**Review of Precht et al. 2016: Unprecedented disease-related coral mortality in Southeastern Florida**

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***Declaration of our competing interest***

*Miami Waterkeeper was a co-plaintiff in an Endangered Species Act litigation regarding impacts to coral reefs resulting from the 2013–15 dredging activities at the Port of Miami. This litigation concluded in August 2018. Miami Waterkeeper is a co-plaintiff in another environmental lawsuit regarding dredging at Port Everglades (Ft. Lauderdale, FL). Author R. Silverstein is currently the Executive Director and Waterkeeper of Miami Waterkeeper.*

**Abstract**

We have identified several scientific and ethical issues regarding the manuscript published in *Scientific Reports* in 2016 entitled "Unprecedented disease-related coral mortality in Southeastern Florida" by Precht et al. These issues include: 1) methodological discrepancies that introduce systematic bias into the conclusions, 2) a lack of reproducibility of findings, 3) an omission of almost 80% of available data, 4) a failure to evaluate potential impacts from a massive, nearby dredging project, and 5) a failure to disclose significant competing interests in at least three separate prescribed categories of the *Scientific Reports* disclosure policy. After attempting to re-create the findings reported in Precht et al. 2016 using the raw datasets provided to us by the authors, we were unable to replicate many of the quantitative findings reported in their publication. We found that a lack of transparency in the description of their Methods, *post hoc* changes made to their data, and inconsistently applied methodologies accounted for many of these discrepancies. The paper by Precht *et al.* reports on a devastating (and ongoing) coral disease epidemic that broke out in late 2014 off Miami's coastline. However, in reporting this outbreak of disease, the authors fail to discuss or to consider include potential impacts from the nearby dredging project that severely impacted their monitoring sites with sediment -- including at the location where they contend the disease was first observed. Without providing scientifically valid rationale, the authors selectively publish findings from only 4 of the 26 locations from which they had collected monitoring data under their subcontract with the dredging company, Great Lakes Dredge and Dock (GLDD). The authors also omit certain critical data and dates and provide contradicting explanations as to why their reported Results do not match the dataset provided. Finally, the authors disclose no Competing Interests, in clear violation of multiple categories of the *Scientific Reports* Competing Interest disclosure policy. We do not dispute the fact that the disease occurred or that this disease has now gone on to kill millions of corals over hundreds of miles of the Florida Reef Tract. This issue has drawn widespread public and scientific concern, media attention and state and Federal investment. With such a high profile issue, however, it is critical that the peer-

reviewed literature on this topic is accurate. Taken together, the scientific and ethical issues raised here amount to a systematic bias in the study that cannot be overcome with a simple correction.

## I. Introduction

The paper by Precht *et al.* reports on a devastating coral disease epidemic that broke out in late 2014 off Miami's coastline and which, over the following years, has spread over a 130 km section of the Florida reef tract. The disease, now known as Stony Coral Tissue Loss Disease (SCTLD, see www.FloridaKeys.NOAA.gov) but referred to as "White Plague" disease in Precht et al., is also now in locations around the Caribbean. This paper describes the incidence, etiology, and epidemiology of the disease, and suggests that the disease is "water-borne, infectious, and highly contagious". However, as described in detail below, the study by Precht et al. suffers from: 1) methodological issues that introduce systematic bias, 2) irreproducible findings, 3) an omission of almost 80% of available data, 4) a failure to discuss or consider the potential relationship between the disease and a massive, nearby dredging project, and 5) a failure to disclose significant competing interests in relation to the dredging project in three separate prescribed categories of the *Scientific Reports* disclosure policy.

Precht et al. 2016 includes observations of coral condition collected by Dial Cordy and Associates ("DCA" or "Dial Cordy"), an environmental monitoring consultancy, as a part of FDEP permit-mandated compliance monitoring of the Port of Miami expansion, which involved a large-scale dredging project offshore from October 2013 through March 2015. With the exception of R. van Woesik, all authors of Precht et al. 2016 were employed by Dial Cordy, which was subcontracted by the dredging company (Great Lakes Dredge and Dock; GLDD), the U.S. Army Corps of Engineers, and the Port of Miami at various times during the data collection and/or analysis and publication phases. Observations reported in Precht et al. span the entire course of the active dredging, ending a few months after dredging concluded offshore in July 2015. DCA collected data including both coral condition data (e.g. bleaching, disease, sediment accumulation, sediment burial, total burial, etc.) and habitat impact data (e.g. sediment accumulation in traps, percent sediment cover of hardbottom, etc.). Compliance monitoring reports, produced by Dial Cordy for FDEP, include the tagged coral data published in Precht et al., as well as a wider collection of data collected and analyzed by the authors (See https://jrcunning.github.io/pom-dredge/scirep/scirep_analysis.html and the data analyzed in Cunning et al. 2019).

In an effort to reanalyze the data collected by DCA during the dredging project, we obtained DCA's compliance monitoring raw datasheets via public records requests from the Florida Department of Environmental Protection (FDEP) under FDEP Permit No. 0305721-001-BI. Our goal was to reanalyze the full scope of the data collected during the dredging project in an effort to understand its impacts to the area's reefs -- and to distinguish the impact of dredging from regional disease mortality. We began by trying to recreate the findings published in Precht et al.

2016 from this publicly available dataset, but we quickly found that hardly any of the findings or figures matched the results that we obtained from the data provided to FDEP by DCA under the monitoring contract. We then requested the raw data used specifically for this publication from corresponding author Bill Precht. It was provided to us on March 8, 2018. As described in detail in the Methods and Results sections below, we found that not only were the datasets provided to us by the authors different from the data that they provided to FDEP, but that we *still* could not recreate most of the published findings from the data provided. We then engaged in correspondence with the authors (all correspondence available at https://jrcunning.github.io/pom-dredge/scirep/scirep_analysis.html). We found that the authors still could not provide scientifically-sound rationale for many of the discrepancies that we identified. We found this to be problematic. These methodological issues -- combined with a failure to disclose clear competing interests that may have influenced the authors' analytical decision-making -- compelled us to bring these issues to the attention of the editors of *Scientific Reports*. Our review of this publication and our findings are described in detail below and are enumerated line by line at https://jrcunning.github.io/pom-dredge/scirep/scirep_analysis.html, as well as described below.

While we in no way dispute that the disease occurred or that this disease has now gone on to kill millions of corals over hundreds of miles of the Florida Reef Tract, this issue has drawn widespread public and scientific concern, state and federal funding, media attention[1],[2], and letters from United States Senators. With such a high profile issue, it is all-the-more critical that the peer-reviewed literature on this topic is accurate.

## II. Methods

Precht et al. 2016 includes observations of coral condition from both timed swims and tagged corals. The tagged coral data are the focus of our analysis, as they were collected as a part of a FDEP permit-mandated compliance monitoring connected to the Port of Miami expansion project, which involved a large-scale dredging project offshore from October 2013 through March 2015. Observations reported in Precht et al. span the entire course of the active dredging, ending a few months after dredging concluded in July 2015.

DCA's compliance monitoring was triggered whenever dredging activity was within 750m of the channel-side monitoring locations. There were a total of 26 tagged coral monitoring locations located north and south of the shipping channel and sites near the channel (within 30 m) and further from the channel in what was originally designed as paired "control" sites (ranging from ~1300m to the south, to ~8000m to the north; see Figure 1).

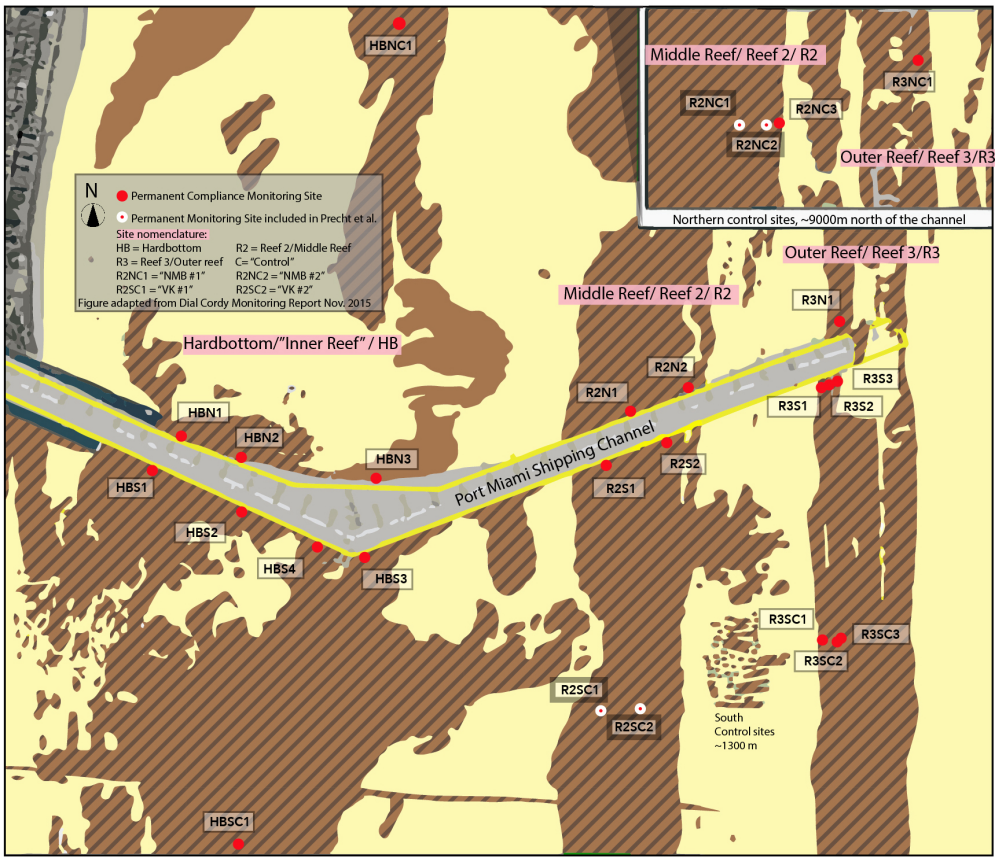


*Figure 1. Tagged-coral site map of monitoring conducted by Dial Cordy and Associates. Sites in white show the only locations from which data was included in Precht et al. 2016.*

Reef areas monitored included hardbottom areas (closest inshore, "inner reef"), the middle reef, and the outer reef areas (together these reefs comprise the "Florida Reef Tract" in this area; the names of these reefs are more accurately described as "nearshore ridge", "inner reef", and "outer reef", respectively, but for the purposes of this review, we use the Precht et al. nomenclature). Precht et al. only report data from 2 sites on the northern middle reef and 2 sites on the southern middle reef, which represent only 4 of the 26 permanent monitoring stations for which these authors had tagged coral data. The sites used in this study were designed in the permitted monitoring scheme to represent paired controls to the channel-side sites. However, because the impacts of the dredging stretched farther than expected, DCA collected data showing that these sites located 1.25 - 2.5 km from the channel are not true controls because they were also impacted by the dredging plumes and sedimentation. (See Figures 2, 3 and 4 below and Cunning et al. 2019). Precht et al. does not include data from any outer reef or inner reef sites, or from any sites directly adjacent to the shipping channel where dredging was occurring. Precht et al. does not mention the existence of additional tagged coral data, nor do they include the physical data that they also collected as part of their compliance monitoring, which includes sediment accumulation data and sediment cover on benthos data (see DCA reports and Cunning et al. 2019 for this analysis).

We did not independently verify DCA data entry from underwater field datasheets, or compare their data to photographs or videos taken of corals during monitoring. We felt that this would inject layers of subjectivity into our analysis, and our intent was to attempt to replicate the data reported in Precht et al. from the datasets that the authors themselves had provided. We also did not independently verify DCA data entry from field sheets or compare their data to photographs or videos taken of corals during monitoring. We did, however, correct instances of data entry error (e.g., dates and species identifications) when such errors were apparent from context, and these modifications were also made using R code for transparency and reproducibility. For full transparency and reproducibility, we have posted the R code we used in each attempt to reproduce Precht et al.'s reported results, along with our associated R outputs in the form of figures and/or tables at https://jrcunning.github.io/pom-dredge/scirep/scirep_analysis.html.

An additional summary spreadsheet (Copy of R2_Ctrls_PCWK4_Verify.xlsx) indicating which corals were assumed to have died from disease *post-hoc* (but were not listed as such in the initial dataset provided) was subsequently provided to us on April 4, 2018 by Mr. Precht. We imported these datasets into R and then proceeded to attempt to replicate results presented in Precht et al. (2016) *Scientific Reports*, (doi:10.1038/srep31374) using the dataset provided to us by the authors upon request on March 8, 2018 (POM_R2_ControlData_Baseline_Post_construction.xlsx). After importing the data provided by authors, we proceeded line by line through Precht et al.'s 'Tagged-coral colonies' Results section, with block quotes taken directly from their paper, followed by our attempt to reproduce results reported in Precht. et al. 2016.

## III. Results

### (1) Inability to Reproduce the Findings Reported in Precht et al. 2016

A line-by-line review of the Results section of Precht et al. along with datasheets and R code is available at https://jrcunning.github.io/pom-dredge/scirep/scirep_analysis.html. A few key findings from our review include the following:

*Precht et al., Page 2 states*: *"All colonies that showed signs of disease died, regardless of species."*

The dataset provided by the authors shows that 15/28 coral colonies recorded with WP ("white plague", the authors' code for coral disease infection) were still alive on July 15, 2015 -- the end of the data collection for this study. Thirteen of the 28 corals were dead. The data therefore reflect a coral mortality rate of 46% after WP infection by the end of the data period of this study and do not support the reported finding that 100% mortality following disease infection.

*Precht et al., Page 2 states, "The first sign of a white-plague disease outbreak (prevalence > 5%) was noticed at the southern monitoring sites, near Virginia Key, on September 26, 2014." (Precht et al. defines an "outbreak" as a prevalence of >5%.)*

Using the data provided by Precht et al., we find that the prevalence of white plague disease ("WP") on Sept. 26, 2014 was only 4% (1/25 of the corals at the site monitored that day). In response to our inquiry regarding this discrepancy, the Precht et al. authors responded, "This was a typo and was not caught in the galley stage. The original statement should have read "< 5%" not "> 5%.'" (see Response to Rachel Silverstein - Part 2 (WFP & BEG 4.20.18).pdf page 2)

This explanation, however, makes little logical sense. Why would the authors report in their Results the "first sign of a white-plague disease outbreak" on a date and site where their threshold for an outbreak had not been met? Further, if this is a "typographical error", it would fundamentally change the conclusions of the paper, the findings stated in the abstract, and the contagion-based model presented.

But the Precht et al. authors then attempt to support the original statement in their paper by pointing to 1) off-transect, untagged corals that were observed informally without mention in the Methods, and 2) multiple colonies at the southern monitoring sites for which WP condition codes were applied retroactively and which are not annotated as such in the dataset. The authors state in their response, "On November 12, 2014 I dove the R2SC sites with the DCA team. Because it appeared that there were more many more corals off our transect lines with WPD-like signs, I performed a 60 min timed-swim survey due south..." (Page 5). A 60 minute, timed swim performed during another dive is not sufficient evidence to conclude that a disease outbreak started "to the south" of a particular location, particularly as this is not described in the Methods. For Precht et al. authors' full response to our inquiry about this issue, see Response to Rachel Silverstein - Part 2 (WFP & BEG 4.20.18).pdf.)

It is still unclear whether the authors intended the original statement as written, or if it is a typo. Either way, the conclusions are unsupported by the data provided.

*Precht et al. states, "The highest recorded prevalence of white-plague disease occurred on July 7, 2015, when 40% (22 of 55 corals surveyed that day) showed signs of white-plague disease infection." (Precht et al, Page 2).*

Using the Precht et al. dataset, we find that only 5.5% of corals observed on July 7, 2015 were recorded as diseased ("WP"). This finding conflicts with the statement that 40% of colonies observed on that day "showed signs of white-plague disease infection."

We subsequently determined that, contrary to what is stated in the Methods, the methodology actually employed by the authors: (1) includes previously diseased corals that are now dead, (2) assumes that dead corals died from disease without ever directly observing disease, and (3) adds together disease prevalence across a long time period but reports it as if it occurred on a specific

day. These undisclosed methods skew the reported findings toward a higher apparent disease prevalence, as described in detail below:

(1) *Inclusion of already-dead corals in disease prevalence results*: We determined, and the authors confirmed, that the disease prevalence data reported in this study actually included more than just actively diseased corals observed on a given date. Rather, their reported disease prevalence data represent the sum total of corals observed with active disease on a particular day ("WP") and corals observed with active disease previously but by then had died ("WPdead"). (see: Response to Sci Rep questions from RS.pdf)

(2) *Inclusion of dead corals never observed with disease in disease prevalence results*: In an April 20th email, the authors additionally confirmed that their disease prevalence totals also included corals never observed with disease but that were found dead. The authors *post-hoc* assumed that these corals died from disease, stating " ...mortality that is "unidentified" is likely related to the white-plague disease epidemic." (Page 1). The assumption that disease caused coral mortality without direct observation may be reasonable in other locations (if made transparent to readers and appropriately defined), but in this case, there is another plausible explanation for sudden death of adult corals in the region: burial in sediment from the nearby dredging project. This possibility is not discussed, as described below.

(3) *Inclusion of disease prevalence over a long time period*: Although the authors clearly report their disease prevalence results as the number corals surveyed *on a specific date* "infected with white plague" or "show[ing] outward signs of white plague", the actual reported Results represent a large range of dates that also include long-dead corals as well as corals with active disease. In their response to us (September 5, 2018), the authors attempt to explain this discrepancy by saying their Methods describing disease prevalence as disease observed "at a given time", actually means during "a certain time period." However, this explanation is belied by their listing of Results on specific date in time – and the plain text of their Methods and Results. This is clearly misleading for readers, and is the equivalent of saying that "10 million people in the United States were 'showing signs of measles' on November 1, 2019", but not disclosing that it is including all measles cases ever recorded in the United States back to 1900.

The Results reported here are therefore irreproducible based on the Methods described and the data provided. The actual methods used by the authors systematically overinflate the apparent disease prevalence.

*Precht et al., Page 2 states, "The majority (81%) of white-plague susceptible corals bleached, prior to becoming infected with the disease (Table 1)."*

When initially describing "bleaching" prevalence in the Results section, Precht et al. combines the field-recorded condition codes in their raw datasheets of "paling", "partial bleaching" and "bleaching" to report an 84% bleaching prevalence on September 24, 2014 (Precht et al., page 2 and confirmed by authors in correspondence). However, if we apply the same methodology to define "bleaching" in the above statement, then 100% of colonies of these species should be recorded as "bleached", "partially bleached", or "pale" before being infected. We are therefore unable to determine how the authors are calculating a bleaching prevalence of 81%. The only assumption we can make is that the authors used a different definition of bleaching in this subsequent analysis that is not described in the Methods.

***(2) Data Errors Left Uncorrected***

Out of 115 tagged corals that were repeatedly sampled over time, 23 (20%) have multiple species IDs associated with them across different points in time, indicative of some (unidentifiable) error in data entry (see: precht_spp_conflicts.txt). While it is possible to reconstruct the correct species IDs from the dataset as the corals were tagged, we do have concerns that these errors in the dataset may have impacted final calculations reported, and that other errors may have been left uncorrected in the authors' final dataset that are not immediately apparent to us. In our present analysis, we attempt to fix these conflicting species assignments by changing species assignments for each coral (defined as unique site-transect-coralID) to the most frequently assigned species for that tagged individual. These and other data errors can be found enumerated at: https://jrcunning.github.io/pom-dredge/scirep/scirep_analysis.html**.**

***(3) Omission of key data and dates***

This study only uses 4 out of 26 sites where tagged corals were monitored by DCA for environmental compliance. This means that over 80% of the data available to the authors were not utilized in this study, which attempts to pinpoint the exact location of a major disease outbreak. The authors seemingly place more confidence in determining the exact location of the outbreak based on off-transect swims than in analyzing data for which they repeatedly tracked the same corals over a 15-month period (see Response to Rachel Silverstein - Part 2 (WFP & BEG 4.20.18).pdf).

The authors also do not mention the existence of more data or explain why it was not included. In our correspondence, the explanations offered do little to improve our understanding of why these dates and locations, which could have provided and improved resolution for their epidemiological model, were omitted. For one example, the authors state that they omitted all of the outer reef data for tagged corals because they did not have timed-swim data from the outer reef (see Response to Rachel Silverstein -- Part 2 (WFP & BEG 4.20.18).pdf, page 1). Considering, however, that the timed swim data is never analyzed alongside the tagged coral data, there is no scientifically valid reason why these data should have been left out of the study.

The authors also chose not to include pertinent data that they collected regarding the impact of corals by sediment and habitat condition, such as sediment accumulation and benthic sediment cover data. These data also show that the "control" locations in this study were influenced by dredging sediment.

Similarly, the authors apparently omitted data from this study on dates there was no paired channel-side data collected (see Response to Rachel Silverstein -- Part 2 (WFP & BEG 4.20.18).pdf, page 5). However, the channel-sides are not included in this study at all, and therefore there is no scientifically valid reason why these data should not be included and analyzed. At times, omission of these key dates fundamentally change the reported findings. For example, Precht et al. report, "In total, white-plague disease was observed on seven of the 13 coral species identified at the four permanent monitoring sites (Table 1)." However, we find that only six species at the four permanent monitoring sites were recorded with WP in the dataset they provided to us. *Colpophyllia natans*, for example, is never recorded as WP in the dataset, although it is reported as one of the species infected in Table 1 of their paper. DCA's photographs provided by FDEP do show that the single tagged *C. natans* colony was indeed diseased on Dec. 12, 2014, but that date is not in the dataset used for this manuscript. Based on their inclusion of this species as "diseased", the authors clearly did rely on this "extra" data to create Table 1, but do not include the data from that date in their other analyses. This means that the authors sometimes relied upon data omitted from this manuscript, and sometimes did not. Based on the data provided by the authors, however, Precht et al.'s report of the number of species susceptible to the disease is not reproducible from the dataset provided.

***(5) Failure to Discuss Dredging as a Significant Regional Factor***

In the body of the manuscript, Precht et al. only mentions the nearby dredging to say, "These four sites were originally designed as controls for environmental compliance monitoring associated with the Port Miami deepening project (Fig. 1)." An average reader would not understand from this statement that these corals were heavily influenced by severe and ongoing sedimentation for a period of 15 months (See Miller et al. 2016 and Cunning et al. 2019). Precht et al. does not appropriately consider the possibility that some observed mortality could be dredging-related, nor does it discuss a possible connection between the disease outbreak, regional coral stress, and the dredging. We also found that the Dial Cordy authors had data in their possession, at the time of this publication, evidence clearly showing their sites were impacted by the dredging sediment (see Cunning et al. 2019 and below). But they do not analyze this data, consider it, discuss it, or present it. As dredging activities have been previously implicated in outbreaks of coral disease (*e.g.*, Pollock et al. 2014[3]), testing this hypothesis remains an important goal in describing the origin and dynamics of this disease outbreak.

Our study, Cunning et al. 2019, attempted to understand the impact of the dredging project on area corals and habitat -- separate and apart from disease mortality. We reanalyzed Dial Cordy's compliance monitoring dataset provided to FDEP that includes data from all 26 monitoring sites.

In addition to these data collected at permanent monitoring sites, DCA had also collected data at a range of distances from the edge of the channel out to several hundred meters away (Fig. 1) at various timepoints before (Dial Cordy and Associates, 2012) and ~2 years after dredging (Dial Cordy and Associates, 2017). The metrics collected at these non-permanent sites included the density of corals (recorded both before and after dredging) and the depth of sediment (only recorded ~2 years after dredging). Our analyses focused on DCA's sediment trap accumulation, benthic sediment cover, and tagged coral condition data, as well as correlations among these measured impacts.

It is clear from our analysis of DCA's data that the monitoring sites located at intermediate distances from the channel (1.25-2.5 km), which includes the southern "middle" reef sites where where Precht et al. places the start of the disease outbreak, suffered significant sedimentation impacts from dredging. The benthos there became covered in sediment during dredging, increasing from 11.2% sediment cover to a peak of 58.1% sediment cover during the time period analyzed by Precht et al. (See Figure 2). Dial Cordy's monitoring data also documented that same site experienced twice the amount of fine sediment accumulation compared to the northern middle (inner) reef site located >9km away. (See Figure 3. Fine sediment is more likely to be dredging-derived than coarse sediment.)

Precht et al.'s purported "ground zero" for the disease outbreak was clearly being influenced by dredging sediment (see also Swart 2016), it is not a true "control" location. It is therefore even more imperative that other scientists have the opportunity to explore alternative hypotheses about any possible impact of dredging on the disease outbreak.

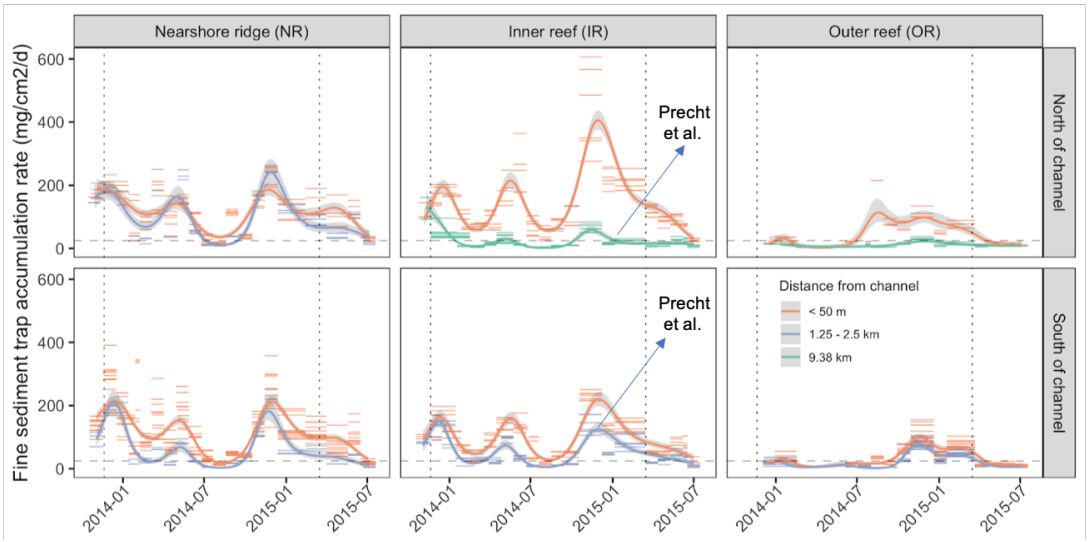


*Figure 2. (Adapted from Cunning et al., Fig. 4.) Accumulation rates of fine sediment in sediment traps throughout the dredging project. Horizontal line segments indicate measured rates of fine sediment accumulation in each trap over each deployment period. Smooth lines are GAM fits for each monitoring area (±95% CI), colored according to distance from channel. Vertical dotted lines indicate the beginning (2013-11-20) and end (2015-03-16) of dredging operations. The horizontal dashed line indicates a threshold of 25 mg cm−2 d−1; sediment deposition rates exceeding this threshold over 30 days may cause severe stress leading to mortality (Nelson et al., 2016). The "Inner Reef" in this figure is what is referred to as the "Middle Reef" in Precht et al. Data indicated as "Precht et al" indicate the sites included in Precht et al. study.*

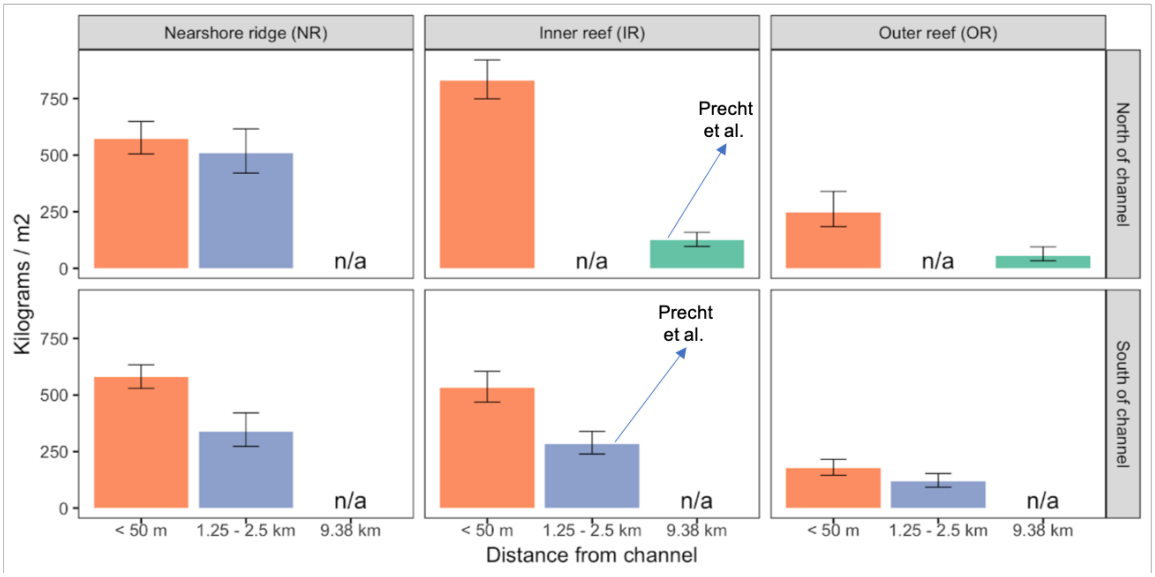


*Figure 3. (Adapted from Cunning et al. 2019, Fig. 5.) Total amount of fine sediment accumulated in sediment traps in each monitoring area throughout dredging operations. Bars indicate the sum of fitted daily fine sediment accumulation rates between 2013-11-20 and 2015-03-16 (Fig. 4) for each monitoring area (±95% CI). Bars are colored corresponding to distance from channel, and 'n/a' indicates areas that were not monitored. The Inner Reef site located 1.25-2.5km south of the channel, included in Precht et al. at "middle reef", clearly shows elevated sediment accumulation south of the channel -- 284 kg/m2 of fine sediment was deposited during the course of dredging, compared to 124 kg/m2 at the site >9km away (green bar at the northern inner reef site). Data indicated as "Precht et al" indicate the sites included in Precht et al. study.*

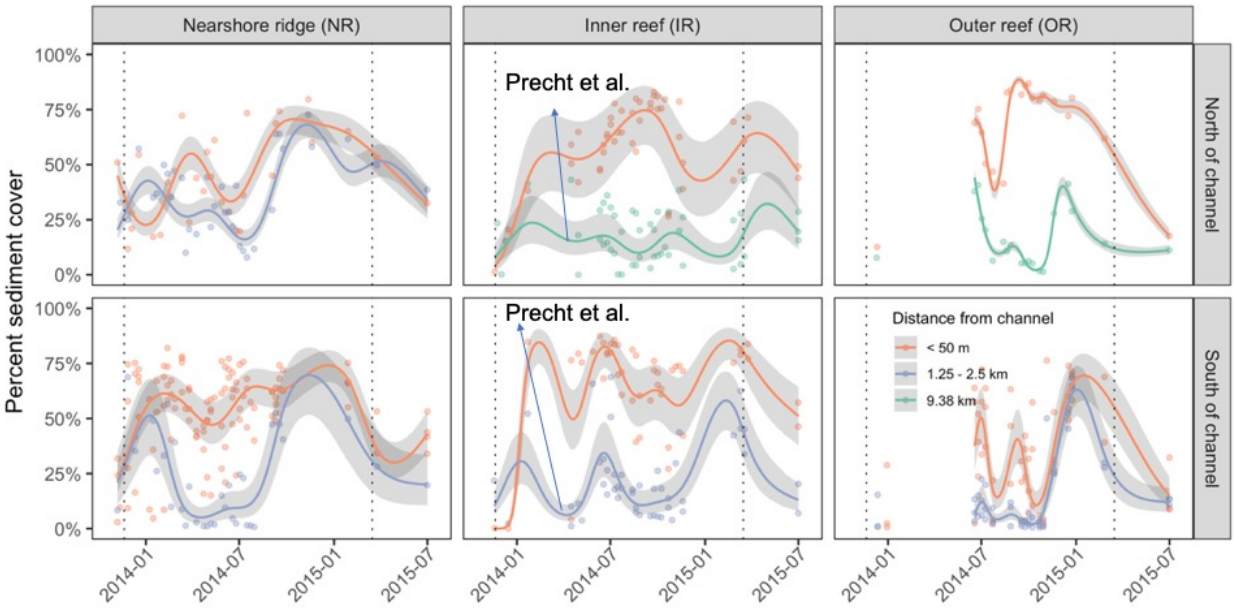


*Figure 4. (Adapted from Cunning et al. 2019, Fig. 6.) Percent sediment cover at each monitoring area during dredging operations. Points indicate the mean percent sediment cover for each transect measured by CPCe analysis, and smooth lines show GAMM fits for each monitoring area (±95% CI). Fitted lines are colored by distance from channel. Vertical dotted lines indicate the beginning (2013-11-20) and end (2015-03-16) of dredging operations. The benthos at the southern inner reef site 1.25-2.5 km (blue line), included in Precht et al. at "middle reef", became covered in sediment during dredging from a start of 11.2% sediment cover to a peak of 58.1% sediment cover during the time period covered in this study. Data indicated as "Precht et al" indicate the sites included in Precht et al. study.*

### *(6) Ethical Violations of the Scientific Reports Competing Interest Policy*

The competing financial interest policy for *Scientific Reports* is clearly detailed.[1] The policy states, "In the interests of transparency and to help readers to form their own judgements of potential bias, authors must declare any competing financial and/or non-financial interests in relation to the work described… For the purposes of this policy, competing interests are defined as financial and nonfinancial interests that could directly undermine, or be perceived to undermine, the objectivity, integrity and value of a publication, through a potential influence on the judgements and actions of authors with regard to objective data presentation, analysis and interpretation."

The areas where we believe this policy has been contravened in the case of Precht et al. (2016), which declared no competing financial interests, are as follows:

**I. Funding:** As a result of their employment (see below), authors' monitoring data collection was funded by either the Army Corps, the dredging company (GLDD), or the Port of Miami. The

[1] ***https://www.nature.com/srep/journal-policies/editorial-policies#competing***

authors state this funding source in the Acknowledgements, saying: "DCA received funding under contract to Great Lakes Dredge and Dock Company, LLC sponsored by the US Army Corps of Engineers, Jacksonville District (FDEP Permit No. 0305721-001-BI). This contract provided partial support to the investigators to undertake monitoring of coral populations in the vicinity of Port Miami in Miami-Dade County." However, they fail to include this funding source in the Competing Interest disclosure. In their response to us dated September 7, 2018, the authors write, "Finally, regarding "potential conflicts of interest" it should be noted that at the time we were preparing the Scientific Reports manuscript, DCA was no longer under contract with GLDD. In fact, we waited until our obligations were complete, all reports had been submitted to the agencies and published on-line, and all the project data was released and in the public domain before submitting and publishing our results in Scientific Reports." This is very misleading, however, as the authors were still conducting compliance monitoring and producing final reports for the dredging project through October 2017. The only difference is, when this paper was published, they were under contract with the Port of Miami directly, rather than GLDD. This new source of employment does not diminish their potential conflicting interest, but actually exacerbates it. They do not disclose anywhere in the manuscript that they had contracts directly with the Port of Miami.

**II. Employment:** Authors' company, Dial Cordy, were contracted at various times (including during the time of data collection and publication) by the Army Corps, the dredging company GLDD, or the Port of Miami themselves. The Army Corps had extensive input into the data collection and monitoring plan through permit negotiations with FDEP, and subsequent permit modifications. Dial Cordy, has had millions of dollars in contracts from the Army Corps or their contractors, and they are bidding on -- or working on -- contracts for future dredging projects with the Army Corps, including at nearby Port Everglades.

**III. Non-Financial Competing Interest:** Lead author Bill Precht was hired to serve as expert witness for the dredging company GLDD. In 2014, Mr. Precht gave testimony in court on behalf of the Army Corps' dredging contractors during which he refuted the conclusions of federal, state, and county agencies who had independently concluded that there were devastating effects of the dredge operation on coral health. (This occurred while the Corps was in litigation for Endangered Species Act violations stemming from coral impacts from the dredging project. Miami Waterkeeper was one of the co-Plaintiffs. Rachel Silverstein is the Executive Director of Miami Waterkeeper.) On or about June 1, 2016, Mr. Precht volunteered to serve as the Corps' media spokesperson on issues related to coral and sediment impacts with the express intention of furthering the Corps' own public narrative regarding the Port of Miami dredging project and to spin the story towards the disease outbreak. According to Susan Jackson of the Corps, Mr. Precht "volunteered to speak about only information published on our website…". Ms. Jackson informed the Corps that she was "working with Bill to get third-parties to provide information to reporters that reinforces what we've already said. Topics these parties might address: impacts of coral diseases on the whole Florida Reef in the past two years…" This email describes the planned media

strategy to downplay the apparent impact of the dredging by emphasizing the disease. These themes have continued in lead author Precht's subsequent writings. (See, for example, https://peerj.com/preprints/27860/).

Finally, acknowledging funding from GLDD is not the same as declaring competing interests, and we believe that these biases listed above clearly influenced the authors' data interpretation. Reviewers and readers should have been properly notified about these competing interests to fairly evaluate the results reported in this manuscript.

**IV. Discussion**

We were unable to reproduce most of the quantitative findings reported in Precht et al. from the dataset provided. In some instances, the difference between our analyses and those reported in Precht et al. are relatively minor. In others, they are significant and fundamentally alter the conclusions of the paper. The authors seem to be inconsistent in how they apply their methodology, and do not disclose the *post hoc* assumptions applied to the dataset. The data themselves have been changed and presented in ways not clearly described in the manuscript's Methods section, to the extent that it is difficult to determine which quantitative conclusions can be relied upon from the study. The authors selectively choose not to report on over 80% of available site data, but provide no scientifically valid reason for doing so. There is also an omission of certain key dates and data types that change the apparent range of species susceptibility and/or dates/times of the disease event. Our review suggests that the authors' data omissions and selectively applied analyses may have changed the apparent severity, lethality, location, and timing of the disease outbreak.

The federal National Oceanic and Atmospheric Administration, in a letter to the Army Corps on September 11, 2015, similarly alleges monitoring reports from DCA (using much of the same data as published here), "selectively choose certain results to downplay the permanent effects of sedimentation to area corals" and that "coral disease is overemphasized as the singular cause of coral impact". [9] It appears that these same biases have been translated to the article by Precht *et al.*

The authors' written responses to our inquiries about issues are at times illogical, inconsistent, and in conflict with the plain text of the paper. These issues, in combination, lead to fundamental concerns of validity that cannot be overcome through a simple addendum or correction. While many claims are made in the authors' lengthy, 47-page response (September 2018, see Precht et al. Response to Silverstein et al. 9.7.18 (WFP FINAL).pdf) to our concerns, nothing in their response describes why the authors cannot provide a single datasheet from which their findings can be faithfully reproduced. In their rebuttal, authors appear to argue that, in order to do so, we would have needed to accompany them on thousands of SCUBA dives and also review and re-interpret the ~5,000 photographs taken of these tagged corals. Re-analyzing photographs would

have injected subjectivity in interpretation that could have explained any disparity in our results as compared to theirs. Additionally, it is, of course, impossible to recreate the SCUBA dives in time and space. It is also entirely unnecessary. We should be able to request from the authors, and be provided with, an error-free dataset from which we can reproduce the same analyses that they have reported in their publication. Using their own interpretation of their dives and photographs, their datasheets, and their published methodology, should be sufficient to arrive at their published findings. This is the definition of reproducible science.

In light of the concerns we outline here and the clear failures to disclose conflicts to reviewers, we believe that Precht *et al.* fails to meet the standards that are the hallmarks of scientific research and which constitute this publication's high standards and policies. Given the importance of this topic for managers and scientists, and the fact that this disease crisis is still ongoing, interest in determining the location, timing, and cause of the outbreak is high. Having a body of literature that is accurate and free from bias is critical to solving this crisis.

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[1] Miami Herald article on coral disease outbreak: http://www.miamiherald.com/news/local/environment/article209447494.html

[2] Miami Herald article on USACE claiming that disease, not dredging, damaged reefs: http://www.miamiherald.com/news/local/environment/article57756768.html and Op Ed by A. Baker refuting this claim: http://www.miamiherald.com/opinion/letters-to-the-editor/article66775797.html

[3] Pollock *et al.* (2014) PLoS One. https://doi.org/10.1371/journal.pone.0102498

[4] https://www.nature.com/srep/journal-policies/editorial-policies#competing

[6] Copies of these reports can be provided upon request.

[7] Florida Department of Environmental Protection, 8 August 2014. "Field notes on impact assessment in Miami Harbor Phase III Federal Channel Expansion Permit # 0305721-001-BI" page 29. <available at github site attachment [14]>

[8] National Marine Fisheries Service, 12 April 2016. "Examination of Sedimentation Impacts to Coral Reef along the Port of Miami Entrance Channel, December 2015". <available at github site attachment [15]>

[9] NOAA (NMFS) letter to US Army Corps. 9 11 2015 <available at github site attachment [16]>

Swart, P.K., (2016). Report on the Mineralogy and the Stable Carbon and Oxygen Isotopic Composition of Samples Supplied by NOAA. University of Miami.