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FISH-KILLING DIATOM BLOOM IN AN URBAN RECREATIONAL POND: AN INDEX CASE FOR A GLOBAL WARMING SCENARIO?

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Abstract: By the end of the exceptionally warm and stormy autumn of 2018, a fish kill occurred in a small hypertrophic pond located in a recreative green area in Buenos Aires (BA, Argentina). As there were no visible signs of an algal bloom, the causes for the die-off were investigated. On 1st June, the pond was sampled while fish, mostly *Bryconamericus iheringii* (Characidae) and A*ustraloheros facetus* (Cichlidae) were still dying. Despite low turbidity (18.9 NTU) and chlorophyll *a* concentration values (15.90 µg/L) as compared to similar BA waterbodies, a heavy bloom of planktonic araphid diatoms (161,600 ind/mL) was detected, mainly caused by *Fragilaria saxoplanctonica* (Fragilariaceae), *Pseudostaurosira neoelliptica* (Fragilariaceae) and *Ulnaria* cf. *acus* (Fragilariaceae). Previous records of high abundances of these or closely related planktonic diatoms around the world were associated with increased temperature and nutrient content, yet they did not cause other than nuisance blooms. Fish necropsy showed good body condition except for gill damage and mucus accumulation due to a large amount of frustules of these species, mainly *P. neoelliptica*, interspersed in the gill filaments. Although this is a common cause for die-offs in marine fish farms, it is unprecedented in freshwater systems, and particularly in urban waterbodies. Conversely to more common –and foreseeable- summer cyanobacterial blooms in these systems, this phenomenon was triggered by an autumnal weather anomaly. This fact is crucial, as non-summer heat waves and heavy storms are predicted to increase in frequency and intensity over the subtropical regions, yet their ecological consequences are less perceived, seldom studied, and far from understood. This could be the first documented case of many to occur in such heavily eutrophicated environments unless effective strategies for eutrophication control and management are taken.

Keywords: climate change; diatoms; fish kill; harmful algal bloom; urban lakes.

INTRODUCTION

Recreational green spaces are key components of the urban design of large cities all over the world. The ecosystem services they provide exert a major impact in the public health of urban populations (Wolch *et al.* 2014). In turn, many city parks include urban lakes and ponds, which concentrate recreational activities such as rowing, paddling and angling. Due to their artificial nature, most urban ponds are small and shallow, and thus can be strongly impacted by the surrounding environment. In particular, anthropogenic eutrophication is a major issue in urban ponds around the world (Waajen *et al.* 2014). Soil nutrients can enter urban ponds through wind-blown dirt and superficial runoff. Also, the introduction of large birds (geese and ducks) and fish populations can result in nutrient enrichment by droppings, and in the case of bottom-feeder fish such as carp (*Cyprinus carpio,* Cyprinidae), also by resuspension of phosphorus-rich sediments (Meijer *et al.* 1999).

Heavily eutrophicated urban ponds are prone to suffer phytoplankton blooms. In most cases, these are caused by the rapid growth of one or few species of cyanobacteria, many of which include toxic strains (e.g. *Microcystis aeruginosa* (Microcystaceae), *Anabaena flos-aquae* (Nostocaceae) and *Planktothrix agardhii* (Microcoleaceae) that represent a serious health threat for animals (including humans), and may produce fish kills (Allende *et al.* 2019). Although cyanobacterial blooms typically occur in summer, over the last years they have been observed to persist during autumn. This has been ascribed to climate change, in particular warming and altered rainfall patterns (Paerl *et al.* 2011). Buenos Aires (34°35′59″ S 58°22′55″ W, *datum* WGS84) is a large city, with 2.89 million inhabitants in its 203 km^2, and has a humid subtropical climate (Cfa) according to Köppen's classification (Buenos Aires 2018). The green space/inhabitant ratio is low (6 m^2 per person) and even lower (5.45 m^2 per person) if plant beds and areas that are not freely accessible are excluded (Estadística Ciudad 2018). Furthermore, their uneven distribution causes a yet stronger anthropic pressure on some public green areas. Buenos Aires green spaces host a total of 14 eutrophic to hypertrophic shallow lakes and ponds (Rodríguez-Flórez *et al.* 2019). This calls for assessing the risk of their undergoing potentially harmful algal blooms. Therefore, a number of studies on phytoplankton ecology were performed in Buenos Aires urban waterbodies. Izaguirre *et al.* (1986) studied the structure and yearly succession of the phytoplankton in two eutrophic shallow lakes (Rosedal and Jardín Japonés). Ehrenhaus & Vigna (2006) analysed the effect of restoration measures on the phytoplankton of Planetario Lake after a *Microcystis aeruginosa* bloom that produced a fish and avian kill in 1999. Recently, Rodríguez-Flórez *et al.* (2019) further pointed out the importance of management measures as the cause for distinct phytoplankton composition and dynamics in shallow lakes Rosedal, Regatas and Centenario, while Allende *et al.* (2019) evaluated the performance of different phytoplankton classification systems as monitoring tools in eutrophic/hypertrophic Lugano shallow lake.

During the last week of May 2018, and after an exceptionally warm autumn, a massive fish kill occurred in the small Saavedra pond, located within the very popular General Paz Park (Buenos Aires), and meters away from the Saavedra Historical Museum. Yet, there were no visible signs of an algal bloom. Museum authorities then requested the intervention of the Instituto de Investigación e Ingeniería Ambiental at the Universidad Nacional de San Martín in order to find out the cause for this phenomenon. Such was the prime objective of this research, yet the novelty of the results merits discussion regarding the global change context.

MATERIAL AND METHODS

Study area and field sampling

Saavedra Pond (Figure 1) is a small (85 m long), P-shaped artificial waterbody with a concrete floor and a depth varying between ca. 80 and 150 cm. The largest and deepest lobe, facing North, hosts a small artificial island, and two 2 m–high spouts that recirculate the water, hence favouring mixing. Although it is mainly fed by phreatic water, the Southern lobe also receives mains water through the outlet of a small tank located within the Museum. The pond bottom was formerly colonized by submerged macrophytes and introduced populations of small characids, cichlids and cyprinids. Although macrophytes were removed in early February 2018 for aesthetic

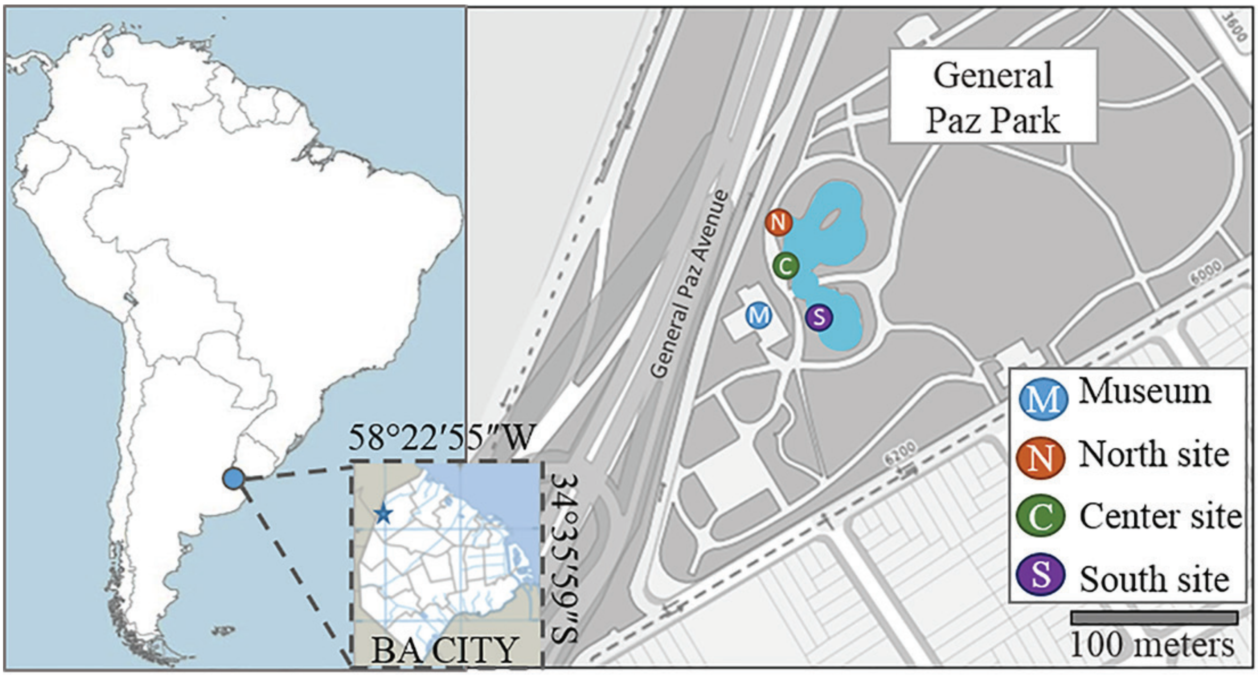

Figure 1. Sampling sites in Saavedra Pond, Buenos Aires, Argentina. The star in the index map shows the location of General Paz Park.

reasons, fish continued to inhabit the pond. From May 25th 2018 on, an increasing number of dead fish accumulated in the North lobe. On June 1st, 2018, the pond was sampled at three points along its N-S oriented main axis. The main limnological parameters (pH, conductivity, temperature, dissolved oxygen and turbidity) were measured *in situ* using a multiparametric probe Horiba U-52-2. At both extremes (North and South sites) water samples for chemical analyses were collected in pre-washed 1L PVC flasks and immediately transported to the laboratory. Also, qualitative and quantitative plankton samples were taken in clean 500 mL flasks. The former was fixed in 1 % formaldehyde and the latter with 2 % acidified Lugol's solution. Dying or dead fishes were collected from the water surface using a hand scoop net and immediately frozen until necropsy.

Sample and data analysis

In order to compare the maximum, minimum and mean monthly temperatures and total monthly precipitation during April and May 2018 with the historical trend, the open data from the Buenos Aires weather station (34°35' S, 58°29' W) belonging to the National Wheather Service (SMN 2018) were used. Mean values for climatological variables are available from this station for the period 1981–2010. To estimate nutrient concentrations a Hach® DR2800 spectrophotometer (Hach Company, USA) with its corresponding reagent kits was used. Dissolved nutrient concentrations were measured in water filtered through fiberglass filters (pore size 0.7 µm). Ammonium (NH_4-N), nitrate (NO_3-N) and phosphate (PO_4-P) were quantified according to the salicylate (No. 8155), cadmium reduction-diazotization (No. 8192), and ascorbic acid (No. 8048) Hach® methods, respectively. Total nitrogen (TN) and total phosphorus (TP) were determined from unfiltered samples according to the cadmium reduction-diazotization (No. 8192), and ascorbic acid (No. 8048) Hach methods after acid digestion with potassium persulfate and boric acid (APHA, 2005). Filters were preserved at -20 °C for photosynthetic pigments extraction with hot ethanol (70 °C) following the methods in Nusch (1980). Chlorophyll *a* concentration free of phaeopigments was measured with a spectrophotometer using the equations in Marker *et al.* (1980). Finally, the formulae proposed by the USF Water Institute (2018) were used to calculate the trophic state index (TSI) for Saavedra Pond based on TN, TP and chlorophyll *a* concentration. This method allows for an unbiased diagnostic of the trophic state, as it calculates separately the TSI based on each of the three variables, and then averages these values taking into account the potentially limiting nutrient expressed by the TN/

TP balance.

Qualitative phytoplankton samples were observed with an Olympus® BX-31 transmitted light microscope. Photographs and measurements of the most frequent species were taken in order to calculate their biovolumes following the formulae in Hillebrandt *et al.* (1999) and Sun & Liu (2003). Quantitative samples were left to sediment for 24 hours in 2 mL chambers, and then individuals were counted with the aid of a Zeiss® inverted microscope following Utermöhl's method (Utermöhl 1958) until counting error was < 20 % for the dominant species (Venrick 1978). This way, both abundances and biovolumes were calculated for the total phytoplankton and the dominant and two subdominant species. As all three were pennate diatoms, samples followed a special treatment for their identification at species level. To this end, plankton samples were oxidized following the modified Van der Werff (1955) method as described in Casa *et al.* (2017). For light microscope (LM) observations, a drop of the cleaned sample was mounted in a permanent slide using Naphrax® and analyzed using a Leica DM 2700 microscope equipped with Nomarski differential interference contrast (DIC) optics and a Leica DFC7000T camera. For scanning electron microscopy (SEM) aliquots of the cleaned material were observed in a Thermo Scientific®Quanta 250 Scanning Electron Microscope in environmental mode. On the basis of the LM and SEM observations and measurement of the valves (N > 20), diatoms were identified by comparison with published diatom floras such as Krammer & Lange-Bertalot (1991), Morales (2002), and Kociolek *et al.* (2018).

Eleven individuals of *Bryconamericus iheringii* (Characidae) and two of *Australoheros facetus* (Cichlidae) were identified at species level following Mirande *et al.* (2015) and Nelson *et al.* (2016) and submitted to post-mortem examination. All these were measured, weighed, and inspected for tegumentary anomalies as well as external infections and parasites. Following dissection, the digestive tract was preserved in 70 % ethanol and subsequently observed with an Arcano® ST 30 L stereo microscope to perform a quali-quantitative analysis of food items and the degree of stomach repletion. Lastly, the gills were extracted and preserved in 5 % formaldehyde for subsequent light microscopy observation. After confirming the presence of numerous frustules in the gills, these were taxonomically identified by digesting the gills in 37 % H_2O_2 and mounting permanent slides for observation as described above.

RESULTS

During April-May 2018, the center-northern region of Argentina was affected by joint high temperatures and excess precipitation. For the whole country, April 2018 was the hottest amongst available digitalized meteorological records, dating back from 1961. Also, in Buenos Aires, minimum monthly temperature largely exceeded the values recorded between 1961 and 2017 (Figure 2a) while the corresponding maximum was the second highest following April 2015 (SMN 2018) (Figure 2b). During May temperatures remained well above the mean (SMN 2018), and the positive deviation of minimum temperatures over the two months largely delayed the onset of autumn. These temperature anomalies co-occurred with a deviation in the distribution of precipitations over the course of 2018, as monthly values over the previous summer were below the 25 % percentile (Figure 3), and those of April and May exceeded previous records except for 2 previous outliers. Rainfall occurred mostly under the form of intense storms (SMN 2018).

On June 1st, Saavedra Pond showed very similar values among sampling stations for all physical and chemical variables except for dissolved oxygen (Table 1), which was somewhat higher in the Northern lobe wherein the mixing spouts are located. While values of physical features (temperature, pH, dissolved oxygen, conductivity and turbidity) were not uncommon, nutrient concentrations were extremely high, particularly those of dissolved nitrate and total nitrogen. Yet, the ratio between TN and TP characterize Saavedra Pond as a nutrient-balanced water body, wherein $10 \leq TN/TP \leq 30$ (USF Water Institute 2018). The value of the Trophic State Index (TSI) thus calculated with the corresponding formulae given in USF Water Institute (2018) was 94.17, which indicates a hypertrophic state associated with a poor water quality.

Phytoplankton analysis showed that on the sampling date Saavedra pond was undergoing a bloom (161,634 ind/mL) strongly dominated by

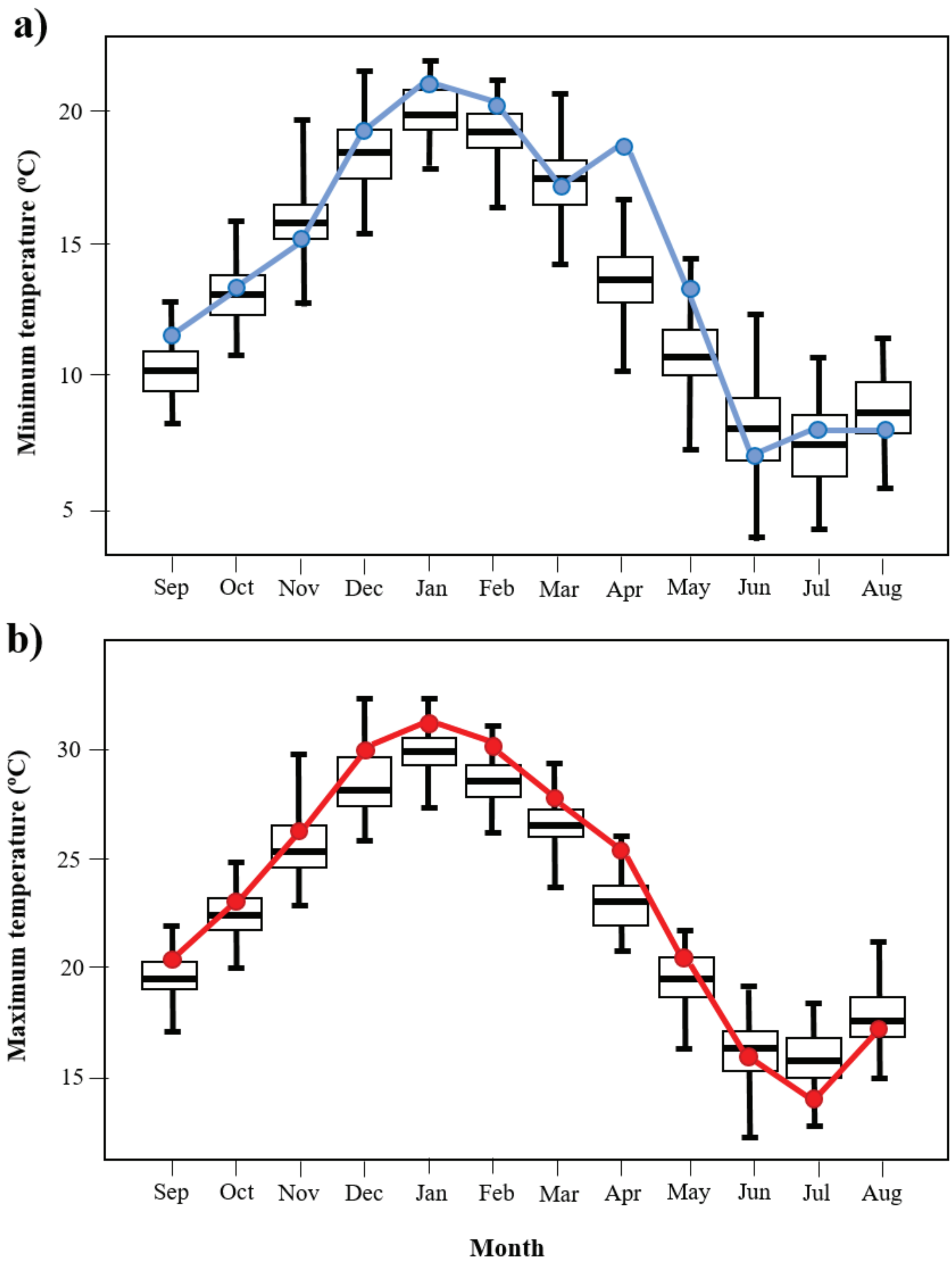

Figure 2. a) Monthly minimum temperatures over 1961-2017 (boxes and whiskers) and 2018 (light blue line). b) Monthly maximum temperatures over 1961-2017 (boxes and whiskers) and 2018 (red line). In both cases, boxes indicate 25-75 percentiles, an whiskers minimum and maximum values, respectively.

three diatoms species from the Fragilariaceae family: a massive population of *Fragilaria saxoplanctonica* was accompanied by *Pseudostaurosira neoelliptica* and *Ulnaria* cf. *acus*. Among them, *F. saxoplanctonica* shows needle-shaped frustules with narrow linear valves that become thinner near the extremes of the capitate apices. The size range of Saavedra population was: length: 41.6–97.4 μm, width: 1.6–2.7 μm, with 22-25 striae in 10 μm, hardly discerned in LM (Figure 4: a and d). The population of *Ulnaria* cf. *acus* presented narrow and lanceolate valves (length: 13.6–213.5 μm, width:4–5.5 μm) with thick, opposite and parallel striae (22–25 in 10 μm) (Figure 4: b and c). The sternum was visible

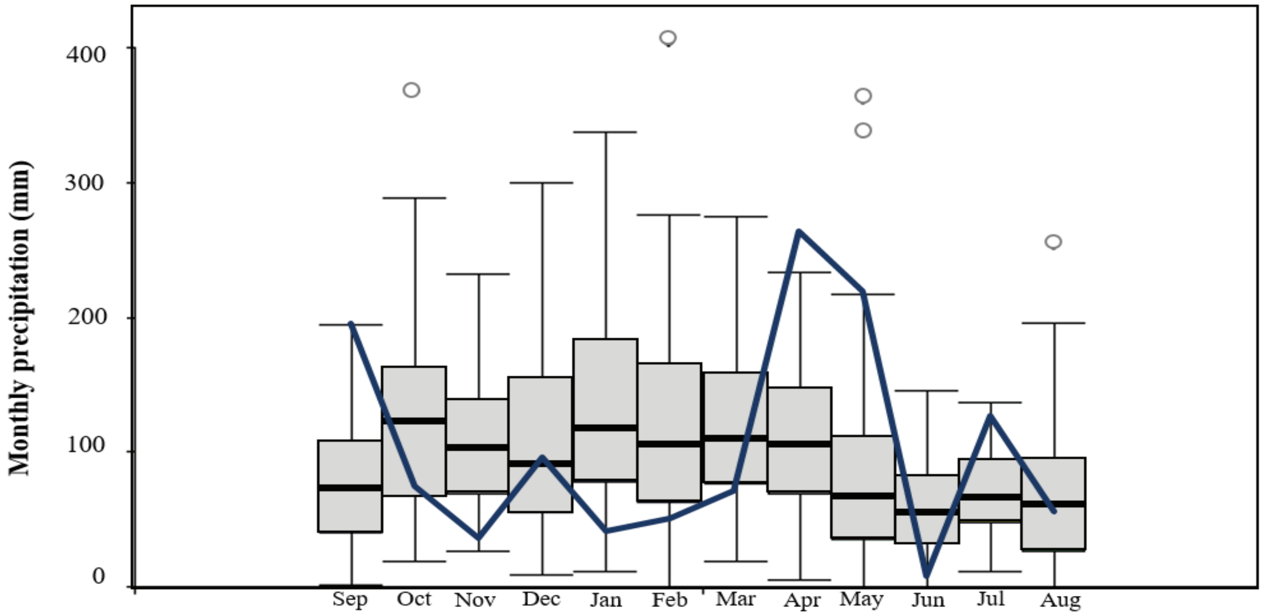

Figure 3. Monthly precipitation over 1961-2017 (boxes and whiskers) and 2018 (dark blue line). Boxes indicate 25-75 percentiles, an whiskers minimum and maximum values, respectively. Circles show outliers.

Table 1. Values of the main limnological features of Saavedra Pond. TN/TP: total nitrogen/total phosphorus.

	North site	Center site	South site	Mean	SD
Temperature (°C)	12.59	12.84	12.31	12.58	0.26
pH	7.74	8.20	8.09	8.01	0.24
Conductivity (mS/cm)	0.82	0.82	0.74	0.79	0.05
Turbidity (NTU)	18.00	18.90	19.90	18.93	0.95
Dissolved oxigen (mg/L)	9.82	8.91	6.98	8.57	1.45
NH_4-N (mg/L)	0.19	-	0.37	0.28	0.13
NO_3-N (mg/L)	6.00	-	5.50	5.75	0.35
Total nitrogen (mg/L)	59.40	-	60.50	59.95	0.78
PO_4-P (mg/L)	0.24	-	0.18	0.21	0.04
Total phosphorus (mg/L)	3.08	-	2.64	2.86	0.31
Chlorophyll a (µg/L)	16.55	-	15.24	15.90	0.93
TN/TP	19.29	-	22.92	21.10	2.57

in LM, with ghost striae frequently present in the central area, and rimoportulae were observed at the apices. Finally, *P. neoelliptica* (Figure.4: E, F and G) population was characterized by small elliptical valves (valve dimension: length: 10.4–15.7µm, width:3.2–4.4 µm) with short spines within the striae (14–16 in 10 µm). Frustules linked together through the spines forming long chains of up to ca. 50 cells.

Dominance of these species was expressed through both relative abundance and biovolume (Figure 5). Chlorophyll *a* concentration was notably lower than expected for such a high algal density (15.90 µg/L). LM observation showed that chlorophytes, mainly represented by a few large individuals of *Scenedesmus* spp. (Scenedesmaceae), *Pediastrum* spp. (Hydrodictyaceae) and *Dictyosphaerium* sp. (Chlorellaceae), as well as by small spherical unicells (Figure 6a), contributed significantly to this despite accounting for only 2.13 % (3442 ind/mL) of the total algal abundance (Figure 5). A few heterotrophic protists such as amoebae, testaceans and ciliates were also observed along with rotifers mainly belonging to the genus *Keratella* (Brachionidae).

Dead fishes showed a good body condition and

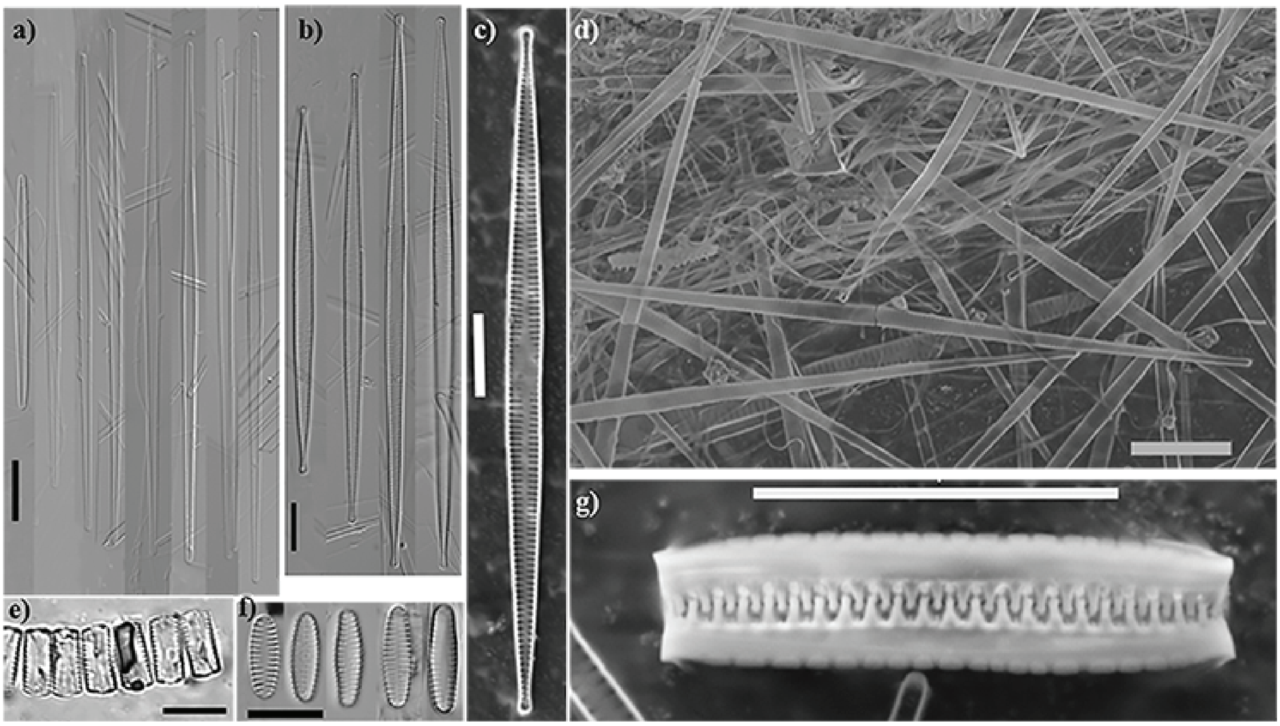

Figure 4. Light and scanning electron micrographs of diatom populations from Saavedra Pond. LM views: a). b). e) and f). SEM views: c). d) and g). a) *Fragilaria saxoplanctonica*; b) *Ulnaria* cf. *acus*; c) internal view of an entire valve of *U*. cf. *acus*; d) diatom bloom; e-g) *Pseudostaurosira neoelliptica*; e): LM girdle view; f): LM valve view; g): SEM girdle view with detail of the linking spines. Scale bars = 10 µm except for Fig. c) where scale bar = 1 µm.

a normal external morphology. Fins, scales and opercular series showed neither lacerations nor ulcers. No pathological alterations or parasites were observed in the internal organs. Analysis of the digestive tract showed that virtually all stomachs and bowels were empty. Nevertheless, the presence of body fat indicates that fishes were not starving. Except for two specimens whose gills were already decaying, thus precluding further analysis, the rest showed alterations in the epithelium of the gill filaments and secondary lamellae, with edemas, mucus accumulation and loss of the branchial architecture. Further microscopic observation of the gill apparatus revealed a large amount of frustules, mainly of *P. neoelliptica* interspersed in the gill filaments (Figure 6b).

DISCUSSION

An undetectable bloom

Urban water bodies previously studied in Buenos Aires have been classified as eu- to hypertrophic (Ehrenhaus & Vigna, 2006, Rodríguez-Flórez *et al.* 2019, Allende *et al.* 2019). Virtually all of them suffered summer algal blooms caused

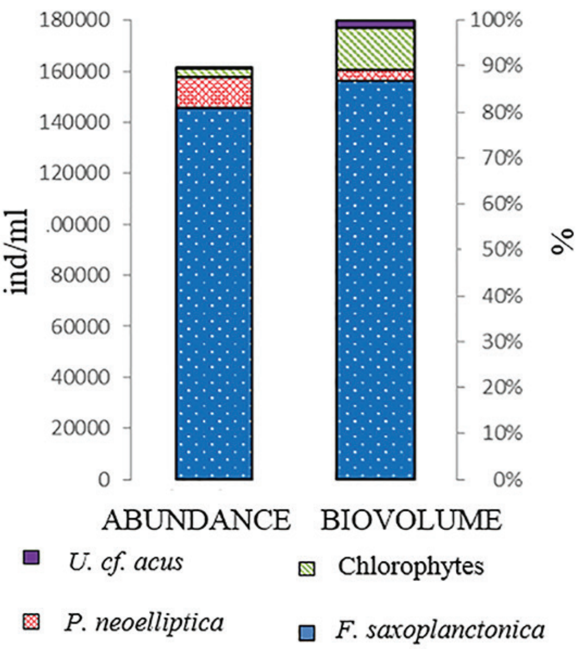

Figure 5. Total abundance and biovolume of the dominant and subdominant species of the phytoplankton.

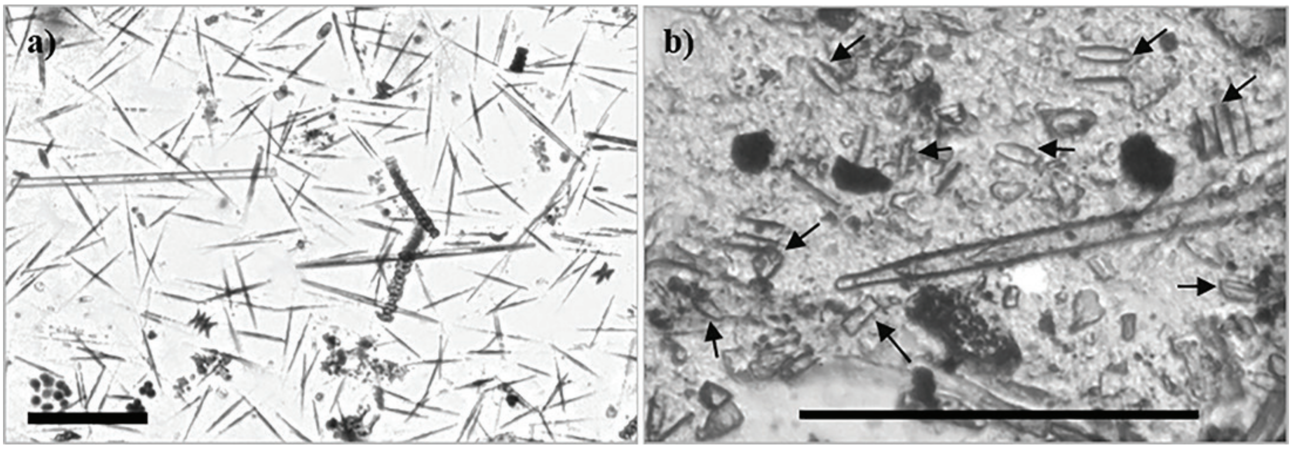

Figure 6. a) Bottom of a 2 mL-Utermöhl chamber observed with an inverted microscope; b) Gill sample with frustules. Arrows show valves of *Pseudostaurosira neoelliptica*. Scale bars= 100 µm.

by cyanobacteria, some of which are toxic. This resulted in a public health concern, as frequently happens in other countries (Waajen *et al.* 2014). Saavedra Pond shows an even higher nutrient concentration than those recorded in the aforementioned shallow lakes, caused by the effect of avian droppings and carp stirring of the sediment, and likely increased by surface runoff during heavy storms. Interestingly, the closest high value for TN was recorded in Centenario Lake (Rodríguez-Flórez *et al.* 2019), which was also strongly dominated by araphid diatoms, amongst them *Fragilaria* spp. Rodríguez-Flórez *et al.* (2019) ascribed the dominance of this group to the water mixing forced by an artificial pump. This is a widely used management tool to avoid cyanobacterial blooms, also used in Saavedra Pond. Nevertheless, artificial mixing of lentic systems also favours growth of sedimentation-sensitive silicified organisms like diatoms through resuspension of nutrients (Wang *et al.* 2012) and of diatoms themselves, and is thus unsuccessful in preventing diatom blooms.

A particular feature of the bloom in Saavedra Pond was a much lower chlorophyll *a*/abundance (µg/ind) ratio than previously recorded from Buenos Aires urban ponds. For instance, in Allende *et al.* (2019) this ratio ranged between 2 and 3.36 E^{-6} during blooms of the cyanobacteria *Planktothrix agardhii* in Lugano Lake, associated with turbidity values of up to 97 and 184 NTU, while for Saavedra Pond this ratio was two orders of magnitude lower (9.84 E^{-8}), and the correspondent turbidity was only 18.94. Here, needle-like *Fragilaria saxoplanctonica* accounted for ca. 87 % of the biovolume and was consequently responsible for the low chlorophyll *a* content of the bloom. These results coincide with those of Kolmakov *et al.* (2002), who found that chlorophyll *a* concentration during blooms of the centric diatom *Stephanodiscus hantzschii* (Stephanodiscaceae) were significantly lower when it was accompanied by needle-like pennate species such as *Nitzschia acicularis* (Bacillariaceae) and *Synedra acus* (= *Ulnaria acus*), an accompanying species also in Saavedra pond. Concurrently, the waters lacked the green coloration typical of algal blooms, allowing the diatom bloom to develop unnoticed and precluding any alert until fish begun to die.

The fish kill

Blooms of marine diatoms have been frequently reported to have deleterious effects on fish through a number of mechanisms, ranging from the production of toxic domoic acid to physical damage (Fryxell & Hasle 2003 and references therein). In particular, a bloom of *Thalassiosira eccentrica* (Thalassiosiraceae) and the spine-bearing *Chaetoceros* spp. in the Gulf of California caused a fish kill by mechanically damaging and clogging the gills (López-Cortés *et al.* 2015). In salmon farms, exposure to high abundances of *Chaetoceros concavicornis* (Chaetocerotaceae) caused fish to produce mucus and subsequently develop blood hypoxia, while in New Zealand chain-forming *Cerataulina pelagica* Hendey, 1937 (Hemiaulaceae) produced fish kills by gill clogging and post-bloom anoxia (Smayda 2006 and references therein). In coincidence with our results, a bloom of mucillaginous colonies of *Chaetoceros socialis*

(Chaetocerotaceae) was reported to affect fish appetite, although this response did not account for the lethal effects of non-spinous diatom blooms (Fryxell & Hasle 2003 and references therein).

The most conspicuous component of the bloom, *Fragilaria saxoplanctonica* is regarded as a planktonic species. The planktonic functional group is the less frequent amongst freshwater diatoms, and one of particular interest due to its sensitivity to changes in epilimnetic temperature and water column stability. Tolotti *et al.* (2007) observed in a lake from the Italian Alps that the biovolume of planktonic *Fragilaria* species was positively correlated to high water inflow and lake water level, as well as to nitrate and silicate concentrations and stratification during summer. In turn, an increase of planktonic *Fragilaria* species, including *F. saxoplanctonica*, has been ascribed to enhanced summer temperatures and high precipitation in a lake from Altai Mountains, China (Lin *et al.* 2018). Additionally, Fritz *et al.* (2018) associated the occurrence of *Fragilaria nanana* (Fragilariaceae), a species highly similar to *F. saxoplanctonica,* with warm temperatures in the tropical Andes. *F. nanana* was also highly dominant in autumn and spring in Jinshahe drinking water reservoir, China, under a subtropical monsoon climate. This dominance was regarded as indicative of eutrophication, as water quality in this reservoir had been affected by industrial and agricultural activities (Zhang *et al.* 2018a). In turn, chain-forming *P. neoelliptica* has been recorded from rivers heavily impacted by urban and agricultural activities (Morales 2002). Yet, no effects other than nuisance blooms were recorded so far for this or any other freshwater planktonic diatom. On the other hand, Gómez (2014) compiled information on 66 freshwater fish kills occurred in Argentina over the 20th century, 80 % of which took place in the lower Río de la Plata basin. According to this author, most die-offs were related with extreme temperatures (below 2 °C or over 32 °C), and 9 % were caused by toxic cyanobacteria, while 12 % of the cases remain unaccountable. It is in this context that this unique record of a fish kill induced by an inconspicuous diatom bloom deserves special attention.

The climate change context

According to the Third National Report on Climatic Change (SAyDS 2014) the climatic trend for Buenos Aires Province between 1950 and 2010 showed an increase of 0.6 °C for the mean temperature and 0.8 °C for the minimum and maximum temperatures. These figures might be even higher for the Buenos Aires Metropolitan Area, wherein Saavedra Pond is located. Moreover, future projections indicate an increase from 0.5–1 °C in the near future (2015-2039) in a moderate emissions scenario, to 2.5–3 °C for the period 2075–2099 for a business as usual scenario. It is ecologically relevant that all these projections point toward an increase in the frequency of heat and cold waves and extreme precipitation events such as the ones recorded here. Extreme temperature waves are a matter of social concern when they coincide with the season of extreme temperatures (e.g. hot waves in midsummer) due to the fatalities and material losses they produce. In particular, development of summer toxic cyanobacterial blooms has deserved much study and concentrated efforts on their prevention and mitigation (Waajen *et al.* 2014 and references therein). On the contrary, extreme temperature events such as autumn and spring heat waves are less perceived (and hence less understood) despite their potential to produce significant ecological effects. These are far from simple, as discussed by Zhang *et al.* (2018b), whose experiment demonstrated that the response of five diatom species to simulated climate warming was affected by interspecific interactions. Algal blooms caused by organisms other than cyanobacteria in urban waterbodies could paradoxically impose a new health risk –either direct or mediated by the accumulation of decomposing biota- on city dwellers that use urban green areas in search of wellbeing (Wolch *et al.* 2014). As such climate-driven deviations from the natural phytoplankton yearly succession are likely to increase in the future, effective steps must be taken toward alleviation of the external loading and active internal recycling of nutrients in these artificial systems. Apart from re-colonising the pond with macrophytes and removing the bottom-feeder cyprinids, increasing the area and balancing the distribution of green spaces containing waterbodies in Buenos Aires and large cities alike would not only be a matter of environmental justice (Wolch *et al.* 2014) but also a prime measure to ease anthropic pressure on these environments, thus preserving the ecosystem health.

Final Remarks

By the end of the hottest autumn of at least the last sixty years in subtropical Buenos Aires, a fish kill was recorded in an urban hypertrophic pond. A bloom of needle-like and chain-forming diatoms which was unnoticed due to low chlorophyll *a* content was responsible for this, through swelling and clogging of the fish gills. Although this cause for fish die-offs is well known from marine nutrient-rich environments, this is the first case reported from a freshwater ecosystem, namely an urban recreational waterbody. On the other hand, blooms of some of these species are known to occur in subtropical rivers and reservoirs yet without harmful consequences for the fauna. When trophic and climatic conditions concur to generate harmful algal blooms, only the former can be managed. Therefore, management efforts must concentrate on reducing nutrient loading and recycling. Also, we observed that common measures to avoid cyanobacterial blooms such as artificial mixing can have the opposite effect on diatoms by favoring resuspension of these heavy algae. Practical consequences of this are twofold: On a waterbody managing level, populating small ponds with large birds and carps should be discouraged. On a city planning level, multiplying and enhancing accessibility to urban green areas with waterbodies would ease the anthropic pressure mainly expressed as eutrophication. Finally, on a global level, it is hypothesized that the projected increase of extreme temperature waves and precipitation events could favour these non-summer, non-cyanobacterial blooms in heavily eutrophicated urban waterbodies over the subtropical regions, with undesirable consequences for environmental urban health. Only through recording and analyzing future similar cases will scientists be able to test this hypothesis.

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