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SUMMER MOVEMENTS OF BLACK SWIFTS IN RELATION TO WEATHER CONDITIONS

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During the summers of 1952 and 1953, the Black Swift (*Nephoecetes niger borealis*) was recorded on the campus of the University of British Columbia in Vancouver and occasionally also at other localities in the province. I made continuous observations from June 1 to August 1, 1952, and April 20 to May 15 and July 15 to August 20, 1953. During my absences from Vancouver, Mrs. D. H. Speirs and Messrs. M. Keenleyside, K. Racey, G. W. Smith, J. M. Speirs and G. J. Spencer kindly noted occurrences of the Black Swift on the observation area. I am indebted to them for their collaboration. From August 1 to September 1, 1952, and from May 15 to July 15, 1953, I made regular observations at Departure Bay, close to Nanaimo. The few swifts noted in Nanaimo are included in the following list.

Table 1 summarizes the occurrence of the swift together with some meteorological data. These data are compiled from the monthly meteorological summaries of the Vancouver International Airport, from the daily weather reports of the Meteorological Division, Canada Department of Transport, and from similar reports of the United States Weather Bureau, Washington, D. C.

DISCUSSION

The appearance of the swifts seemed to coincide remarkably with such prominent weather conditions as barometric pressure, wind direction and precipitation. Table 1 indicates that these conditions were quite uniform at the time of the summer appearance of the Black Swift in Vancouver. Of the 21 days when swifts were seen, 17 had low pressure, 16 had SE-E prevailing wind, and there was rain, at least in traces, on 20 days.

The coincidence is still more striking if we compare these weather factors during the months when swifts were most frequently seen, that is, June, 1952, and June, 1953. Table 2 shows that swifts were seen only exceptionally on days of high air pressure, westerly wind and fair, dry weather. Of the 60 days considered, 15 days had the combination of low pressure, E-SE wind and rain; swifts were noted on 10 of these days. While these 15 days comprise 25 per cent of the period considered, 67 per cent of the swift occurrences were noted on these days.

Low pressure, with prevailing E-NE wind, and rain is well known to the meteorologist as well as to the naturalist in the northern temperate hemisphere. This is one phase of a cyclone passage. Warm, high-pressured air masses meeting cold ones of low pressure cause a counter-clockwise air circulation on a wide scale, resulting in a cyclone which moves southeastward. From the general direction of the air circulation in the cyclone it is evident that E-SE winds prevail in front of its passage. The warm air penetrates from the S-SW and is usually preceded by areas of cold air, by SE wind and by precipitation in the SE sector of the cyclone. The weather reports during a summer month demonstrate that our summer weather is an alternation of cyclone passages and

Table 1

Observations of the Black Swift at Vancouver, B. C.*

Date	Rain	Prevailing direction of the wind	Barometric pressure	Number of swifts observed	Remarks
1952					
June 3	+	SE	L	8–10	
4	+	SE	L	8–10	
10	+	SE	L	100	
11	+	NW	L	1000+	
12	+	E	L	200+	
15	+	S, W	H	10	
16	+	SE	L	20	
20	+	SE	H–L	120+	
26	+	SE	H–L	300–400	
27	+	SE	L	150–200	
July 21	—	E	L	500	
22	+	SE	L	100	
23	+	SE	L	100+	
24	+	SE	L–H	200	
August 22	+	SE	L	30–40	Observed by MK
1953					
April 26	+	E	L	A few	Observed by GS
June 6	+	E	L	8–12, 4*	Observed by GJS; Departure Bay, obs. by DHS, JMS, MDFU
7	+	SE	L	37, 4*	Obs. by KR; Dept. Bay, obs. by MDFU
8	+	SE, NW	L	200+, 1*	Obs. by KR; Dept. Bay, obs. by DHS, JMS, MDFU
13	+	E	L	200+	Obs. by GJS
21		NE	H	3*	Courteney, obs. by DHS
22		NE	H	2*	Dept. Bay, obs. by JMS
24	+	NE	H	12, 12*	Obs. by DHS; Dept. Bay, obs. by JMS, MDFU
28	+	E	L	10–12*	Dept. Bay
July 1	+	E	L	3*	Englishman River, obs. by JMS
August 6	+	SE	L	4–5	
October 1	—	SSE	L	6–7	

* The swift numbers not marked with asterisks refer to observations at Vancouver, B. C.

stable, good weather of high air pressure (anticyclone). In the Vancouver area the passage of the cyclone with its cold, rainy spell is usually accompanied by E or SE wind. depending on how far N or S the center of the cyclone passes by the area.

One representative day of each season (figs. 1 and 2) has been chosen to illustrate such a cyclone passage. Between July 21 and 23, 1952, several hundred swifts passed by and foraged over the university campus in Vancouver. Figure 1 shows that on July 22 Vancouver was NE of a warm front, completely overcast, and that it was raining. About 100 swifts were observed. Figure 2 shows the weather map for 1:30 p.m. on April 26, 1953. A center of low pressure was approaching, and the area of precipitation preceding the warm front had reached the SW coast of Vancouver Island. In the afternoon an east wind predominated with rain in the Vancouver area and this typical cyclone passage brought up the first Black Swifts of the year. This arrival seems quite early, since Rathburn (1925) says, for Seattle, that the swifts are back only in May, coinciding with "a spell of foul weather." In general, the dependence of spring arrival of migrants on particular weather situations is a well known phenomenon in the ornithological literature (Cooke, 1913, etc.). Cyclones as proximate releasers of spring return flight have been shown for several species, as for the European Swift (*Apus apus*) into Hungary (Lovassy, 1894).

The appearance of the Black Swift at localities where it does not breed, and its coincidence with rainy, bad weather, is noted in life history accounts of that species. In fact, one of the first observations of the Black Swift in British Columbia was made on "a foggy day early in June" (Lord, 1866). Rathburn (1925), Swarth (1922) and after them Bent (1940) quote several such coincidences.

Table 2

Some Weather Factors and the Appearance of Swifts

	Number of days with									
	Barometric pressure			Prevailing wind direction				Days of precipitation		
	Low	High	Alternating	SE	E-NE	W-SW, NW	Changing, no wind	With	Without	Totals
June, 1952	14	14	2	10	5	13	2	14	16	30
Swift noted	8	1	1	7	1	1	1	10	....	10
June, 1953	13	15	2	7	15	6	2	20	10	30
Swift noted	4	1	....	1	3	....	1	5	....	5
Total of 60 days	27	29	4	17	20	19	4	34	26	60
Swift noted	12	2	1	8	4	1	2	15	....	15

These data and the above observations appear in a new light if we compare them with observations of the European Swift. Among all the North American swifts, the Black Swift appears to be closest related to this common European species, resembling it in appearance and habits. Recently accumulated observations and systematic physiological experimentation have explained the peculiar habits of the latter in relation to the weather. This swift was long ago considered a weather prophet indicating summer storms by its appearance at localities where it does not breed. I mention as an outstanding example its summer movements through the Swedish bird station at Ottenby (Swärdson, 1950). During July of three years, out of 93 observation days, southbound swifts passed by the southern point of Oland island on 87 days. When cyclonic weather was extended over all Scandinavia, numbers up to 30,000 were observed daily at the bird station.

Koskimies (1947, 1950) gives a plausible explanation of these cyclone movements of the swift. The air masses in front of a cyclone are cool, the wind grows stronger and insect life in the air where the swift hunts becomes scarcer. These circumstances continue while the cyclone approaches and are accompanied by rain. The warm sector of the cyclone, on the other hand, may carry large numbers of aeroplankton as shown by Palmén (1944) who studied the anemochor distribution of the insects. Headed against the wind, the swift flies across the cold air masses and arrives in the southern, southeastern sectors of the cyclone where—even if it still rains—there are more flying insects.

Apparently the juvenal, nonbreeding European Swift as well as most of the breeding adults leave their summer residences when the worst cyclonic condition is about 250–300 miles from them. Flying against the wind, they avoid the cooling down and starvation. Presumably drifting insect masses stimulate them to turn south against the insect-carrying warm winds. When the cyclone passage is over, they return to their nests or residence again by flying against the wind, which in the back of the cyclone is mainly northerly.

The experimental part of Koskimies' study establishes the fact that the nestling swift may survive the period of starvation and cold while its parents are away during the cyclone passage by reversible, temporary torpidity (Koskimies, 1948, 1950). During cold nights the body temperature of a starving swift nestling drops close to the level of the air temperature. By thus reducing metabolism, loss of body weight by starvation is greatly diminished. Even an adult swift is capable of such torpidity if overcome by cold weather. This behavior of the European Swift is highly adaptive. The swift forages only on wing, and cool cyclonic weather causes the aeroplankton to disappear. In such

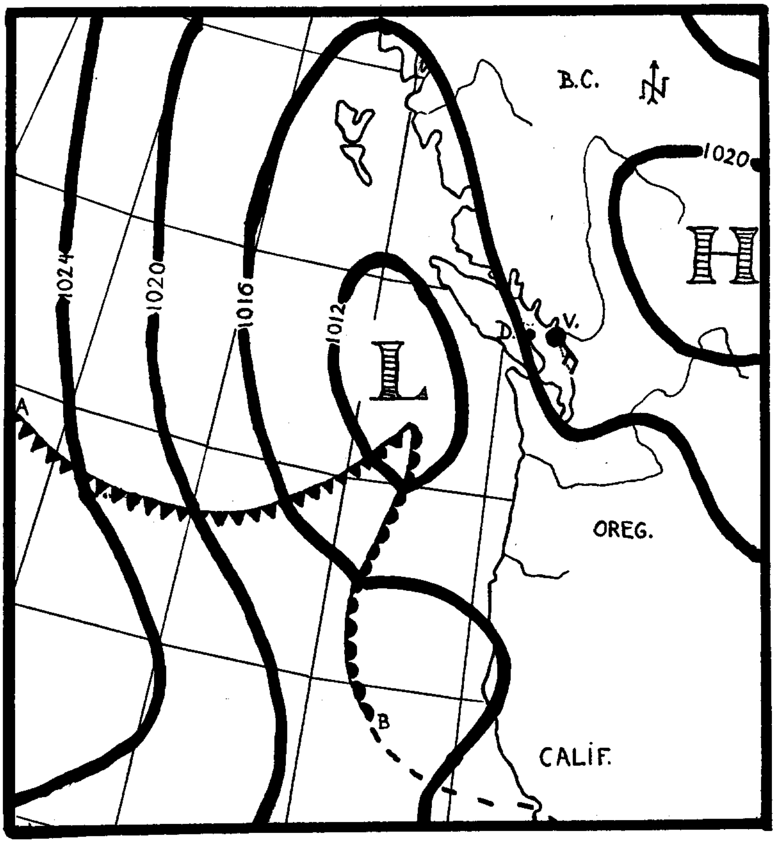

Fig. 1. Weather conditions on July 22, 1952, at 6:30 p.m., from the daily weather map of the Meteorological Division, Canada Department of Transport. Isobars in millibars. A, cold front; B, warm front; H, high pressure center; L, low pressure center; D, Departure Bay; V, Vancouver, with direction and strength of wind indicated.

circumstances swifts of different species have been found dead in or around their breeding places, and naturally their young have succumbed, too. The young swift stands experimental starvation up to nine days while the tolerance of the adult is much less. Thus, avoiding the cyclone by abandoning nest and young gives a fair chance of survival to both age classes if bad weather conditions do not last too long.

This torpidity—or partial poikilothermy—is apparently similar to that just discovered and studied in hummingbirds and in caprimulgids (Huxley, Webb and Best, 1939; Culbertson, 1946; etc.). These families are related to the swifts. A similar phenomenon may occur in other swifts not yet studied systematically in this respect. For example, Bartels (1931) mentions adults of the Alpine Swift (*Apus melba*) which disappeared during periods of rain or, when found at roosts, were conspicuously tame and slow. Hanna (1917) states that the White-throated Swift (*Aëronautes saxatalis*) wintering in California are found in the coldest weather "within the rocks, in a dormant state." McAtee (1947) states that torpidity has been found even in the Chimney Swift (*Chaetura pelagica*).

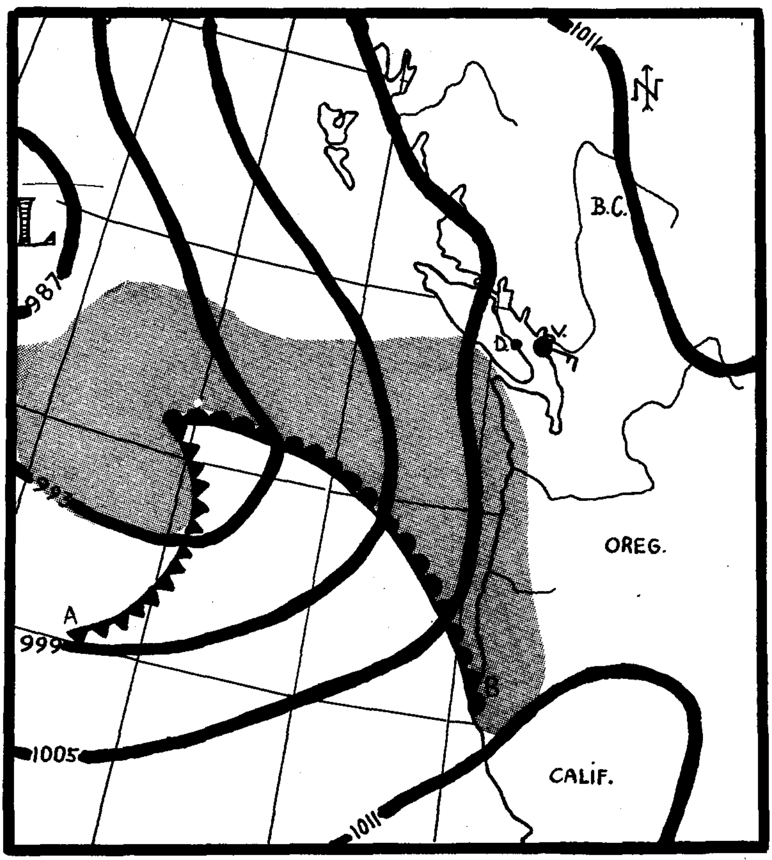

Fig. 2. Weather conditions on April 26, 1953, at 1:30 p.m., from daily weather map of the United States Weather Bureau. Area of precipitation shaded. Other symbols as in figure 1.

No observations were made at the breeding places of the Black Swift to determine whether or not they leave the breeding area periodically. Neither is its physiology or metabolism known. However, its regular appearance coinciding with the typical cyclone passages in the coastal areas of British Columbia indicates that its habits are very similar to those of the swifts of Europe.

The relation of the Black Swift to the weather permits some speculation as to the origin of the swift "swarms" which appear at times in Vancouver. For example, on June 11, 1952: about 1000 were seen; on July 21, 1952: about 500–600; "June 8, 1953. Cloudy and cool. Many hundreds circling . . . " (K. Racey, *in litt.*); "June 13, 1953, Black Swifts thinly distributed as far as the eye can see" (G. J. Spencer, *in litt.*). No breeding data on swifts are recorded for the Lower Fraser Valley. However, the local ornithologists suspect nesting in the mountains of the Coastal Range, north of Vancouver, surrounding Howe Sound (I. McT. Cowan and K. Racey, orally). Even if this is so, the large numbers observed on several occasions indicate that this cannot be a gathering from the nearby valleys, but must be the swift population of a considerable area. Since swifts fly into the wind, I think this area would lie northwest from Vancouver—beginning with either side of the northern part of Georgia Strait and then Johnstone Strait. More detailed speculation is not safe since the data collected are few (about 12 cyclone passages in the two summers) and I was unable to determine the main direction of the swifts' flight, although it appeared to be NNW-SSE.

It would be desirable if future observers in the northern Pacific area would concentrate on summer appearances of the Black Swift. Notes on the number of swifts observed, if possible their flight direction, occurrence of rain or fog, records of temperature change, and wind direction would give the necessary information. These data when coordinated with the maps of the meteorologists would allow calculations as to the origin of the swifts. The European example indicates that the swift journeys in summertime may extend to areas several hundred or even more than a thousand miles from the breeding localities and that swifts easily fly these distances in two or three days.

SUMMARY

Observations of summer occurrences of the Black Swift at Vancouver, British Columbia, and vicinity are analyzed with respect to weather conditions. It was found that in most cases the appearance of swifts coincides with a cyclone passage, and very often in the southeastern sector of the cyclone. The recent literature pertaining to movements and physiology of the related European Swift is reviewed. The author believes that the summer movements of the Black Swift are similarly governed and that the type and magnitude of migration may be of the same order. Comparisons of the weather conditions suggest that the swift swarms accumulate from a wide area, lying not necessarily close to the point of observation.

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