

A Cost Efficiency Analysis for Catch Accounting in NE Groundfish

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NOAA / NEFSC / READ / SSB
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Why invest in catch accounting?

- 1 Ending overfishing (MSA 2007, NS1 guidelines)
- 2 Assessments rely on accurate catch
- 3 Triggering AM's and payback mechanisms only for those responsible
- 4 Functional markets for catch rights (ACE leasing)
 - Prices tell fisherman how and where to fish
 - High-grading and discarding mute price signals
 - Creates differential incentives for lessors (high lease prices) and lessees (low lease prices)

If F drives stock dynamics, and we don't account accurately for removals, stocks assessments will degrade and stocks will fail to rebuild

Three margins for catch accounting:

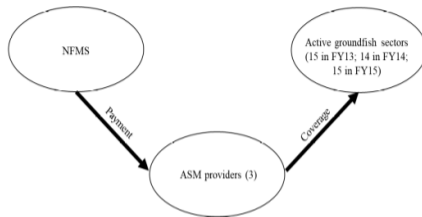
- 1 Landings
- 2 Discards
- 3 Harvest stock area

Data Source	Fishing information provided						Biological info	
	Gear	Fishing Location	Kept Catch		Discard			
			quantity	species	quantity	species	quantity	species
At Sea Monitors (ASM) Northeast Fisheries Observer Program (NEFOP)	I	I	I	I	I	I		
Dealer Reports (Electronic) Vessel Trip Reports (eVTR/VTR)	I	I	I	I	I	I	S	S
Vessel Monitoring System (VMS)	S	S	S	S	S	S		
	S	I*						

ASM Costs

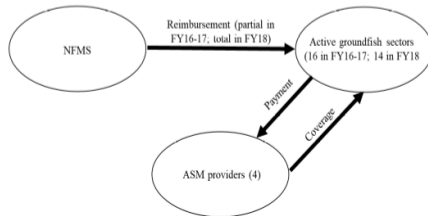
A

Sept. 2013 – Feb. 2016



B

Mar. 2016 – Aug. 2018



ASM costs are estimated by Ardini et al (2019)

- Compares actual provider payments under NMFS (gov't) contracts to the rates in sector-negotiated (private) contracts
- Finds that costs are roughly equivalent for gillnet vessels and small trawlers, but are 20% lower under private contracts for large trawlers
- Cost savings driven almost exclusively by contract efficiencies for multi-day trips

Vessel Type	# Single Day Trips	# Multi Day Trips	% Multi Day Trips	Sector Contracts At-Sea Cost	NMFS Contracts At-Sea Cost	Cost Reduction Under Sector Contracts
Gillnet	1453	209	12.58%	1.09	1.12	2.79%
Large Trawl	249	1000	80.06%	3.44	4.23	18.54%
Small Trawl	945	116	10.93%	0.65	0.65	0.97%

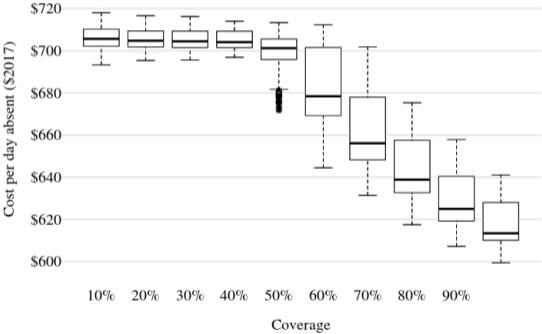
Table 1: At-sea and total cost rates (2017 USD) under NMFS contracts and sector contracts, applied to fishing years 2013-2018, through August 2018.

		Average At-Sea Cost	Average Total Cost
Cost per observed seaday (observed seadays=8918)	NMFS contracts	685	856
	<i>FY16 contracts</i>	579	599
	<i>FY17 contracts</i>	602	623
	<i>FY18 contracts</i>	593	615
	Avg. FY16-18	592	612
Cost per observed day absent (observed day absent=7743)	NMFS contracts	789	986
	<i>FY16 contracts</i>	667	690
	<i>FY17 contracts</i>	694	718
	<i>FY18 contracts</i>	683	709
	Avg. FY16-18	681	705
Cost per total day absent (total days absent=66,626)	NMFS contracts	92	115
	<i>FY16 contracts</i>	78	80
	<i>FY17 contracts</i>	81	83
	<i>FY18 contracts</i>	79	82
	Avg. FY16-18	79	82

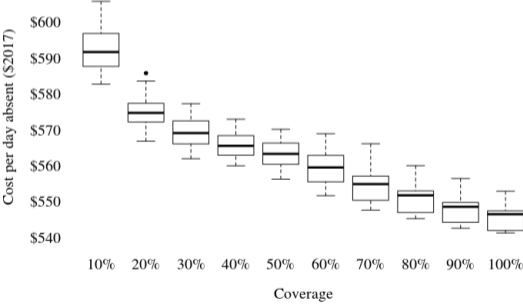
Note: Cost per observed seaday is based on the billing schedule for seadays paid by NMFS (quarter days).

ASM costs are modeled as a function of contract rates, with adjustments for the number of observers needed.

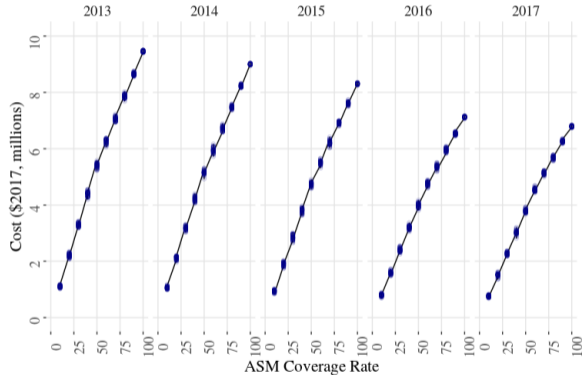
Updated version



Old version



<i>Coverage rate</i>	2013	2014	2015	2016	2017
10	1.1	1.1	1.0	0.8	0.8
20	2.2	2.1	1.9	1.6	1.5
30	3.4	3.2	2.9	2.4	2.3
40	4.5	4.3	3.9	3.2	3.1
50	5.5	5.2	4.8	4.1	3.9
60	6.3	6.0	5.6	4.8	4.6
70	7.1	6.8	6.3	5.4	5.2
80	7.9	7.6	7.0	6.0	5.8
90	8.8	8.3	7.7	6.6	6.3
100	9.6	9.1	8.4	7.2	6.9



Length class	Coverage rate	2013	2014	2015	2016	2017
>=30', <50'	10	2.4	2.1	2.1	1.6	1.8
	20	4.8	4.2	4.2	3.2	3.7
	30	7.2	6.2	6.4	4.8	5.5
	40	9.6	8.3	8.5	6.4	7.3
	50	11.8	10.2	10.6	8.1	9.1
	60	13.6	11.7	12.3	9.6	10.9
	70	15.4	13.2	13.8	10.8	12.4
	80	17.1	14.7	15.3	11.9	13.7
	90	18.8	16.2	16.9	13.1	15.0
	100	20.5	17.7	18.4	14.3	16.3
>=50', <75'	10	5.0	5.0	4.4	3.7	4.1
	20	10.0	10.0	8.9	7.4	8.2
	30	15.0	15.0	13.3	11.2	12.3
	40	20.0	20.0	17.7	14.9	16.4
	50	24.7	24.4	22.1	18.6	20.5
	60	28.4	28.0	25.6	22.1	24.6
	70	32.0	31.7	29.0	24.9	27.9
	80	35.6	35.3	32.1	27.5	30.7
	90	39.2	38.8	35.4	30.3	33.8
	100	42.8	42.4	38.5	33.0	36.6
>=75'	10	9.7	10.2	9.7	9.0	8.1
	20	19.5	20.3	19.4	18.0	16.2
	30	29.2	30.5	29.2	27.0	24.3
	40	38.9	40.7	38.9	36.0	32.4
	50	48.0	49.7	48.6	45.0	40.5
	60	55.2	57.2	56.3	53.4	48.5
	70	62.3	64.6	63.6	60.2	55.0
	80	69.2	71.9	70.5	66.7	60.6
	90	76.3	79.2	77.7	73.3	66.7
	100	83.2	86.5	84.6	79.8	72.2

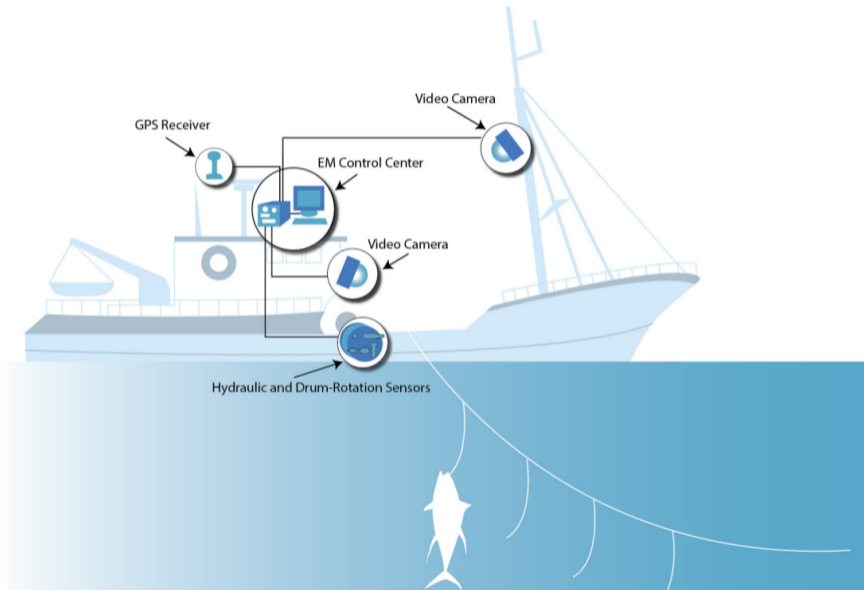
NEFOP isn't going away, "comprehensive monitoring" assumes 91% ASM

	2013	2014	2015	2016	2017
91% coverage	8.84	8.4	7.78	6.68	6.39

Further, single-observer ASM not comprehensive on multi-day trips

Fishing Year	% hauls unobserved on single day trips	% hauls unobserved on multi day trips
2010	2%	14%
2011	2%	14%
2012	1%	13%
2013	2%	14%
2014	1%	15%
2015	2%	14%
2016	1%	16%
2017	1%	15%
2018	2%	20%

EM Costs



Estimates a sum of component costs

- Equipment
- Field services
- Video review
- Data storage

Derived from conversations with four service providers, pilot project data, and a detailed survey

Each aspect modeled separately

- Using provider responses
- Mix-and-match to preserve anonymity
- Actual cost variability may be lost, as EM is a 'package' and providers may optimize around different components
- Other than video review, cost estimates are likely too precise

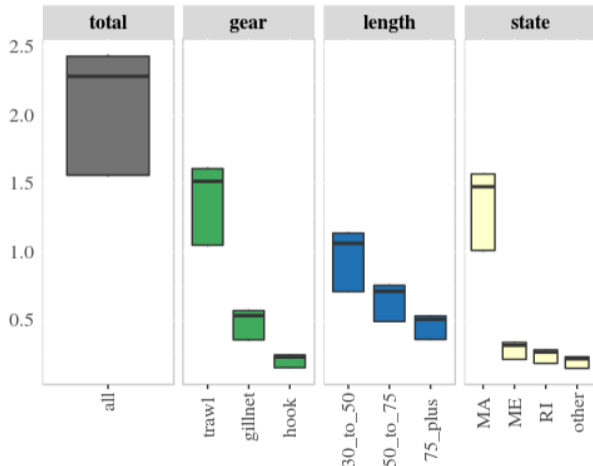
Work began in 2016, costs may be different today

Equipment

Cost is sum of:

- Systems included
 - Three cameras
 - Control box
 - User interface
 - GPS
 - Hydraulic pressure transducer
 - Drum rotation sensor
- Additional cameras
 - three assumed
 - four required on vessels < 40'
- Software
- Spare parts
- Three hard drives
- Other costs

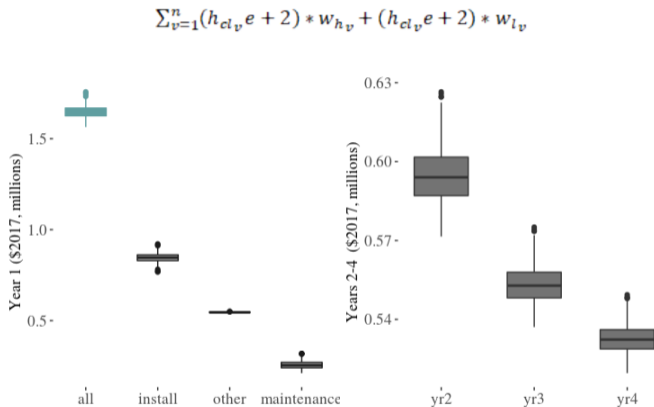
$$\sum_{v=1}^n (SC_v + nC_{lg_v} + S_v + Sp_{l_v} + Hd_v + O_v)$$



Field Services

Cost estimated separately for year one and subsequent years:

- Year 1
 - Installation
 - labor + travel
 - two technicians
 - Maintenance
 - Visits every 7th trip
 - Four hours each visit
 - Various travel assumptions
- Subsequent years
 - Maintenance (as above)
 - Other (phone service, etc)



Video Review

Cost is function of:

- Amount of video needing review
- Relationship between video time and review time
- Steaming review vs. fishing review
- Nature of review itself

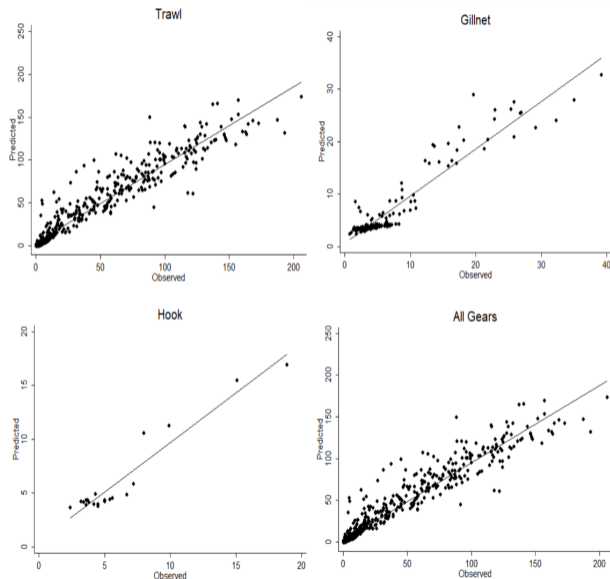
Program design	Discard data source	Disadvantages	Advantages
Census	EM footage	high footage review time specific catch handling protocols	high data quality
Audit	logbook	specific catch handling protocols	lower footage review time fishermen participation in data incentives for catch handling
Compliance	EM footage (presence/absence only)	no discard quantity/composition information	lower footage review time normal catch handling protocols

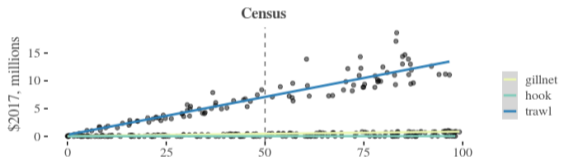
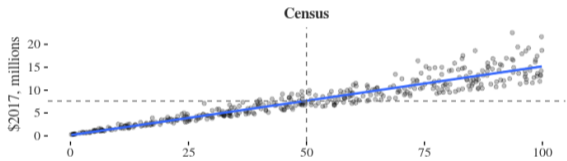
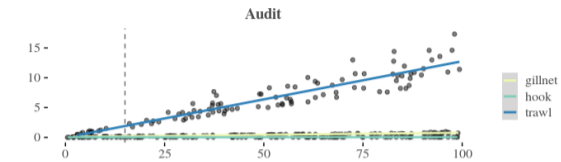
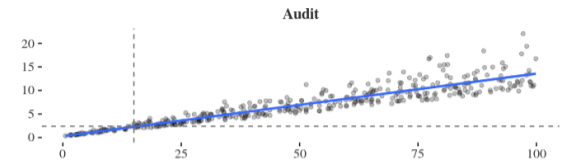
Video Review (con't)

$$\sum_{g=1}^3 \sum_{t=1}^n (R_{S_{gt}} * Td_{gt} + R_{f_{gt}} * Fd_{gt} + P_{gt}) * L_{gt}$$

- Review ratio for transit time
- Transit duration (hours)
- Fishing duration (hours)

*Estimated uniquely for vessel size,
gear type and EM program*





Data Storage

Cost is function of of:

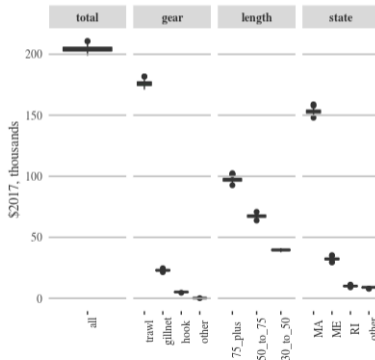
- Resolution
- Frame rate
- Bit rate
- Image itself (multifaceted images create more data)

Additional considerations:

- What qualifies as data?
- Will all footage need to be retained and stored?
- For how long? Is video footage a federal record (retained for seven years)?
- How often do data need to be accessed or stored?

Cost modeled as: $S + P + G + A$, where

- Storage cost
- Put fee (sending data)
- Get fee (retrieving data)
- Marginal fee per unit accessed



AUDIT MODEL

Year	Equipment Costs	Field Costs	Review Costs	Storage Costs	Total
1	2.09	1.65	2.33	0.21	6.28
2	0	0.60	2.13	0.21	2.93
3	0	0.55	2.06	0.20	2.82
4	0	0.53	2.03	0.20	2.76
5	0	0.53	1.95	0.20	2.68
<i>Mean</i>	<i>0.42</i>	<i>0.77</i>	<i>2.10</i>	<i>0.20</i>	<i>3.49</i>

CENSUS MODEL

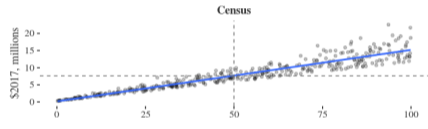
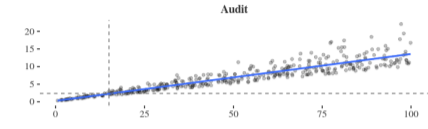
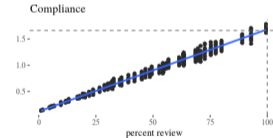
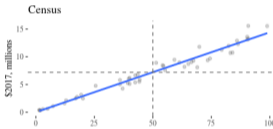
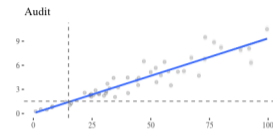
Year	Equipment Costs	Field Costs	Review Costs	Storage Costs	Total
1	2.09	1.65	8.04	0.21	11.99
2	0	0.60	7.25	0.21	8.05
3	0	0.55	7.01	0.20	7.76
4	0	0.53	6.87	0.20	7.61
5	0	0.53	6.70	0.20	7.43
<i>Mean</i>	<i>0.42</i>	<i>0.77</i>	<i>7.17</i>	<i>0.20</i>	<i>8.57</i>

COMPLIANCE MODEL

Year	Equipment Costs	Field Costs	Review Costs	Storage Costs	Total
1	2.09	1.65	3.92	0.21	7.87
2	0	0.60	3.69	0.21	4.49
3	0	0.55	3.60	0.20	4.36
4	0	0.53	3.54	0.20	4.28
5	0	0.53	3.48	0.20	4.21
<i>Mean</i>	<i>0.42</i>	<i>0.77</i>	<i>3.65</i>	<i>0.20</i>	<i>5.04</i>

Summary of changes since previous version:

- ASM problem, as previously noted
- Review time estimates had several coding problems
- Field and Storage costs were not inflation-adjusted (\$2017)
- Summary tables (now Table 14) did not accurately reflect figures
- Continued cleaning up text



Questions?