Inconsistencies among secondary sources of chukar partridge (*Alectoris chukar*) introductions to the United States

Michael P Moulton, Wendell P Cropper, Jr, Andrew J Broz

An important source of information concerning the fates of intentionally introduced exotic bird species has been collections of historical data that sometimes include species released, numbers released, locations of release, and establishment success. These data have been used to assess potential predictors of establishment success such as propagule pressure, site-level factors, and species characteristics. In order to better understand the limitations of such historical compilations, we compared data for the Chukar (*Alectoris chukar*) introductions to the USA from two often used secondary compilations with a more comprehensive source (Christensen (1970). .. We found that the major compilations of Long (1981) and Lever (1987) are inconsistent and likely to be incomplete, and inaccurate, in terms of the taxa introduced, the numbers introduced, and the fates of these introductions. Propagule pressure analyses have often assumed that every bird in every release must be summed to represent the propagule pressure necessary for establishment. We found, however, that large numbers of birds were released into states and counties with already established populations. Additionally, in numerous states very large numbers of Chukars were unsuccessfully released. We conclude that site-level factors were more important influences of establishment success than propagule pressure was.

Inconsistencies Among Secondary Sources of Chukar Partridge (*Alectoris chukar*) Introductions to the United States.

by

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Abstract

An important source of information concerning the fates of intentionally introduced exotic bird species has been collections of historical data that sometimes include species released, numbers released, locations of release, and establishment success. These data have been used to assess potential predictors of establishment success such as propagule pressure, site-level factors, and species characteristics. In order to better understand the limitations of such historical compilations, we compared data for the Chukar (*Alectoris chukar*) introductions to the USA from two often used secondary compilations with a more comprehensive source (Christensen (1970). .. We found that the major compilations of Long (1981) and Lever (1987) are inconsistent and likely to be incomplete, and inaccurate, in terms of the taxa introduced, the numbers introduced, and the fates of these introductions. Propagule pressure analyses have often assumed that every bird in every release must be summed to represent the propagule pressure necessary for establishment. We found, however, that large numbers of birds were released into states and counties with already established populations. Additionally, in numerous states very large numbers of Chukars were unsuccessfully released. We conclude that site-level factors were more important influences of establishment success than propagule pressure was.

Introduction

In attempting to identify the processes that deter or promote establishment of introduced bird populations, several empirical studies have concluded that propagule pressure, meaning the total number of individuals of a species released in some place, is the principal determining factor (e.g. Newsome and Noble 1986; Veltman et al. 1996; Duncan 1997; Green 1997; Cassey et al. 2004; Lockwood et al. 2005; Sol et al. 2012). Although this conclusion has been repeatedly criticized (Moulton et al. 2010, 2011, 2012a,b, 2013; Moulton and Cropper 2014a,b, 2015), and recent studies have emphasized the importance of species-level characteristics over propagule pressure (e.g. Sol et al. 2012; Cassey et al. 2014), some have persisted in touting its primary importance (e.g. Blackburn et al. 2015a, b).

At the same time, site-level factors have largely been ignored by proponents of propagule pressure, despite numerous studies that have shown their importance in bird introductions (e.g. Gullion 1965; Diamond and Veitch 1981; Griffith et al. 1989; Moulton and Pimm 1983, 1987; Lockwood et al. 1993; Lockwood and Moulton 1994; Smallwood 1994; Case 1996; Gamarra et al. 2005; Moulton and Cropper 2014b; Allen et al. 2015).

A principal basis for the propagule pressure hypothesis, as applied to birds, has been compilations of historical records such as those by Thomson (1922), Phillips (1928) Long (1981) Lever (1987, 2005). In relying on such secondary sources, studies that claim to support propagule pressure make two assumptions: first that the chronicle of introductions presented in these sources is complete and accurate; and second that the principal, if not sole, motivation behind the introductions was the establishment of self-sustaining populations. A corollary to this second assumption is that introductions would end once it was perceived that the species was established. We show that for Chukar

(*Alectoris chukar*) introductions to the USA these assumptions are unmet, and we provide evidence that introduction outcomes in Chukars are likely to be mostly influenced by factors other than numbers released.

Our initial motivation for conducting this study came from the observation that the compilations of Long (1981) and Lever (1987) often were quite different from that of Christensen (1970), although both cited Christensen (1970) in their treatments of the Chukar. Long (1981) referred to the species as *Alectoris graeca* but makes it clear that the subspecies involved in the USA were in fact Chukars (Asian origin) and not Rock Partridges (European origin). Lever (1987) noted that 'Greek Chukars' released in California were likely Rock Partridges. Christensen (1970) discussed the difference in nomenclature referring to North American introductions as *Alectoris chukar*, following the work of Watson (1962a,b). Lever (1987) also noted that the species was *Alectoris chukar,* and suggested that the so-called 'Greek Chukars' presented to the state of California were actually Rock Partridges (*Alectoris graeca*).

Historical compilations of bird introductions have often (see above) been used to assess some factors believed to be associated with successful introductions. It is, at least implicitly, assumed that the historical records are either accurate, or that the errors do not significantly bias these analyses. It is difficult to know how complete multi-decade old records actually are, but it is possible to assess the consistency of the major compilations and of the published analyses that have relied on these sources.

Methods and Materials

To illustrate the hazards in depending on secondary sources, we analyzed historical records of introductions of the Chukar to the United States as reported in two major

88 secondary sources: Long (1981) and Lever (1987). We then compare the compilations in
89 these two references to the records reported by Christensen (1970) and then we show how
90 they compare to the records used in a recent study (Sol et al. 2012). Christensen (1970)
91 based his compilation on two separate surveys using questionnaires sent to state wildlife
92 agencies once in the early 1950s and again in the late 1960s. As such we assume it is the
93 more accurate reflection of the true record of Chukar introductions in the USA.
94 The Chukar has a vast range throughout Asia (Watson 1962a), and was once
95 considered a subspecies of the Rock Partridge (*Alectoris graeca*), which occurs in Europe.
96 Watson (1962a,b) showed that subtle but consistent morphological differences exist
97 between adjacent populations of *A. graeca* and *A. chukar* in extreme Eastern Europe. We
98 follow the 4th edition of the Howard and Moore Checklist of Birds of the World (Dickinson
99 and Remsen 2013), which also treats the two as distinct species.
100 We compiled lists of introduction records per state as reported by Long (1981) and
101 Lever (1987). We then compared these lists to Christensen (1970, 1996). We compared
102 the number of individuals released in the states for which all three references reported a
103 total number of individuals released. We transformed the total numbers by calculating
104 their common logarithms and then compared these values using a generalized linear mixed
105 model with state (location) of the introduction as a random factor and the three references
106 as a fixed effect. We used the SAS Glimmix procedure (SAS 2009) for our analyses.
107 We then compare Christensen's (1970) list to the records used in the recent study of
108 introductions by Sol et al. (2012) and show their degree of reliance on the work of Long
109 (1981) and Lever (1987), but not on the seemingly more complete work of Christensen
110 (1970).

Results

Bump (1951) claimed that Chukars had likely been released in every one of the 48 states in the US (Alaska and Hawaii did not become states until 1959) but none of the historical references (Long 1981; Lever 1987; Christensen 1970) listed releases for all 48 states. Christensen (1970, 1996) reported Chukar releases to 40 of the conterminous 48 states (he also noted introductions to Hawaii and Alaska) and listed the total number of individuals released in 35 states (Figure 1). For five other states (Florida, Louisiana, Michigan, Mississippi, and Rhode Island) respondents reported to Christensen (1970) only that a "few" individuals had been released (Table 1). Long (1981) reported introductions of Chukars to just 22 states, but only listed propagule information for 16 states. Lever (1987) listed releases of Chukars to 30 states, but only reported propagule information for 18 states.

Although Long (1981) and Lever (1987) both cited Christensen (1970), neither followed his compilation very closely. The reasons that Long (1981) and Lever (1987) excluded data for so many of the states listed by Christensen (1970) are unknown. Moreover, regarding the 15 states for which all three references listed propagule information, Long (1981) reported the same number listed by Christensen (1970), for only one state (Missouri) and Lever (1987) did not report the same number as Christensen (1970) for any state.

Long (1981) and Lever (1987), both reported numbers for New York, although Christensen (1970) did not. Likely this is due at least in part to Christensen's (1970) report being based on wildlife agency surveys and apparently does not include any private

133 releases. Lever (1987) also reported numbers for Nebraska and Utah, as did Christensen
134 (1970), but not Long (1981).

135 In our mixed linear model the logarithms of the numbers of individuals released
136 across the three references and 15 states, with state of introduction as a random effect and
137 reference as a fixed effect, differed significantly in a Type III test (df. 2, 20; $F = 4.94$; $p = 0.014$). Clearly, most of the variation in numbers released was due to the higher numbers
139 Christensen (1970) reported.

140 Thus, for unknown reasons, Long (1981) and Lever (1987) included only about half
141 the states, and significantly fewer individuals than Christensen (1970). We emphasize that
142 none of these references was compiled for the purpose of testing the propagule pressure
143 hypothesis. Nevertheless, we must conclude that results of any studies involving the
144 Chukar that relied heavily on either Long (1981) or Lever (1987) would likely be based on
145 incomplete and inaccurate information and therefore are suspect.

146 Studies that presumably include Chukar releases to the USA (e.g. Cassey et al. 2004)
147 do not always make their data available. One exception to this is the recent study (Sol et al.
148 2012), which involved a global analysis aimed at disentangling the effects of species-level
149 characters on introduction success in birds. Sol et al. (2012) claim to have updated the
150 database used by Cassey et al. (2004).

151 We were able to match 38 of 40 records of Chukars reported by Sol et al. (2012),
152 using their propagule sizes and ID numbers, to reports by Long (1981) or Lever (1987) for
153 16 (or 17) states in the USA (Table 2). Sol et al. (2012) did not specify individual states in
154 their records, but we surmise that they included multiple releases to Arizona (2), California

(8), and Utah (14), and single releases (sums) for 13 (or 14 -- see New York discussion below) others.

Sol et al. (2012) listed an unsuccessful record of a propagule size of 175 (Sol et al. ID # - 61), but neither Long (1981) nor Lever (1987) listed a propagule of this size. It is possible that this represents a conflation of the record Long (1981) and Lever (1987) listed for Delaware County, New York where 25-150 individuals were released yearly between 1936 and 1939. As shown in Table 2, this record in Sol et al. (2012) falls exactly between values and ID numbers we matched to Lever (1987) for Missouri (1900 - Sol et al. ID # 60) and Pennsylvania (2021 - Sol et al. ID # 62). If this record is actually for New York it would represent the fourteenth state as noted above.

Sol et al. (2012) also listed two unsuccessful releases of 17 individuals each. One of these possibly refers to 17 individuals released in Alaska (Lever 1987) but the other is uncertain. Lever (1987) listed releases to 17 *counties* in Nebraska of 27842, and it is possible that Sol et al. (2012) in the course of updating the data inadvertently included this as a separate release.

We summed multiple releases for Arizona, California and Utah listed by Sol et al. (2012) to make their records comparable to the work of Christensen (1970) Long (1981) and Lever (1987). In a separate mixed model again with state of introduction a random effect and log number of individuals released, we observed a highly significant difference in log number after controlling the random effect of state in the Type III test of fixed effects ($F_{3,45} = 5.88$; $p > F = 0.002$).

We further compared subsets of the sources using two orthogonal contrasts. First, we compared the numbers that Christensen (1970) reported per state to those reported by

178 the combination of Long (1981), Lever (1987), and Sol et al. (2012). In this contrast we
179 observed a significant difference ($t = 16.60$; $p > t = 0.0002$; $df = 45$). Next we compared the
180 combination of Long (1981) and Lever (1987) versus Sol et al. (2012), and here the
181 contrast was not significant ($t = 1.01$; $p > t = -0.32$; $df = 45$).

182 **Discussion**

183 The first assumption of the propagule pressure hypothesis mentioned above was
184 that the historical record was complete and accurate. Whereas there might be more
185 complete and accurate records that are not generally well known , secondary sources such
186 as Long (1981) and Lever (1987) are seemingly incomplete and likely inaccurate. Studies
187 such as Sol et al. (2012) and presumably Cassey et al. (2004) apparently relied heavily on
188 the reports in Lever (1987) and Long (1981) but as we have shown here neither author
189 completely or accurately reflected the introduction data presented by Christensen (1970).
190 Thus, for Chukar introductions to the USA we have shown that the record as presented by
191 Long (1981) and Lever (1987) appears to be incomplete and inaccurate.

192 The second assumption is that all the individuals that were introduced were
193 necessary for establishment. Chukars currently have self-sustaining populations in ten
194 western states (see Table 1). In four of these states (California, Idaho, Nevada, and
195 Washington) Chukars were considered established in 1954 (Christensen 1954); in the
196 other six states (Arizona, Colorado, Montana, Oregon, Utah, and Wyoming) the status was
197 considered uncertain, doubtful (Arizona) or hopeful (Utah, Oregon). However, additional
198 individuals were released in all ten states between 1954 and 1970 (Christensen 1970),
199 strongly suggesting that establishment of wild Chukar populations was not the only goal. -
200 +If propagule pressure was assessed as an essential factor by the professionals introducing

these birds, we might expect the six states where the status was uncertain to release larger numbers after 1954 than the four states where the Chukar was considered established. As indicated in Table 1, Christensen (1954) considered Chukars to be established in four states (California, Idaho, Nevada, and Washington). However, by 1970 additional individuals were released in all four states (California - 10,446; Idaho - 17,129; Nevada - 7256; Washington - 43879). Thus, even in those states where the population of Chukars was considered established, releases continued. In fact, introductions continued for years after Christensen's (1970) report. Thus, `Banks (1981) further reported that in the state of Washington where the Chukar was considered established by 1954, more than 51,000 Chukars were released between 1970 and 1978.

As noted by Duncan et al. (2003) three levels of factors could influence introduction outcome in birds: species-level; event-level; and site-level. As we focus here solely on *Alectoris chukar*, we can ignore the possibility that species-level differences could explain differences in introduction outcomes. Could other event-level characteristics be responsible? Possible event-level factors, other than propagule pressure, include characteristics of the releases themselves. Some studies (e.g. Veltman et al. 1996; Sol et al. 2012), include releases of diverse sets of species that likely were made under differing circumstances, and with different goals. For example, the conditions involved in releases of species introduced for biological control likely differed from those of species released for aesthetic reasons. Such diverse releases likely were made by groups or individuals with different goals. We note that the Chukars were introduced chiefly, if not exclusively, to provide recreational hunting opportunities. The numbers of individuals released in the different states, reported by Christensen (1970) came from questionnaires sent to state

game and fish departments throughout the USA. The Chukar releases Christensen (1970) reported were presumably all made by state sponsored professional wildlife scientists and so it is unlikely that differences in introduction outcomes across the states could simply reflect differences in the levels of competence among personnel in the different states. Despite the seeming homogeneity in Chukar introduction practices, in several states very large numbers of Chukars were unsuccessfully released. For example, 85,000 individuals were released into Minnesota, more than 43,000 into Wisconsin, and more than 28,000 in Nebraska, only to fail.

The results here strongly imply that factors other than sheer numbers, and characteristics of the release events determined the outcome of Chukar introductions. Thus, the logical explanation is that site-level factors such as climate (e.g. Tomlinson 1960) or habitat characteristics (Gullion 1965) were of greater importance than sheer numbers in determining the outcome of Chukar introductions. Indeed, the only states with successful Chukar populations are states that straddle or are west of the continental divide. These states share certain environmental characteristics: all are more arid and mountainous than states where Chukars failed (Johnsgard 1988, Christensen 1996).

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352 Table 1. Chukar releases according to Christensen (Ch 1954, Ch 1970); Lever (1987) and
353 Long (1981). A question mark indicates that the state was mentioned by the source but no
354 propagule information was available. Chukars are considered established in the ten states
355 in italics: Chukars were considered established in 1954 in the 4 italicized states marked
356 with an asterisk.

State	**Ch 1954**	**Ch 1970**	**Lever 1987**	**Long 1981**	**Sol et al. 2012**	**FGIP**
Alabama[1]	720	720	?	?	.	.
Arizona	9866	11737	1133	1133	1133	534
*California**	44554	55000	75173	39186	14287	11837
Colorado	10433	24080	8000	9000	9000	.
Connecticut	100s	1500	.	.	.	.
Florida	few	few	?	.	.	.
Georgia	.	.	?	.	.	.
*Idaho**	8581	25710	28000	28000	25000	.
Illinois	9000	9000	?	.	.	.
Indiana	.	7500	.	.	.	.
Iowa	1847	1847	.	.	.	.
Kansas	7879	7879	?	?	.	.
Kentucky	1500	5480	?	.	.	.
Louisiana	few	few	.	.	.	.
Maryland	.	.	?	.	.	.

Massachusetts	few	500	?	.	.	.
Michigan	few	few	?	?	.	.
Minnesota	85000	85000	84414	84414	84414	.
Mississippi	few	few	.	.	.	.
Missouri	1838	1838	1900	1838	1900	.
Montana	3629	7854	5365	5365	5365	.
Nebraska	14750	28142	27842	?	27842	26748
*Nevada**	6399	13655	5339	6739	5000	.
New Hampshire	130	130	.	.	.	.
New Mexico	4943	31000	16621	7700	.	16471
New York			<600	<600	175[B]	
North Carolina	449	449	.	.	.	.
North Dakota	2300	5600	?	.	.	.
Ohio	20	20	.	.	.	.
Oklahoma	1000s	1000s	.	.	.	.
Oregon	19898	113675	76000	76000	76000	.
Pennsylvania	2377	2377	2021	2021	2021	.
Rhode Island	.	few	.	.	.	.
South Carolina	few	200+	.	.	.	.
South Dakota	1459	1831	1368	1368	1368	75
Tennessee	5824	5824	?	?	.	.
Texas	.	703	?	.	.	.

Utah	8666	185911	458	?	515	73360
Virginia	100	100	.	.	.	
*Washington**	7041	50920	64996	5841	5841	59155[2]
West Virginia	4420	4429	.	.	.	.
Wisconsin	43013	43013	17550	17550	17550	.
Wyoming	14000	60000	17455	53455	17455	.
States	37	40	30	22	17[2]	7
Records	37	40	69	50	65	154
Individuals	320636	793424	451794	446788	294866	188180

[1] These could have been Rock Partridges. Imhof (1976) listed "Chukars" in one part of his book and "Rock Partridges" in another, and as *Alectoris graeca* in both places. Moreover he listed the origin of the birds as "southeastern Europe", and did not include the species in a previous publication on birds new to Alabama (Imhof 1958).

[2] Includes by assumption (see text) one unidentified report as being from the state of New York, possibly one for Nebraska (Table 2) and excludes a release attributable to Alaska.

[2] Of these releases, 51,247 occurred between 1970 and 1978 (Banks 1981).

366 Table 2. Presumed sources for Sol et al. (2012) records. ID refers to the ID number in Sol
367 et al. (2012); Fate = 1 successful, 0 = unsuccessful; Prop = propagule size as listed by Sol et
368 al. (2012). Lever and Long refer to the presence of the record in those two references
369 (Long 1981; Lever 1987): .5 = fewer listed by the reference;1= identical number listed; 2 =
370 additional releases to the state were listed by the reference. The Fates are those Sol et al.
371 (2012) reported (S= Successful; F = Failed).
372

ID	Fate	Prop	State	Lever	Long	Fate
81	1	333	AZ	1	1	S
3204	1	800	AZ	1	1	S
53	1	4600	CA	1	1	S
3197	1	423	CA	.	1	S
3198	1	444	CA	.	1	S
3199	1	440	CA	.	1	S
3200	1	440	CA	.	1	S
3201	1	440	CA	.	1	S
3202	1	7000	CA	1	1	S
3203	1	500	CA	.	1	S
3205	1	9000	CO	1	.5	S
82	1	25000	ID	1	1	S
59	0	84414	MN	1	1	F
60	0	1900	MO	1	.5	F

771	1	5365	MT	1	1	S
1897	0	27842	NE	1	?	F
84	1	5000	NV	2	2	S
61	0	175	NY?	2	2	F
475	1	76000	OR	1	1	S
62	0	2021	PA	1	1	F
1898	1	1368	SD	1	1	S
88	0	50	UT	1	.	F
85	0	13	UT	1	.	F
86	0	23	UT	1	.	F
87	0	50	UT	1	.	F
90	0	41*	UT?	2	.	F
91	0	28	UT	1	.	F
92	0	15	UT	1	.	F
93	0	15	UT	1	.	F
94	0	38	UT	1	.	F
95	0	100	UT	1	.	F
96	0	8	UT	1	.	F
98	0	8	UT	1	.	F
97	0	50	UT	1	.	F
99	0	76	UT	1	.	F
1587	1	5841	WA	2	.	S

467	0	17550	WI	1	1	F
100	1	17455	WY	1	.	S

* ID 90 of Sol et al. (2012) might be a typographical error, as Lever (1987) listed a release of 46 to Utah.

377 Table 3. Chukar release summary by various sources: Ch70 = Christensen (1970); Le87 =

378 Lever (1987); Lo81 = (Long 1981); Sol = Sol et al. (2012).

379

State	Ch70	Le87	Lo81	Sol
Nevada	13655	5339	6739	5000
California	55000	75173	39186	14287
Colorado	24080	8000	9000	9000
Wyoming	60000	17455	53455	17455
Idaho	25710	28000	28000	25000
Washington	50920	64996	5841	5841
Arizona	11737	1133	1133	1133
South Dakota	1831	1368	1368	1368
Missouri	1838	1900	1838	1900
Pennsylvania	2377	2021	2021	2021
Montana	7854	5365	5365	5365
Wisconsin	43013	17550	17550	17550
Oregon	113675	76000	76000	76000
Minnesota	85000	84414	84414	84414
New Mexico	31000	16621	7700	.
Utah	185911	458	.	515
Nebraska	28142	27842	.	27842
New York	.	<600	<600	175?

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Figure 1. Number of states reporting total numbers of Chukars released: Christensen (1970); Lever (1987); Long (1981).

Figure 1(on next page)

Figure 1

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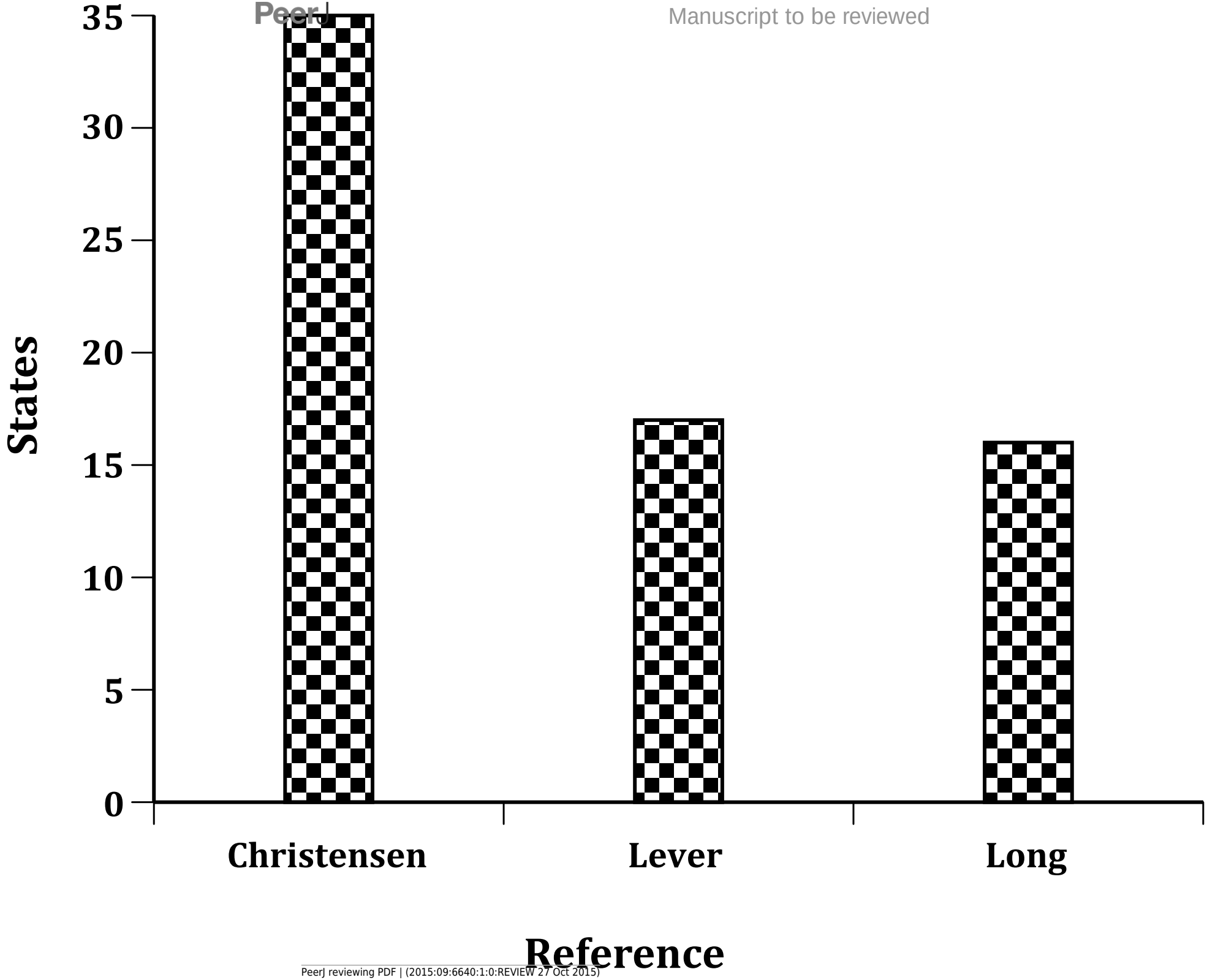
35
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States
Christensen
Lever
Long
Reference

Table 1(on next page)

Table 1

Chukar releases according to Christensen (Ch 1954, Ch 1970); Lever (1987) and Long (1981). A question mark indicates that the state was mentioned by the source but no propagule information was available. Chukars are considered established in the ten states in italics: Chukars were considered established in 1954 in the 4 italicized states marked with an asterisk.

Table 1. Chukar releases according to Christensen (Ch 1954, Ch 1970); Lever (1987) and Long (1981). A question mark indicates that the state was mentioned by the source but no propagule information was available. Chukars are considered established in the ten states in italics: Chukars were considered established in 1954 in the 4 italicized states marked with an asterisk.

State	**Ch 1954**	**Ch 1970**	**Lever 1987**	**Long 1981**	**Sol et al. 2012**	**FGIP**
Alabama[1]	720	720	?	?	.	.
Arizona	9866	11737	1133	1133	1133	534
*California**	44554	55000	75173	39186	14287	11837
Colorado	10433	24080	8000	9000	9000	.
Connecticut	100s	1500	.	.	.	.
Florida	few	few	?	.	.	.
Georgia	.	.	?	.	.	.
*Idaho**	8581	25710	28000	28000	25000	.
Illinois	9000	9000	?	.	.	.
Indiana	.	7500	.	.	.	.
Iowa	1847	1847	.	.	.	.
Kansas	7879	7879	?	?	.	.
Kentucky	1500	5480	?	.	.	.
Louisiana	few	few	.	.	.	.
Maryland	.	.	?	.	.	.

Massachusetts	few	500	?	.	.	.
Michigan	few	few	?	?	.	.
Minnesota	85000	85000	84414	84414	84414	.
Mississippi	few	few	.	.	.	.
Missouri	1838	1838	1900	1838	1900	.
Montana	3629	7854	5365	5365	5365	.
Nebraska	14750	28142	27842	?	27842	26748
*Nevada**	6399	13655	5339	6739	5000	.
New Hampshire	130	130	.	.	.	.
New Mexico	4943	31000	16621	7700	.	16471
New York			<600	<600	175[B]	
North Carolina	449	449	.	.	.	.
North Dakota	2300	5600	?	.	.	.
Ohio	20	20	.	.	.	.
Oklahoma	1000s	1000s	.	.	.	.
Oregon	19898	113675	76000	76000	76000	.
Pennsylvania	2377	2377	2021	2021	2021	.
Rhode Island	.	few	.	.	.	.
South Carolina	few	200+	.	.	.	.
South Dakota	1459	1831	1368	1368	1368	75
Tennessee	5824	5824	?	?	.	.
Texas	.	703	?	.	.	.

Utah	8666	185911	458	?	515	73360
Virginia	100	100	.	.	.	
*Washington**	7041	50920	64996	5841	5841	59155[2]
West Virginia	4420	4429	.	.	.	.
Wisconsin	43013	43013	17550	17550	17550	.
Wyoming	14000	60000	17455	53455	17455	.
States	37	40	30	22	17[2]	7
Records	37	40	69	50	65	154
Individuals	320636	793424	451794	446788	294866	188180

[1] These could have been Rock Partridges. Imhof (1976) listed "Chukars" in one part of his book and "Rock Partridges" in another, and as *Alectoris graeca* in both places. Moreover he listed the origin of the birds as "southeastern Europe", and did not include the species in a previous publication on birds new to Alabama (Imhof 1958).

[2] Includes by assumption (see text) one unidentified report as being from the state of New York, possibly one for Nebraska (Table 2) and excludes a release attributable to Alaska.

[2] Of these releases, 51,247 occurred between 1970 and 1978 (Banks 1981).

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Table 2(on next page)

Table 2

Presumed sources for Sol et al. (2012) records. ID refers to the ID number in Sol et al. (2012); Fate = 1 successful, 0 = unsuccessful; Prop = propagule size as listed by Sol et al. (2012). Lever and Long refer to the presence of the record in those two references (Long 1981; Lever 1987): .5 = fewer listed by the reference;1= identical number listed; 2 = additional releases to the state were listed by the reference. The Fates are those Sol et al. (2012) reported (S= Successful; F = Failed).

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ID	Fate	Prop	State	Lever	Long	Fate
81	1	333	AZ	1	1	S
3204	1	800	AZ	1	1	S
53	1	4600	CA	1	1	S
3197	1	423	CA	.	1	S
3198	1	444	CA	.	1	S
3199	1	440	CA	.	1	S
3200	1	440	CA	.	1	S
3201	1	440	CA	.	1	S
3202	1	7000	CA	1	1	S
3203	1	500	CA	.	1	S
3205	1	9000	CO	1	.5	S
82	1	25000	ID	1	1	S
59	0	84414	MN	1	1	F
60	0	1900	MO	1	.5	F

771	1	5365	MT	1	1	S
1897	0	27842	NE	1	?	F
84	1	5000	NV	2	2	S
61	0	175	NY?	2	2	F
475	1	76000	OR	1	1	S
62	0	2021	PA	1	1	F
1898	1	1368	SD	1	1	S
88	0	50	UT	1	.	F
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