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Trends in Indices of Abundance used in Dusky and Sandbar Shark Stock Assessments

September 6, 2018



Issue / Question

- Compare trends in relative abundance of dusky and sandbar sharks before and after the implementation of the Shark Research Fishery (starting in 2008)



Approach

- Compute some simple correlations for the two periods to examine trends

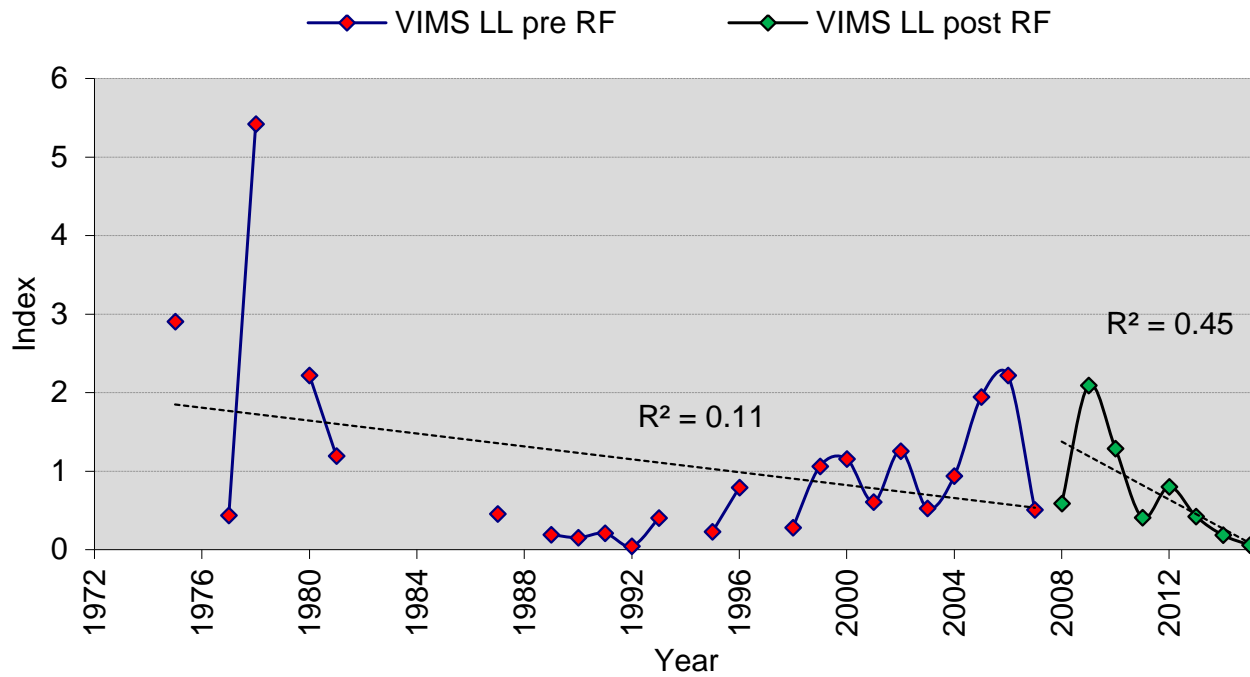


Indices Used

- *Dusky shark*:
 - VIMS LL (fishery-independent; 1975-2015, n=31)
 - PLLOP (commercial; 1992-2015, n=24)
 - NE LL (fishery-independent; 1996-2015, n=8)
 - BLLOP (commercial; 1994-2015, n=22) (already split)
 - LPS (recreational; 1986-2015, n=30)

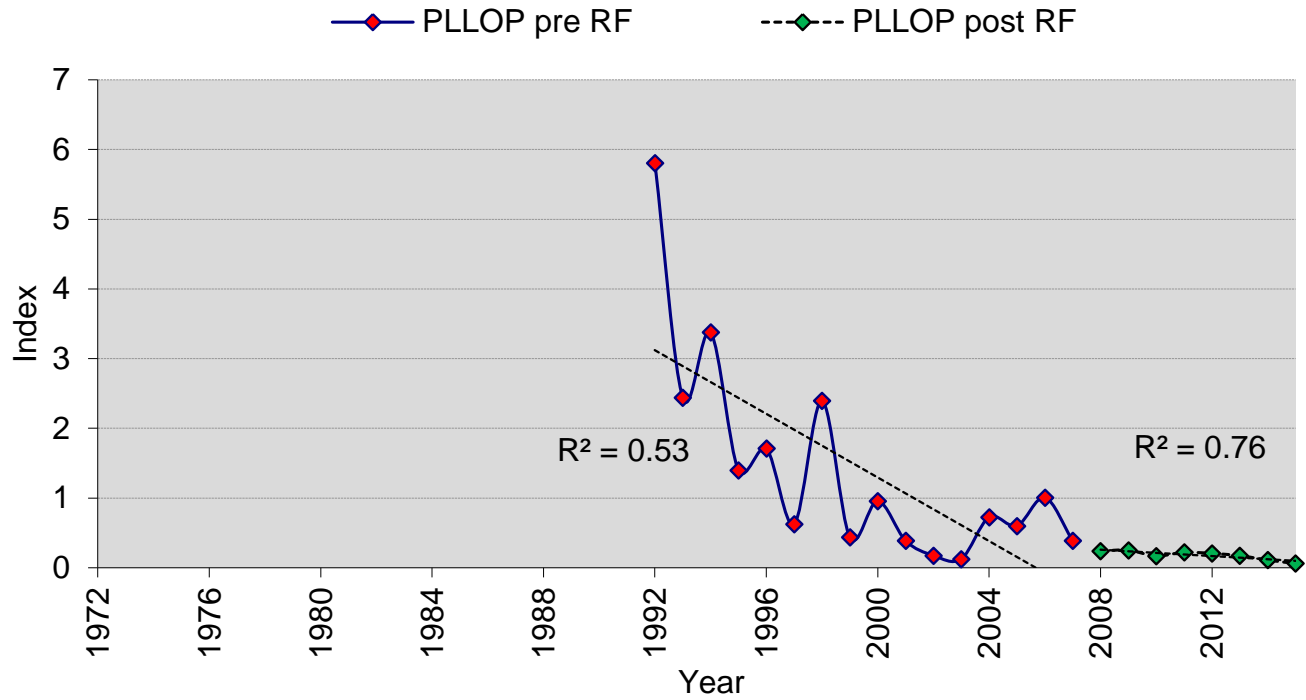


Dusky indices: VIMS LL



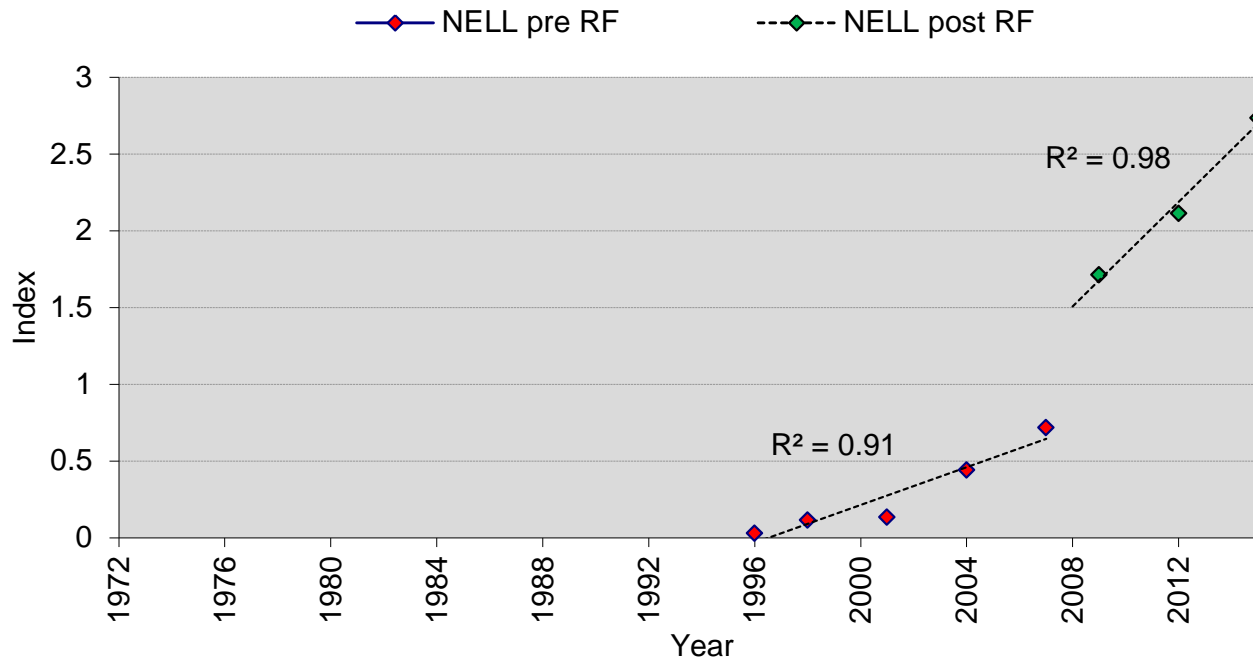


Dusky indices: PLLOP



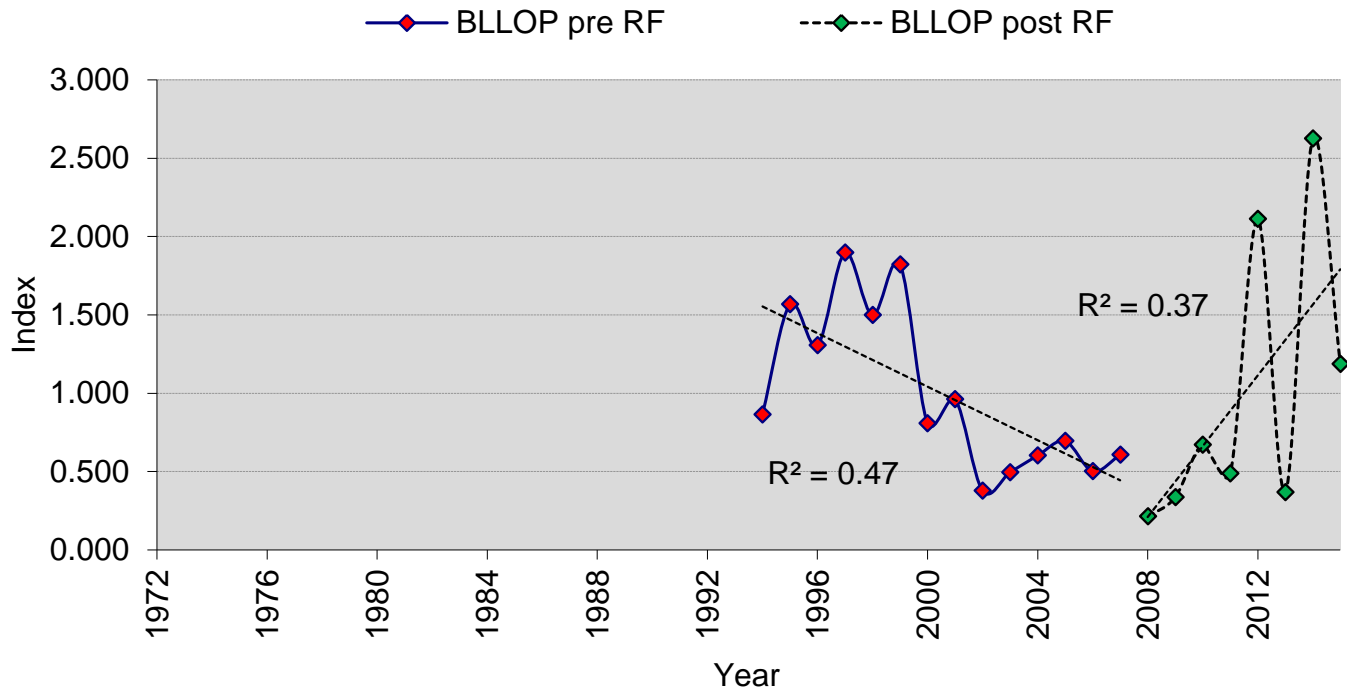


Dusky indices: NELL



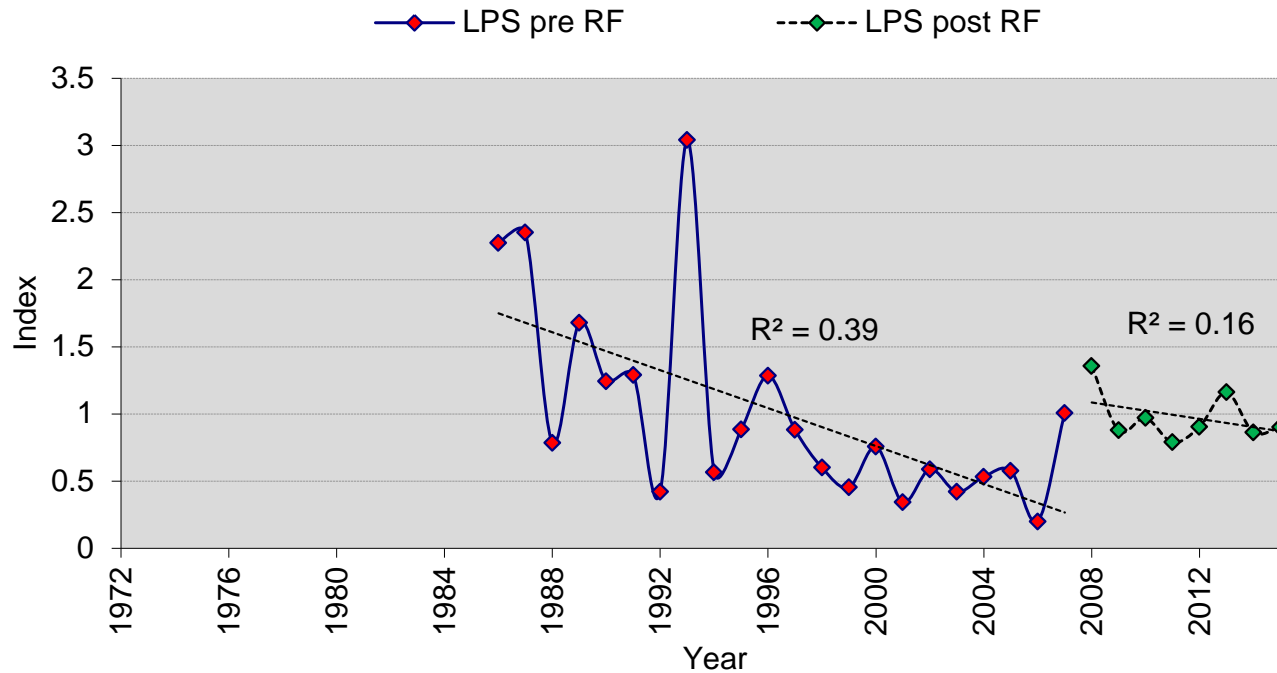


Dusky indices: BLLOP



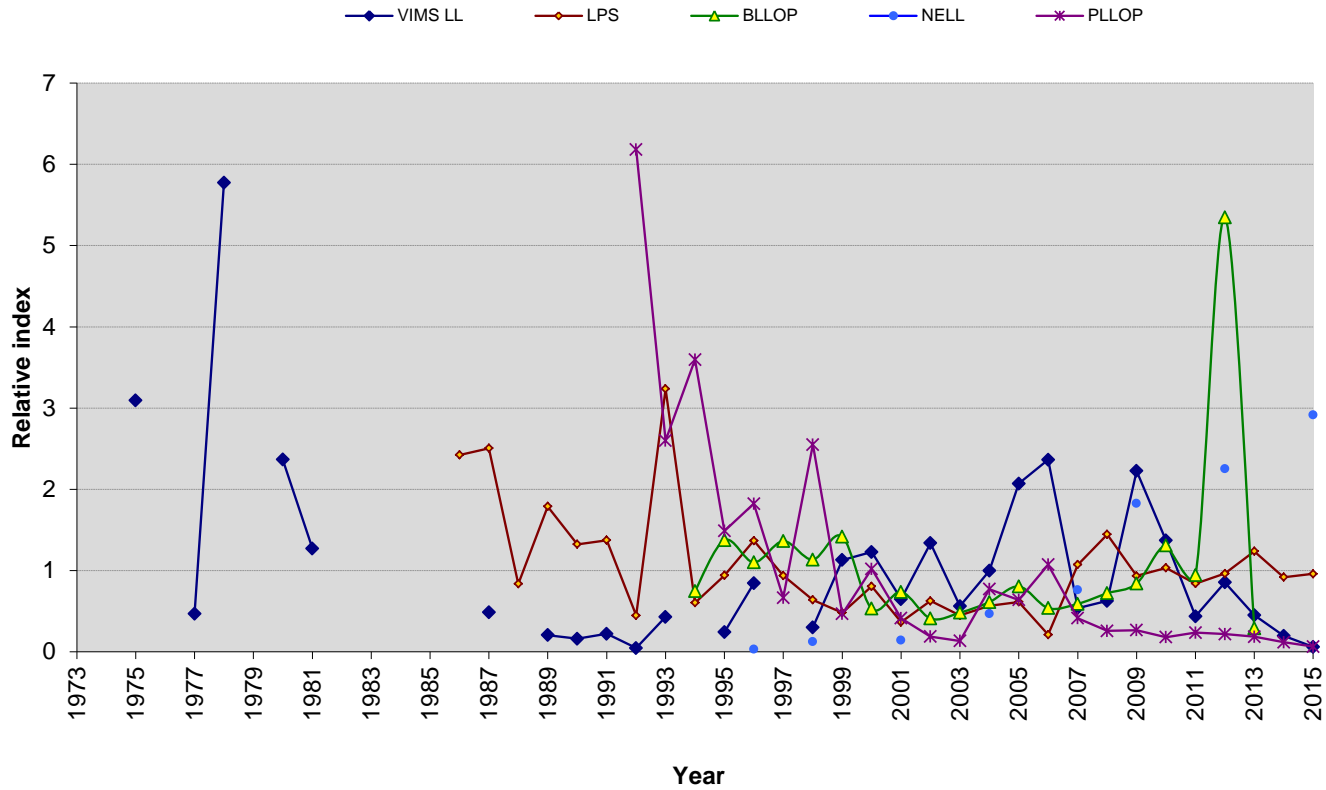


Dusky indices: LPS





Dusky indices: combined

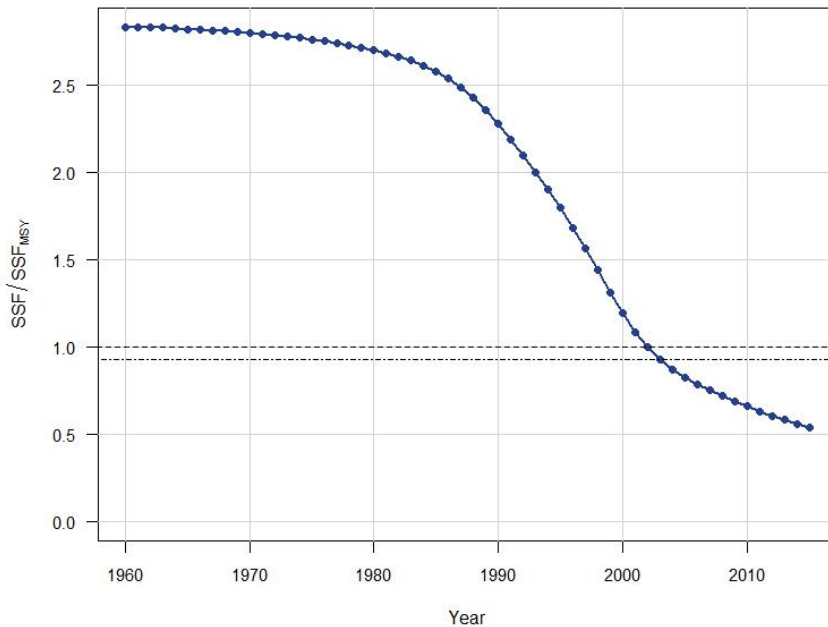


Trend analysis: Dusky

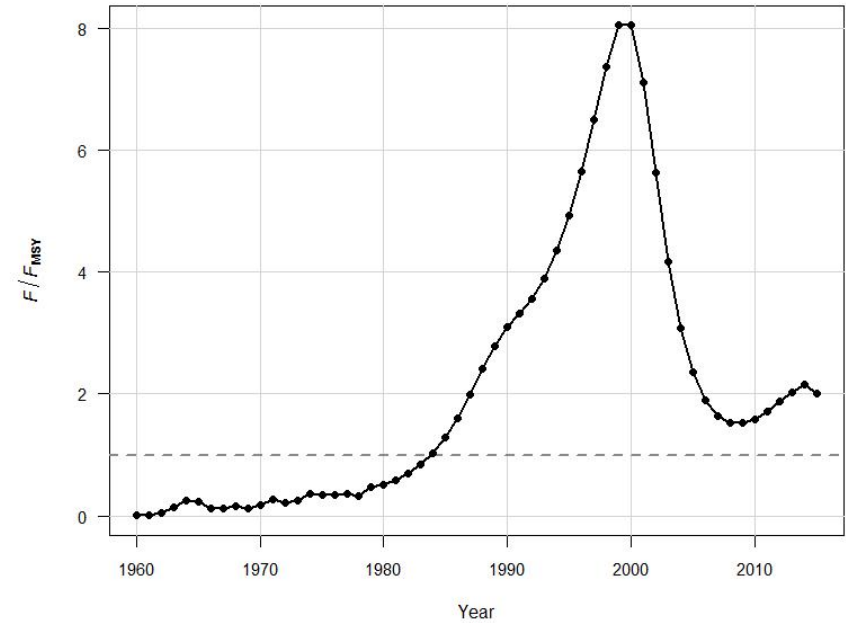
Index	Pre RF			Post RF		
	r^2	r	P value	r^2	r	P value
VIMS LL	0.11	-0.34	0.117	0.45	-0.67	0.067
PLLOP	0.53	-0.73	0.001	0.76	-0.87	0.005
NELL	0.91	0.95	0.012	0.98	0.99	0.080
BLLOP	0.47	-0.69	0.006	0.37	0.61	0.108
LPS	0.39	-0.62	0.002	0.16	-0.40	0.328



Dusky: relative biomass and fishing mortality trajectories



$SSF_{2015} / SSF_{MSY} = 0.50$
(overfished)



$F_{2015} / F_{MSY} = 1.12$
(overfishing)

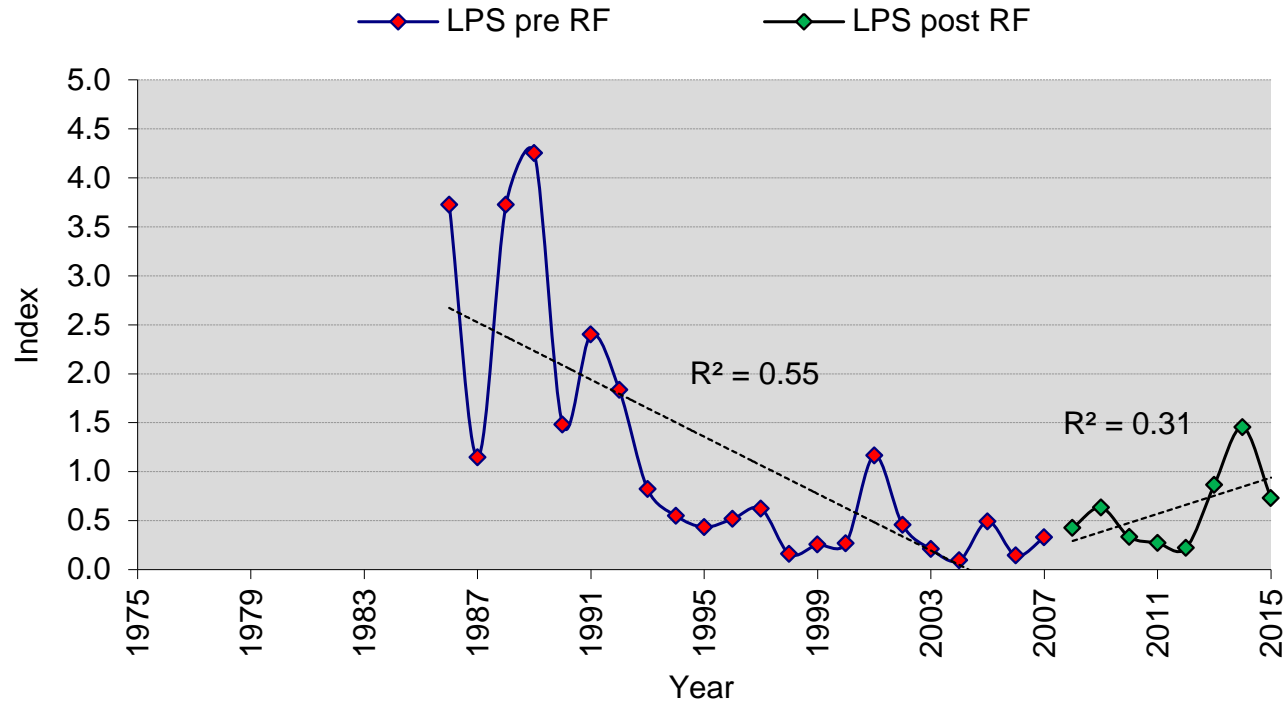


Indices Used

- *Sandbar shark*:
 - LPS (recreational; 1986-2015, n=30)
 - BLLOP (commercial; 1994-2015, n=22) (already split)
 - VIMS LL (fishery-independent; 1975-2015, n=29)
 - NMFS LL SE (fishery-independent; 1995-2015, n=20)
 - Coastspan NE LL (fishery-independent; 2001-2015, n=15)
 - NE LL (fishery-independent; 1996-2015, n=8)
 - PLLOP (commercial; 1992-2015, n=24)
 - Coastspan SE LL (fishery-independent; 2000-2015, n=16)
 - SC Red Drum LL (fishery-independent; 1998-2006, n=9)
 - SEAMAP LL SE (fishery-independent; 2007-2015, n=9)

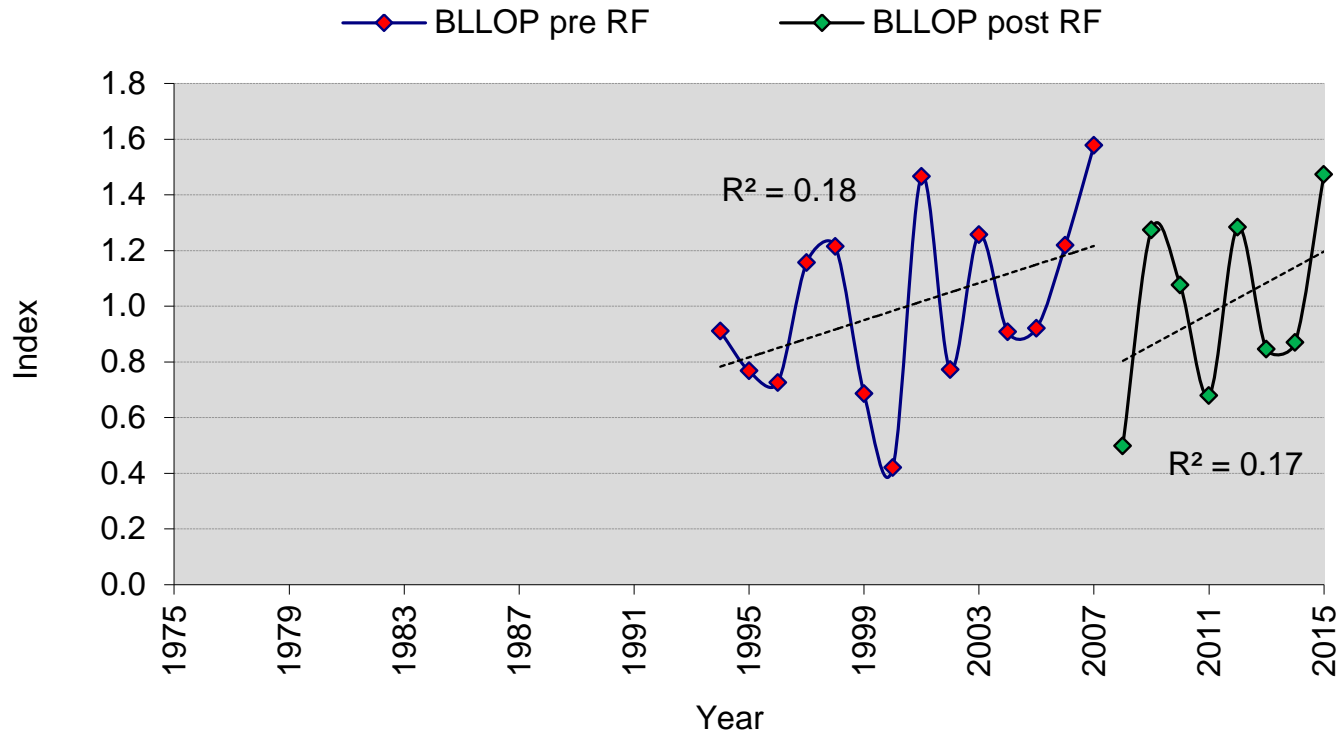


Sandbar indices: LPS



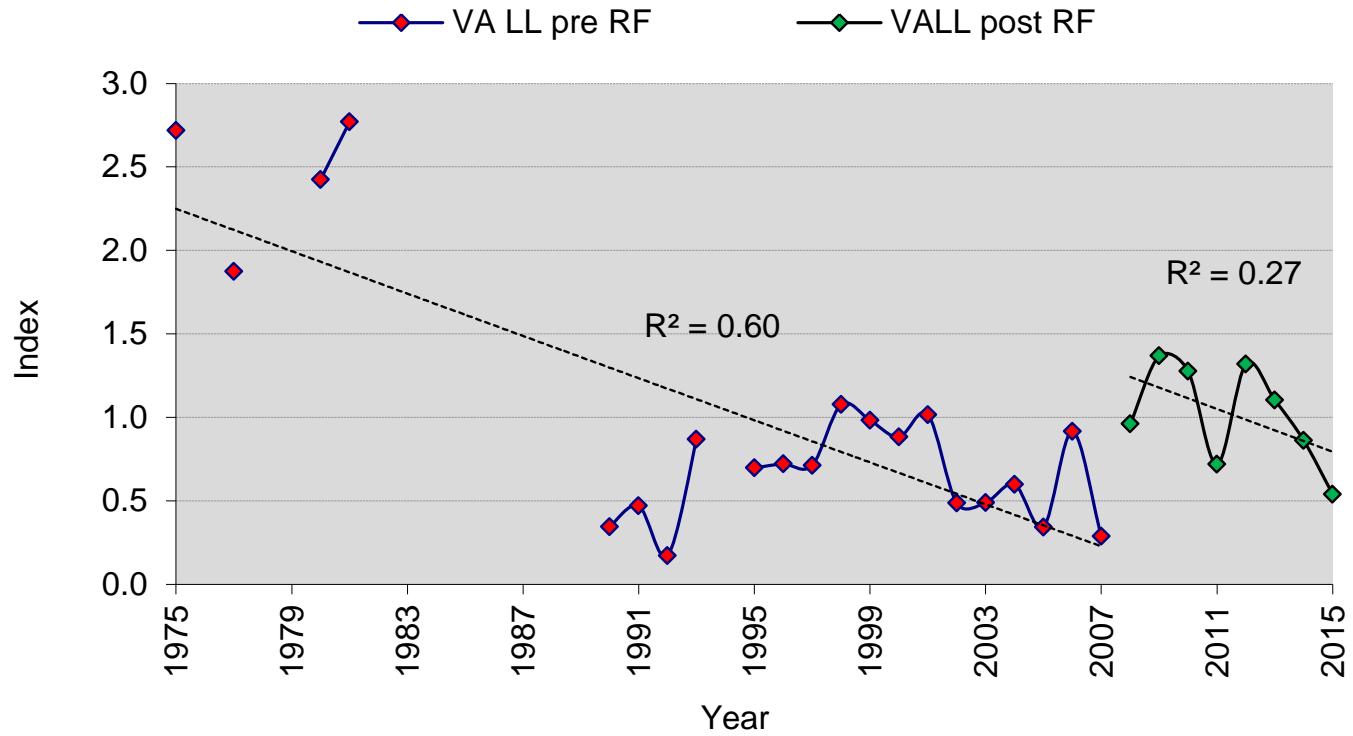


Sandbar indices: BLLOP



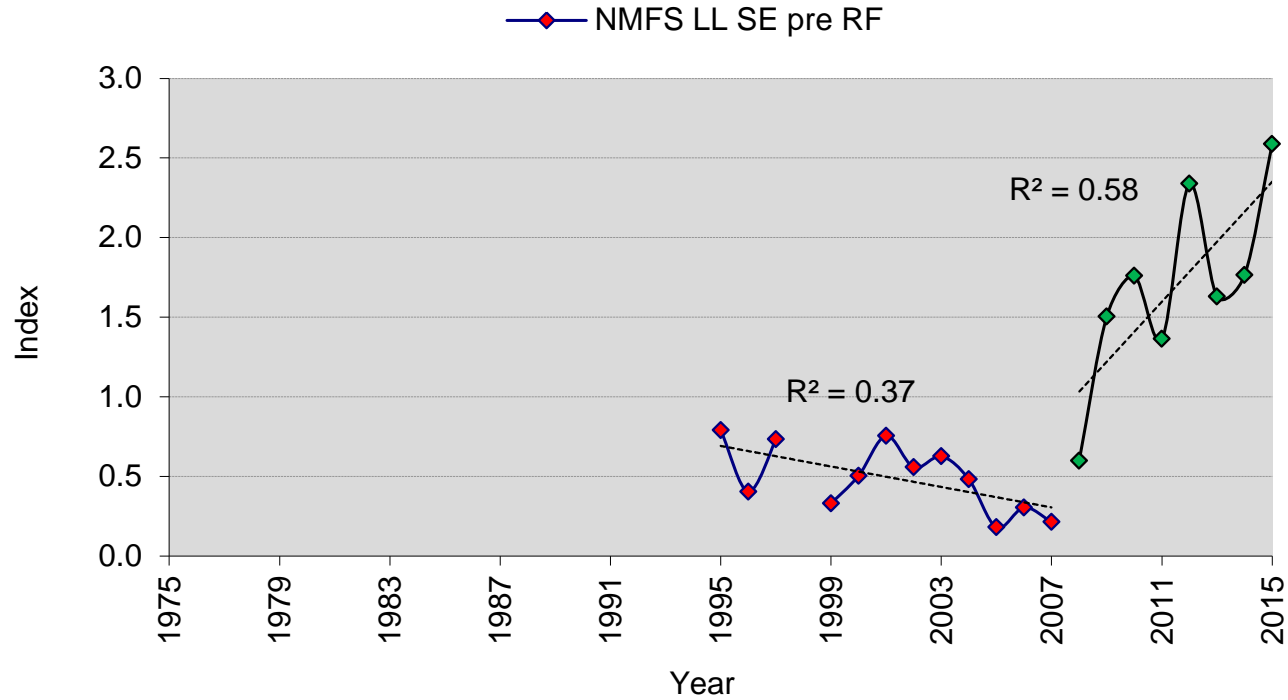


Sandbar indices: VALL



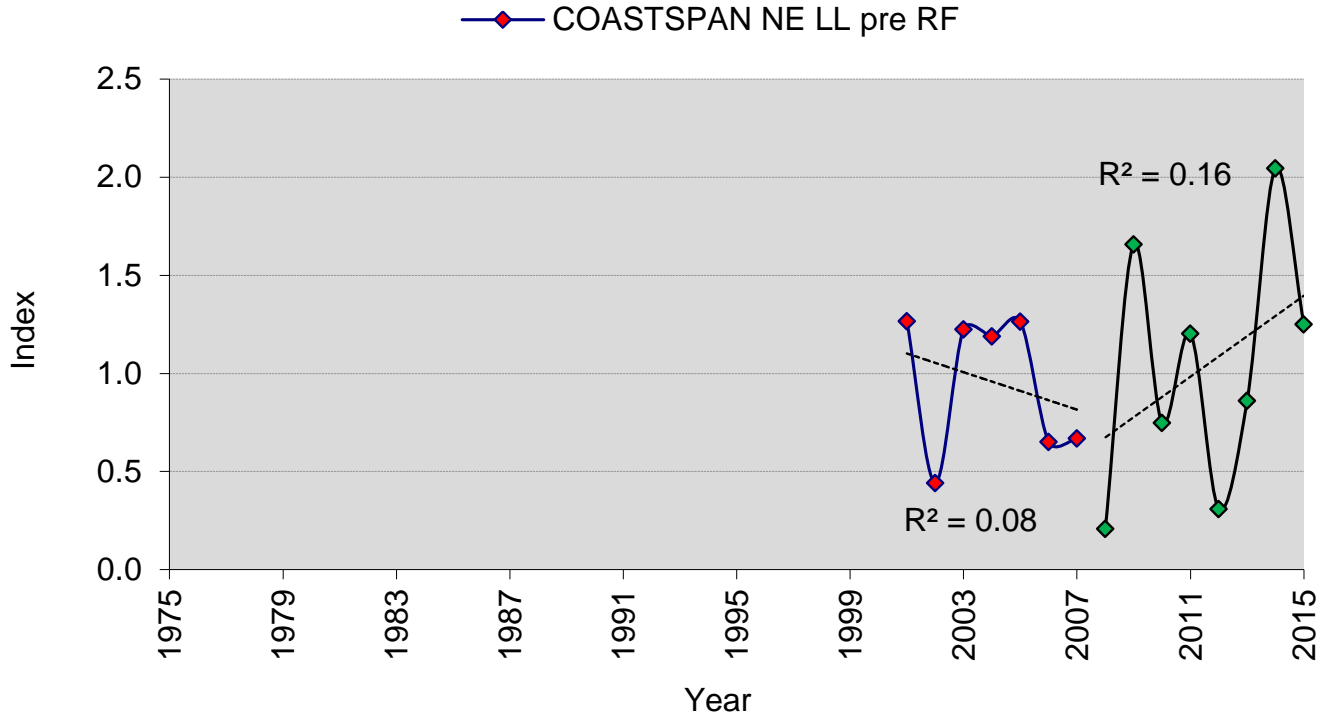


Sandbar indices: NMFS LL SE



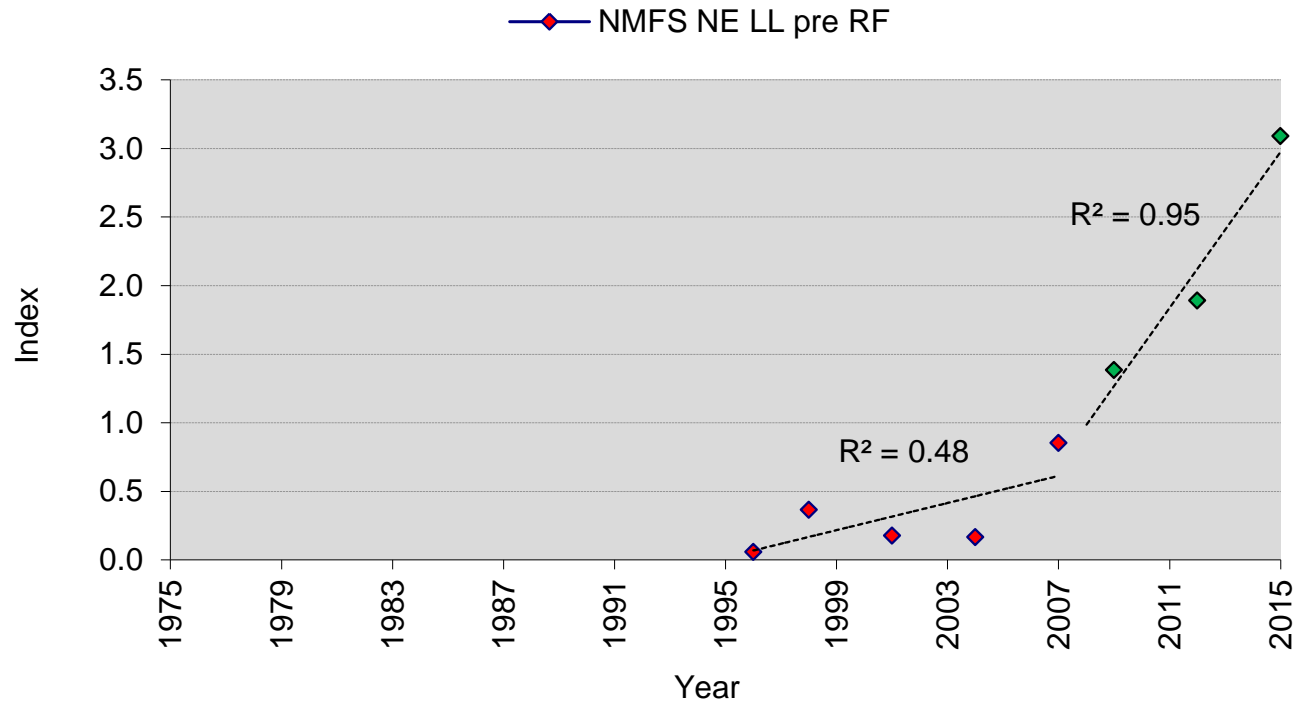


Sandbar indices: Coastspan NE LL



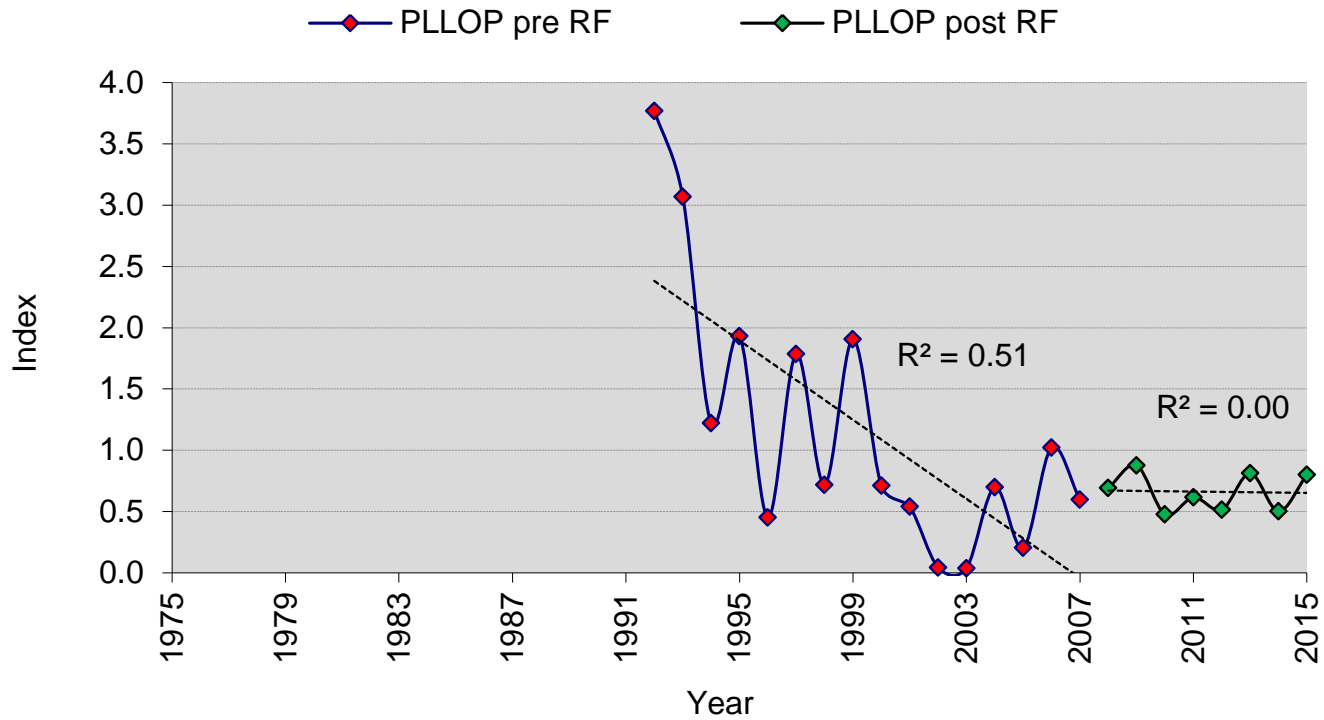


Sandbar indices: NMFS NE LL



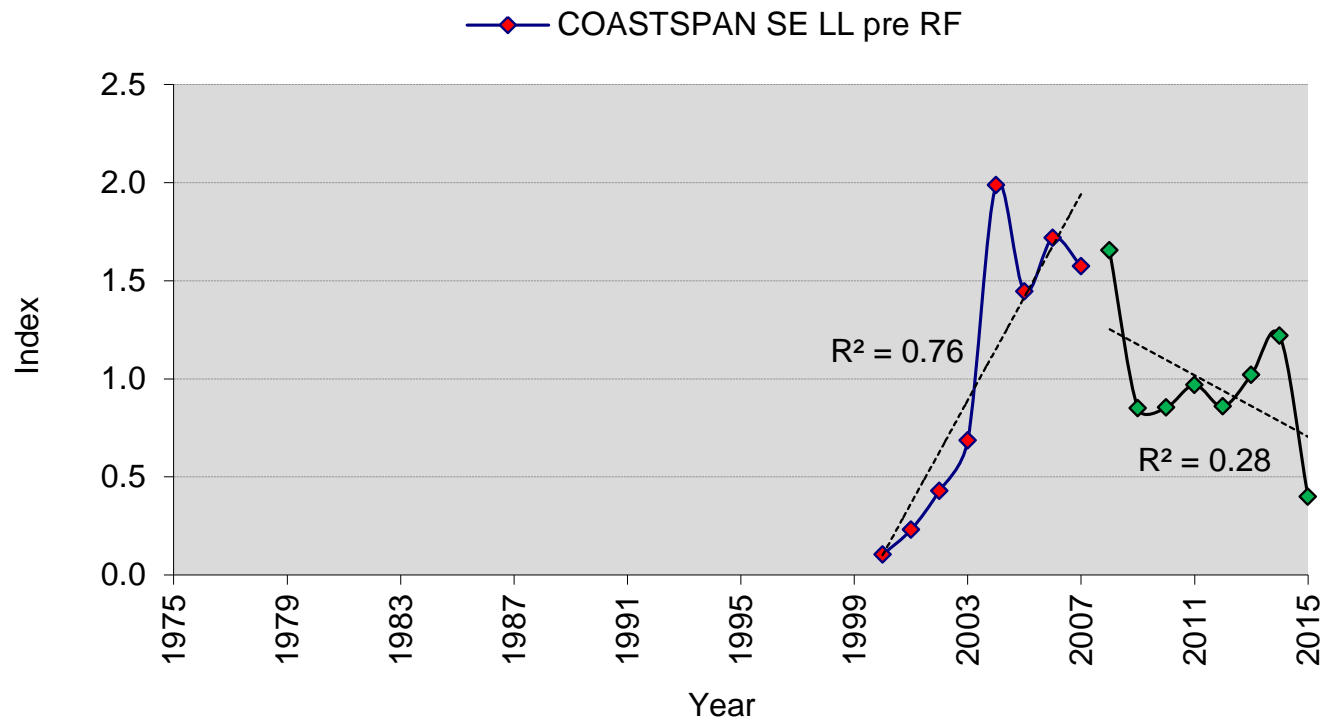


Sandbar indices: PLLOP



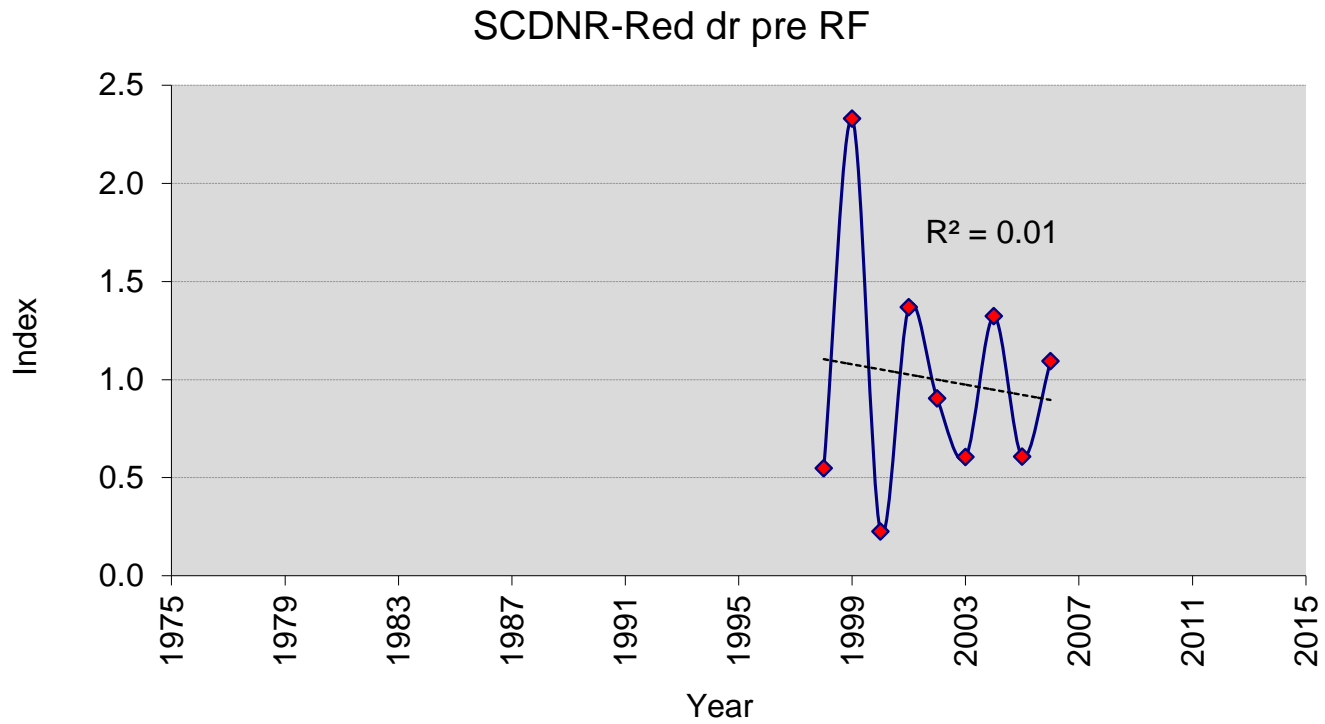


Sandbar indices: Coastspan SE LL



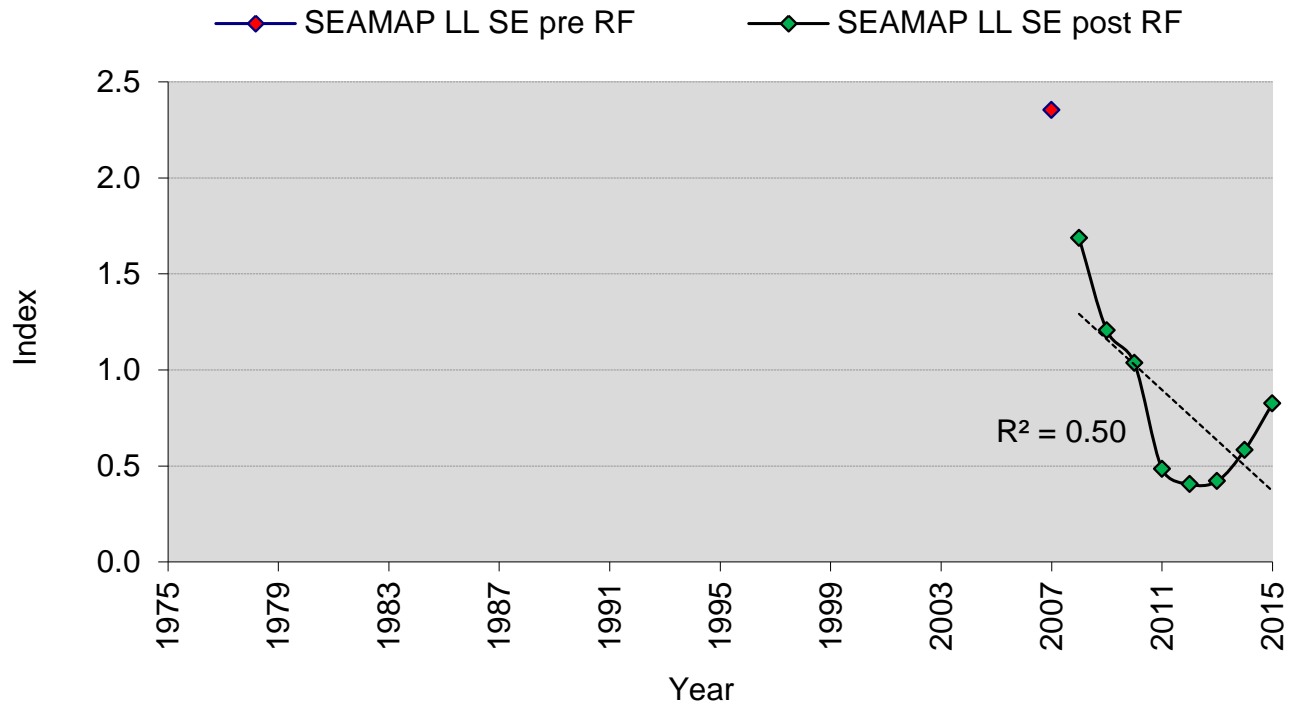


Sandbar indices: SC Red Drum LL



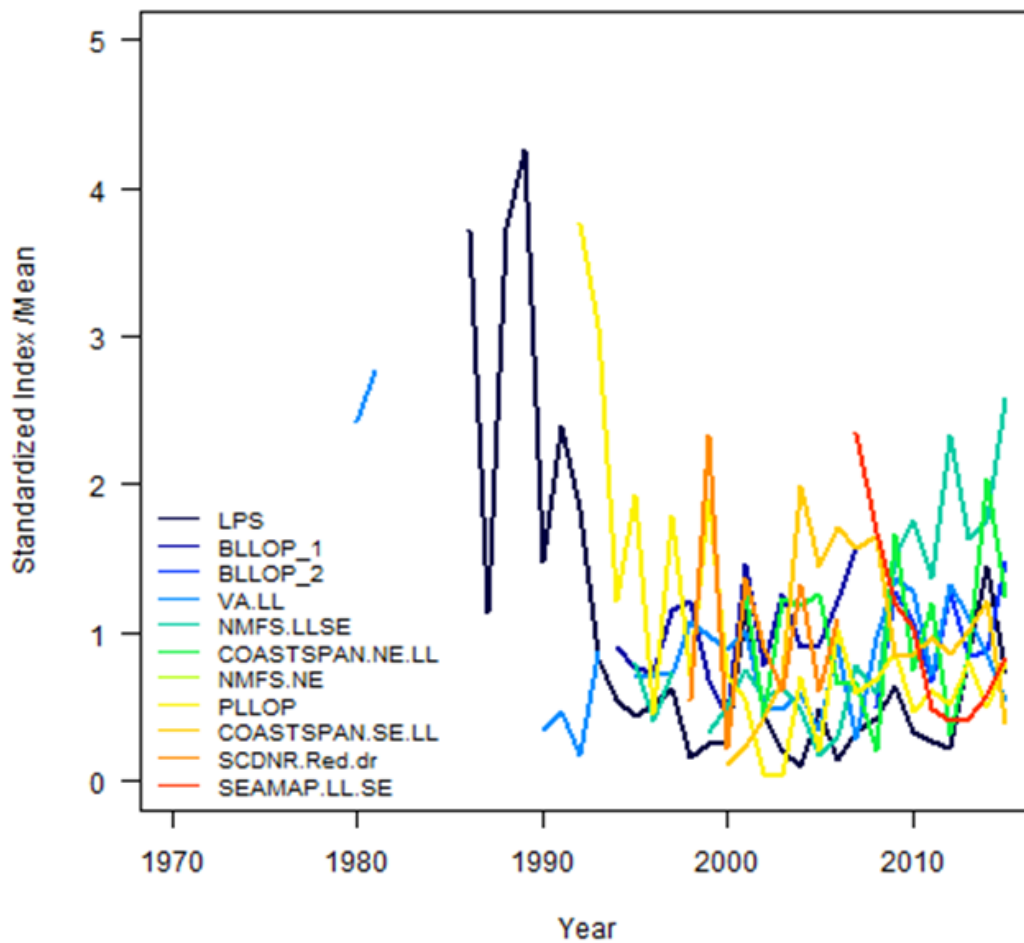


Sandbar indices: SEAMAP LL SE





Sandbar indices: combined

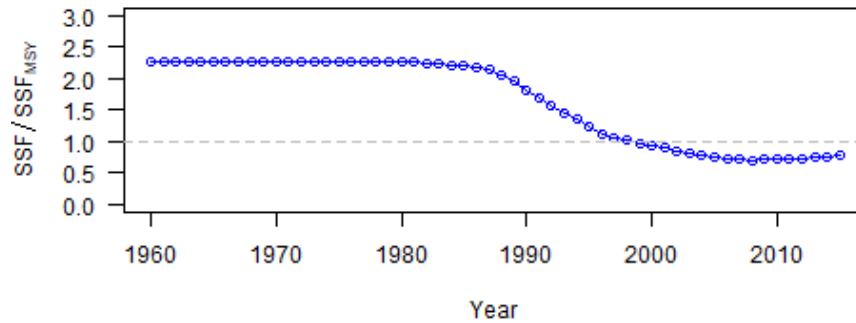


Trend analysis: Sandbar

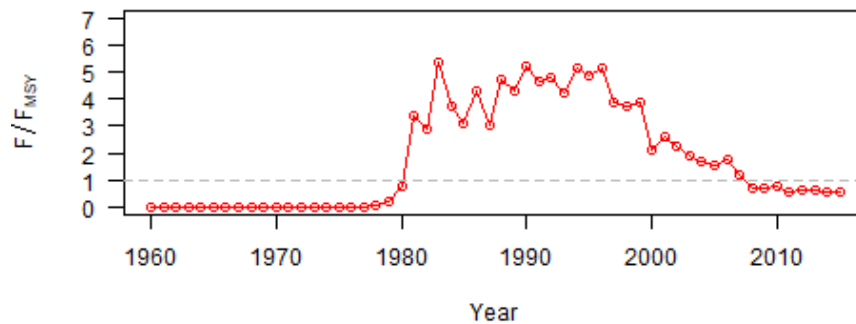
Index	Pre RF			Post RF		
	r ²	r	P value	r ²	r	P value
LPS	0.55	-0.74	0.00007	0.31	0.55	0.153
BLLOP	0.18	0.429	0.126	0.17	0.41	0.311
VIMS LL	0.60	-0.77	0.00003	0.27	-0.52	0.184
NMFS LL SE	0.37	-0.61	0.036	0.58	0.76	0.028
COASTSPAN NELL	0.08	-0.29	0.528	0.16	0.40	0.327
NELL	0.48	0.70	0.191	0.95	0.97	0.146
PLLOP	0.51	-0.72	0.002	0.00	-0.04	0.927
COASTSPAN SELL	0.76	0.87	0.005	0.28	-0.53	0.173
SC RED DRUM	0.01	-0.11	0.771	N/A		
SEAMAP LL SE	N/A			0.50	-0.71	0.048



Sandbar: relative biomass and fishing mortality trajectories



$SSF_{2015}/SSF_{MSY} = 0.77$
(overfished)



$F_{2015}/F_{MSY} = 0.58$
(no overfishing)

Why the different trends in indices?

- Different area coverage (core vs. extremes of stock distribution?)
- Different temporal coverage
- Track different portions of the population (accounted for by selectivity)
- All indices are statistically standardized, but some variables may still be unaccounted for (e.g., immigration and emigration from the sampled stratum)
- In dusky and sandbar assessments, indices were ranked by Index Working Group taking into consideration many of these factors



Why the different trends in the indices?

- Interannual increases in relative abundance of some of the indices seem incompatible with biology of the species: for example, mean annual increases in abundance in NELL index were well above the maximum population rates of increase for these species

Conclusions

- In the stock assessment, we look at composite picture provided by all indices that have been deemed acceptable
- But indices only provide the population trend
- We must also consider 2 other main types of information:
 - Catches, which provide scale
 - Life history, which provides vulnerability