Marinas Interagency Coordinating Committee (MIACC)

Notes from Zoom Meeting

December 7, 2023

Hosted by the California Coastal Commission and State Water Resources Control Board

Please Note: The following meeting notes are paraphrased. The opinions expressed by Committee members, presenters, or any other participant who speaks or otherwise expresses an opinion at a meeting do not necessarily reflect the official policy or position of the State Water Resources Control Board, California Coastal Commission, or Marinas Interagency Coordinating Committee and Anti-Fouling Strategies Workgroup. Meetings of this Committee and Workgroup provide an open forum where all participants are invited to share their input and opinions with mutual respect for other participants. (Notes by Vanessa Metz).

1. Introductions and Announcements

Coordinators:

- Vanessa Metz[1] – Water Quality Program, California Coastal Commission
- Alex Rosado[2] – Nonpoint Source Program, State Water Resources Control Board

Participants and Affiliations:

John Adriany	ChemMetrics
Colin Anderson	American Chemet Corporation
Barbara Baginska	San Francisco Regional Water Board
Carina Bjerner	Drive-In Boatwash / Rentunder AB
Neal Blossom	American Chemet
Shane Burckle	City of Newport Beach
Cristian Centeno	Port of Los Angeles
Wayne Chiu	San Diego Regional Water Board
Emily Duncan	Los Angeles Regional Water Board
Melissa Escaron	California Coastal Commission
Bruce Fritz	Alameda County Department of Environmental Health
Jeremy Haas	San Diego Regional Water Board
Cleve Hardacker	Recreational Boaters of California
Avra Heller	U.S. Environmental Protection Agency
Ray Hiemstra	Orange County Coastkeeper
Eunha Hoh	San Diego State University
Karen Holman	Port of San Diego
John Kappeler	City of Newport Beach

[1] Vanessa Metz (Vanessa.Metz@coastal.ca.gov)

[2] Alex Rosado (Alexandra.Rosado@waterboards.ca.gov)

Bill Kraus	CeRam-Kote Marine Coatings
Steph Leach	California Coastal Commission
Yalin Li	California Product Stewardship Council
Pedro Lima	California Department of Pesticide Regulation
Oskar Lindroth	Drive-In Boatwash
Chad Loflen	San Diego Regional Water Board
Vivian Matuk	California State Parks & CA Coastal Commission
Rio Mecredy	California Department of Pesticide Regulation
Vanessa Metz	California Coastal Commission
Raya Nedelcheva	California State Lands Commission
Brenda Ponton	Los Angeles County Department of Beaches & Harbors
Michael Quill	Los Angeles Waterkeeper
Alex Rosado	State Water Board
Greg Schem	Marina del Rey Lessees Association
Chris Scianni	California State Lands Commission
Randy Short	Almar Management
Barry Snyder	WSP USA, Inc.
Marisa Swiderski	WSP USA, Inc.
Kelly Tait	Port of San Diego
Peter Von Langen	Central Coast Regional Water Board

Participant Updates and Announcements:

- [Vivian Matuk, Environmental Boating Program Manager for California State Parks and Coastal Commission.]: I want to invite everybody to check out our podcast entitled Dockside.[3] We started this effort last year, with the Parks' boating safety unit and the San Francisco Estuary Partnership. We've developed 16 episodes so far, on topics of interest to this group, for example episodes on shark research, whales, boating sewage, and women sailors like Captain Mary Rogers, the first black woman to hold a Commodoreship at a yacht club.

  I also want to give you an update about the effort that we have underway with municipalities, including Alameda, Contra Costa, Marin, and Orange counties, and the Port of L.A., holding free collection events for expired pyrotechnic marine flares. There isn't a statewide system to properly collect and dispose of these flares; this is a nationwide issue. Ten years ago, we started a MIACC working group on this topic. CalRecycle has offered grants for municipalities to hold free collection events, and Alameda County has held more collection events than any other county in the nation. This year alone, California municipalities holding these events collected and properly disposed of 5,500 flares across the state. A key partner is the California Product Stewardship Council, and partnering with the two agencies that I represent, we are launching a campaign called Make the Switch to encourage boaters to switch to electronic marine flares. California was the first state to approve electronic marine flares.

[3] The Dockside podcasts share clean and safe boating practices. See https://dockside.podbean.com/.

2. CeRam-Kote/Ram Protective Coatings

Speaker:

- Bill Kraus[4] – CeRam-Kote Tech Rep for Marine Coatings

Outline:

1. What is CeRam-Kote AF Marine (CK-AF) bottom paint?
2. Short history of bottom paint on recreational boats.
3. Differences between CK-AF and copper bottom paint.
4. Brief background of DoD contract leading to development.
5. Plain CeRam-Kote (no additive) on boat bottoms past 24 years.
6. Performance evaluation of CK-AF.
7. Cleaning cycle.
8. Longevity.
9. Application.
10. Cost.

Handouts (posted on Marinas webpage):

- Photos of CeRam-Kote AF Marine--Bill Kraus
- Letter to Marina Managers & Dockmasters on CeRam-Kote AF Marine--Bill Kraus
- The Log--Article on CeRam-Kote AF Marine--Bill Kraus

Notes on Presentation:

CeRam-Kote has been making ceramic epoxy coatings since 1985, including for oil field and military applications. Today I'm here to talk about the new CeRam-Kote AF (anti-foulant) Marine bottom paint, as a replacement for copper bottom paint. The photos show the performance of CeRam-Kote AF in the water. I can email you an 11-page document on the background of this product if you send me your email. Too much copper in the water column is a problem in various boat basins in the state. CeRam-Kote AF is a non-biocidal paint; zinc oxide is the main ingredient, which EPA ruled is inert. The California Dept. of Pesticide Regulation (DPR) ruled that this product is a minimum-risk pesticide, not requiring registration.

A short history of bottom paint on recreational boats: Tributylin (TBT) was outlawed about 1985 as it's too harmful to marine life. Copper bottom paint was then used until about 2000, when it was ruled that copper oxide was too harmful to marine organisms. The original CeRam-Kote Marine bottom paint was then used as a replacement, as it has no pesticides, was easy to scrub clean, and it lasted. It's still on boat bottoms today, some 20 years later. This was the original CeRam-Kote Marine, not to be confused with this new product, CeRam-Kote AF Marine.

The Dept. of Defense contracted the Chemistry Dept. of Texas A & M University to find a method to kill anthrax spores in livestock feed troughs. They came up with an ion field generation technique using zinc oxide molecules, which is an unbalanced molecule (it has extra ions), to generate a low-voltage shield on the surface. Chevron Oil used the original

[4] Bill Kraus (bill.kraus@sbcglobal.net)

CeRam-Kote on underwater fittings of offshore platforms, and asked the company to use this technique to add zinc oxide to the paint. The company then entered the market for marine anti-fouling paints in California with this new version, CeRam-Kote AF Marine, which adds zinc oxide to the standard CeRam-Kote Marine paint. When it cures, the coating is about 60% ceramics that encapsulate the zinc oxide; the zinc oxide is not soluble in water so it doesn't leach away. The coating lasts at least 10 years, unlike copper bottom paint which needs to be replaced every 2½ to 3 years.

A series of photos shows after three or four weeks some seaweed, algae, and barnacles starting to form on the coating. Using a soft sink sponge to swipe off the growth returns the coating to like new condition. The zinc oxide ion field drives away the microbes, and thus no algae or barnacles attach. The cleaning cycle is every 3½ to 4 weeks, to wipe away seagrass.

We also looked into using encapsulated cuprous oxide instead of zinc oxide, but it was difficult to get EPA approval, even though the cuprous oxide didn't leach. So, we used zinc oxide instead, which works better and is considered inert. Boat owners can coat rudders with CeRam-Kote AF, and if you're underway pretty often, even the seaweed won't be there. The coating application can go on top of old hard copper bottom paint, which is a modified epoxy, but not on ablative paint. You don't have to blast off the old hard copper bottom paint, as CeRam-Kote AF has four times better adhesion than the copper bottom paint. It's not necessary to spray the coating on, it can be rolled on. The cost is about $200 per gallon (by a boat yard), which is competitive with copper bottom paint.

Discussion:

[Randy Short, Almar Marinas]: Can this product be used on wood boats?

> [Bill Kraus]: Wooden boats need to breathe, so it may cause a dry rot problem.

[Carina Bjerner, Drive-In Boatwash]: Can a boat with TBT be coated with this boat paint? TBT has been forbidden in Sweden since the early 1980s.

> [Bill Kraus]: I would not trust it to adhere to TBT, so the TBT must be removed first by the local boatyard. CeRam-Kote needs a good solid substrate.
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> [Carina Bjerner]: Many boats in Sweden are coated with epoxy; will this paint work on top of epoxy?
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> [Bill Kraus]: Yes, once it is thoroughly cleaned and scrubbed with a 6-grit paper. So long as the epoxy is adhering to the boat hull, the CeRam-Kote will adhere to the epoxy.

[Michael Quill, LA Waterkeeper]: They have a ceramic-based paint from HullSpeed, will this product adhere to that? What is needed to prep?

> [Bill Kraus]: There may be trouble adhering to that, I don't know.

[Cleve Hardacker, Recreational Boaters of California]: Sounds like an interesting product. Have you made inroads with boatyards and are they actively promoting this product? My concern is longevity, as the boater is taking a risk trying a product that is relatively unknown. Is there a warranty for the product?

> [Bill Kraus]: We're talking to boatyards, and some don't want to change their paint. The standard warranty is one year. The original CeRam-Kote has lasted 20 plus years on boats; it's on probably over 100 boats in California over the years. It's also on the leading edges of all Air Force fighter wings and vertical/ horizontal stabilizers; it's the toughest ceramic

polymer coating around. They've done pull tests on the standard ceramic coat, and the zinc oxide does not faze it, if the boat hull is clean and prepared properly.

[Greg Schem, Marina del Rey Boatyard]: Boatyards stick with what works. They've tested dozens of paints in LA County, and are looking to see what works. The boatyards cannot take the risk that a new paint may not perform. Boatyards have found the ultra-low copper paints to be pretty effective and minimally impactful in terms of leach rate. But they hope this product excels and becomes the magic bullet.

[Bill Kraus]: The best way is to get it on boat hulls; I know it works as we've been testing it for 4 years. I will talk to the factory to see if they can offer an extended warranty.

[Greg Schem]: We need to get real world experience on boat hulls, and a better warranty is going to find some takers.

[Bill Kraus]: We're hoping that the Port of San Diego will volunteer to have some harbor boats coated with CeRam-Kote AF.

[Michael Quill, LA Waterkeeper]: If you're willing to sponsor a nonprofit to try this alternative, we would be interested.

3. Shift to Assessments of Biological Integrity in Shelter Island Yacht Basin Conditions

Speaker:

- Jeremy Haas[5] – Environmental Program Manager, San Diego Regional Water Quality Control Board

Background:

The Regional Water Quality Control Boards are tasked with protecting and restoring the ability of state waters to support wildlife and human uses. For decades, their decisions have relied upon data from chemistry and toxicity. It is now time to use assessments of biological integrity. The San Diego Regional Water Board is investing heavily to develop and use bioassessment tools to support and inform Board decisions. This presentation will discuss a recent shift in perspective in the Shelter Island Yacht Basin conditions from water chemistry to biological integrity.

Materials:

- PowerPoint presentation: **Shift to Assessments of Biological Integrity in Shelter Island Yacht Basin Conditions** (Haas, Dec 2023). (Note: PPT is not posted on the Marinas webpage because it is not ADA-compliant; see video or request a copy of the PPT).

Notes on Presentation:

This talk is about a shift in our perspective in assessing the Shelter Island Yacht Basin conditions from chemistry to biological integrity, and why biological integrity assessments are the best fit for what our Regional Water Board is expected to do. I'll talk about our statutory responsibilities, and how the Board makes decisions to fulfill their role. The San Diego region is investing heavily in staff time and money to develop the use of bioassessment tools to support

[5] Jeremy Haas (Jeremy.Haas@waterboards.ca.gov)

and inform the Board's decisions. I'll then talk a little bit about what this means for Shelter Island.

Slide 2 shows Shelter Island maps on the left and some pictures on the right. In the top left aerial shot of San Diego Bay you can get an impression of how concentrated this yacht basin is, with so many marinas there. Around the basin, there are hardened shorelines and soft banks, and boats and various kinds of uses. Our mission as a state agency is to protect, restore, and enhance the quality of the water. Our task is to maintain the chemical, physical, and biological integrity of state waters so they can support uses like swimming and fishing and boating, and wildlife uses, too.

Shelter Island Yacht Basin is a modified portion of San Diego Bay. It's near the mouth, so it does get a good exchange with the ocean as opposed to the far inner southern parts of San Diego Bay, where there's much less exchange. Historically, it was mostly mudflats and sand bars, but the water was deep enough in parts to support a bit of a 19th century fishing trade, and then the first Recreational Boat Club in San Diego. Because of its location near the waterfront, this area was one of San Diego's first neighborhoods. About 1975, when the Clean Water Act and our water code statutes really kicked in, the yacht basin was mostly residential, along the northwestern side, with a lot of soft banks with some intertidal rocks. This area had a lot of services related to recreational boating and tourism, including marinas, boating clubs, and hotels.

However, around that time San Diego Bay itself was horribly polluted, with decades of raw sewage going into it, massive fish kills, wide swaths of polluted mussels along the banks, and generally people didn't do a lot of swimming or fishing in San Diego Bay. Following guidance from the federal Clean Water Act and the State Porter Cologne Water Quality Control Act, our response was to focus on the chemical and physical conditions of the bay, and to regulate discharges into it. We cleaned up sites, cleaned up the discharges going in, and focused on assessments of chemistry and physical targets to inform us. Since the seventies, both federal and State agencies said that biological targets are very important, especially for wildlife beneficial uses, and we started funding, testing, and discussing some biological targets.

Today, the yacht basin has primarily recreational boating-related services, some light residential, lots of tourism, lots of swimming and boating and fishing, and good habitat value for birds, etc. Our task at the Water Board is to interpret the water quality and let that assessment drive our actions to protect and restore those uses. How do we do that? Our board makes decisions based on observations and some rational thought, but we don't assess everything, and our decision-making is limited by those observations and the experiences we have. For decades we've relied on information about chemical and physical conditions of the waters and the effect of that water on species, with the intent that those measurements can represent the biological integrity of a water body, and that our Board can make good rational decisions. The Water Board, through public processes with stakeholders, reasonably crafted many restoration plans based on those considerations. For example, many of the cleanup and abatement orders we've worked on with contaminated sediment in San Diego Bay, and many TMDLs [Total Maximum Daily Loads] across the state, including the one for dissolved copper in Shelter Island.

Consistent with that traditional approach, the Water Board determined that aquatic life uses of Shelter Island Yacht Basin were impaired because levels of dissolved copper exceeded the standards established by the U.S. EPA. We adopted a restoration plan called the TMDL that relied on reducing levels of copper discharges from copper-based pesticides applied to boat

hulls, an obvious and substantial source of the dissolved copper that was exceeding the standards and impairing aquatic life uses. As a result of that TMDL, the management of those pesticides has improved greatly.

Each August, the Port of San Diego assesses levels of dissolved copper and runs toxicity tests on laboratory organisms. The question is, can the Water Board and the public make informed decisions about the aquatic life uses in the Yacht Basin based on that information? What we measure to determine whether water quality supports the beneficial uses matters a lot. It is the lens through which we conduct stressor and source identifications. and determine whether the protection and the restoration targets have been met. Now that lens evolves with time and with knowledge. For example, original swimming standards were based on levels of fecal coliform coming out of public sanitation works in the 1950s. A few years ago, the State Board switched to enterococcus and E. Coli, which are slightly better indicator bacteria; several years ago, the State Board also adopted sediment water quality objectives to replace only relying on chemical assessments themselves.

Both the Clean Water Act and the state Porter Cologne Act have built-in requirements for the Water Boards to evolve their plans over time, based on regular review of scientific information and uses of the bays and other waters. Information was limited in the early 1970s when the Clean Water Act and the state Porter Cologne Act were adopted. Federal and State governments knew that better measures of biological integrity were needed and were achievable. That is reflected in the mission of the Clean Water Act to protect and restore the chemical, physical, and biological integrity of waters. Since then, both the federal and the state government have been funding various ways to assess biological integrity.

Three years ago, the San Diego Regional Water Board adopted biological water quality objectives for freshwater streams. This uses benthic macroinvertebrates to determine the state of aquatic life and health of freshwater streams. Most other states also use biological integrity measurements. The point is that it is time for our collective decisions about biological integrity to be based on measures of biological integrity, not just chemical, physical, or laboratory proxies. This is reasonable, it is achievable, and it is efficient. So that's where we're going in Shelter Island in San Diego Bay.

To do that we need to answer some fundamental questions like, what should the marine ecosystem and Shelter Island Yacht Basin look like? How would we assess that? Do we have the data to assess it now? And if not, what do we need to do? And how can we get it? Our staff has been working on addressing some of these questions. Last year Wayne Chiu developed, and the San Diego Regional Water Board adopted, a plan for strategic water quality assessments in San Diego Bay that relies for the habitat and ecosystem benefits uses on measures of biological integrity. I'll leave with a couple of examples that demonstrate the direction we'd like to go.

Sediment quality objectives were measured in Shelter Island Yacht Basin over the last two 5-year cycles. These objectives try to integrate data from chemistry, toxicity, and the benthic communities themselves. It’s best calibrated for soft-bottom areas, but it does include measures of biological integrity within an overall assessment of the aquatic life use in the area.

Eelgrass surveys are conducted by the Port every so often, and are very valuable for many agencies, including ours. They show you the extent of this really productive habitat around the marinas in the bay. But what these surveys don't say much about are actual conditions. So, our Board and some others are developing a conditions assessment that will be tested soon in

all of the coastal bays in the region. This will give us more of a direct assessment of the integrity of the biological conditions within those eelgrass beds that will help us make more informed decisions.

Lots of other work has been done to look at biological communities, both in San Diego Bay and elsewhere, including previous studies in Shelter Island that studied the benthic community relative to the levels of copper within the sediments. These kinds of studies are ones we should be using to inform our decisions.

Moving forward, our Board wants to have a public process to discuss how to rely on biological integrity assessments to inform their decisions in San Diego Bay and in the Shelter Island Yacht Basin as a way to get more results from our copper TMDL. It does not mean to stop worrying about copper; we all know that copper levels in the bay sediment is harming the benthic community, and the biggest source of that copper is anti-fouling boat hull paints. Copper will need to be reduced to achieve aquatic life beneficial uses in this basin, and potentially elsewhere in the bay. However, rather than using copper levels to determine whether biological goals have been met, we want to use measurements and assessments like these two examples that better represent the biological community within Shelter Island Yacht Basin.

Relying on limited chemistry to give us answers about wildlife uses is no longer reasonable. Biological targets are feasible, are in existence, can be developed, and provide much more useful information. They are the best tool to use to meet our Board's responsibility for protecting and restoring water quality for the many uses of Shelter Island Yacht Basin and other areas.

Discussion:

[Ray Hiemstra, Orange County Coastkeeper]: What kind of costs are associated with the biological assessments? I assume it's significantly more than just water chemistry.

> [Jeremy Haas]: I can't give you an answer because our Board has not adopted a particular biological assessment for the Shelter Island Yacht Basin. Perhaps people on this call can give you estimates for what those sediment quality objectives cost or what a survey of eelgrass extent can go for. We have our freshwater biological objective methods and procedures for streams, but we don't have a similar thing for a Yacht Basin at this time.
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> [Ray Hiemstra]: To clarify, the TMDL is still in effect and you're looking to revise the requirements of the TMDL?
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> [Jeremy Haas]: That is correct. The TMDL is in effect, it's part of our basin plan, and will take a full rule-making procedure to change that. What we're considering doing is amending it such that the targets we want to achieve are biological targets. The theory being one of the ways to achieve that biological target would be to focus on the sources and stressors, such as dissolved copper, but recognizing that just because you might eliminate copper doesn't mean you know whether the community is thriving or not. We want to use targets because we also think there could be other management decisions once you start assessing the actual biological conditions rather than just focusing on dissolved copper. And together that leveraging might lead to a more effective and efficient restoration in the basin.

[Carina Bjerner, Drive-In Boatwash]: How do you see the situation with invasive species right now? Is it increasing, or is it stable?

[Jeremy Haas]: Generally, I don't think we have a great idea for this suite of communities. I don't really have much information; we need to do those kinds of assessments.

[Carina Bjerner]: In Europe, generally it's a huge debate right now about it, especially in the lakes, and it's hurting our lakes tremendously.

[Jeremy Haas]: In the context of Shelter Island and copper, I don't know if there's a relationship or not, but we do have an outbreak of Caulerpa in South San Diego Bay now. Caluerpa is extremely threatening to the ecosystem of San Diego Bay, so we're trying to nip that in the bud as best we can. I don't think we know whether it's in any of the other marinas yet. If something like that got out in the bay, it would get immediate attention, more urgent attention than for long-term issues like copper boat paints or climate change.

[Greg Schem, Marina del Rey boatyard]: I'm wondering if it would be a possible outcome that when you get the biological assessment tools in place that could lead to a threshold that, translated to a TMDL, might actually be a higher level, in other words a less restrictive hurdle? And do you think the follow-up could affect the timing of the implementation and some of the reopener meetings that we have with the Water Boards?

[Jeremy Haas]: I don't know what the level of copper is going to be in the future. But if we can base that on some correlation with achieving good biological integrity in the Basin, we'll have a much better justification for that number than we have for the current one that's in the California toxics rule now. So, it would be a more informed and accurate number, and it's quite possible that there might be a new number, once we can get the right data. The weight of evidence is up for interpretation.

We have some notion that copper levels in the sediment have impacted the benthic communities. This needs to be confirmed, but that would suggest there's too much copper in the system. And we have some data from the Port about laboratory toxicity of the water in Shelter Island. Most of the water meets the lab tests, except for a couple of the less well-mixed and dense boat areas. Other than those two examples, I'm not sure what we have to inform us about whether the standard for copper level might go up or down, or stay the same.

[Greg Schem]: Here in Marina del Rey, the concern has been focused on dissolved copper. I understand the benthic impacts, and how that could perhaps not change much. But we seem to have a pretty healthy ecosystem up here, especially since we're a manmade artificial habitat to start off with. I think we're heading in the right direction with that approach.

[Cleve Hardacker, Shelter Island]: I noticed that the views you had of Shelter Island showed that there was much less stuff growing, and high levels of copper up at the head of the basin. A number of us have consistently held that it would be beneficial to construct a conduit to allow better circulation in the basin. Would that be consistent with the Water Board's new approach?

[Jeremy Haas]: It wouldn't really be inconsistent, the point being that once we get assessments of habitat conditions and biological integrity, then we can figure out what the most reasonable and effective responses could be. And if somebody can show that it's opening up a little flow that way, then I'd say this would be consistent. I can't say whether it would be the optimal or the most efficient way, but I don't see why that would be inconsistent.

4. Occurrence and Distribution of Polycyclic Aromatic Hydrocarbons and Polychlorinated Biphenyls in Surface Sediments of San Diego Bay Marinas

Speaker:

- Dr. Eunha Hoh[6] – Professor, Environmental Health, San Diego State University

Background:

PAHs and PCBs were investigated for their spatial distribution and composition in sediments of three recreational marinas in San Diego Bay. There were significant differences among the marinas, with concentrations in one site exceeding 16,000 ng g−1. 'Hotspots' of PAH concentration suggest an association with stormwater outfalls draining into the basins. Total PCB concentrations ranged from 23 to 153, 31–294, and 151–1387 ng g−1 for the three marinas. High-molecular weight PAHs (4–6 rings) were dominant (N86%); the average percentage of potentially carcinogenic PAHs was high in all sites (61.4–70%) but ecotoxicological risks varied among marinas. Highly toxic benzo(a)pyrene (BaP) was the main contributor (N90%) to the total toxic equivalent quantity (TEQ) in marinas. In this presentation, potential sources and ecological toxicity due to the contaminants will be discussed and further environmental monitoring frameworks will be proposed.

Materials:

- PowerPoint presentation: **PAHs & PCBs in Sediment of San Diego Bay Marinas** (Hoh, Dec. 2023). (Note: PPT is not posted on the Marinas webpage because it is not ADA-compliant; see meeting video or request a copy of the PPT).
- Journal article: Neira C, Vales M, Mendoza G, Hoh E, Levin LA. **Polychlorinated biphenyls (PCBs) in recreational marina sediments of San Diego Bay, southern California.** Mar Pollut Bull. 2018 Jan;126:204-214. doi: 10.1016/j.marpolbul.2017.10.096. Epub 2017 Nov 11. https://pubmed.ncbi.nlm.nih.gov/29421090/. (Note: Link posted on the Marinas webpage).
- Journal article: Neira C, Cossaboon J, Mendoza G, Hoh E, Levin LA. **Occurrence and distribution of polycyclic aromatic hydrocarbons in surface sediments of San Diego Bay marinas.** Mar Pollut Bull. 2017 Jan 15;114(1):466-479. doi: 10.1016/j.marpolbul.2016.10.009. Epub 2016 Oct 15. https://pubmed.ncbi.nlm.nih.gov/27751573/. (Note: Link posted on Marinas webpage).

Notes on Presentation:

Today I'm going to talk about some chemical contaminants found in the San Diego Bay marinas. This was a collaborative project several years ago with my own research lab and Dr. Carlos Neira and Lisa Levin's lab group at Scripps institution of Oceanography. The focus of the work was on polycyclic aromatic hydrocarbons and polychlorinated biphenyls. The work that I'm going to present was already published in 2017 and 2018 in the Marine Pollution Bulletin. Lots of details can be found in these papers, but today I'll present a summary of what we found.

[6] Eunha Hoh (ehoh@sdsu.edu)

San Diego Bay is surrounded by urban areas, and has a high population, an airport, military shipping activities, and a substantial commercial fleet. It's no wonder that pollution levels are probably pretty high. We looked at polycyclic aromatic hydrocarbon (PAHs) contaminants in the San Diego Bay marinas. A brief background of PAHs is that they are mostly coming from incomplete combustion. Some of them are known to be human carcinogens, and they're known to be ecotoxic as well. EPA set them as a high-priority pollutant. PAHs can come from many diverse sources. In marinas, PAHs can come from boating activities, including leaking fuels or combustion. The San Diego Bay marinas are also very close to the busy road, airport, and parking lots.

My research is looking at environmental monitoring of chemical contaminants, outdoor and indoor, mostly for human and wildlife exposure assessment. This work in the marinas has many sampling sites, and there are six questions listed in the paper. What I'm going to talk about are the concentrations of PAHs in surface sediments in the three San Diego Bay marinas. Is there a spatial distribution or trend of PAHs with boating or other factors? Also, does a risk assessment of sediment quality toxicity show a potential ecotoxicological risk from PAHs in the marinas?

The three marinas are shown on the map. The Shelter Island Yacht Basin has about 20 stations where surface sediment samples were collected. Harbor Island West has 15 stations, and we have 8 stations in Harbor Island East. The method was to collect surface sediments from 0-5 cm depth at each station, taking a 5-gram (wet weight) sediment sample. The samples were prepared in my lab and analyzed for 36 PAHs, including the 16 EPA high-priority PAHs.

The results graph shows the total PAH concentrations among the three sites. Harbor Island East statistically has much higher concentration of PAHs, looking at both average concentration and distribution. Harbor Island West and Shelter Island Yacht Basin had pretty similar PAH concentrations. There was also one outlier concentration, an extremely high concentration, in Harbor Island East. What happened to this one station to have an extremely high concentration? This station was next to a small storm drain from the parking lot, so possibly the PAHs are coming from the parking lot, where there are lots of cars that produce PAHs that could be carried by stormwater.

The Scripps group used modeling to look at the spatial distribution of PAH concentrations. They found that PAH hotspots for each site do not follow the distribution of moored boats, which is the case for copper in sediment. The PAH hotspots with the highest concentrations were found near a busy road and adjacent to parking lots. So, the PAH concentration is more connected to cars and transportation around the marinas, and the storm drains.

Based on this data, we evaluated the biological risks based on PAH sediment levels. In this study the concentrations of individual PAHs in Shelter Island and Harbor Island West were largely below the level of biological risk, based on Effects Range-Low (ERL). In contrast, in Harbor Island East, the concentrations of several PAHs were between ERL and Effects Range-Medium (ERM), and also the total PAHs exceeded the ERL at one station and exceeded ERM at another station. So, there are ecological risks from PAHs at some stations at Harbor Island East.

We followed up the study using the same sediment samples to analyze for Polychlorinated Biphenyls (PCBs) too. PCBs are persistent, bioaccumulating, biomagnifying toxic chemicals. PCBs are industrial-related chemical contaminants. They're not used any longer, but because

of their persistence, bioaccumulation, and biomagnification, PCBs' existence in the environment is really high, especially in coastal environments. PCBs are known to pollute San Diego Bay.

The questions this study asked are what is the spatial distribution, are there any hotspots associated with boats or other environmental factors, and do they pose a risk of toxicity to aquatic organisms? This study was pretty much parallel to the PAHs study.

The results show that again, Harbor Island East has the highest concentration of PCBs among the three sites, and Shelter Island and Harbor Island West have similar, lower concentrations. The highest PCB concentration was found in one Harbor Island East station that is close to a main storm drain outfall, where a high PAH concentration was also found. Table 3 shows that Harbor Island East's PCB concentrations are in in the high range compared to sediments in other coastal areas in the world.

Looking at the spatial distribution of PCBs concentrations, found that the PCB hotspots were not associated with boat activities, but were more related to urban surroundings, such as urban stormwater runoff outfalls, and possibly historical contamination. The biological risk evaluation based on PCB sediment levels showed that overall, the total PCB concentrations were largely above the Effects Range-Low (ERL). In Harbor Island East, most of the stations exceeded Effect Range-Medium (ERM), suggesting a potential toxicity to aquatic organisms. So, findings show that Harbor Island East has potential toxicity from PCB pollution to aquatic organisms.

A question for future study is whether the sampling stations that were hotspots for both PAHs and PCBs have an additive biological/toxicological effect on aquatic organisms. Also, are there any other contaminants in the marinas, including contaminants of emerging concern, and how can we find those chemical contaminants more proactively? What we are doing in our lab is to implement a non-targeted analytical approach, which is a novel approach for environmental monitoring. We have been working on this non-targeted analytical approach for more than 10 years, and we're actually pretty successful in finding new or unrecognized chemical contaminants in environments. This will lead us to further study of novel contaminants, and a more comprehensive understanding of the status of contaminants. So that really helps us with our research on microplastics and other types of pollutants. We've also been working on many legacy pollutants, including DDT. Offshore DDT pollution was recently discovered in the Southern California Bight, and we're working on overall environmental contaminants by using this new type of analytical approach. Also, sediments, water, and air, all three matrices are very important for source investigation when we try to find out where certain contaminants are coming from.

Discussion:

[Ray Hiemstra, Orange County Coastkeeper]: You mentioned the parking lots as a potential source. You know there's a giant airport right there; I'm sure you looked at that. Maybe there's no drainage into this area from the airport?

> [Eunha Hoh]: Definitely, airplanes are a source of PAHs as well. We analyzed 36 PAHs, and some sampling stations show very different chemical compositions. And then the stormwater drain has a very different chemical composition.

[Vanessa Metz, California Coastal Commission]: Regarding the PCBs in the storm drain outlets, is it your understanding that there are still a lot of PCBs from the watershed that are being washed down in stormwater runoff, or is this mostly from past, legacy events?

[Eunha Hoh]: It's definitely past legacy events. But those chemicals are so persistent, it's possible we're still getting them from the watershed. It's well known in a superfund site like in Puget Sound in Washington State, they constantly receive PCBs from their watershed.

[Karen Holman, Port of San Diego]: I do want to weigh in on some of the questions from Ray and Vanessa. The Port and the Regional Board have been doing a lot of work around the bay. To the point on the PAHs and PCBs coming from upland versus legacy. We're finding that a majority of it is still legacy pollution. There's a lot of other sources in that Harbor Island East area. We've been doing studies, and there's some investigative orders that are out there and other places in the bay. In terms of the work that's been going on, we've been studying it. There's cleanup orders and investigation orders in various locations.

The key take-home that I got is, consistent with what we've found, looks like Harbor East is an area of hotspot, but it doesn't seem to be related to marinas or boating activities. We do a regional harbor monitoring program and we've done a couple of data collections bay-wide since 2014-2015 to assess not just metals, but PCBs and PAHs in sediments, and water quality testing. We've got a pretty robust data set throughout the bay looking at marinas, freshwater input, industrial areas, as well as some areas around hotspots or clean-up areas where we've been doing more specific investigations. If anyone has any more questions or would like more details, there's a lot of good information on Geo-Tracker, on the Regional Board's website. We also have information internally, and I'd encourage you all to reach out to me if you have any more specific questions related to legacy contamination, or anything else for San Diego Bay. (Email kholman@portofsandiego.org).

5. Meeting Wrap-Up

Action Items:

The meeting notes and materials (except PowerPoint presentations) will be posted on the Coastal Commission's Marinas and Recreational Boating webpage under the heading **"Archive of Meeting Notes & Presentations"** – **2023, December.** A video recording of the meeting is posted on the Coastal Commission's YouTube channel.[7] The PowerPoint presentations will not be posted online due to non-compliance with ADA regulations; if you would like a copy of a PowerPoint presentation, please email your request to the presenter.

Next Meeting:

We'd like to ask if you have any ideas for topics for the next meeting, which will probably be in June or July 2024. If you would like to present on a topic, or if there is a topic you would like to hear more about, feel free to email Vanesa Metz or Alex Rosado with any suggestions.

~ End ~

[7] The meeting video is posted at https://www.youtube.com/watch?v=WyH8_pX42UM .

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