Band Wear in Spotted Towhees and Other Passerines

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ABSTRACT

The issue of band wear and band loss has been a concern of bird banders for many years, but has primarily been a concern to larger, longer lived marine birds. There are few reports of and less concern for band wear in smaller, terrestrial, primarily passerine birds. Forty-four worn bands from ten passerine species, California {formerly Western} *Scrub-Jay* [Aphelocoma californica]*, Bewick's Wren* [Thryomanes bewickii]*, Wrentit* [Chamaea fasciata], *California Thrasher* [Toxostoma redivivum]*, California Towhee* [Melozone ={Pipilo} crissalis]*, Spotted Towhee* [Pipilo maculatus]*, Fox Sparrow* [Passerella iliaca], *Song Sparrow* [Melospiza meloidia]*, Gambel's White-crowned Sparrow* [Zonotrichia leucophrys gambelii], *and Purple Finch* [Haemorhous purpureus], *are reported here, coming from six of the smaller band sizes (1, 1B, 1A, 1D, 2, and 3). The percent weight loss per year are comparable to larger, marine birds. Although the actual age at which bands would be lost is not available, the age of the band at which the bander felt that the band was worn sufficiently enough to need replacing averaged about three to four years. This was often less than half of the longevity records for most passerines. Thus, we should concern ourselves with life history studies relying on bird banding records.*

INTRODUCTION

One of the many uses of bird banding data revolves around life history. We can get longevity data, site fidelity information, population dynamics, and life tables. Yet we can not accurately get this information if band become unreadable or lost associated with band wear (Paynter 1966). Band wear on the outside can lead to an inability to read the band number, while wear on either side can make the contact information unreadable, depending upon the band. Band wear can weaken the band to a point where the bird can remove the band, or the band can fall off by itself or when it becomes tangled in vegetation. The loss of bands due to wear can bias survival studies (Anderson 1980, Nelson et al. 1980, Breton et al. 2005). Bailey et al. (1987) noted that Sooty Terns [*Onychoprion fuscatus*] outlive their bands. The loss of bands can affect long term studies for long, lived birds (Kadlec and Drury 1968, Coulson 1976, Harris 1980, Breton et al. 2005). Harris (1980) noted that this band wear would not be an issue for shorter lived birds.

Reports of band wear/loss in higher taxa are fewer and generally involve larger species. Campbell (1946) reported band wear in a Northern Harrier [*Circus cyaneus*]. Among passerines, Bedrosian and Craighead (2007) reported band wear in Common Ravens [*Corvus corax*] and Rowley (1966) reported band wear in Australian Ravens [*Corvus coronoides*]. Bergstrom (1964) reported band wear in Blue Jays [*Cyanocitta cristata*] and Common Grackles [*Quiscalus quiscula*]. Blake (1951) reported band wear in Eastern Towhee [*Pipilo erythrophthalmus*]. The oldest report I found was Law and Law (1929) who reported band wear in Spotted Towhees [*Pipilo maculatus*] and a California Towhee [*Melozone* ={*Pipilo*} *crissalis*]. Among near-passerines, Collins (1971, 1973) reported band wear in White-throated Swifts [*Aeronatues saxatalis*]. This list is probably longer, as I did not look extensively in European journals. Here I report band wear in a suite of smaller passerine birds.

METHODS

The majority of worn bands came from the Zuma Canyon banding station, located (34°01'54" N, 118°48'44" W) in the Santa Monica Mountains National Recreation Area, approximately 12 km west of Malibu, Los Angeles County, CA. The habitat is coastal sage scrub with hard chaparral adjacent to a riparian woodland. Most of the net lanes are located in the bottom of the broad canyon. The riparian area is dry in most years with surface water flowing only after heavy rains. Worn 1D SS bands were provided by S. Craig, banding in CO. One band was provided by H. Garrod, working at Audubon's Starr Ranch in Orange County, CA (33° 36' 34.30" N, 117° 33' 49.09" W), which has a habitat similar to Zuma Canyon. Two bands were provided by N. Gobris, banding at Chadron State Park in NE (42° 42' 33" N, 103° 01' 24" W).

The removal of worn bands and the use of a replacement band were done at the discretion of the bander in charge. This was a somewhat arbitrary decision, but several factors were taken into consideration. Was the band becoming thin and sharp enough potentially to injure or was injuring the bird's leg? Were the band numbers becoming unreadable? Had the band become so thin that it could be pried open readily with one's fingers? Thus, the lengths of time the bands were on the birds described below are essentially a function of when the birds were recaptured.

The worn bands and sets of 10 consecutive unused (new) bands from available strings of 1, 1B, 1A, 1D, 2, and 3 bands were weighed for comparison to the nearest 0.0001 g, using an electronic balance. All weight measurements were converted to mg for ease of calculations. The length of time the worn bands was on the birds were determined to the month, following Lutmerding and Love (2016). Unused bands from the original strings the worn bands came from, or at least the same prefix, were not available except in one case (band size 3), so the average weight of available respective size bands was used. The percent weight loss and average weight loss per year was determined following the protocol by other bird banders (Bailey et al. 1987).

RESULTS

Table 1 presents a list of bird species, band sizes, band type, and percent weight loss/year taken from the literature. The greater majority of species are long-lived, colonial sea bird. The oldest report dates back almost 70 years (Blake 1951). In general, the Monel and Incoloy bands has a much lower percent weight loss/year than aluminum bands.

The weights of 10 consecutive bands from various strings of bands for the six band sizes with worn bands are presented in Table 2 with means and standard deviations (sd) Weights of the individual bands within a string were fairly consistent shown by the low standard deviation Between string variation was calculated using analysis of variance (ANOVA) except for band size 3 where a t-test was used. There was no statistical difference between different strings of bands of a particular size, even though there were often large differences in weight between some strings (29.4 percent difference between 2201 and 2471 for band size 1B; 28.4 percent difference between the 1951 and 2421 series 1A bands) (see Table 2).

I accumulated 44 worn bands from nine passerine species, California {formerly Western} Scrub-Jay [*Aphelocoma californica*], Bewick's Wren [*Thryomanes bewickii*], Wrentit [*Chamaea fasciata*], California Thrasher [*Toxostoma redivivum*], California Towhee, Spotted Towhee, Fox Sparrow [*Passerella iliaca*], Song Sparrow [*Melospiza meloidia*], Gambel's White-crowned Sparrow [*Zonotrichia leucophrys gambelii*], and Purple Finch [*Haemorhous purpureus*]. Worn bands were found in band sizes 1, 1B, 1A, 1D, 2, and 3, although most came from sizes 1A and 2 (n=13 and 15 respectively).

The weights of the 44 worn bands are presented in Tables 3 and 4. Spotted Towhees with band sizes 1A and 2 are presented in Table 3, while the rest of the birds and bands are presented in Table 4. Birds for the respective worn bands are identified by alpha codes [California Scrub-Jay = WESJ, Bewick's Wren = BEWR, Wrentit = WREN, California Thrasher = CATH, California Towhee = CALT, Fox Sparrow = FOSP, Song Sparrow = SOSP, Gambel's White-crowned Sparrow = GWCS, and Purple Finch = PUFI]. The weight loss/year and the percent weight loss/year are presented in the right two columns for each band. Note that in most cases, the worn bands were replaced within 4-5 years. In one case, a Spotted Towhee (Table 3 with #) had its band replaced in 2yr01mo having lost 40.6%, 3x of its initial weight with the second band replaced 2yr 09mo later, having lost 40.2%, 3x of its initial weight. Another Spotted Towhee's band was so worn that only three numbers could be read (x212-9xxxx) and the band lost 87.40% of its original weight (Table 3). Since the age of this band could not be determined, it was not used in the analysis. Assuming this band was one of my bands, the oldest this particular band could be is 6yr01mo. The two harder steel 1D bands had an average of 5.85 percent weight loss/year (Table 4), about half the average percent weight loss/year comparable size aluminum 1A and 2 bands (Tables 3-4), but had higher weight loss/year than the 1A or 2 bands. The discrepancy may be due to the fact that the 1D bands had a higher initial weight.

BAND WEAR

The wear on the 44 bands was on the inner surface and was uneven, with greater wear on the lower parts of the band similar to what was described by Collins (2007) and Collins et al. (2010). If the band is right side up when the bird is standing, the bottom edge of the band became worn and sharp (Collins 2007, Rowley 1966, Bedrosian and Craighead 2007). Collins et al. (2007), however, reports wear on both top and bottom edges of bands on Black Skimmers *(Rynchops niger*). The worn lower edges of the bands were sharp, and often the scutes were worn away on the tarsus. However, no bleeding was observed (Sakai pers. obs.)

The band numbers were legible on the worn bands unless the wear on the lower parts of the band was extensive enough to wear through the band (see example in Collins 2007). All bands were legible, except for the one exception mentioned above (Table 3). The outer surface of the band had minimal wear, as the numbers were legible.

Most of the wear occurred on the inside of the band, as it rubbed against the leg of the bird with debris (sand and soil) between bird's leg and band (Bedrosian and Craighead 2007). Craig (pers. comm.) indicated that wear was extensive enough to remove the lettering on the inside of the band. The abrasion made the band thin enough to be pried open if the band became hooked on a twig or debris (Bailey et al. 1987). The bands did not seem to become thin enough slip over the bird's toes as suggested by Bailey et al. (1987).

Table 5 presents the longevity records of the species discussed here as posted by the Bird Banding Laboratory (Lutmerding and Love 2016). Note that the longevity records for all birds is typically more than twice the age of the replaced, worn bands (see Tables 3-4).

DISCUSSION

Band wear and the potential loss of bird bands have been reported for many years for a wide variety of predominately, larger, colonial, aquatic birds (Table 1). The earliest report of band wear I could find was Law and Law (1929). The phenomenon is not restricted to the U.S., as Harris (1980) conducted an extensive survey of band wear for European birds, Rowley (1966) reported band wear in Australia, and Mills (1972) reported band wear in New Zealand.

The within string variability in band weight being less than the between band string variability was similarly reported by Anderson (1980). Although it was not statistically different, this between string variation may be due to different band making processes and/or alloys used to produce the bands; however, the explanation is beyond the scope of this paper and the metallurgical capabilities of the author. The rate of band wear as measured by the mean annual percentage of weight loss (Tables 3-4) is similar to other published findings (Table 1), in both a wide range of band sizes from size 2 to size 7B and a wide range of species. One anomaly was the order of magnitude lower percent wt loss/yr for the California Scrub-Jay with a band size 2 (Table 4). One possible explanation for this could be that the original weight of bands on this string was much higher than the average value used here. This illustrates the pitfall of looking at percent of weight loss based on the method presentedd here.

STAINLESS STEEL BANDS

One would have expected the harder 1D bands to have less wear than the similar size aluminum bands. New 1D bands weighed about 25 percent more than the 2 bands (Tables 3-4), and the band age at which time the bander in charge determined that the band should be replaced was not appreciably

Table 1. Percent weight loss/year for various birds along with band size and band type from the literature.

Bird		Band size	Type	% loss/year	Source
Northern Fulmor	*Fulmarus glacialis*	6	Al	5.01%	Anderson 1980
Northern Fulmor	*Fulmarus glacialis*	6	Monel	0.65%	Anderson 1980
Sooty Tern	*Onychoprion fuscatus*	3	Al	0.57%	Bailey et al 1987
Eastern Towhee	*Pipilo erythrophthalmus*	2	Al	9.27%	Blake 1951
White-throated Swift	*Aeronatues saxatalis*	2	Al	5-6%	Collins 1973
Elegant Tern	*Thalasseus elegans*	3	Al	4.95%	Collins 2007
Herring Gull	*Larus argentensus*	6	Monel	3.60%	Coulson 1976
Lesser Black-backed Gul	*Larus fuscus*	6	Monel	2.20%	Coulson 1976
Black-legged Kittiwake	*Rissa tridactyla*	3	Al	9.30%	Coulson & White 1955
Laughing Gull	*Larus atricilla*	4A	Al	F 7.6%	Dolberr & Belant 1994
Laughing Gull	*Larus atricilla*	4A	Al	M 6.8%	Dolberr & Belant 1994
Common Goldeneye	*Bucephala clangula*	6	Al	8.40%	DuWors et al 1987
White-winged Scoter	*Melanitta fusca*	7A	Al	3.73%	DuWors et al 1987
Manx Shearwater	*Puffinus puffinus*	4A, 4	Al	10.50%	Harris 1964
Common Tern	*Sterna hirundo*	2	Al	4.08%	Hatch & Nisbet 1983a
Common Tern	*Sterna hirundo*	3	Al	6.62%	Hatch & Nisbet 1983a
Common Tern	*Sterna hirundo*	2, 3	Incoloy	0.58%	Hatch & Nisbet 1983a
Roseate Tern	*Sterna dougalli*	2	Al	6.27%	Nisbet & Hatch 1983
Arctic Tern	*Sterna paradisaea*	3	Al	0.91%	Hatch & Nisbet 1983b
Arctic Tern	*Sterna paradisaea*	2	Al	0.90%	Hatch & Nisbet 1983b
Eared Grebe	*Podiceps nigricollis*	5,5A	Al	9.50%	Jehl 1990
Herring Gull	*Larus argentensus*	6	Al	7.50%	Ludwig 1967
Herring Gull	*Larus argentensus*	6	Monel	1.62%	Ludwig 1967
Common Tern	*Sterna hirundo*	3	Al	5.45%	Ludwig 1967
Caspian Tern	*Hydroprogne caspia*	5	Long Al	1.63%	Ludwig 1967
Caspian Tern	*Hydroprogne caspia*	5	Short Al	3.13%	Ludwig 1967
Caspian Tern	*Hydroprogne caspia*	5	Monel	9.61%	Ludwig 1967
Ring-billed Gull	*Larus delawarensis*	5	Long Al	9.55%	Ludwig 1967
Ring-billed Gull	*Larus delawarensis*	4	Long Al	7.86%	Ludwig 1967
Ring-billed Gull	*Larus delawarensis*	6	Long Al	10.57%	Ludwig 1967
Ring-billed Gull	*Larus delawarensis*	5	Short Al	7.59%	Ludwig 1967
Ring-billed Gull	*Larus delawarensis*	5	Monel	4.30%	Ludwig 1967
Laysan Albatross	*Phoebastria immutabilis*	7B	Al	2.46%	Ludwig et al 1995
Laysan Albatross	*Phoebastria immutabilis*	7B	Monel	0.52%	Ludwig et al 1995
Black-footed Albatross	*Phoebastria nigripes*	7B	Al	1.40%	Ludwig et al 1995
Western Gull	*Larus occidentalis*	6	Al	3.90%	Spear 1980

Type: Al = aluminum, Monel = nickel copper alloy, Incoloy = stainless steel.

longer (4.08 and 7.08 years) (Table 4) vs the 4.33 year average for 2 bands (Table 3). This was contrary to what others have found comparing aluminum vs steel bands (Ludwig 1967, Anderson 1980, Bedrosian and Craighead 2007). Kadlec (1975) found there was no appreciable difference between aluminum, titanium, and incoloy bands in terms of band loss. However, a sample size of two SS bands is insufficient to make any judgement.

CAUSES of BAND WEAR

There have been several suggested causes of band wear, and they tend to have signature signs. The first is the corrosive nature of the aquatic environment [hypersaline (Jehl 1990), Alkaline (Jehl 1990), sewage outfalls and chlorine (Pouling (1954)]. Ludwig (1967) suggested uric acid from bird defecation. Such wear should occur on the inside, outside, top and bottom of the band

Table 2. Mean weights (in mg) of various unused bands from 10 bands per string (100 bands).

Band size	Band Prefix	Mean Wt (mg)	SD (mg)	Average (mg)	ANOVA/ tTest
1	2401	66.63	0.17	65.97	p< 0.01
1	2401	68.23	0.22		
1	1561	63.05	0.25		
1B	1861	123.64	0.07	107.01	p< 0.01
1B	2201	90.38	0.90		
1A	1951	105.16	0.20	119.48	p< 0.01
1A	1951	105.29	0.45		
1A	8101	140.83	0.52		
1A	8081	126.66	1.63		
1A	1891	139.00	0.27		
1A	2421	146.90	1.06		
1D	2491	258.40	0.62	258.40	
2	1212	198.43	0.58	201.54	p< 0.01
2	1202	201.71	0.20		
2	0592	202.85	0.32		
2	0922	197.53	0.44		
2	1342	207.19	0.26		
3	1423	233.56	1.90	234.84	p< 0.01
3	1043	236.13	0.35		

Average is the overall mean of each band size. 1D bands are stainless steel; the rest are aluminum.

(Anderson 1980), but this was not the case in my worn bands.

Collins (1971, 1973) attributes the wear of the outer surface of bands on White-throated Swifts to be caused by abrasion with rock surfaces associated with their nesting and roosting on cliffs. Harris (1980) and Galbraith and Furness (1983) report band wear in European Shags (*phalacrocorax aristotelis*) was due abrasion against rocks. Harris and Rothery (2004) found that abrasion caused band wear due to the fact that Common Murre (*Uria aalge*) tarsi touch the ground when it is on land. Thompson (1970) found Ruddy Turnstone (*Arenaria interpres*) band wear associated with its rock flipping behavior. Spear (1980) attributed wear in Western Gulls (*Fratercula arctica*) to abrasion with rock or cement. Band wear on the outer surface has been reported for burrowing species, such as Manx Shearwater and Atlantic Puffins (Harris 1964, Breton et al. 2005, 2006) and may be the case for other such burrowing birds. Again, this was not the case in my worn bands.

BAND WEAR : ABRASION ON INSIDE OF BAND

The majority of researchers reported band wear on the inside of the band and felt the abrasion caused by sand, silt or other debris between the bird's leg and the band is the cause of band wear (Coulson and White 1959, Rowley 1966, Fordham 1967, Ludwig 1981, Mills 1972, Coulson 1976, Bailey et al. 1987).

UNEVEN BAND WEAR

Rowley (1966), Mills (1972), and Delbeer and Belant (1994) noted that the uneven weight of lock-on band caused a characteristic notching at the top of the band opposite to the lock-on mechanism. Rowley (1966), Coulson (1976) and Wooller (1985) reported band wear greatest on the upper edge of the band, while wear on both top and bottom edges was reported in Elegant Terns (Collins 2007, Collins et al. 2010) and Black Skimmers (Collins et al. 2010). Studying Elegant Terns, Collins (2007) suggested that when bands fit loosely on the tarsus, the bands slide up and down on the tarsus and tilts to one side, leading to abrasion on the inner side of the bands and on the bottom edge of the bands. Collins (2007) found that wear increases as the band becomes more worn and loosely fitting on the tarsus.

BAND WEAR/LOSS and LIFE HISTORY

The loss of bands can affect life history studies (Nelson et al 1980). Band wear in itself generally does not affect life history studies, unless the number becomes unreadable or the band is lost. Wear becomes important when it eventually leads to band loss, as worn bands fall off, are removed by the bird, or are lost when hooked to some vegetation or other objects.

A number of authors expressed concern on the effect of such losses in conducting long term life history studies on the efficacy of the data (Ludwig et al 1995) but should not affect shorter lived birds like passerines (Bergstrom 1964, Anderson 1980, Harris 1980; Nelson et al. 1980). Tables 3-4 show that most of the replacement of aluminum bands in these smaller passerines occurred within four to five years after initial banding, with the longest

Table 3. Weight loss and percent weight loss/year for worn band sizes 1A an 2 from Spotted Towhee.

1A Band number	New bnd (mg)	Worn bnd (mg)	Wt loss (mg)	% wt loss	bnd age yr-mo	yr-mo to decimal	wt loss/yr (mg/yr)	% wt loss/yr
0831-10187	119.5	69.6	49.9	41.8%	5yr01mo	5.08	8.7	8.2%
0831-10148	119.5	66.8	52.7	44.1%	6yr01mo	6.08	8.7	7.3%
0871-61107	119.5	88.1	31.4	26.3%	2yr10mo	2.83	11.1	9.3%
1781-69512	119.5	96.5	23.0	19.2%	2yr00mo	2.00	11.5	9.6%
1781-69655	119.5	98.0	21.5	18.0%	2yr04mo	2.33	9.2	7.7%
1781-69661	119.5	110.9	8.6	7.2%	1yr06mo	1.50	5.7	4.8%
1781-69723	119.5	85.1	34.4	28.8%	3yr00mo	3.00	11.5	9.6%
1781-69845#	119.5	75.6	43.9	36.7%	2yr01mo	2.08	21.1	17.6%
1891-25124#	119.5	76.1	43.4	36.3%	2yr09mo	2.75	15.8	13.2%
1951-65777	119.5	73.4	46.1	38.6%	3yr03mo	3.25	14.2	11.9%
8061-82942	119.5	77.6	41.9	35.1%	4yr07mo	4.58	9.2	7.7%
8081-67732	119.5	89.2	30.3	25.4%	1yr10mo	1.83	16.6	13.9%
8101-10564	119.5	97.3	22.2	18.6%	2yr07mo	2.58	8.6	7.2%
Average				28.9%		2.98	11.7	9.8%
2 Band number	**New bnd (mg)**	**Worn bnd (mg)**	**Wt loss (mg)**	**% wt loss**	**bnd age yr-mo**	**yr-mo to decimal**	**wt loss/yr (mg/yr)**	**% wt loss/yr**
0942-49326	201.5	112.8	88.7	44.0%	4yr09mo	4.75	18.7	9.3%
1142-64416	201.5	124.0	77.5	38.5%	2yr10mo	2.83	27.4	13.6%
1142-64462	201.5	84.7	116.8	58.0%	5yr01mo	5.08	23.0	11.4%
1142-64500	201.5	98.5	103.0	51.1%	4yr09mo	4.75	21.7	10.8%
1202-41782	201.5	81.7	119.8	59.5%	4yr07mo	4.58	26.2	13.0%
1202-41713	201.5	111.8	89.7	44.5%	3yr04mo	3.33	26.9	13.4%
1202-41782	201.5	81.7	119.8	59.5%	5yr10mo	5.83	20.5	10.2%
1202-62905	201.5	67.9	133.6	66.3%	4yr02mo	4.17	32.0	15.9%
1202-41947	201.5	89.8	111.7	55.4%	5yr01mo	5.08	22.0	10.9%
1212-91057	201.5	79.1	122.4	60.7%	5yr00mo	5.00	24.5	12.1%
1212-91061	201.5	116.7	84.8	42.1%	2yr11mo	2.92	29.0	14.4%
1212-91309	201.5	68.4	133.1	66.1%	5yr00mo	5.00	26.6	13.2%
1212-91356	201.5	89.1	112.4	55.8%	4yr05mo	4.42	25.4	12.6%
1212-91421	201.5	154.6	46.9	23.3%	2yr11mo	2.92	16.1	8.0%
Average				51.8%		4.22	24.3	12.1%
x212-9xxxx	201.5	25.4	176	87.40%	?	?	?	?

New bnd = average weight of new band from Table 2. Worn bnd = weight of worn band. Wt loss = New bnd - Worn bnd. %loss = (New bnd - Worn bnd)/New bnd. Yr-mo = year month. Yr-mo to decimal. # = bands replaced on same bird twice.

Table 4. % weight loss/year for individual worn bands

Band size	Species	Band#	New bnd (mg)	Worn (mg)	Wt loss (mg)	% loss	Bnd age yr-mo	yr-mo to decimal	wt loss/yr (mg/yr)	% wt loss/yr
1	PUFI	1601-47574	66.0	54.8	11.2	17.00%	1yr08mo	1.67	6.7	10.17%
1	WREN	1601-47653	66.0	51.1	14.9	22.7%	5yr00mo	5.00	3.0	4.54%
1	BEWR	1601-47922	66.0	52.6	13.4	20.3%	4yr10mo	4.83	2.8	4.2%
1B	FOSP	1641-10195	107.0	65.3	41.7	39.0%	4yr05mo	4.42	9.4	8.8%
1B	SOSP	1871-26139	107.0	90.7	16.3	15.2%	6yr10mo	6.83	2.4	2.2%
1B	SOSP	2201-36489	107.0	55.2	51.8	48.4%	5yr04mo	5.33	9.7	9.1%
1B	GWCS	1961-08256	107.0	73.5	33.5	31.3%	5yr07mo	5.58	6.0	5.6%
1A	FOSP	1951-65353	119.5	76.6	42.9	35.9%	3yr11mo	3.92	10.9	9.2%
1A	FOSP	1951-65389	119.5	70.5	49.0	41.0%	1y10mo	1.83	26.8	22.4%
1A	FOSP	8081-67680	119.5	82.6	36.9	30.8%	3yr02mo	3.17	11.6	9.7%
1D	SPTO	2491-01183	258.4	195.6	62.8	24.3%	4yr01mo	4.08	15.4	6.0%
1D	SPTO	1981-22501	258.4	153.6	104.8	40.6%	7yr01mo	7.08	14.8	5.7%
2	WESJ	0962-79815	201.5	196.0	5.5	2.7%	3yr04mo	3.33	1.7	0.8%
2	CALT	1212-91349	201.5	127.4	74.1	36.8%	5yr01mo	5.08	14.6	7.2%
2	CALT	1212-91432	201.5	106.5	95.0	47.2%	2yr09mo	2.75	34.4	17.2%
3	CATH	1043-97864	234.8	156.9	77.9	33.2%	5yr03mo	5.25	14.8	6.3%

New band weights come from Table 2. Wt loss = (new band - worn band). % loss = (new band - old band)/new band. Yr-mo = year month

Table 6. Longevity records of selected birds as reported on the Bird Banding Laboratory website (as of December 2017).

Bird	Longevity#1	Longevity#2	Longevity#3
Western Scrub-Jay	15y09m	11y11m	
Bewick's Wren	8y00m		
Wrentit	13y05m	11y11m	
California Thrasher	9y02m	7y01m	6y11m
Spotted Towhee	11y00m	10y00m	8y08m
California Towhee	12y10m	10y01m	
Fox Sparrow	10y04m	9y08m	
Song Sparrow	11y04m		
Purple Finch	10y09m		

Lutmerting and Love 2016.

replacement time was 7yr01mo for the steel 1D band. Several of aluminum band replacements were made on birds carrying the band less than three years. One Spotted Towhee had its band replaced twice in less than five years (see Table 3). Collins (2007) showed that the threshold where bands are at risk of being lost was at 50 percent loss in band weight. This means the worn bands I found had about another year or two of life. This illustrates the fact that band wear/loss is not only a problem for long lived species, but also for shorter lived species as well.

One can see that the recorded longevity records of the ten passerines species I found with band wear (Table 5) are almost twice or more as long as the time worn bands were replaced (Tables 3-4). Although it may be a few more years before these bands would naturally be lost, band loss is an important issue in studying the life history of shorter lived birds contrary to what other authors suggest.

SPOTTED TOWHEE

Spotted Towhees are the third most common bird we encounter at the Zuma Canyon banding station, dating back to 1995 (Sakai 2017), yet band wear seems most common in this species. Two other towhees species, California Towhee and Green-tailed Towhee (*Pipilo chlororus*), have been banded at this station, although the latter is quite rare (n=1). At Zuma Canyon, where 2/197 (1.02 percent) California Towhee needed bands replaced vs 28/576 (4.86 percent) for Spotted Towhee (Sakai unpubl.) These numbers are similar to what was reported by Law and Law (1929), who needed to replace bands in 2/313 (0.64 percent) California Towhees versus only 6/96 (6.25 percent) Spotted Towhees. Band wear in Spotted Towhee has been know since the early years of bird banding in the U.S. (Law and Law 1929), yet I found no other reports of band wear in other, smaller passerine birds. But in casual conversation, other banders recall catching birds with similar worn bands. There are likely other unreported cases.

Band wear on Spotted Towhee can be attributed to its foraging behavior. Craig observed injury to the banded leg on recaptured Spotted Towhees with 1A bands. A sharpening effect happened on the lower edge of the band due to the feeding habits of Spotted Towhees, which scratch up dirt and dust particles that settle on the leg under the band. As the bird hops around, the band bounces up and down the leg, and the dirt/dust act as an abrasive, sharpening the lower edge of the band until it shaves off the scutes and/or injures the tarsus or top of the foot. The tarsus under the band is often devoid of its scutes. Law and Law (1929) noted that Spotted Towhees are more persistent scratchers in the litter (Bartos et al 2015) than the California Towhee, so there is more rubbing of the band against the inside of the leg and hence band wear. Spotted Towhees forage almost exclusively on soils covered with litter, while California Towhees forage on sparsely covered ground (Davis 1957) and spend more time pecking (Benedict et al. 2011), e.g. California Towhees are regularly seen foraging on the decomposed granite parking lot at my banding station, on seeds found in the horse manure, yet Spotted Towhees never seem to use the parking lot or this food resource. California Thrashers also work the litter for food, but use their bills (Cody 2011), so their feet/bands are not abraded like the Spotted Towhee. California Scrub-Jays, Wrentits and Bewick's Wrens are gleaners (Curry et al. 2002, Geupel and Ballard 2002, Kennedy and White 2013). The remaining species I found with band wear (Song, Fox and White-crowned sparrows and Purple Finch) are also ground feeders, but the nature of and the degree of ground foraging do not lead to much band wear.

CONCLUSION

Contrary to the notion that shorter lived birds would not be affected by band wear/loss, I report that this problem exists for shorter lived and smaller birds, thus putting into questioning the efficacy of life history studies on smaller bird. I found that band wear is a more widespread problem in smaller passerines than previously reported, although the rate of wear is not uniform across the taxon. Although my sample size is small, we have evidence that harder 1D bands are not necessarily reducing the wear rate as compared to aluminum alloy bands.

Collins (2007) posed two questions that banders should consider before banding a bird: "How long will this bird live?" and "will this band last for the expected life span of the bird?" This becomes a dilemma when band wear is sufficiently high to necessitate replacing bands in just two or three years, while most passerine longevity records are close to or exceeds 10 years.

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