TABLE 1
CHARACTERISTICS OF 3-NOTE CALLS AND "WHINES" FROM HYBRIDS AND PRAIRIE CHICKENS

Characteristic		Pankratz hybrid 3-note (N = 9)[c]	WTymp hybrid 3-note (N = 20)	Prairie chicken 3-note (N = 34)	Prairie chicken "whines" (N = 42)
Number of notes	$\bar{x}$	3.24	3.33	2.83	9.24
	SD	0.01	1.03	0.39	9.10
Note duration[a]	$\bar{x}$	0.15	0.27	0.28	0.19
	SD	0.01	0.05	0.06	0.06
Internote interval[a]	$\bar{x}$	0.03	0.12	0.11	0.20
	SD	0.02	0.13	0.07	0.09
Strongest frequency[b]	$\bar{x}$	501	904	1547	989
	SD	52	190	17	542
Frequency modulation[b]	$\bar{x}$	338	258	122	281
	SD	43	199	63	155

[a] Temporal measurements in sec.
[b] Frequency measurements in Hz.
[c] Reported N are for number of sequences analyzed; 12 and 9 prairie chickens were used for 3-note calls and "whines," respectively.

research is needed before the importance of learning in these species is understood, but some speculation is possible. Vocal learning in these species suggests that their communicatory behavior is more plastic than predicted. Further, learning could promote dialect formation among display grounds which would facilitate recognition of strangers. This recognition may reduce overt aggression among regularly attending males. Interspecific territoriality could also be enhanced by imitation of heterospecific aggressive signals as suggested by the imitation of 3-note calls by prairie chickens and by behavioral switching in the hybrid.

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Common Redpolls using spruce seeds in northern Utah.—During winter in the United States and southern Canada, the Common Redpoll (*Carduelis flammea*) generally is considered a bird of open woodlands, weed patches, fields, and brushy fence rows, where it feeds mainly on birch (*Betula*) and alder (*Alnus*) seeds (Godfrey, The Birds of Canada, Nat. Mus. Bull. No. 203, 1966). Thus, in a mixed flock with 30 White-winged Crossbills (*Loxia leucoptera*) and several Pine Siskins (*Carduelis pinus*) on 30 November 1977, 26 km east of Preston, Franklin Co., Idaho, I was surprised to see 25 Common Redpolls feeding on cones at the top of Engelmann spruce (*Picea engelmannii*). At 13:00 on 7 December 1977, I found 25 Common Redpolls and 25 Pine Siskins feeding on spruce cones in the Bear River Mountains (elev. = 2500 m), Cache Co., 18 km west of Laketown, Utah. I collected 2 males and 1 female from this flock. Previously, only 3 specimens of redpolls had been collected in Utah, but sight records have increased in recent years (Hayward et al., Birds of Utah, Great Basin Nat. Mem. 1, 1976). Several other mixed flocks containing 20–50 redpolls were seen that day.

Upon preparing the specimens (deposited in the collection at Utah State University), I found only hulled Engelmann spruce seeds in the esophageal diverticula (Fisher and Dater, Auk 78:528–531, 1961). Spruce seeds have rarely been mentioned as food of the Common Redpoll in North America (Martin, Ecology 41:126–140, 1960; White and West, Oecologia 27:227–238, 1977), which is certainly enigmatic since spruce seeds are commonly reported as food of Common Redpolls in Europe (e.g., Svärdson, Br. Birds 50:314–343, 1957; Eriksson, Ann. Zool. Fenn. 7:273–282, 1970; references in Newton, Ibis 109:33–98, 1967).

The 3 diverticula contained 120, 52, and 41 seeds. Such variation is not unusual (White and West, op. cit.) since the diverticulum may be filled and emptied several times a day in winter (Brooks, Auk 95:182–183, 1978). (Note that this does not represent triphasic feeding as described in Brooks [op. cit.] since all the seeds were hulled.) The total seed contents of each diverticulum weighed 0.27, 0.14, and 0.12 g, respectively, when dried to constant weight at 60°C. A caloric value of 25.98 ± 0.17 kJ/g ($N = 4$, ± 1 SD) was obtained from the Engelmann spruce seeds using a Phillipson microbomb calorimeter. Therefore, the 3 redpolls had 7.02, 3.64, and 3.12 kJ of energy stored, which represents 7.3, 3.8, and 3.2% of the daily energy budget (based on a daily energy need of 96.23 kJ [cited in White and West, op. cit.]). The amount of energy stored in the diverticulum represents only a small proportion of the Common Redpoll's daily energy needs (White and West, op. cit.).

Brooks (Wilson Bull. 80:253–280, 1968) stated that since Common Redpolls specialize on birch and alder seeds which "are substantially higher in caloric value than most types [of seeds] which have been measured. . . the adaptive value of the redpoll's selectivity of birch seeds in the wild is self-evident." Birch seeds contain only 23.01 kJ/g of energy (White and West, op. cit.), whereas hulled seeds of most conifers have caloric contents in excess of 25.10 kJ/g (see Table 7, Vander Wall and Balda, Ecol. Monogr. 47:89–111, 1977). Spruce seeds also contain twice as much protein and oil as birch seeds (Jones and Earle, Econ. Bot. 20:127–155, 1966), although the nutrient content of spruce seeds can vary considerably geographically (Pulliainen, Ann. Zool. Fenn. 8:326–329, 1971). Hence, use of high energy conifer seeds would increase the efficiency of the diverticulum, since a finite number of seeds can be stored at any given time. Using a diverticulum capacity of 2 g of seed, 20% water content in the seeds, and a redpoll assimilation efficiency of 70% (see White and West, op. cit.), plus the caloric content of 25.98 kJ/g for spruce seeds, the redpoll would gain over 4 kJ/g of seed consumed by using spruce seeds rather than birch seeds. This gain could be even greater since conifer seeds contain only small amounts (<5%) of moisture (Botkin and Shires, New Mex. Exp. Sta. Bull. 344:3–14, 1948). However, if conifer seeds are not as easily digested as birch seeds, then assimilation efficiency might be lower.

White and West (op. cit.) and C. White (pers. comm.) argue that redpolls use birch and alder because seed are: (1) abundant and predictable; (2) available all winter; (3) the correct size for the redpoll's small bill (see Newton, Finches, pp. 103–106, Taplinger Pub. Co., N.Y., N.Y., 1973); and (4) of adequate caloric content. Also, redpolls avoid competition with other finches and red squirrels (*Tamiasciurus hudsonicus*) (Brink and Dean, J. Wildl. Manage. 30:503–512, 1966) for conifer seeds by taking birch and alder seeds. Since redpolls show no hypothermic tendencies (Chaplin, J. Comp. Physiol. 89:321–330, 1974), in order to maintain a normal body temperature (>40°C) at very low ambient temperatures (West, Comp. Biochem. Physiol. 43A:293–310, 1972) they may have to consume as much as 42% of their body weight in 1 day (White and West, op. cit.). A very reliable food source is therefore important and redpolls are probably very sensitive to changes in food abundances.

Bock and Lepthien (Am. Nat. 110:559–571, 1976) found that the Common Redpoll is one of the most synchronously irrupting boreal seed-eating birds in North America, suggesting that widespread seed failure causes many redpolls to move southward (see also Kennard, Bird-Banding 47:231–237, 1976). Redpolls leave the Fairbanks, Alaska, area when birch and alder seed crops fail rather than switching to spruce (C. White, pers. comm.), suggesting that redpolls do not use spruce seeds on their usual wintering grounds. I suspect that spruce seeds are an important secondary food source for Common Redpolls when they are forced out of northern latitudes (see also Clement, U.S. Nat. Mus. Bull. 237:407–421, 1968). At the time of my study the spruce crop in northern Utah was at its highest peak in 30 years, with some trees bearing over 4000 cones (see Smith, West. Birds 9:79–81, 1978). Redpolls may only use the high-energy spruce seeds whenever they are abundant and easily gathered. Also, redpolls may switch to spruce when other preferred seeds are unavailable. Neither birch nor alder are present near my study area, nor were weed seeds available when the redpolls were collected, due to several feet of snow. Another possibility is that northern cones are inferior in quality compared to southern cones as shown by Pulliainen (op. cit.) in Finland, which would affect the efficiency with which cones could be used in the north.

The birds I observed did not appear to have any trouble manipulating spruce cones, so that an energy loss due to differential foraging time (Norberg, J. Anim. Ecol. 46:511–529, 1977) on spruce as opposed to birch would be minimal, provided that spruce cones are abundant. As with Pine Siskins, redpolls, while hanging upside down—either on the cone itself or from the branch to which the cone was attached, extracted seeds from the open cones. Since crossbills were extremely common during 1977 (Smith, op. cit.), the siskins and redpolls may have possibly relied to some extent on cones already opened by crossbills (see Turček, Ibis 98:24–33, 1956).

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Small mammals and birds as food items of Ring-billed Gulls on the lower Great Lakes.—Vermeer (Can. Wildl. Serv. Rep. Ser. 12:1–52, 1970) noted the importance of rodents, mostly the meadow vole (*Microtus pennsylvanicus*), in the diet of Ring-billed Gulls (*Larus delawarensis*) in Alberta, Canada. In contrast, for Ring-billed Gull colonies on Lakes Michigan and Huron, Ludwig (Great Lakes Res. Div., Univ. Mich., Publ. No. 15:80–89, 1966) did not mention the presence of small mammals in his food collections. Jarvis and Southern (Wilson Bull. 88:621–631, 1976) noticed only 1 vole (*Microtus* sp.) regurgitated by an adult Ring-billed Gull during 12 years of observation (1963–1974) at the Roger City, Lake