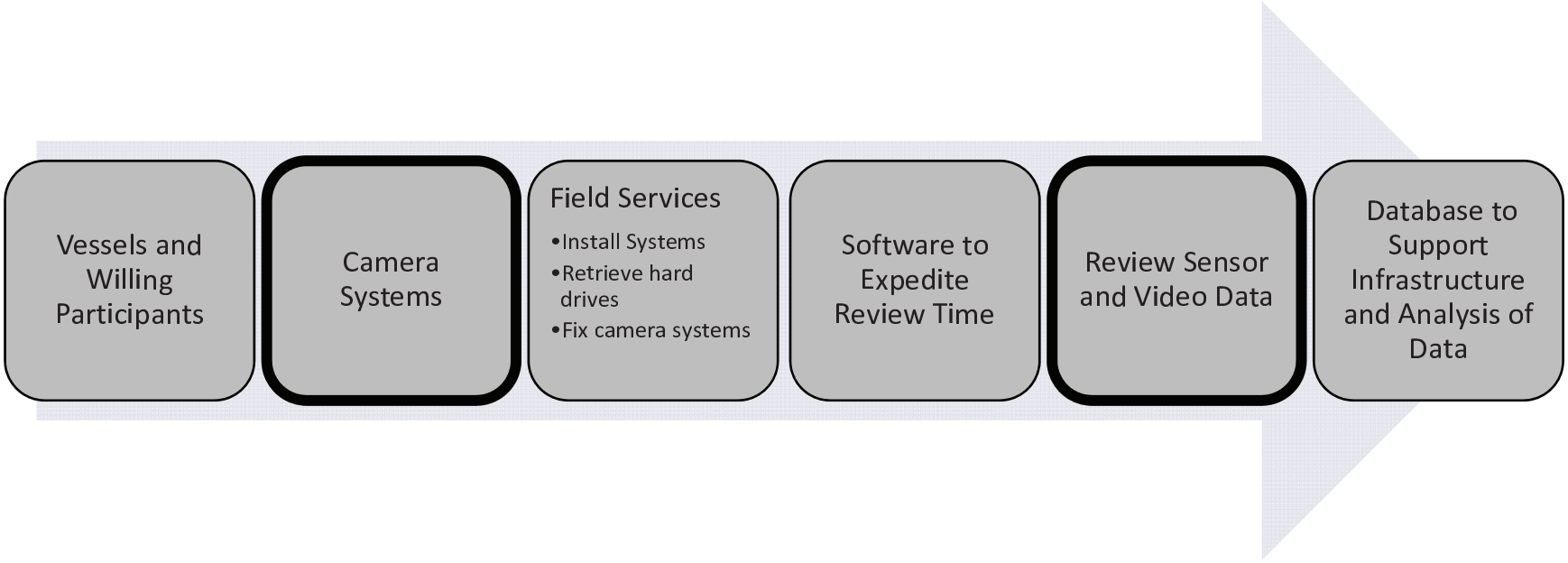
Electronic Monitoring Field Program

Pacific States Marine Fisheries Commission

Pacific Fisheries Management Council

April 5th, 2014

Moving parts of an EM Program



Basic design features

- All participants were volunteer vessels
- All trips had an observer onboard
- All observers conducted science sampling tasks as well as IFQ species compliance monitoring
  - Compliance monitoring: estimating the at-sea discards of vessels for the purposes of effectively debiting quota accounts throughout the fishing season

Working Definitions

Catch:

- Anything that we see that breaks the surface, excluding sea birds and marine mammals that are swimming freely alongside the vessel
- If we see it, we count it

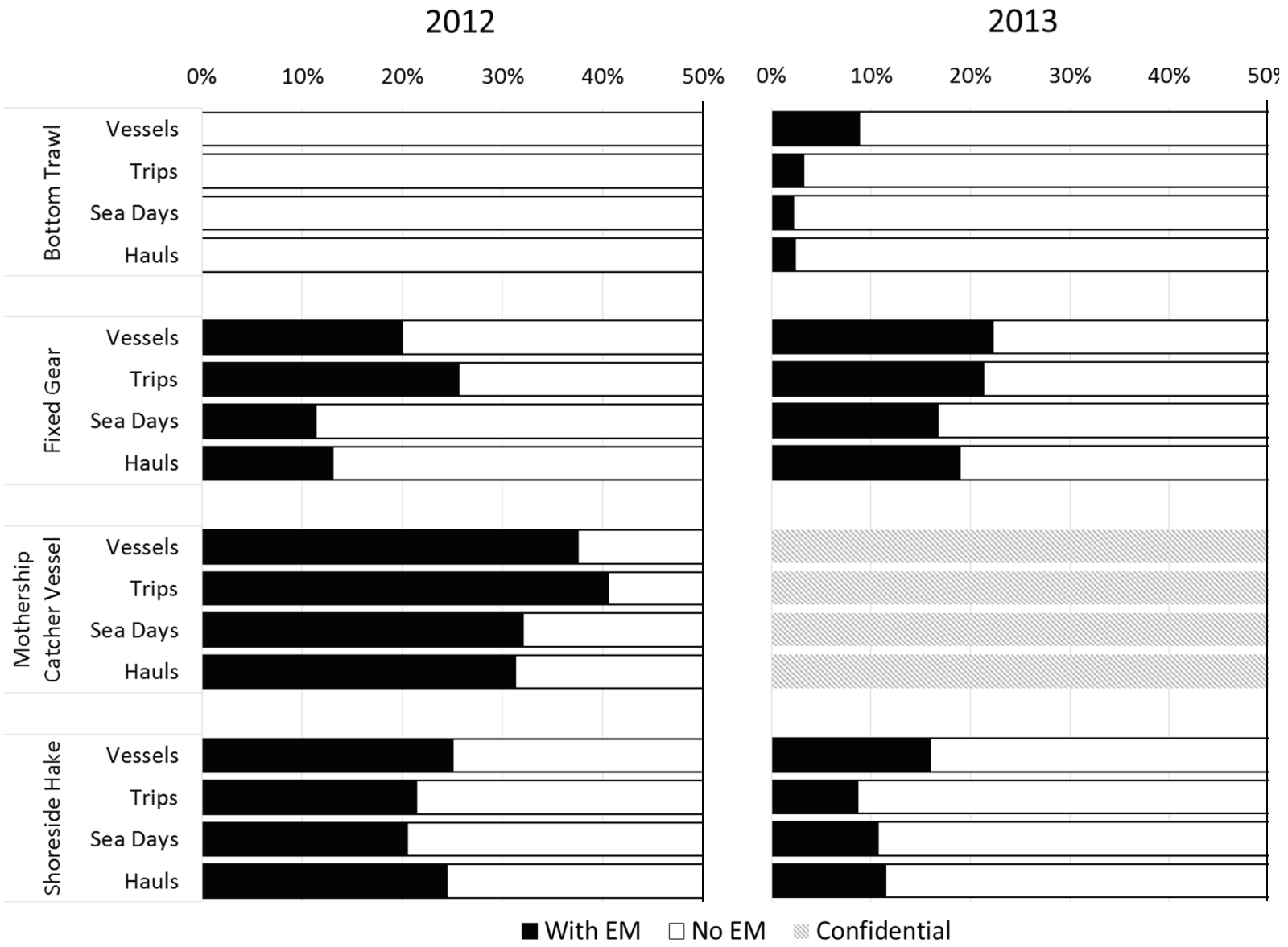
Retained:

- Catch that is kept on the vessel

Discard:

- Catch that is not kept on the vessel
- Discard includes marine organisms that wash out of the net before the net comes onboard the vessel, that fall off or out of fishing gear before it makes it on the vessel, or are free floating on the surface

Proportion of Fleet with EM Coverage



Two camera providers

ARCHIPELAGO
MARINE RESEARCH

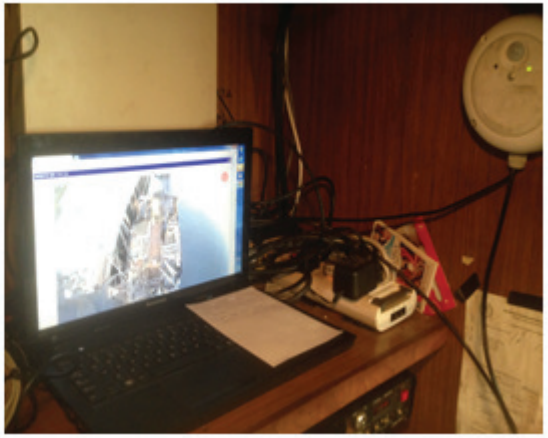
Saltwater Inc.

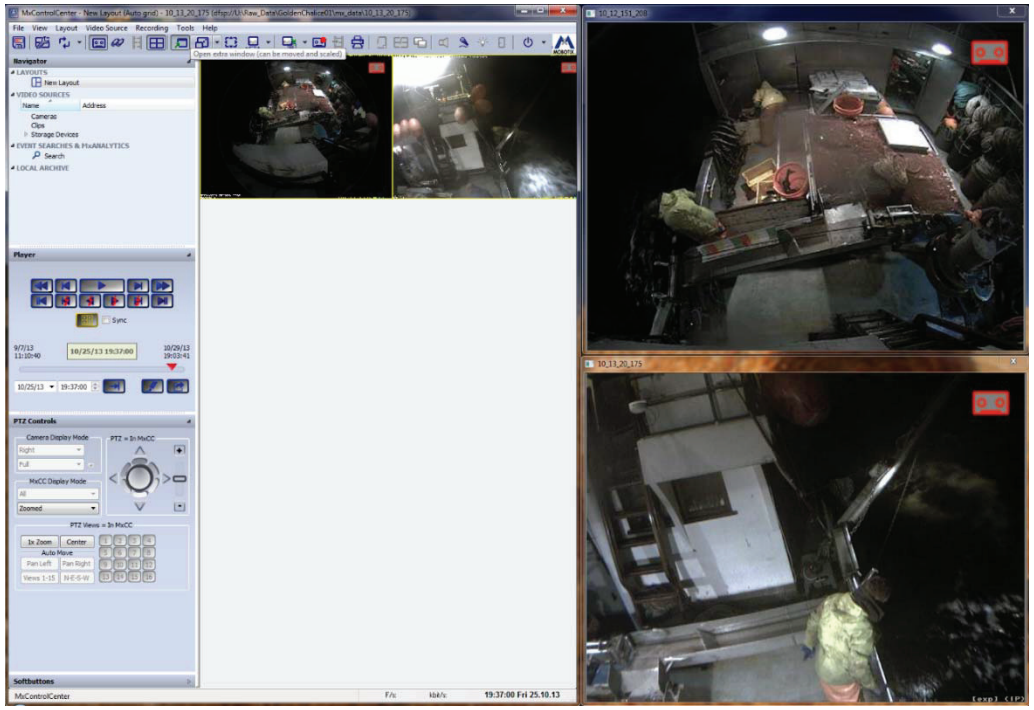
Saltwater Inc.'s Camera System

EMS Camera, GPS and Motion Sensor (2 per vessel)

Hydraulic Pressure Transducer

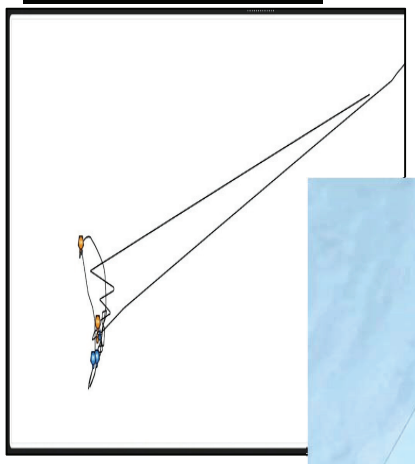
Control Point/User Interface





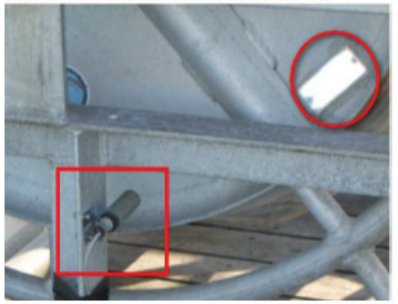
Archipelago Marine Research's Camera System

ARCHIPELAGO MARINE RESEARCH



GPS Receiver

Winch/Drum Rotation Sensor

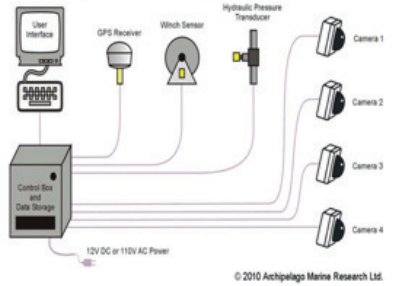


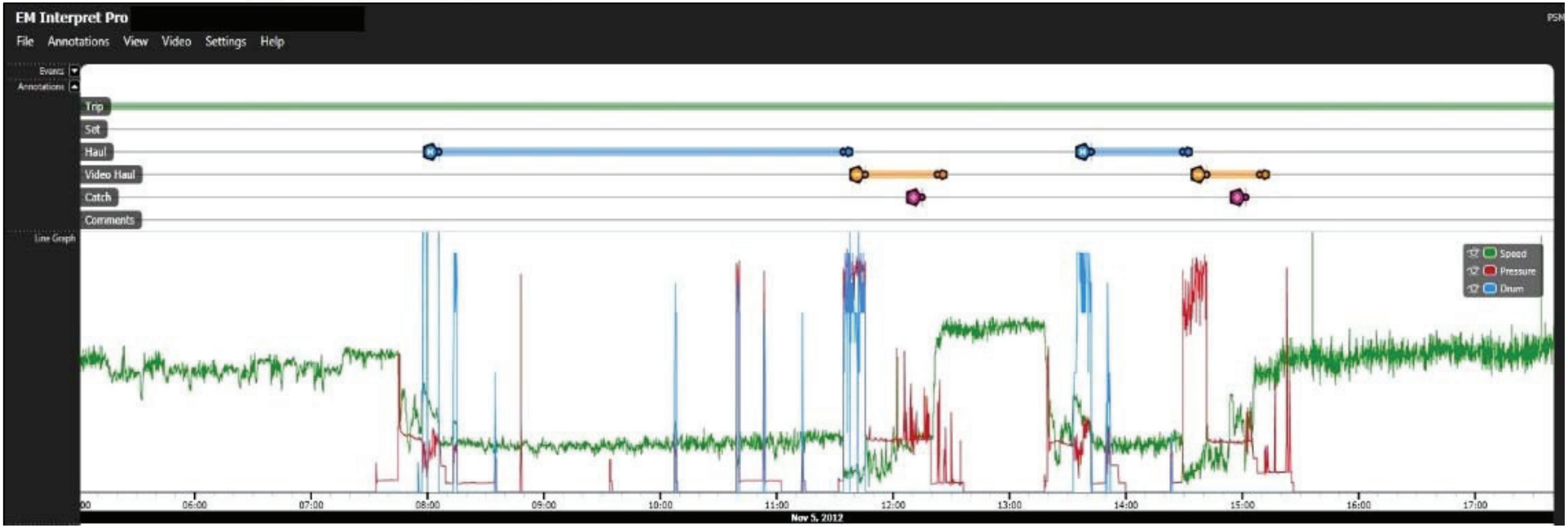
Control Box/User Interface

EMS Camera (3-4 per vessel)

Hydraulic Pressure Transducer

EMS System Components





Demonstration of AMR and Saltwater Software

Saltwater Video

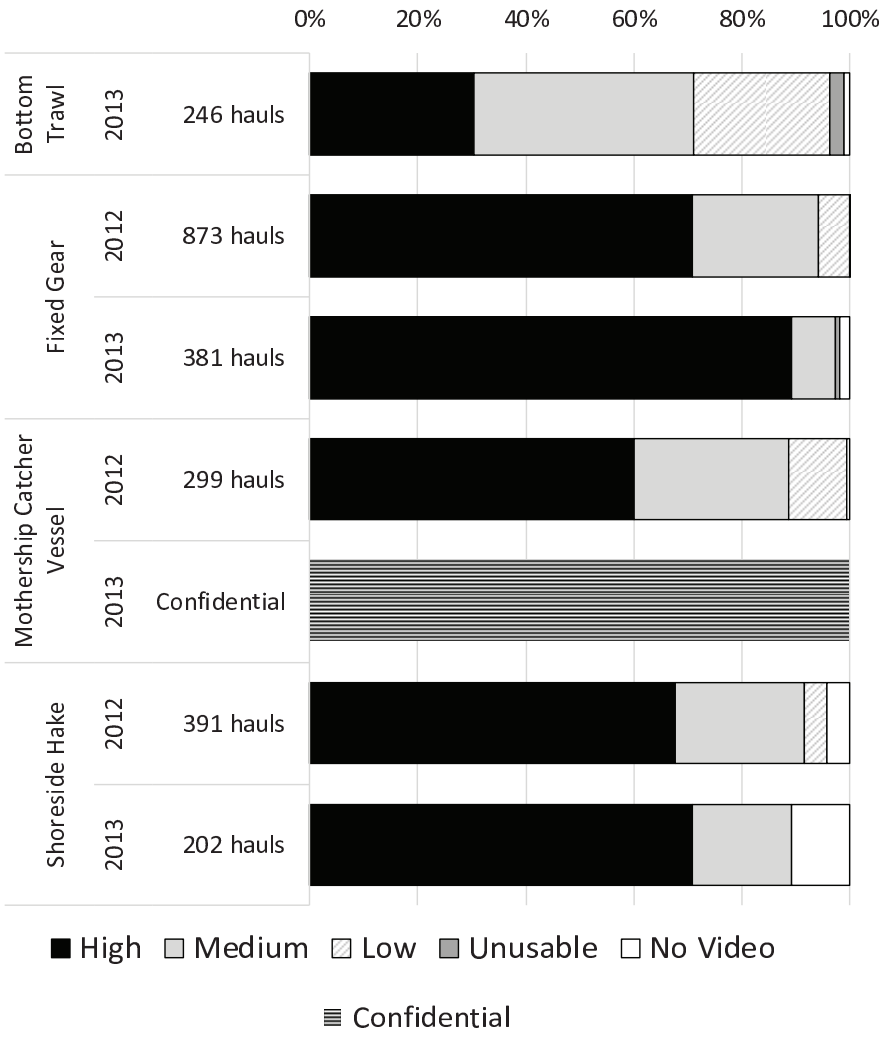
Archipelago Video

Confidence in Data from Video

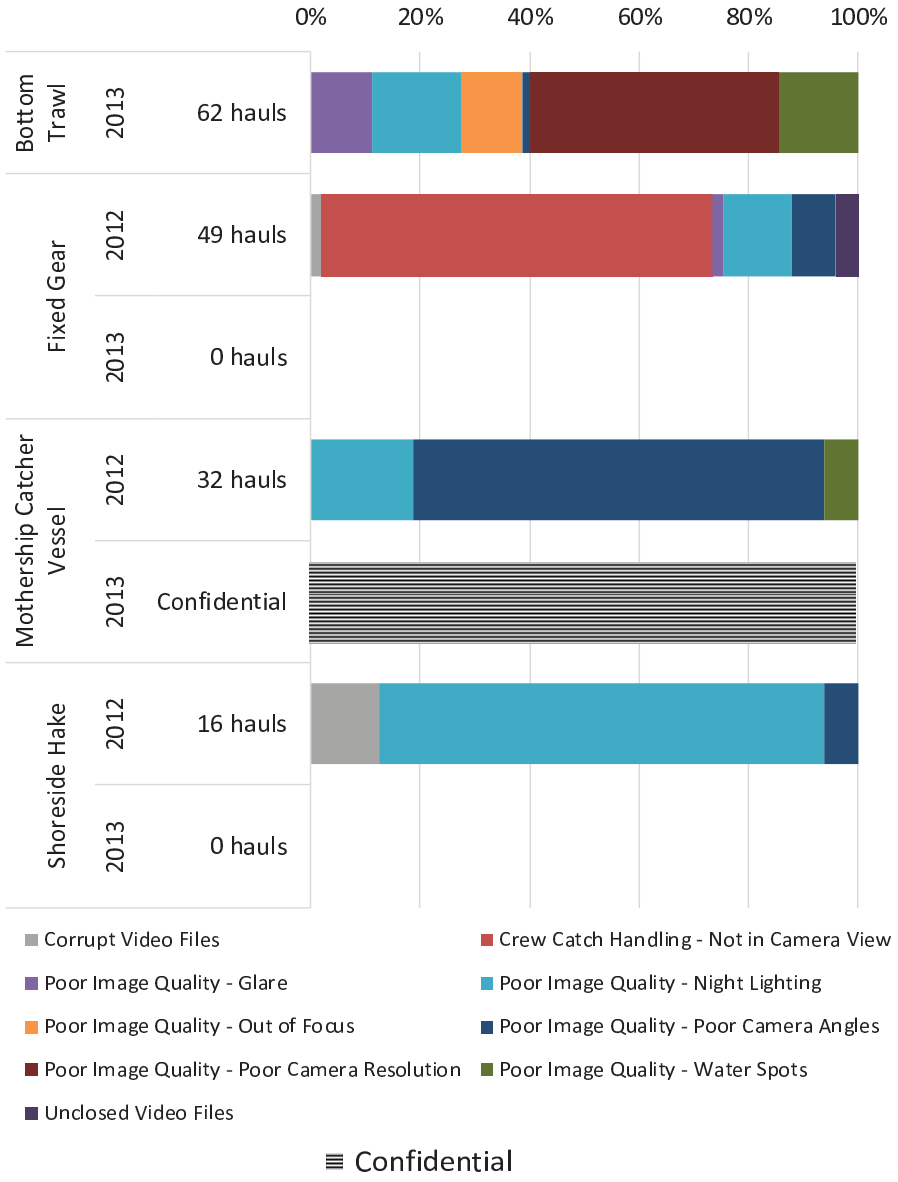
- Can be:
  - High
  - Medium
  - Low or
  - Unusable
- Qualitative measures

It is not the quality of the video – it is the confidence in the data that is captured from the video

Proportion of Hauls: Confidence in Data from Video

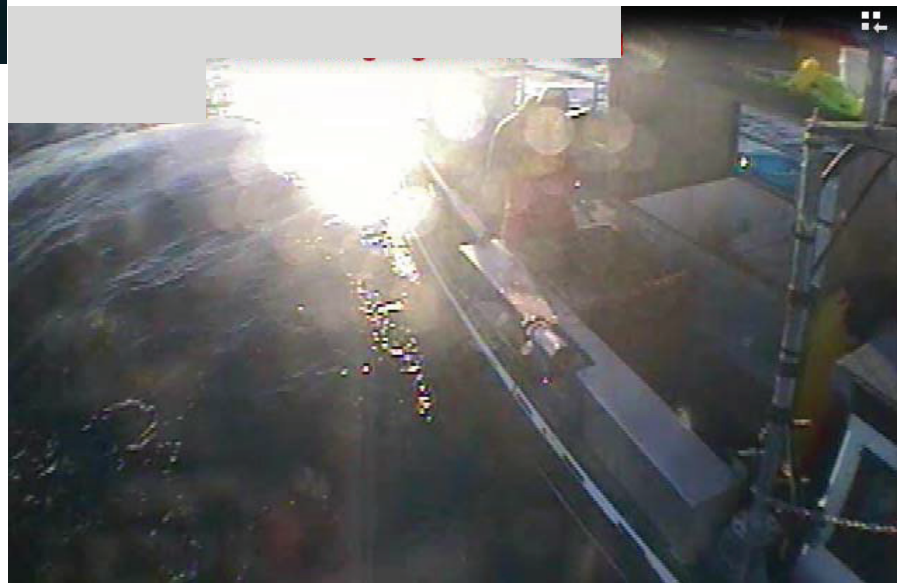


Reason for Low Confidence in Data from Video



Glare

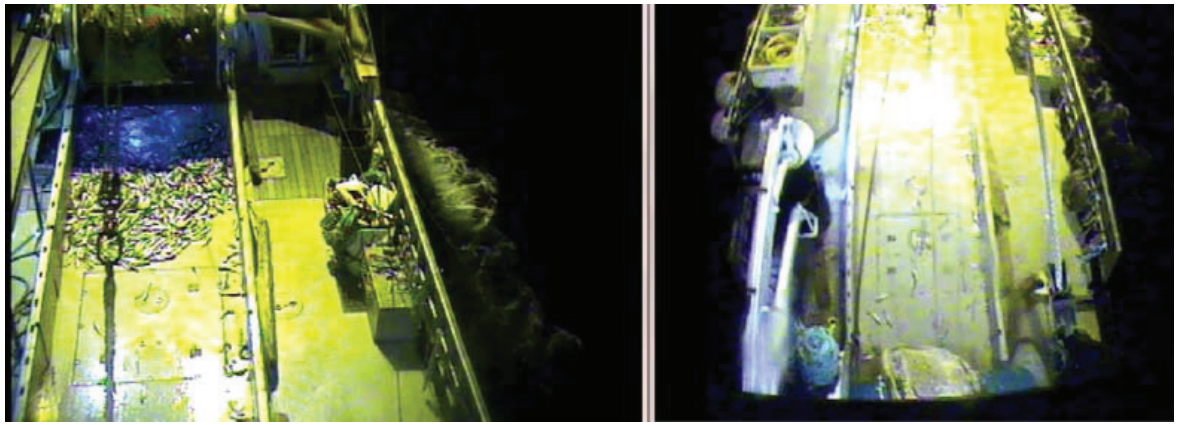
Bottom Trawl Video



Night Lighting

Bottom Trawl Video

MSCV Video



Water Spots

Bottom Trawl Video

MSCV Video (Water spots and Night lighting)

Shoreside Hake Video (Water spots and Night lighting)

Alternatives

1 - Status Quo: Human Observers Estimate Discard
2 - Camera Recordings Used to Estimate Discard (Video is data source)
3 - Logbooks Use to Estimate Discard, with Camera Audits

<u>Alternatives 2 and 3</u>

- Can't speak to effectiveness yet of logbook auditing (Alternative 3)
- Has been used in the BC fishery effectively

The advantages of an audit over a census approach to the review of video imagery in fishery monitoring

Richard D. Stanley[1]*, Howard McElderry[2], Tameezan Mawani[3], and John Koolman[4]

Stanley, R. D., McElderry, H., Mawani, T., and Koolman, J. The advantages of an audit over a census approach to the review of video imagery in fishery monitoring. – ICES Journal of Marine Science, doi:10.1093/icesjms/fsr058.

Received 18 October 2010; accepted 10 March 2011

- Logbooks are being collected – future analysis to come.

- Program currently working under Alternative 2 – 100% video review

Alternatives 2 and 3
Component: Discard Requirements

All Options

- Allow selective discard of trash, mud, coral, etc.
- Require selective discards of prohibited species (except whiting trips);
- Require selective discards of ESA and MMPA species (i.e., protected species).
- Non-selective discard for e.g., safety, "bleeding net", zipper accidentally opened, fish came off hook, gilled in net

Note: Different options may be selected for different sectors & gears.

Option A: Maximized Retention

- No selective discard for catch share species, non-catch share groundfish species
- No selective discard for non-groundfish species

Option B: Optimize Retention of Catch Share Species - Limited Discards.

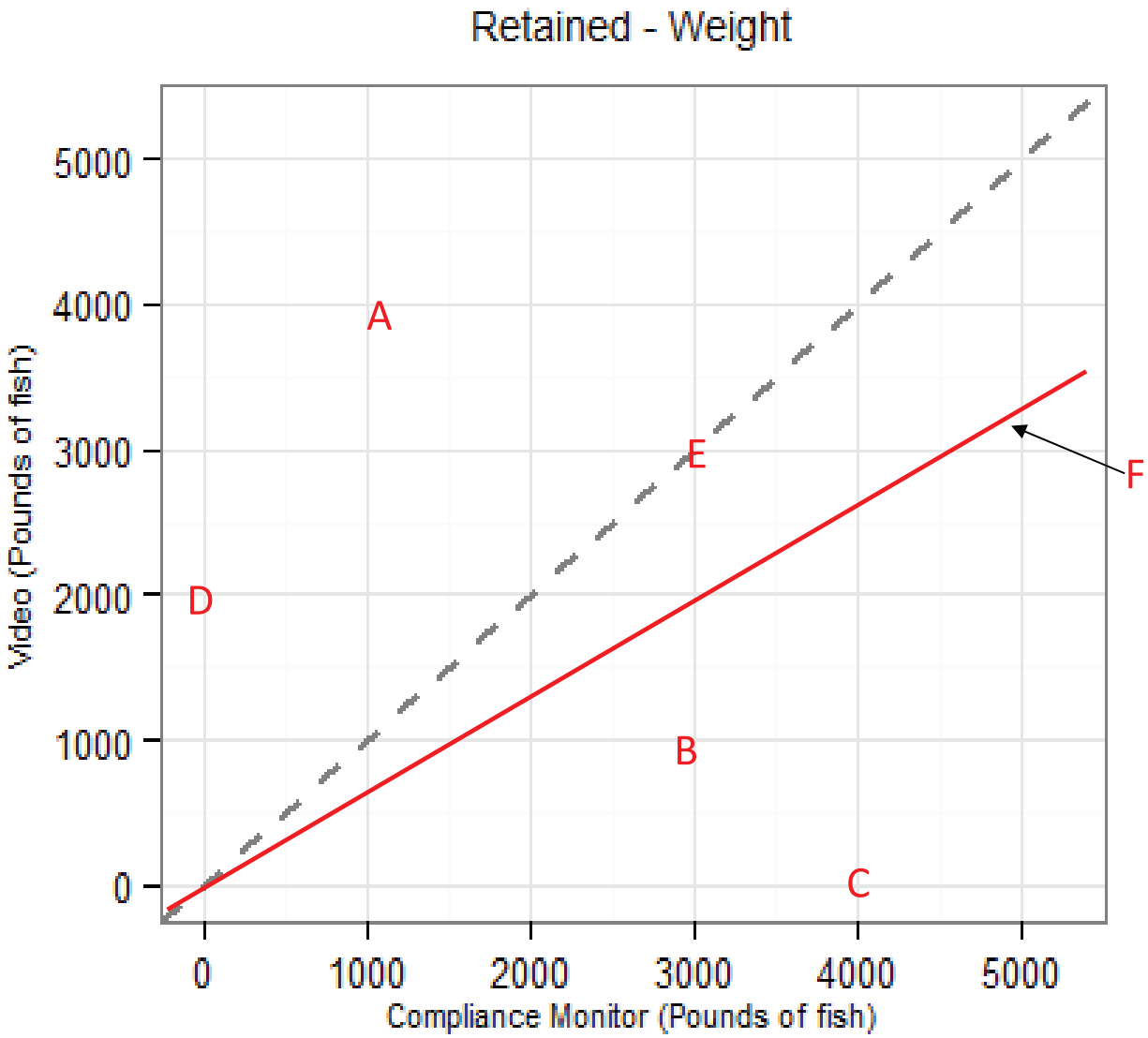
- Discard sub options are not mutually exclusive; **all species approved for discard would need to be verifiable with cameras**
    - Subopt 1: flatfish
    - Subopt 2: lingcod & sablefish
    - Subopt 3: non-rockfish groundfish
    - Subopt 4: spp verifiable with cameras
    - Subopt 5: all nongroundfish spp

Option C: Discard at will (status quo)

Shoreside Hake

- Option B & C (Selective discarding) aren't applicable
  - Fishery currently working under Option A (Maximized retention)
  - EM Data generally supports discard detection of larger discards (> 2,000 pounds)
- Discards are typically from the deck
- Could not speciate well enough to support any selective discarding (Options B or C) with current configuration


Data represented
Retained - Weight
EM on
Y axis
Axis limits always equal
(Graphs are square)
1:1 agreement line
(reference line)
Video (Pounds of fish)
Compliance Monitor (Pounds of fish)
0
1000
2000
3000
4000
5000


Retained - Weight
Video (Pounds of fish)
5000
4000
3000
2000
1000
0
A
E
F
D
B
C
0
1000
2000
3000
4000
5000
Compliance Monitor (Pounds of fish)

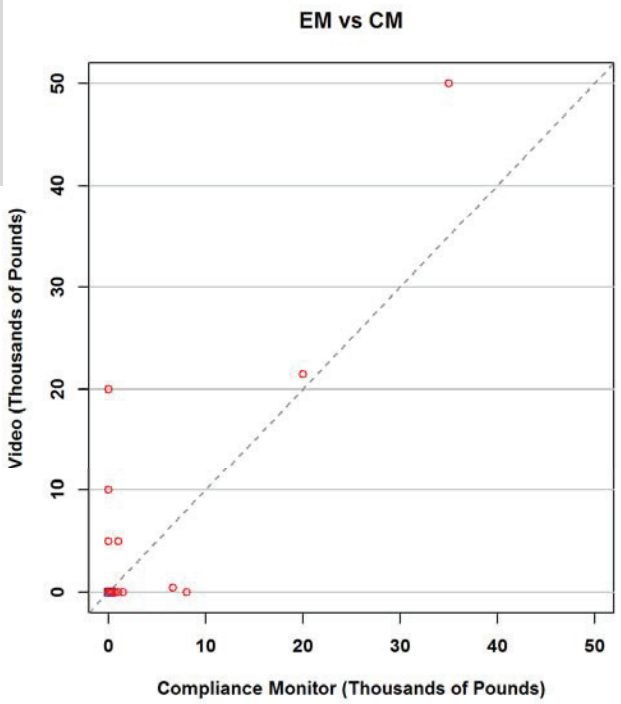
Shoreside Hake
Discarded Catch
Haul Level - EM vs CM

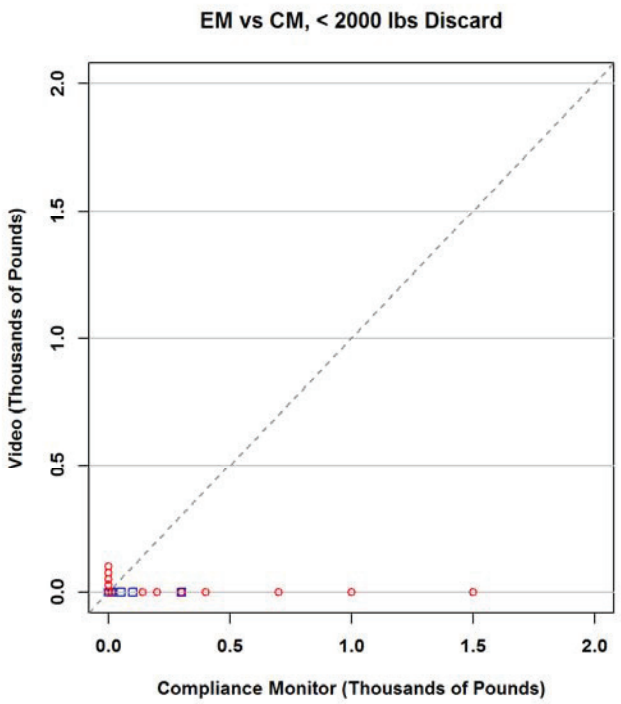
2012 Discards

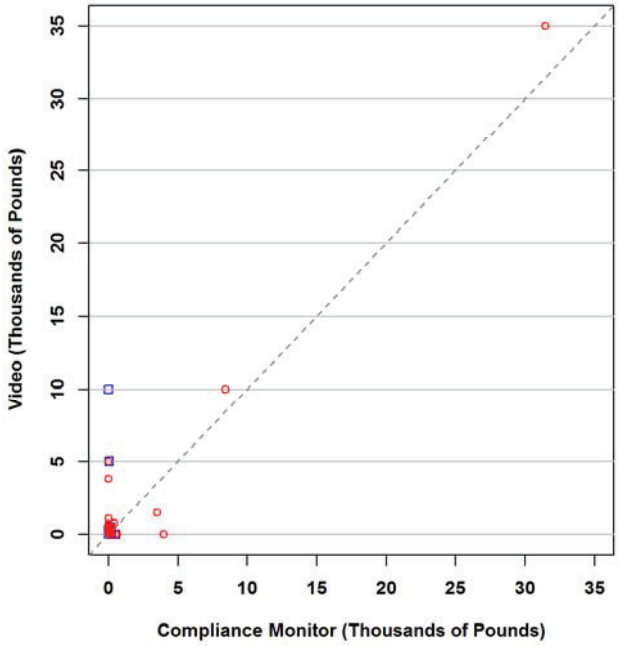
Deck wash

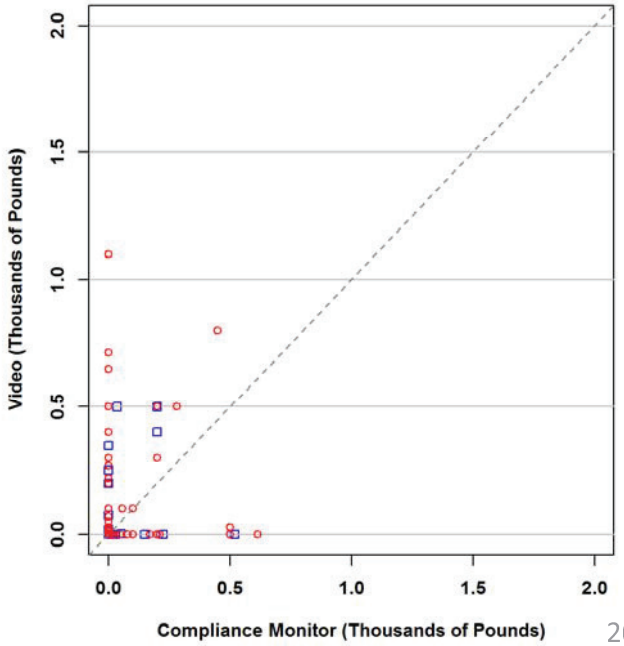
2013 Discards

Blowout Panel









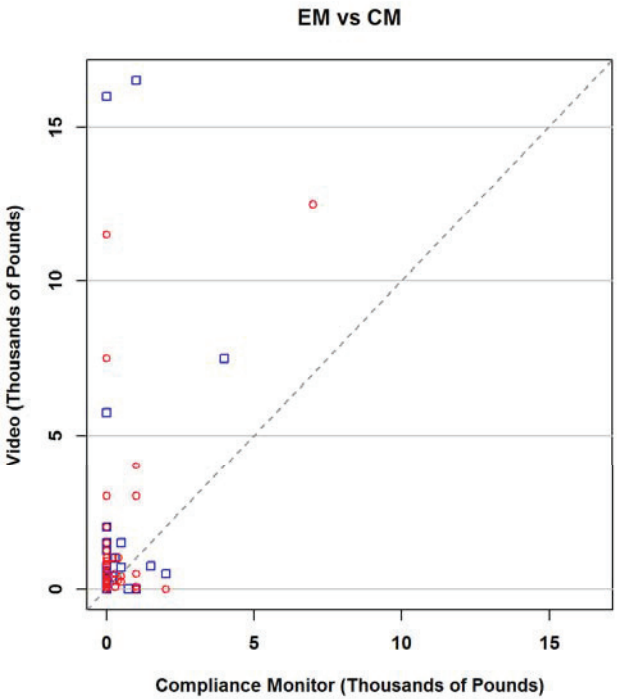
At-sea Hake

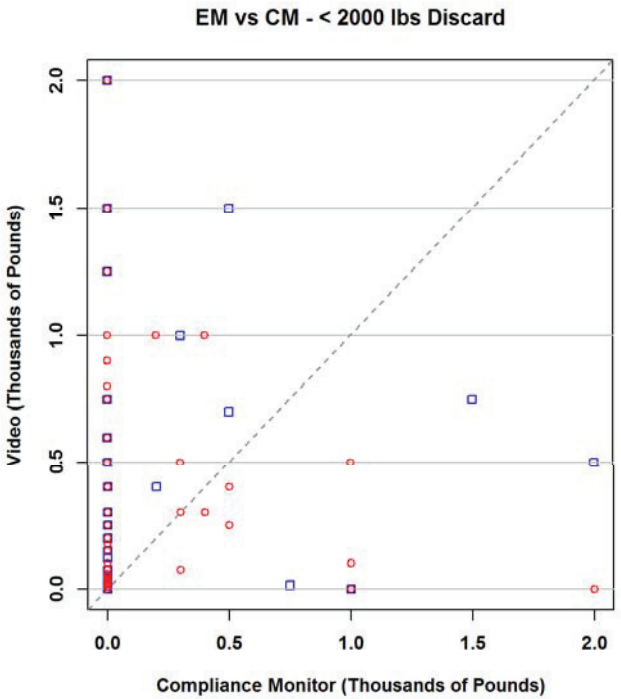
- Option B & C (Selective discarding) aren't applicable
  - Fishery currently working under Option A - Maximized retention
  - EM Data supports discard detection of larger discards (> 2,000 pounds)
- Discards are typically from the trawl alley or in the water
- Could not speciate well enough to support any selective discarding (Options B or C) with current configuration

At-sea Hake
Discarded Catch
Haul Level - EM vs CM

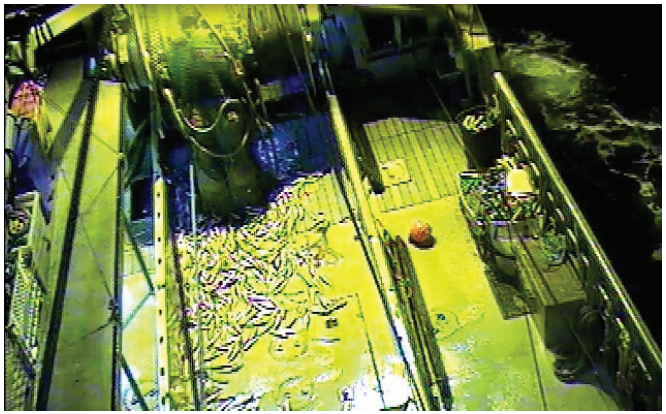
2012 Discards

(2013 Discards confidential)





Remaining fish after zippered codend removed

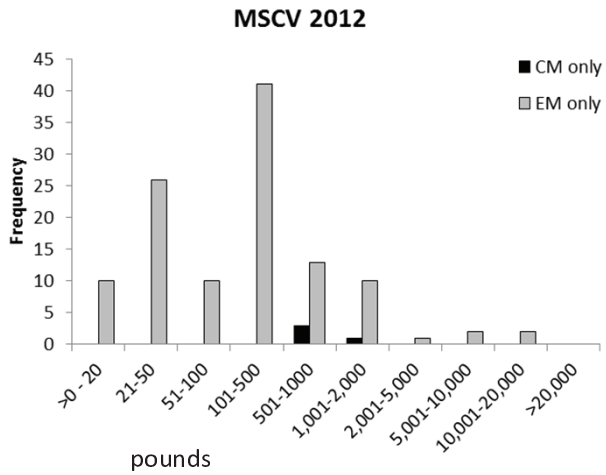


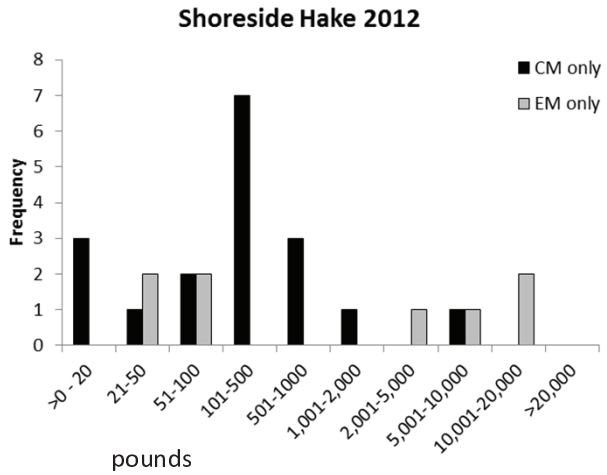
Blowout Panel

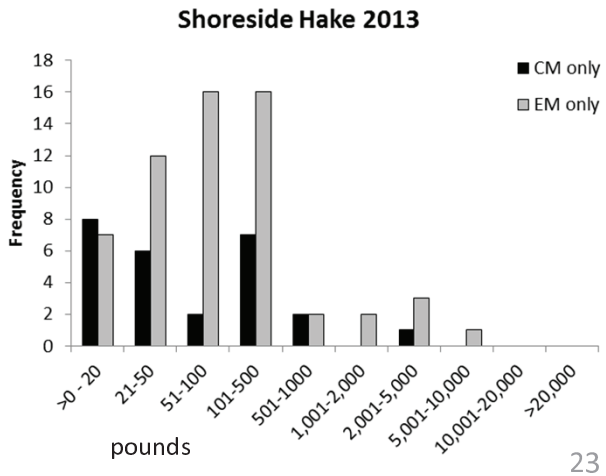
Zippering full codend

Option A - Maximized retention
EM Data generally supports discard detection of larger discards (> 2,000 pounds)

Hauls with Discards in		Mothership Catcher Vessel - 2012 Number of Discard Events	Mothership Catcher Vessel - 2012 Discard (lbs)	Shoreside Hake - 2012 Number of Discard Events	Shoreside Hake - 2012 Discard (lbs)	Shoreside Hake - 2013 Number of Discard Events	Shoreside Hake - 2013 Discard (lbs)
Both Datasets		22		4		15	
	Compliance Monitor		24,650		62,690		45,709
	Video		52,790		77,000		55,233
the Compliance Monitor Dataset but not the Video Dataset		4	5,000	18	14,499	26	7,579
the Video Dataset but not the Compliance Monitor Dataset		115	83,420	8	55,255	59	34,500
Total Number of Discard Events in Each Dataset	Compliance Monitor	26	29,650	22	77,189	41	53,288
	Video	137	136,210	12	132,255	74	89,733
			Retained (lbs)		Retained (lbs)		Retained (lbs)
Total Retained Catch Weigth	Compliance Monitor		21,146,048		33,800,751		21,374,800
	Video		17,450,700		39,131,500		20,892,094







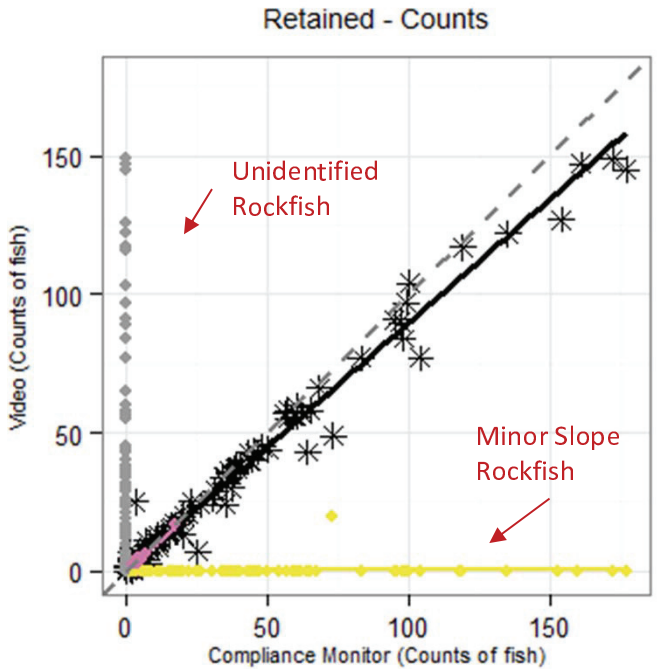
Take Home: Hake

- Under maximized retention (Option A) EM can generally detect large discards

Fixed Gear

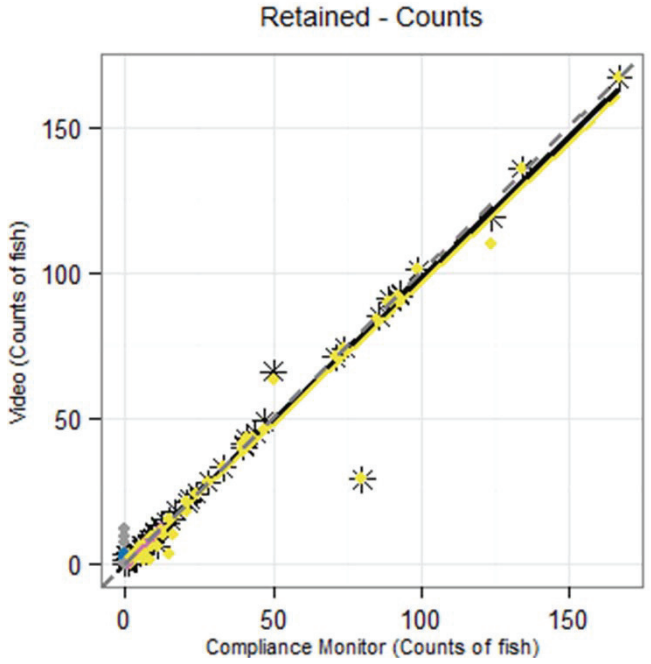
- Functioning under Option C – Discard At Will
- Things to keep in mind:
  - CM was often in a corner of the deck where a good view by video was not available
  - 7% of hauls were sub-sampled by the CM
    - These hauls were not fully sorted prior to discard
    - Data from these hauls were not included in the following graphs
  - Comparisons in the 2013 report are at the haul level
    - 2012 report was at the trip level

2012 Results



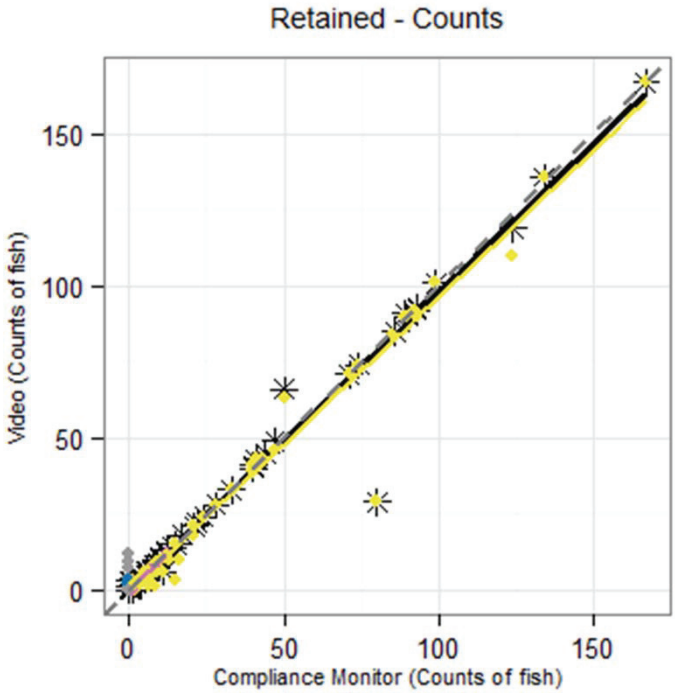
Better species/complex identification and counts in 2013

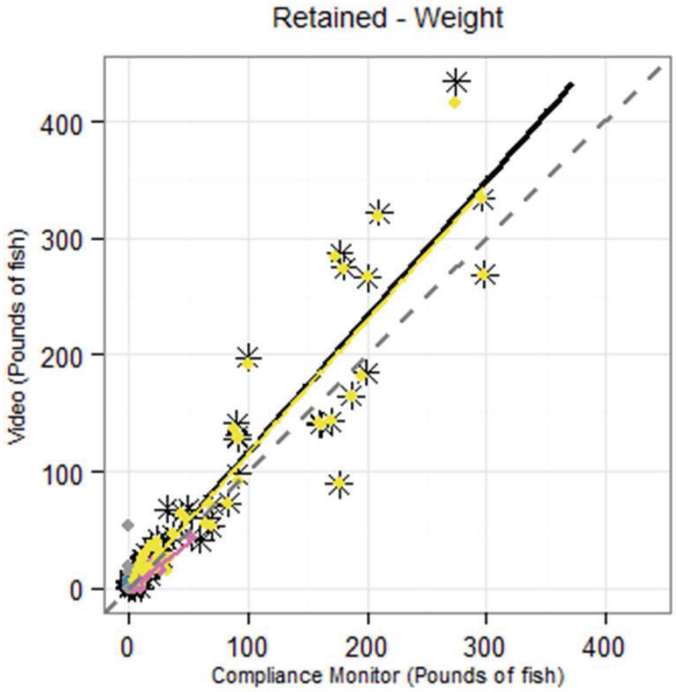
2013 Results



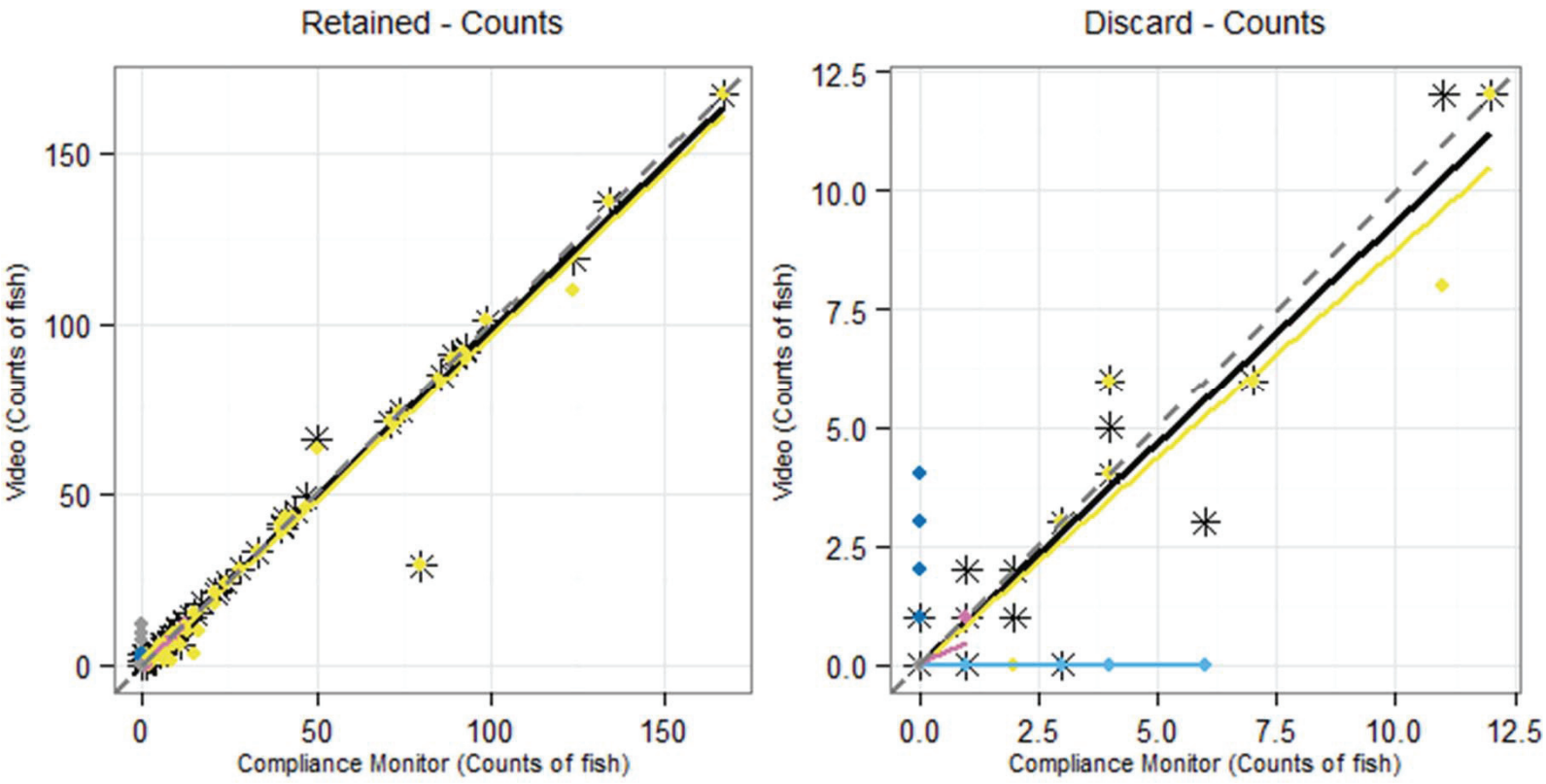
2013 Results

Counts more precise than weights





2013 Results



Species/complex ID of retained better than discards

Rockfish and Thornyheads

IFQ Complex level identification

2013 Results

	Count				Weight			
	Discarded		**Retained**		**Discarded**		**Retained**	
IFQ Complex	CM	Video	CM	Video	CM	Video	CM	Video
Rockfish								
Darkblotched Rockfish				5				12
Pacific Ocean Perch Rockfish			1				2	
Minor Shelf Rockfish				1				2
Minor Slope Rockfish	55	44	1,947	1,834	110	90	4,112	4,820
Rockfish Total	**55**	**44**	**1,948**	**1,840**	**110**	**90**	**4,113**	**4,834**
Thornyheads								
Longspine Thornyhead	38				16			
Shortspine Thornyhead	11	8	57	48	43	48	222	154
Mixed Thornyhead		23		14		13		26
Thornyheads Total	**49**	**31**	**57**	**62**	**59**	**61**	**222**	**179**
Unidentified Rockfish		17		77		25		184
Rockfish and Thornyheads Total	**104**	**92**	**2,005**	**1,979**	**169**	**176**	**4,336**	**5,197**

Flatfish

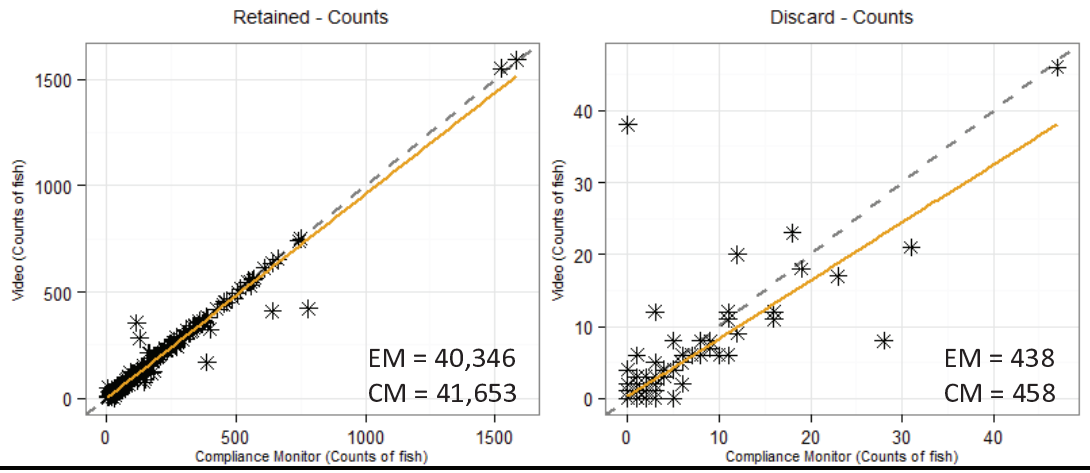
(Option B, Subopt 1)
IFQ Complex level identification

2013 Results

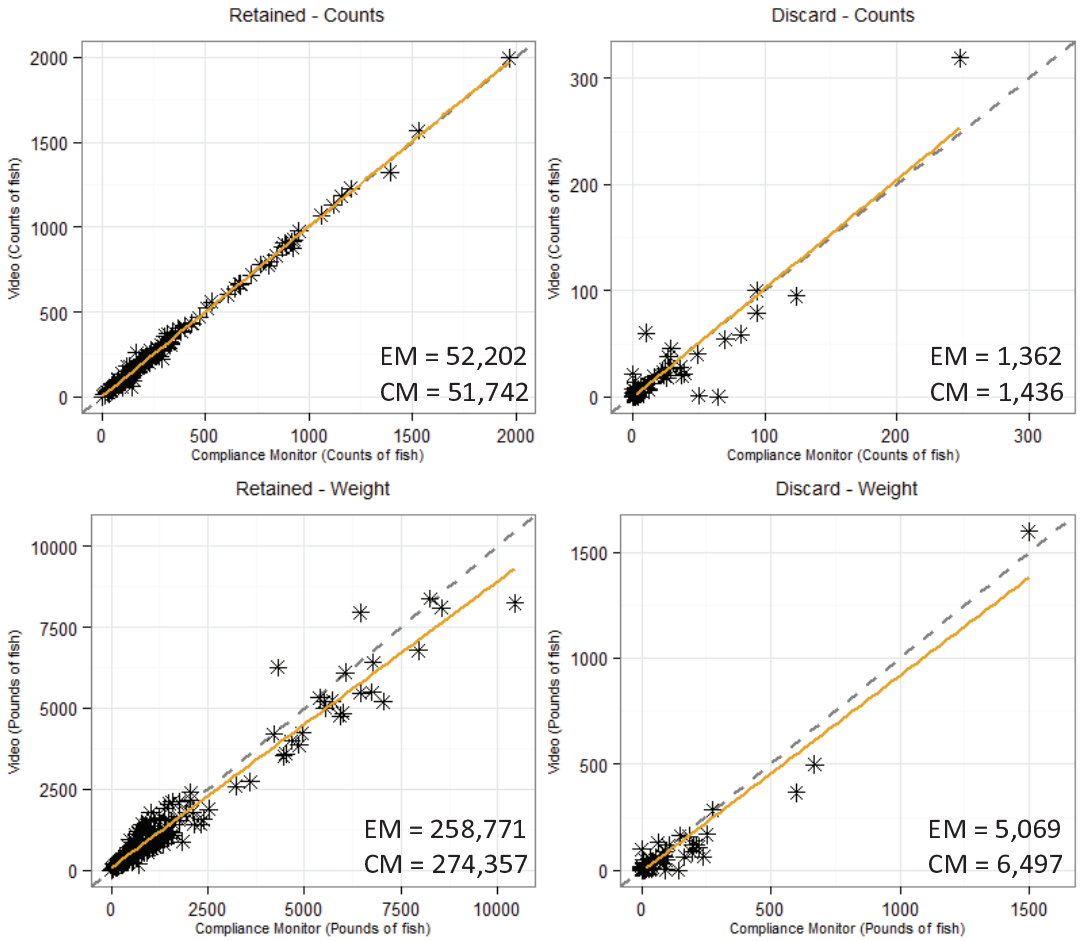
	Count				Weight			
	Discarded		**Retained**		**Discarded**		**Retained**	
IFQ Complex	CM	Video	CM	Video	CM	Video	CM	Video
Flatfish								
Arrowtooth Flounder	1			1	15			6
Dover Sole	28	22	88	86	55	49	133	150
English Sole								
Petrale Sole*	2		9		3		14	
Starry Flounder								
Other Flatfish	3		1	13	2		1	24
Unidentified Flatfish				1				1
NonIFQ	5	3	1	1	6	6	1	1
Flatfish Total	**39**	**25**	**99**	**102**	**81**	**55**	**149**	**182**

Target Species
Sablefish
(Option B, Subopt 2)

2012 Results



2013 Results



Take Home: Fixed Gear

- Three Patterns:
  - Better ID and counts in 2013
  - Counts better than weights
  - Retained estimates better than discarded
- Subopt 1 (Flatfish):
  - Petrale not identifiable
    - CM 2 discards + 9 retained recorded as 10 retained “Petrale & Flathead” by video reviewer
  - Discard & retained disposition problem
- Subopt 2 (Sablefish + Lingcod):
  - Sablefish: Target species retained and discards successfully quantified (counts better than weights)
  - Lingcod: Did not see any lingcod – Cannot speak to ability to detect
- Rockfish almost all minor slope
  - Most are identified successfully in 2013
  - Video agrees with CM 73% of Discarded and 96% of Retained
- Could not identify any Longspine Thornyheads

Bottom Trawl

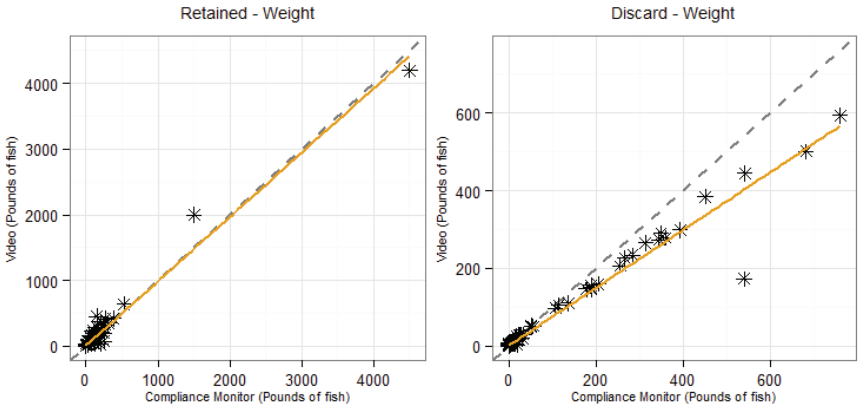
- Functioning under Option C – Discard At Will
- Things to keep in mind:
  - CM was often in a corner of the deck where a good view by video was not available
  - 18% of hauls were sub-sampled by the CM
    - These hauls were not fully sorted prior to discard
    - Data from these hauls were included in the following graphs
    - When discards are not sorted camera reviewers cannot speciate
  - No counts; only weight estimates

Flatfish

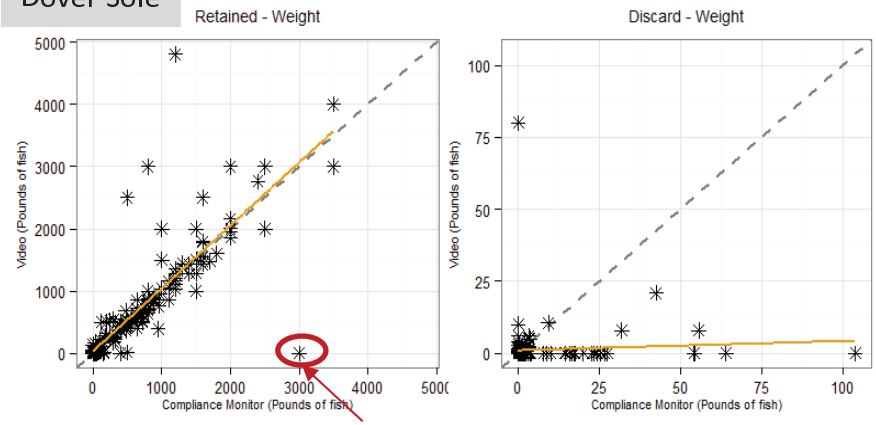
(Option B - Optimized Retention, Subopt 1)
IFQ Complex level identification

Retained = Sorted next to camera

Arrowtooth Flounder

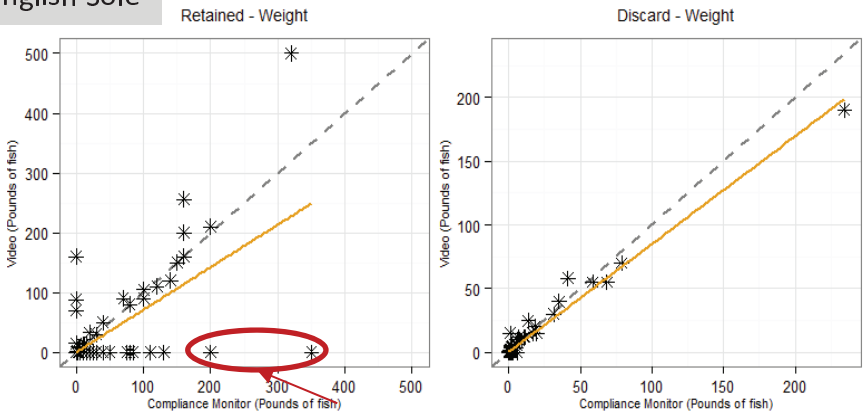


Dover Sole



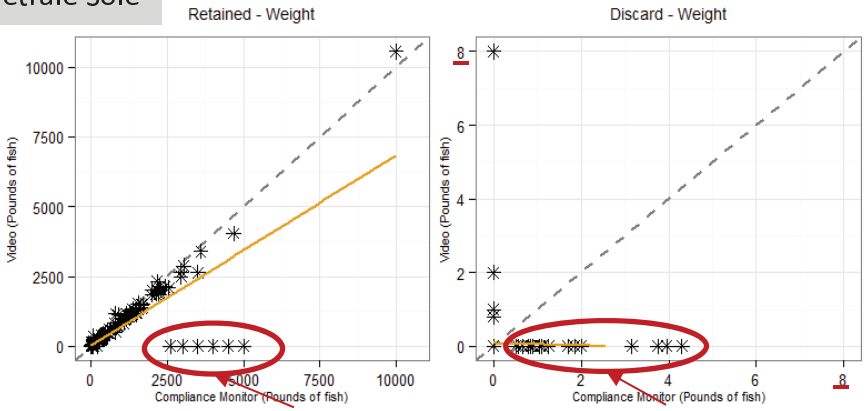
Unsorted catch

English Sole



Unsorted catch

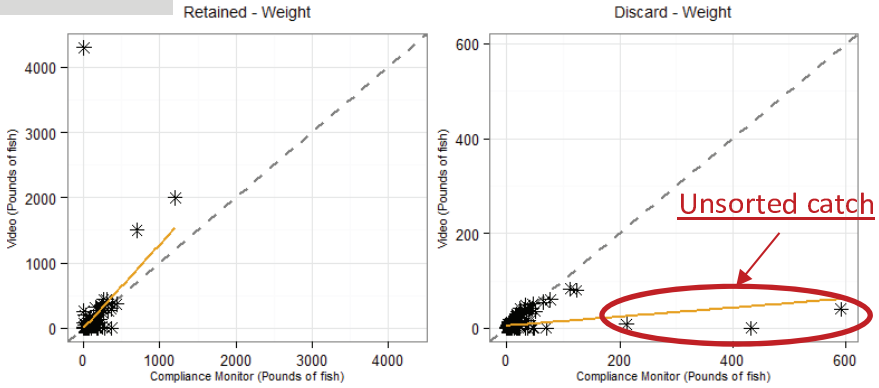
Petrale Sole



Unsorted catch

Flathead/Petrale

Other Flatfish



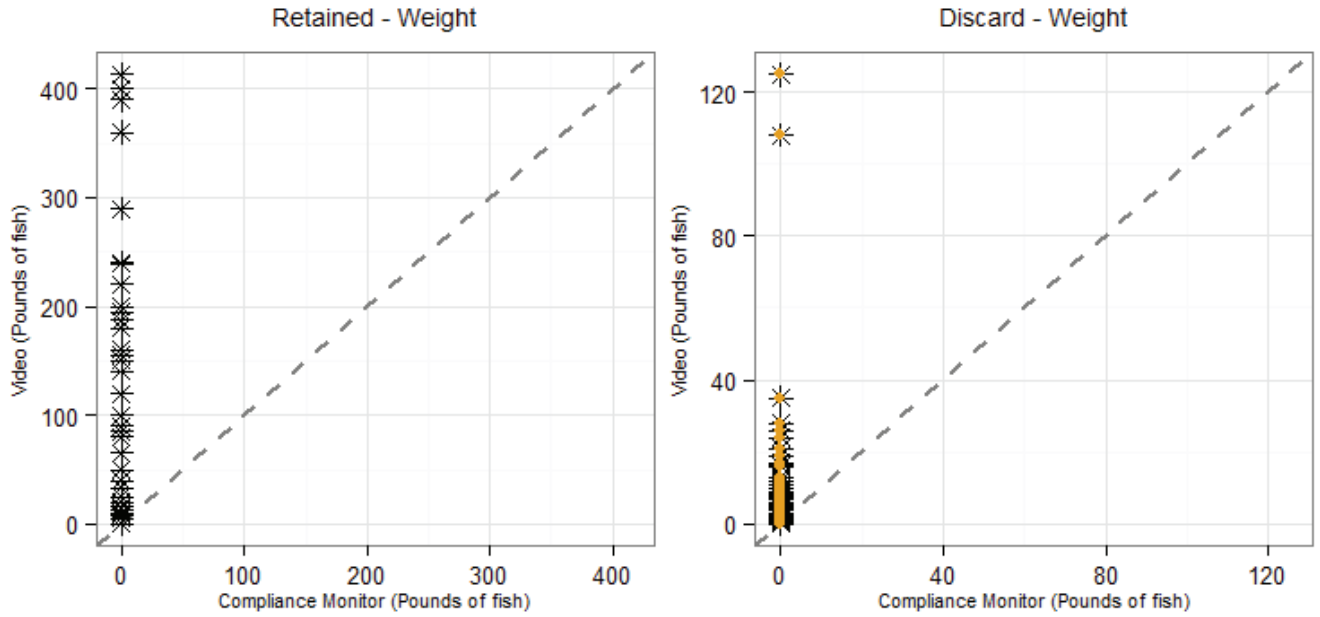
Unsorted catch

When catch not sorted camera reviewers cannot speciate

Flatfish

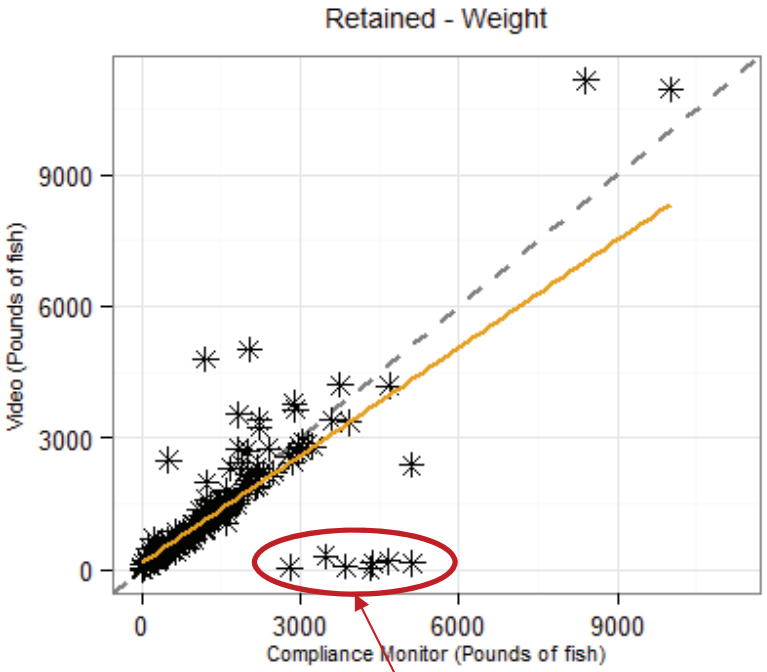
(Option B - Optimized Retention, Subopt 1)
IFQ Complex level identification

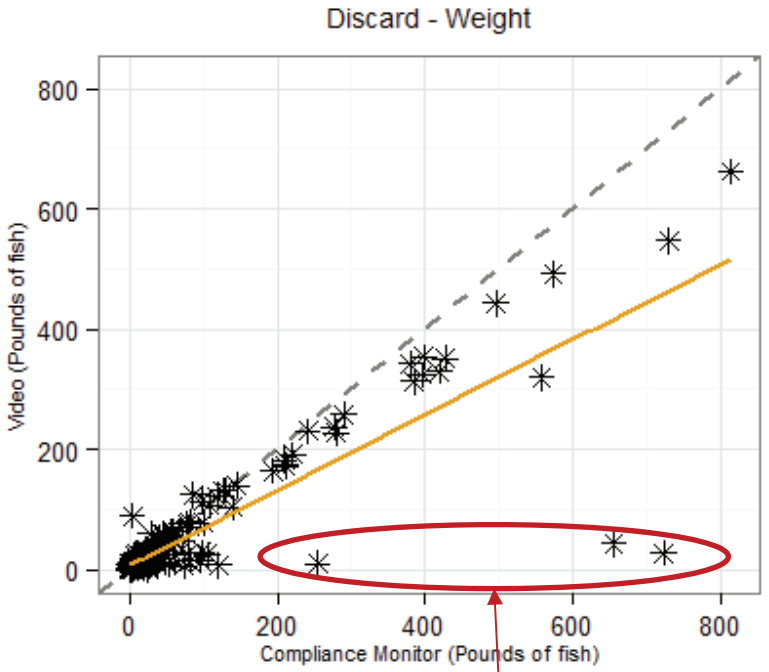
Unidentified Flatfish



Flatfish

(Option B - Optimized Retention, Subopt 1)
Can EM tell us a flatfish is a flatfish?





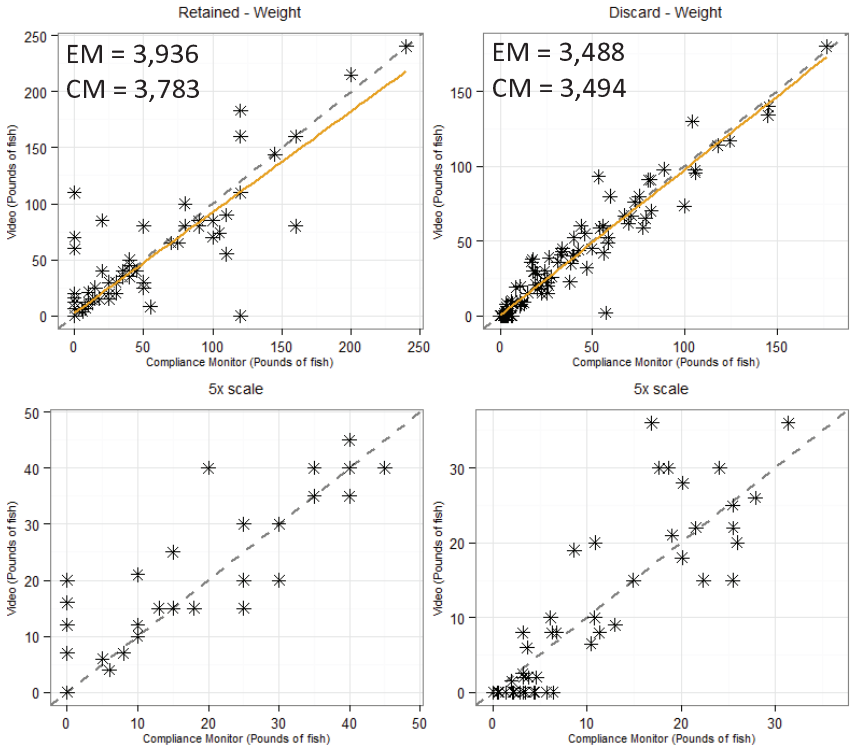
Groundfish Unid – Fish not sorted prior to placing in hold

Fish Unid – discards subsampled – not fully sorted prior to discarding

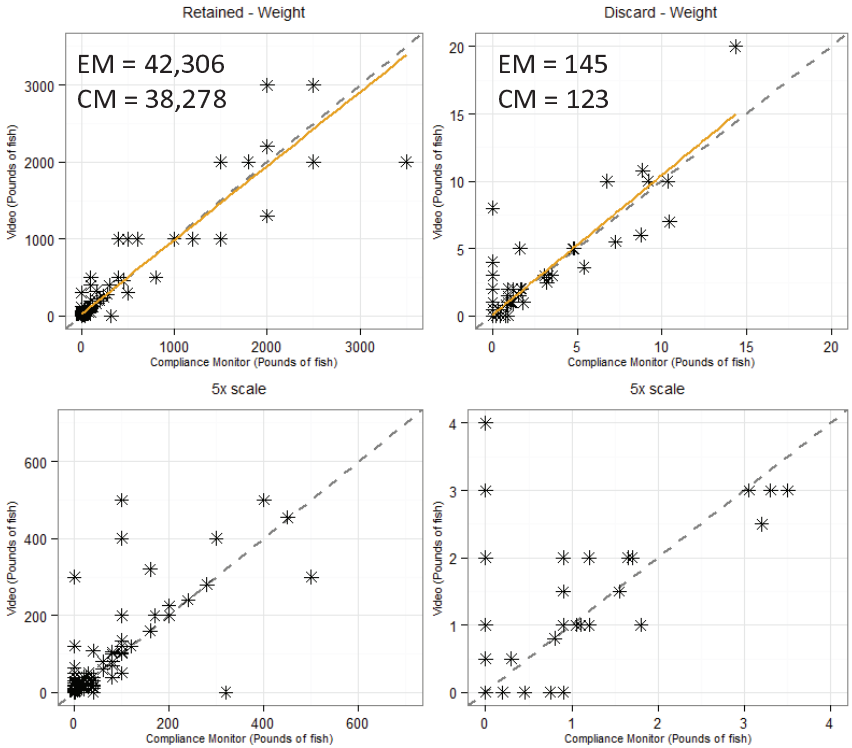
When catch not sorted camera reviewers cannot speciate

Sablefish + Lingcod
(Option B, Subopt 2)

Lingcod



Sablefish



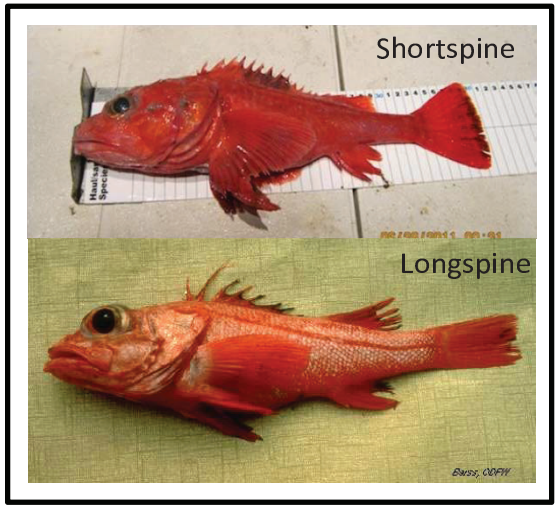
Take Home: Bottom Trawl

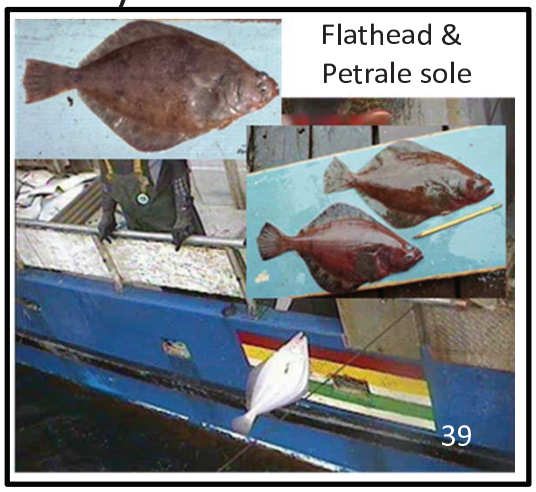
- Some species are problematic for speciation
- Estimates of retained catch is better than discarded catch
  - Retained catch is sorted more thoroughly
  - Retained sorted closer to the camera
  - With sorting of discards and/or control discard points it may be possible to discard IFQ catch of some species

Problem species

IFQ complexes that are not readily identifiable in retained and discarded catch:

- Longspine thornyheads
- Longspine & small Shortspine thornyheads
- Splitnose RF
- Splitnose & Aurora RF (Slope)
- Rougheye & Shortraker RF (both Slope Rock)
- Small Arrowtooth & English sole
- Sanddab (Other flat) & Slender sole (not IFQ)
- Yellowmouth (Slope) & Aurora (Slope) & POP (Slope S 40-10)
- Small Dover & Rex sole (Other flats)
- Petrale & Flathead (Other flats) & English sole
- Canary & Vermillion RF (Shelf)
- Yellowtail (Shelf S 40-10) & Widow RF
- Boccacio (Shelf N 40-10) & Silvergray RF (Shelf)
- Any small fish



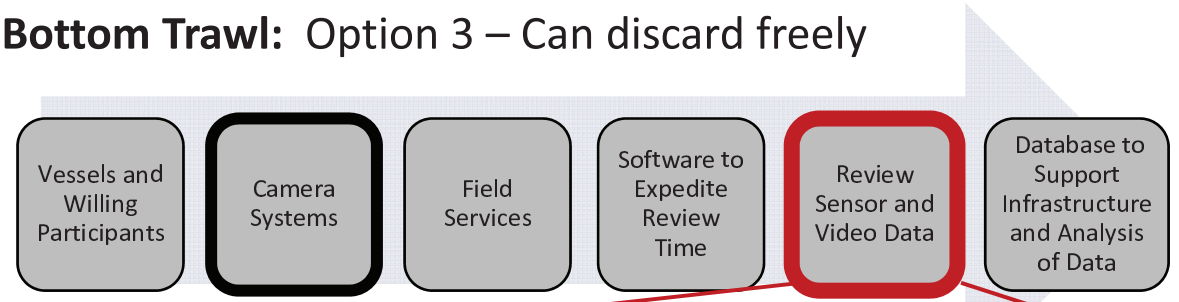


Review of At-Sea Sorting - Costs

Costs are based on Archipelago System

Hake fishery: Option 1 - Maximized retention

Fixed gear and Bottom Trawl: Option 3 – Can discard freely



Fishery	Bottom Trawl	Longline	Pot	MS Catcher Vessel	Shoreside Hake
Average Sea Days per Trip*	3.55	3.59	3.88	13.57	2.17
Average Hauls per Trip*	8.37	7.41	11.67	27.65	1.86
Average Sort Minutes per Haul	133.92	66.46	37.7	40.28	60.57
Average Review Minutes per Haul	159.25	67.5	21.47	15.04	17.53
Average Review Minutes per Sort Minute	1.19	1.02	0.57	0.37	0.29
100% Review (Review Hours per Trip)	22.22	8.34	4.17	6.93	0.54
Cost per trip for review time only (100%)	$ 1,136.00	$ 442.00	$ 233.50	$ 371.50	$ 52.00
Cost per sea day for review time only (100%)	$ 320.00	$ 123.12	$ 60.18	$ 27.38	$ 23.96
20% Review - Number of hauls reviewed	2	2	3	6	1
20% Review (Review Hours per Trip)	5.31	2.25	1.07	1.5	0.29
Cost per average trip for review time only (20%)	$ 290.42	$ 137.50	$ 78.68	$ 100.20	$ 39.61
Cost per average sea day for review time only (20%)	$ 81.81	$ 38.30	$ 20.28	$ 7.38	$ 18.25
Fraction of 100% review cost per sea day	26%	31%	34%	27%	76%

* Source 2013 WCGOP dataset

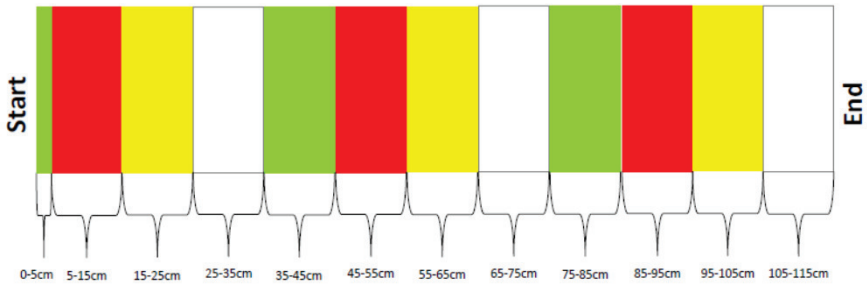
Discard Chute Study on Bottom Trawl

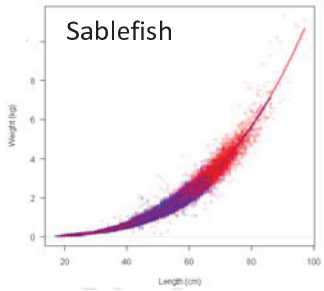
Testing ability to:

- Identify IFQ species and
- Obtain lengths to convert to weights

Will speak to Option B, Subopt 4 (Discard species verifiable with cameras) when a discard chute is used

Length-Weight Relationships

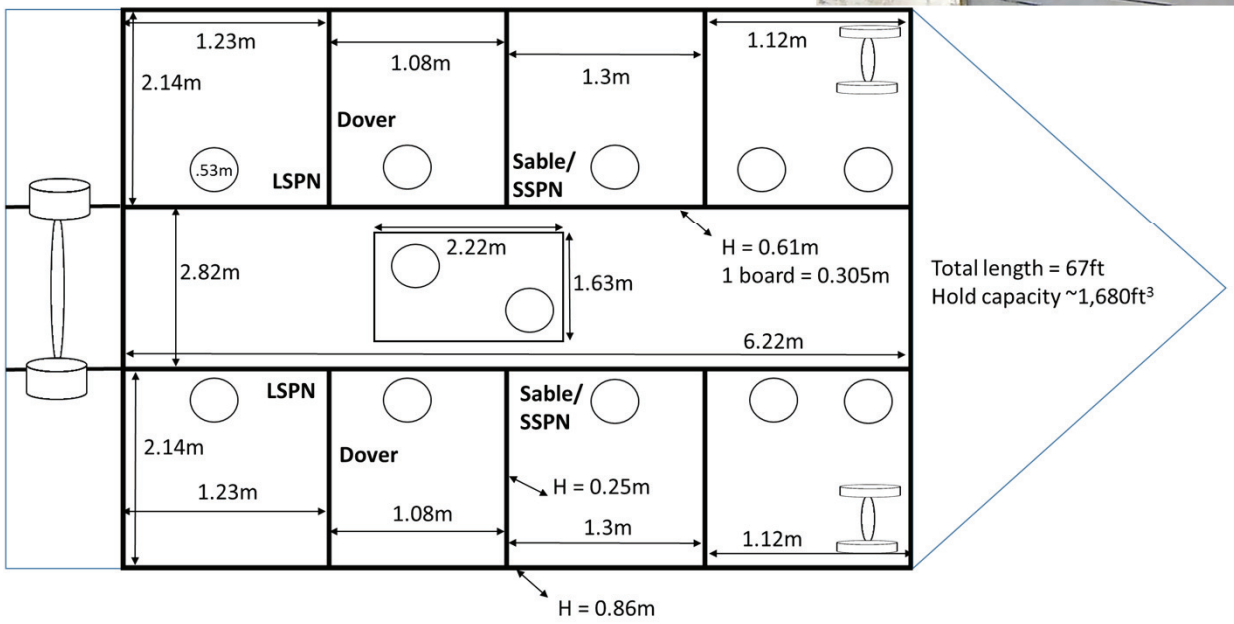




Stewart, I.J., J.T. Thorson, and C. Wetzel. 2011. Status of the U.S. Sablefish resource in 2011. NOAA-NMFS-NWFSC

Volumetric Density Study

Dockside sampling to determine density of IFQ species.
Average weight/volume



If discards are sorted into bins before going overboard, volumetric weight estimation may be usable when there are large amounts of discards

Trawl Discard Logbook

Vessel Name ______________________ Departure: Date _____________ Time ____________ Port _________________

WOC Logbook Page # ________________ Return: Date _______________ Time ____________ Port _________________

DATE (mo/day)	Set Time		Estimated pounds discarded each tow — enter 4 letter code from species list provided															
		Pounds (Required)																
		Count																
		Pounds (Required)																
		Count																
		Pounds (Required)																
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		Pounds (Required)																
		Count																

Year: ____________

EM FIXED GEAR LOGBOOK

Permit (circle one): LE Fixed Gear - LE DTL - IFQ - Open Access **Permit #** ____________

Vessel Name: ____________ Port of Landing: ____________

Vessel Doc. Number: ____________ Buyer(s): ____________

Gear (circle one): pot - barrel - bucket - longline - other

Escapement Hole Size: ____________

Type of Pot (circle one): rectangular - conical - other

Number of Escapement Holes : ____________

Dimensions of Pot: (H/W/L) X X

Pot/Barrel/Bucket Spacing: ____________ ft. apart on groundline

PORT	GEAR

Trip No.	Fish Receiving Ticket Number

Type of Longline Gear: (circle one)
FIXED HOOK - AUTO LINE - SNAP

Gear ID

Longline Gear ID	Length of Skate or Line in Tub (feet)	Hook Size	Hook Spacing (feet)	# Hooks per Skate or Tub	Total Number of Skates or Tubs **Lost**
A					
B					

String or Set #	# of Skates, Tubs, or Pots per Set	LL Gear ID (A or B)	Delivery Date		Set & Up (Retrieve) Date	Time (24 Hour Clock)	String	Depth (Fm)	Latitude & Longitude Deg = Degree: Lat. Deg	Decimal Minutes	Long. Deg	Decimal Minutes	**Estimated Pounds of SABLEFISH** RETAINED	**Estimated Pounds of** RETAINED	**Estimated Pounds of** RETAINED	**Estimated Pounds of** RETAINED	**Estimated Pounds of SABLEFISH RELEASED**	**Estimated Pounds of RELEASED**	**Estimated Pounds of RELEASED**
													Pounds	**Pounds**	**Pounds**	**Pounds**	**Pounds**	**Pounds**	**Pounds**
													Count	**Count**	**Count**	**Count**	**Count**	**Count**	**Count**
				Set			Start												
				Up			End												
				Set			Start												
				Up			End												
				Set			Start												
				Up			End												
				Set			Start												
				Up			End												
				Set			Start												
				Up			End												
				Set			Start												
				Up			End												

Vessel Operator's Signature: ____________ Vessel Operator's Name (print): ____________

Comments:

Hake Logbook

Vessel Name ____________ Departure: Date ________ Time ________ Port ________

Logbook Page # ________ Return: Date ________ Time ________ Port ________

DATE (mo/day)	Haul #	Set Time	Up Time	Estimated pounds discarded each tow — enter 4 letter code from species list provided							
				Retained Pounds	**Discarded**						**Notes**
				Total Estimated Retained Catch	**Species**						
					Discard Type						
					Pound (est.)						
					Count						
					Pound (est.)						
					Count						
					Pound (est.)						
					Count						
					Pound (est.)						
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