5) The stepping-stone model (Jenni 1974, Pitelka et al. 1974, Pienkowski & Greenwood 1977)
Hypothesis: This hypothesis is concerned with the evolutionary route, rather than the ecological selection pressures, producing polyandry. Polyandry evolved in species that primitively had a double clutching system (e.g. Temminck's Stint Calidris temminckii). A trade-off in the female between incubation ability and the ability to compete for further mates resulted in sex-role reversal and polyandry.

Evidence:

a. In arctic sandpipers synchrony of laying implies little opportunity for females to remate. There is no convincing reason why an increase in competitive ability should decrease the ability of females to incubate alone.

b. There is no close taxonomic relationship between double clutching and polyandrous species.

c. In some polyandrous species there is a tendency for females to share incubation with their mates.

Conclusion : Sex-role reversal did not evolve via double-clutching.

Double clutching itself could have evolved (i) from double brooding in monogamous species, or (ii) through mate desertion and attempted polygamy. It is possible that double clutching evolved via the first route in Mountain Plovers Charadrius montanus (where mate change does not normally occur between clutches) and by the second route in sandpipers.

Other environmental influences on the evolution of polyandry that are discussed in this paper include the possibility that single parents have greater reproductive success than two parents, that long breeding seasons may increase the opportunities for polyandry and short seasons increase the chance for the female to desert without risking her mate deserting in response, that global or local sex ratios affect the mating possibilities, and that female dominance and territoriality are related to the reversed sex dimorphism of many shorebirds.

Characters that probably favoured the frequent evolution of polyandry in shorebirds include male parental care, the need for only one parent to tend the young, and small clutch size and the ability of females to lay many clutches.

References:

Emlen,S.T. & Oring,L.W. 1977. Ecology, sexual selection and the evolution of mating systems. Science 197: 215-223.
Graul,W.D. 1974. Adaptive aspects of the Mountain Plover social system. Living Bird 12: 69-74.
Graul,W.D., Derrickson,S.R. & Mock,D.W. 1977. The evolution of avian polyandry. Amer. Nat. 111: 812-816.
Jenni,D.A. 1974. Evolution of polyandry in birds. Amer. Zool. 14: 129-144.
Maynard Smith,J. 1977. Parental investment: a prospective analysis. Anim. Behav. 25: 1-9.
Parmelee,D.F. & Payne,R.B. 1973. On multiple broods and the breeding strategy of arctic Sanderlings. Ibis 115: 218-226.
Pienkowski,M.W. & Greenwood,J.J.D. 1979. Why change mates? Biol. J. Linn. Soc. 12: 85-94.
Pitelka,F.A., Holmes,R.T. & MacLean,S.F.Jr. 1974. Ecology and evolution of social organization in arctic sandpipers. Amer. Zool. 14: 185-204.

HUMBER OIL SPILL

The Humber Estuary in eastern England has reached the newspaper headlines on several occasions in the last few months. The efforts of the Greenpeace organisation to publicise the serious effects of pollution from a Titanium plant at Grimsby (see BBC Wildlife 1983 1: 50-51), were rather overshadowed by the spillage of 6000 tonnes of crude oil into the estuary. The spillage occurred when an incoming, fully-laden tanker hit a pier at Immingham, on the southern shore of the estuary, on 28 September 1983. The resultant slick polluted a large proportion of the estuary.

The incident is of considerable interest, as it is the first time that such extensive oiling has occurred within a British estuary. The incident happened during a period of heavy wader migration. A coordinated wildfowl and wader count just prior to the spillage, made by the Birds of Estuaries Enquiry (BoEE) counting teams, revealed over 22,000 waders and 7,000 wildfowl on the estuary. Sample counts following the oiling showed that up to 20% of all birds counted were oiled. This included many waders. Less than 150 corpses, mainly gulls, were found, although 400 live birds were reported to be 'seriously oiled' and presumably dying.

It thus seems that the immediate effects of the spillage were surprisingly slight, although we cannot be sure how many corpses of the smaller species of waders were not found during searches. The longer-term consequences may, however, be more serious, since the combined effects of the oil and the dispersants used to break it up, resulted in large-scale mortality of intertidal invertebrates, thus reducing the food supply of waders. The full scale of this mortality is not yet known, although data is being collected. The BoEE coordinated counts will continue throughout the winter, to monitor the effects on the Humber bird populations.

Mike Moser, British Trust for Ornithology, Beech Grove, Tring, Herts. HP23 5NR, U.K.