Halibut DMRs – new aggregation and estimation methods

NORTH PACIFIC Fishery Management Council

NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION U.S. DEPARTMENT OF COMMERCE

INTERNATIONAL PACIFIC HALIBUT COMMISSION

IDAHO • OREGON • ALASKA PACIFIC STATES MARINE FISHERIES COMMISSION WASHINGTON • CALIFORNIA

Action

- Provide feedback to Working Group on adequacy of proposed methods
    - General approach
    - Specific decision points

Background

- Proportion of incidentally captured halibut that do not survive after being returned to the water

$$\hat{DMR}_g = \frac{\hat{M}_g}{\hat{D}_g}$$

- Management of groundfish fisheries
  - Projections applied for 3 years
- Halibut assessment
  - Annual DMR estimates account for bycatch mortality
- Long-term (10 year) averages of annual estimates within target fisheries
- Based on observer sampling of halibut viabilities

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Viabilities

Assumed gear/condition-specific mortality probabilities for halibut in calculating DMRs.

Gear	Condition			
	Excellent	Poor		Dead
Trawl[a]	0.20	0.55		0.90
Pot[b]	0.00	1.00		1.00
	Minor	Moderate	Serious	Dead
Longline[c]	0.035	0.363	0.662	1.000

From [a] Clark et al. (1992), [b] Williams (1996), and [c] Kaimmer and Trumble (1998)

Background

- Transition in responsibility

- Improvements in the methodology for calculating DMRs needed (NPFMC 2016)
  - Replication
  - Definition of Target Fishery
  - Declining viability assessments
  - DMR aggregation methods
  - Length of reference timeframe

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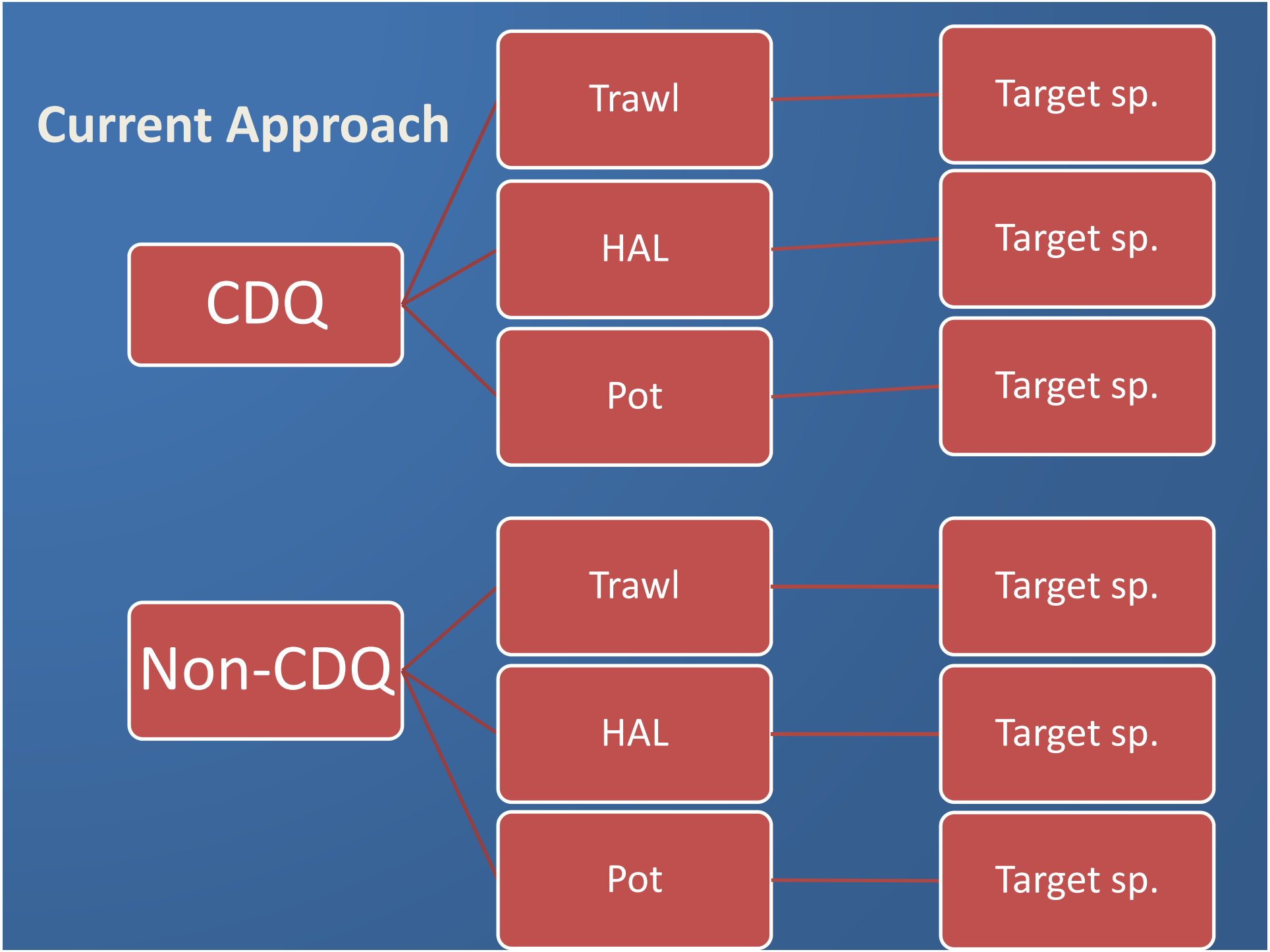
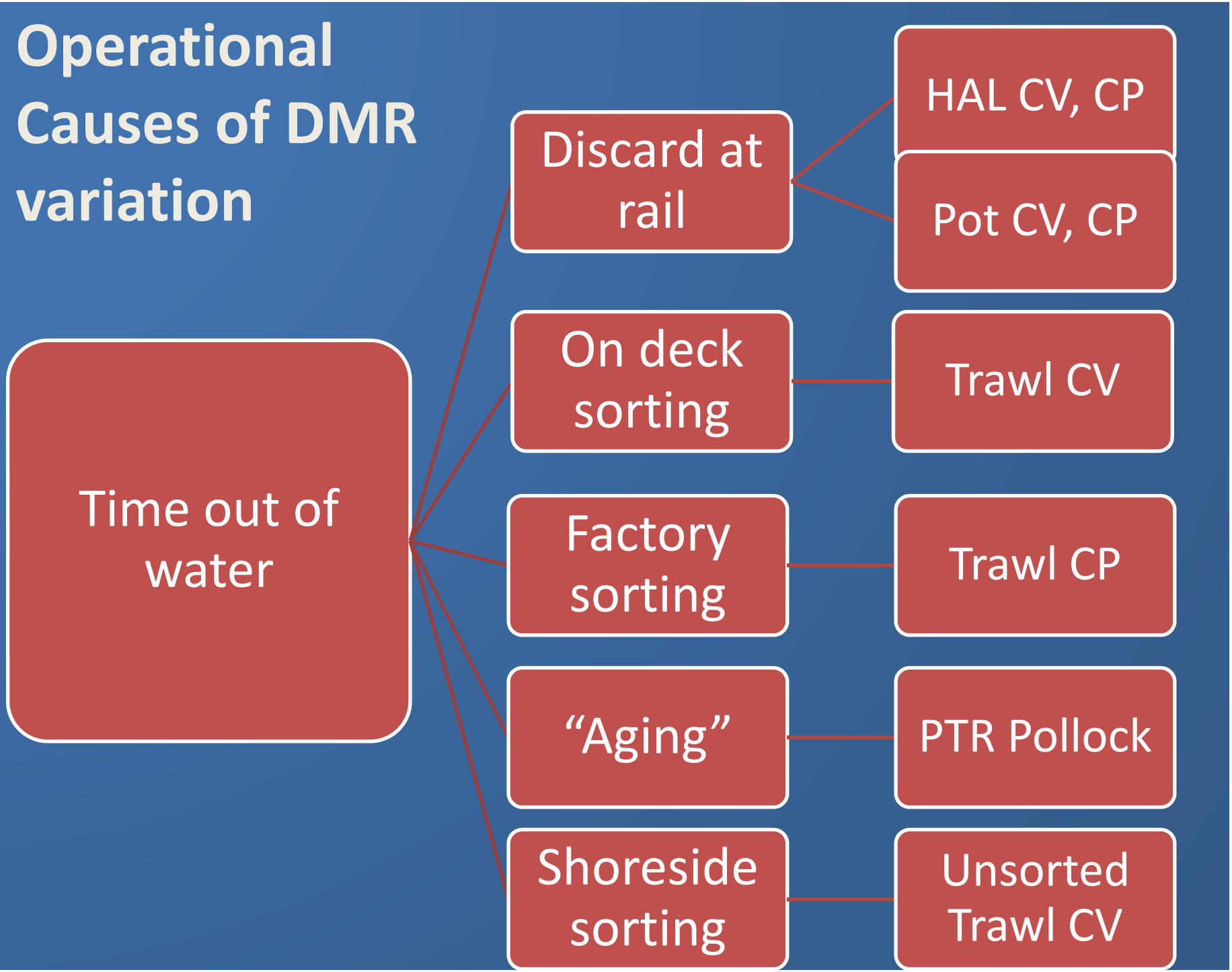
General Approach

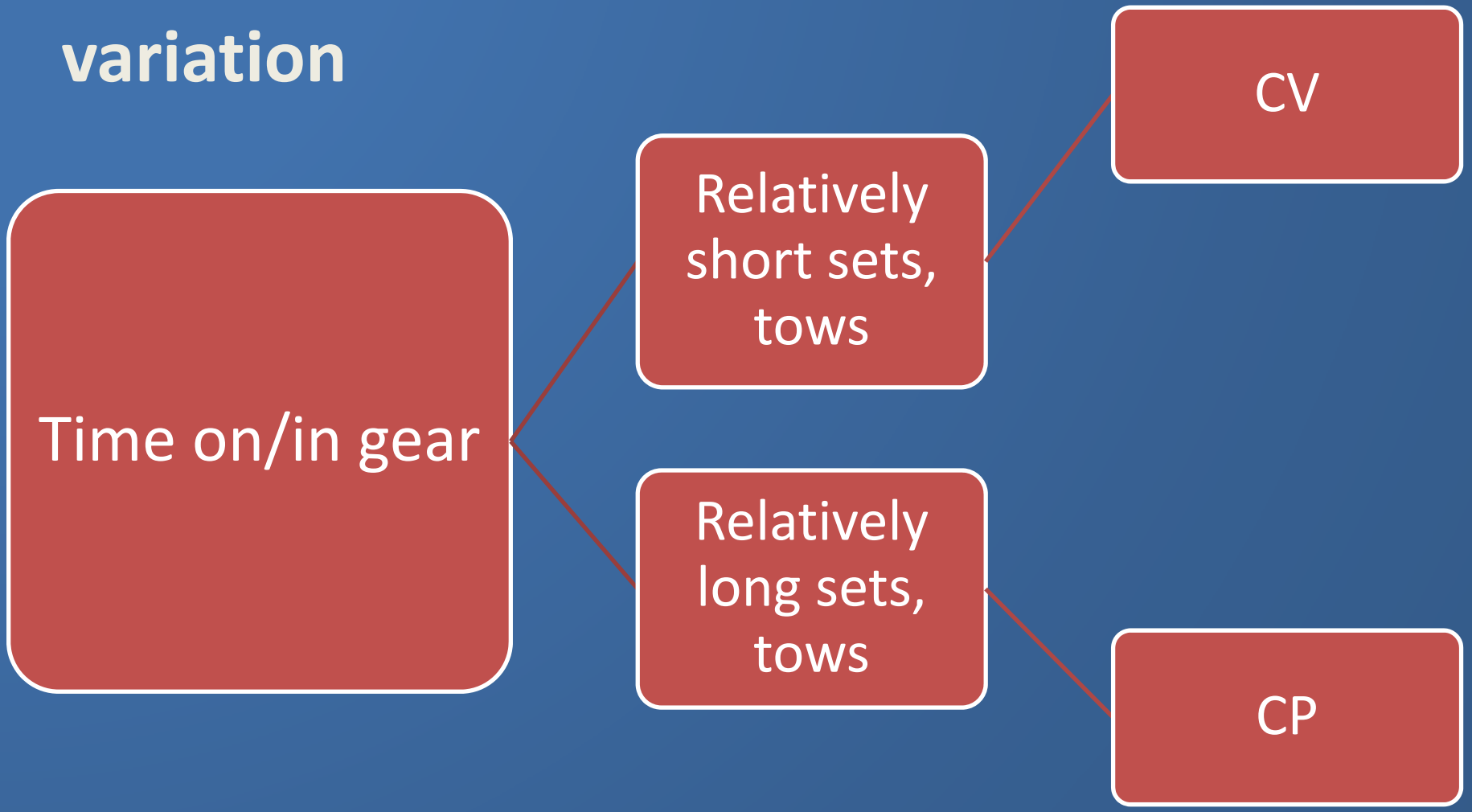
- Consistency with the operational causes of variation in DMRs
- Consistency with Observer Program sampling design


Current Approach
CDQ
Non-CDQ
Trawl
HAL
Pot
Trawl
HAL
Pot
Target sp.
Target sp.
Target sp.
Target sp.
Target sp.
Target sp.

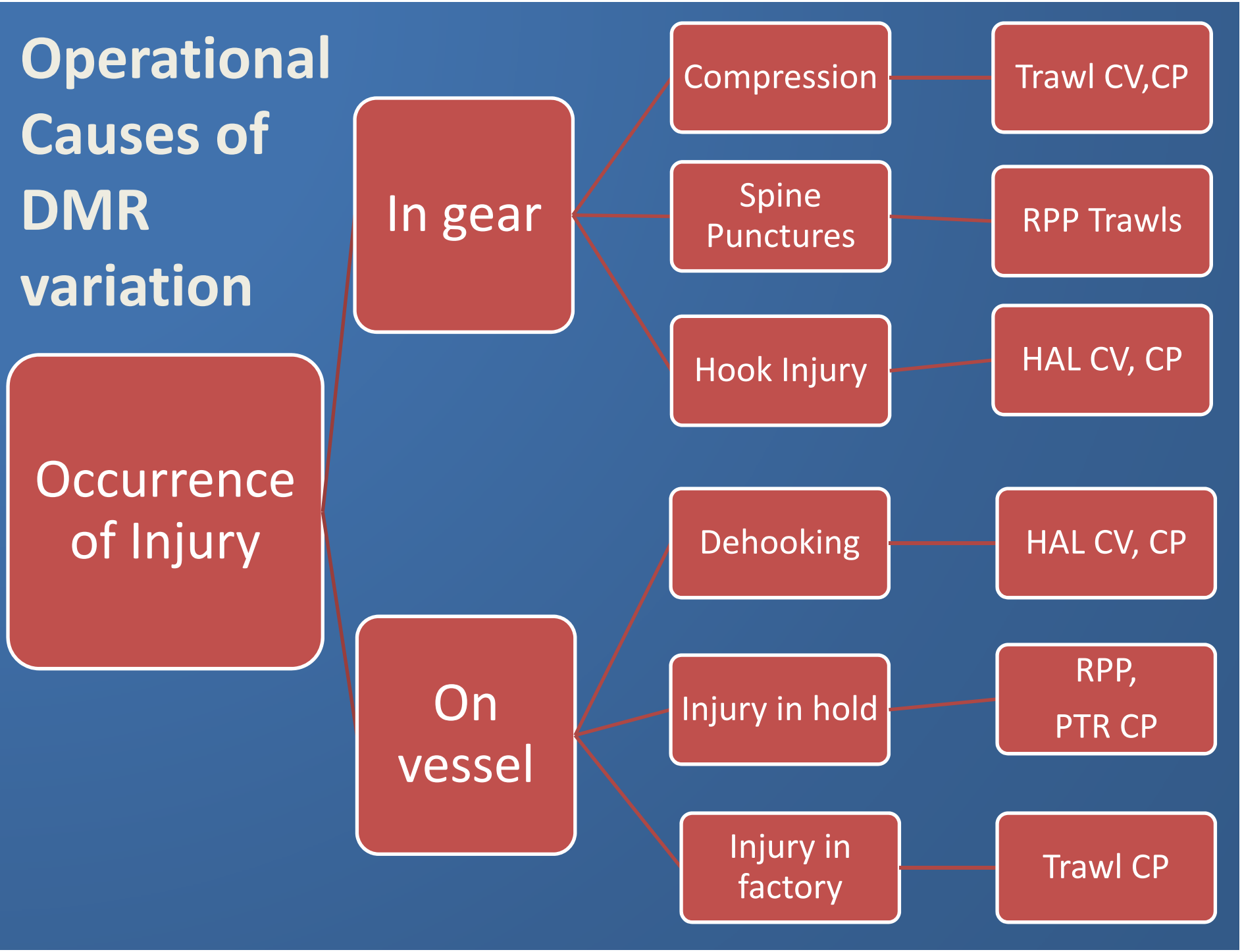
Operational Causes of DMR variation



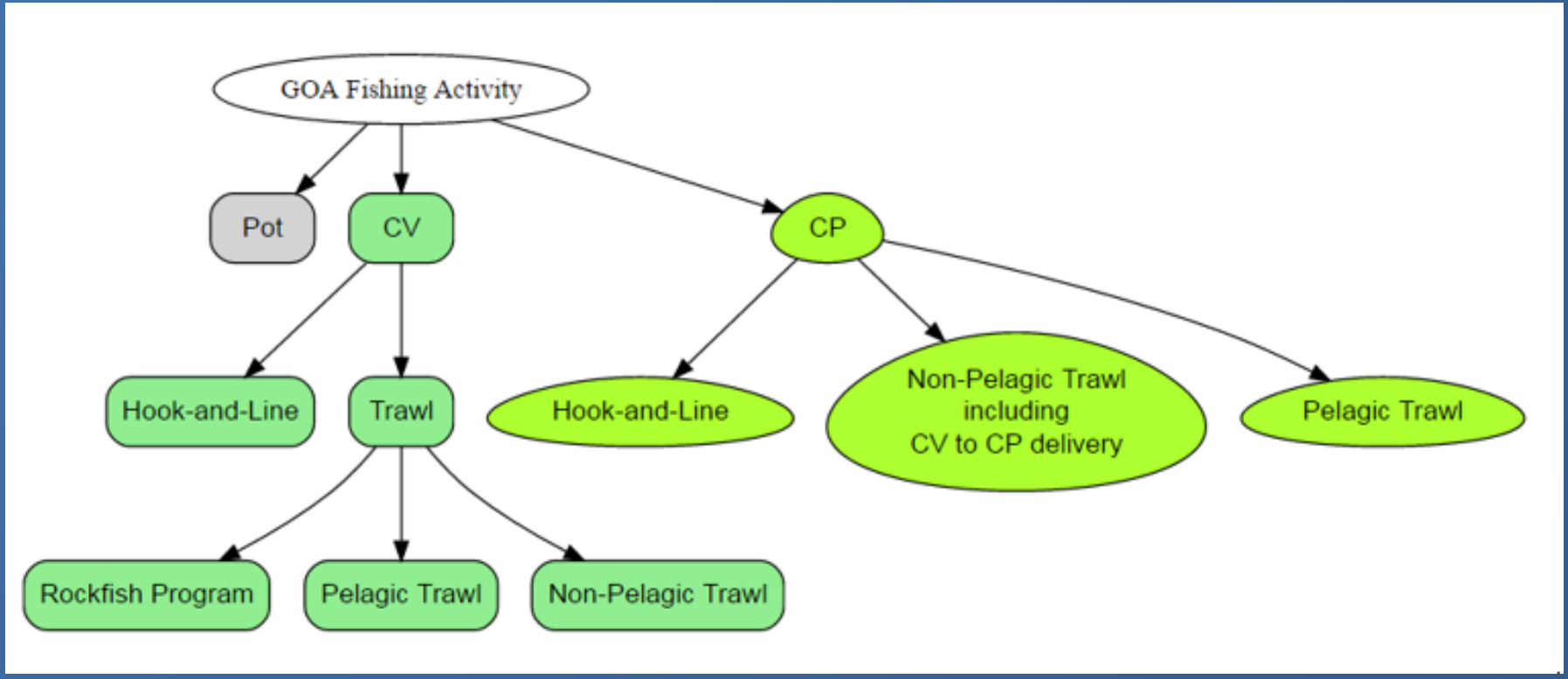
Operational Causes of DMR variation



Operational Causes of DMR variation



Operational Groupings



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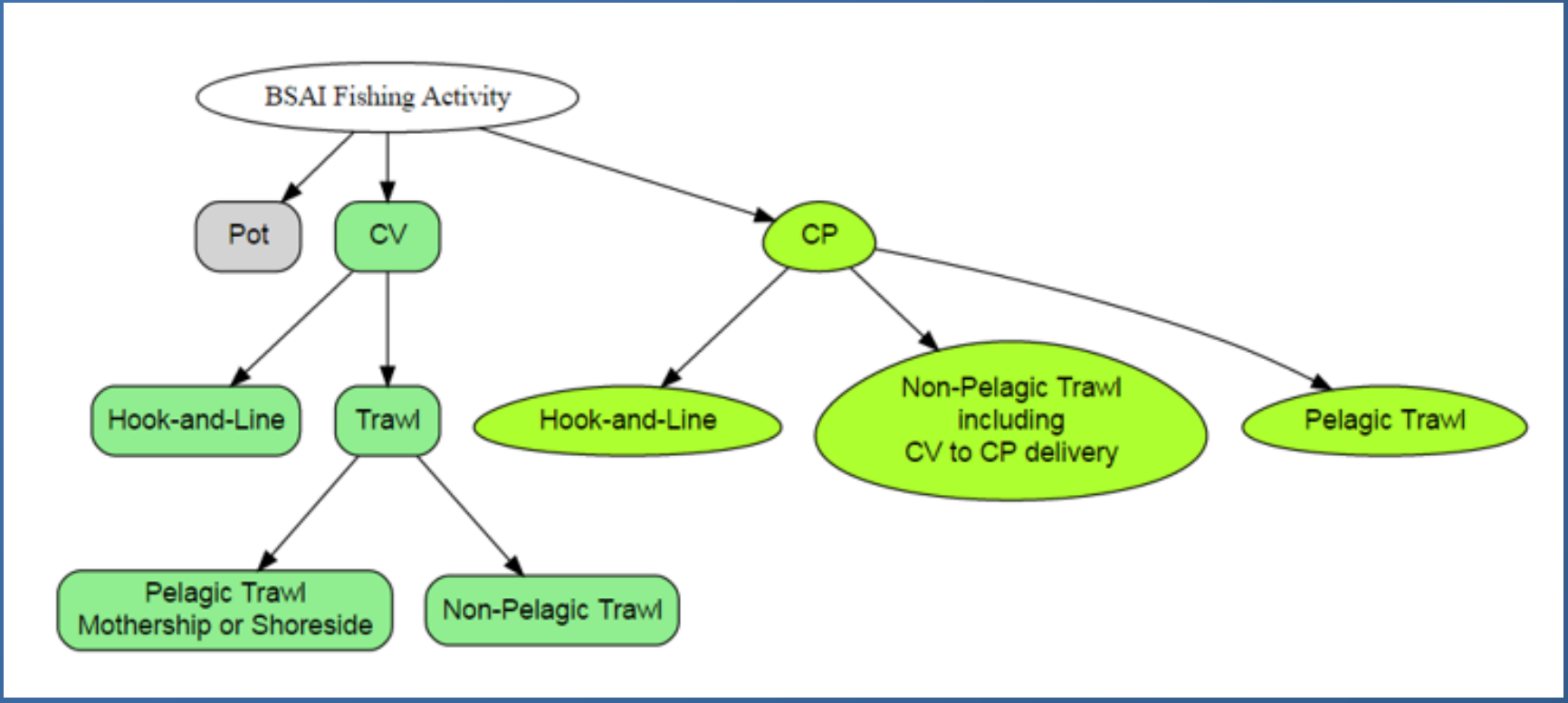
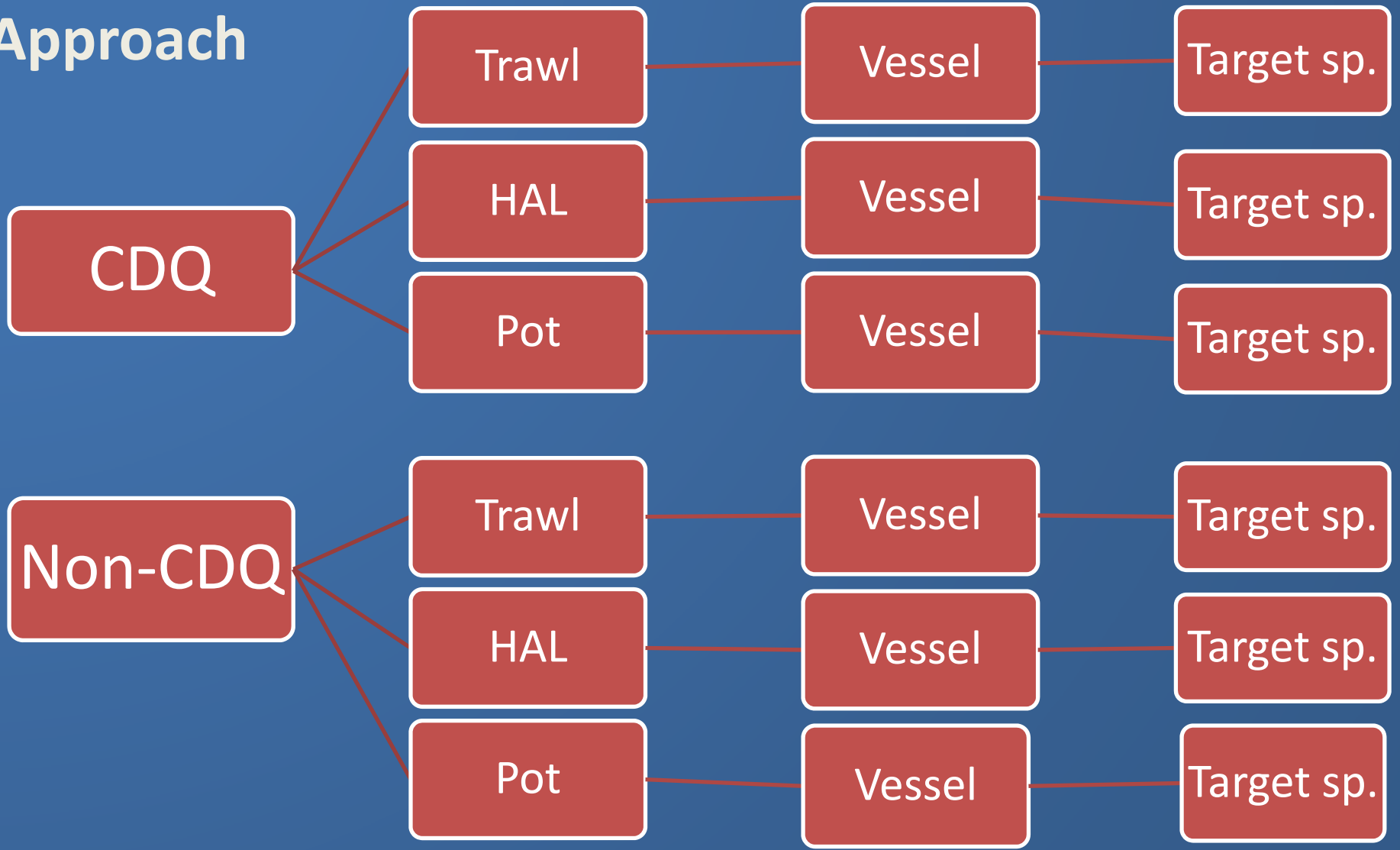
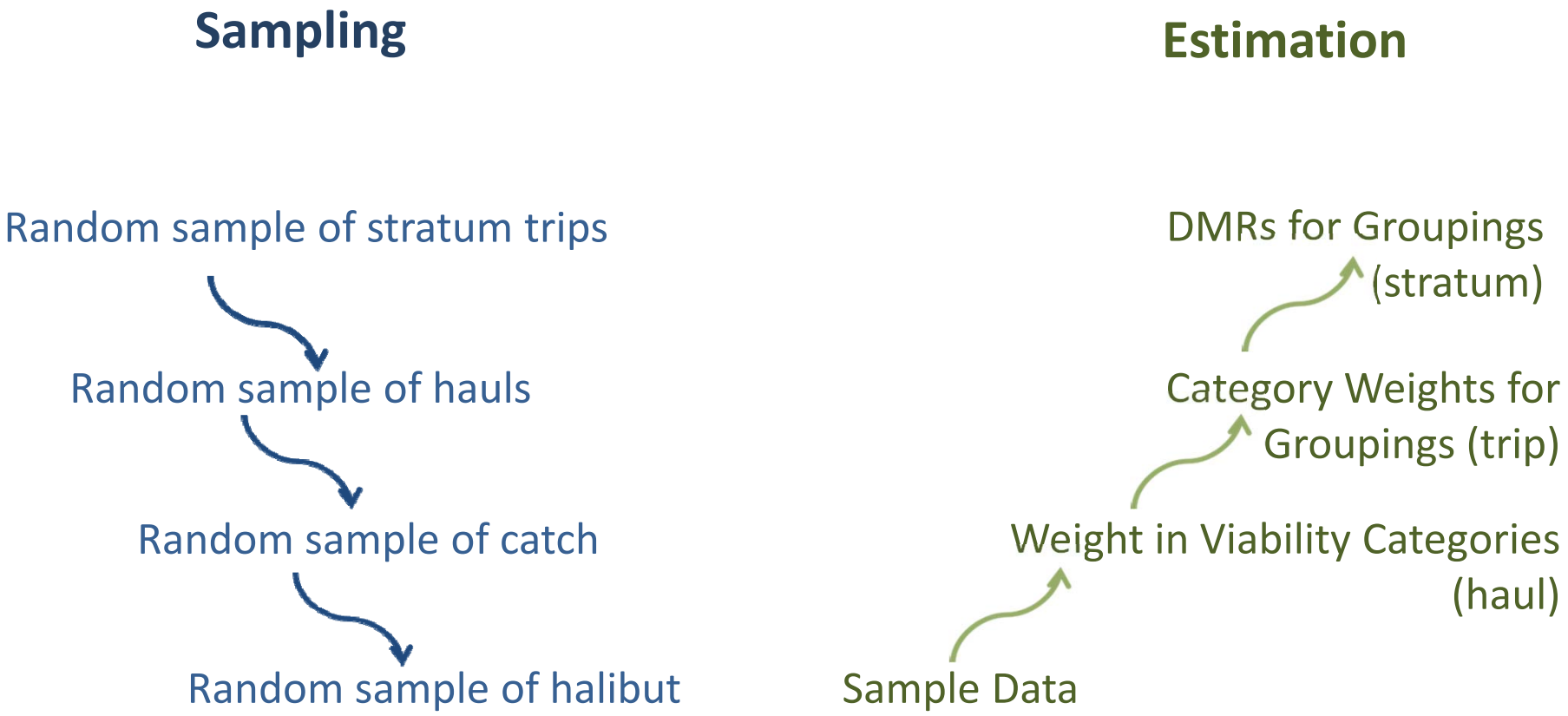


Current Approach



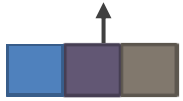
Hierarchical Design



DMR for each Grouping (stratum)

Grouping DMR = Grouping Mortality / Total Discard

Grouping Mortality = Sum(Category Weight * Mortality Rate)



IPHC Mortality

Weight in Each Category and Grouping (stratum)

Same Process

Trip to Operational Groupings within stratum

Proportion * CAS Total Discard

Weight in Each Category and Grouping (trip)

Hauls to Operational Groupings within trip

Proportion * CAS Trip Discard

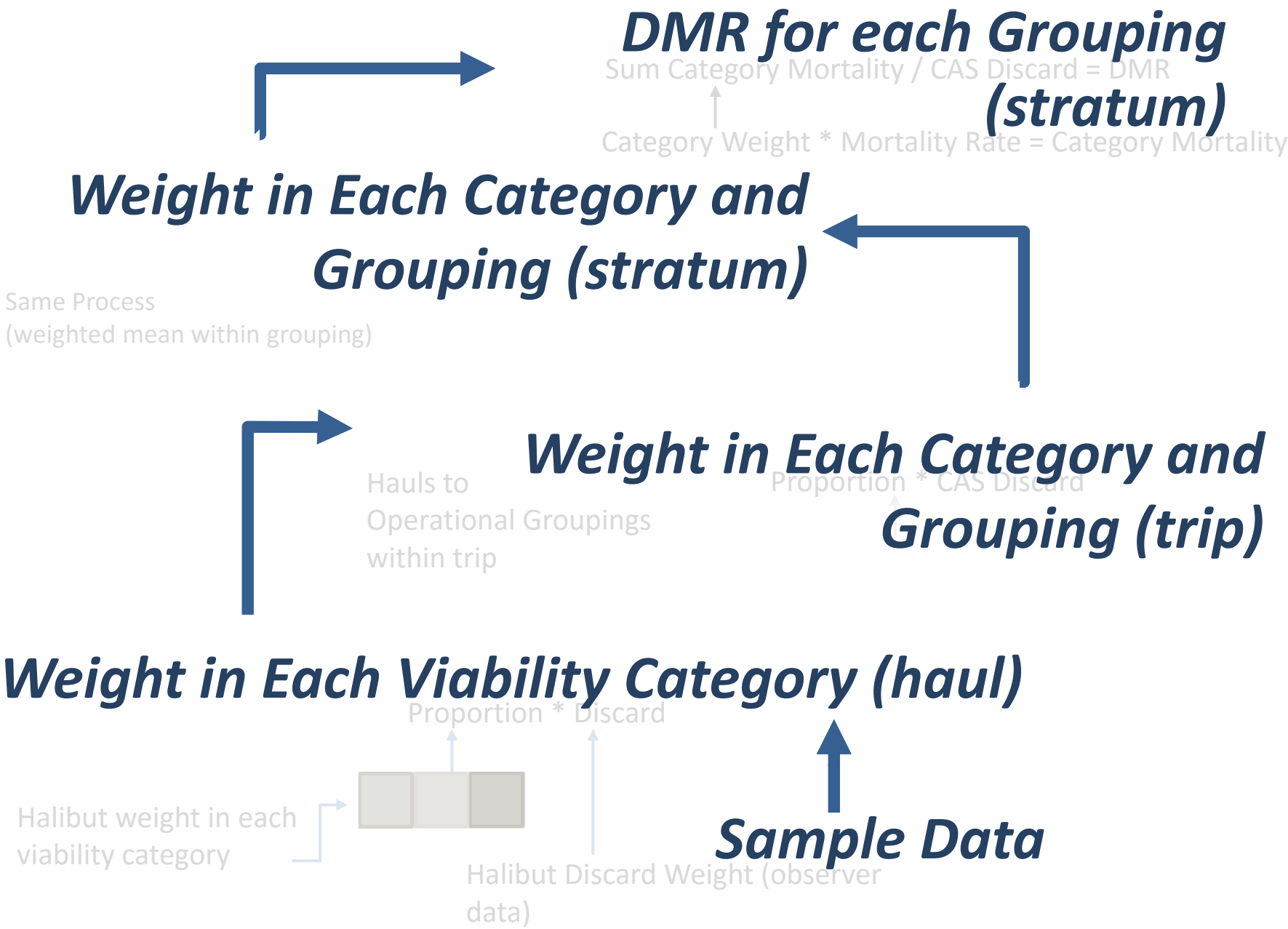
Weight in Each Viability Category (haul)

Proportion * Discard

Halibut weight in each viability category

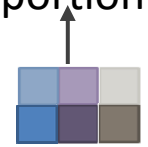
Halibut Discard Weight (observer data)

Sample Data


DMR for each Grouping (stratum)
Sum Category Mortality / CAS Discard = DMR
Category Weight * Mortality Rate = Category Mortality
Weight in Each Category and Grouping (stratum)
Same Process
(weighted mean within grouping)
Weight in Each Category and Grouping (trip)
Proportion * CAS Discard
Hauls to Operational Groupings within trip
Weight in Each Viability Category (haul)
Proportion * Discard
Halibut weight in each viability category
Halibut Discard Weight (observer data)
Sample Data

Weight in Each Category and Grouping (trip)

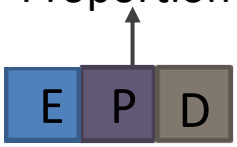
Category Grouping Weight = CAS Trip Discard * Proportion



Hauls to
Operational Groupings
within trip

Weight in Each Viability Category (haul)

Category Weight = Discard * Proportion



Halibut weight in each viability category

Halibut Discard Weight
(observer data)

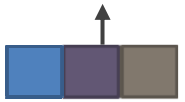
Sample Data

DMR for each Grouping (stratum)

DMR = Grouping Mortality / Total Discard

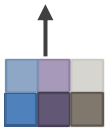
Grouping Mortality = sum(Mortality Rate * Category Weight)

IPHC Mortality



Weight in Each Category and Grouping (stratum)

Category Grouping Weight = CAS Total Discard * Proportion



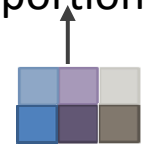
Trip to
Operational Groupings
within stratum

Weight in Each Category and Grouping (trip)

$$\hat{D}_{ctg} = \hat{D}_{tg}\hat{p}_{ctg}$$

Category Grouping Weight = CAS Trip Discard * Proportion

Hauls to
Operational Groupings
within trip

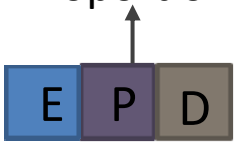


$$\hat{p}_{ctg} = \frac{\sum_{j=1}^{J_t} \hat{D}_{cjtg}}{\sum_{c}\sum_{j=1}^{J_t} \hat{D}_{cjtg}} = \frac{\hat{D}_{ctg}}{\hat{D}_{tg}}$$

Weight in Each Viability Category (haul)

$$\hat{D}_{cj} = \hat{D}_{j}\hat{p}_{cj}$$

Category Weight = Discard * Proportion



Halibut Discard Weight
(observer data)

Halibut weight in each
viability category

$$\hat{p}_{cj} = \frac{\sum_{k=1}^{K_j} w_{cjk}}{\sum_{c}\sum_{k=1}^{K_j} w_{cjk}} = \frac{w_{cj}}{w_j}$$

Sample Data

DMR for each Grouping (stratum)

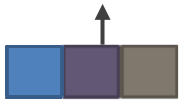
DMR = Sum (Category Mortality) / Total Discard

$$\hat{DMR}_g = \frac{\hat{M}_g}{\hat{D}_g}$$

Category Mortality = sum(Mortality Rate * Category Grouping Weight)

IPHC Mortality

$$\hat{M}_g = \sum_c R_c \hat{D}_{cg} = \sum_c R_c \hat{D}_g \hat{p}_{cg}$$



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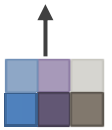
Category Grouping Weight = CAS Total Discard * Proportion

Trip to
Operational Groupings
within stratum



$$\hat{p}_{cg} = \frac{\sum_{t=1}^{T} \hat{D}_{ctg}}{\sum_c \sum_{t=1}^{T} \hat{D}_{ctg}} = \frac{\hat{D}_{cg}}{\hat{D}_g}$$

Results

Operational Group				Sample Size (Mean $N_{Viabilities}$)	Estimate DMR?
Sector	Region	Gear	Target		
CP	BSAI	PTR	non-pollock	*in process*	N (100%)
		NPT[a]	all	4,306	Y
		HAL	all	10,266	Y
		POT	all	686[b]	Y
	GOA	PTR	non-pollock	*in process*	N (100%)
		NPT[a]	all	493	Y
		HAL	all	1,234	Y
		POT	all	523[c]	Y
CV	BSAI	PTR	non-pollock	0	N (100%)
		NPT	all	2,174	Y
		HAL	all	48[d]	Y
		POT	all	686[b]	Y
	GOA	PTR	non-pollock	*in process*	N (100%)
		NPT	all	1,465	Y
		HAL	all	493	Y
		POT	all	523[c]	Y

[a] Very few CP NPT in GOA – pooled with BSAI
[b] CV, CP in same group by design
[c] CV, CP in same group by design
[d] Viability sampling began in 2013

Results
Trawl DMRs

	DMRs 2009	2010	2011	2012	2013	2014	2015	long term average	2013-2015 average
CP									
BSAI									
NPT	88.34%	85.24%	83.08%	84.22%	86.99%	85.52%	83.65%	85.29%	85.38%
PTR	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.00%	100.00%
GOA									
NPT	79.37%	82.66%	76.42%	84.61%	80.98%	86.81%	90.00%	85.29%	85.38%
PTR	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.00%	100.00%
CV									
BSAI									
NPT	83.57%	72.12%	62.32%	68.00%	44.13%	51.58%	59.03%	62.96%	51.58%
PTR	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.00%	100.00%
GOA									
NPT		60.24%	52.73%	58.23%	60.50%	65.29%	64.69%	60.28%	63.49%
PTR	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.00%	100.00%

Results
HAL DMRs

	DMRs									
	2009	2010	2011	2012	2013	2014	2015	2016	long term average	2013-2015 average
CP										
BSAI	9.56%	8.42%	9.83%	7.80%	8.97%	8.49%	7.86%		8.70%	8.44%
GOA	8.2%	9.3%	9.1%	8.7%	12.2%	9.5%	10.5%		9.64%	10.73%
CV										
BSAI	NA	NA	NA	NA	NA	21.92%	3.50%		12.71%	12.71%
GOA	NA	9.52%	5.32%	37.28%	12.66%	8.94%	15.06%		14.79%	12.22%

Results
Pot DMRs

	DMRs								
	2009	2010	2011	2012	2013	2014	2015	long term average	2013-2015 average
BSAI	NA	23.68%	15.28%	8.60%	5.19%	3.06%	6.87%	10.45%	5.04%
GOA	NA	7.53%	4.31%	16.27%	16.20%	10.25%	2.38%	9.49%	9.61%

DMR Changes

Non-CDQ		
Gear	**Fishery**	**DMR (%)**
Trawl	Alaska plaice	66
	Arrowtooth flounder	84
	Atka mackerel	82
	Flathead sole	72
	Greenland turbot	82
	Non-pelagic pollock	84
	Pelagic pollock	81
	Other flatfish	88
	Other species	63
	Pacific cod	66
	Rockfish	66
	Rock sole	86
	Sablefish	66
	Yellowfin sole	84
Hook and line	Greenland turbot	11
	Other species	9
	Pacific cod	9
	Rockfish	9
Pot	Other species	9
	Pacific cod	9

CDQ		
Gear	**Fishery**	**DMR (%)**
Trawl		
	Atka mackerel	82
	Flathead sole	79
	Greenland turbot	89
	Non-pelagic pollock	86
	Pelagic pollock	90
	Pacific cod	87
	Rockfish	70
	Rock sole	86
	Yellowfin sole	85
Hook and line	Greenland turbot	10
	Pacific cod	10
Pot		
	Pacific cod	1
	Sablefish	41

Table 6. 2016 and 2017 Pacific Halibut Discard Mortality Rates for the **GOA**, as established in the annual harvest specifications

Gear	Fishery	DMR (%)
Trawl	Arrowtooth flounder	76
	Deepwater flatfish	62
	Flathead sole	67
	Non-pelagic pollock	58
	Other fisheries[1]	62
	Pacific cod	62
	Pelagic pollock	65
	Rex sole	72
	Rockfish	65
	Sablefish	59
	Shallow-water flatfish	66

Gear	Fishery	DMR (%)
Hook and line	Other fisheries[1]	10
	Pacific cod	10
	Rockfish	10
Pot	Other fisheries[1]	15
	Pacific cod	15

[1]"Other fisheries" includes all gear types for skates, sculpins, squids, octopuses, and hook-and-line sablefish.

GOA Changes

Variable, but mostly smaller DMR
– NPT CV

Larger DMR
- All others

2015 Gulf of Alaska Halibut Mortality using proposed DMRs (as of August 30, 2016)										
Gear	Sector	Program	Halibut	DMR	Current Halibut mortality	Target	New DMR	New Halibut mortality	Current minus	PSC limit
HAL	CP	OA	628	0.1	63	Pacific cod	0.11	67	(5)	
HAL	CP	OA	0	0.1	0	Other species	0.11	0	(0)	116
HAL	CV	OA	1,262	0.1	126	Pacific cod	0.12	154	(28)	145
PTR	CV	RPP	0	0.6	0	Bottom pollock	1.00	0	(0)	
PTR	CV	RPP	5	0.66	3	Rockfish	1.00	5	(2)	
NPT	CV	RPP	0	0.6	0	Bottom pollock	1.00	0	(0)	
NPT	CV	RPP	22	0.62	14	Pacific cod	1.00	22	(8)	
NPT	CV	RPP	30	0.66	20	Rockfish	1.00	30	(10)	
NPT	CV	RPP	3	0.71	2	Shallow water flatfish	1.00	3	(1)	
								-	-	
PTR	CV	OA	6	0.6	4	Bottom pollock	1.00	6		
PTR	CV	OA	1	0.62	1	Pacific cod	1.00	1	(0)	
PTR	CV	OA	7	0.71	5	Pelagic pollock	1.00	7	(2)	
								-	-	
NPT	CV	OA	150	0.6	90	Bottom pollock	0.63	95	(5)	
NPT	CV	OA	757	0.62	469	Pacific cod	0.63	480	(11)	
NPT	CV	OA	99	0.67	66	Shallow water flatfish	0.63	63	3	
NPT	CV	OA	0	0.66	0	Rockfish	0.63	0	0	
NPT	CV	OA	3	0.71	2	Pelagic pollock	0.63	2	0	
NPT	CV	OA	-	0.71	-	Shallow water flatfish	0.63	-		
NPT	CV	OA	488	0.73	356	Arrowtooth flounder	0.63	310	46	
NPT	CV	OA	8	0.69	5	Rex sole	0.63	5	0	
									-	
NPT	CP	OA	0	0.6	0	Bottom pollock	0.85	0	(0)	
NPT	CP	OA	1	0.62	1	Pacific cod	0.85	1	(0)	
NPT	CP	OA	-	0.43	-	Deep water flatfish	0.85	-	-	
NPT	CP	OA	62	0.67	41	Shallow water flatfish	0.85	53	(11)	
NPT	CP	OA	46	0.66	30	Rockfish	0.85	39		
NPT	CP	OA	4	0.65	2	Flathead sole	0.85	3	(1)	
NPT	CP	OA	0	0.71	0	Sablefish	0.85	0	(0)	
NPT	CP	OA	306	0.73	223	Arrowtooth flounder	0.85	261	(38)	
NPT	CP	OA	35	0.69	24	Rex sole	0.85	30	(6)	
NPT	CP	RPP	77	0.66	51	Rockfish	0.85	65	(15)	
NPT	CP	RPP	3	0.73	2	Arrowtooth flounder	0.85	3	(0)	
PTR	CP	OA	-	0.66	-	Rockfish	1.00	-	-	
Total			4,002		1,602			1,706	(105)	2,021
					Trawl only			Trawl only	Trawl only	Trawl PSC limit
					1,413			1,485	(72)	1,760

BSAI Changes

Variable, but mostly smaller DMR
– HAL CP
– NPT CV

Larger DMR
- All others

					Current		New	New	
Gear	Sector	Program	Halibut	DMR	Halibut mortality	Target	DMR	Halibut mortality	Current minus New
HAL	S	OA	17	0.09	2	Pacific cod	0.13	2	(1)
HAL	CP	CDQ	221	0.1	22	Pacific cod	0.08	19	3
HAL	CP	IFQ	-	0.04	-	Rockfish	0.08	-	-
HAL	CP	OA	0	0.09	0	Bottom pollock	0.08	0	0
HAL	CP	OA	3,207	0.09	289	Pacific cod	0.08	271	18
HAL	CP	OA	2	0.09	0	Other species	0.08	0	0
HAL	CP	OA	24	0.13	3	Greenland turbot	0.08	2	1
PTR	M	AFA	2	0.88	2	Pelagic pollock	1.00	2	(0)
PTR	S	AFA	4	0.77	3	Bottom pollock	1.00	4	(1)
PTR	S	AFA	29	0.88	25	Pelagic pollock	1.00	29	(3)
PTR	S	OA	1	0.71	1	Pacific cod	1.00	1	(0)
NPT	M	CDQ	0	0.8	0	Rockfish	0.52	0	0
NPT	M	CDQ	0	0.86	0	Atka mackerel	0.52	0	0
NPT	M	CDQ	15	0.86	13	Yellowfin sole	0.52	8	5
NPT	M	CDQ	1	0.88	1	Rock sole	0.52	0	0
NPT	M	OA	23	0.71	16	Pacific cod	0.52	12	4
NPT	M	OA	6	0.77	4	Atka mackerel	0.52	3	1
NPT	M	OA	0	0.77	0	Bottom pollock	0.52	0	0
NPT	M	OA	1	0.79	1	Rockfish	0.52	1	0
NPT	M	OA	84	0.83	69	Yellowfin sole	0.52	43	26
NPT	M	OA	8	0.85	7	Rock sole	0.52	4	3
NPT	S	OA	297	0.71	211	Pacific cod	0.52	153	58
NPT	CP	A80	-	0.64	-	Greenland turbot	0.85	-	-
NPT	CP	A80	51	0.71	36	Pacific cod	0.85	44	(7)
NPT	CP	A80	3	0.71	2	Alaska Plaice	0.85	2	(0)
NPT	CP	A80	-	0.71	-	Other flatfish	0.85	-	-
NPT	CP	A80	61	0.73	44	Flathead sole	0.85	51	(7)
NPT	CP	A80	58	0.76	44	Kamchatka flounder	0.85	49	(5)
NPT	CP	A80	82	0.76	62	Arrowtooth flounder	0.85	70	(7)
NPT	CP	A80	111	0.77	85	Atka mackerel	0.85	94	(9)
NPT	CP	A80	23	0.77	18	Bottom pollock	0.85	20	(2)
NPT	CP	A80	75	0.79	60	Rockfish	0.85	64	(5)
NPT	CP	A80	696	0.83	578	Yellowfin sole	0.85	592	(14)
NPT	CP	A80	559	0.85	475	Rock sole	0.85	475	-
NPT	CP	CDQ	3	0.76	3	Arrowtooth flounder	0.85	3	(0)
NPT	CP	CDQ	0	0.79	0	Flathead sole	0.85	0	(0)
NPT	CP	CDQ	0	0.8	0	Rockfish	0.85	0	(0)
NPT	CP	CDQ	1	0.83	1	Bottom pollock	0.85	1	(0)
NPT	CP	CDQ	8	0.86	7	Atka mackerel	0.85	7	0
NPT	CP	CDQ	48	0.86	42	Yellowfin sole	0.85	41	0
NPT	CP	CDQ	27	0.88	24	Rock sole	0.85	23	1
NPT	CP	CDQ	12	0.9	11	Pacific cod	0.85	10	1
NPT	CP	OA	18	0.71	13	Pacific cod	0.85	15	(2)
NPT	CP	OA	3	0.73	2	Flathead sole	0.85	3	(0)
NPT	CP	OA	1	0.77	1	Atka mackerel	0.85	1	(0)
NPT	CP	OA	0	0.77	0	Bottom pollock	0.85	0	(0)
NPT	CP	OA	66	0.83	55	Yellowfin sole	0.85	56	(1)
NPT	CP	OA	1	0.85	1	Rock sole	0.85	1	-
				0.7835					
PTR	CP	AFA	7	0.77	5	Bottom pollock	1.00	7	(2)
PTR	CP	AFA	78	0.88	69	Pelagic pollock	1.00	78	(9)
PTR	CP	AIP	-	0.77	-	Bottom pollock	1.00	-	-
PTR	CP	AIP	-	0.79	-	Rockfish		-	-
PTR	CP	AIP	-	0.88	-	Pelagic pollock	1.00	-	-
PTR	CP	CDQ	0	0.83	0	Bottom pollock	1.00	0	(0)
PTR	CP	CDQ	8	0.9	8	Pelagic pollock	1.00	8	(1)
Total			5,942		2,312			2,268	44

Review/Questions for the Plan Team

The Working Group has laid out an alternative approach to defining "fisheries" in the GOA and BSAI based on halibut handling differences (operational groupings) rather than on target species (Section 2).

1. *Does the Plan Team support the general approach of using operational groupings for DMRs as opposed to target fishery-specific DMRs?*

2. Are the specific operational groupings described by the Working Group appropriate?

Review/Questions for the Plan Team

The Working Group has described methods for expanding viability samples from the haul level to defined operational groupings or strata (Section 3).

3. Are the methods for expanding viability samples into strata appropriate?

Review/Questions for the Plan Team

The Working Group is recommending using annual DMR estimates from 2013 forward unless this results in inadequate sample size.

4. Is this the appropriate reference period for calculating DMRs at this time?

Review/Questions for the Plan Team

Some identified strata may have issues with number of vessels and number of viabilities upon which to estimate annual DMRs.

5. Are strata for which sample size is an issue appropriately addressed for management purposes?

Review/Questions for the Plan Team

The Working Group developed the methods for possible application in 2017.

6. Can the proposed methods be used for management in 2017 (given adequate response by November to PT recommendations)?

Review/Questions for the Plan Team

7. *Other issues, questions, concerns?*