

**Biodiversity of Butterflies in the Waterfalls sector in the Barra Honda
National Park, Nicoya, Guanacaste, Costa Rica.**

Authors

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Principal Aim.

Make an inventory of butterflies in the area around the waterfalls and study the richness of biodiversity at the study site.

Secondary aims.

Employ capture techniques that allow the processing of specimens quickly and safely

Identify the species to obtain a list for the area

Compare the species caught in the Waterfalls area and Barra Honda Mountain to see if we have any difference in species composition between study sites.

Methodology.

Study area.

The project was performed in Barra Honda peninsula of Nicoya, Costa Rica, the type of forest represented in this area is dry tropical forest transition to wet tropical forest (Holdridge, 1968) the precipitation at the site is around 1500mm-2000mm and the average temperature is 26-28C° (Atlas IGN, 2008).

Around the 90% of the national park is covered by secondary forest but some areas still maintain primary forest, the secondary forest in Barra Honda is represented by species of trees like *Guazuma ulmifolia*, *Spondias mombin*, *Eugenia salamensis* and *Lonchocarpus minimiflorus*, In the primary forest we found species of trees that are very important for butterflies like *Trichilia glabra*, *Manilkara chicle*, *Brosimum alicastrum* and *Sideroxylon capiri*.

The sector where we caught the butterflies is called Las Cascadas, which is located in the foot slopes of Corralillo hill. It is a rocky area and which holds water in the dry season indicating this is an important place for wildlife.

Sampling techniques.

For sampling we used two different methodologies. The first was Van Someren Rydon traps. These are cylindrical in shape with a height of 1,40m. The traps were placed at different heights in the forest (2m, 4m, 6m) and each trap one had a plate attached. On the plates, “bait” was placed to attract the butterflies and in this case ripe pineapple fruit was successful. By using this methodology we were able to sample butterflies flying at different heights in the forest. The national park has pre-determined study sites in the different sectors of the reserve and, in the case of the site near the waterfalls; we placed our traps in each corner of the sampling areas. These were checked every hour for identifying the captured butterflies.

The second method used was entomological nets. This technique consisted of hiking in the trails of the area and capturing butterflies encountered. The idea of a combination of methodologies was try to have a faster capture rate and a higher number of species recorded in a short time.

Results.

We captured a total of 1821 individuals with both methods of capture, for a total of 68 species (see Annex 1). This included six families Nymphalidae, Pieridae, Papilionidae, Hesperidae, Lycaenidae and Riodinidae. In the Van Someren Rydon traps we captured a total of 1296 individuals. The most common family captured was Nymphalidae with 35 species identified. The most common of these was *Smyrna blomfildia datis* with a total of 789 individuals, followed by *Taygetis laches laches* with 122 and *Siproeta stelenes biplagiata* with 75. *Smyrna blomfildia datis* was the dominant species with a total of 61% of the catch. Some species were found just once like *Prepona dexamaneus dexamaneus*, *Prepona laertes demodice* and *Manataria hercyna maculata*.

Whilst recording the total biodiversity we found a new species for the area. *Hamadryas amphinome mexicana* belongs to the Nymphalidae family and has never been recorded in the region before. The English name is the Cracked Red

butterfly and was found in February for the first time. The individual was collected and placed in the collection of species found in the offices of PNBH.

A second capture of special interest occurred in June. *Hamadryas. amphinome mexicana* is a very rare species in the National Park and whilst it is common to observe or capture other species of the genus *Hamadryas*, *Hamadryas. amphinome mexicana*, was not reported until 2001 by the National Biodiversity Institute of Costa Rica in the conservation area Tempisque. The habitat where the capture was made was secondary forest about 40 years old.

Of the three heights used, more butterflies were found at the height of two meters with a total of 472 individuals, followed by the height of four meters with 417 individuals and finally the height of 6m with 372 individuals. Some of the species seem to prefer flying at certain levels within the forest as they were only captured at fixed heights. *Taygetis mermeria excavata* was only found at a height of two metres, *Adelpha fessonia* was captured at four metres high and *Prepona laertes demodice* at six metres high.

With the methodology of hand nets we were able to capture a total of 525 individuals that represented a total of 43 species of Lepidoptera. This technique obtained a higher percentage of species for the total number of individuals caught. In total, 43 species from 525 individuals were caught using nets whereas the hanging traps recorded 68 species from 1296 individuals. Some species were only captured using nets and these included species of the Pieridae. The species most frequently captured were *Taygetes laches laches* with a total of 75 individuals followed by *Ganyra josephina josepha* and *Smyrna blomfieldia datys*, with 25 captures each.

Whilst *Taygetis laches laches* was the species most captured during the study it was not the species most commonly observed during these months of research. The results are skewed as this species is often found where the rotten fruits of the



Spondias mombin tree lay on the ground. This occurs from February through to June and so the capture of this species is made easier by the access to many individuals feeding along the trails.

Of the 68 species caught in the Van Someren Rydon traps in the area of the waterfalls we had species of just one family, Nymphalidae. The hand nets captured greater diversity in different families, as shown in Annex 6. family Nymphalidae is dominant with 67% of all individuals followed by Pieridae 32, 4%, Papilionidae 3.6% followed by Riodinidae 0.4%, unknown 0.4% and Hesperidae/ Lycaenidae families 0.2%

We compared the investigation of butterflies performed in Barra Honda in 2011 with the study we did in the waterfalls area and the results show us a difference in four species, in 2011 we had 31 but in 2013 we got 35. In the study site on Barra Honda Mountain we collected six species that were absent from the waterfalls area and we registered 13 species that were not found in the first study. It is interesting to see these differences between those areas because both sites have different life zones (Holdridge, 1966) which should reflect the different diversities found in the two areas.

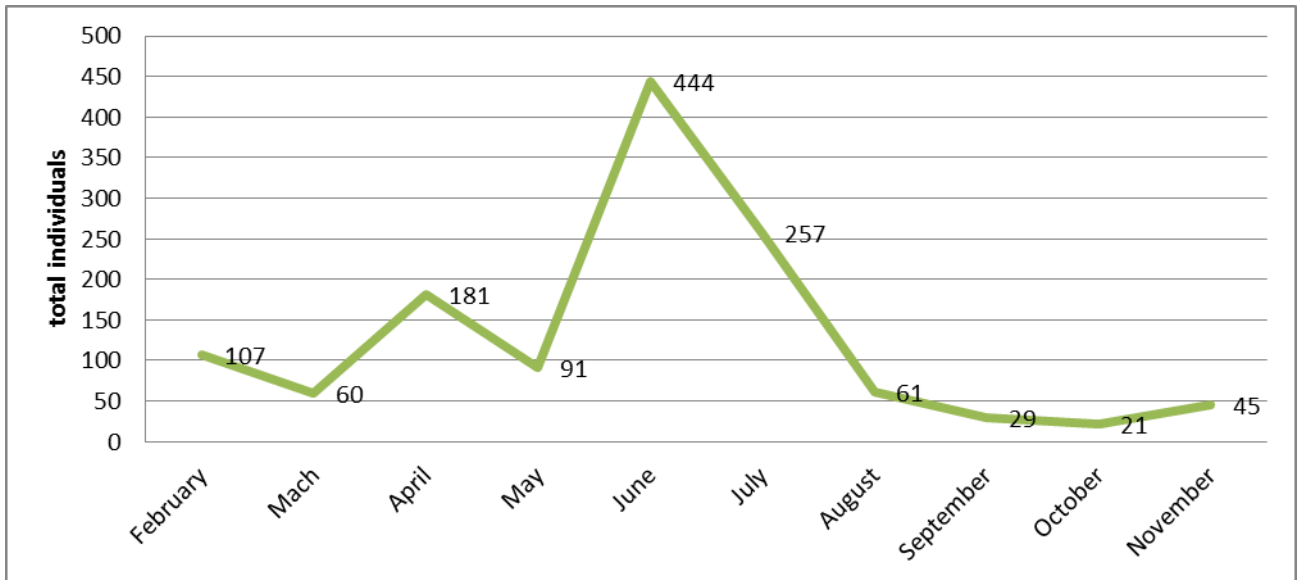
Annex1. Butterflies list of Barra Honda National Park, Waterfall Sector.

Species	Family
<i>Adelpha iphiclus iphiclus</i>	Nymphalidae
<i>Anartia jatrophae</i>	Nymphalidae
<i>Glutophrissa drusilla</i>	Pieridae
<i>Archaeoprepona demophon centralis</i>	Nymphalidae
<i>Archaeoprepona demophon gulina</i>	Nymphalidae
<i>Ganyra josephina josepha</i>	Pieridae
<i>Caligo telamonius memnon</i>	Nymphalidae
<i>Callicore pitheas</i>	Nymphalidae
<i>Chlosyne hippodrome hippodrome</i>	Nymphalidae
<i>Cissia pseudoconfusa</i>	Nymphalidae
<i>Colobura dirce dirce</i>	Nymphalidae
<i>Danaus gilippus thersippus</i>	Nymphalidae
<i>Danous eresimus montezuma</i>	Nymphalidae
<i>Danous plexippus</i>	Nymphalidae
<i>Doxocopa laure laure</i>	Nymphalidae
<i>Dryas iulia moderata</i>	Nymphalidae
<i>Eueides isabella eva</i>	Nymphalidae
<i>Eunica monima</i>	Nymphalidae
<i>Euptoieta hegesia meridiania</i>	Nymphalidae
<i>Eurema daira Eugenia</i>	Pieridae
<i>Eurema nise nelphe</i>	Pieridae
<i>Eurema proterpia</i>	Pieridae
<i>Eurema westwoodi</i>	Pieridae
<i>Eurybia elvina elvina</i>	Nymphalidae
<i>Hamadryas glauconome glauconome</i>	Nymphalidae
<i>Heliconius hecale zuleika</i>	Nymphalidae
<i>Hermeuptychia Hermes</i>	Nymphalidae
<i>Isabella demophile centralis</i>	Pieridae
<i>Junonia evarete evarete</i>	Nymphalidae
<i>Leptophobia aripa aripa</i>	Pieridae
<i>Magneuptychia libye</i>	Nymphalidae
<i>Marpesia berania fruhstorferi</i>	Nymphalidae
<i>Marpesia petreus petreus</i>	Nymphalidae
<i>Mechanitis polymnia isthmia</i>	Nymphalidae
<i>Memphis oenomaïs</i>	Nymphalidae
<i>Microtia elva</i>	Nymphalidae
<i>Morpho helenor marinita</i>	Nymphalidae

<i>Nica flavila canthera</i>	Nymphalidae
<i>Heraclides cresphontes</i>	Papilionidae
<i>Parides erithalion sadyattes</i>	Papilionidae
<i>Parides iphidamas iphidamas</i>	Papilionidae
<i>Phoebis philea philea</i>	Pieridae
<i>Pierella luna pallida</i>	Nymphalidae
<i>Taygetis laches laches</i>	Nymphalidae
<i>Taygetis mermeria excavata</i>	Nymphalidae
<i>Taygetis rufomarginata</i>	Nymphalidae
<i>Tithorea armonia helicaon</i>	Nymphalidae
<i>Zaretis ellos</i>	Nymphalidae
<i>Adelpha fessonia</i>	Nymphalidae
<i>Anaea troglodyta aidea</i>	Nymphalidae
<i>Archaeoprepona amphimachus amphiktion</i>	Nymphalidae
<i>Catonephele numilia esite</i>	Nymphalidae
<i>Eunica monima modesta</i>	Nymphalidae
<i>Hamadryas amphinome mexicana</i>	Nymphalidae
<i>Hamadryas februa ferentina</i>	Nymphalidae
<i>Hamadryas guatemalena guatemalena</i>	Nymphalidae
<i>Hermeuptychia harmonia</i>	Nymphalidae
<i>Hermeuptychia Hermes</i>	Nymphalidae
<i>Historis acheronta acheronta</i>	Nymphalidae
<i>Historis odius odius</i>	Nymphalidae
<i>Manataria hercyna maculata</i>	Nymphalidae
<i>Memphis lyceus</i>	Nymphalidae
<i>Memphis morous bouisdusvali</i>	Nymphalidae
<i>Prepona dexamaneus dexamaneus</i>	Nymphalidae
<i>Prepona laertes demodice</i>	Nymphalidae
<i>Pyrrhogyra otalais otalais</i>	Nymphalidae
<i>Siproeta stelenes biplagiata</i>	Nymphalidae
<i>Smyrna blomfildia datis</i>	Nymphalidae

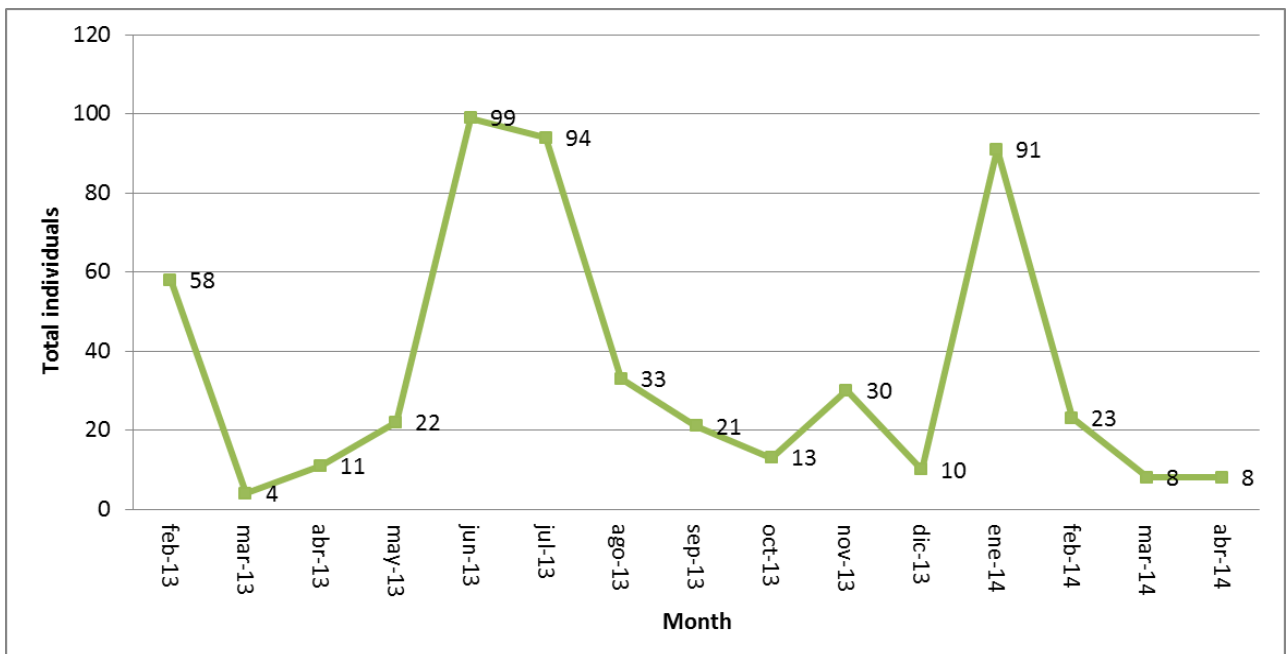
(Cubero et al, 2014).

Annex 2. Behavior of butterflies captured in the study with Van Someren Rydon traps.



(Cubero *et al*, 2014).

Annex 3. Behavior of butterflies captured in the studio with the hand traps.



(Cubero *et al*, 2014).

Annex 4. Species Captured with the Van Someren Rydon Traps and the relative abundances of each species.

Species	Number of individuals	Relative abundance
<i>Adelpha fessonia</i>	1	0,01
<i>Adelpha iphiclus iphiclus</i>	57	0,62
<i>Anaea aidea</i>	11	0,12
<i>Archaeoprepona demophon centralis</i>	14	0,15
<i>Archaeoprepona demophon gulina</i>	9	0,10
<i>Archaeoprepona meander</i>	1	0,01
<i>Caligo telamonius memnon</i>	4	0,04
<i>Callicore pitheas</i>	6	0,07
<i>Cantonephela Rumelia</i>	1	0,01
<i>Cissia confusa</i>	1	0,01
<i>Colubura dirce dirce</i>	3	0,03
<i>Doxocopa laure</i>	3	0,03
<i>Eunica monima modesta</i>	11	0,12
<i>Hamadryas amphinome mexicana</i>	2	0,02
<i>Hamadryas februa ferentina</i>	11	0,12
<i>Hamadryas glauconome glauconome</i>	38	0,41
<i>Hamadryas guatemalena guatemalena</i>	17	0,18
<i>Hermeuptychia harmonia</i>	1	0,01
<i>Hermeuptychia Hermes</i>	11	0,12
<i>Historis acheronta acheronta</i>	35	0,38
<i>Historis odius odius</i>	20	0,22
<i>Junonia evarete evarete</i>	1	0,01
<i>Manataria hercyna maculata</i>	1	0,01
<i>Memphis lyceus</i>	2	0,02
<i>Memphis morous bouisdusvali</i>	4	0,04
<i>Memphis oenomais</i>	11	0,12
<i>Morpho helenor marinita</i>	7	0,08
<i>Prepona dexamaneus dexamaneus</i>	1	0,01
<i>Prepona laertes demodice</i>	1	0,01
<i>Pyrrhogyra otalais otalais</i>	2	0,02
<i>Siproeta stelenes biplagiata</i>	75	0,82
<i>Smyrna blomfieldia datis</i>	789	8,58
<i>Syderone marpesia</i>	1	0,01
<i>Taygetes laches laches</i>	122	1,33
<i>Zaretis ellos</i>	21	0,23

(Cubero et al, 2014).

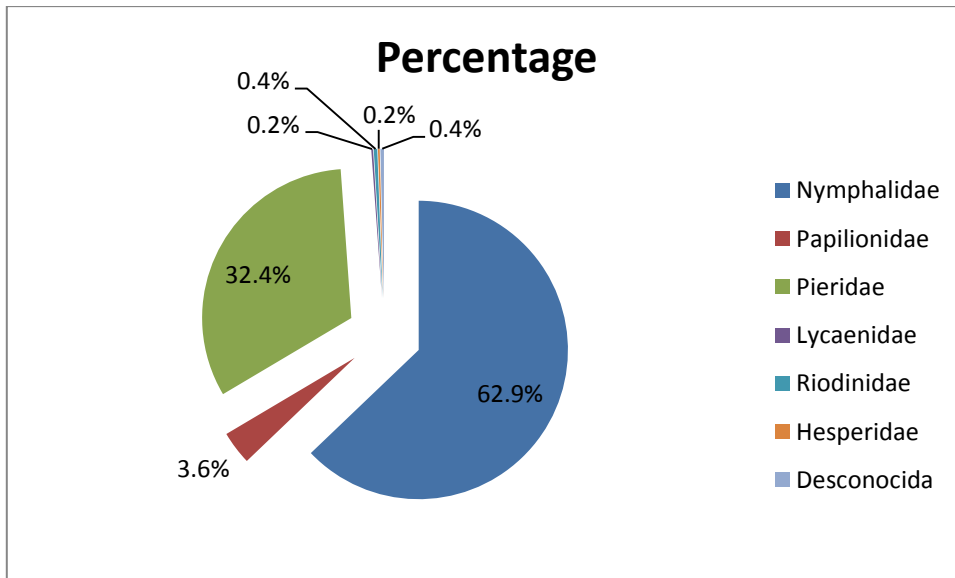
Annex 5. Species captured with the hand nets methodology and the relative abundance of each species.

Species	Numbers of individual	Relative abundance
<i>Adelpha iphiclus iphiclus</i>	22	0,18
<i>Anartia jatrophae</i>	1	0,01
<i>Glutophrissa drusilla</i>	3	0,02
<i>Archaeoprepona demophon centralis</i>	1	0,01
<i>Archaeoprepona demophon gulina</i>	1	0,01
<i>Archaeoprepona sp.</i>	1	0,01
<i>Ganyra josephina josepha</i>	25	0,20
<i>Caligo telamonius memnon</i>	4	0,03
<i>Callicore pitheas</i>	4	0,03
<i>Chlosyne hippodrome</i>	1	0,01
<i>Cissia pseudoconfusa</i>	2	0,02
<i>Colobura dirce dirce</i>	1	0,01
<i>Danaus gilippus thersippus</i>	3	0,02
<i>Danous eresimus</i>	2	0,02
<i>Danous plexippus</i>	2	0,02
<i>Doxocopa laure laure</i>	2	0,02
<i>Dryas iulia moderata</i>	1	0,01
<i>Eueides isabella eva</i>	6	0,05
<i>Eunica monima modesta</i>	3	0,02
<i>Eupotoieta hegesia meridiana</i>	10	0,08
<i>Eurema दौरा</i>	48	0,38
<i>Eurema dina westwoodi</i>	8	0,06
<i>Eurema nise</i>	8	0,06
<i>Eurema proterpia</i>	1	0,01
<i>Eurema westwoodi</i>	1	0,01
<i>Eurybia elvina elvina</i>	4	0,03
<i>Hamadryas glauconome glauconome</i>	1	0,01
<i>Heliconius hecale zuleika</i>	16	0,13
<i>Hermeuptychia Hermes</i>	4	0,03
<i>Hesperidae</i>	4	0,03
<i>Isabella demophile centralis</i>	27	0,22
<i>Junonia evarete evarete</i>	1	0,01

<i>Leptophobia aripa aripa</i>	21	0,17
<i>Lycaenidae sp</i>	1	0,01
<i>Magneptychia libye</i>	7	0,06
<i>Marpesia berania</i>	2	0,02
<i>Marpesia petreus</i>	5	0,04
<i>Mechanitis polymnia isthmia</i>	1	0,01
<i>Memphis oenomaïs</i>	2	0,02
<i>Microtia elva</i>	19	0,15
<i>Morpho helenor marinita</i>	32	0,26
<i>Nica flavila canthera</i>	1	0,01
<i>Papilio Cresphontes</i>	3	0,02
<i>Parides erithalion sodyattes</i>	2	0,02
<i>Parides iphidamas iphidamas</i>	23	0,18
<i>Phoebis philea philea</i>	2	0,02
<i>Pierella luna luna</i>	2	0,02
<i>Siproeta stelenes biplagiata</i>	46	0,37
<i>Smyrna blomfieldia datis</i>	29	0,23
<i>Taygetis laches laches</i>	91	0,73
<i>Taygetis mermeria excavata</i>	1	0,01
<i>Taygetis rufomarginata</i>	1	0,01
<i>Tithorea armonia helicaon</i>	1	0,01
<i>Zaretis ellos</i>	3	0,02

(Cubero et al, 2014).

Annex 6. Distribution of families according to the species captured with the hand traps.



(Cubero *et al*, 2014).

Annex 7. Some species we found during the Project in 2013-2014.



Hamadryas amphinome mexicana. (Frontal, Ventral)



Phyrrogyra otalais otalais. (Frontal, ventral)



Colobura annulata. (Frontal, ventral)



Itaballia demophile centralis. (Frontal, ventral)



Cantonepele numilia esite. (Frontal, ventral)



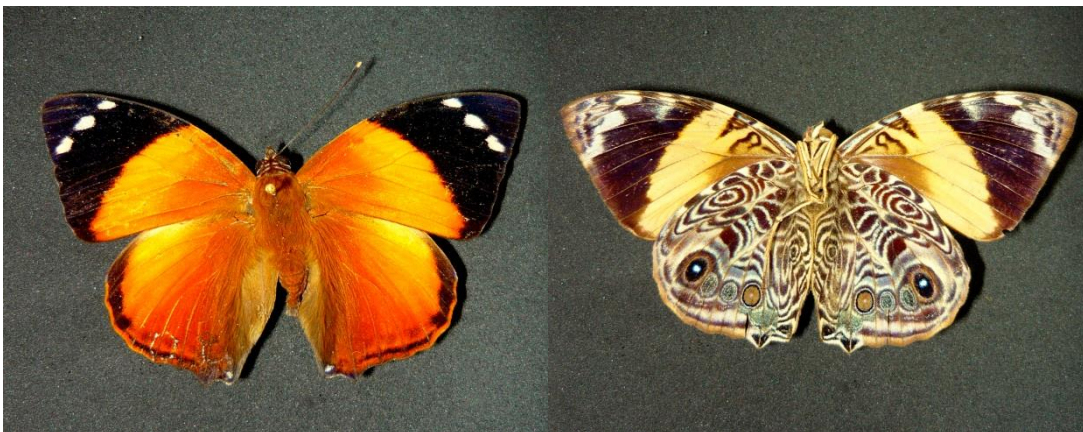
Danus gelipus thersipus. (Frontal, ventral)



Anartia Jatrophae. (Frontal, ventral)



Historis odius. (Frontal, ventral)



Smyrna blomfieldia datis. (Frontal, ventral)



Taygetis laches laches (Frontal, ventral)

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