Need for Funding to Support Studies to Define the Magnitude of the Excessive Bioaccumulation of Organochlorine "Legacy" Pesticides and PCBs in Edible Fish that Can Cause Cancer in Those Who Use Delta/Central Valley Fish as Food

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The California Bay Delta Authority (CBDA) has recently organized a "Fish Mercury Project" Steering Committee that is to provide oversight of a $4.5 million 3-year project devoted to developing information that can be used to begin to manage the excessive bioaccumulation of mercury in Delta and Central Valley fish. At the first meeting of this Steering Committee, held on March 8, 2005, and in subsequent correspondence, questions were raised of the CBDA Fish Mercury Project staff and CBDA project manager (Donna Podger), about whether the CBDA Fish Mercury Project would include the study of the occurrence of excessive bioaccumulation of the organochlorine legacy pesticides (DDT, dieldrin, chlordane, toxaphene, etc.) and PCBs (collectively referred to as OCls) in edible fish in the Delta and its tributaries. While the original proposal that was submitted to CBDA evidently included work on the OCls that would parallel the studies that were proposed for mercury excessive bioaccumulation and its control, D. Podger and the CBDA Fish Mercury Project investigators indicated that the amount of funds awarded by CBDA was only sufficient to enable work on mercury; i.e., there are no funds in this project to support work on the excessive bioaccumulation of OCls.

Drs. G. Fred Lee and Anne Jones-Lee (2002) with support from the CVRWQCB/ SWRCB/USEPA, developed a comprehensive report on the information on the past and current OCl bioaccumulation in edible fish in the Central Valley. This report was made available for review to many individuals and, to the extent that comments were received, changes were made in the final report. Following the development of this report, G. F. Lee and A. Jones-Lee developed for the DeltaKeeper a summary of the issues that were needed to begin to develop the OCl excessive bioaccumulation fish studies. A copy of this write-up is appended to this discussion. Also, Lee and Jones-Lee (2004a) developed a comprehensive review of Delta Water Quality Issues that included additional discussion of the need to conduct comprehensive studies of the excessive bioaccumulation of OCls in Delta and Delta tributary fish. This report is available on their website, www.gfredlee.com.

These reviews include considerable information on the current magnitude of the excessive OCl bioaccumulation in edible fish, which shows that some of the fish in the Delta and its tributaries contain OCl concentrations that are a threat to cause cancer in those who use fish from certain waterbodies as a routine part of their food. It was also concluded by Lee and Jones-Lee (2004a,b) in the Delta Water Quality Issues report that

there is an urgent need for a comprehensive fish tissue monitoring program to define the full extent of the excessive OCl bioaccumulation in edible fish. This information would be used where there is excessive OCl bioaccumulation to define fish advisories to warn the public about eating fish of certain types from certain waterbodies. Further, Lee and Jones-Lee (2002, 2004a,b) provided guidance on the types of studies that are needed to define the current sources of the OCls (such as agriculture and urban areas where the legacy pesticides have been used and are in a waterbody's sediments) and possible sources of the OCls that are bioaccumulating to excessive levels in edible fish. With information on the current sources of OCls that lead to excessive bioaccumulation in edible tissue, it will be possible to begin to initiate excessive OCl bioaccumulation control programs.

As discussed by Lee and Jones-Lee (2002, 2003, 2004a) (see attached write-up), since thus far CALFED/CBDA continues to provide a low priority to funding work on the OCl excessive bioaccumulation issue, it will be necessary to either get CBDA to grant a higher priority to OCl excessive bioaccumulation or for the California legislature/Governor's Office to provide the funds needed to initiate a comprehensive OCl fish tissue monitoring program. The least that should be done is for sufficient funds immediately to be made available so that the fish analyzed as part of the Fish Monitoring Project for mercury are, where appropriate, also analyzed for the OCls.

Dr. Robert Brodberg of OEHHA, who has a major responsibility for developing fish advisories for chemically contaminated fish, in his presentation on "Fish Chemical Bioaccumulation" at the March 8, 2005, Steering Committee meeting, indicated that an important issue that needs attention to protect human health is the excessive bioaccumulation of the OCls. He indicated that work on the OCls is a high priority area that needs funding.

The DeltaKeeper (William Jennings) has placed work on the OCl excessive bioaccumulation in edible fish taken from the Delta and its tributaries as one of the highest priority areas for needed studies. As indicated at the Steering Committee meeting, Bill Jennings and I feel that it is inappropriate to allocate some of the funds that are currently programmed to support the fish mercury studies to fish OCl studies. The fish mercury studies are already short on funds compared to the funding needed to accomplish the objectives of this project. Since several members of the Fish Mercury Steering Committee indicated an interest in the excessive bioaccumulation of OCls in edible fish in the Delta and its tributaries, the Steering Committee may wish to consider adopting a resolution supporting the need for funding to begin to address the excessive bioaccumulation of OCls in Delta and other Central Valley fish.

Questions and comments on the excessive OCl bioaccumulation in edible Delta and tributary fish should be addressed to G. Fred Lee at gfredlee@aol.com.

Dr. Chris Foe of the CVRWQCB was provided with an initial draft of these comments. His response is presented below.

From Dr. C. Foe of the CVRWQCB:

Fred, I agree with your comments. As you know the last CALFED mercury project collected fish for tissue analysis. These fish were saved for possible future OC analysis. Dr Lee and Associates and SFEI both produced reports recommending what analysis should be done next. SFEI, as part of their report, reviewed what fish had been archived from the mercury project and were suitable to analysis for furthering our knowledge of the spatial distribution of pesticides in fish. SWAMP and DeltaKeeper together provided $80,000 for completing the analysis. I am supposed to write up the results. So, we are sort of using the tissue collected from mercury projects to use in OCl analysis. The main problem we have is that the fish species we target for mercury and the locations we collect at are usually not optimal for pesticide analysis. For example, we have used largemouth bass as representative of mercury accumulation yet these to not have a high lipid level so are not particularly high in pesticides. What is needed is a small amount of additional money to collect the "right" species at the "right" locations for pesticides. This should not be a large amount of money as we get the right fish species at many locations as a by catch. We only need to keep fish and game on the site longer to get a sample of sufficient size for a robust statistical analysis. Money for actual analysis can be requested later once the fish are in the freezer. Chris

References

Lee, G. F. and Jones-Lee, A., "Organochlorine Pesticide, PCB and Dioxin/Furan Excessive Bioaccumulation Management Guidance," California Water Institute Report TP 02-06 to the California Water Resources Control Board/Central Valley Regional Water Quality Control Board, 170 pp, California State University Fresno, Fresno, CA, December (2002). http://www.gfredlee.com/OClTMDLRpt12-11-02.pdf

Lee, G. F., "Need for Funding to Support Studies to Control Excessive Bioaccumulation of Organochlorine 'Legacy' Pesticides, PCBs and Dioxins in Edible Fish in the Central Valley of California," Report of G. Fred Lee & Associates, El Macero, CA, July (2003). http://www.gfredlee.com/OCl_Support.pdf

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Lee, G. F. and Jones-Lee, A., "Overview of Sacramento-San Joaquin River Delta Water Quality Issues," Report of G. Fred Lee & Associates, El Macero, CA, June (2004b). http://www.members.aol.com/apple27298/Delta-WQ-IssuesRpt.pdf

Appendix A

Need for Funding to Support Studies to Control Excessive Bioaccumulation of Organochlorine "Legacy" Pesticides, PCBs and Dioxins in Edible Fish in the Central Valley of California[1]

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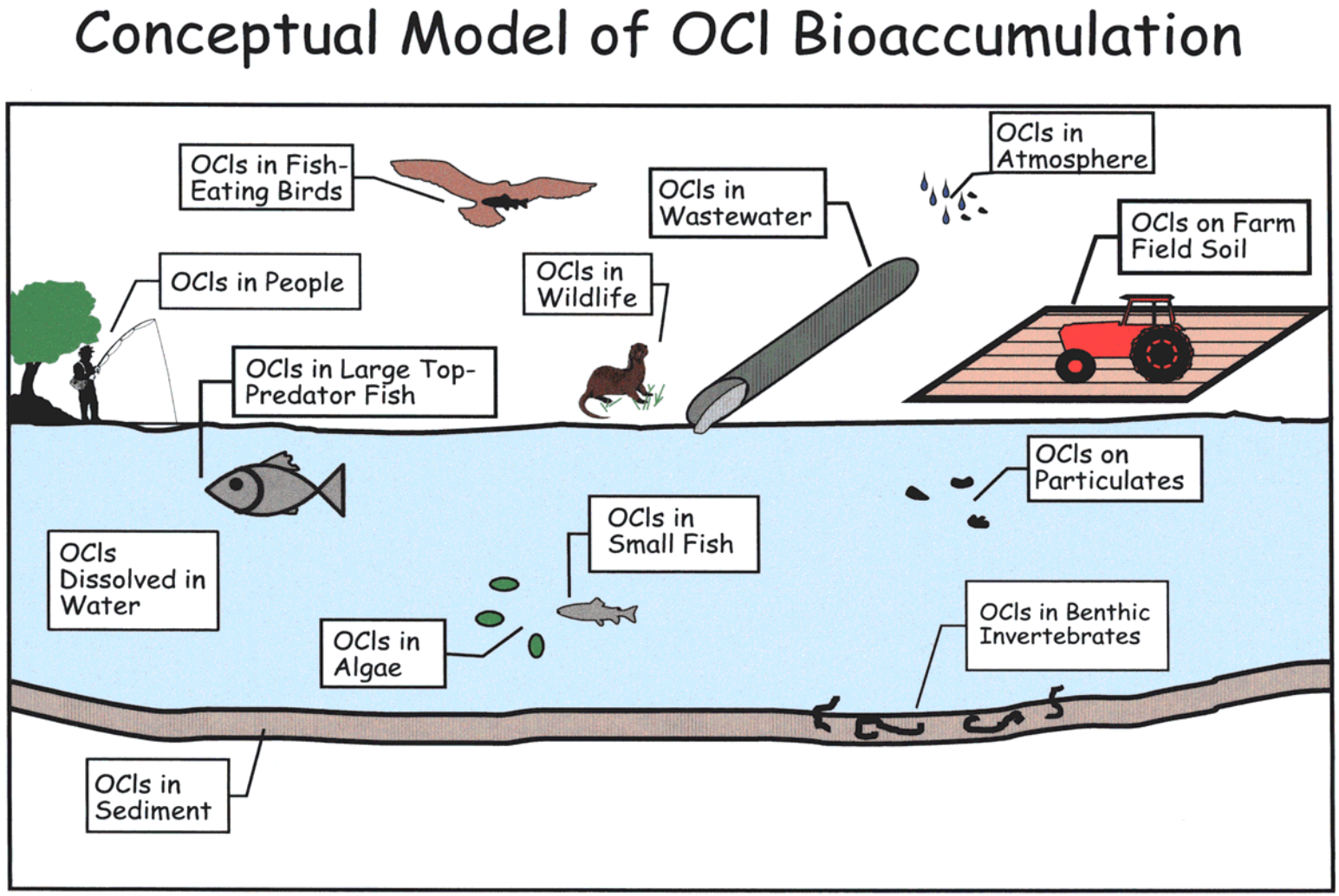
One of the most significant water quality problems that exist in the mainstems of the Sacramento and San Joaquin Rivers and many of their tributaries, as well as the Delta, is the excessive bioaccumulation of organochlorine "legacy" pesticides (DDT, dieldrin, chlordane, toxaphene), PCBs and possibly dioxins/furans. The excessive bioaccumulation of these organochlorines (OCls) causes many of the more desirable fish (such as largemouth bass, white catfish, etc.) to contain sufficient concentrations of these pesticides and/or PCBs so that their use as food represents a threat to cause cancer in those who eat them. This is an environmental justice problem, since the individuals who are most likely impacted to the greatest extent are those who must, because of economic reasons, use local fish as a major source of food in their diet.

Figure 1 shows the nature of the excessive bioaccumulation problem in Central Valley fish and other edible aquatic life. Basically, the problem is a food web accumulation problem, where the OCls are taken up by lower-trophic-level organisms, which ultimately results in elevated concentrations in fish and other organism tissue. Each of the waterbodies of concern has received in the past (and may receive, to some extent, today) sufficient concentrations of one or more OCls to lead to concentrations of these chemicals in some of the waterbodies' fish to be above the California Office of Environmental Health Hazard Assessment (OEHHA) guidelines for the use of the fish as food because of the potential for those who use these fish to acquire cancer.

The former use of one or more of the OCls (except dioxins/furans) in each of the waterbodies' watersheds for agricultural and/or urban purposes has led to stormwater runoff transport and, in some instances, wastewater discharges of the OCl(s) to a sufficient extent to lead to bioaccumulation to excessive levels in some of the edible fish in the waterbodies receiving the runoff/discharges. With respect to dioxins and furans, they may have been discharged to the waterbody or its tributary from former municipal and/or industrial wastewater discharges as well as in stormwater runoff from highways and streets and/or runoff/discharges from areas where low-temperature burning has taken place. They may also have been contaminants in the herbicide 2,4,5-T and could be derived from areas where this herbicide has been used.

[1] Reference as Lee, G. F., "Need for Funding to Support Studies to Control Excessive Bioaccumulation of Organochlorine "Legacy" Pesticides, PCBs and Dioxins in Edible Fish in the Central Valley of California," Report of G. Fred Lee & Associates, El Macero, CA, July (2003).

Figure 1


Conceptual Model of OCl Bioaccumulation
OCls in Fish-Eating Birds
OCls in Atmosphere
OCls in Wastewater
OCls on Farm Field Soil
OCls in People
OCls in Wildlife
OCls in Large Top-Predator Fish
OCls on Particulates
OCls in Small Fish
OCls Dissolved in Water
OCls in Algae
OCls in Benthic Invertebrates
OCls in Sediment

The Central Valley Regional Water Quality Control Board (CVRWQCB) has identified 11 waterbodies in the Central Valley, including the Sacramento and San Joaquin Rivers and the Delta, as well as a number of tributaries, as having excessive concentrations of the organochlorines in edible fish. This has resulted in these waterbodies being listed as Clean Water Act 303(d) "impaired" waterbodies. This listing results in the need for the CVRWQCB to develop a total maximum daily load (TMDL) to control the excessive bioaccumulation of the organochlorines in edible fish.

These waterbodies include the Delta Waterways, Lower American River, Colusa Basin Drain, Lower Feather River, Lower Merced River, Natomas East Main Drain, San Joaquin River, Lower Stanislaus River, Stockton Deep Water Ship Channel, Lower Tuolumne River and Lower Kings River. These waterbodies are listed on the federal Clean Water Act's 303(d) list as "impaired" for organochlorine (OCl) compounds including "Group A" pesticides (such as toxaphene, chlordane, dieldrin, aldrin, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexane [including lindane], and endosulfan), DDT, DDE, DDD, and the non-pesticides polychlorinated biphenyls (PCBs) and dioxins/furans. The water quality problem caused by these chemicals is excessive bioaccumulation of one or more of the OCls in edible fish tissue compared to public health screening values established to protect humans from an increased risk of cancer associated with using the fish as food.

Table 10 from Lee and Jones-Lee (2002) (see attached) lists the Central Valley waterbodies that have been found to contain fish and other edible aquatic life with excessive OCls compared to OEHHA public health guidance for the use of fish as food. As shown, there are several other Central Valley waterbodies that have been found to contain excessive OCls that are not on the CVRWQCB 303(d) list of impaired waterbodies. The Central Valley waterbody OCl fish excessive bioaccumulation problem is likely much larger than indicated based on the 303(d) listing and the information presented in Table 10, since there have not been sufficient funds to conduct comprehensive surveys of Central Valley fish to fully define the extent of this problem.

In discussing this matter with the CVRWQCB staff (Jerry Bruns and others), it is found that the CVRWQCB does not have funds to develop the information needed to begin to address this problem, with the result that one of the most significant water quality problems in the Central Valley, which is directly affecting human health, is not being addressed.

This spring, it was decided that it would be appropriate for the DeltaKeeper to submit a proposal to try to gain funding to start the process of developing the information needed to effectively manage the excessive bioaccumulation of OCl chemicals in edible fish. Based on a review of the potential to gain funding under the SWRCB March 2003 Consolidated Request for Concept Proposals, this excessive bioaccumulation problem of the organochlorines is not eligible for support in any of the many tens of millions of dollars that the legislature has appropriated for studies. The Consolidated Request for Concept Proposals issued in March 2003 by the State Water Resources Control Board covers the California Bay-Delta Authority (CALFED), the US EPA, the California

Coastal Commission and the California Resources Agency. Grants would be made available through funding from Proposition 13, Federal Clean Water Act section 319, and Proposition 50. Based on discussions with CVRWQCB staff responsible for review of Concept Proposal submissions, none of these sources of funds could be used to address the excessive bioaccumulation of OCls.

About two years ago it was determined, with the concurrence of the Central Valley Regional Water Quality Control Board staff responsible for administration of a 319(h) project that had been awarded to the DeltaKeeper, that the project funds should be devoted to conducting a pilot study to determine whether the sediments in Smith Canal, a city of Stockton urban waterway, are the source of the PCBs that have been found in edible fish taken from Smith Canal. The situation is that the DeltaKeeper made settlement funds available to San Francisco Estuary Institute (SFEI) to do a survey of excessive bioaccumulation of organochlorine compounds in Central Valley fish. One of the locations where studies were conducted was in Smith Canal. The fish taken from Smith Canal were found to have some of the highest PCBs of any location in the Central Valley. Smith Canal at that time, and even today, is not on the CVRWQCB list of impaired waterbodies that have excessive bioaccumulation of PCBs. This situation exists for a number of other waterbodies in the Central Valley, where the current 11 waterbodies that are listed could readily be expanded to a much larger number, based on excessive bioaccumulation of organochlorines in edible fish.

The DeltaKeeper 319(h) project resulted in a report,

> Lee, G. F., Jones-Lee, A., and Ogle, R. S., "Preliminary Assessment of the Bioaccumulation of PCBs and Organochlorine Pesticides in *Lumbriculus variegatus* from City of Stockton Smith Canal Sediments, and Toxicity of City of Stockton Smith Canal Sediments to *Hyalella azteca*," Report to the DeltaKeeper and the Central Valley Regional Water Quality Control Board, G. Fred Lee & Associates, El Macero, CA, July (2002),

which demonstrated, using benthic organism uptake studies, that the PCBs in Smith Canal sediments are, at least in part, bioavailable, even though the sediments have a high organic carbon content. Organic carbon in sediments tends to reduce bioavailability of chemicals like the organochlorines. This was the first time that the US EPA's sediment bioaccumulation testing procedure had been used in the Central Valley. It is clear that there is need to conduct a large-scale sediment testing program using this approach to determine the location of the sediments in Central Valley waterbodies from which the organochlorines are being derived that are bioaccumulating to excessive levels in edible fish.

In the summer of 2000, Lee and Jones-Lee submitted a proposal to CALFED to develop the information that is needed to begin to define the sources of the organochlorines that are bioaccumulating to excessive levels in Central Valley waterbody fish. The reviews on the proposal indicated that one of the reasons it was not supported by CALFED was that it is devoted to a human health issue, rather than an ecological

issue. As it turns out, there is no funding within CALFED, outside of the Drinking Water Program, for human health issues. The excessive bioaccumulation of organochlorines is not a drinking water problem. There were also questions by one of the reviewers about the practicality of defining sources of the organochlorines that are bioaccumulating to excessive levels, since this has not been undertaken in the Central Valley. However, as I pointed out, I have been working on organochlorine excessive bioaccumulation issues since the 1960s in other parts of the US, and I know from my experience and the literature that it is possible to define sources and to manage these sources.

At the May 6, 2003, CVRWQCB meeting, Board member Christopher Cabaldon indicated to the Board that the CALFED Environmental Justice Subcommittee had concluded that the excessive bioaccumulation of mercury in Delta and Delta tributary fish is an environmental justice issue, since the excessive bioaccumulation of mercury in edible fish is a threat to human health. Last winter, after I had completed a comprehensive review of the excessive OCl bioaccumulation problem for the CVRWQCB/SWRCB (see below), I contacted Sam Luoma, who directs the CALFED Science Program, indicating that the excessive OCl bioaccumulation problem is a well documented problem that is of significance to human health to people throughout the Central Valley who use Delta and its tributary fish as food. This is clearly an environmental justice issue. I pointed out that, as far as I could tell, there was no CALFED funding for this issue since this is a human health issue as opposed to an ecological issue. Dr. Luoma stated that he agreed that there was no funding to address this problem within CALFED, and that this is an environmental justice issue, but that the CALFED Environmental Justice Subcommittee has no funds to support work in this area.

Beginning about a year ago, the Central Valley Regional Water Quality Control Board, through funding from the State Water Resources Control Board and the US EPA, made funds available to the California Water Institute at California State University, Fresno, which provided support for Dr. Jones-Lee and me to develop a comprehensive report on the organochlorine excessive bioaccumulation issues. This report,

> Lee, G. F. and Jones-Lee, A., "Organochlorine Pesticide, PCB and Dioxin/Furan Excessive Bioaccumulation Management Guidance," California Water Institute Report TP 02-06 to the California Water Resources Control Board/Central Valley Regional Water Quality Control Board, 170 pp, California State University Fresno, Fresno, CA, December (2002) (http://www.gfredlee.com/OClTMDLRpt12-11-02.pdf),

was completed in December 2002. It provides detailed information on the current state of knowledge on excessive bioaccumulation of organochlorines in edible fish (see Table 10). Further, it defines the areas of needed study in order to begin to manage the problem. The principal issues of concern are those of the relative significance of aquatic sediments versus land runoff from agricultural and other areas as a source of organochlorines that are bioaccumulating to excessive levels. It is expected that aquatic sediments are the primary source; however, work in the early 1990s by the US Geological Survey showed that, at least in some areas, the "legacy" pesticides are still

being discharged by agricultural lands at concentrations which could represent a significant source of organochlorines for excessive bioaccumulation in fish. Studies need to be conducted to determine, where excessive organochlorine bioaccumulation is found, whether the current terrestrial land runoff sources are a significant source for the excessive bioaccumulation.

Further, funds are needed to better define where excessive bioaccumulation is occurring. For example, an area of particular concern is excessive bioaccumulation of PCBs in the Sacramento River near Sacramento. This area, according to the data available, has excessive PCBs. It is not listed as a 303(d) "impaired" waterbody due to excessive PCB bioaccumulation. The Regional Board staff feels that there is need for additional studies to confirm the data; however, there are no funds available to do these studies. Lee and Jones-Lee conclude that there are sufficient data now to justify listing the Sacramento River near Sacramento as impaired due to excessive PCB bioaccumulation in fish. This approach would warn the public that many of the more desirable fish taken from the Sacramento River near Sacramento can contain excessive PCBs and, therefore, should not be consumed. It would also establish the need for studies to define the sources of these PCBs.

Recommended Approach for Establishing the OCl Management Program[2]

Lee and Jones-Lee (2002) have discussed a recommended approach for developing management programs for organochlorine pesticides and PCBs. The recommended approach for establishing the legacy pesticide, PCB and dioxin/furan excessive bioaccumulation management program is to first obtain sufficient funding so that a comprehensive study can be conducted on current OCl concentrations in edible fish from the 303(d) listed waterbodies. Particular attention should be given to sampling from various locations within the waterbodies to see if there are areas where fish and other organisms (such as clams) have higher concentrations.

At the same time that sampling is conducted for fish, samples of sediment from various locations in the listed waterbodies should also be taken and analyzed for OCls of concern. It would be highly desirable, although it may not be possible during the initial study, to do the sediment bioaccumulation evaluation using *Lumbriculus variegatus* (the oligochaete), following procedures similar to those used in the Smith Canal sediment PCB study (Lee, *et al.*, 2002).

For each of the listed waterbodies an advisory panel should be appointed to plan, implement and report on the needed studies. Suggested members of this panel include the CVRWQCB staff, DPR staff, county agriculture commissioners, CALFED, agricultural interests, Farm Bureau, county RCDs, irrigation districts, Department of Fish and Game and environmental groups. The results of this monitoring program could take several years to establish current degrees of excessive bioaccumulation for the OCls. This approach would also provide information that is needed to develop a site-specific sediment biota accumulation factor for each listed waterbody or parts thereof.

[2] From Lee and Jones-Lee (2002)

For some of the listed waterbodies − possibly most − there would be need to determine the external loads of OCls associated with summer irrigation season tailwater discharges and winter stormwater runoff. If substantial loads are found of excessive bioaccumulation at the point where the tributary discharges to the waterbody, then forensic studies would need to be conducted to determine the origin of these loads within the waterbody's watershed.

Ultimately, from studies of this type, it should be possible to determine whether current external loads of OCls represent a significant source of OCls that are bioaccumulating to excessive levels. This information could then be used to determine whether there is need to establish a control program from watershed sources of OCls for waterbodies that currently have excessive bioaccumulation of one or more OCls in one or more types of fish.

A list of specific topic areas of further study for OCl bioaccumulation management program development includes the following:

- Determine, for each of the listed waterbodies, as well as other Central Valley waterbodies, the current degree of edible fish tissue OCl residues. These residues should be compared to OEHHA screening values which have been adjusted for local fish consumption rates. This information is essential to defining the waterbodies within the Central Valley where OCls have bioaccumulated to excessive levels in edible fish.
- Determine for each of the listed waterbodies whether stormwater runoff and/or irrigation tailwater discharges and/or domestic and industrial wastewater discharges are currently contributing sufficient concentrations of the OCl(s) of concern in the waterbody to be contributing to the excessive bioaccumulation of this OCl(s) in edible fish tissue.
- Conduct a quantitative assessment of the current atmospheric loads of the OCls for several of the listed waterbodies to evaluate the potential significance of this source.
- Determine the concentrations of the OCls of concern in the listed waterbodies and the bioavailability of the sediment-associated OCl residues for food web accumulation that leads to excessive edible tissue residues.
- Determine the extent of edible fish tissue contamination by dioxins and furans within the Central Valley waterbodies. Where excessive concentrations are found in edible fish tissue, determine likely sources of the dioxins and furans that are bioaccumulating to excessive levels.
- Since the allowable OCl tissue residue for edible fish is dependent on local waterbody fish consumption rates, it is recommended that, as part of developing the management program for the OCl-listed waterbodies, representative fish consumption rates for each listed waterbody be developed.
- It is recommended that studies of the type conducted by USGS NAWQA in the early to mid-1990s be conducted again to verify that the continued transport of several organochlorine pesticides from agricultural and urban areas at potentially significant concentrations is occurring.

- There is need for studies to determine for each OCl-listed waterbody whether current transport of the OCls to the waterbody significantly contributes to the bioavailable OCl residues within the waterbody that lead to excessive bioaccumulation in edible organism tissue.
- Special-purpose studies need to be conducted using aquatic organism incubation to determine if domestic wastewaters are a significant source of OCls for certain Central Valley waterbodies.
- Studies should be conducted to determine if the bioaccumulation by the freshwater clam *Corbicula fluminea* could be used to evaluate the bioaccumulation that may be occurring in edible fish.
- All fish tissue analyses for the OCls should be conducted with an analytical method detection limit that is at least slightly below the OEHHA human health screening value.
- The fish samples that are currently stored frozen, taken from Smith Canal and a number of other locations, should be analyzed for OCl content in edible tissue.
- It is recommended that systematic studies of fish tissue OCl concentrations for the fish types of concern at a particular location be conducted to examine the variability in OCl composition at about the same time and location. This information is essential to understanding whether the apparent changes in OCl composition over time are related to real changes or simply reflect the variability of the data.
- It is also recommended that all OCl measurements of fish tissue include measurements of the lipid content. This information may be useful to normalize the OCl bioaccumulation based on fish edible tissue lipid content.

Additional information on these recommended studies is available in the Lee and Jones-Lee (2002) report.

The fact that none of the Consolidated funding sources have funds that could be used to support the needed organochlorine studies is a major gap in the approach that is being used today by the US EPA, CALFED, the State Water Resources Control Board and the Regional Water Quality Control Boards, where one of the most (if not the most) important water quality problems that affects human health in the Central Valley is not eligible for funding to develop the information base needed to begin to define the full magnitude of this problem, the sources of the organochlorines that are leading to excessive bioaccumulation, and approaches that could be used to potentially control the problem. It is for this reason that I recommend that the DeltaKeeper join with other environmental groups and request that the legislature provide funding to specifically address support for work on this topic. Another option would be to submit proposals to one or more foundations for support.

Discussion of Recent OCl Organism Tissue Data[3]

This section presents an overview discussion of the OCl fish and other aquatic organism recent (post-1997) data relative to exceedance of the OEHHA standard fish consumption screening values. As indicated, these values are based on a 21 g/day fish consumption rate, which translates to about 1 meal/week. They are based on an upper-bound cancer risk of one additional cancer in 100,000 people who consume fish at this rate over their lifetime. It is expected that there will be some individuals for some Central Valley Waterbodies who will consume fish from a listed Waterbody at a greater rate than the rate OEHHA used.

Table 10 presents a summary of all of the OCl aquatic organism tissue residue data that have been collected since 1997 compared to the OEHHA screening values. All data collected from 1997-2001 is, for the purposes of this report, termed "recent" data.

An "x" for an OCl and a location indicates that there are some recent OCl fish tissue or *Corbicula fluminea* (clam) data, where the concentrations of the OCl were above the OEHHA screening value. In situations where some fish had concentrations above the OEHHA screening value and others did not, an "x" was used to indicate that an exceedance of the value has recently occurred in at least one sampling of organisms at the location since 1997. An "o" means that there have been recent data collected with adequate analytical method sensitivity, which have shown that the concentrations of the OCl are below the OEHHA screening value. A "--" means that there have been no measurements made for this OCl at this location. A "?" indicates that the analytical methods used for the recent data have not had adequate sensitivity to determine the OCl at the OEHHA screening value. An "o?" indicates that the concentration of the OCl was just below the OEHHA screening value. An "x?" indicates that the concentration of the OCl in aquatic life tissue collected prior to 1997 was above the OEHHA screening value, but this OCl has not been measured at all, or with adequate sensitivity since 1997. An "*" indicates that organochlorine pesticides have been found in the water column at potentially significant concentrations; however, no data are available on the bioaccumulation of the OCls for this waterbody.

Based on past studies, the primary OCls of concern for excessive bioaccumulation in the Sacramento and San Joaquin River watersheds and the Delta are DDT, dieldrin, chlordane, toxaphene and PCBs. These are referred to herein as the primary OCls of concern.

Some of the past and recent studies have involved the use of analytical methods for certain of the OCls that did not have sufficient sensitivity to detect the OCl in fish tissue samples at the OEHHA screening values. Usually DDT and/or PCBs have been analyzed with sufficient sensitivity to detect exceedances. Unless previous studies showed exceedances of a certain OCl and there is no recent confirming data, the waterbody is not listed as a high priority for future studies.

[3] From Lee and Jones-Lee (2002)

Table 10
Summary of Central Valley Waterbodies with Excessive OCl Residues
Based on 1997 - 2000 Organism Tissue Data and OEHHA Screening Values

Location	Total DDT	Dieldrin	Total Chlordane	Total Toxaphene	Total PCBs
San Joaquin River Watershed					
San Joaquin River at Highway 99	o	O	o	o	o
San Joaquin River at Lander Avenue	o	X	o	o	o
Mud Slough	x	X	?	x	x
Salt Slough	x?	X?	?	x?	?
Merced River	x	X	o	x	x
San Joaquin River at Crow's Landing	o	O	o	o	o
Orestimba Creek	x?	X?	?	x?	?
Spanish Grant Drain	x?	?	?	x?	x?
Olive Avenue Drain*	--	--	--	--	--
Turlock Irrigation District, Lateral #5	o	?	?	?	?
Del Puerto Creek	x?	?	?	?	?
Ingram Creek*	--	--	--	--	--
Hospital Creek*	--	--	--	--	--
Lower Tuolumne River	x	X	o	x	x
Stanislaus River	x	X?	?	x?	x
San Joaquin River at Vernalis	x	x	x	x	x
San Joaquin River "at Bowman Road"	x	?	o	?	x
San Joaquin River at Mossdale	x?	?	?	?	?
San Joaquin River "at Highway 4"	x	?	o	?	o
Sacramento River Watershed					
McCloud River	o	o	o	o	o
Clear Creek	o	o	o	o	o
Sacramento River at Keswick	o	?	o	--	x
Sacramento River at Bend Bridge, near Hamilton City	o	o	o	o	o
Mill Creek	o	o	o	o	o
Deer Creek	o	o	o	o	o
Big Chico Creek	o	o	o	o	o
Sacramento River at Colusa	o	?	o	--	x
Sutter Bypass	x?	x?	x?	x?	x?
Feather River near Nicolaus/Hwy 99	o	o	o	o	x
Feather River at Forbestown	--	--	--	--	x?
Yuba River	x?	?	?	?	?
East Canal near Nicolaus	x?	x?	?	?	?
Sacramento Slough	o	x	o	--	x
Colusa Basin Drain	x	x	x?	x?	o
Sacramento River at Veteran's Bridge	o	?	o	--	x
Natomas East Main Drain	o	?	o	?	x

Table 10 (Cont.)					
Sacramento River Watershed (Cont.)	**Total DDT**	**Dieldrin**	**Total Chlordane**	**Total Toxaphene**	**Total PCBs**
Arcade Creek	o	x?	x?	?	?
American River at Discovery Park	o	x	o	?	x
American River at Watt Avenue	x?	x?	x?	--	x?
American River at J Street	o	?	o	--	x
Sacramento River at Mile 44	x	x	o	--	x
Sacramento River at Hood	x	x	x	x	x
Cache Creek	o	?	?	?	o
Putah Creek	x	?	o	?	o?
Cache Slough	o	x	o	--	o
Sacramento River at Rio Vista	o	?	?	?	o
Delta					
Port of Stockton Turning Basin	x	?	o	?	x
Port of Stockton near Mormon Slough	o	x	?	?	x
Smith Canal	o	?	o	?	x
San Joaquin River around Turner Cut	o	?	o	?	o
White Slough downstream from Disappointment Slough	o	?	?	?	o
San Joaquin River at Potato Slough	o	?	o	?	x
San Joaquin River off Point Antioch	o	?	?	?	o
Sycamore Slough near Mokelumne River	o	x	?	?	?
Mokelumne River between Beaver and Hog Sloughs	o	?	?	?	o
Middle River at Bullfrog	o	?	?	?	o
Old River	x	?	o	?	x
Paradise Cut	x	?	o	?	o
Old River at Central Valley Pump	x	?	o	x	?
O'Neill Forebay/California Aqueduct	x?	?	x?	?	x?
Tulare Lake Basin					
King's River	o	?	o	?	o
Kern River	o?	?	?	?	--

x At least one fish sample taken in the late 1990s or 2000 was above the OEHHA screening value.

o None of the fish samples taken in the late 1990s or 2000 were above the OEHHA screening value.

? The analytical methods used were not sufficiently sensitive to measure the OCl at the OEHHA screening value.

o? The concentrations of an OCl were just below the OEHHA screening value.

x? The concentration of an OCl was above the screening value in the past but either has not been recently analyzed or the recent analytical methods used did not have sufficient sensitivity.

-- No measurements were made for this OCl.

* Organochlorine pesticides have been found in the water column at potentially significant concentrations. No data are available on the bioaccumulation of the OCls for this waterbody.

San Joaquin River Watershed. The uppermost point where fish have been recently collected and OCls have been measured with adequate sensitivity in the San Joaquin River watershed was at the San Joaquin River at Highway 99. The largemouth bass collected in 2000 did not show exceedances of the OEHHA screening value at this location for each of the primary OCls of concern. Further down the SJR at Lander Avenue, only dieldrin in white catfish collected in 1998 was above the OEHHA screening value. DDT, chlordane, toxaphene and PCBs were all below the OEHHA screening value.

Mud and Salt Sloughs are tributaries of the San Joaquin River that enter the River below Lander Avenue but above the Merced River. White catfish taken from Mud Slough in 1998 had concentrations of total DDT, dieldrin, toxaphene and total PCBs above OEHHA screening values. There have been no recent fish tissue data collected from Salt Slough. However, older data showed exceedances of total DDT, dieldrin and toxaphene.

Channel catfish and largemouth bass were collected from the Merced River at the Hatfield St. Recreation Area in 1998. These fish contained excessive concentrations of total DDT, dieldrin, chlordane, toxaphene and total PCBs above the OEHHA screening values. Future studies should include samples taken at several locations at and above the Hatfield St. Recreation Area.

The San Joaquin River at Crow's Landing receives the upstream discharges of Mud Slough, Salt Slough and the Merced River. The recent largemouth bass data collected at this location did not show exceedances for any of the OCls. It appears that Mud Slough, Salt Slough, and the Merced River, as well as the SJR at Lander Avenue, while having fish that show excessive OCls, are not contributing OCls to the San Joaquin River at sufficient concentrations to cause fish taken near Crow's Landing to have excessive OCls.

The westside tributaries to the SJR (Orestimba Creek, Spanish Grant Drain, Del Puerto Creek, Olive Avenue Drain, Ingram Creek and Hospital Creek) are major sources of OCls for the San Joaquin River. These waterbodies were found in the early 1990s to contain measurable concentrations of several of the OCls of concern in the water column that could bioaccumulate to excessive levels in aquatic organisms. There are no recent data on OCl concentrations in aquatic organisms taken from the westside tributaries. This is an area that should be a high priority for further study.

The mid- to lower eastside tributaries (Stanislaus River and Tuolumne River) of the San Joaquin River contain fish with excessive concentrations of several OCls. These tributaries are potentially contributing certain OCls to the San Joaquin River to cause fish taken from the San Joaquin River at Vernalis to show exceedances of the primary OCls of concern.

Fish taken recently from the San Joaquin River at Bowman Road and Highway 4 have had exceedances of one or more OCls. There has been no recent sampling of fish

from the San Joaquin River at Mossdale. It would be expected, however, that they would also have an exceedance of total DDT.

Overall, with respect to the San Joaquin River watershed, the eastside and westside tributaries of the SJR contain fish with exceedances of one or more OCls. It also appears that these tributaries are discharging sufficient concentrations of some OCls to cause the fish taken from the San Joaquin River at Vernalis to contain excessive DDT, dieldrin, chlordane, toxaphene and PCBs.

Sacramento River Watershed. The Sacramento River and its tributaries above the Colusa Basin Drain (except at Keswick for PCBs), have been found, through recent fish collection, to have fish with OCls at less than the OEHHA screening value. While a 1997 sampling showed that there was an exceedance of PCBs in rainbow trout collected in the Sacramento River at Keswick, the subsequent samplings did not show this problem.

The Colusa Basin Drain is a main agricultural drain in the Central Sacramento Valley. Carp taken from the drain have been found to contain excessive DDT and dieldrin. White catfish did not contain excessive OCls. Previously, excessive chlordane and toxaphene have been found; however, there are no recently collected data with adequate sensitivity to ascertain the current situation with regard to toxaphene and chlordane in Colusa Basin Drain fish. The fish from this drain have recently been found to contain PCBs below the OEHHA screening value.

The recent white catfish and largemouth bass samplings from the Feather River near Nicolaus/Highway 99 have shown no exceedances of organochlorine pesticides. However, PCBs were found in pike minnow from the Feather River near Nicolaus/Highway 99 in excess of the OEHHA screening value.

In 1980, a variety of types of fish from the Feather River at Forbestown did show exceedances of PCBs. These exceedances relate to the use of PCB oils for road dust control. There has been no followup on this situation. It is suggested that this should be followed up to determine the current situation.

White catfish taken from the Sacramento Slough in 2000 contained excessive dieldrin and PCBs. Largemouth bass did not have excessive dieldrin, but did have excessive PCBs. DDT and chlordane were less than OEHHA screening values.

Sacramento River at Veteran's Bridge had excessive PCBs in white catfish.

Natomas East Main Drain white catfish and largemouth bass contained excessive PCBs.

Recently sampled largemouth bass from the American River had exceedances of PCBs, while excessive dieldrin was found in pike minnow.

Sacramento River at Mile 44 had excessive DDT, dieldrin and PCBs in white catfish and excessive DDT and PCBs in largemouth bass.

Sacramento River at Hood had white catfish and largemouth bass showing exceedances of all of the primary OCls of concern.

Excessive DDT was found in largemouth bass obtained from Putah Creek.

Largemouth bass from Cache Slough had exceedances of dieldrin.

Delta. The Port of Stockton Turning Basin had excessive PCBs and DDT in largemouth bass.

Dieldrin and PCBs were found in *Corbicula fluminea* sampled from the Port of Stockton near Mormon Slough.

Largemouth bass and white catfish taken from the Smith Canal at Yosemite Lake contained excessive PCBs.

The San Joaquin River below Turner Cut and the Central Delta have not recently been found to contain excessive OCls (DDT and PCBs) in fish.

Sycamore Slough near Mokelumne River had an exceedance of dieldrin found in largemouth bass.

White catfish taken from Old River at several locations have been found to contain excessive DDT and, at one location, PCBs. Excessive DDT was found in largemouth bass from Paradise Cut.

Tulare Lake Basin. No problems were encountered with excessive OCls in recently sampled King's River fish.

References

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