

CHLORINATED HYDROCARBONS IN HUMPBACK WHALES (*Megaptera novaeangliae*)  
FROM SOUTHEAST ALASKAN WATERS

John Peard and John Calambokidis  
CASCADIA RESEARCH COLLECTIVE  
P.O. Box 1434  
Olympia, Wa. 98507

8 October 1981

Report prepared for:  
Sea Search  
P.O. Box 93  
Auke Bay, Alaska 99821

## INTRODUCTION

Chlorinated hydrocarbon contaminants have been found in the tissues of animals from all parts of the world and these chemicals are now considered ubiquitous in the global ecosystem. Relatively high concentrations of these contaminants have been found in the tissues of marine mammals (Risebrough 1978). This is partly the result of the high level on the food chain many marine mammals occupy, the large blubber layers of these animals that serve as a depository for these fat soluble pollutants, and their feeding in the marine environment which serves as a sink for the long-lived chlorinated hydrocarbon contaminants. Chlorinated hydrocarbons have been linked to reproductive problems in several marine mammals including the California sea lion (DeLong et al 1973, Gilmartin et al 1976) and ringed seals (Helle et al 1976a, 1976b).

The humpback whale (*Megaptera novaeangliae*) occurs in all oceans of the world. In the Pacific, humpbacks are seasonal migrants found along shallow coastal shelves. The whales winter in tropical regions such as the Hawaiian Islands, Baja California and the Mariana Islands. They summer in cold temperate areas, from central California north through Alaska, west through the Aleutians, and south to Honshu Island, Japan (U.S. Marine Mammal Commission 1980). Feeding is believed to occur primarily on the summer grounds. We know of no published reports on the concentration of chlorinated hydrocarbons in humpback whales from the north Pacific stock. This paper reports on the levels of chlorinated hydrocarbon contaminants in the blubber of two humpback whales stranded in Seymour Canal, southeast Alaska in 1981.

## LAB METHODS

Blubber samples were weighed, ground with sodium sulfate, and soxhlet extracted with hexane for 24 hours. The hexane extract was concentrated to approximately 50 mls. and a portion was dried over low heat to determine the lipid weight of the sample. Five mls. of the hexane extract was cleaned up on a florisil column. The column contained 30 grams of 1.2% deactivated florisil topped with 1.5 centimeters of sodium sulfate. The sample was eluted from the column as three fractions - fraction #1 used 70 mls. hexane, fraction #2 used 140 mls. of hexane, and fraction #3 used 350 mls. of a hexane:methylene chloride mix (70:30). The separate fractions were concentrated and analyzed by gas chromatography. A control sample, using all chemicals and glassware used in the process, was run along with the blubber samples to check for any possible contamination due to lab materials or methods. Standards of the chemical pollutants investigated were run through a florisil column and percent recovery was determined. Two different gas chromatography columns were used for the analysis. Polychlorinated biphenyls (PCB) were analyzed on a 10% DC-200 column containing a one-inch alkaline pre-column - column temperature was 215° C and detector temperature was 300° C. The remainder of the contaminants reported were analyzed on a 1.5% OV-17 + 1.95% QF-1 column - column temperature was 200° C, detector temperature was 300° C.

## CHEMICALS AND EQUIPMENT USED

Glass-distilled hexane, acetone, isooctane and methylene chloride - Burdick and Jackson Laboratories

Sodium sulfate (granular, soxhlet extracted) - J.T. Baker Chemical Co.

Florisil (60/100 mesh, activated 650° C) - Kensington Scientific Corporation.

Pesticide standards - E.P.A. Triangle Park Laboratories

Two Hewlett-Packard 3380A Integrators

Two Hewlett-Packard 5700A Gas Chromatographs with electron-capture ( $\text{Ni}^{63}$ ) detectors

Mettler H72 balance

Perkin-Elmer AD-2 autobalance

Buchi rotoevaporators

Hamilton microliter syringe

## RESULTS

The percent lipids and concentrations of hexachlorobenzene (HCB) - a fungicide, p,p' DDE - a metabolite of the insecticide DDT, p,p' DDD - a metabolite of the insecticide DDT, dieldrin - an insecticide, heptachlor epoxide - a metabolite of the insecticide heptachlor, oxychlordane - a component and metabolite of the insecticide chlordane, and polychlorinated biphenyls (PCB) - an industrial chemical, are given in Table 1.

The control sample contained no detectable residues at the levels investigated. Percent recovery of known standards through the florasil column ( at levels approximating the concentration in the samples) were as follows: HCB - 88.2%, p,p' DDE - 87.4%, p,p' DDD - 88.2%, dieldrin - 83.8%, heptachlor epoxide - 86.0%, oxychlordane - 85.3%, and PCB - 95.3%.

TABLE 1 : Residues in Humpback Whale Blubber Samples

note: residues reported on a parts per million (ppm) wet weight basis

Sample	% lipids	ppm HCB	ppm p,p' DDE	ppm p,p' DDD	ppm PCB	ppm dieldrin	ppm heptachlor epoxide	ppm oxychlordane
#1 - female <u>Windfall</u> collected 29 March	78.4	.039	.085	T	.087	T	N.D.	N.D.
#2 - male <u>Swan Island</u> collected 28 March	69.3	.21	.15	.05	.13	.067	.013	.010

T - trace

N.D. - not detected

This work was carried out in the environmental pollution laboratory of The Evergreen State College, Olympia, Wa.

## DISCUSSION

Seven chlorinated hydrocarbon contaminants were identified and measured in two humpback whale blubber samples. Although the sample size is very small, the residues reported here indicate that humpback whales from S.E. Alaska carry relatively low residues of chlorinated hydrocarbon pollutants. The levels reported are more than 1000 times lower than the levels of chlorinated hydrocarbons linked to reproductive problems in the California sea lion (Gilmartin et al 1976) and Ringed seals (Helle et al 1976a, 1976b).

Taruski et al (1975) reported on chlorinated hydrocarbon concentrations in humpback whales from the Atlantic (Table 2). Their four samples contained residues approximately 10 to 100 times higher than the whale samples reported here.

We know residue levels of two other marine mammals that were sampled recently from Alaskan waters. Four blubber samples of northern fur seals (*Callorhinus ursinus*) collected from the Pribilof Islands in 1980 contained DDE levels ranging from 2 to 13 ppm and PCB levels ranging from 1.5 to 4 ppm (Cascadia Research, unpublished data). Seventeen bowhead whale (*Balaena mysticetus*) blubber samples collected from N. Alaskan waters (1976-1979) contained low residues of chlorinated hydrocarbon contaminants - .04-.18 ppm HCB, .005-.05 ppm DDE, and .034-.098 ppm dieldrin (National Marine Fisheries Service, unpublished data).

TABLE 2 : Residues in Blubber Samples of Humpback Whales

Residues are parts per million (ppm), on a wet weight basis

Sample	Location	ppm DDE	ppm DDD	ppm DDT	ppm Total DDT	ppm dieldrin	ppm PCB
pregnant female killed in fishery	Novia Scotia	15	3.4	4.7	23.1	N.D.	5.4
juvenile male stranded	New Jersey	3.3	1.0	3.3	7.6	1.2	6.0
juvenile male biopsy	Antigua	1.0	0.1	0.3	1.4	N.D.	1.3
mature male biopsy	Saint Kitts	0.9	0.3	0.9	2.1	0.1	1.5

REFERENCES CITED

- DeLong R.L., W.G. Gilmartin and J.G. Simpson. 1973. Premature births in California sea lions: Association with high organochlorine pollutant residue levels. Science 181: 1168-1170.
- Gilmartin W.G., R.L. DeLong, A.W. Smith, J.C. Sweeney, B.W. DeLappe, R.W. Risebrough, L.A. Griner, M.D. Dailey, and D.B. Peakall. 1976. Premature parturition in the California sea lion. J. Wildl. Dis. 12: 104-115.
- Helle E., M. Olsson and S. Jensen. 1976a. DDT and PCB levels and reproduction in ringed seal from the Bothnian Bay. Ambio 5: 188-189.
- Helle E., M. Olsson and S. Jensen. 1976b. PCB levels correlated with pathological changes in seal uteri. Ambio 5: 261-263.
- Risebrough R.W. 1978. Pollutants in Marine Mammals, a literature review and recommendations for research. Marine Mammal Commission, Wash. D.C., Report No. MMC - 77/12, 64 pp.
- Taruski A.G., C.E. Olney and H.E. Winn. 1975. Chlorinated hydrocarbons in Cetaceans. J. Fish. Res. Bd. Can. 32(11): 2205-2209.
- U.S. Marine Mammal Commission. 1980. Humpback whales in Glacier Bay National Monument, Alaska. Report No. MMC - 79/01, 44 pp.