UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1655 Heindon Road
Arcata, California 95521-4573

February 17, 2022 **Refer to NMFS#:** 10012WCR2022AR00021

Mr. Cade McNamara
County of Humboldt
Planning and Building Department, Planning Division
3015 H Street, Eureka, California 95501

Dear Mr. McNamara,

This letter constitutes NOAA's National Marine Fisheries Service's (NMFS) comments on the Humboldt County's (County) Draft Environmental Impact Report (DEIR) for the proposed Nordic Aquafarms California facility on the Samoa Peninsula in Humboldt County, California.

The Project is located within the jurisdiction of the NMFS West Coast Region California Coastal Office, and requires a U.S. Army Corps of Engineers (Corps) permit. As the lead federal action agency, the Corps must conduct an Endangered Species Act (ESA) Section 7 consultation and a Magnuson-Stevens Fishery Conservation and Management Act (MSA) - Essential Fish Habitat (EFH) consultation with NMFS. For each of these consultations, we will analyze the effects of the water intakes and all of the interrelated activities, including the final consequences of the water withdrawn from Humboldt Bay when it is treated and discharged into the Pacific Ocean. The DEIR and subsequent final EIR are sources of information we will consider when completing consultation with the Corps.

NMFS is the lead federal agency responsible for the stewardship of the nation's offshore living marine resources and their habitats, and implements the ESA, the MSA, and the Marine Mammal Protection Act (MMPA) to fulfill its mission of promoting healthy ecosystems. Federally-managed living marine resources provide an important source of food and recreation for the nation, as well as thousands of jobs and a traditional way of life for many coastal communities, healthy ocean populations and ecosystems. NMFS also plays a central role in developing and implementing policies that enable marine aquaculture and works to ensure that aquaculture complies with existing federal laws and regulations that NOAA implements under its marine stewardship mission.

NOAA's aquaculture goals and objectives as outlined in both the Department of Commerce and NOAA's National Marine Aquaculture policies issued in June 2011, encourage and foster development of sustainable marine aquaculture in the context of NOAA's multiple stewardship missions, and social and economic goals. NOAA recognizes the broad suite of economic, social, and environmental benefits potentially provided by aquaculture, including jobs and business opportunities; meeting the growing demand for seafood; habitat for important commercial, recreational, and endangered and threatened species; species recovery; and cleaner water.

We reviewed the sections of the DEIR that pertain to our trust resources and identified several fundamental issues that require further explanation and revision before we can support the County's conclusions.

Effects to Federally Listed Species

The DEIR does not adequately address effects to federally listed species (Chinook salmon, coho salmon, steelhead, and green sturgeon) and their designated critical habitat. The DEIR suggests that the effects to these federally listed species would be "less than significant" and would not require any further conservation or mitigation measures. More thorough analyses would likely reveal the need for further conservation and mitigation measures to reduce or offset the negative effects of the Project to listed species and designated critical habitats.

Salmonids

The water intakes are proposed to be screened to avoid the entrainment of federally listed species, but as reported in the DEIR, the proposed screens would not be protective of ichthyoplankton, zooplankton, or other small species. The DEIR reports that a number of species will be entrained and killed in the water intakes. The DEIR reports that the species expected to have the highest exposures to entrainment (for example, northern anchovies) are the same species that the DEIR lists as essential prey items for the federally listed salmonid species. The DEIR reports that essential prey species will be entrained, which is an indication that the effects to these species are likely not 'less than significant'. Further evaluation is needed in order to properly offset and mitigate for the reductions in prey and corresponding value of designated critical habitat within Humboldt Bay.

Green Sturgeon

The existing discharge facility is located with designated critical habitat for the Southern Distinct Population Segment (SDPS) of the North American green sturgeon. The DEIR describes some of the Primary Biological Features (PBFs) of SDPS green sturgeon critical habitat (in particular, the Water Quality PBF) but fails to properly evaluate how changes to water quality would affect the quality of the critical habitat. The DEIR states that individual fish move quickly and would avoid the area adjacent to the discharge facility, which the DEIR describes as being the area of toxicity. If individuals are expected to avoid the area of toxicity into the future, those effects and shifts in habitat usage need to be evaluated and further described. Avoidance of habitat in the future likely suggests the changes in water quality are significant.

Effects to Essential Fish Habitat

EFH has been designated in the project area by the Pacific Fishery Management Council (PFMC) for four Federal Fishery Management Plans or FMP's: Pacific Coast Salmon FMP (PFMC 2016); Coastal Pelagic Species FMP (PFMC 2019a), Pacific Coast Groundfish FMP (PFMC 2019b); and Highly Migratory Species FMP (PFMC 2018). As previously discussed, the water intakes and corresponding reduction in productivity within the bay will have significant adverse effects to the prey resources of essential fish habitat (EFH) within Humboldt Bay. Humboldt Bay is also a Habitat Area of Particular Concern (HAPC) for the Pacific Coast Salmon FMP and the Pacific Coast Groundfish FMP (PFMC 2016, PFMC 2019b). HAPC are described in the regulations as subsets of EFH that are identified based on one or more of the following considerations: the importance of the ecological function provided by the habitat; the extent to which the habitat is sensitive to human-induced environmental degradation; whether, and to what extent, development activities are, or will be stressing the habitat type; and the rarity of the habitat type (50 CFR 600.815(a)(8)). Designated

HAPC are not afforded any additional regulatory protection under MSA; however, federal projects with potential adverse impacts to HAPC are more carefully scrutinized during the consultation process.

NMFS provided EFH Conservation Recommendations to the North Coast Regional Water Quality Control Board on June 2, 2021, in response to their draft National Pollutant Discharge Elimination System permit regarding the proposed discharges into the Pacific Ocean. The concerns and EFH Conservation Recommendations (EFH CR's) expressed in our June 2, 2021 letter (enclosed) have not been fully addressed. We understand that the additional denitrification elements we suggested in our EFH CR -1 are not feasible, but we remain concerned and continue to suggest the EFH CR's we have previously provided should be incorporated.

Offsetting Measures

The reduction in productivity expected to occur, as reported in the DEIR, will likely require the restoration of larger scale processes, or areas of habitat that are not currently available to the species exposed in order to offset the anticipated losses. NMFS recommends that the mitigation proposed be refocused to tidelands restoration actions. Levees, tide gates, and other structures around the bay currently restrict and impede both tidal inundation, and habitat area available to those species that would be most impacted by entrainment into the water intakes. Restoring tidal inundation and access for all species in the bay is likely the most efficient approach to increase productivity by restoring tidal processes and increasing the amount of habitat available. This approach would also help offset some of the potential effects of the outfall.

The proposed mitigation for the water intakes relies on a phased approach that corresponds to the volume of water being diverted. The DEIR suggests that for Phase I (0 - 694 gallons per minute, or gpm), there would be no mitigation proposed. For Phase II (695 - 1,250 gpm) there would be one acre of Spartina removal proposed as mitigation. For Phase III (1,251 – 8,250 gpm), there would be 1,004 wooden creosote pilings removed. NMFS recommends that the phased approach be abandoned, and proceed to the removal of 1,004 pilings (as proposed in Phase III). The removal of these pilings should be planned, permitted, and implemented before any of the water use begins to ensure that there are no temporal delays in accruing benefits as the effects to begin to occur. As previously suggested, refocusing on tidelands restoration work would be most efficient to reconcile both the intake and discharge effects.

Thank you for the opportunity to comment on the DEIR and for your collaboration thus far. Please contact Mr. Matt Goldsworthy at Matt.Goldsworthy@noaa.gov if you have any questions concerning these comments.

Sincerely,

Jeffrey Jahn
South Coast Branch Chief
California Coastal Office

cc: Corianna Flannery, California Department of Fish and Wildlife, Eureka
Cassidy Teufel, California Coastal Commission, San Francisco
L. Kasey Sirkin, U.S. Army Corps of Engineers, Eureka

References

PFMC (Pacific Management Fishery Council). 2016. The Fishery Management Plan for U.S. West Coast Commercial and Recreational Salmon Fisheries off the Coast of Washington, Oregon, and California. PFMC, Portland, OR. As Amended through Amendment 19, March 2016.

PFMC. 2018. The Fishery Management Plan for U.S. West Coast Fisheries for Highly Migratory Species. Portland, OR. As amended through Amendment 5, April 2018.

PFMC. 2019a. Coastal Pelagic Species Fishery Management Plan. Portland, OR. As Amended through Amendment 17, June 2019.

PFMC. 2019b. Pacific Coast Ground Fish Fishery Management Plan For California, Oregon, and Washington Groundfish Fishery. Portland, OR. As Amended through Amendment 28, December 2019.

Enclosure: NMFS' June 2, 2021 EFH Conservation Recommendations to the North Coast Regional Water Quality Control Board re: draft NPDES permit for Nordic Aquafarms California.

ENCLOSURE

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1655 Heindon Road
Arcata, California 95521-4573

June 2, 2021 **Refer to NMFS #:** 10012WCR2021AR00040

Mr. Matthias St. John
North Coast Regional Water Quality Control Board
5550 Skylane Blvd. Suite A
Santa Rosa, California 95403

Re: Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Recommendations for the North Coast Regional Water Quality Control Board regarding NPDES Permit for Nordic Aquafarms California, LLC

Dear Mr. St. John,

This letter communicates the National Marine Fisheries Service's (NMFS) essential fish habitat (EFH) conservation recommendations regarding the North Coast Regional Water Quality Control Board's (NCRWQCB) approval and permitting of the discharge of effluents into the Pacific Ocean associated with Nordic Aquafarms California, LLC's land-based aquaculture facility in Samoa, California. NMFS is the lead federal agency responsible for the stewardship of the nation's offshore living marine resources and their habitats, and implements the Endangered Species Act and the Magnuson Stevens Fishery Conservation and Management Act (MSA) to fulfill its mission of promoting healthy ecosystems. Federally-managed living marine resources provide an important source of food and recreation for the nation, as well as thousands of jobs and a traditional way of life for many coastal communities. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the associated physical, chemical, and biological properties that are used by fish (50 CFR 600.10). EFH has been designated in the area by the Pacific Fishery Management Council (PFMC) for four Federal Fishery Management Plans or FMP's: Pacific Coast Salmon FMP (PFMC 2016); Pacific Coast Groundfish FMP (PFMC 2019b); Coastal Pelagic Species FMP (PFMC 2019a); and Highly Migratory Species FMP (PFMC 2018).

NMFS is concerned that the discharge of 12.5 million gallons per day (MGD) into the Pacific Ocean will cause significant adverse effects to EFH, that include the following: the increase in temperatures of up to 4 degrees Celsius represents a significant change in local water temperatures that would likely disrupt the natural species composition in the area, favoring warmer water species; the NCRWQCB assumes in the National Pollutant Discharge Elimination System (NPDES) permitting that Humboldt Bay is enclosed and receives no ocean water, which is largely incorrect and the effluent would likely enter and affect water quality within Humboldt Bay during certain conditions; the perennial discharges of nutrients will support increases in the local population of algae species and likely contribute to increased frequency of future harmful algal blooms and corresponding toxins and depressed dissolved oxygen conditions. Per Section

305(b) of the (MSA), NMFS is required to provide conservation recommendations to avoid, minimize, mitigate or otherwise offset adverse effects to EFH.

Harmful Algal Blooms

NMFS is concerned that the draft permit does not require receiving water monitoring, particularly for nutrient related impacts to algal populations and to establish the distribution patterns of the effluent plume (e.g. does it consistently move in one direction and dilute or do local currents cause it to be retained in the area where concentrations can build up and potentially cause harmful algal blooms (HABs) to develop for prolonged periods, does it enter Humboldt Bay where it could affect wildlife and other aquaculture operations, etc.). NMFS looked for this information in the California Environmental Quality Act (CEQA) related documents available on-line for the project and for information generated for the outfall's historic use for a large sawmill discharge, but could not readily locate useful information.

The lack of receiving water monitoring in the proposed permit seems to be based on an antiquated notion that the discharge of nutrients, particularly nitrogen, do not have potentially negative consequences to ocean waters even at localized scales and that only large scale events such as upwelling can cause related impacts such as HABs. This is the conclusion of the accessible CEQA related documentation available that you have likely reviewed (GHD 2021). However, the potential impacts, explained below, have been recognized and are being addressed by the other Regional Water Quality Control Boards that regulate facilities with ocean discharges in California. The North Coast Board should do the same.

Nitrogen is the primary nutrient limiting phytoplankton production in coastal waters (Booth 2015, Howard et al. 2014) and additions of nitrogen cause phytoplankton production to increase, potentially reaching levels so high that they become HABs. HABs off the California coast are most commonly composed of diatoms or dinoflagellates, or a combination of several of these species and the zooplankton which graze upon them (Smith et al., 2018, Trainer et al. 2010). There are many known species in the California Current which may develop into HAB levels, but the most prevalent seem to be two diatoms, *Pseudo-nitzschia australis* and *P. multiseries,* and dinoflagellates of the *Alexandrium tamarense* complex (*A. catenella* being most prominent), *Akashiwo saguinea* and/or *Lingulodinium polyedrum. Pseudo-nitzschia autralis* and *P. multiseries* (P. spp. when referenced together) produce domoic acid which is responsible for well documented toxic events to marine mammals and birds and amnesiac shellfish poisoning in humans. *L. polyedrum* produces a yessotoxin, a large family of toxins whose presence have been linked to impacts on various invertebrate species (De Wit et. al 2014). The *A. tamarense* complex can produce saxitoxin, which is responsible for paralytic shellfish poisoning and fish kill determinations (Backer and Miller 2016, Gosselin et al. 1989, Kudela et al. 2010, Lefebvre et al. 2004, Trainer et al. 2010). Domoic acid and saxitoxins are responsible for the shellfish consumption warnings frequently posted in coastal counties including Humboldt county.

HAB occurrences appear to be increasing in frequency, duration, size, and severity throughout the California Current system and the world in the last 10-15 years (Booth 2015, Howard et al. 2012, Nezlin et al. 2012). Anderson et. al. (2012) notes that there are multiple reasons for this increasing bloom trend – natural dispersion of algal species, dispersal via human activities such

as ballast water, improved detection of HABs and their toxins, increased aquaculture operations, stimulation due to cultural eutrophication and climate change.

The impacts of nutrient inputs from outfalls have been noted and subject to increased study for some time in the Southern California Bight (SCB). There is a compelling weight of evidence that nutrients are affecting algal dynamics in the SCB with chronic HAB outbreaks in areas that receive anthropogenic nutrient inputs (Booth 2015, Howard et al. 2014, 2012). Nitrogen inputs from anthropogenic sources can be significant compared to nitrogen inputs from upwelling at the spatial scales relevant to the formation of HABs (Booth 2015, Pondella et al. 2016, Howard et al. 2017).

Nezlin et al. (2012) found that all four examined wastewater treatment plants (WWTPs) in the SCB had "hot spots" of high offshore chlorophyll- α (CHL- α), which is indicative of high phytoplankton production, and that these conditions occurred throughout most of the year (i.e. outside of the upwelling season). In the SCB, where the WWTPs discharge at deeper depths and generally further offshore, these subsurface populations of *P. spp.* can then be uplifted into the surface waters and are a probable explanation for the occurrence of "instant" domoic acid events immediately following upwelling rather than a typical delayed bloom development (Smith et al. 2018, Seegers et al. 2015).

The proposed discharge will supply nutrients year round into the photic zone outside of Humboldt Bay. The discharge may have the effect of fertilizing or kick-starting HABs by sustaining or even increasing the duration or population size of HAB species at the surface or in subsurface water "lenses" associated with the effluent plume during periods of stratification (Cochlan et al. 2008, Kudela et al. 2010, Nezlin et al. 2012, Seeyave et al. 2009, Seegers et al. 2015, Trainer et al. 2007) and by providing nitrogen to the upper water column. In the shallow receiving waters of this project, which are always in the photic zone, populations of HABs brought into the near shore area by upwelling or from Humboldt Bay could become entrenched by the year round availability of nitrogen and establish a year round presence. Monitoring of the receiving water is necessary to determine if this happens and to inform corrective actions that result from it.

There are several sources which summarize numerous studies and conclude that reduced forms of nitrogen (ammonium, urea) significantly shift the phytoplankton community toward the development of HABs (Booth 2015, Howard et al. 2012, Reifel et al. 2013, Seegers et al. 2015). Schnetzer et al. (2007) cites several studies that examined *P-spp.* and noted that their effective toxicity can be highly variable. These diatom species seem to produce higher levels of domoic acid when under silica or phosphate stress (i.e. the N:P and/or N:Si ratios are higher than or altered from natural conditions) (Schnetzer et al. 2013, Anderson et al. 2006). The discharge of large amounts of nitrogen could have the effect of unbalancing these ratios at the local level. Urea has been found to produce especially high domoic acid concentrations in *P. autralis* (Howard et al. 2007).

Due to a lack of monitoring in the discharge area, we do not know the algal species composition in the project area although the California Department of Public Health (CDPH) has frequently prohibited shellfish harvesting due to the presence of domoic acid and saxitoxins (see their Toxic

Phytoplankton Observations Map website for access to data layers). As noted previously, *P. spp.* are domoic acid producing diatoms, with *P. autralis* being the most frequently noted HAB species in the SCB and Monterey areas. Domoic acid is a water soluble neutrotoxin that accumulates in shellfish and planktivorous fish such as anchovy and sardine (Smith et al. 2018, Lefebvre et al. 2012).

As mentioned previously, *L. polyedrum* is another dinoflagellate that is frequently associated with red tide events in the California Current (Trainer et al. 2010) and blooms can occur outside of the upwelling season (Kudela et al. 2010). It can produce yessotoxins and this large family of toxins has been identified as the major causative agent in the largest invertebrate mass mortality event recorded in coastal Northern California, in Sonoma County in 2001, which impacted red abalone, sea urchins and crab species from Bodega Bay to Anchor Bay (De Wit et. al 2014). Similar to all dense HABs, its effect to EFH likely comes from impacts to dissolved oxygen levels at the scale of the algal bloom resulting in fish kills (Anderson et al. 2012, Backer and Miller 2016, Trainer et al. 2010) and presumably impacts to other species which cannot escape the HAB area. Algal masses are known to rapidly deplete available dissolved oxygen in the water column due to high respiration by the algae or increased respiration by bacteria during algal decay and this decrease can potentially be to hypoxic levels for periods of time (Backer and Miller 2016, Booth et al. 2015). HAB biomass is believed to be contributing to the overall decline of dissolved oxygen levels in coastal waters (Booth et al. 2015, Capone et al. 2013, McLaughlin et al. 2017).

The *P. spp.* are also known to flocculate and form masses large enough to sink to the ocean floor, carrying domoic acid with them which may be ingested by benthic species spreading the toxin within the benthic food web (Smith et al. 2021, 2018, Schnetzer et al. 2013, Trainer et al. 2010). Rapid transport is likely due to subduction by eddies (Kessouri et al. 2020) and can lead to benthic hot spots. The SCB 2018 Regional Marine Monitoring Program found widespread domoic acid contamination in the sediments of the SCB (Smith et al. 2021). In all, the toxin was detected in 54% of the SCB shelf habitats sampled and was more prevalent in coastal areas with nutrient enriched discharges such as those proposed as part of the permitted project. Domoic acid concentrations in the sediments ranged from 0.57 to 168.0 ng/g sediment over two years of sampling. Marine worms were found to have high levels of contamination compared to other benthic infauna, indicating that this reservoir of domoic acid poses a risk for transfer into the food web including fish species managed under the MSA and marine mammals listed under the ESA.

In addition to requiring receiving water monitoring for nutrient related impacts such as phytoplankton concentrations and typing, NMFS also requests that the discharger use the intervening time before operation to establish baseline information for the discharge area by monitoring plankton populations and HAB related toxins in the receiving water and sediments in the discharge area, conducting the baseline biological survey required in the draft NPDES permit, and establish seasonal current information in the discharge area so that seasonal patterns of plume distribution are established to inform future study needs and decision making. If information exists for any of these items associated with the previous facility's use of the outfall, the Water Board should make this information available for consideration in the permitting and study design process.

Essential Fish Habitat Conservation Recommendations

NMFS believes that the proposed discharge will cause significant adverse effects to EFH for all FMP's occurring off the coast of California (Pacific Coast Salmon, Pacific Coast Groundfish, Coastal Pelagic Species, and Highly Migratory Species). Implementing these conservation recommendations would protect EFH and fulfill the obligations of Section 305(b) of the MSA.

1. The NCRWQCB should require the Applicant to explore the feasibility of incorporating additional denitrification steps into the effluent treatment process in order to convert remaining ammonia into nitrogen gas, rather than the current proposal of converting much of the ammonia in the near final effluent into nitrate, which is then discharged into the Pacific Ocean.

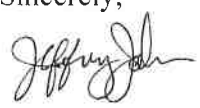
2. The NCRWQCB should direct the Applicant to monitor oceanic conditions to establish baseline information about the receiving water that includes algal species population information and seasonal patterns of currents that will affect the behavior of the discharge plume. This is in addition to the biological monitoring already called for in the draft permit

3. The draft permit should include receiving water monitoring in order to ensure that the discharge is not causing or contributing to HAB's, and if so, provide the NCRWQCB information to revisit the requirements related to the treatment and disposal of effluent.

4. The NCRWQCB should require the Applicant to offset and compensate for the unavoidable effects caused to the local nearshore areas during HAB's, and for the disruption of native fish communities caused by artificially increasing temperature regimes in the nearshore environment. The NCRWQCB should require the Applicant to provide compensatory funding to a tidelands restoration project in Humboldt Bay, such as the City of Eureka's Elk River Estuary Restoration Project, in order to compensate for impacts associated with the effects caused by the discharges.

Please let us know how we can assist the NCRWQCB, as well as fulfill our obligations to provide EFH conservation recommendations to the State as required by the MSA. Please contact Matt Goldsworthy at Matt.Goldsworthy@noaa.gov and Joe Dillon at Joseph.Dillon@noaa.gov.

Sincerely,



Jeffrey Jahn
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Cassidy Teufel, Senior Environmental Specialist. California Coastal Commission

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REFERENCES

Anderson, M.A., A.D. Cembella, and G.M. Hallegraeff. 2012. Progress in understanding harmful algal blooms: Paradigm shifts and new technologies for research, monitoring and management. Ann. Rev. Marine Sci. 4:143-176.

Anderson, C.R., M.A. Brzezinski, L. Washington, and R. Kudela, 2006. Circulation and Environmental Conditions during a toxigenic Pseudo-nitzschia australis bloom in the Santa Barbara Channel, California. Marine Ecology Progress Series 327:119-133.

Backer, L.C. and M. Miller. 2016. Sentinel animals in a one health approach to harmful cyanobacterial and algal blooms. Veterinary Sciences 3(2), 8; doi:10.3390/vetsci30200008

Booth, A. 2015. State of the Bay Report. "Looking Ahead: Nutrients and Hypoxia". Urban Coast 5(1):190-193. Available online: http://urbancoast.org/

Booth, J.A.T., C.B. Woodson, M. Sutula, F. Micheli, S.B. Weisberg, S.J. Bogard, A. Steele, J. Choen, and L.B. Crowder. 2014. Patterns and potential drivers of declining oxygen content along the Southern California coast. Limnology and Oceanography 59(4):1127-1138.

Capone, D.G., and D.A. Hutchins. 2013. Microbial biogeochemistry of coastal upwelling regimes in a changing ocean. Nature Geoscience 6:711-717.

Cochlan, W.P., J. Herndon and R.M. Kudela. 2008. Inorganic and organic nitrogen uptake by the toxigenic diatom Pseudo-nitzschia australis (Bacillariophyceae). Harmful Algae 8:111-118.

De Wit, P., L. Rogers-Bennett, R.M. Kudela, and S.R. Palumbi. 2014. Forensic Genomics as a Novel Tool for Identifying the Causes of Mass Mortality Events. Nature Communications 5:3652, doi:10.1038/ncomms4652

GHD. 2021. Initial Study/Mitigated Negative Declaration. April 23, 2021. Eureka, CA.

Gosselin, S., L. Fortier, and J.A. Gagne. 1989. Vulnerability of Marine Fish Larvae to the Toxic Dinoflagellate Protogonyaulax tamarensis. Marine Ecology Progress Series 57:1-10

Howard, M.D.A., W.P. Cochlan, N. Ladizinsky, and R.M. Kudela. 2007. Nitrogenous preference of toxigenic Pseudo-nitzschia australis (Bacillariophyceae) from field and laboratory Experiments. Harmful Algae 6:206-217.

Howard, M.D.A., A.C. Jones, A. Schnetzer, P.D. Countway, C.R. Tomas, R.M. Kudela, K. Hayashi, P. Chia, and D.A. Caron. 2012. Quantitative real-time polymerase chain reaction for Cochlodinium fulvescens (Dinophyceae), a harmful dinoflagellate from California coastal waters. Journal of Phycology 48:384-393.

Howard, M.D.A., M. Sutula, D.A. Caron, Y. Chao, J.D. Farrar, H. Frenzel, B. Jones, G. Robertson, K. McLaughlin, and A. Sengupta, 2014. Anthropogenic Nutrient Sources Rival Natural Sources on Small Scales in the Coastal Waters of the Southern California Bight. *Limnology and Oceanography* 59(1):285-297

Howard, M.D.A., R.M. Kudela, and K McLaughlin. 2017. New Insights into Impacts of Anthropogenic Nutrients on Urban Ecosystems on the Southern California Coastal Shelf: Introduction and Synthesis. Estuarine, Coastal and Shelf Science v. 186 Part B:163-170. https://doi.org/10.1016/j.ecss.2016.06.028

Kessouri, F., D. Bianchi, L. Renault, J.C. McWilliams, H. Frenzel, and C.A. Deutsch, 2020. Submesoscale currents modulate the seasonal cycle of nutrients and productivity in the California Current System. Global Biogeochemical Cycles, 34, e2020GB006578. https://doi.org/10. 1029/2020GB006578

Kudela, R.M., S. Seeyave, and W.P. Cochlan. 2010. The role of nutrients in regulation and promotion of harmful algal blooms in upwelling systems. Progress in Oceanography 85:122-135.

Lefebvre, K.A., V.L. Trainer, and N.L. Scholz. 2004. Morphological abnormalities and sensorimotor deficits in larval fish exposed to dissolved saxitoxin. Aquatic Toxicology 66:159-170.

Lefebvre, K.A., E.R. Frame, and P.S. Kendrick. 2012. Domoic Acid and Fish Behavior: A Review. Harmful Algae 13:126-130, doi:10.1016/j.hal.2011.09.011

McLaughlin, K., N.P. Nezlin, M.D.A. Howard, C.D.A Beck, R.M. Kudela, M.J. Mengel, and G.L. Robertson. 2017. Rapid nitrification of wastewater ammonium near coastal ocean outfalls, Southern California, USA. Estuarine, Coastal and Shelf Science 186 Part B:263-275.

Nezlin, N.P., M.A. Sutula, R.P. Stumpf and A. Sengupta. 2012. Phytoplankton Blooms Detected by SeaWiFS along the Central and Southern California Coast. J. of Geophysical Research 117, C07004, doi:10.1029/2011JC007773.

PFMC (Pacific Management Fishery Council). 2016. The Fishery Management Plan for U.S. West Coast Commercial and Recreational Salmon Fisheries off the Coast of Washington, Oregon, and California. PFMC, Portland, OR. As Amended through Amendment 19, March 2016.

PFMC. 2018. The Fishery Management Plan for U.S. West Coast Fisheries for Highly Migratory Species. Portland, OR. As amended through Amendment 5, April.

PFMC. 2019a. Coastal Pelagic Species Fishery Management Plan. Portland, OR. As Amended through Amendment 17, June.

PFMC. 2019b. Pacific Coast Ground Fish Fishery Management Plan For California, Oregon, and Washington Groundfish Fishery. Portland, OR. As Amended through Amendment 28, December.

Pondella, D., K. Schiff, R. Schaffner, A. Zellmer, and J. Coates, 2016. Southern California Bight 2013 Regional Monitoring Program: Volume II. Rocky Reefs. June 2016. Southern California Coastal Water Research Project Technical Report 932.

Reifel, K.M., A.A. Corcoran, C. Cash, R. Shipe, and B.H. Jones. 2013. Effects of a Surfacing Effluent Plume on a Coastal Phytoplankton Community. Continental Shelf Research 60:38-50.

Schnetzer, A., B.H. Jones, R.A. Schaffner, I. Cetinic, E. Fitzpatrick, P.E. Miller, E.L. Seubert, and D.A. Caron. 2013. Coastal upwelling linked to toxic Pseudo-nitzschia australis blooms in Los Angeles coastal waters, 2005-2007. Journal of Plankton Research 35(5):1080-1092.

Schnetzer, A., P.E. Miller, R.A. Schaffner, B.A. Stauffer, B.H. Jones, S.B. Weisberg, P.M. DiGiacomo, W.M. Berelson, and D.A. Caron. 2007. Blooms of Pseudo-nitzschia and Domoic Acid in the San Pedro Channel and Los Angeles Harbor areas of the Southern California Bight, 2003-2004. Harmful Algae 6:372-387

Seegers, B.N., J.M. Birch, R. Martin III, C.A. Scholin, D.A. Caron, E.L. Seubert, M.D. A. Howard, G.L. Robertson and B.H. Jones, 2015. Subsurface Seeding of Surface Harmful Algal Blooms Observed through the Integration of Autonomous Gliders, moored environmental sample processors, and satellite remote sensing in Southern California. Limnology and Oceanography 60:754-764.

Seeyave, S., T.A. Probyn, G.C. Pitcher, M.I. Lucas, and D.A. Purdie. 2009. Nitrogen nutrition in assemblages dominated by Pseudo-nitzschia spp., Alexandrium catenella and Dinophysis acuminata off the west coast of South Africa. Marine Ecology Progress Series 379:91-107.

Smith, J., D. Shultz, M.D.A. Howard, G. Robertson, V. Phonsiri, V. Renick, D.A. Caron, R. Kudela, and K. McLaughlin. 2021. Southern California Bight 2018 Regional Monitoring Program: Volume VIII. Harmful Algal Blooms. SCCWRP Technical Report 1170. Available at: https://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/1170_B18HABs.pdf

Smith, J., P. Connell, R.H. Evans, A.G. Gellene, M.D.A. Howard, B.H. Jones, S. Kaveggia, L. Palmer, A. Schnetzer, B.N. Seegers, E.L. Seubert, A.O. Tatters, and D. A. Caron, 2018. A decade and a half of *Pseudo-nitzschia spp.* and domoic acid along the coast of southern California. Harmful Algae 79 (2018) 87–104 .

Trainer, V.L., G.C. Pitcher, B. Reguera and T.J. Smayda. 2010. The distribution and impacts of armful algal bloom species in Eastern Boundary upwelling systems. Progress in Oceanography 85:33-52.

Trainer, V.L., W.P. Cochlan, A. Erickson, B.D. Bill, F.H. Cox, J.A. Borchert, and K.A. Lefebvre. 2007. Recent domoic acid closures of shellfish harvest areas in Washington State inland waterways. Harmful Algae 6:449-459.

Vasconcelos, V., J. Azevedo, M. Silca, and V. Ramos, 2010. Effects of marine toxins on the reproduction and early stages development of aquatic organisms. Marine Drugs 8:59-79; doi:10.3390/md8010059.