect of a large cyclonic movement on bird migration over America was analyzed by Gunn and Crocker (1951). In the present study the netting sites were along spurs of the Tateyama range east of Toyama on the west coast of Japan, about 37° N. latitude and 137° E. longitude. It is along this coast of Japan that migrants from Siberia and regions of the mainland opposite Japan first arrive. The 10,000-foot Tateyama range prevents them from passing directly inland. Instead they move south along the coast and over the low spurs of mountains that finger out from the main range into the coastal plain. Concentrated in this way, the flight offers an easy catch for netters situated on many of the ridge crests.

The two sites selected for study were nearly identical except for altitude. They were about two airline miles apart, at the crests of north-facing slopes and in low deciduous second-growth brush (height about 8 to 10 feet).

Both had been in operation each year for ten or more years during the six-week period from the middle of October to the end of November. Station A, further out on the spur, was at an altitude of about 500 feet and Station B, back and higher, was at more than 1000 feet. Observations were made from October 28 through November 7, 1955, an eleven-day period during the "middle" of migration.

The operators at both sites used the same methods. Paths were cleared along contour lines through the brush, paralleling the crest, and along these paths were stretched mist nets of several sizes and

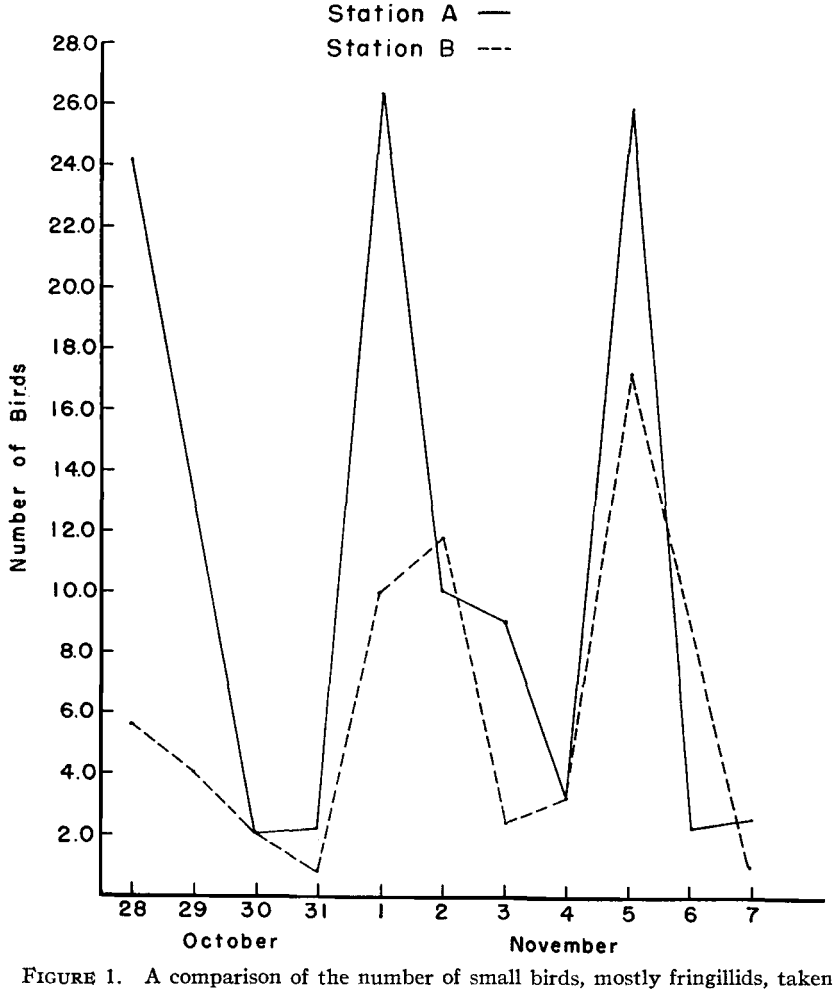

FIGURE 1. A comparison of the number of small birds, mostly fringillids, taken per net per day at two netting stations at different altitudes in Toyama, Japan, in 1955.

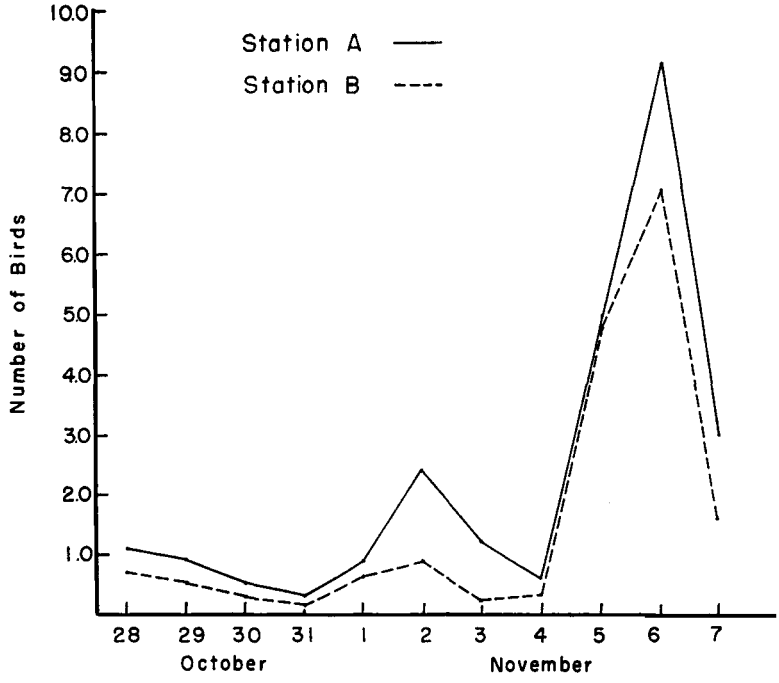

FIGURE 2. A comparison of the number of thrushes taken per net per day by two commercial netters at Toyama, Japan, during the period of observation in 1955

mesh. Living decoys of migrant species, caged and subjected to light conditions contrary to the fall diurnal rhythm so as to bring them into full song, were used to divert passing flocks into the ambush area. At site A there were 12 nets for thrushes and 24 nets for sparrow-sized birds. At site B, 40 thrush nets and 13 sparrow nets were in use. Site A had 15 thrushes for decoys and 38 smaller birds. Site B had 21 thrush decoys and 14 smaller species.

The numbers of birds captured at these two places were surprisingly different. Altitude seemed to be a very important factor. It appeared that the main bird movements were along the edge of the plains and that these paths of flight were transgressed by the low mountain spurs. The birds probably passed along the face of the mountains rather than over the open plains because the plains were under cultivation and offered less variety of food than the wooded hills. More species were traveling at a low altitude, for at Station A 30 species were netted while at the higher Station B only 11 species were taken. Ten of these were similar to those at the lower station. At Station A, 299 thrushes and 2768 smaller birds were taken during the eleven-

day period. At Station B the take was 677 thrushes and 971 small birds. Thrushes moved higher than the smaller birds; the number of thrushes per net per day was about the same at each station, but a much greater population of small birds was passing Station A than Station B. The catch at Station A averaged 2.2 thrushes and 14.8 small birds per net per day, while at Station B the catch was 1.5 thrushes and 6.8 small birds. Figures 1 and 2 compare the daily take of birds per net at each station and show that the fringillid migration was heavy before that of the thrushes. At Station B the movement of thrushes may have been greater than that at Station A, even though the catch per net was less. The take per decoy appeared to support this conclusion, but we have no way of measuring the

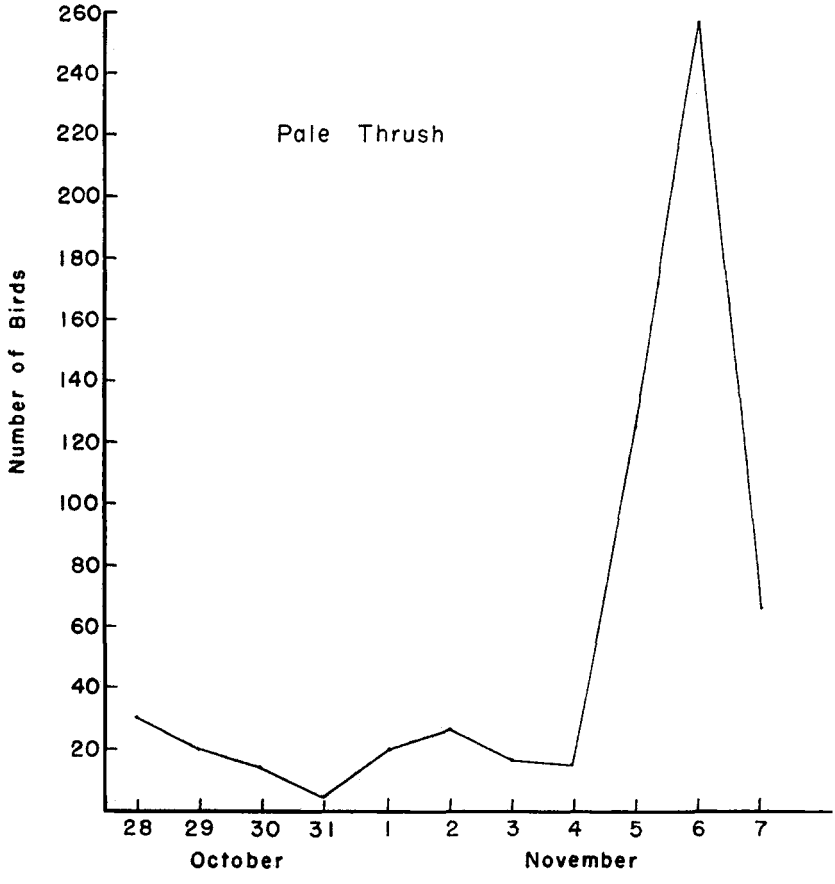

FIGURE 3. Total number of Pale Thrush (*Turdus pallidus*) caught at two netting places in Japan during the period of observation in 1955.

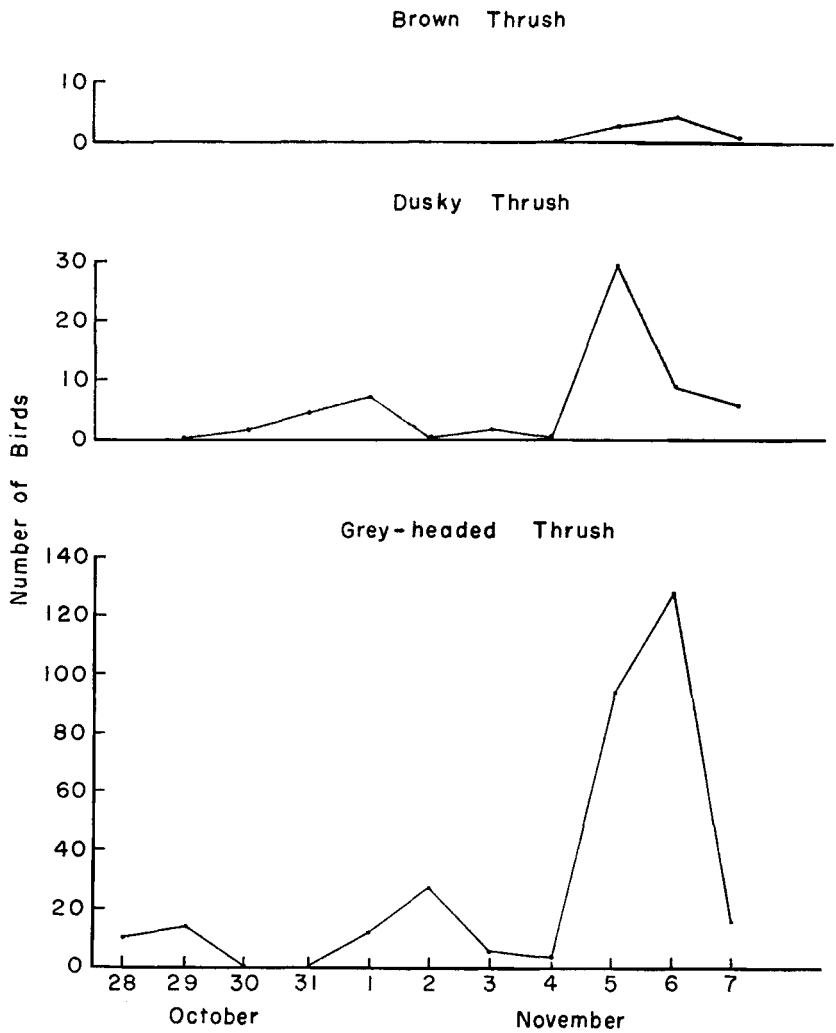

FIGURE 4. Thrushes collected by two commercial netters near Toyama, Japan, during the period of observation in 1955.

effectiveness of a given decoy. A good singer in fine health may attract more birds than several less active singers. At Station B the thrush decoys may have been more vociferous than at Station A, for the average take was 32.2 victims per decoy as compared with 20.0 per decoy at Station A. Small bird decoys were almost equally effective at the two stations; 69.3 victims per decoy were taken at Station B and 72.8 per decoy at Station A. We had no check on the

effectiveness of decoys, since there were no nets without adjacent decoys. We have no information as to what percentage of the birds would have stumbled into the nets without the decoys' enticement. However, it seemed that the success of netting was directly proportional to the number of good decoys used.

The netters complained that the daily catch was low and that the weather was the worst for netting that they had seen in many years. This was the usual netter's or trapper's complaint, for comparison with 1954 data did not support it. At Station A during the period October 26 through 30, 1954, with less rain and bad weather, the daily take averaged 241 birds. During the 1955 period of observations at this station the daily take was 273 birds. Table 1 lists the species caught at both stations during 1955 and the average take per day per decoy and per net. Migration was in flocks of mixed as well as single species. During a heavy flight, birds of several species would strike the nets. The fringillids were usually in flocks separate from the thrushes, for their flight pattern was different.

The numbers of Pale Thrush caught each day are shown in Figure 3, while the takes of Grey-headed Thrushes, Dusky Thrushes, and Brown Thrushes are shown in Figure 4. From these it is evident that the main migration movement did not begin until November 5. Although a number of Pale Thrushes had been taken each day previous to November 5, they moved in large numbers on that date, accompanied by Grey-headed Thrushes. The migration of Dusky Thrushes and Brown Thrushes had just begun when the observations were closed. Comparison with the take in 1954 shows that this movement came approximately ten days later than in the preceding year.

Figure 5 shows the daily catch of Japanese Buntings. The Rustic Bunting, Brambling, Meadow Bunting, and Grey Bunting takes are shown in Figure 6. Japanese Buntings were in greatest abundance, but all of these finches arrived in waves during the eleven-day period.

Migration and the Weather.—The netters explained the presence or absence of migrating flocks on the basis of weather. They said that a north wind was not good but that a mild south wind was favorable; that wind or rain at dawn was bad, but that cloudy weather was no detriment. In the main their observations appeared to be sound. The daily take and weather are shown in Figure 7 for 1954 and Figure 8 for 1955. During the six days of observations in 1954 there was no marked correlation between weather and take except for local weather. A wave apparently passed through on October 25, followed by decreasing numbers until October 30. Rain was

TABLE 1

THE SPECIES OF BIRDS NETTED IN TOYAMA PREFECTURE, JAPAN, FROM OCTOBER 28 THROUGH NOVEMBER 7, 1955, AT TWO SITES USING A TOTAL OF 89 NETS AND 52 DECOYS

	Species	Number decoys	Total take	Average number caught per day	Average number caught per decoy	Average number caught per net
1. Japanese Bunting	*Emberiza spodocephala*	14	2752	250.2	196.6	74.4
2. Pale Thrush	*Turdus pallidus*	11	591	53.7	53.7	11.3
3. Rustic Bunting	*Emberiza rustica*	15	428	39.0	28.5	11.6
4. Grey-headed Thrush	*Turdus obscurus*		313	28.4		6.0
5. Brambling	*Fringilla montifringilla*	9	256	23.3	28.4	6.9
6. Meadow Bunting	*Emberiza cioides*	3	99	9.0	33.0	2.7
7. Dusky Thrush	*Turdus naumanni*	25	60	5.5	2.4	1.1
8. Grey Bunting	*Emberiza variabilis*	1	24	2.2	24.0	0.7
9. White Eye	*Zosterops japonica*	3	20	1.8	6.6	0.5
10. Great Tit	*Parus major*		11			
11. Brown Thrush	*Turdus chrysolaus*		8			
12. Mugimaki Flycatcher	*Siphia mugimaki*		7			
13. Willow Warbler	*Phylloscopus borealis*		6			
14. Grosbeak	*Eophona personata*		5			
15. Grey Thrush	*Turdus cardis*		4			
16. Brown-eared Bulbul	*Ixos amaurotis*		4			
17. Varied Tit	*Parus varius*	2	4	0.4	2.0	0.08
18. Siberian Bluetail	*Erithacus cyanurus*		3			
19. Ruby Throat	*Erithacus calliope*		2			
20. Sparrow Hawk	*Accipiter virgatus*		2			
21. Bullfinch	*Pyrrhula pyrrhula*		2			
22. Willow Tit	*Parus atricapillus*		2			
23. Bush Warbler	*Horeites diphone*	2	2		1.0	
24. Brown Flycatcher	*Muscicapa latirostris*		1			
25. Siskin	*Carduelis spinus*		1			
26. Daurian Redstart	*Phoenicurus auroreus*		1			
27. Long-tailed Rose Finch	*Uragus sibiricus*		1			
28. Japanese Jay	*Garrulus glandarius*		1			
29. Green Finch	*Chloris sinica*		1			
30. Bull-headed Shrike	*Lanius bucephalus*		1			
31. Screech Owl	*Otus asio*		1			

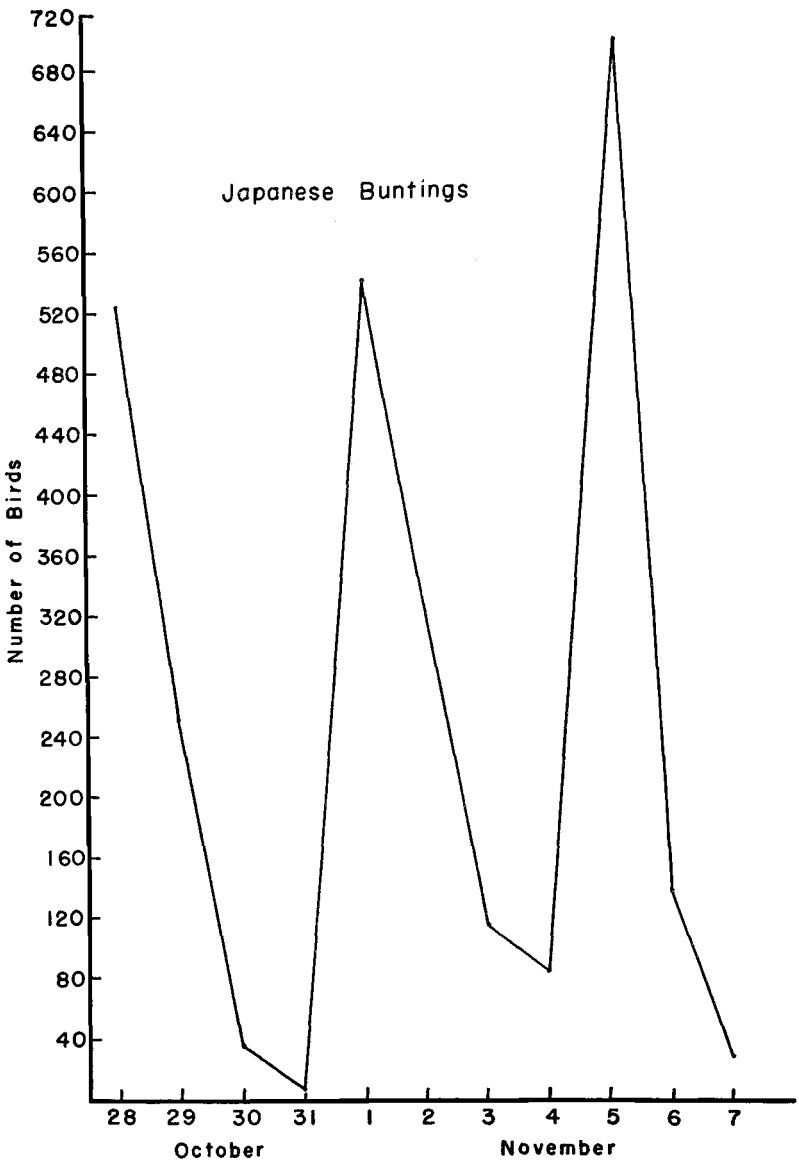

FIGURE 5. The take of Japanese Buntings (*Emberiza spodocephala*) during the period of observation in 1955.

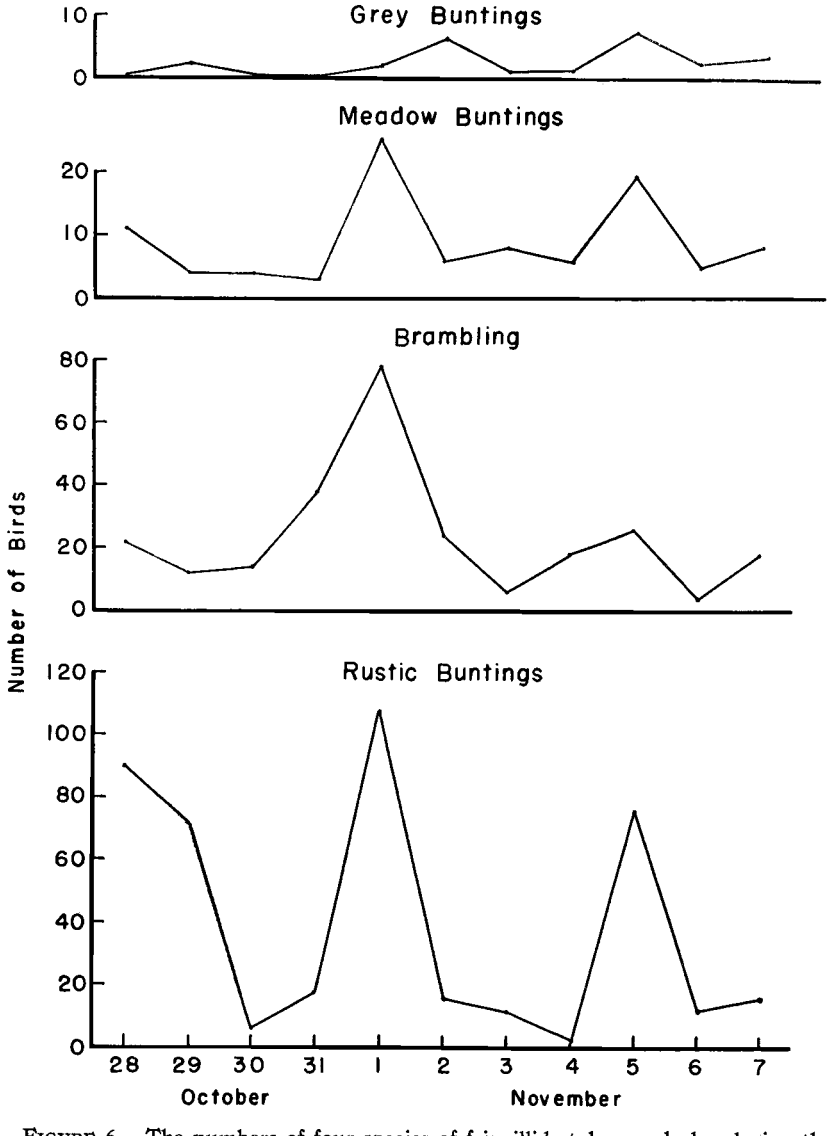

FIGURE 6. The numbers of four species of fringillids taken each day during the period of observation in 1955 at Toyama, Japan.

falling at dawn on October 29, which depressed the take to its lowest point. Devlin (1954) considered the weather at sundown more critical to migration than that during the night or at dawn. If this is true, the 1954 trend could be explained in this way. The wave of birds that arrived from Siberia on October 25 continued on south. Each evening of the following six-day period was favorable to flight except that of October 28. Winds were light and from the south, hence the weather at sundown in Toyama would in all probability be that of sundown the following day along the coast of Siberia and Kamchatka. Since there was no inhibiting weather on the coast of Siberia during this period, the flow of migrants to Japan was steady and uninterrupted, but decreasing. The rain of the night of October 28–29 at Toyama stopped migration of local birds and of birds to the immediate north of Toyama. These renewed their flight after sundown of October 29, bringing an increased take at dawn of October 30.

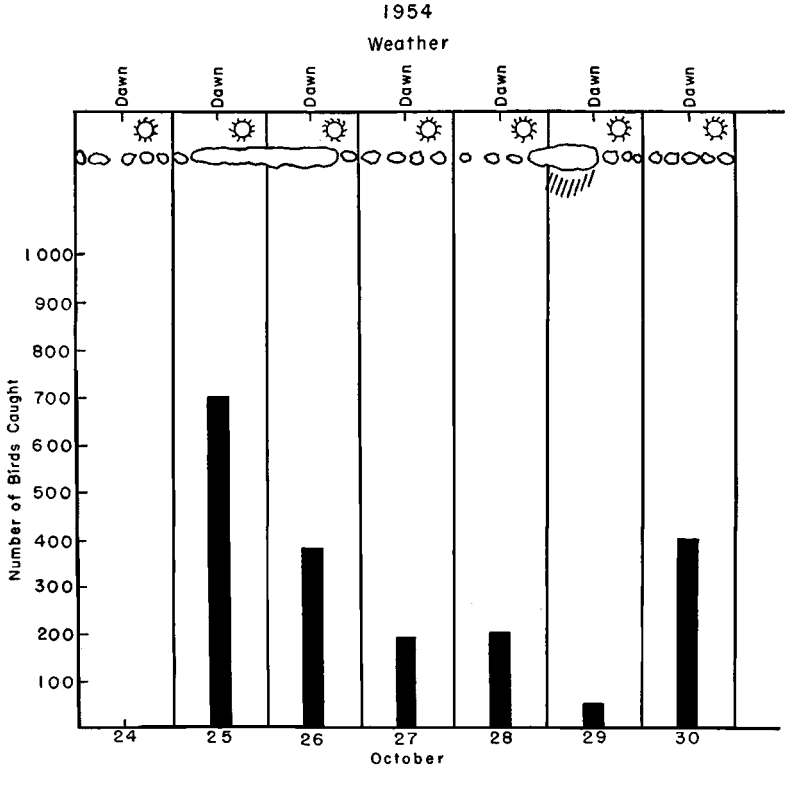

FIGURE 7. Relationship between weather and the number of birds netted at Station A, Toyama, Japan, in 1954.

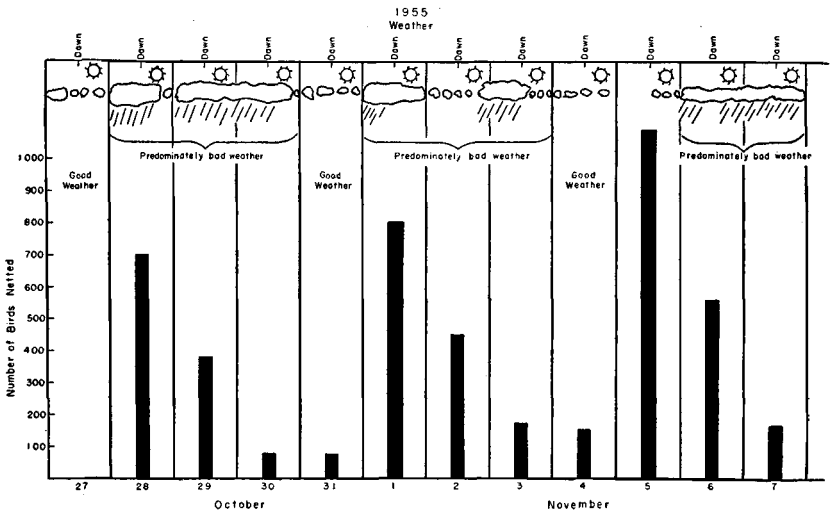

FIGURE 8. Relationship between weather and the catch of birds at Toyama, Japan, in 1955.

Since thrushes and finches migrate at night, Devlin's observations are further supported by the 1955 data (Figure 8). Here it is evident that bad weather will force the birds down and they will remain quiet until the weather improves; hence, the catch is affected by both sundown and dawn weather. During the eleven days of observation in 1955 there were three waves of migrants and three breaks in the bad weather. The cloud movement was from the south during the entire period and at no time were there heavy winds. The weather at sundown of October 26 had been clear and a wave of migrants passed on October 28. It rained until midday of October 30, with the clouds breaking at sundown. A migrant wave appeared on November 1. Bad weather at sundown again set in without a break until the afternoon of November 3. The third wave of migrants arrived on November 5. This sequence of events would appear to support the theory that favorable sundown weather occurring in Toyama 24 hours earlier and moving north approaches the Siberian coast, where it releases migrants pinned down by bad weather. This produces a wave which reaches Toyama on the morning of (or during the night preceding) the second day after the break in weather.

Summary.—During the period from October 28 to November 7, 1955, observations were made of the daily catch of commercial netters located near Toyama on the west coast of Japan. The netting sites were two miles apart on spurs of the Tateyama mountain range, which extended into the coastal plain. Both were at north-facing

hill crests in cut-over deciduous brush: one at 500 feet altitude, the other at 1000 feet. During the eleven days, 4715 birds of 31 species were netted. Most abundant were Japanese Bunting (*Emberiza spodocephala*), Pale Thrush (*Turdus pallidus*), Rustic Bunting (*Emberiza rustica*), Grey-headed Thrush (*Turdus obscurus*), and Brambling (*Fringilla montifringilla*), in that order. Observations indicated that: 1. more species passed in front of the mountains and over the crests at 500 feet than at 1000 feet altitude; 2. thrushes moved up to 1000 feet in about the same density, but fringillids and other small passerines were more than twice as abundant at the 500-foot level; 3. fringillid migration was well under way in October but turdid flights did not begin until early in November; 4. migration was often in mixed flocks and many species not represented by living decoys were captured; 5. the take appeared to be directly proportional to the number of well-trained decoys used as well as to the number of nets in operation; 6. weather at dawn affected the take, especially wind or rain, which reduced it; 7. migration took place in waves related to the weather of the Siberian coast; 8. rain or storms from the south held the birds on the mainland; and a break in weather at sundown over Toyama indicated a flight during the night of the following day and a large catch on the second morning, even though weather conditions might have become adverse again.

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