



NOAA
FISHERIES

Alaska Fisheries
Science Center

Data adequacy for stock assessments

Contributions from REFM Division and Auke Bay
Laboratories

Fishery Dependent and Independent Data Review
August 26, 2013

Terms of reference

(abbreviated)

From some important AFSC stock assessments:

- To what extent do fishery **dependent** and **independent** survey data quality, statistical precision, and timeliness issues impact overall assessment?
 - What are the major successes?
 - What are the major limitations/weaknesses and how could they be resolved?
 - List recommendations for prioritizing fishery-independent and fishery-dependent data collection?
 - Identify the highest priority needs
 - Are data readily accessible to Center stock assessment scientists and to various external researchers who may wish to replicate NMFS stock assessments?

Number of Stock Assessments

- Bering Sea and Aleutian Islands Groundfish FMP
 - 25 ACLs
 - 125 species – 8 complexes of more than one species
- Gulf of Alaska Groundfish FMP
 - 26 ACLs
 - 111 species – 10 complexes of more than one species
- Bering Sea and Aleutian Islands Crab FMP
 - 10 ACLs (AFSC has lead on 4 assessments)
 - Management is deferred to State of AK with Fed oversight

12 minor stocks managed using catch-only data

Major limitation to develop assessments are completed regarding assessments

Stock Assessment and Fishery Evaluation Report

for the Groundfish Resources of the Bering Sea/Aleutian Islands Region

SAFE

Report

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Economic Status of Groundfish Fisheries off Alaska.....	Bound Separately

Outline

- EBS pollock
- EBS Flatfish
- GOA rockfish

Observer data

- Multi-species management
- Data collection for assessments
- Bycatch evaluation

Bycatch evaluation (by pollock fishery)

Table 1.32 Bycatch estimates (t) of other **target species** caught in the BSAI directed pollock fishery, 1997-2011 based on then NMFS Alaska Regional Office reports from observers (*2011 data are preliminary*). **Note that the increase in 2011 is partially due to earlier non-target species being moved into the FMP as “target” species (e.g., skates, squid, octopus etc).**

	Pacific Cod	Flathead Sole	Rock Sole	Yellowfin Sole	Arrowtooth Flounder	Pacific Ocean Perch	Atka Mackerel	Sablefish	Greenland Turbot	Alaska Plaice	Alaska skate	All other	Total
1997	8,262	2,350	1,522	606	985	428	83	2	123	1		879	15,241
1998	6,559	2,118	779	1,762	1,762	682	91	2	178	14		805	14,751
1999	3,220	1,885	1,058	350	273	121	161	7	30	3		249	7,357
2000	3,432	2,510	2,688	1,466	979	22	2	12	52	147		306	11,615
2001	3,878	2,199	1,673	594	529	574	41	21	68	14		505	10,098
2002	5,925	1,843	1,885	768	606	544	221	34	70	50		267	12,214
2003	5,968	1,740	1,419	210	618	935	762	48	40	7		67	11,814
2004	6,437	2,009	2,554	755	557	394	1,053	17	18	8		120	14,100
2005	7,413	2,319	1,125	725	651	653	678	11	31	45		125	13,145
2006	7,291	2,837	1,361	1,304	1,089	737	789	9	65	11		152	14,612
2007	5,630	4,203	510	1,282	2,795	625	315	12	107	3		188	14,494
2008	6,969	4,288	2,125	2,708	1,712	336	20	5	85	49		39	15,205
2009	7,878	4,602	7,602	3,818	2,203	114	25	3	44	176		25	22,861
2010	6,987	4,309	2,330	646	1,502	231	57	2	26	126	1,234	1,579	19,111
2011	9,998	4,846	8,463	1,443	1,599	659	891	1	29	74	881	2,492	29,973
2012	9,998	3,904	6,809	1,468	615	700	263	1	52	125	515	641	25,091
Average	6,615	2,998	2,744	1,244	1,155	485	341	12	64	53	877	527	15,730

Bycatch evaluation (in other fisheries)

Table 1.33 Bycatch estimates (t) of **pollock** caught in the other non-pollock EBS directed fisheries, 2003-2011 based on then NMFS Alaska Regional Office reports from observers (*2012 data are preliminary*).

Target fishery	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Avg.
Pacific cod fishery	16,022	18,610	14,105	15,147	20,296	9,516	7,879	6,416	8,966	7,734	12,469
Yellowfin sole fishery	11,570	10,479	10,312	5,967	4,042	9,867	6,998	5,207	8,694	8,690	8,183
Rock sole fishery	4,925	8,964	7,240	7,040	3,220	4,995	6,150	5,913	7,091	6,769	6,231
Flathead sole fishery	2,989	5,112	3,664	2,641	3,448	4,098	3,166	3,072	1,491	886	3,057
Other flatfish	304	605	262	53	320	7	20	6	2	15	159
Other fisheries	653	826	1,353	1,244	880	725	340	407	1,130	903	846
Total from other fisheries	36,462	44,595	36,936	32,091	32,205	29,208	24,553	21,021	27,375	24,997	30,944

Major success to understand multi-species nature of different fisheries, and compliance w/ TACs

Bycatch evaluation (Prohibited Species)

Table 1.34 Bycatch estimates of prohibited species caught in the BSAI directed pollock fishery, 1997-2012 based on then AKFIN (NMFS Regional Office) reports from observers. Herring and halibut units are in t, all others represent numbers of individuals caught. Preliminary 2012 data are through October 31st, 2012.

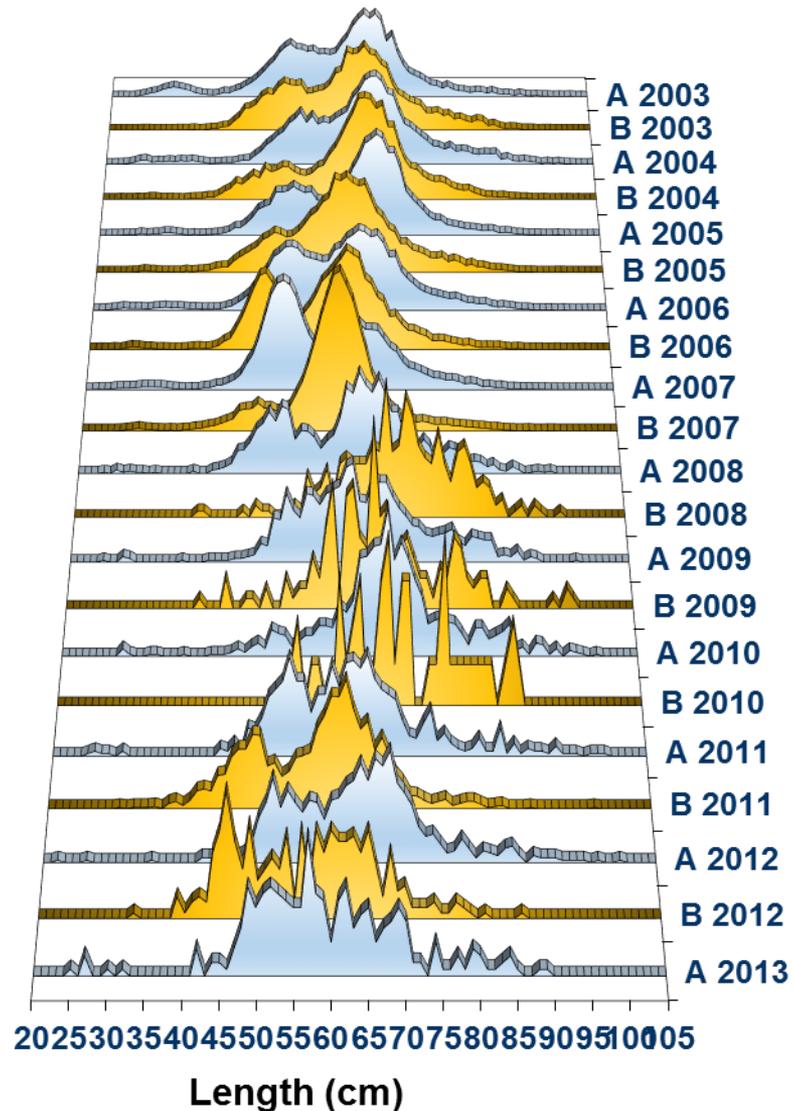
Year	<u>Bairdi</u> Crab	Blue King Crab	Chinook Salmon	Golden King Crab	Halibut catch	Halibut Mort	Herring	Non- Chinook Salmon	<u>Opilio</u> Crab	Other King Crab	Red King Crab
1991	1,398,107		39,054		2,156		3,159	28,709	4,380,023	33,346	17,777
1992	1,500,765		33,672		2,220		647	40,187	4,569,662	20,385	43,874
1993	1,649,103		36,619		1,326		527	241,980	738,259	1,926	58,140
1994	371,214		31,890		963	689	1,627	92,011	811,734	514	42,361
1995	153,993		13,403		492	397	905	17,755	206,651	941	4,644
1996	89,416		55,472		382	321	1,242	77,174	63,398	215	5,934
1997	17,046		44,320		257	200	1,135	65,415	216,152	393	137
1998	57,037		51,244		353	278	801	60,677	123,401	5,093	14,287
1999	2,397		10,381		154	125	800	44,610	15,830	7	91
2000	1,485		4,242		110	91	483	56,867	6,481	121	
2001	5,061		30,937		243	200	225	53,904	5,653	5,139	106
2002	2,113		32,402		199	168	109	77,178	2,698	194	17
2003	733	9	43,021	0	113	96	909	180,782	609		52
2004	1,189	4	51,700	2	109	93	1,104	440,477	743		27
2005	659	0	67,319	1	147	113	610	704,569	2,300		0
2006	1,666	0	82,596	3	156	122	436	309,642	2,947		203
2007	1,519	0	122,262	3	358	290	354	93,167	3,214		8
2008	8,888	8	21,358	33	425	333	128	15,420	9,573		576
2009	6,113	20	12,568	0	598	459	65	46,777	7,425		1,137
2010	13,531	29	9,796	0	355	272	351	13,806	9,439		1,009
2011	10,319	20	25,499	0	509	382	377	193,555	6,332		577
2012	3,650	0	10,157	0	456	369	2,357	21,945	16,508		292

Extended prohibited species analysis

Chinook salmon bycatch sampling

Salmon bycatch

Major issue that genetic sampling has reduced basic biological sampling



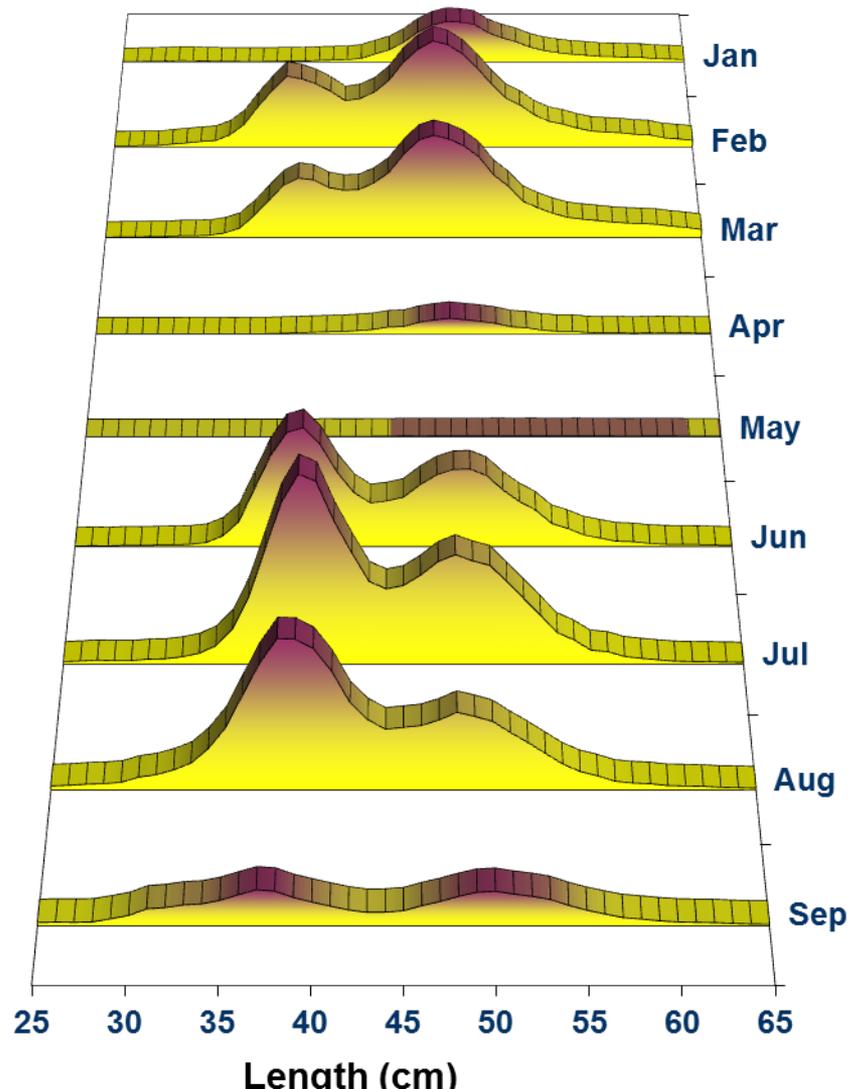
Major success that elaborate bycatch analyses are possible

EBS pollock assessment data

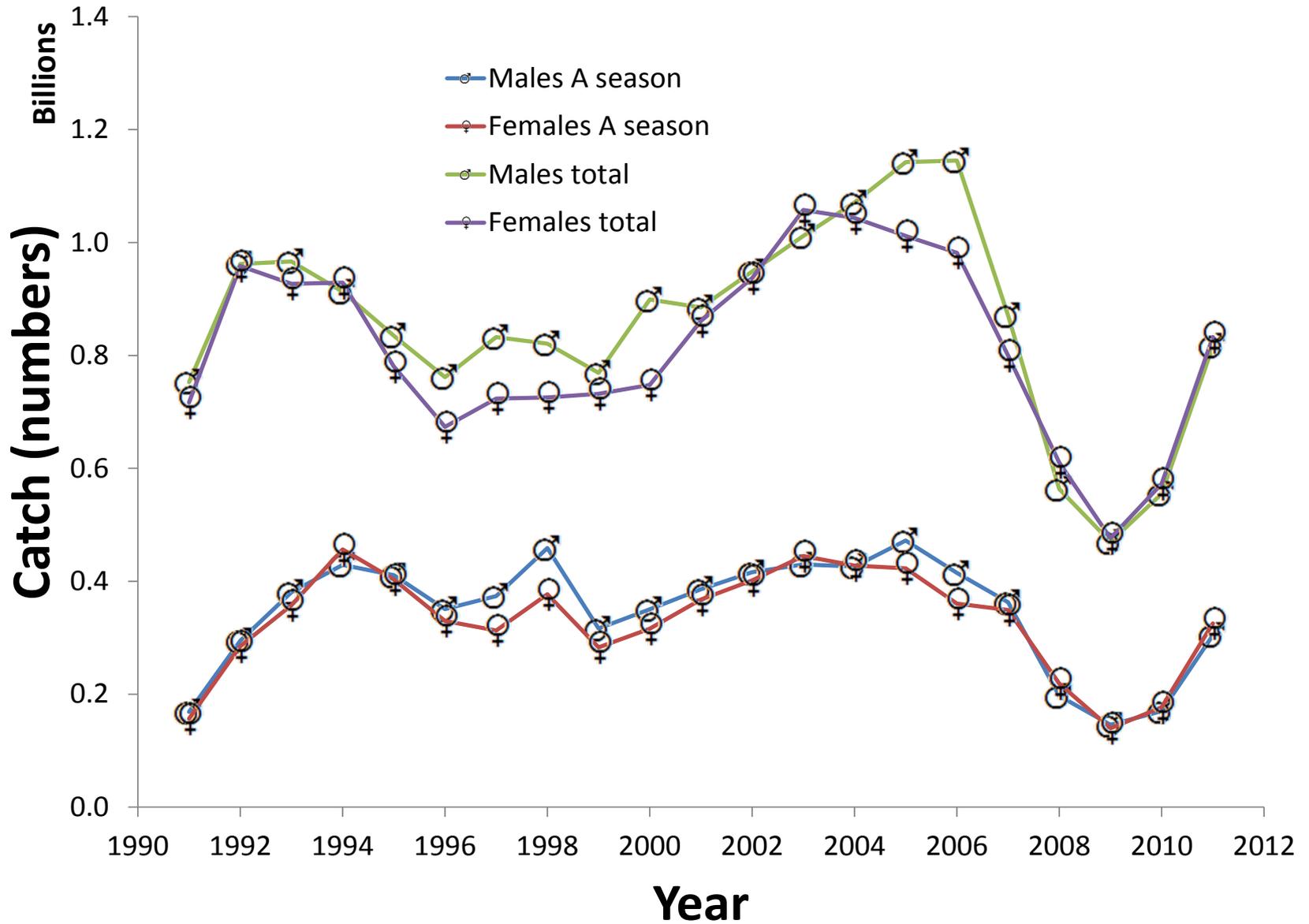
Observer catch estimates

2012

Trends in size

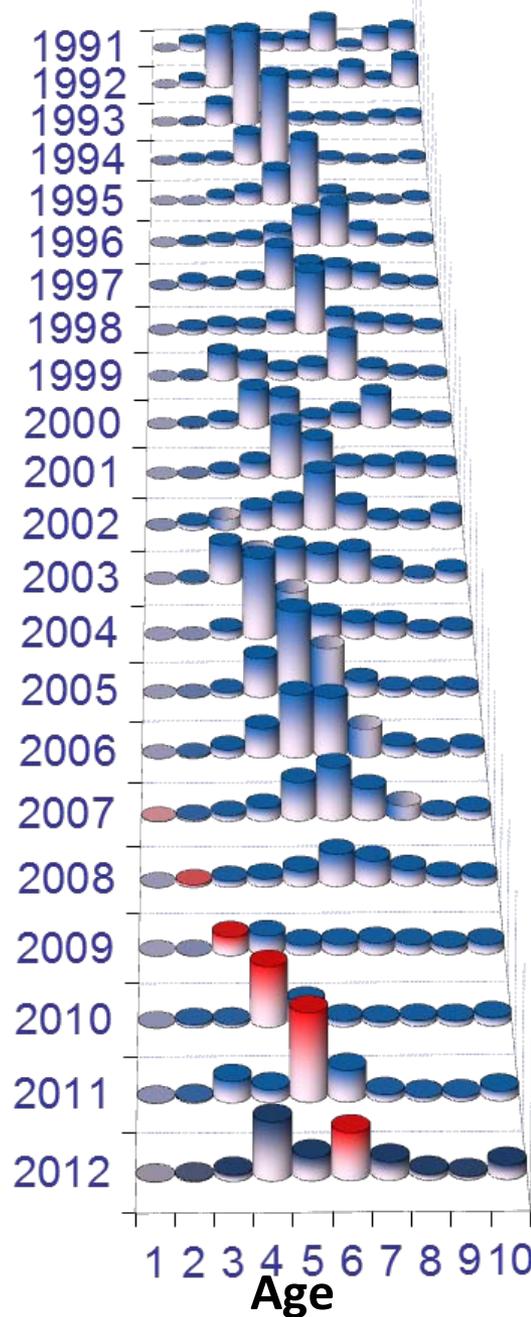


Observer catch estimates



Observer catch estimates

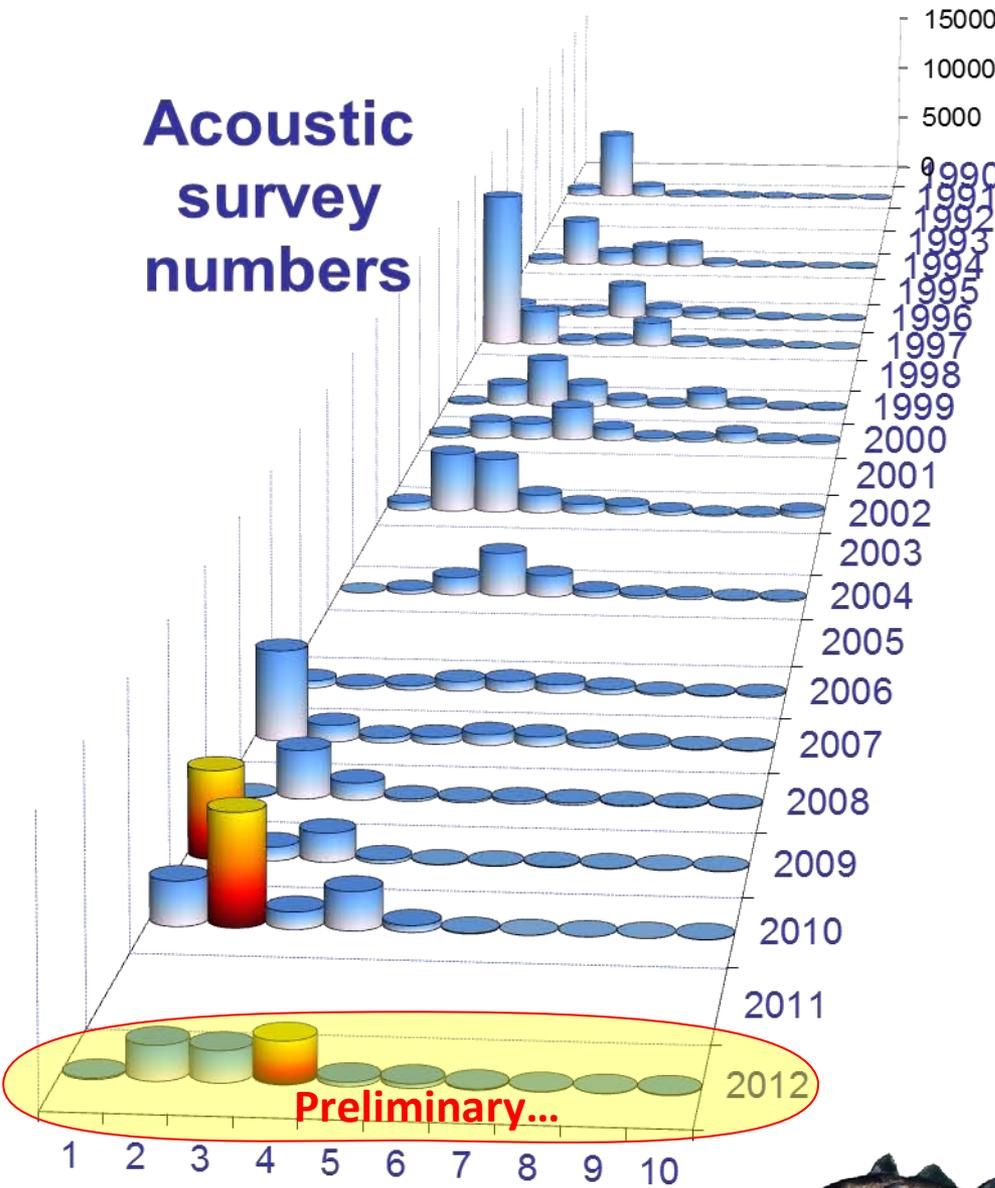
Fishery
Catch
at
age



Fishery dependent data on total catch is well measured

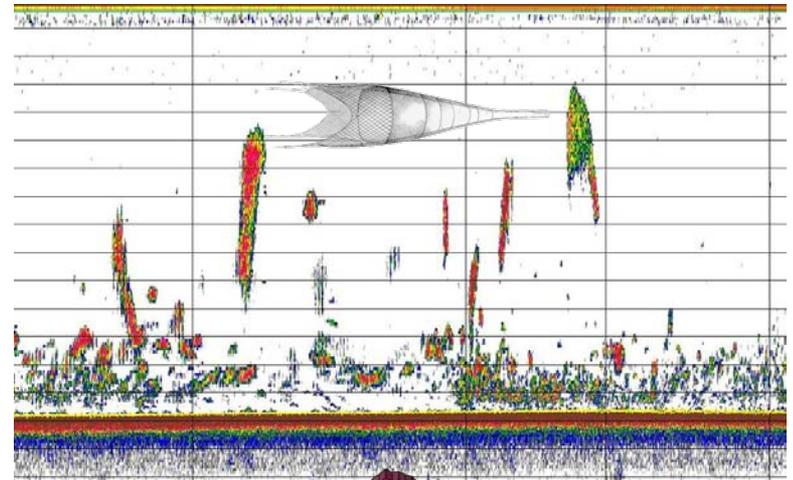
Acoustic Trawl

Acoustic survey numbers



Preliminary...

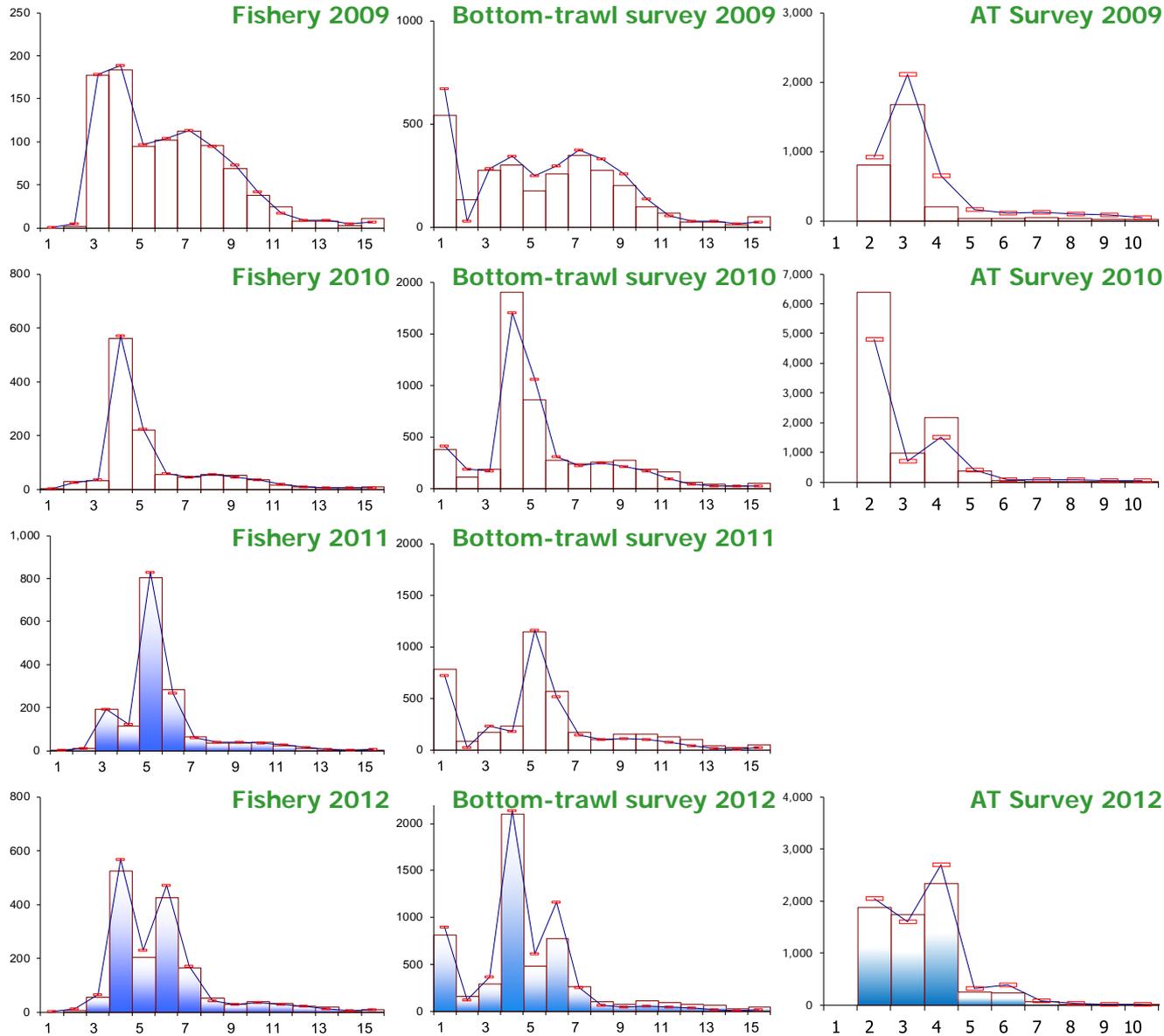
Age



Issue on how to deal with variable stock overlap into Russian zone...

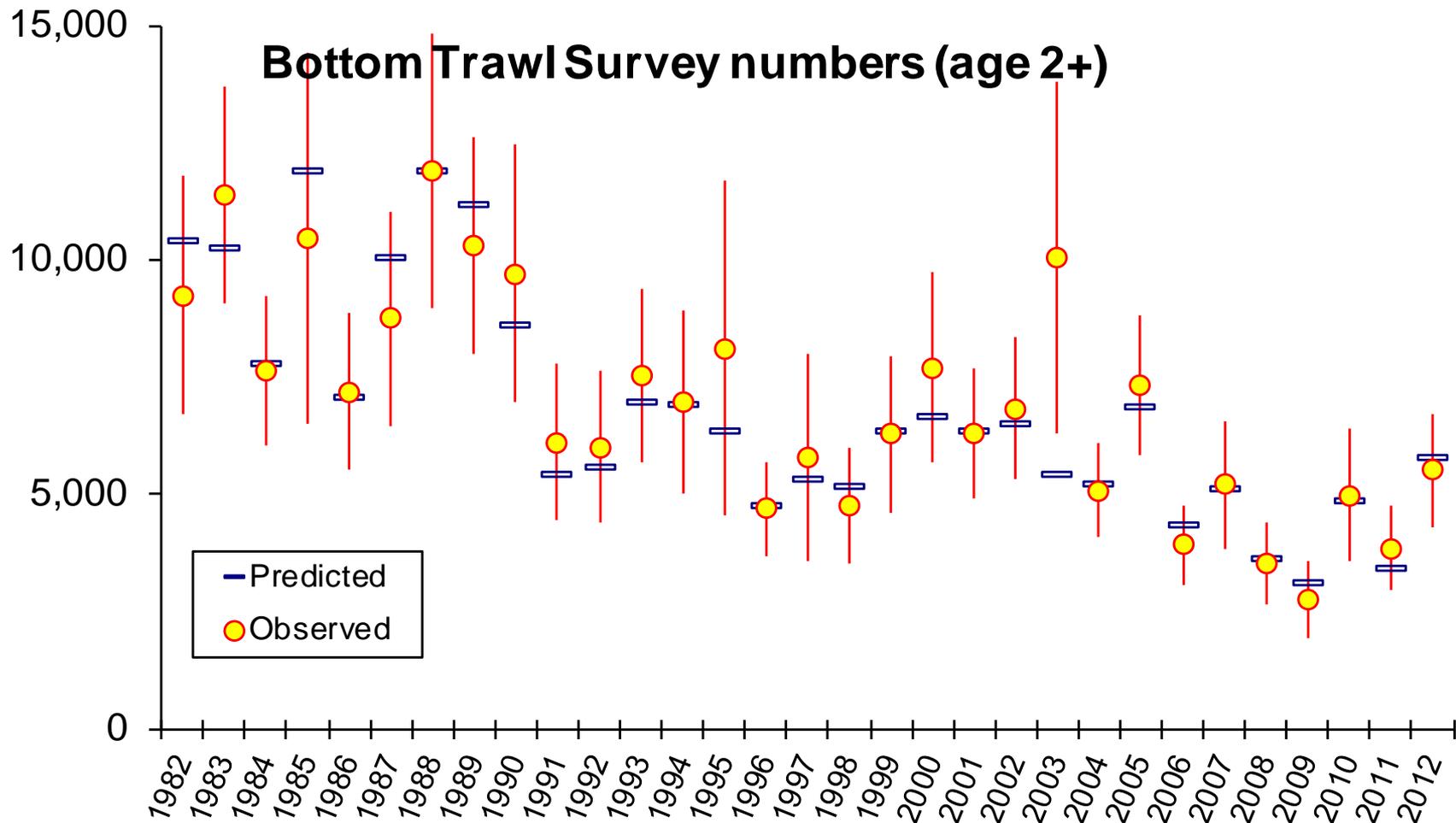
Length (cm)

EBS pollock new age data (2012)



Age

Assessment model fit to bottom trawl survey data; EBS pollock



In some years survey estimates inconsistent with other data and or model

EBS pollock survey age data

- Bottom-trawl ages
 - Done in current year
- Acoustic ages
 - Based on current year's bottom-trawl data collection
 - Plus some side collections to cover youngest ages
 - In odd years the even-years survey age composition data are updated
- Both provide good insight on year-class abundance and update estimation

Major success that survey age data made available in year of survey

EBS pollock, unique data index

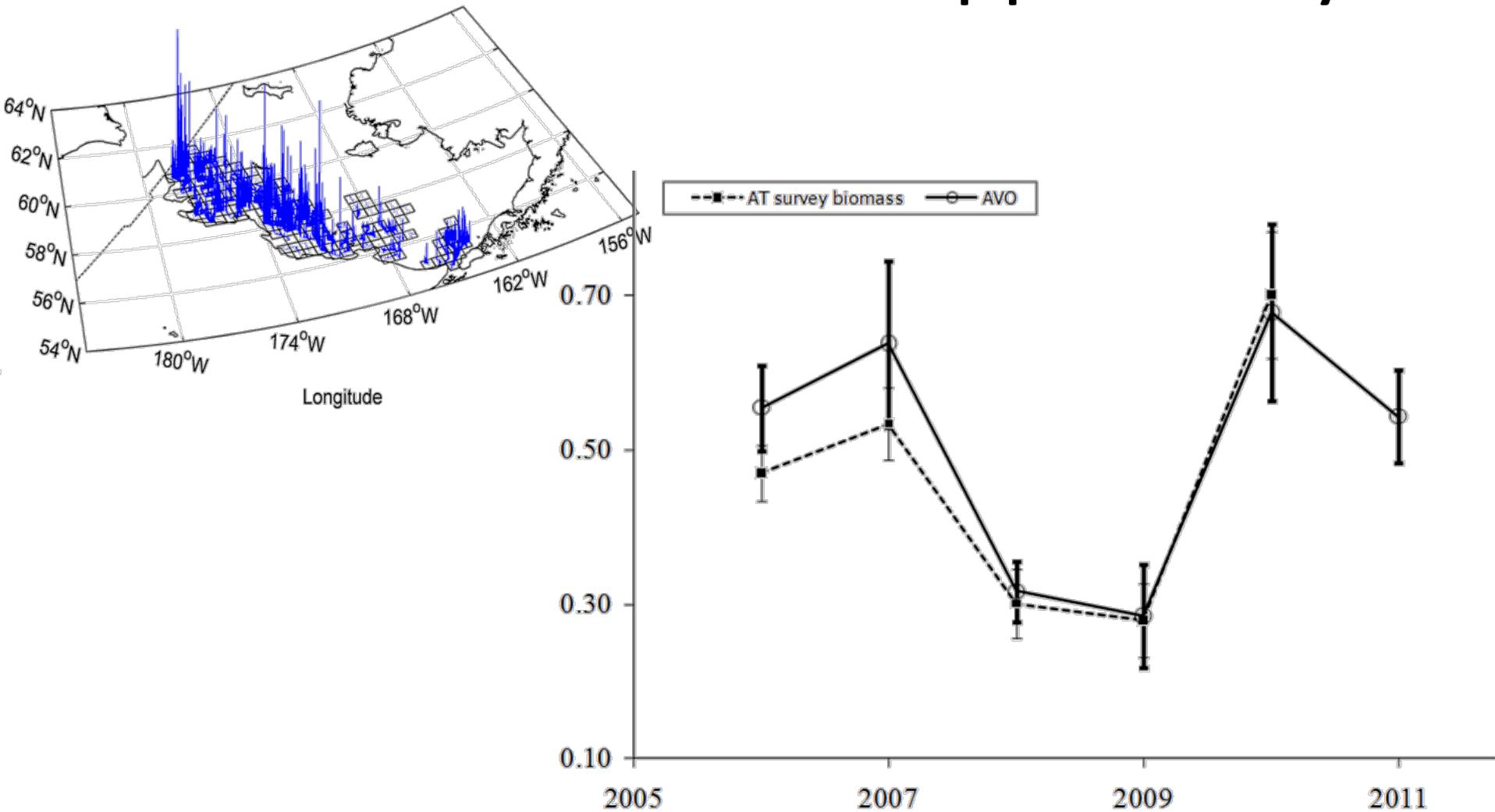
AVO—Acoustic Vessels of Opportunity

- Abundance index used for the first time in 2011
 - Fill gap off-years of Research Vessel
 - 2006-2011
 - Industry-based charters



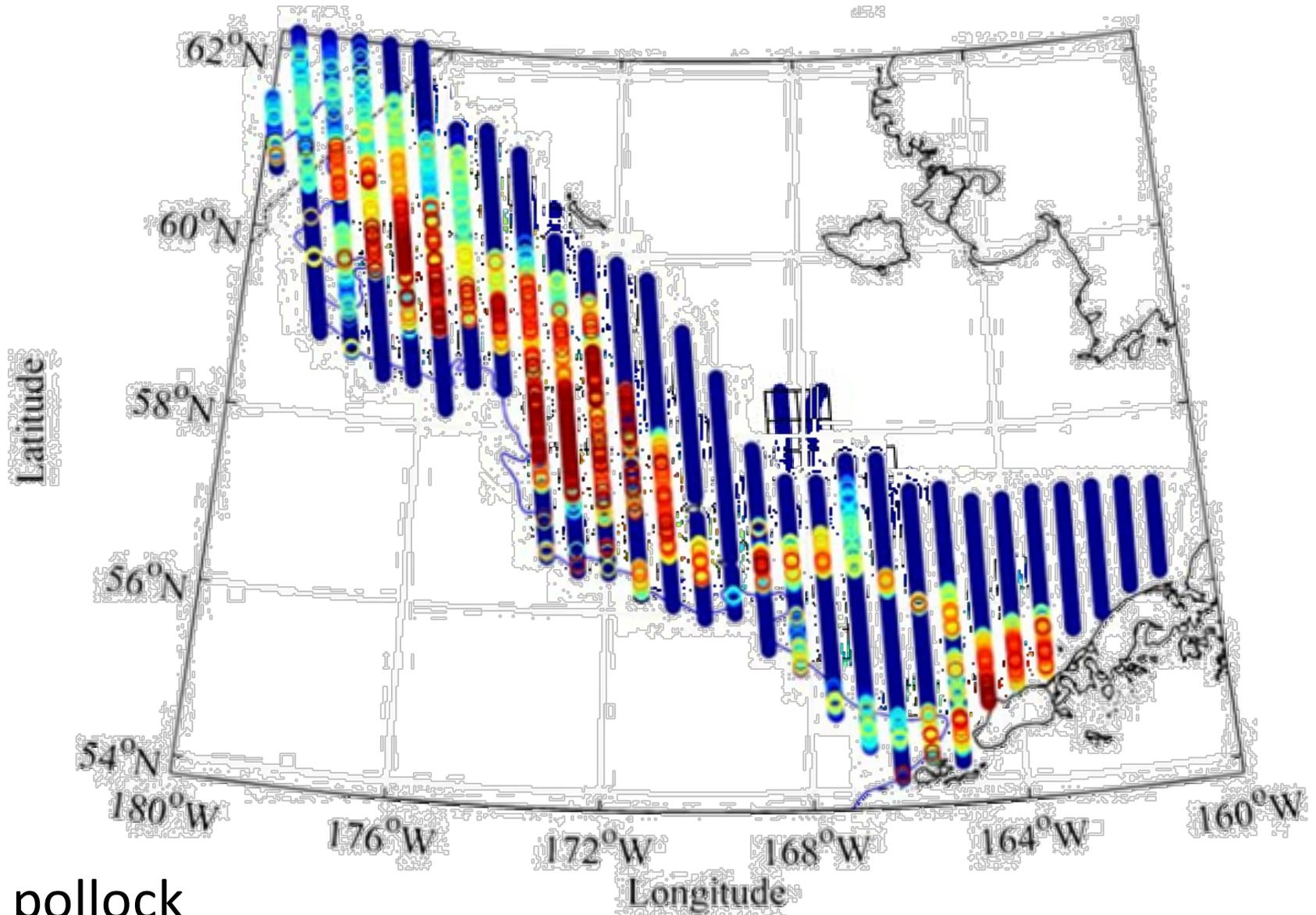
EBS pollock AVO index

Acoustic Vessels-of-Opportunity

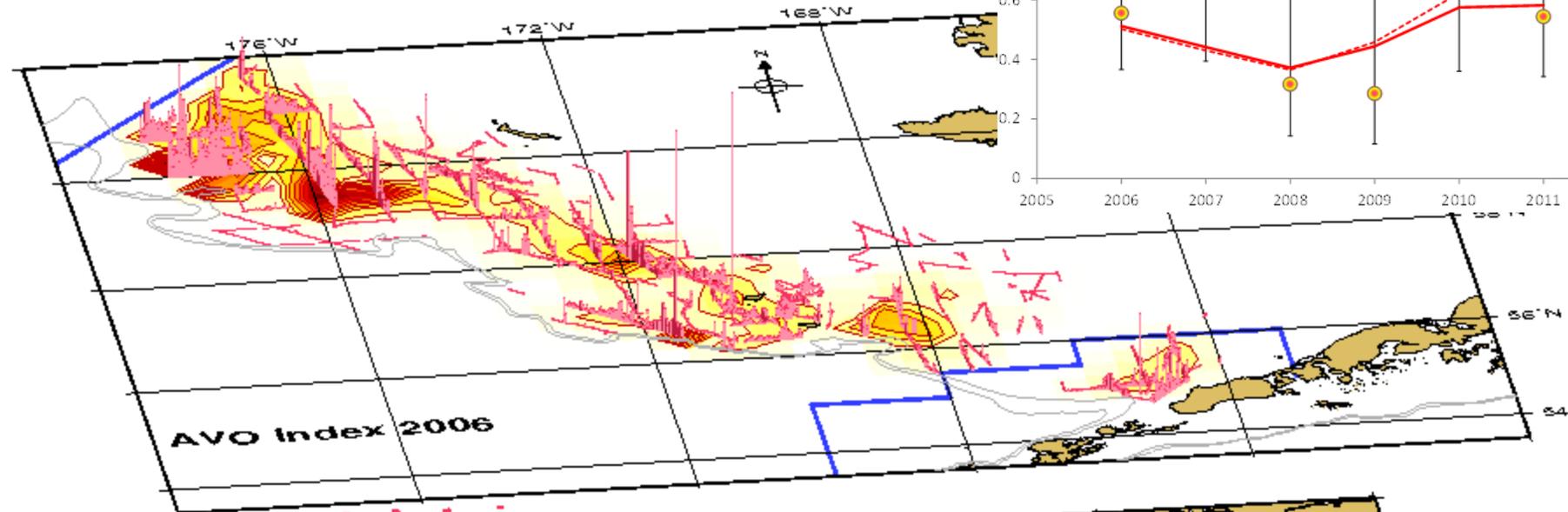


2009

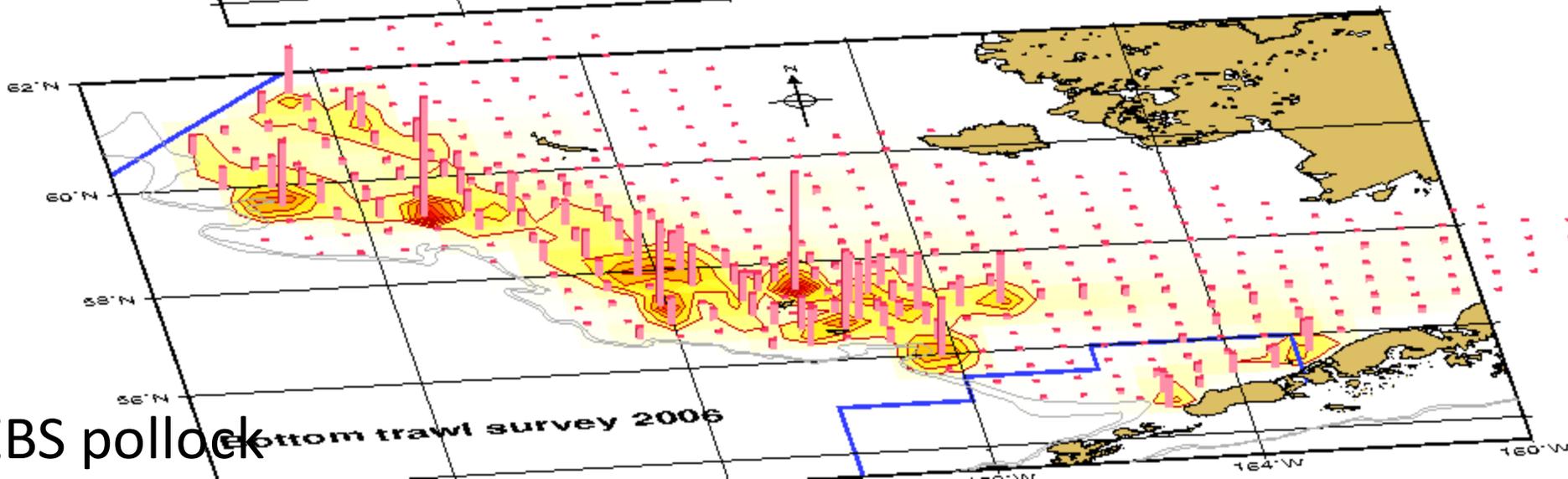
Acoustic trawl (Oscar Dyson)



2006



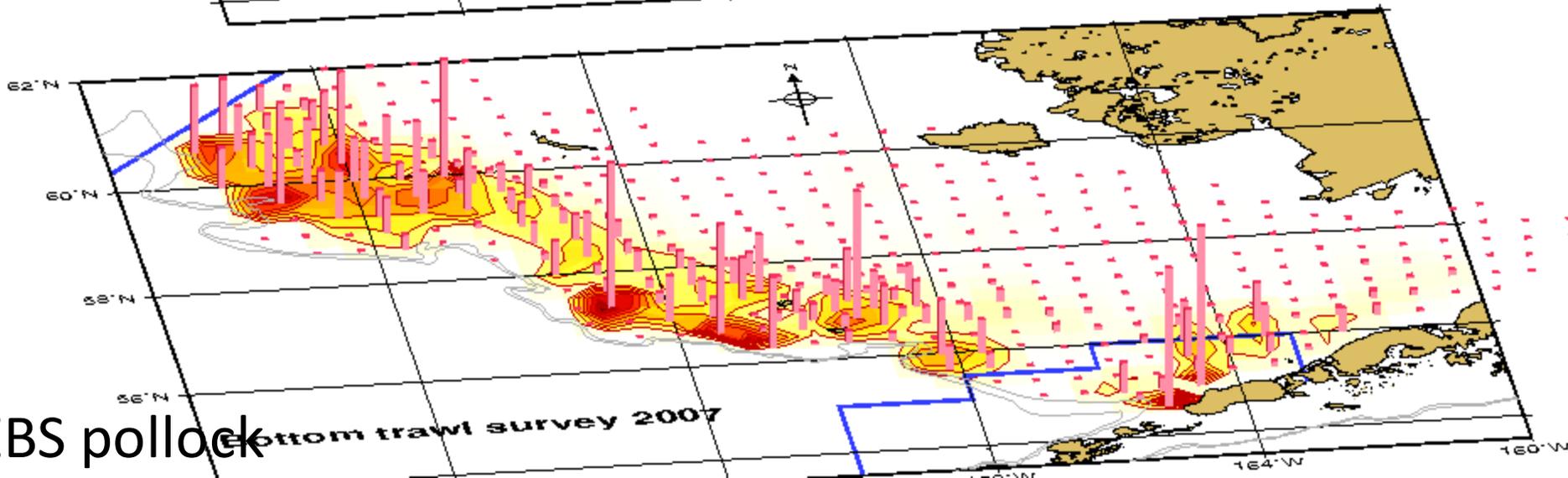
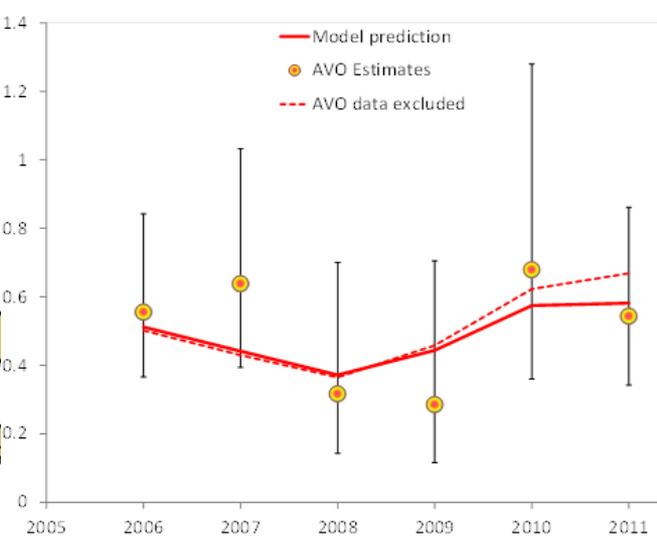
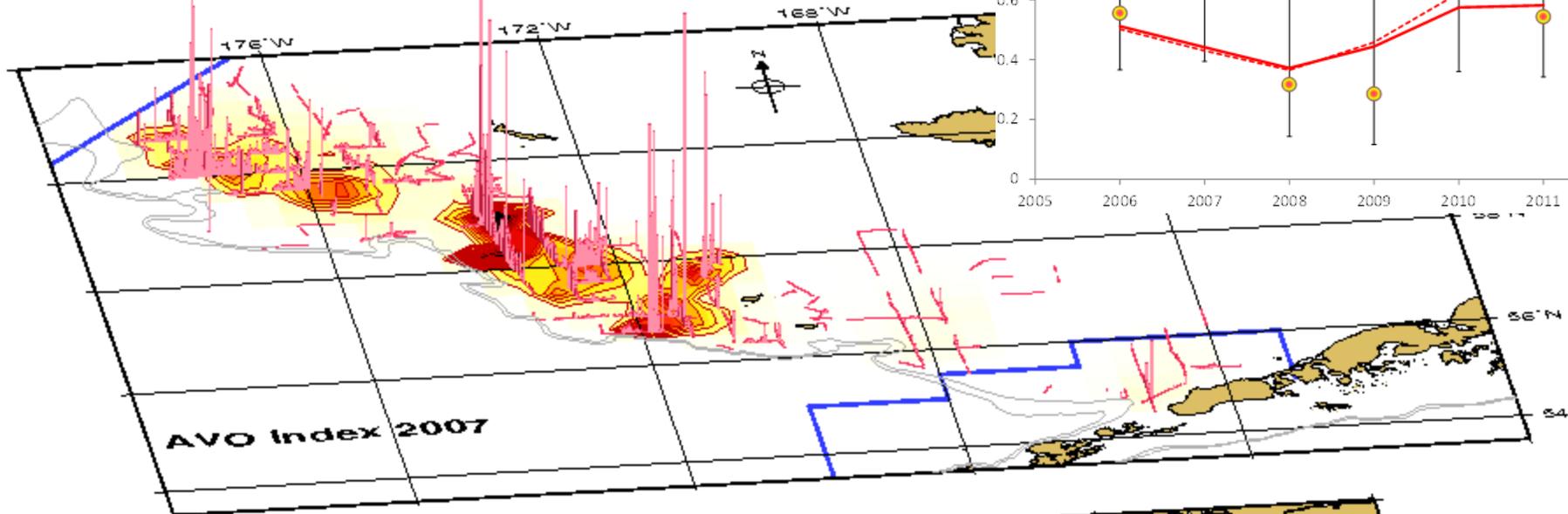
AVO Index 2006



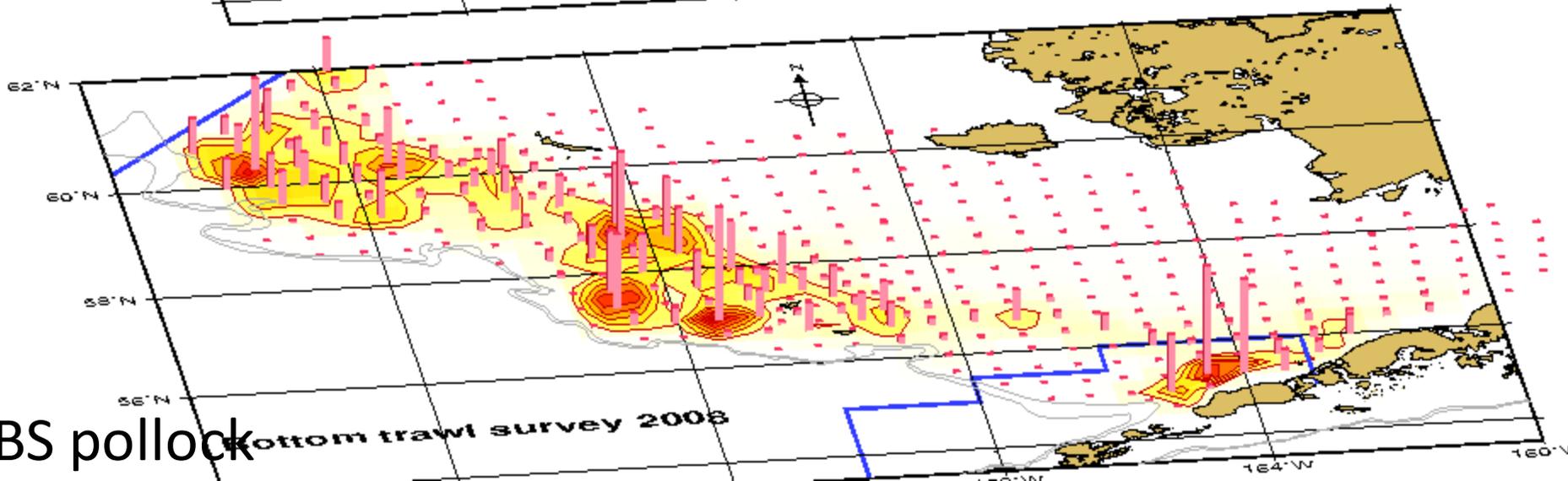
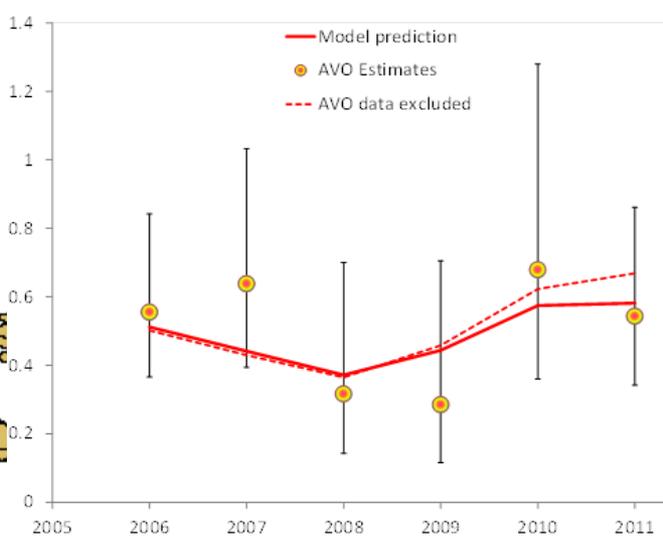
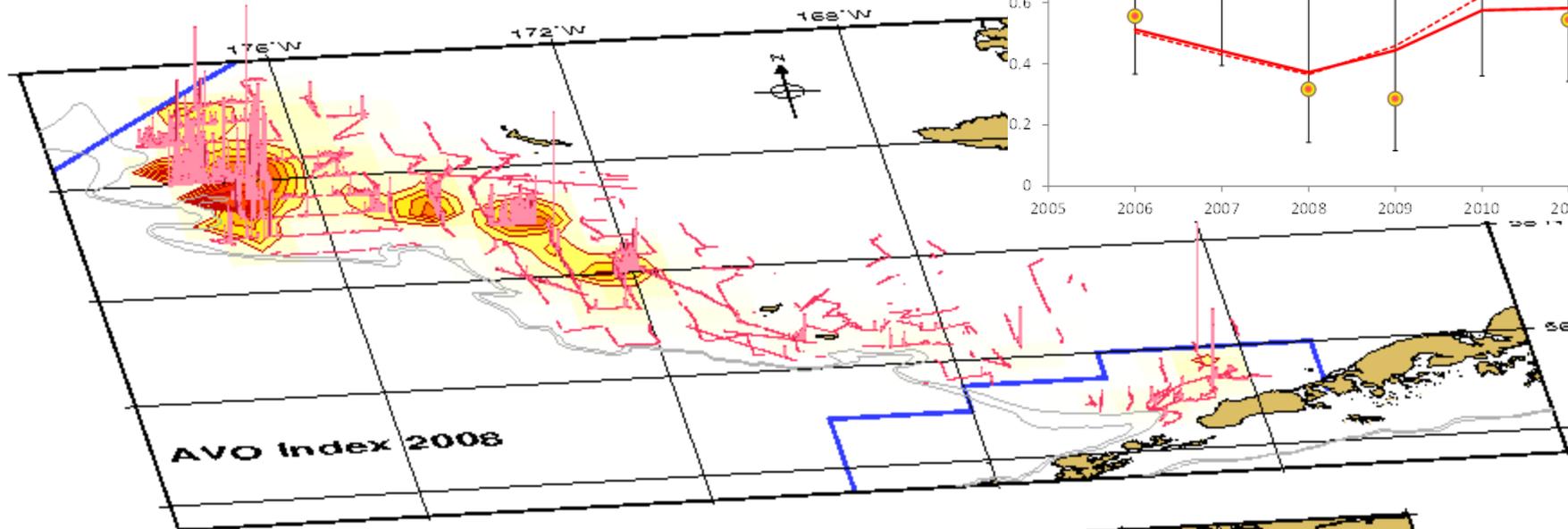
EBS pollock

Bottom trawl survey 2006

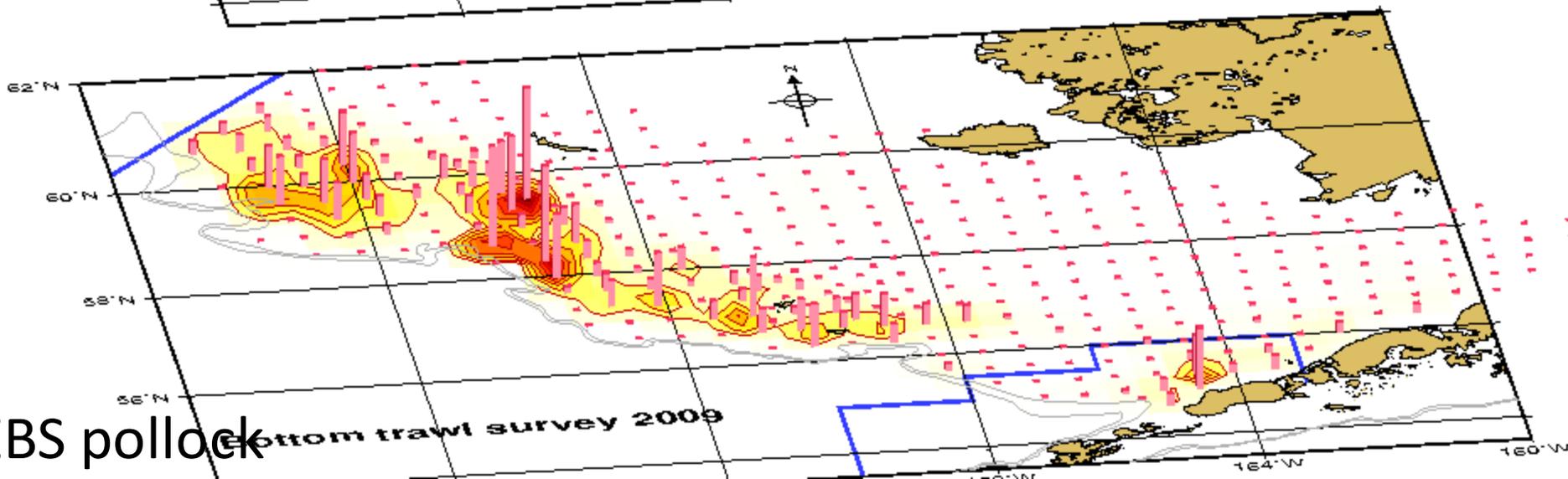
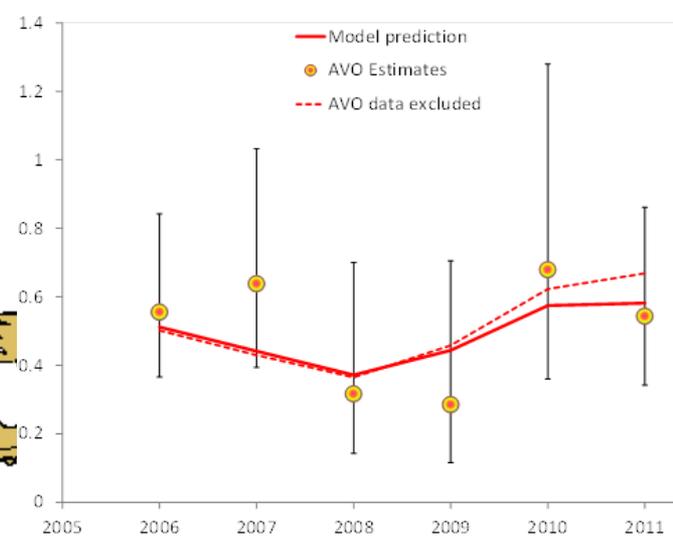
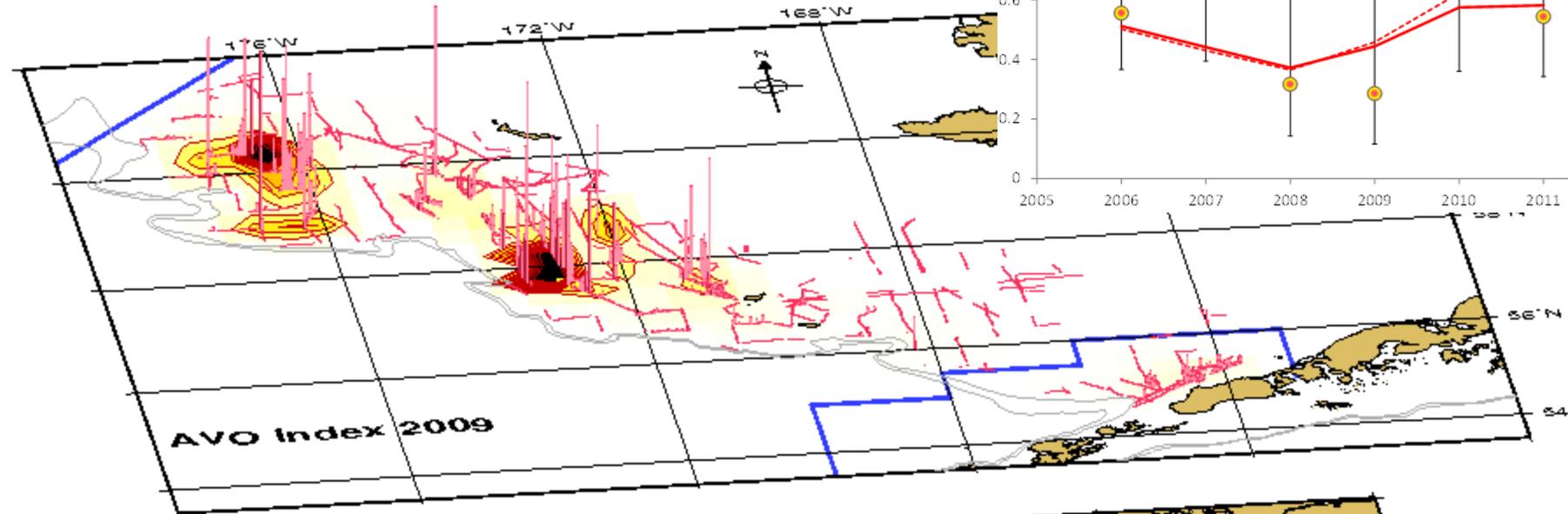
2007



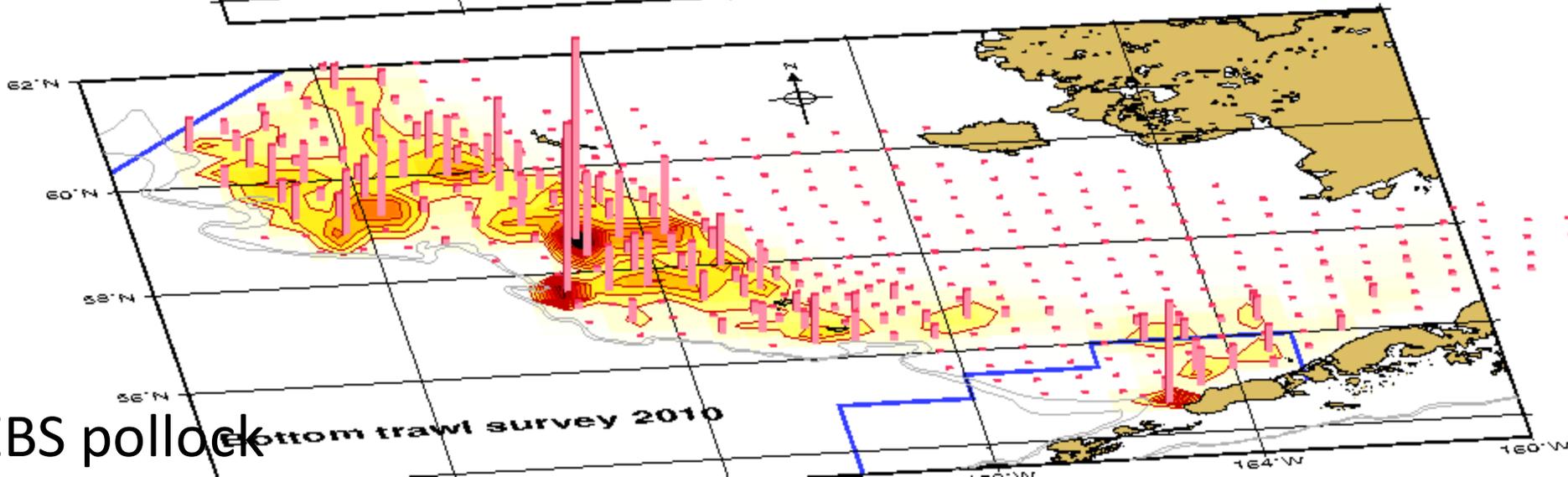
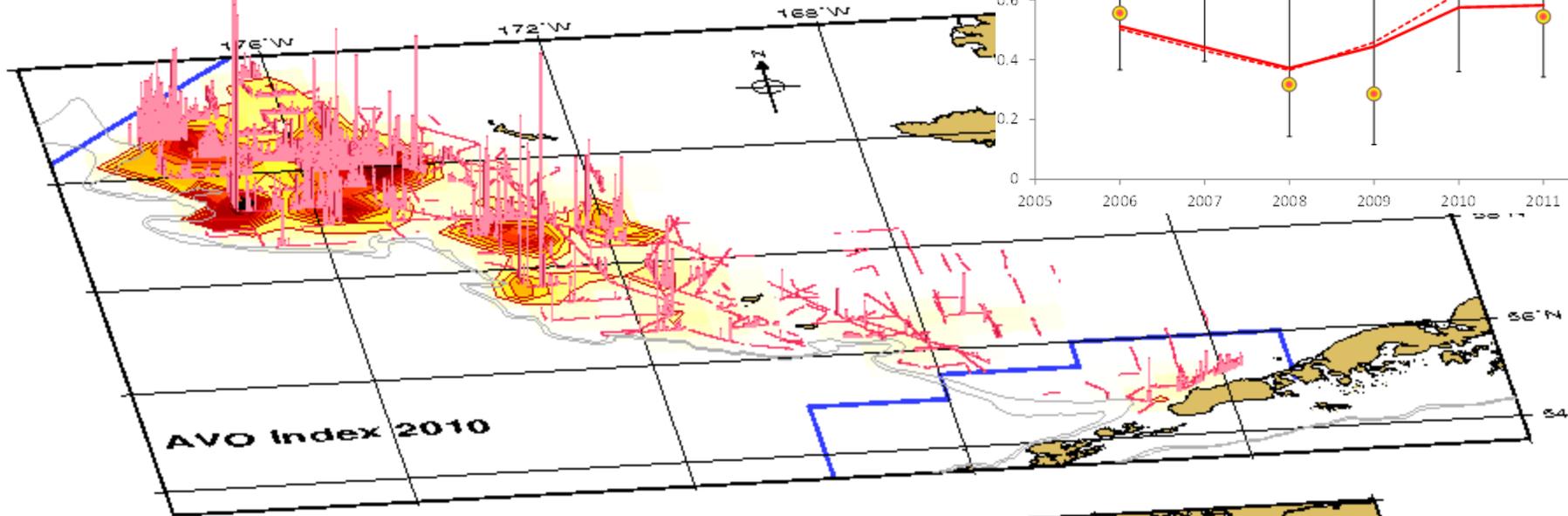
2008



2009

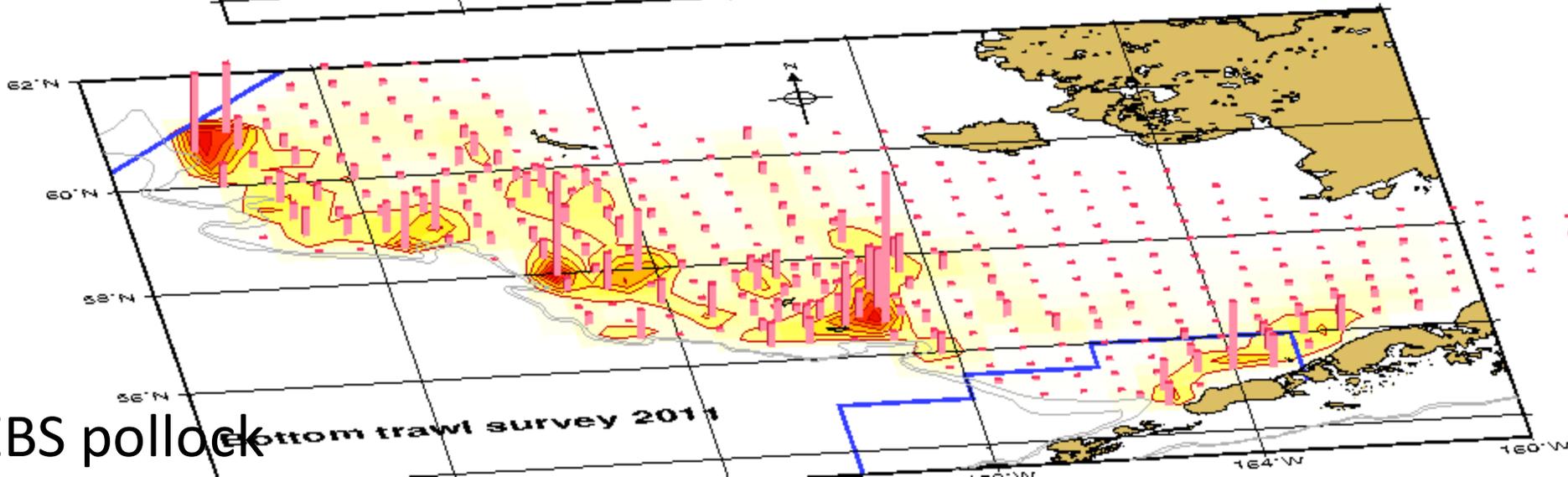
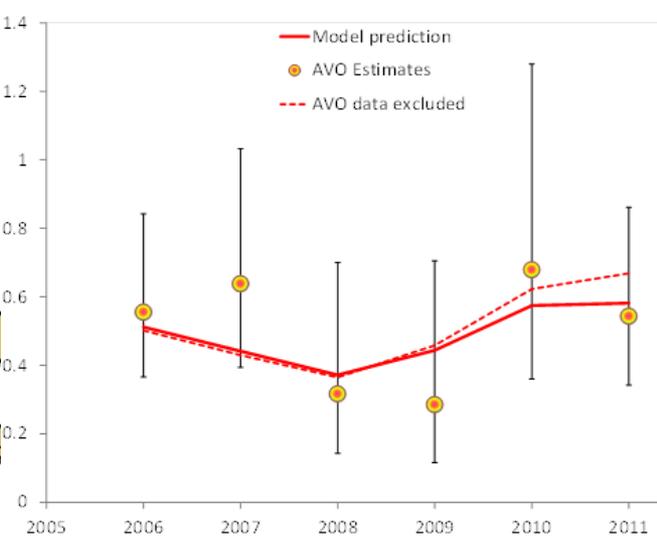
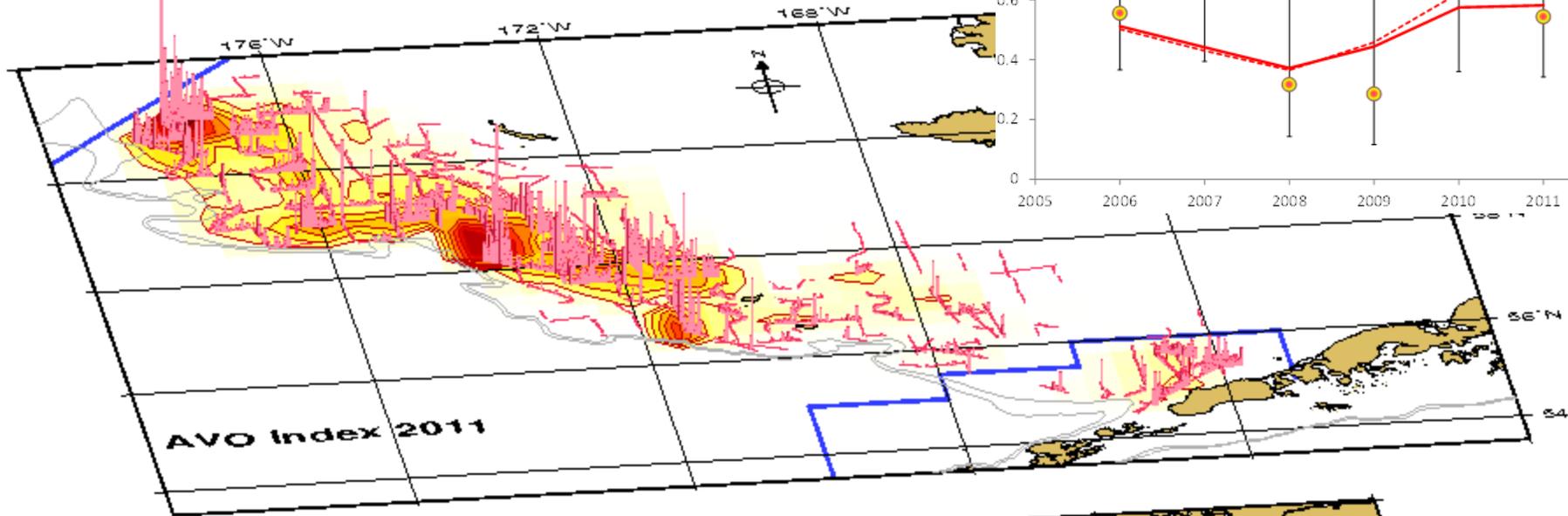


2010

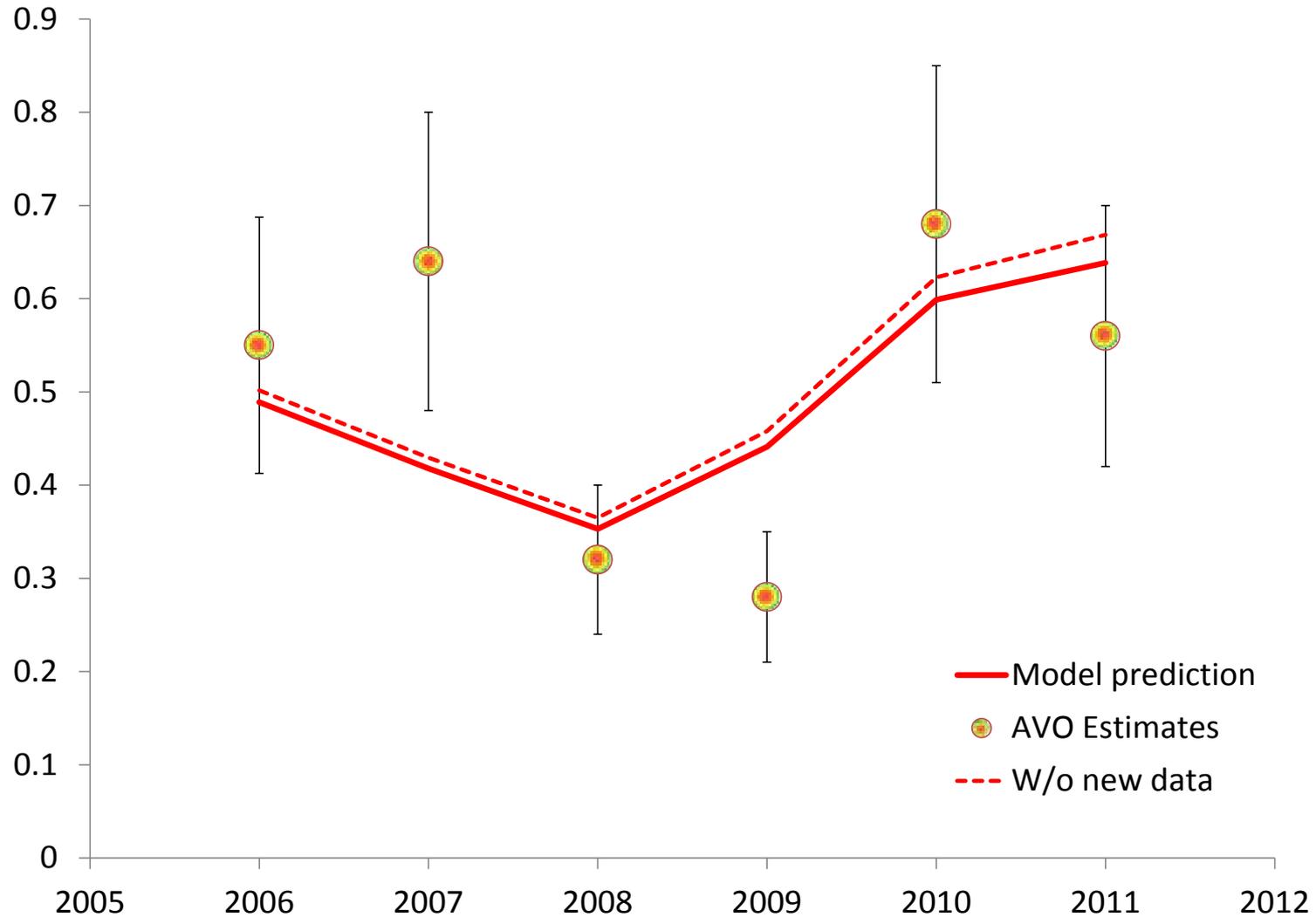


EBS pollock

2011



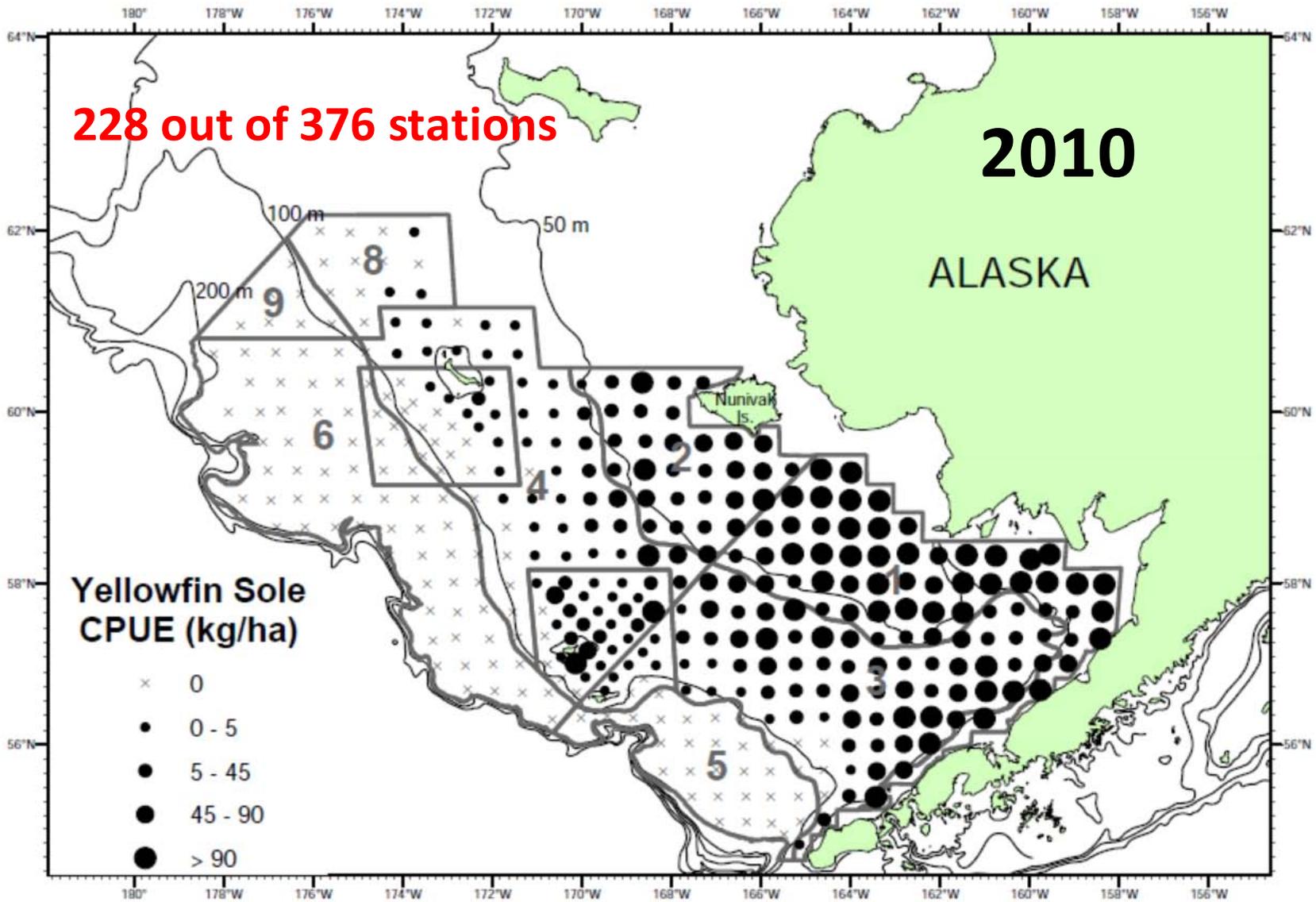
Opportunistic abundance index



Major success that innovative index developed and “fills in gap” for mid-water abundances

Bottom trawl survey and flatfish

- Bering Sea shelf survey is multi-species
 - Works well for the shelf flatfish species
- Survey area covers the majority of distribution
- Observation errors low
- Temperature situation a factor
 - Accounted for thanks to data collection and model implementation



308 out of 376 stations

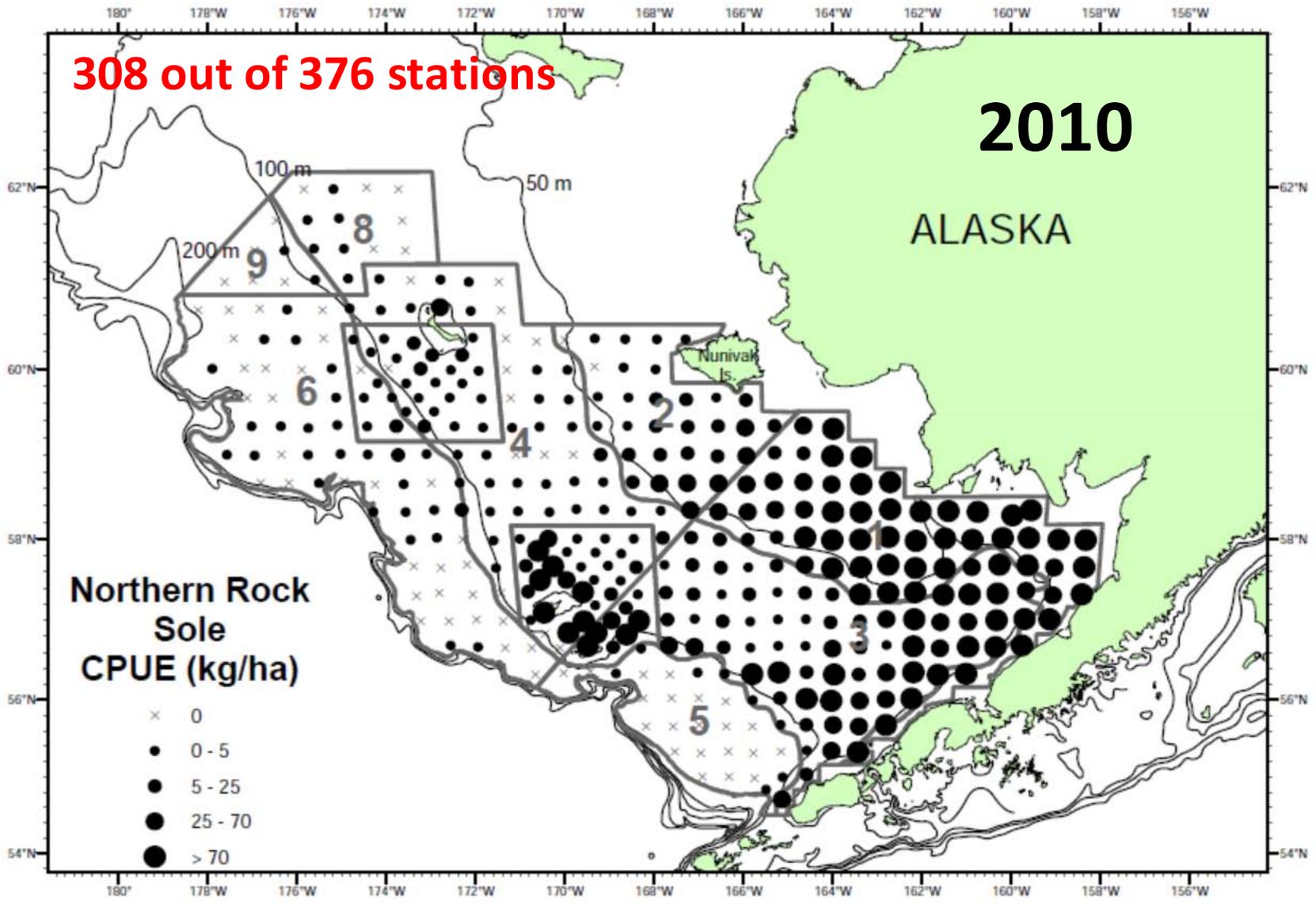
2010

ALASKA

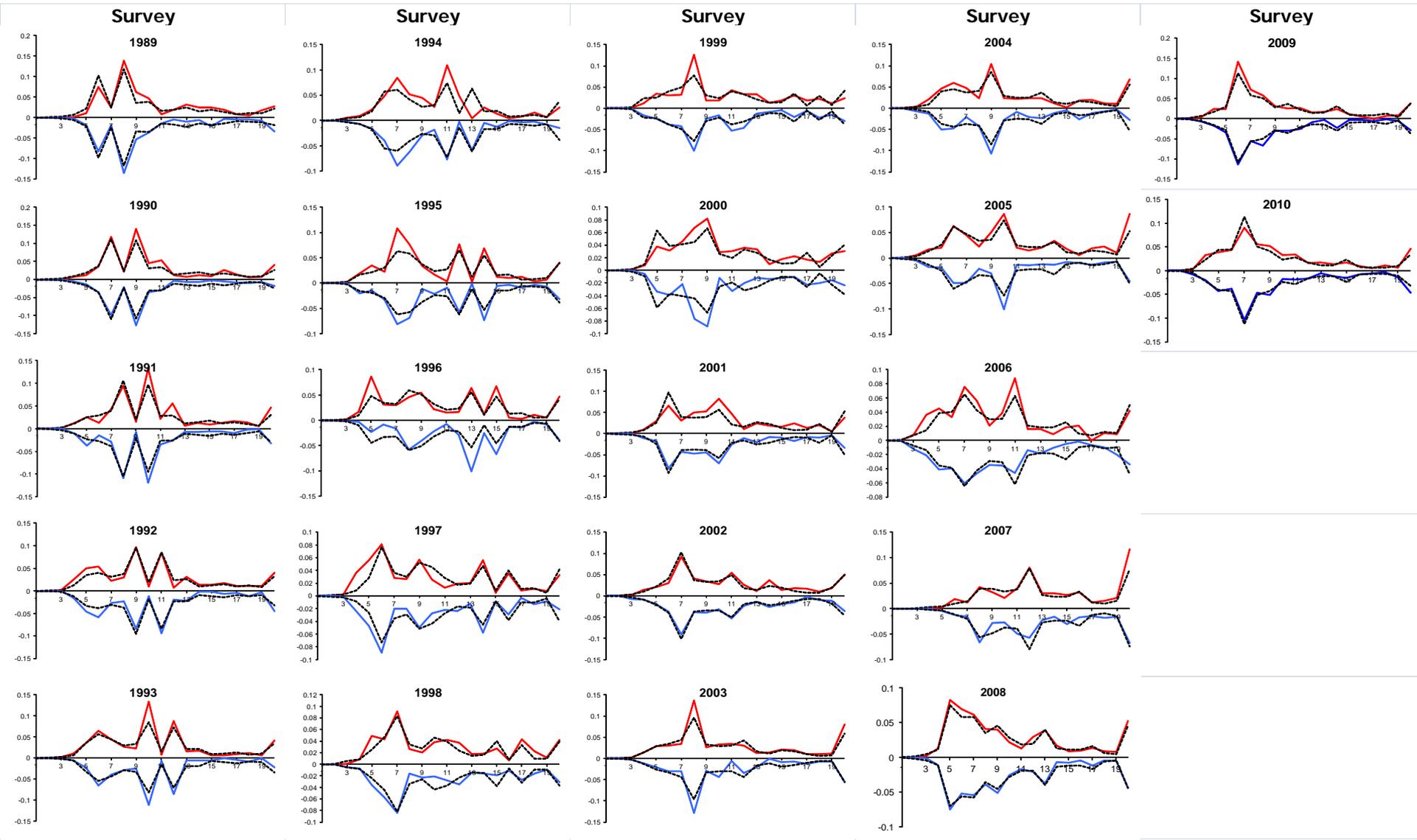
Nunivak

**Northern Rock
Sole
CPUE (kg/ha)**

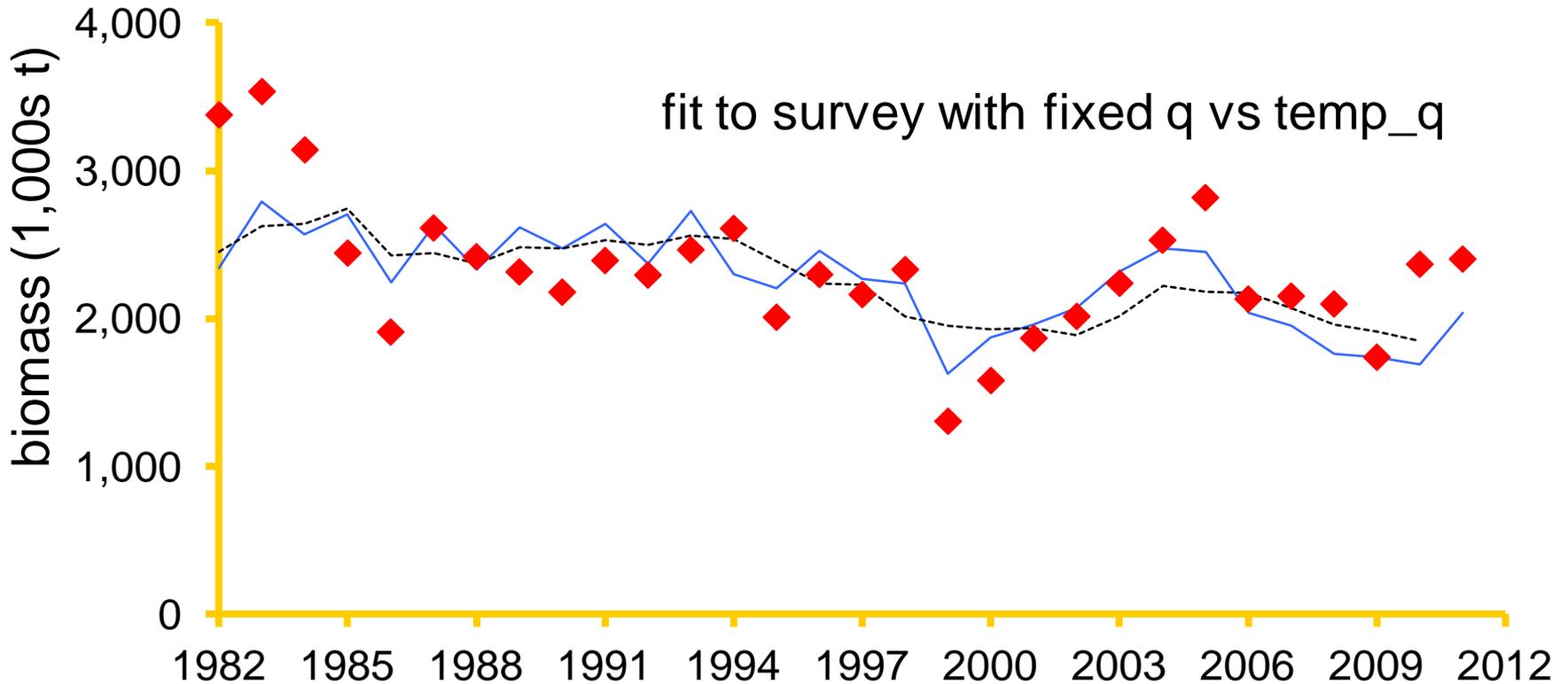
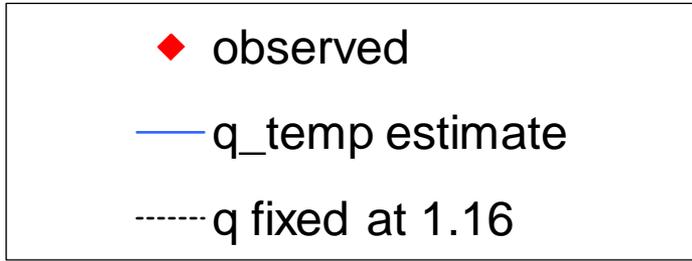
- × 0
- 0 - 5
- 5 - 25
- 25 - 70
- > 70



Yellowfin sole survey age composition



Yellowfin sole



**Major success that survey data
can account for environmental conditions**

$$q = e^{\alpha + \beta T}$$

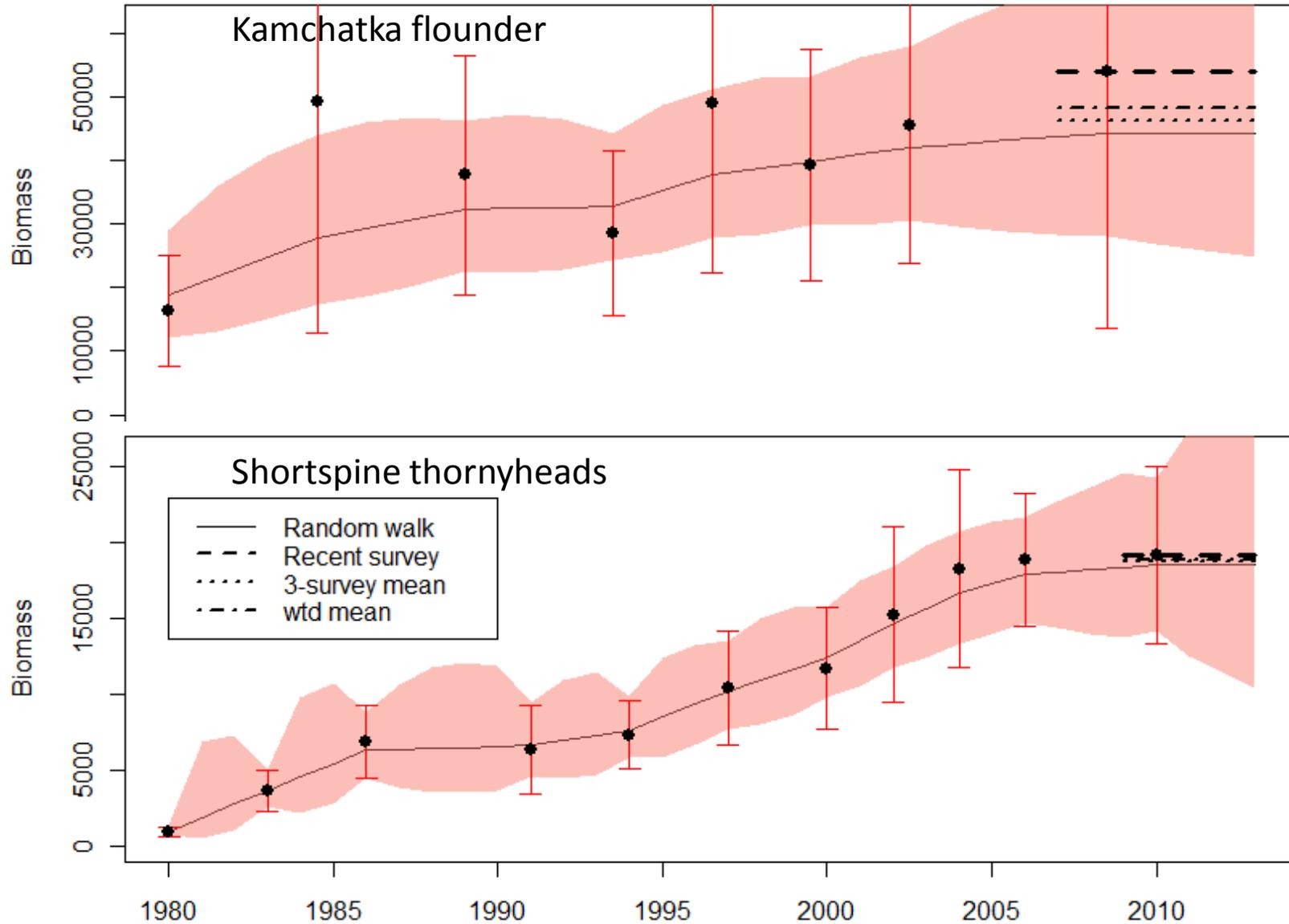
BSAI stocks by FMP Tier

Bering Sea Aleutian Islands						
Tier:	1	2	3	4	5	6
Number of stocks	3	0	12	0	7	3
Biomass estimation method						
NA	3		11			3
Average			1		3	
Weighted average					1	
Kalman filter					1	
Most recent					2	
Proportion estimation method						
NA	3		7		6	3
Average			1			
Weighted average			4		1	

GOA stocks by FMP Tier

Gulf of Alaska						
Tier	1	2	3	4	5	6
Number of stocks	0	0	9	2	11	5
Biomass estimation method						
NA			9			5
Average				1	7	
Most recent				1	3	
Mature biomass					1	
Proportion estimation method						
NA				1	3	4
Average			2		2	
Weighted average			4	1	2	
Most recent			3		4	
Historical catch						1

Survey averaging approach



Challenge to use available information in a timely, appropriate way

GOA Rockfish Issues

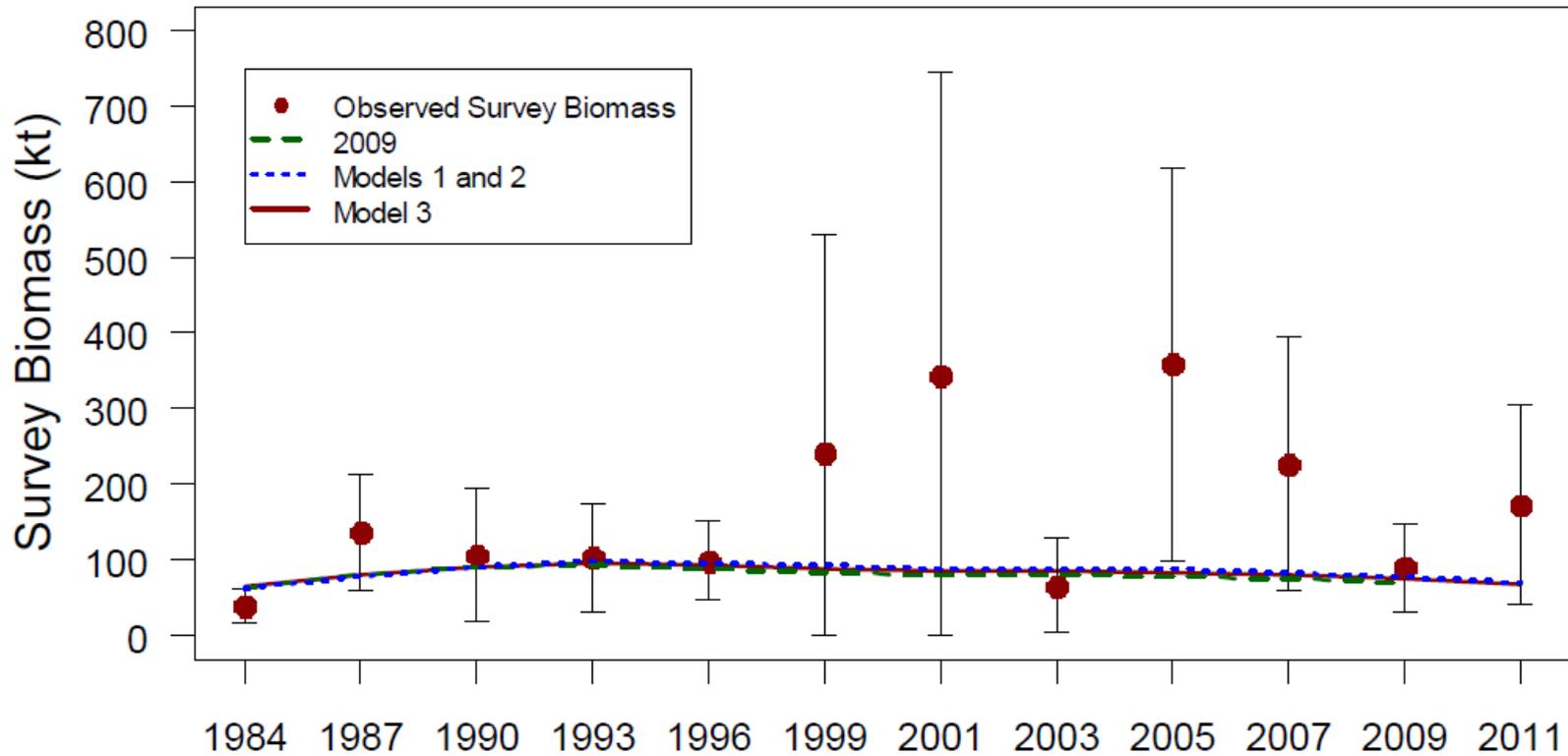
- Rockfish assessments are diverse
(8 assessments)
 - POP is a single species age-structured assessment and target fishery 15,000t
 - Other rockfish complex has 17 species on bycatch only status based on reliable survey biomass

GOA Rockfish Issues

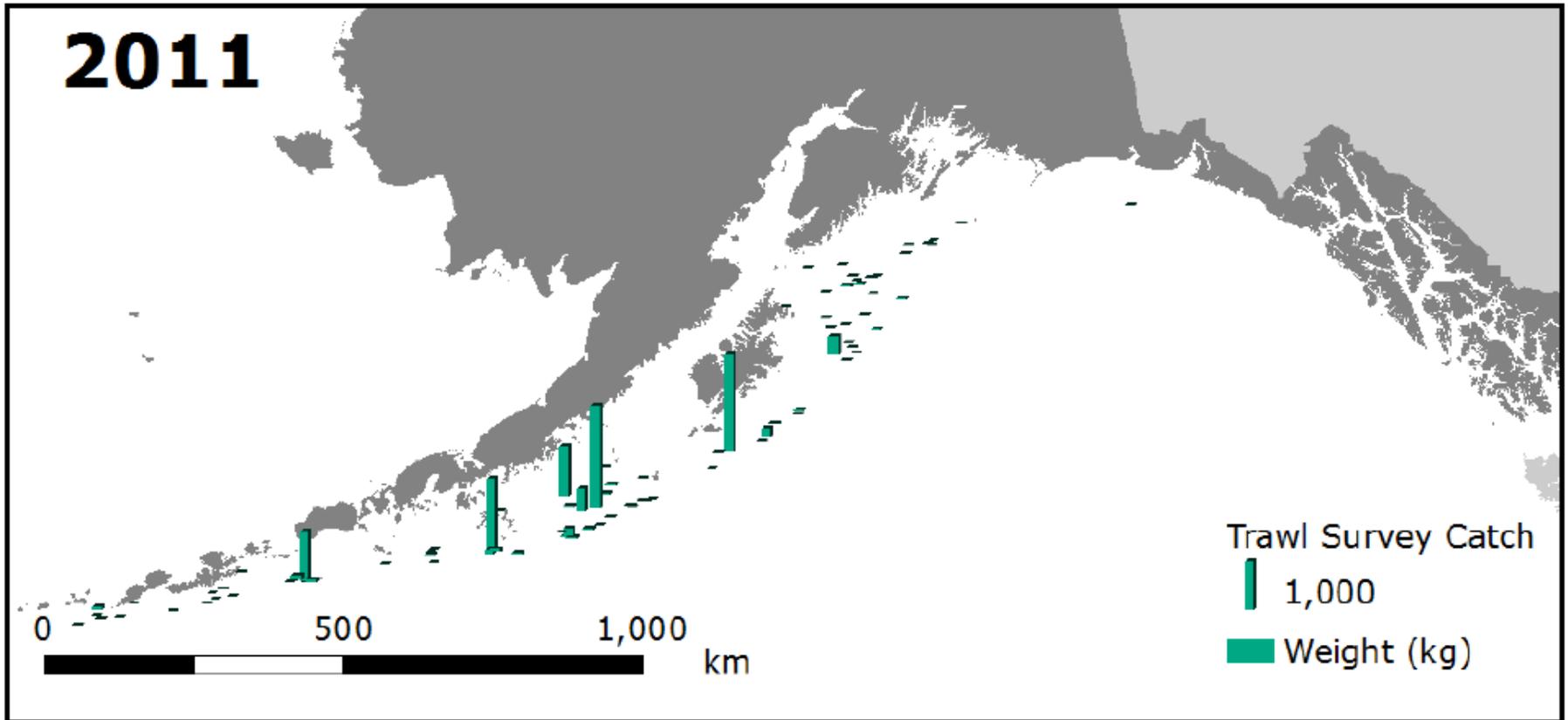
- Fishery Independent Data (Surveys)
 - Trawl survey
 - trawlable /untrawlable issues
 - High variability in survey estimates
 - Reduction in survey effort affects precision
 - Minor species grouped into complexes may be more prevalent in untrawlable habitat

Example: Northern rockfish (NR)

Survey uncertainty



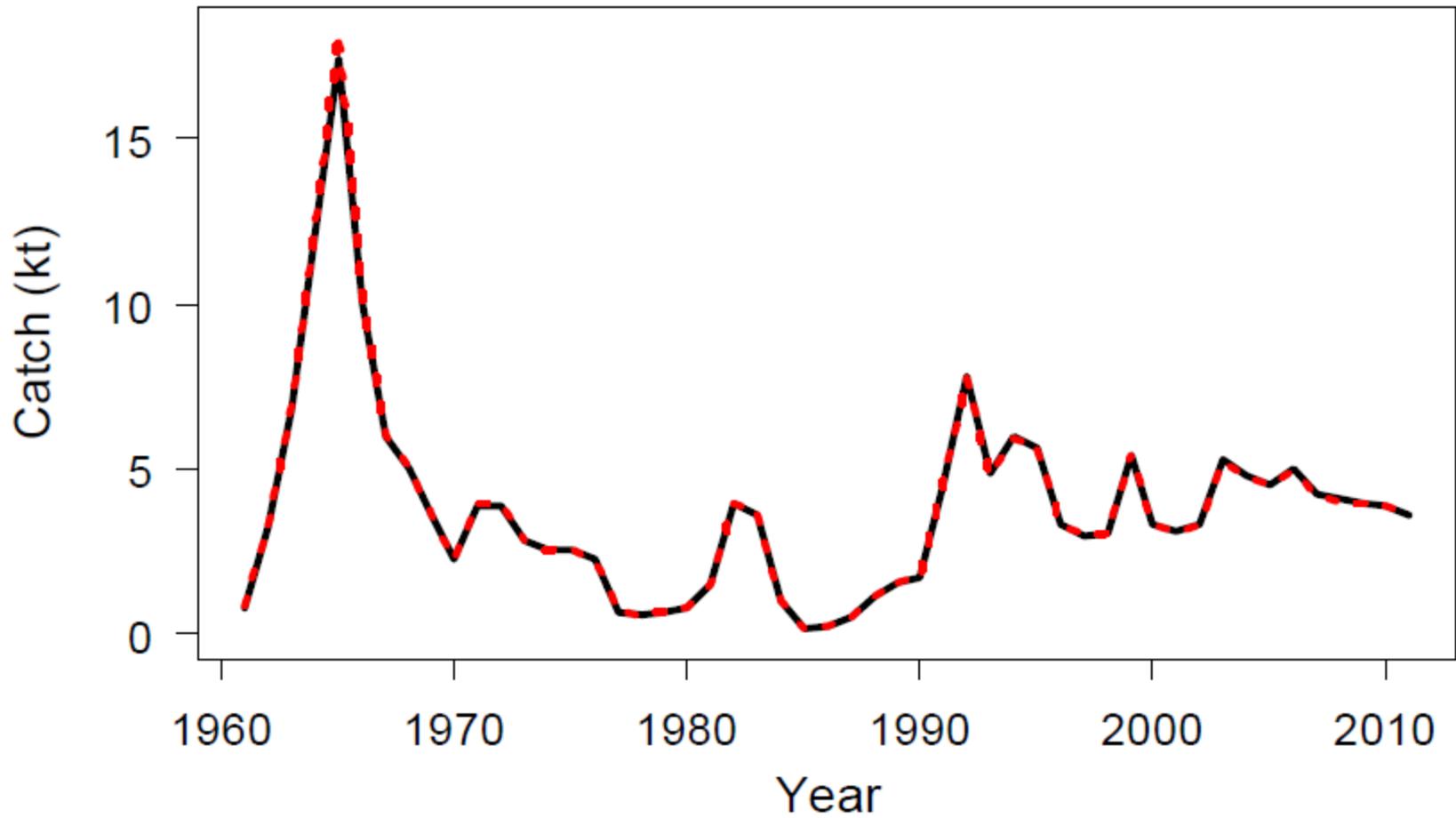
Example: NR patchy distribution



GOA Rockfish Issues

- Fishery Dependent Data (Observer)
 - Good observer coverage – CGOA rockfish plan
 - Numerous species for observer collections (age/length)
 - Catch accounting extrapolations for minor species
 - Historical catches uncertain

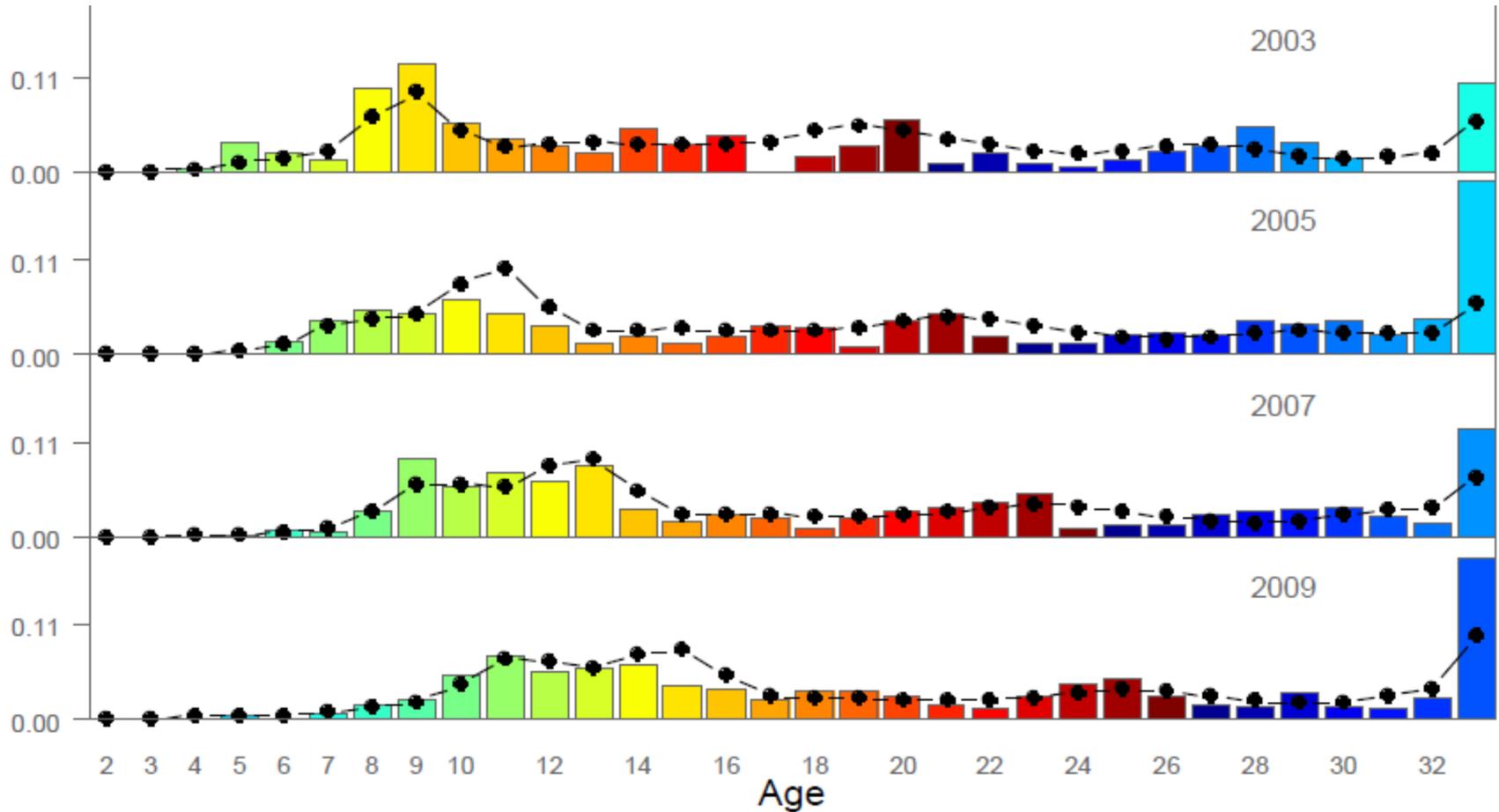
Example: NR Catch



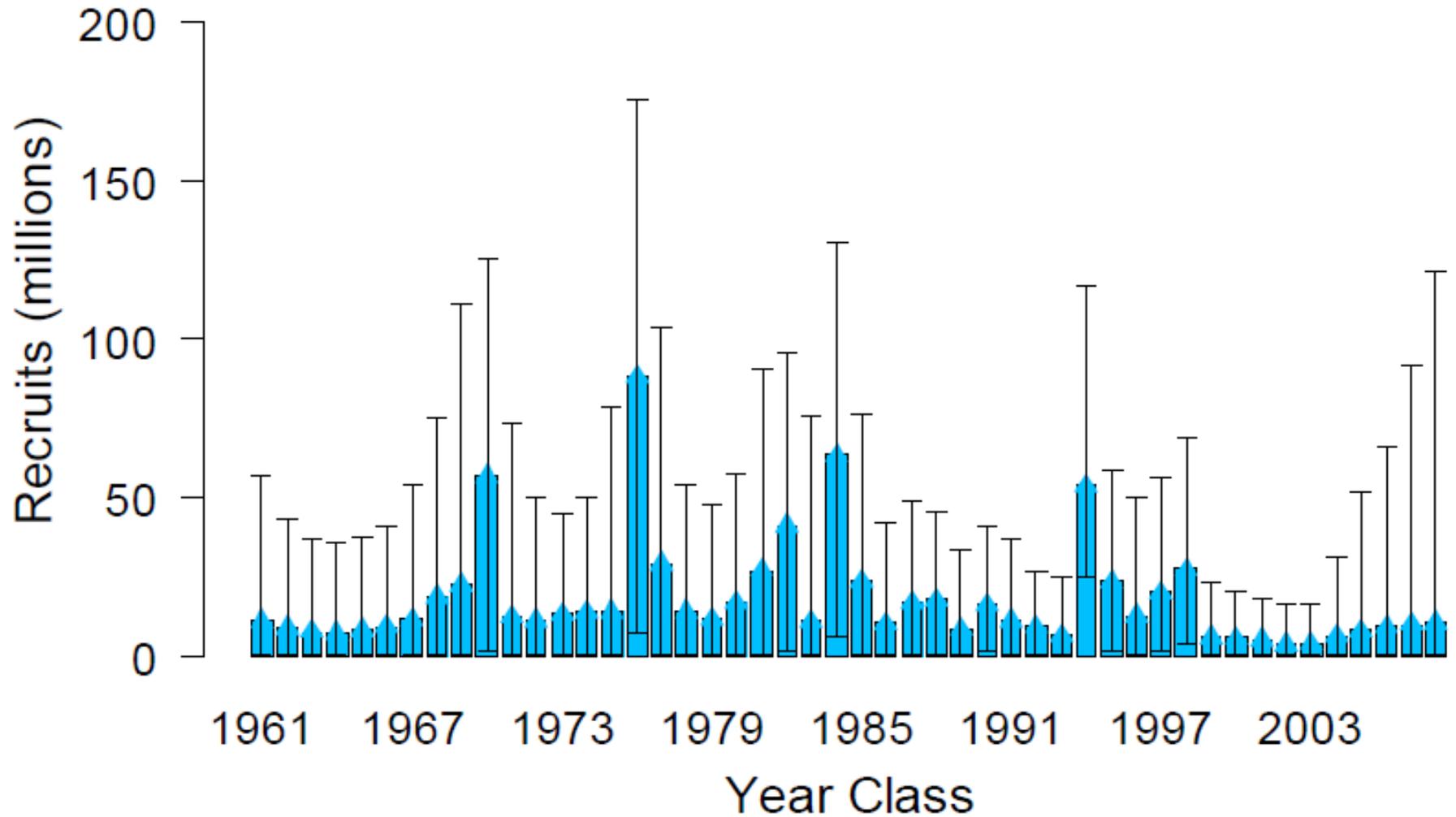
GOA Rockfish Issues

- Fishery Dependent and Independent Data (Biological data)
 - Aging
 - Difficult to age – time consuming and experience needed
 - Bottleneck in numbers that can be aged
 - Numerous species and assessments
 - Increasing demands as assessments expand
 - Maturity
 - Many age at maturity estimates based on little data

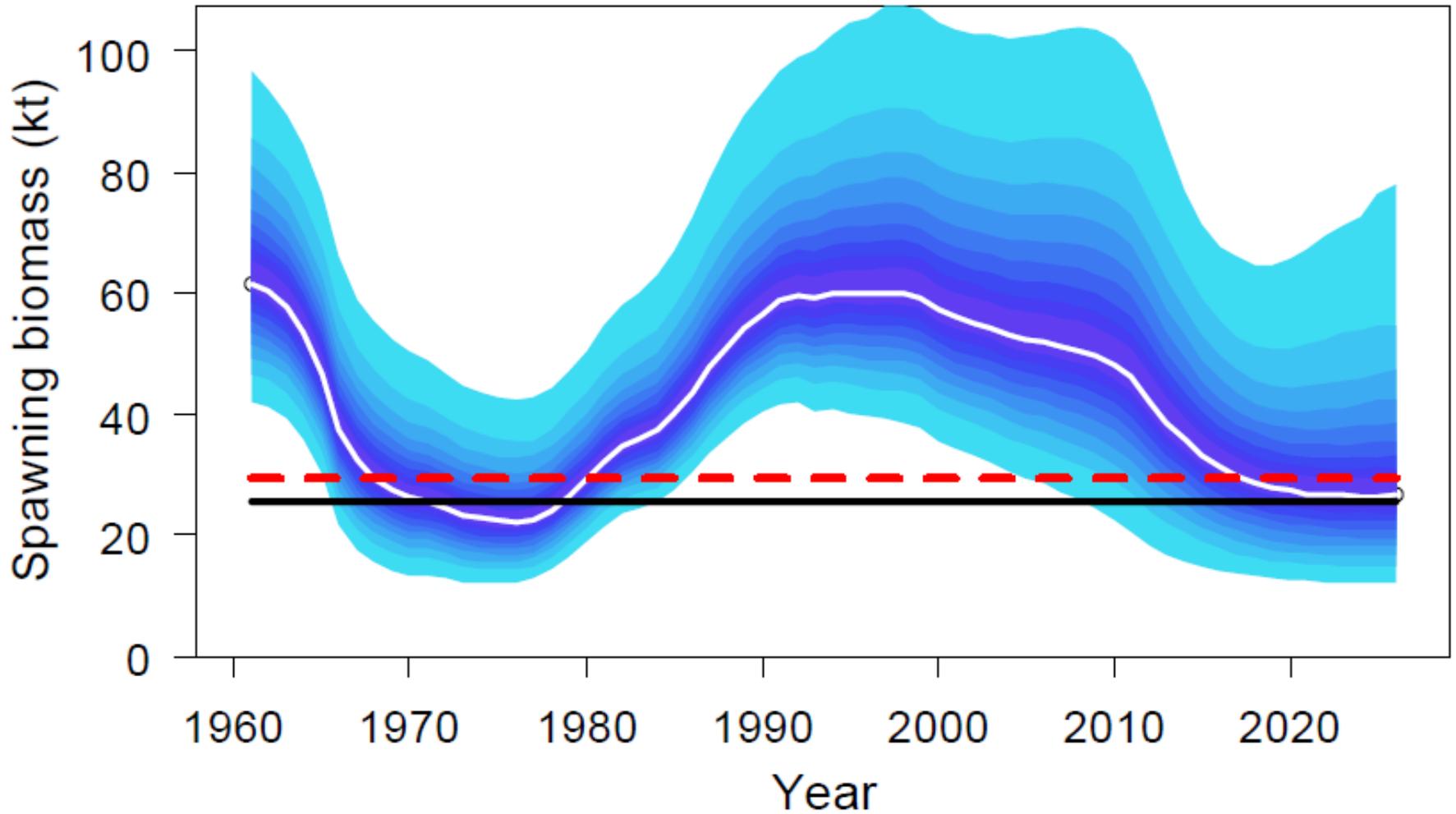
Example: NR age composition



Example: NR Recruitment uncertainty



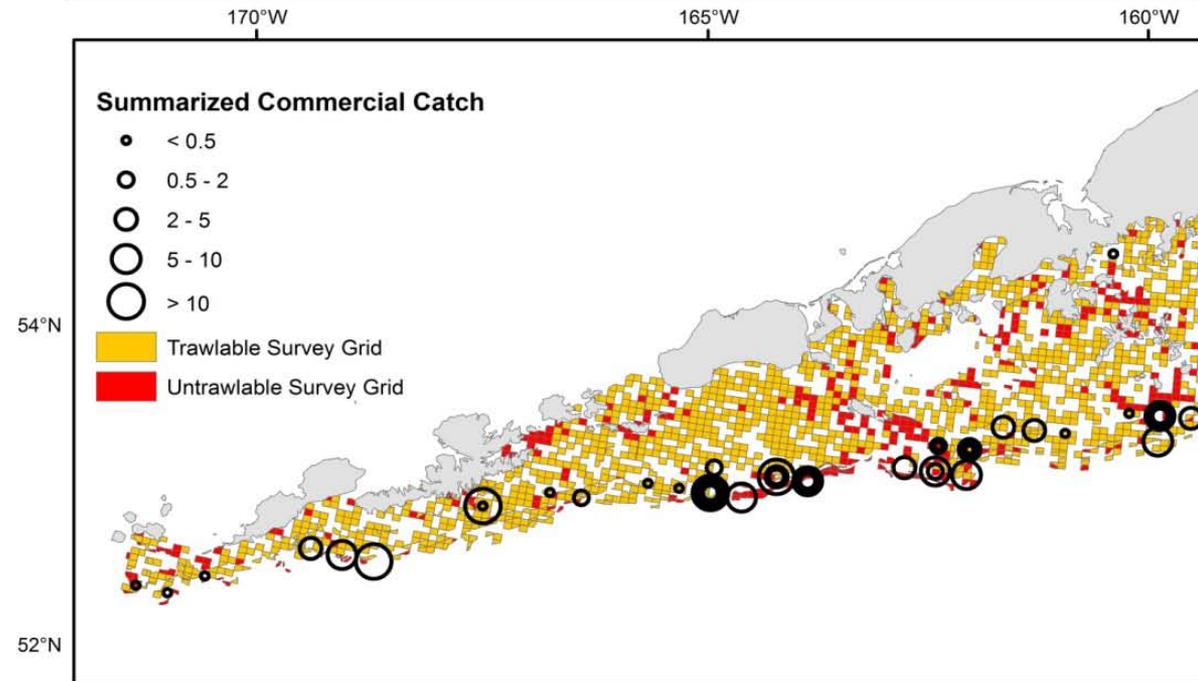
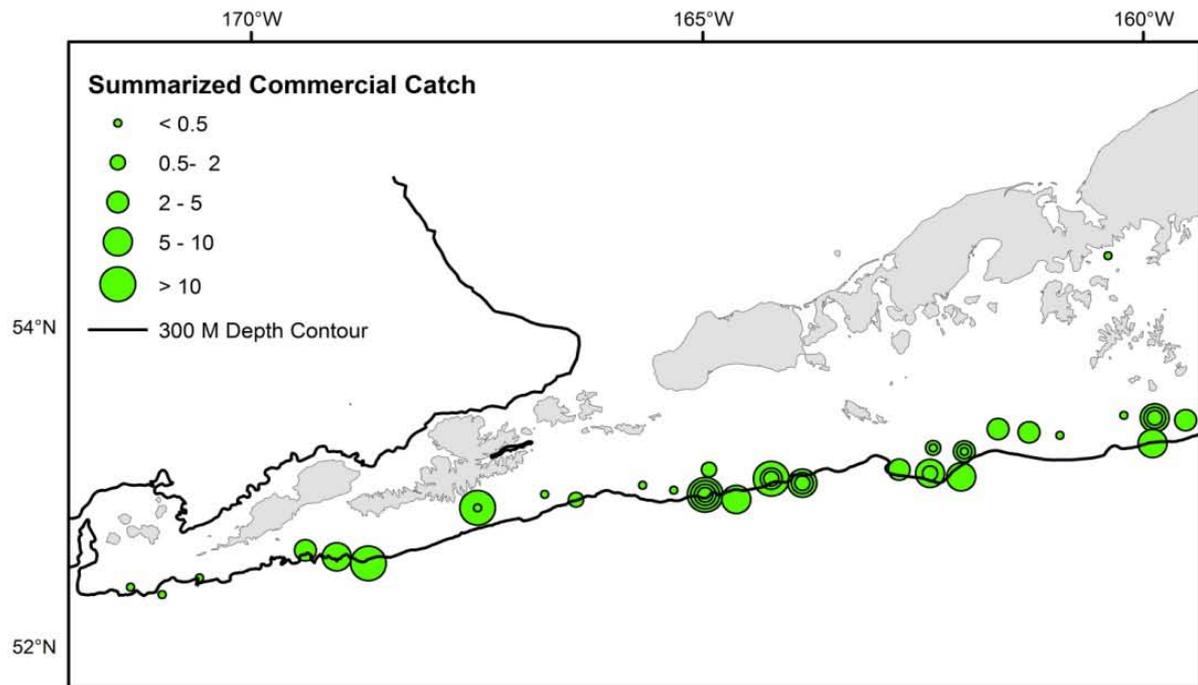
Example: NR Model uncertainty



GOA Rockfish Issues

- Harlequin rockfish example
 - Part of other rockfish (OR) complex – 17 species
 - Caught as bycatch in rockfish fishery
 - Low survey biomass (4% of OR complex)
 - Trawlable/untrawlable?
 - Prominent in commercial rockfish fishery (35% of OR complex)
 - Fishing in survey “untrawlable” grounds?
 - Harlequin proportion of other rockfish ABC exceeded
 - Rockfish fishery constrained – exceeded TAC

Harlequin catch vs survey untrawlable grid



GOA Rockfish Issues

- Rockfish estimates have high uncertainty
 - Limited aging capabilities
 - poor survey coverage and performance
 - Potential trawlable/untrawlable trawl survey issues
 - Management of minor species lumped in complexes difficult
- Rockfish would likely have biggest buffer of AK stocks if managed on an uncertainty based ABC

Extras!

Overarching Questions for Reviewers

- Relationship of current and planned fishery assessment data activities to Center fishery assessments mandates and requirements
 - Is the Center doing the right things?
- Opportunities
 - are there opportunities that the Center should be pursuing in collecting and compiling fishery assessment data, including shared approaches with partners?
- Scientific/technical approach
 - are the Center's fishery data objectives adequate, and is the Center using the best suite of techniques and approaches to meet those objectives?
- Organization and priorities
 - Is the Center's fishery data system properly organized to meet its mandates and is the allocation of resources among program appropriate?
- Scientific conduct
 - are the Center's fishery data programs being conducted properly (survey design, standardization, integrity, peer review, transparency, confidentiality, PII, etc.)?

Area	Stock	Tier	Biomass	Proportions
BSAI	Pacific cod	3	Scaled to BSAI w/ KF	NA
AK	Sablefish	3	NA	5 year wtd avg srvy & fshry
BSAI	Greenland Turbot	3	NA	Most recent three
BSAI	POP	3	NA	4-6-9 weighting by subarea
BSAI	Rougeye/BS	3	NA	4-6-9 weighting by subarea
BSAI	Alaska skate	3	NA	NA
BSAI	Atka mackerel	3	NA	8-12-18-27 weighting
BSAI	Kamchatka	5	7-year average	NA
Bogo	Pollock	5	Most recent	NA
BSAI	Other flatfish	5	Most recent	NA
BSAI	Shortraker rockfish	5	Kalman filter	NA
BSAI	other rockfish	5	4-6-9 weighting	4-6-9 weighting
BSAI	other skates	5	Most recent three	NA
BSAI	sculpins	5	Most recent three	NA
GOA	pollock	3	NA	4 most recent average
GOA	Pacific cod	3	NA	3 most recent average
GOA	Arrowtooth	3	NA	Most recent
GOA	flathead sole	3	NA	Most recent
GOA	northern rockfish	3	NA	4-6-9 weighting
GOA	Pel. shelf rockfish (dusky)	3	NA	4-6-9 weighting
GOA	POP	3	NA	4-6-9 weighting
GOA	RE/BS rockfish	3	NA	4-6-9 weighting
GOA	Shallow flats N, S rock sole	3	NA	Most recent

Area	Stock	Tier	Biomass	Proportions
GOA	Pollock	3	NA	4 most recent average
GOA	Pacific cod	3	NA	3 most recent average
GOA	Arrowtooth	3	NA	Most recent
GOA	flathead sole	3	NA	Most recent
GOA	northern rockfish	3	NA	4-6-9 weighting
GOA	Pel. shelf rockfish (dusky)	3	NA	4-6-9 weighting
GOA	POP	3	NA	4-6-9 weighting
GOA	RE/BS rockfish	3	NA	4-6-9 weighting
GOA	Shallow flats N, S rock sole	3	NA	Most recent
GOA	Demersal shelf	4	Most recent	NA
GOA	Other rockfish – sharpchin	4	Most recent three	4-6-9 weighting
GOA	Big skate	5	Most recent three	Most recent three
GOA	deep flats Dover sole	5	most recent	Most recent (dover)
GOA	longnose skate	5	Most recent three	Most recent three
GOA	Oher rockfish - other	5	Most recent three	4-6-9 weighting
GOA	Other skates	5	Most recent three	NA
GOA	rex sole	5	Mature biomass	Most recent
GOA	Sculpins	5	Most recent four	NA
GOA	shallow flats - others	5	Most recent	Most recent
GOA	Sharks - spiny dogfish	5	Most recent three	NA
GOA	shortraker rockfish	5	Most recent three	4-6-9 weighting
GOA	Thornyhead	5	Most recent	Most recent
GOA	Atka mackerel	6	NA	NA