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# AN ASSESSMENT OF DAMAGES ON SEAGULLS CAUSED BY THE NAKHODKA OIL SPILL IN ISHIKAWA PREFECTURE

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## ABSTRACT

Petroleum oil concentration in a fecal pellet of seagulls was surveyed at a sand beach in Hakui, Ishikawa Prefecture, Japan, immediately after the oil spill by an oil-tanker *Nakhodka*. The flock of seagulls consisted mainly of herring gull (*Larus argentatus*). The concentration of petroleum oil in the pellet was determined as n-hexane extractable material (HEM).

The HEM concentrations in the population in Hakui was obviously higher compared to the those in an unpolluted beach in Himi, Toyama prefecture. The result indicates that seagulls inhabiting lightly polluted beach took the spilled oil by ingesting oil polluted foods.

## INTRODUCTION

On 8 January 1997, the heavy oil that spilled from an oil-tanker *Nakhodka* drifted ashore at Kaga City located at the southernmost coast of Ishikawa Prefecture. After then, the oil reached throughout the coast of Ishikawa Prefecture by 15 January.

A number of seabirds were directly injured by the oil adhering on the plumage. A total of 1315 oil-smothered birds (including 900 corpses) were captured by local governments and volunteers on the coast of the Japan Sea during the period from 8 January to 8 March. About a half of them (615 birds) were captured along the shorelines in Ishikawa Prefecture (Mizutani 1998). Ancient murrelet (*Synthliboramphus antiquus*) and rhinoceros auklet (*Cerorhinca monocerata*), which obtain their food by diving, were the dominant species of the 615 captured birds (Mizutani 1998). On the other hand,

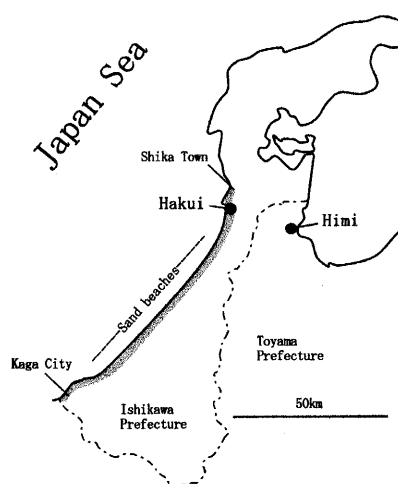
seagulls did not appear to be deadly damaged by oil adhesion, since only a few birds had been captured in Ishikawa Prefecture (Ministry of Environment 1997). Seagulls are euryphagous seabirds. They prey on various coastal animals and dead fish on the shore as well as living fish. The spilled oil should have inflicted indirect damages on the seagulls mainly by ingestion. Petroleum oil concentration in seagull's fecal pellet was surveyed immediately after the oil spill at a shore in Ishikawa Prefecture. The survey was performed to assess the effect of the spilled oil on seagulls inhabiting sand beaches in Ishikawa Prefecture.

## METHODS AND STUDY SITES

Fecal pellets of seagull were collected on 31 January and 23 February 1997 at a lightly polluted sand beach in Hakui City (Figure 1). The drifted oil on the beach formed sticky particles (diameter 1-20 cm). Although the local government and volunteers made efforts to capture the oil, particles were still found sparsely on the beach during the sampling period. The flock of seagulls consisted mainly of herring gull (*Larus argentatus*) and a few common gull (*Larus canus*).

The spilled oil had not reached the shorelines of Himi City, Toyama Prefecture (Fig. 1). Seagull's fecal pellet was collected on 23 February at an unpolluted sand beach in Himi. No sticky oil particle was observed. The flock of seagulls consisted almost completely of herring gull (*Larus argentatus*).

The fecal pellets with the surface sand were collected after the flock of seagulls was driven away. The samples were preserved in a deep freezer (approximately -22°C) for analysis. The concentration of petroleum oil in the pellet was determined as n-hexane extractable material (HEM) by JIS method (Japanese Industrial Standards



**Figure 1** Map of study sites.  
Gray area shows sand beaches.

1993). Extractable materials that may be determined are relatively non-volatile hydrocarbons, vegetable oils, animal fats, waxes, soaps, greases, and related materials. The solvent was distilled away from the extract at 80 °C and the remaining HEM was desiccated and weighed.

## RESULTS AND DISCUSSION

The visual inspection in February revealed that about 10 % of herring gull population at the lightly polluted beach Hakui had oil spots on their abdominal plumage. About 12 % of the herring gull population which migrated from Kaga City to Shika Town (about 100km distance) in February, also had oil spotted plumage (Ishikawa Prefecture 1998). The herring gull population in Hakui is regarded as a typical population that suffered damages by the spilled oil in Ishikawa Prefecture. On the other hand, no seagull with oiled spots was observed in Himi in February.

Means of HEM concentration in Hakui population were 8 to 12 times higher than that in Himi (Table 1). Birds ingest oil when preening oiled plumage, however, about a half of the fecal pellets collected in Hakui exhibited higher HEM values than the maximum value in Himi. Seagulls inhabiting the Hakui shores evidently took spilled oil by ingesting polluted foods.

Based on a variety of information sources, physiological effect of oil ingestion was reviewed by Kajigaya and Oka (1999). As a result of a functional disorder of alimentary canals, the ingestion of oil caused water and osmotic imbalance in bird body as well as nutritional disturbance. A pathological anatomy of dead ancient murrelets and rhinceros auklets, which were found after the *Nakhodka* oil spill, revealed that the birds suffered from intestinal disorders (intestinal bleeding and desquamation of mucosa) even if the

**Table 1** Frequency distribution of HEM concentration in the seagull pellet.

Location	Range of HEM (mg pellet <sup>-1</sup> )										Mean ± SD	
	0	10	20	30	40	50	60	70	80	90		100<
Hakui (January)	3	7	5	2	2	1		1				20.5 ± 17.7
Hakui (February)	6	3	5		3	1	1	1	1		1	30.0 ± 44.3
Himi (February)	14	5										2.6 ± 4.5

The HEM concentrations in Hakui population were significantly higher than those in Himi population (Kruskal-Wallis test,  $p < 0.001$ ). (Nagasaka 1997)

amount of oil in the intestinal canal was the slightest (0.1 % of the intestinal content) (Kajigaya 1998). A several seagulls in Hakui also suffered from these functional disorders of intestinal canals.

In contrast, no detectable HEM was observed in the surface sand collected at both beaches. A detailed analysis is needed to look into the effect of spilled oil on the entire coastal biota. Amount of oil that birds ingest when they contact polluting oils in the natural environment has not been determined (Leighton 1993). Although the accuracy of the measurement in the present study was inferior to other methods (eg. gas chromatographic / mass spectrometric method), analysis of HEM concentration in the fecal pellets provided a simple and effective measure to determine the amount of oil ingested by birds at accidents where a prompt response is required. The analysis would also be useful to diagnose the condition of polluted birds.

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