

STATE MUSSEL WATCH PROGRAM

1993 – 1995 DATA REPORT

96-2WQ

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**STATE WATER RESOURCES CONTROL BOARD
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY**

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LIST OF ABBREVIATIONS

DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DDMS	Dichlorodiphenylmonochlorosaturatedethane
DDMU	Dichlorodiphenylmonochlorounsaturatedethane
DFG	California Department of Fish and Game
EDL	Elevated Data Level(s)
FDA or (USFDA)	United States Food and Drug Administration
HCH	Hexachlorocyclohexane
MIS	Median International Standard(s)
MTRL	Maximum Tissue Residue Level(s)
NAS	National Academy of Sciences
PAH	Polynuclear Aromatic Hydrocarbon(s)
PCB	Polychlorinated Biphenyl(s)
PCP	Pentachlorophenol
PCT	Polychlorinated Terphenyl
ppb	Parts Per Billion (ng/g)
ppm	Parts Per Million ($\mu\text{g/g}$)
RWQCB	Regional Water Quality Control Board(s)
SMWP	State Mussel Watch Program
SWRCB	State Water Resources Control Board
TCP	Tetrachlorophenol
TBT	Tributyltin
USEPA	United States Environmental Protection Agency

1. STATE MUSSEL WATCH PROGRAM

1993 - 1995

Introduction

The California State Mussel Watch Program (SMWP), initiated in 1977 by the State Water Resources Control Board (SWRCB), was organized to provide a uniform statewide approach to the detection and evaluation of the occurrence of toxic substances in the waters of California's bays, harbors, and estuaries. This is accomplished through the analysis of transplanted and resident mussels and clams. The SMWP primarily targets areas with known or suspected impaired water quality and is not intended to give an overall water quality assessment. The California Department of Fish and Game (DFG) carries out the statewide SMWP for the SWRCB by collecting and analyzing samples. The SWRCB provides funding under an ongoing interagency agreement with the DFG. Sampling stations are selected primarily by the six coastal Regional Water Quality Control Boards (RWQCB) which are identified on the inside back cover.

The DFG reports annual sampling results to the SWRCB which distributes the information to the coastal RWQCBs and to other federal, State, and local agencies through annual preliminary data reports. These preliminary data reports are also routinely transmitted to the Office of Environmental Health Hazard Assessment of the California Environmental Protection Agency which has responsibility for evaluating pollutant levels based on human health concerns and issuing consumption health advisories if indicated. This report is the formal report presenting the results of the 1993-94 and 1994-95 sampling and analysis programs.

Information collected in the SMWP is used by the SWRCB, RWQCB, and other agencies to identify waters impacted by toxic pollutants. Through the SWRCB's statewide Water Quality Assessment, SMWP results are used to help classify water bodies from good to impaired water quality relative to each other. SMWP results are also used in the SWRCB's Bay Protection Program in helping identify "Toxic Hot Spots". Lastly, SMWP results are used in the normal regulatory activities of the RWQCBs and other State agencies such as the Department of Pesticide Regulation.

Summary

Appendix A shows area map locations for each station sampled from September 1993 through April 1995. Also included are map locations of five stations in the San Francisco Bay Region (Region 2) where archive samples collected in 1982, 1985, and 1988 were analyzed. Appendix B contains station location information such as latitude and longitude, county, and region identification. A total of 67 samples from 43 stations were analyzed (Appendix C) including eight archive mussel samples and four sediment samples. Samples were analyzed for trace elements (metals), organic chemicals (pesticides and PCBs), polynuclear aromatic hydrocarbons (PAHs), and tributyltin (TBT). Forty-six of the samples were transplanted California mussels (*Mytilus californianus*), 15 were resident California mussels samples, and two were resident bay mussels (*Mytilus edulis*) samples. No freshwater clams were collected or analyzed in the 1993-94 and 1994-95 programs. A complete station sampling history of the SMWP from 1978 to 1995 is provided in Appendix D.

Wet weight sampling results were compared to the following criteria: U.S. Food and Drug Administration (FDA) criteria, Maximum Tissue Residue Levels (MTRLs), Median International Standards (MIS), and Elevated Data Levels (EDLs). Data were not compared to the National Academy of Sciences (NAS) recommended guidelines for predator protection since no freshwater shellfish were collected in 1993-95. A discussion of each criterion can be found in Section 3, Administrative and Comparative Criteria on Page 5. The MTRL criterion was developed from water quality objectives from the 1990 *California Ocean Plan* (SWRCB 1990a), the *Draft November 26, 1990 Functional Equivalent Document - Development of Water Quality Plans For: Inland Surface Waters of California and Enclosed Bays and Estuaries of California* (SWRCB 1990b), and the *Draft April 9, 1991 Supplement to the Functional Equivalent Document* (SWRCB 1991). Only one sample collected from 1993 to 1995 exceeded FDA criteria (Appendix E). Transplanted California mussels collected in 1995 from San Diego Bay/Harbor Island/East Basin/Storm Drain contained 2,305 ppb PCBs which exceeded the FDA tolerance level of 2,000 ppb for PCBs. A similar sample collected in 1988 from the same location also exceeded the FDA tolerance level for PCBs containing 2,738 ppb PCBs. MTRL criteria for ocean waters were exceeded in 16 samples from 9 stations (Appendix F). MTRLs for enclosed bays and estuaries were exceeded in 39 samples from 26 stations (Appendix G) including all eight archive samples from five stations in Region 2. The MIS for trace elements were exceeded in 59 samples from 40 stations including at least one sample from all archive stations (Appendix H). Samples exceeding EDLs for trace elements and organic chemicals can be found in Appendices I and E.

Tabular summaries of all chemistry data are provided in Appendices J through Q. Summaries of all trace element data are provided in Appendix J (wet weight) and Appendix K (dry weight). Summaries of all organic chemical data are provided in Appendix L (wet weight), Appendix M (dry weight), and Appendix N (lipid weight). PAH data summaries can be found in Appendix O (wet weight), Appendix P (dry weight), and Appendix Q (lipid weight).

2. FIELD AND LABORATORY OPERATIONS

The presence of many toxic substances in the State's waters is determined by analyzing tissues from aquatic organisms. Concentrations of these substances in water are often too low or transitory to be reliably detected through the more traditional methods of analysis of water samples. Also, many toxic substances are not water soluble, but can be found associated with sediment or organic matter. Aquatic organisms are sampled because they bioaccumulate and bioconcentrate toxic substances to levels which may be many hundreds of times the levels actually in the water. This concentration factor facilitates detection of toxic pollutants. Mussels are excellent subjects for this purpose because they (1) are sessile, (2) are long-lived, (3) can be successfully transplanted to and maintained in areas where they do not naturally occur, and (4) reliably concentrate toxic pollutants from the water. The following is a general overall discussion of field and laboratory procedures. A detailed discussion is provided in Appendix R.

Substances Measured

Samples are regularly analyzed for up to 13 trace elements (Table R-1) and approximately 45 synthetic organic chemicals including pesticides and PCBs (Table R-6). Arsenic, nickel, selenium, polynuclear aromatic hydrocarbons (PAHs), pentachlorophenol (PCP), and tetrachlorophenol (TCP), and tributyltin (TBT) are looked for on a request basis only. Not every sample is analyzed for all trace elements or organic chemicals. Each sample at each station is handled individually. The requesting agency, usually the RWQCBs, will specify the type of analysis for each sample.

Sample Size and Collection

Forty-five mussels or clams are composited and analyzed for organic chemicals. Three analytical replicates of 15 individuals each of mussels or clams are analyzed for trace elements (trace element results reported herein are mean values). Concentrations in bivalves of certain trace elements and organic chemicals can be directly correlated with several variables such as size of the animal, location of habitation within the tidal zone, and season of collection (Stephenson et al. 1987). In the SMWP, mussels of 55 to 65 mm in length are collected whenever possible in order to reduce size-related effects. In an attempt to minimize variability introduced by location of collection within the intertidal zone, mussels are collected from the highest point in the zone where adequate numbers occur.

Mussels are transplanted where a suitable resident population does not exist and where sampling can be accomplished using scuba equipment. The mussel transplant system used is one of the following three systems; 1) In an area of deep water and no structures, a bottom anchored submerged buoy system is used; 2) In areas with structures (i.e. pilings, floating docks, etc.), a polypropylene line may be tied between two pilings or a line hung beneath a dock; 3) In areas of shallow water, samples may be placed on PVC or wooden stakes that are pounded into the substrate. A two month transplant period is adequate in most cases where pollutant uptake rates are expected to be high, but for trace elements in less contaminated environments a six month interval may be necessary for an adequate sample (Stephenson et al. 1980). A four to six month transplant interval is used for organic chemicals to be consistent with transplant periods for trace elements. Transplanted mussels (*M. californianus*) were collected from Trinidad Head and Bodega Head.

Dry, Wet, and Lipid Weight Measurements

Metal data are presented in parts per million (ppm) while organic chemical data are presented in parts per billion (ppb). Tissue concentrations of trace elements and organic chemicals are measured on a dry weight basis to reduce data variability due to moisture content. Wet and lipid data are back calculated from dry weight measurements. Wet weight data are used to compare to wet weight or fresh weight criteria listed in this report (see Section 3, Administrative and Comparative Criteria). In addition, organic chemicals are expressed on a lipid weight basis. Lipid weight measurements offer several advantages. Because chlorinated hydrocarbons are much more soluble in lipids (fat tissues) than in water, they partition into lipid-rich tissues of aquatic organisms (Stout and Beezhold 1981). Animals with higher proportions of lipid in their tissue usually have had higher concentrations of chlorinated hydrocarbon pollutants (Phillips 1980). Factors such as season, water temperature, health of the organism, stress on the organism, and type of species can affect the lipid levels of samples collected for analysis and can, therefore, cause variability in results. Use of lipid weight measurements may reduce this source of variability, although disadvantages have also been noted (Phillips 1980). As a result, lipid weight values may represent a more realistic measure of environmental availability of chlorinated hydrocarbons than wet weight values. Wet weight measures, however, remain the preferred measure for most readers because all criteria for human health and for predator protection are based on wet weight measures. Also, wet weight measures better reflect the exposure of predators or humans to the actual concentration in fresh mussels or clams.

3. ADMINISTRATIVE AND COMPARATIVE CRITERIA

In this report the term “criteria” is used to refer to the criteria against which a particular trace element or organic chemical is being compared. More than one criterion may apply to any one metal or organic compound. In general, FDA action levels, Maximum Tissue Residue Levels (MTRLs), and Median International Standards (MIS), all human health-related criteria, are considered more important or critical. Following human health criteria are NAS guidelines for predator protection and Elevated Data Levels (EDLs). All five criteria are discussed below.

In interpreting the SMWP data by any of the criteria provided, the reader is cautioned that there is no simple relationship between concentrations of toxic substances observed in tissue samples and actual concentrations in water. Different aquatic organisms tend to bioaccumulate a given toxic substance in water to different levels; however, the differences usually do not prevent a general interpretation of the data. The reader is cautioned that the limited number of samples obtained and analyzed at each station in a single year is generally too small to provide a statistically sound basis for making absolute statements on toxic substance concentrations. The values reported herein should be accepted as indicators of relative levels of toxic pollution in water, not as absolute values. In this sense, trends over time and ranking values of a toxic substance provide only an indication of areas where mussels are evidently accumulating concentrations which are above normal.

FDA Action Levels and NAS Guidelines

The FDA has established maximum concentration levels for some toxic substances in human foods (USFDA 1985). The levels are based on specific assumptions of the quantities of food consumed by humans and the frequency of their consumption. The FDA limits are intended to protect humans from the chronic effects of toxic substances consumed in foodstuffs. The National Academy of Sciences (NAS) has established recommended maximum concentrations of toxic substances in animals (NAS 1973). They were established not only to protect the organisms containing the toxic compounds, but also to protect the species that consume these contaminated organisms. The NAS has set guidelines for marine fish but not for marine shellfish. Only two guidelines apply to freshwater clams. The FDA limits and NAS guidelines are shown in Table 1.

Maximum Tissue Residue Levels (MTRLs)

MTRLs were developed by SWRCB staff from human health water quality objectives in the *1990 California Ocean Plan* (SWRCB 1990a), the *Draft November 26, 1990 Functional Equivalent Document - Development of Water Quality Plans For: Inland Surface Waters of California and Enclosed Bays and Estuaries of California* (SWRCB 1990b), and the *Draft April 9, 1991 Supplement to the Functional Equivalent Document* (SWRCB 1991). The objectives represent concentrations in water that protect against consumption of fish, shellfish, and water (freshwater only) that contain substances at levels which could result in significant human health problems. MTRLs are used as alert levels or guidelines indicating water bodies with potential human health concerns and are an assessment tool and not compliance or enforcement criteria. Tables 2 and 3 lists MTRLs for those substances monitored in ocean waters and enclosed bays and estuaries. The MTRLs for a number of substances listed as carcinogens in the MTRL tables are below the current tissue detection limit for those substances. Detection limits can be found in

Tables R-1, R-6, and R-10 in Appendix R.

The MTRLs were calculated by multiplying the human health water quality objectives by the bioconcentration factor (BCF) for each substance as recommended in the USEPA *Draft Assessment and Control of Bioconcentratable Contaminants in Surface Waters* (USEPA 1991). BCFs were taken from the USEPA 1980 Ambient Water Quality Criteria Documents for each substance. MTRLs were not calculated for objectives that are based on maximum contaminant levels (MCLs) or taste and odor criteria.

Median International Standards (MIS) for Trace Elements

The MIS is an in-house criterion developed from a Food and Agriculture Organization of the United Nations publication of a survey of health protection criteria used by member nations (Nauen 1983). A description of how the Median International Standards were compiled by SWRCB staff is provided in Appendix S. These criteria vary somewhat in the tissues to be analyzed or the level of protection desired but may be compared qualitatively. Table 4 summarizes these standards as an indication of what other countries have determined to be unsafe levels of trace elements. Though the standards do not apply within the United States, they provide an indication of what other nations consider to be an elevated concentration of trace elements in shellfish.

Elevated Data Levels

The “elevated data level” (EDL) was introduced by SWRCB staff in 1983 as an internal comparative measure which ranks a given concentration of a particular substance with previous data from the SMWP. The EDL is calculated by ranking all of the results for a species and exposure condition (resident or transplant) and a given chemical from the highest concentration measured down to and including those records where the chemical was not detected. From this, a cumulative distribution is constructed and percentile rankings are calculated. For example, the 50th percentile corresponds to the median or “middle” value rather than to the mean. With a large number of records, the median can be approximately compared to the mean.

The 85th percentile (EDL 85) was chosen as an indication that a chemical is markedly elevated from the median. The 85th percentile corresponds to measures used by the U.S. Fish and Wildlife Service in its National Contaminant Biomonitoring Program and would represent approximately one and one-half standard deviations from the mean, if the data were normally distributed. The 95th percentile (EDL 95) was chosen to indicate values that are highly elevated above the median. The 95th percentile would represent two standard deviations from the mean, if the data were normally distributed. When used along with other information, these measures provide a useful guideline to determine if a chemical has been found in unusually high concentrations. A more detailed description of EDL rankings is provided in Appendix T. The reader is cautioned that EDLs are not directly related to potentially adverse human or animal health effects; they are only a way to compare findings in a particular area with the larger data base of findings from all over the state. The 1977-95 EDLs and the number of data points used to calculate each EDL are provided in Tables 5 through 9.

TABLE 1

NAS Guidelines and FDA Action Levels for Toxic Chemicals in Shellfish
(wet weight)

Chemical	NAS ^a		FDA ^b	
	Recommended Guideline for Freshwater Shellfish		Action Level for Freshwater and Marine Shellfish	
	µg/g (ppm)	ng/g (ppb)	µg/g (ppm)	ng/g (ppb)
Mercury	-	-	1.0 ^c	1,000
DDT (total)	1.0	1,000	-	-
PCB (total)	0.5	500	2.0 ^d	2,000
aldrin	-	-	0.3	300
dieldrin	-	-	0.3	300
endrin	-	-	0.3	300
heptachlor	-	-	0.3	300
heptachlor epoxide	-	-	0.3	300

a National Academy of Sciences-National Academy of Engineering. 1973. Water Quality Criteria, 1972 (Blue Book). U.S. Environmental Protection Agency, Ecological Research Series.

b U. S. Food and Drug Administration. 1984. Shellfish Sanitation Interpretation: Action Levels for Chemical and Poisonous Substances, June 21, 1984. U.S.F.D.A., Shellfish Sanitation Branch, Washington, D.C.

c As methyl mercury.

d A tolerance, rather than an action level, has been established for PCBs (21CFR 109, published May 29, 1984). An action level is revoked when a regulation establishes a tolerance for the same substance and use.

TABLE 2Maximum Tissue Residue Levels (MTRLs) in Ocean Waters**Carcinogens ^a**

Substance	Water Quality Objective ^b (µg/l)	BCF ^c (l/kg)	MTRL ^d (µg/kg, ppb wet weight)
aldrin	0.000022	e	0.1
chlordane (total)	0.000023	14100	0.32
DDT (total)	0.00017	53600	9.1
dieldrin	0.00004	4670	0.2
heptachlor	0.00072	11200	8.1
hexachlorobenzene (HCB)	0.00021	8690	2.0
PAHs (total)	0.0088	30	0.26
PCBs (total)	0.000019	31200	0.6
toxaphene	0.00021	13100	2.75

- The SMWP does not analyze for any of the non-carcinogens listed in the human health section of Table B of the 1990 Ocean Plan.
- From Table B, Objectives for Human Health, "*California Ocean Plan*" (SWRCB 1990a).
- Bioconcentration Factors taken from the USEPA 1980 Ambient Water Quality Criteria Documents for each substance.
- MTRLs were calculated by multiplying the Water Quality Objective by the BCF, except for aldrin.
- Aldrin MTRL is derived from a combination of aldrin and dieldrin risk factors and BCFs as recommended in the USEPA 1980 "*Ambient Water Quality Criteria for Aldrin/Dieldrin*" (USEPA 1980).

TABLE 3

Maximum Tissue Residue Levels (MTRLs) in Enclosed Bays and Estuaries

Carcinogens

Substance	Water Quality Objective ^a (µg/l)	BCF ^b (l/kg)	MTRL ^c (µg/kg, ppb)
aldrin	0.00014	d	0.33
chlordane (total)	0.000081	14100	1.2
DDT (total)	0.0006	53600	32.0
dieldrin	0.00014	4670	0.7
heptachlor	0.00017	11200	1.9
heptachlor epoxide	0.00007	11200	0.8
hexachlorobenzene (HCB)	0.00069	8690	6.0
hexachlorocyclohexane (HCH), alpha	0.0013	130	1.7
hexachlorocyclohexane (HCH), beta	0.046	130	6.0
hexachlorocyclohexane (HCH), gamma	0.062	130	8.1
PAHs (total)	0.031	30	0.93
PCBs (total)	0.00007	31200	2.2
pentachlorophenol (PCP)	8.2	11	90.0
toxaphene	0.00069	13100	9.0

Non-carcinogens

Substance	Water Quality Objective ^a (mg/l)	BCF ^b (l/kg)	MTRL ^c (mg/kg, ppm)
endosulfan (total)	0.002	270	0.5 (500 ppb)
endrin	0.0008	3970	3.2 (3,200 ppb)
mercury	0.000025	e	1.0
nickel	4.6	47	220.0

- From the *Draft November 26, 1990 Functional Equivalent Document - Development of Water Quality Plans For: Inland Surface Waters of California and Enclosed Bays and Estuaries of California* (SWRCB 1990b), the *Draft April 9, 1991 Supplement to the Functional Equivalent Document* (SWRCB 1991).
- Bioconcentration Factors taken from the USEPA 1980 Ambient Water Quality Criteria Documents for each substance.
- MTRLs were calculated by multiplying the Water Quality Objective by the BCF, except for aldrin and mercury.
- Aldrin MTRL is derived from a combination of aldrin and dieldrin risk factors and BCFs as recommended in the USEPA 1980 "Ambient Water Quality Criteria for Aldrin/Dieldrin" (USEPA 1980).
- The MTRL for mercury is the FDA action level. The water quality objective for mercury in the Enclosed Bays and Estuaries Plan is based on the FDA action level as recommended in the USEPA 1985 "Ambient Water Quality Criteria for Mercury" (USEPA 1985).

TABLE 4

Median International Standards for Trace Elements^a
(edible portion, ppm, wet weight)

Element	Freshwater Fish	Shellfish	Range	Number of Countries with Standards
Arsenic	1.5	1.4	0.1 to 5.0	11
Cadmium	0.3	1.0	0.05 to 2.0	10
Chromium	1.0	1.0	1.0	1
Copper	20.0	20.0	10 to 100	8
Lead	2.0	2.0	0.5 to 10.0	19
Mercury	0.5	0.5	0.1 to 1.0	28
Selenium	2.0	0.3	0.3 to 2.0	3
Zinc	45.0	70.0	40 to 100	6

a Based on: Nauen, C. C., Compilation of Legal Limits for Hazardous Substances in Fish and Fishery Products, Food and Agriculture Organization of the United Nations, 1983.

TABLE 5
 State Mussel Watch Program
 EDL 85 and EDL 95 for Trace Elements in California Mussels (*Mytilus californianus*)
 Calculated Using 1977 - 1995 Data
 (ppm, wet weight)

Resident

Element	EDL 85	EDL 95	Number of Samples
Aluminum	77.90	127.96	589
Arsenic	3.79	4.94	133
Cadmium	1.50	2.03	589
Chromium	0.53	0.93	588
Copper	1.55	2.01	589
Lead	0.96	2.49	588
Manganese	2.06	2.80	589
Mercury	0.06	0.11	586
Nickel	0.62	0.82	277
Selenium	0.53	0.83	51
Silver	0.45	1.55	589
Titanium	5.71	9.95	167
Zinc	33.67	38.87	589

Transplanted

Element	EDL 85	EDL 95	Number of Samples
Aluminum	130.00	224.27	906
Arsenic	2.24	3.39	214
Cadmium	1.59	1.93	906
Chromium	0.63	1.36	905
Copper	5.00	11.82	906
Lead	1.57	2.72	914
Manganese	4.53	6.09	906
Mercury	0.06	0.08	896
Nickel	0.72	0.99	214
Selenium	0.61	0.87	136
Silver	0.10	0.19	906
Titanium	7.55	14.65	139
Zinc	54.48	76.86	906

TABLE 6
 State Mussel Watch Program
 EDL 85 and EDL 95 for Trace Elements in Bay Mussels (*Mytilus edulis*)
 Calculated Using 1977 - 1995 Data
 (ppm, wet weight)

Resident

Element	EDL 85	EDL 95	Number of Samples
Aluminum	134.53	189.92	88
Arsenic	IS	IS	6
Cadmium	1.02	1.25	88
Chromium	0.52	1.18	88
Copper	2.15	3.76	88
Lead	1.85	4.39	88
Manganese	5.08	6.53	88
Mercury	0.05	0.09	87
Nickel	0.74	0.97	22
Selenium	IS	IS	7
Silver	0.06	0.16	88
Titanium	IS	IS	1
Zinc	43.14	53.86	88

IS = Insufficient number of samples to calculate an EDL.

TABLE 7
 State Mussel Watch Program
 EDL 85 and EDL 95 for Organic Chemicals in Resident California Mussels (*Mytilus californianus*)
 Calculated Using 1977 - 1995 Data
 (ppb, wet weight)

Chemical	EDL 85	EDL 95	Number of Samples
Aldrin	ND	ND	165
Chlordene, alpha	ND	ND	136
Chlordene, gamma	ND	ND	135
cis-Chlordane	1.6	3.2	165
cis-Nonachlor	0.2	1.2	141
Oxychlordane	0.2	0.3	165
trans-Chlordane	1.3	2.2	165
trans-Nonachlor	1.4	2.3	165
Total Chlordane	4.4	7.6	175
Chlorbenseide	ND	0.5	130
Chlorpyrifos	ND	ND	164
Dacthal	ND	0.4	164
DDD, o,p'	1.2	2.0	287
DDD, p,p'	3.1	7.5	287
DDE, o,p'	5.8	12.3	168
DDE, p,p'	30.3	105.1	287
DDMS, p,p'	ND	2.4	153
DDMU, p,p'	4.4	8.9	168
DDT, o,p'	0.4	1.2	287
DDT, p,p'	1.8	3.4	287
Total DDT	46.0	128.9	297
Diazinon	ND	ND	138
Dichlorobenzophenone, p,p'	ND	ND	80
Dicofol	ND	ND	54
Dieldrin	1.6	2.5	164
Endosulfan I	0.4	1.3	165
Endosulfan II	ND	ND	69
Endosulfan Sulfate	ND	ND	69
Total Endosulfan	0.3	1.3	175
Endrin	ND	ND	165
Ethion	ND	ND	80
HCH, alpha	1.3	1.7	165
HCH, beta	ND	1.2	164
HCH, delta	ND	ND	164
HCH, gamma	0.2	0.3	164
Heptachlor	ND	ND	165
Heptachlor Epoxide	ND	ND	164
Hexachlorobenzene	ND	0.03	165
Methoxychlor	ND	ND	164
Oxadiazon	ND	0.5	55
Parathion, ethyl	ND	ND	137
Parathion, methyl	ND	ND	137
PCB 1248	ND	ND	391
PCB 1254	14.6	33.3	391
PCB 1260	ND	ND	391
Total PCB	15.1	34.9	391
PCT 5460	ND	ND	69
Pentachlorophenol	1.2	2.7	14
Phenol	0.3	0.4	14
Tetrachlorophenol	1.1	3.0	14
Tetradifon	ND	ND	137
Toxaphene	ND	ND	165
Tributyltin	ND	ND	23

ND = EDL lies below the detection limit.

TABLE 8
 State Mussel Watch Program
 EDL 85 and EDL 95 for Organic Chemicals in Transplanted California Mussels (*Mytilus californianus*)
 Calculated Using 1977 - 1995 Data
 (ppb, wet weight)

Chemical	EDL 85	EDL 95	Number of Samples
Aldrin	ND	ND	540
Chlordene, alpha	0.5	1.0	486
Chlordene, gamma	0.2	0.4	486
cis-Chlordane	7.3	13.4	543
cis-Nonachlor	2.2	3.9	493
Oxychlordane	0.4	0.9	543
trans-Chlordane	6.1	9.9	543
trans-Nonachlor	5.4	9.9	543
Total Chlordane	21.6	35.9	552
Chlorbenseide	ND	1.7	437
Chlorpyrifos	0.4	1.5	538
Dacthal	0.7	6.4	519
DDD, o,p'	6.0	12.7	564
DDD, p,p'	23.9	67.4	564
DDE, o,p'	6.1	10.5	564
DDE, p,p'	97.5	170.1	564
DDMS, p,p'	3.4	6.2	533
DDMU, p,p'	6.5	10.4	564
DDT, o,p'	2.4	8.6	564
DDT, p,p'	7.8	32.6	564
Total DDT	152.5	311.5	573
Diazinon	ND	ND	438
Dichlorobenzophenone, p,p'	ND	ND	279
Dicofol	ND	ND	196
Dieldrin	6.0	18.2	520
Endosulfan I	1.2	23.5	524
Endosulfan II	1.4	15.4	270
Endosulfan Sulfate	8.4	26.8	271
Total Endosulfan	1.6	46.5	533
Endrin	ND	1.4	517
Ethion	ND	ND	279
HCH, alpha	0.6	1.1	535
HCH, beta	ND	ND	519
HCH, delta	ND	ND	518
HCH, gamma	0.4	0.7	518
Heptachlor	ND	0.03	535
Heptachlor Epoxide	0.2	0.5	535
Hexachlorobenzene	ND	0.1	535
Methoxychlor	ND	ND	520
Oxadiazon	1.1	2.3	181
Parathion, ethyl	ND	ND	417
Parathion, methyl	ND	ND	417
PCB 1248	ND	28.3	704
PCB 1254	170.0	374.3	704
PCB 1260	ND	ND	704
Total PCB	176.1	426.1	704
PCT 5460	ND	ND	189
Pentachlorophenol	22.6	34.0	90
Phenol	0.5	0.9	37
Tetrachlorophenol	2.0	5.4	90
Tetradifon	ND	ND	423
Toxaphene	ND	83.3	543
Tributyltin	1474.5	2639.3	150

ND = EDL lies below the detection limit.

TABLE 9
 State Mussel Watch Program
 EDL 85 and EDL 95 for Organic Chemicals in Resident Bay Mussels (*Mytilus edulis*)
 Calculated Using 1977 - 1995 Data
 (ppb, wet weight)

Chemical	EDL 85	EDL 95	Number of Samples
Aldrin	ND	0.3	63
Chlordene, alpha	0.4	1.1	42
Chlordene, gamma	0.5	1.2	42
cis-Chlordane	11.9	17.9	64
cis-Nonachlor	2.8	4.5	53
Oxychlordane	0.5	0.9	64
trans-Chlordane	13.1	17.2	64
trans-Nonachlor	11.3	16.5	64
Total Chlordane	38.8	56.2	64
Chlorbenseide	ND	5.8	55
Chlorpyrifos	ND	1.0	64
Dacthal	9.2	21.2	62
DDD, o,p'	12.1	23.6	83
DDD, p,p'	45.3	83.3	83
DDE, o,p'	7.9	15.6	76
DDE, p,p'	173.9	321.8	83
DDMS, p,p'	3.1	5.3	74
DDMU, p,p'	7.0	11.3	76
DDT, o,p'	7.2	23.1	83
DDT, p,p'	32.2	96.7	83
Total DDT	297.8	496.9	83
Diazinon	ND	ND	54
Dichlorobenzophenone, p,p'	ND	ND	16
Dicofol	IS	IS	9
Dieldrin	12.2	22.2	61
Endosulfan I	93.6	125.9	64
Endosulfan II	53.1	74.3	27
Endosulfan Sulfate	48.7	72.6	26
Total Endosulfan	119.5	231.8	64
Endrin	2.4	4.1	62
Ethion	ND	ND	16
HCH, alpha	0.4	0.5	63
HCH, beta	ND	0.3	62
HCH, delta	ND	ND	62
HCH, gamma	0.3	0.4	62
Heptachlor	0.2	0.6	63
Heptachlor Epoxide	0.2	0.5	63
Hexachlorobenzene	0.1	0.2	63
Methoxychlor	ND	ND	62
Oxadiazon	0.7	1.9	12
Parathion, ethyl	ND	ND	54
Parathion, methyl	ND	ND	54
PCB 1248	ND	14.0	88
PCB 1254	127.9	192.7	88
PCB 1260	ND	ND	88
Total PCB	130.5	192.7	88
PCT 5460	ND	ND	12
Pentachlorophenol	IS	IS	1
Phenol	IS	IS	0
Tetrachlorophenol	IS	IS	1
Tetradifon	ND	ND	53
Toxaphene	108.6	238.7	66
Tributyltin	IS	IS	5

ND = EDL lies below the detection limit.
 IS = Insufficient number of samples to calculate an EDL.

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