Update on the Sargasso Sea Science Case-is it still valid?

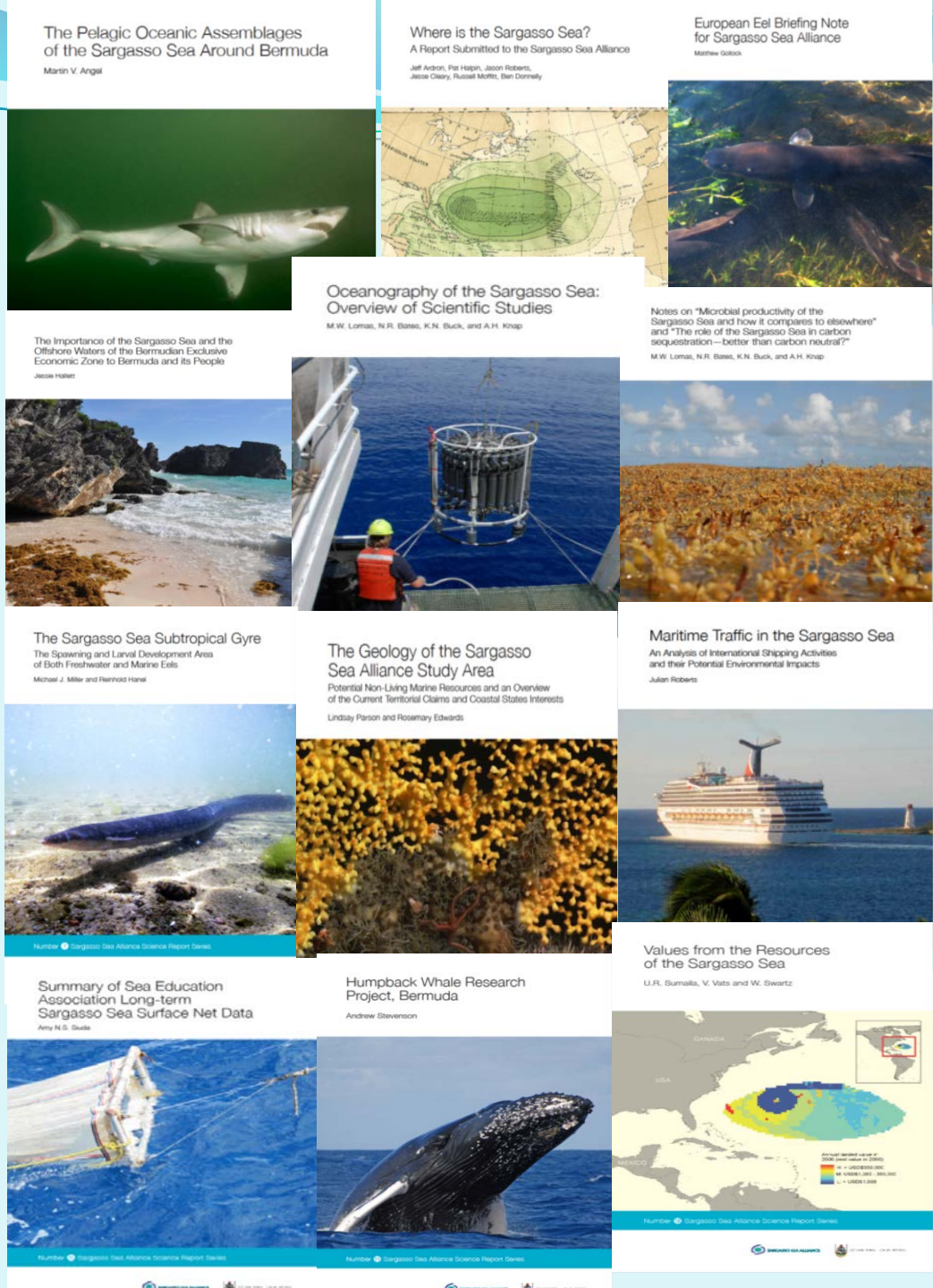
Professor Howard Roe

Sargasso Sea Commission

SARGASSO SEA COMMISSION

74 collaborators,10 countries,
11 research institutions

SARGASSO SEA COMMISSION



71% of the earth's surface is covered by sea
7.4% of this is protected

51% of the earths surface is covered by "High Seas" The ABNJ

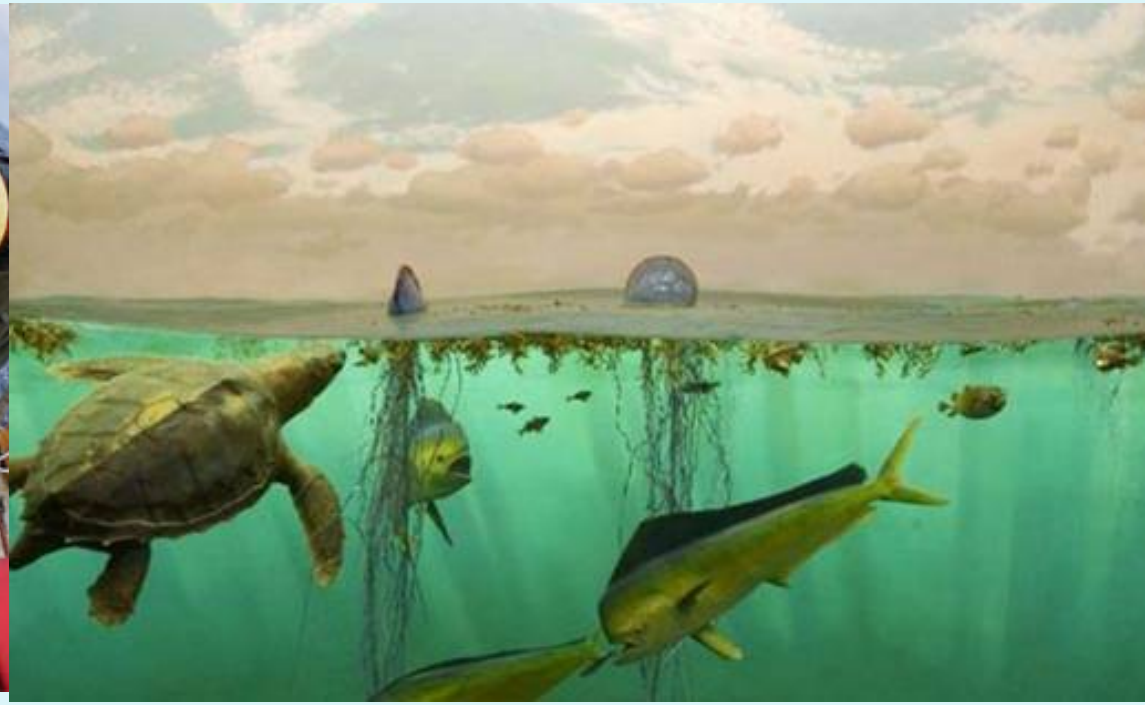
High seas represent ca 90% by volume of the earth's living space

Only 1.18% of the High Seas is protected

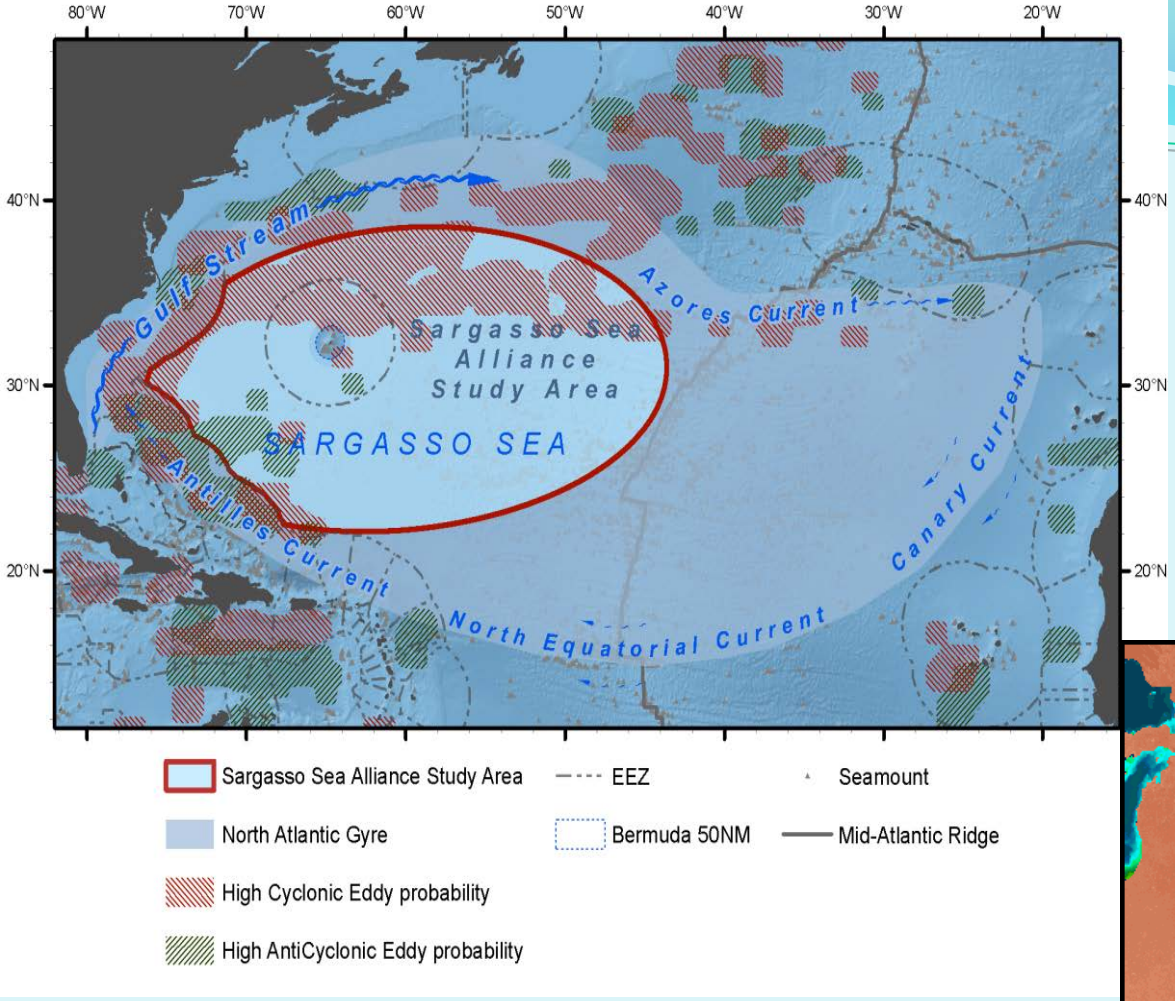
SARGASSO SEA COMMISSION

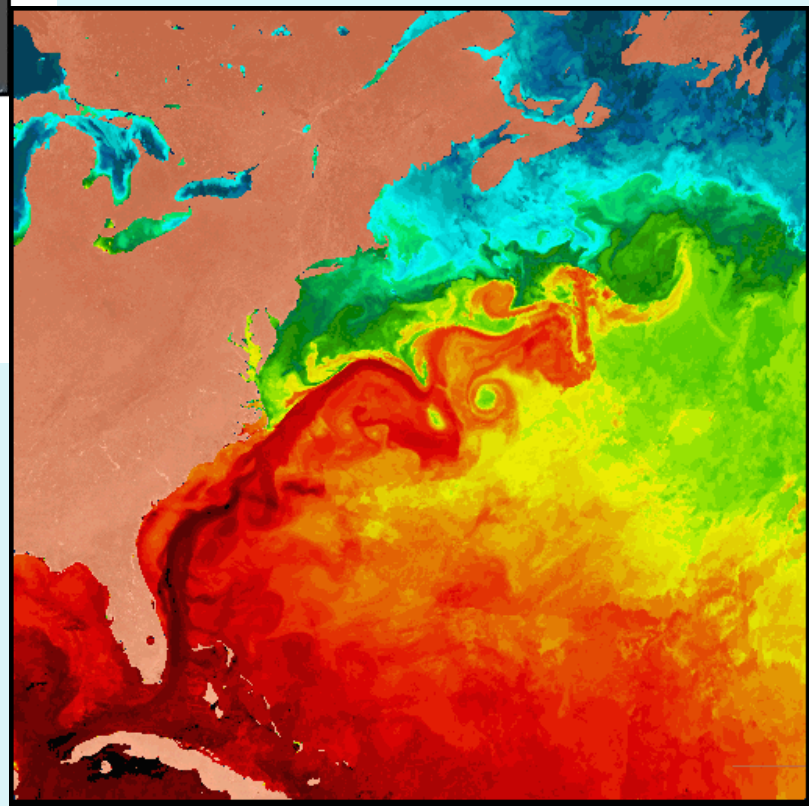
Science of the Sargasso Sea

- Oceanographic conditions
- Biological/ecological issues
- Importance for Research and Monitoring



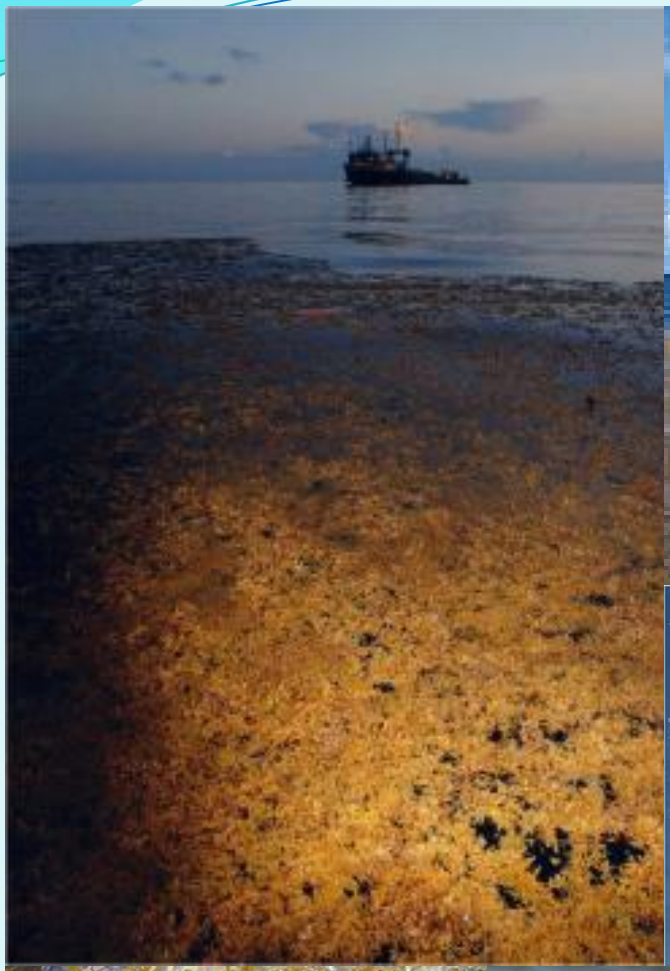
SARGASSO SEA COMMISSION





SARGASSO SEA COMMISSION

A *Sargassum* based ecosystem

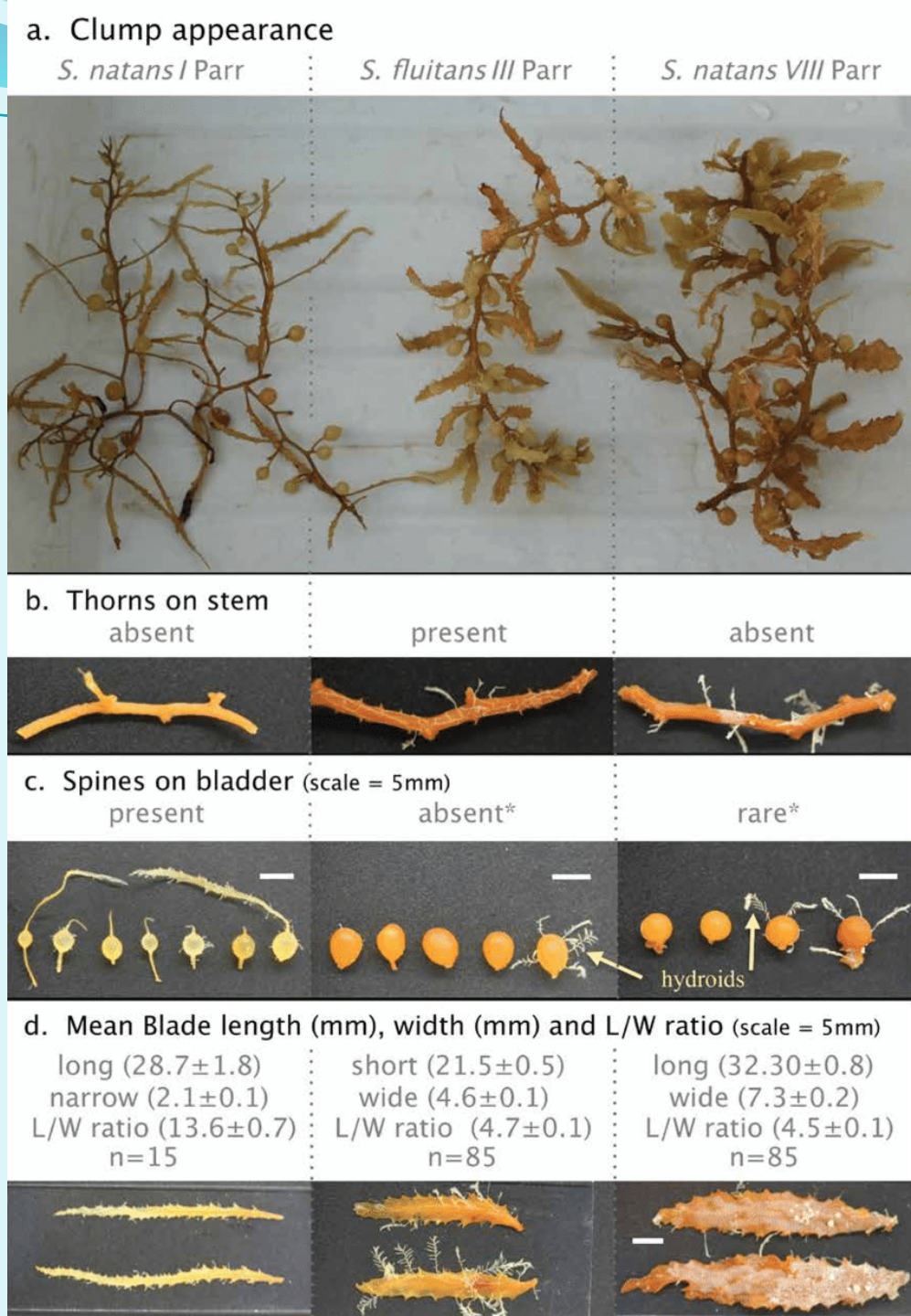


SARGASSO SEA COMMISSION

SARGASSO SEA COMMISSION

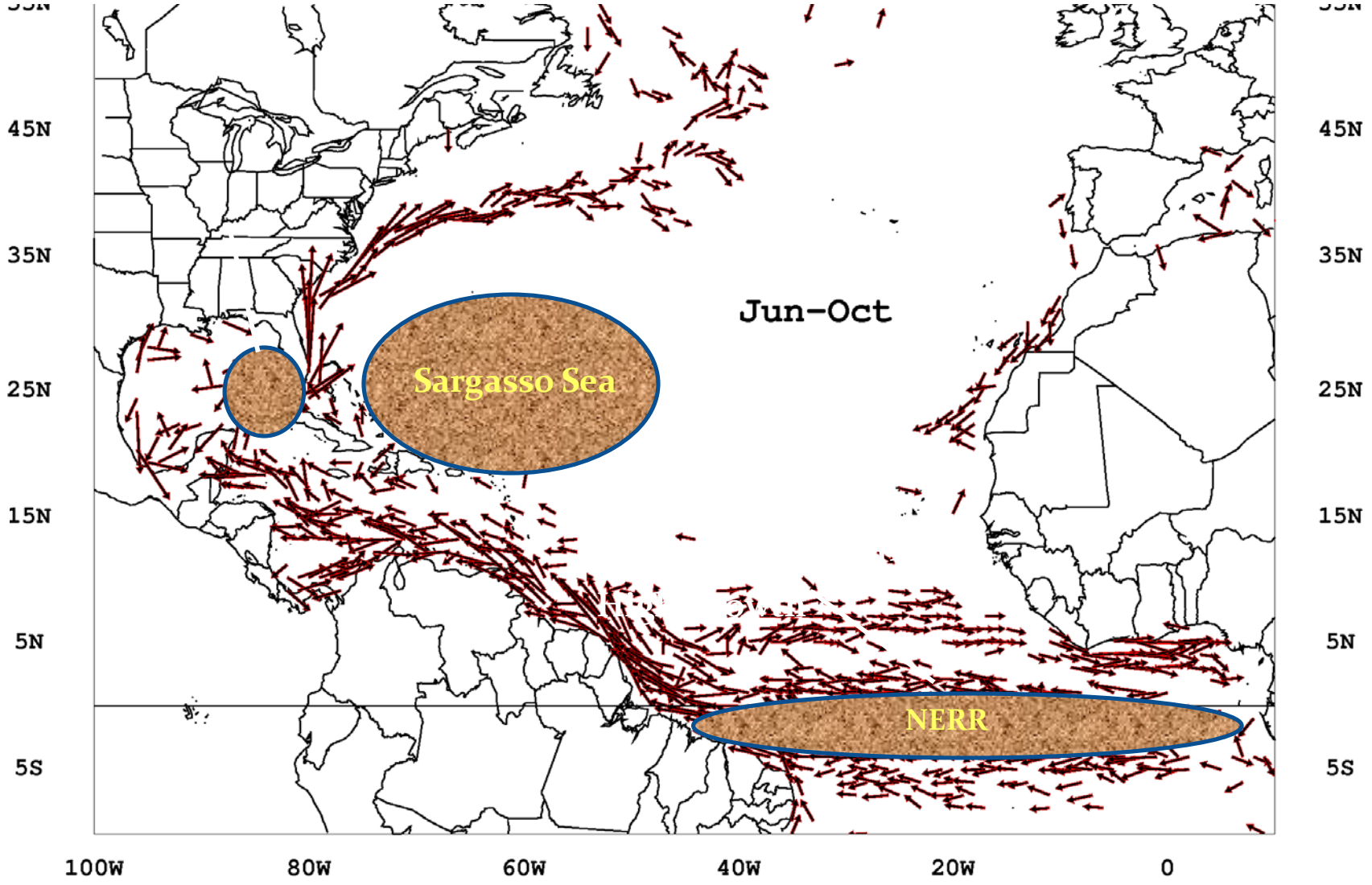
Different forms of pelagic *Sargassum*

J.Schell et al 2015 Oceanography 28(3)



SARGASSO SEA COMMISSION

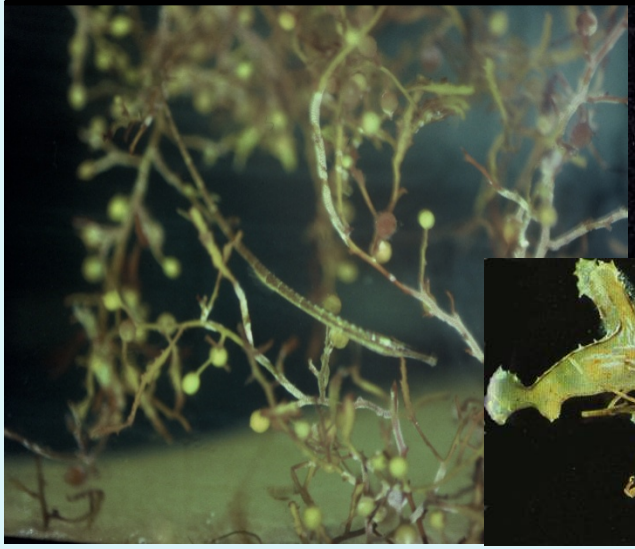
SARGASSO SEA COMMISSION



SARGASSO SEA COMMISSION

J.Franks et al GCFI Caribbean Symposium 2014

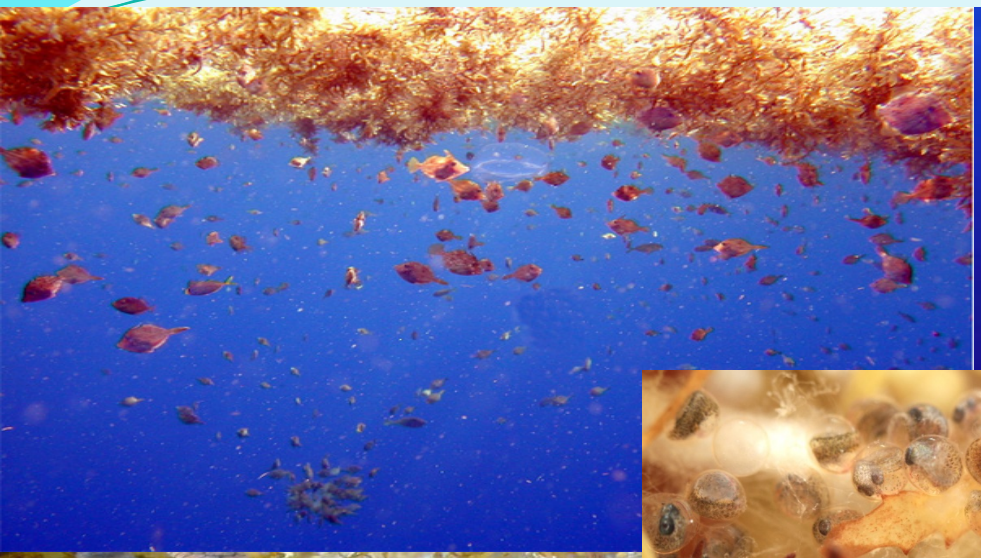
Sargassum endemics



>145 invertebrate species live in association with *Sargassum*

SARGASSO SEA COMMISSION

Nursery/feeding area; eggs/juveniles of > 80 spp of fish occur in *Sargassum*

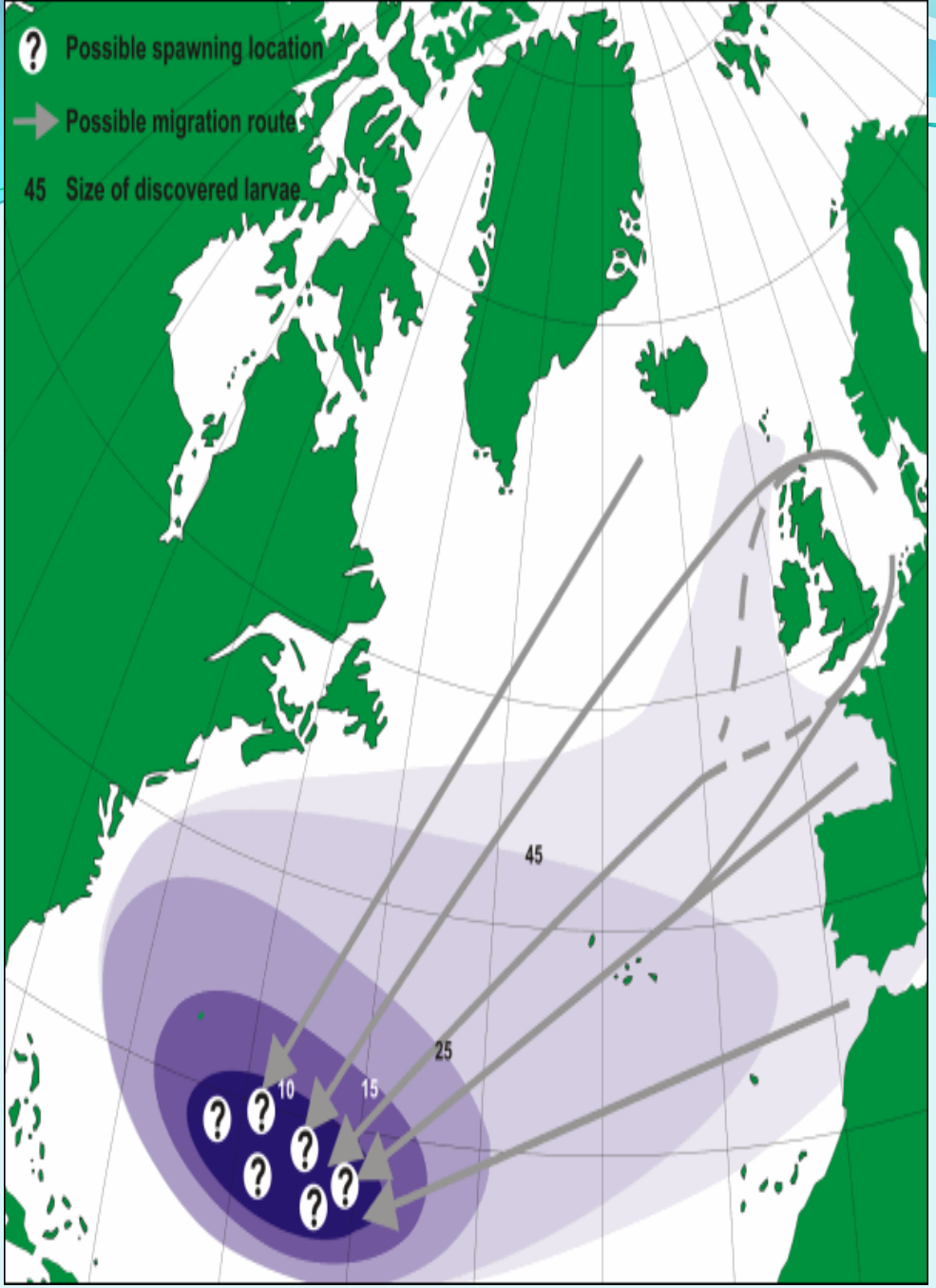


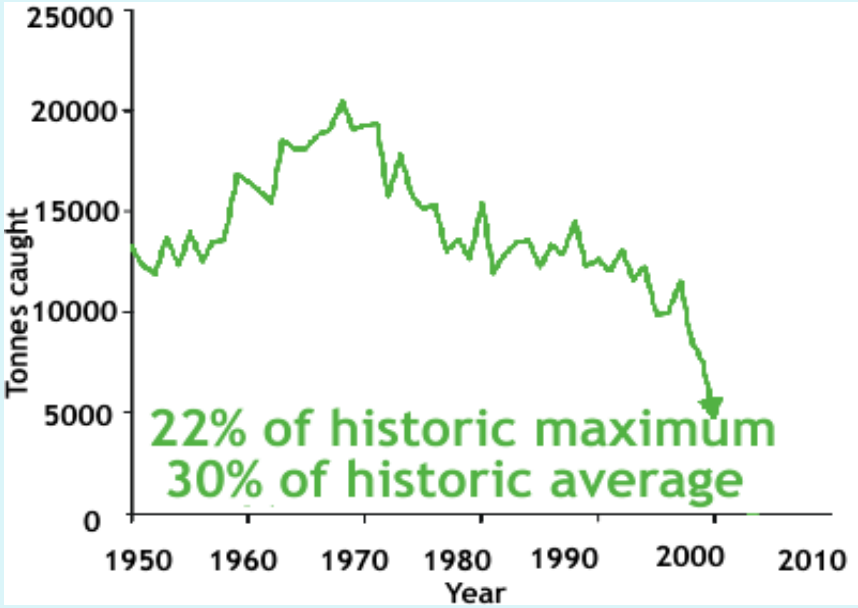
SARGASSO SEA COMMISSION

Migration Route for Many Species

SARGASSO SEA COMMISSION

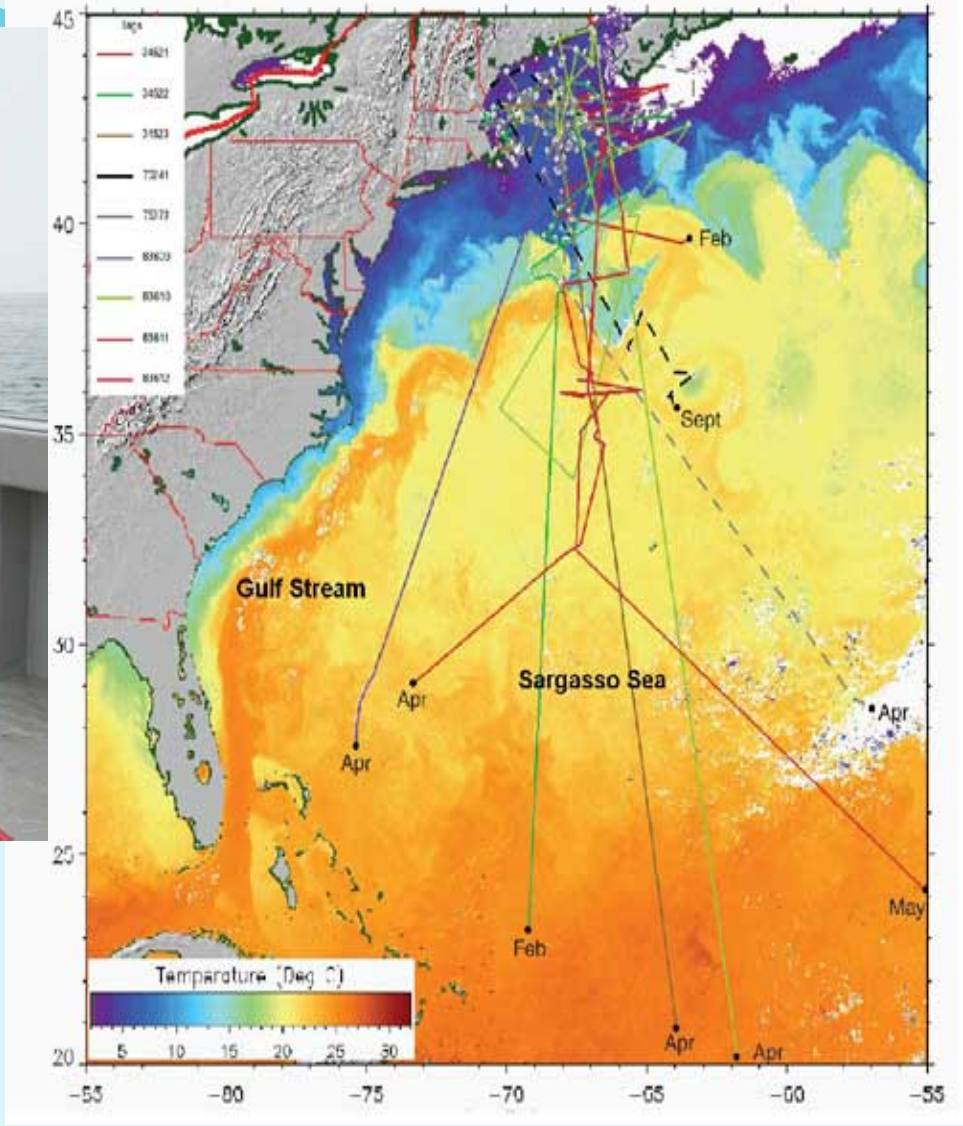
Global Connections





- Catches of yellow and silver eels in EC

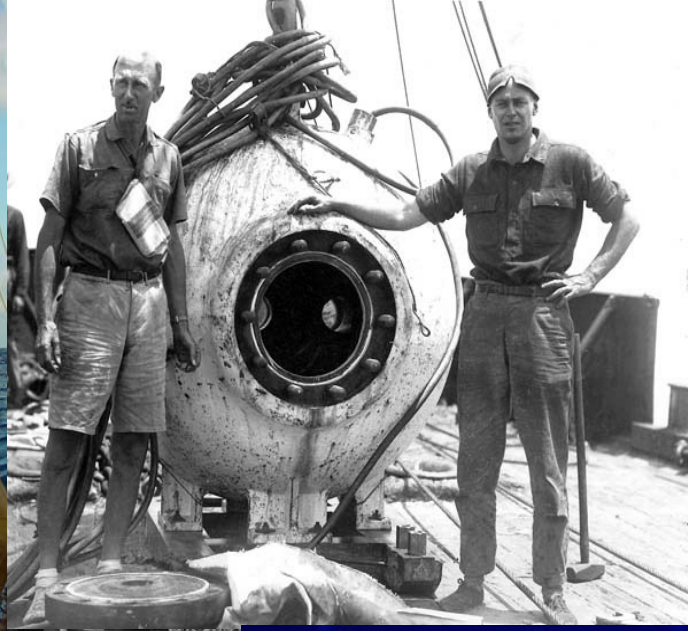
SARGASSO SEA COMMISSION

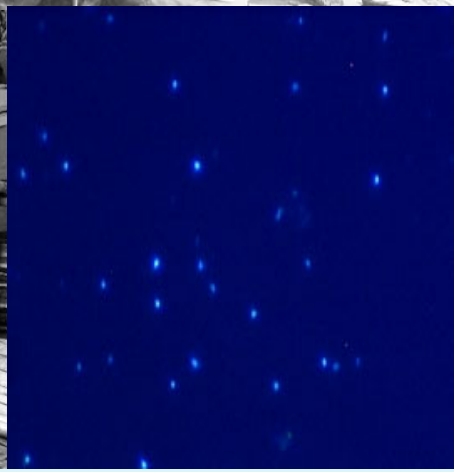


Porbeagle Shark

SARGASSO SEA COMMISSION



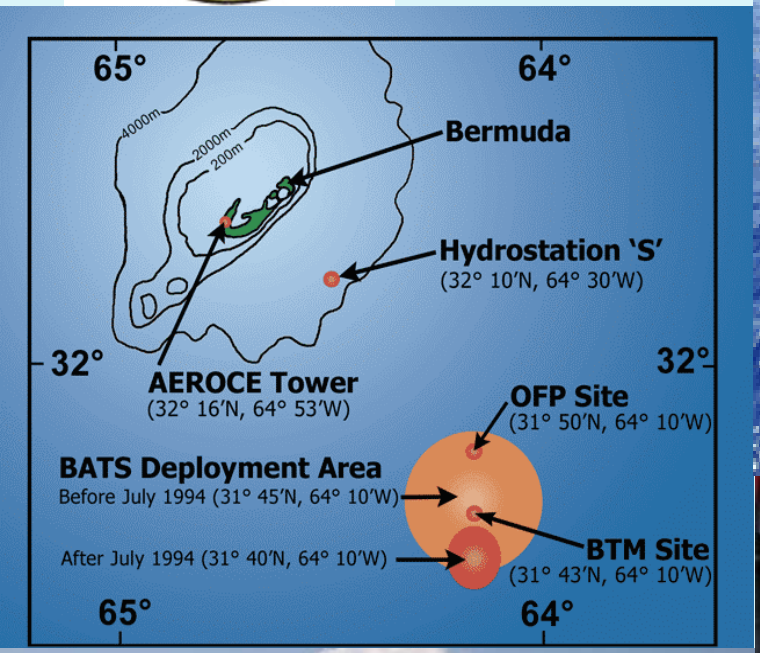


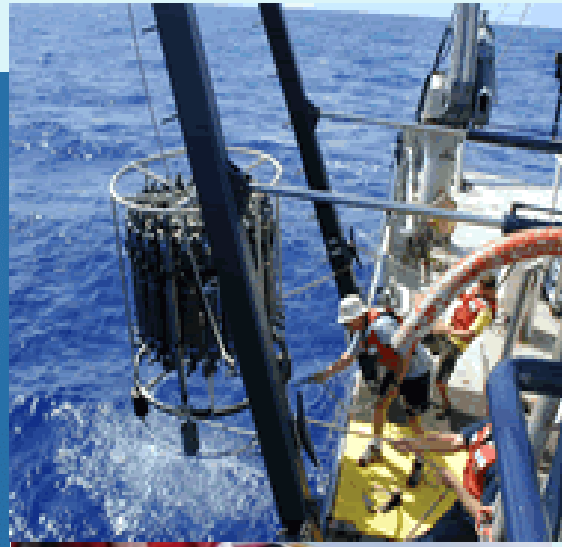



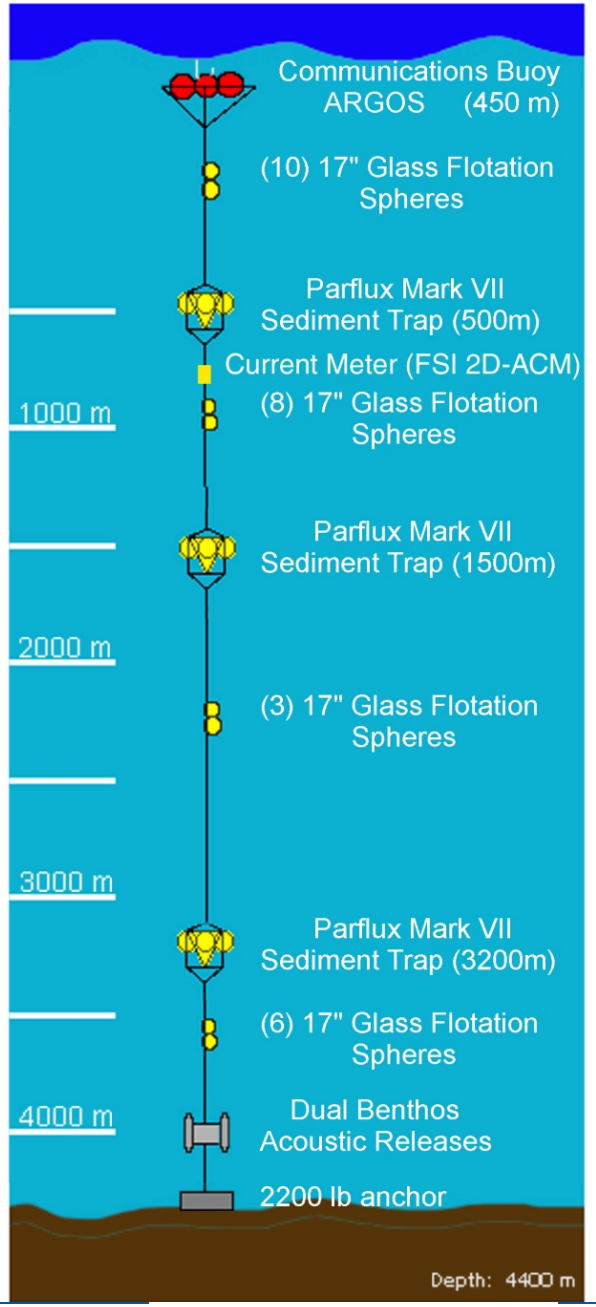

The Sargasso Sea is a critical area for global oceanography

SARGASSO SEA COMMISSION

Ocean time series established 1954







SARGASSO SEA COMMISSION

THE SARGASSO SEA A VITAL ECOSYSTEM OF GLOBAL IMPORTANCE

THE SARGASSO SEA CREATES AN ESSENTIAL HABITAT FOR WORLDWIDE SPECIES GLOBALLY, BUT WHAT IS THE ECONOMIC CONTRIBUTION OF THIS HIGH BIODIVERSE AND PRODUCTIVE AREA?

THE STUDY

THE STUDY LINKS THE ECOLOGICAL HEALTH OF THE SARGASSO SEA TO RELEVANT ECONOMIC SECTORS USING EXISTING DATA. THIS INCLUDES ECOSYSTEM SERVICES THAT ARE ENJOYED DIRECTLY WITHIN THE SARGASSO SEA. THE HEALTH OF THE SARGASSO SEA PROVIDES A FOUNDATION FOR ECONOMIC ACTIVITIES OUTSIDE OF THE SARGASSO SEA. SPECIES OF ECONOMIC INTEREST, SUCH AS EEL, BILLFISH, WHALES, TURTLES RELY ON THE SARGASSO SEA FOR SPAWNING, MATURATION, FEEDING, CRITICAL ROUTE FOR MIGRATION.

PENDLETON, L., F. KROWICKI, P. STROSSER, AND J. HALLETT-MURDOCH. ASSESSING THE ECONOMIC CONTRIBUTION OF MARINE AND COASTAL ECOSYSTEM SERVICES IN THE SARGASSO SEA. (NI R 14-05. DURHAM, NC: DUKE UNIVERSITY)

$100 MILLION

REVENUES FROM COMMERCIAL FISHERIES CAUGHT IN THE SARGASSO SEA

LARGE PELAGICS MIGRATE CLOSER TO SHORE WHERE THEY ALSO ARE CAUGHT

$500 MILLION

REVENUES FROM THE ATLANTIC WHALE WATCHING INDUSTRY. MANY WHALES SPEND TIME EACH YEAR IN THE SEA

IMPORTANT WHALE SPECIES MIGRATE THROUGH THE SARGASSO SEA

$0.6 MILLION

DIRECT REVENUES IN BERMUDA FROM RECREATIONAL FISHING

RECREATIONAL FISHERIES IN THE ATLANTIC US DEPEND ON THE SARGASSO SEA

THE SARGASSO SEA

SARGASSUM

PROVIDES THE ECOLOGICAL STRUCTURE FOR THE PRODUCTION OF ECOSYSTEM SERVICES IN THE SEA

$66 MILLION

REVENUES FROM COMMERCIAL EEL HARVESTS IN NORTH AMERICA AND EUROPE

EELS CAUGHT IN EUROPE AND NORTH AMERICA ARE BORN IN THE SEA

YOUNG TURTLES SPEND YEARS TO FEED, HIDE AND GROW IN SARGASSUM

$15 MILLION

REVENUES FROM TURTLE TOURISM IN THE CARIBBEAN. MANY TURTLES DEPEND ON THE SARGASSO SEA FOR PROTECTION AND HABITAT IN THEIR EARLY YEARS

UNQUANTIFIED BENEFITS

ADDITIONALLY, THE SARGASSO SEA SUPPORTS A LARGE NUMBER OF ECOSYSTEM SERVICES THAT HAVE YET TO BE QUANTIFIED, INCLUDING:

ECOLOGICAL FUNCTION

SARGASSUM CONTRIBUTES TO THE CREATION OF BEACHES AND SHORELINE PROTECTION, CARBON SEQUESTRATION, OXYGEN PRODUCTION, AND BIODIVERSITY PROTECTION

WILDLIFE

ENJOYED BY BIRD WATCHERS AND SEA LIFE VIEWED BY SCUBA DIVERS, SNORKELERS, AND OTHERS

ICONIC ORGANISMS

MORE THAN 100 SPECIES OF INVERTEBRATES, MORE THAN 280 SPECIES OF FISH, AND 23 SPECIES OF SEABIRD, INCLUDING MANY THREATENED AND ENDANGERED SPECIES

PASSIVE USE VALUES

INCLUDING THE EXISTENCE OF CHARISMATIC SPECIES AND RARE OR THREATENED SPECIES LIKE WHALES, TURTLES, SHARKS, AND EMBLEMATIC SPECIES (E.G., THE SARGASSUM ANGLERFISH) AS WELL AS POTENTIAL OPTION VALUES FOR ORGANISMS THAT ARE AS YET UNDISCOVERED. SARGASSUM PROVIDES PROTECTIVE HABITAT FOR YOUNG TURTLES AND SHARKS.

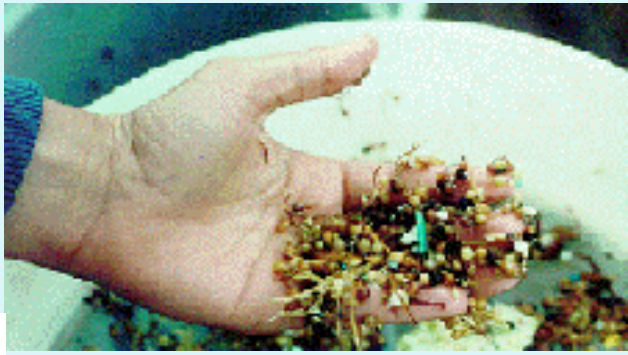
NEW YORK
USA
BERMUDA
MIAMI
ATLANTIC OCEAN
CUBA
HAITI

SARGASSO SEA COMMISSION

Pendleton et al 2014 Nicholson Institute Report

Threats

- Fishing and its adverse impacts
- Garbage and plastics
- Pollution, discharges, spills
- Climate change and ocean acidification
- Underwater noise
- *Sargassum* harvesting
- Exotic species introduction from ballast waters ?
- Deep sea Mining?
- Underwater cables?
- Tourism?

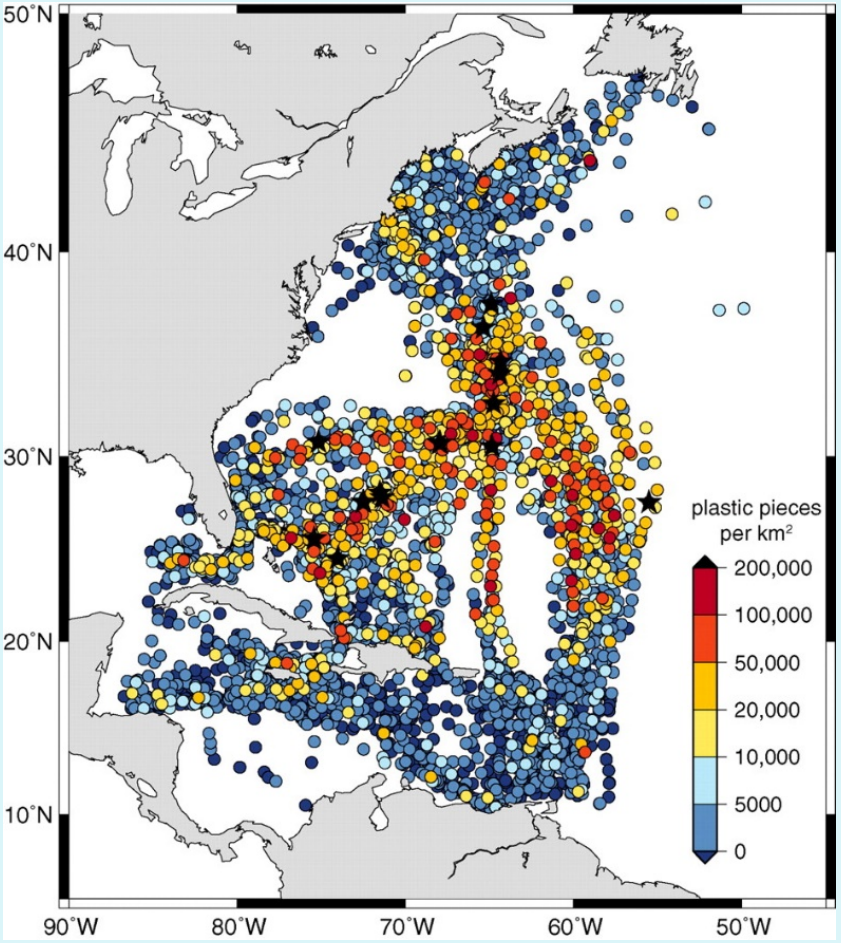


SARGASSO SEA COMMISSION

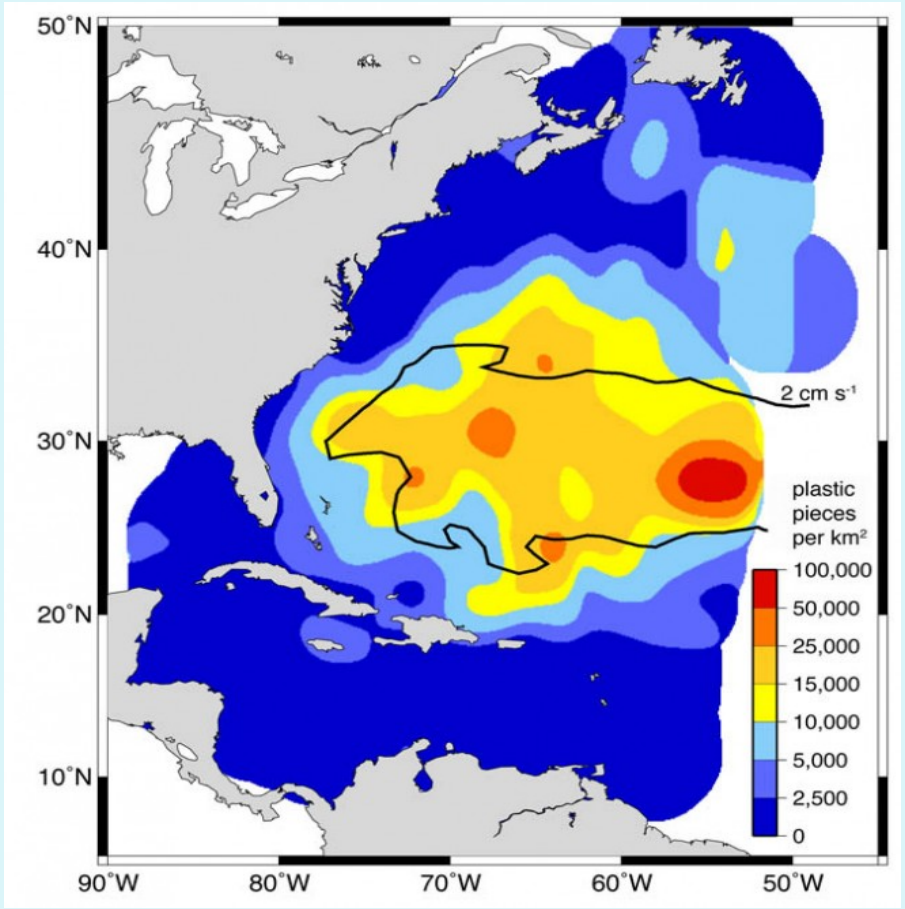
Plastic: The Seventh Continent ?

SARGASSO SEA COMMISSION

Distribution of plastic marine debris collected in 6136 surface plankton net tows on annually repeated cruise tracks from 1986 to 2008 in the western North Atlantic Ocean and Caribbean Sea.



Average plastic concentration(colour shading, units of pieces km-2)computed in 0.5º bins and smoothed with a 700km width Gaussian filter



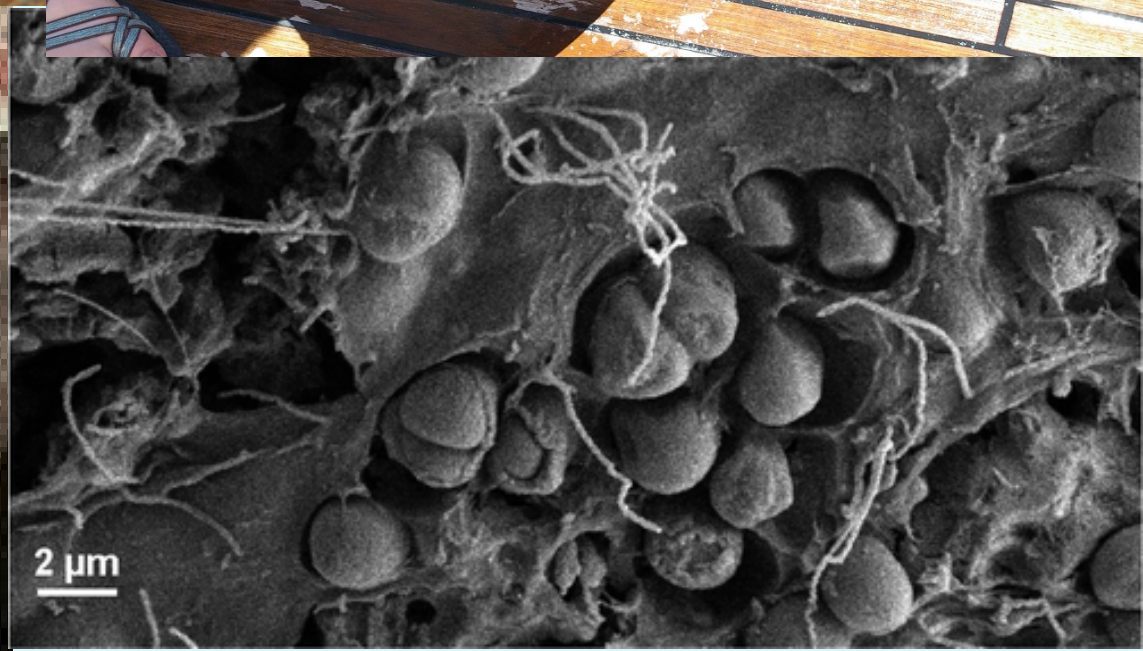
SARGASSO SEA COMMISSION

Kara Lavender Law et al. Science 2010;329:1185-1188

Science AAAS

SARGASSO SEA
COMMISSION

Life in the Plastisphere

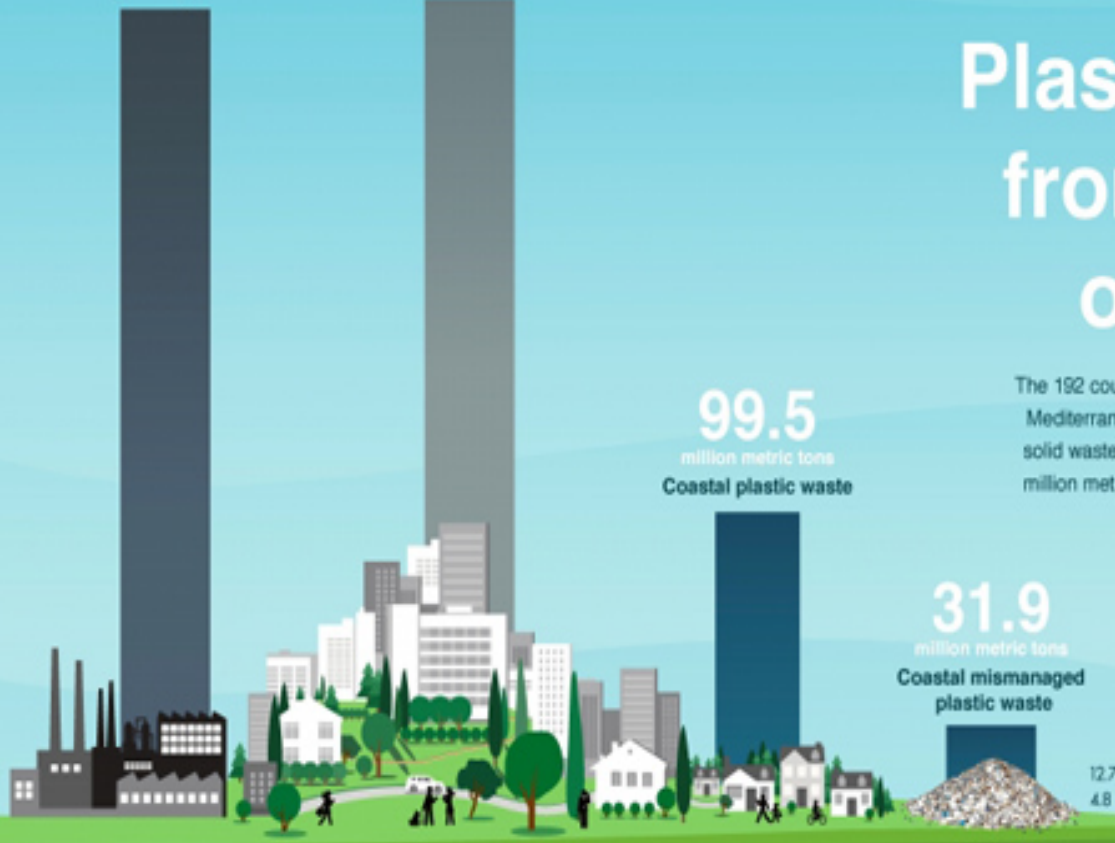


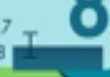
SARGASSO SEA COMMISSION

Jambeck et al., *Science* 2015

Plastic waste inputs from land into the ocean in 2010

The 192 countries with a coast bordering Atlantic, Pacific, and Indian oceans, Mediterranean and Black seas produced a total of 2.5 billion metric tons of solid waste. Of that, 275 million metric tons was plastic, and an estimated 8 million metric tons of mismanaged plastic waste entered the ocean in 2010.





8 Million metric tons of plastic waste goes into the ocean

6,350-245,000 metric tons**

Estimated mass of plastic waste floating at the ocean surface

Mitigation options:

- Reduce plastic in waste stream
- Improve solid waste managment infrastructure
- Increase capture

*Plastics Europe, "Plastics—the Facts 2013" (2010 data)
**Cózar et al., 2014; Eriksen et al., 2014

SARGASSO SEA COMMISSION

Graphic by Lindsay Robinson/University of Georgia

SARGASSO SEA COMMISSION

Subsequent Support for the Science Case

Convention on Biological Diversity CoP 11, Hyderabad 2012

The Sargasso Sea meets all the criteria for recognition as an Ecologically or Biologically Significant Area(EBSA). Of the 7 criteria the SS scored High for six and M for one (naturalness)

World Heritage Report, July 2016

The Sargasso Sea meets all three appropriate world heritage criteria for the natural world

United Nations 2017, World Ocean Assessment 1

Chapter 50 The Sargasso Sea

Convention on Migratory Species ,Malmo 2018

Recognised the Sargasso Sea as a critical spawning site for the European Eel

SARGASSO SEA COMMISSION

So.....Is the Science Case still fit for purpose?

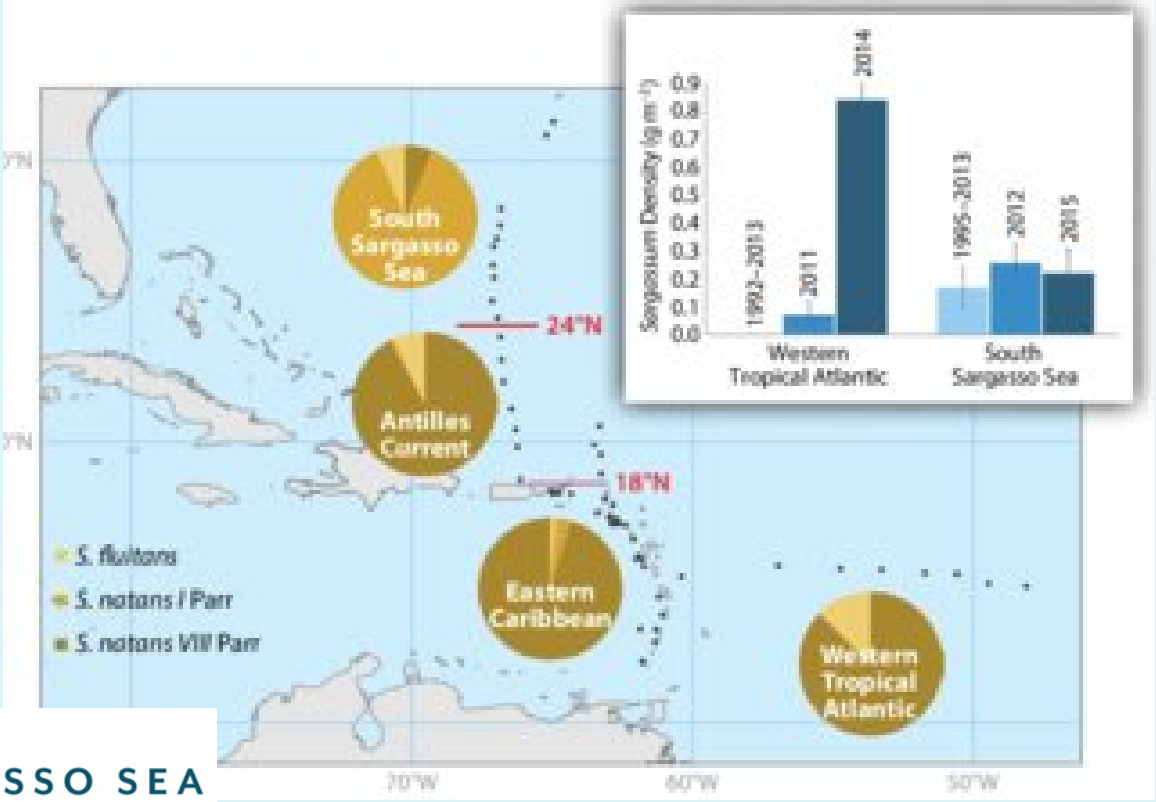
Yes!!!!

SARGASSO SEA COMMISSION

Distribution of *Sargassum*

as 10 times greater than that during ne 2011/2012 event (0.07 g m^{-2}, n = 13, E = 0.05) and 300 times greater than nat of any other autumn over the last wo decades (0.0027 g m^{-2}, n = 270, E = 9.16 × 10^{-5}; ANOVA, p <0.0001).

itoring. With proper field identification of the distinct *S. natans VIII* morphological form, the source region and geographic extent of *Sargassum* inundation events can be tracked at finer spatial resolutions than permitted by remote sensing



SARGASSO SEA COMMISSION

J.M.Schel let al 2015 Oceanography 28,8-10