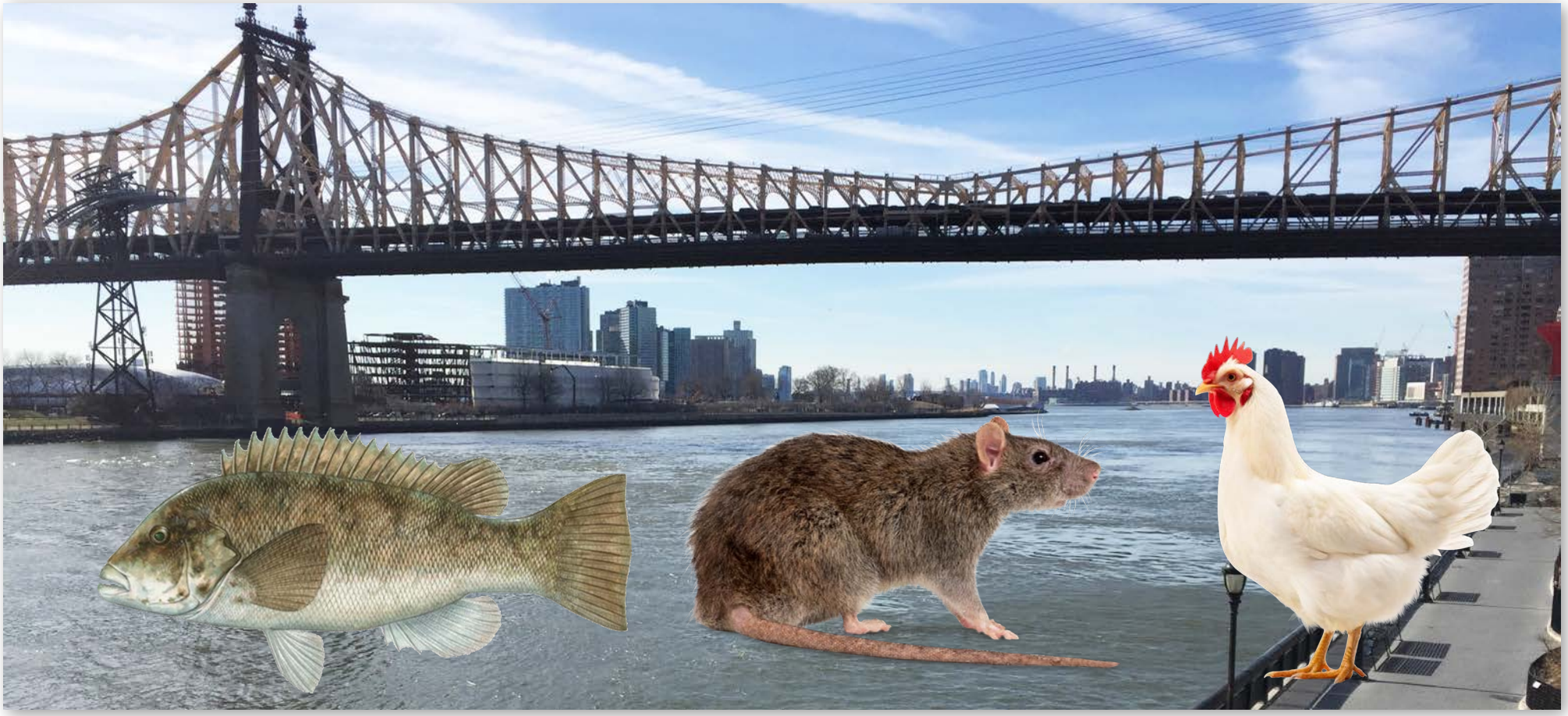
Biomonitoring in the Anthropocene:

Urban estuary environmental DNA tracks marine fish, terrestrial wildlife, and human diet



East River at 63rd ST, New York, NY

PLOS ONE 2026, in press

https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0332676

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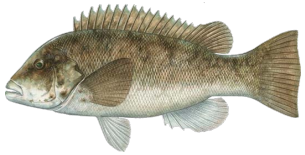
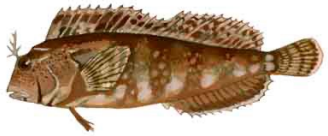
East River eDNA

Tracks marine fish abundance,



Finds overlooked species,




Counts local wildlife,



urban birds,



And household pets,


And reports on what New Yorkers eat,




At modest cost and time.

1 y survey, with weekly sampling:

Cost:	$15,000
Effort:	20% FTE

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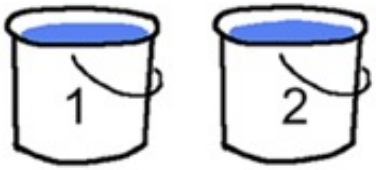
STUDY DESIGN

1 YEAR
(May 2024-
May 2025)

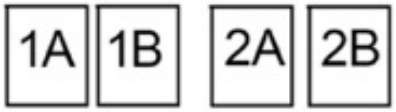
Weekly field replicates



Based on ostrich 12S g-block spike-in std

Riaz 12S primers PCR replicates

NGS libraries



MODEST EFFORT, COST

Summary: 1 y survey, single shoreline site, replicate weekly sampling (96 field samples plus controls), replicate PCR with Riaz primers, MiSeq sequencing; bioinformatics

Effort: 20% FTE
Cost: $15,000

Potential add-on: analyze w addl PCR primer pair (e.g., MiFish, Riaz-cartilaginous)

Addl Effort: 15% FTE
Addl Cost: $10,000

Effort components
- Water collection, filtration
- DNA extraction
- Primary, index PCR
- Library prep
- Bioinformatics

Cost components
- Nitrocellulose filters
- DNeasy PowerSoil Pro Kit
- PCR reagents
- Amplicon sequencing service
- Plastic consumables

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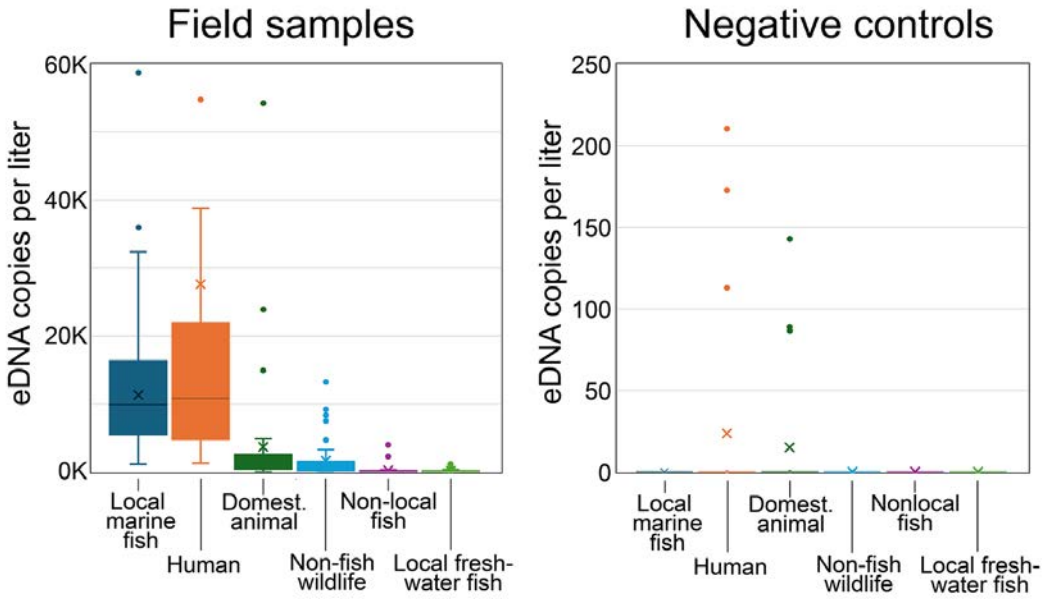
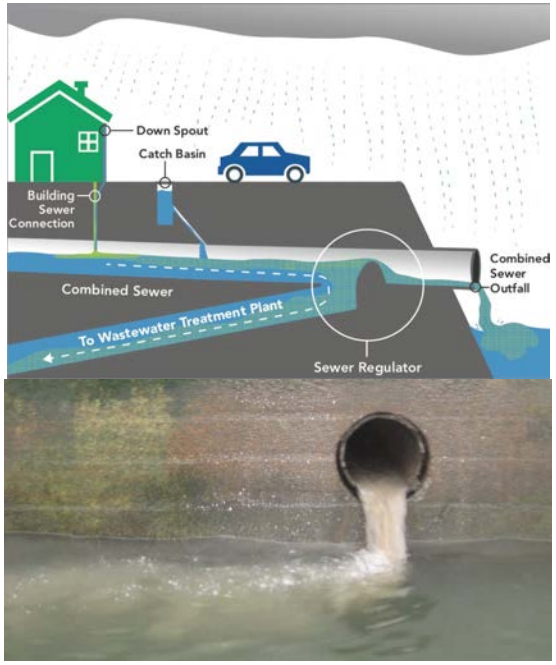
FINDINGS

Whose DNA is in the water?





- Fish, human, other vertebrate eDNA
- Minimal background

NYC combined sewer overflow (CSO) system

- Wastewater may overflow into NYC waterways
- Mainly after rainfall
- CSO likely source human, other vert eDNA

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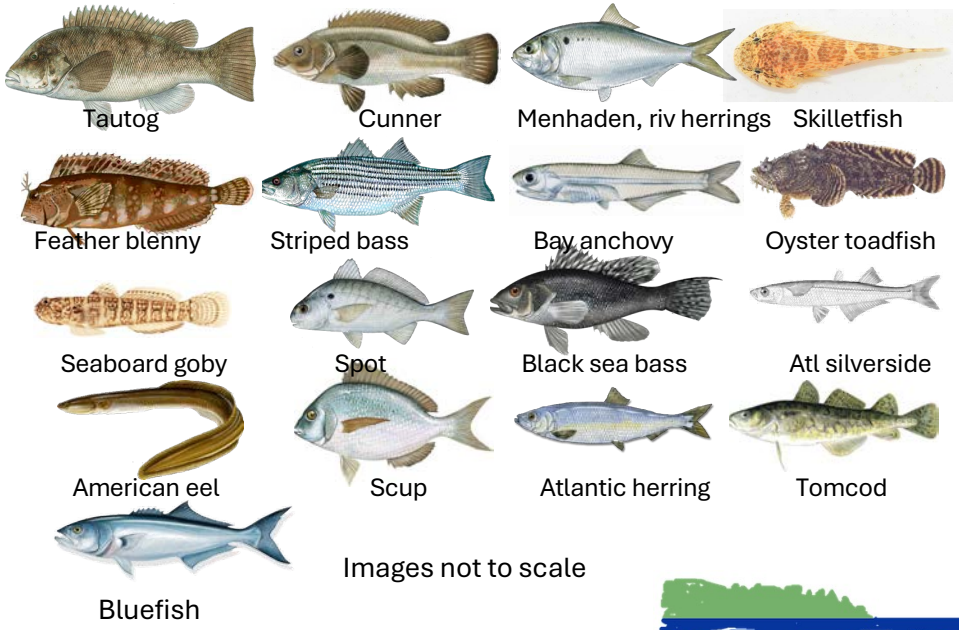
FINDINGS

eDNA defines abundant, common fish species

- eDNA offers new way to measure fish abundance
- Abundant, common fish mostly rocky habitat specialists
- Consistent with rocky habitat E River, capture surveys, recreational fishing

		Ave copies/L	% Local fish
Abundant	Tautog	4298	34.4
	Cunner	1198	9.6
	Menhaden, river herrings	1101	8.8
	Skilletfish	1068	8.5
Common	Feather blenny	531	4.2
	Striped bass	506	4.0
	Bay anchovy	458	3.7
	Oyster Toadfish	439	3.5
	Seaboard goby	419	3.3
	Spot	401	3.2
	Black sea bass	362	2.9
	Atlantic silverside	299	2.4
	American eel	251	2.0
	Scup	144	1.1
	Atlantic herring	132	1.1
	Tomcod	108	0.9
	Bluefish	104	0.8
	Total	**11819**	**94.5**



Images not to scale

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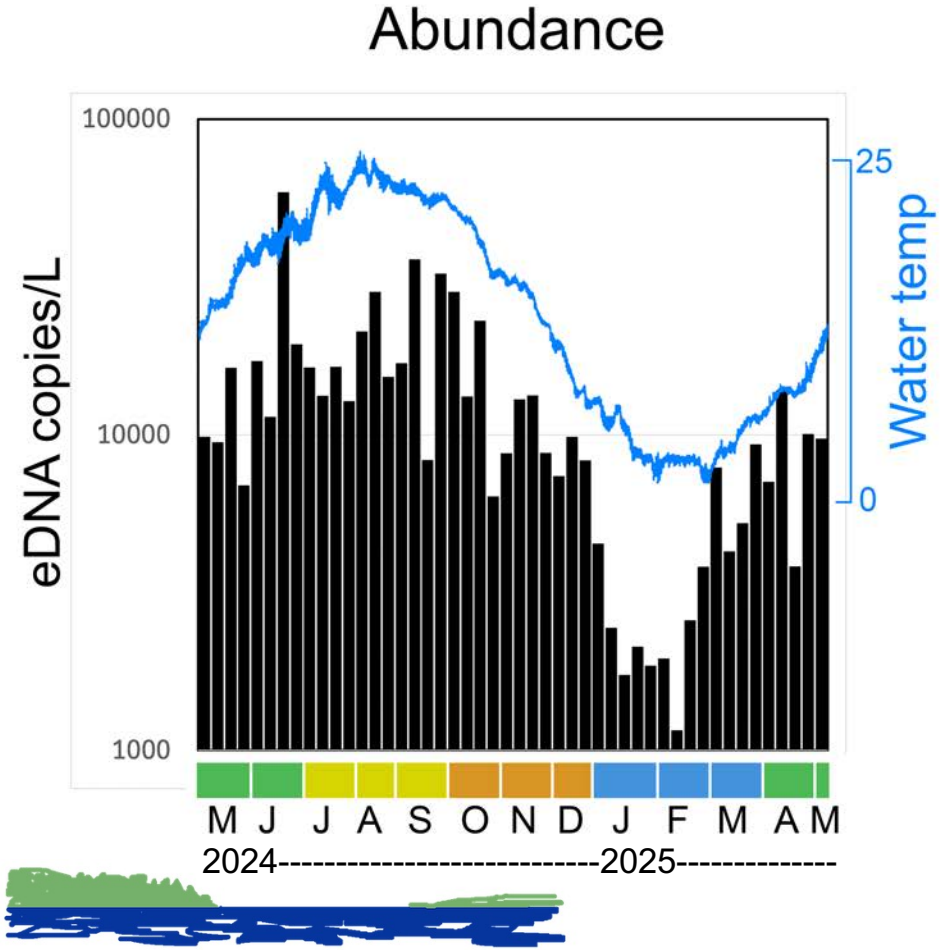
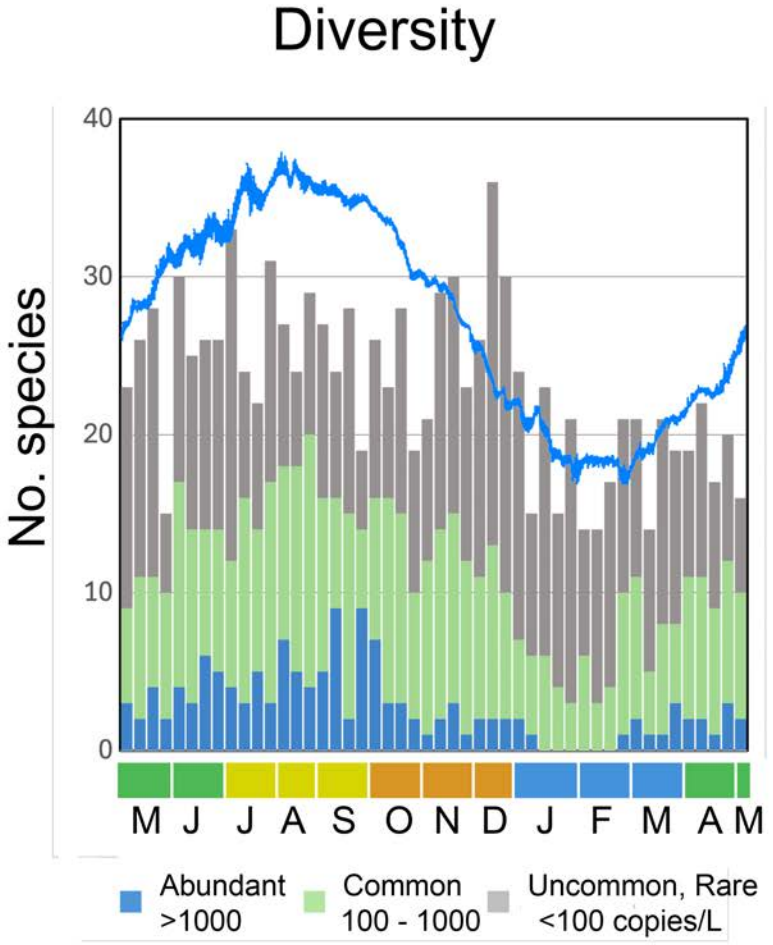
Biomonitoring in the Anthropocene

FINDINGS

- eDNA tracks marine fish seasonal abundance, diversity





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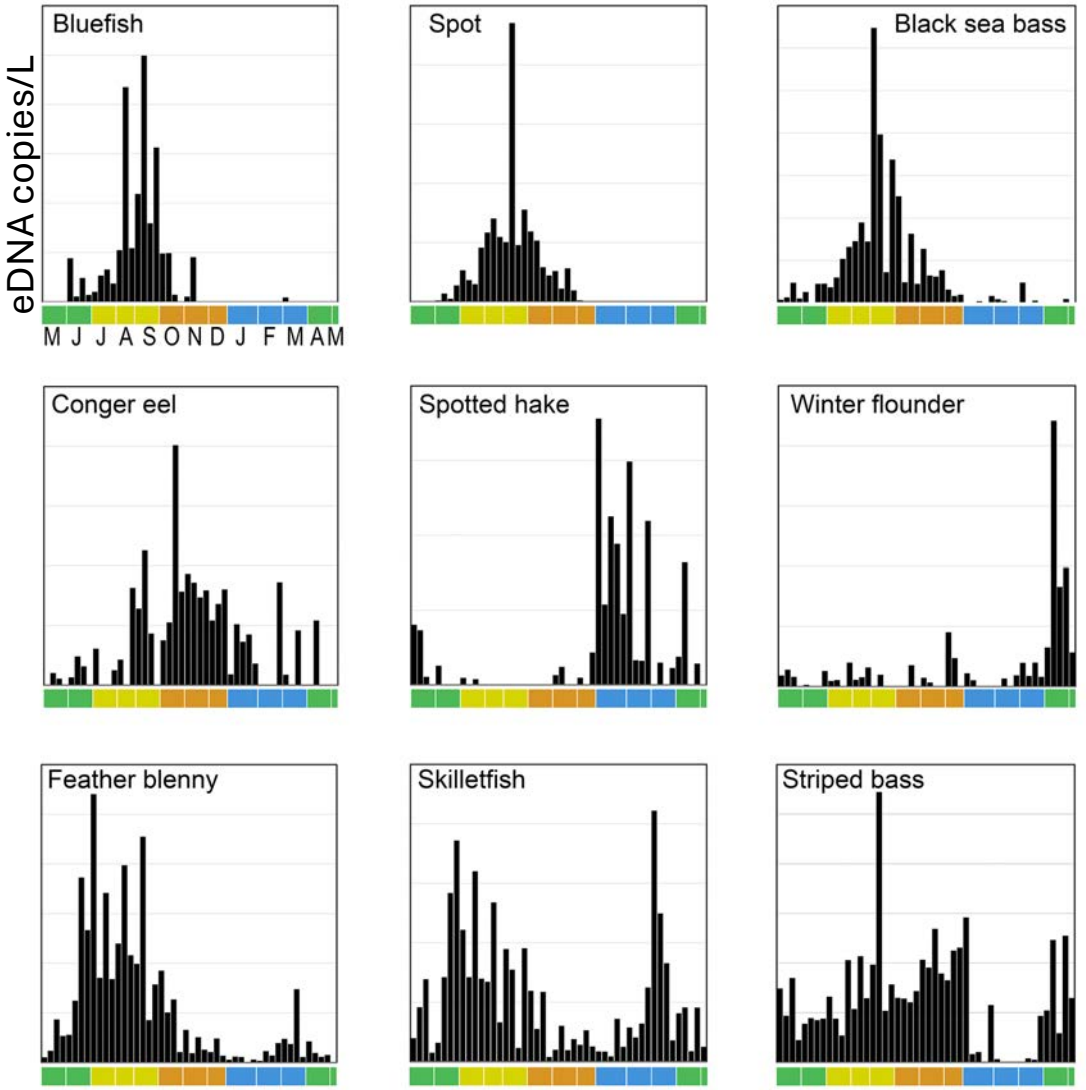
Biomonitoring in the Anthropocene

FINDINGS

- eDNA tracks seasonal abundance individual species

- Marine fish species come and go at different months
- Consistent with capture surveys, known fish biology



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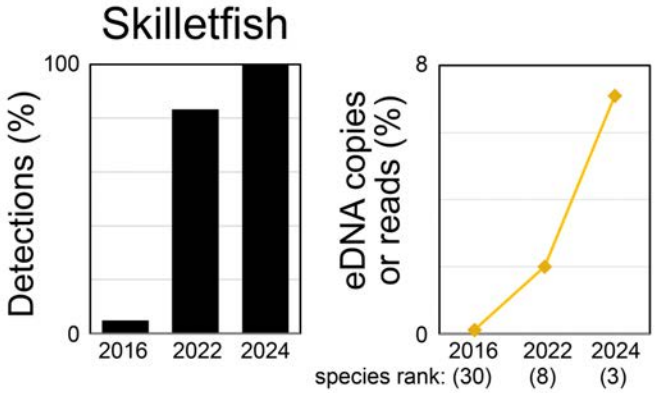
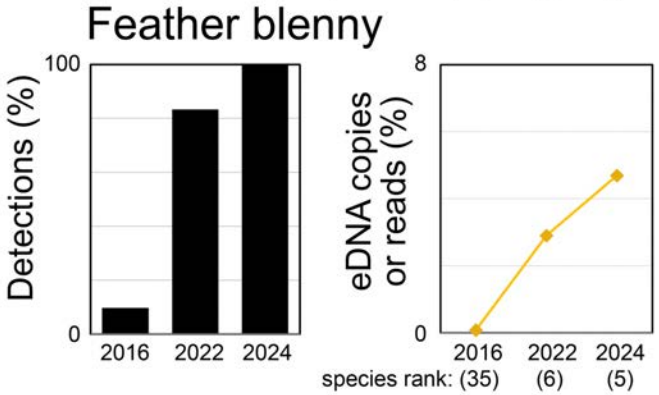
FINDINGS

- eDNA finds overlooked, newly abundant species
- Increase not recorded in published surveys
- Increase may reflect oyster reef restoration



Range: NJ to Brazil
Habitat: structure-associated incl oyster reefs



Range: NJ to TX (occ Nova Scotia)
Habitat: structure-associated incl oyster reefs

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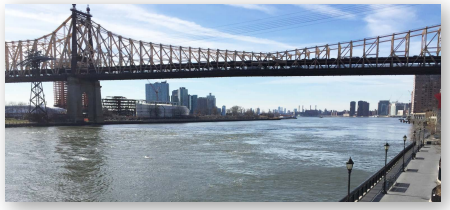
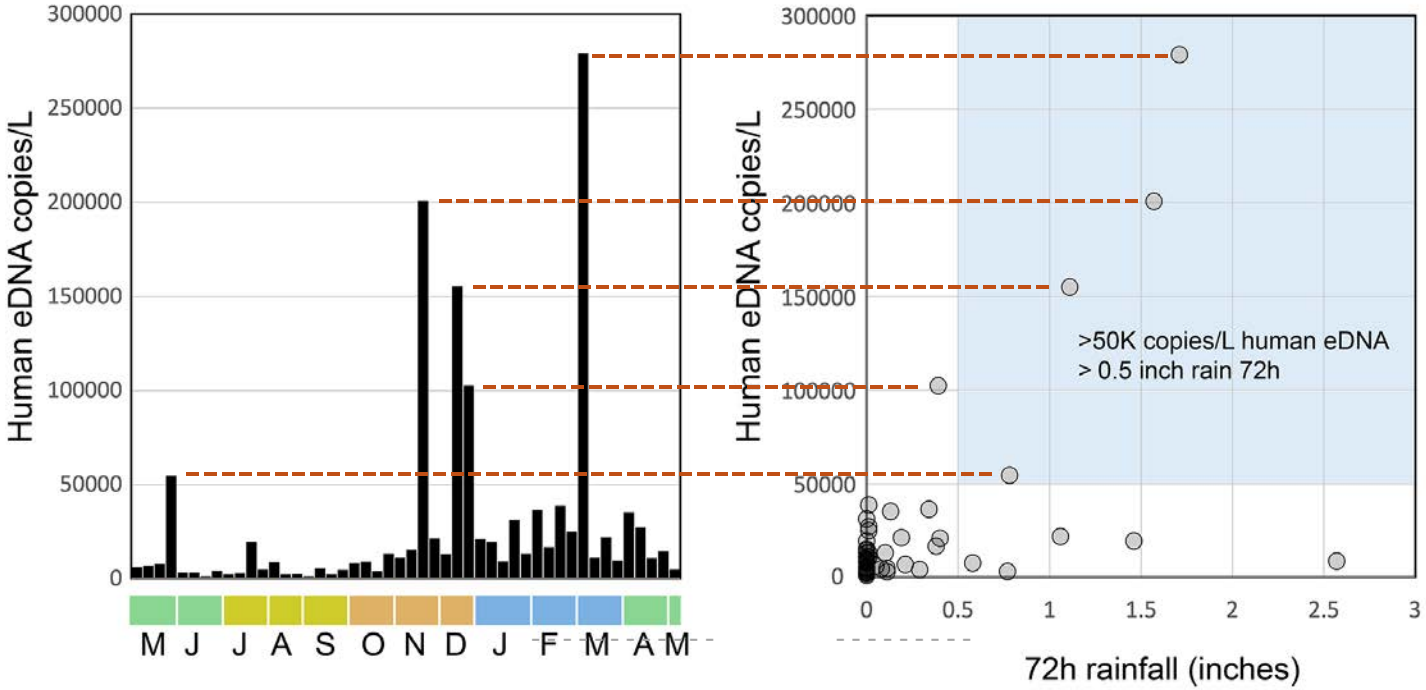


FINDINGS

Human eDNA

- Spikes follow rainfall
- Supports CSO hypothesis



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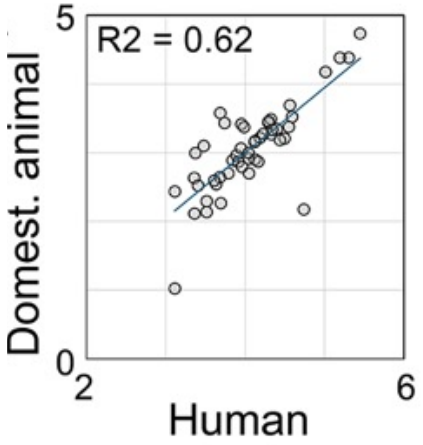
FINDINGS

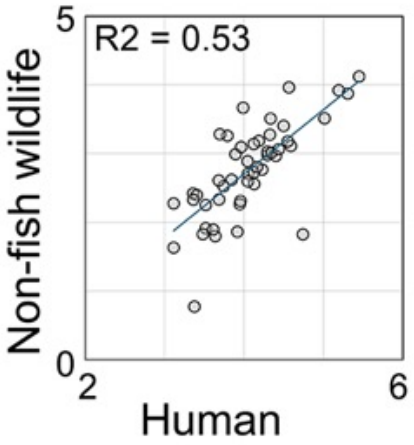
Other vertebrate eDNA categories

- Abundance tracks human eDNA abundance
- Supports CSO hypothesis (i.e., eDNA source sewage or street runoff)

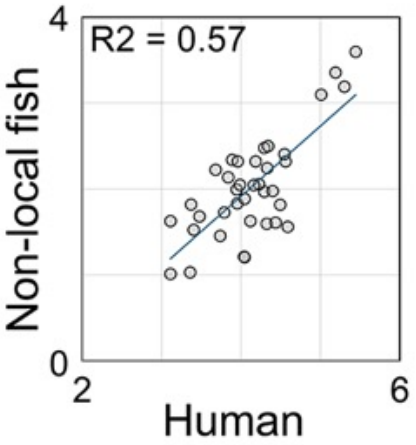
Domesticated animal



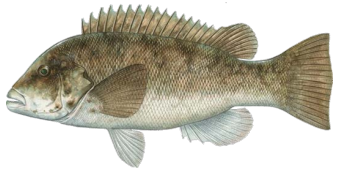
Local wildlife

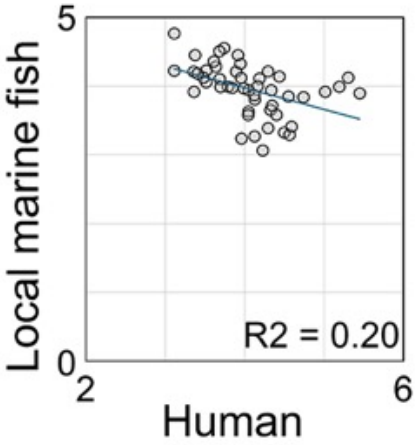


Non-local fish



Local marine fish





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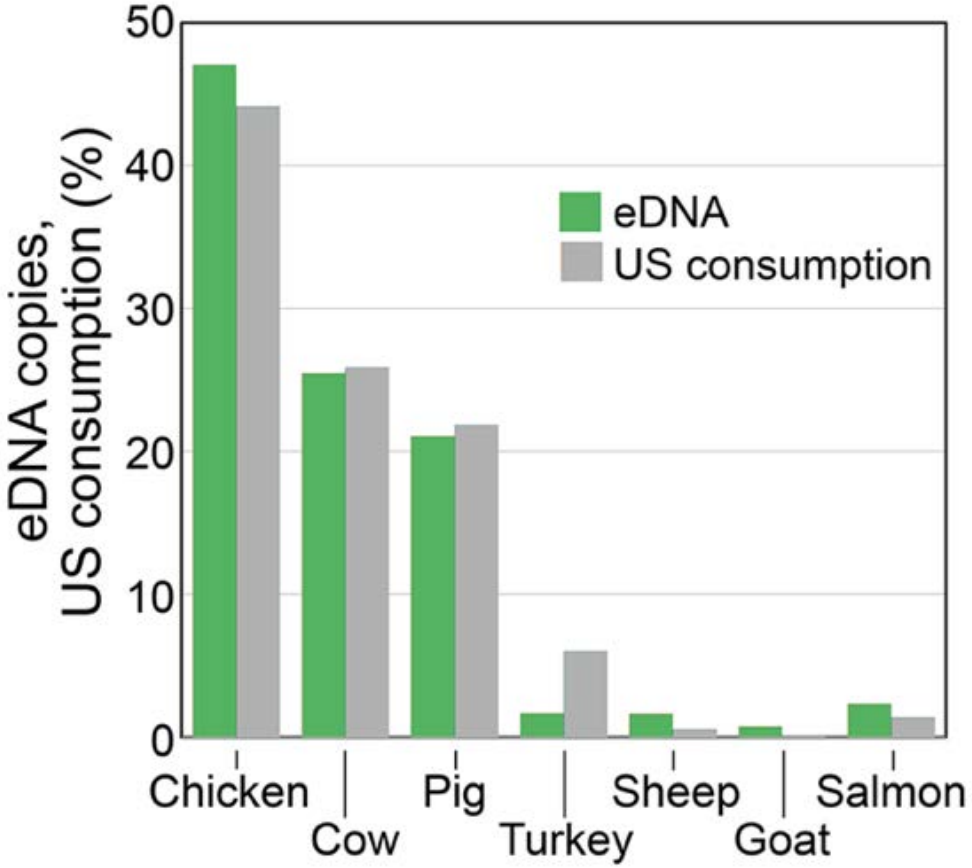
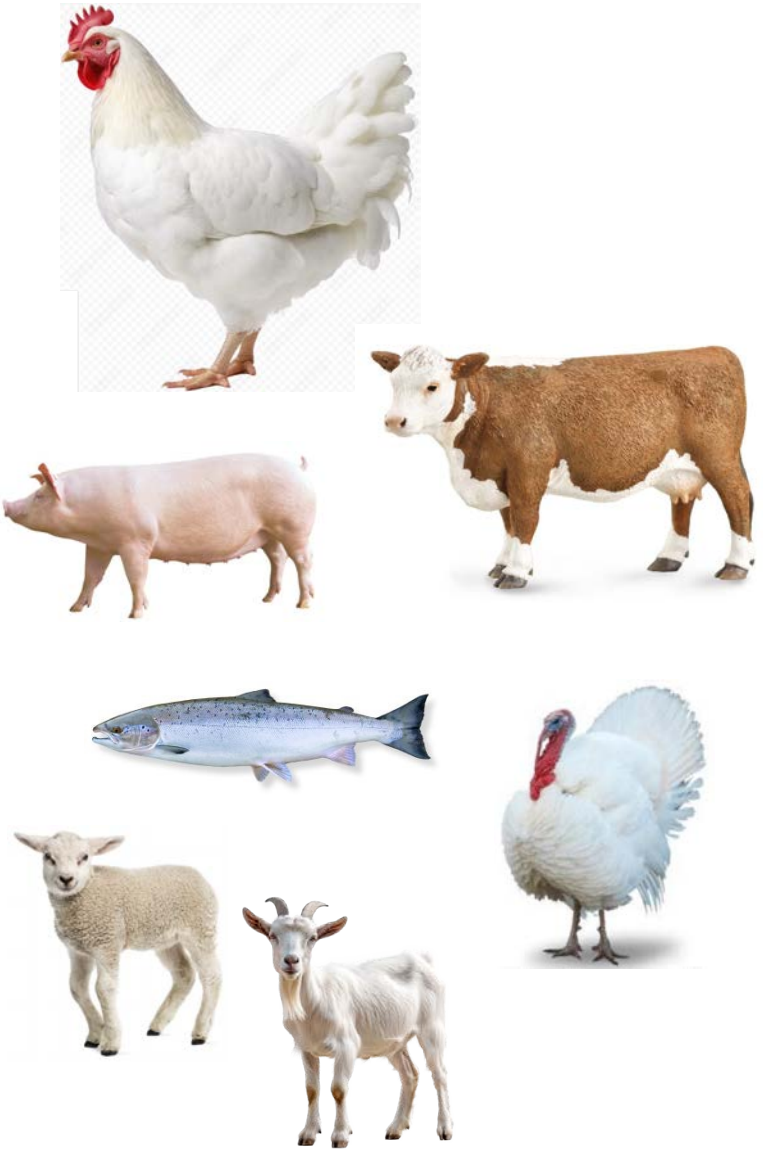
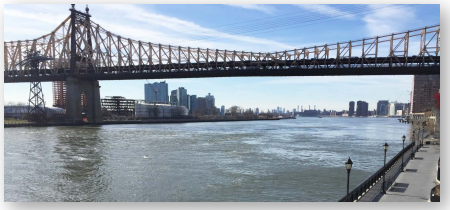
FINDINGS

eDNA food animals

- Proportions track human diet proportions
- Supports CSO hypothesis (eDNA origin sewage)
- Potential utility public health







FINDINGS

Other wildlife eDNA

- Potential utility monitoring environmental restoration
- A few species unexpected (e.g., American bison--maybe from dog food?)


Amer beaver


House mouse


White-tailed deer

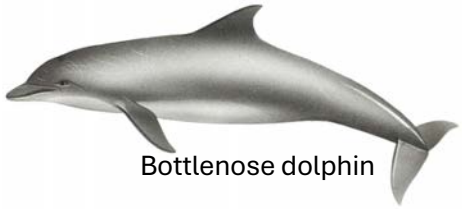

Deer mouse


Opossum


E cottontail


Short tailed shrew


Porcupine*


Bottlenose dolphin


Striped skunk


Harbor seal


Muskrat


Meadow vole


Amer bison*


Harbor porpoise


Red squirrel*

(*) Not recorded in NYC

Biomonitoring in the Anthropocene

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