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Weather and Coastal Conditions

DEPARTMENT OF ECOLOGY State of Washington

2015

2015 - Monthly — *Recent marine weather and coastal conditions*

2015 - Summary — *A yearly review of atmospheric and oceanic conditions*

Figure Explanation — *Figure Explanation and data sources*

"Boundary conditions play an important role for water quality in Puget Sound and coastal Bays"

Note: Weather data for this presentation are summarized from external sources.

www-k12.atmos.washington.edu/k12/grayskies/nw_weather.html

● Weather ○ Coastal conditions

Summary: The air temperature and ocean conditions remain warm. Precipitation got off to a big start, but was below normal for the month. Rivers are above normal except at the coast (Chehalis River). Sunshine and precipitation have been episodic.

Air Temperature	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	1.6											
	Everett	2.1											
	SeaTac	2.0											
	OlyWA	2.2											
	Coast	1.8											

Precipitation	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	0.06											
	Everett	-0.17											
	SeaTac	-0.12											
	OlyWA	-0.07											
	Coast	0.10											

Cloud Cover	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	-0.9											
	Everett	-1.2											
	SeaTac	-0.6											
	OlyWA	-0.2											
	Coast	-1.5											

River Inflow	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Fraser	23											
	Skagit	32											
	Puyallup	19											
	Nisqually	12											
	Chehalis	-5											

*Upwelling Anomalies (PFEL) higher expected lower ■ No data

Weather Coastal conditions

Summary: Air temperatures and ocean boundary conditions were much above normal. Precipitation and river flow were higher in the first half of February and lower in the second half. The Fraser River flow remained high for the entire month. Wind was stronger and from the south during the first half of February.

Air Temperature	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	1.6	3.0										
	Everett	2.1	3.2										
	SeaTac	2.0	3.0										
	OlyWA	2.2	2.5										
	Coast	1.8	3.3										

Precipitation	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	0.06	-0.10										
	Everett	-0.17	0.00										
	SeaTac	-0.12	0.10										
	OlyWA	-0.07	-0.06										
	Coast	0.10	-0.34										

Cloud Cover	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	-0.9	-0.2										
	Everett	-1.2	-0.4										
	SeaTac	-0.6	-0.2										
	OlyWA	-0.2	-0.6										
	Coast	-1.5	-0.8										

River Inflow	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Fraser	23	59										
	Skagit	32	54										
	Puyallup	19	2										
	Nisqually	12	1										
	Chehalis	-5	-1										

*Upwelling Anomalies (PFEL) higher expected lower No data

● Weather ○ Coastal conditions

Summary: Mean March temperatures remain above normal statewide, marking a continuation of the warmer than normal temperatures seen for the past 12 months. Precipitation was about average and river flow higher to the north and lower to the south than average. PDO was significantly warm, and NPGO significantly low. Upwelling/downwelling was seasonally typical.

Air Temperature	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	1.6	3.0	1.7									
	Everett	2.1	3.2	2.1									
	SeaTac	2.0	3.0	2.2									
	OlyWA	2.2	2.5	1.5									
	Coast	1.8	3.3	1.9									

Precipitation	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	0.06	-0.10	0.12									
	Everett	-0.17	0.00	-0.05									
	SeaTac	-0.12	0.10	0.06									
	OlyWA	-0.07	-0.06	0.02									
	Coast	0.10	-0.34	-0.35									

Cloud Cover	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	-0.9	-0.2	-1.4									
	Everett	-1.2	-0.4	-2.0									
	SeaTac	-0.6	-0.2	-1.2									
	OlyWA	-0.2	-0.6	-1.9									
	Coast	-1.5	-0.8	-1.4									

River Inflow	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Fraser	23	59	79									
	Skagit	32	54	11									
	Puyallup	19	2	0									
	Nisqually	12	1	-18									
	Chehalis	-5	-1	-30									

*Upwelling Anomalies (PFEL) higher expected lower ■ No data

● Weather ○ Coastal conditions

Summary: Mean April temperatures were near-normal for most of the state but precipitation was much below normal. River flow was above normal for the Fraser River, but below normal in Washington and with a marked north-to south gradient. Ocean temperatures and PDO remain significantly above normal, and upwelling conditions were normal with approximately equally amounts of up- and downwelling.

Air Temperature	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	1.6	3.0	1.7	0.0								
	Everett	2.1	3.2	2.1	-0.6								
	SeaTac	2.0	3.0	2.2	0.2								
	OlyWA	2.2	2.5	1.5	-0.1								
	Coast	1.8	3.3	1.9	-0.2								

Precipitation	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	0.06	-0.10	0.12	-0.16								
	Everett	-0.17	0.00	-0.05	-0.10								
	SeaTac	-0.12	0.10	0.06	-0.04								
	OlyWA	-0.07	-0.06	0.02	-0.12								
	Coast	0.10	-0.34	-0.35	-0.20								

Cloud Cover	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	-0.9	-0.2	-1.4	-1.7								
	Everett	-1.2	-0.4	-2.0	-1.2								
	SeaTac	-0.6	-0.2	-1.2	-1.4								
	OlyWA	-0.2	-0.6	-1.9	-1.8								
	Coast	-1.5	-0.8	-1.4	-2.0								

River Inflow	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Fraser	23	59	79	101								
	Skagit	32	54	11	-11								
	Puyallup	19	2	0	-14								
	Nisqually	12	1	-18	-11								
	Chehalis	-5	-1	-30	-23								

*Upwelling Anomalies (PFEL) higher expected lower ■ No data

● Weather ○ Coastal conditions

Summary: Mean May temperatures were above-normal and precipitation was below normal around Puget Sound. River flow was below normal in Washington and only slightly above normal for the Fraser River. Ocean temperatures and PDO remain significantly above normal, and upwelling conditions were above normal for the month.

Air Temperature	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	1.6	3.0	1.7	0.0	1.4							
	Everett	2.1	3.2	2.1	-0.6	0.1							
	SeaTac	2.0	3.0	2.2	0.2	1.2							
	OlyWA	2.2	2.5	1.5	-0.1	0.6							
	Coast	1.8	3.3	1.9	-0.2	-0.1							

Precipitation	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	0.06	-0.10	0.12	-0.16	-0.15							
	Everett	-0.17	0.00	-0.05	-0.10	-0.17							
	SeaTac	-0.12	0.10	0.06	-0.04	-0.10							
	OlyWA	-0.07	-0.06	0.02	-0.12	-0.13							
	Coast	0.10	-0.34	-0.35	-0.20	-0.26							

Cloud Cover	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	-0.9	-0.2	-1.4	-1.7	-1.2							
	Everett	-1.2	-0.4	-2.0	-1.2	-1.0							
	SeaTac	-0.6	-0.2	-1.2	-1.4	-0.7							
	OlyWA	-0.2	-0.6	-1.9	-1.8	-0.5							
	Coast	-1.5	-0.8	-1.4	-2.0	0.6							

River Inflow	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Fraser	23	59	79	101	18							
	Skagit	32	54	11	-11	-47							
	Puyallup	19	2	0	-14	-25							
	Nisqually	12	1	-18	-11	-13							
	Chehalis	-5	-1	-30	-23	-13							

*Upwelling Anomalies (PFEL) higher expected lower ■ No data

● Weather ○ Coastal conditions

Summary: June was hot, dry, and sunny in WA state. Mean June temperatures ranked as the warmest on record for nearly the entire state. River flows were low, and the Fraser River transitioned from above to below normal. Upwelling was strong, PDO was warm phase and NPGO negative.

Air Temperature	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	1.6	3.0	1.7	0.0	1.4	2.8						
	Everett	2.1	3.2	2.1	-0.6	0.1	1.5						
	SeaTac	2.0	3.0	2.2	0.2	1.2	3.4						
	OlyWA	2.2	2.5	1.5	-0.1	0.6	4.4						
	Coast	1.8	3.3	1.9	-0.2	-0.1	0.8						

Precipitation	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	0.06	-0.10	0.12	-0.16	-0.15	-0.14						
	Everett	-0.17	0.00	-0.05	-0.10	-0.17	-0.16						
	SeaTac	-0.12	0.10	0.06	-0.04	-0.10	-0.11						
	OlyWA	-0.07	-0.06	0.02	-0.12	-0.13	-0.14						
	Coast	0.10	-0.34	-0.35	-0.20	-0.26	-0.17						

Cloud Cover	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	-0.9	-0.2	-1.4	-1.7	-1.2	-3.2						
	Everett	-1.2	-0.4	-2.0	-1.2	-1.0	-3.5						
	SeaTac	-0.6	-0.2	-1.2	-1.4	-0.7	-2.2						
	OlyWA	-0.2	-0.6	-1.9	-1.8	-0.5	-3.0						
	Coast	-1.5	-0.8	-1.4	-2.0	0.6	-2.3						

River Inflow	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Fraser	23	59	79	101	18	-33						
	Skagit	32	54	11	-11	-47	-78						
	Puyallup	19	2	0	-14	-25	-40						
	Nisqually	12	1	-18	-11	-13	-10						
	Chehalis	-5	-1	-30	-23	-13	-7						

*Upwelling Anomalies (PFEL) higher expected lower ■ No data

● Weather ○ Coastal conditions

Summary: July continued to be hot, dry, and sunny. The average temperature for SeaTac Airport ranked as the warmest month on record. Total precipitation was below normal, though not as low as in other Julys of the past. Rivers were flowing below normal, especially to the north. Only the Nisqually had above-normal flows toward the end of the month. Upwelling diminished back to normal, PDO was warm phase and NPGO negative.

Air Temperature	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	1.6	3.0	1.7	0.0	1.4	2.8	2.3					
	Everett	2.1	3.2	2.1	-0.6	0.1	1.5	1.6					
	SeaTac	2.0	3.0	2.2	0.2	1.2	3.4	2.7					
	OlyWA	2.2	2.5	1.5	-0.1	0.6	4.4	3.0					
	Coast	1.8	3.3	1.9	-0.2	-0.1	0.8	1.5					

Precipitation	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	0.06	-0.10	0.12	-0.16	-0.15	-0.14	-0.06					
	Everett	-0.17	0.00	-0.05	-0.10	-0.17	-0.16	-0.09					
	SeaTac	-0.12	0.10	0.06	-0.04	-0.10	-0.11	-0.06					
	OlyWA	-0.07	-0.06	0.02	-0.12	-0.13	-0.14	-0.06					
	Coast	0.10	-0.34	-0.35	-0.20	-0.26	-0.17	-0.08					

Cloud Cover	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	-0.9	-0.2	-1.4	-1.7	-1.2	-3.2	-0.6					
	Everett	-1.2	-0.4	-2.0	-1.2	-1.0	-3.5	-1.1					
	SeaTac	-0.6	-0.2	-1.2	-1.4	-0.7	-2.2	-0.4					
	OlyWA	-0.2	-0.6	-1.9	-1.8	-0.5	-3.0	-1.1					
	Coast	-1.5	-0.8	-1.4	-2.0	0.6	-2.3	-1.4					

River Inflow	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Fraser	23	59	79	101	18	-33	-93					
	Skagit	32	54	11	-11	-47	-78	-67					
	Puyallup	19	2	0	-14	-25	-40	-20					
	Nisqually	12	1	-18	-11	-13	-10	-2					
	Chehalis	-5	-1	-30	-23	-13	-7	-3					

*Upwelling Anomalies (PFEL) higher expected lower ■ No data

● Weather ○ Coastal conditions

Summary: August air temperatures were again warmer than normal, and the SSTs in the NE Pacific (aka the "blob") were extremely warm as well. The PDO remained significantly above normal. Precipitation in Western WA was higher than normal, although river flow was below normal, especially to the north and particularly for the Fraser River. Upwelling was typical for August.

Air Temperature	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	1.6	3.0	1.7	0.0	1.4	2.8	2.3	1.2				
	Everett	2.1	3.2	2.1	-0.6	0.1	1.5	1.6	0.5				
	SeaTac	2.0	3.0	2.2	0.2	1.2	3.4	2.7	1.4				
	OlyWA	2.2	2.5	1.5	-0.1	0.6	4.4	3.0	1.2				
	Coast	1.8	3.3	1.9	-0.2	-0.1	0.8	1.5	0.5				

Precipitation	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	0.06	-0.10	0.12	-0.16	-0.15	-0.14	-0.06	-0.06				
	Everett	-0.17	0.00	-0.05	-0.10	-0.17	-0.16	-0.09	0.04				
	SeaTac	-0.12	0.10	0.06	-0.04	-0.10	-0.11	-0.06	0.16				
	OlyWA	-0.07	-0.06	0.02	-0.12	-0.13	-0.14	-0.06	0.12				
	Coast	0.10	-0.34	-0.35	-0.20	-0.26	-0.17	-0.08	0.01				

Cloud Cover	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	-0.9	-0.2	-1.4	-1.7	-1.2	-3.2	-0.6	-0.8				
	Everett	-1.2	-0.4	-2.0	-1.2	-1.0	-3.5	-1.1	-1.2				
	SeaTac	-0.6	-0.2	-1.2	-1.4	-0.7	-2.2	-0.4	-0.3				
	OlyWA	-0.2	-0.6	-1.9	-1.8	-0.5	-3.0	-1.1	-1.7				
	Coast	-1.5	-0.8	-1.4	-2.0	0.6	-2.3	-1.4	-1.5				

River Inflow	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Fraser	23	59	79	101	18	-33	-93	-63				
	Skagit	32	54	11	-11	-47	-78	-67	-30				
	Puyallup	19	2	0	-14	-25	-40	-20	-8				
	Nisqually	12	1	-18	-11	-13	-10	-2	1				
	Chehalis	-5	-1	-30	-23	-13	-7	-3	-2				

*Upwelling Anomalies (PFEL) higher expected lower ■ No data

● Weather ○ Coastal conditions

Summary: Ocean conditions remain warm, but air temperatures cool off during September. Clouds and precipitation are higher to the north. River flows recovering to near-normal with near-normal upwelling on the coast. An unremarkable month weather-wise.

Air Temperature	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	1.6	3.0	1.7	0.0	1.4	2.8	2.3	1.2	-1.4			
	Everett	2.1	3.2	2.1	-0.6	0.1	1.5	1.6	0.5	-0.8			
	SeaTac	2.0	3.0	2.2	0.2	1.2	3.4	2.7	1.4	-0.8			
	OlyWA	2.2	2.5	1.5	-0.1	0.6	4.4	3.0	1.2	-1.0			
	Coast	1.8	3.3	1.9	-0.2	-0.1	0.8	1.5	0.5	-0.8			

Precipitation	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	0.06	-0.10	0.12	-0.16	-0.15	-0.14	-0.06	-0.06	0.11			
	Everett	-0.17	0.00	-0.05	-0.10	-0.17	-0.16	-0.09	0.04	0.01			
	SeaTac	-0.12	0.10	0.06	-0.04	-0.10	-0.11	-0.06	0.16	-0.04			
	OlyWA	-0.07	-0.06	0.02	-0.12	-0.13	-0.14	-0.06	0.12	-0.07			
	Coast	0.10	-0.34	-0.35	-0.20	-0.26	-0.17	-0.08	0.01	0.01			

Cloud Cover	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	-0.9	-0.2	-1.4	-1.7	-1.2	-3.2	-0.6	-0.8	0.3			
	Everett	-1.2	-0.4	-2.0	-1.2	-1.0	-3.5	-1.1	-1.2	0.2			
	SeaTac	-0.6	-0.2	-1.2	-1.4	-0.7	-2.2	-0.4	-0.3	0.0			
	OlyWA	-0.2	-0.6	-1.9	-1.8	-0.5	-3.0	-1.1	-1.7	-0.3			
	Coast	-1.5	-0.8	-1.4	-2.0	0.6	-2.3	-1.4	-1.5	-0.7			

River Inflow	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Fraser	23	59	79	101	18	-33	-93	-63	-16			
	Skagit	32	54	11	-11	-47	-78	-67	-30	3			
	Puyallup	19	2	0	-14	-25	-40	-20	-8	-9			
	Nisqually	12	1	-18	-11	-13	-10	-2	1	2			
	Chehalis	-5	-1	-30	-23	-13	-7	-3	-2	-2			

*Upwelling Anomalies (PFEL) higher expected lower ■ No data

● Weather ○ Coastal conditions

Summary: October air temperatures were much warmer than normal, the second warmest October on record in both Olympia and Seattle. Although precipitation was near-normal, there were several instances of heavy amounts that broke daily records on the 10th and 31st at SeaTac. PDO & ENSO were significantly warm phase, NPGO significantly below normal, and up/downwelling was typical.

Air Temperature	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	1.6	3.0	1.7	0.0	1.4	2.8	2.3	1.2	-1.4	1.2		
	Everett	2.1	3.2	2.1	-0.6	0.1	1.5	1.6	0.5	-0.8	2.0		
	SeaTac	2.0	3.0	2.2	0.2	1.2	3.4	2.7	1.4	-0.8	1.9		
	OlyWA	2.2	2.5	1.5	-0.1	0.6	4.4	3.0	1.2	-1.0	1.6		
	Coast	1.8	3.3	1.9	-0.2	-0.1	0.8	1.5	0.5	-0.8	2.0		

Precipitation	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	0.06	-0.10	0.12	-0.16	-0.15	-0.14	-0.06	-0.06	0.11	-0.05		
	Everett	-0.17	0.00	-0.05	-0.10	-0.17	-0.16	-0.09	0.04	0.01	-0.09		
	SeaTac	-0.12	0.10	0.06	-0.04	-0.10	-0.11	-0.06	0.16	-0.04	-0.02		
	OlyWA	-0.07	-0.06	0.02	-0.12	-0.13	-0.14	-0.06	0.12	-0.07	-0.09		
	Coast	0.10	-0.34	-0.35	-0.20	-0.26	-0.17	-0.08	0.01	0.01	-0.08		

Cloud Cover	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	-0.9	-0.2	-1.4	-1.7	-1.2	-3.2	-0.6	-0.8	0.3	-0.5		
	Everett	-1.2	-0.4	-2.0	-1.2	-1.0	-3.5	-1.1	-1.2	0.2	-0.9		
	SeaTac	-0.6	-0.2	-1.2	-1.4	-0.7	-2.2	-0.4	-0.3	0.0	-0.1		
	OlyWA	-0.2	-0.6	-1.9	-1.8	-0.5	-3.0	-1.1	-1.7	-0.3	-0.4		
	Coast	-1.5	-0.8	-1.4	-2.0	0.6	-2.3	-1.4	-1.5	-0.7	-0.6		

River Inflow	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Fraser	23	59	79	101	18	-33	-93	-63	-16	2		
	Skagit	32	54	11	-11	-47	-78	-67	-30	3	-11		
	Puyallup	19	2	0	-14	-25	-40	-20	-8	-9	-11		
	Nisqually	12	1	-18	-11	-13	-10	-2	1	2	-6		
	Chehalis	-5	-1	-30	-23	-13	-7	-3	-2	-2	-10		

*Upwelling Anomalies (PFEL) higher expected lower ■ No data

● Weather ○ Coastal conditions

Summary: Air temperatures were below normal for November, which is a big change from October. Precipitation levels were slightly above normal, particularly for South Sound. One wet period occurred at the beginning of November, and the other mid-month, nevertheless sunshine was above normal in the Puget Sound lowlands. River flows were mostly above normal. Downwelling was much weaker than normal, ENSO & PDO remain warm phase.

Air Temperature	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	1.6	3.0	1.7	0.0	1.4	2.8	2.3	1.2	-1.4	1.2	-0.7	
	Everett	2.1	3.2	2.1	-0.6	0.1	1.5	1.6	0.5	-0.8	2.0	-0.6	
	SeaTac	2.0	3.0	2.2	0.2	1.2	3.4	2.7	1.4	-0.8	1.9	-0.6	
	OlyWA	2.2	2.5	1.5	-0.1	0.6	4.4	3.0	1.2	-1.0	1.6	-0.8	
	Coast	1.8	3.3	1.9	-0.2	-0.1	0.8	1.5	0.5	-0.8	2.0	-0.3	

Precipitation	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	0.06	-0.10	0.12	-0.16	-0.15	-0.14	-0.06	-0.06	0.11	-0.05	0.02	
	Everett	-0.17	0.00	-0.05	-0.10	-0.17	-0.16	-0.09	0.04	0.01	-0.09	-0.02	
	SeaTac	-0.12	0.10	0.06	-0.04	-0.10	-0.11	-0.06	0.16	-0.04	-0.02	0.28	
	OlyWA	-0.07	-0.06	0.02	-0.12	-0.13	-0.14	-0.06	0.12	-0.07	-0.09	0.48	
	Coast	0.10	-0.34	-0.35	-0.20	-0.26	-0.17	-0.08	0.01	0.01	-0.08	0.02	

Cloud Cover	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	-0.9	-0.2	-1.4	-1.7	-1.2	-3.2	-0.6	-0.8	0.3	-0.5	-1.6	
	Everett	-1.2	-0.4	-2.0	-1.2	-1.0	-3.5	-1.1	-1.2	0.2	-0.9	-1.0	
	SeaTac	-0.6	-0.2	-1.2	-1.4	-0.7	-2.2	-0.4	-0.3	0.0	-0.1	-0.9	
	OlyWA	-0.2	-0.6	-1.9	-1.8	-0.5	-3.0	-1.1	-1.7	-0.3	-0.4	-0.7	
	Coast	-1.5	-0.8	-1.4	-2.0	0.6	-2.3	-1.4	-1.5	-0.7	-0.6	-1.4	

River Inflow	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Fraser	23	59	79	101	18	-33	-93	-63	-16	2	7	
	Skagit	32	54	11	-11	-47	-78	-67	-30	3	-11	65	
	Puyallup	19	2	0	-14	-25	-40	-20	-8	-9	-11	62	
	Nisqually	12	1	-18	-11	-13	-10	-2	1	2	-6	7	
	Chehalis	-5	-1	-30	-23	-13	-7	-3	-2	-2	-10	82	

*Upwelling Anomalies (PFEL) ■ No data

● Weather ○ Coastal conditions

Summary: November ended with cold temps, but the first half of December was warmer than normal and the second was cooler. Overall, mean December temperatures were above normal continuing the annual status quo, exceptions being September and November. Total precipitation was above normal. December 2015 was the wettest on record in Olympia, but slightly less impressive on the coast and in the northern Puget Sound region.

Air Temperature	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	1.6	3.0	1.7	0.0	1.4	2.8	2.3	1.2	-1.4	1.2	-0.7	1.3
	Everett	2.1	3.2	2.1	-0.6	0.1	1.5	1.6	0.5	-0.8	2.0	-0.6	0.7
	SeaTac	2.0	3.0	2.2	0.2	1.2	3.4	2.7	1.4	-0.8	1.9	-0.6	0.8
	OlyWA	2.2	2.5	1.5	-0.1	0.6	4.4	3.0	1.2	-1.0	1.6	-0.8	0.9
	Coast	1.8	3.3	1.9	-0.2	-0.1	0.8	1.5	0.5	-0.8	2.0	-0.3	0.4

Precipitation	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	0.06	-0.10	0.12	-0.16	-0.15	-0.14	-0.06	-0.06	0.11	-0.05	0.02	0.08
	Everett	-0.17	0.00	-0.05	-0.10	-0.17	-0.16	-0.09	0.04	0.01	-0.09	-0.02	0.21
	SeaTac	-0.12	0.10	0.06	-0.04	-0.10	-0.11	-0.06	0.16	-0.04	-0.02	0.28	0.42
	OlyWA	-0.07	-0.06	0.02	-0.12	-0.13	-0.14	-0.06	0.12	-0.07	-0.09	0.48	0.50
	Coast	0.10	-0.34	-0.35	-0.20	-0.26	-0.17	-0.08	0.01	0.01	-0.08	0.02	0.43

Cloud Cover	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Bell	-0.9	-0.2	-1.4	-1.7	-1.2	-3.2	-0.6	-0.8	0.3	-0.5	-1.6	0.5
	Everett	-1.2	-0.4	-2.0	-1.2	-1.0	-3.5	-1.1	-1.2	0.2	-0.9	-1.0	0.7
	SeaTac	-0.6	-0.2	-1.2	-1.4	-0.7	-2.2	-0.4	-0.3	0.0	-0.1	-0.9	0.6
	OlyWA	-0.2	-0.6	-1.9	-1.8	-0.5	-3.0	-1.1	-1.7	-0.3	-0.4	-0.7	0.2
	Coast	-1.5	-0.8	-1.4	-2.0	0.6	-2.3	-1.4	-1.5	-0.7	-0.6	-1.4	0.4

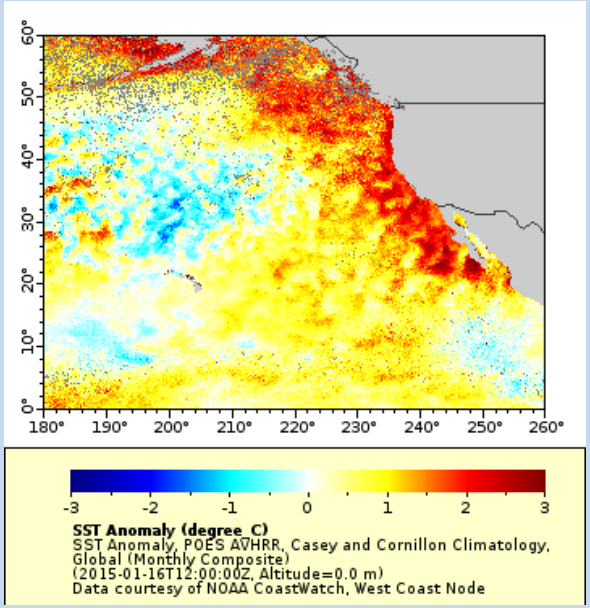
River Inflow	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Fraser	23	59	79	101	18	-33	-93	-63	-16	2	7	4
	Skagit	32	54	11	-11	-47	-78	-67	-30	3	-11	65	24
	Puyallup	19	2	0	-14	-25	-40	-20	-8	-9	-11	62	40
	Nisqually	12	1	-18	-11	-13	-10	-2	1	2	-6	7	54
	Chehalis	-5	-1	-30	-23	-13	-7	-3	-2	-2	-10	82	112

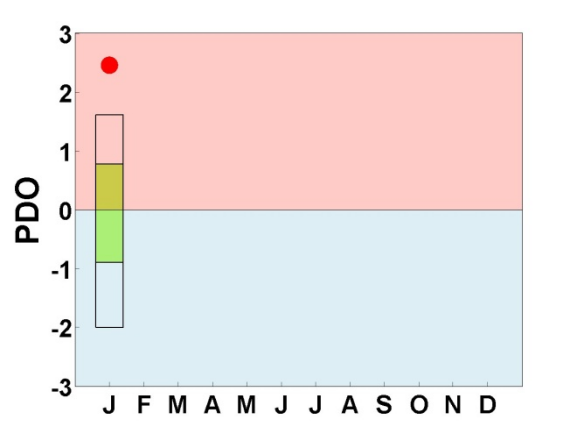
*Upwelling Anomalies (PFEL) No data

Weather Coastal conditions

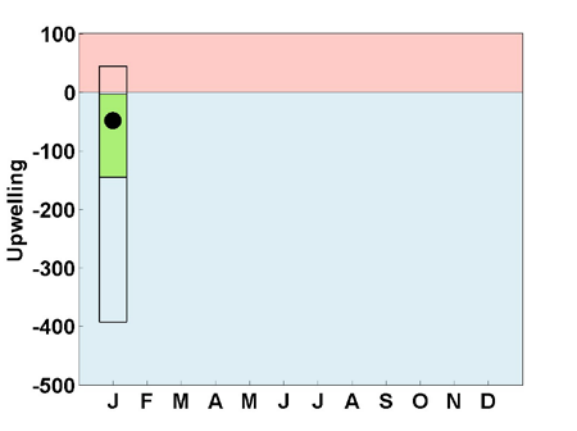
Indices describing oceanic boundary conditions which can affect marine water quality in our state

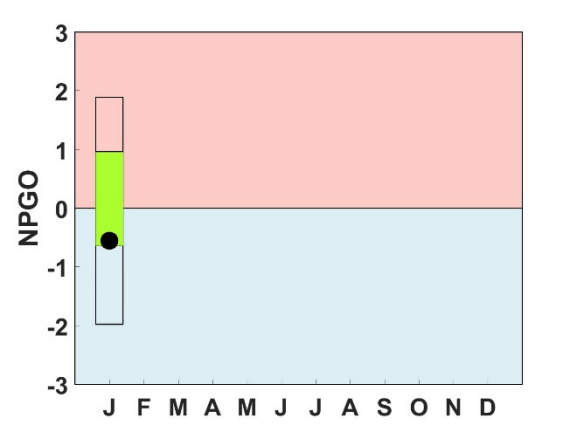
Source: http://coastwatch.pfeg.noaa.gov/





Warm phase
Cool phase





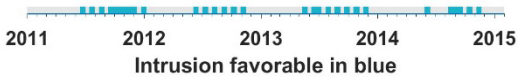
Summary:

Pacific Decadal Oscillation:
PDO significantly above normal for most months since March 2015.

Upwelling Anomalies:
Downwelling as is typical for January.

North Pacific Gyre Oscillation:
The NPGO was significantly below normal.

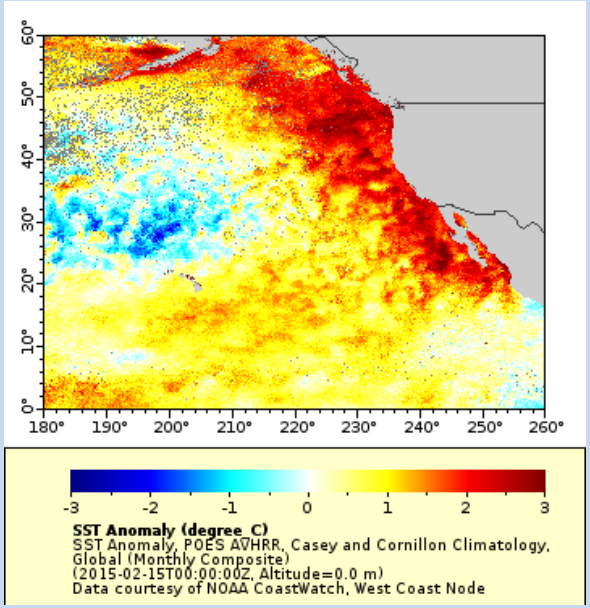
Deppe intrusion index:
Oceanic intrusions are unfavorable this month.

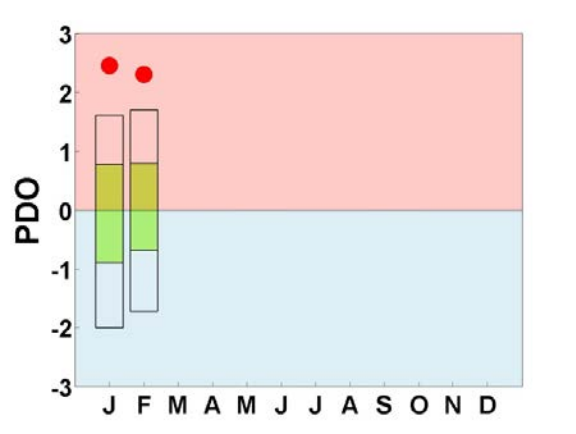


○ Weather ● Coastal conditions Ocean-cold/warm and upwelling dominate year-to-year variability in Puget Sound.

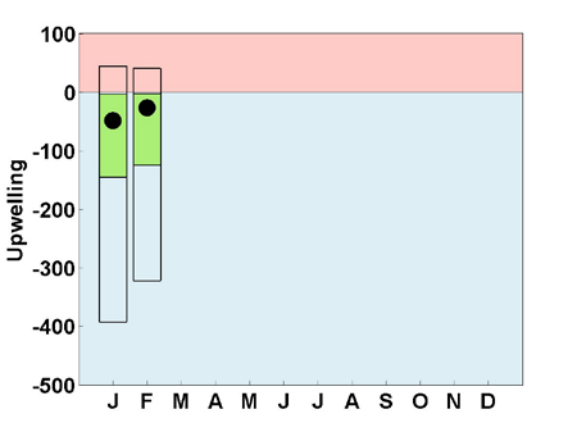
Indices describing oceanic boundary conditions which can affect marine water quality in our state

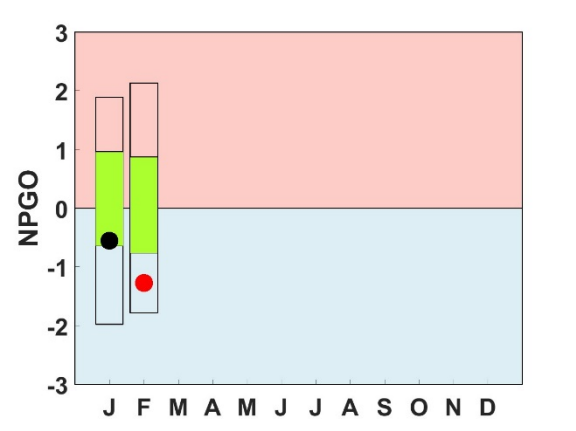
Source: http://coastwatch.pfeg.noaa.gov/





Warm phase
Cool phase





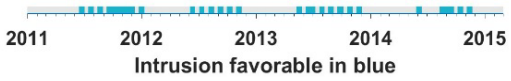
Summary:

Pacific Decadal Oscillation:
PDO significantly above normal for most months since March 2015.

Upwelling Anomalies:
Downwelling as is typical for February.

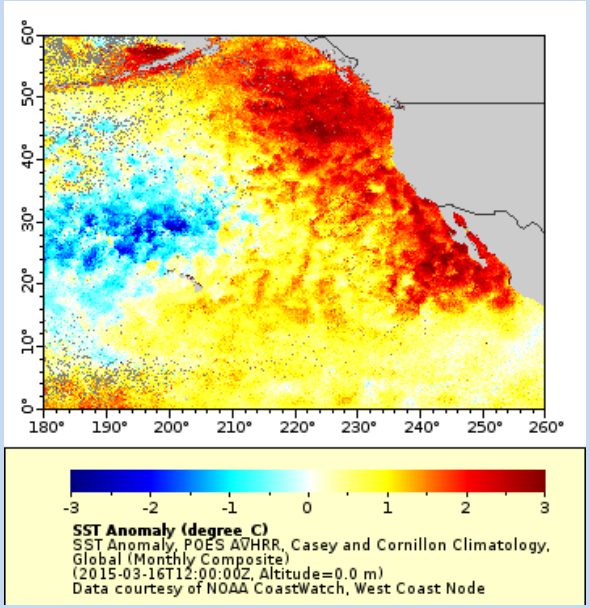
North Pacific Gyre Oscillation:
The NPGO was significantly below normal.

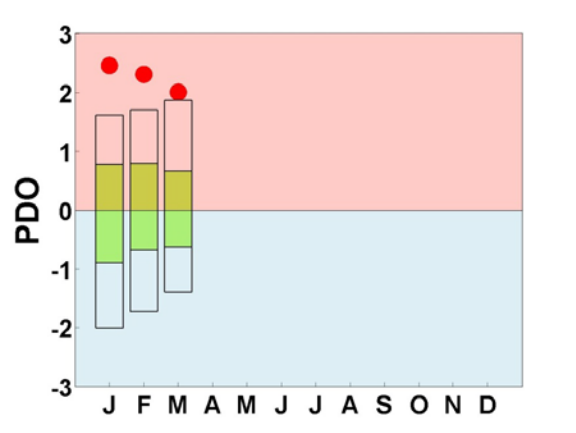
Deppe intrusion index:
Oceanic intrusions are unfavorable this month.



Indices describing oceanic boundary conditions which can affect marine water quality in our state

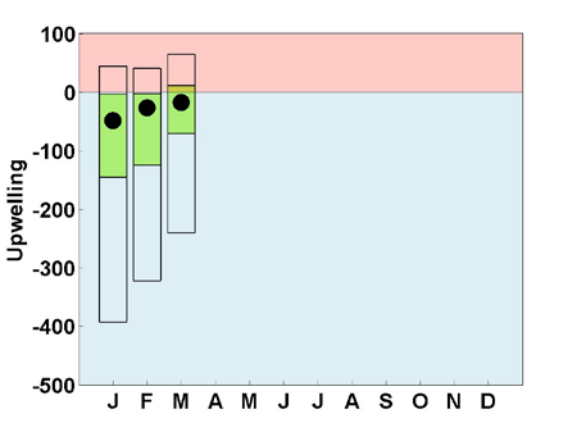
Source: http://coastwatch.pfeg.noaa.gov/

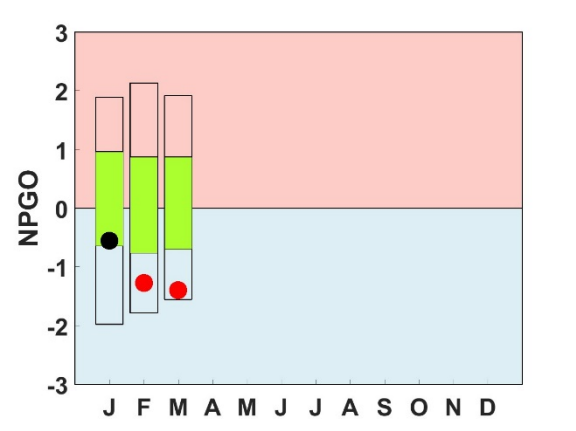




Warm phase

Cool phase





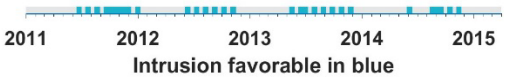
Summary:

Pacific Decadal Oscillation:
PDO significantly above normal for most months since March 2015.

Upwelling Anomalies:
Downwelling as is typical for March.

North Pacific Gyre Oscillation:
The NPGO was significantly below normal.

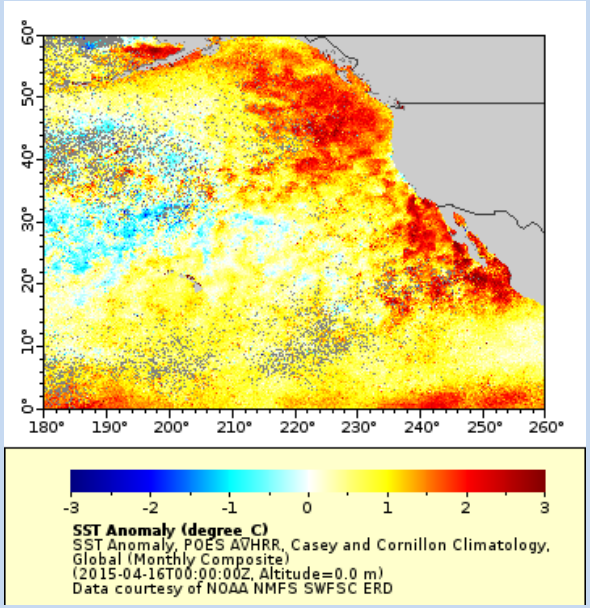
Deppe intrusion index:
Oceanic intrusions are unfavorable this month.

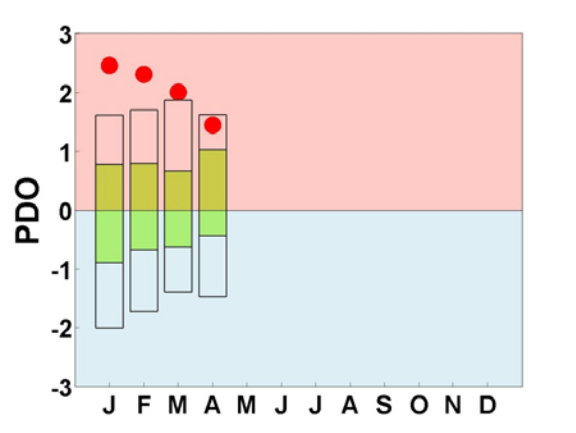


Weather Coastal conditions

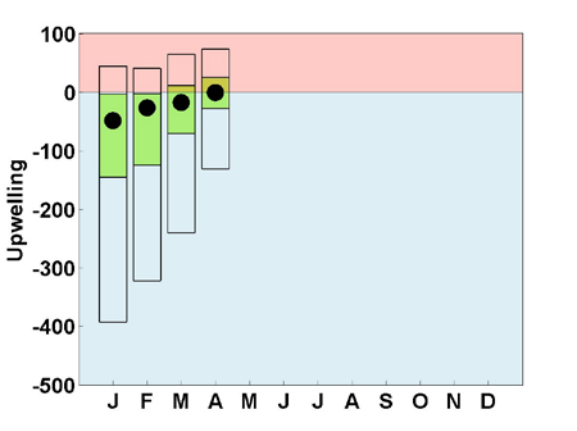
Indices describing oceanic boundary conditions which can affect marine water quality in our state

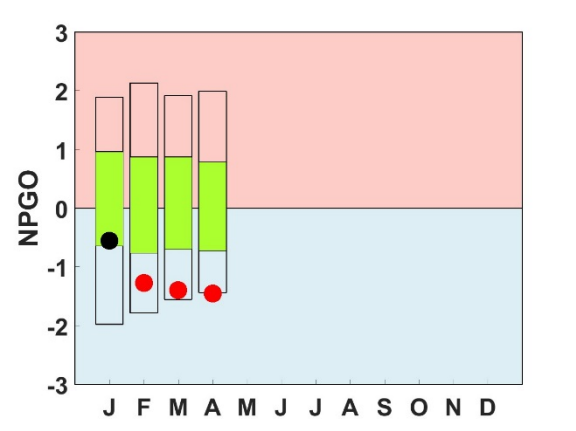
Source: http://coastwatch.pfeg.noaa.gov/





Warm phase
Cool phase





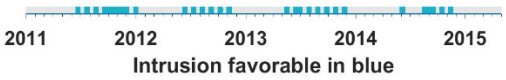
Summary:

Pacific Decadal Oscillation:
PDO significantly above normal for most months since March 2015.

Upwelling Anomalies:
Downwelling neutral as is typical for April.

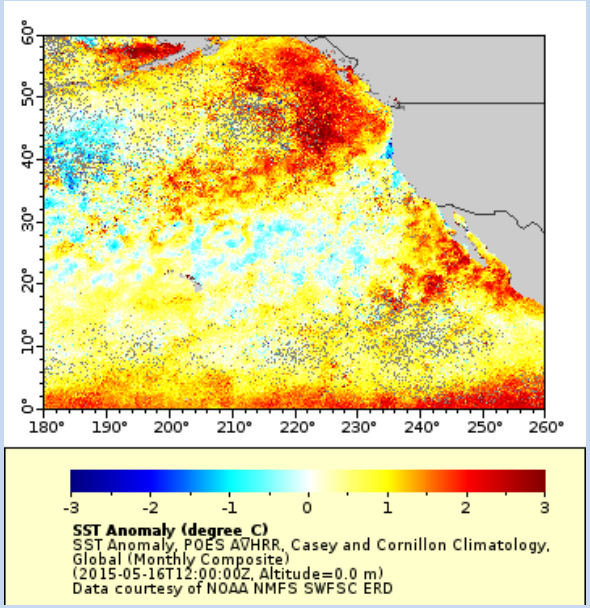
North Pacific Gyre Oscillation:
The NPGO was significantly below normal.

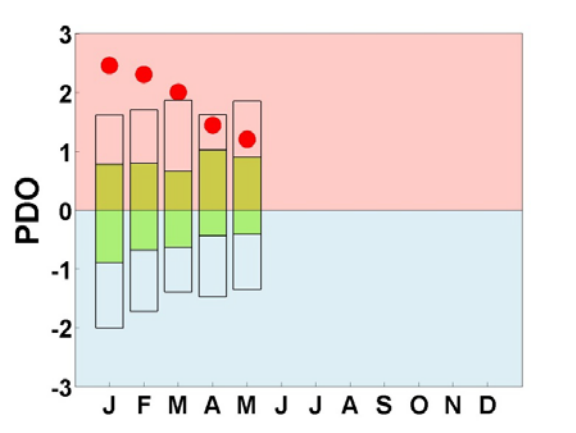
Deppe intrusion index:
Oceanic intrusions are unfavorable this month.



Indices describing oceanic boundary conditions which can affect marine water quality in our state

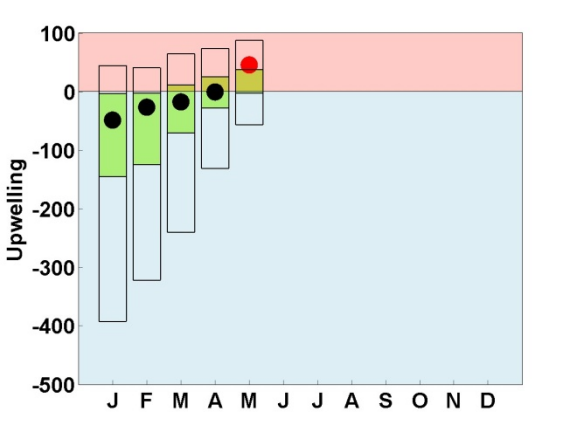
Source: http://coastwatch.pfeg.noaa.gov/

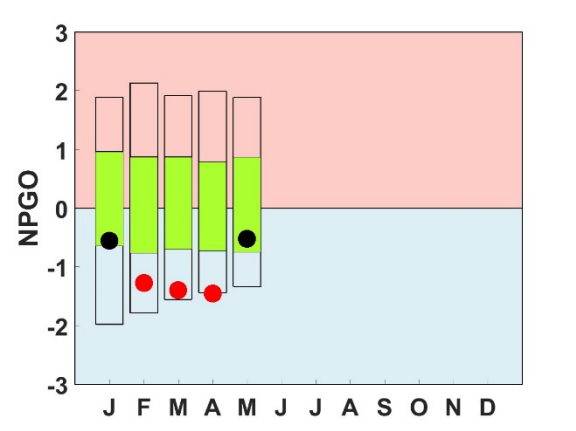




Warm phase

Cool phase





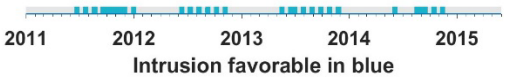
Summary:

Pacific Decadal Oscillation:
PDO significantly above normal for most months since March 2015.

Upwelling Anomalies:
Upwelling was strong during May.

North Pacific Gyre Oscillation:
The NPGO was slightly below normal.

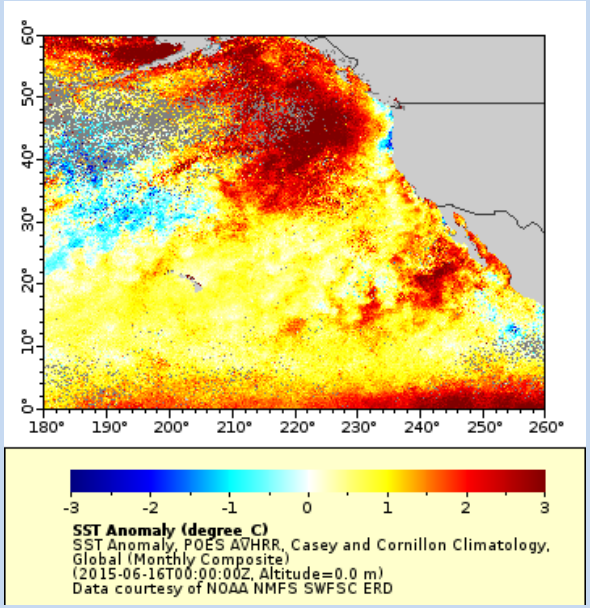
Deppe intrusion index:
Oceanic intrusions are unfavorable this month.

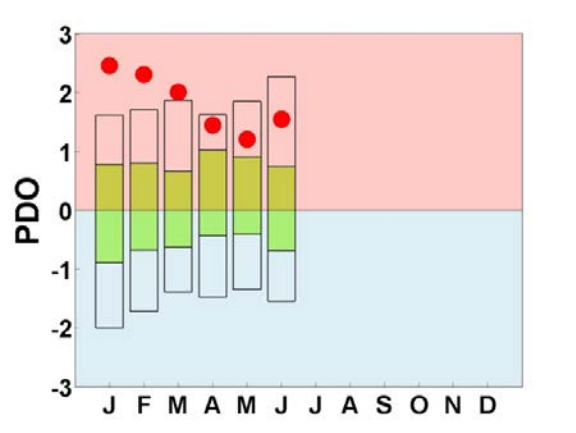


Weather ● Coastal conditions

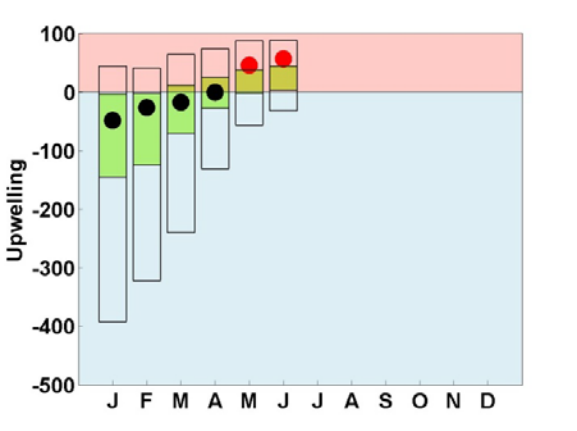
Indices describing oceanic boundary conditions which can affect marine water quality in our state

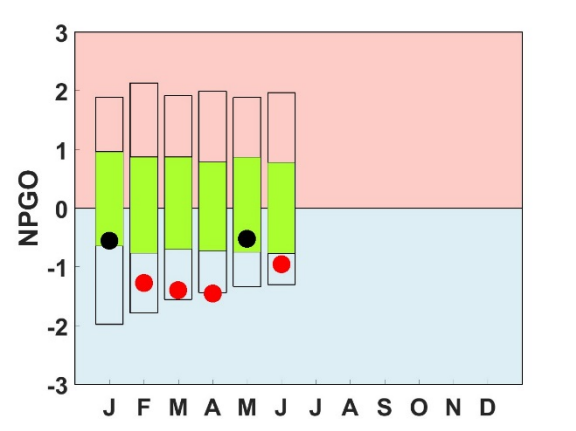
Source: http://coastwatch.pfeg.noaa.gov/





Warm phase
Cool phase





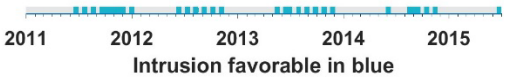
Summary:

Pacific Decadal Oscillation:
PDO significantly above normal for most months since March 2015.

Upwelling Anomalies:
Upwelling was strong during June.

North Pacific Gyre Oscillation:
The NPGO was significantly below normal.

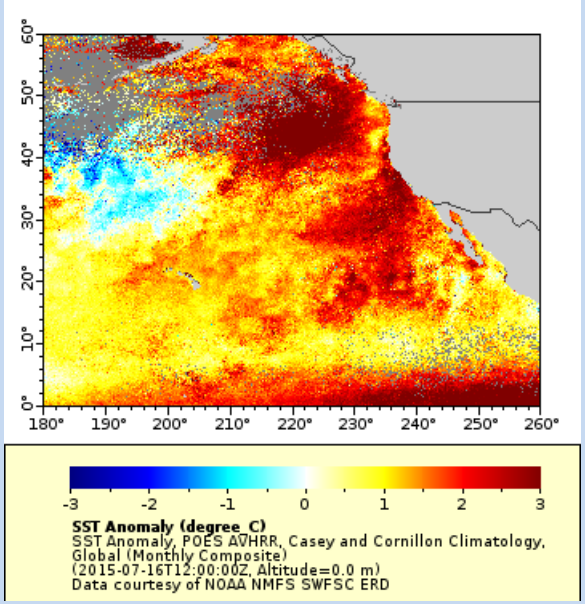
Deppe intrusion index:
Oceanic intrusions are favorable this month.

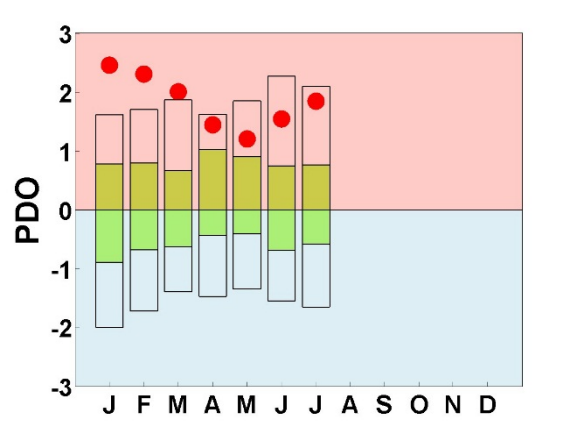


Weather Coastal conditions

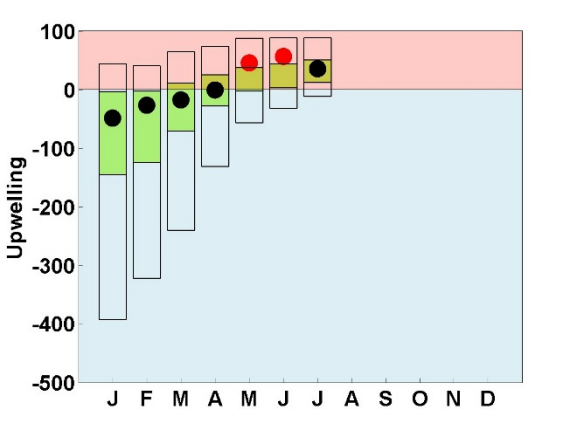
Indices describing oceanic boundary conditions which can affect marine water quality in our state

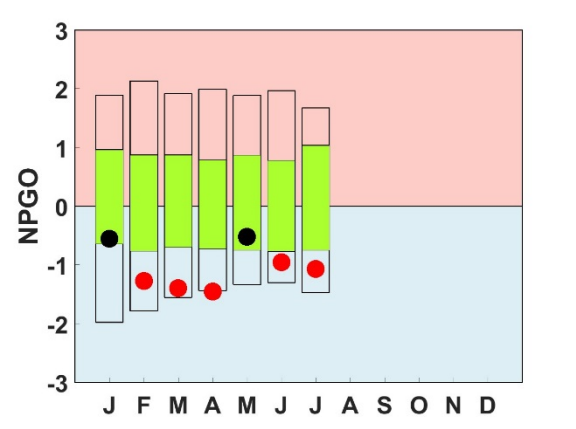
Source: http://coastwatch.pfeg.noaa.gov/





Warm phase
Cool phase





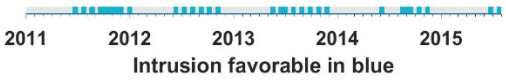
Summary:

Pacific Decadal Oscillation:
PDO significantly above normal for most months since March 2015.

Upwelling Anomalies:
Upwelling was normal during July.

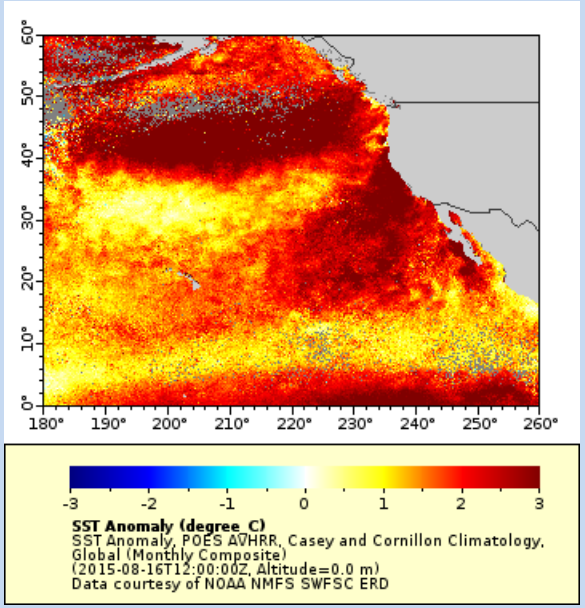
North Pacific Gyre Oscillation:
The NPGO was significantly below normal.

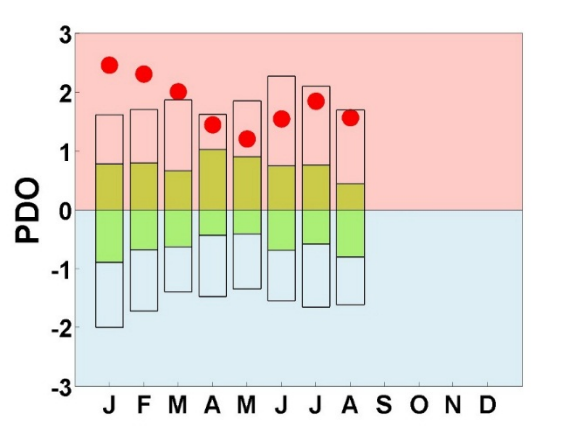
Deppe intrusion index:
Oceanic intrusions are favorable this month.



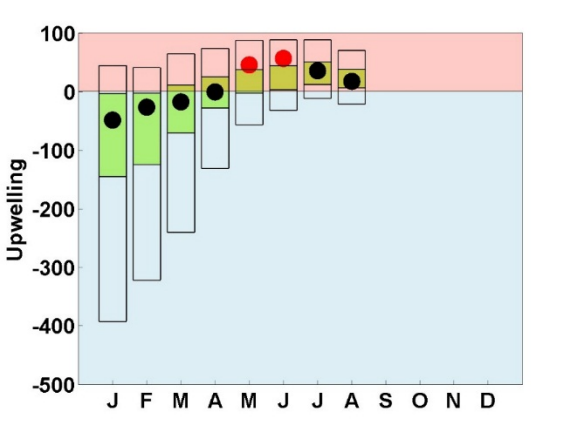
Weather ● Coastal conditions

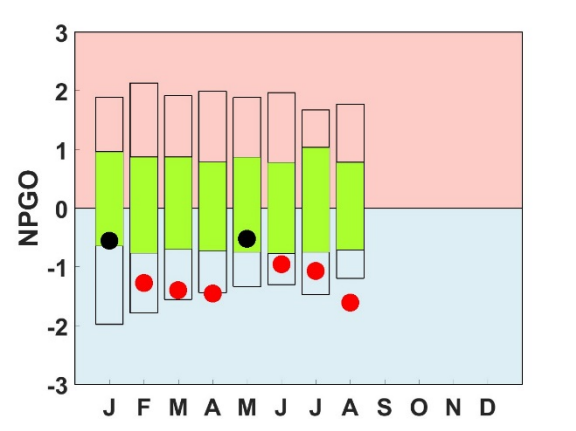
Indices describing oceanic boundary conditions which can affect marine water quality in our state





Warm phase
Cool phase





Summary:

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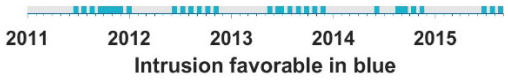
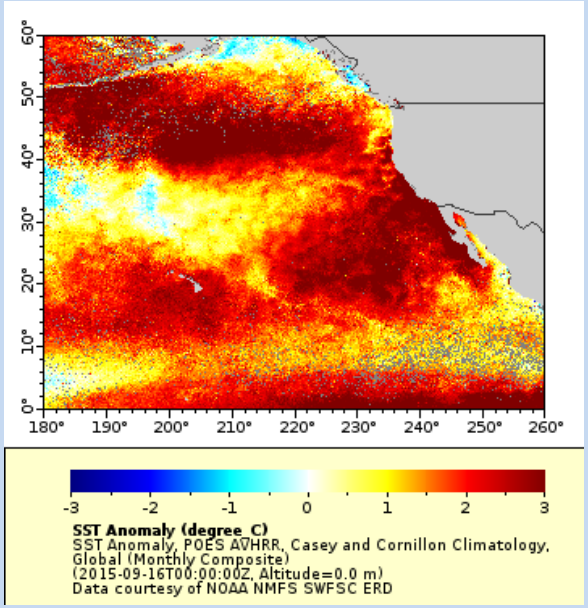
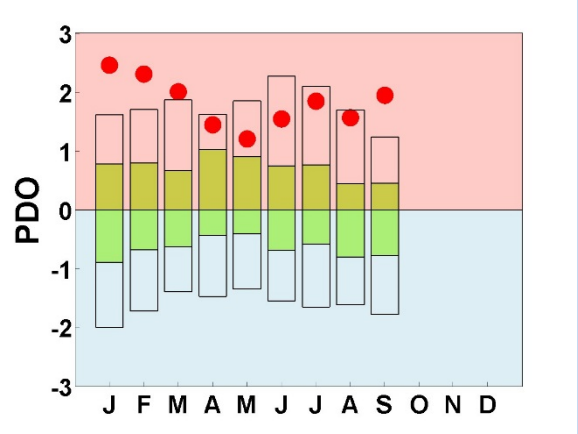


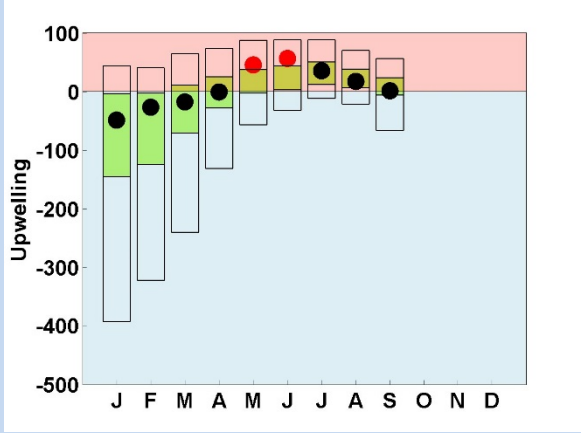
Weather Coastal conditions

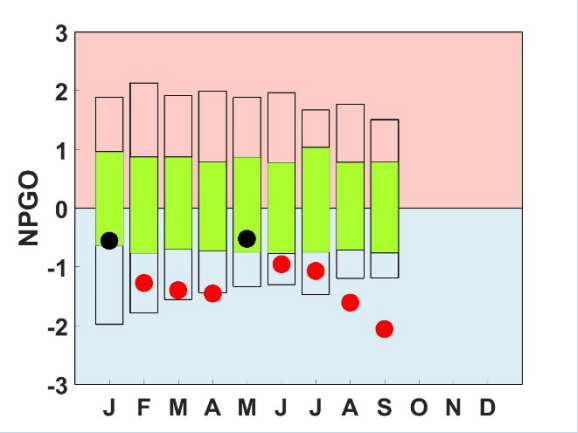
Indices describing oceanic boundary conditions which can affect marine water quality in our state





Warm phase
Cool phase





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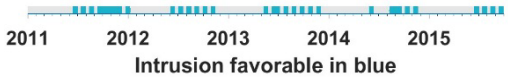
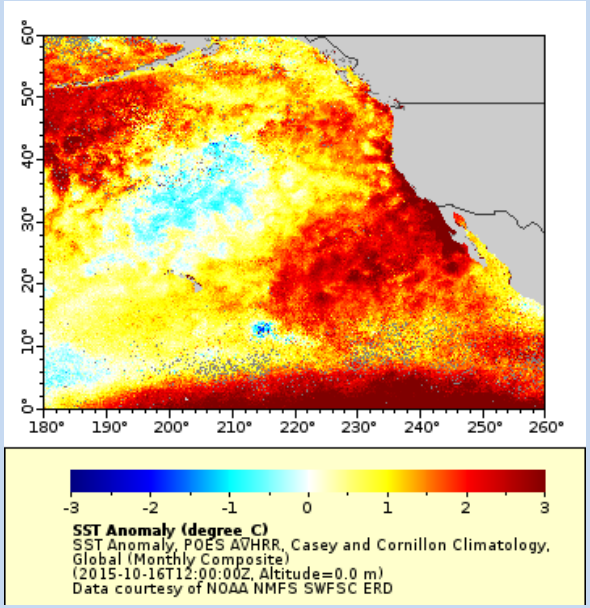
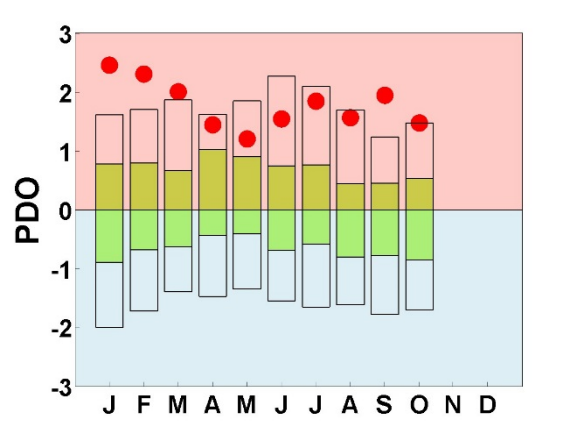


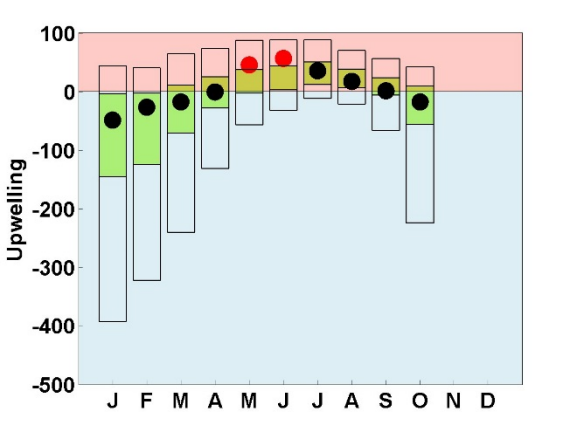
Weather ● Coastal conditions

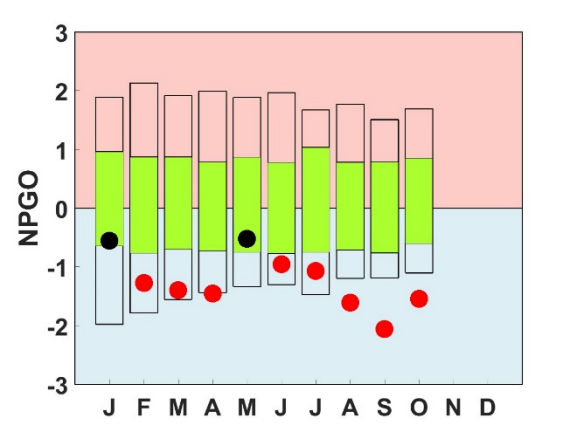
Indices describing oceanic boundary conditions which can affect marine water quality in our state





Warm phase
Cool phase





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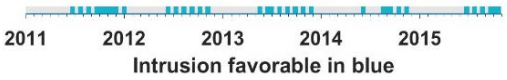
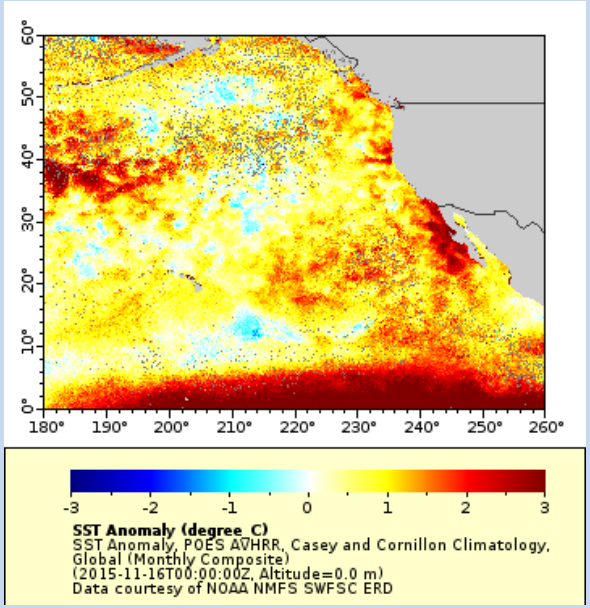
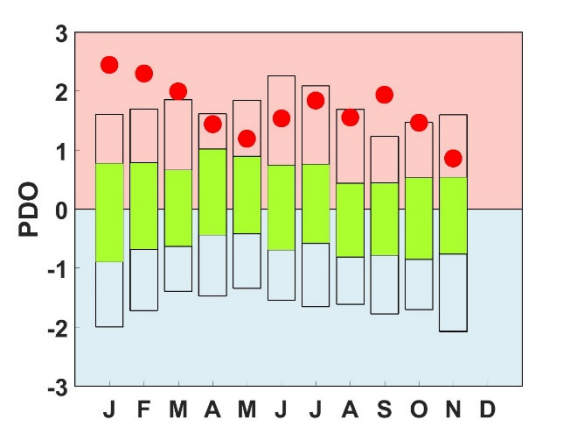


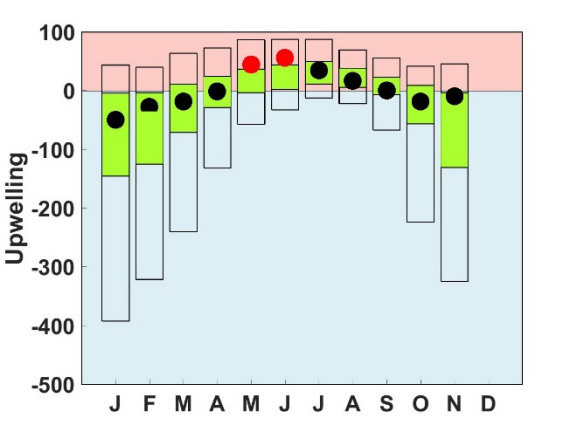
Weather Coastal conditions

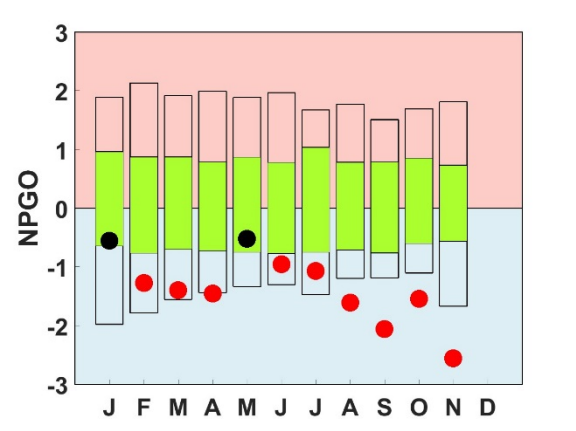
Indices describing oceanic boundary conditions which can affect marine water quality in our state





Warm phase
Cool phase





Summary:

Pacific Decadal Oscillation:
PDO significantly above normal for most months since March 2015.

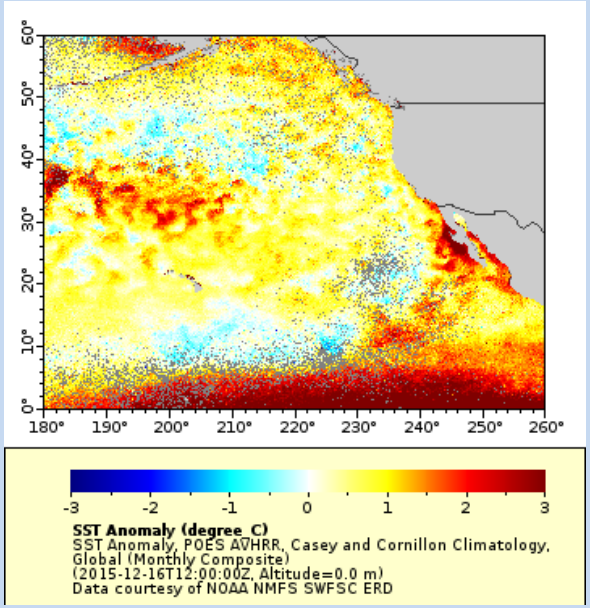
Upwelling Anomalies:
Downwelling was less favorable than typical for November.

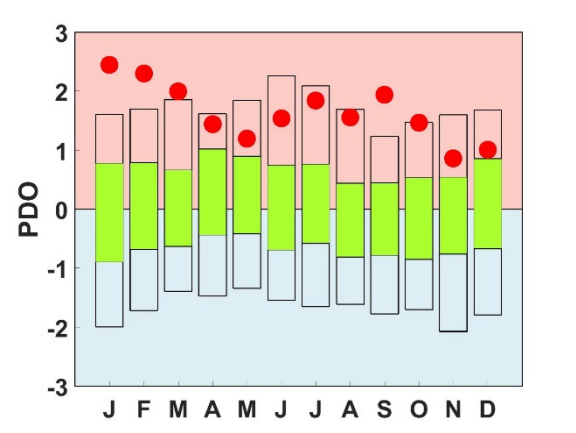
North Pacific Gyre Oscillation:
NPGO significantly below normal.

Deppe intrusion index:
Intrusions less favorable in November than in October.

Weather Coastal conditions

Indices describing oceanic boundary conditions which can affect marine water quality in our state





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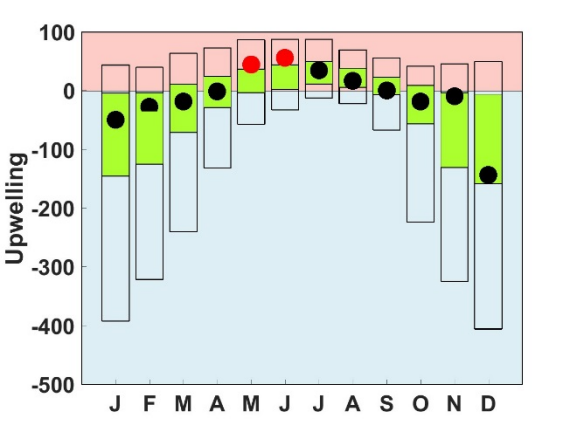
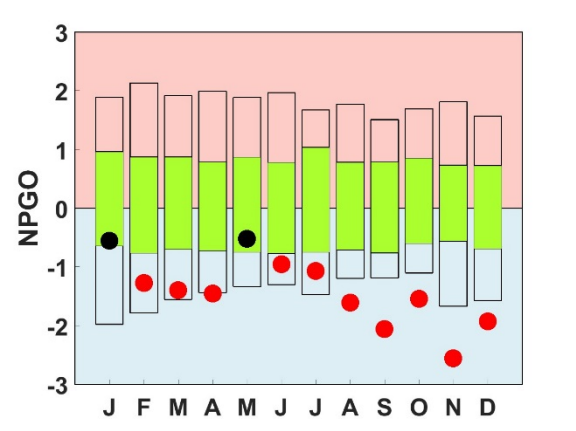
Cool phase





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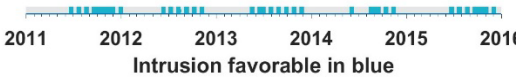
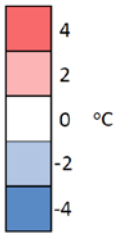


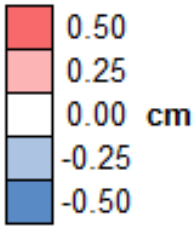
Weather ◯ Coastal conditions

Anomalies in Air Temperature



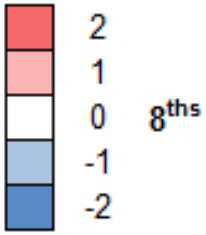
Anomalies of daily mean temperature (°C) from National Climate Data Center, 1971-2000 Climate Normals; red for warmer than normal, blue for cooler than normal.

Anomalies in Cumulative Precipitation



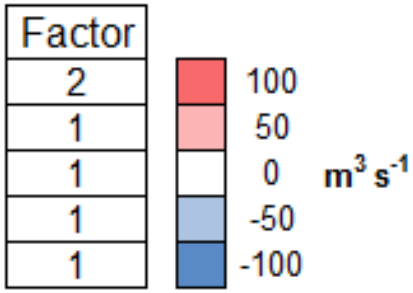
Anomalies of daily mean precipitation (cm) from National Climate Data Center, 1971-2000 Climate Normals; red for wetter than normal, blue for drier than normal.

Anomalies in Cloud Cover



Anomalies of daytime mean cloud cover (8ths) from National Climate Data Center. '0' is fully sunny, '8 is fully cloudy. Red is above monthly averages and blue is below it. Monthly means taken from daylight hours (7-16:00) during 2009-2013.

Anomalies in River Flow

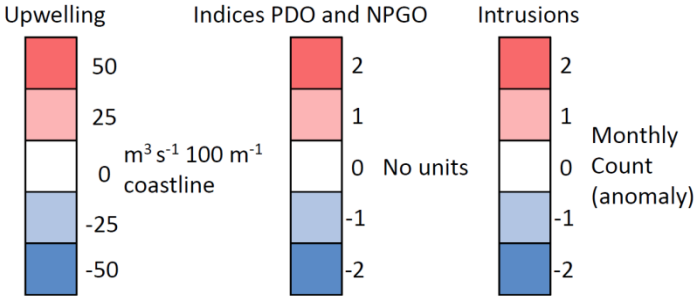


Anomalies of daily river transport (km^3s^{-1}) from USGS, and Environmental Canada for the Fraser River; red for higher flow than normal, blue for lower flow than normal.

Meteorological conditions typically explain up to half of the variance in observed marine variables (Moore et al. 2008), particularly in shallower waters like those of South Puget Sound.

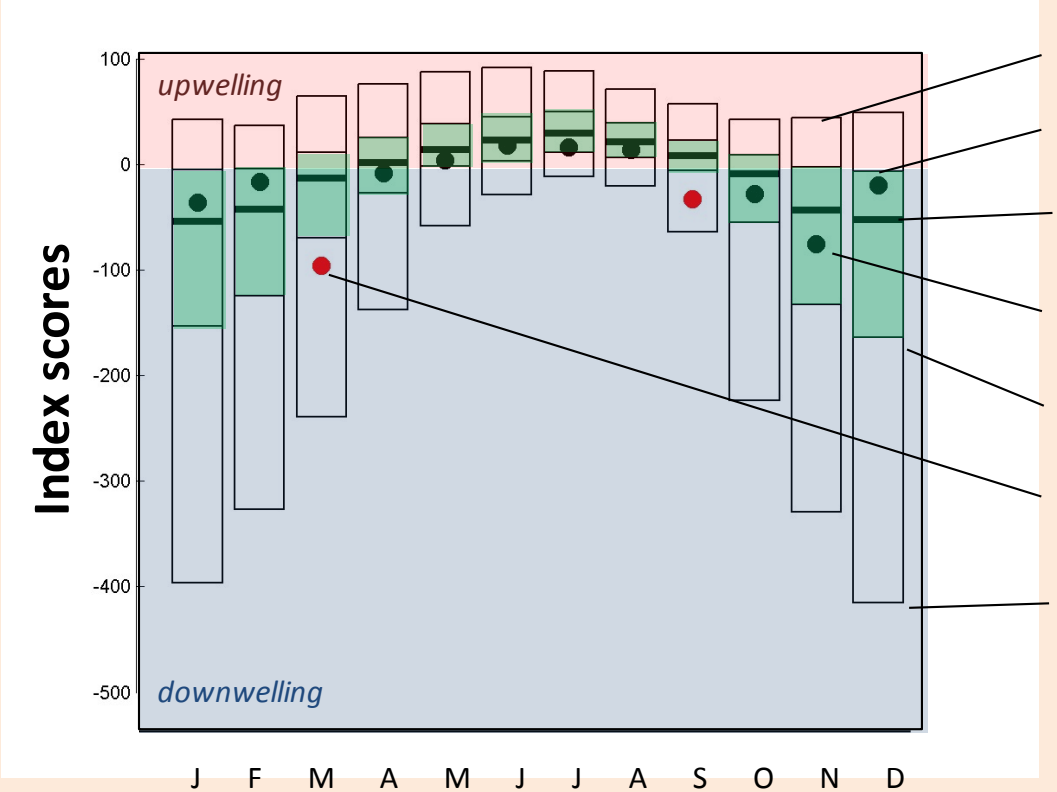
Moore et al. 2008. Local and large-scale climate forcing of Puget Sound oceanographic properties on seasonal to interdecadal timescales. Limnol. Oceanogr., 53(5), 1746–1758

PDO, NGPO, upwelling indices



Weather **Coastal conditions**

Monthly Index Scores and Anomalies



95th percentile

75th percentile

median

this years monthly index score

25th percentile

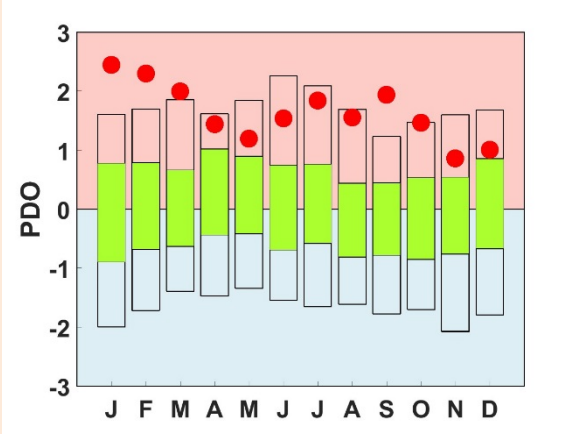
Histogram of Upwelling Index scores

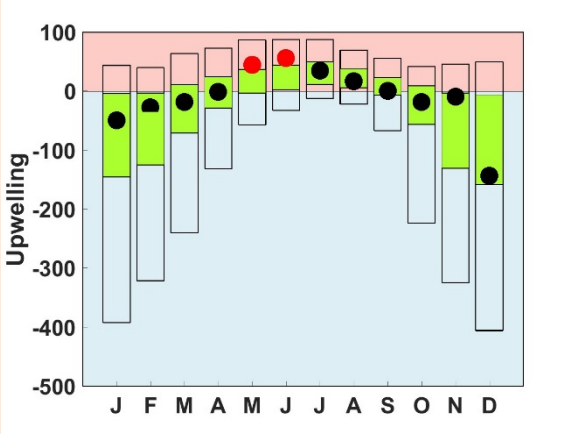
Differs from historical record

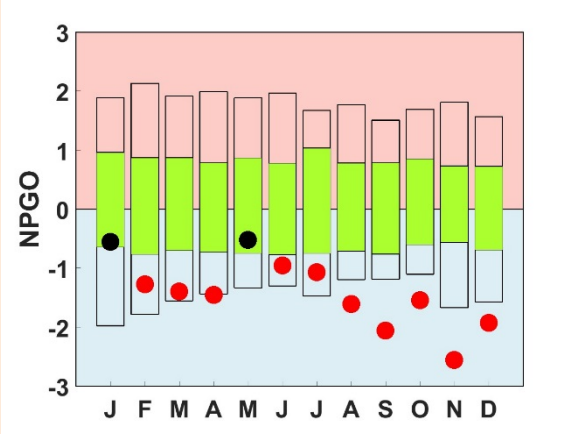
5th percentile

Key indices are the Pacific Decadal Oscillation (PDO, dimensionless) derived from observed Pacific Sea Surface Temperature and Sea Level Pressure, Upwelling ($m^3/s/100$ m coastline) at 48°N and 125°W that is positive for upwelling, and negative for downwelling conditions, and NPGO that is the oceanic expression of the North Pacific Oscillation (Walker and Bliss) the north-south seesaw in sea level pressure.

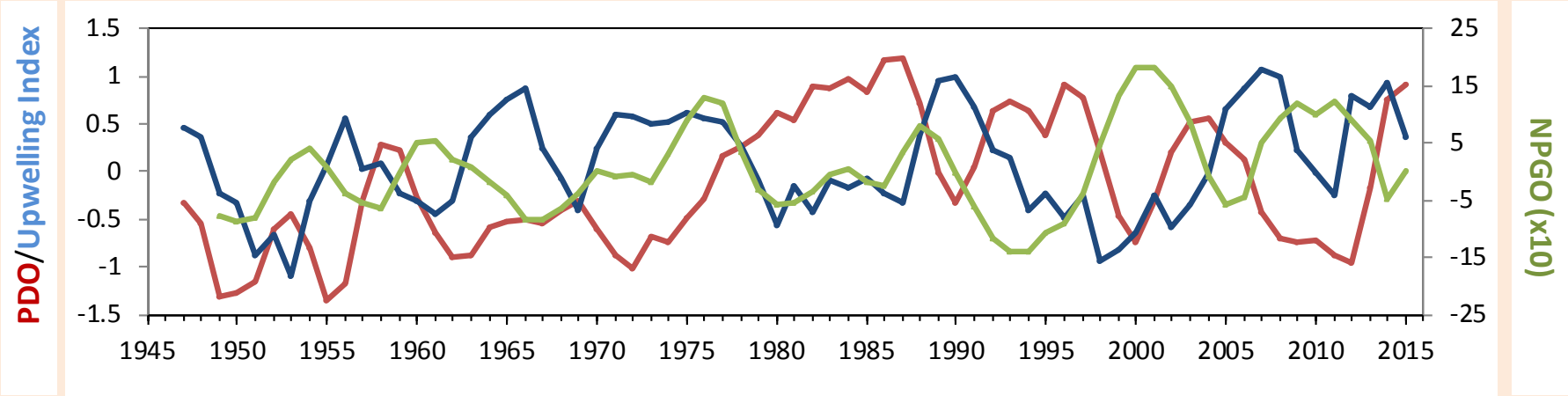
Weather ● Coastal conditions







PDO persisted in warm phase in 2015. Upwelling was above normal in May and June. NPGO is mostly below normal.



Weather **Coastal conditions**

Meteorological conditions typically explain up to half of the variance in observed marine variables (Moore et al. 2008), particularly in shallower waters like those of South Puget Sound. The specific conditions prevalent during the past two weeks, from north to south, are shown below.

Summary:

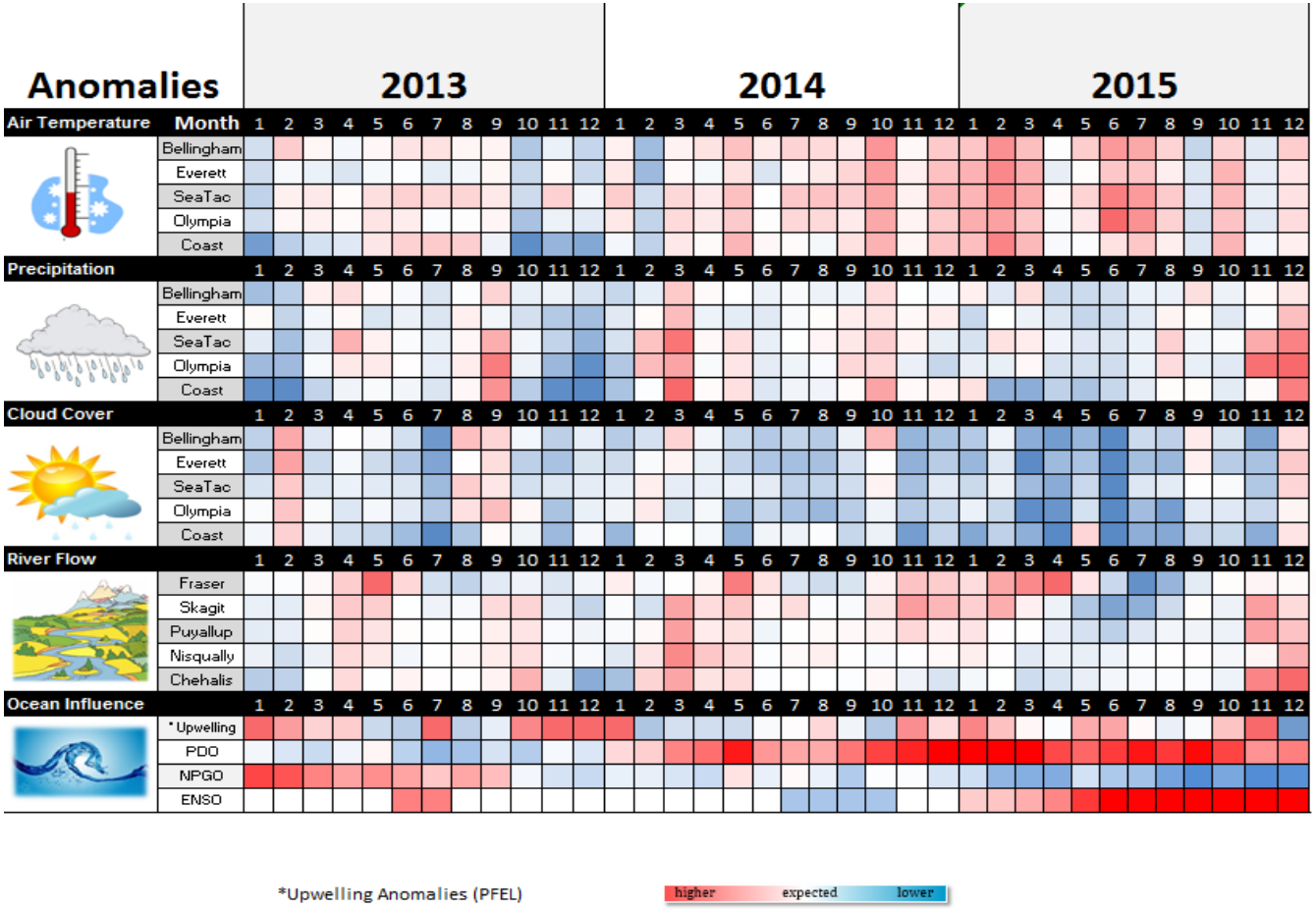
Air temperatures were generally above normal, which was responsible for low snow pack. September and November were cool.

Precipitation was below normal April – July.

Cloud Cover has been mostly below normal, except during December.

Rivers Fraser was high in April, low in summer.

Downwelling has been less vigorous for many winter months & PDO warmer than normal. El Niño developed.



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