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Chinook Salmon Insights from Marine Ecosystem Monitoring in Southeast Alaska

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2012 Alaska Chinook Salmon Symposium

Understanding Abundance and Productivity Trends of Chinook Salmon in Alaska

Anchorage Alaska, 23 October 2012

Presentation outline

A close-up photograph of a Chinook salmon's head, showing its eye, gills, and scales. The fish is dark in color, and the background is a light, textured surface.

- ❖ Highlight some past research studies & insights relevant to Chinook: 1982-1996
- ❖ Review current long-term Southeast Alaska Coastal Monitoring project: 1997-2012
- ❖ Summarize selected findings on Chinook marine distribution, ecology, & production
- ❖ Identify future research needs to better understand Chinook production mechanisms

Juvenile salmon research studies 82-87



Small mesh purse seining
July-Aug of 1982-1983

- 253 seine hauls
- **38 Chinook salmon**

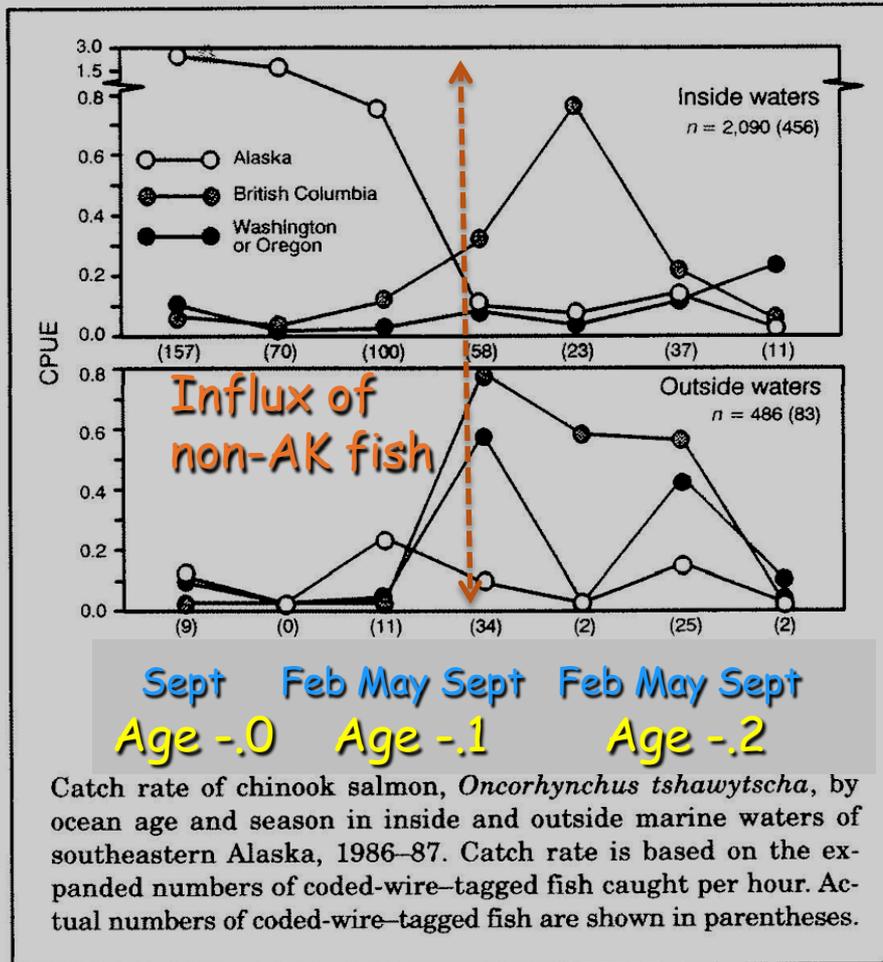


Salmon power trolling w/small
gear-3 regions-May/Sept/Feb
inshore/coastal - 1986-1987



- 135 charter days
- **5,838 Chinook salmon**
(539 coded-wire tags)

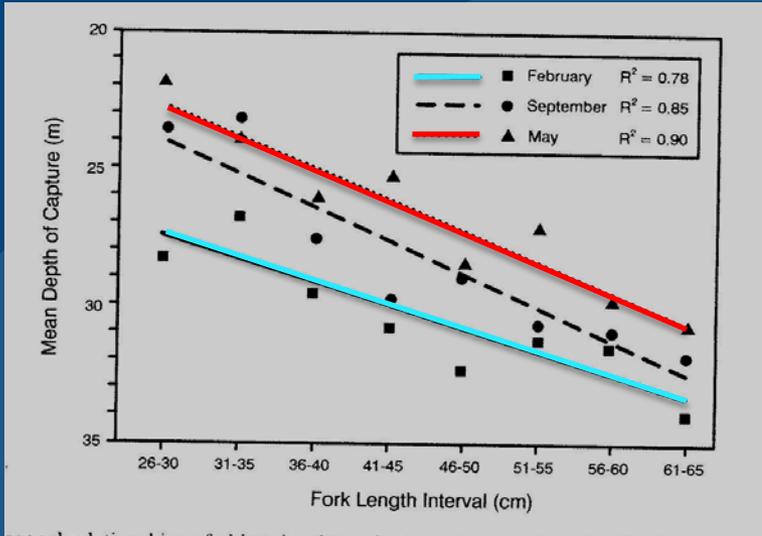
Insights from Chinook research



Marine distribution and origin of prerecruit Chinook salmon in southeastern Alaska
(Orsi and Jaenicke 1996)

- Described seasonal stock-specific distributions of AK, BC, & WA/OR fish from cwts (74 stocks)
- Identified SEAK as an important nursery area for prerecruit Chinook salmon from up to 1,800 km south

Insights from Chinook research...

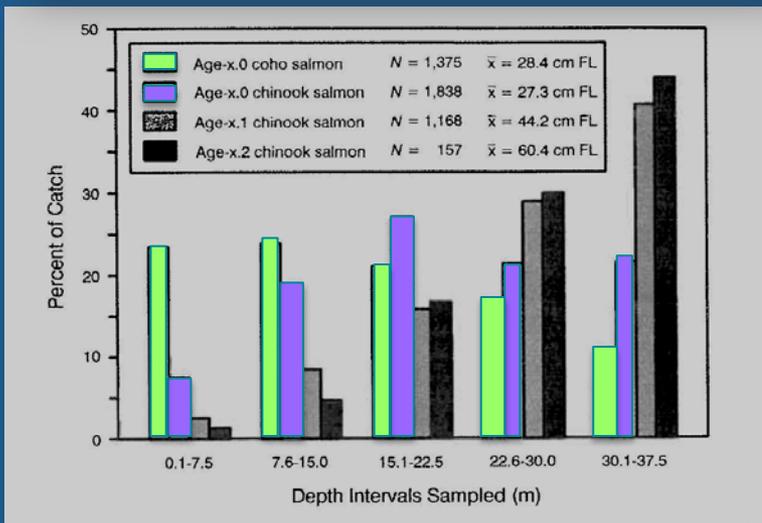


Largest Chinook deepest

Fish shallow in May deep in Winter



Marine vertical distribution of Chinook salmon and coho salmon in southeastern Alaska



Juvenile Chinook deeper than coho: habitat partitioning in September

Older Chinook deeper

(Orsi and Wertheimer 1995)

Juvenile salmon research studies 1993-2012



Two boat pair trawling
June-Aug 1993-1996

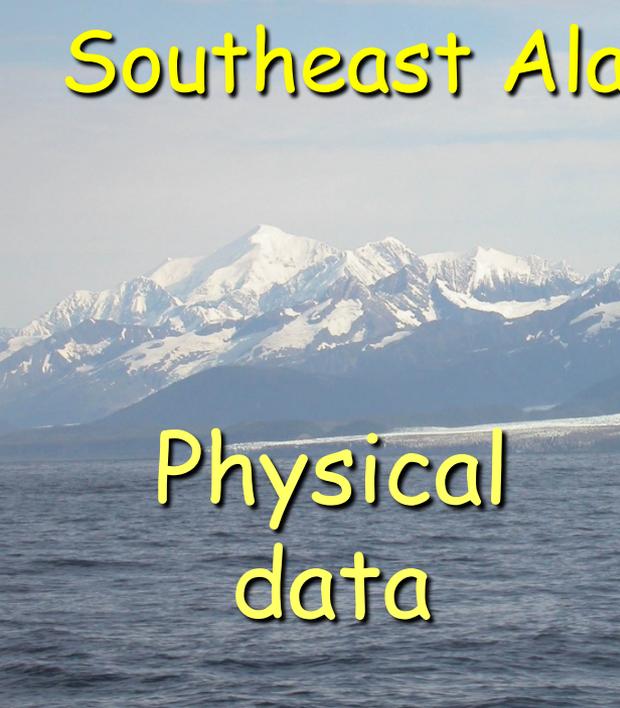
- shallow 3-m, 10 min, night
- ~225 hauls
- **20 Chinook salmon**



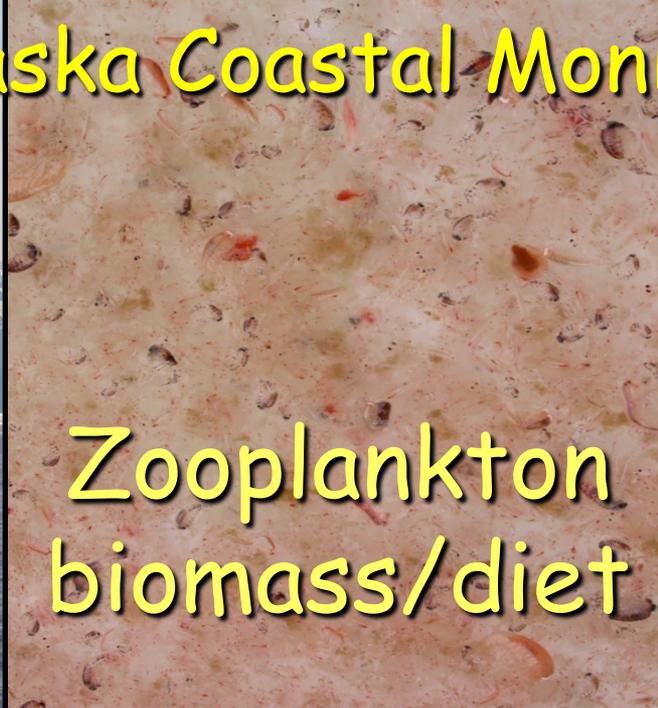
Surface rope trawling (SECM)
May-**Jun-Jul-Aug**-Sep 1997-2012

- 20-m deep, 20 min, day
- 1,382 hauls
- **1,299 Chinook salmon**

Southeast Alaska Coastal Monitoring (SECM)



Physical
data



Zooplankton
biomass/diet



Catches
(CPUE)



Pink

Chum

Size & growth



Pink

Chum

Sockeye

Coho

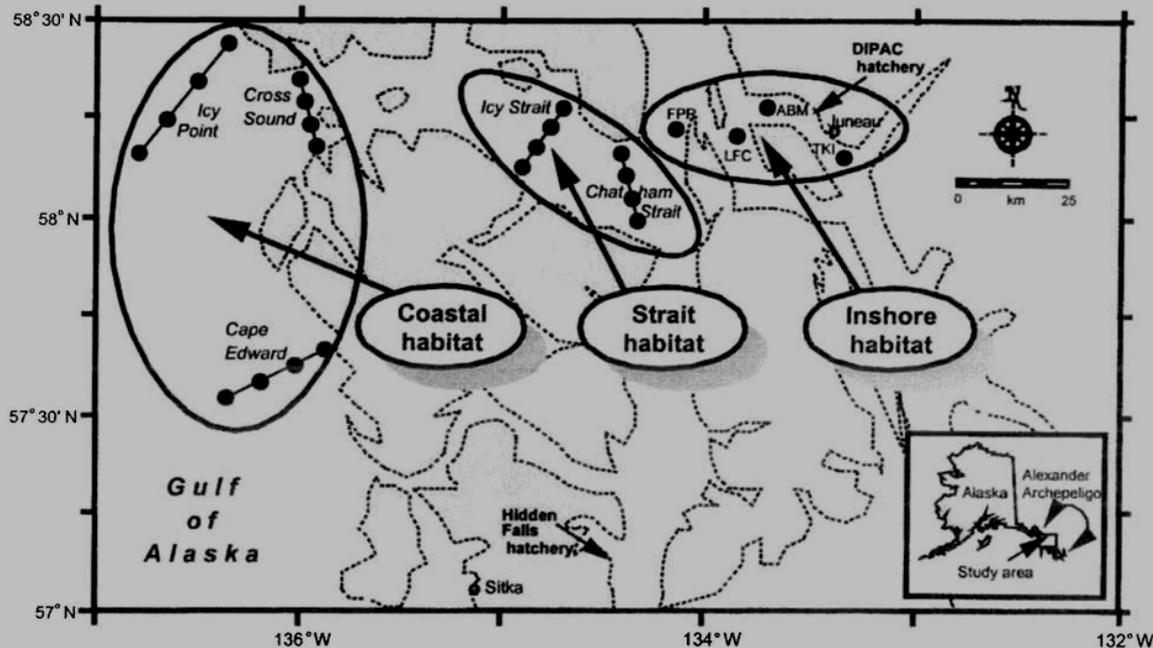
Stock comp



Predation

Seasonal distribution of juvenile salmon

Fig. 1. Stations sampled monthly in inshore, strait, and coastal marine habitats of the northern region of southeastern Alaska, May–October 1997–99. Up to 24 stations were sampled: four stations (ABM: Auke Bay Monitor, FPR: False Point Retreat, LFC: Lower Favorite Channel, TKI: Taku Inlet) in inshore habitats, two transect lines (four stations each) in strait habitats, and three transect lines (four stations each) in coastal habitats. Localities of the two primary salmon hatcheries in the region are identified: DIPAC (Douglas Island Pink and Chum) hatchery and Hidden Falls hatchery.



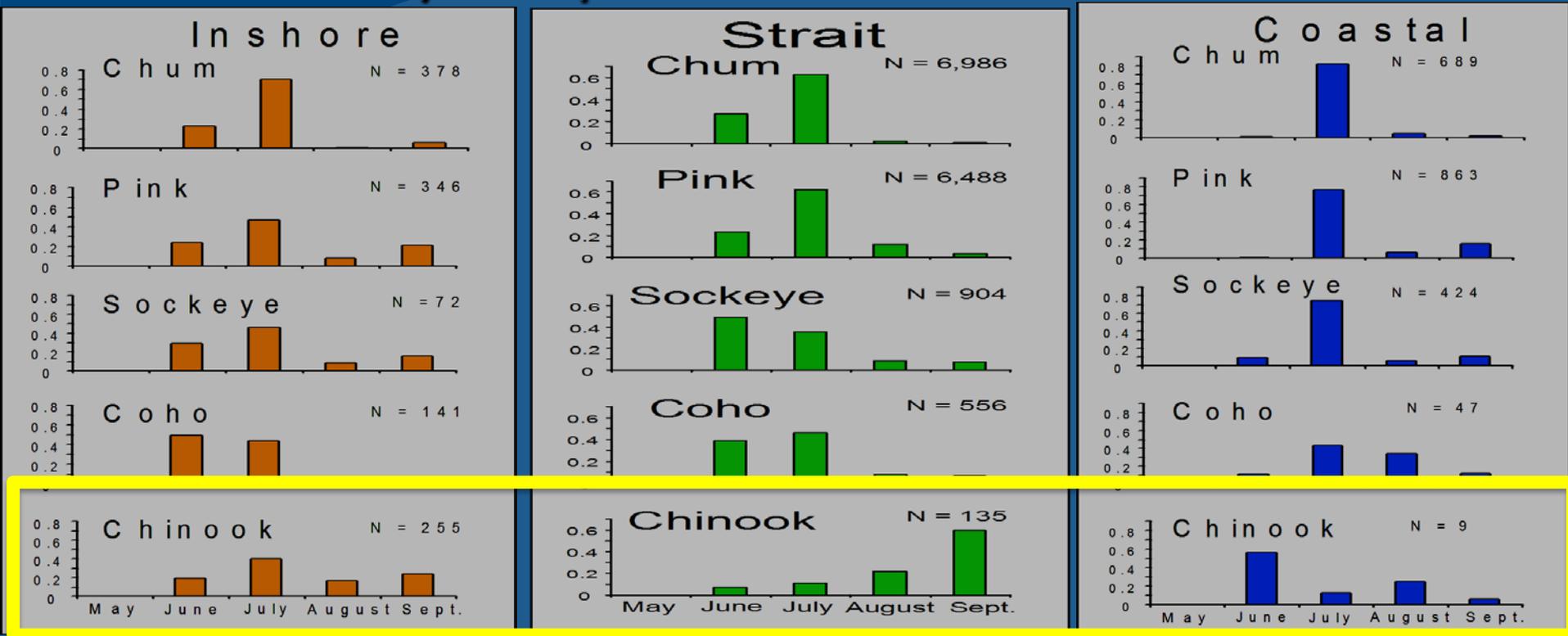
¹Reference to trade names does not imply endorsement by the National Marine Fisheries Service.

Seasonal habitat use and early marine ecology of juvenile Pacific salmon in southeastern Alaska (Orsi et al. 2000)

Differential habitat use by species?

Seasonal signals from May to September?

Juvenile salmon distribution patterns May-September 1997-2000



Inshore (high #s)

Strait (medium #s)

Coastal (low #s)

- Inshore: distributed evenly among months
- Strait: increased from June to September
- Coastal: peaked in June, declined in later months

What is the relative abundance of Chinook compared to other epipelagic fish species?



THE
ECOLOGY
of
JUVENILE
SALMON
in the
NORTHEAST
PACIFIC
OCEAN:

Regional
Comparisons

Churchill B. Grimes
Richard D. Brodeur
Lewis J. Haldorson
Stewart M. McKinnell

Symposium 57



Epipelagic fish assemblages associated with juvenile Pacific salmon in neritic waters of the California Current and the Alaska Current (Orsi et al. 2007)

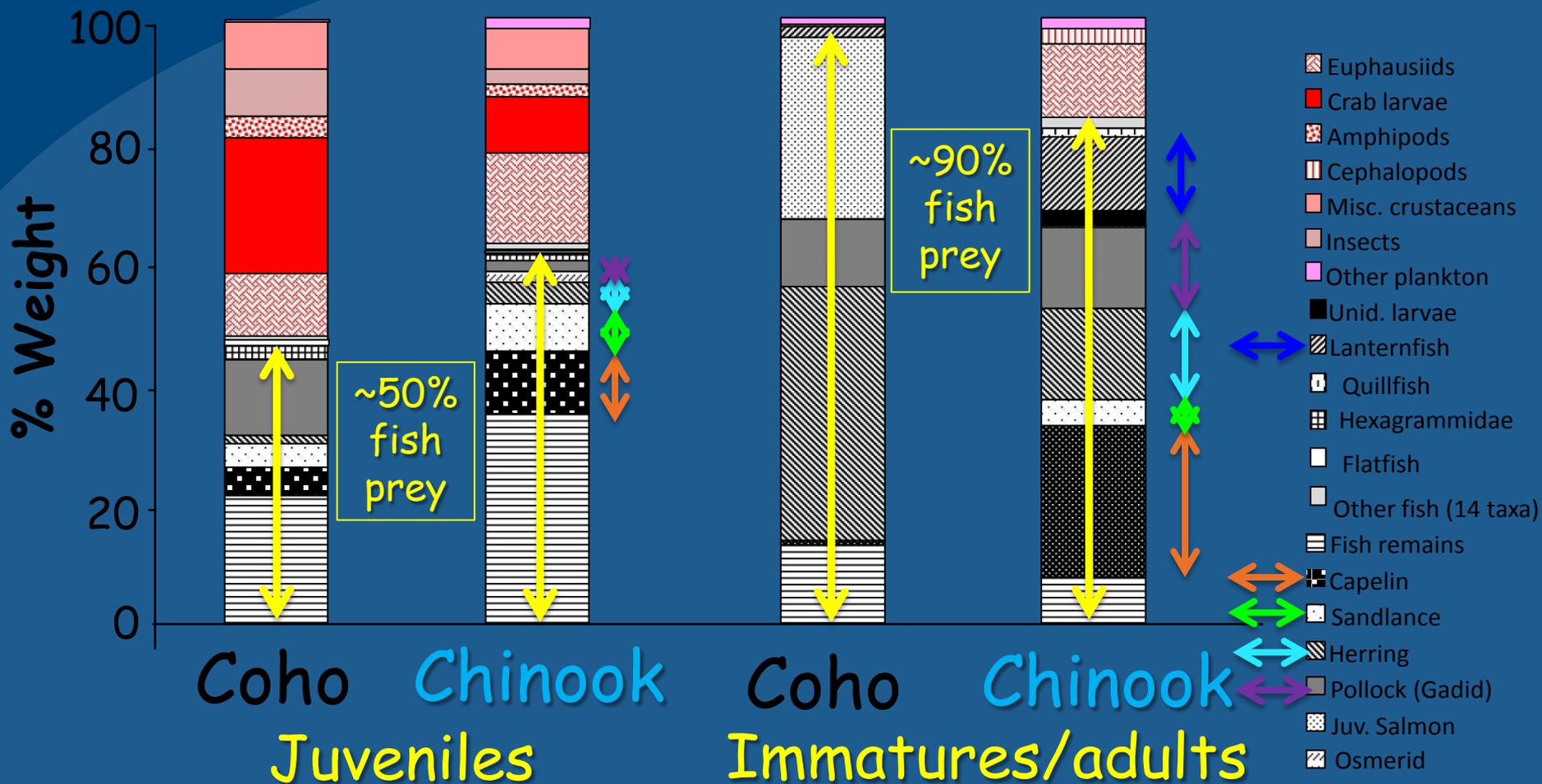
Daytime surface trawls, inshore & coastal waters, spring/summer & summer/fall periods, 2000-2004

1.6 million fish & squid: 52 fish families - 118 species

Large marine ecosystem	Trawl hauls fished	Total fish sampled	Chinook inshore (%)	Chinook Coastal (%)
Alaska Coastal Current	606	120 K	0.005- <u>0.010</u>	0.002-0.005
California Current	1,510	1,560 K	0.015- <u>0.190</u>	0.007-0.010

Chinook salmon numerically comprised 1/100th of 1% of the catch in the AK Coastal Current

Diets of Chinook salmon vs. coho salmon in Southeast Alaska



Data sources: Weitkamp & Sturdevant 2008, Sturdevant et al. 2012

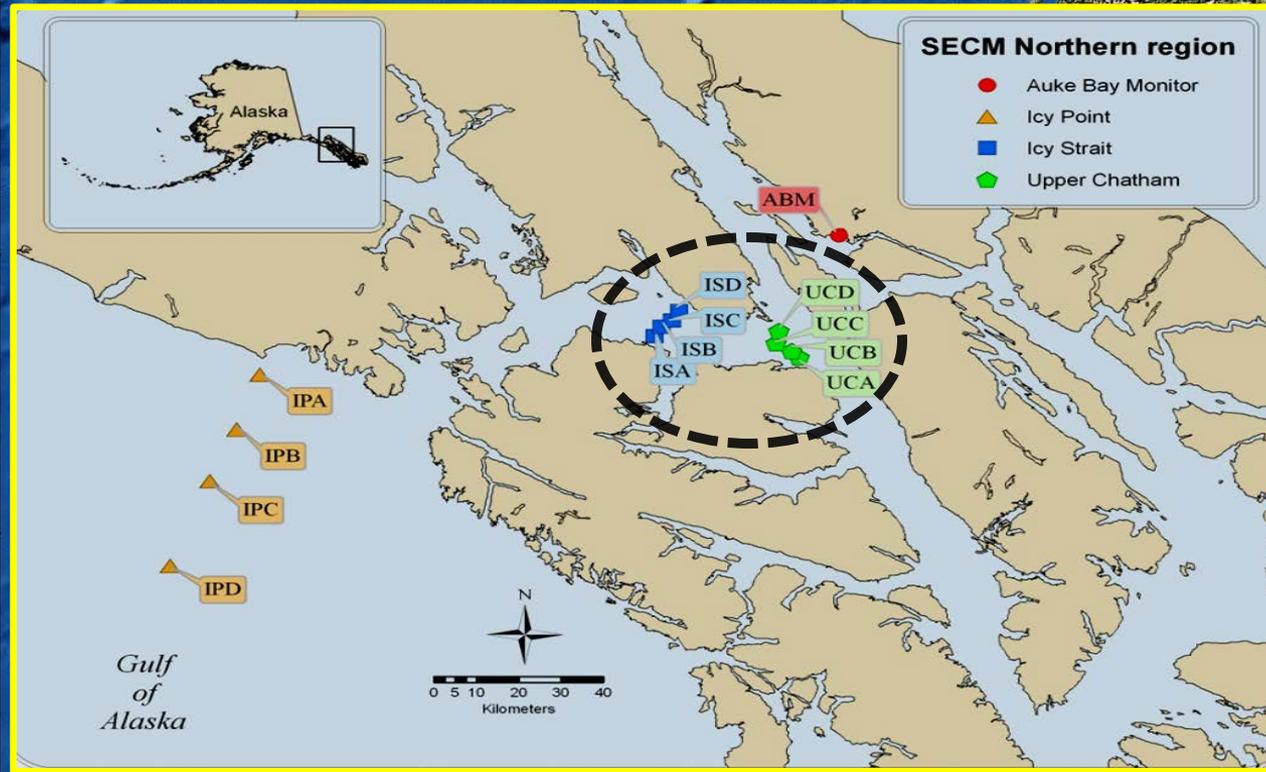
SECM sampling stations in Southeast Alaska May, June, July, August 1997-2012

60°N

55°N

50°N

45°N



145°W

140°W

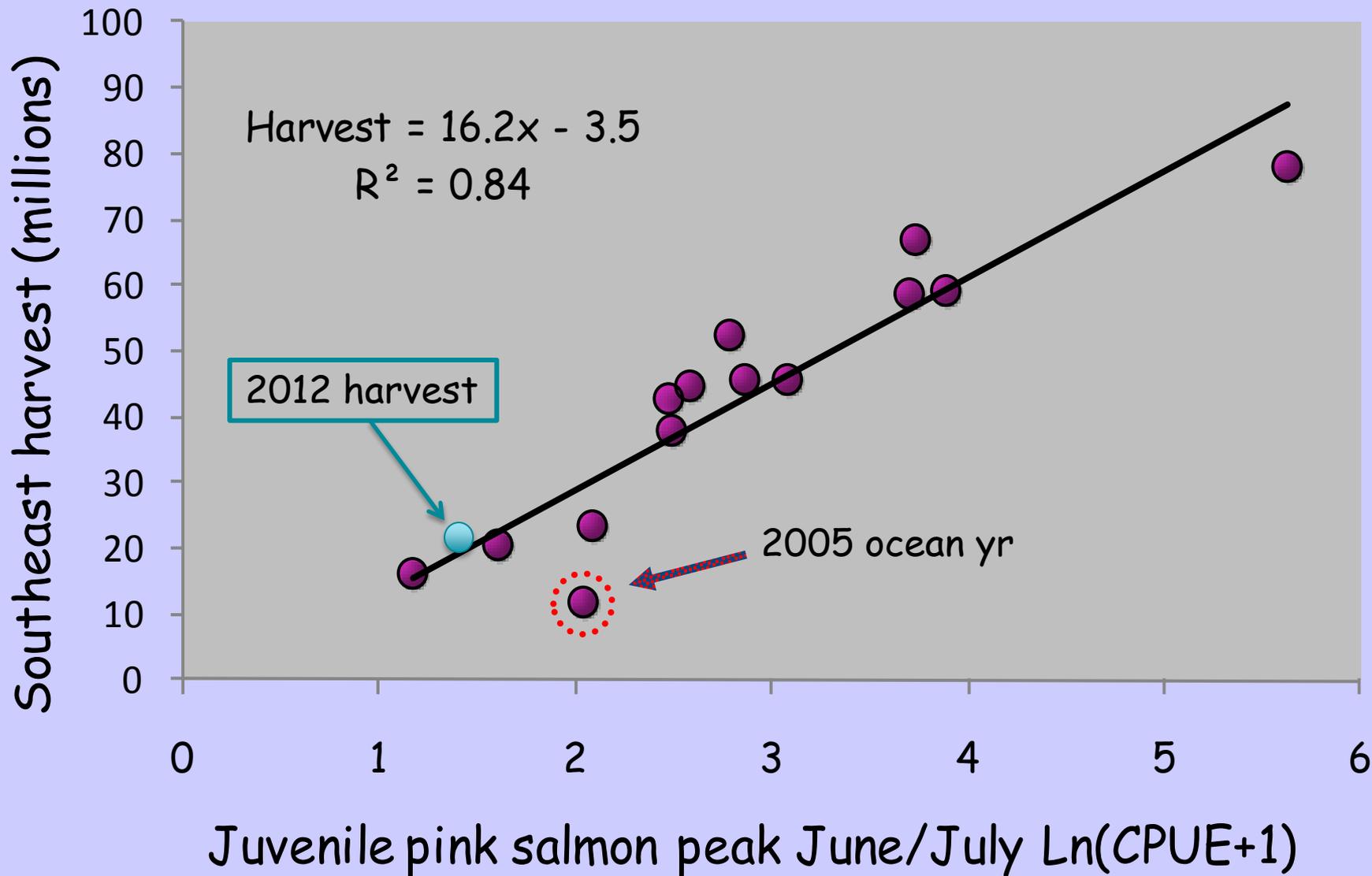
135°W

130°W

125°W

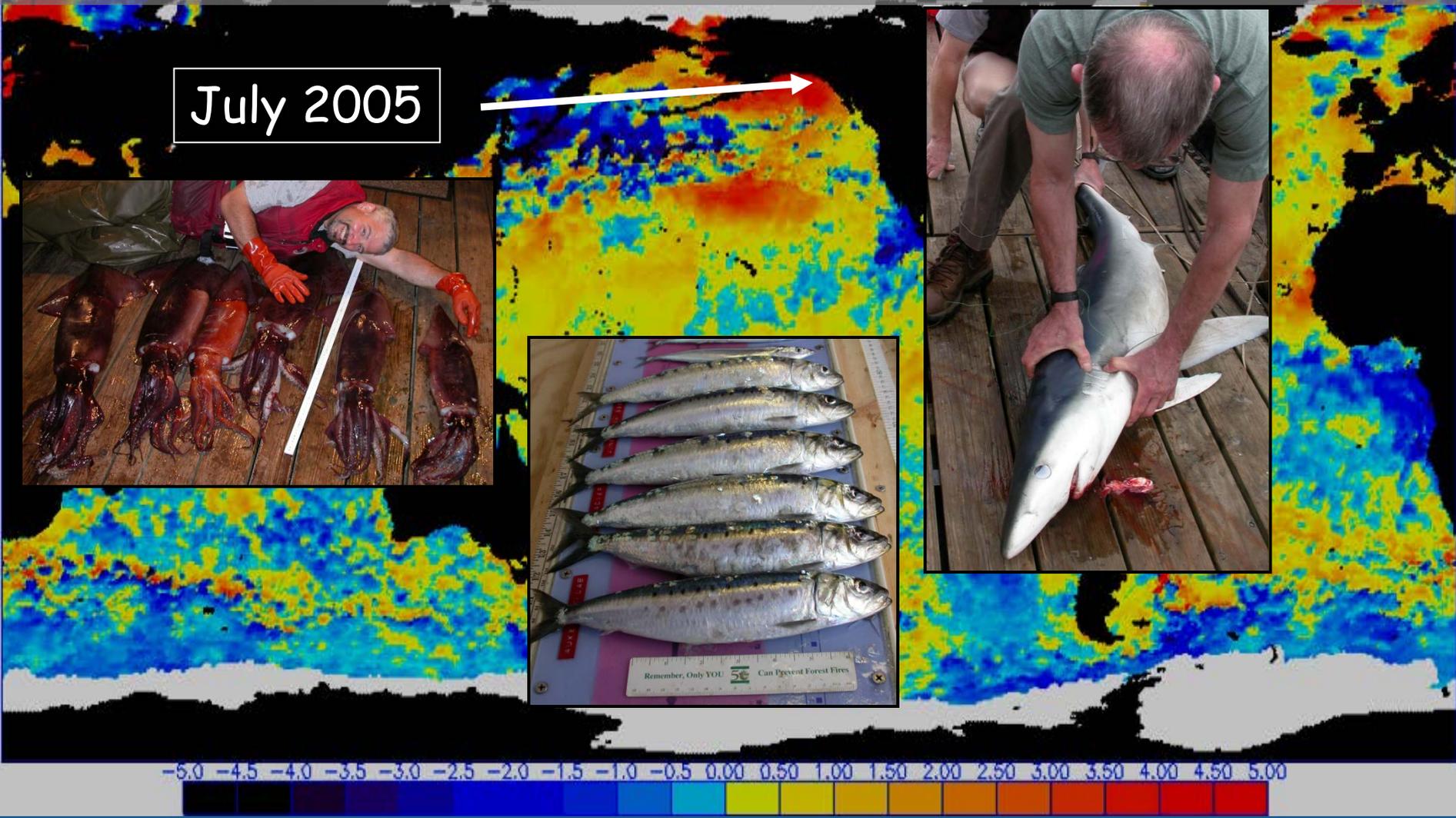
120°W

Strong relationship between SECM juvenile pink catch and adult harvest 1998-2011



Diel epipelagic distribution of juvenile salmon, rockfish, sablefish and ecological interactions with associated species in offshore habitats of the northeast Pacific Ocean (Orsi et al. 2006)

July 2005



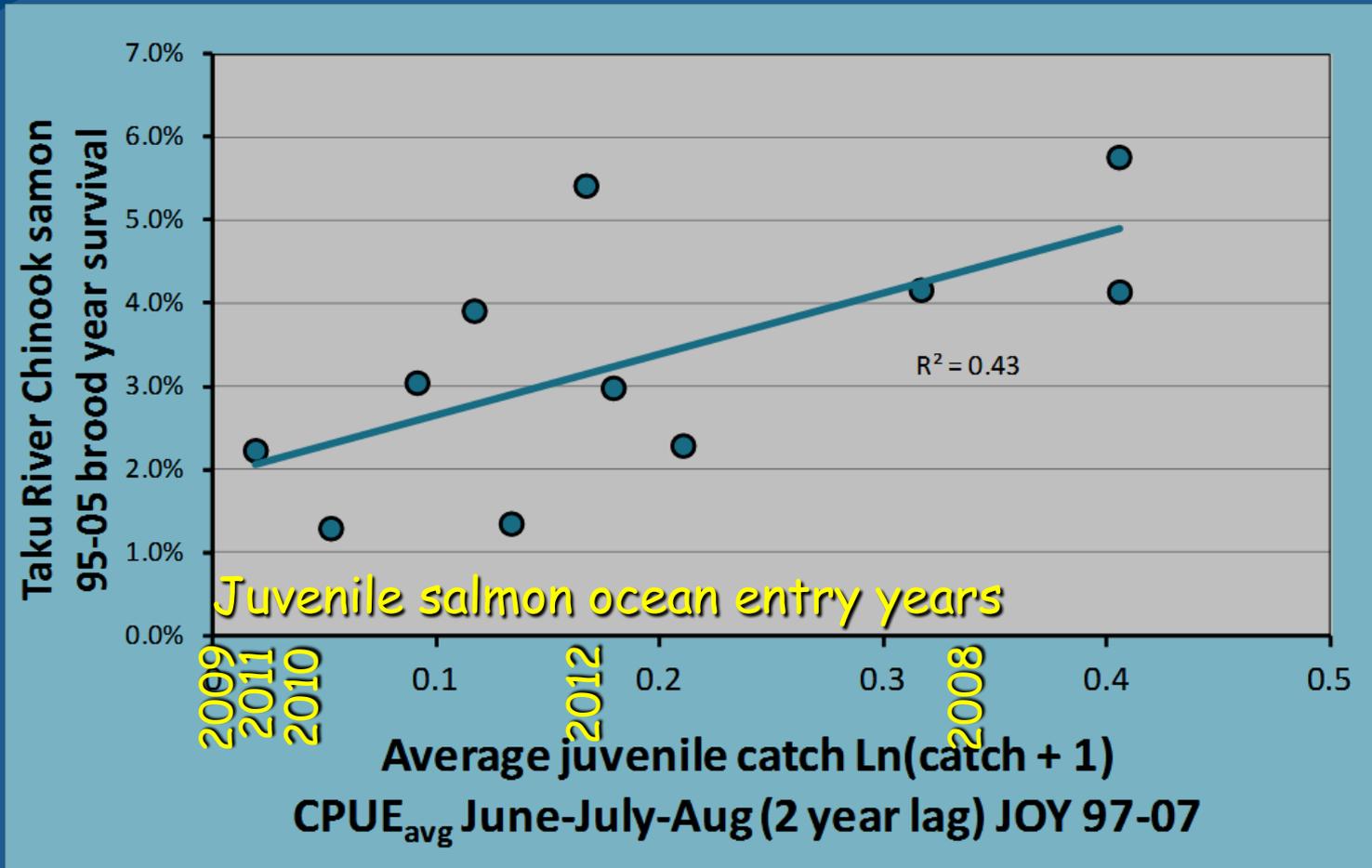
<http://www.osdpd.noaa.gov/PSB/EPS/SST/data/anomnight.7.12.2005.gif>

Correlations between SECM Chinook catches and wild and hatchery Chinook salmon brood year survival

(Chinook data courtesy: E. Jones ADFG, F. Thrower NOAA, C. Blair NSRAA, and R. Focht)

Stock-group	Brood years (BY)	# yrs	Age-.0 juveniles CPUE _{J-J-A} (BY + 2)	Age-.1 immatures CPUE _{J-J-A} (BY + 3)
Stikine River Wild	1998-2002	5		
Chilkat River Wild	1998-2003	6		
Taku River Wild	1995-2005	11		
L. Port Walter Hatchery	1995-1999 2001-2005	10		
Hidden Falls Hatchery	1995-2005	11		
Douglas I. P&C Hatchery	1996-2005	10		

Juvenile Chinook salmon CPUE (1997-2007) vs. Taku River marine survival (BY 1995-2005)



Insights from Chinook sampling in Southeast

Catch rates are low with many sampling techniques:
Chinook numerically represent 1/100th of 1% of catches

A multitude of stocks occur in SEAK, some year-round,
migrate northward from distant localities - as age -.1 fish

Many SEAK stocks have limited early ocean migrations as
evidenced by protracted seasonal habitat use, conversely,
some Columbia R. Basin stocks are highly migratory

Deep vertical distribution relative to the other salmon
species, larger/older fish deepest, and seasonally deepest
in winter

Insights from Chinook sampling in Southeast

Juvenile Chinook salmon have habitat-specific seasonal migration patterns, different from the other salmon species

Chinook salmon are picivores (50-90% of diet), important fish prey are: capelin, herring, sandlance, gadids, & lanternfish

Chinook salmon CPUE shows promise as a tool for indexing Chinook salmon year class strength of some stock groups

Long-term ecosystem monitoring on a seasonal basis has enabled biological signals to be detected

A couple recent studies on Chinook marine distribution and survival...

#1

A refined description of essential fish habitat for Pacific salmon within the U.S. Exclusive Economic Zone in Alaska
(*Echave et al. 2012*)

(Echave et al. 2012)

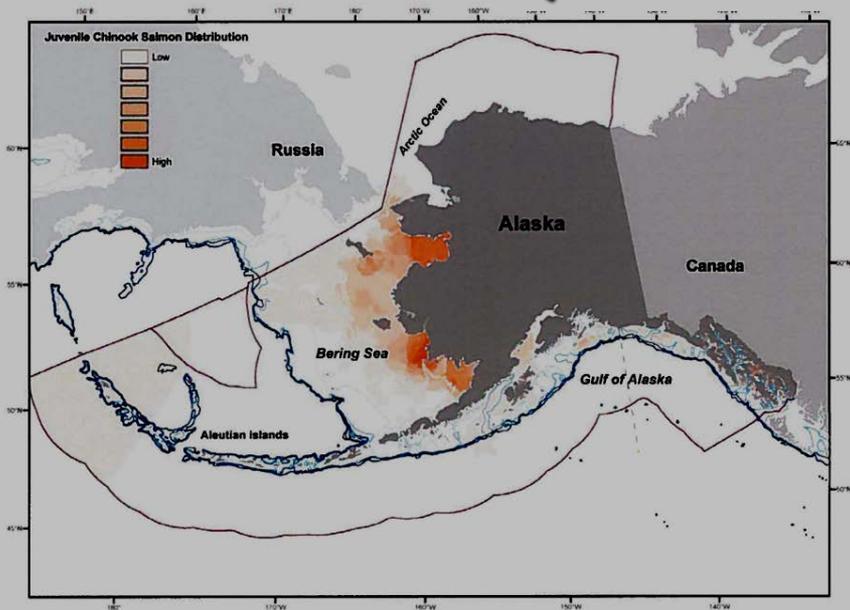


Figure 17a. -- 95% of the spatial distribution of marine juvenile Chinook salmon range. Smooth line represents the EEZ boundary; dotted line is the Cape Suckling longitude separating East and West Gulf of Alaska ADFG management areas, depth contours are 50, 100, 200, 400, and 600 m.

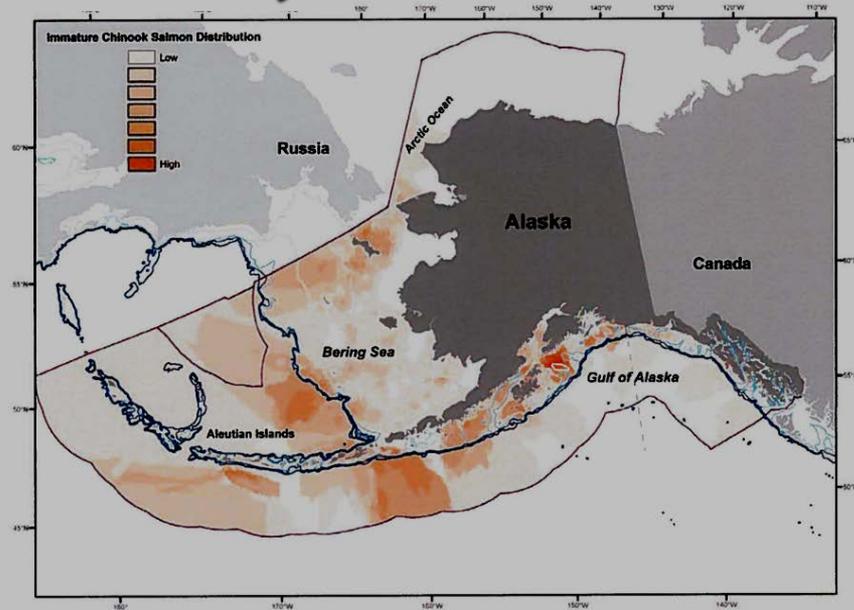


Figure 18a. -- 95% of the spatial distribution of marine immature Chinook salmon range. Smooth line represents the EEZ boundary; dotted line is the Cape Suckling longitude separating East and West Gulf of Alaska ADFG management areas, depth contours are 50, 100, 200, 400, and 600 m.

Juvenile Chinook range,
95% of spatial distribution

Inshore distribution
on the continental shelf

Immature Chinook range,
95% of spatial distribution

Offshore distribution in
western GOA & Bering Sea

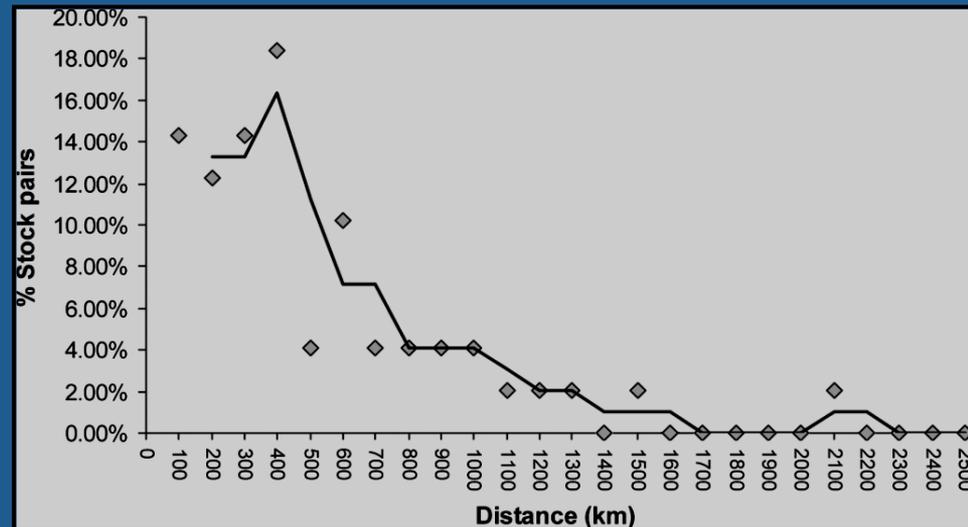
A couple recent studies on Chinook marine distribution and survival...

#2

Relating spatial and temporal scales of climate and ocean variability to survival of Pacific Northwest Chinook salmon
(*Sharma et al. 2012*)

(Sharma et al. 2012)

Examined smolt-adult survival from 22 Chinook salmon stock groups from the Pacific Northwest to Southeast AK



- Ocean survival grouped into 8 distinct regional clusters
- Chinook survival co varies on spatial scale of 350-450 km
- Local ocean conditions following smolt outmigration had a significant effect on survival for most stock groups

What research is needed to better understand marine production mechanisms for Chinook?



Juvenile abundance?

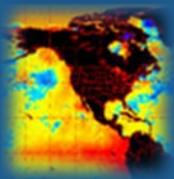


Immature distribution?



Adult production?

Climate?



Prey?



Competitors?



Predators?



Future Chinook marine research direction?

Monitor ecosystems for index stocks seasonally

Identify stock-specific migration patterns

Do northern Chinook stocks have protracted early migrations, or perhaps two life history strategies: upper vs. lower Yukon?

Do Western AK Chinook stocks migrate seasonally like Japanese chum: summer in Bering Sea/winter in GOA?

Investigate trophic linkages (top-down & bottom-up)

Explore ecosystem metric relationships with survival

Maintain collaboration among researchers

Thanks for the survey collaboration! ADFG, U of AK, NWFSC, & SSRAA

