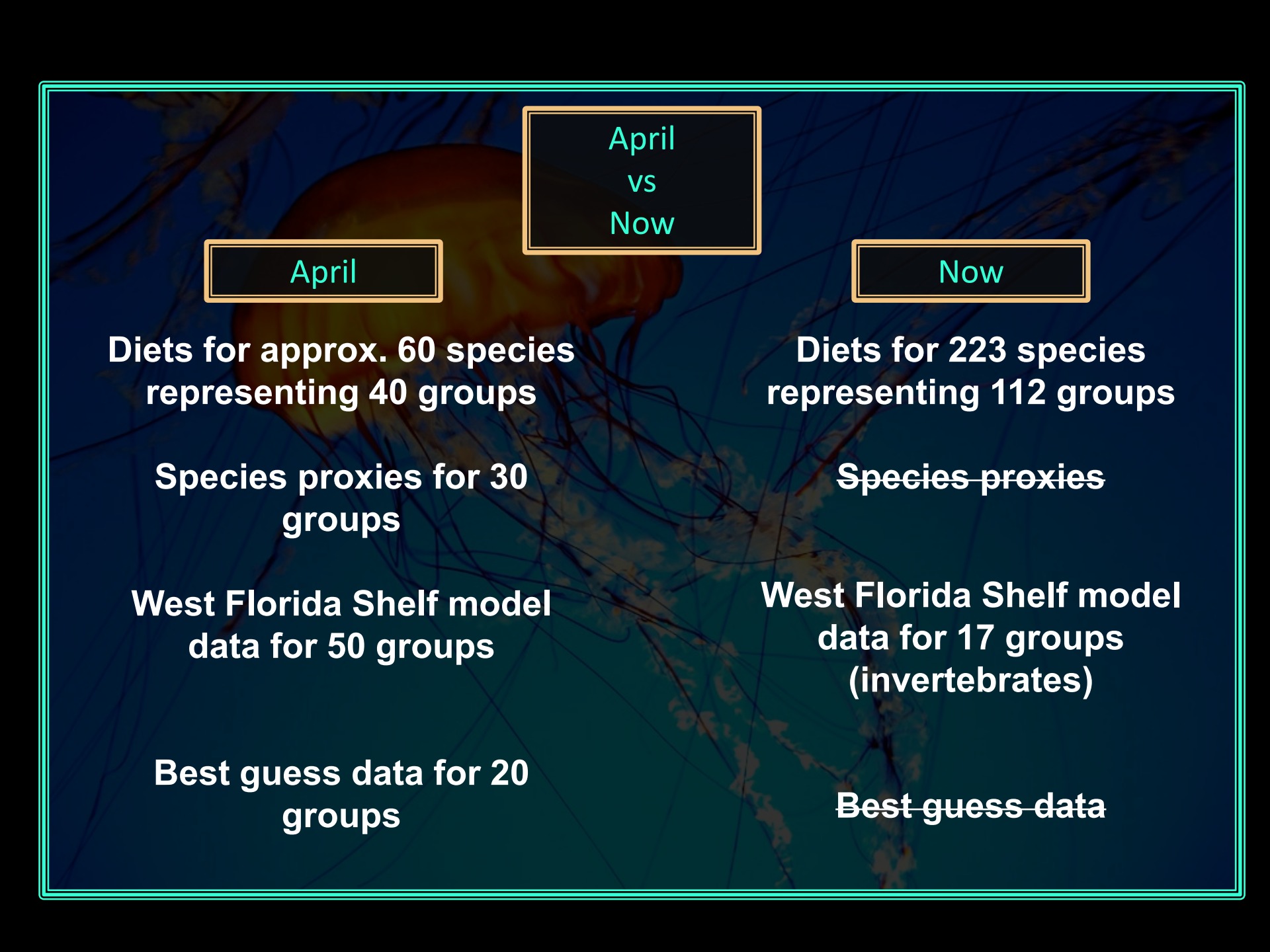


South Atlantic Region Ecosystem Model Diet Update

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April
vs
Now

April

**Diets for approx. 60 species
representing 40 groups**

**Species proxies for 30
groups**

**West Florida Shelf model
data for 50 groups**

**Best guess data for 20
groups**

Now

**Diets for 223 species
representing 112 groups**

~~Species proxies~~

**West Florida Shelf model
data for 17 groups
(invertebrates)**

~~Best guess data~~

670 species

140 groups

6

Photosynthetic groups

Seagrass
Benthic macroalgae
Pelagic macroalgae
Marsh vegetation
Phytoplankton
Microphytobenthos

28

Invertebrate groups

Blue crabs
Spiny lobster
Offshore polychaetes
Squids
Mega-invert predators

...

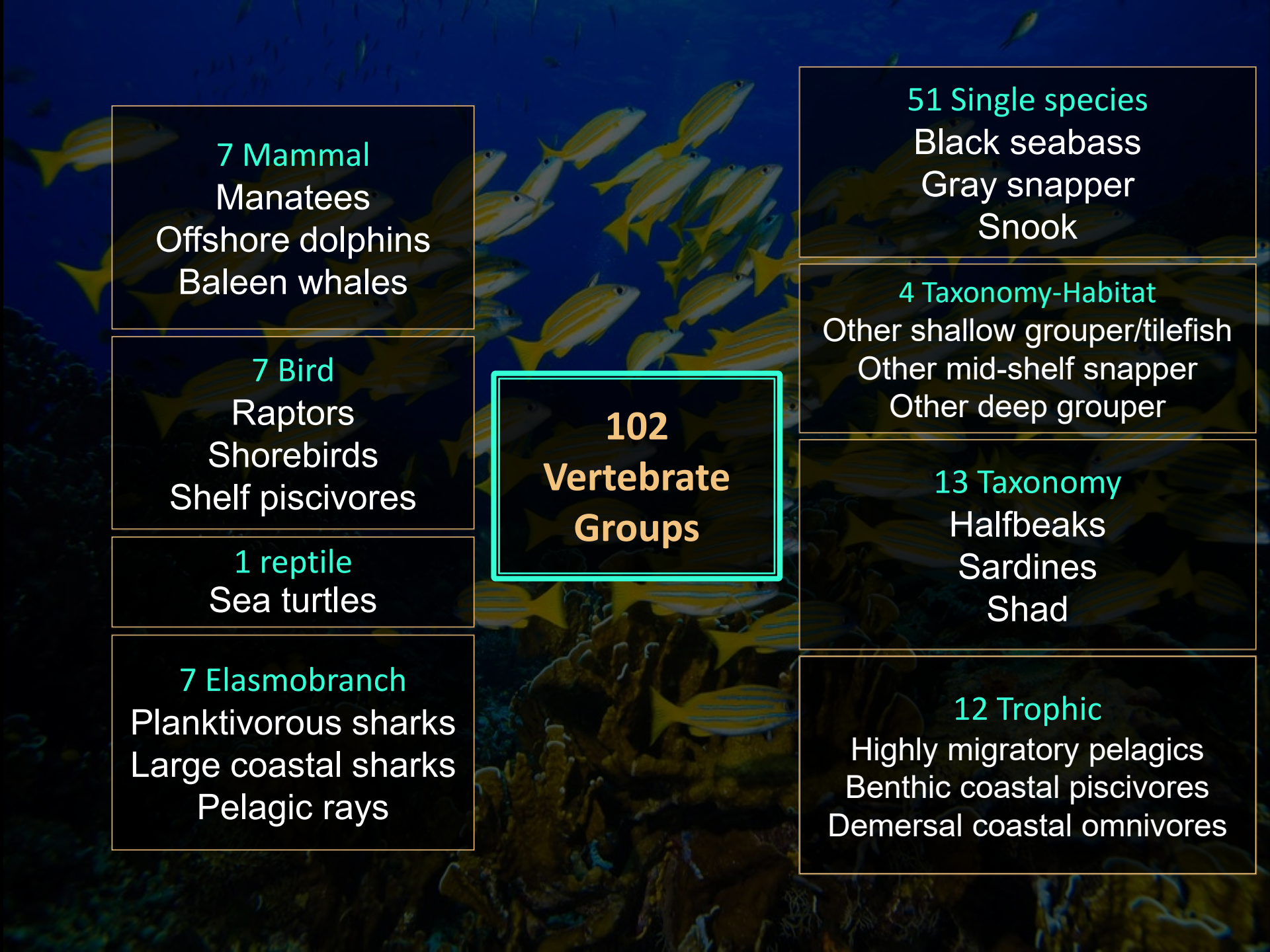
102

Vertebrate groups

Pilot whales
Birds – raptors
Sea turtles
Dogfish sharks
Black seabass
Other deep grouper
Syngnathids
Pelagic planktivores

...

3 detritus groups, 1 dead carcass



7 Mammal
Manatees
Offshore dolphins
Baleen whales

7 Bird
Raptors
Shorebirds
Shelf piscivores

1 reptile
Sea turtles

7 Elasmobranch
Planktivorous sharks
Large coastal sharks
Pelagic rays

**102
Vertebrate
Groups**

51 Single species
Black seabass
Gray snapper
Snook

4 Taxonomy-Habitat
Other shallow grouper/tilefish
Other mid-shelf snapper
Other deep grouper

13 Taxonomy
Halfbeaks
Sardines
Shad

12 Trophic
Highly migratory pelagics
Benthic coastal piscivores
Demersal coastal omnivores

Method

Published stomach contents - %W

Table 1 Diet composition for young-of-the-year (≤ 100 cm fork length, $n = 53$, 0 stomachs empty) tiger sharks by percent number (%N), percent weight (%W), percent frequency of occurrence (%O), and index of relative importance on a percent basis (%IRI). Omission of any categories indicates that prey was not present in the diet or had a %IRI less than 0.01

Young-of-the-year				
Prey Item	%N	%W	%O	%IRI
Birds	5.18	11.14	39.62	6.27
Order Passeriformes				
<i>Mniotilta varia</i>	0.21	0.35	1.89	0.01
Unid. Birds	4.97	10.79	39.62	6.06
Cephalopods	0.62	0.01	5.66	0.03
Unid. Cephalopoda	0.41	<0.1	3.77	0.02
Cnidarians	0.41	0.35	1.89	0.01
Class Anthozoa	0.41	0.35	1.89	0.01
Arthropods	5.80	2.87	35.85	3.01
Subphylum Crustacea	0.83	0.38	7.55	0.09
Class Malacostraca	4.76	2.49	30.19	2.12
Order Decapoda	2.90	2.47	26.42	1.38
Family Portunidae	0.83	1.40	7.55	0.16
<i>Ovalipes ocellatus</i>	0.21	0.61	1.89	0.01
Family Sicyoniidae				
<i>Sicyonia brevirostris</i>	0.41	0.03	3.77	0.02
Order Mysida	1.86	0.02	1.89	0.03
Other Elasmobranchs	1.24	0.60	7.55	0.13
Family Rajidae	1.04	0.58	5.66	0.09
Bryozoan	0.41	0.10	1.89	0.01
Mammals	0.41	3.53	3.77	0.14
Order Cetacea	0.21	1.97	1.89	0.04
Unid. Mammals	0.21	1.56	1.89	0.03
Molluscs	56.11	36.56	50.94	45.79
Class Gastropoda	55.69	36.46	49.06	43.85
Family Naticidae	6.21	2.81	5.66	0.50
<i>Sinus perspectivum</i>	6.00	2.77	3.77	0.32
Family Buccinidae	0.83	0.35	1.89	0.02
Unid. Gastropoda	48.65	33.30	47.17	37.50
Unid. Molluscs	0.21	0.09	1.89	0.01
Plants	0.62	0.09	3.77	0.03
Unid. Plants	0.41	0.09	1.89	0.01
Teleosts	19.88	43.93	71.70	44.38
Order Perciformes				
Family Scombridae	0.21	1.62	1.89	0.03
Order Clupeiformes				
Family Clupeidae	0.41	0.48	3.77	0.03
Order Lophiiformes				
Genus <i>Ogcocephalus</i>	0.41	4.11	3.77	0.17

Table 1 (continued)

Young-of-the-year				
Prey Item	%N	%W	%O	%IRI
Order Pleuronectiformes				
Genus <i>Paralichthys</i>	0.83	0.74	3.77	0.06
<i>Paralichthys oblongus</i>	0.21	0.08	1.89	0.01
Order Tetraodontiformes	2.48	13.89	18.87	3.00
Family Ostraciidae	1.24	8.67	11.32	1.09
Genus <i>Lactophrys</i>	0.83	1.68	7.55	0.18
Family Tetraodontidae	0.62	1.61	3.77	0.08
Family Diodontidae				
Genus <i>Chikomycterus</i>	0.62	3.61	5.66	0.23
<i>Chikomycterus schoepfi</i>	0.41	2.92	3.77	0.12
Order Scorpaeniformes				
Family Triglidae	5.80	5.66	24.53	2.73
Genus <i>Prionotus</i>	3.31	2.78	11.32	0.67
Order Anguilliformes				
Family Ophichthidae	0.21	0.08	1.89	0.01
Order Siluriformes	0.83	0.98	1.89	0.03
Order Aulopiformes				
Family Synodontidae	1.66	4.80	7.55	0.47
<i>Trachinocephalus myops</i>	1.04	1.56	3.77	0.10
<i>Synodus foetens</i>	0.21	2.95	1.89	0.06
Unid. Teleosts	7.04	11.58	37.74	6.82



	A	B	C	D
1	Aines et al 2017 "Feeding habits of the tiger shark, <i>Galeocerdo cuvier</i> , in the northwest A			
2	Location	Sample size	Units	Factors
3	SAR/GOM	169	% weight	Most were adults
4	Original Data			Changes and Calculations
5	Latin	% W	Proportion	New Functional Group Decision
6	Hydroprogne caspia	2.07	0.0207	Shelf piscivores
7	Order Charadriiformes	0.29	0.0029	Shorebirds
8	Teuthida	0.02	0.0002	Squids
9	Anthozoa	0.25	0.0025	Encrusting fauna
10	Ovalipes stephensoni	0.13	0.0013	
11	Sicyonia brevirostris	0.47	0.0047	
12	Stomatopods	0.16	0.0016	
13	Callinectes sapidus	0.4	0.004	

Method

Example of final diet list

Functional Groups	Proportion of Diet
Highly migratory pelagics	0.144299
Sea turtles	0.1217
Demersal coastal omnivores	0.1072
Other deep grouper	0.0917
Echinoderms and gastropods	0.0626
Small coastal sharks	0.056
Pelagic oceanic piscivores	0.0516
Demersal coastal invertivores	0.045801
Offshore dolphins	0.0442
Birds - Wading piscivores	0.0418
Pelagic coastal piscivores	0.0417
Birds - Shelf piscivores	0.0228
Benthic coastal invertivores	0.0209
Benthic coastal piscivores	0.0199
Red snapper	0.0183
Auxis mackerels	0.0129
Pelagic rays	0.0115
Bluefish	0.0113
Birds - Shorebirds	0.0075
Other sciaenids	0.0069
Birds - Shelf invertivores	0.0067
Pelagic planktivores	0.0066
Encrusting fauna	0.0062
Rock shrimps	0.0047
Ocean triggerfish	0.00425
Gray triggerfish	0.00425
Blue crabs	0.004
Demersal rays/skates	0.002
Benthic oceanic invertivores	0.002
Bivalves/oysters	0.0018
Stomatopods	0.0016
Mega-invertebrate predators	0.0013
Marsh vegetation	0.0011

*Multiple species in a group are averaged together in the final matrix

Metadata Scoring

Group #	Group Name	Individual species	Score (0-6)					Ecological role?
			Sample size	Year	Location	Diet richness	Detail	
62	Red grouper	red grouper	1	5	6	1	4	Ecosystem engineer

Analyses – Metadata scores

<10 individuals sampled

Anchovies
Nassau grouper
Ocean triggerfish

<10 prey groups in diet

Anchovies
Shad
Hogfish

>60% stomach contents unknown

Planktivorous sharks
Manatees
Atlantic menhaden

<25% species finished in group

Shad
Dogfish sharks
Mulletts

Data older than 1975

Atlantic spadefish
Bar jack
Blue runner

No location or other ocean

Auxis mackerels
Golden tilefish
Sunfish

Lowest Pedigree Totals

Pelagic rays
Planktivorous sharks
Shad

Species occurring in at least 3 of 7 data-deficient rankings

5

Planktivorous sharks

3

Ocean triggerfish

Shad

Anchovies

My list

All cetaceans

Inverts

Sharks

Red snapper

Shallow grouper

Blueline tilefish

Analyses – Sensitivity

EwE Monte Carlo
simulation routine
for testing uncertainty
in diet data

Results correlated (40%)
with diet richness scores

Thus isolated groups with
high sensitivity
adjustments and
normal/low diet richness

Other mid-shelf snappers
Other shallow grouper
Blueline tilefish
Planktivorous sharks
Shad
Birds
Inverts

Pelagic sharks
Small coastal sharks
Large coastal sharks
Demersal rays/skates

Red drum
Demersal coastal invertivores

Analyses – Sensitivity

Isolated largest single adjustments to a predator/prey pair

Increasing predator diets on high biomass prey

Other mid-shelf snapper --- Squids
Syngnathids --- Small mobile epifauna

Decreasing predator reliance on single prey

Halfbeaks --- Seagrass
Hogfish --- Echinoderms and gastropods
Red snapper --- Other grunts
Coastal bottlenose dolphin --- Weakfish

July Meeting

**Analyses presented to Modeling Workgroup
- changes made**

**1. Species for which no diets will be
found added to larger groups**

**2. Experts for difficult-to-find species
contacted**

**3. Herring placed into own group for
accuracy and importance**

4. Queen triggerfish added to model

Value in the process

Use of diet matrix in other applications

- NOAA Climate Change Vulnerability Assessment
- Ecospecies Database
- Comprehensive prey lists in the future

Identifying data gaps

- Deep water grouper diets
- Tarpon predators?

Identifying interesting/valuable interactions

- Shortfin makos consume 80% bluefish?
- Blue marlin consume 80% Auxis mackerels
- Do red snapper eat that much black seabass?

Next Steps

Fill in more gaps in the diets - ongoing
QAQC estimates (biomass, discard mortality, etc)
-Wraps up Ecopath

Determine predator/prey vulnerabilities
QAQC time series
-Wraps up Ecosim

Add spatial data (Luke McEachron)
Determine major habitat constraints
-Ecospace

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Roger Pugliese, SAFMC
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Luke McEachron, FWRI
Kathleen Okeife, FWRI
Kevin Thompson, FWRI
SAFMC



A vibrant underwater scene featuring several clownfish swimming among the tentacles of a large, green sea anemone. The clownfish have bright orange bodies with white stripes and black outlines. The anemone's tentacles are long and thin, creating a complex, textured background. The water is a clear, deep blue.

Appendices

140 groups (part 1)

MAMMALS

Coastal bottlenose dolphin

Offshore dolphins

Pilot whales

Beaked whales

Sperm whales

Baleen whales

Manatees

ELASMOBRANCHS

Planktivorous sharks

Large coastal sharks

Small coastal sharks

Dogfish sharks

Pelagic sharks

Pelagic rays

Demersal rays/skates

TAXONOMIC GROUPS

Mullets

Other sciaenids

Sardines

Anchovies

Silversides

Halfbeaks

Scads

Shad

Sygnathids

Other shallow
grouper/tilefish

Other deep grouper

Other shallow snapper

Other mid-shelf snapper

Other jacks

Other porgys

Other grunts

Herrings

FUNCTIONAL GROUPS

Highly migratory pelagics

Pelagic oceanic piscivores

Pelagic coastal piscivores

Demersal coastal piscivores

Pelagic planktivores

Demersal coastal
invertivores

Demersal coastal omnivores

Benthic oceanic piscivores

Benthic oceanic invertivores

Benthic coastal piscivores

Benthic coastal invertivores

Benthic coastal planktivores

AVES

Birds -- oceanic piscivores

Birds -- shorebirds

Birds -- shelf piscivores

Birds -- herbivores

Birds -- wading piscivores

Birds -- shelf invertivores

Birds -- raptors

REPTILES

Sea turtles

PHOTOSYNTHETICS

Phytoplankton

Microphytobenthos

Benthic macroalgae

Pelagic macroalgae

Seagrasses

Marsh vegetation

140 groups (part 2)

SINGLE SPECIES GROUPS	SINGLES SPECIES CONT.	SINGLE SPECIES CONT.	INVERTS	INVERTS CONT.
Adult king mackerel	Permit	Auxis mackerels	Carnivorous jellies	Bivalves/Oysters
Juvenile king mackerel	Atlantic spadefish	Blueline tilefish	Encrusting fauna	Offshore infaunal crustaceans
Spanish mackerel	Red Lionfish	Golden tilefish	Squids	Offshore polychaetes
Juv Spanish mackerel	Summer flounder	Yellowtail snapper	Stomatopods	Small mobile epifauna
Bluefish	Southern flounder	Mutton snapper	Octopods	Calico scallops
Weakfish	Gulf flounder	Gray snapper	Blue crabs	Benthic meiofauna
Red drum	Hogfish	Lane snapper	Horseshoe crabs	Deep-burrowing infauna
Atlantic menhaden	Ocean triggerfish	Red snapper	Golden crabs	Carnivorous zooplankton
Spotted seatrout	Gray triggerfish	Greater amberjack	Spiny lobster	Other zooplankton
Striped bass	Gag grouper	Almaco jack	Rock shrimps	Ichthyoplankton
Dolphinfish	Red grouper	Bar jack	Penaeid shrimps	Microbial heterotrophs
Snook	Scamp grouper	Queen triggerfish	Megafaunal predators	DEAD
Tarpon	Goliath grouper	Blue runner	Echinoderms and gastropods	Estuarine benthic detritus
Cobia	Nassau grouper	Red porgy	Estuarine infaunal crustaceans	Offshore benthic detritus
Bonefish	Snowy grouper	White grunt	Estuarine polychaetes	Water-column detritus
Sunfish	Black seabass	Vermillion snapper		Dead carcasses
Wreckfish	Rock/Bank seabass			
Great barracuda	Atlantic mackerel			

6 Metadata Categories and Scores

Sample Size

6	n = 2000+
5	n = 1000 - 2000
4	n = 500 - 1000
3	n = 300 - 500
2	n = 100 - 300
1	n = 10 - 100
0	n = 0 - 10

Diet richness

6	60+ groups in diet
5	50-60
4	40-50
3	30-40
2	20-30
1	10-20
0	0-10

% of group found

6	200% (two diets)
5	100%
4	75-99%
3	50-75%
2	25-50%
1	10-25%
0	0-10%

Year

6	1995-1998
5	1998 - 2019
4	1985 - 1995
3	1975 - 1985
2	1965 - 1975
1	Before 1965
0	No date given

Detail

6	No unknown material, species level ID
5	0-10% unknown material, excellent ID
4	10-30% unknown, some higher taxons
3	30-40% unknown, entirely grouped taxons
2	40-50% unknown, only functional groups
1	50-60% unknown, phylum-level ID only
0	60%+ unknown, most vague (ex. fish and crabs)

Location

6	SAR
5	SAR + else
4	GOM/North ATL
3	Caribbean/Puerto Rico
2	Other Atlantic
1	Other oceans
0	Unspecified

Pelagics

Bar jack
Shad
Scads
Anchovies
Halfbeaks
Almaco jack

Tetradoniformes

Puffers
Filefish

Pelagic planktivores

Pearlsides
Lanternfishes
Codlets

Pelagic oceanic piscivores

Flyingfish
Needlefish

**Could use improved
data**

Sharks

White shark
Oceanic whitetip
Smooth hammerhead
Longfin Mako
Lemon shark
All other SAR sharks

Deep dogfish sharks

Flathead cat shark
Kitefin shark
Sharpnose sevengill
Lined lanternshark

Cetaceans

Dolphins
Beaked whales
Baleen whales

Invasive – never enough data
Lionfish