

Comparing bycatch and economic metrics in U.S. swordfish fisheries

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Swordfish Meeting

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Background

- OPC/ CA Sea grant project to test gears to target swordfish deep during the day
- Broader comparison beyond gear studies
 - Bycatch metrics
 - Economic metrics
 - Commercial volume metrics



Motivation

- DGN gear often characterized as a high-bycatch fishery
 - How does it compare to other US HMS fisheries?
- PFMC asked for research on alternate gear options as complements to DGN
- Given interest in deep-set buoy and longline gear to avoid turtles
 - Look at other deep-gear fisheries
- Standardize bycatch by measures of economic production
- Other similar studies more limited in scope

Selected U.S. Commercial Fisheries with SWO landings (some targeting tuna)

Fishery	Years in analysis	Target	Fleet size				
CA DGN*	2001-2012	SWO	17-68				
CA DSLL	2005-2011	Tuna	1				
CA HPN*	1995-2011	SWO	9 – 40				
HI SSLL*	2005-2012	SWO	18-35				
HI DSLL	2005-2012	Tuna	122-129				
ATL LL	2005-2012	SWO/ Tuna	106-120				
ATL BG*	2007-2012	SWO	42-57				
CA SSLL#	2001-2004	SWO	23-40				

* Declining number of vessels

J hooks and squid bait were used, no longer in existence

Caveats

Comparisons are complicated by differences in:

- Species composition and abundances across regions
- Target species in different fisheries
- Time periods of data
- Scale of fisheries (individual fishers can have different bycatch rates)
- Data from studies (e.g. economic cost-earnings studies include different components)

The perfect dataset does not exist

Bycatch metrics

Goal:

- Develop metrics that can be compared across fisheries
- A number of factors make the comparison a challenge, including differences in 1) scale of fisheries; 2) bycatch species composition; 3) gear types; 4) areas fished

1. Difference in fisheries

- Use landings per number of expected “takes”
 - Helps to standardize for gear type, effort, vessel size

Year	Take (inds.)	Obs cover	Expected Take
2006	2	20%	10
2007	1	15%	6.7
2008	1	18%	5.6
2009	1	17%	5.9
2010	2	14%	14.3
2011	1	20%	5
Total			47.5

Year	Total landings (t) (all species)
2006	625
2007	725
2008	800
2009	700
2010	550
2011	600
Total	4,000

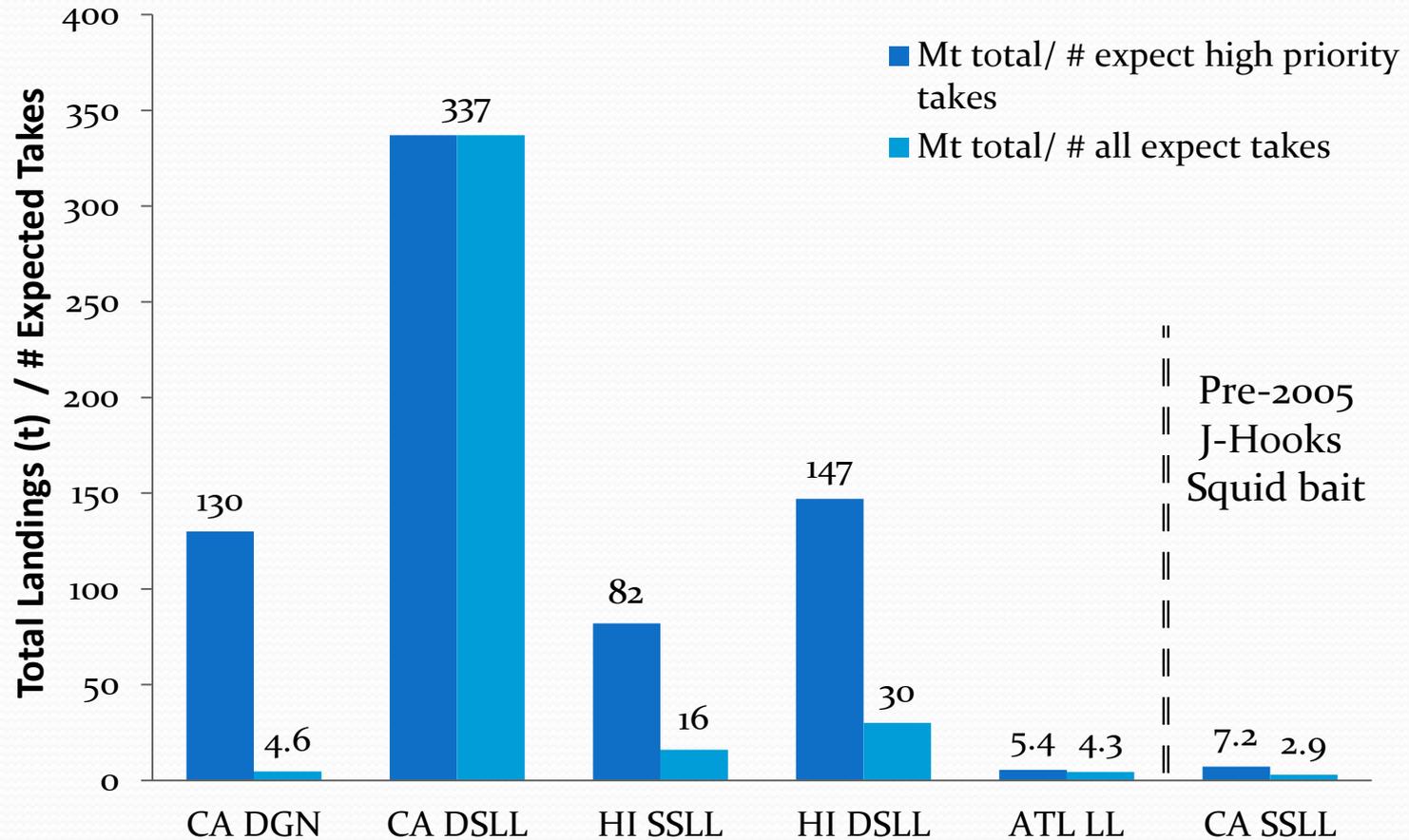
Total landings/total expected takes = 4,000/47.5 = 84.2

2. Difference in bycatch species composition

- Categorize by management priority
 - High priority: ESA listed or strategic stock
 - Other: all other observed marine mammals and sea birds
- Also looked at blue sharks (high levels of take and discard)

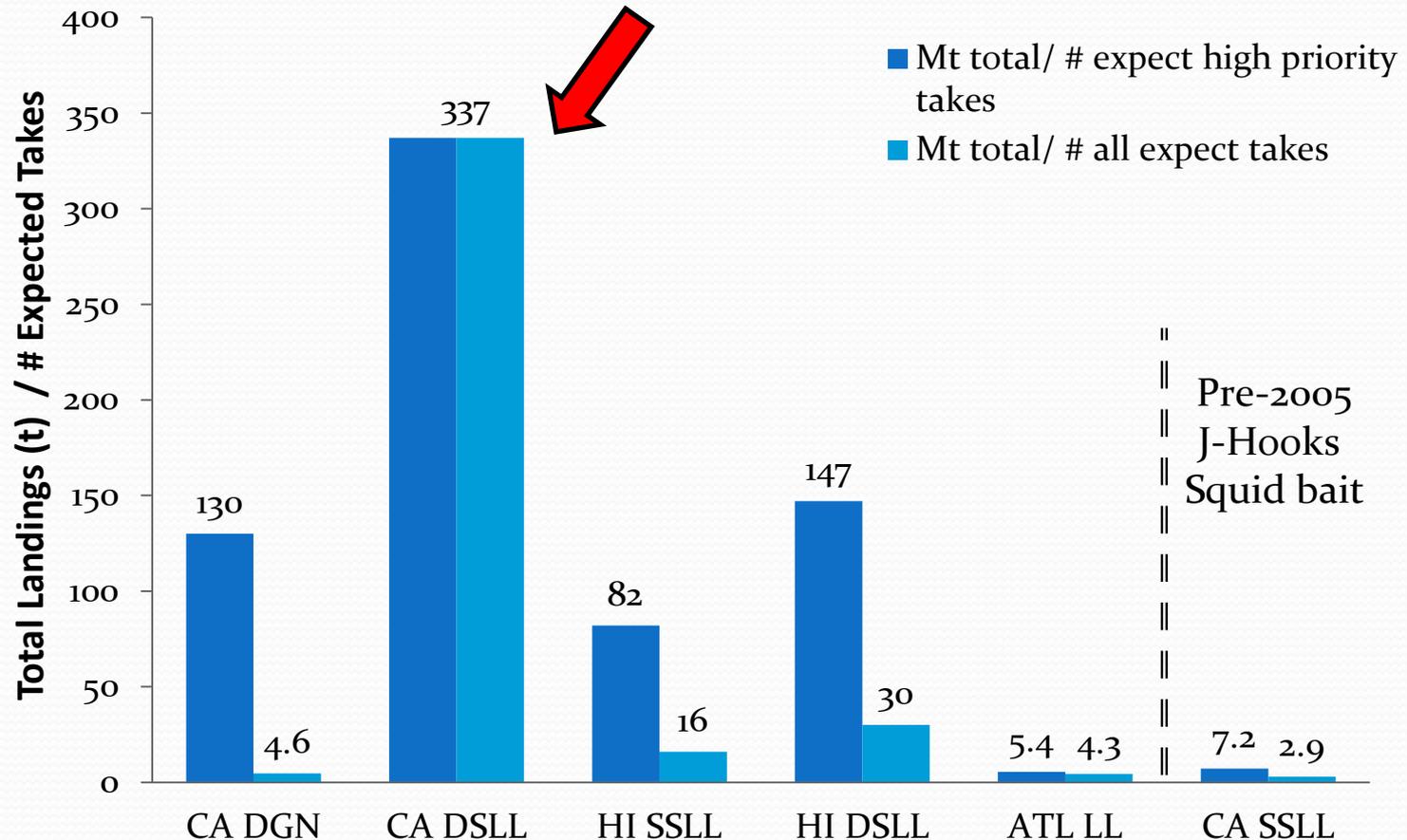
Common name	ESA-listed	SS Pacific	SS Atlantic	DPS listed
Leatherback sea turtle	Y	N/A	N/A	
Loggerhead sea turtle	Y	N/A	N/A	Two DPS
Green sea turtle	Y	N/A	N/A	
Olive ridley sea turtle	Y	N/A	N/A	
Bottlenose dolphin	N	N	Y	
Killer whale	Y	Y	N	South. Resident
False killer whale	Y	Y	N	Hawaii Insular
Humpback whale	Y	Y	Y	
Bryde's whale	N	N	Y	
Sperm whale	Y	Y	Y	
Gray whale	N	N	N	NEP delisted
Atlantic spotted dolphin	N	N	N	
Pantropical spotted dolphin	N	N	N	
Short-beaked common dolphin	N	N	N	
Long-beaked common dolphin	N	N	N	
Risso's dolphin	N	N	N	
Northern right whale dolphin	N	N	N	
Pacific white-sided dolphin	N	N	N	
Rough-toothed dolphin	N	N	N	
Blainville's beaked whale	N	N	N	
Short-finned pilot whale	N	N	N	
Minke whale	N	N	N	
Pygmy killer whale	N	N	N	
Seals and sea lions	N	N	N	
Sea birds	N	N	N	

Landings (t) per take



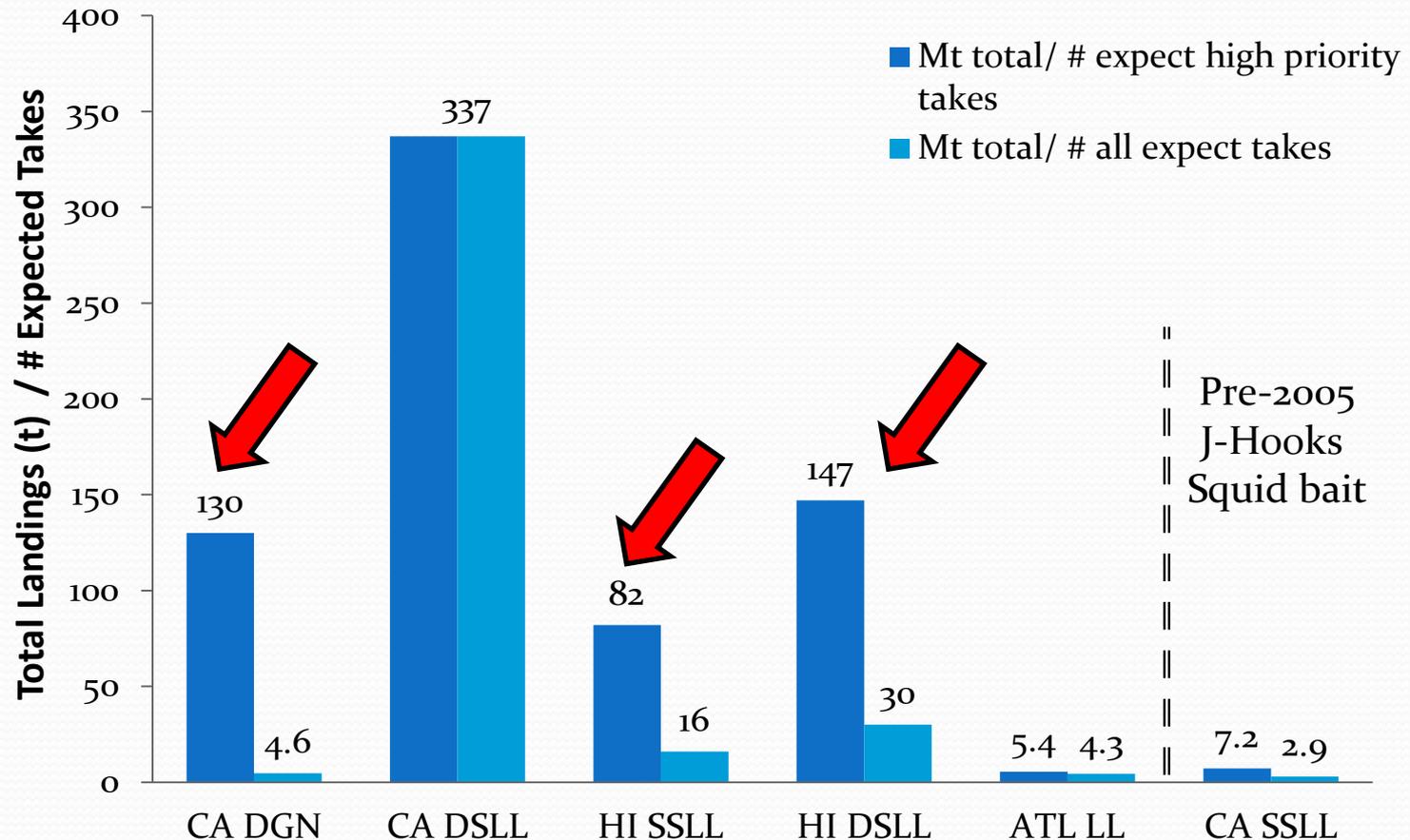
- The CA HPN and ATL BG have no documented protected species takes.

Landings (t) per take



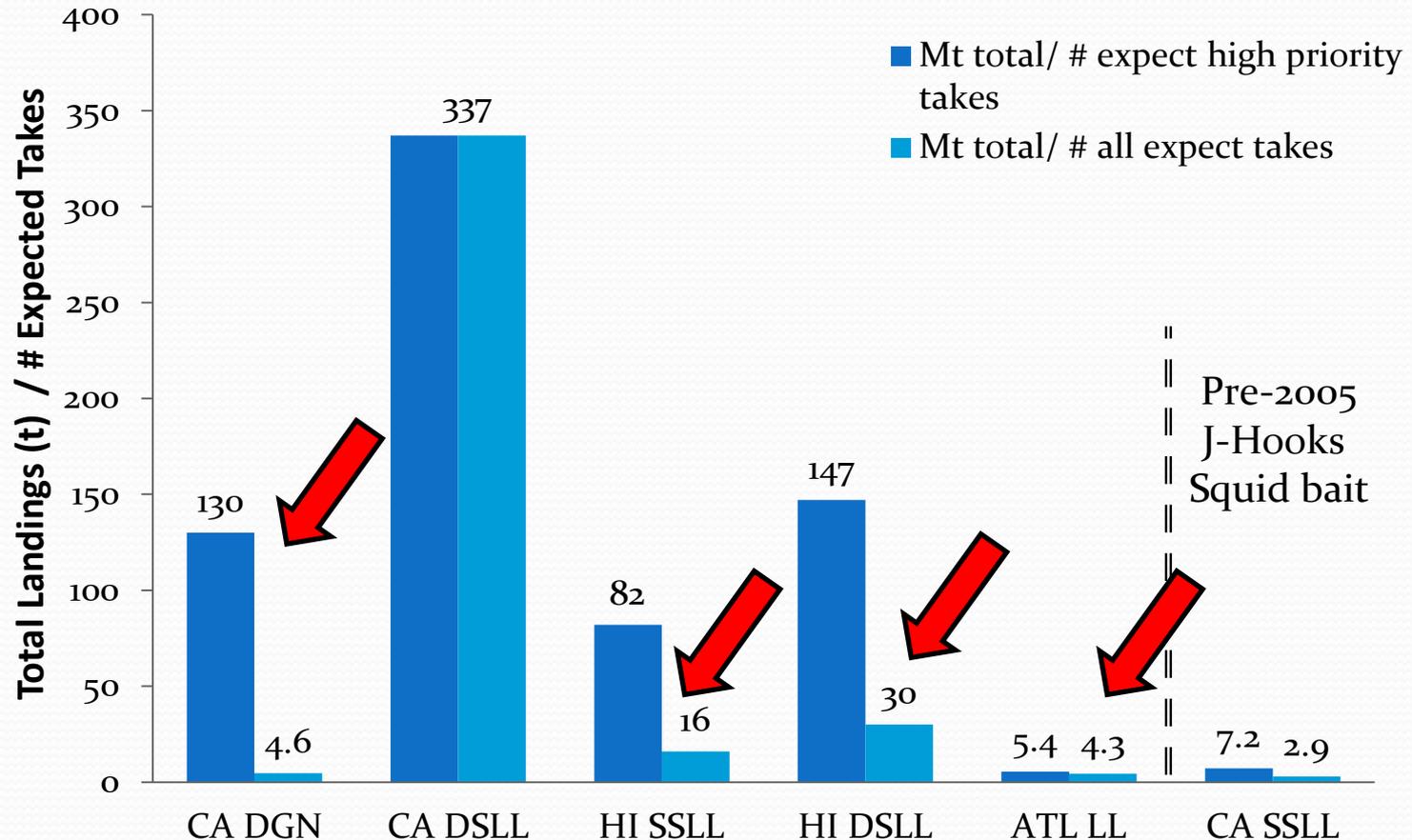
- CA DSLL has highest landings/take across fisheries, lowest rates of bycatch. Keep in mind this represents only one vessel observed over seven years.

Landings (t) per take



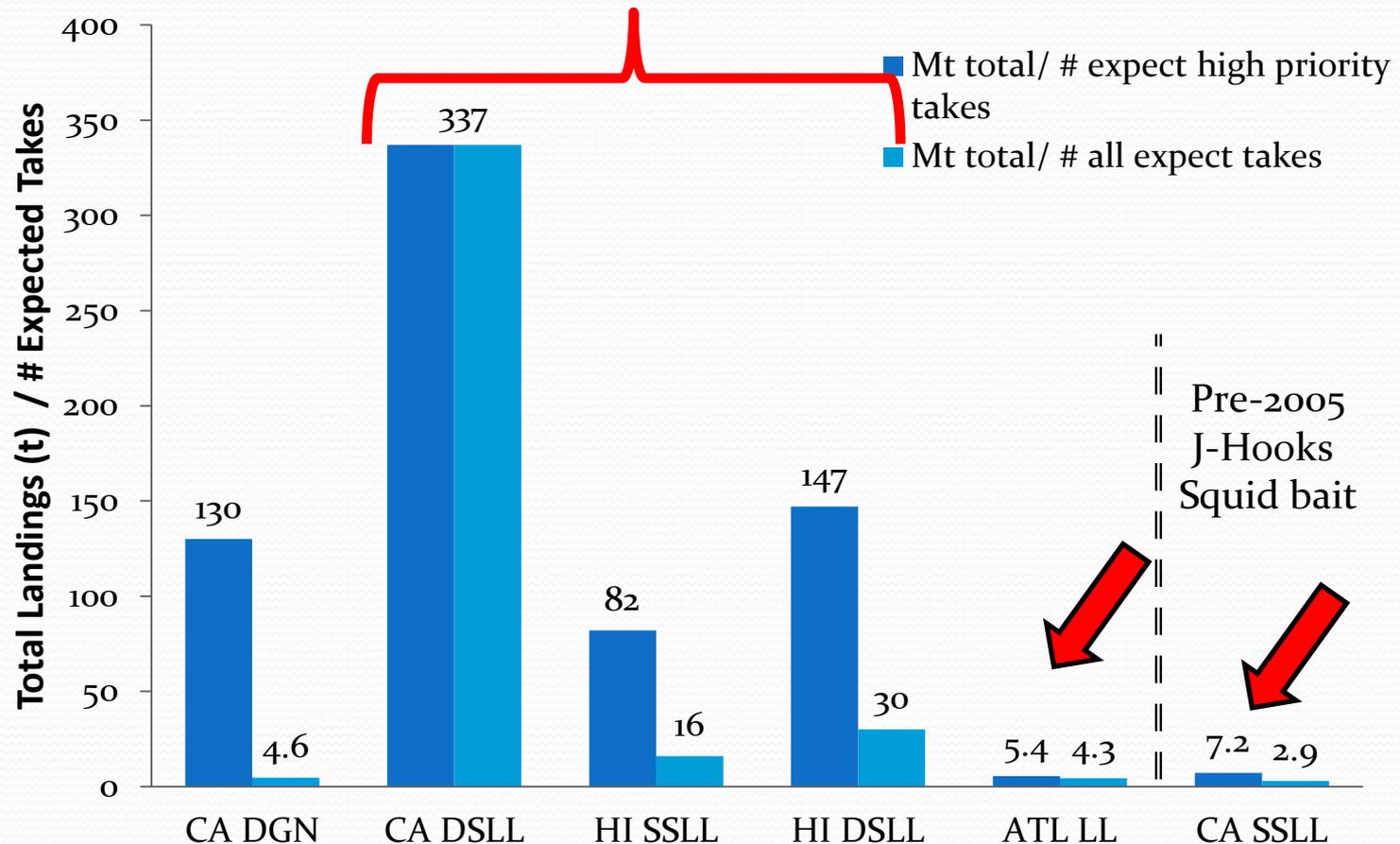
- Landings/take_{hp} for the CA DGN is comparable to the HI DSLL fishery, and higher than in the HI SSL fishery.

Landings (t) per take



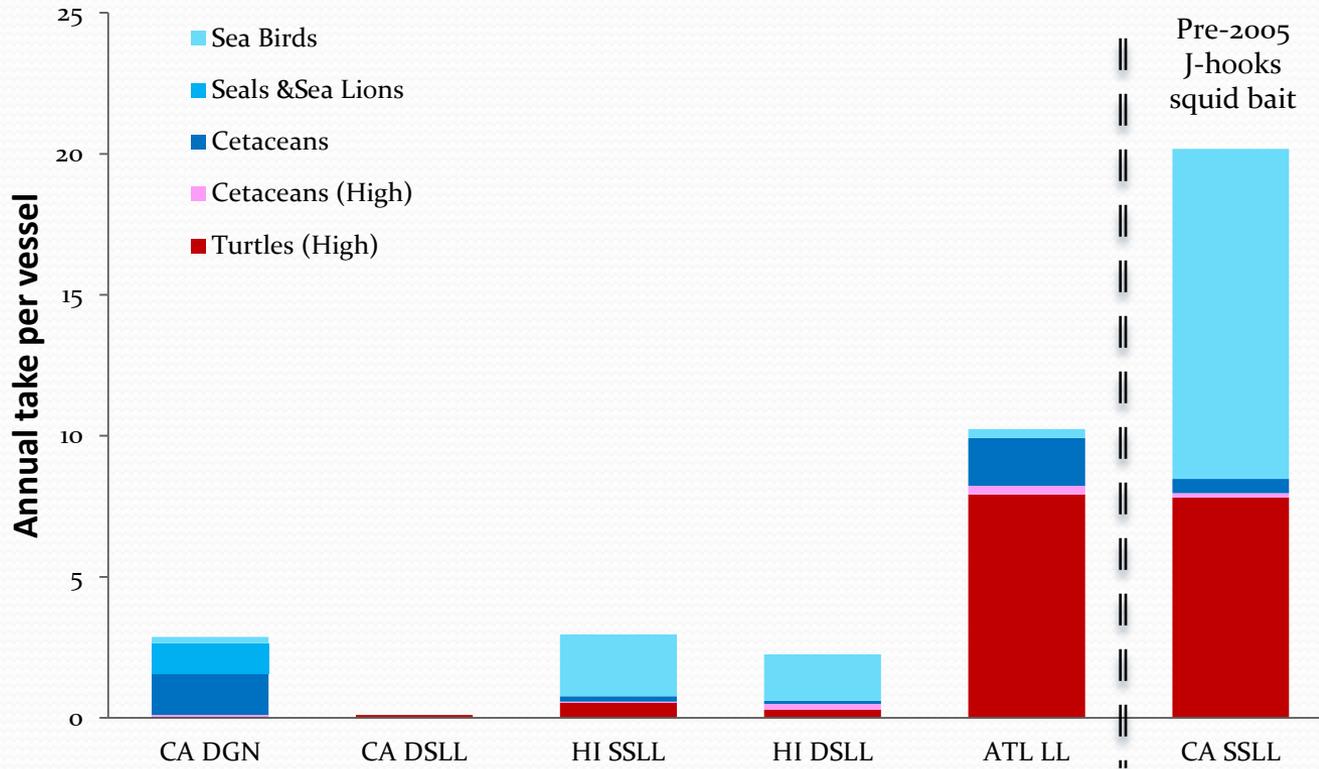
- Landings/take_{total} for the CA DGN is lower than other Pacific fisheries and comparable to the ATL LL.

Landings (t) per take



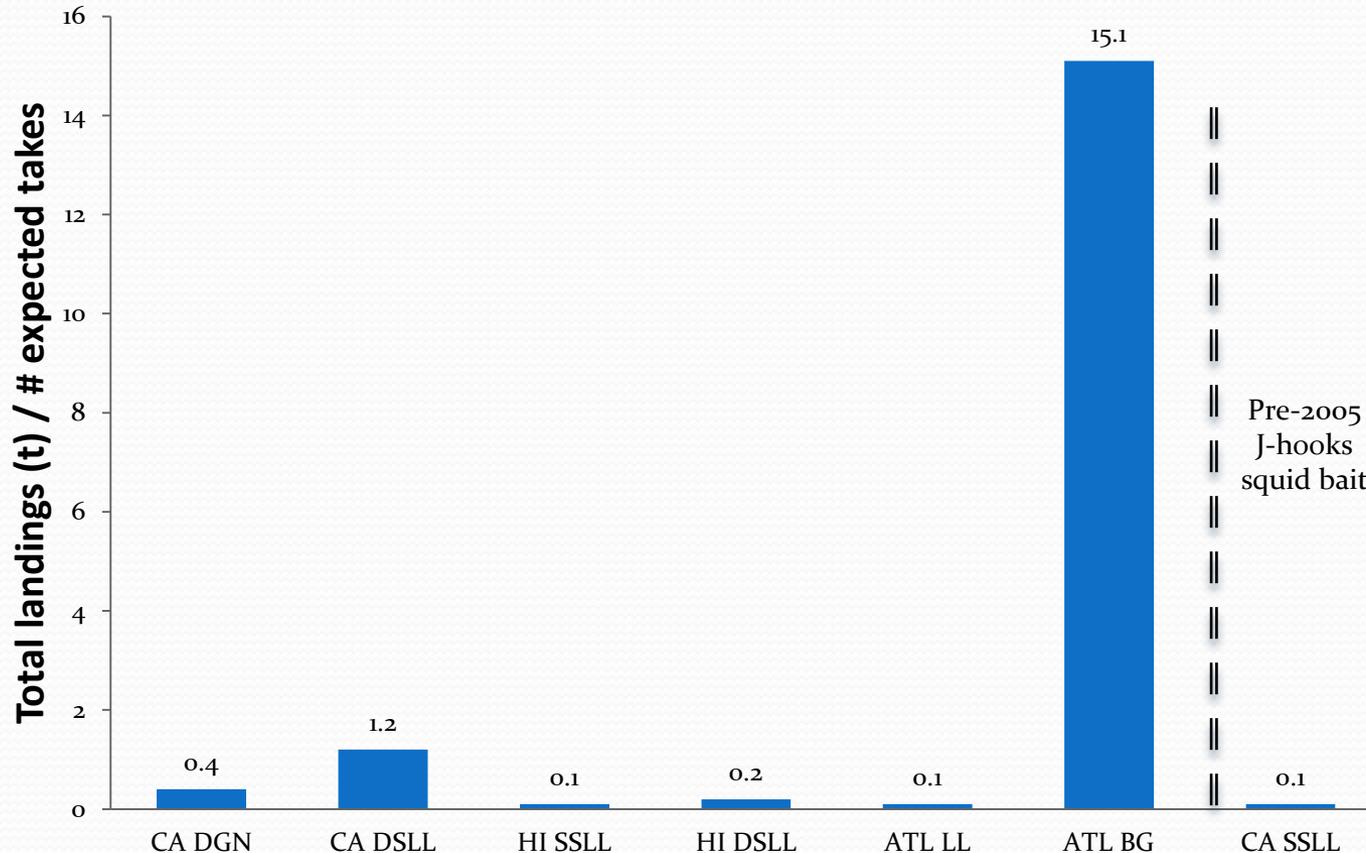
- All the Pacific-based longline fisheries show higher landings/take than both the pre-2005 CA SSL^S and ATL LL^{S,T} fishery.

Take composition



- Majority of takes in CA DGN are marine mammals not defined as high priority
- Turtles and/or sea birds comprise most take in other fisheries
- Atlantic sea turtle populations are healthier than Pacific counterparts

Landings (t) per blue shark

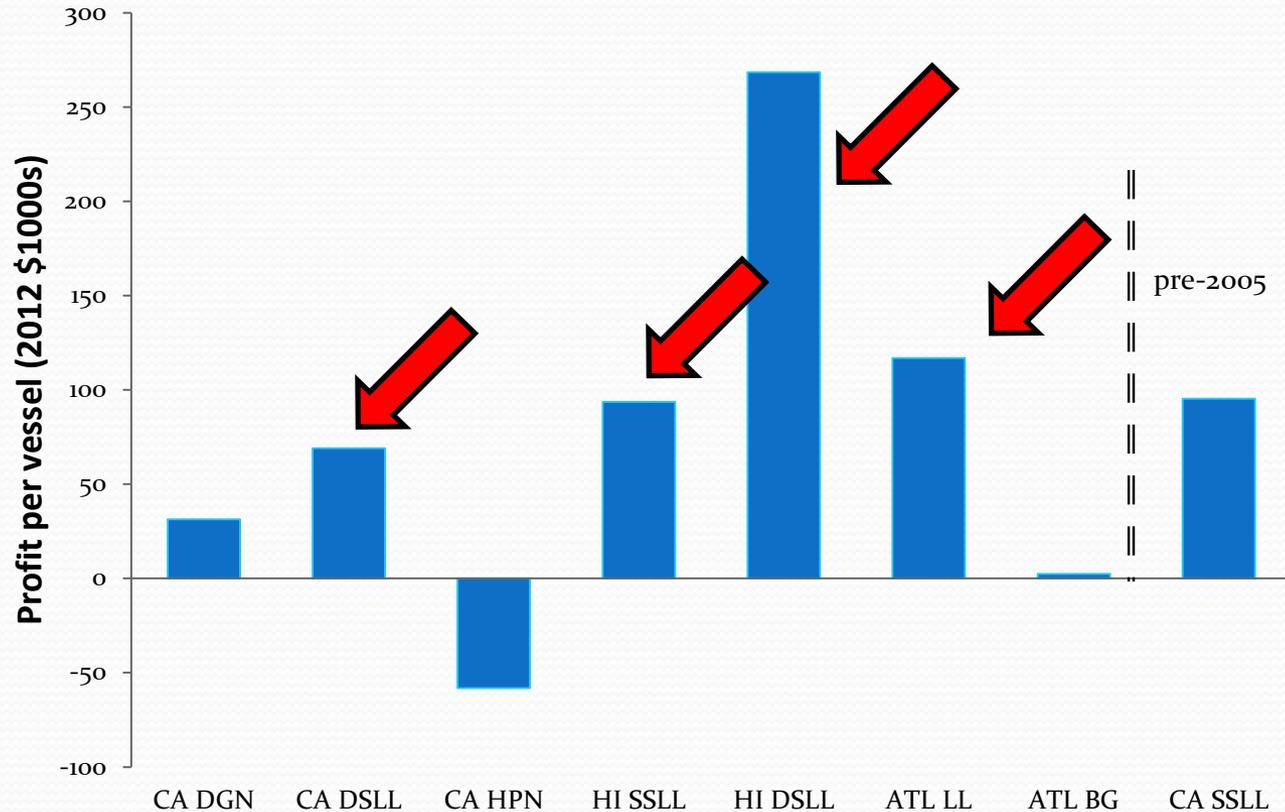


- CA HPN no blue sharks reported taken
- Landings/take: ATL BG^S >> CA DSLL > CA DGN > Other LL fisheries.

Economic Metrics

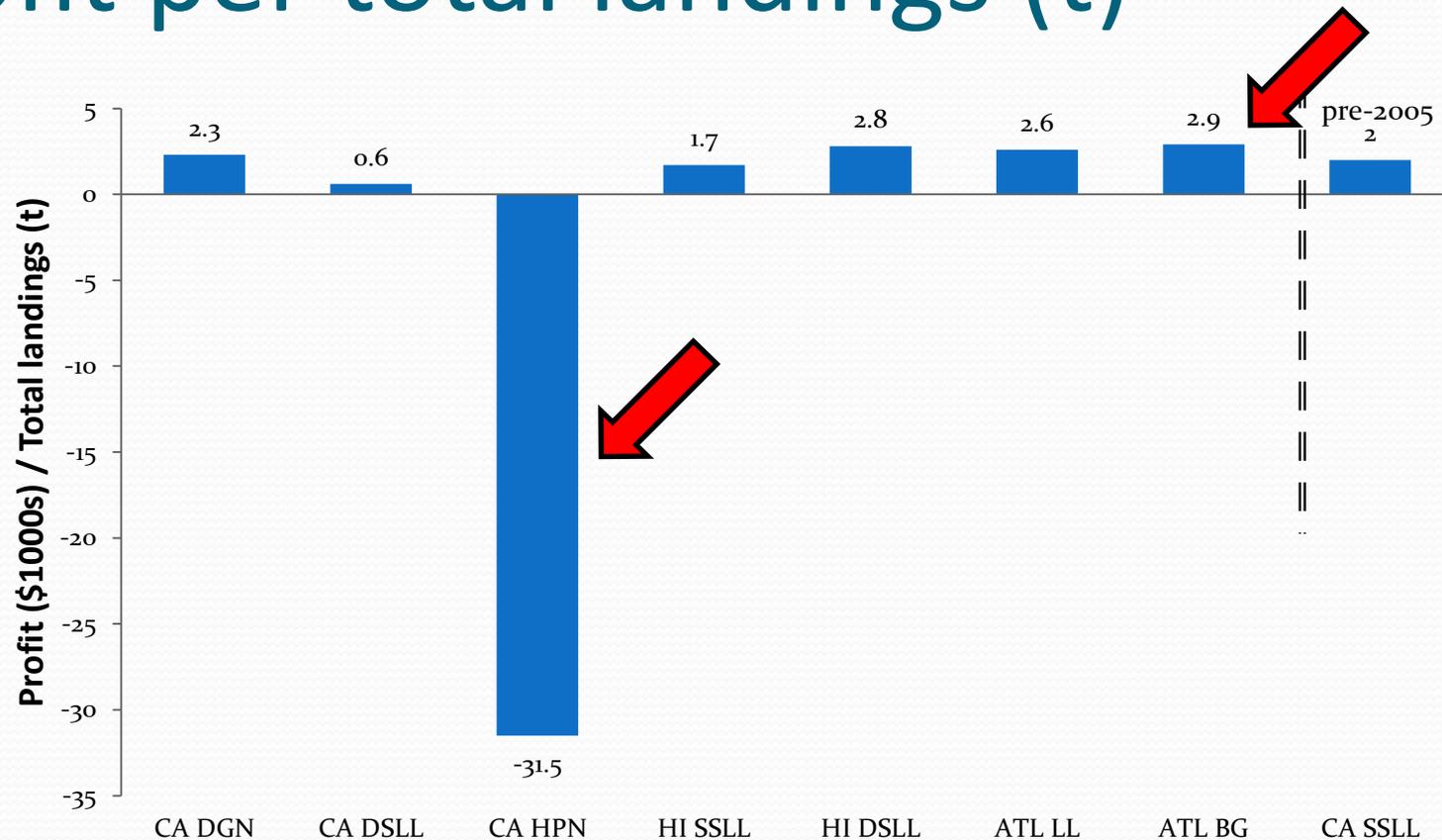
- Revenue-Variable Cost = Net Operating Revenue (Profits)
 - Variable cost: Obtained from cost-earnings studies
 - Fuel, bait, gear, communications, repairs, etc.
 - Revenue: Determined from landings receipts, such as PacFIN fish tickets
 - All dollar values were converted to 2012 dollar value
 - Net operating revenue calculated relative to the fleet, vessel and total and swordfish landings

Average annual profit per vessel



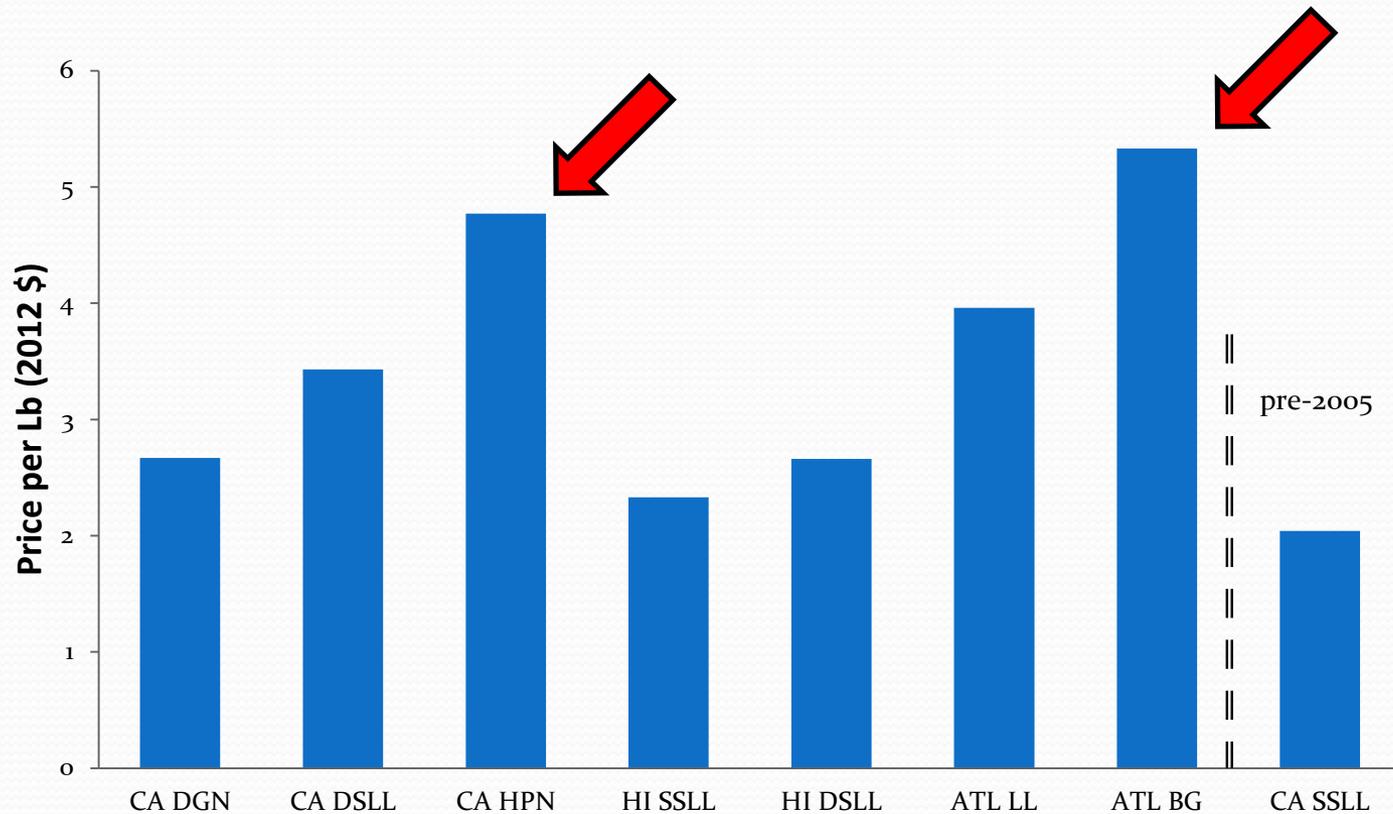
- Longline fisheries produced highest profits per vessel

Profit per total landings (t)



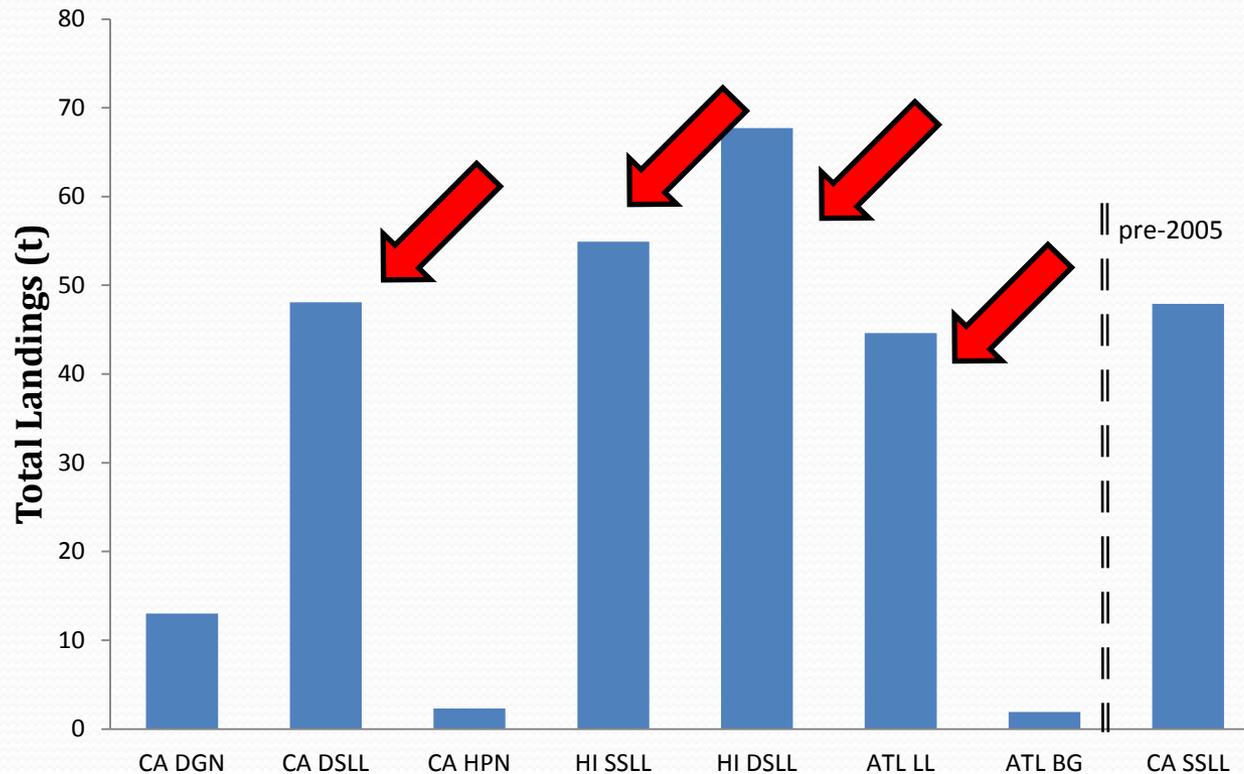
- Profit per metric ton of total landings was highest for ATL BG, and positive for all but CA HPN fishery
- The negative profits for the CA HPN fishery likely result from the fact that the 2 years over which economic metrics were measured had anomalously low catch rates (and respondents may have been high-cost operators)

Average swordfish price per pound



- Average swordfish price per pound was highest for CA HPN and ATL BG

Commercial volume: Average annual total landings per vessel



- Longline fisheries provide the highest commercial volumes of production, CA DGN was an intermediate while CA HPN and ATL BG are lowest

General Conclusions

- BG and HPN very favorable from the perspective of bycatch
 - Low volumes of swordfish, but can be an important component of west coast swordfish fishery
 - Some concern about variable profitability of CA HPN
- The CA DGN fishery is not a high-bycatch fishery compared to HI SSL, HI DSL, or the ATL LL fishery, which is Marine Stewardship Council certified
 - Profits relatively high, though production is relatively low
- The CA DSL fishery had much lower bycatch than all fisheries other than CA HPN and ATL BG
 - The approach shows promise but experiments are needed in the U.S. EEZ
 - Potential swordfish landings not known

Limitations

- Bycatch metrics
 - Results confounded by differences in species abundance, composition and vertical distribution across regions
 - Results don't account for all finfish bycatch
- Economic metrics
 - Cost estimates not entirely consistent across studies
 - Studies may capture anomalous years and not provide a realistic perspective of costs and profits (e.g. the harpoon fishery)
 - Profit metrics currently do not capture potential for direct shore-side marketing
- Commercial volume metrics
 - The comparison of production volumes is confounded by the differences in areas where the fisheries operate



Questions?

General Conclusions

Fishery	Years	Target	Fleet size	Mt _{total} / take _{hp}	Mt _{total} / take _{total}	Profits/ mt _{total}	Mt _{total} / vessel
CA DGN*	2001-2012	SWO	17-68	129.5	4.6	2.3	13
CA DSLL	2005-2011	Tuna	1	337	337	0.6	48.1
CA HPN*	1995-2011	SWO	9 – 40	N/A	N/A	-31.5	2.3
HI SSLL*	2005-2012	SWO	18-35	81.9	16.1	1.7	54.9
HI DSLL	2005-2012	Tuna	122-129	147.1	29.7	2.8	67.7
ATL LL	2005-2012	SWO/ Tuna	106-120	5.4	4.3	2.6	44.6
ATL BG*	2007-2012	SWO	42-57	N/A	N/A	2.9	1.9
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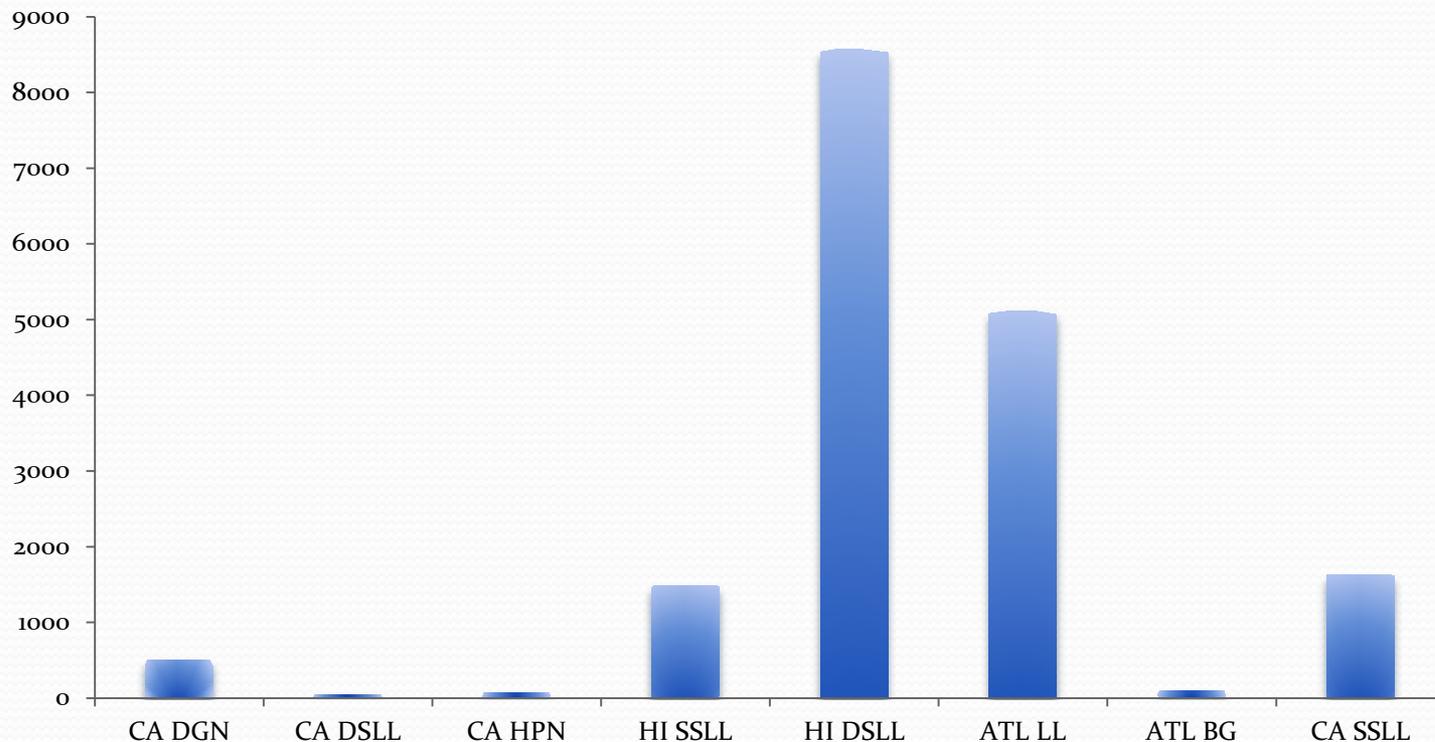
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- Similar to other studies, results show a reduction in bycatch with the adoption of circle hooks and finfish bait

Commercial volume: Average annual total landings by fleet

Average annual total landings (t) by fleet



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