

Observing and Explaining Coastal Fishery Dynamics : An Application to Ports in California

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Research Question

Given:

- Fishing industry changes over time
- Overall declining landings, revenue, participation

Are all ports affected proportionally?

How do inter-port dynamics compare to larger trends in fisheries and the industry?

How do we explain what we see?

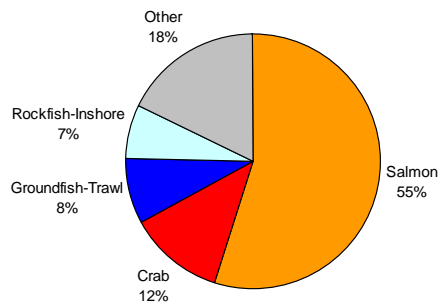
Study Area: Northern and Central California

- 30 ports
- 34 fisheries
- 1981-2007 fish tickets
- 2007
 - 1,178 vessels
 - 25,343 fishing trips
 - 137 million pounds
 - \$58.5 million

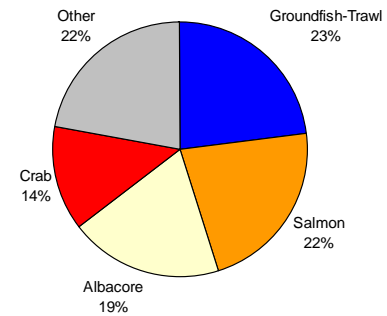


1981-2007 Trips and Revenue By Fishery

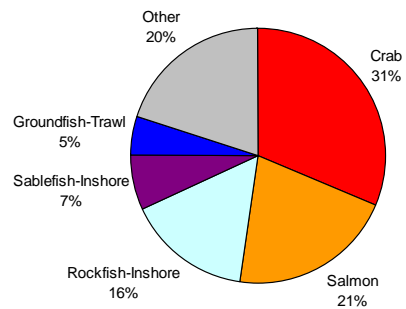
Trips by Fishery - 1981



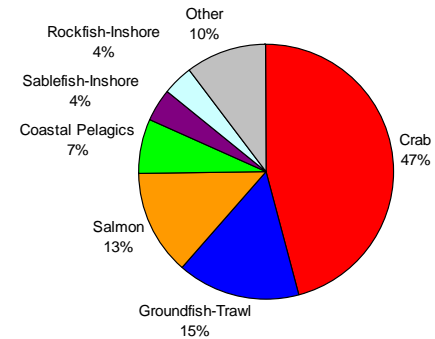
Revenue by Fishery - 1981



Trips by Fishery - 2007

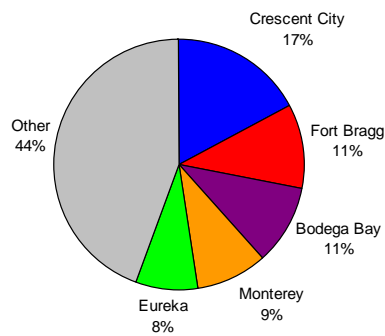


Revenue by Fishery - 2007

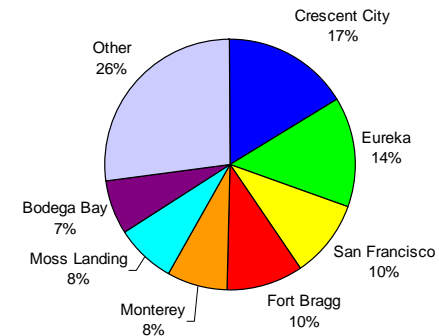


1981-2007 Trips and Revenue By Port

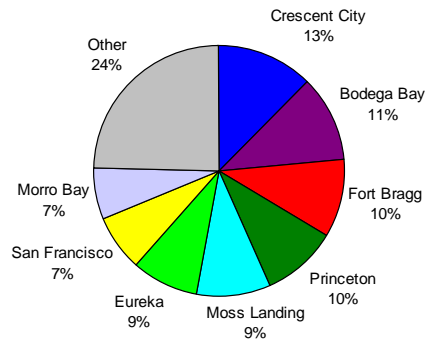
Trips by Port - 1981



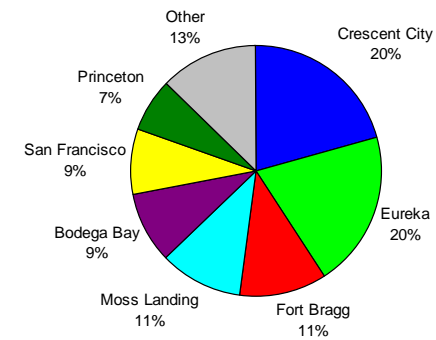
Revenue by Port - 1981



Trips by Port - 2007

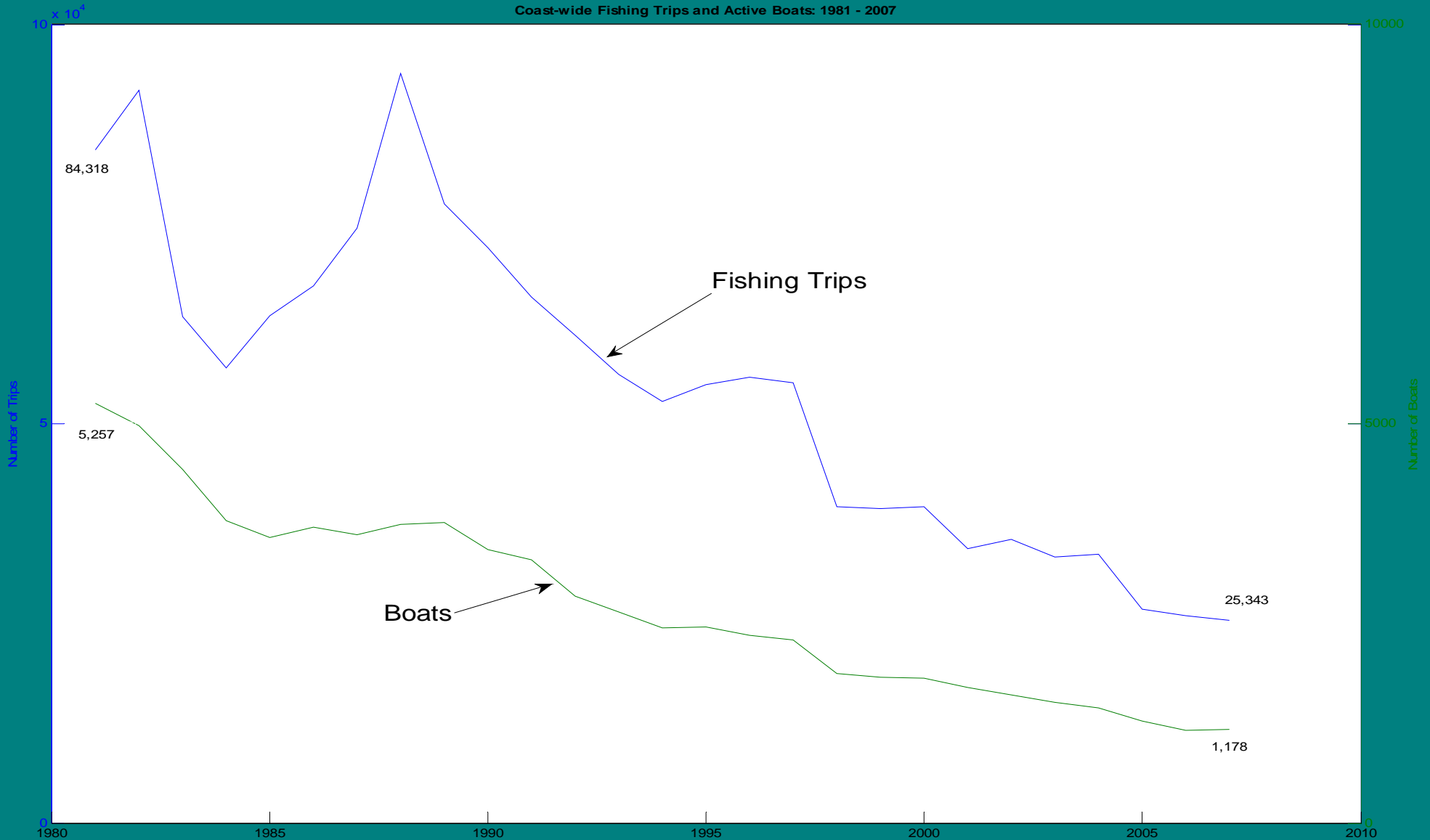


Revenue by Port - 2007

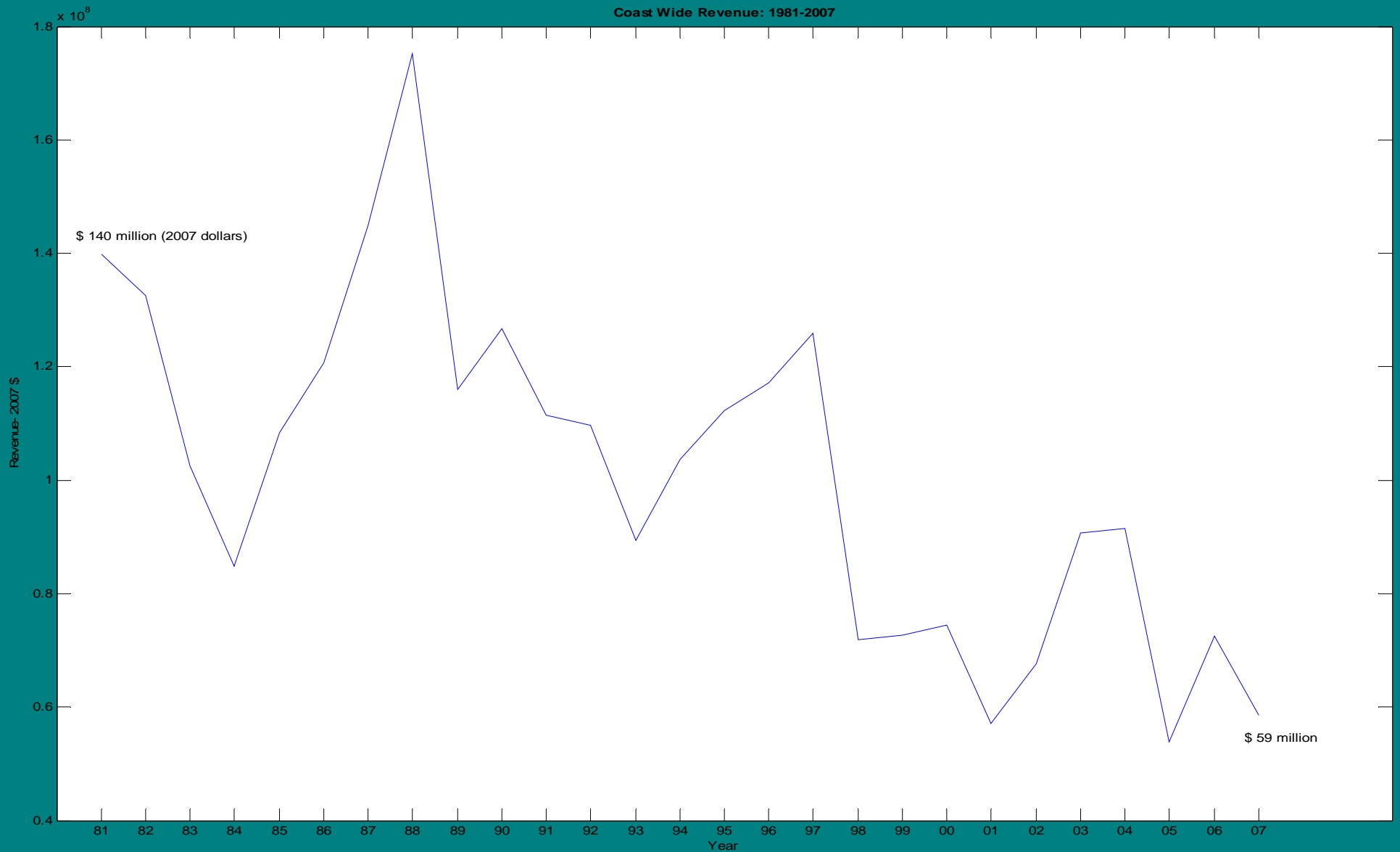


Trends in the commercial fishing industry

Coast-wide Fishing Trips and Active Boats: 1981 - 2007



Trends in the commercial fishing industry



Research Question

Given coast-wide decline in fishing activity:

- Are all ports affected proportionally?
 - H_0 : decline distributed proportionally across ports
- How do we measure differences?
 - Rank correlation
 - Differences in annual changes
 - Regression analysis: test for constant vs. time trends
- Can we explain the differences, or lack of differences?

Rank Correlation

Rank correlation – Kendall's W

- Rank ports in order of revenue and trips in each year
- Compare rankings across years: how similar is the order from year-to-year?

Rank Correlation

1981	1991	2007
Crescent City	San Francisco	Crescent City
Eureka	Crescent City	Eureka
San Francisco	Bodega Bay	Fort Bragg
Fort Bragg	Fort Bragg	Moss Landing
Monterey	Princeton	Bodega Bay
Moss Landing	Eureka	San Francisco
Bodega Bay	Morro Bay	Princeton
Oakland	Monterey	Morro Bay
Fields Landing	Point Arena	Trinidad
Morro Bay	Moss Landing	Santa Cruz

Differences in Annual Changes

Calculate percent change at coast-wide and port levels

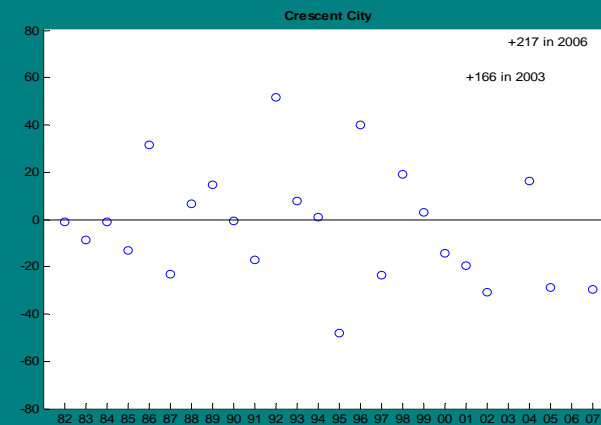
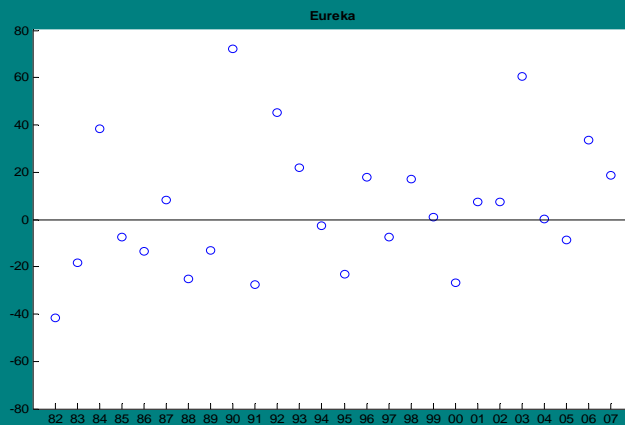
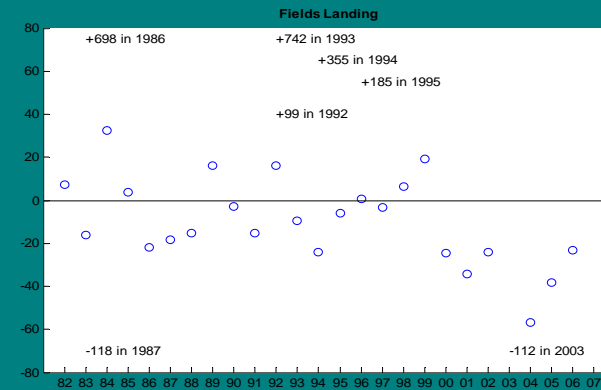
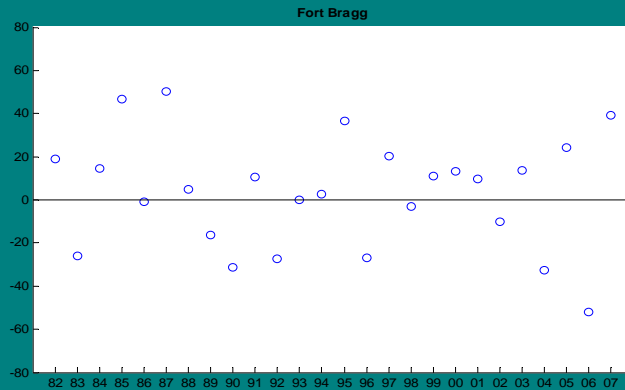
- Year-over-year
- Cumulative

Test whether differences are significant

A t-test for every port

Differences in Annual Changes (Year-over-year)

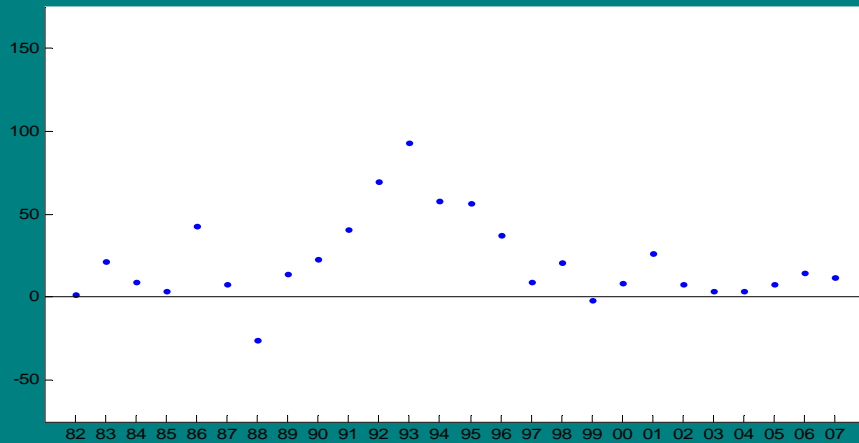
No major ports differ significantly from the mean coast-wide percent change



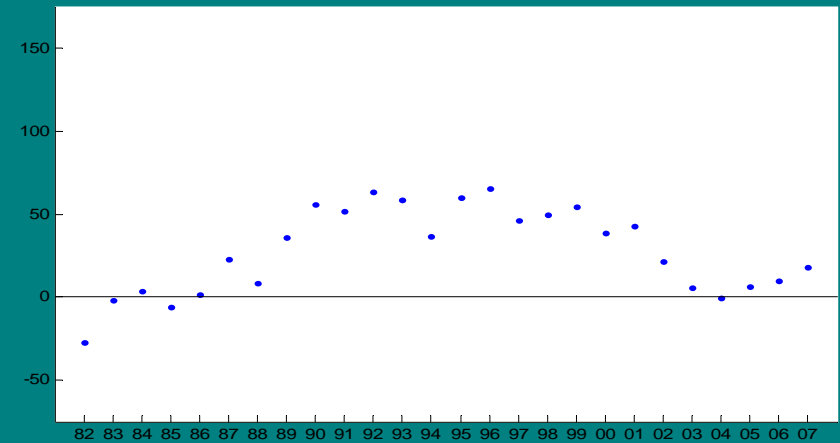
Differences in Cumulative Changes

Trips: 1981 Base Year (South of SF Bay)

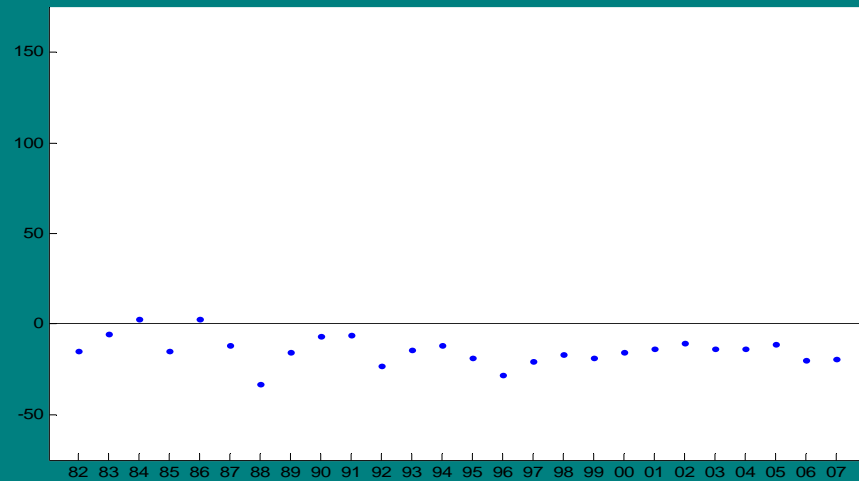
Avila



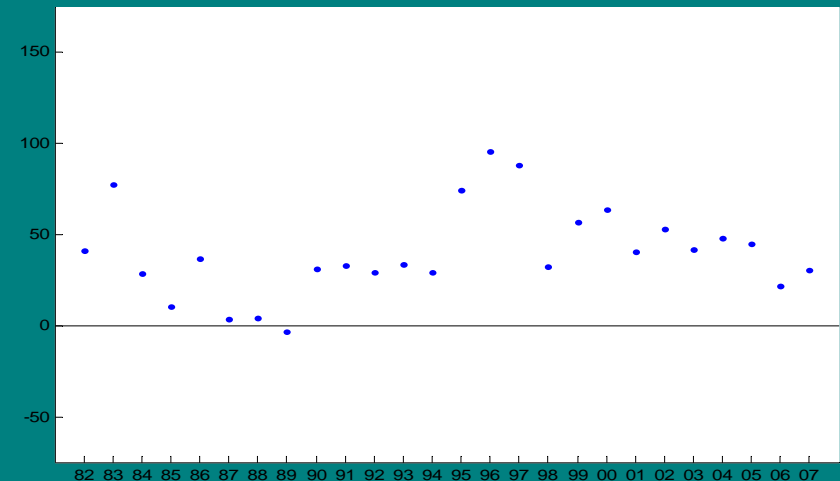
Morro Bay



Monterey



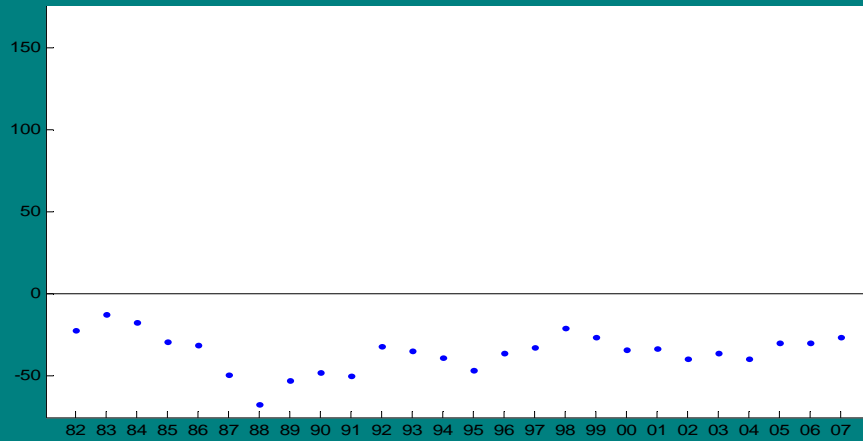
Moss Landing



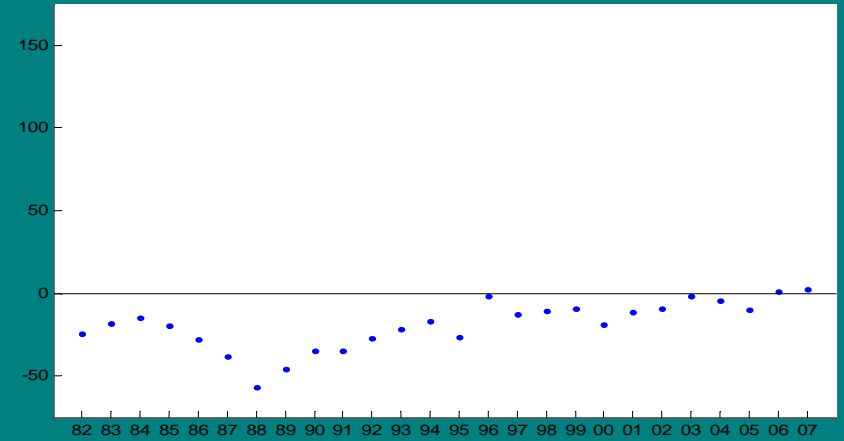
Differences in Cumulative Changes

Trips 1981 Base Year (North Coast Ports)

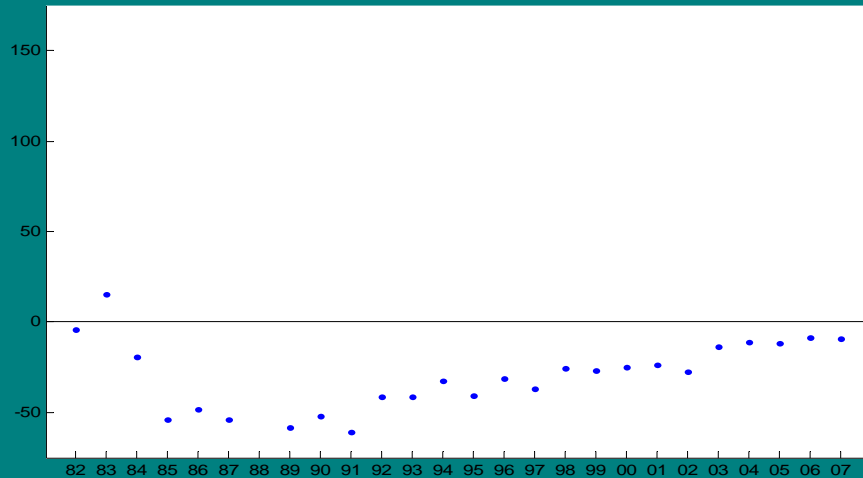
Fields Landing



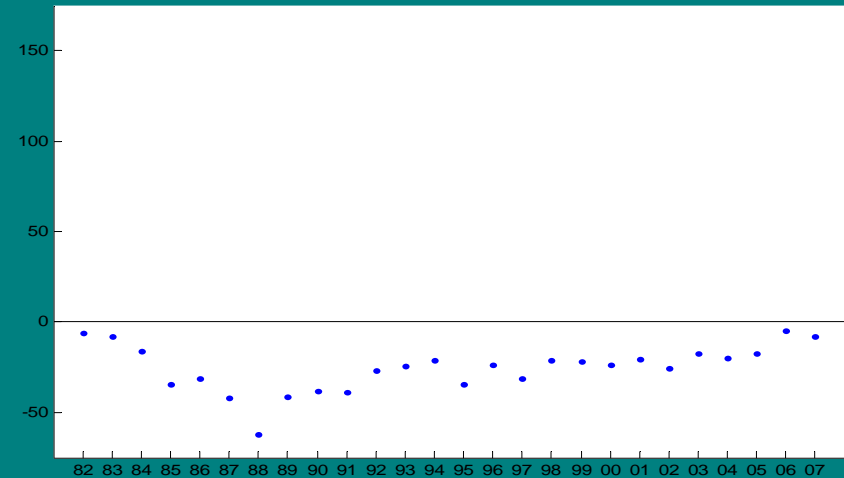
Eureka



Trinidad

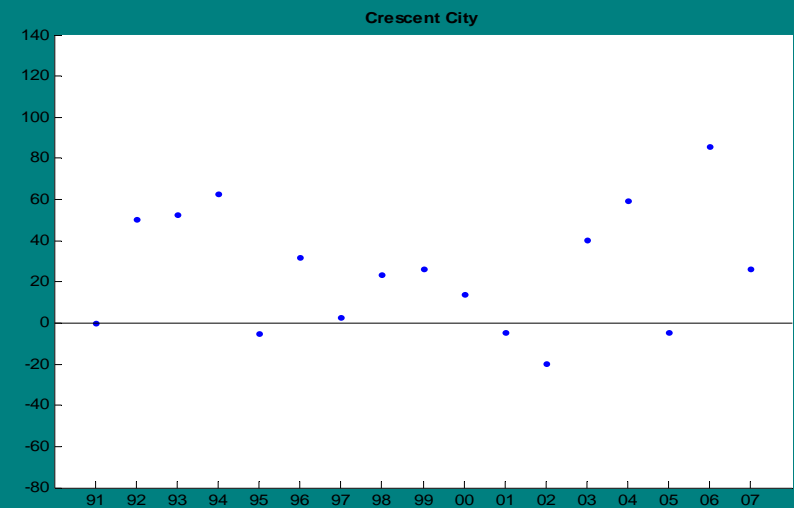
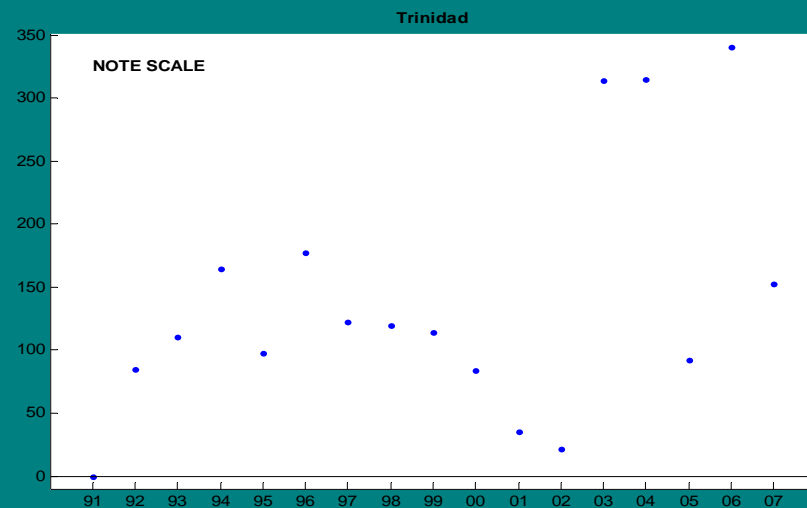
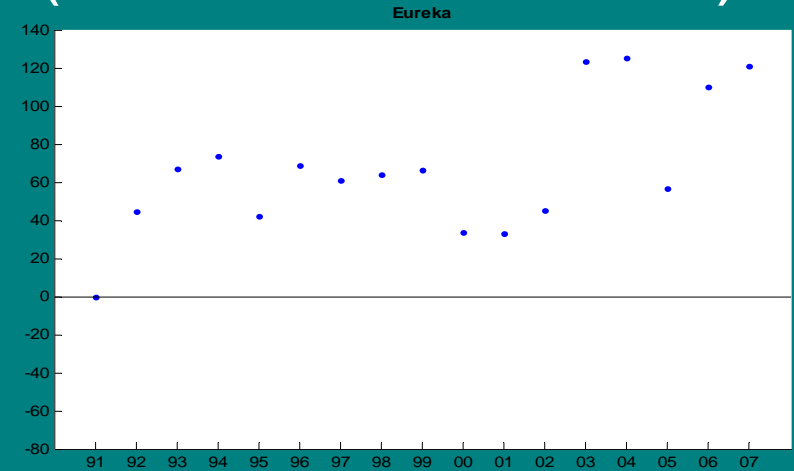
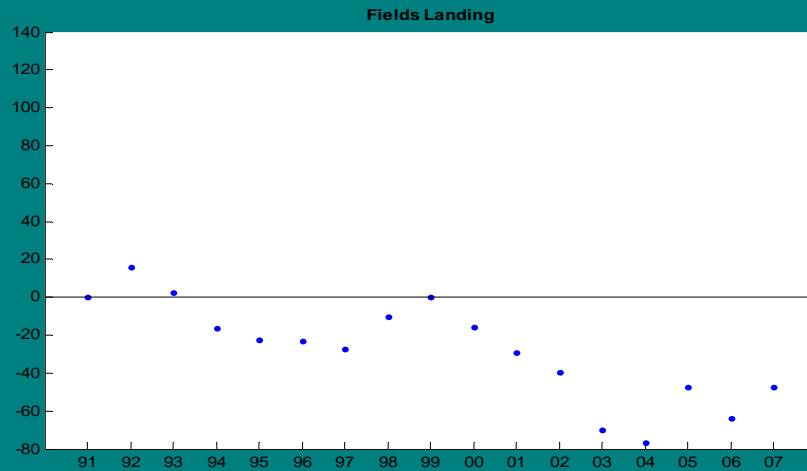


Crescent City



Differences in Cumulative Changes

Revenue 1991 Base Year (North Coast Ports)



Differences in Cumulative Changes

- Ports differ from coast-wide changes
- Base year affects analysis
- Different time trends among ports

Differences in Cumulative Changes

- Ports Differ from Coast-Wide Changes
- Base year effects (1981 vs. 1991)

1981-2007	1991-2007
<i>Ports with Positive Cumulative Differences</i>	
Morro Bay	Moss Landing
Princeton	Princeton
San Francisco	Eureka
Bodega Bay	Trinidad
Trinidad	Crescent City
<i>Ports with Negative Cumulative Differences</i>	
Monterey	San Francisco
Fields Landing	Bodega Bay
Eureka	Fort Bragg

Analysis of Time Trends

- Four regression models – dependent variable is port's share of revenue
 - “Null model” – constant only
 - Time trend – $t = \text{year index}$
 - Time trend – t^2
 - Time trend – t^3
- System of equations (SUR)
- Compare model fit (AIC, BIC)

Analysis of Time Trends

Regression Results

- All trend combinations improve model fit
- Best fit: $t + t^2 + t^3$ (lowest AIC, BIC)
- Significant trends: Monterey, Moss Landing, Princeton, Bodega Bay

Do ports differ from coast-wide trends in fishing activity?

- Stable rankings
- No difference in changes year-over-year
- Cumulative changes exhibit some differences
- Some ports' share of activity over time appears systematic

Implications

Fishery participants are used to variability,
but...

- How does persistent decline affect ports?
- How much variability can ports deal with and maintain ability to adapt?

What drives changes and differences –
regulations, fish stocks, economic
geography?