Reproductive Failure of Harlequin Ducks

by Sam Patten

The reproductive failure of harlequin ducks in the oil spill area is postulated to be a chronic effect of petroleum exposure through contaminated intertidal food. Blue mussels appear to be the most likely source of contamination. Blue mussels concentrate and hold pollutants in their tissues. Restoration studies have documented high concentrations of petroleum compounds known as polynuclear aromatic hydrocarbons (PAHs) remaining in mussels, in the byssal thread mats which anchor the mussels to the bottom, and in the underlying substrates in western Prince William Sound in 1991. Because harlequin ducks consume entire mussels, they ingest petroleum hydrocarbons in mussel tissue, on the shell surface, and in attached byssal threads and sediments. Harlequin ducks collected in 1989-1990 in western Prince William Sound and Southwest Kodiak contained oiled food items in their gullets as well as petroleum residues in liver tissue and bile. Experimental studies have demonstrated that single small doses of petroleum can cause reproductive failure in some seabirds. Searches of U.S. Coast Guard files revealed that approximately 90 blue mussel beds may retain *Exxon Valdez* oil in western Prince William Sound. Field checks indicate additional previously unreported oiled mussel beds in the Sound and along the Kenai coast. Oil also remains associated with dispersed blue mussels in a number of sheltered locations currently under investigation. Extensive oiling of Kenai Fjords National Park is also well documented, and it is reasonable to suspect that there has been some degree of injury to harlequin ducks there.

Restoration

The ultimate goal of current research is the restoration of breeding harlequin ducks to the oil spill area. To achieve this, scientists should determine the geographic extent of the reproductive failure, define the breeding habitat requirements of harlequins, and determine whether hydrocarbon residues are currently present in harlequins in order to clarify the link to persistent oil contamination. If the observed failure of reproduction is related to the contaminated food chain, remaining oil pollution should be removed before restoration can take place, otherwise measures to increase productivity will be fruitless. In some cases these mussel beds remain grossly contaminated. Knowledge of habitat requirements of breeding harlequin ducks may prove valuable for restoration actions such as habitat acquisition and mitigation measures, protection of non-federal lands, and development of marine sanctuaries.

A proposed restoration project would continue to monitor harlequin reproductive success and document the characteristics of harlequin duck nesting habitat. Biologists would conduct surveys to locate harlequin pairs at stream mouths in late spring. This would be followed by trapping in selected stream estuaries. Harlequin females flying to streamside nest sites in early summer would be mist-netted and radio-tagged. Nest sites, broods, and feeding areas will be located by following the radio-tagged hens through the summer nesting and brood-rearing period. Brood count surveys would be conducted in shoreline habitats in late summer in western Prince William Sound and selected areas of the Kenai coast and Afognak. If nests are located in the Sound, Afognak or Kenai areas, researchers would note harlequin nesting habit characteristics in these areas. Results from the oil spill areas would be compared to unoiled control areas on Afognak Island.

Blood samples would also be collected from breeding harlequins in unoiled areas and from molting harlequins in oiled areas. Blood and tissue samples may also be taken from collected ducks. These samples would be analyzed for normal blood parameters and presence of elevated levels of haptaglobins and interleukins, blood proteins indicating stress and suppressed immune systems. Tissue samples (i.e. fat, liver, and bile) would be analyzed for presence of petroleum hydrocarbons. Feather samples would be examined for presence of vanadium, a trace metal indicating petroleum exposure. Fecal samples from flightless birds trapped during the molt would be collected to determine presence or absence of petroleum exposure by means of florescence testing. The proportion of mussels in the harlequin diet would be investigated by dissection of set-aside harlequin carcasses from the "spill bird morgue" in Anchorage and examination of their gullet contents. The information gathered in this study could be used in developing measures to restore breeding harlequin ducks to the oil spill area.

The contaminated food chain remains a significant concern. Because of anoxic conditions created by the dense byssal thread mat in mussel beds, crude oil is trapped and remains unweathered. Thus it retains toxic components. Harlequins eating oiled mussels will remain exposed to contaminated food unless some action is taken to clean oiled mussel beds. If this exposure is sufficient to cause reproductive impairment in these seaducks for many years, local extinction may result in spill areas. Continuing to explore the relationship between the consumption of oiled foods by harlequin ducks and reproductive impairment should be considered.

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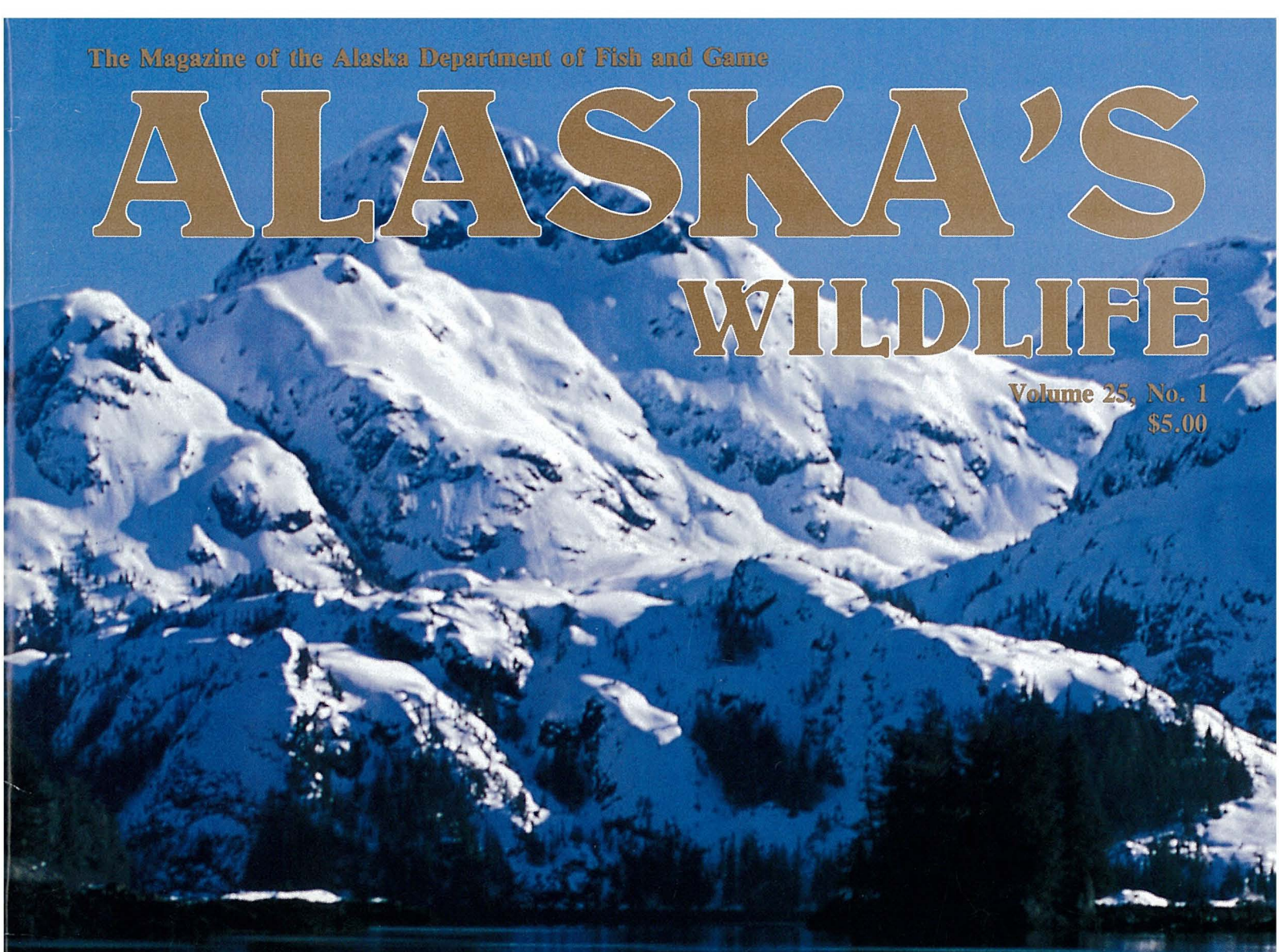

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