

eDNA Expeditions biodiversity survey of Everglades National Park

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1 Introduction

Environmental DNA Expeditions is a global, citizen science initiative that will help measure marine biodiversity, and the impacts climate change might have on the distribution patterns of marine life, across UNESCO World Heritage marine sites. Ocean species shed DNA into the water around them. The genetic material from waste, mucus or cells in one liter of water can determine the species richness in a given area, without the need to actually extract organisms from their en-

vironment. The cost effective, ethical nature of eDNA sampling has the potential to revolutionize knowledge about ecosystems and species diversity and to inspire the next generation of ocean researchers.

eDNA sampling was conducted in Everglades National Park in April 2023. 20 samples were collected at five locations in the park: Trout Creek, North Eagle Creek, Crocodile Dragover, Whip Ray, and Captain.

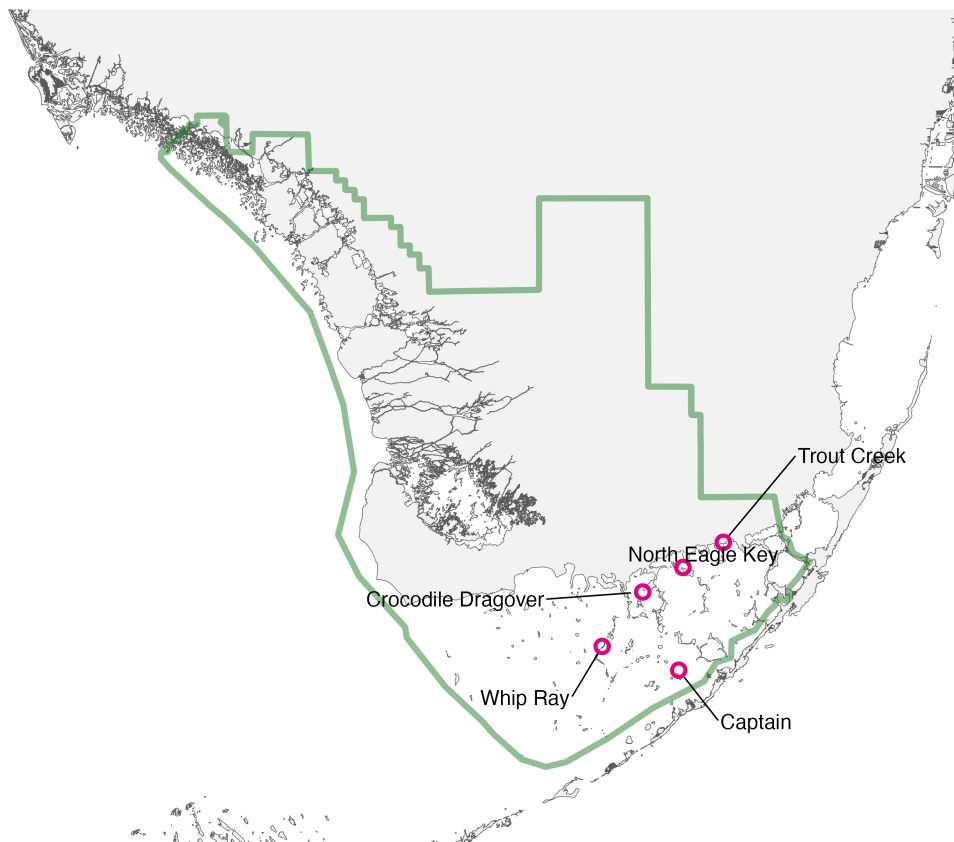


Figure 1: Map of eDNA sampling locations

2 Results

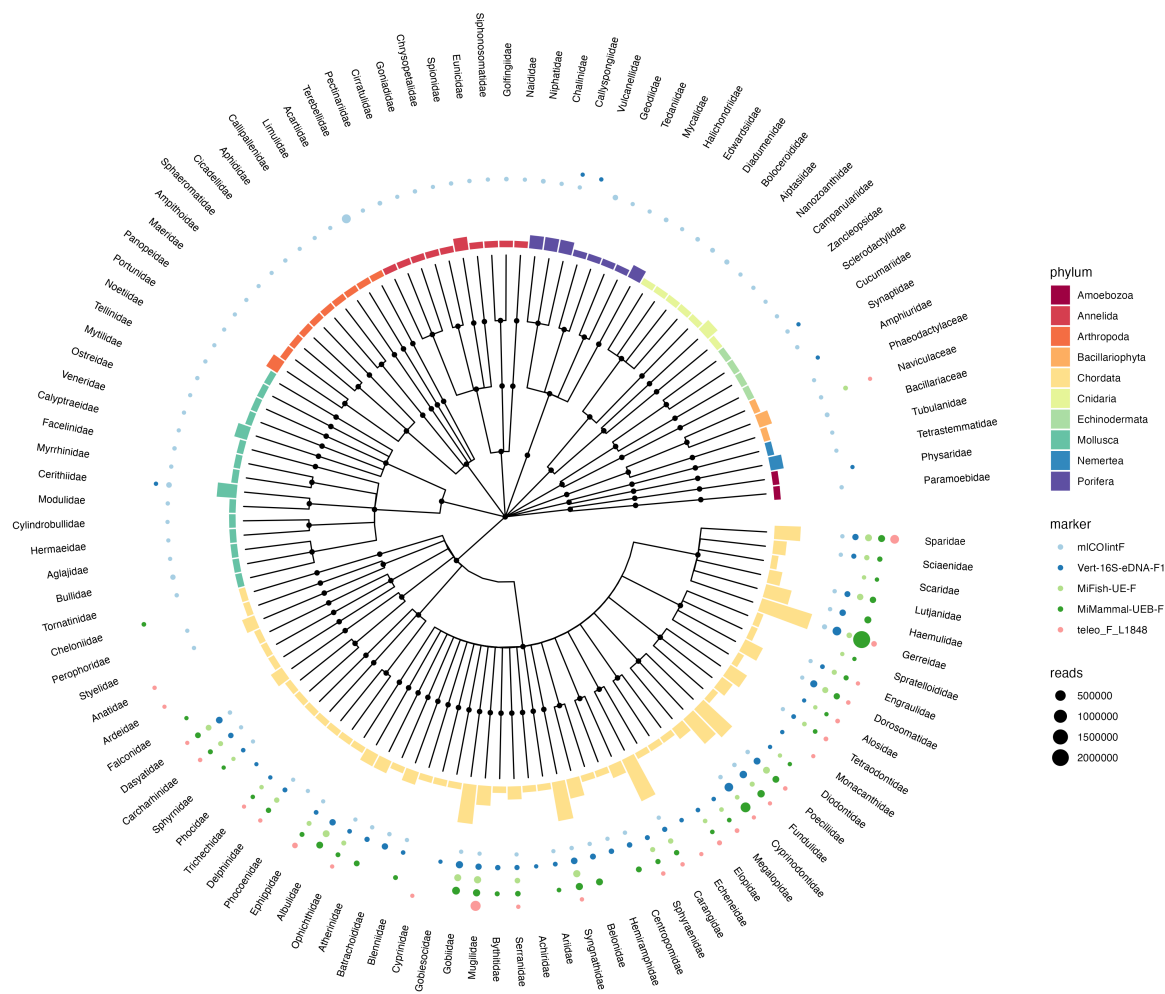


Figure 2: Number of DNA reads and species detected by family

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3 Species list

phylum	class	family	species	category
Amoebozoa	Discosea	Paramoebidae	Paramoeba aestuarina	
Amoebozoa	Myxogastrea	Physaridae	Craterium leucocephalum	
Annelida	Clitellata	Naididae	Thalassodrilides gurwitschi	
Annelida	Polychaeta	Eunicidae	Marphysa sanguinea	
Annelida	Polychaeta	Chrysopetalidae	Bhawania goodei	
Annelida	Polychaeta	Goniadidae	Glycinde multidentis	
Annelida	Polychaeta	Spionidae	Polydora websteri	
Annelida	Polychaeta	Spionidae	Prionospio steenstrupi	
Annelida	Polychaeta	Cirratulidae	Timarete caribous	
Annelida	Polychaeta	Pectinariidae	Pectinaria gouldii	
Annelida	Polychaeta	Terebellidae	Loimia medusa	
Annelida		Golfingiidae	Golfingia elongata	
Annelida		Siphonositidae	Siphonosoma cumanense	
Arthropoda	Copepoda	Acartiidae	Acartia tonsa	
Arthropoda	Hexapoda	Aphididae	Rhopalosiphum padi	
Arthropoda	Hexapoda	Cicadellidae	Macrostelus quadrilineatus	
Arthropoda	Malacostraca	Ampithoidae	Cymadusa compta	
Arthropoda	Malacostraca	Maeridae	Elasmopus nkjaf	
Arthropoda	Malacostraca	Panopeidae	Neopanope packardii	
Arthropoda	Malacostraca	Portunidae	Callinectes sapidus	
Arthropoda	Malacostraca	Portunidae	Portunus sanguinolentus	
Arthropoda	Malacostraca	Sphaeromatidae	Paracerceis caudata	
Arthropoda	Merostomata	Limulidae	Limulus polyphemus	VU
Arthropoda	Pycnogonida	Callipallenidae	Callipallene brevirostris	
Ascomycota	Dothideomycetes	Cladosporiaceae	Cladosporium herbarum	
Ascomycota	Eurotiomycetes	Trichocomaceae	Aspergillus versicolor	
Bacillariophyta	Bacillariophyceae	Bacillariaceae	Cylindrotheca closterium	
Bacillariophyta	Bacillariophyceae	Naviculaceae	Haslea crucigera	
Bacillariophyta	Bacillariophyceae	Naviculaceae	Navicula minima	
Bacillariophyta	Bacillariophyceae	Phaeodactylaceae	Phaeodactylum tricornutum	
Bryozoa	Gymnolaemata	Bugulidae	Bugula rochae	
Bryozoa	Gymnolaemata	Vesiculariidae	Amathia evelinae	
Cercozoa	Chlorarachnea	Chlorarachniaceae	Chlorarachnion reptans	
Chlorophyta	Mamiellophyceae	Dolichomastigaceae	Dolichomastix tenuilepis	
Chlorophyta	Mamiellophyceae	Mamiellaceae	Micromonas pusilla	
Chordata	Ascidiacea	Perophoridae	Ecteinascidia styaloides	
Chordata	Ascidiacea	Styelidae	Botrylloides niger	
Chordata	Ascidiacea	Styelidae	Botrylloides simodensis	
Chordata	Aves	Anatidae	Anas poecilorhyncha	
Chordata	Aves	Ardeidae	Ardea cinerea	
Chordata	Aves	Falconidae	Falco sparverius	
Chordata	Elasmobranchii	Carcharhinidae	Negaprion brevirostris	VU
Chordata	Elasmobranchii	Sphyrnidae	Sphyrna tiburo	EN
Chordata	Elasmobranchii	Dasyatidae	Hypanus americanus	NT
Chordata	Elasmobranchii	Dasyatidae	Hypanus rudis	CR
Chordata	Mammalia	Phocidae	Mirounga leonina	
Chordata	Mammalia	Delphinidae	Tursiops truncatus	
Chordata	Mammalia	Phocoenidae	Neophocaena phocaenoides	VU
Chordata	Mammalia	Trichechidae	Trichechus manatus	VU

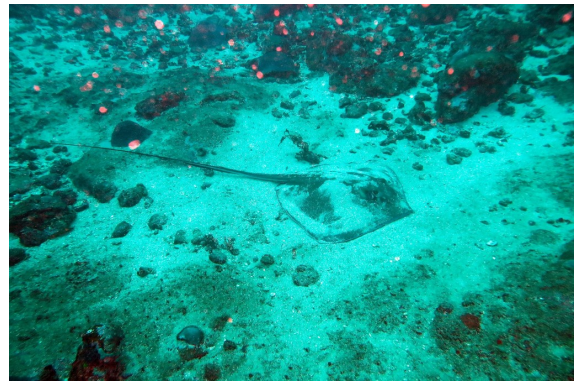
Chordata	Teleostei	Ephippidae	Chaetodipterus faber	
Chordata	Teleostei	Albulidae	Albula glossodonta	VU
Chordata	Teleostei	Albulidae	Albula vulpes	NT
Chordata	Teleostei	Ophichthidae	Myrophis punctatus	
Chordata	Teleostei	Ophichthidae	Myrophis vafer	
Chordata	Teleostei	Atherinidae	Atherinomorus stipes	
Chordata	Teleostei	Batrachoididae	Opsanus beta	
Chordata	Teleostei	Batrachoididae	Opsanus tau	
Chordata	Teleostei	Belonidae	Strongylura notata	
Chordata	Teleostei	Belonidae	Strongylura timucu	
Chordata	Teleostei	Belonidae	Tylosurus crocodilus	
Chordata	Teleostei	Hemiramphidae	Chriodorus atherinoides	
Chordata	Teleostei	Blenniidae	Chasmodes bosquianus	
Chordata	Teleostei	Centropomidae	Centropomus undecimalis	
Chordata	Teleostei	Sphyraenidae	Sphyraena barracuda	
Chordata	Teleostei	Sphyraenidae	Sphyraena jello	
Chordata	Teleostei	Carangidae	Caranx crysos	
Chordata	Teleostei	Carangidae	Caranx hippos	
Chordata	Teleostei	Carangidae	Caranx ignobilis	
Chordata	Teleostei	Carangidae	Caranx latus	
Chordata	Teleostei	Carangidae	Oligoplites saurus	
Chordata	Teleostei	Carangidae	Selene vomer	
Chordata	Teleostei	Carangidae	Trachinotus carolinus	
Chordata	Teleostei	Echeneidae	Echeneis naucrates	
Chordata	Teleostei	Alosidae	Brevoortia tyrannus	
Chordata	Teleostei	Dorosomatidae	Harengula humeralis	
Chordata	Teleostei	Dorosomatidae	Harengula jaguana	
Chordata	Teleostei	Dorosomatidae	Opisthonema oglinum	
Chordata	Teleostei	Engraulidae	Anchoa mitchilli	
Chordata	Teleostei	Spratelloididae	Jenkinsia lamprotaenia	
Chordata	Teleostei	Cyprinidae	Carassius auratus	
Chordata	Teleostei	Cyprinodontidae	Cyprinodon variegatus	
Chordata	Teleostei	Cyprinodontidae	Floridichthys carpio	
Chordata	Teleostei	Fundulidae	Adinia xenica	
Chordata	Teleostei	Fundulidae	Fundulus confluentus	
Chordata	Teleostei	Fundulidae	Fundulus grandis	
Chordata	Teleostei	Fundulidae	Lucania goodei	
Chordata	Teleostei	Fundulidae	Lucania parva	
Chordata	Teleostei	Poeciliidae	Belonesox belizanus	
Chordata	Teleostei	Poeciliidae	Gambusia affinis	
Chordata	Teleostei	Poeciliidae	Gambusia holbrooki	
Chordata	Teleostei	Poeciliidae	Gambusia rhizophorae	
Chordata	Teleostei	Poeciliidae	Poecilia latipinna	
Chordata	Teleostei	Poeciliidae	Poecilia sphenops	
Chordata	Teleostei	Elopidae	Elops saurus	
Chordata	Teleostei	Megalopidae	Megalops atlanticus	VU
Chordata	Teleostei	Gerreidae	Diapterus auratus	
Chordata	Teleostei	Gerreidae	Eucinostomus argenteus	
Chordata	Teleostei	Gerreidae	Eucinostomus gula	
Chordata	Teleostei	Gerreidae	Eucinostomus jonesii	
Chordata	Teleostei	Gerreidae	Eucinostomus melanopterus	
Chordata	Teleostei	Gerreidae	Eugerres plumieri	
Chordata	Teleostei	Gerreidae	Gerres cinereus	

Chordata	Teleostei	Gerreidae	Ulaema lefroyi	
Chordata	Teleostei	Haemulidae	Haemulon aurolineatum	
Chordata	Teleostei	Haemulidae	Haemulon parra	
Chordata	Teleostei	Haemulidae	Haemulon plumierii	
Chordata	Teleostei	Haemulidae	Haemulon sciurus	
Chordata	Teleostei	Lutjanidae	Lutjanus argentimaculatus	
Chordata	Teleostei	Lutjanidae	Lutjanus griseus	
Chordata	Teleostei	Scaridae	Nicholsina usta	
Chordata	Teleostei	Sciaenidae	Cynoscion nebulosus	
Chordata	Teleostei	Sciaenidae	Pogonias cromis	
Chordata	Teleostei	Sparidae	Archosargus probatocephalus	
Chordata	Teleostei	Sparidae	Archosargus rhomboidalis	
Chordata	Teleostei	Sparidae	Diplodus kotschyi	
Chordata	Teleostei	Sparidae	Lagodon rhomboides	
Chordata	Teleostei	Gobiesocidae	Gobiosox strumosus	
Chordata	Teleostei	Gobiidae	Gobiosoma bosc	
Chordata	Teleostei	Gobiidae	Gobiosoma ginsburgi	
Chordata	Teleostei	Gobiidae	Gobiosoma robustum	
Chordata	Teleostei	Gobiidae	Lophogobius cyprinoides	
Chordata	Teleostei	Gobiidae	Microgobius gulosus	
Chordata	Teleostei	Gobiidae	Microgobius microlepis	
Chordata	Teleostei	Mugilidae	Mugil cephalus	
Chordata	Teleostei	Mugilidae	Mugil curema	
Chordata	Teleostei	Mugilidae	Mugil rubrioculus	
Chordata	Teleostei	Bythitidae	Ogilbia cayorum	
Chordata	Teleostei	Serranidae	Epinephelus itajara	VU
Chordata	Teleostei	Serranidae	Epinephelus lanceolatus	
Chordata	Teleostei	Achiridae	Trinectes maculatus	
Chordata	Teleostei	Ariidae	Ariopsis felis	
Chordata	Teleostei	Syngnathidae	Anarchopterus criniger	
Chordata	Teleostei	Syngnathidae	Hippocampus zosterae	
Chordata	Teleostei	Syngnathidae	Syngnathus floridae	
Chordata	Teleostei	Syngnathidae	Syngnathus fuscus	
Chordata	Teleostei	Syngnathidae	Syngnathus schlegeli	
Chordata	Teleostei	Syngnathidae	Syngnathus scovelli	
Chordata	Teleostei	Diodontidae	Chilomycterus schoepfii	
Chordata	Teleostei	Monacanthidae	Stephanolepis cirrifer	
Chordata	Teleostei	Monacanthidae	Stephanolepis hispidus	
Chordata	Teleostei	Tetraodontidae	Sphoeroides maculatus	
Chordata	Teleostei	Tetraodontidae	Sphoeroides parvus	
Chordata	Teleostei	Tetraodontidae	Sphoeroides spengleri	
Chordata	Teleostei	Cheloniidae	Caretta caretta	VU
Cnidaria	Anthozoa	Aiptasiidae	Exaiptasia diaphana	
Cnidaria	Anthozoa	Boloceroideidae	Boloceroideus mcmurrici	
Cnidaria	Anthozoa	Diadumenidae	Diadumene leucolepis	
Cnidaria	Anthozoa	Edwardsiidae	Edwardsia longicornis	
Cnidaria	Anthozoa	Nanozoanthidae	Nanozoanthus harenaceus	
Cnidaria	Hydrozoa	Zancleopsisidae	Zancleopsis dichotoma	
Cnidaria	Hydrozoa	Campanulariidae	Clytia hemisphaerica	
Cnidaria	Hydrozoa	Campanulariidae	Obelia bidentata	
Ctenophora	Tentaculata	Coeloplanidae	Vallicula multiformis	
Echinodermata	Holothuroidea	Synaptidae	Leptosynapta tenuis	
Echinodermata	Holothuroidea	Cucumariidae	Thyonella gemmata	

Echinodermata	Holothuroidea	Sclerodactylidae	Sclerodactyla briareus
Echinodermata	Ophiuroidea	Amphiuridae	Amphipholis squamata
Gnathostomulida		Gnathostomulidae	Gnathostomula axi
Mollusca	Bivalvia	Noetiidae	Arcopsis adamsi
Mollusca	Bivalvia	Tellinidae	Ameritella mitchelli
Mollusca	Bivalvia	Mytilidae	Brachidontes exustus
Mollusca	Bivalvia	Ostreidae	Crassostrea virginica
Mollusca	Bivalvia	Veneridae	Anomalocardia auberiana
Mollusca	Bivalvia	Veneridae	Chione cancellata
Mollusca	Gastropoda	Aglajidae	Philinopsis pusa
Mollusca	Gastropoda	Bullidae	Bulla arabica
Mollusca	Gastropoda	Tornatinidae	Acteocina canaliculata
Mollusca	Gastropoda	Calyptraeidae	Crepidula convexa
Mollusca	Gastropoda	Facelinidae	Learchis poica
Mollusca	Gastropoda	Myrrhinidae	Nanuca occidentalis
Mollusca	Gastropoda	Cerithiidae	Bittium varium
Mollusca	Gastropoda	Cerithiidae	Cerithium eburneum
Mollusca	Gastropoda	Cerithiidae	Cerithium muscarum
Mollusca	Gastropoda	Modulidae	Modulus modulus
Mollusca	Gastropoda	Cylindrobullidae	Cylindrobulla beauui
Mollusca	Gastropoda	Hermaeidae	Cyerce antillensis
Myzozoa	Dinophyceae	Amphidiniaceae	Amphidinium massartii
Nemertea	Hoplonemertea	Tetrastemmatidae	Tetrastemma elegans
Nemertea	Hoplonemertea	Tetrastemmatidae	Tetrastemma wilsoni
Nemertea	Palaeonemertea	Tubulanidae	Tubulanus riceae
Phoronida		Phoronidae	Phoronis psammophila
Porifera	Demospongiae	Callyspongiidae	Callyspongia diffusa
Porifera	Demospongiae	Callyspongiidae	Callyspongia vaginalis
Porifera	Demospongiae	Chalinidae	Cladocroce burapha
Porifera	Demospongiae	Chalinidae	Haliclona vansoesti
Porifera	Demospongiae	Niphatidae	Gelliodes wilsoni
Porifera	Demospongiae	Niphatidae	Pachychalina tenera
Porifera	Demospongiae	Mycalidae	Mycale fibrexilis
Porifera	Demospongiae	Tedaniidae	Tedania ignis
Porifera	Demospongiae	Halichondriidae	Amorphinopsis fenestrata
Porifera	Demospongiae	Halichondriidae	Halichondria melanadocia
Porifera	Demospongiae	Geodiidae	Geodia neptuni
Porifera	Demospongiae	Vulcanellidae	Poecillastra laminaris
Rhodophyta	Florideophyceae	Rhodomelaceae	Polysiphonia echinata



(a) *Sphyrna tiburo*



(b) *Hypanus rudis*



(c) *Epinephelus itajara*

Figure 3: Some of the detected fish species.