



WATERLILY

PHOTO REFERENCE ARCHIVE

Nymphoides indica Vol. 2

Río Dulce, El Golfete
Municipio de Livingston,
Izabal, Guatemala

NICHOLAS **HELLMUTH**

LIVINGSTON

Plants



WATERLILY

PHOTO REFERENCE ARCHIVE

JUNE 2020

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Front Cover Photograph *Nymphoides indica*.

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March, 2020. Camera: NIKON D810
Lens Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/250, f/11, ISO 1600

Title Page Photograph *Nymphoides indica*

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March, 2020. Camera: NIKON D810
Lens: AF-S VR Micro-Nikkor 105mm f/2.8G IF-ED
Settings: 1/250, f/11, ISO 800

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INTRODUCTION TO OUR FLAAR OF WATER-RELATED FLOWERS OF IZABAL, GUATEMALA

During our exploratory botanical field trips to Rio Dulce and El Golfete, Municipio de Livingston, Izabal, we noticed thousands of *Nymphoides indica* waterlily plants in full flowering phase.

Yet *Nymphoides indica* is not a flowering waterlily that I noticed in any of my previous decades of studying *Nymphaea ampla* in the Monterrico area (Canal de Chiquilumilla), Arroyo Pucte (tributary of Rio la Pasion), Rio San Pedro, Yaxha lakes, or Lake Peten Itza (especially the east end). Probably in these earlier decades I was so totally dedicated to studying the flowering and seed pod development sequence of *Nymphaea ampla* that I simply did not notice *Nymphoides indica*? But in the shore areas and lagoons, along both the north and south sides of the east end of El Golfete, there are “thousands” of *Nymphoides indica* flowers (we found so many ecosystems in the east half that we have not yet explored the west half).

For each plant of this area that we find we prepare a research report, focusing on a complete bibliography of articles, theses, dissertations and pertinent websites on this plant. Plus an ample set of full color photographs from being in front of these plants. For *Nymphoides indica* all this is in “Floating heart Water snowflake”, like a Volume 1 of this species.



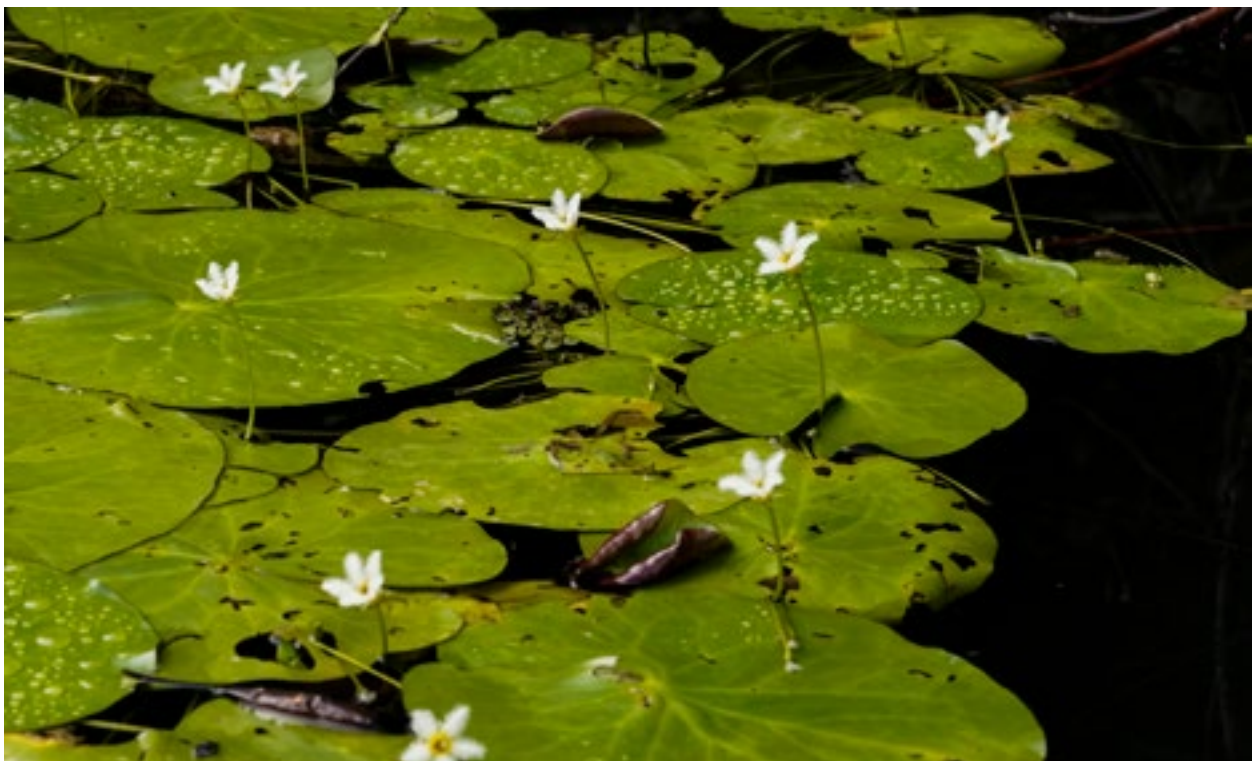
This other report shows additional information about the *Nymphoides indica* waterlily.



The present "Volume 2" is a photo archive to assist botanists, ecologists, and students to plan and prepare their own research on this plant. The present PDF is to show the *Nymphoides indica* flowers, leaves, and ecosystems with enough different photos so that specialists can detect aspects that deserve further study. By us at FLAAR Mesoamerica making all these photographs available in advance, this hopefully makes it easier for other botanists and ecologists to prepare themselves for their own field trips to this Caribbean area of the Municipio de Livingston, Izabal, Guatemala.

Since a PDF needs to be under 20MB to be sendable as an attachment via Gmail, we prefer not to have files over 18MB. Sending via WeTransfer or DropBox is a pain; so we prefer to keep the size that is sendable via WhatsApp, Skype, e-mail, and comparable.

Volume 1 is photographs by María Alejandra Gutierrez and David Arrivillaga. During the current COVID-19 pandemic the team works from their homes, and the Internet is overloaded, so it's not realistic to have easy quick access to a photo folders back in the main office. So it was understandably easier for them to use their own photos in Volume 1. For a Volume 2 it is easier to show the photographs of Nicholas Hellmuth in addition to photos from Mariale and David We would like to create a subsequent volume of the photographs of Juan Pablo Fumagalli (they are not on my hard drives so will do that later this summer).

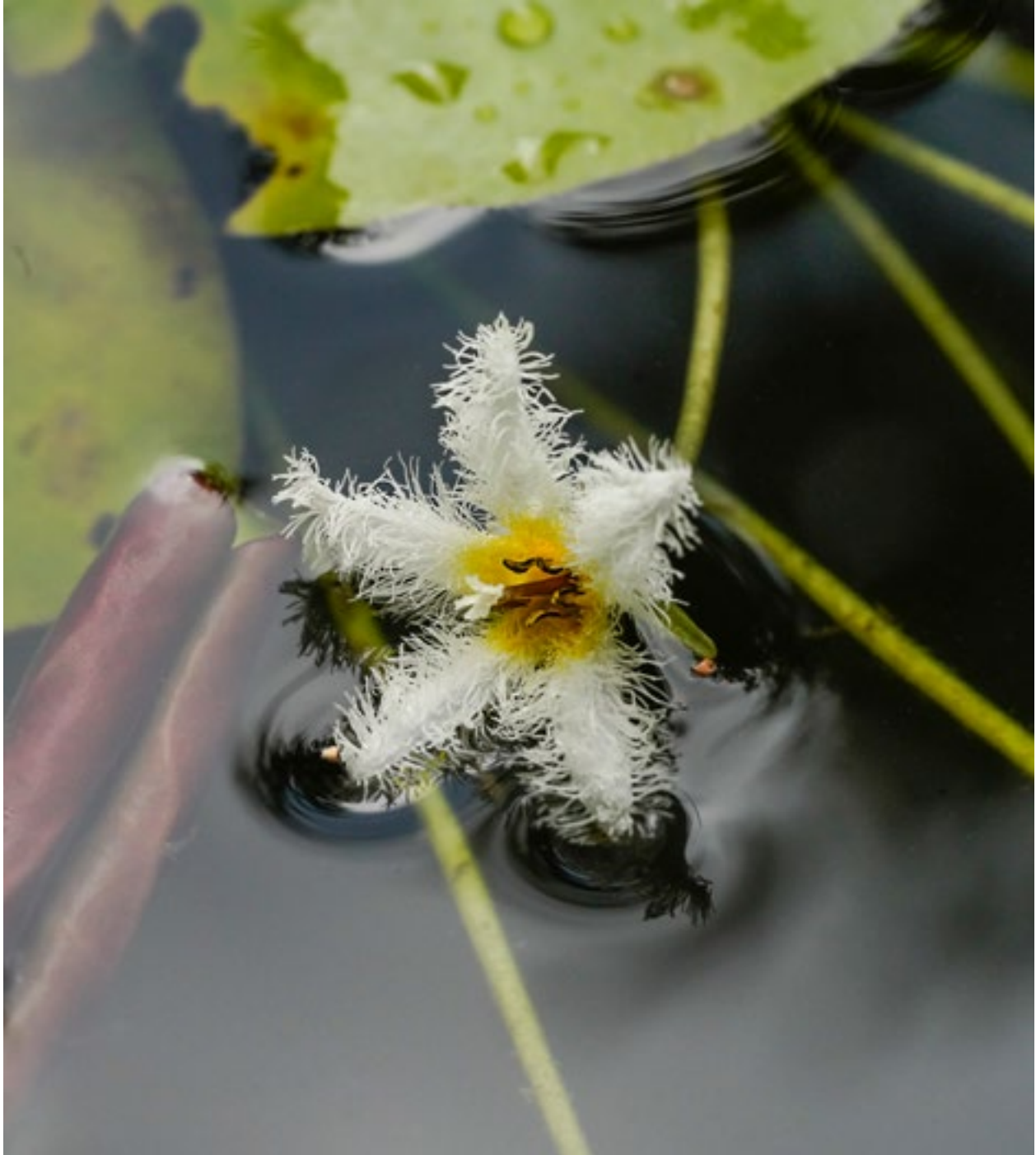


Nymphoides indica founded at the riverside, El Golfete.

Photograph by: María Alejandra Gutiérrez, FLAAR Mesoamerica. March 14, 2020. Camera: SONY DSC-RX10M4. Settings: 1/250, f/13, ISO.3200.

FULL BOTANICAL **NAME AND HABIT**

Nymphoides indica (L.) Kuntze, Family Menyanthaceae. **Habit:** Herb, aquatic.



Nymphoides indica. El Golfete, Livingston.

Photograph by: María Alejandra Gutiérrez, FLAAR Mesoamerica. March 14, 2020.

Camera: SONY a7R IV. Lens: Sony 90mm Macro G OSS. Settings: 1/250, f/13, ISO.3200.

LOCAL NAMES FOR *NYPHOIDES INDICA*

Common names in English are “floating heart” and “water snowflake”.

(<https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=242>).

Called “cebolla de agua”, “corazón de agua” for the area of Cerro San Gil (south side of El Golfete) (CONAP 2008: 152). I find the word cebolla de agua very intriguing. Does that mean the local people are aware that the roots are as edible as the onion?

Local names vary depending on what part of Guatemala you are in. local names are slightly different in Chiapas, Tabasco, Campeche, Yucatan, Quintana Roo, and Belize.

Mayan names depend on whether you are in a Peten Itza Maya area or Q’eqchi’ or other Mayan language area.



Nymphoides indica. El Golfete, Livingston. Photograph by: David Arrivillaga, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D5 Lens: 35mm f/1.4. Settings: 1/640, f/9, ISO 640

NYMPHAEA INDICA GROWING **TOGETHER WITH *NYMPHAEA AMPLA***

We found large areas of both totally unrelated waterlilies growing physically next to each other. We found other large areas of only *Nymphaea ampla* with not one single *Nymphoides indica*. We found other large areas of *Nymphoides indica* with not one single *Nymphaea ampla*.

So we now show these different ecosystems one by one. They were often within a few hundred meters of each other. The *Nymphaea ampla* areas we show in a separate report just on *Nymphaea ampla* of El Golfete, Rio Dulce, Lagunita Creek, etc. So let's start by showing *Nymphaea ampla* and the *Nymphoides indica* next to each other.



Both flowers together. Here there are more *Nymphaea ampla* and the *Nymphoides indica* are primarily further out in the water. El Golfete area, probably Laguna 4 Cayos, Municipio de Livingston, Izabal, Guatemala.

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320 f/13, ISO 1250



Nymphaea ampla primarily. Most of the *Nymphoides indica* is not close to the shore.
El Golfete area, probably Laguna 4 Cayos, Municipio de Livingston, Izabal, Guatemala.

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020.
Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/13, ISO 1250.



You can see that these waterlilies can handle water only up to a certain depth. Once you have deeper water (further away from the shore) you do not get any more waterlilies of either species. Also notice that they grow right smack up to the shoreline. *Nymphoides indica* together with *Nymphaea ampla*, El Golfete area, probably Laguna 4 Cayos, Municipio de Livingston, Izabal, Guatemala.

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810.
Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/13, ISO 1250.



Nymphaea ampla This view is a few meters to the right of the photo above.
El Golfete area, probably Laguna 4 Cayos, Municipio de Livingston, Izabal, Guatemala. 10 am, March 14, 2020.

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. Camera: NIKON D810.
Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/13, ISO 1250.



Nymphoides indica tends to be in deeper water. El Golfete area, probably Laguna 4 Cayos, Municipio de Livingston, Izabal, Guatemala. 10 am, March 14, 2020.

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. Camera: NIKON D810.
Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/13, ISO 500.



Nymphaea ampla is primarily close to the shore; then you get *Nymphoides indica* further out into the water. As you can see, the Great White Heron is oblivious to our presence. Inlets off east half of El Golfete area of Rio Dulce. 10:41am, March 14, 2020.

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. Camera: NIKON D810.
Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/13, ISO 800.



A slightly different habitat (plants on the shore are totally different here). This is because of the biodiversity of the shore areas of each inlet, each lagoon, each area along the El Golfete or Rio Dulce itself.

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810.
Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/400, f/14, ISO 1250.



Pure *Nymphoides indica*. It does indeed grow close to the shore if there is no *Nymphaea ampla* along the same shore.

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810.
Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/400, f/14, ISO 1250.

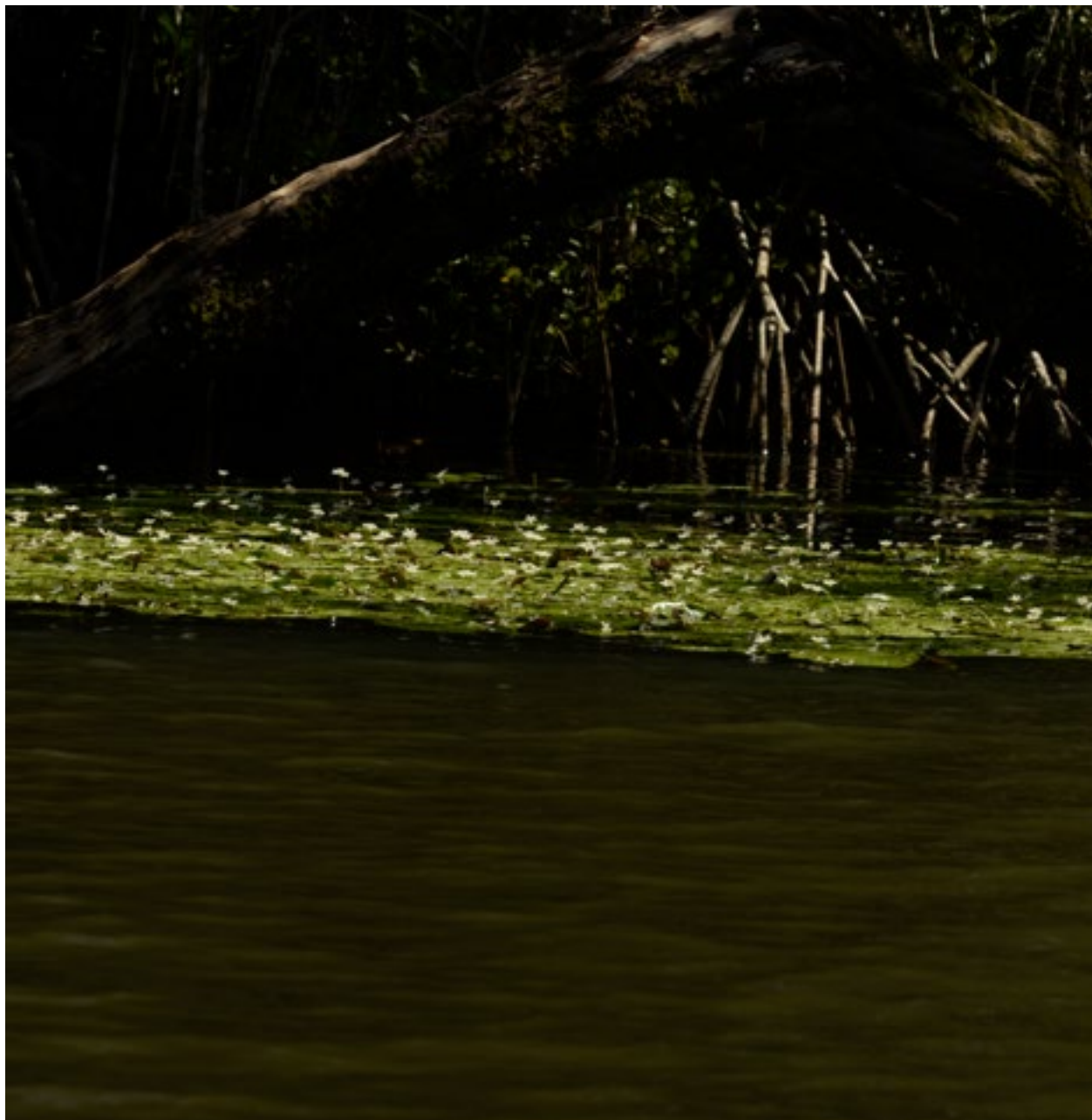


A third species: *Crinum americanum*.

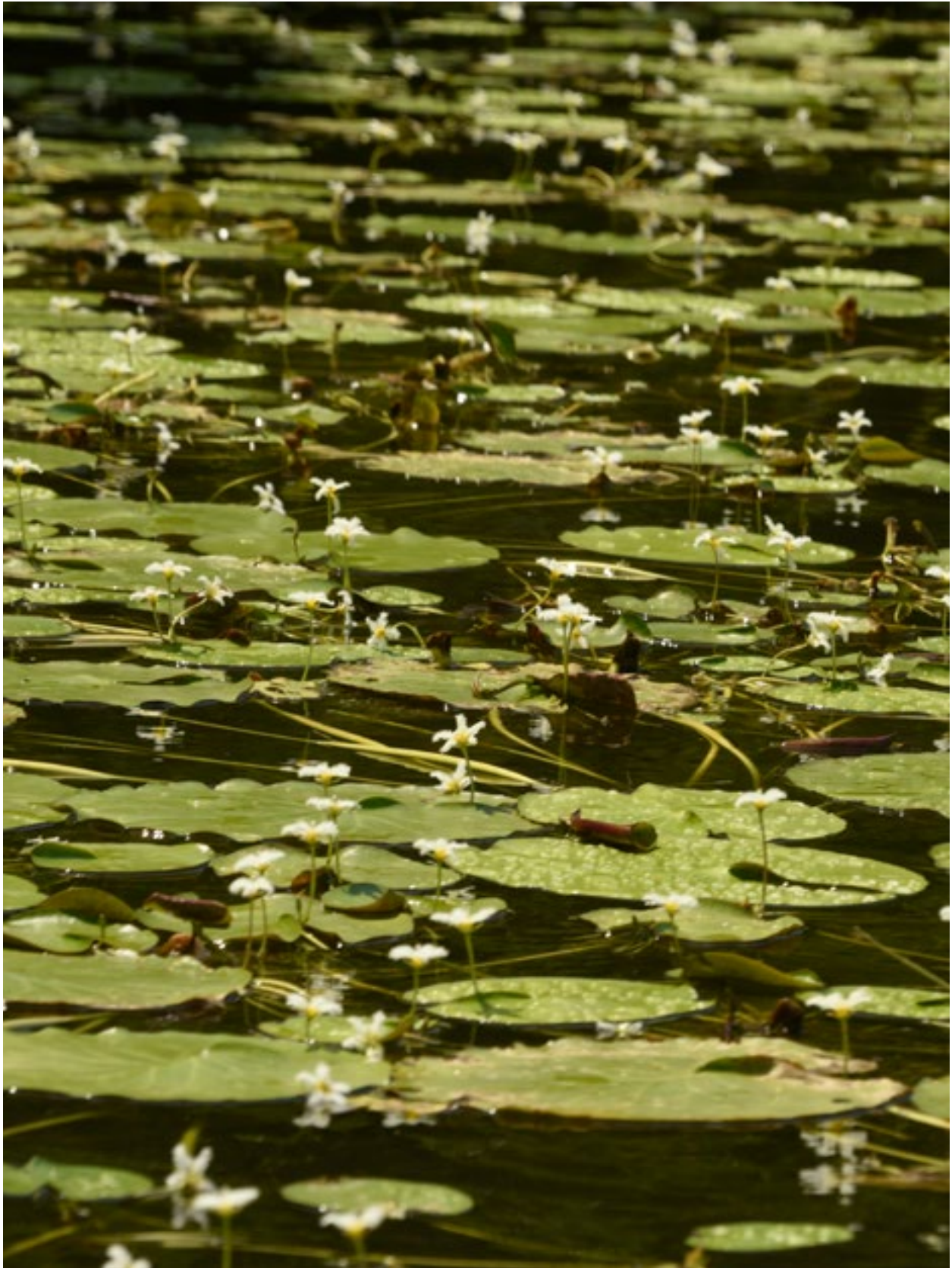
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NYMPHOIDES INDICA **GROWING BY ITSELF**

Nymphaea ampla growing by itself is in the separate report on *Nymphaea ampla*. Now we show *Nymphoides indica* growing by itself.



Nymphoides indica by itself, en masse. Note the mangrove swamp behind.
Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020.
Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro.
Settings: 1/400, f/14, ISO 1250.



Hundreds of *Nymphoides indica*.

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810.
Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/13, ISO 640.

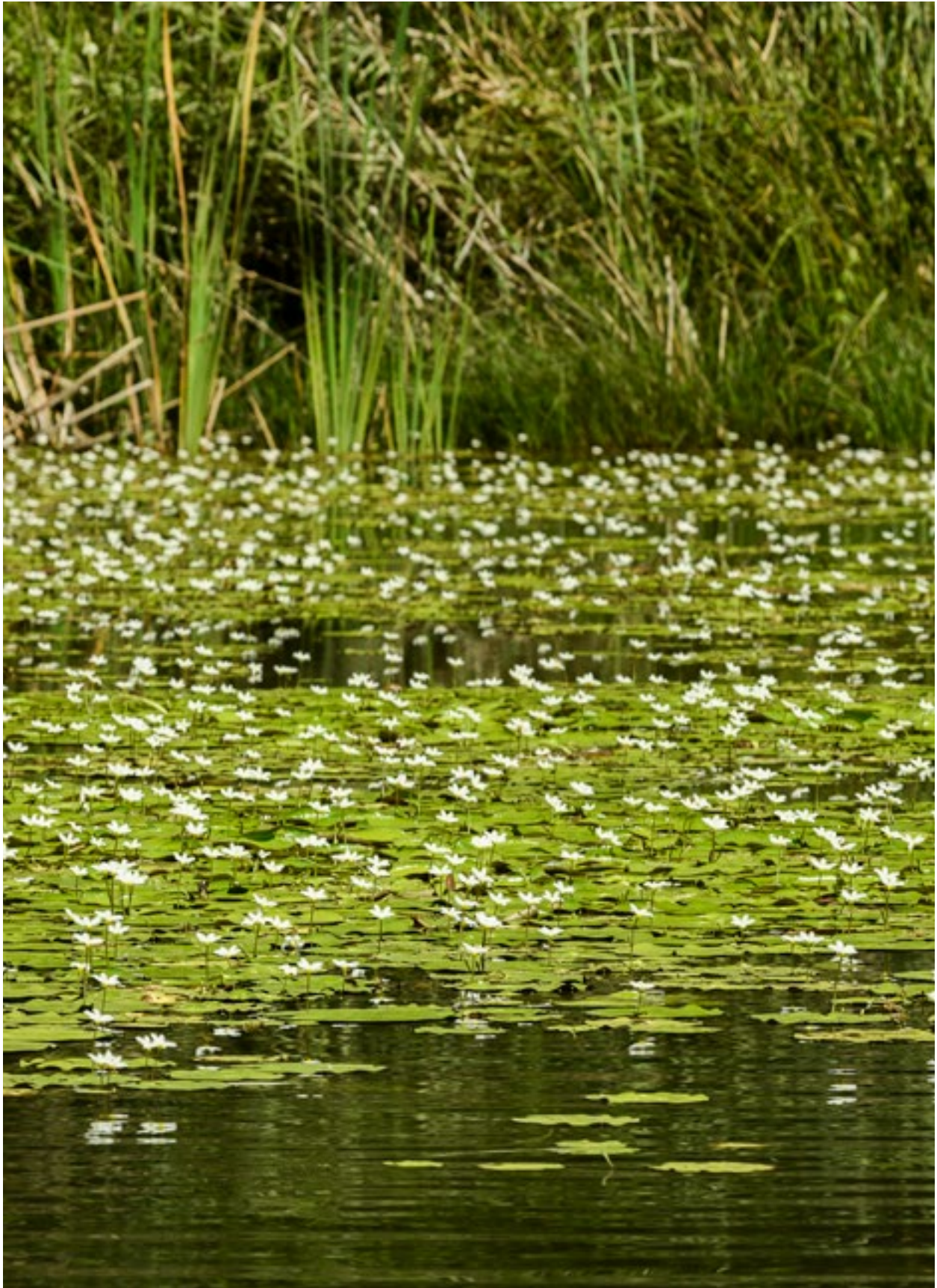


If there are no *Nymphaea ampla* waterlilies the *Nymphoides indica* will grow close to the shore. Here, however, the 'shore' is a reed swamp.
Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/13, ISO 800.



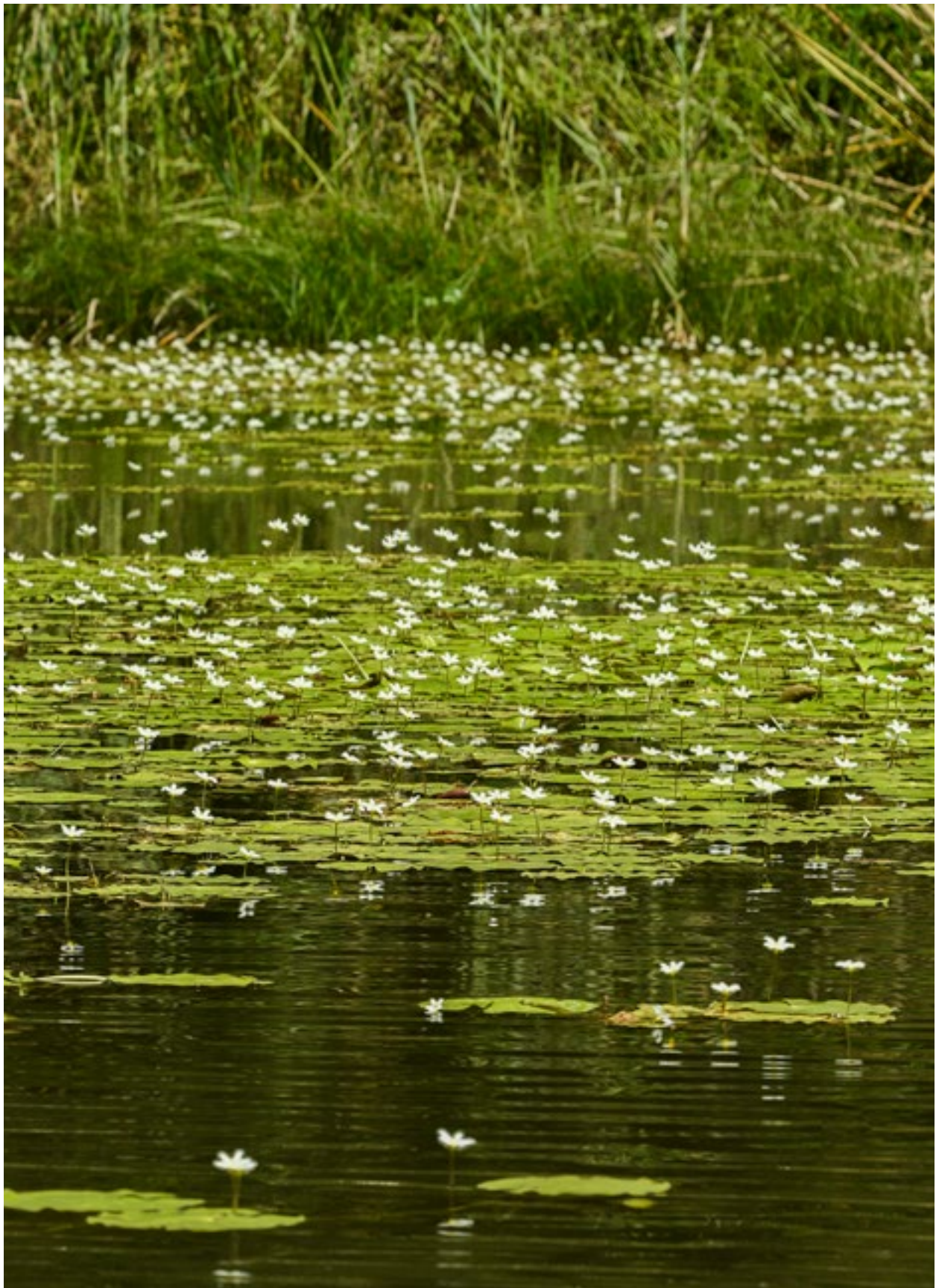
Nymphoides indica

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810.
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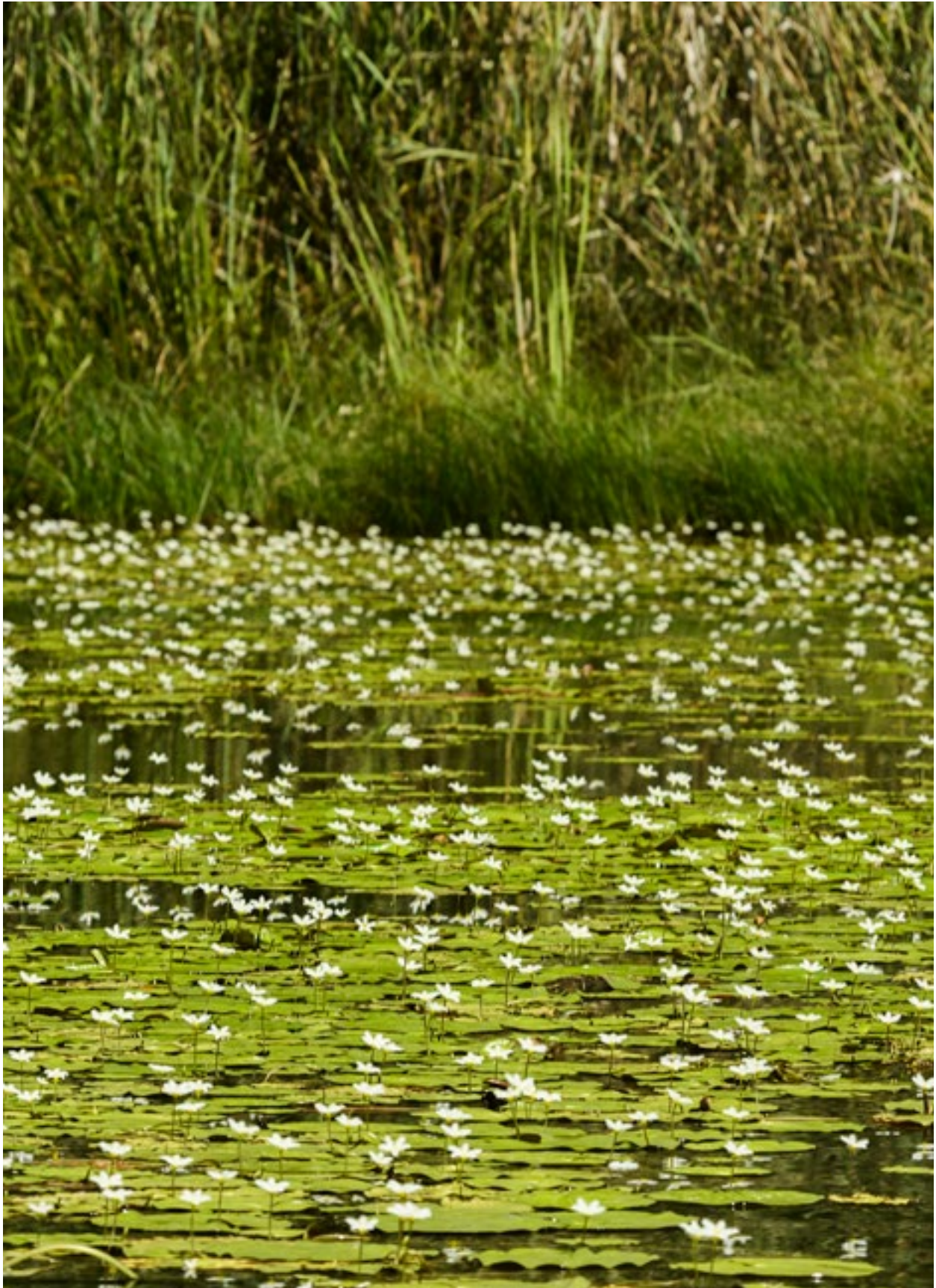
Nymphoides indica

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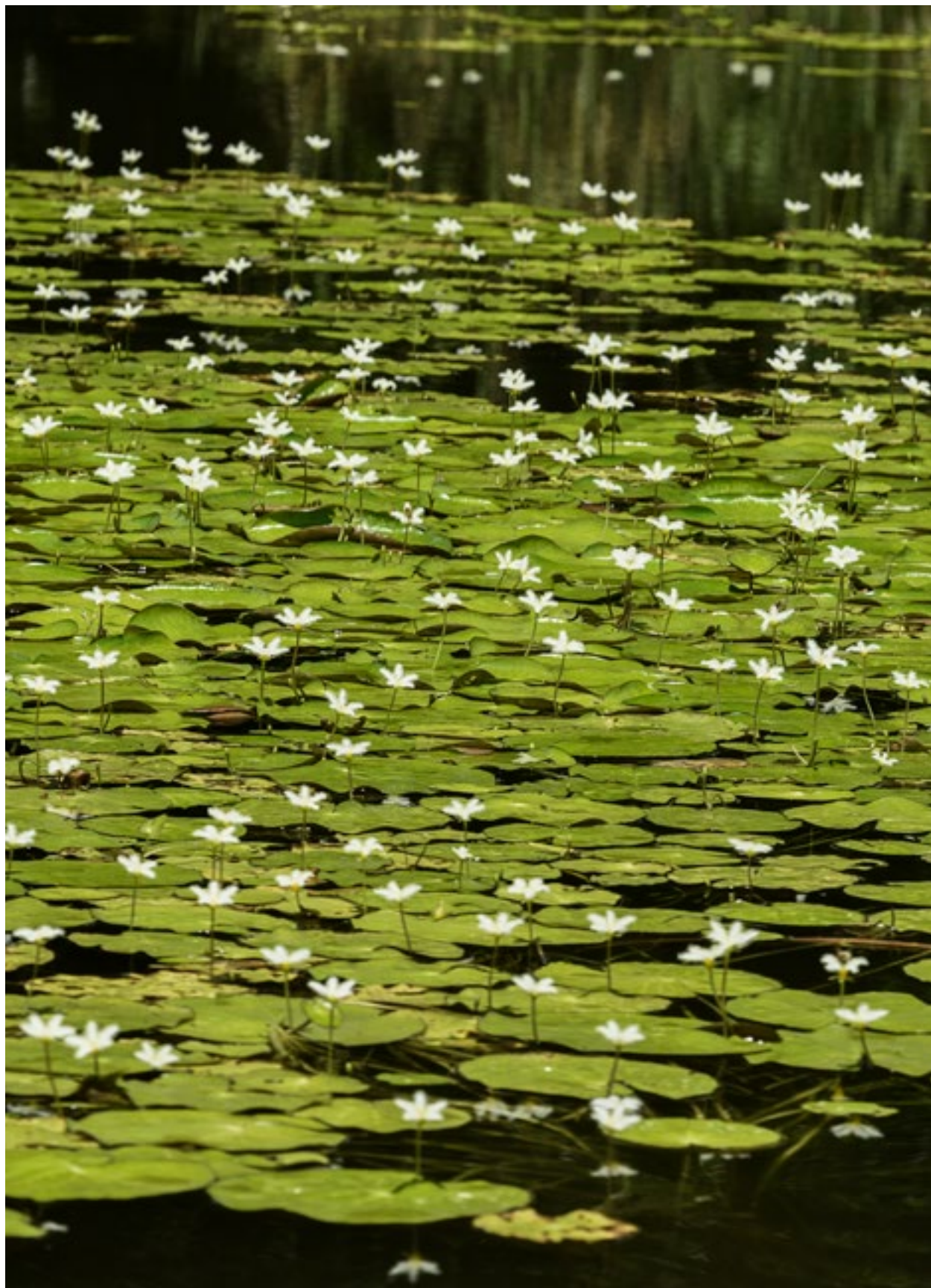
Nymphoides indica

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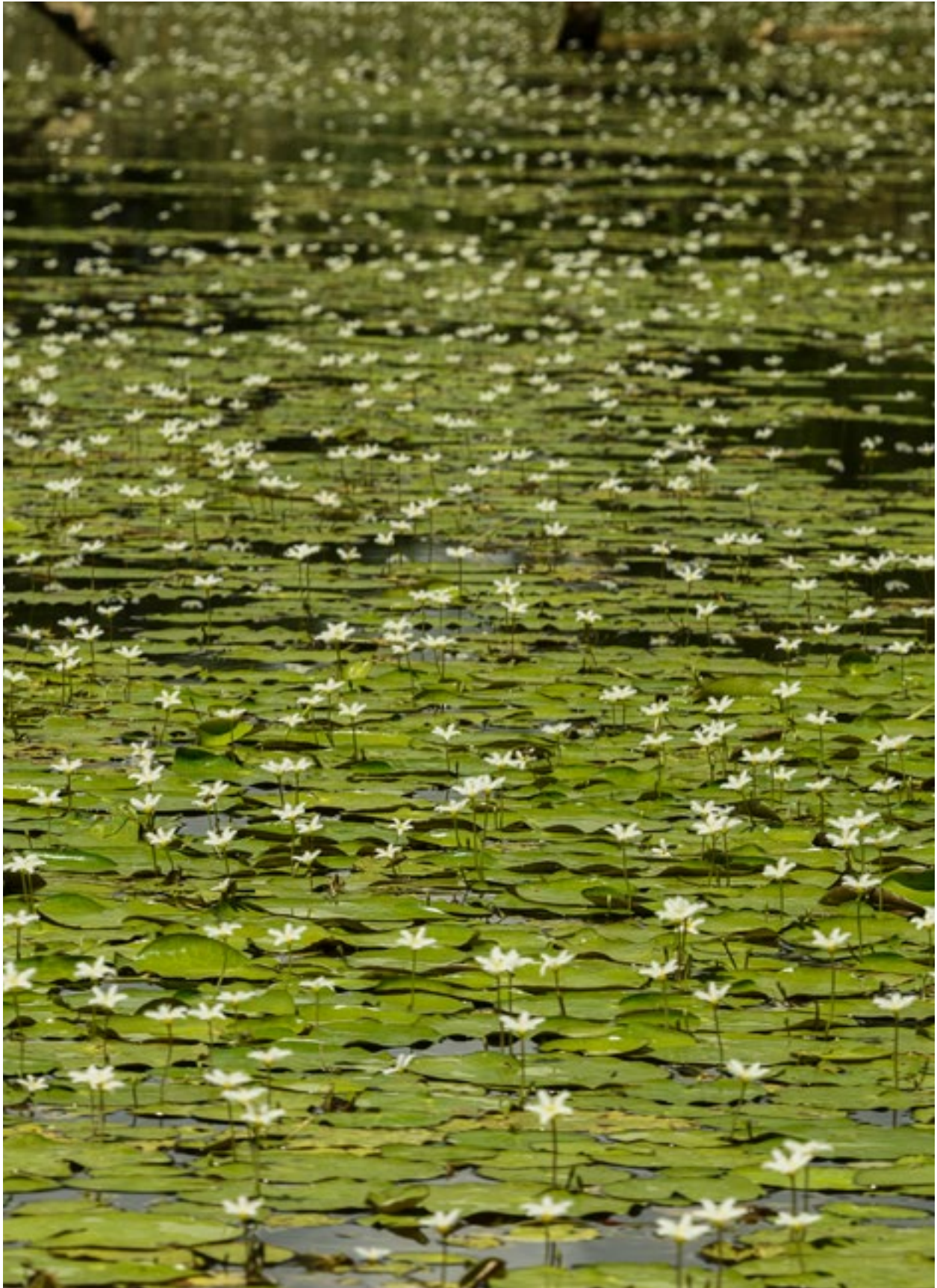
Nymphoides indica

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/13, ISO 800.



Nymphoides indica to show how the leaves cluster near each other.

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: Nikon D810
Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/250, f/14, ISO 800.



Nymphoides indica.

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: Nikon D810.
Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/250, f/14, ISO 640.



Nymphoides indica.

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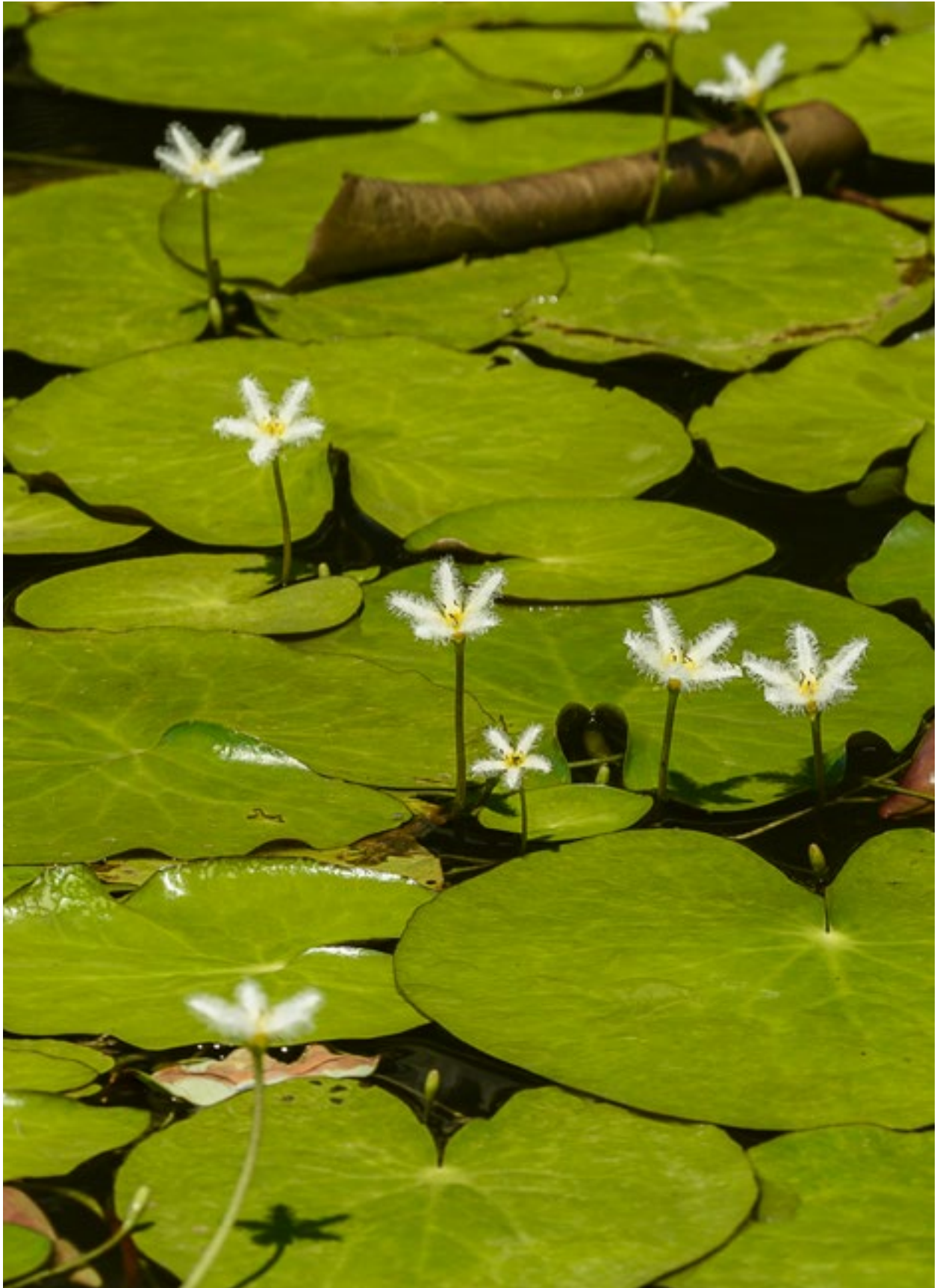
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Nymphoides indica.

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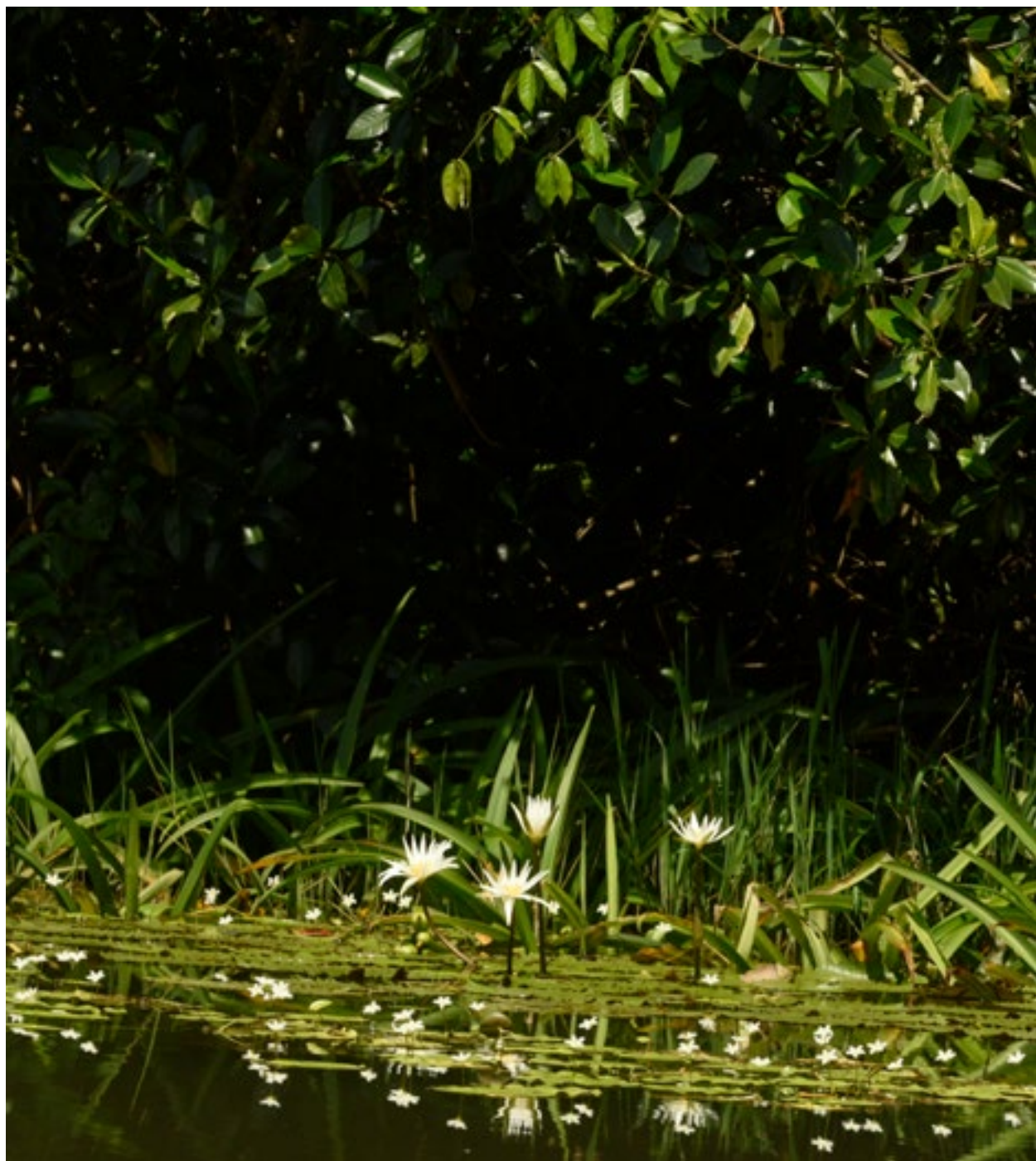
Nymphoides indica. Leaves are in all sizes since some plants are young others are old.
Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810.
Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/14, ISO 640.



Nymphoides inica. It is rare, but not unseen, for a leaf to be away from the main mass. If a crocodile swims through the mass, or a boat comes through the mass, then some leaves will get pushed to one side.

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810.
Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/14, ISO 640.

THREE DIFFERENT WATERLILIES **ALL IN THE SAME HABITAT**



Here are three different waterlily flowers in full bloom on the same day, March 14, 2020. ***Crinum americanum*** (better known from Florida and Texas) and the two more common waterlilies of Izabal.

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/14, ISO 640.



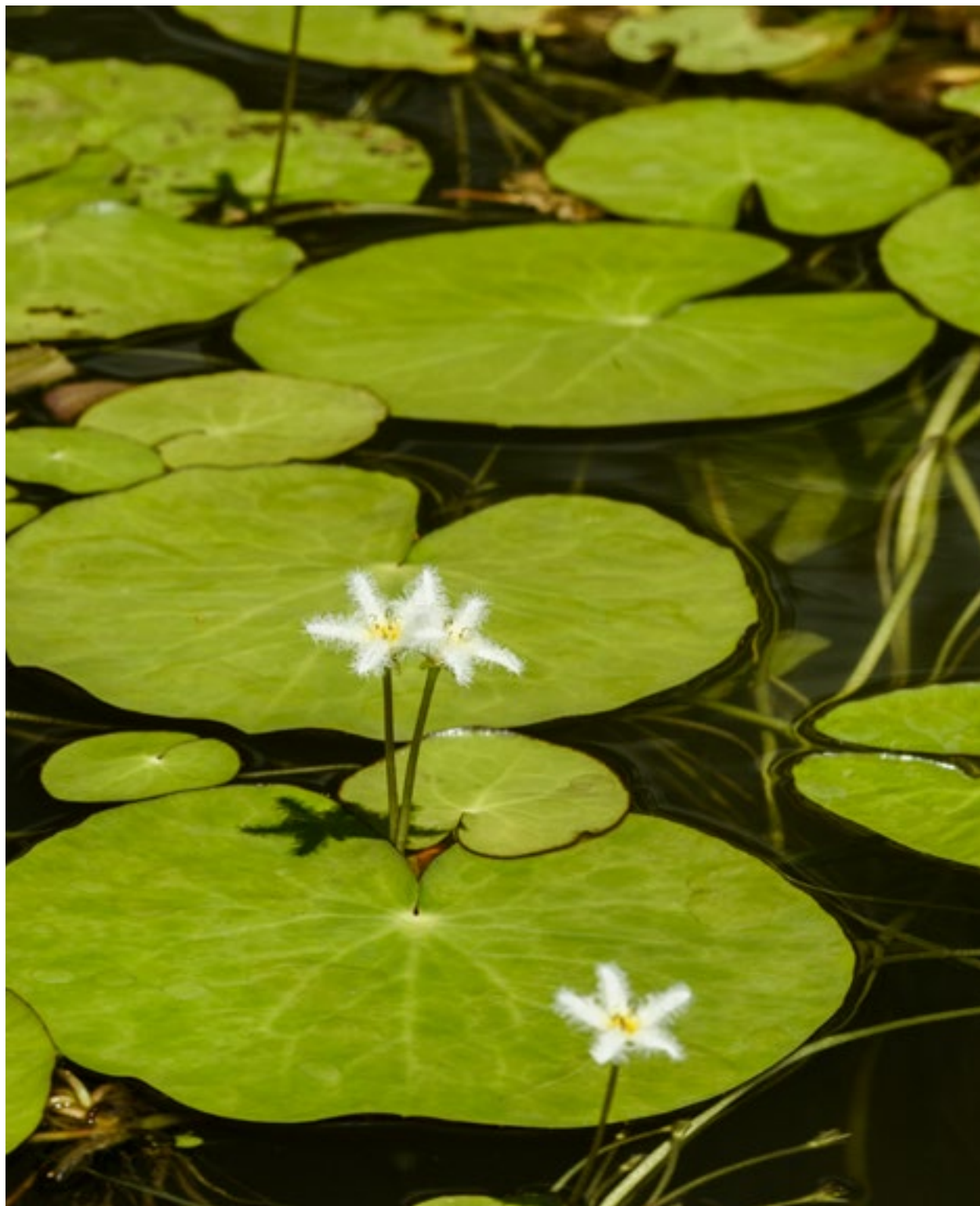
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Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810.
Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/14, ISO 640.

THE FRILLY FUZZY FLOWER OF ***NYMPHOIDES INDICA***



Nymphoides indica. Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020.
Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro.
Settings: 1/320, f/14, ISO 640.

Close up view of flowers. Capturing these types of photos is not so easy. It is tricky as you have to maintain focus from a boat as it moves through the water and waves.

Photograph credits on the next page:

Photograph #1

Nymphoides indica. Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/14, ISO 640.

Photograph #2

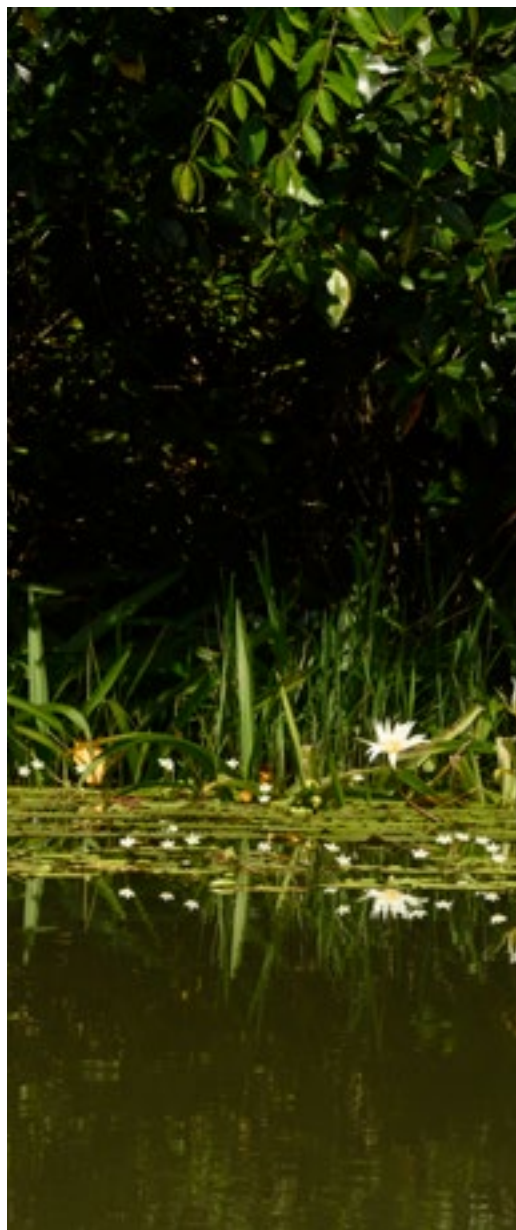
Nymphoides indica. Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/14, ISO 640.

Fotografia #3

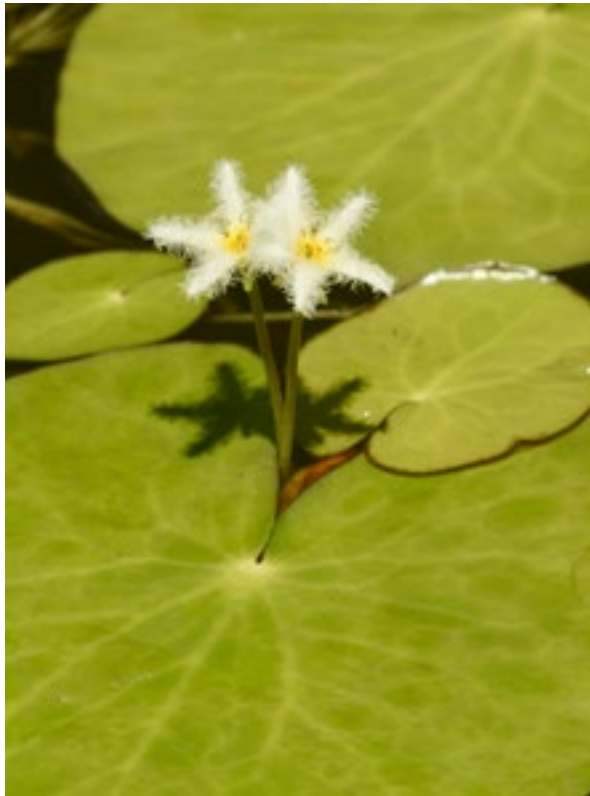
Nymphoides indica. Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/14, ISO 640.

Fotografia #4

Nymphoides indica. Photograph: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/14, ISO 640.



Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. Cámara: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/14, ISO 640.



Photograph #1



Photograph #2



Photograph #3



Photograph #4



Nymphoides indica. Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020.
Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro.
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Nymphoides indica. Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020.
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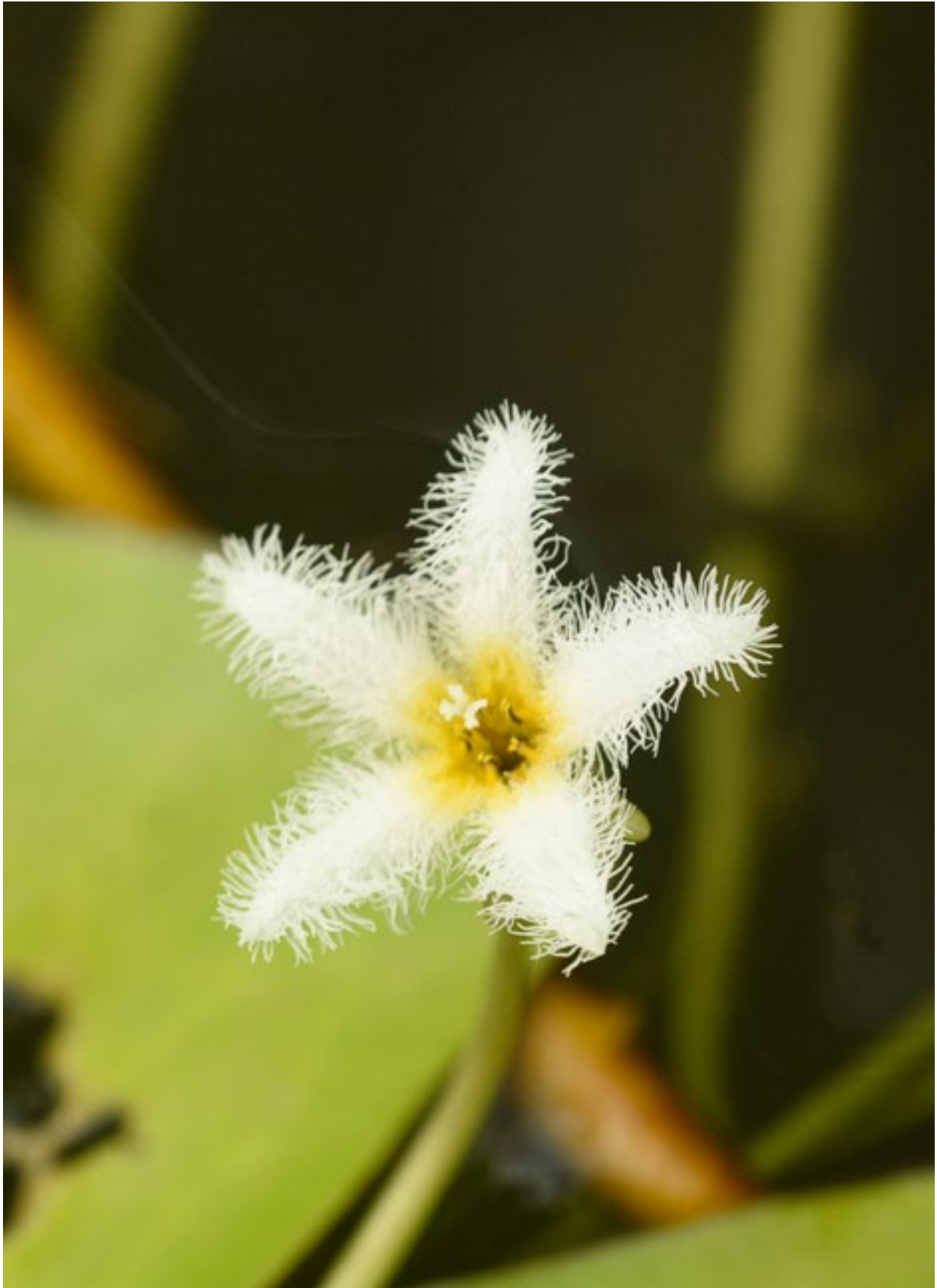
How much natural beauty is here in the lagoons and inlets and creeks along the north and south sides of the east end of El Golfete (and we have not yet explored the west end of El Golfete, nor have we had time to go up the Rio Chocon Machacas and other creeks and rivers that are all over the Municipio de Livingston).

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810.
Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/250, f/14, ISO 640.



South side lagoons and inlets of eastern part of El Golfete.

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810.
Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/250, f/11, ISO 1600.



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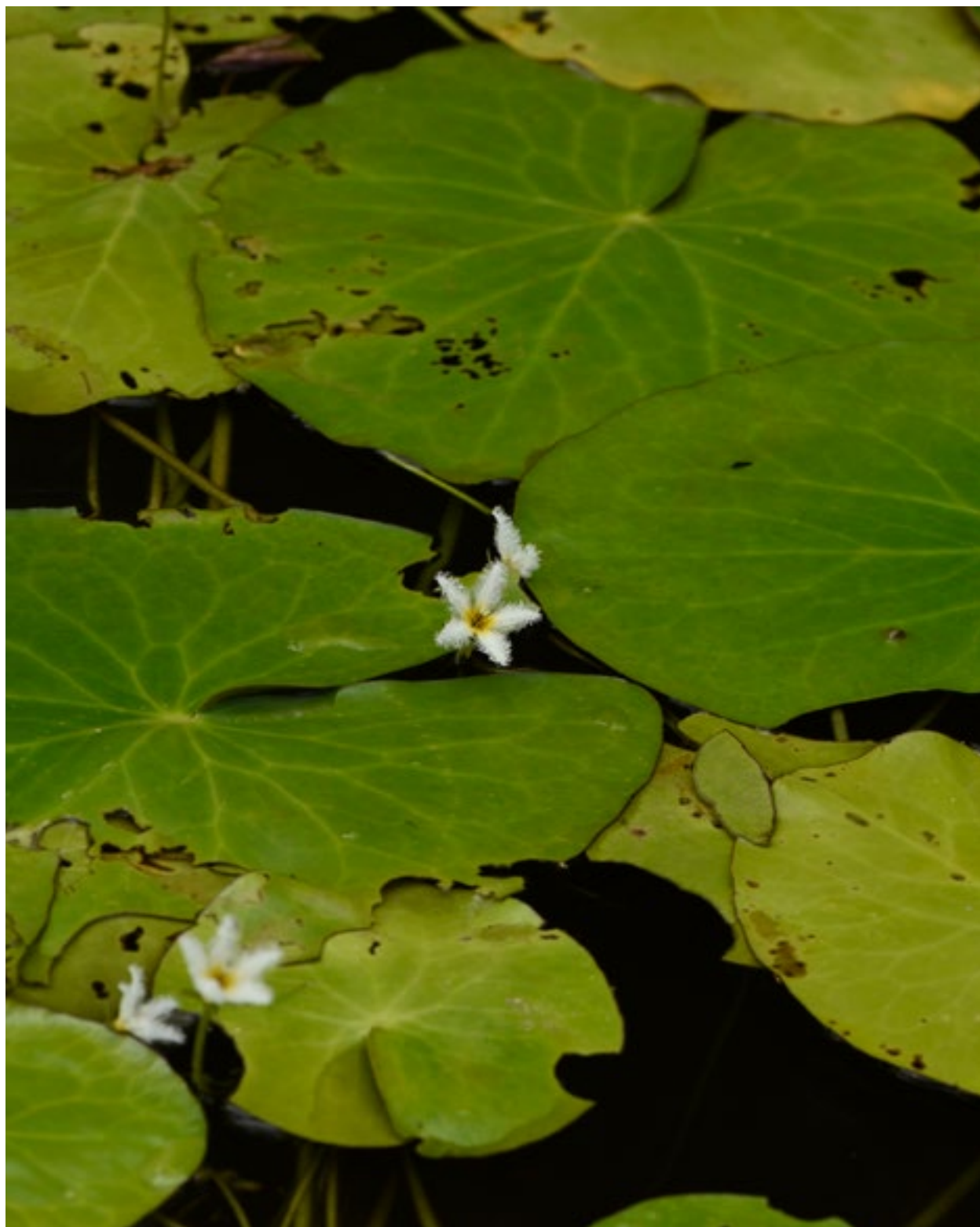


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Settings: 1/250, f/11, ISO 640.

THE LEAVES OF *NYMPHOIDES INDICA* **COME IN VARIOUS SHADES OF GREEN**

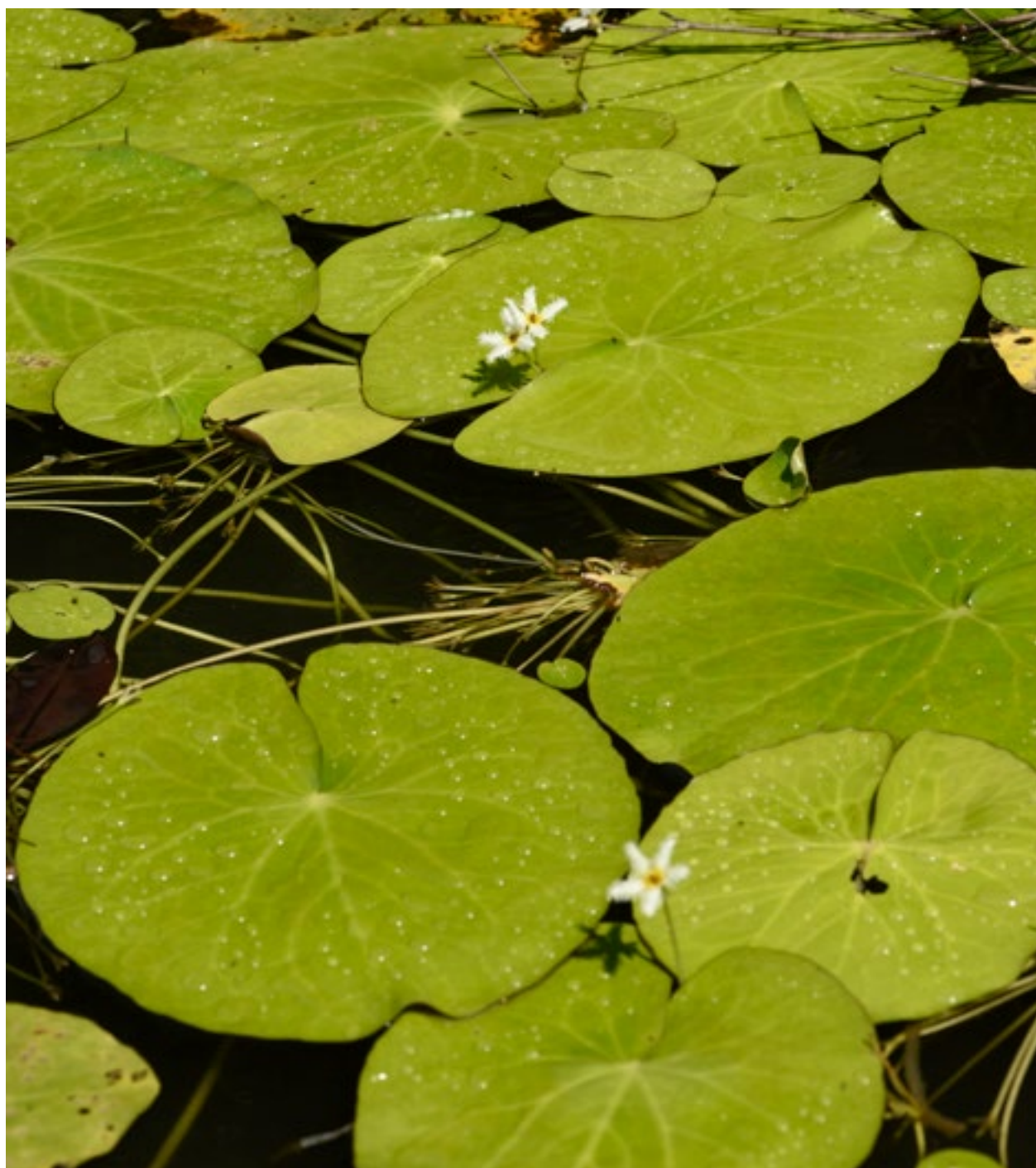


Some leaves are darker green; others are lighter (and more yellow).

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810.
Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/250, f/11, ISO 640.

THE LEAVES OF *NYMPHOIDES INDICA* **COME IN VARIOUS SIZES**

Young leaves are small; large leaves are older, obviously. Would also be helpful to photograph the underside of the leaves.

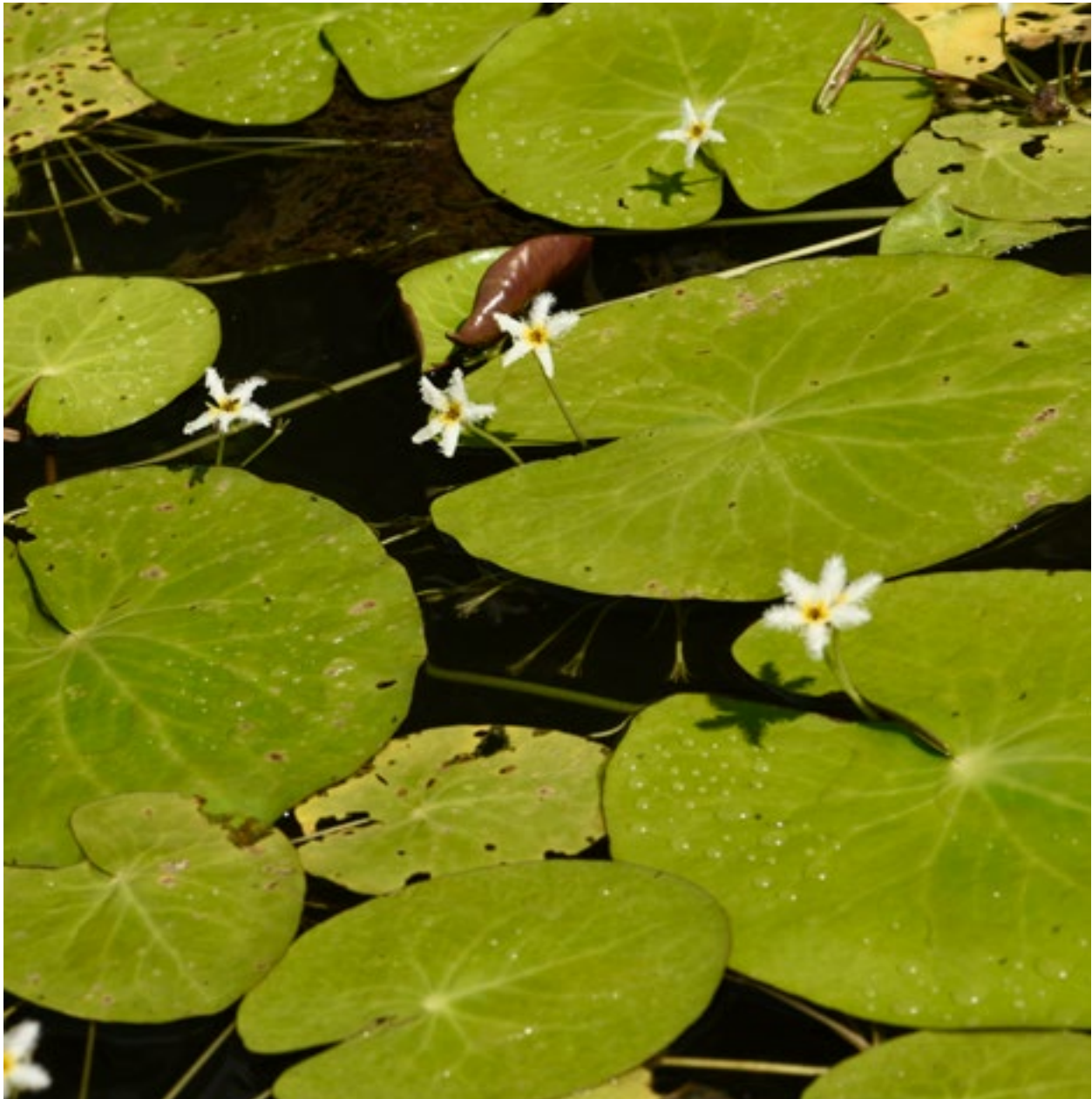


Nymphoides indica. Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020.
Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro.
Settings: 1/320, f/11, ISO 500.

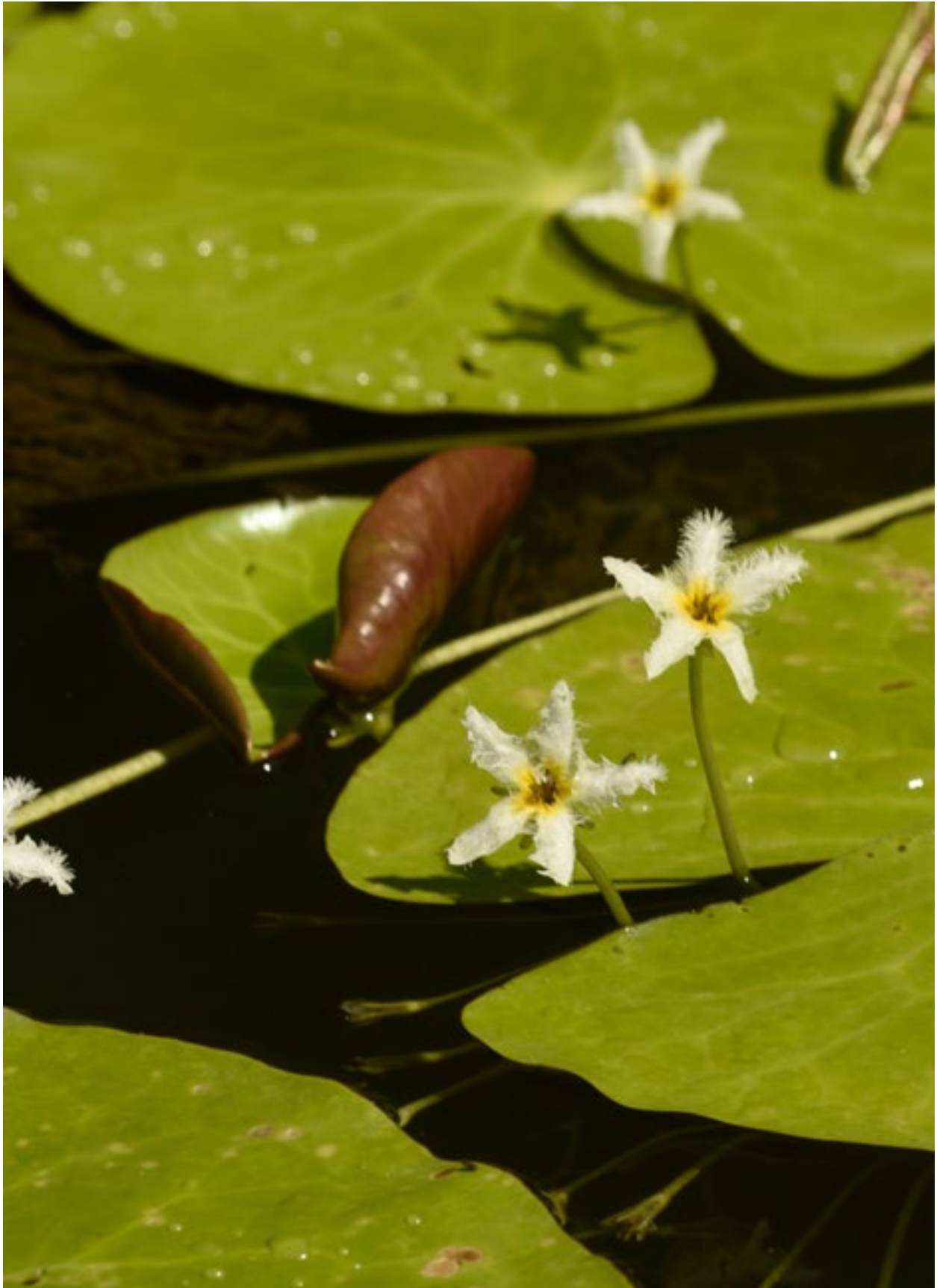
HAS THE OPEN AREA IN THE LEAF EVOLVED TO ALLOW SPACE FOR THE FLOWER TO RISE UP MORE EASILY?

I am curious whether the open area has evolved to allow space for the flower to rise up more easily?

Not always, but a notable percent of the flowers rise up through the narrow open space of the leaf. This raises the question of whether there is co-evolution of these aspects.



Nymphoides indica. Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020.
Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro.
Settings: 1/320, f/13, ISO 500.



Nymphoides indica. I am curious how many other botanists have commented on this aspect of the leaf shape. Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/13, ISO 500.



Not 100% of the flowers of *Nymphoides indica* rise up through the open space, but definitely more than 80%. Would be a good thesis to use a drone and photograph and entire area and count how many do and how many do not. Then do a comparison with *Nymphaea ampla*, since these are so powerful they often literally break through the center of the leaf or push the leaf out of the way. The *Nymphoides indica* are not strong enough to break through the leaf and only rarely could push a leaf out of their way.

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/13, ISO 500.



Not everything in nature is identical. Here are flowers that rise up in other areas. But any number of factors could cause this (a crocodile or manatee swimming through the area; or a Mayan dugout canoe having passed through).

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810.
Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/13, ISO 500.

YOU SEE MORE THAN JUST **THE FLOWERS AND LILY PADS**

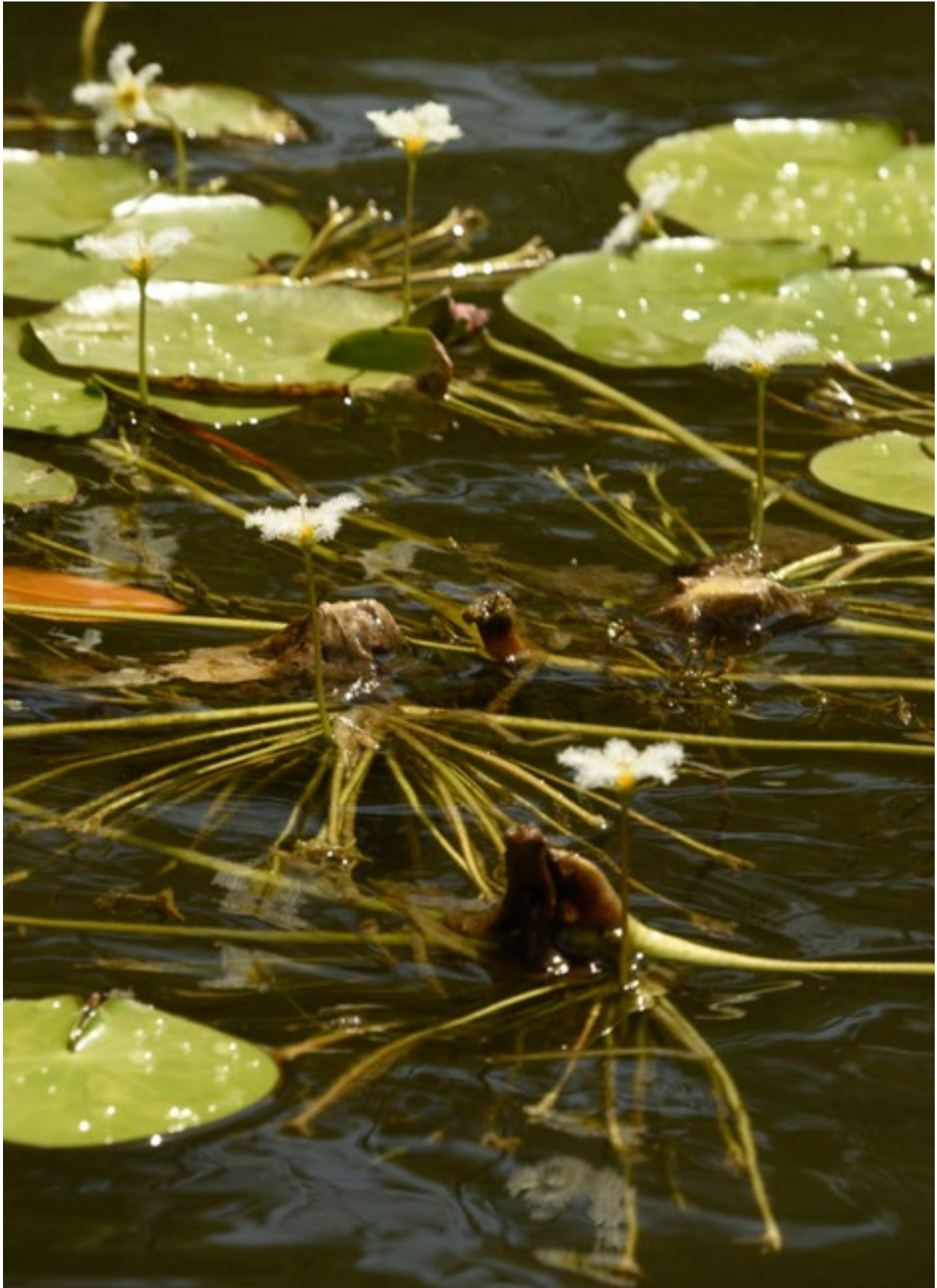
In Arroyo Pucte the water is so pristine clean and clear that you can see up to 3 meters down into the stream. So you can see every centimeter and inch of the *Nymphaea ampla* waterlily underwater aspect. But during the rainy month of March 2020 the Rio Dulce and El Golfete areas had a lot of runoff from the hills.

Nonetheless there were areas where you could see parts of the *Nymphoides indica* underwater.

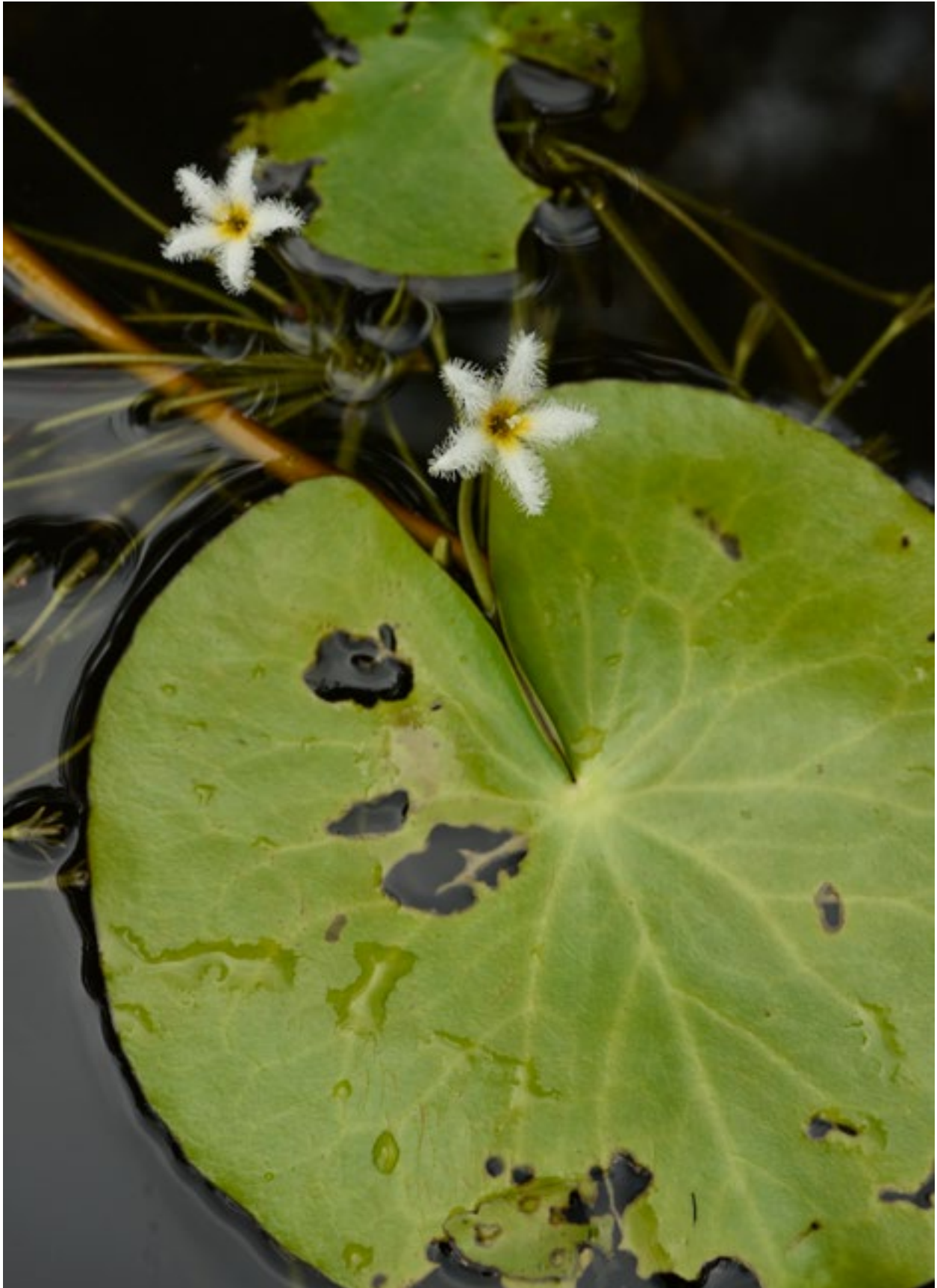


Nymphoides indica. Here you can see the stems underwater.

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810.
Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/13, ISO 500.



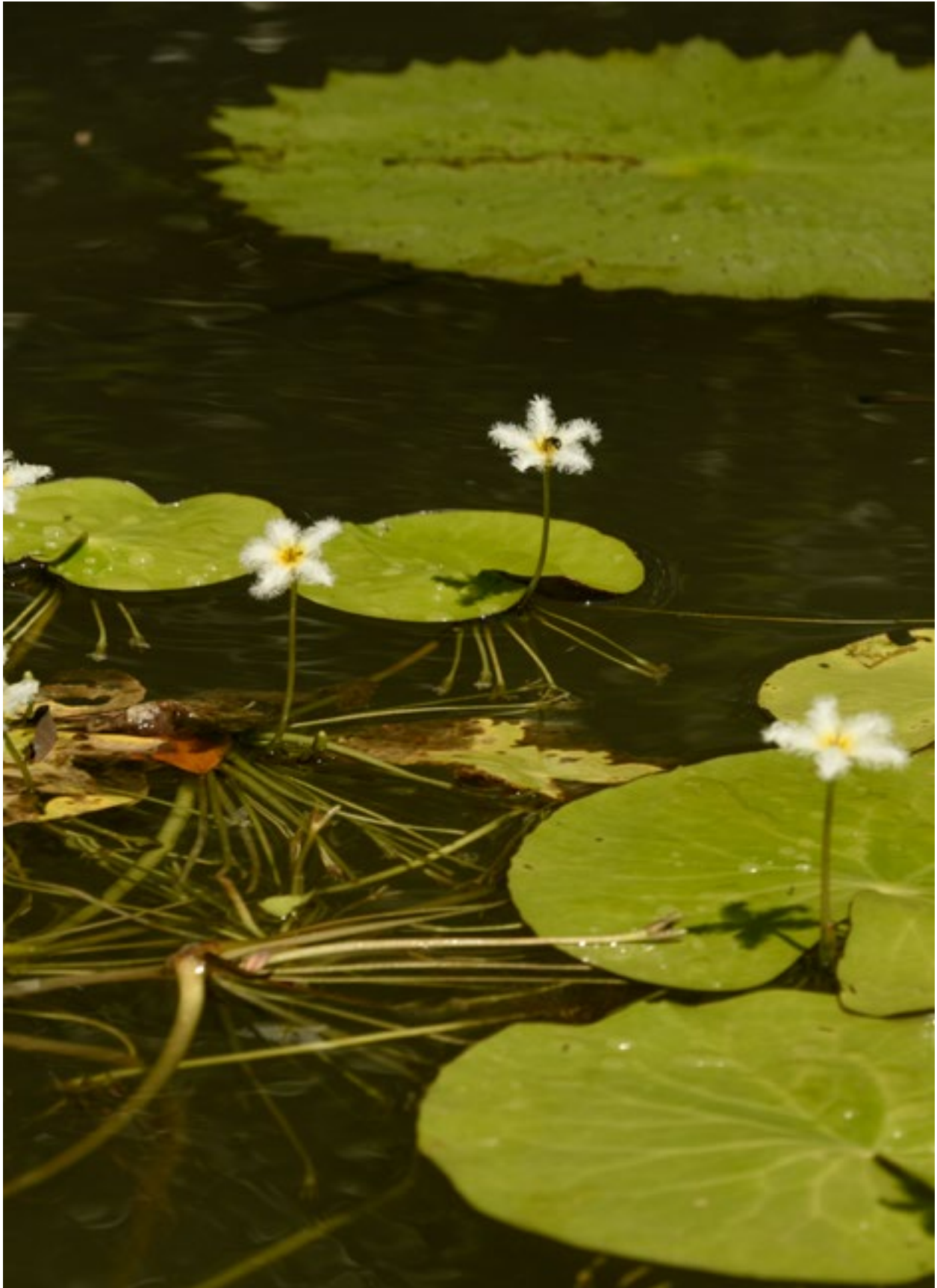
Nymphoides indica. Since several pads here have rotted away, you can see the underwater portion from above. Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/13, ISO 640.



Nymphoides indica. Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020.
Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro.
Settings: 1/250, f/11, ISO 800.



Nymphoides indica. Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020.
Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro.
Settings: 1/250, f/11, ISO 800.



Nymphoides indica. Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020.
Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro.
Settings: 1/320, f/11, ISO 500.

SYNONYMS FOR ***NYPHOIDES INDICA***

We provide the full list of synonyms in Volume 1 for this specie. The most important synonym to remember is *Nymphoides humboldtiana*. *N. humboldtiana* (Kunth) Kuntze is a synonym of *Nymphoides indica* (L.) Kuntze.

(www.theplantlist.org/tpl1.1/record/kew-2385069)

I emphasize this since even US government biologists suggest that *Nymphoides humboldtiana* is a valid species (Thayer and Pflingsten 2018).

Most botanical descriptions of the 1900's and even into the early 2000's use the name *Nymphoides humboldtiana*. And, many botanists even as recent as 2018 consider *N. humboldtiana* and *Nymphoides indica* as both valid and both separate independent species. So when I read the comments of four botanists (Middleton, Anemaet, Quirk and Tippery 2018) I frankly do not understand why Kew Gardens clearly states that *Nymphoides humboldtiana* is merely a synonym. They can't both be correct?

So if you search for information, you also need to search for reports that mention this name. Or it is easiest just to look for the Genus *Nymphoides*.



Nymphoides indica. El Golfete, Livingston.

Photograph by: María Alejandra Gutiérrez, FLAAR Mesoamerica. March 14, 2020.

Camera: SONY DSC-RX10M4 Settings: 1/800, f/8, ISO 640

BOTANICAL DESCRIPTION OF *NYMPHOIDES* ***HUMBOLDTIANUM* BY STANDLEY AND WILLIAMS (1969)**

The species name *Nymphoides indica* was not often used in the 1960's, so the botanists Standley and Williams use the older name *Nymphoides humboldtianum*.

Nymphoides humboldtianum (HBK.) Kuntze, Rev. Gen. PL

2: 429. 1891. *Villarsia humboldtiana* HBK. Nov. Gen. & Sp. 3: 187.

1818. *Limnanthemum humboldtianum* Griseb. Gen. & Sp. Gent. 347.

1838. Cebolla de agua; Corazon de agua.

Floating on ponds or lakes or sometimes submerged or on mud, 2,000 m. or less; Peten; Izabal; Chiquimula; Jalapa; Jutiapa; Santa Rosa; Esquintla; Quiche; Huehuetenango; probably also in other departments. Mexico; British Honduras to Panama. West Indies. South America.

Plants glabrous, with elongate rootstocks, fleshy, the stems stout, often spongy, mostly 40 cm. long or shorter; leaves solitary, orbicular or orbicular-reniform, 3-12 cm. broad, deeply cordate at the base; flowers white or yellow, in a sessile umbel at the base of the petiole, the pedicels few or numerous, very unequal, 3-10 cm. long, deflexed in fruit; calyx segments linear-lanceolate, 8 mm. long; corolla lobes fimbriate, twice as long as the calyx, recurved; capsule somewhat shorter than the calyx; seeds numerous, smooth, globose.

The plants sometimes are found upon mud, where the water has receded. The leaves are often purplish beneath. In Guatemalan plants the flowers are either white or yellow. The plants of this alliance sometimes are placed in a separate family Menyanthaceae.

(Standley and Williams 1969: 326 and 328; Fig. 89 on page 327)

100% of the flowers we saw in every part of Municipio de Livingston were white. None were yellow. Standley and Williams, back in the 1960's, did not realize that the species with yellow flowers is a separate species: *Nymphoides fallax* Ornduff.

No mention whatsoever of the roots being edible, so clearly the botanists were not asking local people (since probably 70% of their research was most probably from dried specimens in herbaria).



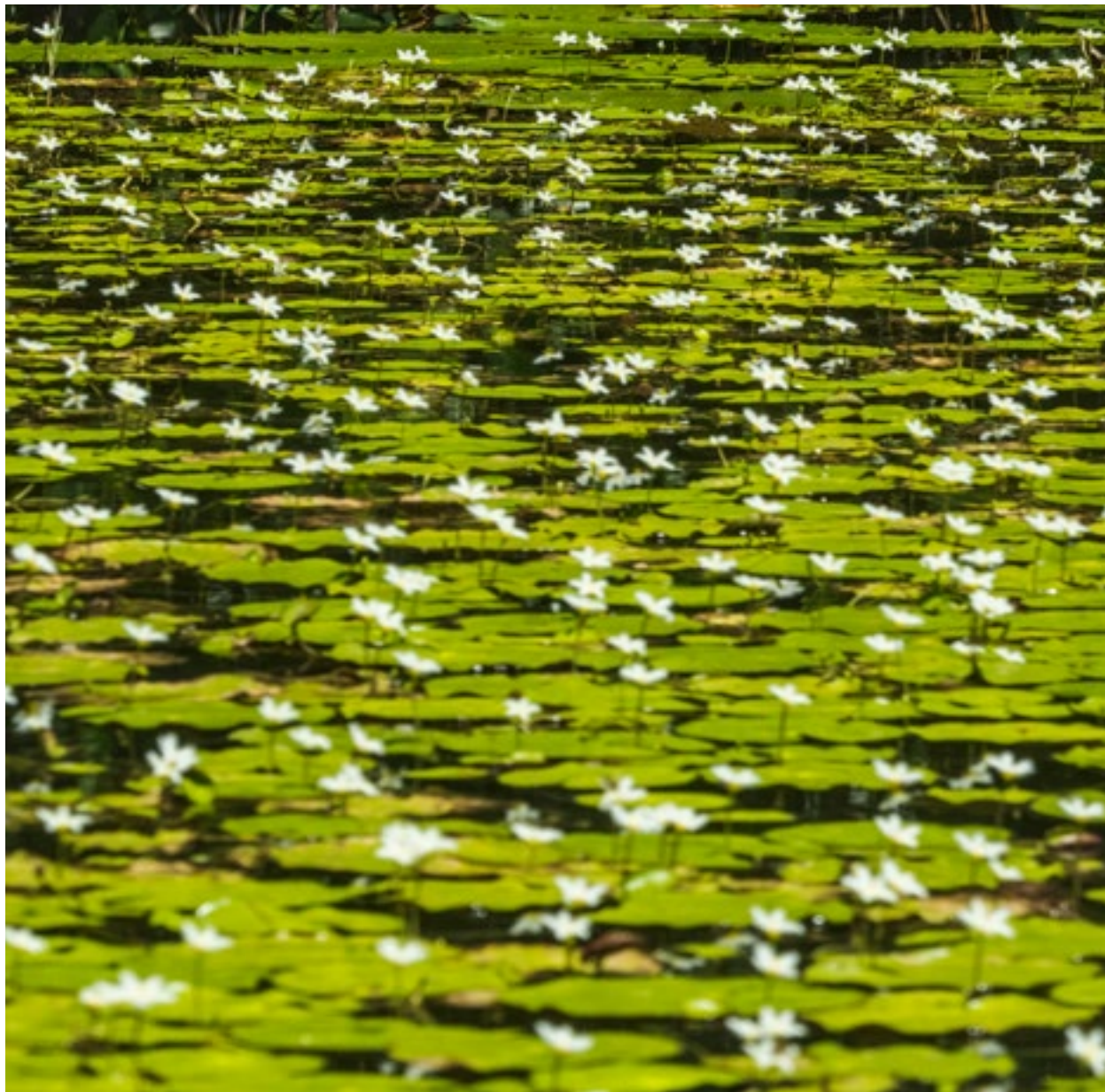
Nymphoides indica..El Golfete, Livingston.

Photograph by: David Arrivillaga, FLAAR Mesoamerica. March 14, 2020.

Camera: Nikon D5 Lens: Nikon 28-300mm VR Settings: 1/500, f/11, ISO 640

NYMPHOIDES INDICA IN BELIZE

So far I have not (yet) noticed any suggestion in Belize reports that *Nymphoides indica* is not native. Nonetheless, it would really help if this nagging question could be answered clearly in TWO clear statements: Yes, it is native, here is the proof. No, it is not introduced, here is the proof.

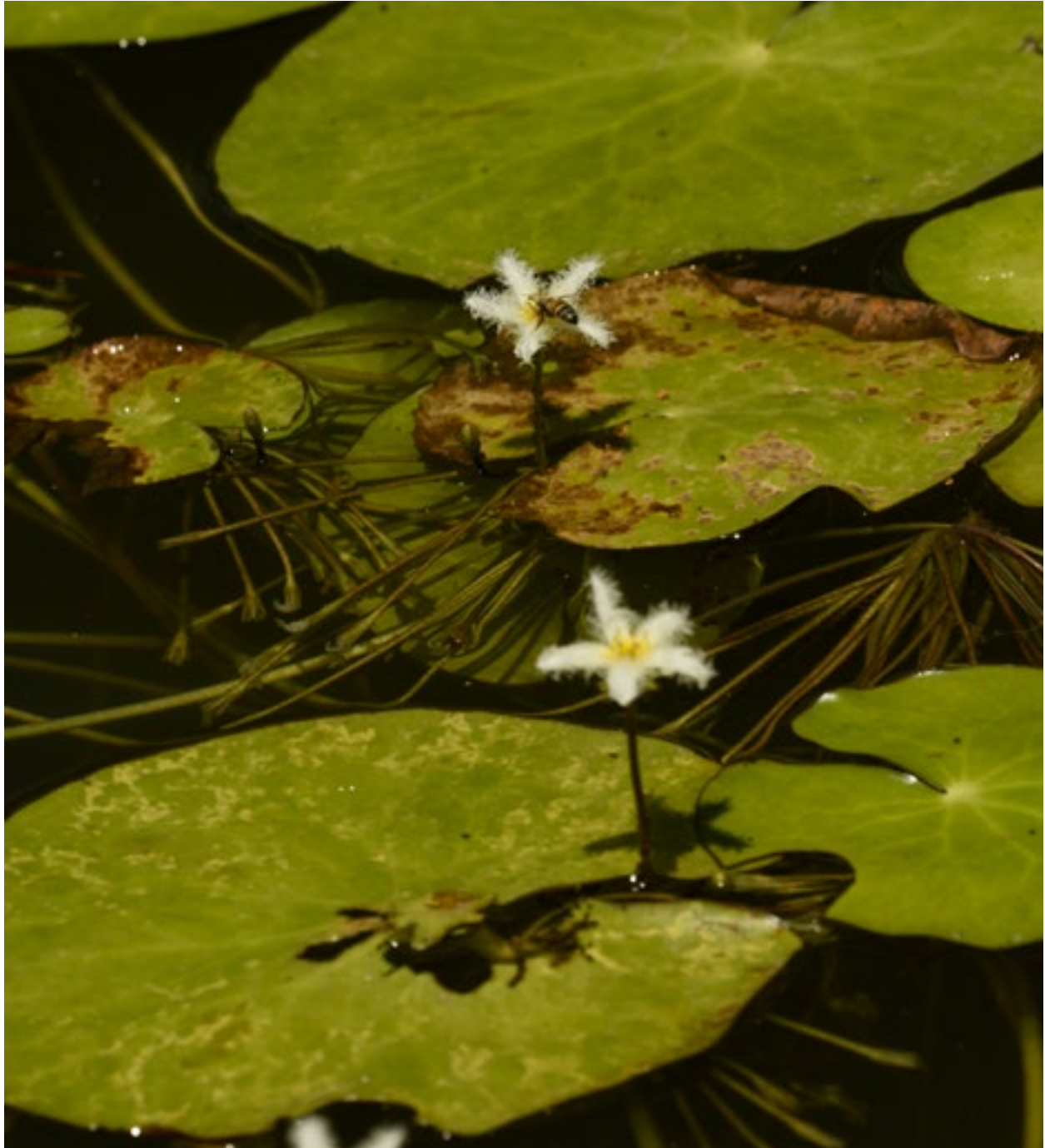


Nymphoides indica..El Golfete, Livingston.

Photograph by: David Arrivillaga, FLAAR Mesoamerica. March 14, 2020. Camera: Nikon D810
Lens: Nikon AF-Micro-NIKKOR 200mm IF-ED tele-macro. Settings: 1/320, f/14, ISO 640.

POLLINATORS OF *NYPHOIDES INDICA*

Several kinds of insects pollinate a flower. But unless you have a camp adjacent to the flower, it is pure luck whether you arrive at a time when a pollinator is available to be photographed.



Bee pollinating flower of *Nymphoides indica* in inlet or lagoon adjacent to El Golfete, Rio Dulce. Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/14, ISO 500.



Bee pollinating flower of *Nymphoides indica* in inlet or lagoon adjacent to El Golfete, Rio Dulce.
Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810.
Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/14, ISO 500.



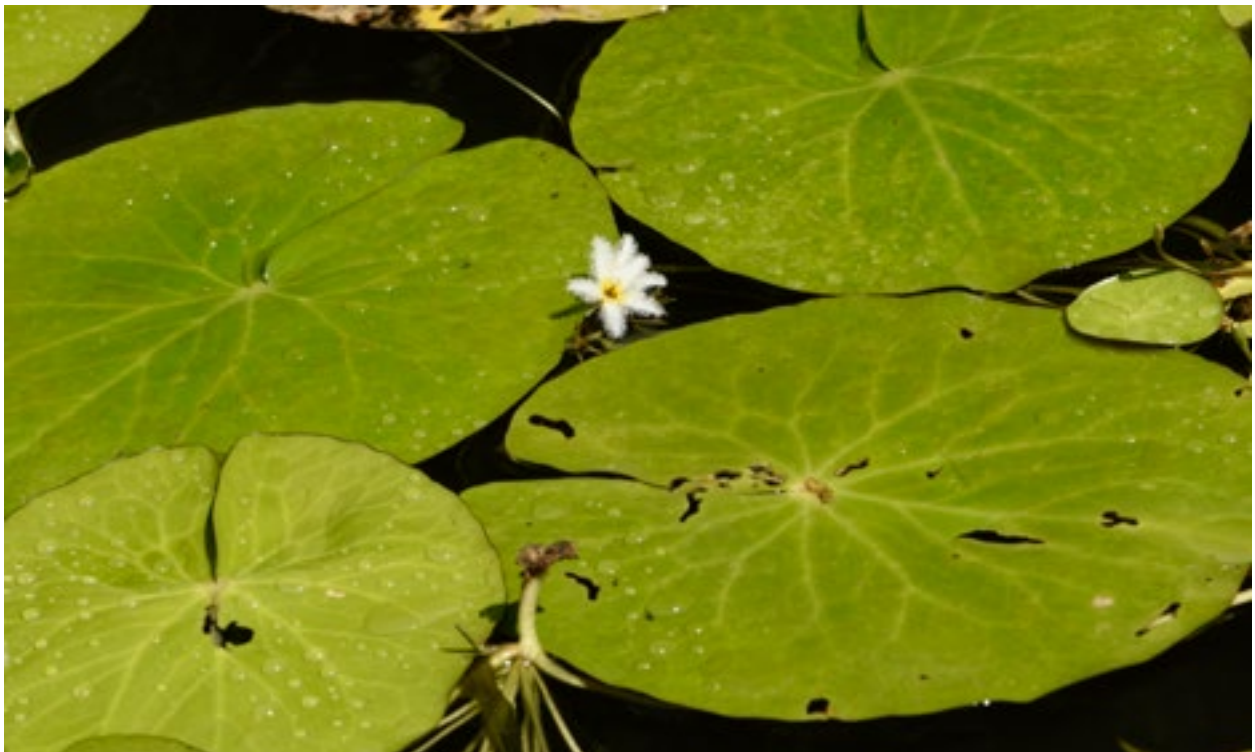
Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020. Camera: NIKON D810.
Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro. Settings: 1/320, f/14, ISO 500.

NEXT STEPS, TO HAVE AVAILABLE MORE DOCUMENTATION **ON *NYMPHOIDES INDICA***

Next step is to have time and boat available to go up every creek and every river that feeds into El Golfete and Rio Dulce. Plus study all the inlets and lagoons of the western half of El Golfete. We would like to find specimens with six petals.

Crucial is to have a drone and licensed drone pilot to show the shore area; it is crucial to show, on a map:

- where the *Nymphoides indica* is by itself,
- where *Nymphoides indica* grows together with *Nymphaea ampla*,
- and where *Nymphaea ampla* grows by itself
- (and there a third wetlands lily, *Crinum americanum*, grows within the same area as both *Nymphoides indica* and *Nymphaea ampla*).



Nymphoides indica.

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020.
Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro.
Settings: 1/320, f/13, ISO 500.

These drone photos can help ecologists, botanists, ecosystem preservation specialists, students. Plus the map will assist local boat captains (lancheros) and local guides to know where it is easiest to take their tourists to experience these waterlily flowers.

In future field trips would also be helpful to make lists of what other water-related plants are along all these biodiverse shore areas.

Does *Nymphoides indica* require brackish water? Brackish water is water with some salt water that comes in (from the Caribbean Sea through Amatique Bay). You get mangrove swamps all along the edges of Rio Dulce, El Golfete and the creeks, rivers, inlets, and lagoons. The presence of mangrove swamps suggests that at least in certain seasons of the year there is brackish water. Does *Nymphoides indica* really like brackish water? Or can you find *Nymphoides indica* far inland on rivers, lakeshores, or wetlands that have no connection to the Caribbean Sea? For example, *Nymphaea ampla* grows in freshwater totally unrelated to brackish water, such as along Arroyo Pucte, deep in the Peten.

Same with *Pachira aquatica* trees: these grow all along the edge of the Rio San Pedro not far from where the entire river literally bubbles out of the (karst) ground. And you get *Pachira aquatica* along the Tikal aguada. No salt water there. But you get lots of *Pachira aquatica* trees in the brackish water of the Municipio de Livingston. So it will help to learn whether *Nymphoides indica* prefers brackish water or is totally adaptable as is *Nymphaea ampla*. USAC graduate student Rebeca Escobar Méndez (2011) documented *Nymphoides indica* as being present in Laguna La Gloria (western Peten, north of the highway leading to town of Naranjo). There is unlikely any Caribbean salt water in Laguna La Gloria.



Nymphoides indica.

Photograph by: Nicholas Hellmuth, FLAAR Mesoamerica. March 14, 2020.
Camera: NIKON D810. Lens: Nikon AF-Micro-NIKKOR 200mm f/4D IF-ED Macro.
Settings: 1/320, f/11, ISO 640.

CONCLUDING DISCUSSION AND SUMMARY ON *NYMPHOIDES INDICA*

Our motivation for preparing this present report is to show the potential of El Golfete and surrounding areas for studies of water plants and wetlands ecosystems. But this is best done in-situ, on field trips, and staying in the area with the assistance of local guides. Plus you need to return every month to see which plants are flowering, which are fruiting in that month.

For close-ups of *Nymphaea* flowers in past years in other rivers, lakes, and swamps we used a tripod out in the water. Downside is that the legs of the tripod sink into the mud and you have to take the whole tripod apart to clean out the mud. Plus the larger problem is that you, the photographer, also sink into the mud. Since we have many years of experience photographing in swamps in many different parts of Guatemala, what we did was to bring a sturdy A-shaped ladder, and lower the ladder into the mud. This way we can be standing with our head out of the water! And can more comfortably take photos.

But using a ladder and tripod mean you spend an hour in each location. Often the ladder sinks so deep into the mud that it takes a while to pry it out. Our first two field trips to Rio Dulce, El Golfete, Amatique Bay, Tapon Creek, Lagunita Creek etc.: February and March 2020, were exploratory. But in the future we would want to return and do stacked focus photography of the fuzzy frilly flowers. Would likewise help to photograph the underside of the leaves. We also need to do underwater photography.



Nymphoides indica. founded at the riverside
Photograph by: María Alejandra Gutiérrez, FLAAR Mesoamerica. March 14, 2020.
Camera: SONY a7R IV Lens: Sony 90mm Macro G OSS. Settings: 1/250, f/13, ISO.3200.



ACKNOWLEDGMENTS FOR LIVINGSTON

We thank Ing. Daniel Esaú Pinto Peña Livingston mayor (Izabal, Guatemala) for the cooperation provided by him and the team of the Municipio de Livingston. Also thank him for accompanying us to Nito Maya during our first field trip and has kindly made time to visit with our team on each of the initial field trips.

We thank Edwin Mármol Quiñonez, Coordinación de Cooperación de Livingston (Izabal, Guatemala), and his son Leonel. He kindly accompanied us every day of the first field trip to the Municipio of Livingston.

We appreciate the cooperation of Juana Lourdes Wallace Ramírez, Asistente Administrativo, Coordinación de Cooperación de Livingston, for organizing the day-by-day transportation and logistics for our team. Lourdes also accompanies us each day of each field trip, including long hikes and deep into caves.

The local guides, the boat captain and boat assistants, the local drivers are helpful because they know the local area. We appreciate that they share their experiences with us; in return we also mention to them the aspects of the different plants that we find on the shore or along the trails.

We will donate all photographs that we take in the Municipio of Livingston to the Municipio. These can be used by the Municipio at no fee; credit to the individual photographer and to FLAAR Mesoamerica is appreciated when an image is used.





ACKNOWLEDGEMENTS TO FLAAR MESOAMÉRICA

The reports are a joint production between the field trip team and the in-house office team. So here we wish to cite the full team:

Flor de Maria Setina is the office manager, overseeing all the diverse projects around the world (since FLAAR-REPORTS research on advanced wide-format digital inkjet printers is a worldwide project for over 20 years. We also utilize the inkjet prints to produce educational banners to donate to schools. On a banner we can show an entire ecosystem at a size even larger than in a coffee table art book.

Vivian Díaz is project manager for flora, fauna projects (field work and resulting reports at a level helpful for botanists, zoologists and ecologists, and for university students). We then utilize our experience to also produce books on ecological rescue concepts for educational projects in local schools in remote areas of Guatemala.

Victor Mendoza identifies plants, mushrooms, lichen, insects, and arachnids. When his university schedule allows, he also likes to participate in field trips on flora and fauna research.

Vivian Hurtado prepares the bibliography for each subject and downloads pertinent research material for our e-library on flora and fauna. All of us use both these downloads plus our in-house library on flora and fauna of Mesoamerica (Mexico through Guatemala into Costa Rica).

Andrea Sánchez is a designer who helps prepare the master-plan for aspects of our publications.

Ximena Arriaga is a designer who puts together the text and photographs to create the actual report.

Jaqueline Gonzalez is a designer who puts together the text and photographs to create the actual report (we have several designers at work since we have multiple reports to produce).

Maria Alejandra Gutierrez is an experienced photographer, especially with the Canon EOS 1D X Mark II camera and 5x macro lens for photographing tiny insects, tiny flowers,

and tiny mushrooms. Work during and after a field trip also includes sorting, naming, and processing. And then preparing reports in PDF format.

David Arrivillaga is an experienced photographer and is able to handle both Nikon and the newest Sony digital cameras. Work during and after a field trip also includes sorting, naming, and processing. And then preparing reports in PDF format.

Roxana Leal is Social Media Manager for flora and fauna research and publications, and MayanToons educational book projects

Juan Carlos Hernandez takes the material that we write and places it into the pertinent modern Internet software to produce our web pages (total network is read by over half a million people around the world).

Paulo Nuñez is a webmaster, overlooking the multitude of web sites. Internet SEO changes every year, so we work together to evolve the format of our web sites.

Valeria Aviles is an illustrator for MayanToons a FLAAR Mesoamerica division which is in charge of preparing material for kids as coloring books, activity books, games, animated videos, Mayan Q'eqchi' children, also for schools at Peten, Yahxa and Izabal in Livingston.

Josefina Sequen is an illustrator for MayanToons and also helps prepare illustrations for Social Media posts and for animated videos.

Rosa Sequen is also an illustrator for MayanToons and also helps prepare illustrations for Social Media posts and for animated videos.

Laura Morales is preparing animated videos in MayanToons style since animated videos are the best way to help school children how to protect the fragile ecosystems and endangered species



LIVINGSTON: THE CARIBBEAN BIODIVERSITY WONDERLAND OF GUATEMALA

Izabal, one of the regional departments of Guatemala that offers a variety of recreational activities, is home to numerous nature parks and diverse natural landscapes. There are white sandy beaches a short boat trip away, with tall jungle-covered mountains in the background, and the Mesoamerican Reef System in the Caribbean Sea on the horizon in front of you. Mangrove swamps, seagrass, islands, cenotes, caves, karst geology canyons and streams of crystal clear water abound along the Rio Dulce and Lake Izabal coast or inland. All this together makes Livingston one of the destinations for tourists wanting to do bird-watching, explore caves, get healthy exercise hiking through trails in the rainforest. In addition to the incredible flora and fauna that the municipality offers, three different cultures coexist in the ecosystem (Mayan Q'eqchi', Garifuna and Ladinos).

In order to conserve the biodiversity found in the municipality and that continues to be of benefit to the ecosystem, it is necessary to have an updated record of the species that inhabit here and thus be able to detect changes in the species population. Thanks to the efforts of different institutions focused on environmental improvement projects at various sites in Livingston (FUNDAECO (Río Sarstun), CONAP (Río Dulce), CECOM-USAC (Chocón-Machacas), ARNPG (more than ten private reserves), among many others) there are records of species of flora, fauna and ecosystems of this municipality of Izabal.

Using this information in the most efficient way and using the potential of digital technology, the database for the municipality can be supplemented with photographic records of flora, fauna, and ecosystems. The FLAAR Mesoamerica team, in cooperation with the municipal authorities, have begun to produce this educational material using the photographic records generated during the cooperation project to account for the flora, fauna and ecosystems that can be seen in Livingston. This will be accomplished in order to provide information to the schools, families and institutions already working to protect the environment.

We hope to attract the attention of professors, botanical garden clubs, orchid and bromeliad societies, students, tourists, experts, explorers, photographers and nature lovers who want to get closer, to marvel at the species of flowering plants, mushrooms and lichen that FLAAR Mesoamerica finds during each field trip each month.





FLAAR Mesoamerica (**Foundation for Latin American Anthropological Research**), is a nonprofit Guatemalan institution founded under the direction and enthusiasm of Biologist Eduardo Sacayon and Dr. Nicholas Hellmuth, a specialist of Classic Mayan iconography and architecture who then evolved his research to focus on edible and utilitarian plants, with the aim of wanting to see our country be recognized throughout the world for its biodiversity of plants, cultures, and natural resources. Likewise, our work has arisen from the interest and support of the board directors of FLAAR Mesoamerica, its president, Eduardo Sacayón, its vice president Flor de María Setina, the secretary Rodrigo Girón, the treasurer Oscar Lambourg and his member Elsa Morales.

One of our main objectives at FLAAR Mesoamerica is to increase consciousness about caring and protecting Mesoamerican natural diversity. By utilizing high-resolution photography, we can better showcase the remarkable flora and fauna of Guatemala. These photographs, and the accompanying information, will awake the admiration and desire in those who follow our work. Thus, the FLAAR Mesoamerica teams create educational material about the biodiversity that deserves recognition and protection.

The work done at FLAAR Mesoamerica consists of the methodological compilation of facts about nature, flora, fauna, history, and cultures of Mesoamerica, and disseminate it to the largest audience both in Guatemala and around the world. We also are inspired to provide for all our readers plenty of annotated suggestions of lots of other reports, articles, thesis, dissertations, and web sites via our bibliographies of suggested additional reading. Our focus is generate materials that are easy to read, educational, reliable, and visually pleasing by using lots of full-color photographs -just like this report!

We also prepare illustrated books and animations for primary school children and Mayan families in Guatemala to have access to information about the need to protect the fragile ecosystems and flora and fauna throughout this Central American republic.

We are open to work with, share, and, expand our accomplishments with other organizations, institutions, or companies that share our vision.

You can find more of our work throughout the different digital platforms of our directory:



www.FLAAR-mesoamerica.org
www.digital-photography.org
www.maya-ethnozoology.org
www.maya-ethnobotany.org

FLAAR_mesoamerica@flaar.org



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2006 Descripción anatómica vegetativa de dos especies de Nymphoides (Menyanthaceae). *Revista Mexicana de Biodiversidad* 77: 81-87, 2006.

Clear crisp botanical illustration of the entire plant, with names for the roots hanging down from near the surface (the roots that do not yet reach the bottom of the swamp or riverside).

Lots of detailed anatomical information and photographs not available in any other publication.

Free Download:

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This chapter on the Internet has a date of 2018. What I estimate is the original book is dated 2017.

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STANDLEY, Paul C. and Louis O. Williams

- 1969 *Flora of Guatemala*. Fieldiana, Botany, Volume 24, Part VIII, Number 4, Field Museum of Natural History.

HELPFUL WEB SITES FOR **ANY AND ALL PLANTS**

There are several web sites that are helpful even though not of a university or botanical garden or government institute.

However most popular web sites are copy-and-paste (a polite way of saying that their authors do not work out in the field, or even in a botanical garden). Many of these web sites are click bait (they make money when you buy stuff in the advertisements that are all along the sides and in wide banners also. So we prefer to focus on web sites that have reliable information.

<https://serv.biokic.asu.edu/neotrop/plantae/>

Neotropical Flora data base. To start your search click on this page:

<https://serv.biokic.asu.edu/neotrop/plantae/collections/harvestparams.php>

<http://enciclovida.mx>

CONABIO. The video they show on their home page shows a wide range of flowers pollinators, a snake and animals. The videos of the insects are great.

www.kew.org/science/tropamerica/imagetdatabase/index.html

Kew gardens in the UK is one of several botanical gardens that I have visited (also New York Botanical Gardens and Missouri Botanical Gardens (MOBOT), in St Louis. Also the botanical garden in Singapore and El Jardín Botánico, the open forest botanical garden in Guatemala City).

www.ThePlantList.org

This is the most reliable botanical web site to find synonyms. In the recent year, only one plant had more synonyms on another botanical web site.

HELPFUL WEB SITES FOR **NYMPHOIDES INDICA**

<http://abm.ojs.inacol.mx/index.php/abm/article/view/50/97>

Lists in which states of Mexico each species of Nymphoides can be found.

www.cicy.mx/sitios/flora%20digital/ficha_virtual.php?especie=1832

Information

<https://colombia.inaturalist.org/taxa/165759-Nymphoides-indica>

Photos and map distribution

<https://florabonaerense.blogspot.com/2012/08/estrella-del-agua-nymphoides-indica.html>

Description and photo

<http://tropical.theferns.info/viewtropical.php?id=Nymphoides+indica>

Information

www.randomharvest.co.za/en-us/South-African-Indigenous-Plants/Show-Plant/PlantId/674/Plant/Nymphoides-indica

Information and photos



The current Alcalde of Livingston, Mr. Daniel Pinto, together with his team of International Cooperation division, Mr. Edwin Mármol, have set the goal of achieving the municipality development in the years 2020-2024 based on the goals and indicators proposed by the 2030 Agenda for Sustainable Development. From this agenda, FLAAR Mesoamerica will collaborate to achieve Sustainable Development Goal (SDG) number 15 "Life on Land".

Throughout this cooperation project, different materials have been prepared, like this Photo Essay, that helps to collect information on species, different ecosystems: terrestrial, wetlands and fresh water biodiversity. This information would also be useful as part of a strategy to protect threatened species and prevent their extinction. The municipality's goals include to promote the sustainable use, conservation and research of the species of flora and fauna of the terrestrial, wetlands and aquatic shore and coastal ecosystems of the Guatemalan Caribbean. Learn more about this project and the SDG indicators at: <https://flaar-mesoamerica.org/rain-forests-rivers-lakes-bays-ocean-caves-canyons-livingston-the-caribbean-biodiversity-wonderland-of-guatemala/>

SERIES OF MUNICIPIO OF LIVINGSTON



Any school, college, university, botanical garden, zoological garden, botanical or zoological association (or club) may post this report on their web sites, (at no cost) as long as they link back to one of our web sites:

www.maya-ethnobotany.org
www.maya-ethnozoology.org
www.maya-archaeology.org
www.digital-photography.org
www.FLAAR-Mesoamerica.org

This report may be cited with this information:

Hellmuth, N. (2020) Waterlily Photo Reference Archive, *Nymphoides indica*, Río Dulce, El Golfete, Livingston, Izabal. Guatemala: FLAAR Mesoamerica.



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All national parks, nature reserves, and comparable are welcome to have and use our reports at no cost. USAC, UVG, URL, Universidad Rural, INTECAP and other Guatemalan universities, and high schools, and schools, are welcome to post our reports, at no cost.

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If you wish our flora and fauna material as a powerpoint presentation

Dr Nicholas (Hellmuth) is flown all around the world to lecture. He has spoken in Holland, Belgium, Germany, Austria, Greece, Italy, Serbia, Croatia, Bosnia, Russia, UK, Dubai, Abu Dhabi, Thailand, Korea, China, Japan, Canada, USA, Mexico, Panama, Guatemala, etc. He can lecture in Spanish, German, or English (or simultaneously translated to your language). He has lectured at Harvard, Yale, Princeton, UCLA, Berkeley and dozens of other universities, colleges, etc. He has also lectured at Rotary Club events, etc. He also writes cartoon books on plants and animals of Guatemala so gives presentations to kindergartens, primary school, high schools, etc. www.MayanToons.org shows our educational material for children.

If your club, association, institute, botanical, garden, zoo, park, university, etc. Wishes high resolution photos for an exhibit in your facility anywhere in the world

The Missouri Botanical Garden (MOBOT) has had two exhibits of the FLAAR Mesoamerica photos on Neotropical flowering plants of Guatemala. Photos by the FLAAR team have also been exhibited at Photokina in Germany and in Austria, Guatemala, and elsewhere. For use of these photos in a book or exhibit, naturally we need to discuss how to share the costs. We have material for entire exhibits on: Orchids of Guatemala (including aquatic orchids), Dye colorants from Mushrooms and Lichens of Guatemala, Bromeliads of Guatemala, Trees of Guatemala, Treetop Ecosystems of Guatemala (includes arboreal flowering cacti, bromeliads, and orchids), Cacao Cocoa Chocolate and their Maya and Aztec Flavorings. We naturally appreciate a contribution to help cover the costs of our office expenses for all the cataloging, processing, and organization of the photos and the field trip data.

To publish photographs

Hellmuth's photographs have been published by National Geographic, by Hasselblad Magazine, and used as front covers on books on Mayan topics around the world. His photos of cacao (cocoa) are in books on chocolate of the Maya and Aztec both by Dr Michael Coe (all three editions) and another book on chocolate by Japanese specialist in Mayan languages and culture, Dr Yasugi. We naturally appreciate a contribution to help cover the costs of our office expenses for all the cataloging, processing, and organization of the photos and the field trip data.

For Social Media

You can post any of the FLAAR Mesoamerica PDFs about the Municipio of Livingston on your Social Media sites; you can send any of these PDFs to your friends and colleagues and family: no cost, no permission needed.



BACKCOVER PHOTOGRAPH

Nymphoides indica.

Photograph by: María Alejandra Gutiérrez. FLAAR Mesoamerica. March, 2020.

Camera: SONY DSC-RX10M4 Lens: 8.8-220mm f/2.4-4.

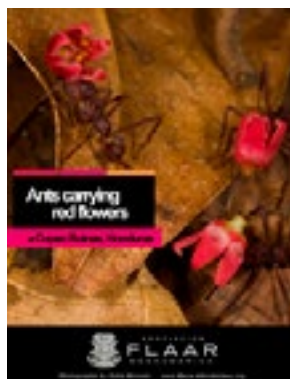
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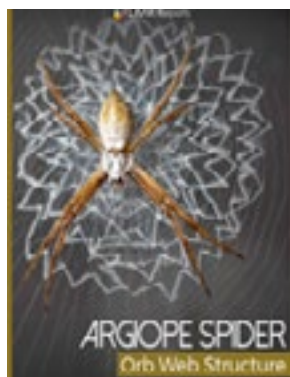
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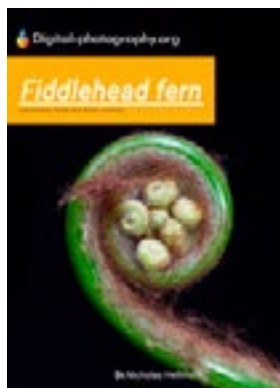
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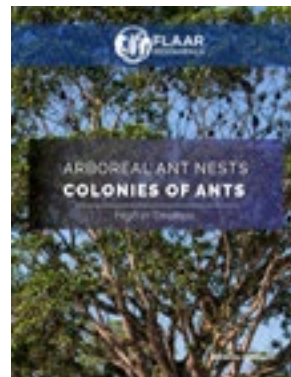
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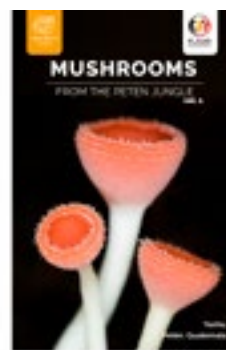
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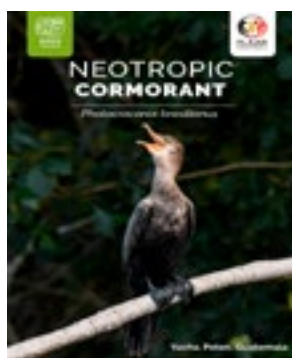
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