An Analysis of Western Grebe Banding and Recovery Data

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INTRODUCTION

Information on the migratory movements of individuals in the "Western" Grebe complex (genus *Aechmophorus)* is limited and based mainly on observations of flock size changes made during migration at Pacific coast sites (Briggs et al. 1987, Campbell et al. 1990). No assessment of movements based on banding recovery data has been made. In this paper I quantify the extent of past "Western" Grebe banding and determine movements based on the available recovery encounter data.

Before 1985, the "Western" Grebe was described as consisting of two color forms, a dark phase and a light phase (Storer 1965, AOU 1983). Currently, these forms are recognized as separate biological species. The dark phase is known as Western Grebe *(A. occidentalis)* and the light phase as Clark's Grebe *(A. clarkii)* (AOU 1985:680-681). For the banding data I can make no distinction between these two species because identification of color forms in banding records is limited and Clark's Grebes were not identified in records before 1989 (D. Bystrak, pers. comm.). However, most bandings are of Western Grebes (in the strict sense) since the majority of records are of individuals banded in Canada where the relative frequency of Clark's Grebes is < 5% (Eichhorst and Parkin 1991). Hereafter in this paper "Western Grebe" refers to both species in this complex.

METHODS

I obtained banding summary data for the period 1955-1986, and recovery encounter data received as of March 1989, from the Bird Banding Laboratory (BBL), U. S. Fish and Wildlife Service. Palmer (1962) reported that 86 Western Grebes were banded through 1957. However, because the "banding retrieval file" only contains data for nongame species banded after 1954, data on the 71 individuals banded before 1955 were not available for this analysis.

Locations of banding and recovery encounter sites were mapped using the program "Atlas Mapmaker" (Strategic Mapping Inc.) on a Macintosh. The latitude-longitude coordinates provided in the banding and encounter data represent the southeast corner of the 10 minute blocks within which bandings or encounters occurred. I adjusted these coordinates before mapping so the points on the maps show centers of 10' blocks. Banding and encounter locale names assigned 10' blocks were provided by BBL.

In this paper I define a direct recovery as one in which one migratory season occurred between banding and recovery encounter, and an indirect recovery as one in which more than one migratory season occurred between banding and recovery encounter.

RESULTS AND DISCUSSION

Bandings

Between 1955 and 1986, 1,429 Western Grebes were banded. By four-year periods, numbers banded and recoveries are as follows: 1955-1958, 16 banded, 0 recoveries; 1959-1962, 9, 0; 1963-1966, 33, 2; 1967-1970, 15, 1; 1971-1974, 224, 7; 1975-1978, 893, 11; 1979-1982, 159, 24; 1983-1986, 81, 9. Banding activity was lowest midwinter, highest in summer, and second highest in fall migration. Numbers banded and recovered by

month are as follows: January, 17 banded, 7 recoveries; February, 37, 8; March, 45, 6; April, 48, 9; May, 77, 6; June, 604, 5; July, 229, 2; August, 43, 1; September, 80, 3; October, 161, 3; November, 73, 2; December, 15, 2.

Banding "status" and "additional information" codes reported to BBL are listed in Table 1. Auxiliary marking was applied to 762 (53.3%) Western Grebes. A total of 304 (21.3%) individuals were banded as a result of sickness or injury (Table 1). Of 1,184 grebes for which age was determined, 88.3% were AHY (Table 2). Of those for which sex was determined (898), 47.3% were males (Table 2).

Western Grebes were banded by 56 permittees. Only seven permittees banded > 15 birds (877, 185, 49, 49, 49, 38, 23 each). Nuechterlein (1975, 1981), as part of studies on Western Grebe colony site selection and social behavior, banded 877 grebes in Manitoba between 1974 and 1978. Seedskadee NWR, Wyoming, between 1975 and 1981, banded 185 grebes as part of an experimental program to recover waterbirds from chemical solar evaporation ponds (T. Pabian, pers. comm.). Almost half of the remaining grebes (169 of 367) were banded as a result of injury, oiling or sickness (Table 1).

Banding occurred within 67 different 10' blocks in 15 different states and provinces (Table 2 and Fig. 1A). The number of grebes banded per block ranged from 1 to 701. Only 13 blocks had > 10 birds banded (701, 176, 83, 56, 54, 50, 49, 44, 42, 21, 18, 15, 11 each).

Recovery encounters

Fifty-four (3.8%) Western Grebes banded between 1955 and 1986 were encountered and reported to BBL as of March 1989. The BBL "recovery file" also contained four encounters of grebes banded before 1955. All recovery encounters are summarized in the Appendix. Further analysis is restricted to post-1954 banded grebes. There are 12 direct and 32 indirect recoveries of Western Grebes.

Encounters occurred during all months but were more frequent between January and June (n = 41) than between July and December (n = 13). The greatest number encountered in any four-year period was 24 during 1979-1982, directly after the four-year period during which the largest number of grebes was banded. No grebes were encountered more than once and only a single individual (#7) was released alive. The time elapsed between banding and encounter ranged from one day (#8) to nearly eight years (#14); mean interval was 1 year 10.5 months.

Encounters were reported from 44 different 10' blocks in 10 states or provinces (Fig. 1B). Most of these blocks are on the Pacific coast (n = 39). One block had three encounters and seven blocks had two encounters each. Nearly equal numbers of males (n = 19) and females (n = 20) are represented.

The remaining discussion deals mainly with Western Grebes banded at two breeding sites in Manitoba which contributed 37 of 54 recoveries. No Western Grebes were recovered in Mexico, which indicates either that most individuals from northern breeding populations do not winter that far south, or that Western Grebes are not recovered and reported from Mexico. I believe the latter possibility is less likely than the former since banded Eared Grebes have been recovered from several Mexican sites (Jehl and Yochem 1986; see #4 in Appendix). Individuals from southern US breeding populations, however, may winter south of the US-Mexican border, but more banding at southern US sites is needed for confirmation.

Manitoba grebes were recovered in winter along the Pacific coast from southern British Columbia to extreme southern California, with the highest concentrations in the Vancouver-Seattle and San Francisco areas. The few recoveries between these two areas is likely a reflection of low human density which reduces band encounters. Locations of direct and indirect recoveries are similar and correspond with the winter distribution based on Christmas Bird Count data (Root 1988). The extensive distribution of Manitoba grebes along the Pacific coast was not due solely to inter-year differences in dispersal. For example, of six grebes banded at Marshy Point in 1977 and recovered that winter, four migrated to the same area in Washington (#20, 28, 36, 38) and two to widely separated coastal sites in California (#24, 37).

Not all Manitoba grebes winter on the Pacific coast. Two indirect recoveries suggest that some grebes winter inland (see #22, 34). In addition, a Western Grebe I banded at Delta Marsh, Manitoba, June 1989, was recovered September 1990 at Caballo Lake, New Mexico.

Although these recoveries indicate where Manitoba grebes winter, routes taken by these grebes during fall migration are not easily discernable. Few individuals were recovered at sites between breeding and wintering grounds. One individual (#13) banded at Delta Marsh was recovered at Okanagan Lake, British Columbia, suggesting a direct route to the west. The only other recovery of a Manitoba grebe in fall is that of #44, a female recovered at Canyon Ferry Lake, Mortana. Assuming she spent the summer somewhere north-to-east of the recovery site, this location, at the eastern base of the Rocky Mountains, suggests a rest stop prior to flying over the mountains, possibly enroute to the Pacific coast.

Two grebes (#53, 54) banded in October near Green River, Wyoming, were both recovered in Nevada at known wintering areas (Alcorn 1988, Root 1988).

Nuechterlein (1982) marked Western Grebes with nasal saddles to identify individuals for behavioral studies. Although he noted that some of the 462 marked individuals returned in later years, he did not attempt to determine the extent of philopatry (Nuechterlein, pers. comm.). Three individuals that he banded were recovered during later breeding seasons. Two males (#33, 46) banded at Marshy Point, located on the east shore of Lake Manitoba, were recovered in the same 10' block on the west shore of Lake Winnipeg, approximately 90 km away. The third individual (#14), a female banded at Delta Marsh, was found dead on a nest two 10' blocks directly south. A grebe (#12) banded at Bear River Migratory Bird Refuge, Utah, was found dead just south of Provo Lake, Utah, the following May. Although these recoveries and Nuechterlein's observations demonstrate that some Western Grebes will return to the same or nearby breeding sites, other individuals disperse to distant breeding sites in later years. For example, a male (#29) from Delta Marsh was recovered just east of Lac la Biche, Alberta.

The only grebe banded in winter and recovered in summer was #55. It was banded on the California coast and found dead the same year near Lajord, Saskatchewan. Intra-winter movement of Western Grebes was minimal. None of seven individuals (#7, 8, 11, 18, 41, 52, 57) recovered within 90 days of banding traveled greater than 20 km. Another individual (#56) banded near San Rafael, California, was recovered six months later but only about 20 km south of its banding block. Palmer (1962:98) stated that spring migration probably begins in late March "with n. coastal movement from the s. extremity of winter range along Pacific coast of Mexico:" but he did not provide any empirical data to support his statement. None of the above eight recoveries are useful in evaluating this hypothesized north-south movement.

Only two Western Grebes (#9, 10) banded during winter were recovered during a subsequent winter. Both were banded in April near Richmond, California. #10 was recovered the following March in the 10' block just south of Richmond. If it migrated and returned from a breeding site, then it provides one instance of winter-site philopatry. The other grebe was recovered near Westport, Washington, about 950 km north of Richmond.

Longevity records

Klimkiewicz and Futcher (1989) mistakenly reported #51 as the longevity record for Western Grebes, at least 6 years 7 months old. Three other individuals are older than #51 and were in BBL records: #40 at 6 years 9 months, #48 at 6 years 10 months, and #14 at 9 years. The current longevity record is that of #14. These minimum ages are based on their assumption that birds had hatched 1 June the year prior to banding. Some Western Grebes apparently live longer than nine years. At Delta Marsh, on 23 June 1989, I observed a Western Grebe that appeared to have a white nasal saddle. Based on when Nuechterlein put nasal saddles on Western Grebes, that individual would have been between 13 and 16 years old in 1989, at minimum.

CONCLUSIONS

The recovery data clearly demonstrate that most Western Grebes from Manitoba breeding sites can be found in winter along the Pacific coast from southern British Columbia to San Diego, California. Therefore, while a portion of the population migrates directly west in the fall, others may move in a more southwesterly direction. Intra-winter movement appears to be minimal and some individuals may return to the same sites in subsequent winters. During later breeding seasons, some individuals will return to the same or nearby marshes, while others disperse to more distant marshes.

Because Western Grebes are gregarious throughout the year, they are vulnerable to habitat alterations and human disturbances during the breeding season (Riske 1976, pers. obs.) and to oil spills during the winter (Smail et al. 1972). In addition, as fish-eating specialists, they are vulnerable to pesticides and toxic pollutants (Rudd and Herman 1972, Henny et al. 1990). Along with other colonial waterbirds, these factors have made them of particular concern to various wildlife agencies (Guertin and Pfannmuller 1985, Koonz and Rakowski 1985, Henny et al. 1990). Complete and comprehensive information about migratory movements is needed if nongame biologists are to make informed management decisions. While we now have information for populations in the northeastern part of the breeding range, it is presumptive to conclude that the same holds for populations in other areas of the range.

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Table 1. Banding Status and Additional Information codes reported for Western Grebes.

Code	Number banded	Number recovered	Explanation
300	213	7	Normal (a)
370	35	1	Caught by spotlighting
608	275	10	Painted, dyed or feathers otherwise marked
611	4	0	Transported out of 10' block where captured
615	1	0	Injured
621	48	2	Sick (or exhausted); released upon recovery
634	1	0	Experimental unknown
636	2	0	Bird held > 24 hr and released
639	25	0	Head or wing tagged
640	47	4	Oil soaked, cleaned & released < 24 hr
650	1	0	Recovered cripple, transported & released
651	462	23	Bill marker attached (nasal saddle or disc)
656	178	2	Sick or injured, held, treated, transported
657	19	1	Injury by weather conditions
660	10	0	Sick or injured, held, treated
675	4	1	Held, transported and released
685	104	3	Miscellaneous

(a) Includes 1 grebe reported with code 400

Appendix. Recovery encounter data for Western Grebes.

	Band No.	Age	Sex	Status	Date Banded	Bander / Location	How Obtnd	Date Enc.	Encounter Location
1	46-21041	AHY	U	300	6-14-34	Nat Bison Range; Willard, UT	00	12-?-36	Santa Cruz, CA
2	46-21267	AHY	U	300	6-27-34	Nat Bison Range; Willard, UT	00	3-?-35	Carpinteria, CA
3	406-83569	J	U	300	7-05-40	unknown; Baja Calif, Mexico	26	9-10-40	Guanajuato, Mexico
4	377-14377	U	U	660	10-15-41	G H True Jr; Tule Lake, CA	01	11-?-41	Tagus, CA
5	597-08307	A	M	300	5-09-64	R R Taylor; Regina, SK	50	7-?-65	Bankeir, BC
6	597-08314	A	F	300	5-20-64	R R Taylor; Regina, SK	45	8-14-64	Regina, SK
7	707-31272	AHY	F	675	11-22-68	Nat Ecol Res Cntr; Lakeport, CA	28	11-29-68	Lowerlake, CA
8	627-94526	AHY	U	640	4-09-71	Pt Reyes Bird Obs;Richmond,CA	00	4-10-71	San Francisco, CA
9	627-94529	AHY	U	640	4-09-71	Pt Reyes Bird Obs;Richmond,CA	00	1-26-73	Westport, WA
10	627-94536	AHY	F	640	4-18-71	Pt Reyes Bird Obs;Richmond,CA	00	3-12-72	San Francisco, CA
11	587-08735	AHY	M	640	5-02-71	Pt Reyes Bird Obs;Richmond,CA	45	7-13-71	Oakland, CA
12	627-44112	AHY	U	370	8-30-73	Bear RiverMBR; 12.3 mi SW Brigham City, UT	00	5-24-74	Provo, UT

Table 2. Banding data for Western Grebes.

State/ Province	Total	No 10' Block	Age U	L	H	SY	AHY	Sex U	F	M
Alberta	7	3	1	0	4	0	2	6	0	1
Arizona	1	1	1	0	0	0	0	1	0	0
B. Columbia	3	2	0	0	0	0	3	3	0	0
California	201	26	40	1	4	0	156	123	42	36
Colorado	10	5	1	1	1	0	7	6	2	2
Manitoba	879	3	0	93	7	0	779	101	410	368
Montana	2	1	0	0	2	0	0	1	0	1
Nevada	1	1	0	0	0	0	1	1	0	0
New York	1	1	1	0	0	0	0	1	0	0
North Dakota	11	1	0	0	0	0	11	3	5	3
Oregon	3	3	1	0	0	0	2	3	0	0
Saskatchewan	31	5	1	1	0	0	29	4	13	14
Utah	50	2	0	23	1	0	26	49	1	0
Washington	33	9	5	0	0	1	27	33	0	0
Wyoming	196	4	194	0	0	0	2	196	0	0
Total	1429	67	245	119	19	1	1045	531	473	425

Note: AHY includes 49 birds aged as "adult," an age designation used prior to 1 July 1967 and which may not correspond exactly to AHY.

Appendix (Continued)

	Band No.	Age	Sex	Status	Date Banded	Bander / Location	How Obtnd	Date Enc.	Encounter Location
13	1007-23975	AHY	M	300	6-15-74	Delta Res Stat; Delta, MB	00	10-20-74	Summerland, BC
14	1007-23985	AHY	F	300	6-15-74	Delta Res Stat; Delta, MB	30	6-06-82	Portage la Prairie, MB
15	1007-23993	AHY	M	300	7-15-74	Delta Res Stat; Delta, MB	00	1-01-77	Presadero, CA
16	1007-08601	L	U	651	9-07-74	Delta Res Stat; Delta, MB	26	1-11-76	Bremerton, WA
17	1007-08619	L	U	651	9-18-74	Delta Res Stat; Delta, MB	00	10-14-74	Otter Rock, OR
18	807-52496	AHY	U	621	1-10-76	C A Sheridan; Tacoma, WA	00	4-01-76	Tacoma, WA
19	1027-40781	L	U	300	7-23-76	Delta Res Stat; Delta, MB	00	1-23-77	Bodega Head, CA
20	1087-30924	AHY	M	651	6-15-77	Delta Res Stat; Clarkleigh, MB	00	3-24-78	7 mi E Olalla, WA
21	1087-30929	AHY	F	651	6-15-77	Delta Res Stat; Clarkleigh, MB	00	4-04-80	8 mi W San Anselmo, CA
22	1087-28107	AHY	M	651	6-20-77	Delta Res Stat; Clarkleigh, MB	00	5-31-80	9 mi E Henderson, NV
23	1087-28118	AHY	F	651	6-20-77	Delta Res Stat; Clarkleigh, MB	00	4-15-79	Suquamish, WA
24	1087-28133	AHY	F	651	6-20-77	Delta Res Stat; Clarkleigh, MB	00	11-15-77	Jenner, CA

Appendix (Continued)

	Band No.	Age	Sex	Status	Date Banded	Bander / Location	How Obtn	Date Enc.	Encounter Location
25	1087-28142	AHY	F	651	6-20-77	Delta Res Stat; Clarkleigh, MB	00	6-03-79	Capalis, WA
26	1087-28148	AHY	M	651	6-20-77	Delta Res Stat; Clarkleigh, MB	00	2-06-79	Ocean Park, WA
27	1087-28158	AHY	M	651	6-20-77	Delta Res Stat; Clarkleigh, MB	09	5-?-82	Vancouver, BC
28	1087-28164	AHY	F	651	6-20-77	Delta Res Stat; Clarkleigh, MB	26	10-16-77	Aberdeen, WA
29	1087-28170	AHY	M	651	6-20-77	Delta Res Stat; Clarkleigh, MB	26	5-23-79	9 mi E Lac la Biche, AB
30	1087-28172	AHY	F	651	6-20-77	Delta Res Stat; Clarkleigh, MB	45	3-10-79	Point Brown, WA
31	1087-28200	AHY	M	651	6-20-77	Delta Res Stat; Clarkleigh, MB	98	5-07-79	Freestone, CA
32	1087-28208	AHY	F	651	6-25-77	Delta Res Stat; Clarkleigh, MB	50	2-06-79	Richmond, CA
33	1087-28253	AHY	M	651	6-25-77	Delta Res Stat; Clarkleigh, MB	26	9-18-79	Hnausa, MB
34	1087-28296	AHY	F	651	6-25-77	Delta Res Stat; Clarkleigh, MB	56	1-29-79	unknown, NV
35	1087-28304	AHY	F	651	6-25-77	Delta Res Stat; Clarkleigh, MB	00	5-21-79	18 mi W Victoria, BC
36	1087-28309	AHY	F	651	6-25-77	Delta Res Stat; Clarkleigh, MB	00	2-12-78	Lake Bay, WA
37	1087-28343	AHY	F	651	6-25-77	Delta Res Stat; Clarkleigh, MB	00	4-09-78	Coronado, CA
38	597-06403	AHY	M	651	6-28-77	Delta Res Stat; Clarkleigh, MB	00	2-19-78	7 mi E Olalla, WA
39	597-06424	AHY	M	651	6-28-77	Delta Res Stat; Clarkleigh, MB	00	1-02-80	Capalis, WA
40	1087-28389	AHY	F	651	7-09-77	Delta Res Stat; Clarkleigh, MB	98	3-17-83	Richmond, CA
41	1027-13434	AHY	U	300	1-28-78	Oaklnd Pk & Rec Ctr;Oaklnd,CA	00	2-16-78	San Francisco, CA
42	1087-30766	AHY	F	608	5-25-78	Delta Res Stat; Clarkleigh, MB	00	sprng 83	Arroyo Grande, CA
43	1087-30770	AHY	M	608	5-25-78	Delta Res Stat; Clarkleigh, MB	00	4-17-79	Fox Island, WA
44	1087-30788	AHY	F	608	5-25-78	Delta Res Stat; Clarkleigh, MB	00	9-26-82	Canyon Ferry Dam, MT
45	1107-34132	AHY	M	608	6-21-78	Delta Res Stat; Clarkleigh, MB	00	2-06-80	Westport, WA
46	1107-34135	AHY	M	608	6-21-78	Delta Res Stat; Clarkleigh, MB	26	6-20-83	Hnausa, MB
47	1107-34153	AHY	F	608	6-21-78	Delta Res Stat; Clarkleigh, MB	00	12-04-82	Ventura, CA
48	597-06474	AHY	M	608	6-26-78	Delta Res Stat; Clarkleigh, MB	23	4-02-84	Ocean Park, WA
49	1107-34159	AHY	F	608	6-26-78	Delta Res Stat; Clarkleigh, MB	00	3-11-83	Clo-oose, BC
50	1107-34233	AHY	M	608	7-11-78	Delta Res Stat; Clarkleigh, MB	50	9-15-83	7 mi E Cassidy, BC
51	1107-34256	AHY	M	608	7-11-78	Delta Res Stat; Clarkleigh, MB	00	1-09-84	5 mi E Manchester, CA
52	1117-23208	AHY	U	657	3-06-79	F Hosea; 11 mi S Moclips, WA	00	4-05-79	Point Brown, WA
53	1127-00805	U	U	656	10-31-79	SeedskadeeNWR;11 mi S Riview,WY	00	12-05-79	Las Vegas, NV

Appendix (Continued)

	Band No.	Age	Sex	Status	Date Banded	Bander / Location	How Obtn	Date Enc.	Encounter Location
54	1127-00806	U	U	656	10-31-79	SeedskadeeNWR;11 mi S Riview,WY	00	2-06-81	Sutcliffe, NV
55	1117-32318	AHY	U	685	1-18-80	JB Holcomb; San Rafael, CA	00	6-23-80	Lajord, SK
56	1117-32347	AHY	U	621	10-21-81	JB Holcomb; San Rafael, CA	00	4-11-82	Berkeley, CA
57	1367-34814	AHY	U	685	2-06-86	Peninsula Humane Soc; Burlingame, CA	00	2-10-86	San Mateo, CA
58	977-00390	AHY	U	685	6-03-86	G Whittell WRC; Nashua, CA	00	6-05-86	Nashua, CA

Age codes J (juvenile) and A (adult) discontinued in 1962.

Recovery codes:

00, found dead
09, caught by or due to hawks, owls, or other raptors
23, caught or found dead due to oil or tar
26, caught by or due to entanglement in fishing gear
28, caught by hand
30, died in nest
45, found dead or injured on highway
50, found dead; band with skeleton or bone only
56, no information other than bird was obtained
98, band or band number only obtained

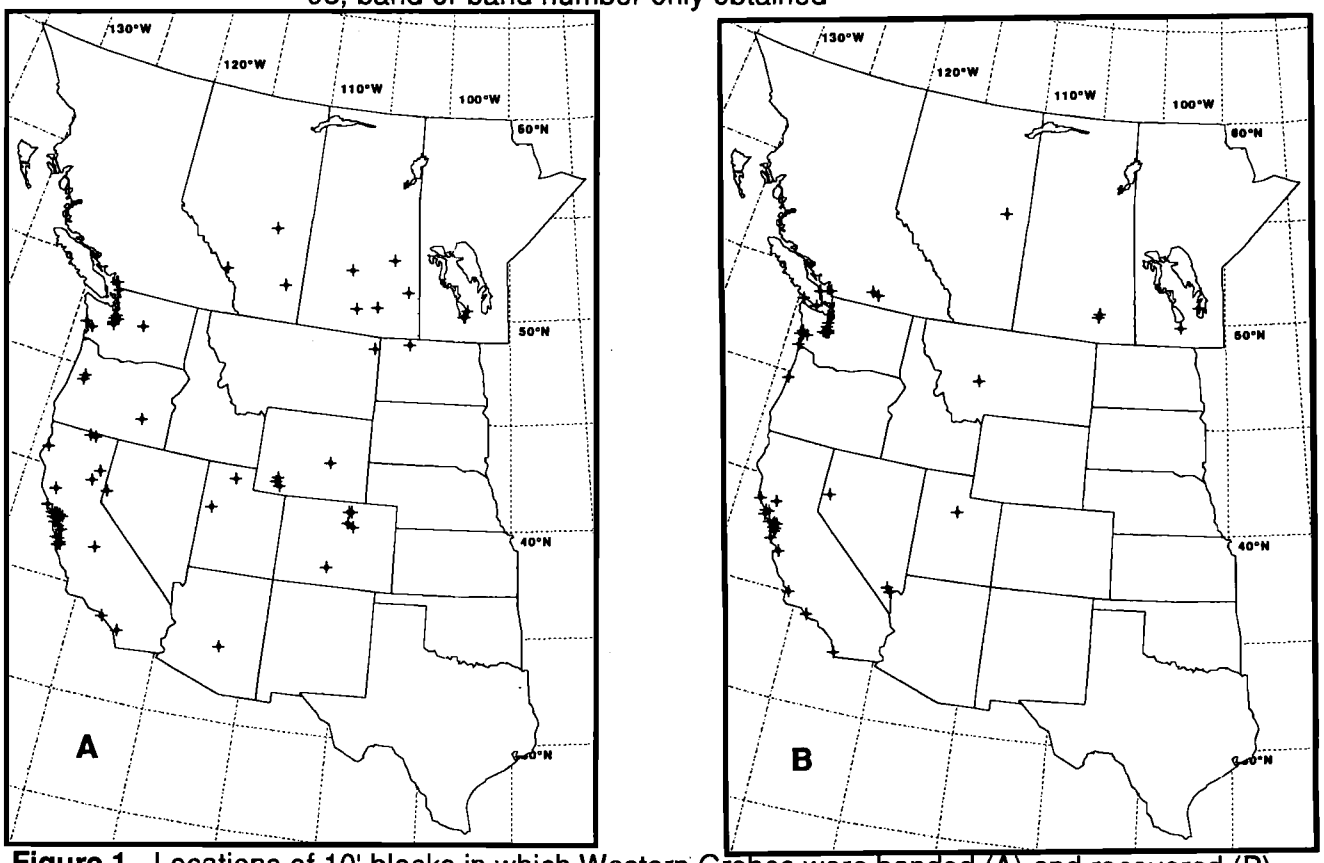

Figure 1. Locations of 10' blocks in which Western Grebes were banded (A) and recovered (B).