Overview of foraging behaviour and diet of Resident killer whales

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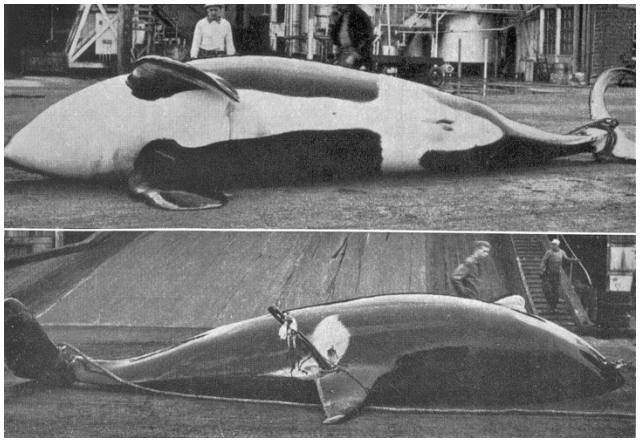
Diet of killer whales poorly known until recently

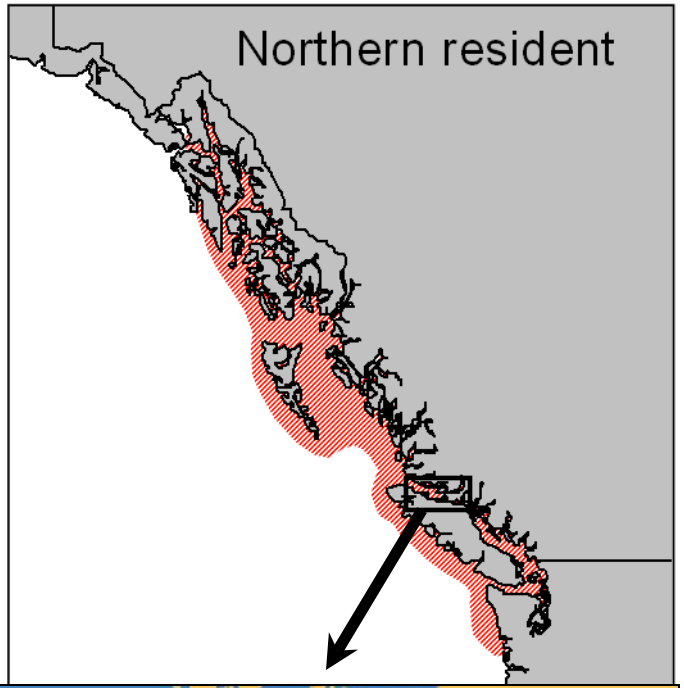
"The usual diet of killer whales on the British Columbia coast is not known.

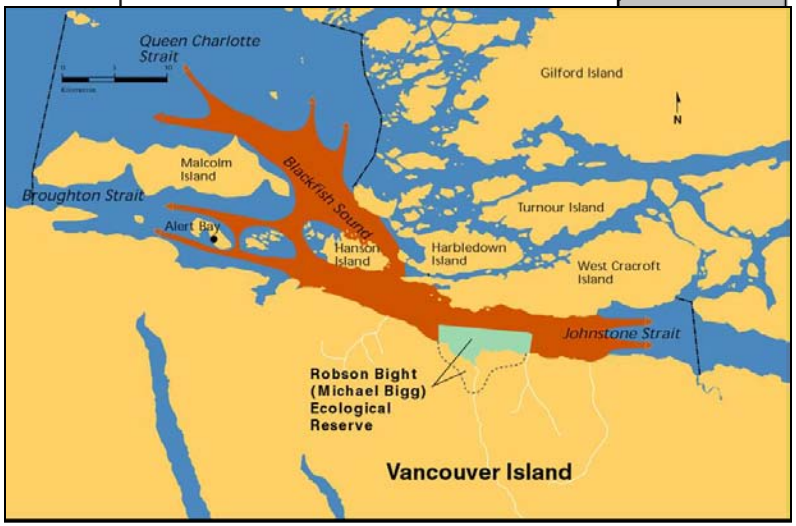
There is circumstantial evidence that they attack salmon and that troll catches of coho and chinook salmon drop off when killer whales enter a fishing area".

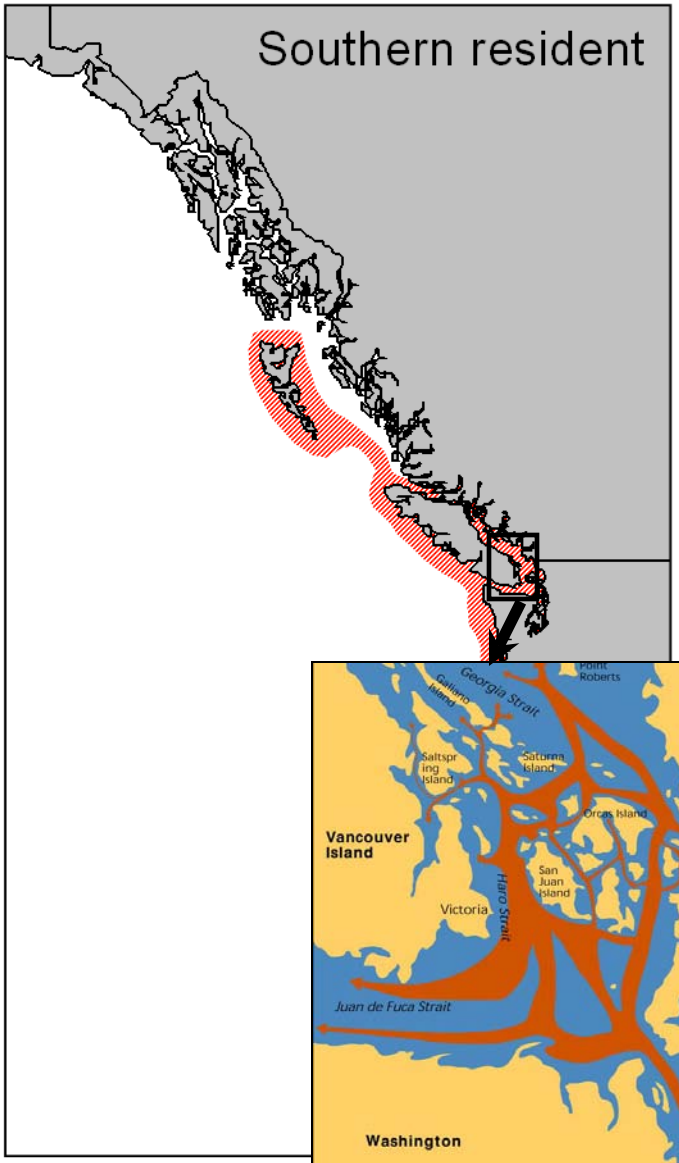
Pike, G.C. & I.B. MacAskie. 1969.
Marine Mammals of British Columbia
Fish. Res. Bd. of Canada Bulletin 171

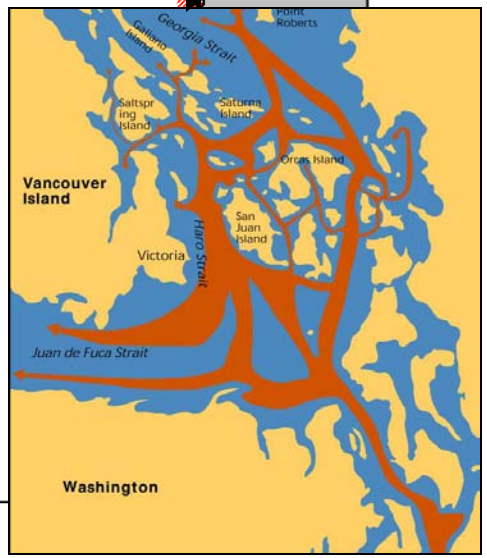


Early studies of resident foraging ecology



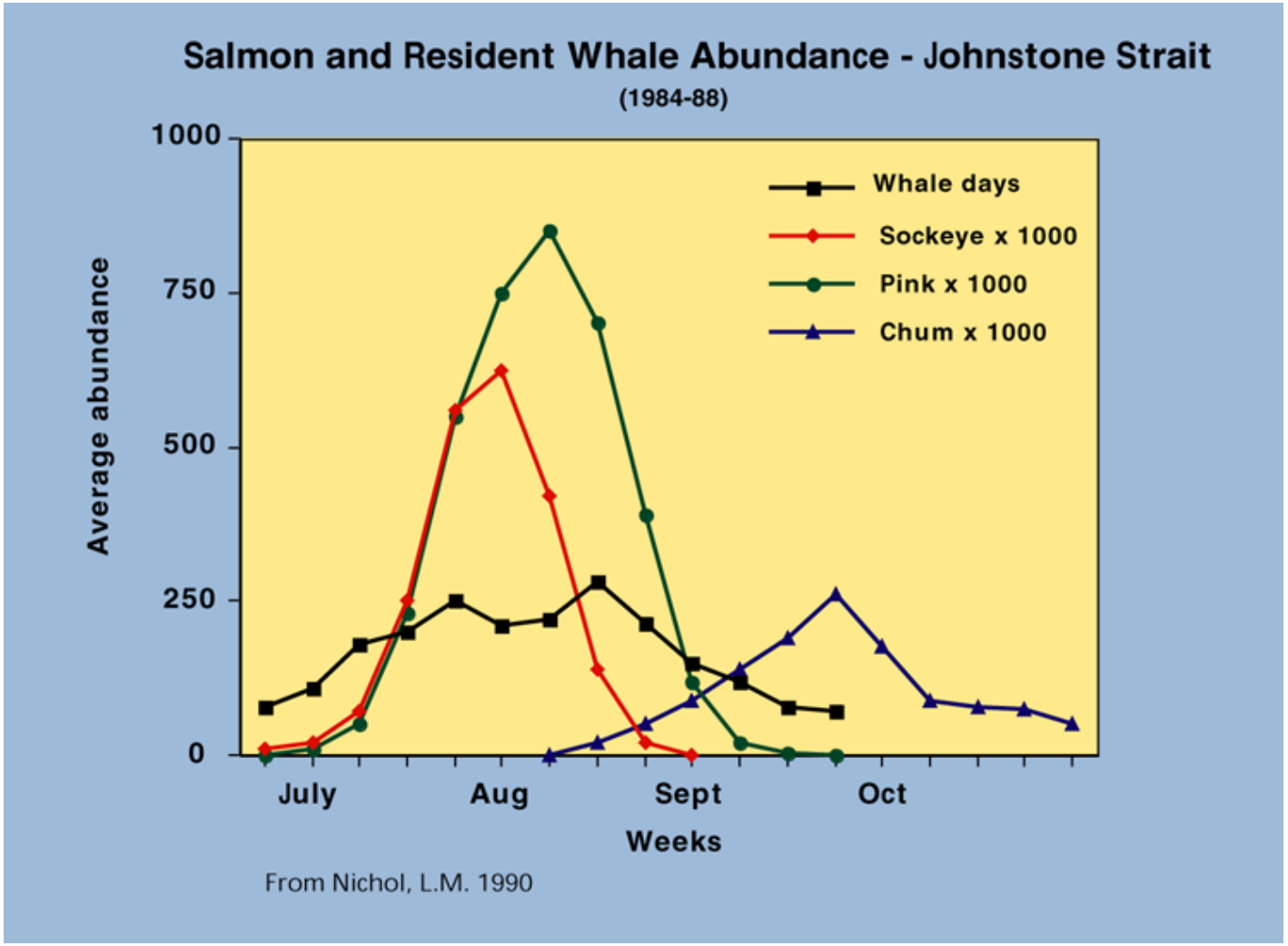






Association of resident killer whales and salmon

- Timing of RKW use of core areas corresponds to salmon migration

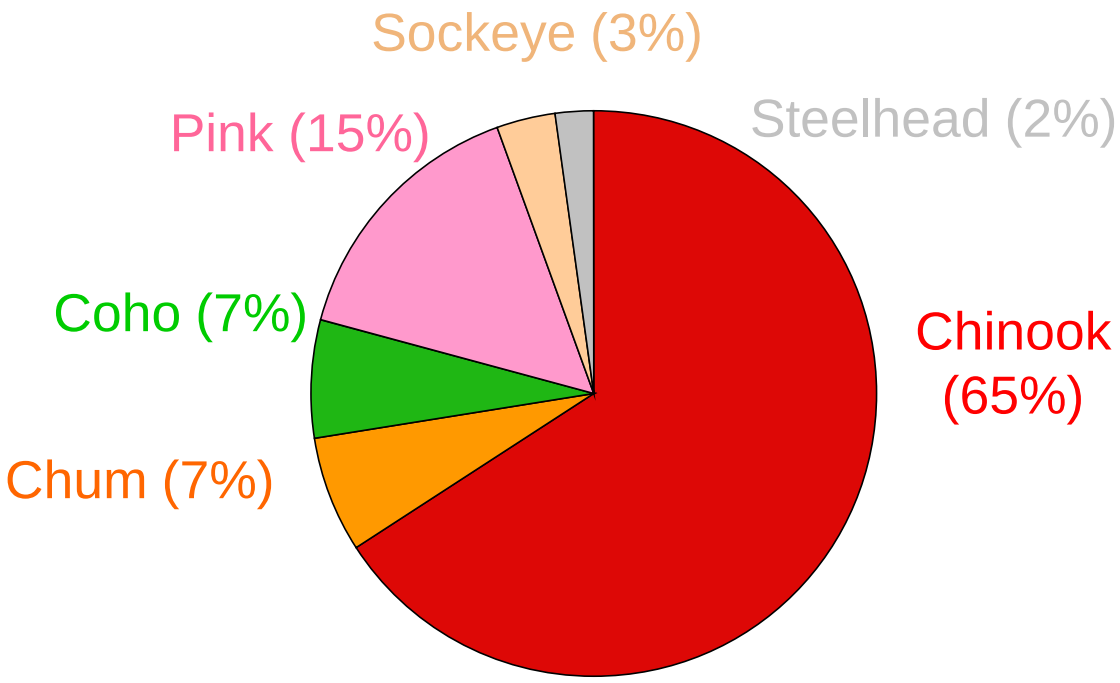


Diet studies: prey fragment collection

Diet studies: analysis of stomach contents

Resident prey composition, 1975-96 (Ford et al. 1998)

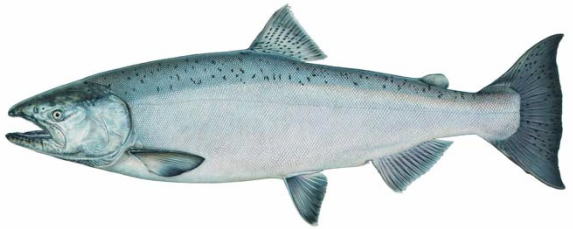
- feeding observations made opportunistically
- 94 feeding events by residents identified to species
- salmonids: 91 (96.8%), non-salmonids: 3 (3.2%)
- salmonid species composition (IDs from scales & obs):



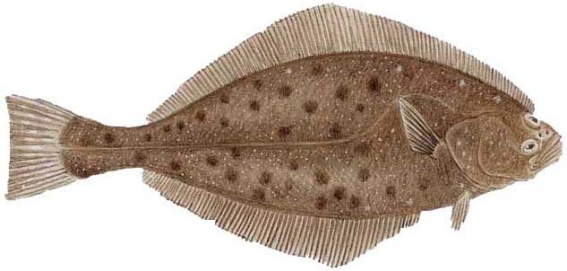
Diet information from stranded residents (Ford et al. 1998)

Of 14 stomachs examined, 7 stomachs had prey remains:

7 = salmonid remains
(Chinook ID'd in 4, no other spp ID'd)



1 = various bottomfish



2 = squid

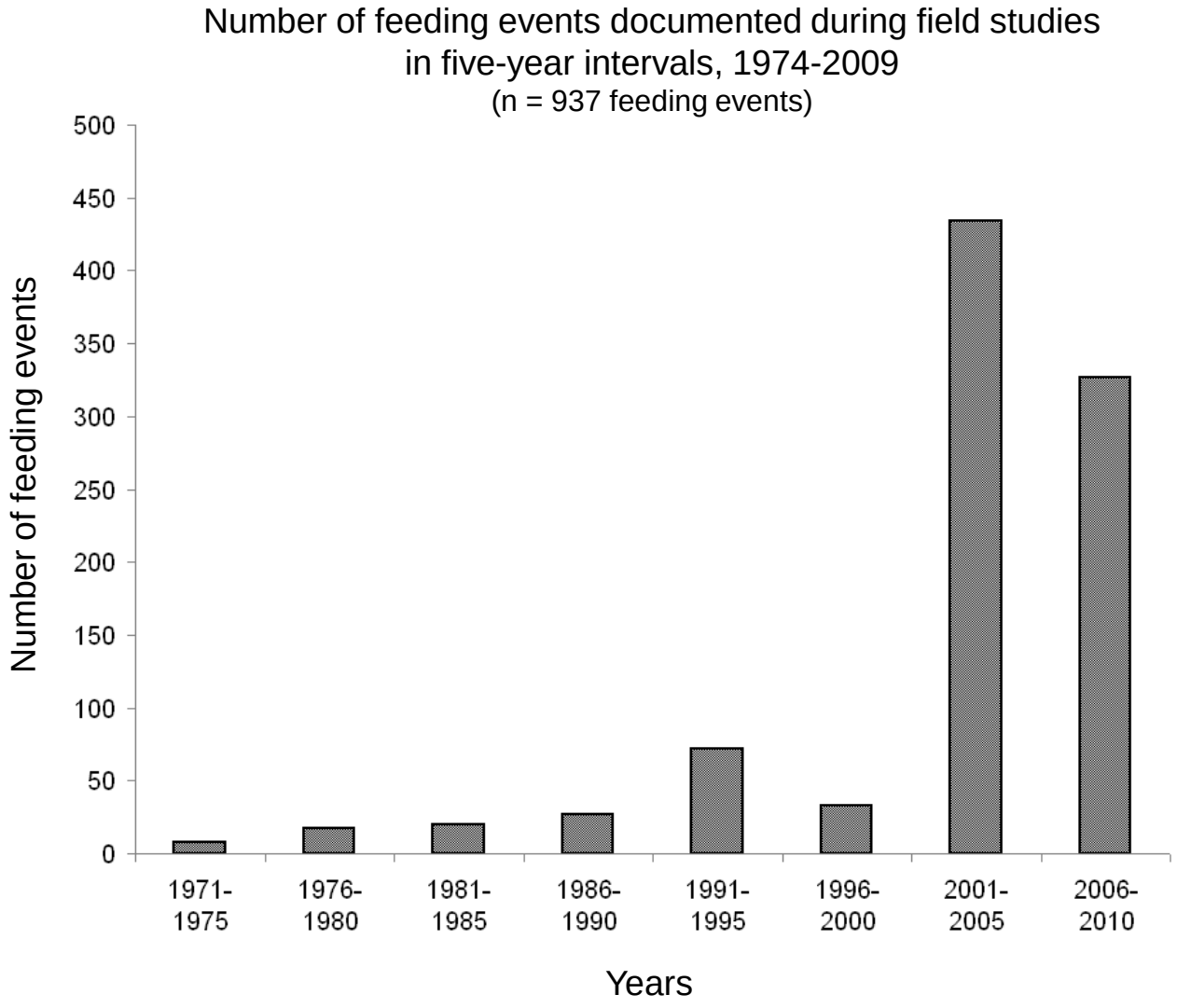
Do prey fragments accurately reflect salmonid species eaten?

Potential biases in fragment sampling 1973-1996:

- opportunistic sampling may cue on highly visible feeding events, miss others
- larger fish more likely to be broken up for consumption?
- larger scales more readily collected than small scales?
- fish caught at surface more likely to be sampled?

Dedicated predation studies, 2002-09

(Ford & Ellis 2005, 2006; Ford et al. 2010)



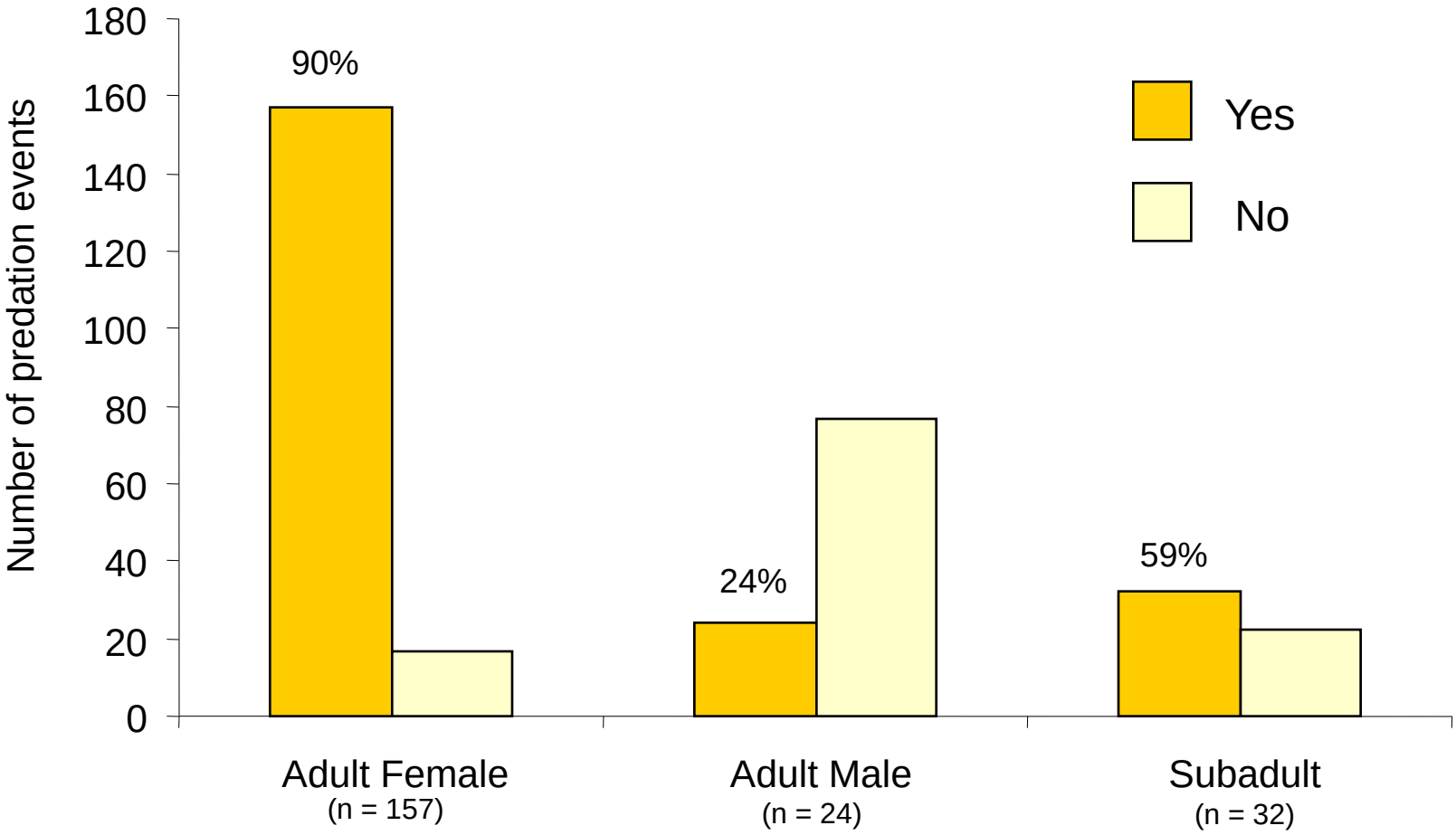
Dedicated predation studies, 2002-09

(Ford & Ellis 2005, 2006; Ford et al. 2010)

- Focal animal and group follows to document foraging
- Observations & u/w video indicate salmon prey routinely brought to surface and broken up, usually for sharing
- Salmonids of all species and sizes shared

Prey sharing

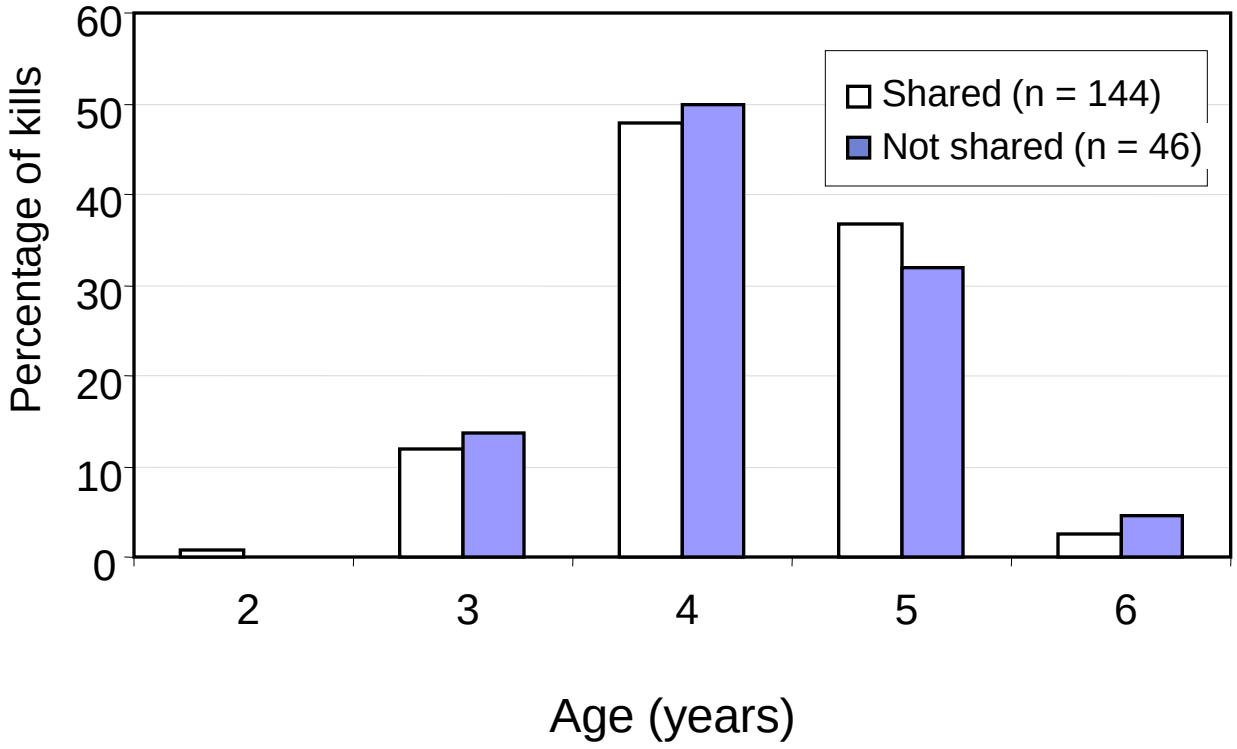
Frequency of food sharing based on age/sex class



Source: Ford and Ellis 2006. MEPS 316:189-199

Sharing of salmonids independent of fish age/size

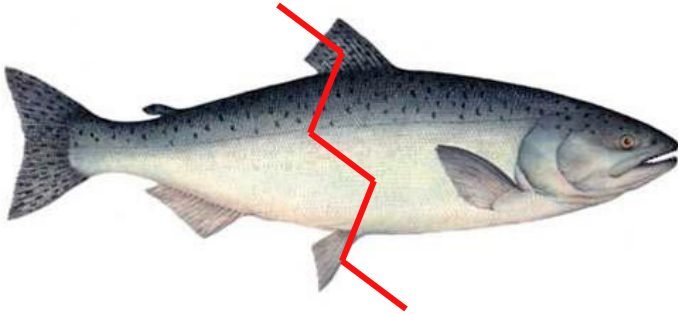
Mean Chinook ages:
shared = 4.28 yrs (±0.07SE, n = 117)
not shared = 4.27 yrs (±0.16SE, n = 32), p=0.87



Source: Ford and Ellis 2006. MEPS 316:189-199

Prey sharing in resident killer whales

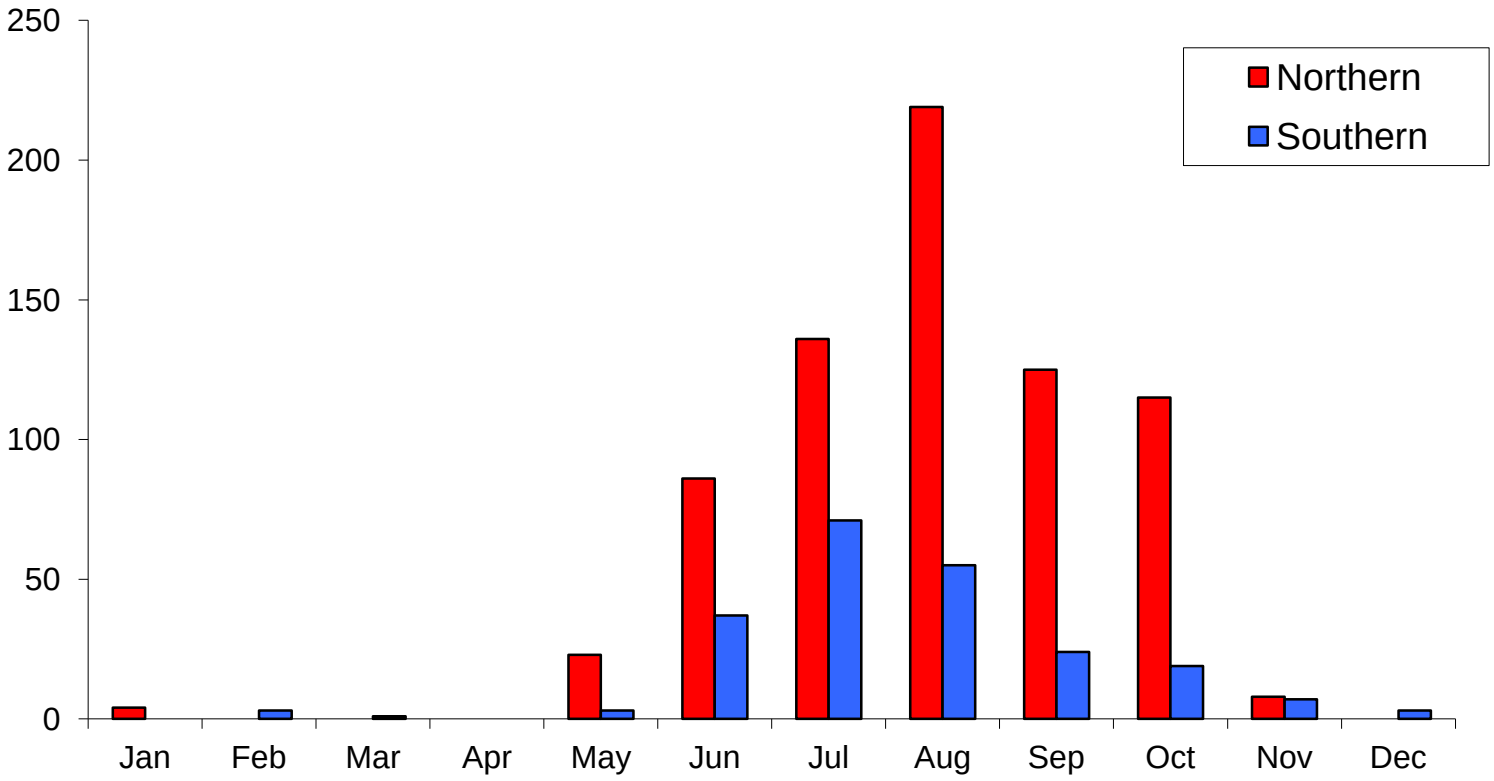
- Stomach contents of stranded female residents A9 and C21 suggest sharing
- A minimum of 19 and 6 Chinook represented in A9 and C21, respectively, from head bone counts
- Most anterior bones present, but missing caudal vertebrae & pelvic bones indicate posterior half of most fish not consumed



Prey sharing in resident killer whales

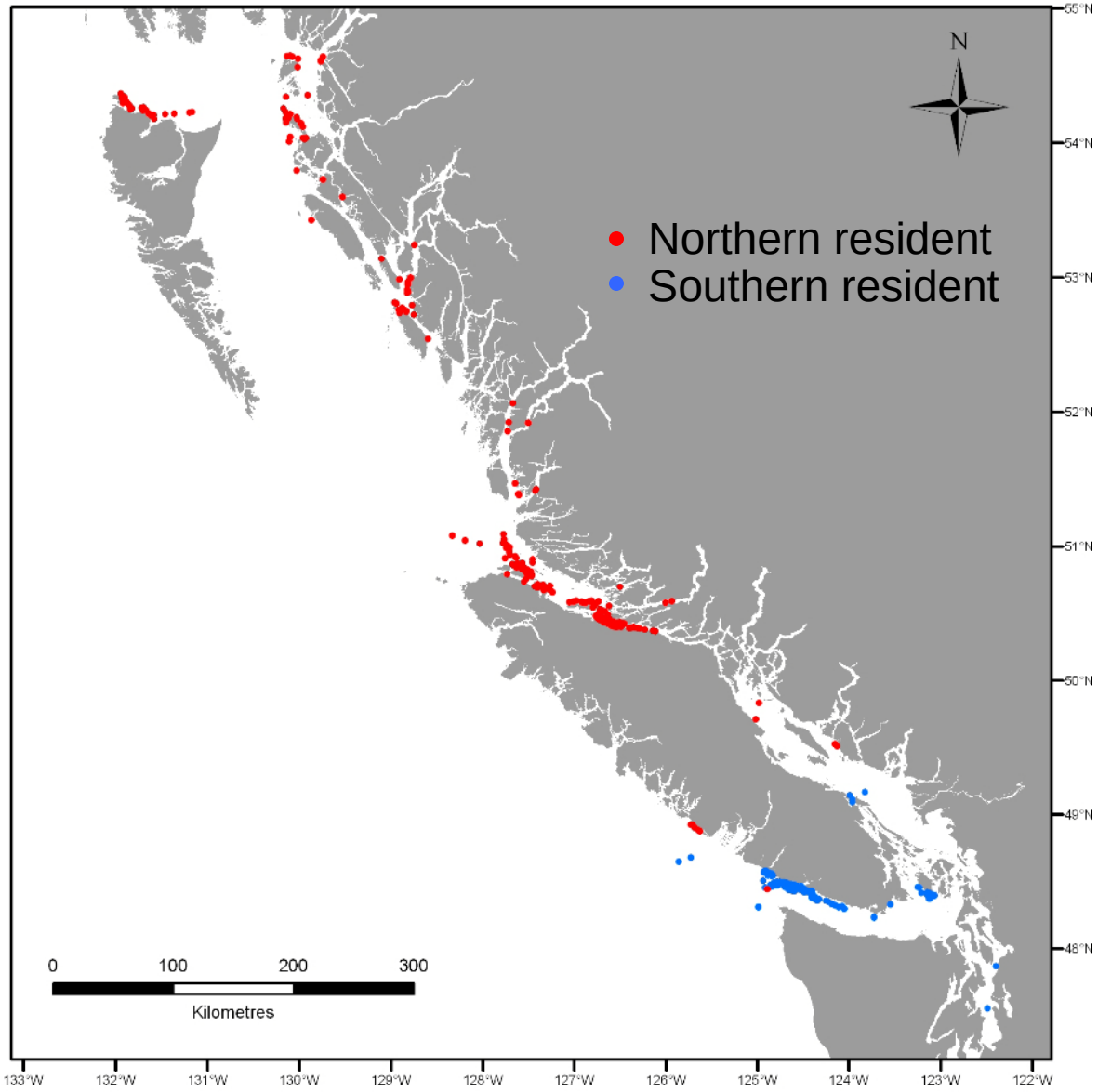
- Sharing posterior section of Chinook consistent with tendency for fish to be held in mouth headfirst

Monthly distribution of feeding events by northern (n = 715) and southern (n = 222) resident killer whales, 1974-2009.



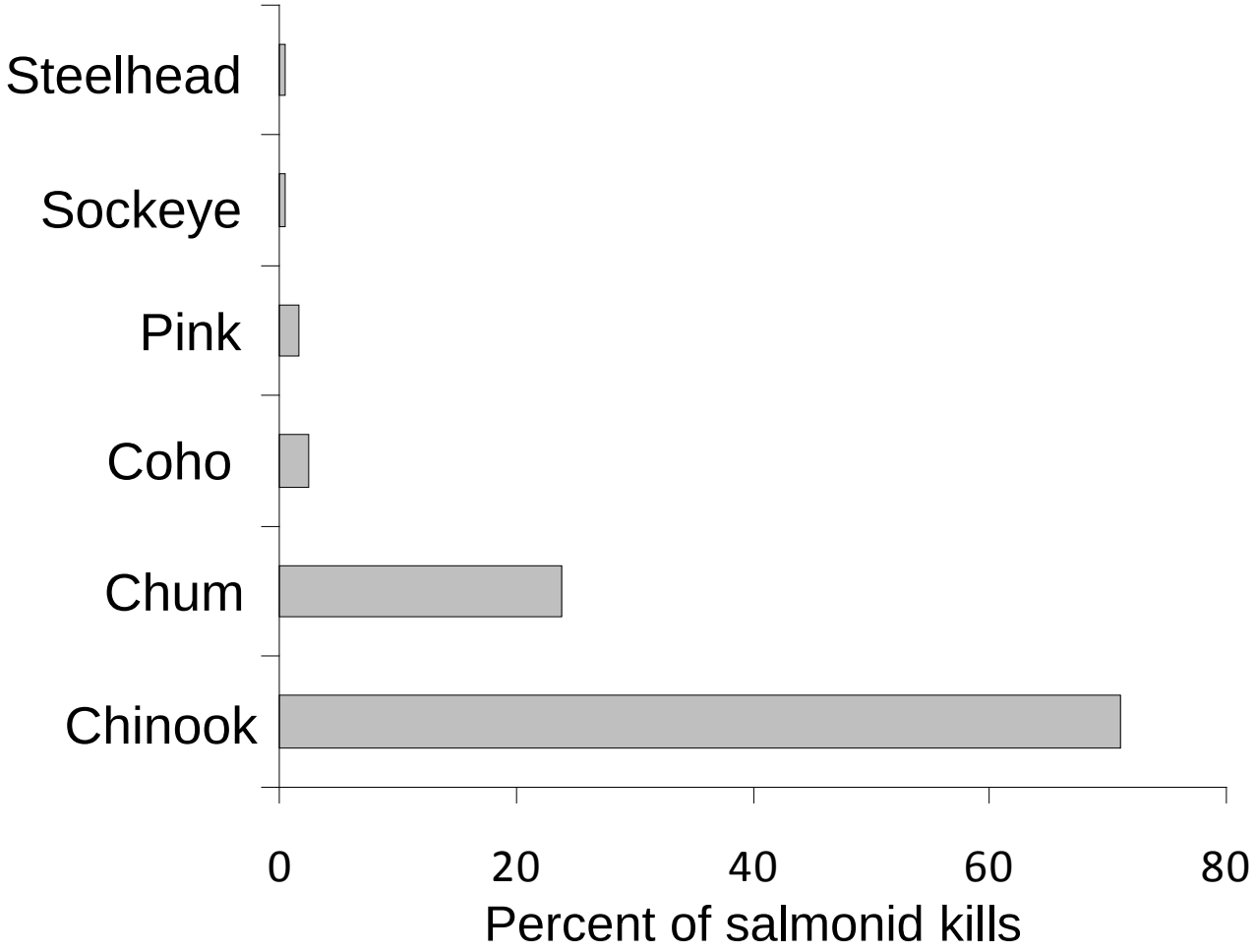
Source: Ford et al. 2010 CSAS Res Doc 2009/101

Locations of 937 feeding events by resident killer whales,1974 - 2009.



Source: Ford et al. 2010 CSAS Res Doc 2009/101

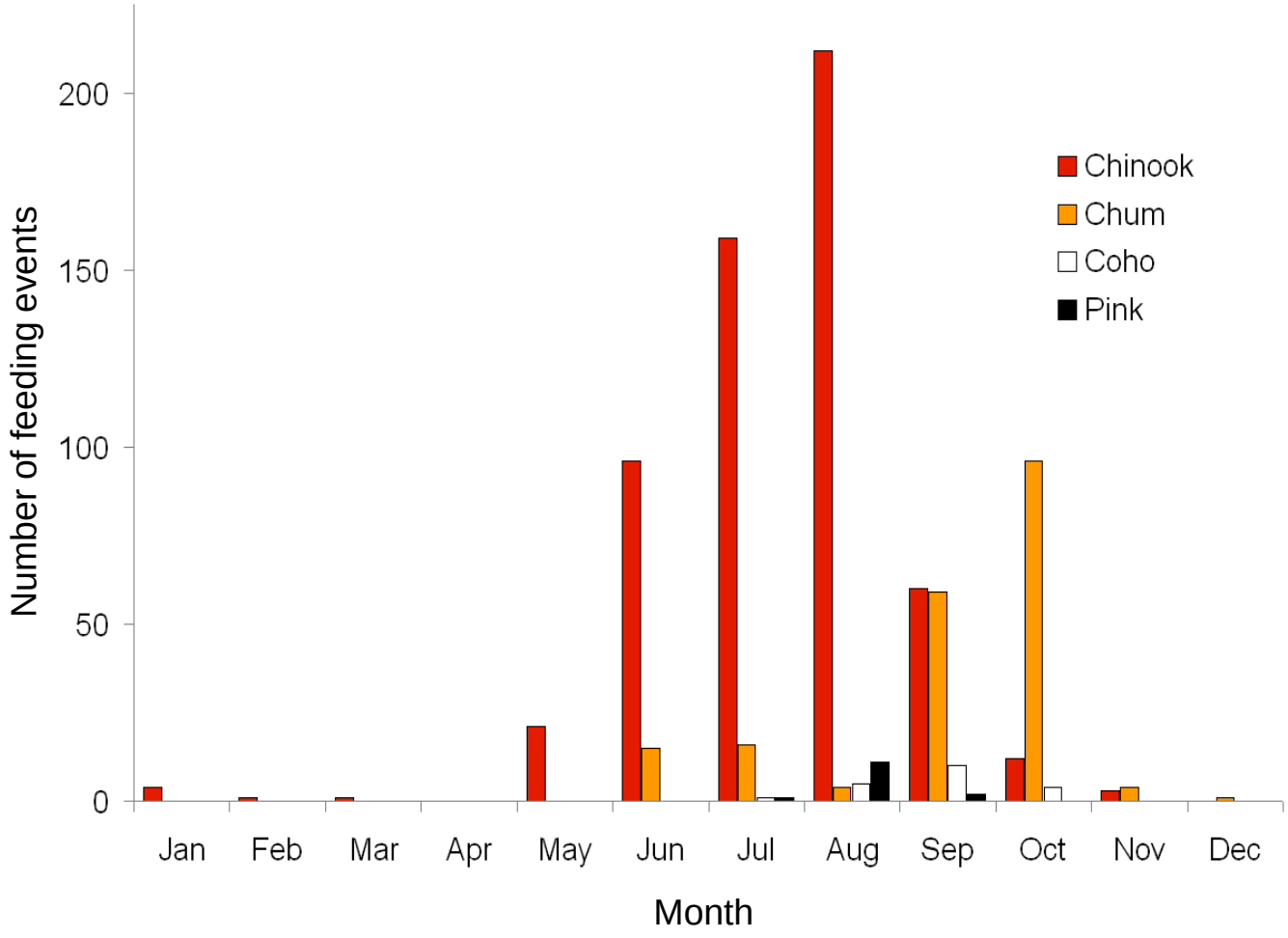
Chinook salmon is (still) primary prey species of resident killer whales (n = 806 salmonid feeding events)



Source: Ford et al. 2010 CSAS Res Doc 2009/101

Salmonid species taken by month

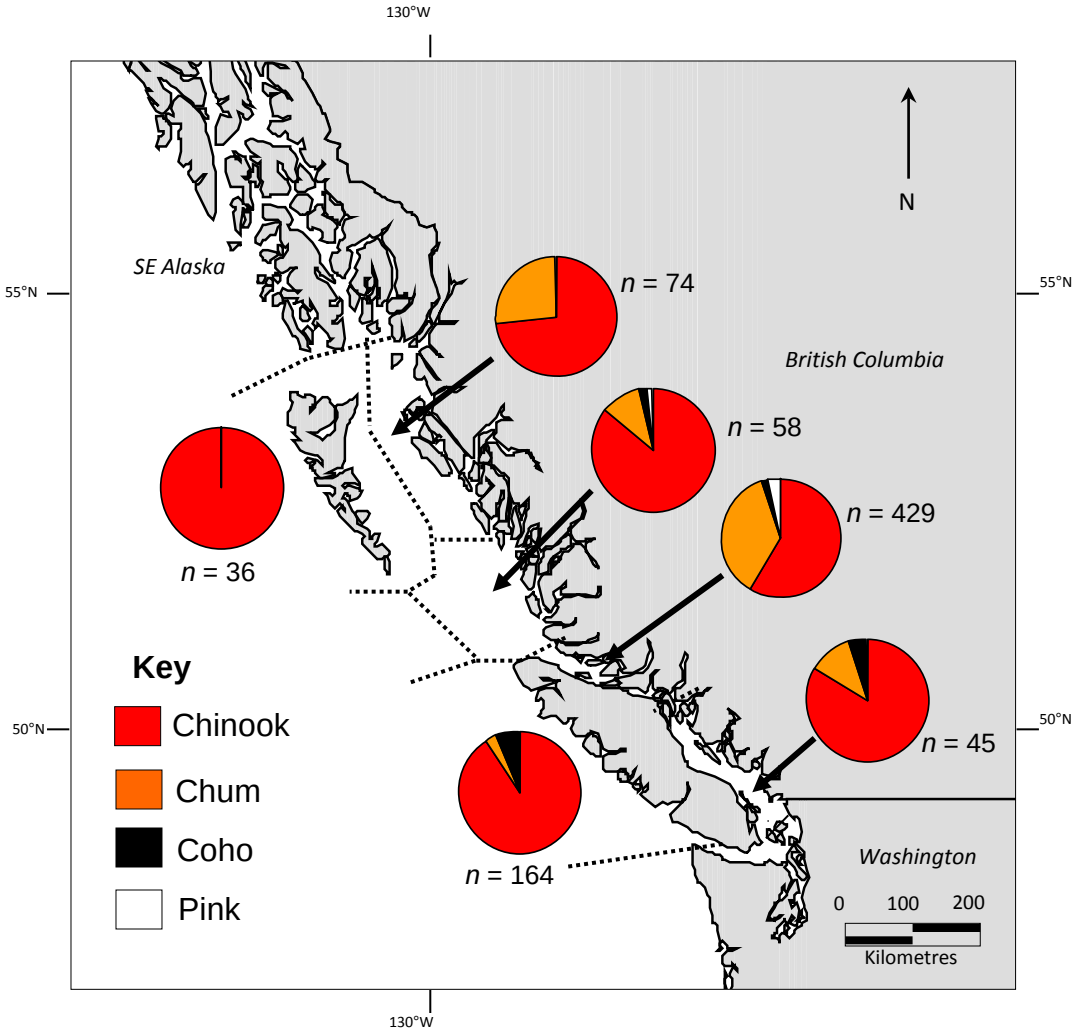
(n = 806 feeding events). Sockeye and steelhead salmon are not illustrated due to their rarity in prey samples.



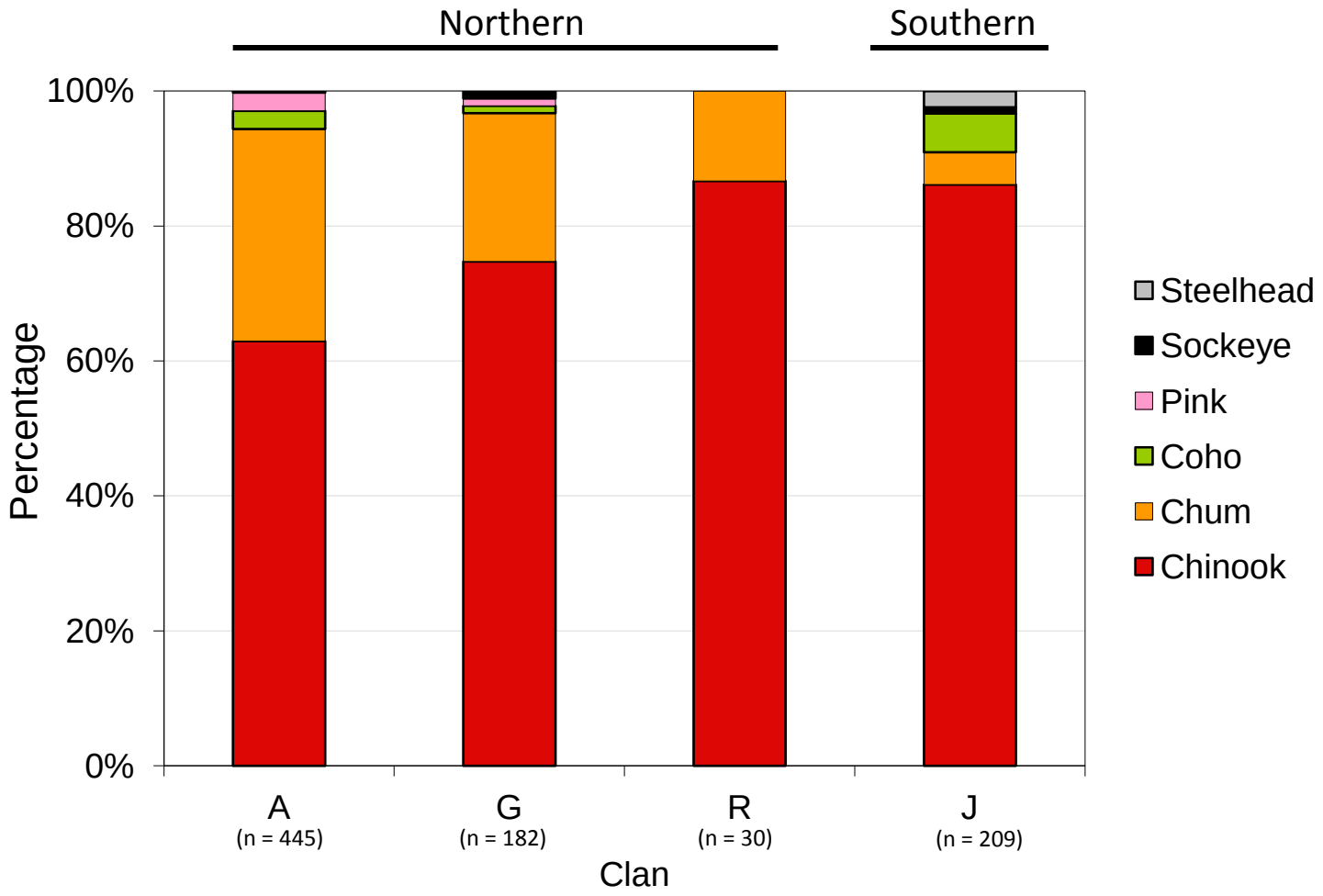
Source: Ford et al. 2010 CSAS Res Doc 2009/101

Salmonid consumption by region

(n = 806 feeding events). Sockeye and steelhead salmon are not illustrated due to their rarity in prey samples.



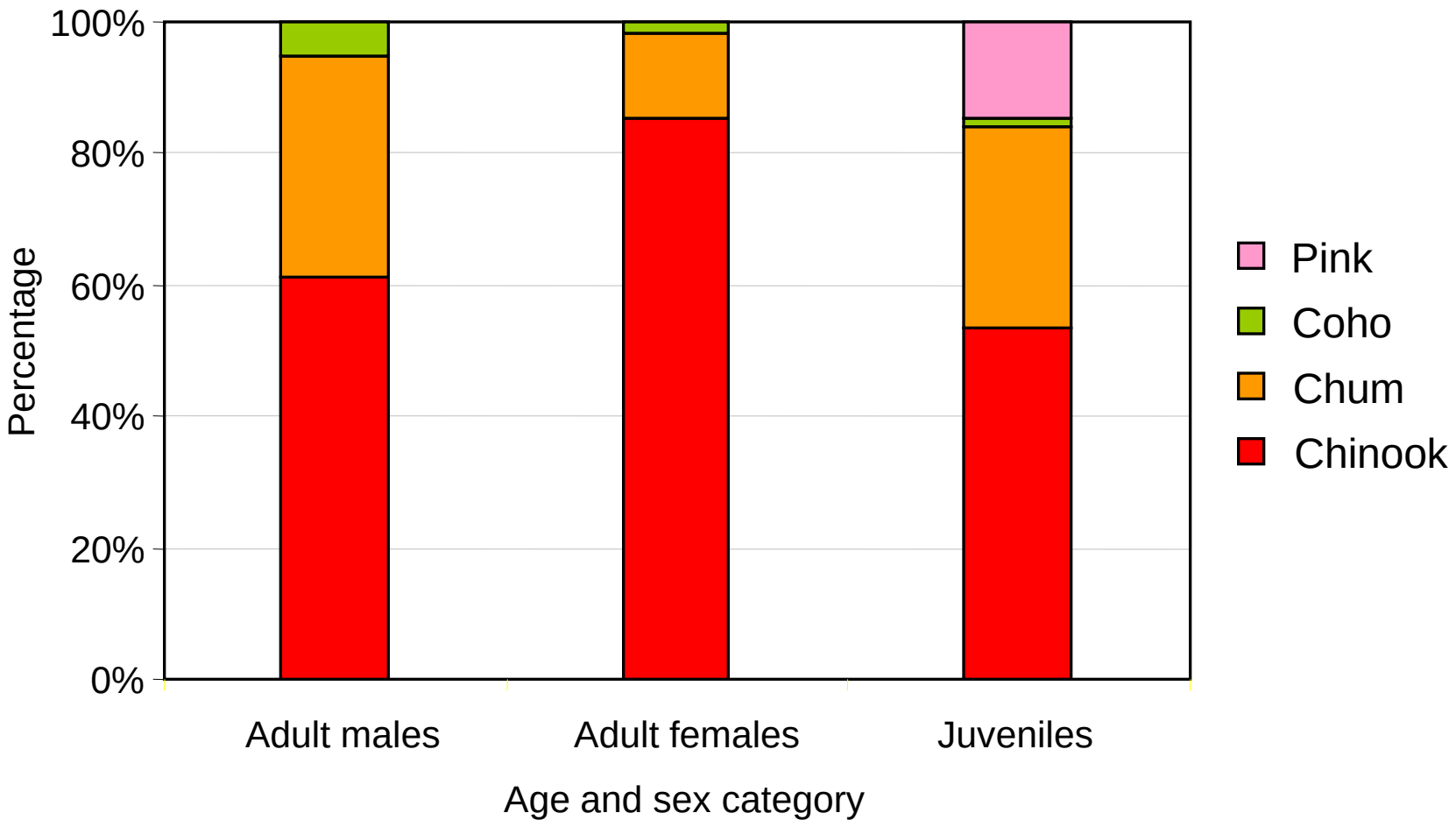
Salmonid prey taken by resident clans (n = 866 feeding events)



Source: Ford et al. 2010 CSAS Res Doc 2009/101;
Cetacean Research Program, PBS, unpubl. data

Salmonid species taken by whale age & sex class

(n = 274 feeding events)

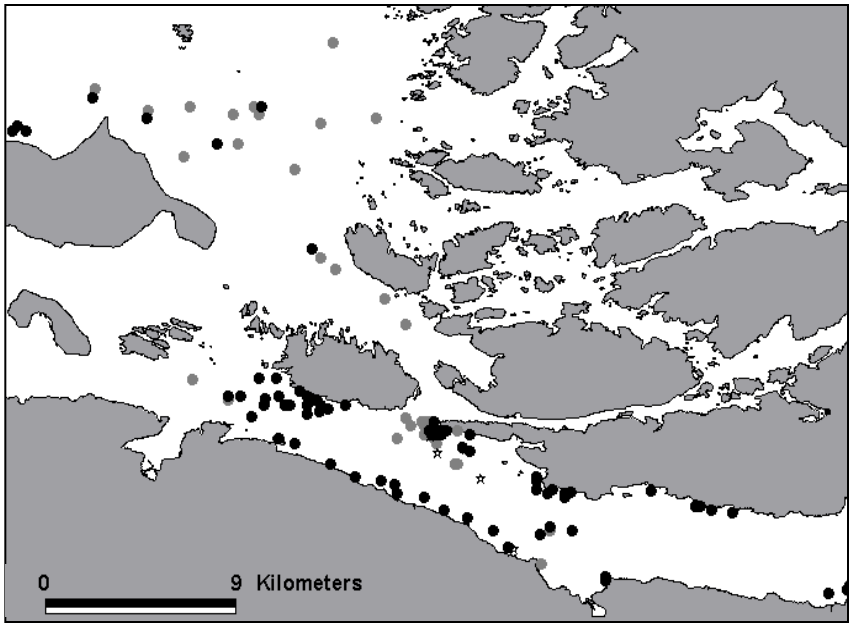


Source: Ford and Ellis 2006. MEPS 316:189-199

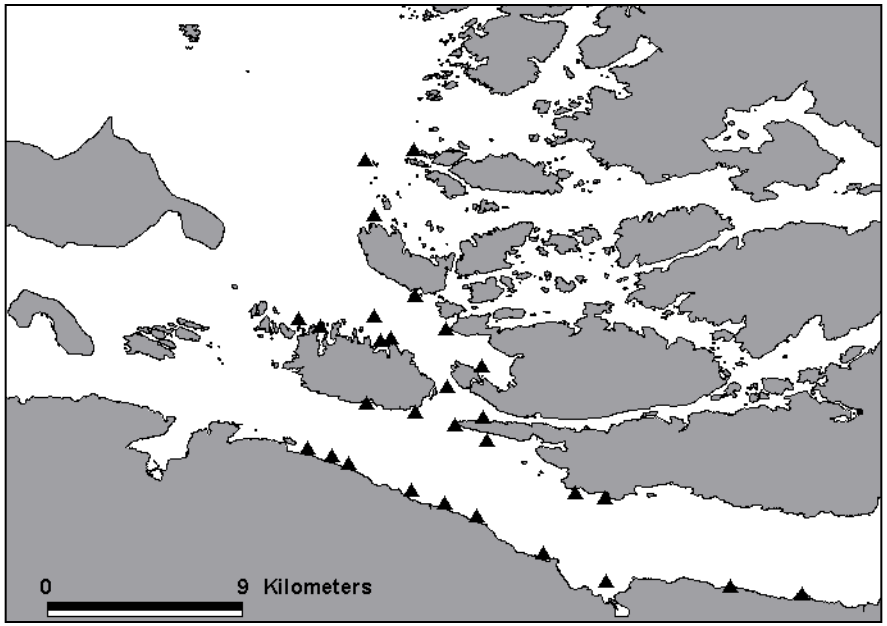
Assessing salmon species selectivity vs availability

- compared NRKW salmon species consumed to relative abundance from DFO seine test fishery, Aug-Oct 2004

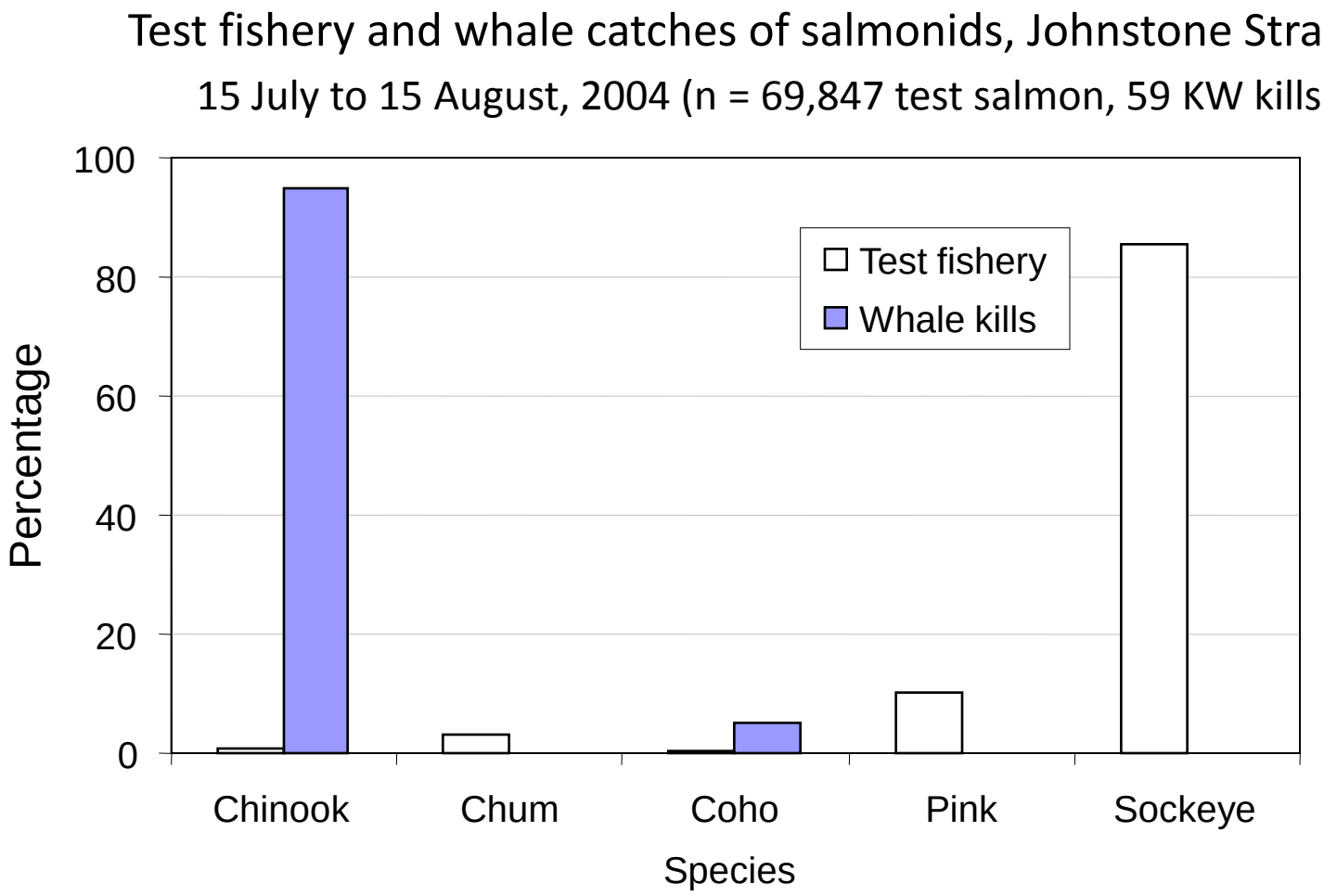
Locations of salmon kills



Locations of test fishery sets

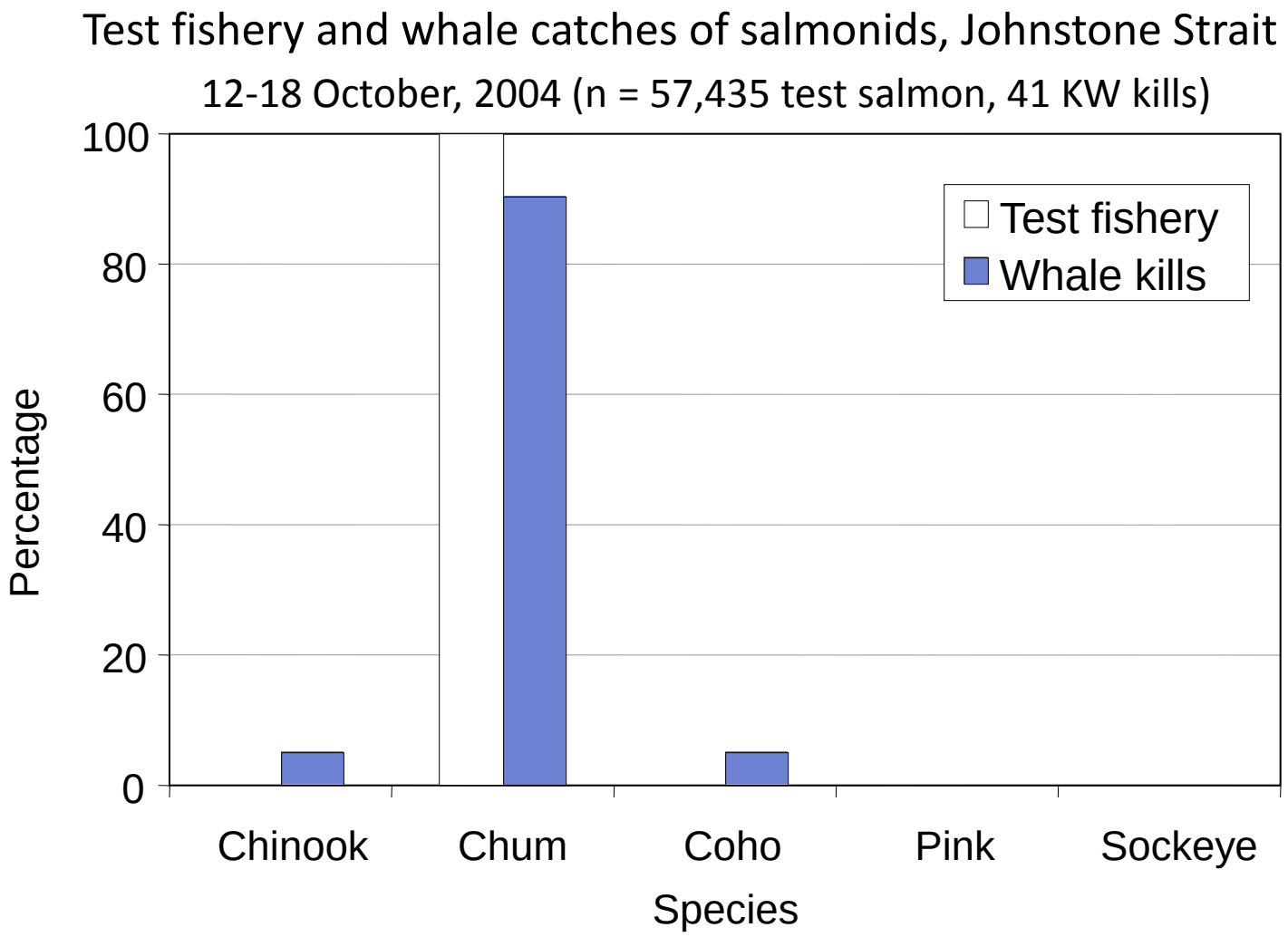


Chinook predominant prey species, July-August



Source: Ford and Ellis 2006. MEPS 316:189-199

Chum predominant prey species, mid October

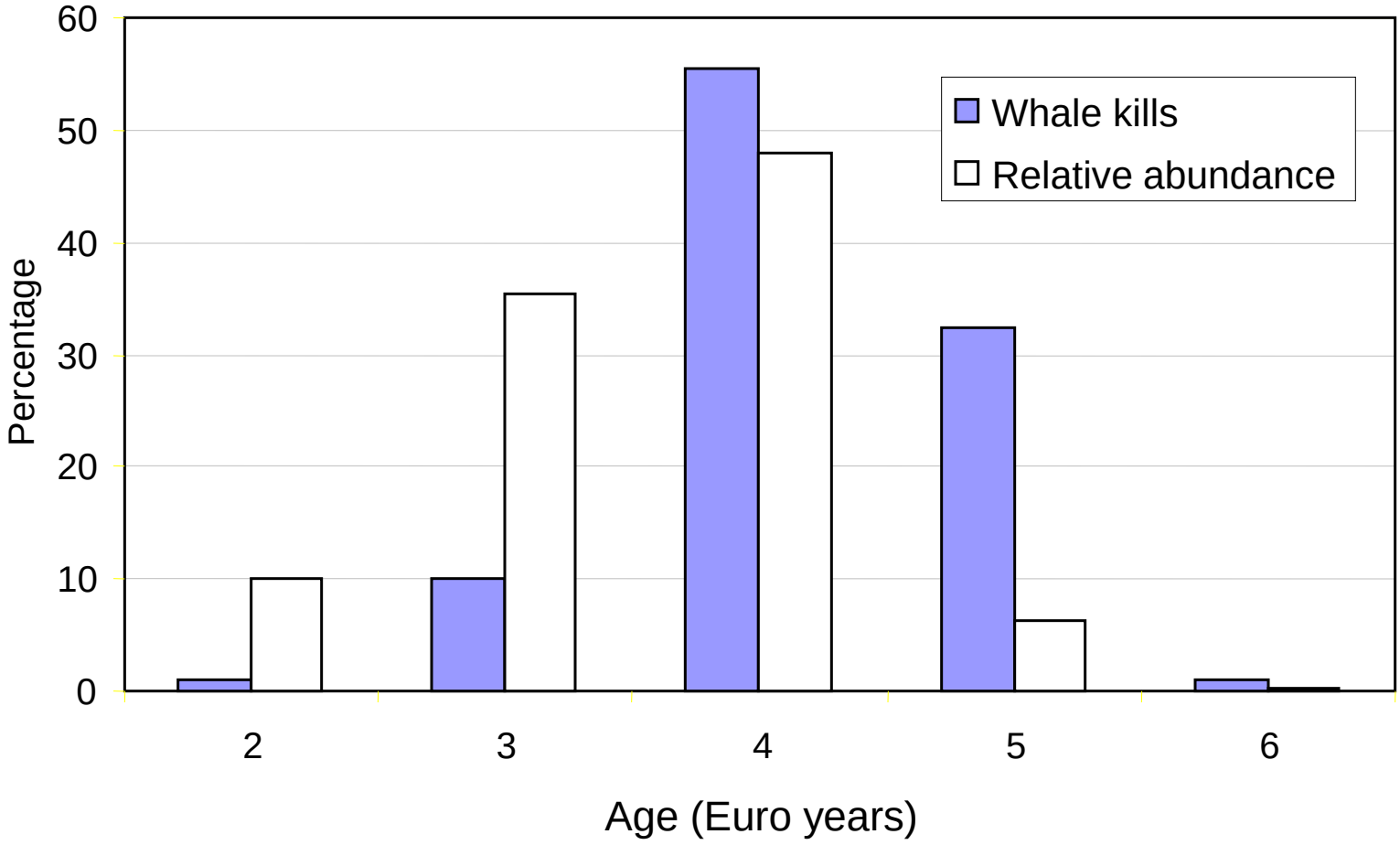


Source: Ford and Ellis 2006. MEPS 316:189-199

Selection for Chinook prey size

Age distribution of Chinook taken by whales vs. relative abundance, PSC Chinook model, NE Vancouver Island, 2000-2004 (n = 124 Chinook samples)

(Mean age of kills = 4.20 yr, mean age of available = 3.52 yr, p<0.001)



Source: Ford and Ellis 2006. MEPS 316:189-199

Did NE Pacific resident killer whales evolve as Chinook specialists?

- Killer whales generally favour large, lipid rich prey
- Chinook are the largest and most lipid rich of the salmonids
- Chinook are found throughout coastal waters year-round
- Foraging tactics of residents may be optimized for efficient predation of Chinook, making the species more profitable than more abundant alternatives
- Historical abundance of Chinook may have supported larger populations of residents than present today

Center for Whale Research

Acknowledgements

Prey sample collection

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Analysis etc.

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