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BIRD MIGRATION IN THE DULUTH AREA-
IMPACT ASSESSMENT FROM COPPER-NICKEL MINING

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Minnesota Environmental Quality Board

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ABSTRACT

Duluth, Minnesota is a major concentration point for migrating birds. Although largely reconized for its impressive flight of hawks each fall, it is also an important area for shorebirds, songbirds and waterfowl. Two of the most important focal points, Minnesota Point and the Hawk Ridge Nature Reserve are located within the city limits. Minnesota Point is a favorite spot for observing numerous species of waterfowl and shorebirds. The Hawk Ridge Nature Reserve has received national recognition as one of the prime areas for observing the fall migration of hawks. More than one-half million hawks have been observed since 1951 with an overall mean observation rate of 194 hawks per hour. Hawk Ridge is most noted for its September flight of broad-winged hawks. Factors that operate to concentrate migrating birds in the Duluth area are discussed. Although possible pollution impacts from copper-nickel mining are largely uninvestigated, a direct impact might result from construction of a smelter within Duluth. Any tall aereal structures such as a stack, powerlines, and etc. could cause a direct toll on migrating birds. Placement of such a facility in Duluth must consider two important factors. First, since the majority of birds observed in Duluth during the year are migratory, any impacts could be geographically far-reaching; second although September is the most important month in terms of total number of birds observed, migration actually spans nearly the entire year.

INTRODUCTION TO THE REGIONAL COPPER-NICKEL STUDY

The Regional Copper-Nickel Environmental Impact Study is a comprehensive examination of the potential cumulative environmental, social, and economic impacts of copper-nickel mineral development in northeastern Minnesota. This study is being conducted for the Minnesota Legislature and state Executive Branch agencies, under the direction of the Minnesota Environmental Quality Board (MEQB) and with the funding, review, and concurrence of the Legislative Commission on Minnesota Resources.

A region along the surface contact of the Duluth Complex in St. Louis and Lake counties in northeastern Minnesota contains a major domestic resource of copper-nickel sulfide mineralization. This region has been explored by several mineral resource development companies for more than twenty years, and recently two firms, AMAX and International Nickel Company, have considered commercial operations. These exploration and mine planning activities indicate the potential establishment of a new mining and processing industry in Minnesota. In addition, these activities indicate the need for a comprehensive environmental, social, and economic analysis by the state in order to consider the cumulative regional implications of this new industry and to provide adequate information for future state policy review and development. In January, 1976, the MEQB organized and initiated the Regional Copper-Nickel Study.

The major objectives of the Regional Copper-Nickel Study are: 1) to characterize the region in its pre-copper-nickel development state; 2) to identify and describe the probable technologies which may be used to exploit the mineral resource and to convert it into salable commodities; 3) to identify and assess the impacts of primary copper-nickel development and secondary regional growth; 4) to conceptualize alternative degrees of regional copper-nickel development; and 5) to assess the cumulative environmental, social, and economic impacts of such hypothetical developments. The Regional Study is a scientific information gathering and analysis effort and will not present subjective social judgements on whether, where, when, or how copper-nickel development should or should not proceed. In addition, the Study will not make or propose state policy pertaining to copper-nickel development.

The Minnesota Environmental Quality Board is a state agency responsible for the implementation of the Minnesota Environmental Policy Act and promotes cooperation between state agencies on environmental matters. The Regional Copper-Nickel Study is an ad hoc effort of the MEQB and future regulatory and site specific environmental impact studies will most likely be the responsibility of the Minnesota Department of Natural Resources and the Minnesota Pollution Control Agency.

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INTRODUCTION

Twice every year thousands of birds migrate through northeastern Minnesota. In spring the birds travel north to breed in the boreal forest or arctic tundra. In fall they travel south, often as far as central South America, to spend the winter in areas where the weather is less severe and the food more abundant. Enroute to either destination there are several localities with unique geographical features that channel and concentrate migrants along major flyways.

Duluth, Minnesota has been reconized as one of the major concentrations points for migrating birds since the early 1950's. Described as "one of the best migrational focal points in the state, if not in the entire country" (Hofstund, 1958 p53__), the area continues to attract an increasing number of professional and amateur ornithologists. The most notable feature of migration in the area is the fall migration of hawks, particularly the September flight of broad-winged hawks. However the spring and fall migration of numerous species of waterfowl, shorebirds and songbirds are equally impressive.

CONCENTRATION AREAS

Two important concentration points within Duluth are Minnesota Point and the Hawk Ridge Nature Reserve. A long and narrow sand island projecting into Lake Superior from the center of the city, Minnesota Point attracts more migrating shorebirds than anywhere else in the state. The combination of sand beaches and grass covered fields is important for attracting many of the more common migrants, such as black-bellied plover (Squatarola squatarola) and American golden plover (Pluvialis dominica). Recently, an extensive survey of Minnesota Point inventoried the number and varity of birds in the area throughout the year (Niemi 1977; unpublished).

The Hawk Ridge Nature Reserve, funded by the city of Duluth and the local chapter of the National Audubon Society, is located less than four miles east of downtown Duluth and is situated atop a 175 m. ridge that parallels the shoreline of Lake Superior. Established in 1972, the Reserve is ideally suited for the observation of migrating hawks. Table 1 summarizes observation statistics from the Duluth Bird Club for the years 1951-1976. Although the statistics are not comparable on a year-to-year basis because total number of observation hours vary per year, they do provide an indication of the magnitude of the migration. Since offical tallying began in 1951, over a half million hawks representing 17 different species have been observed.

Nearly 70 percent of these observations are of broad-winged hawks (Table 1). Heintzelman (1975, p.62) states that "the flight of broad-winged hawks in Duluth is among the most impressive of any occurring on the North American continent". Although the population of broad-wings in North America is not known, it is possible to approximate the proportion passing through the Duluth area. These hawks are consistently observed heading in a southwesterly direction away from the ridge, and it is postualted that their primary flyway is the Texas-Mexico passageway into Central and South America. In the fall of 1976, nearly 220,000 broad-wings were observed in southern Texas (Single, 1976). At Hawk Ridge 30,000 broad-wings were observed, or 14 percent of the total number utilizing the Texas Flyway. Despite the approximate nature of this estimate, it does indicate that a significant proportion of the continential population passes through the Duluth area.

Contributing nearly 17 percent of the total observations at Hawk Ridge is the sharp-shinned hawk. Classified in 1977 as a Blue List species by the National Audubon Society, its current low abundance has caused national concern. The Blue List serves as an "early warning system", focusing attention on

species undergoing local or widespread population declines. Despite several impressive flights in the fall of 1976, the sharp-shinned hawk was retained on the Blue List for 1977. In the fall of 1976 Hawk Ridge reported the second largest total on the continent with 22,000 passing through the area.

Of the remaining 15 species observed in Duluth, seven are 1977 Blue List species and one, The American peregrin falcon (Falco peregrinus), is an endangered species. Additional Blue List species include the Cooper's hawk (Accipter cooperii, marsh hawk (Circus cyaneus), osprey (Pandion haliaetus), merlin (Falco columbarius), American kestrel (Falco sparverius), and Ferruginous hawk (Buteo regalis). Minnesota has also recognized the Cooper's hawk, marsh hawk, osprey and bald eagle (Haliaeetus leucocephalus) as "species of changing or uncertain status" (Moyle,1975). A species classified as such is not presently endangered in the state, but could potentially become extinct in the near future.

Recognized by the U.S. Fish and Wildlife Service as an endangered species, the American perigrine falcon is protected by federal law. The species has probably always been rare in Minnesota, and although indications are that it no longer nests in the state, it is estimated that possibly 20 pairs once nested on cliffs along the Mississippi River and the north shore of Lake Superior (Moyle, 1975). The peregrine falcon is extremely susceptible to the deleteriorus effects of DDE and DDT. By feeding on contaminated small mammals and birds the pesticides accumulate in adults and result in thin eggshells. It is important to provide protection for this falcon not only in areas where it nests and winters, but also in areas through which it migrates.

DULUTH-A NATURAL AVENUE FOR MIGRATION

There are several factors that contribute to the importance of the Duluth area for the migration of birds. One factor long recognized as important in the geographical distribution of flyways is a general reluctance by birds to fly across open water. In the fall, this would tend to funnel birds along the north shore of Lake Superior. However, evidence that numerous flyways exist over the Great Lakes, (Perkins, 1964) would discount this factor as the main reason for the concentration of birds in Duluth. In addition, the theory would predict a major concentration of birds along the entire length of the north shore in fall. Yet, large concentrations of hawks have not been recorded any further north toward the Two Harbors area. The geographic effect of Lake Superior may be important, but several other factors are also operating.

First, Duluth is located at both the western end of Lake Superior and at the southwestern end of the Sawtooth Range. Together the two geographic features form a funnel that aids in channeling birds from the north into the Duluth area. Second, Duluth is also located at the base of a broad triangle of northern boreal forest. To the west, the southern edge of this forest is bordered by prairie, a habitat extremely different to these birds that have bred in forest habitats. It is postulated that many birds head east-southeast because of their reluctance to leave the more familar wooded habitat (Hofslund, 1971). Because the overall trend is for birds to move to the southwest upon reaching Lake Superior they tend to follow the shore toward Duluth.

Third, a factor important primarily to the hawks, is the presence of thermales (Hofslund, 1966). Thermales are updrafts of air that allow hawks to glide effortlessly along. Large, impressive flights of hawks commonly occur two days after a cold front has passed through accompanied by strong

west-northwesterly winds, ample sunlight and/or moisture to produce thermales. The westerly component of the wind moves the thermals to the north shore where they pile up along the range because of the barrier provided by Lake Superior. Hawks following these thermales also tend to concentrate near Duluth. The absence of large hawk flights on days when the wind is from the east-northeast, in addition to the absence of large concentrations northeast of Two Harbors, suggest that the majority of birds migrating through Duluth are from the north-northwest.

All of the above help to explain why thousands of migrating birds concentrate in Duluth each fall. In the spring many birds again pass through the area in route to their breeding grounds further north. Although the spring migration is also impressive, the total number of birds, most notably hawks, is considerably less. There are fewer geographic features present south of Duluth that act in channeling birds north into the harbor area.

DURATION OF THE MIGRATION

During the course of the year there are few occasions when migrants cannot be observed in Duluth. With the majority of broad-winged hawks passing through in September, this month probably records the greatest number of migrants. However, the entire fall migration spans from mid-July, when the first shorebirds begin to appear, through early December when the last migrating hawks and waterfowl appear. Throughout the winter months flocks of evening grosbeaks (Hesperiphona vespertina), Bohemian waxwings (Bombycilla garrulus), and other winter visitants pass through the area. Then as early as February, the first appearance of crows (Corvus bachyrhynchos) signal the beginning of spring migration. The peak of spring migration occurs about the third week in May when the most abundant breeding birds of the boreal

forest, the wood warblers (Family Parulidae), arrive.

IMPACTS OF COPPER-NICKEL MINING

At present, Duluth, Minnesota is under consideration as a possible site for the construction of a smelter. Because thousands of birds travel through the city each year, it is important to investigate any possible impacts this might have on bird migration. Any effects would not only influence breeding bird populations in Duluth, but could potentially influence breeding bird populations as far north as the arctic tundra. However, the possible impacts on wildlife from heavy metal concentrations or atmospheric pollution are largely uninvestigated. If a smelter were located in or near Duluth, the most obvious impact would be physical. Construction of tall buildings, antennas, powerlines and other tall structures along heavily used migration pathways may take a direct toll on thousands of birds every year. The 50-60 m tall stack of a copper-nickel smelter may also create a potential hazard to birds, especially those migrating through the area at night.

TABLE 1

HAWK RIDGE NATURE RESERVE, DULUTH, MINNESOTA: SUMMARY STATISTICS FOR HAWK MIGRATION[A]

YEAR	# DAYS OF OBSERV.	# HOURS OBSERV. PER YEAR	TURKEY VULTURE	GOSHAWK	SHARP-SHINNED HAWK	COOPER'S HAWK	RED TAILED HAWK	RED-SHOULDER HAWK	BROAD-WINGED HAWK	ROUGH-LEGGED HAWK	GOLDEN EAGLE
1951	4	32.25	12		356	46	64		4313	2	
1952	5	41	19	6	1732	55	76	1	6288	20	
1953	4	34.50	36	4	967	129	222	3	4617	2	1
1954	6	32.50	36	6	1704	49	45		1852		2
1955	13	64.50	51	16	3172	37	511		2409	63	1
1956	19	78.50	36	2	2196	26	861	1	1317	14	
1957	12	59.50	26	7	2382	31	273		9881	5	
1958	5	32	109	2	3227	30	114	1	8897	3	
1959	9	55.75	1		1020	8	23		63	1	
1960	17	69.75	75	9	2056	38	636		7110	21	1
1961	35	121.50	281	69	5997	74	1271	1	23642	109	2
1962	42	172	61	332	3668	50	1288		20604	86	3
1963	30	120	26	709	2002	37	1612		2626	261	8
1964	20	83.25	129	30	1627	54	1168		10875	26	2
1965	39	153	143	291	3099	77	1313	6	16220	77	5
1966	11	45.25	19	6	802	13	279		10304	1	1
1967	11	36.50	53	7	2361	25	84		7689	2	
1968	20	74	799	17	1874	30	1063		24768	32	
1969	34	146.25	209	20	2781	32	460		12836	5	3
1970	35	117.50	371	3	5874	42	821	1	62470	45	7
1971	34	143.50	340	9	4245	38	1370		53745	321	1
1972	71	432.50	280	5382	6672	95	3619	2	26912	148	26
1973	69	514.50	304	3517	9348	82	4064		20853	168	15
1974	103	806.75	245	1402	10928	69	2929	1	32278	375	19
1975	87	788.25	368	316	10763	54	7279	2	44220	379	19
1976	91	891.25	352	308	21974	40	6738		30010	418	19
Percent of Total			.68	1.93	17.50	.20	5.98		69.29	.46	.02
Total			4351	12470	111140	1261	35183	19	446799	2944	135

TABLE 1 (CONT.)

YEAR	BALD EAGLE	MARSH HAWK	OSPREY	PEREGRINE FALCON	MERLIN PIGEON HAWK	AMERICAN KESTREL SPARROW HAWK	GRYFALCON	FERRUGINOUS HAWK	UNIDENTIFIED	TOTAL	AVERAGE # HAWKS PER HR/YR
1951	7	43	14	3	9	12			1369	6250	195
1952	4	311	22	10	37	101			235	8917	217
1953		254	16	5	9	52			171	6488	188
1954	4	57	26	4	25	366			336	4512	137
1955	6	168	13	18	38	119			591	7213	112
1956	6	70	24	4	15	121			706	5399	69
1957	6	229	39	4	48	216			350	13497	227
1958	1	185	28	2	39	195			334	13167	411
1959		49	18	2	7	85			134	1411	25
1960	3	119	43	7	14	95			203	10430	149
1961	10	426	60	34	20	368			283	32647	270
1962	8	126	45	4	10	217			196	26690	155
1963	15	147	39	10	7	133			166	7798	65
1964	9	100	16	3	11	195			101	14346	173
1965	37	96	30	11	16	251			500	22172	145
1966	3	46	25	5	3	309			64	11880	264
1967	2	82	13	1	2	106			48	10475	257
1968	4	221	38	4	5	227			62	29144	394
1969	7	245	68	27	17	310			206	17226	118
1970	48	509	72	8	11	554			86	70922	606
1971	29	561	89	4	5	554	1		108	61420	430
1972	31	403	99	11	13	544		1	151	44389	103
1973	44	464	86	5	11	478	1		187	39627	77
1974	93	563	83	8	17	593	1		328	49932	66
1975	60	711	73	20	15	510		1	1285	66435	84
1976	80	1207	114	25	41	776	1	1	359	62463	70
	.08	1.15	.19	.04	.07	1.16	.00	.00	1.33	= 100.0%	
							4	3	8559	Total = 644858	
	517	7395	1193	239	445	7487	4	3	8559	Total = 644858	

A. Unpublished data from J. Green, Duluth, Minn.

$\bar{x}$/yr = 24802.0

Total = 5037

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