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Accumulation of Persistent Organic Pollutants in trout from the Canadian Rocky Mountains

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Accumulation of Persistent Organic Pollutants in trout from the Canadian Rocky Mountains

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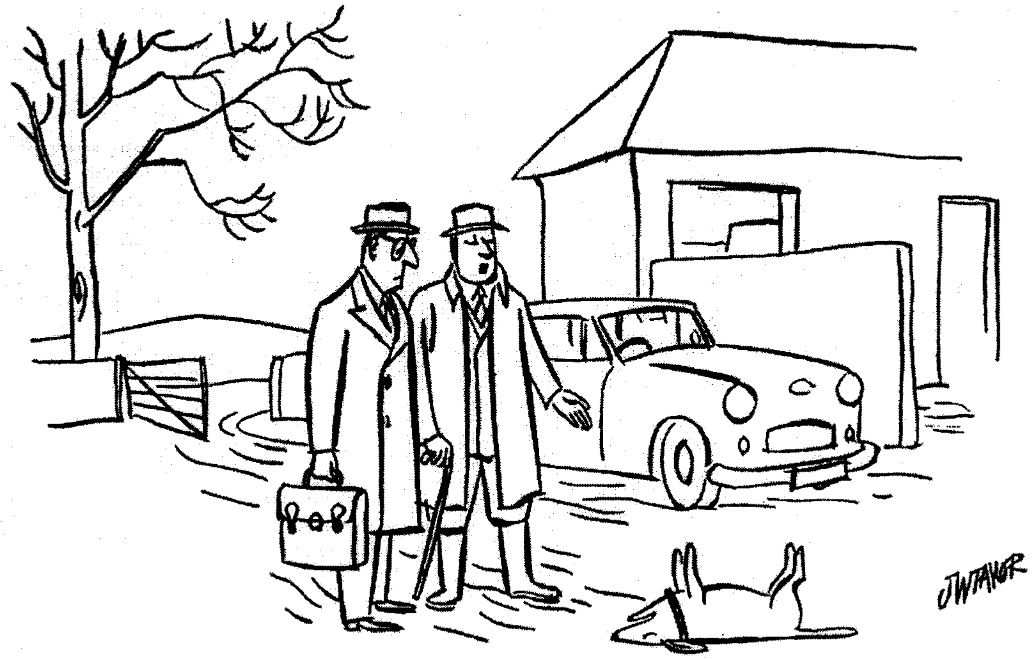

"This is the dog that bit the cat that killed the rat that ate the malt that came from the grain that Jack sprayed."

"While the object of progress is doubtless that modern, comfortable man should have leisure to contemplate his situation and to devise even better and safer ways to maintain it, great care must be taken to ensure that short-sighted action does not nullify the benefits already won, especially if there is the added risk of destroying the machinery that created them in the fist place and might conceivably repeat the process. "

- Gerald T. Brooks, 1974.

ABSTRACT

The accumulation of persistent organic pollutants (POPs) in mountain regions was investigated by collecting trout from eight lakes spanning an elevation gradient of 760 to 2360 m.a.s.l. in the Canadian Rocky Mountains. All lakes were located within (or close to) national parks in Alberta and British Columbia. Concentrations of several organochlorine compounds increased significantly with lake elevation. The compounds, which increased the most with elevation, were the less volatile organochlorine pesticides (OCPs) (e.g. dieldrin, DDTs). The relationship was not as strong for the more volatile organochlorines (e.g. HCHs, HCB). Biological factors such as growth dilution of contaminants appears to be a major determinant of contaminant concentrations of organochlorine compounds in alpine lakes. Principal component analysis (PCA) showed that POP composition in trout relate strongly to octanol/water partition co-efficient (K_{ow}) and lake elevation.

RÉSUMÉ

L'accumulation des polluants organiques persistants (POP) dans les régions de montagnes a été examinée dans des échantillons de truites provenant de huit lacs situés sur une pente d'élévation de 760 à 2360 m dans les Rocheuses canadiennes. Tous les lacs se trouvent dans des parcs nationaux de l'Alberta et de la Colombie-Britannique ou à proximité de ces parcs. On constate une hausse importante des concentrations de plusieurs organochlorés à mesure que l'élévation augmente. Les composés qui ont augmenté le plus avec l'élévation étaient les pesticides organochlorés (POC) les moins volatils (notamment la dieldrine et le DDT). Ce rapport n'était pas aussi marqué dans le cas des organochlorés plus volatils (notamment les HCH et les HCB). Des facteurs biologiques, comme le taux de croissance, semblent être plus importants que l'élévation dans la répartition des BPC dans les lacs alpins. L'analyse de la composante principale (ACP) a permis d'établir que les concentrations de POP dans les truites sont fortement liées au coefficient de partage octanol/eau (K_{ow}) et à l'élévation des lacs.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

GLOSSARY OF ACRONYMS, SYMBOLS, AND ABBREVIATIONS

ANOVA	analysis of variance
BAF	bioaccumulation factor
BCF	bioconcentration factor
BMF	biomagnification factor
CB	chlorobenzene
DCM	dichloromethane
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DEP	dependent variable
DOC	dissolved organic carbon
ECD	electron capture detector
f	fugacity (Pa)
GC	gas chromatograph
H	Henry's law constant ($Pa \cdot m^3 \cdot mol^{-1}$)
H_T	T-adjusted H ($Pa \cdot m^3 \cdot mol^{-1}$)
HCB	hexachlorobenzene
HCH	hexachlorocyclohexane
IND	independent variable
IUPAC	International Union of Pure and Applied Chemistry
K	partition coefficient
Kbio	biota/water partition coefficient
Koc	soil/water partition coefficient
Kow	octanol/water partition coefficient
masl	meters above sea level
MDL	method detection limit ($pg \cdot g^{-1}$ dry weight)
NLET	National Laboratory for Environmental Testing
OC	organochlorine
OCP	organochlorine pesticide
OCN	octachloronaphthalene
PBDE	polybrominated diphenyl ether
PC	principal component
PCA	principal component analysis
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-*p*-dioxin
PCDF	polychlorinated dibenzofuran
POP	persistent organic pollutant
P_L	subcooled liquid vapor pressure (Pa)
R	gas constant ($Pa \cdot m^3 \cdot mol^{-1} \cdot K^{-1}$)
S	solubility
SD	standard deviation
SE	standard error
SVOC	semivolatile organic compound
TBB	tribromobenzene
TTBB	tetrabromobenzene
VOC	volatile organic compound
ΣPCB	sum of all PCB congeners

1.0 GENERAL INTRODUCTION

The production and use of synthetic organic chemicals has increased exponentially over the second half of the 20th century (Schwarzenbach *et al.* 1993). Numerous compounds are continuously introduced into the environment in large quantities (e.g. solvents, components of detergents, dyes and varnishes, additives in plastics and textiles, chemicals used for construction, antifouling agents, pesticides, and flame retardants). Until recently, the novelty, convenience, and profit of these chemicals came first, and environmental questions often were asked later, if ever. The contamination of water, soil, and air with these compounds is and will continue to be a major environmental concern.

Some of the chemicals of greatest concern worldwide are known as synthetic organochlorines or persistent organic pollutants (POPs). These chemicals are created by combining molecules of existing elements (usually carbon, hydrogen, and chlorine) into combinations not naturally present in nature. Structurally, most POP chemicals have in common one or more cyclical ring structures of an aromatic or aliphatic nature, a lack of polar functional groups, and a variable amount of halogen substitutions (usually chlorine). Their molecular mass typically is in the range of 200 to 500 $g{\cdot}mol^{-1}$. Structural similarities result in other shared characteristics such as low solubility in water, high lipophilicity (accumulation in fat), resistance to degradation (having extended half-lives), and high inherent toxicity (Bernes 1998, Johansen 2003). In addition some POPs have the potential to evaporate and travel long distances (Wania and Mackay 1993a, Wania and Mackay 1995, Wania and Mackay 1996, Wania 2003, Wania and Mackay 2003). Of the hundreds of thousands of organic chemicals in existence relatively few substances possess the necessary properties to make them POPs. With respect to the degree of persistence, mobility and toxicity, only those compounds which occur at the extreme ends of a distribution curve for all organic compounds would articulate the required traits to classify them as persistent organic pollutants (Fig 1.1). Important dates relating to the rise and the fall of persistent organochlorine compounds can be seen in Table 1.1.

Of the pollutants released into the environment by human activity, POPs are among the most dangerous. At sufficiently high levels, these chemicals can be highly toxic causing an array of adverse effects such as death, disease, and birth defects among humans and animals. POPs have been implicated in the rising incidence of certain cancers (e.g. breast, prostate), rising rates of endometriosis, allergies and hypersensitivity, damage to the central and peripheral nervous systems, as well as reproductive disorders such as infertility, declining sperm counts, fetal malformations, neurobehavioral impairment, and immune-system dysfunction (Johansen 2003).

The potential harm that these compounds can exert has led many governmental agencies to restrict or ban the use, sale, and production of many POPs. The POPs of greatest concern are the organochlorine pesticides (OCPs) (such as DDT, mirex, hexachlorobenzene (HCB), endrin, aldrin, dieldrin, chlordane, toxaphene, heptachlor), solvents, industrial chemicals including polychlorinated biphenyls (PCBs), and the super-toxic by-products such as dioxins and furans (PCDD/F) which comprise the 'dirty dozen' (Wania and Mackay 1996, Kalff 2002, Johansen 2003).

In spite of the limitations imposed regarding their usage in North America and Western Europe, several POPs are omnipresent in the environment due to improper storage and disposal as well as their ongoing use in other parts of the world (Kalantzi *et al.* 2001, Wania 2003, Kajiwara *et al.* 2004, Ueno *et al.* 2004). The fact that POPs have been detected in remote regions such as the tropics and the arctic where emission sources are minimal or nonexistent, is evidence of their omnipresent nature (Anderson *et al.* 1988, Barrie *et al.* 1992, Lockhart *et al.* 1995, Muir *et al.* 1988, Norstrom *et al.*, 1988, Muir *et al.* 1990, Norheim *et al.* 1992, Norstrom and Muir 1994, Volder and Li 1995, DeMarch *et al.* 1998).

In particular, the contamination of arctic aquatic food chains by organochlorines (OCs) has been documented during the past decades (Barrie *et al.* 1992, Thomas *et al.* 1992, Lockhart *et al.* 1992, Muir *et al.* 1992). Arctic ecosystems are particularly vulnerable to contaminants for several reasons: 1) low temperatures tend to lead to partitioning to aerosols and rapid deposition., 2) low annual primary productivity provides a limited sink for contaminants, leading to increased concentrations in the biota, 3) low ambient temperatures decrease OC degradation rates, 4) fat-based trophic energy transfer in arctic food webs enhances the transfer of these lipophilic contaminants through the food chain, 5) slow growth rates and longevity of arctic freshwater fish increase the likelihood of higher contaminant burdens relative to similar species in temperate climates (Lockhart *et al.* 1992, Schindler *et al.* 1995, Allen-Gil *et al.* 1997).

1.1 GLOBAL TRANSPORT OF PERSISTENT POLLUTANTS

As mentioned previously POPs are chemicals of ubiquitous concern, occurring in virtually every medium around the world. Atmospheric transport is one of the most efficient and rapid ways for the transfer of POPs. Evidence indicates that most POPs are volatile enough to evaporate and deposit, (i.e. cycle) among air, water, and soil at ordinary environmental temperatures (Wania and Mackay 1993a, Wania *et al.* 1996, Wania and McLachlan 2001). Normally, atmospheric dispersion is assumed to follow a dilution pattern, where higher concentrations of pollutants are found closer to point source regions. This pattern does not always hold true with semi-volatile organic compounds (SVOC) for which some compounds exhibit a latitudinal gradient from lower concentrations in temperate regions to higher levels in high latitude sites, e.g. HCB in tree bark (Simonich and Hites 1995a) or hexachlorocyclohexane (HCH) in seawater (Iwata *et al.* 1993, Wania *et al.* 1996). Agrell *et al.*, (1999) found an inverse relationship between atmospheric levels of PCBs and latitude in the Baltic Sea region that was strongest for more volatile congeners.

Detectable or elevated concentrations of selected POPs in colder regions suggest that a compound's physical and chemical properties along with environmental factors govern global distribution more than source proximity and transport mechanisms (Wania and Mackay 1993a). In the early 90's, Wania and Mackay (1993a, 1993b) proposed that a global fractionation process occurs. They suggested that members of the POP family are deposited in different geographical regions on their atmospheric transit toward the North and South Poles.

There are several processes that contribute to the global fractionation theory (Fig. 1.2). One of these processes is 'cold condensation' which refers to the tendency for airborne chemicals to condense onto terrestrial and aquatic surfaces at low temperatures (Wania and Mackay 1993a, Mackay and Wania 1995). Cooler temperatures favor greater absorption of these compounds to atmospheric particulate matter (Wania and Mackay 1993b, Wania and McLachlan 2001, Wania 2003) which then deposits on the surface of terrestrial and aquatic ecosystems. At cooler temperatures, natural decomposition reactions are also slowed down leading to greater persistence of POPs. Net deposition of these chemicals is further increased by the fact that at cooler temperatures water solubility of these chemicals is higher which inhibits the evaporation of POPs. Another process in the model is 'global distillation', which describes chemical transfer of volatiles from warm regions dominated by evaporative processes to regions where cold condensation is favored. Finally 'global fractionation' results in chemical accumulation along a temperature gradient caused by different volatilization and deposition rates for different compounds according to their chemical and physical properties. In this step, individual POP compounds separate in the atmosphere in a fashion similar to the fractionation process that chemists use to separate or isolate individual components of a mixture. On a smaller scale the above process is known as the 'grasshopper effect'. It involves short cycles of evaporation, atmospheric transport, and condensation at lower temperatures that normally coincide with seasonal temperature changes (Wania and Mackay 1996).

Some chemicals are more susceptible to migration than others. Highly volatile compounds with vapor pressures above 1.0 Pa are not likely to partition out of the gaseous phase, while less volatile compounds with vapor pressures below 0.001 Pa are not likely to escape into the gaseous phase (Wania and Mackay 1996). The compounds most likely to migrate are the semi-volatile compounds, which have a vapor pressure between 0.01 and 1.0 Pa (Wania and Mackay 1996). These compounds have relatively high mobility and are volatile enough to undergo long range transport, but still have a tendency to condense at colder temperatures; in the Arctic these compounds include HCB, HCH, and lighter-weight PCBs (Wania and Mackay 1993a, Wania *et al.* 1999, Wania and Mackay 1999, Wania 2003). Chemicals that preferentially accumulate in mid-latitudes normally have vapor pressures between 0.001 and 0.01 Pa and have relatively low mobility (Fig. 1.2) (Wania and Mackay 1996).

However it is important to note that other factors complicate the effectiveness of the global distillation model and it may be unwise to over-interpret global distribution patterns using simple models. First, POPs have been released from many locations over many decades. Thus, the single-pulse concept which describes a batch of POPs migrating uniformly is simplistic. Samples from point source areas may be affected by other chemical emissions in the vicinity which would distort the chemical gradient (Wania 2000). Secondly, and perhaps most importantly, the 'retention effect' in which certain compounds are more strongly retained by environmental compartments, such as water and soil (depending on their chemical characteristics) complicates the fractionation model (Mackay and Wania 1995). For example multimedia partioning in the aquatic environment implies POPs occur both dissolved in water and sorbed to colloidal and particulate matter, especially of organic origin. This partioning process ultimately affects the rate of evaporation because only dissolved chemicals can volatilize. Thus, the fate of POPs in an aquatic system is strongly influenced by the dynamics of organic carbon, and hence trophic status (Wania 2000). Partioning into media other than water and air (such as soil, sediment, fish, ect.) may result in degradative losses and longer retention times. POPs buried in soil or sediment could result in permanent retention which would decrease the quantities of POPs traveling towards colder regions.

For the above reasons it is important to examine several chemical properties when constructing global fate models. Several physical properties can be predicted from structure including vapour pressure (P), solubility (S), Henry's constant (H_c), volatility (P), water/octanol partioning constant ($K_{ow)}$ water/soil or sediment partioning constants (K_{oc}), water/biota partioning constant (K_{BIO}). The key parameter is K_{ow}. From this value the other properties can be estimated from linear regressions (Mill 2004). From these chemical properties more complex models can be constructed that take into account not only the influence of temperature and variability of the environment but also variation in degradation rates and phase partioning coefficients. The resulting models are dynamic, non-steady state models which investigate target chemicals in soil, water, and air in different climatic zones (Scheringer *et al.* 2000).

1.2 BIOACCUMULATION AND BIOMAGNIFICATION

Since OCs are hydrophobic and lipid soluble they rapidly pass from water to living tissue in a phenomenon known as bioaccumulation. Bioaccumulation is the result of more rapid uptake and storage of a stable substance in living tissue than its release, which leads to higher concentration in the individual than in the environment (Bernes 1998). This concentration is in large part responsible for the toxicity of POPs, as they become more toxic at high levels. Uptake involves the absorption to the body surface or gills of lipophilic (high K_{ow}) chemicals, or their uptake in food. Absorption is the chief route of accumulation in small organisms because of their larger surface to volume ratio and elevated metabolic rates. Direct contaminant uptake from water is less important for larger organisms. Most of their contaminant burden is obtained as a result of consuming contaminated food. Reduced metabolic rates (including reduced excretion rates) in larger organisms allow for stronger partioning of POPs to tissues rich in organic matter such as lipids (Gobas *et al.* 1993a). Borgmann and White (1992) documented that adult lake trout appear to accumulate somewhere between 80 and 100 percent of their POP burden from their food and the balance, if any, through direct uptake from the water.

Bioaccumulation is a combination of bioconcentration and biomagnification. Bioconcentration is when the "chemical concentration in an aquatic organism exceeds that in the water as a result of exposure to waterborne chemicals" (Gobas and Morrison 2000). The bioconcentration factor (BCF) is:

$$BCF = [OC_{organism}]/[OC_{water}]$$

Typically bioconcentration factors are calculated in the laboratory measurements which tend to negate concentration of OCs through feeding.

Organochlorines are also capable of being biomagnified up the food chain (Fig. 1.3). Biomagnification is "the process in which chemical concentration in an organism achieves a level that exceeds that in the organism's diet, due to dietary accumulation" (Gobas and Morrison 2000). The biomagnification factor (BMF) is:

$$BMF = [OC_{organism}]/[OC_{food}]$$

When both concentration factors are incorporated into the same equation it's called the bioaccumulation factor (BAF), which is:

$$BAF = [OC_{field\ exposed\ organism}]/[OC_{water}]$$

BAF factors of PCBs from water to predators may be as high as ten million times reaching highest concentrations in the long-lived animals at the top of the food chain (Barrie *et al.* 1992, Lockhart 1995).

Rasmussen *et al.* (1990) and Cabana and Rasmussen (1994) observed that trophic position (length of food chain) is an important variable when comparing POP levels in fish from adjacent lakes. They grouped Ontario lakes into three classes based on the length of the pelagic food chain. Class 1 lakes had the shortest food chains where, in the absence of other prey, the lake trout feed preferentially on certain macrozooplankton and benthic invertebrates. In class 2 lakes, pelagic forage fish feed on the plankton and benthic invertebrates and are prey for larger fish such as lake trout. The fish from class 3 lakes are typically the most contaminated (barring the presence of a point source). In addition to macrozooplankton and forage fish, these lakes also contained *Mysis*, a large predatory zooplankton which is prey for forage fish. By having the longest food chain, class 3 lakes experience the greatest biomagnification. POP concentration increased 3.5 fold with each increase in trophic position (Rasmussen *et al.* 1990).

1.3 POLYCHLORINATED BIPHENYLS

PCBs are a class of 209 discrete chemical compounds, called congeners, in which one to ten chlorine atoms are attached to biphenyl (Fig. 1.4). Throughout this thesis, individual PCB congeners will be identified with their corresponding International Union of Pure and Applied Chemistry (IUPAC) number. PCBs were commercially produced as complex mixtures for a variety of uses. Their chemical stability, low flammability, good heat conducting properties, low electrical conductivity and dielectric properties, as well as their resistance to oxidation, acids, and bases, made them a useful tool in many industrial applications (Hutzinger *et al.* 1974, Mason 1996, Erickson 1997). They have been employed as dielectric fluids in capacitors and transformers, as fire retardants, as plasticizers in adhesives, and as industrial fluids in hydraulic systems, gas turbines, and vacuum pumps. Other uses include heat transfer applications, textiles, surface coatings, sealants, carbonless copy paper, wax polishes, sealing compounds, synthetic rubber, paints, and inks (Hutzinger *et al.* 1974, Mason 1996, Erickson 1997).

The manufacturing of PCBs has been carried out in many countries. The major producer, Monsanto Corporation (St. Louis), marketed PCBs under the trade name Aroclor® from 1929 to 1977. Other trade names include Chlophen, Kanechlor, and Fenchlor (Mason 1996, Erickson 1997). The most common PCB mixtures produced were known as Aroclor mixtures 1242 and 1254, containing 42% and 54% chlorine by weight. From the late 1950s on, PCB production increased dramatically peaking at the end of the 1960s. After discovery of their wide spread environmental occurrence in the 1970s, PCB production decreased. Worldwide production of PCBs is estimated at 1.2×10^9kg (Hansen 1994). A brief history of PCBs can be seen in Figure 1.5.

The reason for the ubiquitous distribution of PCBs lies in their persistence (i.e.the very stability which made them so useful across a range of technical applications). Sooner or later, the products containing these chemicals broke, decomposed or were destroyed by fire – but the PCBs themselves usually survived and, as a result of them, escaped more or less unchanged into the environment (Bernes 1998).

The physical properties of PCBs are important to an understanding of their environmental properties. Most PCB congeners are colourless, odorless crystals; most mixtures are clear viscous liquids whereas the higher chlorinated mixtures are more viscous (i.e. Aroclor 1260 is a sticky resin). Although the physical and chemical properties of PCBs vary widely across homolog series (based on the number of chlorines) (Table 1.1), PCBs in general have low water solubilities and low vapour pressures (Erickson 1997). Higher chlorinated PCBs, those with five or more chlorine atoms, are generally more persistent and accumulate in lipid-rich tissues to a greater extent than lower chlorinated PCBs, which are more easily hydroxylated and excreted by fish and mammals (Hutzinger *et al.* 1974, Bernes

1998), while lower chlorinated PCBs are more susceptible to environmental transport (Wania and Mackay 1993a, Wania and Mackay 1996, Agrell *et al.* 1999).

The environmental toxicology of PCBs is difficult to determine. PCBs can by no means be regarded as a uniform group of compounds with similar biological effects. Many PCB congeners have been found in the natural environment and have been shown to have widely varying effects on living organisms. Much of the damage is caused by a limited number of congeners which make up a very small proportion of the total quantity of PCBs, but which are toxic even at extremely low concentrations (Bernes 1998). For example congeners such as PCB 52 (2,5,2'5'-tetrachlorobiphenyl) and PCB 136 (2,3,6,2'3'6' hexachlorobiphenyl) are considered 'non-toxic' while other isomers such as PCB 77 (3,4,3'4'-tetrachlorobiphenyl) and PCB 169 (3,4,5,3'4'5'-hexachlorobiphenyl) are two of the most potent congeners known. Some congeners can potentiate and a few antagonize the action of other congeners (Erickson 1997).

From the 1930s on, there were several reports of workers involved in industrial production of PCBs having suffered liver damage, which in some cases proved to be fatal. In 1968 it became even clearer that PCBs posed serious health risks, when several thousand people in Japan were affected by a strange illness. Many of them exhibited a broad spectrum of symptoms, such as changes to the skin and mucous membranes, dizziness, coughing, abdominal pain and damage to the central nervous system. Several months later it emerged that all the sufferers had eaten rice oil produced at the same mill which used PCBs in a heat exchanger (Bernes 1998).

Then in the 1970s, recruitment to the Swedish seal populations was so inadequate that they appeared to be heading towards a rapid collapse – with 80 per cent of the females infertile (Bernes 1998). The majority of the seal cows examined exhibited pathological uterine changes, and in many cases these resulted in sterility. Comparisons with analyses of toxic pollutants revealed a correlation between the uterine anomalies observed and substantially elevated concentrations of contaminants particularly PCBs. It gradually emerged that high PCB levels in seals were associated not only with reproductive disorders, but with a whole disease complex which could be directly life-threatening. The symptoms included damage to the skin, claws, intestines, kidneys, adrenal glands and skeleton (Bernes 1998).

1.4 ORGANOCHLORINE INSECTICIDES

Chemicals have been used for pest control since the ancient Greek, Roman, and Chinese civilizations about 3 millennia ago. The first generation of pesticides, based on arsenic, copper and sulphur, were predominant in the late 1800s to 1940s but were not widely used and consequently have not appeared as a global concern. The second generation of pesticides, the organochlorine pesticides (Fig. 1.6), have very different physico-chemical properties (Table 1.2) from the first generation pesticides. At room temperature, most OC insecticides are waxy solids that are stable and resistant to both biodegradation and ultraviolet radiation due to the abundance of inactive carbon-carbon, carbon-hydrogen, and carbon-chlorine bonds (Hassall 1990). Metabolic degradation occurs in target and nontarget organisms or environmentally by either chemical, photolytic, or microbial processes, all of which are slow. As a result, some organochlorine insecticides persist in the environment for more than 30 years. At first these pesticides were praised as being the perfect insecticides, being relatively cheap to manufacture, strikingly effective against numerous insect pests and yet apparently safe to man and other warm blooded animals (Hassall 1990). However; their lipophilic and rather water-insoluble nature means that these compounds tend to accumulate in the fatty tissues of birds, fish, and mammals. These lipophilic molecules tend to enter organisms readily, but once inside, have difficulty escaping.

Dichlorodiphenyltrichloroethane (DDT) or 1,1,1-trichloro-2,2-bis(p-chlorophenyl) ethane was the first highly successful synthetic organic insecticide. DDT was synthesized in 1874, although its insecticidal properties were not reported until 1939, which led to its widespread use as a general pesticide in agriculture. DDT use for disease control began during the Second World War and was the main product used in the global efforts (supported by the World Health Organization) to eradicate malaria in the 1950s and 1960s. Paul Müeller received the Nobel Prize in medicine in 1948 for this momentous discovery (Hansen 1994, Mason 1996, Bernes 1998). A brief history of DDT can be seen in Figure 1.5. DDT continues to be used to control malaria, particularly in tropical regions and in the world's poorest countries (although DDT will likely be phased out throughout the world under the Stockholm Convention). No man-made chemical, not even penicillin, streptomycin, and the sulphonamides have saved as many lives as DDT (Hassall, 1990).

There are three main families of OC insecticides. The first group is the DDT-type, which includes compounds such as 1,1-dichloro-2,2-bis(4-chlorophenyl)-ethane (DDD, TDE, rhothane), methoxychlor, and dicofol (Kelthane). Although effective as insecticides or acaricides, they have relatively low acute mammalian toxicity. They have been widely used in both agricultural and public health practices. DDT is manufactured by condensation of chloral and chlorobenzene in the presence of an excess of concentrated sulfuric acid. The crude product consists of some 80% of the desired *p,p'*-compound together with approximately 20% of the *o,p'*-isomer and a trace of the *o,o'*-isomer. Only the *p,p'*-isomer has significant insecticidal activity (Brooks 1974a). The principal metabolite of DDT, dichlorodiphenyldichloroethylene (DDE), is produced via enzymatic dehydrochlorination. DDE is highly persistent, but has only slight insecticidal activity. In birds and mammals it is slowly metabolized to the carboxylic acid DDA and is sufficiently water soluble to be excreted (Brooks 1974b, Ayres and Hellier 1998). Another metabolite of importance is dichlorodiphenyldichloroethane (DDD). DDD is produced by reductive chlorination in microsomes, dead tissues, and microorganisms. Unlike DDE, DDD has insecticidal properties and has been manufactured and used as a pesticide (Hassall 1990). The parent compound is estrogenic in birds and rats (Cremlyn 1978) and is a strong neurotoxin (Hassall 1990). The lethal mechanism of action of these neurotoxic compounds is a persistent opening of the sodium channels in neurons, resulting in repetitive firing of action potentials which leads to a sodium-potassium imbalance in nerve membranes. The metabolites 3-methylsulfonyl-DDE and *o,p'*-DDD are toxic to cells in the human adrenal cortex (Lindhe *et al.* 2002).

The second major group of organochlorine insecticides is the chlorinated cyclodiene compounds which include aldrin, dieldrin, endrin, heptachlor, endosulfan, and chlordane. These pesticides are produced by condensing hexachlorocyclopentadiene with suitable cyclic hydrocarbons containing five or seven atoms of carbon. The reaction, involving a diene and a dienophile is termed the Diels-Alder reaction (Brooks 1974a, Cremlyn 1978). Dieldrin is formed by the epoxidation of aldrin (Hassall 1990), a highly toxic chemical used as a pesticide and banned in the U.S. in the 1980's. It is the most powerful human carcinogen of all OC pesticides and is metabolized in mammals to water-soluble, excretable compounds

(Ayres and Hellier 1998). Endrin was marketed as a pesticide starting in 1951. Its precursor, isodrin, is also insecticidal, but was never sold as a pesticide (Brooks 1974a). The technical mixture endosulfan consists of 66% α-endosulfan and 34% β-endosulfan. It is rapidly hydrolyzed in mammals to a diol and sulfur dioxide (Brooks 1974b). Chlordane, whose precursor is chlordene (Ayres and Hellier 1998), is a technical mixture which typically consists of approximately 26 compounds, 25% of which is γ -(or *trans*) chlordane (Ayres and Hellier 1998). It may consist of as many as 120 compounds, including α -(or *cis)* chlordane, heptachlor, and nonachlor (Hassall 1990) depending on the conditions during production. Its principal metabolite, oxychlordane and the α-isomer are more toxic than the γ-isomer (Hassall 1990). It is believed to be carcinogenic and causes liver and kidney damage (Ayres and Hellier 1998). The acute toxicity of the cyclodienes vary widely. Their mechanism of action appears to be a reduction of the inhibitory γ-aminobutyric acid (GABA) receptor-chloride ionophore complex with later hyperactive excitatory responses.

Several other important organochlorine insectides have been widely used. These include HCH, toxaphene, mirex, and chlordecone (kepone). These do not have the characteristic structure of either of the above two groups and their mode of action is less precisely defined, although the same mechanism of action as the cyclodienes has been suggested since resistance to this group of pesticides normally means pests are resistant to the cyclodiene pesticides and vice-versa (Brooks 1974b). Hexachlorocyclohexane (HCH), which was at one time named benzenehexachloride (BHC), is manufactured by treatment of benzene with chlorine under the influence of ultraviolet light without catalyst. HCH can theoretically exist as eight different stereoisomers of which only five are actually found in the crude product. The crude product is made up of ~ 70% α – HCH, 13% γ-HCH, 6% of the β –

isomer, 6% of the δ – isomer, and trace amounts of ε - HCH. Of these only the γ-isomer (also referred to as lindane) has powerful insecticidal properties (Cremlyn 1978). The crude product can and has been used directly as dusts for control of various soil pests as well as flea beetles and mushroom flies. However, it suffers from the disadvantage of an unpleasant musty odour and taste which tends to taint foodstuff. Although the γ - isomer cannot be synthesized directly, it can be purified by taking advantage of differences in solubility in different solutions. Extraction with hot methanol followed by fractional recrystallization gives substantially pure (99% or more) γ-HCH (Hassell 1990).

Hexachlorobenzene (HCB), which was used as a fungicide starting in the 1940s is produced from ferric chloride and benzene (Ayres and Hellier 1998). It was primarily used for seed treatment of wheat against smut and was briefly used to replace mercury-based fungicides in the early 1970s and was phased out soon after. HCB is still produced and released into the environment as a by-product of pesticide and lower-chlorinated benzene production (de March *et al.* 1998).

The low cost and efficacy of these compounds has resulted in their intensive use over a large part of the globe, including tropical regions, from the 1950s to the present. While some use of these compounds continues, their production and use is in decline. New-generation (i.e. third generation) pesticides are largely nitrogen- and phosphorus-based. These pesticides differ from OC pesticides in that they generally have a shorter environmental half-life, their toxic mode of action is more specific, and their toxicity is better understood.

1.5 FISH AS VECTORS OF CONTAMINANTS

The contamination of fish with POPs produces economic as well as ecological, cultural and health-related effects. Fish are an essential part of both the sport and commercial fishing economy in several countries. They are a critical pathway in the transfer of nutrients and contaminants to higher trophic level wildlife (Poole *et al.* 1998). Many individuals find fish esthetically pleasing and they are an integral part of the culture to some indigenous people. Fish are also considered an important part of a healthy diet, they contain high-quality protein and other essential nutrients, are low in saturated fat, and contain omega-3 fatty acids.

The accumulation of POPs in fish and higher trophic levels in food chains is complicated by several factors. In general, the uptake rate of pollutants by fish should fall within limits set by species-species factors which control metabolic rate and growth as modified by environmental factors such as water temperature and food availability (Norstrom *et al.* 1976). Although there are only two routes of OC contaminant uptake (water and food, of which, food is the primary intake route) there are several factors affecting contaminant concentrations (Fig. 1.7). Such factors as fish size, age, and exposure duration, (Niimi and Oliver 1983, Stow and Carpenter 1994, Coristine *et al.* 1996, Bentzen *et al.* 1996, Fisk *et al.* 1998), trophic position (Minagawa and Wada 1984, Cabana and Rasmussen 1994, Kidd *et al.* 1998, Fisk *et al.* 2001), feeding behaviour (Hecky and Hesslein 1995, Campbell *et al.* 2000, Kidd *et al.* 2001), depuration rates (Leblanc 1995, Sijm and Van der Linde 1995), differences in lipids (Bentzen *et al.* 1996, Kucklick and Baker 1998, Berglund *et al.* 2001) and growth rate (Hammar *et al.* 1993, Madenjian *et al.* 1994, Strafford and Haines 2001, Blais *et al.* 2003, Straford *et al.* 2004) have been shown to influence contaminant burden in fish.

Given that organochlorines are highly lipophillic compounds, concentration factors are largely a reflection of chemical accumulation in fat (Bertelsen *et al.* 1998). Concentrations of these pollutants in upper-trophic organisms often tend to exceed that expected from lipid content alone (Oliver and Niimi 1988, Kidd *et al.* 1998) Bentzen *et al.* (1996) showed that even when correcting for lipids, a significant amount of additional variation in POP concentration was explained by complexity of food webs (trophic classification).

Trophic classification can be estimated using inferred feeding behaviour, or stomach content analyses. However fish are opportunistic feeders whose diets often change as they grow and can vary significantly among individuals of the same species (Trippel and Beamish 1993). Stable isotope ratios of nitrogen ($^{15}N/^{14}N$; $\delta^{15}N$) provide an alternative to conventional methods for determining an organism's trophic status. The heavier isotope of nitrogen (^{15}N) increases an average of 3 parts per thousand (‰) from prey to predator (Peterson and Fry 1987) due to the preferential excretion of the lighter isotope (^{14}N) through metabolic processes. $\delta^{15}N$ intergrates a signal from an organism's diet over the time period of tissue turnover (months or years) (Peterson and Fry 1987) and can therefore be used as a continuous measure of trophic behaviour (Kidd *et al.* 1995a, Kidd *et al.* 1995b) instead of a snapshot in time as the older conventional methods do. A previous study by Rasmussen *et al.* (1990) categorized lake trout into one of three classes based on the presence-absence of pelagic prey species, was able to demonstrate that trophic positioning was an important factor in explaining differences in organochlorine concentrations in top predators, however it was not possible, with such population-based trophic assignments, to examine the importance of dietary habits on contaminant accumulation in individuals. Vander Zanden and Rasmussen

(1996) demonstrated that PCB concentrations in lake trout were better predicted by a continuous variable measurement describing trophic position rather than classification assignments. Measurements of $\delta^{15}N$ in top predators may be used to directly inspect the intra-system variation in organochlorine bioaccumulation (assuming the $\delta^{15}N$ signal at the base of the food webs is comparable). However; care must be taken as $\delta^{15}N$ in particulate organic matter and primary consumers varies with the productivity of systems, and these differences are reflected in the $\delta^{15}N$ of upper trophic level consumers. In freshwater systems, the typical tissue $\delta^{15}N$ of filter-feeding mussels and other primary consumers ranges from 1.2 to 13‰. Some of this variability is attributed from anthropogenic nitrogen inputs to the watersheds of the high $\delta^{15}N$ systems.

In comparison, carbon isotope ratios ($^{13}C/^{12}C$; $\delta^{13}C$) remain relatively unchanged as fixed carbon is passed through the food web from the prey to predator, (less than 1% enrichment in $\delta^{13}C$ per trophic level), hence $\delta^{13}C$ may be used to elucidate the original source of carbon (i.e. benthic vs pelagic) (Hecky and Hesslein 1995, Campbell *et al.* 2000, Kidd *et al.* 2001) in aquatic systems. In temperate and arctic systems, the range of $\delta^{13}C$ values often become progressively smaller with each successive trophic level, and top predators consistently have $\delta^{13}C$ values between benthic (less negative $\delta^{13}C$) and planktonic (more negative $\delta^{13}C$) primary consumers. These results are attributed to an increase in omnivory with increasing trophic positioning through the food web (Hecky and Hesslein 1995, Kidd *et al.* 1998, Kidd *et al.* 1999). Campbell *et al.* (2000) reported that $\delta^{13}C$ values were highly correlated with organochlorine concentrations in the food webs from Bow Lake in the Canadian Rocky Mountains, where lake trout with a more pelagic signature had higher organochlorine concentrations than littoral-feeding whitefish. In fact, lipid concentrations and carbon sources were better correlated with POP concentrations in Bow Lake biota than trophic position itself. Negative correlations of $\delta^{13}C$ with respect to POP concentrations in the biota indicated that POP bioaccumulation was greater in pelagic organisms which had more depleted carbon signatures and higher lipid.

Differences in growth rates also have the potential to influence POP concentrations in fish via biodilution (Thomann 1989, Bormann and Whittle 1992, Hammar *et al.* 1993, Madenjian *et al.* 1994, Strafford and Haines 2001, Blais *et al.* 2003, Strafford *et al.* 2004). Mackay and Fraser (2000) calculated that a growth doubling time of approximately 693 days can result in noticeable dilution of a substance which has a long clearance rate. For compounds such as PCB 153 and PCB 194, whose elimination rate constants (excluding growth dillution) are not significantly different from zero, decreases in the concentration of these PCBs was attributed only to growth dilution (Sijm *et al.* 1992). This was further confirmed by the fact that the elimination rate constants for PCBs 153 and 194 were similar to the growth rate constant of the respective study fishes.

In addition to fish characteristics, the chemical characteristics of the contaminants in question may also influence the chemical burden within individual fish. Elimination half-lives of POPs generally increase with increasing K_{OW}. Chemicals with K_{OW}s of less than 5 may bioconcentrate in aquatic organisms but generally do not biomagnify because of efficient clearance of chemical to water via gill ventilation (Niimi 1996, Kelly *et al.* 2004). The half-lives of PCBs in fish generally increase with chlorine number up to a maximum half life for PCBs with 7 or 8 chlorines, but decrease for congeners with 9 and 10 chlorines (Fisk *et al.* 1998). Niimi and Oliver (1983) found half lives to decrease at high chlorine number (more than 6 chlorines), which they attributed to redistribution of the PCB congeners to other tissues within the fish. In addition, steric effects in membrane permeation, a large barrier in water diffusivity at the membrane/water interface, and exceptionally long times to reach steady-state partitioning have been used to elucidate the fall off in bioaccumulation observed for very hydrophobic organic chemicals (Gobas *et al.* 1999, Arnot and Gobas 2004).

The influence of fish size on POP bioaccumulation will be greater for more hydrophobic OCs ($K_{ow} > 5$) because of slower partioning out of lipids that results in longer half-lives and concentrations (Borgå *et al.* 2004). The elimination of these highly hydrophobic chemicals is most often observed in small fish but elimination rates decrease significantly with increasing fish size (Sijm and Van der Linde 1995, Fisk *et al.* 1998). The difference in elimination rates is believed to be as a result of higher ventilation rates and larger gill area to body weight ratios in smaller fish (Gobas and Mackay 1987).

The clearance of PCBs in goldfish was found to be correlated with decreasing aqueous solubilities of the compounds. Substitution of chlorine in the position *para* to the phenyl-phenyl bond was found to influence hydrophobicity and bioaccumulation of the PCBs more strongly than substitution in the *ortho* position (Bruggeman *et al.* 1981). In general, the compounds with no vicinal hydrogens at *meta-para* or *ortho-meta* positions (i.e. PCB 153) and congers with *ortho-meta* vicinal hydrogens and 2 or more *ortho* chlorines (i.e. PCB 99) were highly persistent, while congeners with *ortho-meta* vicinal hydrogens and only one *ortho* chlorine were considered relatively non-persistent. Congeners with *meta-para* substitution and 2 vicinal hydrogens or less (i.e. PCB 101) or 3 or more chlorines (i.e. PCB 151) were persistent in some organisms and not in others (Metcalfe and Metcalfe 1997).

The study of the effect of temperature on clearance rates of POPs has generated some inconsistent results. It is generally believed that elimination rates of POPs will decrease with temperature. However; Dabrowska and Fisher (1993) found that increasing temperature noticeably decreased the half life of PCB 133 while that of PCB 153 was not markedly changed. They found that the elimination of PCB 133 was approximately 6 times faster at 20°C than at 13°C with values of $53x10^{-4}d^{-1}$ and $9x10^{-4}d^{-1}$, respectively.

1.6 MOUNTAINS

Mountains are defined as being areas of high altitude as well as areas of low altitude with large slopes (UNEP World Conservation Monitoring Centre 2002). According to this definition approximately 27 % of the earth's landmass is considered mountainous and 22% of the world's population lives within mountainous regions (Daly and Wania 2005). Due to the vast number of geographic regions in which mountain areas can be found, mountains may be very diverse in their environmental characteristics. However, mountains also share many unifying characteristics. Most mountains experience relatively low daytime air temperatures and relatively high amounts of precipitation compared to lowlands. These regions also may experience long-lasting snow cover. Wind speed and solar radiation flux are generally higher than in adjacent lowlands, whereas atmospheric pressure is lower. Lakes in these regions typically have low plankton biomass, low dissolved organic carbon, are normally oligotrophic, and experience extended periods of ice cover (Vilanova *et al.* 2001, Datta *et al.* 1999, Daly and Wania 2005, Fernandez *et al.* 2005). Some of these characteristics will influence the environmental fate and behavior of organic chemicals. In fact, it has been suggested that some of these conditions may result in the amplification of certain contaminants (i.e semi-volatile organochlorines) relative to those in surrounding lowland areas (Wania 1999, MacDonald *et al.* 2002, Daly and Wania 2005). Daly and Wania (2005) wrote a very in depth review about contaminants in mountainous regions and the processes which may result in their amplification up-slope.

The negative temperature gradients up a mountain range not only suppress evaporation of POPs, but are also responsible for the formation of diurnal mountain winds. These winds are produced by temperature contrasts which form within a mountain range or between mountains and the surrounding lowland. Diurnal wind systems carry air up the mountain slope from lowland areas during the daytime and down the mountain at night (Fig. 1.8) (Daly and Wania 2005). These wind systems have the potential to range over several hundred kilometers (Prévôt *et al.* 2000).

Diurnal winds may facilitate the transfer of POPs from lowland areas (where a greater percentage of source emissions are found) to higher altitudes of mountain ranges. During the daytime, the sun radiates on the slopes of the lowland and foothill regions, causing a general increase in temperature. The increased temperatures promote the evaporation of organic contaminants into air masses, which are then able to rise and move up-slope from the valley. As the air masses move up the mountain range, they are exposed to cooler temperatures which favor the deposition of the organic contaminants. Lower temperatures also increase partioning onto particles, which lead to increased particle deposition. Rising air masses also increase the occurrence of precipitation often in the form of fog or snow (better scavengers of organic contaminants). At night, lower temperatures along the entire gradient weaken contaminant evaporation along the entire gradient, which could potentially result in a net transfer of chemical up-slope (Fig. 1.8). Rapid degradation in the daytime atmosphere, by photolysis and reaction with photooxidants, may reduce the effects of such transfers (Daly and Wania 2005).

Several studies have addressed the question of the origin and delivery of organic contaminants in mountain regions and have often sought to establish concentration gradients. A large variety of environmental media, including air, water, snow, glacier ice, foliage, and soil, have been sampled to address this issue. Several POPs have been detected in air sampled at higher elevations in the Yahiko Mountains in Japan (Takase *et al.* 2003), the Canary Islands (van Drooge and Grimalt 2002), the Central Pyrenees (Fernández *et al.* 2002, van Drooge *et al.* 2004), Sierra Nevada, California (Datta et al. 1998), and the Canadian Rockies (Shen *et al.* 2004, Shen *et al.* 2005). A greater proportion of the lighter SVOCs were observed at higher altitudes in both Japan and California, while the annual mean concentrations of α-HCH, γ-HCH, PeCB, HCB, and α-endosulfan were observed to increase significantly with altitude in the Canadian Rockies.

Blais *et al.* (1998) reported that concentrations of many of these compounds in snowpacks from the Canadian Rocky Mountains were positively correlated with site elevation. Organochlorine deposition in snow from the mountain ranges showed a 10 to 100 fold increase between 770 and 3100 m altitude. With increased elevation they also found a change in PCB congener groups, going from the more substituted, less volatile PCBs to a dominance of the less substituted and more volatile PCBs at higher altitudes. A similar increase in concentration with altitude has been found for HCHs and endosulfan in snow from the Sierra Nevada (Landers *et al.* 2002 as seen in Daly and Wania 2005). Carrera *et al.* (2001) also reported organochlorine contaminants in snow cores from catchments of remote mountain lakes.

Altitudinal trends for SVOCs in foliage and soils is more complex. Concentrations of HCB in foliage sampled at high altitudes in the tropical mountains were exceptionally high when compared to the low levels measured at low altitudes, whereas DDTs and HCHs in the same area do not follow this behaviour (Calamari *et al.* 1991). Concentrations of PCBs, PAHs, and OCPs in soil sampled around Kielce, Poland, were also elevated at the higher altitudes in comparison to areas to lower elevation in the same vicinity (Migaszewski 1999). Pentachlorobenzene, chlorobenzene, and several PCB congeners increased with respect to elevation on Pico de Teide (when concentrations were organic carbon normalized) (Ribes *et al.* 2002), however; relationship with elevation disappeared above the inversion layer. Concentrations for several of the more volatile OCPs were elevated at higher elevations in conifer needles in the Canadian Rocky Mountains, although concentrations were lower than in valleys which were located closer to the Pacific (Davidson *et al.* 2003, Davidson *et al.* 2004).

Volatile organic contaminants may enter alpine lakes via atmospheric deposition or runoff. Alpine lakes may be particularly sensitive to airborne contaminants because their catchments are large (compared to lowland areas) and most contain only a thin layer of soil with sparse vegetative cover. Consequently, most alpine catchments are unable to act as effective filters to prevent contaminants from entering surface waters (Vilanova *et al.* 2001, Daly and Wania 2005). However, there are relatively few studies which have measured POPs directly in water, and none which have correlated POP concentration directly to elevation. There is also a lack of sediment studies which have tried to correlate POP levels to elevation. In one of the few studies which have attempted to associate POP concentrations to altitude, Grimalt *et al.* (2001) reported the sediment inventories for several PCB congeners were positively correlated with altitude (also inversely correlated with temperature) in a subset of

19 European alpine lakes. However, no such relationship was observed for other OCs (i.e. OCPs and HCB).

In addition to the physical and chemical characteristics of mountains which may augment the concentrations of POPs in elevated areas, aquatic biota which inhabit higher altitudes are often associated with higher lipid storage, longer life cycles, decreased metabolism and respiratory rates, and slower growth rates. These characteristics may further enhance the bioaccumulation of POPs in individuals from mountainous regions (Wania 1999, MacDonald *et al.* 2002, Daly and Wania 2005).

Elevated POP levels in organisms from alpine lakes have been reported since the 1970s. Cory *et al.* (1970), documented detectable DDE concentrations in frogs at an elevation of 4500 m in the Californian Sierra Nevada. Furthermore, the DDE concentrations were found to be elevated on the western slope of the mountain when compared to organisms from the eastern slope.

Several studies on contaminants in biota from alpine lakes have tried to explain differences in measured contaminant concentration. DDE and PCB in trout from the Canadian Rocky Mountains were directly related to the drainage basin area and weight of fish, whereas fish age and trophic class explained little of the variation (Donald *et al.* 1993). A subsequent study by Donald *et al.* (1998) reported toxaphene levels in fish increased by 1000 fold over a 1500 m rise in lake elevation. Toxaphene was positively correlated with elevation ($r = 0.77$), and negatively correlated with dissolved phosphorus ($r = -0.64$), and percent organic carbon in lake sediment ($r = -0.84$).

Blais *et al.* (2003) reported that the more volatile OCs in amphipods (*Gammarus lacustris*) increased in concentration with respect to elevation. Multiple regressions showed that the effect of elevation, lipid content and temperature on contaminant concentrations was no longer significant once the growth rate of *Gammarus* was included as an independent variable. It was concluded, that growth rate (which generally decreased with altitude) was the dominant influence of the spatial patterns of OC accumulation in *Gamarrus*.

On the other hand, in Europe, the concentrations of DDE and the heavier PCBs in salmonids increased with elevation and decreased with mean lake temperature. Correlations of the more volatile OCs with respect to elevation and temperature were not significant (Grimalt *et al.* 2001, Vives *et al.* 2004). No significant correlations were observed with lipid content, lake productivity, or mean annual rainfall with any of the OCs analysed. The concentrations of the less volatile OCs were also correlated with fish age.

Not all studies showed an increase of OC concentration in alpine organisms. Hofer *et al.* (2001) stated that DDE and PCB concentrations in minnows from remote European lakes were independent of altitude, catchment area, lake productivity, and other water parameters. The southern populations of the European minnow accumulated more *p,p'*- DDE and PCBs than northern populations. This was linked to an increase in agricultural sources regions, as well as an increase in prevailing winds from warmer countries where volatilization of POPs would be favored. Ohyama *et al.* (2004) reported a significant negative correlation (r^2 = 0.882) between PCBs and altitude with fish under 350 grams. The strength of the relationship dropped when all fish were considered, (r^2 = 0.148).

There also appears to be a spatial component to the relationship between POPs and elevation. Angermann *et al.* (2002) noted the temperature regimes at higher latitudes of the more northern mountains (i.e. Canadian Rockies) may be significantly colder on average than those encountered at similar elevations in lower altitude mountains (i.e. Sierra Nevada) resulting in enhanced atmospheric deposition of POPs relative to equivalent elevations in more southerly mountains.

As seen from the above, the issue of POPs in biota can be quite complex. Differences in the measured organism concentrations can be the result of differences in a) the atmospheric deposition to the catchment area of the lake, b) the retention of contaminants in the watershed, c) the in-lake processing of the contaminants, d) the trophic status of the individuals of the biota, and e) the age of the individuals being measured in the biota (Daly and Wania 2005).

Of particular interest, are incidences of contaminant concentrations increasing with altitude. It is believed that mountain regions may have the potential to amplify POPs at elevated altitudes through altitudinal fractionation (same as global fractionation but localized to alpine areas) and the unifying properties which are found in mountain ranges that may influence the fate and behavior of these chemicals. This may result in elevated POP concentrations in areas where organisms are potentially hyper-sensitive to elevated exposure to contaminants (Wania 1999). Increasing SVOC concentrations with altitude have been reported in an array of different sampling media and biota for several different POPs. Several Canadian studies (Shen *et al.* 2004, Shen *et al.* 2005, Blais *et al.* 2003, Davidson *et al.* 2003) have reported increases with respect to elevation for only the more volatile SVOCs. This is in contrast to the European studies (Grimalt *et al.* 2001, Vives *et al.* 2004) which reported increases with elevation for the less volatile SVOCs such as DDT and the higher chlorinated PCBs, but found no relationship with respect to elevation for the more volatile SVOCs. In addition, Angermann *et al.* (2002) reported the hepta- and octachlorinated PCNs prevailed in frog tadpoles at high-altitude sites in the Sierra Nevada and Weiss *et al.* (1998), who observed increases for fairly involatile OCs, such as the PCDD/Fs in spruce needles along transects in Austria. The above studies have raised several questions about the behaviour of organic contaminants in mountains. Daly and Wania (2005) declared many of these questions in their recent review: Why do the Canadian studies produce different results than other studies? Why do some studies show clear concentration gradients or compositional shifts, whereas others do not? Why is it that such gradients and shifts are seen in some compartments, but not in others? Why is an altitudinal pattern observed for one group of compounds, but not another?

1.7 STUDY OBJECTIVES

According to the altitudinal fractionation theory, one would expect concentrations OCPs and PCBs to increase with elevation due to increased deposition and limited volatilization from cooler temperatures at higher altitudes. This relationship should be the strongest for semivolatile organic compounds, or those chemicals with vapor pressures between 0.001 Pa and 0.1 Pa. Other media and biota (air (Shen *et al.*, 2004, Shen *et al.*, 2005), soil (Migaszewski, 1999), snow (Blais et al., 1998, Landers et al., 2002), plants (Davidson *et al.* 2004) and amphipods (Blais *et al.*, 2003)) have reported increases consistent with the altitudinal fractionationation theory. In other words, these studies have shown analogous patterns in these media and biota which are comparable to what would be expected with global fractionation, with the more volatile chemicals (HCHs, HCB, endosulfan, and lower chlorinated PCBs) being enriched in colder areas. However, recent studies in Europe (Grimalt *et al.*, 2001, Vives *et al.*, 2004) have produced results which are inconsistent with altitudinal fractionation. Correlations between the more volatile OCs and elevation as well as temperature were not significant, yet DDE and high molecular weight PCB concentrations increased with elevation.

This project was undertaken to determine the extent to which OCPs and PCBs bioaccumulate in trout from mountainous regions. The lakes were chosen to maximize a range of elevations in the Rocky Mountains of Alberta and British Columbia, while occupying a relatively small surface area (~ 107,519 km^2) removed from point sources. All lakes were located within Banff, Jasper, or Yoho National Parks (except Shere Lake which was located just outside Mt. Robson Provincial Park) Work by Davidson *et al.* (2003) in this region, which looked at longitudinal transect from Alberta to coastal British Columbia revealed that there was very little to no difference in concentrations and composition of these chemicals. Therefore, I grouped all lakes together assuming there was no difference between winward and leeward mountain lakes. In selecting lakes within the same geographic region and minimizing the effect of point sources, the effect of regional differences in sources of POPs is removed. The sampling location and study design allows for a test of the following question: Does the established pattern of altitudinal fractionation apply to trout populations in the Canadian Rocky Mountains as has been observed in other media and biota in alpine areas? If the data support the altitudinal fractionation theory, one would expect POP concentrations to increase with elevation due to increased transport (and/or retention) at higher elevations. This relationship should be strongest for semivolatile compounds, or those chemicals with vapor pressures between 0.001 Pa and 0.1 Pa. In particular, one would expect that the more volatile SVOCs (i.e. HCB, HCHs, endosulfans, and lower chlorinated PCBs) would show the greatest increase with respect to elevation.

In addition to relating POP concentration to elevation, I examined the variance in POPs, with respect to fish specific data (age, length, weight, growth rate, and lipid content), trophic level (indicated by $\delta^{15}N$), and feeding behavior (indicated by $\delta^{13}C$) to distinguish if the influence of contaminant dispersion is more than simple delivery from the atmosphere .

Table 1.1 Important dates relating to the rise and the fall of persistent organochlorine compounds. (adapted from http://pops.gpa.unep.org/04histo.htm)

- **1774** - Kark Eilhelm Scheele discovered the element chlorine. The substitution of hydrogens by chlorine elements provides POP molecules with properties of both persistence and lipophilicity.
- **1825** - Michael Faraday reported the formation of benzene hexachloride to the Royal Society of London. The product consisted of a mixture of various isomers of hexachlorocyclohexane (HCH).
- **1873** - Othmar Zeidler synthesized DDT at the University of Strasbourg.
- **1929** - PCBs were produced in commercial mixtures known as Aroclor. PCBs were manufactured in the United States, Austria, France, Germany, Italy, Spain, United Kingdom, Russian Federation, China, Japan, and exported to virtually every country.
- **1933** - Hexachlorobenzene (HCB) is introduced commercially as a fungicide for wheat. Was also used in organic syntheses as a raw material for synthetic rubber.
- **1939** - Paul Mueller discovered the insecticidal properties of DDT 66 years after its original synthesis.
- **1943** - Van Linden gave the name lindane to the active isomer of HCH which was discovered to have insecticidal properties.
- **1944** - Khanenia and Zhiravlev demostrated that the chlorination of terpenes found in turpentine led to products with increased toxicity to lice. Some years later it becme marketed under the trade name of toxaphene.
- **1949** - Toxicological effects linked to TCDD are observed in workers following an industrial accident during the production of a herbicide at Monsanto plant in Nitro, West Virginia.
- **1957**- Sandermann *et al.* report the first synthesis of 2,3,7,8 – tetrachloro-*p*-dibenzodioxin (TCDD), and for the first time its structure was determined.
- **1962** - Rachel Carson published Silent Spring.
- **1966** - Sõeren Jensen discovered PCBs as an environmental contaminant in Baltic fish.
- **1970** - In this decade, after the discovery of their negative effects on species such as the peregrine falcon and eagles, several organochlorine pesticides were restricted in use and eventually banned.
- **1970** - During this decade, the use of hexachlorobenzene as a fungicide was banned in the U.S., Canada, and some European countries. HCB is still present as an impurity in the pesticides pentachlorophenol, dacthal, atrazine, picloram, pentachloronitobenzene, chlothalonil, and lindane.
- **1973** - February 13th, the Council of the OECD decided to restrict the production and use of some chemicals such as PCBs.
- **1976** - European Directive 76/769/EEC restricted the marketing and use of certain dangerous substances and preparations such as PCBs.
- **1976** - USA banned the manufacturing, processing, distribution and use of PCBs, except in a "totally enclosed manner". Similar action was taken in Japan, Canada and western European countries.
- **1978** - December 21st, European Directive 79/117/EEC prohibited the placing on the market and use of plant protection products containing certain active substances with the exception of some uses (aldrin, chlordane, dieldrin, DDT, endrin, HCH, heptachlor, hexachlorobenzene).
- **1985** - Reproductive impairment in seals is reported in the Baltic Sea (Bergman and Olsson, 1985) and Beluga whales in the St. Lawrence seaway, Canada (Beland *et al.*, 1993). Both effects linked to PCBs.
- **1994** - Immune system damages (Safe, 1994) and behavioral impairment (DeSwart *et al.*, 1994) shown in top predator species correlated with some POPs.
- **1995** - Endocrine disruption in humans and wildlife was linked to some POPs (Harrison *et al.*, 1995).
- **1995** - United Nations Economic Commission for Europe (UNECE), consisting of European countries, Russia, Canada, and the United States agreed on a Protocol which bans the production and use of some POPs and scheduled some others (aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene, polychlorinated biphenyls, dioxins and furans) for elimination at a later stage (Stockholm Convention).
- **1997** - IARC (International Agency for Research on Cancer) published the monograph on the evaluations of carcinogenic risks to humans regarding polychlorinated dibenzo-*para*-dioxins and polychlorinated dibenzofurans.
- **1998** – WHO (World Health Organization) consultation revisited the TDI (Tolerable Daily Intake) for dioxins and related compounds.
- **2001** – Signed the Stockholm Convention on UNEP for elimination of selected POPs.

Table 1.2 Chemical properties of PCB homologue groups. Data from Mackay *et al.* 1992.

	Biphenyl	Mono	Di	Tri	Tetra	Penta	Hexa	Hepta	Octa	Nona	Deca
Molecular weight ($g{\cdot}mol^{-1}$)	154.2	188.7	223.1	257.5	292.0	326.4	360.9	395.3	429.8	464.2	498.7
Chlorine number	0	1	2	3	4	5	6	7	8	9	10
Melting point (C°)	71	25.1-78	24.4-149	28.1-102	47-164	76.5-123	70-201	109-162	132-161	205-206	305
Solubility ($g{\cdot}m^{-3}$)	7.0	1.21 - 5.50	6.0×10^{-2} - 2.0	1.5×10^{-2} - 0.40	4.3×10^{-3} - 1.0×10^{-2}	4.0×10^{-3} - 2.0×10^{-2}	4.0×10^{-4} - 7.0×10^{-4}	4.5×10^{-5} - 2.0×10^{-4}	2.0×10^{-4} - 3.0×10^{-4}	1.8×10^{-4} - 1.2×10^{-3}	7.61×10^{-4}
Vapor pressure (Pa)	1.30	0.271 - 2.04	0.0048 - 0.279	0.0136 - 0.143	5.9×10^{-5} - 5.4×10^{-3}	3.04×10^{-4} - 9.3×10^{-3}	2.0×10^{-5} - 1.5×10^{-3}	2.73×10^{-5}	2.66×10^{-5}	---	5.0×10^{-8}
Henry's Law constant ($Pa{\cdot} m^3 mol^{-1}$)	28.64	42.56 - 75.55	17.0 - 92.21	24.29 - 92.21	1.72 - 47.59	24.8 - 151.4	11.9 - 818	5.4	38.08	---	20.84
Log K_{ow}	3.90	4.3 - 4.6	4.9 - 5.3	3.3 - 5.9	5.6 - 6.5	6.2 - 6.5	6.7 - 7.3	6.7 - 7.0	7.1	7.2 - 8.16	8.26
Mean half-life in air (hours)	55	170	170	550	1,700	1,700	5,500	5,500	17,000	17,000	55,000
Mean half-life in water (hours)	170	5,500	5,500	17,000	55,000	55,000	55,000	55,000	55,000	55,000	55,000
Mean half-life in sediment (hours)	1,700	17,000	17,000	55,000	55,000	55,000	55,000	55,000	55,000	55,000	55,000

Table 1.3 Chemical properties of selected organochlorine pollutants. Data from Mackay *et al.* 1997.

	α-HCH	γ-HCH	HCB	α-chlordane	γ-chlordane	α-endosulfan	β-endosulfan	dieldrin	*p,p'*-DDE	*p,p'*-DDD	*o,p'*-DDT	*p,p'*-DDT
Molecular weight ($g\cdot mol^{-1}$)	290.85	290.85	284.8	409.8	409.8	406.92	406.92	380.93	319	320	354.5	354.5
Melting point (C°)	157-160	112.5	230	107-109	103-105	106	207-209	176-177	88-90	109-110	---	108.5-109
Solubility ($g\cdot m^{-3}$)	1	7.3	$1.8x10^{-5}$	0.056	0.056	0.5	0.45	0.17	$4.0x10^{-2}$	$5.0x10^{-2}$	$2.6x10^{-2}$	$5.5x10^{-3}$
Vapor pressure (Pa)	$3.0x10^{-3}$	$3.7x10^{-3}$	$2.3x10^{-3}$	$4.0x10^{-4}$	$5.2x10^{-4}$	$1.3 x 10^{-3}$	$6.1x10^{-3}$	$5.0x10^{-4}$	$8.7x10^{-4}$	$1.3x10^{-4}$	$2.5x10^{-5}$	$2.0x10^{-5}$
Henry's Law constant ($Pa\cdot m^3 mol^{-1}$)	0.872	0.149	131	0.342	0.262	---	---	1.120	7.95	0.640	0.347	2.36
Log K_{ow}	3.81	3.0	5.50	6.0	6.0	3.62	3.83	5.20	5.7	5.5	---	6.19
Mean half-life in air (hours)	170	170	17,000	55	55	---	---	55	170	---	170	170
Mean half-life in water (hours)	17,000	17,000	55,000	17,000	17,000	55	55	17,000	55,000	---	5,500	5,500
Mean half-life in sediment (hours)	55,000	55,000	55,000	55,000	55,000	170	170	55,000	55,000	---	55,000	55,000

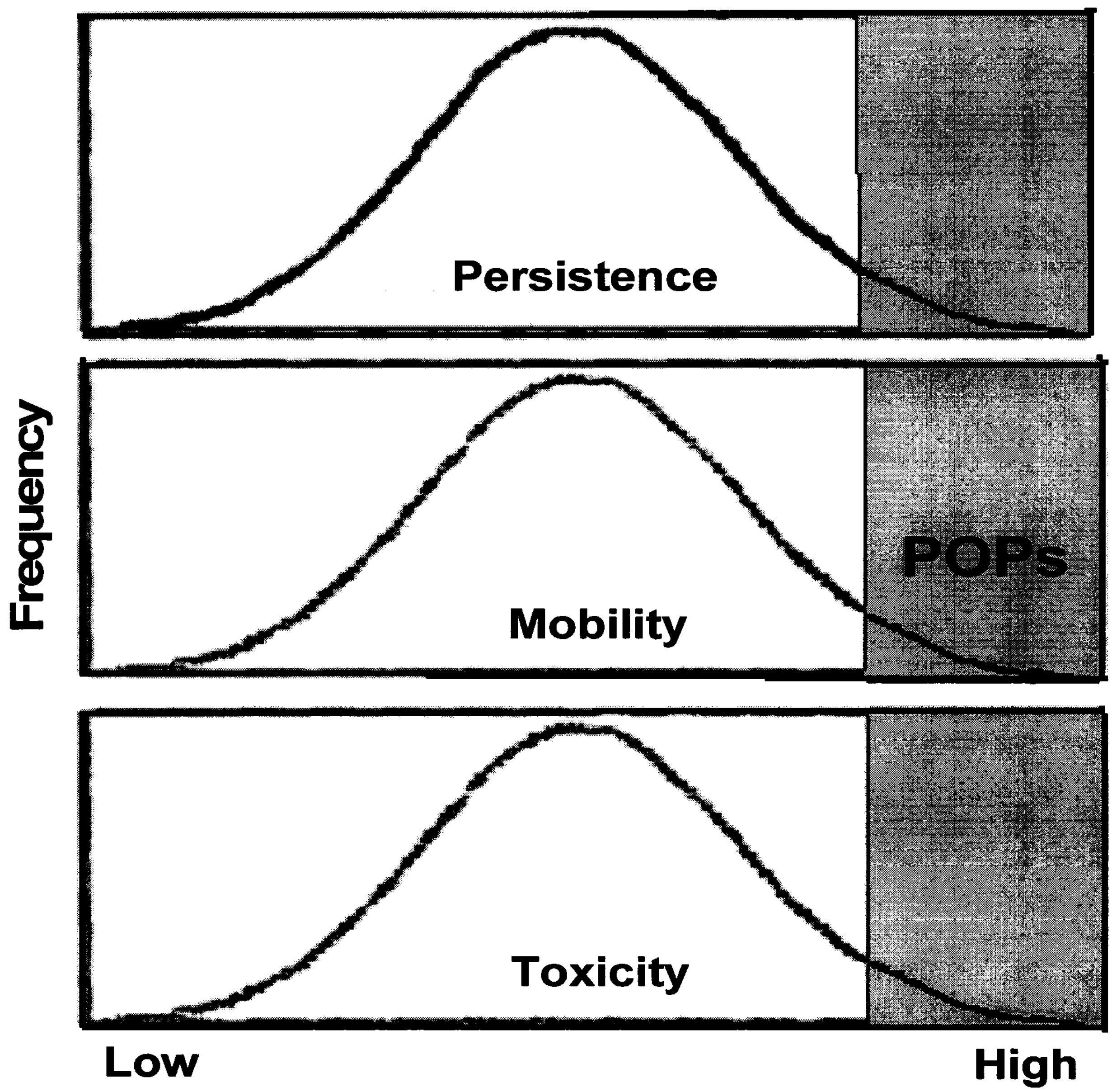

Figure 1.1 Illustration showing the combination of properties needed for the substance to be a persistent organic pollutant (adapted from World Health Organization 2004).

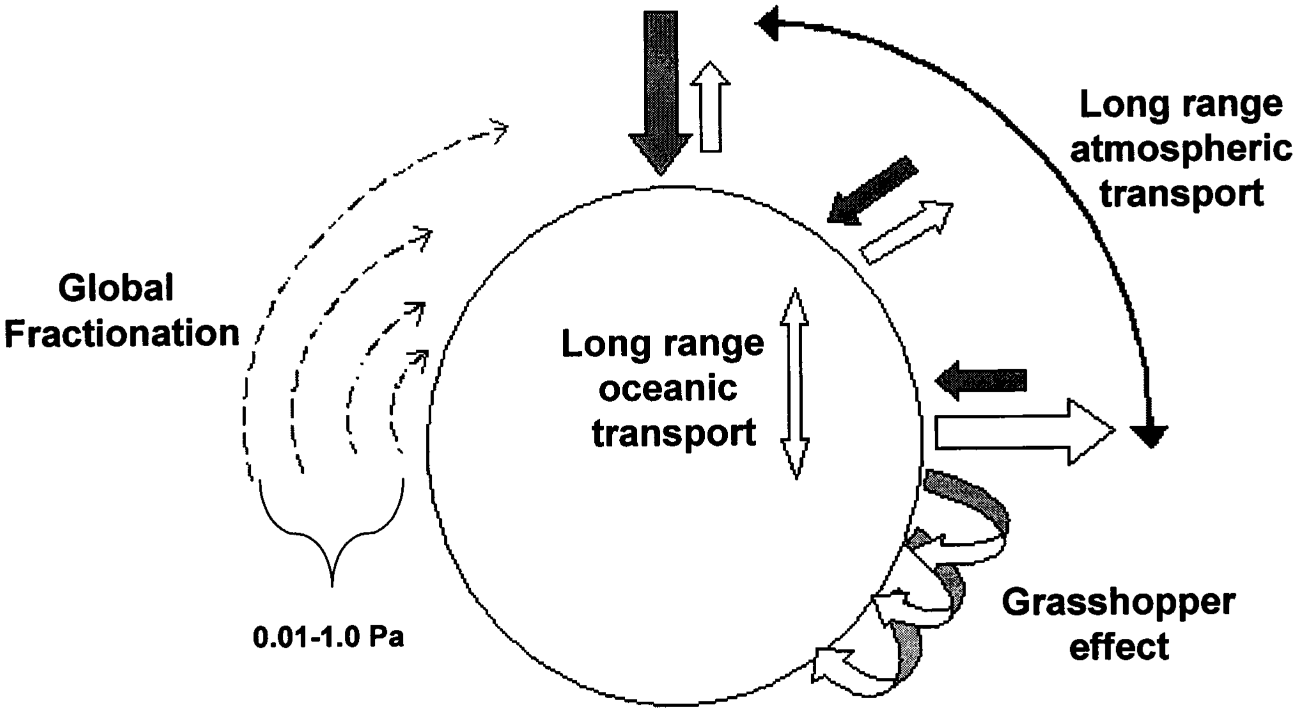

Figure 1.2 Various events which occur in the global transport of POPs where compounds of varying mobility migrate at different rates. At low latitudes, the evaporation rate normally exceeds the deposition rate. Evaporation and deposition at mid-latitudes are governed by seasonal temperature variations. Deposition is more significant at high latitudes, where minimal evaporation occurs (adapted from Wania and Mackay 1996).

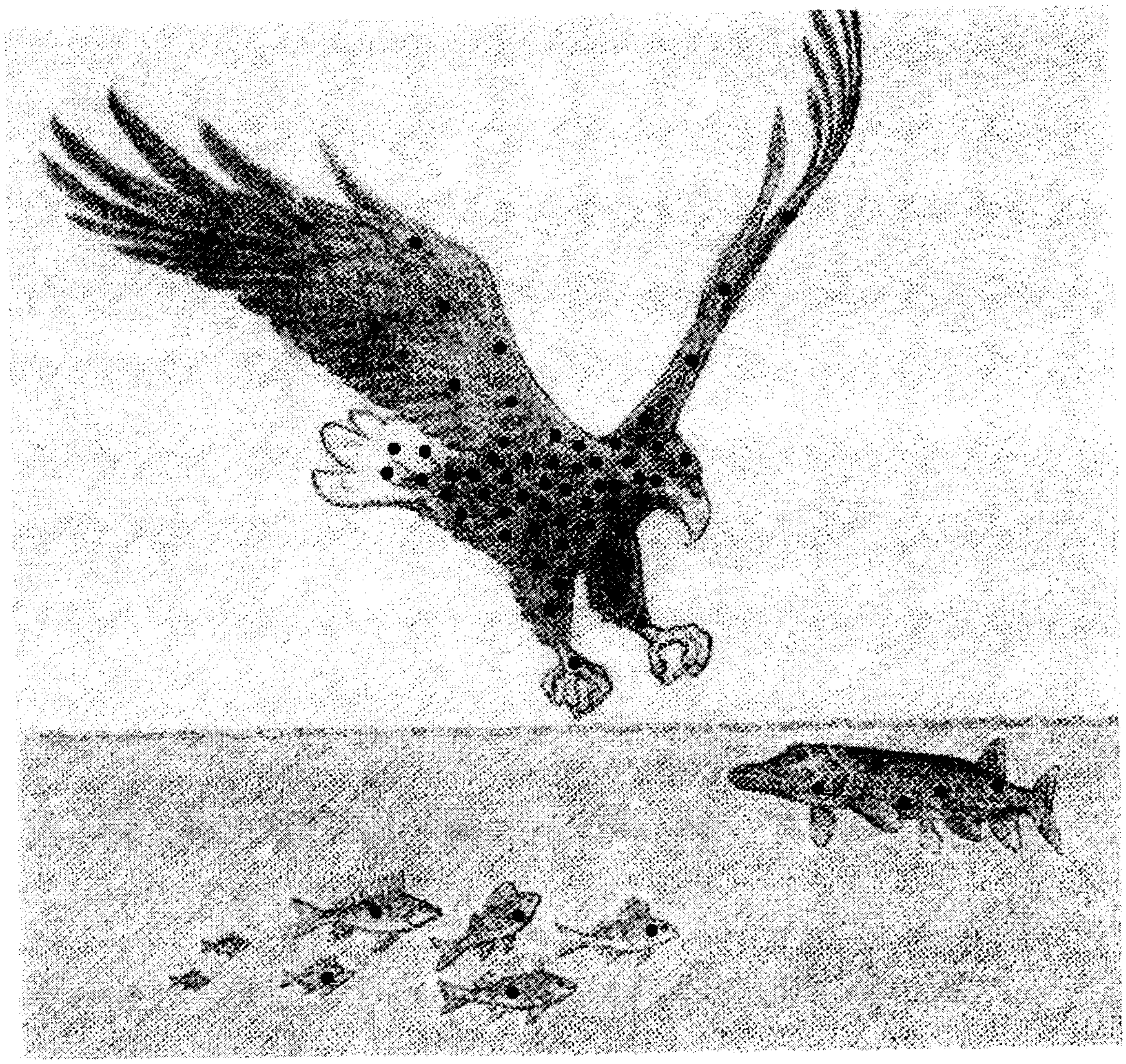

Figure 1.3 During its lifetime, a predatory animal eats hundreds of times its own weight in prey. Biomagnification is the result of the more rapid uptake and storage of a stable substance (shown in black dots) in living tissue than its release, which leads to higher concentration in the individual than in the environment (drawing by Johan Whilke, from Bernes 1998).

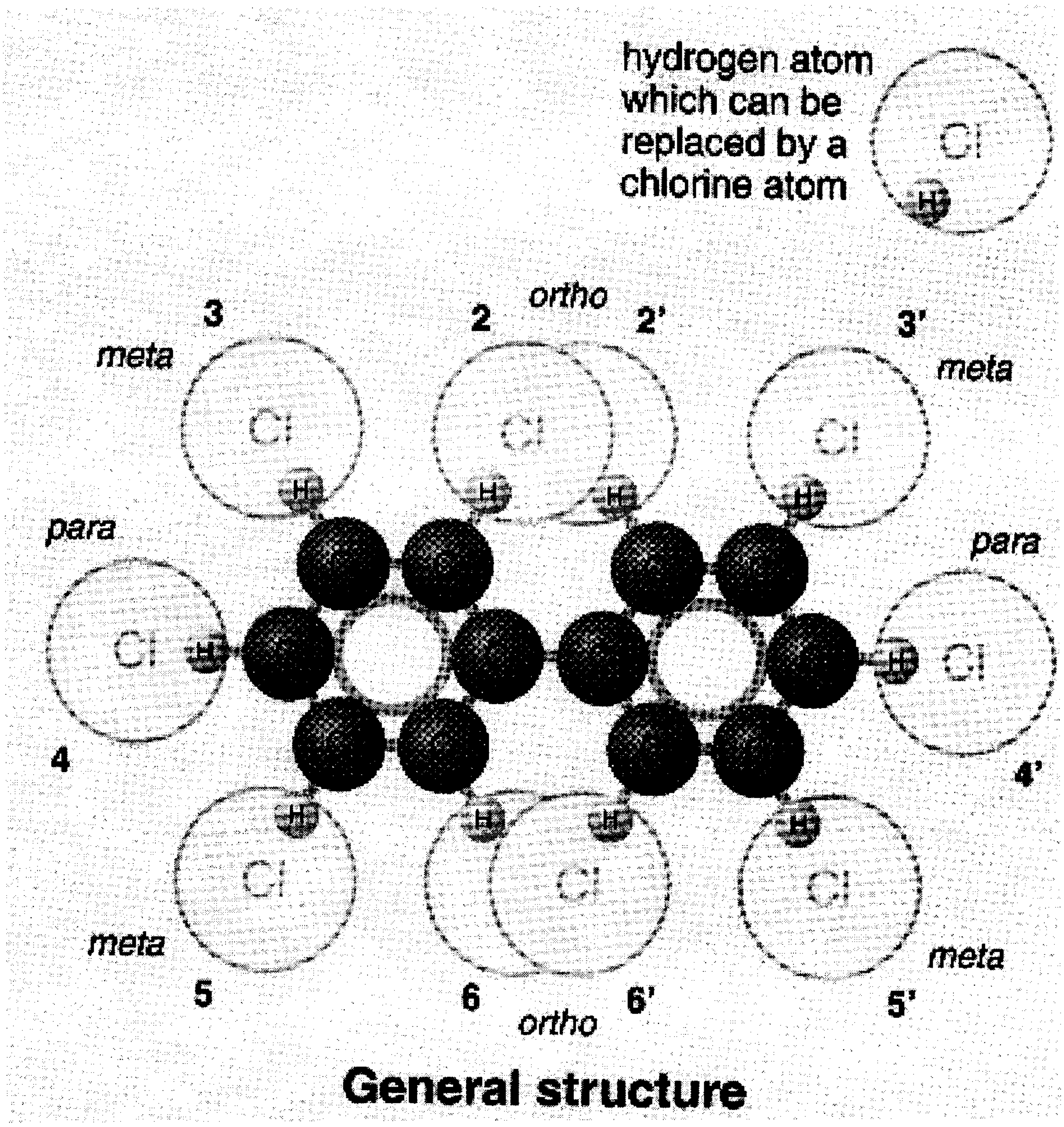

Figure 1.4 PCBs are produced by substituting chlorine atoms for some or all of the hydrogen atoms of biphenyl molecules. In the above diagram one can see the general structure of a PCB molecule, numerical designations for the positions that can be occupied by hydrogen or chlorine atoms are shown. These positions can also be described as *ortho, meta,* or *para* (adapted from Bernes 1998).

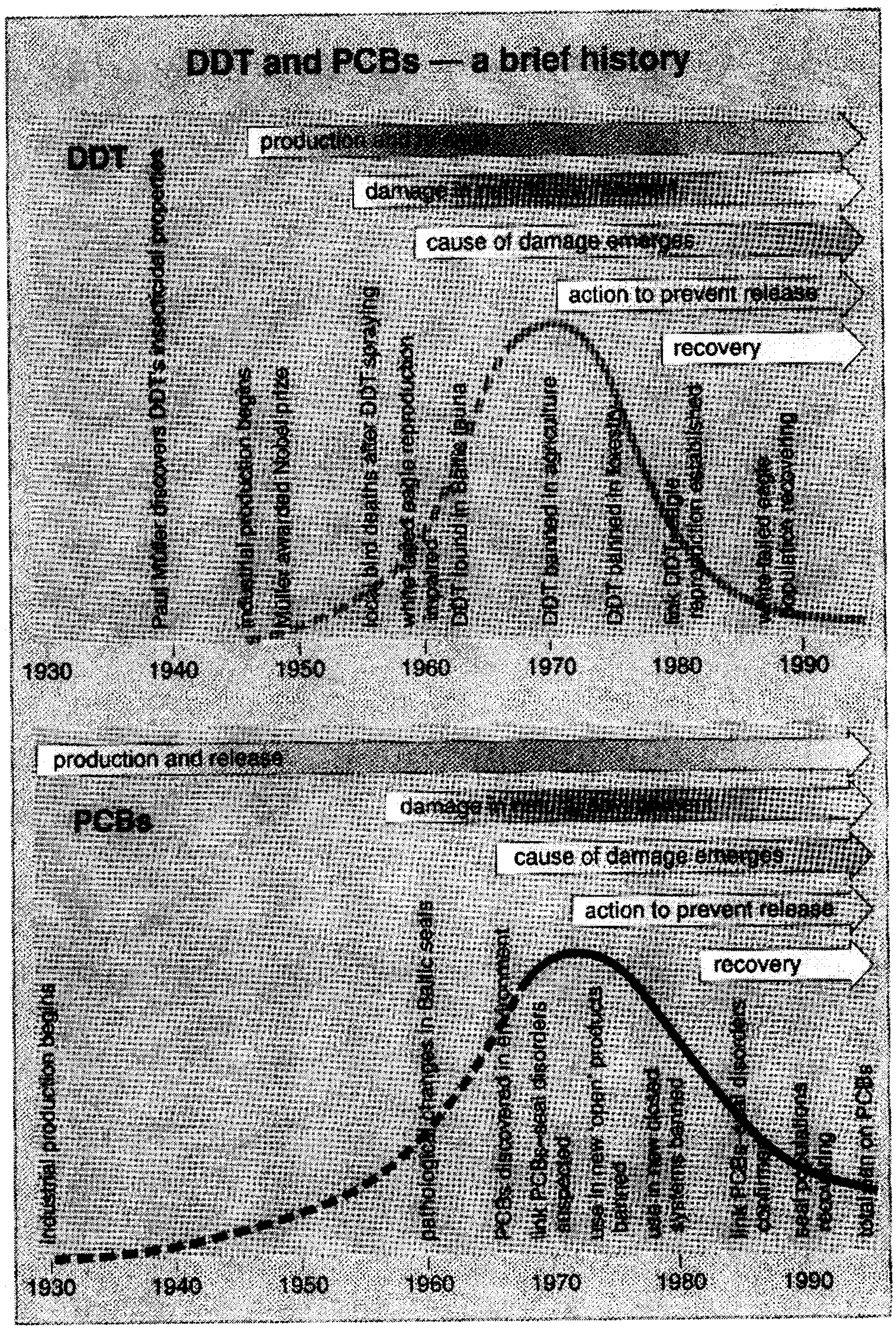

Figure 1.5 Both DDT and PCBs were able to enter the natural environment for decades before their adverse effects became evident. The diagrams above outline the sequence of events, which occurred from the introduction to the phase out of these compounds (with a focus on what happened in Sweden and the Baltic Sea) (adapted from Bernes 1998).

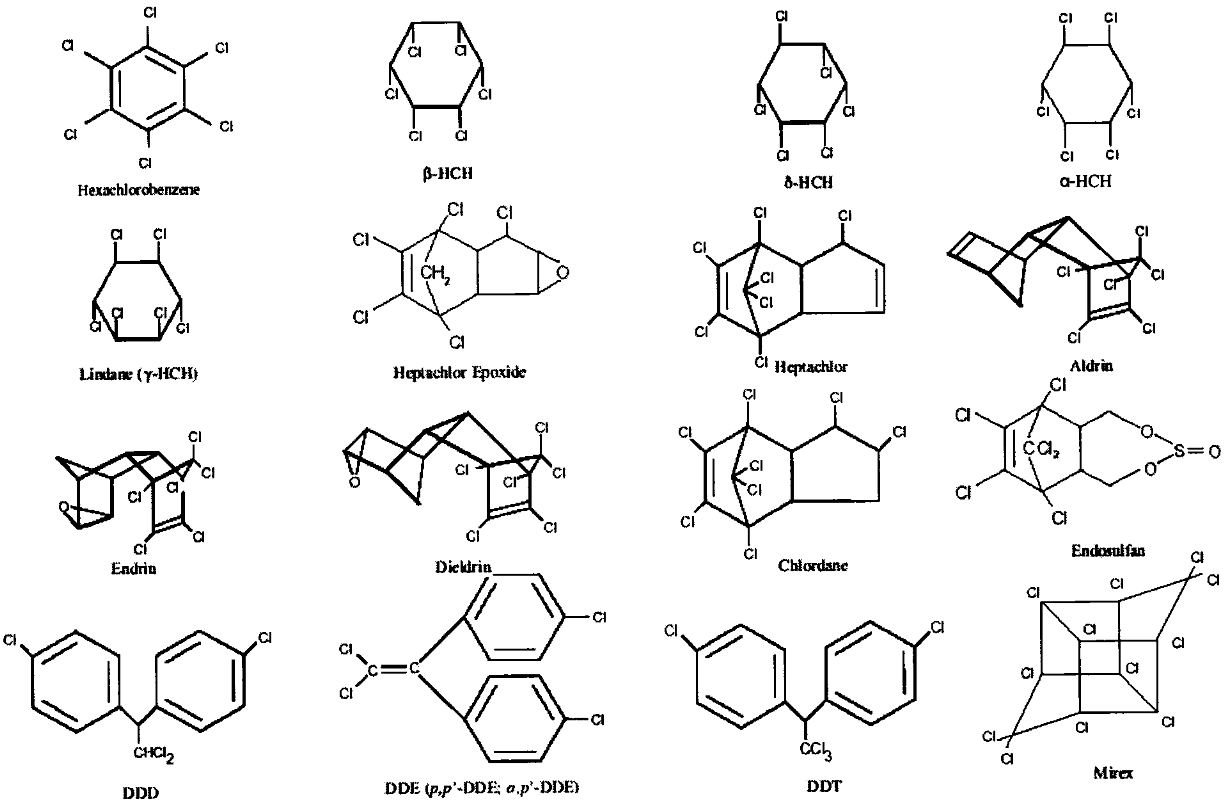

Figure 1.6 Structure of selected organochlorine pollutants.

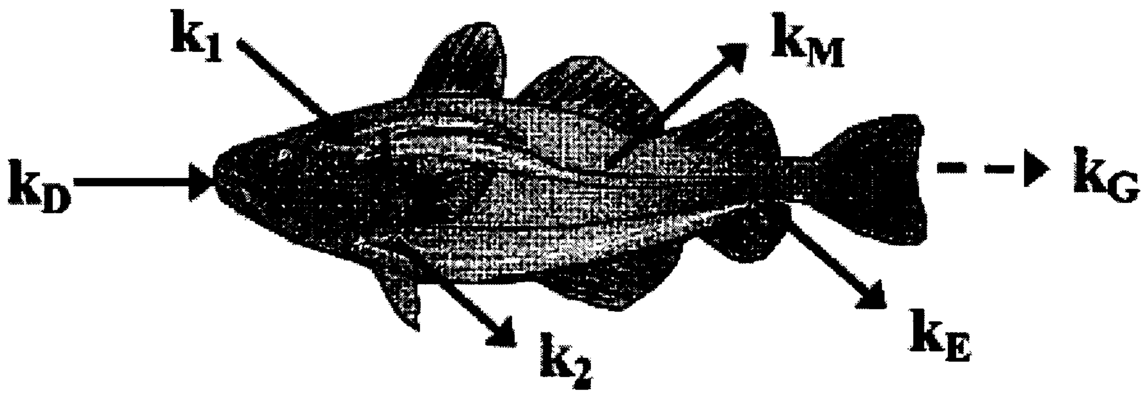

Figure 1.7 A schematic representation representing the major routes of chemical uptake and elimination in an individual fish. K_D - dietary uptake rate constant; K_1 - gill uptake rate constant; K_2 - gill elimination rate constant; K_M - metabolic transformation rate constant; K_E - fecal egestion rate constant; K_G - growth dilution rate constant (adapted from Arnot and Gobas 2004).

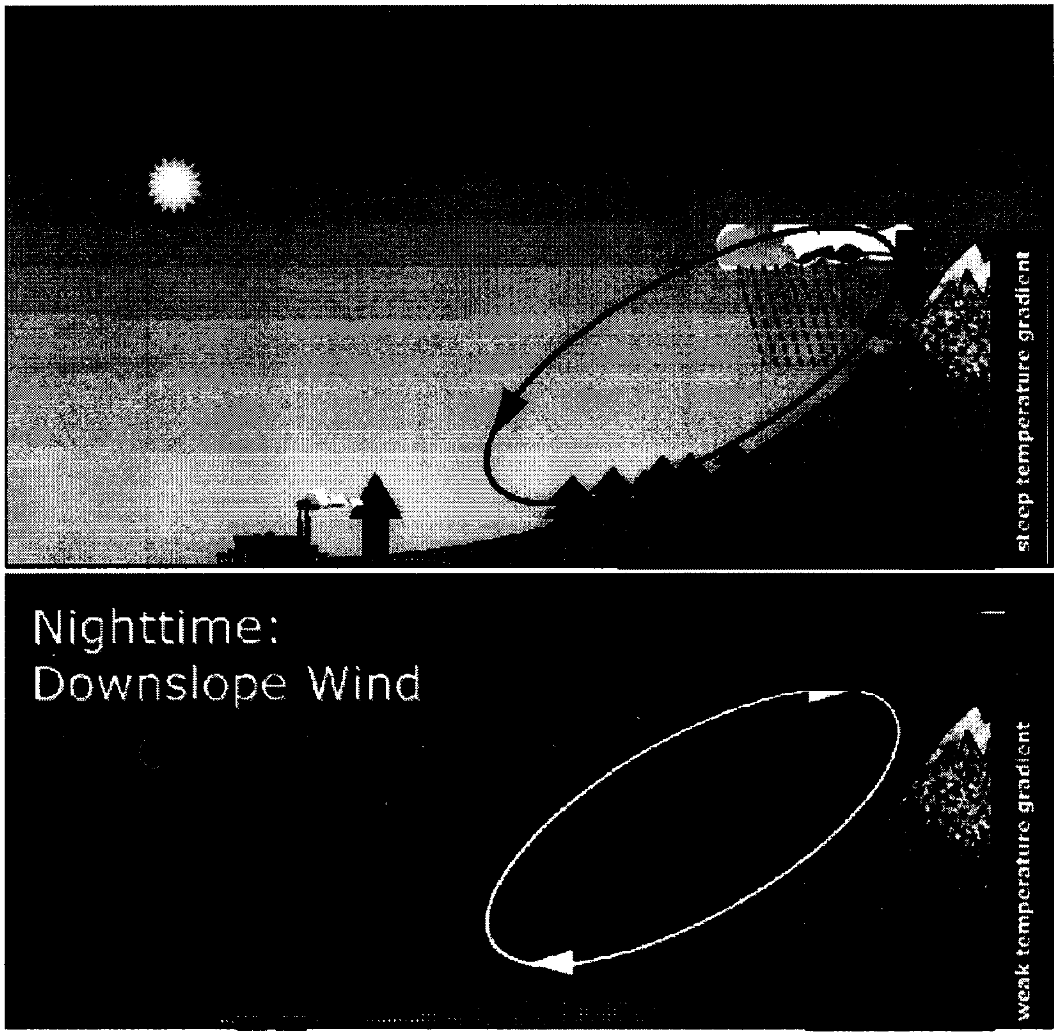

Figure 1.8 Illustration of the processes affecting organic contaminant distribution along a mountain slope. Daytime and nighttime situations differ in terms of the wind direction, the temperature gradient with elevation, and the activity of local sources. During the daytime at lower evelations, most of the sources of pollution at low elevations are active, and high temperatures favor evaporation of organic contaminants. At higher elevations, rising motions increase the likelihood of precipitation (often in the form of snow). Lower temperatures increasing partioning onto particles, as well as increasing the capacity of the surface which increases dry gaseous deposition. At nighttime, many sources at lower elevations are inactive and lower temperatures discourage evaporation. At higher elevations, sinking motions favors the dissipation of clouds and low temperatures discourages evaporation. Therefore, there is a possibility of a net transfer of organic pollutants upslope (adapted from Daly and Wania 2005).

2.0 MATERIALS AND METHODS

2.1 STUDY AREA

The Canadian Rocky Mountains extend from the Interior Plains on the east to the Rocky Mountain Trench on the west, while they are bounded in the north by the Liard River, and in the south by Maria's Pass in Montana. The region measures 1450 km in length and 150 km width, for a total area of 180,000 km^2. The highest point is Mt. Robson at 3954 m above sea level and the lowest point is a confluence of the Liard and Toad rivers at 305 m above sea level. The warmest temperatures typically occur in July, with a typical daily maximum of 20 - 25°C, while the coolest temperatures occur in January, when the average overnight low can reach as low as -30°C in the northern Rockies (Gadd 1995).

Temperatures are typically cooler at higher elevations, which also receive the greatest amount of precipitation. In the winter, more moisture is delivered to the subalpine and alpine areas than in the summer, while in the montane valley floor areas it is the reverse. Air temperature in the Rockies drop approximately 0.7°C for every 100 meter gain in elevation, but can be as much as 1°C for air which is forced to higher elevations. A temperature inversion may sometimes occur during winter when high-pressure cold artic air pushed up from the prairies becomes trapped in valleys (Gadd 1995). Rocky Mountain winds are typically from the southwest, but easterly winds from the prairies often occur in early summer and sporadically during cold periods in the middle of winter. The easterly winds move up the mountain slope where the air expands and cools, condensing into clouds and creating cloudy and rainy conditions on the western slope. In winter, these easterly winds produce a constant precipitation of tiny ice crystals (Gadd 1995).

In the present study, lakes were chosen to maximize a range of elevations (where fish were found) in the Rocky Mountains of Alberta and British Columbia (Canada), while occupying a single region removed from contaminant point sources (Fig.2.1). The altitude of the lakes ranged from 760 to 2360 m.a.s.l and all lakes were located within national parks (Banff, Jasper, or Yoho National Parks) with the exception of Shere Lake which was located ~ 20 km outside Mt. Robson Provincial Park. The lake elevation, latitude, longitude, lake surface area and catchment area were determined using digital 1:50 000 topographic maps from the National Topographic Database (NTDB) in ArcGIS 9 (ESRI) (Table 2.1).

2.2 PHYSICAL AND CHEMICAL LAKE PARAMETERS

Lakes were sampled for physical and chemical parameters after ice break-up (i.e. montane lakes in late May 2001, alpine lakes in early July 2001) with the exception of Bighorn Lake, which was sampled in July 1997.

At each lake, the surface water temperature (°C) and Secchi depth (m) were recorded. Unfiltered surface water samples were collected and processed within one hour in the field. Unfiltered water samples were stored to be analyzed for alkalinity, pH, conductivity, ammonium (NH_4^+), nitrite + nitrate ($NO_2^{-2} + NO_3^-$), total phosphorus (TP), and turbidity. Water was filtered in the field to be analyzed for anions (sulfate (SO_4^{2-}), chloride (Cl^-)), cations (sodium (Na^+), potassium (K^+), calcium (Ca^{2+}), magnesium (Mg^{2+})), dissolved organic carbon (DOC), colour (measured as absorbance at 350 nm), total dissolved nitrogen (TDN), and total dissolved phosphorus (TDP). A subsample of epilimnetic water for chlorophyll a analysis was filtered through 4.25 cm GF/F (~0.7 μm filters (Whatman, Ann Arbor, MI, USA)), which were then wrapped in tin foil to minimize exposure to light. Filters for CHN (carbon, hydrogen, and nitrogen) analysis (2.5 cm GF/F 0.7 μm, Whatman, Ann Arbor, MI, USA) were muffled for 2 hours at 450°C prior to use in the field. Chlorophyll *a* and CHN filters were immediately frozen on dry ice for subsequent analysis. All water chemistry analyses were conducted at the University of Alberta Limnological Services Unit (Edmonton, AB, Canada) as per the methods and instrumentation in Table 1 of the Appendix.

2.3 FISH COLLECTION

In October 2001 and August 2003, gillnets of various mesh sizes were used to catch a variety of fish species over a length and weight gradient. In 2001, a multi-mesh monofilament gillnet (1, 1.5, 2, 3, 4") and a combination of Swedish-style gillnets (1.5, 2 and 3") were set near shore. The nets were checked and fish removed hourly. In 2003, Parks Canada used a multi-mesh test net set overnight to collect additional fish. Brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*) were collected in August 2001 from 6 of the 8 study lakes. Brook trout were collected from Bighorn Lake in 1997 and lake trout (*Salvelinus namaycush*) were captured from Pyramid Lake in August 2003. Additional rainbow, lake, and bull trout were collected at Moab Lake in August 2003 (Table 2.2). Individual fish were identified (Nelson and Paetz 1992, Scott and Crossman 1998), measured for fork and total length (mm) and weight (g) and frozen on dry ice in the field. Data for individual fishes are presented in Table 2 of the Appendix.

In the laboratory (University of Alberta, Edmonton, AB, Canada) otoliths were removed for age determination, different methods were used to age fish by otoliths based on species (Mackay 1990). Brook trout otoliths were easily read under a dissecting microscope with no treatment. Rainbow trout, bull trout, and lake trout were cleared using cedarwood/clove oil for 24 hours and then read using a bottom lit dissecting microscope. Each fish was coded with a letter to prevent biasing ages determinations based on their lengths or weights. Each fish was independently aged twice and the two ages read for each fish were compared. If these ages were not in agreement, the fish was aged for a third time.

A fillet with the skin attached was taken from each fish ensuring that all dissection equipment and surfaces were rinsed with distilled water followed by pesticide-grade acetone and hexane. The fillet was wrapped in aluminum foil that had been solvent rinsed and baked overnight at 200°C to remove any traces of organic substances and then sealed in Whirlpak bags (double bagged). The fillets were then sent to the University of Ottawa, Ottawa, ON, Canada, in an insulated cooler containing dry ice and then stored at -20°C until extraction.

2.4 FOOD WEB SAMPLING

In order to account for trophic effects and feeding relationships samples from different levels of the food chain were collected from each of the study lakes. Pelagic, epilimnetic surface water samples were filtered onto pre-combusted and pre-weighed 2.5 cm GF/F 0.7 μm filters (Whatman, Ann Arbor, MI, USA) to collect particulate organic matter (POM). Epilithic algae was scraped from near-shore rocks into a clean plastic vial and frozen. Macrophytes were collected, sorted, rinsed to remove adhered substances or organisms, put in whirlpacks and frozen. At the laboratory, macrophytes were identified to as low a taxonomic unit as possible (Burland 1989).

Sweep nets were used to collect macroinvertebrates in the littoral zone of the lakes. Substrate was disturbed by foot movement. Rocks wrapped in plastic screening were placed in the lakes and creeks as colonization substrate. Invertebrates netted or picked from screening were transferred to plastic trays, sorted and rinsed (to remove anything adhering to the organism that might confound later analyses). Organisms were then put in whirlpaks and frozen. At the laboratory, organisms were identified (Clifford 1991) to as low a taxonomic unit as possible, organisms were grouped by order for stable isotope analysis. Zooplankton were collected by hauling a 140 μm mesh net vertically through the water column. Sub-sampled copepods were identified to order and cladocerans to family (Edmonson 1959).

2.5 STABLE ISOTOPE ANALYSIS

Skinless dorsal muscle samples from individual fishes were freeze dried in a Labconco Freezeone®12 for 48 hours. Once samples were dried, they were ground to a fine powder using a nitric acid-washed glass mortar and pestle. Invertebrate and vegetation samples were freeze dried and wetted with water to approximately field capacity, and placed in a desiccator containing a beaker with concentrated (12 M) HCl. Samples were left in the desiccator overnight to dissolve any remaining shells and surficial carbonates which are released as CO_2 and then dried in an oven at 60 °C (Hedges and Stern, 1984; Yamamuro and Kayanne, 1995; Harris *et al.*, 2001). POM filters were carefully scraped off and the samples were fumigated with acid as above. All samples were then ground into a fine powder using a mortar and pestle to homogenize the dried content. Samples were then weighed into tin capsules (approximately 0.3-0.5 mg for fish, 1-2 mg for insects and zooplankton, 2-3 mg for macrophytes, 8-10 mg for algae, and 8-10 mg for POM).

All samples were analyzed at G.G. Hatch Isotope Laboratories (University of Ottawa) for carbon and nitrogen. Samples were combusted in an automated Carlo Erba (CE-1110) coupled to a Finnighan Mat Delta ^{PLUS} Isotope Ratio Mass Spectrometer (IRMS) with a Conflow III interface. Helium served as the carrier gas while water was removed using a magnesium perchlorate trap.

Stable isotopes are expressed in "delta" notation (δ) and have units of parts per thousand (per mil) difference from the standard as follows:

$\delta R‰ = [(R_{sample}/R_{standard})-1]x1000$

where R = $^{15}N/^{14}N$ or $^{13}C/^{12}C$. $\delta\ ^{15}N$ and $\delta\ ^{13}C$ values were calculated using a normalized calibration curve based on NBS-22 and IAEACH-6 for carbon and IAEA-N-1 and IAEA-N-2 for nitrogen. Standards were obtained from National Institute of Standards and Technology (NIST). An internal laboratory standard (caffeine) was run every 10^{th} sample to correct for any possible drift in values. Precision was found to be 0.2‰ for nitrogen and 0.3‰ for carbon (based on analyses of replicates (n=20).

Primary consumer $\delta^{15}N$ varies among lakes; therefore basal differences are reflected in the $\delta^{15}N$ of upper trophic level consumers (Vander Zanden *et al.* 1999, Post 2002). All $\delta^{15}N$ trout values were corrected before carrying out lake to lake comparisons by subtracting the $\delta^{15}N$ of *Pelecypoda* spp. from the $\delta^{15}N$ of trout from the same lake. The $\delta^{15}N$ values of *Pelecypoda* spp. ranged from 0.15 to 4.39 ‰ among study lakes. The bivalve (*Pelecypoda* spp.) was chosen to correct for basal $\delta^{15}N$ variations since it is a filter feeder (provides a good representation of lake basal $\delta^{15}N$) and was found in all lakes.

2.6 CHEMICALS

All solvents used for sample extraction were pesticide grade. Omnisolv® acetone, hexane, dichloromethane (DCM), petroleum ether and water were manufactured by EM Science-Merck KGaA (Darmstadt, Germany) while Optima iso-octane was obtained from Fisher Scientific (Fair Lawn, NJ, USA). Omnisolv® water was stored at –4°C. Glassware was rinsed with ACS grade acetone and hexane (BDH Inc., Toronto, ON, Canada).

Granular anhydrous sodium sulfate 10-60 mesh (Traceput ® ACS Grade , EMD Chemicals Inc., Darmstadt, Germany) and chromatographic silica gel 60-100 mesh Davisil 635 (Fisher Scientific, Fair Lawn, NJ, USA) were activated in a muffle furnace at 600°C for 6 hours and stored at 130°C. Glass wool (VWR Scientific, West Chester, PA, USA) was cleaned with DCM in an ultrasonic cleaner (Aquasonic 75D, VWR Scientific, West Chester, PA, USA) for 30 minutes and then stored at 130°C. Hydromatrix © which is an inert diatomaceous earth (Varian, Palo Alto, CA, USA) was rinsed twice with petroleum ether and then stored in a solvent-rinsed container. Bio-beads® (S-X3, 200-400 mesh, Bio-Rad Laboratories, Hercules, CA, USA) were cleaned with DCM and then dried and re-swelled in a 50:50 mixture of hexane:DCM overnight.

All field surrogates, lab surrogates, and pure standards used at the University of Ottawa were obtained from the National Laboratory for Environmental Testing (NLET) in Burlington, ON, Canada. Field surrogates contained 1,3,5-tribromobenzene (1,3,5-TBB), 1,2,4,5-tetrabromobenzene (1,2,4,5-TTBB), and δ-hexachlorocyclohexane (δ-HCH). Laboratory OC surrogates included 1,3-dibromobenzene (1,3-DBB) and endrin ketone, and laboratory PCB surrogates contained PCB 30 and PCB 204. Mirex, used as an internal standard was obtained from Ultra Scientific (North Kingstown, RI, USA) at 100 ng · μl^{-1} in methanol, and further diluted to 2000 pg · μl^{-1} in iso-octane. Pure reference standard solutions were used for instrument calibration, recovery evaluation, and analyte identification and quantification.

2.7 EXTRACTION OF POPs

Approximately 8-10 g of fish muscle tissue (including skin) were homogenized with Hydromatrix © using a mortar and pestle. Samples were packed into 33 mL cells and internal standards of 1,3,5-TBB, 1,2,4,5-TTBB, δ-HCH, 1,3-DBB, endrin ketone, PCB 30, and PCB 204 were added to determine extraction efficiencies. Extracted was performed using an accelerated solvent extractor (ASE® 200 with ASE solvent controller, Dionex Corporation, Sunnyvale, CA, USA). The first extraction was done with DCM for 3 static cycles of 3 minutes at a temperature of 125°C and a pressure of 2000 PSI (Dionex Application Note 342). The second extraction utilized hexane for 2 static cycles of 5 minutes at a temperature of 100°C and a pressure of 2000 PSI (Dionex Application Note 322). Purge time after each extraction was set at 120 and 90 seconds respectively. Extracts were then dried and combined by passing through a bed of sodium sulfate, which was pre-rinsed with 40 mL of hexane. The bed was washed with 15 mL of DCM to make sure no analytes remained in the sodium sulfate bed. The extract was then evaporated down to about 4 mL using a Turbo Vap® II Concentration workstation (Zymark Corporation, Hopkinton, MA, USA) with a water bath temperature of 35°C and a pressure of 15 PSI. The extract was then topped up with about 4 mL of DCM in order to have an 8 mL sample made up of a 50:50 mix of hexane:DCM.

Lipids were removed from the extract by automated gel permeation chromatography (GPC) using a GPC Autoprep 1002A (Analytical Bio Chemistry Laboratories, Columbia, MO, USA) with a flow rate set to 5 ml/min. The column (glass with Teflon fittings, internal diameter 25 mm, length 600 mm) was prepared by adding 65 g (dry weight) of Bio-beads® pre-swelled in the elution solvent (hexane: DCM, 1:1). The elution volume which was required to collect the organic contaminants from the GPC was calibrated using a 1:1 mix of hexane:DCM which contained 0.5 mL of the OC method spiking surrogate and 0.5 mL of the PCB method spiking surrogate. A collection time of 5 minutes was set to collect 15 fractions to determine when the analytes came out of the column.

The elutant was then concentrated to 1 mL with a gentle stream of ultra high purity nitrogen (Praxair, Mississauga, ON, Canada) using a Reacti-Therm evaporating unit and heating module (Pierce, Rockford, IL, USA) kept at 30°C. The extract was cleaned up and fractionated on a silica gel column. The column was wet packed (hexane) as follows: glass wool, 8 g of silica gel, and approximately 1g sodium sulfate. The column was drained until the hexane was approximately 1 mm above the sodium sulfate and then rinsed with 20 ml hexane that was once again drained to approximately 1 mm above the sodium sulfate. The extract was placed on top of the column and allowed to pass through the column prior to fractionation. Fraction 1 (50 mL hexane) contained the non-polar OC pesticides and PCBs while fraction 2 (80 mL of 1:1 hexane:DCM) contained the more polar OC pesticides. Fractions were solvent-exchanged into iso-octane, and evaporated down to 0.5 mL using the Turbo Vap® II Concentration workstation. Mirex was added as an internal standard. Each fraction was stored in a clear 2 mL borosilicate glass vial (Wide opening screw cap vials, Agilent Technologies, Palo Alto, CA, USA) and stored at 4°C until analysis.

The lipid content of each sample was determined by extracting 2-6 g of dorsal muscle using the ASE® 200. The extraction was done with DCM for 2 static cycles of 2 minutes at a temperature of 125°C and a pressure of 2000 PSI (Dionex Application Note 334). The extract was collected in a pre-weighed, 50 mL borosilicate glass vial (VWR Scientific, West Chester, PA, USA). After drying for several days, the vial was placed in the oven at 60°C for several hours and the vial was re-weighed and the percent lipid was calculated.

2.8 ANALYTICAL PROCEDURE

Extracts were analyzed by a Hewlett Packard 6890 Series II GC equipped with a split/splitless injector, a 30 m x 250 μm i.d. DB-5 (J&W Scientific, Chromatographic Specialties Inc. Brockville, ON, Canada) with a 0.25 μm thickness, and a ^{63}Ni microelectron capture detector. One microliter of extract was injected in the splitless mode with an initial injector temperature of 250 °C. Helium was used as the carrier gas with a flow rate of 3.1 mL/min and nitrogen as the make-up gas with a flow rate of 56.9 mL/min. The temperature program conditions were 80 °C held for two minutes, ramped at 10 °C per minute to 110 °C, then at 3 °C per minute to 280 °C and held for five minutes. The detector temperature was 350 °C.

Chromatographic analysis and quantification of sample extracts were performed using HP Chemstation software (Rev. A.06.03, Hewlett Packard, Palo Alto, CA, USA). Sample extracts were screened for 27 OC compounds and 127 PCB congeners, some of which coeluted to give 94 peaks. Analytes were considered present if the sample peak and its corresponding reference peak eluted within a retention time window of 0.02 minutes. A five-point calibration curve was prepared using reference standards between 1.9 and 530 pg · μl^{-1} for OCs and between 1.78 and 721 pg · μl^{-1} for PCBs. Calibration was based on a linear curve forced through the origin with linear weighting to all five points. The coefficients of determination for all calibration curves were 0.99 or higher. Mid-level standards for the OC pesticides and PCBs were analyzed at intervals throughout the sample analysis and used to recalibrate the instrument after every 20 injections. Sample peak quantification was based on the relative response of the internal standard against the target analytes.

2.9 QUALITY CONTROL

All glassware used at the University of Ottawa was washed with Liqui-Nox phosphate free liquid detergent (VWR Scientific, West Chester, PA, USA), rinsed in triplicate with tap water followed by distilled water, rinsed with ACS grade acetone and hexane, and heated for 12 hours at 200°C. Glass Pasteur pipettes (VWR Scientific, West Chester, PA, USA) used for transfer of solvents and sample extracts were also heated for 12 hours at 200°C. ASE cells were washed in the same manner as the glassware and then sonicated with DCM in an ultrasonic cleaner (Aquasonic Model 75D, VWR Scientific Products, West Chester, PA, USA) for two cycles of 20 minutes before being stored in solvent-rinsed glass jars. To monitor potential laboratory contamination, procedural blanks were processed with every set of samples that was run on the ASE. All data were blank-corrected prior to analysis by subtracting the mean blank concentration from the extract concentration. Each ASE run also included a blank sample spiked with the PCB method spiking surrogate and the OC method spiking surrogate to monitor recoveries and fractionation of analytes of interest. A NIST standard reference material (2978 mussel tissue, organic contaminants, Raritan Bay, NJ; US Department of Commerce National Institute of

Standards and Technology, Gathersburg, MD, USA) was routinely analyzed with every sample batch.

The percent recovery for the field surrogates ranged from 50.1 ± 15.0 % for 1,3,5-TBB, 79.9 ± 20.6% for 1,2,4,5-TTBB, and 114.1 ± 27.5 % for δ-HCH. The recovery of OC and PCB laboratory surrogates were 31.1 ± 10.6 % for 1,3-DBB and 52.7 ±% 25.1% for Endrin Ketone, 63.3 ± 10.6% for PCB 30, and 66.3 ±10.1 for PCB 204.

2.10 STATISTICAL ANALYSIS

Concentrations of each compound were calculated on a wet weight and lipid weight basis. All concentration data were $\log_{10}$ transformed to equalize the variance and normalize the data. Weight, length, and growth rate were also $\log_{10}$ transformed. Data were statistically analyzed using SYSTAT 10. Single regression analysis was used to determine the strength of the relationship between elevation and concentration as well as growth rate and concentration. A backward stepwise multiple regression (with alpha-to-enter and alpha-to-remove set to 0.05) was conducted to establish the relative predictive importance of the independent variables.

To explore the variability in the full suite of analytes measured in each trout, a series of multivariate analysis was conducted. Multivariate analyses were conducted on relative abundance data as opposed to the absolute concentrations of contaminants. Data were screened to only include analytes which were present in at least 75 % of the samples and accounting for at least 0.5% of the total POP concentration. This screening step retained 33 analytes and this subset proved to provide a strong representation of the overall POP concentration in the trout. Percent analyte data were log transformed. Principal component analysis was conducted using Canoco 4.5 (Biometris-Plant Research International, Wageningen, Netherlands). PCA is considered as a useful tool for better understanding relationships among variables and for revealing groups or clusters within the data. It reduces dimensionality of the linearly correlated data set using a smaller number of linearly independent new variables. These new variables are principal component/factors, each of which is a linear combination of original correlated variables (Hopke 1992, Jobson 1991). The scores of the resulting PCA axes can then be used as new independent variables in consecutive multivariate analysis. Regression analysis was then conducted to assess the strength of the relationship between the axis scores and lake elevation as well as analyte K_{ow} and vapour pressure. The multivariate relations between organochlorine concentrations and the explanatory variables (age, length, weight, lipid content, growth rate, $\delta^{15}N$, and $\delta^{13}C$) were analyzed by redundancy analysis (RDA). RDA is a constrained form of multivariate multiple regression. It is an intermediate between PCA and separate multiple regressions of each of the dependent variables. The RDA was run using forward selection with 999 Monte Carlo permutations (Jongman *et al.*, 1995). The dependent variables in the diagram are indicated by points, whereas the vectors indicate the independent variables. Variables pointing in roughly the same direction indicate that they are positively correlated; variables crossing at right angles indicate near-zero correlation, and variables pointing in opposite directions indicate high negative correlation. The length of the arrow indicates the importance of the variable in the analysis (Rogenerud *et al.* 2002).

Table 2.1 Some physical, chemical, and biological characteristics of lakes sampled in the Canadian Rocky Mountains. All water chemistry parameters were measured from surface waters (1st meter) from May 2001.

	Shere	Pyramid	Patricia	Moab	Johnson	Emerald	Moraine	Bighorn
Altitude (m.a.s.l.)	760	1180	1180	1249	1320	1416	1917	2360
Latitude (°N)	53 02.102	52 54.921	52 54.628	52.39.935	51 11.924	51 26.454	51 19.584	51 28.756
Longitude (°W)	119 36.331	118 05.320	118 05.462	117 57.358	115 29.284	116 32.467	116 10.894	115 39.148
Surface area (m^2)	66,430	1,241,873	645,282	213,518	1,029,200	156,061	392,000	15,379
Volume X10^6 (m^3)	679	46,264	3,846	4,563	67,643	20,724	65,178	172,312
Max depth (m)	12[a]	19[a]	40[a]	18[a]	3.5	28	23[a]	9.2[a]
Secchi (m)	2.75	7.5	7.5	7.25	1.75	4.0	4.0	N/A
Catchment area (m^2)	881,274	32,177,283	3,171,813	3,421,171	42,396,124	11,560,608	33,327,498	80,658,872
Temperature (°C)	17.25	15.5	16.0	16.0	15.0	13.0	7.0	5.0
Break-up	April[a]	mid May[a]	Mid May[a]	mid May[a]	late May[a]	early June[a]	mid June[a]	early July[a]
Freeze up	late November[a]	November[a]	November[a]	early November[a]	late October[a]	late October[a]	October[a]	early October[a]
DOC (mg · L^{-1})	5.1	2.4	7.7	1.7	1.4	0.8	0.8	0.9[b]
TDP (µg· L^{-1})	5.4	2.7	4.4	2.2	3.5	3.0	0.2	3.1[b]
TP (µg· L^{-1})	11	4	7	4	5	10	2	5[b]
NH4+ (µg· L^{-1})	30	1	15	11	16	37	8	3[b]
NO2 + NO3 (µg· L^{-1})	7	7	6	1	3	58	50	68[b]
TDN (µg· L^{-1})	481	171	366	142	135	151	130	161[b]
Conductivity (µS· cm^1)	104	259	607	148	349	218	131	221[b]
Alkalinity (mg· L^{-1})	51.5	75.5	239.0	57.3	134.4	100.8	58.9	1.2[b]
pH	8.05	8.07	8.64	7.98	8.36	8.26	8.05	8.32[b]
Turbidity (NTU)	0.82	0.44	0.39	0.55	0.56	7.60	0.51	1.60[b]
Chl *a* (µg· L^{-1})	1.3	1.0	1.4	1.3	0.9	1.0	0.1	2.9[b]
Abs 350 nm	0.171	0.089	0.039	0.071	0.052	0.039	0.020	N/A

a- Anderson, 1974.
b- collected by Brian Parker, 1997.

Table 2.2 Summary statistics of trout from selected lakes in the Canadian Rocky Mountains. Species included BK, brook trout; LK, lake trout; RB, rainbow trout; BL, bull trout. All values are reported as mean (± SD)

Lake	Species	*n*	Year collected	Age (year)	Length (mm)	Weight (g)	% lipid	$\delta^{15}N$ (‰)[a]	$\delta^{13}C$ (‰)	Growth rate ($g \cdot yr^{-1}$)[b]
Shere	BK	11	2001	5.9 ± 1.0	331.3 ± 44.9	515.5 ± 255.2	4.5 ± 1.4	3.15 ± 0.41	-22.27 ± 0.38	107.4 ± 31.7
Pyramid	LK	11	2001	7.0 ± 2.3	490.5 ± 45.0	1324.0 ± 387.1	4.2 ± 1.9	8.80 ± 1.34	-30.56 ± 0.67	232.0 ± 51.5
Patricia	BK	1	2001	6.0	273.0	306.0	4.5	12.36	-24.74	61.2
	LK	5	2001	9.5 ± 3.9	475.0 ± 120.8	1316.0 ± 757.2	13.2 ±7.2	11.91 ± 0.60	-26.63 ± 0.49	168.8 ± 77.4
	RB	2	2001	6.5 ± 2.1	389.5 ±61.5	872.5 ± 374.1	11.6 ± 0.5	12.50 ± 0.88	-26.99 ± 1.12	157.2 ± 7.4
Moab	LK	1	2001	7.0	373.0	642.0	5.8	8.74	-30.93	107.0
	RB	5	2001	3.6 ± 0.9	253.0 ± 55.7	233.4 ± 79.6	2.2 ± 0.7	5.07 ± 0.34	-28.16 ± 0.42	90.1 ± 8.1
	BL	2	2001	8.5 ± 2.1	363.5 ± 82.7	931.5 ± 125.2	1.9 ± 0.5	6.85 ± 0.94	-27.88 ± 0.04	126.9 ± 19.2
	LK	5	2003	6.2 ± 1.9	398.6 ± 65.0	809.8 ± 452.5	1.9 ± 0.3	11.30 ± 0.72	-30.55 ± 1.06	148.1 ± 28.2
	RB	5	2003	3.6 ± 0.5	325.6 ± 22.2	365.8 ± 62.8	1.2 ± 0.5	9.16 ± 2.02	-27.77 ± 1.02	144.9 ± 36.3
	BL	1	2003	6.0	397.0	995.0	3.8	9.39	-27.00	199.0
Johnson	BK	9	2001	4.3 ± 1.0	233.1 ± 46.9	156.1 ± 82.1	2.1 ± 0.6	5.25 ± 0.73	-28.75 ± 0.46	48.9 ± 13.5
	RB	3	2001	3.3 ± 1.2	250.0 ± 71.9	197.0 ± 121.3	3.4 ± 1.0	4.46 ± 0.73	-29.01 ± 0.38	78.3 ± 18.5
Emerald	BK	9	2001	6.0 ± 1.6	281.0 ± 47.7	264.4 ± 131.6	1.1 ± 0.6	6.49 ± 0.86	-27.77 ± 0.50	50.0 ± 12.7
	RB	3	2001	2.7 ± 0.6	194.7 ± 29.2	77.7 ± 27.4	1.2 ± 0.1	5.56 ± 1.02	-27.54 ± 0.94	46.5 ± 0.5
Moraine	BK	8	2001	5.1 ± 0.7	247.6 ± 33.4	194.1 ± 64.6	4.7 ± 1.4	4.87 ± 0.33	-24.83 ± 0.39	46.3 ± 11.4
Bighorn	BK	11	1997	6.7 ± 1.9	273.9 ± 28.0	221.9 ±61.2	2.2 ±1.2	4.66 ± 0.84	-18.43 ± 1.30	42.6 ± 16.5

a- Baseline corrected trout $\delta^{15}N$ = trout $\delta^{15}N$ - Pelecypoda $\delta^{15}N$ from the same lake.
b- Weight divided by (age minus 1)(Kidd *et al.* 1995). Growth was assumed to be linear over the age range of the trout sampled

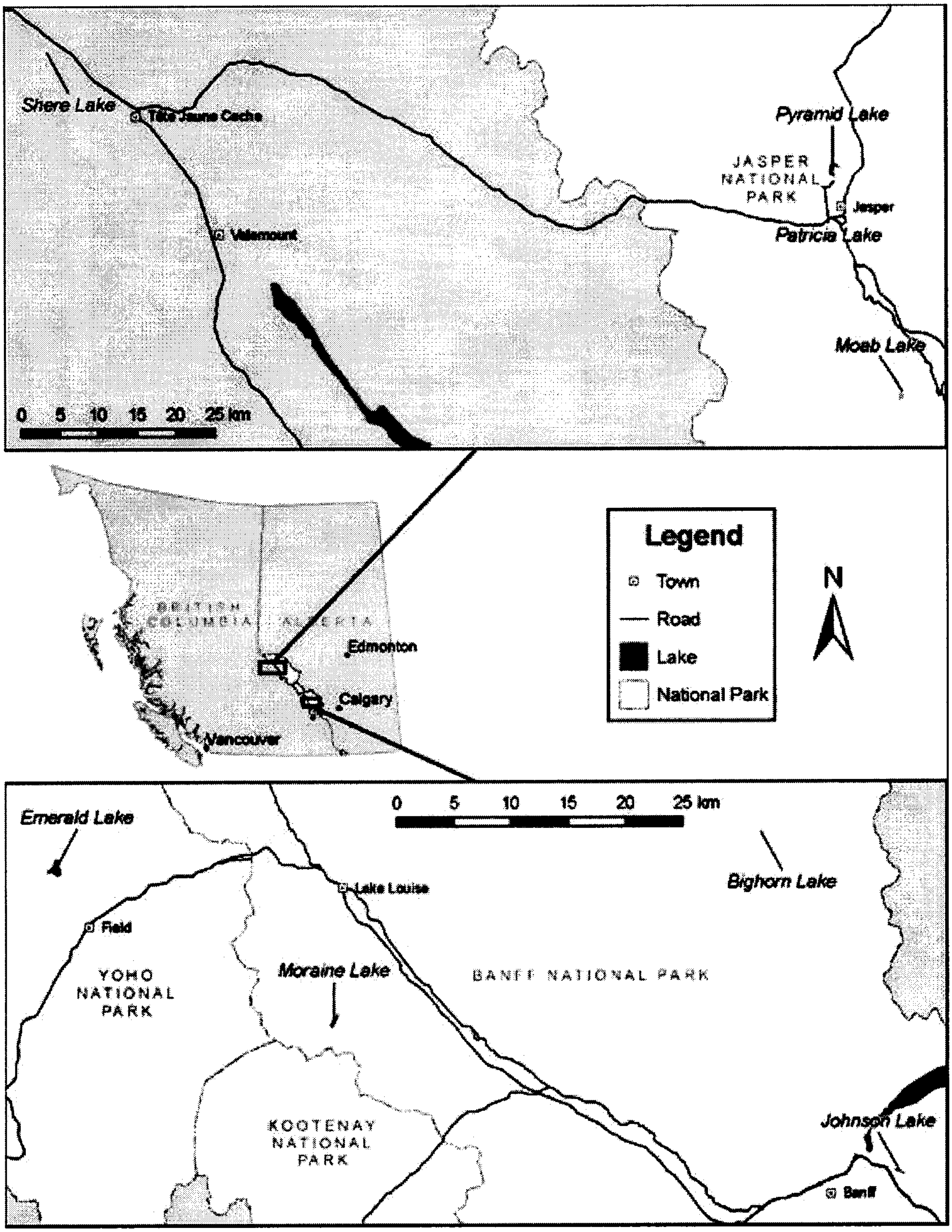

Figure. 2.1 The study area, showing the location of the National Parks and the study lakes.

3.0 RESULTS AND DISCUSSION

3.1 LAKE CHARACTERISTICS

Lake temperature ($r^2 = 0.925, p < 0.0001$) and colour ($r^2 = 0.650, p = 0.0176$) decreased significantly with lake elevation (Table 2.1), while catchment area ($r^2 = 0.518, p = 0.0266$), lake volume ($r^2 = 0.7195, p = 0.0048$), and $NO_2 + NO_3$ ($r^2 = 0.597, p = 0.0149$) were positively correlated with altitude. DOC, TDP, TP, NH_4^+, and alkalinity were negatively related to lake altitude but the relationships were not significant. This is similar to other mountain studies in the Canadian Rockies which have found overall productivity decreases with elevation (Donald *et al.* 1998, Blais *et al.* 2003). As anticipated most of the lakes were oligotrophic (defined as TP 4-10 $\mu g \cdot L^{-1}$, CCME 2004).

3.2 FISH CHARACTERISTICS

Brook trout (*Salvelinus fontinalis*) was the dominant fish collected, appearing in 6 of the 8 study lakes, constituting 49 of the 92 fish analyzed (Table 2.2).Since all of the fish analysed in this study were trout, all of the species were grouped together for analysis. This decision is further justified since within the same lake fish had similar size, growth rate, and $\delta^{15}N$ (Fig. 1-4 of Appendix). Individual fish ranged from 161 to 589 cm in length, and weighed between 46 to slightly over 2000 g. Both fork length and weight were negatively correlated with elevation ($r^2 = 0.108, p = 0.0008, r^2 = 0.147, p < 0.0001$ respectively). This is in agreement with previous work by Wilhelm *et al.* (1999), which showed a significant negative correlation between the weight of fish (at an age of 5 years) and lake elevation (r =

-0.63) in bull trout from selected Rocky Mountain lakes. Wilhelm *et al.* (1999) also reported that fish weight was positively correlated with the natural logarithm of amphipod densities (r = 0.73), the specific conductance of waters (r = 0.63), and the mid-summer water temperature (r = 0.55).

Aging by otolith revealed fish ages ranged from 2 to 10 years (with one individual being 15 years old), while lipid content varied from 0.39 to 22.99%. There was no correlation between age or lipid content and elevation. Growth rate, estimated for each individual fish as weight/(age-1) (Kidd *et al.* 1995), was also negatively correlated with elevation ($r^2 = 0.211$, $p < 0.0001$) and varied between 24 to 322 $g \cdot yr^{-1}$. This estimation gives the best estimate of weight from age because of the lower absolute weight gain in very young fish (Kidd *et al.* 1995). Growth was linear over the age range of the trout sampled (Fig. 5 of the Appendix).

3.3 ISOTOPE STRUCTURE AND INFERRED FEEDING BEHAVIOR OF TROUT

The baseline corrected $\delta^{15}N$, ranged from 2.29 to 13.12‰ and was not correlated with elevation. In other words there was no change in the length of food chains observed with elevation. The baseline corrected $\delta^{15}N$ values from the mid-altitude lakes (Pyramid, Patricia, and Moab in 2003) were higher than in the other lakes, and the range was significantly higher (7.35 -13.23 ‰). The other lakes had a range of $\delta^{15}N$ baseline corrected values between (1.90 - 9.06 ‰). An increase in trophic position is represented by a 3.4 ‰ increase in $\delta^{15}N$ (Minagawa and Wada 1984, Cabana and Rasmussen, 1994, Kidd *et al.* 1995, Vander Zanden *et al.* 1997). Therefore, the range in mean $\delta^{15}N$ indicates that feeding habits of trout populations in study lakes were variable. Trout with a $\delta^{15}N$ in the lower part of the range are likely feeding as primary or secondary consumers in pristine, oligotrophic lakes (Cabana and Rasmussen, 1996, Vander Zanden *et al.* 1997), whereas trout with higher $\delta^{15}N$ values in the upper area of the range are probably piscivorous. Those trout which have intermediate $\delta^{15}N$ values are probably generalist feeding on a range of prey from different trophic levels. Given that the average $\delta^{15}N$ from trout in all lakes was about 6.6 ‰ (and assuming an enrichment factor of 3.4 ‰ $\delta^{15}N$ per trophic level change, as stated above) the average number of energy transfer steps from primary producer to trout was only 1.9. A graphical representation of the relationship of individual trout in relation to trophic position of other organisms in their respective lakes can be seen in Fig. 3.1a and 3.1b.These results corroborate with other studies that showed alpine aquatic foodwebs are simple, with trout typically feeding as secondary consumers (Campbell *et al.* 2000, Catalan *et al.* 2004, Vives *et al.* 2004)

$\delta^{13}C$, which is an indication of the primary carbon source (i.e. benthic vs. pelagic) (Cabana and Rasmussen 1994, France 1995, Vander Zanden *et al.* 1999, Kidd 2001) was positively correlated with lake elevation ($r^2 = 0.263, p < 0.0001$) and varied from -31.96 to -17.52‰. Exchange with atmospheric carbon dioxide and flux rate with the atmosphere driven by carbon inputs from the drainage basin may strengthen this correlation. However, algae and zooplankton were negatively correlated with lake elevation (Fig. 6 in Appendix). This suggests that trout from higher altitude lakes tend to feed more from the benthic foodweb, while fish from lower altitude lakes rely more on pelagic carbon sources.

The mean $\delta^{13}C$ values varied greatly between the lakes from the isotopically heaviest signature in Bighorn (-18.43 ± 1.30 ‰) to the lightest in Pyramid (-30.56 ± 0.67 ‰). Generally, a $\delta^{13}C$ signature above -20‰ implies a significant contribution of the fish's diet is from littoral or (i.e. benthic algae and benthic invertebrates) (France 1995, Hecky and

Hesslein, 1995, Kidd 2001). Allochthanous sources such as flying insects were also found to be a large proportion of the Bighorn brook trout diet (personal communication, Erin Kelly, University of Alberta). On the other hand, a $\delta^{13}C$ signature below -25‰ suggests a significant contribution from pelagic organic carbon sources (i.e. planktonic zooplankton) into the fish's diet (France 1995, Hecky and Hesslein, 1995, Kidd 2001). The trout $\delta^{13}C$ values in most of the study lakes were in between benthic and pelagic $\delta^{13}C$ values (Fig. 3.1a and Fig. 3.1b) indicating that omnivory was prevalent. The trout in these alpine lakes were likely opportunistic feeders having both a pelagic and benthic component to their diet. This is consistent with observations that alpine trout populations are generally feeding on a mix of bottom invertebrates (insect larvaes, snails, and crustaceans), zooplankton, and terrestrial insects (Scott and Crossman, 1985; Wilhelm *et al.* 1999). In fact, Wilhelm *et al.* (1999) made the observation that bull trout fed on seasonally abundant prey species in the Canadian Rocky Mountains. After ice-out in July, the diet was dominated by chironomid pupae, while *Daphnia pulex* and the amphipod *Gammarus lacustris* dominated the diet in August and September. Large bull trout preyed on larger *Daphnia* than did small bull trout. Fish of both size classes consumed large *Gammarus*. Catalan *et al.* (2004) reported a similar observation in alpine brown trout (*Salmo trutta*). In June *S. trutta* fed predominantly on chironomids (when they were abundant) and then switched over to cladocerans, *Daphnia* spp., *Eurycercus* spp. in November (when chironomids are scarce).

3.4 ORGANOCHLORINE CONCENTRATION IN FISH

Average fish concentrations of individual organochlorine pesticides varied from 61 ± 52 $pg \cdot g^{-1}$ for γ-chlordane to 4048 ± 5441 $pg \cdot g^{-1}$ for *p,p'*-DDE. The sum of polychlorinated biphenyls (PCB) concentration in trout averaged 7712 ± 10399 $pg \cdot g^{-1}$, of which the tetra, penta, and hexa-chlorinated congeners were the dominant members (concentrations for the individual fish are given in Tables 3 - 6 of the Appendix). These concentrations are comparable to those previously recorded in fish from lakes in the Rockies (Donald *et al.* 1993) and from European mountain lakes (Grimalt *et al.* 2001, Vives *et al.* 2004, *Caralan et al.* 2004, Vives *et al.* 2005). Overall the trout in this study were not particularly elevated in POPs, except for 4 individual lake trout from Patricia Lake which exceeded the Canadian Tissue Residue Guideline for the protection of wildlife consumers of aquatic biota for *p,p'*-DDE (total DDT = 14000 $pg \cdot g^{-1}$ CCME, 1997).

Concentrations of the majority of the compounds analyzed in fish tissues were significantly correlated with lake elevation. The relationship was even stronger when contaminant concentrations were expressed per gram lipid. Elevation explained between 6.5 to 61% of the variance when POPs were expressed on a lipid basis (Fig. 3.2), whereas only 1.2 to 47% of the total variation was explained when POPs were expressed on a wet weight basis (Fig. 3.3). Lipid correcting the concentrations eliminates some of the variability due to the wide range in lipid (0.39 – 22.99%). Initially, the POP concentration in trout from Patricia Lake appear to be outliers (Fig. 3.3) but when they are expressed as lipid corrected concentrations, a much better correlation with elevation is observed (Fig 3.2).

The compounds which increased the most with elevation were the more hydrophobic (log K_{ow} 5.2-6.2), less volatile organochlorine pesticides (OCPs) (e.g. dieldrin and DDTs) (Fig. 3.4). The relationship was not as strong for the less hydrophobic, more volatile OCPs (e.g. HCH and HCB). PCBs also did not correlate as strongly with elevation as the OCPs when expressed on a lipid and fresh weight basis. Generally, the relationship for elevation appeared to be slightly stronger for the less hydrophobic (approximately the same hydrophobicity as the more hydrophobic OCPs, log K_{ow} 6-6.5), more volatile PCBs (those with fewer chlorines) than the more hydrophobic (log $K_{ow} > 6.5$), less volatile PCBs (those with more chlorines). However the relationship between these variables was not strong enough to imply any type of statistical relationship (Fig 3.4).

3.5 EFFECT OF GROWTH RATE

Growth rates have been shown to influence persistent contaminant levels in fish via biodilution (Hammer *et al.* 1993, Madenjian *et al.* 1994, Kidd *et al.* 1995, Stafford and Haines 2001, Blais *et al.*, 2003 Stafford *et al.*, 2004). In the present study, growth rate generally decreased with elevation and ranged from 42.6 - 232.0 $g \cdot yr^{-1}$ (Table 2.2). A significant decrease in POP concentration with respect to elevation was observed for several POPs (Fig. 3.5). For some OCPs and PCBs (i.e. α-HCH, PCB 31-28, PCB 52, and trichlorinated PCBs), growth rate explained more of the variation in contaminant concentrations than elevation (Table 3.1 and 3.2).

Growth may lead to an appreciable dilution of a substance which has a long clearance rate, i.e. a small respiratory clearance (k_2), metabolic clearance (k_M) and egestion rate constant (k_E). The rate constant for egestion is a critically important determinant of bioaccumulation of more hydrophobic compounds (i.e. PCB 180) (Sijm *et al.* 1992). This is in agreement with the present data; growth rate appears to be more important for those compounds with higher K_{ow} (Fig. 3.5) (with the exception of α-HCH).

3.6 OTHER BIOLOGICAL VARIABLES

Elevation and growth rate are not the only factors which may affect organic contaminant concentrations in the trout. Other factors such as fish size and age (Stow and Carpenter 1994, Bentzen *et al.* 1996 Vives *et al.* 2004, Vives *et al.* 2005), trophic position ($\delta^{15}N$) (Minagawa and Wada 1984, Cabana and Rasmussen 1994, Kidd *et al.* 1995, Fisk *et al.* 2001), feeding behaviour ($\delta^{13}C$)(Meili *et al.* 1993, Hecky and Hesslein 1995, Campbell *et al.* 2000, Kidd *et al.* 2001), and lipid content (Bentzen *et al.* 1996, Larson *et al.* 1996, Berglund *et al.* 2001) have been shown to influence contaminant burden in fish. To determine the extent these factors influenced the spatial patterns of OC accumulation in trout, several multiple regressions were conducted on lipid corrected organochlorine compound concentrations.

In general, elevation, followed by $\delta^{13}C$ and growth rate, explained most of the variation (Table 3.1) in organochlorine pesticides in Rocky Mountain trout. Elevation explained more of the variation in OCP concentration for the more hydrophobic, less volatile organochlorine pesticides. The percentage of variance explained when multiple regressions were conducted with PCBs (also lipid corrected) did not change with hydrophobicity or volatility.

However; unlike the OCPs, growth rate was found to be the best predictor for PCBs, followed by $\delta^{13}C$ and elevation (Table 3.2). This is consistent with the growth dilution theory, where biodilution should be more pronounced for the more persistent, and more strongly biomagnified compounds (i.e. generally those with larger K_{ow}s) like PCBs (Sijm *et al.* 1992, Borgmann and Whittle 1992). For the most part, PCBs have a higher K_{ow} and most PCBs (other than the low chlorinated PCBs) are not as volatile as the OC pesticides;

therefore processes other than atmospheric deposition (i.e. growth rate and feeding behavior) should be more important in explaining their spatial distribution. However; the importance of atmospheric deposition should not be disregarded as the PCBs found in the study lakes almost surely arrived due to atmospheric transport.

When the same regressions were conducted on a wet weight basis instead of lipid weight basis (Table 3.3 and 3.4), lipid content became an important factor in explaining a significant amount of the variation in contaminant concentration. However, elevation was still the factor which explained the most variability in the spatial pattern of the OCP concentrations (Table 3.3) in trout. For PCBs (Table 3.4), percent lipid was usually the most important factor followed by growth rate.

Fish age was an important variable for the less volatile, more hydrophobic compounds such as the DDTs, dieldrin and the more chlorinated PCBs (5 or more chlorines). Higher Kow compounds are more lipophillic and generally have longer residence times in fish (Gobas *et al.* 1993). This is consistent with other studies emphasizing the importance of age in bioaccumulation of such contaminants (Braune *et al.* 1999, Catalan *et al.* 2004, Vives *et al.* 2004, Vives *et al.* 2005). The more volatile compounds such as the HCHs, HCBs, chlordanes and less chlorinated PCBs (less than 5 chlorines) were generally not associated with age, fish size or $\delta^{15}N$, which indicated a diminished capability for these compounds to biomagnify in food chains. These contaminants have been shown to have lower biomagnification factors and higher depuration rates than other higher K_{ow} POPs (Gobas *et al.* 1993, Fisk *et al.* 1998).

3.7 ORGANOCHLORINE COMPOSITION IN FISH

A principal component analysis (PCA) plot of the relative abundance of POP analytes in fish (Fig. 3.6) was plotted. Only the most common POPs from the study lakes were included in the plot. Data was screened to only include analytes which were present in at least 75 % of the samples and accounting for at least 0.5% of the total POP concentration. This screening step retained 33 analytes. The plot separated the OCPs (HCHs, chlordanes, endosulfans, dieldrin, DDTs) from the PCB congeners. The OCPs can be found on the right hand side of the plot while almost all of the PCBs are found on the left of the plot. The lower numbered PCB congeners (more volatile) tended to be found along with the more volatile OCPs in the bottom portion of the PCA plot, while the less volatile analytes were found in the top portion of the PCA plot.

A PCA plot of the individual trout samples (Fig. 3.7) showed distinct groupings where fish from lakes in the different mountain lakes generally clustered together. The general clustering of the trout populations shows that the intra-lake variability within the dataset is greater than the inter-lake variation. This was confirmed by running a one-way MANOVA using the scores of the first and second axis as the dependent variables and the lakes sampled as the random factor. Both analysis showed the fish sampled from one lake were significantly different from another lake ($p < 0.001$, $r^2 = 0.537$ for axis 1 scores and $p < 0.0001$, $r^2 = 0.599$ for axis 2 scores). However the analysis also revelaed that there is a considerable amount of variance in the trout from some lakes. Some trout (i.e. Shere, Patricia, Moraine, and Bighorn) had tighter groupings than others (i.e. Pyramid, Moab, Emerald, and Johnson). The trout samples which formed broader clusters in the PCA plot appeared also to have a more variable $\delta^{15}N$ (Table 2.2). Trout populations within these lakes may be more omnivorous than other populations or may have a greater diversity in diet type.

The eigenvectors indicated that the first axis accounted for 25 % of the variation in the dataset while the first and the second combined to explain 44 % of the variability. Regression analyses between the first PCA axis and log K_{ow} (Fig. 3.8) revealed a strong negative correlation ($r^2 = 0.546, p < 0.0001$) between the two. Compounds with a lower K_{ow} had higher scores on axis 1. Elevation explained a significant amount ($r^2 = 0.322; p < 0.001$) of the variation of the second PCA axis (Fig. 3.9).

The multivariate relations between organochlorines and the explanatory variables (lipid content, age, growth rate, length, weight, $\delta^{13}C$, and $\delta^{15}N$) were analyzed by redundancy analysis (RDA) (Fig. 3.10). RDA is a constrained form of multivariate multiple regression. It is an intermediate between PCA and separate multiple regressions of each of the dependent variables. The eigenvectors indicated that the first RDA axis accounted for 53.9 % and the second RDA axis 21.8 % of the variation in the data set. $\delta^{13}C$ was the variable which had the greatest loading on the first RDA axis (negatively) followed by growth rate (which was negatively related to $\delta^{13}C$). Age and percent lipid formed two highly correlated gradients which loaded primarily on the second axis.

Among the dependent variables, a group of OCPs (*β*-endosulfan, dieldrin, *p,p'*-DDD, *o,p'*-DDT, and *p,p'*-DDT) formed a cluster in the ordination diagram which was associated with the $\delta^{13}C$ gradient. This suggests that changes in feeding behaviour can influence the concentration of these POPs. Some of the more biomagnifying PCBs (PCB 183, 138-163, 187-182, and 153-132-105) and *p,p'*-DDE were associated with the lipid content, age, weight, and length gradients. These compounds typically accumulate in fish with age as they have relatively extended residence times in fish (Gobas *et al.,* 1993, Fisk *et al.,* 1998). HCHs, HCB, α-endosulfan, chlordane, and several of the lighter PCBs were located closer to the center of the RDA plot. These compounds were not positively associated with any of the gradients in the RDA which suggests that these analytes may have less biomagnification potential. Indeed, these compounds have been reported to biomagnify less in food chains (Kidd *et al.* 1998, Fisk *et al.* 1998, Rognerud *et al.* 2002) and are rapidly eliminated in some fish species (Clark and Mackay 1991).

The RDA plot of the fish samples (Fig. 3.11) showed that trout from Patricia, Bighorn, and Pyramid Lakes were on the outer edges of the plot. Trout from Patricia Lake were typically large old fish with high concentrations of *p,p'*- DDE. Trout from Patricia were also typically elevated in the more biomagnifying PCBs (PCB 183, 138-163, 187-182, and 153-132-105). The slower growing fish population in Bighorn Lake had less negative $\delta^{13}C$ values and relatively high concentrations of *β*-endosulfan, dieldrin, *p,p'*-DDD, *o,p'*-DDT, and *p,p'*-DDT. Trout from Pyramid Lake had elevated growth rates and $\delta^{15}N$ and were generally elevated in PCBs 99 and 118.

3.8 INFLUENCE OF OCTANOL/WATER PARTITION COEFFICIENT

The water/octanol partitioning coefficient can explain the observed differences between the OC accumulated in fish tissue and that observed in both laboratory experiments and lake waters (Gobas *et al.,* 1993, Fisk *et al.,* 1998). In this study, compounds with a higher K_{ow} (up to about 6.5 to 7) showed the greatest increases with elevation. These compounds also have been shown to accumulate more readily in fish. Concentrations of selected organochlorines in trout were plotted in relation to K_{ow} to distinguish any patterns with elevation (Fig. 3.12). Since smaller fish are generally better at eliminating higher K_{ow} compounds (Sijm and Van der Linde 1995, Fisk *et al.* 1998) a shift in maxima K_{ow} may have been observed. However, no shift was seen in K_{ow} maxima with elevation which could be do to differences in temperature at different elevations or differences in atmospheric loading. Most of the lakes seem to have a maximum POP concentration which corresponds to a K_{ow} between 5.5 and 7.0.

3.9 IMPLICATIONS TO THE GLOBAL DISTILLATION HYPOTHESIS

According to the global distillation theory (Wania and Mackay 1993a, Wania and Mackay 1996, Wania *et al.* 1998), one would expect that lower volatility compounds such as HCHs and HCB would show the greatest concentration increases with altitude. Several studies in other media and biota (air (Shen *et al.* 2004, Shen *et al.* 2005), soil (Migaszewski 1999), snow (Blais *et al.* 1998, Landers *et al.* 2002), plants (Simonich and Hites 1995a, Simonich and Hites 1995b, Davidson *et al.* 2003) and amphipods (Blais *et al.* 2003)) have reported increases of POP concentration with elevation consistent with the global distillation model. However, the results from this study indicate that additional factors are governing the POP distribution in trout from the Canadian Rocky Mountains.

The results point to the importance of biological characteristics (i.e. growth rate, feeding behaviour, and age) of the fish as well as the chemical characteristics of the compounds (i.e. K_{ow}) as important co-factors. Fish live longer and are also able to better metabolize and eliminate lower K_{ow} compounds than most invertebrates and plants (Gobas *et al.* 1993, Fisk *et al.* 1998). Since fish are able to eliminate the more volatile, hydrophobic OCs more readily, a more uniform relationship with respect to elevation should be seen for these compounds (as seen in this study). Compounds of intermediate volatility, such as dieldrin, DDTs are also transported to higher altitudes. These higher K_{ow} compounds have lower water solubilities and are more readily bioconcentrated in aquatic food chains. These compounds are not only more easily incorporated into the fish (more lipophillic) but, they will take longer to metabolize or eliminate once they are incorporated within the fish (Gobas *et al.,* 1993, Fisk *et al.,* 1998). These compounds will accumulate to a greater extent in fish over time than the lower K_{ow} compounds and would explain why less volatile compounds show greater increases with elevation. For the most part, increases with respect to elevation were not as pronounced for the PCBs. The lack of increases with elevation for the compounds which had the highest K_{ow}s in this study (e.g. PCBs with 6 or more chlorines) is to be expected. These compounds are also the least volatile and may not be noticeably carried to higher altitudes. The relationship of PCBs with respect to elevation may also be further hindered by the 'weathering' of PCBs. PCBs can be transformed either within the surrounding media or within biota. Transformation products can be in the form of lower chlorinated PCBs which may obscure trends which one would expect to see with respect to elevation.

In European lakes, a similar pattern of increasing DDE and DDT concentration in trout with elevation has been reported (Grimalt *et al*, 2001, Catalan *et al.* 2004, Vives *et al.* 2004). However, in contrast to this study greater increases of POP concentration with respect to elevation were seen with the higher chlorinated PCBs. Daly and Wania (2005) recently questioned the validity of these studies because the elevation gradient was confounded by proximity to contaminant source regions. The low altitude lakes (>1100 m) were all in northern Europe (greater distance from point sources), while the high (> 2400 m) and intermediate (1600 – 2300 m) altitude lakes were all in the Alps and Pyrenees respectively (closer proximity to point sources). Daly and Wania wondered if the higher concentration of the less volatile OCs were due to altitudinal fractionation or just an artifact of the sampling design. The study was further questioned since the more volatile OCs, which are less influenced by the proximity to point sources, showed a more uniform relationship with altitude.

Table 3.1 Multiple regressions for selected organochlorine compound concentrations in trout based on lipid weight (pg/g lipid weight).

Chemical	Independent variable	Coefficient ± SE	*p* (partial)	r^2	SE_{est}	*p*
Log α-HCH	Constant	3.489 ± 0.602	< 0.001			
	Growth rate	-0.682 ± 0.309	0.030	0.054	0.832	0.030
Log γ-HCH	Constant	1.469 ± 0.291	< 0.001			
	Elevation	0.001 ± 0.000	0.003	0.093	0.847	0.003
Log HCB	Constant	4.234 ± 0.608	< 0.001			
	Growth rate	-0.781 ± 0.312	0.014	0.069	0.841	0.014
Log γ-chlordane	Constant	0.563 ± 1.095	0.609			
	Elevation	0.001 ± 0.000	0.003			
	C13	-0.073 ± 0.026	0.006			
	Growth rate	0.778 ± 0.359	0.033	0.236	0.759	< 0.001
Log α-endosulfan	Constant	1.571 ± 1.096	0.155			
	Elevation	0.001 ± 0.000	0.014			
	Growth rate	-0.872 ± 0.363	0.018			
	C13	-0.053 ± 0.026	0.043	0.219	0.759	< 0.001
Log α-chlordane	Constant	-0.521 ± 0.806	0.519			
	Elevation	0.001 ± 0.000	0.001			
	C13	-0.072 ± 0.024	0.003	0.144	0.747	0.001
Log dieldrin	Constant	1.941 ± 1.360	0.157			
	Elevation	0.001 ± 0.000	0.002			
	Growth rate	-1.319 ± 0.445	0.004			
	C13	-0.068 ± 0.032	0.036	0.318	0.938	< 0.001
Log *p,p'*-DDE	Constant	1.747 ± 1.246	0.165			
	Elevation	0.001 ± 0.000	0.002			
	C13	-0.087 ± 0.029	0.004			
	Growth rate	-0.835 ± 0.409	0.044	0.242	0.865	< 0.001
Log *β*-endosulfan	Constant	-1.535 ± 1.212	0.210			
	Elevation	0.001 ± 0.000	< 0.001			
	C13	-0.094 ± 0.037	0.014	0.216	1.007	< 0.001
Log *p,p'*-DDD	Constant	-0.744 ± 0.985	0.452			
	Elevation	0.001 ± 0.000	< 0.001			
	C13	-0.072 ± 0.029	0.014	0.209	0.913	< 0.001
Log o,*p'*-DDT	Constant	0.383 ± 1.599	0.801			
	C13	-0.146 ± 0.036	< 0.001			
	Elevation	0.001 ± 0.000	0.001			
	Growth rate	-1.743 ± 0.511	0.001	0.386	0.993	< 0.001
Log *p,p'*-DDT	Constant	0.708 ± 1.430	0.622			
	Elevation	0.001 ± 0.000	0.002			
	C13	-0.100 ± 0.033	0.004			
	Growth rate	-1.164 ± 0.469	0.015	0.268	0.992	< 0.001

Table 3.2 Multiple regressions for selected polychlorinated biphenyls (PCB) concentrations in trout based on lipid weight (pg/g lipid weight).

Chemical	Independent variable	Coefficient ± SE	*p* (partial)	r^2	SE_{est}	*p*
Log total PCBs	Constant	3.464 ± 0.572	< 0.001			
	Growth rate	-0.697± 0.188	< 0.001			
	C13	-0.124 ± 0.013	< 0.001			
	Elevation	-0.000 ± 0.000	0.035	0.595	0.397	< 0.001
Log tri-chlorobiphenyls	Constant	2.653 ± 0.434	< 0.001			
	Growth rate	-1.109 ± 0.213	< 0.001			
	C13	-0.123 ± 0.016	< 0.001	0.424	0.506	< 0.001
Log tetra-chlorobiphenyls	Constant	3.329 ± 0.582	< 0.001			
	Growth rate	-0.852 ± 0.191	< 0.001			
	C13	-0.113 ± 0.014	< 0.001			
	Elevation	-0.000 ± 0.000	0.007	0.559	0.404	< 0.001
Log penta-chlorobiphenyls	Constant	1.874 ± 0.349	< 0.001			
	C13	-0.138 ± 0.013	< 0.001			
	Growth rate	-0.535 ± 0.171	0.002	0.585	0.408	< 0.001
Log hexa-chlorobiphenyls	Constant	2.811 ± 0.668	< 0.001			
	C13	-0.125 ± 0.016	< 0.001			
	Growth rate	-0.695 ± 0.219	0.002			
	Elevation	-0.000 ± 0.000	0.039	0.532	0.463	< 0.001
Log hepta-chlorobiphenyls	Constant	1.415 ± 0.429	0.001			
	C13	-0.135 ± 0.016	< 0.001			
	Growth rate	-0.425 ± 0.210	0.047	0.478	0.501	< 0.001
Log octa-chlorobiphenyls	Constant	0.827± 0.488	0.095			
	C13	-0.146 ± 0.018	< 0.001			
	Growth rate	-0.615 ± 0.243	0.013	0.473	0.560	< 0.001
Log PCB 31-28	Constant	2.078 ± 0.444	< 0.001			
	Growth rate	-1.038 ± 0.217	< 0.001			
	C13	-0.120 ± 0.016	< 0.001	0.420	0.513	< 0.001
Log PCB 174	Constant	1.096 ± 0.431	0.013			
	Growth rate	-0.829 ± 0.211	< 0.001			
	C13	-0.127 ± 0.016	< 0.001	0.456	0.496	< 0.001

Table 3.3 Multiple regressions for selected organochlorine compound concentrations in trout based on wet weight (pg/g wet weight).

Chemical	Independent variable	Coefficient ± SE	*p* (partial)	r^2	SE_{est}	*p*
Log α-HCH	Constant	2.522 ± 0.194	< 0.001			
	Lipid (%)	0.067 ± 0.009	< 0.001			
	C13	0.045 ± 0.008	< 0.001			
	N15	0.034 ± 0.012	0.006	0.598	0.255	< 0.001
Log γ-HCH	Constant	2.723 ± 0.282	< 0.001			
	Lipid (%)	0.043 ± 0.012	< 0.001			
	C13	0.039 ± 0.010	0.001	0.239	0.387	< 0.001
Log HCB	Constant	1.687 ± 0.084	< 0.001			
	Elevation	0.000 ± 0.000	< 0.001			
	Lipid (%)	0.071 ± 0.007	< 0.001	0.587	0.218	< 0.001
Log γ-chlordane	Constant	0.886 ± 0.115	< 0.001			
	Elevation	0.000 ± 0.000	< 0.001			
	Lipid (%)	0.045 ± 0.009	< 0.001	0.346	0.299	< 0.001
Log α-endosulfan	Constant	-0.022 ± 0.346	0.949			
	Elevation	0.001 ± 0.000	< 0.001			
	Growth rate	0.527 ± 0.157	0.001			
	N15	-0.033 ± 0.013	0.013			
	Age	0.039 ± 0.016	0.015	0.384	0.270	< 0.001
Log α-chlordane	Constant	-0.602 ± 0.408	0.144			
	Elevation	0.000 ± 0.000	< 0.001			
	Lipid (%)	0.039 ± 0.010	< 0.001			
	C13	-0.042 ± 0.010	< 0.001			
	Growth rate	0.368 ± 0.145	0.013	0.404	0.283	< 0.001
Log dieldrin	Constant	1.196 ± 0.429	0.007			
	Elevation	0.001 ± 0.000	< 0.001			
	Lipid (%)	0.068 ± 0.013	< 0.001			
	Age	0.053 ± 0.022	0.018			
	Growth rate	-0.424 ± 0.185	0.025	0.646	0.348	< 0.001
Log *p,p'*-DDE	Constant	0.892 ± 0.431	0.042			
	Elevation	0.001 ± 0.000	< 0.001			
	Age	0.087 ± 0.018	< 0.001			
	Lipid (%)	0.074 ± 0.011	< 0.001			
	C13	-0.050 ± 0.010	< 0.001			
	Growth Rate	-0.337 ± 0.159	0.037	0.651	0.298	< 0.001
Log *β*-endosulfan	Constant	0.380 ± 0.242	0.123			
	Elevation	0.001 ± 0.000	< 0.001			
	Lipid (%)	0.072 ± 0.017	< 0.001			
	Age	0.057 ± 0.030	0.060	0.511	0.461	< 0.001
Log o,*p'*-DDT	Constant	-2.873 ± 0.647	0.813			
	Elevation	0.001 ± 0.000	< 0.001			
	Lipid (%)	0.109 ± 0.017	< 0.001			
	C13	-0.102± 0.017	< 0.001			
	Growth rate	-1.409 ± 0.249	< 0.001			
	Age	0.077 ± 0.028	0.008	0.686	0.435	< 0.001
Log *p,p'*-DDT	Constant	-0.071 ± 0.594	0.905			
	Elevation	0.001 ± 0.000	< 0.001			
	Lipid (%)	0.101 ± 0.016	< 0.001			
	Age	0.086 ± 0.025	0.001			
	C13	-0.049 ± 0.014	0.001			
	Growth rate	-0.631 ± 0.219	0.005	0.623	0.411	< 0.001

Table 3.4 Multiple regressions for selected polychlorinated biphenyls (PCB) concentrations in trout based on wet weight (pg/g wet weight).

Chemical	Independent variable	Coefficient ± SE	*p* (partial)	r^2	SE_{est}	*p*
Log total PCBs	Constant	2.521 ± 0.443	< 0.001			
	Lipid (%)	0.075 ± 0.012	< 0.001			
	C13	-0.041 ± 0.011	< 0.001			
	Elevation	0.000 ± 0.000	0.001			
	Growth rate	-0.522± 0.011	0.002			
	Age	0.051± 0.011	0.007	0.483	0.307	< 0.001
Log tri-chlorobiphenyls	Constant	2.724 ± 0.486	< 0.001			
	Lipid (%)	0.045 ± 0.012	< 0.001			
	Growth rate	-0.942 ± 0.172	< 0.001			
	Elevation	0.000 ± 0.000	0.001			
	C13	-0.028 ± 0.012	0.019	0.482	0.337	< 0.001
Log tetra-chlorobiphenyls	Constant	2.455 ± 0.430	< 0.001			
	Lipid (%)	0.058 ± 0.014	< 0.001			
	Growth rate	-0.472 ± 0.153	0.003			
	Elevation	0.000 ± 0.000	0.009			
	C13	-0.025 ± 0.010	0.018	0.334	0.298	< 0.001
Log penta-chlorobiphenyls	Constant	1.572 ± 0.483	0.002			
	Lipid (%)	0.066 ± 0.013	< 0.001			
	C13	-0.045 ± 0.012	< 0.001			
	Elevation	0.000 ± 0.000	0.001			
	Age	0.053 ± 0.020	0.010			
	Growth rate	-0.392 ± 0.178	0.030	0.422	0.335	< 0.001
Log hexa-chlorobiphenyls	Constant	1.710 ± 0.591	0.005			
	Lipid (%)	0.086 ± 0.016	0.007			
	Age	0.085 ± 0.025	0.001			
	C13	-0.042 ± 0.014	0.004			
	Growth rate	-0.579 ± 0.218	0.009			
	Elevation	0.000 ± 0.000	0.024	0.438	0.409	< 0.001
Log hepta-chlorobiphenyls	Constant	1.324 ± 0.607	0.032			
	Age	0.093 ± 0.025	< 0.001			
	Lipid (%)	0.099 ± 0.016	< 0.001			
	C13	-0.051 ± 0.015	0.001			
	Growth rate	-0.687 ± 0.224	0.003			
	Elevation	0.000± 0.000	0.010	0.191	0.552	< 0.001
Log octa-chlorobiphenyls	Constant	3.532 ± 0.480	0.012			
	Lipid (%)	0.104 ± 0.024	< 0.001			
	Growth rate	-1.299 ± 0.287	< 0.001			
	N15	0.089 ± 0.032	0.006	0.351	0.610	< 0.001
Log PCB 31-28	Constant	2.231 ± 0.555	< 0.001			
	Lipid (%)	0.043 ± 0.017	0.011			
	Growth rate	-0.526 ± 0.230	0.025			
	Elevation	0.000 ± 0.000	0.028	0.246	0.444	< 0.001
Log PCB 174	Constant	0.694 ± 0.653	0.292			
	Elevation	0.001 0.000	< 0.001			
	Lipid (%)	0.108 ± 0.017	< 0.001			
	Growth rate	-0.697± 0.238	0.005			
	C13	-0.031 ± 0.016	0.047	0.485	0.434	< 0.001

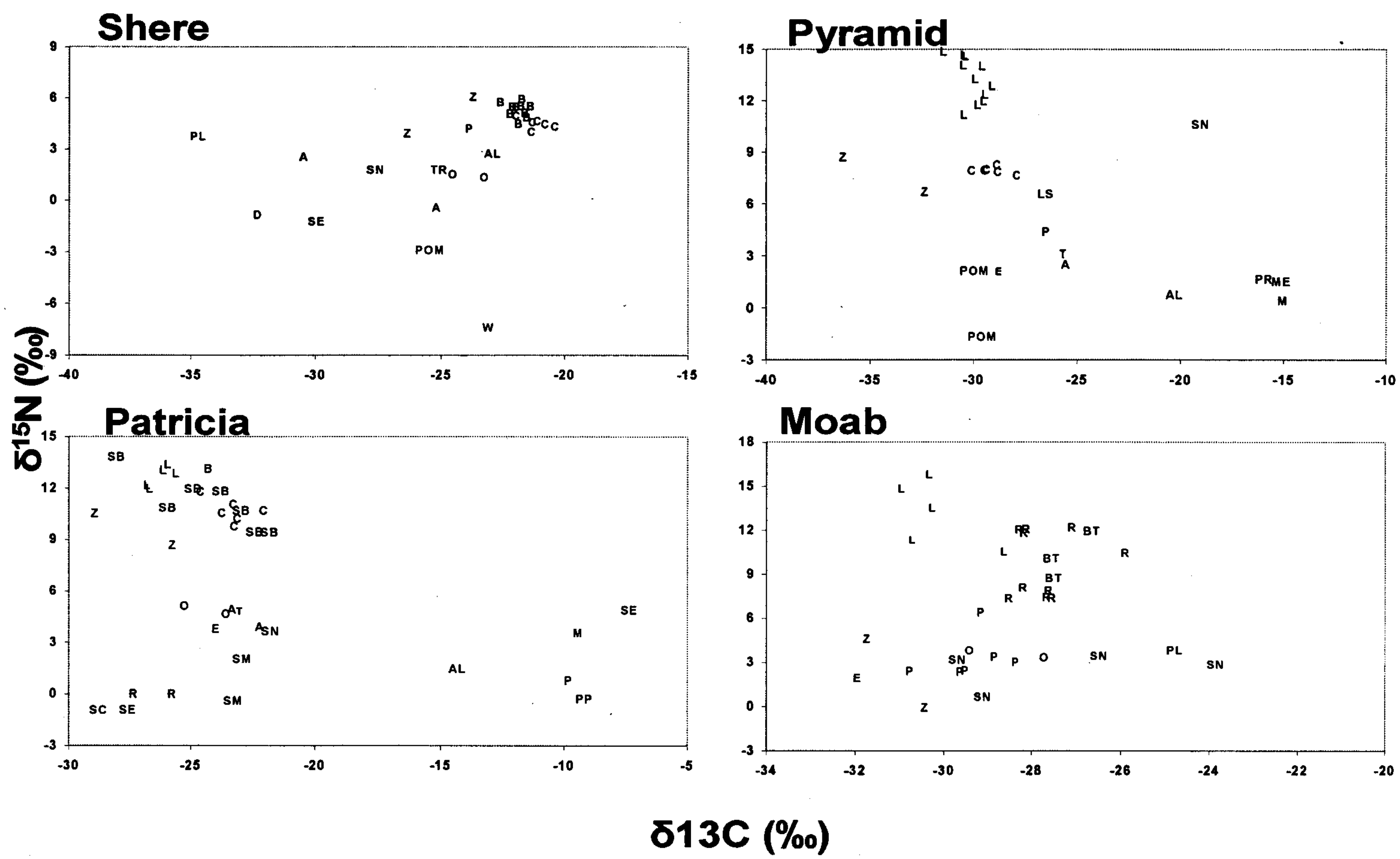

Figure 3.1a Uncorrected stable isotope signatures of various trophic levels. B = brook trout, L = lake trout, R = rainbow trout, C = cutthroat trout, BT = bull trout, W = white sucker, LS = longnose suckers, C = chub, S = sculpin, SB = stickleback, P = Pelecypoda, A = Amphipoda, E = Ephemeroptera, O = Odonata, Pl = Plecoptera, SN = snail, T = Tricoptera, CH= chara, POM = particulate organic matter, Z = zooplankton, MA = macrophytic algae, M = myriophyllum, PR = *Potomogeton richardsonii*, PP = *Potomogeton pectinatus*, PN = *Potomogeton natans*, AL = algae, SM = submergent macrophyte, SE = sedge, SC = scirpus.

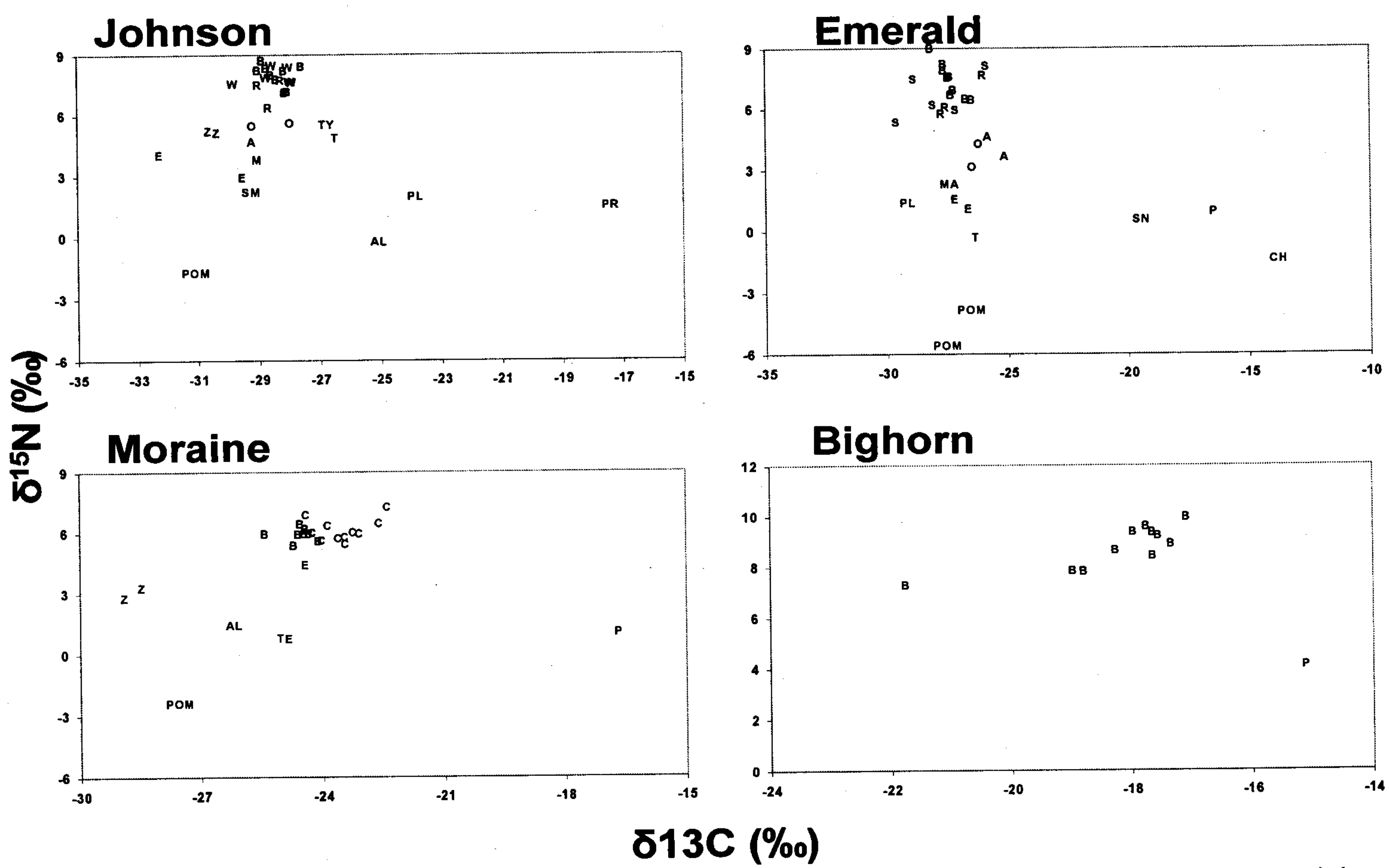

Figure 3.1b Uncorrected stable isotope signatures of various trophic levels. B = brook trout, L = lake trout, R = rainbow trout, C = cutthroat trout, BT = bull trout, W = white sucker, LS = longnose suckers, C = chub, S = sculpin, SB = stickleback, P = Pelecypoda, A = Amphipoda, E = Ephemeroptera, O = Odonata, Pl = Plecoptera, SN = snail, T = Tricoptera, CH= chara, POM = particulate organic matter, Z = zooplankton, MA = macrophytic algae, M = myriophyllum, PR = *Potomogeton richardsonii*, PP = *Potomogeton pectinatus*, PN = *Potomogeton natans*, AL = algae, SM = submergent macrophyte, SE = sedge, SC = scirpus.

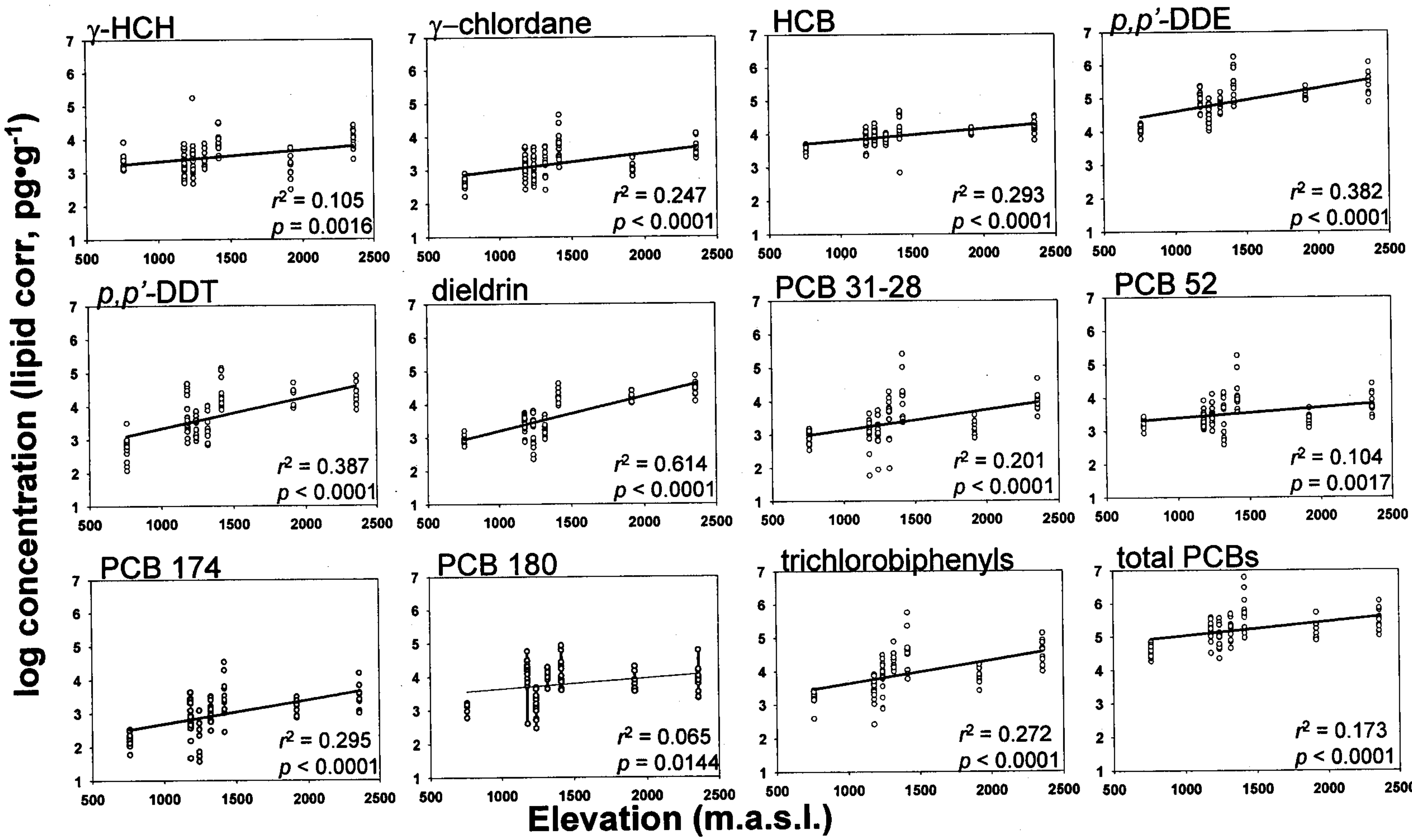

Figure 3.2 Concentrations of selected organochlorine pesticides and polychlorinated biphenyls (PCBs) in trout shown in relation to elevation. Concentrations are expresed on per lipid basis. HCH = hexachlorocyclohexane; HCB = hexachlorobenzene; DDE = dichlorodiphenylethylene; DDT = trichlorodiphenyldichloroethane; m.a.s.l. = meters above sea level. Each point is an individual fish.

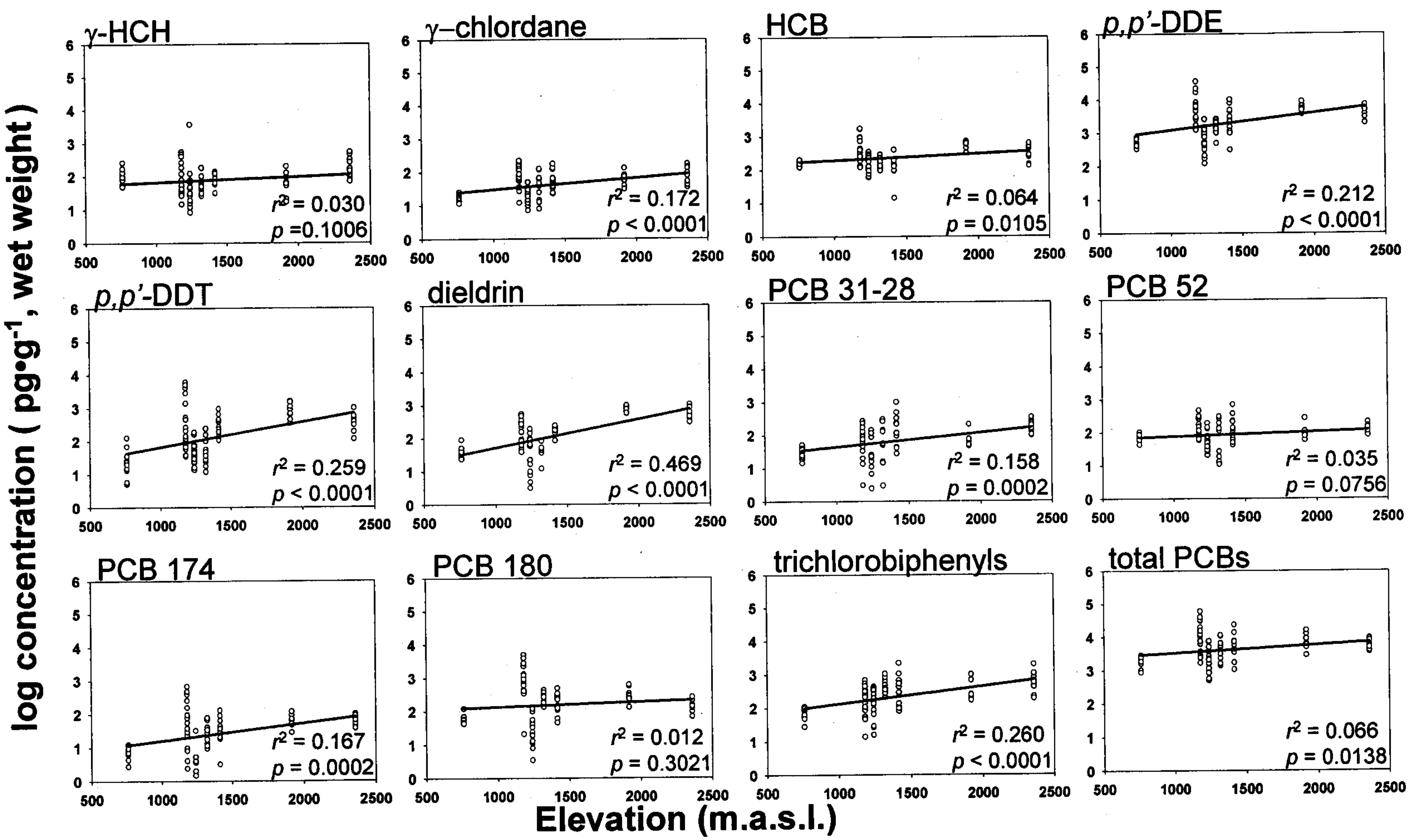

Figure 3.3 Concentrations of selected organochlorine pesticides and polychlorinated biphenyls (PCBs) in trout shown in relation to elevation. Concentrations are expressed on per wet weight basis. HCH = hexachlorocyclohexane; HCB = hexachlorobenzene; DDE = dichlorodiphenylethylene; DDT = trichlorodiphenyldichloroethane; m.a.s.l. = meters above sea level. Each point is an individual fish.

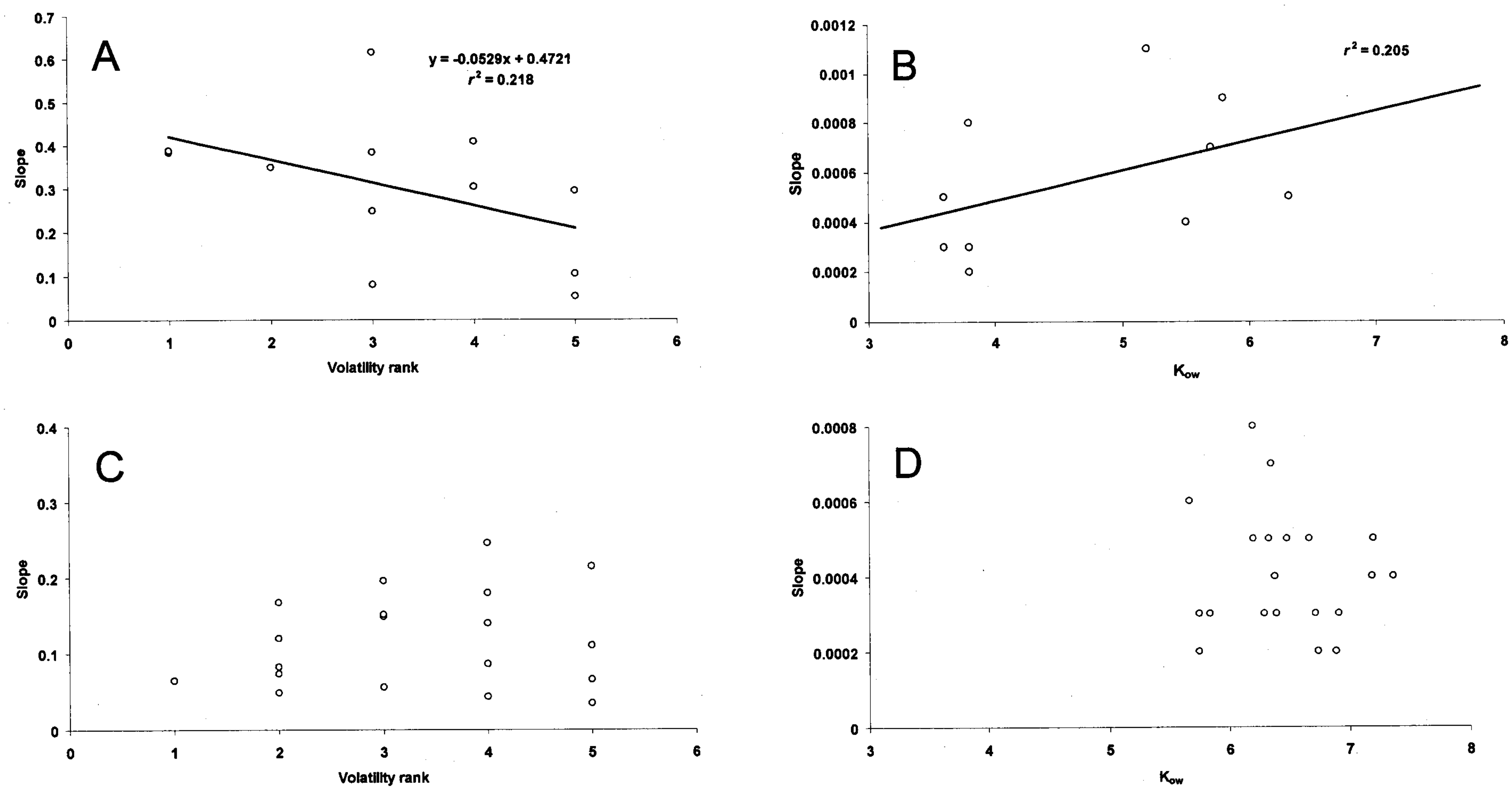

Figure 3.4 Relationship between A) slope of organochlorine pesticides vs elevation and volatility rank B) slope of organochlorine pesticides vs elevation and log K_{ow} C) slope of PCBs vs elevation and volatility rank and D) slope of PCBs vs elevation and log K_{ow}. Volatility rank is determined by assigning each POP a value based on volatility where one would be a compound which is comparatively not very volatile and 5 is a very volatile POP. K_{ow} data was from Hawker and Connell 1988.

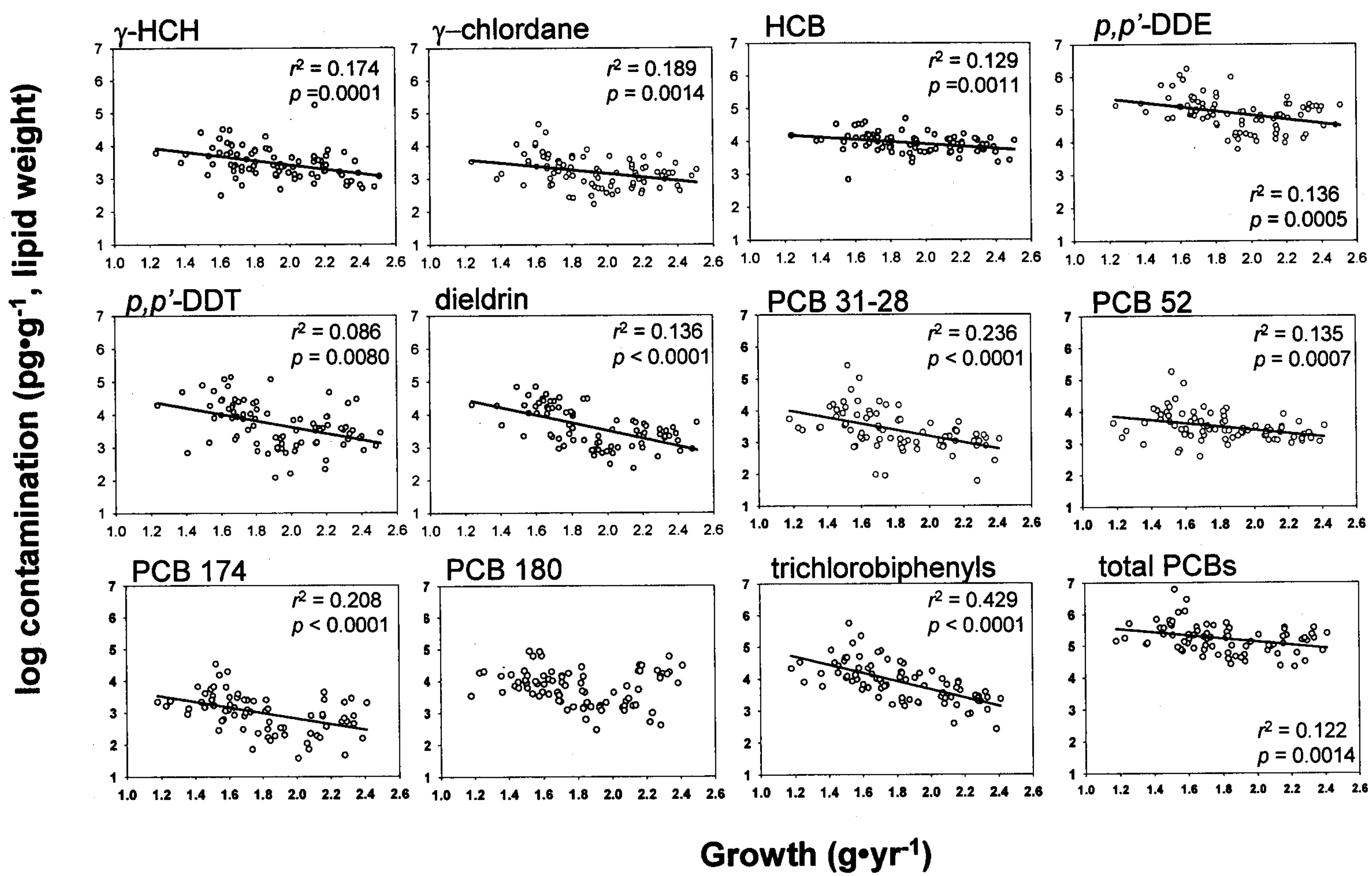

Figure 3.5 Concentrations of selected organochlorine pesticides and polychlorinated biphenyls (PCBs) in trout shown in relation to growth rate. Growth rate was estimated for each individual fish as weight/(age-1). Concentrations are expressed on per lipid gram weight. HCH = hexachlorocyclohexane; HCB = hexachlorobenzene; DDE = dichlorodiphenylethylene; DDT = trichlorodiphenyldichloroethane; m.a.s.l. = meters above sea level. Each point is an individual fish.

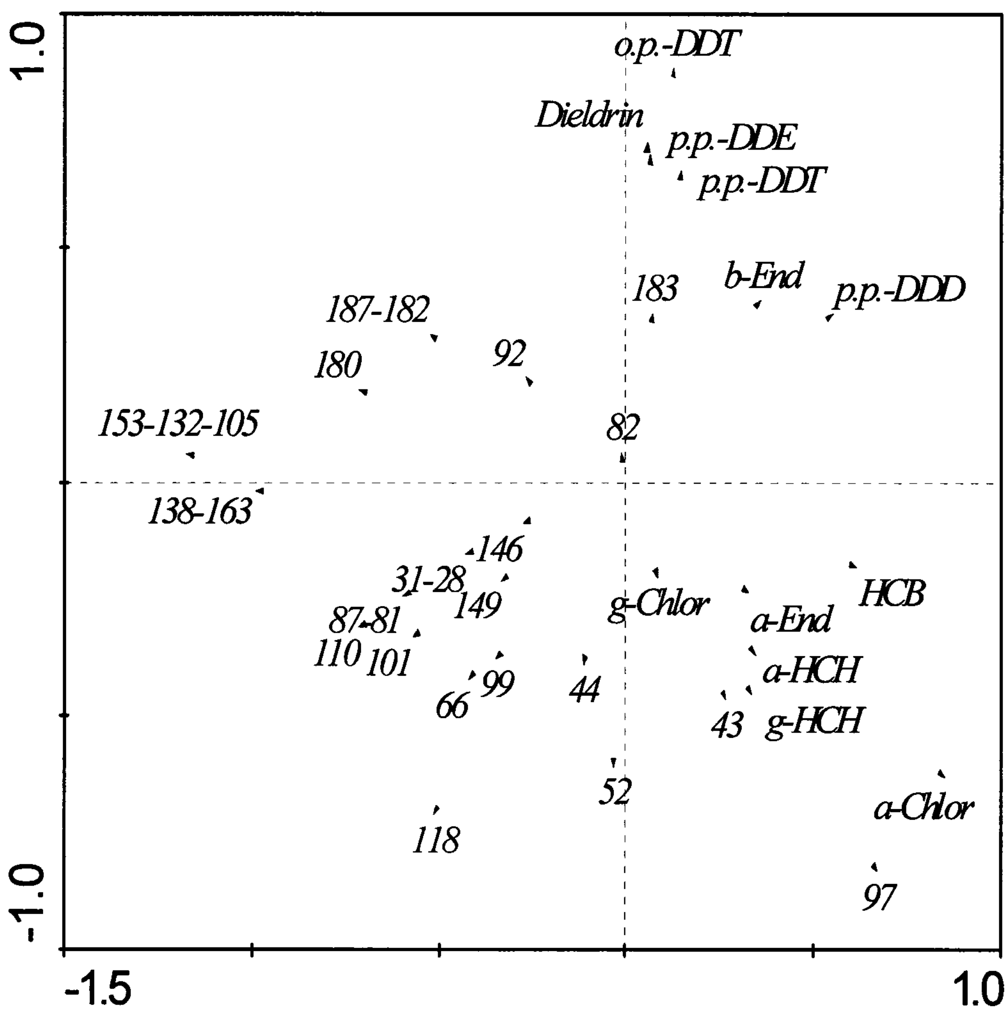

Figure 3.6 Principal component analysis (PCA) plot of the relative abundance of analytes. Data were screened to only include analytes which were present in at least 75 % of the samples and accounting for at least 0.5% of the total POP concentration. This screening step retained 33 analytes and subset proved to provide a strong representation of the overall POP concentration in the trout. Percent analyte data were log transformed.

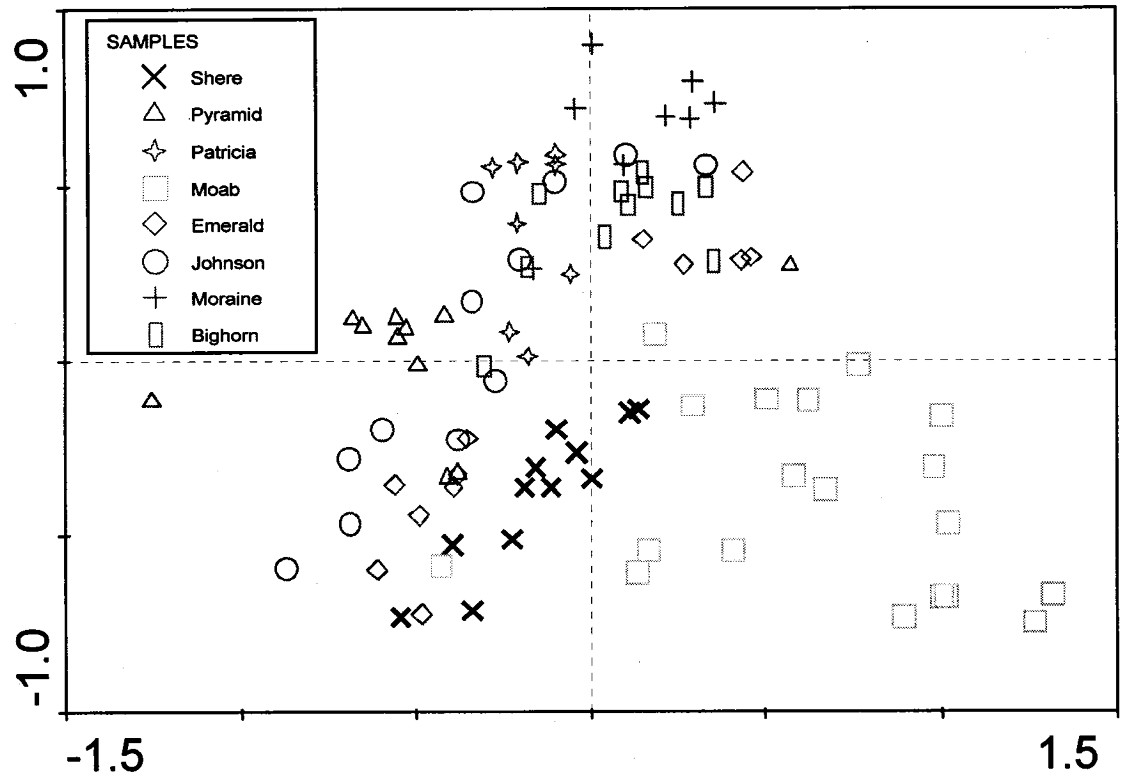

Figure 3.7 Principal component analysis (PCA) plot of trout samples from each lake. Each symbol represents an individual fish. Notice the clustering of trout samples indicating inter-lake variation is greater than intra-lake variation.

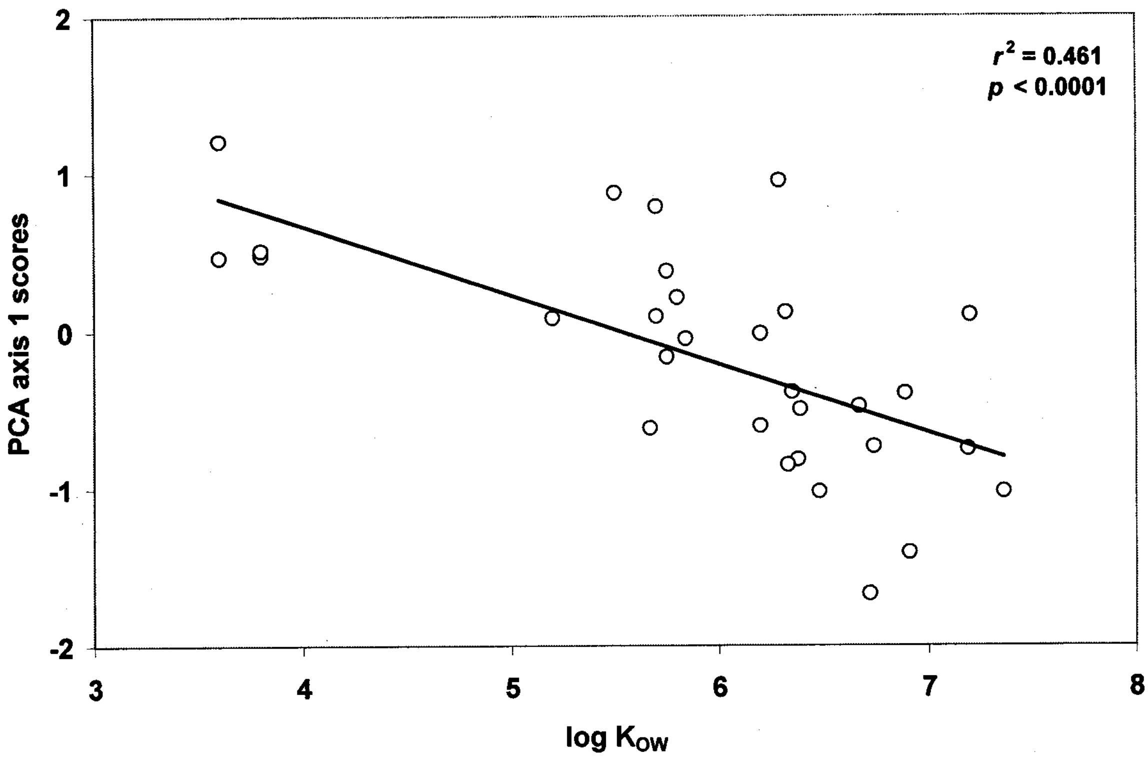

Figure 3.8 Relationship between K_{ow} and the main direction of variation in the chemical data (PCA axis 1 scores).

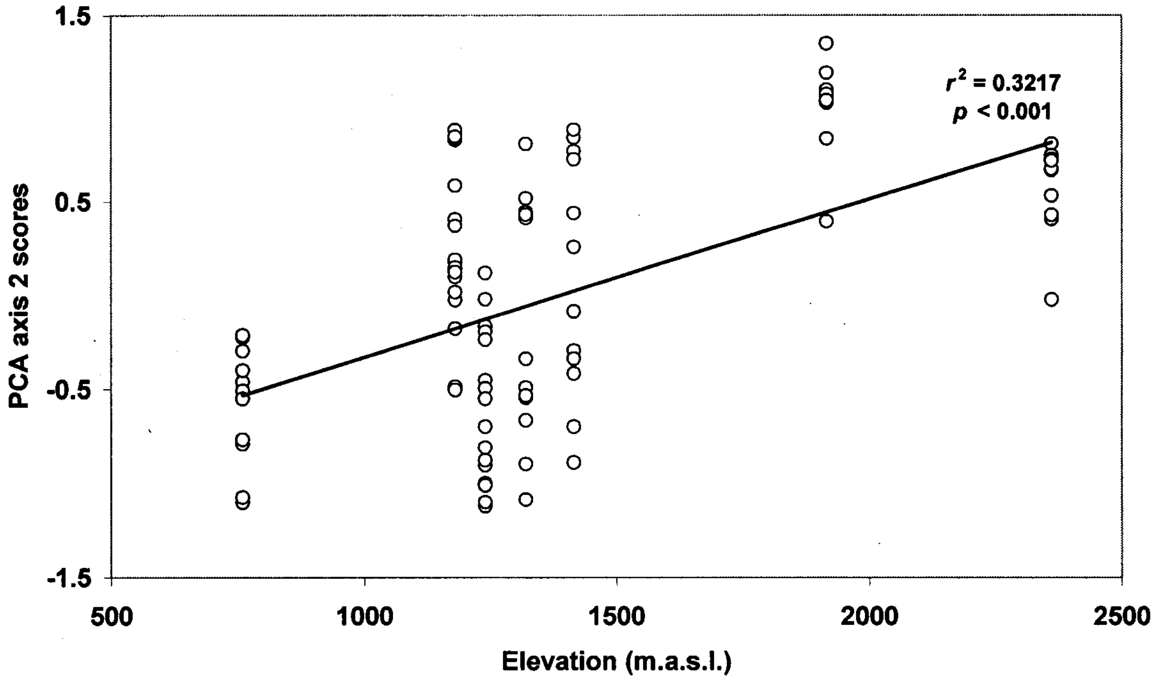

Figure 3.9 Relationship between lake elevation and the secondary direction of variation in the sample data (PCA axis 2 scores).

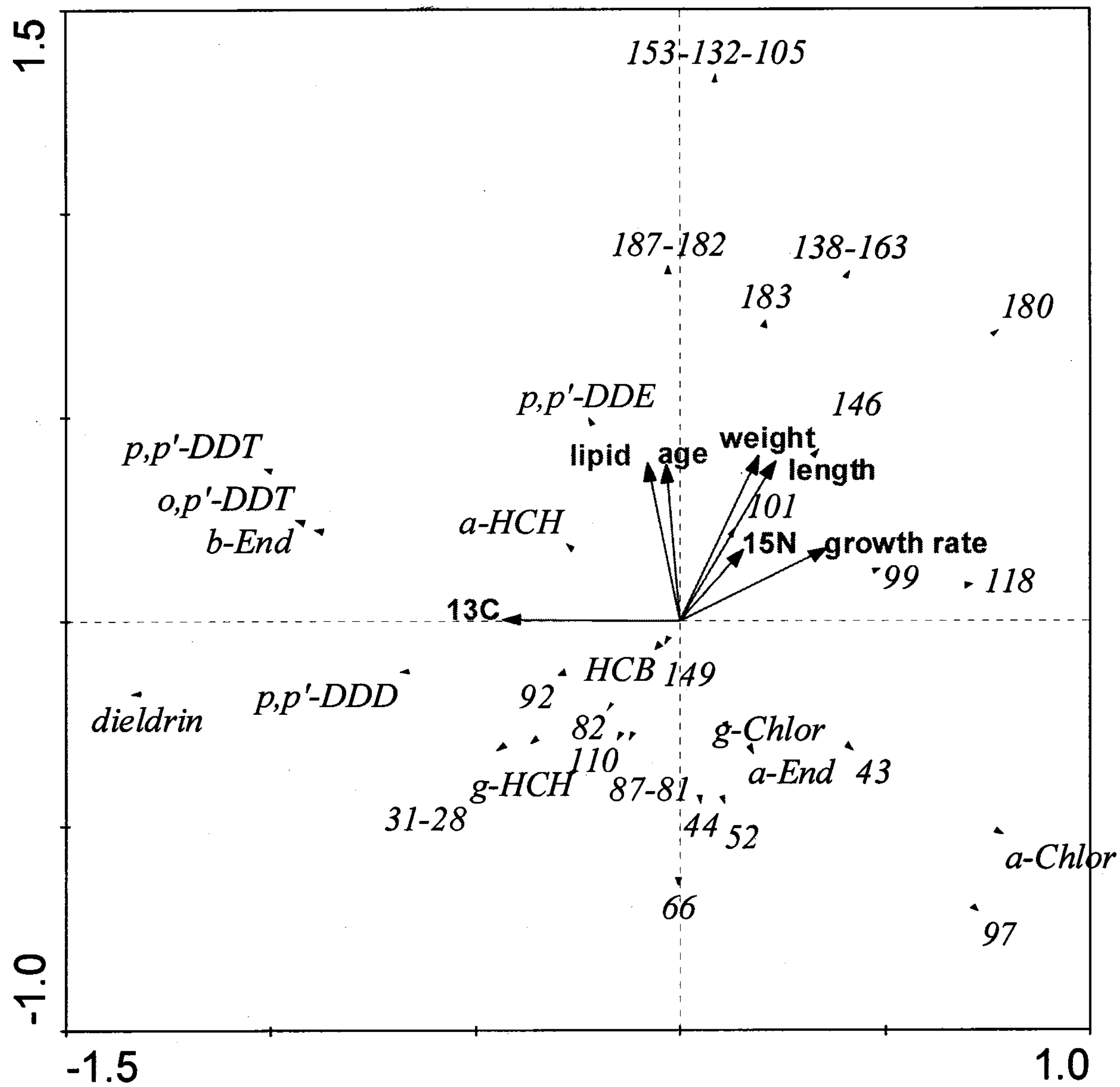

Figure 3.10 Ordination diagram based on the redundancy analysis (RDA) of organochlorine concentrations in fish with respect to age, length, weight, lipid content, growth rate and $\delta^{15}N$ and $\delta^{13}C$ signature.

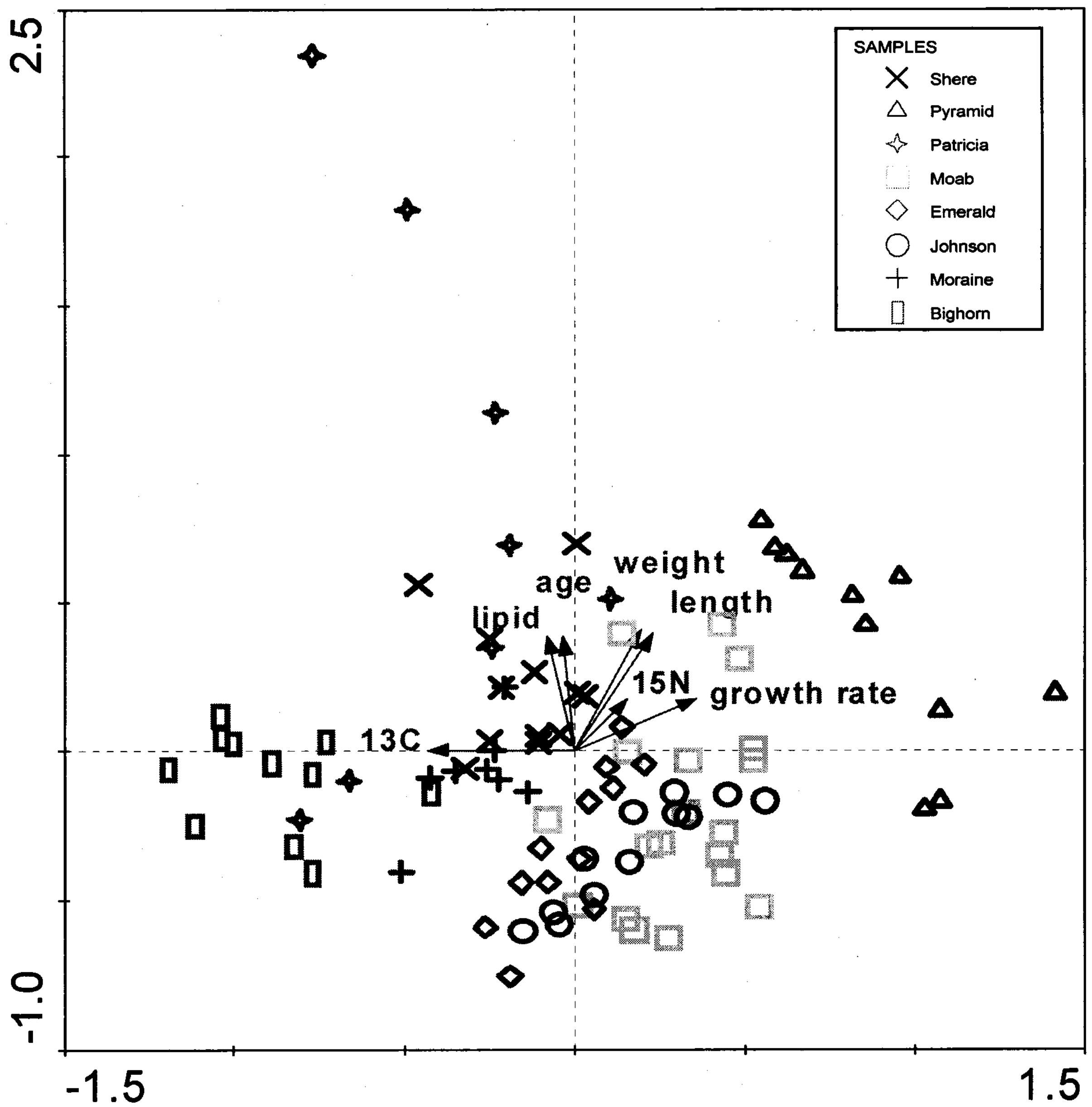

Figure 3.11 Ordination diagram based on the redundancy analysis (RDA) of fish samples with respect to age, length, weight, lipid content, growth rate and $\delta^{15}N$ and $\delta^{13}C$ signature. Each symbol represents an individual fish.

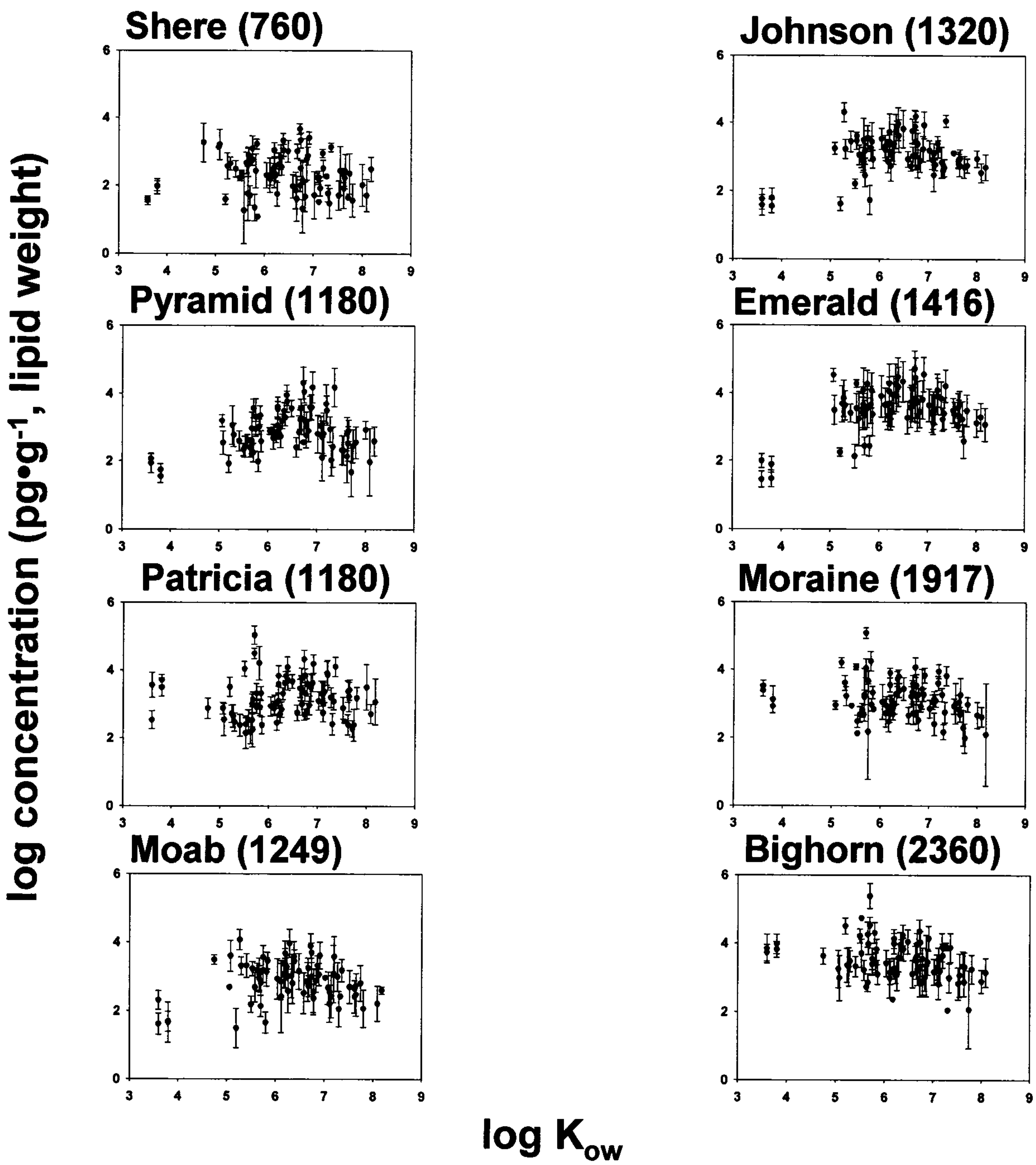

Figure 3.12 Concentrations of selected organochlorine pesticides and polychlorinated biphenyls (PCBs) in trout shown in relation to K_{ow} (octanol water partitioning coefficient). Concentrations are expressed on per lipid gram weight. For each lake, elevation in meters above sea level are given in the brackets. K_{ow} data was from Hawker and Connell 1988.

4.0 GENERAL CONCLUSIONS AND FUTURE WORK

Global distribution of POPs has been a concern for several decades (George and Frear 1966). These chemicals have a low solubility in water, are highly lipophilic, highly toxic, and can be extremely persistent. Once these chemicals enter the food chain they have the ability to biomagnify, reaching levels much higher than in the surrounding environment (Barrie *et al.* 1992, Lockhart 1995). Accumulation of POPs has been documented in virtually all regions, including alpine ecosystems (Cory *et al.* 1970, Simonich and Hites 1995a, Blais *et al.* 1998, Grimalt *et al.* 2001). Atmospheric transport is one of the most efficient and rapid ways for the transfer of POPs. Evidence indicates that most POPs are volatile enough to evaporate and deposit, (i.e. cycle) among air, water, and soil (Wania and Mackay 1993a, Wania *et al.* 1996, Wania and McLachlan 2001).

Unlike other media and biota (i.e. air, soil, water, foliage, and amphipods), the percentage of POP variation explained decreased with increasing volatility. The current study shows that chemical properties of POPs (i.e. K_{ow}) and biological factors (i.e. growth rate, feeding behaviour, and fish age) are additional important predictive variables which determine distribution of POPs in higher trophic levels of alpine food chains. It was found that the strongest relationships with elevation were observed for the intermediately volatile compounds (i.e. dieldrin, DDTs, PCBs with 3-5 chlorines). These compounds typically have a Kow between 5 -6.5, meaning they are more readily bioaccumulated in aquatic food webs than lower Kow, more volatile compounds. Since these compounds have extended half lives, biological variables such as growth rate and fish age can further concentrate POP concentrations in these fish. These compounds are typically more toxic than the more volatile OCs which are preferentially trapped in the Arctic ecosystems, possibly suggesting that the damage associated with the global distribution of OCs may be a more serious and immediate concern in mountain ecosystem (Vives *et al.* 2004).

Although this study reported other variables which may be more predictive of the spatial distribution of POPs in alpine trout, this does not imply that models such as the global distillation model or altitudinal fractionation are not useful. However; these models work best when applied to media or biota that have relatively short life cycles and/or are not capable of metabolizing organochlorines to a considerable extent.

Even though this study has improved the understanding of the processes by which OCs accumulate in trout from alpine system, there are several areas which require further study to fill knowledge gaps. A better understanding of the effects of decreasing temperature on the physiology of fish is required. This study showed that growth rates typically decreased with increasing elevation, but a better estimate of growth rate is required so that more accurate comparisons with growth rate may be carried out. Additionally, it is believed that lower temperatures impair a fish's ability to metabolize chemicals such as OCs but relatively little work has been published in this area (some of which is contradictory). The same can be said about gill transfer. Decreasing temperature is believed to be associated with a lower gill capacity of organochlorine gill exchange (less elimination of OCs through the gill), which would result in progressive OC accumulation with age as fish are unable to eliminate part of the ingested OC through time (Vives *et al.* 2004). Furthermore, it would be worth investigating if the factors highlighted in this study can explain the spatial distribution of other organic contaminants such as PBDEs.

Information which pertains to the chemical bioaccumulation in trout from remote, cooler regions such as the Canadian Rocky Mountains allows us to recognize some of the processes which are important in the distribution of semi-volatile organic pollutants in biota from alpine lakes. Increased understanding of these processes which result in the incorporation of POPs within the food chain, may allow us to make inferences on some of the factors which could conceivably be important in the concentration of POPs in individuals at higher trophic levels in alpine aquatic food chains. Work of this magnitude can be used to further assist advance the development of current (i.e Stockholm Convention) and future regulations governing contaminant emissions.

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APPENDIX

Table 1: Methods and Instrumentation used for Water Chemistry Analyses

Sample type	Specifics	Method and/or Instrumentation	Reference
Anions	alkalinity, bicarbonate (HCO_3^-) and carbonate (CO_3^{2-})	Alkalinity (2320)/Standard Acid Titration Method using a Mettler DL21 Auto Titrator	Greenberg et al. 1992
	sulfate (SO_4^{2-}) and chloride (Cl^-)	Ion Chromatography EPA Method 300.0 using a Dionex 2000i/SP Ion Chromatograph	Pfaff 1993
Cations	calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na^+), potassium (K^+)	Perkin Elmer 3300 Atomic Absorption Spectrometer	Stainton et al. 1977
Carbon	dissolved organic carbon (DOC)	Total Organic Carbon (5310)/Combustion Infrared Method using a Shimandzu Model TOC-5000A Carbon Analyzer	Greenberg et al. 1992
	particulate carbon (PC)	Control Equipment Corporation 440 Elemental Analyzer	Stainton et al. 1977
Chlorophyll *a*		Ethanol extraction, spectrofluorometric method using a Shimadzu Model RF-1501 Spectrofluorophotometer	Welschmeyer 1994, Wintermans and DeMots 1965, Bergmann and Peters 1980, Stainton et al. 1977
Colour	abs 350	Varian Cary 50 Probe and Milton Roy Model 1001 Plus Spectrophotometer	Modified Cuthbert and del Giorgio (1992)
Conductivity		Radiometer/Copenhagen Model CDM 83 conductivity meter	
Nitrogen	ammonium (NH_4^+), nitrite + nitrate (NO_2^{2-} + NO_3^-)	Automated Berthelot Reaction Technicon™ Autoanalyzer ™ II Method # 154-71 W/B using a Technicon™ Autoanalyzer ™ II	
	particulate nitrogen (PN)	Control Equipment Corporation 440 Elemental Analyzer	Stainton et al. 1977
	total dissolved nitrogen (TDN)	Technicon™ Autoanalyzer ™ II	Stainton et al. 1977
pH		Fisher Scientific Accumet pH meter 925	
Phosphorus	total phosphorus (TP) and total dissolved phosphorus (TDP)	Ascorbic acid digestion method using a Varian Cary 50 Probe and Milton Roy Model 1001 Plus Spectrophotometer	Menzel and Corwin 1965 as modified by Prepas and Rigler 1982
Turbidity		Hach Turbidimeter Model 2100A	
Silica (SiO_2)		Silica (4500)/Molybdosilicate Method using a Varian Cary 50 Probe and Milton Roy Model 1001 Plus UV vis-Spectrophotometer	Greenberg et al. 1992

Table 2: Characteristics of trout

	elevation	Species	Year collected	Age	Length	Weight	amount extracted	% lipids
Shere								
	760.3	Brook Trout	2001	5	309	374	10.2574	3.91
	760.3	Brook Trout	2001	7	363	594	14.7108	3.23
	760.3	Brook Trout	2001	6	376	791	10.7698	3.42
	760.3	Brook Trout	2001	5	324	420	11.4480	3.51
	760.3	Brook Trout	2001	6	312	407	13.3460	4.90
	760.3	Brook Trout	2001		265	245	10.6696	4.63
	760.3	Brook Trout	2001	6	355	690	10.3741	4.07
	760.3	Brook Trout	2001	5	297	338	12.1829	4.13
	760.3	Brook Trout	2001	8	425	1095	14.5649	7.19
	760.3	Brook Trout	2001	5	297	296	13.1500	3.14
	760.3	Brook Trout	2001	6	321	420	12.2143	7.09
		Brook Trout	2001				11.3764	
Pyramid								
	1180.0	Lake Trout	2003	7	516	1508	13.1353	4.63
	1180.0	Lake Trout	2003	9	532	1723	12.7888	5.23
	1180.0	Lake Trout	2003	4	424	735	10.9988	1.89
	1180.0	Lake Trout	2003	5	468	1212	12.9278	5.29
	1180.0	Lake Trout	2003	5	492	1290	13.8483	4.37
	1180.0	Lake Trout	2003	10	519	1455	11.0337	3.05
	1180.0	Lake Trout	2003	4	396	596	9.3431	1.13
	1180.0	Lake Trout	2003	9	513	1281	12.0408	3.15
	1180.0	Lake Trout	2003	8	521	1573	10.2913	4.43
	1180.0	Lake Trout	2003	10	532	1901	13.5405	4.48
	1180.0	Lake Trout	2003	6	482	1294	14.8850	8.42
Patricia								
	1180.0	Rainbow Trout	2001	8	433	1137	10.1255	11.30
	1180.0	Lake Trout	2001	15	589	>2000	11.4425	16.60
	1180.0	Brook Trout	2001	6	273	306	8.9290	4.54
	1180.0	Lake Trout	2001	8	468	1163	11.8709	5.94
	1180.0	Lake Trout	2001	9	524	1888	10.1705	14.11
	1180.0	Rainbow Trout	2001	5	346	608	11.6130	11.97
		Lake Trout	2001				10.6858	11.28
	1180.0	Lake Trout	2001	6	273	306	7.8806	6.25
		Rainbow Trout	2001				11.9680	19.09
		Lake Trout	2001				6.5547	3.17
		Lake Trout	2001				11.4318	11.62
	1180.0	Lake Trout	2001	10	521	1907	13.4995	22.99
Moab								
	1240.0	Bull Trout	2001	7	305	843	10.4695	1.62
	1240.0	Rainbow Trout	2001	3	228	207	5.8330	1.04
	1240.0	Rainbow Trout	2001	4	287	267	10.0662	2.68
	1240.0	Bull Trout	2001	10	422	1020	10.1292	2.26
	1240.0	Rainbow Trout	2001	3	210	173	6.1693	1.96
	1240.0	Rainbow Trout	2001	5	334	356	12.7308	2.65
	1240.0	Rainbow Trout	2001	3	206	164	6.2033	2.78
	1240.0	Lake Trout	2001	7	373	642	9.3892	5.76
	1240.0	Rainbow Trout	2003	3	330	411	10.8036	1.94
	1240.0	Rainbow Trout	2003	4	331	322	10.0517	1.20
	1240.0	Rainbow Trout	2003	4	343	403	10.8805	0.88
	1240.0	Rainbow Trout	2003	3	287	277	10.2895	0.57
	1240.0	Rainbow Trout	2003	4	337	416	10.9630	1.22
	1240.0	Lake Trout	2003	7	421	871	10.1890	1.47
	1240.0	Lake Trout	2003	5	360	588	10.8997	2.07
	1240.0	Lake Trout	2003	4	321	344	11.0291	1.71
	1240.0	Lake Trout	2003	6	398	703	11.0126	2.08
	1240.0	Lake Trout	2003	9	493	1543	10.2195	1.96
	1240.0	Bull Trout	2003	6	397	995	10.6554	3.81
Johnson								
	1320.0	Rainbow Trout	2001	2	167	57	7.7626	4.61
	1320.0	Brook Trout	2001	3	166	51	4.1063	1.74
	1320.0	Rainbow Trout	2001	4	291	263	11.7643	3.07
	1320.0	Brook Trout	2001	5	264	214	5.8504	2.30
	1320.0	Brook Trout	2001		180	66	4.8816	2.43
	1320.0	Brook Trout	2001	4	262	193	6.8043	3.13

	1320.0	Rainbow Trout	2001	4	292	271	12.3124	2.64
	1320.0	Brook Trout	2001	4	231	147	8.9670	2.16
	1320.0	Brook Trout	2001	3	183	68	6.5663	1.98
	1320.0	Brook Trout	2001	4	237	144	6.9466	2.09
	1320.0	Brook Trout	2001	6	292	267	12.2347	1.37
	1320.0	Brook Trout	2001	5	283	255	6.0097	1.36
Emerald								
	1416.2	Brook Trout	2001	6	304	320	9.7701	1.87
	1416.2	Brook Trout	2001	7	294	273	9.6146	0.47
	1416.2	Rainbow Trout	2001	3	212	93	5.7481	1.17
	1416.2	Brook Trout	2001	5	244	159	7.8497	1.27
	1416.2	Brook Trout	2001	8	338	446	8.6967	1.55
	1416.2	Brook Trout	2001	4	209	109	8.1725	2.08
	1416.2	Rainbow Trout	2001	2	161	46	7.9185	1.37
	1416.2	Brook Trout	2001	4	230	138	6.9733	1.16
	1416.2	Brook Trout	2001	7	335	464	9.1103	0.81
	1416.2	Rainbow Trout	2001	3	211	94	7.8437	1.15
	1416.2	Brook Trout	2001	8	320	305	9.0241	0.59
	1416.2	Brook Trout	2001	5	255	166	8.0168	0.39
Moraine								
	1916.9	Brook Trout	2001	5	258	214	11.2886	3.39
	1916.9	Brook Trout	2001	5	224	161	8.6129	5.60
	1916.9	Brook Trout	2001	5	262	201	11.1575	3.69
	1916.9	Brook Trout	2001	5	243	197	9.0990	5.17
	1916.9	Brook Trout	2001	6	278	240	10.5371	3.87
	1916.9	Brook Trout	2001		243	173	8.0029	6.30
	1916.9	Brook Trout	2001	6	290	295	14.5316	6.50
	1916.9	Brook Trout	2001	4	183	72	6.2566	3.07
Bighorn								
	2360.0	Brook Trout	1997	7	280	264	7.9326	3.66
	2360.0	Brook Trout	1997	6	264	172	8.2837	2.48
	2360.0	Brook Trout	1997	9	305	290	8.4736	0.98
	2360.0	Brook Trout	1997	5	282	250	8.1007	4.26
	2360.0	Brook Trout	1997	6	262	156	5.2621	1.26
	2360.0	Brook Trout	1997	8	238	121	6.7794	2.82
	2360.0	Brook Trout	1997	9	298	267	10.8909	2.44
	2360.0	Brook Trout	1997		270	225	8.0680	1.66
	2360.0	Brook Trout	1997	6	270	270	8.2280	1.34
	2360.0	Brook Trout	1997	3	224	147	5.5542	2.82
	2360.0	Brook Trout	1997	8	320	279	8.3053	0.43

Table 3: Organochlorine pesticides in trout (lipid corrected)

Species	Length	a-HCH	HCB	g-HCH	Heptachlor	Aldrin	Heptachlor Epoxide	g-Chlordane	a-Endosulfan
Shere									
Brook Trout	309	1821.466	4705.229	2401.942	0.000	71.290	0.000	484.385	697.169
Brook Trout	363	2490.186	4505.844	1504.692	0.000	0.000	484.367	360.425	1182.480
Brook Trout	376	2232.798	5052.563	1652.273	0.000	0.000	403.083	413.264	678.515
Brook Trout	324	2541.399	4681.386	2222.633	0.000	0.000	464.098	584.736	957.110
Brook Trout	312	2759.287	4176.659	2532.360	0.000	0.000	411.372	296.057	1365.488
Brook Trout	265	2326.966	3211.903	2228.728	0.000	0.000	448.325	375.316	783.947
Brook Trout	355	1769.478	4231.522	3209.537	468.656	0.000	0.000	496.300	1044.700
Brook Trout	297	1974.697	2931.745	1194.421	0.000	0.000	0.000	562.891	901.935
Brook Trout	425	3073.324	2808.478	2380.421	0.000	0.000	1318.412	345.154	771.321
Brook Trout	297	2417.870	3972.775	8276.795	0.000	0.000	0.000	813.164	873.802
Brook Trout	321	1401.907	2196.203	1336.602	0.000	0.000	238.238	165.777	425.300
Brook Trout									
Pyramid									
Lake Trout	516	1137.246	4513.942	630.126	0.000	0.000	0.000	579.793	518.421
Lake Trout	532	1305.345	5313.017	680.688	0.000	0.000	0.000	1189.536	2350.498
Lake Trout	424	1943.468	6499.687	1443.722	0.000	0.000	0.000	2885.872	6584.045
Lake Trout	468	819.019	2521.873	553.388	0.000	0.000	0.000	1166.853	1586.808
Lake Trout	492	2816.766	10140.273	1156.059	0.000	35.767	0.000	1850.144	4083.178
Lake Trout	519	2336.879	8955.591	2556.845	418.593	0.000	0.000	4528.318	4696.851
Lake Trout	396	2251.607	10519.728	1307.880	0.000	0.000	0.000	5091.776	8859.934
Lake Trout	513	1797.847	6984.423	1743.874	0.000	0.000	0.000	1991.264	2906.148
Lake Trout	521	1481.308	7584.734	811.310	0.000	0.000	0.000	1420.616	2418.518
Lake Trout	532	1107.810	5659.778	589.277	0.000	0.000	0.000	1545.816	2150.689
Lake Trout	482	609.543	2207.039	492.001	0.000	0.000	0.000	419.775	294.544
Patricia									
Rainbow Trout	433	5365.414	8229.034	4841.203	0.000	0.000	1342.824	756.868	376.510
Lake Trout	589	4223.563	10290.322	2417.456	79.084	0.000	0.000	1007.915	251.169
Brook Trout	273	6444.873	8847.212	5700.776	0.000	0.000	1684.021	267.354	0.000
Lake Trout	468	4912.050	16240.519	7325.167	0.000	0.000	0.000	2159.571	568.750
Lake Trout	524	5517.522	12155.691	3330.704	0.000	0.000	1621.751	1456.760	275.016
Rainbow Trout	346	4382.733	7718.627	3380.101	0.000	0.000	1023.921	935.121	161.575
Lake Trout		4052.974	10097.645	3105.209	0.000	0.000	0.000	1152.739	0.000
Lake Trout	273	5076.259	11682.173	1896.063	0.000	0.000	0.000	1385.055	432.944
Rainbow Trout		2712.293	4657.837	1685.603	0.000	0.000	648.151	587.272	158.586
Lake Trout		10959.238	33933.943	5574.595	0.000	0.000	0.000	5328.331	1289.084

Table 3: Organochlorine pesticides in trout (lipid corrected)

Lake Trout		7038.623	16159.376	3249.186	0.000	0.000	0.000	1892.941	397.363
Lake Trout	521	3161.264	7633.390	793.687	0.000	0.000	0.000	948.382	249.908
Moab									
Bull Trout	305	5073.084	7986.426	4045.557	0.000	0.000	0.000	614.079	2958.444
Rainbow Trout	228	7946.337	20764.963	4326.663	0.000	0.000	0.000	4778.487	4696.160
Rainbow Trout	287	1032.453	9207.626	464.114	0.000	0.000	0.000	502.539	654.752
Bull Trout	422	4077.443	15317.125	3252.994	0.000	0.000	0.000	1457.807	3727.801
Rainbow Trout	210	4498.021	11594.878	2247.191	0.000	0.000	0.000	1259.739	2049.573
Rainbow Trout	334	4099.001	10474.496	2743.319	0.000	0.000	0.000	1028.605	2249.979
Rainbow Trout	206	3167.467	7462.856	4337.934	0.000	0.000	0.000	681.036	1202.730
Lake Trout	373	2842.456	5123.073	1330.566	0.000	0.000	0.000	321.136	0.000
Rainbow Trout	330	2056.747	6188.828	6254.600	0.000	0.000	1284.883	1199.503	3226.324
Rainbow Trout	331	2025.130	5010.295	960.852	0.000	0.000	0.000	813.062	1007.796
Rainbow Trout	343	2562.211	11040.262	1362.534	0.000	0.000	0.000	3830.868	2712.785
Rainbow Trout	287	3901.231	11135.165	4655.457	0.000	0.000	0.000	2121.134	1565.040
Rainbow Trout	337	1244.161	6287.190	684.341	0.000	0.000	0.000	2616.831	3845.950
Lake Trout	421	3196.626	8545.963	1076.750	0.000	0.000	0.000	1446.554	3792.249
Lake Trout	360	4009.664	12698.608	3589.065	0.000	0.000	0.000	1210.269	9015.499
Lake Trout	321	2163.598	5620.820	1128.264	0.000	0.000	0.000	418.628	2359.685
Lake Trout	398	1064.711	4528.734	174654.499	0.000	0.000	0.000	718.933	1738.501
Lake Trout	493	2010.106	11732.309	1572.822	0.000	0.000	0.000	1521.547	2154.292
Bull Trout	397	1175.638	4676.249	1250.805	0.000	0.000	0.000	495.116	1889.621
Johnson									
Rainbow Trout	167	1584.315	6193.248	3870.562	0.000	0.000	742.656	2550.450	2754.486
Brook Trout	166	4232.044	10799.717	5456.559	1085.519	0.000	1013.275	1412.553	1692.243
Rainbow Trout	291	925.468	6014.535	1640.667	0.000	0.000	0.000	1968.975	748.406
Brook Trout	264	931.750	5202.954	1726.610	0.000	0.000	914.115	1663.369	677.217
Brook Trout	180	1471.485	6978.216	7466.067	0.000	0.000	812.780	5151.779	4297.804
Brook Trout	262	718.535	4514.964	1464.206	0.000	0.000	319.581	255.925	867.143
Rainbow Trout	292	1878.291	8416.529	2211.094	0.000	0.000	652.831	1642.487	2641.897
Brook Trout	231	2108.017	10647.983	2576.232	0.000	0.000	0.000	668.306	3248.191
Brook Trout	183	1975.035	5550.371	1288.771	0.000	0.000	0.000	626.186	1475.671
Brook Trout	237	1916.859	8565.940	2378.307	0.000	0.000	0.000	606.020	2213.968
Brook Trout	292	2059.711	9705.266	2251.932	0.000	0.000	892.476	3428.689	1382.782
Brook Trout	283	1277.659	6898.367	7460.432	2810.668	1293.217	0.000	4886.161	1589.589
Emerald									
Brook Trout	304	1410.086	10903.103	3214.673	0.000	0.000	0.000	1209.747	929.631

Table 3: Organochlorine pesticides in trout (lipid corrected)

Brook Trout	294	10433.008	38855.155	29855.180	0.000	0.000	0.000	25827.769	8263.048
Rainbow Trout	212	5302.853	13501.541	11288.056	0.000	0.000	0.000	4172.603	1437.669
Brook Trout	244	1618.833	7373.284	6139.288	0.000	0.000	0.000	10447.261	1627.932
Brook Trout	338	2260.678	12732.828	6959.963	0.000	0.000	0.000	4276.408	5717.885
Brook Trout	209	2101.903	687.311	2747.373	0.000	0.000	0.000	2765.304	1510.267
Rainbow Trout	161	1110.589	7078.838	6337.315	0.000	0.000	1855.202	2419.625	3098.112
Brook Trout	230	3982.744	12559.363	2665.090	0.000	0.000	2982.997	2030.728	1506.721
Brook Trout	335	5581.518	48529.797	7726.919	0.000	0.000	0.000	7594.946	5636.637
Rainbow Trout	211	2727.302	16170.984	10309.799	0.000	0.000	0.000	5529.910	1981.168
Brook Trout	320	3809.984	32472.853	5427.693	0.000	0.000	0.000	6470.129	3029.151
Brook Trout	255	2348.068	32926.423	31877.579	0.000	0.000	0.000	45736.177	0.000
Moraine									
Brook Trout	258	615.678	12944.473	617.175	0.000	0.000	3672.942	2379.460	2480.081
Brook Trout	224	590.638	12600.360	305.979	0.000	0.000	2831.129	2314.827	3945.759
Brook Trout	262	877.798	15264.343	5427.810	0.000	0.000	4862.640	1457.587	2865.226
Brook Trout	243	650.607	13139.950	1015.755	0.000	0.000	3225.850	653.650	2208.079
Brook Trout	278	917.373	15207.491	1701.599	0.000	0.000	4636.940	1004.036	1497.251
Brook Trout	243	930.226	9842.594	975.594	0.000	0.000	3000.026	901.292	4053.023
Brook Trout	290	618.929	9114.041	1953.323	0.000	0.000	2311.195	1111.627	1333.455
Brook Trout	183	2404.966	10353.482	3050.530	0.000	0.000	3710.585	988.639	2715.934
Bighorn									
Brook Trout	280	3965.926	12465.997	12399.195	0.000	798.252	5490.941	4645.080	3615.777
Brook Trout	264	4504.731	9425.785	4844.393	0.000	0.000	4773.090	5679.649	16440.875
Brook Trout	305	5889.484	14413.877	8687.573	1492.711	0.000	5796.930	3488.941	17472.917
Brook Trout	282	2539.323	6310.631	2430.315	0.000	439.373	3001.281	2174.977	2354.642
Brook Trout	262	16840.495	33367.920	25508.865	0.000	0.000	14627.043	11117.361	13636.384
Brook Trout	238	5592.107	15071.488	6038.304	0.000	1216.627	5390.662	3339.002	9097.538
Brook Trout	298	7036.964	20046.980	10635.115	0.000	0.000	14644.075	3153.787	1812.104
Brook Trout	270	5521.678	16497.717	6480.035	0.000	1645.191	13963.611	2763.735	8869.975
Brook Trout	270	6716.724	19916.831	10655.535	0.000	1578.605	0.000	3030.793	5295.718
Brook Trout	224	8993.105	21344.911	19155.270	0.000	1405.845	7242.141	4529.554	2014.187
Brook Trout	320	13267.222	30557.348	16641.461	0.000	0.000	29036.656	12141.281	32073.225

Table 3: Organochlorine pesticides in trout (lipid corrected)

Species	Length	a-Chlordane	Dieldrin	p,p'-DDE	Endrin	b-Endosulfan	p,p'-DDD	o,p'-DDT	p,p'-DDT
Shere									
Brook Trout	309	828.936	664.641	17863.489	334.685	656.061	687.470	568.468	674.910
Brook Trout	363	910.252	740.303	16028.562	0.000	1000.425	1264.894	653.460	157.929
Brook Trout	376	1117.340	946.869	14468.069	197.717	2080.020	3045.057	102.203	391.772
Brook Trout	324	1002.570	1025.524	14643.844	161.155	720.019	856.641	553.923	767.049
Brook Trout	312	649.900	803.855	15752.798	0.000	895.090	951.950	0.000	118.950
Brook Trout	265	842.439	821.372	8931.852	0.000	603.546	818.232	455.486	507.905
Brook Trout	355	842.345	1051.390	12059.256	262.514	1126.488	5484.581	19.122	3153.998
Brook Trout	297	916.468	846.384	12169.352	282.967	949.580	457.462	470.999	865.875
Brook Trout	425	680.259	1268.281	9335.240	326.964	1058.339	820.132	10.822	214.611
Brook Trout	297	1167.931	1635.945	10755.635	0.000	1069.221	2330.881	0.000	638.101
Brook Trout	321	592.151	554.775	6031.453	197.122	0.000	1011.440	331.744	986.976
Brook Trout									
Pyramid									
Lake Trout	516	1436.170	1544.692	117008.495	0.000	1733.343	3261.895	2276.031	2119.887
Lake Trout	532	2625.755	3044.388	139389.548	0.000	0.000	6593.928	2744.648	2544.833
Lake Trout	424	7530.607	2557.555	88065.128	9669.368	0.000	4311.457	617.838	1840.628
Lake Trout	468	1623.273	849.696	32506.668	0.000	0.000	2012.713	1118.057	1096.427
Lake Trout	492	4268.798	5609.897	132136.565	0.000	0.000	10513.675	4279.877	2734.130
Lake Trout	519	5548.313	5014.023	234132.697	0.000	0.000	14228.414	4861.240	8538.318
Lake Trout	396	11202.543	3440.434	110145.123	2172.275	0.000	7550.844	628.938	3351.637
Lake Trout	513	3180.064	2074.407	144223.620	0.000	3660.258	6449.301	2445.815	8285.230
Lake Trout	521	2790.120	2111.492	119647.661	0.000	0.000	2138.515	3775.264	3214.162
Lake Trout	532	2323.555	1883.767	104333.395	0.000	0.000	4411.632	2274.535	1738.504
Lake Trout	482	880.911	746.506	30744.950	0.000	0.000	1826.399	790.628	798.287
Patricia									
Rainbow Trout	433	1901.817	2638.847	53616.967	0.000	1272.664	24134.587	1835.923	4698.021
Lake Trout	589	5312.541	2164.810	217993.860	0.000	4165.747	37218.132	20450.757	36721.491
Brook Trout	273	555.565	4718.449	66871.553	0.000	0.000	28459.857	1306.881	4539.686
Lake Trout	468	6898.635	4280.777	141446.581	0.000	12109.181	29961.596	23252.640	47172.268
Lake Trout	524	5131.369	3847.603	121459.970	0.000	5780.065	36989.725	17343.923	28968.552
Rainbow Trout	346	2559.459	2228.705	59846.103	0.000	2654.100	26036.823	1853.290	3787.496
Lake Trout		5218.582	2787.466	213264.596	0.000	2783.843	36805.113	51785.792	30155.000
Lake Trout	273	3375.605	2546.962	102842.111	0.000	4729.287	25923.170	9456.497	22254.360
Rainbow Trout		1646.011	1095.192	35815.473	0.000	461.632	15695.857	1016.391	2271.408
Lake Trout		14438.124	14836.421	272459.230	736.164	15797.743	61167.235	40352.105	58157.014

Table 3: Organochlorine pesticides in trout (lipid corrected)

Lake Trout		6884.275	5379.294	157837.137	0.000	6792.835	44900.392	19501.255	36953.986
Lake Trout	521	3585.916	2062.164	95608.768	0.000	4676.702	22645.646	12379.455	21704.765
Moab									
Bull Trout	305	13504.095	6183.574	66545.913	15308.782	6047.032	10310.918	3292.302	3309.158
Rainbow Trout	228	25647.433	304.847	96809.185	27150.501	102.864	31800.005	5998.783	6711.954
Rainbow Trout	287	4812.510	815.703	33391.191	3345.996	112.500	4133.125	3408.369	1276.968
Bull Trout	422	20879.337	6379.747	65670.405	24614.117	5422.549	21930.693	4985.090	7116.074
Rainbow Trout	210	17500.095	0.000	18634.213	15779.044	277.669	12006.771	1020.691	1892.013
Rainbow Trout	334	18756.048	2169.527	44759.551	16850.582	27517.956	4522.166	18759.910	918.272
Rainbow Trout	206	7899.779	812.564	19027.778	8126.922	113.678	7979.420	126.020	1993.898
Lake Trout	373	10164.011	3374.668	45510.560	11251.005	2496.568	5994.096	2863.501	3228.957
Rainbow Trout	330	12334.633	0.000	16598.762	12133.459	3655.881	8617.615	70.142	4024.698
Rainbow Trout	331	4721.944	644.511	10387.809	4621.988	0.000	2764.189	0.000	1137.853
Rainbow Trout	343	15038.851	0.000	50320.604	11634.108	4244.361	10804.386	4606.468	5140.869
Rainbow Trout	287	11537.047	0.000	30559.112	9570.752	0.000	8864.695	0.000	3934.560
Rainbow Trout	337	11023.255	0.000	17447.029	12913.780	0.000	4085.376	371.014	1315.582
Lake Trout	421	13862.781	5552.735	66034.751	13392.549	3079.952	10231.104	2423.831	3778.190
Lake Trout	360	18310.765	3114.390	68283.683	20045.635	4106.854	10199.467	3526.897	3248.304
Lake Trout	321	10558.173	968.881	44586.322	10285.414	0.000	6134.690	1390.203	1391.961
Lake Trout	398	5509.707	227.745	23459.315	3639.995	0.000	3061.139	1869.984	1425.085
Lake Trout	493	9756.463	506.817	64697.737	8375.640	3369.258	8001.579	2725.497	3694.493
Bull Trout	397	4488.796	2374.755	12590.499	4608.591	2360.736	3433.254	410.126	1177.620
Johnson									
Rainbow Trout	167	3567.033	1089.141	57808.517	0.000	0.000	7463.280	0.000	3410.737
Brook Trout	166	2965.897	4783.949	83636.588	804.433	0.000	7316.653	17903.525	691.452
Rainbow Trout	291	2971.318	1321.642	82764.137	672.312	1908.133	20015.787	0.000	1825.710
Brook Trout	264	2510.853	1799.100	51148.333	0.000	0.000	6042.875	0.000	10225.203
Brook Trout	180	8242.279	0.000	79753.796	0.000	10369.589	9376.745	13272.082	9974.596
Brook Trout	262	731.336	1637.892	32567.447	0.000	0.000	8546.318	7194.374	770.223
Rainbow Trout	292	2859.179	1396.816	83798.741	0.000	1894.146	23356.082	3740.041	2151.162
Brook Trout	231	1333.505	2090.176	98420.367	0.000	0.000	32903.826	0.000	2171.711
Brook Trout	183	1804.759	2188.144	52368.118	766.083	0.000	9715.326	17380.936	1420.677
Brook Trout	237	1182.654	2395.257	65028.671	0.000	0.000	23942.782	0.000	1762.423
Brook Trout	292	4413.050	900.120	150077.735	0.000	1707.147	36742.886	0.000	7455.331
Brook Trout	283	4075.029	3802.594	36635.194	0.000	0.000	4547.149	0.000	1306.830
Emerald									
Brook Trout	304	2651.793	9037.685	240058.614	0.000	2657.839	13552.825	12314.289	14352.343

Table 3: Organochlorine pesticides in trout (lipid corrected)

Brook Trout	294	27060.874	41666.051	67965.441	1199238.377	10519.634	47149.125	27857.014	139079.654
Rainbow Trout	212	6893.103	15517.555	248762.956	0.000	21250.134	68859.675	19995.527	19691.018
Brook Trout	244	11940.186	17780.255	120876.754	0.000	0.000	8115.563	30323.498	9749.074
Brook Trout	338	6270.153	10620.039	319611.183	0.000	2564.815	12722.507	13399.534	24567.162
Brook Trout	209	5471.739	11073.481	55340.563	0.000	3373.796	18019.621	10481.342	7947.645
Rainbow Trout	161	3642.467	10608.357	73829.358	1149.620	427.646	8572.156	0.000	7832.224
Brook Trout	230	4629.532	16738.265	86279.962	2393.960	2320.433	20115.288	18712.892	16729.071
Brook Trout	335	17082.740	30125.451	985816.485	0.000	20577.428	84977.456	46354.834	117099.732
Rainbow Trout	211	10996.444	14791.929	195578.596	6082.601	8709.425	26137.926	9193.454	12135.420
Brook Trout	320	14491.774	30278.498	1744914.194	0.000	11347.109	53815.600	57207.547	74044.052
Brook Trout	255	56062.203	22291.827	814462.021	0.000	0.000	64206.108	75133.278	120459.848
Moraine									
Brook Trout	258	5111.577	16143.711	108483.063	0.000	14962.455	10217.646	11602.738	10205.808
Brook Trout	224	5352.595	10898.495	118700.269	0.000	10068.000	8011.096	13461.408	28953.115
Brook Trout	262	4707.173	25362.953	170055.355	6852.009	12662.841	16973.655	15143.571	24659.441
Brook Trout	243	2339.478	15565.772	91721.528	6936.185	4823.289	5482.669	6724.675	8573.065
Brook Trout	278	3377.231	25192.726	226126.460	6560.899	0.000	16577.860	22189.280	29060.934
Brook Trout	243	2823.282	11782.999	82254.633	3196.220	7481.090	6751.146	5670.189	10218.006
Brook Trout	290	2167.517	11417.700	82979.325	0.000	6214.461	6623.528	5489.531	10485.354
Brook Trout	183	2222.383	18385.630	154527.069	10009.923	9853.096	36278.216	34838.526	49308.771
Bighorn									
Brook Trout	280	6570.255	26274.453	132964.303	0.000	14279.760	19975.169	12875.388	15162.001
Brook Trout	264	5328.240	19020.455	224993.968	0.000	0.000	22143.108	12180.915	18648.658
Brook Trout	305	5442.591	39189.895	536269.682	8864.260	10745.327	45007.847	23273.496	52698.512
Brook Trout	282	1709.022	11956.272	139217.160	3652.163	8566.390	21284.021	12678.144	7455.302
Brook Trout	262	11904.844	69522.598	556097.598	0.000	41502.375	96619.552	49104.606	78872.035
Brook Trout	238	3012.298	19990.663	131865.820	0.000	6482.452	27437.107	17573.169	19776.256
Brook Trout	298	4585.722	42408.676	121177.167	7511.990	17208.993	40399.922	16347.713	15001.945
Brook Trout	270	5299.487	36716.207	304370.722	8772.714	17926.768	43760.320	9665.326	11339.523
Brook Trout	270	3614.307	32708.501	376939.778	0.000	12349.790	57741.764	16782.399	28026.554
Brook Trout	224	5781.918	29601.622	70438.889	0.000	22037.090	14292.322	14534.761	10684.439
Brook Trout	320	12358.547	69941.011	1134354.831	18469.461	34522.506	35953.949	81652.929	26924.158

Table 4: PCBs in trout (lipid corrected)

Species	Length	1	3	4-10	7-9	6	8-5	19	12-13	18	15-17
Shere											
Brook Trout	309	0.000	0.000	0.000	6110.264	0.000	0.000	0.000	0.000	601.439	0.000
Brook Trout	363	0.000	0.000	0.000	535.452	1361.623	0.000	0.000	0.000	607.305	0.000
Brook Trout	376	0.000	0.000	0.000	759.184	0.000	0.000	0.000	0.000	313.548	0.000
Brook Trout	324	0.000	0.000	0.000	2048.944	0.000	0.000	0.000	0.000	839.805	0.000
Brook Trout	312	0.000	0.000	0.000	2484.115	1294.103	0.000	0.000	0.000	779.250	0.000
Brook Trout	265	0.000	0.000	0.000	448.035	0.000	0.000	0.000	0.000	567.298	0.000
Brook Trout	355	0.000	0.000	4485.674	9858.149	0.000	0.000	732.185	0.000	1067.963	0.000
Brook Trout	297	0.000	0.000	0.000	1904.537	0.000	0.000	0.000	0.000	311.334	0.000
Brook Trout	425	0.000	0.000	723.593	919.246	0.000	0.000	0.000	0.000	42.664	0.000
Brook Trout	297	0.000	0.000	0.000	4726.267	0.000	0.000	0.000	0.000	218.941	0.000
Brook Trout	321	0.000	0.000	0.000	953.515	0.000	0.000	0.000	0.000	277.990	0.000
Brook Trout		0.000	0.000	0.000	600.507	0.000	0.000	0.000	0.000	206.853	0.000
Pyramid											
Lake Trout	516	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lake Trout	532	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3988.983
Lake Trout	424	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lake Trout	468	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lake Trout	492	0.000	0.000	0.000	0.000	1159.379	0.000	614.975	0.000	0.000	0.000
Lake Trout	519	0.000	0.000	0.000	605.331	0.000	0.000	0.000	0.000	0.000	1309.647
Lake Trout	396	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lake Trout	513	0.000	0.000	0.000	0.000	2102.572	0.000	0.000	0.000	0.000	0.000
Lake Trout	521	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lake Trout	532	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lake Trout	482	0.000	0.000	0.000	195.423	0.000	0.000	0.000	0.000	0.000	284.801
Patricia											
Rainbow Trout	433	0.000	0.000	0.000	209.987	0.000	0.000	0.000	920.764	513.439	698.694
Lake Trout	589	0.000	0.000	327.370	121.345	0.000	0.000	0.000	0.000	438.192	301.948
Brook Trout	273	0.000	0.000	0.000	1410.737	1335.043	0.000	0.000	6375.238	1578.730	1257.218
Lake Trout	468	0.000	0.000	1230.332	711.595	0.000	0.000	0.000	0.000	1059.315	678.926
Lake Trout	524	0.000	0.000	558.816	166.432	556.467	0.000	158.416	307.569	298.682	118.809
Rainbow Trout	346	0.000	0.000	751.102	0.000	0.000	0.000	0.000	0.000	367.899	0.000
Lake Trout		0.000	0.000	827.100	609.137	992.596	0.000	118.643	0.000	696.136	0.000
Lake Trout	273	0.000	0.000	0.000	1974.712	582.807	0.000	0.000	0.000	716.591	536.787
Rainbow Trout		0.000	0.000	468.806	113.904	0.000	0.000	0.000	0.000	300.963	0.000
Lake Trout		0.000	0.000	3014.475	541.235	587.184	0.000	307.288	0.000	570.703	308.693

Table 4: PCBs in trout (lipid corrected)

Lake Trout	521	0.000	0.000	536.905	89.724	0.000	0.000	0.000	0.000	205.602	0.000
Moab											
Bull Trout	305	0.000	0.000	0.000	8635.871	0.000	0.000	0.000	0.000	0.000	0.000
Rainbow Trout	228	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	43928.988
Rainbow Trout	287	0.000	0.000	0.000	8826.471	0.000	0.000	0.000	0.000	0.000	16068.657
Bull Trout	422	0.000	0.000	0.000	7052.967	0.000	0.000	2385.276	0.000	0.000	14730.997
Rainbow Trout	210	0.000	0.000	0.000	2503.131	0.000	0.000	0.000	0.000	0.000	7460.164
Rainbow Trout	334	0.000	0.000	3857.496	2365.283	0.000	0.000	0.000	0.000	0.000	9716.373
Rainbow Trout	206	0.000	0.000	0.000	8721.369	0.000	0.000	0.000	0.000	0.000	12425.449
Lake Trout	373	0.000	0.000	2428.117	553.021	482.493	0.000	0.000	3762.261	0.000	3491.955
Rainbow Trout	330	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	11944.265
Rainbow Trout	331	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	13224.837
Rainbow Trout	343	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5332.828	0.000	8023.394
Rainbow Trout	287	0.000	0.000	0.000	0.000	0.000	0.000	0.000	13290.702	0.000	26971.147
Rainbow Trout	337	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	8895.049
Lake Trout	421	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	8635.931
Lake Trout	360	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3288.018
Lake Trout	321	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	28904.091
Lake Trout	398	0.000	0.000	0.000	0.000	0.000	0.000	336.637	0.000	0.000	15767.071
Lake Trout	493	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Bull Trout	397	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Johnson											
Rainbow Trout	167	0.000	0.000	0.000	3099.983	0.000	0.000	0.000	0.000	0.000	10282.322
Brook Trout	166	0.000	0.000	0.000	2093.296	0.000	0.000	0.000	0.000	0.000	48701.972
Rainbow Trout	291	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	8509.240
Brook Trout	264	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	23477.318
Brook Trout	180	0.000	0.000	0.000	2133.943	0.000	0.000	0.000	0.000	0.000	25911.795
Brook Trout	262	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	15523.697
Rainbow Trout	292	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	14835.763
Brook Trout	231	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	17253.741
Brook Trout	183	0.000	0.000	0.000	1809.685	0.000	0.000	0.000	0.000	0.000	11916.786
Brook Trout	237	0.000	0.000	0.000	1127.780	0.000	0.000	0.000	0.000	0.000	22881.820
Brook Trout	292	0.000	0.000	0.000	1122.541	0.000	0.000	0.000	0.000	0.000	21858.189
Brook Trout	283	0.000	0.000	0.000	0.000	0.000	0.000	0.000	27172.305	0.000	87142.466
Emerald											
Brook Trout	304	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	686.110	0.000
Brook Trout	294	0.000	0.000	0.000	3359.527	25408.814	0.000	0.000	0.000	23624.069	28998.810

Table 4: PCBs in trout (lipid corrected)

Rainbow Trout	212	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5399.694	0.000
Brook Trout	244	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1633.330	1505.053
Brook Trout	338	0.000	0.000	0.000	2230.114	0.000	0.000	0.000	0.000	3177.855	4568.691
Brook Trout	209	0.000	0.000	0.000	0.000	0.000	3175.440	0.000	0.000	2707.185	3700.125
Rainbow Trout	161	0.000	0.000	0.000	1737.864	0.000	0.000	0.000	0.000	0.000	0.000
Brook Trout	230	0.000	0.000	0.000	0.000	0.000	1708.268	0.000	0.000	0.000	0.000
Brook Trout	335	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4356.550	5017.435
Rainbow Trout	211	0.000	0.000	0.000	1477.622	0.000	0.000	0.000	0.000	6848.545	6551.840
Brook Trout	320	0.000	0.000	0.000	0.000	0.000	2610.147	0.000	0.000	3915.932	3997.564
Brook Trout	255	0.000	0.000	0.000	17174.638	46969.201	0.000	0.000	0.000	52119.607	68159.650
Moraine											
Brook Trout	258	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4796.072
Brook Trout	224	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7247.095
Brook Trout	262	0.000	0.000	0.000	1007.799	0.000	0.000	0.000	0.000	0.000	5576.851
Brook Trout	243	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4019.895
Brook Trout	278	0.000	0.000	0.000	659.014	0.000	0.000	0.000	6249.024	0.000	6715.309
Brook Trout	243	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3443.610
Brook Trout	290	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2766.395
Brook Trout	183	0.000	0.000	0.000	1147.516	0.000	0.000	0.000	0.000	0.000	1621.091
Bighorn											
Brook Trout	280	0.000	0.000	1890.778	0.000	2474.979	0.000	0.000	0.000	581.138	874.219
Brook Trout	264	0.000	0.000	3133.354	0.000	2280.571	3345.472	0.000	0.000	1761.697	2318.865
Brook Trout	305	0.000	0.000	0.000	0.000	163.548	5226.574	0.000	0.000	5424.700	5800.383
Brook Trout	282	0.000	0.000	0.000	204.748	579.524	937.920	0.000	0.000	3768.878	1412.260
Brook Trout	262	0.000	0.000	9388.742	2368.568	7147.215	11737.437	0.000	0.000	2143.492	155.842
Brook Trout	238	0.000	0.000	3757.165	357.768	1451.049	3225.735	0.000	0.000	3772.970	2699.592
Brook Trout	298	0.000	0.000	4341.546	0.000	4830.475	5203.110	0.000	0.000	4854.388	4064.640
Brook Trout	270	0.000	0.000	2702.462	0.000	821.335	4712.780	0.000	0.000	1664.417	1852.172
Brook Trout	270	0.000	0.000	0.000	0.000	0.000	3799.724	0.000	0.000	234.092	1077.407
Brook Trout	224	0.000	0.000	4719.194	0.000	0.000	5188.224	0.000	0.000	1526.545	0.000
Brook Trout	320	0.000	0.000	8491.412	4928.397	7149.872	6748.305	0.000	0.000	15991.603	21129.564

Table 4: PCBs in trout (lipid corrected)

Species	Length	24-27	16-32	54-29	26	25	31-28	33-20-53	51	22	45
Shere											
Brook Trout	309	0.000	0.000	183.588	0.000	372.880	1117.191	0.000	1236.786	0.000	0.000
Brook Trout	363	0.000	0.000	0.000	0.000	516.197	586.996	0.000	317.430	0.000	0.000
Brook Trout	376	0.000	0.000	674.233	0.000	371.185	1524.263	0.000	424.289	20.011	0.000
Brook Trout	324	0.000	0.000	0.000	0.000	0.000	980.252	0.000	630.581	0.000	0.000
Brook Trout	312	0.000	0.000	0.000	0.000	269.633	822.085	0.000	460.009	0.000	0.000
Brook Trout	265	0.000	325.086	0.000	0.000	0.000	483.567	0.000	0.000	0.000	0.000
Brook Trout	355	0.000	0.000	290.225	0.000	0.000	772.059	0.000	1629.426	0.000	0.000
Brook Trout	297	0.000	601.307	0.000	0.000	293.750	1261.407	0.000	267.183	0.763	0.000
Brook Trout	425	0.000	0.000	0.000	0.000	0.000	349.106	0.000	110.912	0.000	0.000
Brook Trout	297	0.000	0.000	0.000	0.000	0.000	1318.316	0.000	527.114	0.000	0.000
Brook Trout	321	0.000	0.000	252.909	0.000	298.188	528.726	63.031	412.793	136.130	0.000
Brook Trout		0.000	0.000	0.000	0.000	4464.954	429.506	0.000	398.446	59.269	0.000
Pyramid											
Lake Trout	516	0.000	0.000	0.000	0.000	0.000	760.123	0.000	0.000	282.048	0.000
Lake Trout	532	0.000	369.578	292.235	0.000	190.994	59.271	0.000	155.290	0.000	0.000
Lake Trout	424	0.000	1409.250	0.000	0.000	0.000	1061.083	0.000	0.000	476.020	0.000
Lake Trout	468	0.000	0.000	0.000	0.000	0.000	258.796	0.000	0.000	0.000	0.000
Lake Trout	492	0.000	0.000	0.000	0.000	0.000	1244.480	0.000	0.000	415.532	0.000
Lake Trout	519	621.077	879.141	841.258	0.000	1487.270	2093.579	1522.790	391.979	915.744	0.000
Lake Trout	396	0.000	0.000	0.000	0.000	0.000	4308.734	0.000	0.000	0.000	0.000
Lake Trout	513	0.000	0.000	0.000	0.000	0.000	1068.222	0.000	0.000	385.707	0.000
Lake Trout	521	0.000	0.000	0.000	0.000	470.676	1065.537	0.000	0.000	396.376	0.000
Lake Trout	532	0.000	0.000	0.000	0.000	390.564	1711.547	0.000	0.000	310.407	0.000
Lake Trout	482	143.832	243.269	234.691	0.000	171.415	1327.680	114.866	0.000	299.835	0.000
Patricia											
Rainbow Trout	433	0.000	470.582	0.000	554.103	162.783	2411.235	536.096	0.000	308.125	0.000
Lake Trout	589	0.000	211.063	167.192	1089.432	56.008	1396.412	129.792	43.873	560.093	265.675
Brook Trout	273	0.000	665.988	0.000	1811.337	0.000	2730.507	433.497	225.301	323.889	0.000
Lake Trout	468	132.857	610.932	475.764	1663.631	115.809	2197.365	484.680	129.298	693.236	499.662
Lake Trout	524	0.000	312.474	265.779	641.553	39.814	1639.331	168.409	0.000	390.402	273.000
Rainbow Trout	346	0.000	174.231	107.913	0.000	865.422	758.379	114.208	0.000	131.856	114.819
Lake Trout		0.000	0.000	474.198	1326.770	204.063	1754.622	384.385	159.028	664.736	450.766
Lake Trout	273	0.000	0.000	0.000	2585.130	0.000	1218.957	-137.194	355.405	341.135	0.000
Rainbow Trout		0.000	115.583	72.975	0.000	722.143	573.410	73.361	0.000	84.505	144.920
Lake Trout		0.000	0.000	548.730	842.476	0.000	1498.319	266.056	0.000	747.263	0.000

Table 4: PCBs in trout (lipid corrected)

Lake Trout	521	0.000	232.665	237.674	327.448	0.000	760.603	74.727	0.000	261.303	0.000
Moab											
Bull Trout	305	0.000	0.000	1865.526	0.000	0.000	691.404	0.000	1467.854	0.000	0.000
Rainbow Trout	228	0.000	4070.009	3218.264	0.000	2103.338	652.731	0.000	1710.147	0.000	0.000
Rainbow Trout	287	0.000	0.000	0.000	0.000	0.000	5356.225	1917.602	2514.894	1588.965	0.000
Bull Trout	422	0.000	0.000	5541.471	0.000	0.000	3912.263	1043.281	1839.088	0.000	0.000
Rainbow Trout	210	0.000	0.000	0.000	0.000	2472.397	0.000	0.000	919.908	818.832	0.000
Rainbow Trout	334	622.308	1426.780	2447.418	0.000	0.000	971.222	144.468	718.527	0.000	0.000
Rainbow Trout	206	0.000	0.000	0.000	0.000	0.000	89.218	0.000	2202.996	0.000	0.000
Lake Trout	373	554.882	0.000	2940.328	0.000	0.000	2024.387	272.111	0.000	0.000	0.000
Rainbow Trout	330	924.280	0.000	0.000	0.000	788.052	0.000	0.000	0.000	0.000	0.000
Rainbow Trout	331	891.441	1035.189	2375.340	0.000	980.122	0.000	0.000	0.000	0.000	0.000
Rainbow Trout	343	0.000	0.000	2977.017	0.000	0.000	1852.958	0.000	0.000	0.000	0.000
Rainbow Trout	287	887.919	3658.426	3260.989	0.000	2331.393	0.000	0.000	0.000	1624.398	0.000
Rainbow Trout	337	0.000	1549.552	1827.712	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lake Trout	421	0.000	0.000	0.000	0.000	669.963	1444.458	0.000	0.000	0.000	0.000
Lake Trout	360	195.980	0.000	0.000	0.000	336.831	1115.789	0.000	0.000	236.116	0.000
Lake Trout	321	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	324.885	0.000
Lake Trout	398	195.790	0.000	0.000	0.000	249.329	1119.271	0.000	0.000	0.000	0.000
Lake Trout	493	0.000	0.000	1090.230	0.000	0.000	0.000	0.000	0.000	257.160	0.000
Bull Trout	397	68.840	0.000	265.479	0.000	417.567	0.000	0.000	0.000	137.878	0.000
Johnson											
Rainbow Trout	167	0.000	1292.229	0.000	0.000	709.866	6333.889	1582.938	748.627	1016.490	0.000
Brook Trout	166	0.000	2910.670	0.000	0.000	2255.645	2888.937	0.000	1414.343	1242.172	0.000
Rainbow Trout	291	0.000	760.151	0.000	0.000	0.000	4722.403	697.788	0.000	926.887	0.000
Brook Trout	264	0.000	1779.306	0.000	0.000	912.400	5751.322	183.307	0.000	1085.832	0.000
Brook Trout	180	0.000	3273.624	0.000	0.000	1224.410	12603.770	2451.357	1027.108	2597.768	0.000
Brook Trout	262	447.898	671.906	0.000	0.000	631.668	96.020	0.000	0.000	400.699	0.000
Rainbow Trout	292	0.000	1011.814	0.000	0.000	331.697	5083.157	537.047	0.000	823.900	0.000
Brook Trout	231	0.000	0.000	0.000	0.000	399.876	748.965	0.000	0.000	0.000	0.000
Brook Trout	183	795.223	2218.270	1723.677	0.000	1065.427	2864.858	0.000	0.000	1039.006	0.000
Brook Trout	237	0.000	0.000	0.000	0.000	409.910	704.369	0.000	414.415	566.459	0.000
Brook Trout	292	0.000	1757.657	0.000	0.000	650.361	9425.548	2314.646	0.000	1470.657	0.000
Brook Trout	283	0.000	4578.232	4631.003	0.000	0.000	19352.869	3488.317	0.000	4477.753	4047.269
Emerald											
Brook Trout	304	0.000	1424.974	0.000	547.924	0.000	2362.058	915.378	0.000	155.454	0.000
Brook Trout	294	2663.330	17905.142	0.000	14457.818	5550.844	104861.146	38057.419	0.000	15909.197	6879.588

Table 4: PCBs in trout (lipid corrected)

Rainbow Trout	212	0.000	5668.889	0.000	4230.365	8767.690	8148.321	4064.004	0.000	1425.313	5303.414
Brook Trout	244	0.000	2264.936	0.000	826.586	0.000	3418.669	2756.001	0.000	79.759	0.000
Brook Trout	338	1699.817	4457.688	1677.655	5062.993	2456.146	14922.849	5524.190	0.000	2171.786	3231.234
Brook Trout	209	0.000	2372.295	0.000	2338.623	2522.731	15697.292	5082.191	0.000	1186.513	680.309
Rainbow Trout	161	0.000	1713.264	0.000	288.567	0.000	3017.392	1216.106	0.000	0.000	0.000
Brook Trout	230	0.000	1949.115	0.000	2746.490	0.000	2397.697	1938.999	0.000	0.000	1639.763
Brook Trout	335	0.000	3946.052	0.000	4501.690	0.000	14761.996	5112.324	0.000	1545.334	0.000
Rainbow Trout	211	0.000	3887.247	0.000	5775.722	0.000	18940.228	6893.795	0.000	3129.991	4277.254
Brook Trout	320	0.000	5854.168	0.000	10980.368	2486.710	19661.332	4010.367	0.000	2104.397	0.000
Brook Trout	255	5353.464	43410.572	4041.976	56339.968	13559.779	260429.819	89679.998	0.000	40120.240	14762.218
Moraine											
Brook Trout	258	0.000	0.000	0.000	0.000	365.090	1407.795	501.901	409.235	761.927	0.000
Brook Trout	224	0.000	1058.137	0.000	0.000	1383.747	3766.065	1975.143	0.000	854.306	379.334
Brook Trout	262	0.000	0.000	0.000	0.000	0.000	1270.015	1329.955	0.000	366.574	0.000
Brook Trout	243	0.000	0.000	0.000	0.000	0.000	1481.526	1157.851	699.876	336.902	0.000
Brook Trout	278	0.000	0.000	0.000	0.000	0.000	1958.639	1010.137	508.535	557.012	407.722
Brook Trout	243	0.000	0.000	0.000	0.000	12380.288	970.412	566.389	0.000	279.095	189.923
Brook Trout	290	0.000	0.000	0.000	0.000	0.000	779.110	248.127	0.000	262.702	0.000
Brook Trout	183	0.000	2664.452	883.534	0.000	0.000	2443.601	848.928	1219.340	980.171	0.000
Bighorn											
Brook Trout	280	0.000	1888.361	937.263	9544.451	0.000	7255.442	973.204	527.533	898.262	0.000
Brook Trout	264	0.000	2581.389	0.000	6459.229	0.000	10470.972	2564.423	0.000	1489.849	7634.344
Brook Trout	305	0.000	4967.080	0.000	16607.613	0.000	12592.981	3419.724	0.000	2517.927	7499.722
Brook Trout	282	0.000	919.338	0.000	0.000	0.000	3211.522	722.892	0.000	545.686	3352.515
Brook Trout	262	0.000	6912.195	4478.842	49053.873	0.000	13388.667	4839.114	0.000	3987.392	5676.284
Brook Trout	238	0.000	1548.999	0.000	7360.852	0.000	5477.839	1353.822	0.000	1006.551	2103.844
Brook Trout	298	627.474	3027.103	2756.304	13553.568	0.000	13954.199	2995.557	0.000	1687.347	5900.356
Brook Trout	270	0.000	2126.891	0.000	0.000	0.000	5785.276	2011.291	0.000	1256.020	1573.447
Brook Trout	270	0.000	2690.022	0.000	0.000	0.000	7503.237	1608.067	0.000	1883.822	5020.479
Brook Trout	224	0.000	3402.199	1565.954	52863.958	0.000	7849.533	2034.685	0.000	1259.289	2203.021
Brook Trout	320	0.000	11234.110	0.000	38211.174	0.000	45703.885	7988.986	0.000	5935.018	46354.504

Table 4: PCBs in trout (lipid corrected)

Species	Length	46	52	49	43	48-47	44	59-42	40	100
Shere										
Brook Trout	309	0.000	1482.502	0.000	5271.852	650.497	580.019	0.000	141.625	251.170
Brook Trout	363	0.000	2062.753	0.000	999.035	261.735	539.796	0.000	0.000	104.885
Brook Trout	376	0.000	1282.887	0.000	867.391	0.000	474.097	0.000	321.257	0.000
Brook Trout	324	266.965	2208.513	0.000	758.117	363.845	937.171	0.000	3.373	400.167
Brook Trout	312	0.000	1332.624	0.000	1324.728	141.435	396.968	0.000	0.000	169.560
Brook Trout	265	0.000	1571.253	0.000	819.154	0.000	445.586	0.000	0.000	0.000
Brook Trout	355	0.000	1716.238	0.000	1601.774	2193.626	689.588	0.000	788.240	213.038
Brook Trout	297	0.000	2506.683	0.000	4549.144	169.056	1083.837	0.000	24.345	167.245
Brook Trout	425	0.000	1246.220	0.000	342.675	107.196	358.253	0.000	0.000	142.954
Brook Trout	297	0.000	2745.120	0.000	946.674	43.189	881.445	0.000	0.000	0.000
Brook Trout	321	207.629	873.046	0.000	421.162	492.319	396.155	12.132	24.077	233.642
Brook Trout		0.000	1620.072	0.000	2884.110	0.000	507.503	0.000	33.822	325.110
Pyramid										
Lake Trout	516	0.000	1664.898	0.000	1920.176	883.751	847.348	0.000	0.000	507.697
Lake Trout	532	286.105	1163.487	0.000	971.430	634.966	476.065	0.000	0.000	455.727
Lake Trout	424	0.000	4698.280	0.000	10457.134	1520.033	1802.134	0.000	0.000	648.132
Lake Trout	468	0.000	1123.480	0.000	155.532	464.610	385.682	0.000	173.962	520.270
Lake Trout	492	0.000	3609.909	0.000	882.602	1381.808	1383.872	362.532	262.991	1012.056
Lake Trout	519	500.953	3334.860	0.000	1932.577	3015.242	1693.091	803.628	504.916	1103.822
Lake Trout	396	0.000	8270.727	0.000	13277.917	0.000	0.000	0.000	0.000	0.000
Lake Trout	513	0.000	2208.523	0.000	5701.062	1583.675	751.618	0.000	0.000	701.750
Lake Trout	521	0.000	1886.666	0.000	2052.575	879.333	922.553	0.000	0.000	598.602
Lake Trout	532	0.000	1403.814	0.000	2032.185	834.810	1044.459	0.000	0.000	665.446
Lake Trout	482	123.410	1398.453	0.000	1619.280	710.551	594.934	185.275	135.606	359.293
Patricia										
Rainbow Trout	433	0.000	2277.975	0.000	2078.814	760.361	1027.730	222.583	192.856	241.472
Lake Trout	589	72.266	2813.418	0.000	2222.762	1152.384	1202.043	342.499	248.256	547.641
Brook Trout	273	0.000	3438.157	0.000	8183.285	947.476	790.151	234.515	0.000	440.587
Lake Trout	468	470.335	3006.882	0.000	2428.874	1527.893	1185.664	344.394	460.366	890.630
Lake Trout	524	81.058	2112.267	0.000	1806.531	712.172	798.294	333.639	322.585	782.035
Rainbow Trout	346	0.000	1246.560	0.000	1483.375	418.022	571.748	125.769	0.000	286.383
Lake Trout		0.000	3342.912	0.000	2536.814	1463.075	1389.414	294.318	525.083	776.316
Lake Trout	273	0.000	1827.771	0.000	4767.812	996.205	679.432	210.431	391.680	768.788
Rainbow Trout		0.000	770.349	0.000	919.155	261.178	356.867	78.499	0.000	180.126
Lake Trout		0.000	2709.176	0.000	1116.254	1225.444	1262.755	710.803	729.980	1249.723

Table 4: PCBs in trout (lipid corrected)

Lake Trout	521	0.000	1357.825	0.000	1017.012	522.764	518.274	176.322	186.105	432.330
Moab										
Bull Trout	305	0.000	3092.453	0.000	4742.919	2282.713	1510.304	0.000	0.000	2737.549
Rainbow Trout	228	3150.750	12812.990	0.000	10697.948	6992.609	5242.701	0.000	0.000	5018.726
Rainbow Trout	287	0.000	7273.809	0.000	10519.719	5190.353	4773.345	0.000	0.000	4654.867
Bull Trout	422	0.000	3430.768	1214.881	2946.027	1459.012	0.000	0.000	0.000	6423.438
Rainbow Trout	210	0.000	2987.416	0.000	2426.255	1171.937	3124.919	0.000	0.000	2282.201
Rainbow Trout	334	0.000	2482.588	0.000	6235.077	1865.354	844.095	0.000	0.000	3815.116
Rainbow Trout	206	0.000	2759.454	1241.479	3580.093	3300.147	0.000	0.000	0.000	1808.654
Lake Trout	373	1279.034	2509.718	1806.596	5514.987	1500.258	0.000	0.000	0.000	3054.173
Rainbow Trout	330	1054.969	1732.020	1184.732	1828.803	0.000	0.000	0.000	0.000	1447.541
Rainbow Trout	331	1834.704	1752.246	0.000	2555.331	0.000	1100.298	0.000	0.000	465.791
Rainbow Trout	343	0.000	3678.476	0.000	2487.246	0.000	2501.099	0.000	0.000	2877.463
Rainbow Trout	287	0.000	4721.124	0.000	3456.257	761.878	3987.531	0.000	0.000	1611.111
Rainbow Trout	337	0.000	3199.514	638.834	1083.064	726.452	0.000	0.000	0.000	1216.596
Lake Trout	421	0.000	2527.949	0.000	833.695	0.000	1357.533	0.000	0.000	2371.859
Lake Trout	360	0.000	1837.093	0.000	15206.922	0.000	1047.886	0.000	0.000	1664.394
Lake Trout	321	0.000	2929.002	0.000	4304.050	854.223	761.797	0.000	0.000	448.986
Lake Trout	398	0.000	2360.456	0.000	4337.665	1302.232	1328.617	0.000	0.000	2211.678
Lake Trout	493	0.000	1504.456	0.000	7658.966	335.148	342.128	0.000	0.000	862.228
Bull Trout	397	0.000	1003.233	0.000	1321.054	230.378	559.754	0.000	0.000	602.483
Johnson										
Rainbow Trout	167	0.000	5822.726	0.000	3394.965	2431.376	3379.022	559.881	397.717	162.756
Brook Trout	166	5204.537	1564.790	0.000	3695.381	4997.687	5744.299	0.000	0.000	1381.332
Rainbow Trout	291	0.000	4509.722	0.000	4457.832	1708.601	3290.483	557.360	269.897	0.000
Brook Trout	264	0.000	4961.719	0.000	2573.813	2138.720	6343.101	0.000	0.000	0.000
Brook Trout	180	0.000	12680.156	0.000	5895.549	5956.910	9345.943	2634.458	2498.523	1115.161
Brook Trout	262	0.000	390.590	0.000	1189.429	592.049	849.835	0.000	0.000	0.000
Rainbow Trout	292	0.000	4990.153	0.000	4570.182	1665.011	4713.740	582.329	865.447	346.512
Brook Trout	231	1651.062	617.311	0.000	2718.874	504.711	1093.136	0.000	0.000	0.000
Brook Trout	183	0.000	939.974	0.000	2512.281	2252.506	3422.896	845.047	1040.918	0.000
Brook Trout	237	0.000	528.125	0.000	3614.010	846.309	933.881	0.000	0.000	0.000
Brook Trout	292	0.000	9792.313	0.000	4603.396	2694.256	5893.428	1013.183	507.630	0.000
Brook Trout	283	3019.413	14186.683	0.000	8164.387	0.000	9847.288	0.000	2169.523	0.000
Emerald										
Brook Trout	304	0.000	3593.100	0.000	3183.196	0.000	0.000	0.000	0.000	758.875
Brook Trout	294	0.000	79605.331	0.000	25007.737	17479.221	48147.322	10071.327	4735.131	3620.632

Table 4: PCBs in trout (lipid corrected)

Rainbow Trout	212	16075.504	9835.907	0.000	2078.129	0.000	0.000	2203.052	2221.217	0.000
Brook Trout	244	0.000	7534.818	0.000	2192.740	600.397	17023.600	651.850	0.000	0.000
Brook Trout	338	0.000	8960.684	0.000	3912.795	2915.766	10008.790	0.000	1553.150	1271.983
Brook Trout	209	0.000	11138.049	0.000	3397.116	2665.579	7082.811	1083.220	0.000	649.538
Rainbow Trout	161	0.000	4500.892	0.000	920.196	0.000	0.000	0.000	0.000	0.000
Brook Trout	230	0.000	3642.510	0.000	873.201	0.000	0.000	0.000	0.000	0.000
Brook Trout	335	0.000	10121.588	0.000	2542.654	2742.968	18873.386	359.349	0.000	3080.212
Rainbow Trout	211	0.000	18464.654	0.000	6450.332	5494.974	17902.718	3313.689	790.170	1031.376
Brook Trout	320	0.000	8628.179	0.000	959.687	4050.657	6980.922	0.000	0.000	2874.619
Brook Trout	255	22934.289	181845.929	0.000	63029.938	38653.289	103123.240	25157.679	11903.225	4236.563
Moraine										
Brook Trout	258	0.000	1743.105	0.000	3919.190	740.117	0.000	0.000	0.000	1281.819
Brook Trout	224	0.000	4851.748	0.000	8397.003	1430.875	2052.224	702.968	0.000	1383.930
Brook Trout	262	0.000	2098.943	0.000	7958.411	1131.274	0.000	0.000	0.000	1625.673
Brook Trout	243	0.000	1908.930	0.000	7226.775	704.839	1.546	0.000	0.000	1659.507
Brook Trout	278	0.000	2847.619	0.000	10889.777	1232.485	953.515	0.000	0.000	2279.132
Brook Trout	243	0.000	1475.849	0.000	2702.031	583.523	0.000	0.000	483.721	821.850
Brook Trout	290	135.642	1223.444	0.000	2412.321	572.281	173.441	0.000	0.000	863.525
Brook Trout	183	0.000	2544.067	0.000	1615.676	1821.581	0.000	0.000	489.422	746.247
Bighorn										
Brook Trout	280	0.000	2776.838	0.000	1098.071	1641.241	1762.451	550.595	567.385	838.573
Brook Trout	264	0.000	8266.114	0.000	2560.020	2969.692	5486.652	1776.267	748.967	654.768
Brook Trout	305	0.000	14226.567	0.000	4901.054	4414.239	8719.032	2392.188	1919.874	0.000
Brook Trout	282	0.000	2356.011	0.000	950.862	1189.119	1150.659	428.420	0.000	564.176
Brook Trout	262	0.000	12538.282	0.000	5276.044	5491.581	6524.532	2148.792	1741.296	3202.289
Brook Trout	238	0.000	4437.354	0.000	1743.093	1678.165	2345.085	825.306	427.355	941.890
Brook Trout	298	0.000	5271.277	0.000	2063.200	3549.580	3382.473	1333.842	320.564	2327.154
Brook Trout	270	0.000	5595.848	0.000	1640.235	1402.324	2185.885	872.078	544.120	1196.101
Brook Trout	270	0.000	6158.165	0.000	2297.977	2129.400	2557.944	1141.104	809.561	1093.428
Brook Trout	224	0.000	4995.703	0.000	1819.892	2280.331	2684.401	1015.380	547.031	1433.187
Brook Trout	320	54379.860	25719.255	0.000	9193.763	10638.729	12491.334	4037.873	0.000	0.000

Table 4: PCBs in trout (lipid corrected)

Species	Length	63	74	70-76-98	66	91-55	56-60	92	84	101
Shere										
Brook Trout	309	0.000	291.512	514.791	1127.874	0.000	0.000	423.438	167.117	2212.417
Brook Trout	363	0.000	250.278	86.302	896.580	0.000	0.000	321.857	91.249	1967.340
Brook Trout	376	0.000	154.683	0.000	770.057	0.000	425.918	361.948	0.000	1472.963
Brook Trout	324	0.000	422.848	990.404	2108.319	0.000	0.000	603.140	425.842	3792.339
Brook Trout	312	0.000	350.293	424.529	1264.807	156.498	0.000	384.903	0.000	2177.142
Brook Trout	265	0.000	12.722	0.000	601.936	0.000	0.000	105.145	0.000	1320.510
Brook Trout	355	405.877	300.147	631.002	917.313	112.063	0.000	426.834	47.183	1559.959
Brook Trout	297	0.000	633.515	1663.186	2913.296	118.750	61.443	784.423	664.424	4965.578
Brook Trout	425	0.000	244.578	99.593	769.507	0.000	0.000	206.183	0.000	1590.010
Brook Trout	297	0.000	465.635	1171.889	2209.717	0.000	0.000	591.733	379.065	4490.768
Brook Trout	321	225.851	349.893	570.222	671.639	281.688	92.282	240.687	156.324	1011.497
Brook Trout		0.000	183.258	0.000	772.556	0.000	682.392	289.560	216.113	1581.422
Pyramid										
Lake Trout	516	365.746	1376.316	2292.808	3381.903	657.271	687.211	2103.111	0.000	10912.086
Lake Trout	532	370.411	641.092	639.866	1477.104	721.774	144.704	633.860	641.042	1989.430
Lake Trout	424	1092.071	791.583	1727.779	3897.456	474.345	230.273	2468.710	0.000	8041.275
Lake Trout	468	419.252	480.832	715.650	1356.549	0.000	186.082	889.935	0.000	3167.434
Lake Trout	492	468.930	1567.349	3046.145	6606.634	1530.049	1095.496	4746.895	0.000	14131.779
Lake Trout	519	1051.916	2845.918	5017.145	6588.603	1369.127	1492.698	3842.833	0.000	19227.001
Lake Trout	396	0.000	932.105	2654.101	5971.484	0.000	-427.267	2377.607	0.000	12044.440
Lake Trout	513	627.595	1424.314	2187.786	3766.500	497.344	481.876	2485.667	902.501	10707.346
Lake Trout	521	516.471	1269.660	2291.148	3017.692	0.000	603.110	1809.065	0.000	8741.663
Lake Trout	532	533.706	1435.536	2525.460	3133.674	0.000	426.823	1795.111	0.000	9056.776
Lake Trout	482	324.510	894.069	2359.562	3350.797	490.428	603.882	1694.978	0.000	19493.481
Patricia										
Rainbow Trout	433	108.814	1105.226	2531.076	3735.261	565.825	768.802	5234.684	837.993	6729.789
Lake Trout	589	283.464	1819.116	3215.485	0.000	1463.182	864.390	7728.944	0.000	26824.853
Brook Trout	273	0.000	1014.235	2039.105	0.000	586.765	1542.310	7906.254	1123.897	7581.628
Lake Trout	468	434.563	1817.427	3049.364	0.000	1766.973	950.246	5857.680	996.047	18127.840
Lake Trout	524	216.224	1313.846	2217.002	0.000	0.000	644.755	7345.456	0.000	14404.713
Rainbow Trout	346	520.470	664.204	1193.838	2228.289	462.362	423.755	6046.308	0.000	5080.340
Lake Trout		375.188	2357.941	4139.392	8371.456	1721.219	1058.364	9559.840	1762.338	34859.467
Lake Trout	273	259.146	1553.114	2198.769	5020.197	2130.402	1161.334	7592.304	0.000	13631.975
Rainbow Trout		322.381	489.794	918.069	1662.040	572.339	458.759	4173.847	309.729	3442.238
Lake Trout		492.166	2040.980	3210.084	6762.109	0.000	999.725	10708.569	0.000	20859.729

Table 4: PCBs in trout (lipid corrected)

Lake Trout	521	149.453	922.458	1511.842	3274.456	0.000	339.499	4537.382	0.000	11389.434
Moab										
Bull Trout	305	1122.878	1164.190	1082.009	3123.055	0.000	0.000	1123.492	2997.620	5078.833
Rainbow Trout	228	4079.180	7060.077	7046.572	16266.723	7948.594	1593.561	6980.435	7059.524	21908.752
Rainbow Trout	287	1892.548	3612.440	5205.371	10011.260	1124.522	659.662	4140.584	4691.519	15601.380
Bull Trout	422	2717.995	5159.650	1274.881	0.000	0.000	2577.689	1781.178	0.000	10174.690
Rainbow Trout	210	1101.262	904.763	0.000	2657.871	0.000	0.000	832.842	1069.684	2131.167
Rainbow Trout	334	0.000	2145.157	802.747	0.000	0.000	356.133	2150.976	0.000	4651.778
Rainbow Trout	206	0.000	1859.868	0.000	0.000	0.000	2060.513	103.486	89.861	2453.686
Lake Trout	373	2226.100	1939.036	961.837	747.751	118.607	1237.974	553.870	736.084	4109.835
Rainbow Trout	330	0.000	2117.670	63.269	1190.684	0.000	1015.961	32.601	345.558	1907.647
Rainbow Trout	331	0.000	0.000	0.000	1063.201	0.000	0.000	367.341	0.000	182.198
Rainbow Trout	343	2025.600	2388.155	316.973	0.000	0.000	1248.564	0.000	1881.546	3086.467
Rainbow Trout	287	0.000	0.000	0.000	3419.592	0.000	181.000	679.861	293.416	1682.192
Rainbow Trout	337	0.000	282.033	0.000	1864.711	0.000	0.000	461.310	632.632	2208.696
Lake Trout	421	1301.466	854.768	1023.740	0.000	0.000	0.000	269.492	0.000	4797.441
Lake Trout	360	959.151	947.942	1271.568	3237.894	40.761	52.759	321.802	2454.856	6796.236
Lake Trout	321	374.274	590.988	1602.367	3724.701	25.702	0.000	866.735	766.404	7434.177
Lake Trout	398	741.780	737.049	804.577	0.000	0.000	0.000	0.000	2002.856	6982.030
Lake Trout	493	569.522	393.678	0.000	307.575	0.000	0.000	0.000	67.441	2942.627
Bull Trout	397	192.081	187.619	222.170	1194.520	0.000	0.000	291.146	353.709	2231.887
Johnson										
Rainbow Trout	167	254.381	3104.397	8222.987	11164.667	1689.228	2176.440	7999.935	3472.339	17330.826
Brook Trout	166	1316.245	1593.912	1403.981	2318.997	1092.374	1145.723	6782.716	1323.716	4982.536
Rainbow Trout	291	0.000	2475.813	6256.654	8327.232	1222.756	1751.867	8770.923	2547.338	13178.391
Brook Trout	264	0.000	3221.417	8064.734	10792.969	1700.553	2320.976	6938.824	3420.124	17581.296
Brook Trout	180	1098.134	6701.693	17265.186	21945.483	3742.650	5156.655	10956.158	7026.852	35754.529
Brook Trout	262	0.000	618.862	557.309	533.258	306.852	0.000	2744.964	0.000	1342.957
Rainbow Trout	292	0.000	2686.596	6466.979	9409.332	1292.740	1818.618	11047.111	3123.806	14350.071
Brook Trout	231	0.000	687.868	653.945	1443.274	0.000	357.354	7148.739	0.000	2968.486
Brook Trout	183	1335.086	2775.149	3028.164	3184.897	2061.279	2041.159	6672.048	1166.363	4015.596
Brook Trout	237	0.000	803.259	825.593	1447.846	0.000	0.000	5132.833	0.000	2256.165
Brook Trout	292	435.801	5166.941	13556.256	18820.717	2907.614	3762.067	12744.064	6018.378	30518.572
Brook Trout	283	0.000	7193.427	13153.022	19509.727	3189.688	4246.297	9813.557	9155.142	29382.342
Emerald										
Brook Trout	304	0.000	1040.745	2462.708	5187.120	1054.132	0.000	4207.425	0.000	9076.328
Brook Trout	294	5081.675	39251.355	108982.882	139346.823	26422.997	0.000	45452.964	40897.676	212237.749

Table 4: PCBs in trout (lipid corrected)

Rainbow Trout	212	2104.488	3886.434	13442.376	18077.306	8334.778	0.000	9181.003	10143.036	22445.231
Brook Trout	244	0.000	2824.180	12802.427	21004.944	4094.406	0.000	6565.506	7809.937	31222.564
Brook Trout	338	942.433	3791.331	10331.114	12912.814	3306.533	0.000	8871.671	4083.363	22969.248
Brook Trout	209	579.463	5600.597	13924.868	16930.236	2484.600	0.000	5201.806	3694.823	27819.651
Rainbow Trout	161	0.000	1046.029	3352.029	4981.898	1103.247	0.000	2943.266	950.384	6944.774
Brook Trout	230	0.000	622.433	2211.360	2737.725	0.000	0.000	1366.512	0.000	4372.552
Brook Trout	335	0.000	3817.249	9380.100	15999.705	3419.828	0.000	13205.984	0.000	27459.179
Rainbow Trout	211	0.000	5700.971	17522.191	22739.243	3198.284	0.000	9652.904	5656.461	33277.921
Brook Trout	320	2668.124	20441.326	10036.492	32962.340	4309.044	0.000	10187.825	0.000	45622.801
Brook Trout	255	6998.209	86135.043	245010.694	294337.966	43560.286	0.000	85565.152	79113.990	450432.213
Moraine										
Brook Trout	258	0.000	393.043	1173.989	2329.560	701.159	294.928	2733.909	497.405	4957.512
Brook Trout	224	0.000	1929.777	6205.229	8779.880	1207.322	1622.156	5035.464	2640.973	14940.415
Brook Trout	262	0.000	0.000	1928.171	4010.813	1976.840	191.800	6500.010	0.000	6752.129
Brook Trout	243	579.498	0.000	2182.572	4031.483	1679.820	589.787	4908.892	0.000	6018.715
Brook Trout	278	468.346	0.000	2069.184	4553.913	1092.040	0.000	11459.093	0.000	9459.325
Brook Trout	243	238.330	0.000	992.993	2134.104	707.526	2294.676	3964.655	0.000	3533.038
Brook Trout	290	128.376	0.000	1204.793	2393.593	295.012	467.142	3547.742	0.000	3981.649
Brook Trout	183	0.000	424.832	1923.829	3859.051	599.101	230.553	10088.066	0.000	6326.023
Bighorn										
Brook Trout	280	233.180	708.784	2846.390	4067.178	489.003	0.000	4180.465	942.892	8277.949
Brook Trout	264	0.000	2831.928	11042.346	17857.498	2641.551	2251.326	6521.797	7833.241	24467.022
Brook Trout	305	0.000	4727.906	14744.091	27131.789	3287.625	1579.956	10794.557	10433.437	40966.096
Brook Trout	282	0.000	1031.429	2453.165	3829.562	674.794	0.000	2774.670	915.437	6851.662
Brook Trout	262	0.000	2518.815	11382.537	20174.843	2762.225	1868.487	15638.206	8056.471	41618.432
Brook Trout	238	0.000	848.683	3216.384	5482.757	693.582	0.000	3928.657	1581.920	9828.976
Brook Trout	298	0.000	3141.662	5615.117	9247.217	2421.682	1217.896	5771.268	2173.852	12153.117
Brook Trout	270	0.000	925.703	4451.991	8048.623	1109.213	0.000	6698.261	1230.578	14253.290
Brook Trout	270	0.000	1852.716	4974.291	8475.576	993.161	0.000	9544.318	1951.869	21129.628
Brook Trout	224	0.000	1254.674	3416.348	6112.466	584.406	95.008	3212.019	1724.786	9776.490
Brook Trout	320	0.000	5062.924	14359.670	23464.068	4270.819	0.000	21968.611	4151.448	48823.919

Table 4: PCBs in trout (lipid corrected)

Species	Length	99	119	83	97	87-81	85	136	110
Shere									
Brook Trout	309	1007.863	89.458	0.000	476.242	803.405	0.000	0.000	1068.191
Brook Trout	363	1055.913	0.000	30.806	367.601	474.528	0.000	0.000	740.043
Brook Trout	376	836.814	0.000	0.000	239.435	459.148	0.000	0.000	758.375
Brook Trout	324	1747.080	0.000	174.406	1171.922	2260.883	0.000	0.000	2606.589
Brook Trout	312	1325.171	123.572	0.000	654.705	770.956	0.000	0.000	1198.946
Brook Trout	265	621.618	0.000	0.000	167.464	234.098	0.000	0.000	470.351
Brook Trout	355	944.296	0.000	0.000	544.597	397.651	0.000	0.000	655.964
Brook Trout	297	2096.898	34.203	23.105	1239.532	2549.539	0.000	0.000	3763.251
Brook Trout	425	873.506	0.000	0.000	181.794	424.360	0.000	0.000	800.077
Brook Trout	297	1879.300	0.000	68.145	1078.293	2124.714	0.000	0.000	2833.850
Brook Trout	321	616.787	226.475	66.855	270.074	630.809	0.000	0.000	405.539
Brook Trout		960.132	0.000	0.000	163.177	243.507	0.000	0.000	648.723
Pyramid									
Lake Trout	516	7324.422	343.485	678.041	1302.591	3391.094	0.000	0.000	3818.038
Lake Trout	532	1051.829	218.064	111.683	1664.057	1011.522	0.000	0.000	1222.793
Lake Trout	424	5211.520	100.813	935.398	1761.324	3438.427	0.000	0.000	4128.373
Lake Trout	468	2433.394	97.600	239.165	527.962	1213.035	0.000	0.000	1551.365
Lake Trout	492	7425.901	314.532	1016.804	2830.850	5641.656	0.000	0.000	7386.165
Lake Trout	519	13837.669	843.684	1177.984	2839.222	6405.076	0.000	0.000	7323.727
Lake Trout	396	9122.243	0.000	271.926	2857.062	4002.729	0.000	0.000	4903.575
Lake Trout	513	7623.523	223.329	938.969	1584.077	3487.404	0.000	0.000	3648.976
Lake Trout	521	6451.174	286.287	600.142	1147.681	2839.991	0.000	0.000	3641.029
Lake Trout	532	5736.096	459.103	680.863	1230.585	2949.442	0.000	0.000	3324.385
Lake Trout	482	9921.905	185.904	378.013	971.043	3537.963	0.000	0.000	4237.482
Patricia									
Rainbow Trout	433	3055.576	228.987	335.634	1619.718	3567.838	0.000	0.000	4571.182
Lake Trout	589	9662.075	873.437	924.934	2877.857	6019.020	0.000	0.000	7357.214
Brook Trout	273	3837.891	425.793	0.000	2166.524	4503.405	0.000	0.000	4498.874
Lake Trout	468	7135.974	677.673	782.730	2836.556	5136.265	0.000	0.000	6446.902
Lake Trout	524	5682.067	540.055	551.230	2073.027	4132.048	0.000	0.000	4854.739
Rainbow Trout	346	1895.438	303.668	276.270	970.208	1960.499	0.000	0.000	2668.560
Lake Trout		12102.593	1098.838	1042.816	2983.648	7519.330	0.000	0.000	9451.115
Lake Trout	273	6052.716	1083.664	1130.075	2870.993	5717.612	0.000	0.000	4627.387
Rainbow Trout		1820.509	449.892	638.161	1181.099	2066.913	0.000	0.000	2128.464
Lake Trout		7961.908	918.672	1480.595	3151.723	6113.787	0.000	0.000	6877.505

Table 4: PCBs in trout (lipid corrected)

Lake Trout	521	4234.842	370.239	679.786	1495.005	2984.537	0.000	0.000	3033.843
Moab									
Bull Trout	305	3683.375	0.000	0.000	8068.209	816.548	0.000	0.000	1631.560
Rainbow Trout	228	11583.348	2401.447	1229.914	18325.560	11139.463	0.000	0.000	13466.100
Rainbow Trout	287	9295.467	189.906	689.780	9950.807	5246.203	0.000	0.000	8428.359
Bull Trout	422	6588.590	282.991	0.000	38091.150	3669.936	0.000	0.000	2287.925
Rainbow Trout	210	1654.364	0.000	0.000	10716.556	97.202	0.000	0.000	158.905
Rainbow Trout	334	3285.607	0.000	0.000	12067.744	1197.266	0.000	0.000	848.986
Rainbow Trout	206	1193.816	0.000	0.000	25370.892	1439.299	0.000	0.000	1145.774
Lake Trout	373	3925.650	509.139	0.000	14341.182	1969.665	0.000	0.000	993.180
Rainbow Trout	330	1332.542	0.000	0.000	19024.149	472.352	0.000	0.000	220.824
Rainbow Trout	331	477.512	0.000	895.153	629.430	0.000	0.000	0.000	0.000
Rainbow Trout	343	3048.960	0.000	0.000	21045.481	1311.955	0.000	0.000	628.410
Rainbow Trout	287	1708.749	0.000	0.000	4679.798	0.000	0.000	0.000	0.000
Rainbow Trout	337	2514.701	0.000	301.509	4209.674	404.373	0.000	0.000	404.505
Lake Trout	421	4057.196	57.354	0.000	5835.752	3063.785	0.000	0.000	3014.666
Lake Trout	360	4076.486	0.000	33.261	13832.566	1511.440	0.000	0.000	2363.317
Lake Trout	321	2979.076	0.000	0.000	4158.693	1667.446	0.000	0.000	3107.084
Lake Trout	398	3697.901	0.000	0.000	9077.702	1228.555	0.000	0.000	2608.505
Lake Trout	493	1623.745	0.000	0.000	20334.922	22.008	0.000	0.000	0.000
Bull Trout	397	1339.211	0.000	0.000	2607.073	597.606	0.000	0.000	986.930
Johnson									
Rainbow Trout	167	7738.795	540.368	1343.673	5958.182	12114.909	0.000	0.000	15478.761
Brook Trout	166	2207.968	0.000	756.735	1615.077	3207.280	0.000	0.000	3624.641
Rainbow Trout	291	5742.966	468.496	904.991	4024.472	8465.624	0.000	0.000	11252.405
Brook Trout	264	7577.349	0.000	1776.644	4689.652	10751.146	0.000	0.000	14987.974
Brook Trout	180	16769.892	2053.799	3225.677	12062.157	23709.720	0.000	0.000	28981.964
Brook Trout	262	738.770	0.000	0.000	213.170	890.336	0.000	0.000	767.813
Rainbow Trout	292	6454.677	589.470	841.125	4008.889	8342.956	0.000	0.000	11532.055
Brook Trout	231	1096.894	0.000	0.000	413.629	1484.729	0.000	0.000	1497.036
Brook Trout	183	2400.224	798.567	811.887	1191.079	3209.272	0.000	0.000	2635.040
Brook Trout	237	956.747	0.000	0.000	479.250	1150.255	0.000	0.000	1513.142
Brook Trout	292	13442.892	1149.536	2391.549	8844.913	19151.961	0.000	0.000	23638.344
Brook Trout	283	12967.094	1255.703	1083.457	7574.029	17139.152	0.000	0.000	22168.567
Emerald									
Brook Trout	304	4670.545	1735.770	1475.349	2619.501	4817.040	0.000	0.000	5218.678
Brook Trout	294	101567.381	4305.215	9558.782	58212.194	126038.702	0.000	0.000	168551.005

Table 4: PCBs in trout (lipid corrected)

Rainbow Trout	212	9460.726	0.000	2340.337	7515.535	22504.232	0.000	0.000	22261.008
Brook Trout	244	12261.783	1307.951	2405.452	10426.950	27112.529	0.000	0.000	35917.536
Brook Trout	338	12613.243	2102.049	2558.350	5997.422	12716.046	0.000	0.000	13109.761
Brook Trout	209	12278.059	494.778	1314.275	7704.797	16526.633	0.000	0.000	20849.522
Rainbow Trout	161	2803.914	0.000	1143.631	2186.618	5640.023	0.000	0.000	7042.162
Brook Trout	230	2974.762	609.572	1184.481	2249.733	2664.910	0.000	0.000	3206.841
Brook Trout	335	16029.406	2197.597	1782.287	6984.943	14278.766	0.000	0.000	14982.002
Rainbow Trout	211	14881.414	728.814	3114.731	10697.038	20651.453	0.000	0.000	26682.182
Brook Trout	320	50489.264	2817.869	4085.714	9393.768	21661.915	0.000	0.000	16733.844
Brook Trout	255	207844.789	24010.889	44693.276	164997.188	333967.113	0.000	0.000	425216.353
Moraine									
Brook Trout	258	1949.776	486.945	429.946	809.790	1526.123	0.000	0.000	1949.842
Brook Trout	224	6763.789	1128.744	615.225	3837.925	8565.014	0.000	0.000	10016.901
Brook Trout	262	2559.081	423.826	0.000	688.442	1481.731	0.000	0.000	1926.767
Brook Trout	243	2353.945	0.000	0.000	836.301	1691.326	0.000	0.000	2319.132
Brook Trout	278	3112.402	0.000	587.997	1323.108	2690.104	0.000	0.000	6033.837
Brook Trout	243	1430.067	198.078	257.481	511.705	1115.809	0.000	0.000	1143.760
Brook Trout	290	1823.943	458.570	830.671	576.539	883.589	0.000	0.000	1300.317
Brook Trout	183	2191.636	433.710	487.496	1006.469	2648.718	0.000	0.000	4274.671
Bighorn									
Brook Trout	280	2795.712	635.403	338.232	1504.553	3556.663	0.000	0.000	4571.222
Brook Trout	264	9383.450	1285.358	2368.959	8292.661	18417.508	0.000	0.000	26496.217
Brook Trout	305	16966.190	3407.646	2705.649	13382.990	29399.848	0.000	0.000	35232.556
Brook Trout	282	2256.116	230.929	565.559	1187.608	3581.509	0.000	0.000	4002.939
Brook Trout	262	17601.828	5945.604	4196.757	13101.988	29998.793	0.000	0.000	34126.858
Brook Trout	238	3681.756	994.326	381.823	1876.197	4655.910	0.000	0.000	5559.978
Brook Trout	298	5605.897	1446.086	2114.722	4692.847	8208.239	0.000	0.000	10628.373
Brook Trout	270	5380.001	805.919	0.000	2303.405	7551.137	0.000	0.000	7111.617
Brook Trout	270	8517.999	2292.438	3867.659	6014.135	11701.311	0.000	0.000	11637.020
Brook Trout	224	3586.171	1123.388	404.501	1570.889	3972.648	0.000	0.000	5048.192
Brook Trout	320	18959.870	0.000	0.000	0.000	16007.560	0.000	0.000	20574.202

Table 4: PCBs in trout (lipid corrected)

Species	Length	82	151	135-144	147-107	149	118	133	114-134-131	146
Shere										
Brook Trout	309	568.093	189.762	0.000	0.000	1086.035	2252.301	297.483	0.000	682.202
Brook Trout	363	449.684	8.888	0.000	0.000	932.194	2107.181	211.774	0.000	773.619
Brook Trout	376	391.167	186.548	25.492	0.000	1083.901	1838.987	5054.857	0.000	3794.297
Brook Trout	324	516.141	198.447	5.955	0.000	1700.596	3701.930	822.967	0.000	757.382
Brook Trout	312	542.618	179.540	0.000	0.000	1177.940	2539.842	685.104	0.000	799.006
Brook Trout	265	383.430	28.198	0.000	0.000	605.112	1096.077	274.096	0.000	463.994
Brook Trout	355	-334.970	174.779	359.913	0.000	675.161	2217.811	8465.354	0.000	852.395
Brook Trout	297	507.607	267.019	82.687	0.000	2313.635	4521.421	247.417	0.000	744.045
Brook Trout	425	470.480	63.734	0.000	0.000	802.033	1574.422	334.424	0.000	575.072
Brook Trout	297	51.909	7.151	0.000	0.000	1957.758	4167.720	50.667	0.000	779.908
Brook Trout	321	176.646	70.816	26.730	0.000	471.876	815.291	837.920	0.000	293.491
Brook Trout		352.333	42.079	0.000	0.000	807.877	1776.475	1146.225	0.000	575.446
Pyramid										
Lake Trout	516	4702.658	0.000	1799.818	2794.490	3590.040	13554.245	4089.562	0.000	5255.398
Lake Trout	532	1100.845	0.000	298.174	193.261	1003.105	2150.474	483.654	0.000	418.709
Lake Trout	424	0.000	0.000	2454.613	2106.492	4371.308	10876.752	4791.353	0.000	4204.088
Lake Trout	468	2376.447	0.000	1230.431	1100.061	1769.031	4656.672	5165.251	0.000	1914.600
Lake Trout	492	6972.486	1592.580	2860.343	2638.858	8538.024	13721.160	3275.692	0.000	5686.774
Lake Trout	519	6437.365	0.000	3961.153	5681.797	8089.396	26769.763	7008.539	0.000	10712.583
Lake Trout	396	7825.690	0.000	1800.745	1554.197	5665.192	18385.022	9924.194	0.000	6599.418
Lake Trout	513	0.000	0.000	2069.858	2437.003	4100.528	14140.954	5065.499	0.000	5387.389
Lake Trout	521	0.000	0.000	1704.882	2230.368	3347.401	10980.321	3037.714	0.000	4431.083
Lake Trout	532	3350.146	0.000	1606.273	1650.990	2866.096	7673.529	2919.805	0.000	3315.141
Lake Trout	482	5285.252	305.997	1874.307	3271.798	3861.428	29650.914	6120.615	0.000	6091.425
Patricia										
Rainbow Trout	433	3478.747	1408.723	1372.397	707.639	3072.009	6071.661	723.360	0.000	2112.109
Lake Trout	589	12833.612	5931.462	5383.674	0.000	11178.920	11058.789	7121.405	0.000	7391.154
Brook Trout	273	5434.575	2049.929	1741.846	745.181	3594.113	6805.328	1220.226	0.000	3241.747
Lake Trout	468	10681.926	4753.448	4348.725	0.000	10189.519	9364.572	6326.430	0.000	6384.574
Lake Trout	524	0.000	3266.479	3142.164	1355.873	7429.783	6613.115	5048.897	0.000	5009.829
Rainbow Trout	346	3946.716	1507.797	749.986	301.615	2120.753	4326.092	1457.249	0.000	2372.217
Lake Trout		0.000	6602.801	8119.123	2764.817	13850.225	15518.120	9352.102	0.000	8639.446
Lake Trout	273	9145.891	3615.552	4953.324	0.000	7514.447	6588.757	4096.169	0.000	5464.171
Rainbow Trout		2547.130	1094.533	903.024	635.944	1539.631	2995.563	968.755	0.000	1491.139
Lake Trout		17893.091	5151.908	8589.982	2289.222	9798.869	9184.271	7830.834	0.000	6798.306

Table 4: PCBs in trout (lipid corrected)

Lake Trout	521	0.000	2639.253	3465.374	1086.108	5624.967	5515.231	2926.923	0.000	3704.279
Moab										
Bull Trout	305	0.000	0.000	1015.767	676.279	1877.557	5812.985	2869.316	0.000	2744.185
Rainbow Trout	228	12123.138	0.000	3283.664	2128.297	11046.777	23682.268	5326.281	0.000	4611.066
Rainbow Trout	287	10263.353	702.205	2980.553	1326.329	6606.480	14572.227	4634.698	0.000	2627.863
Bull Trout	422	14723.425	0.000	2889.111	704.506	3446.497	9203.496	4983.228	0.000	1943.904
Rainbow Trout	210	0.000	0.000	0.000	0.000	1525.821	3245.907	1934.683	0.000	0.000
Rainbow Trout	334	5130.473	0.000	1178.012	575.127	1470.296	5025.986	1882.397	0.000	1332.289
Rainbow Trout	206	3281.495	0.000	906.913	439.853	2176.177	3823.968	3768.962	0.000	1124.096
Lake Trout	373	0.000	709.253	1891.186	757.002	1902.784	4062.941	2649.726	0.000	2075.015
Rainbow Trout	330	1664.756	0.000	159.055	395.915	952.497	3342.840	1046.712	0.000	329.205
Rainbow Trout	331	1620.707	0.000	0.000	1011.868	677.232	1378.917	677.281	0.000	1227.009
Rainbow Trout	343	7623.525	0.000	887.825	461.712	1769.251	4351.093	3634.181	0.000	1046.915
Rainbow Trout	287	4121.357	0.000	0.000	512.489	1776.744	5422.482	2759.317	0.000	835.158
Rainbow Trout	337	1834.631	0.000	815.373	766.533	1644.840	4297.290	2371.759	0.000	776.720
Lake Trout	421	0.000	0.000	1433.140	382.405	974.173	3643.617	1235.494	0.000	1686.135
Lake Trout	360	0.000	0.000	843.691	432.656	1709.813	6294.328	1752.067	0.000	1513.506
Lake Trout	321	0.000	0.000	119.653	155.992	1974.882	7542.517	1932.129	0.000	616.020
Lake Trout	398	0.000	0.000	448.101	256.522	1215.415	6298.593	1725.721	0.000	818.601
Lake Trout	493	0.000	0.000	233.270	0.000	598.033	2498.054	1180.313	0.000	407.329
Bull Trout	397	0.000	0.000	29.623	120.514	836.270	1977.558	469.742	0.000	302.372
Johnson										
Rainbow Trout	167	2577.509	427.065	0.000	1190.133	8029.734	14780.782	0.000	0.000	1930.758
Brook Trout	166	3042.772	0.000	0.000	803.963	5061.195	0.000	0.000	0.000	3244.644
Rainbow Trout	291	2640.280	0.000	0.000	1070.292	6100.296	11214.777	0.000	0.000	1583.513
Brook Trout	264	2544.065	0.000	0.000	737.660	8406.150	9897.710	0.000	0.000	2178.935
Brook Trout	180	5507.830	0.000	0.000	2440.595	17596.787	24738.506	0.000	0.000	4050.731
Brook Trout	262	1026.312	0.000	0.000	0.000	1343.189	0.000	0.000	0.000	318.501
Rainbow Trout	292	3229.473	0.000	0.000	854.198	6828.355	11208.814	0.000	0.000	2114.629
Brook Trout	231	1727.970	0.000	0.000	525.715	2562.040	0.000	0.000	0.000	540.228
Brook Trout	183	1981.110	0.000	0.000	1236.239	3382.276	0.000	0.000	0.000	1417.286
Brook Trout	237	1950.572	0.000	0.000	488.360	1940.540	0.000	0.000	0.000	691.740
Brook Trout	292	4992.308	683.073	0.000	1190.287	14530.177	24222.849	0.000	0.000	4570.796
Brook Trout	283	4896.845	0.000	0.000	3870.658	15355.792	18064.775	0.000	0.000	3852.304
Emerald										
Brook Trout	304	10984.166	1552.173	2581.937	1310.998	4318.062	6858.481	0.000	0.000	3445.452
Brook Trout	294	54187.964	22484.597	30443.703	18037.472	94595.058	190321.981	0.000	0.000	28779.348

Table 4: PCBs in trout (lipid corrected)

Rainbow Trout	212	17610.220	3882.359	2674.653	8613.271	8939.140	22817.452	0.000	0.000	5831.150
Brook Trout	244	7872.528	4597.812	4425.947	1671.571	21092.921	31918.694	0.000	0.000	5233.639
Brook Trout	338	15093.344	3003.050	3301.295	3707.021	8961.860	17140.455	0.000	0.000	5410.502
Brook Trout	209	3285.497	2898.406	3793.927	1740.337	14152.354	25949.640	0.000	0.000	5267.930
Rainbow Trout	161	4029.425	1430.479	1454.925	0.000	3795.939	7374.661	0.000	0.000	2288.686
Brook Trout	230	4904.835	202.026	0.000	3369.346	1936.228	3622.474	0.000	0.000	395.190
Brook Trout	335	0.000	4282.453	3840.030	2542.326	9452.296	22800.286	0.000	0.000	9127.075
Rainbow Trout	211	8721.213	3923.279	4065.638	1842.645	14290.998	28560.953	0.000	0.000	4572.973
Brook Trout	320	0.000	8542.439	12119.904	7437.127	17697.474	83735.317	0.000	0.000	35383.727
Brook Trout	255	54773.010	46673.190	58642.504	39569.700	198519.469	430408.423	0.000	0.000	46220.686
Moraine										
Brook Trout	258	0.000	1115.496	1361.199	495.380	2235.835	1962.677	801.443	0.000	1152.443
Brook Trout	224	7556.085	2390.272	2519.219	986.779	7018.503	12394.727	2021.791	0.000	1929.376
Brook Trout	262	13083.020	1363.188	2123.355	562.339	4193.952	2864.701	4704.277	0.000	2503.904
Brook Trout	243	9651.667	1474.682	1845.448	0.000	3008.947	3308.928	4515.566	0.000	1833.351
Brook Trout	278	0.000	4138.379	4768.726	2099.790	8202.681	6405.087	5094.484	0.000	3510.670
Brook Trout	243	5783.327	747.561	918.738	198.695	2111.273	1542.743	462.509	0.000	1091.291
Brook Trout	290	5947.886	764.550	1034.522	301.751	2123.255	1550.149	1172.752	0.000	1340.662
Brook Trout	183	0.000	4317.407	9745.372	384.586	6831.554	5928.254	32519.968	0.000	2865.811
Bighorn										
Brook Trout	280	7172.452	1569.190	2925.811	615.297	4136.984	4067.707	0.000	0.000	1088.289
Brook Trout	264	8067.294	3904.954	4616.874	2176.535	13409.622	22131.809	4362.799	0.000	2907.983
Brook Trout	305	19367.540	8929.015	6629.324	5052.833	20047.016	26895.726	0.000	0.000	7281.284
Brook Trout	282	4974.636	1511.412	1544.082	861.755	3773.774	4627.559	0.000	0.000	1476.875
Brook Trout	262	34800.767	13501.212	12633.171	9029.617	26343.982	27009.335	0.000	0.000	7382.391
Brook Trout	238	0.000	1365.740	490.340	614.553	4674.342	5114.363	0.000	0.000	1179.085
Brook Trout	298	12549.105	2670.004	3263.649	2705.552	6813.001	13275.149	11335.549	0.000	3508.628
Brook Trout	270	12379.245	3097.413	781.518	1219.400	8711.460	6614.510	0.000	0.000	2050.399
Brook Trout	270	17910.290	6174.075	5491.838	3599.834	12557.371	11013.420	0.000	0.000	4050.344
Brook Trout	224	0.000	1134.352	721.203	414.835	3852.300	5303.628	219.007	0.000	897.930
Brook Trout	320	26862.450	9589.207	19537.265	0.000	25874.790	23459.320	0.000	0.000	11678.646

Table 4: PCBs in trout (lipid corrected)

Species	Length	153-132-105	141-179	137	176-130	138-163	158	129	178	175
Shere										
Brook Trout	309	4625.304	170.535	0.000	0.000	2473.507	64.666	0.000	171.243	0.000
Brook Trout	363	5268.567	145.211	0.000	0.000	2413.138	2.401	0.000	141.925	0.000
Brook Trout	376	4734.839	76.515	0.000	0.000	4127.290	0.000	0.000	33.308	0.000
Brook Trout	324	6369.583	451.984	27.069	3.330	3794.730	160.602	0.000	47.738	0.000
Brook Trout	312	4966.775	184.273	0.000	0.000	2765.875	0.000	0.000	91.928	0.000
Brook Trout	265	2774.231	48.303	0.000	0.000	1680.322	0.000	0.000	0.000	0.000
Brook Trout	355	5742.336	87.463	13.359	0.000	2625.578	133.914	0.000	0.000	0.000
Brook Trout	297	6421.282	557.259	99.096	33.236	3906.257	238.387	131.996	73.530	0.000
Brook Trout	425	3539.768	187.697	0.000	0.000	1833.986	10.651	0.000	80.590	0.000
Brook Trout	297	6684.694	557.227	22.685	0.000	3713.582	226.057	0.000	0.000	0.000
Brook Trout	321	2131.722	276.145	71.993	80.874	1040.189	96.808	75.970	119.773	8.279
Brook Trout		4061.377	5.400	189.064	0.000	1956.758	16.055	0.000	76.984	0.000
Pyramid										
Lake Trout	516	23865.899	1084.505	1017.448	795.243	19262.734	1342.731	0.000	1329.675	0.000
Lake Trout	532	1594.496	120.226	167.940	73.747	1101.433	0.000	0.000	19.815	0.000
Lake Trout	424	16838.551	1542.148	754.092	628.755	12841.792	441.739	0.000	438.493	0.000
Lake Trout	468	6999.316	585.407	346.868	286.211	5536.921	250.889	0.000	145.552	0.000
Lake Trout	492	28219.160	3901.994	1320.813	1030.150	21783.711	1332.970	342.769	1726.616	0.000
Lake Trout	519	49536.583	4636.074	2364.582	1903.309	39428.861	2896.120	376.401	2734.408	0.000
Lake Trout	396	24202.720	538.336	1232.396	1025.575	19762.497	27.103	0.000	0.000	0.000
Lake Trout	513	24584.466	1782.610	1063.181	829.049	19675.568	1264.422	0.000	1525.894	0.000
Lake Trout	521	18772.153	607.550	839.837	675.216	15041.765	920.393	0.000	1099.157	0.000
Lake Trout	532	37734.357	1239.219	674.657	509.470	22507.411	848.621	0.000	1191.284	0.000
Lake Trout	482	101943.453	1115.696	483.922	360.334	61647.298	632.860	0.000	600.155	103.372
Patricia										
Rainbow Trout	433	11171.362	1878.860	464.987	387.726	8976.479	687.047	481.071	827.193	335.406
Lake Trout	589	39687.724	6581.168	1783.800	1042.253	28662.292	2283.680	0.000	5211.204	0.000
Brook Trout	273	15605.170	2790.976	496.938	575.542	14081.962	0.000	468.119	1498.028	319.340
Lake Trout	468	32082.265	6822.361	1485.936	929.194	22540.920	1869.624	828.260	4130.777	0.000
Lake Trout	524	24744.543	4472.370	1176.798	721.773	17125.964	1350.944	0.000	3448.137	0.000
Rainbow Trout	346	10542.108	1923.771	553.921	392.006	7756.792	701.997	321.319	1004.425	621.405
Lake Trout		52049.306	9322.699	2144.415	1175.957	37806.274	2876.466	704.418	5393.243	0.000
Lake Trout	273	22721.260	5804.887	1109.029	724.068	15740.879	1299.882	0.000	3101.713	0.000
Rainbow Trout		6579.199	1157.476	345.734	244.673	4841.467	439.416	0.000	830.675	387.854
Lake Trout		34844.772	7523.086	1793.855	1224.578	24562.945	2145.755	0.000	4458.271	0.000

Table 4: PCBs in trout (lipid corrected)

Lake Trout	521	19341.768	3724.255	731.382	485.490	13692.030	999.380	358.341	2031.638	0.000
Moab										
Bull Trout	305	3685.689	78.863	1273.321	341.525	2250.844	0.000	0.000	102.976	0.000
Rainbow Trout	228	17559.517	1323.998	1849.454	812.149	12129.617	0.000	0.000	218.219	0.000
Rainbow Trout	287	18515.608	2082.834	1301.838	572.670	10743.567	917.353	0.000	687.431	0.000
Bull Trout	422	9307.300	1487.958	3212.542	903.435	10168.387	0.000	0.000	1919.068	0.000
Rainbow Trout	210	0.000	0.000	679.793	0.000	0.000	0.000	0.000	0.000	0.000
Rainbow Trout	334	4861.264	392.064	780.838	352.964	2803.476	0.000	0.000	25.984	0.000
Rainbow Trout	206	0.000	0.000	1548.338	476.806	1019.913	0.000	0.000	0.000	0.000
Lake Trout	373	5497.329	632.790	1485.808	0.000	12771.532	0.000	0.000	993.661	0.000
Rainbow Trout	330	0.000	0.000	483.066	133.100	0.000	0.000	0.000	0.000	0.000
Rainbow Trout	331	0.000	0.000	404.426	0.000	0.000	0.000	0.000	0.000	308.114
Rainbow Trout	343	0.000	0.000	1185.891	0.000	3986.793	0.000	0.000	0.000	0.000
Rainbow Trout	287	0.000	0.000	666.502	0.000	0.000	0.000	0.000	0.000	0.000
Rainbow Trout	337	0.000	0.000	305.848	0.000	0.000	0.000	0.000	0.000	0.000
Lake Trout	421	25086.625	66.271	1110.739	256.372	5709.869	0.000	0.000	265.007	0.000
Lake Trout	360	10297.037	47.909	733.534	183.596	5580.635	0.000	0.000	100.438	328.511
Lake Trout	321	9679.389	0.000	250.675	95.793	3818.995	0.000	0.000	0.000	0.000
Lake Trout	398	11498.073	0.000	383.798	71.645	4305.375	0.000	0.000	0.000	0.000
Lake Trout	493	3667.658	0.000	427.401	62.523	2159.838	0.000	0.000	0.000	67.598
Bull Trout	397	1410.104	0.000	189.161	72.267	657.046	0.000	0.000	0.000	0.000
Johnson										
Rainbow Trout	167	14212.865	3181.155	987.208	628.468	13919.261	1598.797	1368.852	436.125	0.000
Brook Trout	166	0.000	1617.100	633.666	503.957	7016.102	0.000	0.000	0.000	0.000
Rainbow Trout	291	8834.392	2457.651	714.155	470.442	10734.347	1276.425	930.453	478.009	0.000
Brook Trout	264	890.089	3304.412	945.814	651.134	13419.239	1712.844	1361.572	576.137	0.000
Brook Trout	180	17652.127	6804.520	2353.535	1548.296	27096.441	3731.865	3224.771	1282.593	805.906
Brook Trout	262	0.000	728.807	0.000	0.000	1618.993	0.000	0.000	0.000	0.000
Rainbow Trout	292	8835.868	2859.190	753.450	499.220	11721.213	1281.396	1029.788	487.001	0.000
Brook Trout	231	0.000	838.839	237.864	177.676	3411.575	413.027	215.360	446.499	0.000
Brook Trout	183	0.000	1767.556	493.252	389.321	3710.187	872.767	672.172	430.901	0.000
Brook Trout	237	0.000	933.295	229.647	164.845	3043.146	0.000	299.965	467.201	0.000
Brook Trout	292	24427.947	5798.126	1645.651	1138.865	24818.386	2982.496	2446.191	903.359	0.000
Brook Trout	283	3148.069	5860.133	1721.615	0.000	21155.611	2641.505	2800.978	781.869	0.000
Emerald										
Brook Trout	304	19978.187	2392.161	1034.982	613.909	13406.297	1169.505	0.000	1776.780	0.000
Brook Trout	294	262835.913	37097.181	13409.377	8139.796	179096.790	19867.102	19092.762	11078.198	0.000

Table 4: PCBs in trout (lipid corrected)

Rainbow Trout	212	52864.711	12525.655	3437.517	5337.845	31399.893	3640.149	15244.038	2743.866	0.000
Brook Trout	244	47958.099	6942.862	2274.927	1697.027	32702.313	3810.660	3835.410	1215.500	0.000
Brook Trout	338	38686.978	4763.617	2576.238	1505.537	27764.999	3129.412	2369.475	4236.032	1771.728
Brook Trout	209	34320.071	4666.122	1723.160	1091.378	22881.539	2987.161	2062.777	1130.924	0.000
Rainbow Trout	161	14548.760	993.295	764.629	581.105	9179.388	908.941	0.000	995.967	0.000
Brook Trout	230	6710.893	409.713	720.602	0.000	6969.227	0.000	0.000	0.000	0.000
Brook Trout	335	57661.451	4522.131	3211.139	1638.337	41334.333	4652.138	1121.511	5166.438	0.000
Rainbow Trout	211	42080.537	5419.842	1894.255	1335.532	28271.901	3132.482	2549.788	1752.350	0.000
Brook Trout	320	185983.323	6770.681	7653.002	3363.069	118175.935	8877.055	0.000	12785.809	4099.159
Brook Trout	255	494281.750	73818.575	24275.704	15850.769	345329.844	40313.860	39296.402	14747.526	0.000
Moraine										
Brook Trout	258	7277.491	1242.880	465.142	191.805	4579.091	410.105	276.523	797.067	0.000
Brook Trout	224	18232.855	2832.460	1062.882	485.370	12402.715	1287.929	1168.988	1195.145	0.000
Brook Trout	262	12443.580	1909.021	767.881	304.386	7363.642	662.986	483.219	1954.668	0.000
Brook Trout	243	8395.682	1637.830	819.382	309.683	5359.982	691.502	357.745	1119.709	0.000
Brook Trout	278	19057.615	3268.194	1120.552	563.739	13085.945	1223.720	718.292	2294.693	281.080
Brook Trout	243	6040.097	1055.482	991.659	121.105	4021.019	340.940	268.403	794.060	283.731
Brook Trout	290	6052.927	1248.140	541.527	236.737	4035.972	431.757	285.753	865.190	311.927
Brook Trout	183	38516.884	3142.806	1290.855	1095.860	10608.550	1676.434	1253.561	1838.662	1370.373
Bighorn										
Brook Trout	280	9854.927	2136.241	456.870	331.462	6189.369	638.582	346.822	625.230	0.000
Brook Trout	264	32037.798	4292.167	1632.706	1042.933	18754.882	2323.405	2102.492	1135.509	0.000
Brook Trout	305	47308.284	7434.312	2081.166	1405.760	29243.055	2912.044	1708.468	3992.274	1520.088
Brook Trout	282	8452.921	1519.058	418.987	309.649	5228.841	750.045	332.465	598.778	0.000
Brook Trout	262	48158.214	7536.563	2148.242	1241.910	30364.962	2738.860	1561.150	3558.269	0.000
Brook Trout	238	10872.333	1605.257	407.066	263.130	6266.418	600.810	122.659	762.859	387.170
Brook Trout	298	23036.161	2463.051	1185.424	735.255	13153.316	1415.256	860.788	1450.006	629.553
Brook Trout	270	18667.734	3735.542	817.632	528.999	13245.410	1197.518	1006.545	2088.541	0.000
Brook Trout	270	22561.287	3997.383	965.945	637.827	15119.307	1342.658	655.603	1816.364	0.000
Brook Trout	224	11225.768	1545.224	350.812	443.093	5571.921	522.821	361.108	468.633	0.000
Brook Trout	320	98112.787	13685.838	5967.902	4324.233	74456.143	9415.994	4471.416	9959.024	0.000

Table 4: PCBs in trout (lipid corrected)

Species	Length	187-182	183	128	167	185	174	177	202-171-15€	173	157-200
Shere											
Brook Trout	309	1137.152	473.357	393.284	0.000	0.000	187.026	188.704	252.796	0.000	5.705
Brook Trout	363	1321.023	477.949	406.755	0.000	0.000	198.872	210.556	59.945	0.000	0.000
Brook Trout	376	783.003	587.461	189.294	0.000	0.000	185.944	339.646	85.333	0.000	0.000
Brook Trout	324	1160.823	606.281	722.557	0.000	0.000	337.305	201.904	236.618	0.000	0.000
Brook Trout	312	1085.235	328.980	378.816	171.906	0.000	166.302	171.457	150.646	0.000	33.683
Brook Trout	265	533.887	285.065	316.389	0.000	0.000	60.281	85.714	0.000	0.000	0.000
Brook Trout	355	882.453	537.301	402.677	0.000	0.000	108.113	159.737	0.000	0.000	0.000
Brook Trout	297	885.718	103.706	289.533	0.000	0.000	306.239	145.726	380.053	0.000	0.000
Brook Trout	425	886.816	253.439	94.189	0.000	0.000	163.389	171.990	76.811	0.000	0.000
Brook Trout	297	873.337	138.130	652.091	0.000	0.000	227.646	148.755	179.863	0.000	0.000
Brook Trout	321	532.749	316.353	329.990	203.288	33.800	133.536	142.155	281.014	49.340	77.012
Brook Trout		937.836	279.653	192.019	0.000	0.000	172.167	194.825	56.562	0.000	0.000
Pyramid											
Lake Trout	516	7628.911	5775.434	1877.996	1177.730	0.000	783.215	1396.727	2174.532	0.000	165.499
Lake Trout	532	127.205	404.397	174.249	283.208	31.972	46.141	0.000	0.000	0.000	3.082
Lake Trout	424	5315.145	1242.823	0.000	579.293	0.000	515.691	774.771	437.242	0.000	0.000
Lake Trout	468	2082.028	1380.857	0.000	175.685	0.000	153.508	301.246	325.390	0.000	0.000
Lake Trout	492	8388.539	6333.878	2804.197	1593.242	230.381	1967.206	2409.731	3305.847	0.000	394.568
Lake Trout	519	15692.461	8595.121	5594.611	4546.337	849.100	2525.894	3359.654	5622.153	0.000	950.261
Lake Trout	396	8598.201	1321.208	0.000	647.391	0.000	362.397	989.137	0.000	0.000	0.000
Lake Trout	513	7654.772	5425.136	2583.144	1329.033	0.000	777.999	1422.501	2203.285	0.000	62.443
Lake Trout	521	6562.482	5266.563	1318.246	1235.934	0.000	520.347	987.464	1347.415	0.000	0.000
Lake Trout	532	6065.625	5071.083	2317.883	1223.811	0.000	658.507	945.971	1859.017	0.000	87.515
Lake Trout	482	11665.203	7663.823	1504.921	662.431	39.586	446.250	768.962	2146.467	0.000	103.061
Patricia											
Rainbow Trout	433	2734.401	1681.543	1282.689	679.889	200.469	857.251	809.686	2123.277	0.000	0.000
Lake Trout	589	18251.203	17391.205	3828.942	3026.700	918.465	4099.808	4273.824	5206.414	0.000	1388.315
Brook Trout	273	4826.290	2578.717	1579.686	1019.961	384.642	1217.507	1210.167	2401.591	0.000	0.000
Lake Trout	468	15955.428	14685.618	3112.698	2661.580	1082.885	4274.439	4443.186	5535.900	0.000	2026.440
Lake Trout	524	10767.362	14370.918	2319.401	1890.351	598.545	2751.611	2895.068	3614.586	0.000	1160.286
Rainbow Trout	346	3696.036	2795.177	1354.607	826.429	385.653	798.832	880.552	1820.591	0.000	220.499
Lake Trout		22636.237	20179.704	4701.766	3886.666	1000.223	5186.611	5705.918	7083.440	0.000	1680.067
Lake Trout	273	10482.334	10150.737	2483.453	2417.709	802.982	2520.094	0.000	4029.229	0.000	1252.093
Rainbow Trout		2306.905	1745.192	845.388	515.826	242.526	498.481	561.675	1123.817	0.000	0.000
Lake Trout		14554.882	19907.398	3219.979	2883.638	981.315	3407.690	4282.265	5360.182	0.000	1830.011

Table 4: PCBs in trout (lipid corrected)

Lake Trout	521	8918.750	8725.472	1682.327	1349.174	483.044	2093.110	2218.412	2533.928	0.000	805.416
Moab											
Bull Trout	305	2719.873	7809.113	0.000	1518.536	0.000	221.252	731.570	0.000	0.000	0.000
Rainbow Trout	228	1400.860	4453.449	1918.931	3118.852	352.092	508.127	0.000	0.000	0.000	33.938
Rainbow Trout	287	3590.003	8483.819	4053.557	3010.306	0.000	1213.975	891.882	1111.355	0.000	4807.639
Bull Trout	422	5208.904	16864.780	0.000	2029.673	0.000	37.334	1616.408	0.000	0.000	0.000
Rainbow Trout	210	0.000	707.183	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rainbow Trout	334	1838.962	4592.220	330.023	971.973	0.000	0.000	414.334	0.000	0.000	0.000
Rainbow Trout	206	0.000	2199.810	0.000	0.000	0.000	72.061	0.000	0.000	0.000	0.000
Lake Trout	373	2581.505	9699.201	374.208	2141.922	0.000	0.000	894.979	0.000	0.000	0.000
Rainbow Trout	330	0.000	393.042	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rainbow Trout	331	0.000	0.000	0.000	0.000	0.000	333.414	0.000	0.000	0.000	0.000
Rainbow Trout	343	0.000	5592.021	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rainbow Trout	287	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rainbow Trout	337	0.000	0.000	0.000	212.399	0.000	53.370	93.128	0.000	0.000	0.000
Lake Trout	421	4510.512	12355.673	0.000	970.017	0.000	0.000	0.000	0.000	0.000	0.000
Lake Trout	360	1647.880	11609.115	0.000	392.876	0.000	71.796	116.928	0.000	0.000	0.000
Lake Trout	321	0.000	206.169	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lake Trout	398	1049.987	11116.441	0.000	571.840	0.000	0.000	0.000	0.000	0.000	0.000
Lake Trout	493	498.560	7446.030	0.000	272.103	0.000	0.000	0.000	0.000	0.000	0.000
Bull Trout	397	5.173	816.522	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Johnson											
Rainbow Trout	167	2620.534	1559.605	3451.916	1218.590	271.953	1464.225	857.035	3453.560	0.000	397.404
Brook Trout	166	2390.844	2822.257	3774.344	634.929	0.000	1620.843	873.002	2247.901	0.000	0.000
Rainbow Trout	291	2020.189	1254.507	2776.024	522.275	218.418	1141.155	706.034	2702.169	0.000	292.675
Brook Trout	264	2720.633	2378.224	4655.775	187.148	0.000	1467.061	1017.290	3714.489	0.000	841.114
Brook Trout	180	5023.235	3276.231	7831.516	3256.118	1168.392	3202.851	1935.646	8123.029	463.882	1531.407
Brook Trout	262	756.312	942.901	1592.851	0.000	0.000	304.972	292.183	844.767	0.000	0.000
Rainbow Trout	292	2711.849	1768.618	2875.979	276.723	76.886	1322.461	848.855	3308.111	0.000	425.900
Brook Trout	231	1667.950	0.000	1234.722	0.000	109.783	622.762	337.945	1145.612	0.000	0.000
Brook Trout	183	2162.167	454.027	518.296	0.000	203.929	893.166	803.281	2632.732	0.000	728.217
Brook Trout	237	1609.151	1557.727	2013.694	0.000	123.087	554.005	420.627	1402.101	0.000	0.000
Brook Trout	292	4482.729	2469.907	6364.137	2412.990	637.573	2999.186	1974.204	6391.757	0.000	908.209
Brook Trout	283	4021.366	2561.269	5524.443	314.984	1866.816	2493.889	1572.120	6009.976	0.000	599.066
Emerald											
Brook Trout	304	11579.280	8349.287	4062.290	7928.679	0.000	1057.759	1239.632	1696.545	0.000	1040.225
Brook Trout	294	62559.437	44359.191	39099.019	30715.806	3859.076	19368.683	10265.693	35765.582	0.000	7943.554

Table 4: PCBs in trout (lipid corrected)

Rainbow Trout	212	13978.632	8568.994	13498.114	16060.151	1412.343	5509.252	4756.471	20413.397	4367.494	10854.565
Brook Trout	244	5854.945	3626.953	8334.963	2728.981	1374.615	3330.245	1908.943	6380.679	0.000	1463.387
Brook Trout	338	14726.115	9778.909	4424.261	4243.081	757.918	2316.845	2446.804	6400.935	0.000	1817.559
Brook Trout	209	4585.830	2510.595	4832.523	1525.040	477.898	2144.541	1278.918	4543.738	0.000	1033.811
Rainbow Trout	161	3286.739	1088.875	704.900	1211.150	0.000	1338.458	553.289	950.652	0.000	629.787
Brook Trout	230	2349.420	2575.772	1430.779	4264.573	0.000	276.569	234.983	753.628	0.000	808.538
Brook Trout	335	19325.413	21796.318	6310.806	11356.836	793.591	2517.083	3898.849	6973.791	0.000	1412.716
Rainbow Trout	211	7446.342	4341.926	6827.035	5622.375	860.998	2520.528	1915.516	5835.736	0.000	708.031
Brook Trout	320	64021.515	47819.690	15008.850	25142.726	0.000	6360.908	10960.588	22797.425	0.000	4085.468
Brook Trout	255	44543.648	31900.235	79133.792	29793.976	3703.769	33994.711	21253.647	73935.999	0.000	13527.397
Moraine											
Brook Trout	258	2684.662	8185.777	0.000	1397.479	130.251	836.640	693.620	773.494	0.000	377.904
Brook Trout	224	3220.149	7181.212	3375.161	2747.324	800.064	1685.770	1372.222	2247.386	0.000	794.883
Brook Trout	262	5700.243	12881.237	1407.503	2424.169	323.435	1797.077	1647.002	1519.906	0.000	731.204
Brook Trout	243	3766.567	10087.161	0.000	1378.620	171.234	1225.561	1025.845	1088.607	0.000	334.002
Brook Trout	278	9174.373	21407.532	2222.983	2647.414	468.526	3069.582	2498.338	2405.656	0.000	1139.636
Brook Trout	243	2483.288	5491.780	1248.532	1090.525	105.138	736.407	579.623	595.264	0.000	163.415
Brook Trout	290	2733.612	5008.492	732.213	1159.269	127.934	795.619	852.734	610.550	0.000	193.026
Brook Trout	183	6355.029	8897.517	2247.450	3483.002	511.073	2334.860	1501.180	3026.692	2232.150	2422.466
Bighorn											
Brook Trout	280	3253.035	3446.409	895.999	0.000	247.759	1154.861	641.844	1098.821	0.000	257.483
Brook Trout	264	6496.709	1722.696	1835.068	0.000	538.154	4006.379	2022.055	3139.588	0.000	815.854
Brook Trout	305	18266.288	7559.593	2880.802	6646.389	2178.648	6547.692	4650.823	5698.735	0.000	979.492
Brook Trout	282	2503.023	797.020	0.000	0.000	273.135	992.415	889.456	884.399	0.000	324.293
Brook Trout	262	22274.607	15574.527	5488.399	0.000	2612.082	6573.542	3270.933	5377.166	0.000	1206.749
Brook Trout	238	3715.069	2375.401	0.000	0.000	397.893	2199.813	1229.055	1404.392	0.000	101.113
Brook Trout	298	4972.222	5540.819	3856.978	0.000	296.058	3668.835	2156.955	3024.328	0.000	903.069
Brook Trout	270	8487.503	6594.621	2665.000	0.000	1024.956	2255.501	1483.305	2364.393	0.000	283.467
Brook Trout	270	11792.500	6662.709	1418.714	0.000	858.012	3901.852	2297.672	2991.791	0.000	531.180
Brook Trout	224	2576.786	4622.851	945.215	0.000	160.623	2544.112	900.877	1119.306	0.000	183.494
Brook Trout	320	46611.590	6510.384	0.000	9613.598	2839.975	15185.544	12080.106	16987.054	0.000	4912.796

Table 4: PCBs in trout (lipid corrected)

Species	Length	172	197	180	193	191	199	170-190	198	201	203-196
Shere											
Brook Trout	309	8.555	87.199	1540.944	17.005	0.000	64.143	1180.122	133.618	383.971	432.575
Brook Trout	363	0.000	0.000	1691.793	0.000	0.000	0.000	353.222	0.000	285.267	206.609
Brook Trout	376	0.000	0.000	1644.086	0.000	1424.709	1359.840	11118.272	0.000	0.000	1964.498
Brook Trout	324	20.815	0.000	1459.121	0.000	0.000	42.656	2380.424	21.914	228.282	281.459
Brook Trout	312	0.000	0.000	1455.833	0.000	0.000	20.664	2138.834	0.000	150.143	139.048
Brook Trout	265	0.000	0.000	972.269	0.000	0.000	0.000	569.941	0.000	83.744	0.000
Brook Trout	355	0.000	0.000	1451.147	0.000	0.000	970.808	11449.556	0.000	0.000	443.127
Brook Trout	297	0.000	0.000	1361.550	0.000	0.000	0.000	695.229	0.000	123.094	0.000
Brook Trout	425	0.000	0.000	1704.628	0.000	0.000	21.362	700.452	0.000	207.391	126.748
Brook Trout	297	0.000	0.000	1520.943	0.000	0.000	0.000	686.794	0.000	145.416	22.003
Brook Trout	321	75.273	40.542	614.289	107.372	277.402	316.206	2508.483	403.756	285.441	393.577
Brook Trout		62.163	0.000	1206.383	76.776	51.243	51.073	344.476	36.172	322.407	388.214
Pyramid											
Lake Trout	516	384.769	0.000	18367.939	141.897	0.000	714.788	1828.835	0.000	877.378	704.113
Lake Trout	532	0.000	0.000	401.855	0.000	0.000	0.000	536.730	0.000	31.982	0.000
Lake Trout	424	15.406	0.000	20817.870	0.000	289.194	894.822	433.606	0.000	799.902	641.736
Lake Trout	468	0.000	0.000	8310.650	0.000	77.550	566.470	5308.319	534.682	426.841	832.491
Lake Trout	492	800.472	0.000	30022.992	0.000	0.000	947.524	3492.863	12.423	1900.585	1687.321
Lake Trout	519	1420.496	345.843	31762.209	1049.235	695.316	2133.974	6735.134	825.144	2779.755	3015.952
Lake Trout	396	0.000	0.000	30423.025	0.000	0.000	410.567	498.880	0.000	745.565	245.954
Lake Trout	513	428.867	60.711	20332.957	374.777	0.000	868.084	2185.600	199.893	1210.653	1453.570
Lake Trout	521	252.591	0.000	16635.509	68.129	0.000	749.834	1215.914	0.000	618.373	453.710
Lake Trout	532	132.771	0.000	13640.490	106.142	0.000	645.708	2961.053	0.000	496.596	539.146
Lake Trout	482	214.159	55.470	58700.996	204.911	115.114	386.296	2282.060	42.324	481.288	532.706
Patricia											
Rainbow Trout	433	577.254	94.393	5289.499	259.348	289.000	333.701	1764.829	87.009	1218.716	1030.516
Lake Trout	589	1943.783	349.788	23663.420	1788.110	0.000	3144.546	8398.129	414.065	4647.831	5022.485
Brook Trout	273	929.932	121.313	8983.513	527.524	389.775	555.729	2961.497	127.288	1508.312	1953.024
Lake Trout	468	2074.661	676.660	20105.150	1478.032	0.000	5467.450	7466.438	767.691	4862.345	5074.375
Lake Trout	524	1304.108	183.526	15948.121	0.000	0.000	3210.682	5001.784	261.073	2886.442	2956.814
Rainbow Trout	346	802.168	0.000	6811.043	532.938	317.239	472.476	2096.588	225.834	1019.975	1414.274
Lake Trout		2688.954	488.456	31610.302	2026.196	0.000	4540.198	11683.092	566.482	6076.952	6448.524
Lake Trout	273	1515.330	330.790	14430.488	896.423	0.000	3242.981	4870.562	333.046	3083.333	3098.440
Rainbow Trout		498.923	0.000	4331.734	326.036	299.298	294.899	1312.038	143.092	636.794	890.132
Lake Trout		1712.104	0.000	22835.535	0.000	0.000	3993.512	6434.025	0.000	4241.978	4999.155

Table 4: PCBs in trout (lipid corrected)

Lake Trout	521	991.554	0.000	11899.427	870.163	0.000	2124.967	4079.982	177.886	2362.325	2587.213
Moab											
Bull Trout	305	0.000	27.626	2280.923	1693.500	0.000	16.392	1070.232	0.000	235.947	0.000
Rainbow Trout	228	0.000	0.000	4425.460	0.000	0.000	0.000	5910.783	0.000	352.203	0.000
Rainbow Trout	287	260.124	492.049	4831.290	1056.751	0.000	0.000	4196.126	436.714	1229.054	1739.684
Bull Trout	422	0.000	130.086	4361.601	0.000	0.000	0.000	1241.703	0.000	424.234	0.000
Rainbow Trout	210	0.000	0.000	0.000	0.000	0.000	0.000	1489.237	0.000	29.002	0.000
Rainbow Trout	334	0.000	0.000	2092.381	0.000	0.000	0.000	1083.661	0.000	243.093	90.825
Rainbow Trout	206	0.000	0.000	1228.956	0.000	0.000	0.000	1154.643	0.000	0.000	0.000
Lake Trout	373	0.000	0.000	2070.196	0.000	0.000	0.000	10832.646	0.000	276.694	93.909
Rainbow Trout	330	0.000	0.000	566.746	0.000	0.000	0.000	258.002	0.000	0.000	0.000
Rainbow Trout	331	0.000	94.217	292.338	0.000	0.000	0.000	1097.531	0.000	932.125	519.093
Rainbow Trout	343	0.000	0.000	1399.385	0.000	0.000	0.000	3719.992	0.000	96.302	0.000
Rainbow Trout	287	0.000	0.000	1394.486	0.000	0.000	0.000	2940.844	0.000	0.000	0.000
Rainbow Trout	337	0.000	0.000	1067.530	0.000	0.000	0.000	244.460	0.000	155.679	0.000
Lake Trout	421	0.000	0.000	2763.211	586.504	0.000	0.000	1662.275	0.000	0.000	0.000
Lake Trout	360	0.000	0.000	1598.525	505.189	0.000	0.000	1843.764	0.000	0.000	0.000
Lake Trout	321	0.000	0.000	1171.586	0.000	0.000	0.000	2718.022	0.000	0.000	0.000
Lake Trout	398	0.000	0.000	1154.919	412.926	0.000	0.000	1999.550	0.000	0.000	0.000
Lake Trout	493	0.000	0.000	971.332	68.726	0.000	0.000	0.000	0.000	0.000	0.000
Bull Trout	397	0.000	0.000	503.519	0.000	0.000	0.000	45.834	0.000	0.000	0.000
Johnson											
Rainbow Trout	167	395.100	0.000	9343.871	0.000	0.000	0.000	0.000	0.000	670.614	767.878
Brook Trout	166	566.017	0.000	18365.089	0.000	0.000	0.000	0.000	0.000	1731.976	1548.658
Rainbow Trout	291	322.740	0.000	8569.153	0.000	0.000	0.000	0.000	0.000	607.712	660.150
Brook Trout	264	397.768	0.000	11412.621	0.000	0.000	0.000	0.000	0.000	781.926	885.651
Brook Trout	180	1122.182	544.451	13457.396	1295.215	0.000	0.000	0.000	528.990	1735.586	2670.711
Brook Trout	262	0.000	0.000	4374.168	0.000	0.000	0.000	0.000	0.000	281.251	321.653
Rainbow Trout	292	370.076	0.000	13801.324	0.000	0.000	0.000	0.000	0.000	794.711	830.022
Brook Trout	231	229.763	0.000	8256.094	0.000	0.000	0.000	0.000	0.000	437.840	542.741
Brook Trout	183	658.029	282.206	14561.600	0.000	0.000	0.000	0.000	0.000	776.301	933.168
Brook Trout	237	206.409	0.000	9792.603	0.000	0.000	0.000	0.000	0.000	574.388	534.076
Brook Trout	292	855.769	0.000	19546.200	0.000	0.000	0.000	0.000	0.000	1313.965	1373.201
Brook Trout	283	1026.201	0.000	13427.373	0.000	0.000	0.000	0.000	715.047	1470.403	1822.661
Emerald											
Brook Trout	304	661.688	0.000	7211.802	0.000	0.000	407.348	3566.398	0.000	2320.352	2739.414
Brook Trout	294	7590.866	3864.281	62502.054	7187.569	5977.096	3930.432	26673.065	0.000	9368.423	10489.266

Table 4: PCBs in trout (lipid corrected)

Rainbow Trout	212	7972.050	0.000	21015.783	2866.502	4132.795	2222.896	19257.706	0.000	6150.945	6612.184
Brook Trout	244	905.350	0.000	8614.316	0.000	0.000	852.907	1264.924	0.000	1976.168	2470.746
Brook Trout	338	2087.774	1164.628	17193.282	1879.487	2034.470	1502.248	6274.159	1030.662	4494.755	6268.015
Brook Trout	209	743.007	0.000	7029.783	0.000	1064.735	1122.799	4219.160	0.000	1381.860	1938.733
Rainbow Trout	161	0.000	0.000	4490.253	0.000	0.000	0.000	5643.607	0.000	1146.856	1577.320
Brook Trout	230	0.000	0.000	3983.946	0.000	658.241	295.504	0.000	0.000	905.540	1176.482
Brook Trout	335	2460.255	698.293	27664.276	2944.489	2452.393	1595.664	5081.618	0.000	7046.928	8789.229
Rainbow Trout	211	1159.191	0.000	10664.258	682.544	953.000	634.476	3473.210	0.000	2876.304	3206.627
Brook Trout	320	6838.534	2785.080	83523.130	8729.890	7636.471	2733.416	42973.280	1141.493	16178.513	18378.064
Brook Trout	255	10448.378	0.000	86927.232	4127.563	3705.616	3016.385	44951.110	0.000	14847.198	17242.196
Moraine											
Brook Trout	258	320.281	0.000	3870.364	491.083	773.176	211.688	0.000	0.000	938.096	999.117
Brook Trout	224	555.515	0.000	6033.422	932.959	382.726	277.686	1079.173	0.000	832.295	1082.034
Brook Trout	262	599.019	0.000	7968.059	1086.092	1386.642	1292.172	8071.161	688.638	2117.323	2569.176
Brook Trout	243	425.973	213.221	4474.143	1211.495	660.518	408.980	0.000	0.000	995.942	1244.884
Brook Trout	278	1002.399	103.135	14518.664	1947.998	0.000	628.922	1082.202	0.000	2445.939	2497.854
Brook Trout	243	287.441	0.000	4408.810	539.234	596.744	242.364	0.000	0.000	690.103	774.209
Brook Trout	290	339.854	0.000	3579.636	569.744	384.116	188.666	0.000	0.000	823.873	835.420
Brook Trout	183	2357.356	0.000	20052.211	0.000	19589.774	25800.994	209699.263	0.000	0.000	23517.417
Bighorn											
Brook Trout	280	592.513	112.195	3377.336	278.943	0.000	383.074	2156.959	0.000	1017.518	903.172
Brook Trout	264	784.384	0.000	6108.536	387.584	0.000	674.466	3475.794	0.000	1797.032	1658.187
Brook Trout	305	1986.642	0.000	14991.175	759.373	0.000	1254.611	1693.318	0.000	5104.393	4690.757
Brook Trout	282	385.868	0.000	2265.812	102.440	0.000	297.346	2035.164	0.000	801.331	726.282
Brook Trout	262	1968.054	0.000	16017.069	1380.584	0.000	1079.099	0.000	0.000	5300.225	4674.762
Brook Trout	238	558.398	0.000	3445.316	507.912	221.241	352.458	0.000	0.000	989.561	961.561
Brook Trout	298	806.946	0.000	8535.053	1052.998	823.378	1066.133	12033.266	0.000	1261.209	1319.546
Brook Trout	270	819.842	0.000	7486.433	0.000	0.000	458.472	0.000	0.000	2370.212	1970.773
Brook Trout	270	1168.581	0.000	10224.304	832.628	1402.878	983.363	384.052	0.000	3188.720	2688.896
Brook Trout	224	279.112	0.000	2382.037	0.000	0.000	458.049	3163.054	0.000	643.821	664.156
Brook Trout	320	9410.633	0.000	60752.653	4620.787	7226.366	4535.898	20387.755	0.000	17295.609	17679.353

Table 4: PCBs in trout (lipid corrected)

Species	Length	189	208-195	207	194	205	206	209	total
Shere									
Brook Trout	309	0.000	252.103	400.365	61.255	0.000	132.016	179.845	46274.994
Brook Trout	363	0.000	0.000	0.000	94.540	0.000	0.000	0.000	31936.818
Brook Trout	376	0.000	0.000	1203.228	0.000	0.000	96.126	0.000	54840.325
Brook Trout	324	0.000	0.000	68.934	81.555	0.000	31.493	150.697	52332.795
Brook Trout	312	0.000	75.549	0.000	38.791	0.000	11.930	353.353	39110.104
Brook Trout	265	0.000	0.000	0.000	5.257	412.403	0.000	0.000	18872.534
Brook Trout	355	0.000	0.000	0.000	5.513	0.000	0.000	0.000	70404.598
Brook Trout	297	0.000	0.000	0.000	22.885	0.000	18.361	0.000	59128.704
Brook Trout	425	0.000	0.000	0.000	89.630	9.744	29.292	0.000	23541.165
Brook Trout	297	0.000	0.000	0.000	18.448	164.624	0.000	0.000	51697.585
Brook Trout	321	45.071	219.876	77.077	120.159	98.848	70.575	904.957	26652.727
Brook Trout		0.000	181.985	0.000	74.234	194.604	302.362	0.000	33402.217
Pyramid									
Lake Trout	516	0.000	401.108	0.000	482.334	1061.204	50.983	275.196	176255.198
Lake Trout	532	0.000	0.000	0.000	0.000	0.000	0.000	0.000	32350.060
Lake Trout	424	0.000	103.858	0.000	194.768	868.109	0.000	187.560	152773.380
Lake Trout	468	0.000	36.351	0.000	40.435	264.025	43.917	0.000	69584.687
Lake Trout	492	13.695	828.974	0.000	1183.617	1569.262	593.172	609.936	246173.845
Lake Trout	519	302.977	1735.288	321.413	1586.250	2201.900	570.325	1654.369	376827.615
Lake Trout	396	0.000	0.000	615.665	0.000	699.577	0.000	0.000	214668.035
Lake Trout	513	0.000	955.275	563.712	579.022	1244.187	878.871	1657.152	193468.401
Lake Trout	521	0.000	267.218	0.000	352.169	823.987	0.000	147.059	143998.217
Lake Trout	532	0.000	218.270	0.000	246.609	623.871	1.252	247.675	167856.787
Lake Trout	482	25.865	347.241	52.913	232.979	457.469	83.875	163.364	369315.187
Patricia									
Rainbow Trout	433	129.058	467.872	368.773	617.202	371.202	196.239	165.221	116369.813
Lake Trout	589	300.137	3400.899	0.000	3123.961	8962.293	965.367	3498.252	357782.717
Brook Trout	273	162.170	645.088	900.248	1106.028	785.510	321.976	239.272	167384.071
Lake Trout	468	290.716	5234.098	0.000	2880.113	14997.174	1206.254	6408.012	332520.557
Lake Trout	524	195.277	2593.845	0.000	1829.349	8148.884	544.296	2794.626	229953.319
Rainbow Trout	346	101.972	585.255	126.399	673.783	559.135	331.183	191.287	101851.986
Lake Trout		442.002	4462.954	0.000	4123.092	12623.517	1333.875	5080.691	459968.988
Lake Trout	273	205.359	2872.553	0.000	2085.962	7882.306	632.548	2829.014	247173.931
Rainbow Trout		64.304	377.752	81.078	427.155	354.213	215.069	120.500	71086.019
Lake Trout		311.353	3686.530	0.000	2539.568	12071.843	759.738	4078.276	357994.831

Table 4: PCBs in trout (lipid corrected)

Lake Trout	521	162.939	2022.013	0.000	1511.077	5234.531	461.824	1896.938	173378.950
Moab									
Bull Trout	305	0.000	0.000	0.000	0.000	0.000	0.000	0.000	97972.631
Rainbow Trout	228	0.000	0.000	0.000	0.000	0.000	0.000	0.000	356257.589
Rainbow Trout	287	0.000	521.163	658.216	426.617	0.000	396.535	470.520	271837.105
Bull Trout	422	0.000	0.000	0.000	0.000	0.000	0.000	0.000	223393.723
Rainbow Trout	210	0.000	0.000	0.000	0.000	0.000	0.000	0.000	57103.401
Rainbow Trout	334	0.000	0.000	0.000	35.799	0.000	0.000	0.000	102522.939
Rainbow Trout	206	0.000	0.000	0.000	0.000	0.000	33.056	0.000	95101.104
Lake Trout	373	0.000	0.000	1526.139	104.035	0.000	137.296	333.785	133039.773
Rainbow Trout	330	0.000	0.000	0.000	0.000	0.000	0.000	0.000	58352.856
Rainbow Trout	331	0.000	0.000	1414.501	0.000	0.000	391.705	0.000	42210.613
Rainbow Trout	343	0.000	0.000	0.000	0.000	0.000	0.000	0.000	102467.480
Rainbow Trout	287	0.000	0.000	116.027	0.000	0.000	0.000	0.000	99752.889
Rainbow Trout	337	0.000	0.000	0.000	0.000	0.000	0.000	0.000	47060.476
Lake Trout	421	0.000	0.000	0.000	0.000	0.000	0.000	0.000	106815.085
Lake Trout	360	0.000	0.000	0.000	0.000	0.000	0.000	0.000	110432.866
Lake Trout	321	0.000	0.000	0.000	0.000	0.000	0.000	0.000	96106.502
Lake Trout	398	0.000	0.000	0.000	0.000	0.000	0.000	0.000	100417.210
Lake Trout	493	0.000	0.000	0.000	0.000	0.000	0.000	0.000	58870.600
Bull Trout	397	0.000	0.000	0.000	0.000	0.000	0.000	0.000	22246.322
Johnson									
Rainbow Trout	167	0.000	311.391	0.000	441.469	796.274	174.876	185.031	233454.713
Brook Trout	166	0.000	0.000	0.000	0.000	2982.755	893.100	0.000	179842.076
Rainbow Trout	291	0.000	329.651	0.000	338.987	542.000	166.826	0.000	177475.988
Brook Trout	264	0.000	0.000	0.000	573.537	551.578	0.000	0.000	221241.069
Brook Trout	180	0.000	1561.075	831.628	1304.420	1182.338	925.703	910.631	470518.160
Brook Trout	262	0.000	0.000	0.000	0.000	407.954	178.269	0.000	44841.164
Rainbow Trout	292	0.000	0.000	0.000	509.879	642.562	238.670	0.000	204826.395
Brook Trout	231	0.000	0.000	219.563	327.944	883.448	260.040	0.000	70112.630
Brook Trout	183	0.000	0.000	716.741	879.997	777.339	391.328	0.000	116497.959
Brook Trout	237	0.000	0.000	0.000	397.261	1510.322	306.625	0.000	77803.552
Brook Trout	292	0.000	712.641	0.000	825.771	1111.423	340.234	729.177	395452.995
Brook Trout	283	0.000	0.000	0.000	0.000	0.000	777.718	0.000	478462.196
Emerald									
Brook Trout	304	0.000	1263.062	134.608	1516.182	439.080	1324.423	400.273	187553.825
Brook Trout	294	0.000	4657.997	0.000	5297.972	1525.294	2966.871	0.000	2957684.273

Table 4: PCBs in trout (lipid corrected)

Rainbow Trout	212	10026.965	6326.757	0.000	14405.072	6957.812	3992.341	0.000	636039.127
Brook Trout	244	0.000	646.972	0.000	1197.350	0.000	1065.376	0.000	447491.634
Brook Trout	338	814.696	2890.659	904.428	4074.652	1732.615	3092.308	1102.584	444984.955
Brook Trout	209	0.000	660.260	179.096	1340.785	564.973	764.103	0.000	372776.535
Rainbow Trout	161	0.000	0.000	0.000	975.673	0.000	634.844	0.000	126110.858
Brook Trout	230	0.000	0.000	107.256	666.494	0.000	442.732	0.000	91267.915
Brook Trout	335	0.000	2857.621	414.199	6071.275	1568.067	5169.332	0.000	527049.574
Rainbow Trout	211	0.000	458.625	2773.173	2003.351	479.756	1622.576	0.000	505213.729
Brook Trout	320	732.994	7612.261	453.517	14678.668	2718.771	6861.103	3780.396	1247102.143
Brook Trout	255	1525.273	6814.794	0.000	9098.389	0.000	6650.030	0.000	6118751.192
Moraine									
Brook Trout	258	0.000	0.000	33.612	815.947	257.566	335.218	0.000	84650.732
Brook Trout	224	0.000	356.191	80.028	838.973	233.240	260.984	0.000	220625.880
Brook Trout	262	0.000	636.384	83.033	1134.884	1319.938	493.306	1461.895	167432.723
Brook Trout	243	0.000	461.134	78.700	777.483	247.885	382.272	0.000	121379.452
Brook Trout	278	0.000	913.208	0.000	1915.692	1537.244	719.120	10.651	229307.985
Brook Trout	243	84.177	336.355	0.000	557.241	294.598	204.004	0.000	90700.799
Brook Trout	290	0.000	246.583	0.000	591.454	213.771	256.299	0.000	75817.249
Brook Trout	183	464.321	875.883	505.366	2058.752	1225.691	1544.475	0.000	517609.637
Bighorn									
Brook Trout	280	0.000	320.355	49.602	665.434	548.394	620.820	0.000	136406.163
Brook Trout	264	0.000	548.552	6.605	1528.230	787.868	1211.273	0.000	372638.283
Brook Trout	305	0.000	1391.121	501.503	3923.229	736.533	3526.486	0.000	603329.334
Brook Trout	282	0.000	214.163	17.942	682.191	316.793	564.220	0.000	104104.039
Brook Trout	262	0.000	1389.811	1618.406	3895.252	661.578	3694.490	0.000	699258.302
Brook Trout	238	0.000	333.701	1.322	922.605	0.000	701.964	0.000	144390.286
Brook Trout	298	0.000	463.466	0.000	1003.430	884.003	580.090	0.000	315780.358
Brook Trout	270	0.000	902.648	420.402	1872.987	610.613	1482.672	0.000	217508.086
Brook Trout	270	0.000	851.547	861.793	2390.804	517.513	1806.617	0.000	298606.221
Brook Trout	224	0.000	0.000	0.000	636.612	0.000	636.313	0.000	194219.564
Brook Trout	320	0.000	5408.882	1771.195	15278.512	5096.031	10209.515	0.000	1145779.985

Table 5: Organochlorine pesticides in trout (wet weight)

Species	Length	a-HCH	HCB	g-HCH	Heptachlor	Aldrin	Heptachlor Epoxide	g-Chlordane	-Endosulfa	a-Chlordane
Shere										
Brook Trout	309	71.199	183.921	93.889	0.000	2.787	0.000	18.934	27.251	32.402
Brook Trout	363	80.378	145.438	48.568	0.000	0.000	15.634	11.634	38.168	29.381
Brook Trout	376	76.342	172.754	56.493	0.000	0.000	13.782	14.130	23.199	38.203
Brook Trout	324	89.323	164.537	78.119	0.000	0.000	16.312	20.552	33.640	35.237
Brook Trout	312	135.234	204.700	124.112	0.000	0.000	20.162	14.510	66.923	31.852
Brook Trout	265	107.755	148.734	103.206	0.000	0.000	20.761	17.380	36.302	39.011
Brook Trout	355	71.965	172.097	130.533	19.060	0.000	0.000	20.185	42.488	34.258
Brook Trout	297	81.624	121.184	49.372	0.000	0.000	0.000	23.267	37.282	37.882
Brook Trout	425	220.856	201.824	171.063	0.000	0.000	94.744	24.804	55.429	48.885
Brook Trout	297	76.019	124.906	260.227	0.000	0.000	0.000	25.566	27.473	36.720
Brook Trout	321	99.391	155.704	94.761	0.000	0.000	16.890	11.753	30.152	41.982
Brook Trout		114.383	165.760	61.797	0.000	0.000	21.915	11.302	32.924	44.635
Pyramid										
Lake Trout	516	52.652	208.985	29.173	0.000	0.000	0.000	26.843	24.002	66.491
Lake Trout	532	68.228	277.702	35.578	0.000	0.000	0.000	62.175	122.856	137.244
Lake Trout	424	36.800	123.074	27.337	0.000	0.000	0.000	54.645	124.671	142.595
Lake Trout	468	43.365	133.528	29.301	0.000	0.000	0.000	61.783	84.018	85.949
Lake Trout	492	122.979	442.721	50.473	0.000	1.562	0.000	80.777	178.270	186.374
Lake Trout	519	71.234	272.990	77.939	12.760	0.000	0.000	138.035	143.173	169.127
Lake Trout	396	25.432	118.820	14.773	0.000	0.000	0.000	57.512	100.073	126.533
Lake Trout	513	56.633	220.013	54.933	0.000	0.000	0.000	62.726	91.545	100.173
Lake Trout	521	65.562	335.698	35.908	0.000	0.000	0.000	62.876	107.043	123.490
Lake Trout	532	49.619	253.501	26.394	0.000	0.000	0.000	69.237	96.329	104.072
Lake Trout	482	51.352	185.934	41.449	0.000	0.000	0.000	35.364	24.814	74.213
Patricia										
Rainbow Trout	433	606.316	929.918	547.078	0.000	0.000	151.745	85.530	42.547	214.914
Lake Trout	589	701.286	1708.618	401.397	13.131	0.000	0.000	167.355	41.704	882.101
Brook Trout	273	292.579	401.638	258.799	0.000	0.000	76.450	12.137	0.000	25.221
Lake Trout	468	291.831	964.869	435.197	0.000	0.000	0.000	128.303	33.790	409.856
Lake Trout	524	778.778	1715.732	470.117	0.000	0.000	228.904	205.616	38.817	724.274
Rainbow Trout	346	524.632	923.952	404.612	0.000	0.000	122.568	111.938	19.341	306.378
Lake Trout		457.355	1139.461	350.405	0.000	0.000	0.000	130.080	0.000	588.887
Lake Trout	273	317.316	730.251	118.523	0.000	0.000	0.000	86.580	27.063	211.009
Rainbow Trout		517.868	889.338	321.838	0.000	0.000	123.754	112.130	30.279	314.279
Lake Trout		347.315	1075.418	176.667	0.000	0.000	0.000	168.863	40.853	457.566

Table 5: Organochlorine pesticides in trout (wet weight)

Lake Trout		817.816	1877.554	377.522	0.000	0.000	0.000	219.940	46.169	799.882
Lake Trout	521	726.686	1754.702	182.446	0.000	0.000	0.000	218.006	57.447	824.301
Moab										
Bull Trout	305	82.396	129.714	65.707	0.000	0.000	0.000	9.974	48.050	219.330
Rainbow Trout	228	82.690	216.082	45.024	0.000	0.000	0.000	49.725	48.869	266.889
Rainbow Trout	287	27.693	246.971	12.449	0.000	0.000	0.000	13.479	17.562	129.083
Bull Trout	422	92.210	346.390	73.565	0.000	0.000	0.000	32.968	84.303	472.177
Rainbow Trout	210	88.196	227.351	44.063	0.000	0.000	0.000	24.701	40.188	343.139
Rainbow Trout	334	108.654	277.653	72.718	0.000	0.000	0.000	27.266	59.641	497.176
Rainbow Trout	206	88.083	207.531	120.632	0.000	0.000	0.000	18.939	33.446	219.681
Lake Trout	373	163.597	294.858	76.581	0.000	0.000	0.000	18.483	0.000	584.989
Rainbow Trout	330	39.881	120.002	121.278	0.000	0.000	24.914	23.259	62.559	239.170
Rainbow Trout	331	24.225	59.933	11.494	0.000	0.000	0.000	9.726	12.055	56.484
Rainbow Trout	343	22.620	97.466	12.029	0.000	0.000	0.000	33.820	23.949	132.766
Rainbow Trout	287	22.206	63.382	26.499	0.000	0.000	0.000	12.074	8.908	65.669
Rainbow Trout	337	15.133	76.474	8.324	0.000	0.000	0.000	31.830	46.780	134.081
Lake Trout	421	47.113	125.954	15.870	0.000	0.000	0.000	21.320	55.892	204.316
Lake Trout	360	83.075	263.097	74.360	0.000	0.000	0.000	25.075	186.789	379.373
Lake Trout	321	37.016	96.164	19.303	0.000	0.000	0.000	7.162	40.371	180.634
Lake Trout	398	22.176	94.325	3637.740	0.000	0.000	0.000	14.974	36.210	114.757
Lake Trout	493	39.430	230.138	30.852	0.000	0.000	0.000	29.846	42.258	191.380
Johnson										
Rainbow Trout	167	73.061	285.605	178.493	0.000	0.000	34.248	117.615	127.024	164.495
Brook Trout	166	73.575	187.756	94.864	18.872	0.000	17.616	24.558	29.420	51.563
Rainbow Trout	291	28.396	184.545	50.341	0.000	0.000	0.000	60.415	22.964	91.170
Brook Trout	264	21.396	119.475	39.648	0.000	0.000	20.991	38.196	15.551	57.657
Brook Trout	180	35.732	169.450	181.296	0.000	0.000	19.736	125.099	104.362	200.145
Brook Trout	262	22.459	141.123	45.766	0.000	0.000	9.989	7.999	27.104	22.859
Rainbow Trout	292	49.521	221.900	58.295	0.000	0.000	17.212	43.304	69.653	75.382
Brook Trout	231	45.550	230.082	55.667	0.000	0.000	0.000	14.441	70.187	28.814
Brook Trout	183	39.171	110.082	25.561	0.000	0.000	0.000	12.419	29.267	35.794
Brook Trout	237	40.031	178.888	49.668	0.000	0.000	0.000	12.656	46.236	24.698
Brook Trout	292	28.175	132.758	30.804	0.000	0.000	12.208	46.901	18.915	60.366
Brook Trout	283	17.437	94.145	101.816	38.358	17.649	0.000	66.684	21.694	55.614
Emerald										
Brook Trout	304	26.424	204.315	60.240	0.000	0.000	0.000	22.670	17.421	49.692
Brook Trout	294	48.837	181.882	139.753	0.000	0.000	0.000	120.900	38.680	126.673

Table 5: Organochlorine pesticides in trout (wet weight)

Rainbow Trout	212	62.148	158.234	132.292	0.000	0.000	0.000	48.902	16.849	80.785
Brook Trout	244	20.500	93.373	77.746	0.000	0.000	0.000	132.301	20.616	151.206
Brook Trout	338	34.954	196.871	107.613	0.000	0.000	0.000	66.120	88.408	96.947
Brook Trout	209	43.798	14.322	57.248	0.000	0.000	0.000	57.621	31.470	114.016
Rainbow Trout	161	15.172	96.705	86.575	0.000	0.000	25.344	33.055	42.324	49.760
Brook Trout	230	46.301	146.008	30.983	0.000	0.000	34.679	23.608	17.516	53.820
Brook Trout	335	45.362	394.412	62.798	0.000	0.000	0.000	61.726	45.810	138.835
Rainbow Trout	211	31.452	186.487	118.895	0.000	0.000	0.000	63.772	22.847	126.813
Brook Trout	320	22.310	190.147	31.782	0.000	0.000	0.000	37.886	17.737	84.858
Brook Trout	255	9.054	126.960	122.916	0.000	0.000	0.000	176.353	0.000	216.169
Moraine										
Brook Trout	258	20.884	439.085	20.935	0.000	0.000	124.589	80.713	84.126	173.388
Brook Trout	224	33.104	706.219	17.149	0.000	0.000	158.678	129.740	221.150	300.000
Brook Trout	262	32.347	562.494	200.016	0.000	0.000	179.189	53.712	105.584	173.460
Brook Trout	243	33.666	679.944	52.562	0.000	0.000	166.926	33.824	114.260	121.059
Brook Trout	278	35.518	588.783	65.880	0.000	0.000	179.527	38.873	57.969	130.755
Brook Trout	243	58.596	620.001	61.454	0.000	0.000	188.976	56.774	255.306	177.843
Brook Trout	290	40.230	592.414	126.966	0.000	0.000	150.228	72.256	86.675	140.889
Brook Trout	183	73.733	317.422	93.525	0.000	0.000	113.761	30.310	83.266	68.135
Bighorn										
Brook Trout	280	145.291	456.690	454.242	0.000	29.244	201.160	170.172	132.463	240.700
Brook Trout	264	111.761	233.851	120.188	0.000	0.000	118.419	140.911	407.894	132.192
Brook Trout	305	57.888	141.674	85.390	14.672	0.000	56.978	34.293	171.741	53.495
Brook Trout	282	108.244	269.005	103.598	0.000	18.729	127.936	92.713	100.372	72.851
Brook Trout	262	211.486	419.041	320.345	0.000	0.000	183.689	139.614	171.248	149.503
Brook Trout	238	157.812	425.325	170.404	0.000	34.334	152.127	94.228	256.737	85.009
Brook Trout	298	171.645	488.985	259.411	0.000	0.000	357.198	76.927	44.201	111.855
Brook Trout	270	91.915	274.624	107.868	0.000	27.386	232.441	46.006	147.651	88.216
Brook Trout	270	90.116	267.217	142.961	0.000	21.180	0.000	40.663	71.051	48.492
Brook Trout	224	254.015	602.899	541.052	0.000	39.709	204.558	127.940	56.892	163.314
Brook Trout	320	56.507	130.149	70.879	0.000	0.000	123.672	51.712	136.605	52.637

Table 5: Organochlorine pesticides in trout (wet weight)

Species	Length	Dieldrin	p,p'-DDE	Endrin	b-Endosulfan	p,p'-DDD	o,p'-DDT	p,p'-DDT
Shere								
Brook Trout	309	25.980	698.261	13.082	25.645	26.872	22.221	26.381
Brook Trout	363	23.895	517.365	0.000	32.291	40.828	21.092	5.098
Brook Trout	376	32.375	494.683	6.760	71.119	104.115	3.494	13.395
Brook Trout	324	36.044	514.689	5.664	25.307	30.108	19.469	26.960
Brook Trout	312	39.397	772.052	0.000	43.869	46.656	0.000	5.830
Brook Trout	265	38.035	413.607	0.000	27.948	37.890	21.092	23.520
Brook Trout	355	42.760	490.453	10.677	45.815	223.059	0.778	128.274
Brook Trout	297	34.985	503.022	11.696	39.251	18.909	19.469	35.791
Brook Trout	425	91.142	670.852	23.496	76.055	58.937	0.778	15.422
Brook Trout	297	51.435	338.163	0.000	33.617	73.284	0.000	20.062
Brook Trout	321	39.332	427.611	13.975	0.000	71.708	23.520	69.973
Brook Trout		51.757	628.838	0.000	41.949	39.756	37.589	24.970
Pyramid								
Lake Trout	516	71.516	5417.228	0.000	80.250	151.018	105.375	98.146
Lake Trout	532	159.125	7285.643	0.000	0.000	344.653	143.458	133.014
Lake Trout	424	48.428	1667.544	183.093	0.000	81.639	11.699	34.853
Lake Trout	468	44.990	1721.163	0.000	0.000	106.569	59.199	58.054
Lake Trout	492	244.926	5769.040	0.000	0.000	459.024	186.858	119.371
Lake Trout	519	152.841	7136.991	0.000	0.000	433.720	148.184	260.271
Lake Trout	396	38.860	1244.089	24.536	0.000	85.287	7.104	37.857
Lake Trout	513	65.345	4543.110	0.000	115.300	203.156	77.044	260.989
Lake Trout	521	93.454	5295.574	0.000	0.000	94.650	167.092	142.258
Lake Trout	532	84.374	4673.077	0.000	0.000	197.596	101.876	77.867
Lake Trout	482	62.890	2590.138	0.000	0.000	153.867	66.607	67.252
Patricia								
Rainbow Trout	433	298.202	6058.962	0.000	143.817	2727.319	207.468	530.898
Lake Trout	589	359.448	36195.979	0.000	691.686	6179.746	3395.670	6097.283
Brook Trout	273	214.204	3035.774	0.000	0.000	1291.995	59.329	206.089
Lake Trout	468	254.326	8403.509	0.000	719.421	1780.054	1381.467	2802.560
Lake Trout	524	543.075	17143.636	0.000	815.835	5220.966	2448.032	4088.806
Rainbow Trout	346	266.786	7163.833	0.000	317.707	3116.719	221.847	453.379
Lake Trout		314.550	24065.682	0.000	314.141	4153.245	5843.729	3402.818
Lake Trout	273	159.210	6428.649	0.000	295.627	1620.454	591.125	1391.117
Rainbow Trout		209.109	6838.380	0.000	88.141	2996.868	194.063	433.688
Lake Trout		470.189	8634.643	23.330	500.654	1938.482	1278.819	1843.083

Table 5: Organochlorine pesticides in trout (wet weight)

Lake Trout		625.019	18339.055	0.000	789.258	5216.965	2265.846	4293.674
Lake Trout	521	474.034	21977.775	0.000	1075.043	5205.599	2845.690	4989.317
Moab								
Bull Trout	305	100.432	1080.822	248.641	98.214	167.467	53.473	53.747
Rainbow Trout	228	3.172	1007.402	282.530	1.070	330.913	62.424	69.845
Rainbow Trout	287	21.879	895.634	89.748	3.018	110.861	91.421	34.251
Bull Trout	422	144.275	1485.107	556.637	122.629	495.953	112.736	160.927
Rainbow Trout	210	0.000	365.377	309.393	5.444	235.427	20.014	37.098
Rainbow Trout	334	57.509	1186.463	446.667	729.432	119.871	497.278	24.341
Rainbow Trout	206	22.596	529.135	225.998	3.161	221.896	3.504	55.447
Lake Trout	373	194.229	2619.358	647.551	143.690	344.990	164.809	185.842
Rainbow Trout	330	0.000	321.852	235.269	70.888	167.097	1.360	78.039
Rainbow Trout	331	7.710	124.258	55.288	0.000	33.065	0.000	13.611
Rainbow Trout	343	0.000	444.240	102.708	37.470	95.383	40.667	45.385
Rainbow Trout	287	0.000	173.944	54.477	0.000	50.458	0.000	22.396
Rainbow Trout	337	0.000	212.217	157.077	0.000	49.692	4.513	16.002
Lake Trout	421	81.839	973.248	197.385	45.394	150.790	35.723	55.685
Lake Trout	360	64.526	1414.742	415.318	85.088	211.319	73.072	67.300
Lake Trout	321	16.576	762.804	175.968	0.000	104.955	23.784	23.814
Lake Trout	398	4.744	488.615	75.815	0.000	63.758	38.948	29.682
Lake Trout	493	9.942	1269.095	164.295	66.091	156.957	53.463	72.470
Johnson								
Rainbow Trout	167	50.226	2665.868	0.000	0.000	344.173	0.000	157.288
Brook Trout	166	83.170	1454.044	13.985	0.000	127.202	311.257	12.021
Rainbow Trout	291	40.552	2539.473	20.629	58.548	614.149	0.000	56.019
Brook Trout	264	41.313	1174.517	0.000	0.000	138.762	0.000	234.801
Brook Trout	180	0.000	1936.636	0.000	251.801	227.692	322.282	242.210
Brook Trout	262	51.195	1017.952	0.000	0.000	267.130	224.873	24.075
Rainbow Trout	292	36.827	2209.337	0.000	49.939	615.778	98.605	56.715
Brook Trout	231	45.165	2126.673	0.000	0.000	710.988	0.000	46.926
Brook Trout	183	43.398	1038.632	15.194	0.000	192.687	344.721	28.177
Brook Trout	237	50.022	1358.037	0.000	0.000	500.013	0.000	36.806
Brook Trout	292	12.313	2052.901	0.000	23.352	502.603	0.000	101.981
Brook Trout	283	51.896	499.977	0.000	0.000	62.057	0.000	17.835
Emerald								
Brook Trout	304	169.359	4498.497	0.000	49.806	253.969	230.759	268.951
Brook Trout	294	195.040	318.148	5613.661	49.243	220.706	130.399	651.035

Table 5: Organochlorine pesticides in trout (wet weight)

Rainbow Trout	212	181.861	2915.420	0.000	249.045	807.013	234.341	230.772
Brook Trout	244	225.163	1530.742	0.000	0.000	102.773	384.007	123.459
Brook Trout	338	164.204	4941.723	0.000	39.656	196.711	207.179	379.849
Brook Trout	209	230.741	1153.147	0.000	70.301	375.480	218.403	165.607
Rainbow Trout	161	144.923	1008.598	15.705	5.842	117.106	0.000	106.998
Brook Trout	230	194.590	1003.042	27.831	26.976	233.849	217.546	194.483
Brook Trout	335	244.836	8011.936	0.000	167.237	690.629	376.735	951.694
Rainbow Trout	211	170.584	2255.453	70.146	100.439	301.428	106.021	139.948
Brook Trout	320	177.298	10217.485	0.000	66.444	315.122	334.983	433.571
Brook Trout	255	85.954	3140.460	0.000	0.000	247.570	289.704	464.478
Moraine								
Brook Trout	258	547.606	3679.819	0.000	507.537	346.589	393.573	346.188
Brook Trout	224	610.833	6652.852	0.000	564.286	449.002	754.478	1622.749
Brook Trout	262	934.630	6266.572	252.498	466.628	625.482	558.043	908.705
Brook Trout	243	805.471	4746.249	358.922	249.587	283.708	347.977	443.624
Brook Trout	278	975.378	8754.860	254.016	0.000	641.839	859.095	1125.142
Brook Trout	243	742.230	5181.352	201.335	471.246	425.266	357.174	643.649
Brook Trout	290	742.152	5393.667	0.000	403.941	430.530	356.820	681.549
Brook Trout	183	563.675	4737.561	306.889	302.081	1112.234	1068.095	1511.731
Bighorn								
Brook Trout	280	962.560	4871.123	0.000	523.136	731.787	471.688	555.457
Brook Trout	264	471.893	5582.043	0.000	0.000	549.365	302.205	462.668
Brook Trout	305	385.197	5270.982	87.127	105.616	442.381	228.755	517.972
Brook Trout	282	509.663	5934.442	155.682	365.161	907.279	540.434	317.799
Brook Trout	262	873.078	6983.579	0.000	521.195	1213.367	616.665	990.490
Brook Trout	238	564.147	3721.321	0.000	182.938	774.289	495.924	558.096
Brook Trout	298	1034.431	2955.750	183.232	419.761	985.434	398.753	365.927
Brook Trout	270	611.185	5066.611	146.032	298.412	728.442	160.891	188.760
Brook Trout	270	438.838	5057.259	0.000	165.692	774.699	225.163	376.022
Brook Trout	224	836.115	1989.587	0.000	622.450	403.695	410.543	301.788
Brook Trout	320	297.890	4831.403	78.664	147.037	153.134	347.773	114.674

Table 6: PCBs in trout (wet weight)

Species	Length	1	3	4-10	7-9	6	8-5	19	12-13	18	15-17
Shere											
Brook Trout	309	0.000	0.000	0.000	238.911	0.000	0.000	0.000	0.000	23.516	0.000
Brook Trout	363	0.000	0.000	0.000	17.295	43.980	0.000	0.000	0.000	19.616	0.000
Brook Trout	376	0.000	0.000	0.000	25.964	0.000	0.000	0.000	0.000	10.723	0.000
Brook Trout	324	0.000	0.000	0.000	71.918	0.000	0.000	0.000	0.000	29.477	0.000
Brook Trout	312	0.000	0.000	0.000	121.722	63.411	0.000	0.000	0.000	38.183	0.000
Brook Trout	265	0.000	0.000	0.000	20.744	0.000	0.000	0.000	0.000	26.266	0.000
Brook Trout	355	0.000	0.000	182.567	401.227	0.000	0.000	29.800	0.000	43.466	0.000
Brook Trout	297	0.000	0.000	0.000	78.657	0.000	0.000	0.000	0.000	12.858	0.000
Brook Trout	425	0.000	0.000	52.026	66.094	0.000	0.000	0.000	0.000	3.068	0.000
Brook Trout	297	0.000	0.000	0.000	148.405	0.000	0.000	0.000	0.000	6.875	0.000
Brook Trout	321	0.000	0.000	0.000	67.604	0.000	0.000	0.000	0.000	19.709	0.000
Pyramid											
Lake Trout	516	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lake Trout	532	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	208.497
Lake Trout	424	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lake Trout	468	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lake Trout	492	0.000	0.000	0.000	0.000	50.618	0.000	26.850	0.000	0.000	0.000
Lake Trout	519	0.000	0.000	0.000	18.452	0.000	0.000	0.000	0.000	0.000	39.922
Lake Trout	396	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lake Trout	513	0.000	0.000	0.000	0.000	66.232	0.000	0.000	0.000	0.000	0.000
Lake Trout	521	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lake Trout	532	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lake Trout	482	0.000	0.000	0.000	16.464	0.000	0.000	0.000	0.000	0.000	23.993
Patricia											
Rainbow Trout	433	0.000	0.000	0.000	23.730	0.000	0.000	0.000	104.051	58.021	78.956
Lake Trout	589	0.000	0.000	54.357	20.148	0.000	0.000	0.000	0.000	72.758	50.136
Brook Trout	273	0.000	0.000	0.000	64.043	60.607	0.000	0.000	289.417	71.670	57.074
Lake Trout	468	0.000	0.000	73.095	42.277	0.000	0.000	0.000	0.000	62.935	40.336
Lake Trout	524	0.000	0.000	78.875	23.491	78.543	0.000	22.360	43.412	42.158	16.769
Rainbow Trout	346	0.000	0.000	89.910	0.000	0.000	0.000	0.000	0.000	44.039	0.000
Lake Trout		0.000	0.000	93.333	68.738	112.009	0.000	13.388	0.000	78.555	0.000
Lake Trout	273	0.000	0.000	0.000	123.439	36.431	0.000	0.000	0.000	44.794	33.555
Rainbow Trout		0.000	0.000	89.511	21.748	0.000	0.000	0.000	0.000	57.464	0.000
Lake Trout		0.000	0.000	350.251	62.886	68.225	0.000	35.704	0.000	66.310	35.867
Lake Trout	521	0.000	0.000	123.420	20.625	0.000	0.000	0.000	0.000	47.262	0.000

Table 6: PCBs in trout (wet weight)

Moab											
Bull Trout	305	0.000	0.000	0.000	140.262	0.000	0.000	0.000	0.000	0.000	0.000
Rainbow Trout	228	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	457.128
Rainbow Trout	287	0.000	0.000	0.000	236.748	0.000	0.000	0.000	0.000	0.000	431.001
Bull Trout	422	0.000	0.000	0.000	159.500	0.000	0.000	53.942	0.000	0.000	333.135
Rainbow Trout	210	0.000	0.000	0.000	49.081	0.000	0.000	0.000	0.000	0.000	146.278
Rainbow Trout	334	0.000	0.000	102.253	62.698	0.000	0.000	0.000	0.000	0.000	257.557
Rainbow Trout	206	0.000	0.000	0.000	242.529	0.000	0.000	0.000	0.000	0.000	345.534
Lake Trout	373	0.000	0.000	139.750	31.829	27.770	0.000	0.000	216.537	0.000	200.979
Rainbow Trout	330	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	231.601
Rainbow Trout	331	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	158.195
Rainbow Trout	343	0.000	0.000	0.000	0.000	0.000	0.000	0.000	47.079	0.000	70.832
Rainbow Trout	287	0.000	0.000	0.000	0.000	0.000	0.000	0.000	75.651	0.000	153.521
Rainbow Trout	337	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	108.195
Lake Trout	421	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	127.280
Lake Trout	360	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	68.123
Lake Trout	321	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	494.505
Lake Trout	398	0.000	0.000	0.000	0.000	0.000	0.000	7.012	0.000	0.000	328.400
Lake Trout	493	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Bull Trout	397	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Johnson											
Rainbow Trout	167	0.000	0.000	0.000	142.957	0.000	0.000	0.000	0.000	0.000	474.174
Brook Trout	166	0.000	0.000	0.000	36.392	0.000	0.000	0.000	0.000	0.000	846.696
Rainbow Trout	291	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	261.091
Brook Trout	264	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	539.109
Brook Trout	180	0.000	0.000	0.000	51.818	0.000	0.000	0.000	0.000	0.000	629.208
Brook Trout	262	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	485.220
Rainbow Trout	292	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	391.142
Brook Trout	231	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	372.820
Brook Trout	183	0.000	0.000	0.000	35.892	0.000	0.000	0.000	0.000	0.000	236.349
Brook Trout	237	0.000	0.000	0.000	23.552	0.000	0.000	0.000	0.000	0.000	477.856
Brook Trout	292	0.000	0.000	0.000	15.355	0.000	0.000	0.000	0.000	0.000	298.996
Brook Trout	283	0.000	0.000	0.000	0.000	0.000	0.000	0.000	370.832	0.000	1189.272
Emerald											
Brook Trout	304	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	12.857	0.000
Brook Trout	294	0.000	0.000	0.000	15.726	118.939	0.000	0.000	0.000	110.585	135.744
Rainbow Trout	212	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	63.283	0.000

Table 6: PCBs in trout (wet weight)

Brook Trout	244	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	20.684	19.059
Brook Trout	338	0.000	0.000	0.000	34.481	0.000	0.000	0.000	0.000	49.135	70.640
Brook Trout	209	0.000	0.000	0.000	0.000	0.000	66.168	0.000	0.000	56.410	77.101
Rainbow Trout	161	0.000	0.000	0.000	23.741	0.000	0.000	0.000	0.000	0.000	0.000
Brook Trout	230	0.000	0.000	0.000	0.000	0.000	19.859	0.000	0.000	0.000	0.000
Brook Trout	335	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	35.407	40.778
Rainbow Trout	211	0.000	0.000	0.000	17.040	0.000	0.000	0.000	0.000	78.979	75.557
Brook Trout	320	0.000	0.000	0.000	0.000	0.000	15.284	0.000	0.000	22.930	23.408
Brook Trout	255	0.000	0.000	0.000	66.223	181.107	0.000	0.000	0.000	200.966	262.815
Moraine											
Brook Trout	258	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	162.686
Brook Trout	224	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	406.181
Brook Trout	262	0.000	0.000	0.000	37.138	0.000	0.000	0.000	0.000	0.000	205.508
Brook Trout	243	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	208.015
Brook Trout	278	0.000	0.000	0.000	25.515	0.000	0.000	0.000	241.941	0.000	259.994
Brook Trout	243	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	216.919
Brook Trout	290	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	179.816
Brook Trout	183	0.000	0.000	0.000	35.181	0.000	0.000	0.000	0.000	0.000	49.700
Bighorn											
Brook Trout	280	0.000	0.000	69.268	0.000	90.670	0.000	0.000	0.000	21.290	32.027
Brook Trout	264	0.000	0.000	77.738	0.000	56.580	83.000	0.000	0.000	43.707	57.530
Brook Trout	305	0.000	0.000	0.000	0.000	1.608	51.372	0.000	0.000	53.319	57.012
Brook Trout	282	0.000	0.000	0.000	8.728	24.704	39.981	0.000	0.000	160.657	60.201
Brook Trout	262	0.000	0.000	117.906	29.745	89.756	147.401	0.000	0.000	26.918	1.957
Brook Trout	238	0.000	0.000	106.029	10.096	40.949	91.032	0.000	0.000	106.475	76.184
Brook Trout	298	0.000	0.000	105.899	0.000	117.825	126.914	0.000	0.000	118.408	99.145
Brook Trout	270	0.000	0.000	44.986	0.000	13.672	78.450	0.000	0.000	27.706	30.832
Brook Trout	270	0.000	0.000	0.000	0.000	0.000	50.979	0.000	0.000	3.141	14.455
Brook Trout	224	0.000	0.000	133.296	0.000	0.000	146.544	0.000	0.000	43.118	0.000
Brook Trout	320	0.000	0.000	36.166	20.991	30.452	28.742	0.000	0.000	68.111	89.994

Table 6: PCBs in trout (wet weight)

Species	Length	24-27	16-32	54-29	26	25	31-28	33-20-53	51	22	45
Shere											
Brook Trout	309	0.000	0.000	7.178	0.000	14.580	43.682	0.000	48.358	0.000	0.000
Brook Trout	363	0.000	0.000	0.000	0.000	16.673	18.960	0.000	10.253	0.000	0.000
Brook Trout	376	0.000	0.000	23.059	0.000	12.695	52.130	0.000	14.511	0.684	0.000
Brook Trout	324	0.000	0.000	0.000	0.000	0.000	34.407	0.000	22.133	0.000	0.000
Brook Trout	312	0.000	0.000	0.000	0.000	13.212	40.282	0.000	22.540	0.000	0.000
Brook Trout	265	0.000	15.051	0.000	0.000	0.000	22.389	0.000	0.000	0.000	0.000
Brook Trout	355	0.000	0.000	11.812	0.000	0.000	31.423	0.000	66.318	0.000	0.000
Brook Trout	297	0.000	24.834	0.000	0.000	12.132	52.096	0.000	11.035	0.032	0.000
Brook Trout	425	0.000	0.000	0.000	0.000	0.000	25.101	0.000	7.975	0.000	0.000
Brook Trout	297	0.000	0.000	0.000	0.000	0.000	41.395	0.000	16.551	0.000	0.000
Brook Trout	321	0.000	0.000	17.931	0.000	21.142	37.487	4.469	29.267	9.652	0.000
Pyramid											
Lake Trout	516	0.000	0.000	0.000	0.000	0.000	35.192	0.000	0.000	13.058	0.000
Lake Trout	532	0.000	19.317	15.275	0.000	9.983	3.098	0.000	8.117	0.000	0.000
Lake Trout	424	0.000	26.685	0.000	0.000	0.000	20.092	0.000	0.000	9.014	0.000
Lake Trout	468	0.000	0.000	0.000	0.000	0.000	13.703	0.000	0.000	0.000	0.000
Lake Trout	492	0.000	0.000	0.000	0.000	0.000	54.334	0.000	0.000	18.142	0.000
Lake Trout	519	18.932	26.799	25.644	0.000	45.336	63.818	46.419	11.949	27.914	0.000
Lake Trout	396	0.000	0.000	0.000	0.000	0.000	48.667	0.000	0.000	0.000	0.000
Lake Trout	513	0.000	0.000	0.000	0.000	0.000	33.649	0.000	0.000	12.150	0.000
Lake Trout	521	0.000	0.000	0.000	0.000	20.832	47.160	0.000	0.000	17.543	0.000
Lake Trout	532	0.000	0.000	0.000	0.000	17.493	76.660	0.000	0.000	13.903	0.000
Lake Trout	482	12.117	20.494	19.772	0.000	14.441	111.852	9.677	0.000	25.260	0.000
Patricia											
Rainbow Trout	433	0.000	53.178	0.000	62.616	18.395	272.481	60.581	0.000	34.820	0.000
Lake Trout	589	0.000	35.045	27.761	180.891	9.300	231.862	21.551	7.285	92.999	44.113
Brook Trout	273	0.000	30.234	0.000	82.229	0.000	123.957	19.680	10.228	14.704	0.000
Lake Trout	468	7.893	36.296	28.266	98.838	6.880	130.548	28.795	7.682	41.186	29.686
Lake Trout	524	0.000	44.105	37.514	90.553	5.620	231.386	23.770	0.000	55.104	38.533
Rainbow Trout	346	0.000	20.856	12.918	0.000	103.595	90.781	13.671	0.000	15.784	13.744
Lake Trout		0.000	0.000	53.511	149.718	23.027	197.999	43.376	17.945	75.012	50.866
Lake Trout	273	0.000	0.000	0.000	161.596	0.000	76.197	-8.576	22.216	21.324	0.000
Rainbow Trout		0.000	22.069	13.933	0.000	137.881	109.483	14.007	0.000	16.135	27.670
Lake Trout		0.000	0.000	63.757	97.887	0.000	174.089	30.913	0.000	86.824	0.000
Lake Trout	521	0.000	53.483	54.635	75.271	0.000	174.841	17.178	0.000	60.066	0.000

Table 6: PCBs in trout (wet weight)

Moab											
Bull Trout	305	0.000	0.000	30.299	0.000	0.000	11.230	0.000	23.841	0.000	0.000
Rainbow Trout	228	0.000	42.353	33.489	0.000	21.887	6.792	0.000	17.796	0.000	0.000
Rainbow Trout	287	0.000	0.000	0.000	0.000	0.000	143.667	51.435	67.456	42.620	0.000
Bull Trout	422	0.000	0.000	125.318	0.000	0.000	88.474	23.593	41.590	0.000	0.000
Rainbow Trout	210	0.000	0.000	0.000	0.000	48.478	0.000	0.000	18.037	16.056	0.000
Rainbow Trout	334	16.496	37.820	64.875	0.000	0.000	25.745	3.829	19.046	0.000	0.000
Rainbow Trout	206	0.000	0.000	0.000	0.000	0.000	2.481	0.000	61.262	0.000	0.000
Lake Trout	373	31.936	0.000	169.230	0.000	0.000	116.514	15.661	0.000	0.000	0.000
Rainbow Trout	330	17.922	0.000	0.000	0.000	15.280	0.000	0.000	0.000	0.000	0.000
Rainbow Trout	331	10.663	12.383	28.414	0.000	11.724	0.000	0.000	0.000	0.000	0.000
Rainbow Trout	343	0.000	0.000	26.282	0.000	0.000	16.358	0.000	0.000	0.000	0.000
Rainbow Trout	287	5.054	20.824	18.562	0.000	13.270	0.000	0.000	0.000	9.246	0.000
Rainbow Trout	337	0.000	18.848	22.231	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lake Trout	421	0.000	0.000	0.000	0.000	9.874	21.289	0.000	0.000	0.000	0.000
Lake Trout	360	4.060	0.000	0.000	0.000	6.979	23.118	0.000	0.000	4.892	0.000
Lake Trout	321	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.558	0.000
Lake Trout	398	4.078	0.000	0.000	0.000	5.193	23.312	0.000	0.000	0.000	0.000
Lake Trout	493	0.000	0.000	21.386	0.000	0.000	0.000	0.000	0.000	5.044	0.000
Bull Trout	397	2.620	0.000	10.105	0.000	15.895	0.000	0.000	0.000	5.248	0.000
Johnson											
Rainbow Trout	167	0.000	59.592	0.000	0.000	32.736	292.090	72.998	34.523	46.876	0.000
Brook Trout	166	0.000	50.603	0.000	0.000	39.215	50.225	0.000	24.589	21.595	0.000
Rainbow Trout	291	0.000	23.324	0.000	0.000	0.000	144.899	21.410	0.000	28.440	0.000
Brook Trout	264	0.000	40.858	0.000	0.000	20.951	132.067	4.209	0.000	24.934	0.000
Brook Trout	180	0.000	79.492	0.000	0.000	29.732	306.053	59.525	24.941	63.081	0.000
Brook Trout	262	14.000	21.002	0.000	0.000	19.744	3.001	0.000	0.000	12.525	0.000
Rainbow Trout	292	0.000	26.676	0.000	0.000	8.745	134.016	14.159	0.000	21.722	0.000
Brook Trout	231	0.000	0.000	0.000	0.000	8.641	16.184	0.000	0.000	0.000	0.000
Brook Trout	183	15.772	43.996	34.186	0.000	21.131	56.820	0.000	0.000	20.607	0.000
Brook Trout	237	0.000	0.000	0.000	0.000	8.560	14.710	0.000	8.654	11.830	0.000
Brook Trout	292	0.000	24.043	0.000	0.000	8.896	128.931	31.662	0.000	20.117	0.000
Brook Trout	283	0.000	62.481	63.201	0.000	0.000	264.117	47.607	0.000	61.110	55.235
Emerald											
Brook Trout	304	0.000	26.703	0.000	10.268	0.000	44.263	17.153	0.000	2.913	0.000
Brook Trout	294	12.467	83.814	0.000	67.677	25.984	490.857	178.148	0.000	74.471	32.204
Rainbow Trout	212	0.000	66.438	0.000	49.578	102.754	95.496	47.629	0.000	16.704	62.154

Table 6: PCBs in trout (wet weight)

Brook Trout	244	0.000	28.682	0.000	10.468	0.000	43.293	34.901	0.000	1.010	0.000
Brook Trout	338	26.282	68.923	25.939	78.282	37.976	230.732	85.413	0.000	33.579	49.960
Brook Trout	209	0.000	49.432	0.000	48.731	52.567	327.089	105.899	0.000	24.724	14.176
Rainbow Trout	161	0.000	23.405	0.000	3.942	0.000	41.221	16.613	0.000	0.000	0.000
Brook Trout	230	0.000	22.659	0.000	31.929	0.000	27.874	22.542	0.000	0.000	19.063
Brook Trout	335	0.000	32.070	0.000	36.586	0.000	119.974	41.549	0.000	12.559	0.000
Rainbow Trout	211	0.000	44.829	0.000	66.607	0.000	218.423	79.501	0.000	36.096	49.326
Brook Trout	320	0.000	34.280	0.000	64.296	14.561	115.129	23.483	0.000	12.322	0.000
Brook Trout	255	20.642	167.386	15.585	217.240	52.285	1004.184	345.794	0.000	154.698	56.921
Moraine											
Brook Trout	258	0.000	0.000	0.000	0.000	12.384	47.753	17.025	13.882	25.845	0.000
Brook Trout	224	0.000	59.306	0.000	0.000	77.556	211.078	110.702	0.000	47.882	21.261
Brook Trout	262	0.000	0.000	0.000	0.000	0.000	46.800	49.009	0.000	13.508	0.000
Brook Trout	243	0.000	0.000	0.000	0.000	0.000	76.663	59.914	36.216	17.433	0.000
Brook Trout	278	0.000	0.000	0.000	0.000	0.000	75.832	39.109	19.689	21.566	15.786
Brook Trout	243	0.000	0.000	0.000	0.000	779.854	61.128	35.678	0.000	17.581	11.964
Brook Trout	290	0.000	0.000	0.000	0.000	0.000	50.642	16.128	0.000	17.076	0.000
Brook Trout	183	0.000	81.688	27.088	0.000	0.000	74.917	26.027	37.383	30.051	0.000
Bighorn											
Brook Trout	280	0.000	69.180	34.336	349.659	0.000	265.802	35.653	19.326	32.908	0.000
Brook Trout	264	0.000	64.044	0.000	160.252	0.000	259.782	63.623	0.000	36.963	189.406
Brook Trout	305	0.000	48.821	0.000	163.236	0.000	123.776	33.612	0.000	24.749	73.715
Brook Trout	282	0.000	39.189	0.000	0.000	0.000	136.898	30.815	0.000	23.261	142.908
Brook Trout	262	0.000	86.805	56.246	616.028	0.000	168.137	60.771	0.000	50.074	71.284
Brook Trout	238	0.000	43.714	0.000	207.727	0.000	154.587	38.206	0.000	28.405	59.372
Brook Trout	298	15.305	73.837	67.232	330.598	0.000	340.370	73.068	0.000	41.158	143.921
Brook Trout	270	0.000	35.405	0.000	0.000	0.000	96.303	33.480	0.000	20.908	26.192
Brook Trout	270	0.000	36.091	0.000	0.000	0.000	100.668	21.575	0.000	25.275	67.358
Brook Trout	224	0.000	96.097	44.231	1493.173	0.000	221.715	57.471	0.000	35.569	62.226
Brook Trout	320	0.000	47.848	0.000	162.748	0.000	194.660	34.026	0.000	25.278	197.431

Table 6: PCBs in trout (wet weight)

Species	Length	46	52	49	43	48-47	44	59-42	40	100	63
Shere											
Brook Trout	309	0.000	57.966	0.000	206.129	25.434	22.679	0.000	5.538	9.821	0.000
Brook Trout	363	0.000	66.627	0.000	32.269	8.454	17.435	0.000	0.000	3.388	0.000
Brook Trout	376	0.000	43.875	0.000	29.665	0.000	16.214	0.000	10.987	0.000	0.000
Brook Trout	324	9.370	77.519	0.000	26.610	12.771	32.895	0.000	0.118	14.046	0.000
Brook Trout	312	0.000	65.299	0.000	64.912	6.930	19.451	0.000	0.000	8.308	0.000
Brook Trout	265	0.000	72.749	0.000	37.927	0.000	20.631	0.000	0.000	0.000	0.000
Brook Trout	355	0.000	69.851	0.000	65.192	89.281	28.066	0.000	32.081	8.671	16.519
Brook Trout	297	0.000	103.526	0.000	187.880	6.982	44.762	0.000	1.005	6.907	0.000
Brook Trout	425	0.000	89.603	0.000	24.638	7.707	25.758	0.000	0.000	10.278	0.000
Brook Trout	297	0.000	86.197	0.000	29.726	1.356	27.677	0.000	0.000	0.000	0.000
Brook Trout	321	14.721	61.899	0.000	29.860	34.905	28.087	0.860	1.707	16.565	16.013
Pyramid											
Lake Trout	516	0.000	77.081	0.000	88.900	40.916	39.230	0.000	0.000	23.505	16.933
Lake Trout	532	14.954	60.813	0.000	50.775	33.189	24.883	0.000	0.000	23.820	19.361
Lake Trout	424	0.000	88.964	0.000	198.009	28.782	34.124	0.000	0.000	12.273	20.679
Lake Trout	468	0.000	59.486	0.000	8.235	24.600	20.421	0.000	9.211	27.547	22.199
Lake Trout	492	0.000	157.607	0.000	38.534	60.329	60.419	15.828	11.482	44.186	20.473
Lake Trout	519	15.270	101.655	0.000	58.910	91.913	51.610	24.497	15.391	33.647	32.065
Lake Trout	396	0.000	93.418	0.000	149.974	0.000	0.000	0.000	0.000	0.000	0.000
Lake Trout	513	0.000	69.569	0.000	179.586	49.886	23.676	0.000	0.000	22.105	19.770
Lake Trout	521	0.000	83.503	0.000	90.846	38.919	40.832	0.000	0.000	26.494	22.859
Lake Trout	532	0.000	62.877	0.000	91.021	37.391	46.781	0.000	0.000	29.805	23.905
Lake Trout	482	10.397	117.814	0.000	136.418	59.861	50.121	15.609	11.424	30.269	27.339
Patricia											
Rainbow Trout	433	0.000	257.422	0.000	234.915	85.924	116.138	25.153	21.794	27.287	12.296
Lake Trout	589	11.999	467.143	0.000	369.070	191.343	199.589	56.869	41.221	90.931	47.067
Brook Trout	273	0.000	156.082	0.000	371.497	43.013	35.871	10.646	0.000	20.001	0.000
Lake Trout	468	27.943	178.642	0.000	144.302	90.774	70.442	20.461	27.351	52.913	25.818
Lake Trout	524	11.441	298.139	0.000	254.985	100.520	112.676	47.092	45.532	110.381	30.519
Rainbow Trout	346	0.000	149.219	0.000	177.566	50.039	68.441	15.055	0.000	34.281	62.302
Lake Trout		0.000	377.228	0.000	286.265	165.100	156.787	33.212	59.253	87.603	42.338
Lake Trout	273	0.000	114.254	0.000	298.035	62.273	42.471	13.154	24.484	48.057	16.199
Rainbow Trout		0.000	147.086	0.000	175.498	49.868	68.138	14.988	0.000	34.392	61.553
Lake Trout		0.000	314.778	0.000	129.697	142.384	146.719	82.588	84.816	145.205	57.185
Lake Trout	521	0.000	312.126	0.000	233.783	120.169	119.137	40.531	42.780	99.381	34.355

Table 6: PCBs in trout (wet weight)

Moab											
Bull Trout	305	0.000	50.227	0.000	77.033	37.075	24.530	0.000	0.000	44.463	18.238
Rainbow Trout	228	32.787	133.333	0.000	111.324	72.766	54.556	0.000	0.000	52.225	42.448
Rainbow Trout	287	0.000	195.101	0.000	282.165	139.218	128.033	0.000	0.000	124.855	50.763
Bull Trout	422	0.000	77.585	27.474	66.623	32.995	0.000	0.000	0.000	145.263	61.466
Rainbow Trout	210	0.000	58.577	0.000	47.574	22.979	61.273	0.000	0.000	44.749	21.593
Rainbow Trout	334	0.000	65.807	0.000	165.276	49.446	22.375	0.000	0.000	101.129	0.000
Rainbow Trout	206	0.000	76.736	34.524	99.557	91.772	0.000	0.000	0.000	50.296	0.000
Lake Trout	373	73.615	144.447	103.979	317.415	86.347	0.000	0.000	0.000	175.783	128.123
Rainbow Trout	330	20.456	33.584	22.972	35.461	0.000	0.000	0.000	0.000	28.068	0.000
Rainbow Trout	331	21.947	20.960	0.000	30.567	0.000	13.162	0.000	0.000	5.572	0.000
Rainbow Trout	343	0.000	32.474	0.000	21.958	0.000	22.080	0.000	0.000	25.403	17.882
Rainbow Trout	287	0.000	26.873	0.000	19.673	4.337	22.697	0.000	0.000	9.171	0.000
Rainbow Trout	337	0.000	38.917	7.770	13.174	8.836	0.000	0.000	0.000	14.798	0.000
Lake Trout	421	0.000	37.258	0.000	12.287	0.000	20.008	0.000	0.000	34.957	19.182
Lake Trout	360	0.000	38.062	0.000	315.066	0.000	21.711	0.000	0.000	34.484	19.872
Lake Trout	321	0.000	50.111	0.000	73.636	14.614	13.033	0.000	0.000	7.681	6.403
Lake Trout	398	0.000	49.164	0.000	90.346	27.123	27.673	0.000	0.000	46.065	15.450
Lake Trout	493	0.000	29.511	0.000	150.236	6.574	6.711	0.000	0.000	16.913	11.172
Bull Trout	397	0.000	38.188	0.000	50.286	8.769	21.307	0.000	0.000	22.933	7.312
Johnson											
Rainbow Trout	167	0.000	268.518	0.000	156.560	112.124	155.825	25.819	18.341	7.506	11.731
Brook Trout	166	90.482	27.204	0.000	64.245	86.886	99.866	0.000	0.000	24.015	22.883
Rainbow Trout	291	0.000	138.373	0.000	136.781	52.425	100.963	17.102	8.281	0.000	0.000
Brook Trout	264	0.000	113.936	0.000	59.102	49.111	145.656	0.000	0.000	0.000	0.000
Brook Trout	180	0.000	307.908	0.000	143.160	144.650	226.945	63.972	60.671	27.079	26.666
Brook Trout	262	0.000	12.209	0.000	37.178	18.506	26.563	0.000	0.000	0.000	0.000
Rainbow Trout	292	0.000	131.564	0.000	120.492	43.898	124.277	15.353	22.817	9.136	0.000
Brook Trout	231	35.676	13.339	0.000	58.750	10.906	23.621	0.000	0.000	0.000	0.000
Brook Trout	183	0.000	18.643	0.000	49.827	44.675	67.887	16.760	20.645	0.000	26.479
Brook Trout	237	0.000	11.029	0.000	75.474	17.674	19.503	0.000	0.000	0.000	0.000
Brook Trout	292	0.000	133.948	0.000	62.969	36.855	80.616	13.859	6.944	0.000	5.961
Brook Trout	283	41.207	193.612	0.000	111.423	0.000	134.390	0.000	29.608	0.000	0.000
Emerald											
Brook Trout	304	0.000	67.332	0.000	59.650	0.000	0.000	0.000	0.000	14.221	0.000
Brook Trout	294	0.000	372.634	0.000	117.062	81.821	225.379	47.144	22.165	16.948	23.787
Rainbow Trout	212	188.400	115.274	0.000	24.355	0.000	0.000	25.819	26.032	0.000	24.664

Table 6: PCBs in trout (wet weight)

Brook Trout	244	0.000	95.418	0.000	27.768	7.603	215.581	8.255	0.000	0.000	0.000
Brook Trout	338	0.000	138.547	0.000	60.498	45.083	154.753	0.000	24.014	19.667	14.572
Brook Trout	209	0.000	232.087	0.000	70.787	55.543	147.587	22.571	0.000	13.535	12.074
Rainbow Trout	161	0.000	61.488	0.000	12.571	0.000	0.000	0.000	0.000	0.000	0.000
Brook Trout	230	0.000	42.346	0.000	10.151	0.000	0.000	0.000	0.000	0.000	0.000
Brook Trout	335	0.000	82.260	0.000	20.665	22.293	153.388	2.921	0.000	25.034	0.000
Rainbow Trout	211	0.000	212.938	0.000	74.387	63.369	206.458	38.214	9.112	11.894	0.000
Brook Trout	320	0.000	50.523	0.000	5.620	23.719	40.877	0.000	0.000	16.833	15.623
Brook Trout	255	88.432	701.174	0.000	243.035	149.042	397.630	97.005	45.897	16.336	26.984
Moraine											
Brook Trout	258	0.000	59.127	0.000	132.942	25.105	0.000	0.000	0.000	43.480	0.000
Brook Trout	224	0.000	271.928	0.000	470.631	80.197	115.022	39.400	0.000	77.566	0.000
Brook Trout	262	0.000	77.346	0.000	293.269	41.688	0.000	0.000	0.000	59.906	0.000
Brook Trout	243	0.000	98.780	0.000	373.959	36.473	0.080	0.000	0.000	85.873	29.987
Brook Trout	278	0.000	110.250	0.000	421.616	47.718	36.917	0.000	0.000	88.240	18.133
Brook Trout	243	0.000	92.966	0.000	170.205	36.757	0.000	0.000	30.470	51.770	15.013
Brook Trout	290	8.817	79.524	0.000	156.801	37.198	11.274	0.000	0.000	56.129	8.344
Brook Trout	183	0.000	77.997	0.000	49.534	55.847	0.000	0.000	15.005	22.879	0.000
Bighorn											
Brook Trout	280	0.000	101.729	0.000	40.228	60.127	64.567	20.171	20.786	30.721	8.543
Brook Trout	264	0.000	205.080	0.000	63.513	73.677	136.122	44.069	18.582	16.245	0.000
Brook Trout	305	0.000	139.833	0.000	48.172	43.387	85.699	23.513	18.870	0.000	0.000
Brook Trout	282	0.000	100.430	0.000	40.533	50.689	49.049	18.262	0.000	24.049	0.000
Brook Trout	262	0.000	157.458	0.000	66.258	68.964	81.936	26.985	21.868	40.215	0.000
Brook Trout	238	0.000	125.224	0.000	49.191	47.359	66.179	23.291	12.060	26.581	0.000
Brook Trout	298	0.000	128.577	0.000	50.326	86.581	82.505	32.535	7.819	56.764	0.000
Brook Trout	270	0.000	93.150	0.000	27.304	23.343	36.387	14.517	9.058	19.911	0.000
Brook Trout	270	0.000	82.622	0.000	30.831	28.569	34.319	15.310	10.862	14.670	0.000
Brook Trout	224	0.000	141.107	0.000	51.404	64.409	75.822	28.680	15.451	40.481	0.000
Brook Trout	320	231.613	109.543	0.000	39.158	45.312	53.203	17.198	0.000	0.000	0.000

Table 6: PCBs in trout (wet weight)

Species	Length	74	70-76-98	66	91-55	56-60	92	84	101	99	119
Shere											
Brook Trout	309	11.398	20.128	44.100	0.000	0.000	16.556	6.534	86.506	39.407	3.498
Brook Trout	363	8.084	2.788	28.960	0.000	0.000	10.396	2.947	63.545	34.106	0.000
Brook Trout	376	5.290	0.000	26.336	0.000	14.566	12.379	0.000	50.375	28.619	0.000
Brook Trout	324	14.842	34.763	74.002	0.000	0.000	21.170	14.947	133.111	61.322	0.000
Brook Trout	312	17.164	20.802	61.976	7.668	0.000	18.860	0.000	106.680	64.933	6.055
Brook Trout	265	0.589	0.000	27.870	0.000	0.000	4.868	0.000	61.140	28.781	0.000
Brook Trout	355	12.216	25.682	37.335	4.561	0.000	17.372	1.920	63.490	38.433	0.000
Brook Trout	297	26.164	68.690	120.319	4.904	2.538	32.397	27.441	205.078	86.602	1.413
Brook Trout	425	17.585	7.161	55.328	0.000	0.000	14.825	0.000	114.322	62.805	0.000
Brook Trout	297	14.621	36.797	69.385	0.000	0.000	18.580	11.903	141.010	59.010	0.000
Brook Trout	321	24.807	40.429	47.619	19.972	6.543	17.065	11.083	71.715	43.730	16.057
Pyramid											
Lake Trout	516	63.720	106.152	156.574	30.430	31.816	97.369	0.000	505.205	339.104	15.903
Lake Trout	532	33.509	33.445	77.206	37.726	7.563	33.131	33.506	103.984	54.977	11.398
Lake Trout	424	14.989	32.716	73.800	8.982	4.360	46.746	0.000	152.264	98.682	1.909
Lake Trout	468	25.459	37.892	71.827	0.000	9.853	47.120	0.000	167.709	128.843	5.168
Lake Trout	492	68.430	132.994	288.443	66.801	47.829	207.248	0.000	616.989	324.212	13.732
Lake Trout	519	86.751	152.936	200.838	41.735	45.501	117.140	0.000	586.090	421.809	25.718
Lake Trout	396	10.528	29.978	67.448	0.000	-4.826	26.855	0.000	136.042	103.036	0.000
Lake Trout	513	44.867	68.916	118.646	15.667	15.179	78.300	28.429	337.286	240.144	7.035
Lake Trout	521	56.195	101.406	133.562	0.000	26.693	80.069	0.000	386.904	285.527	12.671
Lake Trout	532	64.297	113.115	140.357	0.000	19.117	80.403	0.000	405.652	256.919	20.563
Lake Trout	482	75.322	198.784	282.291	41.317	50.875	142.795	0.000	1642.247	835.880	15.662
Patricia											
Rainbow Trout	433	124.896	286.023	422.102	63.941	86.878	591.543	94.697	760.497	345.294	25.877
Lake Trout	589	302.048	533.903	0.000	242.949	143.524	1283.324	0.000	4454.033	1604.303	145.027
Brook Trout	273	46.043	92.569	0.000	26.637	70.016	358.921	51.022	344.184	174.229	19.330
Lake Trout	468	107.975	181.166	0.000	104.978	56.455	348.012	59.176	1076.997	423.957	40.261
Lake Trout	524	185.445	312.922	0.000	0.000	91.005	1036.785	0.000	2033.173	802.003	76.227
Rainbow Trout	346	79.508	142.908	266.736	55.347	50.725	723.769	0.000	608.138	226.892	36.350
Lake Trout		266.080	467.107	944.671	194.230	119.430	1078.773	198.870	3933.690	1365.708	123.998
Lake Trout	273	97.085	137.445	313.812	133.171	72.595	474.594	0.000	852.133	378.355	67.740
Rainbow Trout		93.518	175.290	317.339	109.279	87.593	796.928	59.138	657.239	347.597	85.899
Lake Trout		237.141	372.979	785.688	0.000	116.158	1244.226	0.000	2423.686	925.092	106.740
Lake Trout	521	212.047	347.530	752.706	0.000	78.041	1043.017	0.000	2618.112	973.471	85.108

Table 6: PCBs in trout (wet weight)

Moab											
Bull Trout	305	18.908	17.574	50.724	0.000	0.000	18.247	48.687	82.489	59.824	0.000
Rainbow Trout	228	73.468	73.327	169.273	82.714	16.583	72.639	73.462	227.984	120.537	24.990
Rainbow Trout	287	96.895	139.621	268.527	30.162	17.694	111.061	125.838	418.467	249.327	5.094
Bull Trout	422	116.683	28.831	0.000	0.000	58.293	40.281	0.000	230.096	148.998	6.400
Rainbow Trout	210	17.740	0.000	52.115	0.000	0.000	16.330	20.974	41.788	32.439	0.000
Rainbow Trout	334	56.863	21.279	0.000	0.000	9.440	57.017	0.000	123.307	87.093	0.000
Rainbow Trout	206	51.720	0.000	0.000	0.000	57.300	2.878	2.499	68.233	33.198	0.000
Lake Trout	373	111.601	55.358	43.037	6.826	71.252	31.878	42.365	236.541	225.941	29.303
Rainbow Trout	330	41.062	1.227	23.088	0.000	19.700	0.632	6.700	36.990	25.838	0.000
Rainbow Trout	331	0.000	0.000	12.718	0.000	0.000	4.394	0.000	2.179	5.712	0.000
Rainbow Trout	343	21.083	2.798	0.000	0.000	11.023	0.000	16.611	27.248	26.917	0.000
Rainbow Trout	287	0.000	0.000	19.464	0.000	1.030	3.870	1.670	9.575	9.726	0.000
Rainbow Trout	337	3.430	0.000	22.681	0.000	0.000	5.611	7.695	26.865	30.588	0.000
Lake Trout	421	12.598	15.088	0.000	0.000	0.000	3.972	0.000	70.707	59.797	0.845
Lake Trout	360	19.640	26.345	67.085	0.845	1.093	6.667	50.861	140.809	84.459	0.000
Lake Trout	321	10.111	27.414	63.724	0.440	0.000	14.829	13.112	127.187	50.967	0.000
Lake Trout	398	15.351	16.758	0.000	0.000	0.000	0.000	41.716	145.423	77.021	0.000
Lake Trout	493	7.722	0.000	6.033	0.000	0.000	0.000	1.323	57.722	31.851	0.000
Bull Trout	397	7.142	8.457	45.469	0.000	0.000	11.082	13.464	84.956	50.977	0.000
Johnson											
Rainbow Trout	167	143.161	379.207	514.864	77.900	100.368	368.921	160.129	799.219	356.878	24.919
Brook Trout	166	27.711	24.409	40.316	18.991	19.919	117.919	23.013	86.623	38.386	0.000
Rainbow Trout	291	75.966	191.974	255.507	37.518	53.753	269.120	78.161	404.356	176.213	14.375
Brook Trout	264	73.973	185.190	247.839	39.050	53.296	159.336	78.536	403.719	173.998	0.000
Brook Trout	180	162.735	419.245	532.895	90.882	125.217	266.045	170.631	868.216	407.218	49.872
Brook Trout	262	19.344	17.420	16.668	9.591	0.000	85.799	0.000	41.976	23.092	0.000
Rainbow Trout	292	70.832	170.501	248.075	34.083	47.947	291.255	82.359	378.337	170.176	15.541
Brook Trout	231	14.863	14.130	31.186	0.000	7.722	154.470	0.000	64.143	23.702	0.000
Brook Trout	183	55.040	60.058	63.167	40.882	40.483	132.329	23.133	79.642	47.604	15.838
Brook Trout	237	16.775	17.241	30.236	0.000	0.000	107.192	0.000	47.117	19.980	0.000
Brook Trout	292	70.678	185.435	257.447	39.773	51.461	174.325	82.325	417.461	183.884	15.724
Brook Trout	283	98.172	179.505	266.258	43.531	57.951	133.930	124.944	400.994	176.968	17.137
Emerald											
Brook Trout	304	19.503	46.149	97.202	19.754	0.000	78.844	0.000	170.083	87.522	32.527
Brook Trout	294	183.736	510.151	652.286	123.687	0.000	212.766	191.443	993.490	475.439	20.153
Rainbow Trout	212	45.548	157.540	211.860	97.681	0.000	107.598	118.873	263.051	110.877	0.000

Table 6: PCBs in trout (wet weight)

Brook Trout	244	35.764	162.126	266.000	51.850	0.000	83.143	98.902	395.392	155.279	16.563
Brook Trout	338	58.620	159.736	199.654	51.125	0.000	137.171	63.136	355.143	195.022	32.501
Brook Trout	209	116.701	290.156	352.780	51.772	0.000	108.391	76.990	579.686	255.841	10.310
Rainbow Trout	161	14.290	45.793	68.059	15.072	0.000	40.209	12.983	94.874	38.305	0.000
Brook Trout	230	7.236	25.708	31.827	0.000	0.000	15.886	0.000	50.833	34.583	7.087
Brook Trout	335	31.024	76.234	130.033	27.794	0.000	107.328	0.000	223.166	130.274	17.860
Rainbow Trout	211	65.745	202.070	262.234	36.883	0.000	111.319	65.231	383.768	171.616	8.405
Brook Trout	320	119.696	58.769	193.014	25.232	0.000	59.656	-8.547	267.148	295.644	16.500
Brook Trout	255	332.126	944.729	1134.929	167.963	0.000	329.928	305.053	1736.808	801.423	92.583
Moraine											
Brook Trout	258	13.332	39.822	79.020	23.784	10.004	92.736	16.872	168.162	66.138	16.518
Brook Trout	224	108.159	347.787	492.090	67.667	90.918	282.225	148.020	837.373	379.093	63.263
Brook Trout	262	0.000	71.053	147.799	72.847	7.068	239.527	0.000	248.817	94.303	15.618
Brook Trout	243	0.000	112.940	208.614	86.924	30.519	254.017	0.000	311.446	121.808	0.000
Brook Trout	278	0.000	80.112	176.312	42.280	0.000	443.658	0.000	366.233	120.502	0.000
Brook Trout	243	0.000	62.550	134.431	44.568	144.545	249.740	0.000	222.552	90.082	12.477
Brook Trout	290	0.000	78.312	155.584	19.176	30.364	230.604	0.000	258.808	118.557	29.807
Brook Trout	183	13.025	58.982	118.313	18.368	7.068	309.284	0.000	193.946	67.192	13.297
Bighorn											
Brook Trout	280	25.966	104.277	149.000	17.915	0.000	153.151	34.543	303.261	102.420	23.278
Brook Trout	264	70.259	273.958	443.040	65.536	55.855	161.804	194.341	607.021	232.801	31.889
Brook Trout	305	46.470	144.919	266.678	32.314	15.529	106.099	102.550	402.655	166.760	33.494
Brook Trout	282	43.967	104.572	163.244	28.765	0.000	118.276	39.023	292.067	96.172	9.844
Brook Trout	262	31.632	142.944	253.360	34.689	23.465	196.388	101.175	522.652	221.047	74.666
Brook Trout	238	23.950	90.768	154.726	19.573	0.000	110.869	44.643	277.379	103.901	28.060
Brook Trout	298	76.631	136.964	225.558	59.070	29.707	140.773	53.025	296.438	136.739	35.273
Brook Trout	270	15.409	74.109	133.979	18.464	0.000	111.500	20.484	237.263	89.556	13.415
Brook Trout	270	24.857	66.738	113.714	13.325	0.000	128.053	26.187	283.488	114.283	30.757
Brook Trout	224	35.439	96.497	172.650	16.507	2.684	90.725	48.718	276.143	101.293	31.731
Brook Trout	320	21.564	61.160	99.937	18.190	0.000	93.568	17.682	207.949	80.753	0.000

Table 6: PCBs in trout (wet weight)

Species	Length	83	97	87-81	85	136	110	82	151	135-144	147-107
Shere											
Brook Trout	309	0.000	18.621	31.413	0.000	0.000	41.766	22.212	7.420	0.000	0.000
Brook Trout	363	0.995	11.874	15.327	0.000	0.000	23.903	14.525	0.287	0.000	0.000
Brook Trout	376	0.000	8.189	15.703	0.000	0.000	25.936	13.378	6.380	0.872	0.000
Brook Trout	324	6.122	41.134	79.357	0.000	0.000	91.491	18.117	6.965	0.209	0.000
Brook Trout	312	0.000	32.081	37.777	0.000	0.000	58.748	26.588	8.797	0.000	0.000
Brook Trout	265	0.000	7.754	10.839	0.000	0.000	21.777	17.753	1.306	0.000	0.000
Brook Trout	355	0.000	22.165	16.184	0.000	0.000	26.698	-13.633	7.114	14.648	0.000
Brook Trout	297	0.954	51.193	105.296	0.000	0.000	155.422	20.964	11.028	3.415	0.000
Brook Trout	425	0.000	13.071	30.511	0.000	0.000	57.526	33.827	4.582	0.000	0.000
Brook Trout	297	2.140	33.858	66.716	0.000	0.000	88.983	1.630	0.225	0.000	0.000
Brook Trout	321	4.740	19.148	44.724	0.000	0.000	28.753	12.524	5.021	1.895	0.000
Pyramid											
Lake Trout	516	31.392	60.307	157.000	0.000	0.000	176.766	217.722	0.000	83.327	129.379
Lake Trout	532	5.837	86.977	52.870	0.000	0.000	63.913	57.539	0.000	15.585	10.101
Lake Trout	424	17.712	33.351	65.108	0.000	0.000	78.172	0.000	0.000	46.479	39.887
Lake Trout	468	12.663	27.955	64.228	0.000	0.000	82.142	125.828	0.000	65.149	58.246
Lake Trout	492	44.393	123.594	246.313	0.000	0.000	322.478	304.416	69.532	124.882	115.212
Lake Trout	519	35.908	86.547	195.244	0.000	0.000	223.247	196.228	0.000	120.747	173.196
Lake Trout	396	3.071	32.271	45.211	0.000	0.000	55.386	88.391	0.000	20.339	17.555
Lake Trout	513	29.578	49.899	109.855	0.000	0.000	114.944	0.000	0.000	65.201	76.767
Lake Trout	521	26.562	50.796	125.697	0.000	0.000	161.151	0.000	0.000	75.458	98.716
Lake Trout	532	30.496	55.118	132.105	0.000	0.000	148.899	150.053	0.000	71.945	73.948
Lake Trout	482	31.846	81.806	298.059	0.000	0.000	356.991	445.261	25.779	157.903	275.636
Patricia											
Rainbow Trout	433	37.928	183.036	403.182	0.000	0.000	516.564	393.114	159.192	155.087	79.966
Lake Trout	589	153.577	477.843	999.406	0.000	0.000	1221.601	2130.909	984.868	893.912	0.000
Brook Trout	273	0.000	98.354	204.442	0.000	0.000	204.236	246.714	93.061	79.075	33.829
Lake Trout	468	46.503	168.523	305.152	0.000	0.000	383.018	634.626	282.408	258.363	0.000
Lake Trout	524	77.804	292.600	583.224	0.000	0.000	685.229	0.000	461.052	443.505	191.377
Rainbow Trout	346	33.071	116.138	234.680	0.000	0.000	319.438	472.439	180.490	89.776	36.105
Lake Trout		117.676	336.687	848.513	0.000	0.000	1066.504	0.000	745.088	916.196	311.994
Lake Trout	273	70.641	179.465	357.407	0.000	0.000	289.257	571.709	226.008	309.632	0.000
Rainbow Trout		121.846	225.512	394.643	0.000	0.000	406.395	486.333	208.983	172.418	121.423
Lake Trout		172.030	366.198	710.359	0.000	0.000	799.095	2078.994	598.599	998.068	265.984
Lake Trout	521	156.264	343.660	686.061	0.000	0.000	697.395	0.000	606.690	796.592	249.666

Table 6: PCBs in trout (wet weight)

Moab											
Bull Trout	305	0.000	131.042	13.262	0.000	0.000	26.499	0.000	0.000	16.498	10.984
Rainbow Trout	228	12.799	190.697	115.918	0.000	0.000	140.129	126.154	0.000	34.170	22.147
Rainbow Trout	287	18.502	266.905	140.716	0.000	0.000	226.069	275.288	18.835	79.946	35.575
Bull Trout	422	0.000	861.414	82.994	0.000	0.000	51.740	332.964	0.000	65.336	15.932
Rainbow Trout	210	0.000	210.129	1.906	0.000	0.000	3.116	0.000	0.000	0.000	0.000
Rainbow Trout	334	0.000	319.886	31.737	0.000	0.000	22.504	135.996	0.000	31.226	15.245
Rainbow Trout	206	0.000	705.527	40.025	0.000	0.000	31.862	91.254	0.000	25.220	12.232
Lake Trout	373	0.000	825.406	113.364	0.000	0.000	57.162	0.000	40.821	108.847	43.569
Rainbow Trout	330	0.000	368.881	9.159	0.000	0.000	4.282	32.280	0.000	3.084	7.677
Rainbow Trout	331	10.708	7.529	0.000	0.000	0.000	0.000	19.387	0.000	0.000	12.104
Rainbow Trout	343	0.000	185.794	11.582	0.000	0.000	5.548	67.302	0.000	7.838	4.076
Rainbow Trout	287	0.000	26.638	0.000	0.000	0.000	0.000	23.459	0.000	0.000	2.917
Rainbow Trout	337	3.667	51.204	4.919	0.000	0.000	4.920	22.316	0.000	9.918	9.324
Lake Trout	421	0.000	86.010	45.155	0.000	0.000	44.431	0.000	0.000	21.122	5.636
Lake Trout	360	0.689	286.591	31.315	0.000	0.000	48.965	0.000	0.000	17.480	8.964
Lake Trout	321	0.000	71.149	28.527	0.000	0.000	53.157	0.000	0.000	2.047	2.669
Lake Trout	398	0.000	189.072	25.589	0.000	0.000	54.330	0.000	0.000	9.333	5.343
Lake Trout	493	0.000	398.885	0.432	0.000	0.000	0.000	0.000	0.000	4.576	0.000
Bull Trout	397	0.000	99.238	22.748	0.000	0.000	37.567	0.000	0.000	1.128	4.587
Johnson											
Rainbow Trout	167	61.964	274.764	558.685	0.000	0.000	713.811	118.863	19.694	0.000	54.884
Brook Trout	166	13.156	28.079	55.759	0.000	0.000	63.015	52.899	0.000	0.000	13.977
Rainbow Trout	291	27.768	123.484	259.753	0.000	0.000	345.260	81.012	0.000	0.000	32.840
Brook Trout	264	40.797	107.688	246.878	0.000	0.000	344.168	58.419	0.000	0.000	16.939
Brook Trout	180	78.328	292.901	575.735	0.000	0.000	703.760	133.745	0.000	0.000	59.264
Brook Trout	262	0.000	6.663	27.829	0.000	0.000	23.999	32.079	0.000	0.000	0.000
Rainbow Trout	292	22.176	105.694	219.960	0.000	0.000	304.040	85.144	0.000	0.000	22.521
Brook Trout	231	0.000	8.938	32.082	0.000	0.000	32.348	37.338	0.000	0.000	11.360
Brook Trout	183	16.102	23.623	63.650	0.000	0.000	52.262	39.292	0.000	0.000	24.519
Brook Trout	237	0.000	10.008	24.022	0.000	0.000	31.600	40.735	0.000	0.000	10.199
Brook Trout	292	32.714	120.989	261.978	0.000	0.000	323.347	68.289	9.344	0.000	16.282
Brook Trout	283	14.786	103.366	233.906	0.000	0.000	302.544	66.829	0.000	0.000	52.825
Emerald											
Brook Trout	304	27.647	49.087	90.267	0.000	0.000	97.794	205.834	29.086	48.383	24.567
Brook Trout	294	44.745	272.493	589.990	0.000	0.000	788.991	253.655	105.251	142.508	84.434
Rainbow Trout	212	27.428	88.080	263.742	0.000	0.000	260.892	206.386	45.500	31.346	100.945

Table 6: PCBs in trout (wet weight)

Brook Trout	244	30.462	132.043	343.344	0.000	0.000	454.848	99.695	58.225	56.049	21.168
Brook Trout	338	39.556	92.730	196.611	0.000	0.000	202.699	233.368	46.432	51.044	57.317
Brook Trout	209	27.386	160.547	344.370	0.000	0.000	434.447	68.461	60.395	79.055	36.264
Rainbow Trout	161	15.623	29.872	77.049	0.000	0.000	96.204	55.047	19.542	19.876	0.000
Brook Trout	230	13.770	26.154	30.981	0.000	0.000	37.281	57.021	2.349	0.000	39.170
Brook Trout	335	14.485	56.768	116.047	0.000	0.000	121.762	0.000	34.804	31.209	20.662
Rainbow Trout	211	35.920	123.360	238.157	0.000	0.000	307.705	100.575	45.244	46.886	21.250
Brook Trout	320	23.924	55.006	126.843	0.000	0.000	97.986	0.000	50.021	70.969	43.549
Brook Trout	255	172.331	636.208	1287.734	0.000	0.000	1639.579	211.198	179.966	226.118	152.576
Moraine											
Brook Trout	258	14.584	27.469	51.767	0.000	0.000	66.140	0.000	37.838	46.173	16.804
Brook Trout	224	34.482	215.106	480.048	0.000	0.000	561.422	423.500	133.969	141.196	55.307
Brook Trout	262	0.000	25.369	54.602	0.000	0.000	71.002	482.112	50.234	78.246	20.722
Brook Trout	243	0.000	43.275	87.520	0.000	0.000	120.006	499.438	76.309	95.495	0.000
Brook Trout	278	22.765	51.226	104.152	0.000	0.000	233.610	0.000	160.224	184.629	81.297
Brook Trout	243	16.219	32.233	70.287	0.000	0.000	72.047	364.301	47.090	57.873	12.516
Brook Trout	290	53.994	37.475	57.433	0.000	0.000	84.521	386.613	49.696	67.244	19.614
Brook Trout	183	14.946	30.857	81.206	0.000	0.000	131.055	0.000	132.365	298.778	11.791
Bighorn											
Brook Trout	280	12.391	55.119	130.298	0.000	0.000	167.466	262.761	57.487	107.187	22.541
Brook Trout	264	58.773	205.739	456.934	0.000	0.000	657.364	200.148	96.881	114.543	53.999
Brook Trout	305	26.594	131.541	288.970	0.000	0.000	346.300	190.363	87.763	65.159	49.664
Brook Trout	282	24.108	50.624	152.670	0.000	0.000	170.634	212.055	64.427	65.820	36.734
Brook Trout	262	52.704	164.537	376.731	0.000	0.000	428.572	437.035	169.551	158.650	113.396
Brook Trout	238	10.775	52.947	131.392	0.000	0.000	156.905	0.000	38.542	13.838	17.343
Brook Trout	298	51.582	114.468	200.215	0.000	0.000	259.247	306.097	65.127	79.607	65.994
Brook Trout	270	0.000	38.343	125.698	0.000	0.000	118.381	206.067	51.560	13.009	20.298
Brook Trout	270	51.891	80.689	156.992	0.000	0.000	156.130	240.296	82.835	73.682	48.298
Brook Trout	224	11.425	44.371	112.210	0.000	0.000	142.589	0.000	32.040	20.371	11.717
Brook Trout	320	0.000	0.000	68.179	0.000	0.000	87.629	114.412	40.842	83.212	0.000

Table 6: PCBs in trout (wet weight)

Species	Length	149	118	133	114-134-131	146	153-132-105	141-179	137	176-130	138-163
Shere											
Brook Trout	309	42.464	88.065	11.632	0.000	26.674	180.849	6.668	0.000	0.000	96.714
Brook Trout	363	30.110	68.062	6.840	0.000	24.988	170.175	4.690	0.000	0.000	77.944
Brook Trout	376	37.069	62.893	172.876	0.000	129.765	161.932	2.617	0.000	0.000	141.153
Brook Trout	324	59.691	129.938	28.886	0.000	26.584	223.572	15.865	0.950	0.117	133.195
Brook Trout	312	57.719	124.452	33.570	0.000	39.151	243.372	9.029	0.000	0.000	135.528
Brook Trout	265	28.017	50.748	12.691	0.000	21.483	128.447	2.236	0.000	0.000	77.799
Brook Trout	355	27.479	90.265	344.540	0.000	34.692	233.713	3.560	0.544	0.000	106.861
Brook Trout	297	95.553	186.735	10.218	0.000	30.729	265.199	23.015	4.093	1.373	161.328
Brook Trout	425	57.666	113.201	24.045	0.000	41.348	254.509	13.495	0.000	0.000	131.864
Brook Trout	297	61.474	130.866	1.591	0.000	24.489	209.899	17.497	0.712	0.000	116.606
Brook Trout	321	33.456	57.804	59.409	0.000	20.809	151.139	19.579	5.104	5.734	73.749
Pyramid											
Lake Trout	516	166.211	627.531	189.337	0.000	243.313	1104.937	50.210	47.106	36.818	891.821
Lake Trout	532	52.431	112.401	25.280	0.000	21.885	83.341	6.284	8.778	3.855	57.570
Lake Trout	424	82.772	205.955	90.726	0.000	79.606	318.844	29.201	14.279	11.906	243.164
Lake Trout	468	93.667	246.561	273.490	0.000	101.374	370.600	30.996	18.366	15.154	293.169
Lake Trout	492	372.767	599.061	143.016	0.000	248.283	1232.039	170.360	57.666	44.976	951.070
Lake Trout	519	246.586	816.014	213.639	0.000	326.548	1510.008	141.320	72.079	58.018	1201.897
Lake Trout	396	63.988	207.659	112.094	0.000	74.540	273.370	6.080	13.920	11.584	223.217
Lake Trout	513	129.169	445.447	159.566	0.000	169.705	774.422	56.153	33.491	26.115	619.789
Lake Trout	521	148.155	485.986	134.448	0.000	196.119	830.851	26.890	37.171	29.885	665.745
Lake Trout	532	128.372	343.696	130.778	0.000	148.485	1690.116	55.504	30.218	22.819	1008.104
Lake Trout	482	325.310	2497.970	515.637	0.000	513.178	8588.324	93.993	40.768	30.357	5193.536
Patricia											
Rainbow Trout	433	347.151	686.125	81.743	0.000	238.678	1262.415	212.320	52.546	43.815	1014.383
Lake Trout	589	1856.162	1836.215	1182.447	0.000	1227.237	6589.800	1092.746	296.184	173.057	4759.124
Brook Trout	273	163.162	308.942	55.395	0.000	147.166	708.429	126.702	22.560	26.128	639.280
Lake Trout	468	605.371	556.360	375.861	0.000	379.315	1906.046	405.325	88.281	55.205	1339.183
Lake Trout	524	1048.687	933.417	712.634	0.000	707.119	3492.603	631.259	166.101	101.876	2417.268
Rainbow Trout	346	253.863	517.852	174.439	0.000	283.964	1261.935	230.284	66.307	46.925	928.521
Lake Trout		1562.918	1751.131	1055.331	0.000	974.912	5873.465	1052.013	241.985	132.700	4266.220
Lake Trout	273	469.727	411.862	256.051	0.000	341.565	1420.303	362.863	69.325	45.261	983.961
Rainbow Trout		293.967	571.954	184.968	0.000	284.709	1256.191	221.001	66.012	46.716	924.399
Lake Trout		1138.528	1067.118	909.863	0.000	789.893	4048.605	874.105	208.428	142.283	2853.962
Lake Trout	521	1293.022	1267.797	672.818	0.000	851.510	4446.130	856.102	168.124	111.600	3147.414

Table 6: PCBs in trout (wet weight)

Moab											
Bull Trout	305	30.495	94.413	46.603	0.000	44.570	59.862	1.281	20.681	5.547	36.558
Rainbow Trout	228	114.953	246.439	55.426	0.000	47.983	182.725	13.778	19.246	8.451	126.222
Rainbow Trout	287	177.202	390.863	124.314	0.000	70.486	496.634	55.867	34.918	15.360	288.169
Bull Trout	422	77.941	208.133	112.693	0.000	43.961	210.480	33.650	72.650	20.431	229.954
Rainbow Trout	210	29.918	63.645	37.935	0.000	0.000	0.000	0.000	13.329	0.000	0.000
Rainbow Trout	334	38.974	133.226	49.898	0.000	35.316	128.860	10.393	20.698	9.356	74.313
Rainbow Trout	206	60.516	106.339	104.809	0.000	31.259	0.000	0.000	43.057	13.259	28.362
Lake Trout	373	109.515	233.842	152.505	0.000	119.427	316.399	36.420	85.516	0.000	735.065
Rainbow Trout	330	18.469	64.818	20.296	0.000	6.383	0.000	0.000	9.367	2.581	0.000
Rainbow Trout	331	8.101	16.495	8.102	0.000	14.677	0.000	0.000	4.838	0.000	0.000
Rainbow Trout	343	15.619	38.412	32.083	0.000	9.242	0.000	0.000	10.469	0.000	35.196
Rainbow Trout	287	10.113	30.865	15.706	0.000	4.754	0.000	0.000	3.794	0.000	0.000
Rainbow Trout	337	20.007	52.270	28.849	0.000	9.448	0.000	0.000	3.720	0.000	0.000
Lake Trout	421	14.358	53.701	18.209	0.000	24.851	369.737	0.977	16.371	3.779	84.154
Lake Trout	360	35.425	130.410	36.300	0.000	31.358	213.340	0.993	15.198	3.804	115.623
Lake Trout	321	33.787	129.041	33.056	0.000	10.539	165.600	0.000	4.289	1.639	65.337
Lake Trout	398	25.315	131.188	35.944	0.000	17.050	239.484	0.000	7.994	1.492	89.673
Lake Trout	493	11.731	49.001	23.153	0.000	7.990	71.944	0.000	8.384	1.226	42.367
Bull Trout	397	31.833	75.275	17.881	0.000	11.510	53.675	0.000	7.200	2.751	25.010
Johnson											
Rainbow Trout	167	370.295	681.623	0.000	0.000	89.038	655.433	146.700	45.526	28.982	641.893
Brook Trout	166	87.990	0.000	0.000	0.000	56.409	0.000	28.114	11.016	8.761	121.977
Rainbow Trout	291	187.177	344.106	0.000	0.000	48.587	271.068	75.409	21.913	14.435	329.365
Brook Trout	264	193.030	227.281	0.000	0.000	50.035	20.439	75.879	21.719	14.952	308.145
Brook Trout	180	427.297	600.717	0.000	0.000	98.363	428.641	165.232	57.150	37.597	657.974
Brook Trout	262	41.984	0.000	0.000	0.000	9.955	0.000	22.780	0.000	0.000	50.604
Rainbow Trout	292	180.028	295.518	0.000	0.000	55.752	232.956	75.382	19.865	13.162	309.027
Brook Trout	231	55.361	0.000	0.000	0.000	11.673	0.000	18.126	5.140	3.839	73.717
Brook Trout	183	67.082	0.000	0.000	0.000	28.109	0.000	35.056	9.783	7.722	73.585
Brook Trout	237	40.526	0.000	0.000	0.000	14.446	0.000	19.491	4.796	3.443	63.552
Brook Trout	292	198.757	331.342	0.000	0.000	62.524	334.148	79.312	22.511	15.578	339.489
Brook Trout	283	209.567	246.538	0.000	0.000	52.574	42.963	79.976	23.496	0.000	288.720
Emerald											
Brook Trout	304	80.917	128.522	0.000	0.000	64.565	374.374	44.827	19.395	11.504	251.223
Brook Trout	294	442.802	890.901	0.000	0.000	134.717	1230.341	173.653	62.770	38.103	838.356
Rainbow Trout	212	104.764	267.413	0.000	0.000	68.339	619.557	146.797	40.287	62.558	367.996

Table 6: PCBs in trout (wet weight)

Brook Trout	244	267.114	404.208	0.000	0.000	66.277	607.325	87.922	28.809	21.491	414.131
Brook Trout	338	138.565	265.020	0.000	0.000	83.655	598.165	73.653	39.833	23.278	429.293
Brook Trout	209	294.897	540.720	0.000	0.000	109.769	715.137	97.229	35.906	22.741	476.789
Rainbow Trout	161	51.857	100.747	0.000	0.000	31.266	198.754	13.570	10.446	7.939	125.401
Brook Trout	230	22.509	42.113	0.000	0.000	4.594	78.017	4.763	8.377	0.000	81.020
Brook Trout	335	76.821	185.303	0.000	0.000	74.178	468.627	36.752	26.098	13.315	335.933
Rainbow Trout	211	164.807	329.371	0.000	0.000	52.736	485.282	62.503	21.845	15.402	326.037
Brook Trout	320	103.629	490.319	0.000	0.000	207.192	1089.040	39.646	44.813	19.693	691.989
Brook Trout	255	765.465	1659.599	0.000	0.000	178.221	1905.886	284.635	93.604	61.119	1331.547
Moraine											
Brook Trout	258	75.841	66.575	27.186	0.000	39.092	246.857	42.159	15.778	6.506	155.326
Brook Trout	224	393.369	694.693	113.316	0.000	108.137	1021.906	158.752	59.572	27.204	695.141
Brook Trout	262	154.548	105.565	173.353	0.000	92.269	458.548	70.348	28.297	11.217	271.352
Brook Trout	243	155.702	171.225	233.664	0.000	94.869	434.445	84.752	42.400	16.025	277.359
Brook Trout	278	317.580	247.984	197.241	0.000	135.921	737.847	126.534	43.384	21.826	506.644
Brook Trout	243	132.992	97.180	29.134	0.000	68.742	380.476	66.486	62.466	7.629	253.290
Brook Trout	290	138.012	100.760	76.229	0.000	87.143	393.441	81.129	35.199	15.388	262.339
Brook Trout	183	209.445	181.751	997.012	0.000	87.861	1180.868	96.354	39.576	33.597	325.242
Bighorn											
Brook Trout	280	151.558	149.020	0.000	0.000	39.869	361.033	78.261	16.737	12.143	226.746
Brook Trout	264	332.689	549.085	108.240	0.000	72.146	794.850	106.488	40.507	25.875	465.304
Brook Trout	305	197.042	264.357	0.000	0.000	71.568	464.992	73.072	20.456	13.817	287.429
Brook Trout	282	160.866	197.260	0.000	0.000	62.955	360.325	64.753	17.860	13.199	222.891
Brook Trout	262	330.833	339.188	0.000	0.000	92.709	604.780	94.646	26.978	15.596	381.329
Brook Trout	238	131.912	144.330	0.000	0.000	33.274	306.823	45.301	11.488	7.426	176.842
Brook Trout	298	166.183	323.807	276.496	0.000	85.582	561.897	60.079	28.915	17.934	320.835
Brook Trout	270	145.013	110.106	0.000	0.000	34.131	310.747	62.183	13.610	8.806	220.486
Brook Trout	270	168.478	147.763	0.000	0.000	54.342	302.696	53.631	12.960	8.557	202.850
Brook Trout	224	108.810	149.804	6.186	0.000	25.363	317.078	43.646	9.909	12.515	157.382
Brook Trout	320	110.205	99.917	0.000	0.000	49.741	417.878	58.290	25.418	18.418	317.121

Table 6: PCBs in trout (wet weight)

Species	Length	158	129	178	175	187-182	183	128	167	185	174
Shere											
Brook Trout	309	2.528	0.000	6.696	0.000	44.463	18.508	15.377	0.000	0.000	7.313
Brook Trout	363	0.078	0.000	4.584	0.000	42.669	15.438	13.138	0.000	0.000	6.424
Brook Trout	376	0.000	0.000	1.139	0.000	26.779	20.091	6.474	0.000	0.000	6.359
Brook Trout	324	5.637	0.000	1.676	0.000	40.745	21.280	25.362	0.000	0.000	11.839
Brook Trout	312	0.000	0.000	4.504	0.000	53.176	16.120	18.562	8.423	0.000	8.149
Brook Trout	265	0.000	0.000	0.000	0.000	24.719	13.198	14.649	0.000	0.000	2.791
Brook Trout	355	5.450	0.000	0.000	0.000	35.916	21.868	16.389	0.000	0.000	4.400
Brook Trout	297	9.845	5.451	3.037	0.000	36.580	4.283	11.958	0.000	0.000	12.648
Brook Trout	425	0.766	0.000	5.794	0.000	63.762	18.222	6.772	0.000	0.000	11.748
Brook Trout	297	7.098	0.000	0.000	0.000	27.423	4.337	20.476	0.000	0.000	7.148
Brook Trout	321	6.864	5.386	8.492	0.587	37.772	22.429	23.396	14.413	2.396	9.468
Pyramid											
Lake Trout	516	62.165	0.000	61.561	0.000	353.201	267.389	86.947	54.526	0.000	36.261
Lake Trout	532	0.000	0.000	1.036	0.000	6.649	21.137	9.108	14.803	1.671	2.412
Lake Trout	424	8.364	0.000	8.303	0.000	100.644	23.533	0.000	10.969	0.000	9.765
Lake Trout	468	13.284	0.000	7.707	0.000	110.239	73.114	0.000	9.302	0.000	8.128
Lake Trout	492	58.197	14.965	75.384	0.000	366.241	276.535	122.430	69.560	10.058	85.888
Lake Trout	519	88.281	11.474	83.352	0.000	478.348	262.002	170.539	138.585	25.883	76.996
Lake Trout	396	0.306	0.000	0.000	0.000	97.117	14.923	0.000	7.312	0.000	4.093
Lake Trout	513	39.830	0.000	48.066	0.000	241.129	170.894	81.370	41.865	0.000	24.507
Lake Trout	521	40.736	0.000	48.648	0.000	290.454	233.097	58.345	54.702	0.000	23.030
Lake Trout	532	38.010	0.000	53.357	0.000	271.678	227.133	103.818	54.814	0.000	29.494
Lake Trout	482	53.316	0.000	50.561	8.709	982.746	645.646	126.783	55.807	3.335	37.595
Patricia											
Rainbow Trout	433	77.639	54.363	93.477	37.902	309.000	190.022	144.950	76.831	22.654	96.873
Lake Trout	589	379.185	0.000	865.275	0.000	3030.453	2887.658	635.762	502.557	152.503	680.737
Brook Trout	273	0.000	21.251	68.006	14.497	219.100	117.066	71.713	46.303	17.462	55.271
Lake Trout	468	111.077	49.208	245.414	0.000	947.931	872.490	184.929	158.128	64.335	253.950
Lake Trout	524	190.681	0.000	486.692	0.000	1519.774	2028.403	327.375	266.816	84.482	388.380
Rainbow Trout	346	84.032	38.463	120.234	74.385	442.431	334.595	162.152	98.927	46.164	95.624
Lake Trout		324.593	79.490	608.596	0.000	2554.369	2277.164	530.567	438.588	112.869	585.279
Lake Trout	273	81.255	0.000	193.888	0.000	655.249	634.521	155.240	151.131	50.194	157.531
Rainbow Trout		83.899	0.000	158.604	74.054	440.466	333.216	161.413	98.489	46.306	95.177
Lake Trout		249.315	0.000	518.005	0.000	1691.128	2313.035	374.129	335.049	114.019	395.939
Lake Trout	521	229.730	82.373	467.017	0.000	2050.171	2005.741	386.720	310.137	111.038	481.147

Table 6: PCBs in trout (wet weight)

Moab											
Bull Trout	305	0.000	0.000	1.673	0.000	44.175	126.834	0.000	24.664	0.000	3.594
Rainbow Trout	228	0.000	0.000	2.271	0.000	14.577	46.343	19.969	32.455	3.664	5.288
Rainbow Trout	287	24.606	0.000	18.439	0.000	96.293	227.557	108.726	80.744	0.000	32.562
Bull Trout	422	0.000	0.000	43.399	0.000	117.797	381.390	0.000	45.900	0.000	0.844
Rainbow Trout	210	0.000	0.000	0.000	0.000	0.000	13.866	0.000	0.000	0.000	0.000
Rainbow Trout	334	0.000	0.000	0.689	0.000	48.746	121.728	8.748	25.765	0.000	0.000
Rainbow Trout	206	0.000	0.000	0.000	0.000	0.000	61.174	0.000	0.000	0.000	2.004
Lake Trout	373	0.000	0.000	57.190	0.000	148.578	558.237	21.538	123.278	0.000	0.000
Rainbow Trout	330	0.000	0.000	0.000	0.000	0.000	7.621	0.000	0.000	0.000	0.000
Rainbow Trout	331	0.000	0.000	0.000	3.686	0.000	0.000	0.000	0.000	0.000	3.988
Rainbow Trout	343	0.000	0.000	0.000	0.000	0.000	49.367	0.000	0.000	0.000	0.000
Rainbow Trout	287	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rainbow Trout	337	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.584	0.000	0.649
Lake Trout	421	0.000	0.000	3.906	0.000	66.478	182.103	0.000	14.297	0.000	0.000
Lake Trout	360	0.000	0.000	2.081	6.806	34.142	240.525	0.000	8.140	0.000	1.488
Lake Trout	321	0.000	0.000	0.000	0.000	0.000	3.527	0.000	0.000	0.000	0.000
Lake Trout	398	0.000	0.000	0.000	0.000	21.869	231.536	0.000	11.910	0.000	0.000
Lake Trout	493	0.000	0.000	0.000	1.326	9.780	146.059	0.000	5.338	0.000	0.000
Bull Trout	397	0.000	0.000	0.000	0.000	0.197	31.081	0.000	0.000	0.000	0.000
Johnson											
Rainbow Trout	167	73.729	63.125	20.112	0.000	120.847	71.922	159.187	56.196	12.541	67.523
Brook Trout	166	0.000	0.000	0.000	0.000	41.565	49.066	65.618	11.038	0.000	28.179
Rainbow Trout	291	39.165	28.549	14.667	0.000	61.986	38.492	85.177	16.025	6.702	35.014
Brook Trout	264	39.332	31.266	13.230	0.000	62.474	54.611	106.910	4.297	0.000	33.688
Brook Trout	180	90.620	78.306	31.145	19.570	121.978	79.556	190.170	79.067	28.372	77.774
Brook Trout	262	0.000	0.000	0.000	0.000	23.640	29.472	49.787	0.000	0.000	9.532
Rainbow Trout	292	33.784	27.150	12.840	0.000	71.497	46.629	75.825	7.296	2.027	34.866
Brook Trout	231	8.925	4.654	9.648	0.000	36.041	0.000	26.680	0.000	2.372	13.457
Brook Trout	183	17.310	13.331	8.546	0.000	42.883	9.005	10.280	0.000	4.045	17.714
Brook Trout	237	0.000	6.264	9.757	0.000	33.605	32.531	42.053	0.000	2.571	11.570
Brook Trout	292	40.797	33.461	12.357	0.000	61.319	33.786	87.055	33.007	8.721	41.026
Brook Trout	283	36.050	38.226	10.671	0.000	54.881	34.955	75.395	4.299	25.477	34.035
Emerald											
Brook Trout	304	21.916	0.000	33.295	0.000	216.986	156.459	76.124	148.577	0.000	19.822
Brook Trout	294	92.998	89.374	51.857	0.000	292.842	207.646	183.023	143.781	18.064	90.665
Rainbow Trout	212	42.661	178.655	32.157	0.000	163.825	100.426	158.193	188.220	16.552	64.567

Table 6: PCBs in trout (wet weight)

Brook Trout	244	48.257	48.570	15.393	0.000	74.145	45.931	105.551	34.559	17.408	42.173
Brook Trout	338	48.386	36.636	65.496	27.394	227.690	151.198	68.406	65.605	11.719	35.822
Brook Trout	209	62.244	42.983	23.565	0.000	95.556	52.314	100.697	31.778	9.958	44.686
Rainbow Trout	161	12.417	0.000	13.606	0.000	44.901	14.875	9.630	16.546	0.000	18.285
Brook Trout	230	0.000	0.000	0.000	0.000	27.313	29.944	16.633	49.578	0.000	3.215
Brook Trout	335	37.809	9.115	41.989	0.000	157.062	177.143	51.289	92.299	6.450	20.457
Rainbow Trout	211	36.124	29.405	20.208	0.000	85.873	50.072	78.731	64.838	9.929	29.067
Brook Trout	320	51.980	0.000	74.868	24.003	374.883	280.012	87.886	147.225	0.000	37.247
Brook Trout	255	155.445	151.522	56.865	0.000	171.755	123.003	305.130	114.882	14.281	131.079
Moraine											
Brook Trout	258	13.911	9.380	27.037	0.000	91.066	277.667	0.000	47.403	4.418	28.379
Brook Trout	224	72.185	65.519	66.985	0.000	180.481	402.489	189.169	153.981	44.842	94.483
Brook Trout	262	24.431	17.807	72.030	0.000	210.055	474.676	51.867	89.331	11.919	66.223
Brook Trout	243	35.783	18.512	57.941	0.000	194.906	521.973	0.000	71.338	8.861	63.418
Brook Trout	278	47.378	27.810	88.843	10.882	355.201	828.828	86.066	102.499	18.140	118.844
Brook Trout	243	21.476	16.907	50.019	17.873	156.426	345.936	78.647	68.694	6.623	46.387
Brook Trout	290	28.064	18.574	56.237	20.275	177.685	325.553	47.594	75.353	8.316	51.715
Brook Trout	183	51.397	38.432	56.371	42.014	194.835	272.784	68.903	106.783	15.669	71.583
Bighorn											
Brook Trout	280	23.394	12.706	22.905	0.000	119.174	126.259	32.825	0.000	9.077	42.308
Brook Trout	264	57.643	52.162	28.172	0.000	161.182	42.740	45.528	0.000	13.351	99.397
Brook Trout	305	28.622	16.792	39.240	14.941	179.539	74.303	28.315	65.327	21.414	64.357
Brook Trout	282	31.972	14.172	25.524	0.000	106.697	33.975	0.000	0.000	11.643	42.304
Brook Trout	262	34.395	19.605	44.685	0.000	279.729	195.588	68.924	0.000	32.803	82.552
Brook Trout	238	16.955	3.461	21.528	10.926	104.841	67.035	0.000	0.000	11.229	62.080
Brook Trout	298	34.521	20.996	35.369	15.356	121.282	135.152	94.079	0.000	7.221	89.490
Brook Trout	270	19.934	16.755	34.766	0.000	141.285	109.775	44.362	0.000	17.062	37.545
Brook Trout	270	18.014	8.796	24.369	0.000	158.216	89.391	19.034	0.000	11.512	52.350
Brook Trout	224	14.767	10.200	13.237	0.000	72.783	130.575	26.698	0.000	4.537	71.860
Brook Trout	320	40.104	19.044	42.417	0.000	198.526	27.729	0.000	40.946	12.096	64.678

Table 6: PCBs in trout (wet weight)

Species	Length	177	202-171-156	173	157-200	172	197	180	193	191	199
Shere											
Brook Trout	309	7.378	9.884	0.000	0.223	0.335	3.409	60.251	0.665	0.000	2.508
Brook Trout	363	6.801	1.936	0.000	0.000	0.000	0.000	54.645	0.000	0.000	0.000
Brook Trout	376	11.616	2.918	0.000	0.000	0.000	0.000	56.228	0.000	48.725	46.507
Brook Trout	324	7.087	8.305	0.000	0.000	0.731	0.000	51.215	0.000	0.000	1.497
Brook Trout	312	8.401	7.382	0.000	1.650	0.000	0.000	71.336	0.000	0.000	1.013
Brook Trout	265	3.969	0.000	0.000	0.000	0.000	0.000	45.016	0.000	0.000	0.000
Brook Trout	355	6.501	0.000	0.000	0.000	0.000	0.000	59.062	0.000	0.000	39.512
Brook Trout	297	6.018	15.696	0.000	0.000	0.000	0.000	56.232	0.000	0.000	0.000
Brook Trout	425	12.366	5.523	0.000	0.000	0.000	0.000	122.563	0.000	0.000	1.536
Brook Trout	297	4.671	5.648	0.000	0.000	0.000	0.000	47.758	0.000	0.000	0.000
Brook Trout	321	10.079	19.924	3.498	5.460	5.337	2.874	43.553	7.613	19.668	22.419
Pyramid											
Lake Trout	516	64.665	100.676	0.000	7.662	17.814	0.000	850.394	6.570	0.000	33.093
Lake Trout	532	0.000	0.000	0.000	0.161	0.000	0.000	21.004	0.000	0.000	0.000
Lake Trout	424	14.671	8.279	0.000	0.000	0.292	0.000	394.194	0.000	5.476	16.944
Lake Trout	468	15.950	17.229	0.000	0.000	0.000	0.000	440.032	0.000	4.106	29.993
Lake Trout	492	105.208	144.332	0.000	17.227	34.948	0.000	1310.794	0.000	0.000	41.369
Lake Trout	519	102.411	171.378	0.000	28.966	43.301	10.542	968.197	31.984	21.195	65.049
Lake Trout	396	11.172	0.000	0.000	0.000	0.000	0.000	343.628	0.000	0.000	4.637
Lake Trout	513	44.809	69.404	0.000	1.967	13.509	1.912	640.497	11.806	0.000	27.345
Lake Trout	521	43.705	59.636	0.000	0.000	11.180	0.000	736.283	3.015	0.000	33.187
Lake Trout	532	42.370	83.265	0.000	3.920	5.947	0.000	610.956	4.754	0.000	28.921
Lake Trout	482	64.782	180.831	0.000	8.682	18.042	4.673	4945.321	17.263	9.698	32.544
Patricia											
Rainbow Trout	433	91.498	239.940	0.000	0.000	65.232	10.667	597.738	29.307	32.658	37.710
Lake Trout	589	709.631	864.480	0.000	230.518	322.748	58.079	3929.104	296.900	0.000	522.124
Brook Trout	273	54.938	109.025	0.000	0.000	42.216	5.507	407.825	23.948	17.695	25.228
Lake Trout	468	263.975	328.894	0.000	120.393	123.258	40.201	1194.471	87.812	0.000	324.828
Lake Trout	524	408.628	510.186	0.000	163.770	184.070	25.904	2251.020	0.000	0.000	453.176
Rainbow Trout	346	105.406	217.932	0.000	26.395	96.023	0.000	815.311	63.795	37.975	56.557
Lake Trout		643.880	799.325	0.000	189.586	303.433	55.119	3567.041	228.645	0.000	512.335
Lake Trout	273	0.000	251.867	0.000	78.268	94.723	20.678	902.048	56.035	0.000	202.718
Rainbow Trout		107.243	214.574	0.000	0.000	95.261	0.000	827.074	62.251	57.146	56.306
Lake Trout		497.555	622.798	0.000	212.629	198.929	0.000	2653.255	0.000	0.000	464.005
Lake Trout	521	509.951	582.479	0.000	185.143	227.930	0.000	2735.345	200.026	0.000	488.470

Table 6: PCBs in trout (wet weight)

Moab											
Bull Trout	305	11.882	0.000	0.000	0.000	0.000	0.449	37.046	27.505	0.000	0.266
Rainbow Trout	228	0.000	0.000	0.000	0.353	0.000	0.000	46.052	0.000	0.000	0.000
Rainbow Trout	287	23.922	29.809	0.000	128.953	6.977	13.198	129.587	28.345	0.000	0.000
Bull Trout	422	36.554	0.000	0.000	0.000	0.000	2.942	98.636	0.000	0.000	0.000
Rainbow Trout	210	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rainbow Trout	334	10.983	0.000	0.000	0.000	0.000	0.000	55.464	0.000	0.000	0.000
Rainbow Trout	206	0.000	0.000	0.000	0.000	0.000	0.000	34.175	0.000	0.000	0.000
Lake Trout	373	51.511	0.000	0.000	0.000	0.000	0.000	119.150	0.000	0.000	0.000
Rainbow Trout	330	0.000	0.000	0.000	0.000	0.000	0.000	10.989	0.000	0.000	0.000
Rainbow Trout	331	0.000	0.000	0.000	0.000	0.000	1.127	3.497	0.000	0.000	0.000
Rainbow Trout	343	0.000	0.000	0.000	0.000	0.000	0.000	12.354	0.000	0.000	0.000
Rainbow Trout	287	0.000	0.000	0.000	0.000	0.000	0.000	7.937	0.000	0.000	0.000
Rainbow Trout	337	1.133	0.000	0.000	0.000	0.000	0.000	12.985	0.000	0.000	0.000
Lake Trout	421	0.000	0.000	0.000	0.000	0.000	0.000	40.725	8.644	0.000	0.000
Lake Trout	360	2.423	0.000	0.000	0.000	0.000	0.000	33.119	10.467	0.000	0.000
Lake Trout	321	0.000	0.000	0.000	0.000	0.000	0.000	20.044	0.000	0.000	0.000
Lake Trout	398	0.000	0.000	0.000	0.000	0.000	0.000	24.055	8.601	0.000	0.000
Lake Trout	493	0.000	0.000	0.000	0.000	0.000	0.000	19.053	1.348	0.000	0.000
Bull Trout	397	0.000	0.000	0.000	0.000	0.000	0.000	19.166	0.000	0.000	0.000
Johnson											
Rainbow Trout	167	39.523	159.263	0.000	18.326	18.220	0.000	430.897	0.000	0.000	0.000
Brook Trout	166	15.177	39.080	0.000	0.000	9.840	0.000	319.282	0.000	0.000	0.000
Rainbow Trout	291	21.663	82.911	0.000	8.980	9.903	0.000	262.929	0.000	0.000	0.000
Brook Trout	264	23.360	85.296	0.000	19.314	9.134	0.000	262.068	0.000	0.000	0.000
Brook Trout	180	47.003	197.249	11.264	37.187	27.250	13.221	326.782	31.451	0.000	0.000
Brook Trout	262	9.133	26.405	0.000	0.000	0.000	0.000	136.722	0.000	0.000	0.000
Rainbow Trout	292	22.380	87.218	0.000	11.229	9.757	0.000	363.869	0.000	0.000	0.000
Brook Trout	231	7.302	24.754	0.000	0.000	4.965	0.000	178.398	0.000	0.000	0.000
Brook Trout	183	15.932	52.216	0.000	14.443	13.051	5.597	288.804	0.000	0.000	0.000
Brook Trout	237	8.784	29.281	0.000	0.000	4.311	0.000	204.505	0.000	0.000	0.000
Brook Trout	292	27.005	87.432	0.000	12.423	11.706	0.000	267.371	0.000	0.000	0.000
Brook Trout	283	21.455	82.021	0.000	8.176	14.005	0.000	183.249	0.000	0.000	0.000
Emerald											
Brook Trout	304	23.230	31.792	0.000	19.493	12.399	0.000	135.143	0.000	0.000	7.633
Brook Trout	294	48.054	167.419	0.000	37.184	35.533	18.089	292.573	33.645	27.979	18.398
Rainbow Trout	212	55.744	239.238	51.186	127.212	93.430	0.000	246.298	33.594	48.435	26.052

Table 6: PCBs in trout (wet weight)

Brook Trout	244	24.174	80.803	0.000	18.532	11.465	0.000	109.089	0.000	0.000	10.801
Brook Trout	338	37.832	98.969	0.000	28.102	32.280	18.007	265.837	29.060	31.456	23.227
Brook Trout	209	26.649	94.679	0.000	21.542	15.482	0.000	146.482	0.000	22.186	23.396
Rainbow Trout	161	7.559	12.987	0.000	8.604	0.000	0.000	61.342	0.000	0.000	0.000
Brook Trout	230	2.732	8.761	0.000	9.400	0.000	0.000	46.315	0.000	7.652	3.435
Brook Trout	335	31.687	56.677	0.000	11.481	19.995	5.675	224.833	23.930	19.931	12.968
Rainbow Trout	211	22.090	67.299	0.000	8.165	13.368	0.000	122.982	7.871	10.990	7.317
Brook Trout	320	64.181	133.492	0.000	23.923	40.044	16.308	489.076	51.119	44.716	16.006
Brook Trout	255	81.951	285.088	0.000	52.160	40.288	0.000	335.180	15.915	14.288	11.631
Moraine											
Brook Trout	258	23.528	26.237	0.000	12.819	10.864	0.000	131.285	16.658	26.227	7.181
Brook Trout	224	76.910	125.960	0.000	44.551	31.135	0.000	338.158	52.290	21.451	15.564
Brook Trout	262	60.692	56.009	0.000	26.945	22.074	0.000	293.624	40.023	51.098	47.617
Brook Trout	243	53.084	56.331	0.000	17.283	22.043	11.033	231.520	62.690	34.179	21.163
Brook Trout	278	96.727	93.139	0.000	44.123	38.810	3.993	562.114	75.420	0.000	24.350
Brook Trout	243	36.511	37.497	0.000	10.294	18.106	0.000	277.718	33.967	37.590	15.267
Brook Trout	290	55.428	39.686	0.000	12.547	22.091	0.000	232.677	37.033	24.968	12.263
Brook Trout	183	46.024	92.794	68.434	74.269	72.273	0.000	614.770	0.000	600.592	791.019
Bighorn											
Brook Trout	280	23.514	40.255	0.000	9.433	21.707	4.110	123.728	10.219	0.000	14.034
Brook Trout	264	50.167	77.892	0.000	20.241	19.460	0.000	151.551	9.616	0.000	16.733
Brook Trout	305	45.713	56.013	0.000	9.627	19.527	0.000	147.348	7.464	0.000	12.332
Brook Trout	282	37.915	37.699	0.000	13.824	16.448	0.000	96.585	4.367	0.000	12.675
Brook Trout	262	41.077	67.527	0.000	15.155	24.715	0.000	201.145	17.338	0.000	13.552
Brook Trout	238	34.685	39.633	0.000	2.853	15.758	0.000	97.229	14.334	6.244	9.947
Brook Trout	298	52.612	73.769	0.000	22.028	19.683	0.000	208.187	25.685	20.084	26.005
Brook Trout	270	24.691	39.358	0.000	4.719	13.647	0.000	124.621	0.000	0.000	7.632
Brook Trout	270	30.827	40.140	0.000	7.127	15.678	0.000	137.176	11.171	18.822	13.193
Brook Trout	224	25.446	31.615	0.000	5.183	7.884	0.000	67.282	0.000	0.000	12.938
Brook Trout	320	51.451	72.351	0.000	20.924	40.081	0.000	258.755	19.681	30.778	19.319

Table 6: PCBs in trout (wet weight)

Species	Length	170-190	198	201	203-196	189	208-195	207	194	205	206	209	total
Shere													
Brook Trout	309	46.143	5.224	15.013	16.914	0.000	9.857	15.654	2.395	0.000	5.162	7.032	1809.352
Brook Trout	363	11.409	0.000	9.214	6.673	0.000	0.000	0.000	3.054	0.000	0.000	0.000	1031.559
Brook Trout	376	380.245	0.000	0.000	67.186	0.000	0.000	41.150	0.000	0.000	3.288	0.000	1875.539
Brook Trout	324	83.553	0.769	8.013	9.879	0.000	0.000	2.420	2.863	0.000	1.105	5.289	1836.881
Brook Trout	312	104.803	0.000	7.357	6.813	0.000	3.702	0.000	1.901	0.000	0.585	17.314	1916.395
Brook Trout	265	26.388	0.000	3.877	0.000	0.000	0.000	0.000	0.243	19.094	0.000	0.000	873.798
Brook Trout	355	465.997	0.000	0.000	18.035	0.000	0.000	0.000	0.224	0.000	0.000	0.000	2865.467
Brook Trout	297	28.713	0.000	5.084	0.000	0.000	0.000	0.000	0.945	0.000	0.758	0.000	2442.015
Brook Trout	425	50.362	0.000	14.911	9.113	0.000	0.000	0.000	6.444	0.701	2.106	0.000	1692.610
Brook Trout	297	21.565	0.000	4.566	0.691	0.000	0.000	0.000	0.579	5.169	0.000	0.000	1623.304
Brook Trout	321	177.851	28.626	20.238	27.905	3.195	15.589	5.465	8.519	7.008	5.004	64.161	1889.678
Pyramid													
Lake Trout	516	84.671	0.000	40.621	32.599	0.000	18.570	0.000	22.331	49.131	2.360	12.741	8160.216
Lake Trout	532	28.054	0.000	1.672	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1690.880
Lake Trout	424	8.210	0.000	15.146	12.151	0.000	1.967	0.000	3.688	16.438	0.000	3.552	2892.817
Lake Trout	468	281.065	28.310	22.600	44.079	0.000	1.925	0.000	2.141	13.980	2.325	0.000	3684.370
Lake Trout	492	152.497	0.542	82.979	73.668	0.598	36.193	0.000	51.676	68.513	25.898	26.630	10747.870
Lake Trout	519	205.305	25.153	84.734	91.934	9.236	52.896	9.798	48.353	67.120	17.385	50.430	11486.714
Lake Trout	396	5.635	0.000	8.421	2.778	0.000	0.000	6.954	0.000	7.902	0.000	0.000	2424.675
Lake Trout	513	68.847	6.297	38.136	45.788	0.000	30.092	17.757	18.239	39.192	27.685	52.201	6094.344
Lake Trout	521	53.816	0.000	27.369	20.081	0.000	11.827	0.000	15.587	36.469	0.000	6.509	6373.323
Lake Trout	532	132.625	0.000	22.242	24.148	0.000	9.776	0.000	11.046	27.943	0.056	11.093	7518.281
Lake Trout	482	192.254	3.566	40.547	44.878	2.179	29.254	4.458	19.628	38.540	7.066	13.763	31113.311
Patricia													
Rainbow Trout	433	199.434	9.832	137.720	116.453	14.584	52.872	41.673	69.747	41.948	22.176	18.671	13150.320
Lake Trout	589	1394.436	68.752	771.732	833.940	49.835	564.690	0.000	518.706	1488.111	160.291	580.854	59406.699
Brook Trout	273	134.443	5.779	68.473	88.662	7.362	29.285	40.869	50.210	35.660	14.617	10.862	7598.751
Lake Trout	468	443.590	45.609	288.878	301.475	17.272	310.964	0.000	171.111	891.000	71.665	380.708	19755.441
Lake Trout	524	705.984	36.850	407.411	417.344	27.563	366.112	0.000	258.206	1150.186	76.825	394.451	32457.080
Rainbow Trout	346	250.970	27.033	122.095	169.295	12.206	70.057	15.130	80.655	66.931	39.644	22.898	12192.116
Lake Trout		1318.370	63.924	685.749	727.679	49.877	503.619	0.000	465.267	1424.491	150.520	573.327	51904.853
Lake Trout	273	304.458	20.819	192.739	193.683	12.837	179.563	0.000	130.393	492.722	39.541	176.841	15450.814
Rainbow Trout		250.512	27.321	121.585	169.956	12.278	72.126	15.481	81.558	67.631	41.064	23.008	13572.715
Lake Trout		747.568	0.000	492.874	580.850	36.176	428.337	0.000	295.072	1402.624	88.274	473.854	41595.325
Lake Trout	521	937.873	40.891	543.032	594.728	37.455	464.804	0.000	347.354	1203.272	106.160	436.053	39854.960

Table 6: PCBs in trout (wet weight)

Moab													
Bull Trout	305	17.382	0.000	3.832	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1591.247
Rainbow Trout	228	61.508	0.000	3.665	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3707.239
Rainbow Trout	287	112.550	11.714	32.966	46.663	0.000	13.979	17.655	11.443	0.000	10.636	12.620	7291.341
Bull Trout	422	28.081	0.000	9.594	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5051.950
Rainbow Trout	210	29.201	0.000	0.569	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1119.675
Rainbow Trout	334	28.725	0.000	6.444	2.408	0.000	0.000	0.000	0.949	0.000	0.000	0.000	2717.625
Rainbow Trout	206	32.109	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.919	0.000	2644.623
Lake Trout	373	623.472	0.000	15.925	5.405	0.000	0.000	87.837	5.988	0.000	7.902	19.211	7657.098
Rainbow Trout	330	5.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1131.470
Rainbow Trout	331	13.129	0.000	11.150	6.209	0.000	0.000	16.920	0.000	0.000	4.686	0.000	504.921
Rainbow Trout	343	32.841	0.000	0.850	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	904.602
Rainbow Trout	287	16.739	0.000	0.000	0.000	0.000	0.000	0.660	0.000	0.000	0.000	0.000	567.798
Rainbow Trout	337	2.973	0.000	1.894	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	572.419
Lake Trout	421	24.499	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1574.286
Lake Trout	360	38.200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2288.014
Lake Trout	321	46.501	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1644.235
Lake Trout	398	41.647	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2091.510
Lake Trout	493	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1154.791
Bull Trout	397	1.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	846.803
Johnson													
Rainbow Trout	167	0.000	0.000	30.926	35.411	0.000	14.360	0.000	20.359	36.721	8.064	8.533	10765.877
Brook Trout	166	0.000	0.000	30.111	26.924	0.000	0.000	0.000	0.000	51.856	15.527	0.000	3126.601
Rainbow Trout	291	0.000	0.000	18.647	20.256	0.000	10.115	0.000	10.401	16.630	5.119	0.000	5445.540
Brook Trout	264	0.000	0.000	17.955	20.337	0.000	0.000	0.000	13.170	12.666	0.000	0.000	5080.350
Brook Trout	180	0.000	12.845	42.145	64.852	0.000	37.907	20.194	31.675	28.710	22.479	22.113	11425.440
Brook Trout	262	0.000	0.000	8.791	10.054	0.000	0.000	0.000	0.000	12.751	5.572	0.000	1401.588
Rainbow Trout	292	0.000	0.000	20.952	21.883	0.000	0.000	0.000	13.443	16.941	6.292	0.000	5400.206
Brook Trout	231	0.000	0.000	9.461	11.728	0.000	0.000	4.744	7.086	19.090	5.619	0.000	1514.997
Brook Trout	183	0.000	0.000	15.397	18.508	0.000	0.000	14.215	17.453	15.417	7.761	0.000	2310.537
Brook Trout	237	0.000	0.000	11.995	11.153	0.000	0.000	0.000	8.296	31.541	6.403	0.000	1624.823
Brook Trout	292	0.000	0.000	17.974	18.784	0.000	9.748	0.000	11.296	15.203	4.654	9.974	5409.369
Brook Trout	283	0.000	9.759	20.067	24.875	0.000	0.000	0.000	0.000	0.000	10.614	0.000	6529.785
Emerald													
Brook Trout	304	66.831	0.000	43.481	51.334	0.000	23.669	2.522	28.412	8.228	24.819	7.501	3514.602
Brook Trout	294	124.857	0.000	43.854	49.100	0.000	21.804	-3.847	24.800	7.140	13.888	0.000	13841.137
Rainbow Trout	212	225.694	0.000	72.087	77.493	117.513	74.148	0.000	168.823	81.543	46.789	0.000	7454.169

Table 6: PCBs in trout (wet weight)

Brook Trout	244	16.019	0.000	25.026	31.289	0.000	8.193	0.000	15.163	0.000	13.492	0.000	5666.883
Brook Trout	338	97.009	15.936	69.496	96.914	12.597	44.694	13.984	63.001	26.789	47.812	17.048	6880.212
Brook Trout	209	87.916	0.000	28.794	40.398	0.000	13.758	3.732	27.938	11.772	15.922	0.000	7767.649
Rainbow Trout	161	77.098	0.000	15.667	21.548	0.000	0.000	0.000	13.329	0.000	8.673	0.000	1722.826
Brook Trout	230	0.000	0.000	10.527	13.677	0.000	0.000	1.247	7.748	0.000	5.147	0.000	1061.029
Brook Trout	335	41.299	0.000	57.272	71.432	0.000	23.224	3.366	49.343	12.744	42.012	0.000	4283.442
Rainbow Trout	211	40.054	0.000	33.170	36.979	0.000	5.289	31.981	23.103	5.533	18.712	0.000	5826.230
Brook Trout	320	251.633	6.684	94.735	107.614	4.292	44.574	2.656	85.952	15.920	40.176	22.136	7293.959
Brook Trout	255	173.326	0.000	57.249	66.484	5.881	26.277	0.000	35.082	0.000	25.642	0.000	23593.111
Moraine													
Brook Trout	258	0.000	0.000	31.821	33.891	0.000	0.000	1.140	27.677	8.737	11.371	0.000	2871.410
Brook Trout	224	60.485	0.000	46.648	60.645	0.000	19.964	4.485	47.022	13.073	14.628	0.000	12365.527
Brook Trout	262	297.424	25.376	78.024	94.675	0.000	23.451	3.060	41.821	48.640	18.178	53.871	6169.927
Brook Trout	243	0.000	0.000	51.536	64.418	0.000	23.862	4.072	40.232	12.827	19.781	0.000	6280.936
Brook Trout	278	41.899	0.000	94.699	96.709	0.000	35.356	0.000	74.169	59.517	27.842	0.412	8878.038
Brook Trout	243	0.000	0.000	43.471	48.769	5.302	21.188	0.000	35.102	18.557	12.851	0.000	5713.390
Brook Trout	290	0.000	0.000	53.552	54.302	0.000	16.028	0.000	38.445	13.895	16.659	0.000	4928.131
Brook Trout	183	6429.055	0.000	0.000	721.008	14.235	26.853	15.494	63.118	37.578	47.351	0.000	15869.110
Bighorn													
Brook Trout	280	79.020	0.000	37.277	33.088	0.000	11.736	1.817	24.378	20.090	22.744	0.000	4997.215
Brook Trout	264	86.234	0.000	44.584	41.139	0.000	13.609	0.164	37.915	19.547	30.051	0.000	9245.061
Brook Trout	305	16.644	0.000	50.171	46.105	0.000	13.673	4.929	38.561	7.239	34.662	0.000	5930.109
Brook Trout	282	86.753	0.000	34.159	30.959	0.000	9.129	0.765	29.080	13.504	24.051	0.000	4437.667
Brook Trout	262	0.000	0.000	66.561	58.707	0.000	17.454	20.324	48.917	8.308	46.396	0.000	8781.419
Brook Trout	238	0.000	0.000	27.926	27.136	0.000	9.417	0.037	26.036	0.000	19.810	0.000	4050.136
Brook Trout	298	293.515	0.000	30.763	32.186	0.000	11.305	0.000	24.476	21.563	14.150	0.000	7702.506
Brook Trout	270	0.000	0.000	39.455	32.806	0.000	15.026	6.998	31.178	10.164	24.681	0.000	3620.680
Brook Trout	270	5.153	0.000	42.782	36.076	0.000	11.425	11.562	32.077	6.943	24.239	0.000	4006.287
Brook Trout	224	89.342	0.000	18.185	18.759	0.000	0.000	0.000	17.981	0.000	17.973	0.000	5485.844
Brook Trout	320	86.835	0.000	73.665	75.299	0.000	23.037	7.544	65.074	21.705	43.484	0.000	4880.064

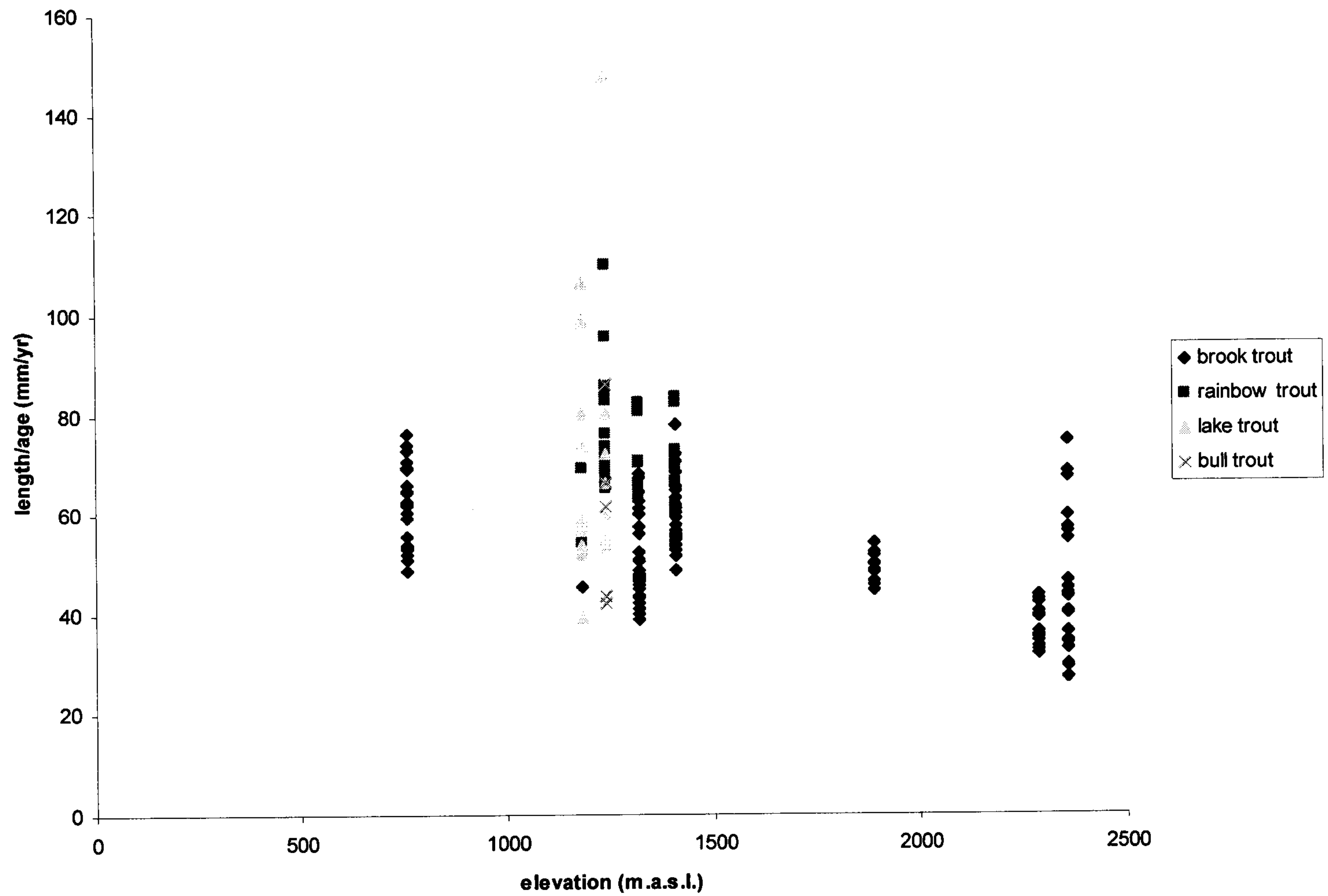

Figure 1: Relationship of trout species length (age normalized) vs elevation. The overlap in this figure justifies the lumping of all species in analysis.

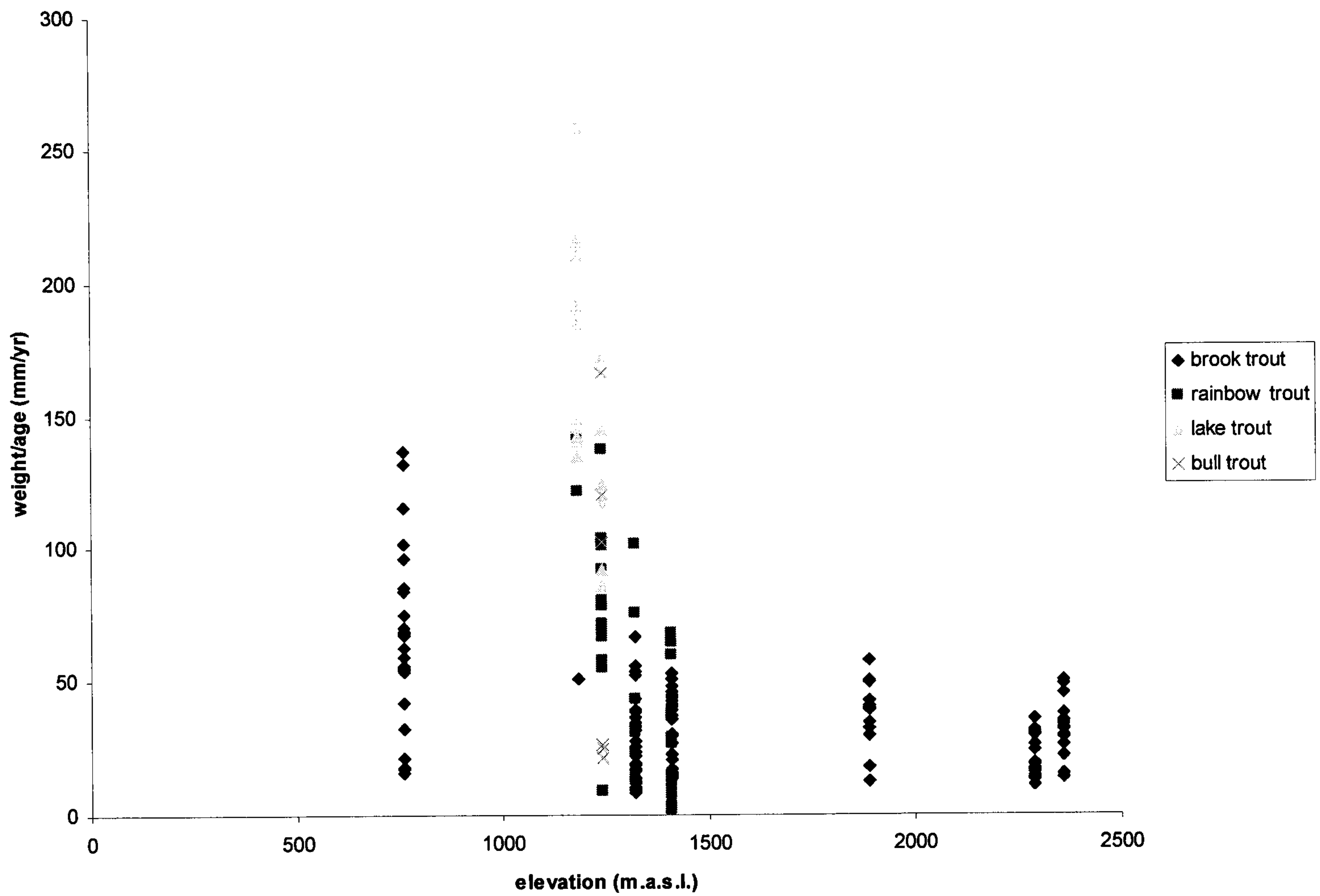

Figure 2: Relationship of trout species weight (age normalized) vs elevation. The overlap in this figure justifies the lumping of all species in analysis.

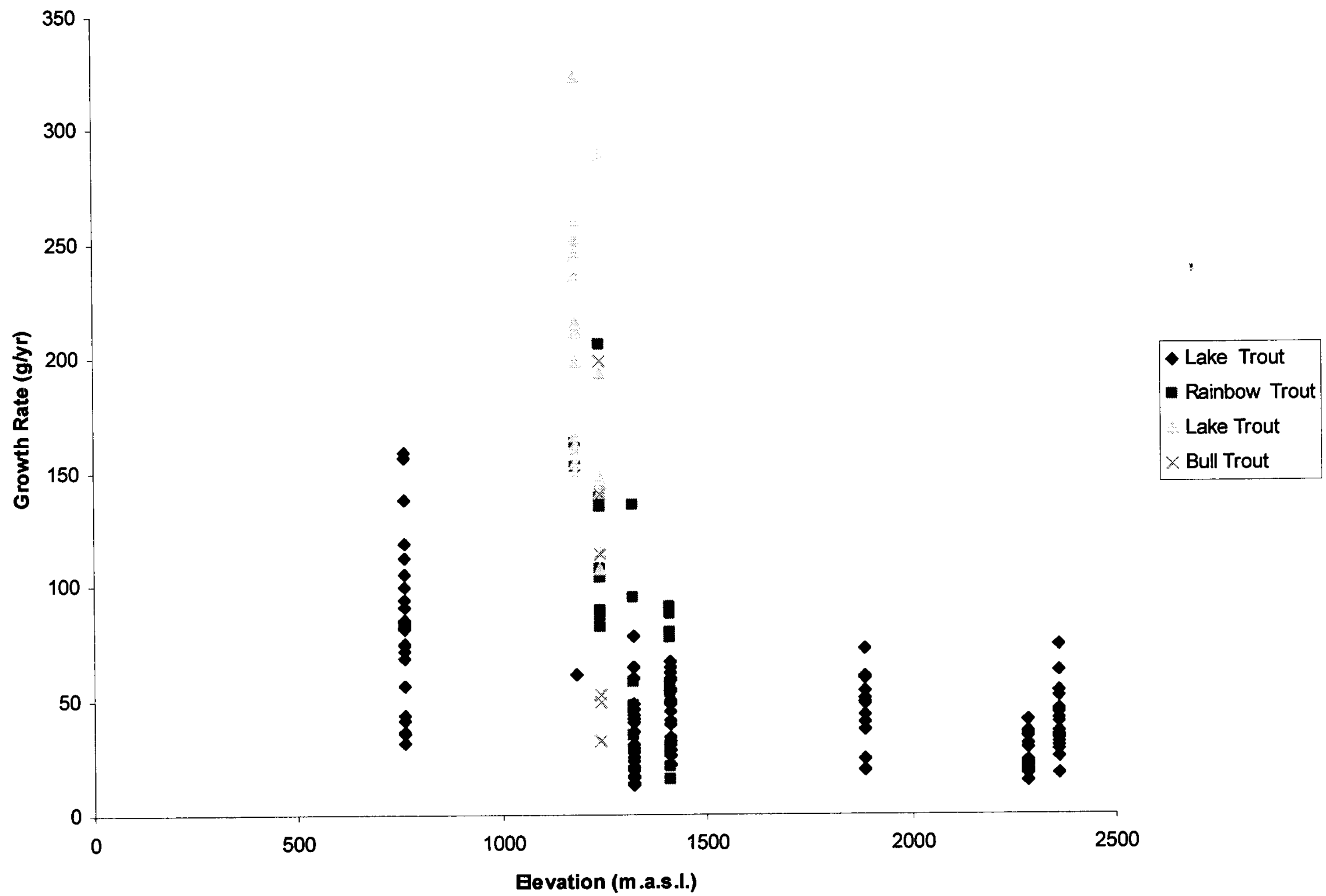

Figure 3: Relationship of trout species growth rate vs elevation. The overlap in this figure justifies the lumping of all species in analysis.

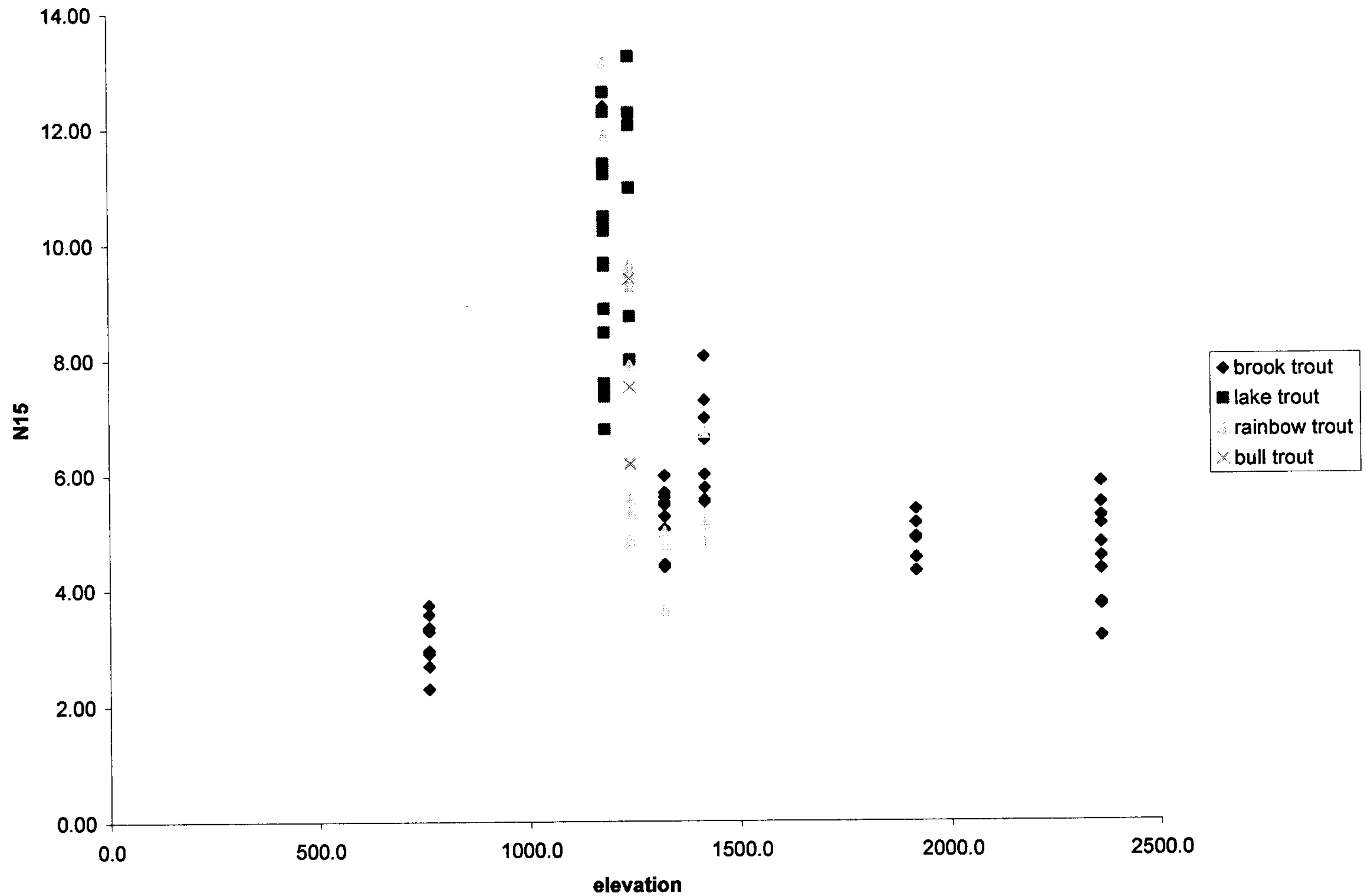

Figure 4: Relationship of trout species $\delta^{15}N$ vs elevation. The overlap in this figure justifies the lumping of all species in analysis.

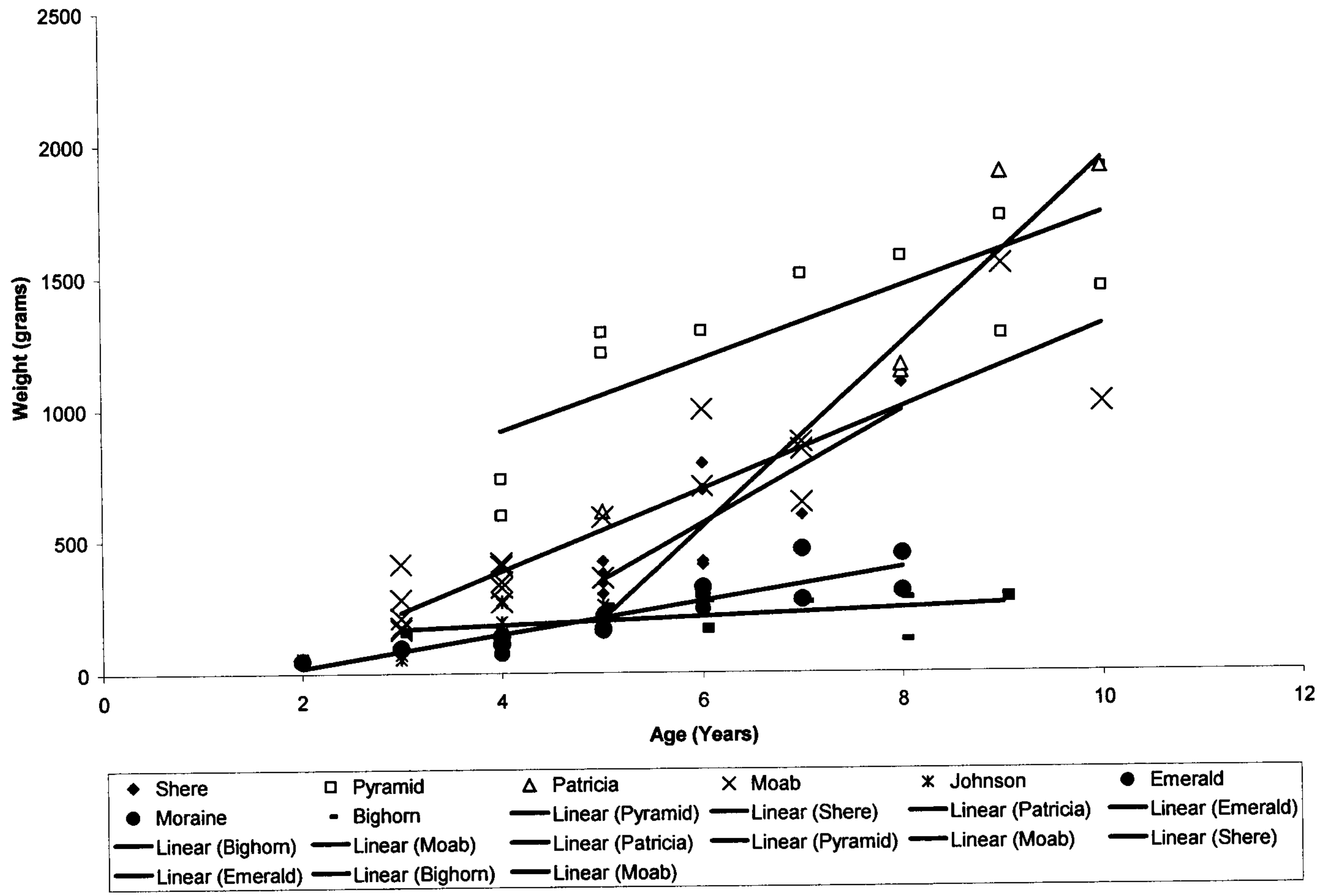

Figure 5: Graph showing the linear relationship between weight and age.

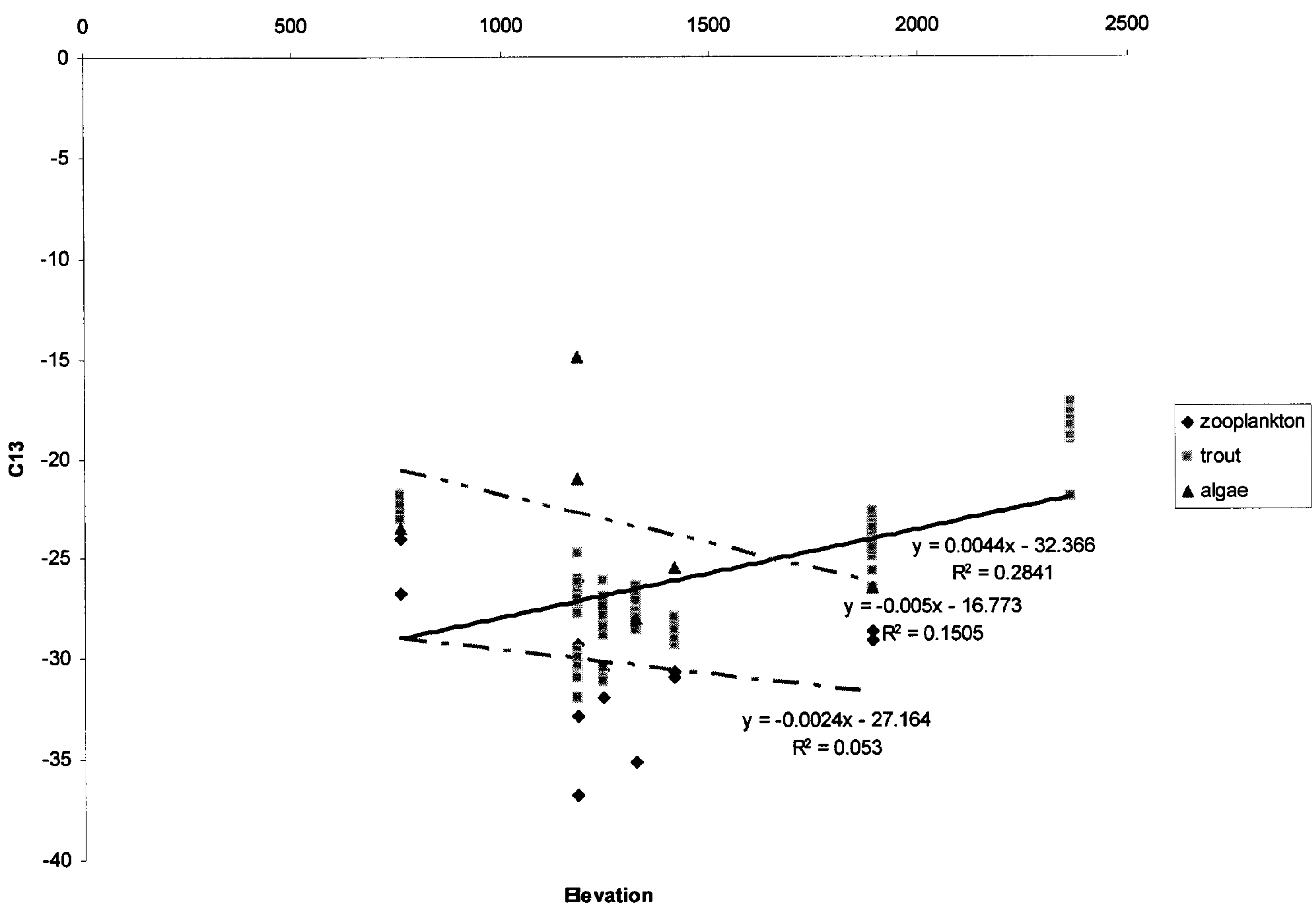

Figure 6: Relationship of $\delta^{13}C$ vs elevation for algae, zooplankton, and algae.