NEWSLETTER Society of Freshwater Science
California Chapter & California Bioassessment Workgroup

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(Above) Drought conditions in 2021 impacted many freshwater ecosystems such as Clear Lake, which provides drinking water to 60% of the Lake County, CA population. Chapter Chair / President Angela De Palma-Dow (below) serves as a program coordinator for the County of Lake Water Resources Department and provides management for Clear Lake.

Join Cal-SFS Today!

Renew or Join SFS at https://freshwater-science.org/ and select "California Chapter" for $10 extra to join Cal-SFS. Chapter revenues go towards providing student & early career opportunities as well as support our annual meetings and chapter activities. You can donate directly to Cal-SFS through our chapter treasury VENMO (**@CalSFS-John-Olson**) or email our treasurer Dr. John Olson to send a check (**joolson@csumb.edu**). Thank you for your continued support of Cal-SFS!!

INSIDE THIS ISSUE:

Message from the Chair

Hello and Happy New Year Cal-SFS! The last year has had it's up's and downs of course, but for me it was year one as serving as your Cal-SFS Chair / President! We have had quite a year, from participating in three events including the Annual SFS Virtual meeting May 23-27th, 2021, the Sixth Annual California Water Boards Water Data Science Symposium on June 28 - 30, 2021, and the 28th Annual CA Bioassessment Working Group/ 9th annual Cal-SFS Meeting October 12-13th, 2021.
We also got a new chapter website, thanks to SFS members Christine Parisek and Ryan Peek. The website can be found at https://cal-sfs.github.io/CABW-conference/index.html. The website contains the previous two annual Cal-SFS meeting poster presentations and lighting talks. It's also the hub to find newsletters and any student, early career, or member opportunities. Thanks Christine and Ryan!
Speaking of opportunities, we had a fabulous first run of our Cal--SFS Fellows program. We had five fellows who particiapted in all our meeting events during 2021. We were lucky to be awarded a SFS Long Range Committee award to offer this fellowship program and we were double lucky to be awarded again in 2022 to recruit another cohort of Cal-SFS fellows. More information on this program and how to apply is located on the last page of this newsletter.

This year in October, Cal-SFS will be having their elections for both Chair/President and the Treasurer/Secretary. The California Chapter is here to provide for the members and what a better way to be directly involved then to vote for those who will determine how the Chapter will function for the next two years. This Chapter belongs to YOU, and YOU have the awesome responsibility to shape and form the way it can best serve you. I encourage all the members to take the time to learn about the candidates in Ocotober and take the effort to cast a vote. The future of freshwater in California is in YOUR hands, literally. Let's take the opportunity to make a difference!

Contact us at any time at our Cal-SFS email: cal.chap.sfs@gmail.com

Angela De Palma-Dow
Cal-SFS Chair / President
she / her / hers

The 28th annual CA Bioassessment Working Group (CABW) / 9th Annual Cal-SFS Meeting was held virtually on October 12-13, 2021. Originally planned as a hydrid meeting, updated COVID restrictions changed the meeting to 100% virtual. However, this did not deter participation with 186 unique viewers on Day 1 and 153 unique viewers on Day 2. There were 19 presentations, a virtual poster session and two Q&A panels; including a Traditional Ecological Knowledge Session and Panel hosted by Cal-SFS. Thank you to the whole SWAMP Water Board team for organizing, coordinating, hosting, and executing another wonderful CABW / Cal-SFS meeting. The entire meeting, videos from day 1 & 2, the Agenda, presentation Abstracts and Presenter Index, are available on the CA Water Board SWAMP training webpage:
https://www.waterboards.ca.gov/water_issues/programs/swamp/bioassessment/training.html

2022 Save The Dates

- **January 2022**- Renewal/Join SFS + Cal-SFS (https://freshwater-science.org/)
- **January 21, 2022** - Joint Aquatic Science Meeting Abstracts Due freshwater-science.org
- **February 20, 2022** - Cal-SFS Fellowship Applications Due via email cal.chap.sfs@gmail.com
- **May 14-20, 2022** - JASM Hybrid / SFS Annual Meeting https://jasm2022.aquaticsocieties.org
- **Late June / Early July, 2022** - CA Water Board Water Data Science Symposium
- **October 12-13 2022** - CA Bioassessment Working Group & Cal-SFS Annual Meeting/ Symposia

CABW / Cal-SFS Meeting Presentation Highlight:

DNA-based methods used to identify toxin-producing cyanobacteria in California waterbodies

Written by: Jayme Smith and Susanna Theroux (SCCWRP)

The Southern California Coastal Water Research Project (SCCWRP) is an aquatic sciences research institute that works to improve management of aquatic systems in Southern California and beyond. As an Research and Development agency, SCCWRP's reputation is built on conducting research and translating this science into actionable guidance and recommendations that inform management decision-making and policy development. Every year at the annual CABW / Cal-SFS meetings, staff scientists from SCCWRP always make a strong showing, demonstrating the current research and management tools being developed or tested at SCCWRP for local, state and tribal agencies, organizations and their partners.

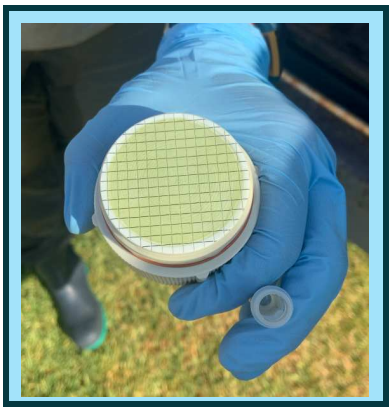
Cyanobacterial harmful algal blooms (cyanoHABs) have been reported statewide across California's inland waters. CyanoHABs can cause ecological and economic harm through the production of a variety of toxins, collectively referred to as cyanotoxins. Exposure to cyanotoxins can harm humans, dogs, livestock, and wildlife. In addition to toxin exposure, excessive cyanobacterial biomass can cause odors, poor aesthetics, and a cascade of ecological effects including growth of pathogenic bacteria, low dissolved oxygen concentrations, and fish kills. Therefore, our ability to monitor and identify cyanobacteria in a rapid and accurate manner is of critical importance to make time-sensitive management decisions.

Monitoring and assessment of cyanoHABs presents a variety of challenges. In particular, accurate identification of cyanobacteria can be a difficult due to morphological diversity. Cyanobacterial morphologies can range from single cells, colonies, and filaments and can range in size from less than a micron to 100s of microns. Many genera of cyanobacteria have the potential to produce one or more types of cyanotoxins, depending on the species and environmental conditions making accurate assessment of cyanobacteria an important element of ultimately understanding the causes of cyanoHAB events.

The spectrum of cyanobacterial morphologies makes traditional microscopy-based identifications difficult and time-intensive. DNA-based methods to identify and quantify cyanobacteria biodiversity offer a promising complement to microscope-based identifications for routine cyanobacterial monitoring. For this study, we coupled microscopy and DNA-based cyanobacteria identifications to better understand cyanobacterial community structure, composition, and toxin-production in river and lake environments in California.

Our first case study was conducted in partnership with the North Coast Regional Water Quality Control Board to examine the diversity of benthic cyanobacterial mats in Northern Californian rivers. We collected grab samples of benthic cyanobacterial mats at nineteen sampling sites across six rivers. We compared the microscopy-based taxonomic identifications to the DNA-based species identities in these samples. The DNA-based identification revealed a greater number of distinct toxin-producing cyanobacteria compared to traditional taxonomic identification. Sites with the greatest relative abundance of putative toxin-producing genera also generally had the greatest diversity of cyanotoxins present concurrently although not all sites where toxin-producing genera were detected also had toxins present.

Image above: One of 17 Los Angeles-area lakes sampled by SCCWRP researchers for the characterization of cyanobacteria and cyanotoxin levels in the weeks around the Labor Day holiday.



Our second case study, conducted in partnership with the Los Angeles Regional Water Quality Control Board, focused on planktonic lake cyanobacteria in Southern California. Samples were collected from seventeen different lakes spanning small lakes in urban locations to large lakes in rural areas. Diverse cyanobacterial communities were observed across lakes and toxin-producing genera were observed in all but one of the lakes. Cyanotoxins were detected in half of the lakes where putative toxin-producing genera were observed.

Overall, both case studies revealed both habitats hosted unexpected cyanobacterial biodiversity, including many novel taxa. Both studies also demonstrated that the presence of cyanotoxin-producing species is not always indicative that toxins are present but having a catalog of toxigenic species helps inform future monitoring and allows managers to specifically target toxins produced by resident taxa. By coupling DNA-based identification of cyanobacteria with the additional characterization of cyanotoxins and environmental conditions, we demonstrated a promising approach for identifying the key drivers of toxic bloom events and providing an improved understanding of cyanobacteria ecology.

Image Above: Samples for DNA analysis are collected via filtration through a sterile filter housing, concentrating the cyanobacterial cells on the filter paper. The filters can then be preserved using a specialized buffer or by freezing for downstream extraction and analysis.

Several regional and statewide studies investigate the challenges of protecting aquatic life in modified channels

Written by: Raphael Mazor (SCCWRP)

One of the major strengths of bioassessment—its ability to reflect the impacts of multiple stressors into an integrative measure of waterbody health—also creates complications for its use in modified channels. In engineered channels and other heavily modified streams, the impacts of direct habitat alteration can be so extensive that they overwhelm the ability of bioassessment tools (such as the California Stream Condition Index, or CSCI) to reflect improvements in water quality or other management actions. Thus, managers need to understand how channel modification affects biointegrity in order to set interim targets or identify strategies for improving conditions.

To address these needs, the Stormwater Monitoring Coalition (SMC) of Southern California, and the Bay Area Regional Water Quality Control Board have completed a number of studies to identify classes of modified channels in regions of the state. These studies, led by the Southern California Coastal Water Research Project (SCCWRP) and the San Francisco Estuary Institute (SFEI) evaluated ranges of CSCI scores in classes of modified channels defined by bed and bank material. The two regions used different approaches—the Southern California studies classified streams based on direct observations of channel form (Mazor 2015, Taniguchi-Quan et al. 2020), whereas the Bay Area study estimated classes inferred from geospatial information about stormwater infrastructure (Dusterhoff et al. 2021). However, both approaches resulted in similar conclusions about constraints on biointegrity in modified channels.

These studies found that hardened channels were associated with a distinctively lower range of CSCI scores than natural channels. In both regions, soft-bottom channels typically scored higher than hard-bottom channels, although variability in this class was very high. Similarly, studies in both regions showed that hardened channels in or close to undeveloped settings typically had higher scores than hardened channels in urban settings. The Southern California showed that there was a muted response to water quality measurements, and the Bay Area study showed that the influence of channel maintenance did not explain variability in index scores in soft- or hard-bottom channels. Several new and ongoing studies led by the State Waterboard, the SMC, and the Central Valley Regional Water Quality Control Board, pick up where these studies left off. These studies will result in a statewide classification system for modified channels based on bed and bank material. In addition, these studies will evaluate the ranges of biostimulatory conditions in modified channels, and investigate the relationship between biointegrity biostimulatory stress.

Previous studies helped the San Diego Regional Water Quality Control Board determine where and how biological objectives might be implemented, and these studies are expected to assist the development and implementation of other biointegrity programs throughout the state.

Figure 1. An earthen engineered channel in the Central Valley, primarily used to move water for agricultural supply.

Figure 2. A concrete channel in Southern California, designed to move stormwater and protect surrounding property from flood damage.

Figure 3. A soft-bottom channel with hardened sides. This stream in southern California is managed both for flood protection and to support groundwater infiltration.

Cited literature

Dusterhoff, S., S. Shaw, and K. McKnight. 2021. San Francisco Bay Region Flood Control Channel Classification. SFEI-ASC Resilient Landscape Program San Francisco Estuary Institute Publication #1046, San Francisco Estuary Institute, Richmond, CA. (Available from: https://www.sfei.org/sites/default/files/biblio_files/San%20Francisco%20Bay%20Region%20Flood%20Control%20Channel%20Classification_FINAL_DELIVERABLE.pdf)

Mazor, R. D. 2015. 2015 Report on the SMC Regional Stream Survey. Technical Report 963, Southern California Coastal Water Research Project, Costa Mesa, CA. (Available from: http://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/963_2015_SMC_Report_EnginChannels.pdf)

Taniguchi-Quan, K., R. D. Mazor, J. Brown, R. Guill, M. Yeager, A. Suter, J. Rudolph, W. Isham, and S. Johnson. 2020. 2018-2019 Report on the SMC Stream Survey. 1127, Southern California Coastal Water Research Project, Costa Mesa, CA. (Available from: https://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/1127_SMC1819.pdf)

For more information, please contact raphalm@sccwrp.org.

Cal-SFS Student Central

Student highlights from the 2021 Annual CABW / Cal-SFS Virtual Meeting

During the annual CABW / Cal-SFS virtual meeting, students were invited to participate in an online competitive poster session via Zoom on Tuesday afternoon. This session held 10 different online virtual "zoom rooms" each hosted by a student. Students presented their poster and answered questions from the audience, much like a traditional in-person poster session. All posters are available for viewing on the Cal-SFS new website at https://cal-sfs.github.io/CABW-conference/index.html. Previous year's posters are also available for viewing on this website. Great Job to all the participating students, there were so many great projects and research on display!

Poster Winners - Alyssa & Morgan Tied for First Place!! Congrats!

Name: Alyssa Schaer **Status:** Undergraduate student **Contact:** aschaer@csumb.edu
Affiliation: CSU Monterey Bay **Title:** Freshwater invertebrate composition depends on river salinity

Summary: Healthy freshwater rivers are populated by aquatic invertebrates from the orders Ephemeroptera, Plecoptera, and Trichoptera often referred to as EPT. However, tidal streams have metacommunities that include freshwater EPT from upstream and marine invertebrates from downstream. We quantified the composition of invertebrates in tidal streams to see how assemblages change across a salinity gradient, from 2596.77 uS/cm to 20270.5 uS/cm. We deployed leaf packs in three tidal streams (Pajaro, Aptos, Baldwin) to sample aquatic and marine invertebrates.

Comparing low salinity rivers to high salinity rivers, we observed that the high salinity rivers have less EPT and New Zealand mudsnails. We also observed that high salinity rivers have an increased number of non-EPT invertebrates, including Amphipoda and Isopoda. Biologically, this means as salinity increases, we see a decrease in EPT composition. It is expected that many coastal freshwater rivers will experience salinity intrusion resulting from sea-level rise. It is likely that aquatic invertebrate metacommunities will indicate diminishing biological health with increasing tidal influence.

This year's Cal-SFS conference was my first scientific conference. It was a great experience for me to interact with and learn from a community of passionate freshwater scientists. While the conference was virtual, I still shared my project results to a wide virtual audience, receiving commentary and gaining valuable insight. I would like to thank everyone who provided feedback on my poster and those that made the Cal-SFS conference possible.

Name: Morgan A. Clark
Contact:
m.morganclark@gmail.com
website: morganaclark.org
twitter: @morganichemistry
Affiliation: Research Associate, Anderson Lab, University of California, Riverside **Title:** Intersex condition of largemouth bass (*Micropterus salmoides*) in an effluent dominated river

Summary: The intersex condition of freshwater fishes in effluent waterways across the United States has been widely documented. Studying how human waste products such as estrogenically active compounds (EAC) affect freshwater species may inform water management decisions. However, limited research has been focused on intersex condition in fishes in the effluent-dominated urban headwaters of the Santa Ana River in Southern California.

In this study, we examined the effect of wastewater on the intersex condition of invasive largemouth bass (*Micropterus salmoides*) in this waterway. We first quantified the intersex condition of largemouth bass along a spatial gradient below the two major wastewater outflows in the Santa Ana River. We then used a linear model to analyze the relationship between distance from wastewater outflow sites and the proportion of intersex largemouth bass. River reaches closest to wastewater outflow sites contained more intersex largemouth bass, and distance from wastewater outflow site was significantly correlated with proportion of intersex largemouth bass. This suggests that the relationship between distance from wastewater outflow site and proportion of intersex largemouth bass may be related to estrogenically active compounds (EAC) in wastewater. To elucidate the factors behind this relationship, future research will include increased sampling for largemouth bass to increase sample size, water sampling for EACs, in situ measurement of EAC in invasive and native fish tissues, and assays that measure EAC across trophic levels.

Presenting this research at the CABW / Cal-SFS virtual meeting allowed me to discuss my findings with other researchers and freshwater stakeholders while also sharing how I used this research in my classroom as a high school science educator. This was my first time presenting at a CABW / CAl-SFS meeting, and I was thankful I got to ask and answer insightful questions in the virtual setting. I look forward to attending future meetings and sharing my next research findings!

Don't forget that your annual $10 membership to Cal-SFS provides student research and presentation opportunities. Want to provide more support? You can donate directly to Cal-SFS through our chapter treasury VENMO (@CalSFS-John-Olson) or email our treasurer to send a check (joolson@csumb.edu).

Second Place Poster Award

Name: Melissa von Mayrhauser **Affiliation:** PhD student, UC Berkeley, Ruhi and Grantham Labs **Contact:** Twitter: @melissavonmay

Poster Title: From Stoneflies to Spiders: Integrating Aquatic and Terrestrial Invertebrate Monitoring to Understand the Effects of Effluent on Stream Ecosystems in Southern California

Summary: Wastewater effluent has dominated streamflow in many Southern California rivers since the mid-to-late 1900s, but wastewater treatment plant (WTP) operators plan to increase water recycling to fulfill conservation mandates. With reduced effluent discharges, additional reaches of the historically intermittent Los Angeles and Santa Clara Rivers are likely to run dry seasonally, affecting in-stream and riparian ecological communities. Previous California research has focused on aquatic invertebrates in wadeable and perennial streams, focusing less on dry streams or terrestrial invertebrates. In July and September 2021, I collected samples at twelve Santa Clara River and LA River sites, which represented a gradient of hydrologic and riparian conditions upstream and downstream of effluent discharges.

I hypothesize that in habitats of comparable hydroperiod, aquatic invertebrate communities upstream of WTP effluent inputs will be more diverse, more sensitive, and less abundant than at downstream sites, which may be exposed to increased flows, temperature, and nutrients. Terrestrial invertebrates upstream of effluent inputs will be more diverse, less sensitive, and less abundant because they need to resist harsher conditions. In upcoming field seasons, I will replicate this study design, quantifying how effluent discharge changes affect the composition and structure of invertebrate communities. This study will inform decision-making around how effluent can be a tool to restore ecosystem health and improve human well-being.

The poster session was a wonderful opportunity to discuss research ideas with a range of CABW/Cal-SFS participants. I appreciated the chance to learn about other participants' insights and answer their questions, which gave me helpful food for thought as I continue on with my PhD research.

Third Place - Poster Award

Name: Joseph Curti **Affiliation:** Ph.D. Student, Wayne and Shaffer Labs, University of California, Los Angeles (UCLA)
Contact: Website is josephcurti.com, IG is @nikkocurti, Email is jcurti3@g.ucla.edu
Poster Title: State of the ART: Using artificial refuge traps to control invasive crayfish in southern California streams

Summary: In Southern California, the invasive red swamp crayfish (*Procambarus clarkii*; Girard, 1852) poses a significant threat to native aquatic fauna. Local conservation managers have led eradication efforts since 2010, but little empirical research has been done to improve the efficacy of this work. This month-long study tested the effect of modifications on novel artificial refuge traps (ARTs) that resemble crayfish burrows to remove invasive crayfish. We tested ART diameter, color, and soak time on *P. clarkii* catch effectiveness across 160 traps.

We evaluated catch data by creating multiple candidate generalized linear mixed models predicting *P. clarkii* catches with different modeling parameterizations and *a priori* hypothesized predictor variables. During the study period, ARTs removed a total of 240 red swamp crayfish with no incidental bycatch. Black-colored 5.1-cm-diameter traps removing the greatest amount of the total *P. clarkii* and ARTs with 4-d and 7-d deployment durations had lower catch/unit effort than traps with 1-d and 2-d deployments.This study demonstrates that ARTs can be a valuable tool for conservation managers interested in restoring streams through invasive crayfish removal, especially where there are sensitive biological resources and native bycatch would otherwise pose a significant threat.

This was my first time presenting at Cal-SFS and also presenting at a virtual poster session. The opportunity to meet with managers and freshwater researchers was valuable to me. I am glad to get an opportunity to hear from the intended audience of this paper and get the chance to think about future directions for invasive species management in my work. I'm thankful to the conference organizers for giving me this unique opportunity!

2022 Cal-SFS FELLOWSHIP PROGRAM
Call for applications - Due Feb 20, 2022

Cal-SFS is now accepting applications to second year of their Cal-SFS Fellowship Program! We are looking for students and early career freshwater scientists to serve as Cal-SFS Fellows from March 2022 – March 2023. This Fellowship Program is meant to foster and support the next generation of Cal-SFS members and satisfies several of the Society of Freshwater Science Long Range Planning Committee values and goals, including the promotion and development of students and early career freshwater scientists and practitioners through specific programs and actions. Cal-SFS Fellows will receive many benefits, and the chapter will benefit greatly from investment in the Fellowship program. Please share this notice widely with anyone you think would be interested in applying. We hope that you, or someone you know, will consider applying to the 2021 Cal-SFS Fellowship Program today!

Please refer to full application details on the Cal-SFS website

What do fellows receive?

- Recognition as a 2021 Cal-SFS Fellow
- Mentor opportunity with someone from the California Water Boards of similar research interests or career goals
- Financial assistance where needed. This could include SFS/ Chapter Membership or renewal, SFS Annual Meeting registration, Research tools or software financial support Publication support, OR Workshop enrollment to further career or research skills. Stipend up to $800.

What are fellows required to do during their tenure?

- Participate in the SFS Annual Meeting (Hybrid in May 2022)
- Attend the Free California Water Data Science Symposium (June/July 2022)
- Present a talk, poster, and/or lightning talk at the annual CABW / Cal-SFS Meeting (Oct 11-12, 2022)
- Collaborate on a funded special project w / other fellows
- Submit written contribution to the 2022-2023 winter newsletter
- Contribute and post to Cal-SFS social media as appropriate
- Participate in Cal-SFS meetings during the Fellowship

Who is eligible to be a fellow?

Students currently enrolled in undergraduate, masters, or doctoral programs and will be considered eligible if:

- Student applicant must be enrolled in a water-related academic program that is at an institution physically located within the state of California, or
- Involves aquatic systems located in California but the institution itself is not located in California, or
- Enables the student to conduct research outside of California while residing in California and the student is or has been active in Cal-SFS in the last 5 years

Early Career or Postdoctoral applicants will be considered eligible if:

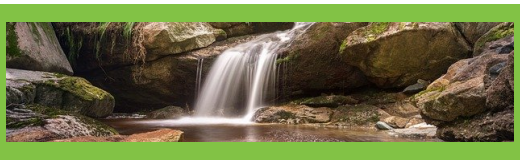
- They are currently within 10 years of graduation from their terminal degree
- If their place of employment or research is physically located within the state of California
- They are working in policy, management, application, or research and development of aquatic systems located in California

How do I Apply?

Send a completed application to Cal-SFS by the application deadline via email to Cal-SFS at cal.chap.sfs@gmail.com
Subject line: "Cal-SFS Fellowship Application – Your FULL NAME" & Attach a PDF file, 1-2 pages in length, use 12 pt. font and 1 inch margins
Name your PDF file: LastName_FirstName_CalSFS_Fellowship_App.pdf.

- For student applicants: Name of Institution, Degree Program, Degree Sought
- For early career or postdoctoral applicants: Name of Employer, Brief work or research description, Years since terminal degree
- First and Last Name, Preferred Pronouns
- List research / career interests in 4-7 keywords or phrases
- 1,000 word statement to emphasize your education, vocation or career goals and how a Cal-SFS fellowship will help you achieve those goals
- 1-2 sentence statement describing your intended involvement at the JASM-SFS Meeting in May 2022 (Ex. Do you plan to present/attend a workshop) OR the Annual Cal-SFS Meeting in October.

Need more information? Contact Cal-SFS Chapter President / Chair, Angela De Palma-Dow (she/her/hers) via email at: Adepalmadow@gmail.com



Want to support Cal-SFS? Want to get involved? There are several options for you!

#1 Join Cal-SFS today!

Renew or Join SFS & Cal-SFS at **https://freshwater-science.org/** and select **"California Chapter"** for $10 to join Cal-SFS. Chapter revenues go directly towards providing student & early career opportunities, support annual meetings and other chapter activities.

#2 Donate directly to Cal-SFS by check or VENMO!

VENMO directly to our treasurer (@CalSFS-John-Olson), or

E mail our treasurer to send a check (joolson@csumb.edu).

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