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SCIENTIFIC NOTE

Unusual high density of foureye butterflyfish (*Chaetodon capistratus*) in Punta Francés coral reef, Cuba

Inusual alta densidad del parche ocelado (*Chaetodon capistratus*) en el arrecife de coral de Punta Francés, Cuba

Zenaida María Navarro-Martínez[1*]
Jorge Angulo-Valdés[2]

[1] Center for Marine Research, University of Havana (CIM-UH), 16 No. 114, Miramar, Playa, CP 11300, Havana, Cuba.

[2] Galbraith Marine Science Laboratory, Eckerd College, 4200 54th Avenue South, St. Petersburg, FL 33711, United States of America.

[*] Autor para correspondencia: zenaida@cim.uh.cu

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Centro de Investigaciones Marinas. Universidad de La Habana.

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Abstract

We report an unusual high density of the foureye butterflyfish (*Chaetodon capistratus*) in Punta Francés coral reef, Isle of Youth, Cuba. Foureye butterflyfish were swimming together in associations of 10 to 34 individuals throughout a survey carried out on spur and groove habitat, in July, 2014. This species is commonly observed single or in pairs in the Caribbean coral reefs, tending to contribute significantly to the reef fish abundance in the region. We consider important to record this particular behavior, despite we are unable to explain the causes with the current available data.

Keywords: associations, Caribbean, Chaetodontidae, reef fishes.

Resumen

Se reporta una inusual alta densidad del parche ocelado (*Chaetodon capistratus*) en el arrecife de coral de Punta Francés, Isla de la Juventud, Cuba. Dichos peces se observaron nadando juntos en asociaciones de 10 a 34 individuos, en muestreos realizados en hábitat de camellones en julio de 2014. Esta especie es comúnmente observada en solitario o en pareja en arrecifes de coral del Caribe, tendiendo a contribuir significativamente a la abundancia de los peces de arrecife en la región. Se considera importante el registro de esta conducta particular, a pesar de la imposibilidad de explicar las causas con los datos disponibles actualmente.

Palabras clave: asociaciones, Caribe, Chaetodontidae, peces de arrecife.

Introduction

Foureye butterflyfish *Chaetodon capistratus* Linnaeus, 1758 is usually observed in pairs in the Caribbean coral reefs (Fig. 1), as it also happens with others members of the family Chaetodontidae. *C. capistratus* is the most common butterflyfish on

Fig. 1. *Chaetodon capistratus* swimming in pair in Punta Francés, Cuba. Photo: Duncan Wright.

shallow reefs in the Caribbean (Randall, 1967; Birkeland and Neudecker, 1981). In numerous studies focused on reef fish assemblages in Cuba, this species contributes to the major proportions of fishes (e.g., Chevalier and Cárdenas, 2006; Cobián and Chevalier, 2009; Aguilar et al., 2014).

The presence and abundance of butterflyfishes is significant for ecological studies, given their role as "indicator of coral health" (Hourigan et al., 1988). On the contrary, their abundance has been linked with increment in coral diseases due to their possible role as disease's vector (Raymundo et al., 2009). González-Sansón et al. (2009), on the other hand, reported higher abundance of butterflyfishes in Cuban waters subject to intense fishing pressure.

Here, we report the unusual high density of *C. capistratus* recorded during a reef fish assessment in Punta Francés National Park, Cuba. Pristine habitats are included in this well-known Cuban marine protected area, which has fishing restrictions and SCUBA diving as most important activity (Guardia et al., 2004a; Angulo-Valdés, 2005; Angulo-Valdés et al., 2007).

Materials and methods

Diver operated stereo-video method (stereo-DOV) was used to survey coral reef fishes in Punta Francés, Isle

of Youth, Cuba (Fig. 2) during July and August, 2011 -2014 (Navarro-Martínez et al., 2021). Punta Francés includes a habitat mosaic composed by a shallow back reef with seagrass beds, mangrove channels, sandy bottom with macroalgaes, areas with seagrass and patch reefs, reef crests, terrace, slope, deep patch reefs, spur and groove, and a typical drop off wall that marks the end of the insular shelf (Guardia et al., 2004a). The study area includes the Punta Francés National Park where the complete habitat mosaic is well represented.

We processed the stereo-DOV recorded in reef crest, reef slope, and spur and groove, in six different sites: NP1, NP2, NP3, O1, O2, and O3 (Fig. 2); of which the three first locations belong to the National Park area. During the analysis of one of the videos recorded, we noticed an unusual number of foureye butterflyfish together.

We compared these unusual associations with the other records found during the complete survey [411 transects of 125 m^2 each one]. We calculated the mean, 0.95 confidence interval, and standard error per habitat. The analyses and figure were developed in R language (R Core Team, 2020), using the ggplot2 (Wickham, 2016) and Hmisc (Harrell et al., 2021) packages.

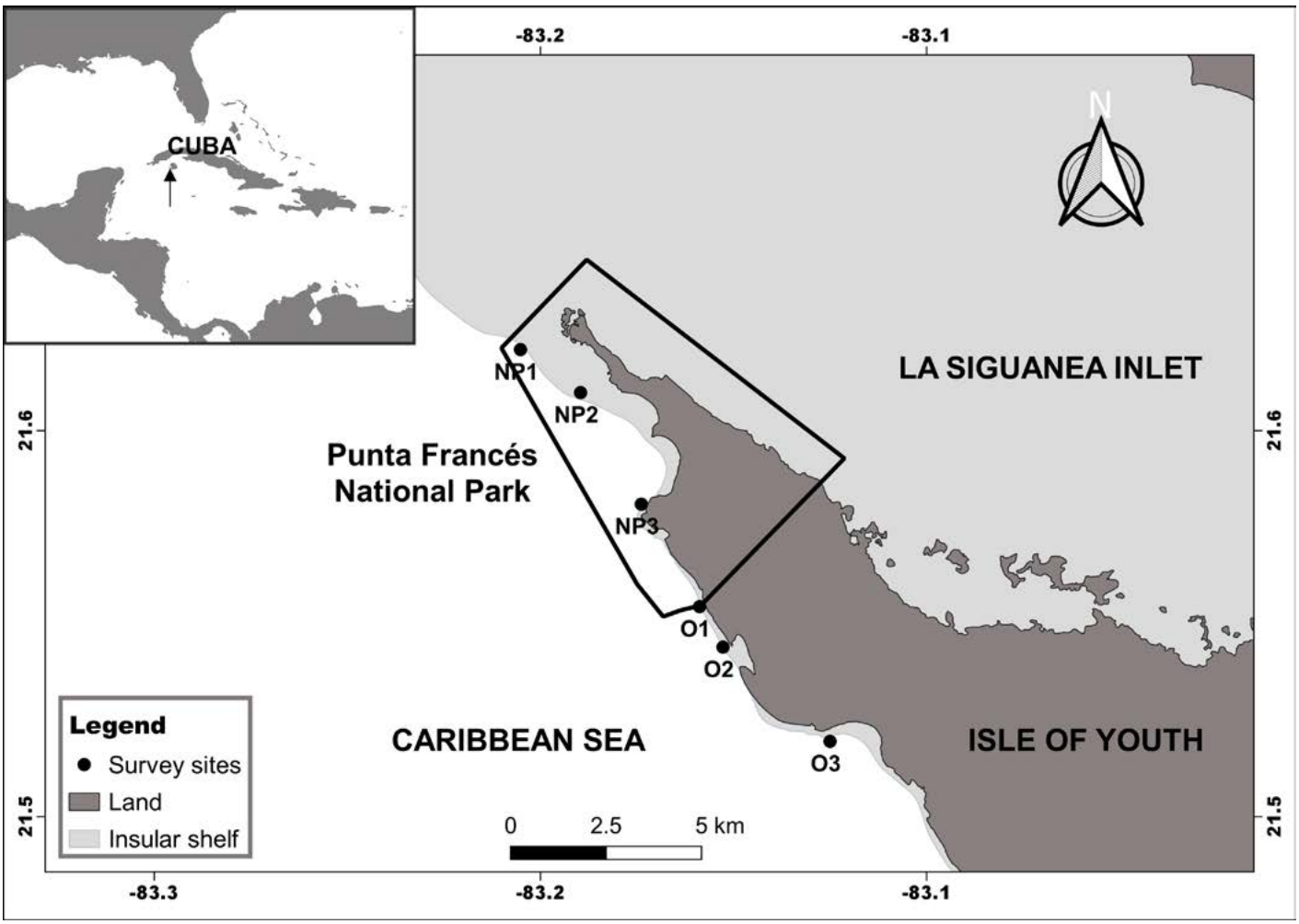

Fig. 2. Geographic location where reef fish surveys were carried out and high density of *Chaetodon capistratus* was recorded (NP3) in Punta Francés, Cuba. The polygon marked with a black line indicates the limits of the National Park.

Results and discussion

A total of 90 individuals of *C. capistratus* in groups of more than 10 together were found in site NP3 [date: July 23rd, 2014, time: 1000 – 1100 hrs, depth: ~15 – 20 m, coral reef habitat: spur and groove] labeled as NP3. SG.2014. The most numerous group had a total of 34 individuals together (Fig. 3). We can confirm the highest abundance on that survey as considerably higher than the other records for this species in Punta Francés during the survey time (Fig. 4), where similar phenomenon was not observed for this or other butterflyfish species.

Feeding associations could be probable in this area with heterogeneity of habitats, including mangroves and seagrass beds. In this sense, *C. capistratus* juveniles have shown preference (or some dependence) for mangroves and seagrass beds as nurseries (Nagelkerken et al., 2001; 2002). However, according to their feeding behavior, *C. capistratus* is a browser on anthozoans and an active generalist (Birkeland and Neudecker, 1981), usually observed single or in pairs.

During the spawning season of corals and octocorals, butterflyfishes can feed on the eggs (Lasker, 1985; Villanueva and Edwards, 2010), taking advantage of this nutrient-rich item. The spawning season of several corals/octocorals recorded in the spur and groove habitats of Punta Francés [e.g., *Acropora cervicornis* (Lamarck, 1816), *Diploria labyrinthiformis* (Linnaeus, 1758), *Montastraea cavernosa* (Linnaeus, 1767), *Pseudodiploria strigosa* (Dana, 1846), *Plexaura* spp. Lamouroux, 1812 (Guardia et al., 2004a, b)] includes July, and the spawning occur some days after full-moon [usually less than 12 days (Lasker, 1985; Jordan, 2018)]. Considering the date of the event that we report (July 23rd, 11 days after full moon), we can expect a probable relationship between the butterflyfish high density and coral spawning events. Nevertheless, this explanation remain doubtful since (1) we lack strong evidence, (2) the mentioned coral/octocorals were not the most abundant species in the spur and groove habitats of Punta Francés (Guardia et al., 2004a, b), and (3) because the distribution pattern of the observed associations doesn't fit the patterns previously described for *Chaetodon* spp. during coral and octocoral spawning (Lasker, 1985; Villanueva and Edwards, 2010).

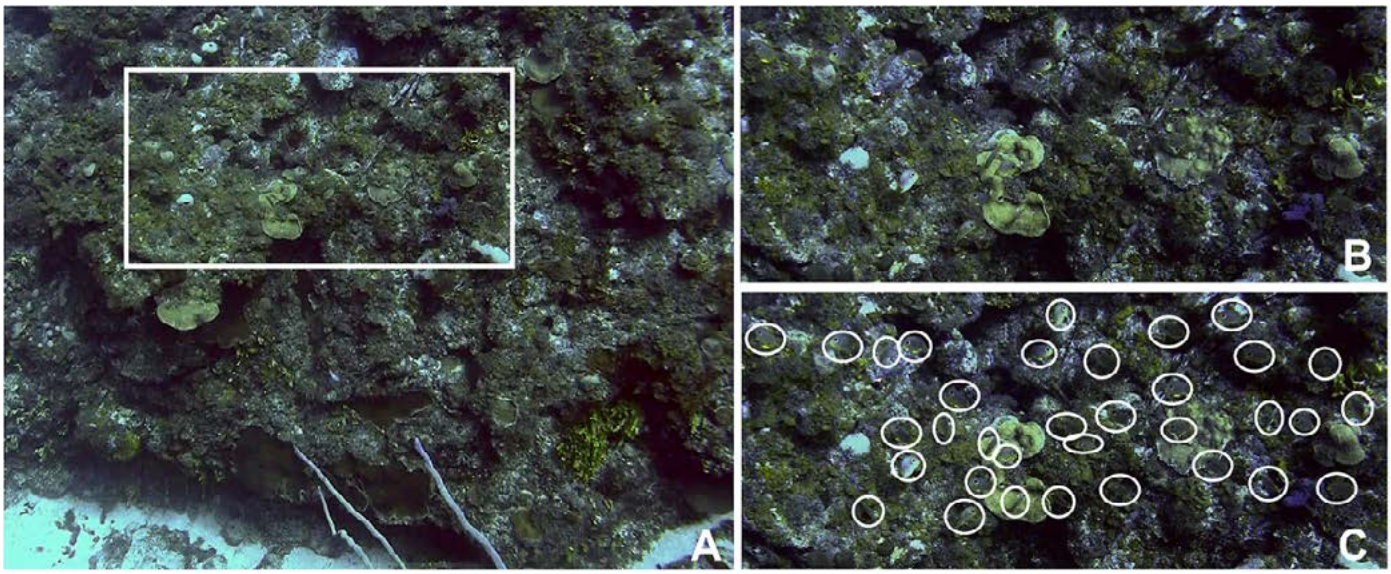

Fig. 3. High densities of *Chaetodon capistratus* recorded in Punta Francés coral reef, Cuba. A. Wall where was found one part of the associations, B. Closer view to the area highlighted in A by the white rectangle, C. Same view than B with white circles standing out the fish.

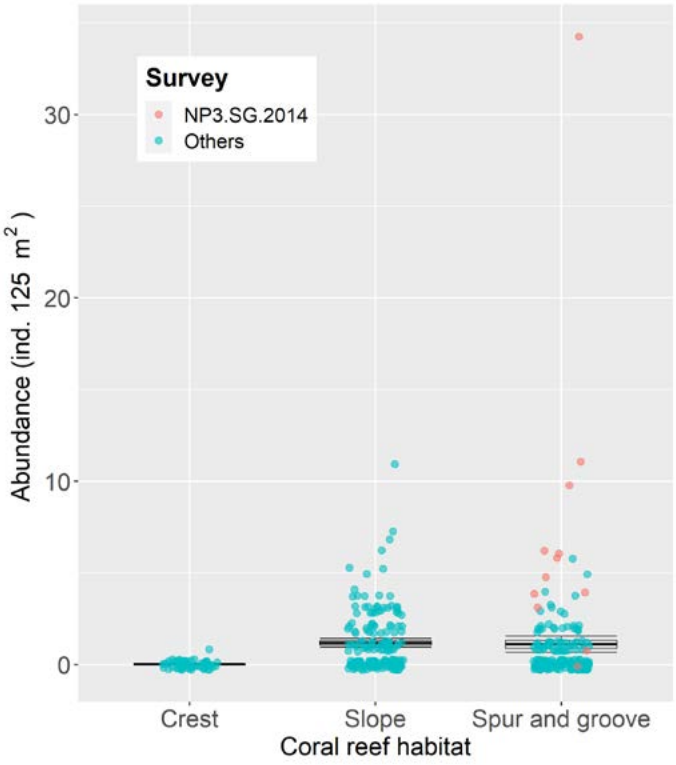

Fig. 4. Abundance of *Chaetodon capistratus* recorded per transect (n= 411) in Punta Francés, Cuba in July and August during the period 2011-2014, given as individuals per 125 m^2. Horizontal lines indicate the mean, boxes indicate the standard error, and error lines indicate the 0.95 confidence interval. Each point represents a transect (125 m^2).

Plankton-feeding association was reported in *Chaetodon striatus* Linnaeus, 1758 (Sazima and Sazima, 2001). While, associations of around 24 individuals of *Chaetodon trifascialis* Quoy & Gaimard, 1825 were recorded in the remote Phoenix Islands Protected Area (Coker et al., 2016). This last behavior was considered unusual in that solitary and territorial species. The species of the family Chaetodontidae tend to be characterized by one of the different types of social groups, i.e. solo, pair, aggregation, mixed, although more than one behavior can be found in some species (Yabuta, 2007).

We are unable to explain the causes of these butterflyfish associations, because we did not observe any social behavior or external evidence which allows inferring the causes. Additionally, calibration problems with the stereo-DOV unable to record fish sizes and estimate the fish reproductive stages. However, we consider important to record this particular phenomenon for foureye butterflyfish. For our knowledge, this is the first report of numerous associations in *C. capistratus*. It will be an important insight into the behavior of this charismatic and ecologically important species in the Caribbean coral reefs.

Conclusions

This represents the first report of high density groups of *C. capistratus* as well as contributes to previous unusual high density records for the family Chaetodontidae. Considering the representativeness of this family in the coral reefs, this event give us an idea about how is still unknown from shallow-water species behavior. Future studies focused on reef fish biology and behavior can clarify the nature of this kind of associations and its potential effect over the coral reefs.

Declarations

Authors' Contribution

Methodology, JAV, ZMNM; Analysis of the videos, ZMNM; Observation of the reported phenomenon, ZMNM; Data analysis, ZMNM, JAV; Writing of the first draft, ZMNM; Writing and revision of several versions, ZMNM, JAV; Funding acquisition, JAV.

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Conflicts of Interest

The authors have declared that no exist financial or non-financial competing interests relevant to the manuscript content.

Ethical behavior

Animals were none used during this research.

Survey permission

The authors have received the necessary permissions from the pertinent authorities to develop the surveys.

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References

Angulo-Valdés, J. A. (2005). *Effectiveness of a Cuban Marine Protected Area in meeting multiple management objectives.* (Ph.D. Thesis), Dalhousie University, Halifax, Nova Scotia.

Angulo-Valdés, J. A., Borrego-Acevedo, R., Borrego-Hernández, R., & González-Sansón, G. (2007). Effects of tourism activities on coral reef communities in the Punta Frances National Park, Cuba. *Rev. Invest. Mar., 28(2),* 159-175.

Aguilar, C., González-Sansón, G., Cabrera, Y., Ruiz, A., Curry, R. A. (2014). Inter-habitat variation in density and size composition of reef fishes from the Cuban Northwestern shelf. *Rev. Biol. Trop., 62,* 589-602.

Birkeland, C., Neudecker, S. (1981). Foraging Behavior of Two Caribbean Chaetodontids: *Chaetodon capistratus* and *C. aculeatus*. *Copeia, 1,*169-178.

Chevalier, P. P., Cárdenas, A. L. (2006). Estudio diagnóstico del arrecife coralino del Rincón de Guanabo, Ciudad de La Habana, Cuba. 2. Peces. *Rev. Invest. Mar*., *27,* 121-132.

Cobián, D., Chevalier, P. P. (2009). Evaluación de las asociaciones de peces de los arrecifes coralinos del Centro Internacional de Buceo María la Gorda, Parque Nacional Guanahacabibes, Cuba. *Rev. Mar. Cost., 1,*111-125.

Coker, D. J., Braun, C. D., Cavin, J., Payet, S., Berumen, M. L. (2016). Remote marine protected area reveals unusual social behaviour in *Chaetodon trifascialis*. *Mar. Biodiv., 48,* 155-156.

González-Sansón, G., Aguilar, C., Hernández, I., Cabrera, Y., Curry, R.A. (2009). The influence of habitat and fishing on reef fish assemblages in Cuba. *Gulf. Caribb. Res., 21,* 13-21

Guardia, E. d. l., Angulo, J., González-Sansón, G., Aguilar, C., González-Díaz, P. (2004a). Biodiversidad en la zona de buceo del Parque Nacional de Punta Francés, Isla de la Juventud, Cuba. *Rev. Invest. Mar., 25(2),* 90-102.

Guardia, E. d. l., González-Díaz, P., Iglesias, S. C. (2004b). Estructura de la comunidad de grupos bentónicos sésiles en la zona de buceo de Punta Francés, Cuba. *Rev. Invest. Mar., 25(2),* 81-90.

Harrell F. E. Jr., with contributions from Charles Dupont and many others (2021). *Hmisc: Harrell Miscellaneous*. R package version 4.5-0. https://CRAN.R-project.org/package=Hmisc.

Hourigan, T. F., Timothy, C. T., Reese, E. S. (1988). Coral reef fishes as indicators of environmental stress in coral reefs. In D.F. Soule, G.S. Kleppel, (eds.) *Marine organisms as indicators* (pp. 107-135). New York: Springer.

Jordan, A. C. (2018). *Patterns in Caribbean Coral Spawning.* Master Thesis. Nova Southeastern University. Retrieved from NSUWorks, (468) https://nsuworks.nova.edu/occ_stuetd/468.

Lasker, H. R. (1985). Prey preferences and browsing pressure of the butterflyfish *Chaetodon capistratus* on Caribbean gorgonians. *Mar. Ecol. Prog. Ser., 21,* 213-220.

Nagelkerken, I., Kleijnen, S., Klop, T., Brand, R. A. C. J. , Cocheret de la Morinière, E., van der Velde, G. (2001). Dependence of Caribbean reef fishes on mangroves and seagrass beds as nursery habitats: a comparison of fish faunas between bays with and without mangroves/seagrass beds. *Mar. Ecol. Prog. Ser., 214,* 225-235.

Nagelkerken, I., Roberts, C. M., van der Velde, G., Dorenbosch, M., van Riel, M. C., Cocheret de la Morinière, E., Nienhuis, P. H. (2002). How important are mangroves and seagrass beds for coral-reef fish? The nursery

hypothesis tested on an island scale. *Mar. Ecol. Prog. Ser., 244,* 299-305.

Navarro-Martínez, Z. M., Guardia, E. d. l., Szelistowski, W., Angulo-Valdés, J. A. (2021). An overview of coral reef fish composition in Punta Francés, Cuba, surveyed using diver operated stereovideo. *Rev. Invest. Mar.*, *41*(2), 56-75.

R Core Team (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Randall, J. E. (1967). Food habits of reef fishes of the West Indies. *Stud. Trop. Oceanogr. Miami., 5*, 665-847.

Raymundo, L. J., Halford, A. R., Maypa, A. P., Kerr, A. M. (2009). Functionally diverse reef-fish communities ameliorate coral disease. *PNAS., 106,* 17067-17070.

Sazima, C., Sazima, I. (2001). Plankton-feeding aggregation and occasional cleaning by adult butterflyfish, *Chaetodon striatus* (Chaetodontidae), in southwestern Atlantic. *Cybium., 25,* 145-151.

Villanueva, R. D., Edwards A. J. (2010). Butterflyfishes feed on externally brooded larvae of the blue coral, *Heliopora coerulea*. *Coral Reefs, 29,* 105.

Wickham, H. (2016). *Ggplot2: Elegant Graphics for Data Analysis*. Springer-Verlag New York.

Yabuta, S. (2007). Social groupings in 18 species of butterflyfish and pair bond weakening during the nonreproductive season. *Ichthyol. Res., 54,* 207-210.

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