

**BEHAVIOR OF SPRING MIGRANT BLACK-BELLIED
PLOVERS AT TOTTEN INLET, WASHINGTON:
AGONISTIC OR COURTSHIP FUNCTION?**

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The ecology of Black-bellied Plovers (*Pluvialis squatarola*) has been well investigated in much of the species' Palearctic and Nearctic range. Detailed descriptions of this plover's behavior were provided by Cramp and Simmons (1983), Paulson (1995) and Byrkjedal and Thompson (1998). Although Black-bellied Plovers are known to be territorial in the non-breeding season (Panov 1963, Stinson 1977, Myers et al. 1979, Turpie 1995), and foraging territories may be maintained by overtly aggressive behavior (Michael 1935, Paulson 1995), mutual avoidance generally maintains adequate spacing (Stinson 1977, 1980).

Aspects of agonistic behavior have been described for Black-bellied Plovers and other *Pluvialis* species (Paulson 1995, Byrkjedal and Thompson 1998). Some agonistic behavior – for example, the “torpedo runs” used by European Golden-Plovers (*P. apricaria*) – is difficult to distinguish from courtship behavior (Byrkjedal and Thompson 1998), except likely by the context in which it is expressed. Pair formation in Black-bellied Plovers appears to occur on the breeding territory (Flint and Kondratjew 1977 [in Byrkjedal and Thompson 1998], Paulson 1995), and although most records of agonistic or courtship-type behavior in *Pluvialis* plovers south of the breeding grounds involve European Golden-Plovers (Byrkjedal and Thompson 1998), this behavior has been reported in Black-bellied Plovers during winter in South Africa (Turpie 1995). In North America, agonistic or courtship chasing behavior was reported for American Golden-Plovers (*P. dominica*) during spring in Indiana (Johnson 1941), and for Black-bellied Plovers during autumn and winter in southern California (Michael 1935) and the non-breeding season in Massachusetts (Drury 1961) and Washington (Paulson 1995). Based on the dearth of records, such behavior appears rare in North America during migration. In this paper I report several observations of agonistic or courtship behavior involving spring migrant Black-bellied Plovers in western Washington.

STUDY AREA

The observations reported in this paper were made at Totten Inlet (47° 5.829' N, 123° 4.819' W), a small inlet at the south terminus of Puget Sound in western Washington. Two small creeks flow into the south end of the inlet on either side of a small salt marsh (Zuckerberg and Pearson 2006). Extensive mud flats are exposed at mid- and lower-tide periods.

More detailed site descriptions are provided elsewhere (Buchanan 1988, Zukerberg and Pearson 2006). Totten Inlet supports among the highest number of Black-bellied Plovers in Puget Sound during migration and winter periods, and in the last two decades plover numbers there have increased dramatically (Buchanan 2006).

OBSERVATIONS

The observations reported below occurred during spring migration in 2004. All observations were noted during mid-phases in the tidal cycle when extensive mud flats were exposed. Black-bellied Plover numbers were building toward their peak of spring abundance on 13 and 18 April (515 and 637 birds were present on these two dates, respectively; J. Buchanan, unpublished data). The observation on 28 April occurred after the peak of migration, when only 103 birds were present.

Incident 1

At 08:56 on 13 April 2004, my attention was drawn to two Black-bellied Plovers that were calling and flying at one another on the tide flats west of the Totten Inlet salt marsh and west of the Kennedy Creek channel. Between 08:56 and 09:00 I observed at least 23 flights involving a plover (hereafter, plover 1) in alternate plumage and another individual that showed very little molt and was still in predominantly basic plumage. Plover 1 initiated about 75% of the flights. The flights began with both birds on the mud flats at distances of 1–6 meters apart. When one bird flew at the other, the target bird would duck its head low with the bill pointed forward and tail feathers raised – the tail feathers often slightly fanned and tilted noticeably to one side – while the approaching bird flew overhead, nearly close enough to make contact. The bird in flight would drop its legs in an apparent attempt to make contact with the other. On two additional occasions the approaching bird ran in a crouching position, rather than flying. This crouched approach is referred to as the torpedo run (Connors et al. 1993). In both cases the target bird jumped up at the last moment as the approaching bird passed a few cm beneath. The bird in basic plumage ended the bout at 09:00 by flying about 10 meters away.

At 09:02, the two plovers were back together and within 30 seconds six more flights occurred, similar to those made moments earlier. One of these involved one bird jumping up as the other flew beneath it. The bird in basic plumage again flew off about 10 meters, but returned within one minute and they again engaged. This time plover 1 performed a wing-hanging display at 09:04. Plover 1 abruptly issued a loud “cur-lee, cur-lee” at 09:05 and then flew, giving this same call three times in flight. The bird in basic plumage and a small flock of Dunlins (*Calidris alpina*) foraging in the area flushed when the vocalizations were given.

Plover 1 returned and landed in the same area at 09:06 after a short flight. At 09:10, the bird in basic plumage returned and landed about 20

meters away. It approached at 09:11 and flew at plover 1. For the next five minutes these two birds engaged in numerous flights and chases. The behavior was similar to the previous bouts except that in most chases the target bird, after beginning in the crouched position (head-down, fanned tail held up and tilted toward the other bird), would leap up at the last possible moment and land behind the onrushing plover. The crouched position was given prior to several aborted chases. In this session of interactions the chases occurred when the birds were closer together (about 1–2 meters apart) and flights were used when the birds were farther apart (about 3–6 meters). A loud noise from a vehicle on a nearby roadway apparently alarmed the birds and they departed at 09:16.

Both plovers returned at 09:17 and landed several meters apart. They made only two or three passes by 09:24, but continued to forage 1–4 meters apart. Several calls were given during this period. The bird in basic plumage moved off about 15 meters at 09:28, but returned to within 3 meters of plover 1 at 09:33. They again foraged within several meters of one another until the other bird left at 09:40. The bird in basic plumage returned to within 8 meters at 09:42 but then quickly flew off about 20 meters and did not return before I left the area at 09:46.

Incident 2

On 18 April 2004, additional interactions were observed in the same mud flat area where Incident 1 was observed five days earlier. After a few chases and short flights, similar to those described above, one of the members of the pair under observation gave a loud and abrupt “klee-ear” call at 09:44. A mixed group of about 100 shorebirds (Black-bellied Plovers and Dunlins) within about 50 meters simultaneously flushed and left the area.

A few minutes later, a third plover joined the pair. One bird exhibited molt (about 20% black on the belly) and the other two were in basic plumage. The molting bird gave an incessant, loud “klee-ear” call. These three birds took turns running at each other, or flying, with the resultant crouching and jumping behavior noted in Incident 1. Within a couple of minutes both of the birds in basic plumage ran toward and then jumped at the third plover. With this, the molting bird gave a loud, shrill “klee-ear” or “klier” (i.e., slightly more abrupt than previously) call and all three birds immediately flushed. This call and flight resulted in or coincided with a major flush of 634 other Black-bellied Plovers and over 1,700 Dunlins present at the site. The other plovers and Dunlins flew out over the bay and briefly engaged in predator avoidance behavior (although no predators were observed). The trio of plovers did not join the others out over the water but instead flew westward over adjacent forested uplands toward another estuary about 5 kilometers distant.

By 10:06, three plovers were again present on the mud flats only 20 meters from where I stood. I assumed that at least two birds were from the earlier group (the molting bird and one of the birds in basic plumage). The third bird had a substantial amount of black on the belly and

was therefore a new participant. One bird gave several “klee-ear” calls and the bird in basic plumage once gave a tern-like and raspy-sounding “kee” call, after which, for about two minutes, there were several parallel walks (Byrkjedal and Thompson 1998) and torpedo runs involving the original molting bird and the bird in basic plumage. In the parallel walks, two birds would crouch down and walk, parallel to one other, for 2 – 3 meters before stopping. The torpedo runs were similar except that one bird followed behind or ran toward the other. None of the runs resulted in an approach to the third plover. During these runs the molting bird frequently gave a “kee-o-ee” call. The bird in basic plumage was silent. After these runs the two birds exchanged approaches, resulting in jumping and flapping upward to a height of about 2.5 meters (much higher than previous jumps I had seen). After this, the two plovers engaged in torpedo runs followed by a 30-meter chase in flight. The two birds landed near another plover that quickly approached them. Both birds moved away, and flew back and landed within 1 meter of the third member of the trio. This bird made a flapping, upward jump and the other two birds flew about 5 meters to the area where the earlier chasing had occurred. Other than this upward jump, this third bird was not involved in any of the physical activities, but it was clearly in the spatial domain of the two primary participants, and may have issued some of the vocalizations heard earlier.

The two more active birds in the trio continued to vocalize, chase and jump until they flew at 10:13. They traveled only about 10 meters and landed in a 3 meter² area where five Black-bellied Plovers – all in nearly complete alternate plumage – stood and had been foraging. Upon landing, all seven plovers stood nearly motionless for about one minute before all began to walk and forage. At 10:20, all plovers to the south of this area flushed and flew north toward more expansive mud flats exposed by the falling tide. The group of five plovers joined the others as they passed over in low flight. The pair of chasing plovers remained, as did the other member of the trio. The pair of plovers stood about 10 meters apart and about 25 meters from the third plover at 10:24. The molting member of the pair flew away at 10:25. Another bird in basic plumage landed about 15 meters from the other bird in basic plumage at 10:27. These two and the other plover remained when I left the area at 10:30.

Incident 3

This particular bout of interactions, also on 18 April 2004, occurred about 150 meters from the other interactions and involved different birds that interacted concurrently with those described in Incident 2. One of the two birds was in nearly full alternate plumage and the other was in basic plumage. In these interactions, the bird in basic plumage rushed at the other plover, and this other bird would jump up with a quick flap of the wings to avoid contact. These birds were never more than 1.5 meters apart when facing each other prior to these interactions. The bird in basic plumage flew away and was replaced two or three minutes later by another bird

in basic plumage. This new bird almost immediately approached the other plover and initiated the same routine.

Incident 4

A single encounter, differing from earlier ones, was observed in the same area as incidents 1 and 2, at 09:10 on 28 April. A bird in basic plumage assumed a crouched position and ran at a plover that was in nearly full alternate plumage. The approaching bird remained crouched and the target bird stood upright. The approaching bird took to flight and the target bird crouched at the last possible moment and lifted its wings straight up as the other bird flew over and struck the lower bird with its feet. The bird in flight landed nearby and the other plover flew away. I saw no other encounters between these or any other birds before leaving at 09:32.

DISCUSSION

The various aspects of behavior I observed were either previously unreported for Black-bellied Plovers in North America, or had been observed under substantially different circumstances. The primary behavioral element I observed was the torpedo run, a behavior most often observed on the breeding grounds. The torpedo run involves two plovers, one or both of which runs at the other. As one bird approaches in a hunched or crouched run with the head held low (Connors et al. 1993), the other crouches down, runs away, or takes flight (see figure 8.11 in Byrkjedal and Thompson 1998). Many of the torpedo runs I observed involved a stationary target bird. Although target birds occasionally took flight, the most common action was to jump up with a few wing strokes when the approaching plover drew near (see below).

The torpedo run has been most strongly associated with European Golden-Plovers (Byrkjedal and Thompson 1998) and American Golden-Plovers (Connors et al. 1993). Torpedo runs have been noted for Black-bellied Plovers in the non-breeding season in Massachusetts (Drury 1961), California (Michael 1935) and South Africa (Turpie 1995). Byrkjedal and Thompson (1998) surmised that torpedo runs used by European Golden-Plovers, even during spring migration when some pairing occurs, were used by males to isolate or possess females and fend off other males, although males will also chase females in this manner.

Plovers may engage in a variety of additional activities while involved in torpedo runs. For example, birds may fan and tilt the tail feathers, and peck at the ground or at debris (Drury 1961). In my observations, only the target bird fanned or tilted its tail, and I did not see pecking at the ground. I also observed wing hanging, a behavior previously noted during breeding and non-breeding seasons in Black-bellied Plovers in North America (Drury 1961) and South Africa (Turpie 1995), and heard a distinct "klee-ear" call, also previously noted from the breeding grounds in both Black-bellied Plovers and American Golden-Plovers (Drury 1961). The tail

fanning while in a crouched position appears similar to the distraction display given by Black-bellied Plovers on the breeding grounds (Höhn 1957). This has also been reported in South Africa (Turpie 1995).

Jumping upward to avoid contact has not been described for Black-bellied Plovers. Other *Pluvialis* plovers engage in "leap-frogging," often in association with torpedo runs, but the actual jumping or "leap-frogging" (see figure 1 in Edwards 1982) is done by the approaching bird (Edwards 1982, Byrkjedal and Thompson 1998). My observations involved jumping by the target bird to avoid physical contact. This behavior was noted in response to both aerial and ground approaches.

The parallel walk is a common behavior during the breeding season in European Golden-Plovers and American Golden-Plovers (Byrkjedal and Thompson 1998), and in Black-bellied Plovers during the non-breeding season in South Africa (Turpie 1995). On the breeding grounds, this behavior occurs when a male defends its territory against an intruding male after eggs have hatched and territory boundaries begin to break down (Byrkjedal and Thompson 1998). In South Africa, the parallel walk occurred during territorial encounters on mud flat foraging areas (Turpie 1995). The parallel walk has the appearance of a ritualized behavior whereby both males walk in parallel (see figure 8.17a in Byrkjedal and Thompson 1998). On the breeding grounds, the parallel walk may escalate to other, more aggressive defensive behavior (Byrkjedal and Thompson 1998).

Three additional aspects of the encounters I observed have not been previously reported for migrant Black-bellied Plovers, if at all: a distinct tern-like "keee" call, the involvement of three birds in encounters, and physical contact between plovers. The "keee" call might be a variant of an alarm call ("kleee") given on the breeding grounds by this species (Paulson 1995) and American Golden-Plovers (Drury 1961). The involvement of multiple birds in territorial or agonistic encounters could reasonably be expected based on the perceived function of torpedo runs during spring (Byrkjedal and Thompson 1998), but this was not clearly specified in the literature (Cramp and Simmons 1983, Paulson 1995, Byrkjedal and Thompson 1998). Although I could find no records of physical contact with other plovers while one bird was in flight, Black-bellied Plovers have been observed striking Long-tailed Jaegers (*Stercorarius longicaudus*) in flight in Alaska (Bent 1929). Edwards (1982) reported physical contact between European Golden Plovers on breeding grounds in Scotland, and Johnson (1941) observed "fights" involving migrant American Golden-Plovers in Indiana. Connors et al. (1993) reported unspecified physical contact (apparently on the ground) between American Golden-Plovers and Pacific Golden-Plovers (*P. fulva*) on the breeding grounds in western Alaska. With the exception of a few other species (e.g. Hamilton 1959, Recher and Recher 1969), encounters involving physical contact are uncommon in shorebirds during migration.

Byrkjedal and Thompson (1998) reported that certain aspects of agonistic and courtship behavior in the *Pluvialis* plovers – for example, the

torpedo run – appeared to be similar in either context. Such behavior would therefore likely be best understood in the context in which it was expressed. In contrast to other *Pluvialis* plovers (Byrkjedal and Thompson 1998), Black-bellied Plovers are not known to establish pair bonds during spring migration (Flint and Kondratjew 1977 [in Byrkjedal and Thompson 1998], Paulson 1995). Consequently, whereas courtship-type behavior in other *Pluvialis* plovers may have a courtship function during spring migration, this is likely not the case with Black-bellied Plovers. This suggests that the behavior I observed was agonistic in nature.

In the non-breeding season, Black-bellied Plovers employ a variety of strategies to maximize intake of prey resources. In some areas an avoidance strategy to maintain foraging territories has been observed (Stinson 1977, 1980). This apparently allows the birds to spend less time in active territorial defense and more time searching for food, a reasonable strategy for a visual forager (Baker 1974), and a means to reduce disturbance of their prey (Byrkjedal and Thompson 1998). The avoidance strategy is not universal, however, as overt territorial behavior has been described in various parts of the species' non-breeding range (Michael 1935, Drury 1961), including areas where avoidance has also been reported (Townshend et al. 1984, Turpie 1995). Moreover, individual Black-bellied Plovers may switch from avoidance to territorial behavior which may be used for a varying duration (from days to months) within a season (Townshend 1981, Byrkjedal and Thompson 1998). Townshend et al. (1984: 158) proposed seven factors that may influence the likelihood that territoriality will occur in this species: 1) unevenness and dissection by creeks of the feeding area, 2) inconspicuousness of cues given by prey, 3) rapid drying out of the substrate, 4) low density of available prey, 5) marked short-term depressions of prey availability and capture rate, 6) high densities of Black-bellied Plovers, and 7) low densities of other bird species feeding on the same prey species. It is not currently possible to support or refute the importance of any of these factors at the Kennedy Creek estuary, although factors 1 (perhaps), 2, 6 and 7 seem likely to apply.

Although the abundance of food resources available to and used by Black-bellied Plovers at Totten Inlet is unknown, it appears plentiful, as these plovers were regularly observed extracting large worms from the mud in all seasons (J. Buchanan, personal observation). I never saw territorial interactions (other than parallel walk and short flights) in any season in several hundred visits to this site prior to those described here. A high density of plovers is one of seven factors identified as having the potential to increase the likelihood of territorial behavior in this species (Townshend et al. 1984). Indeed, Turpie and Hockey (1997) found that the density of plovers influenced prey intake, suggesting a competitive effect; they also reported that plovers had little difficulty meeting their prey requirements. The abundance of Black-bellied Plovers increased dramatically at Totten Inlet in the two decades prior to the observations reported here (Buchanan 2006). Given this increase, I suspect that densities of plovers reached a threshold where mutual avoidance became less effective,

prompting some birds to adopt a more active form of territorial behavior. I have seen numerous instances of such active territorial behavior in spring migration and winter since making the observations reported here.

Territorial behavior has been documented in other shorebird species during the non-breeding season. Recher and Recher (1969) noted an increase in the frequency of aggressive interactions between Semipalmated Sandpipers (*Calidris pusillus*) as the density of the birds increased. Conversely, Sanderlings (*Calidris alba*) at low densities in coastal California maintained foraging territories, whereas the territories broke down when Sanderlings were present at high densities (Myers et al. 1979a, 1979b). It was concluded that Sanderling foraging could be optimized at low densities of competitors (i.e., other Sanderlings), but at high densities too much time would be spent in territorial defense to maintain an adequate level of prey consumption, and therefore territorial behavior was abandoned (Myers et al. 1979b). In short, the abundance or availability of prey influenced to some extent the use of these different strategies (Myers et al. 1979b).

Finally, some of the behavior I noted has not been associated with territorial defense of foraging areas and is related to the breeding period (or courtship), such that the behavioral elements do not typically occur together (Schoener 1971, Goss-Custard 1980, Dugan 1982). For this reason, I suspect that some of the behavior observed was misplaced breeding season behavior expressed south of the breeding grounds. Such behavior is not known for this species (Flint and Kondratjew 1977 [*in* Byrkjedal and Thompson 1998], Paulson 1995), but I speculate that it was stimulated by the increased territorial defense maintained by the plovers following an unprecedented increase in plover abundance at the site.

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