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Dear Darrell,

Enclosed are 2 copies of the Final Report for the winter plover surveys (finally!). One copy is for you, another for Katie. I will scan the slide showing how the tire tracks damage the tidal flow for you and email it (please remind me if I forget to do so).

It was great to meet you and Katie. Thank you both for your support and time involved with the surveys. Your efforts are greatly appreciated! If you should have any questions please feel free to ask.

Thank you,

A handwritten signature in cursive script, appearing to read 'Katie', written in dark ink.

Katherine

FINAL REPORT

Non-breeding Piping Plover (*Charadrius melodus*) Surveys Along the Texas Gulf Coast

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ABSTRACT

Marking and resighting individuals is important to conservation efforts, as these data are necessary to gain estimates of survival and understand migration patterns. I surveyed portions of coastal tidal flats along the southern coast of Texas during December 2002, where I recorded the number of banded and unbanded Piping Plovers (*Charadrius melodus*), habitat type, and location of observed plovers. In addition, to single surveys of an area, I conducted multiple surveys on three subset areas within the study area. Multiple surveys of the same area were used to calculate population size for these select areas and estimate the percent of Piping Plovers missed during a single survey event. During a 3-week period, I resighted a total of 68 banded individuals that included 7.8% (18/231) of all adult Piping Plovers marked or resighted during 2002 on Saskatchewan breeding areas. These data provide evidence that Piping Plovers from the Canadian Prairies follow the Central Flyway to reach non-breeding areas. Furthermore, data suggest that individuals from the same breeding areas share similar non-breeding areas. Individuals from the same breeding area used habitats 0-198-km apart on non-breeding habitats.

INTRODUCTION

Resighting marked individuals on both the breeding and wintering areas is important to population dynamics, as it provides insight to migrational connectivity (Webster et al. 2002) and survival (Lebreton et al. 1992). Environmental and habitat conditions that an individual encounters in one season can affect performance in the next season (Davidson 1981, Alisauskas 2002, Fournier and Hines 1994; Dierschke 1998). Thus, if individuals from the same breeding population also share the same wintering area, entire breeding or non-breeding populations could be affected by factors such as habitat loss in one of the areas (Esler 2000). Therefore, linking wintering and breeding areas will inevitably lead to a stronger understanding of population demography (Fretwell 1972; Evans and Pienkowski 1984, Webster et al. 2002).

Piping Plovers (*Charadrius melodus*) are ideal for finding marked individuals throughout the annual cycle. Although small bodied, which makes them more difficult to find, Piping Plovers use open habitats throughout the annual cycle and congregate into relatively small areas during the non-breeding period (Haig and Oring 1988, Haig and Plissner 1993). Use of open habitats, combined with flocking behaviour, lend toward more successful observations of marked individuals. Importantly, Piping Plovers are federally listed shorebirds that are endemic to North America. Therefore, not only do surveys of Piping Plovers provide a unique opportunity to learn about migratory connectivity, information gained from these surveys is important to the recovery of the species.

Recent efforts to colour-band breeding Piping Plovers and young in the Canadian Prairies offered a unique opportunity for conducting surveys, searching non-breeding

areas for individuals previously marked on breeding habitats. During 2002, within Saskatchewan, 228 adults and 43 pre-fledged young were marked with unique band-combinations. In addition, within Alberta and Saskatchewan 239 pre-fledged young were banded with non-individual band-combinations. I conducted surveys along the coastline of south Texas searching for marked and unmarked Piping Plovers to delineate if Piping Plovers from the same breeding area migrated to non-breeding area of close proximity, including marked young and their parents. In addition to single surveys, I conducted multiple surveys within three sub-units of the study area. Multiple surveys were used to account for detection probability, or the chance of missing individuals during a given survey, and to obtain population estimates for key wintering areas.

STUDY AREA AND METHODS

I surveyed portions of coastal tidal flats and beach habitats near Corpus Christi (about 60-km linear area), Brownsville (12-km) and South Padre Island (22-km), Texas (Figure 1). The Upper Laguna Madre or Corpus Christi survey area incorporated San Jose Island and Mustang Island, including portions of beach habitat along Padre Island National Seashore. The Lower Laguna Madre survey area included tidal flats and beaches from the Rio Grand River to 22 km north of the developed area of South Padre Island town site. The study area was chosen because of traditional use of the area by large numbers of non-breeding Piping Plovers (Plissner and Haig 2000). Habitat types consisted of beach, algal flat, lower sandflat, and mudflat. See Judd and Lonard 1985 (Lower Laguna Madre) and Withers 1994 (Upper Laguna Madre) for detailed descriptions of habitat types.

Surveys were conducted on ATV and by foot. Using binoculars and a spotting-

scope, I searched tidal flats for Piping Plovers, Semi-palmated Plovers (*Charadrius semipalmatus*), and Snowy Plovers (*C. alexandrinus*). I recorded band combinations of marked plovers, as well as date, location recorded on a Global Positioning System (GPS; 95% accuracy to within 100 m), habitat type, and flock size of all plover sightings throughout the survey period. Plover locations were classified as occurring within designated critical Piping Plover wintering habitat (United States Fish and Wildlife Service 2001) and further classified as federally or state protected land, private, or other conservation status.

In addition to single surveys of the study area, I conducted multiple surveys on three subset areas. Multiple survey areas included: 1) Three surveys on South Padre Island (tidal flats adjacent to the Laguna Madre from the northern extent of the development to 22-km northward) ; 2) Two surveys on Brazos Santiago (beach habitats from the Rio Grand River north to the Brownsville Ship Channel); and 3) Two surveys on North Pass (tidal flats of San Jose Island, adjacent to Aransas Bay). These three areas were chosen as multiple survey areas because they supported the largest number of Piping Plovers during the 1996 International Piping Plover Census (Plisssner and Haig 2000). Because Piping Plovers exhibit high over-winter survival and are known to move among juxtaposed, available habitats throughout the non-breeding period (Drake et al. 2001), multiple surveys were spaced from 24 hours to 7 days apart to account for temporal differences in the number of birds using these habitats. Population estimates for areas of multiple surveys were calculated using Bowden's estimate (Bowden 1993) within NOREMARK (White 1996). Detection probability for an area was estimated by dividing the number of birds counted in a single survey by the estimated population size

for that area. Finally, upon completion of surveys, band combinations were used to link breeding and wintering areas.

RESULTS

Total number of Piping Plovers counted during all surveys was 1217 with a total of 97 band resightings ($n=29$ secondary sightings of the same marked individuals). Total number of other plover species counted was 757 Snowy Plovers ($n=3$ band resightings) and 382 Semi-palmated Plovers ($n=0$ band resightings). Resighting of marked Piping Plovers included 68 different band combinations ($n=39$ Corpus Christi, $n=29$ South Padre Island). Due to non-unique band combinations, I was unable to link all resightings with exact band location. For those bands which could be traced to breeding areas, 18 were banded in Saskatchewan as adults ($n=17$ identifiable to exact band location; Table 1). Resighting of adult banded plovers included one plover that was originally marked in Alberta at the pre-fledgling stage (2001) and recaptured as a breeding adult on Lake Diefenbaker, Saskatchewan (2002). Twenty-six individuals were known to be banded at the pre-fledgling stage (13 Saskatchewan, 6 Alberta, 2 Missouri River, U.S., and 5 of unknown band location; see Appendix A). Resightings of individuals banded at the pre-fledgling stage included four captive-reared young. Two of which originated from Chaplin Lake, Saskatchewan, and two from the Missouri River, U.S. Banding locations for 24 marked individuals are unknown at this time. Six of these individuals, may have been banded on South Padre Island during the winter of 1997-98 (Drake et al. 2001); however, missing bands did not allow for confirmation. Data precludes linking migration of breeding adults with corresponding young.

Total estimated percent of marked birds for the study area was 8.0% (97/1217).

The majority of observed Piping Plovers occurred within designated Piping Plover critical habitat (98.8%; 1204/1217). Observed use of different habitat types varied among survey areas. Plovers occurred most often on algal flat and lower sandflat habitats. Observed use of habitat types varied between that of Upper and Lower Laguna Madre (Table 2). Estimated population size was 245 (95% CI = 207-290) and 303 (95% CI = 299-308) for South Padre Island and North Pass, respectively. Number of Piping Plovers counted during multiple surveys of South Padre Island and North Pass, varied by as much as 190 and 53 Piping Plovers, respectively (Table 3). Detection probability, or the percent of Piping Plovers observed during a single survey, relative to the estimated population size for that area, varied from 17.9% – 95.5% for South Padre Island and 56.1% - 73.6% for North Pass.

Assuming that all adults marked in Saskatchewan during 2002, successfully migrated to the non-breeding areas, 7.8% (18/231) of Piping Plovers marked or resighted in Saskatchewan during 2002 were resighted in southern Texas. Piping Plovers migrated as far as 2,850 km from Canadian Prairie breeding areas to reach Texas non-breeding habitats. Individuals that shared the same lakeshore breeding areas used habitats from 0 – 197 km apart on the wintering areas (Table 1). Two Piping Plovers banded at Lake Diefenbaker, Saskatchewan and three individuals banded at Big Quill Lake, Saskatchewan, respectively, were found together within the same flock. These same flocks also included individuals from breeding areas as far apart as the Missouri River, U.S. and Big Quill Lake and Lake Diefenbaker, Saskatchewan.

DISCUSSION

Large number of band resightings over a relatively short time period indicate that

increased banding efforts on the breeding areas and subsequent survey of wintering habitats for banded individuals is a successful means of exploring migration connectivity. High resighting probability (7.8%) of adult Piping Plovers banded in Saskatchewan during 2002, provide evidence that at least some individuals from the same breeding area also share nonbreeding areas (Table 1). Although Piping Plovers from the same breeding area wintered ≤ 197 -km apart, on the landscape scale, it suggests strong connectivity may exist between Canadian Prairie breeding populations and south Texas wintering areas (Webster et al. 2002). In addition, these data on band resightings suggest that Piping Plovers follow key migrational routes, with birds from the Great Plains following the Central Flyway to reach non-breeding areas along the Gulf of Texas (Fortman 1991, Jenkins and Criston 2002). This migration route may explain, in part, why habitats along the Texas Gulf Coast consistently contain the largest number of non-breeding Piping Plovers during all International Piping Plover Censuses (Haig and Plissner 1993, Plissner and Haig 2000, Mabee et al. 2001). Considering that the majority of Piping Plovers (63%; Haig 1992) breed in the Northern Great Plains and that most of these birds use the Central Flyway, Texas would then lie at the southern extent of the migrational path for the majority of the Piping Plover population. However, Piping Plovers from other breeding populations are also known to winter in Texas (Haig and Plissner 1993, Drake et al. 2001). Unfortunately, few Piping Plovers are marked from other breeding populations (Haig and Plissner 1993), making it difficult to draw inference about broad scale migrational patterns.

High use of designated critical habitat (98.8%) by Piping Plovers in this study provides support that these designated areas are important for Piping Plovers. These

numbers should be viewed with caution, as they likely do not reflect Piping Plover use of designated, relative to nondesignated areas. Low documented use of nondesignated habitats by Piping Plovers during these surveys is likely the result of few of these non-designated areas actually being surveyed. The only individuals found outside of designated critical habitats were those individuals using habitats within the Padre Island National Seashore.

Multiple surveys of the same area revealed high variation in the number of Piping Plovers counted during a single survey (Table 3). Variation with Piping Plover counts was likely due to individuals moving in response to changing environmental and habitat conditions. Drake et al. (2001) found that once Piping Plovers arrived on non-breeding areas, they made small, localized movements but remained on primary winter areas until the onset of spring migration. Thus, it is likely that the non-breeding population remained stable but individuals were not counted during the survey because they had moved to nearby, unsurveyed habitats. Complete census of a population is not possible, as it is inevitable that some individuals will go undetected (MacKenzie and Kendall 2002, Sandercock and Beissinger 2002).

Variability in Piping Plovers counts indicate the inaccuracy that can arise with count surveys and likely explains why International Piping Plover Census counts vary in the percent of breeding Piping Plovers accounted for on wintering areas (40-60% of total estimated breeding population; Haig and Plissner 1993, Plissner and Haig 2000). Results from this study indicate that during strong north winds, $\leq 82\%$ of Piping Plovers can be missed during a single survey, presumably when birds fly to nearby, unsurveyed habitats. It is likely that the percent of birds missing during the International Piping Plover Census

occur within the survey area but go undetected. Breeding surveys likely yield larger, more consistent number of Piping Plovers because birds are more stationary during this time, as they remain near their nests. In addition, potential breeding habitats are well documented, lending to more complete census of these areas (Plissner and Haig 2000). In comparison, non-breeding areas with suitable habitat are widespread and difficult to census due to expansive tidal flats and areas inaccessible to surveys (Plissner and Haig 2000, Drake et al. 2001). Future surveys should incorporate multiple surveys of the same area to obtain accurate population estimates for key non-breeding areas. Although these surveys require more time and cost, without this information we are left with biased low estimates which provide no information on true population trends (MacKenzie and Kendall 2002, Sandercock and Beissinger 2002).

In conclusion, resighting of marked individuals is important for understanding migration connectivity and annual survival. The species' status, [threatened - U.S. Northern Great Plains and Atlantic coast; endangered - U.S. Great Lakes and Canada], increases the importance of collecting these data and thus, the need for continued banding efforts and subsequent surveys searching for marked Piping Plover during the non-breeding period. Collaboration of government and conservation offices that are located near key non-breeding habitats, would facilitate survey of these habitats reduce cost of surveys. With the cooperation of several agencies, habitats could be divided between agencies and annual surveys could be conducted with a minimal time contribution from any one office. Surveyors should be supplied with band colours used on breeding habitats and instructed on how to read band combinations (i.e., record all bands from all joints, ensuring to look for stacked bands of the same colour). Captures on the non-breeding

areas should also be implemented and non-uniquely marked and unmarked individuals could be targeted (Mehl et al. *in review*). Captured non-uniquely marked individuals could then be linked to the breeding areas. Furthermore, during trapping efforts, additional Piping Plovers could be banded and eventually resighted during annual Piping Plover breeding surveys.

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Table 1. Total number of adult Piping Plovers banded in Saskatchewan during 2002 and subsequently identified on south Texas wintering areas in December 2002. Three additional marked Piping Plovers were observed and traceable to Province but not to the exact banding location. These individuals are excluded from the table.

Band Location	No. Adults Marked (%)	No. Obs. On Winter area (%)^a	Distance (km) from individuals of same breeding area
Lake Diefenbaker	110 (48%)	10 (9.1%)	0-197
Big Quill Lake	55 (24%)	4 (7.3%)	0-181
Missouri Coteau	37 (16%)	3 (8.1%)	12-140
Chaplin Lake	25 (11%)	0	-
Last Mountain Lake	4 (2%)	0	-
Total	231	17	

^aPercent of the total number of adults banded for each breeding area resighted on the non-breeding area.

Table 2. Number and corresponding percent of Piping Plovers observed across different habitat types for all surveys areas combined and for Upper Laguna Madre (ULM) and Lower Laguna Madre (LLM), separately.

Habitat	Total No. Piping Plovers (%)	Total No. Piping Plovers ULM (%)	Total No. Piping Plovers LLM (%)
Algal Flat	522 (46%)	399 (62%)	123 (26%)
Lower Sandflat	379 (34%)	22 (3%)	357 (74%)
Beach	206 (18%)	206 (32%)	0 (0%)
Mud flat	17 (2%)	17 (3%)	0 (0%)

Table 3. Total number of banded and unbanded Piping Plovers counted in southern Texas, December, 2002, for areas surveyed >1 time. Wind speed and wind direction correspond to conditions during the survey period where wind speed was estimated based on the Beaufort Scale.

Area	Survey 1			Survey 2			Survey 3		
	No. Banded	No. Unbanded	Wind Dir./ Speed (kph)	No. Banded	No. Unbanded	Wind Dir./ Speed (kph)	No. Banded	No. Unbanded	Wind Dir./ Speed (kph)
South Padre Island	3	41	N 39-49	13	95	SSE 20-28	22	212	SSE 1-5
North Pass	9	214	SSE 39-49	15	155	SSE 41-50	-	-	-
South Bay	0	0	N 39-49	0	0	0 wind	-	-	-

Figure 1. Study area for Piping Plover surveys adjacent to the Upper Laguna Madre (Corpus Christi) and Lower Laguna Madre (South Padre Island), Texas, December 2002.

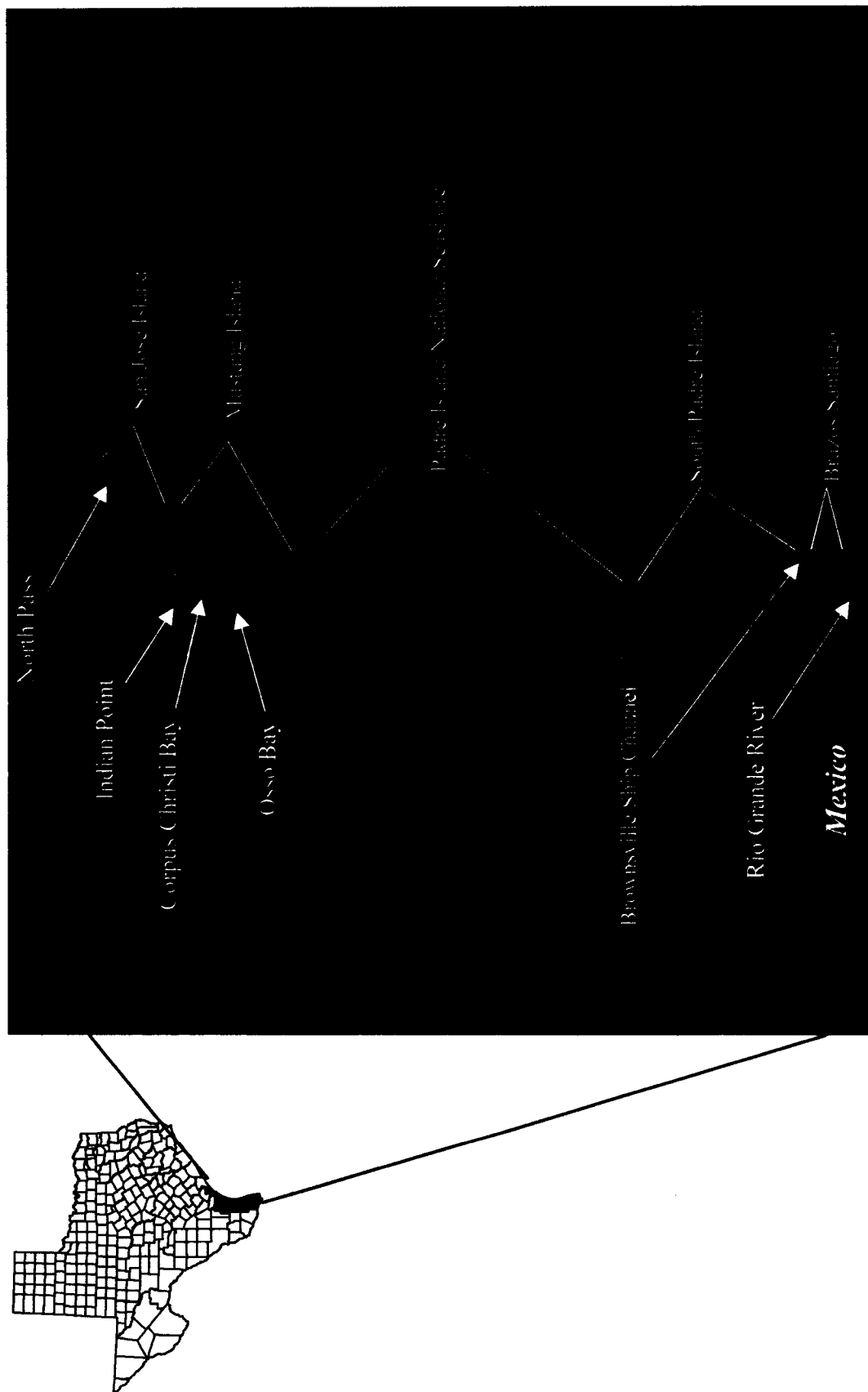
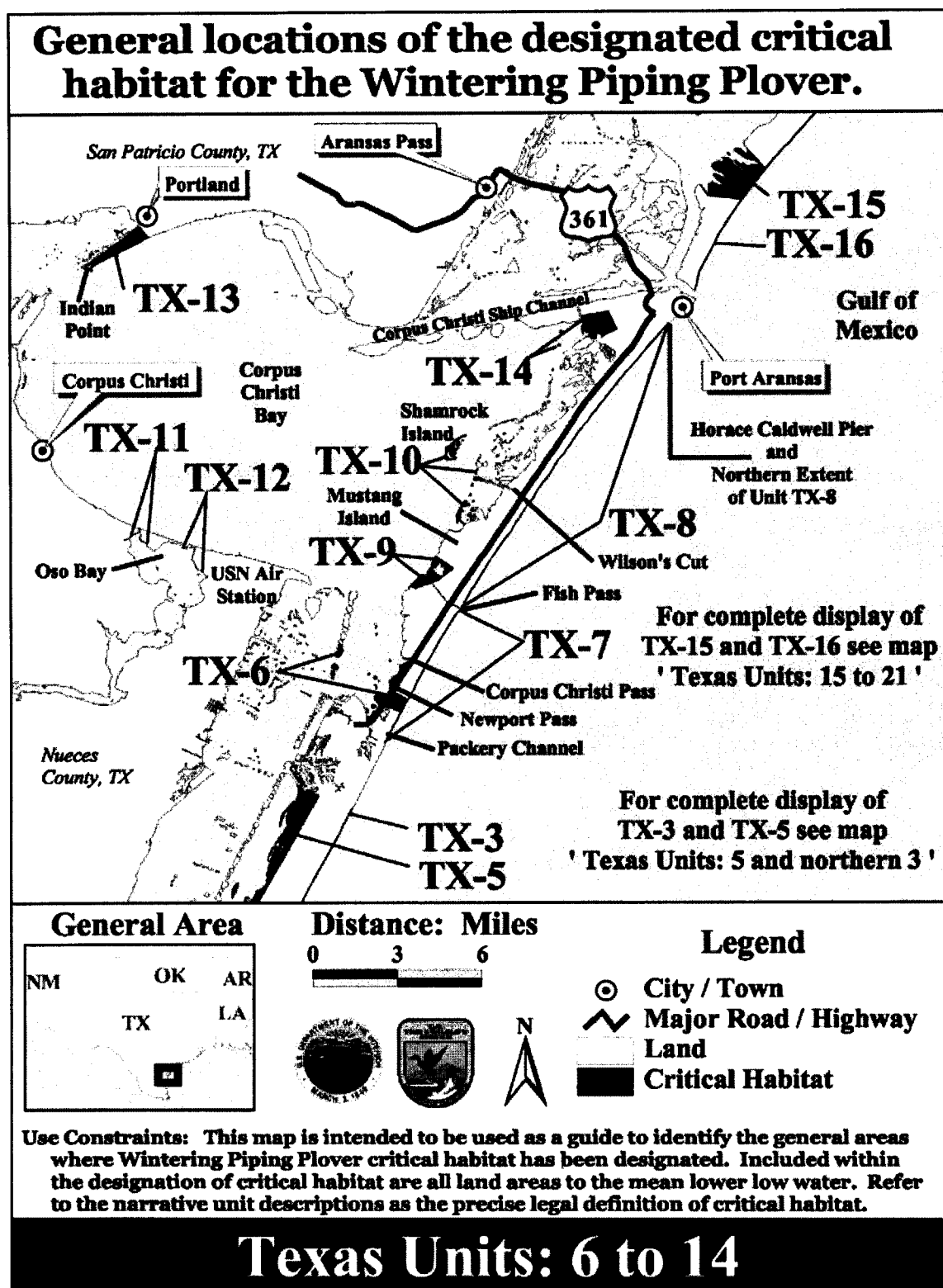


Figure 2. Designated critical habitat for the Upper Laguna Madre, Texas

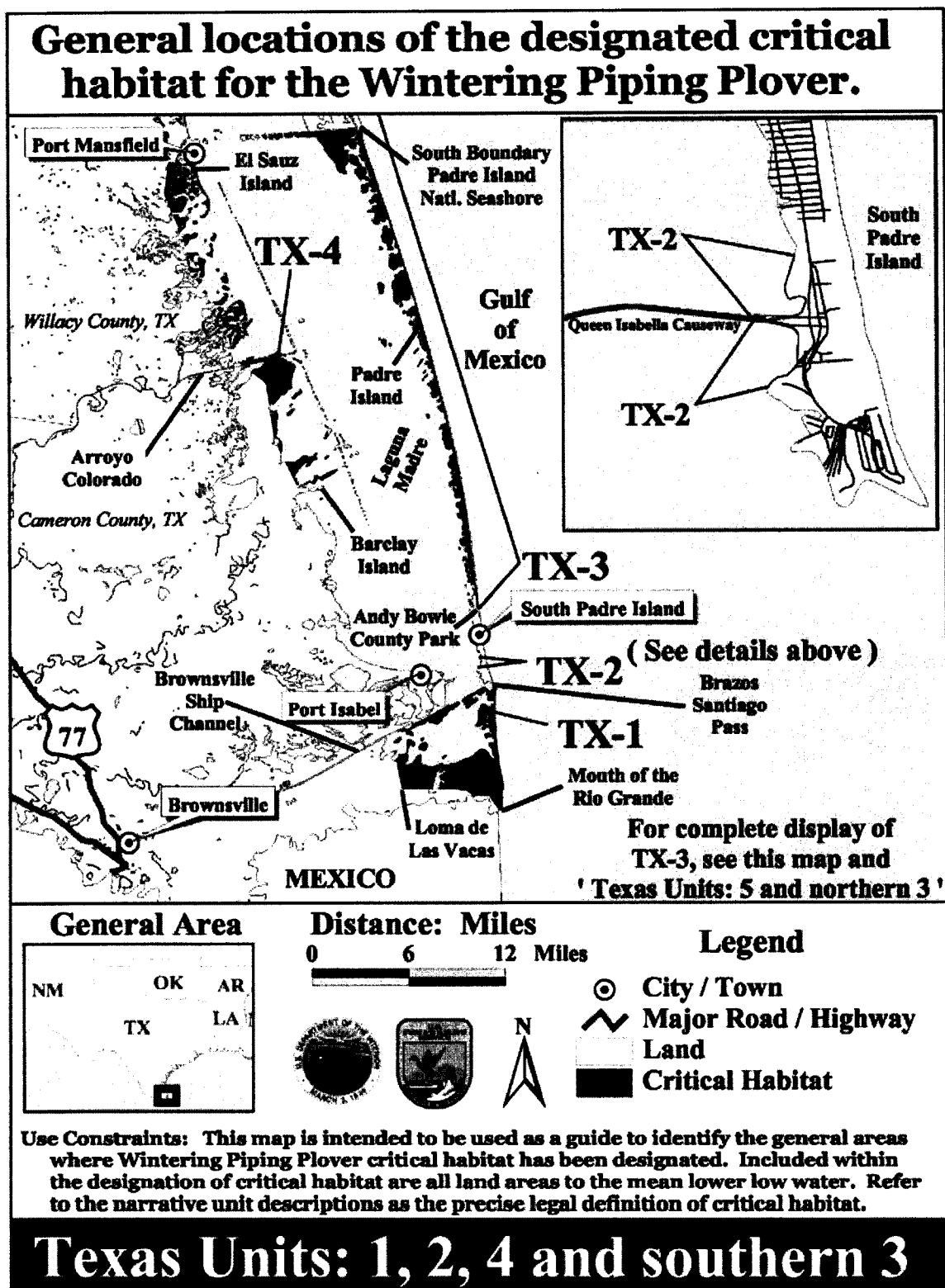
(http://plover.fws.gov/finalchmaps/Plover_TX_6_to_14.jpg).



Some locations have been slightly enlarged for display purposes only.

Figure 3. Designated critical habitat for the Lower Laguna Madre,

Texas(http://plover.fws.gov/finalchmaps/Plover_TX_1_2_4_and_southern_3.jpg).



Some locations have been slightly enlarged for display purposes only.

Appendix A. Band combinations and banding location for Piping Plovers resighted on habitats of Upper and Lower Laguna Madre, Texas, December 2002.

Band Combinations				UTM		Habitat ^a	Status ^b	Area ^c	Obs ^d	Age	Band Location ^e
Upper Left	Lower Left	Upper Right	Lower Right	Eastings	Northing						
Metal	Purple or Blue	White Flag	Mint	693657	3087163	AF	P	NP	CL,BH	Adult SK	
Metal	Mint, Navy	White Flag	Red	672182	3044006	B	P	MI	KRM	Adult SK, Big Quill Lake	
Metal	Navy, Mint	White Flag	Navy	679105	2906677	AF	NC	SPI	KRM	Adult SK, Big Quill Lake	
Metal	Navy, Red	White Flag	Red	679105	2906677	AF	NC	SPI	KRM	Adult SK, Big Quill Lake	
Metal	Orange, Navy	White Flag	Red	678969	2907290	AF	NC	SPI	KRM	Adult SK, Big Quill Lake	
Metal	Mint	White	Forest	680089	2902842	LSF	P	SPI	KRM	Adult SK, Missouri Coteau	
Metal	Forest, Forest	White Flag	Forest	681675	2896422	LSF	P	SPI	KRM	Adult SK, Missouri Coteau	
Metal	Forest	White Flag	Red, Red	669062	3036429	B	F	PINS	KRM	Adult SK, Missouri Coteau	
Metal	Forest, Forest	White Flag	Yellow	670111	3039113	B	F	PINS	KRM	Adult SK, Lake Diefenbaker	
White	Metal	White ^f	Orange, Orange	681311	2896678	LSF	P	SPI	KRM	Adult SK, Lake Diefenbaker	
-	Mint, Navy	White	Yellow, Metal	675583	3051613	B	P	MI	KRM	Adult SK, Lake Diefenbaker	
Metal	Forest, Forest	White Flag	Mint	678317	2908266	LSF	NC	SPI	KRM	Adult SK, Lake Diefenbaker	
Metal	Forest, Navy	White Flag	Orange	678317	2908266	LSF	NC	SPI	KRM	Adult SK, Lake Diefenbaker	
-	Yellow, Yellow	White Flag	Red, Metal	708637	3103114	B	P	SJI	KRM	Adult SK, Lake Diefenbaker	
Metal	Yellow, Yellow	White Flag	Mint	693807	3087831	AF	P	NP	KRM	Adult SK, Lake Diefenbaker	
Metal	Dark ?	White Flag	Yellow	693657	3087163	AF	P	NP	KRM	Adult SK, Lake Diefenbaker	
Metal	Navy, LtBlue or Green	White Flag	Mint	693657	3087163	AF	P	NP	CL,BH	Adult SK, Lake Diefenbaker	
Metal	Yellow, Orange	White Flag	Yellow	693657	3087163	AF	P	NP	KRM	Adult SK, Lake Diefenbaker	
-	Metal	Bi-B&W ^g	-	709840	3104393	B	P	SJI	KRM	Chick AB - missing bands	
-	Metal	Bi-B&W	-	672629	3045032	B	P	MI	KRM	Chick AB - missing bands	
Bi-B&W	-	-	Metal	680845	2899989	LSF	P	SPI	KRM	Chick AB - missing bands	
-	Metal	-	Bi-B&W	673964	3048015	B	P	MI	KRM	Chick AB - missing bands	
-	Metal	Bi-B&W	Yellow	680625	2900684	LSF	P	SPI	KRM	Chick AB, Reflex Lakes	
Bi-B&W	-	Metal	Yellow	678317	2908266	LSF	NC	SPI	KRM	Chick AB, Reflex Lakes	
Metal	White	Bi-B&W	-	693657	3087163	AF	P	NP	CL,BH	Chick AB?	
-	Metal	Light Blue Flag	-	669549	3037697	B	F	PINS	KRM	Chick Missouri River, U.S.A.	
-	Metal	Light Blue Flag	-	679105	2906677	AF	NC	SPI	KRM	Chick Missouri River, U.S.A.	
Metal	-	White Flag	-	682277	2892313	LSF	P	SPI	KRM	Chick SK	
-	Metal	-	-	670283	3045920	AF	F	PINS	KRM	Chick SK	
-	Metal	-	-	677759	2909454	LSF	NC	SPI	KRM	Chick SK	
White Flag	Metal	-	-	680211	2901906	LSF	P	SPI	KRM	Chick SK?	

Appendix A	Continued	Combinations					UTM		Habitat ^a	Status ^b	Area ^c	Obs. ^d	Age	Band Location
		Band		Upper Right		Lower Right	Eastings	Northing						
Upper Left		Lower Left		Upper Right		Lower Right	Eastings	Northing	Habitat ^a	Status ^b	Area ^c	Obs. ^d	Age	Band Location
White		Black, Black		-		Metal	664326	306836	AF	P	OB	KRM	Chick	SK Captive-release
White		Black, Black		-		Metal	677759	2909454	LSF	NC	SPI	KRM	Chick	SK Captive-release
Bi-B&W		White		Metal		-	693657	3087163	AF	P	NP	KRM	Chick	SK or AB
-		-		-		Metal	669259	3036933	B	F	PINS	KRM	Chick	SK or AB
-		-		-		Metal	672861	3045539	B	P	MI	KRM	Chick	SK or AB
Metal		Orange, Red		White Flag		Navy	693657	3087163	AF	P	NP	KRM	Chick	SK, Big Quill
White		Dark Forest		-		Metal	693807	3087831	AF	P	NP	KRM	Chick	SK, Lake Diefenbaker
White		Forest, Red		-		Metal	671188	3001708	B	P	MI	KRM	Chick	SK, Lake Diefenbaker
White		-		-		Metal	682277	2892313	LSF	P	SPI	KRM	Chick	SK, Lake Diefenbaker
White		Yellow, Forest		-		Metal	675284	3050849	B	P	MI	KRM	Chick	SK, Lake Diefenbaker
-		Light Blue, Metal		-		-	673314	3046556	B	P	MI	KRM	Chick	SK, Lake Diefenbaker
-		Light Blue		-		Metal	664041	3082983	LSF	P	IP	KRM, RC	Chick	SK, Lake Diefenbaker
White		-		Metal		Red, Forest	682034	2892879	LSF	P	SPI	KRM	Chick	SK, Lake Diefenbaker
Metal		-		-		Yellow	681774	2895129	LSF	P	SPI	KRM	Unknown	Unknown
?		Forest		Metal		Forest	681431	2896638	LSF	P	SPI	KRM	Unknown	Unknown
-		Yellow		-		-	682277	2892313	LSF	P	SPI	KRM	Unknown	Unknown
-		Black		-		White	681734	2894725	LSF	P	SPI	KRM	Unknown	Unknown
White		Metal		-		-	680419	2900864	LSF	P	SPI	KRM	Unknown	Unknown
Mint		-		Metal		-	667989	3033495	B	F	PINS	KRM	Unknown	Unknown
-		-		-		Forest	668821	3035761	B	F	PINS	KRM	Unknown	Unknown
-		-		White		Yellow, Metal	670684	3040510	B	P	MI	KRM	Unknown	Unknown
-		White		-		-	678865	3058757	B	P	MI	KRM	Unknown	Unknown
-		Yellow		-		-	670283	3045920	AF	F	PINS	KRM	Unknown	Unknown
-		Red		-		White	681828	2895231	LSF	P	SPI	KRM	Unknown	Unknown
-		Metal		White Flag		-	681860	2895958	LSF	P	SPI	KRM	Unknown	Unknown
Red		-		-		White	680719	2900181	LSF	P	SPI	KRM	Unknown	Unknown
-		White		-		White	679105	2906677	AF	NC	SPI	KRM	Unknown	Unknown
-		-		-		White	678969	2907290	AF	NC	SPI	KRM	Unknown	Unknown
-		Red		-		-	678393	2908139	LSF	NC	SPI	KRM	Unknown	Unknown
-		-		Mint, Metal		-	693807	3087831	AF	P	NP	KRM	Unknown	Unknown
-		Metal		-		Yellow	693807	3087831	AF	P	NP	KRM	Unknown	Unknown
-		White		Metal		-	693807	3087831	AF	P	NP	KRM	Unknown	Unknown
White Flag		-		-		Metal	693807	3087831	AF	P	NP	KRM	Unknown	Unknown

Appendix A Continued

BandCombinations				UTM							
Upper Left	Lower Left	Upper Right	Lower Right	Easting	Northing	Habitat ^a	Status ^b	Area ^c	Obs. ^d	Age	Band Location
-	-	Mint	Metal	693657	3087163	AF	P	NP	CL,BH	Unknown	Unknown
-	Mint	Metal	Mint	693657	3087163	AF	P	NP	CL,BH	Unknown	Unknown
-	Yellow	-	Metal	693657	3087163	AF	P	NP	KRM	Unknown	Unknown
Black	Metal	-	-	693657	3087163	AF	P	NP	CL,BH	Unknown	Unknown

Legend – Appendix A

^aHabitat type: AF = Algal Flat; B = beach; LSF = lower sandflat; MF = mud flat

^bStatus: F = Federally owned lands; NC = Nature Conservancy owned lands; P = Privately owned lands

^cArea: IP = Indian Point, Corpus Christi; MI = Mustang Island; NP = North Pass, San Jose Island; OB = Osso Bay, Corpus Christi; PINS = Padre Island National Seashore; SJI = San Jose Island; SPI = South Padre Island

^dObs. = Observer present. CL = Clare Lee (USFWS); BH = Beau Hardegree; KRM = Katherine R. Mehl. Other observers were present during many resightings.

^eBand Location: SK = Saskatchewan, AB = Alberta

^f - = no band present on this joint

^gBi-B&W = Bi-coloured black and white band

Appendix B. Location and flock size of Piping Plovers (PIPLs), Snowy Plovers (SNPLs), Semi-palmated

Plovers (SEPLs) observed on habitats of the Upper and Lower Laguna Madre, Texas, December 2002.

UTM Easting	UTM Northing	No.PIPLs	No. SNPLs	No. SEPLs	Habitat ^a	Area ^b	Habitat Status
671188	3001708	1	0	0	B	CC	Federal
661970	3009533	1	1	0	B	CC	Federal
667989	3033495	1	0	0	B	CC	Federal
668175	3034007	1	0	0	B	CC	Federal
668213	3034117	1	0	0	B	CC	Federal
668369	3034550	1	0	0	B	CC	Federal
668498	3034885	1	0	0	B	CC	Federal
668543	3034980	1	0	0	B	CC	Federal
668571	3035083	1	0	0	B	CC	Federal
668595	3035153	1	0	0	B	CC	Federal
668707	3035461	1	0	0	B	CC	Federal
668756	3035589	1	0	0	B	CC	Federal
668781	3035654	1	1	0	B	CC	Federal
668821	3035761	1	1	0	B	CC	Federal
668889	3035957	1	0	0	B	CC	Federal
668933	3036071	1	1	0	B	CC	Federal
669062	3036429	4	1	0	B	CC	Federal
669259	3036933	4	1	0	B	CC	Federal
669549	3037697	1	0	0	B	CC	Federal
669685	3038046	1	0	0	B	CC	Federal
669714	3038120	1	0	0	B	CC	Federal
669800	3038329	1	0	0	B	CC	Federal
669837	3038424	1	0	0	B	CC	Federal
669883	3038546	1	0	0	B	CC	Federal
669956	3038734	1	0	0	B	CC	Federal
670040	3038944	1	0	0	B	CC	Federal
370052	3038981	1	0	0	B	CC	Federal
670111	3039113	1	0	0	B	CC	Federal
670168	3039244	2	0	0	B	CC	Federal
670363	3039739	4	0	0	B	CC	Federal
670507	3040088	1	1	0	B	CC	Federal
-	-	0	7	0	B	CC	Federal
-	-	0	3	0	B	CC	Federal
-	-	0	2	0	B	CC	Federal
680891	2900221	4	32	0	AF	SPI	Nature Conservancy
679105	2906677	64	30	1	AF	SPI	Nature Conservancy
681048	2898995	6	15	0	LSF	SPI	Nature Conservancy
680999	2899026	4	2	0	LSF	SPI	Nature Conservancy
680884	2899332	1	0	0	LSF	SPI	Nature Conservancy
680912	2899536	2	1	0	LSF	SPI	Nature Conservancy
680892	2899706	1	0	0	LSF	SPI	Nature Conservancy
680844	2899803	1	1	0	LSF	SPI	Nature Conservancy
680845	2899989	5	2	0	LSF	SPI	Nature Conservancy
680762	2900093	1	0	0	LSF	SPI	Nature Conservancy
680719	2900181	2	0	0	LSF	SPI	Nature Conservancy
680747	2900253	1	0	0	LSF	SPI	Nature Conservancy
680645	2900317	3	1	0	LSF	SPI	Nature Conservancy
680755	2900408	1	0	0	LSF	SPI	Nature Conservancy
680624	2900449	1	3	0	LSF	SPI	Nature Conservancy
680660	2900553	1	1	0	LSF	SPI	Nature Conservancy

Appendix B -
Continued

UTM Easting	UTM Northing	No. PIPLs	No. SNPLs	No. SEPLs	Habitat ^a	Area ^b	Habitat Status
680625	2900684	2	0	0	LSF	SPI	Nature Conservancy
680419	2900864	2	1	0	LSF	SPI	Nature Conservancy
680655	2900919	2	3	0	LSF	SPI	Nature Conservancy
680547	2901017	3	0	0	LSF	SPI	Nature Conservancy
680491	2901179	2	0	0	LSF	SPI	Nature Conservancy
680464	2901697	1	0	0	LSF	SPI	Nature Conservancy
680323	2901736	1	0	0	LSF	SPI	Nature Conservancy
680211	2901906	10	2	0	LSF	SPI	Nature Conservancy
680049	2902296	3	0	0	LSF	SPI	Nature Conservancy
680236	2902649	2	1	0	LSF	SPI	Nature Conservancy
680089	2902842	4	0	0	LSF	SPI	Nature Conservancy
680139	2902889	1	0	0	LSF	SPI	Nature Conservancy
680132	2903039	6	0	0	LSF	SPI	Nature Conservancy
680177	2903262	4	0	0	LSF	SPI	Nature Conservancy
680092	2903329	2	2	0	LSF	SPI	Nature Conservancy
680141	2903516	3	0	0	LSF	SPI	Nature Conservancy
680160	2903736	1	0	0	LSF	SPI	Nature Conservancy
680208	2903773	1	0	0	LSF	SPI	Nature Conservancy
680137	2903840	1	0	0	LSF	SPI	Nature Conservancy
680131	2903938	1	0	0	LSF	SPI	Nature Conservancy
680110	2904237	1	12	0	LSF	SPI	Nature Conservancy
680080	2904427	1	0	0	LSF	SPI	Nature Conservancy
679961	2904743	1	0	0	LSF	SPI	Nature Conservancy
679809	2904751	6	1	0	LSF	SPI	Nature Conservancy
679527	2905343	1	0	0	LSF	SPI	Nature Conservancy
679543	2905433	3	0	0	LSF	SPI	Nature Conservancy
679427	2905673	6	0	0	LSF	SPI	Nature Conservancy
679169	2906303	1	0	0	LSF	SPI	Nature Conservancy
678393	2908139	1	2	0	LSF	SPI	Nature Conservancy
678317	2908266	32	2	5	LSF	SPI	Nature Conservancy
678281	2908412	1	0	0	LSF	SPI	Nature Conservancy
677759	2909454	19	0	14	LSF	SPI	Nature Conservancy
676829	2913884	0	57	0	LSF	SPI	Nature Conservancy
676829	2913884	0	57	0	LSF	SPI	Nature Conservancy
-	-	0	12	0	LSF	SPI	Nature Conservancy
-	-	0	5	0	LSF	SPI	Nature Conservancy
-	-	0	20	0	LSF	SPI	Nature Conservancy
670283	3045920	6	0	0	AF	CC	Private
664543	3066668	0	0	12	AF	CC	Private
664235	3066702	1	0	28	AF	CC	Private
664326	3066836	13	1	15	AF	CC	Private
693657	3087163	16	23	5	AF	CC	Private
693668	3087165	217	9	39	AF	CC	Private
693772	3087723	146	38	80	AF	CC	Private
682327	2892454	54	0	19	AF	SPI	Private
681927	2895457	1	5	0	AF	SPI	Private
678253	3063989	0	2	0	LSF	CC	Private
678514	3064097	1	2	0	LSF	CC	Private
662230	3081728	5	0	0	LSF	CC	Private

Appendix B -
Continued

UTM Easting	UTM Northing	No. PIPLs	No. SNPLs	No. SEPLs	Habitat ^a	Area ^b	Habitat Status
662344	3081833	4	0	5	LSF	CC	Private
662379	3081866	1	2	9	LSF	CC	Private
663192	3082408	0	0	38	LSF	CC	Private
693547	3088117	93	5	36	LSF	CC	Private
664041	3082983	5	48	29	LSF	CC	Private
693095	3087356	6	0	0	LSF	CC	Private
682277	2892313	36	0	21	LSF	SPI	Private
682273	2892496	20	0	0	LSF	SPI	Private
682149	2892822	2	0	0	LSF	SPI	Private
682034	2892879	6	0	0	LSF	SPI	Private
681969	2892963	6	0	13	LSF	SPI	Private
681910	2894532	4	0	0	LSF	SPI	Private
681787	2894650	1	0	0	LSF	SPI	Private
681783	2894663	2	0	0	LSF	SPI	Private
681734	2894725	2	0	0	LSF	SPI	Private
681712	2894785	4	6	0	LSF	SPI	Private
681723	2895035	1	0	0	LSF	SPI	Private
681760	2895108	1	0	0	LSF	SPI	Private
681774	2895129	5	3	0	LSF	SPI	Private
681796	2895222	4	0	0	LSF	SPI	Private
681828	2895231	21	10	0	LSF	SPI	Private
681818	2895336	5	0	0	LSF	SPI	Private
681861	2895484	1	1	0	LSF	SPI	Private
681805	2895849	2	0	0	LSF	SPI	Private
681879	2895862	1	0	0	LSF	SPI	Private
679341	2895887	1	0	0	LSF	SPI	Private
681808	2895951	1	0	0	LSF	SPI	Private
681860	2895958	3	0	0	LSF	SPI	Private
681808	2896013	3	0	0	LSF	SPI	Private
681770	2896133	1	0	0	LSF	SPI	Private
681718	2896187	4	0	0	LSF	SPI	Private
681689	2896317	2	1	0	LSF	SPI	Private
681709	2896386	1	4	0	LSF	SPI	Private
681675	2896422	6	3	0	LSF	SPI	Private
681475	2896578	4	14	0	LSF	SPI	Private
681513	2896601	5	0	0	LSF	SPI	Private
681431	2896638	2	5	0	LSF	SPI	Private
681376	2896669	5	0	0	LSF	SPI	Private
681311	2896678	5	0	0	LSF	SPI	Private
681300	2896999	2	1	0	LSF	SPI	Private
681268	2897257	3	0	0	LSF	SPI	Private
681329	2897312	2	0	0	LSF	SPI	Private
671279	2897426	2	0	0	LSF	SPI	Private
681252	2897675	6	1	0	LSF	SPI	Private
681170	2897814	5	14	0	LSF	SPI	Private
681073	2898273	8	1	0	LSF	SPI	Private
681049	2898279	4	12	0	LSF	SPI	Private
681001	2898726	1	0	0	LSF	SPI	Private
681009	2898826	2	3	0	LSF	SPI	Private

Appendix B -
Continued

UTM Easting	UTM Northing	No. PIPLs	No. SNPLs	No. SEPLs	Habitat ^a	Area ^b	Habitat Status
667023	3065870	5	1	0	MF	CC	Private
664843	3066158	2	0	6	MF	CC	Private
667400	3066229	2	0	3	MF	CC	Private
693232	3087283	8	0	4	MF	CC	Private
-	-	0	3	0	LSF	SPI	Private
-	-	0	3	0	LSF	SPI	Private
-	-	0	6	0	B	CC	Private
-	-	0	2	0	B	CC	Private
-	-	0	4	0	B	CC	Private
-	-	0	4	0	B	CC	Private
-	-	0	97		LSF	CC	Private
-	-	0	22	0	B	CC	Private
-	-	0	5	0	B	CC	Private
-	-	0	7	0	B	CC	Private
-	-	0	1	0	B	CC	Private
-	-	0	10	0	B	CC	Private
-	-	0	5	0	B	CC	Private
-	-	0	9	0	B	CC	Private
-	-	0	5	0	B	CC	Private
-	-	0	3	0	B	CC	Private
670684	3040510	1	0	0	B	CC	Texas State
670769	3040712	1	0	0	B	CC	Texas State
670855	3040914	1	0	0	B	CC	Texas State
670914	3041056	1	0	0	B	CC	Texas State
670969	3041180	1	1	0	B	CC	Texas State
671051	3041384	2	0	0	B	CC	Texas State
671131	3041574	1	0	0	B	CC	Texas State
671302	3041962	1	0	0	B	CC	Texas State
671425	3042254	1	0	0	B	CC	Texas State
671518	3042474	1	0	0	B	CC	Texas State
671554	3042555	1	0	0	B	CC	Texas State
671705	3042912	1	0	0	B	CC	Texas State
671779	3043083	3	1	0	B	CC	Texas State
671848	3043244	1	0	0	B	CC	Texas State
671961	3043507	2	0	0	B	CC	Texas State
672012	3043614	1	1	0	B	CC	Texas State
672070	3043752	2	0	0	B	CC	Texas State
672152	3043939	1	0	0	B	CC	Texas State
672182	3044006	1	0	0	B	CC	Texas State
672280	3044235	2	0	0	B	CC	Texas State
672366	3044432	2	0	0	B	CC	Texas State
672424	3044560	1	1	0	B	CC	Texas State
672509	3044750	1	1	0	B	CC	Texas State
672525	3044791	1	2	0	B	CC	Texas State
672629	3045032	1	0	0	B	CC	Texas State
672815	3045436	1	0	0	B	CC	Texas State
672861	3045539	1	0	0	B	CC	Texas State
672938	3045708	1	0	0	B	CC	Texas State
672983	3045809	1	0	0	B	CC	Texas State

Appendix B -
Continued

UTM Easting	UTM Northing	No.PIPLs	No. SNPLs	No. SEPLs	Habitat ^a	Area ^b	Habitat Status
673127	3046132	1	0	0	B	CC	Texas State
673220	3046343	1	1	0	B	CC	Texas State
673314	3046556	1	1	0	B	CC	Texas State
673364	3046671	2	0	0	B	CC	Texas State
673380	3046713	1	2	0	B	CC	Texas State
673565	3047119	1	1	0	B	CC	Texas State
673612	3047224	1	0	0	B	CC	Texas State
673741	3047520	2	0	0	B	CC	Texas State
673801	3047649	1	0	0	B	CC	Texas State
673852	3047762	1	0	0	B	CC	Texas State
673901	3047874	1	1	0	B	CC	Texas State
673938	3047957	1	0	0	B	CC	Texas State
673964	3048015	1	0	0	B	CC	Texas State
674052	3048223	2	1	0	B	CC	Texas State
674097	3048322	1	4	0	B	CC	Texas State
674155	3048453	1	4	0	B	CC	Texas State
674205	3048562	1	1	0	B	CC	Texas State
674219	3048592	1	2	0	B	CC	Texas State
674270	3048711	1	1	0	B	CC	Texas State
674400	3048992	2	1	0	B	CC	Texas State
674476	3049162	1	0	0	B	CC	Texas State
674517	3049256	2	0	0	B	CC	Texas State
674660	3049579	1	0	0	B	CC	Texas State
674741	3049752	1	0	0	B	CC	Texas State
674836	3049974	1	0	0	B	CC	Texas State
674916	3050141	1	0	0	B	CC	Texas State
674944	3050207	1	0	0	B	CC	Texas State
675095	3050534	1	0	0	B	CC	Texas State
675126	3050602	1	0	0	B	CC	Texas State
675165	3050692	1	0	0	B	CC	Texas State
675284	3050849	2	0	0	B	CC	Texas State
675583	3051613	1	0	0	B	CC	Texas State
675749	3051939	1	0	0	B	CC	Texas State
675771	3051996	1	0	0	B	CC	Texas State
675841	3052187	1	0	0	B	CC	Texas State
675868	3052257	1	0	0	B	CC	Texas State
675889	3052319	1	0	0	B	CC	Texas State
675938	3052427	1	0	0	B	CC	Texas State
676035	3052669	1	0	0	B	CC	Texas State
676051	3052707	1	0	0	B	CC	Texas State
676191	3053039	1	0	0	B	CC	Texas State
676231	3053131	1	0	0	B	CC	Texas State
676282	3053242	1	0	0	B	CC	Texas State
676330	3053352	2	0	0	B	CC	Texas State
676366	3053430	1	0	0	B	CC	Texas State
677046	3054882	1	0	0	B	CC	Texas State
677584	3056070	1	0	0	B	CC	Texas State
677779	3056527	2	0	0	B	CC	Texas State
677936	3056848	1	0	0	B	CC	Texas State

Appendix B -
Continued

UTM Easting	UTM Northing	No. PIPLs	No. SNPLs	No. SEPLs	Habitat ^a	Area ^b	Habitat Status
678178	3057400	1	2	0	B	CC	Texas State
678229	3057466	1	0	0	B	CC	Texas State
678443	3057899	1	0	0	B	CC	Texas State
678488	3057994	1	0	0	B	CC	Texas State
678519	3058059	1	0	0	B	CC	Texas State
678683	3058326	1	0	0	B	CC	Texas State
678776	3058577	1	0	0	B	CC	Texas State
678865	3058757	3	2	0	B	CC	Texas State
678955	3058947	1	0	0	B	CC	Texas State
699915	3092991	1	0	0	B	CC	Texas State
703971	3097959	1	0	0	B	CC	Texas State
704348	3098378	1	0	0	B	CC	Texas State
704439	3098485	1	4	0	B	CC	Texas State
705014	3099129	1	1	0	B	CC	Texas State
705107	3099236	1	5	0	B	CC	Texas State
705329	3099483	1	0	0	B	CC	Texas State
705644	3099840	2	2	0	B	CC	Texas State
705712	3099914	1	0	0	B	CC	Texas State
705766	3099975	1	0	0	B	CC	Texas State
705932	3100157	1	1	0	B	CC	Texas State
705952	3100181	2	3	0	B	CC	Texas State
706011	3100242	1	1	0	B	CC	Texas State
706119	3100363	1	3	0	B	CC	Texas State
706680	3100983	1	0	0	B	CC	Texas State
706768	3101075	1	1	0	B	CC	Texas State
706820	3101135	1	3	0	B	CC	Texas State
707066	3101397	1	0	0	B	CC	Texas State
707090	3101425	0	3	0	B	CC	Texas State
707451	3101524	2	0	0	B	CC	Texas State
707207	3101553	1	1	0	B	CC	Texas State
707251	3101607	1	2	0	B	CC	Texas State
707539	3101973	1	1	0	B	CC	Texas State
707625	3102017	2	1	0	B	CC	Texas State
707725	3102134	1	0	0	B	CC	Texas State
707866	3102280	1	1	0	B	CC	Texas State
707959	3102384	1	1	0	B	CC	Texas State
708047	3102483	1	2	0	B	CC	Texas State
708173	3102618	1	0	0	B	CC	Texas State
708380	3102841	1	1	0	B	CC	Texas State
708552	3103029	1	0	0	B	CC	Texas State
708638	3103114	2	0	0	B	CC	Texas State
708724	3103213	1	0	0	B	CC	Texas State
708778	3103273	1	1	0	B	CC	Texas State
708947	3103453	1	0	0	B	CC	Texas State
709119	3103634	1	0	0	B	CC	Texas State
709242	3103764	2	0	0	B	CC	Texas State
709313	3103838	2	0	0	B	CC	Texas State
709419	3103952	1	0	0	B	CC	Texas State
709443	3103978	1	0	0	B	CC	Texas State

Appendix B -
Continued

UTM Easting	UTM Northing	No. PIPLs	No. SNPLs	No. SEPLs	Habitat ^a	Area ^b	Habitat Status
709546	3104085	1	0	0	B	CC	Texas State
709607	3104152	1	0	0	B	CC	Texas State
709689	3104238	1	0	0	B	CC	Texas State
709840	3104393	1	0	0	B	CC	Texas State
709992	3104548	1	3	0	B	CC	Texas State
710083	3104641	1	0	0	B	CC	Texas State
710154	3104717	1	0	0	B	CC	Texas State
710239	3104806	1	0	0	B	CC	Texas State
710314	3104879	1	0	0	B	CC	Texas State
710354	3104922	1	0	0	B	CC	Texas State
710438	3105008	1	0	0	B	CC	Texas State
710485	3105058	1	0	0	B	CC	Texas State
710571	3105149	2	0	0	B	CC	Texas State
710643	3105223	1	0	0	B	CC	Texas State

^aHabitat: AF = Algal Flat, B = Beach, LSF = Lower Sandflat; MF = Mud Flat

^bArea: CC = Corpus Christi (Upper Laguna Madre), SPI = South Padre Island (Lower Laguna Madre)

Appendix C. Band combinations for Snowy Plovers resighted on habitats of Upper and Lower Laguna Madre, Texas, December 2002. Banding locations are unknown.

Band Combination				UTM		Habitat ^a	Habitat Status	Area ^b	Obs.
Upper Left	Lower Left	Upper Right	Lower Right	Easting	Northing				
White	White	Metal	*	681048	2898995	LSF	Nature Conservancy	SPI	KRD
Metal	White	*	*	680891	2900221	LSF	Nature Conservancy	SPI	KRD
*	*	*	Metal	693807	3087831	AF	Private	NP	KRD

^aHabitat: AF = Algal Flat, B = Beach, LSF = Lower Sandflat; MF = Mud Flat

^bArea: CC = Corpus Christi (Upper Laguna Madre), SPI = South Padre Island (Lower Laguna Madre)