

UNESCO environmental DNA (eDNA) Expeditions in marine World Heritage sites

Biodiversity survey for Coiba National Park and its Special Zone of Marine Protection

Interim Results Based on 50% of Samples Analyzed
Not for public distribution

UNESCO's eDNA Expeditions is a global, citizen science initiative that is conducted with the intention to measure marine biodiversity and predict the impact climate change on marine community composition across UNESCO World Heritage marine sites.

eDNA is a cost effective and minimally invasive method to measure biodiversity in any given area. Marine species continuously shed DNA into the water around them in the form of waste, mucus, or cells. By collecting this DNA from water samples, and subsequently amplifying and sequencing specific regions within these DNA strands, experts can detect a wide variety of species without removing any organisms from their environment. The amplified regions are selected depending on the scope of the study: while some markers are suitable to obtain a broad overview of biodiversity across many groups of species, other markers are particularly suited to get high resolution insight for a more specific taxonomic group. The UNESCO eDNA Expeditions initiative combines a number of markers tailored for marine vertebrates (fish, mammals, and turtles). A general marker was added to allow to detect also species from other groups such as invertebrates which can give a broader insight in the marine species diversity in a given area.

Between September 2022 and May 2023, UNESCO organized eDNA sampling campaigns in 21 marine World Heritage sites across 17 countries around the world. At every World Heritage site, about 20 samples were collected from different habitats. Over 250 young people participated in the local sampling expeditions. They were guided by local experts and park management staff, using protocols and eDNA sampling equipment provided by UNESCO.

Biodiversity inventories generated from the samples are being combined with existing species distribution data from public biodiversity databases such as the Ocean Biodiversity Information System (OBIS) in view of obtaining a comprehensive overview of marine life across marine World Heritage sites. Through the use of climate scenarios and species distribution models, an estimate will be made of the impact of climate change, in particular rising temperatures, on local biodiversity and its potential future distribution patterns.

More information about the initiative is available on the UNESCO website: <https://www.unesco.org/en/edna-expeditions>.

Results

Sampling and sample processing

eDNA sampling was conducted in Coiba National Park and its Special Zone of Marine Protection in July to September 2023. A total of 20 samples were collected at 5 locations in the park: Canales de afuero, Isla tortuga, Oceanica, Rio San Juan, and Tres Islas (Figure 1). Up to 1800 mL of seawater was filtered through filter cartridges with a 0.8 μm pore size. After sampling, the filter cartridges were flushed with preservation liquid and shipped to UNESCO. From the 20 samples, 10 have now (December 2023) been processed. A second batch of samples will be processed in January 2024. DNA from these samples was extracted and amplified, and then sent to the sequencing facility at KU Leuven in Belgium, a specialized university eDNA lab contracted by UNESCO for this work. PCR amplification was done using five primer pairs selected to capture as much biodiversity as possible in the target groups of the study: fish, mammals, and turtles. The results in this preliminary report are based on a first batch of 10 samples that were analyzed covering all locations that were sampled in the World Heritage site.

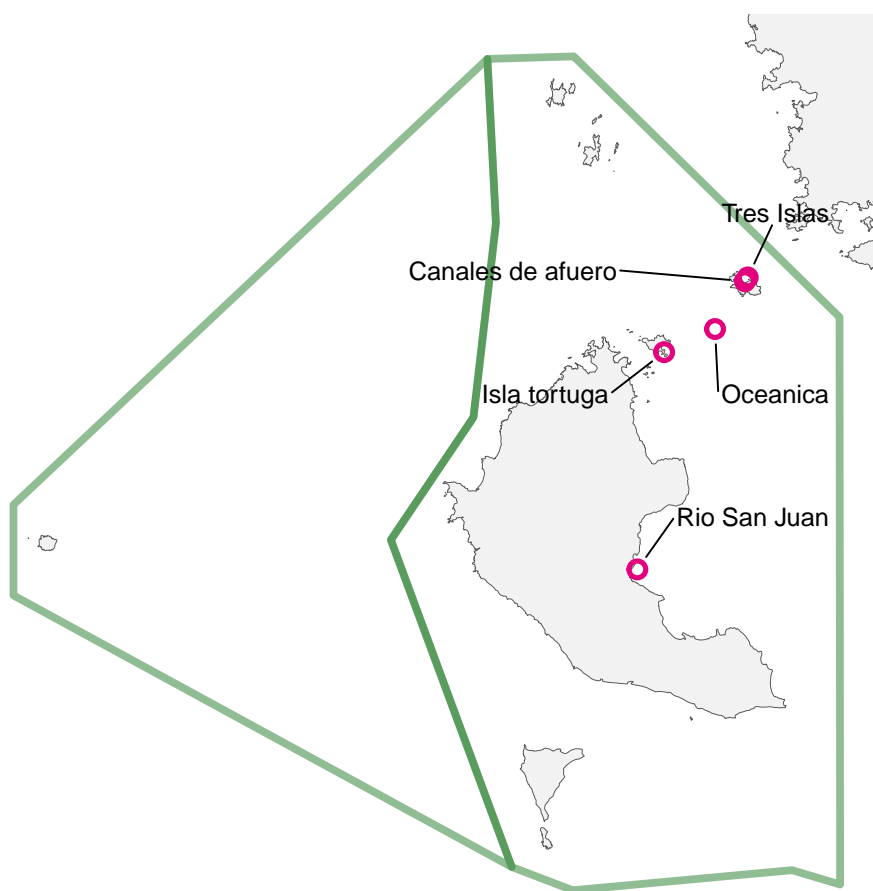


Figure 1: Map of the sampling locations.

DNA sequencing

Sequencing of the DNA from 10 samples resulted in over 16 million sequence reads (Table 2), from which we collected 16212 unique sequences or ASVs. By matching those sequences with reference sequences in public databases, we were able to detect 309 species. Most of these species are vertebrates, but also species from other groups were detected, including algae, jellyfish, molluscs, copepods, and sponges (Figure 2). Of the 309

species detected, 193 are not among the 1621 species previously reported from Coiba National Park and its Special Zone of Marine Protection to the UNESCO OBIS database.

reads	asvs
16596157	16212

Table 1: Reads, ASVs, and species across all samples.

locality	materialSampleID	sampleSize	reads	asvs	species
Canales de afuero	EE0160	1800	2083026	5707	115
Canales de afuero	EE0238	1800	1644498	8980	94
Isla tortuga	EE0207	1500	1452893	1208	60
Isla tortuga	EE0208	1380	935017	7078	153
Oceanica	EE0237	1500	1309084	8507	94
Oceanica	EE0240	1500	1142154	8535	110
Rio San Juan	EE0192	1500	1546095	4904	51
Rio San Juan	EE0209	1500	1481781	1371	59
Rio San Juan	EE0241	1500	3098907	902	19
Tres Islas	EE0239	1440	1896469	9433	143

Table 2: Reads, ASVs, and species by sample.

Species identification

The marker sequences obtained from sequencing were matched with sequence reference databases built using public data available from the National Center for Biotechnology Information (NCBI). This resulted in the identification of 309 species, of which 162 fish species, 1 mammalian species, and 1 turtle species (Table 3). This represents about NA% of the species known from Coiba National Park and its Special Zone of Marine Protection in the OBIS database. 8 of the detected species are listed as threatened on the IUCN Red List (Table 4). A full list of species is added at the end of this report.

group	eDNA species	total species	fraction
fish	162	600	0.27
mammals	1	8	0.12
turtles		3	

Table 3: Number of species in the three target groups, from the OBIS database and from eDNA sampling.

category	eDNA species	total species	fraction
CR	1	5	0.20
EN		8	
VU	7	31	0.23

Table 4: Number of species by IUCN Red List category, from the OBIS database and from eDNA sampling.

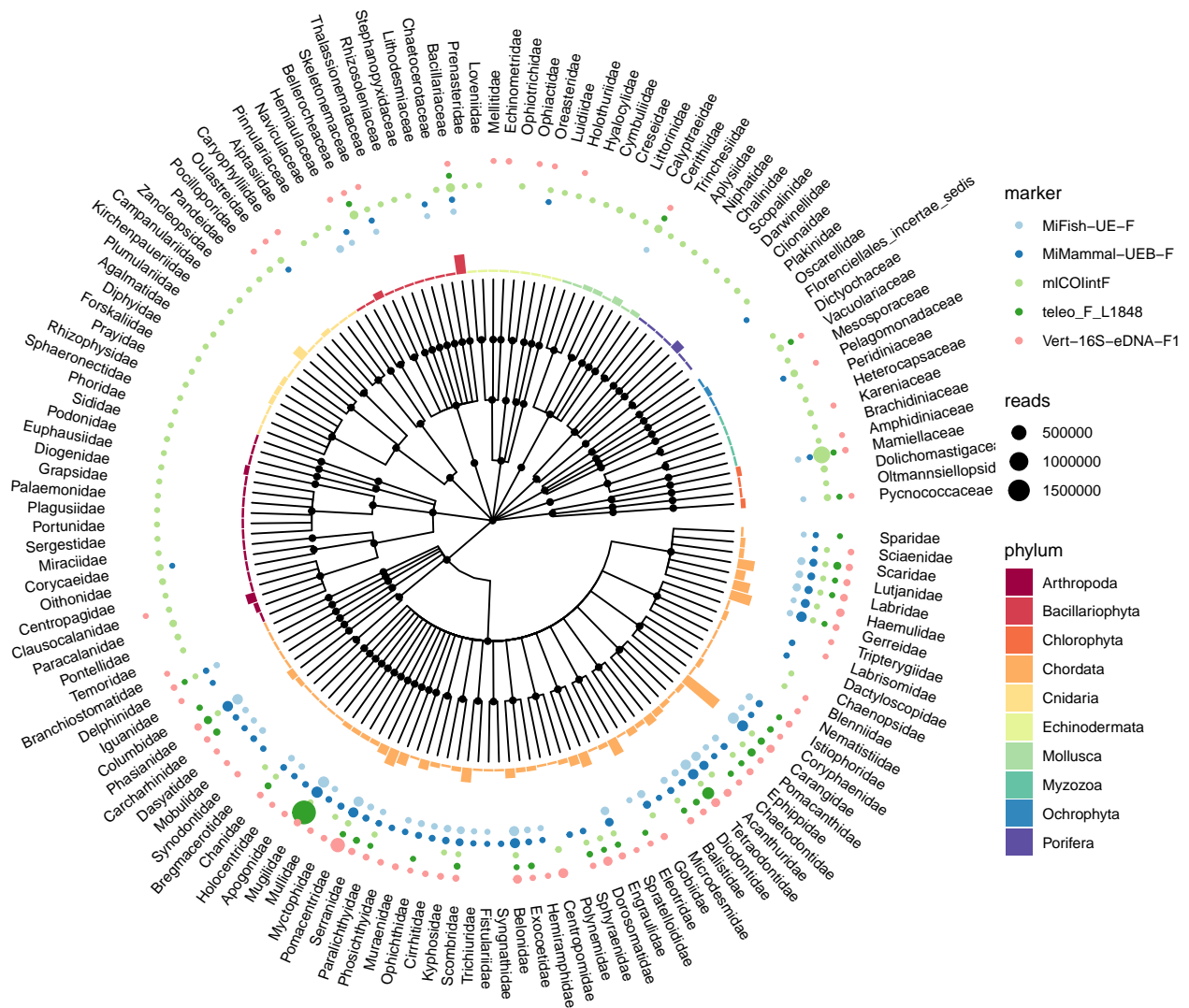


Figure 2: Number of DNA reads (bubbles) and species detected (bars) by family.

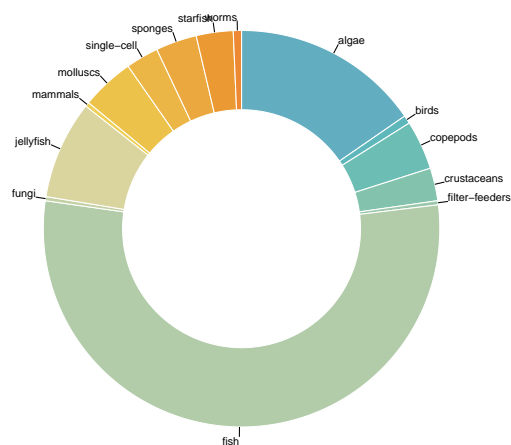


Figure 3: Distribution of detected species across groups.

phylum	class	species	group	category	new	vernacular
Amoebozoa	Discosea	Neoparamoeba aestuarina	single-cell		yes	
Annelida	Polychaeta	Iphione henshawi	worms		yes	
Annelida	Polychaeta	Phyllochaetopterus verrilli	worms		yes	
Arthropoda	Branchiopoda	Penilia avirostris			yes	
Arthropoda	Branchiopoda	Pseudevadne tergestina			yes	
Arthropoda	Copepoda	Bestiolina similis	copepods		yes	
Arthropoda	Copepoda	Calanopia minor	copepods		yes	
Arthropoda	Copepoda	Calocalanus pavo	copepods		yes	
Arthropoda	Copepoda	Calocalanus plumulosus	copepods		yes	
Arthropoda	Copepoda	Centropages furcatus	copepods		yes	
Arthropoda	Copepoda	Clausocalanus furcatus	copepods		yes	
Arthropoda	Copepoda	Farranula gibbula	copepods		yes	
Arthropoda	Copepoda	Labidocera acuta	copepods		yes	
Arthropoda	Copepoda	Macrosetella gracilis	copepods		yes	
Arthropoda	Copepoda	Oithona attenuata	copepods		yes	
Arthropoda	Copepoda	Paracalanus indicus	copepods		yes	
Arthropoda	Copepoda	Temora discaudata	copepods		yes	
Arthropoda	Hexapoda	Megaselia scalaris			yes	
Arthropoda	Malacostraca	Callinectes arcuatus	crustaceans			arched swimming crab
Arthropoda	Malacostraca	Clibanarius lineatus	crustaceans		yes	
Arthropoda	Malacostraca	Euphausia eximia	crustaceans		yes	
Arthropoda	Malacostraca	Euphausia lamelligera	crustaceans		yes	
Arthropoda	Malacostraca	Goniopsis pulchra	crustaceans			
Arthropoda	Malacostraca	Neosergestes edwardsii	crustaceans		yes	
Arthropoda	Malacostraca	Palaemonella holmesi	crustaceans			southern algae shrimp
Arthropoda	Malacostraca	Plagusia squamosa	crustaceans		yes	scaly rock crab
Ascomycota	Dothideomycetes	Cladosporium herbarum	fungi		yes	
Bacillariophyta	Bacillariophyceae	Bellerrochea polymorpha	algae		yes	
Bacillariophyta	Bacillariophyceae	Chaetoceros socialis	algae		yes	
Bacillariophyta	Bacillariophyceae	Cylindrotheca closterium	algae		yes	
Bacillariophyta	Bacillariophyceae	Eucampia striata	algae		yes	
Bacillariophyta	Bacillariophyceae	Eucampia zodiacus	algae		yes	
Bacillariophyta	Bacillariophyceae	Hemiaulus sinensis	algae		yes	
Bacillariophyta	Bacillariophyceae	Lithodesmioides polymorpha	algae		yes	
Bacillariophyta	Bacillariophyceae	Navicula minima	algae		yes	
Bacillariophyta	Bacillariophyceae	Pinnularia acrosphaeria	algae		yes	
Bacillariophyta	Bacillariophyceae	Pseudo-nitzschia circumpora	algae		yes	
Bacillariophyta	Bacillariophyceae	Pseudo-nitzschia cuspidata	algae		yes	
Bacillariophyta	Bacillariophyceae	Pseudo-nitzschia multistriata	algae		yes	
Bacillariophyta	Bacillariophyceae	Pseudo-nitzschia pseudodelicatissima	algae		yes	
Bacillariophyta	Bacillariophyceae	Pseudo-nitzschia sabit	algae		yes	
Bacillariophyta	Bacillariophyceae	Pseudo-nitzschia subfraudulenta	algae		yes	
Bacillariophyta	Bacillariophyceae	Pseudo-nitzschia subpacific	algae		yes	
Bacillariophyta	Bacillariophyceae	Skeletonema menzelii	algae		yes	
Bacillariophyta	Bacillariophyceae	Stephanopyxis turris	algae		yes	
Bacillariophyta	Bacillariophyceae	Sundstroemia setigera	algae		yes	
Bacillariophyta	Bacillariophyceae	Thalassionema nitzschioides	algae		yes	
Cercozoa	Chlorarachnea	Bigelowiella natans	single-cell		yes	
Cercozoa	Chlorarachnea	Chlorarachnion reptans	single-cell		yes	
Chaetognatha	Sagittoidea	Aidanosagitta neglecta			yes	

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phylum	class	species	group	category	new	vernacular
Chaetognatha	Sagittoidea	Flaccisagitta enflata			yes	
Chaetognatha	Sagittoidea	Krohnitta subtilis			yes	
Chlorophyta	Mamiellophyceae	Dolichomastix tenuilepis	algae		yes	
Chlorophyta	Mamiellophyceae	Micromonas commoda	algae		yes	
Chlorophyta	Mamiellophyceae	Micromonas pusilla	algae		yes	
Chlorophyta	Pyramimonadophyceae	Pseudoscurfieldia marina	algae		yes	
Chlorophyta	Pyramimonadophyceae	Pycnococcus provasolii	algae		yes	
Chlorophyta	Ulvophyceae	Oltmannsiellopsis viridis	algae		yes	
Chlorophyta		Chloroparvula pacifica	algae		yes	
Chlorophyta		Chloropicon laureae	algae		yes	
Chlorophyta		Chloropicon primus	algae		yes	
Chlorophyta		Chloropicon roscoffensis	algae		yes	
Chlorophyta		Chloropicon sieburthii	algae		yes	
Chordata	Aves	Columba livia	birds	LC	yes	
Chordata	Aves	Meleagris gallopavo	birds	LC	yes	
Chordata	Elasmobranchii	Carcharhinus leucas	fish	VU		bull shark, requin-bouledogue
Chordata	Elasmobranchii	Carcharhinus limbatus	fish	VU		blacktip shark
Chordata	Elasmobranchii	Hypanus americanus	fish	NT	yes	
Chordata	Elasmobranchii	Hypanus longus	fish	VU		
Chordata	Elasmobranchii	Mobula munkiana	fish	VU	yes	pygmy devil ray
Chordata	Elasmobranchii	Triadenodon obesus	fish	VU		whitetip reef shark
Chordata	Leptocardii	Branchiostoma lanceolatum			yes	lancelet, amphioxus
Chordata	Mammalia	Tursiops truncatus	mammals	LC		bottlenose dolphin, grand dauphin
Chordata	Teleostei	Ablennes hians	fish	LC		flat needlefish
Chordata	Teleostei	Abudefduf troschelii	fish	LC		Panamic sergeant major
Chordata	Teleostei	Acanthocybium solandri	fish	LC		wahoo
Chordata	Teleostei	Acanthurus triostegus	fish	LC		convict surgeonfish
Chordata	Teleostei	Acanthurus xanthopterus	fish	LC		yellowfin surgeonfish
Chordata	Teleostei	Alectis ciliaris	fish	LC		African pompano
Chordata	Teleostei	Anchoa hepsetus	fish	LC	yes	striped anchovy
Chordata	Teleostei	Anchoa ischana	fish	LC	yes	sharpnose anchovy
Chordata	Teleostei	Anchoa macrolepidota	fish	LC		bigscale anchovy
Chordata	Teleostei	Apogon binotatus	fish	LC	yes	barred cardinalfish
Chordata	Teleostei	Apogon imberbis	fish	LC	yes	
Chordata	Teleostei	Arothron hispidus	fish	LC		bristly puffer
Chordata	Teleostei	Arothron meleagris	fish	LC		Guineafowl puffer
Chordata	Teleostei	Atule mate	fish	LC	yes	yellowtail scad
Chordata	Teleostei	Auxis rochei	fish	LC	yes	Bonito, bonite
Chordata	Teleostei	Auxis thazard	fish	LC	yes	frigate tuna, auxide
Chordata	Teleostei	Axoclinus lucillae	fish	LC		Panamic triplefin
Chordata	Teleostei	Azurina atrilobata	fish			
Chordata	Teleostei	Balistes polylepis	fish	LC		finescale triggerfish
Chordata	Teleostei	Bathygobius andrei	fish	LC		
Chordata	Teleostei	Bathygobius fuscus	fish	LC	yes	dusky frill-goby
Chordata	Teleostei	Benthosema panamense	fish	LC		
Chordata	Teleostei	Benthosema pterotum	fish	LC	yes	skinnycheek lanternfish
Chordata	Teleostei	Bodianus diplotaenia	fish	LC		Mexican hogfish
Chordata	Teleostei	Bregmaceros bathymaster	fish	LC		East Pacific codlet
Chordata	Teleostei	Bryx dunckeri	fish	LC	yes	pugnose pipefish
Chordata	Teleostei	Calamus penna	fish	LC	yes	sheepshead porgy

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phylum	class	species	group	category	new	vernacular
Chordata	Teleostei	Canthidermis maculata	fish	LC		rough triggerfish
Chordata	Teleostei	Canthigaster janthinoptera	fish	LC		spotted puffer
Chordata	Teleostei	Caranx caballus	fish	LC		green jack
Chordata	Teleostei	Caranx caninus	fish	LC		Pacific crevalle jack
Chordata	Teleostei	Caranx hippos	fish	LC	yes	common jack, carangue crevalle
Chordata	Teleostei	Caranx latus	fish	LC	yes	horse-eye jack
Chordata	Teleostei	Caranx melampygus	fish	LC		bluefin trevally
Chordata	Teleostei	Caranx sexfasciatus	fish	LC		bigeye trevally
Chordata	Teleostei	Centropomus medius	fish	LC		blackfin snook
Chordata	Teleostei	Cephalopholis microprion	fish	LC	yes	
Chordata	Teleostei	Cephalopholis panamensis	fish	LC		Panama graysby
Chordata	Teleostei	Cephalopholis sexmaculata	fish	LC	yes	sixspot grouper
Chordata	Teleostei	Cetengraulis mysticetus	fish	LC	yes	anchoveta
Chordata	Teleostei	Chaenomugil proboscideus	fish	LC		snouted mullet
Chordata	Teleostei	Chaenopsis celeste	fish		yes	
Chordata	Teleostei	Chaetodipterus faber	fish	LC	yes	Atlantic spadefish
Chordata	Teleostei	Chaetodon ocellatus	fish	LC	yes	spotfin butterflyfish
Chordata	Teleostei	Chanos chanos	fish	LC		milkfish, chano
Chordata	Teleostei	Cheilopogon spilonotopterus	fish		yes	stained flyingfish
Chordata	Teleostei	Cirrhitichthys oxycephalus	fish	LC		pixy hawkfish
Chordata	Teleostei	Citharichthys gilberti	fish	LC		bigmouth sanddab
Chordata	Teleostei	Citharichthys sordidus	fish	LC	yes	Pacific sanddab, limande sordide
Chordata	Teleostei	Coryphaena hippurus	fish	LC		common dolphinfish, corphène commune
Chordata	Teleostei	Coryphopterus urospilus	fish	LC		redlight goby
Chordata	Teleostei	Ctenogobius sagittula	fish	LC		longtail goby
Chordata	Teleostei	Cyclopsetta fimbriata	fish	LC	yes	spotfin flounder
Chordata	Teleostei	Decapterus macarellus	fish	LC		mackerel scad
Chordata	Teleostei	Deckertichthys aureolus	fish			
Chordata	Teleostei	Diapterus auratus	fish	LC	yes	Irish mojarra
Chordata	Teleostei	Diapterus brevirostris	fish			
Chordata	Teleostei	Diodon holocanthus	fish	LC		balloonfish
Chordata	Teleostei	Diodon hystrix	fish	LC		spot-fin porcupinefish
Chordata	Teleostei	Echidna nebulosa	fish	LC		snowflake moray
Chordata	Teleostei	Elagatis bipinnulata	fish	LC		rainbow runner
Chordata	Teleostei	Eleotris picta	fish	LC		spotted sleeper
Chordata	Teleostei	Engraulis japonicus	fish	LC	yes	Japanese anchovy
Chordata	Teleostei	Engraulis mordax	fish	DD	yes	Californian anchovy, anchois du Pacifique
Chordata	Teleostei	Ethmalosa fimbriata	fish	LC	yes	Bonga shad
Chordata	Teleostei	Etropus crossotus	fish	LC	yes	fringed flounder
Chordata	Teleostei	Eucinostomus currani	fish	LC		Pacific flagfin mojarra
Chordata	Teleostei	Eucinostomus dowii	fish	LC	yes	Pacific spotfin mojarra
Chordata	Teleostei	Eucinostomus gracilis	fish	LC		graceful mojarra
Chordata	Teleostei	Eucinostomus gula	fish	LC	yes	Jenny mojarra
Chordata	Teleostei	Eucinostomus melanopterus	fish	LC	yes	flagfin mojarra
Chordata	Teleostei	Euleptorhamphus viridis	fish			ribbon halfbeak
Chordata	Teleostei	Euthynnus affinis	fish	LC	yes	kawakawa, thonine orientale
Chordata	Teleostei	Fistularia commersonii	fish	LC		cornetfish
Chordata	Teleostei	Gerres cinereus	fish	LC		yellowfin mojarra
Chordata	Teleostei	Gillellus greyae	fish	LC	yes	arrow stargazer
Chordata	Teleostei	Gnathanodon speciosus	fish	LC		golden trevally

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phylum	class	species	group	category	new	vernacular
Chordata	Teleostei	Gobiomorus maculatus	fish	LC	yes	Pacific sleeper
Chordata	Teleostei	Gobulus birdsongi	fish	CR	yes	
Chordata	Teleostei	Gymnothorax undulatus	fish	LC		undulated moray
Chordata	Teleostei	Haemulon aurolineatum	fish	LC	yes	tomtate grunt
Chordata	Teleostei	Haemulon flaviguttatum	fish	LC		Cortez grunt
Chordata	Teleostei	Haemulon maculicauda	fish	LC		spottail grunt
Chordata	Teleostei	Haemulon plumierii	fish	LC	yes	grunt
Chordata	Teleostei	Haemulopsis leuciscus	fish	LC		raucous grunt
Chordata	Teleostei	Haemulopsis nitidus	fish	LC		shining grunt
Chordata	Teleostei	Halichoeres notospilus	fish	LC		banded wrasse
Chordata	Teleostei	Hemanthias signifer	fish	LC		hookthroat bass
Chordata	Teleostei	Hemiramphus balao	fish	LC	yes	balao
Chordata	Teleostei	Holacanthus passer	fish	LC		king angelfish
Chordata	Teleostei	Holocentrus adscensionis	fish	LC	yes	squirrelfish
Chordata	Teleostei	Hoplopagrus guentherii	fish	LC		barred pargo
Chordata	Teleostei	Isopisthus remifer	fish	LC	yes	bigeye corvina
Chordata	Teleostei	Istiophorus platypterus	fish	VU		Indo-Pacific sailfish, voilier indo-pacifique
Chordata	Teleostei	Johrndallia nigrirostris	fish	LC		barberfish
Chordata	Teleostei	Kyphosus elegans	fish	LC		Cortez sea chub
Chordata	Teleostei	Kyphosus vaigiensis	fish	LC		brassy chub
Chordata	Teleostei	Larimus pacificus	fish	LC	yes	Pacific drum
Chordata	Teleostei	Lutjanus argentiventris	fish	LC		amarillo snapper
Chordata	Teleostei	Lutjanus campechanus	fish	VU	yes	northern red snapper
Chordata	Teleostei	Lutjanus colorado	fish	LC		colorado snapper
Chordata	Teleostei	Lutjanus fulvus	fish	LC	yes	blacktail snapper
Chordata	Teleostei	Lutjanus griseus	fish	LC	yes	grey snapper
Chordata	Teleostei	Lutjanus novemfasciatus	fish	LC		Pacific dog snapper
Chordata	Teleostei	Malacotenus triangulatus	fish	LC	yes	saddled blenny
Chordata	Teleostei	Microgobius brevispinis	fish	LC	yes	Balboa goby
Chordata	Teleostei	Mugil curema	fish	LC		silverside mullet
Chordata	Teleostei	Mulloidichthys vanicolensis	fish	LC		yellowfin goatfish
Chordata	Teleostei	Muraena lentiginosa	fish	LC		jewel moray
Chordata	Teleostei	Myrophis vafer	fish	LC		Pacific worm eel
Chordata	Teleostei	Nematistius pectoralis	fish			roosterfish
Chordata	Teleostei	Novaculichthys taeniourus	fish	LC		rockmover wrasse
Chordata	Teleostei	Oligoplites altus	fish	LC		longjaw leatherjack
Chordata	Teleostei	Ophichthus zophochir	fish	LC	yes	yellow snake eel
Chordata	Teleostei	Ophioblennius steindachneri	fish	LC		Panamic fanged blenny
Chordata	Teleostei	Opisthonema bulleri	fish	LC		slender thread herring
Chordata	Teleostei	Opisthonema libertate	fish	LC	yes	deepbody thread herring, Chardin du Pacifique
Chordata	Teleostei	Opisthonema oglinum	fish	LC	yes	Atlantic thread herring
Chordata	Teleostei	Paranthias colonus	fish			Pacific creolefish
Chordata	Teleostei	Parexocoetus brachypterus	fish			sailfin flyingfish
Chordata	Teleostei	Platybelone argalus	fish	LC		keeltail needlefish
Chordata	Teleostei	Polydactylus virginicus	fish	LC	yes	barbu, barbure de flaque
Chordata	Teleostei	Pomacanthus zonipectus	fish	LC		Cortez angelfish
Chordata	Teleostei	Prionurus laticlavus	fish	LC		razor surgeonfish
Chordata	Teleostei	Pseudogramma thaumasia	fish			
Chordata	Teleostei	Pseudupeneus grandisquamis	fish	LC		bigscale goatfish
Chordata	Teleostei	Ptereleotris carinata	fish	LC		Panamic dartfish

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phylum	class	species	group	category	new	vernacular
Chordata	Teleostei	Rhencus macracanthus	fish			
Chordata	Teleostei	Rypticus saponaceus	fish	LC	yes	greater soapfish
Chordata	Teleostei	Scarus ghobban	fish	LC		bluechin parrotfish
Chordata	Teleostei	Scarus rubroviolaceus	fish	LC		ember parrotfish
Chordata	Teleostei	Scomberomorus sierra	fish	LC		Pacific sierra
Chordata	Teleostei	Selar crumenophthalmus	fish	LC		bigeye scad
Chordata	Teleostei	Seriola lalandi	fish	LC		yellowtail, sériele chicard
Chordata	Teleostei	Sicydium salvini	fish		yes	
Chordata	Teleostei	Sphoeroides annulatus	fish	LC		bullseye puffer
Chordata	Teleostei	Sphyræna ensis	fish	LC		Mexican barracuda
Chordata	Teleostei	Sphyræna guachancho	fish	LC	yes	guaguanche
Chordata	Teleostei	Spratelloides delicatulus	fish	LC	yes	delicate round herring
Chordata	Teleostei	Starksia ocellata	fish	LC	yes	checkered blenny
Chordata	Teleostei	Stegastes flavilatus	fish	LC		beaubrummel
Chordata	Teleostei	Stegastes rectifraenum	fish	LC		Cortez damselfish
Chordata	Teleostei	Sufflamen verres	fish	LC		orangeside triggerfish
Chordata	Teleostei	Syacium papillosum	fish	LC	yes	dusky flounder
Chordata	Teleostei	Synodus lacertinus	fish	LC		calico lizardfish
Chordata	Teleostei	Tetrapturus angustirostris	fish	DD	yes	shortbill spearfish, makaire à rostre court
Chordata	Teleostei	Thalassoma lucasanum	fish	LC		Cortez rainbow wrasse
Chordata	Teleostei	Thunnus alalunga	fish	LC	yes	albacore, thon blanc
Chordata	Teleostei	Trachinotus carolinus	fish	LC	yes	pompano
Chordata	Teleostei	Trachinotus goodei	fish	LC	yes	palometa
Chordata	Teleostei	Trachinotus rhodopus	fish	LC		gafttopsail pompano
Chordata	Teleostei	Trichiurus lepturus	fish	LC		largehead hairtail, poisson-sabre commun
Chordata	Teleostei	Tylosurus acus	fish	LC		agujon needlefish
Chordata	Teleostei	Tylosurus crocodilus	fish	LC		houndfish
Chordata	Teleostei	Uropterygius macularius	fish	LC	yes	marbled moray
Chordata	Teleostei	Vinciguerria lucetia	fish	LC		
Chordata		Iguana iguana		LC	yes	
Cnidaria	Anthozoa	Exaiptasia diaphana	jellyfish			
Cnidaria	Anthozoa	Heterocyathus sulcatus	jellyfish	LC	yes	striped bum coral
Cnidaria	Anthozoa	Oulastrea crispata	jellyfish	LC	yes	zebra coral
Cnidaria	Anthozoa	Pocillopora acuta	jellyfish		yes	
Cnidaria	Anthozoa	Pocillopora verrucosa	jellyfish	LC	yes	cauliflower coral
Cnidaria	Hydrozoa	Athorybia rosacea	jellyfish		yes	
Cnidaria	Hydrozoa	Campanularia hincksii	jellyfish		yes	
Cnidaria	Hydrozoa	Clytia brevithecata	jellyfish		yes	
Cnidaria	Hydrozoa	Clytia gracilis	jellyfish		yes	
Cnidaria	Hydrozoa	Diphyes dispar	jellyfish		yes	
Cnidaria	Hydrozoa	Forskalia edwardsii	jellyfish		yes	
Cnidaria	Hydrozoa	Forskalia tholoides	jellyfish		yes	
Cnidaria	Hydrozoa	Kirchenpaueria halecioides	jellyfish		yes	
Cnidaria	Hydrozoa	Larsonia pterophylla	jellyfish		yes	
Cnidaria	Hydrozoa	Lensia conoidea	jellyfish		yes	
Cnidaria	Hydrozoa	Nanomia bijuga	jellyfish		yes	
Cnidaria	Hydrozoa	Obelia bidentata	jellyfish			doubletoothed hydroid
Cnidaria	Hydrozoa	Obelia dichotoma	jellyfish			sea thread hydroid
Cnidaria	Hydrozoa	Plumularia setacea	jellyfish		yes	little seabristle
Cnidaria	Hydrozoa	Rhizophysa filiformis	jellyfish		yes	

Continued on next page

phylum	class	species	group	category	new	vernacular
Cnidaria	Hydrozoa	Rosacea flaccida	jellyfish		yes	
Cnidaria	Hydrozoa	Sphaeronectes koellikeri	jellyfish		yes	
Cnidaria	Hydrozoa	Zancleopsis dichotoma	jellyfish		yes	
Cryptophyta	Cryptophyceae	Hemiarma marina			yes	
Ctenophora	Tentaculata	Ocyropsis maculata	jellyfish		yes	ocyroé tachée
Echinodermata	Asteroidea	Luidia magnifica	starfish		yes	
Echinodermata	Asteroidea	Pentaceraster cumingi	starfish			
Echinodermata	Echinoidea	Agassizia scrobiculata	starfish		yes	
Echinodermata	Echinoidea	Echinometra vanbrunti	starfish		yes	
Echinodermata	Echinoidea	Encope micropora	starfish		yes	
Echinodermata	Echinoidea	Lovenia cordiformis	starfish		yes	
Echinodermata	Holothuroidea	Holothuria (Thymiosycia) impatiens	starfish			
Echinodermata	Ophiuroidea	Ophiactis savignyi	starfish		yes	
Echinodermata	Ophiuroidea	Ophiothrix (Ophiothrix) spiculata	starfish		yes	
Gastrotricha		Urodasys calicostylis			yes	
Haptophyta	Coccolithophyceae	Chrysochromulina tobinii	algae		yes	
Haptophyta	Coccolithophyceae	Emiliana huxleyi	algae		yes	
Haptophyta	Coccolithophyceae	Gephyrocapsa oceanica	algae		yes	
Haptophyta	Coccolithophyceae	Phaeocystis globosa	algae		yes	
Mollusca	Gastropoda	Boasia chierchiaie	molluscs		yes	
Mollusca	Gastropoda	Cerithium adustum	molluscs			
Mollusca	Gastropoda	Cerithium stercusmuscarum	molluscs			
Mollusca	Gastropoda	Cerithium uncinatum	molluscs			
Mollusca	Gastropoda	Corolla spectabilis	molluscs		yes	
Mollusca	Gastropoda	Crepidula striolata	molluscs		yes	
Mollusca	Gastropoda	Creseis conica	molluscs		yes	
Mollusca	Gastropoda	Dolabella auricularia	molluscs		yes	wedge sea hare
Mollusca	Gastropoda	Echinolittorina conspersa	molluscs			
Mollusca	Gastropoda	Hyalocylis striata	molluscs		yes	
Mollusca	Gastropoda	Littoraria varia	molluscs			
Mollusca	Gastropoda	Phestilla sibogae	molluscs		yes	
Mollusca	Gastropoda	Stylocheilus rickettsi	molluscs			
Myxozoa	Dinophyceae	Amphidinium massartii	single-cell		yes	
Myxozoa	Dinophyceae	Heterocapsa rotundata	single-cell		yes	
Myxozoa	Dinophyceae	Karenia brevis	single-cell		yes	
Myxozoa	Dinophyceae	Karlodinium veneficum	single-cell		yes	
Myxozoa	Dinophyceae	Kryptoperidinium triquetrum	single-cell		yes	
Ochromytha	Dictyochophyceae	Octactis octonaria	algae		yes	
Ochromytha	Dictyochophyceae	Pseudochattonella farcimen	algae		yes	
Ochromytha	Pelagophyceae	Pelagomonas calceolata	algae		yes	
Ochromytha	Phaeophyceae	Mesospora indopacifica	algae		yes	
Ochromytha	Raphidophyceae	Chattonella marina	algae		yes	
Ochromytha	Raphidophyceae	Chattonella subsalsa	algae		yes	
Phoronida		Phoronopsis californica	filter-feeders		yes	golden phoronid
Porifera	Demospongiae	Chelonaplysilla erecta	sponges		yes	
Porifera	Demospongiae	Cliona celata	sponges		yes	boring sponge, clione jaune
Porifera	Demospongiae	Cliona mariae	sponges		yes	Maria Santana's Cliona
Porifera	Demospongiae	Cliona vermifera	sponges		yes	orange boring sponge
Porifera	Demospongiae	Gelliodes wilsoni	sponges		yes	
Porifera	Demospongiae	Haliclona pigmentifera	sponges		yes	

Continued on next page

phylum	class	species	group	category	new	vernacular
Porifera	Demospongiae	Pione vastifica	sponges			boring sponge, clione rouge
Porifera	Demospongiae	Svenzea cristinae	sponges		yes	
Porifera	Homoscleromorpha	Oscarella pearsei	sponges		yes	
Porifera	Homoscleromorpha	Plakortis halichondrioides	sponges		yes	
Rhodophyta	Florideophyceae	Acanthophora spicifera	algae		yes	
Rhodophyta	Florideophyceae	Lithophyllum prototypum	algae		yes	
Rhodophyta	Florideophyceae	Melanothamnus ramireziae	algae		yes	
Rhodophyta	Florideophyceae	Pterocladella caerulescens	algae		yes	
Rhodophyta	Florideophyceae	Rhodachlya hawaiiiana	algae		yes	