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# Biological Monitoring of Toxic Trace Metals Volume 2. Toxic Trace Metals in Plants and Animals of the World. Part I

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Prepared for

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Las Vegas, NV

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# BIOLOGICAL MONITORING OF TOXIC TRACE METALS
## Volume 2. Toxic Trace Metals in Plants and Animals of the World
## Part I

by

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16. ABSTRACT


The needs and priorities in using biological accumulator organisms for monitoring toxic trace metals in plants and animals are analyzed. The toxic trace metals selected for study are antimony, arsenic, beryllium, boron, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, tin, and vanadium. Data on the toxicity to humans, abundance, production, use and emissions of trace elements are presented and sources and pathways to plants and animals listed.

Volume 1 of the two volumes evaluates available data for the purpose of selecting biological monitoring organisms to monitor the 14 selected toxic metals, and recommends various organisms for use in national and international monitoring systems and networks. This study is based on the data compilation in Volume 2.

Volume 2 brings together the majority of the significant data on bioaccumulation and bioconcentration of the 14 trace metals discussed, which are considered to be of most importance to man and his food organisms. This volume provides a concise reference of baseline data for delineating the background or "normal" levels of toxic trace metals as well as levels that occur under various pollutant conditions.


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| a. DESCRIPTORS | b. IDENTIFIERS/OPEN ENDED TERMS | c. COSATI Field/Group |
|---|---|---|
| trace metals<br>antimony, arsenic, beryllium, boron, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, tin, vanadium<br>toxicology | bioaccumulation<br>bioconcentration<br>monitoring networks | 57Y<br>68G<br>99D |

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## FOREWORD

Protection of the environment requires effective regulatory actions based on sound technical and scientific data. The data must include the quantitative description and linking of pollutant sources, transport mechanisms, interactions, and resulting effects on man and his environment. Because of the complexities involved, assessment of exposure to specific pollutants in the environment requires a total systems approach that transcends the media of air, water, and land. The Environmental Monitoring Systems Laboratory at Las Vegas contributes to the formation and enhancement of a sound monitoring-data base for exposure assessment through programs designed to:

- develop and optimize systems and strategies for monitoring pollutants and their impact on the environment
- demonstrate new monitoring systems and technologies by applying them to fulfill special monitoring needs of the Agency's operating programs

Volume 1 of the two volumes in this report evaluates available data for the purpose of selecting biological monitoring organisms to monitor 14 of the more important toxic metals, and recommends various organisms for use in national and international monitoring systems and networks. This study is based on the data compilation in volume two.

Volume 2 brings together the majority of the significant data on bioaccumulation and bioconcentration of 14 of the trace metals of most importance to man and his food organisms. This volume provides a concise reference of baseline data for delineating the background or "normal" levels of toxic trace metals as well as levels that occur under various pollutant conditions.

The report was complied primarily to aid those who are seeking the best biological samplers to use in a biological monitoring system or network, and will help to show environmental movement, pathways, and sinks for selected metals in relation to biological organisms. Further information concerning these volumes and biological monitoring network design may be obtained from the Exposure Assessment Division at the Environmental Monitoring Systems Laboratory.

Glenn Schweitzer
Director
Environmental Monitoring Systems Laboratory
Las Vegas, Nevada

ABSTRACT

This volume reviews the concentration levels of fourteen selected toxic trace metals or matalloids in plants and animals of the world except man. The trace elements, selected on the basis of being toxic, being common or widespread, presenting a hazard or potential hazard, and becoming of greater importance, are antimony, arsenic, beryllium, boron, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, tin and vanadium.

This Volume 2 of two volumes lists data on the bioaccumulation and bioconcentration of the trace elements to provide the information required to select the best organisms for biological monitoring as described in Volume 1. Other objectives are to provide reference baseline data for delineating background or "normal" levels and levels that occur in polluted environments, to provide data on levels of trace metals that occur in food of man and domestic animals, and to show the ecological role organisms play in the environmental transport, pathways and sinks for these trace elements.

The compiled data are organized phylogenetically by taxonomic order of organisms for each trace metal. The data presented include the common and scientific name, geographic location, data on monitoring of environmental gradients, tissues analyzed, wet, dry or ash basis of measurement and the authority. The data are presented as ppm, or pCi/g for radioactive elements. The important toxic metals lead, cadmium, and mercury each have been measured in about 1,000 species of organisms.

Summaries of data on baselines, monitoring environmental gradients and selection of monitoring organisms are presented in Volume 1.

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Volume 2. Toxic Trace Metals in Plants and Animals of the World

Part I



Part II



Part III

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- Library, World Health Organization, Geneva, Switzerland.

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- Libraries, U.S. Environmental Protection Agency, Las Vegas, Nevada, and Washington, D.C.

- Library, National Research Council, Advisory Center on Toxicology, Washington, D.C.

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- Library, Mote Marine Laboratory, Sarasota, Fla.

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# I. INTRODUCTION

Toxic trace elements, especially those known as toxic metals or heavy metals, are becoming of greater importance to man as he mines and uses greater quantities of these metals and increases the pollution of his environment each year. There is still uncertainty concerning the levels of toxic metals that can be tolerated in the environment without causing health hazards to man. This is especially true with regard to long-term low-level exposures that may produce delayed effects after several decades. There is also the problem of contamination of biological organisms which serve as food, and the impact of these toxic materials on domestic animals and agricultural crops.

Bioaccumulation and bioconcentration of toxic elements by certain biological organisms cause increased interest to be focused on specific species of plants and animals. Some biological organisms are able to concentrate toxic metals many thousand times the level of metals found in aquatic systems. Some organisms can change the chemical form of an element to a more toxic form.

The presence of toxic trace elements in biological organisms is of great importance to man since he is dependent upon organisms for all of his food. The ingestion of toxic metals in food can have direct healh impacts either immediate or delayed. Toxic metals can also cause illness, death or decreased production in both animals and plants. The presence of trace elements in the biological organisms can be used to quantitatively measure the extent of contamination of man's environment. Changes in levels of toxic elements in organisms can also be used to show historic trends of pollution levels and to predict future levels.

In studying the relationships between toxic trace elements and biological organisms, the major areas of scientific interest and research are: 1) bioaccumulation, bioconcentration and biomagnification in organisms, 2) investigations concerning rate and type of accumulation in organisms following controlled exposure, and 3) toxicity studies to determine biological effects on organisms, including lethality and delayed effects, and 4) studies of effects on ecological communities and populations.

This compilation deals only with the first category on bioaccumulation, bioconcentration and biomagnification, with a small amount of data on experimental exposure to help delimit the special organisms or organs and tissues that would be of greatest value for biological monitoring.

The objective of this review (Volume 2) is to bring together the majority of the significant data available on bioaccumulation, bioconcentration and biomagnification of the most important toxic metals in biological organisms, except man. This study also provides data on the amounts of toxic metals that

occur in food organisms of man including domestic animals, agricultural crops, fish and shellfish. It provides reference baseline data for delineating the background or "normal" levels in addition to levels that occur under various pollutant concentrations of the environment. This review enables selection of those biological organisms and tissues which could provide the best biological samplers for establishing a monitoring system or network. It can also be used to show environmental movement, pathways, and sinks for selected metals in relation to biological organisms.

These data have been analyzed for use in biological monitoring in Volume 1. They have been summarized to show baseline levels and maximum concentrations in polluted areas. The data on use of biological organisms to measure environmental gradients of each trace metal have also been reviewed.

The toxic trace elements were selected on the basis of the following criteria:

1) The elements are toxic to man and/or his food organisms.

2) The elements are fairly common and widespread.

3) Exposure to elements is sufficient to cause a hazard or potential hazard.

4) The elements are becoming of greater importance due to increased production and/or use.

On the basis of these criteria 14 toxic trace elements were selected. These toxic metals or metalloids are the following: antimony (Sb), arsenic (As), beryllium (Be), boron (B), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni), selenium (Se), tin (Sn), and vanadium (V). Some of these, such as cadmium, lead and mercury, are of immediate importance while others, such as beryllium, boron, vanadium and others, do not appear to be of more than local importance at present. Also, additional trace elements, such as manganese, zinc and others could have been considered for inclusion in the list.

While the scope of this compilation is to provide a worldwide and comprehensive coverage for the selected toxic trace elements, no attempt was made to make a complete or exhaustive coverage of the world literature as it is not practical and would result in much duplication. The scope of the project increased by several times after its initiation due to the geometrically increasing volume of data appearing each year. It was necessary to establish a cutoff date in 1977.

In a review article entitled "Trace Metals in Soils, Plants, and Animals" published in 1972, Dr. Donald J. Lisk states:

> "Research dealing with the existence and association of essential metals in soils and their mobility, reactions, and effects in biological systems has been extensive. The recent discovery of relatively high levels of mercury in fish in North America has now focused intense concern on

numerous other potentially toxic metals such as lead, cadmium, arsenic, selenium, chromium, nickel, beryllium, antimony, barium, zirconium and others which may be ubiquitous in ecosystems. This, in turn, has stimulated a spiraling number of surveys and other investigations of their effects. It is thus perhaps unfortunate that a reviw such as this could not instead be prepared five years hence when the expected mountain of new data will have accrued."

It is now over 5 years hence, the surveys have spiraled, and the mountain of new data has accrued! This report is an attempt to retrieve, compile, and partially evaluate the most important part of the accured mountain.

SOURCES OF DATA

The enormous volume of scientific data on bioaccumulation of toxic metals in biological organisms is scattered throughout the world scientific and popular literature. It is published in books, scientific journals of a wide range of technical disciplines, as well as in international, national, state and institution journals, proceedings of many scientific meetings and symposia, journals on methodology of measurement, popular articles and in newspapers and magazines. The data have been published in 16 or more of the languages of the world.

The majority of data for this compilation were taken from the original publications, published in scientific journals and proceedings of scientific meetings and symposia. Many of these sources provided full details of all or most of the information required to complete the tabls. However, many foreign small or obscure journals or reports were not available, so that it was necessary to us abstracts, citations of data in scientific papers and review articles. In using these secondary sources, there was often loss of important detail such as scientific names, geographic location, tissue used, or whether reported on a wet, dry or ash basis.

Several reviews have been written on marine or aquatic organisms. The first major review or compilation of data on bioaccumulation of trace elements was made on marine organisms by Vinogradov (1953) in his book entitled "The Elementary Chemical Composition of Marine Organisms" published as a memoir by the Sears Foundation for Marine Research. While this is an excellent compilation (with the usual errors of transcription of most large compilations) it is unfortunately based on data using the often unreliable analytical methods of the period 1900 to 1950. While some of these data, e.g. after 1925, have been quoted for comparison, or in the absence of other data, many are highly suspect. A report entitled "Accumulation of Trace Metals by Marine Organisms, Fish-Eating Birds and Freshwater Fish" by P. T. Johnson (1973) was contributed to by the present reviewer. This compilation provided valuable earlier references for the present study. A report by Bernhard and Zattera (1975) "Major Pollutants in the Marine Environment" reviewed selected biological data on eight trace metals and included levels in sea water and sediments. A report by Phillips and Russo (1978) on "Metal Bioaccumulation in Fishes and Aquatic Invertebrates, A Literature Review" compiled primarily experimental exposure and uptake studies, and cited some surveys. This study is mainly outside of the scope of the present review and was not used.

No comprehensive reviews or compilations of data on concentrations of trace metals in terrestrial animals or plants was discovered. Various documents review data on the effects of specific toxic metals such as "WHO Criteria Documents" and "Reviews of Environmental Effects of Pollutants" by Oak Ridge National Laboratory and EPA. In addition, reviews on "Medical and Biologic Effects of Environmental Pollutants" by the Committee on Medical and Biologic Effects of Environmental Pollutants, National Academy of Sciences have summarized information on effects of specific pollutants.

In the Present compilation, review of the literature extended to 1977. Selected important documents were included after this date, especially for trace metals for which there was limited data. Compilations for some of the metals are fairly complete, but for some, such as mercury, it was necessary to select representative data since the volume of information was extensive and partly repetitious.

METHOD OF COMPILATION AND PRESENTATION OF DATA

An enormous amount of data on measurement of toxic elements in biological organisms has been published. It was necessary to compile these data in an organized, orderly and comparable fashion in order to allow evaluation of their significance and value, and to determine those species and the specific tissues best suited for developing efficient and effective biological monitoring systems and networks.

The most important available data published in the world literature on the bioaccumulation and bioconcentration of the 14 selected toxic trace metals have been compiled for all biological organisms except man. The data are presented for each toxic trace metal in a series of separate tables. The tables are organized by phylum and order in phylogenetic sequence starting with mammals and continuing with birds, reptiles, amphibia, fish, molluscs, arthropods, echinodrms, and other invertebrates. These are followed by higher plants (spermatophytes), mosses, lichens, fungi, and algae. In some cases, the mammals and birds have been divided into aquatic, predatory, or other groups, and fish have been divided into marine and freshwater species.

The species are designated with the scientific name, including genus and species and in some cases subspecies, and usually the common name (in English). For some species, especially fish, the scientific name has been changed. The species is then listed under the new scientific name and the older synonym name (as listed in the publications cited) is included in parentheses to permit reference to the publications, e.g. Melanogramma aeglefinus (=Gadus aeglefinus). Latest synonymy has been taken from various publications, such as Amer. Fish. Soc. (1970) "A List of Common and Scientific Names of Fishes from the United States and Canada." Where only a non-specific common name is given, e.g. shrimp, which could belong to any of several genera or species, the data are presented at the end of the alphabetical list of scientific names in the taxonomic group to which it belongs.

The geographic location of the collection site of the organism is given by country, State, or more specific location, or by ocean, sea, gulf, lake or river. Marine specimens are listed by the country nearst the collection area,

which usually means offshore from the country or State listed. If data on pollution contamination and concentration gradients were published, more specific geographic locations are usually presented.

Data are presented on levels of toxic trace elements in relation to polluted vs. non-polluted areas. The increase in bioaccumulation or bioconcentration resulting from pollution sources, whether natural or resulting from activitis of man, are of great importance in developing a biological monitoring system. The source of pollution or exposure is presented, and the metal concentration of exposed organisms is often compared with controls. If a gradient of the level of metal from a source occurs, and measurements have been made on biological organisms at different distances from the source, this has been included in concise form. The data in these tables using biological organisms to monitor environmental gradients of trace element metals have been summarized in Volume 1 to assist in selecting the best potential monitoring organisms.

The tissue (or organ) of an organism analyzed for trace metal content is presented if published. This is of great importance since certain tissues or organs bioaccumulate or bioconcentrate metals at different concentrations in comparison with other tissus or organs. It is important to select the best tissue(s) or organ(s) in developing an efficient biological monitoring system. Analysis of different tissues or organs of the same species are also presented if published. Some data are also available for comparing the metal contents of organisms of different size, age, or time of the year. Data on trace metal concentrations are also included for different years or over historical periods, if included in the publications.

The basis of calculation of concentration of a metal in an organism is critical, whether based on live or wet weight (W), dry weight (D), or ash weight (A). Even though the basis of calculation may be given, there is much inherent variation. An animal may be killed and drained of blood and drying may occur, or plants may air dry and wilt during shipment to the laboratory, yet the specimen may be considered on a live or wet weight basis. Some specimens are also washed to remove external contamination, and excess water allowed to air dry before analysis.

Dry weight basis is also variable since the specimen may be air dried (in high or low humidity) or oven dried at any of various temperatures. This may result in loss of some of the metal content. For example, it has been shown under certain conditions that 50 percent of the mercury may be lost by oven drying the specimens. The difference between live or wet weight and dry weight is usually about 80 percent but may be 90 percent or more in specific marine organisms such as comb jellies (Ctenophora) or in certain plants. In preserved bones, nails, or hair the difference between "wet" and "dry" basis may be less than 10 percent. The difference between air dry and oven dry can be considerable in some organisms.

The ash weight basis is probably less variable, but ashing the specimen can result in losss of the metal content. It is more difficult to convert ash weight to wet or dry weight for comparison. Ash weight basis formerly was used more frequently than in more recent studies. It has been used rather extensively in analyzing trace metal composition of plants.

Many of the publications consulted provide excellent details on methodology and techniques and careful statistical evaluation, but fail to state the basis for calculation of metal content. They may state that the specimens have been dried and/or ashed during the process of sample preparation, but fail to state the basis on which the data are calculated and presented.

If published papers include comparative wet, dry and ash basis data, these data are included in this review to help in evaluating and comparing closely related species for which comparable-basis data are not available.

The data in this report are expressed in parts per million (ppm) on a weight basis (except data on radionuclides). The data have been compiled from publications and reports that may present the original results as ppm, or as any of the following: picograms, nanograms, micrograms, milligrams, or as grams per gram, per 100 grams, per milligram, or per kilogram. Data are also presented in the literature as percent (%) per gram, per 100 grams, or per kilogram, or they are expressed as % times $10^{-6}$ or other exponent. All these were calculated by the reviewer to parts per million to permit better comparison and for ease of handling and analysis.

Data on content of radionuclides are presented as disintegrations per minute (dis/min) or more usually as picocuries per gram (pCi/g) or per milligram (pCi/mg). Limited experimental data on radionuclides are included because this usually involves uptake studis, which are not within the scope of this report.

The data on metal contents are often presented as a single figure representing a mean or a single measurement. Frequently the data include ranges indicating the minimum and maximum. These are presented by enclosing them in parentheses. This is frequently followed by the arithmetic mean. If the standard dviation (SD), or standard error (SE), has been calculated, this follows the mean with a plus-or-minus ($\pm$) sign. If the median or geometric mean are calculated, these are designated by (med.) or (geom. mean). For some data, when no arithmetic mean is presented in the publication, the mean has been calculated by the reviewer and included following the range.

Under "authority", the author (or authors) and the date of publication are given, which refers to the refernces listed under literature cited.

After careful evaluation, it was decided that the most critical data needed for selection of potential biological monitoring organisms are those items considered above. However, it is fully recognized that other information is highly desirable and would be of value, especially in evaluating the validity of the data. The information which could not be included due to space limitations were data on sample collection, sample preparation (some data are presented in this review on the effects of washing hair or leaf samples), sample size, analytical equipment and methods used, and validation (e.g. use of standard comparison samples or adding known quantities of an element to determine percent recovery). Many of the original publications consulted, present all or part of this information, while some do not. Therefore, if this information is needed, the data presented in this

river should be considered as a reference source for obtaining more detailed information. Also, since about 20 percent of the data in this voluminous compilation was taken from secondary sources such as reviews, abstracts, translations, and summary translations of some foreign articles, consulting the original publications may be desirable for more specific uses.

## PROBLEMS AND SOURCES OF ERROR IN EVALUATING DATA

There has been great improvement in the methods of analysis of toxic trace metals in biological materials since the compilation of data on toxic metals by Vinogradov (1953). However, this is a difficult technical field and there are many inherent problems and possible sources of errors in sampling, analyzing, and presentation of data.

Collection of samples first requires correct scientific identification of the species being sampled. There must be an adequate sample, preferably from a number of individual organisms of the same species. For example, in analyzing the toxic metals in bivalve molluscs, the weight, size, age, sex, exposure, temperature, salinity, time of year or season, position of sampling and coexistence of several metals are of importance (Phillips, 1977). In sampling animal or human hair to determine trace metal concentrations, the age, sex, location of hair on body, distance of hair sample from base of hair, external contamination, type of washing solution and washing procedures are of importance (Jenkins, 1979). In sampling plant material, the external contamination of leaves, branches, roots and bark is important. Various washing procedures with water, alcohol, or detergents may greatly affect the results (Martin & Little, 1973). Samples should be collected without contamination from metals in using collecting equipment, knives, and other dissection equipment, and storage containers.

There is inherent error in sampling, due to loss of blood and body fluids or plant sap which can affect measurement of body or plant weight. Unavoidable drying and dessication and washing procedures and removal of excess moisture is a source of error for live or wet basis measurement. For making measurements on a dry weight basis, error is possible depending on whether specimens are air dried (at different relative humidities) or at different oven temperatures.

Analysis of trace metal content is highly technical and requires use of modern improved analytical equipment and strict avoidance of any contamination. To obtain high precision and confidence in the results, it is necessary to use standard samples, e.g. standardized kale or orchard leaves, analysis of additions of known quantities of trace element, and interlaboratory comparison studies. This is most important when measuring levels near the threshold limits of detection of trace elements, or when the presence of other elements may affect the results. Interlaboratory comparisons of analytical procedures has helped greatly to reduce errors. More recent determinations, using more sophisticated and accurate analytic equipment and methods, have been given greater credence than earlier determinations. Some of the earlier data, before 1950, and selected data in the review by Vinogradov (1953) are presented for comparison only, and most should be considered as questionable or suspect, especially if the data are

greatly different from recent data analysed by more reliable equipment and methods. These older data have rarely been used in selecting proposed biological monitoring organisms and in analysis of biological monitoring of environmental gradients of trace elements in Volume 1.

In addition to problems and errors in sampling and analysis, there are also problems of human error in analysis, computation, copying, typographical, and printing errors, especially in abstracts, reviews and compilations where important data are often omitted, e.g. such as whether wet, dry or ash basis of measurement is used.

Despite all of the inherent and other potential errors in analyzing levels of trace metal elements in biological organiams, there is often good correlation of results even from different laboratories in different parts of the world. The relatively recent progress in improving analytical equipment and procedures has greatly increased the validity of data. In addition, for certain trace metals such as mercury, lead, and cadmium, there is often an adequate amount of confirmatory data for a specific tissue of a single species based on analyses by various workers, so that it is possible to accept the confirmed data as probably valid. While data in some studies may not be completely valid or confirmed, data have been used only for comparative purposes, such as comparison of levels in different tissues of the same species, or comparing samples at different distances from a source. These comparative data may be acceptable if done by the same laboratory.

It is necessary to consider all of these problems and errors and to treat the data with appropriate scientific reservation, especially older data. Nevertheless, there now exists an extremely valuable body of highly useful data on the levels and concentrations of toxic metals in biological organisms.

SPECIES OF PLANTS AND ANIMALS ANALYZED

The extent to which each trace metal has been analyzed in biological organisms is indicated in the summary of numbers of species of plants and animals analyzed. This shows that the important toxic metals lead, cadmium, and mercury have each been measured in about 1,000 species of organisms. If mercury had been more exhaustively reviewed the figure would increase substantially. There are also fairly large numbers of species analyzed for arsenic, chromium, cobalt, copper and nickel. While the number of species analyzed for beryllium (76 species) and for antimony, boron, and tin are relatively small, special effort was made to obtain all of the available data for these trace metals.

Many more species of animals than plants (about two times or more) have been analyzed for antimony, arsenic, cadmium, lead and mercury while more plant species have been analyzed for boron and nickel.

The numbers of species analyzed for each trace metal are probably a good indication of the level of effort and interest in each trace metal. The totals for all metals in the summary (vertical columns) includes counting some of the specis several times since in many cases the same species was analyzed for several different trace metals.

# II TRACE METALS IN BIOLOCICAL ORGANISMS.

## ANTIMONY IN MAMMALS (1)

| Species | Locality | Tissue | Analysis PPM (2) | | Authority |
|---|---|---|---|---|---|
| Pronghorn antelope *Antilocapra americana* | Idaho | hair | | (0.4-0.97) 0.86 | Huckabee et al. (1972) |
| Coyote *Canis latrans* | Wyoming | " | | (0.09-1.8) 0.67 | " |
| Guinea pig *Cavia porcellus* | United States | liver | D | (1.4-1.9)1.6 | Furr et al. (1976) |
| " " | " | kidney | D | (0.3-0.8)0.5 | " |
| " " | " | muscle | D | (0.5-2.5)1.5 | " |
| " " | " | adrenal | D | (2.3-9.5)5.1 | " |
| " " | " | spleen | D | (1.6-4.4)2.8 | " |
| Elk *Cervus canadensis* | Idaho | hair | | (0.9-13.0)4.2 | Huckabee et al. (1972) |
| Red-backed vole *Clethrionymys gapperi* | Wyoming | " | | (0.1-0.6)0.3 | " |
| Chipmunk *Eutamias sp.* | " | " | | 1.8 | " |
| Vole *Microtus longicaudus* | Idaho | " | | 2.4 | " |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation, standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | | |
|---|---|---|---|---|---|
| Mountain vole<br>*Microtus montanus* | Wyoming | hair | | 1.9 | Huckabee et al. (1972) |
| Meadow vole<br>*Microtus pennsylvanicus* | " | " | | 1.3 | " |
| Richardsons vole<br>*Microtus richardsoni* | " | " | | 0.7 | " |
| Mouse<br>*Mus musculus* | | lung | W | 0.012 | Molokhia & Smith (1969) |
| " " | | kidney | W | 0.01 | " |
| " " | | spleen | W | 0.01 | " |
| " " | | liver | W | 0.007 | " |
| " " | | bone | W | 0.006 | " |
| " " | | other organs | W | <0.005 | " |
| " " | 15 days after ingestion of Sb, highest levels were in teeth, and flat bones of skull | | | | " |
| " " | Dosed with 20 mg/kg tartar emetic--to 16 hrs.: | | | | Smith (1970) |
| " " | " " | plasma | W | (0.35-2.35) | " |
| " " | " " | RBC | W | (0.33-5.88) | " |
| Mule deer<br>*Odocoileus hemionus* | Idaho | hair | | (0.06-12.0)4.2 | Huckabee et al. (1972) |
| Mountain goat<br>*Oreamnus americanus* | " | " | | (0.28-0.29) | " |
| Bighorn sheep<br>*Ovis canadensis* | Wyoming | " | | 1.0 | " |

| | | | | | |
|---|---|---|---|---|---|
| Harbor seal *Phoca vitulina* | Great Britain | blood | W | 0.002±0.001 | Hamilton (1976) |
| " " | " | spleen | W | 0.02±0.01 | " |
| " " | " | heart | W | 0.03±0.01 | " |
| " " | " | muscle | W | 0.004±0.0007 | " |
| " " | " | kidney | W | 0.004±0.001 | " |
| " " | " | liver | W | 0.008±0.003 | " |
| Shrew *Sorex vagrans* | Wyoming | hair | | (0.3-2.5) 1.14 | Huckabee et al. (1972) |
| *Zapus princeps* | " | " | | 0.0 | " |
| " " | " | | | 0.06 | " |

## ANTIMONY IN BIRDS (1)

| Species | Locality | Tissue | Analysis PPM (2) | | Authority |
|---|---|---|---|---|---|
| Mallard duck *Anas platyrhynchos* | Canada | feather | D | <0.2 | Kelsall (1970) |
| Black duck *Anas rubripes* | " | " | D | <0.2 | " |
| White-fronted goose *Anser albifrons* | " | " | D | <0.2 | " |
| Lesser scaup *Aythya affinis* | " | " | D | <0.2 | " |

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## ANTIMONY IN MARINE FISH (1)

| Species | Locality | Tissue | Analysis (2) PPM | | Authority |
|---|---|---|---|---|---|
| Silverfish<br>*Argyrozona argyrozona* | S.W. Africa | muscle | W | 0.029 | Van As et al. (1975) |
| *Atractoscion aequidens* | " | " | W | 0.059 | " |
| Bogue<br>*Boops boops* | Adriatic Sea | | W | 0.16 | Strohal et al. (1975) |
| Pilchard<br>*Clupea pilchardus* | " | | W | 0.61 | " |
| *Chrysoblephus gibbiceps* | S.W. Africa | muscle | W | 0.0020 | Van As et al. (1975) |
| Wrasse<br>*Ctenolabrus rupestris* | Sweden | | D | 0.2 | Noddack & Noddack (1940) |
| Lanternfish<br>*Diaphus dumerili* | N.W. Africa | | D | 0.022 | Leatherland et al. (1973) |
| Adriatic anchovy<br>*Engraulis encrasicholus* | Adriatic Sea | | W | 0.51 | Strohal et al. (1975) |

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| | | | | | |
|---|---|---|---|---|---|
| Priest shark<br>*Etomopterus spinax* | N.W. Africa | liver | D | (0.003-0.01) | Leatherland et al. (1973) |
| Rock cod<br>*Gadus callarius* | Great Britain | muscle | D | 0.011 | Leatherland & Burton (1974) |
| Lanternfish<br>*Hygophum macrochir* | N.W. Africa | | D | 0.025 | Leatherland et al. (1973) |
| Kabeljou<br>*Johnius holologidotus* | S.W. Africa | muscle | W | 0.013±SD 0.006 | Van As et al. (1975) |
| *Lithognathus lithognathus* | " | " | W | 0.019 | " |
| Angler<br>*Lophius piscatorius* | " | " | W | 0.066 | " |
| Hake<br>*Merluccius capensis* | " | " | W | 0.075±SD 0.062 | " |
| Dover sole<br>*Microstomus pacificus* | Los Angeles | liver | W | (0.001-0.007) | DeGoeij et al. (1974) |
| Bass<br>*Morone labrax* | Great Britain | muscle | D | 0.010 | Leatherland & Burton (1974) |
| Mullet<br>*Mugil richardsoni* | S.W. Africa | " | W | 0.024 | Van As et al. (1975) |
| Hottentot<br>*Pachymetopon grande* | " | " | W | 0.19 | " |
| Sea bream<br>*Pagellus erithrinus* | Adriatic Sea | | W | 0.24 | Strohal et al. (1975) |
| *Platichthys flesus* | Great Britain | muscle | D | 0.006 | Leatherland & Burton (1974) |
| Sardine<br>*Sardinops ocellata* | S.W. Africa | " | W | 0.26 | Van As et al. (1975) |
| Chub mackerel<br>*Scomber japonicus* | " | | W | 0.19±SD 0.17 | " |

| | | | | | |
|---|---|---|---|---|---|
| Atlantic mackerel<br>Scomber scombrus | Adriatic Sea | | W | 0.52 | Strohal et al. (1975) |
| " " | Great Britain | muscle | D | 0.006 | Leatherland & Burton (1974) |
| Atlantic saury<br>Scomberesox saurus | N.W. Africa | " | D | 0.003 | Leatherland et al. (1973) |
| " " | " | heart | D | 0.017 | " |
| " " | " | liver | D | 0.007 | " |
| Scombrops dubius | S.W. Africa | muscle | W | 0.055 | Van As et al. (1975) |
| Yellowtail<br>Seriola pappei | " | " | W | 0.057±SD 0.042 | " |
| Sole<br>Solea solea | Adriatic Sea | | W | 0.49 | Strohal et al. (1975) |
| Dogfish shark<br>Squalus acanthius | Sweden | | D | 0.2 | Noddack & Noddack (1940) |
| Sole<br>Synaptura marginata | S.W. Africa | muscle | | 0.14±SD 0.09 | Van As et al. (1975) |
| Horse mackerel<br>Trachurus trachurus | Adriatic Sea | | W | 0.05 | Strohal et al. (1975) |
| " " | S.W. Africa | muscle | W | 0.028 | Van As et al. (1975) |
| Rouget, sea robin<br>Triglia capensis | " | " | W | 0.020 | " |
| Kingslip<br>Xiphurus capensis | " | " | W | 0.037± SE 0.032 | " |
| "Fish" | | | | (0.0005-0.009) | Rancitelli et al. (1969) |
| " | | | | (0.0001-0.11) | " |

## ANTIMONY IN FRESHWATER FISH (1)

| Species | Locality | Tissue | Analysis PPM (2) | | Authority |
|---|---|---|---|---|---|
| Whitefish<br>*Alburnus sp.* | Danube R.<br>Austria | | D | 0.0 | Rehwoldt et al. (1975) |
| Alewife<br>*Alosa pseudoharengus* | Great Lakes | whole | W | (0.005-0.1) | Lucas et al. (1970) |
| Eel<br>*Anguilla anguilla* | Great Britain | muscle | D | 0.015 | Leatherland & Burton (1974) |
| Goldfish<br>*Carassius auratus* | Great Lakes | liver | W | (0.005-0.1) | Lucas et al. (1970) |
| Lake herring<br>*Coregonus artedii* | " | " | W | (0.005-0.1) | " |
| Lake whitefish<br>*Coregonus clupeaformis* | " | muscle | W | (0.0022-0.0031) | Uthe & Bligh (1971) |
| " " | " | liver | W | (0.005-0.1) | Lucas et al. (1970) |

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| | | | | | |
|---|---|---|---|---|---|
| Carp<br>*Cyprinus carpio* | Danube R.<br>Austria | | D | 0.0 | Rehwoldt et al. (1975) |
| Northern pike<br>*Esox lucius* | Great Lakes | muscle | W | (0.0032-0.0043) | Uthe & Bligh (1971) |
| White bass<br>*Morone chrysops*<br>(= *Roccus chrysops*) | " | liver | W | (0.005-0.1) | Lucas et al. (1970) |
| Spottail shiner<br>*Notropis hudsonius* | " | whole | W | (0.005-0.1) | " |
| American smelt<br>*Osmerus mordax* | Lake Erie | muscle | W | 0.0035 | Uthe & Bligh (1971) |
| Yellow perch<br>*Perca flavescens* | " | " | W | 0.0031 | " |
| Trout-perch<br>*Percopsis omiscomaycus* | Great Lakes | whole | W | (0.005-0.1) | Lucas et al. (1970) |
| Round whitefish<br>*Prosopium cylindraceum* | " | liver | W | (0.005-0.1) | " |
| Lake trout<br>*Salvelinus namaycush* | " | " | W | (0.005-0.1) | " |
| " " | New York | | W | (0.046-0.86) | Tong et al. (1974) |
| Walleye pike<br>*Stizostedion vitreum vitreum* | Great Lakes | | W | (0.005-0.1) | Lucas et al. (1970) |

ANTIMONY IN LOWER ANIMALS (1)

| Species | Locality | Tissue | Analysis (2) PPM | | Authority |
|---|---|---|---|---|---|
| MOLLUSCA | | | | | |
| Buttercup *Anodonta cygnea* | Great Britain | | D | (0.029-0.054) | Leatherland & Burton (1974) |
| Northern whelk *Buccinum undatum* | " | | D | 0.012 | " |
| Edible cockle *Cerastoderma edule* (=Cardium edule) | " | soft parts | D | (0.034-0.063 | " |
| " " | " | mantle cavity | D | 0.18 | " |
| Black mussel *Choromytilus meridionalis* | S.W. Africa | soft parts | W | 0.20 | Van As et al. (1975) |
| Portuguese oyster *Crassostrea angulata* | Great Britain | " | D | 0.0 | Leatherland & Burton (1974) |
| American oyster *Crassostrea virginica* | Texas | shell | D | 1.0 | Smith & Wright (1962) |

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| | | | | | |
|---|---|---|---|---|---|
| Atlantic slipper shell<br>Crepidula fornicata | Great Britain | | D | (0.038-0.053) | Leatherland & Burton (1974) |
| White mussel<br>Donax sera | S.W. Africa | soft parts | W | 0.18±SD 0.08 | Van As et al. (1975) |
| Abalone<br>Haliotus midae | " | muscle | W | 0.083 | " |
| Periwinkle<br>Littorina littoralis | Great Britain | | D | 0.124 | Leatherland & Burton (1974) |
| Periwinkle<br>Littorina littorea | Great Britain | | D | (0.095-0.10) | " |
| Squid<br>Loligo vulgaris | Adriatic Sea | | W | 0.84 | Strohal et al. (1975) |
| Blue mussel<br>Mytilus edulis | New Zealand | | D | <30.0 | Brooks & Rumsby (1965) |
| " " | Great Britain | | D | (0.042-0.047) | Leatherland & Burton (1974) |
| Mussel<br>Mytilis galloprovincialis | Adriatic Sea | soft parts | W | 0.51 | Strohal et al. (1975) |
| Dog whelk<br>Nucella lapillus | Great Britain | | D | (0.007-0.014) | Leatherland & Burton (1974) |
| Octopus<br>Octopus vulgaris | Adriatic Sea | | W | 0.92 | Strohal et al. (1975) |
| Oyster<br>Ostrea edulis | Great Britain | | D | (0.010-0.015) | Leatherland & Burton (1974) |
| Oyster<br>Ostrea sinuata | New Zealand | muscle | D | 80.0 | Brooks & Rumsby (1965) |
| " " | " | other organs | D | <30.0 | " |

| | | | | | |
|---|---|---|---|---|---|
| European limpet<br>*Patella vulgata* | Great Britain (contam. area) | | D | 0.12 | Leatherland & Burton (1974) |
| " " | " (non-contam.) | | D | (0.060-0.070) | " |
| Scallop<br>*Pecten novaezelandiae* | New Zealand | | D | <30.0 | Brooks & Rumsby (1965) |
| Squid<br>*Sepia officinalis* | Great Britain | gill | D | 0.026 | Leatherland & Burton (1974) |
| " " | " | mantle | D | 0.010 | " |
| CRUSTACEA | | | | | |
| Decapod<br>*Acanthephyra eximia* | N.W. Africa | | D | 0.035 | Leatherland et al. (1973) |
| Copepod<br>*Acartia clausi* | Greece | | D | (0.06-1.1)<br>0.31 | Zafiropoulos & Grimanis (1977) |
| "Amphipods" | S.W. Africa | | W | 0.009 | Van As et al. (1975) |
| "Copepods" | " | | W | (0.037-6.1) | " |
| " | Adriatic Sea | | W | (0.12-0.40) | Strohal et al. (1975) |
| *Diplodus annularis* | " | | W | 0.23 | " |
| Mysidacid<br>*Eucopia sculpticauda* | N.W. Africa | whole | D | 0.011 | Leatherland et al. (1973) |
| Rock lobster<br>*Jasus lalandii* | S.W." | muscle | W | 0.12±SD 0.07 | Van As et al. (1975) |
| Copepod<br>*Labidocera acutifrons* | N.W. " | whole | D | 0.037 | Leatherland et al. (1973) |
| Decapod<br>*Leander serratus* | Adriatic Sea | | W | 0.53 | Strohal et al. (1975) |

| | | | | | |
|---|---|---|---|---|---|
| Euphausid<br>*Meganyctiphanes norvegica* | N.W. Africa | whole | D | 0.037 | Leatherland et al. (1973) |
| Decapod<br>*Oplophorus sp.* | " | | D | 0.055 | " |
| Shrimp<br>*Palaemon elegans* | Great Britain | | D | 0.016 | Leatherland & Burton (1974) |
| Decapod<br>*Systellaspis debilis* | N.W. Africa | | D | 0.013 | Leatherland et al. (1973) |
| ECHINODERMATA | | | | | |
| Sea urchin<br>*Arbacia lixula* | Adriatic Sea | whole | D | 5.5 | Papadopoulou & Kanias (1976) |
| Sea star<br>*Asterias rubens* | Sweden | no viscera | D | 0.10 | Noddack & Noddack (1940) |
| " " | Great Britain | | D | 0.010 | Leatherland & Burton (1974) |
| Sea urchin<br>*Brissopsis lyrifera* | Sweden | no viscera | D | 0.18 | Noddack & Noddack (1940) |
| Sea urchin<br>*Echinaster sepositus* | Adriatic Sea | whole | D | 0.020 | Papadopoulou & Kanias (1976) |
| Sea cucumber<br>*Holothuria tubulosa* | " | " | D | 0.050 | " |
| Starfish<br>*Marthasterias glacialis* | Great Britain | | D | 0.027 | Leatherland & Burton (1974) |
| " " | Greece | whole | D | 0.020 | Papadopoulou & Kanias (1976) |
| Serpent star<br>*Ophioderma longicauda* | Adriatic Sea | " | D | 0.010 | " |

| | | | | | |
|---|---|---|---|---|---|
| Sea urchin<br>*Paracentrotus lividus* | Adriatic Sea | whole | D | 0.070 | Papadopoulou & Kanias (1976) |
| Sea urchin<br>*Sphaerechinus granularis* | " | " | D | 0.13 | " |
| Sea cucumber<br>*Stichopus tremulus* | Sweden | no viscera | D | 0.24 | Noddack & Noddack (1940) |
| TUNICATA | | | | | |
| Tunicate<br>*Botryllus schlosseri* | Great Britain | | D | 0.26 | Leatherland & Burton (1974) |
| Tunicate<br>*Ciona intestinalis* | Sweden | | D | 0.10 | Noddack & Noddack (1940) |
| " " | Greece | whole | W | 0.0070 | Papadopoulou & Kanias (1977) |
| " " | " | " | D | 0.16 | " |
| " " | " | tunic | W | 0.0050 | " |
| " " | " | " | D | 0.15 | " |
| " " | " | other than tunic | W | 0.016 | " |
| " " | " | " | D | 0.40 | " |
| Tunicate<br>*Microcosmus sulcatus* | " | whole | W | 0.016 | " |
| " " | " | " | D | 0.10 | " |
| Tunicate<br>*Pyrosoma sp.* | N.W. Africa | " | D | 0.023 | Leatherland et al. (1973) |
| Tunicate<br>*Styela clava* | Great Britain | " | D | 0.15 | Leatherland & Burton (1974) |
| PORIFERA | | | | | |
| Sponge<br>*Halichondria panicea* | N.W. Africa | | D | 0.089 | " |

| | | | | | |
|---|---|---|---|---|---|
| Sponge<br>*Halichondria sp.* | Sweden | | D | 0.08 | Noddack & Noddack (1940) |
| COELENTERATA | | | | | |
| Jellyfish<br>*Cyanea capillata* | " | whole | D | 0.16 | " |
| " " | New England | " | A | ND | Nicholls et al. (1959) |
| Sea anemone<br>*Metridium dianthus* | Sweden | | D | 0.23 | Noddack & Noddack (1940) |
| *Tealia felina* | Great Britain | | D | 0.022 | Leatherland & Burton (1974) |
| ANNELIDA | | | | | |
| Ragworm<br>*Nereis diversicolor* | " | | D | 0.031 | " |
| PROTOZOA | | | | | |
| *Schistosoma mansoni* | | | D | 1.0 | Smith (1970) |
| SCYPHAZOA | | | | | |
| *Pelagia sp.* | N.W. Africa | whole | D | 0.043 | Leatherland et al. (1973) |
| CHAETOGNATHA | | | | | |
| Arrowworm<br>*Sagitta sp.* | S.W. Africa | | W | (0.22-1.2) | Van As et al. (1975) |

## ANTIMONY IN HIGHER PLANTS (1)

| Species | Locality | Tissue | Analysis (2) PPM | | Authority |
|---|---|---|---|---|---|
| "Angiosperms" | | | D | 0.6 | Bowen (1966) |
| Swiss chard<br>*Beta vulgaris cicla* | United States (grown in soil pH 5.5) | | D | 2.2 | Furr et al. (1976) |
| " " " | " " " pH 6.5 | | D | 4.4 | " |
| " " " | " " " pH 6.0 | | D | 3.7 | " |
| " " " | " (sludge fortified, pH 6.5) | | D | 11.5 | " |
| " " " | " " " pH 5.5 | | D | 6.1 | " |
| Kale<br>*Brassica oleracea acephala* | | | | 0.07 | Rancitelli et al. (1969) in O'Toole et al. (1971) |
| Northern reed grass<br>*Calamagrostis canadensis* | N.W. Territories | leaf & stem | D | (2.47-15.4) | O'Toole et al. (1971) |
| Tea<br>*Camellia sinensis* | | leaf | | 0.04651±SD 0.00625 | Shah et al. (1971) |
| Orange<br>*Citrus sinensis* | | | | 0.00004 | In O'Toole et al. (1971) |

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| | | | | | |
|---|---|---|---|---|---|
| Coffee<br>Coffea arabica | | bean | | (0.00554-0.0158) | Shah et al. (1971) |
| Tobacco<br>Nicotiana tabacum | | leaf | | 10.6 | Nadkarni et al. (1970) |
| " " | | in cigarette smoke | | 1.9 | " |
| " " | | leaf | D | 2.8 | Nadkarni & Ehman (1970) |
| " " | | stem | D | 0.66 | " |
| " " | | tobacco, cigarette | D | (0.3-38.0) | " |
| " " | | ", pipe | D | (8.5-13.0) | " |
| " " | | ", cigar | D | (0.5-1.2) | " |
| Ponderosa pine<br>Pinus ponderosa | Idaho | wood | D | (0.0023-0.011) | Sheppard & Funk (1925) |
| Wild rose<br>Rosa acicularis | N.W. Territories Dist. from smelter (mi): | | | | O'Toole et al. (1971) |
| " " | " " 0.4 | leaf & stem | D | 1.85 | " |
| " " | " " 0.8 | " | D | 1.82 | " |
| " " | " " 1.8 | " | D | 0.79 | " |
| " " | " " 1.9 | " | D | 0.17 | " |
| Eel grass<br>Zostera marina | Adriatic Sea | | W | 0.093 | Strohal et al. (1975) |
| Various plant species | Florida | | | 0.0 | Carrigan & Rogers (1940) |
| Wire grass | United States (salt-sick & healthy areas) | | | 0.0 | Russoff (1937) |

| | | | | |
|---|---|---|---|---|
| Plant parts in children's insitutional diet | | | (0.209-0.693) | Murthy et al. (1971) |
| "Honey" | New York | W | (0.001-0.014) | Tong et al. (1975) |

## ANTIMONY IN ALGAE (1)

| Species | Locality | Tissue | Analysis PPM (2) | | Authority |
|---|---|---|---|---|---|
| Red alga *Ahnfeltia plicata* | Great Britain | | D | 0.080 | Leatherland & Burton (1974) |
| Red alga *Chondrus crispus* | " | | D | 0.019 | " |
| Brown alga *Cystoseira abrotanifolia* | Adriatic Sea | | W | 0.22 | Strohal et al. (1975) |
| Kelp *Ecklonia maxima* | S.W. Africa | | W | 0.082±SD 0.028 | Van As et al. (1975) |
| Brown alga *Fucus serratus* | Great Britain | | D | 0.047 | Leatherland & Burton (1974) |
| Brown alga *Fucus versoides* | Adriatic Sea | | W | 0.14 | Strohal et al. (1975) |
| Red alga *Gigartina rachula* | S.W. Africa | | W | 0.24 | Van As et al. (1975) |
| Brown alga *Halidrys siliquosa* | Great Britain | | D | 0.060 | Leatherland & Burton (1974) |

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| | | | | | |
|---|---|---|---|---|---|
| Brown alga<br>*Laminaria digitata* | Great Britain | | D | 0.029 | Leatherland & Burton (1974) |
| Brown alga<br>*Laminaria hyperborea* | | frond | D | 0.09 | Lunde (1970a) |
| Brown alga<br>*Laminaria saccharina* | Great Britain | | D | 0.016 | Leatherland & Burton (1974) |
| Red alga<br>*Porphyra capensis* | S.W. Africa | | W | 0.21±SD 0.15 | Van As et al. (1975) |
| Red ribbons<br>*Suhria vittata* | " | | W | 0.23 | " |
| Sea lettuce<br>*Ulva lactuca* | Adriatic Sea | | W | 0.067 | Strohal et al. (1975) |
| Sea lettuce<br>*Ulva spp.* | S.W. Africa | | W | 0.16±SD 0.09 | Van As et al. (1975) |
| Green algae | Germany, Dortmund | | D | (0.1-1.2)<br>0.45 | Payer et al. (1975) |
| " " | Bangkok, Thailand | | D | (0.15-0.3)<br>0.22 | " |
| Algae (marine) | | | | 0.8 | Bowen (1966) |
| Algae | Danube R. Austria | | D | (1.51-7.87)<br>4.3 | Rehwoldt et al. (1975) |

(1)

ARSENIC IN MAMMALS

| Species | Locality | Tissue | Analysis PPM (2) | | Authority |
|---|---|---|---|---|---|
| Fin whale *Balaenoptera physalis* | Antarctica | blubber, oil | W | 1.8 | Lunde (1967) |
| " " | " | muscle, bone, blubber, oil | W | 2.3 | " |
| " " | " | muscle, oil | W | 2.4 | " |
| " " | " | muscle | D | 0.36 | " (1970) |
| " " | " | water soluble, muscle | D | 0.9 | " |
| Cow *Bos bovis* | United States | muscle | W | 1.3 | Schroeder & Balassa (1966) |
| " " | " " | milk, evap. | W | 0.17 | " |
| " " | " " | unsalted butter | W | 0.23 | " |

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| | | | | | | |
|---|---|---|---|---|---|---|
| Cow *Bos bovis* | | | muscle | | 0.056 | Kingsley et al. (1951) |
| " " | Montana | | " | W | 0.2 | Lewis (1972) |
| " " | " | | liver | W | 0.05 | " |
| " " | Washington, dairy cattle downwind from Cu smelter | 10-13 mi | hair | W | (3.7-19.0) 8.9 | Orheim et al. (1974) |
| " " | " " " | | milk | W | (0.007-0.02) 0.013 | " |
| " " | " " " | | blood | W | (0.023-0.030) 0.0258 | " |
| " " | " " (controls) | 37 mi. | hair | W | (0.13-0.84)0.46 | " |
| " " | " " " | | milk | W | (0.003-0.01) 0.0025 | " |
| " " | " " " | | blood | W | (0.001-0.015) 0.0094 | " |
| " " | | | 20 X increase of As in hair & urine 2 X control | | | " |
| " " | Germany | | Cattle died near Cu smelter | | | Bischoff & Haun (1939) |
| " " | | | calf, muscle | W | (0.005-0.1) | Barnard (1911) |
| " " | | | | W | 0.008 | " |
| " " | Italy | | " | W | 0.52 | Pezzeri (1970) |
| " " | | | calf liver | W | 0.15 | " |
| " " | | | liver | W | 0.063 | Orvini et al. (1974) |

| | | | | | |
|---|---|---|---|---|---|
| Cow<br>*Bos bovis* | | milk | W | (0.0005-0.07) | Barnard (1911) |
| " " | United States | muscle | W | (ND-0.1)0.02 | Jelinek & Corneliussen (1977) |
| " " | " | liver | W | (ND-0.05)0.03 | " |
| " " | " | milk | W | (ND-0.2)0.02 | " |
| Northern fur seal<br>*Callorhinus ursinus* | Pribilif Islands | kidney | W | <0.2 | Anas (1974) |
| " " | " | liver | W | <0.2 | " |
| Rock squirrel<br>*Callospermophilus lateralis* | Utah | " | D | (0.1-9.4) | Sharma & Shupe (1975) |
| Guinea pig<br>*Cavia porcellus* | Maryland | " | D | (0.06-0.21) | Furr et al. (1976) |
| " " | " | kidney | D | (0.01-0.04) | " |
| " " | " | muscle | D | (0.06-0.12) | " |
| " " | " | adrenal | D | (0.1-0.54) | " |
| " " | " | spleen | D | (0.02-0.25) | " |
| Common dolphin<br>*Delphinus delphis* | New Zealand | liver | W | (0.13-0.8) | Koeman et al. (1972) |
| Opossum<br>*Didelphis marsupialis virginiana* | Tennessee | | D | 0.2 | Andren et al. (1973) |
| Horse<br>*Equus caballus* | Montana | mane | D | (0.0-7.5) | Lewis (1972) |
| " " | " dist. from smelter 1.0 mi SSE | | D | (2.1-7.5)4.2 | " |
| " " | " " N 1.0 mi | | D | (0.0-4.5)1.3 | " |
| " " | " " E 2.9 mi | | D | (0.0-4.4)0.34 | " |

| | | | | | | |
|---|---|---|---|---|---|---|
| Horse<br>Equus caballus | | Montana, dist. from smelter 5.3 mi. SE | mane | D | (0.0-2.3)0.2 | Lewis (1972) |
| " | " | " all other sites | | D | 0.0 | " |
| " | " | " | lung | W | 0.7 | " |
| " | " | " | liver | W | 0.1 | " |
| " | " | " | kidney | W | trace | " |
| " | " | " | muscle | W | 0.11 | " |
| " | " | " | mane | W | 2.0 | " |
| " | " | Germany | Horses died near Cu smelter | | | Bischoff & Haun (1939) |
| Dusky dolphin<br>Lagenorhynchos obscurus | | New Zealand | liver | W | (0.13-0.8) | Koeman et al. (1972) |
| Woodchuck<br>Marmota monax | | United States | " | W | 0.52 | Schroeder & Balassa (1966) |
| Mouse<br>Mus musculus | | Laboratory | kidney | W | 1.3 | " |
| " | " | " | spleen | W | 5.6 | " |
| " | " | " | liver | W | 0.0 | " |
| White-tailed deer<br>Odocoileus virginiana | | Tennessee | 19 deer killed from arsenic acid herbicide | | | Swiggart et al. (1972) |
| " | " | " | liver | | (14.7-24.3)<br>18.96 | " |
| " | " | " | kidney | | (7.6-33.0)<br>17.78 | " |
| " | " | " | rumen contents | | (18.0-31.8)<br>22.5 | " |

| | | | | | | |
|---|---|---|---|---|---|---|
| Rabbit<br>Oryctolagus cuniculus | | Switzerland | Feeding As produced local pigmentation in fur | | | Robert & Zurcher (1950) |
| " | " | Russia (fed As) | muscle | W | (1.0-2.0) | Shtenberg (1938) |
| " | " | " | liver | W | 3.0 | " |
| " | " | " | kidney | W | 3.0 | " |
| " | " | | Rabbits 1 km from power plant had high accumulation of As in fur | | | Bencko (1970) |
| " | " | Montana | muscle | W | 0.6 | Lewis (1972) |
| Sheep<br>Ovis aries | | New Zealand Fed 3 wks dry Elodea with 300 ppm As: | kidney | W | 3.76 | Lancaster et al. (1971) |
| " | " | " " " | muscle | W | 1.13 | " |
| " | " | " " " | liver | W | 3.07 | " |
| " | " | " " " | wool | D | 12.6 | " |
| " | " | " " " | hoof | D | 2.21 | " |
| " | " | United States | muscle | W | 0.35 | Schroeder & Balassa (1966) |
| " | " | Germany | Sheep died near Cu smelter | | | Bischoff & Haun (1939) |
| Common harbor seal<br>Phoca vitulina | | Great Britain | blood | W | $0.08 \pm 0.03$ | Hamilton (1976) |
| " | " | " | spleen | W | $0.2 \pm 0.1$ | " |
| " | " | " | heart | W | $0.1 \pm 0.05$ | " |
| " | " | " | muscle | W | $0.3 \pm 0.1$ | " |
| " | " | " | kidney | W | $0.3 \pm 0.1$ | " |

| | | | | | |
|---|---|---|---|---|---|
| Common harbor seal<br>*Phoca vitulina* | Great Britain | liver | W | 0.2±0.09 | Hamilton (1976) |
| Harbour porpoise<br>*Phocoena phocoena* | North Sea | brain | W | (<0.01-0.16) | Koeman et al. (1972) |
| Whale<br>*Physeter macrocephalus* | Antarctica | blubber, oil | W | 0.6 | Lunde (1967) |
| Rat<br>*Rattus rattus* | United States | kidney | W | 0.0 | Schroeder & Balassa (1966) |
| " " | " " | liver | W | (0.0-0.52) | " |
| " " | " " | brain | W | (0.0-0.44) | " |
| Squirrel<br>*Sciurus sp.* | Tennessee | | D | 0.8 | Andren et al. (1973) |
| Surinam dolphin<br>*Sotalia guianensis* | Surinam | liver | W | (0.15-0.19) | Koeman et al. (1972) |
| Pig<br>*Sus scrofa* | United States | muscle | W | 0.06 | Schroeder & Balassa (1966) |
| " " | " " | liver | W | (1.07-1.4) | " |
| " " | " " | kidney | W | 0.0 | " |
| " " | " " | muscle | W | (ND-0.1)0.02 | Jelinek & Corneliussen (1977) |
| " " | " " | liver | W | (ND-0.05)0.02 | " |
| " " | Italy | muscle | W | (0.22-0.32) | Barela & Pezzeri (1966) |
| " " | | " | W | 0.02 | Ledet et al. (1973) |

| | | | | | |
|---|---|---|---|---|---|
| Pig<br>*Sus scrofa* | Michigan<br>Fed arsanilic acid (clinical signs) | liver | | 5.0 | Vorhies et al. (1969) |
| " " | Fed high to low amts. of $H_2O$ | " | | (0.02-3.3) | " |
| " " | control | " | | 0.6 | " |
| Bottle-nosed dolphin<br>*Tursiops truncatus* | From dolphinarium, fed North Sea fish | " | W | (0.13-0.8) | Koeman et al. (1972) |
| Fox<br>*Vulpes sp.* | United States (wild) | kidney | W | 0.39 | Schroeder & Balassa (1966) |
| " " | " | heart | W | 0.25 | " |
| " " | " | lung | W | 0.69 | " |
| " " | Tennessee | | D | 0.8 | Andren et al. (1973) |
| Whale | Antarctica | blubber, oil | W | (2.2-2.8) | Lunde (1967) |
| " | " | muscle | W | 0.36 | " (1970) |

TABLE ARSENIC IN BIRDS (1)

| Species | Locality | Tissue | Analysis PPM (2) | | Authority |
|---|---|---|---|---|---|
| Mallard duck *Anas platyrhynchos* | Canada | feather | D | (0.1-0.2) 0.5 | Kelsall (1970) |
| " " | New York | liver | W | <0.4 | Baker et al. (1976) |
| " " | " | muscle | W | <0.4 | " |
| Black duck *Anas rubripes* | Canada | feather | D | (0.1-0.2) 0.17 | Kelsall (1970) |
| " " | New York | liver | W | <0.4 | Baker et al. (1976) |
| " " | " | muscle | W | <0.4 | " |
| White-fronted goose *Anser albifrons* | Canada | feather | D | (0.2-0.5) 0.38 | Kelsall (1970) |
| Lesser scaup *Aythya affinis* | " | " | D | (0.1-0.2)0.15 | " |
| Greater scaup *Aythya marila nearctica* | New York | liver | W | <0.4 | Baker et al. (1976) |
| " " " | " | muscle | W | <0.4 | " |
| " " " | " | brain | W | <0.4 | " |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | | |
|---|---|---|---|---|---|
| Canvasback<br>Aythya valisineria | New York | liver | W | <0.4 | Baker et al. (1976) |
| " " | " | muscle | W | <0.4 | " |
| " " | " | brain | W | <0.4 | " |
| Canada goose<br>Branta canadensis | " | liver | W | <0.4 | " |
| " " | " | muscle | W | <0.4 | " |
| " " | " | brain | W | <0.4 | " |
| Cattle egret<br>Bubulcus ibis | S. Florida | egg | W | (<0.07-0.3) | Ogden et al. (1974) |
| Bufflehead<br>Bucephala albeola | New York | liver | W | <0.4 | Baker et al. (1976) |
| " " | " | muscle | W | <0.4 | " |
| Red-shouldered hawk<br>Buteo lineatus | S. Florida | muscle & brain | W | 0.15 | Ogden et al. (1974) |
| Common egret<br>Casmerodius albus | " | egg | W | <0.10 | " |
| Crow<br>Corvus brachyrhynchos | Tennessee | | D | 0.1 | Andren et al. (1973) |
| White ibis<br>Eudocimus albus | S. Florida | " | W | (<0.1-0.24) | Ogden et al. (1974) |
| " " | " | muscle | W | 1.76 | " |
| Chicken<br>Gallus domesticus | United States | " | W | 0.0 | Schroeder & Balassa (1966) |
| " " | United Kingdom | As overdose, liver | | (6.0-12.0) | Baker & Parker (1969) |

| | | | | | |
|---|---|---|---|---|---|
| Chicken *Gallus domesticus* | | egg | | 0.013 | Kingsley & Schaffert (1951) |
| " " | Portugal | muscle | W | 0.02 | Costa et al. (1970) |
| " " | " | kidney | W | 0.05 | " |
| " " | " | liver | W | ≤2.2 | " |
| " " | " | bone marrow | W | (0.0-0.4) | " |
| " " | | kidney | W | 0.02 | George et al. (1973) |
| " " | | liver | W | 0.02 | " |
| " " | Great Britain | muscle | W | 0.02 | Baron (1969) |
| " " | " | kidney | W | 0.05 | " |
| " " | " | liver | W | 0.08 | " |
| " " | " | egg yolk | W | 0.005 | Barnard (1911) |
| " " | United States | muscle | W | (ND-0.5) 0.08 | Jelinek & Corneliussen (1977) |
| " " | " | liver | W | (ND-0.4)0.08 | " |
| " " | " | egg | W | (ND-0.2)0.03 | " |
| White-singed scoter *Melanitta deglandi* | New York | liver | W | <0.4 | Baker et al. (1976) |
| " " | " | muscle | W | <0.4 | " |
| Turkey *Meleagris gallopavo* | | liver | W | 0.04 | Frost et al. (1955) |
| " " | | muscle | W | 0.03 | " |

| | | | | | |
|---|---|---|---|---|---|
| Osprey<br>Pandion haliaetus | S. Florida | egg | W | <0.10 | Ogden et al. (1974) |
| Brown pelican<br>Pelecanus occidentalis | " | " | W | <0.10 | " |
| " " | South Carolina | " | W | (0.076-0.85) 0.31 | Blus et al. (1977) |
| " " | Florida | " | W | (0.07-0.18)0.10 | " |
| " " | " | liver | W | (0.47-0.89) | " |
| " " | South Carolina | " | W | (0.29-1.02) | " |
| " " | Georgia | " | W | 0.23 | " |
| Double-breasted cormorant<br>Phalacrocorax auritus | S. Florida | egg | W | <0.10 | Ogden et al. (1974) |
| Starling<br>Sturnus vulgaris | United States (1971) | whole body except beak, foot, & wing | W | (0.01-0.04) | Martin & Nickerson (1973) |
| " " | Lansing, Michigan (1971) | " | W | 0.21 | " |
| " " | United States (urban, 1973) | " | W | (<0.05-1.40) 0.171±SE 0.063 geom. mean 0.085 | White et al. (1977) |
| " " | United States (rural, 1973) | " | W | (<0.05-0.52) 0.139±SE 0.024 geom. mean 0.057 | " |
| " " | As in starlings showed 88% increase in 1973 over 1971 | | | | " |
| Goose | | down | W | 1.2 | (1902) in Vinogradov (1953) |
| Peacock | | feather | W | 2.5 | " |

| | | | | |
|---|---|---|---|---|
| Sparrow | Tennessee | D | 0.2 | Andren et al. (1973) |
| Hawk | " | D | 0.4 | " |
| Owl | " | D | 0.05 | " |

## ARSENIC IN REPTILES AND AMPHIBIA (1)

| Species | Locality | Tissue | Analysis PPM (2) | Authority |
|---|---|---|---|---|
| REPTILES | | | | |
| Alligator *Alligator mississipiensis* | S. Florida | egg | W (0.05-0.2) | Ogden et al. (1974) |
| Crocodile *Crocodylus acutus* | " | " | W (0.06-0.08) | " |
| AMPHIBIA | | | | |
| Toad *Bombina variegata* | Yugoslavia Idrija Hg mine | liver | W (0.035-0.048) | Byrne et al. (1975) |
| " " | Poljane | " | W (0.036-0.039) | " |
| Toad *Bufo bufo* | Yugoslavia Dolenjska | " | W 0.021 | " |
| " " | Idrija Hg mine | " | W 0.038 | " |

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| | | | | | |
|---|---|---|---|---|---|
| Frog *Rana esculenta* | Yugoslavia Macedonia | liver | W | (0.078-0.444) | Byrne et al. (1975) |
| " " | " | thyroid gland | W | 1.0 | " |
| " " | Rab | liver | W | (0.107-0.183) | " |
| Leopard frog *Rana pipiens* | S. Florida | whole | W | 0.07 | Ogden et al. (1974) |
| Frog *Rana temporaria* | Yugoslavia Ljubljana | liver | W | 0.047 | Byrne et al. (1975) |
| " " | Idrija Hg mine | " | W | 0.195 | " |

ARSENIC IN MARINE FISH (1)

| Species | Locality | Tissue | Analysis PPM (2) | | Authority |
|---|---|---|---|---|---|
| Sturgeon *Acipenser güldenstädti* | Caspian Sea | | W | 1.31 | Shtenberg (1939) |
| " " | " | | D | 5.02 | " |
| " " | Sea of Azov | | W | 1.39 | " |
| " " | " | | D | 5.96 | " |
| Sturgeon *Acipenser sp.* | New York | | W | (0.08-0.44) | Pakkala et al. (1972) |
| " " | Russia | egg | W | 3.8 | Chapman (1926) |
| Sturgeon *Acipenser stellatus* | Caspain Sea | | W | 1.1 | Shtenberg (1939) |
| " " | " | | D | 5.27 | " |
| " " | Sea of Azov | | W | 1.45 | " |
| " " | " | | D | 6.3 | " |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | | |
|---|---|---|---|---|---|
| Spotted wolffish<br>Anarchichas minor | Barents Sea | | W | 2.7 | Shtenberg (1939) |
| " " | " | | D | 14.3 | " |
| " " | W. Greenland | muscle | D | (17.0-195.0)<br>78.3 | Bohn (1975) |
| " " | " | liver | D | (19.3-55.9)<br>40.1 | " |
| Bay anchovy<br>Anchoa mitchelli | N.W. Atlantic | whole | D | 2.1 | Windom et al. (1973b) |
| " " | Norway | | W | (7.1-10.7) | Lunde (1973) |
| Blue hake<br>Antimora rostrata | Mid Atlantic Bight | muscle | W | 21.0 | Greig et al. (1976) |
| " " | " | liver | W | 4.8 | " |
| Barred cardinal fish<br>Apogon sp. | Grand Bahamas Island | whole | | 5.03 | Taylor & Bright (1973) |
| Sea catfish<br>Arius felis<br>(=Galeichthys felis) | S. Florida | | W | (3.12-7.47) | Ogden et al. (1974) |
| Aspius aspius | Norway | muscle oil | W | 0.9 | Lunde (1967) |
| Catfish<br>Bagre marinus | N. Atlantic | | D | <1.0 | Windom et al. (1973b) |
| Lanternfish<br>Bolinichthys indicus | Bermuda | midsection | D | <1.0 | Gibbs et al. (1974) |
| Turbot<br>Bothina sp. | Great Britain | muscle | W | (0.6-1.8) | Cox (1925) |
| Menhaden (Machete)<br>Brevoortia maculata | Peru | " | | (0.16-0.5)<br>0.33 | Echegaray (1974) |

| | | | | | |
|---|---|---|---|---|---|
| Menhaden<br>Brevoortia tyrannus | North America | oil | W | 15.5 | (1925) in Vinogradov (1953) |
| Cusk<br>Brosme brosme | Norway | liver oil | W | 1.8 | Lunde (1967) |
| Porgy<br>Calamus brachysomus | Peru | muscle | | 1.12 | Echegaray (1974) |
| Crevalle jack<br>Caranx hippos | S. Florida | whole | W | (0.5-0.55) | Ogden et al. (1974) |
| Black sea bass<br>Centropristes striatus | N.W. Atlantic | muscle | D | 6.4 | Windom et al. (1973b) |
| Lanternfish<br>Ceratoscopelus warmingi | Bermuda | midsection | D | (<1.0-1.0) | Gibbs et al. (1974) |
| " " | N. Atlantic | | D | <1.0 | Windom et al. (1973b) |
| Atlantic herring<br>Clupea harengus | Norway | lipid | W | (3.1-20.2) | Lunde (1973) |
| " " | " | meal | D | (2.7-6.9) | " |
| " " | " | muscle | D | 3.8 | " (1970) |
| " " | " | bone | D | 1.9 | " |
| " " | " | skin | D | 7.2 | " |
| " " | Sweden | muscle | W | (0.16-4.8) | Ljunggren et al. (1971) |
| " " | Great Britain | | W | (0.4-0.8) | Cox (1925) |
| " " | Sweden | muscle | W | (0.1-0.3) | " |
| " " | Caspian Sea | " | W | 1.5 | " |
| " " | Nova Scotia | " | W | 1.4 | Reinke et al. (1975) |

| | | | | | |
|---|---|---|---|---|---|
| Atlantic herring<br>Clupea harengus | Denmark | | W | 2.0 | Sadolin (1928) |
| " " | Sweden | muscle | W | 0.2 | Shtenberg (1939) |
| " " | " | | D | 3.9 | " |
| " " | Norway | water soluble | D | (5.2-21.6) | Lunde (1969) |
| " " | W. Norway | | D | 4.2 | " (1973) |
| Eel<br>Conger sp. | N.W. Atlantic | muscle | D | <1.0 | Windom et al. (1973b) |
| Wrasse<br>Ctenolabrus rupestris | Sweden | | D | 12.0 | Noddack & Noddack (1940) |
| Spotted trout<br>Cynoscion nebulosus | N.W. Atlantic | muscle | D | 2.5 | Windom et al. (1973b) |
| Round seal<br>Decapterus punctatus | " | " | D | 1.8 | " |
| Lanternfish<br>Diaphus dumerili | N.W. Africa | whole | D | 2.7 | Leatherland et al. (1973) |
| Lanternfish<br>Diaphus mollis | Bermuda | midsection | D | <1.0 | Gibbs et al. (1974) |
| " " | N.W. Atlantic | muscle | D | <1.0 | Windom et al. (1973b) |
| Pejerrey<br>Dontesthes regia | Peru | " | | (0.30-0.52)<br>0.33 | Echegaray (1974) |
| Drepanopsetta platessoides | Barents Sea | | W | 2.5 | Shtenberg (1939) |
| " " | " | | D | 12.3 | " |

| | | | | | |
|---|---|---|---|---|---|
| Moray eel<br>*Enchelycore sp.* | Bahama Islands | whole | | 4.79 | Taylor & Bright (1973) |
| Grouper, Rock hind<br>*Epinephelus adscensionis* | " | muscle | | (0.21-0.54) | " |
| Red hind<br>*Epinephalus guttatus* | " | " | | (0.41-2.48) | " |
| Nassau grouper<br>*Epinephalus striatus* | " | " | | (1.62-13.65)<br>9.9±SD 4.89 | " |
| " " | " | liver | | (6.58-15.94)<br>9.79±SD 4.86 | " |
| " " | " | kidney | | (3.45-8.80) | " |
| " " | " | heart | | (4.10-5.95) | " |
| Priest shark<br>*Etmopterus spinax* | N.W. Africa | liver | D | (1.2-1.3) | Leatherland et al. (1973) |
| Damselfish<br>*Eupomacentrus partitus* | Bahama Islands | whole | | 3.96 | Taylor & Bright (1973) |
| Little tunney<br>*Euthynnus alleteratus* | N.W. Atlantic | muscle | D | 1.1 | Windom et al. (1973b) |
| Squirrelfish<br>*Flammeo marianus* | Bahama Islands | whole | | (0.75-1.36) | Taylor & Bright (1973) |
| Rock cod<br>*Gadus callarius* | Barents Sea | | W | 3.8 | (1939) in Vinogradov (1953) |
| " " | " | | D | 18.0 | " |
| " " | Great Britain | muscle | D | 4.8 | Leatherland & Burton (1974) |

| | | | | | |
|---|---|---|---|---|---|
| Norway pout<br>Gadus esmarki | Norway | oil | W | 3.2 | Lunde (1967) |
| Gadus macrocephalus | | | W | 11.8 | (1935) in Vinogradov (1953) |
| " " | | | W | 6.5 | " |
| Atlantic cod<br>Gadus morhua | Norway | muscle | D | 2.2 | Lunde (1970) |
| " " | " | bone | D | 0.9 | " |
| " " | " | liver | D | 9.8 | " |
| " " | " | skin | D | 3.5 | " |
| " " | Sweden | muscle | W | (0.26-11.0) | Ljunggren et al. (1971) |
| " " | " | " | W | (0.2-0.4) | Cox (1925) |
| " " | Norway | oil, liver | W | (0.8-26.0) | Lunde (1967) |
| " " | Great Britain | muscle | W | (0.8-2.0) | Cox (1925) |
| " " | Sweden | " | W | 0.4 | (1926) in Vinogradov (1953) |
| " " | | | W | (1.0-3.3) | (1933) in Vinogradov (1953) |
| " " | | | W | 13.0 | (1928) in Vinogradov (1953) |
| " " | | liver | W | 20.0 | " |
| " " | | muscle | W | 6.0 | " |
| " " | | meal | W | 15.5 | (1929) in Vinogradov (1953) |
| " " | | fat | D | 0.7 | " |
| " " | Sweden (1919) | | | (0.5-4.1) | Bang (1919) |

| | | | | | |
|---|---|---|---|---|---|
| Atlantic cod *Gadus morhua* | Gulf of Bothnia | muscle | | (0.26-0.49) | Westermark (1969) |
| " " | " | liver | | (3.4-4.2) | " |
| " " | Norway | | D | (3.69-24.3) | Lunde (1973) |
| " " | Denmark | muscle | D | (0.4-0.8) | Sadolin (1928) |
| " " | " | liver | W | (0.7-3.2) | " |
| " " | Newfoundland | muscle | W | (0.4-1.5) 0.8±SD 0.61 | Kennedy (1976) |
| " " | New Brunswick | " | D | (0.4-1.5) | Penrose et al. (1975) |
| " " | N.W. Atlantic | " | W | (1.2-7.4) 3.5±SD 1.7 | Zook et al. (1976) |
| " " | Iceland | " | W | (0.3-1.6) 0.8±SD 0.4 | " |
| *Gadus navaga* | Indiga River | | W | 2.4 | Shtenberg (1939) |
| " " | " | | D | 11.8 | " |
| Greenland cod *Gadus ogac* | W. Greenland | muscle | D | (23.9-152.0) 62.5 | Bohn (1975) |
| " " | " | liver | D | (7.6-46.3)21.9 | " |
| Cod *Gadus sp.* | | muscle | | 540.0 (max.) | Robertson et al. (1972) (cited in Bohn (1975)) |
| " " | | liver | | (3.4-4.2) | Westermark (1969) |
| " " | | muscle | | (0.26-0.49) | " |
| " " | | " age 6 | | 0.26 | " |

| | | | | | |
|---|---|---|---|---|---|
| Cod<br>Gadus sp. | | muscle, age 8-10 | | 0.47 | Westermark (1969) |
| " " | | " age 10 | | 0.49 | " |
| Yuyo<br>Gigartina chamissoi | Peru | muscle | | 1.22 | Echegaray (1974) |
| Fairy basslet<br>Gramma loreto | Bahama Islands | whole | | (1.51-2.33) | Taylor & Bright (1973) |
| Wrasse<br>Halichoeres dispilus | Peru | muscle | | 1.19 | Echegaray (1974) |
| Greenling<br>Hexagrammos sp. | W. Canada | " | W | (<0.4-0.8) | LeBlanc & Jackson (1973) |
| Cow shark<br>Hexanchus griseus | " | " | W | (<0.4-5.9)3.5 | LeBlanc & Jackson (1973) |
| Halibut<br>Hippoglossus hippoglossus | | | | | |
| | Norway | liver, oil | W | 5.3 | Lunde (1967) |
| " " | Great Britain | muscle | W | 0.3 | (1926) in Vinogradov (1953) |
| " " | " | " | W | (0.0-0.3) | Cox (1925) |
| " " | Nova Scotia | " | W | 1.8 | Reinke et al. (1975) |
| American plaice<br>Hippoglossoides platessoides | | | | | |
| | New Brunswick | " | D | (1.4-11.7) | Penrose et al. (1975) |
| " " | Newfoundland | " | W | (1.4-11.7)<br>4.4±SD 3.0 | Kennedy (1976) |
| Pacific halibut<br>Hippoglossus stenolepis | Gulf of Alaska | " | W | (0.8-3.9)<br>1.8±SD 1.0 | Zook et al. (1976) |

| | | | | | |
|---|---|---|---|---|---|
| Longspine squirrelfish<br>*Holocentrus rufus* | Bahama Islands | whole | | (4.87-6.12) | Taylor & Bright (1973) |
| *Huso huso* | Sea of Azof | | W | 1.41 | (1939) in Vinogradov (1953) |
| " " | " | | D | 6.19 | " |
| Ratfish<br>*Hydrolagus colliei* | W. Canada | muscle | W | (0.4-10.3)10.2 | LeBlanc & Jackson (1973) |
| Lanternfish<br>*Hygophum hygomi* | Bermuda | midsection | D | <1.0 | Gibbs et al. (1974) |
| " " | (1914 in alcohol) | | D | 1.3? | " |
| " " | (1885 in alcohol) | | D | 7.9? | " |
| " " | N.W. Atlantic | muscle | D | <0.1 | Windom et al. (1973b) |
| Lanternfish<br>*Hygophum macrochir* | N.W. Africa | whole | D | 2.5 | Leatherland et al. (1973) |
| Barred hamlet<br>*Hypoplectrus puella* | Bahama Islands | " | | 8.56 | Taylor & Bright (1973) |
| Pinfish<br>*Lagodon rhomboides* | S. Florida | whole | W | (2.05-3.52) | Ogden et al. (1974) |
| Lanternfish<br>*Lampanyctus photonotus* | Bermuda | midsection | D | <1.0 | Gibbs et al. (1974) |
| Lanternfish<br>*Lampanyctus pusillus* | " | " | D | <1.0 | " |
| " " | N.W. Atlantic | muscle | D | 1.0 | Windom et al. (1973b) |

| | | | | | |
|---|---|---|---|---|---|
| *Lepidophanes indicus* | N.W. Atlantic | muscle | D | <1.0 | Windom et al. (1973b) |
| Yellowtail flounder *Limanda ferruginea* | " | " | W | (2.1-10.3) 4.5±SD 3.0 | Zook et al. (1976) |
| Lanternfish *Lobianchia dofleini* | Bermuda | midsection | D | <2.0 | Gibbs et al. (1974) |
| " " | N.W. Atlantic | muscle | D | <1.0 | Windom et al. (1973b) |
| Red snapper *Lutjanus campechanus* | Gulf of Mexico | " | W | (0.2-1.0) 0.4±SD 0.1 | Zook et al. (1976) |
| Gray snapper *Lutjanus griseus* | S. Florida | whole | W | (1.4-2.23) | Ogden et al. (1974) |
| Black marlin *Makaira indica* | N.E. Australia | muscle | W | (0.1-1.65) 0.6±SE 0.054 | Mackay et al. (1973) |
| " " | " | liver | W | (0.1-2.75)1.0 ±SE 0.083 | " |
| Blue marlin *Makaira nigricans* | Japan | muscle | W | (0.1-0.2) 0.77± 0.43 | Nishigaki et al. (1974) |
| Capelin *Mallotus villosus* | Norway | oil | W | 13.2 | Lunde (1967) |
| " " | " | water-soluble | W | 7.9 | " (1969) |
| " " | " | | D | 6.1 | " (1973) |
| Haddock *Melanogrammus aeglefinus* (=Gadus aeglefinus) | Great Britain | | W | (0.1-0.6) | Cox (1925) |
| " " | Sweden | | W | (0.1-0.2) | " |
| " " | " | | | 10.3 | Lunde (1973) |

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|---|---|---|---|---|---|
| Haddock<br>Melanogrammus aeglefinus<br>(=Gadus aeglefinus) | Barents Sea | | W | 3.4 | (1933) in Vinogradov (1953) |
| " " | " | | W | 2.87 | (1939) in Vinogradov (1953) |
| " " | " | | D | 15.6 | " |
| " " | United States | muscle | W | 2.17 | Schroeder & Balassa (1966) |
| " " | N.W. Atlantic | " | W | (1.8-9.5)<br>6.6±SE 2.8 | Zook et al. (1976) |
| " " | Norway | | D | 10.8 | Lunde (1973) |
| " " | Nova Scotia | muscle | W | 10.0 | Reinke et al. (1975) |
| " " | Washington | | D | (5.4-10.8) | Cardiff (1937) |
| Whiting<br>Menticirrhus saxatilis | Great Britain | muscle | W | (0.1-3.3) | Cox (1925) |
| " " | " | | W | (0.1-3.3) | Chapman (1926) |
| Silver hake, whiting<br>Merluccius bilinearis | N.W. Atlantic | " | W | (2.3-5.4)<br>3.7±SD 0.9 | Zook et et al. (1976) |
| European hake<br>Merluccius merluccius | Great Britain | " | W | 0.3 | Chapman (1926) |
| " " | " | " | W | (0.2-0.3) | Cox (1925) |
| Merluza<br>Merluccius peruanus | Peru | " | | (0.05-0.3)<br>0.18 | Echegaray (1974) |
| Pacific hake<br>Merluccius productus | N.W. Atlantic | " | W | (0.2-1.0)<br>0.6±SD 0.2 | Zook et al. (1976) |

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|---|---|---|---|---|---|
| Dover sole<br>Microstomus pacificus | S. California (contam. area) | muscle | W | 4.12±SE 0.62 | Fowler et al. (1975) |
| " " | " (uncontam. area) | " | W | 2.43±SE 0.37 | " |
| " " | S. California | " | W | (1.3-3.1) | DeGoeij et al. (1974) |
| Planehead filefish<br>Monocanthus hispidus<br>(=Stephanolepsis hispidus) | Mid. Atlantic Bight | whole | W | 1.5 | Greig et al. (1976) |
| Bass<br>Morone labrax | Great Britain | muscle | D | 7.1 | Leatherland & Burton (1974) |
| Striped bass<br>Morone saxatilis | N.W. Atlantic | " | D | 1.8 | Windom et al. (1973b) |
| Striped mullet<br>Mugil cephalus | Peru | " | | (0.68-1.33)<br>1.02 | Echegaray (1974) |
| " " | S. Florida | | W | (1.22-2.51) | Ogden et al. (1974) |
| " " | N.W. Atlantic | " | D | <1.0 | Windom et al. (1973b) |
| " " | United States | whole | W | (0.02-0.75) | Walsh et al. (1977) |
| Tollo shark<br>Mustelus sp. | Peru | muscle | | (0.6-0.96)<br>0.75 | Echegaray (1974) |
| Grouper<br>Mycteroperca bonaci | Bahama Islands | " | | (0.1-0.17) | Taylor & Bright (1973) |
| Scamp<br>Mycteroperca phenax | " | " | | (0.10-3.82) | " |
| Tiger grouper<br>Mycteroperca tigris | " | " | | (1.0-3.04) | " |
| " " | " | liver | | (0.55-1.16) | " |

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|---|---|---|---|---|---|
| Yellowfin grouper<br>Mycteroperca venenosa | Bahama Islands | muscle | | (0.14-2.38) | Taylor & Bright (1973) |
| Shorthorn sculpin<br>Myoxocephalus scorpius | W. Greenland | " | D | (19.3-72.3)<br>43.4 | Bohn (1975) |
| " " | " | liver | D | (20.1-126.0)<br>57.9 | " |
| Nematonurus armatus | Mid. Atlantic Bight | muscle | W | (10.0-20.0) | Greig et al. (1976) |
| " " | " | liver | W | 10.4 | " |
| Yellowfin tuna<br>Neothunnus macropterus | Japan | muscle | W | (0.5-1.4)<br>0.98±0.29 | Nishigaki et al. (1974) |
| Lanternfish<br>Notoscopelus caudispinosus | Bermuda | midsection | D | <1.0 | Gibbs et al. (1974) |
| " " | N.W. Atlantic | muscle | D | <1.0 | Windom et al. (1973b) |
| Pejerrey<br>Odontesthes regia | Peru | " | | (0.3-0.52)<br>0.33 | Echegaray (1974) |
| Lingcod<br>Ophiodon elongatus | W. Canada | " | W | 0.3 | LeBlanc & Jackson (1973) |
| Shrimp eel<br>Ophichthus gomesi | N.W. Atlantic | " | D | 1.0 | Windom et al. (1973b) |
| Palespotted eel<br>Ophichthus ocellatus | " | " | D | 1.0 | " |
| Yellowhead jawfish<br>Opistagnathus macrognathus | Bahama Islands | whole | | 4.47 | Taylor & Bright (1973) |

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|---|---|---|---|---|---|
| Sand bass (Cabrilla) *Paralabrax humeralis* | Peru | muscle | | (0.63-0.74) 0.69 | Echegaray (1974) |
| Flounder (Lenguado) *Paralichthys adspersus* | " | " | | (0.31-0.4) 0.35 | " |
| Flounder *Paralichthys lethostigma* | N.W. Atlantic | " | D | <1.0 | Windom et al. (1973b) |
| Flounder *Paralichthys sp.* | Nova Scotia | " | W | 1.8 | Reinke et al. (1975) |
| Corvina *Paralonchurus peruanus* | Peru | " | | 2.0 | Echegaray (1974) |
| English sole *Parophrys vetulus* | W. Canada | " | W | (0.6-11.5)1.1 | LeBlanc & Jackson (1973) |
| Flounder *Pleuronectes flesus* (=Platichthys flesus) | Sweden | " | W | (0.58-7.40) | Ljunggren et al. (1971) |
| " " | Skagerrak Norway | " | W | (1.24-7.4)3.54 | " |
| " " | Baltic Sea Norway | " | W | (0.58-0.79)0.685 | " |
| " " | Great Britain | " | D | 8.7 | Leatherland & Burton (1974) |
| Plaice *Pleuronectes platessa* | Sweden | " | W | (0.5-0.9) | (1926) in Vinogradov |
| " " | Great Britain | " | W | (1.4-3.0) | " |
| " " | Norway | oil, liver | W | (1.0-4.0) | Lunde (1967) |
| " " | " | oil, tissue | W | (2.0-2.2) | " |
| " " | " | oil | W | 6.1 | " (1972) |

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|---|---|---|---|---|---|
| Plaice<br>*Pleuronectes platessa* | Baltic Sea | muscle | W | (0.84-5.7) | Ljunggren et al. (1971) |
| " " | Japanese Sea | | W | 1.25 | Shtenberg (1939) |
| " " | | | W | (6.0-10.0) | (1926) in Vinogradov (1953) |
| " " | Sweden | | W | (0.3-0.9)0.5 | Cox (1925) |
| " " | Great Britain | | W | (0.8-3.0)1.7 | " |
| Mackerel<br>*Pneumatophorus japonicus* | Japan | muscle | D | 0.015 | Fukai & Meinke (1962) |
| Pollock, coal fish<br>*Pollachius virens* | Norway | | W | 7.2 | Lunde (1973) |
| " " | " | liver oil | W | 3.2 | Lunde (1967) |
| " " | N.W. Atlantic | muscle | W | (1.1-4.7)<br>2.4±SD 1.1 | Zook et al. (1976) |
| Sand sole<br>*Psettichthys melanostictus* | W. Canada | " | W | (0.6-11.5)1.1 | LeBlanc & Jackson (1973) |
| Skate<br>*Raja sp.* | " | " | W | 16.2 | " |
| Greenland halibut<br>*Reinhardtius hippoglossoides* | W. Greenland | " | D | (14.7-307.0)<br>69.8 | Bohn (1975) |
| " " | " | liver | D | (23.7-228.0)93.9 | " |
| " " | Newfoundland | muscle | W | (0.2-1.5)<br>0.8±SD 0.48 | Kennedy (1976) |
| Pacific bonito<br>*Sarda chilensis* | Peru | " | | 0.12 | Echegaray (1974) |
| Corvina<br>*Sciaena gilberti* | " | " | | (0.07-0.8)0.34 | " |

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|---|---|---|---|---|---|
| Atlantic mackerel *Scomber scombrus* | Norway | muscle | W | (3.0-3.5) | Lunde (1970) |
| " " | " | liver oil | W | 5.0 | " (1967) |
| " " | " | oil, muscle | D | (4.2-7.3) | " |
| " " | " | water soluble, muscle | W | 3.1 | " (1969) |
| " " | " | | D | (4.7-9.2) | " (1973) |
| " " | Great Britain | muscle | W | (0.2-0.5) | Cox (1925) |
| " " | Sweden | " | W | 0.1 | " |
| " " | | | W | (0.025-0.04) | (1904) in Vinogradov (1953) |
| " " | Nova Scotia | " | W | 1.5 | Reinke et al. (1975) |
| " " | Great Britain | " | D | 9.2 | Leatherland & Burton (1974) |
| " " | " | " | D | 2.2 | " |
| Spanish mackerel *Scomberomorus maculatus* | N. W. Atlantic | " | D | 1.8 | Windom et al. (1973) |
| " " | " | liver | D | 2.7 | " |
| Atlantic saury *Scomberesox saurus* | S.W. Africa | muscle | D | 5.4 | Leatherland et al. (1973) |
| " " | " | heart | D | 6.6 | " |
| " " | " | liver | D | 8.4 | " |
| Windowpane flounder *Scophthalmus aquosus* | Long Island | muscle | W | 2.7 | Greig et al. (1977b) |
| " " | New York Bight | " | W | (1.4-2.8) | " |

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|---|---|---|---|---|---|
| Windowpane flounder<br>Scophthalmus aquosus | Delaware | muscle | W | 1.8±SE 0.3 | Greig et al. (1977b) |
| " " | Chincoteague | " | W | 2.0 | " |
| Rousette<br>Scyllium caniculata | Atlantic | | D | 0.13 | (1903) in Vinogradov (1953) |
| Sea perch, Norway haddock<br>Sebastes marinus | Barents Sea | | W | 2.7 | (1939) in Vinogradov (1953) |
| " " | " | | D | 13.0 | " |
| " " | Great Britain | muscle | W | 0.8 | Cox (1925) |
| " " | Norway | liver oil | W | 4.3 | Lunde (1967) |
| " " | " | muscle | D | 3.3 | " (1970) |
| " " | Newfoundland | " | W | (0.4-1.4)<br>0.8±SD 0.36 | Kennedy (1976) |
| " " | Nova Scotia | " | W | (0.7-3.2)<br>1.3±SD 0.8 | Zook et al. (1976) |
| Sea perch<br>Sebastes sp. | W. Canada | " | W | (<0.3-2.6)0.3 | LeBlanc & Jackson (1973) |
| Amberjack<br>Seriola sp. | Mid. Atlantic Bight | " | W | 1.2 | Greig et al. (1976) |
| Cojinova<br>Seriolela violacea | Peru | " | | 0.72 | Echegaray (1974) |
| Comber<br>Serranus atricauda | Atlantic | | D | 0.05 | (1903) in Vinogradov (1953) |
| " " | " | " | D | 0.06 | " |
| " " | " | scale | D | 0.05 | " |

| | | | | | |
|---|---|---|---|---|---|
| Sole<br>*Solea solea* | Great Britain | | W | 5.2 | Chapman (1926) |
| Sole<br>*Solea sp.* | Sweden | muscle | W | (0.1-0.2) | Cox (1925) |
| " " | Great Britain | " | W | 0.3 | " |
| " " | | | W | 7.0 | " |
| Sprat<br>*Sprattus sprattus* | Sweden | | W | (0.8-1.72) | Ljunggren et al. (1971) |
| Spiny dogshark<br>*Squalus acanthias* | " | without viscera | W | 6.0 | Noddack & Noddack (1940) |
| " " | N.W. Atlantic | | D | 10.0 | Windom et al. (1973b) |
| " " | W. Canada | muscle | W | (1.5-5.6)<br>3.8 | LeBlanc & Jackson (1973) |
| " " | Italy | | W | 0.53 | Barela & Pezzeri (1966) |
| *Synaphobranchus kaupi* | Mid Atlantic Bight | whole | W | 8.0 | Greig et al. (1976) |
| Cunner<br>*Tautogolabrus adspersus* | Newfoundland | muscle | D | 0.6±SD 0.9 | Penrose et al. (1975) |
| " " | New Brunswick | " | D | (0.0-1.5) | " |
| Striped marlin<br>*Tetrapterus audax* | Japan | " | W | (0.1-1.5)<br>1.10±0.15 | Nishigaki et al. (1974) |
| Albacore, germon<br>*Thunnus alalunga* | " | " | W | (0.7-1.4)<br>0.91±0.22 | " |

| | | | | | |
|---|---|---|---|---|---|
| Albacore, germon<br>Thunnus alalunga | Atlantic Ocean | | D | 0.15 | (1903) in Vinogradov (1953) |
| Bigeye tuna<br>Thunnus obesus | Japan | muscle | W | (0.3-1.9)<br>0.91±0.41 | Nishigaki et al. (1974) |
| Tunny, bluefin tuna<br>Thunnus thynnus | Norway | | D | 9.6 | Lunde (1973) |
| Tinca tinca | | | W | 0.4 | (1924) in Vinogradov (1953) |
| Scad<br>Trachurus symmetricus murphyi | Peru | muscle | | (0.19-0.77)0.4 | Echegaray (1974) |
| Rouget, sea robin<br>Trigla pini | Atlantic | | D | 0.15 | (1903) in Vinogradov (1953) |
| " " | " | muscle | D | 0.045 | " |
| " " | " | | D | 0.15 | " |
| Swordfish<br>Xiphias gladius | Peru | " | | (0.35-1.32)<br>0.72 | Echegaray (1974) |
| " " | Japan | " | W | (0.2-1.6)<br>0.61±0.36 | Nishigaki et al.(1974) |
| Zeus sp. | Great Britain | | W | <0.1 | (1925) in Vinogradov (1953) |
| Kingfish | United States | | W | 8.86 | Schroeder & Balassa (1966) |
| Blenny | Newfoundland | muscle | D | (0.4-0.8) | Penrose et al. (1975) |

ARSENIC IN FRESHWATER FISH (1)

| Species | Locality | Tissue | Analysis PPM (2) | | Authority |
|---|---|---|---|---|---|
| Alewife<br>Alosa pseudoharengus | Lake Michigan | whole | W | 0.023 | Lucas et al. (1970) |
| " " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| Rock bass<br>Ambloplites rupestris | New York | | W | (0.03-0.18) | Pakkala et al. (1972) |
| " " | Wisconsin | muscle | W | (0.10-0.12) | Kleinert et al. (1974) |
| " " | United States | whole | W | (<0.05-0.21) | Walsh et al. (1972) |
| Catfish<br>Ameiurus melas | " | | W | 0.225 | Ellis et al. (1941) |
| " " | " | | D | 1.06 | " |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | | |
|---|---|---|---|---|---|
| Bowfin<br>*Amia calva* | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| " " | New York | " | W | 0.04 | Pakkala et al. (1972) |
| " " | United States | whole | W | (0.20-0.22) | Walsh et al. (1977) |
| European eel<br>*Anguilla anguilla* | | | W | 1.6 | (1933) in Vinogradov (1953) |
| " " | | | W | 0.12 | (1928) in Vinogradov (1953) |
| " " | Great Britain | muscle | D | 1.7 | Leatherland & Burton (1974) |
| " " | Norway | oil, liver | W | 8.9 | Lunde (1967) |
| " " | " | oil, tissue | W | 0.5 | " |
| " " | | liver | | 0.6 | in Vinogradov (1953) |
| American eel<br>*Anguilla rostrata* | N.W. Atlantic | muscle | W | 1.0 | Windom et al. (1973b) |
| Freshwater drum, sheephead<br>*Aplodinotus grunniens* | Wisconsin | " | W | 0.0 | Kleinert et al. (1974) |
| " " | Lake Erie | " | W | (0.09-0.12) | Willford (1971) |
| " " | New York | " | W | (0.04-0.18) | Pakkala et al. (1972) |
| " " | United States | | W | 0.09 | Pillay et al. (1974) |
| " " | " | whole | W | (0.05-0.16) | Walsh et al. (1974) |

| | | | | | |
|---|---|---|---|---|---|
| Atlantic pomfret<br>Brama brama<br>(=Abramis brama) | Norway | | W | 0.3 | Lunde (1967) |
| " " | Lake Pskov | | W | 2.2 | (1939) in Vinogradov (1953) |
| " " | | | D | 12.9 | " |
| " " | Don River | | W | 2.38 | " |
| " " | | | D | 11.4 | " |
| " " | Volga River | | W | 1.21 | " |
| " " | Great Britain | | W | 0.4 | (1924) in Vinogradov (1953) |
| Goldfish<br>Carassius auratus | Lake Erie | liver | W | 0.006 | Lucas et al. (1970) |
| " " | Wisconsin | muscle | W | 0.10 | Kleinert et al. (1974) |
| " " | New York | " | W | (0.04-0.06) | Pakkala et al. (1972) |
| " " | United States | whole | W | (0.06-0.21) | Walsh et al. (1977) |
| River carpsucker<br>Carpiodes carpio | " | " | W | (0.05-0.28) | " |
| Quillback<br>Carpiodes cyprinus | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| Longnose sucker<br>Catostomus catostomus | United States | whole | W | (0.06-0.17) | Walsh et al. (1977) |
| Bridgelip sucker<br>Catostomus columbianus | " | " | W | (0.06-0.27) | " |
| White sucker<br>Catostomus commersoni | New York | muscle | W | (0.03-0.13) | Pakkala et al. (1972) |

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|---|---|---|---|---|---|
| White sucker<br>Catostomus commersoni | United States | whole | W | (0.05-0.16) | Walsh et al. (1977) |
| " " | Lake Erie | muscle | W | (0.09-0.12) | Willford (1971) |
| " " | | | W | 0.11 | Pillay et al. (1974) |
| Catostomidae | United States | | D | 0.93 | Ellis et al. (1941) |
| Flannelmouth sucker<br>Catostomus latipinnis | " | whole | W | (0.08-0.26) | Walsh et al. (1977) |
| Largescale sucker<br>Catostomus macrocheilus | " | " | W | (0.05-0.28) | " |
| Klamath sucker<br>Catostomus snyderi | " | " | W | (0.10-0.12) | " |
| Cisco, Lake herring<br>Coregonus artedii | Lake Superior | liver | W | 0.069±0.03 | Lucas et al. (1970) |
| " " | Wisconsin | muscle | W | 0.1 | Kleinert et al. (1974) |
| " " | New York | " | W | (0.04-0.12) | Pakkala et al. (1972) |
| Lake white fish<br>Coregonus clupeaformis | Lake Superior | liver | W | 0.0064± 0.0007 | Lucas et al. (1970) |
| " " | Lake Michigan | " | W | 0.021±0.003 | " |
| " " | Manitoba | muscle | W | 0.09 | Uthe & Bligh (1971) |
| " " | Lake Ontario | " | W | 0.70 | " |
| " " | United States | whole | W | (0.56-0.6) | Walsh et al. (1977) |
| " " | New York | muscle | W | (0.03-0.12) | Pakkala et al. (1972) |
| " " | United States (polluted area) | viscera | W | 3.6 | Ellis (1934) |

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|---|---|---|---|---|---|
| Lake white fish *Coregonus clupeaformis* | United States (polluted area) | muscle | W | 2.7 | Ellis (1934) |
| Bloater *Coregonus hoyi* | Lake Superior | liver | W | 0.063±0.017 | Lucas et al. (1970) |
| " " | Lake Michigan | " | W | 0.012 | " |
| " " | United States | whole | W | (0.42-3.40) | Walsh et al. (1977) |
| Whitefish *Coregonus lavaretus* | Norway | liver | W | <0.1 | Lunde (1967) |
| Whitefish *Coregonus sp.* | Gulf of Finland | | W | 1.25 | (1939) in Vinogradov (1953) |
| " " | " | | D | 4.8 | " |
| Whitefish *Coregonus williamsoni cismontanus* | United States | muscle | W | 2.7 | Ellis (1934) |
| " " " | " | " | D | 18.4 | " |
| " " " | " | intestine | W | 3.6 | " |
| " " " | " | " | D | 20.1 | " |
| Slimy sculpin *Cottus cognatus* | Great Lakes | | | (0.23-0.37) | Thomas (1972) |
| Carp *Cyprinus carpio* | Don River | | W | 2.49 | (1939) in Vinogradov (1953) |
| " " | " | | D | 7.35 | " |
| " " | Volga River | | W | 1.28 | " |
| " " | " | | D | 6.0 | " |
| " " | United States | | W | 0.51 | Ellis et al. (1941) |
| " " | " | | D | 2.35 | " |

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| Carp *Cyprinus carpio* | United States | whole | W | (0.05-0.52) | Walsh et al. (1977) |
| " " | New York | muscle | W | 0.12 | Pakkala et al. (1972) |
| " " | Wisconsin | " | W | (0.0-0.1) | Kleinert et al. (1974) |
| " " | Lake Erie | " | W | (0.14-0.21) | Willford (1971) |
| Gizzard shad *Dorosoma cepedianum* | New York | " | W | (0.0-0.25) | Pakkala et al. (1972) |
| " " | United States | | W | (0.13-1.47) | Pillay et al. (1974) |
| " " | Lake Erie | " | W | (0.34-0.40) | Willford (1971) |
| " " | United States | whole | W | (<0.05-0.32) | Walsh et al. (1977) |
| Shad *Dorosoma sp.* | " | | W | 0.645 | Ellis et al. (1941) |
| " " | " | | D | 3.855 | " |
| Northern pike *Esox lucius* | Lake Ladoga | | W | 1.28 | (1939) in Vinogradov (1953) |
| " " | " | | D | 7.65 | " |
| " " | Caspian Sea | | W | 1.22 | " |
| " " | " | | D | 6.0 | " |
| " " | Don River | | W | 1.2 | " |
| " " | " | | D | 6.4 | " |
| " " | Norway | | W | <0.1 | Lunde (1967) |
| " " | Germany | | W | (0.0-0.11) | Thumann (1941) |
| " " | Canada | | W | (<0.05-0.09) | Uthe & Bligh (1971) |

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|---|---|---|---|---|---|
| Northern pike<br>*Esox lucius* | Manitoba | muscle | W | <0.05 | Uthe & Bligh (1971) |
| " " | " | " | W | 0.09 | " |
| " " | Lake Erie | " | W | <0.05 | " |
| " " | Sweden | " | W | 0.026 | Ljunggren et al. (1971) |
| " " | New York | " | W | (0.03-0.09) | Pakkala et al. (1972) |
| " " | Wisconsin | " | W | (0.0-0.1) | Kleinert et al. (1974) |
| " " | Great Britain | | W | 0.8 | Chapman (1926) |
| Muskalonge<br>*Esox masquinongy* | New York | muscle | W | 0.20 | Pakkala et al. (1972) |
| Pickerel<br>*Esox niger* | United States | | W | (0.13-0.73)<br>0.255 | Ellis et al. (1941) |
| " " | " | | D | 1.125 | " |
| " " | New York | " | W | (0.03-0.08) | Pakkala et al. (1972) |
| " " | United States | whole | W | (<0.5-0.5) | Walsh et al. (1977) |
| Pike<br>*Esox sp.* | | | W | 0.3 | (1919) in Vinogradov (1953) |
| " " | Great Britain | | W | 1.0 | Chapman (1924) |
| Mosquito fish<br>*Gambusia affinis* | S. Florida | whole | W | 0.07 | Ogden et al. (1974) |
| Mosquito fish<br>*Gambusia patruelis* | United States | | W | 0.412 | Ellis et al. (1941) |

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|---|---|---|---|---|---|
| Mosquito fish<br>Gambusia patruelis | United States | | D | 1.94 | Ellis et al. (1941) |
| Bluegill sunfish<br>Helioperca incisor | " | | W | 0.517 | " |
| " " | " | | D | 2.01 | " |
| Goldeye<br>Hiodon alosoides | " | whole | W | (<0.05-0.28) | Walsh et al. (1977) |
| Mooneye<br>Hiodon tergisus | " | " | W | 0.10 | " |
| White catfish<br>Ictalurus catus | " | " | W | (<0.05-0.20) | " |
| Blue catfish<br>Ictalurus furcatus | " | " | W | (<0.05-0.11) | " |
| Black bullhead<br>Ictalurus melas | " | " | W | (<0.05-0.16) | " |
| Brown bullhead<br>Ictalurus nebulosus | " | " | W | (<0.05-0.21) | " |
| Channel catfish<br>Ictalurus punctatus | Louisiana | wild, muscle | W | (0.0-0.3)<br>0.1±SD 0.1 | Zook et al. (1976) |
| " " | Mississippi & Arkansas | cultivated, muscle | W | (0.2-3.1)<br>2.2±SD 1.3 | " |
| " " | Lake Erie | muscle | W | (0.07-0.08) | Willford (1971) |
| " " | United States | whole | W | (<0.05-0.31) | Walsh et al. (1971) |
| Catfish<br>Ictalurus sp. | New York | | W | (0.03-0.04) | Pakkala et al. (1972) |
| " " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| " " | New York | " | W | (0.0-0.09) | Pakkala et al. (1972) |

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| Smallmouth buffalo, Bullhead catfish *Ictiobus bubalus* | United States | | W | 0.705 | Ellis et al. (1941) |
| " " | " | | D | 3.037 | " |
| Bigmouth buffalo *Ictiobus cyprinellus* | " | whole | W | (0.05-0.26) | Walsh et al. (1977) |
| *Labeo rohita* | Paro, India | | W | 0.57 | (1935) in Vinogradov (1953) |
| Lamprey *Lampetra sp.* | United States | | W | 0.547 | Ellis et al. (1941) |
| " " | " | | D | 2.75 | " |
| *Lepibema chrysops* | " | | W | 0.48 | " |
| " " | " | | D | 1.94 | " |
| Spotted gar *Lepisosteus oculatus* | " | whole | W | 0.05 | Walsh et al. (1977) |
| Long-nose gar *Lepisosteus osseus* | " | | W | (0.35-0.4) 0.367 | Ellis et al. (1941) |
| " " | " | " | D | 1.118 | " |
| " " | " | " | W | (<0.05-0.08) | Walsh et al. (1977) |
| Florida gar *Lepidosteus platyrhincus* | S. Florida | " | W | 0.5 | Ogden et al. (1974) |
| Redbreast sunfish *Lepomis auritus* | United States | " | W | (<0.05-0.11) | Walsh et al. (1977) |
| Pumkinseed *Lepomis gibbosus* | Wisconsin | muscle | W | (0.13-0.17) | Kleinert et al. (1974) |
| " " | United States | whole | W | (<0.05-0.16) | Walsh et al. (1977) |

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|---|---|---|---|---|---|---|
| Bluegill<br>*Lepomis macrochirus* | Wisconsin | | | | (0.09-0.19) | Gilderhus (1966) |
| " " | " pools treated with As | | | | (0.12-11.6) | " |
| " " | " " | muscle | | | 1.3 | " |
| " " | " " | skin & scale | | | 2.4 | " |
| " " | " " | gill & digestive tract | | | 17.6 | " |
| " " | " " | liver | | | 11.6 | " |
| " " | " " | kidney | | | 5.9 | " |
| " " | " " | ovary | | | 8.4 | " |
| " " | Wisconsin | muscle | | W | (0.0-0.11) | Kleinert et al. (1974) |
| " " | S. Florida | whole | | W | (0.05-0.09) | Ogden et al. (1974) |
| " " | United States | " | | W | 0.52 | Ellis et al. (1941) |
| " " | " | " | | W | (<0.05-0.15) | Walsh et al. (1977) |
| Longear sunfish<br>*Lepomis megalotis* | " | " | | W | 0.22 | " |
| Chub<br>*Leuciscus cephalus* | Norway | oil | | W | 0.7 | Lunde (1967) |
| " " | Great Britain | muscle | | W | 0.5 | Chapman (1926) |
| Roach<br>*Leuciscus idus* | Norway | oil | | W | <0.1 | Lunde (1967) |
| Burbot<br>*Lota lota* | New York | muscle | | W | 0.19 | Pakkala et al. (1972) |

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| Burbot *Lota lota* | Wisconsin | muscle | W | 0.1 | Kleinert et al. (1974) |
| Pike-perch *Lucioperca lucioperca* | New Ladoga | | W | 1.8 | (1939) in Vinogradov (1953) |
| " " | " | | D | 9.2 | " |
| " " | Don River | | W | 1.88 | (1939) in Vinogradov (1953) |
| " " | " | | D | 11.9 | " |
| " " | Volga River | | W | 1.02 | " |
| " " | " | | D | 5.2 | " |
| " " | Kura River | | W | 1.24 | " |
| " " | " | | D | 5.55 | " |
| " " | Caspian Sea | | W | 1.54 | " |
| " " | " | | D | 6.2 | " |
| " " | Norway | oil | W | 0.3 | Lunde (1967) |
| Smallmouth bass *Micropterus dolomieui* | Wisconsin | muscle | W | (0.0-0.12) | Kleinert et al. (1974) |
| " " | Lake Erie | " | W | 0.22 | Willford (1971) |
| " " | New York | " | W | (0.03-0.51) | Pakkala et al. (1972) |
| " " | United States | whole | W | (<0.05-0.28) | Walsh et al. (1977) |
| Largemouth bass *Micropterus salmoides* | " | | W | 0.622 | Ellis et al. (1941) |
| " " | " | | D | 3.09 | " |
| " " | " | liver, oil | W | (7.37-77.31) 40.0 | " |

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| Largemouth bass *Micropterus salmoides* | United States | whole | D | 1.74 | Ellis et al. (1941) |
| " " | " | fat | | 2.34 | " |
| " " | " | liver | W | 4.5 | " |
| " " | " | " | D | 15.0 | " |
| " " | " | liver fat | | 40.5 | " |
| " " | " | whole | W | (<0.05-0.22) | Walsh et al. (1977) |
| " " | S. Florida | " | W | 0.05 | Ogden et al. (1974) |
| " " | Wisconsin | muscle | W | (0.0-0.12) | Kleinert et al. (1974) |
| " " | New York | " | W | (0.03-0.16) | Pakkala et al. (1972) |
| Spotted sucker *Minytrema melanops* | United States | whole | W | (0.062-0.253) 0.21 | Ellis et al. (1941) |
| " " | " | " | | 1.24 | " |
| " " | " | " | W | (<0.05-0.12) | Walsh et al. (1977) |
| White perch *Morone americana* | " | " | W | (<0.05-0.24) | " |
| White bass *Morone chrysops* (=Roccus chrysops) | Lake Erie | liver | W | 0.098 | Lucas et al. (1970) |
| " " | " | muscle | W | (0.18-0.28) | Willford (1971) |
| " " | New York | " | W | (0.15-0.28) | Pakkala et al. (1972) |
| " " | Wisconsin | " | W | (0.0-0.11) | Kleinert et al. (1974) |
| " " | United States | | W | (0.28-0.48) | Ellis et al. (1941) |

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| White bass<br>Morone chrysops<br>(=Roccus chrysops) | United States | whole | W | (<0.05-0.24) | Walsh et al. (1977) |
| Striped bass<br>Morone saxatilis | New York | muscle | W | (0.23-0.69) | Pakkala et al. (1972) |
| Redhorse<br>Moxostoma sp. | Wisconsin | " | W | (0.0-0.1) | Kleinert et al. (1974) |
| " " | United States | whole | W | (<0.05-0.11) | Walsh et al. (1977) |
| Peamouth chub<br>Mylocheilus caurinus | " | " | W | (<0.05-0.80) | " |
| Golden shiner<br>Notemigonus chrysoleucas | " | | W | (0.55-1.95)<br>0.975 | Ellis et al. (1941) |
| " " | " | whole | D | 5.66 | " |
| " " | " | " | W | (0.09-0.10) | Walsh et al. (1977) |
| Spot-tail shiner<br>Notropis hudsonius | Lake Michigan | " | W | 0.003 | Lucas et al. (1970) |
| " " | Lake Erie | " | W | 0.0035±0.003 | " |
| Salmon<br>Oncorhynchus gorbuscha | Kamtchatka | | W | 0.9 | (1939) in Vinogradov (1953) |
| " " | " | | D | 3.5 | " |
| Chum salmon<br>Oncorhynchus keta | Okhotsk Sea | | W | 1.5 | " |
| " " | " | | D | 6.0 | " |
| Coho salmon<br>Oncorhynchus kisutch | Wisconsin | muscle | W | (0.0-0.14) | Kleinert et al. (1974) |
| " " | Lake Erie | " | W | (0.07-0.17) | Willford (1971) |

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| Coho salmon<br>*Oncorhynchus kisutch* | New York | muscle | W | (0.0-0.49) | Pakkala et al. (1972) |
| " " | United States | " | W | 0.09 | Pillay et al. (1974) |
| Salmon<br>*Oncorhynchus sp.* | W. Canada | " | W | <0.4 | LeBlanc & Jackson (1973) |
| Rainbow smelt<br>*Osmerus mordax* | Lake Erie | " | W | 0.15 | Uthe & Bligh (1971) |
| " " | " | whole | W | 0.26 | Willford (1971) |
| " " | Lake Michigan | liver | W | 0.002 | Lucas et al. (1970) |
| " " | Great Lakes | | | (0.18-1.09) | Thomas (1972) |
| Sacramento blackfish<br>*Orthodon microlepidnotus* | United States | whole | W | 0.10 | Walsh et al. (1977) |
| Yellow perch<br>*Perca flavescens* | Lake Erie | liver | W | 0.007±0.002 | Lucas et al. (1970) |
| " " | " | muscle | W | <0.05 | Uthe & Bligh (1971) |
| " " | " | " | W | (0.04-0.05) | Willford (1971) |
| " " | Wisconsin | " | W | (0.0-0.11) | Kleinert et al. (1974) |
| " " | United States | whole | W | (<0.05-0.16) | Walsh et al. (1977) |
| European perch<br>*Perca fluviatilis* | Norway | oil | W | (<0.1-0.8) | Lunde (1967) |
| " " | Great Britain | | W | 0.6 | Chapman (1926) |

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|---|---|---|---|---|---|
| Perch<br>*Perca sp.* | | | W | 0.6 | (1925) in Vinogradov (1953) |
| " " | Great Britain | | W | 0.57 | (1926) in Vinogradov (1953) |
| " " | New York | muscle | W | (0.03-0.08) | Pakkala et al. (1972) |
| Trout perch<br>*Percopsis omiscomaycus* | Lake Michigan | whole | W | 0.043±0.012 | Lucas et al. (1970) |
| " " | Lake Superior | " | W | 0.007±0.002 | " |
| Sucker-mouthed minnow<br>*Phenacobius mirabilis* | United States | | W | 0.27 | Ellis et al. (1941) |
| " " | " | | D | 1.155 | " |
| White crappie<br>*Pomoxis annularis* | " | whole | W | (0.05-0.34) | Walsh et al. (1977) |
| Black crappie<br>*Pomoxis nigromaculatus* | New York | muscle | W | (0.03-0.16) | Pakkala et al. (1972) |
| " " | United States | whole | W | (0.05-0.42) | Walsh et al. (1977) |
| " " | New York | | | (<0.1-0.14) | Ullman et al. (1961) |
| Crappie<br>*Pomoxis sp.* | Wisconsin | muscle | W | (0.0-0.1) | Kleinert et al. (1974) |
| Round whitefish<br>*Prosopium cylindraceum* | Lake Superior | liver | W | 0.0056± 0.0034 | Lucas et al. (1970) |
| " " | United States | whole | W | (<0.05-0.13) | Walsh et al. (1977) |
| Northern squawfish<br>*Ptychocheilus cregonensis* | " | " | W | (<0.05-0.31) | " |

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|---|---|---|---|---|---|
| Flathead catfish<br>*Pylodictus olivaris* | United States | whole | W | (ND-0.12) | Walsh et al. (1977) |
| Yellow bass<br>*Roccus mississippiensis* | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| Loach<br>*Rutilus rutilus* | Great Britain | | W | 0.4 | Chapman (1926) |
| " " | Don River | | W | 1.06 | Shtenberg (1939) |
| " " | " | | D | 4.7 | " |
| Char<br>*Salmo alpinus* | Norway | muscle, oil | | <0.1 | Lunde (1967) |
| *Salmo eriox* | " | " | | <0.1 | " |
| Rainbow trout, steelhead<br>*Salmo gairdneri* | Wisconsin | muscle | W | (0.0-0.14) | Kleinert et al. (1974) |
| " " | United States | whole | W | (0.05-0.16) | Walsh et al. (1977) |
| " " | New York | muscle | W | (0.03-0.09) | Pakkala et al. (1972) |
| " " | W. Canada | " | W | <0.4 | LeBlanc & Jackson (1973) |
| Yellowstone cut-throat<br>*Salmo lewisi* | United States | " | | 2.4 | Ellis et al. (1941) |
| " " | " | " | D | 17.4 | " |
| " " | " | intestine | W | 5.3 | " |
| " " | " | " | D | 10.6 | " |
| Atlantic salmon<br>*Salmo salar* | Norway | oil, liver | W | 6.7 | Lunde (1967) |
| " " | " | oil,muscle | W | 3.1 | " |

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|---|---|---|---|---|---|
| Atlantic salmon *Salmo salar* | Norway | oil, muscle | W | (0.75-1.73) 1.02 | Ljunggren et al. (1971) |
| Salmon *Salmo sp.* | Kura River | | W | 2.46 | (1939) in Vinogradov (1953) |
| " " | | | D | 6.42 | " |
| Brown trout *Salmo trutta* | Gulf of Finland | | W | 1.43 | " |
| " " | " | | D | 5.27 | " |
| " " | New York | muscle | W | (0.03-0.2) | Pakkala et al. (1972) |
| " " | Wisconsin | " | W | 0.0 | Kleinert et al. (1974) |
| " " | United States | whole | W | (0.05-0.23) | Walsh et al. (1977) |
| Brook trout, speckled trout *Salvelinus fontinalis* | New York | " | W | (0.03-0.09) | Pakkala et al. (1972) |
| " " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| Splake *Salvelinus fontinalis* X *namaycush* | New York | | W | 0.04 | Pakkala et al. (1972) |
| Lake trout *Salvelinus namaycush* | Lake Superior | liver | W | $0.08 \pm 0.01$ | Lucas et al. (1970) |
| " " | Lake Michigan | " | W | $0.018 \pm 0.003$ | " |
| " " | New York | muscle | W | (0.03-0.3) | Pakkala et al. (1972) |
| " " | Wisconsin | " | W | (0.12-0.35) | Kleinert et al. (1974) |
| " " | United States | whole | W | (0.06-0.68) | Walsh et al. (1977) |

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|---|---|---|---|---|---|
| Fallfish<br>Semotilus atromaculatus | United States | | W | 0.577 | Ellis et al. (1941) |
| " " | " | | D | 2.7 | " |
| Sheatfish<br>Silurus glanis | Don River | | W | 3.85 | Shtenberg (1939) |
| " " | " | | D | 25.0 | " |
| " " | Volga River | | W | 3.55 | " |
| " " | " | | D | 13.4 | " |
| Sauger<br>Stizostedion canadense | United States | whole | W | (<0.05-0.19) | Walsh et al. (1977) |
| Walleye<br>Stizostedion vitreum | Lake Erie | liver | W | (0.030-0.098) | Lucas et al. (1970) |
| " " | " | muscle | W | (0.11-0.12) | Willford (1971) |
| " " | " | " | W | (0.10-0.12) | Pillay et al. (1972) |
| " " | Great Lakes | | | (0.23-0.95) | Thomas (1972) |
| " " | New York | " | W | (0.03-0.3) | Pakkala et al. (1972) |
| " " | United States | whole | W | (<0.05-0.24) | Walsh et al. (1977) |
| " " | Wisconsin | muscle | W | (0.0-0.16) | Kleinert et al. (1974) |
| Arctic grayling<br>Thymallus arcticus | United States | whole | W | <0.05 | Walsh et al. (1977) |
| Tench<br>Tinca tinca | Great Britain | | W | 0.4 | Chapman (1926) |

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|---|---|---|---|---|
| Vimba | vimba | Don River | 0.85 | (1939) in Vinogradov (1953) |
| " | " | " | 3.41 | " |
| " | " | " | 1.26 | " |

ARSENIC IN MOLLUSCA (1)

| Species | Locality | Tissue | Analysis (2) PPM | | Authority |
|---|---|---|---|---|---|
| Calico scallop *Aequipecten gibbus* | Florida | soft parts | W | (3.5-5.0) 4.2±SD 0.4 | Zook et al. (1976) |
| Atlantic bay scallop *Aequipecten irradians* (=Argopecten irradians) | N.W. Atlantic | " | W | 0.70±SE 0.31 | Nelson et al. (1976) |
| " " | Massachusetts | " | W | (0.5-1.1) 0.7±SD 0.2 | Zook et al. (1976) |
| Buttercup *Anodonta cygnea* | Great Britain | " | D | 4.3 | Leatherland & Burton (1974) |
| *Aolliceps cornucopia* | Portugal | cooked | W | (1.2-8.6) | Costa & DaFonseca (1967) |
| *Aristeus antennatus* | " | | W | (4.4-19.6) | " |
| Cholgas *Aulacomya ater* | Peru | muscle | | (0.56-1.4) | Echegaray (1974) |
| Northern whelk *Buccinum undatum* | Great Britain | soft parts | W | (12.0-49.0) 24.0 | Chapman (1926) |
| " " | " | " | D | 11.0 | Leatherland & Burton (1974) |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | | |
|---|---|---|---|---|---|
| Channeled whelk<br>*Busycon canaliculatum* | Maryland | heart & tongue | W | (1.2-2.2)<br>1.6±SD 0.3 | Zook et al. (1976) |
| " " | Long Island | muscle | W | 9.0 | Greig et al. (1977b) |
| Cockle<br>*Cerastoderma edule*<br>(=Cardium edule) | Great Britain | soft parts | D | (5.1-6.3) | Leatherland & Burton (1974) |
| " " | " | mantle fluid | D | 8.4 | " |
| " " | " | | W | (17.0-40.0)<br>22.5 | Chapman (1926) |
| " " | Washington | | W | 12.8 | Cardiff (1937) |
| " " | Portugal | | W | (1.3-2.4) | Costa & DaFonseca (1967) |
| Chiton<br>*Chiton sp.* | Grand Bahama Island | whole | | 2.10 | Taylor & Bright (1973) |
| Cockle<br>*Clinocardium sp.* | W. Canada | soft parts | W | (<0.5-15.6)<br>med. 1.1 | LeBlanc & Jackson (1973) |
| Portuguese oyster<br>*Crassostrea angulata*<br>(=Gryphia angulata) | Great Britain | | W | (33.0-70.0)<br>44.0 | Chapman (1926) |
| " " | " | soft parts | D | 10.0 | Leatherland & Burton (1974) |
| " " | | | W | 34.0 | Vinogradov (1953) |
| " " | Portugal | | W | (1.2-3.6) | Costa & DaFonseca (1967) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Rock oyster *Crassostrea commercialis* | | Australia | soft parts | W | (0.3-3.4)1.2 | Mackay et al. (1975a) |
| Giant pacific oyster *Crassostrea gigas* | | W. United States | " | W | (<0.1-0.4) 0.07 | Jelinek & Corneliussen (1977) |
| American oyster *Crassostrea virginica* | | | | D | (0.1-1.5) 1.0 | (1919) in Vinogradov (1953) |
| " | " | United States | fresh | W | 2.9 | Schroeder & Balassa (1966) |
| " | " | " | frozen | W | 2.7 | " |
| " | " | " | | D | (0.0-1.5) | Vinogradov (1953) |
| " | " | " | tinned | W | (0.4-0.8) | Chapman (1926) |
| " | " | Texas | soft parts | D | 1.3 | Sims & Presley (1976) |
| " | " | United States | canned | W | 0.22 | Dick & Pugsley (1950) |
| " | " | " | smoked | W | 1.0 | " |
| " | " | " | | W | (0.5-1.0) | (1926) in Vinogradov (1953) |
| " | " | N.W. Atlantic | | D | (<1.0-3.6) <1.6 | Windom (1972) |
| " | " | " | | W | (0.15-0.54) <0.24 | " |
| " | " | United States | soft parts | W | (ND-1.2)0.09 | Jelinek & Corneliussen (1977) |

| | | | | | |
|---|---|---|---|---|---|
| American oyster<br>Crassostrea virginica | Long Island | soft parts | W | (0.6-2.5)<br>1.0±SD 0.5 | Zook et al. (1976) |
| " " | Chesapeake Bay | " | W | (0.6-1.6)<br>0.8±SD 0.3 | " |
| Atlantic slipper shell<br>Crepidula fornicata | Great Britain | " | D | (8.1-13.0) | Leatherland & Burton (1974) |
| Donax<br>Donax sp. | Peru | | | 1.7 | Echegaray (1974) |
| Donax<br>Donax trunculus | Portugal | | W | (1.8-3.7) | Costa & DaFonseca (1967) |
| Garden snail<br>Helix hortensis | Great Britain | soft parts | W | 0.4 | Chapman (1926) |
| Periwinkle<br>Littorina littoralis | " | " | D | 12.0 | Leatherland & Burton (1974) |
| Periwinkle<br>Littorina littorea | " | " | W | (20.0-40.0)<br>24.8 | Chapman (1926) |
| " " | " | " | D | (14.0-19.0) | Leatherland & Burton (1974) |
| " " | Newfoundland | " | D | (4.0-15.0) | Penrose et al. (1975) |
| " " | Norway | oil | W | 84.0 | Lunde (1972) |
| " " | " | fatty acid | W | 32.0 | " |
| " " | Portugal | soft parts (cooked) | W | (3.6-6.3) | Costa & DaFonseca (1967) |

| | | | | | |
|---|---|---|---|---|---|
| Squid<br>*Loligo vulgaris* | Portugal | soft parts | W | (0.8-7.5) | Costa & DaFonseca (1967) |
| " " | " | " cooked | W | (0.4-3.3) | " |
| " " | Norway | fatty acid | W | 0.7 | Lunde (1972) |
| Short squid<br>*Loliguncula brevis* | N.W. Atlantic | | D | (<1.0-2.1)<br><1.2 | Windom (1972) |
| " " | " | | W | (<0.27-0.57)<br><0.325 | " |
| Macoma clam<br>*Macoma sp.* | W. Canada | soft parts | W | (<0.5-15.6)<br>med. 1.1 | LeBlanc & Jackson (1973) |
| Northern quahog<br>*Mercenaria mercenaria* | N.W. Atlantic | " | D | (9.0-50.0)<br>28.0 | Windom (1972) |
| " " | " | " | W | (1.0-2.5)<br>1.8±SD 0.6 | Zook et al. (1976) |
| " " | Great Britain | " | D | 5.9 | Leatherland & Burton (1974) |
| " " | " | mantle | D | 7.8 | " |
| " " | " | adductor | D | 1.8 | " |
| " " | " | gill | D | 12.2 | " |
| " " | " | | D | (2.0-12.0) | Raymont (1972) |
| " " | United States | soft parts | W | (<0.1-1.4)<br>0.12 | Jelinek & Corneliussen (1977) |
| Machas<br>*Mesmodesma donacium* | Peru | muscle | | (0.53-0.89)<br>0.71 | Echegaray (1974) |

| | | | | | |
|---|---|---|---|---|---|
| Rock shell *Murex trunculus* | Portugal | | W | (14.6-26.4) | Costa & DaFonseca (1967) |
| Soft shell clam *Mya arenaria* | | | W | 2.0 | (1933) in Vinogradov (1953) |
| " " | United States | soft parts | W | (<0.1-0.9) 0.14 | Jelinek & Corneliussen (1977) |
| " " | Chesapeake Bay | " | W | (1.0-2.5) 1.8±SD 0.6 | Zook et al. (1976) |
| Blue mussel *Mytilus edulis* | Great Britain | | W | (36.0-119.0) 80.5 | Chapman (1926) |
| " " | " | | D | (9.5-15.0) | Leatherland & Burton (1974) |
| " " | " | | D | (9.0-15.0) | Raymont (1972) |
| " " | Norway | raw material | D | 8.0 | Lunde (1970) |
| " " | " | oil | W | 18.0 | " (1972) |
| " " | " | fatty acid | W | 22.0 | " |
| " " | " | water soluble | D | 9.7 | " (1970) |
| " " | " | whole | D | 0.6 | " (1973) |
| " " | W. Greenland | soft parts | D | (14.1-16.7) | Bohn (1975) |
| " " | | | | (1.3-5.0) | Kohn-Abrest (1951) |
| " " | France (exposed to As 100 µg/l | muscle | | (0.04-0.1) | Sautet et al. (1964) |

| | | | | | |
|---|---|---|---|---|---|
| Blue mussel<br>*Mytilus edulis* | France | shell | | (0.005-0.02) | Sautet et al. (1964) |
| " " | " | byssus | | (2.5-5.0) | " |
| " " | " | excreta | | (5.5-8.0) | " |
| " " | California | | W | 0.085 | Gorgy et al. (1948) |
| " " | | | W | 69.0 | Vinogradov (1953) |
| " " | Newfoundland | soft parts | D | (1.6-5.3) | Penrose et al. (1975) |
| " " | Italy (fed arsenic) | | W | (0.04-3.73) | Del Vecchio et al. (1962) |
| " " | " (normal) | | W | 0.01 | " |
| Mussel<br>*Mytilus magellonicus* | Peru | | D | (10.5-26.1) | Moyana (1956) |
| Dog whelk<br>*Nucella lapillus* | Great Britain | soft parts | D | (16.0-38.0) | Leatherland & Burton (1974) |
| Octopus<br>*Octopus bimaculatus* | California | tentacle | W | 0.121 | Gorgy et al. (1948) |
| Octopus<br>*Octopus sp.* | Bahama Islands | whole | | 16.11 | Taylor & Bright (1973) |
| Atlantic octopus<br>*Octopus vulgaris* | N.W. Atlantic | | D | 24.0 | Windom (1972) |
| " " | Portugal | raw | W | (2.6-40.3) | Costa & DaFonseca (1967) |
| " " | " | cooked | W | (3.0-24.3) | " |

| | | | | | |
|---|---|---|---|---|---|
| Squid<br>*Ommastrephes sagittatus* | Norway | raw material | D | 6.5 | Lunde (1970) |
| " " | " | water soluble | D | 17.0 | " |
| Oyster<br>*Ostrea edulis* | " | raw material | D | 7.6 | " |
| " " | " | " | W | 2.6 | " |
| " " | " | water soluble | D | 9.8 | " |
| " " | Great Britain | soft tissue | W | (3.0-10.0)<br>5.5 | Chapman (1926) |
| " " | " | | W | 6.0 | " |
| " " | | | | (1.8-3.1) | Kohn-Abrest (1951) |
| " " | " | " | D | (5.1-6.4) | Leatherland & Burton (1974) |
| " " | " | mantle cavity fluids | D | 8.4 | " |
| European limpet<br>*Patella vulgata* | Irish Sea | | W | (1.0-4.7) | Peden et al. (1973) |
| " " | Great Britain | soft parts | D | (11.0-24.0) | Leatherland & Burton (1974) |
| Scallop<br>*Pecten maximus* | Norway | raw material | W | 11.6 | Lunde (1970) |
| " " | " | water soluble | W | 18.0 | " |
| " " | " | lipid | W | 4.8 | " (1972) |

| | | | | | |
|---|---|---|---|---|---|
| Scallop<br>*Pecten sp.* | Grand Bahama Island | whole | | 1.79 | Taylor & Bright (1973) |
| Smooth sea scallop<br>*Placopecten magellanicus* | N.W. Atlantic | soft parts | W | (1.3-2.4)1.6 ±SD 0.3 | Zook et al. (1976) |
| Shark eye<br>*Polineces duplicatus* | N.W. Atlantic | | D | (3.2-5.0) 4.2 | Windom (1972) |
| Almejas, semele<br>*Semele solida* | Peru | muscle | | 1.39 | Echegaray (1974) |
| Cuttlefish<br>*Sepia officinalis* | Great Britain | gill | D | 73.0 | Leatherland & Burton (1974) |
| " " | " | mantle | D | 198.0 | " |
| " " | | | D | 49.0 | (1903) in Vinogradov (1953) |
| " " | Portugal | raw | W | (6.2-11.5) | Costa & DaFonseca (1967) |
| " " | " | cooked | W | (0.8-6.8) | " |
| Jackknife clam<br>*Solen marginatus* | " | raw | W | (1.92-4.2) | " |
| " " | " | cooked | W | (1.4-2.7) | " |
| Atlantic surf clam<br>*Spisula solidissima* | Chincoteague Maryland | muscle | W | 1.3±SE 0.09 | Greig et al. (1977b) |
| Conch<br>*Strombus sp.* | | fresh | W | 3.1 | Schroeder & Balassa (1966) |
| " " | | dried | W | 5.63 | " |

| | | | | | |
|---|---|---|---|---|---|
| Littleneck clam *Tapes decussatus* | Portugal | | W | (3.7-6.6) | Costa & Da Fonseca (1967) |
| Littleneck clam *Tapes japonica* | Japan | | D | 0.0036? | Fukai & Meinke (1962) |
| Dogwinkle *Thais chocolata* | Peru | | | (0.24-46.08) 9.26 | Echegaray (1974) |
| *Vivipara japonica* | | | | (4.6-6.1) | (1934) in Vinogradov (1953) |
| "Clams" | United States | frozen | W | 2.52 | Schroeder & Balassa (1966) |
| " | Canada | canned | D | 15.9 | Dick & Pugsley (1950) |
| " | " | " | W | 0.36 | " |
| " | " | " | W | 0.85 | Cardiff (1937) |
| "French edible snail" | | | W | 0.5 | Chapman (1926) |
| "Scallops" | United States | fresh | W | 1.67 | Schroeder & Balassa (1966) |
| " | Great Britain | " | W | (36.0-85.0) 46.0 | Chapman (1926) |
| "Marine mollusca" | Pacific | | D | 3.49 | (1939) in Vinogradov (1953) |

ARSENIC IN ARTHROPODA (1)

| Species | Locality | Tissue | Analysis (2) | PPM | Authority |
|---|---|---|---|---|---|
| CRUSTACEA | | | | | |
| Decapod | | | | | |
| Acanthephyra eximia | N.W. Africa | | D | 17.0 | Leatherland et al. (1973) |
| Copepod | | | | | |
| Acartia clausi | Greece | whole | D | (1.6-4.0) 2.9±0.5 | Zafiropoulos & Grimanis (1977) |
| Crayfish | | | | | |
| Astacus pallipes | Great Britain | | W | (1.0-2.0) 1.35 | Chapman et al. (1926) |
| " " | " | | W | (0.8-1.5) | " |
| Blue crab | | | | | |
| Callinectes sapidus | N.W. Atlantic | | D | (1.0-4.4)1.8 | Windom (1972) |
| " " | S. Florida | whole | W | 7.68 | Ogden et al. (1974) |
| " " | Chesapeake Bay | soft parts | W | (0.5-1.8) 1.3±SD 0.4 | Zook et al. (1976) |
| " " | Texas | whole | D | 0.6 | Sims & Presley (1976) |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ±Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | | |
|---|---|---|---|---|---|
| Crayfish<br>Cambarus sp. | S. Florida | whole | W | 0.38 | Ogden et al. (1974) |
| Crab<br>Cancer anthonyi | S. California | muscle | W | (17.29-51.02) | Fowler et al. (1975) |
| Rock crab<br>Cancer irroratus | Delaware | " | W | 1.9 | Greig et al. (1977b) |
| Dungeness crab<br>Cancer magister | W. Canada | " | W | (2.2-37.8)<br>med. 6.5 | LeBlanc & Jackson (1973) |
| Crab<br>Cancer pagurus | Portugal | cooked | W | (2.1-33.4) | Costa & DaFonseca (1967) |
| Green crab<br>Carcinus maenas | " | " | W | (2.5-7.0) | " |
| Shrimp<br>Eualus macilentus | Newfoundland | egg | W | (2.6-12.7)<br>6.7±SD 3.15 | Kennedy (1976) |
| Mysidacid<br>Eucopia sculpticauda | N.W. Africa | | D | 30.0 | Leatherland et al. (1973) |
| Euphausiidae | Newfoundland | whole | W | (1.5-2.3)<br>1.8±SD 0.35 | Kennedy (1976) |
| Gammaridae | " | " | W | (4.4-8.9)<br>6.6±SD 3.18 | " |
| Red crab<br>Geryon quinquedens | Middle Atlantic Bight | muscle | W | 1.6 | Greig et al. (1976) |
| " " | " | gill | W | 9.1 | " |
| Mantis shrimp<br>Gonodactylus sp. | Grand Bahama Island | whole | | (1.50-11.96) | Taylor & Bright (1973) |
| American lobster<br>Homarus americanus | Newfoundland | muscle | D | (3.8-7.6) | Penrose et al. (1975) |

| | | | | | |
|---|---|---|---|---|---|
| American lobster *Homarus americanus* | Canada | canned | W | 22.1 | Dick & Pugsley (1950) |
| " " | " | " | W | 0.94 | " |
| " " | Nova Scotia | tail muscle | | 40.5 | Reinke et al. (1975) |
| " " | " | hepato-pancreas | | 22.5 | " |
| " " | N.W. Atlantic | | W | (0.5-16.0) 10.0 | Windom (1972) |
| " " | | | D | 0.06 | (1903) in Vinogradov (1953) |
| Lobster *Homarus sp.* | S. Florida | | W | (15.5-18.8) | Ogden et al. (1974) |
| " " | | | D | 14.5 (max.) | (1933) in Vinogradov (1953) |
| " " | Great Britain | | W | (18.0-40.0) | Chapman (1926) |
| " " | " | muscle | W | (105.0-110.0) | " |
| " " | | liver | W | 36.0 | " |
| " " | " | stomach contents | W | 17.0 | " |
| " " | Portugal | cooked | W | (10.8-17.2) | Costa & DaFonseca (1967) |
| " " | | muscle | W | 0.022 | Barnard (1911) |
| " " | | whole | W | 0.453 | " |
| Lobster *Homarus vulgaris* | Norway | muscle | D | 5.3 | Lunde (1970) |
| " " | " | water soluble | D | 14.0 | " |

| | | | | | |
|---|---|---|---|---|---|
| Lobster<br>*Homarus vulgaris* | Sweden | tail muscle | W | 8.0 | Ljundggren et al. (1971) |
| Copepod<br>*Labidocera acutifrons* | N.W. Africa | | D | 14.5 | Leatherland et al. (1973) |
| *Lepas anatifera* | | | D | 16.7 | (1929) in Vinogradov (1953) |
| Euphausid<br>*Meganyctiphanes norvegica* | N.W. Africa | | D | 42.0 | Leatherland et al. (1973) |
| " " | Baltic Sea | | W | (1.95-5.5) | Ljunggren et al. (1971) |
| Stone crab<br>*Menippe mercenaria* | S. Florida | whole | W | (8.97-11.8) | Ogden et al. (1974) |
| Spider crab<br>*Mithrax sp.* | Grand Bahama Island | " | | (3.66-5.47) | Taylor & Bright (1973) |
| Crab<br>*Mursia gaudichaudii* | S. California | muscle | W | (2.10-10.08)<br>6.23±SE 0.97 | Fowler et al. (1975) |
| " " | " | gonad | W | (3.79-30.54)<br>9.19±SE 3.14 | " |
| " " | " | digestive gland | W | (3.27-25.80)<br>12.44±SE 2.44 | " |
| Dublin Bay prawn<br>*Nephrops norvegicus* | Great Britain | muscle | W | (38.0-100.0)<br>56.6 | Chapman (1926) |
| " " | " | | W | (27.0-130.5) | " |
| " " | " | internal organs | W | (20.0-70.0)<br>39.2 | " |
| " " | " | shell | W | (5.0-7.0) | " |

| | | | | | |
|---|---|---|---|---|---|
| Dublin Bay prawn<br>Nephrops norvegicus | Baltic Sea | tail muscle | W | 8.0 | Ljunggren et al. (1971) |
| " " | Portugal | cooked | W | (7.2-19.4) | Costa & DaFonseca (1967) |
| Decapod<br>Oplophorus sp. | N.W. Africa | | D | 23.5 | Leatherland et al. (1973) |
| Shrimp<br>Palaemon elegans | Great Britain | | D | 16.0 | Burton (1974) |
| Shrimp<br>Palaemon serratus | Portugal | cooked | W | (1.0-2.7) | Costa & DaFonseca (1967) |
| Deep sea prawn,<br>Pandalus borealis | W. Greenland | | | 80.2 (max.) | Bohn (1975) |
| " " | " | head & shell | D | (65.9-70.6)68.3 | " |
| " " | " | abdominal muscle | D | (52.5-70.6)61.6 | " |
| " " | Oslo Fjord, Norway | oil | D | 42.0 | Lunde (1973) |
| " " | Skagerak Norway | " | D | 30.0 | " |
| " " | " | fatty acid | W | 4.8 | " (1972) |
| " " | " | oil | W | 10.1 | " |
| " " | " | " | W | 13.0 | Luzanski (1936) |
| " " | N.W. Atlantic | | W | (3.6-9.4)<br>6.0±SD 1.9 | Zook et al. (1976) |
| " " | Newfoundland | egg | W | (3.7-14.0) | Kennedy (1976) |

| | | | | | |
|---|---|---|---|---|---|
| Prawn<br>*Pandalus montagui* | Newfoundland | egg | W | (4.0-19.6) | Kennedy (1976) |
| Shrimp<br>*Pandalus sp.* | Japan | soft parts | D | 0.051 | Fukai & Meinke (1962) |
| " " | " | | A | 0.83 | " |
| " " | South Carolina | | W | (5.94-41.60) | Coulson et al. (1935) |
| " " | Great Britain | | W | 18.9 | Chapman (1926) |
| " " | | | W | 10.0 (max.) | (1933) in Vinogradov (1953) |
| Spiny lobster<br>*Panulirus argus* | N.W. Atlantic | | D | 14.0 | Windom (1972) |
| Spiny lobster<br>*Panulirus borealis* | Florida | tail muscle | W | (3.2-9.6)<br>7.2±SD 1.9 | Zook et al. (1976) |
| Spiny lobster<br>*Panulirus sp.* | | whole | W | 0.45 | (1904) in Vinogradov (1953) |
| " " | | muscle | W | (0.0016-0.357) | " |
| " " | | carapace | W | (0.076-1.04) | " |
| " " | Florida | whole | W | (15.5-18.8) | Ogden et al. (1974) |
| Spiny lobster<br>*Panulirus vulgaris* | Great Britain | muscle | W | (20.0-45.0)<br>32.2 | Chapman (1926) |
| " " | " | spawn | W | 70.0 | " |
| " " | " | stomach contents | W | (10.0-24.0)18.0 | " |

| | | | | | |
|---|---|---|---|---|---|
| Spiny lobster<br>*Panulirus vulgaris* | Portugal | cooked | W | (12.0-54.6) | Costa & DaFonseca (1967) |
| King crab<br>*Paralithodes camschatica* | Alaska | body muscle | W | (2.6-7.0)<br>3.8±SD 1.2 | Zook et al. (1976) |
| " " | " | leg muscle | W | (2.3-6.7)<br>4.3±SD 1.5 | " |
| Shrimp<br>*Parapenaeus longirostris* | Portugal | | W | (1.7-38.2) | Costa & DaFonseca (1967) |
| Brown shrimp<br>*Penaeus aztecus* | Texas | muscle | W | (3.1-5.2)<br>4.4±SD 0.7 | Zook et al. (1976) |
| " " | " | whole | D | 0.6 | Sims & Presley (1976) |
| White shrimp<br>*Penaeus setiferus* | N.W. Atlantic | | D | (2.2-6.3)3.8 | Windom (1972) |
| " " | Texas | whole | D | 3.8 | Sims & Presley (1976) |
| " " | Mississippi | muscle | W | (1.7-4.4)<br>3.0±SD 0.8 | Zook et al. (1976) |
| " " | Florida | " | W | (2.8-7.7)<br>4.6±SD 1.3 | " |
| Kelp crab<br>*Pugettia producta* | California | feces | A | 266.0±74.0 | Boothe & Knauer (1972) |
| Shrimp<br>*Sabinea septemcarinenta* | Newfoundland | egg | W | (3.9-22.7) | Kennedy (1976) |
| " " | " | muscle | W | (5.4-10.4) | " |
| Arrow crab<br>*Stenorhynchus sp.* | Bahama Islands | whole | | 20.17 | Taylor & Bright (1973) |

| | | | | | |
|---|---|---|---|---|---|
| Decapod *Systellapis debilis* | N.W. Africa | | D | 22.0 | Leatherland et al. (1973) |
| "Crab" | Great Britain | muscle | W | (36.0-70.0) 49.0 | Chapman (1926) |
| " | | | W | 10.0 | (1933) in Vinogradov (1953) |
| " | | | W | 79.5 | " |
| " | Japan | canned | W | (20.0-85.0) | Chapman (1926) |
| " | Canada | " | | 25.0 | Dick & Pugsley (1950) |
| " | Nova Scotia | | | 3.7 | Reinke et al. (1975) |
| "Crayfish" | Great Britain | " | W | (17.0-20.0) | Dick & Pugsley (1950) |
| " | " | fresh | W | (1.0-2.0) 1.3 | " |
| "Prawn" | " | muscle | W | (36.0-174.0) 71.5 (The sample with 174.0 was 24 prawns) | Chapman (1926) |
| " | " | spawn | W | (64.0-67.0) | " |
| " | " | | W | 14.5 | (1933) in Vinogradov (1953) |
| " | United States | canned | W | (10.5-30.0) | Chapman (1926) |
| " | Japan | " | W | (15.0-63.8) | " |
| "Pagurid crab" | Grand Bahama Island | | | 5.45 | Taylor & Bright (1973) |

| | | | | | |
|---|---|---|---|---|---|
| "Shrimp" | Great Britain | muscle | W | (12.0-40.0) 24.5 | (1926) in Vinogradov (1953) |
| " | " | canned, muscle | W | (11.0-25.0) 18.0 | " |
| "Bay shrimp" | S.E. United States | | W | (1.27-18.80) | Coulson et al. (1935) |
| "Shrimp" | Canada | canned | | 19.9 | Dick & Pugsley (1950) |
| " | Gulf of Mexico | | W | (2.5-12.7) | Johnson & Braman (1975) |
| " | United States | shell | W | 15.3 | Schroeder & Balassa (1966) |
| " | " | frozen | W | 1.5 | " |
| " | Nova Scotia | | | 3.9 | Reinke et al. (1975) |
| "Gulf shrimp" | Texas | | W | 1.94 | Coulson et al. (1935) |
| INSECTA | | | | | |
| Honeybee *Apis mellifera* | Victoria | adults, dead from As spray | W | (3.22-12.0) | Eagland (1936) |
| " " | | " | W | (20.8-31.2) | Lockemann (1935) |
| " " | Victoria | larvae, dead from As spray | W | (4.95-13.0) | Eagland (1936) |
| " " | United States | pupae, dead from As dust | W | 10.0 | Eckert & Allinger (1936) |
| "Insects" | Tennessee | | D | 10.0 | Andren et al. (1973) |

ARSENIC IN LOWER ANIMALS (1)

| Species | Locality | Tissue | Analysis PPM (2) | Authority |
|---|---|---|---|---|
| PORIFERA | | | | |
| Sponge *Desmacidon fruticosum* | | | D 0.15 | (1903) in Vinogradov (1953) |
| Sponge *Ephydatia fluviatilis* | fresh water | | D (8.1-12.0) | (1929) in Vinogradov (1953) |
| Sponge *Halichondria sp.* | Sweden fresh water | | D 5.0 | Noddack & Noddack (1940) |
| Sponge *Halichondria panicea* | Great Britain | | D 2.8 | Leatherland & Burton (1974) |
| Sponge *Spongia sp.* | | | D 5.5 | (1923) in Vinogradov (1953) |
| Sponge *Spongilla lacustris* | fresh water | | D (9.1-24.0) | (1929) in Vinogradov (1953) |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | | |
|---|---|---|---|---|---|
| "Sponge" | Grand Bahama Island | whole | | 0.90 | Taylor & Bright (1973) |
| COELENTERATA | | | | | |
| Jellyfish<br>*Cynaea capillata* | Sweden | | D | 50.0 | Noddack & Noddack (1940) |
| Actinian<br>*Chitonactis richardi* | Sea of Azof | | D | 0.015 | Vinogradov (1953) |
| Sea anemone<br>*Metridium dianthus* | Sweden | | D | 9.0 | Noddack & Noddack (1940) |
| "Hydromedusa" | Sea of Azof | | D | 16.7 | Vinogradov (1953) |
| Coral<br>*Pocillopora verrucosa* | Eniwetok Island | Reduces As V to As III | | | Pilson (1974) |
| *Tealia felina* | Great Britain | | D | 72.0 | Leatherland & Burton (1974) |
| SCYPHOZOA | | | | | |
| *Pelagia sp.* | N.W. Africa | | D | 11.0 | Leatherland et al. (1973) |
| ANNELIDA | | | | | |
| Tubificid<br>*Limnodrilus sp.* | | | D | 13.0 | Vinogradov (1953) |
| Clam worm, ragworm<br>*Nereis diversicolor* | Great Britain | | D | 5.2 | Leatherland & Burton (1974) |
| Polychaetes | Grand Bahama Islands | whole | | 20.68 | Taylor & Bright (1973) |
| "Earthworms" | Tennessee | | D | 19.0 | Andren et al. (1973) |

ECHINODERMATA

| | | | | | |
|---|---|---|---|---|---|
| Sea star<br>*Asterias rubens* | Sweden | without viscera | D | 4.0 | Noddack & Noddack (1940) |
| " " | Great Britain | | D | 10.0 | Leatherland & Burton (1974) |
| Sea urchin<br>*Brissopsis lyrifera* | Sweden | | D | 8.0 | Noddack & Noddack (1940) |
| Sand dollar<br>*Echinarachnius parma* | Newfoundland | whole | D | (1.5-10.8) | Penrose et al. (1975) |
| Sea star<br>*Marthasterias glacialis* | Great Britain | | D | 5.8 | Leatherland & Burton (1974) |
| Sea star<br>*Pisoster ochraceus* | California | | D | 1.26 | Gorgy et al. (1948) |
| Sea cucumber<br>*Stichopus tremulus* | Sweden | without viscera | D | 2.0 | Noddack & Noddack (1940) |
| Sea urchin<br>*Strongylocentrus droebachiensis* | Newfoundland | gonad | D | (1.3-6.0) | Penrose et al. (1975) |
| " " | leachate, dist. from stibnite mine (meters): | | | | |
| " " | " " | 0 | D | 6.0±SD 2.3 | " |
| " " | " " | 35 | D | 5.6±SD 1.5 | " |
| " " | " " | 57 | D | 3.8±SD 0.9 | " |
| " " | " " | 117 | D | 1.35 | " |
| " " | " " | 180 | D | 2.1±SD 1.0 | " |

| | | | | | |
|---|---|---|---|---|---|
| Sea urchin *Strongylocentrus droebachiensis* | leachate, dist. from stibnite mine (meters): | | | | Penrose et al. (1975) |
| " " | " " | 189 | D | 1.9±SD 0.1 | " |
| " " | " " | 280 | D | 3.3±SD 0.5 | " |
| Crinoid | Grand Bahama Island | | | 9.81 | Taylor & Bright (1973) |
| Ophiurida | " | | | (16.40-50.90) | " |
| "Starfish" | Norway | oil | W | 9.1 | Lunde (1972) |
| " | " | fatty acid | W | 7.5 | " |
| TUNICATA | | | | | |
| Tunicate *Botryllus schlosseri* | Great Britain | | D | 6.6 | Leatherland & Burton (1974) |
| Tunicate *Ciona intestinalis* | Sweden | | D | 3.0 | Noddack & Noddack (1940) |
| Tunicate *Pyrosoma sp.* | N.W. Africa | | D | 1.5 | Leatherland et al. (1973) |
| Tunicate *Styela clava* | Great Britain | | D | 4.8 | Leatherland & Burton (1974) |

ARSENIC IN HIGHER PLANTS (1)

| Species | Locality | Tissue | Analysis PPM (2) | | Authority |
|---|---|---|---|---|---|
| Fir<br>Abies alba | Italy | wood | | 0.11 | Minguzzi & Naldoni (1950) |
| Balsam fir<br>Abies lasiocarpa | British Columbia | twig | A | <1.0 | Warren et al. (1968) |
| Bentgrass<br>Agrostis canina | Great Britain (on mine waste) | | D | 460.0 (max.)<br>mean 350.0 | Porter & Peterson (1975) |
| Bentgrass<br>Agrostis stolonifera | " " | | D | 1,350.0 (max.)<br>mean 1,000.0 | " |
| Colonial bentgrass<br>Agrostis tenuis | " " | | D | 3,470.0 (max.)<br>mean 1,480.0 | " |
| " " | Great Britain (on low As soil) | | D | (0.28-3.0) | " |
| " " | " (on mine waste) | seed | D | 2000.0 | " |
| " " | " " | leaf | D | 670.0 | " |

(1)
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? indicates questionable data.

(2)
W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ±Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported.
pCi/g = picocuries per gram.

| | | | | | |
|---|---|---|---|---|---|
| Colonial bentgrass *Agrostis tenuis* | Great Britain (on mine waste) | young leaf | D | 100.0 | Porter & Peterson (1975) |
| " " | " " | old leaf | D | 1,340.0 | " |
| Onion *Allium cepa* | New Hampshire | | W | (0.14-0.18) | Schroeder & Balassa (1966) |
| " " | Montana (smelter area) | | W | (0.05-3.2) | Hindawi & Neely (1972) |
| " " | | top | D | 3.19 | Jones & Hatch (1945) |
| " " | New York | | D | 0.4 | Elfving et al. (1978) |
| Garlic *Allium sativum* | United States | | W | 0.24 | Schroeder & Balassa (1966) |
| Alder *Alnus sp.* | British Columbia | twig | A | (1.0 | Warren et al. (1968) |
| Ragweed *Ambrosia sp.* | | | D | 1.0 | Williams & Whetstone (1940) |
| Pineapple *Ananas comosa* | | | W | 0.08 | Jadin & Astruc (1912) |
| Celery *Apium graveolens dulce* | | stalk | D | 0.6 | Williams & Whetstone (1940) |
| " " " | | whole plant | D | 2.32 | Jadin & Astruc (1912) |

| | | | | | |
|---|---|---|---|---|---|
| Celery<br>Apium graveolens dulce | Canada | root | D | 1.0 | Chattopadhyay et al. (1972) |
| " " " | | | D | (0.2-0.75) | Nat. Acad. Sci. (1977) |
| Parsley<br>Apium petroselinum | New Hampshire | | W | 1.3 | Schroeder & Balassa (1966) |
| Sagebrush<br>Artemisia tridentata | Wyoming | | D | (6.0-28.0)<br>12.7 | Cannon (1969) |
| Sagebrush<br>Artemisia sp. | " | | D | 60.0 | " (1974) |
| Asparagus<br>Asparagus officinalis | | | D | 0.1 | Jadin & Astruc (1912) |
| Wild aster<br>Aster sp. | | | D | 2.0 | Williams & Whetstone (1940) |
| Locoweed<br>Astragalus bisulcatus | | | D | <0.1 | " |
| Locoweed<br>Astragalus pectinatus | | | D | <0.1 | " |
| Fern<br>Athyrium angustatum | United States | | W | 0.24 | Schroeder & Balassa (1966) |
| Saltbush<br>Atriplex confertifolia | New Zealand | | D | 3.2 | Headden (1910) |
| Oats<br>Avena sativa | Montana (near smelter area) | kernel | W | 0.1 | Hindawi & Neely (1972) |
| " " | Canada | grain | D | (0.09-0.13) | Chisholm & MacPhee (1972) |

| | | | | | |
|---|---|---|---|---|---|
| Oats<br>*Avena sativa* | Canada | straw | D | 0.28 | Chisholm & MacPhee (1972) |
| " " | | | D | (<0.1-2.28) | Nat. Acad. Sci.(1977) |
| Beet<br>*Beta vulgaris* | United States | root | W | 0.0 | Schroeder & Balassa (1966) |
| " " | " " | leaf | W | 0.24 | " |
| " " | Montana (smelter area) | | W | (0.0-0.4) | Hindawi & Neely (1972) |
| " " | | | D | 1.27 | Jones & Hatch (1945) |
| " " | | top | D | (0.07-3.48) | Nat. Acad. Sci. (1977) |
| " " | | root | D | (0.1-1.3) | " |
| Swiss chard<br>*Beta vulgaris cicla* | Maryland | leaf & stem | D | (0.16-0.66) | Furr et al. (1976) |
| " " " | United States | | W | 0.56 | Schroeder & Balassa (1966) |
| " " " | | | D | (<0.01-0.08) | Chisholm (1972) |
| Rutabaga<br>*Brassica napobrassica* | Montana (smelter area) | | W | 0.5 | Hindawi & Neely (1972) |
| " " | | | D | 0.8 | Williams & Whetstone (1940) |
| Kale<br>*Brassica oleracea acephala* | | | D | (0.11-0.22) | Nat. Acad. Sci. (1977) |

| | | | | | |
|---|---|---|---|---|---|
| Kale<br>Brassica oleracea acephala | | top | D | (0.01-0.99) | Bradicich et al. (1969) |
| " " " | | | D | (0.01-0.99) | Jones & Hatch (1945) |
| " " " | | root | D | 0.39 | " |
| Cauliflower<br>Brassica oleracea botrytis | | | D | 0.86 | Jadin & Astruc (1912) |
| Cabbage<br>Brassica oleracea capitata | Montana | head | W | (0.0-0.9) | Hindawi & Neely (1972) |
| " " " | New York | " | D | <0.1 | Elfving et al. (1978) |
| Brussels sprouts<br>Brassica oleracea gemmifera | New Hampshire | | W | ND | Schroeder & Balassa (1966) |
| Kohlrabi<br>Brassica oleracea gongylodes | Montana (smelter area) | | W | (0.05-0.1) | Hindawi & Neely (1972) |
| Broccoli<br>Brassica oleracea italica | grown on soil with Pb arsenate | | D | trace | McLean et al. (1944) |
| Turnip<br>Brassica rapa | United States | root | W | 0.0 | Schroeder & Balassa (1966) |
| " " | | " | D | <0.01 | Chisholm (1972) |
| " " | | top | D | 0.03 | Bradicich et al. (1969) |

| | | | | | |
|---|---|---|---|---|---|
| Northern reed grass *Calamagrostis canadensis* | N.W. Territory | | D | (12.6-89.4) | O'Toole et al. (1971) |
| " " | dist. from smelter(mi.): | | | | |
| | | 0.3 | D | 12.6 | " |
| " " | " " | 1.0 | D | 19.8 | " |
| " " | " " | 1.8 (highest soil As conc.) | D | 89.4 | " |
| " " | " " | 2.3 | D | 12.9 | " |
| Scotch heather *Calluna vulgaris* | Great Britain (low As area) | | D | 0.33 (max.) mean 0.3 | Porter & Peterson (1975) |
| " " | Great Britain (on mine waste, high As site) | | D | 4,130.0 (max.) mean 1,260.0 | " |
| Chili pepper *Capsicum annuum* | United States | | W | ND | Schroeder & Balassa (1966) |
| Red pepper *Capsicum frutescens* | " " | | W | 0.06 | " |
| " " | | | D | 0.0 | Bradicich et al. (1969) |
| " " | | root | D | 1.57 | Jones & Hatch (1945) |
| " " | | | D | 0.39 | " |
| Sedge *Carex sp.* | Malaya (near tin smelter) | | D | 33.0 | Peterson et al. (1976) |
| Hickory *Carya sp.* | Tennessee | | D | (0.1-0.4) | Andren et al. (1973) |

| | | | | | |
|---|---|---|---|---|---|
| Chestnut<br>Castanea vesca | Italy | wood | D | 0.05 | Minguzzi & Naldoni (1950) |
| " " | France | | D | 0.11 | Jadin & Astruc (1912) |
| Coontail<br>Ceratophyllum demersum | New Zealand (geothermal area) | | D | (20.0-1,060.0) | Lancaster et al. (1971) |
| " " | " " | | D | 971.0 | Reay (1972) |
| Japanese quince<br>Chaenomales maulei | United States | leaf | W | 0.19 | Schroeder & Balassa (1966) |
| Lambs quarter<br>Chenopodium album | | | D | 1.0 | Williams & Whetstone (1940) |
| Endive<br>Cichcrium endiva | | | D | 0.21 | Von Fellenberg (1929) |
| Chicory<br>Cichorium intybus | Italy | | D | 0.62 | Barela & Pizzeri (1966) |
| " " | | | W | 0.1 | Jadin & Astruc (1912) |
| Lemon<br>Citrus limon | Italy | fruit | D | 0.5 | Barela & Pezzeri (1966) |
| " " | | leaf | D | 0.35 | Liebig et al. (1959) |
| Grapefruit<br>Citrus paradisi | Florida | " | D | (2.0-3.0) | Roy (1943) |
| Tangerine<br>Citrus reticulata | | | D | 0.85 | Jadin & Astruc (1912) |

| | | | | |
|---|---|---|---|---|
| Orange<br>*Citrus sinensis* | Florida | W | 0.11 | Miller et al. (1933) |
| " " | United States | W | 0.0 | Schroeder & Balassa (1966) |
| Yellow clintonia<br>*Clintonia borealis* | Quebec (Cu mine area smelter) leaf | D | (<2.0-52.0) | LeBlanc et al. (1974) |
| " " | " (control) " | D | (<2.0-4.0) | " |
| Coffee<br>*Coffea arabica* | treated with Pb arsenate bean | D | (0.5-1.5) | Pereira & Echandi (1964) |
| *Compsopogon hookeri* | New Zealand (in geothermal area) | D | 550.0 | Reay (1972) |
| Filbert<br>*Corylus avellana* | | D | 0.11 | Jadin & Astruc (1912) |
| Hazelnut<br>*Corylus sp.* | | D | 0.78 | Barela & Pezzeri (1966) |
| Gherkin<br>*Cucumis anguria* | | D | 0.14 | Cardiff (1937) |
| Canteloupe<br>*Cucumis melo* | New Hampshire | W | ND | Schroeder & Balassa (1966) |
| Cucumber<br>*Cucumis sativus* | | D | (0.02-2.4) | Nat. Acad. Sci. (1977) |
| Squash<br>*Cucurbita maxima* | United States | D | (0.023-0.034) | McLean et al. (1944) |
| " " | New Hampshire | W | 0.0 | Schroeder & Balassa (1966) |

| | | | | | |
|---|---|---|---|---|---|
| Pumpkin<br>*Cucurbita pepo* | | | W | 0.09 | Jadin & Astruc (1912) |
| Italian cypress<br>*Cupressus sempervirens* | Italy | wood | | 1.4 | Minguzzi & Naldoni (1950) |
| Carrots<br>*Daucus carota* var *sativa* | New Hampshire | root | W | 0.74 | Schroeder & Balassa (1966) |
| " " " | Virgin Islands | " | W | 0.0 | " |
| " " " | Montana (smelter area) | | W | (0.0-2.9) | Hindawi & Neely (1972) |
| " " " | | " | D | 0.32 | Jones & Hatch (1945) |
| " " " | | top | D | (0.0-0.57) | " |
| " " " | | | D | (0.03-0.8) | Nat. Acad. Sci. (1977) |
| " " " | New York | root | D | 0.9 | Elfving et al. (1978) |
| *Egeria densa* | New Zealand (geothermal area) | | D | (266.0-310.0) | Lancaster et al. (1971) |
| Water weed<br>*Elodea canadensis* | " " | | D | (48.0-700.0) | " |
| " " | | | D | 3.0 | " |
| *Ehretia microphylla* | Malaya (near tin smelter) | | D | 74.0 | Peterson et al. (1976) |
| Spurge<br>*Euphorbia sp.* | | | D | <1.0 | Williams & Whetstone (1940) |

| | | | | | |
|---|---|---|---|---|---|
| Buckwheat<br>*Fagopyrum fagopyrum* | United States | grain | W | 1.3 | Schroeder & Balassa (1966) |
| Beech<br>*Fagus sylvatica* | Italy | wood | D | <0.05 | Minguzzi & Naldoni (1950) |
| Fern<br>*Gleichenia linearis* | Malaya (near tin smelter) | | D | (0.4-1.3) | Peterson et al. (1976) |
| Japanese millet<br>*Echinochloa crusgalli* var. *frumentacea* | New York | | D | 0.9 | Elfving et al. (1978) |
| Soybean<br>*Glycine max* | Japan | bean | D | 0.08 | Kawashiro & Kondo (1962) |
| " " | United States | " | D | (0.05-1.22) | Ansul Co. (1971) |
| " " | " " | fodder | D | (0.07-2.12) | " |
| " " | " " | oil | D | 0.09 | Bradicich et al. (1969) |
| Cotton<br>*Gossypium herbaceum* | " " | cottonseed oil | W | 0.0 | Schroeder & Balassa (1966) |
| " " | " " | " | D | 0.05 | Baker et al. (1969) |
| " " | " " | leaf | D | 0.055 | Bradicich et al. (1969) |
| *Haplopappus fremontii* | | | D | 1.0 | Williams & Whetstone (1940) |
| Sunflower<br>*Helianthus annuus* | Montana (smelter area) | " | W | 3.3 | Hindawi & Neely (1972) |

| | | | | | |
|---|---|---|---|---|---|
| Sunflower *Helianthus annuus* | | | D | (<1.0-2.0) | Cardiff (1937) |
| Velvet grass *Holcus lanatus* | Great Britain (on mine waste, high As site) | | D | max. 560.0 mean 350.0 | Porter & Peterson (1975) |
| Barley *Hordeum vulgare* | United States | grain | W | 0.85 | Schroeder & Balassa (1966) |
| " " | Montana (smelter area) | kernel | W | (0.0-0.9) | Hindawi & Neely (1972) |
| " " | " " | straw | W | 14.3 | " |
| " " | Washington | grain | W | <0.1 | Haller et al. (1969) |
| " " | | | D | (<0.1-0.55) | Nat. Acad. Sci. (1977) |
| Sweet potato *Ipomoea batatas* | | | D | 0.0 | Bradicich et al. (1969) |
| *Jasione montana* | Great Britain (on mine waste high As site) | | D | max. 6,640.0 mean 2,040.0 | Porter & Peterson (1975) |
| Black walnut *Juglans nigra* | | | W | 0.13 | Jadin & Astruc (1912) |
| Walnut *Juglans sp.* | | | D | 0.07 | Barela & Pezzeri (1966) |
| Lettuce *Lactuca sativa* | New Hampshire | | W | 0.27 | Schroeder & Balassa (1966) |
| " " | Montana (smelter area) | | W | (0.0-2.1) | Hindawi & Neely (1972) |

| | | | | | |
|---|---|---|---|---|---|
| Lettuce<br>*Lactuca sativa* | | | D | 0.12 | Jones & Hatch (1945) |
| " " | | root | D | 0.47 | " |
| " " | | | D | (0.01-3.78) | Nat. Acad. Sci. (1977) |
| Lakeweed<br>*Lagarosiphon major* | New Zealand (geothermal area) | | D | (29.0-1,450.0) | Lancaster et al. (1971) |
| " " | " " | | D | 405.0 | Reay (1972) |
| Sweet pea<br>*Lathyrus odoratus* | Montana (smelter area) | | W | (0.05-0.1) | Hindawi & Neely (1972) |
| Duckweed<br>*Lemna sp.* | New Zealand | | D | 2.5 | Lancaster et al. (1971) |
| Lentil<br>*Lens culinaris* | | | W | 0.1 | Jadin & Astruc (1912) |
| *Leptospermum ericoides* | New Zealand (geothermal area) | | D | <1.0 | Reay (1972) |
| *Leptospermum scoparium* | " " | | D | 1.7 | " |
| Tulip poplar<br>*Liriodendron tulipifera* | Tennessee | | D | (0.08-0.4) | Andren et al. (1973) |
| Tomato<br>*Lycopersicon esculentum* | New Hampshire | fruit | W | (0.0-0.37) | Schroeder & Balassa (1966) |
| " " | Virgin Islands | | W | 0.0 | " |
| " " | | | | (0.01-2.95) | Nat. Acad. Sci. (1977) |

| | | | | | |
|---|---|---|---|---|---|
| Tomato<br>*Lycopersicon esculentum* | | stem & leaf | D | 6.75 | Jones & Hatch (1945) |
| " " | | " | D | <0.2 | Geisman et al. (1969) |
| " " | | root | D | <0.2 | " |
| " " | | " | D | (0.26-0.49) | Jones & Hatch (1945) |
| " " | New York | fruit | D | <0.1 | Elfving et al. (1978) |
| Apple<br>*Malus sylvestris* | Montana (smelter area) | " | W | (0.05-0.1) | Hindawi & Neely (1972) |
| " " | Washington | " | W | 0.018±0.006 | Haller et al. (1969) |
| " " | United States | " | W | 0.0 | Schroeder & Balassa (1966) |
| " " | | | D | (0.04-1.72) | Nat. Acad. Sci. (1977) |
| Scarlet mallow<br>*Malva sp.* | | | D | 1.0 | Williams & Whetstone (1940) |
| Maidapple<br>*Mamordica carenthia* | Virgin Islands | | W | 0.29 | Schroeder & Balassa (1966) |
| Alfalfa<br>*Medicago sativa* | United States | | W | 1.6 | " |
| " " | Montana (smelter area) | | W | (0.4-5.7) | Hindawi & Neely (1972) |
| " " | | | D | (0.05-3.38) | Jadin & Astruc (1912) |

| | | | | | |
|---|---|---|---|---|---|
| Alfalfa<br>*Medicago sativa* | | | D | (0.05-3.38) | Morrison (1969) |
| " " | | top | D | 1.97 | Jones & Hatch (1945) |
| " " | | root | D | 3.15 | " |
| *Melastoma malabathricum* | Malaya (near tin smelter) | | D | (1.6-3.3) | Peterson et al. (1976) |
| Banana<br>*Musa acuminata* | | | D | 0.06 | Jadin & Astruc (1912) |
| Parrot feather<br>*Myriophyllum propinquum* | New Zealand (geothermal area) | whole | D | 456.0 | Lancaster et al. (1971) |
| Tobacco<br>*Nicotiana tabacum* | United States | leaf | W | (0.0-51.0) | Jenkins (1972) |
| " " | " | cigarette | D | (1.8-15.4) | Nadkarni & Ehmann (1970) |
| " " | " | pipe | D | (2.0-4.5) | " |
| " " | " | cigar | D | (1.5-5.8) | " |
| Nitella<br>*Nitella hookeri* | New Zealand (geothermal area) | whole | D | 182.0 | Lancaster et al. (1971) |
| " " | " (control) | " | D | 13.0 | " |
| *Oreocarya sp.* | | | D | <1.0 | Williams & Whetstone (1940) |
| Mimosa<br>*Mimosa pudica* | Malaya (near tin smelter) | | D | (32.0-50.0) | Peterson et al. (1976) |

| | | | | | |
|---|---|---|---|---|---|
| Clayton's fern<br>Osmunda claytoniana | United States | | W | 0.0 | Schroeder & Balassa (1966) |
| Cinnamon fern<br>Osmunda cinnamomea | " | | W | 0.21 | " |
| Royal fern<br>Osmunda regalis | " | | W | 0.49 | " |
| Rice<br>Oryza sativum | " | grain | W | 0.13 | " |
| " " | Madagascar | " | W | 0.48 | " |
| " " | | " | D | <0.1 | Haller et al. (1969) |
| " " | | | D | 0.4 | Reed & Sturgis (1936) |
| " " | | " | D | (<0.07-3.53) | Nat. Acad. Sci. (1977) |
| " " | | whole | D | (0.8-5.0) | Epps & Sturgis (1939) |
| Parsnip<br>Pastinaca sativa | Washington | | D | 0.2 | Cardiff (1937) |
| Garden parsley<br>Petroselinum crispum latifolium | | | D | (0.1-8.0) | " |
| Lima bean<br>Phaseolus limensis | Washington | bean | D | <0.1 | Haller et al. (1969) |
| " " | New Hampshire | " | W | 0.0 | Schroeder & Balassa (1966) |
| " " | | | D | 0.4 | Cardiff (1937) |
| Bean<br>Phaseolus spp. | United States | bean | W | (0.0-0.09) | Schroeder & Balassa (1966) |

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|---|---|---|---|---|---|
| Bean<br>*Phaseolus spp.* | Montana | green bean | W | <0.05 | Hindawi & Neely (1972) |
| " " | | " | D | trace | Clements & Munson (1947) |
| " " | | pod | D | 0.27 | Jacobs et al. (1970) |
| " " | | leaf | D | 0.21 | " |
| " " | | bean | D | 0.07 | Machlis (1941) |
| " " | | vine | D | 0.18 | Jones & Hatch (1945) |
| " " | | root | D | 0.29 | " |
| Bush bean<br>*Phaseolus vulgaris* | Russia | bean | D | 0.33 | Kapandze (1948) |
| " " | New York | " | D | <0.1 | Elfving et al. (1978) |
| Date palm<br>*Phoenix dactylifera* | | | W | 0.12 | Jadin & Astruc (1912) |
| White spruce<br>*Picea alba* | Canada (near gold mine, As contaminated soil) | branch | | (2.8-14.3) | Rosehart & Lee (1973) |
| " " | " " | leaf | | (2.08-9.5) | " |
| " " | " " | trunk | | (0.3-55.0) | " |
| " " | " " | root | | (45.0-130.0) | " |
| " " | " (control) | branch | | 2.1 | " |
| " " | " " | leaf | | 2.1 | " |
| " " | " " | trunk | | 2.4 | " |
| " " | " " | root | | 1.0 | " |

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|---|---|---|---|---|---|
| Black spruce<br>*Picea mariana* | Quebec Cu mine area | leaf | D | (<1.0-96.0) | LeBlanc et al. (1974) |
| Spruce<br>*Picea sp.* | British Columbia | twig | A | (<1.0-13.0) | Warren et al. (1968) |
| Lodgepole pine<br>*Pinus contorta* | " | " | A | (13.0-14.0) | " |
| Short-leaf pine<br>*Pinus echinata* | Tennessee | | D | (0.1-0.2) | Andren et al. (1973) |
| White pine<br>*Pinus flexilis* | British Columbia | leaf | A | <1.0 | Warren et al. (1968) |
| *Pinus laricinus* | Italy | wood | D | 0.13 | Minguzzi & Naldoni (1950) |
| Scotch pine<br>*Pinus sylvestris* | " | " | D | 0.05 | " |
| Peas<br>*Pisum sativum* | Virgin Islands | dried | W | 0.09 | Schroeder & Balassa (1966) |
| " " | " | fresh | W | 0.0 | " |
| " " | Washington | dried, split | D | <0.1 | Haller et al. (1969) |
| " " | | | D | (0.01-0.4) | Jones & Hatch (1945) |
| Fern<br>*Polystichum acrostichoides* | United States | | W | 0.2 | Schroeder & Balassa (1966) |
| Posidonia<br>*Posidonia oceanica* | | leaf | D | 0.45 | (1913) in Vinogradov (1953) |
| " " | | root | D | 0.35 | " |

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|---|---|---|---|---|---|
| Pondweed<br>Potamogeton cheesemanii | New Zealand (geothermal area) | whole | D | 45.0 | Lancaster et al. (1971) |
| " " | " (control) | " | D | 16.0 | " |
| Pondweed<br>Potamogeton crispus | New Zealand (geothermal area) | whole | D | (11.0-436.0) | " |
| Almond<br>Prunus amygdalus | | | D | 0.3 | Jadin & Astruc (1912) |
| Apricot<br>Prunus armeniaca | | | D | (0.15-1.5) | Collins (1918) |
| Peach<br>Prunus persica | | | D | (0.07-1.5) | Bradicich et al. (1969) |
| Douglas fir<br>Pseudotsuga menziesii | British Columbia (in As-bearing areas & mine) | | | | Warren et al. (1968) |
| | | 2nd-yr stem | A | (2.0-8,200.0) | |
| " " | " " | 1st-yr stem | A | (510.0-2,110.0) | " |
| " " | " " | 1st-yr needle | A | (120.0-1,060.0) | " |
| " " | " " | 2nd-yr stem | A | (70.0-1,390.0) | " |
| " " | " " | 2nd-yr. needle | A | (25.0-180.0) | " |
| " " | " " | stem (max.) | A | 8,200.0 | " |
| " " | " (in non-As area) | stem, needle | A | (3.0-100.0) | " |
| " " | | needle | D | (4.0-8,000.0) | Delavault & Manson (1971) |

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|---|---|---|---|---|---|
| Fern<br>*Pteridium latiusculum* | United States | | W | 0.73 | Schroeder & Balassa (1966) |
| Fern<br>*Pteritis nodulosa* | " | | W | 0.34 | " |
| Pear<br>*Pyrus communis* | France | | | 0.07 | Bertrand (1920) |
| " " | Washington | fruit | W | 0.046±0.006 | Haller et al. (1969) |
| " " | United States | " | W | 0.0 | Schroeder & Balassa (1966) |
| " " | | " | W | 0.17 | Jadin & Astruc (1912) |
| " " | | " | D | 0.39 | Headden (1910) |
| " " | Japan | skin | D | (0.4-0.6) | Tankawa & Nakane (1969) |
| Chestnut oak<br>*Quercus prinoides* | Tennessee | | D | (0.05-0.4) | Andren et al. (1973) |
| " " | " | acorn | D | 0.1 | " |
| " " | " | root | D | 11.0 | " |
| Buttercup<br>*Ranunculus aquatilus* | Wyoming | | D | 180.0 | Cannon (1974) |
| Radish<br>*Raphanus sativus* | Montana (smelter area) | root | W | trace | Hindawi & Neely (1972) |
| Rhubarb<br>*Rheum rhaponticum* | United States | | W | 0.48 | Schroeder & Balassa (1966) |

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|---|---|---|---|---|---|
| Rhubarb<br>Rheum rhaponticum | | | D | <0.1 | Williams & Whetstone (1940) |
| Watercress<br>Rorippa nasturtium-aquaticum | | | D | (1.84-2.1) | Jadin & Astruc (1912) & Kapanadze (1948) |
| Wild rose<br>Rosa acicularis | Northwest Territories Dist. from smelter (miles) | | | | O'Toole et al. (1971) |
| " " | " " " | 0.4 | D | 138.0 | " |
| " " | " " " | 0.8 | D | 39.1 | " |
| " " | " " " | 1.8 | D | 26.9 | " |
| " " | " " " | 1.9 | D | 15.4 | " |
| Sorrel<br>Rumex acetosella | Italy (in As-containing area) | | | (0.9-1.7) | Berbenni (1959) |
| Sugarcane<br>Saccharum officinarum | | | D | 2.0 | Pemberton (1934) |
| Willow<br>Salix sp. | British Columbia | leaf & twig | A | (1.0-4.0) | Warren et al. (1968) |
| Rush<br>Scirpus sp. | New Zealand (geothermal area) | | D | 12.0 | Reay (1972) |
| Rye<br>Secale cereale | United States | grain | W | (0.0-0.16) | Schroeder & Balassa (1966) |
| " " | Russia | | D | <0.1 | Shtenberg (1940) |

| | | | | | |
|---|---|---|---|---|---|
| Millett<br>Setaria italica | Russia | | D | <0.1 | Shtenberg (1940) |
| " " | United States | | W | 1.03 | Schroeder & Balassa (1966) |
| Soopolallia<br>Shepherdia canadensis | British Columbia | twig | A | <0.1 | Warren et al. (1968) |
| Egg plant<br>Solanum melogena | Virgin Islands | | W | 0.82 | Schroeder & Balassa (1966) |
| " " | New Hampshire | | W | 0.0 | " |
| " " | Russia | | D | (0.18-0.77) | Kapandze (1948) |
| " " | | | D | (0.0-6.14) | McLean (1944) |
| " " | | root | D | 0.98 | Jones & Hatch (1945) |
| Potato<br>Solanum tuberosum | United States | | W | 0.13 | Schroeder & Balassa (1966) |
| " " | Wisconsin | potato skin | D | (0.4-2.4) | Steevens et al. (1972) |
| " " | " | tuber | | 1.0 | " |
| " " | Italy (As containing area) | leaf | | (0.3-0.6) | Berbenni (1959) |
| " " | Montana (smelter area) | tuber | W | (0.0-0.1) | Hindawi & Neely (1972) |
| " " | | | D | (0.01-0.05) | Chisholm (1972) |
| " " | Sweden | " | D | 0.2 | Sihlbom (1956) |

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|---|---|---|---|---|---|
| Potato<br>Solanum tuberosum | | | D | (0.0076-1.25) | Nat. Acad. Sci. (1977) |
| " " | New York | tuber | D | <0.1 | Elfving et al. (1978) |
| Spinach<br>Spinacia oleracea | New Hampshire | | W | 1.1 | Schroeder & Balassa (1966) |
| " " | | | D | (0.04-2.25) | Nat. Acad. Sci. (1977) |
| Sudan grass<br>Sorghum vulgare sudanense | | | D | 0.7 | Machlis (1941) |
| Cocoa<br>Theobroma cacao | | Hershey chocolate | W | 0.59 | Schroeder & Balassa (1966) |
| Cedar<br>Thuya plicata | British Columbia | twig | A | 1.0 | Warren et al. (1968) |
| Spanish moss<br>Tillandsia usnoides | United States | | A | (<0.1-2.0) geom. mean 0.79 | Shacklette & Connor (1973) |
| " " | | | Good monitoring organism for As | | " |
| Tridax procumbens | Malaya (near tin smelter) | | D | (1.0-122.0) | Peterson et al. (1976) |
| Red clover<br>Trifolium pratense | | | D | 0.37 | Cardiff (1937) |
| " " | | | D | (0.11-0.39) | Sieczka & Lisk (1971) |
| White clover<br>Trifolium repens | | | D | 3.64 | Jones & Hatch (1945) |

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|---|---|---|---|---|---|
| Clover<br>*Trifolium sp.* | | | D | (<0.1-0.17) | Morrison (1969) |
| " " | | | D | 0.46 | Chisholm & MacPhee (1972) |
| Wheat<br>*Triticum aestivum* | United States | | W | (0.17-2.4) | Schroeder & Balassa (1966) |
| " " | Montana (smelter area) | kernel | W | (0.0-trace) | Hindawi & Neely (1972) |
| " " | | | D | (0.09-0.16) | Ansul Co. (1971) |
| " " | | | D | (0.007-0.3) | Nat. Acad. Sci. (1977) |
| Hemlock<br>*Tsuga canadensis* | | leaf | D | (0.2-0.4) | Sinclair et al. (1975) |
| Tulip<br>*Tulipa gesneriana* | Netherlands | | W | (0.0-3.6) | Schroeder & Balassa (1966) |
| " " | | | D | 2.0 | Williams & Whetstone (1940) |
| Cat tail<br>*Typha orientalis* | New Zealand (in geothermal area) | | D | 8.0 | Lancaster et al. (1971) |
| " " | " " | | D | 8.0 | Reay (1972) |
| Lowbush blueberry<br>*Vaccinium angustifolium* | Maine (soil arsenic) | leaf | D | (6.74-14.97) | Anastasia & Kender (1973) |
| " " | " (untreated) | " | D | 0.78 | " |
| " " | " " | stem | D | 0.27 | " |
| " " | " " | root | D | 2.4 | " |

| | | | | | |
|---|---|---|---|---|---|
| Ironweed<br>*Vernonia sp.* | | | D | 1.0 | Williams & Whetstone (1940) |
| Vetch<br>*Vicia sativa* | | plant | D | 1.22 | Jones & Hatch (1945) |
| " " | | root | D | 7.15 | " |
| Grape<br>*Vitis sp.* | United States | wild | W | 0.17 | Schroeder & Balassa (1966) |
| " " | Washington | raisin | D | <0.1 | Haller et al. (1969) |
| " " | Europe | juice | | 0.0 | Herrman & Kretsdorn (1939) |
| " " | " | skin | | 0.0 | " |
| " " | " | leaf | D | 2.3 | " |
| " " | | fruit | D | (0.75-1.2) | Tankawa & Nakane (1969) |
| " " | | " | D | 0.05 | Daris et al. (1971) |
| Cocklebur<br>*Xanthium strumarium* | | | | <1.0 | Williams & Whetstone (1940) |
| Corn<br>*Zea mays* | United States | grain | W | 0.11 | Schroeder & Balassa (1966) |
| " " | " " | meal | W | 0.78 | " |
| " " | " " | oil | W | 0.0 | " |
| " " | | grain | D | (<0.01-0.05) | " |
| " " | | " | D | (0.05-0.07) | " |

| | | | | |
|---|---|---|---|---|
| Corn<br>*Zea mays* | stalk & leaf | W | 0.04 | Jadin & Astruc (1912) |
| " " | " | D | (0.6-2.5) | Woolson (1972) |
| " " | " | D | 0.71 | Jones & Hatch (1945) |
| " " | seedling | D | 3.0 | Woolson et al. (1973) |
| "Forage grasses" | | | (0.1-0.62)<br>0.3 | Cannon (1974) |
| " " | | | (0.1-14.0)5.4 | " |

ARSENIC IN MOSS[1]

| Species | Locality | Tissue | Analysis PPM[2] | Authority |
|---|---|---|---|---|
| *Hylocomium splendens* | Quebec Cu mine area | | D (4.0-99.0) | LeBlanc et al. (1974) |
| *Pleurozium schreberi* | " | | D (1.0-10.0) | " |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

ARSENIC IN ALGAE (1)

| Species | Locality | Tissue | Analysis PPM (2) | Authority |
|---|---|---|---|---|
| Green alga<br>*Agarum fimbretum* | Norway | | D 4.0 | Lunde (1973) |
| Red alga<br>*Ahnfeltia plicata* | Nova Scotia | | D 2.0 | Young & Langille (1958) |
| " " | Great Britain | | D 39.0 | Leatherland & Burton (1974) |
| Red alga<br>*Alsidium helminthochorton* | | | D 0.25 | (1911) in Vinogradov (1953) |
| Brown alga<br>*Ascophyllum nodosum* | Nova Scotia | | D 38.0 | Young & Langille (1958) |
| " " | | | D 0.05 | (1913) in Vinogradov (1953) |
| " " | Newfoundland | | D 9.8±SD 2.0 | Penrose et al. (1975) |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | | |
|---|---|---|---|---|---|
| Brown alga<br>Ascophyllum nodosum | Newfoundland (runoff from stibnite mine) | | D | 17.2 ± SD 2.5 | Penrose et al. (1975) |
| " " | Norway | lipid | D | (7.8-49.0) | Lunde (1972a) |
| " " | " | fatty acid | D | (5.2-21.0) | " |
| Green alga<br>Casteria castata | United States | | D | 1.0 | Williams & Whetstone (1940) |
| Red alga<br>Ceramium rubrum | Nova Scotia | | D | 7.0 | Young & Langille (1958) |
| Green alga<br>Chaetomorpha melagonium | " | | D | 5.0 | " |
| Green alga<br>Chlorella ovalis | Norway | lipid | D | 0.7 | Lunde (1972a) |
| Green alga<br>Chlorella pyrenoidosa | " | " | D | 0.5 | " |
| Irish moss<br>Chondrus crispus | Nova Scotia | | D | 5.0 | Young & Langille (1958) |
| " " | Great Britain | | D | (5.0-11.0) | Jones (1922) |
| " " | " " | | W | 6.3 | (1933) in Vinogradov (1953) |
| " " | " " | | D | 12.0 | Chapman (1926) |
| " " | " " | | D | 11.0 | Leatherland & Burton (1974) |
| Green alga<br>Cladophora rupestris | Nova Scotia | | D | 10.0 | Young & Langille (1958) |

| | | | | | |
|---|---|---|---|---|---|
| Green alga *Cladophora utriculosa* | | | D | 0.8 | (1913) in Vinogradov (1953) |
| " " | France | | D | 0.08 | (1902) in Vinogradov (1953) |
| Seaweed *Cystophyllum fusiforme* | Japan | | D | (122.0-180.0)152.0 | Shimokawa et al. (1971) |
| Brown alga *Cystoseira sp.* | | | D | 0.4 | (1913) in Vinogradov (1953) |
| Green alga *Enteromorpha compressa* | Great Britain | | D | 15.0 | Jones (1922) |
| Green alga *Enteromorpha nana* | New Zealand geothermal area | | D | 14.0 | Lancaster et al. (1971) |
| Brown alga *Fucus digitatus* | France | | D | 2.08? | (1902) in Vinogradov (1953) |
| Brown alga *Fucus evanescens* | Nova Scotia | | D | (30.0-75.0) | Young & Langille (1958) |
| Brown alga *Fucus nodosus* | Great Britain | | D | (57.0-60.0) | Jones (1922) |
| " " | " " | thallus | D | 32.0 | " |
| " " | " " | filament | D | 40.0 | " |
| Brown alga *Fucus serratus* | " " | | D | 90.0 | " |
| " " | " " | | D | (48.0-54.0) | Leatherland & Burton (1974) |
| " " | France | | D | 0.82? | (1902) in Vinogradov (1953) |

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|---|---|---|---|---|---|
| Brown alga *Fucus serratus* | Norway | lipid | D | 27.0 | Lunde (1972a) |
| " " | " | fatty acid | D | 6.1 | " |
| " " | | | D | 1.7 | Portmann & Riley (1964) |
| Brown alga *Fucus sp.* | Newfoundland (control) | | D | 12.1±SD 6.6 | Penrose et al. (1975) |
| " " | " (runoff from stibnite mine) | | D | 17.2±SD 7.8 | " |
| Brown alga *Fucus spiralis* | Norway | | D | 15.0-34.0) | Lunde (1972a) |
| " " | " | | D | 5.7 | " |
| " " | " | | D | 5.0 | " |
| Brown alga *Fucus vesiculosus* | Nova Scotia | | D | 58.0 | Young & Langille (1958) |
| " " | Great Britain | | D | 80.0 | Jones (1922) |
| " " | France | | D | 0.82? | (1902) in Vinogradov (1953) |
| " " | Norway | lipid | D | 35.0 | Lunde (1972a) |
| " " | " | fatty acid | D | 5.1 | " |
| " " | W. Greenland | | D | (35.2-35.8) | Bohn (1975) |
| Red alga *Gelidium cartilageneum* | Nova Scotia | | D | 5.0 | Young & Langille (1958) |
| Red alga *Gigartina mammillosa* | Great Britain | | D | (6.0-23.0) | Jones (1922) |
| Red alga *Gigartina stellata* | Nova Scotia | | D | 10.0 | Young & Langille (1958) |

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|---|---|---|---|---|---|
| Red alga<br>Gracilaria confervoides | Nova Scotia | | D | 8.0 | Young & Langille (1958) |
| Brown alga<br>Halidrys siliquosa | Great Britain | | D | 26.0 | Leatherland & Burton (1974) |
| " " | " " | | D | 40.0 | Jones (1922) |
| Red alga<br>Halopitys pinastroides | | | D | 0.2 | (1913) in Vinogradov (1953) |
| Red alga<br>Halosaccion ramentaceum | Nova Scotia | | D | 8.0 | Young & Langille (1958) |
| Red alga<br>Jania rubens | | | D | 3.0 | (1913) in Vinogradov (1953) |
| Brown alga<br>Laminaria digitata | Great Britain | | D | 125.0 | Jones (1922) |
| " " | Nova Scotia | | D | 50.0 | Young & Langille (1958) |
| " " | " | frond | D | 55.0 | " |
| " " | " | stipe | D | 42.0 | " |
| " " | Great Britain | | D | 47.0 | Leatherland & Burton (1974) |
| " " | | | D | 0.5 | (1911) in Vinogradov (1953) |
| " " | Norway | lipid | D | 221.0 | Lunde (1972a) |
| " " | " | fatty acid | D | 36.0 | " |

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|---|---|---|---|---|---|---|
| Brown alga<br>Laminaria digitata lamina | Norway | | D | (107.0-109.0) | Lunde (1970a) |
| Brown alga<br>Laminaria hyperborea | " | | D | 63.0 | " |
| " " | " | lipid | D | 197.0 | " (1972a) |
| " " | " | | D | 142.0 | " (1973) |
| Brown alga<br>Laminaria longicrurus | Nova Scotia | | D | 52.0 | Young & Langille (1958) |
| Brown alga<br>Laminaria saccharina | Great Britain | | D | 70.0 | Jones (1922) |
| " " | " " | | D | 45.0 | Leatherland & Burton (1974) |
| " " | Norway | lipid | D | 155.0 | Lunde (1972a) |
| " " | | | D | 0.1 | (1911) in Vinogradov (1953) |
| Brown alga<br>Laminaria sp. | Japanese Sea | | D | 30.8 | Shtenberg (1939) |
| Red alga<br>Laurencia obtusa | | | D | 5.0 | (1913) in Vinogradov (1953) |
| Brown alga, kelp<br>Macrocystis pyrifera | California | | D | 17.3 | Gorgy et al. (1948) |
| " " | " | (calc.) | D | (48.0-96.0)<br>77.0 | Boothe & Knauer (1972) |
| " " | " | | A | (72.0-144.0)<br>116.0±26.0 | " |
| " " | New Zealand | | D | 58.0 | Wilson & Fieldes (1941) |

| | | | | | |
|---|---|---|---|---|---|
| *Oscillatoria rubescens* | Norway | lipid | D | (0.4-0.5) | Lunde (1972a) |
| Brown alga<br>*Padina pavonia* | | | D | 0.9 | (1913) in Vinogradov (1953) |
| Brown alga, channel wrack<br>*Pelvetia canaliculata* | Norway | | D | (15.0-22.0) | Lunde (1970a) |
| " " | " | lipid | D | 10.8 | " (1972a) |
| " " | " | fatty acid | D | 7.3 | " |
| Seaweed<br>*Phaedactylum tricornutum* | " | lipid | D | (3.6-4.8) | " |
| Green alga<br>*Plocamium coccineum* | Great Britain | | D | 10.0 | Jones (1922) |
| Red alga<br>*Poryphyra sp.* | Nova Scotia | | D | 0.0 | Young & Langille (1958) |
| Seaweed<br>*Pterygophera californica* | United States | | D | 12.0 | Williams & Whetstone (1940) |
| Seaweed<br>*Rhodemia pertusa* | | | D | 1.0 | " |
| Red alga<br>*Rhodymenia palmata* | Nova Scotia | | D | 10.0 | Young & Langille (1958) |
| Sargassum weed<br>*Sargassum filipendula* | Florida | | W | 5.8 | Johnson & Braman (1975) |
| Sargassum weed<br>*Sargassum fluitans* | " | | W | 19.5 | " |
| Sargassum weed<br>*Sargassum spp.* | " | | D | (4.2-12.7) | " |
| Red alga<br>*Sphaerococcus coronopifolius* | | | D | 4.0 | (1913) in Vinogradov (1953) |

| | | | | |
|---|---|---|---|---|
| Green alga<br>Spongomorpha arcta | Nova Scotia | D | 8.0 | Young & Langille (1958) |
| Green alga<br>Ulva lactuca | " | D | 4.0 | " |
| " " | | D | 0.15? | (1911) in Vinogradov (1953) |
| Green alga<br>Ulva sp. | Japan | D | 1.2 | Fukai & Meinke (1962) |
| " " | " | A | 5.4 | " |
| Green alga<br>Ulva latissima | Great Britain | D | 8.0 | Jones (1922) |
| Undaria pinnatifida | Japan | D | (29.0-72.0) 42.0 | Shimokawa et al. (1971) |
| Red alga<br>Wrangelia penicillata | | D | 4.0 | (1913) in Vinogradov (1953) |
| "Seaweed" | " | D | (13.0-33.0) 24.0 | Shimokawa et al. (1971) |
| "Agar" | " | D | <0.1 | " |
| "Green laver" | " | D | (0.4-0.9)0.6 | " |
| "Tangleweed" | " | D | (29.0-91.0)49.0 | " |

## BERYLLIUM IN ANIMALS (1)

| Species | Locality | Tissue | Analysis (2) PPM | | Authority |
|---|---|---|---|---|---|
| MAMMALS | | | | | |
| Cow<br>Bos bovis | Australia | milk | A | (ND-0.09)<br>0.02 | Meehan & Smythe (1967) |
| " " | | liver | A | 0.05±SD 0.003 | Owens & Gladney (1975) |
| Harbor seal<br>Phoca vitulina | Great Britain | spleen | W | <0.005 | Hamilton (1976) |
| " " | " | heart | W | <0.03 | " |
| " " | " | muscle | W | 0.02±0.009 | " |
| " " | " | kidney | W | <0.04 | " |
| " " | " | liver | W | <3.0 | " |
| Rat<br>Rattus rattus | | Be is deposited in bone and some in liver, spleen, kidneys and muscle. | | | Taylor and Arnold (1971) |

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pCi/g = picocuries per gram.

BIRDS

| | | | | | |
|---|---|---|---|---|---|
| Mallard<br>*Anas platyrhynchos* | New York | liver | | <1.0 | Baker et al. (1976) |
| " " | " | muscle | | <1.0 | " |
| " " | Canada | feather | D | <0.5 | Kelsall (1970) |
| Black duck<br>*Anas rubripes* | New York | liver | | <1.0 | Baker et al. (1976) |
| " " | " | muscle | | <1.0 | " |
| " " | Canada | feather | D | <0.5 | Kelsall (1970) |
| White-fronted goose<br>*Anser albifrons* | " | " | | <0.5 | " |
| Lesser scaup<br>*Aythya affinis* | " | " | | <0.5 | " |
| Greater scaup<br>*Aythya marila nearctica* | New York | liver | | <1.0 | Baker et al. (1976) |
| " " " | " | muscle | | <1.0 | " |
| " " " | " | brain | | <1.0 | " |
| Canvasback<br>*Aythya valisneria* | " | liver | | <1.0 | " |
| " " | " | muscle | | <1.0 | " |
| Canada goose<br>*Branta canadensis* | " | liver | | <1.0 | " |
| " " | " | muscle | | <1.0 | " |
| " " | " | brain | | <1.0 | " |
| " " | Washington | egg | A | ND ($Be^7$) | Richard & Sweany (1977) |
| " " | " | shell | A | ND " | " |

| | | | | | |
|---|---|---|---|---|---|
| Bufflehead<br>*Bucephala albeola* | New York | liver | | <1.0 | Baker et al. (1976) |
| " " | " | muscle | | <1.0 | " |
| Chicken<br>*Gallus domesticus* | Australia | egg yolk | A | 0.01 | Meehan & Smythe (1967) |
| " " | " | egg white & yolk | A | 0.006 | " |
| " " | " | egg shell & yolk | A | 0.014 | " |
| White-winged scoter<br>*Melanitta deglandi* | New York | liver | | <1.0 | Baker et al. (1976) |
| " " | " | muscle | | <1.0 | " |
| FISH<br>Bream<br>*Acanthopagrus sp.* | Australia | gut | A | 0.1 | Meehan & Smythe (1967) |
| " " | " | | A | ND | " |
| Blackfish<br>*Girella tricuspidata* | " | whole | A | (0.08-0.39) 0.23 | " |
| " " | " | gut | A | (0.46-1.78) 0.99 | " |
| " " | " | muscle | A | 0.01 | " |
| Guppy<br>*Lebistes reticulatus* | | highest Be conc. in viscera and intestine and kidney and ovary. (exposed to $^{7}Be$) | | | Slonim & Damm (1972) |
| Eel<br>*Leptocephalus sp.*? | | | A | ND | Meehan & Smythe (1967) |

| | | | | | |
|---|---|---|---|---|---|
| Mullet<br>*Mugil cephalus*? | Australia | whole | A | (0.03-0.36)0.21 | Meehan & Smythe (1967) |
| " " | " | gut | A | (0.04-0.71) | " |
| " " | " | muscle | A | (ND-0.07)0.04 | " |
| Leatherjacket<br>*Navodon sp.* | " | gut | A | (0.48-0.63)0.56 | " |
| Bonito<br>*Sarda chiliensis*? | " | muscle | A | 0.01 | " |
| "Redfin" | " | " | A | 0.01 | " |
| INVERTEBRATES | | | | | |
| Jelly blubber<br>*Catostylus mosaicus* | " | | A | ND | " |
| American oyster<br>*Crassostrea virginica* | Texas | shell | D | <0.1 | Smith & Wright (1962) |
| Oyster<br>*Crassostrea sp.* & *Ostrea sp.* | Australia | "flesh" | A | (0.01-0.27) 0.03 | Meehan & Smythe (1967) |
| " " | " | "liquid" | A | (0.01-0.03)0.02 | " |
| " " | " | shell | A | (0.01-0.08)0.04 | " |
| Scallop, Tasmanian<br>*Pecten novaezelandiae* | | | A | 0.02 | " |
| Cunjevoi, tunicate<br>*Pyura stolonifera* | " | "flesh" | A | (0.10-0.53) | " |
| " " | " | tunic | A | (0.05-0.30) | " |
| "Shellfish" | " | "flesh" | A | (0.07-1.15) | " |
| " | " | shell | A | (ND-0.01) | " |
| Marine crab | | | A | (0.07-0.17) | " |
| Green prawn | | | A | 0.03 | " |

| | | | | | |
|---|---|---|---|---|---|
| Starfish | Australia | whole | A | 0.02 | Meehan & Smythe (1967) |
| "Plankton" | " | | A | ND | " |

BERYLLIUM IN HIGHER PLANTS (1)

| Species | Locality | Tissue | Analysis PPM (2) | | Authority |
|---|---|---|---|---|---|
| Acacia<br>*Acacia sp.* | Australia | | A | (0.10-1.06)<br>0.46 | Meehan & Smythe (1967) |
| Peanut<br>*Arachis hypogaea* | " | nut | A | (0.01-0.03)<br>0.02 | " |
| " " | " | shell | A | (0.41-0.52)<br>0.47 | " |
| Sagebrush<br>*Artemisia sp.* | Russia | | A | (0.01-0.50) | Mursaliev (1969) |
| Birch<br>*Betula sp.* | " | Be indicator plant | A | 3.0 (max.) | Nickonova (1967) |
| Cabbage<br>*Brassica oleracea capitata* | Australia | head | A | 0.03 | Meehan & Smythe (1967) |

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| | | | | | |
|---|---|---|---|---|---|
| Hickory<br>*Carya spp.* | | Best Be accumulator plant known | | | Griffitts et al. (1977) |
| " " | | leaf | D | 1.0 | " |
| " " | | " | A | 30.0 | " |
| Dogwood<br>*Cornus sp.* | | " | D | >0.1 | " |
| " " | | " | A | >1.0 | " |
| Cedar<br>*Juniperus communis* | Missouri | needle & twig | D | <0.12 | Connor et al. (1970) |
| Lettuce, green<br>*Lactuca sativa* | W. Germany | head | D | 0.33 | Zorn & Diem (1974) |
| Lupine<br>*Lupinus sp.* | Australia | seed | A | 0.02 | Meehan & Smythe (1967) |
| Tomato<br>*Lycopersicon esculentum* | " | fruit | A | 0.02 | " |
| " " | W. Germany | " | D | 0.24 | Zorn & Diem (1974) |
| Alfalfa<br>*Medicago sativa* | United States | (Grown in nutrient soln. with 16 ppm Be) | | | Romney & Childress (1965) |
| " " | " | leaf & stem | D | 27.6 | " |
| Tobacco<br>*Nicotiana tabacum* | W. Germany | per cigarette | D | (0.47-0.74) | Zorn & Diem (1974) |
| Rice<br>*Oryza sativa* | " | grain (polished) | D | 0.08 | " |
| Bean<br>*Phaseolus vulgaris* | Australia | bean | A | (ND-0.01)<br>0.01 | Meehan & Smythe (1967) |

| | | | | | |
|---|---|---|---|---|---|
| Engleman spruce<br>*Picea engelmanni* | Colorado & Idaho | | A | <1.0 | Griffitts et al. (1977) |
| Lodgepole pine<br>*Pinus contorta* | " | | A | <1.0 | " |
| Pine<br>*Pinus sp.* | Russia | Be indicator plant | A | 3.0 (max.) | Nickonova (1967) |
| Almond<br>*Prunus amygdalus* | Australia | nut | A | 0.01 | Meehan & Smythe (1967) |
| " " | " | shell | A | 0.01 | " |
| Douglas fir<br>*Pseudotsuga taxifolia* | Colorado & Idaho | | A | <1.0 | Griffitts et al. (1977) |
| Pea<br>*Pisum sativum* | California | (grown in nutrient soln. with 16 ppm Be) | | | Romney & Childress (1965) |
| " " | | leaf & stem | D | 75.3 | " |
| Aspen<br>*Populus sp.* | Russia | Be indicator plant | A | 3.0 (max.) | Nickonova (1967) |
| Willow<br>*Salix sp.* | " | " | A | 3.0 (max.) | " |
| Potato<br>*Solanum tuberosum* | W. Germany | tuber | D | 0.17 | Zorn & Diem (1974) |
| Spanish moss<br>*Tillandsia usnoides* | United States | whole | A | 2.0 | Shacklette & Connor (1973) |
| Ladino clover<br>*Trifolium sp.* | California | (grown on Be-treated kaolin soil) | | | Romney & Childress (1965) |

| | | | | | |
|---|---|---|---|---|---|
| Corn<br>*Zea mays* | France<br>(with $BeSO_4$ supplement) | | | | Oustrin et al. (1967) |
| " " | " " | shoot | A | (2.4-2.8) | " |
| " " | " " | root | A | (2.7-2.8) | " |
| " " | " " | ear | A | (8.1-15.7) | " |
| Eel grass<br>*Zostera sp.* | Australia | whole | A | (0.28-1.12)<br>0.60 | Meehan & Smythe (1967) |
| "Angiosperms" | " | | A | (0.15-2.00)<br>0.69 | " |
| "Conifers" | | | D | 0.1 | Griffitts et al. (1977) |
| " | | | A | 1.0 | " |
| Desert shrubs | S.W. United States (desert) | | More Be in twigs than leaves | | " |
| "Vegetation" | | | A | $<2.0$ | Cannon (1960) |
| "Orchard leaves" | | | A | (0.030-0.067) | Owens & Gladney (1975) |

## BERYLLIUM IN LOWER PLANTS (1)

| Species | Locality | Tissue | Analysis (2) PPM | | Authority |
|---|---|---|---|---|---|
| MOSSES | | | | | |
| "Bryophytes" | in specimens containing Be (26.3% contain Be) | | A | 6.0 | Shacklette (1965) |
| LICHENS | | | | | |
| Lecanora rubina | Colorado | whole | | <1.0 | Leroy & Koksoy (1962) |
| Parmelia conspersa | " | " | | <1.0 | " |
| Parmelia saxatilis | | " | A | (0.0-trace) | Fearon (1935) |
| Umbilicaria hyperborea | " | " | | (1.0-3.0) | Leroy & Koksoy (1962) |
| Xanthoria elegans | " | " | | <1.0 | " |
| Xanthoria parietina | | " | A | (0.0-trace) | Fearon (1935) |

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| | | | | | |
|---|---|---|---|---|---|
| FUNGI | | | | | |
| "Mushrooms" | Australia | whole | A | 0.12 | Meehan & Smythe (1967) |
| Yeast, bakers | " | " | A | 0.02 | " |
| ALGAE | | | | | |
| "Rockweed algae" | " | " | A | (0.02-0.54) 0.28 | " |
| " | " | " | A | 0.01 | " |
| "Seaweed" | " | " | A | (0.29-1.02) 0.66 | " |
| "Bubbleweed" | " | " | A | (0.01-0.05) 0.03 | " |

## BORON IN MAMMALS (1)

| Species | Locality | Tissue | Analysis (2) PPM | | Authority |
|---|---|---|---|---|---|
| Harbor Seal *Phoca vitulina* | Great Britain | blood | W | 2.0 ±0.4 | Hamilton (1976) |
| " " | " | spleen | W | 0.5±0.2 | " |
| " " | " | heart | W | 0.1±0.05 | " |
| " " | " | muscle | W | 0.3±0.1 | " |
| " " | " | kidney | W | 0.01±0.01 | " |
| " " | " | liver | W | 0.2±0.1 | " |
| "Mammals" | | brain | D | 0.6 | Bowen (1966) |
| " | | heart | D | 0.2 | " |
| " | | kidney | D | 0.5 | " |
| " | | liver | D | 0.48 | " |
| " | | lung | D | 0.24 | " |
| " | | muscle | D | 0.31 | " |
| " | | skin | D | 0.2 | " |
| " | | bone | D | 5.0 | " |

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## BORON IN FISH (1)

| Species | Locality | Tissue | Analysis PPM (2) | Authority |
|---|---|---|---|---|
| Atlantic herring *Clupea harengus* | | | D 3.0 | Vinogradov (1953) |
| " " | | | W 1.5 | " |
| Anchovetta *Engraulis ringens* | California | whole | A (3.3-3.8) | Goldberg (1962) |
| Atlantic cod *Gadus morhua* | | | D 57.6 | Vinogradov (1953) |
| " " | | | W 1.83 | " |
| " " | | immature | D 1.5 | " |
| *Lepadogaster gouanii* | | | D 100.0 (ppm of sum of ash cations) | " |
| Haddock *Melanogrammus aeglefinus* (=Gadus aeglefinus) | | | D 17.5 | " |
| " " | | | W 3.45 | " |

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| | | | | | |
|---|---|---|---|---|---|
| Yellowfin tuna<br>Neothunnus macropterus | California | heart | A | 1.5 | Goldberg (1962) |
| " " | " | spleen | A | 3.3 | " |
| " " | " | stomach | A | 150.0 | " |
| " " | " | blood | A | 1.5 | " |
| " " | " | eyeball | A | 5.6 | " |
| " " | " | muscle | A | 39.0 | " |
| " " | " | gill | A | 1.8 | " |
| " " | " | whole | A | 9.0 | " |
| Pollock<br>Pollachius virens<br>(=Gadus virens) | | | D | 6.32 | Vinogradov (1953) |
| " " | | | W | 1.3 | " |
| " " | | immature | D | 35.9 | " |
| " " | | " | W | 6.24 | " |
| Lake trout<br>Salvelinus namaycush | New York | muscle | W | (0.25-0.63) | Tong et al. (1974) |
| Albacore<br>Thunnus alalunga | California | heart | A | 33.0 | Goldberg (1962) |
| " " | " | liver | A | 82.0 | " |
| " " | " | pyloric caeca | A | 33.0 | " |
| " " | " | gill | A | 1.6 | " |
| " " | " | hyoid bone | A | 1.0 | " |
| " " | " | skin | A | 2.7 | " |
| " " | " | muscle | A | (11.0-13.0) | " |
| " " | " | bone | A | (1.0-1.4) | " |

## BORON IN MOLLUSCA[1]

| Species | Locality | Tissue | Analysis PPM[2] | | Authority |
|---|---|---|---|---|---|
| Pteropod<br>*Clione limacina* | N.E. United States | whole | A | 90.0 | Nicholls et al. (1959) |
| American oyster<br>*Crassostrea virginica* | Texas | shell | D | 5.0 | Smith & Wright (1962) |
| Pteropod<br>*Limacina retroversa* | N.E. United States | | A | 50.0 | Nicholls et al. (1959) |
| Squid<br>*Ommastrephes illicebrosa* | " | | A | 420.0 | " |
| "Mollusca" | | | D | 20.0 | Bowen (1966) |
| " | | hard tissue | D | 3.0 | " |

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## BORON IN CRUSTACEA[1]

| Species | Locality | Tissue | Analysis[2] PPM | | Authority |
|---|---|---|---|---|---|
| Common barnacle *Balanus balanoides* | | | W | 2.43 | Vinogradov (1953) |
| " " | | | D | 18.6 | " |
| Copepod *Calanus finmarchius* | Barents Sea | | W | 9.52 | " |
| " " | " | | D | 71.6 | " |
| " " | N.E. United States | whole | A | 760.0 | Nicholls et al. (1959) |
| " " | " | | | | |
| (+ phytoplankton) | | | A | 325.0 | " |
| " " | " | | D | 134.0 | " |
| Hermit crab *Eupagurus bernhardus* | Great Britain | | D | 100.0 | Webb (1937) |
| Copepod *Centropagus hamatus* | N.E. United States | whole | A | 160.0 | Nicholls et al. (1959) |
| Beach flea *Gammarus locusta* | | | W | 14.5 | Vinogradov (1953) |
| " " | | | D | 71.4 | " |

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| | | | | | |
|---|---|---|---|---|---|
| Shrimp<br>*Palaemon sp.* | | | W | 2.5 | Vinogradov (1953) |
| " " | | | D | 11.3 | " |
| Spiny lobster<br>*Panulirus sp.* | | | W | 2.5 | " |
| " " | | | D | 11.3 | " |
| Freshwater crayfish<br>*Potamobius fluviatilis* | | | W | 9.03 | " |
| " " | | | D | 31.3 | " |
| Euphausid<br>*Euphausia krohnii* | N.E. United States | whole | A | 440.0 | Nicholls et al. (1959) |
| "Crustacea" | | | D | 15.0 | Bowen (1966) |

## BORON IN LOWER ANIMALS (1)

| Species | Locality | Tissue | Analysis (2) PPM | | Authority |
|---|---|---|---|---|---|
| ECHINODERMATA | | | | | |
| Sea star *Asterias rubens* | Great Britain | | D | 1,500.0 | Webb (1937) |
| Sea urchin *Echinus esculentus* | " | | D | 300.0 | " |
| Sea star *Marthasterias glacialis* | Sweden | | D | 300.0 | Noddack & Noddack (1940) |
| Brittlestar *Ophiocomina nigra* | Great Britain | disc, arm | D | 800.0 | Webb (1937) |
| Sea urchin *Paracentrotus lividus* | " | ovary | D | 100.0 | " |
| " " | " | coelomic fluid | D | 300.0 | " |
| "Echinodermata" | | | D | 46.0 | Bowen (1966) |
| " | | hard tissue | D | 30.0 | " |
| COELENTERATA | | | | | |
| Coral *Anomocora fecunda* | Jamaica | | D | 70.0 | Livingston & Thompson (1971) |

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| | | | | |
|---|---|---|---|---|
| Coral<br>Bathycyanthus maculatus | Jamaica | D | 80.0 | Livingston & Thompson (1971) |
| Coral<br>Caryophyllia clavus | " | D | 65.0 | " |
| Coral<br>Caryophyllia communis | " | D | 50.0 | " |
| Coral<br>Cladocera patriarca | " | D | 95.0 | " |
| Jellyfish<br>Cyanaea capillata | N.E. United States | A | 100.0 | Nicholls et al. (1959) |
| Coral<br>Dendrophyllia sp. | Jamaica | D | 100.0 | Livingston & Thompson (1971) |
| Coral<br>Desmophyllum cristogalli | " | D | (65.0-75.0) | " |
| Coral<br>Madracis asperula | " | D | 95.0 | " |
| Coral<br>Madracis mirabilis | " | D | (80.0-90.0) | " |
| Coral<br>Madracis pharensis | " | D | 80.0 | " |
| Coral<br>Meandrina areolata | " | D | 110.0 | " |
| Coral<br>Meandrina braziliensis | " | D | (55.0-70.0) | " |
| Coral<br>Montastrea annularis | " | D | (50.0-65.0) | " |
| Coral<br>Phyllangia americana | " | D | 60.0 | " |
| Coral<br>Porites porites | " | D | (40.0-50.0) | " |
| Coral<br>Scolmia cubensis | " | D | (60.0-80.0) | " |

| | | | | | |
|---|---|---|---|---|---|
| Coral<br>*Solenosmilia variabilis* | Jamaica | | D | (65.0-80.0) | Livingston & Thompson (1971) |
| Coral<br>*Trochocyanthus sp.* | " | | D | 85.0 | " |
| PORIFERA | | | | | |
| Sponge<br>*Aphrocallistes bocageia* | | in spongin skeleton | A | 1,000.0 | Vinogradov (1953) |
| Sponge<br>*Spongia sp.?* | | " | A | 5,000.0 | " |
| NEMERTEA | | | | | |
| *Lineus longissimus* | | | A | 500.0 | Webb (1937) |
| ANNELIDA | | | | | |
| Polychaete<br>*Nephthys sp.* | | | A | 1,000.0 | " |
| Annelida | | | D | 2.1 | Bowen (1966) |
| CHAETOGNATHA | | | | | |
| Arrow worm<br>*Sagitta elegans* | N.E. United States | whole | A | 130.0 | Nicholls et al. (1959) |
| CTENOPHORA | | | | | |
| Comb jelly<br>*Beroe cucumis* | " | " | A | 115.0 | " |
| TUNICATA | | | | | |
| Tunicate<br>*Salpa fusiformis* | " | " | A | 50.0 | " |
| FORAMINIFERA | | hard tissue | D | 500.0 | Bowen (1966) |

## BORON IN HIGHER PLANTS (1)

| Species | Locality | Tissue | Analysis PPM (2) | | Authority |
|---|---|---|---|---|---|
| Pickel weed *Allenrolfea sp.* | Russia | Absorbs large quantities of B in desert basin brines. Used for prospecting for B. | | | Buyalov & Shvyryayeva (1961) |
| Sagebrush *Artemisia tridentata* | Nevada Greenhouse | leaf | D | 73.0 | Wallace & Romney (1972) |
| " " | " " | stem | D | 20.0 | " |
| " " | " (on high B soil) | leaf | D | (45.0-62.0) | " |
| " " | " " | stem | D | (21.0-54.0) | " |
| " " | " " | leaf | D | (37.0-74.0) | " |
| " " | " " | whole | D | (134.0-250.0) | " |
| " " | " " | leaf | D | (87.0-156.0) | " |
| Locoweed *Astragalus lentiginosus* | " greenhouse | leaf | D | 107.0 | " |
| " " | " " | stem | D | 46.0 | " |

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| | | | | | | |
|---|---|---|---|---|---|---|
| Saltbush *Atriplex canescens* | Nevada greenhouse | stem | D | 14.0 | Wallace & Romney (1972) |
| " " | " " | leaf | D | 40.0 | " |
| " " | " (on high B soil) | " | D | (52.0-62.0) | " |
| " " | " (nutrient soln.) | " | D | (23.0-40.0) | " |
| " " | " " | stem | D | (9.0-19.0) | " |
| " " | " " | root | D | (3.0-21.0) | " |
| " " | " (field grown) | leaf | D | (60.0-106.0) | " |
| " " | " (with salts) | " | D | (234.0-680.0) | " |
| " " | " " | stem | D | (41.0-94.0) | " |
| " " | " " | root | D | (49.0-129.0) | " |
| Saltbush *Atriplex confertifolia* | " greenhouse | leaf | D | 37.0 | " |
| " " | " " | stem | D | 14.0 | " |
| " " | " (nutrient soln.) | leaf | D | (14.0-32.0) | " |
| " " | " " | stem | D | (27.0-46.0) | " |
| " " | " " | root | D | (14.0-23.0) | " |
| " " | " | cutting | D | (109.0-160.0) | " |
| " " | " (grown on soil) | leaf | D | (40.0-90.0) | " |
| " " | " (low salt) | " | D | (39.0-41.0) | " |
| " " | " (high salt) | " | D | (36.0-43.0) | " |

| | | | | | |
|---|---|---|---|---|---|
| Saltbush<br>*Atriplex hymenelytra* | Nevada greenhouse | leaf | D | 46.0 | Wallace & Romney (1972) |
| " " | " " | stem | D | 24.0 | " |
| " " | " (in NaCl) | leaf | D | (27.0-46.0) | " |
| " " | " " | stem | D | (14.0-25.0) | " |
| " " | " " | root | D | 13.0 | " |
| " " | " (field grown) | leaf | D | (192.0-1,588.0) | " |
| " " | " (in B solns.) | root | D | (39.0-61.0) | " |
| " " | " " | stem | D | (23.0-103.0) | " |
| " " | " " | leaf | D | (22.0-155.0) | " |
| Saltbush, desert holly<br>*Atriplex polycarpa* | " greenhouse | " | D | 93.0 | " |
| " " | " " | stem | D | 12.0 | " |
| Swiss chard<br>*Beta vulgaris cicla* | Maryland | leaf | D | (38.0-40.0) | Furr et al. (1976) |
| " " " | " (on sludge-amended soil) | " | D | (40.0-42.0) | " |
| Watershield<br>*Brasenia schreberi* | Pennsylvania | whole | D | 35.0 | Adams et al. (1973) |
| Cabbage<br>*Brassica oleracea capitata* | Maryland (control) | | D | 21.0 | Furr et al. (1977) |
| " " " | " (grown in soil & fly ash) | | D | (16.0-145.0) | " |
| Hickory<br>*Carya spp.* | Tennessee | branch | D | (7-70) | Van Hook et al. (1974) |
| Hornwort<br>*Ceratophyllum demersum* | Pennsylvania | whole | D | (25.0-62.0) | Adams et al. (1973) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Rabbit brush<br>Chrysothamnus nauseosus | Nevada greenhouse | leaf | D | 189.0 | Wallace & Romney (1972) |
| " " | " " | stem | D | 22.0 | " |
| Rabbis brush<br>Chrysothamnus viscidiflorus | " " | leaf | D | 178.0 | " |
| " " | " (field) | stem | D | 52.0 | " |
| Blackbrush<br>Coleogyne ramosissima | " | leaf | D | (22.0-50.0) | " |
| " " | " | stem | D | (13.0-49.0) | " |
| " " | " (grown on high B soil) | leaf | D | (44.0-78.0) | " |
| Dodder<br>Cuscuta nevadensis | " | whole | D | (24.0-30.0) | " |
| Tansy mustard<br>Descurainia pinnata | " greenhouse | top | D | 61.0 | " |
| Needle spike rush<br>Eleocharis acicularis | Pennsylvania | whole | D | (25.0-60.0) | Adams et al. (1973) |
| Blunt spike rush<br>Eleocharis obtusa | " | " | D | (18.0-20.0) | " |
| Waterweed<br>Elodea canadensis | " | " | D | (22.0-44.0) | " |
| Waterweed<br>Elodea nuttalli | " | " | D | (35.0-45.0) | " |
| Mormon tea<br>Ephedra funerea | Nevada | shoot | D | (12.0-14.0) | Wallace & Romney (1972) |
| Mormon tea<br>Ephedra nevadensis | " | " | D | (9.0-55.0) | " |
| Mormon tea<br>Ephedra torreyana | " | " | D | (21.0-28.0) | " |

| | | | | | |
|---|---|---|---|---|---|
| Mormon tea<br>Ephedra viridis | Nevada | shoot | D | (15.0-29.0) | Wallace & Romney (1977) |
| Winterfat<br>Eurotia ceratoides | Russia | Used for prospecting for B | | | Buyalov & Shvyryayeva (1961) |
| Winterfat<br>Eurotia lanata | Nevada greenhouse | leaf | D | 101.0 | Wallace & Romney (1972) |
| " " | " " | stem | D | 9.0 | " |
| " " | " (grown in field) | leaf | D | (43.0-104.0) | " |
| " " | " (high B soil) | " | D | (154.0-278.0) | " |
| " " | " (in field) | " | D | (49.0-279.0) | " |
| " " | " " | stem | D | (17.0-28.0) | " |
| Burro bush<br>Franseria dumosa | " greenhouse | leaf | D | 353.0 | " |
| " " | " " | stem | D | 30.0 | " |
| " " | " (in high B soil) | plant | D | (209.0-314.0) | " |
| " " | " (field) | leaf | D | (31.0-362.0) | " |
| " " | " (in solns. of B) | root | D | (70.0-270.0) | " |
| " " | " " | stem | D | (22.0-401.0) | " |
| " " | " " | leaf | D | (53.0-973.0) | " |
| " " | " (field) | " | D | 178.6±SD 65.1 | " |
| " " | " " | stem | D | 46.0±SD 19.5 | " |

| | | | | | |
|---|---|---|---|---|---|
| Spiny hop sage<br>*Grayia spinosa* | Nevada (grown in field) | leaf | D | (43.0-96.0) | Wallace & Romney (1972) |
| " " | " (in high B soil) | " | D | (36.0-76.0) | " |
| " " | " (field) | " | D | (28.5-36.5) | " |
| " " | " " | stem | D | (14.2-20.6) | " |
| " " | " " | leaf | D | 50.4±SD 18.1 | " |
| " " | " " | stem | D | 24.2±SD 9.3 | " |
| Creeping Saint Johns wort<br>*Hypericum adpressum* | Pennsylvania | whole | D | 18.0 | Adams et al. (1973) |
| Riverbank quillwort<br>*Isoetes riparia* | " | " | D | 26.3 | " |
| Bog rush<br>*Juncus effusus* | " | " | D | (11.3-22.3) | " |
| Rush<br>*Juncus sp.* | Russia | absorbs large quantities of B, used for prospecting | | | Buyalov & Shvyryayeva (1972) |
| Juniper<br>*Juniperus osteosperma* | Nevada | leaf | D | 24.0 | Wallace & Romney (1972) |
| Cedar<br>*Juniperus virginianus* | Missouri | branch | D | (14.0-16.0) | Connor et al. (1970) |
| Krameria<br>*Krameria parvifolia* | Nevada | leaf | D | (49.0-36.0) | Wallace & Romney (1972) |
| " " | " | stem | D | (18.0-43.0) | " |
| Larch<br>*Larix occidentalis* | United States | Used for prospecting for B | | | Carlisle & Cleveland (1958) |

| | | | | | |
|---|---|---|---|---|---|
| Creosote bush<br>*Larrea divaricata* | Nevada greenhouse | leaf | D | 66.0 | Wallace & Romney (1972) |
| " " | " " | stem | D | 10.0 | " |
| " " | " (field grown) | leaf | D | (68.0-192.0) | " |
| " " | " (in high B soil) | shoot | D | (56.0-205.0) | " |
| " " | " (field) | leaf | D | (52.8-156.0) | " |
| " " | " " | stem | D | (24.7-69.0) | " |
| Statice<br>*Limonium suffruticosum* | Russia | Used for prospecting for B | | | Buyalov & Shvyryayeva (1961) |
| Tulip poplar<br>*Liriodendron tulipifera* | Tennessee | branch | D | (5-10) | Van Hook et al. (1974) |
| Ludwigia<br>*Ludwigia palustris americana* | Pennsylvania | whole | D | 31.3 | Adams et al. (1973) |
| Box thorn<br>*Lycium andersonii* | Nevada greenhouse | leaf | D | 163.0 | Wallace & Romney (1972) |
| " " | " " | stem | D | 7.0 | " |
| " " | " (field) | " | D | (9.0-26.0) | " |
| " " | " " | leaf | D | (57.0-123.0) | " |
| " " | " (grown in high B soil) | " | D | (33.0-93.0) | " |
| " " | " (in nutrient solns.) | " | D | (26.0-131.0) | " |
| " " | " " | stem | D | (9.0-19.0) | " |
| " " | " " | root | D | (25.0-74.0) | " |
| " " | " (field) | leaf | D | 83.4±SD 23.7 | " |
| " " | " " | stem | D | 24.3±SD 12.6 | " |

| | | | | | |
|---|---|---|---|---|---|
| Boxthorn<br>*Lycium pallidum* | Nevada (field) | leaf | D | (60.0-100.0) | Wallace & Romney (1972) |
| " " | " (in high B soil) | " | D | (74.0-201.0) | " |
| " " | " (field) | " | D | 63.9±SD 12.7 | " |
| " " | " " | stem | D | 22.9±SD 9.9 | " |
| Boxthorn<br>*Lycium shockleyi* | " " | leaf | D | (44.0-50.0) | " |
| Sweet clover<br>*Melilotus sp.* | United States | Used for prospecting for B | | | Carlisle & Cleveland (1958) |
| Water milfoil<br>*Myriophyllum brasiliense* | Pennsylvania | whole | D | 36.0 | Adams et al. (1973) |
| Water milfoil<br>*Myriophyllum exalbescens* | " | " | D | (25.0-42.0) | " |
| Water milfoil<br>*Myriophyllum farwelli* | " | " | D | 53.6 | " |
| Threadlike naias<br>*Naias gracillima* | " | " | D | 45.6 | " |
| Yellow pond lily<br>*Nuphar advena* | " | " | D | 31.0 | " |
| Yellow pond lily<br>*Nuphar variegatum* | " | " | D | (23.0-30.0) | " |
| White water lily<br>*Nymphaea tuberosa* | " | " | D | 30.3 | " |
| Indian rice grass<br>*Oryzopsis hymenoides* | Nevada greenhouse | top | D | 78.0 | Wallace & Romney (1972) |
| " " | " (field) | leaf | D | (37.0-42.0) | " |
| Reed canarygrass<br>*Phalaris arundinacea* | Pennsylvania | whole | D | 11.3 | Adams et al. (1973) |
| Lodgepole pine<br>*Pinus contorta* | United States | Used for prospecting for B | | | Carlisle & Cleveland (1958) |

| | | | | | |
|---|---|---|---|---|---|
| Shortleaf pine<br>*Pinus echinata* | Tennessee | branch | D | (3-50) | Van Hook et al. (1974) |
| Riverweed<br>*Podostemon ceratophyllum* | Pennsylvania | whole | D | 44.3 | Adams et al. (1973) |
| Knotweed<br>*Polygonum amphibium stipulaceum* | " | " | D | 47.6 | " |
| Aspen<br>*Populus tremuloides* | United States | Used for prospecting for B | | | Carlisle & Cleveland (1958) |
| Black cottonwood<br>*Populus trichocarpa* | " | " | | | " |
| Pondweed<br>*Potamogeton amplifolius* | Pennsylvania | whole | D | 35.6 | Adams et al. (1973) |
| Pondweed<br>*Potamogeton crispus* | " | " | D | (18.0-50.0) | " |
| Pondweed<br>*Potamogeton epihydrus muttellii* | " | " | D | (51.6-56.0) | " |
| Pond weed<br>*Potamogeton filiformis borealis* | " | " | D | 141.0 | " |
| Pond weed<br>*Potamogeton gramineus* | " | " | D | 41.6 | " |
| Pond weed<br>*Potamogeton illinoensis* | " | " | D | (30.0-55.0) | " |
| Sago pondweed<br>*Potamogeton pectinatus* | " | " | D | 170.0 | " |
| Pond weed<br>*Potamogeton richardsonii* | " | " | D | 38.0 | " |
| Pond weed<br>*Potamogeton robbinsii* | " | " | D | 40.6 | " |
| Pond weed<br>*Potamogeton zosteriformis* | " | " | D | (33.0-34.0) | " |

| | | | | | |
|---|---|---|---|---|---|
| Chestnut oak<br>Quercus prinus | Tennessee | branch | D | (20-80) | Van Hook et al. (1974) |
| Buttercup<br>Ranunculus longirostris | Pennsylvania | whole | D | 53.0 | Adams et al. (1973) |
| Arrowhead<br>Sagittaria subulata | " | " | D | (50.6-67.3) | " |
| Glasswort<br>Salicornia herbacea | | Severe changes occur in plants growing on high B soils, used for prospecting for B | | | Cannon (1971) |
| Saltwort<br>Salsola nitraria | Russia | Used as B indicator plant in prospecting. Grows in soils with up to 36% B. | | | Buyalov & Shvyryayeva (1961) |
| Lizards tail<br>Saururus cernuus | Pennsylvania | whole | D | 57.0 | Adams et al. (1973) |
| Three-square<br>Scirpus americanus | " | " | D | 16.3 | " |
| Great bulrush<br>Scirpus validus creber | " | " | D | 16.3 | " |
| Soolpolallie<br>Shepherdia canadensis | United States | Used for prospecting for B | | | Carlisle & Cleveland (1958) |
| Squirreltail<br>Sitanion hystrix | Nevada | top | D | 28.0 | Wallace & Romney (1972) |
| Bur-reed<br>Sparganium americanum | Pennsylvania | whole | D | (18.0-70.0) | Adams et al. (1973) |
| Globe mallow<br>Sphaeralcea ambigua | Nevada | leaf | D | (89.8-159.0) | Wallace & Romney (1972) |
| " " | " | stem | D | (13.5-24.7) | " |

| | | | | | |
|---|---|---|---|---|---|
| Wire grass<br>Sporobolus spp. | United States | B detected in all samples in salt sick, marginal & healthy areas. | | | Rusoff (1937) |
| Stanleya<br>Stanleya pinnata | Nevada | leaf | D | 57.0 | Wallace & Romney (1972) |
| Spanish moss<br>Tillandsia usneoides | United States | whole | A | (70.0-300.0) geom. mean 150.0 | Shacklette & Connor (1973) |
| Cattail<br>Typha latifolia | Pennsylvania | " | D | (15.0-30.0) | Adams et al. (1973) |
| Bladderwort<br>Utricularia vulgaris | " | " | D | 37.6 | " |
| Eel grass<br>Vallisneria americana | " | " | D | (38.0-55.0) | " |
| Speedwell<br>Veronica scutellata | " | " | D | 42.6 | " |
| Yucca<br>Yucca brevifolia | Nevada | leaf | D | (11.0-21.0) | Wallace & Romney (1972) |
| " " | " (grown in high B soil) | shoot | D | (38.0-46.0) | " |
| Yucca<br>Yucca schidigera | " greenhouse | top | D | 31.0 | " |
| " " | " (grown in high B soil) | shoot | D | (26.0-108.0) | " |
| " " | " | whole | D | (20.0-25.0) | " |
| " " | " (seedling) | top | D | 30.0 | " |
| " " | " " | root | D | 11.0 | " |
| " " | " (irrad. & grown in high B soil) | shoot | D | (87.0-321.0) | " |

| | | | | |
|---|---|---|---|---|
| "Plants" | | A | 400 | Vinogradov (1953) |
| Ave. of over 100 sp. of plants | growing on unmineralized ground | A | 700 | Cannon (1960) |
| "Plants" | Florida | Present in all species of plants tested. | | Carrigan & Rogers (1940) |
| Pteridophytes | | D | 77.0 (ave.) | Bowen (1966) |
| Gymnosperms | | D | 63.0 " | " |
| Angiosperms | | D | 50.0 " | " |

## BORON IN ALGAE (1)

| Species | Locality | Tissue | Analysis PPM (2) | Authority |
|---|---|---|---|---|
| *Ascophyllum nodosum* | | | | |
| *Fucus serratus* | | | | |
| *Fucus vesiculosus* | | | D to 100.0 | Oy (1940) |
| "Marine algae" 5 species | | | D (4.2-14.9) | Igelsrud et al. (1938) |
| "Red algae" | | hard tissue | D 60.0 | Bowen (1966) |
| "Brown algae" | | | D 120.0 | " |
| OTHER PLANTS | | | | |
| Bacteria | | | D 5.5 (ave.) | " |
| Fungi | | | D 5.0 " | " |
| Bryophytes | | | D 20.0 " | " |

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(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

## CADMIUM IN MAMMALS[1]

| Species | Locality | Tissue | Analysis[2] PPM | Authority |
|---|---|---|---|---|
| Moose<br>*Alces alces gigas* | Alaska | hair | D (0.2-1.6) 0.8 | Flynn et al. (1975) |
| " " " | " | " | Cd was 2 X higher in July-Oct. than Nov.-June in 3-yr. period | " |
| " " " | " | hair | D (1.0-1.4) | Flynn & Franzmann (1974) |
| " " " | " | hoof | D (0.7-0.8) | " |
| Longtailed field mouse<br>*Apodemus sylvaticus* | Great Britain | liver | W (<0.01-0.28) | Jefferies & French (1976) |
| " " | " " | kidney | W (<0.01-0.77) | " |
| " " | " " | testes | W (<0.01-6.34)? | " |
| " " | " " | whole body | W (0.06-0.14) | " |
| Short-tailed shrew<br>*Blarina brevicauda* | New Hampshire | " " | W 0.4±SD 0.01 | Schlesinger & Potter (1974) |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | | | |
|---|---|---|---|---|---|---|
| Short-tailed shrew *Blarina brevicauda* | Ohio | leg | W | (0.07-0.63) | Curnow et al. (1977) |
| " " | " | liver | W | (ND-1.29) | " |
| Cow *Bos bovis* | Missouri | Cattle exposed to Cd from lead smelter and trucking Pb concentrate: | | | Dorn et al. (1974) |
| " " | " | exposed cattle on test farm: | | | |
| | " | fall, hair | W | 1.29 | " |
| " " | " | winter, " | W | 1.74 | " |
| " " | " | spring, " | W | 2.80 | " |
| " " | " | summer, " | W | 0.67 | " |
| " " | " | unexposed cattle on control farm: | | | |
| " " | " | fall, hair | W | 0.06 | " |
| " " | " | winter, " | W | 0.13 | " |
| " " | " | spring, " | W | 0.05 | " |
| " " | " | summer, " | W | 0.04 | " |
| " " | " | Cd in cattle hair in terminal summer sample was 12 X higher than control. | | | " |
| " " | Missouri dist. from smelter (km): | | | | Dorn et al. (1973) |
| " " | " " 0.8 | liver | W | 0.9 | " |
| " " | " " 72.4 (control) | " | W | 0.24 | " |
| " " | " " 0.8 | kidney | W | 3.7 | " |
| " " | " " 72.4 (control) | " | W | 1.4 | " |
| " " | " " 0.8 | diaphragm | W | 0.1 | " |

| | | | | | | |
|---|---|---|---|---|---|---|
| Cow *Bos bovis* | | Missouri dist. from smelter (km): | | | | Dorn et al. (1973) |
| " | " | " " 72.4 (control) | diaphragm | W | 0.1 | " |
| " | " | " " 0.8 | milk | W | (0.002-0.0042) | " |
| " | " | " " 72.4 (control) | " | W | (0.003-0.0043) | " |
| " | " | Montana (near Pb smelter) | milk | W | 0.02 | Lewis (1972) |
| " | " | " " | patella bone | W | 1.4 | " |
| " | " | " " | liver | W | 0.2 | " |
| " | " | " " | muscle | W | 0.4 | " |
| " | " | 24.1 km from Zn smelter | liver | W | (0.2-0.43) 0.34 | Munshower (1972) |
| " | " | " " " | kidney | W | (1.03-2.31) 1.67 | " |
| " | " | " " " | liver | W | (0.33-1.4) 0.76 | " |
| " | " | " " " | kidney | W | (1.53-5.7) 3.04 | " |
| " | " | United States | " | W | (0.22-1.0) | Schroeder & Balassa (1961) |
| " | " | " " | leg muscle | W | 0.024 | " |
| " | " | " " | liver | W | (0.16-0.2) | " |
| " | " | " " | milk | W | (0.017-0.030) | Murthy & Rhea (1968) |
| " | " | Germany | kidney | | (to 40.0) 12.0 | Kropf & Geldmacher (1968) |

| | | | | | |
|---|---|---|---|---|---|
| Cow *Bos bovis* | United States | milk | W | (0.017-0.041) 0.025 med. | Pinkerton et al. (1972) |
| " " | Romania | muscle | W | 0.060 | Rautu & Sporn (1970) |
| " " | Japan | " | W | 0.054 | Ishazaki et al. (1970) |
| " " | Texas | liver | W | 0.22±SD 0.04 | Horowitz & Presley (1977) |
| " " | Kansas | milk | W | (0.0013-0.0054) | Lagerwerff & Brower (1974) |
| " " | Japan | muscle | W | 0.052 | Yamagata & Shigematsu (1970) |
| " " | " | liver | W | 0.22 | " |
| " " | United States (1000 cattle) | liver | W | (0.02-3.17) 0.231 | USDA (1971) |
| " " | " " | muscle | W | (0.01-0.90) 0.086 | " |
| " " | " " | kidney | W | (0.01-7.82) 0.509 | " |
| " " | Czechoslovakia | milk | W | 0.01 | Lener & Bibr (1970) |
| " " | Germany (control area) | kidney | W | 4.7±SD 3.4 | Anke et al. (1976) |
| " " | Germany (Cd emission area) | " | W | 29.0±SD 22.0 | " |
| " " | Washington, D. C. | milk | W | (0.0031-0.0048) 0.0044 | Lagerwerff & Brower (1974) |

| | | | | | |
|---|---|---|---|---|---|
| Northern fur seal *Callorhinus ursinus* | Washington coast | kidney (fetus & 1 yr.) | W | (0.1-6.9) | Anas (1974) |
| " " | " | kidney (3-20 yr.) | W | (0.2-15.6)5.2 | " |
| " " | " | liver (fetus & 1 yr.) | W | (0.5-0.9) | " |
| " " | " | liver (3-20 yr.) | W | (1.1-4.6)1.7 | " |
| Dog *Canis familiaris* | Vermont | liver | W | 0.59 | Schroeder et al. (1967) |
| " " | " | kidney | W | 1.47 | " |
| Coyote *Canis latrans* | United States | " | W | 0.36 | " |
| Goat *Capra americana* | " " | " | D | 2.7 | Miller et al. (1969) |
| " " | " " | duodenum | D | 2.5 | " |
| " " | " " | liver | D | 1.6 | " |
| " " | Germany (fed 500 ppm Cd) | kidney (male) | W | 853.0 | Anke et al. (1976) |
| " " | " " " | kidney (female) | W | 443.0 | " |
| " " | " " " | liver (male) | W | 84.0 | " |
| " " | " " " | liver (female) | W | 48.0 | " |
| " " | " " " | heart muscle (male) | W | 4.7 | " |
| " " | " " " | heart muscle (female) | W | 2.4 | " |

| | | | | | |
|---|---|---|---|---|---|
| Roe deer<br>Capreolus capreolus | Germany (Cd emission area) | kidney | W | 32.0 | Anke et al. (1976) |
| Guinea pig<br>Cavia porcellus | United States | liver | D | (1.8-2.4) | Furr et al. (1976) |
| " " | " " | kidney | D | (6.2-10.6) | " |
| " " | " " | muscle | D | (0.05-0.1) | " |
| " " | " " | adrenal | D | (0.05-0.09) | " |
| " " | " " | spleen | D | (0.11-0.19) | " |
| " " | United States (control) | kidney | D | 6.2 | " |
| " " | United States (fed swiss chard grown on sludge fortified soil) | " | D | (7.4-10.6) | " |
| Elk<br>Cervus sp. | Finland | liver | D | 1.5 | Jaakola et al. (1971) |
| " " | " | kidney | D | 8.05 | " |
| " " | " | muscle | D | 0.59 | " |
| Columbia ground squirrel<br>Citellus columbianus | Montana | liver | W | (0.2-1.4) | Gordon (1972) |
| " " | " | kidney | W | (1.4-4.0) | " |
| Bank vole<br>Clethrionomys glareolus | Great Britain | whole body | W | 0.12 | Jefferies & French (1976) |
| " " | " " | " " | D | 0.45 | " |
| " " | " " | liver | W | <0.01 | " |
| " " | " " | kidney | W | 0.72 | " |

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|---|---|---|---|---|---|
| Common dolphin<br>Delphinus delphis | New Zealand | liver | W | (0.21-1.55) | Koeman et al. (1973) |
| Sea otter<br>Enhydra lutris | California | kidney | D | (89.0-300.0) | in Anderlini (1974) |
| Horse<br>Equus caballus | Montana (control) | mane | W | (0.2-0.6)0.3 | Lewis (1972) |
| " " | Montana (near smelter) | " | W | (0.6-9.6)1.8 | " |
| " " | Montana dist. from smelter (mi): | | | | |
| " " | " " NE 2.9 | " | W | 9.0 | " |
| " " | " " E 2.6 | " | W | 2.9 | " |
| " " | " " SSE 1.0 | " | W | 2.4 | " |
| " " | " " NW 1.4 | | W | 2.2 | " |
| " " | " " N 1.0 | " | W | 2.2 | " |
| " " | " " W 3.0 | " | W | 1.7 | " |
| " " | " " E 2.9 | " | W | 1.4 | " |
| " " | " " NNW 1.9 | " | W | 1.3 | " |
| " " | " " WNW 7.6 | " | W | 1.3 | " |
| " " | " " E 4.7 | " | W | 1.0 | " |
| " " | " Proximity of stacks of the smelter correlates with increased levels of Cd in horse manes and are consistent with Cd in soil and pasture grass. | | | | " |
| " " | " 3 yr. old horse died, toxic levels of Cd: | | | | " |
| " " | " " " | kidney | W | (228.0-410.0) 319.0 | " |
| " " | " " " | bone | W | 1.0 | " |

| | | | | | |
|---|---|---|---|---|---|
| Horse<br>Equus caballus | Montana<br>3 yr. old horse died, toxic levels of Cd: | | | | Lewis (1972) |
| " " | " " " | liver | W | 80.0 | " |
| " " | " " " | spleen | W | 4.1 | " |
| " " | " " " | lung | W | (0.6-1.6)1.1 | " |
| " " | " " " | heart | W | 0.4 | " |
| " " | " " " | flank muscle | W | 3.9 | " |
| " " | Wales (Smelter area) | kidney (normal) | W | 35.0 | Goodman & Roberts (1971) |
| " " | " " | liver (normal) | W | 1.6 | " |
| " " | " " | lung (normal) | W | <0.1 | " |
| " " | " " | kidney (affected) | W | 330.0 | " |
| " " | " " | liver (affected) | W | 7.5 | " |
| " " | " " | lung (affected) | W | 0.3 | " |
| Porcupine<br>Erethizon dorsatum | Vermont | heart | W | 0.35 | Schroeder et al. (1967) |
| Bearded seal<br>Erignathus barbatus | Alaska | kidney | W | $43.4 \pm 19.7$ | Buhler & Mate (1973) |
| " " | " | liver | W | $11.1 \pm 10.2$ | " |
| " " | " | muscle | W | $0.222 \pm 0.292$ | " |

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|---|---|---|---|---|---|
| Gray seal<br>Halichoerus grypus | Oregon coast | kidney | W | 22.0 | Buhler et al. (1975) |
| " " | Great Britain | | Cd accumulated with age in kidney | | Heppleston & French (1973) |
| Dusky dolphin<br>Lagenomorphus obscurus | New Zealand | liver | W | (0.21-1.55) | Koeman et al. (1973) |
| Woodchuck<br>Marmota monax | Ohio | liver | W | ND | Lynch (1973) |
| Field vole<br>Microtus agrestis | Sweden (smelter area) | kidney | D | (0.17-3.9)1.09 | Westermark et al. (1974) |
| Mouse<br>Mus musculus | Sweden | hair (44 days after injection of Cd) | W | 0.00011 ± 0.00005 | Nordberg & Nishiyami (1972) |
| " " | " | hair (112 days after injection of Cd) | W | 0.00007 ± 0.000033 | " |
| " " | United States | commercial grown, kidney | W | 0.01-0.3 | Schroeder et al. (1964) |
| " " | " " | controls, kidney | W | 0.0 | " |
| Weasel<br>Mustela nivalis | Montana | kidney | W | 1.87 | Munshower (1972) |
| Mink<br>Mustela vison | Ohio | leg bone | W | ND | Lynch (1973) |
| White-tailed deer<br>Odocoilus virginiensis | Vermont | kidney | W | 2.07 | Schroeder et al. (1967) |

| | | | | | |
|---|---|---|---|---|---|
| White-tailed deer<br>Odocoilus virginiensis | Vermont | fat | W | 0.12 | Schroeder et al. (1967) |
| " " | " | brain | W | 0.08 | " |
| " " | Tennessee | kidney | W | (2.1-11.7) | Schroeder & Balassa (1961) |
| " " | " | liver | W | 0.35-0.74) | " |
| " " | Ohio | " | W | (ND-0.39) 0.07 | Devendorf (1975) |
| " " | " | muscle | W | (ND-0.32)0.02 | " |
| " " | " | brain | W | 0.12±0.17 | Lynch (1973) |
| " " | " | kidney | W | 0.7±0.74 | " |
| " " | " | leg muscle | W | 0.09±0.08 | " |
| " " | " | liver | W | 0.27±0.27 | " |
| " " | " | leg bone | W | 0.56±0.11 | " |
| Domestic rabbit<br>Oryctolagus cuniculus | Montana (near Pb smelter) | feral, liver | W | (3.9-5.8)5.1 | Gordon (1972) |
| " " | " " " | feral, kidney | W | (19.0-61.0)35.6 | " |
| " " | " " " | control, liver | W | 0.1 | " |
| " " | " " " | control, kidney | W | 0.3 | " |
| Sheep<br>Ovis aries | United States | lamb kidney | W | 0.14 | Schroeder & Balassa (1961) |
| " " | " " | lamb liver | W | 0.14 | " |

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|---|---|---|---|---|---|
| Sheep<br>Ovis aries | United States | lamb muscle | W | 0.015 | Schroeder & Balassa (1961) |
| " " | Germany (non-smelter area) | kidney | W | (1.4-2.8) | Anke et al. (1976) |
| " " | " " " | liver | W | (0.51-0.72) | " |
| " " | Germany (smelter area) | kidney | W | (12.0-40.0) | " |
| " " | " " | liver | W | (2.8-3.5) | " |
| White-footed mouse<br>Peromyscus leucopus | Ohio (strip mine area) | leg | W | (0.02-0.69) medians | Curnow et al. (1977) |
| " " | " " " | liver | W | (ND-1.1) medians | " |
| " " | Ohio (non-strip mine area) | leg | W | (0.12-0.4) medians | " |
| " " | " " " | liver | W | (0.02-0.22) medians | " |
| Deer mouse<br>Peromyscus m. maniculatus | New England | whole body | W | 0.4±SD 0.01 | Schlesinger & Potter (1974) |
| Harbor seal<br>Phoca vitulina richardi | California coast | | | (0.01-0.76) 0.116 | Roberts et al. (1975) |
| Harbor seal, common seal<br>Phoca vitulina | Netherlands | | | (0.05-0.3) | Koeman et al. (1973) |
| " " | Great Britain | blood | W | 0.02±0.01 | Hamilton (1976) |
| " " | " " | spleen | W | 0.1±0.05 | " |
| " " | " " | heart | W | 0.03±0.01 | " |

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|---|---|---|---|---|---|
| Harbor seal, common seal *Phoca vitulina* | Great Britain | muscle | W | 0.2±0.1 | Hamilton (1976) |
| " " | " " | kidney | W | 10.0±9.0 | " |
| " " | " " | liver | W | 0.8±0.7 | " |
| " " | " " | kidney | | (2.2-22.0) | Heppleston & French (1973) |
| " " | " " | brain | | <1.0 | " |
| " " | " " | liver | | <1.0 | " |
| " " | West Scotland | " | W | (0.2-1.1) | Roberts et al. (1976) |
| " " | " " | kidney | W | (0.1-1.9) | " |
| " " | " " | spleen | W | 0.13±SD 0.06 | " |
| " " | " " | brain | W | 0.15±SD 0.16 | " |
| " " | " " | muscle | W | 0.13±SD 0.06 | " |
| " " | " " | claw | W | 0.52±SD 0.33 | " |
| " " | " " | rib | W | 0.41±SD 0.33 | " |
| " " | East Anglia | liver | W | (0.2-0.8) | " |
| " " | " " | kidney | W | (0.1-0.6) | " |
| " " | Great Britain | liver, mother | W | 0.72 | " |
| " " | " " | liver, foetus | W | 0.19 | " |
| " " | " " | kidney, mother | W | 1.54 | " |
| " " | " " | kidney, foetus | W | 0.14 | " |
| Harbor porpoise *Phocoena phocoena* | North Sea | liver | W | (0.05-1.2) | Koeman et al. (1973) |
| " " | " " | brain | W | (<0.01-0.15) | " |

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|---|---|---|---|---|---|
| Rat<br>*Rattus rattus* | United States | kidney | W | 0.0 | Schroeder & Balassa (1961) |
| Gray squirrel<br>*Sciurus carolinensis* | Vermont | kidney | W | 3.62 | " |
| " " | Florida | kidney, urban, 1 yr. | W | (3.91-14.93) | McKinnon et al. (1976) |
| " " | " | " " 2 " | W | 15.9 | " |
| " " | " | " " 3 " | W | 15.9 | " |
| " " | " | kidney, rural area, 2 yrs. | W | (2.04-4.63) | " |
| Red squirrel<br>*Sciurus hudsonicus* | United States | kidney | W | (7.97-17.35) | Schroeder & Balassa (1961) |
| " " | " " | liver | W | (0.8-2.03) | " |
| " " | " " | " | W | 0.73 | Schroeder et al. (1967) |
| Squirrels<br>*Sciurus carolinensis* & *hudsonicus* | Ohio | brain | W | 0.086±0.06 | Lynch (1973) |
| " " " | " | kidney | W | 1.99±2.4 | " |
| " " " | " | leg muscle | W | 0.22±0.18 | " |
| " " " | " | liver | W | 0.92±0.89 | " |
| " " " | " | leg bone | W | 0.71±0.46 | " |
| Surinam dolphin<br>*Sotalia guianensis* | Surinam | liver | W | (0.02-0.058) | Koeman et al. (1973) |
| Columbian ground squirrel<br>*Spermophilus columbianus* | Montana (control) | immature, liver | W | 0.11 | Munshower (1972) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Columbian ground squirrel *Spermophilus columbianus* | | Montana (control) | mature, liver | W | 0.25 | Munshower (1972) |
| " | " | " " | immature, kidney | W | 0.23 | " |
| " | " | " " | mature, kidney | W | 1.18 | " |
| " | " | Montana (24 km from Zn smelter) | immature, liver | W | 0.29 | " |
| " | " | " " " | mature, liver | W | 0.7 | " |
| " | " | " " " | immature, kidney | W | 0.99 | " |
| " | " | " " " | mature, kidney | W | 3.74 | " |
| " | " | Montana (near Pb smelter) | liver | W | 1.4 | Gordon (1972) |
| " | " | " " " | kidney | W | 4.0 | " |
| " | " | Montana (control) | liver | W | 0.02 | " |
| Pig *Sus scrofa* | | Montana | liver | W | 0.2 | Lewis (1972) |
| " | " | " | kidney | W | 0.8 | " |
| " | " | Montana (24.1 km from Zn smelter) | liver | W | (0.2-0.43) | Munshower (1972) |
| " | " | " " " | kidney | W | (0.71-2.77) | " |
| " | " | United States | kidney | W | (0.15-0.6) | Schroeder & Balassa (1961) |
| " | " | " " | muscle | W | 0.025 | " |
| " | " | " " | liver | W | (0.1-0.2) | " |

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|---|---|---|---|---|---|
| Pig<br>Sus scrofa | United States | muscle | W | 0.25 | Schroeder et al. (1967) |
| " " | Czechoslovakia | liver & kidney | W | (0.16-1.59) | Lener & Bibr (1969) |
| " " | Romania | muscle | W | 0.034 | Rautu & Sporn (1970) |
| " " | Japan | " | W | 0.016 | Ishazaki et al. (1970) |
| " " | " | muscle | W | 0.032 | Yamagata & Shigematsu (1970) |
| | | liver | W | 0.080 | |
| " " | Montana | heart | W | 0.1 | Lewis (1972) |
| " " | " | liver | W | 0.2 | " |
| " " | " | kidney | W | 0.8 | Gordon (1972) |
| Eastern cottontail<br>Sylvilagus floridanus | United States | kidney | W | 3.58 | Schroeder & Balassa (1961) |
| " " | " " | liver | W | 0.3 | " |
| " " | Ohio | leg muscle | W | 0.09 | Bachant & Schumann (1971) |
| " " | " | kidney | W | 1.3 | " |
| " " | " | brain | W | (ND-0.65)<br>0.25±0.19 | Lynch (1973) |
| " " | " | kidney | W | (0.018-13.47)<br>1.61±2.17 | " |
| " " | " | leg muscle | W | (ND-0.52)<br>0.084±0.11 | " |
| " " | " | liver | W | (0.03-1.19)<br>0.414±0.39 | " |

| | | | | | |
|---|---|---|---|---|---|
| Eastern cottontail<br>Sylvilagus floridanus | Ohio | leg bone | W | (0.26-3.59)<br>1.0±0.67 | Lynch (1973) |
| " " | " | liver | W | (ND-2.13)0.12 | Devendorf (1975) |
| " " | " | muscle | W | (ND-0.181)0.04 | " |
| Mountain cottontail<br>Sylvilagus nuttallii | Montana (near Pb smelter) | liver | W | 9.1 | Gordon (1972) |
| " " | " " " | kidney | W | 53.0 | " |
| Rabbit | Germany | kidney | W | 0.6 | Kropf & Geldmacher (1968) |
| " | " | liver | W | 0.6 | " |
| Badger<br>Taxidea taxus | Montana | | W | 2.04 | Munshower (1972) |
| Bottle-nosed dolphin<br>Tursiops truncatus | fed North Sea fish | liver | W | (0.05-0.3) | Koeman et al. (1973) |
| Gray fox<br>Urocyon cinearoargenteus | Ohio | leg muscle | W | 0.065 | Lynch (1973) |
| " " | " | leg bone | W | 0.56 | " |
| Red fox<br>Vulpes vulpes | Montana | kidney | W | 1.35 | Munshower (1972) |
| " " | Ohio | leg muscle | W | (ND-0.08) | Lynch (1973) |
| " " | " | leg bone | W | (0.44-0.64) | " |
| " " | Sweden smelter area | kidney | D | (2.6-11.2)<br>6.0 | Westermark et al. (1974) |
| " " | Sweden | muscle | D | (0.04-0.15)<br>0.08 | " |

| | | | | | |
|---|---|---|---|---|---|
| California sea lion *Zalophus californianus* | | liver | W | 6.0 | in Anas (1974) |
| " " | | kidney | W | 60.0 | " |
| " " | Oregon coast 1970 | kidney | W | 0.7±13.98 | Buhler et al. (1975) |
| " " | " " " | liver | W | 2.35±1.17 | " |
| " " | " " " | muscle | W | 0.076±0.033 | " |
| " " | " " 1971 | kidney | W | (11.5-12.0)means | " |
| " " | " " " | liver | W | (2.29-3.46) " | " |
| " " | " " " | muscle | W | (0.069-0.16) " | " |
| " " | " " 1973 | heart | W | 0.14±0.05 | " |
| " " | " " " | kidney | W | 7.22±2.71 | " |
| " " | " " " | liver | W | 1.61±0.16 | " |
| " " | " " " | muscle | W | 0.085±0.013 | " |
| " " | California | kidney | D | (18.0-63.0) | in Anderlini (1974) |
| " " | " | liver, mother | D | (4.3-90.0) 10.0 | Martin et al. (1976) |
| " " | " | kidney, mother | D | (68.0-569.0) 97.0 | " |
| Walrus | Alaska | kidney | W | 51.6±35.5 | Buhler & Mate (1973) |
| " | " | liver | W | 7.70±1.31 | " |
| " | " | muscle | W | 0.445±0.311 | " |
| Whale | | muscle | W | (0.25-0.4) 0.33 | Ishazaki et al. (1970) |

## CADMIUM IN BIRDS[1]

| Species | Locality | Tissue | Analysis[2] PPM | Authority |
|---|---|---|---|---|
| Coopers Hawk *Accipiter cooperi* | Arizona | egg | W 0.12±SE 0.023 | Snyder et al. (1973) |
| " " | | | in 20 of 24 eggs, limits of detection 0.015-0.024 | " |
| Mallard *Anas platyrhynchos* | Alberta | feather | D 0.01 | Kelsall (1970) |
| " " | New York | liver | <2.0 | Baker et al. (1976) |
| " " | " " | muscle | <2.0 | " |
| Black duck *Anas rubripes* | Alberta | feather | D <0.01 | Kelsall (1970) |
| " " | New York | liver | <2.0 | Baker et al. (1976) |
| " " | " " | muscle | <2.0 | " |
| White-fronted goose *Anser albifrons* | Alberta | feather | D 0.01 | Kelsall (1970) |
| Great blue heron *Ardea herodias* | Ohio | breast muscle | W (ND-1.98) | Hoffman & Curnow (1973) |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | | |
|---|---|---|---|---|---|
| Great blue heron *Ardea herodias* | Ohio | liver | W | ND | Hoffman & Curnow (1973) |
| Lesser scaup *Aythya affinis* | Alberta | feather | D | <0.01 | Kelsall (1970) |
| Greater scaup *Aythya marila nearctica* | New York | liver | | 2.0 | Baker et al. (1976) |
| " " " | " " | muscle | | <2.0 | " |
| " " " | " " | brain | | <2.0 | " |
| Canvasback *Aythya valisineria* | " " | liver | | 4.0 | " |
| " " | " " | muscle | | <2.0 | " |
| " " | " " | brain | | 4.0 | " |
| Ruffed grouse *Bonasa umbellus* | Vermont | liver | W | 0.88 | Schroeder et al. (1967) |
| " " | United States | liver | W | 2.04 | Schroeder & Balassa (1961) |
| " " | " | kidney | W | 51.35? | " |
| " " | Ohio | leg muscle | W | <0.001 | Lynch (1973) |
| Canada goose *Branta canadensis* | New York | liver | | <2.0 | Baker et al. (1976) |
| " " | " " | muscle | | (<2.0-2.36) | " |
| " " | " " | brain | | 2.0 | " |
| Great horned owl *Bubo virginianus* | Ohio | leg muscle | W | 0.045 | Lynch (1973) |

| | | | | | |
|---|---|---|---|---|---|
| Bufflehead<br>Bucephala albeola | N.W. Atlantic | muscle | D | (0.3-0.4) | Windom (1972) |
| " " | New York | muscle | | <2.0 | Baker et al. (1976) |
| " " | " " | liver | | (<2.0-2.0) | " |
| American egret<br>Casmerodius albus | Ohio | breast muscle | W | ND | Hoffman & Curnow (1973) |
| " " | S. Florida | egg | W | <0.05 | Ogden et al. (1974) |
| Guillemot<br>Cephus sp. | Great Britain | liver | D | (0.1-13.0) | Holdgate (1970) |
| " " | " " | " | D | (0.2-12.0) | " |
| White ibis<br>Eudocinus albus | S. Florida | | W | 0.05 | Ogden et al. (1974) |
| " " | " " | muscle | W | 9.0 | " |
| " " | " " | egg | W | (<0.5-0.5) | " |
| Common puffin<br>Fratercula arctica | | | | | Parslow et al. (1972) |
| " " | Great Britain Angus | liver | D | 5.5 | " |
| " " | Great Britain, Aberdeen | " | D | 6.8 | " |
| " " | Great Britain, Northumb | " | D | (2.9-7.5) | " |
| " " | Great Britain, Farnes | " | D | 8.4 | " |
| " " | Great Britain St. Kilda | " | D | 12.9 | " |
| " " | Great Britain, Clo Mor | " | D | 22.3 | " |
| " " | (The St. Kilda and Clo Mor breeding populations were declining. No other levels of pollutants were high.) | | | | " |

| | | | | | |
|---|---|---|---|---|---|
| Chicken *Gallus domesticus* | United States | liver | W | trace | Schroeder & Balassa (1961) |
| " " | " | muscle | W | 2.0 | " |
| " " | " | egg yolk | W | 0.15 | " |
| " " | Montana | muscle | W | 0.06 | Lewis (1972) |
| " " | United States | wing | W | 0.31 | Schroeder et al. (1967) |
| " " | " | egg | W | 0.09 | " |
| " " | " | muscle | | 0.039±0.088 | USHEW (1975) |
| " " | Germany | " | | 0.61 | Anke et al. (1970) |
| " " | " | femur | | 5.07 | " |
| " " | " | feather | | 0.07 | " |
| " " | " | kidney | | 13.57 | " |
| " " | " | liver | | 3.20 | " |
| " " | " | egg | | 0.46 | " |
| " " | Germany, fed 200 ppm Cd daily | muscle | | 1.23 | " |
| " " | " " " | femur | | 6.42 | " |
| " " | " " " | feather | | 0.34 | " |
| " " | " " " | kidney | | 632.0 | " |
| " " | " " " | liver | | 245.0 | " |
| " " | " " " | egg | | 0.37 | " |
| " " | Czechoslovakia | egg yolk | W | 0.120±SE 0.005 | Lener & Bibr (1971) |

| | | | | | |
|---|---|---|---|---|---|
| Chicken<br>*Gallus domesticus* | Czechoslovakia | egg white | W | 0.076±SE<br>0.004 | Lener & Bibr (1971) |
| " " | Romania | egg | W | 0.021 | Rautu & Sporn (1970) |
| " " | Japan | muscle | W | 0.52 | Yamagata & Shigematsu (1970) |
| " " | " | liver | W | 0.53 | " |
| " " | " | viscera | W | 0.20 | " |
| " " | " | muscle | W | 0.027 | Ishizaki et al. (1970) |
| " " | " | egg | W | 0.015 | " |
| Bald eagle<br>*Haliaeetus leucocephalus* | United States | | | ND | Krantz et al. (1970) |
| Herring gull<br>*Larus argentatus* | Great Britain | egg | W | (0.03-0.06) | Peden et al. (1973) |
| Lesser black-backed gull<br>*Larus fuscus fuscus* | " " | " | W | 0.06 | " |
| " " " | Norway | muscle | D | 1.0 | Lande (1977) |
| " " " | " | liver | D | 4.0 | " |
| " " " | " | kidney | D | 10.0 | " |
| Hooded merganser<br>*Lophodytes cucullatus* | N.W. Atlantic | muscle | D | (<0.1-0.3) | Windom (1972) |
| White-winged scoter<br>*Melanitta deglandi* | New York | liver | | (<2.0-2.0) | Baker et al. (1976) |
| " " | " " | muscle | | <2.0 | " |
| Red-breasted merganser<br>*Mergus serrator* | N.W. Atlantic | " | D | (0.1-0.2) | Windom (1972) |

| | | | | | |
|---|---|---|---|---|---|
| Black-crowned night heron<br>Nycticorax nycticorax | Ohio | brain | W | ND | Hoffman & Curnow (1973) |
| " " | " | feather | W | ND | " |
| Wilson's petrel<br>Oceanites oceanicus | Hallet, Antarctica | liver | D | 20.3±5.8 | Anderlini et al. (1972) |
| " " | " | breast muscle | D | 3.67±2.14 | " |
| " " | " | bone | D | 0.86±0.35 | " |
| " " | Palmer, Antarctica | liver | D | 20.7±4.9 | " |
| " " | " | breast muscle | D | 3.25±0.97 | " |
| " " | " | bone | D | 1.42±0.42 | " |
| Ashy petrel<br>Oceanodroma homochroa | California coast | liver | D | 53.2±20.5 | " |
| " " | " | breast muscle | D | 8.0±4.52 | " |
| " " | " | bone | D | 1.88±0.85 | " |
| Snow petrel<br>Oceanodroma sp. | Antarctic | liver | D | 27.7±12.2 | " |
| " " | " | breast muscle | D | 5.57±1.88 | " |
| " " | " | bone | D | 0.88±0.17 | " |
| Ruddy duck<br>Oxyura jamaicensis | New Jersey | liver | W | (0.27-1.6)<br>0.61±SE 0.15 | White & Kaiser (1976) |
| " " | " " | liver, adult | W | (0.51-1.60) | " |
| " " | " " | liver, immature | W | (0.27-0.41) | " |

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|---|---|---|---|---|---|
| Osprey *Pandion haliaetus* | S. Florida | egg | W | <0.05 | Ogden et al. (1974) |
| Brown pelican *Pelecanus occidentalis* | Florida coast | liver | W | (1.32-2.39)1.8 | Connors et al. (1972) |
| " " | " | breast muscle | W | (0.25-0.32)0.275 | " |
| " " | " | bone | W | (1.38-1.66)1.66 | " |
| " " | California coast | liver | W | (0.62-13.62)4.95 | " |
| " " | " | breast muscle | W | (0.24-0.64)0.392 | " |
| " " | " | bone | W | (1.08-1.96)1.52 | " |
| " " | S. Florida | egg | W | <0.05 | Ogden et al. (1974) |
| " " | S. Carolina | " | W | (0.002-0.008) 0.004 geom. mean | Blus et al. (1977) |
| " " | Florida | " | W | (0.003-0.011) 0.004 | " |
| " " | S. Carolina | liver | W | (0.01-0.02) | " |
| " " | Florida | " | W | (0.21-1.06) | " |
| " " | Georgia | " | W | 0.03 | " |
| Cormorant *Phalacrocorax auritus* | S. Florida | egg | W | 0.05 | Ogden et al. (1974) |
| Pheasant *Phasianus colchicus* | United States | liver | W | 0.9 | Schroeder & Balassa (1961) |
| " " | Ohio | breast muscle | W | <0.087 mean | Bachant & Schumann (1971) |
| " " | " | liver | W | 0.773 " | " |

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|---|---|---|---|---|---|---|
| Pheasant *Phasianus colchicus* | Ohio | brain | W | 0.001 mean | | Lynch (1973) |
| " " | " | breast muscle | W | 0.168 | " | " |
| " " | " | feather | W | 1.31 | " | " |
| " " | " | femur | W | 1.01 | " | " |
| " " | " | kidney | W | 7.45 | " | " |
| " " | " | leg muscle | W | 0.078 | " | " |
| " " | " | liver | W | 0.19 | " | " |
| " " | " | ovary | W | <0.001 | " | " |
| " " | Illinois | blood | W | (0.07-0.09) | | Anderson & Stewart (1969) |
| " " | " | kidney | W | (0.89-1.46) | | " |
| Eider *Somateria mollisima* | Norway | | | | | Lande (1977) |
| " " | " | muscle | D | 2.0 | | " |
| " " | " | liver | D | 13.0 | | " |
| " " | " | kidney | D | 25.0 | | " |
| " " | " | egg | D | 1.0 | | " |
| Chipping sparrow *Spizella passerina* | fed $^{109}Cd$ 21 days | gut | W | 75.0 n Ci/g | | Anderson & Van Hook (1973) |
| " " | " " " | kidney | W | 29.0 n Ci/g | | " |
| " " | " " " | liver | W | 14.0 n Ci/g | | " |
| " " | " " " | feather | W | 8.0 n Ci/g | | " |
| " " | " " " | whole body | W | 0.007 | | " |

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|---|---|---|---|---|---|
| Common tern *Sterna hirundo* | New York Long Island | bone | W | 1.61 | Conners et al. (1975) |
| " " | " " | breast muscle | W | 0.38 | " |
| " " | " " | liver | W | 3.82 | " |
| " " | " " | kidney | W | 21.3 | " |
| " " | Canada Lake Ontario | bone | W | 1.47 | " |
| " " | " " | breast muscle | W | 0.69 | " |
| " " | " " | liver | W | 3.69 | " |
| " " | " " | kidney | W | 29.5 | " |
| Starling *Sturnus vulgaris* | City areas with over 0.1 ppm in 1971: | | | | Martin & Nickerson (1973) |
| " " | Phoenix, Arizona | body less skin, beak, feet & wings | W | 0.11 | " |
| " " | Stuttgart, Arkansas | " " " | W | 0.1 | " |
| " " | Bakersfield, California | " " " | W | 0.24 | " |
| " " | Lansing, Michigan | " " " | W | 0.12 | " |
| " " | Farmington, N. M. | " " " | W | 0.12 | " |
| " " | Elkins, West Va. | " " " | W | 0.12 | " |
| " " | 1971 and 1973 | | W | (<0.05-0.2) | " |
| " " | (Collected at 56 sites in 44 states. 46 areas of U. S. below 0.1, 72% contained 0.05 or less.) | | | | " |

| | | | | | |
|---|---|---|---|---|---|
| Starling<br>*Sturnus vulgaris* | There was slight increase in Cd levels in 1973 over 1971 in the National Monitoring Program on starlings. | | | | White et al. (1977) |
| " " | United States 1971 | | W | (0.05-0.24)<br>0.048±SE 0.006<br>geom. mean 0.038 | " |
| " " | United States 1973 | | W | (<0.05-0.20)<br>0.056±SE 0.005<br>geom. mean 0.048 | " |
| " " | United States urban, 1973 | | W | (<0.05-0.11)<br>0.042±SE 0.007 | " |
| " " | United States rural, 1973 | | W | (<0.05-0.20)<br>0.053±SE 0.008 | " |
| " " | United States | kidney | W | 1.0 | Schroeder & Balassa (1961) |
| " " | " " | liver | W | 0.57 | " |
| Robin<br>*Turdus migratorius* | " " | kidney | W | 2.03 | " |
| " " | " " | liver | W | 0.55 | " |
| Mourning dove<br>*Zenaida macroura* | Ohio | breast muscle | W | 0.41 | Lynch (1973) |

## CADMIUM IN REPTILES[1]

| Species | Locality | Tissue | Analysis[2] PPM | Authority |
|---|---|---|---|---|
| Softshell turtle *Trionyx spinifer* | Tennessee (downstream from plating industry) | kidney | to 9.87 | Robinson & Wells (1975) |
| Turtle | Hudson River, N. Y. | egg | W (0.005-0.05) | Schroeder (1974) |
| Crocodile *Crocodylus acutus* | Florida | egg | W 0.05 | Ogden et al. (1974) |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

## CADMIUM IN MARINE FISH[1]

| Species | Locality | Tissue | Analysis[2] PPM | | Authority |
|---|---|---|---|---|---|
| Black bream *Acanthopagrus butcheri* | Tasmania | | W | 0.05 | Eustace (1974) |
| Smooth sandeel *Ammodytes tobianus* | Great Britain | muscle | D | 0.4 | Stevens & Brown (1974) |
| Flounder *Ammotretis sp.* | Tasmania | muscle | W | <0.05 | Eustace (1974) |
| Catfish *Anarchichas lupus* | Norway | | D | 0.02 | Lande (1977) |
| Wolf fish *Anarchichas minor* | W. Greenland | muscle | W | <0.2 | Bollingberg (1975) |
| " " | " " | liver | W | (0.4-12.5) | " |
| Deepbody anchovy *Anchoa compressa* | Los Angeles Bay | | D | 0.7 | Emerson et al. (1976) |
| Bay anchovy *Anchoa mitchelli* | N.W. Atlantic | whole body | D | 0.6 | Windom et al. (1973b) |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | | |
|---|---|---|---|---|---|
| Bay anchovy<br>*Anchoa mitchelli* | Texas | whole body | D | 0.5 | Sims & Presley (1976) |
| European eel<br>*Anguilla anguilla* | Great Britain | muscle | D | 0.03 | Leatherland & Burton (1974) |
| " " | " " | " | W | (0.12-0.17) | Wharfe & Van Den Broek (1977) |
| " " | " " | liver | W | (0.24-0.37) | " |
| American eel<br>*Anguilla rostrata* | N.W. Atlantic | muscle | D | <0.1 | Windom et al. (1973b) |
| Blue hake<br>*Antimora rostrata* | Middle Atlantic Bight | muscle | W | (<0.09-<0.12) | Greig et al. (1976) |
| " " | " " " | liver | W | (0.32-0.36) | " |
| Striped cowfish<br>*Aracana aurita* | Tasmania | muscle | W | 0.14 | Eustace (1974) |
| Atlantic argentine<br>*Argentina silus* | Norway | | D | 0.02 | Lande (1977) |
| Sea catfish<br>*Arius felis*<br>(=Galeichthys felis) | S. Florida | whole | W | (0.12-0.15) | Ogden et al. (1974) |
| Australia salmon<br>*Arripis trutta* | Tasmania | muscle | W | <0.05 | Eustace (1974) |
| Porcupine fish<br>*Atopomycterus nichthemerus* | Tasmania | | W | 0.15 | " |
| Gafftopsail catfish<br>*Bagre marinus* | N.W. Atlantic | muscle | D | <0.1 | Windom et al. (1973b) |

| | | | | | |
|---|---|---|---|---|---|
| Silver perch<br>Bairdiella chrysura | N.W. Atlantic | muscle | D | 0.4 | Windom et al. (1973b) |
| Garfish<br>Belone belone | Great Britain (off shore) | muscle | D | <0.05 | Stevens & Brown (1974) |
| " " | Great Britain (in estuary) | " | D | 0.9 | " |
| Lanternfish<br>Bolinichthys indicus | Bermuda | mid-section | D | 0.9 | Gibbs et al. (1974) |
| Mutugoro<br>Boleophthalmus pectinirostris | Japan (1970) | muscle | | (0.09-0.12) | Yamazoe & Otubo (1975) |
| " " | Japan (1974) | " | | (0.02-0.07) | " |
| Menhaden (Machete)<br>Brevoortia maculata | Peru | whole | | (0.01-0.26)<br>0.13 | Echegaray (1974) |
| Gulf menhaden<br>Brevoortia patronus | Texas | " | D | <0.1 | Sims & Presley (1976) |
| Jolthead porgy<br>Calamus bajonada | Puerto Rico | muscle | D | 0.38 | Lowman et al. (1966) |
| " " | " " | " | W | 0.09 | " |
| " " | " " | gill | D | 0.79 | " |
| " " | " " | " | W | 0.09 | " |
| " " | " " | intestine | D | 2.6 | " |
| " " | " " | " | W | 0.59 | " |
| " " | " " | vertebrae | D | 1.3 | " |
| " " | " " | " | W | 0.76 | " |
| " " | " " | scale | D | 2.7 | " |

| | | | | | |
|---|---|---|---|---|---|
| Jolthead porgy<br>*Calamus bajonada* | Puerto Rico | scale | W | 1.9 | Lowman et al. (1966) |
| Pacific porgy<br>*Calamus brachysomus* | Peru | | | 0.12 | Echegaray (1974) |
| Elephant shark<br>*Callorhynchus millii* | Tasmania | muscle | W | <0.05 | Eustace (1974) |
| Crevalle jack<br>*Caranx hippos* | S. Florida | whole | W | 0.05 | Ogden et al. (1974) |
| Silky shark<br>*Carcharhinus falciformis* | N.W. Atlantic | muscle | D | 1.0 | Windom et al. (1973b) |
| " " | " " | liver | D | 5.0 | " |
| " " | " " | kidney | D | 2.6 | " |
| " " | " " | brain | D | <0.2 | " |
| " " | " " | gonad | D | <0.2 | " |
| " " | " " | gill | D | <0.2 | " |
| " " | " " | spleen | D | <0.2 | " |
| Oceanic whitetip shark<br>*Carcharhinus longimanus* | Puerto Rico | | W | (0.02-0.56) 0.13 | Lowman et al. (1966) |
| " " | " " | | D | (0.03-1.3)0.71 | " |
| Sandbar shark<br>*Carcharhinus milberti* | | liver | D | <0.1 | Windom et al. (1973b) |
| Dusky shark<br>*Carcharhinus obscurus* | | muscle | D | 2.1 | " |
| " " | | liver | D | 1.6 | " |
| " " | | brain | D | <0.1 | " |
| " " | | pup | D | (0.2-0.3) | " |

| | | | | | |
|---|---|---|---|---|---|
| Anchovy<br>Catengraulis edentulus | Puerto Rico | | D | (0.59-2.6)1.3 | Lowman et al. (1966) |
| " " | " " | | W | (0.15-0.75)<br>0.36 | " |
| Black sea bass<br>Centropristis striatus | N.W. Atlantic | muscle | D | 0.4 | Windom et al. (1973b) |
| Lanternfish<br>Ceratoscopelus caudispinosus | Bermuda | midsection | D | (0.3-0.5 | Gibbs et al. (1974) |
| Lanternfish<br>Ceratoscopelus warmingi | " | " | D | (0.5-0.8) | " |
| " " | " | preserved | D | (0.7-1.8) | " |
| " " | N.W. Atlantic | | D | 0.7 | Windom et al. (1973b) |
| Thick-lipped gray mullet<br>Chelon labrosus<br>(= Crenimugil labrosus) | Great Britain | | W | 0.08 | Peden et al. (1973) |
| Bumper<br>Chloroscombrus sp. | Puerto Rico | | D | (0.48-1.0)0.78 | Lowman et al. (1966) |
| " " | " " | | W | (0.06-0.42)0.17 | " |
| Rabbit fish<br>Chimaera monstrosa | Norway | | D | 0.01 | Lande (1977) |
| Wrasse<br>Choerodon sp. | Norway | muscle | W | <0.002 | Havre et al. (1973) |
| Bearded rockling<br>Ciliata mustela | Great Britain | whole | D | 8.1±SD 2.27 | Hardisty et al. (1974a) |
| Atlantic herring<br>Clupea harengus | Norway | | D | (<0.2-0.2) | Andersen et al. (1973) |
| " " | " | | D | 0.01 | Lande (1977) |

| | | | | | |
|---|---|---|---|---|---|
| Atlantic herring<br>*Clupea harengus* | Scotland | muscle | W | (<0.03-0.12) | Topping (1973a) |
| " " | Norway | " | W | (0.004-0.033) | Havre et al. (1973) |
| " " | " | " | D | (0.012-0.081) | " |
| Conger eel<br>*Conger myriaster* | Japan | " | D | (0.028-0.034) | Ishio et al. (1973) |
| Eel<br>*Conger sp.* | N.W. Atlantic | " | D | 0.3 | Windom et al. (1973b) |
| Wrasse<br>*Ctenolabrus rupestris* | Sweden | | D | 3.0 | Noddack & Noddack (1940) |
| Lumpsucker, lumpfish<br>*Cyclopterus lumpus* | Norway | muscle | W | 0.001 | Havre et al. (1973) |
| " " | Great Britain | skin | W | 1.7 | Wright (1976) |
| " " | " " | stomach | W | 0.6 | " |
| " " | " " | liver | W | 1.08 | " |
| " " | " " | fat body | W | 0.82 | " |
| " " | " " | kidney | W | 1.83 | " |
| " " | " " | muscle | W | 0.12 | " |
| Shiner perch<br>*Cymatogaster aggregata* | Los Angeles Bay | | D | 0.8 | Emerson et al. (1976) |
| White sea trout<br>*Cynoscion arenarius* | Texas | | D | 1.8 | Sims & Presley (1976) |
| Spotted sea trout<br>*Cynoscion nebulosus* | " | | D | 0.1 | " |
| " " | N.W. Atlantic | muscle | D | 0.5 | Windom et al. (1973b) |

| | | | | | |
|---|---|---|---|---|---|
| Sea carp<br>Dactylopagrus carponemus | Tasmania | | W | <0.05 | Eustace (1974) |
| Stingray<br>Dasyatis brevicaudatus | " | | W | <0.05 | " |
| Round scad<br>Decapterus punctatus | N.W. Atlantic | muscle | D | <0.1 | Windom et al.(1973b) |
| Lanternfish<br>Diaphus dumerilii | N.W. Africa | whole | D | 0.73 | Leatherland et al. (1973) |
| Lanternfish<br>Diaphus mollis | Bermuda | midsection | D | 0.8 | Gibbs et al. (1974) |
| " " | N.W. Atlantic | " | D | 0.8 | Windom et al.(1973b) |
| Longfinned pike<br>Dinolestes lewini | Tasmania | muscle | W | <0.05 | Eustace (1974) |
| Porgy<br>Diplodus vulgaris | Israel | " | D | 0.3 | Roth & Hornung (1977) |
| Adriatic anchovy<br>Engraulis encrasicholus | Adriatic Sea | skin | W | (0.2-0.6)0.4 | Gilmartin & Revelante (1975) |
| " " | " " | gill | W | (0.1-0.3)0.2 | " |
| " " | " " | muscle | W | (ND-<0.1)<0.1 | " |
| " " | " " | gut | W | (0.2-0.4)0.2 | " |
| " " | " " | liver | W | (ND-1.4)0.7 | " |
| " " | " " | whole | W | (0.09-0.20)0.1 | " |
| Northern anchovy<br>Engraulis mordax | California | | D | 0.9 | Emerson et al. (1976) |

| | | | | | |
|---|---|---|---|---|---|
| Petrale sole<br>*Eopsetta jordani* | Oregon | muscle | W | (0.008-0.012) | Childs & Gaffke (1974) |
| Grouper<br>*Epinephelus aeneus* | Israel | muscle | D | (0.1-0.2) | Roth & Hornung (1977) |
| Merou blanc<br>*Epinephelus guaza* | " | " | D | 0.1 | " |
| Red hind<br>*Epinephelus guttatus* | Grand Bahama Isl. | " | | (0.02-0.04)<br>0.024±0.008 | Taylor & Bright (1973) |
| Nassau grouper<br>*Epinephelus striatus* | " " " | " | | (0.01-0.09)<br>0.02±0.02 | " |
| " " | " " " | liver | | (0.87-2.19) | " |
| "Marine" pike<br>*Esox lucius* | Gulf of Bothnia | muscle | W | (0.004-0.13) | Jaakkola et al. (1972) |
| " " | " " " | liver | W | (0.034-0.113) | " |
| " " | " " " | kidney | W | (0.169-0.339) | " |
| Priest shark<br>*Etomopterus spinax* | Norway | | D | 0.02 | Lande (1977) |
| Little tunny<br>*Euthynnus alletteratus* | N.W. Atlantic | muscle | D | 0.2 | Windom et al. (1973b) |
| Skipjack tuna<br>*Euthynnus pelamis* | Peru | " | D | 1.0 | Lowman et al. (1967) |
| " " | " | head | D | 2.0 | " |
| " " | " | " | W | 1.0 | " |

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|---|---|---|---|---|---|
| Killifish, mummichog *Fundulus heteroclitus* | Rhode Island (in 0.01 ppm Cd 21 days) | | A | 7.6 | Eisler et al. (1972) |
| " " | " " " " | | W | 0.48 | " |
| " " | Rhode Island (control) | | A | 5.6 | " |
| " " | " " " | | W | 0.33 | " |
| Rock cod *Gadus callarius* | Great Britain commercial catch | | D | 0.0 | Leatherland & Burton (1974) |
| Atlantic cod *Gadus morhua* | Norway | muscle | W | (0.003-0.012) | Havre et al. (1973) |
| " " | " | " | D | (0.013-0.059) | " |
| " " | Great Britain | | W | (0.12-0.26) | Peden et al. (1973) |
| " " | " " | muscle & liver | W | 0.12 | Portmann (1972) |
| " " | North Sea | " | W | 0.18 | " |
| " " | | " | W | <0.05 | " |
| " " | Scotland | muscle | W | <0.03 | Topping (1973a) |
| " " | Atlantic Ocean | " | W | (0.0-0.158) 0.048±0.051 | Zook et al. (1976) |
| " " | Norway | | D | (0.01-0.02) | Lande (1977) |
| " " | Great Britain | skeleton | W | (0.25-1.32) | Wright (1976) |
| " " | " " | skin | W | (0.4-3.5) | " |
| " " | " " | stomach | W | (0.12-0.65) | " |
| " " | " " | liver | W | (0.06-1.72) | " |

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|---|---|---|---|---|---|
| Atlantic cod<br>*Gadus morhua* | Great Britain | fat body | W | 0.17±0.18 | Wright (1976) |
| " " | " " | kidney | W | 0.99±1.36 | " |
| " " | " " | muscle | W | (0.11-1.35) | " |
| " " | " " | gonad | W | 0.09±0.06 | " |
| " " | " " | gill | W | 1.25 | " |
| " " | Norway | muscle | D | (ND-0.35) | Stenner & Nickless (1974) |
| " " | " | gill | D | (1.2-2.4) | " |
| " " | " | liver | D | (ND-1.0) | " |
| " " | Iceland | muscle | W | (0.0-0.119)<br>0.043±SD 0.119 | Zook et al.(1976) |
| " " | Atlantic | " | W | (0.0-0.155)<br>0.048±0.051 | " |
| Black-mouthed dogfish<br>*Galeus melastomus* | Norway | | D | 0.03 | Lande (1977) |
| School shark<br>*Galiorhinus australis* | Tasmania | muscle | W | 0.05 | Eustace (1974) |
| White croaker<br>*Genyonemus lineatus* | Los Angeles Bay | | D | 1.2 | Emerson et al. (1976) |
| Witch<br>*Glyptocephalus cynoglossus* | Norway | | D | 0.01 | Lande (1977) |
| Rex sole<br>*Glyptocephalus zachirus* | Oregon | | W | (0.069-0.097) | Robertson et al. (1972) |
| " " | " | | D | (0.36-0.53) | " |
| " " | " | muscle | W | (0.012-0.026) | Childs & Gaffke (1974) |

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|---|---|---|---|---|---|
| Sand goby<br>Gobius minutus | Great Britain | whole | D | 3.2±SD 0.53 | Hardisty et al. (1974a) |
| Soldier fish<br>Gymnopastes marmoratus | Tasmania | muscle | W | <0.05 | Eustace (1974) |
| Wrasse (Doncella)<br>Halichoeres dispilus | Peru | | | 0.04 | Echegaray (1974) |
| Halosauran<br>Halosauropsis macrochir | Middle Atlantic Bight | muscle | W | <0.12 | Greig et al. (1976) |
| Scaled sardine<br>Harengula sp. | Puerto Rico | | D | (0.78-1.7)1.08 | Lowman et al. (1965) |
| " " | " " | | W | (0.23-0.44)0.31 | " |
| Red rock gurnard<br>Heliocelenus papillosis | Tasmania | muscle | W | 0.06 | Eustace (1974) |
| Sea horse<br>Hippocampus sp. | " | " | W | <0.05 | " |
| Pacific halibut<br>Hippoglossus stenolepis | Alaska | " | W | (0.0-0.97)<br>0.056±SD 0.31 | Zook et al. (1976) |
| Longspine squirrel fish<br>Holocentrus rufus | Puerto Rico | | D | (0.98-4.1)2.2 | Lowman et al. (1966) |
| " " | " " | | W | (0.36-1.6)0.84 | " |
| Lanternrisn<br>Hygophum hygomi | Bermuda | midsection | D | (<0.1-<0.2) | Gibbs et al. (1974) |
| " " | " | preserved 1958-72 | D | (0.1-1.3) | " |
| " " | " | preserved 1914 | D | 6.8 | " |
| " " | " | preserved 1885 | D | 1.3 | " |

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|---|---|---|---|---|---|
| Lanternfish<br>Hygophum hygomi | Middle Atlantic Bight | whole | W | (<0.07-0.11) | Greig et al. (1976) |
| " " | N.W. Atlantic | midsection | D | <0.1 | Windom et al. (1973b) |
| Lanternfish<br>Hygophum macrochir | N.W. Africa | whole | D | 0.98 | Leatherland et al. (1973) |
| Pinfish<br>Lagodon rhomboides | S. Florida | " | W | (0.05-0.12) | Ogden et al. (1974) |
| Porbeagle, mackerel shark<br>Lamna nasus | Great Britain | liver | D | <0.05 | Stevens & Brown (1974) |
| " " | " " | epigonal organ | D | 0.5 | " |
| Lanternfish<br>Lampanyctus photonotus | Bermuda | midsection | D | 0.4 | Gibbs et al. (1974) |
| Lanternfish<br>Lampanyctus pusillus | " | " | D | 1.6 | " |
| " " | N.W. Atlantic | " | D | (0.4-1.6) | Windom et al. (1973b) |
| Trumpeter<br>Latridopsis forsteri | Tasmania | muscle | W | <0.05 | Eustace (1974) |
| Greater ponyfish<br>Leiognathus equulus | Thailand | | W | 0.007 | Huschenbeth & Harms (1975) |
| Splendid ponyfish<br>Leiognathus splendens | " | | W | 0.02 | " |
| Ponyfish<br>Leiognathus sp. | " | | W | 0.04 | " |
| Leionura atun | Tasmania | muscle | W | <0.05 | Eustace (1974) |

| | | | | | |
|---|---|---|---|---|---|
| Spot<br>Leistomus xanthurus | Texas | muscle | D | 0.2 | Sims & Presley (1976) |
| " " | N.W. Atlantic | " | D | 0.5 | Windom et al. (1973b) |
| Lepidophanes indicus | N.W. Atlantic | midsection | D | 0.9 | " |
| Lepidopus caudatus | Spain & Portugal | muscle | D | (ND-0.56) | Stenner & Nickless (1975) |
| " " | " | gill | D | (2.7-4.3) | " |
| Conger eel<br>Leptocephalus wilsoni | Tasmania | muscle | W | 0.3 | Eustace (1974) |
| Yellowtail flounder<br>Limanda ferruginea | Atlantic Ocean | muscle | W | (0.0-0.059)<br>0.028±0.023 | Zook et al. (1976) |
| " " | New York Bight | " | W | (0.05-0.1) | Greig & Wenzloff (1977) |
| " " | " " " | liver | W | (0.09-0.5) | " |
| Sand dab<br>Limanda limanda<br>(=Pleuronectes limanda) | Norway | muscle | D | 0.7 | Stenner & Nickless (1974) |
| " " | " | gill | D | 2.5 | " |
| " " | Great Britain | skeleton | W | 0.47 | Wright (1976) |
| " " | " " | skin | W | 0.26 | " |
| " " | " " | liver | W | 1.38 | " |
| " " | " " | kidney | W | 0.21 | " |
| " " | " " | muscle | W | 0.18 | " |
| Grey mullet<br>Liza ramada | " " | whole | D | 3.0±SD 1.2 | Hardisty et al. (1974a) |

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|---|---|---|---|---|---|
| Lanternfish<br>Lobianchia dofleini | Bermuda | midsection | D | 1.6 | Gibbs et al. (1974) |
| " " | N.W. Atlantic | " | D | 1.6 | Windom et al. (1973b) |
| Angler<br>Lophius piscatorius | Norway | muscle | W | 0.023 | Havre et al. (1973) |
| " " | " | liver | W | 2.5 | " |
| Red snapper<br>Lutjanus campechanus | Gulf of Mexico | muscle | W | (0.0-0.119)<br>0.057±0.044 | Zook et al. (1976) |
| Gray snapper<br>Lutjanus griseus | S. Florida | whole | W | (0.07-0.11) | Ogden et al. (1974) |
| New Zealand whiptail<br>Macruronus novaezelandiae | Tasmania | muscle | W | <0.05 | Eustace (1974) |
| Grenadier<br>Macrurus rupestris | Norway | | D | 0.02 | Lande (1977) |
| Black marlin<br>Makaira indica | N.E. Australia | " | W | (0.05-0.4)<br>0.9±SE 0.009 | Mackay et al. (1975) |
| " " | " " | liver | W | (0.2-83.0)<br>9.2±SE 2.10 | " |
| Blue marlin<br>Makaira nigricans | Puerto Rico | | D | (0.39-1.9)<br>1.0 | Lowman et al. (1967) |
| " " | " " | | W | (0.14-0.4)0.24 | " |
| " " | St. Thomas | | D | (0.42-1.9)<br>0.97 | Lowman et al. (1966) |
| " " | " " | | W | (0.1-0.4)0.23 | " |
| " " | Japan | muscle | W | (0.01-0.15)<br>0.055±0.048 | Nishigaki et al. (1974) |

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|---|---|---|---|---|---|---|
| Haddock<br>Melanogrammus aeglefinus<br>(= Gadus aeglefinus) | | (frozen) | muscle | W | 0.08 | Schroeder & Balassa (1961) |
| " | " | N. Atlantic | " | W | 0.09 | Schroeder (1974) |
| " | " | Scotland | " | W | <0.03 | Topping (1973b) |
| " | " | Atlantic Ocean | " | W | (0.0-0.083) 0.046±SD 0.03 | Zook et al. (1976) |
| " | " | Norway | | D | (0.02-0.03) | Lande (1977) |
| Whiting<br>Merlangius merlangus<br>(= Gadus merlangus) | | Great Britain | | W | 0.09 | Peden et al. (1973) |
| " | " | Norway | | D | 0.02 | Lande (1977) |
| " | " | " | muscle | W | (0.002-0.03) | Havre et al. (1973) |
| " | " | " | " | D | (0.008-0.13) | " |
| " | " | Great Britain | whole | D | 6.2±SD 0.19 | Hardisty et al. (1974a) |
| " | " | " " | <15 cm muscle | W | (0.1-0.15)0.13 | Wharfe & Van Den Broek (1977) |
| " | " | " " | >15 cm muscle | W | (0.13-0.28)0.21 | " |
| " | " | " " | liver | W | (0.13-0.18)0.15 | " |
| " | " | " " | gut wall | W | (0.08-0.21)0.15 | " |
| " | " | " " | whole | D | (1.94-2.50) | Badsha & Sainsbury (1977) |

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|---|---|---|---|---|---|
| Silver hake<br>Merluccius bilinearis | Atlantic Ocean | muscle | W | (0.0-0.2)<br>0.047±0.061 | Zook et al. (1976) |
| European hake<br>Merluccius merluccius | Norway | " | W | (0.003-0.032) | Havre et al. (1973) |
| " " | " | liver | W | 0.17 | " |
| " " | Great Britain | | W | 0.09 | Peden et al. (1973) |
| " " | Israel | muscle | D | (0.2-0.3) | Roth & Hornung (1977) |
| Merluza<br>Merluccius peruanus | Peru | whole | | 0.0 | Echegaray (1974) |
| Pacific hake<br>Merluccius productus | Pacific Ocean | muscle | W | (0.0-0.059)<br>0.02±0.19 | Zook et al. (1976) |
| Atlantic croaker<br>Micropogon undulatus | Texas | " | D | 0.10 | Horowitz & Presley (1977) |
| " " | " | skin | D | 0.21 | " |
| " " | " | whole | D | <0.1 | Sims & Presley (1976) |
| Dover sole<br>Microstomus pacificus | Oregon | | W | 0.03 | Cutshall & Holton (1972) |
| " " | " | | D | 0.14 | " |
| " " | " | | W | (0.011-0.014) | Childs & Gaffke (1974) |
| " " | S. California (polluted) | muscle | D | (<1.8-<3.0) | Alexander et al. (1975) |
| " " | " " | kidney | D | (<3.2-<4.0) | " |

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|---|---|---|---|---|---|
| Dover sole<br>*Microstomus pacificus* | S. California (polluted) | gonad | D | (<4.2-<5.2) | Alexander et al. (1975) |
| " " | " " | skin | D | (<3.0-<4.8) | " |
| " " | S. California | muscle | D | <3.0 | McDermott et al. (1976) |
| " " | " | gonad | D | <3.0 | " |
| " " | S. California (outfall) | liver | D | 3.8 | " |
| " " | S. California (control) | " | D | 6.4 | " |
| " " | S. California | liver | W | (0.19-0.58) | DeGoeij et al. (1974) |
| Ling<br>*Molva molva* | Norway | muscle | W | 0.003 | Havre et al. (1973) |
| Planehead filefish<br>*Monacanthus hispidus*<br>(=Stephanolepis hispidus) | Middle Atlantic Bight | whole | W | (<0.13-0.14) | Greig et al. (1976) |
| Bass<br>*Morone labrax* | Great Britain | muscle | D | 0.03 | Leatherland & Burton (1974) |
| Striped bass<br>*Morone saxatilis* | Long Island | | W | 0.249 | Zawacki & Briggs (1976) |
| " " | " " | | D | 0.796 | " |
| " " | N.W. Atlantic | muscle | D | <0.01 | Windom et al. (1973b) |
| Rockling<br>*Motella sp.* | Great Britain | | W | 0.06 | Peden et al. (1973) |

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|---|---|---|---|---|---|
| Striped mullet<br>*Mugil cephalus* | Peru | | | (0.0-0.09)<br>0.03 | Echegaray (1974) |
| " " | Tasmania | muscle | W | <0.05 | Eustace (1974) |
| " " | N.W. Atlantic | " | W | <1.0 | Windom et al. (1973b) |
| " " | Japan | " | D | 0.0 | Ishio et al. (1973) |
| Silver mullet, white mullet<br>*Mugil curema* | S. Florida | whole | W | (0.05-0.06) | Ogden et al. (1974) |
| Mullet<br>*Mugil sp.* | Spain & Portugal | muscle | D | ND | Stenner & Nickless (1975) |
| " " | " | gill | D | 2.6 | " |
| " " | | | W | 0.08 | Peden et al. (1973) |
| " " | N.W. Atlantic | | W | 0.1 | Windom (1972) |
| Goatfish<br>*Mullus barbatus* | Israel | muscle | D | (0.2-0.7) | Roth & Hornung (1977) |
| Gummy shark<br>*Mustelus antarcticus* | Tasmania | muscle | W | <0.05 | Eustace (1974) |
| Smooth dogfish<br>*Mustelus canis* | New York Bight | muscle | W | <0.1 | Greig & Wenzloff (1977) |
| " " | " " " | liver | W | (<0.1-<0.2) | " |
| Shark<br>*Mustelus mustelus* | Spain & Portugal | muscle | D | ND | Stenner & Nickless (1975) |
| " " | " " | gill | D | ND | " |

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|---|---|---|---|---|---|
| Tollo<br>*Mustelus sp.* | Peru | whole | | (0.0-0.08)<br>0.05 | Echegaray (1974) |
| Scamp<br>*Myctoperca phenax* | Grand Bahama Isl. | muscle | | (0.01-0.03)<br>0.018±0.007 | Taylor & Bright (1973) |
| Tiger grouper<br>*Myctoperca tigris* | " " " | muscle | | (0.01-0.15)<br>0.02±0.006 | " |
| " " | " " " | liver | | (0.63-2.55) | " |
| Yellowfin grouper<br>*Myctoperca venenosa* | " " " | muscle | | (0.01-0.04) | " |
| Four-horned sculpin<br>*Myoxocottus quadrecornis* | Finland | " | D | 0.388 | Jaakkala et al. (1972) |
| " " | " | " | W | 0.007 | " |
| " " | " | kidney | D | 2.658 | " |
| " " | " | " | W | 0.478 | " |
| Leatherjacket<br>*Navodon sp.* | Tasmania | muscle | W | <0.05 | Eustace (1974) |
| Perch<br>*Nemadactylus macropterus* | " | muscle | W | <0.05 | " |
| *Nematonurus armatus* | Middle Atlantic Bight | " | W | (<0.1-0.14) | Greig et al. (1976) |
| " " | " " " | liver | W | (1.21-1.33) | " |
| Redspot threadfin bream<br>*Nemipterus peronii* | Thailand Inner Gulf | muscle | W | 0.15 | Huschenbeth & Harms (1975) |
| Threadfin bream<br>*Nemipterus sp.* | " " " | " | W | (0.03-0.062) | " |
| Yellowfin tuna<br>*Neothunnus macropterus* | California | integument | A | 1,500.0 | Goldberg (1962) |

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|---|---|---|---|---|---|
| Croaker<br>*Nibea albiflora* | Japan | muscle | D | 0.0 | Ishio et al. (1973) |
| Seven-gilled shark<br>*Notorhynchus cepedianus* | Tasmania | " | | <0.05 | Eustace (1974) |
| Lanternfish<br>*Notoscopelus caudispinosus* | Bermuda | midsection | D | (0.3-0.5) | Gibbs et al. (1974) |
| " " | N.W. Atlantic | " | D | 0.4 | Windom et al. (1973b) |
| Pejerrey<br>*Odontesthes regia* | Peru | muscle | | (0.0-0.57)<br>0.13 | Echegaray (1974) |
| Shrimp eel<br>*Ophichthus gomesi* | N.W. Atlantic | " | D | <0.1 | Windom et al.(1973b) |
| Palespotted eel<br>*Ophichthus ocellatus* | " " | " | D | 0.3 | " |
| Lingcod<br>*Ophiodon elongatus* | Oregon | muscle | W | (0.009-0.224) | Childs & Gaffke (1974) |
| Atlantic thread herring<br>*Opisthonema oglinum* | Puerto Rico | | D | (0.42-1.4)<br>0.77 | Lowman et al. (1966) |
| " " | " " | | W | (0.11-0.32)<br>0.2 | " |
| " " | " " | | D | (0.39-0.76)<br>0.62 | Lowman et al. (1965) |
| " " | " " | | W | (0.12-0.17)<br>0.15 | " |
| Silver pomfret<br>*Pampus argenteus* | Thailand | | W | 0.29 | Huschenbeth & Harms (1975) |

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|---|---|---|---|---|---|
| Kelp bass, calico bass<br>Paralabrax clathratus | California | muscle | D | (2.0-4.0) | Stapleton (1968) |
| " " | " | gonad | D | (3.0-10.0) | " |
| " " | " | liver | D | (11.0-24.0) | " |
| " " | " | integument | D | (2.0-6.0) | " |
| " " | " | heart | D | (2.0-4.0) | " |
| " " | " | eyeball | D | (4.0-6.0) | " |
| Sand bass (Cabrilla)<br>Paralabrax humeralis | Peru | whole | | (0.0-0.04)0.02 | Echegaray (1974) |
| Flounder (Lenguado)<br>Paralichthys adspersus | Peru | | | (0.0-0.06)0.03 | " |
| Southern flounder<br>Paralichthys lethostigma | N.W. Atlantic | muscle | D | 1.3 | Windom et al.(1973b) |
| " " | Texas | | D | 0.3 | Sims & Presley (1976) |
| Corvina (Coco)<br>Paralonchurus peruanus | Peru | | | 0.09 | Echegaray (1974) |
| Black pomfret<br>Parastromateus niger | Thailand | | W | (0.03-0.051) | Huschenbeth & Harms (1975) |
| English sole<br>Parophrys vetulus | N.W. Atlantic | | D | (0.081-0.09) | Windom et al.(1973b) |
| " " | " " | | W | (0.016-0.017) | " |
| " " | Oregon coast | | D | 0.42 | Robertson et al. (1972) |
| " " | " " | | W | 0.075 | " |

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|---|---|---|---|---|---|
| White sea perch<br>Phanerodon furcatus | Los Angeles Bay | | D | 0.4 | Emerson et al. (1976) |
| Cod<br>Physiculus barbatus | Tasmania | muscle | W | <0.05 | Eustace (1974) |
| Sand flathead<br>Platycephalus bassensis | Tasmania | " | W | <0.05 | " |
| Flounder<br>Pleuronectes flesus<br>(=Platichthys flesus) | Norway | muscle | W | (0.001-0.004) | Havre et al. (1973) |
| " " | Great Britain | | W | (0.62-1.67) | Peden et al. (1973) |
| " " | " " | muscle | D | 0.03 | Leatherland & Burton (1974) |
| " " | " " | whole | D | (1.1-5.2) | Hardisty et al. (1974a) |
| " " | " " | " | D | 5.6±SD 0.29 | " |
| " " | " " | | D | (3.4-7.3)means | (1974b) |
| " " | " " | muscle | W | (0.06-0.08)<br>0.065 | Wharfe & Van Den Broek (1977) |
| " " | " " | liver | W | (0.15-0.22)<br>0.18 | " |
| " " | " " | gut wall | W | (0.13-0.23)0.19 | " |
| " " | " " | ovary | W | 0.08 | " |
| Plaice<br>Pleuronectes platessa<br>(=Platichthys stellatus) | " " | | W | 0.07 | Portmann (1972) |
| " " | North Sea | | W | 0.12 | " |
| " " | | | W | 0.05 | " |
| " " | Scotland | muscle | W | (<0.03-0.03) | " |

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|---|---|---|---|---|---|
| Plaice<br>Pleuronectes platessa<br>(=Platichthys stellatus) | W. Greenland | muscle | W | <0.03 | Bollingberg (1975) |
| " " | Great Britain | " | W | (0.05-0.15) | Wharfe & Van Den Broek (1977) |
| " " | " " | liver | W | (0.16-0.21)0.18 | " |
| " " | " " | gut wall | W | (0.20-0.25)0.22 | " |
| " " | Oregon | muscle | W | 0.008±0.002 | Childs & Gaffke (1974) |
| " " | Great Britain | skeleton | W | 0.8 | Wright (1976) |
| " " | " " | skin | W | 1.33 | " |
| " " | " " | stomach wall | W | 3.96 | " |
| " " | " " | liver | W | 2.91 | " |
| " " | " " | muscle | W | 1.44 | " |
| Pollock<br>Pollachius pollachius | " " | | W | 0.46 | Peden et al. (1973) |
| Pollock, coalfish<br>Pollachius virens | Massachusetts | muscle | W | (0.0-0.11)<br>0.048±0.036 | Zook et al. (1976) |
| " " | Norway | " | W | (0.001-0.002) | Havre et al. (1973) |
| " " | " | " | D | (<0.005-0.007) | " |
| " " | Great Britain | gill | W | 3.23 | Wright (1976) |
| " " | " " | skeleton | W | 1.37 | " |
| " " | " " | skin | W | 3.1 | " |
| " " | " " | stomach wall | W | 2.1 | " |

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|---|---|---|---|---|---|
| Pollock, coalfish *Pollachius virens* | Great Britain | kidney | W | 4.2 | Wright (1976) |
| " " | " " | muscle | W | 0.64 | " |
| Bluefish *Pomatomus saltatrix* | Long Island | | W | 0.166 | Zawacki & Briggs (1976) |
| " " | " " | | D | 1.14 | " |
| Sand goby *Pomatoschistus minutus* | Great Britain | whole | W | (0.20-0.28) 0.24 | Wharfe & Van Den Broek (1977) |
| " " | " " | | D | 3.2±SD 0.5 | Hardisty et al. (1974b) |
| Blue shark *Prionace glauca* | Great Britain | liver | D | (0.05-8.4) | Stevens & Brown (1974) |
| " " | " " | muscle | D | <0.05 | " |
| " " | " " | testis | D | <0.05 | " |
| " " | " " | ovary | D | <0.05 | " |
| " " | " " | epigonal organ | D | (<0.05-2.1) | " |
| Common sawshark *Pristiophorus cirratus* | Tasmania | muscle | W | <0.05 | Eustace (1974) |
| Wenchman *Pristipomoides aquilonaris* | Texas | muscle | D | 0.08 | Horowitz & Presley (1977) |
| " " | " | skin | D | 0.24 | " |
| " " | " | viscera | D | 2.58 | " |

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|---|---|---|---|---|---|
| Turbot<br>Psetta maxima<br>(=Scophthalmus maximus) | Spain &<br>Portugal | muscle | D | ND | Stenner &<br>Nickless<br>(1975) |
| " " | " | gill | D | 4.3 | " |
| Sand sole<br>Psettichthys melanostictus | Oregon | | D | (0.095-0.15) | Robertson<br>et al.<br>(1972) |
| " " | " | | W | (0.018-0.03) | " |
| Parrotfish<br>Pseudolabrus sp. | Tasmania | muscle | W | <0.05 | Eustace<br>(1974) |
| Winter flounder<br>Pseudopleuronectes<br>americanus | Texas | muscle | D | (0.07-0.19)<br>0.12 | Horowitz<br>& Presley<br>(1977) |
| " " | " | skin | D | (0.14-0.4)0.3 | " |
| " " | New York<br>Bight | muscle | W | <0.1 | Greig &<br>Wenzloff<br>(1977) |
| " " | " " " | liver | W | (<0.1-0.29) | " |
| Blue skate<br>Raja batis | Great Britain | | W | 0.47 | Peden et<br>al. (1973) |
| Skate<br>Raja clavata | Spain &<br>Portugal | muscle | D | 2.45 | Stenner &<br>Nickless<br>(1975) |
| " " | " " | gill | D | 2.9 | " |
| Clearnose skate<br>Raja eglanteria | N.W. Atlantic | muscle | D | 0.6 | Windom et<br>al.(1973b) |
| " " | " " | liver | D | <0.2 | " |
| " " | " " | yolk sac | D | 0.5 | " |

| | | | | | |
|---|---|---|---|---|---|
| Greenland halibut *Reinhardtius hippoglossoides* | W. Greenland | muscle | W | (<0.02-1.7) | Bollingberg (1975) |
| Atlantic guitarfish *Rhinobatos lentiginosus* | N.W. Atlantic | " | D | 0.4 | Windom et al.(1973b) |
| " " | " " | liver | D | 1.4 | " |
| " " | " " | stomach | D | 0.4 | " |
| " " | " " | yolk sac | D | 0.2 | " |
| Cownose ray *Rhinoptera bonasus* | " " | muscle | D | 0.2 | " |
| " " | " " | liver | D | 0.6 | " |
| " " | " " | brain | D | <0.1 | " |
| " " | " " | stomach | D | 0.4 | " |
| " " | " " | spiral | D | 0.5 | " |
| " " | " " | uterus | D | 0.6 | " |
| Pacific bonito *Sarda chiliensis* | Peru | whole | | 0.08 | Echegaray (1974) |
| " " (?) | Japan | (processed) | W | 1.14 | Yamagata & Shigematsu (1970) |
| Pilchard *Sardina pilchardus* | Great Britain | muscle | D | <0.05 | Stevens & Brown (1974) |
| " " | Spain & Portugal | muscle | D | (0.3-0.6) | Stenner & Nickless (1975) |
| " " | " " | gill | D | 2.3 | " |
| " " | Adriatic Sea | skin | W | (0.2-0.5)0.4 | Gilmartin & Revelante (1975) |

| | | | | | |
|---|---|---|---|---|---|
| Pilchard<br>Sardina pilchardus | Adriatic Sea | gill | W | (0.1-0.2)0.2 | Gilmartin & Revelante (1975) |
| " " | " " | muscle | W | (ND-<0.1)<0.1 | " |
| " " | " " | gut | W | (ND-0.3)0.1 | " |
| " " | " " | liver | W | (ND-0.4)0.2 | " |
| " " | " " | whole | W | (0.09-0.11)0.1 | " |
| Gilt sardine<br>Sardinella aurita | Israel | muscle | D | (0.5-0.6) | Roth & Hornung (1977) |
| Longer lizard fish<br>Saurida elongata | Thailand | muscle | W | 0.04 | Huschenbeth & Harms (1975) |
| Lizardfish<br>Saurida sp. | " | " | W | (0.05-0.15) | " |
| Lizardfish<br>Saurida undosquamis | Israel | " | D | (0.2-0.4) | Roth & Hornung (1977) |
| Corvina<br>Sciaena gilberti | Peru | whole | | (0.0-0.07)0.02 | Echegaray (1974) |
| Atlantic mackerel<br>Scomber scombrus | Great Britain | muscle | D | 0.5 | Stevens & Brown (1974) |
| " " | Spain & Portugal | " | D | 0.77 | Stenner & Nickless (1975) |
| " " | " | gill | D | 7.8 | " |
| " " | Great Britain | muscle | D | ND | Leatherland & Burton (1974) |

| | | | | | |
|---|---|---|---|---|---|
| King mackerel<br>Scomberomorus cavalla | Puerto Rico | | D | (0.19-1.4)<br>0.49 | Lowman et al. (1967) |
| " " | " " | | W | (0.05-0.96)<br>0.26 | " |
| " " | " " | muscle | D | (0.19-1.4)<br>0.6 | Lowman et al. (1966) |
| " " | " " | " | W | (0.05-0.96)<br>0.3 | " |
| Spanish mackerel<br>Scomberomorus maculatus | N.W. Atlantic | muscle | D | 0.3 | Windom et al.(1973b) |
| Atlantic saury<br>Scomberesox saurus | S.W. Africa | " | D | 0.05 | Leatherland et al. (1973) |
| " " | " " | heart | D | 0.1 | " |
| " " | " " | liver | D | 0.62 | " |
| Windowpane<br>Scophthalmus aquosus | Long Island Sound | muscle | W | <0.1 | Greig et al. (1977b) |
| " " | New York Bight | liver | W | <0.1 | " |
| " " | Long Island Sound | | W | 0.285 | Zawacki & Briggs (1976) |
| " " | " " " | | D | 1.14 | " |
| Spotted dogfish<br>Scyliorhinus canicula | Spain & Portugal | muscle | D | (ND-3.2) | Stenner & Nickless (1975) |
| " " | " | gill | D | (ND-0.42) | " |
| Sea perch<br>Sebastes marinus | Maine | muscle | W | (0.0-0.2)<br>0.069±0.056 | Zook et al.(1976) |

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|---|---|---|---|---|---|
| Amberjack<br>Seriola sp. | Middle Atlantic Bight | muscle | W | <0.1 | Greig et al. (1976) |
| " " | " " " | liver | W | 0.24 | " |
| Cojinova<br>Seriolela violacea | Peru | whole | | 0.05 | Echegaray (1974) |
| Queenfish<br>Seriphus politus | Los Angeles Bay | | D | 0.9 | Emerson et al. (1976) |
| Black-ear bass<br>Serranus atrobranchius | Texas | muscle | D | 0.14 | Horowitz & Presley (1977) |
| " " | " | skin | D | 0.28 | " |
| Mackerel trevalley<br>Serrilela ameculita | Tasmania | muscle | W | 0.05 | Eustace (1974) |
| Siganus rivulatus | Israel | " | D | 0.2 | Roth & Hornung (1977) |
| Spotted whiting<br>Sillago punctata | Tasmania | muscle | | <0.05 | Eustace (1974) |
| Sole<br>Solea solea | Spain & Portugal | muscle | D | (0.08-2.1) | Stenner & Nickless (1975) |
| " " | " | gill | D | (3.3-4.3) | " |
| " " | Israel | muscle | D | 0.2 | Roth & Hornung (1977) |
| Barracuda<br>Sphyraena sphyraena | Israel | muscle | D | 0.3 | " |
| Scalloped hammerhead<br>Sphyrna lewini | N.W. Atlantic | " | D | <0.1 | Windom et al.(1973b) |

| | | | | | |
|---|---|---|---|---|---|
| Scalloped hammerhead<br>Sphyrna lewini | N.W. Atlantic | liver | D | <0.1 | Windom et al.(1973b) |
| " " | " " | stomach | D | <0.1 | " |
| " " | " " | intestine | D | 0.8 | " |
| Bonnethead<br>Sphyrna tiburo | " " | muscle | D | 0.4 | " |
| " " | " " | liver | D | 0.9 | " |
| " " | " " | stomach | D | 0.9 | " |
| " " | " " | spleen | D | 0.6 | " |
| " " | " " | ovary | D | 0.7 | " |
| Spondyliosoma cantharus | Spain & Portugal | muscle | D | ND | Stenner & Nickless (1975) |
| " " | " | gill | D | 2.9 | " |
| Sprat<br>Sprattus sprattus<br>(=Gadus sprattus) | Great Britain | whole | W | (0.50-0.60)<br>0.29 | Wharfe & Van Den Broek(1977) |
| " " | " " | skin | W | 0.84±SD 0.11 | Wright (1976) |
| " " | " " | muscle | W | 0.24±SD 0.136 | " |
| Spiny dogshark<br>Squalus acanthias | Sweden | muscle | D | 0.0 | Noddack & Noddack (1940) |
| " " | N.W. Atlantic | muscle | D | 0.4 | Windom et al.(1973b) |
| " " | " " | stomach | D | 3.7 | " |
| " " | " " | spleen | D | 1.4 | " |
| " " | " " | liver | D | 1.0 | " |
| " " | " " | yolk sac | D | 0.2 | " |
| " " | Great Britain | | W | (0.07-0.59) | Peden et al. (1973) |

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|---|---|---|---|---|---|
| California dogfish<br>*Squalus suckleyi* | Oregon | | D | (0.06-0.21)<br>0.13 | Cutshall & Holton (1972) |
| Dogfish<br>*Squalus sp.* | Tasmania | muscle | W | <0.05 | Eustace (1974) |
| Longspined porgy<br>*Stenotomus chrysops* | Texas | " | D | (0.05-0.16)0.1 | Horowitz & Presley (1977) |
| " " | " | skin | D | (0.14-0.34)0.26 | " |
| Anchovy<br>*Stolephorus sp.* | Thailand | | W | 0.25 | Huschenbeth & Harms (1975) |
| *Synaphobranchus kaupi* | Middle Atlantic Bight | whole | W | 0.12 | Greig et al. (1976) |
| Lizardfish<br>*Synodus similis* | Thailand | | W | 0.03 | Huschenbeth & Harms (1975) |
| Seawater catfish<br>*Tachysurus sp.* | Thailand | | W | 0.003 | " |
| Striped marlin<br>*Tetrapturus audax* | Japan | muscle | W | (0.01-0.03)<br>0.02±0.0 | Nishigaki et al. (1974) |
| Albacore<br>*Thunnus alalunga* | Japan | muscle | W | (0.01-0.02)<br>0.012±0.0 | " |
| Albacore tuna<br>*Thunnus albacares* | California | liver | A | 3,500.0 | Goldberg (1962) |
| " " | Peru | muscle | D | 1.0 | Lowman et al. (1967) |
| " " | Japan | " | W | 0.01 | Nishigaki et al. (1974) |

| | | | | | |
|---|---|---|---|---|---|
| Bigeye tuna<br>*Thunnus obesus* | Japan | muscle | W | (0.01-0.06)<br>0.027±0.015 | Nishigaki et al. (1974) |
| Russel's dark<br>*Trachinotus russellii* | Thailand | whole | W | 0.12 | Huschenbeth & Harms (1975) |
| Rough scad<br>*Trachurus lathami* | Texas | muscle | D | (0.08-0.21)<br>0.15 | Horowitz & Presley (1977) |
| " " | " | skin | D | (0.41-0.42)0.42 | " |
| " " | " | viscera | D | 0.77 | " |
| Scad<br>*Trachurus symmetricus murphyi* | Peru | whole | | (0.0-0.1)<br>0.04 | Echegaray (1974) |
| Horse mackerel<br>*Trachurus trachurus* | Great Britain | muscle | D | <0.05 | Stevens & Brown (1974) |
| Atlantic cutlass fish<br>*Trichiurus lepturus* | Puerto Rico | | W | (<0.005-0.11)<br>0.05 | Lowman et al. (1967) |
| " " | " " | | D | (0.13-0.25)<br>0.19 | Lowman et al. (1966) |
| " " | " " | | W | (0.029-0.057)<br>0.044 | " |
| " " | " " | | D | (<0.005-0.3)<br>0.2 | Lowman et al. (1967) |
| Poor cod<br>*Trisopterus minutus* | Great Britain | whole | D | 8.5±SD 1.23 | Hardisty et al. (1974a) |
| Dwarf goatfish<br>*Upeneus moluccensis* | Israel | muscle | D | (0.2-0.4) | Roth & Hornung (1977) |

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|---|---|---|---|---|---|
| Red hake<br>*Urophycis chuss* | New York Bight | muscle | W | <0.1 | Greig & Wenzloff (1977) |
| " " | " " " | liver | W | (0.1-<0.3) | " |
| White hake<br>*Urophycis tenuis* | " " " | muscle | W | <0.1 | " |
| " " | " " " | liver | W | <0.1 | " |
| Swordfish<br>*Xiphias gladius* | Peru | whole | | (0.0-0.21)<br>0.07 | Echegaray (1974) |
| " " | Japan | muscle | W | (0.01-0.22)<br>0.053±0.06 | Nishigaki et al. (1974) |
| Viviparous blenny<br>*Zoarces viviparus* | Great Britain | skeleton | W | 0.84±SD 0.35 | Wright (1976) |
| " " | " " | skin | W | 1.91±SD 0.94 | " |
| " " | " " | stomach wall | W | 1.07±SD 0.91 | " |
| " " | " " | liver | W | 0.42±SD 0.14 | " |
| " " | " " | muscle | W | 0.29±SD 0.21 | " |
| " " | " " | gonad | W | 1.63 | " |

CADMIUM IN FRESHWATER FISH[1]

| Species | Locality | Tissue | Analysis[2] PPM | | Authority |
|---|---|---|---|---|---|
| Atlantic sturgeon *Acipenser oxyrhynchus* | New York | | W | 0.0915±0.021 | Lovett et al.(1972) |
| Sturgeon *Acipenser sp.* | " " | | W | 0.0262±0.0035 | " |
| " " | St. Lawrence River | without head & viscera | W | 0.06 | Tong et al.(1972) |
| Alewife *Alosa pseudoharengus* | Lake Michigan | whole | W | 0.062±0.015 | Lucas et al. (1970) |
| " " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| Rockbass *Ambloplites rupestris* | New York | | W | (0.014-0.065) | Lovett et al. (1972) |
| " " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| " " | New York | whole | W | (ND- 0.05) | Walsh et al. (1977) |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | | |
|---|---|---|---|---|---|
| Bowfin<br>*Amia calva* | New York | | W | 0.016 | Lovett et al. (1972) |
| " " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| " " | South Carolina | whole | W | ND | Walsh et al. (1977) |
| Freshwater drum, sheephead<br>*Aplodinotus grunniens* | New York | | W | (0.014-0.0289) | Lovett et al. (1972) |
| " " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| " " | Alabama | | W | 0.03 | Schroeder (1974) |
| " " | Tennessee | whole | W | (0.05-0.8) | Berger (1974) |
| " " | Lake Erie | " | W | <0.05 | Walsh et al. (1977) |
| " " | Louisiana | " | W | (0.05-0.28) | " |
| " " | Mississippi | " | W | <0.05 | " |
| " " | Tennessee | " | W | 0.8 | " |
| " " | Lake Erie | " | W | <0.05 | " |
| " " | Alabama | " | W | <0.05 | " |
| Goldfish<br>*Carassius auratus* | Lake Erie | liver | W | $1.4 \pm 1.1$ | Lucas et al. (1970) |
| " " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| " " | Hudson River | | W | 0.142 | Lovett et al. (1972) |
| " " | Quebec | whole | D | (0.2-0.4) | Delisle et al. (1975) |

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|---|---|---|---|---|---|
| Goldfish<br>Carassius auratus | New York | whole | W | (0.52-1.3) | Walsh et al. (1977) |
| River carpsucker<br>Carpiodes carpio | Texas | " | W | (ND-0.11) | " |
| " " | Tennessee | " | W | <0.05 | " |
| Quillback<br>Carpiodes cyprinus | Illinois | muscle | W | (0.004-0.046)<br>0.024 | Mathis & Cummings (1973) |
| " " | Wisconsin | " | W | 0.0 | Kleinert et al. (1974) |
| Longnose sucker<br>Catostomus catostomus | Alaska | whole | W | (<0.05-0.26) | Walsh et al. (1977) |
| Bridgelip sucker<br>Catostomus columbianus | Oregon | " | W | (<0.05-0.06) | " |
| " " | Washington | " | W | (0.07-0.28) | " |
| White sucker<br>Catostomus commersoni | New York | | W | (0.016-0.023) | Lovett et al. (1972) |
| " " | " " | without head & viscera | W | 0.05 | Tong et al. (1972) |
| " " | Maine | whole | W | (ND-<0.05) | Walsh et al. (1977) |
| " " | Massachusetts | " | W | (<0.05-0.3) | " |
| " " | New Jersey | " | W | (<0.05-0.10) | " |
| " " | Colorado | " | W | <0.05 | " |
| " " | New York | " | W | <0.05 | " |
| " " | Pennsylvania | " | W | (ND-0.06) | " |
| " " | Minnesota | " | W | 0.05 | " |
| " " | Virginia | " | W | <0.05 | " |

| | | | | | |
|---|---|---|---|---|---|
| White sucker<br>Catostomus commersoni | Tennessee | whole | W | <0.05 | Walsh et al. (1977) |
| " " | Wisconsin | " | W | 0.05 | " |
| " " | Nebraska | " | W | 0.05 | " |
| Flannelmouth sucker<br>Catostomus latipennis | Utah | " | W | <0.05 | " |
| Largescale sucker<br>Catostomus macrocheilus | Idaho | " | W | (<0.05-0.36) | " |
| " " | Washington | " | W | (ND-0.13) | " |
| " " | Oregon | " | W | (<0.05-0.16) | " |
| " " | Washington | " | W | (0.54-0.6) | " |
| Sacramento sucker<br>Catostomus occidentalis | California | " | W | (<0.05-0.17) | " |
| Klamath sucker<br>Catostomus snyderi | " | " | W | (<0.05-0.17) | " |
| Sucker<br>Catostomus sp. | Montana | muscle | W | 0.6 | Van Meter (1974) |
| " " | " | liver | W | 0.79 | " |
| " " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| Teymann's spotted catfish<br>Clarius batrachus | Thailand | muscle | W | (0.010-0.07) | Huschenbeth & Harms (1975) |
| Lake herring, cisco<br>Coregonus artedii | Lake Superior | liver | W | 1.6 | Lucas et al. (1970) |
| " " | New York | | W | 0.0123 | Lovett et al. (1972) |
| " " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |

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|---|---|---|---|---|---|
| Lake herring, cisco *Coregonus artedii* | Hudson River | | W | 0.16 | Schroeder (1974) |
| Lake whitefish *Coregonus clupeaformis* | New York | | W | (0.015-0.115) | Lovett et al. (1972) |
| " " | Lake Superior | liver | W | 0.3±0.1 | Lucas et al. (1970) |
| " " | Lake Michigan | " | W | 0.09±0.01 | " |
| " " | Montana | muscle | W | 0.2 | Van Meter (1974) |
| " " | " | liver | W | 0.65 | " |
| " " | Canada | muscle | W | <0.05 | Uthe & Bligh (1971) |
| " " | Lake Ontario | " | W | <0.05 | " |
| " " | Wisconsin | whole | W | (<0.05-0.2) | Walsh et al. (1977) |
| Bloater *Coregonus hoyi* | Lake Superior | liver | W | 0.7±0.4 | Lucas et al. (1970) |
| " " | Lake Michigan | " | W | 0.4±0.1 | " |
| " " | " " | whole | W | (<0.05-0.08) | Walsh et al. (1977) |
| " " | Wisconsin | " | W | (<0.05-0.09) | " |
| Carp *Cyprinus carpio* | New York | | W | <0.01 | Lovett et al. (1972) |
| " " | Hudson River | muscle | W | (0.2-1.2) | Schroeder (1974) |
| " " | " " | kidney | W | (1.8-39.7) | " |
| " " | " " | muscle | W | (0.4-0.67) | " |
| " " | " " | kidney | W | 20.44 | " |
| " " | New York Saratoga Lake | without head & viscera | W | 0.14 | Tong et al. (1972) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Carp *Cyprinus carpio* | | Mississippi | whole | W | (<0.05-1.3) | Berger (1974) |
| " | " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| " | " | Illinois River | muscle | W | (0.011-0.069) 0.035 | Mathis & Cummings (1973) |
| " | " | Japan | | W | (0.01-0.02) | Yamagata & Shigematsu (1970) |
| " | " | Indiana | whole | W | (0.5-1.4) | Berger (1974) |
| " | " | Japan | | W | 0.003 | Ishizaki et al. (1970) |
| " | " | Maryland | whole | W | (ND-0.11) | Walsh et al. (1977) |
| " | " | S. Carolina | " | W | (ND-<0.05) | " |
| " | " | Georgia | " | W | <0.05 | " |
| " | " | Alabama | " | W | (ND-<0.05) | " |
| " | " | Louisiana | " | W | <0.05 | " |
| " | " | Colorado | " | W | (ND-0.05) | " |
| " | " | Michigan | " | W | <0.05 | " |
| " | " | Pennsylvania | " | W | 0.07 | " |
| " | " | West Virginia | " | W | ND | " |
| " | " | Ohio | " | W | (<0.05-0.08) | " |
| " | " | Indiana | " | W | (0.05-0.12) | " |
| " | " | Illinois | " | W | (0.1-0.12) | " |
| " | " | Montana | " | W | 0.3 | " |
| " | " | Oregon | " | W | (0.05-0.11) | " |
| " | " | New Mexico | " | W | <0.05 | " |

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|---|---|---|---|---|---|
| Carp<br>Cyprinus carpio | Arizona | whole | W | 0.1 | Walsh et al. (1977) |
| " " | Nevada | " | W | <0.05 | " |
| Gizzard shad<br>Dorosoma cepedianum | New York | | W | 0.072 | Lovett et al. (1972) |
| " " | Illinois | muscle | W | (0.005-0.068)<br>0.033 | Mathis & Cummings (1973) |
| " " | Texas | whole | W | (ND-0.06) | Walsh et al. (1977) |
| " " | Kansas | " | W | (0.27-1.3) | " |
| Lake chub sucker<br>Erimyzon sucella | Michigan | " | W | (0.028-0.055)<br>0.036±0.017 | Mathis & Kevern (1975) |
| Northern pike<br>Esox lucius | Sweden | whole | D | (0.66-0.99) | Ljunggren et al. (1971) |
| " " | " | muscle | W | (0.02-0.1) | " |
| " " | " | bone | W | (<0.02-0.03) | " |
| " " | Norway | muscle | W | (<0.001-0.008) | Havre et al. (1973) |
| " " | " | " | D | (<0.005-0.039) | " |
| " " | Canada | " | W | <0.05 | Uthe & Bligh (1971) |
| " " | Lake Erie | " | W | <0.05 | " |
| " " | New York | | W | (0.014-0.045) | Lovett et al. (1972) |
| " " | " " | without head & viscera | W | (0.05-0.14) | Tong et al. (1972) |

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|---|---|---|---|---|---|
| Northern pike<br>Esox lucius | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| " " | Illinois | " | W | (0.013-0.031)<br>0.022 | Mathis & Cummings (1973) |
| " " | New York | whole | W | (0.31-0.58) | Walsh et al. (1977) |
| " " | Minnesota | " | W | (ND-<0.05) | " |
| Muskelunge<br>Esox masquinongy | New York | | W | (0.014-0.03) | Lovett et al. (1972) |
| " " | " " | without head & viscera | W | 0.05 | Tong et al. (1972) |
| Chain pickerel<br>Esox niger | " " | | W | (<0.01-0.031) | Lovett et al. (1972) |
| " " | " " | without head & viscera | W | (0.05-0.13) | Tong et al. (1972) |
| " " | Maine | whole | W | (ND-<0.05) | Walsh et al. (1977) |
| " " | Vermont | " | W | <0.05 | " |
| Swamp eel<br>Fluta alba | Thailand | muscle | W | 0.010 | Huschenbeth & Harms (1975) |
| Mummichog<br>Fundulus heteroclitus | Rhode Island | whole | W | 0.33 | Eisler et al. (1972) |
| Goldeye<br>Hiodon alosioides | North Dakota | " | | (<0.12-0.85) | Berger (1974) |
| " " | Nebraska | " | W | <0.05 | Walsh et al. (1977) |
| " " | Montana | " | W | <0.05 | " |

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|---|---|---|---|---|---|
| Goldeye<br>*Hiodon alosioides* | North Dakota | whole | W | (<0.05-0.85) | Walsh et al. (1977) |
| Mooneye<br>*Hiodon tergisus* | Wisconsin | " | W | <0.05 | " |
| White catfish<br>*Ictalurus catus* | New York (given dose of Cd) | kidney (4 days) | 4.0% of total body | | Rowe & Massaro (1974) |
| " " | " " " | kidney (14 days) | 17.6% of total body | | " |
| " " | " " " | kidney (21 days) | 34.0% of total body | | " |
| " " | Connecticut | whole | W | (0.17-1.5) | Berger (1974) |
| " " | " | " | W | (0.14-0.56) | Walsh et al. (1977) |
| " " | New Jersey | " | W | <0.05 | " |
| " " | California | " | W | <0.05 | " |
| " " | North Carolina | " | W | <0.05 | " |
| " " | Florida | " | W | <0.05 | " |
| " " | Massachusetts | " | W | 0.06 | " |
| Blue catfish<br>*Ictalurus furcatus* | Texas | " | W | <0.05 | " |
| " " | Missouri | " | W | <0.05 | " |
| " " | Louisiana | " | W | (<0.05-0.21) | " |
| Black bullhead<br>*Ictalurus melas* | Minnesota | whole | W | (ND-<0.05) | " |
| " " | Colorado | " | W | (ND-<0.05) | " |
| " " | Utah | " | W | ND | " |
| Yellow bullhead<br>*Ictalurus natalis* | Michigan | muscle | W | (0.026-0.051)<br>0.039±0.008 | Mathis & Kevern (1975) |

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|---|---|---|---|---|---|
| Yellow bullhead *Ictalurus natalis* | Minnesota | whole | W | <0.05 | Walsh et al. (1977) |
| " " | Arizona | " | W | <0.05 | " |
| Brown bullhead *Ictalurus nebulosus* | New York | | W | 0.023 | Lovett et al. (1972) |
| " " | Ohio | whole | W | (<0.05-0.76) | Berger (1974) |
| " " | New Jersey | " | W | <0.05 | Walsh et al. (1977) |
| " " | N. Carolina | " | W | (ND-0.12) | " |
| " " | West Virginia | " | W | (ND-0.13) | " |
| " " | Nevada | " | W | <0.05 | " |
| " " | California | " | W | (ND-<0.05) | " |
| " " | Oregon | " | W | (ND-<0.05) | " |
| " " | S. Carolina | " | W | <0.05 | " |
| Channel catfish *Ictalurus punctatus* | Arkansas | muscle (cultured) | W | (0.020-0.152) 0.079±0.052 | Zook et al. (1976) |
| " " | Louisiana | muscle | W | (0.0-0.091) 0.046±0.044 | " |
| " " | Texas | whole | W | (<0.05-0.17) | Berger (1974) |
| " " | Ohio | " | W | (<0.05-0.76) | " |
| " " | Maryland | whole | W | <0.05 | Walsh et al. (1977) |
| " " | Virginia | " | W | ND | " |
| " " | N. Carolina | " | W | (ND-<0.03) | " |
| " " | Florida | " | W | (ND-0.06) | " |
| " " | Louisiana | " | W | <0.05 | " |
| " " | Texas | " | W | <0.05 | " |

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|---|---|---|---|---|---|
| Channel catfish *Ictalurus punctatus* | Indiana | whole | W | <0.05 | Walsh et al. (1977) |
| " " | California | " | W | (ND-<0.05) | " |
| " " | Alabama | " | W | 0.16 | " |
| Catfish *Ictalurus sp.* | " | | W | 0.02 | Schroeder (1974) |
| " " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| " " | New York | | W | (0.013-0.092) | Lovett et al. (1972) |
| " " | Georgia | | W | 0.05 | Roberts et al. (1975) |
| Smallmouth buffalo *Ictiobus bubalus* | Texas | whole | W | <0.05 | Walsh et al.(1977) |
| " " | Arkansas | " | W | (<0.05-0.06) | " |
| " " | Illinois | " | W | <0.05 | " |
| " " | Wisconsin | " | W | <0.05 | " |
| " " | Missouri | " | W | <0.05 | " |
| " " | Mississippi | " | W | (ND-<0.05) | " |
| Bigmouth buffalo *Ictiobius cyprinellus* | Illinois | muscle | W | (0.001-0.055) 0.032 | Mathis & Cummings (1973) |
| " " | " | whole | W | <0.05 | Walsh et al. (1977) |
| River lamprey *Lampetra fluviatilis* | Great Britain | " | D | 0.5±SD 0.3 | Hardisty et al. (1974b) |
| Brook lamprey *Lampetra planeri* | " " | whole, adult | D | 0.75±SD 0.3 | " |

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|---|---|---|---|---|---|
| Brook lamprey<br>Lampetra planeri | Great Britain | ammoecoete | D | (0.23-1.25) | Hardisty et al. (1974b) |
| Guppy<br>Lebistes reticulatus | (grown in 0.1 ppm Cd water) | | | 10.5 | Landner & Jernelov (1969) |
| " " | (control) | | | 0.3 | " |
| " " | (grown in 1.0 ppm Cd water with Cd sludge) | | | 14.5 | " |
| " " | (grown in 1.0 ppm Cd water with no Cd sludge) | | | 9.0 | " |
| Spotted gar<br>Lepisosteus oculatus | Texas | whole | W | 0.05 | Walsh et al. (1977) |
| Long nose gar<br>Lepisosteus osseus | " | " | W | (ND-<0.05) | " |
| Short-nose gar<br>Lepisosteus platostomus | Illinois | muscle | W | (0.004-0.085)<br>0.03 | Mathis & Cummings (1973) |
| Florida gar<br>Lepisosteus platyrhincus | S. Florida | whole | W | 0.05 | Ogden et al. (1974) |
| Red breast sunfish<br>Lepomis auritus | Florida | " | W | <0.05 | Walsh et al. (1977) |
| " " | Maryland | " | W | <0.05 | " |
| Green sunfish<br>Lepomis cyanellus | Nebraska | " | W | <0.05 | " |
| Punkinseed<br>Lepomis gibbosus | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| " " | Vermont | whole | W | (ND-<0.05) | Walsh et al. (1977) |

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|---|---|---|---|---|---|
| Punkinseed *Lepomis gibbosus* | Massachusetts | whole | W | ND | Walsh et al. (1977) |
| " " | New York | " | W | <0.05 | " |
| Bluegill *Lepomis macrochirus* | Alabama | muscle | W | (0.01-0.08) | Schroeder (1974) |
| " " | Indiana | whole (young) | W | 0.46±0.009 | Yost et al. (1974) |
| " " | " | muscle | W | (0.036-0.038) 0.037 | " |
| " " | " | " | | (ND-1.7)0.55 | Atchison (1975) |
| " " | Wisconsin | " | W | 0.0 | Kleinert et al. (1974) |
| " " | Georgia | | W | (0.05-0.5) 0.28 | Roberts et al. (1975) |
| " " | S. Florida | whole | W | (0.05-0.09) | Ogden et al. (1974) |
| " " | S. Carolina | " | W | (ND-<0.05) | Walsh et al. (1977) |
| " " | Florida | " | W | ND | " |
| " " | Tennessee | " | W | <0.05 | " |
| " " | Oklahoma | " | W | (ND-<0.05) | " |
| " " | N. Carolina | " | W | (<0.05-0.05) | " |
| " " | Arizona | " | W | <0.05 | " |
| Red-eared sunfish *Lepomis microlophis* | Alabama | | | 0.02 | Schroeder (1974) |
| Roach *Leuciscus rutilus* | Sweden | 0.5-1.5 cm | D | (0.16-0.71) | Ljunggren et al. (1971) |

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|---|---|---|---|---|---|
| Roach<br>Leuciscus rutilus | Sweden | 1.5-2.5 cm | D | (0.5-2.4) | Ljunggren et al. (1971) |
| " " | " | bone | W | <0.057 | " |
| " " | " | muscle | W | <0.007 | " |
| Burbot<br>Lota lota | New York | | W | <0.01 | Lovett et al. (1972) |
| Smallmouth bass<br>Micropterus dolomieui | " " | | W | (<0.01-0.039) | " |
| " " | " " | without head & viscera | W | (0.05-0.12) | Tong et al. (1972) |
| " " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| " " | Alabama | " | W | (0.01-0.08) | Schroeder (1974) |
| " " | Illinois | muscle | W | 0.005 | Mathis & Cummings (1973) |
| " " | Ohio | " | W | (0.043-0.047) | Kelso & Frank (1974) |
| " " | Hudson R. (contaminated) | " | W | 12.3 | Schroeder (1974) |
| " " | Maine | whole | W | (ND-<0.05) | Walsh et al. (1977) |
| " " | Maryland | " | W | (ND- 0.05) | " |
| " " | Idaho | " | W | (ND-<0.05) | " |
| " " | Pennsylvania | " | W | <0.05 | " |
| Largemouth bass<br>Micropterus salmoides | Georgia | | W | 0.05 | Roberts et al. (1975) |
| " " | " | | | (0.05-0.5) | Mitre Corp (1975) |

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|---|---|---|---|---|---|---|
| Largemouth bass *Micropterus salmoides* | | Michigan | muscle | W | (0.02-0.048) 0.036±0.036 | Mathis & Kevern (1975) |
| " | " | New York | without head & viscera | W | 0.05 | Tong et al. (1972) |
| " | " | " " | | W | (<0.01-0.022) | Lovett et al. (1972) |
| " | " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| " | " | S. Carolina | whole | W | (<0.05-0.55) | Berger (1974) |
| " | " | S. Florida | whole | W | 0.08 | Ogden et al. (1974) |
| " | " | Illinois | muscle | W | (0.004-0.06) 0.022 | Mathis & Cummings (1973) |
| " | " | Indiana | " | | (ND-15.98) 0.72 | Atchison (1975) |
| " | " | " | " | W | 0.025±0.005 | Yost et al. (1974) |
| " | " | Indiana | whole (young) | W | 0.068±0.02 | " |
| " | " | New York | whole | W | <0.05 | Walsh et al. (1977) |
| " | " | N. Carolina | " | W | (ND-0.06) | " |
| " | " | S. Carolina | " | W | (ND -<0.55) | " |
| " | " | Florida | " | W | (ND-<0.05) | " |
| " | " | Alabama | " | W | (<0.05-0.1) | " |
| " | " | New Mexico | " | W | (ND-<0.05) | " |
| " | " | Tennessee | " | W | (<0.05-0.07) | " |
| " | " | Nevada | " | W | (<0.05-0.23) | " |
| " | " | California | " | W | <0.05 | " |

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| Spotted sucker<br>Minytrema melanops | Georgia | | W | (0.1-0.12)0.11 | Roberts et al. (1975) |
| " " | " | whole | W | (<0.05-0.12) | Walsh et al.(1977) |
| " " | Florida | " | W | <0.05 | " |
| " " | Alabama | " | W | <0.05 | " |
| White perch<br>Morone americana | Connecticut | " | W | (<0.05-0.39) | " |
| " " | New Jersey | " | W | <0.05 | " |
| " " | New York | " | W | <0.05 | " |
| " " | Maine | W | W | <0.05 | " |
| White bass<br>Morone chrysops<br>(=Roccus chrysops) | Lake Erie | liver | W | 0.2 | Lucas et al. (1970) |
| " " | " " | | W | 0.028 | Lovett et al. (1972) |
| " " | New York | | W | <0.01 | " |
| " " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| " " | Illinois | " | W | (0.004-0.038) 0.024 | Mathis & Cummings (1973) |
| " " | Ohio | " | W | (0.007-0.034) | Kelso & Frank (1974) |
| " " | New Mexico | whole | W | (ND-<0.05) | Walsh et al. (1977) |
| " " | Utah | " | W | (ND-<0.05) | " |
| Yellow bass<br>Morone mississippiensis<br>(=Roccus mississippiensis) | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |

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| Striped bass<br>Morone saxatilis | New York | | W | 0.012 | Lovett et al. (1972) |
| " " | " " | without head & viscera | W | 0.05 | Tong et al. (1972) |
| " " | Hudson River | | W | 0.25 | Schroeder (1974) |
| Sucker<br>Moxostoma sp. | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| Red horse sucker, shorthead redhorse<br>Moxostoma macrolepidnotum | Illinois | muscle | W | (0.005-0.031)<br>0.017 | Mathis & Cummings (1973) |
| " " | Maryland | whole | W | (0.06-0.09) | Walsh et al. (1977) |
| " " | Virginia | " | W | (ND-0.23) | " |
| " " | N. Carolina | " | W | (ND-0.17) | " |
| " " | New York | " | W | <0.05 | " |
| " " | Ohio | " | W | <0.05 | " |
| " " | Montana | " | W | 0.32 | " |
| " " | Minnesota | " | W | 0.06 | " |
| Striped mullet<br>Mugil cephalus | Florida | " | W | (<0.05-0.05) | " |
| " " | Alabama | " | W | (ND-<0.05) | " |
| Peamouth chub<br>Mylocheilus caurinus | Idaho | " | W | <0.05 | " |
| Golden shiner<br>Notemigonus chrysoleucas | Indiana | " | | (0.68-0.79)<br>0.76 | Atchison (1975) |
| " " | Hudson River (contaminated) | " | W | (0.2-68.9) | Schroeder (1974) |

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| Golden shiner<br>Notemigonus chrysoleucas | Hudson River (contaminated) | kidney | W | (6.4-16.29) | Schroeder (1974) |
| " " | New Jersey | whole | W | <0.05 | Walsh et al. (1977) |
| Spottail shiner<br>Notropis hudsonius | Lake Erie | " | W | 0.1±0.03 | Lucas et al. (1970) |
| Coho salmon<br>Onchorhynchus kisutch | Lake Ontario | | W | 0.0135 | Lovett et al. (1972) |
| " " | New York | | W | (0.011-0.024) | " |
| " " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| Striped snakehead<br>Ophiocephalus striatus | Thailand | " | W | 0.017 | Huschenbeth & Harms (1975) |
| American smelt<br>Osmerus mordax | Lake Michigan | liver | W | 0.07±0.01 | Lucas et al. (1970) |
| " " | Canada Lake Erie | muscle | W | 0.06 | Uthe & Bligh (1971) |
| River catfish<br>Pangasius pangasius | Thailand | " | W | 0.012 | Huschenbeth & Harms (1975) |
| Yellow perch<br>Perca flavescens | Canada Lake Erie | muscle | W | <0.05 | Uthe & Bligh (1971) |
| " " | " " | liver | W | 0.54±0.06 | Lucas et al. (1970) |
| " " | " " | whole | W | (0.039-0.063) | Kelso & Frank (1974) |

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| Yellow perch *Perca flavescens* | Lake Erie | | W | 0.016 | Lovett et al. (1972) |
| " " | " " | liver | | 0.5 | Thomann et al. (1974) |
| " " | New York | | W | (0.03-0.051) | " |
| " " | " " | without head & viscera | W | 0.11 | Tong et al. (1972) |
| " " | Hudson River | | W | 0.25 | Schroeder (1974) |
| " " | Michigan | muscle | W | (0.019-0.073) 0.04±0.009 | Mathis & Kevern (1973) |
| " " | Wisconsin | " | W | 0.0 | Kleinert et al. (1974) |
| " " | Maine | whole | W | (ND-0.05) | Walsh et al. (1977) |
| " " | Vermont | " | W | (<0.05-0.06) | " |
| " " | Massachusetts | " | W | ND | " |
| " " | Maryland | " | W | <0.05 | " |
| " " | Idaho | " | W | <0.05 | " |
| " " | California | " | W | (0.07-0.12) | " |
| " " | Pennsylvania | " | W | <0.05 | " |
| " " | Michigan | " | W | 0.01 | " |
| " " | Connecticut | " | W | <0.05 | " |
| Perch *Perca fluviatilis* | Norway | muscle | W | 0.009 | Havre et al. (1973) |
| Trout-perch *Percopsis omiscomaycus* | Lake Michigan | whole | W | 0.076±0.008 | Lucas et al. (1970) |
| " " | Lake Superior | " | W | 0.14±0.06 | " |

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|---|---|---|---|---|---|
| White crappie *Pomoxis annularis* | Texas | whole | W | <0.05 | Walsh et al. (1977) |
| " " | West Virginia | " | W | (ND-0.05) | " |
| " " | Indiana | " | W | <0.05 | " |
| " " | Illinois | " | W | (<0.05-0.3) | " |
| " " | Missouri | " | W | (ND-<0.05) | " |
| " " | Nebraska | " | W | <0.05 | " |
| Black crappie *Pomoxis nigromaculatus* | New York | | W | (0.012-0.014) | Lovett et al. (1972) |
| " " | " " | without head & viscera | W | 0.05 | Tong et al. (1972) |
| " " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| " " | Texas | whole | W | 0.05 | Walsh et al. (1977) |
| " " | California | " | W | (ND-0.13) | " |
| " " | Washington | " | W | (ND-<0.05) | " |
| Round whitefish *Prosopium cylindraceum* | Lake Superior | liver | W | $0.4 \pm 0.1$ | Lucas et al. (1970) |
| " " | Alaska | whole | W | (ND-0.07) | " |
| Northern squawfish *Ptychocheilus oregonensis* | Washington | " | W | (0.16-1.7) | Berger (1974) |
| " " | Montana | liver | W | 0.53 | Van Meter (1974) |
| " " | Idaho | whole | W | (ND-<0.05) | Walsh et al. (1977) |
| " " | Washington | " | W | (<0.05-1.7) | " |
| " " | Oregon | " | W | (<0.05-0.42) | " |

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|---|---|---|---|---|---|
| Flathead catfish<br>*Pylodictis olivaris* | Arkansas | whole | W | (0.05-0.06) | Walsh et al. (1977) |
| Dace<br>*Reinichthys sp.* | Hudson River (contaminated) | | W | 9.1 | Schroeder (1974) |
| Rainbow trout, steelhead<br>*Salmo gairdneri* | New York | | W | (0.013-0.027) | Lovett et al. (1972) |
| " " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| " " | Colorado | " | W | 3.3 | Roberts et al. (1975) |
| " " | " | whole | W | (2.7-3.0) | " |
| " " | " | bone | W | (2.8-19.9) | " |
| " " | " | liver | W | (1.1-7.4) | " |
| " " | Alaska | whole | W | (<0.05-0.07) | Walsh et al. (1977) |
| " " | Arizona | " | W | <0.05 | " |
| Brown trout<br>*Salmo trutta* | New York | | W | (0.01-0.021) | Lovett et al. (1972) |
| " " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| " " | Colorado | " | W | (0.0-4.2) | Roberts et al. (1975) |
| " " | " | whole | W | (0.0-3.0) | " |
| " " | " | bone | W | (1.6-26.4) | " |
| " " | " | liver | W | (0.0-13.5) | " |
| Brook trout, speckled trout<br>*Salvelinus fontinalis* | New York | | W | 23.0 | Lovett et al. (1972) |

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|---|---|---|---|---|---|---|
| Brook trout, speckled trout | | | | | | |
| Salvelinus | fontinalis | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| " | " | Colorado | " | W | (0.0-3.1) | Roberts et al. (1975) |
| " | " | " | whole | W | (0.0-6.5) | " |
| " | " | " | bone | W | (0.0-20.3) | " |
| " | " | " | liver | W | (0.0-7.7) | " |
| Lake trout | | | | | | |
| Salvelinus | namaycush | New York | | W | (<0.01-0.0807) | Lovett et al. (1972) |
| " | " | " " | without head & viscera | W | (0.05-0.1) | Tong et al. (1972) |
| " | " | Lake Superior | liver | W | ≤3.0 | Lucas et al. (1970) |
| " | " | New York | muscle (age 1-12 yrs.) | W | (0.0021-0.0063) | Tong et al. (1974) |
| " | " | Lake Michigan | liver | W | 0.06±0.02 | Lucas et al. (1970) |
| " | " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| " | " | " | whole | W | <0.05 | Walsh et al. (1977) |
| " | " | Alaska | " | W | (<0.07-0.07) | " |
| Sauger | | | | | | |
| Stizostedion | canadense | Wisconsin | " | W | (<0.05-0.05) | " |
| " | " | Ohio | " | W | <0.05 | " |
| " | " | Iowa | " | W | (ND- 0.05) | " |
| " | " | Montana | " | W | <0.05 | " |
| Walleye pike | | | | | | |
| Stizostedion | vitreum | Lake Erie | liver | W | 0.2 | Lucas et al. (1970) |

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|---|---|---|---|---|---|
| Walleye pike *Stizostedion vitreum* | Lake Erie | | W | 0.016 | Lovett et al. (1972) |
| " " | " " | liver | | 0.2 | Thomann et al. (1974) |
| " " | New York | | W | (0.01-0.064) | Lovett et al. (1972) |
| " " | " " | without head & viscera | W | (0.05-0.176) | Tong et al. (1972) |
| " " | Wisconsin | muscle | W | 0.0 | Kleinert et al. (1974) |
| " " | Pennsylvania | whole | W | (<0.05-0.06) | Walsh et al. (1977) |
| " " | Washington | " | W | (<0.05-0.16) | " |
| " " | Iowa | " | W | 0.05 | " |
| " " | Nebraska | " | W | <0.05 | " |
| " " | North Dakota | " | W | <0.05 | " |
| Arctic grayling *Thymallus arcticus* | Alaska | " | W | (ND-<0.05) | " |

## CADMIUM IN MOLLUSCA[1]

| Species | Locality | Tissue | Analysis[2] PPM | | Authority |
|---|---|---|---|---|---|
| *Acaultocardia aculeata* | Spain & Portugal | | D | ND | Stenner & Nickless (1975) |
| Gastropod *Acmaea digitalis* | California | shell | D | (<2.5-6.2) | Graham (1972) |
| " " | " | body | D | (6.7-12.1) | " |
| Clam *Amblema plicata* | Illinois | soft parts | W | (0.15-1.41) 0.38 | Mathis & Cummings (1973) |
| Blood clam *Anadara broughtonii* | Japan | " | D | (0.0-1.204) | Ishio et al. (1973) |
| Arch shell *Anadara granosa* | Thailand | " | W | 0.28 | Huschenbeth & Harms (1975) |
| Blood clam *Anadara granosa bisenensis* | Japan | " | D | 1.938 | Ishio et al. (1973) |
| Blood clam *Anadara nipponensis* | " | " | D | (1.601-2.999) | " |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | | |
|---|---|---|---|---|---|
| Blood clam<br>*Anadara satowi* | Japan | soft parts | D | (1.601-2.999) | Ishio et al. (1973) |
| Blood clam<br>*Anadara subcrenata* | " | " | D | (1.09-3.353) | " |
| *Anodonta cygnea* | Great Britain | " | D | (0.49-9.2) | Leatherland & Burton (1974) |
| *Anodonta sp.* | Illinois | shell | D | 1.35±0.26 | Anderson (1977) |
| " " | " | soft parts | D | 1.78 | " |
| Saddle oyster<br>*Anomia walteri* | New Zealand | " | W | 2.0 | Nielsen & Nathan (1975) |
| Calico scallop<br>*Aequipecten gibbus* | Florida | | W | (1.57-3.19)<br>2.34±0.41 | Zook et al. (1976) |
| Atlantic bay scallop<br>*Aequipecten irradians*<br>(=argopecten irradians) | Rhode Island (in 0.01 ppm Cd seawater 21 days) | adductor muscle | A | 74.1 | Eisler et al. (1972) |
| " " | " " " " | " | W | 1.68 | " |
| " " | " " " " | soft parts | A | 85.0 | " |
| " " | " " " " | " | W | 2.74 | " |
| " " | (control) | adductor muscle | A | 49.2 | " |
| " " | " | " | W | 1.41 | " |
| " " | " | soft parts | A | 29.5 | " |
| " " | " | " | W | 1.05 | " |
| " " | Massachusetts | " | W | (0.0-0.1)<br>0.035±0.031 | Zook et al. (1976) |
| " " | Connecticut | | W | 4.8±SE 0.2 | Nelson et al. (1976) |

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|---|---|---|---|---|---|
| Archidorus britannica | | mantle | A | 300.0 | Webb (1937) |
| " " | | other soft parts | A | 100.0 | " |
| Ribbed mussel Arcuatela demissus (=Modiolus demissus) | New England (control) | soft parts | D | 1.98±SE 0.09 | Valiela et al. (1974) |
| " " | New England (light sewage sludge) | | D | 3.75±SE 0.13 | " |
| | New England (heavy sewage sludge) | | D | 7/13±SE 3.24 | " |
| " " | Norway | | D | 15.6 | Anderson & Neelaktan (1974) |
| Ridged mussel Aulocomya ater | Peru | | | (0.04-0.73) 0.45 | Echegaray (1974) |
| " " (Cholgas) | " | | | 1.58 | " |
| Ridged mussel Aulocomya maoriana | New Zealand | soft parts | W | (0.16-2.40) 0.94 | Nielsen & Nathan (1975) |
| Whelk Buccinum undatum | Great Britain | shell | D | 0.018 | Mullin & Riley (1956) |
| " " | " " | soft parts | D | 31.8 | " |
| " " | " " | mantle | D | 0.96 | " |
| " " | " " | foot | D | 0.29 | " |
| " " | " " | digestive gland | D | 68.0 | " |
| " " | " " | renal organ | D | 17.7 | |

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|---|---|---|---|---|---|
| Whelk<br>*Buccinum undatum* | Great Britain | male gonad | D | 24.3 | Mullin & Riley (1956) |
| " " | " " | female gonad | D | 11.4 | " |
| " " | Scotland Irish Sea | soft parts | D | 2.2 | Mackay et al. (1972) |
| " " | Scotland (dump area) | " | D | 5.75 | " |
| " " | Great Britain | " | D | 2.2 | Segar et al. (1971) |
| Prosabranch<br>*Bullia digitalis* | South Africa | whole body | W | (1.58-39.1)<br>30.1±SE 3.5 | Cuthbert et al. (1976) |
| " " | " " | " | D | (65.7-164.9)<br>125.3±SE 14.5 | " |
| " " | " " | viscera | W | (107.0-387.6)<br>203.9±SE 40.4 | " |
| Channeled whelk<br>*Busycon canaliculatum* | Long Island Sound | muscle | W | (0.17-0.21) | Greig et al. (1977b) |
| " " | " " " | digestive gland | W | (15.7-23.8) | " |
| " " | Chincoteague Inlet | " | W | 7.4 | " |
| Beaded top shell<br>*Calliostoma zizyphinum* | Great Britain | shell | D | 0.049 | Mullin & Riley (1956) |
| " " | " " | soft parts | D | 3.05 | " |
| " " | Spain & Portugal | | D | 9.0 | Stenner & Nickless (1975) |
| Snail<br>*Campeloma sp.* | Illinois | soft parts | D | 1.76 | Anderson (1977) |

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|---|---|---|---|---|---|
| Cockle<br>Cerastoderma edule<br>(=Cardium edule) | Norway | | D | (4.5-19.3) | Stenner & Nickless (1974a) |
| " " | Great Britain | soft parts | D | (0.81-0.92) | Leatherland & Burton (1974) |
| " " | " " | mantle fluids | D | 2.1 | " |
| " " | " " | soft parts | D | 1.5 | Segar et al. (1971) |
| New Zealand cockle<br>Chione stutchburyi | New Zealand | " | W | 0.19 | Nielsen & Nathan (1975) |
| Scallop<br>Chlamys operculis | Great Britain | shell | A | 0.008 | Mullin & Riley (1956) |
| " " | " " | " | D | 0.008 | " |
| " " | " " | gill | A | 6.5 | " |
| " " | " " | " | D | 1.24 | " |
| " " | " " | mantle & viscera | A | 44.5 | " |
| " " | " " | " | D | 9.62 | " |
| " " | " " | muscle | A | 13.4 | " |
| " " | " " | " | D | 0.87 | " |
| " " | " " | gonad | A | 21.2 | " |
| " " | " " | " | D | 2.21 | " |
| " " | " " | soft parts | W | 0.65 | Bryan (1973) |
| " " | " " | " | D | 5.5 | " |
| " " | " " | kidney | W | 9.3 | " |
| " " | " " | " | D | 41.0 | " |

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|---|---|---|---|---|---|
| Scallop *Chlamys operculis* | Great Britain | digestive gland | W | 7.1 | Bryan (1973) |
| " " | " " | " | D | 27.0 | " |
| South African black mussel *Choromytilis meridionalis* | South Africa | soft parts | D | (1.0-8.0)3.7 | Watling & Watling (1976b) |
| " " | " " | " | W | (0.33-0.53) | " (1976a) |
| *Clinocardium sp.* | Oregon coast | | W | 0.019±0.01 | Caldwell & Buhler (1976) |
| *Corbicula sp.* | Japan | soft parts | W | 0.07-1.58 | Yamagata & Shigematsu (1970) |
| Portuguese oyster *Crassostrea angulata* | Spain & Portugal | " | D | (2.9-3.5) | Stenner & Nickless (1975) |
| Sydney rock oyster *Crassostrea commercialis* | Tasmania | " | W | 0.0 | Ratkowsky et al. (1974) |
| " " | New South Wales | " | W | (0.1-1.0)0.2 | Mackay et al. (1975a) |
| Pacific oyster *Crassostrea gigas* | Tasmania | " | W | (0.0-30.69) | Ratkowsky et al. (1974) |
| " " | U.S. Pacific coast | " | W | (0.20-2.10) 1.14 | Pringle et al. (1968) |
| " " | Washington coast | " | W | (0.80-1.40) | " |
| " " | California (not polluted) | " | W | (0.8-1.0) | Ayling (1973) |
| " " | California (polluted) | " | W | (14.0-27.0) | " |

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|---|---|---|---|---|---|
| Pacific oyster *Crassostrea gigas* | South Africa | soft parts | D | 9.0 | Watling & Watling (1976b) |
| " " | " " | " | D | (3.7-9.0) | " (1976a) |
| " " | Great Britain | " | D | (2.0-27.0) | Thornton et al. (1976) |
| " " | Great Britain (polluted) | " | D | (6.0-40.0) 32.0 | Boyden & Romeril (1974) |
| " " | Tasmania Derwent estuary | " | W | (10.1-31.7) (means) | Thrower & Eustace (1973) |
| " " | Tasmania (Tamar estuary) | " | W | (2.3-14.6) (means) | " |
| " " | Tasmania | " | W | ( 2.0-5.7) (means) | " |
| " " | Great Britain (polluted) | " | W | (1.8-3.8) | Darracott & Watling (1975) |
| " " | " " " " | " | D | (14.1-26.1) | " |
| " " | Great Britain (not polluted) | " | W | (0.2-0.3) | " |
| " " | " " " " | " | D | (1.6-2.2) | " |
| " " | " " " " | whole | W | 0.8 | " |
| " " | " " " " | gill | W | (1.3-1.7) | " |
| " " | " " " " | mantle | W | (0.8-1.6) | " |
| New Zealand oyster *Crassostrea glomerata* | New Zealand | soft parts | W | (0.55-0.75 | Nielsen (1975) |
| " " | " " | " | W | (0.12-5.0) 1.3 | Nielsen & Nathan (1975) |

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|---|---|---|---|---|---|---|
| Oyster *Crassostrea margaritacea* | | South Africa Krysna | soft parts | D | 2.5 | Watling & Watling (1976a) |
| " | " | South Africa Langebaan Lagoon | " | D | 7.0 | " |
| Atlantic oyster *Crassostrea virginica* | | (exposed to 0.1 ppm Cd in sea-water, died in 16 weeks) | " | W | (118.2-122.5) | Schuster & Pringle (1969) |
| " | " | (exposed to 0.2 ppm Cd in sea-water, died in 15 weeks) | " | W | (96.5-125.8) | " |
| " | " | (control in flow-through seawater) | " | W | (0.21-3.43) | " |
| " | " | United States | " | W | (3.0-3.66) | Schroeder & Balassa (1961) |
| " | " | Connecticut | " | W | (0.0-43.0) 7.91 | Roberts et al. (1975) |
| " | " | " | " | W | (0.0-9.6) | " |
| " | " | " | " | D | (15.6-28.1) | Greig et al. (1975) |
| " | " | Rhode Island (in 0.01 ppm Cd seawater 21 days) | " | A | 52.1 | Eisler et al. (1972) |
| " | " | " " " " | " | W | 1.49 | " |
| " | " | Rhode Island (control) | " | A | 9.3 | " |
| " | " | " " " | " | W | 0.33 | " |
| " | " | Rhode Island (at emetic threshold of over 0.01 ppm Cd) | " | W | (13.0-15.0) | " |

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|---|---|---|---|---|---|---|
| Atlantic oyster *Crassostrea virginica* | | New England (control) | soft parts | D | 7.18±SE 0.52 | Valiela et al. (1974) |
| " | " | New England (light sewage sludge) | " | D | 8.60±SE 0.49 | " |
| " | " | New England (heavy sewage sludge) | " | D | 9.45±SE 0.51 | " |
| " | " | Chesapeake Bay | " | | (<0.6->2.5) | Bender et al. (1972) |
| " | " | Maine to N. Carolina | " | W | (0.10-7.80) 3.10 | Pringle et al. (1968) |
| " | " | N.W. Atlantic | " | D | (1.0-7.7) 2.4 | Windom & Smith (1972b) |
| " | " | Mobile Bay | " | W | (<0.05-1.61) 0.62 | Kopfler & Mayer (1973) |
| " | " | Florida | " | W | 0.2 | Nielsen (1975) |
| " | " | U.S. Atlantic coast | " | W | (0.08-7.78) 2.40 | Schuster & Pringle (1969) |
| " | " | " " " | " | W | (3.1-7.8) | Schroeder (1974) |
| " | " | Gulf of Mexico | " | W | (0.88-2.6) | " |
| " | " | Chesapeake Bay | " | W | (0.375-1.29) 0.621±0.317 | Zook et al. (1976) |
| " | " | Massachusetts | " | W | 0.78±0.48 | Roberts et al. (1975) |
| " | " | Long Island | " | W | (1.6-2.37) 2.06±0.023 | Zook et al. (1976) |
| " | " | Texas | " | W | (0.05-4.1) | Roberts et al. (1975) |

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|---|---|---|---|---|---|
| Atlantic oyster<br>Crassostrea virginica | Texas | shell | D | 0.1 | Smith & Wright (1962) |
| " " | " | soft parts | D | (2.4-40.0) | Sims & Presley (1976) |
| " " | E. United States | " | | (<0.6-2.5) | Huggett et al. (1973) |
| Atlantic slipper shell<br>Crepidula fornicata | Great Britain | | D | (0.69-1.4) | Leatherland & Burton (1974) |
| Crepidula sp. | San Diego Bay | | W | (1.1-4.7)<br>2.6 | Seba (undated) |
| Donax vittatus | Spain & Portugal | | D | (ND-1.3) | Stenner & Nickless (1975) |
| Razor clam<br>Ensis arcuatus | " | | D | 0.3 | " |
| Clam<br>Fusconaia flava | Illinois | soft parts | W | (0.36-1.17)<br>0.69 | Mathis & Cummings (1973) |
| Top shell<br>Gibbula cineraria | Spain & Portugal | | D | 5.0 | Stenner & Nickless (1975) |
| Top shell<br>Gibbula lineata | " | | D | 6.2 | " |
| Top shell<br>Gibbula umbilicalis | Great Britain | shell | D | 0.029 | Mullin & Riley (1956) |
| " " | " " | soft parts | D | 0.829 | " |
| " " | Spain & Portugal | " | D | (3.6-7.8) | Stenner & Nickless (1975) |

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|---|---|---|---|---|---|
| *Glycymeris glycymeris* | Great Britain | soft parts | D | 3.3 | Segar et al. (1971) |
| *Goniobasis sp.* | Illinois | " | D | 2.19±0.37 | Anderson (1977) |
| Abalone *Haliotis corrugata* | California | muscle | W | (0.28-0.31) | Vattuone et al. (1976) |
| " " | " | digestive gland | W | (50.6-82.2) | " |
| Abalone, paua *Haliotis iris* | New Zealand | soft parts | W | (0.09-0.24) 0.17 | Nielsen & Nathan (1975) |
| Red abalone *Haliotis rufescens* | California | gill | D | (3.5-20.0) means | Anderlini (1974) |
| " " | " | mantle | D | (2.8-12.8) means | " |
| " " | " | digestive gland | D | (183.6-1162.7) means | " |
| " " | " | digestive gland (max.) | D | 1400.0 | " |
| " " | " | foot | D | (0.17-0.31) means | " |
| Snail *Helix aspersa* | Great Britain (not polluted) | albumin | D | 0.24±SE 0.07 | Coughtrey & Martin (1976) |
| " " | " " " | gonad | D | 0.26±SE 0.02 | " |
| " " | " " " | collar | D | 0.24±SE 0.05 | " |
| " " | " " " | skin | D | 0.11±SE 0.06 | " |
| " " | " " " | foot | D | 0.5±SE 0.06 | " |
| " " | " " " | kidney | D | 0.16±SE 0.06 | " |
| " " | " " " | crop | D | 0.86±SE 0.01 | " |
| " " | " " " | digestive gland | D | 2.36±SE 0.19 | " |

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|---|---|---|---|---|---|
| Snail<br>Helix aspersa | Great Britain<br>(polluted area) | (total) | D | 64.71±SE | Coughtrey & Martin (1976) |
| " " | " " " | albumin | D | 0.96±SE 0.41 | " |
| " " | " " " | gonad | D | 5.04±SE 0.65 | " |
| " " | " " " | collar | D | 5.35±SE 1.25 | " |
| " " | " " " | skin | D | 6.99±SE 1.04 | " |
| " " | " " " | foot | D | 12.35±SE 1.47 | " |
| " " | " " " | kidney | D | 82.63±SE 8.91 | " |
| " " | " " " | crop | D | 115.86±SE 28.53 | " |
| " " | " " " | digestive gland | D | 198.45±SE 23.92 | " |
| " " | (non-polluted area) | (total) | D | 6.04±SE 0.64 | " |
| " " | | | A | 300.0 | Webb (1937) |
| Rock scallop<br>Hinnites multirugosus | California<br>Anacapa Isl. | muscle | W | (0.32-0.79)<br>0.51±SD 0.12 | Vattuone et al. (1976) |
| " " | " | kidney | W | (3.8-16.6)<br>10.1±SD 3.6 | " |
| " " | " | digestive gland & stomach | W | (123.0-288.0)<br>211.0±SD 51.9 | " |
| " " | California<br>Santa Barbara Isl. | muscle | W | (0.26-0.68)<br>0.35±SD 0.12 | " |
| " " | " | soft parts | W | (1.8-46.8)<br>31.2±SD 15.2 | " |
| " " | " | viscera | W | (2.5-69.4)<br>46.3±SD 22.6 | " |
| Lampsilis sp. | Illinois | soft parts | D | 2.23±0.27 | Anderson (1977) |

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|---|---|---|---|---|---|
| *Lasmigona sp.* | Illinois | soft parts | D | 1.43 | Anderson (1977) |
| Sea snail *Liparis liparis* | Great Britain | " | D | 16.8±SD 0.87 | Hardisty et al. (1974a) |
| " " | " " | " | D | (13.7-16.8) | " (1974b) |
| Periwinkle *Littorina littoralis* | Norway | " | D | (0.0-12.5) | Stenner & Nickless (1974a) |
| " " | Norway (near metal smelter) | " | D | 20.0 | " |
| " " | Great Britain | " | D | 3.54 | Mullin & Riley (1956) |
| " " | Great Britain Severn Beach | " | D | 178.0 | Leatherland & Burton (1974) |
| Periwinkle *Littorina littorea* | Great Britain | shell | D | 0.012 | Mullin & Riley (1956) |
| " " | " " | soft parts | D | 1.84 | " |
| " " | | " | A | 10.0 | Webb (1937) |
| " " | Scotland coast | " | W | (0.03-0.5) 0.2 | Topping (1973b) |
| " " | Great Britain | " | D | (0.94-1.5) | Leatherland & Burton (1974) |
| " " | " " | " | D | (8.0-75.0) | Nickless et al. (1972) |
| " " | Great Britain Severn estuary (polluted) | " | D | (100.0-520.0) | Butterworth et al. (1972) |

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|---|---|---|---|---|---|
| Periwinkle<br>Littorina littorea | Great Britain | soft parts | W | (0.25-1.93) | Wharfe & Van Den Broek (1977) |
| Periwinkle<br>Littorina littorina | " " | " | D | (15.0-210.0) | Butterworth et al. (1972) |
| " " | Irish Sea | " | W | (2.0-15.0) | Nickless et al. (1972) |
| Periwinkle<br>Littorina saxatilis | Norway | " | D | 6.0 | Stenner & Nickless (1974a) |
| Squid<br>Loligo opalescens | Central California | liver | D | (22.6-265.5)<br>85.0±51.6 | Martin & Flegal (1975) |
| " " | S. California | " | D | (33.0-233.1)<br>121.5±57.9 | " |
| Squid<br>Loliguncula brevis | N.W. Atlantic | | D | (0.5-0.7)0.6 | Windom (1972) |
| Macoma<br>Macoma nasuta | Los Angeles harbor | | D | (0.9-1.0) | Emerson et al. (1976) |
| Hard shell clam, quahog<br>Mercenaria mercenaria | New England (control) | soft parts | D | 1.25±SE 0.12 | Valiela et al. (1974) |
| " " | New England (light sewage sludge) | " | D | 2.18±SE 0.13 | " |
| " " | New England (heavy sewage sludge) | " | D | 2.08±SE 0.12 | " |
| " " | U.S. coasts | " | W | (0.10-0.73)<br>0.19 | Pringle et al. (1968) |
| " " | Carolina coast | " | W | (0.1-0.73)<br>0.19 | Ronk (1971) |

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|---|---|---|---|---|---|
| Hard shell clam, quahog<br>*Mercenaria mercenaria* | N. W. Atlantic | soft parts | D | (0.2-1.2)0.7 | Windom (1972) |
| " " | Massachusetts | " | W | 0.26±0.31 | Roberts et al. (1975) |
| " " | Great Britain | " | D | 2.1 | Segar et al. (1971) |
| " " | Virginia | | W | (0.098-0.159) | Zook et al. (1976) |
| | Chincoteague | " | | 0.122±0.02 | |
| Machas<br>*Mesodesma donacium* | Peru | | | (0.32-0.78)<br>0.55 | Echegaray (1974) |
| Ribbed mussel<br>*Modiolus modiolus* | Great Britain | " | D | 5.8 | Segar et al. (1971) |
| Black mussel<br>*Modiolus neozelanicus* | New Zealand | " | W | 0.04 | Nielsen & Nathan (1975) |
| Softshell clam<br>*Mya arenaria* | Chesapeake | | W | (0.059-0.293) | Zook et al. (1976) |
| | Bay | " | | 0.184±0.082 | |
| " " | Eastern United States | " | W | (0.10-0.90)<br>0.27 | Pringle et al. (1968) |
| " " | Massachusetts | " | W | 0.30±0.33 | Roberts et al. (1975) |
| " " | Oregon coast | " | W | 0.029±0.018 | Caldwell & Buhler (1976) |
| Ocean mussel<br>*Mytilus californianus* | California | " | W | (1.43-2.63)<br>1.88±SD 0.44 | Vattuone et al. (1976) |
| " " | " | " | D | (2.0-4.9)3.1 | Graham (1972) |
| " " | " | shell | D | (<2.5-9.2)4.7 | " |

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|---|---|---|---|---|---|
| Common mussel *Mytilus edulis* | Great Britain | shell | D | 0.003 | Mullin & Riley (1956) |
| " " | " " | soft parts | D | 3.21 | " |
| " " | Norway | " | D | (1.9-29.0) | Stenner & Nickless (1974a) |
| " " | Norway (near metal smelter) | " | D | 140.0 | " |
| " " | Irish Sea | " | W | (0.8-12.0) | Nickless et al. (1972) |
| " " | " " | " | D | (0.4-60.0) | " |
| " " | Great Britain | " | D | 2.5 | Leatherland & Burton (1974) |
| " " | Scotland | " | W | (0.1-0.93) 0.33 | Topping (1973b) |
| " " | " | " | | 2.0 | " |
| " " | Irish Sea | " | D | 5.1 | Segar et al. (1971) |
| " " | " " | " | W | 0.57 | " |
| " " | California | " | D | (3.1-6.8)5.0 | Graham (1972) |
| " " | " | shell | D | (<2.5-5.8)4.6 | " |
| " " | W. Greenland | | W | (<0.4-0.9) | Bollingberg (1975) |
| " " | Great Britain | soft parts | W | (0.55-1.50) | Wharfe & Van Den Broek (1977) |
| Mussel *Mytilis edulis aotaenus* | New Zealand Tasman Bay | " | D | (<10.0-<20.0) | Brooks & Rumsby (1965) |

| | | | | | |
|---|---|---|---|---|---|
| Mussel *Mytilis edulis aotaenus* | Australia | soft parts | D | (0.51-2.95) | Shapiro (1975) |
| " " " | Tasmania | " | W | 5.5 | Eustace (1974) |
| " " " | Australia (polluted bay) | " | D | (2.8-83.0) | Talbot et al. (1976) |
| " " " | New Zealand | " | W | (0.26-1.6) 0.63 | Nielsen & Nathan (1975) |
| Mussel *Mytilis galloprovincialis* | Mediterranean | " | D | 3.94 | Fowler & Benayoum (1974) |
| " " | " | " | W | 1.3 | " |
| " " | | shell | D | 5.41 | " |
| " " | | " | W | 1.78 | " |
| " " | | mantle | D | 1.26 | " |
| " " | | " | W | 0.42 | " |
| " " | | gill | D | 1.21 | " |
| " " | | " | W | 0.4 | " |
| " " | | viscera | D | 1.44 | " |
| " " | | " | W | 0.48 | " |
| " " | | muscle | D | 2.08 | " |
| " " | | " | W | 0.95 | " |
| " " | N.W. Mediterranean | soft parts | D | (0.4-5.9)1.9 | Fowler & Oregioni (1976) |
| Mussel *Mytilis viridis* | Thailand | " | W | 0.38 | Huschenbeth & Harms (1975) |
| Mud snail *Nassarius fossatus* | Los Angeles harbor | | D | 2.3 | Emerson et al. (1976) |

| | | | | | |
|---|---|---|---|---|---|
| Squid<br>Notodarius gouldi | Tasmania | | W | <0.05 | Eustace (1974) |
| Dog whelk<br>Nucella lapillus<br>(=Thais lapillus) | Great Britain | shell | D | 0.082 | Mullin & Riley (1956) |
| " " | " " | | D | 37.9 | " |
| " " | " " | soft parts | W | (31.0-72.5) | Nickless et al. (1972) |
| " " | Great Britain Severn estuary (polluted) | " | D | (62.0-425.0) | Butterworth et al. (1972) |
| " " | Great Britain | " | D | 73.0 | Segar et al. (1971) |
| " " | Great Britain (polluted area) | " | W | (16.3-39.0) | Peden et al. (1973) |
| " " | Great Britain (control) | " | W | 2.2 | " |
| " " | Norway | | D | (13.0-39.0) | Stenner & Nickless (1974a) |
| " " | Great Britain | " | D | 21.0 | Leatherland & Burton (1974) |
| " " | Great Britain (clean water) | " | D | (11.0-62.0)<br>36.0±SD 14.0 | Stenner & Nickless (1974b) |
| " " | (transplanted to polluted Bristol Channel) 1 mo. | " | D | (44.0-93.0)<br>63.0±SD 18.0 | " |
| " " | " " " 5 mo. | " | D | (167.0-243.0)<br>211.0±SD 27.0 | " |
| " " | Great Britain Bristol Channel (polluted) | " | D | (500.0-1,120.0)<br>780.0±SD 200.0 | " |

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|---|---|---|---|---|---|
| Dog whelk<br>Nucella lapillus | Great Britain Bristol Channel (polluted) | soft parts | D | (31.0-725.0) | Nickless et al. (1972) |
| Octopus<br>Octopus vulgaris | N.W. Atlantic | | D | 0.5 | Windom (1972) |
| " " | " " | | W | 0.12 | " |
| " " | Spain & Portugal | leg | D | 8.0 | Stenner & Nickless (1975) |
| Octopus<br>Octopus sp. | Tasmania | | W | <0.05 | Eustace (1974) |
| Herbivorous gastropod<br>Olivella biplacata | California | soft parts | D | (2.3-4.2) | Schwimer (1973) |
| " " | " | shell | D | 0.2±0.4 | " |
| Squid<br>Ommastrephes illecebrosa | N. W. Atlantic | | A | 500.0 | Nicholls et al. (1959) |
| Squid<br>Ommastrephes bartrami | Pacific Ocean | liver | D | (71.0-694.0)<br>287.0±202.0 | Martin & Flegal (1975) |
| Pacific oyster<br>Ostrea angasi | Tasmania | soft parts | W | (0.24-18.65) | Ratkowsky et al. (1974) |
| " " | Tasmania | " | W | 10.7 | Eustace (1974) |
| " " | " | " | W | (<2.0-2.5) | Thrower & Eustace (1973) |
| " " | Tasmania (polluted estuaries) | " | W | 18.7±SD 4.2 | " |
| " " | Australia (polluted bay) | " | D | (35.5-174.3) | Talbot et al. (1976) |

| | | | | | |
|---|---|---|---|---|---|
| Oyster *Ostrea edulis* | Great Britain | soft parts | W | 1.2 | Portmann & Yardley (1972) |
| " " | " " | " | D | (3.0-5.0) | Watling & Watling (1976a) |
| " " | South Africa | " | D | 3.1 | " |
| " " | Great Britain | " | W | 0.5 | Darracott & Watling (1975) |
| " " | " " | " | D | 3.2 | " |
| Dredge oyster *Ostrea lutaria* | New Zealand Tasman Bay | " | W | 6.0 | Brooks & Rumsby (1965) |
| " " | " " " | " | D | 35.0 (max.) | " |
| " " | " " " | " | W | (0.12-9.0) | Nielsen (1975) |
| " " | Foveaux Strait & Stewart Is. | " | W | (1.40-7.90) 5.75 | " |
| " " | " " " | " | D | (8.7-49.6) | " |
| " " | New Zealand | " | W | (0.12-7.9) 3.9 | Nielsen & Nathan (1975) |
| Oyster *Ostrea sinuata* | New Zealand (control) | " | D | 23.0 | Brooks & Rumsby (1967) |
| " " | " " " | muscle | D | <10.0 | " |
| " " | " " " | gill | D | <10.0 | " |
| " " | " " " | visceral mass | D | 12.0 | " |
| " " | " " " | mantle | D | <10.0 | " |
| " " | " " " | heart | D | 36.0 | " |

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|---|---|---|---|---|---|
| Oyster<br>Ostrea sinuata | New Zealand (100 hrs. in 50 ppm Cd seawater) | soft parts | D | 100.0 | Brooks & Rumsby (1967) |
| " " | " " " | white muscle | D | 53.0 | " |
| " " | " " " | striated muscle | D | 25.0 | " |
| " " | " " " | gill | D | 360.0 | " |
| " " | " " " | visceral mass | D | 141.0 | " |
| " " | " " " | mantle | D | 83.0 | " |
| " " | " " " | heart | D | 285.0 | " |
| " " | New Zealand (normal) | soft parts | D | (<10.0-43.0) 35.0 | Brooks & Rumsby (1965) |
| " " | New Zealand Tasman Bay | muscle | D | 207.0 | " |
| " " | " | gill | D | 20.0 | " |
| " " | " | striated muscle | D | 97.0 | " |
| " " | " | visceral mass | D | 61.0 | " |
| " " | " | kidney | D | 118.0 | " |
| " " | " | heart | D | 154.0 | " |
| " " | " | shell | D | 20.0 | " |
| Pipi<br>Paphies australis | New Zealand | soft parts | W | (0.12-0.14) 0.13 | Nielsen & Nathan (1975) |
| Tuatua<br>Paphies subtriangulata | " " | " | W | (0.29-0.34)0.29 | " |

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|---|---|---|---|---|---|
| Toheroa *Paphies ventricosa* | New Zealand | soft parts | W | (0.07-0.17) 0.11 | Nielsen & Nathan (1975) |
| European limpet *Patella vulgata* | Great Britain | " | D | 16.4 | Mullin & Riley (1956) |
| " " | Great Britain (polluted) | " | D | (30.0-550.0) | Butterworth et al. (1972) |
| " " | " " " | " | W | (10.3-118.5) | Peden et al. (1973) |
| " " | Great Britain Somerset coast, Devon (control) | " | W | 2.0 | " |
| " " | Great Britain (from Watchet) | soft parts | W | (46.5-78.0) | " |
| " " | " " " | shell | W | (2.7-3.3) | " |
| " " | Great Britain Severn estuary | soft parts | D | (30.0-550.0) | Butterworth et al. (1972) |
| " " | Great Britain | " | D | (9.0-500.) | Nickless et al. (1972) |
| " " | Irish Sea | " | D | (2.8-35.0) | Preston et al. (1972) |
| " " | " " | " | D | 31.0 | Segar et al. (1971) |
| " " | " " | " | W | 5.5 | " |
| " " | Great Britain | " | D | (62.0-425.0) | Butterworth et al. (1972) |
| " " | " " | " | D | (2.7-8.1) | Leatherland & Burton (1974) |

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|---|---|---|---|---|---|
| Limpet *Patella vulgaris* (?) | Norway | soft parts | D | (15.0-17.0) | Stenner & Nickless (1974a) |
| Limpet *Patella sp.* | Great Britain | " | D | 4.4 | Dutton et al. (1973) |
| " " | " " | | D | 11.0 | Stenner & Nickless (1974b) |
| " " | Great Britain (unpolluted) | | D | (3.5-28.0) 11.0 | " |
| " " | (transplanted to polluted Bristol Channel 3 mo.) | | D | (100.0-300.0) 200.0 | " |
| " " | Bristol Channel (local specimens) | | D | (67.0-440.0) 220.0 | " |
| Scallop *Pecten maximus* | Great Britain | shell | D | 0.001 | Mullin & Riley (1956) |
| " " | " " | gill | D | 8.5 | " |
| " " | " " | gonad | D | 0.79 | " |
| " " | " " | muscle | D | (1.86-1.95) | " |
| " " | " " | foot | D | 6.3 | " |
| " " | " " | digestive gland | D | 532.0 | " |
| " " | " " | mantle | D | 5.8 | " |
| " " | " " | renal organ | D | 152.0 | " |
| " " | " " | liver | A | (500.0-2,000.0) | Vinogradov (1953) |
| " " | Scotland | | W | (0.55-1.03) 0.77 | Topping (1973b) |

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|---|---|---|---|---|---|---|
| Scallop *Pecten maximus* | Great Britain | soft parts | D | 32.5 | | Bryan (1973) |
| " " | " " | " | W | 4.1 | | " |
| " " | " " | kidney | D | 79.0 | | " |
| " " | " " | " | W | 15.5 | | " |
| " " | " " | digestive gland | D | 321.0 | | " |
| " " | " " | " | W | 91.7 | | " |
| " " | " " | soft parts | D | 13.0 | | " |
| " " | " " | " | W | 0.37 | | " |
| Scallop *Pecten novaezelandiae* | New Zealand | " | W | (0.14-0.28) 0.18 | | Nielsen & Nathan (1975) |
| " " | " " | stomach | W | (15.0-329.0) 137.0 | | " |
| " " | " " | gonad | W | (0.59-2.4) | 1.5 | " |
| " " | " " | adductor muscle | W | (0.20-0.82) | 0.51 | " |
| " " | " " | soft parts | D | (210.0-299.0) 249.0 | | Brooks & Rumsby (1965) |
| " " | " " | mantle | D | <20.0 | | " |
| " " | " " | gill | D | <20.0 | | " |
| " " | " " | muscle | D | <20.0 | | " |
| " " | " " | foot | D | <20.0 | | " |
| " " | " " | visceral mass | D | 2,000.0 | | " |
| " " | " " | gonad | D | <20.0 | | " |
| " " | " " | shell | D | <20.0 | | " |

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|---|---|---|---|---|---|
| Green-lipped mussel<br>*Perna canaliculus* | New Zealand | soft parts | W | (0.10-1.0)<br>0.30 | Nielsen & Nathan (1975) |
| South African brown mussel<br>*Perna perna* | South Africa | | W | 0.29 | Darracott & Watling (1975) |
| Pond snail<br>*Physa sp.* | Illinois | soft parts | D | 2.97±0.44 | Anderson (1977) |
| Giant scallop<br>*Placopecten magellanicus* | New York Sound | | W | (0.04-0.234)<br>0.136±0.053 | Zook et al. (1976) |
| " " | Delaware (ocean dump site, polluted) | | D | (10.1-59.3)<br>20.9±6.8 | Pesch et al. (1977) |
| *Pleurobranchus plumula* | | | A | 400.0 | Webb (1937) |
| *Pleurocera sp.* | Illinois | soft parts | D | 2.31±0.03 | Anderson (1977) |
| *Polineces duplicata* | N.W. Atlantic | | D | (0.1-0.3)<br>0.2 | Windom & Smith (1972b) |
| *Polineces lewisii* | California | soft parts | D | (0.3-1.6) | Schwimer (1973) |
| " " | " | anterior shell | D | 1.4±1.9 | " |
| " " | " | posterior shell | D | 1.1±1.6 | " |
| Burrowing clam<br>*Protothaca staminea* | " | soft parts | D | 5.7±SD 0.2 | Graham (1972) |
| " " | " | shell | D | 2.9±SD 0.1 | " |
| *Purpura lapillus* | | | A | 300.0 | Webb (1937) |

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|---|---|---|---|---|---|
| Clam<br>Quadrula quadrula | Illinois | soft parts | W | (0.31-1.37)<br>0.56 | Mathis & Cummings (1973) |
| Clam<br>Rangia cuneata | Texas | " | D | 0.5 | Sims & Presley (1976) |
| Almejas<br>Semele solida | Peru | | | 0.45 | Echegaray (1974) |
| Cuttlefish<br>Sepia officinalis | Great Britain | gill | D | 0.11 | Leatherland & Burton (1974) |
| " " | " " | mantle | D | 0.03 | " |
| Solen marginatus | Spain & Portugal | | D | 0.9 | Stenner & Nickless (1975) |
| Sphaerium sp. | Illinois | soft parts | D | 1.99±0.19 | Anderson (1977) |
| Surf clam<br>Spisula solida | Spain & Portugal | | D | 0.7 | Stenner & Nickless (1975) |
| Surf clam<br>Spisula solidissima | Maryland | heart & tongue | W | (0.0-0.098)<br>0.061±0.03 | Zook et al. (1976) |
| " " | E. United States | muscle | W | <0.25 | Greig et al. (1977b) |
| Surf clam<br>Spisula subtruncata | Spain & Portugal | | D | (2.9-9.4) | Stenner & Nickless (1975) |
| Spider snail<br>Strombus pugilis | Puerto Rico | shell | W | (4.2-4.6) | Lowman (1966) |
| " " | " " | muscle | W | (0.16-0.18) | " |

| | | | | | |
|---|---|---|---|---|---|
| Spider snail<br>*Strombus pugilis* | Puerto Rico | muscle | D | (0.66-0.81) | Lowman (1966) |
| " " | " " | soft parts | W | (0.11-0.22) | |
| " " | " " | " | D | (0.73-1.4) | " |
| " " | " " | " | W | (0.18-0.32) | " |
| " " | " " | " | D | (1.1-1.4) | " |
| Clam<br>*Strophitus sp.* | Illinois | " | D | 2.52 | Anderson (1977) |
| Squid<br>*Symplectoteuthis oualaniensis* | Pacific Ocean | liver | D | (427.0-1,106.0)<br>782.0±255.0 | Martin & Flegal (1975) |
| Short-necked clam<br>*Tapes philippinarum* | Japan | soft parts | D | (0.474-0.832) | Ishio et al. (1973) |
| Little-neck clam<br>*Tapes semidecussata* | California | " | D | 9.6±SD 1.4 | Graham (1972) |
| " " | " | shell | D | 9.6±SD 1.4 | " |
| *Tegula funebralis* | " | soft parts | D | (<0.1-4.8) | " |
| " " | " | shell | D | (<2.5-9.7) | " |
| Dog whelk (carocal)<br>*Thais chocolata* | Peru | | | (0.09-7.9)<br>2.2 | Echegaray (1974) |
| Dog whelk<br>*Thais emarginata* | California | soft parts | D | 13.5±SD 0.1 | Graham (1972) |
| " " | " | shell | D | (<2.5-3.3) | " |
| *Thracia distorta* | Spain & Portugal | | D | ND | Stenner & Nickless (1975) |

| | | | | | |
|---|---|---|---|---|---|
| *Venus striatula* | Spain & Portugal | | D | (1.2-7.7) | Stenner & Nickless (1975) |
| *Venerupis decussata* | " | | D | 1.6 | " |
| *Venerupis rhomboides* | " | | D | (2.8-3.7) | " |
| "Cuttlefish" | Japan | edible parts | W | 0.12-0.18 | Yamagata & Shigematsu (1970) |
| "Octopus" | " | " | W | <0.01 | " |
| "Clam" | " | " | W | 0.16 | " |

## CADMIUM IN ARTHROPODA[1]

### CRUSTACEA

| Species | Locality | Tissue | Analysis[2] PPM | | Authority |
|---|---|---|---|---|---|
| Decapod | | | | | |
| *Acanthonephyra eximea* | N.W. Africa | | D | 3.0 | Leatherland et al. (1973) |
| Copepod | | | | | |
| *Acartia clausi* | Greece | whole | D | (0.49-0.84) 0.61±0.07 | Zafiropoulos & Grimanis (1977) |
| Amphipod | | | | | |
| *Amphipoda sp.* | Norway | | D | (5.1-8.8) | Stenner & Nickless (1974a) |
| Sowbug | | | | | |
| *Asellus aquaticus* | Sweden | | D | (0.88-6.3) | Ljunggren et al. (1971) |
| Sowbug | | | | | |
| *Asellus sp.* | Illinois | whole | D | 2.62±0.66 | Anderson (1977) |
| Acorn barnacle | | | | | |
| *Balanus amphitrites* | Spain & Portugal | | D | (10.8-12.1) | Stenner & Nickless (1975) |
| Common barnacle | | | | | |
| *Balanus balanoides* | Great Britain | | D | (0.146-0.148) | Mullin & Riley (1956) |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

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|---|---|---|---|---|---|
| Barnacle<br>*Balanus perforatus* | Spain & Portugal | | D | (4.5-5.8) | Stenner & Nickless (1975) |
| Ghost shrimp<br>*Callianassa californiensis* | Los Angeles harbor | | D | (0.7-1.9) | Emerson et al. (1976) |
| Blue crab<br>*Callinectes sapidus* | N.W. Atlantic | | D | (0.2-0.6)<br>0.4 | Windom (1972) |
| " " | S. Florida | | W | 0.42 | Ogden et al. (1974) |
| " " | Gulf of Mexico | | | (0.06-0.63) | Roberts et al. (1975) |
| " " | Texas | whole | D | 0.1 | Sims & Presley (1976) |
| " " | Chesapeake Bay | muscle | W | (0.02-0.158)<br>0.101±SD 0.047 | Zook et al. (1976) |
| Crayfish<br>*Cambarus sp.* | Illinois | whole | D | 1.74±0.05 | Anderson (1977) |
| Rock crab<br>*Cancer irroratus* | E. United States | muscle | W | (0.08-1.0) | Greig et al. (1977b) |
| " " | " " " | digestive gland | W | (1.1-4.8) | " |
| " " | " " " | gill | W | (0.65-2.7) | " |
| " " | New York Bight | larvae | D | (1.2-2.6) | " (1977a) |
| Dungeness crab<br>*Cancer megister* | Oregon | | W | 0.023±0.007 | Caldwell & Buhler (1976) |
| Crab<br>*Cancer pagurus* | Great Britain | muscle | D | 0.153 | Mullin & Riley (1956) |

| | | | | | |
|---|---|---|---|---|---|
| Crab<br>Cancer pagurus | N.W. Atlantic | | W | (0.03-3.42) | Windom (1972) |
| " " | Great Britain | whole | W | 0.36±SD 0.42 | Wright (1976) |
| " " | " " | muscle | | (0.02-8.6) | Reynolds & Reynolds (1971) |
| " " | " " | muscle (male) | | (0.17-8.2) | " |
| " " | " " | muscle (female) | | (2.1-9.7) | " |
| " " | Scotland | muscle | W | (3.60-13.0) | Topping (1973a) |
| " " | " | all organs | W | (<0.2-2.1) | " (1973b) |
| " " | Great Britain North Devon | | W | 5.0 | Peden et al. (1973) |
| Coastal green crab<br>Carcinus maenas | Norway | | D | (1.9-6.9) | Stenner & Nickless (1974a) |
| " " | " | | D | <1.0 | Lande (1977) |
| " " | Great Britain Somerset Coast (polluted) | | W | (14.3-33.1) | Peden et al. (1973) |
| " " | Great Britain (after 7 wks. cleansing) | | W | 16.7 | " |
| " " | Great Britain | carapace | W | 2.63±SD 0.40 | Wright (1976) |
| " " | " " | gill | W | 0.63±SD 0.49 | " |
| " " | " " | muscle | W | 0.51±SD 0.18 | " |
| " " | " " | hepato-pancreas | W | 1.02±SD 0.62 | " |

| | | | | | |
|---|---|---|---|---|---|
| Coastal green crab<br>Carcinus maenas | Great Britain | gonad | W | 0.92±SD 0.45 | Wright (1976) |
| " " | " " | whole | W | 0.98±SD 0.32 | " |
| " " | " " | " | W | (0.75-3.00) | Wharfe & Van Den Broek (1977) |
| Barnacle<br>Chthamalus stellatus | Spain & Portugal | | D | (5.1-6.3) | Stenner & Nickless (1975) |
| Stridulating hermit crab<br>Clibanarius strigimanus | Tasmania | | W | <0.05 | Eustace (1974) |
| Copepods (mixed spp.) | N.W. Atlantic | | D | (0.9-3.1)1.7 | Windom (1972) |
| Crab<br>Corystes cassivelaunus | Great Britain | | D | 0.149 | Mullin & Riley (1956) |
| Sand shrimp<br>Crangon vulgaris | " " | whole | D | (4.9-124.8) | Hardisty et al. (1974b) |
| " " | " " | " | W | 3.50±SD 2.10 | Wright (1976) |
| Mycidacid<br>Eucopia sculpticauda | N.W. Africa | | D | 2.0 | Leatherland et al. (1973) |
| Hermit crab<br>Eupagurus bernhardus | Spain & Portugal | | D | (2.9-7.9) | Stenner & Nickless (1975) |
| Hermit crab<br>Eupagurus sp. | Great Britain | | D | 1.31 | Mullin & Riley (1956) |
| Euphausiacea<br>Euphausia pacifica | Oregon | whole | W | (0.045-0.36) | Robertson et al. (1972) |
| " " | " | " | D | (0.33-2.8) | " |

| | | | | | |
|---|---|---|---|---|---|
| *Gammarus sp.* | Illinois | whole | D | <0.5 | Anderson (1977) |
| Red crab *Geryon quinquedens* | Middle Atlantic Bight | muscle | W | <0.1 | Greig et al. (1976) |
| " " | " " " | gill | W | 0.81 | " |
| American lobster *Homarus americanus* | Rhode Island (in 0.01 ppm Cd 21 days) | whole lobster | A | 5.4 | Eisler et al. (1972) |
| " " | " " " | " | W | 0.72 | " |
| " " | " " " | muscle | A | 11.7 | " |
| " " | " " " | " | W | 0.25 | " |
| " " | " " " | exo-skeleton | A | 4.4 | " |
| " " | " " " | " | W | 0.88 | " |
| " " | " " " | gill | A | 31.3 | " |
| " " | " " " | " | W | 0.87 | " |
| " " | Rhode Island (control) | viscera | A | 37.5 | " |
| " " | " " " | " | W | 1.21 | " |
| " " | " " " | whole lobster | A | 5.3 | " |
| " " | " " " | " | W | 0.51 | " |
| " " | " " " | muscle | A | 10.0 | " |
| " " | " " " | " | W | 0.2 | " |
| " " | " " " | exo-skeleton | A | 4.1 | " |
| " " | " " " | " | W | 0.59 | " |
| " " | " " " | gill | A | 17.2 | " |
| " " | " " " | " | W | 0.49 | " |

| | | | | | |
|---|---|---|---|---|---|
| American lobster<br>Homarus americanus | Rhode Island (control) | viscera | A | 33.8 | Eisler et al. (1972) |
| " " | " " " | " | W | 1.21 | " |
| " " | United States | | W | 0.25 | Schroeder & Balassa (1961) |
| " " | N.W. Atlantic | | D | (<0.1-0.5)<br><0.2 | Windom (1972) |
| European lobster<br>Homarus vulgaris | Scotland | tail | W | (0.02-0.20)<br>0.08 | Topping (1973b) |
| " " | " | liver | W | (3.60-8.75)<br>4.88 | " |
| " " | " | claw | W | (0.05-0.15)<br>0.11 | " |
| " " | " | gonad | W | (0.22-0.40)<br>0.30 | " |
| " " | " | gill | W | (1.25-4.15)<br>2.50 | " |
| " " | " | muscle | W | (<0.03-0.09) | " |
| Copepoda<br>Labidocera acutifrons | N.W. Africa | | D | 9.8 | Leatherland et al. (1973) |
| Leander serratus | Great Britain | whole | W | 2.80±SD 0.91 | Wright (1976) |
| Lysmata seticaudata | Mediterranean Sea | whole | W | 0.41 | Fowler & Benayoun (1974) |
| " " | " | " | D | 1.7 | " |
| " " | " | exo-skeleton | W | 0.76 | " |
| " " | " | " | D | 3.15 | " |
| " " | " | viscera | W | 0.91 | " |

| | | | | | |
|---|---|---|---|---|---|
| *Lysmata seticaudata* | Mediterranean Sea | viscera | D | 2.76 | Fowler & Benayoun (1974) |
| " " | " | muscle | W | 0.09 | " |
| " " | " | " | D | 0.39 | " |
| " " | " | eye | W | 0.42 | " |
| " " | " | " | D | 1.26 | " |
| " " | " | moult | W | 1.26 | " |
| " " | " | " | D | 5.46 | " |
| Freshwater prawn *Macrobrachium rosenbergii* | Thailand | | W | 0.06 | Eustace (1974) |
| " " | " | muscle | W | 0.15 | " |
| *Maia squinada* | Spain & Portugal | brown muscle | D | 0.46 | Stenner & Nickless (1975) |
| " " | " | white muscle, shell | D | 0.74 | " |
| " " | " | white muscle, leg | D | 0.69 | " |
| Euphausid *Meganyctiphanes norvegica* | N.W. Africa | | D | 0.25 | Leatherland et al. (1973) |
| Stone crab *Menippe mercenaria* | S. Florida | | W | (0.05-0.76) | Ogden et al. (1974) |
| Crab *Mursia gaudichaudii* | S. California | gonad | W | (0.2-18.1) 5.89±SE 2.17 | Fowler et al. (1975) |
| " " | " " | digestive gland | W | (0.2-38.4) 14.62±SE 4.8 | " |
| " " | " " | muscle | W | (0.6-1.0) 0.8±SE 0.19 | " |

| | | | | | |
|---|---|---|---|---|---|
| Lobster<br>Nephrops norvegicus | Spain & Portugal | head | D | (3.4-6.3) | Stenner & & Nickless (1975) |
| " " | " | muscle | D | 0.7 | " |
| " " | " | tail muscle | D | 3.3 | " |
| " " | " | head & soft parts | D | 32.0 | " |
| Decapod<br>Oplophorus sp. | N.W. Africa | | D | 13.0 | Leatherland et al. (1973) |
| Beach hopper<br>Orchestoidea californiana | California | whole body | D | (12.5-25.0) | Bender (1975) |
| Beach hopper<br>Orchestoidea corniculata | " | " | D | (12.5-25.0) | " |
| Crayfish<br>Orconectes sp. | Illinois | whole | D | $1.60 \pm 0.50$ | Anderson (1977) |
| Hermit crab<br>Pagurus bernhardus | Spain & Portugal | | D | (2.9-7.9) | Stenner & Nickless (1975) |
| Shrimp<br>Palaemon (Leander) adspersus | | | | trace | Petkevich & Stepanyuk (1970) |
| Shrimp<br>Palaemon elegans | Great Britain | | D | 0.31 | Leatherland & Burton (1974) |
| Pink shrimp<br>Pandalus borealis | Gulf of Mexico | | W | (0.0-0.2)<br>$0.069 \pm 0.066$ | Zook et al. (1976) |
| " " | Florida | | W | 0.09 | Ogden et al. (1974) |

| | | | | | |
|---|---|---|---|---|---|
| Prawn<br>*Pandalus jordanii* | Oregon | whole body | D | (0.18-0.96)<br>0.49 | Cutshall & Holton (1972) |
| " " | " | edible part | D | (0.23-1.06)0.62 | " |
| " " | " | " | D | (0.54-1.0)<br>0.82 | Robertson et al. (1972) |
| Spiny lobster<br>*Panulirus argus* | N.W. Atlantic | | W | 0.648 | Windom & Smith (1972b) |
| " " | " " | | D | 2.4 | " |
| Spiny lobster<br>*Panulirus borealis* | Florida | tail muscle | W | (0.059-0.233)<br>0.133±SD 0.054 | Zook et al. (1976) |
| Spiny lobster<br>*Panulirus interruptus* | S. California | muscle | W | (0.07-0.18) | Vattuone et al. (1976) |
| " " | " " | hepato-pancreas | W | (5.63-29.34) | " |
| Spiny lobster<br>*Panulirus sp.* | S. Florida | | W | (0.09-0.21) | Ogden et al. (1974) |
| " " | Atlantic Ocean | | W | 0.133±SD<br>0.054 | Zook et al. (1976) |
| King crab<br>*Paralithodes camschatica* | Alaska | leg muscle | W | (0.0-0.158)<br>0.072±SD 0.049 | " |
| " " | " | body muscle | W | (0.02-0.189)<br>0.121±SD 0.047 | " |
| Brown shrimp<br>*Penaeus aztecus* | Gulf of Mexico | | W | (0.0-0.119)<br>0.045±0.044 | Roberts et al. (1975) |
| " " | Texas | whole | D | <0.4 | Sims & Presley (1976) |

| | | | | | |
|---|---|---|---|---|---|
| Brown shrimp<br>*Penaeus aztecus* | Texas | muscle | D | (0.05-0.33)<br>0.16 | Horowitz & Presley (1977) |
| " " | " | exo-skeleton | D | (0.32-0.89)<br>0.50 | " |
| " " | " | viscera | D | (1.40-3.50)<br>2.55 | " |
| " " | " | | W | (0.0-0.119)<br>0.045±0.044 | Zook et al. (1976) |
| " " | | | W | (0.04-0.24)<br>0.09±SD 0.06 | Sidwell & Loomis (1976) |
| Blue leg king prawn<br>*Penaeus latisulcatus* | Thailand | | W | 0.19 | Huschenbeth & Harms (1975) |
| Prawn<br>*Penaeus merguiensis* | " | | W | 0.046 | " |
| Tiger prawn<br>*Penaeus monodon* | " | | W | (0.1-0.13) | " |
| Green tiger prawn<br>*Penaeus semisulcatus* | " | | W | 0.01 | " |
| White shrimp<br>*Penaeus setiferus* | Gulf of Mexico off Mississippi | | W | (0.056-0.112)<br>0.079±SD 0.022 | Zook et al. (1976) |
| " " | Florida | | W | (0.0-0.076)<br>0.049±SD 0.023 | " |
| " " | N.W. Atlantic | | | (<0.1-0.5)<br><0.2 | Windom & Smith (1972b) |
| " " | S.E. United States | | D | <0.2 | Windom (1972) |
| Shrimp<br>*Penaeus spp.* | United States | | W | 0.25 | Schroeder & Balassa (1961) |

| | | | | | |
|---|---|---|---|---|---|
| Copepod<br>*Pleuromamma xiphias* | Puerto Rico | | A | (8.0-36.0) | Martin (1970) |
| " " | " " | | W | (0.32-1.4) | " |
| " " | " " | | D | (2.7-12.0) | " |
| Crayfish<br>*Procambarus gracilis* | Indiana | tail | W | $0.11 \pm 0.05$ | Yost et al. (1974) |
| Crayfish<br>*Procambarus sp.* | Illinois | whole | D | $2.77 \pm 0.04$ | Anderson (1977) |
| Kelp crab<br>*Pugettia producta* | California | feces | A | (ND-3.2) | Booth & Knauer (1972) |
| Decapos<br>*Systellaspis debilis* | N.W. Africa | | D | 13.0 | Leatherland et al. (1973) |
| Fiddler crab<br>*Uca pugilator* | Canada (exposed to 10 ppm Cd 72 hrs.) | gill | | (10.2-92.0) | O'Hara (1973) |
| " " | " " " | hepato-pancreas | | (6.5-200.2) | " |
| Copepod<br>*Undinula vulgaris* | Puerto Rico | | A | (7.0-27.0) | Martin (1970) |
| " " | " " | | W | (0.21-1.1) | " |
| " " | " " | | D | (2.3-9.0) | " |

CADMIUM IN ARTHROPODA

INSECTA

| | | | | | |
|---|---|---|---|---|---|
| DIPTERA | | | | | |
| Beach fly<br>Coelopa vanduzeii | California | adult | D | (10.0-149.7) | Bender (1975) |
| " " | " | larva | D | 35.0 | " |
| Blood worm<br>Chironomid larvae | Indiana | whole body | W | 0.19 | Yost et al. (1974) |
| " " | " | " | W | 4.3 | " |
| " " | Illinois | " | D | 2.17 | Anderson (1977) |
| Fruitfly<br>Drosophila athabasca | Missouri (control) | " | D | (1.5-4.1)<br>2.8 | Lower (1974) |
| Fruitfly<br>Drosophila robusta | " | " | D | (1.2-2.3)<br>1.7 | " |
| Fruitfly-3 species<br>Drosophila athabasca<br>Drosophila melanogaster<br>Drosophila robusta | Missouri dist. from smelter (km): | | | | |
| " " " " " " " " " 0.16 | | " | D | 8.1±0.9 | " |
| " " " " " " " " " 0.8 | | " | D | 7.4±1.4 | " |
| " " " " " " " " " 1.6 | | " | D | 4.9±0.2 | " |
| " " " " " " " " " 3.2 | | " | D | 4.6±0.2 | " |
| " " " " " " " " " 8.0 | | " | D | 3.8±0.6 | " |
| " " " " " " " " " 8.0 | (hotspot) | " | D | 9.7±1.2 | " |
| " " " " " " " " "32.2 | | " | D | 2.6±0.1 | " |
| Beach fly<br>Fucellia rufitibia | California | adult | D | (10.0-149.7) | Bender (1975) |

| | | | | | |
|---|---|---|---|---|---|
| Beach fly<br>*Fucellia rufitibia* | California | larva | D | 35.0 | Bender (1975) |
| Midge<br>*Glyptotendipes sp.* | Idaho | whole body | | 16.0 | Funk et al. (1973) |
| Blackfly<br>*Simulium sp.* | Illinois | larva, whole body | D | 2.53 | Anderson (1977) |
| COLEOPTERA | | | | | |
| Water beetle<br>*Berosus sp.* | Illinois | larva | D | <0.5 | Anderson (1977) |
| Water beetle<br>*Dineutes sp.* | " | " | D | <0.5 | " |
| *Helophorus sp.* | " | adult | D | <0.5 | " |
| Lady bug beetle<br>*Hippodamia sp.* | California | " | D | 0.0 | Bender (1975) |
| *Tropisternus sp.* | Illinois | larva | D | <0.5 | Anderson (1977) |
| NEUROPTERA | | | | | |
| Alderfly<br>*Sialis sp.* | Sweden | whole body | D | (0.17-11.0) | Ljunggren et al. (1971) |
| EPHEMEROPTERA | | | | | |
| Mayfly<br>*Baetis sp.* | Idaho | " | | 70.0 | Funk et al. (1973) |
| Mayfly<br>*Baetis sp.* | Illinois | nymph | D | <0.5 | Anderson (1977) |
| Mayfly<br>*Hexagenia sp.* | " | " | D | <0.5 | " |

| | | | | | |
|---|---|---|---|---|---|
| Mayfly<br>*Potamanthus sp.* | Illinois | nymph | D | 6.33 | Anderson (1977) |
| Mayfly<br>*Stenonema sp.* | " | " | D | $5.55 \pm 0.46$ | " |
| ODONATA | | | | | |
| Damselfly<br>*Agrion splendens* | Sweden | larva | D | (5.8-9.7) | Ljundggren et al. (1971) |
| " " | " | adult | D | (0.95-2.0) | " |
| Damselfly<br>*Amphiagrion sp.* | Illinois | nymph | D | <0.05 | Anderson (1977) |
| Dragonfly<br>*Anax junius* | " | " | D | <0.05 | " |
| Damselfly<br>*Argia sp.* | " | " | D | <0.05 | " |
| Damselfly<br>*Senagrion sp.* | Sweden | larva | D | 1.5 | Ljundggren et al. (1971) |
| ORTHOPTERA | | | | | |
| Cricket<br>*Acheta domestica* | Tennessee (fed $^{109}CdO$) | | Retained 8% in 12 days | | Andersen et al. (1973) |
| Cricket<br>*Pteronemobius sp.* | Tennessee ($^{109}Cd$ added to field) | | | 0.42 | " |
| TRICHOPTERA | | | | | |
| Caddis fly<br>*Cheumatopsyche* | Illinois | larva | D | $1.49 \pm 0.46$ | Anderson (1977) |
| Caddis fly<br>*Hydropsyche pellucidula* | Sweden | | D | (0.28-1.5) | Ljundggren et al. (1971) |

| | | | | | |
|---|---|---|---|---|---|
| Caddis fly *Hydropsyche sp.* | Idaho | whole body | | 45.0 | Funk et al. (1973) |
| Caddis fly *Hydropsyche sp.* | Illinois | larva | D | $1.52 \pm 0.76$ | Anderson (1977) |
| HEMIPTERA | | | | | |
| *Belostoma sp.* | " | adult | D | <0.05 | " |
| Water boatman *Notonecta sp.* | " | " | D | <0.05 | " |
| *Ranatra sp.* | " | " | D | <0.05 | " |
| *Sigara sp.* | " | " | D | <0.05 | " |
| ARACHNIDA | | | | | |
| Wolf spider *Lycosa sp.* | Tennessee (fed on $^{109}CdO$ crickets for 30 days) | | D | 0.03 | Andersen et al. (1973) |

## CADMIUM IN ECHINODERMATA[1]

| Species | Locality | Tissue | Analysis[2] PPM | Authority |
|---|---|---|---|---|
| Sea star *Asterias rubens* | Great Britain | | D 1.66 | Mullin & Riley (1956) |
| " " | " " | | D 1.6 | Leatherland & Burton (1974) |
| " " | Sweden | without viscera | D (1.1-1.7) | Noddack & Noddack (1940) |
| " " | | | A 30.0 | Webb (1937) |
| " " | Norway | | D (10.0-18.0) | Stenner & Nickless (1974a) |
| " " | Spain & Portugal | | D (0.6-12.0) | " (1975) |
| " " | Russia | | D 1.1 | Malyuga (1941) |
| Sea urchin *Brissopsis lyrifera* | Sweden | without viscera | D 0.03 | Noddack & Noddack (1940) |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | | |
|---|---|---|---|---|---|
| Red starfish<br>*Coscinasterias calamaria* | Tasmania | | W | 0.6 | Eustace (1974) |
| Asteroid<br>*Echinus esculentus* | Great Britain | | D | 0.325 | Mullin & Riley (1956) |
| Echinoid<br>*Henricia sanguinolenta* | " " | | D | 1.12 | " |
| Echinoid<br>*Luidia ciliaris* | " " | | D | 14.8 | " |
| Sea star<br>*Marthasterias glacialis* | " " | | D | 1.46 | " |
| Sand dollar<br>*Mellita lata* | Puerto Rico | | D | (4.0-4.7)<br>4.3 | Lowman et al. (1966) |
| Brittle star<br>*Ophiocomina nigra* | Great Britain | | D | (0.94-0.963) | Mullin & Riley (1956) |
| " " | | | A | 30.0 | Webb (1937) |
| Sea urchin<br>*Paracentrotus lividus* | | ovary | A | 30.0 | " |
| Mud starfish<br>*Patiriella regularis* | Tasmania | | W | 0.7 | Eustace (1974) |
| Sea star<br>*Pisaster brevispinus* | S. California | ray | D | (0.7-2.4) | Schwimer (1973) |
| " " | " " | gonad | D | $0.6 \pm 0.8$ | " |
| " " | " " | stomach | D | (1.9-3.6) | " |
| " " | " " | hepatic caecum | D | (7.1-46.3) | " |
| Sea star<br>*Pisaster sp.* | California (outfall, polluted) | " | D | $46.3 \pm 20.6$ | Graham (1972) |

| | | | | | |
|---|---|---|---|---|---|
| Echinoid *Porania pulvillus* | Great Britain | skin, aboral surface | D | 16.3 | Mullin & Riley (1956) |
| " " | " " | " | A | 26.9 | " |
| " " | " " | inter-radial septa | D | 13.1 | " |
| " " | " " | " | A | 17.7 | " |
| Sea urchin *Psammechinus miliaris* | " " | | D | (0.435-0.45) | " |
| Asteroid *Spatangus purpureus* | " " | without gut | D | 0.24 | " |
| " " | " " | gut and contents | D | 0.81 | " |
| Echinoid *Stichastrella rosea* | " " | | D | 6.3 | " |
| Sea cucumber *Stichopus tremulus* | Sweden | without viscera | D | 2.6 | Noddack & Noddack (1940) |
| Purple sea urchin *Strongylocentrotus franciscanus* | California | gonad | W | 0.57 | Vattuone et al. (1976) |
| "Sea cucumber" | Japan | edible part | W | 0.076 | Yamagata & Shigematsu (1970) |
| "Sea urchin" | " | soft parts | W | 0.076 | " |

## CADMIUM IN LOWER INVERTEBRATES[1]

### PROTOZOA

| Species | Locality | Tissue | Analysis[2] PPM | Authority |
|---|---|---|---|---|
| Foraminifera | | | | |
| *Ramulina sp.* | Great Britain | whole | D (2.18-2.24) | Mullin & Riley (1956) |

## CADMIUM IN LOWER INVERTEBRATES

### CTENOPHORA

| | | | | |
|---|---|---|---|---|
| "Comb jellyfish" | New York Bight | whole | D (1.8-2.4) | Greig et al. (1977a) |

## CADMIUM IN LOWER INVERTEBRATES

### SCYPHOZOA

| | | | | |
|---|---|---|---|---|
| *Pelagia sp.* | N.W. Africa | whole | D 5.3 | Leatherland et al. (1973) |

## CADMIUM IN LOWER INVERTEBRATES

### PORIFERA

| | | | | |
|---|---|---|---|---|
| Sponge | | | | |
| *Halichondria sp.* | Sweden | | D 1.10 | Noddack & Noddack (1940 |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | |
|---|---|---|---|---|
| Sponge<br>*Halichondria panicea* | Great Britain | D | 1.85 | Mullin & Riley ( 1956) |
| " " | " " | D | 0.85 | Leatherland & Burton (1974) |
| Brittle cup sponge | Puerto Rico | D | (1.2-2.5)<br>2.1 | Lowman et al. (1966) |
| Pliable cup sponge | " " | D | (2.0-4.5)<br>3.3 | " |
| " " " | " " | W | (0.25-1.0)<br>0.61 | " |

## CADMIUM IN LOWER INVERTEBRATES

### COELENTERATA

| | | | | |
|---|---|---|---|---|
| Coral<br>*Alcyonium digitatum* | Great Britain | D | 1.15 | Mullin & Riley (1956) |
| *Cerianthus sp.* | California | D | 0.9 | Emerson et al. (1976) |
| Jellyfish<br>*Cynaea capillata* | Sweden | D | 11.0 | Noddack & Noddack (1940) |
| Coral<br>*Eusmilia fastigiata* | Puerto Rico | D | (3.5-4.4)<br>4.0 | Lowman et al. (1966) |
| Coral<br>*Meandrina neandrite* | " " | D | (2.9-4.6)<br>4.2 | " |
| Sea anemone<br>*Metridium dianthus* | Sweden | D | 0.4 | Noddack & Noddack (1940) |
| *Tealia felina* | Great Britain | D | 0.07 | Leatherland & Burton (1974) |

| | | | | | |
|---|---|---|---|---|---|
| "jellyfish" | New York Bight | | D | 2.1 | Greig et al. (1977a) |

CADMIUM IN LOWER INVERTEBRATES

NEMERTEA

| | | | | | |
|---|---|---|---|---|---|
| *Lineus longissimus* | | | A | 20.0 | Webb (1937) |

CADMIUM IN LOWER INVERTEBRATES

TUNICATA

| | | | | | |
|---|---|---|---|---|---|
| *Ascidiacea sp.* | Tasmania | whole | W | 0.2 | Eustace (1974) |
| *Botryllus schlosseri* | Great Britain | | D | 2.7 | Leatherland & Burton (1974) |
| *Ciona intestinalis* | Sweden | | D | 0.6 | Noddack & Noddack (1940) |
| " " | California | tunic | D | 3.0 | Emerson et al. (1976) |
| " " | " | internal organs | D | 1.2 | " |
| *Pyrosoma sp.* | N.W. Africa | | D | 0.44 | Leatherland et al. (1973) |
| Sea squirt | San Diego Bay | | W | (<0.1-0.5) 0.2 | Seba (undated) |

CADMIUM IN LOWER INVERTEBRATES

ANNELIDA

| | | | | | |
|---|---|---|---|---|---|
| Earthworm *Alabophera sp.* | Tennessee | whole | D | (3.1-9.3) 5.7 | Van Hook (1974) |

| | | | | | |
|---|---|---|---|---|---|
| Earthworm<br>Allolobophora chlorotica<br>Allolobophora trapezpides<br>Allolobophora turgida<br>Lumbricus terrestris | Maryland dist. from highway (meters): | | | | Gish & Christensen (1973) |
| All species | " " 3 | | D | 12.6 | " |
| " " | " " 6.1 | | D | 8.8 | " |
| " " | " " 12.2 | | D | 8.3 | " |
| " " | " " 24.4 | | D | 6.9 | " |
| " " | " " 48.8 | | D | 7.1 | " |
| " " | Patuxent (control) | | D | 3.0 | " |
| Cirriformia luxuriosa | California | | D | (1.0-1.8) | Emerson et al. (1976) |
| Earthworm<br>Eisenia rosea | Illinois (control) | | D | 2.0 | Illinois (1972) |
| " " | Illinois (exp. 55 cm sludge) | | D | 18.0 | " |
| " " | Illinois (exp. 110 cm sludge) | | D | 30.0 | " |
| Leech<br>Erpobdella sp. | Sweden | | D | (0.34-1.7) | Lundggren et al. (1971) |
| Leech<br>Erpobdella sp. | Illinois | whole | D | $3.8 \pm 0.3$ | Anderson (1977) |
| Tubificid worm<br>Limnodrilus hoffmeisteri | " | " | W | (0.5-3.2)1.1 | Mathis & Cummings (1973) |
| Limnodrilus longissimus | | | A | 0.02 | Vinogradov (1953) |

| | | | | | |
|---|---|---|---|---|---|
| Earthworm<br>*Lumbricus sp.* | Tennessee | whole | D | (3.1-9.3)<br>5.7 | Van Hook (1974) |
| *Lumbrineris sp.* | California | | D | 1.3 | Emerson et al. (1976) |
| *Nephthys sp.* | Tennessee | | A | 0.0 | Vinogradov (1953) |
| Sandworm<br>*Nereis diversicolor* | Great Britain | | D | (0.08-3.6) | Bryan & Hummerstone (1973a) |
| " " | " " | whole | W | (0.2-0.5) | Wharfe & Van Den Broek (1977) |
| *Notomastus tenuis* | California | | D | 0.6 | Emerson et al. (1976) |
| Earthworm<br>*Octolasium sp.* | Tennessee | whole | D | (3.1-9.3)<br>5.7 | Van Hook (1974) |
| *Oligochaetes* | Idaho | whole body | W | 4.3 | Funk et al. (1973) |
| " | Indiana | " | | 230.0 | Yost et al. (1975) |
| Leech<br>*Placobdella sp.* | Illinois | " | D | <0.5 | Anderson (1977) |
| Polychaete<br>*Sigambra tentacula* | California | " | D | (1.3-8.3) | Emerson et al. (1976) |
| Tubificid worm<br>*Tubifex tubifex* | Illinois | " | W | (0.5-3.2)<br>1.1 | Mathis & Cummings (1973) |

## CADMIUM IN HIGHER PLANTS[1]

| Species | Locality | Tissue | Analysis[2] PPM | Authority |
|---|---|---|---|---|
| Mountain maple *Acer glabrum* | Rocky Mountains | leaf | A 1.6±3.06 | Shacklette (1972) |
| " " | " " | stem | A 4.9±2.0 | " |
| " " | " " | leaf | D 0.09 | " |
| " " | " " | stem | D 0.17 | " |
| Norway maple *Acer platanoides* | Connecticut | leaf | D (0.5-2.0) 1.0±SE 0.1 | Smith (1973) |
| " " | " | twig | D (0.5-2.0)0.7 ±SE 0.1 | " |
| Red maple *Acer rubrum* | United States | leaf | D 1.7 | Hanna & Grant (1962) |
| " " | Tennessee | " | D 0.17 | Van Hook et al. (1974) |
| " " | " | branch | D 0.34 | " |
| " " | " | trunk | D 0.24 | " |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | | |
|---|---|---|---|---|---|
| Silver maple<br>*Acer saccharinum* | United States | leaf | D | 0.1 | Hanna & Grant (1962) |
| Sugar maple<br>*Acer saccharum* | United States | " | D | 0.21 | " |
| " " | Connecticut | " | D | (0.5-1.5)<br>1.0±SE 0.1 | Smith (1973) |
| " " | " | twig | D | (0.5-1.5)<br>0.8±SE 0.1 | " |
| " " | New Hampshire & Vermont | twig & leaf | D | (0.0-5.0) | " |
| Milfoil<br>*Achillea millefolium* | Germany | leaf | D | 0.02 | Ernst (1975) |
| Bunch grass<br>*Agropyron sp.* | Idaho (near $PO_4$ processing plant) | | D | (2.0-250.0) | Gough & Severson (1976) |
| Onion<br>*Allium cepa* | United States | bulb | W | 0.01 | Schroeder et al. (1967) |
| " " | Montana | " | W | (0.1-0.5) | Hindawi & Neely (1972) |
| " " | Canada | leaf | D | (0.63-1.5) | Hutchinson et al. (1974) |
| " " | " | bulb | D | (0.25-3.1) | " |
| " " | " | " | D | (0.93-1.4) | " |
| " " | Great Britain | " | W | (0.01-0.09)<br>0.04 | Thomas et al. (1972) |
| " " | Czechoslavakia | " | W | 0.047±SE 0.003 | Lener & Bibr (1971) |
| " " | Romania | " | W | 0.0077 | Rautu & Sporn (1970) |

| | | | | | |
|---|---|---|---|---|---|
| Onion<br>*Allium cepa* | Japan | bulb | W | 0.012 | Ishizaki et al. (1970a) |
| " " | " | " | W | (0.003-0.018) | Yamagata & Shigematsu (1970) |
| " " | Germany (control) | " | W | 0.08±0.06 | Anke et al. (1976) |
| " " | Germany (polluted) | " | W | 0.4±0.19 | " |
| Welsh onion<br>*Allium fistulosa* | Japan (500 m from refinery) | | D | 14.0 | Kobayashi (1972) |
| " " | Japan (unpolluted) | | D | 1.0 | " |
| Leek<br>*Allium porrum* | Great Britain | | W | (0.02-0.09) 0.04 | Thomas et al. (1972) |
| Garlic<br>*Allium sativum* | Czechoslavakia | | W | 0.077±SE 0.001 | Lener & Bibr (1971) |
| Ragweed<br>*Ambrosia artemisiifolia* | | leaf & stem | D | 0.46 | Prince (1957) |
| Ragweed<br>*Ambrosia elatior* | (in 100 ppm Cd solution) | leaf | | 480.0 | Illinois (1972) |
| " " | (in 250 ppm Cd solution) | " | | 3,080.0 | " |
| " " | (in 500 ppm Cd solution) | " | | 4,700.0 | " |
| Pineapple<br>*Ananas comosus* | | fruit (canned) | | 0.059 | USHEW (1975) |
| Big bluestem grass<br>*Andropogon gerardii* | Missouri | stem & leaf | A | 0.5 | Shacklette (1972) |
| " " | " | " | D | 0.03 | " |

| | | | | | |
|---|---|---|---|---|---|
| Bluestem grass | | | | | |
| Andropogon sp. | Indiana | | D | 0.55 | Yost et al. (1975) |
| " " | Tennessee | | D | 0.21±SD 0.06 | Huckabee & Blaylock (1973) |
| Anemone | | | | | |
| Anemone cylindrica | Indiana | | D | 1.2 | Yost et al. (1975) |
| Celery | | | | | |
| Apium graveolans dulce | (Cd in soil 0, control) | stalk | D | 1.26 | Haghiri (1973) |
| " " " | (Cd in soil 2.5 ppm) | " | D | 5.83 | " |
| " " " | (Cd in soil 10.0 ppm) | " | D | 14.87 | " |
| " " " | (Cd in soil 0, control) | leaf | D | 0.83 | " |
| " " " | (Cd in soil 2.5 ppm) | " | D | 3.77 | " |
| " " " | (Cd in soil 10.0 ppm) | " | D | 10.77 | " |
| " " " | Czechoslavakia | stalk | W | 0.058±SE 0.013 | Lener & Bibr(1971) |
| " " " | Great Britain | | W | (<0.01-0.05) 0.04 | Thomas et al. (1972) |
| " " " | Ontario | leaf | D | (1.14-2.02) | Hutchinson et al. (1974) |
| " " " | " | root | D | (0.73-4.3) | " |
| Apios americana | Indiana | | D | 4.4 | Yost et al. (1975) |
| Kinnikinnik | | | | | |
| Arctostaphylos uva-ursi | Colorado | | A | 5.0 geom. mean | Shacklette (1972) |
| " " | " | stem | D | 0.23 | " |

| | | | | | |
|---|---|---|---|---|---|
| Kinnikinnik<br>*Arctostaphylos uva-ursi* | Colorado | leaf | D | 0.21 | Shacklette (1972) |
| Pink<br>*Armeria calaminaria* | Germany | " | D | 1.1 | Ernst (1975) |
| Big sagebrush<br>*Artemisia tridentata* ssp. *tridentata* | Idaho (dist. from $PO_4$ factories): | | | | Gough & Severson (1976) |
| " " " | " " 3 km upwind | | D | (23.0-38.0) | " |
| " " " | " " 3 km downwind | | D | (78.0-130.0) | " |
| Asparagus<br>*Asparagus officinalis* | Japan (500 m from refinery) | | D | 9.0 | Kobayashi (1972) |
| Aster<br>*Aster sp.* | Indiana | | D | 2.42 | Yost et al. (1975) |
| Oats<br>*Avena sativa* | | | (increased Cd in soil increased Cd in root but not in top) | | John et al. (1972) |
| " " | Montana | | W | 0.6 | Hindawi & Neely (1972) |
| " " | Sweden | | W | (0.005-0.048) | Kjellstrom et al. (1974) |
| " " | Sweden (4 km NW Cd alloy plant) | | W | (0.081-0.108) | " |
| " " | Canada | leaf | D | 0.8 | Hutchinson et al. (1974) |
| " " | " | root | D | 2.0 | " |
| " " | " | grain | D | 0.6 | " |

| | | | | | |
|---|---|---|---|---|---|
| Oats<br>*Avena sativa* | | grain | D | 3.9 | John (1973) |
| " " | Germany (control) | " | W | 0.04±0.04 | Anke et al. (1976) |
| " " | Germany (polluted) | " | W | 0.21±1.48 | " |
| Beet<br>*Beta vulgaris* | Montana | | W | (0.1-2.5) | Hindawi & Neely (1972) |
| Swiss chard<br>*Beta vulgaris cicla* | Maryland (control) | | D | 1.2 | Furr et al. (1976) |
| " " " | Maryland (grown on sludge fortified soil) | | D | (3.3-4.1) | " |
| Birch<br>*Betula sp.* | S.W. Missouri (on mineralized ground) | leaf | D | 18.0 | Cannon (1974) |
| " " | " " " " | twig | D | 14.0 | " |
| " " | " " " " | wood | D | 6.5 | " |
| " " | " " " " | bark | D | 21.0 | " |
| Rutabaga<br>*Brassica napobrassica* | Montana | | W | 0.3 | Hindawi & Neely (1972) |
| Kale<br>*Brassica oleracea acephala* | | | D | 1.0 | Shacklette (1972) |
| " " " | | | D | 0.89±0.16 | Cheuca et al. (1969) |
| " " " | (polarographic) | | D | 1.0±0.1 | Shacklette (1972) |
| " " " | (neutron activation) | | D | 0.384 | " |

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|---|---|---|---|---|---|---|---|
| Cauliflower | | | | | | | |
| Brassica | oleracea | botrytis | Canada | leaf | D | (0.55-1.03) | Hutchinson et al. (1974) |
| " | " | " | " | root | D | (0.49-1.3) | " |
| " | " | " | " | head | D | 0.52 | " |
| " | " | " | " | leaf | D | 4.8 | John (1973) |
| " | " | " | " | root | D | 1.8 | " |
| Cabbage | | | | | | | |
| Brassica | oleracea | capitata | Montana | | W | (<0.05-0.4) | Hindawi & Neely (1972) |
| " | " | " | Japan | leaf | W | (0.12-0.022) | Yamagata & Shigematsu (1970) |
| " | " | " | United States | " | W | 0.07 | Schroeder et al. (1967) |
| " | " | " | Romania | " | W | 0.0 | Rautu & Sporn (1970) |
| " | " | " | Japan | " | W | 0.009 | Ishazaki et al. (1970) |
| " | " | " | United States | " | W | 0.034 | Fulkerson & Goeller (1973) |
| " | " | " | Great Britain | " | W | (0.01-0.15) 0.04 | Thomas et al.(1972) |
| " | " | " | Canada | " | D | (0.6-2.3) | Hutchinson et al. (1974) |
| " | " | " | " | root | D | (0.48-2.6) | " |
| " | " | " | Japan (1200 m from refinery) | outer leaf | D | 7.0 | Kobayashi (1972) |
| " | " | " | " " " " | inner leaf | D | 3.0 | " |

| | | | | | |
|---|---|---|---|---|---|
| Cabbage | | | | | |
| *Brassica oleracea capitata* | Montana | leaf | D | 12.0 | Gordon (1972) |
| " " " | Japan | head | W | 0.012 | Yamagata & Shigematsu (1970) |
| Brussels sprouts | | | | | |
| *Brassica oleracea gemmifera* | Great Britain | | W | (0.01-0.11) 0.03 | Thomas et al. (1972) |
| Kohlrabi | | | | | |
| *Brassica oleracea gongyloides* | Montana | | W | (0.1-0.2) | Hindawi & Neely (1972) |
| " " " | United States | | W | 0.09 | Schroeder et al. (1967) |
| " " " " " | | | W | 0.052 | Fulkerson & Goeller (1973) |
| " " " | Germany (control) | | W | $0.08 \pm 0.05$ | Anke et al. (1976) |
| " " " | Germany (polluted) | | W | $0.42 \pm 0.33$ | " |
| Broccoli | | | | | |
| *Brassica oleracea italica* | | leaf | D | 2.7 | John (1973) |
| " " " | | root | D | 6.5 | " |
| Turnip | | | | | |
| *Brassica rapa* | Japan (450 m from refinery) | root | D | 5.0 | Kobayashi (1972) |
| " " | " " " | leaf | D | 15.0 | " |
| " " | Germany (control) | " | W | $0.19 \pm 0.12$ | Anke et al. (1976) |
| " " | Germany (polluted) | " | W | $5.87 \pm 3.75$ | " |

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|---|---|---|---|---|---|
| Scotch heather *Calluna vulgaris* | Sweden | | | 0.73 g Cd/ha | Tyler et al. (1973) |
| Tea *Camellia sinensis* | | Japanese green tea leaf | W | 2.5 | Schroeder & Balassa (1961) |
| " " | United States | instant tea | W | 0.008 | " |
| " " | Germany | | | (0.29-0.32) | Kropf & Geldmacher (1968) |
| " " | | infusion | W | 0.01 | Schroeder et al. (1967) |
| " " | | instant | W | 0.008 | " |
| Bluebell *Campanula rotundifolia* | Germany | leaf | D | 0.95 | Ernst (1975) |
| Pepper *Capsicum frutescens* | (Cd in soil 0, control) | | D | 0.76 | Haghiri (1973) |
| " " | (Cd in soil 2.5 ppm) | | D | 3.82 | " |
| " " | (Cd in soil 10.0 ppm) | | D | 6.28 | " |
| " " | Missouri | | | <0.5 | Missouri Univ. (1972) |
| " " | Australia | | D | 0.63 | Beavington (1975) |
| Sedge *Carex stricta* | Indiana | | D | 0.47 | Yost et al. (1975) |
| Shagbark hickory *Carya ovata* | Missouri | stem | D | 1.27 | Shacklette (1972) |
| Hickory *Carya spp.* | Tennessee | leaf | D | 0.38 | Van Hook et al. (1974) |

| | | | | | |
|---|---|---|---|---|---|
| Hickory<br>*Carya spp.* | Tennessee | twig | D | 0.93 | Van Hook et al. (1974) |
| " " | " | branch | D | 0.39 | " |
| " " | " | bole | D | 0.33 | " |
| " " | " | root | D | 0.33 | " |
| " " | " | $O_1$ litter | D | 0.62 | " |
| " " | " | $O_2$ litter | D | 0.20 | " |
| Sticky laurel<br>*Ceanothus velutinus* | Colorado | branch | D | 0.03 | Shacklette (1972) |
| Coontail<br>*Ceratophyllum demersum* | Michigan | | D | (0.048-0.291)<br>0.164±0.036 | Mathis & Kevern (1975) |
| Rabbit brush<br>*Chrysothamnus sp.* | Montana<br>(leaves collected Cd in airborne dust) | | | | Munshower (1972) |
| Tangarine<br>*Citrus reticulata* | United States | | W | 0.02 | Schroeder et al. (1967) |
| " " | Japan | | W | 0.003 | Ishazaki et al. (1970a) |
| Orange<br>*Citrus sinensis* | United States | fruit | | (0.0-0.43)<br>0.04 | US HEW (1975) |
| " " | Japan | " | W | 0.002 | Yamagata & Shigematsu (1970) |
| Yellow clintonia<br>*Clintonia borealis* | Canada<br>dist. from smelter (km): | | | | LeBlanc et al. (1974) |
| " " | " " " | 1.1 | D | 4.6 | " |
| " " | " " " | 1.9 | D | 15.7 | " |

| | | | | | |
|---|---|---|---|---|---|
| Yellow clintonia<br>Clintonia borealis | Canada (dist. from smelter (km)): | | | | LeBlanc et al. (1974) |
| " " | " " " | 3.0 | D | 5.0 | " |
| " " | " " " | 5.0 | D | 3.2 | " |
| " " | " " " | 6.3 | D | 2.8 | " |
| " " | " " " | 8.3 | D | <0.4 | " |
| " " | " " " | 11.0 | D | <0.4 | " |
| Coffee<br>Coffea arabica | | seed (ground) | W | 0.32 | Schroeder et al. (1967) |
| " " | | instant | W | 0.006 | " |
| " " | | instant, dried | W | 2.27 | " |
| " " | | ground | W | 0.35 | " |
| Coreopsis<br>Coreopsis lanceolata | Indiana | | D | 4.4 | Yost et al. (1975) |
| Coreopsis<br>Coreopsis tripteris | " | | D | 4.85 | " |
| Dogwood<br>Cornus florida | Tennessee | twig | D | 0.40 | Van Hook et al. (1974) |
| " " | " | branch | D | 0.04 | " |
| " " | " | bole | D | 0.31 | " |
| " " | " | leaf | D | 1.10 | " |
| Hawthorn<br>Crataegus monogyna | Great Britain | unwashed leaf | D | 6.04±0.98 | Little (1973) |
| Sugi, Japanese cedar<br>Cryptomeria japonica | Japan (smelting area) | | High levels of Cd in rings from 1910-1943 | | Ishizaki et al. (1970a) |

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|---|---|---|---|---|---|
| Cucumber<br>*Cucumis sativus* | Great Britain | | W | 0.01 | Thomas et al. (1972) |
| Pumpkin<br>*Cucurbita pepo* | Japan | | D | <0.1 | Kobayashi (1972) |
| Curly top grass<br>*Danthonia spicata* | United States | | | 0.028 | Williams & David (1973) |
| Carrot<br>*Daucus carota* | United States | | W | 0.3 | Schroeder et al. (1967) |
| " " | New York | root | D | 0.96 | Cannon (1969) |
| " " | Great Britain | " | W | (0.09-0.22) 0.13 | Thomas et al. (1972) |
| " " | Czechoslavakia | " | W | 0.086±SE 0.024 | Lener & Bibr(1971) |
| " " | Japan | | W | 0.041 | Ishizaki et al. (1970) |
| " " | " | " | W | 0.05 | Yamagata & Shigematsu (1970) |
| " " | Japan (700 m from refinery) | " | D | 10.0 | Kobayashi (1972) |
| " " | Canada | leaf | D | (0.99-1.5) | Hutchinson et al. (1974) |
| " " | " | root | D | (0.43-0.98) | " |
| " " | New York | " | D | 0.96 | Cannon (1969) |
| " " | Kansas (smelter) | | D | 8.0 | Lagerwerff & Brower (1974) |
| " " | Washington, D.C. | | D | 1.5 | " |

| | | | | | |
|---|---|---|---|---|---|
| Hairgrass<br>Deschampsia flexuosa | Sweden<br>(polluted area) | leaf | D | 7.6 | Tyler<br>(1972) |
| " " | " " " | root | D | 11.0 | " |
| " " | " " " | leaf<br>litter | D | 12.0 | " |
| Crowberry<br>Empetrum nigrum | Sweden | | | 0.1 g/ha | " |
| Horsetail rush<br>Equisetum arvense | Indiana | | D | 2.0 | Yost et<br>al. (1975) |
| Horsetail<br>Equisetum fluviatile | Nova Scotia<br>(above ground) | | D | (0.92-6.08) | Ray &<br>White<br>(1976) |
| " " | Nova Scotia<br>(below ground) | | D | (3.59-5.54) | " |
| Scouring rush<br>Equisetum hyemale | Indiana | | D | 0.87 | Yost et al.<br>(1975) |
| Heath<br>Erica tetralix | Sweden | | | 0.69 g/ha | Tyler<br>(1972) |
| Eryngo<br>Eryngium yuccifolium | Indiana | | D | 0.37 | Yost et<br>al. (1975) |
| Euphorbia<br>Euphorbia corollata | " | | D | 0.86 | " |
| Euphrasia stricta | Germany | leaf | D | 0.4 | Ernst<br>(1975) |
| Beech<br>Fagus grandifolia | United States | | W | 0.04 | Schroeder<br>et al.<br>(1967) |
| Fescue grass<br>Festuca ovina | Germany | leaf | D | 0.13 | Ernst<br>(1975) |

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|---|---|---|---|---|---|
| Red fescue grass *Festuca rubra* | Wales dist. downwind from industry (km): | | | | Goodman & Roberts (1971) |
| " " | " " " | 1.5 | D | 40.0 | " |
| " " | " " " | 3.0 | D | 9.0 | " |
| " " | " " " | 5.0-6.0 | D | (2.5-3.0) | " |
| " " | " " " | 6.5 | D | 0.7 | " |
| " " | " " " | 16.0 | D | (1.3-1.4) | " |
| " " | Wales (uncontaminated, 18 km upwind) | | D | 0.8 | " |
| " " | Wales (uncontaminated grass hay) | | D | 1.0 | " |
| " " | Wales (contaminated grass hay) | | D | 9.0 | " |
| " " | Tennessee ($^{109}Cd$ added to area) | | D | (0.002-0.01) | Andersen et al. (1973) |
| " " | Wales time after closing Zn/Pb smelter (mo.): | | | | Roberts & Goodman (1973) |
| " " | " " " | 0 | D | 48.0 | " |
| " " | " " " | 3 | D | 11.0 | " |
| " " | " " " | 9 | D | 9.0 | " |
| " " | " " " | 11 | D | 7.0 | " |
| Tall fescue *Festuca sp.* | Maryland dist. from road (m): | | | | Lagerwerff & Specht (1970) |
| " " | " " " | 8 | D | (0.75-0.95) | " |
| " " | " " " | 16 | D | (0.63-0.73) | " |

| | | | | | |
|---|---|---|---|---|---|
| Tall fescue<br>Festuca sp. | Maryland dist. from road (m): | | | | Lagerwerff & Specht (1970) |
| " " | " " " | 32 | D | (0.48-0.50) | " |
| " " | Tennessee | | D | 0.279±SD 0.5 | Huckabee & Blaylock (1973) |
| Strawberry<br>Fragaria virginiana | Indiana | | D | 0.89 | Yost et al. (1975) |
| Bedstraw<br>Galium obtusum | " | | D | 1.8 | " |
| Soybean<br>Glycine max | (Cd in soil 10 ppm) | plant top | D | 13.0 | Haghiri (1973) |
| " " | (Cd in soil 50 ppm) | " | D | 24.0 | " |
| " " | (Cd in soil 100 ppm) | " | D | 26.0 | " |
| " " | Ohio (sludge-treated soil) | bean | | 2.4 | Kirkham (1974) |
| " " | " " " | leaf | | 10.2 | " |
| " " | (with Cd dust in soil 29 ppm + lime) | | D | 4.7 | Andersen et al. (1973) |
| " " | (58 ppm Cd + lime) | | D | 5.3 | " |
| " " | (116 ppm Cd + lime) | | D | 13.0 | " |
| " " | (29 ppm Cd, no lime) | | D | 17.0 | " |
| " " | (58 ppm Cd, no lime) | | D | 23.0 | " |
| " " | (116 ppm Cd, no lime) | | D | 36.0 | " |
| " " | (control + lime) | | D | 1.5 | " |
| " " | (control, no lime) | | D | 1.0 | " |

| | | | | | |
|---|---|---|---|---|---|
| Soybean<br>*Glycine max* | Kansas<br>( 2 km from smelter) | stem | D | 2.9 | Lagerwerff et al. (1973) |
| " " | " " " | leaf | D | 5.8 | " |
| " " | " " " | pod | D | 1.0 | " |
| Sunflower<br>*Helianthus divaricatus* | Indiana | | D | 1.72 | Yost et al. (1975) |
| Sunflower<br>*Helianthus occidentalis* | " | | D | 5.16 | " |
| Sunflower<br>*Helianthus sp.* | Montana | leaf | W | 1.0 | Hindawi & Neely (1972) |
| *Hoeleria cristata* | Indiana | | D | 1.01 | Yost et al. (1975) |
| Barley<br>*Hordeum vulgare* | Japan<br>(0.4 to 2.5 km from mine refinery) | | | 6.8 | Kobayashi et al. (1970) |
| " " | " " " | | | 4.0 | Kobayashi et al. (1970) |
| " " | Montana | grain | W | (0.1-1.2) | Hindawi & Neely (1972) |
| " " | " | leaf | W | 6.3 | " |
| " " | Sweden<br>(1963-1971) | grain | W | (0.025-0.045) | Kjellström et al. (1975) |
| *Hypoxis hirsuta* | Indiana | | D | 7.7 | Yost et al. (1975) |
| American holly<br>*Ilex opaca* | United States | leaf | D | 5.2 | Hanna & Grant (1962) |

| | | | | | |
|---|---|---|---|---|---|
| Rush<br>*Juncus sp.* | Indiana | | D | 0.39 | Yost et al. (1975) |
| Juniper<br>*Juniperus communis* ssp. *nana* | Colorado | leaf | D | 0.11 | Shacklette (1972) |
| " " " | " | branch | D | 0.26 | " |
| Red cedar<br>*Juniperus virginianus* | Missouri | stem & leaf | D | 0.1 | " |
| " " | Missouri (near lead smelter ore trucks) | | A | 9.3 | Connor et al. (1971) |
| " " | Missouri (control) | | A | 2.8 | " |
| " " | Missouri | | A | (1.7-1.8) | " |
| " " | " | | D | (0.098-0.11) | Connor et al. (1970) |
| " " | " | | D | 0.56 max. | " |
| Mountain laurel<br>*Kalmia latifolia* | United States | leaf | D | 0.43 | Hanna & Grant (1962) |
| Lettuce<br>*Lactuca sativa* | (control) | | D | 2.80 | Haghiri (1973) |
| " " | (Cd in soil 2.5 ppm) | | D | 11.50 | " |
| " " | (Cd in soil 10.0 ppm) | | D | 27.10 | " |
| " " | Missouri (smelter town) | root | D | (2.0-98.3) | Hemphill et al. (1973) |
| " " | " " " | leaf | D | (3.29-34.5) | " |
| " " | United States | | | 0.062±0.124 | US HEW (1975) |

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| Lettuce<br>*Lactuca sativa* | Canada | leaf | D | 1.9 | Hutchinson et al. (1974) |
| " " | " | root | D | 2.3 | " |
| " " | Australia (near Cu smelter) | leaf | D | 4.5±1.2 | Beavington (1975) |
| " " | Montana (grown in smelter area) | " | D | (4.0-28.0)10.6 | Gordon (1972) |
| " " | Montana (grown at Missoula) | " | D | (<1.0-1.2) | " |
| " " | United States | | D | (0.3-0.5) | Shacklette (1972) |
| " " | Kansas-smelter | | D | 3.8 | Lagerwerff & Brower (1974) |
| " " | Washington, D.C. | | D | 0.84 | " |
| Duckweed<br>*Lemna minor* | Connecticut (polluted lake) | whole plant | D | 17.0? | Cowgill (1970) |
| Duckweed<br>*Lemna valdiviana* | Canada | | | 7.2 | Hutchinson & Czyrska (1972) |
| Blazing star<br>*Liatris spicata* | Indiana | | D | 4.79 | Yost et al. (1975) |
| Orchid<br>*Liparis lilifolia* | " | | D | 1.9 | " |
| Sweet gum<br>*Liquidambar styraciflua* | Missouri | stem | D | 0.41 | Shacklette (1972) |
| Tulip poplar<br>*Liriodendron tulipifera* | Tennessee | leaf | D | 0.29 | Van Hook et al. (1974) |
| " " | " | twig | D | 0.05 | " |

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| Tulip poplar<br>*Liriodendron tulipifera* | Tennessee | branch | D | 0.03 | Van Hook et al. (1974) |
| " " | " | bole | D | 0.03 | " |
| " " | " | root | D | 0.15 | " |
| " " | " | $O_1$ litter | D | 0.79 | " |
| " " | " | $O_2$ litter | D | 1.00 | " |
| *Lithospermum canescens* | Indiana | | D | 0.94 | Yost et al. (1975) |
| Perennial ryegrass<br>*Lolium perenne* | Great Britain (near smelter) | | D | 50.0 (max.) | Little & Martin (1972) |
| Birdsfoot trefoil<br>*Lotus corniculatus* | Germany | leaf | D | 0.02 | Ernst (1975) |
| Lupine<br>*Lupinus perennis* | Indiana | | D | 0.7 | Yost et al. (1975) |
| Tomato<br>*Lycopersicum esculentum* | Ohio (sludge-treated soil) | fruit | | 0.5 | Kirkham (1974) |
| " " | " " " | leaf | | 6.1 | " |
| " " | United States | fruit | W | 0.03 | Schroeder et al. (1967) |
| " " | Netherlands | " | W | 0.25 | " |
| " " | Italy | fruit (canned) | | (0.02-0.05) | Nilsson (1970) |
| " " | Japan (near smelter) | | D | 2.0 | Kobayashi (1972) |
| " " | Japan | fruit | W | 0.032 | Ishizaki et al. (1970) |

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| Tomato<br>*Lycopersicum esculentum* | Romania | fruit | W | 0.013 | Rautu & Sporn (1970) |
| " " | Kansas (smelter area) | | D | 1.8 | Lagerwerff & Brower (1974) |
| " " | Washington, D.C. | | D | 0.28 | " |
| " " | Great Britain | | W | (0.01-0.08) 0.02 | Thomas et al. (1972) |
| " " | Missouri | fruit | | (<0.5-0.75) | Missouri Univ. (1972) |
| " " | Germany (control) | fruit | W | $0.03 \pm 0.01$ | Anke et al. (1976) |
| " " | Germany (polluted) | " | W | $0.18 \pm 0.18$ | " |
| Apple<br>*Malus malus* | Canada | | leaves sprayed with $CdCl_2$ transferred to fruit | | Ross & Stewart (1969) |
| " " | " | | higher Cd content in peel than pulp | | " |
| " " | United States | juice | | (0.0-0.264) 0.023 | US HEW (1975) |
| " " | " " | apple-sauce | | (0.0-0.18) 0.007 | " |
| " " | Montana | | W | (<0.05-0.1) | Hindawi & Neely (1972) |
| " " | Japan | fruit | W | (0.002-0.004) | Yamagata & Shigematsu (1970) |
| " " | Romania | " | W | 0.0065 | Rautu & Sporn (1970) |

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|---|---|---|---|---|---|
| Apple<br>*Malus malus* | Japan | fruit | W | 0.004 | Ishazaki et al. (1970) |
| " " | Connecticut | blossom | D | 24.0 | Cowgill (1970) |
| " " | Germany (control) | fruit | W | $0.07 \pm 0.09$ | Anke et al. (1976) |
| " " | Germany (polluted) | " | W | $0.11 \pm 0.07$ | " |
| Alfalfa<br>*Medicago sativa* | Arizona | leaf | D | (0.021-0.035) | Shacklette (1972) |
| " " | United States | " | D | (0.02-2.4) | " |
| " " | Utah | " | D | 0.026 | " |
| " " | Montana | " | D | 1.0 | Gordon (1972) |
| " " | Montana (near smelter) | | W | (0.3-3.2) | Hindawi & Neely (1972) |
| " " | Missouri (1.7 km from smelter) | | D | 2.5 | Lagerwerff et al. (1972) |
| Peppermint<br>*Mentha piperita* | | | | $^{115}$Cd taken up in plants readily | Gordee et al. (1960) |
| *Minuartia verna* | Germany | leaf | D | 0.65 | Ernst (1975) |
| Horsemint<br>*Monarda fistulosa* | Indiana | | D | 0.93 | Yost et al. (1975) |
| Mulberry<br>*Morus sp.* | Japan dist from refinery (km): | | | | Kobayashi (1972) |
| " " | " " 0.4 | leaf | D | 17.0 | " |

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| Mulberry<br>Morus sp. | Japan<br>dist from<br>refinery (km): | | | | Kobayashi<br>et al.<br>(1972) |
| " " | " " 1.0 | leaf | D | 7.0 | " |
| " " | " " 2.5 | " | D | 3.3-4.0 | " |
| " " | Japan (control) | " | D | 1.0 | " |
| Banana<br>Musa acuminata | | fruit | W | 0.03 | Schroeder<br>et al.<br>(1967) |
| " " | | " | W | 0.011 | Ishazaki et<br>al. (1970) |
| Water milfoil<br>Myriophyllum spicatum | | | Coefficient of accumulation was 10,110 (highest tested) | | Makhonina &<br>Gileva<br>(1968) |
| Naiad<br>Najas guadulepensis | Oklahoma<br>(control) | | A | 7.1±SD 1.7 | Cearley &<br>Coleman<br>(1974) |
| " " | Oklahoma<br>(Cd added<br>0.007 ppm) | | A | 60.4±SD 1.7 | " |
| " " | Oklahoma<br>(Cd added<br>0.9 ppm) | | A | 4,357.9±SD 89.9 | " |
| Tobacco<br>Nicotiana tobacum | | | (70% of Cd in leaf passes into smoke in cigarette) | | Nandi et al.<br>(1969) |
| " " | Virginia | | | 2.01 | Schroeder<br>& Balassa<br>(1961) |
| " " | Greece | | | 0.89 | " |
| Water lily<br>Nuphar luteum | Sweden | | D | (0.52-1.8) | Ljundggren<br>et al.<br>(1971) |

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| Water lily<br>*Nuphar luteum* | Illinois | stem | D | (0.048-0.175)<br>0.102 | Mathis & Kevern (1975) |
| " " | " | root | D | (0.038-0.049)<br>0.041 | " |
| " " | " | leaf | D | (0.069-0.928)<br>0.291 | " |
| Blackgum<br>*Nyssa sylvatica* | Tennessee | branch | D | 0.06 | Van Hook et al. (1974) |
| " " | " | leaf | D | 0.38 | " |
| " " | " | bole | D | 0.12 | " |
| Olive<br>*Olea europea* | Spain | | | 1.22 | Schroeder et al. (1967) |
| Rice<br>*Oryza sativa* | Japan | | | polished has3.5-4 x Cd of unpolished grain. | Moritsugu & Kobayashi (1964) |
| " " | " | grain (polished) | W | 0.06 | Schroeder et al. (1967) |
| " " | " | grain (brown) | W | 0.04 | " |
| " " | | root | | (0.19-0.27) | Williams & David (1973) |
| " " | | straw | | (0.05-0.1) | " |
| " " | | grain | | (0.01-0.02) | " |
| " " | Japan | " | | 1.0 | Yamagata & Shigematsu (1970) |
| " " | " | " | | (0.18-1.19) | Kobayashi (1970) |

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|---|---|---|---|---|---|
| Sourwood<br>Oxydendron arboreum | Tennessee | twig | D | 0.21 | Van Hook et al. (1974) |
| " " | " | leaf | D | 0.84 | " |
| " " | " | branch | D | 0.24 | " |
| " " | " | bole | D | 0.15 | " |
| Parsnip<br>Pastinica sativa | United States | | W | 0.14 | Schroeder & Balassa (1961) |
| " " | United States (control) | | W | 3.0 | Schroeder & Balassa (1963) |
| " " | United States (fertilizer with 7.25 ppm of Cd is a Cd accumulator) | | | | " |
| " " | Canada | leaf | D | (0.6-0.9) | Hutchinson et al. (1974) |
| " " | " | root | D | (1.1-3.1) | " |
| Princess tree<br>Paulownia tomentosa | Tokyo (in city) | leaf | | (0.7-1.3) | Maeno (1971) |
| Lousewort<br>Pedicularis canadensis | Indiana | | D | 2.5 | Yost et al. (1975) |
| Parsley<br>Petroselinum crispum | Czechoslavakia | leaf | W | 0.088 | Lener & Bibr (1971) |
| Canary grass<br>Phalaris sp. | United States | | | (0.02-0.048) | Williams & David (1973) |
| Bean<br>Phaseolus spp. | " " | | W | (0.01-0.04) | Corneliussen (1972) |

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| Bean<br>*Phaseolus spp.* | United States | fresh | W | 0.01 | Schroeder et al. (1967) |
| " " | " " | canned | W | 0.03 | " |
| " " | Missouri (near smelter) | root | D | (0.76-39.8) 7.05 | Hemphill et al. (1973) |
| " " | " " " | pod | D | (0.5-8.5) 2.36 | " |
| " " | United States | | | 0.018 | US HEW (1975) |
| " " | " " | | | 0.0 | |
| " " | " " | | | <0.5 | Missouri Univ. (1972) |
| " " | Kansas (smelter area) | | D | 0.73 | Lagerwerff & Brower (1974) |
| " " | Washington, D.C. | | D | 0.24 | " |
| " " | Montana | | W | 0.1 | Hindawi & Neely (1972) |
| Kidney bean<br>*Phaseolus vulgaris* | | | (Uptake of Cd was 10x with iron chelate at pH 4.6) | | Francis & Rush (1973) |
| " " | United States | | W | 0.07 | Schroeder et al. (1967) |
| " " | Japan | | W | 0.019 | Ishizaki et al. (1970) |
| Phlox<br>*Phlox pilosa* | Indiana | | D | 0.75 | Yost et al. (1975) |
| Ground cherry<br>*Physalis heterophylla* | " | | D | 1.0 | " |
| Norway spruce<br>*Picea abies* | Connecticut | leaf | D | (0.5-1.0)0.7 ±SE 0.2 | Smith (1973) |

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| Norway spruce<br>*Picea abies* | Connecticut | twig | D | (0.5-1.0)<br>0.8±SE 0.2 | Smith (1973) |
| " " | Sweden | root | D | (1.5-2.7) | Tyler (1972) |
| " " | " | wood | D | <0.1 | " |
| " " | " | bark | D | 2.5 | " |
| " " | " | twig | D | (2.7-5.4) | " |
| " " | " | needle | D | (0.4-1.0) | " |
| Englemann's spruce<br>*Picea englemannii* | Colorado | stem | D | 0.22 | Shacklette (1972) |
| " " | " | leaf | D | 0.05 | " |
| Black spruce<br>*Picea mariana* | Quebec dist. from smelter (km): | | | | Le Blanc et al. (1974) |
| " " | " " 0.5 | leaf | D | 0.7 | " |
| " " | " " 1.1 | " | D | 2.3 | " |
| " " | " " 1.9 | " | D | 2.1 | " |
| " " | " " 3.0 | " | D | 1.1 | " |
| " " | " " 4.8 | " | D | 1.7 | " |
| " " | " " 6.3 | " | D | <0.4 | " |
| " " | " " 8.3 | " | D | <0.4 | " |
| " " | " " 11.0 | " | D | <0.4 | " |
| Colorado blue spruce<br>*Picea pungens* | Colorado | stem | D | 0.03 | Shacklette (1972) |
| *Pieris japonica* | United States | leaf | D | 1.2 | Hanna & Grant (1962) |
| Lodgepole pine<br>*Pinus contorta* var. *latifolia* | Colorado | stem | D | 0.38 | Shacklette (1972) |

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| Lodgepole pine *Pinus contorta* var. *latifolia* | Colorado | leaf | D | 0.21 | Shacklette (1972) |
| Short-leaf pine *Pinus echinata* | Tennessee | " | D | 0.48 | Van Hook et al. (1974) |
| " " | " | twig | D | 0.26 | " |
| " " | " | branch | D | 0.30 | " |
| " " | " | bole | D | 0.21 | " |
| " " | " | root | D | 0.30 | " |
| " " | " | $0_1$ litter | D | 0.26 | " |
| " " | " | $0_2$ litter | D | 0.60 | " |
| " " | Missouri | stem & leaf | D | 0.42 | Shacklette (1972) |
| " " | " | needle | D | (<0.5-0.96) | Bolter et al. (1973) |
| " " | Missouri (near ore trucks) | stem & leaf | A | 20.0 | " |
| Limber pine *Pinus flexilis* | Colorado | stem | D | 0.14 | " |
| " " | " | leaf | D | 0.1 | " |
| Ponderose pina *Pinus ponderosa* var. *scopulorum* | " | stem | D | 0.22 | " |
| " " " | " | leaf | D | 0.11 | " |
| White pine *Pinus strobus* | United States | " | D | 0.9 | Hanna & Grant (1962) |
| Pine *Pinus sp.* | United States | " | W | 0.05 | Schroeder et al. (1967) |

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|---|---|---|---|---|---|
| Garden pea<br>*Pisum sativum* | United States | | W | 0.04 | Schroeder et al. (1967) |
| " " | Kansas (smelter area) | | D | 0.7 | Lagerwerff & Brower (1974) |
| " " | Washington, D. C. | | D | 0.42 | " |
| Blue grass<br>*Poa sp.* | Indiana | | D | 0.37 | Yost et al. (1975) |
| " " | | | D | (0.25-0.49) | Lagerwerff & Specht (1970) |
| Solomon's seal<br>*Polygonatum biflorum* | Indiana | | D | 0.5 | Yost et al. (1975) |
| Aspen<br>*Populus tremula* | Russia | bark | D | 1.6 | Malyuga (1941) |
| Quaking aspen<br>*Populus tremuloides* | Colorado | stem | D | 0.77 | Shacklette (1972) |
| " " | " | leaf | D | 0.45 | " |
| " " | Indiana | | D | 7.35 | Yost et al. (1975) |
| Poplar<br>*Populus sp.* | S.W. Missouri (on old mine dump) | leaf | D | 40.0 | Cannon (1974) |
| " " | " " " " | twig | D | 45.0 | " |
| " " | " " " " | wood | D | 22.0 | " |
| " " | " " " " | bark | D | 37.0 | " |
| *Potamogeton richardsoni* | Nova Scotia | leaf & stem | D | (0.65-4.86) | Ray & White (1976) |
| " " | " " | root | D | (1.32-6.73) | " |

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|---|---|---|---|---|---|
| Apricot<br>*Prunus armeniaca* | United States | fruit (canned) | W | 0.01 | Schroeder et al. (1967) |
| " " | " " | fruit | | 0.011 | US HEW (1975) |
| Peach<br>*Prunus persica* | " " | " | | 0.003 | " |
| Choke cherry<br>*Prunus virginiana* | Indiana | | D | 0.39 | Yost et al. (1975) |
| Douglas fir<br>*Pseudotsuga menziesii* | Colorado | stem | D | 0.2 | Shacklette (1972) |
| " " | " | leaf | D | 0.07 | " |
| Pear<br>*Pyrus communis* | Great Britain | fruit | W | (0.01-0.09)<br>0.03 | Thomas et al. (1972) |
| " " | " " | skin | W | (0.01-0.04)<br>0.02 | " |
| " " | " " | flesh | W | (0.01-0.09)<br>0.02 | " |
| " " | United States | | | 0.013 | US HEW (1975) |
| White oak<br>*Quercus alba* | Missouri | leaf | D | (<0.5-0.96) | Bolter et al. (1973) |
| " " | Tennessee | " | D | 0.12 | Van Hook et al. (1974) |
| " " | " | branch | D | 0.03 | " |
| " " | " | bole | D | 0.05 | " |
| " " | Missouri | stem | D | 0.16 | Shacklette (1972) |
| Pin oak<br>*Quercus palustris* | Connecticut | leaf & twig | D | (1.5-3.0)<br>2.3±SE 0.2 | Smith (1973) |

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|---|---|---|---|---|---|
| Pin oak<br>Quercus palustris | United States | leaf | D | 2.4 | Hanna & Grant (1962) |
| Willow oak<br>Quercus phellos | Missouri | stem | D | 0.28 | Shacklette (1972) |
| Chestnut oak<br>Quercus prinus | Tennessee | leaf | D | 0.16 | Van Hook et al. (1974) |
| " " | " | twig | D | 0.29 | " |
| " " | " | branch | D | 0.11 | " |
| " " | " | bole | D | 0.02 | " |
| " " | " | root | D | 0.34 | " |
| " " | " | $O_1$ litter | D | 0.42 | " |
| " " | " | $O_2$ litter | D | 0.81 | " |
| Oak<br>Quercus robur | Great Britain | unwashed leaf | D | $6.82 \pm 1.33$ | Little (1973) |
| Red oak<br>Quercus rubra | Tennessee | leaf | D | 0.35 | Van Hook et al. (1974) |
| " " | " | branch | D | 0.08 | " |
| " " | " | bole | D | 0.11 | " |
| Post oak<br>Quercus stellata | Missouri | stem | D | 0.11 | Shacklette (1972) |
| " " | " | leaf | D | ($<$0.5-0.96) | Bolter et al. (1973) |
| Black oak<br>Quercus velutina | Indiana | new growth | D | 0.5 | Yost et al. (1975) |
| " " | " | branch | D | 0.7 | " |
| " " | Tennessee | leaf | D | 0.69 | Van Hook et al. (1974) |

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|---|---|---|---|---|---|
| Black oak<br>Quercus velutina | Tennessee | branch | D | 0.3 | Van Hook et al. (1974) |
| " " | " | bole | D | 0.14 | " |
| Oak<br>Quercus sp. | United States | leaf | W | 0.09 | Schroeder et al. (1967) |
| Radish<br>Raphanus sativus | | | (200 m from highway, 40% of Cd was from air) | | Lagerwerff (1971) |
| " " | Japan | | W | 0.017 | Yamagata & Shigematsu (1970) |
| " " | Montana | | W | 0.6 | Hindawi & Neely (1972) |
| " " | Japan (1.2 km from refinery) | leaf | D | 15.0 | Kobayashi (1972) |
| " " | " " " " | root | D | 3.0 | " |
| " " | Canada | leaf | D | 2.5 | Hutchinson et al. (1974) |
| " " | " | root | D | 1.1 | " |
| " " | | top | D | 1.57 | Haghiri (1973) |
| " " | | root | D | 0.51 | " |
| " " | Japan | " | W | 0.017 | Yamagata & Shigematsu (1970) |
| Rhubarb<br>Rheum rhapsonticum | Kansas (smelter area) | stalk | D | 2.6 | Lagerwerff & Brower (1974) |
| " " | Washington, D.C. | " | D | 0.57 | " |

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| Sumach<br>Rhus aromatica | Indiana | | D | 0.5 | Yost et al. (1975) |
| Winged sumach<br>Rhus capallina | Missouri | stem | D | 0.11 | Shacklette (1972) |
| Smooth sumach<br>Rhus glabra | Missouri | " | D | 0.14 | " |
| Poison ivy<br>Rhus radicans | Indiana | | D | 0.52 | Yost et al. (1975) |
| Wild gooseberry<br>Ribes sp. | Colorado | " | D | 0.08 | Shacklette (1972) |
| " " | " | leaf | D | 0.07 | " |
| Water cress<br>Rorripa nasturtum-aquaticum | Great Britain | leaf & stem | W | (0.01-0.04) 0.02 | Thomas et al. (1972) |
| Wild rose<br>Rosa carolina | Indiana | | D | 0.61 | Yost et al. (1975) |
| Rudbeckia hirta | " | | D | 9.25 | " |
| Sour dock<br>Rumex acetosa | Germany | leaf | D | 0.16 | Ernst (1975) |
| Sugar cane<br>Saccharum officinarum | | | | 0.0083 | Mahaffey et al. (1975) |
| " " | | | | 0.1 | US HEW (1975) |
| " " | | cane pulp | | 0.04 | Schroeder et al. (1967) |
| " " | | cane sugar | | 0.06 | " |
| Willow<br>Salix alba | Great Britain | unwashed leaf | D | 7.85±1.24 | Little (1973) |

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|---|---|---|---|---|---|
| Willow<br>*Salix nigra* | Connecticut | catkin | D | 25.0? | Cowgill (1970) |
| Willow<br>*Salix sp.* | Indiana | | D | 9.4 | Yost et al. (1975) |
| " " | Colorado | stem | D | 1.5 | Shacklette (1972) |
| " " | " | leaf | D | 0.97 | " |
| Aquatic fern<br>*Salvinia natans* | (control) | | | 2.1 | Hutchinson & Czyrska (1972) |
| " " | (in 1.0 ppm Cd aquatic culture) | | | 6400.0 | " |
| Rye<br>*Secale cereale* | Sweden | | W | (0.01-0.021) | Kjellstrom et al. (1974) |
| Pink<br>*Silene cucubalus* | Germany | leaf | D | 0.02 | Ernst (1975) |
| *Smilacina stellata* | Indiana | | D | 1.44 | Yost et al. (1975) |
| Eggplant<br>*Solanum melongena* | Japan (700 m from mine refinery) | | | (41.0-61.0) | Kobayashi et al. (1969) |
| " " | Japan | fruit | D | 8.0 | Kobayashi (1972) |
| " " | | " | D | 8.0 | Shacklette (1972) |
| Potato<br>*Solanum tuberosum* | United States | tuber | W | 0.03 | Schroeder et al. (1967) |
| " " | Germany | " | | (0.18-0.2) | Kropf & Geldmacher (1968) |

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|---|---|---|---|---|---|
| Potato *Solanum tuberosum* | Germany (control) | tuber | W | 0.04±0.03 | Anke et al. (1976) |
| " " | Germany (polluted) | " | W | 0.31±0.39 | " |
| " " | United States | | | (0.01-0.08) | Corneliussen (1972) |
| " " | " " | | | 0.046 | Mahaffey et al. (1975) |
| " " | " " | tuber | | 0.057 | US HEW (1975) |
| " " | Japan | " | | 0.041 | Yamagata & Shigematsu (1970) |
| " " | Czechoslovakia | " | W | 0.092± SE 0.002 | Lener & Bibr (1971) |
| " " | Romania | " | W | 0.017 | Rautu & Sporn (1970) |
| " " | Japan | " | W | 0.038 | Ishizaki et al. (1970) |
| " " | Japan (800 m from refinery) | " | D | 2.0 | Kobayashi (1972) |
| " " | Montana | | W | (<0.05-0.2) | Hindawi & Neely (1972) |
| " " | Great Britain | " | W | (0.01-0.17) 0.08 | Thomas et al. (1972) |
| " " | Canada | leaf | D | (0.86-1.5) | Hutchinson et al. (1974) |
| " " | " | tuber | D | (0.45-1.05) | " |
| " " | United States | | D | (0.05-0.3) | Shacklette (1972) |
| " " | New York | | D | 0.36 | Cannon (1970) |
| Goldenrod *Solidago sp.* | Indiana | | D | 1.0 | Yost et al. (1975) |

| | | | | | |
|---|---|---|---|---|---|
| Saltgrass<br>*Spartina alternifolia* | S.E. Atlantic (salt marshes) | | D | (0.1-1.9)<br>0.5 | Windom (1974) |
| " " | N.W. Atlantic | leaf | D | 0.5 | Windom & Smith (1972) |
| Sorghum<br>*Sorghum vulgare* | Kansas | stem | D | 4.7 | Lagerwerff et al. (1973) |
| " " | " | leaf | D | 5.4 | " |
| " " | " | seed | D | 1.6 | " |
| Spinach<br>*Spinacia oleracea* | United States | fresh leaf | W | 0.45 | Schroeder et al. (1967) |
| " " | Romania | " | W | 0.064 | Rautu & Sporn (1970) |
| " " | United States | | | 0.057 | US HEW (1975) |
| " " | " " | leaf | D | (0.6-1.2) | Shacklette (1972) |
| " " | Japan | | W | 0.095 | Yamagata & Shigematsu (1970) |
| " " | " | | W | 0.128 | Ishizaki et al. (1970) |
| Grass<br>*Stipa spartea* | Indiana | | D | 0.24 | Yost et al. (1975) |
| Snowberry<br>*Symphoricarpus occidentalis* | Colorado | stem | D | 0.09 | Shacklette (1972) |
| " " | " | leaf | D | 0.12 | " |
| Buckbush<br>*Symphoricarpus orbiculatus* | Missouri | stem | D | 0.41 | " |

| | | | | | |
|---|---|---|---|---|---|
| Yew<br>*Taxus sp.* | Connecticut | leaf | D | (0.5-2.5)<br>1.2±SE 0.2 | Smith (1973) |
| " " | " | twig | D | (0.5-4.1)<br>2.0±SE 0.4 | " |
| *Tetradymia sp.* | Montana | | | (leaf collected Cd in airborne dust) | Munshower (1972) |
| Turtle grass<br>*Thalassia testudinum* | Puerto Rico | | D | (1.9-2.6)<br>2.2 | Lowman et al. (1966) |
| " " | " " | | W | (0.29-0.45)<br>0.34 | " |
| Grass<br>*Themeda sp.* | United States | | | 0.028 | Williams & David (1973) |
| Pennycress<br>*Thlaspi alpestre* | Germany | leaf | D | 4.83 | Ernst (1975) |
| *Thymus serpyllum* | " | " | D | 0.3 | " |
| Spanish moss<br>*Tillandsia usneoides* | | | | (excellent bio-indicator for Cd from smelter, roadside, urban, or industry) | Shacklette & Connor (1973) |
| " " | United States | | A | (0.8-27.0)<br>geom. mean 7.9<br>geom. dev. ±1.65 | " |
| " " | Florida, Mississippi, Louisiana | | A | >20.0 | " |
| Wandering jew<br>*Tradescantia phiensis* | Indiana | | D | 0.93 | Yost et al. (1975) |
| Red clover<br>*Trifolium pratense* | Germany (control) | | W | 0.05±0.05 | Anke et al. (1976) |

| | | | | | |
|---|---|---|---|---|---|
| Red clover *Trifolium pratense* | Germany (polluted) | | W | 0.35±0.22 | Anke et al. (1976) |
| Wheat *Triticum aestivum* | United States | bread (whole wheat) | W | 0.15 | Schroeder et al. (1967) |
| " " | " " | bread (white) | W | 0.22 | " |
| " " | Japan (0.4-1.2 km from mine refinery) | | | 6.8 | Kobayashi et al. (1970) |
| " " | Germany (control) | grain | W | 0.02±0.06 | Anke et al. (1976) |
| " " | Germany (polluted) | | W | 0.47±0.23 | " |
| " " | Montana | | W | (0.1-1.5) | Hindawi & Neely (1972) |
| " " | Sweden (control) | grain | D | 0.067±SE 0.007 | Linnman et al. (1973) |
| " " | " | flour | D | 0.033 | " |
| " " | " | bran | D | 0.148 | " |
| " " | Sweden (6.5 tons/ha sewage sludge) | grain | D | 119.0±SE 0.005 | " |
| " " | (58 tons/ha ") | " | D | 257.0±SE 0.009 | " |
| " " | Sweden, 1918 | " | W | 0.024 | Kjellstrom et al. (1975) |
| " " | " 1920 | " | W | 0.013 | " |
| " " | " 1925 | " | W | 0.022 | " |
| " " | " 1930 | " | W | 0.037 | " |
| " " | " 1935 | " | W | 0.015 | " |

| | | | | | |
|---|---|---|---|---|---|
| Wheat<br>*Triticum aestivum* | Sweden, 1940 | grain | W | 0.014 | Kjellstrom et al. (1975) |
| " " | " 1949 | " | W | 0.019 | " |
| " " | " 1955 | " | W | 0.043 | " |
| " " | " 1960 | " | W | 0.050 | " |
| " " | " 1965 | " | W | 0.038 | " |
| " " | Japan | " | W | 0.025 | Ishizaki et al. (1970) |
| " " | Sweden (4 km from Cu plant) | " | W | (0.081-0.181) | Kjellstrom et al. (1975) |
| " " | Sweden (control) | " | W | (0.029-0.053) | " |
| " " | United States | hard | D | 0.1±SD 0.02 | Zook et al. (1970) |
| " " | " " | soft | D | 0.07±SD 0.02 | " |
| " " | " " | durum | D | 0.13±SD 0.01 | " |
| Eastern hemlock<br>*Tsuga canadensis* | Connecticut | leaf | D | (0.5-1.0)0.9 ±SE 0.1 | Smith (1973) |
| " " | " | twig | D | (0.5-1.8)1.2 ±SE 0.2 | " |
| " " | | needle | | 0.083± SE 0.052 | Huckabee & Blaylock (1973) |
| " " | | twig | | 0.326±SD 0.181 | " |
| " " | United States | leaf | D | 0.6 | Hanna & Grant (1962) |
| Cattail<br>*Typha angustifolium* | Indiana | | D | 1.71 | Yost et al. (1975) |

| | | | | | |
|---|---|---|---|---|---|
| Elm<br>Ulmus glabra | Great Britain (near smelter) | leaf | D | 50.0 | Little & Martin (1972) |
| " " | Great Britain (10-15 km from smelter) | " | D | 0.25 | " |
| " " | Great Britain (in smelter area) | unwashed leaf | D | (30.0-55.0) | Little (1973) |
| " " | Great Britain (% removed washed in deionized water 62.0%) | | | | " |
| " " | Great Britain (% removed washed in detergent water 78.0%) | | | | " |
| " " | Great Britain (% removed washed in 5% $HNO_3$ 98.9%) | | | | " |
| " " | Great Britain (% removed washed in 1% $HNO_3$ 98.7%) | | | | " |
| Bilberry<br>Vaccinium myrtillus | Sweden | leaf & stem | D | 4.4 | Tyler (1972) |
| Dryland blueberry<br>Vaccinium pallidum | Missouri | leaf | D | (<0.5-0.96) | Bolter et al. (1973) |
| Cowberry<br>Vaccinium vitis idaea | Sweden | leaf & stem | D | 3.2 | Tyler (1972) |
| Violet<br>Viola calaminaria | Germany | leaf | D | 0.02 | Ernst (1975) |
| Grape<br>Vitis riparis | Indiana | | D | 0.42 | Yost et al. (1975) |

| | | | | | |
|---|---|---|---|---|---|
| Grape *Vitis sp.* | Romania | | W | 0.007 | Rautu & Sporn (1970) |
| Corn *Zea mays* | United States | hybrid | W | 0.12 | Schroeder et al. (1967) |
| " " | Ohio (in sludge-treated soil) | grain | | 1.0 | Kirkham (1975) |
| " " | " " " " | leaf | | 13.9 | " |
| " " | (non-polluted) | | D | 0.1 | Shacklette (1972) |
| " " | (polluted area) | | D | 2.0 | " |
| " " | Romania | | W | 0.0 | Rautu & Sporn (1970) |
| " " | United States | leaf | | 1.0 | Prince (1957) |
| " " | " " | grain | D | 0.96 | " |
| " " | " " | husk | | 0.67 | " |
| " " | Ontario | leaf | D | 0.7 | Hutchinson et al. (1974) |
| " " | " | root | D | 0.4 | " |
| " " | " | flower | D | 1.2 | " |
| " " | Japan | grain | D | 0.5 | Kobayashi (1972) |
| " " | United States | | W | 0.033 | Fulkerson & Goeller (1973) |
| " " | United States (grown in sludge-treated soil) | fruit | | 1.03 | Kirkham (1974) |
| " " | " " " " | leaf | | 11.6 | " |

| | | | | |
|---|---|---|---|---|
| *Zizia aurea* | Indiana | D | 0.6 | Yost et al. (1975) |
| Eel grass *Zostera marina* | Black Sea | D | 0.23 | Vinogradov (1953) |
| " " | Spain & Portugal | D | (2.0-5.3) | Stenner & Nickless (1975) |
| " " | Norway | D | 2.8 | " |
| "Grass" | Canada (N.E. from Pb smelter (m)): | | | De Koning (1974) |
| " | " " " 80 | D | 4.0 | " |
| " | " " " 170 | D | 3.0 | " |
| " | " (N from Pb smelter (m)): | | | |
| " | " " " 80 | D | 3.8 | " |
| " | " " " 170 | D | 1.0 | " |
| " | " (Ave. all directions, 80) | D | 2.4 | " |
| " | " (Ave. all directions, 170) | D | 1.8 | " |

CADMIUM IN MOSSES, LICHENS, AND FUNGI[1]

MOSSES

| Species | Locality | Tissue | Analysis[2] PPM | | Authority |
|---|---|---|---|---|---|
| Anomodon rostratus | Missouri | | A | (5.2-5.6) (ave.) | Shacklette (1972) |
| Atrichum angustifolium | " | | A | (5.2-5.6) (ave.) | " |
| Brachythecium rivulare | Tennessee (uptake of $^{109}Cd$ in 12 days) | | | (1.0-2.0) | Huckabee et al. cited in Fulkerson & Goeller (1973) |
| Cirriphyllum illecebrum | Missouri | | A | (5.2-5.6) (ave.) | Shacklette (1972) |
| Dicranum scoparium | " | | A | (5.2-5.6) (ave.) | " |
| Dicranum sp. | Tennessee | | D | 0.421±SD 0.143 | Huckabee & Blaylock (1973) |
| Eurhynchium hians | Tennessee (uptake of $^{109}Cd$ in 12 days) | | | (1.0-2.0) | Huckabee et al. cited in Fulkerson & Goeller (1973) |
| Eurhynchium praelongum | Great Britain (near smelter) | | D | 148.0 | Little & Martin (1972) |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | |
|---|---|---|---|---|
| Eurhynchium sp. | Great Britain Bristol dist. from Zn smelter (mi): | | | Burkitt et al. (1972) |
| " " | " " " " 2.4 | D | 86.0 | " |
| " " | " " " " 2.9 | D | 148.0 | " |
| " " | " " " " 6.0 | D | 49.0 | " |
| Fontinalis antipiretica | Sweden | D | (1.6-17.0) | Ljundggren et al. (1971) |
| Hedwigia ciliata | Missouri | A | (5.2-5.6) (ave.) | Shacklette (1972) |
| Hylocomium splendens | (windward of urban area) | | (3.0-4.0) | Jaakkola et al. (1971) |
| " " | (to 100 km away from urban area) | | 1.0 | " |
| " " | Quebec (Cu smelter area) | D | (<0.5-12.0) | LeBlanc et al. (1974) |
| " " | Quebec (control) | D | 1.1 | " |
| " " | S. Scandinavia | D | (0.8-1.5) | Ruhling & Tyler (1973) |
| " " | N. Norway | D | <0.1 | " |
| Hylocomium sp. | N. Finland (Lapland) | D | 0.18 | " |
| " " | S. Finland | D | (0.49-0.70) | " |
| Hypnum compressiforme | Sweden (polluted forest) | D | 30.0 | Tyler (1972) |
| " " | Sweden (normal Cd) | D | (0.7-1.2) | Ruhling (1971) |
| " " | Sweden (polluted areas) | D | (7.5-81.7) | " (1969) |

| | | | | |
|---|---|---|---|---|
| Hypnum compressiforme | Wales dist. from smelter industrial area (km): | | | Goodman & Roberts (1971) |
| " " | " " " 1.5 | D | dead | " |
| " " | " " " 3.0 | D | dead | " |
| " " | " " " 8.0 | D | 9.5 | " |
| " " | " " " 8.0 | D | 4.5 | " |
| " " | " " " 6.5 | D | 1.0 | " |
| " " | " " " 25.0 | D | (1.0-3.0) | " |
| " " | " " " (upwind) 18.0 | D | 1.8 | " |
| " " | S. Sweden (control) | D | 0.76 | Ruhling & Tyler (1970) |
| Hypnum compressiforme var. filiforma | Time after closure of Zn/Pb smelter (mo): | | (ng Cd/cm$^2$/day by moss bags) | Roberts & Goodman (1973) |
| " " " | " " " 0 | (D" | 35.0±SE 9.0) | " |
| " " " | " " " 1 | (D" | 5.0±SE 1.0) | " |
| " " " | " " " 8 | (D" | 1.3±SE 1.0) | " |
| " " " | Endemic moss at time of closure | D | (1.39-7.6) | " |
| " " " | low contamination site (control) | D | (0.6-2.5) 1.6 ±SE 0.14 | " |
| Leucobryum glaucum | Missouri | A | (5.2-5.6) ave. | Shacklette (1972) |
| Mnium affine | " | A | (5.2-5.6) ave. | " |
| Pleurozium schreberi | Quebec Cu smelter area | D | (<0.5-4.4) | LeBlanc et al. (1974) |
| " " | Quebec (control) | D | <0.5 | " |

| | | | | |
|---|---|---|---|---|
| Polytrichum commune | Missouri | A | (5.2-5.6) ave. | Shacklette (1972) |
| Polytrichum sp. | Tennessee | D | 0.383±SD 0.114 | Huckabee & Blaylock (1973) |
| Sphagnum angustifolium | S. Finland | D | 0.18 | Pakarinen & Tolanem (1976) |
| " " | Great Slave Lake, N.W.T. | D | 0.19 | " |
| Sphagnum balticum | S. Finland | D | 0.63 | " |
| Sphagnum fuscum | " " | D | 0.56 | " |
| " " | Finland | D | (0.17-0.47) 0.3 | " |
| " " | Great Slave Lake, N.W.T. | D | 0.2 | " |
| " " | Edmonton, Alberta | D | 0.17 | " |
| Sphagnum magellanicum | S. Finland | D | 0.45 | " |
| " " | S. Sweden | D | 1.0 | Ruhling & Tyler (1970) |
| Sphagnum squarrosum (and related species) | Great Britain (exposed in moss bags) | | | Little & Martin (1974) |
| " " | (collected/day) | | (1.93-2.84)2.56 μg/g/day | " |
| " " | (mapped contour lines of Cd contamination around Zn & Pb smelter area using moss bags) | | | " |
| " " | (mapped contours from 0.225-0.3 μg/g/day) | | | " |
| Sphagnum sp. | Antarctica K. Haakan | D | 0.12-0.84 | Goodman et al. (1973) |

| | | | | |
|---|---|---|---|---|
| Sharpiella striatella | Tennessee (uptake of $^{109}Cd$ in 12 days) | | (1.0-2.0) | Huckabee et al. cited in Fulkerson & Goeller(1973) |

## CADMIUM IN MOSSES, LICHENS, AND FUNGI

### LICHENS

| | | | | |
|---|---|---|---|---|
| Cladonia alpestris | Finland, Lapland (unpolluted area) | D | (0.1-0.2) | Jaakkola et al. (1973) |
| " " | Finland (6 mos. after close of Zn smelter) | D | 1.0 | " |
| " " | Finland (unpolluted areas) | D | (0.3-0.4) | " |
| " " | Finland, Lapland (unpolluted areas) | D | (0.05-0.43) 0.13 | " (1971) |
| Cladonia cristatella | Pennsylvania | D | 22.0 | Nash (1975) |
| Cladonia rangiferina | Missouri (growing on dolomite) | | 0.19 | Shacklette (1972) |
| Cladonia rangiformis | Germany | D | 0.41 | Ernst (1975) |
| Cladonia squamosa | Pennsylvania | D | 10.0 | Nash (1975) |
| Cladonia uncialis | " | D | (3.0-32.0) | " |
| Cladonia sp. | Antarctica K Haakan | D | 0.24 | Goodman et al. (1973) |
| Lasallia papulosa | Pennsylvania (Zn smelter area) | D | 32.0 | Nash (1975) |
| " " | Pennsylvania (control) | D | 1.0 | " |
| Micarea trisepta | Pennsylvania (near Zn smelter) | D | (33.0-320.0) | " |

| | | | |
|---|---|---|---|
| Parmelia baltimorensis | Washington, D. C. (1938) | 5.0 | Hale (1975) |
| " " | " (1958) | 6.0 | " |
| " " | " (1970) | 9.0 | " |
| " " | " (1971) | 6.0 | " |
| " " | Connecticut (1971) | 5.0 | " |
| Parmelia caperata | Japan (urban area) | D 1.14±SD 0.55 | Saeki et al. (1977) |
| Parmelia clavulifera | " " | D 0.59±SD 0.11 | " |
| Parmelia conspersa | " " | D 0.84±SD 0.33 | " |
| " " | Pennsylvania | D 32.0 | Nash (1975) |
| Parmelia physodes | Sweden (polluted forest) | D 12.0 | Tyler (1972) |
| Parmelia plittii | Pennsylvania | D 30.0 | Nash (1975) |
| Parmelia taractica | " | D 4.0 | " |
| Parmelia tinctorum | Japan (urban area) | D 0.70±SD 0.19 | Saeki et al. (1977) |
| Parmelia sp. | Great Britain (near smelter) | D 90.0 (max.) | Little & Martin (1972) |
| Parmelia sp. | Great Britain Bristol dist. from Zn smelter (mi): | | Burkitt et al. (1972) |
| " " | " " " 1-3 | D (72.0-90.0) | " |
| " " | " " " 6.0 | D 20.0 | " |
| Stereocaulon spp. | Finland | Cd strikingly concentrated | in Ferry et al. (1973) |
| Umbilicaria mammulata | Pennsylvania | D 5.0 | Nash (1975) |
| Umbilicaria spp. | Finland | Cd strikingly concentrated | in Ferry et al. (1973) |

| | | | | | |
|---|---|---|---|---|---|
| Umbilicaria pustulata | Finland (on siliceous rocks) | | | (30.0-3000.0) | in Ferry et al. (1973) |
| Verrucaria nigrescens | Pennsylvania (near Zn smelter) | | | 334.0 | Nash (1972) |
| "Lichens" | Pennsylvania | | | Cd more toxic & important than $SO_2$ | in Ferry et al. (1973) |
| 15 species lichens | Finland | | A | (10.0-300.0) | Lounamaa (1956) |
| " " " | " | | A | (30.0-600.0) | " |

CADMIUM IN MOSSES, LICHENS, AND FUNGI

FUNGI

| | | | | | |
|---|---|---|---|---|---|
| Gem-studded puffball Lycoperdon perlatum | Connecticut (near highway) | sporophores unwashed | D | 2.62 | McCreight & Schroeder (1977) |
| " " | " " " | sporophores washed | D | 3.12 | " |
| " " | " " " | sporophores (max.) | D | 5.34 | " |
| " " | " " " | gleba | D | 1.71 | " |
| " " | " " " | base | D | 0.0 | " |
| "Mushroom" | Great Britain | | W | (0.01-0.02) 0.02 | Thomas et al. (1972) |

## CADMIUM IN ALGAE[1]

| Species | Locality | Tissue | Analysis[2] PPM | Authority |
|---|---|---|---|---|
| *Acanthopeltis japonica* | Japan | | D 0.1 | Ishibashi et al. (1964) |
| Red alga *Ahnfeltia plicata* | Great Britain | | D 0.0 | Leatherland & Burton (1974) |
| *Allaria esculenta* | Russia | | D 1.0 | Malyuga (1941) |
| *Anabaena sp.* | Indiana | | D 0.22 | Yost et al. (1974) |
| Brown alga, knotted wrack *Ascophyllum nodosum* | Great Britain | | D 0.349 | Mullin & Riley (1956) |
| " " | Norway (polluted) | | D (1.5-11.5) | Stenner & Nickless (1974a) |
| " " | Norway (non-polluted) | | D (1.0-1.5) | " |
| " " | Norway | | D (<0.7-1.0) | Haug et al. (1974) |
| " " | " | | D (<0.1-2.0) | Lande (1977) |
| " " | Russia | | D (0.29-0.34) | Malyuga (1941) |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | |
|---|---|---|---|---|
| *Bossea sp.* | S. California | W | (2.39-2.72) | Vattuone et al. (1976) |
| Red alga *Bryothamnium triquetrum* | Puerto Rico | A | 6.0 (ave.) | Lowman et al. (1966) |
| Chara *Chara fragilis* | Indiana | D | (<0.2-0.2) | Yost et al. (1974) |
| Irish moss *Chondrus crispus* | Spain & Portugal | D | 4.9 | Stenner & Nickless (1975) |
| Brown alga *Chorda filum* | Norway (non-polluted) | D | (ND-3.5) | " (1974a) |
| " " | Norway (polluted) | D | (0.9-20.0) | " |
| " " | Spain & Portugal | D | 0.7 | " (1975) |
| Green alga *Cladophora glomerata* | Sweden | D | (2.0-6.0) | Hägerhäll (1972) |
| Green alga *Cladophora sp.* | Idaho (contaminated) | | 36.0 | Funk et al. (1973) |
| Green alga *Codium fragile* | Korea | D | 0.52 | Kim (1972) |
| Green alga *Codium sp.* | Great Britain | D | 0.865 | Mullin & Riley (1956) |
| Green alga *Codium taylori* | Puerto Rico | A | 5.0 (ave.) | Lowman et al. (1966) |
| Red alga *Corallina officinalis* | Norway | D | 3.0 | Stenner & Nickless (1974a) |
| " " | Great Britain | D | 0.858 | Mullin & Riley (1956) |

| | | | | |
|---|---|---|---|---|
| Red alga<br>Corallina officinalis | Spain & Portugal | D | (4.4-6.2) | Stenner & Nickless (1975) |
| Cymodocea sp. | Puerto Rico | D | (2.0-3.1)<br>2.3 | Lowman et al. (1966) |
| " " | " " | W | (0.15-0.49)<br>0.23 | " |
| Cystophyllum sisymbrioides | Korea | D | <0.02 | Kim (1972) |
| Delesseria sanguinea | Spain & Portugal | D | 4.1 | Stenner & Nickless (1975) |
| Desmarestia viridis | Japan | D | 0.1 | Ishibashi et al. (1964) |
| Ecklonia stolonifera | Korea | D | (0.03-0.82) | Kim (1972) |
| Egregia laevigata | S. California | W | (0.94-1.14) | Vattuone et al. (1976) |
| Eisenia bicyclis | Japan | D | 0.3 | Ishibashi et al. (1964) |
| Green alga<br>Enteromorpha linza | Korea | D | (0.02-1.2) | Kim (1972) |
| Green alga<br>Enteromorpha intestinalis | Sweden | D | (1.0-10.0) | Hägerhäll (1972) |
| Green alga<br>Enteromorpha prolifera | Korea | D | (0.14-0.72) | Kim (1972) |
| Green alga<br>Enteromorpha sp. | Norway (non-polluted) | D | (0.7-3.2) | Stenner & Nickless (1974a) |
| " " | Norway (polluted) | D | (2.7-13.0) | " |
| Bladder wrack<br>Fucus ceranoides | Norway | D | (3.2-8.2) | " |

| | | | | |
|---|---|---|---|---|
| Wrack<br>*Fucus distichus* | W. Greenland | W | (0.57-8.0) | Bollingberg (1975) |
| Wrack<br>*Fucus inflatus* | Russia | D | 0.16 | Malyuga (1941) |
| Wrack<br>*Fucus serratus* | Norway (non-polluted) | D | (2.3-3.2) | Stenner & Nickless (1974a) |
| " " | Norway (polluted) | D | (3.1-13.0) | " |
| " " | Great Britain | D | 0.792 | Mullin & Riley (1956) |
| " " | Great Britain Portland | D | 0.3 | Leatherland & Burton (1974) |
| " " | Great Britain Severn Estuary | D | 53.0 | " |
| " " | Russia | D | (0.29-0.34) | Malyuga (1941) |
| Wrack<br>*Fucus spiralis* | Norway | D | 5.9 | Stenner & Nickless (1974a) |
| Bladder wrack<br>*Fucus vesiculosus* | Great Britain | D | (2.03-2.08) | Mullin & Riley (1956) |
| " " | Great Britain Bristol Channel | D | (2.0-75.0) | Nickless et al. (1972) |
| " " | South Wales, Aberavon Beach | D | (0.7-11.0) 9.3 | Nickless (1973) |
| " " | Great Britain Severn Estuary | D | (15.0-220.0) | Butterworth et al. (1972) |
| " " | " " | D | $1.7 \pm 0.24$ | Preston et al. (1972) |

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|---|---|---|---|---|
| Bladder wrack<br>*Fucus vesiculosus* | Great Britain<br>Severn Estuary<br>(1961) | D | (0.05-21.0) | Preston et al. (1972) |
| " " | " " " (1970) | D | (0.4-20.8) | " |
| " " | W. Greenland | W | (0.57-8.0) | Bollingberg (1975) |
| " " | Norway | D | 1.0 | Lande (1977) |
| " " | Norway<br>(polluted) | D | (4.7-12.5) | Stenner & Nickless (1974a) |
| " " | Norway<br>(non-polluted) | D | (1.8-2.8) | " |
| " " | Great Britain<br>Irish Sea | D | (0.10-4.30) | Fuge & James (1974) |
| " " | Great Britain<br>Bristol Channel<br>(polluted) | D | (6.07-25.60)<br>13.81±SD 7.31 | " |
| " " | " " " " | D | (3.82-19.5) | Morris & Bale (1975) |
| " " | Great Britain<br>Cornish Coast | D | (0.9-8.5) | Bradfield et al. (1976) |
| Red alga<br>*Galaxaura marginata* | Puerto Rico | A | 6.0 | Lowman et al. (1966) |
| Red alga<br>*Gelidium sp.* | Japan | D | 0.2 | Ishibashi et al. (1964) |
| Red alga<br>*Gigartina stellata* | Norway | D | (0.6-1.3) | Stenner & Nickless (1974a) |
| *Gliopeltis furcata* | Korea | D | (0.65-1.26) | Kim (1972) |
| Red alga<br>*Gracilaria caudata* | Puerto Rico | A | 6.0 (ave.) | Lowman et al. (1966) |

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|---|---|---|---|---|
| Red alga<br>*Gracilaria cornea* | Puerto Rico | A | 6.0 (ave.) | Lowman et al. (1966) |
| Brown alga<br>*Halidrys siliquosa* | Great Britain | D | 0.43 | Leatherland & Burton (1974) |
| *Halimeda gracilis* | Indian Ocean | D | 0.312 | Mullin & Riley (1956) |
| *Halimeda opuntia* | Puerto Rico | A | 5.0 (ave.) | Lowman et al. (1966) |
| *Ishige sinicola* | Korea | D | 0.60 | Kim (1972) |
| *Hizikia sp.* | " | D | (0.41-1.18)0.97 | " |
| *Laminaria digitata* | Great Britain | D | 0.134 | Mullin & Riley (1956) |
| " " | " " | D | 0.15 | Leatherland & Burton (1974) |
| " " | Norway | D | (2.3-4.3) | Stenner & Nickless (1974a) |
| Brown alga<br>*Laminaria japonica* | Korea | D | (0.14-0.38) | Kim (1972) |
| Brown alga<br>*Laminaria reliosa* | " | D | (0.13-1.18) | " |
| Brown alga<br>*Laminaria saccharina* | Great Britain | D | 0.35 | Leatherland & Burton (1974) |
| " " | Russia | D | 0.14 | Malyuga (1941) |
| Brown alga<br>*Laminaria sp.* | S. California | W | (0.44-0.81) | Vattuone et al. (1976) |

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|---|---|---|---|---|---|
| Red alga<br>*Laurencia obtusa* | Puerto Rico | | A | 6.0 (ave.) | Lowman et al. (1966) |
| Red alga<br>*Lithophyllum sp.* | | | D | 0.358 | Mullin & Riley (1956) |
| Red alga<br>*Lithothamnion sp.* | Great Britain | | D | 0.844 | " |
| Green alga<br>*Lyngbia mayuscula* | Puerto Rico | | A | 5.0 (ave.) | Lowman et al. (1966) |
| *Lyngbya sp.* | Indiana | | D | 0.35 | Yost et al. (1974) |
| Brown alga<br>*Macrocystis pyrifera* | California | | A | (2.9-3.8)<br>3.4±0.4 | Boothe & Knauer (1972) |
| " " | " | (calc.) | D | (1.93-2.53)2.25 | " |
| Brown alga<br>*Macrocystis sp.* | S. California | blade | W | 0.85±SD 0.21 | Vattuone et al. (1976) |
| Green alga<br>*Nostoc muscorum* | | | | accumulated $^{115}$Cd | Makhonina & Gileva (1968) |
| *Oscillatoria sp.* | Nova Scotia | | D | (0.85-0.98) | Ray & White (1976) |
| Brown alga, channel wrack<br>*Pelvetia canaliculata* | Great Britain | | D | (0.5-0.508) | Mullin & Riley (1956) |
| " " | Norway | | D | (1.3-1.8) | Stenner & Nickless (1974a) |
| " " | " | | D | <1.0 | Lande (1977) |
| *Phormidium sp.* | Indiana | | D | 1.02±0.13 | Yost et al. (1974) |
| *Phyllaria dermatoidea* | Russia | | D | 0.1 | Malyuga (1941) |

| | | | | |
|---|---|---|---|---|
| Laverweed<br>*Porphyra pseudolinearis* | Korea | D | (0.08-0.10) | Kim (1972) |
| Laverweed<br>*Porphyra tenera* | Japan | D | (0.085-4.046) | Ishio et al. (1973) |
| " " | Korea | D | (0.04-0.67) | Kim (1972) |
| Laverweed<br>*Porphyra umbilicalis* | Great Britain<br>Irish Sea | D | (0.05-0.97) | Preston et al. (1972) |
| Laverweed<br>*Porphyra yezoensis* | Korea | D | 0.27 | Kim (1972) |
| Sargassum weed<br>*Sargassum fulvellum* | " | D | (0.11-0.31)<br>0.18 | Kim & Won (1974) |
| " " | " | D | (0.57-1.48) | Kim (1972) |
| Sargassum weed<br>*Sargassum horneri* | " | D | 0.3 | " |
| Sargassum weed<br>*Sargassum sp.* | Carribean Sea | D | (1.3-5.2)<br>3.1 | Forster et al. (1972) |
| " " | Texas | D | (1.25-2.38)<br>1.82 | Horowitz & Presley (1977) |
| Green alga<br>*Spirogyra sp.* | Indiana | D | $2.33 \pm 0.41$ | Yost et al. (1974) |
| Brown alga<br>*Turbinaria turbinata* | Puerto Rico | A | 6.0 | Lowman et al. (1966) |
| Green alga<br>*Udotea flabellum* | " " | D | (0.75-1.7)<br>0.69 | " |
| " " | " " | W | (0.18-0.79)<br>0.45 | " |
| Green alga<br>*Ulva lactuca* | Norway | D | (0.9-1.5) | Stenner & Nickless (1974a) |

| | | | | | |
|---|---|---|---|---|---|
| Green alga *Ulva lactuca* | Spain & Portugal | | D | (0.5-2.0) | Stenner & Nickless (1975) |
| " " | Puerto Rico | | A | 5.0 (ave.) | Lowman et al. (1966) |
| Green alga *Ulva sp.* | Japan | | D | 0.2 | Ishibashi et al. (1964) |
| *Undaria pinnatifida* | Korea | natural | D | (0.03-0.60) | Kim (1972) |
| " " | " | cultured | D | 0.63 | " |
| " " | " | sporophyll | D | (0.02-0.25) | " |
| " " | " | blade | D | (0.20-0.56) | " |
| " " | " | " | D | (0.22-3.2) 0.44 | Kim & Won (1974) |
| " " | " | sporophyll | D | (0.14-0.32) 0.23 | " |
| Green alga *Valonia ventricosa* | Puerto Rico | | A | 5.0 (ave.) | Lowman et al. (1966) |
| *Zygnema sp.* | Indiana | | D | $2.33 \pm 0.41$ | Yost et al. (1974) |

## CHROMIUM IN MAMMALS (1)

| Species | Locality | Tissue | Analysis PPM (2) | | | Authority |
|---|---|---|---|---|---|---|
| Pronghorn antelope *Antilocapra americana* | Idaho | hair | | | (1.9-640.0) | Huckabee et al. (1972) |
| " " | Wyoming | " | | | (0.3-130.0) | " |
| Cow *Bos bovis* | United States | bone marrow | W | 0.03 | | Schroeder et al. (1962) |
| " " | " | muscle | W | 0.09 | | " |
| " " | " | whole milk | W | 0.01 | | " |
| " " | " | milk, skim dried | D | 0.07 | | " |
| " " | " | calf liver | D | 1.67 | | Toepfer et al. (1973) |
| " " | " | muscle | D | 0.37 | | " |
| " " | " | milk, skim | D | 0.13 | | " |
| " " | " | butter | D | 0.15 | | " |
| " " | Texas | liver | D | 0.4±SD 0.0 | | Horowitz & Presley (1977) |

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| | | | | | |
|---|---|---|---|---|---|
| Coyote<br>*Canis latrans* | Wyoming | hair | | (0.7-12.0) | Huckabee et al. (1972) |
| Guinea pig<br>*Cavia porcellus* | United States | liver | D | (1.1-1.9) | Furr et al. (1976) |
| " " | " | kidney | D | (1.7-3.4) | " |
| " " | " | muscle | D | (1.8-3.4) | " |
| " " | " | adrenal | D | (5.6-9.5) | " |
| " " | " | spleen | D | (3.0-6.0) | " |
| Elk<br>*Cervus canadensis* | Idaho | hair | | (1.9-570.0) | Huckabee et al. (1972) |
| Opposum<br>*Didelphis virginiana* | Tennessee | | D | 0.6 | NRCC (1976) |
| Porcupine<br>*Erethizon dorsatum* | Wyoming | hair | | 0.9 | Huckabee et al. (1972) |
| " " | " | quill | | 0.8 | " |
| Chipmunk<br>*Eutamias sp.* | " | hair | | 29.1 | " |
| Vole<br>*Microtus longicaudus* | Idaho | " | | 1.7 | " |
| Mountain vole<br>*Microtus montanus* | Wyoming | " | | (4.7-180.0) | " |
| Meadow vole<br>*Microtus pennsylvanicus* | " | " | | (5.6-8.2) | " |
| Richardson's vole<br>*Microtus richardsoni* | " | " | | 10.0 | " |
| Mouse<br>*Mus musculus* | with 0.1 ppm Cr in food & water | kidney | W | 0.36 | Schroeder et al. (1964) |
| " " | " | liver | W | 0.12 | " |
| " " | " | heart | W | 0.67 | " |

| | | | | | |
|---|---|---|---|---|---|
| Mouse<br>Mus musculus | with 0.1 ppm Cr in food & water | lung | W | 0.28 | Schroeder et al. (1964) |
| " " | " | spleen | W | 0.41 | " |
| " " | " | | W | 0.36 ave. mean | " |
| " " | With 5.1 ppm Cr in food & water | kidney | W | 0.86 | " |
| " " | " | liver | W | 0.51 | " |
| " " | " | heart | W | 1.7 | " |
| " " | " | lung | W | 0.95 | " |
| " " | " | spleen | W | 1.83 | " |
| " " | " | | W | 1.23 ave mean | " |
| Mule deer<br>Odocoileus hemionus | Idaho | hair | | (13.0-630.0) | Huckabee et al. (1972) |
| Mountain goat<br>Oreamnus americanus | " | " | | (4.0-5.5) | " |
| Sheep<br>Ovis aries | United States | lamb muscle | W | 0.12 | Schroeder et al. (1962) |
| Bighorn sheep<br>Ovis canadensis | Wyoming | hair | | 0.0 | Huckabee et al. (1972) |
| Common harbor seal<br>Phoca vitulina | Great Britain | blood | W | 0.03±SD 0.01 | Hamilton (1976) |
| " " | " | spleen | W | 0.004±SD 0.001 | " |
| " " | " | heart | W | 0.007 | " |
| " " | " | muscle | W | 0.01±SD 0.003 | " |
| " " | " | kidney | W | 0.01±SD 0.005 | " |
| " " | " | liver | W | 0.006±SD 0.004 | " |

| | | | | | | |
|---|---|---|---|---|---|---|
| Rat<br>Rattus rattus | | New England (laboratory) | liver | D | (0.49-0.50) | Schroeder & Nason (1976) |
| " | " | " | lung | D | (1.84-2.14) | " |
| " | " | " | heart | D | (2.30-3.82) | " |
| " | " | " | kidney | D | (1.79-2.47) | " |
| " | " | " | spleen | D | (3.01-4.03) | " |
| Squirrel<br>Sciurus sp. | | Tennessee | | D | 0.8 | NRCC (1976) |
| Cotton rat<br>Sigmodon hispidus | | " | pelt, control | W | 0.092±0.007 | Taylor et al. (1975) |
| " | " | Tennessee exposed to drift from cooling tower | pelt | W | 1.056±0.133 | " |
| " | " | Tennessee | hair, control | W | 0.395±0.021 | " |
| " | " | " exposed to drift | hair | W | 4.397±0.555 | " |
| " | " | " 100-130 m from source | pelt | W | (0.93-1.2) | " |
| " | " | " " | hair | W | (3.9-4.8) | " |
| " | " | | | | There was a 10 fold increase in Cr in both pelt and hair when rats ate vegetation with high levels of Cr | " |
| " | " | Tennessee | heart | W | (0.105-0.124) | " |
| " | " | " | liver | W | (0.046-0.160) | " |
| " | " | " | kidney | W | (0.087-0.124) | " |
| " | " | " | spleen | W | (0.493-0.713) | " |
| " | " | " | lung | W | (0.289-0.292) | " |

| | | | | | |
|---|---|---|---|---|---|
| Cotton rat<br>*Sigmodon hispidus* | Tennessee | bone | W | (0.160-0.460) | Taylor et al. (1975) |
| " " | " | muscle | W | (0.234-0.288) | " |
| " " | " | intestine | W | (1.006-1.046) | " |
| " " | " | pelt | W | (0.092-1.056) | " |
| " " | " | hair | W | (0.395-4.397) | " |
| Shrew<br>*Sorex vagrans* | Wyoming | hair | | 15.0 | Huckabee et al. (1972) |
| Pig<br>*Sus scrofa* | | muscle | W | 0.1 | Schroeder et al. (1972) |
| Red fox<br>*Vulpes fulva* | Tenessee | | D | 0.8 | NRCC 91976) |
| Western jumping mouse<br>*Zapus princeps* | Wyoming | hair | | (23.0-45.0) | Huckabee et al. (1972) |

## CHROMIUM IN BIRDS (1)

| Species | Locality | Tissue | Analysis PPM (2) | Authority |
|---|---|---|---|---|
| Mallard *Anas platyrhynchos* | Canada | feather | D 0.05 | Kelsall (1970) |
| Black duck *Anas rubripes* | " | " | D 0.05 | " |
| White-fronted goose *Anser albifrons* | " | " | D 0.05 | " |
| Lesser scaup duck *Aythya affinis* | " | " | D 0.05 | " |
| Barrow goldeneye *Bucephala islandica* | | low levels of $Cr^{51}$ only in gut, blood, lungs | | Davis et al. (1958) |
| Crow *Corvus brachyrhynchos* | Tennessee | | D 1.0 | Andren et al. (1973) |
| Chicken *Gallus domesticus* | United States | breast muscle | W 0.26 | Schroeder et al. (1962) |
| " " | " | gizzard | W 0.11 | " |
| " " | " | skin | W 0.27 | " |
| " " | " | egg | W 0.16 | " |

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| | | | | | |
|---|---|---|---|---|---|
| Chicken<br>Gallus domesticus | | muscle | D | 0.37 | Toepfer et al. (1973) |
| " " | | egg | D | 0.7 | " |
| Lesser black-backed gull<br>Larus fuscus fuscus | Norway | muscle | D | 1.0 | Lande (1977) |
| " " " | " | liver | D | 1.0 | " |
| " " " | " | kidney | D | 1.0 | " |
| Sparrow<br>Passer domesticus | Tennessee | | D | 1.0 | Andren et al. (1973) |
| Brown pelican<br>Pelecanus occidentalis | Florida | egg | W | (0.005-0.067)<br>geom. mean 0.014 | Blus et al. (1977) |
| " " | South Carolina | " | W | (0.001-0.15)<br>geom. mean 0.011 | " |
| " " | " | liver | W | (0.026-0.056) | " |
| " " | Georgia | " | W | 0.020 | " |
| " " | Florida | | W | (0.049-0.110) | " |
| Eider<br>Somateria mollissima | Norway | muscle | D | 1.0 | Lande (1977) |
| " " | " | liver | D | 1.0 | " |
| " " | " | kidney | D | 1.0 | " |
| " " | " | egg | D | 1.0 | " |
| Hawk | Tennessee | | D | 1.0 | Andren et al. (1973) |
| Owl | " | | D | 0.2 | " |
| Partridge | United States | gizzard | W | 0.13 | Schroeder et al. (1962) |

## CHROMIUM IN MARINE FISH (1)

| Species | Locality | Tissue | Analysis (2) PPM | Authority |
|---|---|---|---|---|
| Atlantic wolffish *Anarchichas lupus* | Norway | | D 1.0 | Lande (1977) |
| Deepbody anchovy *Anchoa compressa* | California | muscle | D 0.8 | Emerson et al. (1976) |
| Sablefish *Anoplopoma fimbria* | Oregon | | W (0.0-43.0) pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| Blue hake *Antimora rostrata* | New Jersey | muscle | W <0.61 | Greig et al. (1976) |
| " " | " | liver | W (<0.52-0.59) | " |
| Greater silver smelt *Argentina silus* | Norway | | D 1.0 | Lande (1977) |
| Silverfish *Argyrozona argyrozona* | S. Africa | muscle | W <0.1 | Van As et al. (1975) |
| *Atractoscion aequidens* | " | " | W 0.0 | " |

(1)
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? indicates questionable data.

(2)
W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported.
pCi/g = picocuries per gram.

| | | | | | |
|---|---|---|---|---|---|
| Bogue<br>Boops boops | Mediterranean | muscle | D | 0.22 | Fukai & Broquet (1965) |
| " " | " | internal organs | D | 0.5 | " |
| Filamented rattail<br>Chalinura filifera | Oregon | | W | 7.2 pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| Rabbitfish<br>Chimaera monstrosa | Norway | | D | 1.0 | Lande (1977) |
| Chrysoblephus gibbiceps | S. Africa | muscle | W | <0.1 | Van As et al. (1975) |
| Herring<br>Clupea harengus | " | " | D | 1.0 | " |
| Shiner perch<br>Cymatogaster aggregata | California | " | D | 2.0 | Emerson et al. (1976) |
| Sand sea trout<br>Cynoscion arenarius | Texas | " | D | (5.5-8.3)6.9 | Horowitz & Presley (1977) |
| " " | " | skin | D | (3.5-3.8)3.7 | " |
| " " | " | air bladder | D | (1.8-2.7)2.6 | " |
| Porgy<br>Diplodus vulgaris | Israel | muscle | D | 1.0 | Roth & Hornung (1977) |
| Northern anchovy<br>Engraulis mordax | California | " | D | 2.5 | Emerson et al. (1976) |
| Anchovy<br>Engraulis ringens | Pacific | | A | (0.11-0.16) | Goldberg (1962) |
| Grouper<br>Epinephelus aeneus | Israel | muscle | D | 1.0 | Roth & Hornung (1977) |

| | | | | | |
|---|---|---|---|---|---|
| Merou blanc<br>*Epinephalus guaza* | Israel | muscle | D | 2.4 | Roth & Hornung (1977) |
| Priest shark<br>*Etmopterus spinax* | Norway | | D | 1.0 | Lande (1977) |
| Atlantic cod<br>*Gadus morhua* | N.E. Atlantic | muscle | W | (0.0-0.16)<br>0.07±SD 0.05 | Zook et al. (1976) |
| " " | Iceland | " | W | (0.0-0.20)<br>0.12±SD 0.06 | " |
| " " | Norway | | D | (1.0-2.0) | Lande (1977) |
| Black-mouthed dogfish<br>*Galeus melastomus* | " | | D | 1.0 | " |
| White croaker<br>*Genyonemus lineatus* | California | muscle | D | 0.3 | Emerson et al. (1976) |
| Rex sole<br>*Glyptocephalus zachirus* | Oregon | | W | (0.0-7.7)<br>pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| Halosauran<br>*Halosauropsis macrochir* | New Jersey | muscle | W | (0.98-1.17) | Greig et al. (1976) |
| Pacific halibut<br>*Hippoglossus stenolepis* | Gulf of Alaska | " | W | (0.05-0.47)<br>0.18±SD 0.11 | Zook et al. (1976) |
| Longspine squirrelfish<br>*Holocentrus rufus* | Puerto Rico | | W | (10.0-11.0)<br>10.5 | Lowman et al. (1966) |
| Lanternfish<br>*Hygophum hygomi* | New Jersey | whole | W | <0.49 | Greig et al. (1976) |
| Surf smelt<br>*Hypomesus pretiosus* | Oregon | | W | 84.0 pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| Kabeljou<br>*Johnius hololepidotus* | S. Africa | muscle | W | 0.72±SD 0.97 | Van As et al. (1975) |

| | | | | | |
|---|---|---|---|---|---|
| Yellowtail flounder<br>Limanda ferruginea | Long Island | muscle | W | (<0.1-0.2) | Greig & Wenzloff (1977) |
| " " | " " | liver | W | (<0.1-0.2) | " |
| " " | N.E. Atlantic | muscle | W | (0.0-0.29)<br>0.09±0.09 | Zook et al. (1976) |
| Lithognathus lithognathus | S. Africa | " | W | 0.11 | Van As et al. (1975) |
| Angler<br>Lophius piscatorius | " | " | W | <0.1 | " |
| Red snapper<br>Lutjanus campechanus | Gulf of Mexico | " | W | (0.0-0.50)<br>0.12±SD 0.13 | Zook et al. (1976) |
| Grenadier<br>Macrurus rupestris | Norway | | D | 1.0 | Lande (1977) |
| Blue marlin<br>Makaira nigricans | Japan | muscle | W | (0.01-0.03)<br>0.06±0.02 | Nishiyaki et al. (1974) |
| Haddock<br>Melanogrammus aeglefinus<br>(=Gadus aeglefinus) | | | W | 0.02 | Schroeder et al. (1962) |
| " " | | | D | 0.34 | Toepfer et al. (1973) |
| " " | N.W. Atlantic | muscle | W | (0.0-0.22)<br>0.12±SD 0.07 | Zook et al. (1976) |
| " " | Norway | | D | (1.0-2.0) | Lande (1977) |
| Whiting<br>Merlangius merlangus | " | | D | 1.0 | " |
| Silver hake, whiting<br>Merluccius bilinearis | Maine | muscle | W | (0.0-0.26)<br>0.09±SD 0.09 | Zook et al. (1976) |
| Hake, stockfish<br>Merluccius capensis | S. Africa | " | W | 0.26±SD 0.44 | Van As et al. (1975) |

| | | | | | |
|---|---|---|---|---|---|
| European hake<br>Merluccius merluccius | Israel | muscle | D | (2.2-2.7) | Roth & Hornung (1977) |
| Pacific hake<br>Merluccius productus | Washington, Oregon | " | W | (0.0-0.23)<br>0.09±SD 0.07 | Zook et al. (1976) |
| Atlantic croaker<br>Micropogon undulatus | Texas | " | D | 7.3 | Horowitz & Presley (1977) |
| " " | " | skin | D | 4.8 | " |
| Dover sole<br>Microstomus pacificus | California | | W | (0.0-1.1)0.5 | Fowler et al. (1975) |
| " " | " | muscle | D | <0.2 | McDermott et al. (1976) |
| " " | " | gonad | D | (<0.2-0.9) | " |
| " " | " | liver | D | (<0.2-0.6) | " |
| " " | " | kidney | D | (0.2-0.5) | " |
| " " | " | heart | D | (<0.2-0.4) | " |
| Planehead filefish<br>Monocanthus hispidus<br>(=Stephanolepis hispidus) | New Jersey | whole | W | <0.52 | Greig et al. (1976) |
| Striped bass<br>Morone saxatilis | Long Island | | W | 0.613 | Zawacki & Briggs (1976) |
| " " | " " | | D | 1.96 | " |
| Mullet<br>Mugil richardsoni | S. Africa | muscle | W | <0.1 | Van As et al. (1975) |
| Goatfish<br>Mullus barbatus | Israel | " | D | (2.4-4.9) | Roth & Hornung (1977) |

| | | | | | |
|---|---|---|---|---|---|
| Smooth dogfish *Mustelus canis* | Long Island | muscle | W | <0.3 | Greig & Wenzloff (1977) |
| " " | " " | liver | W | <0.8 | " |
| *Nematonurus armatus* | New Jersey | muscle | W | <0.68 | Greig et al. (1976) |
| " " | " | liver | W | <0.86 | " |
| Yellowfin tuna *Neothunnus macropterus* | Pacific | whole | A | (0.04-0.3) | Goldberg (1962) |
| " " | " | blood | A | 0.05 | " |
| " " | " | pyloric caeca | A | 1.20 | " |
| " " | " | eyeball | A | 0.07 | " |
| " " | " | white muscle | A | 0.03 | " |
| " " | " | dark muscle | A | 0.07 | " |
| " " | " | gill | A | 0.05 | " |
| " " | " | heart | A | 0.35 | " |
| " " | " | intestine | A | 0.04 | " |
| " " | " | integument | A | 0.16 | " |
| " " | " | spleen | A | 0.11 | " |
| " " | " | stomach | A | 0.06 | " |
| " " | " | in stomach (squid) | A | 0.06 | " |
| " " | Japan | | W | (0.05-0.00) 0.09±0.01 | Nishigaki et al. (1974) |
| Hottentot *Pachymetopon grande* | S. Africa | muscle | W | 3.0 | Van As et al. (1975) |

| | | | | | |
|---|---|---|---|---|---|
| Sea bream<br>Pagellus centrodontus | Mediterranean | muscle | D | 0.03 | Fukai & Broquet (1965) |
| " " | " | internal organs | D | 0.25 | " |
| Calico bass<br>Paralabrax clathratus | California | dorsal muscle | D | (1.3-1.7) | Stapleton (1968) |
| " " | " | ventral muscle | D | 1.4 | " |
| " " | " | gonad | D | (2.0-2.6) | " |
| " " | " | liver | D | (1.0-1.5) | " |
| " " | " | integument | D | (1.4-1.9) | " |
| " " | " | heart | D | (0.9-1.7) | " |
| " " | " | eyeball | D | (4.8-5.5) | " |
| Flounder<br>Paralichthys sp. | United States | muscle | W | 0.01 | Schroeder et al. (1962) |
| " " | " | skin | W | 0.18 | " |
| White sea perch<br>Phanerodon furcatus | California | muscle | D | 0.6 | Emerson et al. (1976) |
| Pollock<br>Pollachius virens | N.W. Atlantic | " | W | (0.0-0.18)<br>0.08±SD 0.07 | Zook et al. (1976) |
| Bluefish<br>Pomatomus saltatrix | Long Island | | W | 0.498 | Zawacki & Briggs (1976) |
| " " | " | | D | 1.22 | " |
| Wenchman<br>Pristipomoides aquilonarus | Texas | muscle | D | 2.4 | Horowitz & Presley (1977) |
| " " | " | skin | D | 3.5 | " |
| " " | " | viscera | D | 4.5 | " |

| | | | | | |
|---|---|---|---|---|---|
| Winter flounder *Pseudopleuronectes americanus* | Texas | muscle | D | (0.6-7.4)3.3 | Horowitz & Presley (1977) |
| " " | " | skin | D | (2.9-7.4)4.4 | " |
| " " | Long Island | muscle | W | (<0.5-0.5) | Greig & Wenzloff (1977) |
| Pilchard *Sardina pilchardus* | Mediterranean | muscle | D | 0.14 | Fukai & Broquet (1965) |
| " " | " | internal organs | D | 0.3 | " |
| Gilt sardine *Sardinella aurita* | Israel | muscle | D | (2.1-3.4) | Roth & Hornung (1977) |
| Lizardfish *Saurida undosquamis* | Israel | " | D | (0.6-2.2) | Roth & Hornung (1977) |
| Chub mackerel *Scomber japonicus* | S. Africa | muscle | W | 0.65±SD 0.85 | Van As et al. (1975) |
| Atlantic mackerel *Scomber scombrus* | Mediterranean | " | D | 0.05 | Fukai & Broquet (1965) |
| " " | " | internal organs | D | 0.4 | " |
| Windowpane flounder *Scophthalmus aquosus* | Long Island | | W | 0.6±SE 0.3 | Greig et al. (1977b) |
| " " | New York Bight | | W | <0.5 | " |
| " " | Delaware | | W | <0.5 | " |
| " " | Maryland | | W | <0.2 | " |

| | | | | | |
|---|---|---|---|---|---|
| Windowpane flounder<br>Scophthalmus aquosus | Long Island | | W | 0.386 | Zawacki & Briggs (1976) |
| " " | " | | D | 1.54 | " |
| Ocean perch, redfish<br>Sebastes marinus | Maine | muscle | W | (0.0-0.23)<br>0.10±SD 0.08 | Zook et al. (1976) |
| Rock fish<br>Sebastodes spp. | Oregon | | W | (0.0-15.0)<br>pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| Queenfish<br>Seriphus politus | California | muscle | D | 0.7 | Emerson et al. (1976) |
| Yellowtail<br>Seriola pappei | S. Africa | " | W | 1.0±SD 1.8 | Van As et al. (1975) |
| Amberjack<br>Seriola sp. | New Jersey | muscle | W | <0.52 | Greig et al. (1976) |
| " " | " | liver | W | <1.26 | " |
| Black-ear bass<br>Serranus atrobranchius | Texas | muscle | D | 7.2 | Horowitz & Presley (1977) |
| " " | " | skin | D | 4.9 | " |
| Siganus rivulatus | Israel | muscle | D | 1.4 | Roth & Hornung (1977) |
| Sole<br>Solea solea | " | " | D | 1.1 | " |
| Barracuda<br>Sphyraena sphyraena | " | " | D | (1.7-2.0) | " |
| Spiny dogshark<br>Squalus acanthius | Sweden | without viscera | D | 0.2 | Noddack & Noddack (1940) |

| | | | | | |
|---|---|---|---|---|---|
| Long-spined porgy *Stenotomus chrysops* | Texas | muscle | D | (0.9-3.2)2.0 | Horowitz & Presley (1977) |
| " " | " | skin | D | (3.5-15.0)8.1 | " |
| " " | " | viscera | D | 3.8 | " |
| *Synaphobranchus kaupi* | New Jersey | whole | W | <0.42 | Greig et al. (1976) |
| Sole *Synaptura marginata* | S. Africa | muscle | W | 1.3±SD 1.8 | Van As et al. (1975) |
| Striped marlin *Tetrapturus audax* | Japan | " | W | (0.02-0.13) 0.08±0.04 | Nishigaki et al. (1974) |
| Albacore *Thunnus alalunga* | Pacific | spleen | A | 35.0 | Goldberg (1962) |
| " " | " | heart | A | 0.04 | " |
| " " | " | gall-bladder | A | 0.1 | " |
| " " | " | liver | A | 0.04 | " |
| " " | " | pyloric caeca | A | 0.04 | " |
| " " | " | stomach | A | 0.03 | " |
| " " | " | dorsal muscle | A | 0.06 | " |
| " " | " | midline muscle | A | 0.04 | " |
| " " | Japan | muscle | W | (0.03-0.07) 0.04±0.01 | Nishigaki et al. (1974) |
| Albacore tuna *Thunnus albacares* | Mexico to Panama | " | W | (0.0-0.14) 0.07±SD 0.05 | Zook et al. (1976) |

| | | | | | |
|---|---|---|---|---|---|
| Big eye tuna<br>*Thunnus obesus* | Mexico to Panama | muscle | W | (0.02-0.26)<br>0.07±0.05 | Nishigaki et al. (1974) |
| Rough scad<br>*Trachurus lathami* | Texas | " | D | (2.7-5.0)<br>3.9 | Horowitz & Presley (1977) |
| " " | " | skin | D | (2.8-4.6)3.7 | " |
| " " | " | viscera | D | 3.8 | " |
| Horse mackerel<br>*Trachurus trachurus* | S. Africa | muscle | W | 0.14 | Van As et al. (1975) |
| Sea robin<br>*Triglia capensis* | " | " | W | <0.1 | " |
| Sea robin<br>*Triglia sp.* | Texas | " | D | (0.9-3.9)2.5 | Horowitz & Presley (1977) |
| " " | " | skin | D | (2.2-5.0)3.1 | " |
| Dwarf goatfish<br>*Upeneus moluccensis* | Israel | muscle | D | (2.0-4.1) | Roth & Hornung (1977) |
| Red hake<br>*Urophycis chuss* | Long Island | " | W | <0.2 | Greig & Wengloff (1977) |
| " " | " | liver | W | <0.2 | " |
| White hake<br>*Urophycis tenuis* | " | muscle | W | <0.2 | " |
| " " | " | liver | W | <0.2 | " |
| Swordfish<br>*Xiphias gladius* | Japan | muscle | W | (0.03-0.28)<br>0.08±0.07 | Nishigaki et al. (1974) |
| Kingklip<br>*Xiphiurus capensis* | S. Africa | " | W | 0.92±SD 1.54 | Van As et al. (1975) |

## CHROMIUM IN FRESHWATER FISH (1)

| Species | Locality | Tissue | Analysis (2) PPM | | Authority |
|---|---|---|---|---|---|
| Whitefish *Alburnus sp.* | Danube River | | D | (0.21-0.98)0.5 | Reywoldt et al. (1975) |
| Alewife *Alosa pseudoharengus* | Lake Michigan | whole | W | 1.1±SE 0.5 | Lucas et al. (1970) |
| " " | Wisconsin | | W | 0.0 | Kleinert et al. (1974) |
| Rockbass *Ambloplites rupestris* | " | | W | 0.0 | " |
| Bowfin *Amia calva* | " | | W | 0.09 | " |
| Freshwater drum *Aplodinotus grunniens* | " | | W | (0.0-0.04) | " |
| Goldfish *Carassius auratus* | " | | W | 0.0 | " |
| Quillback *Carpioides cyprinus* | " | | W | 0.0 | " |
| " " | Illinois | muscle | W | (0.02-0.60) 0.21 | Mathis & Cummings (1973) |

(1)
Blank spaces indicate information not available or not applicable.
? indicates questionable data.

(2)
W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported.
pCi/g = picocuries per gram.

| | | | | | |
|---|---|---|---|---|---|
| Largescale sucker<br>*Catastomus macrocheilus* | Columbia River | highest $Cr^{51}$ is in blood, liver, kidney and spleen | | | Davis et al. (1958) |
| Sucker<br>*Catastomus sp.* | Wisconsin | | W | (0.0-0.2) | Kleinert et al. (1974) |
| Cisco, Lake herring<br>*Coregonus artedii* | " | | W | 0.0 | " |
| Lake whitefish<br>*Coregonus clupeaformis* | Moose Lake | | W | 0.033 | Uthe & Bligh (1971) |
| " " | Lake Ontario | | W | 0.017 | " |
| Slimy sculpin<br>*Cottus cognatus* | Great Lakes | | | (0.094-0.48) | Thomas (1972) |
| Carp<br>*Cyprinus carpio* | Wisconsin | | W | (0.0-0.27) | Kleinert et al. (1974) |
| " " | Illinois | muscle | W | (0.02-0.46)<br>0.16 | Mathis & Cummings (1973) |
| " " | Danube River | | D | (0.21-0.98)<br>0.5 | Reywoldt et al. (1975) |
| Gizzard shad<br>*Dorosoma cepedianum* | Illinois | muscle | W | (0.10-1.06)<br>0.45 | Mathis & Cummings (1973) |
| Northern pike<br>*Esox lucius* | Moose Lake & Lake St. Pierre | | W | (<0.026-0.035) | Uthe & Bligh (1971) |
| " " | Lake Erie | | W | <0.031 | " |
| " " | Illinois | muscle | W | (0.02-0.22)<br>0.13 | Mathis & Cummings (1973) |
| " " | Wisconsin | | W | (0.0-0.09) | Kleinert et al. (1974) |
| Catfish<br>*Ictalurus spp.* | " | | W | 0.03 | " |

| | | | | | |
|---|---|---|---|---|---|
| Bigmouth buffalo<br>*Ictiobius cyprinellus* | Illinois | muscle | W | (0.02-0.53)<br>0.13 | Mathis & Cummings (1973) |
| Shortnose gar<br>*Lepisosteus platostomus* | Illinois | " | W | (0.10-0.20)<br>0.14 | " |
| Pumpkinseed<br>*Lepomis gibbosus* | Wisconsin | | W | 0.08 | Kleinert et al. (1974) |
| Blue gill<br>*Lepomis macrochirus* | " | | W | (0.0-0.07) | " |
| Burbot<br>*Lota lota* | " | | W | 0.0 | " |
| Smallmouth bass<br>*Micropterus dolomieui* | " | | W | (0.03-0.18) | " |
| " " | Illinois | muscle | W | (0.04-0.27)<br>0.16 | Mathis & Cummings (1973) |
| Largemouth bass<br>*Micropterus salmoides* | Wisconsin | | W | (0.0-0.07) | Kleinert et al. (1974) |
| " " | Illinois | muscle | W | (0.04-0.24)<br>0.11 | Mathis & Cummings (1973) |
| White bass<br>*Morone chrysops*<br>(=Roccus chrysops) | Illinois | muscle | W | (0.04-0.08)<br>0.06 | " |
| " " | Wisconsin | | W | (0.0-0.04) | Kleinert et al. (1974) |
| Red horse sucker<br>*Moxostoma macrolepidotum* | Illinois | muscle | W | (0.07-0.15)<br>0.09 | Mathis & Cummings (1973) |
| Redhorse<br>*Moxostoma sp.* | Wisconsin | | W | 0.04 | Kleinert et al. (1974) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Spottail shiner<br>Notropis hudsonius | Lake Michigan | whole | | W | 0.9±SE 0.5 | Lucas et al. (1970) |
| " " | Lake Erie | " | | W | 10.0? | " |
| American smelt<br>Osmerus mordax | " | muscle | | W | 0.034 | Uthe & Bligh (1971) |
| " " | Great Lakes | | | | (0.063-0.35) | Thomas (1972) |
| Coho salmon<br>Oncorhynchus kisutch | Wisconsin | | | W | 0.0 | Kleinert et al. (1974) |
| Yellow perch<br>Perca flavescens | Lake Erie | muscle | | W | <0.065 | Uthe & Bligh (1971) |
| " " | Wisconsin | | | W | (0.0-0.1) | Kleinert et al. (1974) |
| Trout-perch<br>Percopsis omiscomaycus | Lake Michigan | whole | | W | 1.6±SE 0.2 | Lucas et al. (1970) |
| " " | Lake Superior | " | | W | ≤3.0? | " |
| Crappie<br>Pomoxis sp. | Wisconsin | | | W | (0.0-0.1) | Kleinert et al. (1974) |
| Yellow bass<br>Roccus mississippiensis | " | | | W | 0.04 | " |
| Rainbow trout<br>Salmo gairdnerii | " | | | W | (0.0-0.09) | " |
| Brown trout<br>Salmo trutta | " | | | W | (0.0-0.09) | " |
| Brook trout<br>Salvelinus fontinalis | " | | | W | 0.0 | " |
| Lake trout<br>Salvelinus naymaycush | " | | | W | 0.08 | " |
| " " | Lake Cayuga<br>New York | age in years | 1 | W | 0.0052 | Tong et al. (1974) |
| " " | " | " | 2 | W | 0.0023 | " |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Lake trout | | | | | | | |
| Salvelinus | naymaycush | Lake Cayuga New York | age in years | 3 | W | 0.0032 | Tong et al. (1974) |
| " | " | " | " | 4 | W | 0.0041 | " |
| " | " | " | " | 5 | W | 0.012 | " |
| " | " | " | " | 6 | W | 0.0128 | " |
| " | " | " | " | 7 | W | 0.011 | " |
| " | " | " | " | 8 | W | 0.0052 | " |
| " | " | " | " | 9 | W | 0.010 | " |
| " | " | " | " | 10 | W | 0.011 | " |
| " | " | " | " | 11 | W | 0.032 | " |
| " | " | " | " | 12 | W | 0.090 | " |
| Walleye | | | | | | | |
| Stizostedion | vitreum | Wisconsin | | | W | (0.0-0.14) | Kleinert et al. (1974) |
| " | " | Great Lakes | | | | (0.069-0.43) | Thomas (1972) |

TABLE 18. CHROMIUM IN MOLLUSCS[1]

| Species | Locality | Tissue | Analysis[2] PPM | | Authority |
|---|---|---|---|---|---|
| Limpet<br>Acmaea digitalis | California | shell | D | 5.7 | Graham (1972) |
| " " | " | soft parts | D | (7.1-24.2) | " |
| Calico scallop<br>Aequipecten gibbus | Florida | " | W | (0.0-0.23)<br>0.10±SD 0.06 | Zook et al. (1976) |
| Atlantic bay scallop<br>Aequipecten irradians | Massachusetts | " | W | (0.0-0.15)<br>0.05±SD 0.05 | " |
| Clam<br>Amblema plicata | Illinois | " | W | (0.6-9.9)4.4 | Mathis & Cummings (1973) |
| Common northern buccinum<br>Buccinum undatum | Scotland | " | D | 25.0 | Mackay et al. (1972) |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | | |
|---|---|---|---|---|---|
| Channeled whelk<br>Busycon canaliculatum | Long Island | muscle | W | <0.8 | Greig et al. (1977b) |
| " " | Chincoteague | " | W | <0.5 | " |
| " " | " | digestive gland | W | <0.5 | " |
| " " | Long Island | " | W | <0.8 | " |
| Pteropod<br>Cavolinia quadridentata | Gulf of Aquaba | | | (0.43-4.91) | Turekian et al. (1973) |
| Pteropod<br>Cavolinia unicata | " | | | 0.50±0.19 | " |
| Scallop<br>Chlamys opercularis | Great Britain | soft parts | D | 2.2 | Bryan (1973) |
| Scallop<br>Chlamys septemradiata | Scotland | " | D | 42.0 | Mackay et al. (1972) |
| Black mussel<br>Choromytilis meridionalis | S. Africa | " | W | 0.10±SD 0.06 | Van As et al. (1975) |
| " " | " | " | D | 1.4 | Watling & Watling (1976b) |
| Pteropod<br>Clio pyramidata | Gulf of Aquaba | | | (1.13-4.09) | Turekian et al. (1973) |
| Portuguese oyster<br>Crassostrea angulata<br>(=Gryphaea angulata) | France coast | soft parts | D | 0.5 | Fukai & Broquet (1965) |
| Pacific oyster<br>Crassostrea gigas | Oregon | | W | (0.0-15.0) pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| " " | Pacific coast - U.S. | " | W | (0.10-0.30) | Pringle et al. (1968) |

| | | | | | |
|---|---|---|---|---|---|
| Pacific oyster<br>Crassostrea gigas | Tasmania | | D | 7.9 | Ayling (1973) |
| American oyster<br>Crassostrea virginica | New England | | W | (<0.12-3.37) | Schuster & Pringle (1969) |
| " " | " " | 20 wks in 0.05 ppm Cr | W | (5.81-6.28) | " |
| " " | " " | 20 wks in 0.1 ppm Cr | W | (10.87-11.49) | " |
| " " | Texas | shell | D | <1.0 | Smith & Wright (1962) |
| " " | Atlantic coast-U.S. | soft parts | W | (0.04-3.40)<br>0.40 | Pringle et al. (1968) |
| " " | Mobile Bay | | W | (<0.1-3.3)<br>0.35 | Kopfler & Mayer (1973) |
| " " | Chesapeake Bay | " | W | (0.0-0.15)<br>0.09±SD 0.06 | Zook et al. (1976) |
| " " | Long Island | " | W | (0.12-0.54)<br>0.19±SD 0.12 | " |
| Atlantic slipper shell<br>Crepidula fornicata | Great Britain | | W | 0.3 | Segar et al. (1971) |
| " " | " | | D | 2.0 | " |
| Pteropod<br>Cresius acicula | Gulf of Aquaba | | | (1.70-2.71) | Turekian et al. (1973) |
| White mussel<br>Donax serra | S. Africa | soft parts | W | 0.24±SD 0.03 | Van As et al. (1975) |
| Octopus<br>Eledone moschata | Mediterranean | whole | D | 0.12 | Fukai & Broquet (1965) |

| | | | | | |
|---|---|---|---|---|---|
| Clam<br>*Fusconaia flava* | Illinois | soft parts | W | (1.1-11.6)7.7 | Mathis & Cummings (1973) |
| Abalone<br>*Haliotis midae* | S. Africa | " | W | 0.50±SD 0.25 | Van As et al. (1975) |
| Red abalone<br>*Haliotis rufescens* | California | gill | D | (0.5-4.4) | Anderlini (1974) |
| " " | " | mantle | D | (0.0-13.0) | " |
| " " | " | digestive gland | D | (1.4-13.2) | " |
| Squid<br>*Illex sp.* | Texas | muscle with skin | D | (3.0-4.7)<br>6.1 | Horowitz & Presley (1977) |
| " " | " | muscle | D | (0.4-11.0)<br>5.4 | " |
| " " | " | viscera | D | (2.7-7.1)<br>3.9 | " |
| " " | " | pen | D | 3.1 | " |
| Pteropoda<br>*Limacina retroversa* | New England | | A | <1.0 | Nicholls et al. (1959) |
| " " | South Atlantic | | | ND | Turekian et al. (1973) |
| Squid<br>*Loligo vulgaris* | France coast | soft parts | D | 0.07 | Fukai & Broquet (1965) |
| Bent-nose macoma<br>*Macoma nasuta* | California | | D | (19.1-22.2) | Emerson et al. (1976) |
| Northern quahog<br>*Mercenaria mercenaria* | Great Britain | | W | 0.16 | Segar et al. (1971) |

| | | | | | |
|---|---|---|---|---|---|
| Northern quahog<br>Mercenaria mercenaria | Great Britain | | D | 0.79 | Segar et al. (1971) |
| " " | United States | | W | (0.19-5.80)<br>0.31 | Pringle et al. (1968) |
| " " | E. United States | | W | (0.06-0.64)<br>0.17±SD 0.17 | " |
| Northern horse mussel<br>Modiolus modiolus | Irish Sea | | W | 0.03 | Segar et al. (1971) |
| " " | " | | D | 0.14 | " |
| Murex<br>Murex trunculus | Mediterranean | soft parts | D | 0.9 | Fukai & Broquet (1965) |
| Soft shell clam<br>Mya arenaria | Oregon | | W | (0.0-78.0)<br>pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| " " | Atlantic coast United States | | W | (0.0-0.43)<br>0.23±SD 0.12 | Zook et al. (1976) |
| " " | " | | W | (0.10-5.0)<br>0.52 | Pringle et al. (1968) |
| Californian mussel<br>Mytilus californianus | Oregon | | W | (0.0-140.0)<br>pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| " " | California | shell | D | (<5.7-14.2) | Graham (1972) |
| " " | " | soft parts | D | (<1.5-7.8) | " |
| " " | Pacific Coast United States | " | D | (1.2-1.8) | Alexander & Rowland (1966) |
| " " | California | digestive gland | D | (0.8-61.0) | Alexander & Young (1976) |
| Common mussel<br>Mytilus edulis | New Zealand | | D | (9.0-24.0)<br>16.0 | Brooks & Rumsby (1965) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Common mussel *Mytilus edulis* | | New Zealand | mantle | D | <3.0 | Brooks & Rumsby (1965) |
| " | " | " | gill | D | 10.0 | " |
| " | " | " | muscle | D | <3.0 | " |
| " | " | " | visceral mass | D | 29.0 | " |
| " | " | " | intestine | D | <3.0 | " |
| " | " | " | foot | D | <3.0 | " |
| " | " | " | gonad | D | <3.0 | " |
| " | " | " | shell | D | <3.0 | " |
| " | " | " | soft parts | D | 1.0 | " |
| " | " | Mediterranean | " | D | 1.0 | Fukai & Broquet (1965) |
| " | " | Belgium | " | D | (0.56-2.0) 1.23 | Bertine & Goldberg (1972) |
| " | " | Netherlands | " | D | 6.6 | " |
| " | " | Irish Sea Great Britain | " | W | 0.17 | Segar et al. (1971) |
| " | " | " | " | D | 1.5 | " |
| " | " | California | shell | D | 5.7 | Graham (1972) |
| " | " | " | soft parts | D | (<1.5-7.6) 4.0 | " |
| " | " | Oregon | | W | (0.0-140.0) pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| " | " | Norway | soft parts | D | (4.0-49.0) | Lande (1977) |
| " | " | " | shell | D | (1.0-2.0) | " |

| | | | | | |
|---|---|---|---|---|---|
| Common mussel<br>*Mytilus edulis* | Mediterranean | soft parts | D | (0.5-28.8)<br>7.5 | Fowler & Oregioni (1976) |
| " " | California | digestive gland | D | (2.0-15.2) | Alexander et al. (1975) |
| Mussel<br>*Mytilus galloprovincialis* | Mediterranean | | D | (0.5-28.8) | Fowler & Oregione (1976) |
| Giant western nassa<br>*Nassarius fossatus* | California | | D | 12.1 | Emerson et al. (1976) |
| Eastern mud nassa<br>*Nassarius obsoletus* | Oregon | | W | (0.0-5.3)<br>pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| Nut clam<br>*Nucula sulcata* | Scotland | soft parts | D | 18.0 | Mackay et al. (1972) |
| Squid<br>*Ommastrephes illecebrosa* | New England | | A | <1.0 | Nicholls et al. (1959) |
| Oyster<br>*Ostrea sinuata* | New Zealand | | D | (2.0-6.0)<br>3.0 | Brooks & Rumsby (1965) |
| " " | " | mantle | D | <3.0 | " |
| " " | " | gill | D | <3.0 | " |
| " " | " | muscle | D | <3.0 | " |
| " " | " | kidney | D | <3.0 | " |
| " " | " | heart | D | 9.0 | " |
| " " | " | shell | D | <3.0 | " |
| Limpet<br>*Patella intermedia* | France coast | soft parts | D | 0.8 | Fukai & Broquet (1965) |

| | | | | | |
|---|---|---|---|---|---|
| Limpet<br>Patella intermedia | France coast | shell | D | 0.07 | Fukai & Broquet (1965) |
| Limpet<br>Patella vulgata | Israel at discharge pipe | soft parts | D | (18.5-23.2) | Navrot et al. (1974) |
| " " | " not at discharge pipe | " | D | (9.7-14.0) | " |
| " " | Israel | shell | D | (9.3-10.4) | " |
| " " | Norway | | D | (7.0-17.0) | Lande (1977) |
| " " | " | | D | (1.0-2.0) | " |
| Giant pacific scallop<br>Pecten caurinus<br>(=Patinopecten caurinus) | Oregon | | W | (3.8-18.0) pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| Scallop<br>Pecten jacobaeus | France coast | soft parts | D | 1.1 | Fukai & Broquet (1965) |
| Scallop<br>Pecten maximus | Great Britain | " | D | 1.3 | Bryan (1973) |
| Scallop<br>Pecten novae-zelandiae | New Zealand | | D | (3.0-23.0)<br>16.0 | Brooks & Rumsby (1965) |
| " " | " | mantle | D | <3.0 | " |
| " " | " | gill | D | 145.0 | " |
| " " | " | muscle | D | <3.0 | " |
| " " | " | visceral mass | D | 8.0 | " |
| " " | " | intestine | D | 24.0 | " |
| " " | " | kidney | D | 17.0 | " |
| " " | " | foot | D | 8.0 | " |
| " " | " | gonad | D | <3.0 | " |

| | | | | | |
|---|---|---|---|---|---|
| Scallop<br>Pecten novae-zelandiae | New Zealand | shell | D | <3.0 | Brooks & Rumsby (1965) |
| Atlantic deep sea scallop<br>Placopecten magellanicus | Delaware | | D | (0.89-6.88) 3.08 | Pesch et al. (1977) |
| " " | E. United States | | W | (0.0-0.12) 0.06±SD 0.04 | Zook et al. (1976) |
| Common Pacific littleneck<br>Protothaca staminea | California | soft parts | D | <1.5 | Graham (1972) |
| " " | " | shell | D | <5.7 | " |
| Clam<br>Quadrula quadrula | Illinois | soft parts | W | (1.8-8.3)4.7 | Mathis & Cummings (1973) |
| Pacific razor clam<br>Siliqua patula | Oregon | | W | (0.0-38.0) pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| Surf clam<br>Spisula solidissima | Virginia | heart & tongue | W | (0.20-0.69) 0.39±SD 0.15 | Zook et al. (1976) |
| " " | Delaware | | W | <0.7 | Greig et al. (1977b) |
| " " | Chincoteague | | W | <0.5 | " |
| Pteropod<br>Styliola tubula | South Atlantic | | | (0.66-0.72) | Turekian et al. (1973) |
| Littleneck clam<br>Tapes decussatus<br>(=Venerubis decussatus) | Mediterranean | | D | 1.6 | Fukai & Broquet (1965) |
| Littleneck clam<br>Tapes semidecussata | California | shell | D | 10.3±SD 0.7 | Graham (1972) |
| " " | " | soft parts | D | 10.3±SD 0.7 | " |

| | | | | | |
|---|---|---|---|---|---|
| Beaded periwinkle<br>Tectarius muricatus | Puerto Rico | soft parts | W | (3.0-12.0)7.1 | Lowman et al. (1965) |
| " " | " | " | D | (13.0-42.0)21.8 | " |
| " " | " | " | W | 68.2 | Stevenson et al. (1966) |
| " " | " | shell | W | 43.52 | " |
| Black tegula<br>Tegula funebralis | California | " | D | (<5.7-15.8) | Graham (1972) |
| " " | " | soft parts | D | (<1.5-12.2) | " |
| Short-spired dogwinkle<br>Thais emarginata | Oregon | | W | (0.0-4.3) pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| " " | California | " | D | 1.5 | Graham (1972) |
| " " | " | shell | D | (<5.7-10.5) | " |
| Venus shell<br>Venus verrucosa | Mediterranean | soft parts | D | 0.5 | Fukai & Broquet (1965) |

## CHROMIUM IN ARTHROPODA (1)

| Species | Locality | Tissue | Analysis PPM (2) | | Authority |
|---|---|---|---|---|---|
| CRUSTACEA | | | | | |
| Decapoda | | | | | |
| Ghost shrimp *Callianassa californiensis* | California | | D | (3.4-5.7) | Emerson et al. (1976) |
| Blue crab *Callinectes sapidus* | Chesapeake Bay | muscle | W | (0.07-0.35) 0.18±SD 0.09 | Zook et al. (1976) |
| Crab *Cancer anthonyi* | California | | W | (0.1-0.5) | Fowler et al. (1975) |
| Rock crab *Cancer irroratus* | Long Island | muscle | W | 0.6±SE 0.12 | Greig et al. (1977b) |
| " " | New York Bight | " | W | <0.5 | " |
| " " | Delaware | " | W | <0.3 | " |
| " " | Chincoteague | " | W | <0.5 | " |
| " " | Long Island to Chincoteague | digestive gland | W | (0.4-1.2) | " |
| " " | " | gill | W | (0.80-2.5) | " |
| " " | New York Bight | | D | (<3.5-35.2) | " (1977a) |

(1) Blank spaces indicate information not available or not applicable
? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | | |
|---|---|---|---|---|---|
| Shore crab *Carcinus maenas* | Mediterranean | soft parts | D | 0.4 | Fukai & Broquet (1965) |
| " " | Norway | " | D | 8.0 | Lande (1977) |
| Sand shrimp *Crangon allmani* | Scotland | " | D | (9.0-13.0) | Mackay et al. (1972) |
| Sand shrimp *Crangon crangon* | Mediterranean | carapace | D | 0.3 | Fukai & Broquet (1965) |
| " " | " | soft parts | D | 0.04 | " |
| " " | Belgium | | D | (0.04-2.1) | Bertine & Goldberg (1972) |
| Crab *Eriphia verrucosa* | " | carapace | D | 0.4 | Fukai & Broquet (1965) |
| " " | " | soft parts | D | 0.7 | " |
| Red crab *Geryon quinquedens* | New Jersey | | W | <0.52 | Greig et al. (1976) |
| American lobster *Homarus americana* | United States | claw muscle | W | 0.0 | Schroeder et al. (1962) |
| " " | " | tail muscle | W | 0.0 | " |
| " " | " | digestive gland | W | 0.33 | " |
| " " | " | shell | W | 0.0 | " |
| Rock lobster *Jasus lalandii* | S. Africa | | W | 0.08±SD 0.08 | Van As et al. (1975) |

| | | | | | |
|---|---|---|---|---|---|
| Crab<br>*Mursia gaudichaudii* | California | | W | ND | Fowler et al. (1975) |
| Pink shrimp<br>*Pandalus borealis* | N.W. Atlantic | | W | (0.0-0.25)<br>0.10±SD 0.07 | Zook et al. (1976) |
| Prawn<br>*Pandalus montagui* | Scotland | soft parts | D | (17.0-20.0) | Mackay et al. (1972) |
| Spiny lobster<br>*Panulirus borealis* | Florida | tail muscle | W | (0.06-0.31)<br>0.14±SD 0.08 | Zook et al. (1976) |
| King crab<br>*Paralithodes camschatica* | Alaska | body muscle | W | (0.0-0.24)<br>0.10±SD 0.09 | " |
| " " | " | leg muscle | W | (0.0-0.30)<br>0.13±SD 0.09 | " |
| " " | " | muscle | D | 0.09 | Fukai & Broquet (1965) |
| Shrimp<br>*Parapenaeus longirostris* | Mediterranean | soft parts | D | 0.11 | " |
| " " | " | carapace | D | 0.5 | " |
| Brown shrimp<br>*Penaeus aztecus* | Texas | muscle | D | (0.4-3.8)2.1 | Horowitz & Presley (1977) |
| " " | " | exoskeleton | D | (7.6-17.3)10.6 | " |
| " " | " | viscera | D | (3.1-5.3)4.0 | " |
| " " | " | | W | (0.0-0.19)<br>0.10±SD 0.06 | Zook et al. (1976) |
| White shrimp<br>*Penaeus setiferus* | Mississippi | | W | (0.15-0.25)<br>0.19±SD 0.04 | " |
| " " | Florida | | W | (0.0-0.11)<br>0.05±SD 0.01 | " |

| | | | | | |
|---|---|---|---|---|---|
| Crab<br>*Pisa nodipes* | Mediterranean | whole | D | 1.1 | Fukai & Broquet (1965) |
| Long-eyed swimming crab<br>*Podophthalmus vigil* | Washington | gills absorb very high levels of $Cr^{51}$ | | | Sather (1967) |
| Kelp crab<br>*Pugettia producta* | California | feces | A | (ND-7.6) 4.1±3.3 | Boothe & Knauer (1972) |
| Rock shrimp | Texas | muscle | D | (1.8-4.2) 2.8 | Horowitz & Presley (1977) |
| " " | " | exoskeleton | D | (0.5-2.7)1.7 | " |
| Copepoda | | | | | |
| Copepod<br>*Acartia clausi* | Mediterranean | whole | D | 1.5 | Fukai & Broquet (1965) |
| " " | Greece | | D | (1.51-5.25) 3.26 | Zafiropoulos & Grimanis (1977) |
| Copepod<br>*Centropagus hamatus* and *typicus* | New England | | A | 260.0 | Nicholls et al. (1959) |
| Copepod<br>*Clausocalanus sp.* | Mediterranean | | D | 2.1 | Fukai & Broquet (1965) |
| *Paracalanus sp.* | " | | D | 2.1 | " |
| Isopoda | | | | | |
| Slater<br>*Ligia pallasii* | Oregon | whole | W | (0.0-27.0) pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |

| | | | | | |
|---|---|---|---|---|---|
| Cirripedia | | | | | |
| Goose barnacle *Mitella polymerus* | Oregon | | W | (0.0-12.0) pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| " " | Washington | stem | D | 3.6 | Alexander & Rowland (1966) |
| " " | " | body | D | 14.0 | " |
| Euphausiacea | | | | | |
| *Euphausia krohnii* | New England | | A | <1.0 | Nicholls et al. (1959) |
| Euphausids | S. Africa (with copepods) | | W | (0.05-0.15) | Van As et al. (1975) |
| INSECTA | | | | | |
| Termite *Odontotermes transvaalensis* & *Trinervitermes dispar* | Rhodesia | worker | D | 1,500.0 | Wild (1975) |
| " " | " | soldier | D | 300.0 | " |
| " " | " | queen | D | 20.0 | " |

## CHROMIUM IN ECHINODERMATA (1)

| Species | Locality | Tissue | Analysis PPM (2) | | Authority |
|---|---|---|---|---|---|
| Sea urchin<br>*Arbacia lixula* | Greece | whole | D | 13.0 | Papadopoulou et al. (1976) |
| Sea Star<br>*Asterias rubens* | Sweden | without viscera | D | 0.02 | Noddack & Noddack (1940) |
| Starfish<br>*Astropecten irregularis* | Mediterranean | whole | D | 1.2 | Fukai & Broquet (1965) |
| Sea urchin<br>*Brissopsis lyrifera* | Sweden | without viscera | D | 0.02 | Noddack & Noddack (1940) |
| Sea urchin<br>*Echinaster sepositus* | Greece | whole | D | 0.83 | Papadopoulou et al. (1976) |
| Sea urchin<br>*Echinometra lucunter* | Puerto Rico | | W | 43.2 | Stevenson et al. (1966) |
| Sea cucumber<br>*Holothuria forskalii* | Mediterranean | | D | 0.3 | Fukai & Broquet (1965) |

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| | | | | | |
|---|---|---|---|---|---|
| Sea cucumber<br>*Holothuria tubulosa* | Greece | whole | D | 0.80 | Papadopoulou et al. (1976) |
| Starfish<br>*Marthasterias glacialis* | " | " | D | 1.6 | " |
| Serpent star<br>*Ophioderma longicauda* | " | " | D | 0.46 | " |
| Brittle star<br>*Ophiothrix suensoni* | Puerto Rico | | W | 24.17 | Stevenson et al. (1966) |
| Brittle star<br>*Ophiura texturata* | Mediterranean | whole | D | 0.8 | Fukai & Broquet (1965) |
| *Paracentrotus lividus* | Greece | whole | D | 4.8 | Papadopoulou et al. (1976) |
| Sea urchin<br>*Parechinus sp.* | S. Africa | | W | <0.1 | Van As et al. (1975) |
| Starfish<br>*Pisaster ochraceus* | Pacific coast United States | | D | (3.5-12.3) | Alexander & Rowland (1966) |
| Sea cucumber<br>*Stichopus regalis* | Mediterranean | without viscera | D | 1.1 | Fukai & Broquet (1965) |
| Sea cucumber<br>*Stichopus tremulus* | Sweden | " | D | 0.9 | Noddack & Noddack (1940) |
| Sea urchin<br>*Tripneustes esculenta* | Puerto Rico | testis | W | 19.9 | Stevenson et al. (1966) |

## CHROMIUM IN LOWER ANIMALS (1)

| Species | Locality | Tissue | Analysis (2) PPM | Authority |
|---|---|---|---|---|
| PORIFERA | | | | |
| Sponge<br>*Halichondra sp.* | Sweden | | D 0.2 | Noddack & Noddack (1940) |
| COELENTERATA | | | | |
| Coral<br>*Anomacora fecunda* | W. Atlantic Ocean | | D 2.0 | Livingston & Thompson (1971) |
| Sea anemone<br>*Anthopleura xanthigrammica* | Oregon | | W (0.0-27.0) pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| Coral<br>*Bathycyathus maculatus* | W. Atlantic Ocean | | D 4.0 | Livingston & Thompson (1971) |
| Coral<br>*Caryophyllia clavus* | " | | D <2.0 | " |
| Coral<br>*Caryophyllia communis* | " | | D 3.0 | " |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | |
|---|---|---|---|---|
| *Cerianthus sp.* | California | D | 2.4 | Emerson et al. (1976) |
| Coral *Cladocera patriarca* | W. Atlantic Ocean | D | 2.0 | Livingston & Thompson (1971) |
| Jelly fish *Cynaea capillata* | New England | A | 0.6 | Nicholls et al. (1959) |
| " " | Sweden | D | 1.3 | Noddack & Noddack (1940) |
| Jelly fish | New York Bight | D | <14.0 | Greig et al. (1977a) |
| Coral *Dendrophyllia sp.* | W. Atlantic Ocean | D | 2.0 | Livingston & Thompson (1971) |
| Coral *Desmophyllum cristogalli* | " | D | (<1.0-1.2) | " |
| Coral *Madracis asperula* | " | D | 4.0 | " |
| Coral *Madracis mirabilis* | " | D | (0.2-14.0) | " |
| Coral *Madracis pharensis* | " | D | 23.0 | " |
| Coral *Meandrina areolata* | " | D | <1.0 | " |
| Coral *Meandrina braziliensis* | " | D | (1.1-<2.0) | " |
| Sea anemone *Metridium dianthus* | Sweden | D | 0.0 | Noddack & Noddack (1940) |
| Coral *Montastrea annularis* | W. Atlantic Ocean | D | (<2.0-10.0) | Livingston & Thompson (1971) |

| | | | | |
|---|---|---|---|---|
| Coral<br>*Phyllangia americana* | W. Atlantic Ocean | D | <2.0 | Livingston & Thompson (1971) |
| Coral<br>*Porites porites* | " | D | <2.0 | " |
| Coral<br>*Scolmia cubensis* | " | D | (2.0-5.0) | " |
| Coral<br>*Solenosmilia variabilis* | " | D | (0.94-<2.0) | " |
| Coral<br>*Trochocyanthus sp.* | " | D | 1.5 | " |
| CTENOPHORA | | | | |
| Comb jelly<br>*Beroe cucumis* | New England | A | 1.0 | Nicholls et al. (1959) |
| Comb jellyfish | New York Bight | D | (<3.5-8.8) | Greig et al. (1977a) |
| ANNELIDA | | | | |
| Polychaete worm<br>*Aphrodite aculeata* | Mediterranean whole | D | 14.7 | Fukai & Broquet (1965) |
| Polychaete worm<br>*Cirriformia luxuriosa* | California | D | (4.8-75.3) | Emerson et al. (1976) |
| Palolo worm<br>*Eunicia sp.* | Puerto Rico | W | (16.9-20.9) | Stevenson et al. (1966) |
| Polychaete worm<br>*Hermione hystrix* | Mediterranean whole | D | 8.1 | Fukai & Broquet (1965) |
| " " | " | | trivalent $Cr^{51}$ not accumulated | Chipman (1967) |
| " " | | | hexavalent $Cr^{51}$ is accumulated | " |

| | | | | | | |
|---|---|---|---|---|---|---|
| Polychaete worm<br>*Hermione hystrix* | | Mediterranean | | W | 1.4 | Chipman (1967) |
| Tubificid worm<br>*Limnodrilus hoffmeisteri* | | Illinois | | W | (4.0-21.0)<br>10.0 | Mathis & Cummings (1973) |
| Earthworm<br>*Lumbricus* spp.<br>(and others) | | Tennessee | | D | 5.0 | NRCC (1976) |
| *Lumbrineris sp.* | | California | | D | 10.2 | Emerson et al. (1976) |
| Polychaete worm<br>*Nephthys sp.* | | | | A | 600.0 | Webb (1937) |
| Polychaete worm<br>*Notomastus tenuis* | | " | | D | 33.0 | Emerson et al. (1976) |
| Polychaete worm<br>*Sigambra tentacula* | | " | | D | (9.3-21.6) | " |
| Tubificid worm<br>*Tubifex tubifex* | | Illinois | | W | (4.0-21.0)<br>10.0 | Mathis & Cummings (1973) |
| TUNICATA | | | | | | |
| Tunicate<br>*Ciona intestinalis* | | | $Cr^{51}$ in tests in soft parts | | but not | Townsley (1962) |
| " | " | California | tunic | D | 7.0 | Emerson et al. (1975) |
| " | " | " | internal organs | D | 13.3 | " |
| " | " | Greece | whole | W | 0.24 | Papadopoulou & Kanias (1977) |
| " | " | " | " | D | 5.5 | " |
| " | " | " | tunic | W | 0.075 | " |
| " | " | " | " | D | 1.9 | " |

| | | | | | |
|---|---|---|---|---|---|
| Tunicate<br>*Ciona intestinalis* | Greece | rest of body | W | 0.25 | Papadopoulou & Kanias (1977) |
| " " | " | " | D | 6.1 | " |
| Tunicate<br>*Microcosmus sulcatus* | " | whole | W | 1.10 | " |
| " " | " | " | D | 6.6 | " |
| Tunicate<br>*Salpa fusiformis* | New England | | A | <1.0 | Nicholls et al. (1959) |
| CHAETOGNATHA | | | | | |
| Arrow worm<br>*Sagitta elegans* | New England | | A | 1.0 | Nicholls et al. (1959) |
| " " | | | W | 0.02 | " |
| Arrow worm<br>*Sagitta sp.* | S. Africa (with copepods) | | W | (0.0-3.6) | Van As et al. (1975) |

CHROMIUM IN HIGHER PLANTS (1)

| Species | Locality | Tissue | Analysis (2) PPM | Authority |
|---|---|---|---|---|
| Norway maple *Acer platanoides* | Connecticut | leaf | D (1.2-6.2) 2.8±SE 0.2 | Smith (1973) |
| " " | " | twig | D (1.1-2.3) 1.6±SE 0.1 | " |
| Red maple *Acer rubrum* | United States | green leaf | D 0.11 | Schroeder et al. (1962) |
| " " | " | " | A 1.8 | " |
| " " | " | red leaf | D 0.20 | " |
| " " | " | " | A 3.2 | " |
| " " | " | leaf | D (0.27-0.38) | Hanna & Grant (1962) |
| Silver maple *Acer saccharinum* | " | " | D 0.27 | " |
| Sugar maple *Acer saccharum* | Connecticut | " | D (1.2-3.4) 1.9±SE 0.3 | Smith (1973) |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

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|---|---|---|---|---|---|
| Suger maple<br>Acer saccharum | Connecticut | twig | D | (1.8-3.4)<br>2.3±SE 0.2 | Smith (1973) |
| " " | New Hampshire | branch | D | (0.3-11.0) | " |
| " " | United States | leaf | D | 0.38 | Hanna & Grant (1962) |
| Bent grass<br>Agrostis stolonifera | Scotland on serpentine | shoot | A | (35.0-82.0) | Shewry & Peterson (1976) |
| " " | Scotland chromite tailings | " | A | (25.0-65.0) | " |
| Onion<br>Allium cepa | Great Britain | | W | (0.04-0.83)<br>0.19 | Thomas et al. (1974) |
| " " | United States | | W | (0.01-0.02) | Schroeder et al. (1962) |
| Leek<br>Allium porrum | Great Britain | | W | (0.02-0.16)<br>0.08 | Thomas et al. (1974) |
| " " | " " | | D | (0.28-1.0) | Le Riche (1968) |
| Onion<br>Allium schoenoprasum | Finland | | A | (1.0-10.0) | Lounamaa (1956) |
| Alder<br>Alnus incana | " | | A | (1.0-30.0) | " |
| Aloe<br>Aloe spp. | | | A | 17.0 | Baumslag & Keen (1972) |
| Amaranth<br>Amaranthus spp. | | | A | 38.0 | " |
| Pineapple<br>Ananas comosus | | | W | (0.02-0.09)<br>0.04 | Thomas et al. (1974) |

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|---|---|---|---|---|---|
| *Anisotome aromatica* | New Zealand on serpentine | | A | 115.0 | Lyon et al. (1970) |
| Celery *Apium graveolens dulce* | Great Britain | | W | (0.08-0.12) 0.11 | Thomas et al. (1974) |
| Common thrift *Armeria maritima* | Scotland on serpentine | shoot | A | (140.0-253.0) | Shewry & Peterson (1976) |
| " " | " non-serpentine | " | A | 14.0 | " |
| " " | " on chromite tailings | " | A | 23.0 | " |
| Big sagebrush *Artemisia tridentata tridentata* | Idaho downwind from phosphate plant | | D | (30.0-500.0) | Gough & Severson (1976) |
| " " | " upwind | | D | (15.0-200.0) | " |
| " " | " downwind 3 km | | D | (270.0-400.0) | " |
| " " | " upwind 3 km | | D | (77.0-117.0) | " |
| Breadfruit *Artocarpus altilis* | Panama | fruit | D | 2.0 | Ewing et al. (1969) |
| Asparagus *Asparagus officinalis* | Great Britain | frozen | W | 0.01 | Thomas et al. (1974) |
| " " | " " | canned | W | (0.01-0.18) | " |
| Wallrue spleenwort *Asplenium rutamuraria* | Austria on serpentine | frond | A | 66.0 | Shewry & Peterson (1976) |
| Forked spleenwort *Asplenium septentrionale* | Finland | | A | (1.0-1000.0) | Lounamaa (1956) |

| | | | | | |
|---|---|---|---|---|---|
| Maidenhair spleenwort<br>*Asplenium trichomanes* | Finland | | A | (1.0-100.0) | Lounamaa (1956) |
| Saltbush<br>*Atriplex confertifolia* | Nevada | leaf | D | 0.4 | Wallace & Romney (1972) |
| " " | " | stem | D | <0.1 | " |
| " " | " | root | D | 0.1 | " |
| Oats<br>*Avena sativa* | on serpentine | leaf & stem | D | (3.0-11.0) | Pratt (1966) |
| " " | United States | oatmeal | W | 0.06 | Schroeder et al. (1962) |
| Beet<br>*Beta vulgaris* | " " | root | W | (0.01-0.03) | " |
| " " | Great Britain | | W | (0.04-0.12)<br>0.08 | Thomas et al. (1974) |
| " " | " | top | D | (0.8-1.2) | LeRiche (1968) |
| " " | " | root | D | (0.3-1.1) | " |
| Swiss chard<br>*Beta vulgaris cicla* | Maryland | leaf & stem | D | (1.0-1.1) | Furr et al. (1976) |
| " " " | United States | " | W | 0.06 | Schroeder et al. (1962) |
| White birch<br>*Betula papyrifera* | United States | leaf | D | 0.19 | " |
| " " | " | " | A | 3.2 | " |
| Birch<br>*Betula verrucosa* | Finland | | A | (1.0-60.0) | Lounamaa (1956) |
| Kale<br>*Brassica oleracea acephala* | Kentucky | | D | 0.33±0.06 | Nadkarni & Ehmann (1970) |

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|---|---|---|---|---|---|
| Cauliflower<br>Brassica oleracea botrytis | United States | flower | W | 0.02 | Schroeder et al. (1962) |
| Cabbage<br>Brassica oleracea capitata | " | leaf | W | (0.01-0.06) | " |
| " " " | Great Britain | | W | (0.05-0.29)0.15 | Thomas et al. (1974) |
| Brussels sprouts<br>Brassica oleracea gemmifera | " | fresh | W | (0.01-0.64)0.14 | " |
| " " " | " | frozen | W | (0.08-0.25)0.16 | " |
| Kohlrabi<br>Brassica oleracea gongylodes | United States | | W | 0.0 | Schroeder et al. (1962) |
| Broccoli<br>Brassica oleracea italica | Great Britain | | W | (0.06-0.33)<br>0.19 | Thomas et al. (1974) |
| Turnip<br>Brassica rapa | United States | leaf | W | (0.04-0.06) | Schroeder et al. (1962) |
| Northern reed grass<br>Calamagrostis canadensis | Canada | leaf | D | (0.59-21.9) | O'Toole et al. (1971) |
| Scotch heather<br>Calluna vulgaris | Finland | | A | (1.0-100.0) | Lounamaa (1956) |
| " " | Scotland on serpentine | shoot | A | (252.0-417.0) | Shewry & Peterson (1976) |
| " " | " on chromite tailings | " | A | 190.0 | " |
| Tea<br>Camellia sinensis | | leaf | | 0.177±SD 0.022 | Shah et al. (1971) |
| Pepper<br>Capsicum annuum | United States | fruit | W | 0.19 | Schroeder et al. (1962) |

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|---|---|---|---|---|---|
| Bush red pepper<br>*Capsicum frutescens* | | | D | 1.28 | Toepfer et al. (1973) |
| " " | United States | fruit | W | 0.01 | Schroeder et al. (1962) |
| Sedge<br>*Carex pendula* | | | D | 0.12 | Horowitz et al. (1974) |
| Hickory<br>*Carya spp.* | Tennessee | | D | (0.2-0.4) | Van Hook et al. (1974) |
| *Cassinia banksii* | New Zealand on serpentine | leaf | A | 52.0 | Lyon et al. (1970) |
| *Cassinia cunninghami* | " " | " | A | (52.0-60.0) | " |
| *Cassinia vauvilliersii* | " " | " | A | (815.0-1,300.0) | " (1971) |
| " " | " non-serpentine | " | A | (13.0- 30.0) | " |
| *Cassinia vauvilliersii* var. *serpentina* | " " | " | A | (13.0-4,600.0) | " |
| Cerastium<br>*Cerastium holosteoides* | Scotland on serpentine | shoot | A | 173.0 | Shewry & Peterson (1976) |
| " " | " on chromite tailings | " | A | 45.0 | " |
| Cerastium<br>*Cerastium nigrescens* | Scotland on serpentine | " | A | 141.0 | " |
| Lip fern<br>*Cheilanthes marantae* | Austria on serpentine | " | A | 46.0 | " |
| Grapefruit<br>*Citrus paradisi* | Great Britain | | W | (0.01-0.07)<br>0.04 | Thomas et al. (1974) |
| Orange<br>*Citrus sinensis* | " " | fruit | W | (<0.01-0.05)<br>0.02 | " |

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|---|---|---|---|---|---|
| Orange<br>Citrus sinensis | | fruit | D | 0.31 | Toepfer et al. (1973) |
| " " | | leaf | D | (0.2-10.0) | Pratt (1966) |
| Coconut<br>Cocos nucifera | Panama | fruit | D | 0.15 | Ewing et al. (1969) |
| Coffee<br>Coffea arabica | | bean | | <0.040 | Shah et al. (1971) |
| Coprosma parviflora | New Zealand on serpentine | | A | (44.0-740.0) | Lyon et al. (1970) |
| Cucumber<br>Cucumis sativus | Great Britain | | W | (0.15-0.2)<br>0.17 | Thomas et al. (1974) |
| " " | United States | fruit | W | (0.01-0.03) | Schroeder et al. (1962) |
| Summer squash<br>Cucurbita sp. | " " | " | W | 0.02 | " |
| Brittle bladder fern<br>Cystopteris fragilis | Finland | | A | (3.0-300.0) | Lounamaa (1956) |
| Dacrydium biforme | New Zealand on serpentine | | A | (36.0-44.0) | Lyon et al. (1970) |
| Orchard grass<br>Dactylis glomerata | United States | shoot | D | 1.30 | Schroeder et al. (1962) |
| " " | " " | " | A | 22.5 | " |
| " " | | flower | D | 0.5 | Davey & Mitchell (1968) |
| " " | | leaf | D | 1.5 | " |
| " " | | sheath | D | 0.4 | " |
| " " | | stem | D | 0.1 | " |
| Daphne<br>Daphne mezereum | Finland | | A | (3.0-100.0) | Lounamaa (1956) |

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|---|---|---|---|---|---|
| Carrot<br>Daucus carota | Great Britain | | W | (<0.01-0.13)<br>0.08 | Thomas et al. (1974) |
| " " | United States | root | W | (0.0-0.03) | Schroeder et al. (1962) |
| " " | | top | | (0.44-0.94) | LeRiche (1968) |
| " " | | root | | (0.03-0.09) | " |
| Wavy hair grass<br>Deschampsia caespitosa | Finland | | A | (3.0-100.0) | Lounamaa (1956) |
| Finland pink<br>Dianthus superbus | " | | A | (3.0-100.0) | " |
| Dicoma niccolifera | Rhodesia | | A | 30,000 | Wild (1974b) |
| Dracophyllum filifolium var. collinum | New Zealand on serpentine | | A | 300.0 | Lyon et al. (1970) |
| Dracophyllum pronum | " " | | A | 4,400.0 | " |
| Dracophyllum uniflorum | " " | | A | 2,900.0 | " |
| Canada waterweed<br>Elodea canadensis | | | D | 0.43 | Horowitz et al. (1974) |
| Crowberry<br>Empetrum nigrum | Finland | | A | (3.0-600.0) | Lounamaa (1956) |
| Encephalartos lehmanii | | | D | (0.05-0.53) | Horowitz et al. (1974) |
| Mormon tea<br>Ephedra gerardiana | | | D | (0.45-0.56) | " |
| Horwetail<br>Equisetum giganteum | | | D | 0.45 | " |
| Beech<br>Fagus grandifolia | United States | leaf | D | 0.26 | Hanna & Grant (1962) |

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|---|---|---|---|---|---|
| Beech<br>*Fagus grandifolia* | United States | leaf | D | 0.29 | Schroeder et al. (1962) |
| " " | " " | " | A | 5.6 | " |
| Fescue grass<br>*Festuca ovina* | Finland | | A | (3.0-100.0) | Lounamaa (1956) |
| " " | Scotland on serpentine | shoot | A | 132.0 | Shewry & Peterson (1976) |
| Red fescue<br>*Festuca rubra* | " " | " | A | (63.0-93.0) | " |
| " " | " on chromite tailings | " | A | (35.0-49.0) | " |
| Fescue grass<br>*Festuca vivipara* | Scotland on serpentine | " | A | 32.0 | " |
| Strawberry<br>*Fragaria vesca* | | | D | 0.34 | Toepfer et al. (1973) |
| Gentian<br>*Gentiana corymbifera* | New Zealand on serpentine | | A | (400.0-5,400.0) | Lyon et al. (1970) |
| Ginkgo<br>*Ginkgo biloba* | | | D | 0.20 | Horowitz et al. (1974) |
| *Hebe odora* | New Zealand on serpentine | | A | (13.0-8,500.0) | Lyon et al. (1970) |
| " " | " not serpentine | | A | (18.0-(30.0) | " (1971) |
| Barley<br>*Hordeum vulgare* | Washington | grain | D | (0.016-0.030) | Haller et al. (1969) |
| " " | | leaf | D | 7.6 | Pratt (1966) |
| *Hybanthus floribundus* | Australia | | D | (0.04-12.0) | Cole (1973) |
| *Hymenanthera alpina* | New Zealand on serpentine | | A | (70.0-6,000.0) | Lyon et al. (1970) |

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|---|---|---|---|---|---|
| Holly<br>*Ilex opaca* | United States | leaf | D | (0.06-0.37) | Hanna & Grant (1962) |
| Sweet potato<br>*Ipomoea batatas* | Panama | tuber | D | (0.1-0.2) | Ewing et al. (1969) |
| Rush<br>*Juncus articulatus* | Scotland on serpentine | shoot | A | 77.0 | Shewry & Peterson (1976) |
| Juniper<br>*Juniperus communis* | United States | berry | D | 0.49 | Schroeder et al. (1962) |
| " " | " " | " | A | 14.5 | " |
| " " | | | D | (0.37-0.64) | Horowitz et al. (1974) |
| " " | Finland | | A | (1.0-30.0) | Lounamaa (1956) |
| Eastern red cedar<br>*Juniperus virginiana* | Missouri | twig & needle | D | (3.0-4.3) | Connor et al. (1970) |
| Mountain laurel<br>*Kalmia latifolia* | United States | leaf | D | (0.08-0.62) | Hanna & Grant (1962) |
| Lettuce<br>*Lactuca sativa* | Great Britain | | W | (0.12-0.21)<br>0.17 | Thomas et al. (1974) |
| " " | United States | leaf | W | 0.07 | Schroeder et al. (1962) |
| " " | " " | head | W | (0.02-0.13) | " |
| Fern<br>*Lastrea phegopteris* | Finland | | A | (3.0-300.0) | Lounamaa (1956) |
| Lentin<br>*Lens culinaris* | United States | seed | D | 0.09 | Schroeder et al. (1962) |

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|---|---|---|---|---|---|
| *Leptospermum scoparium* | New Zealand on serpentine | | A | (210-9,000.0) | Lyon et al. (1970) |
| " " | " not on serpentine | | A | (<30.0-220.0) | " (1971) |
| Tulip poplar *Liriodendron tulipifera* | Tennessee | | D | (0.1-0.2) | Van Hook et al. (1974) |
| " " | | | D | 0.37 | Horowitz et al. (1974) |
| Honeysuckle *Lonicera xylosteum* | Finland | | A | (1.0-10.0) | Lounamaa (1956) |
| Tomato *Lycopersicon esculentum* | Great Britain | | W | (0.16-0.37) 0.24 | Thomas et al. (1974) |
| " " | United States | fruit | W | 0.01 | Schroeder et al. (1962) |
| Lycopodium *Lycopodium australianum* | New Zealand on serpentine | | A | 7,700.0 | Lyon et al. (1970) |
| Lycopodium *Lycopodium circinatum* | | | D | (0.33-0.59) | Horowitz et al. (1974) |
| Apple *Malus malus* | Great Britain | skin | W | (0.07-0.13) 0.1 | Thomas et al. (1974) |
| " " | " " | fruit | W | (0.06-0.16) 0.11 | " |
| " " | United States | " | D | 0.13 | Schroeder et al. (1962) |
| " " | " " | " | W | 0.02 | " |
| " " | " " | " | A | 5.9 | " |
| " " | " " | leaf | D | 0.33 | " |
| " " | " " | " | A | 3.2 | " |
| " " | " " | skin | D | 1.48 | Toepfer (1973) |

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|---|---|---|---|---|---|
| Apple<br>Malus malus | | fruit | D | 0.09 | Toepfer (1973) |
| " " | Washington | " | D | 0.037±0.001 | Haller et al. (1969) |
| Cassava<br>Manihot utilitissima | Panama | tuber | D | (0.15-1.5) | Ewing et al. (1969) |
| Alfalfa<br>Medicago sativa | United States | shoot | D | 0.09 | Schroeder et al. (1962) |
| " " | " " | " | A | 1.0 | " |
| Mint<br>Mentha spicata | " " | | W | (0.0-2.0)pCi/g | Foster (1963) |
| Metrosideros umbellata | New Zealand on serpentine | | A | 20.0 | Lyon et al. (1970) |
| Molinia coerulea | Finland | | A | (3.0-60.0) | Lounamaa (1956) |
| Plantian<br>Musa paradisiaca | Panama | fruit | D | (0.1-1.2) | Ewing et al. (1969) |
| Banana<br>Musa sapientum | | | D | 0.38 | Toepfer et al. (1973) |
| " " | Panama | " | D | (0.1-0.5) | Ewing et al. (1969) |
| Forget-me-not<br>Myosotis monroi | New Zealand on serpentine | | A | (460.0-3,500.0) | Lyon et al. (1970) |
| Myrsine divaricata | | | A | (52.0-850.0) | " |
| Tobacco<br>Nicotiana tabacum | Kentucky | burley, leaf | D | 2.5 | Nadkarni & Ehmann (1970) |
| " " | " | cigarette, leaf | D | (0.25-6.3) | " |
| " " | " | pipe, leaf | D | 2.8 | " |
| " " | " | cigar, leaf | D | (3.1-6.2) | " |

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| Beech<br>Nothofagus solandri var. cliffortioides | New Zealand on serpentine | | A | (36.0-44.0) | Lyon et al. (1970) |
| Notothlaspi australe | " " | | A | (200.0-1,300.0) | " |
| Fern<br>Ophioglossum pendunculosum | | | D | 0.45 | Horowitz et al. (1974) |
| Rice<br>Oryza sativa | Japan | grain | W | 0.04 | Schroeder et al. (1962) |
| " " | | " | W | 0.05 | " |
| " " | Washington | " | D | (0.027-0.035) | Haller et al. (1969) |
| " " | Panama | " | D | 0.6 | Ewing et al. (1969) |
| Parsnip<br>Pastinica sativa | United States | root | W | 0.13 | Schroeder et al. (1962) |
| " " | " | leaf | W | (0.08-0.19) | " |
| Avocado<br>Persea americana | Panama | fruit | D | 0.003 | Ewing et al. (1969) |
| Lima bean<br>Phaseolus limensis | Washington | bean | D | 0.027±0.010 | Haller et al. (1969) |
| Bush bean<br>Phaseolus vulgaris | United States | " | W | (0.05-0.08) | Schroeder et al. (1962) |
| " " | Panama | " | D | 0.05 | Ewing et al. (1969) |
| " " | California | root | D | 1.6 | Wallace & Romney (1977) |
| " " | " | stem | D | 0.3 | " |
| " " | " | leaf | D | 0.6 | " |

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|---|---|---|---|---|---|
| *Phormium colensoi* | New Zealand on serpentine | | A | 700.0 | Lyon et al. (1970) |
| *Phyllocladus alpinus* | " " | | A | (13.0-52.0) | " |
| Water plant *Phyllospadix iwatensis* | Sea of Japan | | D | 8.8 | Saenko et al. (1976) |
| Norway spruce *Picea abies* | Connecticut | leaf | D | (2.3-3.4) 2.6±SD 0.4 | Smith (1973) |
| " " | " | twig | D | (4.6-5.7) 4.9±SD 0.4 | " |
| " " | Finland | | A | (1.0-100.0) | Lounamaa (1956) |
| Red spruce *Picea rubra* | United States | leaf | D | 0.24 | Schroeder et al. (1962) |
| " " | " " | " | A | 6.9 | " |
| Heath *Pieris japonica* | " " | " | D | (0.01-0.60) | Hanna & Grant (1962) |
| *Pimelia suteri* | New Zealand on serpentine | | A | 3,200.0 | Lyon et al. (1970) |
| Short leaf pine *Pinus echinata* | Tennessee | | D | (0.1-0.3) | Van Hook et al. (1974) |
| Ponderosa pine *Pinus ponderosa* | Idaho | wood | D | (0.02-0.9) | Sheppard & Funk (1975) |
| Scotch pine *Pinus silvestris* | Finland | | A | (1.0-60.0) | Lounamaa (1956) |
| Eastern white pine *Pinus strobus* | United States | leaf | D | 0.49 | Schroeder et al. (1962) |
| " " | " " | " | A | 15.8 | " |
| " " | " " | " | D | (0.25-2.4) | Hanna & Grant (1962) |

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|---|---|---|---|---|
| Pea<br>Pisum sativum | Great Britain | W | (0.12-1.13)<br>0.38 | Thomas et al. (1974) |
| " " | Washington seed | D | 0.034±0.011 | Haller et al. (1969) |
| Plantain<br>Plantago maritima | Scotland<br>on serpentine | A | 91.0 | Shewry & Peterson (1976) |
| " " | " on chromite tailings | A | (16.0-56.0) | " |
| " " | " non-serpentine | A | 5.0 | " |
| Sycamore, American plane tree<br>Platanus occidentalis | United States leaf | D | 0.23 | Hanna & Grant (1962) |
| Podocarpus<br>Podocarpus totara | New Zealand<br>on serpentine | A | 80.0 | Lyon et al. (1970) |
| Polygonatum odoratum | Finland | A | (1.0-60.0) | Lounamaa (1956) |
| Polypody fern<br>Polypodium vulgare | " | A | (1.0-300.0) | " |
| European aspen<br>Populus tremula | " | A | 3.0 | " |
| Quaking aspen<br>Populus tremuloides | United States leaf | D | 0.25 | Schroeder et al. (1962) |
| " " | " " " | A | 4.0 | " |
| Eel grass<br>Posidonia oceanica | Mediterranean | D | (1.3-1.9) | Fukai & Broquet (1965) |
| Self heal<br>Prunella vulgaris | Scotland<br>on serpentine | A | 82.0 | Shewry & Peterson (1976) |

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|---|---|---|---|---|---|
| Apricot<br>Prunus armeniaca | | canned | W | (0.02-0.08)0.04 | Thomas et al. (1974) |
| Garden plum<br>Prunus domestica | Great Britain | " | W | (<0.01-2.64) | " |
| " " | " " | fresh | W | (<0.01-0.01) | " |
| " " | United States | fruit | W | 0.01 | Schroeder et al. (1962) |
| Peach<br>Prunus persica | | | W | (0.03-0.06)<br>0.05 | Thomas et al. (1974) |
| " " | " " | fruit | W | 0.01 | Schroeder et al. (1962) |
| Wild cherry<br>Prunus serotina | " " | leaf | D | 0.57 | " |
| " " | " " | " | A | 7.9 | " |
| Fern<br>Psilotum triquetrum | | | D | (0.27-0.97) | Horowitz et al. (1974) |
| Pulmonaria saccharata | | | D | 0.43 | " |
| Mountain ash<br>Pyrus americana | United States | leaf | D | 0.70 | Schroeder et al. (1962) |
| " " | " " | " | A | 7.7 | " |
| Pear<br>Pyrus communis | Great Britain | skin | W | (0.2-0.5)<br>0.3 | Thomas et al. (1974) |
| " " | " " | fruit | W | (0.7-0.32)<br>0.18 | " |
| " " | United States | " | W | 0.01 | Schroeder et al. (1962) |
| " " | | whole fruit | D | 0.03 | Pratt (1966) |
| " " | | pericarp | D | 0.50 | " |
| " " | | peel | D | 0.85 | " |

| | | | | | |
|---|---|---|---|---|---|
| Pear<br>*Pyrus communis* | Washington | fruit | D | 0.029±0.001 | Haller et al. (1969) |
| Pin oak<br>*Quercus palustris* | United States | leaf | D | (2.3-12.5)<br>3.8±SD 0.8 | Smith (1973) |
| " " | " " | twig | D | (1.2-5.7)<br>2.8±SD 0.4 | " |
| " " | | leaf | D | (0.10-0.58) | Hanna & Grant (1962) |
| Chestnut oak<br>*Quercus prinus* | Tennessee | | D | (0.05-0.3) | Van Hook et al. (1974) |
| Red oak<br>*Quercus rubra* | United States | leaf | D | 0.17 | Schroeder et al. (1962) |
| " " | " " | " | A | 9.2 | " |
| " " | " " | acron | D | 0.02 | " |
| " " | " " | " | A | 0.9 | " |
| Garden radish<br>*Raphanus sativus* | " " | root | W | 0.0 | " |
| Rhubarb<br>*Rheum rhaponticum* | " " | stem | W | 0.02 | " |
| " " | Great Britain | | W | (0.01-1.84)<br>0.66 | Thomas et al. (1974) |
| Rhododendron<br>*Rhododendron roseum* | United States | leaf | D | (0.06-0.38) | Hanna & Grant (1962) |
| European black currant<br>*Ribes nigrum* | Great Britain | | W | (0.02-0.08)<br>0.03 | Thomas et al. (1974) |
| Water cress<br>*Rorippa nasturtium-aquaticum* | " " | | W | (0.05-0.31)<br>0.16 | " |
| Wild rose<br>*Rosa acicularis* | N.W. Territories | leaf & fruit | D | (3.5-3.9) | O'Toole et al. (1971) |

| | | | | |
|---|---|---|---|---|
| Rose<br>Rosa majalis | Finland | A | 100.0 | Lounamaa (1956) |
| Red raspberry<br>Rubus idaeus | " | A | (1.0-30.0) | " |
| Blackberry<br>Rubus sp. | United States fruit | W | 0.0 | Schroeder et al. (1962) |
| Boysenberry<br>Rubus sp. | | W | (0.0-0.9) pCi/g | Foster (1963) |
| Blackberry<br>Rubus saxatilis | Scotland on serpentine shoot | A | 103.0 | Shewry & Peterson (1976) |
| Sour grass<br>Rumex acetosella | Finland on serpentine | A | (1.0-10.0) | Lounamaa (1956) |
| Sugar cane<br>Saccharum officinarum | Panama | D | 0.7 | Ewing et al. (1969) |
| " " | | D | 0.02 | Toepfer et al. (1973) |
| Sagina sp. | Scotland on serpentine | A | (111.0-344.0) | Shewry & Peterson (1976) |
| Water fern<br>Salvinia auriculata | | D | (1.0-4.4) | Horowitz et al. (1974) |
| Saxifrage<br>Saxifraga granulata | Finland on serpentine | A | (1.0-10.0) | Lounamaa (1956) |
| Rye<br>Secale cerealis | United States seed | W | 0.05 | Schroeder et al. (1962) |
| " " | " " whole | W | 0.04 | " |
| " " | Ontario on sludge-amended soil | D | (2.2-3.3) | Bates et al. (1975) |

| | | | | | |
|---|---|---|---|---|---|
| Sedum | | | | | |
| Sedum telephium | Finland on serpentine | | A | (1.0-1000.0) | Lounamaa (1956) |
| Selaginella | | | | | |
| Selaginella willdencwii | | | D | 0.43 | Horowitz et al. (1974) |
| Moss campion | | | | | |
| Silene acaulis | Scotland on serpentine | | A | 41.0 | Shewry & Peterson (1976) |
| " " | " non-serpentine | | A | 16.0 | " |
| Silene maritima | " on serpentine | | A | 74.0 | " |
| " " | " on chromite tailings | | A | 10.0 | " |
| " " | " non-serpentine | | A | 9.0 | " |
| Silene otites | Austria on serpentine | | A | 36.0 | " |
| Silene vulgaris | " " | | A | 20.0 | " |
| Potato | | | | | |
| Solanum tuberosum | United States | tuber | W | 0.0 | Schroeder et al. (1962) |
| " " | | old | D | 0.55 | Toepfer et al. (1973) |
| " " | | new | D | 0.57 | " |
| " " | Great Britain | | W | (0.06-0.4) 0.15 | Thomas et al. (1974) |
| " " | | tuber | D | 0.002 | Pratt (1966) |
| European ash | | | | | |
| Sorbus aucuparia | Finland | | A | (1.0-30.0) | Lounamaa (1956) |
| Spinach | | | | | |
| Spinacia oleracea | Great Britain | | W | (0.12-0.28) 0.2 | Thomas et al. (1974) |
| " " | United States | leaf | W | (0.0-0.05) | Schroeder et al. (1962) |

| | | | | | |
|---|---|---|---|---|---|
| Spinach<br>*Spinacia oleracea* | | | D | 1.03 | Toepfer et al. (1973) |
| Chickweed<br>*Stellaria roughii* | New Zealand on serpentine | | A | (350.0-3,600.0) | Lyon et al. (1970) |
| Meadow succisa<br>*Succisa pratensis* | Scotland on serpentine | shoot | A | 59.0 | Shewry & Peterson (1976) |
| *Sutera fodina* | | | A | 48,000 | Wild (1974b) |
| Yew<br>*Taxus sp.* | Connecticut | leaf | D | (2.3-5.7)<br>3.9±SE 0.3 | Smith (1973) |
| " " | " | twig | D | (2.3-16.3)<br>6.0±SE 1.4 | " |
| *Thalassia testudinum* | Puerto Rico | | W | 10.5 | Stevenson et al. (1966) |
| Cocoa<br>*Theobroma cacao* | Panama | bean | D | 0.50 | Ewing et al. (1969) |
| *Thymus drucei* | Scotland on serpentine | shoot | A | (108.0-152.0) | Shewry & Peterson (1976) |
| " " | " on chromite tailings | " | A | (22.0-87.0) | " |
| " " | " non-serpentine | " | A | 32.0 | " |
| *Thymus serpyllum* | Austria on serpentine | " | A | 27.0 | " |
| " " | Finland | | A | (3.0-100.0) | Lounamaa (1956) |
| Arborvitae<br>*Thuja occidentalis* | United States | leaf | D | 0.35 | Schroeder et al. (1962) |
| " " | " " | " | A | 6.7 | " |
| " " | " " | bud | A | 0.0 | " |

| | | | | | |
|---|---|---|---|---|---|
| Spanish moss<br>Tillandsia usneoides | United States | whole plant | A | (7.0-1,500.0)<br>geom. mean 57.0 | Shacklette & Connor (1973) |
| White clover<br>Trifolium repens | " " | shoot | D | 0.34 | Schroeder et al. (1962) |
| Wheat<br>Triticum aestivum | " " | flour | D | (0.17-0.38) | Zook et al. (1970) |
| " " | " " | seed | D | (0.003-0.043) | Welch & Cary (1975) |
| " " | Arizona | grain | D | 0.1 | Cannon (1969) |
| " " | " | " | A | 3.4 | " |
| " " | | leaf | D | (4.5-14.8) | Pratt (1966) |
| " " | | grain | W | 0.08 | Schroeder et al. (1962) |
| Eastern hemlock<br>Tsuga canadensis | Connecticut | leaf | D | (1.2-4.6)<br>2.8±SE 0.4 | Smith (1973) |
| " " | " | twig | D | (1.2-4.6)<br>3.5±SE 0.4 | " |
| " " | | leaf | D | (0.37-0.56) | Hanna & Grant (1962) |
| Cranberry<br>Vaccinium macrocarpon | | jelly | W | 0.0 | Thomas et al. (1974) |
| Blueberries<br>Vaccinium sp. | | | D | 0.22 | Toepfer et al. (1973) |
| Vaccinium vitis-idaea | Finland | | A | (1.0-100.0) | Lounamaa (1956) |
| Cowpea<br>Vicia cracca | | | A | (10.0-100.0) | " |

| | | | | | |
|---|---|---|---|---|---|
| *Viscaria vulgaris* | Finland | | A | (1.0-300.0) | Lounamaa (1956) |
| Grape *Vitis sp.* | United States | raisin | D | 0.075±0.011 | Haller et al. (1969) |
| " " | " " | " | W | 0.02 | Schroeder et al. (1962) |
| Fern *Woodsia ilvensis* | Finland | | A | (3.0-30.0) | Lounamaa (1956) |
| Corn *Zea mays* | Panama | seed | D | 0.25 | Ewing et al. (1969) |
| " " | United States | kernel | W | 0.02 | Schroeder et al. (1962) |
| " " | " " | oil | W | 0.47 | " |
| " " | | cornmeal | D | (0.06-0.13) | Toepfer et al. (1973) |
| " " | Arizona | grain | D | 0.1 | Cannon (1970) |
| " " | " | " | A | 3.4 | " |
| Eel grass *Zostera asiatica* | Sea of Japan | | D | 4.3 | Saenko et al. (1976) |
| Eel grass *Zostera sp.* | Mediterranean | | D | 4.2 | Fukai & Broquet (1965) |
| "Black pepper" | | | | 2.26 | Schroeder et al. (1962) |
| " " | | | D | 0.38 | Toepfer et al. (1973) |

## CHROMIUM IN LOWER PLANTS (1)

| Species | Locality | Tissue | Analysis PPM (2) | Authority |
|---|---|---|---|---|
| MOSSES | | | | |
| Hylocomium splendens | Finland | | A (10.0-100.0) | Lounamaa (1956) |
| " " | S. Sweden & Norway | | D (4.0-6.0) | Ruhling & Tyler (1973) |
| " " | " | | D (<1.0-1.5) | " |
| Hypnum cupressiforme | Sweden | | D (5.3-14.0) | " (1969) |
| " " | N.E. Götland | | D 4.5 | " |
| " " | Skane | | D 7.9 | " |
| " " | Sweden, museum specimens, (1870-1969) | | D (1.0-15.0) | " |
| " " | " in region of ferro alloy plant | | D 12,000.0 | " |
| " " | " "normal" | | D 10.0 | " |

(1)
Blank spaces indicate information not available or not applicable.
? indicates questionable data.

(2)
W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported.
pCi/g - picocuries per gram.

| | | | | |
|---|---|---|---|---|
| Hypnum cupressiforme | | D | 8.0 | Horowitz et al. (1974) |
| Marchantia polymorpha | | D | (1.0-14.0) | " |
| Polytrichum commune | | D | 2.5 | " |
| Rhacomitrium lanuginosum | Finland | A | (100.0-300.0) | Lounamaa (1956) |
| Sphagnum acutifolium | | D | 7.0 | Horowitz et al. (1974) |
| Sphagnum angustifolium | S. Finland | D | 2.2 | Pakarinen & Tolonen (1976) |
| " " | Great Slave Lake, N.W.T. | D | 0.6 | " |
| Sphagnum balticum | S. Finland | D | 2.3 | " |
| Sphagnum fuscum | " | D | 2.8 | " |
| " " | Finland | D | (2.0-7.8)5.0 | " |
| " " | Great Slave Lake, N.W.T. | D | 0.5 | " |
| " " | Edmonton, Alberta | D | 2.4 | " |
| Sphagnum magellanicum | S. Finland | D | 3.0 | " |
| Tortella tortuosa | Finland | A | (10.0-300.0) | Lounamaa (1956) |
| LICHENS | | | | |
| Cladina alpestris | Finland | A | (10.0-1,000.0) | " |
| Cladonia retipora | | D | 4.6 | Horowitz et al. (1974) |
| Lecanora rubina | Colorado | A | 30.0 | Leroy & Koksoy (1962) |
| Parmelia centrifuga | Finland | A | (10.0-300.0) | Lounamaa (1956) |

| | | | | | |
|---|---|---|---|---|---|
| Parmelia centrifuga | Finland on serpentine | | A | 600.0 | Lounamaa (1956) |
| Parmelia conspersa | Colorado | | A | (50.0-150.0) | Leroy & Koksoy (1962) |
| Parmelia saxatilis | Finland | | A | (200.0-10,000.0) | Lounamaa (1956) |
| Peltigera canina | " | | A | (6.0-30.0) | " |
| Peltigera rufescens | Great Britain Distance from steel smelter | 0 m | | 127.4 | Seaward (1973) |
| " " | " " | 100 m | | 64.26 | " |
| " " | " " | 270 m | | 61.37 | " |
| " " | " " | 440 m | | 32.76 | " |
| " " | " " | 610 m | | 41.9 | " |
| " " | " " | 780 m | | 24.84 | " |
| " " | " " | 910 m | | 25.81 | " |
| Stereocaulon paschale | Finland | | A | (10.0-30.0) | Lounamaa (1956) |
| Umbilicaria hyperborea | Colorado | | A | (100.0-150.0) | Leroy & Koksoy (1962) |
| Xanthoria elegans | " | | A | 150.0 | " |
| FUNGI | | | | | |
| Alcuria aurantia | | | D | 2.7 | Horowitz et al. (1974) |
| Aspergillus microcysticus | | | D | 27.0 | " |
| Bulgaria inquinans | | | D | 1.1 | " |
| Clavulina cinerea | | | D | 1.1 | " |
| Elaphomyces granulatus | | | D | 0.43 | " |
| Hypoxylon fragiforme | | | D | 0.65 | " |

| | | | |
|---|---|---|---|
| *Lycoperdon pyriforme* | D | 3.0 | Horowitz et al. (1974) |
| *Scleroderma verucosa* | D | 9.0 | " |
| *Stereum hirsutum* | D | 3.3 | " |
| "Mushroom" | W | 0.04 | Toepfer et al. (1973) |
| " | D | 1.27 | " |

## CHROMIUM IN ALGAE (1)

| Species | Locality | Tissue | Analysis PPM (2) | | Authority |
|---|---|---|---|---|---|
| Brown alga | | | | | |
| Agarum cribosum | Sea of Japan | | D | (12.05-14.19) | Gryzhankova et al. (1973) |
| " " | " | | D | 11.8 | Saenko et al. (1976) |
| Red alga | | | | | |
| Ahnfeltia plicata | | | D | 2.9 | Horowitz et al. (1974) |
| Amphiroa fragilissima | Puerto Rico | | W | 12.9 | Stevenson et al. (1966) |
| Anacystis nidulas | | | D | 1.2 | Horowitz et al. (1974) |
| Aphanizomenon flos-aquae | | | D | 9.0 | " |
| Knotted wrack | | | | | |
| Ascophyllum nodosum | Scotland | | D | (0.7-1.9) | Black & Mitchell (1952) |
| " " | " | | W | 0.47 | " |
| " " | Norway | | D | (1.0-13.0) | Lande (1977) |
| " " | Great Britain | | D | (2.2-2.8) | Foster (1976) |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | |
|---|---|---|---|---|
| Red alga<br>Bryothamnion triquetum | Puerto Rico | W | 4.71 | Stevenson et al. (1966) |
| Caulerpa prolifera | | D | 11.0 | Horowitz et al. (1974) |
| Red alga<br>Ceramium gardneri | Oregon | W | (45.0-190.0) pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| Chara<br>Chara fragilis | | D | 0.82 | Horowitz et al. (1974) |
| Red alga<br>Chondrus yendoi | Sea of Japan | D | 9.0 | Saenko et al. (1976) |
| Brown alga<br>Chorda filum | " | D | (2.37-3.08) | Gryzhankova et al. (1973) |
| " " | " | D | 6.2 | Saenko et al. (1976) |
| Brown alga<br>Chordaria maggelanica | " | D | 5.31±SD 0.61 | Gryzhankova et al. (1973) |
| Green alga<br>Cladophora fascicularis | Puerto Rico | W | 0.61 | Stevenson et al. (1966) |
| Brown alga<br>Coccophora langsdorfii | Sea of Japan | D | 2.29 | Gryzhankova et al. (1973) |
| Green alga<br>Codium elongatum | Mediterranean | D | 0.4 | Fukai & Broquet (1965) |
| Green alga<br>Codium isthomocladus | Puerto Rico | W | 8.13 | Stevenson et al. (1966) |
| Green alga<br>Codium sp. | Sea of Japan | D | (4.70-5.70) | Gryzhankova et al. (1973) |

| | | | | |
|---|---|---|---|---|
| Green alga<br>Codium tomentosum | Israel | D | (2.6-2.7) | Roth & Hornung (1977) |
| Green alga<br>Codium yessoensis | Bay of Japan | D | 21.9 | Saenko et al. (1976) |
| Red alga<br>Corallina virgata | Israel | D | 6.7 | Roth & Hornung (1977) |
| Brown alga<br>Costaria costata | Bay of Japan | D | 3.5 | Saenko et al. (1976) |
| Cymopolia barbata | Puerto Rico | W | 11.73 | Stevenson et al. (1966) |
| Brown alga<br>Cystoseira fimbriata | Mediterranean | D | 1.0 | Fukai & Broquet (1965) |
| Brown alga<br>Cystoseira myriophylloides | " | D | 1.4 | " |
| Green alga<br>Derbesia marina | Oregon | W | 94.0pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| Brown alga<br>Dictyopteris justii | Puerto Rico | W | 1.78 | Stevenson et al. (1966) |
| " " | " | W | (1.9-8.5)4.6 | Lowmann et al. (1965) |
| " " | " | D | (16.0-33.0)<br>25.5 | " |
| Brown alga<br>Dictyosphaeria cavernosa | " | W | 10.33 | Stevenson et al. (1966) |
| Brown alga<br>Dictyota dichotoma | Sea of Japan | D | 1.87±SD 0.24 | Gryzhankova et al. (1973) |

| | | | | |
|---|---|---|---|---|
| Brown alga<br>Dictyota divaricata | Puerto Rico | W | 0.49 | Stevenson et al. (1966) |
| Kelp<br>Ecklonia maxima | S. Africa | W | 0.13±SD 0.15 | Van As et al. (1975) |
| Green alga<br>Enteromorpha linza | Mediterranean | D | 1.6 | Fukai & Broquet (1965) |
| Green alga<br>Enteromorpha prolifera | Bay of Japan | D | 23.4 | Saenko et al. (1976) |
| Green alga<br>Enteromorpha ralfsii | France coast | D | 0.9 | Fukai & Broquet (1965) |
| Green alga<br>Enteromorpha sp. | Mediterranean | D | 0.4 | " |
| " " | Sea of Japan | D | (4.55-6.35) | Gryzhankova et al. (1973) |
| Green alga<br>Enteromorpha tubulosa | Oregon | W | 0.0 pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| Red alga<br>Eudocladia muricata | " | W | 0.0 pCi/g $Cr^{51}$ | " |
| Bladder wrack<br>Fucus ceranoides | France coast | D | 0.6 | Fukai & Broquet (1965) |
| Wrack<br>Fucus furcatus | Oregon | W | (0.0-55.0) pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| Wrack<br>Fucus serratus | Scotland | D | (0.7-2.6) | Black & Mitchell (1952) |
| " " | " | W | 0.14 | |

| | | | | | |
|---|---|---|---|---|---|
| Wrack<br>*Fucus spiralis* | Scotland | | D | (0.9-3.7) | Black & Mitchell (1952) |
| " " | " | | W | 0.68 | " |
| Bladder wrack<br>*Fucus vesiculosus* | " | | D | (1.5-1.8) | " |
| " " | " | | W | 0.35 | " |
| " " | France coast | | D | (0.6-1.0) | Fukai & Broquet (1965) |
| " " | Great Britain | | D | (3.8-4.5) | Foster (1976) |
| Red alga<br>*Gigartina rachula* | S. Africa | | W | 0.23 | Van As et al. (1975) |
| Red alga<br>*Gigartina spp.* | Oregon | | W | (0.0-110.0) pCi/g $Cr^{51}$ | Seymour & Lewis (1969) |
| Brown alga<br>*Heterochordaria abietina* | Bay of Japan | | D | 8.7 | Saenko et al. (1976) |
| Red alga<br>*Jania rubens* | Mediterranean | | D | 4.1 | Fukai & Broquet (1965) |
| Brown alga<br>*Laminaria cichorioides* | Bay of Japan | | D | 6.7 | Saenko et al. (1976) |
| Brown alga<br>*Laminaria cloustoni* | Scotland | frond | D | (1.2-1.5) | Black & Mitchell (1952) |
| " " | " | " | D | 0.9 | " |
| Brown alga<br>*Laminaria digitata* | " | " | D | (0.4-1.1) | " |
| " " | " | " | D | (1.5-1.8) | " |

| | | | | | |
|---|---|---|---|---|---|
| Brown alga<br>Laminaria digitata | Scotland | stipe | D | (0.4-2.9) | Black & Mitchell (1952) |
| " " | " | frond | W | (0.15-0.31) | " |
| " " | " | stipe | W | (0.23-0.32) | " |
| Brown alga<br>Laminaria japonica | Bay of Japan | | D | 2.9 | Saenko et al. (1976) |
| Brown alga<br>Laminaria saccharina | | | D | 6.0 | Horowitz et al. (1974) |
| Red alga<br>Lithophyllum incrustans | Mediterranean | | D | 12.1 | Fukai & Broquet (1965) |
| Brown alga<br>Macrocystis pyrifera | California | | A | (2.0-9.2)<br>5.0±SD 3.5 | Boothe & Knauer (1972) |
| " " | " | | D | 0.42 | Robertson et al. (1972) |
| Green alga<br>Monostroma zostericola | Oregon | | W | 0.0 pCi/g<br>$Cr^{51}$ | Seymour & Lewis (1964) |
| Brown alga<br>Padina gymnospora | Puerto Rico | | W | 9.34 | Stevenson et al. (1966) |
| Channel wrack<br>Pelvetia canaliculata | Scotland | | D | (0.6-1.2) | Black & Mitchell (1952) |
| " " | " | | W | 0.28 | " |
| Wrack<br>Pelvetia wrightii | Sea of Japan | | D | 3.79±SD 0.34 | Gryzhankova et al. (1973) |

| | | | | |
|---|---|---|---|---|
| Wrack<br>Pelvetia wrightii | Sea of Japan | D | 6.5 | Saenko et al. (1976) |
| Brown alga<br>Pelvetiopsis limitata | Oregon | W | 0.0 pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| Green alga<br>Penicillus capitatus | Puerto Rico | W | 7.19 | Stevenson et al. (1966) |
| Red alga<br>Polysiphonia japonica | Sea of Japan | D | 22.4 | Saenko et al. (1976) |
| Red alga<br>Polysiphonia spp. | Oregon | W | (0.0-6.9) pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| Laverweed<br>Porphyra capensis | S. Africa | W | 0.47±SD 0.30 | Van As et al. (1975) |
| Laverweed<br>Porphyra spp. | Oregon | W | (0.0-36.0) pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| Red alga<br>Prionitis spp. | " | W | (0.0-100.0) pCi/g $Cr^{51}$ | " |
| Red alga<br>Pterochondria spp. | | W | 0.78 pCi/g $Cr^{51}$ | " |
| Red alga<br>Ptilota filicina | Bay of Japan | D | 6.0 | Saenko et al. (1976) |
| Red alga<br>Rhodomela larix | Sea of Japan | D | 15.7 | " |
| Sargassum<br>Sargassum lengiderum | Puerto Rico | W | 2.19 | Stevenson et al. (1966) |
| Sargassum<br>Sargassum miyabei | Sea of Japan | D | 1.73±SD 0.10 | Gryzhankova et al. (1973) |

| | | | | | |
|---|---|---|---|---|---|
| Sargassum<br>Sargassum pallidum | Sea of Japan | leaf blade | D | 1.62±SD 0.05 | Gryzhankova et al. (1973) |
| " " | " | swim bladder | D | 7.14±SD 0.35 | " |
| " " | " | cauliform part | D | 4.61±SD 0.36 | " |
| " " | " | | D | 3.9 | Saenko et al. (1976) |
| Sargassum<br>Sargassum sp. | Texas | | D | (1.2-2.6)1.6 | Horowitz & Presley (1977) |
| Red ribbons<br>Suhria vittata | S. Africa | | W | 0.87±SD 0.11 | Van As et al. (1975) |
| Red alga<br>Tichocarpus crinitus | Sea of Japan | | D | 2.21±SD 0.98 | Gryzhankova et al. (1973) |
| Green alga<br>Udotea flabellum | Puerto Rico | | W | (0.41-100.0) 28.0 | Lowman et al. (1967) |
| " " | " | | D | (0.5-110.0) 36.0 | " |
| Sea lettuce<br>Ulva fenestrata | Sea of Japan | | D | 1.23±SD 0.15 | Gryzhankova et al. (1973) |
| " " | " | | D | 3.5 | Saenko et al. (1976) |
| Sea lettuce<br>Ulva lactuca | Oregon | | W | (0.0-18.0) pCi/g $Cr^{51}$ | Seymour & Lewis (1964) |
| " " | France coast | | D | 1.4 | Fukai & Broquet (1965) |
| " " | Mediterranean | | D | 0.4 | " |

| | | | | |
|---|---|---|---|---|
| Sea lettuce<br>*Ulvaria splendens* | Sea of Japan | D | 1.1 | Saenko et al. (1976) |
| Sea lettuce<br>*Ulva spp.* | S. Africa | W | 0.45±SD 0.38 | Van As et al. (1975) |

## COBALT IN MAMMALS (1)

| Species | Locality | Tissue | Analysis PPM | | Authority |
|---|---|---|---|---|---|
| Cow *Bos bovis* | | Co highest in liver, heart, kidney and pancreas. | | | Comar & Davis (1947) |
| " " | Russia | liver | | 0.35 | Skoropostiznaya (1957) |
| " " | " | fat | | 0.0 | " |
| " " | United States | muscle | W | (0.08-0.94) | Schroeder et al. (1967) |
| " " | " | kidney | W | 0.04 | " |
| " " | " | liver | W | <0.16 | " |
| " " | " | fat | W | <0.25 | " |
| " " | " | milk | W | (0.02-0.06) | " |
| " " | " | evaporated milk | W | 0.32 | " |
| " " | East Asia | milk | W | 0.004 | Leung (1973) |

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| | | | | | |
|---|---|---|---|---|---|
| Dog<br>*Canis familiaris* | United States | kidney | W | 0.26 | Schroeder et al. (1967) |
| Coyote<br>*Canis latrans* | " | " | W | 0.26 | " |
| " " | East Asia | milk | W | 0.0 | Leung (1973) |
| Guinea pig<br>*Cavia porcellus* | Maryland (fed on swiss chard grown on sludge soil) | liver | D | (0.4-0.6) | Furr et al. (1976) |
| " " | " " | kidney | D | (0.2-0.3) | " |
| " " | " " | muscle | D | (0.2-0.3) | " |
| " " | " " | adrenal | D | (0.37-1.8) | " |
| " " | " " | spleen | D | (0.12-0.50) | " |
| Horse<br>*Equus caballus* | United States | red blood cells | W | 0.04 | Schroeder et al. (1967) |
| Porcupine<br>*Erethizon dorsatum* | " | heart | W | 0.13 | " |
| White-tailed deer<br>*Odocoilus virginiensis* | " | kidney | W | 0.36 | Schroeder et al. (1967) |
| " " | " | brain | W | (0.07-0.32) | " |
| Sheep<br>*Ovus aries* | " | | W | 0.37 | Schroeder et al. (1967) |
| " " | | lamb, muscle | W | (0.01-0.27) | " |
| " " | | Co highest in liver, heart, kidney, and pancreas. | | | Keener et al. (1951) |
| " " | East Asia | muscle | W | 0.002 | Leung (1973) |

| | | | | | |
|---|---|---|---|---|---|
| Harbor seal *Phoca vitulina* | Great Britain | blood | W | 0.02±0.01 | Hamilton (1976) |
| " " | " | spleen | W | <0.05 | " |
| " " | " | heart | W | <0.01 | " |
| " " | " | muscle | W | 0.03±0.02 | " |
| " " | " | kidney | W | 0.03±0.01 | " |
| " " | " | liver | W | 0.02±0.005 | " |
| Racoon *Procyon lotor* | United States | kidney | W | (0.10-0.12) | Schroeder et al. (1967) |
| " " | " | liver | W | (0.06-0.28) | " |
| " " | " | heart | W | (0.13-0.29) | " |
| " " | " | lung | W | 0.16 | " |
| " " | " | spleen | W | (0.09-0.26) | " |
| " " | " | fat | W | (0.22-0.65) | " |
| Laboratory rat *Rattus rattus* | " | red blood cells | W | (0.03-0.04) | " |
| Gray squirrel *Sciurus carolinensis* | " | liver | W | 0.55 | " |
| Pig *Sus scrofa* | | Co highest in liver, heart, kidney and pancreas | | | Braude et al. (1949) |
| " " | United States | muscle | W | (0.11-0.23) | Schroeder et al.(1967) |
| " " | " | liver | W | 0.41 | " |
| " " | " | fat | W | 0.04 | " |
| " " | East Asia | muscle | W | 0.011 | Leung (1973) |

| | | | | | |
|---|---|---|---|---|---|
| Red fox<br>*Vulpes vulpes* | United States | liver | W | 0.36 | Schroeder et al. (1967) |
| "Bat" | " | " | W | 0.76 | " |
| " | " | heart | W | <2.98 | " |
| " | " | whole | W | 0.37 | " |
| " | " | foot | W | <1.26 | " |
| " | " | wing & leg | W | 1.48 | " |

## COBALT IN BIRDS (1)

| Species | Locality | Tissue | Analysis PPM (2) | | Authority |
|---|---|---|---|---|---|
| Mallard *Anas platyrhynchos* | Canada | feather | D | <0.05 | Kelsall (1970) |
| Black duck *Anas rubripes* | " | " | D | <0.05 | " |
| Noddy tern *Anous stolidus* | Eniwetok | not in tissues | excreted $Co^{57,58,59}$ | | Lowman (1963) |
| Lesser scoup duck *Aythya affinis* | Canada | feather | D | <0.05 | Kelsall (1970) |
| White-fronted goose *Anser albifrons* | " | " | D | <0.05 | " |
| Ruffed grouse *Bonasa umbellus* | United States | liver | W | 0.20 | Schroeder et al. (1967) |
| Swiflet *Collacalia inexpectata* | East Asia | dried nest | W | 0.051 | Leung (1973) |
| Fairy tern *Gyris alba* | Eniwetok | not in tissues | excreted $Co^{57,58,59}$ | | Lowman (1963) |

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| | | | | | | |
|---|---|---|---|---|---|---|
| Chicken *Gallus domesticus* | | | egg white | | 0.034 | Skoropostizhnaya (1957) |
| " | " | | egg yolk | | 0.068 | " |
| " | " | United States | " | W | 0.12 | Schroeder et al. (1967) |
| " | " | " | egg white | W | 0.06 | " |
| " | " | " | whole egg | W | 0.10 | " |
| " | " | " | wing | W | 0.29 | " |
| " | " | " | leg | W | 0.21 | " |
| " | " | East Asia | whole | W | 0.102 | Leung (1973) |
| " | " | " | yolk | W | 0.225 | " |
| " | " | " | white | W | 0.004 | " |
| " | " | " | chick | W | 0.084 | " |

## COBALT IN MARINE FISH (1)

| Species | Locality | Tissue | Analysis PPM (2) | | Authority |
|---|---|---|---|---|---|
| Sablefish, black cod *Anoplopoma fimbria* | Oregon | liver | W | (0.0-0.37) pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| " " | " | muscle | | (0.0-0.09) pCi/g $Co^{60}$ | " |
| White croaker *Argyrosomus argentatus* | Japan | skin | W | (0.020-0.048) | Ichikawa & Ohno (1974) |
| " " | " | muscle | W | (0.0025-0.0085) | " |
| " " | " | viscera | W | (0.024-0.032) | " |
| " " | " | bone | W | (0.0087-0.037) | " |
| Silverfish *Argyrozona argyrozona* | S. Africa | muscle | W | 0.0026 | Van As et al. (1975) |
| *Atractoscion aequidens* | " | " | W | 0.0041 | " |
| Ghost shark *Callorhincus callorhincus* | Chile | skin | W | 0.028 | Ichikawa & Ohno (1974) |
| " " | " | muscle | W | 0.0015 | " |

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| | | | | | |
|---|---|---|---|---|---|
| Porgy<br>*Chrysophrys major* | Japan | skin | W | 0.033 | Ichibawa & Ohno (1974) |
| " " | " | muscle | W | 0.0058 | " |
| Pacific saury<br>*Cololabis saira* | East Asia | " | W | 0.125 | Leung (1973) |
| Dolphin<br>*Corphaena hippura* | Japan | skin | W | 0.020 | Ichikawa & Ohno (1974) |
| " " | " | liver | W | 0.0003 | " |
| Wrasse<br>*Ctenolabrus rupestris* | Sweden | less viscera | D | 3.8 | Noddack & Noddack (1940) |
| Yellow porgy<br>*Dentex macrocanus* | South America | muscle | W | 0.0034 | Ichikawa & Ohno (1974) |
| " " | " | viscera | W | 0.059 | " |
| Surf perch<br>*Ditrema temmincki* | Japan | muscle | W | 0.018 | " |
| " " | " | viscera | W | 0.107 | " |
| Big-eye sardine<br>*Etrumeus micropus* | " | muscle | W | (0.013-0.014) | " |
| " " | " | bone | W | 0.012 | " |
| Atlantic cod<br>*Gadus morhua* | | adult | A | 2.7 | Malyuga (1946) |
| " " | | " | D | 0.33 | " |
| " " | | " | W | 0.065 | " |
| " " | | immature | A | 2.8 | " |
| " " | | " | D | 0.42 | " |
| " " | | " | W | 0.076 | " |

| | | | | | |
|---|---|---|---|---|---|
| Tiger shark<br>*Galeocerdo cuvieri* | Hawaii | liver | W | 0.0 pCi/kg $Co^{60}$ | Folsom & Young (1965) |
| Rex sole<br>*Glyptocephalus zachirus* | Oregon | muscle | W | (0.0-0.14) pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| Shad<br>*Harengula zunasi* | Japan | " | W | 0.011 | Ichikawa & Ohno (1974) |
| " " | " | bone | W | 0.057 | " |
| Kabeljon<br>*Johnius hololepidotus* | S. Africa | muscle | W | 0.0022 ±SD 0.0004 | Van As et al. (1975) |
| Seabass<br>*Lateolabrax japonicus* | East Asia | " | W | 0.046 | Leung (1973) |
| Flounder<br>*Limanda herzensteini* | Japan | skin | W | (0.012-0.089) | Ichikawa & Ohno (1974) |
| " " | " | muscle | W | (0.0027-0.011) | " |
| *Lithognathus lithognathus* | S. Africa | " | W | 0.0031 | Van As et al. (1975) |
| Angler<br>*Lophius piscatorius* | " | " | W | 0.0062 | " |
| Blue marlin<br>*Makaira nigricans* | Puerto Rico | liver | W | 0.5 dpm/g $Co^{57}$ | Lowman et al. (1966) |
| " " | " " | " | W | 0.1 dpm/g $Co^{60}$ | " |
| Haddock<br>*Melanogrammus aeglefinus*<br>(=Gadus aeglefinus) | | | A | 4.2 | Malyuga (1946) |
| " " | | | D | 0.68 | " |
| " " | | | W | 0.01 | " |
| Silver hake<br>*Merluccius bilinearis* | | | A | 10.0 | Vinogradov (1953) |
| " " | | | D | 1.4 | " |
| " " | | | W | 0.28 | " |

| | | | | | |
|---|---|---|---|---|---|
| Hake, stockfish<br>Merluccius capensis | S. Africa | muscle | W | 0.0037<br>±SD 0.0011 | Van As et al. (1975) |
| Hake<br>Merluccius gayi | South America | " | W | 0.0026 | Ishikawa & Ohno (1974) |
| " " | " | viscera | W | 0.035 | " |
| Dover sole<br>Microstomus pacificus | Oregon | muscle | W | (0.0-0.09)<br>pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| " " | " | liver | W | (0.0-0.09)<br>pCi/g $Co^{60}$ | " |
| " " | Los Angeles (sewer outfalls) | " | W | (0.037-0.061) | DeGoeij et al. (1974) |
| " " | S. California (control) | muscle | W | (0.1-0.5) | Fowler et al. (1975) |
| " " | " (contam. area) | " | W | (0.1-0.2) | " |
| Striped bass<br>Morone saxatilis | Long Island | | W | 0.109 | Zawacki & Briggs (1976) |
| " " | " | | D | 1.31 | " |
| Goatfish<br>Mulloidichtys samoensis | Guam | | W | 20 μμc/g<br>$Co^{57}$ | Seymour (1963) |
| " " | " | | W | 2 μμc/g $Co^{60}$ | " |
| File fish<br>Navodon modestus | Japan | skin | W | (0.028-0.066) | Ichikawa & Ohno (1974) |
| " " | " | muscle | W | (0.0027-0.0036) | " |
| Atlantic thread herring<br>Opisthonema oglinum | Puerto Rico | | A | (15.0-50.0)<br>31.0 | Ting & Vega (1969) |
| Smelt<br>Osmerus eperlanus | | | A | 10.0 | Malyuga (1946) |
| " " | | | D | 1.4 | " |
| " " | | | W | 1.1 | " |

| | | | | | |
|---|---|---|---|---|---|
| Hottentot<br>*Pachymetopon grande* | S. Africa | muscle | W | 0.0020 | Van As et al. (1975) |
| Calico bass, sand bass<br>*Paralabrax clathratus* | California | dorsal muscle | D | (1.4-2.2) | Stapleton (1968) |
| " " | " | ventral muscle | D | (1.2-4.3) | " |
| " " | " | gonad | D | (3.6-4.4) | " |
| " " | " | liver | D | (1.4-1.9) | " |
| " " | " | integument | D | (1.4-1.8) | " |
| " " | " | heart | D | (1.2-1.7) | " |
| " " | " | eyeball | D | (5.1-5.2) | " |
| Grunt<br>*Parapristipoma trilineatum* | Japan | skin | W | 0.064 | Ichikawa & Ohno (1974) |
| " " | " | bone | W | 0.040 | " |
| English sole<br>*Parophrys vetulus* | Oregon | liver | W | 0.0 pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| Green cod<br>*Pollachius virens* | | | A | 2.4 | Malyuga (1946) |
| " " | | | D | 0.4 | " |
| " " | | | W | 0.07 | " |
| Bluefish<br>*Pomatomus saltatrix* | Long Island | | W | 0.995 | Zawacki & Briggs (1976) |
| " " | " | | D | 2.11 | " |
| Flyingfish<br>*Prognichthys agoo* | Japan | skin | W | 0.038 | Ichikawa & Ohno (1974) |
| " " | " | muscle | W | 0.0018 | " |
| Pilchard<br>*Sardinops melanostica* | East Asia | " | W | 0.021 | Leung (1973) |
| Sardine, pilchard<br>*Sardinops ocellata* | S. Africa | " | W | 0.033 | Van As et al. (1975) |

| | | | | | |
|---|---|---|---|---|---|
| False whiting<br>Sciaena deliciosa | Peru | muscle | W | 0.0041 | Ichikawa & Ohno (1974) |
| " " | " | viscera | W | 0.284 | " |
| Mackerel<br>Scomber japonicus | Japan | muscle | W | (0.0025-0.0099) | " |
| " " | " | liver | W | (0.051-0.071) | " |
| Chub mackerel<br>Scomber japonicus | S. Africa | muscle | W | 0.020<br>±SD 0.017 | Van As et al. (1975) |
| Scombrops dubius | " | " | W | 0.0034 | " |
| Windowpane flounder<br>Scophthalmus aquosus | Long Island | | W | 0.821 | Zawacki & Briggs (1976) |
| " " | " | | D | 3.28 | " |
| Pacific ocean perch<br>Sebastes alutus<br>(=Sebastodes alutus) | Oregon | muscle | W | (0.0-0.09)<br>pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| Stingfish<br>Sebastes inermis | Japan | " | W | 0.0037 | Ichikawa & Ohno (1974) |
| " " | " | skin | W | 0.013 | " |
| Rock fish<br>Sebastes spp. | Oregon | liver | W | (0.0-0.37)<br>pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| Yellowtail<br>Seriola pappei | S. Africa | muscle | W | 0.008<br>±SD 0.0049 | Van As et al. (1975) |
| Yellowtail<br>Seriola quinqueradiata | Japan | " | W | 0.0055 | Ichikawa & Ohno (1974) |
| " " | " | viscera | W | 0.015 | " |
| " " | East Asia | muscle | W | 0.022 | Leung (1973) |
| Sand smelt<br>Sillago sihama | Japan | viscera | W | (0.054-0.202) | Ichikawa & Ohno (1974) |
| " " | " | muscle | W | (0.0022-0.0042) | " |

| | | | | | |
|---|---|---|---|---|---|
| Spiny dog shark<br>*Squalus acanthius* | Sweden | less viscera | D | 0.1 | Noddack & Noddack (1940) |
| File fish<br>*Stephanolepis cirrhifer* | Japan | muscle | W | 0.004 | Ichikawa & Ohno (1974) |
| " " | " | viscera | W | 0.024 | " |
| Sole<br>*Synaptura marginata* | S. Africa | muscle | W | 0.0031 ±0.0004 | Van As et al. (1975) |
| Albacore<br>*Thunnus alalunga* | N. Pacific | liver | W | 160.0±SE 20.0 pCi/kg $Co^{60}$ | Folsom & Young (1965) |
| " " | S. Pacific | " | W | 30.0±5.0 pCi/kg $Co^{60}$ | " |
| " " | | gall bladder | A | 30.0 | Goldberg (1962) |
| Horse mackerel<br>*Trachurus japonicus* | Japan | skin | W | 0.131 | Ichikawa & Ohno (1974) |
| " " | " | muscle | W | 0.0097 | " |
| " " | East Asia | " | W | 0.042 | Leung (1973) |
| Horse mackerel<br>*Trachurus trachurus* | S. Africa | " | W | 0.0081 | Van As et al. (1975) |
| Sea robin<br>*Triglia capensis* | " | " | W | 0.011 | " |
| Swordfish<br>*Xiphias gladius* | East Asia | " | W | 0.009 | Leung (1973) |
| Kingklip<br>*Xiphiurus capensis* | S. Africa | " | W | 0.0032 ±SD 0.0013 | Van As et al. (1975) |
| "Cod" | United States | " | W | 1.21 | Schroeder et al. (1967) |
| "Smelt" | " | " | W | 7.21 | " |

## COBALT IN FRESHWATER FISH (1)

| Species | Locality | Tissue | Analysis PPM (2) | | Authority |
|---|---|---|---|---|---|
| Sturgeon *Acipenser sp.* | New York | muscle, bone & skin | W | 0.13 | Tong et al. (1972) |
| Bleak *Alburnus alborella* | Italy | muscle | A | 1.2±SE 0.23 | Merlini et al. (1971) |
| " " | " | bone | A | 0.07±SE 0.01 | " |
| " " | " | scale | A | 0.0 | " |
| Alewife *Alosa pseudoharengus* | Lake Michigan | whole | W | 0.029±0.014 | Lucas et al. (1970) |
| River carpsucker *Carpiodes cyprinus* | Illinois | muscle | W | (0.04-0.12) 0.087 | Mathis & Cummings (1973) |
| White sucker *Catastomus commersoni* | New York | muscle, bone & skin | W | 0.34 | Tong et al. (1972) |
| Lake herring *Coregonus artedii* | Lake Superior | liver | W | 0.020 | Lucas et al. (1970) |

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| | | | | | |
|---|---|---|---|---|---|
| Lake whitefish *Coregonus clupeaformis* | Lake Superior | liver | W | 0.010 | Lucas et al. (1970) |
| " " | Lake Michigan | " | W | 0.036±0.005 | " |
| Bloater *Coregonus hoyi* | Lake Superior | " | W | 0.012±0.001 | " |
| " " | Lake Michigan | " | W | 0.040±0.006 | " |
| Whitefish *Coregonus macrophthalmus* | Italy | muscle | A | 0.64±SE 0.13 | Merlini et al. (1971) |
| " " | " | bone | A | 0.14±SE 0.04 | " |
| " " | " | scale | A | 0.24±SE 0.09 | " |
| Carp *Cyprinus carpio* | Austria | kidney | D | 0.032 | Rehwolt et al. (1976) |
| " " | " | liver | D | 0.076 | " |
| " " | " | muscle | D | 0.004 | " |
| " " | " | bone | D | 0.067 | " |
| " " | New York | " muscle & skin | W | 0.03 | Tong et al. (1972) |
| " " | Illinois | muscle | W | (0.03-0.10) 0.068 | Mathis & Cummings (1973) |
| Gizzard shad *Dorosoma cepedianum* | " | " | W | (0.10-0.25) 0.16 | " |
| Northern pike *Esox lucius* | " | " | W | (0.03-0.11) 0.07 | " |
| " " | New York | muscle, bone & skin | W | (0.16-4.7) | " |
| Muskellunge *Esox masquinongy* | " | " | W | (0.33-1.7) | Tong et al. (1972) |
| Chain pickerel *Esox niger* | " | " | W | (0.07-0.32) | " |

| | | | | | |
|---|---|---|---|---|---|
| Bigmouth buffalo<br>*Ictiobius cyprinellus* | Illinois | muscle | W | (0.06-0.12)<br>0.081 | Mathis & Cummings (1973) |
| Shortnose gar<br>*Lepisosteus platostomus* | " | " | W | (0.11-0.18)<br>0.15 | " |
| Blue gill<br>*Lepomis macrochirus* | United States | | W | 3.72 | Schroeder et al. (1967) |
| Smallmouth bass<br>*Micropterus dolomieui* | Illinois | muscle | W | (0.14-0.16)<br>0.15 | Mathis & Cummings (1973) |
| " " | New York | muscle, bone & skin | W | (0.16-1.6) | Tong et al. (1972) |
| Largemouth bass<br>*Micropterus salmoides* | Illinois | muscle | W | (0.06-0.18)<br>0.09 | Mathis & Cummings (1973) |
| " " | New York | muscle, bone & skin | W | (0.15-0.29) | Tong et al. (1972) |
| White bass<br>*Morone chrysops*<br>(=*Roccus chrysops*) | Lake Erie | liver | W | 0.043±0.002 | Lucas et al. (1970) |
| Striped bass<br>*Morone saxatilis* | New York | muscle, bone & skin | W | 0.13 | Tong et al. (1972) |
| Shorthead redhorse<br>*Moxostoma macrolepidotum* | Illinois | muscle | W | (0.05-0.11)<br>0.083 | Mathis & Cummings (1973) |
| Spottail shiner<br>*Notropis hudsonius* | Lake Erie | whole | W | 0.025±0.004 | Lucas et al. (1970) |
| " " | Lake Michigan | " | W | 0.042±0.015 | " |

| | | | | | |
|---|---|---|---|---|---|
| American smelt<br>*Osmerus mordax* | Lake Michigan | liver | W | 13.0±4.0 | Lucas et al. (1970) |
| Yellow perch<br>*Perca flavescens* | Lake Erie | " | W | 0.12±0.060 | " |
| Trout perch<br>*Percopsis omiscomaycus* | Lake Michigan | whole | W | 0.024±0.002 | " |
| " " | Lake Superior | " | W | 0.022±0.005 | " |
| Black crappie<br>*Pomoxis nigromaculatus* | New York | muscle, bone & skin | W | 0.08 | Tong et al. (1972) |
| Round whitefish<br>*Prosopium cylindraceum* | Lake Superior | liver | W | 0.047±0.008 | Lucas et al. (1970) |
| Lake trout<br>*Salvelinus namaycush* | " | " | W | 0.031±0.003 | " |
| " " | Lake Michigan | " | W | 0.036±0.004 | " |
| " " | New York | muscle, bone & skin | W | (0.06-0.42) | Tong et al. (1972) |
| Rudd<br>*Scardinius erythrophthalmus* | N. Italy | muscle | A | 0.48±SE 0.09 | Merlini et al. (1971) |
| " " | " | bone | A | 0.08±SE 0.01 | " |
| " " | " | scale | A | 0.18±SE 0.03 | " |
| Walleye<br>*Stizostedion vitreum* | Lake Erie | liver | W | 0.045±0.025 | Lucas et al. (1970) |
| " " | New York | muscle, bone & skin | W | (0.09-4.7) | Tong et al. (1972) |

## COBALT IN MOLLUSCS (1)

| Species | Locality | Tissue | Analysis PPM (2) | | Authority |
|---|---|---|---|---|---|
| Copepod<br>*Acartia clausi* | Greece | whole | D | (0.19-1.3) | Zafiropoulos & Grimanis (1977) |
| Freshwater clam<br>*Amblema plicata* | Illinois | soft parts | W | (0.4-1.2)0.7 | Mathis & Cummings (1973) |
| Arch shell<br>*Anadara granosa* | Bombay | " | W | 0.11 | Bhatt et al. (1968) |
| Sea hare<br>*Aplysia sp.* | | liver | D | trace | Fox & Ramage (1931) |
| Gastropod<br>*Archidoris tuberculata* | Great Britain | " | D | (0.31-0.34) | " |
| Pteropod<br>*Cavolinia quadridentata* | Gulf of Aquaba | whole | | (0.064-0.199) | Turekion et al. (1973) |
| Pteropod<br>*Cavolinia unicata* | " | " | | 0.084±0.003 | " |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ±Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | | |
|---|---|---|---|---|---|
| Cockle<br>Cerastoderma edule<br>(=Cardium edule) | | | D | 2.1 | Vinogradov (1953) |
| " " | | | W | 0.43 | " |
| Scallop<br>Chlamys opercularis | Great Britain | soft parts | D | 0.33 | Bryan (1973) |
| Black mussel<br>Choromytilus meridionalis | S. Africa | " | D | (0.9-3.0) | Watling & Watling (1976b) |
| " " | " | " | W | 0.038±SD 0.006 | Van As et al. (1975) |
| Pteropod<br>Clio pyramidata | Gulf of Aquaba | whole | | (0.078-0.176) | Turekian et al. (1973) |
| Pteropod<br>Clione limacina | N.W. Atlantic | " | A | 30.0 | Nicholls et al. (1959) |
| Pacific oyster<br>Crassostrea gigas | Oregon | soft parts | W | (0.0-0.7) pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| " " | Washington | " | W | (0.10-0.20) | Pringle et al. (1968) |
| " " ? | Great Britain | " | D | (2.2-3.5) | Boyden & Romeril (1974) |
| Oyster<br>Crassostrea gryphoides | Bombay | " | W | 0.06 | Bhatt et al. (1968) |
| Atlantic oyster<br>Crassostrea virginica | | | W | <0.12 | Shuster & Pringle (1969) |
| " " | Texas | shell | D | <1.0 | Smith & Wright (1962) |
| " " | Atlantic Coast United States | soft parts | W | (0.06-0.20) 0.10 | Pringle et al. (1968) |
| " " | " | " | W | (0.14-0.18) | Schroeder et al. (1967) |

| | | | | | |
|---|---|---|---|---|---|
| Pteropod<br>*Cresius aciculà* | Gulf of Aquaba | whole | | (0.057-0.149) | Turekian et al. (1973) |
| White mussel<br>*Donax sera* | S. Africa | soft parts | W | 0.038±SD 0.024 | Van As et al. (1975) |
| Freshwater clam<br>*Fusconaia flava* | Illinois | " | W | (0.5-1.3)<br>0.8 | Mathis & Cummings (1973) |
| *Glycimerus glycimerus* | Irish Sea | " | D | 0.9 | Segar et al. (1971) |
| Abalone<br>*Haliotis gigantea* | East Asia | muscle | W | 0.009 | Leung (1973) |
| Abalone<br>*Haliotus midae* | S. Africa | soft parts | W | 0.025±<br>SD 0.007 | Van As et al. (1975) |
| Abalone<br>*Haliotis sp.* | | podium | D | 0.0 | Vinogradov (1953) |
| Sponge<br>*Ircinia strobilina* | Puerto Rico | | A | 0.0 dis/mg $Co^{60}$ | Lowman et al. (1967) |
| Squid<br>*Illex illecebrosus* | Atlantic Grand Bank | liver | W | 0.0 pCi/kg $Co^{60}$ | Folsom & Young (1965) |
| Octopus<br>*Japatella heathi* | Oregon | | W | 0.07 pCi/kg $Co^{60}$ | Seymour & Lewis (1964) |
| Clam<br>*Katelysia marmorata* | Bombay | soft parts | W | (0.01-0.24)<br>0.10 | Bhatt et al. (1968) |
| Gastropod<br>*Lambis lambis* | Guam | | W | (59.0-231.0) μμc/g $Co^{57}$ | Seymour (1963) |
| " " | " | | W | (2.0-19.0) μμc/g $Co^{60}$ | " |

| | | | | | |
|---|---|---|---|---|---|
| Pteropod<br>Limacina retroversa | N.W. Atlantic | whole | A | 20.0 | Nicholls et al. (1975) |
| " " | South Atlantic | " | | (1.01-1.04) | Turekian et al. (1973) |
| Squid<br>Loligo opalescens | California | liver | W | 0.0 pCi/kg $Co^{60}$ | Folsom & Young (1965) |
| Quahog, hard shell clam<br>Mercenaria mercenaria | Atlantic Coast United States | soft parts | W | (0.10-0.20) 0.20 | Pringle et al. (1968) |
| " " | Great Britain | " | D | 4.3 | Segar et al. (1971) |
| Clam<br>Meretrix meretrix | Bombay | " | W | (0.09-0.52) 0.25 | Bhatt et al. (1968) |
| Clam<br>Meretrix sp. | East Asia | " | W | 0.409 | Leung (1973) |
| Horse mussel<br>Modiolus agripeta | Okinawa | " | W | 40.0±SE 4.0 pCi/kg $Co^{60}$ | Folsom & Young (1965) |
| Horse mussel<br>Modiolus modiolus | Irish Sea | " | D | 5.5 | Segar et al. (1971) |
| Squid<br>Moroteuthis robusta | Oregon | | W | (0.0-1.0) pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| Softshell clam<br>Mya arenaria | " | " | W | (0.0-0.59) pCi/g $Co^{60}$ | " |
| " " | Atlantic Coast United States | " | W | (0.10-0.20) 0.10 | Pringle et al. (1968) |
| Intertidal mussel<br>Mytilus californianus | S. California | " | W | 10.0±SE 0.1 pCi/kg $Co^{60}$ | Folsom & Young (1965) |

| | | | | | |
|---|---|---|---|---|---|
| Common mussel<br>Mytilus edulis | | | D | 1.7 | Webb (1937) |
| " " | | | W | 0.33 | " |
| " " | Oregon | | W | (0.0-0.34) pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| " " | Mediterranean | soft parts | D | (0.4-5.9) | Fowler & Oregioni (1976) |
| " " | Yugoslavia | " | D | 12.0 | Lulic & Strohal (1974) |
| " " | Great Britain | " | D | 1.6 | Segar et al. (1971) |
| " " | Belgium | " | D | (1.21-2.23) 1.74 | Bertini & Goldberg (1972) |
| " " | Netherlands | " | D | 2.27 | " |
| Mussel<br>Mytilus galloprovincialis | Mediterranean | " | D | (0.5-7.4) | Fowler & Oregione (1976) |
| Mussel<br>Mytilus viridis | Bombay | " | W | 0.0 | Bhatt et al. (1968) |
| Mud snail<br>Nassarius obsoletus | Oregon | whole | W | (0.0-0.19) pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| Octopus<br>Octopus vulgaris | " | edible parts | W | 0.106 | " |
| Squid<br>Ommastrephes illecebrosa | N.E. United States | | A | 3.0 | Nicholls et al. (1959). |
| Scallop<br>Pecten caurinus<br>(=Patinopecten caurinus) | Oregon | | W | (0.0-0.04) pCi/g $Co^{60}$ | Seymour & Lewis (1964) |

| | | | | | |
|---|---|---|---|---|---|
| Scallop<br>Pecten islandicus | | | W | 0.015 | Malyuga (1946) |
| " " | | | D | 0.068 | " |
| Scallop<br>Pecten maximus | Irish Sea | soft parts | D | 8.5 | Segar et al. (1971) |
| " " | Great Britain | " | D | 0.25 | Bryan (1973) |
| Scallop<br>Pecten yessoensis | East Asia | " | W | 0.372 | Leung (1973) |
| Pen shell<br>Pinna sp. | | kidney | D | 60.0 | Fox & Ramage (1931) |
| Sea scallop<br>Placopecten magellanicus | Delaware (dump site) | whole | D | (0.29-1.02) 0.56 | Pesch et al. (1977) |
| Pleurobranchus plumula | | | | 250.0 | Vinogradov (1953) |
| Freshwater clam<br>Quadrula quadrula | Illinois | soft parts | W | (0.6-1.6) 1.2 | Mathis & Cummings (1973) |
| Cuttlefish<br>Sepia spp. | East Asia | edible parts | W | 0.013 | Leung (1973) |
| Pacific razor clam<br>Siliqua patula | Oregon | soft parts | W | (0.0-0.71) pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| Squid<br>Stenoteuthis bartrami | N.E. Pacific | liver | W | (1,100.0-3,800.0) pCi/kg $Co^{60}$ | Folsom & Young (1965) |
| " " | Hokkaido coast | | W | 0.0 pCi/kg $Co^{60}$ | " |
| Pteropod<br>Styliola turbula | South Atlantic | whole | | (0.409-0.571) | Turekian et al. (1973) |

| | | | | | |
|---|---|---|---|---|---|
| Clam<br>Sunetta donacina | Bombay | soft parts | W | 0.06 | Bhatt et al. (1968) |
| Squid<br>Symplectoteuthis oualaniensis | Okinawa | liver | W | 600.0 pCi/kg $Co^{60}$ | Folsom & Young (1965) |
| Short-necked clam<br>Tapes philippinarum | Japan | soft parts | W | (0.110-0.22) | Ichikawa & Ohno (1974) |
| " " | " | foot & mantle | W | (0.110-0.540) | " |
| " " | " | gill & viscera | W | (0.096-0.180) | " |
| Tridacna clam<br>Tridacna sp. | Guam | kidney | W | 2340±30.0 μμc/g $Co^{57}$ | Seymour (1963) |
| " " | Palau | " | W | (16.0-294.0) μμc/g $Co^{60}$ | " |
| "Scallops" | E. United States | | W | 2.25 | Schroeder et al. (1967) |
| "Clams" | " | soft parts | W | 0.33 | " |
| "Molluscs" | Puerto Rico | " | A | ±50.0 | Lowman et al. (1966) |

## COBALT IN ARTHROPODS (1)

| Species | Locality | Tissue | Analysis (2) PPM | Authority |
|---|---|---|---|---|
| CRUSTACEA | | | | |
| Copepod *Calanus finmarchius* | N.E. United States | whole | A 3.0 | Nicholls et al. (1959) |
| Crayfish *Cambarus longulus longirostris* | Tennessee | | <5.0 | Wiser & Nelson (1964) |
| " " " | " | $Co^{60}$ was concentrated in gut, hepatopancreas and integument, relatively little in blood, muscle, and gut | | " |
| Copepod *Centropagus hematus* and *typicus* | | whole | A 4.0 | Nicholls et al. (1939) |
| Euphausid *Euphausia krohni* | United States | | A 5.0 | Nicholls et al. (1959) |
| Lobster *Homarus americanus* | E. United States | muscle | W (0.07-0.16) | Schroeder et al. (1967) |

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| | | | | | |
|---|---|---|---|---|---|
| *Hyas araneus* | | | A | 1.4 | Malyuga (1939) |
| " " | | | D | 0.77 | " |
| " " | | | W | 0.15 | " |
| Rock lobster *Jasus lalandii* | S. Africa | muscle | W | 0.0039± SD 0.0015 | Van As et al. (1975) |
| Decapod *Leander adspersus* | Russia | | | 0.0 | Petkevich & Stepanyuk (1970) |
| Gooseneck barnacle *Lepas anatifera* | N.E. Pacific | whole | W | 40.0±SE 4.0 pCi/kg $Co^{60}$ | Folsom & Young (1965) |
| Gooseneck barnacle *Lepas anserifera* | N. Borneo | " | W | 10.0±SE 4.0 pCi/kg $Co^{60}$ | " |
| Isopod *Ligia pallasii* | Oregon | | W | (0.0-0.65) pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| Barnacle *Mitella polymerus* | " | | W | 0.0 pCi/g $Co^{60}$ | " |
| Sea crab *Neptunus spp.* | East Asia | muscle | W | 0.007 | Leung (1973) |
| Spiny lobster *Panulirus sp.* | | | W | 200.0 | Vinogradov (1953) |
| Shrimp *Peneus orientalis* | Japan | soft parts | W | (0.014-0.020) | Ichikawa & Ohno (1974) |
| " " | " | carapace | W | (0.030-0.036) | " |
| Shrimp *Peneus spp.* | East Asia | muscle | W | 0.034 | Leung (1973) |
| Copepod *Pleuromamma xiphias* | Puerto Rico | whole | A | (20.0-50.0) 37.0 | Martin (1970) |
| " " | " | " | D | 12.3 | " |

| | | | | | |
|---|---|---|---|---|---|
| Kelp crab<br>*Pugettia producta* | California | feces | A | (ND-0.9) | Boothe & Knauer (1972) |
| Copepod<br>*Undinula vulgaris* | Puerto Rico | whole | A | (25.0-60.0)<br>44.0 | Martin (1970) |
| " " | " | " | D | 14.3 | " |
| "Shrimp" | E. United States | muscle | W | 0.12 | Schroeder et al. (1967) |
| " | " | whole | W | 1.81 | " |
| | Puerto Rico | | A | ±20.0 | Lowman et al. (1966) |
| INSECTA | | | | | |
| *Hyalophora cecropia*<br>(=Cecropia) | New England | pupa | W | 0.21 | Schroeder et al. (1967) |
| " " | " | cocoon | W | 2.55 | " |
| *Anthaeria polyphemus*<br>(=Polyphemus) | " | pupa | W | 0.36 | " |
| Praying mantis<br>*Paratenodora sinensis* | | adult | W | (1.32-2.52) | " |

## COBALT IN LOWER ANIMALS (1)

| Species | Locality | Tissue | Analysis PPM | | Authority |
|---|---|---|---|---|---|
| CTENOPHORA | | | | | |
| Comb jelly<br>*Beröe cucumis* | N.E. United States | whole | A | <1.0 | Nicholls et al. (1959) |
| CHAETOGNATHA | | | | | |
| Arrow worm<br>*Sagitta elegans* | " | " | A | 110.0 | " |
| PORIFERA | | | | | |
| Sponge<br>*Halichondra sp.* | Sweden | | D | 0.05 | Noddack & Noddack (1940) |
| Sponge<br>*Spheciospongia vesparia* | Puerto Rico | | A | (2.8-13.0) dis./mg $Co^{60}$ | Lowman et al. (1967) |
| ANNELIDA<br>Polychaete<br>*Aphrodita aculeata* | | | D | 25.0 | Vinogradov (1953) |

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| | | | | | |
|---|---|---|---|---|---|
| Sand worm<br>*Arenicola marina* | Gulf of Kola | | A | 9.5 | Malyuga (1946) |
| " " | " | | D | 5.5 | " |
| " " | " | | W | 2.0 | " |
| Tubificid worm<br>*Limnodrilus hoffmeisteri* | Illinois | | W | (0.2-2.5)1.6 | Mathis & Cummings (1973) |
| *Myxicola infundibulum* | | | D | 20.0 | Vinogradov (1953) |
| Tubificid worm<br>*Tubifex tubifex* | Illinois | | W | (0.2-2.5)1.6 | Mathis & Cummings (1973) |
| COELENTERATA | | | | | |
| Coral<br>*Anomacora fecunda* | W. Atlantic Ocean | | D | 1.5 | Livingston & Thompson (1971) |
| Coral<br>*Bathycyanthus maculatus* | " | | D | 1.3 | " |
| Coral<br>*Caryophyllia clavus* | " | | D | 7.0 | " |
| Coral<br>*Caryophyllia communis* | " | | D | <2.0 | " |
| Coral<br>*Cladocera patriarca* | " | | D | <2.0 | " |
| Jellyfish<br>*Cynaea capillata* | NE United States | whole | A | 3.0 | Nicholls et al. (1959) |
| " " | " | | D | 1.9 | " |
| " " | Sweden | " | D | 7.1 | Noddack & Noddack (1940) |
| Coral<br>*Dendrophyllia sp.* | W. Atlantic Ocean | | D | 2.0 | Livingston & Thompson (1971) |

| | | | | | |
|---|---|---|---|---|---|
| Coral<br>*Desmophyllum cristogalli* | W. Atlantic Ocean | | D | (1.0-16.0) | Livingston & Thompson (1971) |
| Coral<br>*Madracis asperula* | " | | D | 3.0 | " |
| Coral<br>*Madracis mirabilis* | " | | D | (0.061-0.17) | " |
| Coral<br>*Madracis pharensis* | " | | D | 0.077 | " |
| Coral<br>*Meandrina areolata* | " | | D | 0.04 | " |
| Coral<br>*Meandrina braziliensis* | " | | D | (0.058-0.067) | " |
| Sea anemone<br>*Metridium dianthus* | Sweden | | D | 1.7 | Noddack & Noddack (1940) |
| Coral<br>*Montastrea annularis* | W. Atlantic Ocean | | D | (0.064-0.12) | Livingston & Thompson (1971) |
| Coral<br>*Phyllangia americana* | " | | D | 2.0 | " |
| Coral<br>*Porites porites* | W. Atlantic Ocean | | D | (<2.0-2.0) | " |
| Coral<br>*Scolmia cubensis* | " | | D | (0.058-0.47) | " |
| Coral<br>*Solenosmilia variabilis* | " | | D | (<0.2-105.0) | " |
| Coral<br>*Trochocyanthus sp.* | " | | D | 14.0 | " |
| ECHINODERMATA | | | | | |
| Sea urchin<br>*Arbacia lixula* | Greece | whole | D | 0.32 | Papadopoulou et al. (1976) |

| | | | | | |
|---|---|---|---|---|---|
| Sea star<br>Asterias rubens | Sweden | without viscera | D | 0.9 | Noddack & Noddack (1940) |
| " " | | | D | 3.0 | Malyuga (1941) |
| Sea urchin<br>Brissopsis lyrifera | " | " | D | 2.0 | Noddack & Noddack (1940) |
| Sea cucumber<br>Cucumaria frondosa | | | D | 0.67 | Malyuga (1941) |
| Sea urchin<br>Echinaster sepositus | Greece | whole | D | 0.38 | Papadopoulou et al. (1976) |
| Sea cucumber<br>Holothuria tubulosa | " | " | D | 0.11 | " |
| Starfish<br>Marthasterias glacialis | " | " | D | 0.090 | " |
| Serpent star<br>Ophioderma longicauda | " | " | D | 0.20 | " |
| Sea urchin<br>Paracentrotus lividus | " | " | D | 0.28 | " |
| Sea urchin<br>Parechinus sp. | S. Africa | | W | 0.006 | Van As et al. (1975) |
| Sea urchin<br>Sphaerechinus granularis | Greece | whole | D | 0.66 | Papadopoulou et al. (1976) |
| Sea cucumber<br>Stichopus tremulus | Sweden | without viscera | D | 1.2 | Noddack & Noddack (1940) |
| Sea urchin<br>Stronglylocentrus pulcherrimus | Japan | ovary | W | (0.071-0.084) | Ishikawa & Ohno (1974) |
| "Sea cucumber" | " | whole | W | (0.0082-0.019) | " |
| Starfish | Puerto Rico | | A | >30.0 | Lowman et al. (1966) |

TUNICATA

| | | | | | |
|---|---|---|---|---|---|
| Tunicate *Ciona intestinalis* | Sweden | whole | D | 2.3 | Noddack & Noddack (1940) |
| " " | Greece | " | W | 0.022 | Papadopoulou & Kanias (1977) |
| " " | " | " | D | 0.52 | " |
| " " | " | tunic | W | 0.017 | " |
| " " | " | " | D | 0.44 | " |
| " " | " | other than tunic | W | 0.050 | " |
| " " | " | " | D | 1.4 | " |
| Tunicate *Microcosmus sulcatus* | " | whole | D | 0.31 | " |
| " " | " | " | D | 1.9 | " |
| Red bait *Pyura microcosmus* | S. Africa | " | W | 0.075 | Van As et al. (1975) |
| Tunicate *Salpa fusiformis* | NE United States | " | A | <1.0 | Nicholls et al. (1959) |

## COBALT IN HIGHER PLANTS (1)

| Species | Locality | Tissue | Analysis (2) PPM | | Authority |
|---|---|---|---|---|---|
| Sugar maple<br>*Acer saccharum* | New England | | W | (0.07-1.14) | Schroeder et al. (1967) |
| Maple<br>*Acer sp.* | Canada | bough | D | 0.08 | Warren & Delavault (1957) |
| Balsam fir<br>*Abies balsamifera* | " | " | D | (0.1-0.6) | " |
| Quack grass<br>*Agropyron repens* | United States | | D | 0.09 | Beeson et al. (1947) |
| Red top grass<br>*Agrostis alba* | " | | D | 0.08 | " |
| Onion<br>*Allium cepa* | | bulb | | 0.13 | Bertrand & Mokragnatz (1930) |
| " " | East Asia | " | W | 0.13 | Leung (1973) |
| " " | New England | " | W | (0.06-0.18) | Schroeder et al. (1967) |

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| | | | | | |
|---|---|---|---|---|---|
| Green onion<br>*Allium porrum* | Russia | bulb | | 0.26 | Skoropostizhnaya (1957) |
| " " | East Asia | " | W | 0.001 | Leung (1973) |
| Garlic<br>*Allium sativum* | " | " | W | 0.009 | " |
| " " | New England | " | W | 0.32 | Schroeder et al. (1967) |
| Alder<br>*Alnus rugosa* (?) | Canada | bough | D | (0.06-0.25) | Warren & Delavault (1957) |
| Pineapple<br>*Aranas comosus* | East Asia | fruit | W | 0.0016 | Leung (1973) |
| Custard apple<br>*Anona reticulata* | " | " | W | 0.002 | " |
| Peanut<br>*Arachis hypogaea* | United States | hay | | 0.08 | Mitchell (1951) |
| " " | East Asia | nut | W | 0.375 | Leung (1973) |
| " " | United States | " | W | 0.37 | Schroeder et al. (1967) |
| " " | Lower Dahomey | " | D | 0.60 | Cresta et al. (1975) |
| Big sagebrush<br>*Artemisia tridentata* | Nevada | stem | D | (0.5-2.3) | Wallace & Romney (1972) |
| " " | " | leaf | D | (0.5-2.6) | " |
| Jackfruit<br>*Artocarpus heterophyllus* | | seed | W | 0.007 | Leung (1973) |
| *Athyrium augustum* | New England | | W | 0.24 | Schroeder et al. (1967) |
| Salt bush<br>*Atriplex canescens* | Nevada | leaf | D | (1.0-1.7) | Wallace & Romney (1972) |

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| Salt bush<br>Atriplex confertifolia | Nevada (experimental) | leaf | D | (0.1-0.6) | Wallace & Romney (1972) |
| " " | " " | stem | D | (0.1-1.6) | " |
| " " | " " | root | D | (1.0-5.0) | " |
| " " | " | leaf | D | (0.5-1.6) | " |
| Salt bush<br>Atriplex hymenelytra | " | " | D | (1.0-1.2) | " |
| Oats<br>Avena sativa | | bran | | 0.01 | Bertrand & Mokragnatz (1930) |
| " " | | grain | trace | | " |
| " " | Canada | hay | | (0.02-0.7) | Bowstead et al. (1942) |
| " " | United States | whole | | (0.03-0.23) | Mitchell (1951) |
| " " | Scotland | | D | (0.003-0.03) | Burridge (1970) |
| " " | East Asia | grain | W | 0.019 | Leung (1973) |
| Bilimbi<br>Averrhoa bilimbi | " | fruit | W | 0.002 | " |
| Carambola<br>Averrhoa carambola | " | " | W | 0.002 | " |
| Bamboo<br>Bambusa spp.<br>and others | " | shoot | W | 0.003 | " |
| Barberry<br>Berberis vulgaris | New England | | W | (0.13-0.56) | Schroeder et al. (1967) |
| Swiss chard<br>Beta vulgaris cicla | United States | | D | 0.09 | Hurwitz & Beeson (1944) |
| " " " | Maryland (on sludge-amended soil) | leaf & stem | D | (1.5-3.1) | Furr et al. (1976) |

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| Beet<br>Beta vulgaris | United States | root | D | (0.05-0.09) | Hurwitz & Beeson (1944) |
| " " | " | top | D | (0.39-0.41) | " |
| Mangel<br>Beta vulgaris | " | leaf | D | (0.16-0.54) | " |
| Bog birch<br>Betula glandulosa | Alaska | " | D | 0.51 | Kubota et al. (1970) |
| " " | " | twig | D | 0.42 | " |
| Paper birch<br>Betula papyrifera | " | leaf | D | 0.40 | " |
| " " | " | twig | D | 0.30 | " |
| Birch<br>Betula sp. | Canada | bough | D | (0.03-0.25) | Warren & Delavault (1957) |
| Rape<br>Brassica napus | Russia | | | (0.10-0.12) | Meleshko (1957) |
| Cabbage<br>Brassica oleracea var. capitata | United States | head | D | 0.07 | Beeson (1941) |
| " " " | "<br>Russia | " | D | (0.07-0.24) | Hurwitz & Beeson (1944) & Skoropostizhnaya (1957) |
| " " " | United States | | W | 0.55 | Schroeder et al. (1967) |
| Turnip<br>Brassica rapa | " | leaf | D | (0.03-1.07) | Hurwitz & Beeson (1944) |
| Brome grass<br>Bromus inermis (?) | "<br>Canada | | D | (0.03-0.09) | Beeson et al. (1947) & Arthur et al. (1953) |

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| Bluejoint grass<br>Calamagrostis canadensis | Alaska | | D | 0.14 | Kubota et al. (1970) |
| " " | Canada, NWT | | D | (0.83-5.78) | O'Toole et al. (1971) |
| Pepper<br>Capsicum sativum | East Asia | fruit | W | 0.003 | Leung (1973) |
| " " | New England | " | W | (0.04-0.20) | Schroeder et al. (1967) |
| Papaya<br>Carica papaya | East Asia | " | W | 0.004 | Leung (1973) |
| " " | Virgin Islands | " | W | (0.05-0.10) | Schroeder et al. (1967) |
| Rabbitbrush<br>Chrysothamnus viscidflorus | Nevada | leaf | D | 0.5 | Wallace & Romney (1972) |
| " " | " | stem | D | 0.5 | " |
| Water melon<br>Citrullus vulgaris | Russia | | | 0.18 | Meleshko (1957) |
| " " | East Asia | fruit | W | 0.001 | Leung (1973) |
| Lime<br>Citrus aurantiifolia | | | D | 0.2 | Bertrand & Mokragnatz (1930) |
| Pomelo<br>Citrus grandis | East Asia | fruit | W | 0.11 | Leung (1973) |
| Orange, tangerine<br>Citrus reticulata | " | " | W | 0.003 | " |
| Clethra barbinervis | Japan | leaf | A | (100 x other plants tested) | Yamagata & Murakami (1958) |
| " " | " | " | A | 700 | " |
| Sea grape<br>Cocoloba uvifera | Virgin Islands | fruit | W | 0.45 | Schroeder et al. (1967) |

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| Coconut<br>Cocos nucifera | East Asia | kernel | W | 0.039 | Leung (1973) |
| " " | Virgin Islands | " | W | (0.04-0.24) | Schroeder et al. (1967) |
| Coffee<br>Coffea arabica | | bean | | 0.002 | Bertrand & Mokragnatz (1930) |
| " " | | " | D | 0.10±SD 0.0078 | Shah et al. (1971) |
| Black brush<br>Coleogyne ramosissima | Nevada | leaf | D | (trace-2.6) | Wallace & Romney (1972) |
| " " | " | stem | D | (trace-4.9) | " |
| Sweetfern<br>Comptonia peregrina | Canada<br>Ontario<br>Dist. from Ni smelter (mi): | | | | Hutchinson & Whitby (1973) |
| " " | " " " | 1.0 | D | 10.0 | " |
| " " | " " " | 1.4 | D | 12.0 | " |
| " " | " " " | 4.6 | D | 7.0 | " |
| " " | " " " | 6.5 | D | 7.0 | " |
| " " | " " " | 8.4 | D | 5.0 | " |
| " " | " " " | 18.0 | D | 5.0 | " |
| " " | " " " | 31.0 | D | 7.0 | " |
| Rattlebox<br>Crotalaria cobalticola | Katanga | (indicator of Co) | | | NASA (1968) |
| " " | " | | A | 17,700.0 (max.) | Duvigneaud (1959) |
| Bermuda grass<br>Cynodon dactylon | United States | | D | (0.04-0.15) | Arthur et al. (1953)<br>Beeson et al. (1947) |
| Pumpkin<br>Cucurbita pepo | East Asia | fruit | W | 0.002 | Leung (1973) |

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|---|---|---|---|---|---|
| Dodder<br>Cuscuta nevadensis | Nevada | whole | D | 0.5 | Wallace & Romney (1972) |
| Orchard grass<br>Dactylus glomeratus | United States | | D | 0.08 | Beeson et al. (1947) |
| Carrot<br>Daucus carota | | leaf | | 0.31 | Bertrand & Mokragnatz (1930) |
| " " | | root | | 0.02 | " |
| " " | East Asia | " | W | 0.002 | Leung (1973) |
| " " | New England | " | W | (0.04-0.16) | Schroeder et al. (1967) |
| Wavy hair grass<br>Deschampsia flexuosa | Canada, Ontario<br>Dist. from Ni smelter (mi): | | | | Hutchinson & Whitby (1973) |
| " " | " " | 1.0 | D | 32.5 | " |
| " " | " " | 4.6 | D | 12.0 | " |
| " " | " " | 6.5 | D | 5.5 | " |
| " " | " " | 8.4 | D | 8.0 | " |
| " " | " " | 12.0 | D | 5.5 | " |
| " " | " " | 31.0 | D | 5.5 | " |
| Salt grass<br>Distichlis spicata | | | | (0.15-0.66) | Vinogradov (1954) |
| Yam<br>Dioscorea alata | East Asia | root | W | 0.03 | Leung (1973) |
| " " | New England | " | W | (0.06-0.08) | Schroeder et al. (1967) |
| Durian<br>Durio zibethicus | East Asia | fruit | W | 0.004 | Leung (1973) |

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|---|---|---|---|---|---|
| Waterweed<br>*Elodea sp.* | Italy | whole | A | 18.0±SE 2.7 | Merlini et al. (1971) |
| Millet<br>*Eleusine coracana* | East Asia | grain | W | 0.264 | Leung (1973) |
| Mormon tea<br>*Ephedra funerea* | Nevada | shoot | D | (trace-2.0) | Wallace & Romney (1972) |
| Mormon tea<br>*Ephedra nevadensis* | " | " | D | (trace-1.0) | " |
| Mormon tea<br>*Ephedra torreyana* | " | " | D | (2.0-5.0) | " |
| Mormon tea<br>*Ephedra viridis* | " | " | D | (2.0-6.0) | " |
| Fireweed<br>*Epilobium angustifolium* | Alaska | leaf & stem | D | 0.14 | Kubota et al. (1970) |
| Horsetail<br>*Equisetum sp.* | " | | D | 1.22±SD 1.27 | " |
| Centipede grass<br>*Eremochloa ophiuroides* | United States | | | 0.04 | Mitchell (1951) |
| Cotton grass<br>*Eriophorum sp.* | Alaska | | D | 0.15 | Kubota et al. (1970) |
| Winterfat<br>*Eurotia lanata* | Nevada | leaf | D | (trace-4.6) | Wallace & Romney (1972) |
| Buckwheat<br>*Fagopyrum sagittatum* | | grain | | 0.36 | Bertrand & Mokragnatz (1930) |
| Beech<br>*Fagus grandifolium* | | bark | | 1.10 | " |
| " " | | wood | | (0.05-0.09) | " |
| " " | | leaf | D | 0.35 | " |
| " " | New England | | W | 0.16 | Schroeder et al. (1967) |

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| Fig<br>*Ficus carica* | | | | 0.20 | Bertrand & Mokragnatz (1930) |
| Strawberry, wild<br>*Fragaria vesca* (?) | Russia | | | (0.10-0.12) | Meleshko (1957) |
| Burro bush<br>*Franseria dumosa* | Nevada | leaf | D | (trace-2.7) | Wallace & Romney (1972) |
| " " | " | stem | D | (trace-1.3) | " |
| Soy bean<br>*Glycine max* | United States | hay | | 0.05 | Mitchell (1951) |
| " " | East Asia | seed | W | 0.195 | Leung (1973) |
| Spiny hop sage<br>*Grayia spinosa* | Nevada | leaf | D | (1.0-2.1) | Wallace & Romney (1972) |
| Okra<br>*Hibiscus esculentus* | East Asia | fruit | W | 0.006 | Leung (1973) |
| Johnson grass<br>*Holcus halepensis* | United States | | | 0.08 | Mitchell (1951) |
| Barley<br>*Hordeum vulgare* | " | grain | D | (0.0012-0.003) | Haller et al. (1969) |
| " " | East Asia | " | W | 0.20 | Leung (1973) |
| Sweet potato<br>*Ipomoea batatas* | United States | | | (0.02-0.03) | Hurwitz & Beeson (1944) |
| " " | East Asia | root | W | 0.215 | Leung (1973) |
| Black walnut<br>*Juglans nigra* | | nut | | 0.05 | Bertrand & Mokragnatz (1930) |
| Cedar<br>*Juniperus communis* | Canada | bough | D | 0.01 | Warren & Delavault (1957) |

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|---|---|---|---|---|---|
| Juniper<br>*Juniperus osteosperma* | Nevada | leaf | D | 0.5 | Wallace & Romney (1972) |
| Cedar<br>*Juniperus virginianum* | Missouri | twig & leaf | D | <0.6 | Connor et al. (1970) |
| Krameria<br>*Krameria parvifolia* | Nevada | leaf | D | trace | Wallace & Romney (1972) |
| " " | " | stem | D | (trace-1.4) | " |
| Lettuce<br>*Lactuca sativa* | | leaf | D | (0.05-0.23) | Bertrand & Mokragnatz (1930) |
| " " | East Asia | " | W | 0.140 | Leung (1973) |
| " " | New England | " | W | (0.10-0.14) | Schroeder et al. (1967) |
| Calabash<br>*Lagenaria spp.* | East Asia | fruit | W | 0.001 | Leung (1973) |
| Langsat<br>*Lansinum domesticum* | " | " | W | 0.002 | " |
| Creosote bush<br>*Larrea divaricata* | Nevada | leaf | D | (trace-1.1) | Wallace & Romney (1972) |
| " " | " (experimental) | " | D | (1.0-1.1) | " |
| " " | | stem | D | (trace-0.9) | " |
| Tamarack, larch<br>*Larix laricina* | Canada | bough | D | (0.06-0.15) | Warren & Delavault (1957) |
| Labrador tea<br>*Ledum groenlandicum* | " | " | D | (0.04-0.75) | " |
| Lentil<br>*Lens lentil* | East Asia | seed | W | 0.179 | Leung (1973) |
| Lespedeza<br>*Lespedeza cuneata* | United States | | | (0.03-0.73) | Mitchell (1951) |

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|---|---|---|---|---|---|
| Lily<br>Lilium longiflorum | | leaf | | 0.016 | Yamada (1958) |
| " " | | petal | | 0.133 | " |
| " " | | pollen | | 0.07 | " |
| " " | | stigma | | 0.056 | " |
| " " | | style | | 1.182 | " |
| Composite<br>Linosyris villosa | Russia (indicates Ni-Co deposits in Ural mts.) | | | | Vinogradov (1954) |
| Lupine<br>Lupinus sp. | Alaska | leaf & stem | D | 0.12 | Kubota et al. (1970) |
| Lycium<br>Lycium andersoni | Nevada | leaf | D | (1.2-2.7) | Wallace & Romney (1972) |
| " " | " | stem | D | (trace-1.1) | " |
| Lycium pallidum | " | leaf | D | (0.5-1.5) | " |
| Lycium shockleyi | " | " | D | 0.5 | " |
| Tomato<br>Lycopersicum esculentum | | | | 0.10 | Bertrand & Mokragnatz (1930) |
| " " | East Asia | fruit | W | 0.09 | Leung (1973) |
| " " | New England | " | W | (0.05-0.06) | Schroeder et al. (1967) |
| Apple<br>Malus malus | United States | " | D | 0.0219±SD 0.0003 | Haller et al. (1969) |
| " " | East Asia | " | W | 0.004 | Leung (1973) |
| " " | New England | | W | (0.25-0.34) | Schroeder et al. (1967) |
| " " | " | " | W | <0.2 | " |
| Mango<br>Mangifera indica | East Asia | " | W | 0.003 | Leung (1973) |

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| Cassava<br>Manihot esculenta | East Asia | root | W | 0.009 | Leung (1973) |
| " " | Lower Dahomy | " | D | (0.30-1.0) | Cresta et al. (1975) |
| Alfalfa<br>Medicago sativa | Canada | hay | | (0.01-0.62) | Arthur et al. (1953)<br>Bowstead et al. (1942) |
| " " | Italy | " | | (0.01-0.62) | Cambi (1950) |
| " " | United States | " | | (0.01-0.62) | Mitchell (1951) |
| Horseradish, dish tree<br>Moringa oleifera | East Asia | leaf | W | 0.009 | Leung (1973) |
| Banana<br>Musa sapientum | " | fruit | W | 0.006 | " |
| " " | Virgin Islands | " | W | 0.05 | Schroeder et al. (1969) |
| Water milfoil<br>Myriophyllum sp. | Italy | whole | A | 19.9±SD 2.8 | Merlini et al. (1971) |
| Water cress<br>Nasturtium officionale | | | | 0.15 | Bertrand & Mokragnatz (1930) |
| Swamp black gum<br>Nyssa aquatica | United States | Leaf excellent for Co surveys | | | Lazar & Beeson (1956) |
| Black gum<br>Nyssa sylvatica biflorum | " | | D | 800.0 | " |
| Tobacco<br>Nicotiana tabacum | Kentucky | leaf | D | (0.44-1.7) | Nadkarni & Ehmann (1970) |
| " " | " | stem | D | 1.9 | " |
| Pondweed<br>Najas sp. | Italy | whole | A | 3.8±SE 0.3 | Merlini et al. (1971) |

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| Water lily<br>*Nuphar sp.* | Italy | whole | A | 1.7±SE 0.15 | Merlini et al. (1971) |
| Rice<br>*Oryza sativa* | | polished grain | | (0.006-0.13) | Bertrand & Mokragnatz (1930) |
| " " | Japan | straw | | (0.42-9.3) | Kandatsu & Mori (1957) |
| " " | | grain | D | (0.018-0.027) | Haller et al. (1969) |
| " " | East Asia | " | W | (0.009-0.042) | Leung (1973) |
| " " | Lower Dahomey | " | D | (0.10-0.20) | Cresta et al. (1975) |
| Indian ricegrass<br>*Oryzopsis hymenoides* | Nevada | top | D | 0.5 | Wallace & Romney (1972) |
| Cinnamon fern<br>*Osmunda cinnamomea* | New England | frond | W | 0.25 | Schroeder et al. (1967) |
| Claytons fern<br>*Osmunda claytonia* | " | " | W | 0.18 | " |
| Royal fern<br>*Osmunda regalis* | " | " | W | 0.13 | " |
| Para grass<br>*Panicum purpurescens* | United States | | D | 0.07 | Beeson et al. (1947) |
| Dallis grass<br>*Paspalum dilatatum* | " | | D | (0.03-0.15) | " |
| " " | South Carolina | | D | (0.03-0.15) | Mitchell (1951) |
| Bahia grass<br>*Paspalum notatum* | United States | | D | 0.08 | Beeson et al. (1947) |
| Vasey grass<br>*Paspalum urvillei* | " | | D | 0.08 | " |

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|---|---|---|---|---|---|
| Passionfruit<br>*Passiflora quadrangularis* | East Asia | fruit | W | 0.007 | Leung (1973) |
| Parsnip<br>*Pastinica sativa* | " | root | W | 0.012 | " |
| " " | New England | " | W | 0.18 | Schroeder et al. (1967) |
| Lima bean<br>*Phaseolus lunatus* | East Asia | seed | W | 0.078 | Leung (1973) |
| Mungo bean<br>*Phaseolus mungo* | " | " | W | 0.165 | " |
| Field bean<br>*Phaseolus vulgaris* | (French)<br>Russia | | | 0.07 | Skoropostizhnaya (1957) |
| " " | (wax)<br>United States | | D | 0.1 | Hurwitz & Beeson (1944) |
| " " | (field) | | | 0.01 | Bertrand & Mokragnatz (1930) |
| " " | " United States | | D | 0.01 | Beeson (1941) |
| " " | California | root | D | 3.5 | Wallace & Romney (1977) |
| " " | " | stem | D | 0.3 | " |
| " " | " | leaf | D | 0.4 | " |
| " " | United States | bean | D | 0.058±SD 0.002 | Haller et al. (1969) |
| " " | East Asia | " | W | 0.068 | Leung (1973) |
| Timothy<br>*Phleum pratense* | United States | | D | (0.01-0.08) | Beeson et al. (1947) |
| Reed grass<br>*Phragmites sp.* | Italy | whole | A | 2.5±SE 0.56 | Merlini et al. (1971) |
| White spruce<br>*Picea abies* | New England | needle | W | 0.04 | Schroeder et al. (1967) |

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| Black spruce<br>*Picea nigra* | Canada | bough | D | (0.15-0.7) | Warren & Delavault (1957) |
| Lodgepole pine<br>*Pinus contorta* | " | " | D | 0.25 | " |
| Ponderosa pine<br>*Pinus ponderosa* | Washington | wood | D | (0.007-0.067) | Sheppard & Funk (1975) |
| White pine<br>*Pinus strobus* | New England | needle | W | 0.08 | Schroeder et al. (1967) |
| Guava<br>*Pisidium guajava* | East Asia | fruit | W | 0.0024 | Leung (1973) |
| Pea<br>*Pisum sativum* | | seed | | (0.03-0.15) | Bertrand & Mokragnatz (1930) |
| " " | Russia | " | | (0.03-0.15) | Meleshko (1957) |
| " " | United States | " | | 0.15 | Mitchell (1951) |
| " " | " " | " | D | 0.128 | Haller et al. (1969) |
| " " | New England | " | W | (0.01-0.24) | Schroeder et al. (1967) |
| " " | East Asia | " | W | 0.035 | Leung (1973) |
| Bluegrass<br>*Poa annua* | United States | | D | (0.13-0.25) | Beeson et al. (1947) |
| Kentucky bluegrass<br>*Poa pratensis* | " | | D | (0.13-0.25) | " |
| " " | Canada | | D | (0.13-0.25) | Arthur et al. (1953) |
| Christmus fern<br>*Polystichum acrosticoides* | New England | | W | 0.31 | Schroeder et al. (1967) |

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|---|---|---|---|---|---|
| Balsam poplar<br>Populus balsamifera | Canada | bough | D | 0.3 | Warren & Delavault (1957) |
| Cottonwood<br>Populus sp. | " | " | D | (0.1-0.3) | " |
| Quaking aspen<br>Populus tremuloides | Alaska | leaf | D | 1.13 | Kubota et al. (1970) |
| " " | " | twig | D | 0.35 | " |
| Pondweed<br>Potamogeton sp. | Italy | whole | A | 8.0±SE 1.0 | Merlini et al. (1971) |
| Apricot<br>Prunus armeniaca | | leaf | D | 0.4 | Bertrand & Mokragnatz (1930) |
| " " | | fruit | D | 0.03 | " |
| Cherry<br>Prunus sp. | | " | D | 0.005 | " |
| Black cherry<br>Prunus serotina | Canada | bough | D | 0.02 | Warren & Delavault (1957) |
| " " | New England | | W | 0.27 | Schroeder et al. (1967) |
| Bracken<br>Pteridium latiusculum | " | | W | 0.28 | " |
| Ostrich fern<br>Pteritis nodulosa | " | | W | 0.17 | " |
| Pasque flower<br>Pulsatilla patens | Plants become white in presence of Ni-Co deposits in Ural mts. | | | | Vinogradov (1954) |
| Pear<br>Pyrus communis | | fruit pulp | | 0.18 | Bertrand & Mokragnatz (1930) |
| " " | United States | " | D | 0.010±0.0002 | Haller et al. (1969) |

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|---|---|---|---|---|---|---|
| Pear<br>Pyrus communis | New England | | fruit pulp | W | 0.32 | Schroeder et al. (1967) |
| Radish<br>Raphanus sativa | Russia | | | | 0.3 | Skoropostizhnaya (1957) |
| " " | New England | | root | W | (0.04-0.11) | Schroeder et al. (1967) |
| " " | " | | leaf | W | 0.34 | " |
| Sumach<br>Rhus sp. | " | | " | W | 0.45 | " |
| " " | " | | seed | W | 0.27 | " |
| Natal grass<br>Rhynchelytrium roseum | United States | | | D | 0.05 | Beeson et al. (1947) |
| Wild rose<br>Rosa acicularis | Canada, N.W.T.<br>Dist. from smelter (mi): | | | | | O'Toole et al. (1971) |
| " " | " " | 0.4 | fruit & leaf | D | 1.14 | " |
| " " | " " | 0.8 | " | D | 1.09 | " |
| " " | " " | 1.8 | " | D | 0.79 | " |
| " " | " " | 1.9 | " | D | 0.06 | " |
| Ruppia spiralis | Caspian Sea | | | D | 66.0 | Vinogradov (1954) |
| Willow<br>Salix sp. | Canada | | bough | D | (0.08-0.35) | Warren & Delavault (1957) |
| Willow<br>Salix spp. | Alaska | | leaf | D | 1.80 | Kubota et al. (1970) |
| " " | " | | twig | D | 0.55 | " |
| Rye<br>Secale cereale | East Asia | | grain | W | 0.11 | Leung (1973) |
| Catchfly<br>Silene cobaltica | Katanga | | (good indicator of Co) | | | NASA (1968) |

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|---|---|---|---|---|---|
| Squirreltail grass<br>*Sitanion hystrix* | Nevada | top | D | 0.5 | Wallace & Romney (1972) |
| Eggplant<br>*Solanum melongena* | East Asia | fruit | W | 0.005 | Leung (1973) |
| " " | New England | " | W | (0.03-0.1) | Schroeder et al. (1967) |
| " " | " | leaf | W | 0.33 | " |
| Potato<br>*Solanum tuberosum* | United States | | D | 0.06 | Beeson (1941) |
| " " | East Asia | tuber | W | 0.06 | Leung (1973) |
| " " | | | | (0.04-0.06) | Bertrand & Mokragnatz (1930) |
| " " | New England | " | W | (0.07-0.14) | Schroeder et al. (1967) |
| Mountain ash<br>*Sorbus americana* | " | leaf | W | 0.28 | " |
| " " | " | berry | W | 0.07 | " |
| Spinach<br>*Spinacia oleracea* | | | | (0.07-1.2) | Bertrand & Mokragnatz (1930) |
| " " | United States | | D | (0.07-1.2) | Hurwitz & Beeson (1944) |
| " " | New England | leaf | W | 0.34 | Schroeder et al. (1967) |
| " " | Lower Dahomey | " | D | (3.30-5.50) | Cresta et al. (1975) |
| Wiregrass<br>*Sporobolus sp.* | United States | | | 0.03 | Mitchell (1951) |
| Basswood<br>*Tilia americana* | New England | | W | 0.17 | Schroeder et al. (1967) |

| | | | | | |
|---|---|---|---|---|---|
| Spanish moss *Tillandsia usnoides* | S. United States | whole | A | (<0.007-0.070) geom. mean 0.0098±0.00183 | Shacklette & Connor (1973) |
| " " | | | | good indicator of Co | " |
| New Zealand Spinach *Tetragonia expansa* | United States | | D | 0.09 | Hurwitz & Beeson (1944) |
| Red clover *Trifolium pratense* | Japan | | | 1.3 | Kandatsu & Mori (1957) |
| " " | Scotland | | | (0.08-0.28) | Reith (1970) |
| White clover *Trifolium repens* | New Zealand | | | (0.17-4.6) | Askew & Dixon (1937) |
| " " | Canada | | | " | Arthur et al. (1953) |
| Wheat *Triticum aestivum* | United States | grain | D | 0.01 | Beeson (1941) |
| " " | | bran | | 0.01 | Bertrand & Mokragnatz (1930) |
| " " | | grain | | (0.01-0.04) | " |
| " " | Russia | " | | " | Skoropostizhnaya (1957) |
| " " | United States | whole | | (0.05-0.15) | Mitchell (1951) |
| " " | East Asia | grain | W | 0.11 | Leung (1973) |
| Blueberry *Vaccinium angustifolium* | Canada, Ontario Dist. from Ni smelter (mi): | | | | Hutchinson & Whitby (1973) |
| " " | " " 1.0 | | D | 10.0 | " |
| " " | " " 1.4 | | D | 8.0 | " |
| " " | " " 4.6 | | D | 6.8 | " |
| " " | " " 6.5 | | D | 8.0 | " |
| " " | " " 8.4 | | D | 5.5 | " |
| " " | " " 31.0 | | D | 5.5 | " |

| | | | | | |
|---|---|---|---|---|---|
| Blueberries<br>*Vaccinium sp.* | Canada | bough | D | (0.07-0.75) | Warren & Delavault (1957) |
| Vetch<br>*Vicia cracca* | United States | | | (0.03-0.35) | Mitchell (1951) |
| Cowpea<br>*Vigna unguiculata* | " | pea | D | (0.06-0.31) | Hurwitz & Beeson (1944) |
| " " | " | hay | | (0.05-0.12) | Mitchell (1951) |
| " *sp.* | East Asia | seed | W | 0.188 | Leung (1973) |
| Grape<br>*Vitis sp.* | United States | raisin | D | 0.001±SD 0.0005 | Haller et al. (1969) |
| Yucca<br>*Yucca brevifolia* | Nevada | leaf | D | (0.5-0.8) | Wallace & Romney (1972) |
| Yucca<br>*Yucca schidigera* | " | shoot | D | <0.5 | " |
| Corn<br>*Zea mays* | United States | kernel | | (0.01-0.02) | Mitchell (1951) |
| " " | Russia | " | | (0.01-0.02) | Skoropostizhnaya (1957) |
| " " | East Asia | " | W | 0.224 | Leung (1973) |
| " " | Lower Dahomey | " | D | 0.30 | Cresta et al. (1975) |
| " " | United States | " | D | 0.01 | Beeson (1941) |
| " " | | " | | (0.01-0.02) | Bertrand & Mokragnatz (1930) |
| " " | United States | " | D | (0.01-0.02) | Hurwitz & Beeson (1944) |

| | | | | | |
|---|---|---|---|---|---|
| Ginger<br>*Zingiber officinale* | East Asia | root | W | 0.019 | Leung (1973) |
| Eel grass<br>*Zostera asiatica* | Sea of Japan | | D | 3.9 | Saenko et al. (1976) |
| Eel grass<br>*Zostera marina* | Black sea | | D | 30.0 | Vinogradov (1953) |
| Eel grass<br>*Zostera nana* | Caspian Sea | | D | 15.0 | " |

## COBALT IN ALGAE (1)

| Species | Locality | Tissue | Analysis PPM (2) | Authority |
|---|---|---|---|---|
| Brown alga<br>*Agarum cribosum* | Sea of Japan | | D 0.9 | Saenko et al. (1976) |
| Red alga<br>*Ahnfeltia plicata* | Nova Scotia | | D 0.49 | Young & Langille (1958) |
| *Alaria esculenta* | Gulf of Kola | | A 1.7 | Malyuga (1946) |
| " " | " | | A 0.45 | " |
| " " | " | | W 0.078 | " |
| Brown alga, knotted wrack<br>*Ascophyllum nodosum* | Nova Scotia | | D 0.40 | Young & Langille (1958) |
| " " | Scotland | | D (0.41-0.73) | Black & Mitchell (1952) |
| " " | " | | W 0.17 | " |
| " " | Gulf of Kola | | 1.2 | Malyuga (1946) |

(1) Blank spaces indicate information not available or not applicable. ? indicates questionable data.

(2) W, D or A indicates on a Wet, Dry or Ashed basis. A single number indicates a single determination or mean. (x-y) indicates range of values, followed by the mean. ± Standard deviation (SD), standard error (SE), median, and geometric mean are indicated as reported. pCi/g = picocuries per gram.

| | | | | |
|---|---|---|---|---|
| Brown alga, knotted wrack<br>Ascophyllum nodosum | Gulf of Kola | | 0.22 | Malyuga (1946) |
| " " | " | | 0.007 | " |
| Green alga<br>Caulerpa racemosa | Texas | D | (2.0-4.2) | Harriss (1965) |
| Red alga<br>Ceramium gardneri | Oregon | W | 0.77 pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| Red alga<br>Chondrus crispus | Nova Scotia | D | 0.39 | Young & Langille (1958) |
| " " | " | D | (0.22-0.34) | " |
| Red alga<br>Chondrus yendoi | Sea of Japan | D | 1.1 | Saenko et al. (1976) |
| Brown alga<br>Chorda filum | " | D | 2.7 | " |
| Brown alga<br>Costaria costata | " | D | 0.6 | " |
| Green alga<br>Codium yessoensis | " | D | 0.3 | " |
| Green alga<br>Derbesia marina | Oregon | D | 3.2 pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| Brown alga, kelp<br>Ecklonia maxima | S. Africa | W | 0.0064± 0.0021 | Van As et al. (1978) |
| Red alga<br>Endocladia muricata | Oregon | W | 0.0 pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| Green alga<br>Enteromorpha prolifera | Sea of Japan | D | 9.8 | Saenko et al. (1976) |
| Green alga<br>Enteromorpha tubulosa | Oregon | W | 0.0 pCi/g $Co^{60}$ | Seymour & Lewis (1964) |

| | | | | |
|---|---|---|---|---|
| Wrack *Fucus furcatus* | Oregon | W | (0.0-1.7) pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| Wrack *Fucus serratus* | Scotland | D | (0.47-0.63) | Black & Mitchell (1952) |
| " " | " | W | 0.12 | " |
| " " | Gulf of Kola | A | 5.3 | Malyuga (1946) |
| " " | " | D | 1.3 | " |
| " " | " | W | 0.28 | " |
| Wrack *Fucus spiralis* | Scotland | D | (1.39-2.0) | Black & Mitchell (1952) |
| " " | " | W | 0.37 | " |
| Wrack *Fucus vesiculosis* | " | D | (0.65-0.91) | " |
| " " | " | W | 0.21 | " |
| " " | Nova Scotia | D | 0.66 | Young & Langille (1958) |
| " " | Great Britain Bristol Channel | | (5.5-11.3) | Fuge & James (1974) |
| Red alga *Gigartina rachula* | S. Africa | W | $0.018 \pm 0.003$ | Van As et al. (1975) |
| Red alga *Gigartina spp.* | Oregon | W | (0.0-0.87) pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| Red alga *Halosaccion ramentaceum* | Nova Scotia | D | 0.47 | Young & Langille (1958) |

| | | | | | |
|---|---|---|---|---|---|
| *Hesperophycus sp.* | Oregon | | W | (0.05-0.47) pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| Brown alga *Laminaria cichoroides* | Sea of Japan | | D | 2.6 | Saenko et al. (1976) |
| Brown alga *Laminaria cloustoni* | Scotland | frond | D | (0.21-0.56) | Black & Mitchell (1952) |
| Brown alga *Laminaria digitata* | " | " | D | (0.21-0.31) | " |
| " " | " | " | D | (0.22-1.46) | " |
| " " | " | stipe | D | (0.43-0.92) | " |
| " " | " | frond | W | 0.03 | " |
| " " | " | stipe | W | 0.07 | " |
| " " | Nova Scotia | | D | 0.25 | Young & Langille (1958) |
| " " | " | frond | D | 0.19 | " |
| " " | " | stipe | D | 0.52 | " |
| Brown alga *Laminaria hyperborea* | Scotland | frond | D | 0.39 | Black & Mitchell (1952) |
| " " | | " | D | 0.14 | Lunde (1970a) |
| Brown alga *Laminaria longicruris* | Nova Scotia | | D | 0.51 | Young & Langille (1958) |
| " " | " | frond | D | 0.11 | " |
| " " | " | stipe | D | 0.07 | " |
| Brown alga *Laminaria saccharina* | Gulf of Kola | | A | 4.4 | Malyuga (1946) |
| " " | " | | D | 0.15 | " |
| " " | " | | W | 0.13 | " |

| | | | | |
|---|---|---|---|---|
| Brown alga<br>*Laminaria spp.* | Oregon | W | 0 pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| Brown alga, kelp<br>*Macrocystis pyrifera* | | D | 1.4 | Vinogradov (1953) |
| " " | California | A | (0.3-0.4)<br>0.3±0.05 | Boothe & Knauer (1972) |
| Green alga<br>*Monostroma zostericola* | Oregon | W | 0.0 pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| Brown alga, channel wrack<br>*Pelvetia canaliculata* | Scotland | D | (0.37-1.3) | Black & Mitchell (1952) |
| Brown alga<br>*Pelvetiopsis limitata* | Oregon | W | 0.03 pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| Brown alga<br>*Pelvetia wrightii* | Sea of Japan | D | 2.2 | Saenko et al. (1976) |
| *Phyllaria sp.* | Gulf of Kola | A | 1.9 | Malyuga (1946) |
| " " | " | D | 0.46 | " |
| " " | " | W | 0.067 | " |
| Red alga<br>*Phyllophora membranifolia* | Nova Scotia | D | 6.25 | Young & Langille (1958) |
| Red alga<br>*Polysiphonia japoncia* | Sea of Japan | D | 5.3 | Saenko et al. (1976) |
| Red alga<br>*Polysiphonia spp.* | Oregon | W | 0.0 pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| Red alga<br>*Porphyra capensis* | S. Africa | W | 0.054±0.013 | Van As et al. (1975) |
| Red alga<br>*Ptilota filicina* | Sea of Japan | D | 4.5 | Saenko et al. (1976) |

| | | | | |
|---|---|---|---|---|
| Red alga<br>Rhodomela larix | Sea of Japan | D | 5.4 | Saenko et al. (1976) |
| Red alga<br>Rhodymenia palmata | Nova Scotia | D | 0.13 | Young & Langille (1958) |
| Brown alga<br>Sargassum pallidum | Sea of Japan | D | 1.6 | Saenko et al. (1976) |
| Green alga<br>Spongomorpha arcta | Nova Scotia | D | 0.09 | Young & Langille (1958) |
| Red ribbons<br>Suhria vittata | S. Africa | W | 0.048± 0.004 | Van As et al. (1975) |
| Brown alga<br>Turbinaria turbinata | Puerto Rico | A | 31.0 | Lowman et al. (1966) |
| Green alga<br>Ulva fenestrata | Sea of Japan | D | 0.9 | Saenko et al. (1976) |
| Green alga<br>Ulva lactuca | Nova Scotia | D | 0.69 | Young & Langille (1958) |
| " " | " | D | (1.55-1.57) | " |
| " " | Gulf of Kola | A | 5.5 | Malyuga (1946) |
| " " | " | D | 1.1 | " |
| " " | " | W | 0.22 | " |
| " " | Great Britain | D | (4.0-40.0) | Boyden (1975) |
| Green alga<br>Ulva spp. | Oregon | W | (0.0-0.1) pCi/g $Co^{60}$ | Seymour & Lewis (1964) |
| " " | S. Africa | W | 0.038±0.013 | Van As et al. (1975) |

| | | | |
|---|---|---|---|
| "Green algae" | Puerto Rico | A 20.0 | Lowman et al. (1966) |
| "Red algae" | " | A 26.0 | " |

DATE DUE