

EAGLE RIVER FLATS WATERFOWL DIE-OFF

BACKGROUND

Site

Fort Richardson consists of 71,372 acres in southcentral Alaska, between the city of Anchorage on the west and the community of Eagle River-Chugiak on the east. The installation is bounded by the waters of the Knik Arm of the Cook Inlet on the north and by the Chugach State Park on the south and southeast. The Eagle River Flats (ERF) are located in the northwest sector of Fort Richardson and consist of about 11,200 acres. The ERF area is fed by the Eagle River and is frequently flooded by tidal action from the Knik Arm. The Eagle River drainage basin consists of approximately 192 square miles, of which 20 square miles are occupied by glaciers. The chief source of Eagle River is meltwater from the Eagle Glacier, which is augmented by meltwater from 11 smaller glaciers and two principal tributaries, Raven Creek and South Fork Eagle River. The mean annual flow of Eagle River is 314.7 million gallons per day (MGD). Flows range from 16.9 to 1435.5 MGD, with the largest flows occurring in late summer due to glacier melt. Located upstream on the Eagle River beyond Fort Richardson boundaries is the Eagle River sewage treatment plant discharge site and a closed landfill along the riverside. The ERF serve as an impact area for 0.50-caliber and M-60 machine guns, 40 mm/90 mm recoilless rifles, M203 grenade launchers, rockets, and missiles. Chemical rounds include riot control agents, white phosphorus, smokes, and incendiary rounds. The ERF delta has been the primary impact area for Fort Richardson since World War II.

Waterfowl Background

The ERF are important staging areas for ducks, geese, and swans during the spring and fall migrations. Spring waterfowl populations have been estimated to reach 3,000 to 5,000. There appear to be four major areas of waterfowl concentrations on the flats. During the summer, populations decline significantly, but a resident population of ducks and shorebirds remains on the flats. Waterfowl die-offs were recorded during late summer and early fall of 1983 and 1984 on the ERF. Waterfowl die-offs have been estimated to have numbered 1,500 to 2,000 birds. No significant die-offs were reported during 1985 migration periods. Waterfowl did not mass in large numbers on the ERF during the 1985 fall migration period, possibly due to extensive firing into the impact area and unusually mild fall temperatures.

ACTION TO DATE

1982 and 1983

In August of 1982, an unusually large number of dead ducks were found near Fox Point on the ERF. This prompted the interest of Army biologists. During August of 1983, the Army again noticed a large number of duck carcasses on the ERF. The area was searched on foot three times during early September, resulting in the discovery of 228 carcasses. Fifteen were sent to the U.S. Fish and Wildlife Service (FWS) National Wildlife Health Laboratory (NWHL) in Madison, Wisconsin, for necropsy. It appeared from the condition of the carcasses that most of the ducks found died during June and July.

More searches were conducted during October, 1983, resulting in a total of 368 carcasses found that year. A total of 22 were sent to NWHL for necropsy. Gross examination of the samples did not result in any diagnosis, except that the birds apparently died suddenly, but not as a result of artillery impact or concussion (Table 1).

1984

As a result of the 1983 surveys, more frequent searches were conducted by Army and FWS personnel in 1984. During August, about 140 carcasses were found, and at least 17 were sent to NWHL. In late August, the Director of Engineering and Housing at Fort Richardson, Col. H.A. Froehle, sent a request to the Aberdeen Proving Ground in Maryland for assistance in collection and analysis of soil, water, and air samples on the ERF.

In September, 1984, the NWHL, in a telephone conversation with an Army biologist, reported that botulism had been conclusively ruled out, and that necropsies on one group of birds had shown congested lungs, suggestive of an inhaled toxicant. Also, one bird had lesions on its liver, also indicative of the possibility of a toxicant. However, lungs were negative for a number of organics (smoke shell components?) (Memo - C. Franson to D. Derksen, 9/18/84). The files do not contain the final necropsy/analytical reports on the 1984 birds.

In September of 1984, another search was conducted on the Flats. Twenty-nine carcasses were found, and four were collected to be sent to NWHL. In late October, another phone call to the Army from the NWHL (10/25/84) indicated that analysis for organic components had been negative (Table 2).

1985

The FWS had been involved in some of the carcass collections in 1983 and 1984, but the first formal involvement began in February, 1985, with a letter from the Regional Director (RD) to the Commander of Fort Richardson. In this letter, the FWS suggested a cooperative FWS, Army, and Alaska Department of Fish and Game (ADF&G) plan to identify the cause and reduce mortality to the waterfowl. In March, a coordination meeting was held. Subsequently, the RD formally requested authorization to continue monitoring and sampling, and proposing a joint study under terms of the "Cooperative Plan for Management of Fish and Wildlife Resources on Army Installations in Alaska." Authorization to enter the ERF was received in May, 1985. Field work began that month. An aerial survey conducted by the Army on May 12 recorded at least 1,500 ducks, 39 swans, 5 sandhill cranes, 6 bald eagles, 50 ravens, and several hundred gulls. On May 13, white phosphorus smoke bombs were fired onto the flats, and a survey on May 14 found half the number of waterfowl as on May 12. However, there were 22 eagles, most feeding on waterfowl carcasses, that day. In the two and one-half hour collection period on May 16, over 70 carcasses were noted, and an eagle and two ducks were recovered. These, plus another eagle recovered a week earlier, were sent to NWHL (Table 3).

During June, 1985, staff from the Army Environmental Hygiene Agency (USAEHA) sampled sediments and water at seven sites on the ERF and two control sites at Goose Bay, across the Knik Arm. Macroinvertebrate collections were also

made. Results, quantified in a report from the Environmental Hygiene Agency on February 7, 1986, were inconclusive. The latest piece of correspondence in the file is a copy of a "disposition form" from Colonel Johnston of Fort Richardson stating that the Natural Resources Branch staff will:

- a. Continually monitor and protect waterfowl populations of Eagle River Flats (ERF) under the guidelines established by AR 200-1 and AR 420-74.
- b. Resample macroinvertebrates on ERF and control areas of Goose Bay with technical support from USAEHA personnel.
- c. Systematically search ERF for sick and recently dead birds throughout spring, summer, and fall to collect waterfowl tissue and blood serum for analysis.
- d. Coordinate efforts with U.S. Fish and Wildlife Service, Wildlife Biologists, and Law Enforcement personnel because of the federal protective status given to migrating birds under investigation.

This, apparently, is where the situation remained until now. On January 30, 1987, the RD again wrote to Col. Johnston identifying the Eagle River Flats issue as a high-priority FWS concern, and requesting cooperation and coordination on continued studies.

ANALYTICAL RESULTS TO DATE

Analyses of birds, soil, and water have, to date, resulted in no positive findings. Botulism has been ruled out, and apparently heavy metals are considered an unlikely possibility as a cause of the die-offs. The most likely possibilities, based on analytical results to date, appear to be:

1. Phosphorus - a component of smoke bombs; possibly inhaled.
2. Nitrates
3. An undetermined inhaled toxicant such as vinyl chloride, a component of plasticizers in explosives, which is a cholinesterase inhibitor. The four ducks tested (1984) for cholinesterase inhibition showed negative results, but it is possible that post-mortem changes could have affected cholinesterase activity (Hill and Fleming, 1982). Acute toxicity tests of inhaled vinyl chloride on guinea pigs resulted in congestion and edema of lungs (EPA, Ambient Water Quality Criteria for Vinyl Chloride, 1980), which was one of the recurring findings in the waterfowl samples.

STUDY NEEDS

A study plan for 1987 has not been developed yet. Meetings with Army, FWS, ADF&G, and other interested people are in the planning stages. Analytical funds are available for this fiscal year. The Regional Environmental Coordinator has been contacting various agency personnel, including those from Patuxent, in an effort to determine the best way to design the study. Discussions need to be held among all parties involved to determine what specific chemicals are being used in the ERF, in order to determine what tests should be conducted and, therefore, how the samples should be handled. Another consideration is the safety factor; there are concerns that it is not safe to conduct searches of the area because of unexploded ammunition. One possibility for the basics of the study, as outlined by the Environmental Coordinator, is presented below:

1. Place cages with live birds on the flats, and monitor their survival. Dead and sick birds would be immediately preserved for laboratory analysis.
2. Blood serum from sick birds would be taken and analyzed. The kidney, liver, and digestive tract would be taken from dead birds for laboratory analysis.
3. An attempt will be made to use both Patuxent and Aberdeen (military) laboratories to analyze blood and tissue obtained.
4. A continued monitoring program of dead birds should occur on the Flats during the spring and fall migration period.

There may be difficulty in gaining access to the ERF area to carry out the study; cages may need to be emplaced via helicopter or boat, and would need to be designed accordingly.

An attempt should be made to correlate bird behavior and possible illness with military activity on the flats. This may be accomplished by the strategic placement of observer(s) who could watch for changes in the behavior of birds, presence of gas or smoke clouds, etc.

Table 1. Samples of waterfowl collected on Eagle River Flats and analytical findings, 1983.

BIRD	DATE COLLECTED	RESULTS	DATE
Pintail	9/30/83	Too decayed; not examined	11/4/83
Mallard 3427-33124	9/30/83	Gunshot Brain ChE activity 0% inhibited	11/4/83 10/17/84
Mallard 3427-33125	9/30/83	Adequate fat; lungs congested; very dark blood; swollen, congested kidneys Brain ChE activity 0% inhibited	11/4/83 10/17/84
Mallard 3427-33126	9/30/83	No obvious lesions; too decomposed for further tests	11/4/83
Shoveler 3410-33026	9/83	Held for possible future analysis	
Mallard 3410-33027	9/83	Abundant fat; lungs somewhat congested; spleen very congested	9/28/83
Green-winged teal 3410-33028	9/16/83	(collected with shotgun) Lungs congested	9/28/83
Green-winged teal 3410-33029	9/83	Liver pale; excess mucus in gut	9/28/83
Green-winged teal 3410-33030	9/83	Abundant fat; too decomposed for further analysis	9/28/83
Green-winged teal 3410-33031	9/83	Held for possible analysis in future	
Green-winged teal 3410-33032	9/83	rotten	9/28/83
Green-winged teal 3410-33033	9/83	Adequate fat; heart congested; liver discolored. Lungs fluid-filled	9/28/83
Green-winged teal 3410-33034	9/83	Heart normal. Minute white foci in liver; spleen very congested	9/28/83
Green-winged teal 3410-33035	9/83	Abundant fat; minute white foci in liver; lungs dark, appear to be fluid-filled	9/28/83
Wigeon 3410-33036	9/83	Minimal fat. Occas. small white foci in liver; gunshot/peritonitis	9/28/83

Table 1, continued

BIRD	DATE COLLECTED	RESULTS	DATE
Wigeon 3410-33037	9/83	Held for possible future analysis	9/28/83
Pintail 3410-33038	9/83	Held for possible future analysis	9/28/83
Pintail 3410-33039	9/83	Adequate fat. Lungs fluid-filled (probably post-mortem)	9/28/83
Pintail 3410-33040	9/83	Held for possible future analysis	9/28/83
Pintail 3410-33041	9/83	Held for possible future analysis	9/28/83
Mallard 3427-33127	10/17/83	Abundant fat. Blood almost black. Clots; lungs wet; kidneys congested Brain ChE activity 0% inhibited	11/4/83 10/17/84
Mallard 3427-33128	10/17/83	Blood very dark; lungs fluid- filled, either hemorrhage or consolidation present; kidneys congested Brain ChE activity 0% inhibited	11/4/83 10/17/84
Pintail 3427-33129	9/30/83	Rotten	10/17/84

Additional Lab Comments:

1. Darkness of blood raises possibility of nitrate/nitrite poisoning.
2. No indication of infectious agent.
3. Trauma not suspect.
4. Brain ChE activity (in 4 samples) was normal.
5. Good nutritional state; i.e., acute toxicity indicated. Rules out heavy metals.
6. Botulism tests negative so far.
7. Phosphorus a possibility; samples being analyzed.
8. Organophosphates should be considered.
9. 8/21/84: Four intestinal tracts were examined for phosphorus: results showed 8500 ppm dry weight phosphorus; 6200 ppm; 1960 ppm; and 2500 ppm. Lab didn't know if this was white phosphorus (toxic) or red phosphorus (non-toxic), but considered levels unusually high.
10. High levels of blood methemoglobin, associated with nitrate poisoning. However, this could be due to autolysis.

Table 2. Samples of Waterfowl Collected on Eagle River Flats and Analytical Findings, 1984.

BIRD	DATE COLLECTED	RESULTS	DATE
Pintail	8/10/84	All these samples are listed in the files as having been collected in 1984; they were apparently sent to NWHL, but no official analytical results were found in the files; notes from two telephone communications are in the files, listing fluid in lungs, lesions on the liver of one bird, negative for botulism, and negative for a number of unnamed organics.	
Green-winged teal	8/10/84		
Snipe	8/10/84		
Green-winged teal	8/10/84		
Mallard	8/10/84		
Snipe	8/10/84		
Mallard	8/10/84		
Pintail	8/10/84		
Mallard	8/10/84		
Mallard	8/10/84		
Pintail	8/9/84		
Mallard	8/9/84		
Snipe	8/9/84		
Mallard	8/7/84		
Green-winged teal	8/7/84		
Pintail	8/10/84		

Table 3. Samples of Birds Collected from Eagle River Flats and Analytical Findings, 1985.

BIRD	DATE COLLECTED	RESULTS	DATE
Bald Eagle 5616-001	5/16/85	Nephrosis (kidney failure); poor nutritional condition	7/30/85
Bald Eagle 5616-002	5/85	Nephrosis; mycotic esophagitis; sarcosporidiosis; elevated liver lead level	7/30/85
Shoveler	5/16/85	Marked post-mortem changes; good nutritional condition; Botulism ruled out; ---	8/7/85
Green-winged teal	5/16/85	histopathology non-contributory; trauma to one of the teal	
Tundra Swan	5/12/85		
Green-winged teal	5/14/85		
Dowitcher	5/14/85		

REFERENCES

Hill, E.F., and W.J. Fleming. 1982. Anticholinesterase Poisoning of Birds: Field Monitoring and Diagnosis of Acute Poisoning. Environ. Toxicol. and Chem. 1:27-38.

Environmental Protection Agency. 1980. Ambient Water Quality Criteria for: Vinyl Chloride. 83 pp.