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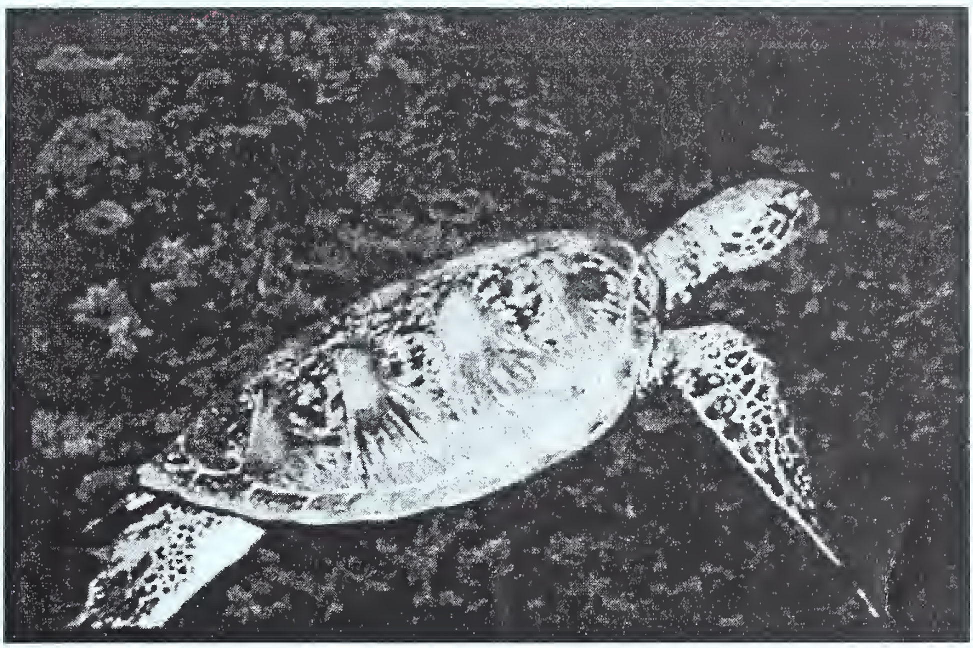
SEA TURTLE CONTAMINANTS:
A Review with Annotated Bibliography



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Donald L. Evans, Secretary

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PREFACE

This annotated bibliography and review was developed from published literature on environmental contaminants in all species of marine turtles, world-wide. All seven species of marine turtles have been listed on Appendix I of the Convention of International Trade in Endangered Species (CITES) since 1981, and are classified as either threatened or endangered by national and international regulations among individual populations and ranges. Sea turtles are protected by law in most regions of the world, which makes the collection of specimens difficult for researchers. This may contribute to the fact that existing data on contaminants in sea turtle tissues and eggs are scarce.

For comparative purposes, additional information has been added to this report on contaminants in the snapping turtle (*Chelydra serpentina)*, and related health effects. The snapping turtle is one of the most often used turtle species to monitor contaminants in freshwater environments and because they are relatively large in size, the tissues are readily obtained for analyses. Previous studies have shown that high levels of contaminants in freshwater turtles have associated effects, which may include embryonic and hatchling deformities.

This report is divided into three sections: (1) a synthesis of information based on the review, (2) tables that summarize the published data, and (3) an annotated bibliography, listing references that pertain to marine turtles and contaminants. The annotated bibliography is provided as a hard copy in this report, as well as on PC disk (Pro-Cite 5.0 for Windows). The Pro-Cite program will allow for entering additional references to this bibliography as they are published. The bibliography is divided into two parts, a database for references containing vital information on sea turtles, all species, and a second supplemental database that includes research relating to contaminants and freshwater turtles, particularly snapping turtles. Currently, 83 references are entered, each including an abstract and a keyword index. The abstracts, where possible, have been taken directly from the cited articles and books but many of the "gray literature" and other reports have no abstracts; therefore, if the paper was available, abstracts have been written for inclusion in this bibliography.

One additional annotated bibliography has been completed in a similar format on harbor seals (*Phoca vitulina*) in Alaska. More annotated bibliographies are also planned and will include the following marine vertebrates: (1) additional marine mammal species and (2) colonial seabirds. These bibliographies will provide initial guides to the literature on contaminants in these organisms, and will be published in hard copy report form and on PC disks in Pro-Cite 5.0 for Windows. PC disks containing the current bibliographies can be obtained by contacting:

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DISCLAIMER

Certain commercial equipment or instruments are identified in this paper to specify adequately the experimental procedures. Such identification does not imply recommendations or endorsement by the National Institute of Standards and Technology nor does it imply that the equipment or instruments are the best available for the purpose.

SECTION I

CONTAMINANTS IN SEA TURTLES: A SUMMARY OF THE AVAILABLE DATA

BACKGROUND

There are seven living species and one subspecies of marine turtles belonging to two families, Cheloniidae and Dermochelyidae. Five species, the loggerhead (*Caretta caretta*), green turtle (*Chelonia mydas mydas*), hawksbill (*Eretmochelys imbricata*), Kemp's ridley (*Lepidochelys kempii*), olive ridley (*Lepidochelys olivaceaf*), and flatback turtle (*Natator depressus*), along with one subspecies, East Pacific green or black turtle (*Chelonia mydas agassizi*) belong to the family Cheloniidae (Meyers-Schone and Walton, 1994). The leatherback turtle (*Dermochelys coriacea*) is the only species that belongs to the Dermochelyidae family. Sea turtles inhabit tropical and subtropical seas throughout the world and while their distribution and habitats are species-specific, all species can be found in the U.S. coastal waters of the Atlantic Ocean and/or Gulf of Mexico except for the Australian flatback and black turtle. There are several common characteristics that all species of marine turtles share: a two-part shell (the upper carapace and lower plastron), relatively nonretractile extremities, extensively roofed skulls, and paddle-like flippers with one or two claws (National Research Council, 1990). The leatherback is the only turtle that does not have a hard shell, but instead, a tough, rubbery leather-like shell. Sea turtles are relatively large animals (35 kg to 500 kg) that spend their entire lives at sea, with the exception of nesting. Female turtles swim ashore to lay their eggs in nests they create in the sand. Hatchling turtles emerge from the sand approximately two months later and swim off to sea (National Research Council, 1990).

A comparison of the diets and habitats for eight species of sea turtles is summarized in Table I.1. The food habits of sea turtles are species-specific and have been reviewed by Bjorndal (1997). Adult loggerhead turtles are carnivorous, primarily feeding on benthic invertebrates, such as molluscs and crustaceans. They prefer to feed in coastal bays and estuaries, along with shallow water along the continental shelves of the Atlantic, Pacific, and Indian Oceans. Juvenile green turtles are omnivorous, eating a variety of foods but as they mature they become herbivorous with a diet consisting mainly of sea grass. These turtles mostly spend their lives in bays and protected shores near Central America, the Bahamas, and the United States. The black turtle subspecies is found along the west coasts of North, Central, and South America and has similar food habits as the green turtle. The green turtle and black turtle are the only sea turtles that are strictly herbivorous as adults. The hawksbill turtle diet consists of sponges, including siliceous species (Meylan, 1988) as well as shrimp, squid, and anemones. They are found in tropical regions predominantly in coastal reefs, rocky areas and lagoons of the Atlantic, Pacific, and Indian Oceans. The Kemp's ridley and olive ridleys have similar diets as loggerheads. They are carnivorous feeding on bottom dwelling crustaceans, squid, sea urchins, fish, and jellyfish. The olive ridleys are found in the tropical regions of the Pacific, Indian, and Atlantic Oceans while the Kemp's ridleys live mostly in the Gulf of Mexico but some occur along the Atlantic coast (Hildebrand, 1982). The diet of the Australian flatback consists of sea cucumbers, jellyfish, mollusks, and other invertebrates as well as seaweed. They have the most restricted range, limited to the turbid inshore waters and bays of the northwestern, northern, and northeastern regions of Australia. The leatherback is the most pelagic of all the species and feeds almost exclusively on jellyfish. They range from northern Alaska to the southern tip of Africa and are primarily found in open ocean.

Since 1981, all species of marine turtles have been listed on Appendix I of the Convention of International Trade in Endangered Species (CITES) (Hutchinson and Simmonds, 1994). Individual populations have also received different classifications in different countries. Most populations of sea turtles are considered threatened or endangered by national and international regulations and are protected by law. The decline of sea turtles has caused concern among scientists and one of the many possible threats to these animals are environmental contaminants. Sea turtles live most of their lives at sea, are relatively long-lived, widely distributed, and utilize a number of different habitats. These characteristics could make them a target for the bioaccumulation of environmental contaminants.

Table. I.1. Comparison of diet and habitat for eight species of sea turtles.

Species	Diet	Habitat
Loggerhead (*Caretta caretta*)	benthic invertebrates: molluscs and crustaceans	coastal bays, shallow continental shelf
Green Turtle (*Chelonia mydas mydas*)	omnivorous (young) herbivorous (adult)	nearshore; coastal bays
Black Turtle (*Chelonia mydas agassizi*)	omnivorous (young) herbivorous (adult)	nearshore; coastal bays
Hawksbill (*Eretmochelys imbricata*)	sponges, shrimp, squid, anemones	coastal areas, reefs, and lagoons
Kemp's ridley (*Lepidochelys kempii*)	fish and benthic invertebrates: crustaceans, squid, sea urchins, jellyfish	coastal bays, shallow continental shelf
Olive ridley (*Lepidochelys olivacea*)	fish and benthic invertebrates: crustaceans, squid, sea urchins, jellyfish	coastal bays, shallow continental shelf
Flatback (*Natator depressus*)	sea weed and invertebrates: sea cucumbers, jellyfish, molluscs	turbid inshore waters; bays limited to Australia
Leatherback (*Dermochelys coriacea*)	jellyfish	pelagic

There has not been any direct correlation between sea turtle mortalities and high contaminant levels. However, some studies have reported levels of chlorinated pesticides and other organochlorine compounds higher in sea turtles than in fish, as well as studies of other species, such as freshwater turtles, have shown associated effects that may include embryonic and hatchling deformities (Hutchinson and Simmonds, 1994). Past studies have reported polychlorinated biphenyl (PCB) levels in sea turtles but most of them only report the total PCB concentrations, not individual congeners (Thompson et al., 1974). An extensive review on turtles and environmental contaminants was published by Meyers-Schone and Walton (1994), but the majority of the studies were related to freshwater species. Therefore, a database needs to be established that will allow scientists to determine what role organochlorines and other contaminants may have in the decline of sea turtle populations. The development of this database, existing data, and literature on contaminants in sea turtles, as well as literature on snapping turtles to be used for comparative values, have been compiled and reviewed.

Currently, 83 references have been entered into the bibliography (Section III) that pertain to sea turtles worldwide, and snapping turtles in association with environmental contaminants, such as persistent chlorinated compounds, heavy metals, petroleum hydrocarbons from oil spills, and radionuclides. Of these 83 references, 36 deal with persistent chlorinated compounds (primarily PCBs and DDT) and metals in sea turtles, 23 address petroleum effects, one paper deals with radionuclides, and 15 concern snapping turtles.

PERSISTENT CHLORINATED COMPOUNDS

Persistent organic pollutants, which are usually defined as chemicals that require 2 years to 5 years for 75 % to 100% disappearance of residues from the site of application (Menzer and Nelson, 1980), include persistent chlorinated compounds, such as PCBs, hexachlorobenzene (HCB), dioxins, furans, chlorinated pesticides (i.e., DDT, dieldrin, chlordane, endrin, toxaphene, hexachlorocyclohexane [HCH], mirex, and kepone), and some non-chlorinated organic compounds, such as polycyclic aromatic hydrocarbons (PAHs). The geographic distribution of published data on persistent chlorinated compounds in sea turtle tissues and eggs is shown in Figures I.1 and I.2, respectively. For the United States, published tissue concentration data are limited to loggerhead, Kemps ridley, and green turtles (Lake et al., 1994; Rybitski, 1994, 1995; Rybitski et al., 1995; McKim and Johnson, 1983), while egg concentration data have only been published for loggerheads (Clark and Krynitsky, 1980; Wood and Cobb, 1994; Cobb and Wood, 1997). Comparative data are available for loggerhead and green turtles in the Mediterranean Sea (Mckenzie et al., 1999), loggerhead and leatherbacks in the Atlantic waters of the United Kingdom (Mckenzie et al., 1999), leatherbacks in the Mediterranean (Vicente, 1982), and green turtles nesting on Ascension Island in the South Atlantic (Thompson et al., 1974).

The following persistent chlorinated compounds have been reported in the fat, livers, and eggs of sea turtles: PCBs (expressed as Aroclors, sum of congeners, and congener-specific data), DDT (expressed as total DDT and as isomers of DDT, DDD, and DDE), chlordane compounds (*cis*-chlordane, oxychlordane, *trans*-nonachlor, and heptachlor expoxide), endrin, and dieldrin (see Section II, Tables II.1 and II.2). No data are available for HCB and toxaphene, and a very small number of data are available for HCH in loggerheads from the Mediterranean (Mckenzie et al., 1999)

Figure I.1. Persistent chlorinated compounds reported in sea turtle tissues. [1]Long Island, New York (Lake et al., 1994); [2]Virginia and North Carolina (Rybitski, 1994; Rybitski, 1995; Rybitski et al., 1995); [3]Florida Atlantic (McKim and Johnson (1983); [4]United Kingdom and Cyprus, Mediterranean (Mckenzie et al., 1999); [5]Mediterranean (Vicente, 1982).

Figure I.2. Persistent chlorinated compounds reported in sea turtle eggs. [1]Ascension Island (Thompson et al., 1974); [2]Florida Atlantic (Clark and Krynitsky, 1980); [3]South Carolina (Cobb and Wood, 1997; Wood and Cobb, 1994); [4]Cyprus, Mediterranean (Mckenzie et al., 1999).

and mirex in loggerhead eggs from Florida (Clark and Krynitsky, 1980).

Polychlorinated biphenyls (PCBs). Much of the past data on PCBs in environmental samples are presented as "total" PCBs or represented as the amount of technical mixtures (Aroclors, Clophens, etc.). Expressing the data in terms of technical mixtures has come about through the use of commercial technical mixtures as reference materials. With the development of high-resolution gas chromatography with electron capture detection (GC-ECD), the individual PCBs congeners are now routinely separated, identified, and quantified. Rather than using technical mixtures as reference materials, the individual congeners of interest can then be used for comparison.

The value of congener-specific analysis is apparent when the composition of various commercial mixtures with different overall chlorine contents differs from those of environmental mixtures, although technical mixtures are the original source of PCBs in the environment (Duinker et al. 1988). The sum of PCBs may be appropriate for identifying hot spots and trend monitoring, but a real understanding of the "trends" and the ability to interpret the meaning of the data requires identification and quantification of individual congeners. This requirement is emphasized by the fact that although PCBs are metabolized by a wide variety of organisms, not all congeners are metabolized at the same rate, nor are all congeners labile (Kannan et al. 1989). In addition, some congeners are apparently more toxic than others. For example, based on toxicity that is similar to that of 2,3,7,8- tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD), the PCBs with the molecules in planar configuration (i.e., PCB-77, -126, and -169) and mono-ortho substituted derivatives of the planar compounds (i.e., PCB-105 and -118) have higher toxicities than other PCB congeners. Although there are no data on planar PCBs in sea turtles, the few data on these compounds in marine vertebrates suggest that they probably contribute a minor fraction to the total PCB congener concentrations in sea turtle tissues, the more highly concentrated ortho-substituted PCB congeners contributing more to the toxicity of these compounds (Tanabe et al. 1989; 1997), and Herbert et al. (1993) suggest that PCB-105 may be an important contributor to the toxic burden of the freshwater snapping turtle, *Chelydra serpentina*, in southern Ontario, Canada).

The older published PCB concentration data on sea turtles are reported on the basis of equivalents of commercial Aroclors (i.e., Aroclor 1254, 1242, 1248, or 1260) (McKim and Johnson, 1983, Clark and Krynitsky, 1980). This presents great difficulty in comparing these older data with the more recent congener-specific data, since the more recent data are not directly comparable with older PCB data reported on the basis of Aroclors or Clophens. The earliest PCB data were particularly reported as Aroclor 1254, which has been found to be an overestimate of as much as 200 % when compared to more recent reporting of the sum of PCB congeners (Norstrom et al., 1988; Eganhouse and Gossett, 1991). In addition, if all the congeners present in a sample were analyzed, their sum would be equal to the total PCBs. However, not all congeners can be clearly separated. In most cases this sum does not equal the total, but something less; how much less is usually unknown. An additional difficulty arises when data are reported as homologs, i.e., congeners grouped according to degree of chlorination (Cobb and Wood, 1997), rather than congener specific. Other problems for comparison of data and information from different publications include reporting concentration values for different tissue types (fat, liver, kidney, muscle) and reporting values based on different mass values (wet mass, lipid mass) and not providing conversion factors.

PCB congeners that have been reported in sea turtle tissues include: PCB-28, -52, -101, -132, -118,

-153, -138, -187, -170, -180, -187, and -190 (Section II, Tables II.1 and II.2) Because of different extraction and analytical techniques used in measuring PCBs in environmental specimens, the number and kinds of congeners reported are not consistent between laboratories. However, PCB-153 is routinely reported by all laboratories. This relatively non-toxic congener is highly resistant to metabolic breakdown, is passed up the food chain relatively unaffected, and almost always dominates the concentration of PCBs in animal tissues. PCB-153 is, therefore, a good congener for comparing relative differences in PCB concentrations among different populations of animals and among different laboratories and data sets, if congener-specific data are reported.

PCB 153 has been reported in the tissues of Kemp's ridleys and loggerheads from the East Coast of the U.S., loggerheads and green turtles from the Mediterranean Sea, and leatherbacks from the United Kingdom (Lake et al., 1994; Rybitski et al., 1995; Mckenzie et al., 1999) (Figure I.1; Table I.2). The highest mean values for PCB 153 concentrations in fat were reported in the Kemp's ridleys and the lowest mean values in the green turtles (Fig I.3). These values are an order of magnitude lower than PCB 153 concentrations reported by Becker et al. (1997) in the blubber of pilot whales and harbor porpoises from the East Coast of the United States, but similar to some of the lowest levels reported for marine mammals from the Alaskan arctic and subarctic areas (Fig. 1.4).

The only mono-ortho substituted congener reported from sea turtle fat is PCB 118, which has some toxicity. The relative concentration differences for this congener in Kemp's ridleys, loggerheads, green turtles, and leatherbacks are the same as that for PCB 153 (Table I.2).

DDT and Metabolites. Although many different compounds have been identified in various organisms as metabolic products of DDT (dichlorodiphenyltrichloroethane), the predominant ones in vertebrates are DDD (dichlorodiphenyldichloroethane), DDE (dichlorodiphenyldichloroethylene), and DDA (dichlorodiphenyl acetic acid) (Menzie, 1969; 1974). DDD is rarely stored as a metabolite, is unstable, and readily degrades through a series of intermediates to DDA, which is water soluble and excreted in urine. DDE is a degradation product of DDT through the loss of one molecule of HCl (dehydrohalogenation) (Meister, 1986). Metabolism of DDT to either DDE or DDD is considered to be quite fast in terms of years. DDE further degrades to DDA by the loss of two more molecules of HCL but this reaction is very slow. DDE is relatively stable and tends to persist. The persistence of DDE results in a portion of the parent compound (DDT) accumulating in the tissues as DDE.

The individual isomers of DDT and its metabolites also vary in the rates of degradation depending on the molecular arrangement of chlorine atoms. The ratio of 2,4'-DDT to 4,4'-DDT in the technical mixture is 1:4. The missing 1,4- disubstitution in one of the phenyl rings of 2,4'-DDT facilitates its degradation. The metabolites 2,4'-DDD and 2,4'-DDE are rarely found to be enhanced to the same extent as are the 4,4'-derivatives (Ballschmitter, 1980).

The degradation of DDT begins in the soil through the activity of microorganisms. DDE has a greater volatility than DDT; therefore, it is probably more easily transported through the atmosphere into areas where application has not taken place, such as to the open oceanic regions. Also one would expect the ratio, DDE/DDT, to be generally higher in the open-ocean environment and the organisms inhabiting this environment than in the coastal environment. As the DDT is metabolized and passed along the food chain, one would also expect the ratio to be higher at the upper trophic levels.

Table I.2. Comparison of concentration ranges and geometric means ± 1 standard deviation (ng/g wet mass) of chlorinated hydrocarbons measured in the fat of sea turtles from the United States waters with sea turtles from other regions.

Location	PCB 153	PCB 118	Σ DDT	4,4'-DDE	4,4'-DDE / Σ DDT	Dieldrin	Chlordane[1]	n	Date
Kemp's Ridley:									
Long Island, NY[3]	384 ± 289	221 ± 195	454 ± 298	386 ± 250	0.85	n.r.[2]	n.r.	7	1985
Atlantic	161 ± 95.6	76.8 ± 42.2	261 ± 176	232 ± 157				6	1989
VA/NC, Atlantic[4]	188 ± 105 90.4 - 283	50.0 ± 37.2 19.4 - 91.9	288 ± 48 236 - 322	176 ± 98.2 95.7 - 292	0.61	n.r.	n.r.	3	1991
Loggerhead:									
VA/NC, Atlantic[4]	97.2 ± 120 12.1 - 406	30.6 ± 57.8 4.55 - 193	121 ± 239 28.9 - 1224	108 ± 266 2.86 - 1210	0.89	n.r.	n.r.	20	1991
Cyprus, Mediterranean[5]	240 ± 17.7 229 - 261	62 ± 8.5 54 - 62	508 ± 152 391 - 739	491 ± 173 376 - 705	0.97	4.7 ± 3.1 <1.8 - 9.2	17.7 ± 11.6 12 - 33	3	1994-95
Green:									
Cyprus, Mediterranean[5]	10 ± 15 <2.2 - 32	6.0 ± 14 2.2 - 27	9.4 ± 8.2 3.3 - 23	6.5 ± 8.7 2.4 - 19	0.69 <1.9 - 3.5	2.7 ± 0.67 <1.9 - <3.2	<2.6	3	1995-96 (juveniles)
Leatherback:									
United Kingdom[5]	26.9 7.8 - 46	7.7 7.2 - 8.3	28.5 14 - 58	24.0 10 - 57	0.84	15.7 13 - 19	16.2 12 - 22	2	1993-95 (males)

[1]The sum of oxychlordane, heptachlor epoxide, and *trans*-nonachlor
[2]n.r. - not reported
[3]Lake et al. (1994)
[4]Rybitski et al. (1995)
[5]Mckenzie et al. (1999)

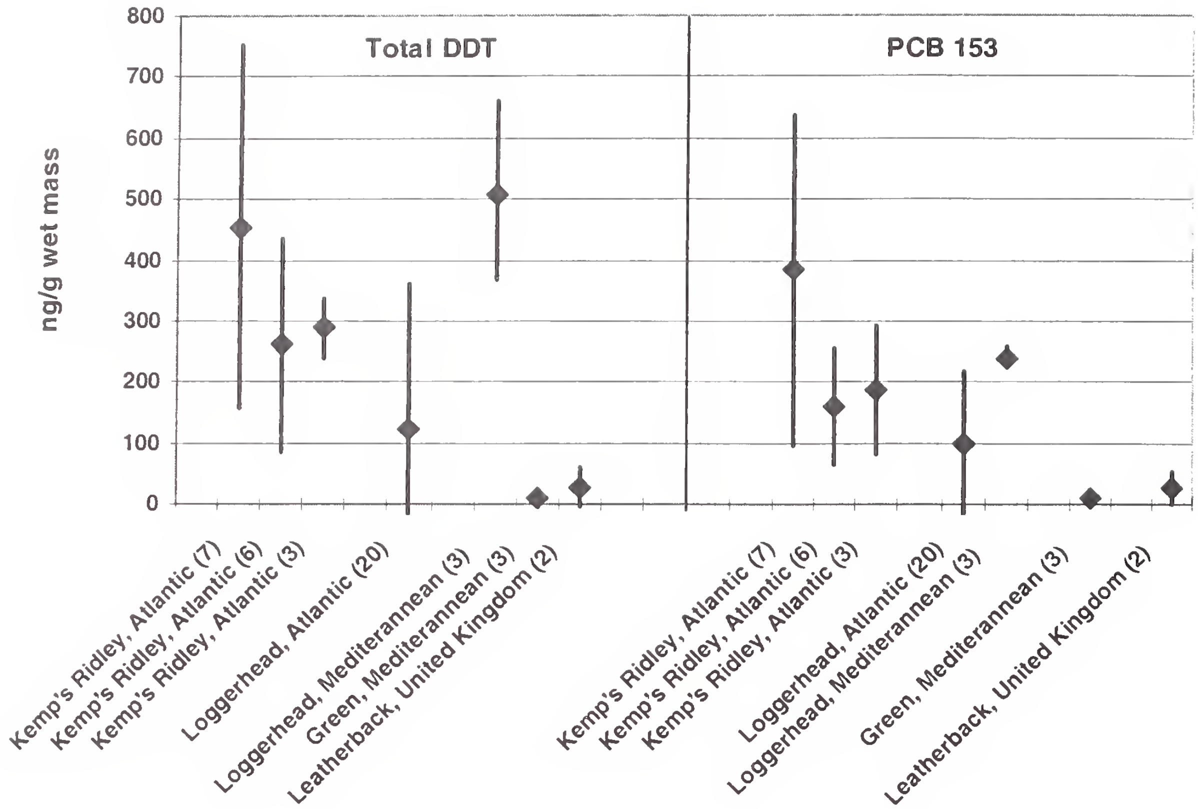

Figure I.3. Concentrations of PCB-153 and ΣDDT in fat of sea turtles. Values are expressed as means ± 1 standard deviation. Numbers of individuals are in parentheses (n). Data are from Lake et al. (1994), Rybitski et al. (1995), and Mckenzie et al. (1999).

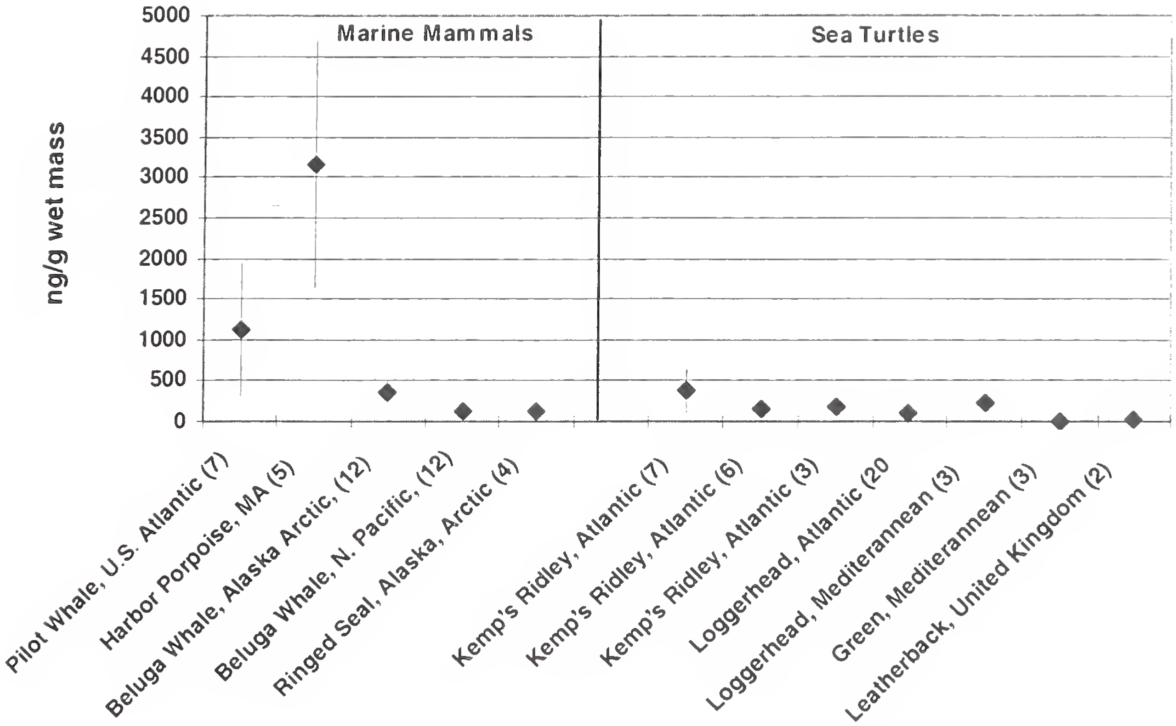

Figure I.4. Concentrations of PCB 153 in fat of sea turtles compared with values reported for marine mammal blubber. Values are expressed as means ±1 standard deviation. Numbers of individuals are in parentheses (n). Data are from Becker et al. (1997), Lake et al. (1994), Rybitski et al. (1995), and Mckenzie et al. (1999).

Concentrations of 4,4'-DDE and ΣDDT (DDE + DDD + DDT) reported in the fat of Kemp's ridleys and loggerheads from the Atlantic Coast of the United States are compared in Table I.2 with those measured in loggerheads and green turtles from the Mediterranean Sea and leatherbacks from the United Kingdom. As was the case for PCB-153 and -118, the highest concentrations occurred in the Kemp's ridleys and loggerheads (Fig. I.3). Concentrations of ΣDDT in sea turtles were at the low end of the range of values reported for marine mammals and seabirds (Fig. I.5), and the average 4,4'-DDE/DDT ranged from 0.61 to 0.97, reflecting the high percentage of metabolized DDT occurring in the fat of sea turtles. This range of ratios is similar to values reported for seabirds from high latitudes, 0.85 to 0.95 for Glaucous Gulls from Svalbard (Gabrielsen et al., 1995). This range is also similar to the high end of the range of ratios reported for marine mammals, such as pelagic fur seals from the North Pacific, i.e., 0.93, and ringed seals from the Chukchi Sea (Arctic Ocean), i.e., 0.85 (Becker et al., 1995). However, most marine mammal ratios average 0.6 or less (Fig I.6). The high average 4,4'-DDE/ΣDDT in the sea turtles may be due to its feeding in the open ocean, far from DDT sources or to the physiological capability of sea turtles to metabolize the parent DDT compounds.

Hexachlorobenzene (HCB). Of the various chlorobenzene compounds, hexachlorobenzene (HCB) is the most toxic and most persistent. This is a very volatile compound which has the potential for long distance atmospheric transport to the open ocean and northern latitudes. Although persistent in lipids of mammals and birds, HCB is gradually metabolized to a wide variety of metabolites that appear in the feces and urine. Levels of HCB in fat are usually much higher than those of liver. No HCB data have been reported for sea turtle tissues or eggs.

Hexachlorocyclohexane (*gamma*-HCH). Hexachlorocyclohexane (HCH) occurs as several isomers, α-HCH, β-HCH, and γ-HCH (lindane). The levels in the fat of mammals and birds are an order of magnitude higher than in the liver or other internal organs, i.e., kidney, spleen, heart, and brain. γ-HCH is less stable than α-HCH and may be transformed to the latter during atmospheric transport. Therefore, one might expect a proportionately smaller amount of γ-HCH occurring in animals from higher latitudeds. Except for a single value reported by Mckenzie et al. (1999), no data on HCHs have been reported for sea turtle tissues or eggs.

Dieldrin. Dieldrin, which accumulates in animal tissue and is eliminated slowly, is easily analyzed and is one of the most commonly reported pesticides in marine biota. However, as compared to PCBs and DDT, the data available for dieldrin in sea turtles are very limited. Some comparisons for concentrations in fat are presented in Table I.2. For those sea turtles with comparable data, dieldrin concentration is an order of magnitude or more lower in fat than PCB 153 or 4,4'-DDE.

Chlordane-Related Compounds. Technical chlordane is a mixture of as many as 45 isomers and congeners of related cyclopentadienes. Chlordane-type compounds identified in sea turtle tissues include *cis*-chlordane, *trans*-chlordane, *cis*-nonachlor, *trans*-nonachlor, oxychlordane, and heptachlor epoxide. Heptachlor has been used as a pesticide separate from technical chlordane. Not all investigators have measured all of these compounds and some have measured more. In many cases, it is very difficult to assess chlordane trends because it is not always clear from published reports which of the different chlordane group compounds were measured to derive the total chlordane values.

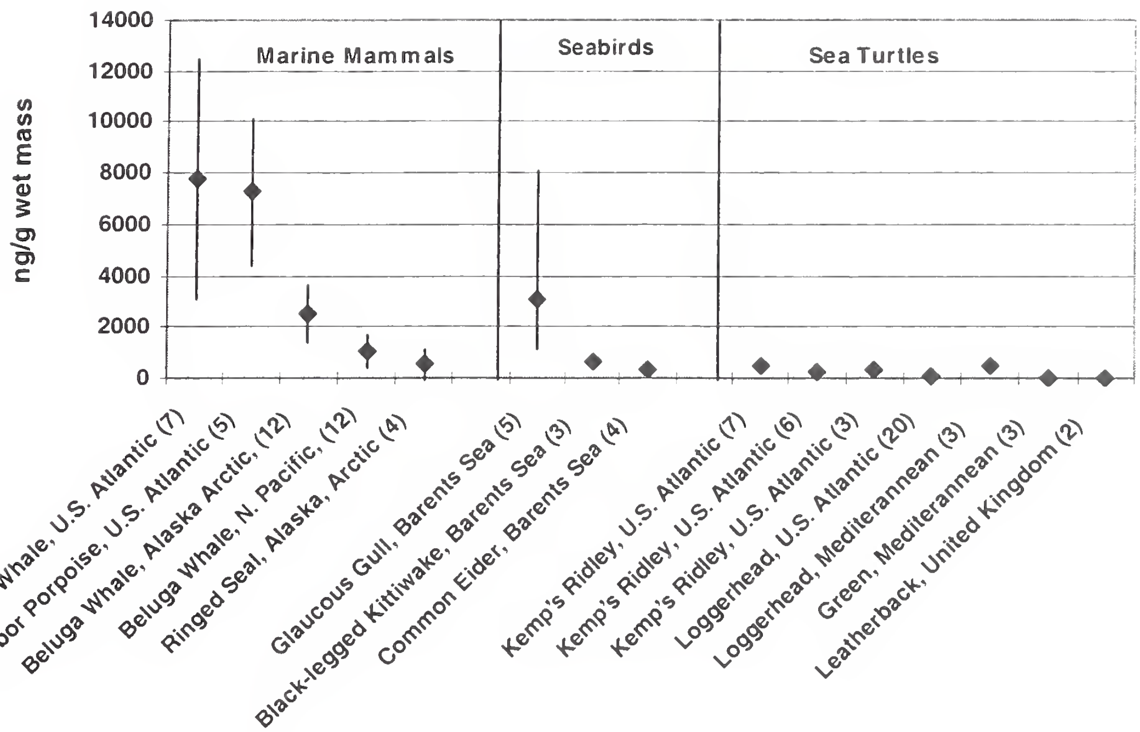

Figure I.5. Comparison of concentrations of ΣDDT in fat of sea turtles with values reported for seabirds and marine mammals. Values are expressed as means ±1 standard deviation. Numbers of individuals are in parentheses (n). Data are from Becker et al. (1997), Savinova et al. (1995), Lake et al. (1994), Rybitski et al. (1995), and Mckenzie et al. (1999).

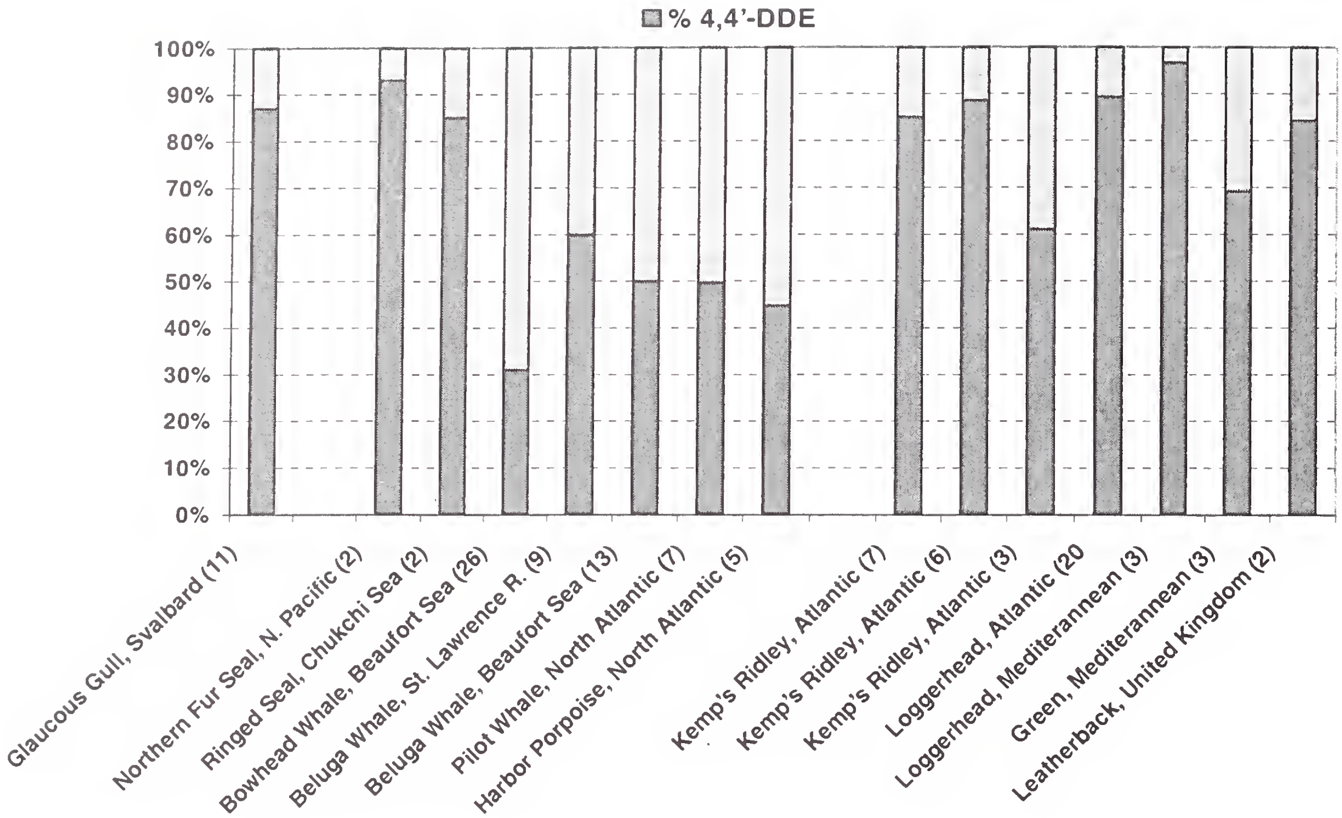

Figure I.6. Contribution of 4,4'-DDE to the total DDT concentration in fat of sea turtles compared to that reported for marine mammals and seabirds. Numbers of individuals are in parentheses (n). Data are from Becker et al. (1997), Gabrielsen et al. (1995), Lake et al. (1994), O'Hara et al., (1999), Mckenzie et al. (1999), and Rybitski et al. (1995).

Individual isomers of chlordane differ in their degree of persistence and, therefore, their ability to accumulate in the food web. It appears that of the two prominent isomers of technical chlordane, *trans*-chlordane is metabolized much more readily than *cis*-chlordane (Kawano et al. 1984; 1988). However, the most prominent chlordane compounds in marine mammal and sea turtle tissues are *trans*-nonachlor, oxychlordane, and heptachlor epoxide, the latter two being metabolites.

Chlordane readily volatilizes following soil application. Long-range atmospheric transport appears to be an important mechanism for the global spreading of this compound (Atlas and Giam, 1981; Bidleman and Leonard, 1982; Oehme and Mano, 1984). Chlordane was second only to DDT and PCBs in abundance in 1981-82 samples of marine life from the Gulf of Alaska and Bering Sea (Kawano, et al. 1986). In contrast to DDT and PCB, chlordane increased in concentration during 1971-82 in fishes in the Baltic Sea (Moilianen, et al. 1982).

Some comparisons for concentrations of chlordane in sea turtle fat are presented in Table I.2. As is the case for dieldrin, chlordane concentrations are much less than concentrations of PCB 153 or 4,4'-DDE.

Toxaphene. Technical toxaphene consists of a mixture of hundreds of polychlorinated camphenes and bornanes produced under the name "toxaphene." This pesticide was commonly used in agricultural areas of the southeastern U.S. before being banned in the early 1980s. Twenty polychlorinated camphenes have been reported in marine biota (Muir et al., 1990; 1992). Toxaphene has also been reported in beluga whales of the Alaskan Arctic at levels approaching those of PCBs and DDT (Becker et al., 1977). Due to the need for additional analytical techniques for toxaphene measurement and the need for the development of toxaphene standards, this group of compounds is not usually measured in marine environmental specimens. No toxaphene data are available for sea turtles.

Other Persistent Chlorinated Compounds. Dioxins and furans, a group of chlorinated chemicals that are similar in molecular structure to PCBs, are primarily created in high-temperature processes, such as waste incineration, metal industries, and pulp and paper mills that use chlorine in the bleaching process. The toxicity mechanisms of dioxins and furans are also similar to coplanar PCBs and vary depending on the actual dioxin or furan compound involved. The compound, 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD), which is the most toxic of this group of compounds, is used as the basis for estimating the relative toxicity of other dioxin and furan compounds as well as specific PCB congeners through the calculation of "toxicity equivalents" (TEQs). Refer to Barnes (1991) for a review of TEQs. Although no concentration data are available for these compounds in sea turtles, they have been measured in snapping turtles (Ryan et al., 1986)

Other persistent organic compounds that have not been measured in sea turtles, but due to their similarity in toxicity to PCBs should also be considered for future measurement, are polybrominated diphenyl ethers (PBDPEs) and polychlorinated diphenyl ethers (PCDPEs). These compounds have been commonly used as fire retardants and have become quite prevalent in the environment. The future measurement of these chemicals will depend on the development of analytical standards and methods since presently, these are not readily available.

Persistent Chlorinated Compounds Reported in Eggs. Table 1.3 summarizes the published data on concentrations of PCB 153, PCB 118, DDT, DDE, dieldrin, and chlordane in sea turtle eggs and hatchlings. As was the case for fat concentrations, the lowest egg and hatchling concentrations of these compounds have been reported from the green turtle (Mckenzie et al., 1999). For loggerheads from the Mediterranean, the mean concentrations in the eggs and hatchlings were lower than mean concentrations in fat tissue of the adults (Table I.2). The average ratio of 4,4'-DDE to total DDT in the eggs (0.99) was very high and similar to that in the fat of the adult turtles (0.97). This high ratio indicates that almost all of the DDT had been metabolized to the recalcitrant DDE and much of it had been "offloaded" to the eggs and ultimately to the hatchlings.

HYDROCARBONS

Petroleum derived hydrocarbons have only been reported from liver and kidney tissues of green sea turtles from the Laguna Madre, in the Gulf of Mexico, as part of a study looking at the effects of petroleum activities on sea turtles (Hall et al., 1983). Nine aliphatic and six aromatic compounds were found at extremely low concentration levels. The values are presented in Section II, Table II.3.

METALS AND OTHER ELEMENTS

Heavy metal concentrations in sea turtles have usually been reported for liver and kidney, although some data have been published for muscle, bone, blood, and even fat. For many of the trace elements in sea turtle tissues (including heavy metals), little is known of what concentrations are within the normal ranges for a particular species. Concentrations of essential trace elements, such as copper and zinc, are generally characterized by relatively narrow ranges of values within a species and, for many elements, the ranges are similar from one species to another. The concentrations of selenium within animals vary much more widely than most other essential elements; however, this is probably due to its relationship to the accumulation of mercury and the positive correlation between the two metals in the livers of animals that accumulate mercury. The nonessential, potentially toxic elements, such as arsenic, cadmium, mercury, and lead, show the greatest variability with concentration ranges often spanning several orders of magnitude.

The geographic distribution of published data on metals and metalloids in sea turtle tissues and sea turtle eggs is shown in Figures I.7 and I.8, respectively. For the United States, published tissue concentration data are limited to loggerhead turtles (Hillestad, 1974; Fletemeyer, 1980; Stoneburner, 1979; Stoneburner et al., 1980), while egg concentration data have only been published for green turtles from the Hawaiian Islands (Aguirre, 1994). Comparative data are available for loggerheads from the Mediterannean (Storelli et al., 1998a &b; Godley et al., 1999), Queensland, Australia (Gordon et al., 1998), and Japan (Sakai et al., 1995), and green turtles from the Mediterranean Sea (Godley et al., 1999). No data are available for eggs of Kemp's ridley turtles.

Table I.3. Comparison of concentration ranges and geometric means ± 1 standard deviation (ng/g wet mass) of persistent chlorinated compounds measured in eggs and hatchlings of sea turtles from the United States waters with sea turtles from other regions.

Location	PCB 153	PCB 118	Σ DDT	4,4'-DDE	4,4'-DDE / Σ DDT	Dieldrin	Chlordane[1]	n	Date
Loggerhead:									
FL, Atlantic (egg)[2]	n.r.[3]	n.r.	n.r.	47 18 - 200	n.r.	n.d.[6] n.d. - 48 (n = 4)	16 n.d. - 32 (n = 2)	9	1991
Mediterranean (egg)[4]	2.8	7.2	155	154	0.99	0.6	1.8	1	1995
Mediterranean (hatch)[4]	4.87 ± 6.96 2.8 - 19	2.20 ± 2.20 1.1 - 6.5	28.6 ± 47.4 5.3 - 113	25.3 ± 44.2 4.5 - 104	0.88	1.33 ± 3.68 <0.2 - 9.2	2.79 ± 2.62 0.9 - 7.9	3	1994-95
Green:									
Ascension I. (egg)[5] Atlantic	n.r.	n.r.	n.r.	3.11 n.d. - 9	n.r.	n.r.	n.r.	9	1974
Mediterranean (hatch)[4]	<0.4 - 1.1	<0.4 <0.4 - <0.4	0.77 ± 2.68 <0.4 - 5.8	<0.4 - 0.5	-	<0.4 - 0.3	<0.4 - 0.4	3	1995-96
Mediterranean (egg)[4]	1.1	<0.3	4.3	2.3	0.53	<0.3	<0.3	1	1995

[1]The sum of oxychlordane, heptachlor epoxide, and *trans*-nonachlor
[2]Clark and Krkynitsy (1980)
[3]n.r. - not reported
[4]Mckenzie et al. (1999)
[5]Thompson et al. (1974)
[6]n.d. - not detected

Figure I.7. Heavy metals reported in sea turtle tissues. [1]United Kingdom (Davenport and Wrench, 1990; Davenport et al., 1990); [2]Adriatic Sea (Storelli et al., 1998a & b); [3]Cyprus, Mediterranean (Godley et al., 1999); [4]Mediterranean (Vicente, 1982); [5]Ecuador (Witkowski, 1982); [6]Gahirmatha, India, Bay of Bengal (Sahoo et al., 1996); [7]Japan (Sakai et al., 1995); [8]Hawaiian Islands (Aguirre, 1994).

Figure I.8. Heavy metals reported in sea turtle eggs. [1]Florida Atlantic, Georgia, South Carolina and North Carolina, (Hillestad, 1974; Stoneburner, 1979; Stoneburner et al., 1980; Fletemeyer, 1980); [2]Mexico, Pacific (Vazquez et al., 1997); [3]Japan (Sakai et al., 1995); [4]Cyprus, Mediterranean (Godley et al., 1999); [5]Gahirmatha, India, Bay of Bengal (Sahoo et al. (1996); [6]Queensland, Australia (Gordon et al., 1988).

The concentrations of the following heavy metals and metalloids have been reported from sea turtle tissues: mercury, selenium, cadmium, copper, iron, manganese, zinc, aluminum, arsenic, barium, nickel, chromium, titanium, vanadium, molybdenum, calcium, and lead, (see Section II, Tables II.4 and II.5).

Cadmium. Cadmium is a non-essential element, with limited metabolic regulation by vertebrates. Highest concentrations occur in kidney and liver, with most of the body burden occurring in the kidney. Cadmium has an extremely long half-life (30 years in humans). Cadmium is incorporated in a metallothionein complex in the liver and kidney and may combine with selenium to form an insoluble cadmium selenide complex, thereby reducing the toxicity of the metal. Cadmium concentration levels reported for sea turtle tissues are summarized in Table I.4. Similar to other vertebrates, the highest concentrations for sea turtles occur in the kidney, with the next highest values usually reported for liver. Comparison of liver values of sea turtles with the range of values reported for marine mammals, sea birds, and freshwater snapping turtles is presented in Figure I.9. The range of hepatic cadmium concentrations reported in sea turtles are similar to what has been reported in other marine biota, and substantially higher than what has been reported in freshwater snapping turtles.

Mercury. Mercury is a non-essential, toxic trace element that tends to concentrate to its highest level in liver tissue. Concentration values of mercury among species, within species, and among geographical areas vary widely. Since it is not easily regulated internally by vertebrates, this element tends to bioaccumulate. The organic form, particularly methylmercury, has a relatively long half-life and is relatively toxic. Mercury concentration levels reported for sea turtle livers are shown in Table I.4. Most papers present the hepatic mercury values as total mercury (inorganic plus organic mercury). Storelli et al. (1998b) was the only paper that reported methylmercury in sea turtle livers, specifically for loggerheads from the Mediterranean. The average methylmercury concentration was 0.28 mg/kg wet mass, representing 40 % of the average total hepatic mercury (0.70 mg/kg wet mass). Methylmercury concentrations ranged from 0.24 mg/kg to 0.33 mg/kg wet mass, contributing 21 % to 65 % to the total hepatic mercury. These methylmercury values are low compared to what has been reported in some marine mammals, i.e., up to 2.2 mg/kg wet mass in beluga whales, *Delphinapterus leucas*, and narwhals, *Monodon monoceros*, from Western Greenland (Dietz et al., 1990).

Concentrations of hepatic total mercury in sea turtles are compared with the range of values reported for marine mammals, seabirds, and freshwater turtles in Figure I.10. In order to show all values, a logarithmic scale was used because the marine mammal values appear to be one to two orders of magnitude higher than sea turtle values. In addition, seabird values also appear to be substantially higher than sea turtle values. The lowest values have been reported in green and leatherback turtles and the loggerheads appear to have concentrations of mercury in their livers at about the same level as that reported for snapping turtles from the eastern U.S. The highest hepatic mercury values tend to occur in fish-feeding marine mammals and seabirds. One would therefore expect that among the sea turtles, the highest total mercury values would occur in species that include fish in their diets (e.g., loggerheads, Kemp's ridleys, and Olive ridleys).

Selenium. Selenium is an essential element believed to have an antidotal action on the toxic effects of mercury, cadmium, arsenic, copper, and thallium. Although the mechanism for this action is not

Table I.4. Comparison of concentration ranges and geometric means ± 1 standard deviation (mg/kg wet mass) of mercury, selenium, methylmercury, and cadmium measured in tissues of sea turtles from the United States waters with sea turtles from other regions.

Location	Hg	Se	Methyl-Hg	Cd (kidney)	Cd (Liver)	Gender	n	Date
Green:								
Hawaiian Is.[1] Pacific	n.r.[7]	0.47 ± 0.28 0.14 - 0.90	n.r..	15.8 ± 17.2 4.77 - 47.4	4.91 ± 8.90 1.8 - 26.0	F	7	1985
	n.r.	0.84 ± 1.02 0.32 - 2.53	n.r.	22.4 ± 29.9 4.72 - 70.2	6.66 ± 10.8 1.12 - 25.6	M	4	1989
Loggerhead:								
Japan, Pacific[2]	1.51 ± 2.93 0.253 - 8.15	n.r.	n.r.	39.4 ± 16.2 18.1 - 56.5	9.29 ± 3.30 5.99 - 14.6	n.r.	7	1990
Mediterranean[3]	0.42 ± 0.26 0.088 - 0.93	3.97 ± 1.85 0.530 - 6.86	n.r.	6.06 ± 5.35 0.098 - 16.0	1.90 ± 1.51 0.765 - 5.06	n.r.	12	1990-91
Mediterranean[4]	0.70 ± 0.32 0.37 - 1.10	n.r.	0.28 ± 0.03 0.24 - 0.33	n.r.	n.r..	n.r.	4	1994-96
Mediterranean[5]	0.602 (median) 0.205 - 1.88	n.r.	n.r..	n.r.	n.r.	n.r.	5	1994-96
Leatherback:								
U.K., Atlantic[6]	0.098	0.353	n.r.	n.r.	0.055	M	1	1988
Green:								
Mediterranean[5]	0.138 (median) 0.068 - 0.343	n.r.	n.r..	n.r.	n.r.	n.r.	6	1994-96

[1]Aguirre (1994)
[2]Sakai et al. (1995)
[3]Storelli et al. (1998a)
[4]Storelli et al. (1998b)
[5]Godley et al. (1999)
[6]Davenport et al. (1990)
[7]n.r. - not reported

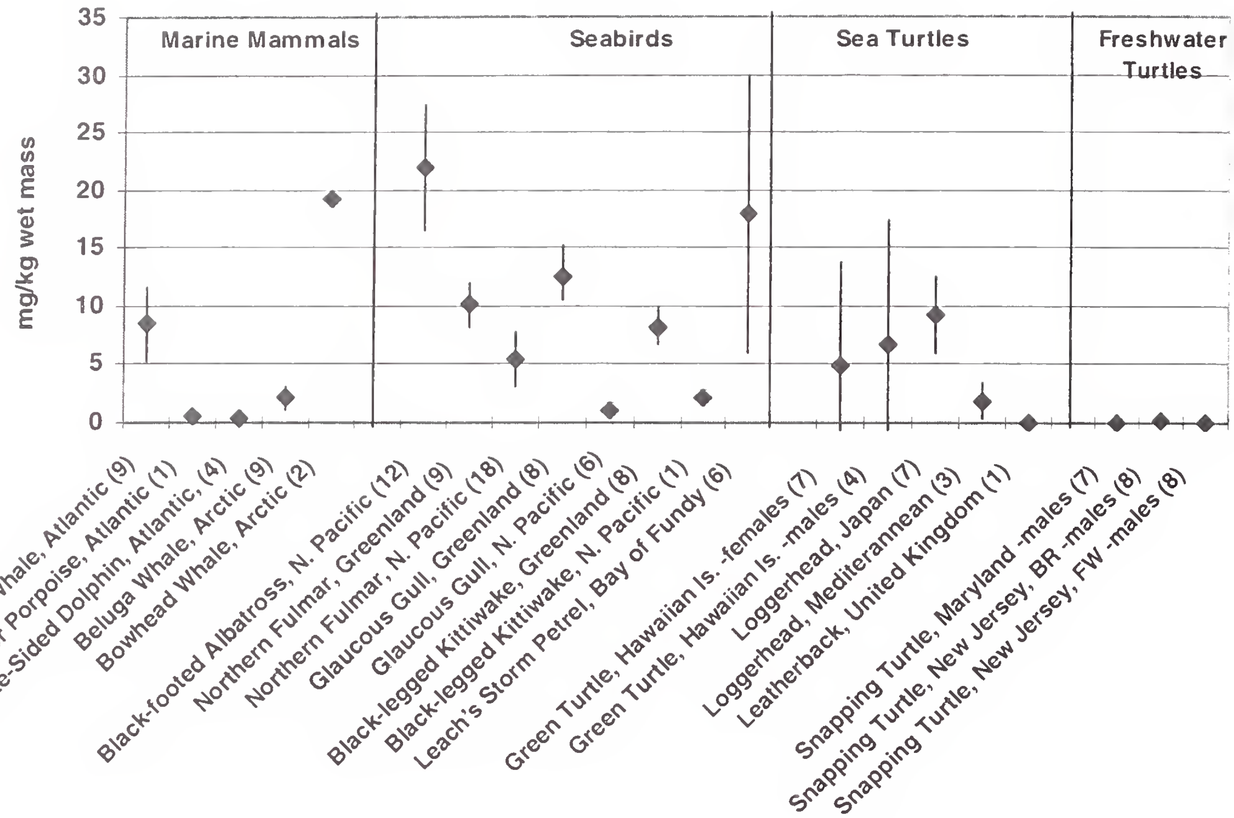

Figure I.9. Comparison of concentrations of cadmium in livers of sea turtles with those of freshwater turtles, seabirds, and marine mammals. Values are expressed as geometric mean ± 1 standard deviation. Numbers of individuals are in parentheses (n). For snapping turtles, BR = brackish water and FW = freshwater. Data are from Becker et al. (1997), Honda et al. (1990), Dietz et al. (1996), Elliott et al. (1992), Aguirre (1994), Sakai et al. (1995), Storelli et al. (1998a), Davenport et al. (1990), and Albers et al. (1986).

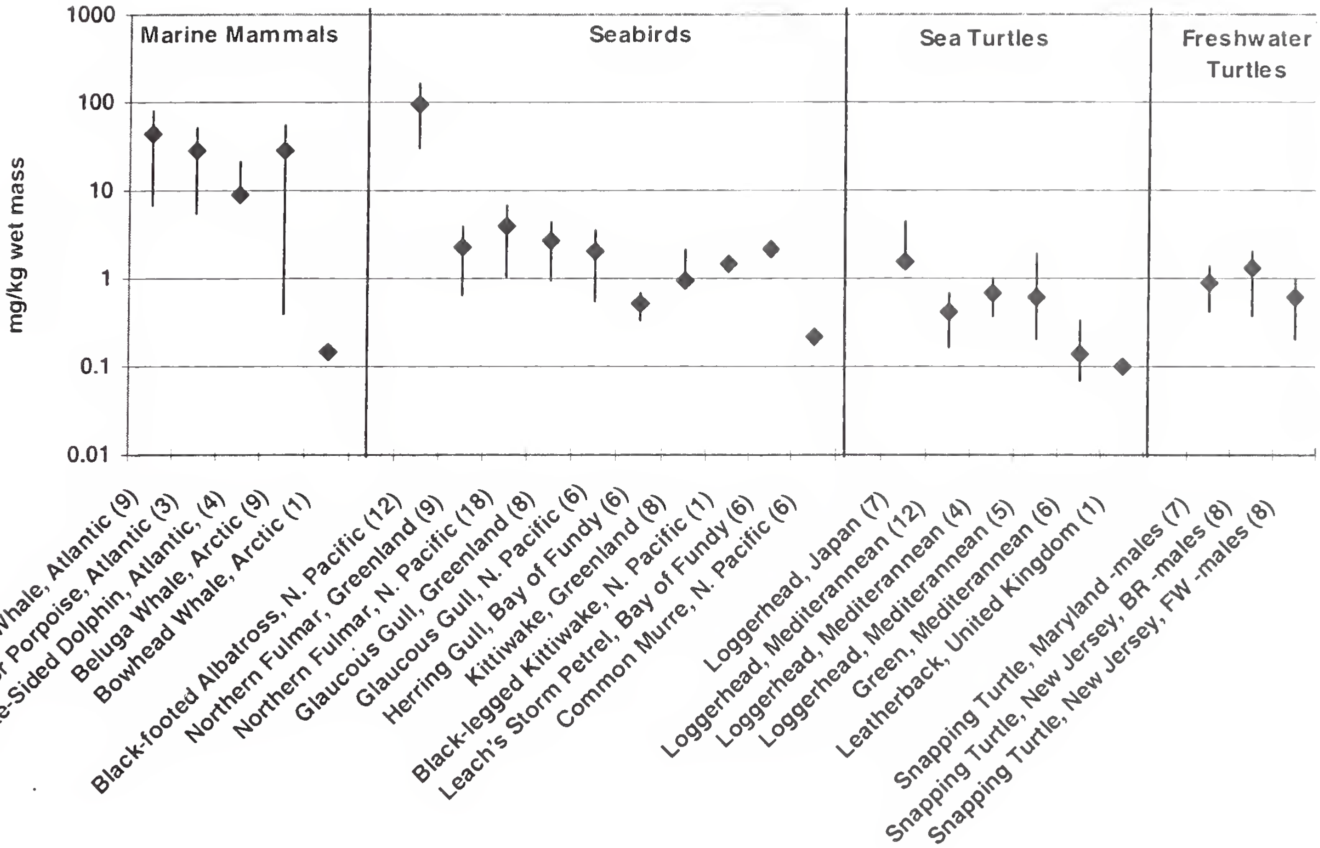

Figure I.10. Comparison of concentrations of mercury in livers of sea turtles with those of freshwater turtles, seabirds, and marine mammals. Values are expressed as geometric mean ± 1 standard deviation. Numbers of individuals are in parentheses (n). For snapping turtles, BR = brackish water and FW = freshwater. Data are from Becker et al. (1997), Honda et al. (1990), Dietz et al. (1996), Elliott et al. (1992, Aguirre (1994), Sakai et al. (1995), Storelli et al. (1998a & b), Godley et al. (1999), Davenport et al. (1990), and Albers et al. (1986).

clear, two possibilities are that the selenium stimulates the formation of metallothioneins or that heavy metals are incorporated in insoluble selenide compounds (Martoja and Viale, 1977). At high mercury concentrations, selenium and mercury levels tend to be strongly and positively correlated. (Becker et al., 1995). Very few data on selenium have been reported for sea turtles (Table I.4). These have been for green turtles from the Hawaiian Islands (Aguirre, 1994), loggerheads from the Mediterranean (Storelli et al. 1998a), and one leatherback turtle from the United Kingdom (Davenport et al., 1990). Based on the small amount of data available, any relationship between mercury and selenium concentrations in sea turtle livers can not be discerned.

Copper. Copper is an essential element and is regulated metabolically in vertebrates. As has been reported for other vertebrates, the highest sea turtle values occur in the liver, followed by kidney and muscle. Copper concentrations tend to vary among and within species and attempts to correlate copper concentration with areas of pollution have not been successful (Thompson, 1990). Diet appears to be important in determining copper levels in animals.

Hepatic copper concentrations have been reported for green turtles from the Hawaiian Islands (Aguirre, 1994), loggerheads from Japan (Sakai et al., 1995), and leatherbacks from the United Kingdom (Davenport et al., 1990) and Mediterranean (Godley et al., 1999). The highest values were from the green turtles (Table 1.5). A comparison of the hepatic copper range of values reported for marine mammals, seabirds, and freshwater snapping turtles (Fig. I.11) shows that the green turtles had much higher concentrations than what have been reported for any of the other vertebrates. These levels may reflect the diet of the green turtles, i.e., sea grass, which is unique among the sea turtle species (Table I.1).

Zinc. Similar to copper, zinc is an essential element that is regulated metabolically by vertebrates. Hepatic concentrations vary little between species, generally ranging from 20 mg/kg to 60 mg/kg wet mass (Thompson, 1990). Values for sea turtles (Table I.5) are generally within this range, and when compared to the range of concentrations reported for marine mammals, seabirds, and freshwater snapping turtles (Fig. I.12), the values reported for sea turtles are basically the same. The highest range in values shown in Figure I.12 for black-footed albatross (North Pacific), Leach's storm petrel (Bay of Fundy) and snapping turtle (New Jersey Brackish water) may be reflective of a dietary source that is high in zinc for these regions.

Lead. Lead is a non-essential element that has probably increased markedly in the environment over the last century due to anthropogenic sources. Although most of the environmental exposure is probably of lead in its inorganic form, the organic alkyl lead, which is lipid soluble, results in a more severe toxic response. Although tetraethyl- and tetramethyl-lead degrade rapidly, triethyl-lead is relatively stable and once absorbed by vertebrates, it becomes rapidly distributed among brain, liver, kidney, and blood. The principal route of excretion is urinary.

Few lead values have been reported for sea turtles (Table I.5). Caution is required when using reported lead values (particularly older data) since this trace element is easily introduced into a sample during sample collections, handling, and analytical determinations.

Arsenic. Marine organisms generally have higher concentrations of arsenic than terrestrial or freshwater organisms. Hepatic arsenic concentrations have been reported for loggerheads from the

Table I.4. Comparison of concentration ranges and geometric means ± 1 standard deviation (mg/kg wet mass) of mercury, selenium, methylmercury, and cadmium measured in tissues of sea turtles from the United States waters with sea turtles from other regions.

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	n.r.	0.84 ± 1.02 0.32 - 2.53	n.r.	22.4 ± 29.9 4.72 - 70.2	6.66 ± 10.8 1.12 - 25.6	M	4	1989
Loggerhead:								
Japan, Pacific[2]	1.51 ± 2.93 0.253 - 8.15	n.r.	n.r.	39.4 ± 16.2 18.1 - 56.5	9.29 ± 3.30 5.99 - 14.6	n.r.	7	1990
Mediterranean[3]	0.42 ± 0.26 0.088 - 0.93	3.97 ± 1.85 0.530 - 6.86	n.r.	6.06 ± 5.35 0.098 - 16.0	1.90 ± 1.51 0.765 - 5.06	n.r.	12	1990-91
Mediterranean[4]	0.70 ± 0.32 0.37 - 1.10	n.r.	0.28 ± 0.03 0.24 - 0.33	n.r.	n.r..	n.r.	4	1994-96
Mediterranean[5]	0.602 (median) 0.205 - 1.88	n.r.	n.r..	n.r.	n.r.	n.r.	5	1994-96
Leatherback:								
U.K., Atlantic[6]	0.098	0.353	n.r.	n.r.	0.055	M	1	1988
Green:								
Mediterranean[5]	0.138 (median) 0.068 - 0.343	n.r.	n.r..	n.r.	n.r.	n.r.	6	1994-96

[1]Aguirre (1994)
[2]Sakai et al. (1995)
[3]Storelli et al. (1998a)
[4]Storelli et al. (1998b)
[5]Godley et al. (1999)
[6]Davenport et al. (1990)
[7]n.r. - not reported

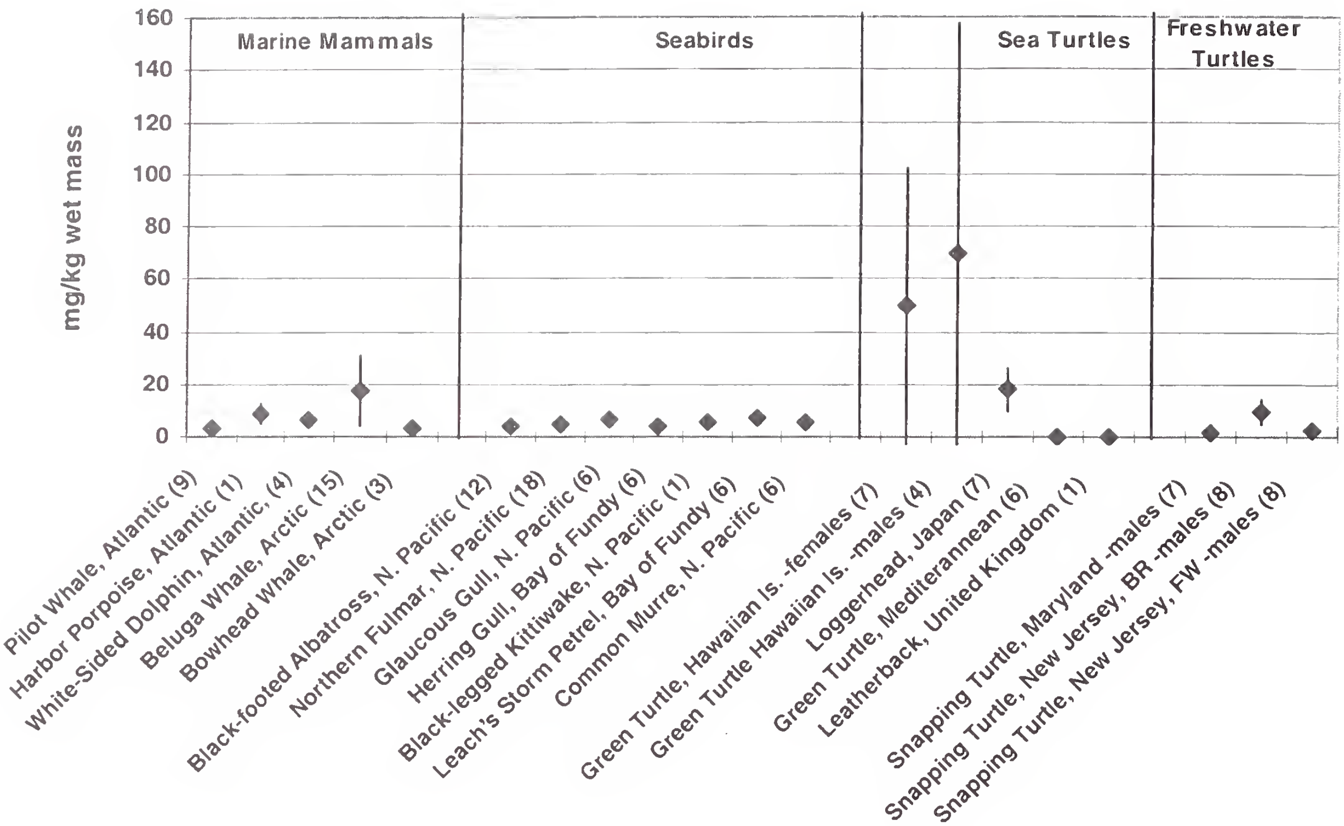

Figure I.11. Comparison of concentrations of copper in livers of sea turtles with those of freshwater turtles, seabirds, and marine mammals. Values are expressed as geometric mean ± 1 standard deviation. Numbers of individuals are in parentheses (n). For snapping turtles, BR = brackish water and FW = freshwater. Data are from Becker et al. (1997), Honda et al. (1990), Elliott et al. (1992), Aguirre (1994), Sakai et al. (1995), Godley et al. (1999), Davenport et al. (1990), and Albers et al. (1986).

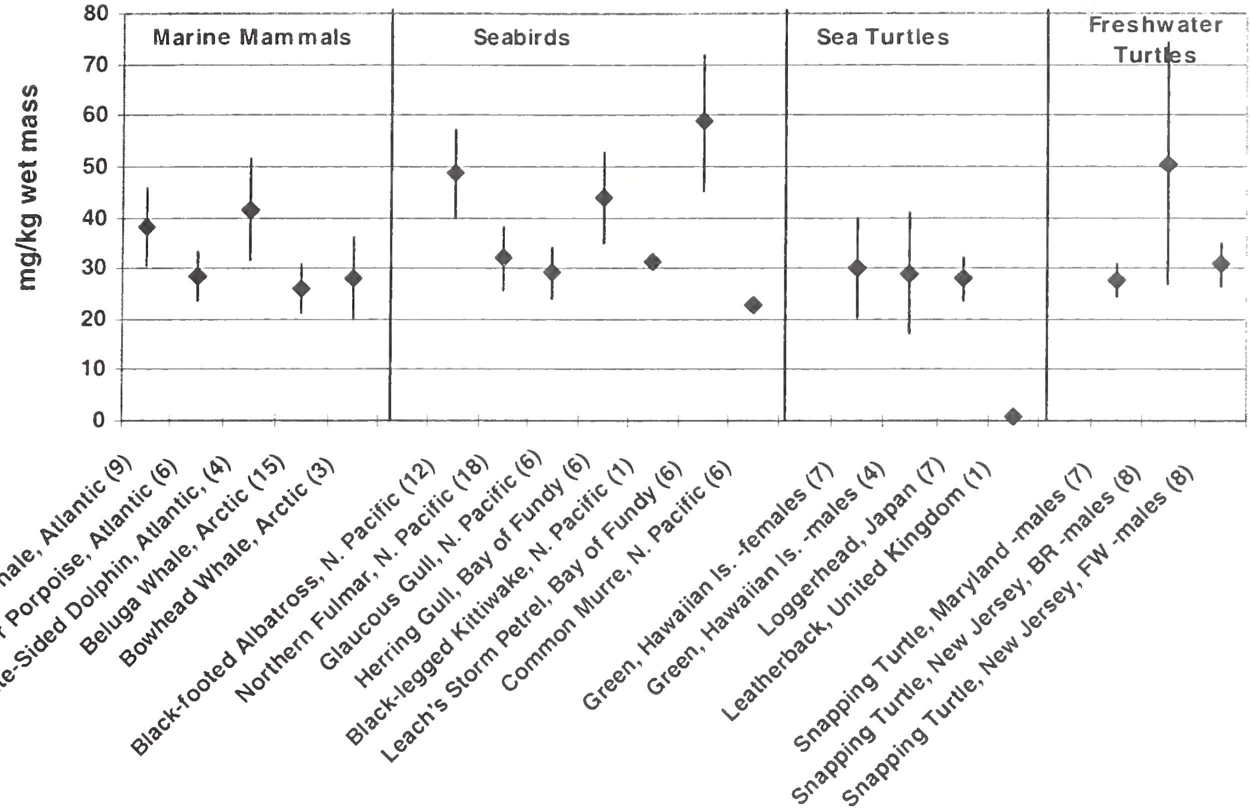

Figure I.12. Comparison of concentrations of zinc in livers of sea turtles with those of freshwater turtles, seabirds, and marine mammals. Values are expressed as geometric mean ± 1 standard deviation. Numbers of individuals are in parentheses (n). For snapping turtles, BR = brackish water and FW = freshwater. Data are from Becker et al. (1997), Honda et al. (1990), Elliott et al. (1992), Aguirre (1994), Sakai et al. (1995), Davenport et al. (1990), and Albers et al. (1986).

Mediterranean (Storelli et al., 1998a) and leatherbacks from the United Kingdom (Davenport et al., 1990). The levels reported by Storelli et al. (1998) for the Mediterranean loggerheads (Table 1.5) are very high when compared to marine mammals and seabirds. Thompson (1990) indicates that concentrations of arsenic in liver tissue of birds and mammals rarely exceed 1.0 mg/kg wet mass. The mean value for the Mediterranean loggerheads was 5.42 mg/kg $\pm$ 4.30 mg/kg wet mass and ranged from 0.21 mg/kg to 14.1 mg/kg wet mass. These values are more similar to marine crustaceans, i.e. 3 to 10 mg/kg wet mass (Hall et al., 1978), and finfish, i.e., 2 mg/kg to 5 mg/kg wet mass (Eisler, 1988) than they are to marine mammals, which have hepatic values ranging from < 0.5 mg/kg to 2.5 mg/kg wet mass (Becker et al. 1997).

In marine fish, crustaceans, and molluscs, arsenic occurs mainly as the non-toxic pentavalent organic compound, arsenobetaine. A recent study by Goessler et al. (1998) identified arsenobetaine as the predominant arsenic compound in marine mammal liver tissue. Additional organoarsenic compounds identified in this study were arsenocholine, tetramethylarsonium cation, dimethylarsinic acid, and an unknown arsenic compound.

Tin. Organotin compounds can be toxic and can bioaccumulate. Butyltin compounds have been used worldwide since the 1960s as antifouling agents (tributyltin) for boats and aquaculture nets, as stabilizers for chlorinated polymers, and as catalysts for silicones and polyurethane foams (monobutyltin and dibutyltin). Degradation products of tributyltin (TBT) are dibutyltin (DBT) and monobutyltin (MBT). Both TBT and DBT can cause immunosuppression (Kannan et al., 1997; 1998). Because of their use, one would expect butyltin (BT) compounds to occur in higher concentrations in coastal waters than in offshore waters. No data on organotin compounds have been reported for sea turtles.

Metals and Metalloids Reported in Eggs. Table I.6 summarizes the published data on concentrations of mercury, selenium, cadmium, copper, zinc, and lead reported in sea turtle eggs. Most of the published data are for loggerheads (Stoneburner et al., 1980; Sakai et al., 1995; Godley et al., 1999), with a very small number of data available for green turtles from the Mediterranean (Godley et al., 1999) and Olive ridleys from the Bay of Bengal (Sahoo et al., 1996). The concentrations of mercury reported for loggerhead eggs from the U.S. Atlantic coast (Stoneburner et al., 1980) are an order of magnitude higher than values reported from Japan or the Mediterranean, while cadmium, copper, and zinc concentrations were similar. (Sakai et al., 1995; Godley et al., 1999). No data have been reported on selenium concentrations in eggs. Zinc concentrations were consistent with little variation among regions and were also basically the same as has been reported for sea turtle hepatic concentrations (Table I.5).

Sakai et al. (1995) compared the concentrations of mercury, cadmium, copper, and zinc in sea turtle egg yolk versus albumen. Except for copper, the highest concentrations occurred in the yolk (Table I.6). For copper, concentrations in the yolk and albumen were primarily the same.

Table I.6. Comparison of concentration ranges and geometric means ± 1 standard deviation (mg/kg wet mass) of selected elements measured in sea turtle eggs from the United States waters with eggs of sea turtles from other regions.

Location	Hg	Se	Cd	Cu	Zn	Pb	n	Date
Loggerhead:								
FL, Atlantic, yolk[1]	0.34 ± 0.01	n.r.[5]	0.030 ± 0.02	1.49 ± 0.20	19.28 ± 2.32	0.545 ± 0.300	27	1977
NC, Atlantic, yolk[1]	0.35 ± 0.03	n.r.	0.05 ± 0.018	1.24 ± 0.28	18.38 ± 0.91	0.283 ± 0.210	33	
NC, Atlantic, yolk[1]	0.16 ± 0.003	n.r.	0.01 ± 0.001	1.36 ± 0.28	19.63 ± 1.67	0.443 ± 0.288	15	
NC, Atlantic, yolk[1]	0.10 ± 0.003	n.r.	0.01 ± 0.003	1.65 ± 0.32	20.12 ± 1.39	0.310 ± .0.260	21	
Japan, Pacific[2]								
yolk	0.0121 ± 0.0034 0.0080 - 0.0158	n.r.	0.026 ± 0.007 0.019 - 0.035	1.57 ± 0.07 1.48 - 1.68	34.4 ± 3.18 30.5 - 38.0	n.r.	5	1990
albumen	0.0005 ± 0.0002 0.0001 - 0.0008	n.r.	<0.01	1.29 ± 0.083 0.034 - 0.235	0.594 ± 0.584 0.058 - 1.54	n.r.	5	1990
Mediterranean[3]								
yolk + albumen	0.048 (median) <DL - 0.142	n.r.	n.r.	n.r.	n.r.	0.048 (median) <DL - 0.982	4	1994-96
Green:								
Mediterranean[3]								
yolk + albumen	<DL (median) <DL - 0.048	n.r.	0.28 ± 0.03 0.24 - 0.33	n.r.	n.r.	<DL (median) <DL - 0.402	4	1994-96
Olive Ridley:								
Bay of Bengal[4]								
yolk + albumen	n.r.	n.r.	<0.25	0.90 ± 0.125	1.08 ± 0.375	0.90 ± 0.275	8	1988

[1]Stoneburner et al. (1980)
[2]Sakai et al. (1995)
[3]Godley et al. (1999)
[4]Sahoo et al. (1996)
[5]n.r. - not reported
[6]DL - detection limit

RADIONUCLIDES

The only publication that addresses radionuclides in sea turtles was published by Hillestad (1974) in his early investigation of contaminants in loggerheads from the South Atlantic U.S. Coast. He reported very low levels of gamma emitters in tissues he collected from loggerheads from the Georgia coast. Levels were found to be several orders of magnitude lower than other coastal reptiles, mammals, and fish.

GENDER, AGE, AND FOOD WEB AS RELATED TO CONTAMINANT CONCENTRATIONS

Gender, age, and food web location (diet) are all important factors in the potential for an animal to bioaccumulate persistent compounds. For lipophilic substances, such as the persistent chlorinated compounds, the highest concentrations occur in the fat. In many cases, normalizing concentrations based on lipid weight rather than wet weight allows one to compare concentrations in various tissues on a one-to-one basis. Therefore one may be able to use liver, kidney, or fat for monitoring all of these kinds of compounds. However, when considering the sea turtles (all of which are legally protected species), fat biopses are probably more practical on a routine basis than attempts to collect biopsy material from liver or kidney of live turtles.

Lipophilic substances and non-essential heavy metals (e.g., mercury and cadmium) tend to bioaccumulate; therefore, the highest concentrations usually occur in the oldest animals of a population. This holds true for all species of vertebrates. Factors modifying this potential include off-loading the substances to the young, via parturition and nursing (by mammals), and via egg laying (by birds and sea turtles). Since this avenue of off-loading is restricted to females, one would expect the males to demonstrate increased bioaccumulation with age, while bioaccumulation in females would depend upon their reproductive state. One would also expect that post-reproductive females would continue to accumulate these materials and show patterns similar to those of males.

Animals that feed at the top of the food web generally have higher concentrations of bioaccumulative materials than those feeding at lower levels. Due to their position in the food web (as compared to other sea turtle species), loggerhead and Kemp's ridley turtles generally have the highest levels of these substances. A switch in diet and food web location by a life stage of a species may change the accumulative patterns in the animal. An interesting variation of this occurs in the green sea turtle, in which the young are omnivorous and feed at a higher trophic level than the adults. The adults of this species feed exclusively on sea grass. Therefore, one would expect the adult green turtles to have lower levels of persistent chlorinated compounds than the young and that the tissue concentrations would decrease with an increase in age.

Unlike the persistent chlorinated compounds, metals occur naturally in the environment and tissue concentrations may reflect natural as well as anthropogenic sources. In the case of metals and metalloids, diet is a major factor in accumulation and, except for mercury, the pattern of increased concentration does not necessarily correlate with trophic position. In this regard the pattern seen in sea turtles is consistent with what has been reported in marine mammals and seabirds. Among the sea turtles, the highest hepatic and kidney cadmium concentrations have been reported in the herbivorous green turtle (Aguirre, 1994), while the highest mercury concentrations have been reported in the fish and crustacean feeding loggerhead turtles (Sakai et al., 1995; Storelli et al., 1998a & b). High hepatic copper concentrations have also been reported in the green turtles sampled from the Hawaiian Islands (Aguirre, 1994). For essential elements that are well regulated, such as zinc, liver and kidney concentrations vary little among individuals and species. The range of values for hepatic zinc that has been reported for sea turtles are within the normal range reported for seabirds and marine mammals and are basically the same as what has been reported in sea turtle eggs.

CONTAMINANT LEVELS AND HEALTH EFFECTS

Determining the role of contaminants on animal health and response of the animal population to contaminant tissue concentrations and body loads requires much more than data on contaminant concentration in tissues or measurement of metabolite residues. Sea turtles are affected by numerous health problems, and environmental stress has a large bearing on how the animal will respond to infections, nutritional deficiencies, and physical trauma (George, 1997). Little is know about the sea turtle immune system. It can be assumed, however, that like other vertebrates, these animals may suffer reduction in immune response when stressed. In reptiles, low ambient temperature may itself reduce immune competence by reducing immunoglobulin production (George, 1997). It is presently not known if the sea turtle exhibits the same physiological responses to these factors as other reptiles (e.g., fresh water turtles, snakes, lizards, and crocodiles). Exposure to environmental contaminants is one source of stress; however, the ability to link a "significant" negative response to a specific contaminant or group of contaminants is very difficult and there are no good examples to cite regarding accomplishing this at sublethal chronic levels in any marine vertebrate.

Heavy metals occur naturally in the environment and several, such as mercury, lead, arsenic, and cadmium, are highly toxic when in the appropriate valence state. The route of exposure for an animal (i.e., ingestion, inhaling, dermal absorption, etc.) is also critical in determining the toxicity of metals. Whether the metal is incorporated within an organic molecule (e.g., methylmercury and tributyltin) also effects toxicity. One can not equate the "normal" levels of a toxic metal in a terrestrial animal to that of a marine species since the bioaccumulation of trace elements and metals in the marine food web is a world-wide pervasive condition. High levels of mercury commonly occur in upper trophic level fish. The same situation occurs for cadmium in some species of crustaceans, and arsenic in many marine invertebrates and fish. Similar to marine mammals and seabirds, sea turtles are commonly exposed to elevated levels of these, as well as other trace elements, via their food source. High liver or kidney levels of mercury or cadmium in a marine animal does not necessarily mean that the animal is being detrimentally affected. The key to evaluating potential effects is to determine the form of the metal (organic or inorganic; associated with a protein complex [metallothionen] or other binding metal [selenium], valence state, etc.). Unfortunately, most reported metal concentrations in marine mammal tissues are only expressed as "total" values.

Most of the persistent pesticides (i.e., chlorinated pesticides, such as DDT, dieldrin, endrin, chlordane, and toxaphene), that are now banned in most developed countries, have relatively low vertebrate toxicity as compared to the less persistent current-use pesticides. However, the persistent pesticides bioaccumulate and their effects can be much more subtle, being carcinogenic and/or affecting immune functions, hormone levels, embryological development, etc. Persistent industrial chemicals (i.e., PCBs, dioxins, and furans) have also been implicated in such subtle effects in vertebrates. When considering the potential for such effects to occur, one should remember that sensitivity to such chemicals vary by species, sex, and age, and that these animals are being exposed to not just one chemical, but to thousands of chemicals that may interact to either increase or decrease a specific effect. Health of individual animals (and populations) are also affected by physical environmental conditions, the quality and abundance of food resources, disease organisms, hereditary disease, and naturally occurring biotoxins. Thus, animals are usually responding to a myriad of health insults with a potentially toxic compound (contaminant) being only one of these.

Aquirre (1994) investigated what role, if any, environmental contaminants might have in the incidence of fibropapillomas in green turtles from the Hawaiian Islands. Concentrations of persistent chlorinated compounds were very low in the tissues and eggs of this species. The non-persistent, current use pesticides (organophosphate and carbamate pesticides) were also measured and were also at very low concentrations or non-detectable. Selenium, cadmium, and other heavy metals were also measured in green turtles, but no relationship was found between the contaminants measured and the occurrence of this disease.

A developing field of research is addressing questions regarding potential endocrine disruption by many of the anthropogenic compounds considered to be persistent toxicants (such as PCBs, DDE, chlordane, toxaphene, HCB), others thought to be broken down more readily in the environment (i.e., endosulphan, malathion, and parathion) and some heavy metals (i.e., tributyltin and mercury). Although these materials plus many others have been identified as endocrine disrupters or potential endocrine disrupters through testing of individual compounds, response to mixtures of these compounds is unknown. The animal response to such compounds may be reflected in changes in reproductive capacity in adults and disruption of embryonic development. Reduction in productivity may, therefore, be the ultimate biotic response to such compounds. De Solla et al. (1998) provided evidence suggesting that the high levels of some persistent chlorinated compounds in common snapping turtles from a contaminated site in Ontario, Canada, may have a role in the apparent modification of the sexually dimorphic morphology of this species. However, there was no demonstratable affect on testosterone or estrogen levels in the adults.

In a recent investigation on the possible role of DDE as an endocrine disrupter in sea turtles, Podreka et al. (1998) evaluated the effect of this DDT metabolite on gender determination in green sea turtle hatchlings. These investigations indicated that eggs of this species with concentrations of DDE <543 ng/g should not affect hatching success, survival rate, or normally differentiated gonads in the hatchlings.

Compared to sea turtles, a more substantial effort has been devoted to investigating the effects of contaminants on freshwater turtles, with the intent of using these animals (particularly snapping turtles) as environmental monitoring and evaluation tools (Bishop et al., 1991; Hebert et al., 1993; Helwig and Hora, 1983; Myers-Schone and Walton, 1994; Olafsson et al., 1983; Ryan et al., 1986 Struger et al., 1993). Experiments with snapping turtles have also been used to investigate tissue distribution and metabolism of contaminants in turtles (Bryan et al. 1987a &b). Albers et al. (1996), in their study of snapping turtles occurring in a heavy metal contaminated area of New Jersey, found no relationship in body burdens with physiological measures of amino-levulinic acid dehydratase, albumin, glucose, hemoglobin, osmolarity, packed cell volume, total protein, triglycerides, and uric acid in the blood that would indicate physiological impairment. Bishop et al. (1991) found a statistical relationship between tissue concentrations of persistent chlorinated compounds in snapping turtles in the Great Lakes and rates of deformities and unhatched eggs. However, the authors also pointed out that there were several chemicals present that could cause similar reproductive effects, and no specific chemical effect could be identified.

Unlike persistent chlorinated compounds, detrimental effects of oil (petroleum) exposure to sea turtles has been extensively studied and documented, particularly in the Gulf of Mexico. Fritts and McGehee (1981) conducted research that indicated that petroleum effects on the hatchability of turtles' eggs depended to a large extent on the degree of oil weathering and timing of the spill. Bossart (1986) showed statistically significant changes in hematology and serum chemistries of loggerhead turtles exposed to crude oil and described severe histopathological changes in the skin due to this exposure. They hypothesized that this could ultimately lead to a break in the integumentary carrier, bacterial infection, and subsequent septicemia and neoplastic transformation. In addition, osmoregulation appeared to have been affected which could have serious consequences to sea turtles exposed to oil spills at sea (Lutz and Lutcavage, 1989). Although such acute affects appeared to be reversible during a 21 day recovery period, long-term chronic effects are essentially unknown (Lutcavage et al., 1995).

CONCLUSIONS

Compared to other marine vertebrates (i.e., finfish, seabirds, and marine mammals), the database on contaminants in sea turtles are limited. The data from the United States coastal waters are particularly scarce, especially in the Gulf of Mexico. Most of the published data is from loggerhead turtles, with a substantially lesser number for green and Kemp's ridley turtles.

The persistent chlorinated compounds that have been reported in fat, livers, and eggs of sea turtles are: PCBs, DDT and its metabolites, some chlordane compounds, endrin, dieldrin, and mirex. No data are available for toxaphene and HCB, and a very small number of data has been published on HCH (but not for animals from the United States). Also, much of the older PCB data have been reported on the basis of equivalents of commercial Aroclors, which makes comparison with recent congener-specific data very difficult. The comparison of concentration data from different publications is also complicated by the problem of reporting values for different types of tissues and on different mass basis (wet mass vs. lipid mass) with no conversion factors included.

The data that are available for sea turtles suggest that tissue concentrations of persistent chlorinated compounds for these animals are on the low end of the range of values reported for seabirds and marine mammals. However, particular attention should be given to establishing a database for these compounds in Kemp's ridley turtles, since the adult feeding areas are concentrated in the Gulf of Mexico, the potential for exposure to a myriad of different anthropogenic contaminants in this area is high, and nothing is known regarding contaminant loads in this species in this region.

Heavy metal concentrations in sea turtles have been reported for liver, kidney, eggs, muscle, bone, and fat from a limited number of geographical locations. The following metals and metalloids have been reported: mercury, selenium, cadmium, copper, iron, manganese, zinc, aluminum, arsenic, barium, nickel, chromium, titanium, vanadium, molybdenum, calcium, and lead. However, as is the case for the persistent chlorinated compounds, comparisons between sea turtle species and geographical areas are difficult due to reporting based on analyses of different kinds of tissues and on different mass basis with no conversion factors.

As in seabirds and marine mammals, lipophilic substances and non-essential heavy metals (mercury and cadmium) tend to bioaccumulate and the highest concentrations occur in the oldest animals, particularly the oldest males since females transfer these substances to their young (i.e., off-load) through parturition and nursing (in mammals) and egg laying (in seabirds and sea turtles). Animals that feed at the top of the food web generally have higher concentrations of bioaccumulative substances than those feeding at lower levels. This is reflected by the higher concentrations reported in loggerheads and Kemp's ridley turtles as compared to other sea turtle species. Unlike the persistent chlorinated compounds, metals occur naturally in the environment and tissue concentration may reflect natural as well as anthropogenic sources. Diet is a major factor in accumulation and, except for mercury, the pattern of increased concentrations does not correlate with trophic position. The patterns seen in sea turtles are consistent with what has been reported in marine mammals and seabirds.

Determining the role of contaminants in sea turtle health will require more than just measurement of contaminant concentrations in tissues or measurements of metabolite residues. Along with increasing the database on such measurements, increased effort on determining the role of such substances on immune response, hormone levels, embryological development, and physiological response will be required to determine what effect, if any, the existing contaminant loads may have on the health of individual sea turtles and sea turtle populations.

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SECTION II

DATA TABLES

Table II.1. Mean Concentrations of Persistent Chlorinated Compounds of Sea Turtle Tissues.[a]

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Kemp's Ridley	Long Island, NY	1980	n.r.[c]	IUPAC 118	141		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	IUPAC 118	152 (147)	n.r.	8	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1986	n.r.	IUPAC 118	110		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1987	n.r.	IUPAC 118	38.4 (27.1)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	IUPAC 118	50.1 (23.8)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1980	n.r.	IUPAC 138	150		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	IUPAC 138	168 (148)	n.r.	8	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1986	n.r.	IUPAC 138	157		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1987	n.r.	IUPAC 138	45.0 (21.0)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	IUPAC 138	54.7 (24.9)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1980	n.r.	IUPAC 153	222		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	IUPAC 153	238 (190)	n.r.	8	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1986	n.r.	IUPAC 153	217		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1987	n.r.	IUPAC 153	77.9 (37.8)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	IUPAC 153	95.3 (42.8)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1980	n.r.	IUPAC 170+190	17.3		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	IUPAC 170+190	24.0 (26.3)	n.r.	8	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1986	n.r.	IUPAC 170+190	26.5		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1987	n.r.	IUPAC 170+190	8.67 (6.85)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	IUPAC 170+190	9.48 (6.30)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1980	n.r.	IUPAC 180	54.2		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	IUPAC 180	76.3 (63.3)	n.r.	8	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1986	n.r.	IUPAC 180	82.5		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1987	n.r.	IUPAC 180	23.9 (15.9)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	IUPAC 180	31.2 (13.6)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1980	n.r.	IUPAC 187	70.4		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	IUPAC 187	78.8 (63.3)	n.r.	8	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1986	n.r.	IUPAC 187	87		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1987	n.r.	IUPAC 187	23.7 (18.2)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	IUPAC 187	31.5 (14.2)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1980	n.r.	Sum of Congeners	655		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	Sum of Congeners	738 (737)	n.r.	8	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1986	n.r.	Sum of Congeners	680		1	Liver	Lake et al., 1994

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Kemp's Ridley	Long Island, NY	1987	n.r.	Sum of Congeners	218 (127)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	Sum of Congeners	272 (126)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	IUPAC 118	221 (195)	n.r.	7	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	IUPAC 118	76.8 (42.2)	n.r.	6	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	IUPAC 138	284 (228)	n.r.	7	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	IUPAC 138	106 (56.3)	n.r.	6	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	IUPAC 153	384 (289)	n.r.	7	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	IUPAC 153	161 (95.6)	n.r.	6	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	IUPAC 170+190	51.7 (39.2)	n.r.	7	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	IUPAC 170+190	18.6 (12.4)	n.r.	6	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	IUPAC 180	151 (109)	n.r.	7	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	IUPAC 180	54.4 (32.9)	n.r.	6	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	IUPAC 187	126 (125)	n.r.	7	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	IUPAC 187	59.3 (33.3)	n.r.	6	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	Sum of Congeners	1250 (985)	n.r.	7	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	Sum of Congeners	476 (273)	n.r.	6	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1980	n.r.	p,p'-DDE	195		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	p,p'-DDE	253 (162)	n.r.	8	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1986	n.r.	p,p'-DDE	173		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1987	n.r.	p,p'-DDE	176 (97.6)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	p,p'-DDE	137 (85.3)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1980	n.r.	p,p'-DDD	57.1		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	p,p'-DDD	44.7 (43.8)	n.r.	8	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1986	n.r.	p,p'-DDD	39.7		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1987	n.r.	p,p'-DDD	22.6 (14.9)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	p,p'-DDD	11.3 (9.54)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1980	n.r.	p,p'-DDT	11.1		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	p,p'-DDT	1.79 (2.30)	n.r.	8	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1986	n.r.	p,p'-DDT	not detected		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1987	n.r.	p,p'-DDT	6.79 (9.01)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	p,p'-DDT	7.21 (4.40)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1980	n.r.	Total DDT	263		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	Total DDT	300 (207)	n.r.	8	Liver	Lake et al., 1994

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Kemp's Ridley	Long Island, NY	1986	n.r.	Total DDT	213		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1987	n.r.	Total DDT	205 (122)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	Total DDT	156 (99.2)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	p,p'-DDE	386 (250)	n.r.	7	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	p,p'-DDE	232 (157)	n.r.	6	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	p,p'-DDD	57.9 (44.9)	n.r.	7	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	p,p'-DDD	15.5 (8.11)	n.r.	6	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	p,p'-DDT	10.3 (3.36)	n.r.	7	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	p,p'-DDT	4.1 (11.2)	n.r.	6	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	Total DDT	454 (298)	n.r.	7	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	Total DDT	261 (176)	n.r.	6	Body Fat	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1980	n.r.	a-chlordane	ND[d]		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	a-chlordane	2.86 (4.88)	n.r.	8	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1986	n.r.	a-chlordane	ND		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1987	n.r.	a-chlordane	4.87 (4.53)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	a-chlordane	0.18 (0.32)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1980	n.r.	trans-nonachlor	75.4		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	trans-nonachlor	86.0 (78.1)	n.r.	8	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1986	n.r.	trans-nonachlor	53.6		1	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1987	n.r.	trans-nonachlor	29.6 (20.1)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	trans-nonachlor	27.5 (12.6)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	a-chlordane	2.26 (4.23)	n.r.	7	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	a-chlordane	5.30 (11.3)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1985	n.r.	trans-nonachlor	129 (112)	n.r.	7	Liver	Lake et al., 1994
Kemp's Ridley	Long Island, NY	1989	n.r.	trans-nonachlor	48.9 (29.4)	n.r.	6	Liver	Lake et al., 1994
Kemp's Ridley	Gwynn's Island, VA	1991	F	p,p'-DDE	55.5		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Gwynn's Island, VA	1991	F	p,p'-DDE	95.7		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Gwynn's Island, VA	1991	F	p,p'-DDD	9.75		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Gwynn's Island, VA	1991	F	p,p'-DDD	15.5		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Gwynn's Island, VA	1991	F	p,p'-DDT	ND		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Gwynn's Island, VA	1991	F	p,p'-DDT	ND		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Gwynn's Island, VA	1991	F	Sum PCB	360		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Gwynn's Island, VA	1991	F	Sum PCB	281		1	Sub. Fat	Rybitski et al., 1995

[a] μg/kg wet mass ($\pm$ 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Kemp's Ridley	Gwynn's Island, VA	1991	F	IUPAC 153/132	152		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Gwynn's Island, VA	1991	F	IUPAC 153/132	90.4		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Gwynn's Island, VA	1991	F	IUPAC 138/158	26.1		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Gwynn's Island, VA	1991	F	IUPAC 138/158	38.9		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Gwynn's Island, VA	1991	F	IUPAC 180	13.6		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Gwynn's Island, VA	1991	F	IUPAC 180	19.1		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Gwynn's Island, VA	1991	F	IUPAC 118	14.8		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Gwynn's Island, VA	1991	F	IUPAC 118	19.4		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Gwynn's Island, VA	1991	F	IUPAC 187	7.79		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Gwynn's Island, VA	1991	F	IUPAC187	11.2		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Newpoint, VA	1991	F	p,p'-DDE	54.2		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Newpoint, VA	1991	F	p,p'-DDE	194		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Newpoint, VA	1991	F	p,p'-DDD	11.4		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Newpoint, VA	1991	F	p,p'-DDD	42.1		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Newpoint, VA	1991	F	p,p'-DDT	ND		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Newpoint, VA	1991	F	p,p'-DDT	ND		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Newpoint, VA	1991	F	Sum PCB	608		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Newpoint, VA	1991	F	Sum PCB	794		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Newpoint, VA	1991	F	IUPAC 153/132	259		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Newpoint, VA	1991	F	IUPAC 153/132	194		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Newpoint, VA	1991	F	IUPAC 138/158	35.6		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Newpoint, VA	1991	F	IUPAC 138/158	101		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Newpoint, VA	1991	F	IUPAC 180	19.5		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Newpoint, VA	1991	F	IUPAC 180	45.5		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Newpoint, VA	1991	F	IUPAC 118	16.8		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Newpoint, VA	1991	F	IUPAC 118	70.3		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Newpoint, VA	1991	F	IUPAC 187	8.92		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Newpoint, VA	1991	F	IUPAC187	27.1		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Beaufort, NC	1991	n.r.	p,p'-DDE	56.8		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Beaufort, NC	1991	n.r.	p,p'-DDE	292		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Beaufort, NC	1991	n.r.	p,p'-DDD	4.94		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Beaufort, NC	1991	n.r.	p,p'-DDD	24.4		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Beaufort, NC	1991	n.r.	p,p'-DDT	ND		1	Liver	Rybitski et al., 1995

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Kemp's Ridley	Beaufort, NC	1991	n.r.	p,p'-DDT	5.19		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Beaufort, NC	1991	n.r.	Sum PCB	158		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Beaufort, NC	1991	n.r.	Sum PCB	904		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Beaufort, NC	1991	n.r.	IUPAC 153/132	43.1		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Beaufort, NC	1991	n.r.	IUPAC 153/132	283		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Beaufort, NC	1991	n.r.	IUPAC 138/158	28.7		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Beaufort, NC	1991	n.r.	IUPAC 138/158	156		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Beaufort, NC	1991	n.r.	IUPAC 180	10.3		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Beaufort, NC	1991	n.r.	IUPAC 180	64		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Beaufort, NC	1991	n.r.	IUPAC 118	18.7		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Beaufort, NC	1991	n.r.	IUPAC 118	91.9		1	Sub. Fat	Rybitski et al., 1995
Kemp's Ridley	Beaufort, NC	1991	n.r.	IUPAC 187	4.9		1	Liver	Rybitski et al., 1995
Kemp's Ridley	Beaufort, NC	1991	n.r.	IUPAC187	34.6		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	p,p'-DDE	15.8		1	Liver	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	p,p'-DDE	105		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	p,p'-DDE	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	p,p'-DDE	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	p,p'-DDD	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	p,p'-DDD	2.39		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	p,p'-DDD	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	p,p'-DDD	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	p,p'-DDT	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	p,p'-DDT	ND		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	p,p'-DDT	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	p,p'-DDT	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	Sum PCB	29.3		1	Liver	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	Sum PCB	274		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	Sum PCB	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	Sum PCB	4.82		1	Kidney	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 153/132	12.8		1	Liver	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 153/132	98.2		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 153/132	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 153/132	2.66		1	Kidney	Rybitski et al., 1995

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 138/158	5.77		1	Liver	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 138/158	36		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 138/158	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 138/158	2.15		1	Kidney	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 180	2.26		1	Liver	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 180	24.2		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 180	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 180	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 118	3.7		1	Liver	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 118	28.6		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 118	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 118	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 187	2.38		1	Liver	Rybitski et al.. 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 187	13.7		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 187	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 187	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	p,p'-DDE	16.8		1	Liver	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	p,p'-DDE	28.9		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	p,p'-DDE	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	p,p'-DDD	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	p,p'-DDD	ND		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	p,p'-DDD	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	p,p'-DDT	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	p,p'-DDT	ND		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	p,p'-DDT	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	Sum PCB	15.1		1	Liver	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	Sum PCB	55.4		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	Sum PCB	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	IUPAC 153/132	3.62		1	Liver	Rybitski et al., 1995
Loggerhead	Kilmarnock. VA	1991	F	IUPAC 153/132	19.7		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	IUPAC 153/132	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	IUPAC 138/158	3.59		1	Liver	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	IUPAC 138/158	10.6		1	Sub. Fat	Rybitski et al., 1995

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Loggerhead	Kilmarnock, VA	1991	F	IUPAC 138/158	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	IUPAC 180	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	IUPAC 180	5.41		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	IUPAC 180	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	IUPAC 118	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	IUPAC 118	4.55		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	IUPAC 118	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	IUPAC 187	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	IUPAC 187	3.9		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Kilmarnock, VA	1991	F	IUPAC 187	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	p,p'-DDE	13.8		1	Liver	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	p,p'-DDE	45.5		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	p,p'-DDE	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	p,p'-DDE	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	p,p'-DDD	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	p,p'-DDD	7.04		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	p,p'-DDD	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	p,p'-DDD	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	p,p'-DDT	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	p,p'-DDT	ND		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	p,p'-DDT	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	p,p'-DDT	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	Sum PCB	41.9		1	Liver	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	Sum PCB	95.6		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	Sum PCB	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	Sum PCB	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	IUPAC 153/132	8.93		1	Liver	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	IUPAC 153/132	18.7		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	IUPAC 153/132	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	IUPAC 153/132	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	IUPAC 138/158	5.33		1	Liver	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	IUPAC 138/158	17.5		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	IUPAC 138/158	ND		1	Pec. Muscle	Rybitski et al., 1995

[a] $\mu g/kg$ wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Loggerhead	Yorktown, VA	1991	F	IUPAC 138/158	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	IUPAC 180	2.26		1	Liver	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	IUPAC 180	7.37		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	IUPAC 180	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	IUPAC 180	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	IUPAC 118	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	IUPAC 118	6.04		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	IUPAC 118	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	IUPAC 118	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	IUPAC 187	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	IUPAC 187	5.26		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	IUPAC 187	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Yorktown, VA	1991	F	IUPAC 187	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	p,p'-DDE	34.6		1	Liver	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	p,p'-DDE	408		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	p,p'-DDE	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	p,p'-DDD	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	p,p'-DDD	12.2		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	p,p'-DDD	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	p,p'-DDT	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	p,p'-DDT	4.31		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	p,p'-DDT	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	Sum PCB	33.5		1	Liver	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	Sum PCB	609		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	Sum PCB	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 153/132	13.6		1	Liver	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 153/132	186		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 153/132	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 138/158	6.78		1	Liver	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 138/158	110		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 138/158	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 180	ND		1	Liver	Rybitski et al., 1995

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Loggerhead	Bena, VA	1991	n.r.	IUPAC 180	46.8		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 180	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 118	2.32		1	Liver	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 118	45.1		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 118	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 187	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 187	35.4		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 187	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	p,p'-DDE	9.35		1	Liver	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	p,p'-DDE	98.9		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	p,p'-DDE	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	p,p'-DDE	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	p,p'-DDD	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	p,p'-DDD	3.01		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	p,p'-DDD	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	p,p'-DDD	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	p,p'-DDT	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	p,p'-DDT	ND		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	p,p'-DDT	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	p,p'-DDT	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	Sum PCB	84.3		1	Liver	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	Sum PCB	227		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	Sum PCB	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	Sum PCB	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	IUPAC 153/132	29.2		1	Liver	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	IUPAC 153/132	57.4		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	IUPAC 153/132	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	IUPAC 153/132	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	IUPAC 138/158	7.53		1	Liver	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	IUPAC 138/158	44.4		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	IUPAC 138/158	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	IUPAC 138/158	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	IUPAC 180	3.66		1	Liver	Rybitski et al., 1995

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Loggerhead	Fort Monroe, VA	1991	n.r.	IUPAC 180	26		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	IUPAC 180	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	IUPAC 180	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	IUPAC 118	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	IUPAC 118	14.6		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	IUPAC 118	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	IUPAC 118	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	IUPAC 187	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	IUPAC 187	11.5		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	IUPAC 187	ND		1	Pec. Muscle	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	n.r.	IUPAC 187	ND		1	Kidney	Rybitski et al., 1995
Loggerhead	Seaford, VA	1991	n.r.	p,p'-DDE	31.6		1	Liver	Rybitski et al., 1995
Loggerhead	Seaford, VA	1991	n.r.	p,p'-DDE	96.2		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Seaford, VA	1991	n.r.	p,p'-DDD	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Seaford, VA	1991	n.r.	p,p'-DDD	5.55		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Seaford, VA	1991	n.r.	p,p'-DDT	3.44		1	Liver	Rybitski et al., 1995
Loggerhead	Seaford, VA	1991	n.r.	p,p'-DDT	ND		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Seaford, VA	1991	n.r.	Sum PCB	3.3		1	Liver	Rybitski et al., 1995
Loggerhead	Seaford, VA	1991	n.r.	Sum PCB	184		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Seaford, VA	1991	n.r.	IUPAC 153/132	124		1	Liver	Rybitski et al., 1995
Loggerhead	Seaford, VA	1991	n.r.	IUPAC 153/132	62.6		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Seaford, VA	1991	n.r.	IUPAC 138/158	19.3		1	Liver	Rybitski et al., 1995
Loggerhead	Seaford, VA	1991	n.r.	IUPAC 138/158	29.2		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Seaford, VA	1991	n.r.	IUPAC 180	15.8		1	Liver	Rybitski et al., 1995
Loggerhead	Seaford, VA	1991	n.r.	IUPAC 180	15.4		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Seaford, VA	1991	n.r.	IUPAC 118	5.3		1	Liver	Rybitski et al., 1995
Loggerhead	Seaford, VA	1991	n.r.	IUPAC 118	13.1		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Seaford, VA	1991	n.r.	IUPAC 187	5.53		1	Liver	Rybitski et al., 1995
Loggerhead	Seaford, VA	1991	n.r.	IUPAC187	7.87		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	F	p,p'-DDE	21		1	Liver	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	F	p,p'-DDE	158		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	F	p,p'-DDD	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	F	p,p'-DDD	18.3		1	Sub. Fat	Rybitski et al., 1995

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Loggerhead	Fort Monroe, VA	1991	F	p,p'-DDT	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	F	p,p'-DDT	ND		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	F	Sum PCB	345		1	Liver	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	F	Sum PCB	1030		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	F	IUPAC 153/132	140		1	Liver	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	F	IUPAC 153/132	229		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	F	IUPAC 138/158	28.9		1	Liver	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	F	IUPAC 138/158	171		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	F	IUPAC 180	20.2		1	Liver	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	F	IUPAC 180	98.1		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	F	IUPAC 118	10		1	Liver	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	F	IUPAC 118	88.1		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	F	IUPAC 187	8.97		1	Liver	Rybitski et al., 1995
Loggerhead	Fort Monroe, VA	1991	F	IUPAC187	53.4		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Deltaville, VA	1991	F	p,p'-DDE	45.6		1	Liver	Rybitski et al., 1995
Loggerhead	Deltaville, VA	1991	F	p,p'-DDE	272		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Deltaville, VA	1991	F	p,p'-DDD	4.08		1	Liver	Rybitski et al., 1995
Loggerhead	Deltaville, VA	1991	F	p,p'-DDD	35.6		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Deltaville, VA	1991	F	p,p'-DDT	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Deltaville, VA	1991	F	p,p'-DDT	ND		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Deltaville, VA	1991	F	Sum PCB	434		1	Liver	Rybitski et al., 1995
Loggerhead	Deltaville, VA	1991	F	Sum PCB	1730		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Deltaville, VA	1991	F	IUPAC 153/132	144		1	Liver	Rybitski et al., 1995
Loggerhead	Deltaville, VA	1991	F	IUPAC 153/132	406		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Deltaville, VA	1991	F	IUPAC 138/158	49.4		1	Liver	Rybitski et al., 1995
Loggerhead	Deltaville, VA	1991	F	IUPAC 138/158	236		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Deltaville, VA	1991	F	IUPAC 180	19.6		1	Liver	Rybitski et al., 1995
Loggerhead	Deltaville, VA	1991	F	IUPAC 180	120		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Deltaville, VA	1991	F	IUPAC 118	28.5		1	Liver	Rybitski et al., 1995
Loggerhead	Deltaville, VA	1991	F	IUPAC 118	193		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Deltaville, VA	1991	F	IUPAC 187	14.5		1	Liver	Rybitski et al., 1995
Loggerhead	Deltaville, VA	1991	F	IUPAC187	78.4		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	North, VA	1991	n.r.	p,p'-DDE	4.99		1	Liver	Rybitski et al., 1995

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Loggerhead	North, VA	1991	n.r.	p,p'-DDE	77.4		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	North, VA	1991	n.r.	p,p'-DDD	ND		1	Liver	Rybitski et al., 1995
Loggerhead	North, VA	1991	n.r.	p,p'-DDD	6.44		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	North, VA	1991	n.r.	p,p'-DDT	ND		1	Liver	Rybitski et al., 1995
Loggerhead	North, VA	1991	n.r.	p,p'-DDT	3.5		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	North, VA	1991	n.r.	Sum PCB	8.26		1	Liver	Rybitski et al., 1995
Loggerhead	North, VA	1991	n.r.	Sum PCB	203		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	North, VA	1991	n.r.	IUPAC 153/132	5.75		1	Liver	Rybitski et al., 1995
Loggerhead	North, VA	1991	n.r.	IUPAC 153/132	48.4		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	North, VA	1991	n.r.	IUPAC 138/158	ND		1	Liver	Rybitski et al., 1995
Loggerhead	North, VA	1991	n.r.	IUPAC 138/158	36		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	North, VA	1991	n.r.	IUPAC 180	ND		1	Liver	Rybitski et al., 1995
Loggerhead	North, VA	1991	n.r.	IUPAC 180	12.4		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	North, VA	1991	n.r.	IUPAC 118	ND		1	Liver	Rybitski et al., 1995
Loggerhead	North, VA	1991	n.r.	IUPAC 118	16		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	North, VA	1991	n.r.	IUPAC 187	ND		1	Liver	Rybitski et al., 1995
Loggerhead	North, VA	1991	n.r.	IUPAC187	11.2		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	p,p'-DDE	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	p,p'-DDE	76.1		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	p,p'-DDD	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	p,p'-DDD	7.03		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	p,p'-DDT	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	p,p'-DDT	2.63		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	Sum PCB	10.3		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	Sum PCB	316		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 153/132	2.04		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 153/132	79.5		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 138/158	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 138/158	43.8		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 180	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 180	20.5		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 118	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 118	22.2		1	Sub. Fat	Rybitski et al., 1995

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Loggerhead	Beaufort, NC	1991	F	IUPAC 187	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC187	16.7		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	F	p,p'-DDE	59.1		1	Liver	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	F	p,p'-DDE	186		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	F	p,p'-DDD	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	F	p,p'-DDD	7.62		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	F	p,p'-DDT	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	F	p,p'-DDT	3.77		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	F	Sum PCB	237		1	Liver	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	F	Sum PCB	1010		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	F	IUPAC 153/132	78.1		1	Liver	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	F	IUPAC 153/132	293		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	F	IUPAC 138/158	27.5		1	Liver	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	F	IUPAC 138/158	116		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	F	IUPAC 180	18.1		1	Liver	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	F	IUPAC 180	90.1		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	F	IUPAC 118	18.5		1	Liver	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	F	IUPAC 118	73.9		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	F	IUPAC 187	9.36		1	Liver	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	F	IUPAC187	39.7		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	p,p'-DDE	30.6		1	Liver	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	p,p'-DDE	202		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	p,p'-DDD	2.87		1	Liver	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	p,p'-DDD	21.6		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	p,p'-DDT	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	p,p'-DDT	ND		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	Sum PCB	126		1	Liver	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	Sum PCB	834		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 153/132	37.4		1	Liver	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 153/132	239		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 138/158	20.8		1	Liver	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 138/158	125		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 180	12		1	Liver	Rybitski et al., 1995

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 180	71.1		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 118	11.2		1	Liver	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 118	82.1		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC 187	7.19		1	Liver	Rybitski et al., 1995
Loggerhead	Gwynn's Island, VA	1991	F	IUPAC187	47.1		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	p,p'-DDE	6.72		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	p,p'-DDE	54.5		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	p,p'-DDD	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	p,p'-DDD	4.11		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	p,p'-DDT	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	p,p'-DDT	5.29		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	Sum PCB	7.46		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	Sum PCB	205		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	IUPAC 153/132	5.42		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	IUPAC 153/132	49.1		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	IUPAC 138/158	2.04		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	IUPAC 138/158	41.6		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	IUPAC 180	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	IUPAC 180	15.3		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	IUPAC 118	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	IUPAC 118	18.8		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	IUPAC 187	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	IUPAC187	13.1		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Newport News, VA	1991	M	p,p'-DDE	63.1		1	Liver	Rybitski et al., 1995
Loggerhead	Newport News, VA	1991	M	p,p'-DDE	185		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Newport News, VA	1991	M	p,p'-DDD	2.04		1	Liver	Rybitski et al., 1995
Loggerhead	Newport News, VA	1991	M	p,p'-DDD	7.68		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Newport News, VA	1991	M	p,p'-DDT	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Newport News, VA	1991	M	p,p'-DDT	10.8		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Newport News, VA	1991	M	Sum PCB	115		1	Liver	Rybitski et al., 1995
Loggerhead	Newport News, VA	1991	M	Sum PCB	446		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Newport News, VA	1991	M	IUPAC 153/132	39.1		1	Liver	Rybitski et al., 1995
Loggerhead	Newport News, VA	1991	M	IUPAC 153/132	105		1	Sub. Fat	Rybitski et al., 1995

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Loggerhead	Newport News, VA	1991	M	IUPAC 138/158	15.5		1	Liver	Rybitski et al., 1995
Loggerhead	Newport News, VA	1991	M	IUPAC 138/158	67.5		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Newport News, VA	1991	M	IUPAC 180	6.7		1	Liver	Rybitski et al., 1995
Loggerhead	Newport News, VA	1991	M	IUPAC 180	31.2		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Newport News, VA	1991	M	IUPAC 118	7.54		1	Liver	Rybitski et al., 1995
Loggerhead	Newport News, VA	1991	M	IUPAC 118	29		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Newport News, VA	1991	M	IUPAC 187	6.74		1	Liver	Rybitski et al., 1995
Loggerhead	Newport News, VA	1991	M	IUPAC187	28.9		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1992	M	p,p'-DDE	25.9		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1992	M	p,p'-DDE	441		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1992	M	p,p'-DDD	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1992	M	p,p'-DDD	6.33		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1992	M	p,p'-DDT	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1992	M	p,p'-DDT	ND		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1992	M	Sum PCB	132		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1992	M	Sum PCB	1140		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1992	M	IUPAC 153/132	65.4		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1992	M	IUPAC 153/132	352		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1992	M	IUPAC 138/158	13.8		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1992	M	IUPAC 138/158	160		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1992	M	IUPAC 180	12.6		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1992	M	IUPAC 180	198		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1992	M	IUPAC 118	3		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1992	M	IUPAC 118	57.4		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1992	M	IUPAC 187	3.3		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1992	M	IUPAC187	54.1		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	p,p'-DDE	13.6		1	Liver	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	p,p'-DDE	99		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	p,p'-DDD	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	p,p'-DDD	ND		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	p,p'-DDT	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	p,p'-DDT	ND		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	Sum PCB	156		1	Liver	Rybitski et al., 1995

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Loggerhead	Bena, VA	1991	n.r.	Sum PCB	506		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 153/132	49.8		1	Liver	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 153/132	189		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 138/158	16.2		1	Liver	Rybitski et al.. 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 138/158	74.6		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 180	9.52		1	Liver	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 180	57.3		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 118	5.11		1	Liver	Rybitski et al., 1995
Loggerhead	Bena. VA	1991	n.r.	IUPAC 118	33.3		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC 187	4.98		1	Liver	Rybitski et al., 1995
Loggerhead	Bena, VA	1991	n.r.	IUPAC187	26		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	n.r.	p,p'-DDE	458		1	Liver	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	n.r.	p,p'-DDE	1210		1	Sub. Fat	Rybitski et al.. 1995
Loggerhead	Virginia Beach, VA	1991	n.r.	p,p'-DDD	3.76		1	Liver	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	n.r.	p,p'-DDD	11.6		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	n.r.	p,p'-DDT	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	n.r.	p,p'-DDT	2.68		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	n.r.	Sum PCB	514		1	Liver	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	n.r.	Sum PCB	1340		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	n.r.	IUPAC 153/132	131		1	Liver	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	n.r.	IUPAC 153/132	298		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	n.r.	IUPAC 138/158	65.8		1	Liver	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	n.r.	IUPAC 138/158	212		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	n.r.	IUPAC 180	16.4		1	Liver	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	n.r.	IUPAC 180	60.8		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	n.r.	IUPAC 118	59.5		1	Liver	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	n.r.	IUPAC 118	214		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	n.r.	IUPAC 187	16		1	Liver	Rybitski et al., 1995
Loggerhead	Virginia Beach, VA	1991	n.r.	IUPAC187	60.1		1	Sub. Fat	Rybitski et al.. 1995
Loggerhead	Beaufort, NC	1991	F	p,p'-DDE	4.03		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	p,p'-DDE	74.7		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	p,p'-DDD	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	p,p'-DDD	8.28		1	Sub. Fat	Rybitski et al., 1995

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Loggerhead	Beaufort, NC	1991	F	p,p'-DDT	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	p,p'-DDT	6.08		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	Sum PCB	13.8		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	Sum PCB	374		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 153/132	6.95		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 153/132	91.2		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 138/158	2.75		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 138/158	74.2		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 180	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 180	17.8		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 118	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 118	44.6		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 187	ND		1	Liver	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC187	22.4		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	p,p'-DDE	76.8		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	p,p'-DDD	6.19		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	p,p'-DDT	7.07		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	Sum PCB	356		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	IUPAC 153/132	82.8		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	IUPAC 138/158	68.7		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	IUPAC 180	22.3		1	Sub. Fat	Rybitski et al.. 1995
Loggerhead	Beaufort, NC	1991	M	IUPAC 118	29.8		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	M	IUPAC187	21.1		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	p,p'-DDE	2.86		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	p,p'-DDD	ND		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	p,p'-DDT	3.19		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	Sum PCB	82.9		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 153/132	12.1		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 138/158	3.77		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 180	ND		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC 118	7.26		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	Beaufort, NC	1991	F	IUPAC187	ND		1	Sub. Fat	Rybitski et al., 1995
Loggerhead	East Coast of FL	n.r.	n.r.	Total DDE	8	1.0-45.0	9	Muscle	McKim and Johnson, 1983

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Loggerhead	East Coast of FL	n.r.	n.r.	Aroclor 1242	ND		9	Muscle	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	Aroclor 1248	4.81 (3.75)	1.9-13	9	Muscle	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	Aroclor 1254	1.3 (0.825)	ND-2.2	9	Muscle	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	Aroclor 1260	6.69 (10.13)	1.4-33	9	Muscle	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	Total PCB (1248,1254,1260)	12.87 (12.98)	5.0-46	9	Muscle	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	Total DDE	1		2	Muscle	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	Aroclor 1242	ND		4	Muscle	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	Aroclor 1248	1.45 (0.971)	ND-2.0	4	Muscle	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	Aroclor 1254	2.35 (0.81)	1.7-3.5	4	Muscle	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	Aroclor 1260	2.88 (1.70)	1.4-5.3	4	Muscle	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	Total PCB (1248,1254,1260)	6.8 (1.78)	5.4-9.4	4	Muscle	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	Aroclor 1242	ND		3	Liver	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	Aroclor 1248	3.33 (5.77)	ND-10	3	Liver	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	Aroclor 1254	4.77 (4.96)	ND-9.9	3	Liver	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	Aroclor 1260	23.53 (20.74)	3.6-45	3	Liver	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	Total PCB (1248,1254,1260)	32 (23.52)	8.0-55.0	3	Liver	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	Aroclor 1242	ND		3	Liver	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	Aroclor 1248	10.67 (18.48)	ND-32	3	Liver	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	Aroclor 1254	25.7 (24.8)	8.1-54	3	Liver	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	Aroclor 1260	76.33 (58.38)	13-128	3	Liver	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	Total PCB (1248,1254,1260)	113 (82.79)	21.0-135.0	3	Liver	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	Aroclor 1242	ND		2	Liver	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	Aroclor 1248	ND		2	Liver	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	Aroclor 1254	21.5 (2.12)	20-23	2	Liver	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	Aroclor 1260	19 (4.24)	16-22	2	Liver	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	Total PCB (1248,1254,1260)	40 (2.12)	39.0-42.0	2	Liver	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	Aroclor 1242	ND		2	Liver	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	Aroclor 1248	12.5 (0.71)	12.0-13.0	2	Liver	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	Aroclor 1254	15 (1.41)	14-16	2	Liver	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	Aroclor 1260	29.5 (19.09)	16-43	2	Liver	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	Total PCB (1248,1254,1260)	57 (19.09)	43.0-70.0	2	Liver	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	Aroclor 1242	ND		1	Liver	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	Aroclor 1248	ND		1	Liver	McKim and Johnson, 1983

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Green	East Coast of FL	n.r.	n.r.	Aroclor 1254	23		1	Liver	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	Aroclor 1260	57		1	Liver	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	Total PCB (1248,1254,1260)	80		1	Liver	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	Aroclor 1242	ND		1	Liver	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	Aroclor 1248	8.9		1	Liver	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	Aroclor 1254	28		1	Liver	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	Aroclor 1260	31		1	Liver	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	Total PCB (1248,1254,1260)	68		1	Liver	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	DDE	15.67 (12.10)	2.0-25.0	3	Liver	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	DDE	37 (54.58)	4.0-100.0	3	Liver	McKim and Johnson, 1983
Loggerhead	East Coast of FL	n.r.	n.r.	DDE	7 (4.24)	4.0-10.0	2	Liver	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	DDE	10		1	Liver	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	DDE	2		1	Liver	McKim and Johnson, 1983
Green	East Coast of FL	n.r.	n.r.	DDE	1		1	Liver	McKim and Johnson, 1983
Loggerhead	Cyrprus, Greece	1995	M	IUPAC 28	<1.6		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	IUPAC 28	<.5		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	J	IUPAC 28	<.5		1	Liver	Mckenzie et al., 1999
Loggerhead	Greece	1995	J	IUPAC 28	<.5		1	Liver	Mckenzie et al., 1999
Loggerhead	UK	1995	J	IUPAC 28	<.9		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1993	M	IUPAC 28	<.8		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1995	M	IUPAC 28	<.5		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 28	<1.5		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 28	<1.1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 28	<1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 28	<.8		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 28	<.7		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 28	<3.4		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 28	<1.7		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 28	<2.4		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 28	<.86		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	IUPAC 52	<1.6		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	IUPAC 52	<.5		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	J	IUPAC 52	1.3		1	Liver	Mckenzie et al., 1999

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Loggerhead	Greece	1995	J	IUPAC 52	0.8		1	Liver	Mckenzie et al., 1999
Loggerhead	UK	1995	J	IUPAC 52	15		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1993	M	IUPAC 52	<.8		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1995	M	IUPAC 52	3.9		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 52	2.2		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 52	<1.1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 52	2.2		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 52	1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 52	0.7		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 52	4.3		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 52	3.5		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 52	3		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 52	2		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	IUPAC 101	3.1		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	IUPAC 101	3.4		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	J	IUPAC 101	1.5		1	Liver	Mckenzie et al., 1999
Loggerhead	Greece	1995	J	IUPAC 101	<.5		1	Liver	Mckenzie et al., 1999
Loggerhead	UK	1995	J	IUPAC 101	16		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1993	M	IUPAC 101	<.8		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1995	M	IUPAC 101	<.6		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 101	4.1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 101	<1.1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 101	3.4		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 101	1.3		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 101	0.9		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 101	7.4		1	Liver	Mckenzie et al.. 1999
Green	Cyrprus, Greece	1996	J	IUPAC 101	3.9		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 101	2.8		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 101	3.2		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	IUPAC 118	8.7		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	IUPAC 118	4.9		1	Liver	Mckenzie et al.. 1999
Loggerhead	Cyrprus, Greece	1995	J	IUPAC 118	3.3		1	Liver	Mckenzie et al., 1999
Loggerhead	Greece	1995	J	IUPAC 118	6.4		1	Liver	Mckenzie et al., 1999

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Loggerhead	UK	1995	J	IUPAC 118	12		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1993	M	IUPAC 118	<.8		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1995	M	IUPAC 118	<.6		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 118	2.8		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 118	<1.1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 118	3		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 118	1.3		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 118	<.7		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 118	4.8		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 118	1.7		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 118	<2.4		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 118	2.6		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	IUPAC 153	29		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	IUPAC 153	27		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	J	IUPAC 153	13		1	Liver	Mckenzie et al., 1999
Loggerhead	Greece	1995	J	IUPAC 153	26		1	Liver	Mckenzie et al., 1999
Loggerhead	UK	1995	J	IUPAC 153	24		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1993	M	IUPAC 153	1.3		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1995	M	IUPAC 153	1.5		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 153	6.1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 153	<1.1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 153	9.2		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 153	5.8		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 153	2		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 153	13		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 153	3.4		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 153	12		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 153	6.3		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	IUPAC 138	24		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	IUPAC 138	20		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	J	IUPAC 138	12		1	Liver	Mckenzie et al., 1999
Loggerhead	Greece	1995	J	IUPAC 138	18		1	Liver	Mckenzie et al., 1999
Loggerhead	UK	1995	J	IUPAC 138	20		1	Liver	Mckenzie et al., 1999

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Leatherback	UK	1993	M	IUPAC 138	0.8		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1995	M	IUPAC 138	<.6		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 138	6		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 138	<1.1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 138	7.6		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 138	6.4		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 138	2		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 138	11		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 138	2.2		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 138	10		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 138	5.2		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	IUPAC 180	11		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	IUPAC 180	18		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	J	IUPAC 180	7.3		1	Liver	Mckenzie et al., 1999
Loggerhead	Greece	1995	J	IUPAC 180	11		1	Liver	Mckenzie et al., 1999
Loggerhead	UK	1995	J	IUPAC 180	12		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1993	M	IUPAC 180	<.8		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1995	M	IUPAC 180	<.6		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 180	2.5		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 180	<1.1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 180	5.3		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 180	3.5		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 180	1.1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 180	6.7		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 180	1.9		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	IUPAC 180	7.4		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	IUPAC 180	2.8		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	Sum CB	102		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	Sum CB	101		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	J	Sum CB	50		1	Liver	Mckenzie et al., 1999
Loggerhead	Greece	1995	J	Sum CB	83		1	Liver	Mckenzie et al., 1999
Loggerhead	UK	1995	J	Sum CB	159		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1993	M	Sum CB	3.7		1	Liver	Mckenzie et al., 1999

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Leatherback	UK	1995	M	Sum CB	3.1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Sum CB	35		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Sum CB	<1.1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Sum CB	45		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Sum CB	25		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Sum CB	10		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Sum CB	77		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Sum CB	29		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Sum CB	47		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Sum CB	34		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	Endrin	nm		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	J	Endrin	<.2		1	Liver	Mckenzie et al., 1999
Loggerhead	Greece	1995	J	Endrin	1		1	Liver	Mckenzie et al., 1999
Loggerhead	UK	1995	J	Endrin	nm		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1993	M	Endrin	1.1		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1995	M	Endrin	1.3		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Endrin	0.6		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Endrin	<1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Endrin	nm		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Endrin	<.4		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Endrin	nm		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Endrin	<1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Endrin	<.8		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Endrin	<1.2		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Endrin	<.4		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	Dieldrin	nm		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	Dieldrin	2.7		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	J	Dieldrin	0.3		1	Liver	Mckenzie et al., 1999
Loggerhead	Greece	1995	J	Dieldrin	2.5		1	Liver	Mckenzie et al., 1999
Loggerhead	UK	1995	J	Dieldrin	nm		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1993	M	Dieldrin	2.5		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1995	M	Dieldrin	3.1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Dieldrin	3		1	Liver	Mckenzie et al., 1999

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Green	Cyrprus, Greece	1995	J	Dieldrin	0.5		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Dieldrin	nm		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Dieldrin	2.4		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Dieldrin	nm		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Dieldrin	<1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Dieldrin	1.5		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Dieldrin,	1.9		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Dieldrin	<.4		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	p,p'-DDD	nm		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	p,p'-DDD	<.5		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	J	p,p'-DDD	<.2		1	Liver	Mckenzie et al., 1999
Loggerhead	Greece	1995	J	p,p'-DDD	<.5		1	Liver	Mckenzie et al., 1999
Loggerhead	UK	1995	J	p,p'-DDD	nm		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1993	M	p,p'-DDD	<.7		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1995	M	p,p'-DDD	<.6		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	p,p'-DDD	<.7		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	p,p'-DDD	<1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	p,p'-DDD	nm		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	p,p'-DDD	<.4		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	p,p'-DDD	nm		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	p,p'-DDD	<1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	p,p'-DDD	<.8		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	p,p'-DDD	<1.2		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	p,p'-DDD	<.4		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	p,p'-DDE	76		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	p,p'-DDE	49		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	J	p,p'-DDE	68		1	Liver	Mckenzie et al., 1999
Loggerhead	Greece	1995	J	p,p'-DDE	49		1	Liver	Mckenzie et al., 1999
Loggerhead	UK	1995	J	p,p'-DDE	149		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1993	M	p,p'-DDE	1.7		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1995	M	p,p'-DDE	6.5		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	p,p'-DDE	6.2		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	p,p'-DDE	<1.0		1	Liver	Mckenzie et al., 1999

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Green	Cyrprus, Greece	1995	J	p,p'-DDE	2.7		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	p,p'-DDE	1.3		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	p,p'-DDE	1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	p,p'-DDE	21		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	p,p'-DDE	1.3		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	p,p'-DDE	4.2		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	p,p'-DDE	5.8		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	p,p'-DDT	nm		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	p,p'-DDT	<0.5		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	J	p,p'-DDT	0.7		1	Liver	Mckenzie et al., 1999
Loggerhead	Greece	1995	J	p,p'-DDT	<0.5		1	Liver	Mckenzie et al., 1999
Loggerhead	UK	1995	J	p,p'-DDT	nm		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1993	M	p,p'-DDT	<0.7		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1995	M	p,p'-DDT	<0.6		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	p,p'-DDT	0.8		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	p,p'-DDT	<1.0		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	p,p'-DDT	nm		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	p,p'-DDT	<0.4		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	p,p'-DDT	nm		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	p,p'-DDT	<1.0		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	p,p'-DDT	<0.8		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	p,p'-DDT	<1.2		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	p,p'-DDT	<0.4		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	Sum DDT	77		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	Sum DDT	49		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	J	Sum DDT	69		1	Liver	Mckenzie et al., 1999
Loggerhead	Greece	1995	J	Sum DDT	51		1	Liver	Mckenzie et al., 1999
Loggerhead	UK	1995	J	Sum DDT	152		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1993	M	Sum DDT	9.1		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1995	M	Sum DDT	14		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Sum DDT	10		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Sum DDT	1.2		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Sum DDT	2.7		1	Liver	Mckenzie et al., 1999

[a] μg/kg wet mass (± 1 SD)

[b] M-male; F-female; J-juvenile, sex not determined

[c] n.r. - not reported

[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Green	Cyrprus, Greece	1996	J	Sum DDT	2.2		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Sum DDT	1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Sum DDT	23		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Sum DDT	2.9		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Sum DDT	5.1		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Sum DDT	6.2		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	Sum Chlor	nm		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	Sum Chlor	2.1		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	J	Sum Chlor	1.8		1	Liver	Mckenzie et al., 1999
Loggerhead	Greece	1995	J	Sum Chlor	5		1	Liver	Mckenzie et al., 1999
Loggerhead	UK	1995	J	Sum Chlor	nm		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1993	M	Sum Chlor	2.3		1	Liver	Mckenzie et al., 1999
Leatherback	UK	1995	M	Sum Chlor	2.3		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Sum Chlor	<.7		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Sum Chlor	<1.0		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Sum Chlor	nm		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Sum Chlor	<0.4		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Sum Chlor	2.7		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Sum Chlor	<1.0		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Sum Chlor	<0.8		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1996	J	Sum Chlor	3.7		1	Liver	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Sum Chlor	<0.4		1	Liver	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	CB 28	<5.4		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	CB 28	<8.0		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	F	CB 28	<4.8		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1993	M	CB 28	<7.2		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1995	M	CB 28	<4.7		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 28	<3.2		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 28	<2.2		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 28	<3.7		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	CB 52	24		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	CB 52	37		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	F	CB 52	8.6		1	Adipose	Mckenzie et al., 1999

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Leatherback	UK	1993	M	CB 52	12		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1995	M	CB 52	12		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 52	25		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 52	13		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 52	19		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	CB 101	28		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	CB 101	32		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	F	CB 101	8		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1993	M	CB 101	<7.2		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1995	M	CB 101	5.8		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 101			1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 101	12		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 101	5.7		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 101	33		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	CB 118	71		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	CB 118	54		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	F	CB 118	62		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1993	M	CB 118	<7.2		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1995	M	CB 118	8.3		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 118	3.7		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 118	<2.2		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 118	27		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	CB 153	229		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	CB 153	232		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	F	CB 153	261		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1993	M	CB 153	7.8		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1995	M	CB 153	46		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 153	14		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 153	<2.2		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 153	32		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	CB 138	132		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	CB 138	133		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	F	CB 138	169		1	Adipose	Mckenzie et al., 1999

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Leatherback	UK	1993	M	CB 138	<7.2		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1995	M	CB 138	25		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 138	8.2		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 138	<2.2		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 138	28		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	CB 180	73		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	CB 180	154		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	F	CB 180	116		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1993	M	CB 180	<7.2		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1995	M	CB 180	24		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 180	7.8		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 180	<2.2		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	CB 180	13		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	Sum CB	775		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	Sum CB	893		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	F	Sum CB	853		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1993	M	Sum CB	47		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1995	M	Sum CB	178		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Sum CB	109		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Sum CB	39		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Sum CB	261		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	Endrin	<6.0		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	Endrin	<2.0		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	F	Endrin	10		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1993	M	Endrin	<8.1		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1995	M	Endrin	<6.2		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Endrin	<3.2		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Endrin	<1.9		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Endrin	<3.0		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	Dieldrin	9.2		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	Dieldrin	6.2		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	F	Dieldrin	<1.8		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1993	M	Dieldrin	19		1	Adipose	Mckenzie et al., 1999

[a] μg/kg wet mass (± 1 SD)

[b] M-male; F-female; J-juvenile, sex not determined

[c] n.r. - not reported

[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Leatherback	UK	1995	M	Dieldrin	13		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Dieldrin	3.5		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Dieldrin	<1.9		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Dieldrin	<3.0		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	p,p'-DDD	<6.0		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	p,p'-DDD	6.6		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	F	p,p'-DDD	<1.8		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1993	M	p,p'-DDD	<8.1		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1995	M	p,p'-DDD	<6.2		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	p,p'-DDD	<3.2		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	p,p'-DDD	<1.9		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	p,p'-DDD	<3.0		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	p,p'-DDE	705		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	p,p'-DDE	376		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	F	p,p'-DDE	446		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1993	M	p,p'-DDE	10		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1995	M	p,p'-DDE	57		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	p,p'-DDE	19		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	p,p'-DDE	2.4		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	p,p'-DDE	6		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	p,p'-DDT	8		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	p,p'-DDT	<2.0		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	F	p,p'-DDT	4.6		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1993	M	p,p'-DDT	<8.1		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1995	M	p,p'-DDT	<6.2		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	p,p'-DDT	<3.2		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	p,p'-DDT	<1.9		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	p,p'-DDT	<3.0		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	Sum DDT	739		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	Sum DDT	391		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	F	Sum DDT	454		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1993	M	Sum DDT	14		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1995	M	Sum DDT	58		1	Adipose	Mckenzie et al., 1999

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.1. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Green	Cyrprus, Greece	1995	J	Sum DDT	23		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Sum DDT	3.3		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Sum DDT	11		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	M	Sum Chlor	12		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1994	J	Sum Chlor	14		1	Adipose	Mckenzie et al., 1999
Loggerhead	Cyrprus, Greece	1995	F	Sum Chlor	33		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1993	M	Sum Chlor	22		1	Adipose	Mckenzie et al., 1999
Leatherback	UK	1995	M	Sum Chlor	12		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Sum Chlor	<3.2		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Sum Chlor	<1.9		1	Adipose	Mckenzie et al., 1999
Green	Cyrprus, Greece	1995	J	Sum Chlor	<3.0		1	Adipose	Mckenzie et al., 1999

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female; J-juvenile, sex not determined
[c] n.r. - not reported
[d] ND - not detected

Table II.2. Mean Concentrations of Persistent Chlorinated Compounds in Sea Turtle Eggs[a]

Species	General Location	Date	Egg Part	Compound	Geometric Mean	Range	n	Citation
Green	Ascension Island	1972	yolk	PCB[d]	0.0925 (0.04)	0.03-0.12	4	Thomspon, et al., 1974
Green	Ascension Island	1972	yolk	PCB[e]	0.065 (0.08)	0.02-0.22	6	Thomspon, et al., 1974
Green	Ascension Island	1972	yolk	p,p'-DDE	0.005		1	Thomspon, et al., 1974
Green	Ascension Island	1972	yolk	p,p'-DDE	0.009		1	Thomspon, et al., 1974
Green	Ascension Island	1972	yolk	p,p'-DDE	0.001		1	Thomspon, et al., 1974
Green	Ascension Island	1972	yolk	p,p'-DDE	0.005		1	Thomspon, et al., 1974
Green	Ascension Island	1972	yolk	p,p'-DDE	ND[b]		1	Thomspon, et al., 1974
Green	Ascension Island	1972	yolk	p,p'-DDE	0.001		1	Thomspon, et al., 1974
Green	Ascension Island	1972	yolk	p,p'-DDE	0.003		1	Thomspon, et al., 1974
Green	Ascension Island	1972	yolk	p,p'-DDE	0.004		1	Thomspon, et al., 1974
Green	Ascension Island	1972	yolk	p,p'-DDE	ND		1	Thomspon, et al., 1974
Loggerhead	Merritt Island, FL	1976	n.r[c]	p,p'-DDE	0.047	0.018-0.200	9	Clark and Krynitsky, 1980
Loggerhead	Merritt Island, FL	1976	n.r	p,p'-DDT		ND-0.048	2	Clark and Krynitsky, 1980
Loggerhead	Merritt Island, FL	1976	n.r	Dieldrin		ND-0.028	4	Clark and Krynitsky, 1980
Loggerhead	Merritt Island, FL	1976	n.r	Hepatchlor(epoxide)		ND-0.006	2	Clark and Krynitsky, 1980
Loggerhead	Merritt Island, FL	1976	n.r	Oxychlordane		ND-0.017	2	Clark and Krynitsky, 1980
Loggerhead	Merritt Island, FL	1976	n.r	*trans*-Nonachlor		ND-0.009	1	Clark and Krynitsky, 1980
Loggerhead	Merritt Island, FL	1976	n.r	Mirex		ND-0.005	1	Clark and Krynitsky, 1980
Loggerhead	Merritt Island, FL	1976	n.r	Aroclor 1260	0.078	0.032-0.201	9	Clark and Krynitsky, 1980
Loggerhead[f]	Cape Romain NWR	1993	n.r	diCB	9.3 (4.2)	n.r	16	Cobb and Wood, 1997
Loggerhead[f]	Cape Romain NWR	1993	n.r	triCB	8.7 (1.6)	n.r	16	Cobb and Wood, 1997
Loggerhead[f]	Cape Romain NWR	1993	n.r	tetraCB	120 (31)	n.r	16	Cobb and Wood, 1997
Loggerhead[f]	Cape Romain NWR	1993	n.r	pentaCB	446 (138)	n.r	16	Cobb and Wood, 1997
Loggerhead[f]	Cape Romain NWR	1993	n.r	hexaCB	427 (106)	n.r	16	Cobb and Wood, 1997
Loggerhead[f]	Cape Romain NWR	1993	n.r	heptaCB	173 (46)	n.r	16	Cobb and Wood, 1997
Loggerhead[f]	Cape Romain NWR	1993	n.r	octaCB	30.3 (5.9)	n.r	16	Cobb and Wood, 1997
Loggerhead[f]	Cape Romain NWR	1993	n.r	nonaCB	3.7 (0.7)	n.r	16	Cobb and Wood, 1997
Loggerhead[f]	Cape Romain NWR	1993	n.r	Total PCB	1188 (311)	n.r	16	Cobb and Wood, 1997
Loggerhead[f]	Cape Romain NWR	1993	n.r	decaCB	5.4 (0.8)	n.r	16	Cobb and Wood, 1997
Loggerhead[f]	Cape Romain NWR	1993	CAM[g]	diCB	236 (136)	n.r	16	Cobb and Wood, 1997

[a] μg/g wet mass (± 1 SD)
[b] ND - not detected
[c] n.r. - not reported
[d] average of Aroclor 1248 & 1254
[e] quantitated as Aroclor 1254 only
[f] μg/kg lipid mass (± 1 SD)
[g] CAM - chorioallantoic membranes
[h] μg/kg wet mass (± 1 SD)

Table II.2. (continued)

Species	General Location	Date	Egg Part	Compound	Geometric Mean	Range	n	Citation
Loggerhead[f]	Cape Romain NWR	1993	CAM[g]	triCB	889 (345)	n.r	16	Cobb and Wood, 1997
Loggerhead[f]	Cape Romain NWR	1993	CAM[g]	tetraCB	2406 (1298)	n.r	16	Cobb and Wood, 1997
Loggerhead[f]	Cape Romain NWR	1993	CAM[g]	pentaCB	2998 (1645)	n.r	16	Cobb and Wood, 1997
Loggerhead[f]	Cape Romain NWR	1993	CAM[g]	hexaCB	2707 (1539)	n.r	16	Cobb and Wood, 1997
Loggerhead[f]	Cape Romain NWR	1993	CAM[g]	heptaCB	763 (406)	n.r	16	Cobb and Wood, 1997
Loggerhead[f]	Cape Romain NWR	1993	CAM[g]	octaCB	197 (107)	n.r	16	Cobb and Wood, 1997
Loggerhead[f]	Cape Romain NWR	1993	CAM[g]	nonaCB	37 (21)	n.r	16	Cobb and Wood, 1997
Loggerhead[f]	Cape Romain NWR	1993	CAM[g]	Total PCB	10100 (5466)	n.r	16	Cobb and Wood, 1997
Loggerhead[f]	Cape Romain NWR	1993	CAM[g]	decaCB	55 (20)	n.r	16	Cobb and Wood, 1997
Snapping [h]	Hudson River, NY	1976-1977	n.r	PCB's	28.9 (12.1)	10.4-42.9	6	Stone et al., 1980
Snapping [h]	Hudson River, NY	1976-1977	n.r	DDE	<0.18 (0.254)	<0.05-0.56	4	Stone et al., 1980
Snapping [h]	Hudson River, NY	1976-1977	n.r	Dieldrin	<0.035 (0.019)	<0.05-0.049	6	Stone et al., 1980
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 28	1		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 28	0.5		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 28	0.7		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 28	0.6		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 28	0.6		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 28	<.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 28	<.4		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Egg	IUPAC 28	0.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Egg	IUPAC 28	0.3		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 52	7.3		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 52	3.8		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 52	5.6		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 52	4.6		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 52	4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 52	<.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 52	0.5		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Egg	IUPAC 52	2.7		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Egg	IUPAC 52	2.2		1	Mckenzie et al., 1999

[a] μg/g wet mass (± 1 SD)
[b] ND - not detected
[c] n.r. - not reported
[d] average of Aroclor 1248 & 1254
[e] quantitated as Aroclor 1254 only
[f] μg /kg lipid mass (± 1 SD)
[g] CAM - chorioallantoic membranes
[h] μg/kg wet mass (± 1 SD)

Table II.2. (continued)

Species	General Location	Date	Egg Part	Compound	Geometric Mean	Range	n	Citation
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 101	4		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 101	2.4		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 101	5.1		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 101	3.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 101	1.9		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 101	<.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 101	<.4		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Egg	IUPAC 101	1.2		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Egg	IUPAC 101	1.1		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 118	1.5		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 118	2.2		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 118	6.5		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 118	1.1		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 118	<.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 118	<.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 118	<.4		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Egg	IUPAC 118	7.2		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Egg	IUPAC 118	<.3		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 153	3.2		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 153	3.3		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 153	19		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 153	2.8		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 153	1.1		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 153	<.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 153	<.4		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Egg	IUPAC 153	29		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Egg	IUPAC 153	<.3		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 138	1.8		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 138	2.1		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 138	9.2		1	Mckenzie et al., 1999

[a] μg/g wet mass (± 1 SD)
[h] ND - not detected
[c] n.r. - not reported
[d] average of Aroclor 1248 & 1254
[e] quantitated as Aroclor 1254 only
[f] μg /kg lipid mass (± 1 SD)
[g] CAM - chorioallantoic membranes
[h] μg/kg wet mass (± 1 SD)

Table II.2. (continued)

Species	General Location	Date	Egg Part	Compound	Geometric Mean	Range	n	Citation
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 138	1.3		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 138	0.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 138	<.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 138	<.4		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Egg	IUPAC 138	14		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Egg	IUPAC 138	<.3		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 180	4.1		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 180	0.5		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 180	5.3		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 180	0.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 180	<.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 180	<.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	IUPAC 180	<.4		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Egg	IUPAC 180	12		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Egg	IUPAC 180	<.3		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	Sum CB	45		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	Sum CB	22		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	Sum CB	71		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	Sum CB	23		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	Sum CB	13		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	Sum CB	<.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	Sum CB	1.1		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Egg	Sum CB	89		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Egg	Sum CB	6.1		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	Endrin	0.4		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	Endrin	1.3		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	Endrin	0.4		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	Endrin	<.2		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	Endrin	<.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	Endrin	<.4		1	Mckenzie et al., 1999

[a] μg/g wet mass (± 1 SD)
[b] ND - not detected
[c] n.r. - not reported
[d] average of Aroclor 1248 & 1254
[e] quantitated as Aroclor 1254 only
[f] μg/kg lipid mass (± 1 SD)
[g] CAM - chorioallantoic membranes
[h] μg/kg wet mass (± 1 SD)

Table II.2. (continued)

Species	General Location	Date	Egg Part	Compound	Geometric Mean	Range	n	Citation
Green[h]	Cyrprus, Greece	1995	Hatchling	Endrin	<.4		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Egg	Endrin	<.3		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Egg	Endrin	<.3		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	Dieldrin	1.3		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	Dieldrin	9.2		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	Dieldrin	1.3		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	Dieldrin	<.2		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	Dieldrin	0.3		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	Dieldrin	<.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	Dieldrin	<.4		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Egg	Dieldrin	0.6		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Egg	Dieldrin	<.3		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDD	1		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDD	<.4		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDD	<.4		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDD	<.2		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDD	<.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDD	<.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDD	<.4		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Egg	p,p'-DDD	0.3		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Egg	p,p'-DDD	<.3		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDE	104		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDE	18		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDE	49		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDE	4.5		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDE	0.5		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDE	<.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDE	<.4		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Egg	p,p'-DDE	154		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Egg	p,p'-DDE	2.3		1	Mckenzie et al., 1999

[a] μg/g wet mass (± 1 SD)
[b] ND - not detected
[c] n.r. - not reported
[d] average of Aroclor 1248 & 1254
[e] quantitated as Aroclor 1254 only
[f] μg /kg lipid mass (± 1 SD)
[g] CAM - chorioallantoic membranes
[h] μg/kg wet mass (± 1 SD)

Table II.2. (continued)

Species	General Location	Date	Egg Part	Compound	Geometric Mean	Range	n	Citation
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDT	1.9		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDT	0.8		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDT	0.4		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDT	<.2		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDT	3.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDT	<.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	p,p'-DDT	<.4		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Egg	p,p'-DDT	0.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Egg	p,p'-DDT	0.5		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	Sum DDT	113		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	Sum DDT	22		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	Sum DDT	51		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	Sum DDT	5.3		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	Sum DDT	5.8		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	Sum DDT	0.2		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	Sum DDT	<.4		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Egg	Sum DDT	155		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Egg	Sum DDT	4.3		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	Sum Chlor	3.3		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	Sum Chlor	7.9		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	Sum Chlor	2.6		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Hatchling	Sum Chlor	0.9		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	Sum Chlor	0.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	Sum Chlor	<.4		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Hatchling	Sum Chlor	<.4		1	Mckenzie et al., 1999
Loggerhead[h]	Cyrprus, Greece	1995	Egg	Sum Chlor	1.8		1	Mckenzie et al., 1999
Green[h]	Cyrprus, Greece	1995	Egg	Sum Chlor	<.3		1	Mckenzie et al., 1999

[a] μg/g wet mass (± 1 SD)
[b] ND - not detected
[c] n.r. - not reported
[d] average of Aroclor 1248 & 1254
[e] quantitated as Aroclor 1254 only
[f] μg/kg lipid mass (± 1 SD)
[g] CAM - chorioallantoic membranes
[h] μg/kg wet mass (± 1 SD)

Table II.3. Mean Concentrations of Hydrocarbons in Green Turtles (*Chelonia mydas*) Tissues[a].

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Green	Laguna Madre, Mexico	1979	n.r.[c]	n-C_{12}	0.02	n.r.	2	Liver	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	n-C_{13}	0.02	n.r.	2	Liver	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	n-C_{14}	0.03	n.r.	2	Liver	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	Octylcyclohexane	not detected	n.r.	2	Liver	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	n-C_{15}	0.05	n.r.	2	Liver	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	Nonylcyclohexane	not detected	n.r.	2	Liver	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	n-C_{16}	0.03	n.r.	2	Liver	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	n-C_{17}	0.1	n.r.	2	Liver	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	Pristane	0.08	n.r.	2	Liver	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	n-C_{18}	0.05	n.r.	2	Liver	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	Phytane	0.02	n.r.	2	Liver	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	n-C_{19}	0.02	n.r.	2	Liver	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	n-C_{20}	0.03	n.r.	2	Liver	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	Naphthalene	0.02	n.r.	2	Liver	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	1-methylnaphthalene	not detected	n.r.	2	Liver	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	n-C_{12}	0.08		1	Kidney	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	n-C_{13}	0.1		1	Kidney	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	n-C_{14}	0.11		1	Kidney	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	Octylcyclohexane	0.05		1	Kidney	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	n-C_{15}	0.15		1	Kidney	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	Nonylcyclohexane	0.01		1	Kidney	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	n-C_{16}	0.09		1	Kidney	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	n-C_{17}	0.54		1	Kidney	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	Pristane	0.12		1	Kidney	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	n-C_{18}	0.29		1	Kidney	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	Phytane	0.07		1	Kidney	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	n-C_{19}	0.12		1	Kidney	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	n-C_{20}	0.13		1	Kidney	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	Naphthalene	0.09		1	Kidney	Hall et al., 1983
Green	Laguna Madre, Mexico	1979	n.r.	1-methylnaphthalene	0.01		1	Kidney	Hall et al., 1983

[a] μg/kg wet mass (± 1 SD)
[b] M-male; F-female
[c] n.r. - not reported

Table II.4. Mean Concentrations of Metals and Metalloids in Sea Turtle Tissues.[a]

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	n.r.[c]	Fe	649 (385)	226-1260	7	Liver	Sakai, et. al, 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	n.r.	Mn	2.07 (0.459)	1.44-2.94	7	Liver	Sakai, et. al, 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	n.r.	Zn	27.9 (4.35)	23.2-35.1	7	Liver	Sakai, et. al, 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	n.r.	Cu	17.9 (8.17)	6.47-33.9	7	Liver	Sakai, et. al, 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	n.r.	Cd	9.29 (3.30)	5.99-14.6	7	Liver	Sakai, et. al, 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	n.r.	Hg	1.51 (2.93)	0.253-8.15	7	Liver	Sakai, et. al, 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	n.r.	Fe	35.9 (35.1)	11.4-110.0	7	Kidney	Sakai, et. al, 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	n.r.	Mn	1.57 (0.495)	0.808-1.97	7	Kidney	Sakai, et. al, 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	n.r.	Zn	25.8 (4.17)	19.2-30.4	7	Kidney	Sakai, et. al, 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	n.r.	Cu	1.30 (0.197)	0.988-1.56	7	Kidney	Sakai, et. al, 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	n.r.	Cd	39.4 (16.2)	18.1-56.5	7	Kidney	Sakai, et. al, 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	n.r.	Hg	0.247 (0.130)	0.040-0.441	7	Kidney	Sakai, et. al, 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	n.r.	Fe	20.1 (8.00)	11.3-35.2	7	Muscle	Sakai, et. al, 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	n.r.	Mn	0.300 (0.115)	0.129-0.446	7	Muscle	Sakai, et. al, 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	n.r.	Zn	24.2 (3.80)	19.5-31.0	7	Muscle	Sakai, et. al, 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	n.r.	Cu	0.830 (0.258)	0.531-1.28	7	Muscle	Sakai, et. al, 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	n.r.	Cd	0.062 (0.026)	0.041-0.117	7	Muscle	Sakai, et. al, 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	n.r.	Hg	0.108 (0.049)	0.053-0.189	7	Muscle	Sakai, et. al, 1995
Green	Hawaiian Islands	n.r.	F	Al	1.52 (0.548)	1.0-2.0	5	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Al	1	1	4	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	F	Al	2.38 (1.60)	1.0-5.0	6	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Al	1.59 (0.58)	1.0-2.0	3	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	As	6.8		1	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	As	6.4		1	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	F	Ba	0.97 (0.27)	0.76-1.58	7	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Ba	0.94 (0.07)	0.86-1.01	4	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	F	Ba	0.68 (0.10)	0.58-0.78	7	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Ba	0.67 (0.06)	0.63-0.75	4	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	F	Cd	15.78 (17.15)	4.77-47.4	7	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Cd	22.39 (29.90)	4.72-70.2	4	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	F	Cd	4.91 (8.90)	1.8-26.0	7	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Cd	6.66 (10.84)	1.12-25.65	4	Liver	Aguirre, 1994

[a] μg/g wet mass (± 1 SD)
[b] M - male; F - female
[c] n.r. - not reported
[d] μg/g dry mass (± 1 SD)
[e] μg/g ash mass (± 1 SD)
[f] Fresh hatchling
[g] Median
[h] ND - not detected

Table II.4. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Green	Hawaiian Islands	n.r.	F	Cr	0.2		1	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Cr	0.2	n.r.	2	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	F	Cu	2.34 (2.09)	1.1-6.9	7	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Cu	3.12 (1.19)	1.8-4.7	4	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	F	Cu	49.61 (52.59)	1.3-149.0	7	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Cu	69.63 (88.86)	20.2-189.0	4	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	F	Fe	30.18 (67.84)	8.8-179	7	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Fe	19.07 (26.96)	10.5-66.5	4	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	F	Fe	729.64 (887.89)	155.0-2450.0	7	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Fe	778.90 (883.07)	101.0-2260.0	4	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	F	Mn	0.85 (0.31)	0.48-1.23	7	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Mn	1.04 (0.37)	0.56-1.39	4	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	F	Mn	1.05 (0.82)	0.15-2.79	7	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Mn	1.85 (0.40)	1.39-2.34	4	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	F	Mo	0.16 (0.08)	0.1-0.3	5	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Mo	0.24 (0.06)	0.2-0.3	4	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	F	Mo	0.35 (0.17)	0.2-0.6	4	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Mo	0.2	n.r.	3	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	F	Ni	0.65 (0.15)	0.5-0.8	3	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Ni	0.89 (0.1)	0.8-1.0	3	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	F	Se	0.25 (0.11)	0.159-0.445	7	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Se	0.52 (0.66)	0.208-1.58	4	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	F	Se	0.47 (0.28)	0.136-0.899	7	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Se	0.84 (1.02)	0.316-2.53	4	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	F	Ti	0.89 (0.14)	0.8-1.0	2	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Ti	0.95 (0.07)	0.9-1.0	2	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	F	V	0.3		1	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	V	1.32 (1.27)	0.7-2.5	2	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	F	V	0.54 (0.55)	0.2-1.5	6	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	V	0.62 (0.26)	0.3-0.9	4	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	F	Zn	18.16 (5.14)	12.5-26.3	7	Kidney	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Zn	25.06 (8.78)	19.1-38.1	4	Kidney	Aguirre, 1994

[a] μg/g wet mass (± 1 SD)
[b] M - male; F - female
[c] n.r. - not reported
[d] μg/g dry mass (± 1 SD)
[e] μg/g ash mass (± 1 SD)
[f] Fresh hatchling
[g] Median
[h] ND - not detected

Table II.4. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Green	Hawaiian Islands	n.r.	F	Zn	30.23 (9.70)	19.6-41.9	7	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	M	Zn	29.04 (11.98)	18.1-45.8	4	Liver	Aguirre, 1994
Green	Control, Captive	n.r.	F	Al	1		1	Kidney	Aguirre, 1994
Green	Control, Captive	n.r.	F	Al	1		1	Liver	Aguirre, 1994
Green	Control, Captive	n.r.	F	Ba	0.88		1	Kidney	Aguirre, 1994
Green	Control, Captive	n.r.	F	Ba	0.7		1	Liver	Aguirre, 1994
Green	Control, Captive	n.r.	F	Cd	22		1	Kidney	Aguirre, 1994
Green	Control, Captive	n.r.	F	Cd	3.1		1	Liver	Aguirre, 1994
Green	Control, Captive	n.r.	F	Cr	0.4		1	Kidney	Aguirre, 1994
Green	Control, Captive	n.r.	F	Cr	0.5		1	Liver	Aguirre, 1994
Green	Control, Captive	n.r.	F	Cu	10.5		1	Kidney	Aguirre, 1994
Green	Control, Captive	n.r.	F	Cu	116		1	Liver	Aguirre, 1994
Green	Control, Captive	n.r.	F	Fe	16.3		1	Kidney	Aguirre, 1994
Green	Control, Captive	n.r.	F	Fe	765		1	Liver	Aguirre, 1994
Green	Control, Captive	n.r.	F	Mn	0.82		1	Kidney	Aguirre, 1994
Green	Control, Captive	n.r.	F	Mn	2.13		1	Liver	Aguirre, 1994
Green	Control, Captive	n.r.	F	Mo	0.1		1	Kidney	Aguirre, 1994
Green	Control, Captive	n.r.	F	Mo	0.1		1	Liver	Aguirre, 1994
Green	Control, Captive	n.r.	F	Se	0.7		1	Kidney	Aguirre, 1994
Green	Control, Captive	n.r.	F	Se	0.999		1	Liver	Aguirre, 1994
Green	Control, Captive	n.r.	F	V	0.3		1	Liver	Aguirre, 1994
Green	Control, Captive	n.r.	F	Zn	31.7		1	Kidney	Aguirre, 1994
Green	Control, Captive	n.r.	F	Zn	37.8		1	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	n.r.	As	0.9		1	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	n.r.	Ba	0.83		1	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	n.r.	Ca	0.96		1	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	n.r.	Cu	2.8		1	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	n.r.	Fe	92.8		1	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	n.r.	Mn	1.59		1	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	n.r.	Mo	0.2		1	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	n.r.	Se	3.39		1	Liver	Aguirre, 1994
Green	Hawaiian Islands	n.r.	n.r.	Tl	1.1		1	Liver	Aguirre, 1994

[a] μg/g wet mass (± 1 SD)
[b] M - male; F - female
[c] n.r. - not reported
[d] μg/g dry mass (± 1 SD)
[e] μg/g ash mass (± 1 SD)
[f] Fresh hatchling
[g] Median
[h] ND - not detected

Table II.4. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Green	Hawaiian Islands	n.r.	n.r.	Zn	15.1		1	Liver	Aguirre, 1994
Leatherback[d]	Harlech Beach, UK	1988	M	Hg	0.39		1	Liver	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	Hg	0.12		1	Pec. Muscle	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	Hg	0.11		1	Fat	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	Cd	0.22		1	Liver	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	Cd	0.06		1	Pec. Muscle	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	Cd	<0.01		1	Fat	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	Cu	0.15		1	Liver	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	Cu	0.26		1	Pec. Muscle	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	Cu	0.06		1	Fat	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	Ni	2.13		1	Liver	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	Ni	1.62		1	Pec. Muscle	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	Ni	0.07		1	Fat	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	Pb	0.12		1	Liver	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	Pb	0.31		1	Pec. Muscle	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	Pb	0.04		1	Fat	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	Se	1.41		1	Liver	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	Se	3.61		1	Pec. Muscle	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	Se	<0.05		1	Fat	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	As	0.58		1	Liver	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	As	0.21		1	Pec. Muscle	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	As	1.28		1	Fat	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	Zn	2.62		1	Liver	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	Zn	1.89		1	Pec. Muscle	Davenport, et al., 1990
Leatherback[d]	Harlech Beach, UK	1988	M	Zn	0.07		1	Fat	Davenport, et al., 1990
Olive Ridley[e]	Manta, Ecuador	1981	n.r.	Mn	8.4 (1.7)	7.2-9.6	3	Bone	Witkowski, 1982
Olive Ridley[e]	Manta, Ecuador	1981	n.r.	Mn	35.67 (2.08)	34.0-38.0	3	Bone	Witkowski, 1982
Olive Ridley[e]	Manta, Ecuador	1981	n.r.	Mn	33.5 (2.12)	32.0-35.0	3	Bone	Witkowski, 1982

[a] μg/g wet mass (± 1 SD)
[b] M - male; F - female
[c] n.r. - not reported
[d] μg/g dry mass (± 1 SD)
[e] μg/g ash mass (± 1 SD)
[f] Fresh hatchling
[g] Median
[h] ND - not detected

Table II.4. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Olive Ridley[e]	Manta, Ecuador	1981	n.r.	Fe	78.5 (27.78)	57.5-110.0	3	Bone	Witkowski, 1982
Olive Ridley[e]	Manta, Ecuador	1981	n.r.	Fe	198.3 (8.62)	189.0-206.0	3	Bone	Witkowski, 1982
Olive Ridley[e]	Manta, Ecuador	1981	n.r.	Fe	309.0 (61.73)	268.0-380.0	3	Bone	Witkowski, 1982
Olive Ridley[e]	Manta, Ecuador	1981	n.r.	Cu	9.1 (2.69)	7.2-11.0	3	Bone	Witkowski, 1982
Olive Ridley[e]	Manta, Ecuador	1981	n.r.	Cu	8.6 (1.70)	7.3-9.7	3	Bone	Witkowski, 1982
Olive Ridley[e]	Manta, Ecuador	1981	n.r.	Cu	8.9 (1.63)	7.7-10.0	3	Bone	Witkowski, 1982
Olive Ridley[e]	Manta, Ecuador	1981	n.r.	Zn	575		1	Bone	Witkowski, 1982
Olive Ridley[e]	Manta, Ecuador	1981	n.r.	Zn	815		1	Bone	Witkowski, 1982
Olive Ridley[e]	Manta, Ecuador	1981	n.r.	Zn	955		1	Bone	Witkowski, 1982
Olive Ridley[e]	Manta, Ecuador	1981	n.r.	Pb	41.5 (3.54)	39.0-44.0	3	Bone	Witkowski, 1982
Olive Ridley[e]	Manta, Ecuador	1981	n.r.	Pb	86.6 (12.02)	72.7-94.0	3	Bone	Witkowski, 1982
Olive Ridley[e]	Manta, Ecuador	1981	n.r.	Pb	97.2 (11.28)	88.6-110.0	3	Bone	Witkowski, 1982
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	Pb	1.23 (1.01)	n.d.-3.38	12	Liver	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	Pb	0.60 (0.35)	n.d.-1.10	12	Lung	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	Pb	0.70 (0.35)	n.d.-1.35	12	Kidney	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	Pb	0.54 (0.17)	n.d.-0.74	12	Muscle	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	Cr	1.05 (0.58)	0.20-2.07	12	Liver	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	Cr	2.29 (1.73)	0.38-5.41	12	Lung	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	Cr	1.57 (2.05)	0.20-6.80	12	Kidney	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	Cr	1.43 (0.87)	0.30-2.89	12	Muscle	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	Cd	7.60 (6.05)	3.06-20.23	12	Liver	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	Cd	2.15 (2.80)	0.32-10.5	12	Lung	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	Cd	24.23 (21.40)	0.39-64.00	12	Kidney	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	Cd	0.55 (0.63)	0.09-2.21	12	Muscle	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	Hg	1.68 (1.04)	0.35-3.72	12	Liver	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	Hg	0.45 (0.28)	0.12-0.97	12	Lung	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	Hg	0.65 (0.34)	0.30-1.53	12	Kidney	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	Hg	0.69 (0.46)	0.17-1.81	12	Muscle	Storelli et al., 1998a

[a] μg/g wet mass (± 1 SD)
[b] M - male; F - female
[c] n.r. - not reported
[d] μg/g dry mass (± 1 SD)
[e] μg/g ash mass (± 1 SD)
[f] Fresh hatchling
[g] Median
[h] ND - not detected

Table II.4. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	As	21.67 (17.22)	0.83-56.55	12	Liver	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	As	24.0 (10.7)	10.62-44.93	12	Lung	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	As	29.91 (39.48)	6.09-139.60	12	Kidney	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	As	68.94 (45.8)	11.21-139.60	12	Muscle	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	Se	15.88 (7.40)	2.12-27.44	12	Liver	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	Se	10.77 (7.01)	4.12-30.52	12	Lung	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	Se	10.33 (3.25)	5.73-15.57	12	Kidney	Storelli et al., 1998a
Loggerhead[d]	Apulian coast (S. Adriatic Sea)	1990-91	n.r.	Se	10.81 (2.89)	6.51-15.45	12	Muscle	Storelli et al., 1998a
Loggerhead	Apulian coast (S. Adriatic Sea)	1991, 1995	n.r.	Total Hg	0.21 (0.13)	0.07-0.43	7	Muscle	Storelli et al., 1998b
Loggerhead	Apulian coast (S. Adriatic Sea)	1991, 1995	n.r.	MeHg	0.23 (0.12)	ND[h]-0.41	7	Muscle	Storelli et al., 1998b
Loggerhead	Apulian coast (S. Adriatic Sea)	1991, 1995	n.r.	Se	2.33 (0.67)	1.19-3.24	7	Muscle	Storelli et al., 1998b
Loggerhead	Apulian coast (S. Adriatic Sea)	1991, 1995	n.r.	Total Hg	0.70 (0.32)	0.37-1.10	7	Liver	Storelli et al., 1998b
Loggerhead	Apulian coast (S. Adriatic Sea)	1991, 1995	n.r.	MeHg	0.28 (0.03)	0.24-0.33	7	Liver	Storelli et al., 1998b
Loggerhead	Apulian coast (S. Adriatic Sea)	1991, 1995	n.r.	Se	4.86 (0.85)	4.00-6.11	7	Liver	Storelli et al., 1998b
Loggerhead[d,g]	Northern Cyrpus, Mediterranean Sea	1994-96	n.r.	Hg	2.41	0.82-7.5	5	Liver	Godley et al., 1999
Loggerhead[d,g]	Northern Cyrpus, Mediterranean Sea	1994-96	n.r.	Hg	0.47	0.13-0.80	2	Kidney	Godley et al., 1999
Loggerhead[d,g]	Northern Cyrpus, Mediterranean Sea	1994-96	n.r.	Hg	0.48	ND-1.78	7	Muscle	Godley et al., 1999
Loggerhead[d,g]	Northern Cyrpus, Mediterranean Sea	1994-96	n.r.	Ca	8.64	5.14-12.97	4	Liver	Godley et al., 1999
Loggerhead[d,g]	Northern Cyrpus, Mediterranean Sea	1994-96	n.r.	Ca	30.5	18.8-42.2	2	Kidney	Godley et al., 1999
Loggerhead[d,g]	Northern Cyrpus, Mediterranean Sea	1994-96	n.r.	Ca	0.57	0.3-1.43	4	Muscle	Godley et al., 1999
Loggerhead[d,g]	Northern Cyrpus, Mediterranean Sea	1994-96	n.r.	Pb	ND	ND-4.90	4	Liver	Godley et al., 1999
Loggerhead[d,g]	Northern Cyrpus, Mediterranean Sea	1994-96	n.r.	Pb	2.45	ND-4.90	2	Kidney	Godley et al., 1999
Loggerhead[d,g]	Northern Cyrpus, Mediterranean Sea	1994-96	n.r.	Pb	2.46	ND-5.53	4	Muscle	Godley et al., 1999
Green[d,g]	Northern Cyrpus, Mediterranean Sea	1994-96	n.r.	Hg	0.55	0.27-1.37	6	Liver	Godley et al., 1999
Green[d,g]	Northern Cyrpus, Mediterranean Sea	1994-96	n.r.	Hg	ND		1	Kidney	Godley et al., 1999
Green[d,g]	Northern Cyrpus, Mediterranean Sea	1994-96	n.r.	Hg	0.09	ND-0.37	5	Muscle	Godley et al., 1999
Green[d,g]	Northern Cyrpus, Mediterranean Sea	1994-96	n.r.	Ca	5.89	2.53-10.73	6	Liver	Godley et al., 1999
Green[d,g]	Northern Cyrpus, Mediterranean Sea	1994-96	n.r.	Ca	3.46		1	Kidney	Godley et al., 1999

[a] μg/g wet mass (± 1 SD)
[b] M - male; F - female
[c] n.r. - not reported
[d] μg/g dry mass (± 1 SD)
[e] μg/g ash mass (± 1 SD)
[f] Fresh hatchling
[g] Median
[h] ND - not detected

Table II.4. (continued)

Species	General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Green[d,g]	Northern Cyrpus, Mediterranean Sea	1994-96	n.r.	Ca	0.37	0.12-0.78	6	Muscle	Godley et al., 1999
Green[d,g]	Northern Cyrpus, Mediterranean Sea	1994-96	n.r.	Pb	ND	ND-1.84	6	Liver	Godley et al., 1999
Green[d,g]	Northern Cyrpus, Mediterranean Sea	1994-96	n.r.	Pb	1.81		1	Kidney	Godley et al., 1999
Green[d,g]	Northern Cyrpus, Mediterranean Sea	1994-96	n.r.	Pb	ND	ND-2.45	6	Muscle	Godley et al., 1999

[a] μg/g wet mass ($\pm$ 1 SD)
[b] M - male; F - female
[c] n.r. - not reported
[d] μg/g dry mass ($\pm$ 1 SD)
[e] μg/g ash mass ($\pm$ 1 SD)
[f] Fresh hatchling
[g] Median
[h] ND - not detected

Table II.5. Mean Concentrations of Metals and Metalloids in Sea Turtle Eggs.[a]

Species	General Location	Date	Egg Part	Compound	Geometric Mean	Range	n	Citation
Loggerhead[c]	Canaveral Nat. Seashore, FL	1977	Yolk	Al	6.30 (2.92)	n.r.[b]	27	Stoneburner et al., 1980
Loggerhead[c]	Cumberland Island Nat. Seashore, NC	1977	Yolk	Al	3.81 (1.60)	n.r.	33	Stoneburner et al., 1980
Loggerhead[c]	Cape Lookout Nat. Seashore, NC	1977	Yolk	Al	4.09 (2.42)	n.r.	15	Stoneburner et al., 1980
Loggerhead[c]	Cape Hatteras Nat. Seashore, NC	1977	Yolk	Al	3.56 (2.61)	n.r.	21	Stoneburner et al., 1980
Loggerhead[c]	Canaveral Nat. Seashore, FL	1977	Yolk	Ba	2.60 (0.19)	n.r.	27	Stoneburner et al., 1980
Loggerhead[c]	Cumberland Island Nat. Seashore, NC	1977	Yolk	Ba	2.49 (0.18)	n.r.	33	Stoneburner et al., 1980
Loggerhead[c]	Cape Lookout Nat. Seashore, NC	1977	Yolk	Ba	6.87 (1.12)	n.r.	15	Stoneburner et al., 1980
Loggerhead[c]	Cape Hatteras Nat. Seashore, NC	1977	Yolk	Ba	2.09 (0.25)	n.r.	21	Stoneburner et al., 1980
Loggerhead[c]	Canaveral Nat. Seashore, FL	1977	Yolk	Cd	0.11 (0.08)	n.r.	27	Stoneburner et al., 1980
Loggerhead[c]	Cumberland Island Nat. Seashore, NC	1977	Yolk	Cd	0.20 (0.07)	n.r.	33	Stoneburner et al., 1980
Loggerhead[c]	Cape Lookout Nat. Seashore, NC	1977	Yolk	Cd	0.04 (0.002)	n.r.	15	Stoneburner et al., 1980
Loggerhead[c]	Cape Hatteras Nat. Seashore, NC	1977	Yolk	Cd	0.03 (0.01)	n.r.	21	Stoneburner et al., 1980
Loggerhead[c]	Canaveral Nat. Seashore, FL	1977	Yolk	Co	0.05 (0.01)	n.r.	27	Stoneburner et al., 1980
Loggerhead[c]	Cumberland Island Nat. Seashore, NC	1977	Yolk	Co	0.04 (0.01)	n.r.	33	Stoneburner et al., 1980
Loggerhead[c]	Cape Lookout Nat. Seashore, NC	1977	Yolk	Co	0.07 (0.01)	n.r.	15	Stoneburner et al., 1980
Loggerhead[c]	Cape Hatteras Nat. Seashore, NC	1977	Yolk	Co	ND[e]	ND	21	Stoneburner et al., 1980
Loggerhead[c]	Canaveral Nat. Seashore, FL	1977	Yolk	Cr	1.15 (0.03)	n.r.	27	Stoneburner et al., 1980
Loggerhead[c]	Cumberland Island Nat. Seashore, NC	1977	Yolk	Cr	1.71 (0.32)	n.r.	33	Stoneburner et al., 1980
Loggerhead[c]	Cape Lookout Nat. Seashore, NC	1977	Yolk	Cr	1.04 (0.02)	n.r.	15	Stoneburner et al., 1980
Loggerhead[c]	Cape Hatteras Nat. Seashore, NC	1977	Yolk	Cr	1.23 (0.20)	n.r.	21	Stoneburner et al., 1980
Loggerhead[c]	Canaveral Nat. Seashore, FL	1977	Yolk	Cu	5.97 (0.79)	n.r.	27	Stoneburner et al., 1980
Loggerhead[c]	Cumberland Island Nat. Seashore, NC	1977	Yolk	Cu	4.97 (1.12)	n.r.	33	Stoneburner et al., 1980
Loggerhead[c]	Cape Lookout Nat. Seashore, NC	1977	Yolk	Cu	5.44 (1.11)	n.r.	15	Stoneburner et al., 1980
Loggerhead[c]	Cape Hatteras Nat. Seashore, NC	1977	Yolk	Cu	6.61 (1.29)	n.r.	21	Stoneburner et al., 1980
Loggerhead[c]	Canaveral Nat. Seashore, FL	1977	Yolk	Fe	71.68 (13.12)	n.r.	27	Stoneburner et al., 1980
Loggerhead[c]	Cumberland Island Nat. Seashore, NC	1977	Yolk	Fe	71.28 (8.38)	n.r.	33	Stoneburner et al., 1980
Loggerhead[c]	Cape Lookout Nat. Seashore, NC	1977	Yolk	Fe	72.98 (11.72)	n.r.	15	Stoneburner et al., 1980
Loggerhead[c]	Cape Hatteras Nat. Seashore, NC	1977	Yolk	Fe	74.67 (16.30)	n.r.	21	Stoneburner et al., 1980
Loggerhead[c]	Canaveral Nat. Seashore, FL	1977	Yolk	Hg	1.36 (0.04)	n.r.	27	Stoneburner et al., 1980

[a] μg/g wet mass (± 1 SD)
[b] n.r. - not reported
[c] μg/g dry mass (± 1 SD)
[d] Median
[e] ND - not detected
[f] BDL - below detection limit

Table II.5. (continued)

Species	General Location	Date	Egg Part	Compound	Geometric Mean	Range	n	Citation
Loggerhead[c]	Cumberland Island Nat. Seashore, NC	1977	Yolk	Hg	1.39 (0.11)	n.r.	33	Stoneburner et al., 1980
Loggerhead[c]	Cape Lookout Nat. Seashore, NC	1977	Yolk	Hg	0.64 (0.01)	n.r.	15	Stoneburner et al., 1980
Loggerhead[c]	Cape Hatteras Nat. Seashore, NC	1977	Yolk	Hg	0.41 (0.01)	n.r.	21	Stoneburner et al., 1980
Loggerhead[c]	Canaveral Nat. Seashore, FL	1977	Yolk	Mo	17.93 (1.88)	n.r.	27	Stoneburner et al., 1980
Loggerhead[c]	Cumberland Island Nat. Seashore, NC	1977	Yolk	Mo	2.67 (1.01)	n.r.	33	Stoneburner et al., 1980
Loggerhead[c]	Cape Lookout Nat. Seashore, NC	1977	Yolk	Mo	3.13 (1.50)	n.r.	15	Stoneburner et al., 1980
Loggerhead[c]	Cape Hatteras Nat. Seashore, NC	1977	Yolk	Mo	3.81 (1.53)	n.r.	21	Stoneburner et al., 1980
Loggerhead[c]	Canaveral Nat. Seashore, FL	1977	Yolk	Ni	ND	ND	27	Stoneburner et al., 1980
Loggerhead[c]	Cumberland Island Nat. Seashore, NC	1977	Yolk	Ni	0.25 (0.17)	n.r.	33	Stoneburner et al., 1980
Loggerhead[c]	Cape Lookout Nat. Seashore, NC	1977	Yolk	Ni	2.28 (0.80)	n.r.	15	Stoneburner et al., 1980
Loggerhead[c]	Cape Hatteras Nat. Seashore, NC	1977	Yolk	Ni	ND	ND	21	Stoneburner et al., 1980
Loggerhead[c]	Canaveral Nat. Seashore, FL	1977	Yolk	Pb	2.18 (1.20)	n.r.	27	Stoneburner et al., 1980
Loggerhead[c]	Cumberland Island Nat. Seashore, NC	1977	Yolk	Pb	1.13 (0.84)	n.r.	33	Stoneburner et al., 1980
Loggerhead[c]	Cape Lookout Nat. Seashore, NC	1977	Yolk	Pb	1.77 (1.15)	n.r.	15	Stoneburner et al., 1980
Loggerhead[c]	Cape Hatteras Nat. Seashore, NC	1977	Yolk	Pb	1.24 (1.04)	n.r.	21	Stoneburner et al., 1980
Loggerhead[c]	Canaveral Nat. Seashore, FL	1977	Yolk	Sr	67.26 (8.01)	n.r.	27	Stoneburner et al., 1980
Loggerhead[c]	Cumberland Island Nat. Seashore, NC	1977	Yolk	Sr	72.27 (6.71)	n.r.	33	Stoneburner et al., 1980
Loggerhead[c]	Cape Lookout Nat. Seashore, NC	1977	Yolk	Sr	66.13 (6.04)	n.r.	15	Stoneburner et al., 1980
Loggerhead[c]	Cape Hatteras Nat. Seashore, NC	1977	Yolk	Sr	74.03 (8.35)	n.r.	21	Stoneburner et al., 1980
Loggerhead[c]	Canaveral Nat. Seashore, FL	1977	Yolk	Zn	77.10 (9.29)	n.r.	27	Stoneburner et al., 1980
Loggerhead[c]	Cumberland Island Nat. Seashore, NC	1977	Yolk	Zn	73.54 (3.64)	n.r.	33	Stoneburner et al., 1980
Loggerhead[c]	Cape Lookout Nat. Seashore, NC	1977	Yolk	Zn	78.51 (6.70)	n.r.	15	Stoneburner et al., 1980
Loggerhead[c]	Cape Hatteras Nat. Seashore, NC	1977	Yolk	Zn	80.50 (5.55)	n.r.	21	Stoneburner et al., 1980
Loggerhead[c]	Playon de Mexiquillo	1992-1993	Shell	Cu	0.90 (0.61)	n.r.	5	Vazquez et al., 1997
Loggerhead[c]	Playon de Mexiquillo	1992-1993	Shell	Ca	8.90 (1.26)	n.r.	5	Vazquez et al., 1997
Loggerhead[c]	Playon de Mexiquillo	1992-1993	Shell	Zn	11.9 (10.0)	n.r.	5	Vazquez et al., 1997
Loggerhead[c]	Playon de Mexiquillo	1992-1993	Shell	Ni	7.9 (5.11)	n.r.	5	Vazquez et al., 1997
Loggerhead[c]	Playon de Mexiquillo	1992-1993	Shell	Pb	11.6 (26.0)	n.r.	5	Vazquez et al., 1997
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Yolk	Fe	25.1 (2.18)	22.9-28.3	5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Yolk	Mn	0.91 (0.42)	0.52-1.4	5	Sakai, et al., 1995

[a] μg/g wet mass (± 1 SD)
[b] n.r. - not reported
[c] μg/g dry mass (± 1 SD)
[d] Median
[e] ND - not detected
[f] BDL - below detection limit

Table II.5. (continued)

Species	General Location	Date	Egg Part	Compound	Geometric Mean	Range	n	Citation
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Yolk	Zn	34.4 (3.18)	30.5-38.0	5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Yolk	Cu	1.57 (0.07)	1.48-1.68	5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Yolk	Cd	0.026 (0.007)	0.019-0.035	5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Yolk	Hg	0.0121 (0.0034)	0.0080-0.0158	5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Shell	Fe	10.6 (2.20)	7.23-13.3	5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Shell	Mn	0.68 (0.48)	ND-1.2	5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Shell	Zn	2.17 (0.59)	1.66-2.87	5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Shell	Cu	5.57 (0.77)	4.25-6.18	5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Shell	Cd	<0.01		5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Shell	Hg	0.0040 (0.0013)	0.0020-0.0054	5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Albumen	Fe	0.870 (0.377)	0.499-1.30	5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Albumen	Mn	0.17 (0.30)	ND-0.71	5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Albumen	Zn	0.594 (0.584)	0.058-1.54	5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Albumen	Cu	0.129 (0.083)	0.034-0.235	5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Albumen	Cd	<0.01		5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Albumen	Hg	0.0005 (0.0002)	0.0001-0.0008	5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Egg	Fe	11.5 (1.29)	10.5-13.7	5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Egg	Mn	0.52 (0.26)	0.30-0.90	5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Egg	Zn	14.7 (1.44)	13.2-16.5	5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Egg	Cu	1.05 (0.199)	0.772-1.31	5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Egg	Cd	0.013 (0.004)	0.008-0.015	5	Sakai et al., 1995
Loggerhead	Cape Ashizure, Kochi Prefecture, Japan	1990	Egg	Hg	0.0055 (0.0016)	0.0038-0.0074	5	Sakai et al., 1995
Olive ridley[c]	Gahirmatha, India	1993	Egg Shell	Cd	1.3 (0.5)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Egg Shell	Co	7.6 (2.0)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Egg Shell	Cr	10.0 (1.7)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Egg Shell	Cu	7.6 (1.5	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Egg Shell	Fe	47.3 (8.1)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Egg Shell	Ni	13.0 (4.0)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Egg Shell	Mn	3.6 (2.0)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Egg Shell	Pb	11.0 (3.6)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Egg Shell	Zn	13.0 (2.6)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Albumen-yolk	Cd	<1	n.r.	8	Sahoo et al., 1996

[a] $\mu g/g$ wet mass (± 1 SD)
[b] n.r. - not reported
[c] $\mu g/g$ dry mass (± 1 SD)
[d] Median
[e] ND - not detected
[f] BDL - below detection limit

Table II.5. (continued)

Species	General Location	Date	Egg Part	Compound	Geometric Mean	Range	n	Citation
Olive ridley[c]	Gahirmatha, India	1993	Albumen-yolk	Co	2.3 (0.5)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Albumen-yolk	Cr	2.6 (1.5)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Albumen-yolk	Cu	3.6 (0.5)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Albumen-yolk	Fe	19.3 (3.2)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Albumen-yolk	Ni	5.0 (2.0)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Albumen-yolk	Mn	4.3 (2.5)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Albumen-yolk	Pb	3.6 (1.1)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Albumen-yolk	Zn	4.3 (1.5)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Hatched Egg Shell	Cd	<1	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Hatched Egg Shell	Co	4.6 (1.5)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Hatched Egg Shell	Cr	11.6 (5.6)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Hatched Egg Shell	Cu	18.0 (6.0)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Hatched Egg Shell	Fe	41.6 (9.7)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Hatched Egg Shell	Ni	12.6 (4.1)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Hatched Egg Shell	Mn	5.3 (2.5)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Hatched Egg Shell	Pb	15.6 (3.2)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Hatched Egg Shell	Zn	16.6 (6.0)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Hatchling	Cd	2.0 (1.0)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Hatchling	Co	12.3 (2.5)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Hatchling	Cr	10.3 (3.0)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Hatchling	Cu	9.3 (1.5)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Hatchling	Fe	65.6 (11.0)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Hatchling	Ni	25.0 (3.6)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Hatchling	Mn	23.6 (4.0)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Hatchling	Pb	20.0 (5.2)	n.r.	8	Sahoo et al., 1996
Olive ridley[c]	Gahirmatha, India	1993	Hatchling	Zn	17.3 (9.4)	n.r.	8	Sahoo et al., 1996
Loggerhead[c,d]	Alagadi Beach, northern Cyprus	1994-96	Hatchling	Hg	0.02	BDL[f]-0.75	16	Godley et al., 1999
Loggerhead[c,d]	Alagadi Beach, northern Cyprus	1994-96	Embryo	Hg	0.01	BDL-0.22	27	Godley et al., 1999
Loggerhead[c,d]	Alagadi Beach, northern Cyprus	1994-96	Yolk and albumen	Hg	0.19	BDL-0.57	3	Godley et al., 1999
Loggerhead[c,d]	Alagadi Beach, northern Cyprus	1994-96	Hatchling	Ca	0.34	BDL-1.45	16	Godley et al., 1999

[a] μg/g wet mass (± 1 SD)
[b] n.r. - not reported
[c] μg/g dry mass (± 1 SD)
[d] Median
[e] ND - not detected
[f] BDL - below detection limit

Table II.5. (continued)

Species	General Location	Date	Egg Part	Compound	Geometric Mean	Range	n	Citation
Loggerhead[c,d]	Alagadi Beach, northern Cyprus	1994-96	Embryo	Ca	0.21	BDL-1.09	29	Godley et al., 1999
Loggerhead[c,d]	Alagadi Beach, northern Cyprus	1994-96	Yolk and albumen	Ca	0.23	0.23-0.56	3	Godley et al., 1999
Loggerhead[c,d]	Alagadi Beach, northern Cyprus	1994-96	Hatchling	Pb	0.13	BDL-10.56	16	Godley et al., 1999
Loggerhead[c,d]	Alagadi Beach, northern Cyprus	1994-96	Embryo	Pb	ND	BDL-6.48		Godley et al., 1999
Loggerhead[c,d]	Alagadi Beach, northern Cyprus	1994-96	Yolk and albumen	Pb	0.19	BDL-3.93	3	Godley et al., 1999
Green[c,d]	Alagadi Beach, northern Cyprus	1994-96	Hatchling	Hg	BDL	BDL-0.24	24	Godley et al., 1999
Green[c,d]	Alagadi Beach, northern Cyprus	1994-96	Embryo	Hg	BDL	BDL-0.12	18	Godley et al., 1999
Green[c,d]	Alagadi Beach, northern Cyprus	1994-96	Yolk and albumen	Hg	BDL	BDL-0.19	17	Godley et al., 1999
Green[c,d]	Alagadi Beach, northern Cyprus	1994-96	Hatchling	Ca	0.23	BDL-0.94	29	Godley et al., 1999
Green[c,d]	Alagadi Beach, northern Cyprus	1994-96	Embryo	Ca	0.33	BDL-0.93	16	Godley et al., 1999
Green[c,d]	Alagadi Beach, northern Cyprus	1994-96	Yolk and albumen	Ca	0.27	BDL-1.22	24	Godley et al., 1999
Green[c,d]	Alagadi Beach, northern Cyprus	1994-96	Hatchling	Pb	BDL	BDL-3.86	29	Godley et al., 1999
Green[c,d]	Alagadi Beach, northern Cyprus	1994-96	Embryo	Pb	0.66	BDL-3.41	16	Godley et al., 1999
Green[c,d]	Alagadi Beach, northern Cyprus	1994-96	Yolk and albumen	Pb	BDL	BDL-1.61	24	Godley et al., 1999

[a] μg/g wet mass (± 1 SD)
[b] n.r. - not reported
[c] μg/g dry mass (± 1 SD)
[d] Median
[e] ND - not detected
[f] BDL - below detection limit

Table II.6. Mean Concentrations of Persistent Chlorinated Compounds in Snapping Turtle (*Chelydra serpentina*) Tissues.[a]

General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Mississippi River-St. Paul	1981	F	PCB (Aroclor 1260)	0.072 (0.02)	n.r.[c]	3	Meat	Helwig and Hora, 1983
Mississippi River-St. Paul	1981	M	PCB (Aroclor 1260)	0.038		1	Meat	Helwig and Hora, 1983
Mississippi River-St. Paul	1981	M	PCB (Aroclor 1260)	<0.025		1	Meat	Helwig and Hora, 1983
Mississippi River-Prairie Isl.	1981	M	PCB (Aroclor 1260)	0.047 (0.023)	0.033-0.073	3	Meat	Helwig and Hora, 1983
Mississippi River-Prairie Isl.	1981	F	PCB (Aroclor 1260)	<0.025		1	Meat	Helwig and Hora, 1983
Mississippi River-Lake City	1981	M	PCB (Aroclor 1260)	<0.025		1	Meat	Helwig and Hora, 1983
Mississippi River-Lake City	1981	M	PCB (Aroclor 1260)	<0.025		1	Meat	Helwig and Hora, 1983
Mississippi River-Lake City	1981	M	PCB (Aroclor 1260)	<0.025		1	Meat	Helwig and Hora, 1983
Reeds Lake-Waseca Co.	1981	M	PCB (Aroclor 1260)	<0.025		1	Meat	Helwig and Hora, 1983
Reeds Lake-Waseca Co.	1981	M	PCB (Aroclor 1260)	<0.025		1	Meat	Helwig and Hora, 1983
Pomme de Terre River-Glendwood	1981	n.r.	PCB (Aroclor 1260)	<0.025		1	Meat	Helwig and Hora, 1983
Pomme de Terre River-Glendwood	1981	n.r.	PCB (Aroclor 1260)	<0.025		1	Meat	Helwig and Hora, 1983
Silver Lake-Wright Co.	1981	F	PCB (Aroclor 1260)	<0.025		1	Meat	Helwig and Hora, 1983
Mississippi River-St. Paul	1981	F	PCB (Aroclor 1260)	29.65 (25.53)	n.r.	3	Fat	Helwig and Hora, 1983
Mississippi River-St. Paul	1981	M	PCB (Aroclor 1260)	18.25 (7.14)	13.2-23.3	2	Fat	Helwig and Hora, 1983
Mississippi River-Prairie Isl.	1981	M	PCB (Aroclor 1260)	33.47 (6.35)	28.8-40.7	3	Fat	Helwig and Hora, 1983
Mississippi River-Prairie Isl.	1981	F	PCB (Aroclor 1260)	60.5		1	Fat	Helwig and Hora, 1983
Mississippi River-Lake City	1981	M	PCB (Aroclor 1260)	13.67 (11.04)	1.4-22.8	3	Fat	Helwig and Hora, 1983
Reeds Lake-Waseca Co.	1981	M	PCB (Aroclor 1260)	0.8		1	Fat	Helwig and Hora, 1983
Pomme de Terre River-Glendwood	1981	n.r.	PCB (Aroclor 1260)	<0.2		1	Fat	Helwig and Hora, 1983
Silver Lake-Wright Co.	1981	F	PCB (Aroclor 1260)	5		1	Fat	Helwig and Hora, 1983
Sarnia, S. Ontario[d]	1988-89	n.r.	Total PCB (1254 & 1260)	125.98 (54.34)	n.r.	3	Muscle	Hebert et al., 1993
Walpole Island, S. Ontario[d]	1988-89	n.r.	Total PCB (1254 & 1260)	29.32 (6.45)	n.r.	5	Muscle	Hebert et al., 1993
Stoney Point, S. Ontario[d]	1988-89	n.r.	Total PCB (1254 & 1260)	350.20 (257.34)	n.r.	3	Muscle	Hebert et al., 1993
Turkey Creek, S. Ontario[d]	1988-89	n.r.	Total PCB (1254 & 1260)	392.58 (136.28)	n.r.	4	Muscle	Hebert et al., 1993
Hillman Marsh, S. Ontario[d]	1988-89	n.r.	Total PCB (1254 & 1260)	136.33 (47.50)	n.r.	6	Muscle	Hebert et al., 1993
Long Point, S. Ontario[d]	1988-89	n.r.	Total PCB (1254 & 1260)	41.33 (23.20)	n.r.	5	Muscle	Hebert et al., 1993

[a] μg/g wet mass (± 1 SD)
[b] M - male; F - female
[c] n.r. - not reported
[d] μg/kg wet mass (± 1 SD)
[e] ND - not detected
[f] pg/g
[g] 2,3,7,8-F = 2,3,7,8-tetrachlorodibenzofuran
[h] 2,3,7,8-D = 2,3,7,8-tetrachlorodibenzo-*p*-dioxin
[i] 1,2,3,7,8-F = 1,2,3,7,8-pentachlorodibenzofuran
[j] 2,3,4,7,8-F = 2,3,4,7,8-pentachlorodibenzofuran
[k] 1,2,3,7,8-D = 1,2,3,7,8-pentachlorodibenzo-*p*-dioxin
[l] Total HxF = hexachlorodibenzofuran including the 1,2,3,4,7,8-; 1,2,3,6,7,8-; and 2,3,4,6,7,8-isomers
[m] Total HxD = hexachlorodibenzo-*p*-dioxin including the 1,2,3,6,7,8-; 1,2,3,4,7,8-; and 1,2,3,7,8,9-isomers
[n] 1,2,3,4,6,7,8-F = 1,2,3,4,6,7,8-hexachlorodibenzofuran
[o] 1,2,3,4,6,7,8-D = 1,2,3,4,6,7,8-hexachlorodibenzo-*p*-dioxin
[p] 1,2,3,4,6,7,8,9-D = 1,2,3,4,6,7,8,9-octachlorodibenzo-*p*-dioxin

Table II.6. (continued)

General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Grand River, S. Ontario[d]	1988-89	n.r.	Total PCB (1254 & 1260)	23.83 (10.99)	n.r.	5	Muscle	Hebert et al., 1993
Welland River, S. Ontario[d]	1988-89	n.r.	Total PCB (1254 & 1260)	131.73 (34.50)	n.r.	12	Muscle	Hebert et al., 1993
Martindale Pond, S. Ontario[d]	1988-89	n.r.	Total PCB (1254 & 1260)	182.49 (112.07)	n.r.	8	Muscle	Hebert et al., 1993
Jordan Harbour, S. Ontario[d]	1988-89	n.r.	Total PCB (1254 & 1260)	29.01 (3.91)	n.r.	3	Muscle	Hebert et al., 1993
Lynde Creek, S. Ontario[d]	1988-89	n.r.	Total PCB (1254 & 1260)	134.82 (34.75)	n.r.	5	Muscle	Hebert et al., 1993
Murray Canal, S. Ontario[d]	1988-89	n.r.	Total PCB (1254 & 1260)	29.96 (8.55)	n.r.	5	Muscle	Hebert et al., 1993
Moira River, S. Ontario[d]	1988-89	n.r.	Total PCB (1254 & 1260)	ND	n.r.	3	Muscle	Hebert et al., 1993
Sawguin Marsh, S. Ontario[d]	1988-89	n.r.	Total PCB (1254 & 1260)	7.41 (4.49)	n.r.	3	Muscle	Hebert et al., 1993
Tweed, S. Ontario[d]	1988-89	n.r.	Total PCB (1254 & 1260)	12.26 (4.63)	n.r.	2	Muscle	Hebert et al., 1993
Cornall Island, S. Ontario[d]	1988-89	n.r.	Total PCB (1254 & 1260)	655.28 (309.06)	n.r.	6	Muscle	Hebert et al., 1993
Sarnia, S. Ontario[d]	1988-89	n.r.	Total DDT	8.40 (2.37)	n.r.	3	Muscle	Hebert et al., 1993
Walpole Island, S. Ontario[d]	1988-89	n.r.	Total DDT	2.05 (0.46)	n.r.	5	Muscle	Hebert et al., 1993
Stoney Point, S. Ontario[d]	1988-89	n.r.	Total DDT	43.85 (41.05)	n.r.	3	Muscle	Hebert et al., 1993
Turkey Creek, S. Ontario[d]	1988-89	n.r.	Total DDT	6.73 (2.46)	n.r.	4	Muscle	Hebert et al., 1993
Hillman Marsh, S. Ontario[d]	1988-89	n.r.	Total DDT	7.74 (3.81)	n.r.	6	Muscle	Hebert et al., 1993
Long Point, S. Ontario[d]	1988-89	n.r.	Total DDT	2.21 (1.34)	n.r.	5	Muscle	Hebert et al., 1993
Grand River, S. Ontario[d]	1988-89	n.r.	Total DDT	0.71 (0.41)	n.r.	5	Muscle	Hebert et al., 1993
Welland River, S. Ontario[d]	1988-89	n.r.	Total DDT	1.91 (0.60)	n.r.	12	Muscle	Hebert et al., 1993
Martindale Pond, S. Ontario[d]	1988-89	n.r.	Total DDT	164.60 (135.36)	n.r.	8	Muscle	Hebert et al., 1993
Jordan Harbour, S. Ontario[d]	1988-89	n.r.	Total DDT	0.86 (0.25)	n.r.	3	Muscle	Hebert et al., 1993
Lynde Creek, S. Ontario[d]	1988-89	n.r.	Total DDT	7.24 (2.05)	n.r.	5	Muscle	Hebert et al., 1993
Murray Canal, S. Ontario[d]	1988-89	n.r.	Total DDT	1.04 (0.57)	n.r.	5	Muscle	Hebert et al., 1993
Moira River, S. Ontario[d]	1988-89	n.r.	Total DDT	ND	n.r.	3	Muscle	Hebert et al., 1993
Sawguin Marsh, S. Ontario[d]	1988-89	n.r.	Total DDT	1.01 (0.51)	n.r.	3	Muscle	Hebert et al., 1993
Cornall Island, S. Ontario[d]	1988-89	n.r.	Total DDT	13.34 (7.09)	n.r.	6	Muscle	Hebert et al., 1993
Sarnia, S. Ontario[d]	1988-89	n.r.	Mirex	0.07 (0.07)	n.r.	3	Muscle	Hebert et al., 1993
Walpole Island, S. Ontario[d]	1988-89	n.r.	Mirex	0.10 (0.07)	n.r.	5	Muscle	Hebert et al., 1993

[a] μg/g wet mass (± 1 SD)
[b] M - male; F - female
[c] n.r. - not reported
[d] μg/kg wet mass (± 1 SD)
[e] ND - not detected
[f] pg/g
[g] 2,3,7,8-F = 2,3,7,8-tetrachlorodibenzofuran
[h] 2,3,7,8-D = 2,3,7,8-tetrachlorodibenzo-*p*-dioxin
[i] 1,2,3,7,8-F = 1,2,3,7,8-pentachlorodibenzofuran
[j] 2,3,4,7,8-F = 2,3,4,7,8-pentachlorodibenzofuran
[k] 1,2,3,7,8-D = 1,2,3,7,8-pentachlorodibenzo-*p*-dioxin
[l] Total HxF = hexachlorodibenzofuran including the 1,2,3,4,7,8-; 1,2,3,6,7,8-; and 2,3,4,6,7,8-isomers
[m] Total HxD = hexachlorodibenzo-*p*-dioxin including the 1,2,3,6,7,8-; 1,2,3,4,7,8-; and 1,2,3,7,8,9-isomers
[n] 1,2,3,4,6,7,8-F = 1,2,3,4,6,7,8-hexachlorodibenzofuran
[o] 1,2,3,4,6,7,8-D = 1,2,3,4,6,7,8-hexachlorodibenzo-*p*-dioxin
[p] 1,2,3,4,6,7,8,9-D = 1,2,3,4,6,7,8,9-octachlorodibenzo-*p*-dioxin

Table II.6. (continued)

General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Stoney Point, S. Ontario[d]	1988-89	n.r.	Mirex	0.31 (0.31)	n.r.	3	Muscle	Hebert et al., 1993
Turkey Creek, S. Ontario[d]	1988-89	n.r.	Mirex	1.70 (0.88)	n.r.	4	Muscle	Hebert et al., 1993
Hillman Marsh, S. Ontario[d]	1988-89	n.r.	Mirex	1.34 (0.28)	n.r.	6	Muscle	Hebert et al., 1993
Long Point, S. Ontario[d]	1988-89	n.r.	Mirex	0.04 (0.04)	n.r.	5	Muscle	Hebert et al., 1993
Grand River, S. Ontario[d]	1988-89	n.r.	Mirex	0.05 (0.05)	n.r.	5	Muscle	Hebert et al., 1993
Welland River, S. Ontario[d]	1988-89	n.r.	Mirex	0.38 (0.12)	n.r.	12	Muscle	Hebert et al., 1993
Martindale Pond, S. Ontario[d]	1988-89	n.r.	Mirex	1.39 (1.11)	n.r.	8	Muscle	Hebert et al., 1993
Lynde Creek, S. Ontario[d]	1988-89	n.r.	Mirex	3.95 (1.22)	n.r.	5	Muscle	Hebert et al., 1993
Murray Canal, S. Ontario[d]	1988-89	n.r.	Mirex	1.01 (0.29)	n.r.	5	Muscle	Hebert et al., 1993
Moira River, S. Ontario[d]	1988-89	n.r.	Mirex	ND	n.r.	3	Muscle	Hebert et al., 1993
Sawguin Marsh, S. Ontario[d]	1988-89	n.r.	Mirex	ND	n.r.	3	Muscle	Hebert et al., 1993
Cornall Island, S. Ontario[d]	1988-89	n.r.	Mirex	2.90 (1.35)	n.r.	6	Muscle	Hebert et al., 1993
Sarnia, S. Ontario[d]	1988-89	n.r.	octachlorostyrene	0.05 (0.05)	n.r.	3	Muscle	Hebert et al., 1993
Walpole Island, S. Ontario[d]	1988-89	n.r.	octachlorostyrene	0.99 (0.32)	n.r.	5	Muscle	Hebert et al., 1993
Stoney Point, S. Ontario[d]	1988-89	n.r.	octachlorostyrene	1.26 (0.63)	n.r.	3	Muscle	Hebert et al., 1993
Turkey Creek, S. Ontario[d]	1988-89	n.r.	octachlorostyrene	0.59 (0.15)	n.r.	4	Muscle	Hebert et al., 1993
Hillman Marsh, S. Ontario[d]	1988-89	n.r.	octachlorostyrene	0.51 (0.21)	n.r.	6	Muscle	Hebert et al., 1993
Long Point, S. Ontario[d]	1988-89	n.r.	octachlorostyrene	ND	n.r.	5	Muscle	Hebert et al., 1993
Grand River, S. Ontario[d]	1988-89	n.r.	octachlorostyrene	ND	n.r.	5	Muscle	Hebert et al., 1993
Welland River, S. Ontario[d]	1988-89	n.r.	octachlorostyrene	0.06 (0.04)	n.r.	12	Muscle	Hebert et al., 1993
Martindale Pond, S. Ontario[d]	1988-89	n.r.	octachlorostyrene	0.26 (0.16)	n.r.	8	Muscle	Hebert et al., 1993
Jordan Harbour, S. Ontario[d]	1988-89	n.r.	octachlorostyrene	0.54 (0.24)	n.r.	3	Muscle	Hebert et al., 1993
Lynde Creek, S. Ontario[d]	1988-89	n.r.	octachlorostyrene	0.28 (0.08)	n.r.	5	Muscle	Hebert et al., 1993
Murray Canal, S. Ontario[d]	1988-89	n.r.	octachlorostyrene	ND	n.r.	5	Muscle	Hebert et al., 1993
Moira River, S. Ontario[d]	1988-89	n.r.	octachlorostyrene	ND	n.r.	3	Muscle	Hebert et al., 1993
Sawguin Marsh, S. Ontario[d]	1988-89	n.r.	octachlorostyrene	ND	n.r.	3	Muscle	Hebert et al., 1993
Tweed, S. Ontario[d]	1988-89	n.r.	octachlorostyrene	0.16 (0.16)	n.r.	2	Muscle	Hebert et al., 1993

[a] μg/g wet mass (± 1 SD)
[b] M - male; F - female
[c] n.r. - not reported
[d] μg/kg wet mass (± 1 SD)
[e] ND - not detected
[f] pg/g
[g] 2,3,7,8-F = 2,3,7,8-tetrachlorodibenzofuran
[h] 2,3,7,8-D = 2,3,7,8-tetrachlorodibenzo-*p*-dioxin
[i] 1,2,3,7,8-F = 1,2,3,7,8-pentachlorodibenzofuran
[j] 2,3,4,7,8-F = 2,3,4,7,8-pentachlorodibenzofuran
[k] 1,2,3,7,8-D = 1,2,3,7,8-pentachlorodibenzo-*p*-dioxin
[l] Total HxF = hexachlorodibenzofuran including the 1,2,3,4,7,8-; 1,2,3,6,7,8-; and 2,3,4,6,7,8-isomers
[m] Total HxD = hexachlorodibenzo-*p*-dioxin including the 1,2,3,6,7,8-; 1,2,3,4,7,8-; and 1,2,3,7,8,9-isomers
[n] 1,2,3,4,6,7,8-F = 1,2,3,4,6,7,8-hexachlorodibenzofuran
[o] 1,2,3,4,6,7,8-D = 1,2,3,4,6,7,8-hexachlorodibenzo-*p*-dioxin
[p] 1,2,3,4,6,7,8,9-D = 1,2,3,4,6,7,8,9-octachlorodibenzo-*p*-dioxin

Table II.6. (continued)

General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Cornall Island, S. Ontario[d]	1988-89	n.r.	octachlorostyrene	0.07 (0.05)	n.r.	6	Muscle	Hebert et al., 1993
Laurel, MD	1981-82	M	*Cis*-chlordane	ND	n.r.	7	Visceral Fat	Albers et al., 1986
Laurel, MD	1981-82	F	*Cis*-chlordane	ND	n.r.	6	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	*Cis*-chlordane	ND	n.r.	8	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	*Cis*-chlordane	0.12 (0.20)	n.r.	3	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	*Cis*-chlordane	ND	n.r.	8	Visceral Fat	Albers et al., 1986
Laurel, MD	1981-82	M	Oxychlordane	2.00 (1.27)	n.r.	7	Visceral Fat	Albers et al., 1986
Laurel, MD	1981-82	F	Oxychlordane	1.53 (3.17)	n.r.	6	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	Oxychlordane	9.33 (16.10)	n.r.	8	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	Oxychlordane	2.12 (3.03)	n.r.	3	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	Oxychlordane	1.30 (1.04)	n.r.	8	Visceral Fat	Albers et al., 1986
Laurel, MD	1981-82	M	*Trans*-chlordane	0.08 (0.13)	n.r.	7	Visceral Fat	Albers et al., 1986
Laurel, MD	1981-82	F	*Trans*-chlordane	0.04 (0.09)	n.r.	6	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	*Trans*-chlordane	ND	n.r.	8	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	*Trans*-chlordane	ND	n.r.	3	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	*Trans*-chlordane	ND	n.r.	8	Visceral Fat	Albers et al., 1986
Laurel, MD	1981-82	M	*Cis*-nonachlor	0.59 (0.71)	n.r.	7	Visceral Fat	Albers et al., 1986
Laurel, MD	1981-82	F	*Cis*-nonachlor	0.31 (0.74)	n.r.	6	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	*Cis*-nonachlor	3.53 (7.03)	n.r.	8	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	*Cis*-nonachlor	0.64 (1.10)	n.r.	3	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	*Cis*-nonachlor	0.31 (0.32)	n.r.	8	Visceral Fat	Albers et al., 1986
Laurel, MD	1981-82	M	*Trans*-chlordane	0.87 (1.46)	n.r.	7	Visceral Fat	Albers et al., 1986
Laurel, MD	1981-82	F	*Trans*-chlordane	0.34 (0.81)	n.r.	6	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	*Trans*-chlordane	4.01 (6.19)	n.r.	8	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	*Trans*-chlordane	0.93 (1.61)	n.r.	3	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	*Trans*-chlordane	0.68 (0.67)	n.r.	8	Visceral Fat	Albers et al., 1986
Laurel, MD	1981-82	M	DDT	ND	n.r.	7	Visceral Fat	Albers et al., 1986

[a] μg/g wet mass (± 1 SD)
[b] M - male; F - female
[c] n.r. - not reported
[d] μg/kg wet mass (± 1 SD)
[e] ND - not detected
[f] pg/g
[g] 2,3,7,8-F = 2,3,7,8-tetrachlorodibenzofuran
[h] 2,3,7,8-D = 2,3,7,8-tetrachlorodibenzo-*p*-dioxin
[i] 1,2,3,7,8-F = 1,2,3,7,8-pentachlorodibenzofuran
[j] 2,3,4,7,8-F = 2,3,4,7,8-pentachlorodibenzofuran
[k] 1,2,3,7,8-D = 1,2,3,7,8-pentachlorodibenzo-*p*-dioxin
[l] Total HxF = hexachlorodibenzofuran including the 1,2,3,4,7,8-; 1,2,3,6,7,8-; and 2,3,4,6,7,8-isomers
[m] Total HxD = hexachlorodibenzo-*p*-dioxin including the 1,2,3,6,7,8-; 1,2,3,4,7,8-; and 1,2,3,7,8,9-isomers
[n] 1,2,3,4,6,7,8-F = 1,2,3,4,6,7,8-hexachlorodibenzofuran
[o] 1,2,3,4,6,7,8-D = 1,2,3,4,6,7,8-hexachlorodibenzo-*p*-dioxin
[p] 1,2,3,4,6,7,8,9-D = 1,2,3,4,6,7,8,9-octachlorodibenzo-*p*-dioxin

Table II.6. (continued)

General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Laurel, MD	1981-82	F	DDT	ND	n.r.	6	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	DDT	ND	n.r.	8	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	DDT	ND	n.r.	3	Visceral Fat	Albers et al., 1986
Laurel, MD	1981-82	M	DDD	ND	n.r.	7	Visceral Fat	Albers et al., 1986
Laurel, MD	1981-82	F	DDD	ND	n.r.	6	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	DDD	ND	n.r.	8	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	DDD	ND	n.r.	3	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	DDD	0.13 (0.34)	n.r.	8	Visceral Fat	Albers et al., 1986
Laurel, MD	1981-82	M	DDE	0.39 (0.31)	n.r.	7	Visceral Fat	Albers et al., 1986
Laurel, MD	1981-82	F	DDE	0.10 (0.16)	n.r.	6	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	DDE	0.16 (0.29)	n.r.	8	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	DDE	0.26 (0.44)	n.r.	3	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	DDE	2.03 (1.24)	n.r.	8	Visceral Fat	Albers et al., 1986
Laurel, MD	1981-82	M	Dieldrin	0.03 (0.07)	n.r.	7	Visceral Fat	Albers et al., 1986
Laurel, MD	1981-82	F	Dieldrin	ND	n.r.	6	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	Dieldrin	ND	n.r.	8	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	Dieldrin	ND	n.r.	3	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	Dieldrin	0.07 (0.10)	n.r.	8	Visceral Fat	Albers et al., 1986
Laurel, MD	1981-82	M	Endrin	ND	n.r.	7	Visceral Fat	Albers et al., 1986
Laurel, MD	1981-82	F	Endrin	ND	n.r.	6	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	Endrin	ND	n.r.	8	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	Endrin	ND	n.r.	3	Visceral Fat	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	Endrin	ND	n.r.	8	Visceral Fat	Albers et al., 1986
Laurel, MD	1981-82	M	Heptachlor epoxide	0.17 (0.25)	n.r.	7	Visceral Fat	Albers et al., 1986
Laurel, MD	1981-82	F	Heptachlor epoxide	0.04 (0.08)	n.r.	6	Visceral Fat	Watson et al., 1985
Hackensack Meadowlands, NJ-brackish	1981-82	M	Heptachlor epoxide	ND	n.r.	8	Visceral Fat	Watson et al., 1985
Hackensack Meadowlands, NJ-brackish	1981-82	F	Heptachlor epoxide	ND	n.r.	3	Visceral Fat	Watson et al., 1985

[a] μg/g wet mass (± 1 SD)
[b] M - male; F - female
[c] n.r. - not reported
[d] μg/kg wet mass (± 1 SD)
[e] ND - not detected
[f] pg/g
[g] 2,3,7,8-F = 2,3,7,8-tetrachlorodibenzofuran
[h] 2,3,7,8-D = 2,3,7,8-tetrachlorodibenzo-*p*-dioxin
[i] 1,2,3,7,8-F = 1,2,3,7,8-pentachlorodibenzofuran
[j] 2,3,4,7,8-F = 2,3,4,7,8-pentachlorodibenzofuran
[k] 1,2,3,7,8-D = 1,2,3,7,8-pentachlorodibenzo-*p*-dioxin
[l] Total HxF = hexachlorodibenzofuran including the 1,2,3,4,7,8-; 1,2,3,6,7,8-; and 2,3,4,6,7,8-isomers
[m] Total HxD = hexachlorodibenzo-*p*-dioxin including the 1,2,3,6,7,8-; 1,2,3,4,7,8-; and 1,2,3,7,8,9-isomers
[n] 1,2,3,4,6,7,8-F = 1,2,3,4,6,7,8-hexachlorodibenzofuran
[o] 1,2,3,4,6,7,8-D = 1,2,3,4,6,7,8-hexachlorodibenzo-*p*-dioxin
[p] 1,2,3,4,6,7,8,9-D = 1,2,3,4,6,7,8,9-octachlorodibenzo-*p*-dioxin

Table II.6. (continued)

General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Hackensack Meadowlands, NJ-freshwater	1981-82	M	Heptachlor epoxide	0.38 (0.60)	n.r.	8	Visceral Fat	Watson et al., 1985
Laurel, MD	1981-82	M	Toxaphene	ND	n.r.	7	Visceral Fat	Stone et al., 1980
Laurel, MD	1981-82	F	Toxaphene	ND	n.r.	6	Visceral Fat	Stone et al., 1980
Hackensack Meadowlands, NJ-brackish	1981-82	M	Toxaphene	ND	n.r.	8	Visceral Fat	Stone et al., 1980
Hackensack Meadowlands, NJ-brackish	1981-82	F	Toxaphene	ND	n.r.	3	Visceral Fat	Stone et al., 1980
Hackensack Meadowlands, NJ-freshwater	1981-82	M	Toxaphene	ND	n.r.	8	Visceral Fat	Stone et al., 1980
Laurel, MD	1981-82	M	PCB	41.20 (37.24)	n.r.	7	Visceral Fat	Stone et al., 1980
Laurel, MD	1981-82	F	PCB	36.17 (81.16)	n.r.	6	Visceral Fat	Stone et al., 1980
Hackensack Meadowlands, NJ-brackish	1981-82	M	PCB	291.13 (304.82)	n.r.	8	Visceral Fat	Stone et al., 1980
Hackensack Meadowlands, NJ-brackish	1981-82	F	PCB	34.07 (15.56)	n.r.	3	Visceral Fat	Stone et al., 1980
Hackensack Meadowlands, NJ-freshwater	1981-82	M	PCB	23.55 (11.19)	n.r.	8	Visceral Fat	Stone et al., 1980
Township of Moreau, NY	1982-84	n.r.	Total PCB	4530		1	Fat	Stone et al., 1980
Township of Moreau, NY	1982-84	n.r.	Total PCB	185		1	Liver	Stone et al., 1980
Township of Moreau, NY	1982-84	n.r.	Total PCB	17		1	Muscle	Stone et al., 1980
Township of Moreau, NY	1982-84	n.r.	Total PCB	81		1	Fat	Stone et al., 1980
Hudson River, NY	1976-78	M	PCB's	3559.6 (3098.2)	330-7990	8	Fat	Stone et al., 1980
Hudson River, NY	1976-78	F	PCB's	714.5 (577.7)	306-1123	2	Fat	Stone et al., 1980
Otselic River, NY	1977	F	PCB's	99.9		1	Fat	Stone et al., 1980
Spring Lakes (Dutchess Co.), NY	1977	F	PCB's	44.4		1	Fat	Stone et al., 1980
Black Pond, NY	1978	F	PCB's	372.5 (53.03)	335-410	2	Fat	Stone et al., 1980
St. Lawrence River, NY	1978	F	PCB's	310		1	Fat	Stone et al., 1980
White Creek, NY	1978	M	PCB's	2281		1	Fat	Stone et al., 1980
Black Creek Marsh, NY	1978	M	PCB's	15.58 (21.52)	30.8-0.36	2	Fat	Stone et al., 1980
Hudson River, NY	1976-78	M	DDE	12.13 (23.05)	n.d.-57.5	6	Fat	Stone et al., 1980
Irondequoit Bay (Lake Ontario)	1978	M	PCB's	666		1	Fat	Stone et al., 1980
Hudson River, NY	1976-78	F	DDE	<5.0		1	Fat	Stone et al., 1980
Otselic River, NY	1977	F	DDE	0.14		1	Fat	Stone et al., 1980

[a] μg/g wet mass (± 1 SD)
[b] M - male; F - female
[c] n.r. - not reported
[d] μg/kg wet mass (± 1 SD)
[e] ND - not detected
[f] pg/g
[g] 2,3,7,8-F = 2,3,7,8-tetrachlorodibenzofuran
[h] 2,3,7,8-D = 2,3,7,8-tetrachlorodibenzo-*p*-dioxin
[i] 1,2,3,7,8-F = 1,2,3,7,8-pentachlorodibenzofuran
[j] 2,3,4,7,8-F = 2,3,4,7,8-pentachlorodibenzofuran
[k] 1,2,3,7,8-D = 1,2,3,7,8-pentachlorodibenzo-*p*-dioxin
[l] Total HxF = hexachlorodibenzofuran including the 1,2,3,4,7,8-; 1,2,3,6,7,8-; and 2,3,4,6,7,8-isomers
[m] Total HxD = hexachlorodibenzo-*p*-dioxin including the 1,2,3,6,7,8-; 1,2,3,4,7,8-; and 1,2,3,7,8,9-isomers
[n] 1,2,3,4,6,7,8-F = 1,2,3,4,6,7,8-hexachlorodibenzofuran
[o] 1,2,3,4,6,7,8-D = 1,2,3,4,6,7,8-hexachlorodibenzo-*p*-dioxin
[p] 1,2,3,4,6,7,8,9-D = 1,2,3,4,6,7,8,9-octachlorodibenzo-*p*-dioxin

Table II.6. (continued)

General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Spring Lakes (Dutchess Co.), NY	1977	F	DDE	1.4		1	Fat	Stone et al., 1980
Black Pond, NY	1978	F	DDE	5.9 (3.54)	3.4-8.4	2	Fat	Stone et al., 1980
St. Lawrence River, NY	1978	F	DDE	8.8		1	Fat	Stone et al., 1980
White Creek, NY	1978	M	DDE	ND		1	Fat	Stone et al., 1980
Black Creek Marsh, NY	1978	M	DDE	15.58 (21.52)	0.36-30.8	2	Fat	Stone et al., 1980
Irondequoit Bay (Lake Ontario)	1978	M	DDE	666		1	Fat	Stone et al., 1980
Hudson River, NY	1976-78	M	Dieldrin	8.41 (10.22)	0.33-26.5	6	Fat	Stone et al., 1980
Hudson River, NY	1976-78	F	Dieldrin	8.6 (11.88)	0.2-17.0	2	Fat	Stone et al., 1980
Otselic River, NY	1977	F	Dieldrin	ND		1	Fat	Stone et al., 1980
Spring Lakes (Dutchess Co.), NY	1977	F	Dieldrin	ND		1	Fat	Stone et al., 1980
Black Pond, NY	1978	F	Dieldrin	2.0 (0.57)	1.6-2.4	2	Fat	Stone et al., 1980
St. Lawrence River, NY	1978	F	Dieldrin	ND		1	Fat	Stone et al., 1980
White Creek, NY	1978	M	Dieldrin	ND		1	Fat	Stone et al., 1980
Black Creek Marsh, NY	1978	M	Dieldrin	0.06		1	Fat	Stone et al., 1980
Irondequoit Bay (Lake Ontario)	1978	M	Dieldrin	34.1		1	Fat	Stone et al., 1980
Hudson River, NY	1976-78	M	PCB's	82.23 (180.58)	0.54-683	14	Liver	Stone et al., 1980
Hudson River, NY	1976-78	F	PCB's	34.98 (37.69)	3.13-107	8	Liver	Stone et al., 1980
Spring Lakes (Dutchess Co.), NY	1977	F	PCB's	0.48		1	Liver	Stone et al., 1980
Black Pond, NY	1978	F	PCB's	5.35 (2.9)	3.3-7.4	2	Liver	Stone et al., 1980
St. Lawrence River, NY	1978	F	PCB's	21.4		1	Liver	Stone et al., 1980
White Creek, NY	1978	M	PCB's	1.39		1	Liver	Stone et al., 1980
Black Creek Marsh, NY	1978	M	PCB's	0.15 (0.07)	n.r.	0.1-0.2	Liver	Stone et al., 1980
Irondequoit Bay (Lake Ontario)	1978	M	PCB's	27.8		1	Liver	Stone et al., 1980
Hudson River, NY	1976-1978	M	DDE	1.92 (5.17)	0.001-17.4	11	Liver	Stone et al., 1980
Hudson River, NY	1976-1978	F	DDE	0.97 (0.443)	0.05-0.99	6	Liver	Stone et al., 1980
Black Pond, NY	1978	F	DDE	0.044 (0.008)	0.038-0.049	2	Liver	Stone et al., 1980
St. Lawrence River, NY	1978	F	DDE	0.77		1	Liver	Stone et al., 1980

[a] μg/g wet mass (± 1 SD)
[b] M - male; F - female
[c] n.r. - not reported
[d] μg/kg wet mass (± 1 SD)
[e] ND - not detected
[f] pg/g
[g] 2,3,7,8-F = 2,3,7,8-tetrachlorodibenzofuran
[h] 2,3,7,8-D = 2,3,7,8-tetrachlorodibenzo-*p*-dioxin
[i] 1,2,3,7,8-F = 1,2,3,7,8-pentachlorodibenzofuran
[j] 2,3,4,7,8-F = 2,3,4,7,8-pentachlorodibenzofuran
[k] 1,2,3,7,8-D = 1,2,3,7,8-pentachlorodibenzo-*p*-dioxin
[l] Total HxF = hexachlorodibenzofuran including the 1,2,3,4,7,8-; 1,2,3,6,7,8-; and 2,3,4,6,7,8-isomers
[m] Total HxD = hexachlorodibenzo-*p*-dioxin including the 1,2,3,6,7,8-; 1,2,3,4,7,8-; and 1,2,3,7,8,9-isomers
[n] 1,2,3,4,6,7,8-F = 1,2,3,4,6,7,8-hexachlorodibenzofuran
[o] 1,2,3,4,6,7,8-D = 1,2,3,4,6,7,8-hexachlorodibenzo-*p*-dioxin
[p] 1,2,3,4,6,7,8,9-D = 1,2,3,4,6,7,8,9-octachlorodibenzo-*p*-dioxin

Table II.6. (continued)

General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Black Creek Marsh, NY	1978	M	DDE	ND		1	Liver	Stone et al., 1980
Irondequoit Bay (Lake Ontario)	1978	M	DDE	3.58		1	Liver	Stone et al., 1980
White Creek, NY	1978	M	DDE	0.01		1	Liver	Stone et al., 1980
Hudson River, NY	1976-1978	M	Dieldrin	0.057 (0.067)	0.001-0.086	5	Liver	Stone et al., 1980
Hudson River, NY	1976-1978	F	Dieldrin	0.015 (0.013)	0.001-0.026	3	Liver	Stone et al., 1980
Black Pond, NY	1978	F	Dieldrin	0.05 (0.03)	0.03-0.07	2	Liver	Stone et al., 1980
St. Lawrence River, NY	1978	F	Dieldrin	ND		1	Liver	Stone et al., 1980
White Creek, NY	1978	M	Dieldrin	ND		1	Liver	Stone et al., 1980
Black Creek Marsh, NY	1978	M	Dieldrin	ND		1	Liver	Stone et al., 1980
Irondequoit Bay (Lake Ontario)	1978	M	Dieldrin	0.99		1	Liver	Stone et al., 1980
Hudson River, NY	1976-1978	M	PCB's	3.31 (4.55)	0.19-11.4	15	Muscle	Stone et al., 1980
Hudson River, NY	1976-1978	F	PCB's	6.21 (10.23)	0.47-27.62	7	Muscle	Stone et al., 1980
Spring Lakes (Dutchess Co.), NY	1977	F	PCB's	0.28		1	Muscle	Stone et al., 1980
Black Pond, NY	1978	F	PCB's	0.6 (0.30)	0.39-0.81	2	Muscle	Stone et al., 1980
St. Lawrence River, NY	1978	F	PCB's	0.34		1	Muscle	Stone et al., 1980
White Creek, NY	1978	M	PCB's	0.48		1	Muscle	Stone et al., 1980
Irondequoit Bay (Lake Ontario)	1978	M	PCB's	0.36		1	Muscle	Stone et al., 1980
Hudson River, NY	1976-1978	M	DDE	0.107 (0.134)	0.01-0.26	3	Muscle	Stone et al., 1980
Hudson River, NY	1976-1978	F	DDE	0.194 (0.364)	0.015-0.74	4	Muscle	Stone et al., 1980
Black Pond, NY	1978	F	DDE	<0.013 (0.011)	<0.01-0.025	2	Muscle	Stone et al., 1980
St. Lawrence River, NY	1978	F	DDE	0.013		1	Muscle	Stone et al., 1980
White Creek, NY	1978	M	DDE	0.042		1	Muscle	Stone et al., 1980
Irondequoit Bay (Lake Ontario)	1978	M	DDE	0.023		1	Muscle	Stone et al., 1980
Hudson River, NY	1976-1978	M	Dieldrin	0.022 (0.017)	0.034-0.01	2	Muscle	Stone et al., 1980
Hudson River, NY	1976-1978	F	Dieldrin	0.019		1	Muscle	Stone et al., 1980
Black Pond, NY	1978	F	Dieldrin	0.01		1	Muscle	Stone et al., 1980
St. Lawrence River, NY	1978	F	Dieldrin	<0.01		1	Muscle	Stone et al., 1980

[a] μg/g wet mass (± 1 SD)
[b] M - male; F - female
[c] n.r. - not reported
[d] μg/kg wet mass (± 1 SD)
[e] ND - not detected
[f] pg/g
[g] 2,3,7,8-F = 2,3,7,8-tetrachlorodibenzofuran
[h] 2,3,7,8-D = 2,3,7,8-tetrachlorodibenzo-*p*-dioxin
[i] 1,2,3,7,8-F = 1,2,3,7,8-pentachlorodibenzofuran
[j] 2,3,4,7,8-F = 2,3,4,7,8-pentachlorodibenzofuran
[k] 1,2,3,7,8-D = 1,2,3,7,8-pentachlorodibenzo-*p*-dioxin
[l] Total HxF = hexachlorodibenzofuran including the 1,2,3,4,7,8-; 1,2,3,6,7,8-; and 2,3,4,6,7,8-isomers
[m] Total HxD = hexachlorodibenzo-*p*-dioxin including the 1,2,3,6,7,8-; 1,2,3,4,7,8-; and 1,2,3,7,8,9-isomers
[n] 1,2,3,4,6,7,8-F = 1,2,3,4,6,7,8-hexachlorodibenzofuran
[o] 1,2,3,4,6,7,8-D = 1,2,3,4,6,7,8-hexachlorodibenzo-*p*-dioxin
[p] 1,2,3,4,6,7,8,9-D = 1,2,3,4,6,7,8,9-octachlorodibenzo-*p*-dioxin

Table II.6. (continued)

General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
White Creek, NY	1978	M	Dieldrin	ND		1	Muscle	Stone et al., 1980
Irondequoit Bay (Lake Ontario)	1978	M	Dieldrin	0.16		1	Muscle	Stone et al., 1980
Steele's Bay, St. Lawrence River[f]	1984	M	2,3,7,8-F[g]	12		1	Fat	Ryan et al., 1986
Steele's Bay, St. Lawrence River[f]	1984	M	2,3,7,8-F[g]	ND		1	Liver	Ryan et al., 1986
Steele's Bay, St. Lawrence River[f]	1984	M	2,3,7,8-D[h]	474		1	Fat	Ryan et al., 1986
Steele's Bay, St. Lawrence River[f]	1984	M	2,3,7,8-D[h]	107		1	Liver	Ryan et al., 1986
Steele's Bay, St. Lawrence River[f]	1984	M	1,2,3,7,8-F[i]	ND		1	Fat	Ryan et al., 1986
Steele's Bay, St. Lawrence River[f]	1984	M	1,2,3,7,8-F[i]	ND		1	Liver	Ryan et al., 1986
Steele's Bay, St. Lawrence River[f]	1984	M	2,3,4,7,8-F[j]	152		1	Fat	Ryan et al., 1986
Steele's Bay, St. Lawrence River[f]	1984	M	2,3,4,7,8-F[j]	29		1	Liver	Ryan et al., 1986
Steele's Bay, St. Lawrence River[f]	1984	M	1,2,3,7,8-D[k]	63		1	Fat	Ryan et al., 1986
Steele's Bay, St. Lawrence River[f]	1984	M	1,2,3,7,8-D[k]	12		1	Liver	Ryan et al., 1986
Steele's Bay, St. Lawrence River[f]	1984	M	Total HxF[l]	ND		1	Fat	Ryan et al., 1986
Steele's Bay, St. Lawrence River[f]	1984	M	Total HxF[l]	ND		1	Liver	Ryan et al., 1986
Steele's Bay, St. Lawrence River[f]	1984	M	Total HxD[m]	23		1	Fat	Ryan et al., 1986
Steele's Bay, St. Lawrence River[f]	1984	M	Total HxD[m]	3		1	Liver	Ryan et al., 1986
Steele's Bay, St. Lawrence River[f]	1984	M	1,2,3,4,6,7,8-F[n]	ND		1	Fat	Ryan et al., 1986
Steele's Bay, St. Lawrence River[f]	1984	M	1,2,3,4,6,7,8-F[n]	ND		1	Liver	Ryan et al., 1986
Steele's Bay, St. Lawrence River[f]	1984	M	1,2,3,4,6,7,8-D[o]	2.3		1	Fat	Ryan et al., 1986
Steele's Bay, St. Lawrence River[f]	1984	M	1,2,3,4,6,7,8-D[o]	4.5		1	Liver	Ryan et al., 1986
Steele's Bay, St. Lawrence River[f]	1984	M	1,2,3,4,6,7,8,9-D[p]	34		1	Fat	Ryan et al., 1986
Steele's Bay, St. Lawrence River[f]	1984	M	1,2,3,4,6,7,8,9-D[p]	27		1	Liver	Ryan et al., 1986
Goose Bay East, St. Lawrence River[f]	1984	F	2,3,7,8-F[g]	6		1	Fat	Ryan et al., 1986
Goose Bay East, St. Lawrence River[f]	1984	F	2,3,7,8-F[g]	ND		1	Liver	Ryan et al., 1986
Goose Bay East, St. Lawrence River[f]	1984	F	2,3,7,8-D[h]	232		1	Fat	Ryan et al., 1986
Goose Bay East, St. Lawrence River[f]	1984	F	2,3,7,8-D[h]	32		1	Liver	Ryan et al., 1986
Goose Bay East, St. Lawrence River[f]	1984	F	1,2,3,7,8-F[i]	ND		1	Fat	Ryan et al., 1986

[a] μg/g wet mass (± 1 SD)
[b] M - male; F - female
[c] n.r. - not reported
[d] μg/kg wet mass (± 1 SD)
[e] ND - not detected
[f] pg/g
[g] 2,3,7,8-F = 2,3,7,8-tetrachlorodibenzofuran
[h] 2,3,7,8-D = 2,3,7,8-tetrachlorodibenzo-*p*-dioxin
[i] 1,2,3,7,8-F = 1,2,3,7,8-pentachlorodibenzofuran
[j] 2,3,4,7,8-F = 2,3,4,7,8-pentachlorodibenzofuran
[k] 1,2,3,7,8-D = 1,2,3,7,8-pentachlorodibenzo-*p*-dioxin
[l] Total HxF = hexachlorodibenzofuran including the 1,2,3,4,7,8-; 1,2,3,6,7,8-; and 2,3,4,6,7,8-isomers
[m] Total HxD = hexachlorodibenzo-*p*-dioxin including the 1,2,3,6,7,8-; 1,2,3,4,7,8-; and 1,2,3,7,8,9-isomers
[n] 1,2,3,4,6,7,8-F = 1,2,3,4,6,7,8-hexachlorodibenzofuran
[o] 1,2,3,4,6,7,8-D = 1,2,3,4,6,7,8-hexachlorodibenzo-*p*-dioxin
[p] 1,2,3,4,6,7,8,9-D = 1,2,3,4,6,7,8,9-octachlorodibenzo-*p*-dioxin

Table II.6. (continued)

General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Goose Bay East, St. Lawrence River[f]	1984	F	1,2,3,7,8-F[i]	ND		1	Liver	Ryan et al., 1986
Goose Bay East, St. Lawrence River[f]	1984	F	2,3,4,7,8-F[j]	95		1	Fat	Ryan et al., 1986
Goose Bay East, St. Lawrence River[f]	1984	F	2,3,4,7,8-F[j]	13		1	Liver	Ryan et al., 1986
Goose Bay East, St. Lawrence River[f]	1984	F	1,2,3,7,8-D[k]	33		1	Fat	Ryan et al., 1986
Goose Bay East, St. Lawrence River[f]	1984	F	1,2,3,7,8-D[k]	4.6		1	Liver	Ryan et al., 1986
Goose Bay East, St. Lawrence River[f]	1984	F	Total HxF[l]	ND		1	Fat	Ryan et al., 1986
Goose Bay East, St. Lawrence River[f]	1984	F	Total HxF[l]	ND		1	Liver	Ryan et al., 1986
Goose Bay East, St. Lawrence River[f]	1984	F	Total HxD[m]	16		1	Fat	Ryan et al., 1986
Goose Bay East, St. Lawrence River[f]	1984	F	Total HxD[m]	6.4		1	Liver	Ryan et al., 1986
Goose Bay East, St. Lawrence River[f]	1984	F	1,2,3,4,6,7,8-F[n]	ND		1	Fat	Ryan et al., 1986
Goose Bay East, St. Lawrence River[f]	1984	F	1,2,3,4,6,7,8-F[n]	ND		1	Liver	Ryan et al., 1986
Goose Bay East, St. Lawrence River[f]	1984	F	1,2,3,4,6,7,8-D[o]	17		1	Fat	Ryan et al., 1986
Goose Bay East, St. Lawrence River[f]	1984	F	1,2,3,4,6,7,8-D[o]	4		1	Liver	Ryan et al., 1986
Goose Bay East, St. Lawrence River[f]	1984	F	1,2,3,4,6,7,8,9-D[p]	36		1	Fat	Ryan et al., 1986
Goose Bay East, St. Lawrence River[f]	1984	F	1,2,3,4,6,7,8,9-D[p]	ND		1	Liver	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	2,3,7,8-F[g]	330		1	Fat	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	2,3,7,8-F[g]	74		1	Liver	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	2,3,7,8-D[h]	370		1	Fat	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	2,3,7,8-D[h]	74		1	Liver	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	1,2,3,7,8-F[i]	600		1	Fat	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	1,2,3,7,8-F[i]	100		1	Liver	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	2,3,4,7,8-F[j]	3020		1	Fat	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	2,3,4,7,8-F[j]	480		1	Liver	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	1,2,3,7,8-D[k]	104		1	Fat	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	1,2,3,7,8-D[k]	22		1	Liver	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	Total HxF[l]	890		1	Fat	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	Total HxF[l]	160		1	Liver	Ryan et al., 1986

[a] μg/g wet mass (± 1 SD)
[b] M - male; F - female
[c] n.r. - not reported
[d] μg/kg wet mass (± 1 SD)
[e] ND - not detected
[f] pg/g
[g] 2,3,7,8-F = 2,3,7,8-tetrachlorodibenzofuran
[h] 2,3,7,8-D = 2,3,7,8-tetrachlorodibenzo-*p*-dioxin
[i] 1,2,3,7,8-F = 1,2,3,7,8-pentachlorodibenzofuran
[j] 2,3,4,7,8-F = 2,3,4,7,8-pentachlorodibenzofuran
[k] 1,2,3,7,8-D = 1,2,3,7,8-pentachlorodibenzo-*p*-dioxin
[l] Total HxF = hexachlorodibenzofuran including the 1,2,3,4,7,8-; 1,2,3,6,7,8-; and 2,3,4,6,7,8-isomers
[m] Total HxD = hexachlorodibenzo-*p*-dioxin including the 1,2,3,6,7,8-; 1,2,3,4,7,8-; and 1,2,3,7,8,9-isomers
[n] 1,2,3,4,6,7,8-F = 1,2,3,4,6,7,8-hexachlorodibenzofuran
[o] 1,2,3,4,6,7,8-D = 1,2,3,4,6,7,8-hexachlorodibenzo-*p*-dioxin
[p] 1,2,3,4,6,7,8,9-D = 1,2,3,4,6,7,8,9-octachlorodibenzo-*p*-dioxin

Table II.6. (continued)

General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
East Massena, St. Lawrence River[f]	1985	F	Total HxD[m]	102		1	Fat	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	Total HxD[m]	18		1	Liver	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	1,2,3,4,6,7,8-F[n]	69		1	Fat	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	1,2,3,4,6,7,8-F[n]	13		1	Liver	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	1,2,3,4,6,7,8-D[o]	3.7		1	Fat	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	1,2,3,4,6,7,8-D[o]	3.7		1	Liver	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	1,2,3,4,6,7,8,9-D[p]	17		1	Fat	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	1,2,3,4,6,7,8,9-D[p]	ND		1	Liver	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	2,3,7,8-F[g]	ND		1	Liver	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	2,3,7,8-D[h]	ND		1	Liver	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	1,2,3,7,8-F[i]	ND		1	Liver	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	2,3,4,7,8-F[j]	ND		1	Liver	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	1,2,3,7,8-D[k]	ND		1	Liver	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	Total HxF[l]	ND		1	Liver	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	Total HxD[m]	ND		1	Liver	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	1,2,3,4,6,7,8-F[n]	ND		1	Liver	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	1,2,3,4,6,7,8-D[o]	ND		1	Liver	Ryan et al., 1986
East Massena, St. Lawrence River[f]	1985	F	1,2,3,4,6,7,8,9-D[p]	16		1	Liver	Ryan et al., 1986

[a] μg/g wet mass (± 1 SD)
[b] M - male; F - female
[c] n.r. - not reported
[d] μg/kg wet mass (± 1 SD)
[e] ND - not detected
[f] pg/g
[g] 2,3,7,8-F = 2,3,7,8-tetrachlorodibenzofuran
[h] 2,3,7,8-D = 2,3,7,8-tetrachlorodibenzo-*p*-dioxin
[i] 1,2,3,7,8-F = 1,2,3,7,8-pentachlorodibenzofuran
[j] 2,3,4,7,8-F = 2,3,4,7,8-pentachlorodibenzofuran
[k] 1,2,3,7,8-D = 1,2,3,7,8-pentachlorodibenzo-*p*-dioxin
[l] Total HxF = hexachlorodibenzofuran including the 1,2,3,4,7,8-; 1,2,3,6,7,8-; and 2,3,4,6,7,8-isomers
[m] Total HxD = hexachlorodibenzo-*p*-dioxin including the 1,2,3,6,7,8-; 1,2,3,4,7,8-; and 1,2,3,7,8,9-isomers
[n] 1,2,3,4,6,7,8-F = 1,2,3,4,6,7,8-hexachlorodibenzofuran
[o] 1,2,3,4,6,7,8-D = 1,2,3,4,6,7,8-hexachlorodibenzo-*p*-dioxin
[p] 1,2,3,4,6,7,8,9-D = 1,2,3,4,6,7,8,9-octachlorodibenzo-*p*-dioxin

Table II.7. Mean Concentrations of Persistent Chlorinated Compounds in Snapping Turtle (*Chelydra serpentina*) Eggs.[a]

General Location	Date	Compound	Geometric Mean	Range	n	Citation
Loon I & Highway #2, St. Lawrence River, Canada	1984	PCB (1254:1260)	2.12 (1.29)	12.1-3.03	2	Struger et al., 1993
Ingleside, St. Lawrence River, Canada	1984	PCB (1254:1260)	1.31		1	Struger et al., 1993
Morrisburg, St. Lawrence River, Canada	1984	PCB (1254:1260)	2.23		1	Struger et al., 1993
South of Moira River, Bay of Quinte, Canada	1984	PCB (1254:1260)	6.71		1	Struger et al., 1993
Sawgun Creek, Bay of Quinte, Canada	1984	PCB (1254:1260)	0.66		1	Struger et al., 1993
Big I., Bay of Quinte, Canada	1984	PCB (1254:1260)	4.883 (2.08)	3.22-7.21	3	Struger et al., 1993
Dead Creek, Murray Canal, Canada	1984	PCB (1254:1260)	1.94		1	Struger et al., 1993
Murray Canal, Canada	1984	PCB (1254:1260)	3.23 (0.84)	2.21-4.26	4	Struger et al., 1993
Lynde Shores Conservation Area, Canada	1984	PCB (1254:1260)	2.312 (3.55)	0.130-8.61	5	Struger et al., 1993
Cootes Paradise, Hamilton Harbour, Canada	1984	PCB (1254:1260)	3.25		1	Struger et al., 1993
Cootes Paradise, Hamilton Harbour, Canada	1984	PCB (1254:1260)	3.49		1	Struger et al., 1993
Grindstone Creek, Hamilton Harbour, Canada	1984	PCB (1254:1260)	12.067 (0.153)	11.9-12.1	3	Struger et al., 1993
Big Creek Nat. Wildlife Area, Canada	1981	PCB (1254:1260)	2.14 (2.11)	0.65-5.75	5	Struger et al., 1993
Rondeau Provincial Park, Canada	1984	PCB (1254:1260)	2.326 (1.49)	0.35-4.3	5	Struger et al., 1993
Thames River, Lake St. Clair, Canada	1984	PCB (1254:1260)	0.84		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	PCB (1254:1260)	1.62		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	PCB (1254:1260)	3.72		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	PCB (1254:1260)	3.34		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	PCB (1254:1260)	3.45		1	Struger et al., 1993
Pinery Prov Pk, Port Franks, Canada	1984	PCB (1254:1260)	3.76		1	Struger et al., 1993
Thedford Cons. Area, Port Franks, Canada	1984	PCB (1254:1260)	2.843 (0.706)	2.22-3.61	3	Struger et al., 1993
Algonquin Provincial Park, Canada	1981	PCB (1254:1260)	0.272 (0.102)	0.18-0.42	6	Struger et al., 1993
Loon I & Highway #2, St. Lawrence River, Canada	1984	Total PCBs	0.869 (0.578)	0.496-1.242	2	Struger et al., 1993
Ingleside, St. Lawrence River, Canada	1984	Total PCBs	0.537		1	Struger et al., 1993
Morrisburg, St. Lawrence River, Canada	1984	Total PCBs	0.914		1	Struger et al., 1993
South of Moira River, Bay of Quinte, Canada	1984	Total PCBs	2.751		1	Struger et al., 1993
Sawgun Creek, Bay of Quinte, Canada	1984	Total PCBs	0.271		1	Struger et al., 1993
Big I., Bay of Quinte, Canada	1984	Total PCBs	2.002 (0.851)	1.32-2.956	3	Struger et al., 1993
Dead Creek, Murray Canal, Canada	1984	Total PCBs	0.795		1	Struger et al., 1993
Murray Canal, Canada	1984	Total PCBs	1.324 (0.345)	0.906-1.747	4	Struger et al., 1993
Lynde Shores Conservation Area, Canada	1984	Total PCBs	1.017 (1.77)	0.057-3.788	5	Struger et al., 1993

[a] μg/g wet mass (± 1 SD)
[b] μg/kg wet mass (± 1 SD)
[c] ND - not detected
[d] n.r. - not reported

Table II.7. (continued)

General Location	Date	Compound	Geometric Mean	Range	n	Citation
Cootes Paradise, Hamilton Harbour, Canada	1984	Total PCBs	1.268		1	Struger et al., 1993
Cootes Paradise, Hamilton Harbour, Canada	1984	Total PCBs	1.361		1	Struger et al., 1993
Grindstone Creek, Hamilton Harbour, Canada	1984	Total PCBs	4.706 (0.06)	4.641-4.758	3	Struger et al., 1993
Big Creek Nat. Wildlife Area, Canada	1981	Total PCBs	1.006 (0.993)	0.306-2.702	5	Struger et al., 1993
Rondeau Provincial Park, Canada	1984	Total PCBs	1.093 (0.698)	0.164-2.021	5	Struger et al., 1993
Thames River, Lake St. Clair, Canada	1984	Total PCBs	0.344		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	Total PCBs	0.0664		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	Total PCBs	1.525		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	Total PCBs	1.369		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	Total PCBs	1.415		1	Struger et al., 1993
Pinery Prov Pk, Port Franks, Canada	1984	Total PCBs	1.542		1	Struger et al., 1993
Thedford Cons. Area, Port Franks, Canada	1984	Total PCBs	1.166 (0.289)	0.910-1.480	3	Struger et al., 1993
Algonquin Provincial Park, Canada	1981	Total PCBs	0.187 (0.070)	0.124-0.290	6	Struger et al., 1993
Loon I & Highway #2, St. Lawrence River, Canada	1984	DDE	0.010 (0)	0.010-0.010	2	Struger et al., 1993
Ingleside, St. Lawrence River, Canada	1984	DDE	0.18		1	Struger et al., 1993
Morrisburg, St. Lawrence River, Canada	1984	DDE	0.06		1	Struger et al., 1993
South of Moira River, Bay of Quinte, Canada	1984	DDE	0.35		1	Struger et al., 1993
Sawgun Creek, Bay of Quinte, Canada	1984	DDE	0.02		1	Struger et al., 1993
Big I., Bay of Quinte, Canada	1984	DDE	0.17 (0.085)	0.090-0.260	3	Struger et al., 1993
Dead Creek, Murray Canal, Canada	1984	DDE	0.06		1	Struger et al., 1993
Murray Canal, Canada	1984	DDE	0.09 (0.059)	0.04-0.17	4	Struger et al., 1993
Lynde Shores Conservation Area, Canada	1984	DDE	0.09 (0.139)	0.010-0.330	5	Struger et al., 1993
Cootes Paradise, Hamilton Harbour, Canada	1984	DDE	0.15		1	Struger et al., 1993
Cootes Paradise, Hamilton Harbour, Canada	1984	DDE	0.25		1	Struger et al., 1993
Grindstone Creek, Hamilton Harbour, Canada	1984	DDE	0.34 (0.101)	0.23-0.43	3	Struger et al., 1993
Big Creek Nat. Wildlife Area, Canada	1981	DDE	0.097 (0.073)	0.04-0.225	5	Struger et al., 1993
Rondeau Provincial Park, Canada	1984	DDE	0.042 (0.026)	0.01-0.08	5	Struger et al., 1993
Thames River, Lake St. Clair, Canada	1984	DDE	0.13		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	DDE	0.05		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	DDE	0.17		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	DDE	0.18		1	Struger et al., 1993

[a] μg/g wet mass (± 1 SD)
[b] μg/kg wet mass (± 1 SD)
[c] ND - not detected
[d] n.r. - not reported

Table II.7. (continued)

General Location	Date	Compound	Geometric Mean	Range	n	Citation
Mitchell Bay, Lake St. Clair, Canada	1984	DDE	0.11		1	Struger et al., 1993
Pinery Prov Pk, Port Franks, Canada	1984	DDE	0.33		1	Struger et al., 1993
Thedford Cons. Area, Port Franks, Canada	1984	DDE	0.116 (0.088)	0.018-0.190	3	Struger et al., 1993
Algonquin Provincial Park, Canada	1981	DDE	0.027 (0.041)	ND-0.100	6	Struger et al., 1993
Loon I & Highway #2, St. Lawrence River, Canada	1984	Mirex	0.02 (0.014)	0.01-0.03	2	Struger et al., 1993
Ingleside, St. Lawrence River, Canada	1984	Mirex	0.03		1	Struger et al., 1993
Morrisburg, St. Lawrence River, Canada	1984	Mirex	0.05		1	Struger et al., 1993
South of Moira River, Bay of Quinte, Canada	1984	Mirex	0.12		1	Struger et al., 1993
Sawgun Creek, Bay of Quinte, Canada	1984	Mirex	ND[c]		1	Struger et al., 1993
Big I., Bay of Quinte, Canada	1984	Mirex	0.137 (0.076)	0.07-0.22	3	Struger et al., 1993
Dead Creek, Murray Canal, Canada	1984	Mirex	0.03		1	Struger et al., 1993
Murray Canal, Canada	1984	Mirex	0.083 (0.022)	0.05-0.100	4	Struger et al., 1993
Lynde Shores Conservation Area, Canada	1984	Mirex	0.039 (0.059)	0.005-0.130	5	Struger et al., 1993
Cootes Paradise, Hamilton Harbour, Canada	1984	Mirex	0.03		1	Struger et al., 1993
Cootes Paradise, Hamilton Harbour, Canada	1984	Mirex	0.02		1	Struger et al., 1993
Grindstone Creek, Hamilton Harbour, Canada	1984	Mirex	0.123 (0:032)	0.10-0.16	3	Struger et al., 1993
Big Creek Nat. Wildlife Area, Canada	1981	Mirex	0.0098 (0.007)	0.005-0.02	5	Struger et al., 1993
Rondeau Provincial Park, Canada	1984	Mirex	0.005 (0.004)	ND-0.01	5	Struger et al., 1993
Thames River, Lake St. Clair, Canada	1984	Mirex	ND		1	Struger et al.. 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	Mirex	ND		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	Mirex	0.01		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	Mirex	0.005		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	Mirex	0.01		1	Struger et al., 1993
Pinery Prov Pk, Port Franks, Canada	1984	Mirex	0.005		1	Struger et al., 1993
Thedford Cons. Area, Port Franks, Canada	1984	Mirex	0.003 (0.003)	ND-0.005	3	Struger et al., 1993
Algonquin Provincial Park, Canada	1981	Mirex	0.003 (0.003)	ND-0.005	6	Struger et al., 1993
Loon I & Highway #2. St. Lawrence River, Canada	1984	HCB	0.022 (0.030)	ND-0.043	2	Struger et al., 1993
Ingleside, St. Lawrence River, Canada	1984	HCB	ND		1	Struger et al., 1993
Morrisburg, St. Lawrence River, Canada	1984	HCB	0.006		1	Struger et al., 1993
South of Moira River, Bay of Quinte, Canada	1984	HCB	0.002		1	Struger et al., 1993
Sawgun Creek, Bay of Quinte, Canada	1984	HCB	ND		1	Struger et al., 1993

[a] μg/g wet mass (± 1 SD)
[b] μg/kg wet mass (± 1 SD)
[c] ND - not detected
[d] n.r. - not reported

Table II.7. (continued)

General Location	Date	Compound	Geometric Mean	Range	n	Citation
Big I., Bay of Quinte, Canada	1984	HCB	0.004 (0.005)	ND-0.101	3	Struger et al., 1993
Dead Creek, Murray Canal, Canada	1984	HCB	0.001		1	Struger et al., 1993
Murray Canal, Canada	1984	HCB	0.003 (0.002)	0.002-0.005	4	Struger et al., 1993
Lynde Shores Conservation Area, Canada	1984	HCB	0.003 (0.005)	ND-0.011	5	Struger et al., 1993
Cootes Paradise, Hamilton Harbour, Canada	1984	HCB	0.01		1	Struger et al., 1993
Cootes Paradise, Hamilton Harbour, Canada	1984	HCB	0.016		1	Struger et al., 1993
Grindstone Creek, Hamilton Harbour, Canada	1984	HCB	0.029 (0.020)	0.014-0.052	3	Struger et al., 1993
Big Creek Nat. Wildlife Area, Canada	1981	HCB	0.004 (0.002)	0.002-0.006	5	Struger et al., 1993
Rondeau Provincial Park, Canada	1984	HCB	0.003 (0.002)	ND-0.005	5	Struger et al., 1993
Thames River, Lake St. Clair, Canada	1984	HCB	0.007		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	HCB	0.004		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	HCB	0.005		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	HCB	0.13		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	HCB	0.04		1	Struger et al., 1993
Pinery Prov Pk, Port Franks, Canada	1984	HCB	0.014		1	Struger et al., 1993
Thedford Cons. Area, Port Franks, Canada	1984	HCB	0.011 (0.002)	0.010-0.014	3	Struger et al., 1993
Algonquin Provincial Park, Canada	1981	HCB	0.001 (0.001)	ND-.001	6	Struger et al., 1993
Loon I & Highway #2, St. Lawrence River, Canada	1984	Dieldrin	0.013 (0.011)	0.005-0.02	2	Struger et al., 1993
Ingleside, St. Lawrence River, Canada	1984	Dieldrin	0.01		1	Struger et al., 1993
Morrisburg, St. Lawrence River, Canada	1984	Dieldrin	0		1	Struger et al., 1993
South of Moira River, Bay of Quinte, Canada	1984	Dieldrin	0.02		1	Struger et al., 1993
Sawgun Creek, Bay of Quinte, Canada	1984	Dieldrin	0.005		1	Struger et al., 1993
Big I., Bay of Quinte, Canada	1984	Dieldrin	0.012 (0.008)	0.005-0.02	3	Struger et al., 1993
Dead Creek, Murray Canal, Canada	1984	Dieldrin	0.005		1	Struger et al., 1993
Murray Canal, Canada	1984	Dieldrin	0.009 (0.003)	0.005-0.01	4	Struger et al., 1993
Lynde Shores Conservation Area, Canada	1984	Dieldrin	0.013 (0.015)	0.005-0.04	5	Struger et al., 1993
Cootes Paradise, Hamilton Harbour, Canada	1984	Dieldrin	0.01		1	Struger et al., 1993
Cootes Paradise, Hamilton Harbour, Canada	1984	Dieldrin	0.04		1	Struger et al., 1993
Grindstone Creek, Hamilton Harbour, Canada	1984	Dieldrin	0.083 (0.038)	0.04-0.11	3	Struger et al., 1993
Big Creek Nat. Wildlife Area, Canada	1981	Dieldrin	0.018 (0.008)	0.01-0.03	5	Struger et al., 1993
Rondeau Provincial Park, Canada	1984	Dieldrin	0.011	0.005-0.03	5	Struger et al., 1993

[a] μg/g wet mass (± 1 SD)
[b] μg/kg wet mass (± 1 SD)
[c] ND - not detected
[d] n.r. - not reported

Table II.7. (continued)

General Location	Date	Compound	Geometric Mean	Range	n	Citation
Thames River, Lake St. Clair, Canada	1984	Dieldrin	0.01		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	Dieldrin	0.01		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	Dieldrin	0.02		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	Dieldrin	0.02		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	Dieldrin	0.01		1	Struger et al., 1993
Pinery Prov Pk, Port Franks, Canada	1984	Dieldrin	0.06		1	Struger et al., 1993
Thedford Cons. Area, Port Franks, Canada	1984	Dieldrin	0.07 (0.01)	0.06-0.08	3	Struger et al., 1993
Algonquin Provincial Park, Canada	1981	Dieldrin	not detected		6	Struger et al., 1993
Loon I & Highway #2, St. Lawrence River, Canada	1984	Oxychlordane	0.01 (0)	0.01-0.01	2	Struger et al., 1993
Ingleside, St. Lawrence River, Canada	1984	Oxychlordane	0.01		1	Struger et al., 1993
Morrisburg, St. Lawrence River, Canada	1984	Oxychlordane	not detected		1	Struger et al., 1993
South of Moira River, Bay of Quinte, Canada	1984	Oxychlordane	0.03		1	Struger et al., 1993
Sawgun Creek, Bay of Quinte, Canada	1984	Oxychlordane	0.005		1	Struger et al., 1993
Big I., Bay of Quinte, Canada	1984	Oxychlordane	0.02 (0)	0.02-0.02	3	Struger et al., 1993
Dead Creek, Murray Canal, Canada	1984	Oxychlordane	0.01		1	Struger et al., 1993
Murray Canal, Canada	1984	Oxychlordane	0.015 (0.01)	0.01-0.03	4	Struger et al., 1993
Lynde Shores Conservation Area, Canada	1984	Oxychlordane	0.012 (0.012)	0.005-0.03	5	Struger et al., 1993
Cootes Paradise, Hamilton Harbour, Canada	1984	Oxychlordane	0.04		1	Struger et al., 1993
Cootes Paradise, Hamilton Harbour, Canada	1984	Oxychlordane	0.11		1	Struger et al., 1993
Grindstone Creek, Hamilton Harbour, Canada	1984	Oxychlordane	0.073 (0.015)	0.06-0.09	3	Struger et al., 1993
Big Creek Nat. Wildlife Area, Canada	1981	Oxychlordane	0.024 (0.015)	0.01-0.05	5	Struger et al., 1993
Rondeau Provincial Park, Canada	1984	Oxychlordane	0.014 (0.011)	0.005-0.03	5	Struger et al., 1993
Thames River, Lake St. Clair, Canada	1984	Oxychlordane	0.005		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	Oxychlordane	0.01		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	Oxychlordane	0.02		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	Oxychlordane	0.02		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	Oxychlordane	0.02		1	Struger et al., 1993
Pinery Prov Pk, Port Franks, Canada	1984	Oxychlordane	0.03		1	Struger et al., 1993
Thedford Cons. Area, Port Franks, Canada	1984	Oxychlordane	0.029 (0.006)	0.02-0.03	3	Struger et al., 1993
Algonquin Provincial Park, Canada	1981	Oxychlordane	0.002 (0.003)	ND-0.005	6	Struger et al., 1993
Loon I & Highway #2, St. Lawrence River, Canada	1984	*Cis*-Chlordane	0.003 (0.004)	ND-0.005	2	Struger et al., 1993

[a] μg/g wet mass (± 1 SD)
[b] μg/kg wet mass (± 1 SD)
[c] ND - not detected
[d] n.r. - not reported

Table II.7. (continued)

General Location	Date	Compound	Geometric Mean	Range	n	Citation
Ingleside, St. Lawrence River, Canada	1984	*Cis*-Chlordane	0.005		1	Struger et al., 1993
Morrisburg, St. Lawrence River, Canada	1984	*Cis*-Chlordane	0.005		1	Struger et al., 1993
South of Moira River, Bay of Quinte, Canada	1984	*Cis*-Chlordane	0.01		1	Struger et al., 1993
Sawgun Creek, Bay of Quinte, Canada	1984	*Cis*-Chlordane	ND		1	Struger et al., 1993
Big I., Bay of Quinte, Canada	1984	*Cis*-Chlordane	0.005 (0)	0.005-0.005	3	Struger et al., 1993
Dead Creek, Murray Canal, Canada	1984	*Cis*-Chlordane	0.005		1	Struger et al., 1993
Murray Canal, Canada	1984	*Cis*-Chlordane	0.006 (0.003)	0.003-0.010	4	Struger et al., 1993
Lynde Shores Conservation Area, Canada	1984	*Cis*-Chlordane	0.004 (0.004)	ND-0.01	5	Struger et al., 1993
Cootes Paradise, Hamilton Harbour, Canada	1984	*Cis*-Chlordane	0.02		1	Struger et al., 1993
Cootes Paradise, Hamilton Harbour, Canada	1984	*Cis*-Chlordane	0.06		1	Struger et al., 1993
Grindstone Creek, Hamilton Harbour, Canada	1984	*Cis*-Chlordane	0.023 (0.012)	0.01-0.03	3	Struger et al., 1993
Big Creek Nat. Wildlife Area, Canada	1981	*Cis*-Chlordane	0.004 (0.002)	ND-0.005	5	Struger et al., 1993
Rondeau Provincial Park, Canada	1984	*Cis*-Chlordane	0.005 (0.004)	ND-0.01	5	Struger et al., 1993
Thames River, Lake St. Clair, Canada	1984	*Cis*-Chlordane	ND		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	*Cis*-Chlordane	0.005		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	*Cis*-Chlordane	0.01		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	*Cis*-Chlordane	0.01		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	*Cis*-Chlordane	0.005		1	Struger et al., 1993
Pinery Prov Pk, Port Franks, Canada	1984	*Cis*-Chlordane	0.01		1	Struger et al., 1993
Thedford Cons. Area, Port Franks, Canada	1984	*Cis*-Chlordane	0.013 (0.006)	0.01-0.02	3	Struger et al., 1993
Algonquin Provincial Park, Canada	1981	*Cis*-Chlordane	ND		6	Struger et al., 1993
Loon I & Highway #2, St. Lawrence River, Canada	1984	*Trans*-Nonachlor	0.003 (0.004)	ND-0.005	2	Struger et al., 1993
Ingleside, St. Lawrence River, Canada	1984	*Trans*-Nonachlor	0.005		1	Struger et al., 1993
Morrisburg, St. Lawrence River, Canada	1984	*Trans*-Nonachlor	ND		1	Struger et al., 1993
South of Moira River, Bay of Quinte, Canada	1984	*Trans*-Nonachlor	0.01		1	Struger et al., 1993
Sawgun Creek, Bay of Quinte, Canada	1984	*Trans*-Nonachlor	ND		1	Struger et al., 1993
Big I., Bay of Quinte, Canada	1984	*Trans*-Nonachlor	0.005 (0.005)	ND-0.01	3	Struger et al., 1993
Dead Creek, Murray Canal, Canada	1984	*Trans*-Nonachlor	0.005		1	Struger et al., 1993
Murray Canal, Canada	1984	*Trans*-Nonachlor	0.005 (0)	0.005-0.005	4	Struger et al., 1993
Lynde Shores Conservation Area, Canada	1984	*Trans*-Nonachlor	0.006 (0.008)	ND-0.02	5	Struger et al., 1993
Cootes Paradise, Hamilton Harbour, Canada	1984	*Trans*-Nonachlor	0.01		1	Struger et al., 1993

[a] μg/g wet mass (± 1 SD)
[b] μg/kg wet mass (± 1 SD)
[c] ND - not detected
[d] n.r. - not reported

Table II.7. (continued)

General Location	Date	Compound	Geometric Mean	Range	n	Citation
Cootes Paradise, Hamilton Harbour, Canada	1984	*Trans* -Nonachlor	0.01		1	Struger et al., 1993
Grindstone Creek, Hamilton Harbour, Canada	1984	*Trans* -Nonachlor	0.023 (0.006)	0.02-0.03	3	Struger et al., 1993
Big Creek Nat. Wildlife Area, Canada	1981	*Trans* -Nonachlor	0.003 (0.003)	ND-0.005	5	Struger et al., 1993
Rondeau Provincial Park, Canada	1984	*Trans* -Nonachlor	0.005 (0.004)	ND-0.01	5	Struger et al., 1993
Thames River, Lake St. Clair, Canada	1984	*Trans* -Nonachlor	0.005		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	*Trans* -Nonachlor	0.005		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	*Trans* -Nonachlor	0.01		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	*Trans* -Nonachlor	0.01		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	*Trans* -Nonachlor	0.01		1	Struger et al., 1993
Pinery Prov Pk, Port Franks, Canada	1984	*Trans* -Nonachlor	0.01		1	Struger et al., 1993
Thedford Cons. Area, Port Franks, Canada	1984	*Trans* -Nonachlor	0.01 (0)	0.01-0.01	3	Struger et al., 1993
Algonquin Provincial Park, Canada	1981	*Trans* -Nonachlor	ND		6	Struger et al., 1993
Loon I & Highway #2, St. Lawrence River, Canada	1984	Heptachlor Expoxide	0.005 (0)	0.005-0.005	2	Struger et al., 1993
Ingleside, St. Lawrence River, Canada	1984	Heptachlor Expoxide	0.005		1	Struger et al., 1993
Morrisburg, St. Lawrence River, Canada	1984	Heptachlor Expoxide	ND		1	Struger et al., 1993
South of Moira River, Bay of Quinte, Canada	1984	Heptachlor Expoxide	0.01		1	Struger et al., 1993
Sawgun Creek, Bay of Quinte, Canada	1984	Heptachlor Expoxide	0.005		1	Struger et al., 1993
Big I., Bay of Quinte, Canada	1984	Heptachlor Expoxide	0.005 (0)	0.005-0.005	3	Struger et al., 1993
Dead Creek, Murray Canal, Canada	1984	Heptachlor Expoxide	0.005		1	Struger et al., 1993
Murray Canal, Canada	1984	Heptachlor Expoxide	0.008 (0.003)	0.005-0.01	4	Struger et al., 1993
Lynde Shores Conservation Area, Canada	1984	Heptachlor Expoxide	0.004 (0.002)	ND-0.005	5	Struger et al., 1993
Cootes Paradise, Hamilton Harbour, Canada	1984	Heptachlor Expoxide	0.005		1	Struger et al., 1993
Cootes Paradise, Hamilton Harbour, Canada	1984	Heptachlor Expoxide	0.01		1	Struger et al., 1993
Grindstone Creek, Hamilton Harbour, Canada	1984	Heptachlor Expoxide	0.01 (0)	0.01-0.01	3	Struger et al., 1993
Big Creek Nat. Wildlife Area, Canada	1981	Heptachlor Expoxide	0.003 (0.004)	ND-0.01	5	Struger et al., 1993
Rondeau Provincial Park, Canada	1984	Heptachlor Expoxide	0.005 (0.004)	ND-0.01	5	Struger et al., 1993
Thames River, Lake St. Clair, Canada	1984	Heptachlor Expoxide	0.005		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	Heptachlor Expoxide	0.005		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	Heptachlor Expoxide	0.005		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	Heptachlor Expoxide	0.01		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	Heptachlor Expoxide	0.005		1	Struger et al., 1993

[a] μg/g wet mass (± 1 SD)
[b] μg/kg wet mass (± 1 SD)
[c] ND - not detected
[d] n.r. - not reported

Table II.7. (continued)

General Location	Date	Compound	Geometric Mean	Range	n	Citation
Pinery Prov Pk, Port Franks, Canada	1984	Heptachlor Expoxide	0.01		1	Struger et al., 1993
Thedford Cons. Area, Port Franks, Canada	1984	Heptachlor Expoxide	0.07 (0.006)	ND-0.01	3	Struger et al., 1993
Algonquin Provincial Park, Canada	1981	Heptachlor Expoxide	ND		6	Struger et al., 1993
Loon I & Highway #2, St. Lawrence River, Canada	1984	B-HCH	0.005 (0.007)	ND-0.01	2	Struger et al., 1993
Ingleside, St. Lawrence River, Canada	1984	B-HCH	ND		1	Struger et al., 1993
Morrisburg, St. Lawrence River, Canada	1984	B-HCH	ND		1	Struger et al., 1993
South of Moira River, Bay of Quinte, Canada	1984	B-HCH	ND		1	Struger et al., 1993
Sawgun Creek, Bay of Quinte, Canada	1984	B-HCH	ND		1	Struger et al., 1993
Big I., Bay of Quinte, Canada	1984	B-HCH	ND		3	Struger et al., 1993
Dead Creek, Murray Canal, Canada	1984	B-HCH	0.01		1	Struger et al., 1993
Murray Canal, Canada	1984	B-HCH	0.015 (0.006)	0.01-0.02	4	Struger et al., 1993
Lynde Shores Conservation Area, Canada	1984	B-HCH	0.02 (0.007)	0.01-0.03	5	Struger et al., 1993
Cootes Paradise, Hamilton Harbour, Canada	1984	B-HCH	ND		1	Struger et al., 1993
Cootes Paradise, Hamilton Harbour, Canada	1984	B-HCH	ND		1	Struger et al., 1993
Grindstone Creek, Hamilton Harbour, Canada	1984	B-HCH	ND		3	Struger et al., 1993
Big Creek Nat. Wildlife Area, Canada	1981	B-HCH	0.008 (0.018)	ND-0.04	5	Struger et al., 1993
Rondeau Provincial Park, Canada	1984	B-HCH	0.014 (0.005)	0.01-0.02	5	Struger et al., 1993
Thames River, Lake St. Clair, Canada	1984	B-HCH	ND		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	B-HCH	ND		1	Struger et al., 1993
St. Clair Nat. Wildlife, Lake St. Clair, Canada	1984	B-HCH	ND		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	B-HCH	ND		1	Struger et al., 1993
Mitchell Bay, Lake St. Clair, Canada	1984	B-HCH	ND		1	Struger et al., 1993
Pinery Prov Pk, Port Franks, Canada	1984	B-HCH	ND		1	Struger et al., 1993
Thedford Cons. Area, Port Franks, Canada	1984	B-HCH	ND		3	Struger et al., 1993
Algonquin Provincial Park, Canada	1981	B-HCH	ND		6	Struger et al., 1993
Hoople Creek, Cornwall Area, Canada[d]	1990	Total PCB	678 (109.5)	n.r.[d]	4	Bonin et al., 1995
Hoople Creek, Cornwall Area, Canada[d]	1990	HCB	2.9 (0.8)	n.r.	4	Bonin et al., 1995
Hoople Creek, Cornwall Area, Canada[d]	1990	OCS	2.8 (0.7)	n.r.	4	Bonin et al., 1995
Long Sault, Cornwall Area, Canada[d]	1990	Total PCB	2834 (4259)	n.r.	3	Bonin et al., 1995
Long Sault, Cornwall Area, Canada[d]	1990	HCB	8.4 (12)	n.r.	3	Bonin et al., 1995
Long Sault, Cornwall Area, Canada[d]	1990	OCS	5.6	n.r.	3	Bonin et al., 1995

[a] μg/g wet mass (± 1 SD)
[b] μg/kg wet mass (± 1 SD)
[c] ND - not detected
[d] n.r. - not reported

Table II.7. (continued)

General Location	Date	Compound	Geometric Mean	Range	n	Citation
Grays Creek, Cornwall Area, Canada[d]	1990	Total PCB	873 (625)	n.r.	5	Bonin et al., 1995
Grays Creek, Cornwall Area, Canada[d]	1990	HCB	4.0 (3.9)	n.r.	5	Bonin et al., 1995
Grays Creek, Cornwall Area, Canada[d]	1990	OCS	0.7 (0.4)	n.r.	5	Bonin et al., 1995
Raquette River, Massena Area, Canada[d]	1990	Total PCB	5094 (3715)	n.r.	5	Bonin et al., 1995
Raquette River, Massena Area, Canada[d]	1990	HCB	2.7 (0.9)	n.r.	5	Bonin et al., 1995
Raquette River, Massena Area, Canada[d]	1990	OCS	2.2 (0.1)	n.r.	5	Bonin et al., 1995
St. Regis River, Massena Area, Canada[d]	1990	Total PCB	942		1	Bonin et al., 1995
St. Regis River, Massena Area, Canada[d]	1990	HCB	3		1	Bonin et al., 1995
St. Regis River, Massena Area, Canada[d]	1990	OCS	1.2		1	Bonin et al., 1995
Akwasasne, Massena Area, Canada[d]	1990	Total PCB	5073		1	Bonin et al., 1995
Akwasasne, Massena Area, Canada[d]	1990	HCB	2.1		1	Bonin et al., 1995
Akwasasne, Massena Area, Canada[d]	1990	OCS	ND		1	Bonin et al., 1995
Akwasasne, Massena Area, Canada[d]	1990	Total PCB	1575		1	Bonin et al., 1995
Akwasasne, Massena Area, Canada[d]	1990	HCB	17.2		1	Bonin et al., 1995
Akwasasne, Massena Area, Canada[d]	1990	OCS	4.3		1	Bonin et al., 1995
Dundee, St. Lawrence River, Canada[d]	1989	Total PCB	1862 (1418)	n.r.	7	Bonin et al., 1995
Dundee, St. Lawrence River, Canada[d]	1989	HCB	2 (3.1)	n.r.	7	Bonin et al., 1995
Dundee, St. Lawrence River, Canada[d]	1989	OCS	0.6 (0.5)	n.r.	7	Bonin et al., 1995
Beauharnois, St. Lawrence River, Canada[d]	1990	Total PCB	6.3 (0.5)	n.r.	3	Bonin et al., 1995
Beauharnois, St. Lawrence River, Canada[d]	1990	HCB	72.4 (0.9)	n.r.	3	Bonin et al., 1995
Beauharnois, St. Lawrence River, Canada[d]	1990	OCS	1837 (1109)	n.r.	3	Bonin et al., 1995
Boucherville, St. Lawrence River, Canada[d]	1989	Total PCB	181		1	Bonin et al., 1995
Boucherville, St. Lawrence River, Canada[d]	1989	HCB	0.4		1	Bonin et al., 1995
Boucherville, St. Lawrence River, Canada[d]	1989	OCS	ND		1	Bonin et al., 1995
Boucherville, St. Lawrence River, Canada[d]	1990	Total PCB	3343		1	Bonin et al., 1995
Boucherville, St. Lawrence River, Canada[d]	1990	HCB	6.6		1	Bonin et al., 1995
Boucherville, St. Lawrence River, Canada[d]	1990	OCS	0.6		1	Bonin et al., 1995
Thurso, Ottawa River, Canada[d]	1990	Total PCB	106 (47)	n.r.	7	Bonin et al., 1995
Thurso, Ottawa River, Canada[d]	1990	HCB	0.4 (0.2)	n.r.	7	Bonin et al., 1995
Thurso, Ottawa River, Canada[d]	1990	OCS	ND	n.r.	7	Bonin et al., 1995

[a] μg/g wet mass (± 1 SD)
[b] μg/kg wet mass (± 1 SD)
[c] ND - not detected
[d] n.r. - not reported

Table II.8. Mean Concentrations of Metals and Metalloids in Snapping Turtle (*Chelydra serpentina*) Tissues.[a]

General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Mississippi River-St. Paul	1981	F	Hg	0.185 (0.11)	n.r.[c]	3	Meat	Helwig and Hora, 1983
Mississippi River-St. Paul	1981	M	Hg	0.19 (0.06)	0.15-0.23	2	Meat	Helwig and Hora. 1983
Mississippi River-Prairie Isl.	1981	M	Hg	0.12 (0.04)	0.08-0.15	3	Meat	Helwig and Hora, 1983
Mississippi River-Prairie Isl.	1981	F	Hg	0.29		1	Meat	Helwig and Hora, 1983
Mississippi River-Lake City	1981	M	Hg	0.09 (0.01)	0.08-0.1	3	Meat	Helwig and Hora, 1983
Reeds Lake-Waseca Co.	1981	M	Hg	0.08 (0.04)	0.05-0.11	2	Meat	Helwig and Hora, 1983
Pomme de Terre River-Glendwood	1981	n.r.	Hg	0.1 (0.06)	0.06-0.14	2	Meat	Helwig and Hora, 1983
Silver Lake-Wright Co.	1981	F	Hg	0.3		1	Meat	Helwig and Hora, 1983
Mississippi River-St. Paul	1981	F	Cd	0 014 (0.002)	n.r.	3	Meat	Helwig and Hora, 1983
Mississippi River-St. Paul	1981	M	Cd	0.005 (0.004)	0.002-0.008	2	Meat	Helwig and Hora, 1983
Mississippi River-Prairie Isl.	1981	M	Cd	0.012 (0.006)	0.006-0.016	3	Meat	Helwig and Hora, 1983
Mississippi River-Prairie Isl.	1981	F	Cd	0.007		1	Meat	Helwig and Hora, 1983
Mississippi River-Lake City	1981	M	Cd	0.011 (0.012)	0.004-0.025	3	Meat	Helwig and Hora, 1983
Mississippi River-St. Paul	1981	F	Hg	0.02	n.r.	3	Fat	Helwig and Hora. 1983
Mississippi River-St. Paul	1981	M	Hg	0.02		1	Fat	Helwig and Hora, 1983
Mississippi River-Prairie Isl.	1981	M	Hg	0.02	0.02-0.02	2	Fat	Helwig and Hora, 1983
Mississippi River-Prairie Isl.	1981	F	Hg	0.03		1	Fat	Helwig and Hora, 1983
Mississippi River-Lake City	1981	M	Hg	0.03 (0.01)	0.02-0.04	3	Fat	Helwig and Hora, 1983
Reeds Lake-Waseca Co.	1981	M	Hg	<0.02		1	Fat	Helwig and Hora, 1983
Pomme de Terre River-Glendwood	1981	n.r.	Hg	0.03		1	Fat	Helwig and Hora, 1983
Silver Lake-Wright Co.	1981	F	Hg	0.04		1	Fat	Helwig and Hora, 1983
Laurel, MD	1981-82	M	Cd	0.07 (0.04)	n.r.	7	Liver	Albers et al., 1986
Laurel, MD	1981-82	F	Cd	0.06 (0.03)	n.r.	6	Liver	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	Cd	0.10 (0.06)	n.r.	8	Liver	Albers et al.. 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	Cd	0.08 (0.05)	n.r.	3	Liver	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	Cd	0.08 (0.07)	n.r.	8	Liver	Albers et al., 1986
Laurel, MD	1981-82	M	Cr	1.00 (0.76)	n.r.	7	Liver	Albers et al., 1986
Laurel, MD	1981-82	F	Cr	1.97 (1.48)	n.r.	6	Liver	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	Cr	0.60 (0.32)	n.r.	8	Liver	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	Cr	0.60 (0.23)	n.r.	3	Liver	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	Cr	0.36 (0.32)	n.r.	8	Liver	Albers et al., 1986
Laurel, MD	1981-82	M	Cu	1.28 (0.52)	n.r.	7	Liver	Albers et al., 1986
Laurel, MD	1981-82	F	Cu	1.57 (0.59)	n.r.	6	Liver	Albers et al.. 1986

[a]μg/g wet mass (± 1 SD)

[b]M - male; F - female

[c]n.r. - not reported

Table II.8. (continued)

General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Hackensack Meadowlands, NJ-brackish	1981-82	M	Cu	9.72 (4.61)	n.r.	8	Liver	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	Cu	5.17 (3.59)	n.r.	3	Liver	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	Cu	2.08 (0.63)	n.r.	8	Liver	Albers et al., 1986
Laurel, MD	1981-82	M	Pb	0.07 (0.06)	n.r.	7	Liver	Albers et al., 1986
Laurel, MD	1981-82	F	Pb	not detected	n.r.	6	Liver	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	Pb	not detected	n.r.	8	Liver	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	Pb	not detected	n.r.	3	Liver	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	Pb	0.12 (0.20)	n.r.	8	Liver	Albers et al., 1986
Laurel, MD	1981-82	M	Hg	0.90 (0.48)	n.r.	7	Liver	Albers et al., 1986
Laurel, MD	1981-82	F	Hg	0.46 (0.18)	n.r.	6	Liver	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	Hg	1.28 (0.79)	n.r.	8	Liver	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	Hg	1.27 (0.34)	n.r.	3	Liver	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	Hg	0.60 (0.40)	n.r.	8	Liver	Albers et al., 1986
Laurel, MD	1981-82	M	Ni	0.44 (0.36)	n.r.	7	Liver	Albers et al., 1986
Laurel, MD	1981-82	F	Ni	0.99 (0.85)	n.r.	6	Liver	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	Ni	0.24 (0.15)	n.r.	8	Liver	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	Ni	0.27 (0.15)	n.r.	3	Liver	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	Ni	0.13 (0.10)	n.r.	8	Liver	Albers et al., 1986
Laurel, MD	1981-82	M	Zn	27.72 (3.25)	n.r.	7	Liver	Albers et al., 1986
Laurel, MD	1981-82	F	Zn	29.29 (3.60)	n.r.	6	Liver	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	Zn	50.38 (23.74)	n.r.	8	Liver	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	Zn	38.95 (10.67)	n.r.	3	Liver	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	Zn	. 30.68 (4.44)	n.r.	8	Liver	Albers et al., 1986
Laurel, MD	1981-82	M	Cd	0.07 (0.05)	n.r.	7	Kidney	Albers et al., 1986
Laurel, MD	1981-82	F	Cd	0.07 (0.04)	n.r.	6	Kidney	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	Cd	0.24 (0.18)	n.r.	8	Kidney	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	Cd	0.30 (0.37)	n.r.	3	Kidney	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	Cd	0.09 (0.06)	n.r.	8	Kidney	Albers et al., 1986
Laurel, MD	1981-82	M	Cr	0.93 (0.47)	n.r.	7	Kidney	Albers et al., 1986
Laurel, MD	1981-82	F	Cr	1.26 (0.73)	n.r.	6	Kidney	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	Cr	2.97 (1.52)	n.r.	8	Kidney	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	Cr	2.70 (2.18)	n.r.	3	Kidney	Albers et al., 1986

[a] $\mu g/g$ wet mass (± 1 SD)
[b] M - male; F - female
[c] n.r. - not reported

Table II.8. (continued)

General Location	Date	Sex[b]	Compound	Geometric Mean	Range	n	Tissue	Citation
Hackensack Meadowlands, NJ-freshwater	1981-82	M	Cr	1.13 (0.77)	n.r.	8	Kidney	Albers et al., 1986
Laurel, MD	1981-82	M	Cu	0.82 (0.28)	n.r.	7	Kidney	Albers et al., 1986
Laurel, MD	1981-82	F	Cu	1.07 (0.43)	n.r.	6	Kidney	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	Cu	1.81 (1.20)	n.r.	8	Kidney	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	Cu	1.27 (0.38)	n.r.	3	Kidney	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	Cu	1.73 (1.01)	n.r.	8	Kidney	Albers et al., 1986
Laurel, MD	1981-82	M	Pb	0.07 (0.05)	n.r.	7	Kidney	Albers et al., 1986
Laurel, MD	1981-82	F	Pb	0.16 (0.14)	n.r.	6	Kidney	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	Pb	0.19 (0.24)	n.r.	8	Kidney	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	Pb	not detected	n.r.	3	Kidney	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	Pb	0.10 (0.05)	n.r.	8	Kidney	Albers et al., 1986
Laurel, MD	1981-82	M	Hg	0.44 (0.14)	n.r.	7	Kidney	Albers et al., 1986
Laurel, MD	1981-82	F	Hg	0.56 (0.44)	n.r.	6	Kidney	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	Hg	0.55 (0.26)	n.r.	8	Kidney	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	Hg	0.41 (0.13)	n.r.	3	Kidney	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	Hg	0.39 (0.22)	n.r.	8	Kidney	Albers et al., 1986
Laurel, MD	1981-82	M	Ni	0.35 (0.18)	n.r.	7	Kidney	Albers et al., 1986
Laurel, MD	1981-82	F	Ni	0.43 (0.27)	n.r.	6	Kidney	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	Ni	1.24 (0.65)	n.r.	8	Kidney	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	Ni	1.07 (0.91)	n.r.	3	Kidney	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	Ni	0.45 (0.34)	n.r.	8	Kidney	Albers et al., 1986
Laurel, MD	1981-82	M	Zn	8.80 (0.99)	n.r.	7	Kidney	Albers et al., 1986
Laurel, MD	1981-82	F	Zn	9.60 (0.88)	n.r.	6	Kidney	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	M	Zn	9.93 (1.18)	n.r.	8	Kidney	Albers et al., 1986
Hackensack Meadowlands, NJ-brackish	1981-82	F	Zn	9.79 (0.69)	n.r.	3	Kidney	Albers et al., 1986
Hackensack Meadowlands, NJ-freshwater	1981-82	M	Zn	10.51 (0.41)	n.r.	8	Kidney	Albers et al., 1986

[a] $\mu g/g$ wet mass (± 1 SD)
[b] M - male; F - female
[c] n.r. - not reported

SECTION III

ANNOTATED BIBLIOGRAPHY

* References were added to the bibliography but were not reviewed.

Aguirre, A. A. 1994. Organic Contaminants and Trace Metals in the Tissues of Green Turtles (*Chelonia mydas*) Afflicted with Fibropapillomas in the Hawaiian Islands. Mar. Poll. Bull. 28:109-114.

KEY WORDS: environmental contaminants, fibropapillomas, green turtle, Hawaiian Islands, heavy metals, pollutants, trace metals

ABSTRACT: Environmental contaminants have been listed as a possible cause of green turtle fibropapillomas (GTFP). Brain, fat, liver, and kidney tissues from 10 juvenile green turtles (*Chelonia mydas*) afflicted with GTFP, were tested to determine exposure to selected environmental pollutants and any possible relation to GTFP. One juvenile green turtle free of the disease, one pelagic green turtle, and one pelagic loggerhead turtle (*Caretta caretta*) served as controls. Egg shells and tissues from three green turtle hatchlings were also tested. The tissues and shells analysed in this study indicated that none contained any of the listed organochlorine, polychlorinated biphenyl, organophosphate, or carbamate insecticides in concentrations above the stated method of detection limits. Most of the concentrations of selenium and heavy metals were also considered to be below levels reported normal in other animal species. No correlation was found between the contaminants tested and GTFP because of the low levels detected. Trace metals and other pollutants tested in this study play a minor role in the aetiology of GTFP in a discrete green turtle population at Kaneohe Bay, Island of Oahu, Hawaii.

*Alam, S.K. and M.S. Brim. 2000. Organochlorine, PCB, PAH, and metals concentrations in eggs of loggerhead sea turtles (*Caretta caretta*) from Northwest Florida, USA. J. Environ. Sci. Health B35(6): 705-724.

KEY WORDS: sea turtle, loggerhead, *Caretta caretta*, metals, organochlorine pesticides, polychlorinated biphenyls, polycyclic aromatic hydrocarbons

ABSTRACT: Composite samples of unhatched and physically unaltered loggerhead sea turtle, *Caretta caretta*, eggs collected from 20 nests along northwest Florida were analyzed for organochlorine pesticides (OCPs), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and metals. Chemical analyses revealed that turtle eggs contained detectable amounts of metals, PAHs, and PCBs. Only one OCP, p,p'-DDD, was detected, and its presence was restricted to eggs from two nesting sites. None of the PCB concentrations exceeded the Food and Drug Administration's (FDA) action limit. Concentrations of dioxin-like PCB congeners, 105, 118, and 126, and total PCBs were also detected and are contributors to the toxic burden of loggerhead sea turtle eggs. Concentrations of PAHs, 1,2,5,6-dibenzanthracene, 1-methyl naphthalene, C1-naphthalene and naphthalene were variable at nesting sites. Comparison of mean metal burdens in eggs from different beaches suggested that no uniform geographic gradients exist. Presence of OCPs, PCBs, PAHs and metals and their additive or synergistic toxicity is a concern to loggerhead sea turtle eggs; however, additive or synergistic impacts for loggerhead sea turtles are largely undocumented.

Balazs, G. H. 1985. Impact of Ocean Debris on Marine Turtles: Entanglement and Ingestion. Proc. Workshop on the Fate and Impact of Marine Debris, Shomura, R.S. and Yoshida, H.O. (eds.), NOAA Tech. Memo. NMFS-SWFS-54, Honolulu, HI, pp. 387-429.

Bellmund, S. A., P. Defur, C. W. Su, and J. A. Musick. 1985. Aromatic Hydrocarbon Analysis of Virginia Sea Turtles: Methods and Implications. In: J.I. Richardson (Compiler). Proceedings of the Fifth Annual Workshop on Sea Turtle Biology and Conservation. Athens: Institute of Ecology, University of Georgia. (unpublished) 56 pp.

Bossart, G. D. 1986. Clinicopathological Effects, in Final Report. Study of the Effects of Oil on Marine Turtles. Vargo, S., Lutz, P.L., Odell, D.K., Van Vleet, T., and Bossart, G. (Eds.). Minerals Management Service Contract Number 14-12-0001-30063, Florida Inst. of Oceanography, St. Petersburg, FL.

KEY WORDS: Atlantic, clinicopathologic parameters, loggerhead turtles, oil exposure, oil-fouled, physiological

ABSTRACT: The objective of this portion of the overall study was to determine selected clinicopathologic parameters from the captive behavioral and physiological experimental sea turtle population as well as stranded oil-fouled turtles salvaged along the Atlantic and Gulf coastlines. This report will present evidence that exposure to oil does have certain deleterious clinicopathologic effects in experimental animals and in some oil-fouled stranded sea turtles. Exposure to South Louisiana Crude Oil (SLCO) in the physiological experiments caused two statistically significant changes in the hematology and serum chemistries of loggerhead turtles. The most severe pathological effect on the turtles due to oil exposure was the marked histopathological changes present in the skin. These changes could ultimately lead to a break in the integumentary carrier, bacterial infection, and subsequent septicimia, and neoplastic transformation.

Bossart, G. D., M. Lutcavage, D. Hudson, D. Odell, and P. Lutz. 1987. The Dermatological Effects of Oil on Sea Turtles. In: Serino, J.L. (Compiler), Seventh Annual Workshop on Sea Turtle Biology and Conservation,10 pp.

*Caurant, F., P. Bustamante, M. Bordes, and P. Miramand. 1999. Bioaccumulation of Cadmium, Copper and Zinc in Some Tissues of Three Species of Marine Turtles Stranded along the French Atlantic Coasts. Mar. Poll. Bull. 38(12): 1085-1091.

KEY WORDS: France, bioaccumulation, heavy metals, turtles, cadmium, zinc, copper, water pollution effects, tissues, kidney, liver, muscle

ABSTRACT: Cadmium, copper and zinc have been analysed in some tissues and organs of Loggerhead, Kemp's Ridley (only muscle for this species) and Leatherback turtles stranded along the Atlantic coasts of France. The pancreas analysed only in Leatherback turtles exhibited the highest metal concentrations, which is very surprising for an organ which does not play a role in the detoxification processes. The distribution of these elements in kidney, liver and muscle were quite similar to that found in marine mammals or seabirds. Nevertheless, mean cadmium concentrations in the kidney were as high as 13.3 mu g g (-1) wet weight in the Loggerhead turtles and 30.3 mu g g (-1) wet weight in the Leatherback turtles. Such high concentrations in the Leatherback turtles have never been recorded before. The main source of cadmium for marine turtles is probably the food. The Leatherback turtles are known to feed mainly on jellyfish in this area. Ten times higher cadmium concentrations have been determined in jellyfish compared to fish. This would imply a greater exposure to cadmium for Leatherback turtles, which probably need to eat great quantities of jellyfish to cover their needs.

Chan, E. H. and H. C Liew. 1988. A Review of the Effects of Oil-Based Activities and Oil Pollution on Sea Turtles. In: A. Sasekumar, R. D'Cruz, S.L.H. Lim,(Eds.), Thirty Years of Marine Science Research and Development. Proceedings of the 11th Annual Seminar of the Malaysian Society of Marine Science, 26 March 1988. Kuala Lumpur, Malaysia, pp.159-168.

Clark, D. R., Jr. and A. J. Krynitsky. 1985. DDE Residues and Artificial Incubation of Loggerhead Sea Turtle Eggs. Bull. Environ. Contam. Toxicol. 34:121-125.
KEY WORDS: contamination, DDE, eggs, Florida, loggerhead turtles, PCBs
ABSTRACT: A clutch of 109 loggerhead (*Caretta caretta*) eggs were collected at Merritt Island, Florida and analyzed for DCBP (4,4-dichlorobenzophenone), a breakdown product that would be present if DDE were metabolized. Eight eggs were frozen and the remaining eggs began artificial incubation. Of the fifty-six eggs that were analyzed, 40 contained PCBs and 55 contained DDE. The overall geometric mean of DDE was 0.099 ppm and ranged between 0.056-0.15 ppm. Concentration of DDE (geometric mean and 95% confidence intervals) in 15 eggs at a similar incubation interval (40 and 50 day samples) from previous reports, were higher at 0.091 and 0.098-0.099 ppm. The weight of loggerhead eggshells did not change during incubation except for an average loss of 209.7 mg between the 50 and 61 day samples, which could be attributable to sloughing of the mineral layer.

Clark, D. R., Jr. and A. J. Krynitsky. 1980. Organochlorine Residues in Eggs of Loggerhead and Green Sea Turtles Nesting at Merritt Island, Florida--July and August 1976. Pestic. Monit. J. 14:7-10.
KEY WORDS: clutches, DDE, eggs, Florida, green turtles, loggerhead turtles, nesting, PCB
ABSTRACT: Eggs from nine clutches of loggerhead turtles (*Caretta caretta*) and two clutches of green turtles (*Chelonia mydas*) were collected as they were laid on Merritt Island, Florida. Eggs were incubated, frozen, and analyzed for organochlorines. Levels of DDE and PCB, the major contaminants, averaged less than 0.08 ppm in loggerhead eggs and were even lower in green turtle eggs. These concentrations are far below levels thought to be potentially harmful. Loggerhead eggs were frozen after 43-52 days incubation; both DDE and PCB declined significantly during this interval. Authors estimate that DDE averaged about 0.2 ppm in loggerhead eggs when they were laid. DDE levels in eggs of both turtle species were less than levels in eggs of crocodiles (*Crocodylus acutus*) from Everglades National Park and in eggs of 13 species of aquatic birds nesting on Merritt Island. The remarkably low residues in the turtle eggs probably indicate that, when not nesting, the turtles live and feed in areas remote from Florida.

Cobb, G. P. and P. D. Wood. 1997. PCB Concentrations of Eggs and Chorioallantoic Membranes of Loggerhead Sea Turtles (*Caretta caretta*) from the Cape Romain National Wildlife Refuge. Chemosphere 34:539-549.

KEY WORDS: Cape Romain National Wildlife Refuge, chorioallantoic membrane, contamination, eggs, loggerhead sea turtles, PCBs

ABSTRACT: PCBs were found in eggs and chorioallantoic membranes (CAMs) of loggerhead sea turtles (*Caretta caretta*). Total PCB concentrations in CAMs were larger than concentrations in eggs. Total PCB concentrations in egg and CAM tissues were highly correlated ($r^2 = 0.782$; $p = 0.0001$). Sums of PCB congeners within homologue groups were also correlated in the two tissues. Data from these turtle eggs indicate 1) PCB concentrations in CAMs represent PCB concentrations in whole eggs and 2) CAMs can be collected in a nonlethal manner to determine PCB concentrations in sea turtle hatchlings.

*Corsolini, S., S. Aurigi, and S. Focardi. 2000. Presence of Polychlorobiphenyls (PCBs) and Coplanar Congeners in the Tissue of the Mediterranean Loggerhead Turtle *Caretta caretta*. Mar. Poll. Bull. 40(11): 952-960.

KEY WORDS: sea turtle, Mediterranean Sea, PCBs, coplanar congeners, pollution monitoring, TEQ

ABSTRACT: The loggerhead turtle *Caretta caretta* is a species sensitive to environmental changes caused by human activity. Stranded specimens found along the Adriatic, Baltic and Northern coasts seem to indicate that their diet, reproduction habits and aerials are the most affected ecological aspects of these organisms. We sampled liver, muscle and fat in *C. caretta* to detect the presence of polychlorobiphenyls (PCBs) including congeners with *meta* and *para* chlorine substitutions (dioxin-like planar configuration). The specimens analysed in this study come from the Adriatic Sea and were provided by the Fondazione Cetacea, member of the 'Progetto Tartarughe'. Results have revealed average ΣPCB concentrations of 119 ng/g w.w. in liver, 15 ng/g w.w. in muscle and 334 ng/g w.w. in fat. Differences were found among concentrations of single congeners and of each class of isomers, which were detected as well. Coplanar PCB distribution was consistent with ΣPCB s, as contamination levels were higher in fat with respect to liver and muscle. Such finding suggests not only that metabolic activity takes place in the liver, but that these contaminants bioaccumulate differently in the different tissues.

Davenport, J. and J. Wrench. 1990. Metal Levels in a Leatherback Turtle. Mar. Poll. Bull. 21:40-41.

KEY WORDS: contamination, heavy metals, leatherback turtle, United Kingdom coast

ABSTRACT: The leatherback turtle, *Dermochelys coriacea*, is the largest and most pelagic of living turtles. This species is an ideal indicator of the degree of contamination of the oceanic food web by accumulating materials such as heavy metals. Tissue samples were taken from a leatherback that stranded along the UK coast in 1988 and analyzed for trace metals. Results are presented to form a baseline for any future studies upon beached leatherbacks.

Davenport, J., J. Wrench, J. McEvoy, and V. Camacho-Ibar. 1990. Metal and PCB Concentrations in the "Harlech" Leatherback. Mar. Turt. Newsl. 48:1-6.

KEY WORDS: contamination, heavy metal, leatherback turtle, PCB, tissues

ABSTRACT: No studies of metal concentrations/effects have been carried out on *Dermochelys* turtles and a rare opportunity arose when a male Harlech turtle washed ashore dead on Harlech Beach in September of 1988. Fresh tissue samples were collected from a large leatherback turtle, *Dermochelys coriacea*, to determine metal and PCB concentrations. Because this animal is a continuously browsing species, its metal and PCB levels should represent an integration and biomagnification of concentrations in gelatinous plankton living in a great area of ocean. The total PCB concentration was 1-3 orders of magnitude higher than the lowest levels reported from fish taken from the open North Atlantic but was similar to the lowest concentrations reported from marine mammals. Therefore, the metal and PCB concentrations recorded did not reveal evidence of significant contamination but these results will function as a baseline for future analyses of leatherback tissues.

Fletemeyer, J. 1980. A Preliminary Analysis of Sea Turtle Eggs for DDE. Mar. Turt. Newsl. 15:6-7.

KEY WORDS: contamination, DDE, effects, eggs, loggerhead sea turtle

ABSTRACT: This preliminary report discusses the contamination of four sterile loggerhead sea turtle eggs collected during the summer of 1979 on the southeast coast of Florida. DDE was found in all four eggs at the level of 34 ppb (dry weight). Few investigations have studied the subtle effects of low level DDE contamination and therefore, no comparative data could be used. Some investigators suggest that even small levels may cause harmful effects.

Florida Institute of Oceanography. 1985. Study of the Effects of Oil on Marine Turtles. Final Report Submitted by the Florida Institute of Oceanography (FIO) to the U.S. Minerals Management Service, Volume 2-Technical Report: 143 pp.

Fritts, T. H. 1983. Oil and Gas Impacts on Marine Turtles in the Gulf of Mexico. In: Owens, D. (Ed.), Western Gulf of Mexico Sea Turtle Workshop Proceedings. TAMU-SG-84-105, pp. 49-58.

KEYWORDS: contaminants, crude oil, embryos, juvenile and neonate turtles, marine turtles, oil spills, petroleum effects

ABSTRACT: Little research has been performed on the impacts of petroleum exploration and production on marine turtles. This paper will be limited to two main perspectives: first, work already done on the effects of petroleum on the development and survival of marine turtle embryos, and secondly, a series of research approaches to the informational voids that hamper our evaluation of petroleum impacts on turtles.

Fritts, T. H. and M. A. McGehee. 1981. Effects of Petroleum on the Development and Survival of Marine Turtles Embryos. U.S. Fish and Wildlife Service, U.S. Department of the Interior, Washington, D.C., Contract No. 14-16-00009-80-946, FWS/OBS-81-37. 41 pp.

KEYWORDS: crude oil, embryos, Ixtoc oil spill, Mexico, mortality, nesting beaches, oil contamination, sea turtle

ABSTRACT: An investigation of the effects of petroleum on the development and survival of marine turtle embryos was conducted to determine the vulnerability of marine turtle progeny to petroleum spills in adjacent and distant waters. Field studies of *Lepidochelys*

kempi (Kemp's ridley turtle) involved the analysis of the concentration and distribution of hydrocarbons on the nesting beach in Tamaulipas, Mexico and the effects of petroleum on the development of embryos. Analysis of sands from the nesting beach indicated that the oil spilled in marine waters was deposited within the nesting zone by wave action. Field experiments in which paired samples of turtle eggs were incubated in clean and contaminated sands from the beach did not result in significant effects related to oil contamination. In laboratory experiments, eggs of *Caretta caretta*, (the loggerhead turtle) were incubated in sands treated with varying amounts of crude oil at different times during incubation. Experiments using varying quantities of oil mixed with the sand at the initiation of incubation resulted in differences in hatchling morphology but not in survival. Experiments in which oil was added on top of the sand containing the eggs after incubation was partially complete resulted in significant embryonic mortality and differences in hatchling morphology. The results suggested that aged petroleum is less toxic to turtle embryos than is fresh petroleum. The aged oil found on the beach studies infield experiments produced no detectable effects on turtle embryos, whereas fresh oil in the laboratory produced a variety of effects. Our results suggest that a marine oil spill resulting in contamination of turtle nesting beaches before the nesting season may affect nesting success for only a short period, if at all. However, a spill resulting in the deposition of oil on eggs or on top of a nest already constructed is likely to increase mortality and affect hatchling morphology. The timing of the spill and age of oil may be critical in determining the overall effect on turtles. The effects of oil contamination on marine turtles in ocean waters remain unknown. However, the present study provides a basis for evaluating potential effects of oil contamination and for developing oil spill contingency plans for turtle nesting beaches.

George, R. H. 1997. Health Problems and Diseases in Sea Turtles. The Biology of Sea Turtles. CRC Marine Science Series, CRC Press, Inc., Boca Raton, FL. pp. 363-385.
KEY WORDS: disease, environment, environmental stresses, health, pathogenesis, sea turtles
ABSTRACT: Sea turtles are affected by a variety of health problems. Some of these problems are naturally occurring processes, such as parasitism, and are observed in both wild and captive animals. Other conditions, such as certain nutritional deficiencies, are essentially a result of prolonged captivity. The term captive animal will be used throughout this chapter to indicate animals held in confinement, including those in oceanariums, commercial farms, research institutions, and head-start programs. The environment sea turtles occupy predisposes them to some of the disease processes with which they must contend. For example, how a turtle deals with exposure to an infectious organism and its response to physical trauma is greatly affected by environmental stress. While little is known about the sea turtle immune system, it can be assumed that, like other animals, they suffer a reduction in ability to fight disease when stressed. In stressed sea turtles, the adrenal glands release corticosterone which may reduce the humoral and/or cell-mediated defense mechanisms of the turtle, thus inhibiting the ability of the immune system to respond to infectious agents. Stresses can be environmental (salinity, pollution, temperature, etc.), nutritional, or physical (trauma). Low ambient temperature has been shown to reduce immunoglobulin production and the competence of the immune response in reptiles. This chapter describes some of the health and disease problems commonly observed in both wild and captive sea turtles. Only

those problems with high morbidity and mortality rates or those syndromes which are commonly noted are included. The health problems discussed here are grouped according to etiology. In some cases where the cause of a disease process is unproven or there are multiple factors involved in the pathogenesis, the disease is described in the section concerning the primary or most probable agent.

Giam, C. S. and L. E. Ray. 1987. Pollutant Studies in Marine Animals. CRC Press Inc., Boca Raton, Florida, 187 pp.

Godley, B. J., M. J. Gaywood, R. J. Law, C. J. McCarthy, C. McKenzie, I. A. P. Patterson, R. S. Penrose, R. J. Reid, and H. M. Ross. 1998. Patterns of Marine Turtle Mortality in British Waters (1992-1996) with Reference to Tissue Contaminant Levels. J. Mar. Biol. Assoc. UK 78:973-984.

Godley, B.J., C. McKenzie, D.E. Well, and R.W. Furness. 1998. Concentrations of Chlorobiphenyls and Organochlorine Pesticides in Marine Turtles from the Mediterranean and European Atlantic Waters. In: Epperly, S.P., Braun, J. (Compilers), Proceedings of the Seventeenth Annual Sea Turtle Symposium. U.S. Dept. Commerce. NOAA Tech. Memo. NMFS-SEFSC-415, p. 58.

Godley, B. J., D. R. Thomspon, and R. W. Furness. 1999. Do Heavy Metal Concentrations Pose a Threat to Marine Turtles from the Mediterranean Sea? Mar. Poll. Bull. 38:497-502.
KEY WORDS: marine turtles, Mediterranean, heavy metals, *Caretta caretta*, *Chelonia mydas*, mercury, cadmium, lead
ABSTRACT: Concentrations of heavy metals (Hg, Cd and Pb) were determined in internal organs and nest contents of green turtles *Chelonia mydas* and loggerhead turtles *Caretta caretta* from northern Cyprus, eastern Mediterranean Sea. Concentrations of mercury in liver tissue were higher in loggerhead turtles (median 2.41 mu g g(-1) dry weight) than in green turtles (0.55 mu g g(-1) dry weight). Preliminary data suggest cadmium concentrations to be highest in kidney tissue of loggerhead turtles (median 30.50 mu g g(-1) dry weight) but in liver tissue of green turtles (median 5.89 mu g g(-1) dry weight). Concentrations of lead in internal tissues were often below analytical detection limits in both species, but when measurable, tended to be higher in loggerhead turtles. Concentrations of mercury and cadmium in nest contents from both species were low, often below analytical detection limits, while those of lead were relatively high in loggerhead turtle hatchlings (up to 10.56 mu g g(-1) dry weight). When measurable, concentrations of all three metals tended to be higher in loggerhead turtle nest contents than in green turtle nest contents. Results presented here are consistent with inter-specific differences in diet and trophic status. Heavy metal burdens in loggerhead turtles and green turtles from the Mediterranean are similar or lower than corresponding concentrations in turtles from Japan and Hawaii, but some lead concentrations in Mediterranean loggerhead hatchlings are at levels known to cause subclinical toxic effects in other vertebrates.

Gordon, A. N., A. R. Pople, and J. Ng. 1998. Trace Metal Concentrations in Livers and Kidneys of

Sea Turtles from South-Eastern Queensland, Australia. Mar. Freshwat. Res. 49:409-414.
KEY WORDS: trace metals, marine turtles, Australia, bioaccumulation, liver, kidney, pollution effects, *Chelonia mydas*, *Caretta caretta*, *Eretmochelys imbricata*, *Lepidochelys olivacea*
ABSTRACT: The concentrations of some or all of arsenic (As), cadmium (Cd), mercury (Hg), selenium (Se) and zinc (Zn) were determined in the livers and kidneys of 50 stranded sea turtles (38 *Chelonia mydas*, eight *Caretta caretta*, three *Eretmochelys imbricata*, one *Lepidochelys olivacea*) from the Moreton Bay region of south-eastern Queensland, Australia. Concentrations of Cd, Se and Zn in the kidney tended to decrease with age, whereas concentrations of Zn in the liver tended to increase. Concentrations of Cd in all sea turtle species (1.7- 75.9 mu g g(-1) wet weight) were amongst the highest recorded for marine vertebrates globally. Although there was no obvious association between metal concentrations and particular diseases in *C. mydas*, the high concentrations of Cd found in edible turtle tissues may pose a threat to the health of indigenous people whose diet includes *C. mydas*.

Gramentz, D. 1986. Cases of Contamination of Sea Turtles with Hydrocarbons. U.N. ROCC Info. 17:25-27.

Gramentz, D. 1988. Involvement of Loggerhead Turtle with the Plastic, Metal, and Hydrocarbon Pollution in the Central Mediterranean. Mar. Poll. Bull. 19:11-13.
KEY WORDS: hydrocarbons, loggerhead turtles, Malta, metal, plastic, pollution
ABSTRACT: Over 20% of loggerhead turtles examined at Malta were contaminated with plastic or metal litter and hydrocarbons. The nature of the contamination suggests that the number of sea turtles suffering from pollution is certainly higher.

Hall, R. J. 1980. Effects of Environmental Contaminants on Reptiles: A Review. Special Scientific Report-Wildlife No. 228, U.S. Dept. Interior, 12 pp.
KEY WORDS: environmental contaminants, enzymes, pesticide, physiological effects, reproduction, reptiles, review, vertebrates
ABSTRACT: The literature relating to the effects of environmental contaminants on reptiles is reviewed and certain generalizations based on studies of other kinds of vertebrates are presented. Reports of reptilian mortality from pesticide applications are numerous enough to establish the sensitivity of reptiles to these materials. Reports of residue analyses demonstrate the ability of reptiles to accumulate various contaminants, but the significance of the residues to reptilian populations is unknown. A few authors have reported the distribution of residues in reptilian tissues; others have investigated uptake or loss rates. Physiological studies have shown that organochlorines may inhibit enzymes involved in active transport and have correlated the activity of potential detoxifying enzymes with residue levels. There is some suggestion that pesticide residues may interfere with reproduction in oviparous snakes. Needs for future research are discussed.

Hall, R. J., A. A. Belisle, and L. Sileo. 1983. Residues of Petroleum Hydrocarbons in Tissues of Sea Turtles Exposed to the Ixtoc I Oil Spill. J. Wildl. Dis. 19:106-109.

KEY WORDS: birds, contamination, ingested oil, Ixtoc I oil spill, lethal effects, oil, sea turtles, Texas

ABSTRACT: Sea turtles found dead when the Ixtoc I oil spill reached Texas waters were necropsied and tissues were analyzed for residues of petroleum hydrocarbons. Two of the three turtles were in poor flesh, but had no apparent oil-caused lesions. There was evidence of oil in all tissues examined and indications that the exposure had been chronic. Comparison with results of studies done on birds indicate consumption of 50,000 ppm or more of oil in the diet. Some possible mechanisms of mortality are suggested.

Hillestad, H. O. 1974. Pesticides, Heavy Metals, and Radioactive Uptake in Loggerhead Sea Turtles from South Carolina to Georgia . Herp. Rev. 5:75.

KEY WORDS: chlorinated hydrocarbons, contamination, DDT, eggs, Georgia, heavy metals, loggerhead turtle, South Carolina, yolk

ABSTRACT: Loggerhead sea turtle (*Caretta caretta*) eggs from three nesting beaches in Georgia and South Carolina were analyzed for chlorinated hydrocarbons and heavy metals. Tissue samples were obtained from Georgia turtles for radionuclide analysis. Total DDT (DDE + DDD + DDT) residue levels ranged from 0.058 ppm to 0.305 ppm. Dieldrin residue levels ranged from trace to 0.564 ppm. Mercury levels in yolks ranged from 0.02 ppm to 0.09 ppm and 0.01 ppm to 0.03 ppm in the albumen. Zinc levels averaged 32.25 ppm in yolk and 26 ppm in the albumen. There were significant differences between the yolk and albumen levels of cadmium, copper and lead. Cadmium levels averaged 0.17 ppm in yolk and 0.56 ppm in albumen; copper levels averaged 2.08 ppm in yolk and 6.0 ppm in albumen; lead averaged 2.87 ppm in yolk and 12.0 ppm in albumen. Radionuclide detection for the gamma emitters revealed very low levels in tissue samples. Levels were found to be much lower, by several orders of magnitude, than in other coastal reptiles, mammals and fish.

Hutchinson, J. 1991. A Review of the Effects of Pollution on Marine Turtles. Greenpeace International, 27 pp.

KEY WORDS: entanglement, ingestion, marine turtles, oil, organochlorine compounds, pesticides, plastic debris, pollution, review

ABSTRACT: Mortality in marine turtles is caused by many factors. This naturally includes predation and climatic abnormalities. Despite the official listing of all turtle species on Appendix I of CITES, and the regulations to try and protect them, trade, man-made habitat disruption and fisheries interactions continue to damage turtle populations. Less well known, but not necessarily less important, are the impacts of pollution including marine debris, oil pollution and bioaccumulative chemicals. This report considers these factors.

Plastic debris, including discarded fishing netting, packing bands and plastic bags, have been associated with turtle mortality and there is evidence that this is an increasingly important problem. The incidence of stranded turtles which were entangled in such materials or which were found to have ingested marine debris has almost certainly increased because of the development of plastics and their entry and increased prevalence in the marine environment.

Convergence zones in the oceans have been found to bring together young, pelagic turtles, their foodstuffs and regrettably, plastic debris. This increases the chances of ingestion and entanglement. Entanglement may cause drowning, infected wounds or behavioral changes, including altered feeding reactions, ultimately contributing to the animals demise. Recent research reveals that more than half of the turtle population may have debris of anthropogenic origin in their digestive tracts. Ingestion may cause internal blockages, ulcers or injuries. Some material may also pass harmlessly through the gut but plastics retained there for a period of time may also partly decompose. This would be expected to release plasticizers (such as PCBs), concentrations of which have been found in birds to correlate with ingested plastics. Tar or oil droplets are amongst the marine debris turtles have been found to ingest. Turtles have been regularly found with evidence of oiling - external and internal. They do not appear to perceive crude oil as a threat and direct oiling of nesting beaches presents another danger. Oil has been shown to choke turtles or stick their jaws together and to inhibit their normal movement and behavior. Sublethal effects of oil ingestion include the metabolic production of potentially carcinogenic compounds, immune suppression, lung damage, diminished salt gland function, hormonal and behavioral abnormalities, and restricted assimilation of nutrients from the gut. All these factors are likely eventually to adversely affect survival.

Underwater explosions conducted by the oil industry have also been associated with turtle deaths. There is little evidence from marine turtles of the impact of pesticides and related organochlorine compounds on these animals. Reported levels are higher than in fish and, from work on other species (including freshwater turtles), associated effects may well include various embryonic and hatchling deformities. In humans and marine mammals organochlorine body burdens have been correlated with reproductive and immune system abnormalities. Similarly there is little data available about heavy metals in turtles. In the absence of hard information, extrapolation from other species, especially marine mammals, indicates that the presence of these chemicals is of great concern.

Lake, J. L. 1994. PCBs and Other Chlorinated Organic Contaminants in Tissues of Juvenile Kemp's Ridley Turtles (*Lepidochelys kempi*). Mar. Environ. Res. 38:313-327.

KEY WORDS: contamination, Kemp's ridley sea turtle, Long Island, NY, pesticides, polychlorinated biphenyls

ABSTRACT: Concentrations of PCBs (polychlorinated biphenyls) and chlorinated pesticides were measured in liver and body fat samples of juvenile Kemp's ridley sea turtles (*Lepidochelys kempi*). These turtles were killed in the fall or early winter by rapid seasonal temperature drops and were collected on the eastern shores of Long Island from 1980 to 1989. These endangered organisms contained average PCB concentrations (on a wet weight basis) ranging from 655 ng/g in 1980 to 272 ng/g in 1989 in the liver samples, and 1250 ng/g in 1985 to 476 ng/g in 1989 in body fat. The average liver concentrations were four to ten times higher than those found in the livers of other sea turtles. The highest PCB concentration found in a Kemp's ridley turtle was more than a factor of 20 below those reported to cause reproductive effects in snapping turtles (*Chelydra serpentina*) from freshwater environments. Average yearly concentrations of other compounds in the tissues of Kemp's ridley turtles ranged from 137 to 386 ng/g (wet weight) for p,p'-DDE and from 27.5 to 129 ng/g (wet weight) for *trans*-nonachlor. Strong correlations were found between liver and body fat concentrations for PCBs ($r^2 = 0.90$), p,p-DDE ($r^2 = 0.80$) and *trans*-nonachlor ($r^2 = 0.93$) which suggested that either tissue may be used for monitoring these

contaminants in Kemp's ridley turtles.

Loehefener, R. R., W. Hoggard, C. L. Roden, K. D. Mullin, and C. M. Rogers. 1989. Petroleum Structures and the Distribution of Sea Turtles. In: Proc. Spring Ternary Gulf of Mexico Studies Meeting, Mineral Management Service, U.S. Department of the Interior, New Orleans, LA, p. 31.

Lutcavage, M. E., P. L. Lutz, G. D. Bossart, and D. M. Hudson. 1995. Physiologic and Clinicopathologic Effects of Crude Oil on Loggerhead Sea Turtles. Arch. Environ. Contam. Toxicol. 28:417-422.
KEY WORDS: biological effects, clinicopathologic effects, crude oil, juvenile, loggerhead sea turtles
ABSTRACT: The physiologic and clinicopathologic effects of weathered South Louisiana crude oil exposure were studied in the laboratory in juvenile loggerhead sea turtles. Sea turtles ingested oil incidentally, and oil was observed clinging to the nares, eyes, and upper esophagus, and was found in the feces. Oiled turtles had up to a four-fold increase in white blood cell counts, a 50% reduction in red blood cell counts, and red blood cell polychromasia. Most serum blood chemistries (e.g. BUN, protein) were within normal ranges, although glucose returned more slowly to baseline values than in the controls. Gross and histologic changes were present in the skin and mucosal surfaces of oiled turtles, including acute inflammatory cell infiltrates, dysplasia of epidermal epithelium, and a loss of cellular architectural organization of the skin layers. The cellular changes in the epidermis are of particular concern because they may increase susceptibility to infection. Although many of the observed physiological insults resolved within a 21-day recovery period, the long-term biological effects of oil on sea turtles remain completely unknown.

Lutcavage, M. E., T. Plotkin, B. Witherington, and P. L. Lutz. 1997. Human Impacts on Sea Turtle Survival. In: Lutz, P.L. and Musick, J.A. (Eds.), The Biology of Sea Turtles. CRC Marine Science Series, CRS Press, Inc., Boca Raton, FL, pp. 387-409.
KEY WORDS: entanglement, foraging habitats, habitat alteration, human impacts, incidental capture, nesting beaches, oil pollution, sea turtles
ABSTRACT: Today, sea turtle numbers are drastically reduced to the point that all seven remaining sea turtle species are considered either threatened or endangered on a worldwide basis. Undoubtedly, human interference is the cause of this collapse. The challenges that sea turtles now face from human activities impact every stage of their life cycle, from loss of nesting beach and foraging habitats to mortalities on the high seas through intense pelagic fishing practices. They are also harmed by the increasing load of nonbiodegradable waste and pollutants that the ocean and coastal zones now receive. Clearly, a full consideration of all human activities that adversely impact sea turtles and required conservation measures would be beyond the scope of a single chapter. However, a review of the more compelling effects will give an indication of the extent of the challenges sea turtles face and the efforts required to protect them. A word of caution: by its very nature much of the data on this subject is only found in the grey literature of government and conservation organization reports and such like, and is therefore scientifically unreviewed. This is sometimes the case

in conservation biology, where threats to survival are first recognized and conservation remedies proposed by biologists familiar with the status of local populations.

Lutz, P. 1989. Methods for Determining the Toxicity of Oil and Dispersants to Sea Turtles. Proc. of a Workshop on Tech. Spec., New Orleans, LA. Tech. Res. Inc. OCS Study MMS 89-0042, U.S. Dept. of Int., Minerals Mang. Serv.

Lutz, P., M. Lutcavage, and G. D. Bossart. 1987. Effects of Oil on the Physiology of Marine Turtles. Proc. of the Seventh Annual Gulf of Mexico Information Transfer Meeting, U.S. Dept. Int., Minerals Management Service. OCS Study, MMS-87-0058, pp. 173-174.
KEY WORDS: marine turtles, petroleum effects, physiological effects, South Louisiana Crude Oil
ABSTRACT: The objective of this study was to determine the effects of petroleum on marine turtles. An experimental program was carried out on 12-15 month old loggerhead and green turtles to determine the physiological effects of oil using South Louisiana Crude Oil (SLCO) preweathered for 48 hours. The physiological experiments showed that some aspects of respiration, blood chemistry and salt gland function of loggerhead sea turtles were significantly effected. Experimental and field results indicate that marine turtles would be at risk if they encountered an oil spill or large amounts of tar in the environment. An emergency strategy for dealing with oil spills in areas with marine turtles is discussed.

Lutz, P. L. and M. Lutcavage. 1989. The Effects of Petroleum on Sea Turtles: Applicability to Kemp'sRidley. In: Caillouet, C.W. and Landry, A.M. (Eds.), Proc. of the First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management, TAMU-SG-89-105, pp. 52-54.
KEY WORDS: Kemp's ridley, management, oil spills, osmoregulatory functions, petroleum, physiological effects, sea turtles
ABSTRACT: Contact with petroleum is likely to be harmful to all sea turtles. Yet, because of reduced population size and restricted nesting distribution, the Kemp's ridley (*Lepidochelys kempi*) may be especially vulnerable to damage from accidental spills. In behavioral studies with green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) sea turtles there was no evidence that sea turtles detect and avoid oil slicks or distinguish tar balls from food items. Physiological studies showed that loggerhead sea turtles chronically exposed to crude oil in our laboratory showed cell abnormalities of the skin, alteration of respiratory patterns and blood cell dysfunctions. During exposure, sea turtles ingested oil incidentally, and oil sometimes appeared in the feces. Salt secretion and minor ion regulation by the salt gland were reduced or delayed. At sea, failure of osmoregulatory systems could prove fatal. It appears that sea turtles are highly sensitive to oil, which must be considered another factor threatening the Kemps ridley. Management options for mitigating the damage of accidental oil spills are urgently required.

Lutz, P. L., M. Lutcavage, and D. Hudson. 1986. Physiological Effects, in Final Report. Study of the Effects of Oil on Marine Turtles. Vargo, S., Lutz, P.L., Odell, D.K., Van Vleet, T., and Bossart, G. (Eds.). Minerals Management Service Contract Number 14-12-0001-30063,

Florida Inst. of Oceanography, St. Petersburg, FL, pp. 93-131.
KEY WORDS: acute and chronic oil exposure, blood serum chemistry, loggerhead turtles, regulatory systems
ABSTRACT: Two levels of oil exposure were used to determine if exposure to crude oil, such as might be encountered in an actual oil spill or blowout at sea, is detrimental to the health of sea turtles. Subadult loggerhead turtles (*Caretta caretta*) were obtained from mixed clutches in Florida and the Bahamas and exposed to two concentrations of oil for 96 hours (chronic and acute exposure). Changes in ventilation and some blood serum chemistries were produced along with an induced immune response involving white blood cells.

Mckenzie, C., B. J. Godley, R. W. Furness, and D. E. Wells. 1999. Concentrations and Patterns of Organochlorine Contaminants in Marine Turtles from Mediterranean and Atlantic Waters. Mar. Environ. Res. 47:117-135.
KEYWORDS: marine turtles, *Caretta caretta*, *Chelonia mydas*, *Dermochelys coriacea*, organochlorine pesticides
ABSTRACT: Concentrations of individual chlorobiphenyls (CBs) and organochlorine pesticides (OCPs) in marine turtle tissues collected from the Mediterranean (Cyprus, Greece) and European Atlantic waters (Scotland) between 1994 and 1996 are described. ΣCB concentrations were highest in adipose tissue and ranged from 775 to 893, 39 to 261 and 47 to 178 μg/kg wet wt in loggerhead (*Caretta carretta*), green (*Chelonia mydas*) and leatherback (*Dermochelys coriacea*) turtles, respectively. Omnivorous loggerhead turtles had the highest organochlorine contaminant (OC) concentrations in all tissues sampled. It is thought that dietary preferences were likely to be the main differentiating factor among species. Decreasing lipid contaminant burdens with turtle size were observed in green turtles, most likely attributable to a change in diet with age. Principal component analysis of data from loggerhead and green turtles indicated that there were also pattern differences between species, confirming bioaccumulation differences.

McKim, J. M., Jr. and K. L Johnson. 1983. Polychlorinated Biphenyls and p,p'-DDE in Loggerhead and Green Postyearling Atlantic Sea Turtles. Bull. Environ. Contam. Toxicol. 31:53-60.
KEY WORDS: contamination, DDE, Florida, green turtle, loggerhead turtle, organochlorines, PCBs, postyearlings
ABSTRACT: The present study will examine PCB and DDE levels in the liver and muscle tissues of post yearling Green and Loggerhead turtles collected along the east coast of Florida. A total of nine loggerhead and four Green turtles were collected and used in this study. DDE residues ranged from 1-45 ppb in the Loggerhead and were <1 ppb in the Green turtle muscle samples. Liver samples contained DDE concentrations which ranged from 2-100 ppb in the Loggerhead and were less than 10 ppb in the Greens. In the muscle samples of the Loggerhead, total PCB concentrations ranged from 5-46 ppb and in the Green, 5.4-9.4 ppb. Total PCB concentrations in the liver ranged from 8-182 ppb and 43-80 ppb in the Loggerhead and Green turtles, respectively. Overall, organochlorine residues in both species of postyearling turtles exist at unusually low concentrations, in the muscle and liver tissues. Although the residues in these turtles are low, the levels of these chemicals should continue to be monitored to insure the protection of these currently endangered species.

Meteorological and Environmental Protection Administration. 1989. Oil and Marine Turtles of Saudi Arabia: Volumes 1 and 2. In: Miller, J.D. (Ed.), Meteorological and Environmental Protection Administration (MEPA), Ministry of Defense and Aviation, Kingdom of Saudi Arabia, MEPA Coastal and Marine Management Services Report 9.

Meyers-Schone, L. 1994. Turtles as Monitors of Chemical Contaminants in the Environment. Rev. Environ. Contam. Toxicol. 135:93-153.
KEY WORDS: biological monitoring, biomonitoring tools, environmental contaminants, radionuclide contaminants, review, toxicity, turtles
ABSTRACT: The purpose of this review is to provide residue data and biological information to facilitate the selection of an appropriate turtle species for field studies designed to evaluate the bioavailability of toxicants in aquatic and terrestrial environments. An underlying premise in this review is that biological monitoring studies yield more useful data when these studies are designed with careful consideration of the characteristics of the site, properties of the chemical or radionuclide contaminant(s), and biology of the species under investigation. Not all species of a given taxon can be expected to be equally useful indicators of toxicants within a contaminated ecosystem (i.e., Talmage and Walton, 1991); thus, care should be given to sample those species most likely to experience toxicant exposure as a result of what they eat and where they spend their time. The published literature on toxicant residues in turtles and the use of biochemical analyses and growth indices as endpoints for toxicant exposure under field conditions are reviewed. General guidelines are provided for the inclusion of turtles in biological monitoring programs for chemical and radionuclide contaminants.

National Research Council, Committee on Sea Turtle Conservation. 1990. Decline of Sea Turtles: Causes and Prevention. National Academy Press, Washington, D.C. 259 pp.
KEY WORDS rare species, population dynamices, sea turtles, mortality causes, reproductive behavior, *Caretta caretta*, *Dermochelys coriacea*, *Chelonia mydas, Eretmochelys imbricata*
ABSTRACT Five species of sea turtles regularly spend part of their lives in U.S. coastal waters of the Atlantic Ocean and the Gulf of Mexico, Kemp's ridley, loggerhead, green turtle, hawksbill, and leatherback. Concerns about the continuing declines of sea turtle populations and the potential impact of new gear regulations on commercial shrimp trawlers prompted the Congress to add a provision to the Endangered Species Act Amendments of 1988 mandating an independent review by the National Academy of Sciences. This report presents scientific and technical information on the population biology, ecology, and reproductive behavior of five endangered or threatened species of sea turtles. It evaluates population declines, causes of turtle mortality, and the effectiveness of past and current mitigation efforts, and recommends conservation measures to protect or increase turtle populations.

Odell, D. K. and C. MacMurray. 1986. Behavioral Response to Oil, in Final Report. Study of the Effects of Oil on Marine Turtles. Vargo, S., Lutz, P.L., Odell, D.K., Van Vleet, T., and Bossart, G. (Eds.). Minerals Management Service Contract Number 14-12-0001-30063, Florida Inst. of Oceanography, St. Petersburg, FL.

KEY WORDS: behavior, crude oil exposure, green turtle, loggerhead turtle, oil slick, petroleum hydrocarbons, tar balls
ABSTRACT: The objective of this portion of the study was to determine if loggerhead and green sea turtles of a variety of age classes showed a behavioral response to weathered South Louisiana Crude oil or to tar balls. Hatchling loggerhead and green sea turtles were obtained from headstart programs, placed in fiberglass pools and exposed to mineral oil or weathered crude oil. Tar balls were also presented to each turtle in a circular array designed to maximize discovery by the turtle. The turtles may be responding visually to the dark surface layer and not to petroleum hydrocarbons. In the natural environment turtles may respond to an oil slick by seeking open water, increasing dive times, and descending in the water column.

*Orvik, L.M. 1997. Trace Metal Concentration in Blood of the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*). Texas A & M University, Thesis. 61 pp.
KEY WORDS: sea turtles, Kemp's ridley, trace metals, blood
ABSTRACT: Trace metal concentration was analyzed from the blood of 106 critically endangered Kemp's ridley sea turtles (*Lepidochelys kempii*), captured off the coast of Texas and Louisiana during June-October 1994 and May-August 1995. These analyses characterized the level of five trace metals in Kemp's ridleys and compared these levels in headstart and wild cohorts as well as between sexes. Overall, copper, lead, mercury, silver and zinc levels in the blood of Kemp's ridleys were: copper (range = 215-1,300 ng/g, mean = 524 ng/g), lead (range = 0.00-34.3 ng/g, mean = 11.0 ng/g), mercury (range = 0.50-67.3 ng/g, mean 18.0 ng/g), silver (range = 0.042-2.74 ng/g, mean = 0.94 ng/g) and zinc (range = 3,280-18,900 ng/g, mean = 7,500 ng/g). Metal concentration appeared to reflect dietary uptake. There were no significant differences between mean trace metal concentration in whole blood of headstart, wild, female and male ridleys. Copper, mercury and zinc concentration exhibited significant positive relationships with size of turtle. Female ridleys displayed a stronger positive correlation between mercury and zinc concentration and turtle size than did male counterparts. Trace metal blood levels in ridleys were lower thatn tissue levels reported in the literature for marine and freshwater turtles, other reptiles, invertebrates, fish, marine birds and mammals. The present study indicates that analysis of blood for trace metals is an effective method to detect and monitor trace metals levels in living sea turtles. Future research needs include a synoptic analysis of trace metals in blood and selected tissues and comparison of resulting concentrations.

Plotkin, P. and A. F. Amos. 1990. Effects of Anthropogenic Debris on Sea Turtles in the Northwestern Gulf of Mexico. In: Shomura, R. S. ,Godfrey, M. L. (Eds.) Proceedings of the Second International Conference on Marine Debris. NOAA Tech. Memo. NMFS-SWFSC-154, pp. 736-743.

Podreka, S., A. Georges, B. Maher, and C. J. Limpus. 1998. The Environmental Contaminant DDE Fails to Influence the Outcome of Sexual Differentiation in the Marine Turtle *Chelonia mydas*. Environ. Health Perspect. 106:185-188.
KEY WORDS: DDE, eggs, embryo, green turtle, marine turtles, organochlorine

contaminants, sex ratios

ABSTRACT: In many turtles, the temperature experienced during the middle of egg incubation determines the sex of the offspring. The implication of steroid sex hormones as the proximate trigger for sex determination opens the possibility that endocrine-disrupting contaminants may also influence the outcome of sexual differentiation. In this study we investigate the potential effects of DDE (a common DDT metabolite) on sexual differentiation of *Chelonia mydas* (green sea turtle). Four clutches of eggs collected from Heron Island, Queensland, Australia, were treated with DDE at the beginning of the thermosensitive period for sexual determination. An incubation temperature of 28° C or less produces male hatchlings in this species, whereas 30° C or more produces female hatchlings. Dosed eggs were consequently incubated at two temperatures (27.6° C and 30.4° C) on the upper and lower boundaries of the sex determination threshold for this species. DDE, ranging from 3.3 to 66.5 microg, was dissolved in 5, 10, and 25 microl ethanol and applied to eggshells above the embryo. Less than 2.5 ng/g DDE was present in eggs prior to dosing. Approximately 34% of the applied DDE was absorbed in the eggs, but only approximately 8% of applied DDE was found in embryos. Thus, treated eggs, corrected for background DDE, had up to 543 ng/g DDE. The sex ratio at these doses did not differ from what would be expected on consideration of temperature alone. Incubation time, hatching success, incidence of body deformities, hatching size, and weight were also within the limits of healthy developed hatchlings. This indicates that the eggs of *C. mydas* in the wild with concentrations of DDE less than 543 ng/g should produce hatchlings with relatively high hatching success, survival rate, and normally differentiated gonads.

Raloff, J. 1986. When Sea Turtles are Awash in Oil. Sci. News 30:358.

Rybitski, M. J. 1995. Organochlorines in Atlantic Loggerheads (*Caretta caretta*). Proc. of the Twelfth Annual Workshop on Sea Turtle Biology and Conservation, NOAA Tech. Memo. NMFS-SEFSC-361, pp. 226-229.

KEY WORDS: Chesapeake Bay, loggerhead sea turtles, organochlorine accumulation, PCBs, tissue

ABSTRACT: The tissue distribution patterns of organochlorines accumulated in loggerhead sea turtles (*Caretta caretta*) in the Chesapeake Bay are presented. Polychlorinated biphenyls (PCBs) are also reported in terms of predominant congeners. The major organochlorines detected were PCBs, DDE, and chlordane. Subcutaneous fat had the highest concentration of organochlorines, followed by liver, kidney, and pectoral muscle. PCB congener 153 (IUPAC numbering) was the major PCB component and accounted for more than 25% of the total PCB content of all the tissues analyzed. Five congeners (153, 138, 183, 180, and 118) accounted for greater than 50% of the total PCB concentration in all the tissues analyzed. The turtles in this study preferentially accumulated congeners with five or more substituent chlorine atoms.

Rybitski, M. J. 1994. Relationship Between Organochlorines and Lipid Composition in Sea Turtles. Proc. of the Fourteenth Annual Symp. on Sea Turtle Biology and Conservation. NOAA Tech. Memo. NMFS-SEFSC-351, pp. 274-276.

KEY WORDS: loggerhead turtles, North Carolina, organochlorine pollutants, pollutants, triglycerides, Virginia

ABSTRACT: Organochlorine pollutants are a ubiquitous, environmentally persistent family of anthropogenic compounds. Polychlorinated biphenyls (PCBs), a class of organochlorines characterized by low water solubility, high dielectric constants, low vapor pressures and low flammability, were widely used in industry until the 1970s. Due to their low water solubility, they are lipophilic and partition into tissues with high percentages of lipid, particularly neutral lipids such as triglycerides. The tissue distribution patterns of polychlorinated biphenyls (PCBs) observed in loggerhead sea turtles (*Caretta caretta*) from Virginia and North Carolina are presented, relative to tissue lipid class composition. Five loggerhead sea turtles from Virginia and North Carolina were analyzed for pollutants, total lipid and lipid class composition. Subcutaneous fat, composed predominantly of triglycerides, had the highest concentration of PCBs.

Rybitski, M. J., R. C. Hale, and J. A. Musick. 1995. Distribution of Organochlorine Pollutants in Atlantic Sea Turtles. Copeia: 372.

KEY WORDS: DDT, Kemp's ridley turtle, loggerhead turtle, organochlorine pollutants, PCBs, tissue

ABSTRACT: Tissues from juvenile loggerhead (*Caretta caretta*) and Kemps ridley (*Lepidochelys kempi*) turtles stranded in Virginia and North Carolina were analyzed by capillary gas chromatography to determine concentrations of organochlorine pollutants. The predominant organochlorines were polychlorinated biphenyls (PCBs), DDT and its breakdown products, DDE and DDD. Organochlorine concentrations were related to tissue type and relative lipid content. Subcutaneous fat had the highest lipid content (mean = 49.3% wet mass, SD = 19.1) and organochlorine concentrations (mean = 252 μg/kg, SD = 196), followed by liver, kidney, and pectoral muscle. Subsequent analyses of subcutaneous fat and liver from Atlantic loggerheads and Kemps ridleys yielded a range of organochlorine contaminant concentrations of 55.4-1730 μg/kg and 7.46-607 μg/kg, respectively. Five congener groups accounted for a mean of 66.0% of the total PCBs in the liver (SD = 15.9). A similar pattern was seen in the subcutaneous fat. Congener 153/132 (IUPAC nomenclature) was the major congener group present, followed by 138/158, 180, 118, and 187. Selected sea turtle tissues were extracted using a modified Bligh and Dyer procedure, and lipid classes were examined. Subcutaneous fat contained the highest proportion of triglycerides, followed by liver and pectoral muscle. This pattern corresponds to the pattern of organochlorine accumulation.

Sahoo, G., R. K. Sakoo, and P. Mohanty-Hejmadi. 1996. Distribution of heavy metals in the eggs and hatchlings of olive ridley sea turtle, *Lepidochelys olivacea*, from Gahirmatha, Orissa. Indian Journal of Marine Sciences 25:371-372.

KEY WORDS: olive ridley sea turtle, heavy metals, concentrations, eggs, Orissa

ABSTRACT: Shell and yolk-albumen of fresh eggs, hatched egg shells and newly emerged hatchlings of olive ridley sea turtle, *Lepidochelys olivacea*, along with eight nesting beach sand samples showed higher iron, zinc and lead concentrations than cobalt, chromium, copper and nickel. Beach sand samples recorded higher values of all metals than the egg

components. Newly emerged hatchlings also recorded higher values than the fresh eggs. Embryos might have accumulated these metals from the nesting beach during incubation.

Sakai, H. 1995. Heavy Metal Monitoring in Sea Turtles Using Eggs. Mar. Poll. Bull. 30:347-353.
KEY WORDS: egg yolks, eggs, green turtles, heavy metals, inter-clutch, loggerhead turtles, pollution
ABSTRACT: Heavy metals in the muscles, livers, kidneys and eggs of loggerhead turtles and green sea turtles were analysed to develop a non-killing method of heavy metal monitoring using eggs. Heavy metal concentrations were higher in the liver and kidney than in the muscle and eggs of loggerhead turtles. Within an egg, yolk contained the highest concentrations and burdens of heavy metals. Heavy metal concentrations in egg yolks within the oviducts of a single loggerhead turtle were uniform without significant inter-oviduct variation. Similarly, there were no inter-clutch differences of an individual green turtle during one nesting season. Heavy metal concentrations in the yolk of eggs from the oviduct indicate the accumulation levels in female turtles, suggesting that the analysis in yolks of sea turtle eggs collected randomly from any clutch enable the estimation of the heavy metal concentrations in nesting female turtles, since there is less fluctuation of heavy metal concentrations in yolks of eggs laid by nesting loggerhead and green turtles.

Sakai, H. 1996. Tissue Distribution of Heavy Metals in Loggerhead Turtles (*Caretta caretta*). J. Env. Chem. 6:27-34.

Schenck, F. J., R. Wagner, M. K. Hennessy, and J. L., Jr. Okrasinski. 1994. Screening Procedure for Organochlorine and Organophosphorus Pesticide Residues in Eggs Using a Solid-Phase Extraction Cleanup and Gas Chromatographic Detection. J. AOAC Int. 77:1036-1040.

Stoneburner, D. L. 1979. Heavy Metal Concentrations in Loggerhead Sea Turtle Eggs at Canaveral, Cumberland Island, Cape Lookout and Cape Hatteras National Seashores. Report for the Superintendent, Dept. of the Interior, National Park Service, Southeast Regional Office, Atlanta, GA, 7 pp.
KEY WORDS: eggs, heavy metals, loggerhead sea turtles, nesting beaches
ABSTRACT: Concentrations of 13 heavy metals in loggerhead sea turtle eggs, collected from four nesting beaches, were determined. Comparisons of mean heavy metal burdens in eggs from the four different beaches suggested that no uniform geographic gradients exist in the nesting population. The comparisons did indicate that eggs laid on each beach had significantly different mean concentrations of heavy metals, and that the number of significantly different means increases as the distance between nesting beaches increased. These analyses suggest the presence of groups of turtles and support the hypothesis that the Western Atlantic Loggerhead population is composed of distinct, localized populations.

Stoneburner, D. L. 1980. Heavy Metals in Loggerhead Sea Turtle Eggs (*Caretta caretta*): Evidence to Support the Hypothesis that Demes Exist in the Western Atlantic Population. J. Herpetol. 14:171-175.
KEY WORDS: demes, eggs, heavy metals, loggerhead sea turtles, nesting beaches

ABSTRACT: Concentrations of thirteen heavy metals in Loggerhead sea turtle eggs, collected from four nesting beaches were determined. Comparisons of mean heavy metal burdens in eggs from different beaches suggested that no uniform geographic gradients exist in the nesting population. The comparisons did indicate that eggs laid on each beach had significantly different mean concentrations of barium, cobalt, chromium, mercury, molybdenum, nickel and lead. These data suggest the presence of groups of turtles and indirectly support the hypothesis that the Western Atlantic Loggerhead population is composed of demes.

Storelli, M. M., E. Ceci, and G. O. Marcotrigiano. 1998. Comparison of Total Mercury, Methylmercury, and Selenium in Muscle Tissues and in the Liver of *Stenella coeruleoalba* (Meyen) and *Caretta caretta* (Linnaeus). Bull. Environ. Contam. Toxicol. 61:541-547.

KEY WORDS: loggerhead turtle, striped dolphin, methylmercury, total mercury, Italy, heavy metals, contaminants, liver, muscle

ABSTRACT: There are several studies concerning total mercury and methylmercury accumulation in cetaceans but no information is available for marine turtles. Therefore, the objective of this study is to compare data about total and methylmercury concentrations in the liver and muscle tissue of striped dolphins (*Stenella coeruleoalba*) and loggerhead turtles (*Caretta caretta*). A total of 30 striped dolphin and 7 loggerhead turtle specimens were found beached along the Apulian coast during parts of 1991 and 1995. The liver and muscle tissue were collected and analyzed for total mercury, methylmercury and selenium. The highest total Hg, Se and MeHg concentrations were in the liver of both species examined. In the muscle tissue of both species, Hg was present mainly in the methylated form. Also, the molar ratio Se/Hg (inorganic) found was high, particularly in the loggerhead turtles. The high molar ratio Se/Hg (inorganic) = 48 found in the liver turtles, does seem to indicate that selenium does not have a protective action against mercury toxicity. Consequently, other results suggest that when Hg (inorganic) concentrations increase, though in a small proportion, Se might be involved in the detoxification mechanism.

Storelli, M. M., E. Ceci, and G. O. Marcotrigiano. 1998. Distribution of Heavy Metal Residues in Some Tissues of *Caretta caretta* (Linnaeus) Specimen Beached Along the Adriatic Sea (Italy). Bull. Environ. Contam. Toxicol. 60:546-552.

KEY WORDS: marine turtles, contaminants, heavy metals, Italy, loggerhead turtle, *Caretta caretta* , tissues, pollution

ABSTRACT: Three of the seven species of marine turtles exist in the Mediterranean Sea: the Loggerhead (*Caretta caretta*), Green (*Chelnoia mydas*) and Leatherback (*Dermochelys coriacea*) turtles. Because of the endangered status of these animals and the lack of literature pertaining to heavy metal contaminants, the aim of this study was to assess the presence of heavy metals in different tissues of loggerhead turtles that beached along the Italian coasts. A total of twelve specimens were found along Apulian coasts in 1990 and 1991. Liver, lung, kidney and muscle tissues were collected and analyzed for Hg, Pb, Cd, Cr, As and Se. The highest concentrations of mercury and lead were found in the liver (aver. 1.68 mg/kg and aver. 1.23 mg/kg, respectively) while the highest cadmium levels were found in the kidney (aver. 24.23 mg/kg). Arsenic was observed highest in the muscle (68.94 mg/kg) and highest

selenium concentrations in the liver (aver. 15.88 kg/mg). There was a significant positive correlation between mercury and cadmium concentrations in the tissues of the young and their weight which suggests that these metals tend to accumulate in tissues. Analytical data cannot be placed in proper context because of the lack of contaminant studies and marine turtles but this work my help fill that void and stimulate similar studies.

Thompson, N. P., P. W. Rankin, and D. W. Johnston. 1974. Polychlorinated Biphenyls and p,p'-DDE in Green Turtle Eggs from Ascension Island, South Atlantic Ocean. Bull. Environ. Contam. Toxicol. 11:399-406.

KEY WORDS: Ascension Island, DDT, eggs, green turtles, industrial pollutants, PCBs, sea birds, sea turtles

ABSTRACT: Industrial pollutants are known to be widely distributed in global ecosystems. In the majority of reports available, the PCB-laden organisms reside in waters that also contain industrial pollutants, including PCBs. Ascension Island, an isolated, volcanic island in the South Atlantic Ocean, inhabits sea birds and turtles, especially the Green turtle, *Chelonia mydas*. Samples of these birds and turtle eggs were obtained for PCB and pesticide analyses in 1972. Female turtles laying eggs on Ascension obtained PCBs and the DDT metabolite from organisms eaten en route to Ascension or from waters off the eastern coast of Brazil. None of these marine environments are in regions of high industrial pollution.

Van Vleet, E.S. and G. G. Pauley. 1987. Characterization of Oil Residues Scraped from Stranded Sea Turtles from the Gulf of Mexico. Carib. J. Sci. 23:77.

KEY WORDS: Florida, internal organs, oil contamination, oil residues, sea turtles

ABSTRACT: Gas chromatographic analysis of oil residues scraped from several stranded sea turtles suggests that turtles were impacted by oil originating from tanker discharge. Analysis of internal organs and feces from dead and live turtles indicates that turtles actively ingest floating oil residues and that sea turtle strandings with previously published studies on water circulation, pelagic tar, and beach tar indicate that Floridas southeast coastline has one of the highest probabilities that marine turtles will be impacted by oil contamination.

Vargo, S., P. Lutz, D. Odell, E. Van Vleet, and G. Bossart. 1986. Study of the Effects of Oil on Marine Turtles. PB87-199931. Minerals Management Service. Reston, VA, 3 Volumes:28 pp.

KEY WORDS: behavior, green turtle, loggerhead turtle, Lousiana crude oil, marine turtle, oil slicks, physiological effects, tar balls

ABSTRACT: The objective of the study was to determine the effects of oil on marine turtles. An experimental program was carried out on 3-20 month-old loggerhead and 3-16 month-old green turtles to determine behavioral and physiological effects of oil using South Louisiana crude oil (SLCO) preweathered for 48 hrs. The behavioral experiments indicated that both species of marine turtles had a limited ability to avoid oil slicks, but experiments to determine avoidance/attraction to floating tar balls were inconclusive. The physiological experiments showed that the respiration, skin, some aspects of blood chemistry and composition, and salt gland function of 15-18 month old loggerhead sea turtles were

significantly affected. Oil was observed clinging to the nares and eyes and in the upper portion of the esophagus and was found in the feces of all turtles in the physiological experiments. Some similar effects were found in stranded oil fouled turtles. Based on these experimental results, it is our opinion that given the proper circumstances, sea turtles will be at risk in the event of an oil spill. Spills in the vicinity of nesting beaches are of special concern. Mitigation strategies for such an event are discussed. Dispersants with microbial nutrients are of interest, but they should only be used if they are found harmless to sea turtles.

Vazquez, G. F., M. C. Reyes, G. Fernandez, J. E. C. Aguayo, and V. K. Sharma. 1997. Contamination in Marine Turtle (*Dermochelys coriaca*) Egg Shells of Playon de Mexiquillo, Michoacan, Mexico. Bull. Environ. Contam. Toxicol. 58:326-333.
KEY WORDS: contamination, eggshells, grease, heavy metals, Mexico, oil, Playon de Mexiquillo, sea turtles, seawater
ABSTRACT: High levels of oil and grease in seawater and metals (cadmium, copper, zinc, nickel and lead) in sand may be responsible for contamination of turtle eggshells. Oil and grease may derive from recreational boating activities, and were higher in January and March.

Vicente, N. 1982. Analysis of Micropollutants (Heavy Metals, Pesticides, PCB) of a Leatherback Turtle (*Dermochelys coriacea* L.) Stranded on the Mediterranean Littoral. Vie Marine 4:75-79.
KEY WORDS: contamination, heavy metals, leatherback turtle, marine mammals, Mediterranean sea, PCBs, pollution
ABSTRACT: Grounding of leatherback turtle (*Dermochelys coriacea* L.) in the Mediterranean sea are uncommon, and it was interesting to make analysis to inspect the impact of pollution on this big matrating animal. Results show the existence of a contamination by heavy metals and pesticides that yet appear smaller than those of the mediterranean marine mammals.

Witham, P. R. 1978. Does a Problem Exist Relative To Small Sea Turtles and Oil Spills? Proc. Conf. the Assessment of Ecological Impacts of Oil Spills, American Institute of Biological Science, 1978.

Witkowski, S. A. and J. G. Frazier. 1982. Heavy Metals in Sea Turtles. Mar. Poll. Bull. 13:254-255.
KEY WORDS: barnacle, bone, heavy metals, olive ridley turtle, pilot study, sea turtles
ABSTRACT: This short report discusses a pilot study that analyzed adult cheloniid turtle bones and barnacle samples for heavy metals. It is difficult to interpret the significance of the findings because little is known about baseline levels and physiological effects of heavy metals in sea turtles.

Witzell, W. N. and W. G. Teas. 1994. The Impacts of Anthropogenic Debris on Marine Turtles in the Western North Atlantic Ocean. NOAA Tech. Memo. NMFS-SEFSC-355, 21 pp.
KEY WORDS: anthropogenic debris, entanglement, ingestion, marine debris, NMFS, petroleum, sea turtles, STSSN

ABSTRACT: The documentation of debris ingestion and entanglement has been fairly extensive, but overall estimates the magnitude of sea turtle/debris interaction are lacking and need to be addressed. The impacts of marine debris on threatened and endangered sea turtles must be assessed for resource managers to formulate sound recovery and management plans as mandated by the Endangered Species Act of 1973 and subsequent amendments. This report summarized the impacts of marine debris on sea turtles, by species, by geographic subregion, in the western north Atlantic from stranding data. Data were obtained from the National Marine Fisheries Service (NMFS) Sea Turtle Stranding and Salvage Network (STSSN) database. It was summarized by species and geographic subregion into three categories; 1) entanglement, 2) ingestion, and 3) petroleum impacts from 1980 through 1992.

Wood, P. D. and G. P. Cobb. 1994. Aroclor and Coplanar PCB Determination in Eggs of Loggerhead Sea Turtles and American Alligators from South Carolina. 207th National Meeting of the American Chemical Society. Abstracts of Papers American Chemical Society 207:204.

Supplemental Information

Albers, P. H., L. Sileo, and B. M. Mulhern. 1986. Effects of Environmental Contaminants on Snapping Turtles of a Tidal Wetland. Arch. Environ. Contam. Toxicol. 15:39-49.

KEY WORDS: contamination, environmental contaminants, Hackensack Meadowlands, metals, PCBs, snapping turtles, wetland

ABSTRACT: Snapping turtles (*Chelydra serpentina*) were collected from a brackish-water and a nearly freshwater area in the contaminated Hackensack Meadowlands of New Jersey and an uncontaminated freshwater area in Maryland to determine the effects of environmental contaminants on a resident wetland species. No turtles were observed or caught in the Meadowlands at two trapping sites that were the most heavily contaminated by metals. Snapping turtles from the brackish-water area had an unusually low lipid content of body fat and reduced growth compared to turtles from the freshwater areas in New Jersey and Maryland. Despite the serious metal contamination of the Hackensack Meadowlands, the metal content of kidneys and livers from New Jersey turtles was low and not greatly different from that of the Maryland turtles. Organochlorine pesticide concentrations in body fat were generally low at all three study areas. Polychlorinated biphenyls (PCBs) concentrations in fat were highest in male turtles from the New Jersey brackish-water area. Analysis of blood for amino-levulinic acid dehydratase, albumin, glucose, hemoglobin, osmolality, packed cell volume, total protein, triglycerides, and uric acid failed to reveal any differences among groups that would indicate physiological impairment related to contaminants.

Bergeron, J. M., D. Crews, and J. A. McLachlan. 1994. PCBs as Environmental Estrogens: Turtle Sex Determination as a Biomarker of Environmental Contamination. Environ. Health Perspect. 102:780-781.

KEY WORDS: endocrine function, environmental pollutants, PCBs, reproduction, reptile

ABSTRACT: Polychlorinated biphenyls (PCBs) are widespread, low-level environmental pollutants associated with adverse health effects such as immune suppression and teratogenicity. There is increasing evidence that some PCB compounds are capable of disrupting reproductive and endocrine function in fish, birds, and mammals, including humans, particularly during development. Research on the mechanism through which these compounds act to alter reproductive function indicates estrogenic activity, whereby the compounds may be altering sexual differentiation. Here we demonstrate the estrogenic effect of some PCBs by reversing gonadal sex in a reptile species that exhibits temperature-dependent sex determination.

Bishop, C. A., R. J. Brooks, J.H. Carey, and R. J. Norstrom. 1991. The Case for a Cause-Effect Linkage Between Environmental Contamination and Development in Eggs of the Common Snapping Turtle (*Chelydra S.serpentina*) from Ontario, Canada. J. Toxicol. Environ. Health 33:521-547.

KEY WORDS: *Chelydra serpentina*, contamination, eggs, Lake Erie, Lake Ontario, organochlorine contaminants, PCBs, snapping turtle

ABSTRACT: Concentrations of polychlorinated biphenyls (PCBs), dibenzo-p-dioxins, and dibenzofurans, organochlorine pesticides, and their metabolites were measured in eggs of the common snapping turtle (*Chelydra s. serpentina*) collected from four wetlands on the shorelines of Lakes Ontario, and Erie, and one control location in central Ontario, Canada. Snapping turtle eggs from these sites were also artificially incubated to determine hatching success, and incidence of deformities in embryo and hatchling turtles. The hypothesis that elevated incidences of egg death and/or deformities of hatchling turtles would occur in populations with high concentrations of organochlorine contaminants in eggs was tested. The results were elevated using epidemiological criteria. Unhatched eggs and deformities occurred at significantly higher rates in eggs from Lake Ontario wetlands. Two of three sites from Lake Ontario had substantially higher levels of PCBs, dioxins, and furans compared to eggs from Lake Erie and the control site. It could not be shown that contamination of eggs preceded the occurrence of poor development of eggs, although excellent hatching success and low numbers of deformities in eggs from the control site were considered representative of development in healthy eggs. The statistical association between contaminant levels in eggs and poor development of these eggs supported the hypothesis that eggs from sites with the greatest contamination had the highest rates of abnormalities. PCBs were the most strongly associated chemicals, although possible effects due to the presence of other chemicals in eggs was a confounding factor. The deformities and rates of unhatched eggs were similar to those occurring in other vertebrates collected from highly contaminated areas of the Great Lakes. There were several chemicals present in the eggs that can cause similar reproductive effects in other species; therefore a specific chemical effect was not identified. Results were coherent with known statistical and biological information. Theoretical and factual evidence of PCB contamination in wild-caught snapping turtles supported the hypothesis. However, lack of controlled studies of reproductive effects of polychlorinated hydrocarbons upon this species hindered the agreement of all factual and theoretical evidence with the hypothesis.

Bishop, C. A., R. J. Norstrom, R. J. Brooks, and K. E. Pettit. 1996. Temporal and Geographic Variation of Organochlorine Residues in Eggs of the Common Snapping Turtle (*Chelydra serpentina serpentina*) (1981-1991) and Comparisons to Trends in the Herring Gull (*Larus argentatus*) in the Great Lakes basin in Ontario, Canada. Arch. Environ. Contam. Toxicol. 31:512-524.

KEY WORDS: Great Lake Basin, herring gull, organochlorine contaminants, PCBs, PCDDs, PCDFs, snapping turtle, turtle eggs

ABSTRACT: Common snapping turtle (*Chelydra serpentina serpentina*) eggs from five sites within the Great Lakes basin, and from a reference site in north-central Ontario were collected during 1981-1991 and analyzed for four organochlorine pesticides, polychlorinated biphenyls (PCBs) including six non-ortho PCBs, polychlorinated dibenzodioxins (PCDDs), and polychlorinated dibenzofurans (PCDFs). The pattern of geographic variation was consistent over time in eggs with Cootes Paradise/ Hamilton Harbour and Lynde Creek eggs on Lake Ontario containing the highest concentrations and most PCDD and PCDF congeners among all sites. Eggs from Cranberry Marsh on Lake Ontario contained organochlorine concentrations similar to those from Big Creek Marsh and Rondeau Provincial Park on Lake

Erie except PCDDs and PCDFs which occurred at higher concentrations and more congeners were detectable in Cranberry Marsh eggs. Concentrations of most contaminants in turtle eggs from Algonquin Park, the reference site, have significantly decreased in the past decade. Dieldrin concentrations, however, increased in Algonquin Park eggs from 1981 to 1989. Significant decreases in concentrations of hexachlorobenzene, mirex and PCBs occurred between turtle eggs collected in 1981/84 and 1989 at Big Creek Marsh and Rondeau Provincial Park, whereas there was no significant change in concentrations of p,p'-DDE and dieldrin. In Lake Ontario eggs, concentrations of PCBs, p,p'-DDE and dieldrin increased significantly between 1984 and 1991. Differences were also found in patterns of temporal variation in contamination between herring gulls (*Larus argentatus*) and snapping turtles which were attributed to differences in diet. Elevated and continued contamination in turtle eggs from Lake Ontario is probably due to a combination of local sources of chemicals and consumption of large migratory fish that spawn in wetlands inhabited by these turtles.

Bonin, J., J.-L. DesGranges, C. A. Bishop, J. Rodrigue, A. Gendron, and J. E. Elliott. 1995. Comparative Study of Contaminants in the Mudpuppy (*Amphibia*) and the Common Snapping Turtle (*Reptilia*), St. Lawrence River, Canada. Arch. Environ. Contam. Toxicol. 28:184-194.

KEY WORDS: Canada, mudpuppy, organochlorine contaminants, polluted waters, snapping turtles

ABSTRACT: Levels of organochlorine pesticides, polychlorinated biphenyl (PCB) congeners and mercury were measured in mudpuppy bodies, livers and gonads and in snapping turtle eggs to determine how the composition and concentration of these bioaccumulated contaminants differ between the two species. Furthermore, the geographic variation in contamination patterns were examined between the highly polluted St. Lawrence River and the much less polluted Ottawa River, Canada. Principal component analysis performed with 69 tissue samples (30 samples of mudpuppy tissues and 39 turtle egg clutches) indicated distinct contamination patterns in the two species for PCB congeners; PCB congener composition in mudpuppies resembled the pattern reported for fish while the turtle pattern was more akin to the bird pattern. This could be related to the metabolic capacity of each species. The organochlorine pesticide contamination profile was also species-specific although highly variable among locations. Contamination profiles were similar for mudpuppy gonads and carcasses but lipid weight basis concentrations were often a little higher in gonads. In both species, geographic variations in contamination patterns were noticeable and significant differences in contamination levels were detected between Ottawa River and St. Lawrence River samples. However, in both species, concentrations varied considerably within a single location. Sources of variability are discussed although the basic life history of these species in the St. Lawrence River system is relatively unknown.

Bryan, A. M., P. G. Olafsson, and W. B. Stone. 1987. Disposition of Low and High Environmental Concentrations of PCBs in Snapping Turtle Tissues. Bull. Environ. Contam. Toxicol. 38:1000-1005.

KEY WORDS: albumin, contamination, lipoprotein solubility, PCB, snapping turtle

ABSTRACT: Two snapping turtles, *Chelydra serpentina*, were subjected to widely differing degrees of PCB environmental contamination to determine if the order of quantitative disposition of PCBs in the various tissues would be maintained as the concentration in each site increased. Two turtles were collected, one from a region of very low contamination and the other from a highly polluted area. The data suggest that the binding of PCB congeners by lipoproteins and albumin involve slowly reversible hydrophobic interactions with a quasi steady state between adipose tissue, blood and remaining tissues over the extremes of PCB concentrations. Their accumulation within the turtle shows an ordered preference for specific locations and the higher concentrations found in the latter regions reflect the lipoprotein solubility of PCBs.

Bryan, A. M., W. B. Stone, and P. G. Olafsson. 1987. Disposition of Toxic PCB Congeners in Snapping Turtle Eggs: Expressed as Toxic Equivalents of TCDD. Bull. Environ. Contam. Toxicol. 39:791-796.
KEY WORDS: eggs, fat bodies, PCBs, snapping turtles, TCDD, toxicology, toxicity
ABSTRACT: The present study was conducted to determine if the heavy fat bodies of the female snapping turtle provide a sufficiently large sink to retain the toxic congeners and prevent their incorporation into the eggs. The major factor controlling the elimination of toxic compounds involves metabolism. Toxicological studies have demonstrated that the most toxic PCB congeners, isosteriomers of tetrachlorodibenzo-p-dioxin (TCDD), require no metabolic activation. A comparison of the relative PCB toxicity associated with environmental samples, on the basis of total concentration of PCBs, is difficult. The environments from which the sample were taken may have differed markedly in the types of Aroclor to which they were subjected.

de Solla S.R., C.A. Bishop, G. Van Der Kraak, and R. J. Brooks. 1998. Impact of Organochlorine Contamination on Levels of Sex Hormones and External Morphology of Common Snapping Turtles (*Chelydra serpentina serpentina*) in Ontario, Canada. Environ. Health Perspect. 106:253-260.
KEY WORDS: organochlorine contaminants, PCBs, pesticides, sexual morphology, snapping turtles
ABSTRACT: Recent research has suggested that contaminants in the environment may influence sex differentiation and reproductive endocrine function in wildlife. Concentrations of organochlorine contaminants (total polychlorinated biphenyls, pesticides) were higher in the blood plasma of snapping turtles from contaminated sites than in those from reference sites. The ratio of the precloacal length to the posterior lobe of the plastron (PPR) is sexually dimorphic in snapping turtles. There were significant reductions in the PPR at three contaminated sites versus two reference sites. The magnitude of the response was such that a significantly higher proportion of PPRs of males from a contaminated site (Cootes Paradise) overlapped with those of females than PPRs of males from a reference site (Lake Sasajewun). Observers can incorrectly identify the sex of turtles at the contaminated site based on secondary sexual characteristics alone. Unlike the changes to the morphology, there were few changes in 17 beta-estradiol or testosterone levels, and where differences occurred, there was more variation among reference sites than between the reference and contaminated sites. Our results suggest that environmental contaminants may affect sexually dimorphic

morphology in snapping turtles without affecting circulating testosterone or estrogen levels in the adults.

Hebert, C. E., V. Glooschenko, G. D. Haffner, and R. Lazar. 1993. Organic Contaminants in Snapping Turtle (*Chelydra serpentina*) Populations from Southern Ontario, Canada. Archives of Environ. Contam. Toxicol. 24:35-43.
KEY WORDS: Canada, DDT, mirex, organochlorine contaminants, PCB, snapping turtle, toxicity
ABSTRACT: Organochlorine contaminant levels were measured in 78 adult snapping turtles collected from 16 sites in southern Ontario, Canada in 1988/89 to evaluate the risk to humans of consuming snapping turtles. Significant differences in turtle contaminant levels were observed among sites. Mean levels in muscle, at all sites, were below fish consumption guidelines for total polychlorobiphenyls (PCBs), total DDT and mirex. However, contaminant levels in older turtles from some sites exceeded guidelines values. Multivariate statistical techniques indicated the existence of a highly significant relationship between contaminant levels in adult female turtles and their eggs. Multivariate techniques also identified differences in contaminant composition in adult snapping turtles from sites in the Great Lakes where differences in reproductive success have been previously observed. The mono-ortho substituted PCB congener 2,3,3',4,4'-pentachlorobiphenyl (IUPAC #105) may be an important contributor to the toxic burden of snapping turtle populations.

Helwig, D. D. and M. E. Hora. 1983. Polychlorinated Biphenyl, Mercury, and Cadmium Concentrations in Minnesota Snapping Turtles. Bull. Environ. Contam. Toxicol. 30:186-190.
KEY WORDS: cadmium, *Chelydra serpentina*, concentrations, mercury, Minnesota, Mississippi River, polychlorinated biphenyls, snapping turtles
ABSTRACT: The primary objective of this study was to determine the concentrations of selected toxicants in the meat and fat bodies of the Minnesota snapping turtle, *Chelydra serpentina*. Turtles were collected from several locations in Minnesota and tissues were collected and analyzed for polychlorinated biphenyl, lipid, mercury and cadmium concentrations. Low levels of PCBs were found in the meat of all turtles collected from the Mississippi River and other locations along with low levels of mercury and cadmium found in all turtles sampled. High levels of PCBs, up to 60.5 mg/kg, were found in the fat of turtles collected from the Mississippi River below the Twin Cities.

Olafsson, P. G., A. M. Bryan, B. Bush, and W. Stone. 1983. Snapping Turtles: A Biological Screen for PCBs. Chemosphere 12:1525-1532.
KEY WORDS: Aroclor, DDE, Great lakes, Hudson River, Lake Ontario, mirex, organic compounds, organochlorine compounds, pollutant identification, polychlorinated biphenyls, turtles
ABSTRACT: Snapping turtles are capable of storing extremely high concentrations of organochlorine compounds in their fat without any apparent detrimental effect. This tolerance, to high bioconcentration, permits a wide gradation between the extremes in pollution levels and facilitates the detection of extremely toxic substances present in trace amounts. Consequently snapping turtles provide an excellent biological screen for these

compounds.

Ryan, J. J., B. P. Lau, J. A. Hardy, W. B. Stone, P. O'Keefe, and J. F. Gierthy. 1986. 2,3,7,8-Tetrachlorodibenzo-p-dioxin and Related Dioxins and Furans in Snapping Turtle (*Chelydra serpentina*) Tissue from the Upper St. Lawrence River. Chemosphere 15:537-548.
KEY WORDS: bioassay, contamination, gas chromatography, mass spectrometry, PCDD, PCDF, snapping turtle, St. Lawrence River, TCDD
ABSTRACT: Fat and liver samples from three snapping turtles (*Chelydra serpentina*) from the upper St. Lawrence River were analyzed for tetra- up to octa- chlorinated dibenzo-p-dioxins (PCDDs) and chlorinated dibenzofurans (PCDFs) by two gas chromatography - mass spectrometry techniques and by a bioassay. The tissues contained only 2,3,7,8-chlorine substituted PCDDs and PCDFs with high levels occurring for 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). On a wet weight basis, fat levels of 2,3,7,8-TCDD were 4 to 7 times higher than liver levels with up to 500 pg/g present in turtle fat. One fat sample also contained over 3 ng/g of 2,3,4,7,8-pentachlorodibenzofuran (PnCDF) suggestive of a PCB source of contamination. The TCDD levels in the turtles are consistent with the consumption of a fish diet containing about 20 pg/g 2,3,7,8-TCDD, a level currently found in eel samples from the same region. Comparison of this limited snapping turtle data with that of other aquatic species from the same and different bodies of water suggest that the Niagara River via Lake Ontario, could be a possible source of contamination of 2,3,7,8-TCDD for the St. Lawrence River. The results also show that turtles are excellent monitors for PCDD and PCDF contamination. Human consumption of turtle tissue samples containing the highest levels of 2,3,7,8-TCDD and PCDFs so far detected in wildlife samples may constitute a hazard.

Stone, W. B., E. Kiviat, and S. A. Butkas. 1980. Toxicants in Snapping Turtles. New York Fish and Game Journal 27:39-50.
KEY WORDS: toxicants, snapping turtles, Hudson River, contamination, human consumption, PCB, DDT
ABSTRACT: Selected tissues from 32 snapping turtles from New York waters were analyzed for organochlorine contaminants. High levels of organochlorines, especially PCBs were found in the fat (e.g., a mean of 2,990.60 ppm for the specimens from the Hudson River). Snapping turtles from the Hudson River and some other localities in the State seem unsuitable for human consumption because of contamination of their tissues with persistent pollutants. It is suggested that the snapping turtle would make a useful addition to the species used for monitoring, and finding, cumulative toxicants.

Struger, J., J. E. Elliot, C. A. Bishop, M. E. Obbard, R. J. Norstrom, D. V. Weseloh, M. Simon, and P. Ng. 1993. Environmental Contaminants in Eggs of the Common Snapping Turtle (*Chelydra serpentina serpentina*) from the Great Lakes-St. Lawrence River Basin of Ontario, Canada.. Journal of Great Lake Research 19:681-694.
KEY WORDS: bioaccumulation, Canada, *Chelydra serpentina serpentina*, chlorinated hydrocarbons, contamination, ecological effects, eggs, Great Lakes, organochlorine compounds, 2,3,4,7,8-pentachlorodibenzofuran, pesticides, polychlorinated biphenyls,

turtles, water pollution effects
ABSTRACT: Common snapping turtle eggs were collected at nesting sites from two locations in 1981 and eight locations in 1984 in Ontario, Canada, and analyzed for chlorinated hydrocarbons. Nine locations were within the Great Lakes-St. Lawrence River basin and one location, Algonquin Provincial Park, served as a control site outside the basin. Total PCBs ranged from 0.057 to 4.76 mg/kg (wet wt.) among the Great Lakes-St. Lawrence River samples. Mean total PCB concentration at Algonquin Park was 0.187 mg/kg. Eggs from Hamilton Harbour, Port Franks, Bay of Quinte/Murray Canal, and Lake St. Clair were the most contaminated among the ten sample locations. There was statistically significant variation in concentrations of all organochlorine compounds among sites. In some locations, there was high variation in contamination among clutches. A pool of eggs from Hamilton Harbour contained 67 ng/kg of 2378-tetrachlorodibenzo-p-dioxin and 14.0 ng/kg of 2,3,4,7,8-pentachlorodibenzofuran. Some dioxin congeners were present in turtle eggs at concentrations higher or equal to that in herring gull eggs from Hamilton Harbour. Comprehensive GC/MS analysis of the Hamilton Harbour eggs also revealed the presence of trace amounts of o,p'-dicofol, octachlorostyrene, and toxaphene. Geographic variation in contaminant levels in snapping turtle eggs from wetlands is similar to that in spottail shiners and herring gull eggs collected in the pelagic zone of the Great Lakes. This may be due to the consumption of migrant fish by snapping turtles in nearshore wetlands.

Watson, M. R., W. B. Stone, J. C. Okoniewski, and L. M. Smith. 1985. Wildlife as Monitors of the Movement of Polychlorinated Biphenyls and Other Organochlorine Compounds from a Hazardous Waste Site. In: Sayre, M. (Ed.) Transactions of the Northeast Section of the Wildlife Society 1985 Northeast Fish and Wildlife Conference. "Conflict and Communications in Natural Resource Management". Hartford, Connecticut, May 5-8, pp. 91-102.
KEY WORDS: biota, snapping turtle, short-tailed shrew, contamination, monitoring, PCB, toxic compounds, New York
ABSTRACT: This study investigated the movement of PCBs and associated organochlorine compounds from contaminated soil into biota near a hazardous waste site in the Town of Moreau, Saratoga County, New York. The waste site had received at least 452 tons of liquid wastes containing PCBs and other toxic compounds. The access road had been repeatedly treated with oil containing PCBs for dust control. PCB concentrations were as high as 6300 ppm in the access road. The data showed that PCBs were moving from the soil and accumulating in the biota. Some upper trophic level consumers showed extremely high levels of PCBs in their tissues. A snapping turtle (*Chelydra serpentina*) fat sample contained 4530 ppm, wwt. and a short-tailed shrew (*Blarina brevicauda*) carcass had 166 ppm, wwt. Other contaminants found moving into the food chain were chlorinated napthalenes, chlordane and its metabolites, and the highly toxic polychlorinated dibenzofurans. Toxicological analyses of wildlife specimens proved to be an effective means of discovered areas of chemical contamination and monitoring the escape of toxics such as PCBs from a hazardous waste site.