

QUASI MONOSPECIFIC PROLIFERATION OF *Pteroncola inane* (GIFFEN) ROUND (FRAGILARIALES; BACILLARIOPHYCEAE) ON BLADES OF *Eisenia arborea* ARESCHOUG

Proliferación cuasimonoespecífica de *Pteroncola inane* (Giffen) Round (Fragilariales; Bacillariophyceae) en láminas de *Eisenia arborea* Areschoug

RESUMEN. La diatomea arráfrica *Pteroncola inane* es un taxón que comúnmente habita en plumas de aves marinas y como epífita en costas europeas, pero hasta ahora no estaba registrada para las costas de México. En este estudio se registran proliferaciones de *P. inane* sobre láminas de *Eisenia arborea* recolectadas en Bahía Magdalena Baja California Sur, México en donde fue el taxón dominante dentro de la asociación de diatomeas epifitas que incluyó a 75 taxa; la mayoría de estos raros y poco comunes. En preparaciones en fresco los especímenes mostraron dos cloroplastos laminares parietales; no se observó algún tipo de colonia. En preparaciones permanentes *P. inane* presentó apariencia hialina, ausencia de estructura valvar y puntos a lo largo del margen del manto valvar. La identificación de este taxón se logró mediante microscopía electrónica de barrido (MEB), con la cual se observaron las estrias de las valvas y un sternum angosto apenas perceptible. Asimismo, se notó que los puntos marginales consisten en perforaciones de la primera banda intercalar y que exhibe engrosamientos del manto valvar a manera de puntos. Este constituye el primer registro de *P. inane* para México y el primero como epífita en ambiente bentónico para el Pacífico este.

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Floristic studies for diatoms are still lacking and the exploration of other localities and different substrata are expected to add new records to floristics everywhere, maybe even with new species records. Such studies are under way for the northwestern region of México where macroalgae are being examined as an ideal substrate for diatoms.

A particular interest exists on epiphytic diatoms

of kelps such as *M. pyrifera* inasmuch its heavily epiphytized blades constitute the main food-source for several abalone species, besides being the most abundant kelp on the western coast of the Baja California peninsula (México). Thus, we were interested in knowing which diatom taxa could be found on other macroalgae that are also grazed by abalone (Siqueiros Beltrones *et al.*, 2002), such as *Placodium cartilagineum* (Lamoroux) Dixon (Rhodophyta) (Siqueiros Beltrones & Argumedo-Hernández, 2014) and, in this case, other phaeophyceae such as *Eisenia arborea* J.E. Areschoug, the second most abundant kelp along the western coast of the peninsula (Hernández-Carmona *et al.*, 2009). Although earlier observations on *E. arborea* blades from Bahía Tortugas, BCS indicated that no diatom epiphytes were present (Siqueiros Beltrones *et al.*, 2002), for this study we had confirmed that this kelp may be heavily colonized by diatoms and by many filamentous macroalgae and cyanophytes, depending on the age of the blade (Siqueiros Beltrones *et al.*, submitted).

Blades of *E. arborea* were collected at Punta Arenas (24° 33' 2" N and 112° 05' 28" W), off Isla Magdalena (Fig. 1), in the west coast of BCS, on September, November, December 2013, and January, March, June 2014. Epiphytized blades free from bryozoans were selected. The epiphytes were scraped-off with a glass-slide while rinsing with purified water and observed in fresh preparations. To clean the diatoms, the concentrate from each

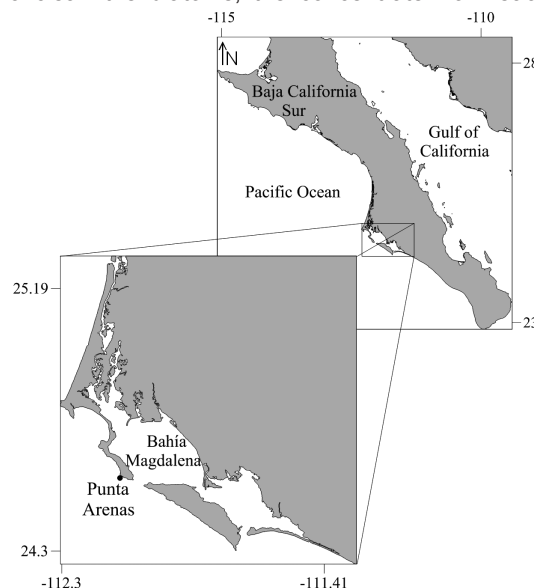


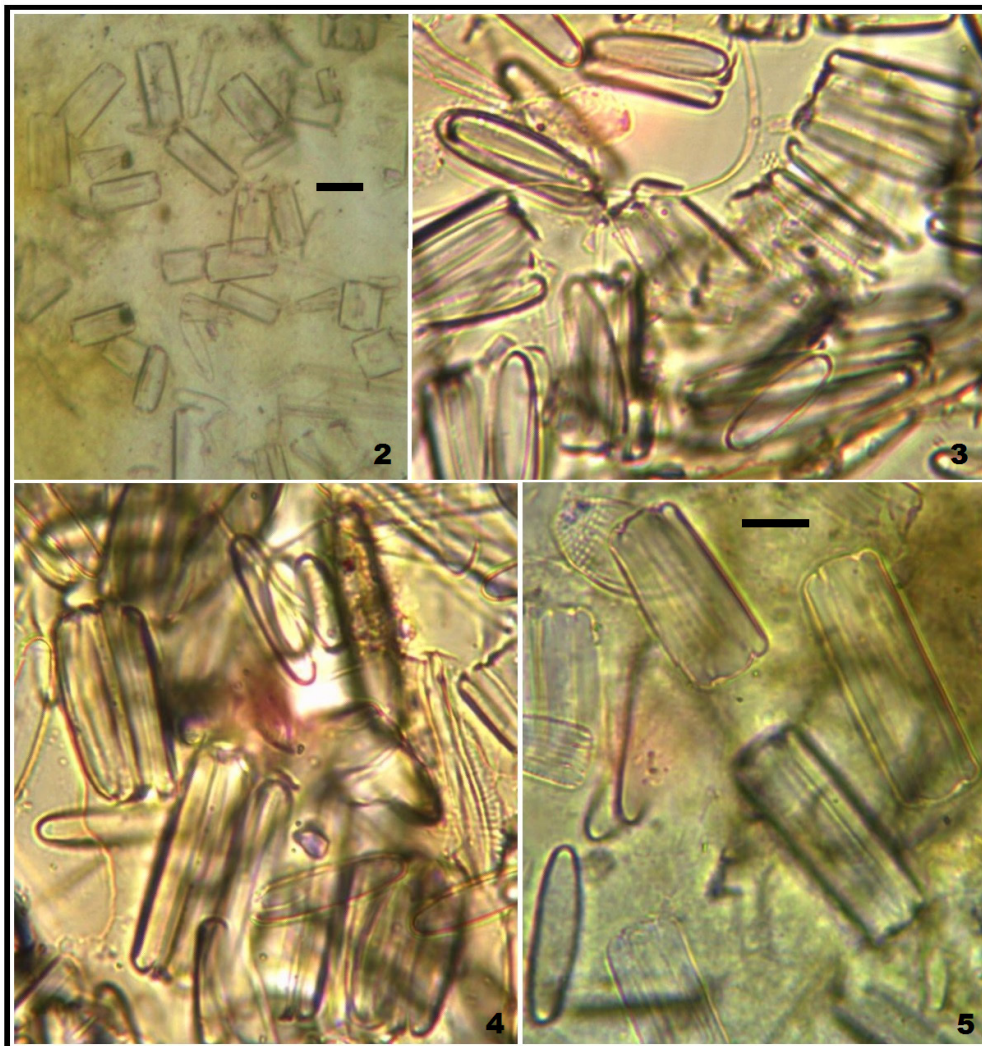
Figure 1. Location of sampling site Punta Arenas off Isla Magdalena, BCS, México.

date was oxidized using a mixture of sample, commercial alcohol, and nitric acid at 1:3:5 proportions (Siqueiros-Beltrones & Voltolina, 2000). The oxidized samples were rinsed with purified water until a pH ≥ 6 was reached. Five double permanent slides per date were mounted using Pleurax (RI= 1.7). Diatom identification was carried out at 1000 $\times$ under an Olympus CH-2 microscope with phase contrast. Fresh specimens were also observed. Taxonomic references used included Round *et al.* (1990) and Witkowski *et al.* (2000) as main sources, and the regional works by Siqueiros Beltrones (2002), Siqueiros Beltrones & Valenzuela-Romero (2001), Siqueiros Beltrones *et al.* (2004), Siqueiros-Beltrones & Argumedo-Hernández (2005), and Siqueiros Beltrones and Hernández-Almeida (2006).

Observations. The pennate araphid diatom *Pteroncola inane* (Giffen) Round is recorded for the first time

for this region from *Eisenia arborea* blades collected in Bahía Magdalena, BCS, México. The observed diatom assemblage yielded 75 diatom taxa throughout the sampling period, albeit most were uncommon or rare, and required an *ex profeso* analysis (Siqueiros Beltrones *et al.*, submitted). In contrast, *P. inane* was abundant, as reported by Holmes & Croll (1984), albeit only in the January (Fig. 2) and September samples (Figs. 3-5), where multispecies clumps amply dominated by this taxon remained in the permanent slides. However, although *P. inane* appeared throughout the whole period it was not abundant in the other samples and was even scarce in the May sample. A closer examination of the degree of fouling on fresh *E. arborea* blades is required before relating these variations to the sampling dates.

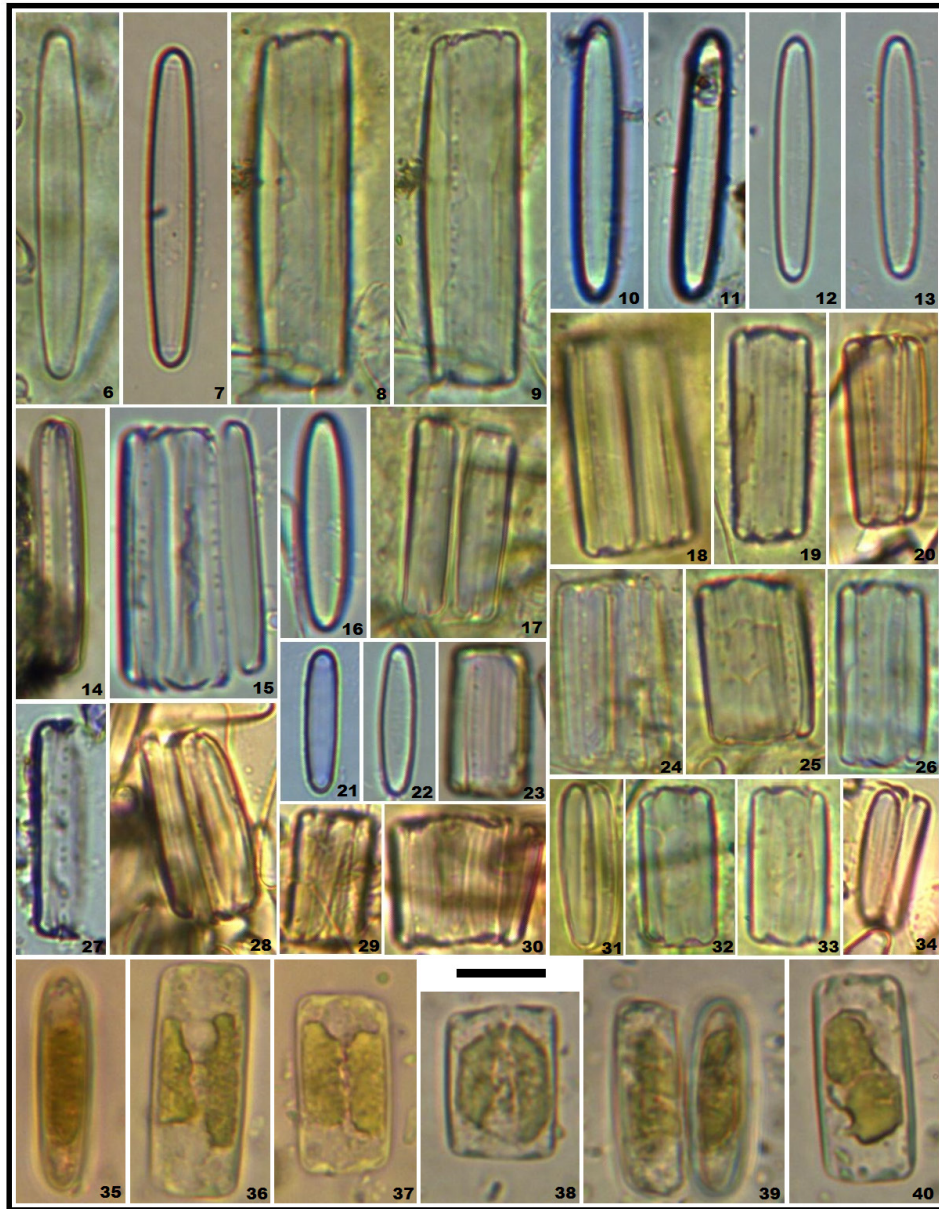
Description. *Pteroncola inane* was first recorded as *Dimeregramma inane* by Giffen (1970) and later as



Figures 2-5.- Clumps of *Pteroncola inane* from the January (Fig. 2) and September (Figs. 3-5) samples, associated to host tissue at 400 $\times$ (Fig. 2) and at 1000 $\times$ (Figs. 3-5).

Pteroncola marina by Holmes & Croll (1984) as an abundant taxon living on feathers of marine diving birds but common also as an epiphyte (Witkowski *et al.*, 2000). Under light microscopy our observed specimens of *P. inane* fit the general description by Round *et al.* (1990) in having a hyaline appearance, without a noticeable structure. But the cells of *P. inane* living on *E. arborea* blades are solitary or paired and do not form colonies. However, the wider description of the genus by Almandoz *et al.* (2014) to include a new species refers to solitary cells. In

our specimens, under light microscopy, the frustule is rectangular (square in smaller cells) in girdle view, with rounded corners and showing several intercalary bands. Valves are linear to linear-elliptic with rounded apices (Figs. 6-34). Puncta below the mantle in girdle view are evident, 5-11 at irregular intervals. Specimens ranged in size from around 8 to 40 μm along the apical axis, 3 to 5 μm in transapical axis, and 6 to 8 μm deep (girdle view), being larger than in Witkowski *et al.* (2000). Fresh cells exhibit two laminate parietal chloroplasts (Figs. 35-40), as



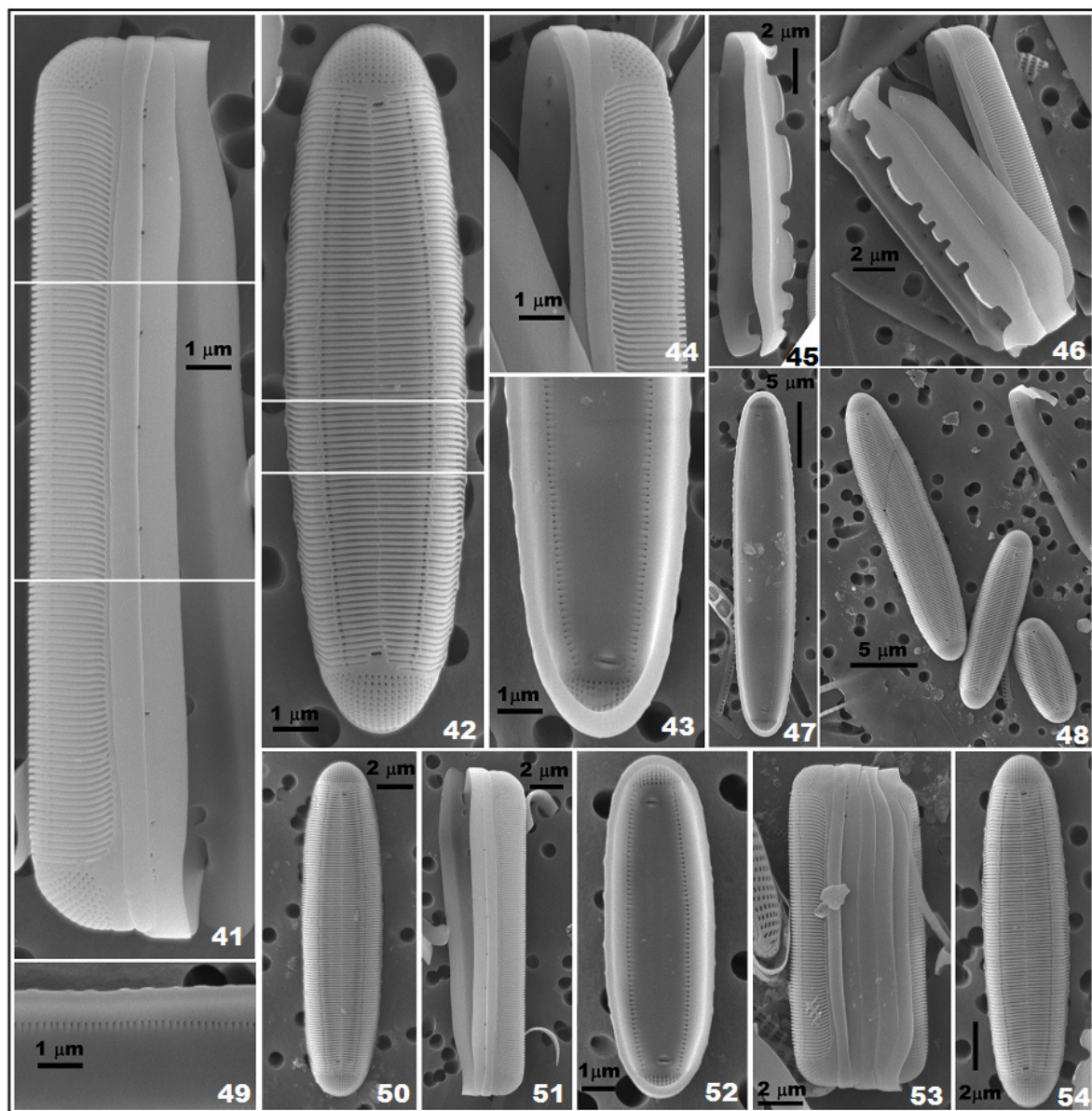
Figures 6-40. - (6-34) Array of *Pteroncola inane* showing size variation in valvular and girdle views. Under light microscopy this taxon is characterized by hyaline linear to linear-elliptic valves with rounded apices, and rectangular to almost square frustules in girdle view; puncta are visible in the girdle bands; striae and rimoportulae are not resolved at 1000 $\times$. (35-40) Cells of *P. inane* showing two laminate, parietal chloroplasts (1000 $\times$).

in the description of Almandoz *et al.* (2014) at genus level.

SEM observations. Under SEM 60 striae/10 μm can be distinguished, interrupted along the middle by a barely perceptible sternum limited at the ends by the apical pore fields that show up to fourteen rows of pores (vs. five in Almandoz *et al.*, 2014), and two rimoportulae open to the outside as narrow slits, one to the right and one to the left of the raphe ends (Figs. 41-44, 48). Two lines of perforated areolae run longitudinally between the valve margins and the sternum, which are visible also from the inside

of the valve (Figs. 42-43, 47, 50, 52, 54). The first girdle band shows indentations (Figs. 45-46), each one corresponding to one or two of the girdle puncta below the mantle (Figs. 41, 51, 53). Also, around 14 puncta/10 μm along the valve mantle and visible only under SEM are seen to be thickenings (Figs. 43, 49). Figure 55 shows main structures in valval view for specimens of different sizes.

Final remarks. This constitutes the first record of *P. inane* for México and its first record as an epiphyte for the Eastern Pacific. Very similar specimens tentatively identified as *Hyalinella* sp. have been



Figures 41-54.- Scanning electron micrographs of *P. inane* showing fine structure of the frustules that allows for identification at genus and species level.

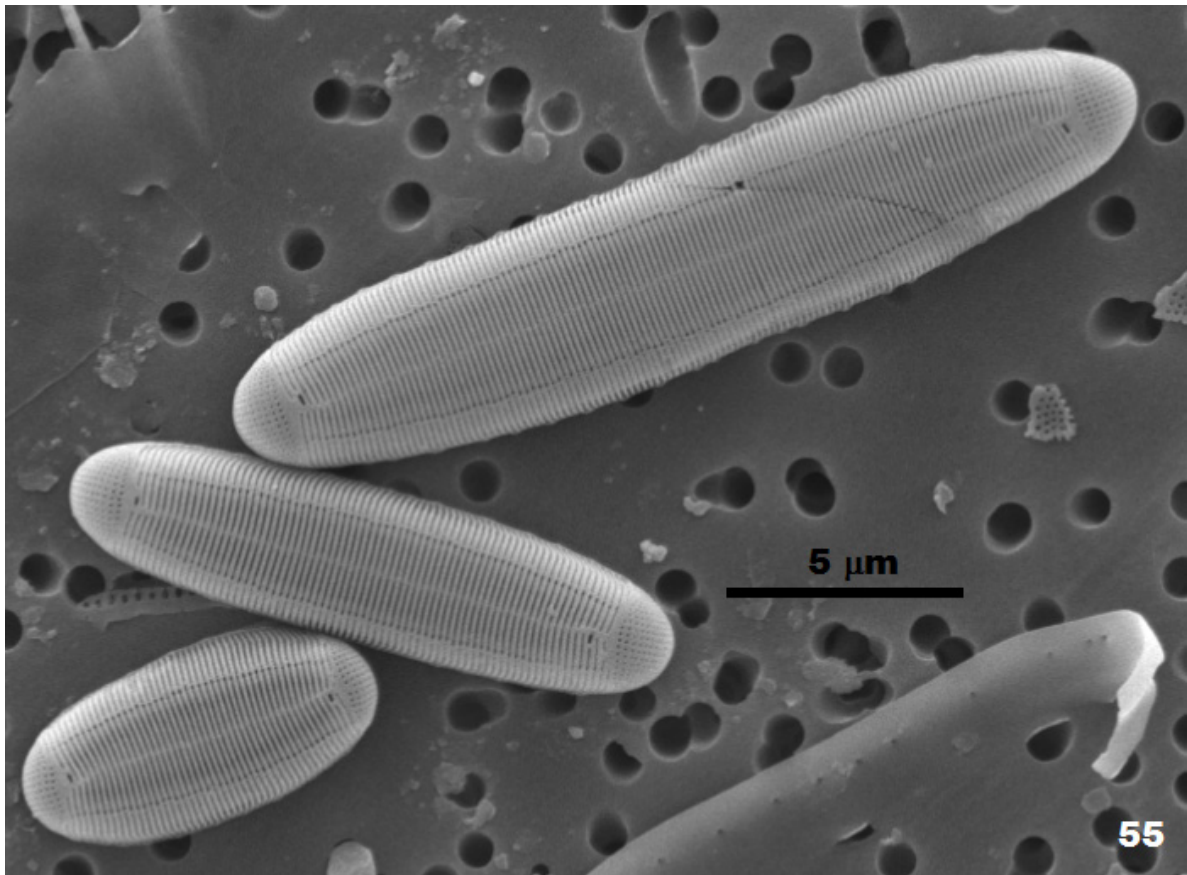


Figure 55.- Different sizes of *Pteroncola inane* showing distinctive valve characteristics.

recorded as infrequent in gut contents of abalone (*Haliotis* spp.) in the region (Argumedo-Hernández & Siqueiros Beltrones, 2010). However, the epiphytic diatom inventory from other kelp such as *Macrocystis pyrifera* (Linnaeus) C. Agardh does not include *P. inane* among the 170 taxa recorded (Siqueiros Beltrones & Argumedo-Hernández, 2005). Thus, the absence of this taxon from all other floristic lists in the region and its high abundance on *E. arborea* suggest that this host may be providing specific conditions which favor the growth of *P. inane*. Because the high abundances corresponded with summer and winter conditions, the observed proliferations may be more related to the age of the *E. arborea* blades than to seasonal variations. A higher frequency successional study of the epiphytic diatom assemblage and *P. inane* growing on *E. arborea* is in order.

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LITERATURE CITED

- Almandoz, G. O., M. E. Ferrario, M. J. Sullivan, L. Ector & I. R. Schloss. 2014. A new *Pteroncola* species (Bacillariophyceae) from the South Shetland Islands, Antarctica. *Phycologia*, 53(2): 188–194. <https://doi.org/10.2216/13-210.1>
- Argumedo-Hernández, U. & D. A. Siqueiros Beltrones. 2010. Non selective *in situ* grazing of diatoms by juvenile green abalone (*Haliotis fulgens* Philippi, 1945). *Hidrobiológica*, 20: 13-19.
- Hernández-Carmona, G., S. Carrillo-Domínguez, D. L. Arvizu-Higuera, Y. E. Rodríguez-Montesinos, J. I. Murillo-Álvarez, M. Muñoz-Ochoa & R. M. Castillo-Domínguez. 2009. Monthly variation in the chemical composition of *Eisenia arborea* J. E. Areschoug. *Journal of Applied Phycology*, 21: 607-616. <https://doi.org/10.1007/s10811-009-9454-5>
- Holmes, R.W. & D.A. Croll. 1984. Initial observations on the composition of dense diatom growths on the body feathers of three species of diving

- seabirds. pp. 265-277, in: D.G. Mann (ed.) Proceedings of the 7th International diatom symposium. O. Koeltz. Koenigstein.
- Siqueiros Beltrones, D.A. 2002. Diatomeas bentónicas de la Península de Baja California; diversidad y potencial ecológico. *Oceánides/CICIMAR-IPN/UABCS*. 102 p. ISBN 970-18-7595-8.
- Siqueiros Beltrones, D.A., E. Serviere-Zaragoza & U. Argumedo-Hernández. 2002. Epiphytic diatoms of *Macrocystis pyrifera* (L.) Ag. from the Baja California peninsula. *Oceánides*, 17:3-39
- Siqueiros Beltrones, D. A. & U. Argumedo-Hernández. 2005. Florística de diatomeas epifitas en láminas apicales de *Macrocystis pyrifera* (L.) C. Ag. *CICIMAR Oceánides* 20: 37-63.
<https://doi.org/10.37543/oceanides.v20i1-2.21>
- Siqueiros Beltrones, D. A. & U. Argumedo-Hernández. 2014. Particular structure of an epiphytic diatom assemblage living on *Plocclum cartilagineum* (Lamouroux) Dixon (Rhodophyceae: Gigartinales). *CICIMAR-Oceánides*, 29(2): 11-24.
<https://doi.org/10.37543/oceanides.v29i2.136>
- Siqueiros Beltrones, D.A. & D. Voltolina. 2000. Grazing selectivity of red abalone *Haliotis rufescens* postlarvae on benthic diatom films under culture conditions. *Journal of the World Aquaculture Society*, 31: 239-246.
<https://doi.org/10.1111/j.1749-7345.2000.tb00359.x>
- Siqueiros Beltrones, D. A., G. Valenzuela-Romero, O. Hernández-Almeida, U. Argumedo-Hernández & F. O. López-Fuerte. 2004. Catálogo iconográfico de diatomeas de hábitat rocosos y su incidencia en la dieta de abulones (*Haliotis* spp.) jóvenes de Baja California Sur, México. *CICIMAR-Oceánides* 19: 1-79.
<https://doi.org/10.37543/oceanides.v19i1-2.16>
- Siqueiros Beltrones, D. A. & O. U. Hernández-Almeida. 2006. Florística de diatomeas epifitas en macroalgas de un manchón subtropical. *CICIMAR-Oceánides*, 21: 11-61.
<https://doi.org/10.37543/oceanides.v21i1-2.25>
- Siqueiros Beltrones, D.A., U. argumedo-Hernández & C. Landa Cansigno. Submitted Uncommon species diversity values in epiphytic diatom assemblages of the kelp *Eisenia arborea* J.E. Arechoug. *Hidrobiológica*.
- Witkowski, A., H. Lange-Bertalot & D. Metzeltin. 2000. Diatom flora of Marine coasts I. A.R.G. Gantner Verlag K.G., Germany. 925 p.

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