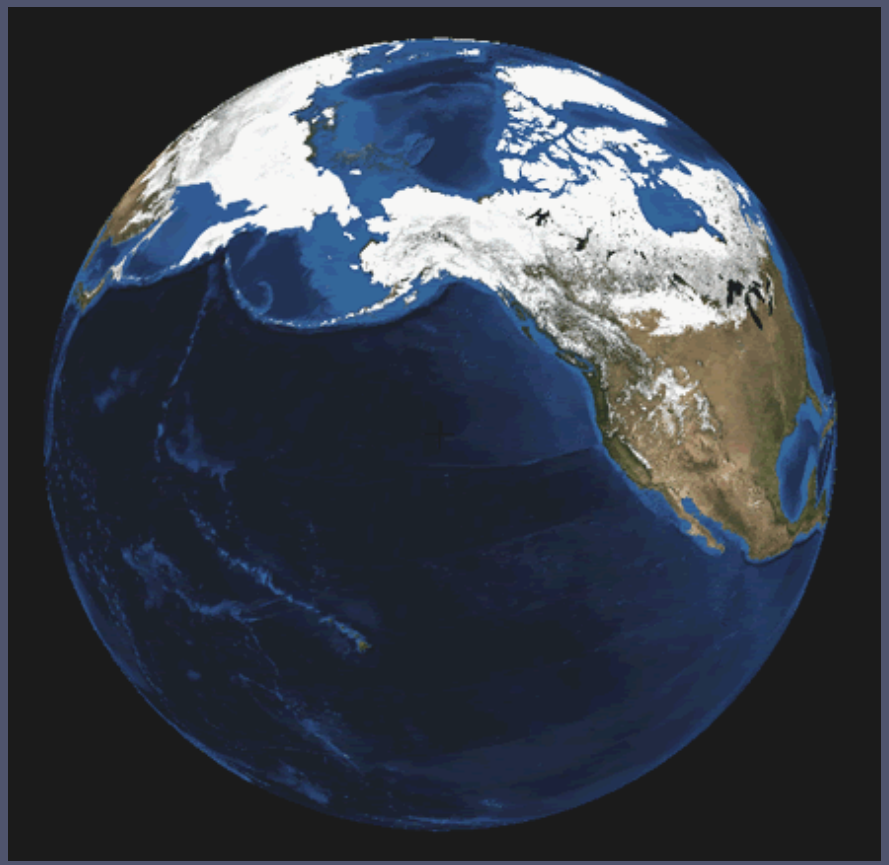
ECOSYSTEM CONSIDERATIONS

For the Gulf of Alaska



Stephani Zador

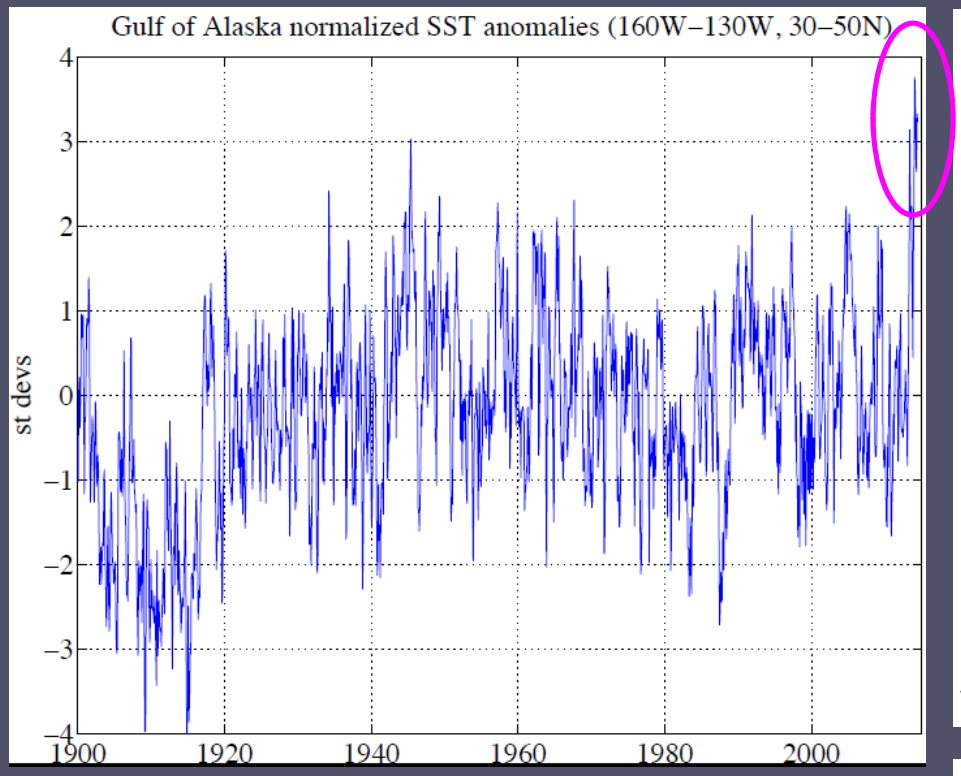
GOA Groundfish Plan Team meeting

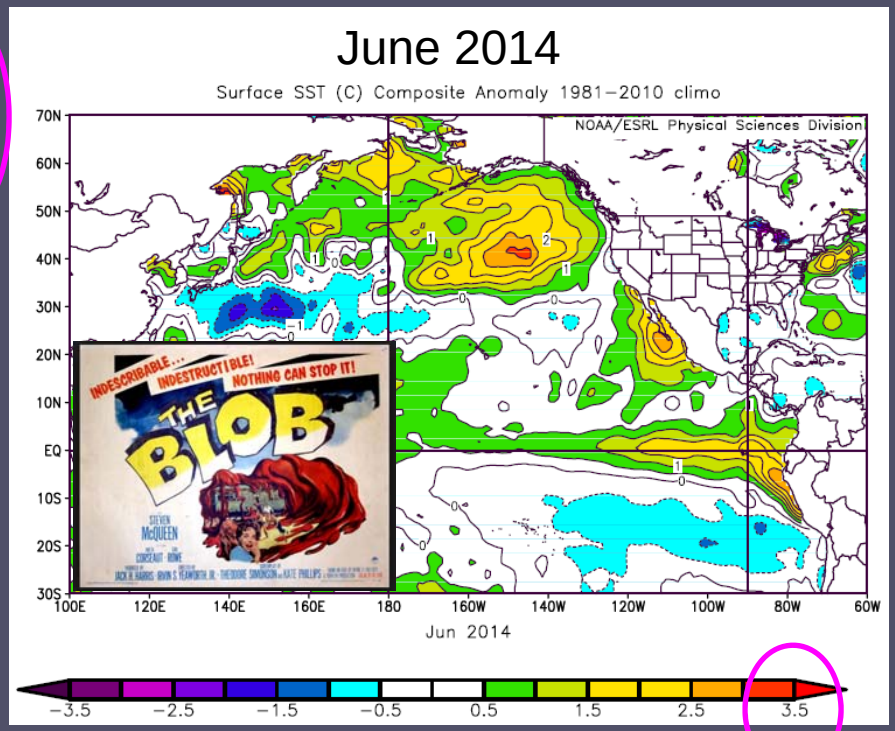
Sept 24, 2015

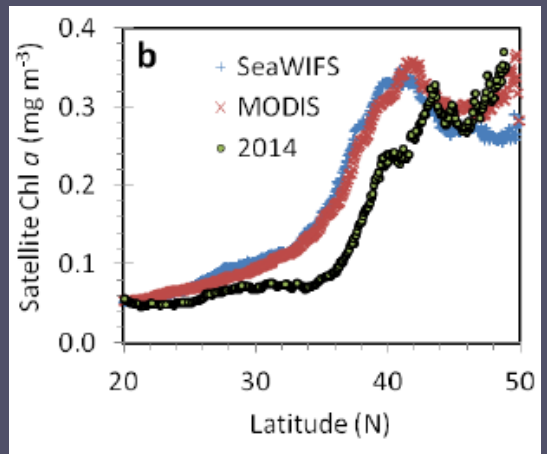
OUTLINE

1. New 2014 (mostly) ecosystem indicator updates
2. Physical conditions
3. Full 2015 updates, assessment, new report card in November

Back to 2014







Ecosystem impacts?

- TZCF 240 km north
- Sunfish, skipjack tuna, Humboldt squid

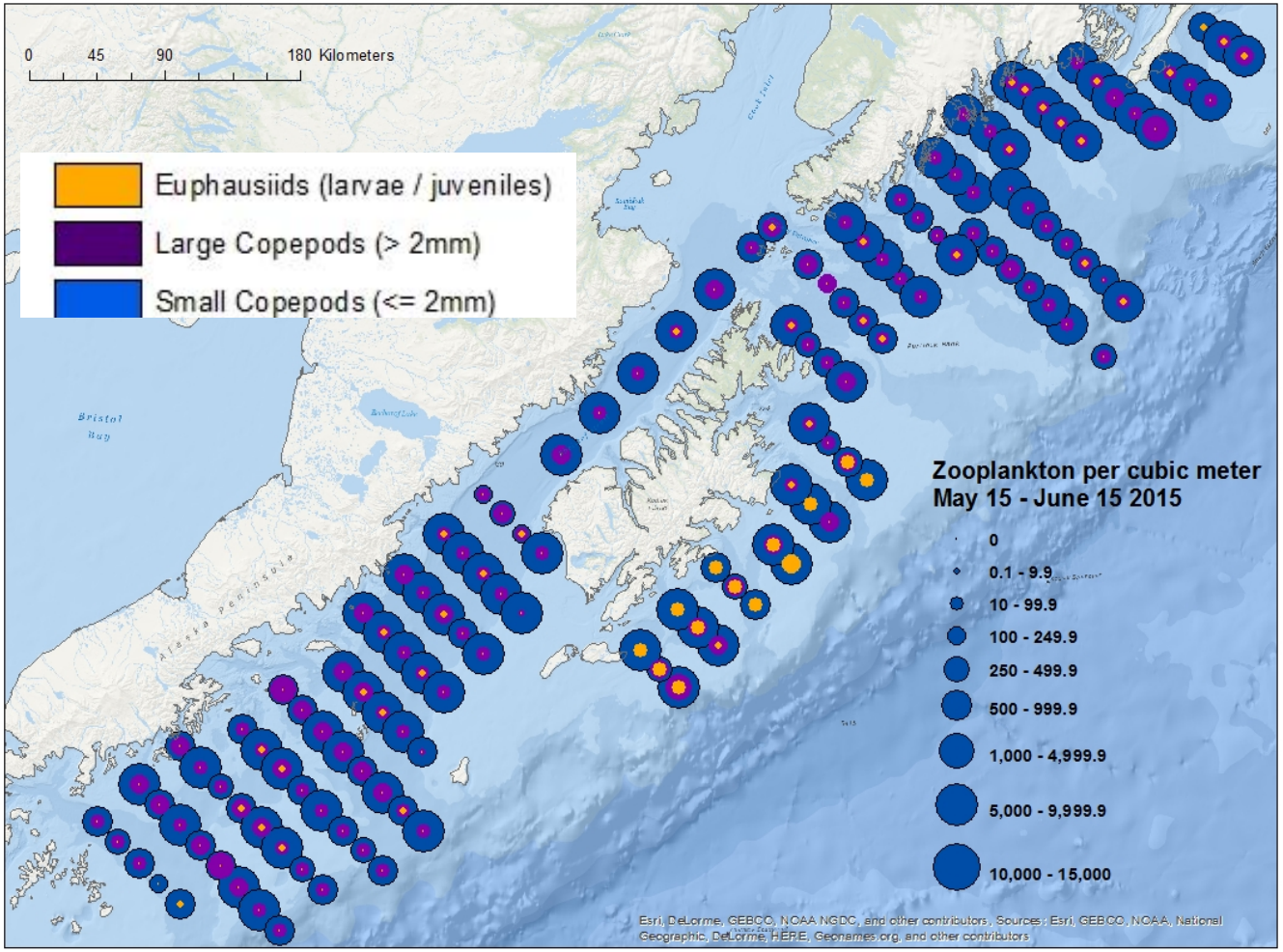
NEW 2014

ECOSYSTEM STATUS INDICATORS

Zooplankton, ichthyoplankton, salmon, groundfish, disease

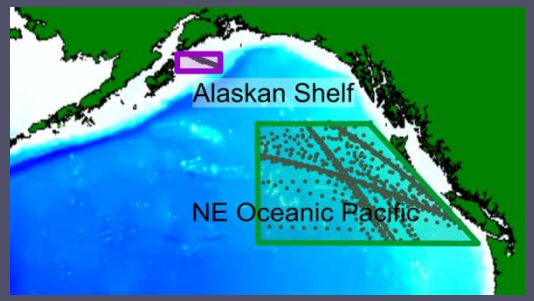
NEW Spring EBS Zooplankton Rapid Assessment

(Ferm, ecoFOCI)



- Rough count, preliminary estimate
- Small copepods most common (warm conditions)
- Euphausiids highest SE of Kodiak
- Temps cooler SW of Kodiak, higher large zoop abundances

Continuous Plankton Recorder Data from the NE Pacific (Batten)

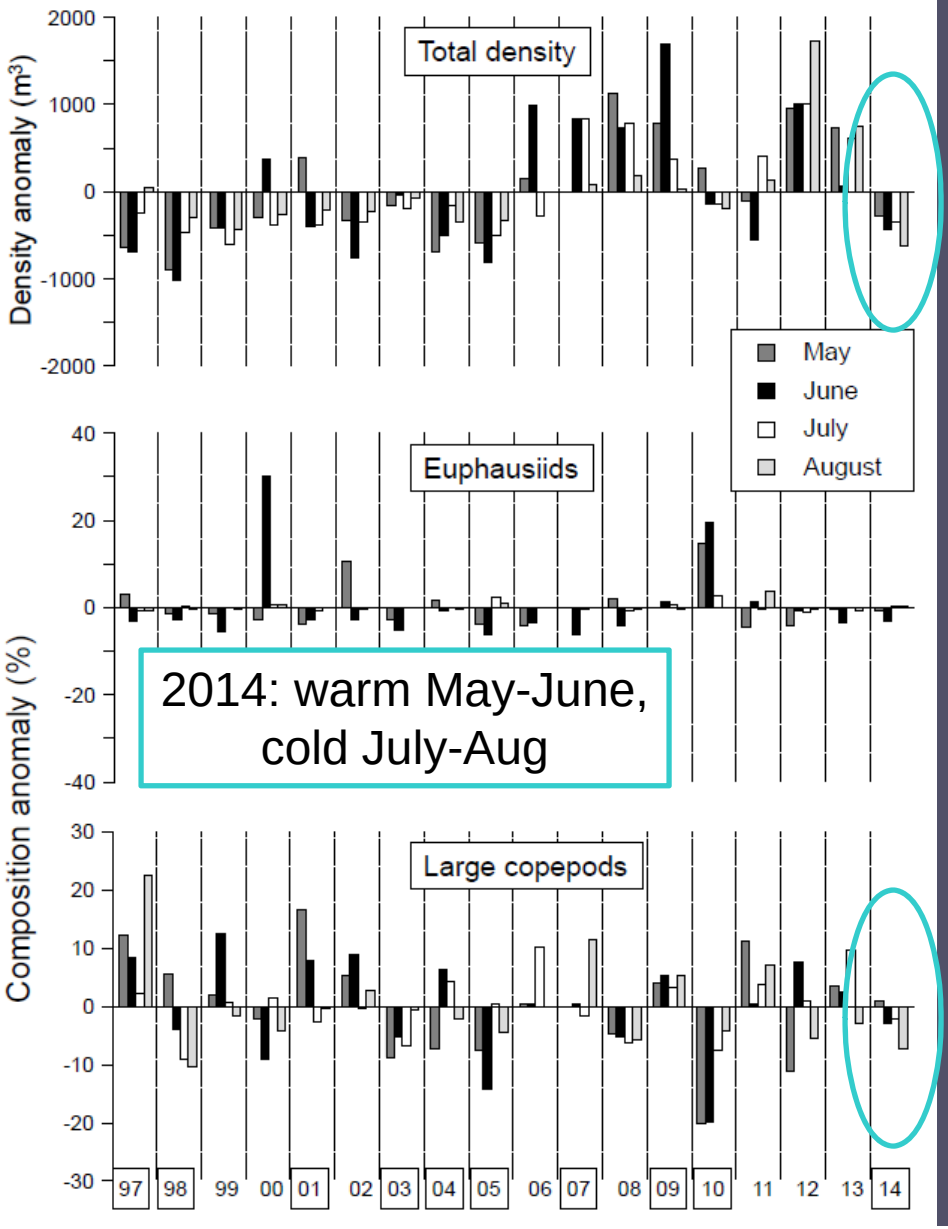


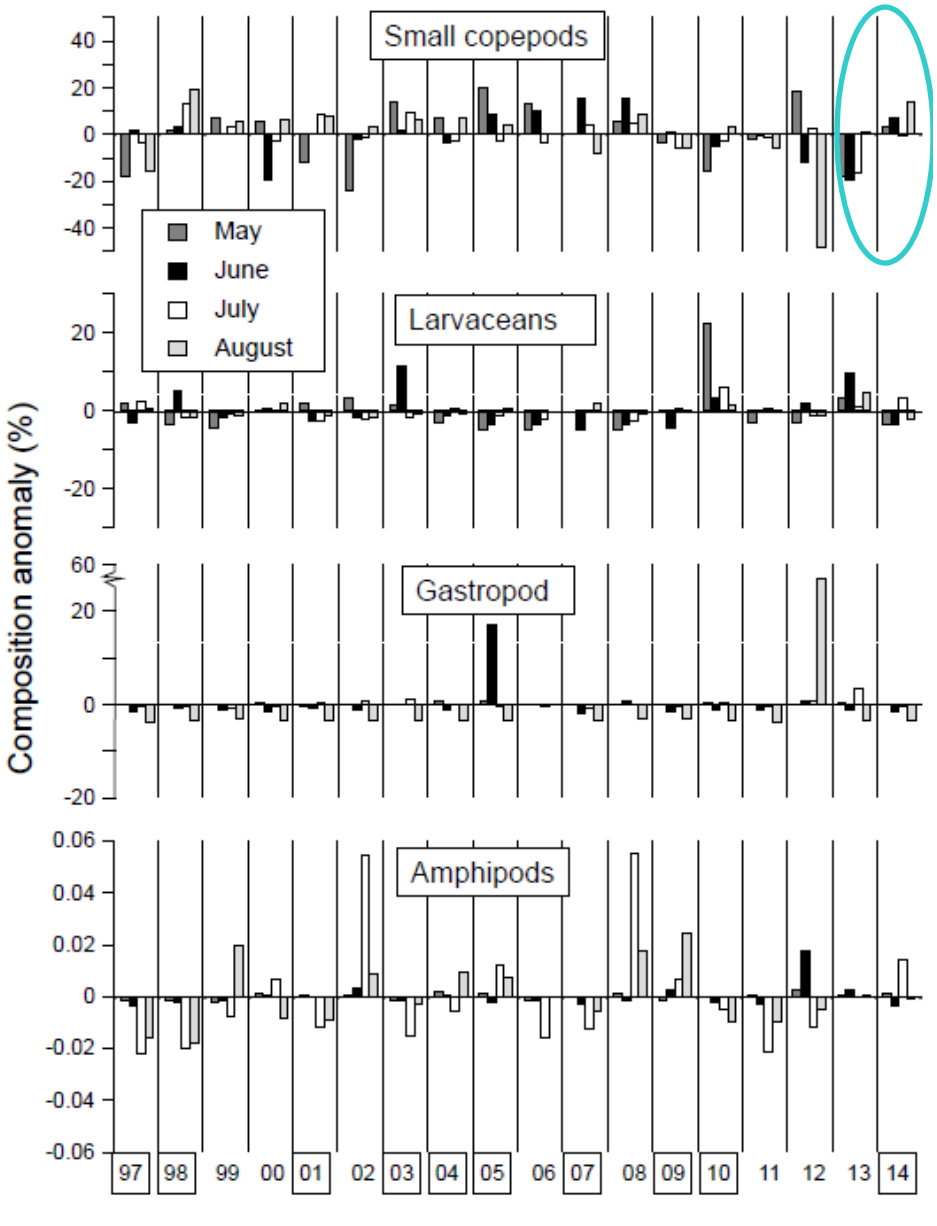
2014:

- More smaller copepods
- High late spring values of mesozoops
- Warm anomaly offshore reduced nutrient export -> low diatom

Zooplankton in Icy Strait

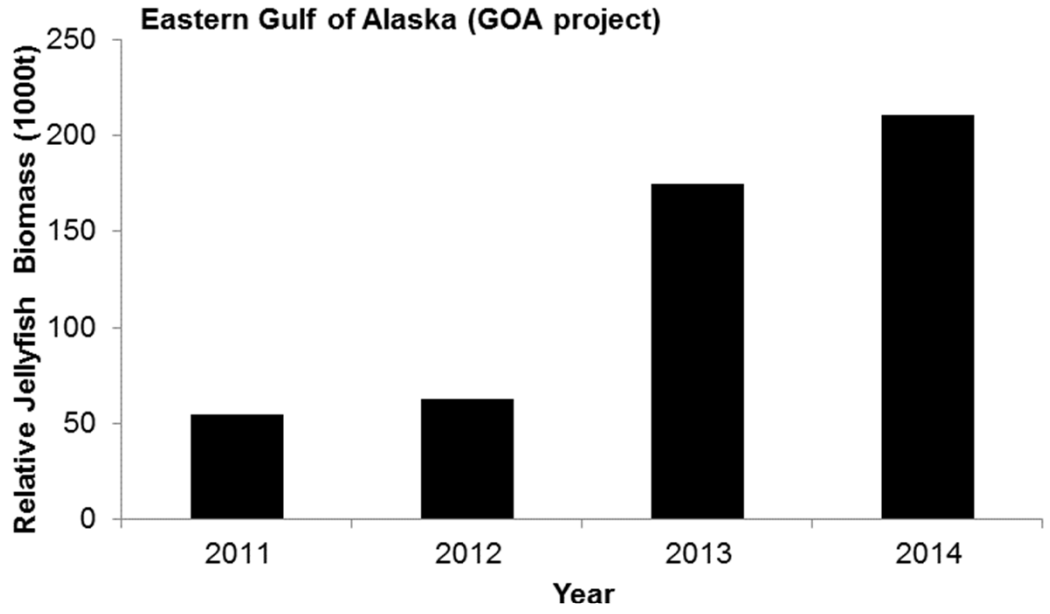
(Fergusson et al)

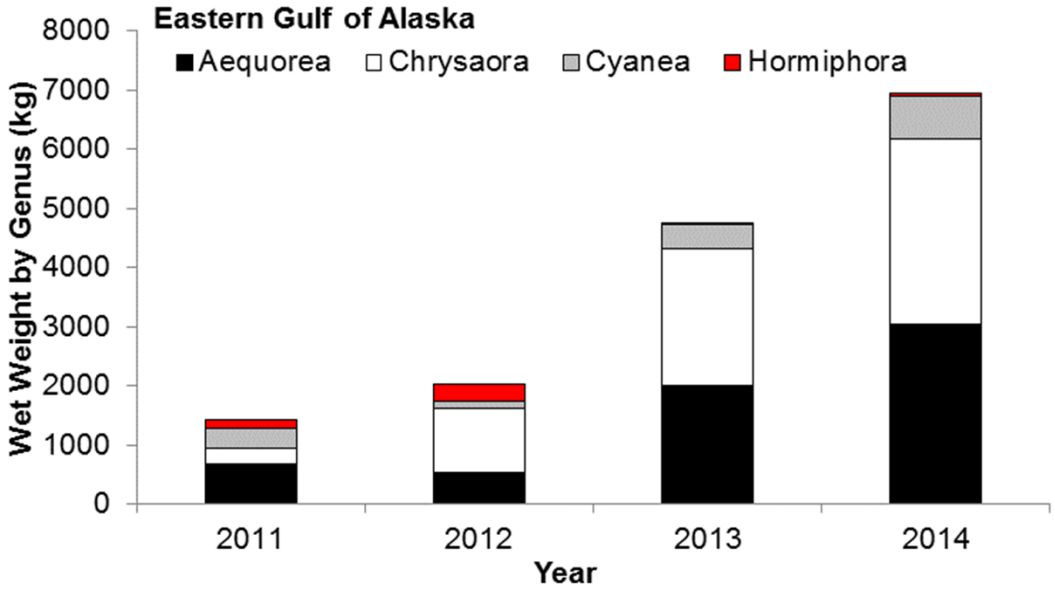




Trends in jellyfish and gelatinous zooplankton bycatch from the GOA Project survey

(Cieciel and Gann)

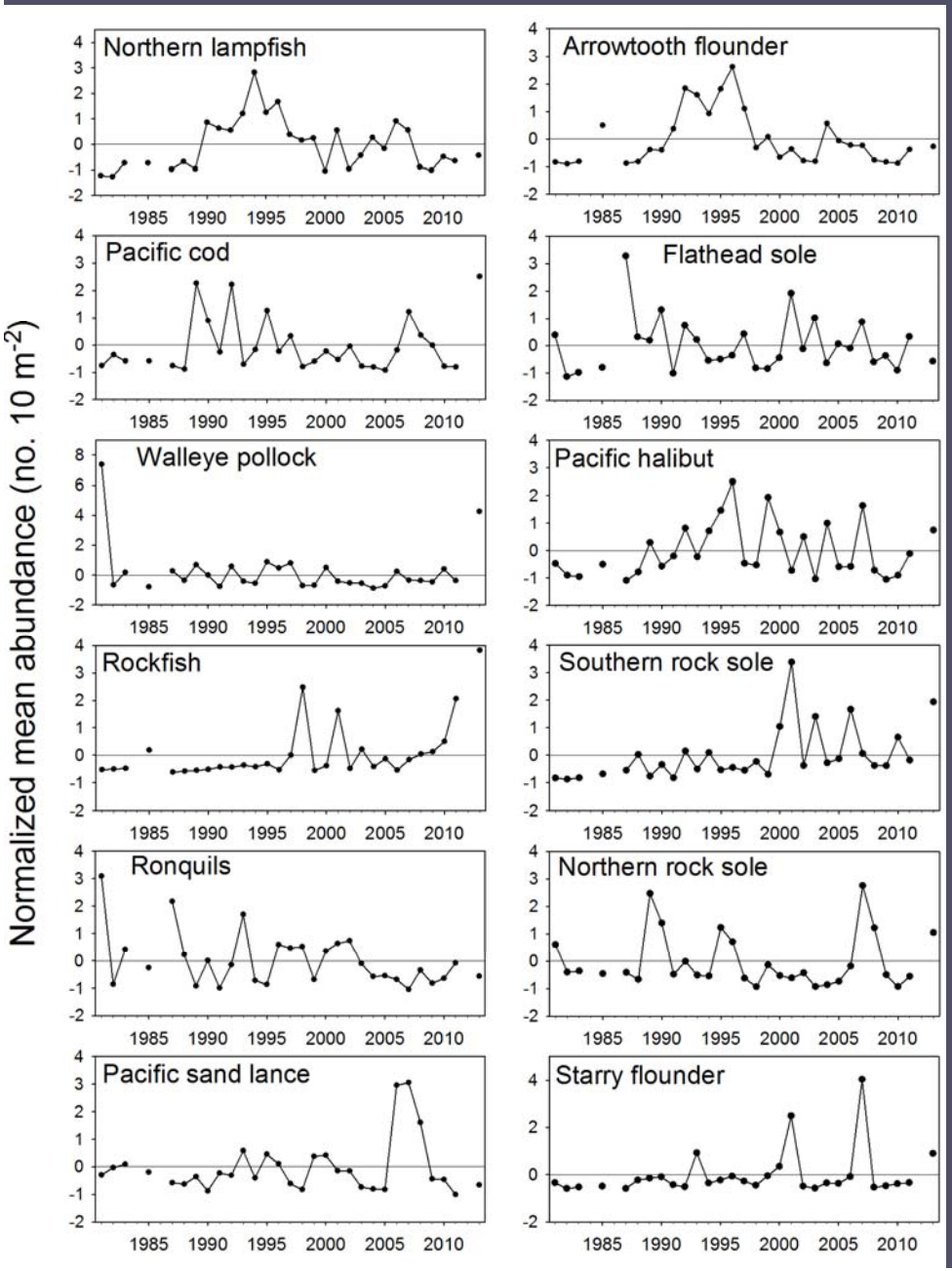




- 2014 had largest biomass
- Higher diversity than the EBS
- Large blooms can have predatory impact on juvenile and forage fishes

Gulf of Alaska ichthyoplankton abundance indices 1981-2013

(Matarese, Mier, Doyle)



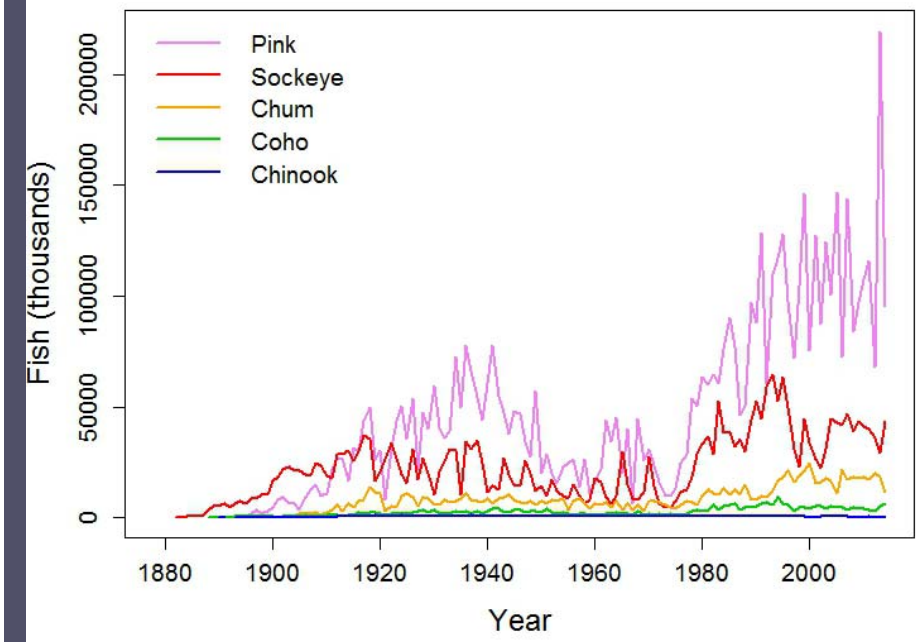
2013:

- High abundance of Pacific cod larvae
- Pollock larvae second highest in time series after 1981
- Rockfish larvae record abundance
- Flatfishes moderately high and low
- Increases may be due to increased retention (eddies), improved growth with moderate temps, favorable feeding conditions (in prep)

Historical and current salmon trends

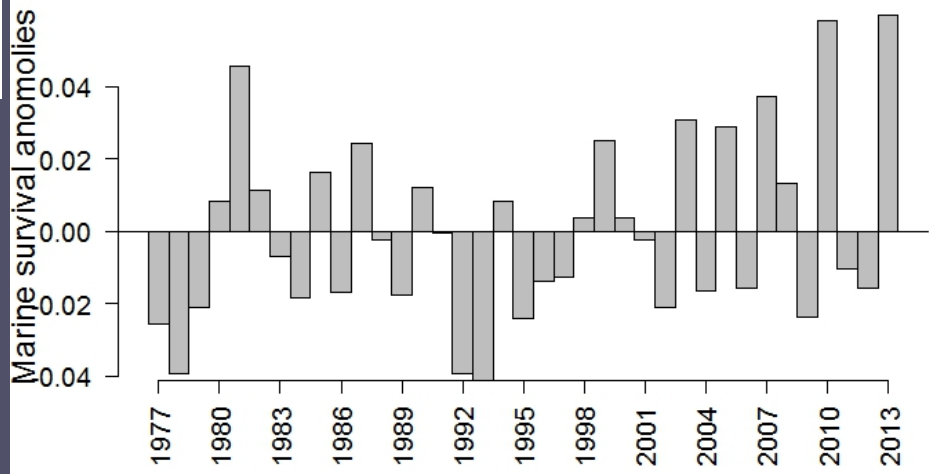
(Whitehouse)

Alaska commercial catch



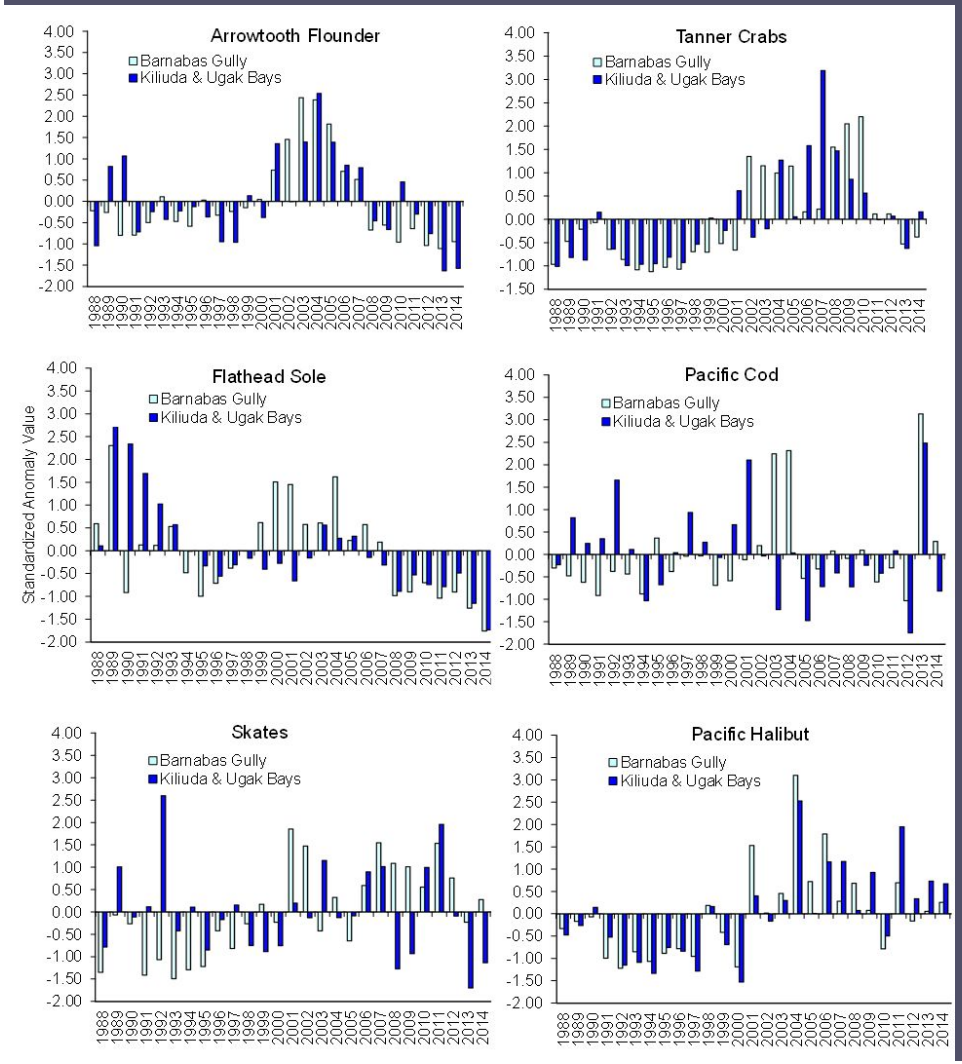
- Pink salmon were 75% of harvest
- 2014 harvest 44% of record 2013
- Marine survival 2013 (2011) record 11.33%

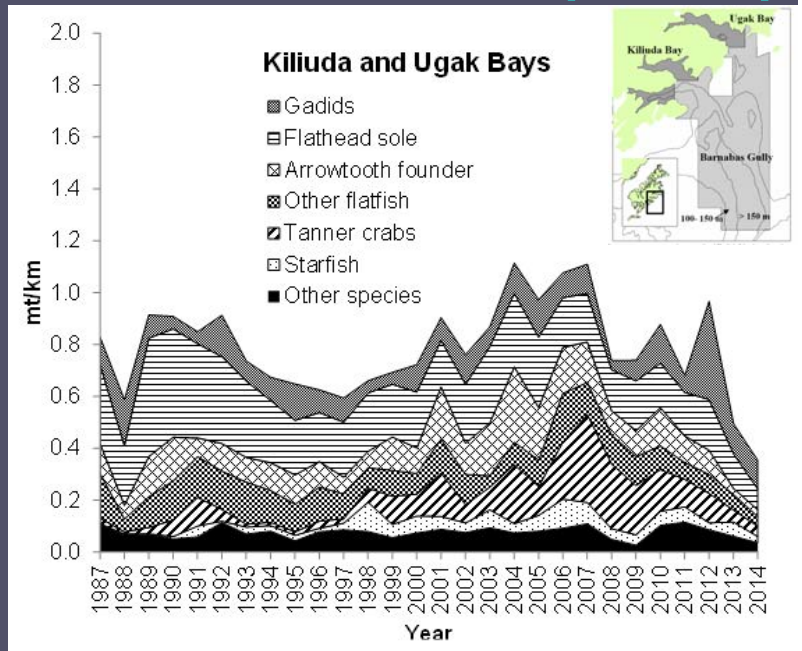
Marine survival PWS hatchery pinks

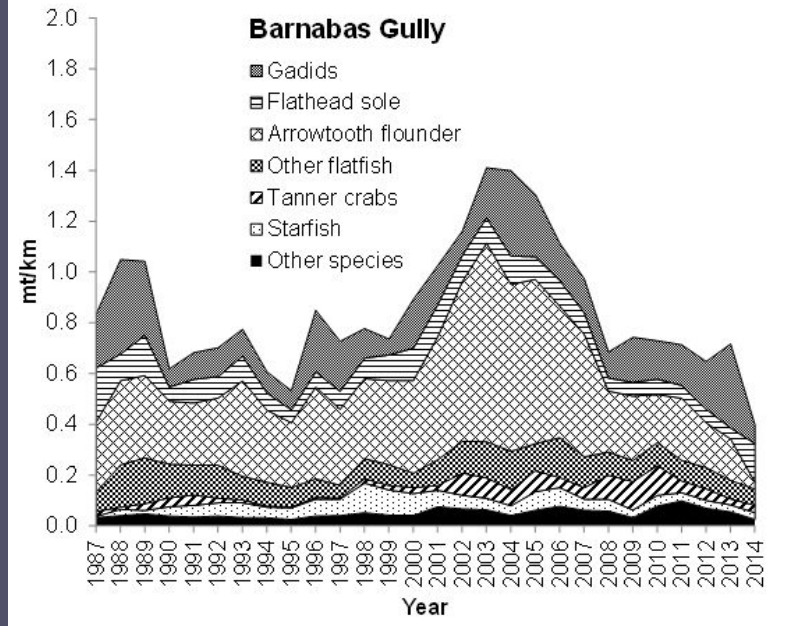


ADF&G Gulf of Alaska Trawl Survey (Worton)

- Decrease in overall biomass since 2007; flatfish continue to dominate catch
- In 2014, halibut increased; flathead sole/ATF below; lower cod inshore.





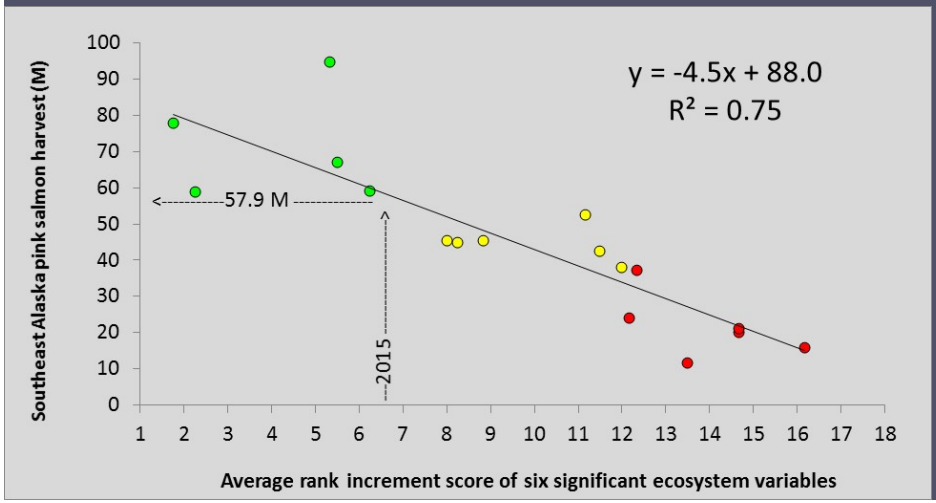


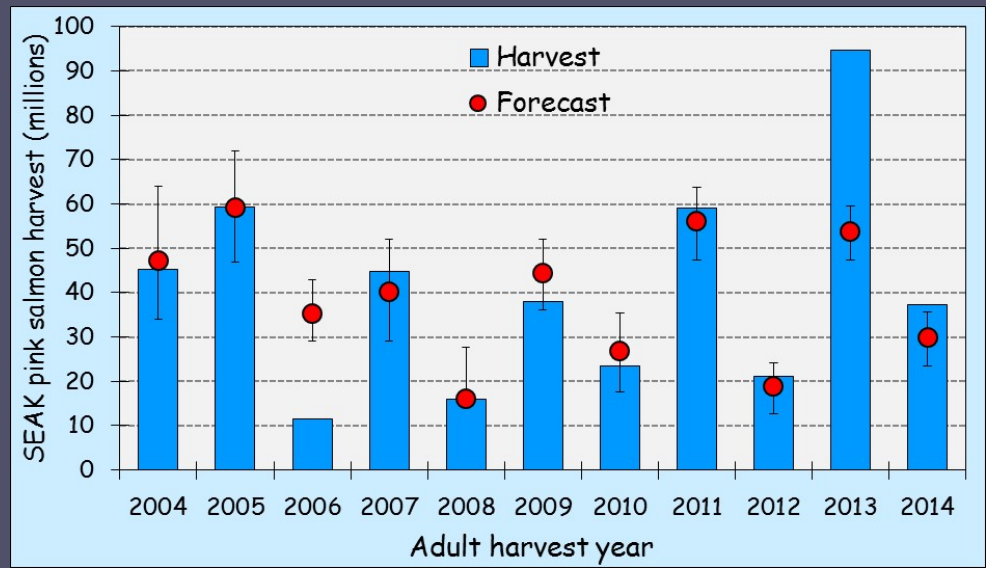
Forecasting Pink Salmon in Southeast Alaska
(Orsi et al)

Pink salmon parent brood year				Chronological ecosystem variables											Pink salmon harvest	
Brood year (BY)	SEAK pink harvest (M)	Pink regional proportionality (% Northern harvest: Green= 40-60%, Yellow= >20-<40%, or >60-<80%, Red = ≤ <20%,>80%)	SEAK pink escapement index	Ocean entry year (BY lagged 1 yr later)	Auke Creek fry outmigration (1,000s) Lat 58°N	Upper 1-20 m avg. Icy Strait temp. °IST° May-Aug	Juvenile peak pink (CAL) CPUE June or July	Juvenile peak pink (TTD) CPUE June or July	Peak seaward migration month	Proportion of pink in trawl hauls in June-July-Aug	Adult coho predation impact Coho total #s/J-pink CPUE	North Pacific Index (June, July, Aug)	Ranking of the average annual scores of the six significant variables		SEAK pink harvest (M) (BY lagged 2 yrs later)	SEAK pink harvest (M) (response variable)
Data source	*ADFG*$_1$	*ADFG*	*ADFG*$_2$		*NOAA*$_1$	*NOAA*$_2$	*NOAA*$_2$	*NOAA*$_2$	*NOAA*$_2$	*NOAA*$_2$	*NOAA*$_2$ *ADFG*$_3$	*CGD*	↓			*ADFG*$_1$
1996	64.6	17%	18.1	1997	31.1	9.5	2.5	2.2	July	18%	1.5	15.6	11		1998	42.4
1997	28.9	47%	14.8	1998	60.8	9.7	5.6	5.3	June	46%	0.8	18.1	1		1999	77.8
1998	42.4	44%	14.3	1999	53.5	9.0	1.6	1.4	July	9%	3.9	15.8	16		2000	20.2
1999	77.8	50%	27.3	2000	132.1	9.0	3.7	3.3	July	28%	1.0	16.9	4		2001	67.0
2000	20.2	39%	10.8	2001	61.5	9.5	2.9	2.6	July	30%	2.0	16.8	8		2002	45.3
2001	67.0	22%	18.6	2002	150.1	8.6	2.8	2.5	July	26%	2.5	15.6	10		2003	52.5
2002	45.3	49%	16.6	2003	95.1	9.8	3.1	2.7	July	20%	1.8	16.1	9		2004	45.3
2003	52.5	44%	20.0	2004	169.6	9.7	3.9	3.4	June	32%	1.4	15.1	5		2005	59.1
2004	45.3	54%	15.7	2005	87.9	10.2	2.0	1.7	Aug	35%	3.3	15.5	15		2006	11.6
2005	59.1	51%	19.9	2006	65.9	8.9	2.6	2.3	June	23%	1.9	17.0	7		2007	44.8
2006	11.6	72%	10.2	2007	81.9	9.3	1.2	1.0	Aug	17%	3.7	15.7	18		2008	15.9
2007	44.8	29%	17.6	2008	117.6	8.2	2.5	2.2	Aug	24%	2.1	16.1	12		2009	38.0
2008	15.9	14%	9.5	2009	34.8	9.5	2.1	2.7	Aug	26%	1.7	15.1	13		2010	24.0
2009	38.0	31%	12.7	2010	121.6	9.6	3.7	5.0	June	60%	0.9	17.6	2		2011	58.9
2010	24.0	43%	11.2	2011	30.9	8.9	1.3	1.6	Aug	27%	4.1	15.7	17		2012	21.3
2011	58.9	81%	14.3	2012	61.8	8.7	3.2	4.3	July	49%	1.1	16.7	3		2013	94.7
2012	21.3	13%	11.0	2013	51.2	9.2	1.9	2.6	July	13%	2.8	16.0	14		2014	37.2
2013	94.7	44%	25.2	2014	47.4	9.4	3.4	4.6	July	57%	2.1	15.8	6		2015	??.?
Harvest correlations	0.46	0.24	0.39		0.29	-0.20	0.81	0.84	-0.65	0.61	-0.81	0.61	Pearson correlation "r"			
Probability value=	0.06	0.36	0.13		0.28	0.46	0.00*	0.00*	0.01*	0.01*	0.00*	0.01*	(*=significant@p<0.05)			

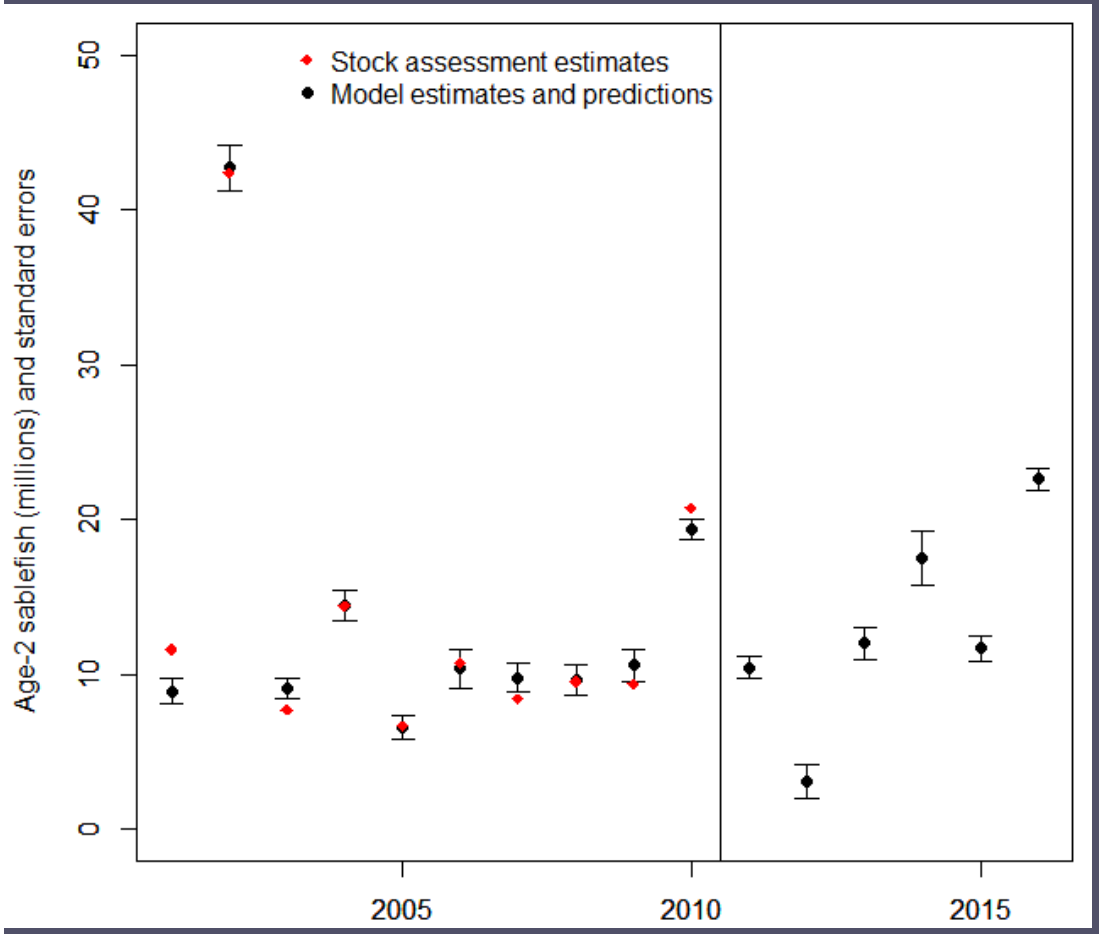
Data sources: ADFG (S. Heinl$_1$, A. Piston$_2$, and L. Shaul$_3$), CGD = Climate & Global Dynamics (J. Hurrell, http://www.cgd.ucar.edu/cas/jhurrell/indices.data.html), & NOAA Auke Bay Laboratories (J. Joyce$_1$ - Auke Creek research station & E. Fergusson/J. Orsi/E. Yasumiishi$_2$ - Southeast Coastal Monitoring project)

- Monthly oceanography/surface trawls May – Aug in Icy Strait
- 2015 forecast is 54.5 M (48-58) ** ADFG blue sheet 9/24 SE 34, PWS 98 M
- Green variables: juvenile CPUE, % pink in trawls





Southeast coastal monitoring survey indices and the recruitment of GOA sablefish **(Yasumiishi)**



Icy Strait

Data: temperature, chl a, pink salmon productivity

Provides: rearing habitat for sablefish

Higher recruitment appears to be a function of warmer SST and more chl a during age-0 stage and higher pink salmon productivity

Chl a R^2 = 0.88, temp and productivity explained 10%

Prediction: above-average age-2 recruitment in 2016.

New Disease Ecology section as suggested by the SSC

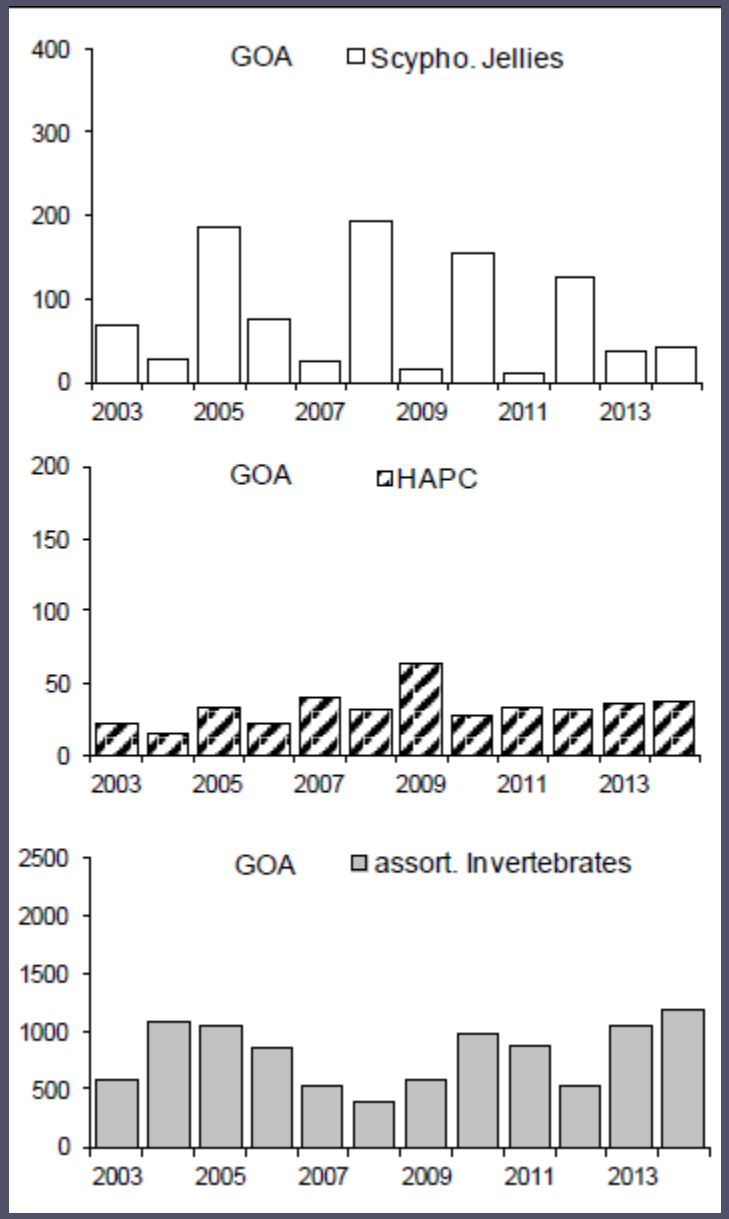
- Ichthyophonus parasite
- Mushy halibut

NEW 2014 EBFM INDICATORS

Non-targets, discards, habitat disturbance

Time Trends in Non-Target Catch

(Whitehouse)



Jellyfish: caught in pollock

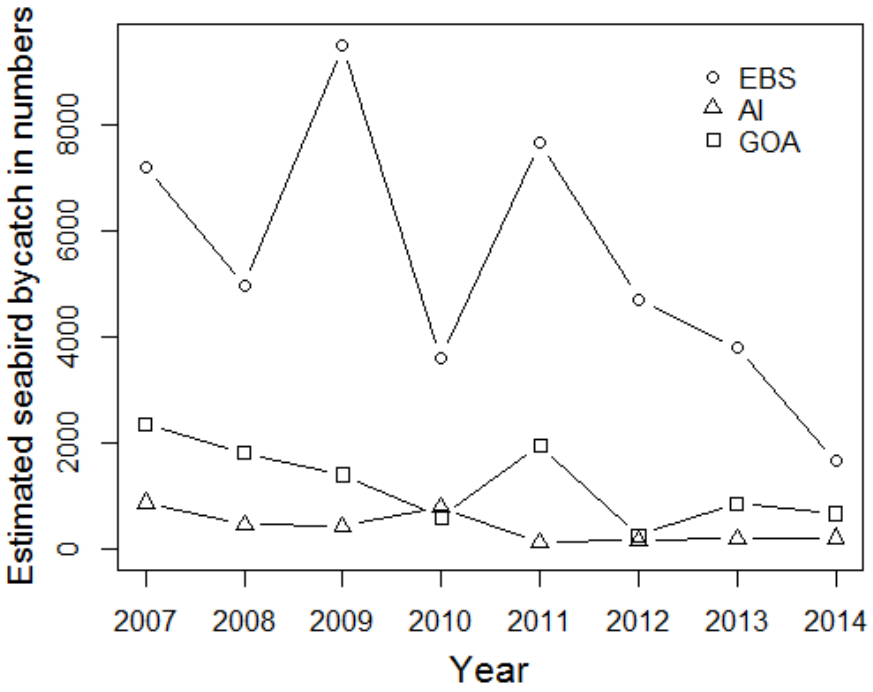
HAPC: anemones (flatfish and cod)

Other Inverts: sea stars (cod and flatfish)

Seabird bycatch, 2007-2014

(Zador, Fitzgerald, Mondragon)

Total estimated bycatch, all gear types



- 2014 moderately low number of birds bycaught in the GOA
- Increase in black-footed albatross
- Few fulmars

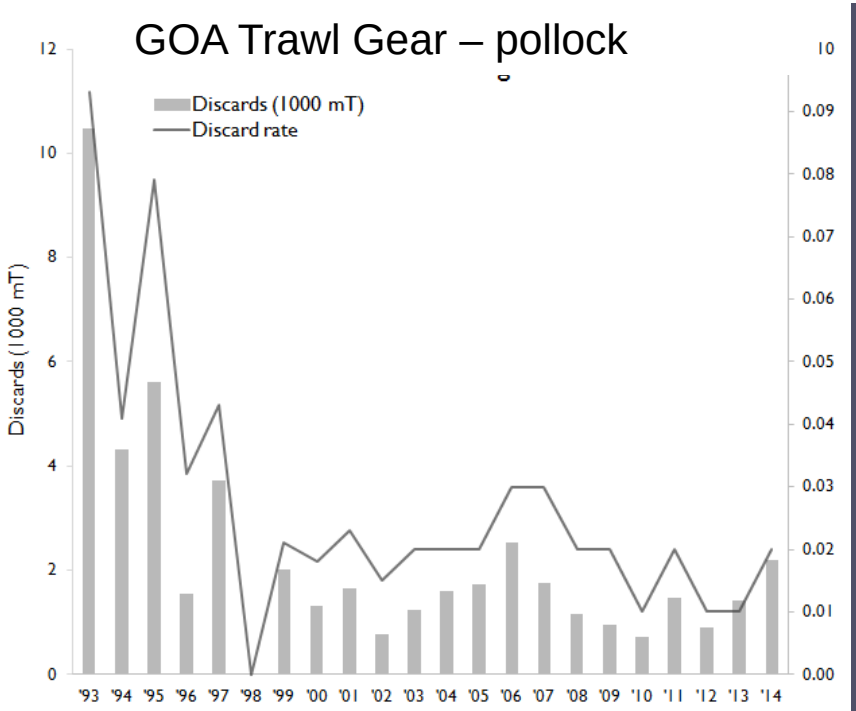
Estimated numbers of birds caught in GOA

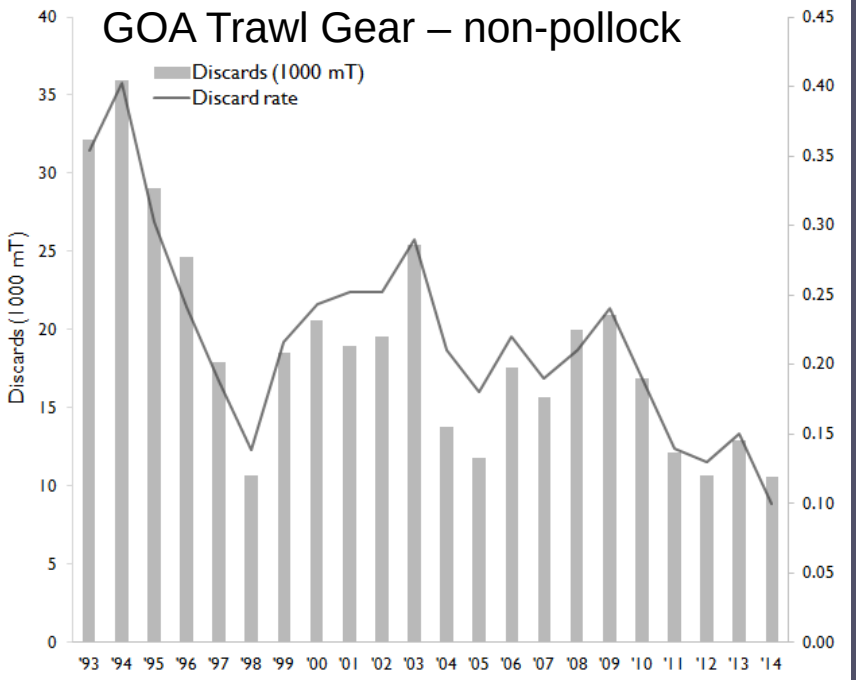
Species/Species Group	2007	2008	2009	2010	2011	2012	2013	2014
Unidentified Albatross	17	0	0	0	10	0	19	0
Black-footed Albatross	182	295	51	62	215	141	232	376
Laysan Albatross	0	168	101	85	164	17	75	32
Northern Fulmar	1466	893	678	175	873	19	337	43
Shearwaters	31	0	0	0	61	0	65	0
Gull	593	184	387	279	614	50	119	164
Auklets	0	0	0	0	0	0	0	5
Other	0	0	0	0	0	0	0	49
Unidentified	49	274	188	0	9	33	7	0
Grand Total	2339	1814	1406	601	1946	260	854	670

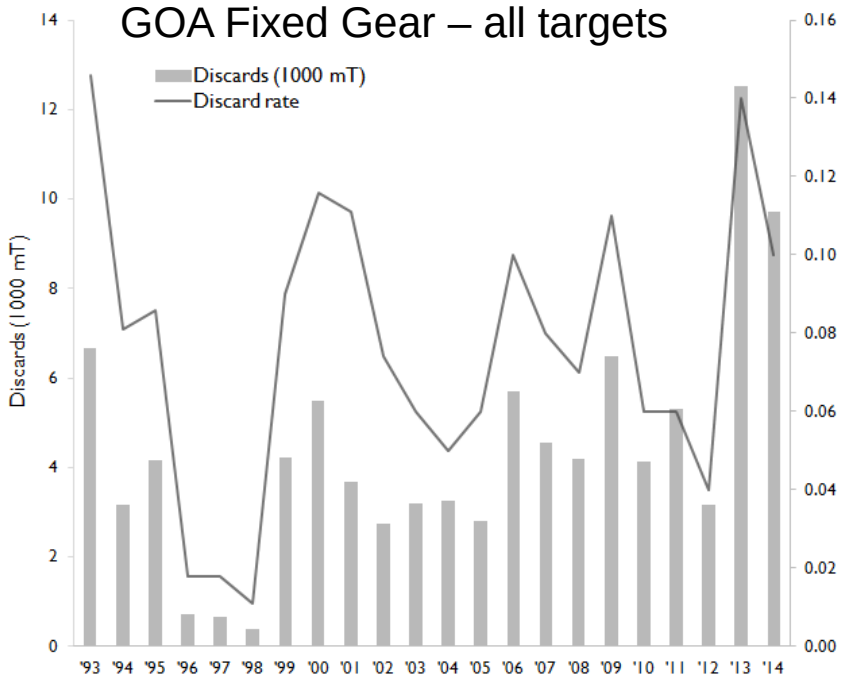
2014 Time Trends in Groundfish Discards

(Lee)

Beginning in 2013, includes estimates from fixed gear halibut, so 2013-2014 not comparable to earlier years

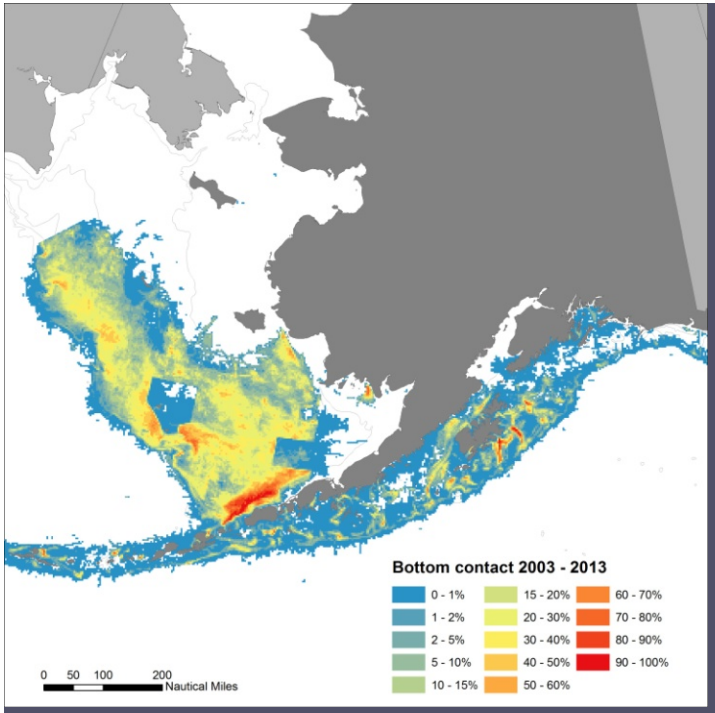


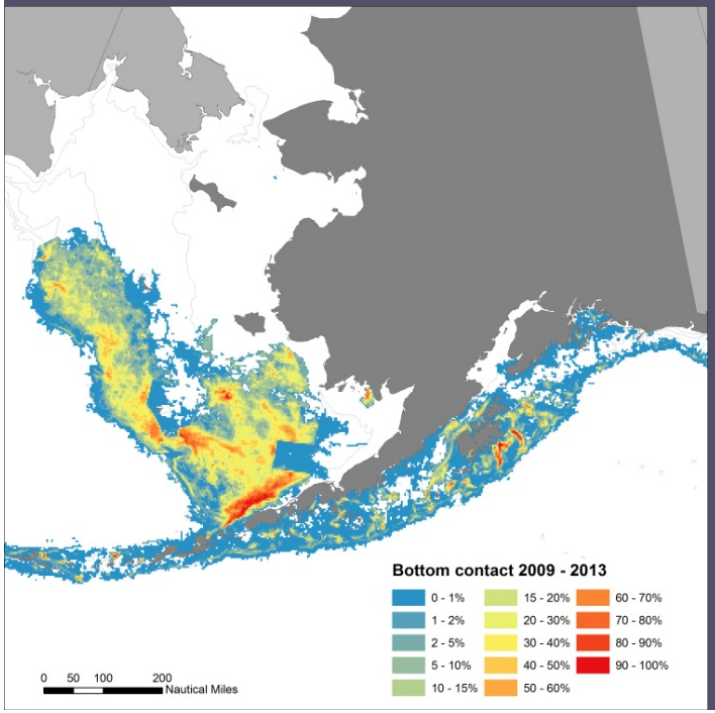


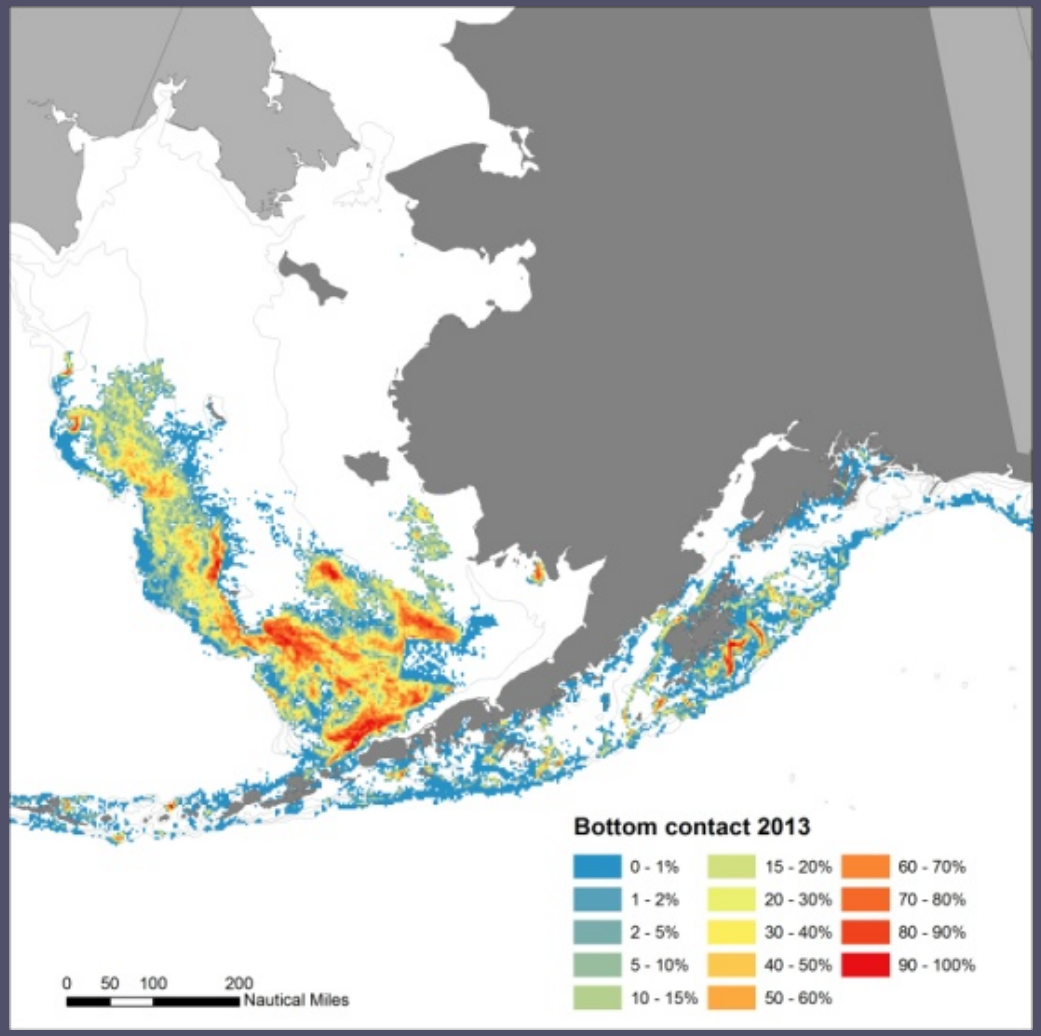


New habitat disturbance indicator in development

(Lewis, Olson et al)





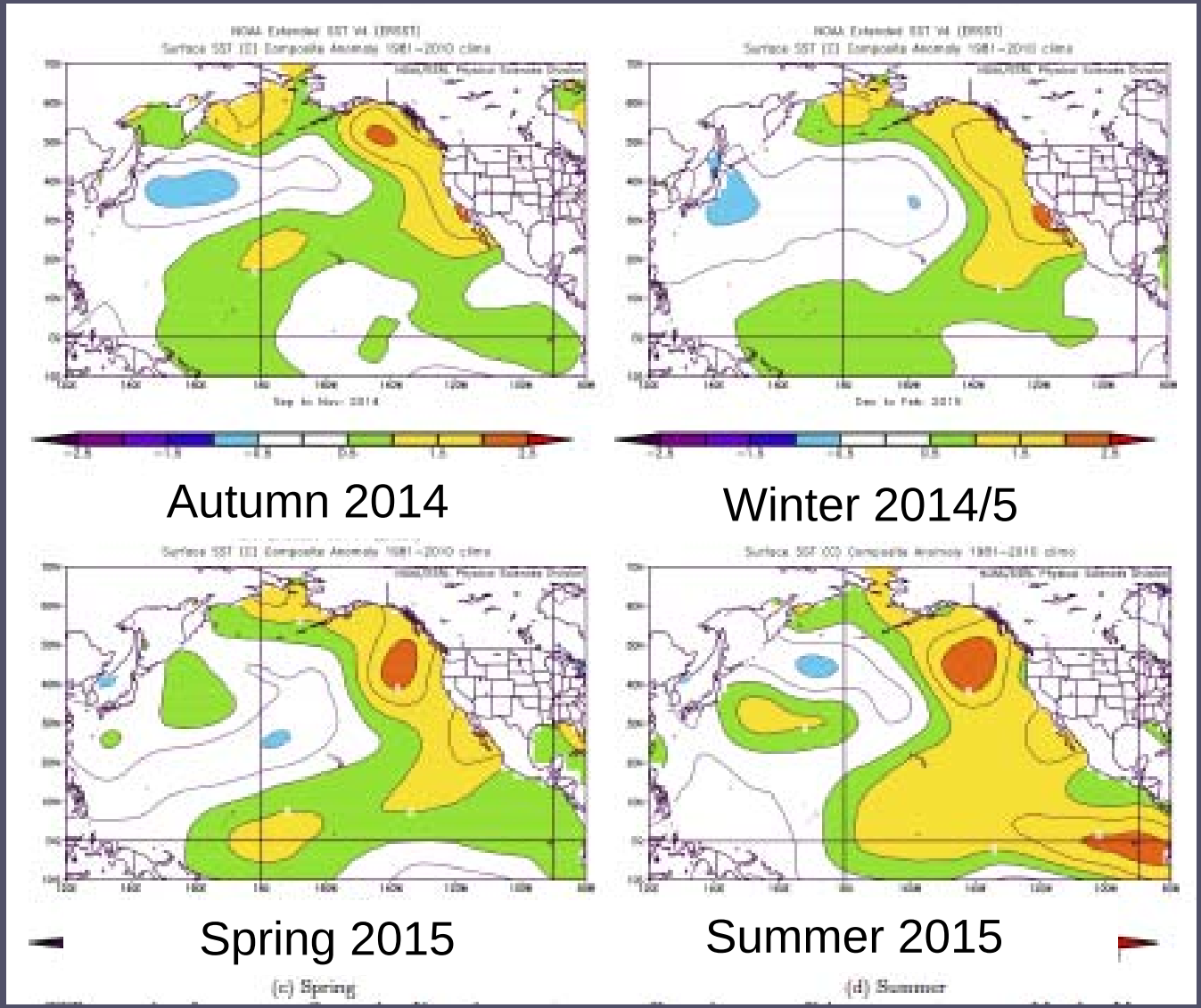


% of grid cell that was contacted over a 1, 5, and 10 year span with the actual dimensions of the gear

PHYSICAL CONDITIONS

Climate and oceanography

Sea Surface Temperature Anomalies (Bond)

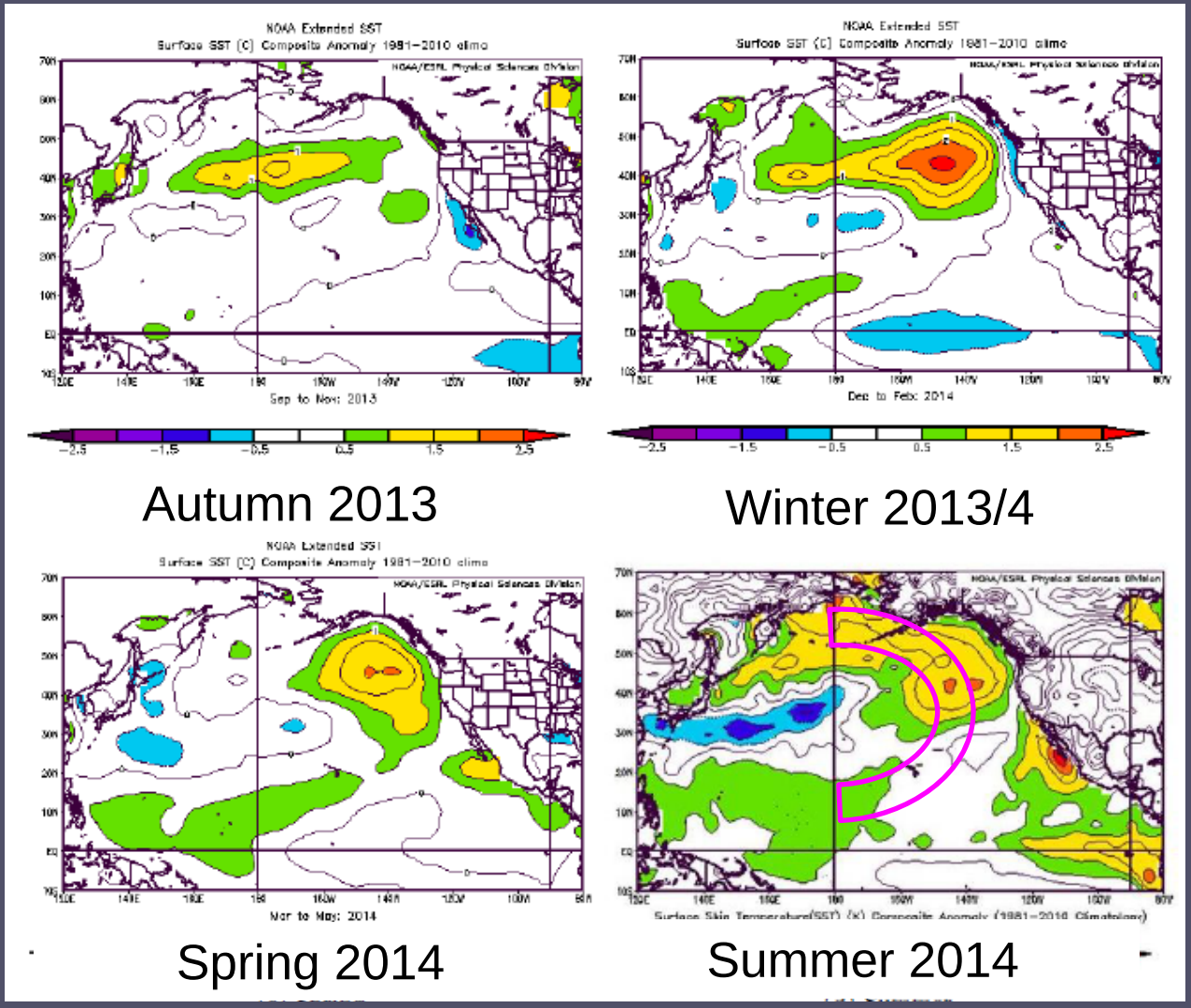


Fewer, weaker cold air outbreaks

Warm, typical storminess

From NOAA's Extended Reconstructed SST analysis

Sea Surface Temperature Anomalies (Bond)



>2.5ºC warm anomalies during winter

Warm anomalies across northern basin in summer, in positive PDO pattern

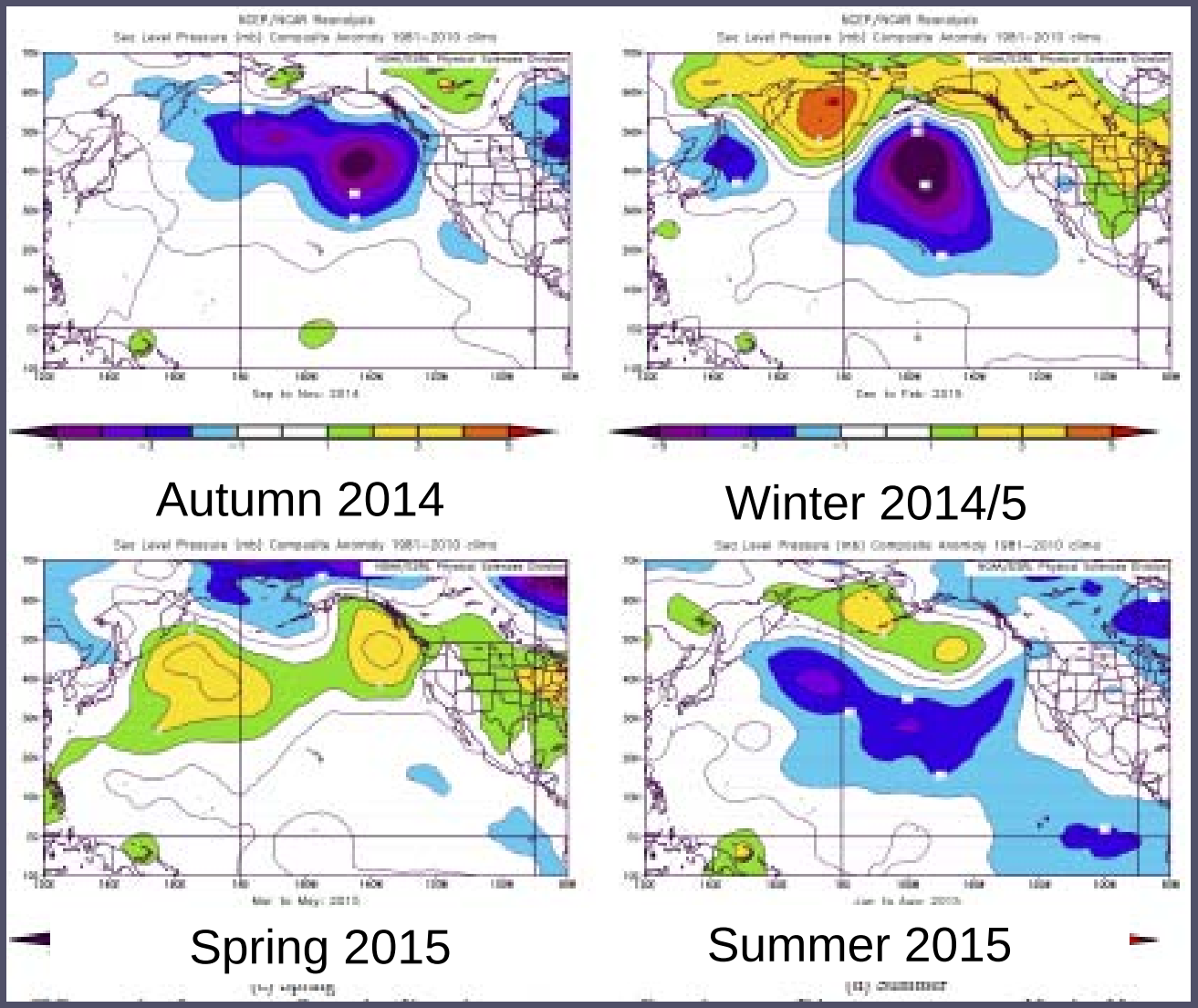
From NOAA's Extended Reconstructed SST analysis

Sea Level Pressure Anomalies (Bond)

Winds from the east in EBS

Most intense storm on record for N Pacific (Nuri)

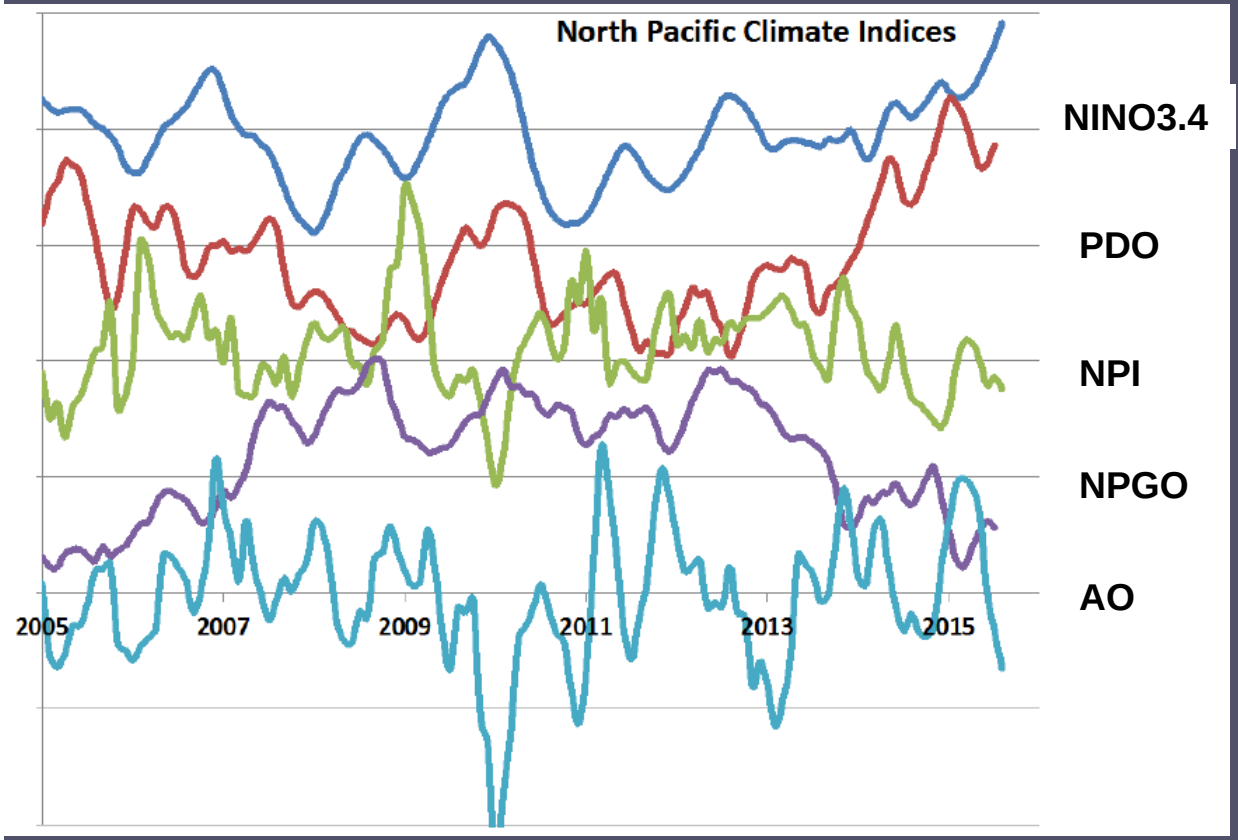
Typically cold weather pattern, but still warm due to ocean temp and low ice



Reduced storminess

From the NCEP/NCAR Reanalysis project

Climate Indices **(Bond)**



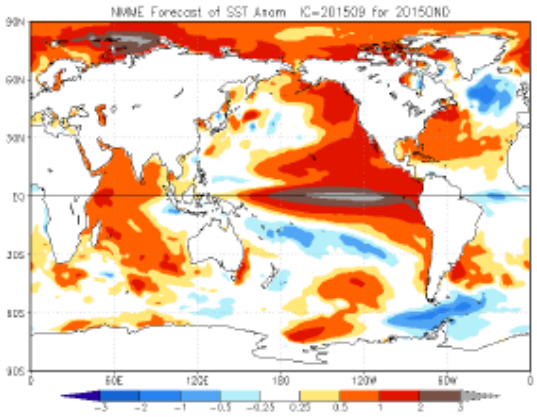
Strongly positive ENSO

PDO in Dec 2014 largest winter value since 1900, leading ENSO recently

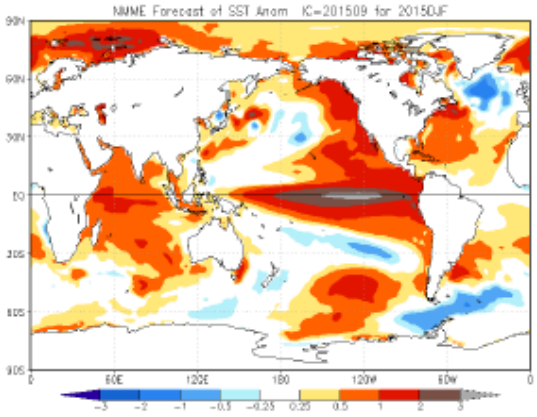
NPI implies strong Aleutian Low

NPGO relates to chemical and biological properties in GOA and CalCOFI area. Negative→ reduced flows in Alaska and CA currents

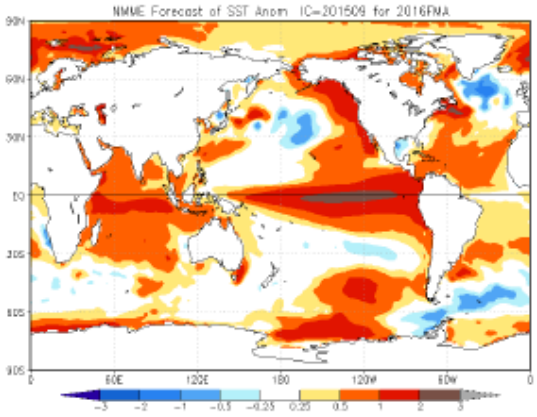
AO measures strength of polar vortex. Positive = low pressure over Arctic, high over Pacific (45º). Not strongly related to AK conditions recently.



(a) Months OND



(b) Months DJF



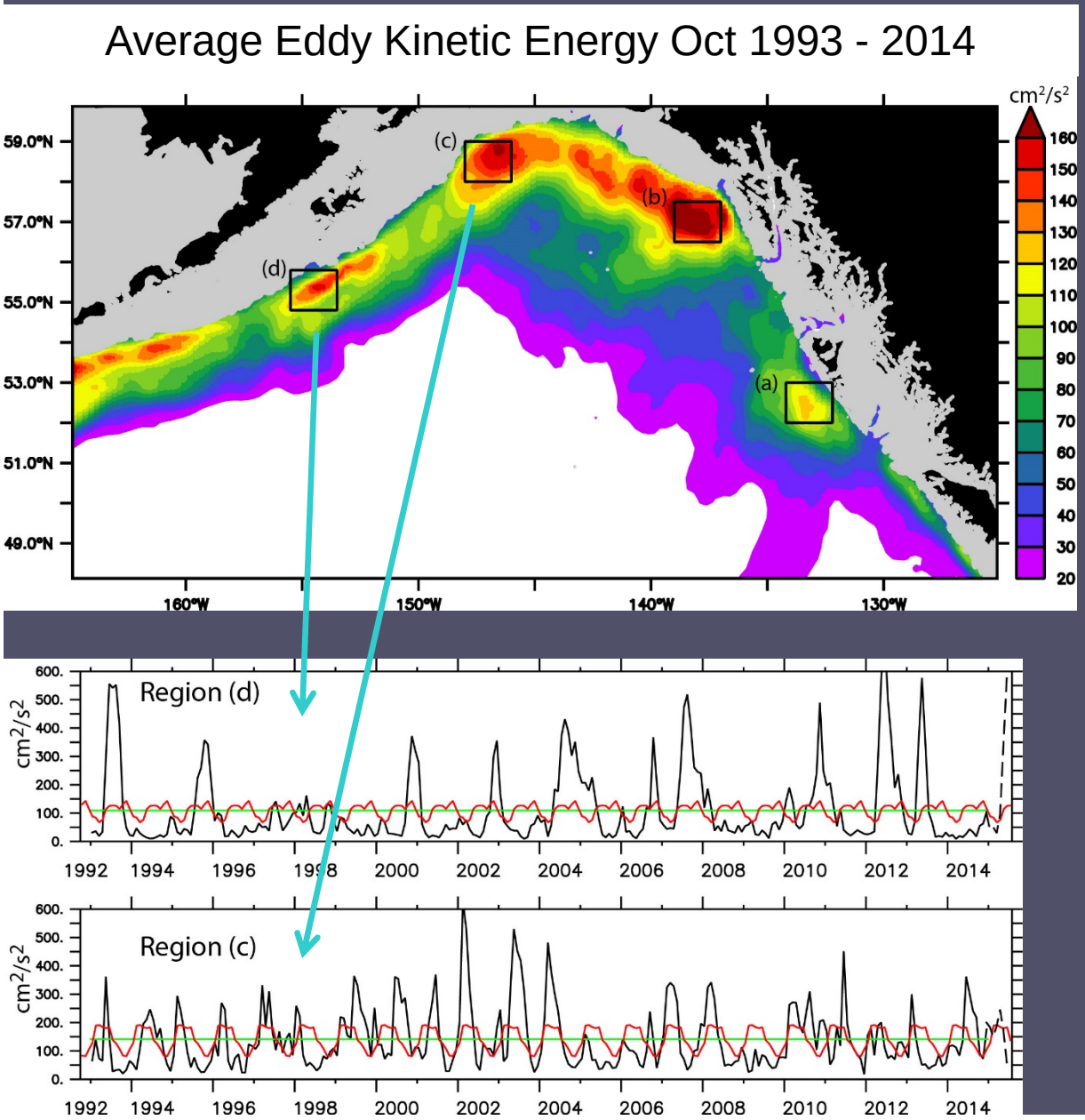
(c) Months FMA

Seasonal Projections from the National Multi-Model Ensemble (NMME) (Bond)

- SST projections
- NMME is average of 6 models
- Moderate-strong El Nino likely to strengthen
- Likely to have teleconnections to North Pacific, deeper than normal Aleutian Low
- Warmer than normal SSTs until spring 2016

Eddies in the Gulf of Alaska

(Ladd)



Seasonal cycles:

(c) High EKE in spring

(d) High EKE in fall

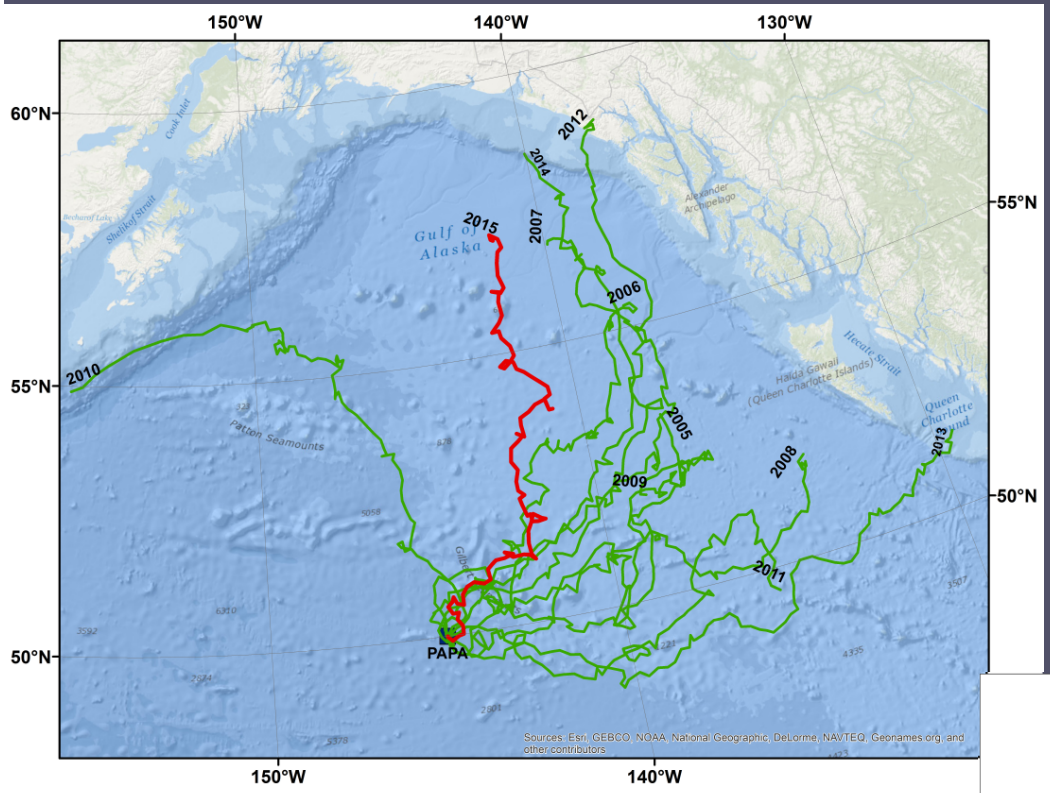
(c) → near climatological mean in 2015

(d)→ High 2012, 2013, 2015: phytoplankton extended farther off shelf; cross-shelf transport higher

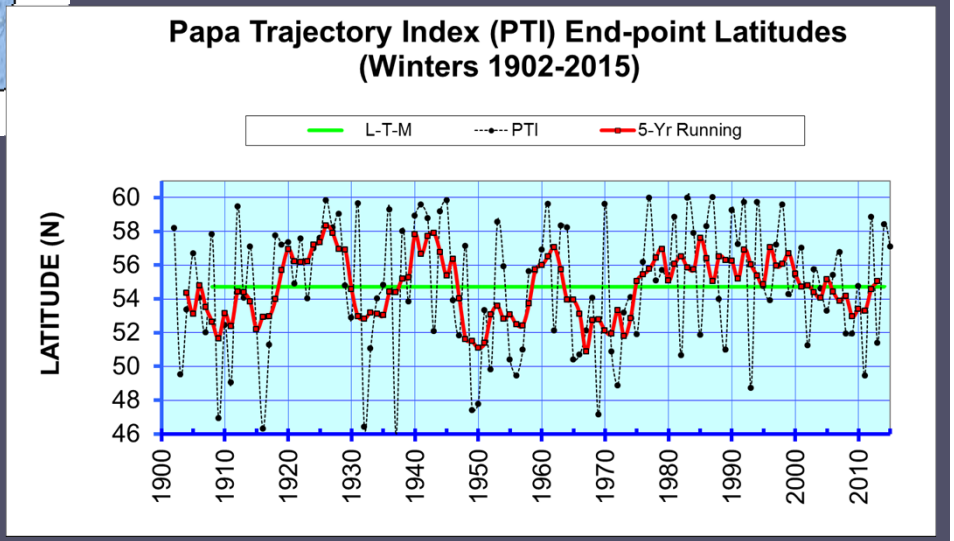
E GOA: influenced by winds (climate and gap scale)

W GOA: influenced by propagation and intrinsic variability

Ocean Surface Currents – PAPA Trajectory Index
(Stockhausen and Ingraham)



- Simulated surface drifter released from Ocean Station PAPA Dec 1 90 days
- 2014/15 trajectory: similar to 2013/14 (S wind anomalies -> "Blob")
- N-ward shift in "boundary" between sub-arctic and sub-tropical species; absence of open ocean LT organisms in SE AK



- Changed little from last year - rare
- Recent period of mostly southerly flow is shortest in time-series
- Does **not** indicate return to surface drift conditions similar to <1977 regime shift

Website

http://access.afsc.noaa.gov/reem/ecoweb/index.php