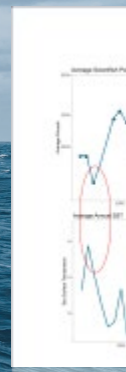
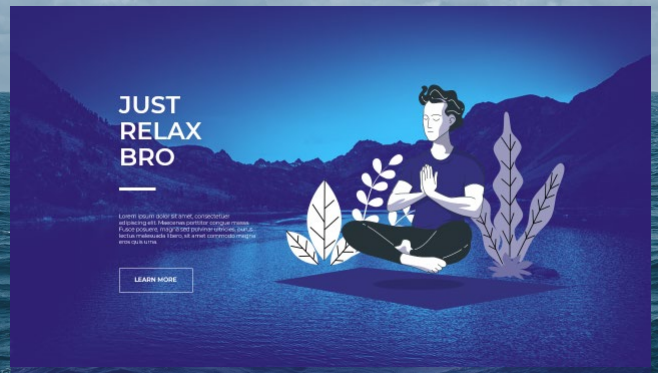
Seascape Applications:

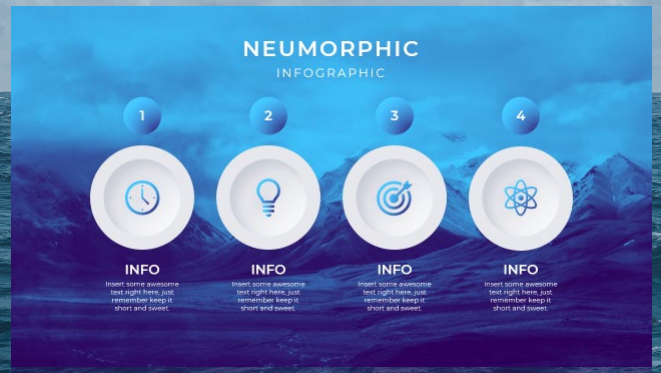
Swordfish Habitat in Proposed Chumash National Marine Sanctuary



Seascape Applications:

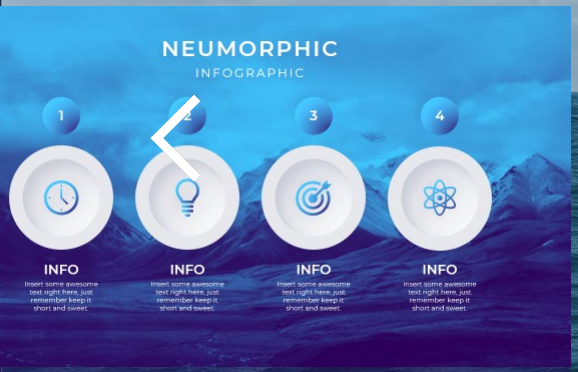
Swordfish Habitat Compression in Proposed Chumash National Marine Sanctuary

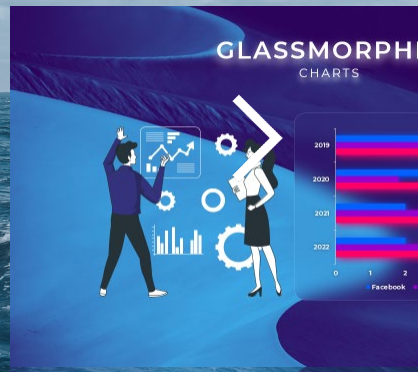




Seascape Applications:

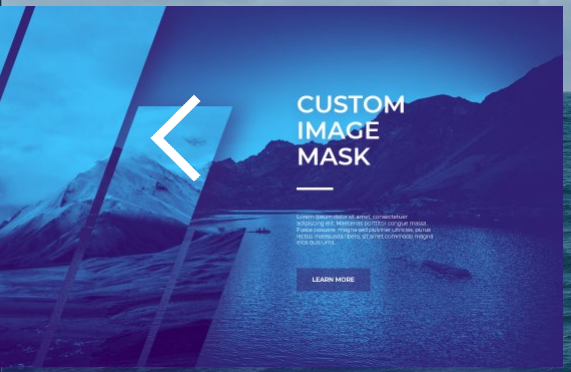
Swordfish Habitat Compression in Proposed Chumash National Marine Sanctuary

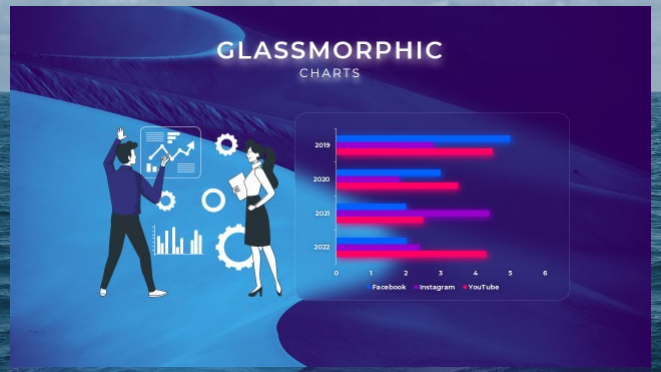




Seascape Applications:

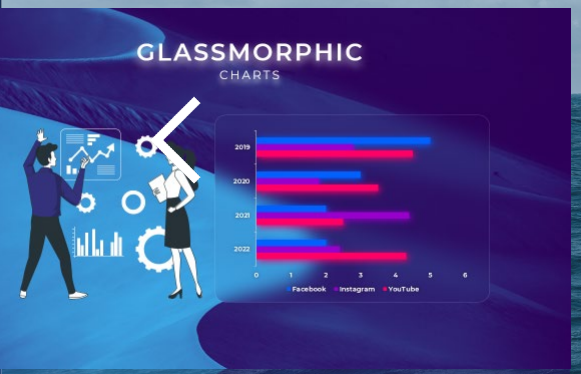
Swordfish Habitat Compression in Proposed Chumash National Marine Sanctuary





Seascape Applications:

Swordfish Habitat Compression in Proposed Chumash National Marine Sanctuary



BACKGROUND

SEASCAPES

Seascapes are classes of water masses defined by surface properties obtained via satellite (temperature, salinity, Chlorophyll a, CDOM, …) and an ordination statistical process (Kavanaugh et al. 2016).

SEASCAPE ID NUMBER	NOMINAL DESCRIPTOR	SST (°C)	SSS (psu)	ADT (m)	ICE (%)	CDOM (m^{-1})	CHLA ($mg\ m^{-3}$)	NFLH ($W\ m^{-2}\ um^{-1}\ sr^{-1}$)	NFLH:CHL	LATITUDE	DOMINANT HEMISPHERE	DOMINANT SEASON
1	NORTH ATLANTIC SPRING, ACC TRANSITION	5.08	34.18	-0.37	0	0.01	0.21	0.08	0.37	SUBPOLAR	SOUTH	SPRING-AUTUMN
2	SUBPOLAR TRANSITION	12.23	34.43	0.5	0	0.01	0.12	0.06	0.51	TEMPERATE	SOUTH	YEAR ROUND
3	TROPICAL SUBTROPICAL TRANSITION	24.12	35.34	0.68	0	0.01	0.15	0.06	0.4	TROPICAL	BOTH	YEAR ROUND
4	WESTERN WARM POOL SUBTROPICAL	28.25	34.4	1.1	0	0	0.06	0.05	0.79	SUBTROPICAL	BOTH	AUTUMN
5	SUBTROPICAL GYRE TRANSITION	23.95	35.89	0.71	0	0	0.07	0.04	0.5	SUBTROPICAL TEMPERATE	BOTH	AUTUMN-WINTER
6	ACC, NUTRIENT STRESS	1.38	34.01	-1	0	0.01	0.18	0.07	0.42	SUBPOLAR POLAR	SOUTH	WINTER
7	TEMPERATE TRANSITION	12.98	34.72	0.37	0	0.01	0.28	0.11	0.41	TEMPERATE	BOTH	WINTER
8	INDOPACIFIC SUBTROPICAL GYRE	25.13	34.52	0.99	0	0	0.07	0.02	0.34	SUBTROPICAL	BOTH	YEAR ROUND
9	EQUATORIAL TRANSITION	28.01	33.84	0.86	0	0.01	0.14	0.05	0.37	TROPICAL	BOTH	YEAR ROUND
10	HIGHLY OLIGOTROPHIC SUBTROPICAL GYRE	23.85	35.64	0.87	0	0	0.04	0.03	0.79	SUBTROPICAL	SOUTH	SUMMER
11	TROPICAL/SUBTROPICAL UPWELLING	22.94	34.79	0.83	0	0.01	0.27	0.11	0.39	"TROPICAL, SUBTROPICAL"	BOTH	WINTER
12	SUBPOLAR	8.62	32.91	0.3	0	0.02	0.37	0.08	0.22	TEMPERATE/ SUBPOLAR	BOTH	YEAR ROUND
13	SUBTROPICAL GYRE MESOSCALE INFLUENCED	23.47	35.89	0.52	0	0.01	0.1	0.02	0.19	SUBTROPICAL TEMPERATE	BOTH	SPRING-SUMMER
14	TEMPERATE BLOOMS UPWELLING	9.95	33.91	-0.01	0	0.03	0.84	0.16	0.19	TEMPERATE/ SUBPOLAR	BOTH	SPRING SUMMER
15	TROPICAL SEAS	25.35	35.4	0.51	0	0.02	0.32	0.06	0.2	TROPICAL/SUBTROPICAL	BOTH	WINTER
16	MEDITERRANEAN RED SEA	18.74	37.87	0.03	0	0.02	0.22	0.05	0.22	SUBTROPICAL/ TEMPERATE	NORTH	WINTER
17	SUBTROPICAL TRANSITION LOW NUTRIENT STRESS	20.89	33.59	0.64	0	0.01	0.17	0.02	0.15	TROPICAL/ SUBTROPICAL	NORTH	SUMMER
18	MEDITERRANEAN RED SEA	21.94	37.72	-0.05	0	0.01	0.11	0.01	0.1	TEMPERATE/ SUBPOLAR	BOTH	SPRING-SUMMER
19	ARTIC/ SUBPOLAR SHELVES	7.63	31.55	0.15	0	0.05	1.19	0.11	0.09	TEMPERATE/ SUBPOLAR	BOTH	YEAR ROUND
20	SUBTROPICAL, FRESH INFLUENCED COASTAL	27.45	31.82	0.88	0	0.02	0.34	0.06	0.18	SUBTROPICAL	NORTH	WINTER/YEAR-ROUND
21	WARM, BLOOMS, HIGH NUTS	22.54	34.46	0.57	0	0.07	2.09	0.24	0.12	TROPICAL/ SUBTROPICAL	BOTH	WINTER/YEAR-ROUND
22	ARCTIC LATE SUMMER	6.26	30.1	-0.09	0.43	0.03	0.47	0.03	0.06	SUBPOLAR/POLAR	NORTH	SUMMER
23	FRESHWATER INFLUENCED POLAR/SUBPOLAR SHELVES	8	27.74	0.11	1	0.05	1.16	0.06	0.05	SUBPOLAR/POLAR	NORTH	SUMMER
24	ANTARCTIC SHELVES	0.23	33.84	-1.11	18.62	0.01	0.32	0.1	0.3	SUBPOLAR/POLAR	SOUTH	SPRING SUMMER
25	ICE PACK/LARGE POLYNAS	0.8	30.64	-0.38	62.24	0.02	0.51	0.06	0.12	SUBPOLAR/POLAR	BOTH	SPRING SUMMER
26	ANTARCTIC ICE EDGE	0.26	33.58	-0.97	34.35	0.01	0.4	0.11	0.27	POLAR	SOUTH	SUMMER
27	HYPERSALINE EUTROPHIC, PERSIAN GULF, RED SEA	25.95	38.14	0.54	0	0.07	1.15	0.11	0.09	SUBTROPICAL/ TEMPERATE	NORTH	WINTER/YEAR-ROUND
28	ARCTIC ICE EDGE	2.33	27.76	0.06	35.84	0.03	0.64	0.03	0.05	POLAR	NORTH	SUMMER
29	ANTARCTIC	0.15	33.89	-1.15	9.13	0.01	0.27	0.09	0.32	POLAR	SOUTH	SUMMER
30	ICE EDGE BLOOM	2.32	29.87	0.04	15.52	0.04	0.81	0.05	0.06	SUBPOLAR/POLAR	NORTH	SPRING SUMMER
31	1-30% ICE PRESENT	NaN	NaN	NaN	15	NaN	NaN	NaN	NaN	SUBPOLAR POLAR	BOTH	YEAR ROUND
32	30-80% MARGINAL ICE	NaN	NaN	NaN	50	NaN	NaN	NaN	NaN	SUBPOLAR POLAR	BOTH	YEAR ROUND
33	PACK ICE	NaN	NaN	NaN	90	NaN	NaN	NaN	NaN	SUBPOLAR POLAR	BOTH	YEAR ROUND

METHODS

1

Catch Data

Understanding spatial and temporal distribution of data

2

netCDF SST

Data exploration of relationship between catch and SST

3

SS and HSI

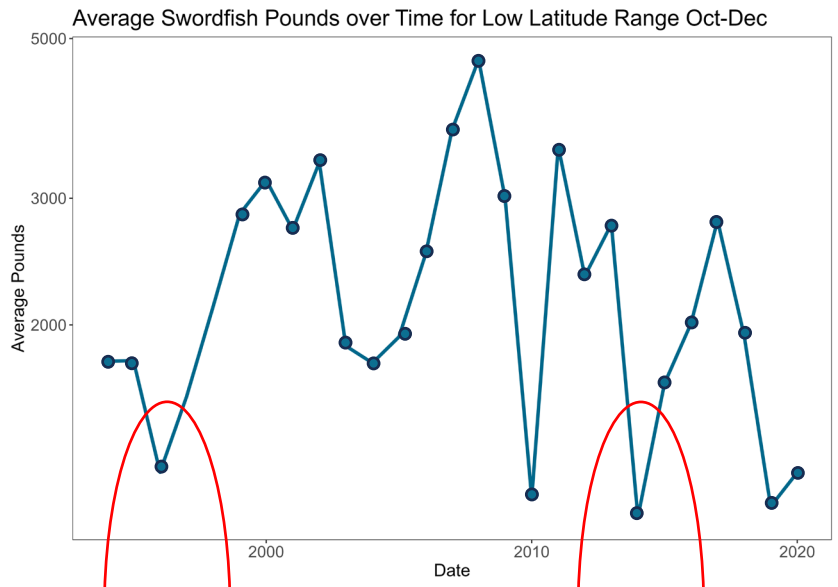
Additional data exploration with seascapes and habitat suitability

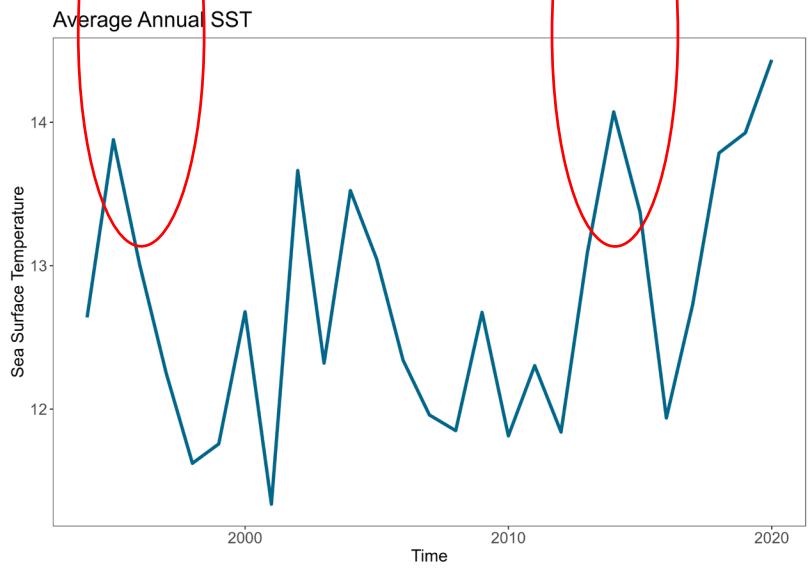
4

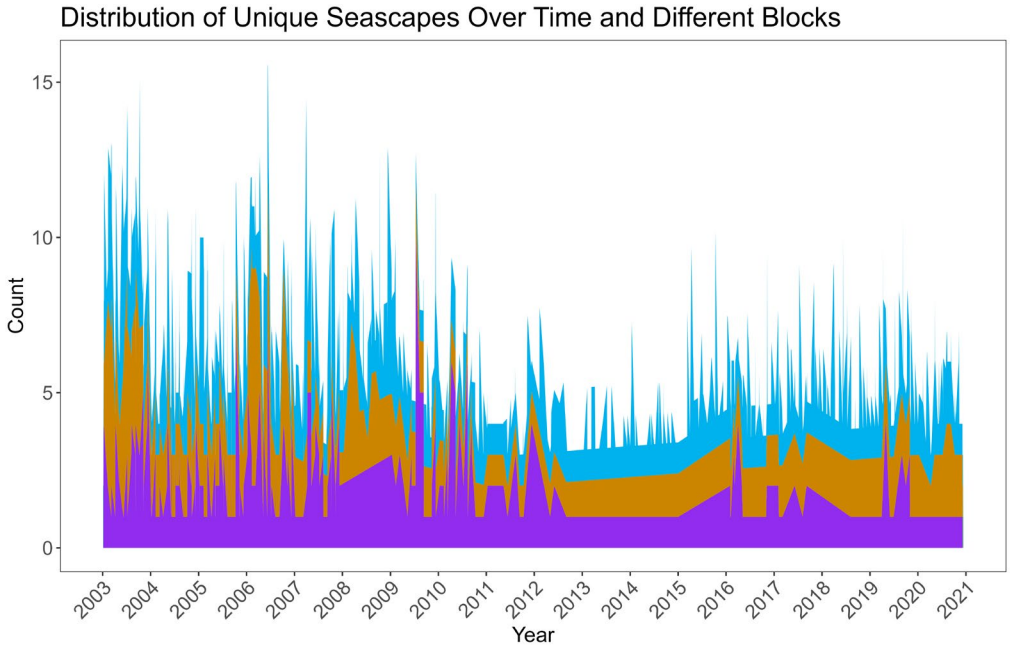
Analysis

Spearman's Correlation and Log-likelihood testing

Data Exploration

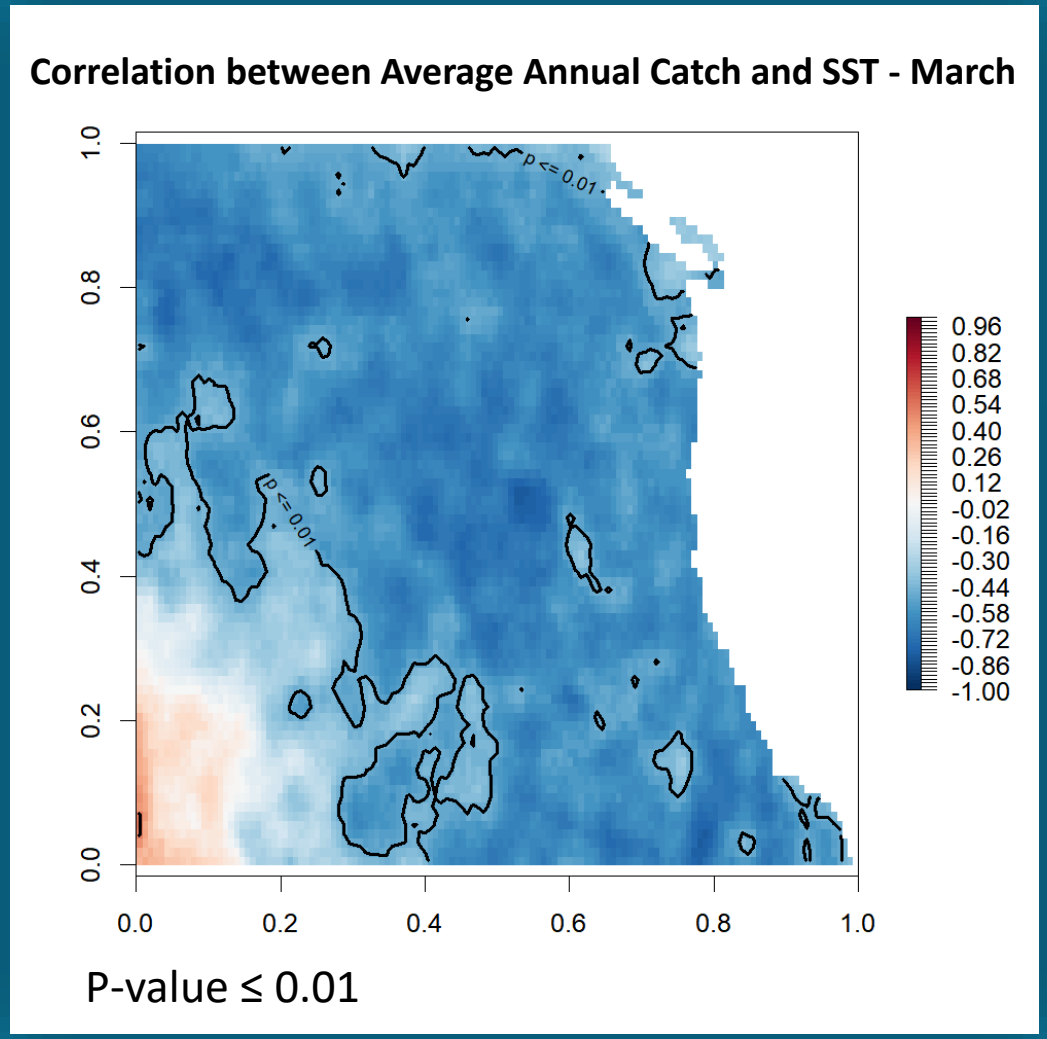






12	Sub-Polar	Year Round
14	Temperate Blooms Upwelling	Spring Summer
17	Subtropical Transition Low Nutrient Stress	Summer

Results



$$\lambda = log(Nx/N/px)$$

SS ID	Descriptor	Dominant Season	Z-value	P-value
12	Sub-Polar	Year Round	0.695439	0.486779
14	Temperate Blooms Upwelling	Spring Summer	-3.35864	0.000783
17	Subtropical Transition Low Nutrient Stress	Summer	3.52103	0.0004298

So What?

next steps

1. Temperature as a potential proxy
2. SS can improve efficiency by managing for habitat rather than species
3. Correlation Plots for HSI
4. Investigate incorporating SS into a predictive model

Acknowledgements

Thank you:

Maria Kavanagh, Elliott Hazen, Issac Schroeder, Ryan Freedman, Adena Schonfeld, and Nerea Ochoa

This presentation was made possible by the National Oceanic and Atmospheric Administration, Office of Education Educational Partnership Program award number (NA16SEC4810007). Its contents are solely the responsibility of the award recipient and do not necessarily represent the official views of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration.

Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration.

Additional Figures