

ance responses of a host species, the Red-footed Booby. *Condor* 99:162–168.

LE CORRE, M., AND P. JOUVENTIN. 1997b. Ecological significance and conservation priorities of Europa Island (western Indian Ocean), with special reference to seabirds. *Terre et Vie* 52:205–220.

LE G

suggesting that female migratory ducks bring their offspring to wintering areas, a pattern similar to geese and swans. This may be facilitated by an unusual strategy of wing molt, in which Harlequin Ducks molt after migrating to wintering areas. Due to winter pairing and strong philopatry in Harlequin Ducks, migration of families may contribute to genetic differentiation among populations.

Key words: brood abandonment, Harlequin Duck, *Histrionicus histrionicus*, migration, parental care, population structure.

Los Juveniles de *Histrionicus histrionicus* Migratorios Acompañan a las Hembras a las Áreas de Invernada

Resumen. Presentamos evidencia de que los juveniles de *Histrionicus histrionicus* acompañan a sus madres desde los arroyos de reproducción hasta las áreas costeras de muda o invernada. Las observaciones indicaron que todos los grupos sobrevivientes de hembras y crías abandonaron juntos las áreas de reproducción. Más adelante observamos algunos miembros de grupos familiares cerca unos de otros en la costa, sugiriendo que habían llegado juntos y luego se habían separado. Observamos grupos familiares en las áreas de invernada en agosto y septiembre. Los grupos familiares tendieron a separarse rápidamente, aunque algunos miembros mantuvieron contacto por más de cinco meses. A nuestro entender, esta es la primera evidencia de que las hembras de patos migratorios llevan a sus crías a los sitios de invernada, un patrón similar al de los gansos y cisnes. Esto podría ser facilitado por una estrategia poco usual, en la que *H. histrionicus* muda las plumas de las alas después de migrar hacia las áreas de invernada. Debido a la formación de parejas en invierno y a la fuerte filopatría en *H. histrionicus*, la migración de familias podría contribuir a la diferenciación genética entre poblaciones.

The age at which juveniles separate from their parents can be predicted from theories of parent-offspring conflict (Carlisle 1982). Parents should abandon their young when prospects for future fitness through abandonment are greater than fitness gained from attending the present brood. Among waterfowl there are two broad patterns of brood abandonment. In swans and geese (Anserini), which have long-term pair bonds, juveniles generally accompany both parents throughout the first year of life, staying with them during both migratory journeys between breeding and wintering grounds (Prevett and MacInnes 1980). In contrast, in seasonally monogamous ducks (Anatini, Aythyini, Mergini), males of migratory species abandon their mates, usually before young hatch, while females accompany their young for a variable period but typi-

vent, mottled yellow and gray legs and feet, dusky faces, and occasionally, notched tail feathers.

On wintering areas, we defined a "family" as an association between one adult female and one or more juveniles in which the adult female had full old primaries, indicating recent arrival, and assumed a leading or vigilant role. To avoid duplicate recording of families, we report separate families only if they were seen concurrently, were separated in time by at least 10 days (this is the average time to the loss of primaries, FC unpubl. data), or if females were identified.

We recorded composition of all Harlequin Duck groups to determine the frequency of family groups and the social choices of juveniles in all locations in 1999 and at Hornby Island and Cape Lazo in 2000. We defined a group as one or more individuals separated from others by at least 10 m. Surveys conducted at the same location on different days may have included juveniles sampled on previous days. We did not attempt to correct for duplicate sightings, but conducted only one survey in any location on any day.

We captured three family groups, one at Cape Lazo in 1999, and one each at Cape Lazo and Hornby Island in 2000 (families had four, four, and two juveniles, respectively) using mist nets and decoys. We marked all individuals with tarsal bands and nasal disks in both years, and with external radio transmitters in 2000. We conducted 10-min to 2-hr behavioral observations on the two families marked at Cape Lazo on four and five occasions in 1999 and 2000, respectively. We observed both juveniles from the family at Hornby Island on three occasions one and two days following capture; both died shortly thereafter. During observations we recorded the relative locations and social interactions of family members.

RESULTS

We were able to monitor the fates of 15 families that were radio-marked at breeding areas. No female abandoned her brood prior to migration from the breeding stream. When both the female and her brood survived (three cases), the entire family departed at the same time. For the remaining females, either the female died (five cases) or the brood died (seven cases).

We observed two cases of at least temporary adoption on the breeding streams. One female added a duckling to her brood of 6 for at least 14 days. One duckling whose mother died joined a female that had lost her brood and appeared to migrate with her, as both disappeared from the stream at the same time. We also observed one case of brood amalgamation and one case of at least temporary brood mixing.

At wintering areas we resighted two families that had been marked at the breeding streams. Family members were sighted in the same general area (within 15 km), but were not observed to associate with each other.

We observed 25 different Harlequin Duck families

some family-like groups were unrelated, because we observed one group that could not have been a true family, and adoption and brood amalgamation in breeding areas has been observed in this and in other studies (Bengston 1966, Rodway et al. 1998).

The arrival of entire families at wintering areas has implications for population genetic structure, demographics, and conservation. If juveniles arrive at the molting or wintering area of their mothers, then they may find themselves in the same wintering locations as their siblings from multiple breeding seasons, given high site fidelity of females to molting and wintering

- CASSIRER, E. F., AND C. R. GROVES. 1991. Harlequin Duck ecology in Idaho: 1987–1990. Idaho Department of Fish and Game, Boise, ID.
- COOKE, F., G. J. ROBERTSON, C. M. SMITH, R. I. GOUDIE, AND W. S. BOYD. 2000. Survival, emigration, and winter population structure of Harlequin Ducks. *Condor* 102:137–144.
- DIAMOND, S., AND P. FINNEGAN. 1993. Harlequin Duck ecology on Montana's Rocky Mountain Front. USDA Forest Service, Rocky Mountain District, Lewis and Clark National Forest, Choteau, MT.
- EADIE, J. M., M. L. MALLORY, AND H. G. LUMSDEN. 1995. Common Goldeneye. *In* A. Poole and F. Gill [EDS.], *The birds of North America*, No. 170. The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, DC.
- HOHMAN, W. L., C. D. ANKNEY, AND D. H. GORDON. 1992. Ecology and management of postbreeding waterfowl, p. 128–189. *In* B. D. J. Batt, A. D. Afton, M. G. Anderson, C. D. Ankney, D. H. Johnson, J. A. Kadlec, and G. L. Krapu [EDS.], *Ecology and management of breeding waterfowl*. University of Minnesota Press, Minneapolis, MN.
- JOYNER, D. E. 1977. Behavior of Ruddy Duck broods in Utah. *Auk* 94:343–349.
- KUCHEL, C. R. 1977. Some aspects of the behavior and ecology of Harlequin Ducks breeding in Glacier National Park, Montana. M.Sc. thesis, University of Montana, Missoula, MT.
- LANCOT, R., B. GOATCHER, K. SCRIBNER, S. TALBOT, B. PIERSON, D. ESLER, AND D. ZWIEFELHOFER