# **SEDAR 63: Gulf Menhaden**



**NOAA** FISHERIES Fishery–Dependent Data Collection at the NMFS Beaufort Laboratory



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SEDAR 63 Review Workshop – November 6, 2018

### Fishery-Dependent Data for the Gulf Menhaden Fishery

Maintained at the NMFS Beaufort Lab in *three large data files*:

- 1. <u>Catch Records</u>: Landings and nominal fishing effort
- 2. <u>Port Samples</u>: Size and age composition of the catch
- 3. <u>Captain's Daily Fishing Reports (CDFRs, or logbooks):</u> Itemize set location, catch, distance from shore, etc for each purse-seine set



#### Catch Records: Catch/Effort Data

- Since 1964, the gulf menhaden fishery has reported their daily vessel unload values (= landings), usually on a monthly basis
- In 1960s, industry allowed NMFS biologists access to company records - back to the 1940s
  - able to re-construct monthly/total landings and fishing effort back to 1948
- Daily vessel unloads are in "thousands of standard fish"
  - by convention, 1,000 std fish = 670 lbs
  - converted to metric tons (x 0.3039)
- In recent years, vessel unloads are reported to the NMFS daily or weekly via spreadsheet attachment to email



#### Landings reported to the NMFS

- Landings are daily vessel unloads, and in thousands of standard fish
- One hopper dump (22,000 cu. in.) = 1,000 std fish
- One standard fish = 2/3 lb
- One hopper dump = 670 lb or 0.3039 mt
  - J. Kutkuhn ms (1966)











Month: July ORD OF DAILY MENHADEN PURSE SE CATCH 1 of 2 RINGEDST Year: Location VESSEL NUMBER Aggregate from Previous 73,352 Months VESSEL NAME Daily Aggre-Plant gate Total Total Date 567 737 486 470 402 438 4,861 78,213 2. 3. 4. 5. 290 771 636 383 3,262 81,475 6. 7. 8. 9. 10. 644 1,526 85, 317 212 3842 87 039 95,782 420 600 1.722 1,615 1.771 250 н 1454 Ы 1,283 1 101 8.743  $\frac{11}{12}$ . 76 192 186 543 96,325 498 1.265 1.428 7,106 937 103.431 14. 263 358 104.368 20 271 222 342 370 222 2,886 107.254 16. 17. 18. 19. 20. 21. 22. 306 610 748 385 1,312 2,864 110,118 4,944 375 318 390 115, do2 529 375 115.437 23.24.25.26.27.28.29.30. 472 421 302 238 246 344 3.129 118,566 440 631 744 3,542 122,108 470 1,128 295 216 602 409 3.670 31. 3,172 Month 4,037 5,345 6,730 7,785 6,331 52,426 Total 13,576 14,570 8,822 16,244 Season 9,868 14,066 125,778 Total

Hand-copied from plant records/ledgers

Key-entered into NMFS Beaufort 'Catch Records' data base



Older catch

records,

~1964-2005

# Company catch records since ~2005 via daily spreadsheets





#### **Total Reduction Fishery Landings of Gulf Menhaden**

- Catch records summed across all plant-months to get:
  - Total gulf menhaden landings for the fishing season





#### Landings in the Gulf Menhaden Fishery, 1955-2017





### Nominal or Observed Fishing Effort

- Catch records do not list active fishing days
- Logbooks placed on gulf vessels in 1960s, but compliance incomplete
  - program discontinued in late 1960s, but revived in late 1970s as CDFRs
- Nicholson (1971) argued that a vessel-week on the Atlantic coast was satisfactory unit of nominal effort [1 vessel, fishing at least 1 day of a given wk]
- Chapoton (1971) noted that on the Gulf coast, fish catching ability was more related to size of the vessel and its fish hold capacity
  - thus, a vessel-ton-week became the preferred measure of nominal effort for the gulf menhaden fishery
    - = one vessel, fishing at least one day of a week, times its net tonnage



#### Catch and Nominal Effort for the Gulf Menhaden Fishery, 1948-2017



Figure 4.2 in Report



Gulf Menhaden reduction landings (1000mt) and nominal fishing effort (vtw), 1948-2017.





### The Port Samples: Size and Age Composition of the Catch







### Menhaden Sampling

- Two-stage cluster design:
  - <u>First-stage (vessels or sets)</u>: Vessels chosen at random
    - Top of fish hold assumed to be last set of the trip
    - Fishing location received from logbook or crew







- <u>Second-stage (fish from bucket or dip net)</u>: Originally, 20 fish randomly chosen from sample for size and age composition and processed for:
  - Fork length in mm
  - Weight in grams
  - and scales removed for ageing
- In 1972, sample size reduced to 10 fish
  - Within-sample variation smaller than among-sample













#### Methodology for estimating catch in numbers-at-age: <u>Merge</u> catch records with the port samples

- Used consistently over time (Nelson & Ahrenholz 1986; Vaughan 1987; Vaughan et al. 1996, 2000, 2007)
- Detailed sampling of landings allows biomass to be converted into catch in numbers-at-age
- For each *port/week*, port sampling provides estimate of mean weight and age distribution of fish caught
- Dividing total landings for given *port/week* by mean weight of sampled fish allows the numbers of fish landed to be estimated
  - Age proportion then allows numbers at age to be estimated
  - Sum across all *port/weeks* to get total numbers-at-age in total landings
- SAS statistical routine (BS003) re-written by D. Colby in late 1990s better accounts for <u>port/weeks</u> without samples
- Catch-at-age matrix developed at the *port/week* level provides for considerably greater precision than is typical for most assessments



#### Merge catch records (landings) with the port samples on a port/week basis

- Total landings for given *port/week* are divided by mean weight of sampled fish
  - Example:





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Sum across all *port/weeks* to get total numbers-at-age in total landings



• Proportion of catch for given area determined by locations of port samples and applied to landings





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  - Landings for *port/week/area* are divided by mean weight of sampled fish





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  - Landings for *port/week/area* are divided by mean weight of sampled fish
  - Numbers-at-age estimated for each area from port sample proportions





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• Sum across all port/week/areas to get total numbers-at-age in total landings



Total numbers Gulf Menhaden caught, 1964–2017



Gulf Menhaden Caught (in millions)



#### Total numbers of catch-at-age for gulf menhaden, 1964–2017







## **Captain's Daily Fishing Report**

- The Captain's Daily Fishing Report is a joint Industry, State, and Federal effort
  - Began in late 1970s
    - Updated to include latitude and longitude in 2009
  - Provides effort data for:
    - Fishery Management
    - Company Records
- From the CDFRs we get:
  - Effort estimates (including days not fished)
    - Days fishing
    - Days not fishing (traveling, maintenance)
    - Number, duration, and catch of sets
      - Distance from shore
    - Use (or not) of spotter pilot
    - Environmental variables (air temperature, wind speed and direction, cloud cover)



### **Captain's Daily Fishing Report Timeline**

- CDFR existed as paper files until ~1992
  - Not used as extensively as today, not routinely key-entered
- In 1992, NMFS Beaufort began saving Gulf CDFRs as dBase files
- In about 1999, collaborated with GSMFC to enter pre-1992 CDFR data sets
  - Available electronically to 1983
  - Available on DVD from 1979
- In 2009, NMFS Beaufort altered forms to use an optical scanner
- CHANGE: GPS locations of sets recorded from approximately 2004



### **Captain's Daily Fishing Report: Old**

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### **Captain's Daily Fishing Report: Current**

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#### Alternate Estimates of Nominal Fishing Effort

- Traditional: Vessel-ton-weeks (VTW)
- From Catch Records: Number of successful fishing trips
- From CDFRs: Number of purse-seine sets





### **Comparison of Normalized Effort**



Figure 4.5 in Report



### **Comparison of Normalized CPUE**



Figure 4.6 in Report



### **Questions?**





#### Menhaden Sampling Time Line

- Samplers were temporary/seasonal *Federal* employees through ~1994
- ~1994 lost all temporary Federal positions NMFS-wide
- Since ~1995, company dockside employees at Louisiana fish factories solicited to acquire weekly samples noting <u>date</u>, <u>vessel</u>, <u>fishing location</u>; freeze samples in chest freezers
  - Target number of samples per week
  - Paid a nominal fee for their services
  - QA/QC: Date of sample checked against daily logbooks



Processing of Menhaden Samples from Louisiana Fish Factories

- ~1995-2003: GSMFC hired <u>independent contractors</u> to process samples from LA for size and age; forward data to NMFS Beaufort
- 2004 to present: GSMFC contracts <u>w/ LDWF</u> to process samples from Empire, Abbeville, and Cameron; forward data to NMFS Beaufort





Processing of Menhaden Samples From <u>Mississippi</u> Fish Factory

- 1995-2009, an employee of NMFS Pascagoula Lab acquired samples at fish factory in Moss Point, MS, and processed those samples; sent data to NMFS Beaufort
- In recent years, GSMFC has hired an independent contractor to process the samples and forward data to NMFS Beaufort.





Mean ne	t tonnage of the gulf n	nenhaden fleet by deca	de since 1970
Fishing	Mean net tonnage	No. of vessels in	Range of net
Year		calculation	tonnages
1970	248	72	80-386
1980	315	79	139-453
1990	317	75	147-447
2000	338	43	197-453
2010	361	32	293-453
2017	354	34	213-453

Table 4.10 in Report



#### Catch at Age 1964–2017



Figure 4.3 in Report

