

NOAA

FISHERIES

Living Marine Resources

The Heartbeat of Ocean Observations

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NOAA Fisheries Mission

Stewardship of living marine resources through science-based conservation and management and the promotion of healthy ecosystems.



Case for incorporating environmental data into stock assessments

With Magnuson-Stevens Act we have largely ended overfishing, identified and protected critical habitat

One might consider our job as done, but ...

we and the species on which we work live in a dynamic environment

Aim of our 'Next Generation' of population assessments is to explicitly consider environmental factors



Some examples

- 1. Satellite derived indices of red tide severity
- 2. Modeling recruitment
- 3. Poleward shifts in swordfish distribution
- 4. Oxygen minimum zones and habitat compression



Red Tide





Red tides (Karenia brevis) in Gulf of Mexico



- Dinoflagellate, Karenia brevis
- brevetoxin paralyzes, suffocates fish and mammals; bioaccumulates by ingestion
- First recorded by Hernan De Soto 1500's
- 1946–47 bloom estimated kill of 500 million fish
- •Human health concern
- shellfish and beach closures
- Large research initiatives (EcoHab, FWRI, etc.)



http://www.whoi.edu/science/B/redtide/rtphotos/rtphotos.html

NMFS survey in 2005 sampled during the red tide event. One station was close to a very high in red tide measurement.



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 NMFS Longline station, August 24, 2005
Station log:

"During steam for 3 or so hours broad area of dead fish floating at surface, what looked like a 50 lb warsaw grouper spotted at haulback end."

DO on bottom: 0.1

By September red tide was everywhere sampling extended





Red tide overlaps the core grouper distribution, particularly the inshore regions



SeaWiFS satellite-derived indices of red tide probability 2005 Bloom 2010 No red tide



Avg se Avg se(prob(hab)) 2005 Oct



-83

-82

-85

0.4

0.10





Including the index greatly improves population modeling and explains what was otherwise unexplained declines (~20% of the population, or 8 million gag and red grouper combined) in 2005



Walter et al 2013

2005-06 Red and Gag Grouper indices ~ 50% decline





Red snapper stock:recruitment





Stock – recruitment relationship



Spawning Stock Biomass (eggs)



We know where the currents are...

(www.hycom.org)



• Data-assimilative hydrodynamic model (HYCOM)

...and we know where the eggs are released and where the larvae settle...



...so we can model recruitment events





C

Oceanographic currents

2008 - bad year

Larvae advected away from settlement areas

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2012 – good year

Larvae advected towards settlement areas



Larval transport in good vs. bad years



• June

July

August







Karnauskas et al. 2013.

Effect on stock assessment model

 Integrating environmental factors into stock assessment reduces "cone of uncertainty"





Atlantic swordfish distributions





A HYPOTHESIS OF A RECENT POLEWARD SHIFT IN

THE DISTRIBUTION OF NORTH ATLANTIC SWORDFISH

VERSION 1.0

DRAFT

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September 2, 2013



This study sought to address three questions:

- (1) is there sufficient evidence to conclude that there has been a recent poleward shift in the Swordfish distribution in the north Atlantic;
- (2) if so, can this shift be quantified and are we making progress by accounting for it within the stock assessment model; and
- (3) assuming number one is true, is this poleward shift unidirectional, or are we merely observing an abbreviated section of a reoccurring decadal cycle, the direction of which could change again sometime in the future?









Month

telat

2.0 1.9

1.8 1.7

1.6

1.5

1.4

1.3

1.2

1.1

1.0

Change in CPUE Coincident with switching in AWP and the AMO

16 Aug 1996

16 Aug 2010

20 Aug 2013



Expanding Oxygen Minimum Zones, Tropical Pelagic Predators, and the Atlantic LL Fisheries that Exploit them.

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Tropical tunas and billfish have high a performance physiology



- They are all obligate ram ventilators;
- They require large amounts of dissolved oxygen; and,
- Start exhibiting physiological stress below DO concentrations of about 3.5 mL L⁻¹, the hypoxic threshold used in this study.



Compression Impacts and the Stock Assessment Process



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Partnerships with OOS are critical for this to succeed

