N.C. Division of Marine Fisheries Stock Assessment Overview

Trip Ticket Program

Recreational Fishery Data Collection

Dependent Sampling Program

Independent Sampling Program

Stock Assessments

Marine Fisheries Commission Meeting

Dec. 3, 2009

Trip Ticket Program

Alan Bianchi
Trip Ticket Coordinator

What is the Trip Ticket Program?

A self reporting system through which dealers report every fish they purchase from fishermen for every commercial fishing trip that is made.

Approximately 150,000 to 250,000 Trip Tickets are processed annually

Example Trip Ticket

1 -
NORTH CAROLINA TRIP TICKET (FINFISH)

FISHERMAN NAME	FISH DEALER #
FISHERMAN LICENSE #	CHECK BOX IF NO VESSEL USED →
TRIP START DATE: MO / DAY / YR	CFVR # P
UNLOADING DATE: MO / DAY / YR	NO. OF CREW

TRANSACTION #

CIRCLE ALL GEARS USED

020	Beach Seine	340	Eel Pot	610	Rod-n-Reel
030	Haul Seine	345	Fish Pot	660	Trolling
025	Swipe Net	426	Small Mesh Set Gill Net (< 5 in.)	677	Shark Longline
125	Purse Seine	427	Large Mesh Set Gill Net (>=5 in.)	735	Cast Net
275	Pound Net	470	Drift Gill Net	760	Gigs
310	Hoop/Fyke Net	475	Runaround Net		

CIRCLE ONE WATERBODY WHERE MOST OF CATCH WAS MADE

01	Albemarle Sound	10	Currituck Sound	33	Pamlico River
02	Alligator River	11	Lockwood Folly	34	Pamlico Sound
03	Bay River	12	Masonboro Sd.	45	Roanoke Sound
05	Bogue Sound	29	Neuse River	38	Shallotte River
06	Cape Fear River	30	New River	39	Stump Sound
08	Core Sound	31	Newport River	41	Topsail Sound
09	Croatan Sound	43	North River/ Back Sound	42	White Oak River
53	Inland Waterway - Brunswick			54	Inland Waterway - Onslow
20	Ocean 0-3 miles (North of Cape Hatteras)			21	Ocean 0-3 miles (South of Cape Hatteras)
22	Ocean greater than 3 miles (North of Cape Hatteras)			23	Ocean greater than 3 miles (South of Cape Hatteras)

KIND		CODE	POUNDS	UNIT PRICE	TOTAL PRICE
Black Drum		2100			
Bluefish	Small	1352			
	Med.	1353			
	Lg.	1354			
	Lg. Gutted	1364			
Butterfish		1550			
Catfish Mixed		1700			
Croaker	Small	1952			
	Med.	1953			
	Lg.	1954			
Dogfish-Smooth Carcass		5940			
Dogfish-Smooth Fins		5920			
Dogfish-Spiny Whole		5950			
Flounder	Mixed	2300			
	Small	2302			
	Med.	2303			
	Lg.	2304			
	Jumbo	2305			

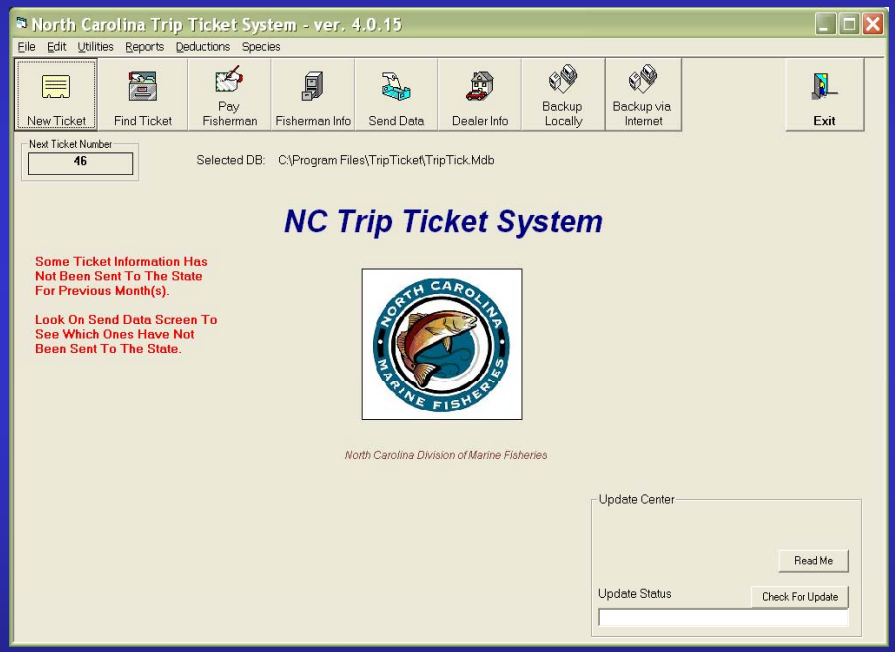
KIND		CODE	POUNDS	UNIT PRICE	TOTAL PRICE
Eels, American		2200			
Gars/Skippers		6100			
Gray Trout	Pan	5252			
	Med.	5253			
	Lg.	5254			
Hogfish/Pigfish		4500			
Jumping Mullet		4350			
Mullet	Red Roe	4357			
	White Roe	4358			
Little Tunny Whole (False Alb.)		7300			
Pompano	Small	4652			
	Lg.	4654			
Puffers Whole (Sea Chickens)		6850			
Puppy/Red Drum	Redfish	2150			
Sea Mullet		4000			
Roe Shad (Am. Shad)		5356			
Buck Shad (Am. Shad)		5359			
Jacks (Hickory Shad)		3800			
Sharks Mixed	Carcass	5410			
	Fins	5420			
Sheepshead		6000			
Spadefish		6650			
Spanish Mackerel	Small	6702			
	Med.	6703			
	Lg.	6704			
Speckled Trout	Pan	5302			
	Med.	5303			
	Lg.	5304			
Spot		6750			
Starbutters		3700			
Striped Bass		6800			
Thread Herring		3750			
White Perch		7650			
Menhaden Bait (LBS)		4200			
Mixed Bait		7900			

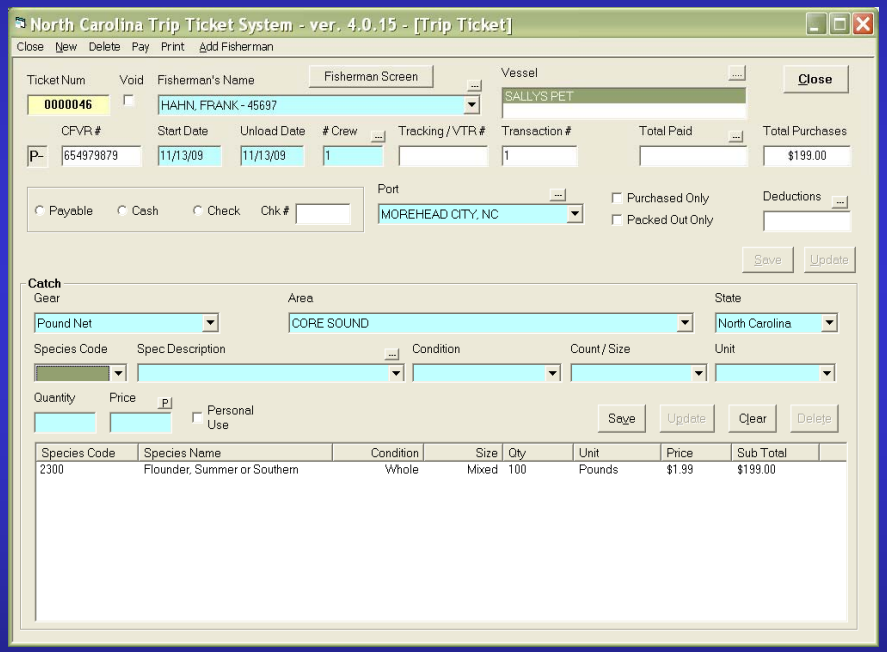
Dealer/Fisherman Use

FISHERMAN COPY

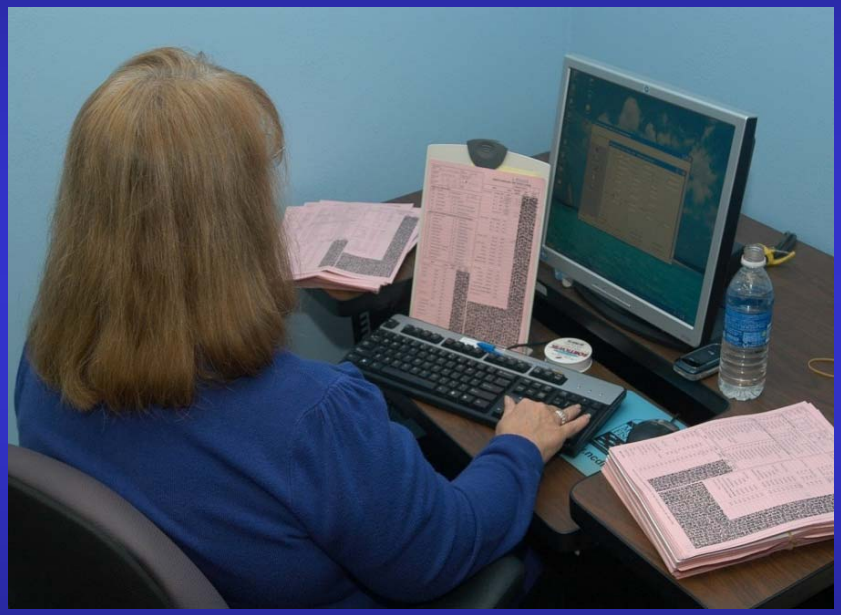
North Carolina Division of Marine Fisheries, PO Box 769, Morehead City, NC 28557-0769

Trip Ticket Software Example





Quality Assurance and Compliance



Marine Patrol

Port Agent

Rigorous data quality system

- Double Key Entry
- Port Agent Review
- Warning and Edits

Comparison to Other States

- Includes all fisheries from all coastal waters
- Second oldest on East Coast
- SC, GA, RI and ME Trip Ticket Programs are patterned after NC's
- Extremely rigorous data quality control program
- Trip ticket analysts are very sensitive to discrepancies and confidentiality

Types of Analysis

Economic Aid Programs

- Hurricane Floyd
- Shrimp
- Crab

Smooth Dogfish Trip Limit Analysis

Economic Analysis

Federal Data Workshops

Analysis Continued

More detailed analysis can also be completed

- Poundage ranges by trip or fishermen
- Can be combined with license data
- Multispecies analysis can be conducted

Recreational Fishery Data Collection

Doug Mumford
Marine Recreational Statistics Coordinator

Marine Recreational Information Program (MRIP)

Two types of statistical survey design:

Effort Surveys
- Coastal Household Telephone
- Angler Directory Telephone
- For-Hire Survey

Angler Surveys
- Access Point Intercept Surveys

Methodology for Effort
(Angler Trips)

Coastal Household Telephone Survey

- Random calls to coastal residents
- Accounts for exemptions in license frame

Angler License Directory Survey

- Much more efficient
- Still suffers from exemptions

For Hire Survey

- Frame from blanket license and permit
- 10% Captains called each week

Effort Surveys

Provide Estimates of Overall Angler Trips

Coastal Household Telephone

- > 15,000 calls annually
- Every two months

Angler License Directory

- > 4,000 calls annually
- Every two months

For Hire

- > 3,000 calls annually
- Weekly

No catch data on phone

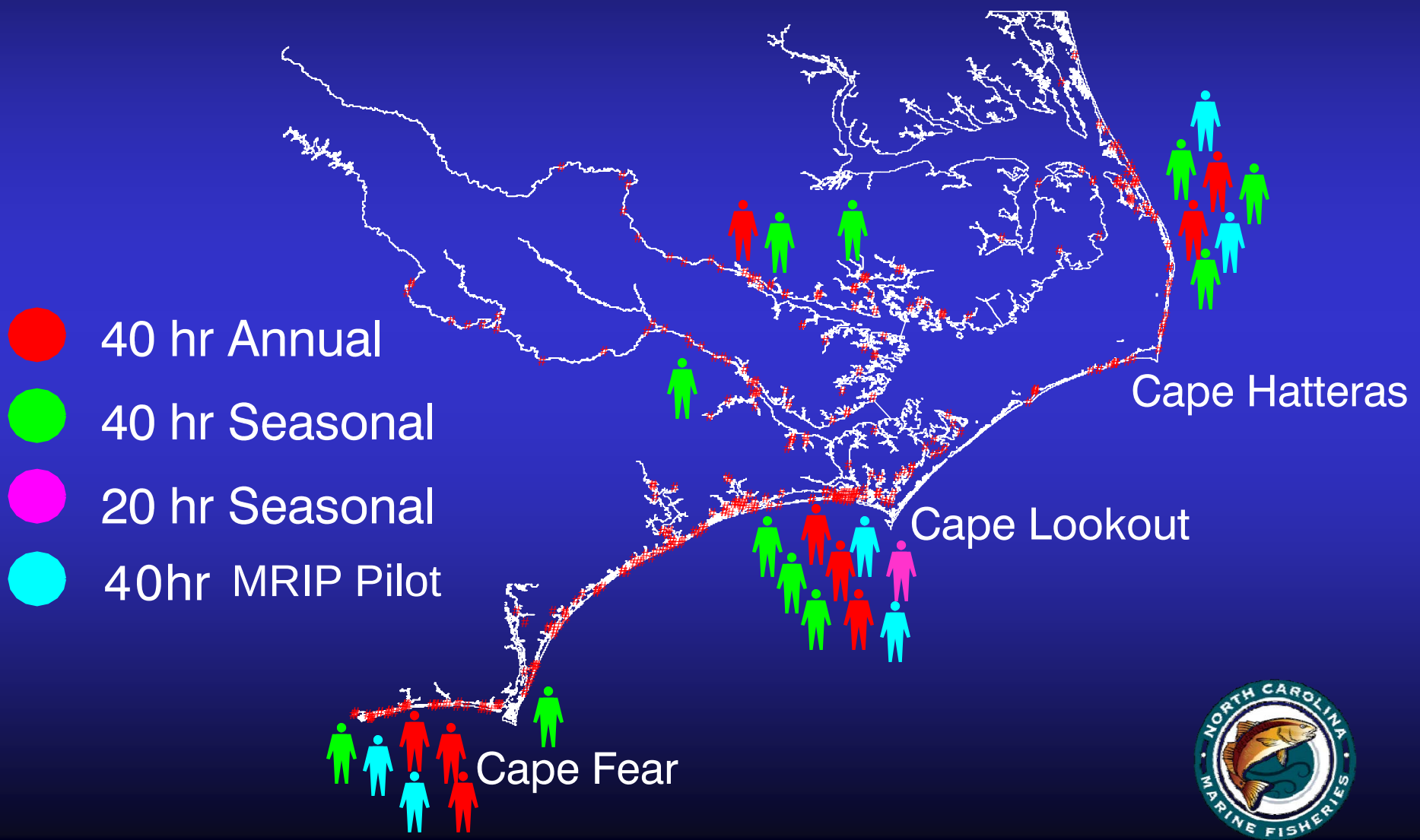
Effort Estimates

Intercept Survey

- Comprehensive list of public sites
- Random surveys at access sites
- Interview anglers at end of trip
- > 15,000 angler interviews annually
- 27 interviewers statewide

- Data collected includes:
  - Area fished, type of fishing, tournament activity, artificial reef usage, hours fished, other
- Biological data collected includes:
  - Species observed and reported, disposition, lengths, weights

Sampler Distribution 2010



MRIP Catch Estimation

Effort Surveys

Access Point Intercept Survey

Total Angler Trips

X

Average Catch Per Trip

=

Total Catch

What Makes Good Data?

Precision

- Mathematical analysis
- Standards

Validation

- Adjustment for bad memories
- Ensure procedures followed
- Cross-checking

What Makes N.C. Data Better?

First in nation in state participation

- Joined in 1987, nine other states have followed our lead
- Conducted more than 400,000 angler interviews

Addressed limitations of MRFSS

- Increased sample size
- Developed Catch Card Program, Ocean Striped Bass Catch Card, Upper Estuarine and Anadromous Sampling

MRIP Participation

- MRIP Pilot Programs
- Coastal Angling Program (CRFL funded)

Why is MRIP Important?

Avoid duplication

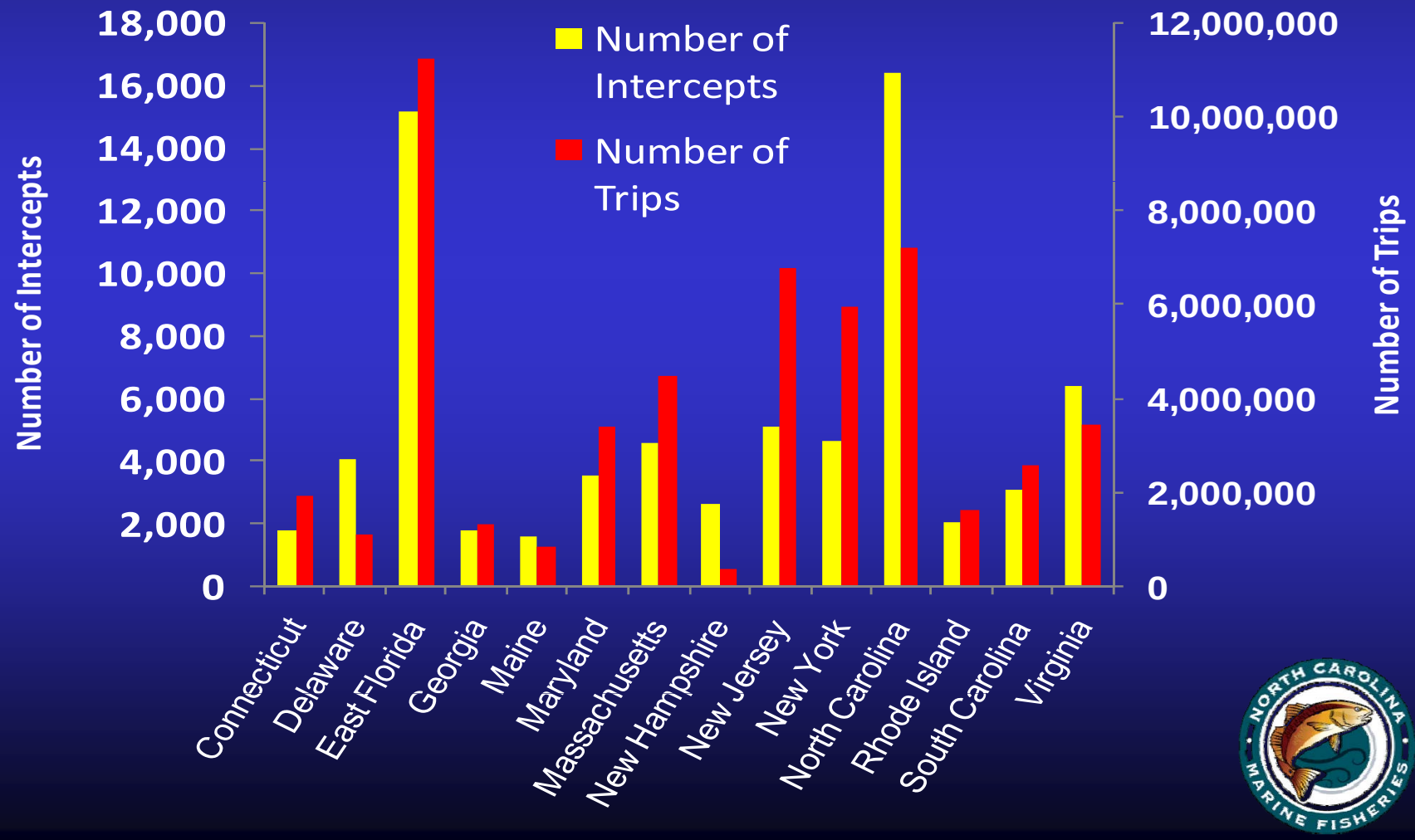
Take advantage of NOAA funding

Recognize need for regional database

Collective input for improvements

- Pilot programs underway nationwide
- Magnuson reauthorization
  - NOAA must fix recreational data collection
  - Over fishing must end in all areas by 2011

Atlantic Coast Trips and Intercept Sampling 2008



What Will the Future Bring?

North Carolina Coastal Angler Program

- Staged for implementation in 2010
- Immediate increase in samples (5,000)
- Internet e-reporting
  - Angler diary
  - Optional reporting
- Private access
- Flounder gigging and other nighttime fisheries
- Recreational shellfish

Dependent Sampling Programs

Clark Gray
DMF Biologist

What is Dependent Sampling?

The collection, recording and processing of data from commercial and recreational fishing for use in management of the fisheries stocks.

Predominant Fisheries Sampled:

- Ocean gill net
- Estuarine gill net
- Long haul seine/swipe net
- Winter trawl
- Pound net
- Beach seine/stop net
- Crab pots

Dependent Sampling Programs

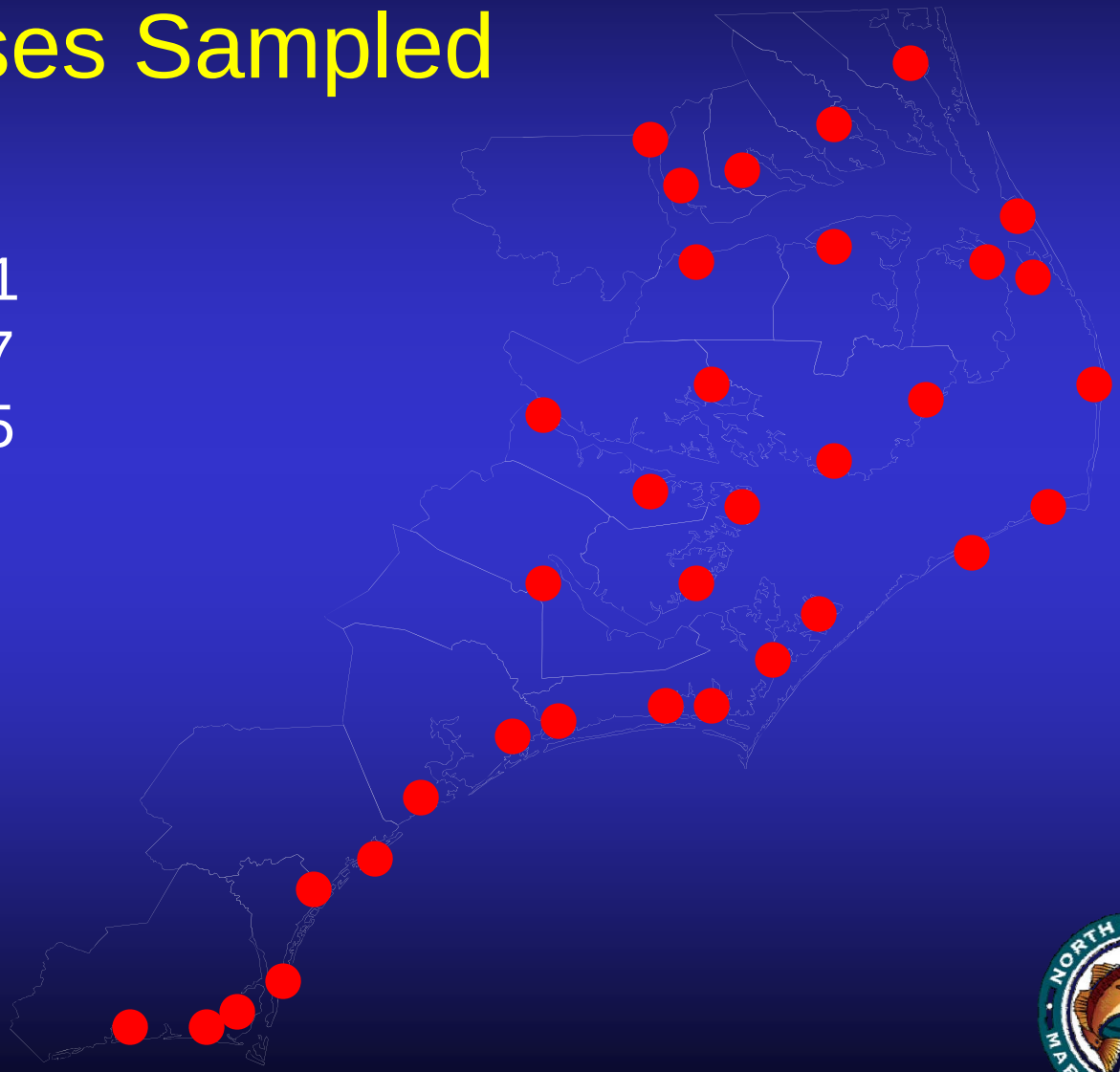
- Commercial fish house sampling program
- Observer program

How We Sample

Fish houses are selected for sampling based on their broad representation of fisheries and fishermen.

Fish Houses Sampled

- Northern 31
- Central 37
- Southern 15



Why We Sample

To determine size, age, sex and species composition of fish taken in commercial gears.

Biological Data Collection

- From a representative subsample of the catch
  - Species/bycatch identification
  - Lengths
  - Weights
- From the total catch
  - Total weight
  - Species observed
  - Specific gear, effort, and location information

Sampling Summary
2008

Fishery	Trips sampled	Number of fish/ crabs measured	Length/Metric Ton
Estuarine gill nets	1,053	49,630	18
Winter trawls	122	47,520	14
Sink nets	225	21,827	8
Pound nets	119	18,414	31
Crab pots	486	24,514	2
Long haul seines	47	16,331	55
Other	461	16,031	
Total	**2,513**	**194,267**	

Aging Samples
2008

	Number of Samples
Southern flounder	892
Atlantic croaker	669
Bluefish	552
Spotted sea trout	538
Red drum	450
Weakfish	417

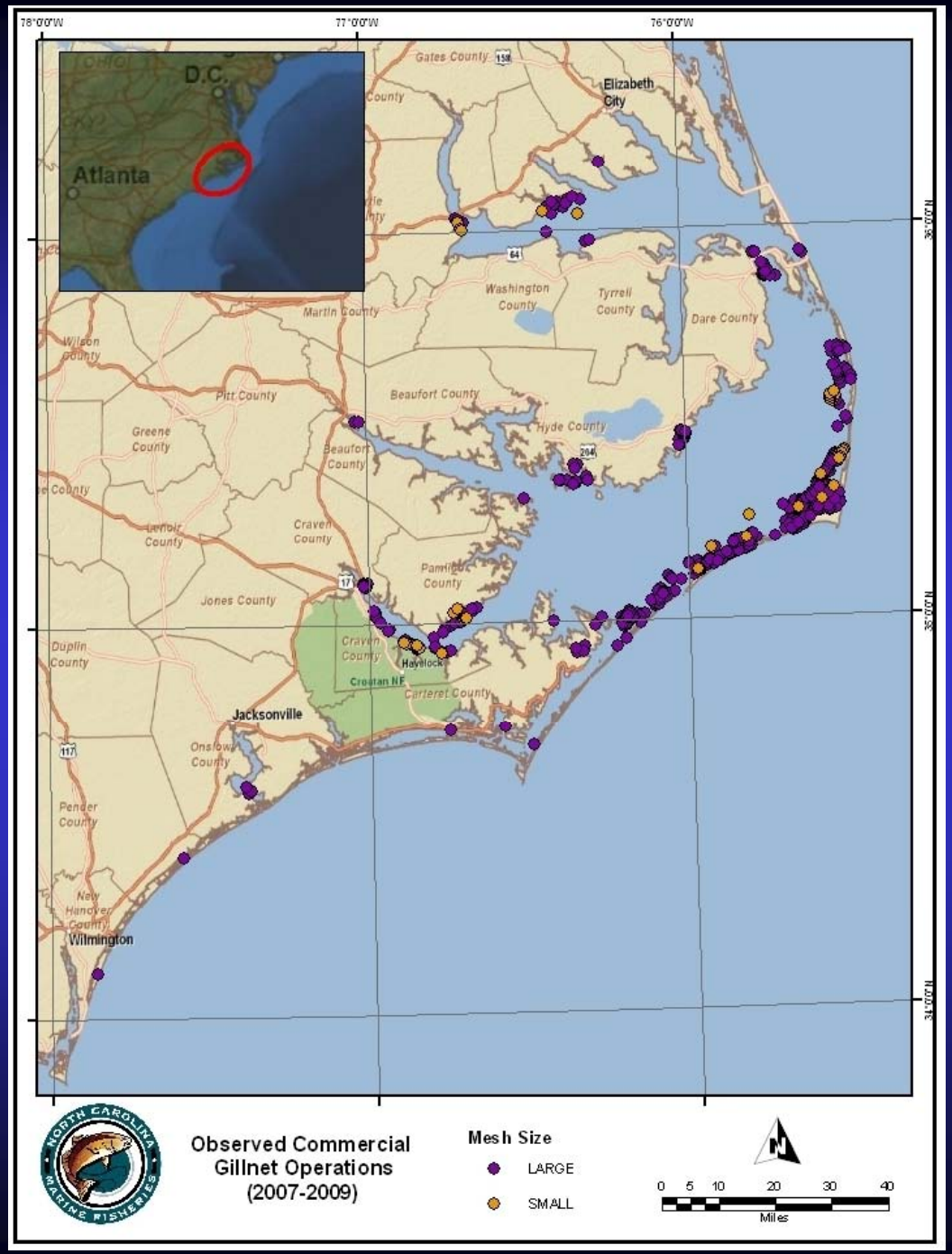
Comparison of Dependent Data Collection in Other States

	Required # lengths	Completed # lengths
North Carolina	474	6,343
Virginia	1,104	2,827
New Jersey	438	1,046
Delaware	66	409
Maryland	48	242
New York	234	213
Rhode Island	54	14

ASMFC FMP biological sampling of weakfish

Observer Data Collection

- Subsample catch (count, measure and weigh target/bycatch species)
- Document time and location
- Characterize gear
- Record interactions with protected species
- Collect environmental conditions



Observer Summary

August 07- March 09

425 Trips

19,532 Measurements

Data Uses

- Coast wide assessments
- Annual compliance reports
- Length-at-age keys
- Catch-at-age matrices

Benefits

- Provides timely and accurate data
- Allows evaluation of effectiveness of current management
- Continues development of long-term databases in North Carolina and the Atlantic coast
- Give opportunity for public outreach/input

Independent Sampling Programs

Lee Paramore
Biologist

What Is Independent Sampling?

Information collected by biologists that does not involve the commercial or recreational harvest of fish.

Why Do We Need It?

Fishery dependent data is biased. Fishermen use certain types of gear and employ fishing methods designed to target select species.

Fishery independent data is unbiased. Biologists use consistent methods with the same gear for the duration of a survey.

Independent Sampling Design and Standardization

- Stratified random or fixed station design
- Standardized gear construction and sampling techniques
- Designed to encompass occurrence by season and area
- Not dependent on skill of sampler, but can be replicated following set protocol
- Value of survey increases with time

Juvenile Trawl Survey

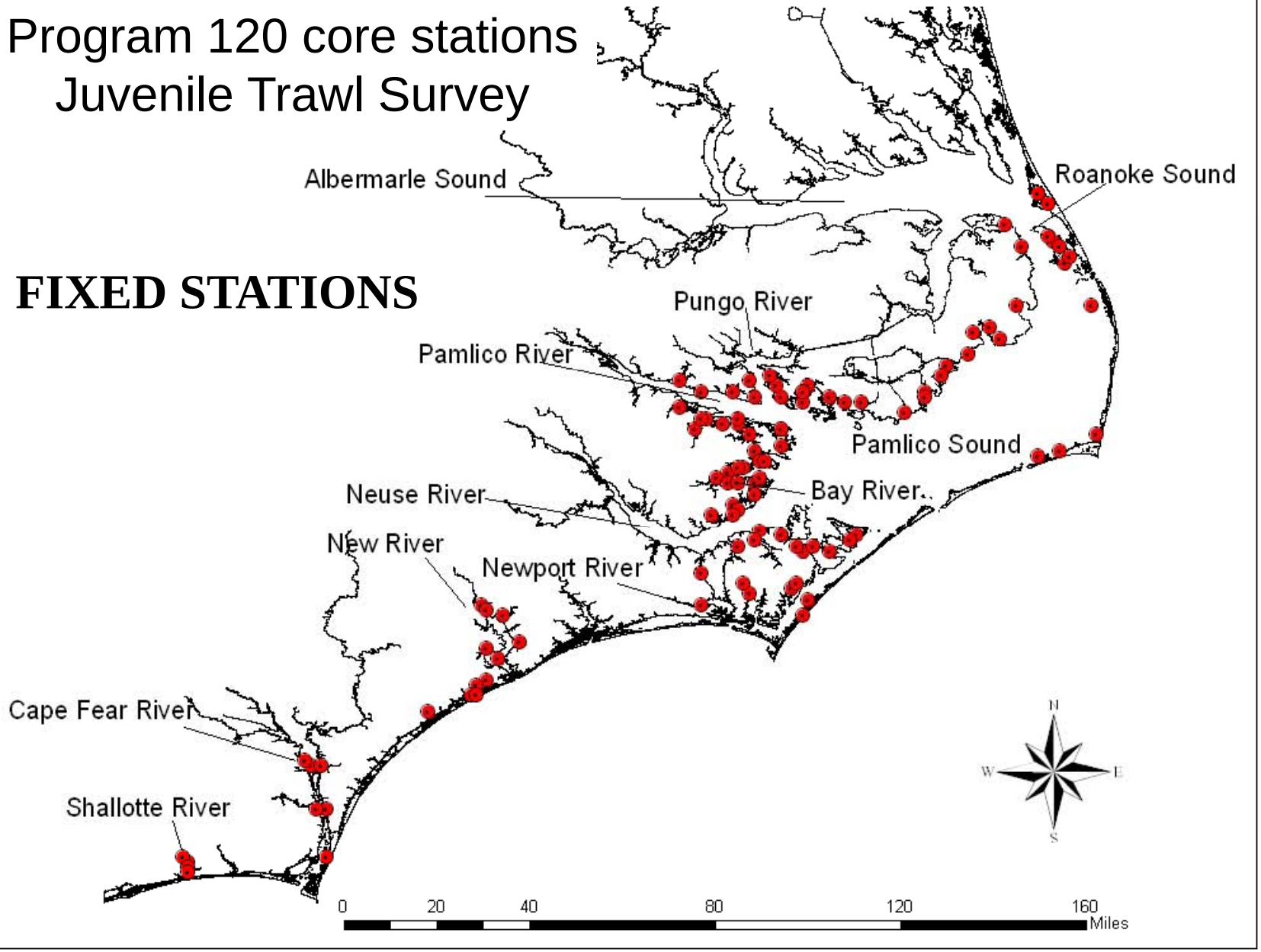
Purpose

- Produce annual recruitment indices
- Identify nursery areas for fish and shellfish

Methods

- May and June after 1989 (monthly back to 1978)
- Statewide fixed stations (105 core stations every year)
- Two seam 10.5’ otter trawl, 1/8 inch bag, 1-minute tow
- Environmental and bottom type data
- Count and measure captured species

Program 120 core stations
Juvenile Trawl Survey



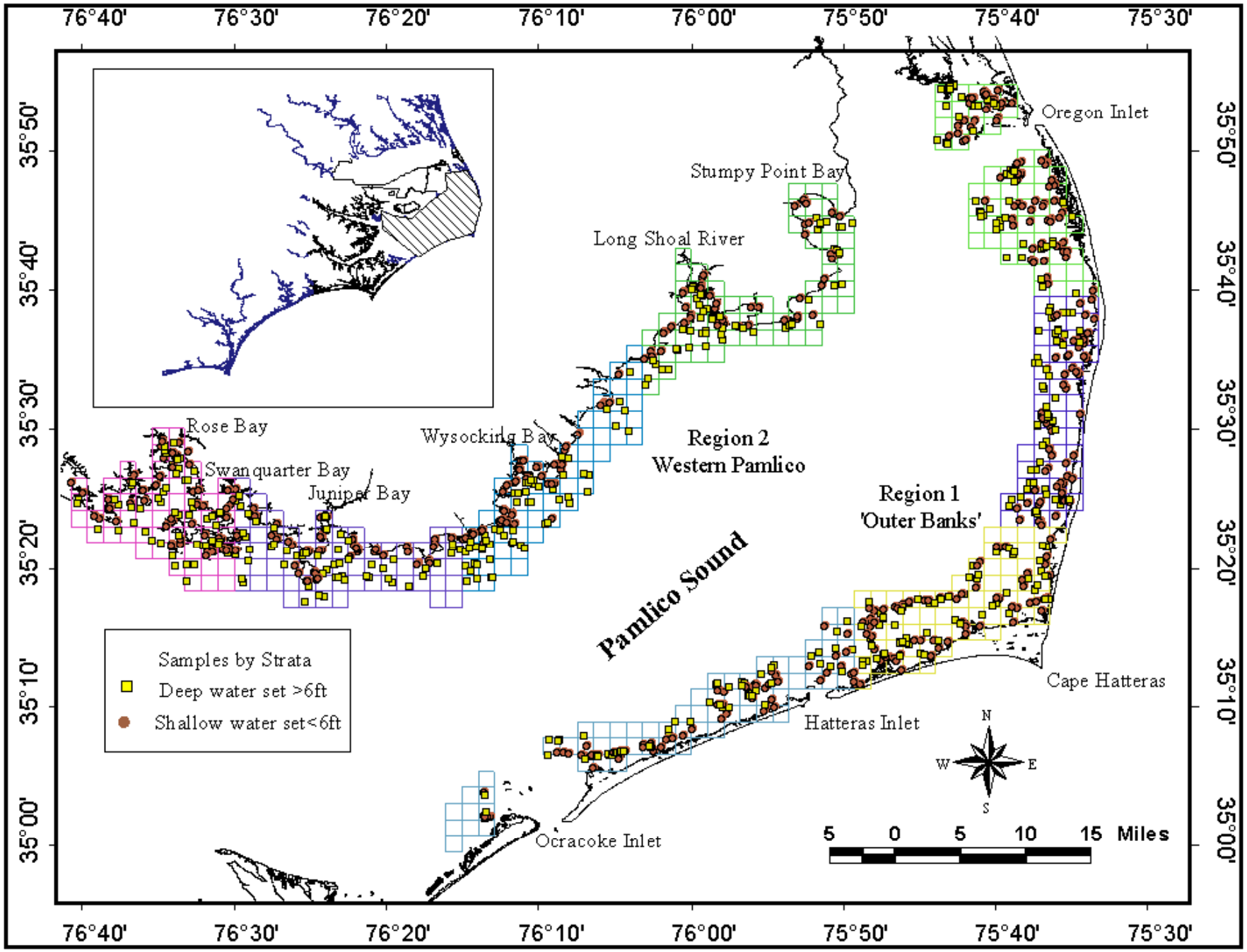
FIXED STATIONS

Juvenile Trawl Survey

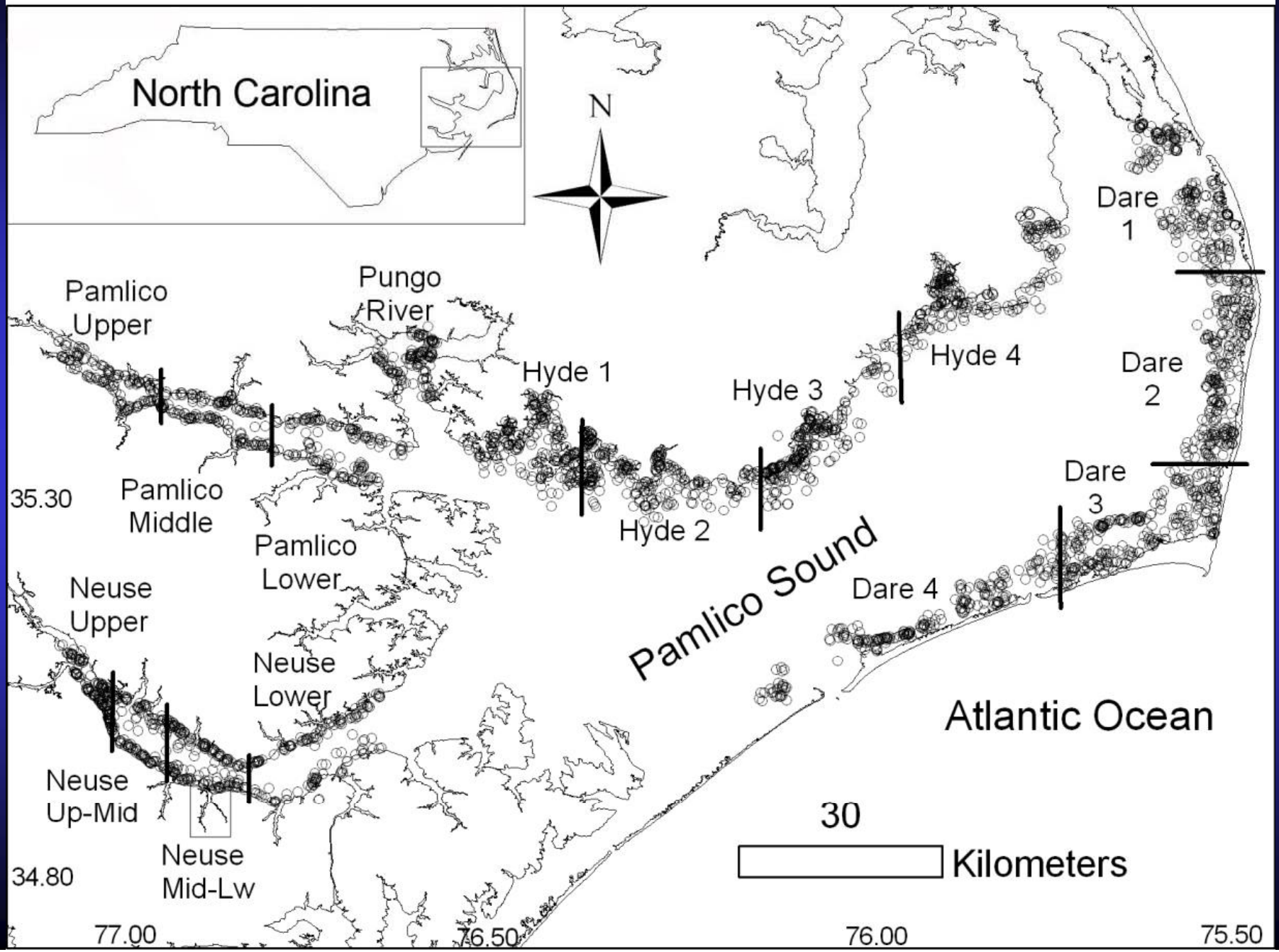
- One of longest running fishery-independent surveys on east coast (1978)
- Used in identification of critical habitat for key species (i.e. primary and secondary nursery areas)
- Fixed stations and long time series allow for evaluation of development and other factors influencing habitat use over time
- Provides index of abundance for key juvenile species including: blue crab, southern flounder, spot, Atlantic croaker, and brown shrimp

Pamlico Sound Independent Gill Net Survey

- Purpose
  - Produce annual abundance indices by age-class
  - Characterize habitat use
- Methods
  - February to December (64 samples per month)
  - Stratified Random (OBX, Hyde Co Bays, Neuse and Pamlico/Pungo; shallow & deep)
  - Gang of gill nets 30 yards each, 3 to 6 ½ by ½ inch (240 yard/sample)
  - Environmental and bottom type data
  - Determine condition, count, measure


76°40'
76°30'
76°20'
76°10'
76°00'
75°50'
75°40'
75°30'
35°50'
35°40'
35°30'
35°20'
35°10'
35°00'
Oregon Inlet
Stumpy Point Bay
Long Shoal River
Rose Bay
Swanquarter Bay
Juniper Bay
Wysocking Bay
Region 2
Western Pamlico
Region 1
'Outer Banks'
Pamlico Sound
Cape Hatteras
Hatteras Inlet
Ocracoke Inlet
Samples by Strata
Deep water set >6ft
Shallow water set<6ft
N
W
E
S
5 0 5 10 15 Miles

NC Independent Gill Net Survey



Pamlico Sound Independent Gill Net Survey

- Provides age-specific relative abundance indices
- Used as a tuning index in stock assessments for southern flounder, red drum, weakfish, spotted seatrout
- Provides baseline data to identify changes in stock abundance that can result from fishing regulations or environmental changes
- Provides data to evaluate habitat use patterns for key estuarine species

Examples of more NC Independent Surveys

- Pamlico Sound Trawl Survey (1987 – on)
- Albemarle Sound Independent Gill Net Survey (1990 – on)
- Juvenile Anadromous Survey (1972 – on)
- Assessment of Fish Population in the Cape Fear (1997 - on)
- Red Drum Seine Survey (1992 – on)
- Red Drum Longline Survey (2007 – on)
- Striped Mullet Electroshock (2003 – on)
- Shrimp Sampling in Estuarine Areas (1970's – on)
- Tagging Programs (1980's - on)

Summary

North Carolina has a wide range of independent surveys that provide indices of relative abundance on various life history stages of key species

Independent surveys provide critical data for both monitoring trends in relative abundance and for evaluating critical habitat needs

Surveys are scientifically designed and sampling methods are standardized to minimize sampling bias

How It All Fits Together

Stock Assessment Reference Points, Models and Projections

Louis Daniel
DMF Director

What Is a Stock Assessment?

A stock assessment is a compilation of what is known about a stock that tells a logical story explaining historic trends and predicting future trends.

What Does a Stock Assessment Do?

Provides past and present stock status - Is the stock getting bigger or smaller?

Makes predictions on a stock' s response to management options

Recruits

'Births'

Natural Mortality

'Deaths'

Growth

'Weight/Maturity'

Fishing Mortality

'Death by Misadventure'

What Do Stock Assessments Use?

Biological information (independent and dependent)

- Monitoring surveys
- Age and growth
- Environmental conditions

Fishing activity (commercial and recreational)

- Landings and discards
- Gear
- Effort

What Methods Are Used?

LOW

Data Needs

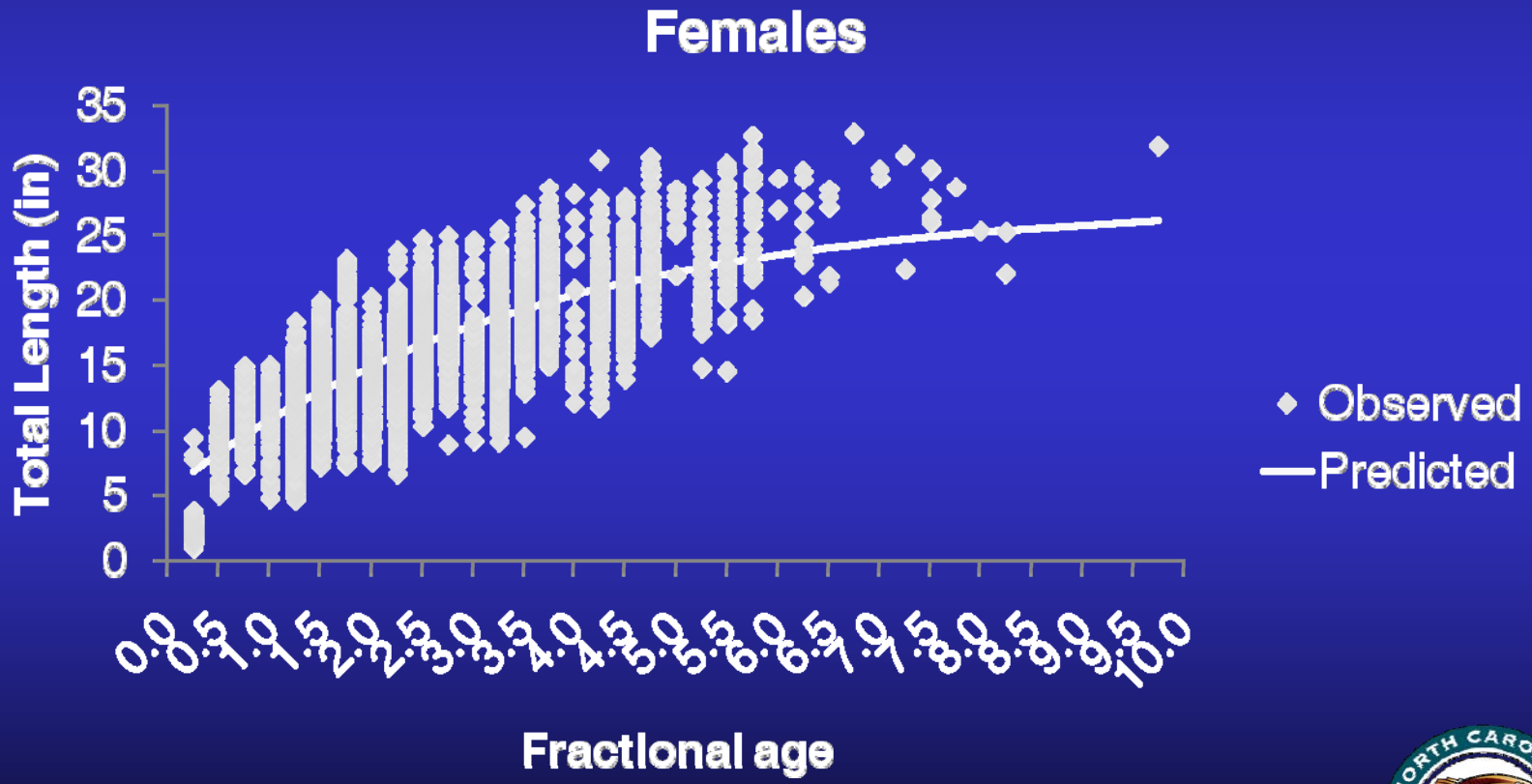
Complexity

Information

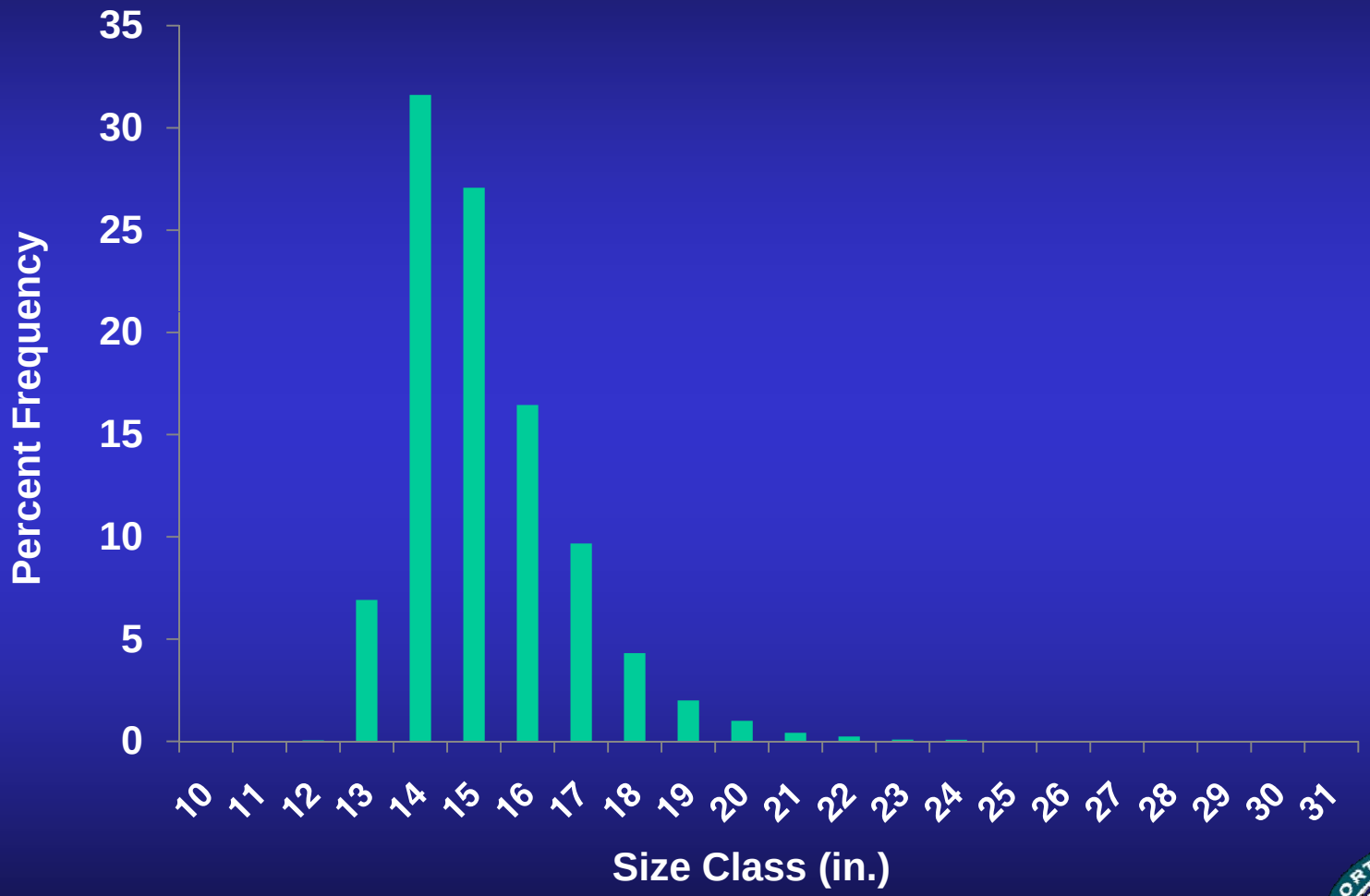
HIGH

- Trends Analysis
- CPUE
- Catch Curve
- Biomass & Production
- Catch Survey Analysis
- Virtual Population Analysis
- Mark-Recapture, Tag Return
- Statistical Catch-at-Age
- Multi-species

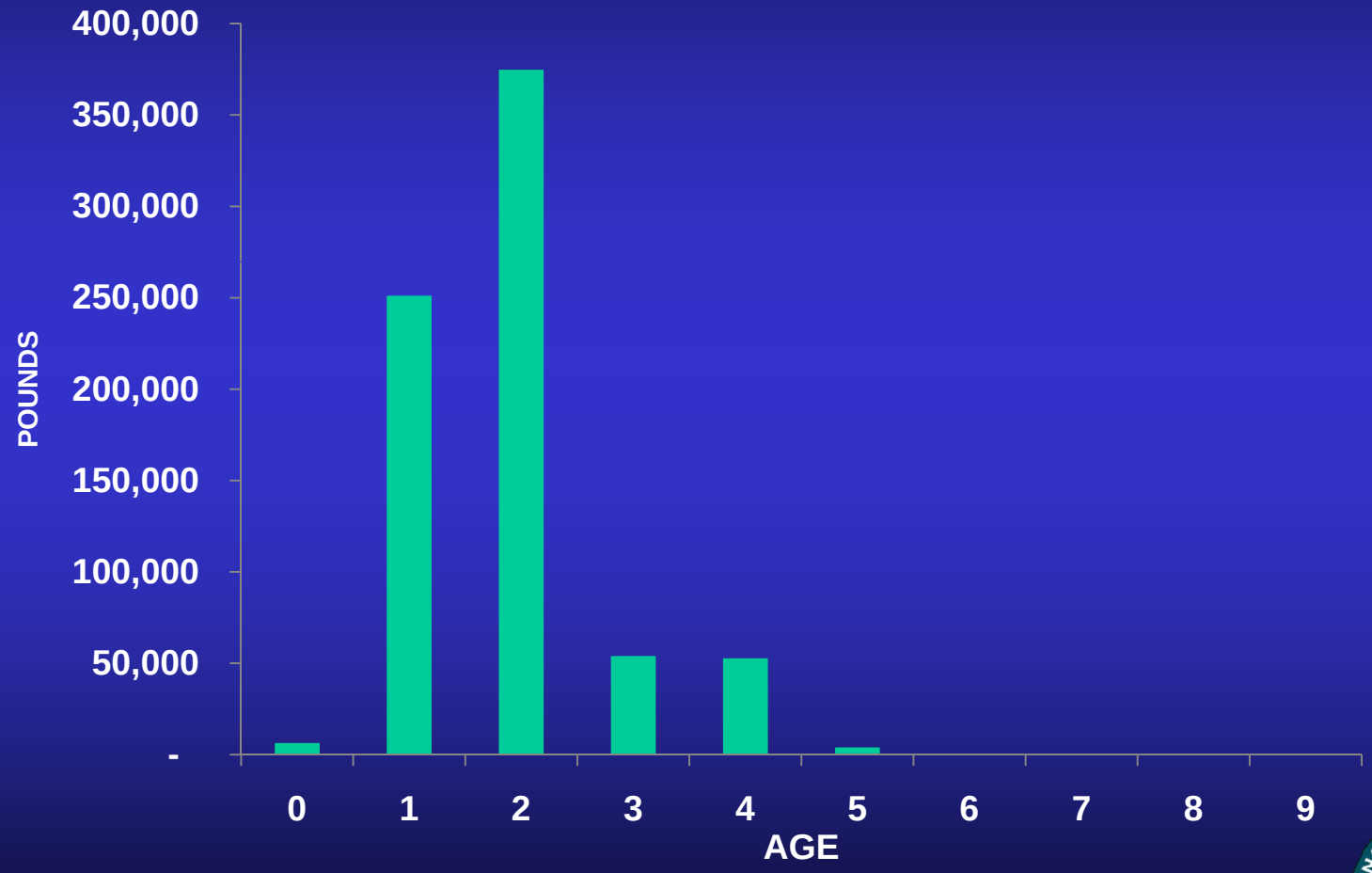
Length at Age Flounder



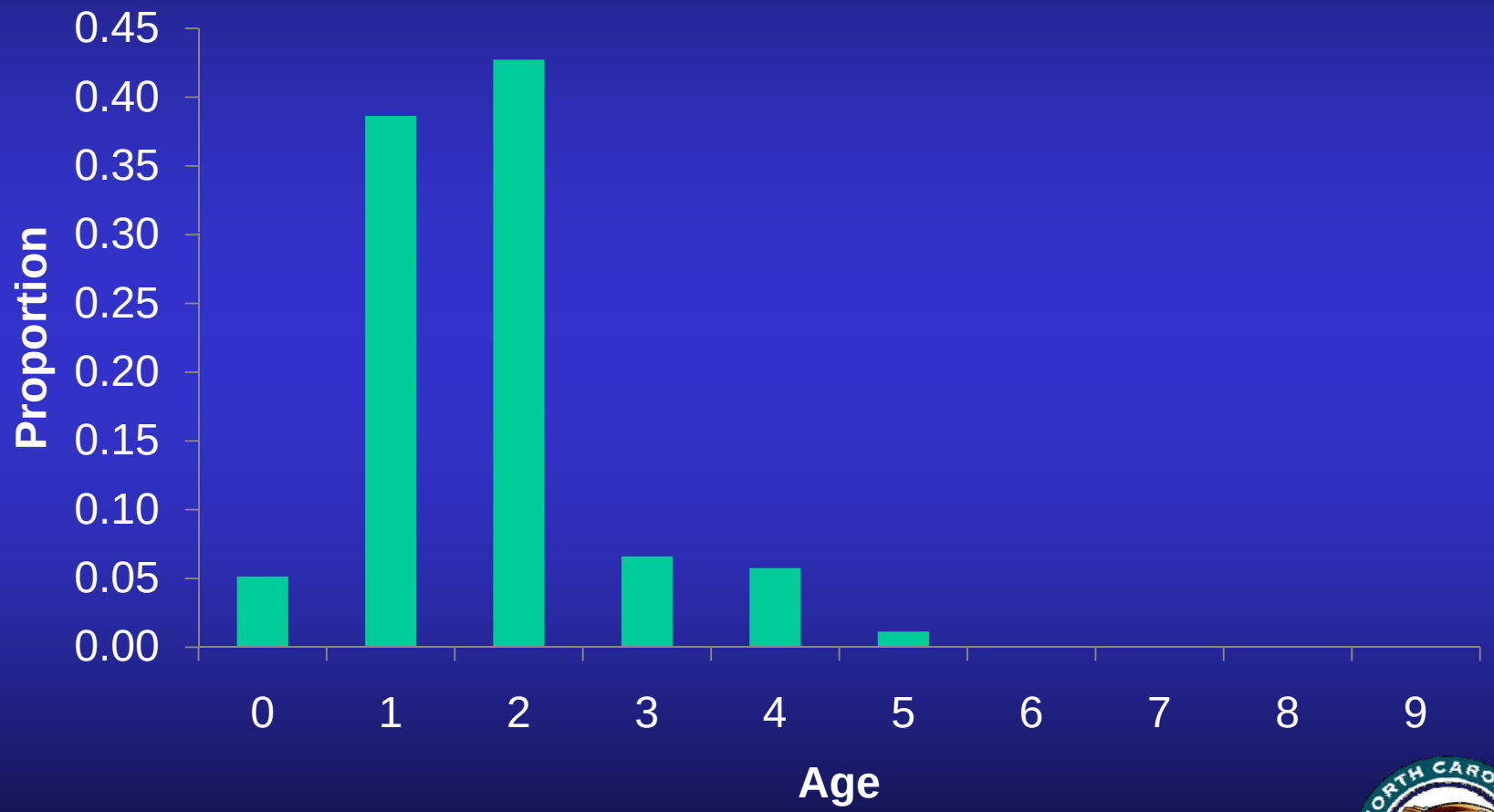
Flounder Estuarine Gillnet



Flounder Estuarine Gillnet



Flounder Independent Gill Net

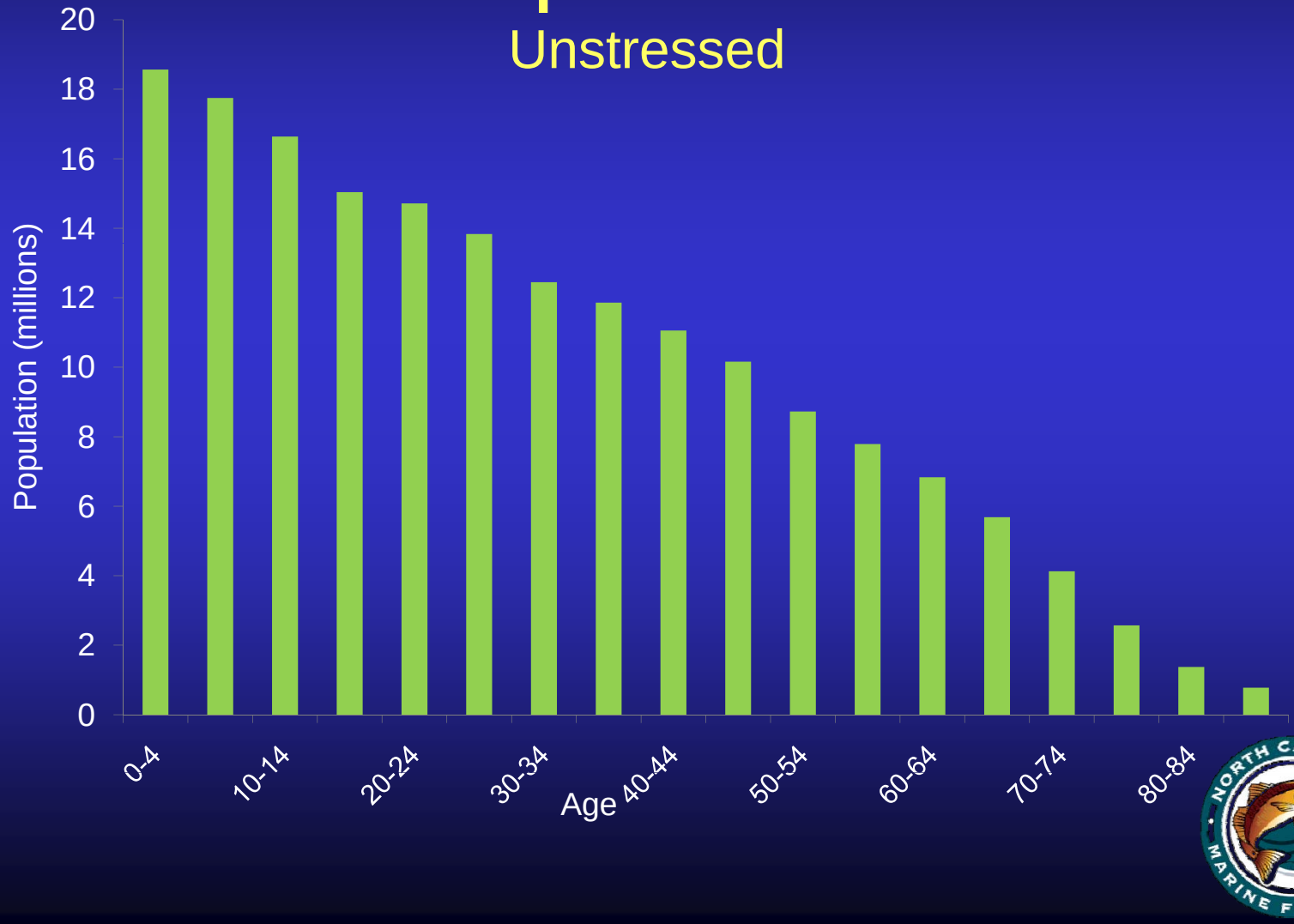


What does age structure tell us?

- At what age the fish are harvested
- How long the fish live
- How many of what age make up the stock

Hypothetical Human Population

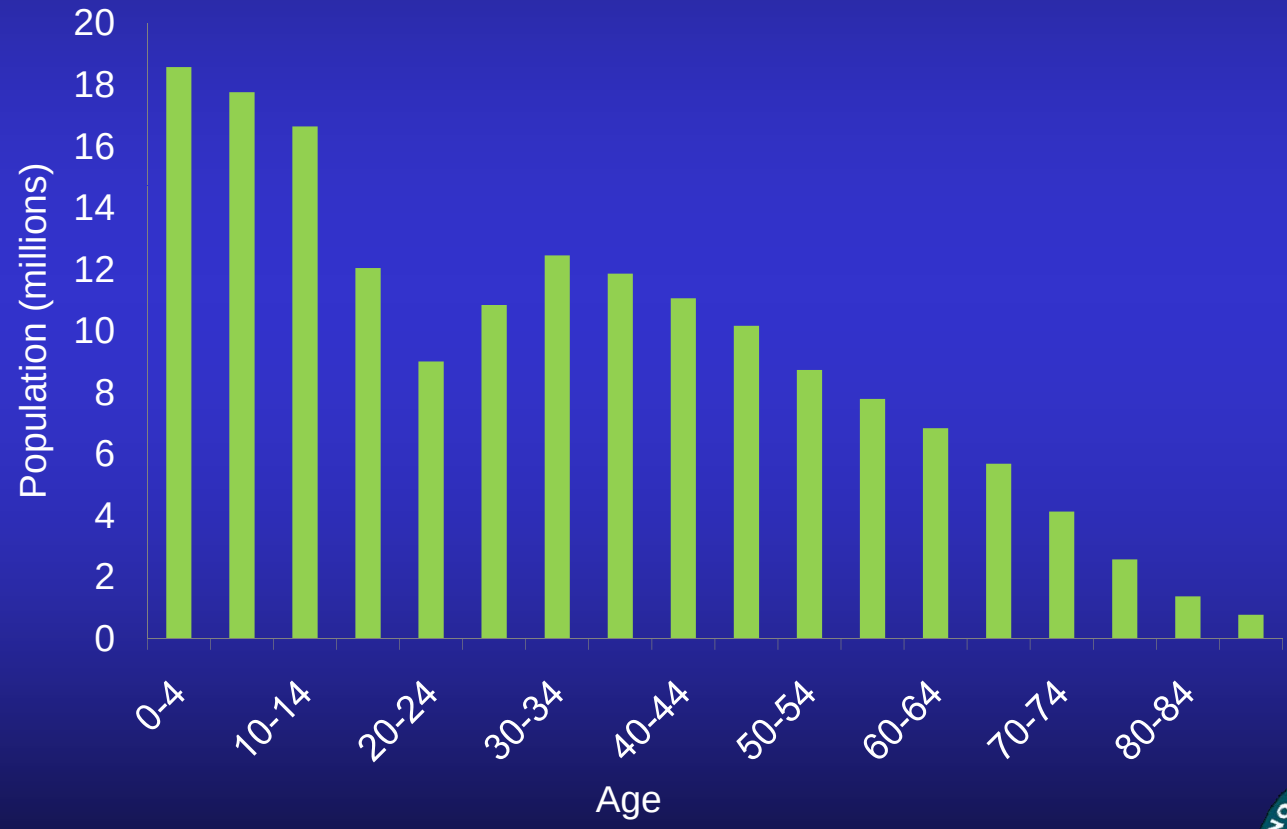
Unstressed



Stressed


Population (millions)
20
18
16
14
12
10
8
6
4
2
0
0-4
10-14
20-24
30-34
40-44
50-54
60-64
70-74
80-84
Age

At War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20
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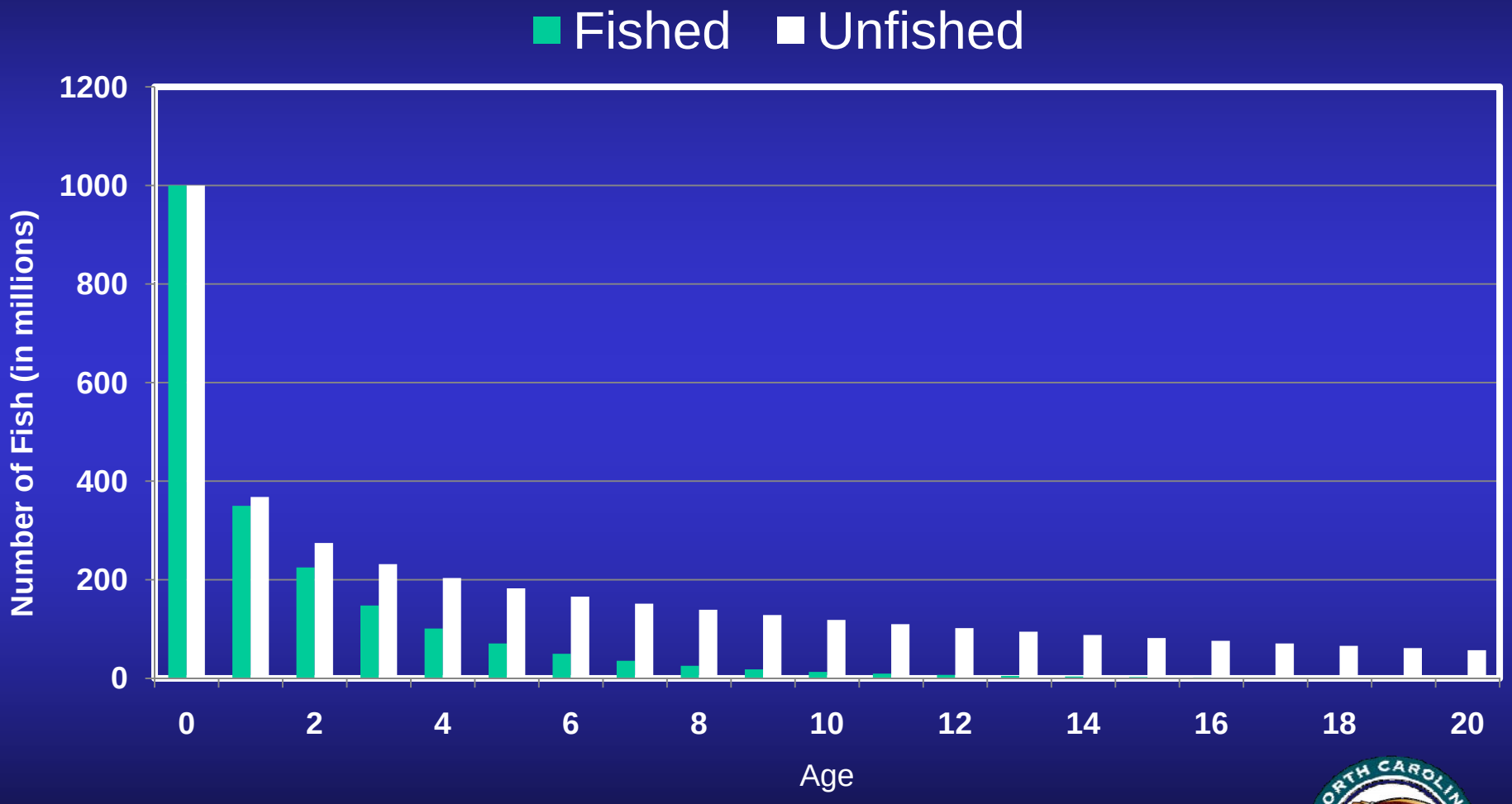
8
6
4
2
0
0-4
10-14
20-24
30-34
40-44
50-54
60-64
70-74
80-84
Age

What Is Mortality?

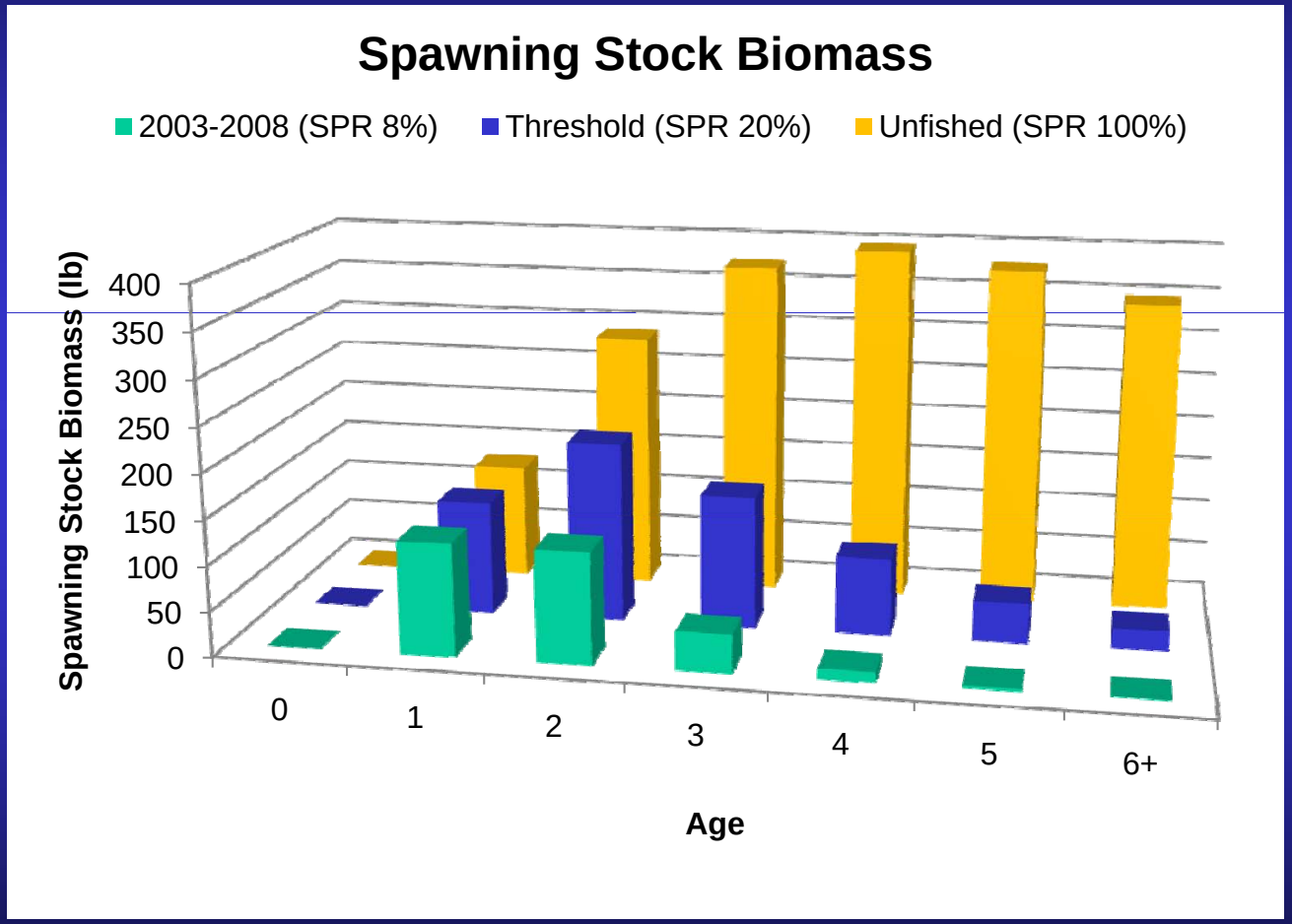
Rate that fish die

- Fishing mortality = death from fishing
  - Landings
  - Discards
- Natural mortality = any other death
  - Predation
  - Disease
  - Environmental
  - Old age

How Do We Determine Mortality?



Speckled Trout



The Final Step: Using Results

Biological Reference Points

- Targets
- Thresholds

Projections

- Using the results and same basic models, work forward to predict what might happen under management alternatives

Biological Reference Points

Biological reference points indicate the chosen stock state and mark the boundary of undesirable stock conditions

Provides guidance in determining

- If the population is too small
- If F is too high

Choosing Reference Points

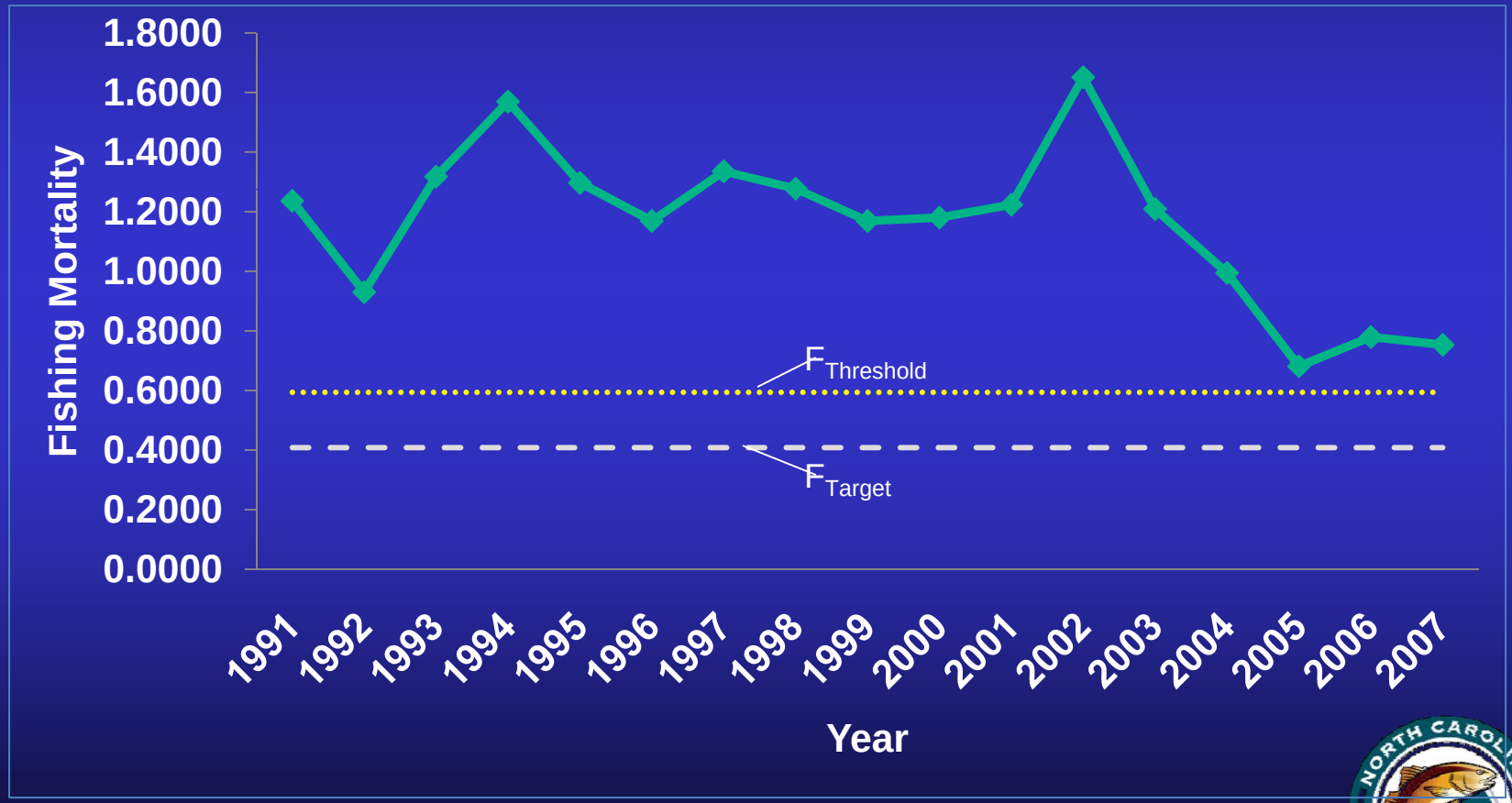
Begin with a management goal

- Sustainable harvest
- Preserve the parent stock
- Rebuild the parent stock

Quantify that goal

- Yield- based points
- Spawning stock biomass per recruit
- Maximum sustainable yield

Fishing Mortality with Reference Points



Spawning Stock Biomass with Reference Points

Sustainable Resource

$50 Monthly Light Bill

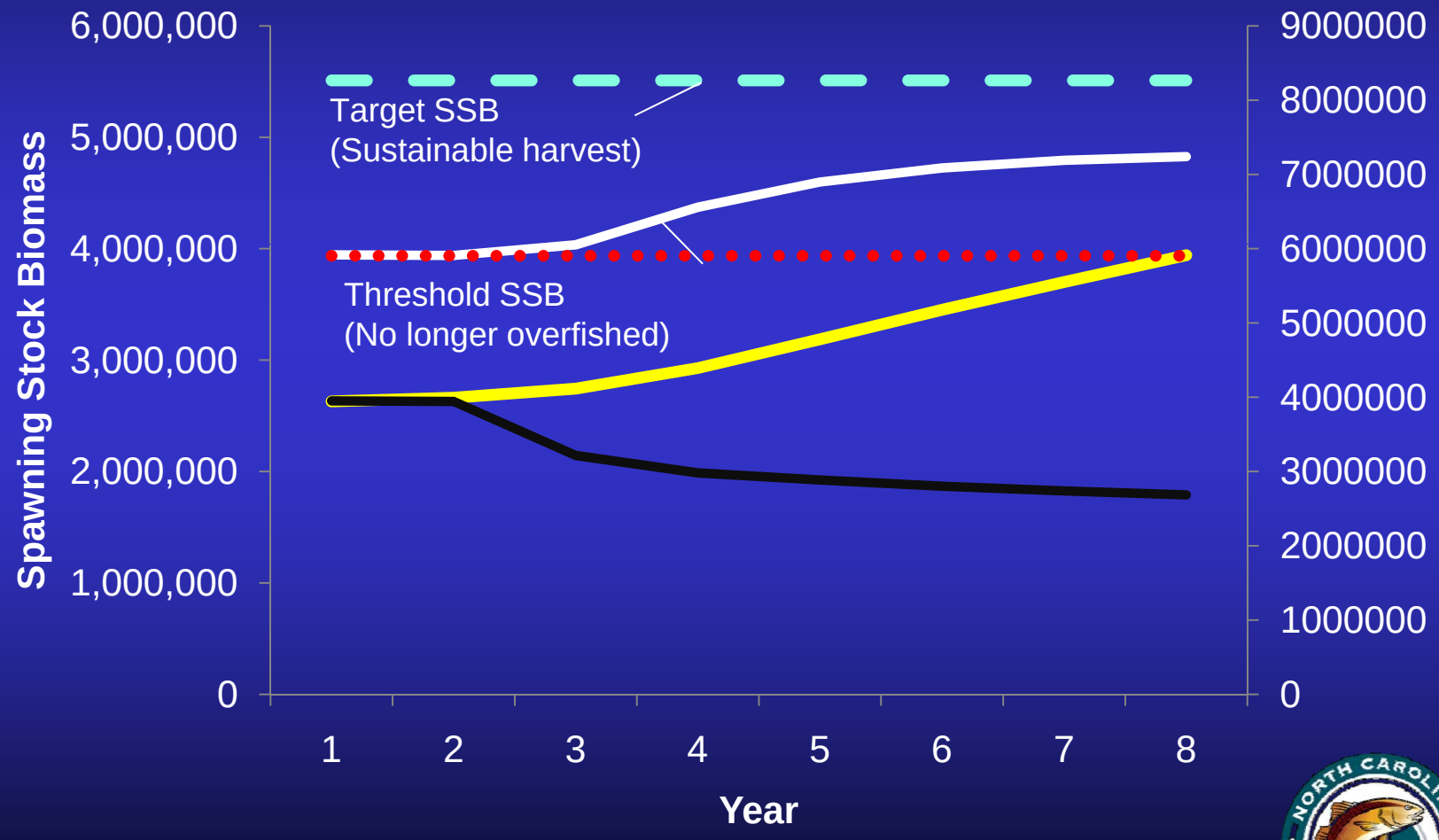
$1,000 Principal (SSB)	5% Interest (F)	$50 Earnings (Sustainable Harvest)
$800 Principal (Red Tide)	5% Interest	$40 Earnings
	$790 Principal	
$800 Principal	8% Interest F Rebuilding	$64 Earnings
	$814 Principal	

Projections Are Used To:

Estimate stock responses to management scenarios that end overfishing and rebuild the stock

Answer ‘what if’ questions

Projections



Uncertainty in Data Projections

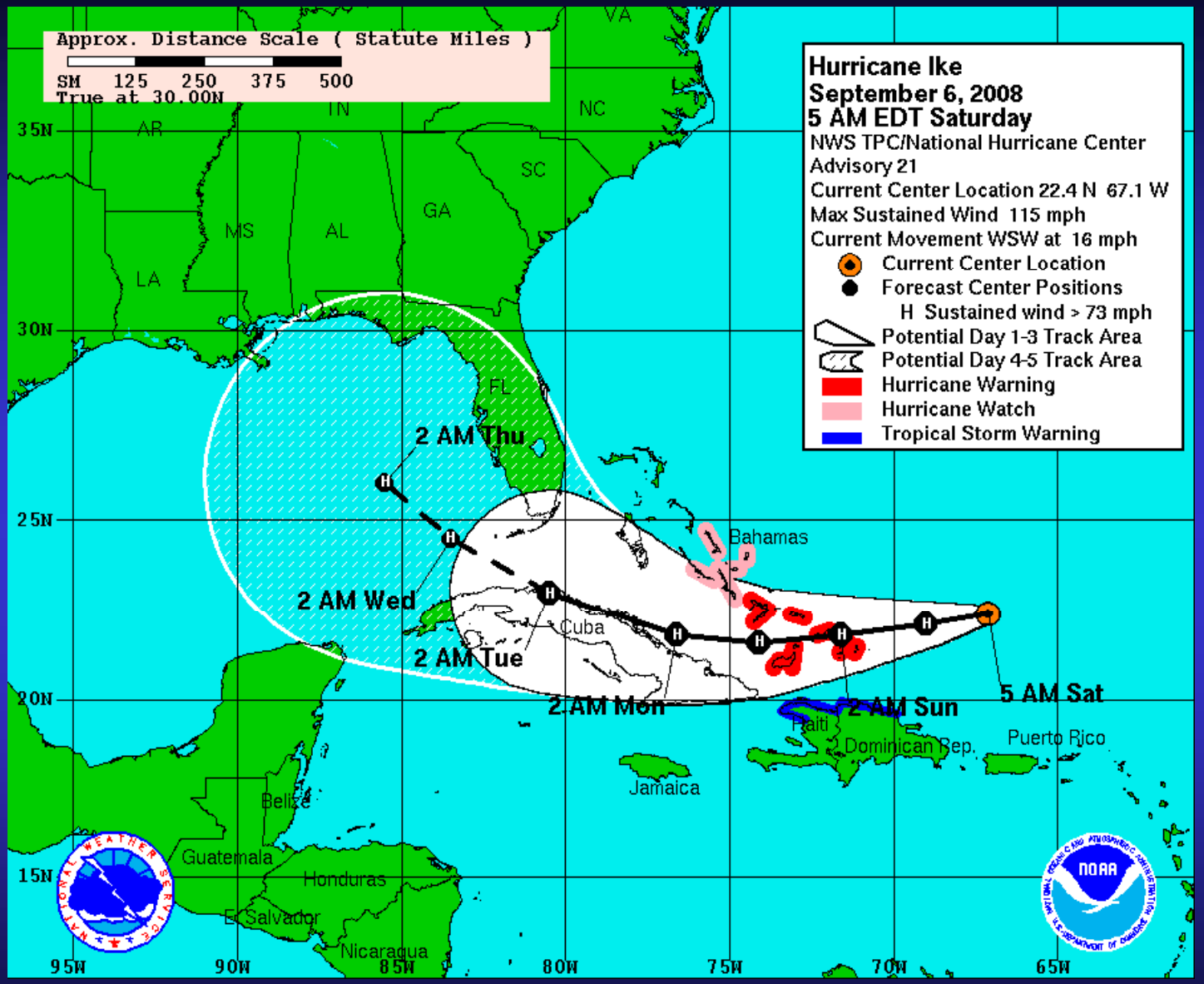
Arises from many sources

- Input data
- Model assumptions
- Environmental Influences
- Model Limitations

Uncertainty

Assessments and projections should show, as best they can, the levels of uncertainty in the results

Knowledge of this uncertainly helps managers make informed decisions


Approx. Distance Scale (Statute Miles)
SM 125 250 375 500
True at 30.00N
Hurricane Ike
September 6, 2008
5 AM EDT Saturday
NWS TPC/National Hurricane Center
Advisory 21
Current Center Location 22.4 N 67.1 W
Max Sustained Wind 115 mph
Current Movement WSW at 16 mph
Current Center Location
Forecast Center Positions
H Sustained wind > 73 mph
Potential Day 1-3 Track Area
Potential Day 4-5 Track Area
Hurricane Warning
Hurricane Watch
Tropical Storm Warning
2 AM Thu
2 AM Wed
2 AM Tue
2 AM Mon
2 AM Sun
5 AM Sat
Bahamas
Cuba
Haiti
Dominican Rep.
Puerto Rico
Jamaica
Belize
Guatemala
Honduras
El Salvador
Nicaragua
VA
NC
TN
AR
SC
GA
MS
AL
LA
FL
35N
30N
25N
20N
15N
95W
90W
85W
80W
75W
70W
65W
NOAA