waters studied consist mainly of the water mass known as North Pacific Tropical Water, but includes much of the water of the mid-latitude thermocline. A method is developed to trace these waters from 137°E back through the subtropical gyre to their outcrops. Subducted waters are aged using this technique and found to be between 0.5 and 35 years old by the time they reach 137°E. For this subducted regime, waters on a given isopycnal observed along 137°E increase in age with decreasing latitude, with waters at the southern end of the section being 2-3 times older than waters at the northern end. This estimate of age is consistent with previous estimates calculated from chlorofluorocarbon measurements. It is found that subducted water masses are strongly homogenized by the time they reach 137°E. That is, the originally subducted waters have a wide variation in θ-S characteristics, but by the time they reach 137°E, they form a coherent water mass with a tight θ-S relation. It is shown that isopycnal mixing is not a plausible mechanism for this homogenization but diapycnal mixing is a more likely process.

URL: http://www.fredbingham.com/wep/ReverseTrajectory

OS51G-08 1035h

Upper Ocean Hydrographic Structure and Determination of Fronts in the Subarctic North Pacific

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The abundance of sea surface temperature (SST) measurements from satellite data has increased our ability to determine surface ocean thermal frontal boundaries, but the determination of subsurface fronts is still hampered by relatively sparse and infrequent subsurface temperature and salinity measurements. Consequently the relationships between sea surface and subsurface fronts are still poorly defined. Frontal boundaries are not precise lines, but are actually zones where horizontal property gradients change rapidly, are usually associated with enhanced currents, and are often related to ecological zones. In the North Pacific, the subarctic frontal boundary has also been distinguished by the limit of the subsurface temperature minimum, or dichothermal layer. Here we use hydrographic data from the NODC World Ocean Database to estimate the properties of the upper mesothermal layers in the North Pacific. These are compared to derived horizontal gradient estimates and frontal determinations from synoptic sections (including WOCE), and to satellite SST gradients. A method is developed to determine the subarctic fronts from properties of the temperature minimum layer, with error limits estimated by differences from the other determinations. Relationships between the surface and subsurface features are examined, and the method is applied to all available hydrographic data since 1950 to indicate annual, interannual, and decadal subarctic frontal variability.

OS51G-09 1050h

Mesoscale processes at the Subarctic Front in the northwestren Pacific Ocean

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We present a detailed analysis of eddies and fronts monitored in September-October, 1987 by intense shipboard observations of the region between 150°-158°E and 38°-43°N. Data from 623 hydrocasts and 118 moorings are synthesized with GEOSAT altimetry and ECMWF winds in the framework of a variational data assimilation scheme to produce a dynamically and statistically consistent analysis of oceanic circulation. The 3d baroclinic QG model controlled by the initial and open lateral boundary conditions fits all the data types within prescribed error bars (2 cm/sec for velocity, 3 cm for sea surface height anomalies and 30% for relative density variations at all levels). The dynamically interpolated fields demonstrate a number of events which shed light on the mechanism of cross-frontal exchange of water properties and on the origin of instable modes of the Subarctic Front. Eddy-mean flow interactions, potential vorticity and energy budgets are quantitatively assessed and analyzed.

OS51G-10 1105h

A Mean Sea Level for Satellite Altimetry in the Northeast Pacific

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Climatological salinity and temperature data from a variety of sources are combined with the offshore winds from fifteen buoys to force a diagnostic, finite element model calculation of seasonal sea surface elevations and flows from Oregon to the Alaska Panhandle. Additional barotropic components in the flow field, such as the California Undercurrent, are included through the inversion of long-term current measurements off Vancouver Island. The resultant seasonal elevations are validated against coastal tide gauge observations and a mean sea level is computed. This reference level is then combined with satellite altimeter anomalies to estimate "true" sea levels and surface currents at particular times.

OS51G-11 1120h

PDO-related Changes in the Thermocline Heat Budget in a Model of the North Pacific

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The Pacific Decadal Oscillation is characterized by changes in both the sea surface temperature and windstress fields of the North Pacific. Changes in the windstress field can influence the temperature field, both through direct Ekman advection and by changes in the geostrophic transport of the subtropical gyre due to Ekman pumping. The largest interannual variability of the SST field in the North Pacific occurs in the Kuroshio Extension. PDO-related thermocline heat budget changes in the Kuroshio current system are analyzed using an eddy-permitting isopycnal model coupled to a mixed layer model. In particular, two runs are compared, the first driven by positive-PDO-like atmospheric windstress and thermal forcing and the second with negative-PDO-like forcing. Changes to the geostrophic and Ekman advection of temperature are compared in the two cases, as well as changes in mode water properties and formation rate. Ocean-atmosphere heat exchange is calculated using bulk parameterization of air-sea fluxes.

OS51G-12 1135h

The Response of the North Pacific Ocean to Decadal Variability in Atmospheric Forcing: Wind Versus Buoyancy Forcing

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Both wind variability and buoyancy forcing result in thermocline variability in the North Pacific. Wind variability forces mostly a first baroclinic mode response while buoyancy forcing, since it is applied in a different part of the water column, forces a higher baroclinic mode response. A vertical modal analysis of the density deviations in an ocean general circulation model of the North Pacific is used to identify the spatial and temporal patterns of the different baroclinic modes. The different dynamic vertical modes show distinct propagation characteristics, with the first baroclinic mode exhibiting consistent westward propagation at latitudes south of 40N, while the higher baroclinic modes show westward phase propagation at low latitudes, but propagate eastward at higher latitudes. The propagation characteristics of each mode can be understood by the inclusion of the zonal mean flow in the vertical structure equation.

Projection of the Ekman pumping and diapycnal fluxes in the quasi-geostrophic potential vorticity equation for each dynamic vertical mode distinguishes their effects on the thermocline variability. Ekman pumping is important throughout the North Pacific for forcing first mode variability. Diabatic pumping, or that associated with thermal forcing, is important in the Kuroshio Extension, and much less so further to the south. The spatial distribution of the forcing is consistent with the structure of the energy in the baroclinic modes. The first baroclinic mode energy increases to the west, while the second baroclinic mode has a band of positive energy emanating westward from the eastward end of the Kuroshio Extension and ends at the western boundary at 20N, reflecting the strong effect of the mean flow on wave propagation.

The results confirm the importance of inclusion of the first baroclinic mode as well as higher baroclinic modes in studies of the decadal variability in the ocean. The analysis suggests that at least the first three baroclinic modes should be included and that 2 and one half layer models of the ocean may be inadequate for understanding the role of the ocean in mid-latitude coupled modes of variability in the ocean-atmosphere system.

OS51G-13 1150h

Model-based upper ocean climatology for the North Pacific

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A fifty-three year (1948-2000) simulation of the North Pacific from 25^oN to 65^oN at a coarse $1^{\lfloor}o$ horizontal resolution, but high vertical resolution (51levels), is used to generate a climatology of the upper ocean and characterize the seasonal and interannual variability of the mixed layer and upper pycnocline. The model is initialized from Levitus' climatology and forced by fluxes from the NCEP reanalysis dataset. The mixed layer is parameterized using the KPP formulation of Large, et al. (1994). Comparison with the time series at Hawaii and Papa show surprising fidelity between the model mixed layer depth (MLD) and sea surface temperature (SST) and the observations. At HOT, the 20^oC isotherm during the 1990's is 40 m deeper than the Levitus climatology, which is reproduced by the model. Comparisons with the TAO buoy data in the tropics is less favorable. Again large differences are observed between the depth of the 20^oC isotherm between the buoy data and Levitus climatology. However, the model is unable to reduce these differences significantly.

An EOF analysis of the model SST and MLD shows dominance of the low modes by the seasonal cycle in the subtropical gyre. Interannual variability is dominated by El Nino and La Nina cycles. One mode dominates the decadal variability with a transition in sign in the late 1970's and near zero amplitude in 2000.

Results from coupling this model with an ecosystem will be presented in another paper.

OS51H HC: 314 Friday 0830h

Marine Ecosystem Responses to Climate: The Responses of Large Marine Ecosystems to Interdecadal-Scale Climate Variability II

Presiding: **W T Peterson,** National Marine Fisheries Service**; A J Miller,** Scripps Institution of Oceanography

OS51H-01 0830h

North Pacific Regime Shifts and the Pacific Decadal Oscillation

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Changes in the marine environment and ecosystems that persist for multiple years have been termed "regime shifts" by both fishery and climate scientists. A special class of Pacific regime shifts has been dubbed the Pacific Decadal Oscillation (PDO. The PDO has been described by some as a long-lived El Nio-like pattern of Pacific climate variability, and by others as a blend of two sometimes independent modes having distinct spatial and temporal characteristics of North Pacific sea surface temperature (SST) variability. A growing body of evidence highlights a strong tendency for PDO impacts in the Southern Hemisphere, with important surface climate anomalies over the mid-latitude South Pacific Ocean, Australia and South America. Several independent studies find evidence for just two full PDO cycles in the past century: "cool" PDO regimes prevailed from 1890-1924 and again from 1947-1976, while "warm" PDO regimes dominated from 1925-1946 and from 1977 through (at least) the mid-1990's. Interdecadal changes in Pacific climate have

widespread impacts on natural systems, including water resources in the Americas and many marine fisheries in the North Pacific. Tree-ring and Pacific coral based climate reconstructions suggest that PDO variations–at a range of varying time scales–can be traced back to at least 1600, although there are important differences between different proxy reconstructions. While 20th Century PDO fluctuations were most energetic in two general periodicities–one from 15-to-25 years, and the other from 50-to-70 years– the mechanisms causing PDO variability remain unclear. To date, there is little in the way of observational evidence to support a mid-latitude coupled air-sea interaction for PDO, though there are several well-understood mechanisms that promote multi-year persistence in North Pacific upper ocean temperature anomalies.

URL: http://jisao.washington.edu/pdo

OS51H-02 0845h

Ecosystem Change in the Northern California Current: Evidence for a Large-Scale Climate Regime Shift in 1999

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Retrospective analysis of time series data on zooplankton biomass and species composition collected off the central Oregon coast has revealed strong correlations between the Pacific Decadal Oscillation (PDO) and zooplankton biomass, species composition and community structure. Our data set includes zooplankton samples collected at two stations located 9 and 18 km off Newport, Oregon (44°40'N) at biweekly intervals in 1969-1973, 1983, 1991, and 1996 to present. All samples were enumerated to species and data analysis included cluster analysis, Non-Metric Multidimensional Scaling and Indicator Species Analysis using PC-ORD. These data provide examples of zooplankton community structure in the Oregon upwelling zone during the cold, productive climate regime of the 1970's, two El Nino periods (1983 and 1997-98), the warm climate regime of the 1990's and the hypothesized new, cool regime, which was initiated in 1999. The results of our analyses show that the PDO averaged for summer months was negative during most years of the cool regime of 1947-1976, positive for all years between 1977-1997, then turned negative in July 1998 and has remained so since that time. Copepod species abundances were highly correlated with the PDO. During the 1969-1973 cool period, boreal copepod species had anomalously high biomass, but during the warm periods of 1983 and 1996-1998, boreal species had an anomalously low biomass; these species include *Pseudocalanus mimus*, *Calanus marshallae*, *Acartia longiremis* and *Centropages abdominalis*. Conversely, subtropical and transition zone copepod species had anomalously low biomass during the cool periods and high biomass during the warm periods; these species include *Mesocalanus tenuicornis*, *Eucalanus californicus*, *Paracalanus parvus* and several species of *Clausocalanus*. Cluster analysis revealed that during the cool regime, the boreal copepod assemblage dominated from March through October whereas during warm regimes, boreal species were only found from May or June through October suggesting a fundamental difference in the length of the upwelling season between regimes. This fact may explain our observation that copepod biomass was twice as high during cool periods as during warm periods. Finally, since the advent of the cool regime in 1999, the spawning season of euphausiids has increased greatly to February-October as compared to July-August during warm periods, northern anchovy have resumed spawning in coastal waters, and salmon numbers have rebounded to levels not seen since the 1970's.

OS51H-03 0900h

Ecosystem Response to Predictable Changes of the Northwest Pacific Ocean Climate

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A portion of SST variability in the Kuroshio-Oyashio Extension (KOE) region around Japan is predictable on interannual timescales due to Rossby waves excited by wind-stress curl in the central North Pacific. Hence, a portion of the ecosystem in the KOE region may also be predictable. The possible impact of the predictable component of ocean physics (including changes in SST, thermocline depth, upwelling, and horizontal advection) on the ecosystem (including phytoplankton, zooplankton, and small pelagic fish populations) of the KOE region will be discussed in the context of available observations and ocean model hindcasts of the past 50 years.

OS51H-04 0915h

Regime Shifts in the California Current: the 1999 Node

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The 52 year (and ongoing) CalCOFI time series provides a sufficiently long measurement record to differentiate ecosystem perturbations of different types: El Nio-La Nia cycles, secular trends, and Regime Shifts. The geographic location of current CalCOFI sampling is well situated for early detection of ecosystem state changes because of proximity to a biogeographic boundary region: for marine zooplankton the cool water Transition Zone fauna intersects the warm water Subtropical fauna. Our retrospective studies of CalCOFI zooplankton assemblages, conducted as a part of the U.S. GLOBEC NE Pacific program, have uncovered evidence for changes in diverse epipelagic zooplankton taxa, including salps, doliolids, pyrosomes, and euphausiids, in both 1977 and 1999. Beginning in 1999, several physical properties in the water column changed: the PDO index changed sign, SST measured at the Scripps pier decreased, and the water column in the CalCOFI region became less thermally stratified. In parallel with these physical changes, total zooplankton biomass has been anomalously high since 1999, abruptly reversing the previously documented long term decline in biomass. A number of cool-regime zooplankton taxa have increased in biomass and several warm-water zooplankton taxa have decreased in abundance. Decadal-scale variations in subtropical euphausiids, in particular, are correlated with variations in the large-scale PDO index. We hypothesize that transitions into a warm regime are initiated by increased northward transport, but then subtropical taxa subsequently become self-sustaining in the region through increased survivorship and reproduction. Transitions into a cool regime, such as seems to have occurred in 1999, would be initiated through intensified southward transport.

OS51H-05 0930h

Marine Bird Populations in the Southern California Current System: Response to Oceanographic Variability Over Multiple Temporal Scales

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We have surveyed the demography and diet of seabird populations breeding at the Farallon Islands (central California, 1971- 2001), and marine bird abundance and community structure at-sea using seasonal CalCOFI cruises (southern California, 1987- 2001). Our research suggests that seabirds respond to variability in ocean climate at two temporal scales: short-term (interannual) fluctuations associated with ENSO variability, and longer-term (decadal) trends in response to ocean warming. In the short-term, changes in at-sea communities, diet, and reproductive success have been dramatic, apparently in response to transient warm-water and cold-water events. In the long-term, seabird abundance, community structure, diets, and reproductive success have undergone gradual and persistent changes, concurrent with an increase in ocean temperature and a decrease in macrozooplankton biomass. In particular, our research has revealed that seabird species with high foraging costs appear to be most susceptible to climatic changes in the productivity of the California Current. The CalCOFI program has documented declines in the at-sea abundance of the numerically dominant cold-water seabirds (Sooty Shearwater and Cassins Auklet), concordant with changes population declines (50% - 90%) and shifts in the diet and productivity of locally-breeding populations at the Farallon Islands. These results suggest that specific life-history adaptations influence community-level responses to climatic change, and highlight the value of marine birds as indicators of changes in marine ecosystems.

OS51H-06 0945h

Climate-Driven Changes in Kelp Forest Distribution and Productivity in the Southern California Bight Since the Last Glacial Maximum

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Kelp forest distributions are constrained by the availability of rocky substrate within the depth range tolerable for growth and reproduction. The size and distribution of such reefs may vary over relatively short geological timescales (100s of yrs) due to interactions between coastal bathymetry and climate-driven changes in eustatic sea level. I developed a digital bathymetric map for the southern California coast. Using a Geographic Information System (GIS) and published sea level curves and kelp depth tolerances for the same region, I reconstructed changes in the maximum size, distribution, and productivity of insular giant kelp (Macrocystis pyrifera) forests in the Southern California Bight since the last glacial maximum. Reconstructions were validated by comparing the known size and distribution of present-day giant kelp forests to GIS predictions based on current sea level. Reconstructions predicted that the total area of available kelp forest habitat was approximately 200% greater at 16.5 kyr BP (1130 square km), than at present (382 square km). Available kelp forest habitat during the last glacial maximum (18.5 kyr BP; 628 square km) was approximately 64% greater than at present, the difference between 16.5 and 18.5 kyr BP being due to greater exposure of the steep shelf slope during lowest sea levels. Coupled with area-specific biomass and productivity estimates from present-day kelp forests, these reconstructions suggested more productive and spatially extensive kelp forests in the Southern California Bight near the last glacial maximum than at present. The large climate-driven (i.e. sea level) decreases in kelp forest distribution and productivity since the last glacial maximum likely had important historical impacts on the ecology and evolution of the present-day kelp ecosystem, as well as the exploitation of marine resources by the early human inhabitants of southern California.

OS51H-07 1020h

The modulation of Pacific Decadal Oscillation on the ENSO activities and ecosystem responses in the equatorial Pacific: a coupled biological-physical modeling study

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Although decadal scale physical changes have been observed at several locations in the Pacific Ocean, it remains largely unclear how these subtle but pervasive variations have altered ecosystem processes and biogeochemical fluxes. Based on a coupled biological-physical model forced with observed surface wind and heat flux between 1955-1993, we compare the ecosystem responses to the ENSO events in the equatorial Pacific before and after the climatic regime shift occurred in 1976/77. The results show decreased nutrient fluxes and generally reduced primary production in the equatorial Pacific during the warm phase of PDO. These decreases of nutrient fluxes are largely due to the reduction of interior meridional fluxes from both north and south subtropics. In addition, the thermocline tilt along the equator decreases in response to westerly anomalies in the western Equatorial Pacific. This combined effect enhances the strength of El Nino events while it weakens the La Nina events,

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which is consistent with growing evidences of enhanced El Nino activities after 1976/77. During cooling phase of PDO, the equatorial system shows reversed patterns. As a consequence, the primary production tends to have stronger positive anomalies during La Nina before 1976/77 and stronger negative anomalies during El Ninos after 1976/77. Therefore, the mean primary production in the equatorial Pacific during cooling phase of PDO is higher than during the warm phase. Another manifestation of PDO in the equatorial Pacific is that during the cooling phase of PDO, the modeled SST and nutrient anomalies in eastern equatorial Pacific tend to lead its anomalies in the central equatorial Pacific by 4-5 months before the peak of El Nino, whereas no significant difference in timing of anomalies can be observed during the warm phase of PDO.

OS51H-08 1035h

1990's Ecosystem Change in the Eastern Tropical Pacific Ocean?

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Interdecadal variability of the environment and marine ecosystem responses are well-known in the North Pacific, where long time series of oceanographic data and fish catch are available, but not in the tropical Pacific. The eastern tropical Pacific supports a large, but poorly observed, ecosystem that is subject to substantial variability at periods of 2-6 years. Yearly surveys of the eastern tropical Pacific Ocean in 1986-1990 and 1998-2000 show physical and biological variability between years related to the El Niño/Southern Oscillation. Time series of surface temperature and thermocline depth show little or no change corresponding to the 1988-89 regime shift in the North Pacific, although large interdecadal changes occurred in this region earlier in the century. Plankton, seabird, and flyingfish data are examined for changes in abundance, diversity, and distribution that might indicate an ecosystem response to longer-term climate change.

OS51H-09 1050h

Climate-Related Ocean Ecological Responses - Forecasting for Proactive Resource Management

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Among the principal forces affecting marine ecosystems are surface winds - driven by pressure disparities, the results of various sources of lagged seasonal temperature gradients - over longer-term patterned forces. Equatorial ocean-atmosphere energetics captured many researchers attention over the recent decades. Others have stepped back to larger time and space scales in order to understand these dynamics - and their upstream forcings. A.A. Girs monitored and defined specific Atmospheric Circulation Indices (ACI) for the Asian-Pacific region (as well as Wangengeim's Atlantic-Eurasian ACI classifications) that appear to reflect general trends and processes that affect regional climate, and in turn, regional ecosystems measured via regional species responses - are of general ecosystem and economic interests to many societal sectors. Marcel Leroux's 1998 "Dynamic Analysis of Climate and Weather" focused on observations of the consequences of Mobile Polar Highs (MPH) on terrain/ocean surface temperatures and surface winds that control upper ocean heating and cooling. With this in mind, we returned to early 1990s studies of ocean ENSO Warm Event surface heat content reflected at both sides of the Pacific Ocean, as planetary waves progress over years from the equator to higher latitudes - west, then east, then back west again - until they are dissipated near the poles. All of these processes are linked, and over decades, result in the 45-60 year or so ecosystem response cycle(s) evidenced in paleosediments beneath the world's more productive coastal fisheries.

'Traditional' fisheries stock assessment logic presumes that there is a somewhat stable 'mean' state (a single target) that can be managed toward. The reality is that there are at least four (4) obvious states, within these decadal scale coming-and-going fugues in response to these atmospheric changes within each double peaked fishery production cycle. Optimal fishing practices will produce the greatest yields from each of the two major (so-called Warm/Cold) periods only if there is considerable restraint in the second and fourth stages when Neither populations/species group is in good shape - as both are vulnerable to over-exploitation, and the growth of the incoming species complex can be compromised. Understanding these transition periods is critical to resource management. Recent history provides excellent examples.

Patterns of ACI and Length of Day are now tracked, and used in forecasts of each phase of these ocean ecosystem processes, particularly the all-important transitions - useful not only in fisheries management, but also in regional rainfall forecasting for agricultural planning purposes. Linkages will be made and processes followed from initial polar Subsidence Events, to the equator, and back - and subsequent ecosystem responses related.

URL: http://www.john-daly.com/sharp.htm

OS51H-10 1105h

Effects of Climate and Stock Size on Recruitment and Growth of Pacific Halibut

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This paper compares long-term changes in Pacific halibut Hippoglossus stenolepis recruitment and growth with long-term changes in climate and stock size. It appears that environmental variability?both interdecadal and interannual?is responsible for most of the observed variation in Pacific halibut recruitment. The large changes in growth rates that occurred during the twentieth century appear to have been density dependent responses to changes in stock size, with virtually no environmental influence.

URL: http://www.iphc.washington.edu/Staff/hare/html/papers/hist-hal/abst-najfm.html

OS51H-11 1120h

Tracking Environmental Bottlenecks in the Coastal Zone: What are the Mechanisms Linking Climate Variability to Oregon Coho (Oncorhynchus kisutch) Marine Survival?

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To better understand the mechanisms driving variability in Oregon coho (Oncorhynchus kisutch) marine survival, we developed a conceptual model of four environmental bottlenecks through which coho must pass during early marine life: 1) winter climate prior to smolt migration from freshwater to ocean, 2) the date of the spring transition from winter downwelling to spring/summer upwelling, 3) the spring upwelling season and 4) winter ocean conditions near the end of the maturing coho's first year at sea. We then parameterized a General Additive Model (GAM) with Oregon Production Index (OPI) coho smolt-to-adult survival estimates from 1969 to 1998 and environmental data representing each bottleneck (pre-smolt winter SST, spring transition date, spring upwelling wind indices, and post-smolt winter SST). The model explained a high and significant proportion of the variation in coho survival during the period of record (R^2=0.73). To examine linkages with climate variability, we evaluate the relationships between our local environmental indices and indices tracking hemispheric scale climate patterns, specifically indices for the Aleutian Low, the El Nino-Southern Oscillation, and the Pacific Decadal Oscillation. This approach allows for an assessment of the potential predictability of ocean conditions for OPI coho.

OS51H-12 1135h

Will the coral reef survive global climate change ?

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Certain reef-building corals have the potential to provide information about coral growth and climate over the past several centuries. Proxy records from corals may provide informations about long-term variability in the performance of coral reefs, allowing unnatural change to be distinguished from natural variability. Measuring how fast corals grow is in this way a fundamental problem in coral reef research, particularly relationships with the global change. In this paper, we have generated several centuries-long time series of change in corals growth of Porites corals heads in order to investigate environmental controls on growth of the massives corals in the tropical South Central and Western Pacific region. Measurements of corals growth has led to a refined record of skeletal extension, density and calcification on material from Moorea Island (French Polynesia) and Yasawa island (Fiji island). Correlations of coral growth characteristics with instrumental records indicates a link between variations in average annual calcification variations and air temperature. Linear regression of temperature versus calcification data shows a trend in which a rise in temperature would increase the calcification rate. These data suggest that calcification has increased over recent decades, which differs notable from the 6-14% decline in calcification over the past 100 years predicted by certain researchers. Furthermore, the study relies coupled analysis of different proxies: oxygen and carbon isotopic compositions, Sr/Ca ratios Long-lived massive corals can contribute to the monitoring of coral reefs environments through the growth records measurable in the annual density patterns ; these can provide a historical perspective against which to assess environmental changes and help to establish limits of coral growth.

OS51I HC: 319 A Friday 0830h

Chemical Oceanography: Biologically Important Compounds

Presiding: **R Turner,** Coastal Ecology Institute**; M R Anderson,** Science Oceans and Environment Branch Fisheries and Oceans Canada

OS51I-01 0830h

A Paleo-Reconstruction of Water Quality in the Charlotte Harbor Estuary (Florida)

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A suite of proxies for water quality were examined to use as indicators of water quality change in the shallow subtropical estuary Charlotte Harbor, Florida (USA). Sediment cores were collected in the region of mid-summer hypoxic zone and also upstream from a Juncus sp. marsh. Dating with 210Pb was sufficient to establish chronologies back to before major watershed