Notes on Rectrix Molt in Barred Owls (*Strix varia*)

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ABSTRACT

In an ongoing 10-year study concerning population dynamics and dispersal of Barred Owls (Strix varia) *on Bainbridge Island, Kitsap County, WA, the authors documented rectrix molt and plumage characteristics, some that differed from the most current published information for this species. Most of the after-second-year birds that were monitored underwent an annual and complete rectrix molt. Five second-year birds underwent a complete rectrix molt in the summer of their second year. Observations of tailless birds support our belief that the rectrix molt may occur rapidly. Tip characteristics were not definitive in ageing Barred Owls (BDOW). Pyle (1997) notes that ageing criteria parallels that of the Spotted Owl and that the terminal band of young birds is pure whitish. We observed seven hatching-year birds with mottled rectrix tips, indicating that caution should be used when using this characteristic. These observations support the claim that more study is needed regarding the ageing and molt patterns of BDOW. We also noted that in paired birds, females molted slightly earlier than their mates. We observed an atypical feature of one adult bird with 13 rectrices.*

INTRODUCTION

Bent (1938; BDOW) remarked about the lack of Barred Owl (*Strix varia*) specimens in molt but referred to a complete molt in the adult birds during summer and early fall. The current guide to owl molt patterns (Pyle 1997) stated that little has been published on the molt in Barred Owls (BDOW) and that rectrix molt in this genus is not well documented. Pyle (1997) suggested that it parallels that of Spotted Owl (*Strix occidentalis;* SPOW), although more study is needed. Mazur and James (2000) referenced Pyle, likening the BDOW molt to that of the Spotted Owl (SPOW), the majority of which undergo a complete replacement of rectrices every other year beginning with the third prebasic molt (PB). Pyle (1997) also noted that SPOW rectrix molt rarely can occur during the second PB.

While studying molt patterns of Spotted Owls, Forsman (1981) documented that the general pattern of rectrices molt was rapid as opposed to gradual, leaving the birds tailless for some time. He also noted that rapid rectrices molt occurred in two other *Strix* owls, the Tawny Owl (*Strix aluco*) and occasionally in the Barred Owl (Forsman 1981).

Although literature reports that rectrices age characteristics parallel that of the SPOW (Pyle 1997), we noted a different molt strategy and rectrices tip characteristics which could potentially confound ageing this species in hatch-year (HY) and second-year (SY) birds. This information is valuable for understanding BDOW demographics and dispersal, particularly with current management projects that propose to remove BDOW where they have invaded SPOW habitat in the Pacific Northwest (Wesley 2009). We also include interesting observations that add to the knowledge base of BDOW molt strategy.

METHODS

As part of an ongoing study of population changes and juvenile dispersal of BDOW on Bainbridge

Island, WA, rectrices tip characteristics and molt were documented. Our observations consisted of two groups of owls: those fitted with color bands and sometimes transmitters and others that were unbanded. Banding and transmitter installations were conducted under Federal Bird Banding Permits 21792-F and 21074-V. Tail-mounted transmitters were attached to the underside of the central rectrices (R1) with epoxy. Birds were either found and observed during telemetry outings or called in using playback of BDOW vocalizations. Individuals were identified by radio frequency and/or color band or the lack of a band. Unbanded owls were identified as specific individuals by their consistent presence at locations indicating they were on territories.

We aged the BDOWs by a combination of plumage characteristics and behavior. After-second-year (ASY) BDOWs had adult truncate rectrices with dark mottled tips as illustrated in Fig.1. ASY birds, especially breeding birds post brooding, tended to look somewhat ragged, with well-worn plumage and were generally silent in response to a call. We aged HY BDOWs by their white, tapered rectrices tips (Fig. 2), fresher overall plumage and/or retained down on feather tips. HY birds frequently gave a food begging call. SY BDOWs were aged before the second PB molt when they still retained the HY rectrices.

For our observations of rectrices tip color in HY birds, we documented if tips had brown mottling. Acker also examined tip characteristics of HY/SY BDOW specimens at the University of Washington's Burke Museum. Additional tip color observations were provided by Tracy Fleming (pers. comm.) who was banding and monitoring Barred Owls in southwest Washington.

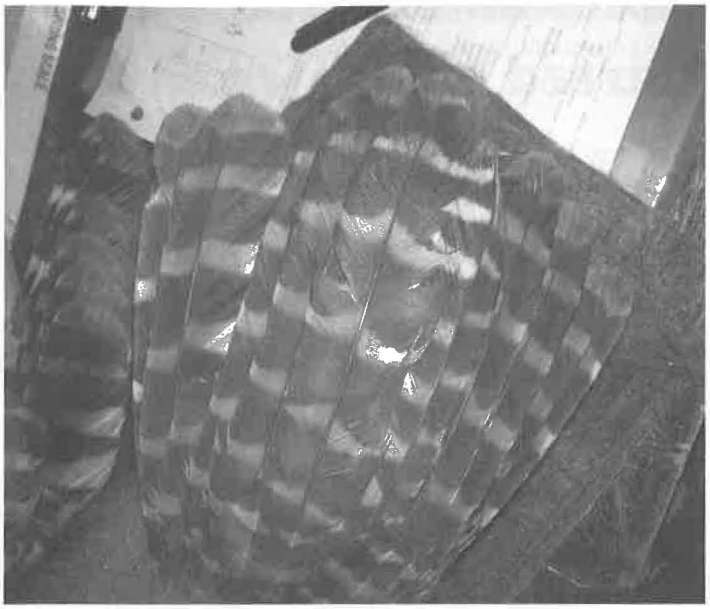

Fig. 1. Typical adult Barred Owl rectrices. Note dense dark mottling on tips and relatively truncate shape.

Fig. 2. Typical HY rectrices. Note the tapered white tips with no mottling. Fresh tips appear to have less barb density.

RESULTS

We included 17 individual BDOWs in our tables. Some individuals represented specific molt events, so were listed more than once. For example, "Gus," the male of the Islandwood pair, was included in Tables 1 and 4, representing annual molt (Table 1) and pair molt (Table 4).

Table 1 lists the BDOWs with sequential years of molt data, including a SY bird, supporting our opinion that BDOW are likely to molt their rectrices

Table 1. BDOW rectrix molt data showing complete annual molt in all but one individual. The rectrix molt was unknown for a second individual.

Individual	Sex	Age	Observation Date	Rectrix Molt	Transmitter	Nest Status	Comments
1387-04515	F	ATY	2002	No	Yes	Fledged 2	
		A4Y	18 Jul 03	Yes	Yes	Fledged 3	
		A5Y	30 Aug 04	Yes	Yes	Fledged 3	
		A6Y	27 Jun 05	Yes	Yes	Nest Failture	
		A7Y	Nov 06	No	Yes	Fledged 2	
1387-04540	F	SY	26 May 02	Yes	Yes	Unknown	2nd PB Molt
		TY	06 Jun 03	Yes	No	Unknown	Swallowtail
		4Y	2004	U		Fledged 2	Pulled transmitter off
		5Y	21 Jul 05	Yes	No	Unknown	20 Aug; - new tail
		6Y	09 Jul 06	Yes	Yes	Fledged 1	
1387-04535	F	ASY	22 Jul 03	Yes	Yes	Fledged 2	
		ATY	22 Jul 04	Yes	Yes	Fledged 2	
		A4Y	25 Jul 05	Yes	No	Fledged 3	
1387-04524	M	ATY	13 Aug 02	Yes	Yes	Unknown	
		A4Y	Jul 03	Yes	Yes	Fledged 2	
1177-49604	M	AHY	02 Aug 05	Yes	No	Nest Failure?	Unbanded at the time
		AHY	10 Sep 06	Yes	No	Fledged 2	
1387-04545 Gus	M	ASY	22 Jul 04	Yes	Yes	Fledged 3	13 Rectrices
		ATY	15 Jul 02 02 Aug 05 20 Aug 05	Yes	Yes	Fledged 1	Old Tail - full Transmitter recovered New tail 33% 13 Rectrices
		A4Y	08 Aug 06	Yes	Yes	Fledged 2	Transmitter recovered
		A5Y	28 Jan 07	Yes	Yes		13 Rectrices Transmitter Install

Table 2. SY molt observations showing complete rectrix molt occurred in the second prebasic molt.					
Individual	**Sex**	**Observation Date**	**Complete Rectrix Molt**	**Transmitter**	**Comments**
1387-04516 Grace	F	26 May 02	Yes	Yes	2nd PB molt non-breeder
1387-04560 Pistachio	F	15 Aug 05	Yes	No	2nd PB molt non-breeder
1387-04554 Phelps	M	10 Jul 05	Yes	No	2nd PB molt non-breeder
1177-49612 Isabel	F	19 Aug 07	Yes	No	2nd PB molt breeding
1177-49616 Elaine	F	19 Aug 07	Yes	No	2nd PB molt breeding uneven rectrix molt

Table 3. Additional ASY summer complete rectrix molt observations observed but not quantified.					
Individual	**Sex**	**Observation Date**	**Complete Rectrix Molt**	**Transmitter**	**Comments**
Euclid	F	21 Aug 05	Yes	No	Unbanded
1387-04516 Grace	F	Aug 06	Yes	Yes	Banded
Tani Court	F	25 Jul 06	Yes	No	Unbanded Hit by vehicle - Mortality
Day Road	M	10 Jul 05	Yes	No	Unbanded -Nest Failure
Lovgreen	M	20 Aug 05	Yes	No	Unbanded
Old Woods	U	22 Jun 05	Yes	No	Unbanded - Nest Failure
Tolo	M	10 Jul 05	Yes	No	Unbanded
	F	10 Jul 05	Yes	No	Unbanded

Table 4. Observed pair molt, females molted their rectrices in advance of males.				
Individual	**Sex**	**Observation Date**	**Comments**	**Transmitter**
Day	F	27 Jun 05	No tail; male has partial old tail	Yes
	M	10 Jul 05	No tail	No
Euclid	F	21 Aug 05	75% tail in	No
	M	21 Aug 05	33% tail in	No
Lovgreen	F	21 Jul 05	20 Aug; new tail	No
	M	20 Aug 05	No tail	No
Wacky Nut**	F	15 Aug 05	New tail 70% in	Yes
	M	10 Jul 05	No tail	Yes
Islandwood	F	19 Aug 07	New tail 25% in	Yes
	M	19 Aug 07	No tail	Yes

every year beginning with the second PB (second year of life). We missed one year of molt data on this SY bird, so we do not know if she molted her rectrices for five consecutive years or skipped a year after two consecutive years of molt. One female molted her rectrices every year in a three year period. A female that we observed for five years molted her rectrices for three consecutive years. Of the males with only two years of observation, each molted their rectrices in both years. One male observed for four years molted his rectrices each year. This individual also molted in 13 rectrices each year, with the extra retrix located on the right side between R1 and R6 (Table 1, Fig. 4).

Table 2 lists five SY birds and Table 3 lists eight ASY BDOW all with just one year of observation but that completely molted their rectrices. One bird (Grace) has two years of rectrix molt observation but they were four years apart (Tables 2 and 3).

Table 4 shows that in five paired birds, the females molted slightly earlier than the males.

We observed varying degrees of BDOW rectrices feather loss: a) entirely tailless, b) a "swallowtail" configuration in which only the outer two rectrices (r6) on each side temporarily remained, c) an uneven configuration, (e.g., two outermost rectrices (r5-r6) remaining only on one side). Tables 1, 2, and 4 also describe or quantify the molt pattern for 13 individual owls (i.e., swallowtail, tailless, and percentage of–see comments column), supporting a strategy that could parallel a rapid molt as described in the SPOW (Forsman 1981). For example, we observed one BDOW (Gus) on 15 Jul with a full tail, his transmitter was recovered on 2 Aug (with two central rectrices–indicating he began rectrices molt) and he was observed with a full set of rectrices with about 33% growth on 20 Aug (Table 1), 18 days later.

Of our in-hand observations of 18 individuals (16 HY / 2 SY) banded before the second PB molt, 11 (61%) had white tips as in Fig. 2 and seven (39%) had mottled tips as in Fig. 3. Of the 22 HY/SY Burke Museum BDOW specimens, 12 (55%) had white tipped tails and 10 (45%) had some degree of mottling. Fleming (pers. comm) reports all (100%) HY/SY BDOWs (n = 5) and HY Barred x Spotted Owls (n = 2) he had recently banded had pure white tips, as had HY/SY rehabilitation birds / road mortalities he had observed (n = 20+).

DISCUSSION

Regarding molt strategy, our observations show that at least in some birds, BDOW rectrix molt is complete and annual. We did not record specific beginning and end dates for rectrix molt. However, based on our observations of different stages of rectrices development including tailless and the example of Gus above, we conclude that the BDOW may also molt their rectrices rapidly as described for other *Strix* Owls, including Spotted, Tawny, and Barred owls (Forsman 1981). Forsman (1981) described three patterns of tail replacement in Spotted Owls, including a rapid and complete molt explained as all rectrices being shed *rapidly*, within a period of several days or weeks leaving the bird without a functioning tail for some period. The other two patterns were a disjunct molt (complete but over a longer period of time) and a partial molt (Forsman 1981).

In paired owls (Table 4), we observed that male BDOW lose their rectrices slightly later in the summer than do females, which is typical of some diurnal raptors such as North American accipiters (Henny et al. 1985). Both members of BDOW pairs were observed simultaneously or within a month of each other and the female rectrix molt was more advanced than the male molt (Table 4). Nesting success did not seem to be a factor as to whether a BDOW underwent rectrix molt, also observed in studies of rectrix molt in the Tawny Owl (Petty 1994). Breeding success and the energetics of chick rearing have been related to molt suspension (Espie et al. 1996, Henny et al. 1985) or a varied number of feathers molted in some diurnal raptors (Pietiainen et al. 1984). In our study, in the two cases where summer rectrix molt did not occur, young were

Fig 3 HY rectrices with brown mottling. Thin and tapered rectrices are other evident juvenal characteristics

Fig 4. ASY Barred owl "Gus" with 13 rectrices, the extra on his right side.

fledged; and in one confirmed nest failure, the female molted her rectrices (Table 1). This particular female fledged chicks successfully in both molt and non-molt years, confounding the influence of chick rearing on BDOW rectrix molt, which is likely influenced by multiple factors. She had a nest failure (predation of at least one cavity-bound owlet) in 2005, and molted her rectrices in June, a bit earlier than most ASYs. In the same year, her mate molted his rectrices in early July. To our knowledge, biennial molt did not occur in other birds in our study.

Our data show that in most years BDOWs underwent a complete annual rectrix molt beginning in the second year. This information contradicted the assumption that BDOW rectrix molt paralleled that of the SPOW (Pyle 1997, Mazur and James 2000). BDOWs did not undergo a biennial molt like the Tawny Owl and SPOW but both BDOW and Tawny owls molted their rectrices in their second year.

HY Rectrices Tip Characteristics - We originally thought the mottling of the HY terminal rectrices tips may be anomalous. Although Pyle (1997) expressed caution when ageing and sexing BDOW, he noted that as in the Spotted Owl, the terminal tips of the HY/SY rectrices are pure whitish. Flemings' captured, injured, and dead BDOW followed this pattern, but our observations indicate that mottling (17 of 40 birds) in the rectrices tips may be a common feature in HY/SY birds. We advise when ageing BDOW, the rectrices be examined not only for color but also for shape and quality. For example, HY/SY birds did show other juvenal rectrices characters, common juvenal plumage characteristics of passerines and near-passerines (Pyle 1997). These included acuminate (Moen et al. 1991) or tapered tips (Fig. 2 and 3), and appeared to be of inferior quality (e.g., thinner) feathers. Although there is some overlap, quantifying the numbers of bars and distance between bars on BDOW rectrices as reported in Pyle (1997) could also be useful in ageing owls with suspicious tip characteristics.

A Typical Number of Rectrices - Of 20 individuals that we fitted with tail mounted transmitters, one ASY male had 13 rectrices, instead of the normal 12, the extra feather located on the right side. Clark et al. (1988) document supernumerary rectrices in five species of diurnal raptors noting that the majority of extra feathers were on the right side. We did not find documentation of supernumerary rectrices in owls during literature searches.

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