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Alaska Fisheries Science Center

The NOAA 2013 Southeast Pink Salmon Forecast from Ecosystem Monitoring in Southeast Alaska

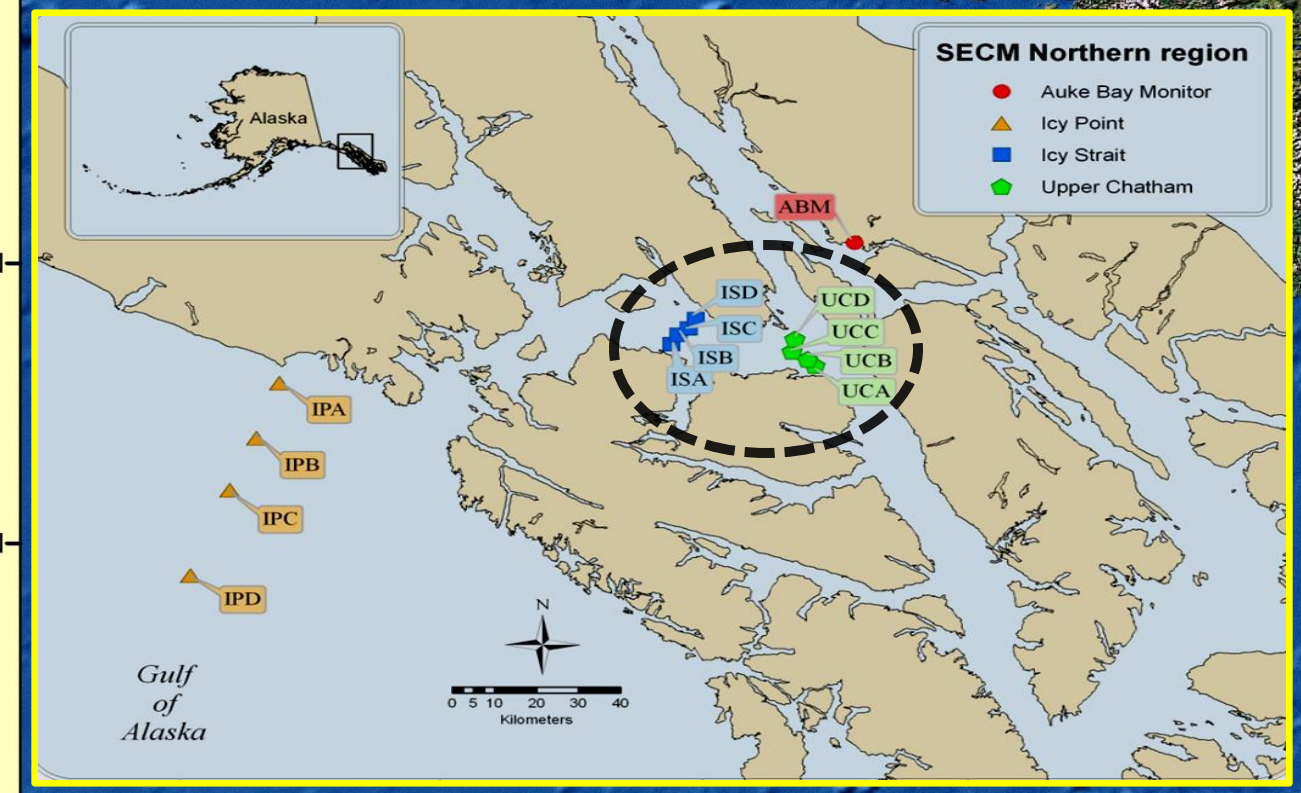
Joe Orsi, Molly Sturdevant, & Emily Fergusson

Southeast Alaska Purse Seine Task Force Meeting
Juneau, Alaska, 06 December 2012

Presentation outline

- Overview of ABL's Southeast Coastal Monitoring (SECM) project: 1997-2012
- Introduce ecosystem metrics considered for use in forecasting pink salmon returns
- Review past model performances and present the NOAA 2013 pink forecast
- Discuss assumptions & answer questions?

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

Southeast Alaska Coastal Monitoring (SECM)

Physical data

Zooplankton biomass/diet

Catches (CPUE)

Size & growth

Stock comp

Predation

Selected biophysical factors considered for forecasting Southeast pink salmon harvest

Biological (region)

J-pink salmon: Peak CPUE*, peak migration month, catch composition, growth, size at time, cond., etc.

Prey fields: Surface and integrated measures of zoop., stomach fullness (% of body weight), etc.

Physical (region & ocean basin)

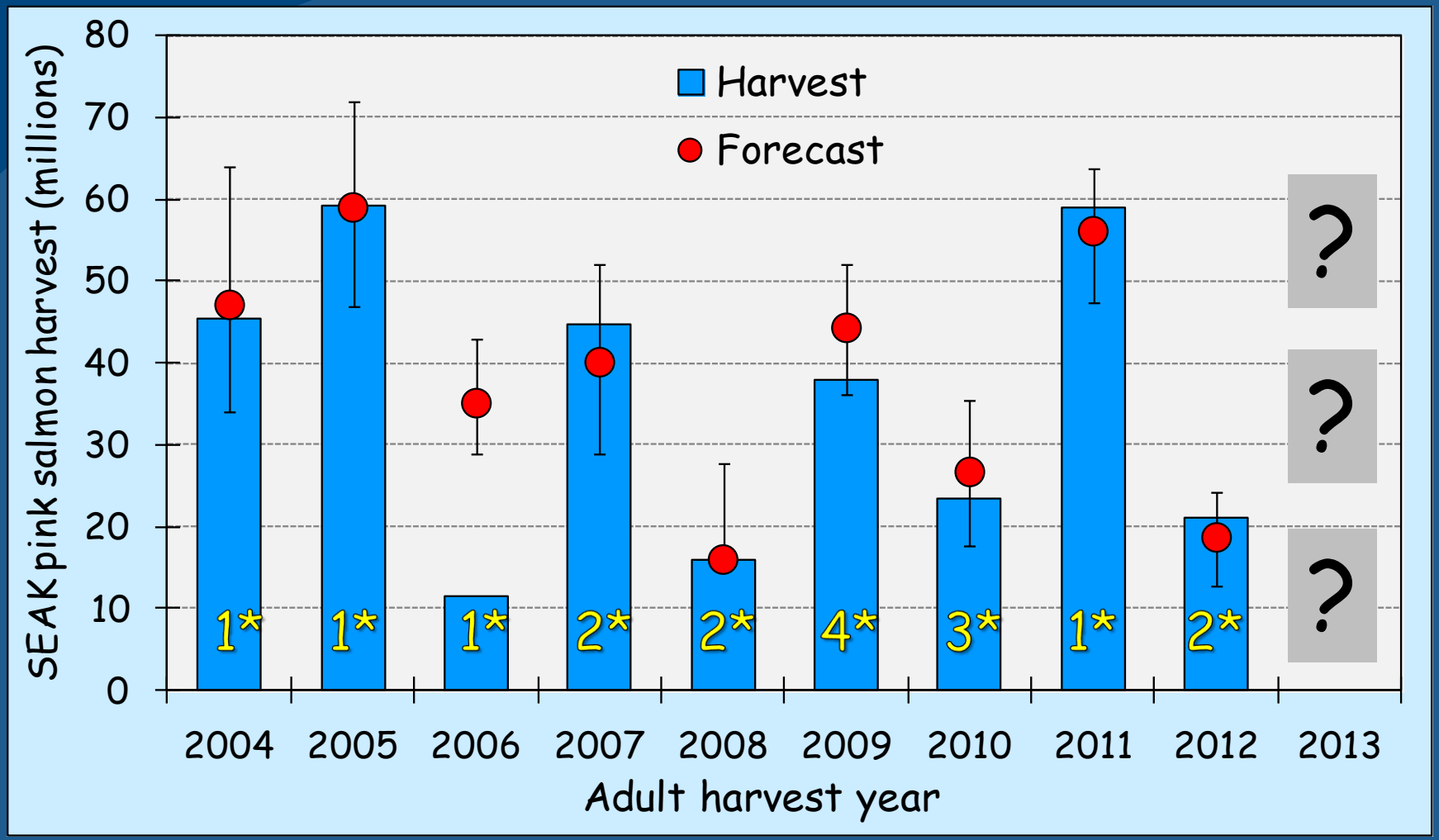
Region: Temperature (surface + integrated-"ISTI"), salinity, & mixed layer depth, etc.

Ocean basin: ENSO (El Niño Southern Oscillation Index), NPI (North Pacific Index), PDO (Pacific Decadal Oscillation Index), etc.

SECM sampling in 2012

- Sampled osho with RV *Sashin* in May, & trawled with FV *Northwest Explorer* -June, July, & August
- Fourth highest juvenile pink CPUE, favorable July migration timing, high % pink in catch, cold temps
- No vessel calibration in 2012: our 3rd year using *NW Explorer,* fishing power assumed to be high
- ADFG and SSRAA participation: Malika Burnett, Susan Dougherty, and Michelle Morris

SECM pink salmon forecast models 2004-2012: Accurate (avg. 7% of harv.) in 8 of 9 past yrs



*Model parameters: 1=CPUE only, 2=CPUE+MayTemp, 3=CPUE+MayTemp+ENSOj, & 4=CPUE+MayTemp+ENSOj+MLD

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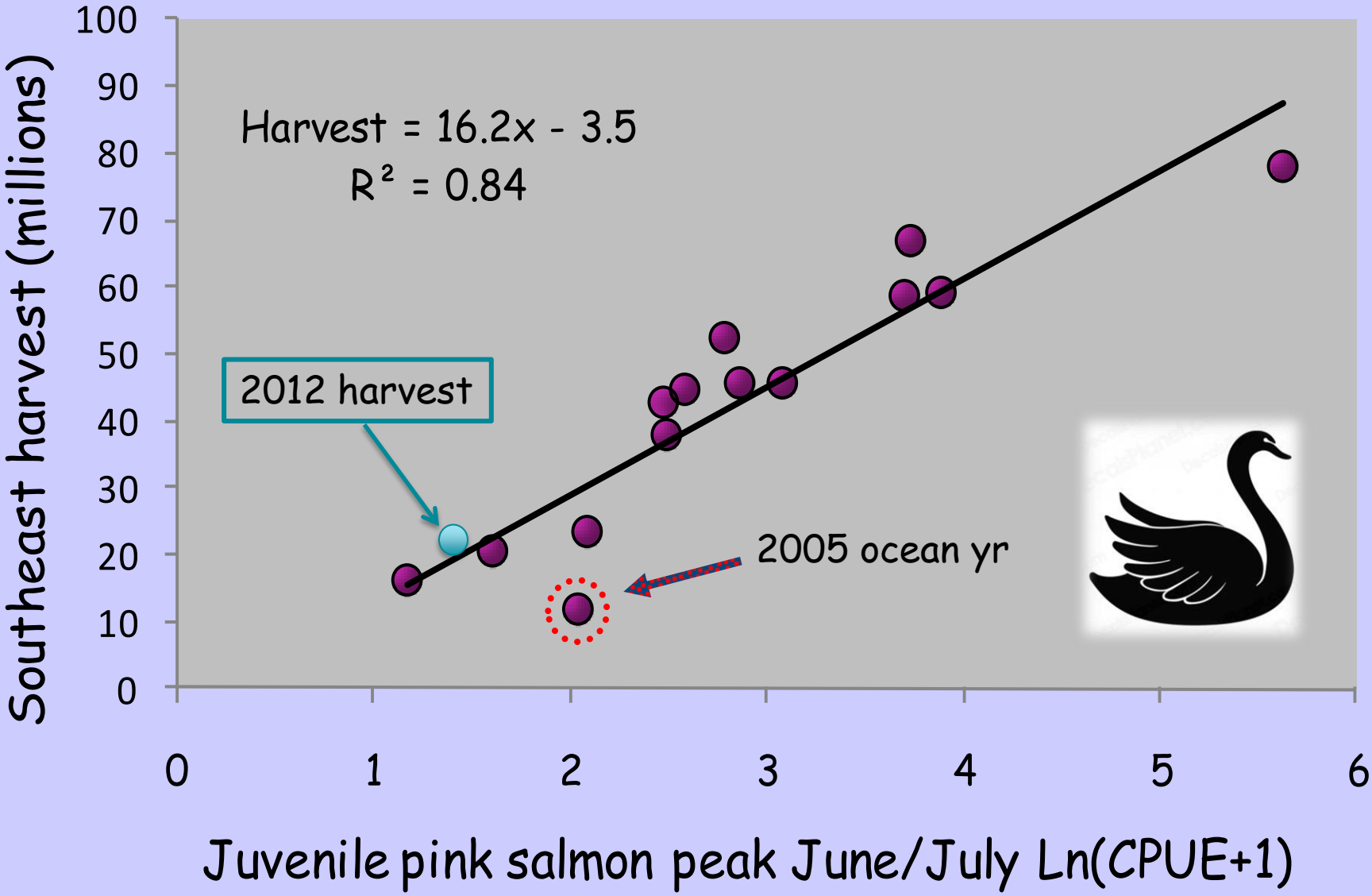
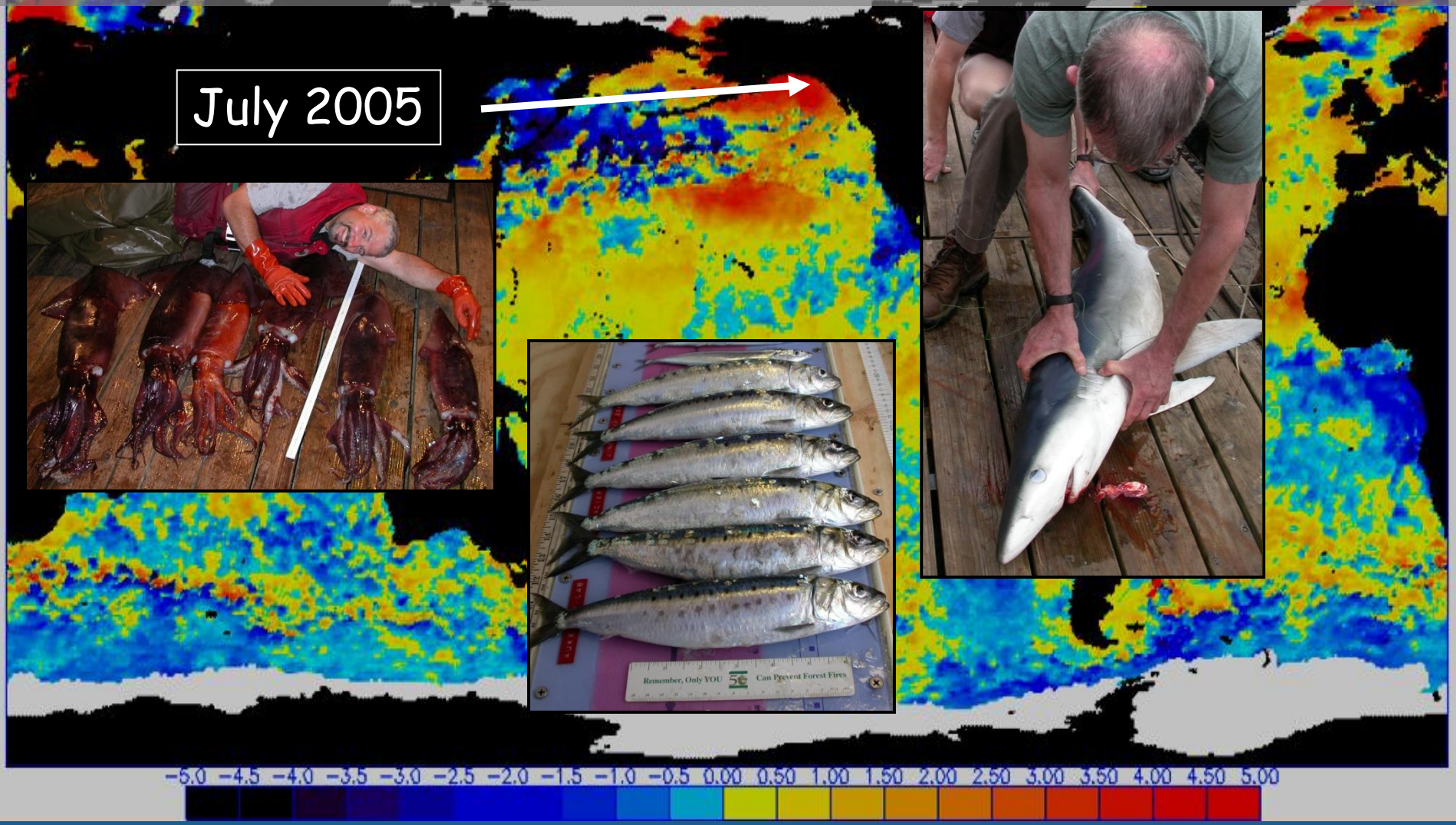
Strong relationship between SECM juvenile pink catch and adult harvest 1998-2012



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*)



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

Forecasting procedures using a general linear model

1) Forward-Backward Stepwise Regression considering all variables, $P < 0.05$

2) Use Corrected Akiake Information Criteria (AIC_c) to check for "over parameterization"

3) "Jackknife" procedure to evaluate models over time series

4) Bootstrap re-sampling of CPUE data to generate forecast confidence intervals and examine effect of measurement error

2013 pink salmon forecast models

Models considered	Adj. R^2	AIC_c	Regression *P* value	Prediction for 2011 (80% CI)
Peak j-pink $CPUE_{JJ}$	85%	98.1	< 0.001	47.8 M (42-52)
Peak j-pink $CPUE_{JJ}$ + Icy Strait 20-m $temp_{MJJA}$ "ISTI"	91%	92.0	< 0.001	**53.8 M (46-58)**

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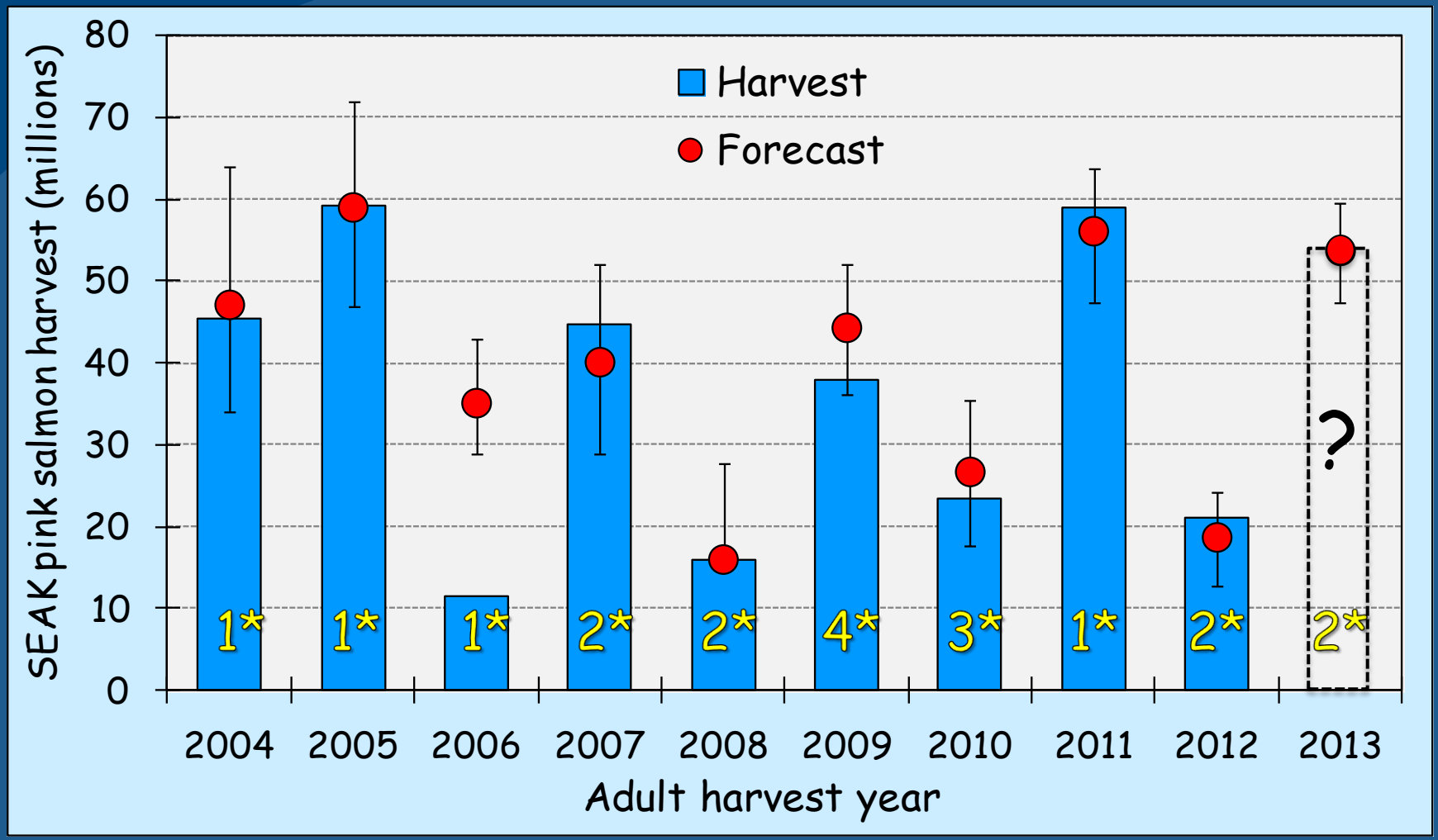

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Assumptions in using our SECM juvenile pink CPUE data to predict SEAK harvest:

1. Icy Strait CPUE represents the entire region
2. Monthly "peak" CPUE adequately captures the magnitude of the seaward migration signal
3. No significant mortality events after juveniles enter the ocean (like the 2005 "Black Swan")
4. Fishing efficiency among survey vessels is reasonably taken into account each year

Ecosystem metrics considered over the SECM time series for forecasting the 2013 pink salmon harvest in Southeast Alaska

"Top" (1st Quartile) | "Upper Middle" (2rd Quartile) | "Lower Middle" (3rd Quartile) | "Bottom" (4th Quartile)

Brood year (BY) +2				BY +1
Adult pink salmon return year	SE pink harvest (response variable)	Ocean entry year	Juvenile peak pink CPUE June or July	Upper 1-20 m avg. Icy Strait temp. "ISTI" May-Aug
Data	--->	$SECM_{year}$	NOAA	NOAA
1998	42.5	1997	2.5	9.5
1999	77.8	1998	5.6	9.6
2000	20.2	1999	1.6	9.0
2001	67.0	2000	3.7	9.0
2002	45.3	2001	2.9	9.4
2003	52.5	2002	2.8	8.6
2004	45.3	2003	3.1	9.8
2005	59.1	2004	3.9	9.7
2006	11.6	2005	2.0	10.3
2007	44.8	2006	2.6	8.9
2008	15.9	2007	1.2	9.3
2009	38.0	2008	2.5	8.3
2010	23.4	2009	2.1	9.6
2011	58.5	2010	3.7	9.6
2012	20.7	2011	1.4	8.9
Pearson correlation "*r*"			0.93	-0.06
P-value (*= significant @ <0.05)			0.00*	0.84
2013	53.8 ?	2012	3.2	8.7

Data sources: NOAA (SECM/Auke Creek-J. Joyce), Climate & Global Dynamics (J. Hurrell, http://www.cgd.ucar.edu/cas/jhurrell/indices.data.html), & ADFG (A. Piston)

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2002	45.3	2001	2.9	July	16.8	19%	9.4
2003	52.5	2002	2.8	July	15.6	14%	8.6
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2009	38.0	2008	2.5	Aug	16.1	14%	8.3
2010	23.4	2009	2.1	Aug	15.1	22%	9.6
2011	58.5	2010	3.7	June	17.6	66%	9.6
2012	20.7	2011	1.4	Aug	15.7	21%	8.9
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2006	11.6	2005	2.0	Aug	15.5	19%	15.7	87.9	10.3
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2008	15.9	2007	1.2	Aug	15.7	9%	10.2	81.9	9.3
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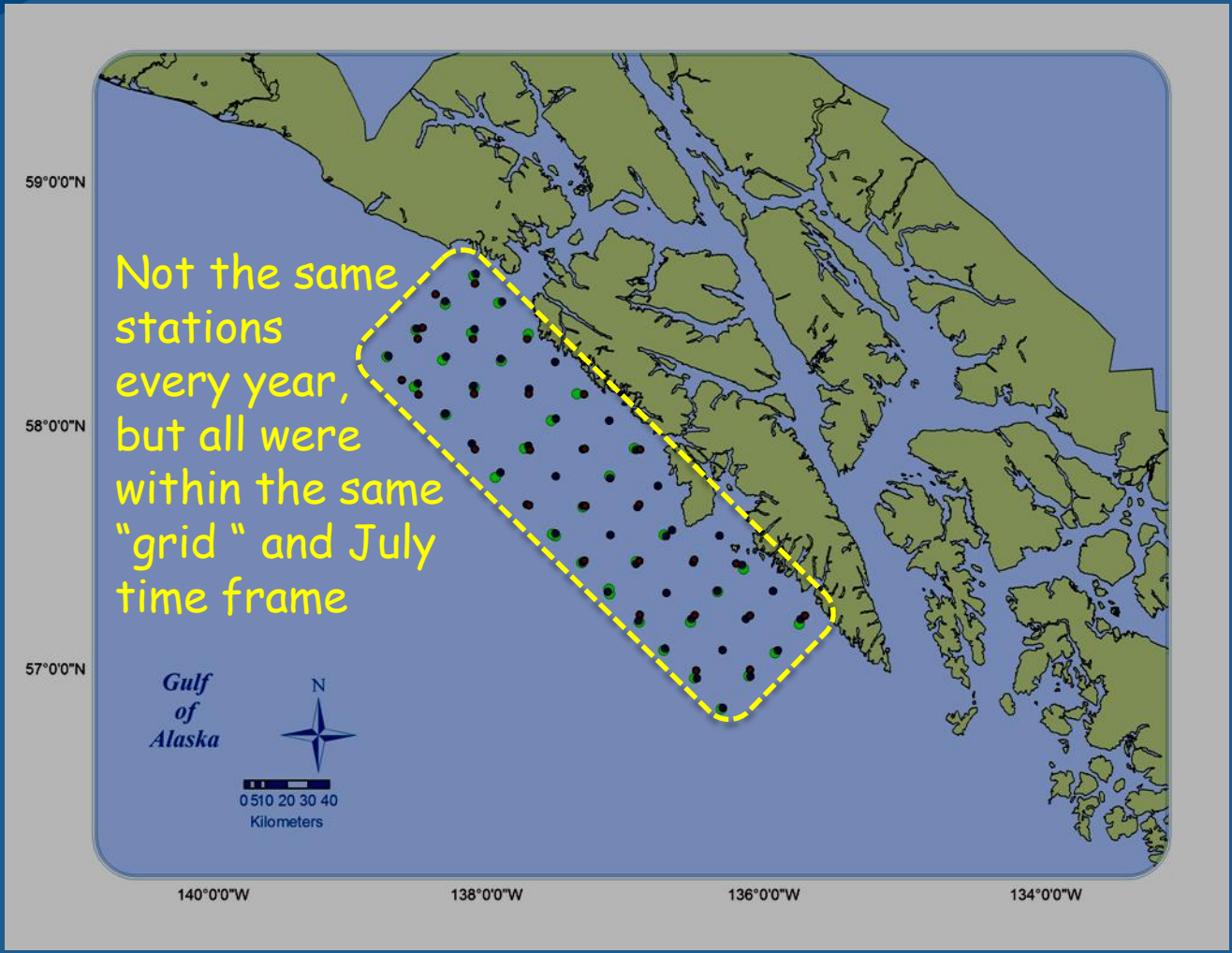
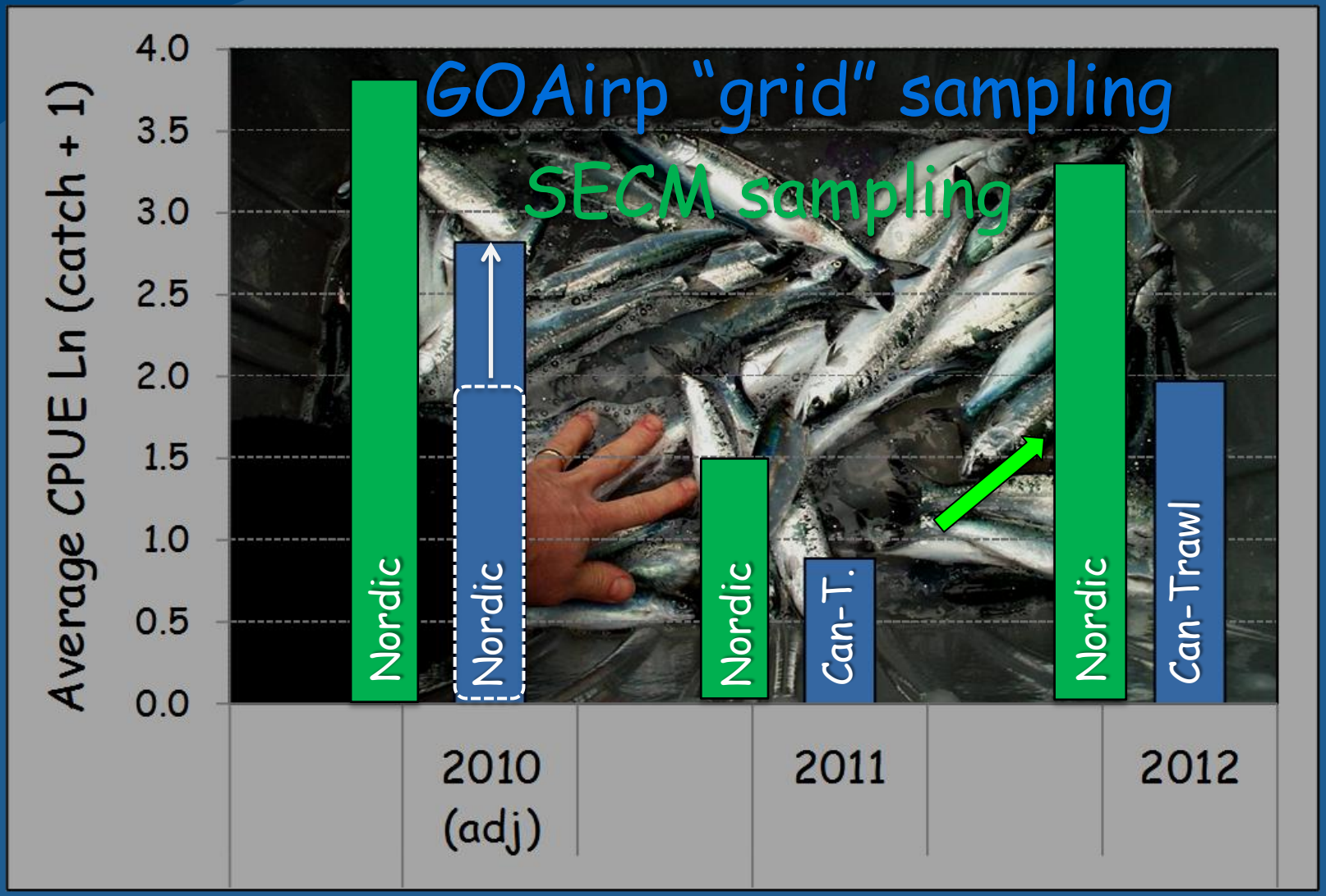
Gulf of AK Integrated Ecosystem Research Project (GOAirp) coastal trawl sampling off SEAK: Subset of "grid stations" July, 2010, 11, & 12



GOAirp coastal sampling grid off SEAK in July



What about SEAK regional harvest patterns?

2012 harvest (13% North) vs. 2011 harvest (81% North)

Will juvenile $pink_{CPUE}$ in Icy Strait continue to track the total regional harvest?

Will adult pinks return strong in the south and blow the forecast out of the water in 2013 ?

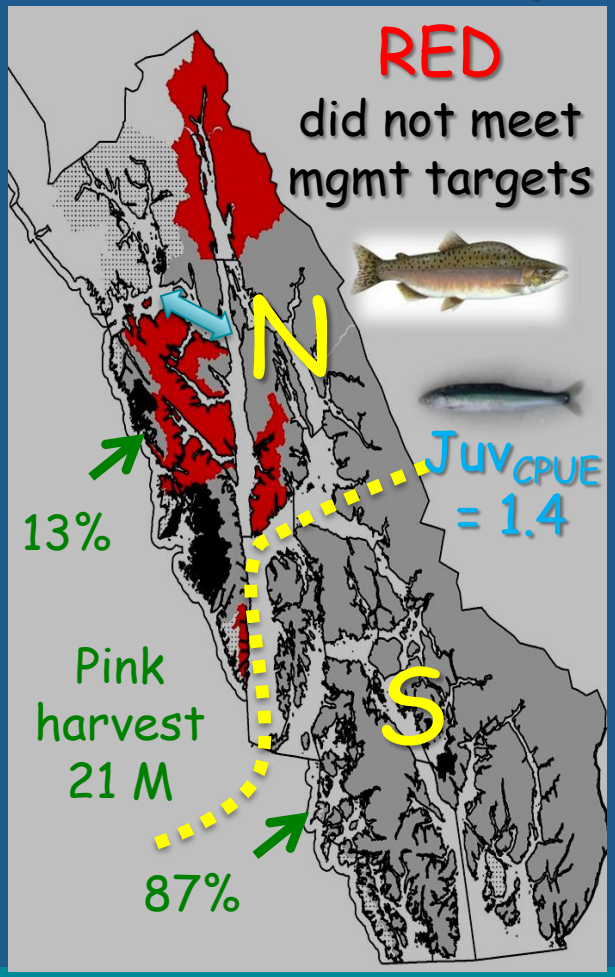
Adult pink escapement data 2009-11, courtesy Andy Piston

2010 brood yr

2011 ocean yr

2012 harvest yr

GRAY
met mgmt target



BLACK
exceeded mgmt targets

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2009 brood yr
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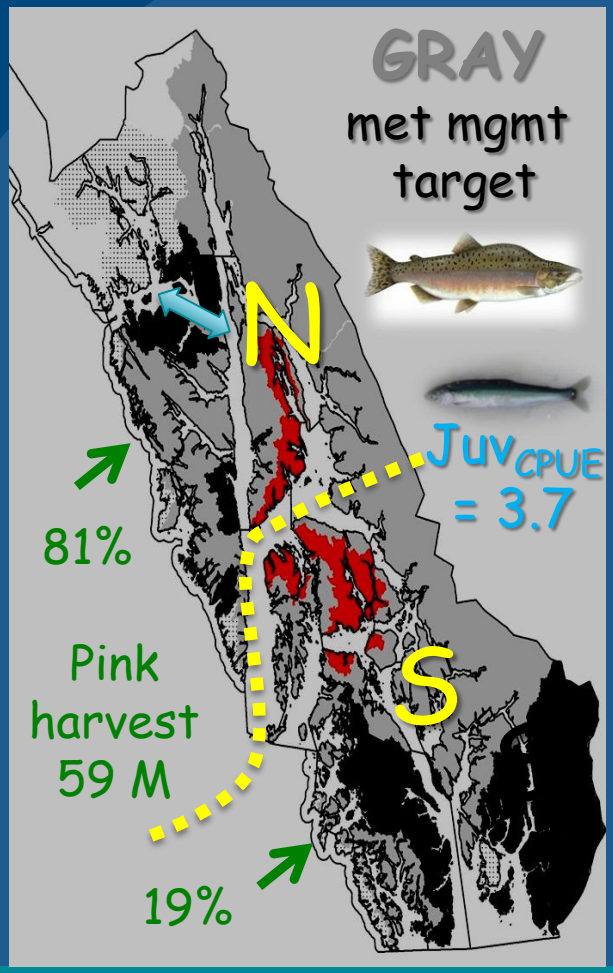

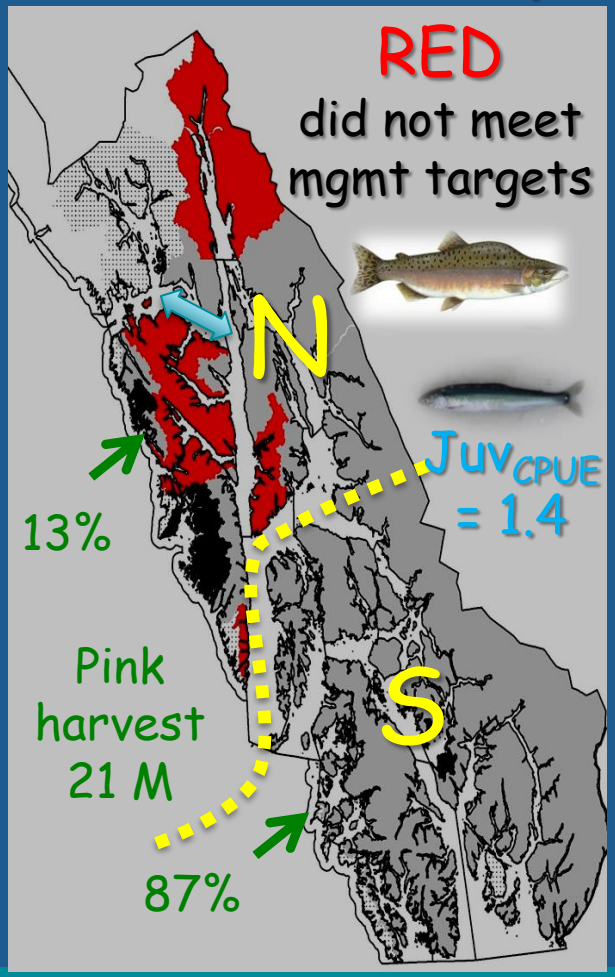

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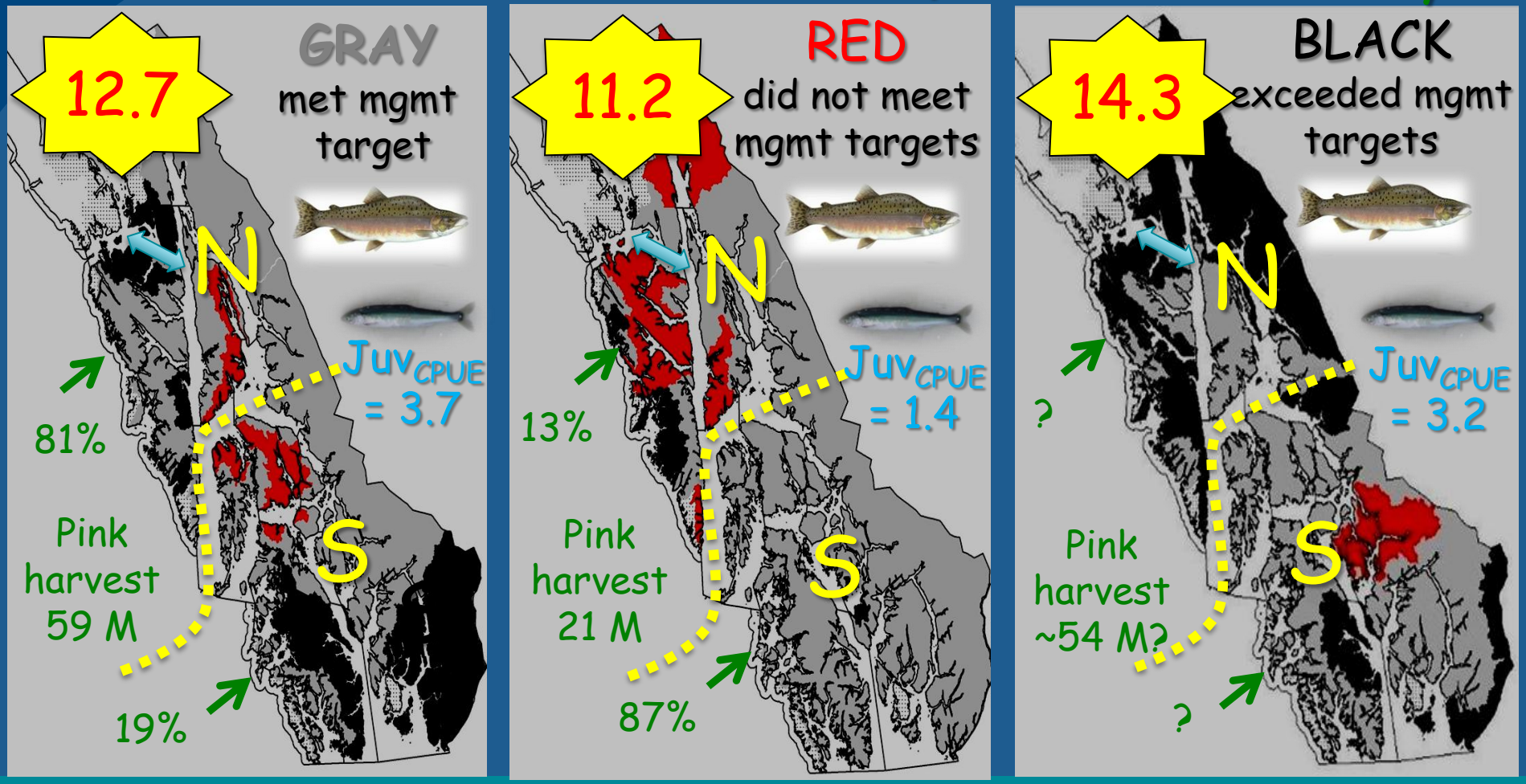
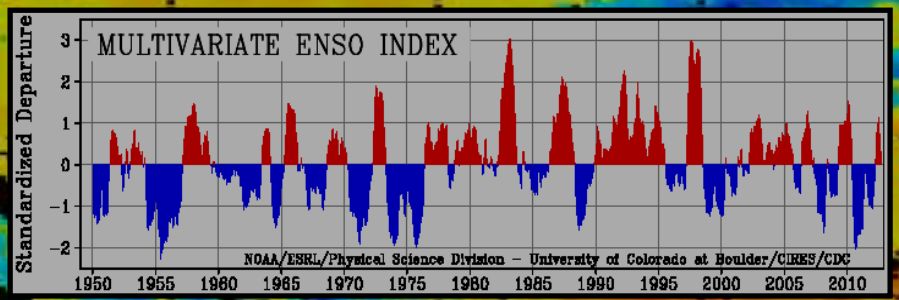
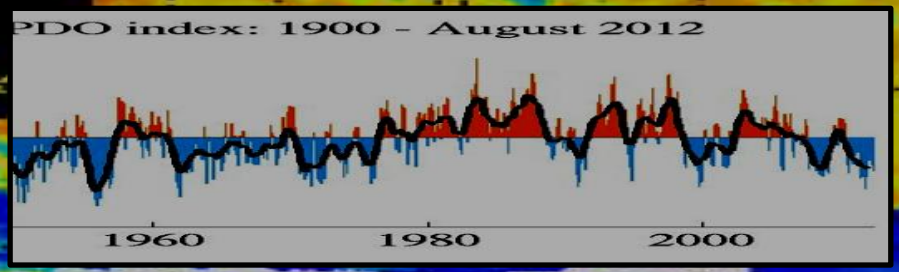
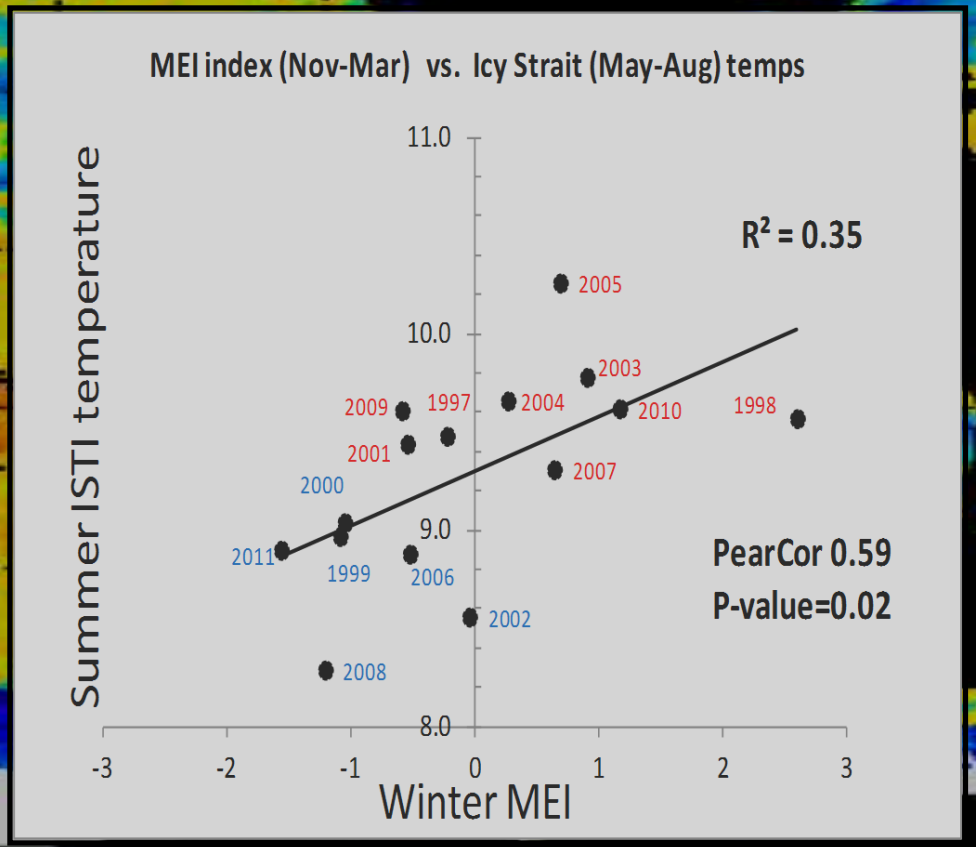
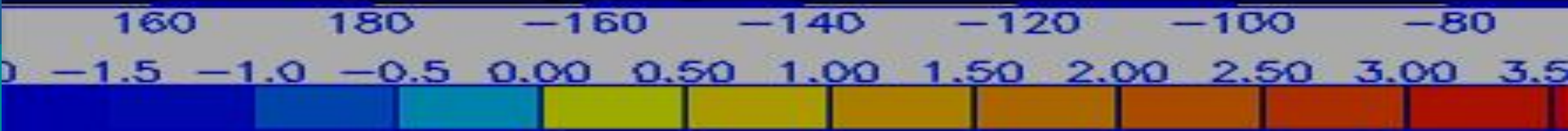


Sea Surface Temperature Anomolies - 03 Dec. 2012







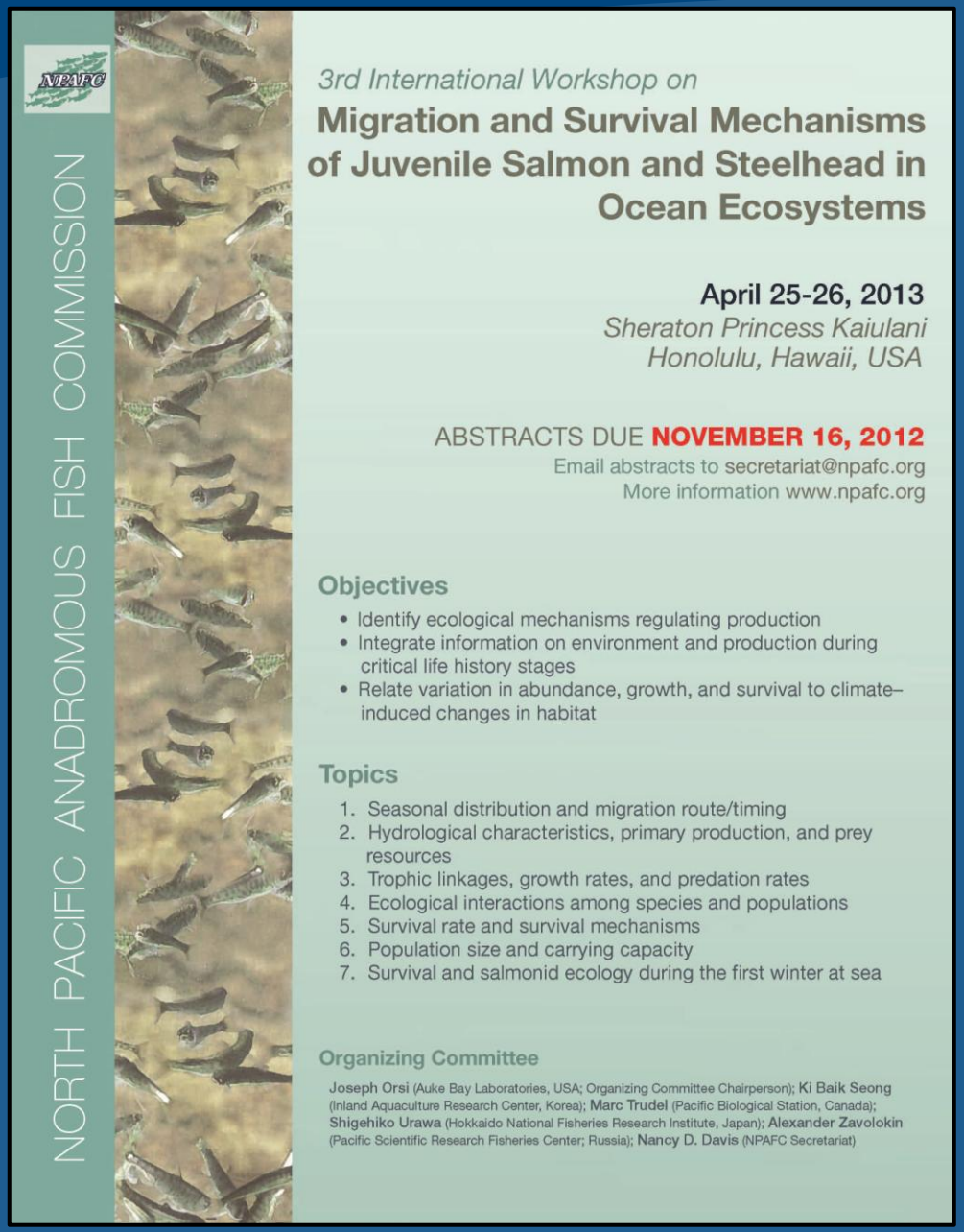


Next research meeting…

3rd International Workshop on Migration and Survival Mechanisms of Juvenile Salmon and Steelhead in Ocean Ecosystems

Sponsored by the North Pacific Anadromous Fisheries Commission

25-26 April 2013
Honolulu, HI



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