Science, Service, Stewardship

Evolving Bycatch Risk in the Pacific Groundfish Trawl IFQ

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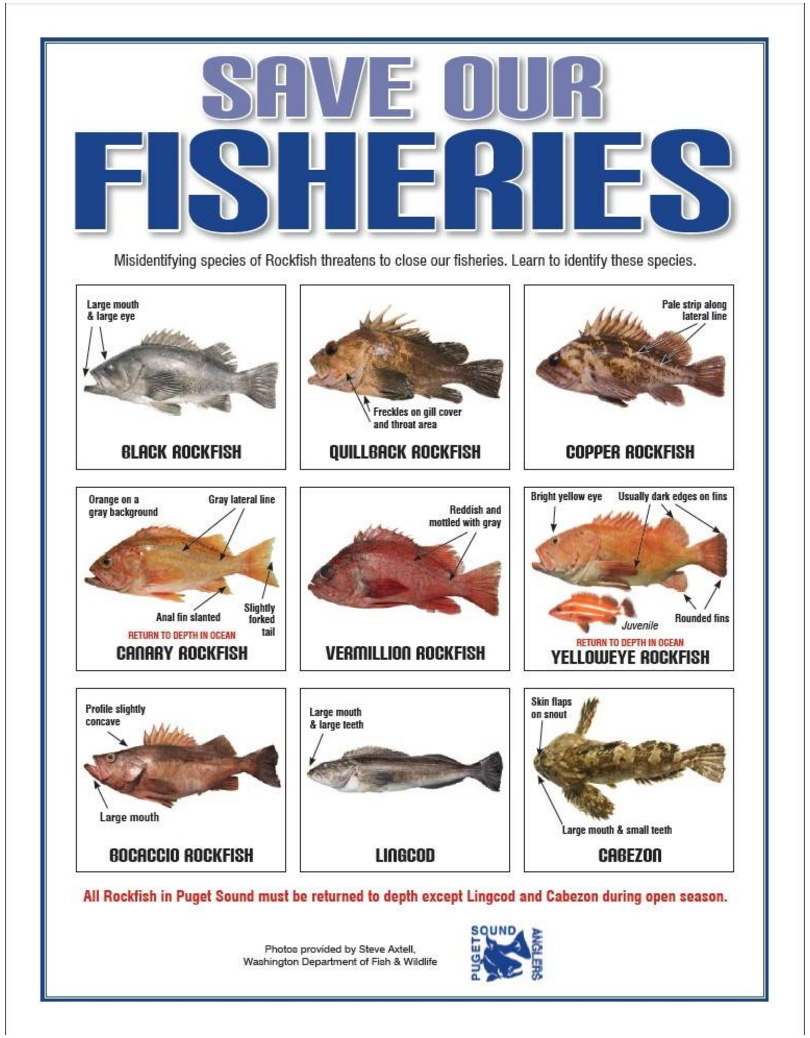
NOAA FISHERIES SERVICE

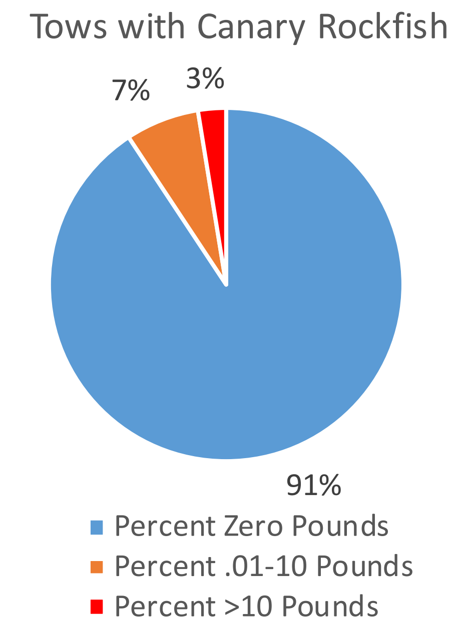
Managing Rare and Uncertain Fishery Bycatch in IFQs

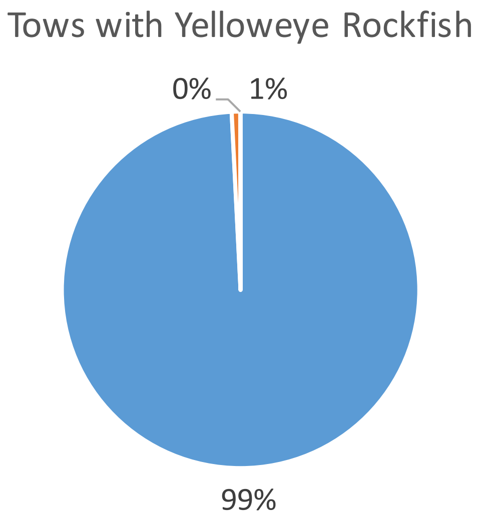
- When bycatch is rare and highly uncertain, catches are likely to be concentrated and may not match quota allocations
- Quota markets may fail to re-allocate quota efficiently creating substantial financial risk for fishermen who are forced to cease fishing if they exceed their quota
- Failure to re-allocate quota effectively, and concerns about being able to purchase quota to cover unexpected catch, may result in underutilization of target species quotas
- I explore how fishermen in the Pacific groundfish trawl IFQ responded to the problem of potential bycatch "choke" stocks
- I show how "bycatch risk" has evolved since implementation of the Pacific groundfish IFQ as a result of bycatch avoidance and rebuilding of overfished rockfish stocks



Measuring Bycatch Risk

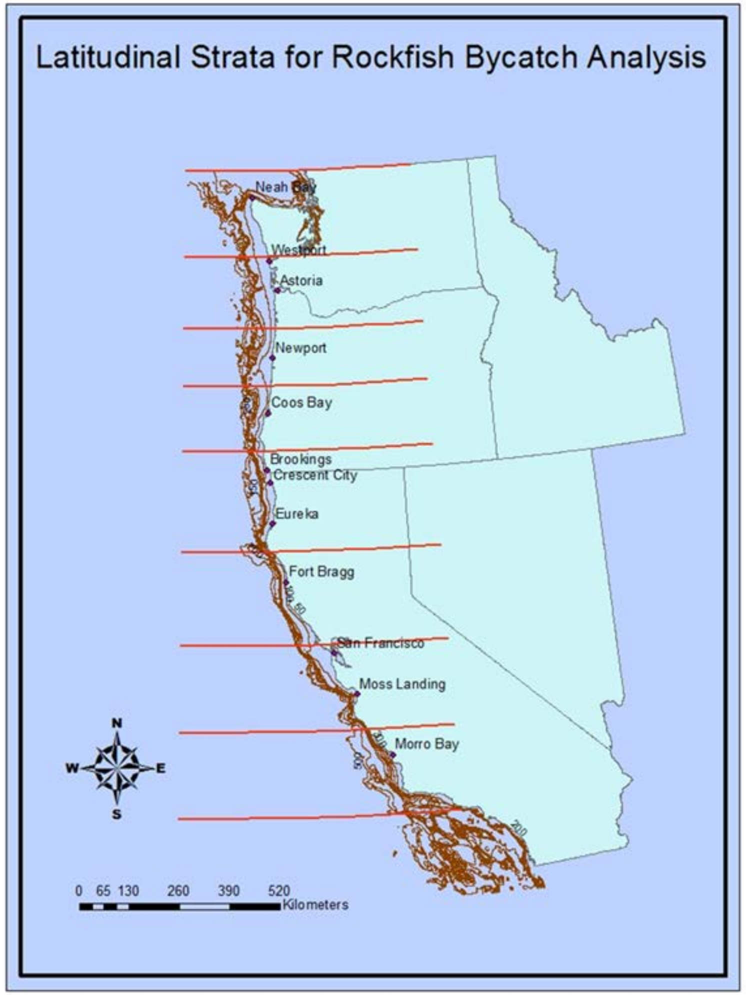
- Catches of some overfished rockfish species are zero on most tows and highly skewed, so average or median catch is not a good measure of potential bycatch risk for an individual
- One useful metric used to evaluate risk that has become popular with insurance actuaries is tail conditional expectation (TCE) which is simply the expected value of the loss associated with some percentile of the distribution taken from the right tail (e.g. the 95th percentile bycatch).
- Bycatch risk is a function of potential bycatch relative to the quota available to cover that bycatch
- I measure bycatch risk as the ratio of the 95th TCE of bycatch from a median number of tows to the median quota pound allocation
- An alternative would be TCE*quota pound price, but this may undervalue risk of lost opportunity





Tail Conditional Expectation as a Measure of Risk

- Data: observer data records location and catch per tow (25% coverage pre-IFQ – 100% coverage post IFQ)
- Randomly draw with replacement 100 tows from spatially stratified samples of tows from specified time periods - pre or post IFQ.
- Repeat 10,000 times to get distribution of catch from 100 tows (representing annual catch for an average vessel)
- Calculate 95th TCE as average of the top 5% of the distribution of total catch (by species) from 100 tows – the average of the worst 5% of outcomes.
- Calculate bycatch risk as ratio of 95th TCE to median quota pound allocations



High Potential Risk of Exceeding Quota Pound Allocations When IFQ Implemented

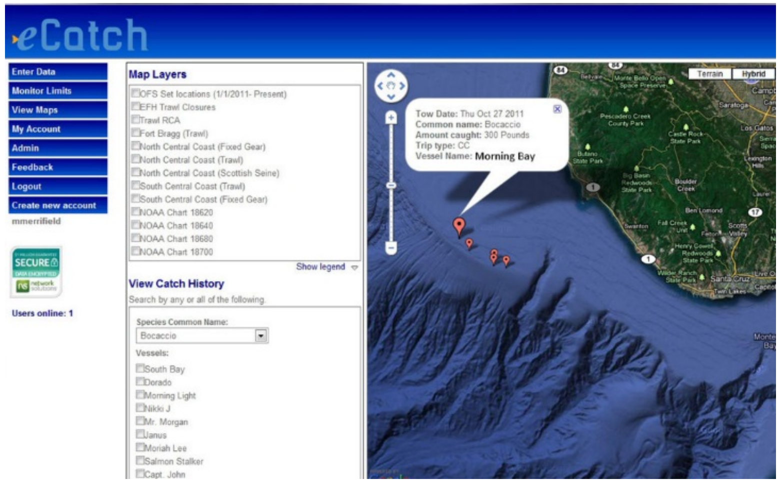
Area	Bocaccio	Canary	Cowcod	Dark-blotched	Pacific halibut	POP	Widow	Yelloweye
	95th Percentile TCE (2002-2009 Obseved Tows)							
North of 47°	n.a.	3,209	n.a.	8,341	23,074	25,512	6,418	199
45°20' to 47°	n.a.	1,132	n.a.	6,974	3,583	24,500	26,760	56
44°to 45°20'	n.a.	938	n.a.	20,063	11,493	14,715	1,052	63
42°30' to 44°	n.a.	3,496	n.a.	13,251	5,082	2,477	257	110
40°10' to 42°30'	n.a.	11,452	n.a.	10,867	4,295	960	27,799	16
38° to 40°10'	7,904	845	406	5,301	n.a.	n.a.	2,176	60
36° to 38°	7,892	1,081	245	3,030	n.a.	n.a.	6,366	31
2011 Median Vessel QP Allocations	309	326	9	1,885	932	1,124	4,760	4
	Ratio of 95th Percentile TCE/2011 Median Vessel QP Limits							
North of 47°	n.a.	10	n.a.	4	25	23	1	50
45°20' to 47°	n.a.	3	n.a.	4	4	22	6	14
44°to 45°20'	n.a.	3	n.a.	11	12	13	0	16
42°30' to 44°	n.a.	11	n.a.	7	5	2	0	27
40°10' to 42°30'	n.a.	35	n.a.	6	5	1	6	4
38° to 40°10'	26	3	45	3	n.a.	n.a.	0	15
36° to 38°	26	3	27	2	n.a.	n.a.	1	8

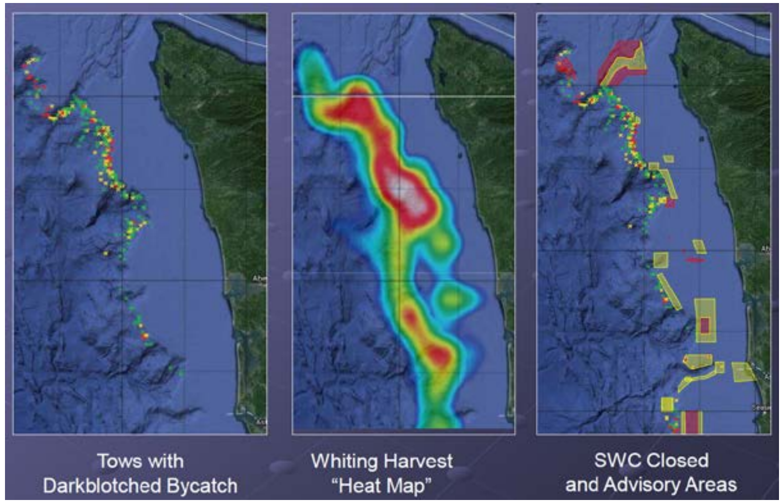
Risk Pool Formation in West Coast Groundfish Fishery

- Several risk pools reportedly formed when IFQ Implemented
- Californial Risk Pool: A coalition of fishermen's from three Northern California ports in cooperation with the Nature Conservancy
- Whiting Mothership Cooperative (included a bycatch risk pool as part of the operating agreement)
- The Ilwaco Fishermen and Marketing Cooperative (IFMC) in WA
- An inshore whiting risk pool formed in 2012
- Anecdotal reports suggest that some groups developed cooperative approaches and informal risk pools in conjunction with processors rather than joining formal risk pools
- Details of operation and current status of some risk pools is uncertain as most are not regulated entities

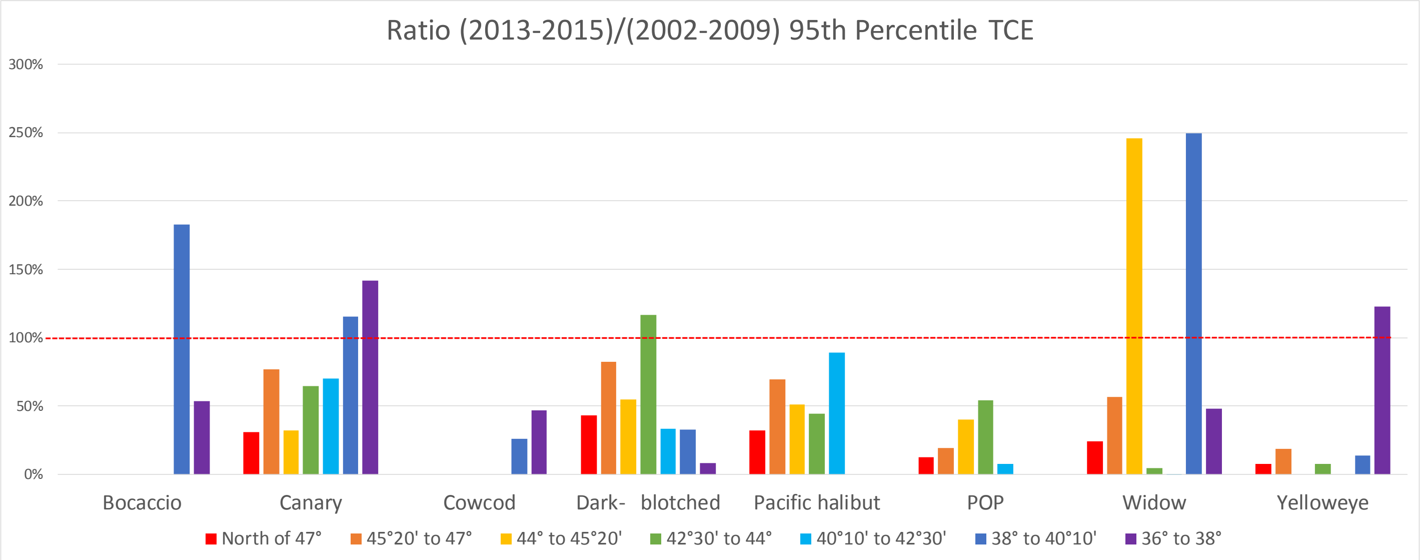
Common Characteristics of Risk Pools

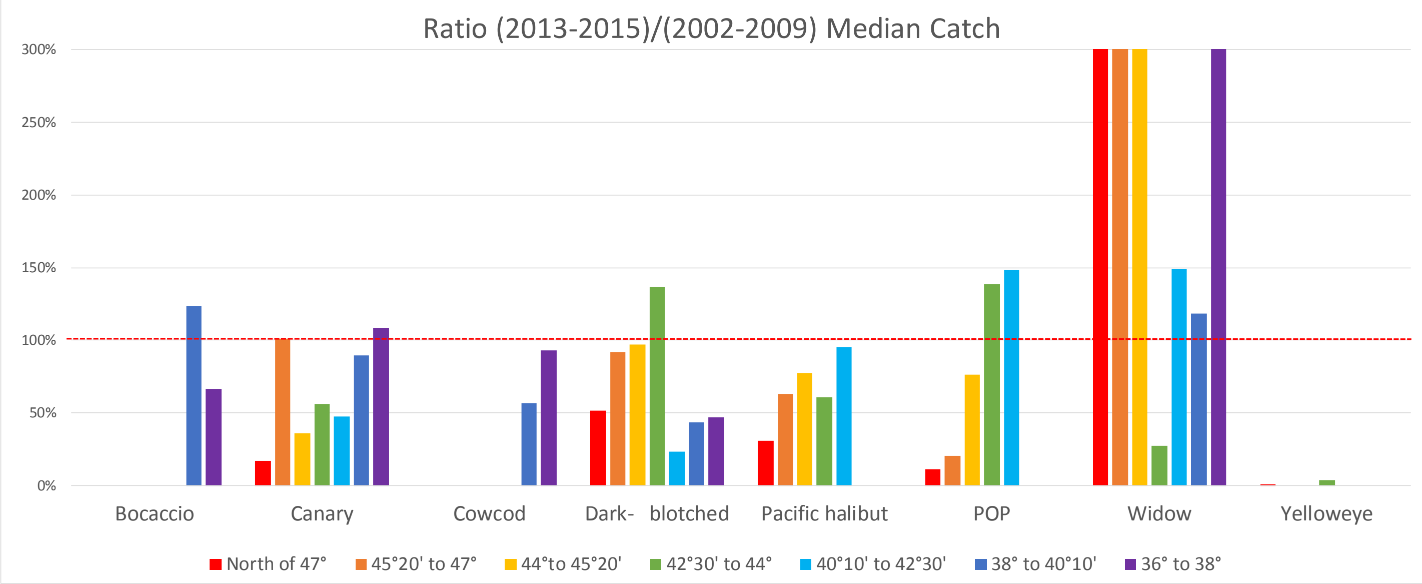
- Generally avoid monetizing bycatch quota – don't charge a price for withdrawals to cover bycatch event (though initial contribution of quota may be required or enable withdrawals from pool)
- Create an agreement and a system to share real-time information to avoid bycatch
- Define best practices for minimizing bycatch risk (e.g. delineate areas to avoid fishing, move-on rules, no night fishing, etc.).
- Penalties or lost access to risk pool quota if not following rules or if average bycatch rates are too high (monitored by risk pool manager)
- Shore-based whiting risk pool requires in-kind (quota) premiums and in-kind co-pays if vessels exceed prescribed bycatch ratio





Reduction in Bycatch Post IFQ



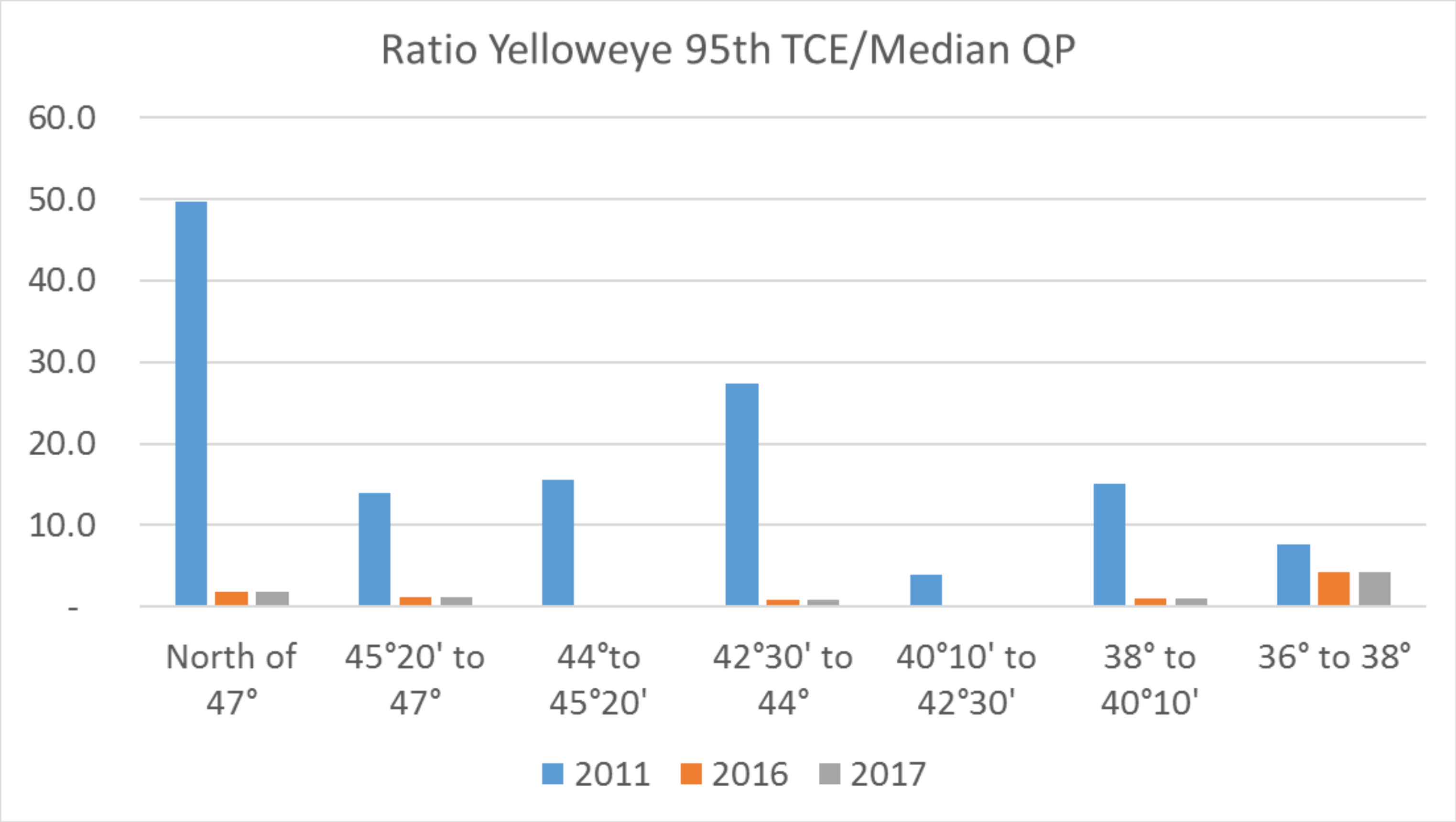


Ratio of 95th Percentile Tail Conditional Expectation of Catch from 100 Tows to Median Quota Pound Allocations

Area	Bocaccio	Canary	Cowcod	Dark-blotched	Pacific halibut	POP	Widow	Yelloweye
	Ratio of 95th Percentile TCE (2002-2009 observed tows)/Vessel QP Limits 2011							
North of 47°	n.a.	10	n.a.	4	25	23	1	50
45°20' to 47°	n.a.	3	n.a.	4	4	22	6	14
44°to 45°20'	n.a.	3	n.a.	11	12	13	0	16
42°30' to 44°	n.a.	11	n.a.	7	5	2	0	27
40°10' to 42°30'	n.a.	35	n.a.	6	5	1	6	4
38° to 40°10'	26	3	45	3	n.a.	n.a.	0	15
36° to 38°	26	3	27	2	n.a.	n.a.	1	8
	Ratio of 95th Percentile TCE (2013-2015 observed tows)/Vessel QP Limits 2017							
North of 47°	n.a.	0	n.a.	0	14	2	0	2
45°20' to 47°	n.a.	0	n.a.	1	5	3	0	1
44°to 45°20'	n.a.	0	n.a.	1	11	3	0	-
42°30' to 44°	n.a.	0	n.a.	2	4	1	0	1
40°10' to 42°30'	n.a.	1	n.a.	0	7	0	0	-
38° to 40°10'	6	0	12	0	n.a.	n.a.	0	1
36° to 38°	2	0	13	0	n.a.	n.a.	0	4

Bycatch Risk Reduced By Avoidance

- Median quota pound allocations have remained very small
- 4 pounds in 2011 up to 9 pounds in 2017
- Aggregate catch of the fleet has not exceeded 10% of total quota pounds



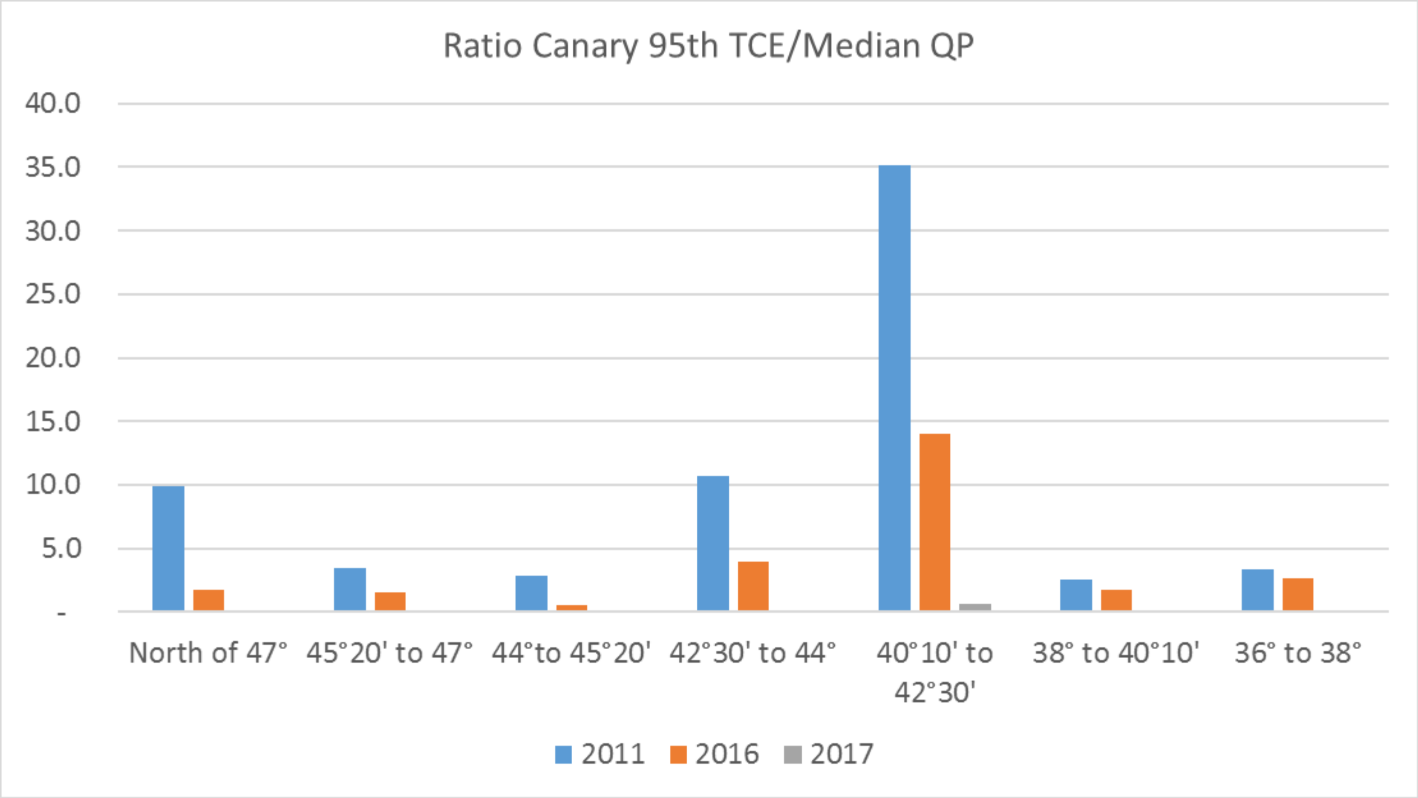
Bycatch Risk Reduced by Rebuilding

- Several of the overfished stocks have rebuilt including Canary rockfish in 2016
- Choke stocks may now be targets and new fisheries are opening up (e.g. midwater trawl for yellowtail and widow rockfish which had been constrained by Canary)
- A few stocks (cowcod, yelloweye rockfish, and POP) remain potential choke species.

	Median QP Allocation		
IFQ Species	2011	2016	2017
Bocaccio rockfish South of 40Â°10' N	309	696	2,474
Canary rockfish	326	573	12,769
Cowcod South of 40Â°10' N	9	9	9
Darkblotched rockfish	1,885	2,194	7,486
Pacific halibut (IBQ) North of 40Â°10' N	932	749	550
Pacific ocean perch North of 40Â°10' N	1,124	1,112	1,783
Widow rockfish	4,760	20,410	163,677
Yelloweye rockfish	4	9	9

Bycatch Risk Reduce by Quota Increase

- Ratios of 95th TCE to median quota have fallen in part due to more effective avoidance – steep drop in post IFQ catches
- Ratios have also dropped due to increasing TACs and quota allocations as species rebuild



Quota Utilization in the Pacific Groundfish IFQ

IFQ Species	2011	2012	2013	2014	2015	2016	2016 Sector Quota
Arrowtooth flounder (TAC dropped 60% in 2013)	20%	26%	63%	50%	52%	47%	6,687,458
Bocaccio rockfish South of 40°10' N.	9%	15%	17%	11%	47%	51%	187,437
Canary rockfish	14%	28%	26%	26%	104%	48%	98,062
Chilipepper rockfish South of 40°10' N.	21%	22%	36%	29%	16%	6%	2,637,280
Cowcod South of 40°10' N.	1%	5%	22%	20%	26%	21%	3,175
Darkblotched rockfish	36%	36%	44%	35%	43%	42%	645,536
Dover sole	35%	33%	36%	29%	14%	16%	101,370,312
English sole	1%	2%	3%	5%	4%	6%	14,631,287
Lingcod North of 40Ã‚Â°10' N.			28%	21%	16%	24%	2,388,422
Lingcod South of 40Ã‚Â°10' N.			3%	4%	7%	6%	929,491
Lingcod Combined	16%	21%	21%	16%	14%	19%	3,317,913
Longspine thornyheads North of 34°27' N.	49%	48%	59%	50%	26%	23%	6,206,189
Minor shelf rockfish North of 40°10' N.	3%	8%	6%	7%	3%	3%	2,417,413
Minor shelf rockfish South of 40°10' N.	3%	15%	25%	12%	5%	2%	423,993
Minor slope rockfish North of 40°10' N.	17%	27%	25%	23%	19%	13%	2,711,554
Minor slope rockfish South of 40°10' N.	14%	33%	31%	26%	16%	12%	937,516
Other flatfish	17%	16%	19%	20%	11%	14%	13,922,412
Pacific cod	22%	35%	14%	15%	37%	37%	2,273,870
Pacific halibut (IBQ) North of 40°10' N.	28%	43%	31%	25%	43%	38%	199,954
Pacific ocean perch North of 40°10' N.	39%	45%	45%	36%	42%	44%	273,704
Pacific whiting	**98%**	**96%**	**99%**	**83%**	**47%**	**61%**	**310,867,464**
Petrale sole	**93%**	**100%**	**92%**	**97%**	**98%**	**95%**	**5,805,653**
Sablefish North of 36° N.	**94%**	**91%**	**101%**	**95%**	**100%**	**95%**	**5,315,874**
Sablefish South of 36° N.	86%	44%	15%	32%	24%	26%	1,736,140
Shortspine thornyheads North of 34°27' N.	50%	50%	60%	50%	45%	48%	3,446,795
Shortspine thornyheads South of 34°27' N.	17%	1%	7%	5%	2%	4%	110,231
Splitnose rockfish South of 40°10' N.	3%	4%	3%	4%	2%	1%	3,634,827
Starry flounder	2%	1%	0%	2%	1%	2%	1,674,080
Widow rockfish	40%	45%	41%	66%	57%	62%	3,131,931
Yelloweye rockfish	10%	6%	6%	6%	4%	5%	2,381
Yellowtail rockfish North of 40°10' N.	24%	32%	27%	40%	32%	26%	9,648,906

Ratio of Quota Pound Price to Ex-vessel Price

- Quota prices well above ex-vessel prices for overfished rockfish species and halibut despite excess QP every year.
- QP prices for some bycatch specie declined in 2015 but still above ex-vessel for several species.

IFQ Species	2011	2012	2013	2014	2015	2016
Arrowtooth flounder	--	0.16	0.09	--	0.10	0.10
Bocaccio rockfish South of 40?10' N.	0.75	--	0.25	0.40	0.37	0.36
Canary rockfish	2.24	2.91	6.18	3.88	2.05	2.75
Chilipepper rockfish South of 40?10' N.	0.08	0.04	0.03	0.04	0.03	--
Cowcod South of 40?10' N.	--	--	--	--	--	2.20
Darkblotched rockfish	0.84	0.45	1.11	2.43	1.15	1.21
Dover sole	0.15	--	--	--	--	--
English sole	--	--	--	--	--	--
Lingcod	0.09	0.07	--	--	--	--
Lingcod North of 40?10' N.	--	--	--	--	--	0.01
Lingcod South of 40?10' N.	--	--	--	--	0.01	--
Longspine thornyheads North of 34?27' N.	0.09	0.11	0.11	0.14	0.07	0.07
Minor shelf rockfish North of 40?10' N.	--	--	--	--	--	--
Minor shelf rockfish South of 40?10' N.	--	--	0.02	0.02	--	--
Minor slope rockfish North of 40?10' N.	--	--	0.07	0.08	0.06	0.03
Minor slope rockfish South of 40?10' N.	0.05	0.03	0.06	--	0.03	--
Other flatfish	--	--	--	--	--	--
Pacific cod	0.09	0.03	--	0.04	0.02	--
Pacific halibut (IBQ) North of 40?10' N.	1.31	1.19	1.76	0.58	0.58	0.72
Pacific ocean perch North of 40?10' N.	0.28	--	1.58	2.30	1.14	1.17
Pacific whiting	0.18	0.28	0.33	0.27	--	0.14
Petrale sole	0.24	0.27	0.20	0.25	0.29	0.28
Sablefish North of 36? N.	0.38	0.52	0.50	0.46	0.49	0.45
Sablefish South of 36? N.	0.33	0.51	--	--	--	--
Shortspine thornyheads North of 34?27' N.	0.10	0.06	0.06	0.07	0.05	0.04
Shortspine thornyheads South of 34?27' N.	0.04	--	--	--	--	--
Splitnose rockfish South of 40?10' N.	--	--	--	--	--	--
Starry flounder	--	--	--	--	--	--
Widow rockfish	1.01	0.81	1.18	0.53	0.37	0.36
Yelloweye rockfish	60.43	41.24	52.32	43.15	35.11	--
Yellowtail rockfish North of 40?10' N.	--	0.02	0.06	0.04	0.02	0.02

*QP price over one for Pacific Halibut

Conclusions

- Concerns about bycatch risk and failures of the IFQ market to cover unforeseen bycatch did cause many fishers to join risk pools and may have caused hoarding of quota and high quota pound prices
- Reduced bycatch rates and frequency of large bycatch events demonstrate the fishers responded to incentives created by individual quotas by avoiding bycatch
- This avoidance (perhaps excessive avoidance) may have contributed to low utilization rates of many quota stocks
- The combination of effective bycatch avoidance, recovery of overfished stocks and, perhaps, improving market may allow higher utilization rates in coming years
- More effective quota markets or alternatives such as deemed value or multi-year quotas might have enabled higher utilization in the early years of the IFQ and should be considered when designing catch share systems with potential bycatch “choke” species.