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Analysis of the Price and Effort Response in The U.S. Pacific Sardine Fishery

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I. Education:

Ph.D., Dept of Agricultural, Resource and Managerial Economic, Cornell University (8/1990 to 1/1994)

II. Experience

(1) Management Procedure for Commission of Conservation of Southern Bluefin Tuna (CCSBT)

(2) Global Tuna Demand, Fisheries Dynamics and Fisheries Management: Assessing the Market Structure of International Tuna Cannery and the Japanese Tuna Sashimi Market

(3) Evaluation of the Impact Trade Liberalization and Free Trade Agreement on the Fishery Sector

(4) Evaluation of the Optimal Fishing Capacity

(5) Potential Economic Benefits of El Niño/La Niña Forecast on the Fishery Sector

Outline

1. **Background and Motivation**

2. **Sardine Landings and Prices in US West Coast**

3. **Results of Estimation:**
   (A) Market Price Response
   (B) Number of Trip Response

4. **Summary and Conclusions**

1. Background

- **Up until 2008 the full sardine HG was more than adequate to meet the needs of industry.**

- **In 2008, there was substantial decline in the estimated sardine biomass which translated into a 42% reduction in the HG from 2007.**

1. Background

Income to Fishers

- the dynamics of the fleet might be influenced by both the availability of resources and price levels.

Market Price Response

- whether the sardine local market is effectively pricing to response to the landings.

Fishers' Response

- a challenge to understand fishers responds to changes in market structure, ecosystem conditions, and regulatory regimes.

- **Our research is motivated by an interest in the supply and demand response of the sardine fishery given variability in the stock and sardine markets**

- **Our research investigates:**
  - **Price flexibility/response in the exvessel market for Pacific sardine**

    -- the change in ex-vessel price given a change in the quantity of landings

  - **Effort response in the sardine fishery to changes in the HG and exvessel price.**

Data source:

- Our source of landings and exvessel price data for this research is the Pacific Fisheries Information Network (PacFIN) regional fisheries database.
- The weekly weighted average sardine price and landings are analyzed (for those landings is greater than 8,000 Lbs per ticket, the recorded price ranged $0.03~$0.30/Lbs, and were landed by major fishing gears, i.e., seine net in California and Washington and other net gear in Oregon.

2. Sardine Landings and Prices in US West Coast

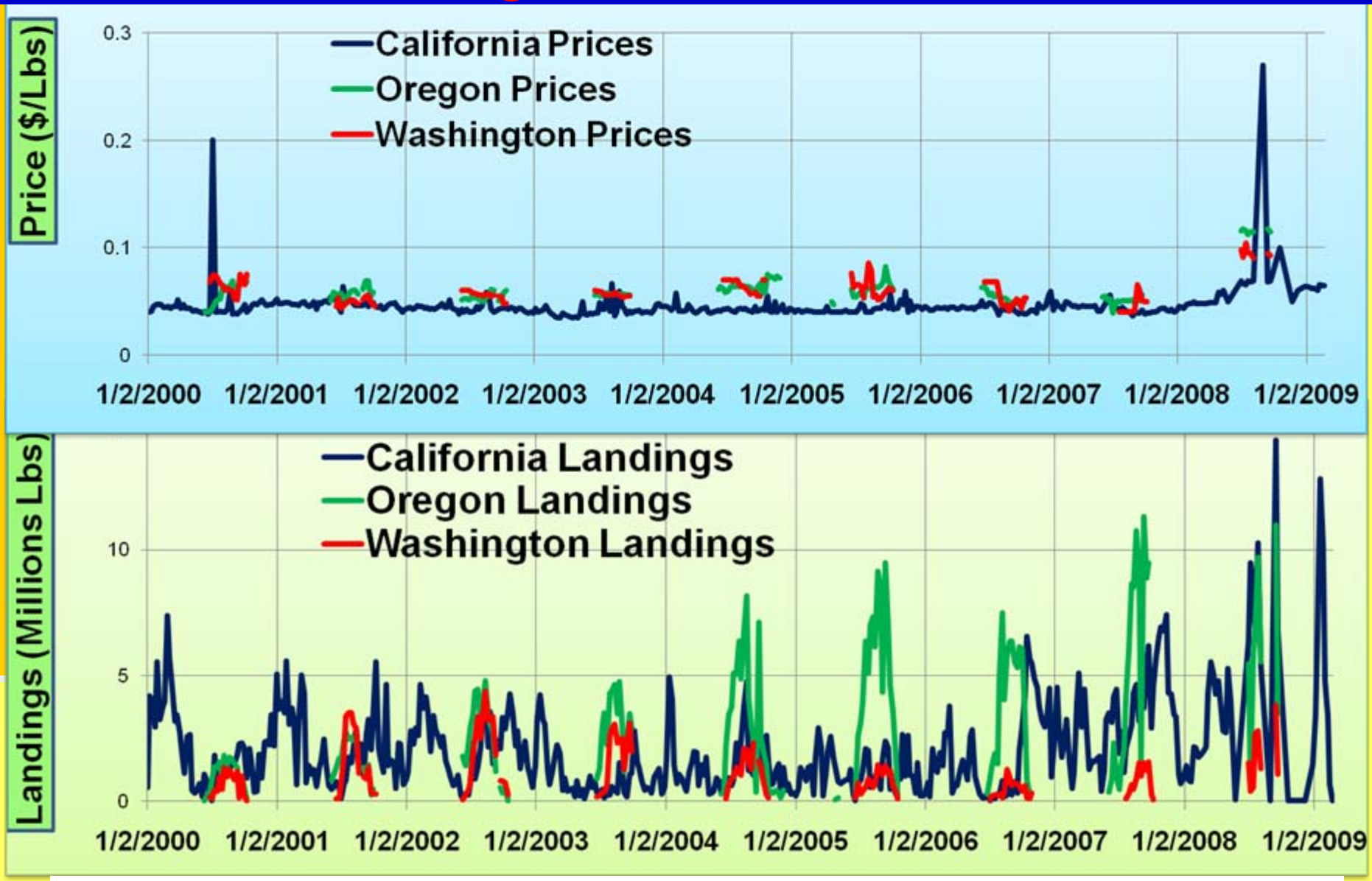


Figure 2. California, Oregon and Washington weekly sardine catches and Prices, 2000.1.2-2009.2.23

In 2008, a substantial decline in the estimated sardine biomass which translated into a 40% reduction in the HG from 2007.

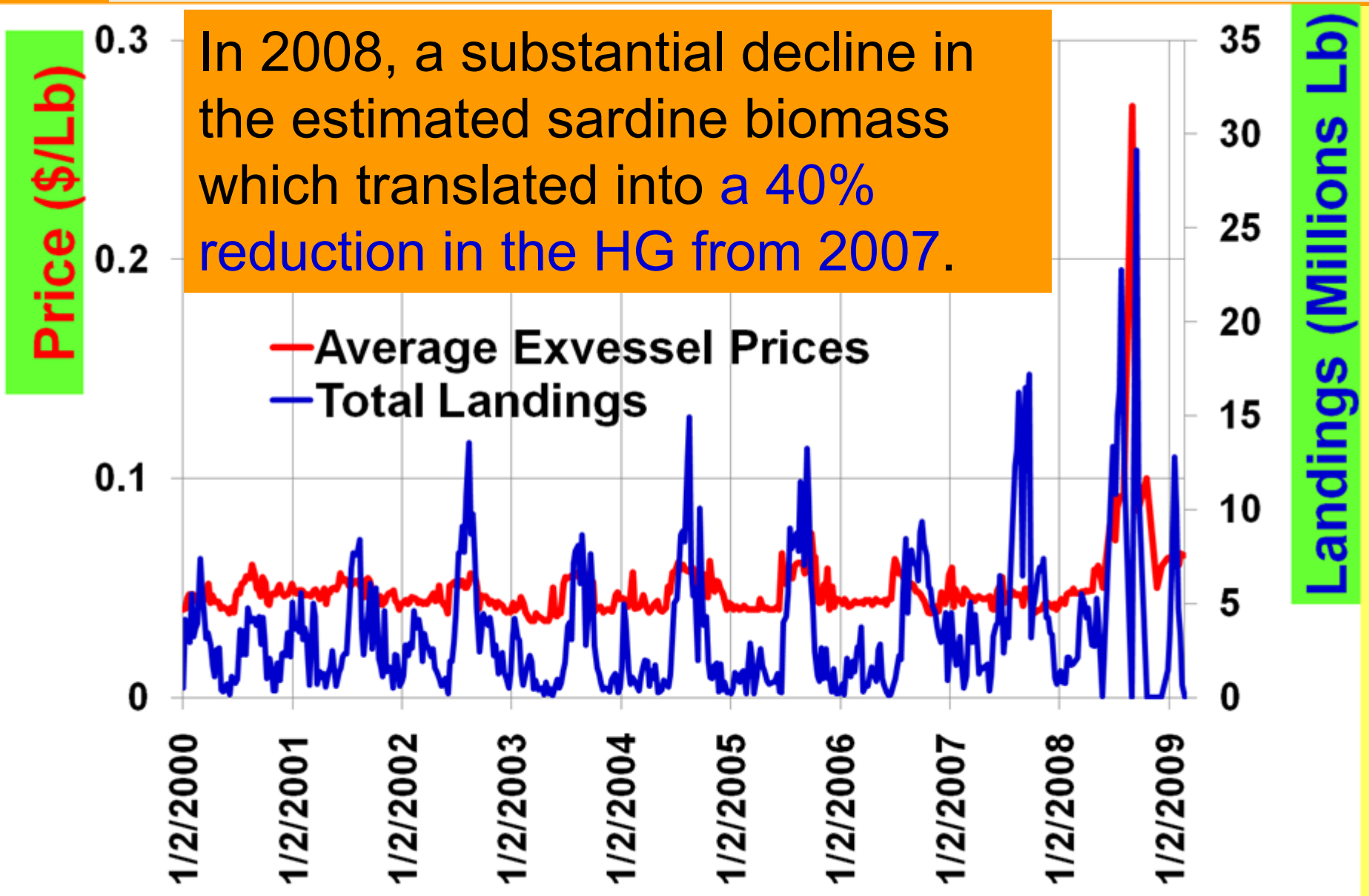


Figure 3. Total US Sardine Landing weekly sardine catches and Prices, 2000.1.1-2009.2.23

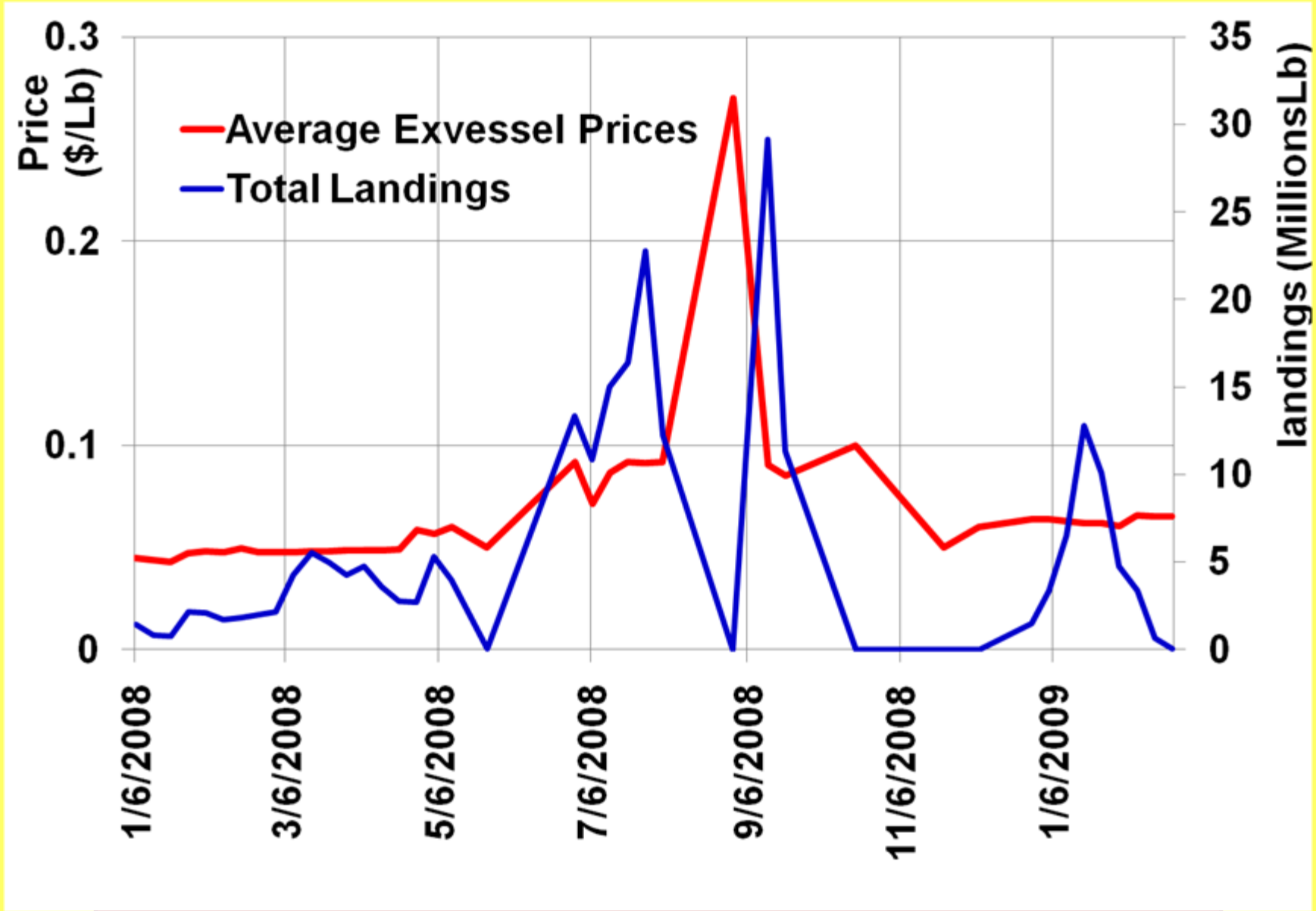
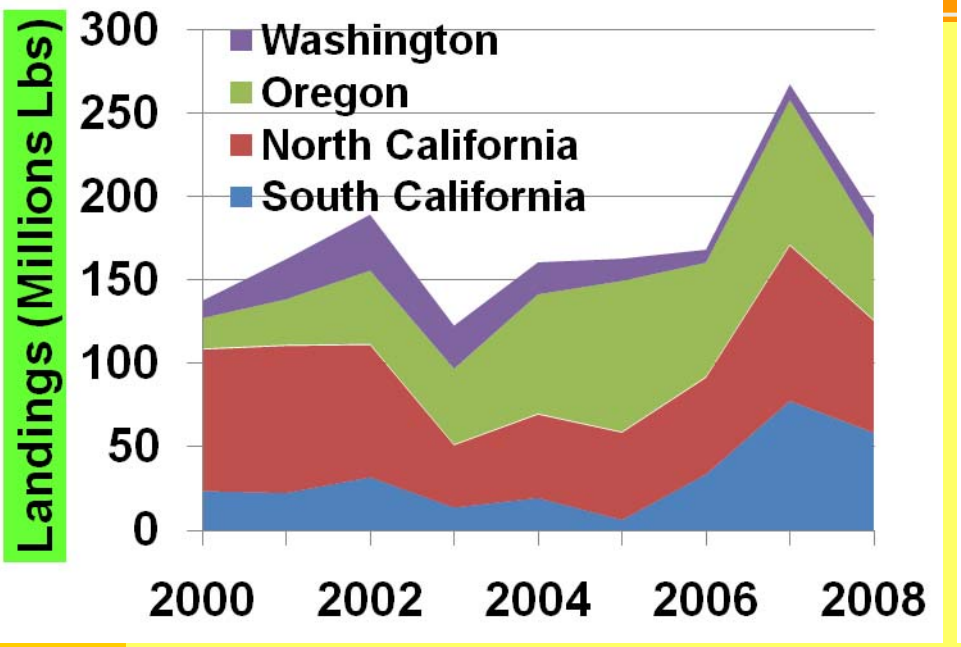
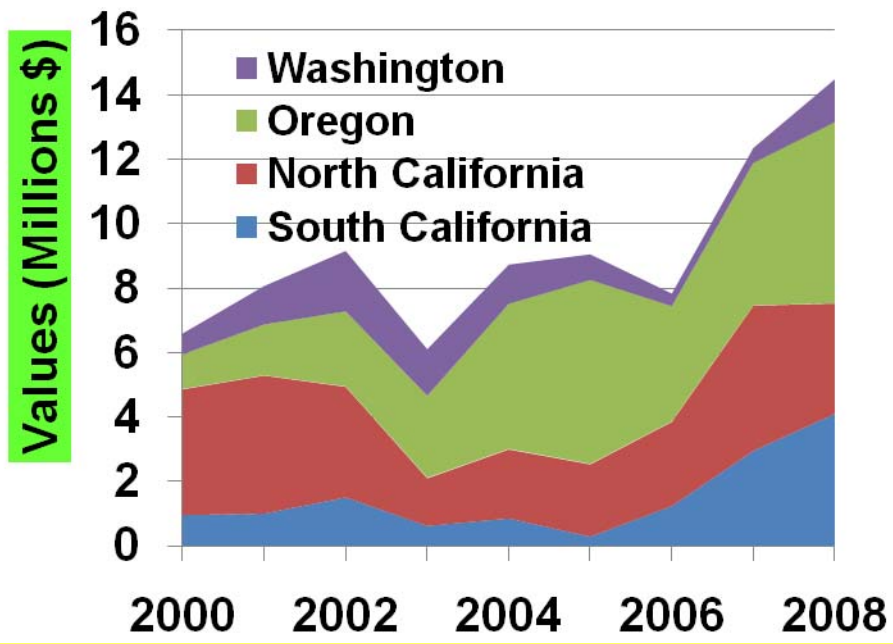
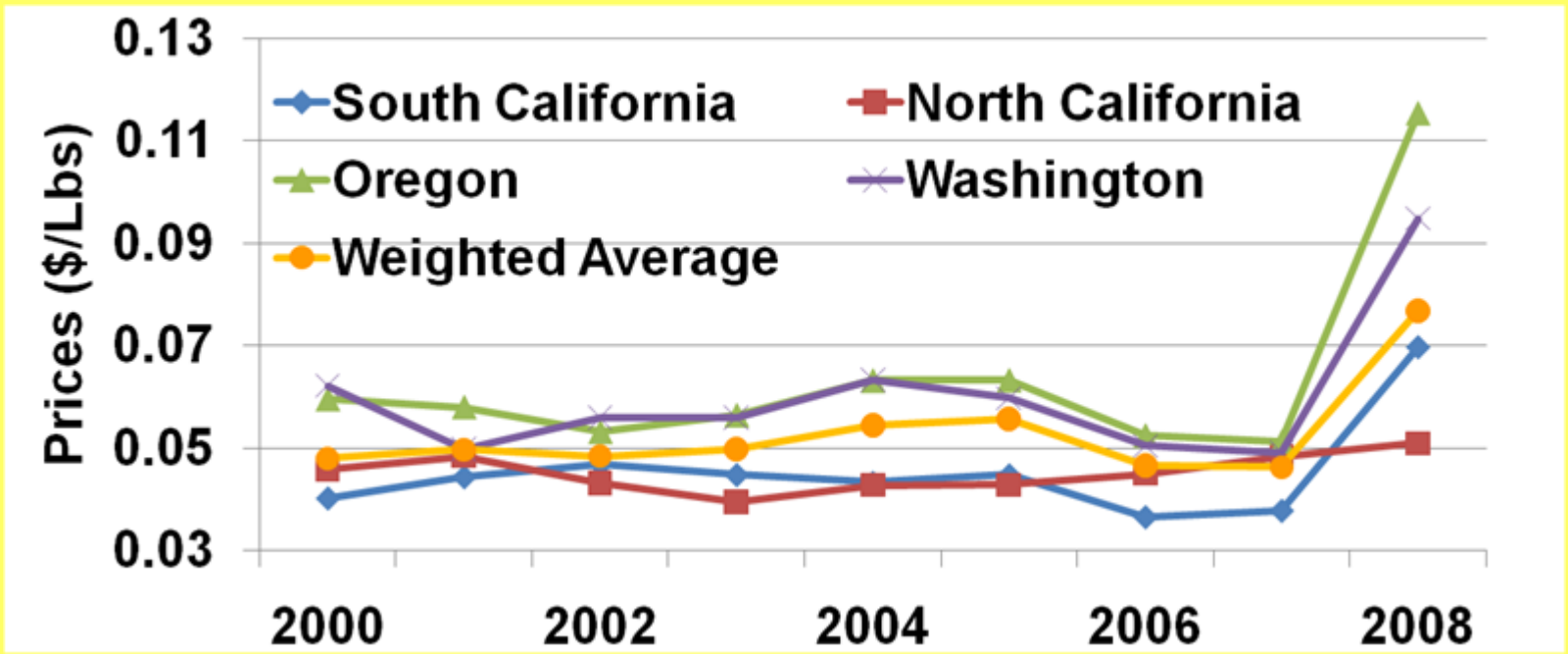


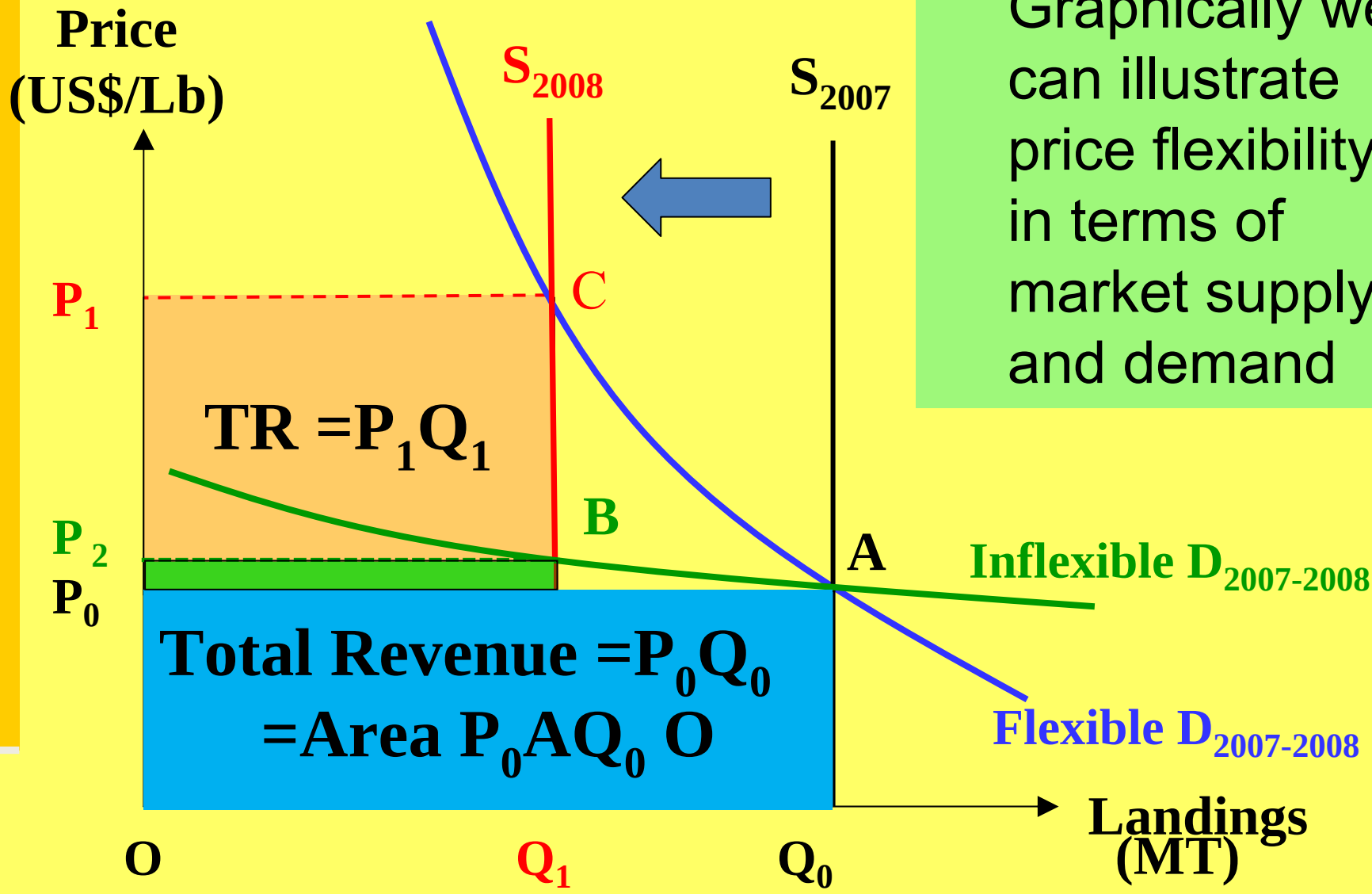
Figure 4. Total US Sardine Landing weekly sardine catches and Prices, 2008.1.1-2009.2.23







- **Figure 5 Total Landings, Values and Prices of Sardine by State**



Graphically we can illustrate price flexibility in terms of market supply and demand

Figure 6. Demand, Supply and Welfare Analysis

The total revenue received shifts from P_0Q_0 to

(1) P_1Q_1 for flexible demand curves,

where the price flexibility ($\eta = \frac{\%\Delta P}{\%\Delta Q}$) > 1

or

(2) P_2Q_1 for the inflexible demand curves,

where the price flexibility ($\eta = \frac{\%\Delta P}{\%\Delta Q}$) < 1.

where $P_1Q_1 > P_0Q_0 > P_2Q_1$

3. Results of Estimation: (A) Market Price Response

Our preliminary results suggest price inflexibility in the Pacific sardine fishery, meaning that the ex-vessel price of sardines is relatively unresponsive to changes in the quantities landed.

This indicates that there is no incentive for fishers to reduce their landings, since a decrease in revenues from a decrease in landings will only be partially offset by an increase in price.

Table 1 Maximum Likelihood Estimates of Weekly Price Response of US Pacific Sardine Fishery

Variable	Estimate	t Value	Approx Pr > |t|
Dependent Variable: ln (averagep)			
Intercept	-0.61***	-3.03	0.0026
lnaveragep1	0.71***	19.23	<.0001
lntotalq	-0.04**	-2.24	0.0254

The absolute value of the estimated price flexibility is -0.04, which is much less than 1.0

s2	0.01	0.75	0.4538
y08s1	0.26***	4.58	<.0001
y08s2	0.31***	4.15	<.0001
y08s3	0.34***	5.64	<.0001
y09s1	0.27***	4.90	<.0001

Total R-Square =0.78; Degree of Freedom = 445; Root MSE=0.11; *, **, and *** represents significant under 10%, 5% and 1% significant level.

The estimated price flexibility is -0.04,

$$\%\Delta P = -0.04 * \%\Delta Q$$

$$= -0.04*(-1\%) = 0.04\%$$

$$TR = P * Q$$

$$\%\Delta TR = \%\Delta P + \%\Delta Q$$

-0.96% = (+0.04)+(-1%)

By holding everything else constant, the total revenue will be reduced by 0.96% under the situation that only 0.04 % increase in price will be realized after a 1% reduction in landings.

- **With the current exvessel market structure, if harvest costs do not adjust with the decrease in landings, profits will decrease.**
- **Under recent conditions in the Pacific sardine fishery harvest costs are likely to increase if a continued reduction in the harvest guideline intensifies the race for fish.**

Costs Related to Effort

- **Costs are expected to be directly related to the amount of effort expended in harvesting sardines.**
  - **How does effort respond to changes in the HG?**
  - **How does effort respond to changes in the exvessel price?**
  - **Assume that the number of fish tickets (landings receipts) per week is a reasonable proxy for weekly fishing effort**
- **To address these questions we investigated the relationship between the number of "fish tickets", the amount of HG remaining, and the exvessel price.**

3. Results of Estimation: (B) Number of Trips Response

Table 3 Maximum Likelihood Estimates of Weekly Number of Tickets Response of US Pacific Sardine Fishery

Variable	Estimate	t Value	Approx Pr > |t|
Dependent Variable: ln (ticket)			
Intercept	-2.06***	-5.75	<.0001
lnticket1	0.71***	19.53	<.0001
lnaveragep1	0.20***	3.62	0.0003
lntotalq	0.80***	79.65	<.0001
lntotalq1	-0.55***	-17.1	<.0001
lnQuota_left1	-0.01*	-1.69	0.0914
s1	0.05***	3.49	0.0005
s2	0.10***	3.75	0.0002
y08s1	0.21	1.35	0.1774
y08s2	-0.15	-1.13	0.2571
y08s3	0.32***	2.08	0.0377
y09s1	0.05	0.39	0.6995
AR1	0.42***	7.53	<.0001
AR2	0.22***	4.26	<.0001

Total R-Square =0.98; Degree of Freedom = 445; Root MSE=0.18;

*, **, and *** represents significant under 10%, 5% and 1% significant level.

The estimation result shows that the number of fish tickets in weekly basis is significantly and positively related to average price in the preceding week and the amount of HG remaining in the current week.

If costs are directly related to effort then costs are likely to increase if a continued reduction in the harvest guideline intensifies the race for fish.

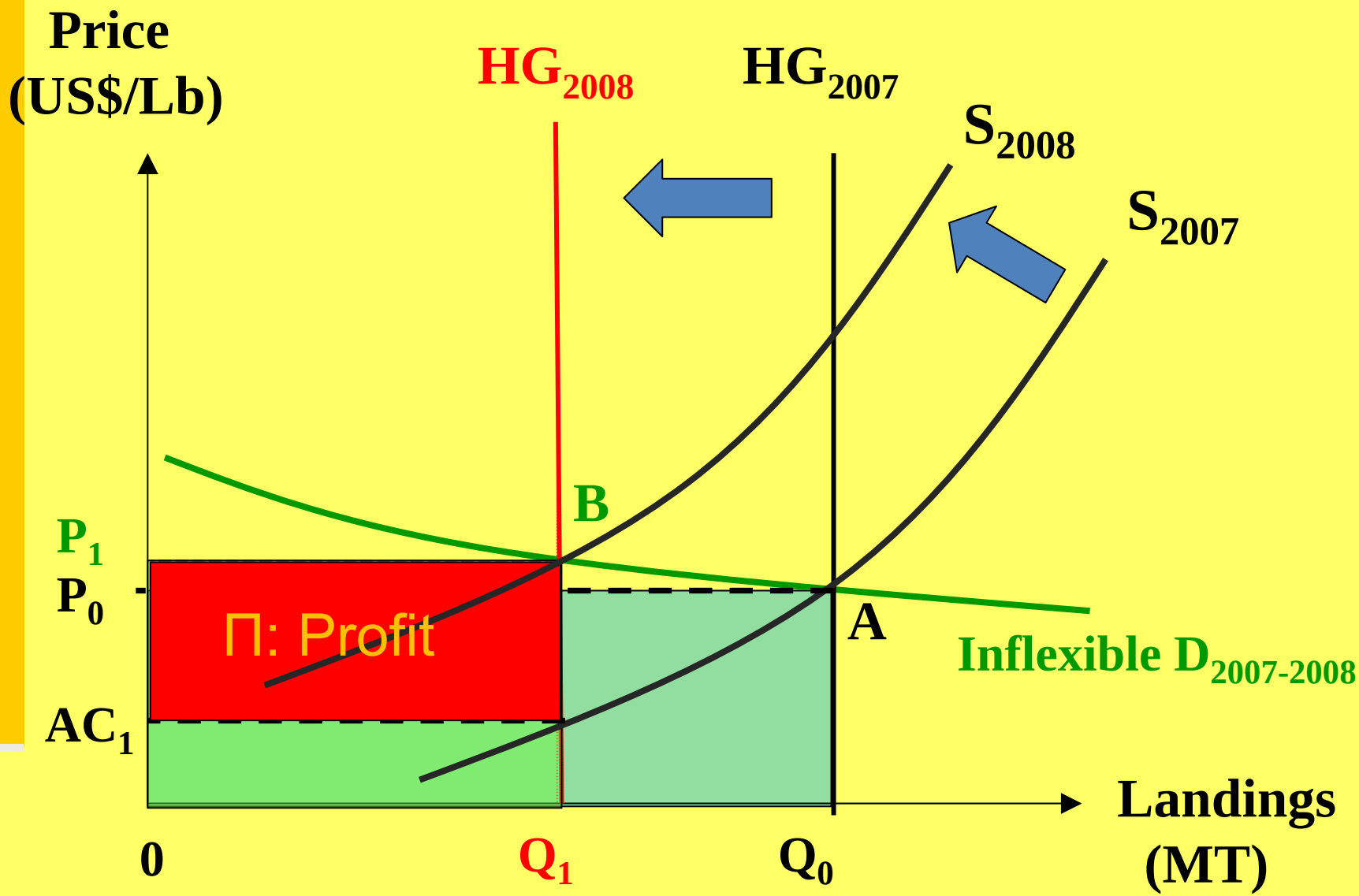
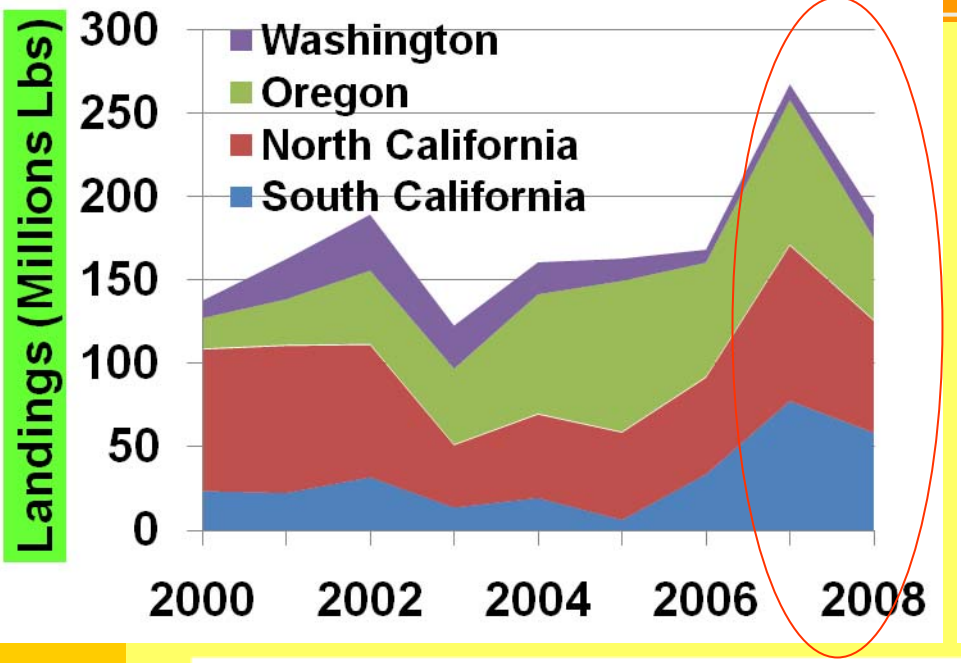
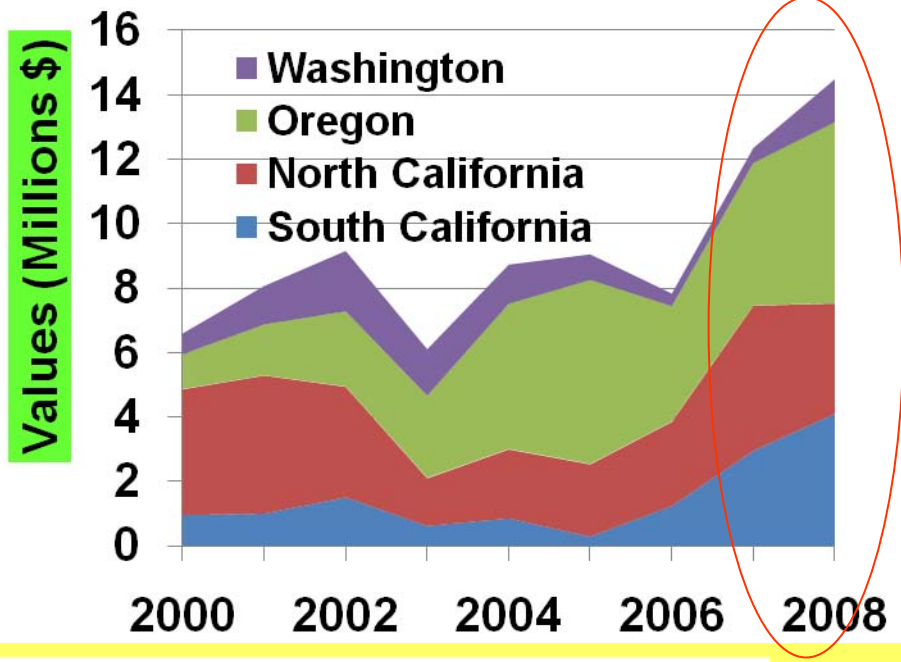
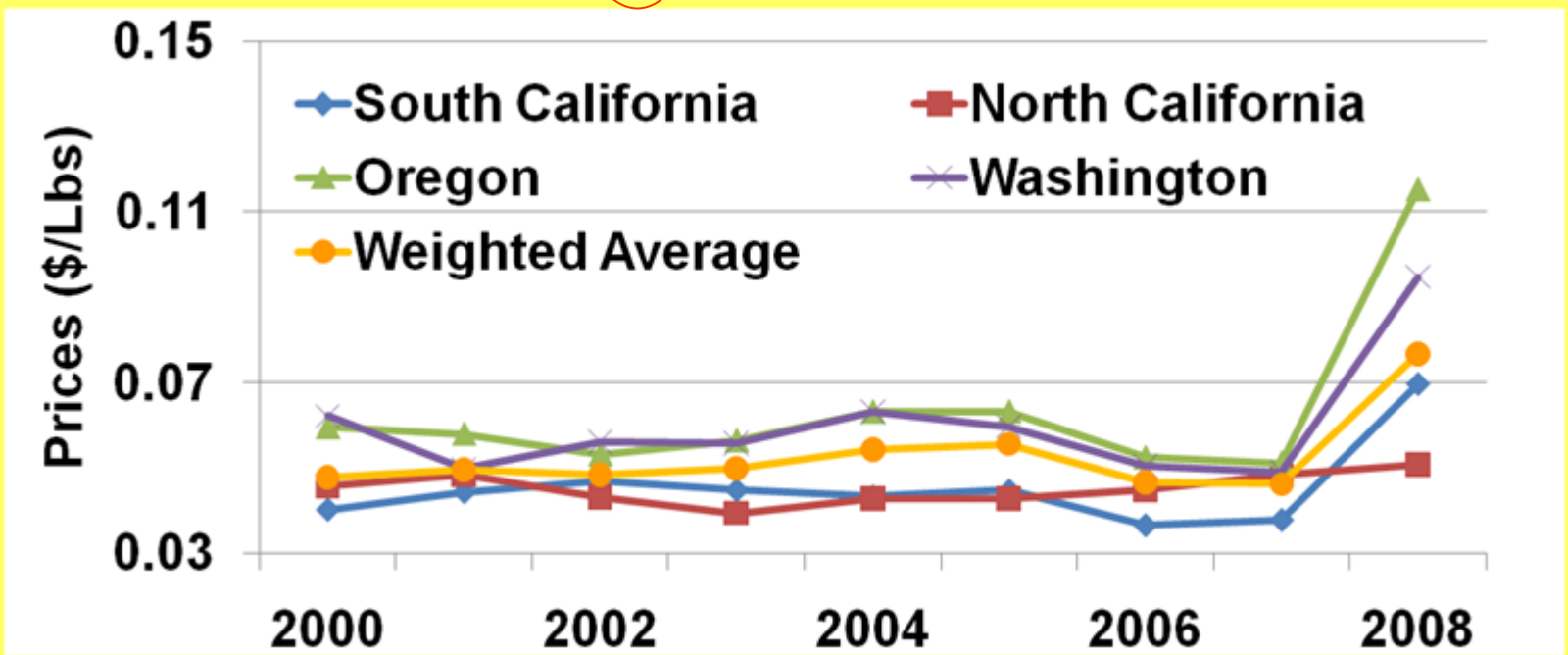


Figure 6. Demand, Supply and Welfare Analysis of US Sardine Fishery







- **Figure 5 Total Landings, Values and Prices of Sardine by State**

4. Summary and Conclusion

The sardine price in US west coast is not responsive to the landings and might depends more on the world price.

Sardine Photo:Tanaka Juuyoh, 2007

The existence of a negative inflexibile price response indicates fishers' welfare would suffer when the harvest guideline is at or near full utilization.

Seasonal allocations can create "perverse" economic incentives that incite a race to harvest the available catch, and stimulate increases in operation cost.

4. Summary and Conclusion

- If the HG continues to decrease and nothing else changes in the fishery, profits will decrease as a result of reduction in revenues and an increase in costs

Under rights-based management we would expect the:

- **Lower costs of harvest**
- **Higher quality and more uniform supply of landings**
  - **Higher exvessel price**
  - **Processor able to maintain more stable labor supply**
- **Efficiencies gains from tradable quota shares**
  - **Monopoly profits**
- **Investment in the future of the resource**
- **Less risk**

Right-Based Management

- **When resources can be well defined, costs and benefits can be apportioned more clearly, and there is greater likelihood of private property rights emerging, then ITQs or ITEs.**
- **Private property more directly reduces the costs of using the resource by making the full costs and benefits clear to the decision makers.**
- **Common or group property can also be effective.**

(Summarized by Dale Squires for "Workshop on Rights-based Management and Buybacks in International Tuna Fisheries", Sponsored by Inter-American Tropical Tuna Commission and the World Bank, La Jolla, CA, USA, 5-9 May 2008.)

Workshop on Global Tuna Demand, Fisheries Dynamics and Fisheries Management in the Eastern Pacific Ocean

Sponsored by the Inter-American Tropical Tuna Commission (IATTC) and NOAA Fisheries

May 13-14, 2010, La Jolla, CA

Coordinators: Chin-Hwa "Jenny" Sun, Minling Pan, and Dale Squires

- Rights can be specified by gear type or method of fishing or area.
- Creates incentives to reduce overcapacity, increase economic efficiency, and incentives for collective action to maximize asset values, such as group enforcement.

Bioeconomic Modeling and Management Priority

Market Response

- Prices
- Trade
- Management

Fishermen's Response

- Landings
- Trips

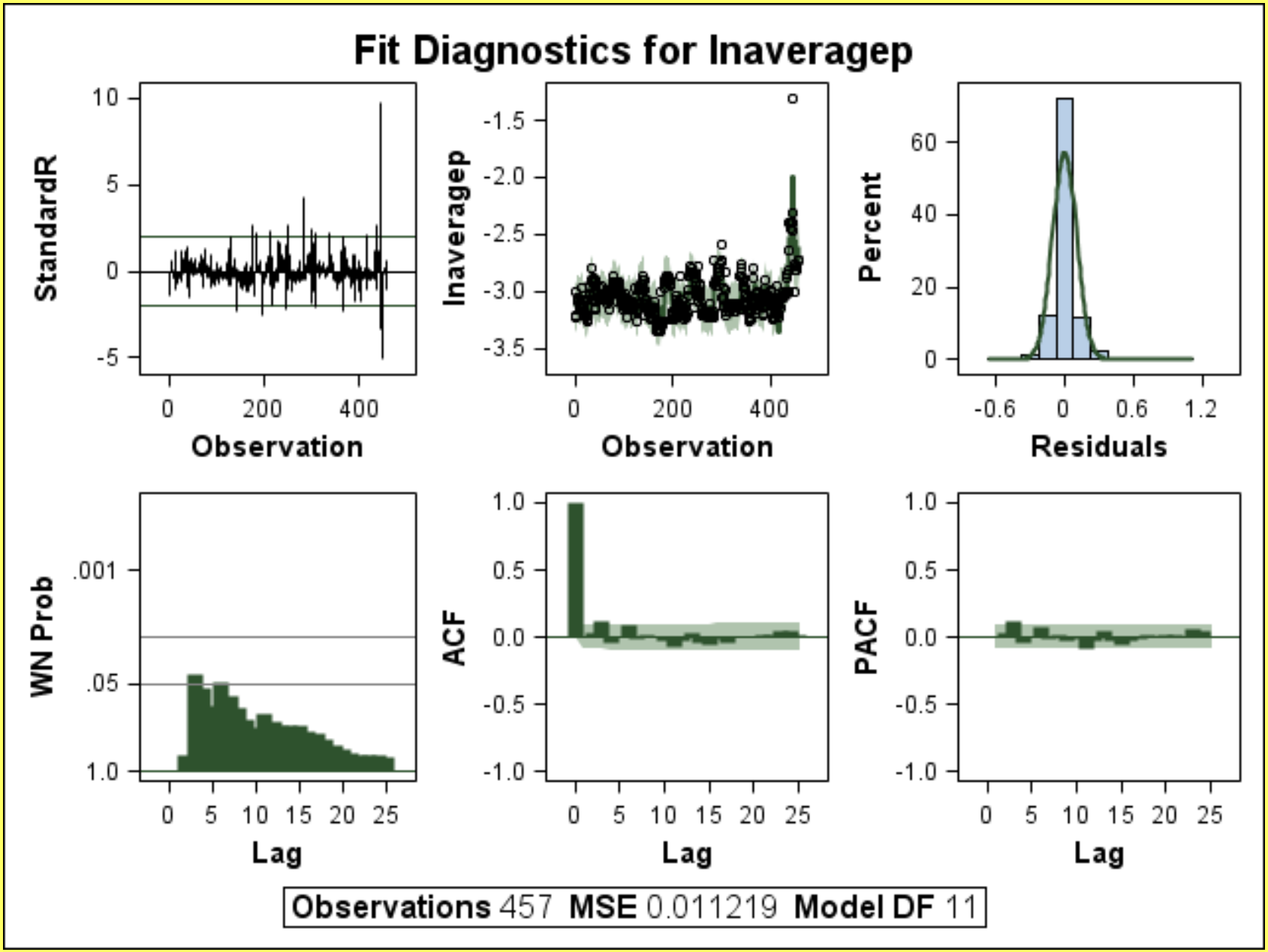
Catch Availability

- CPUE
- ENSO
- Climate Change

:Current Research

: Not Available Yet
Future Research

Thank You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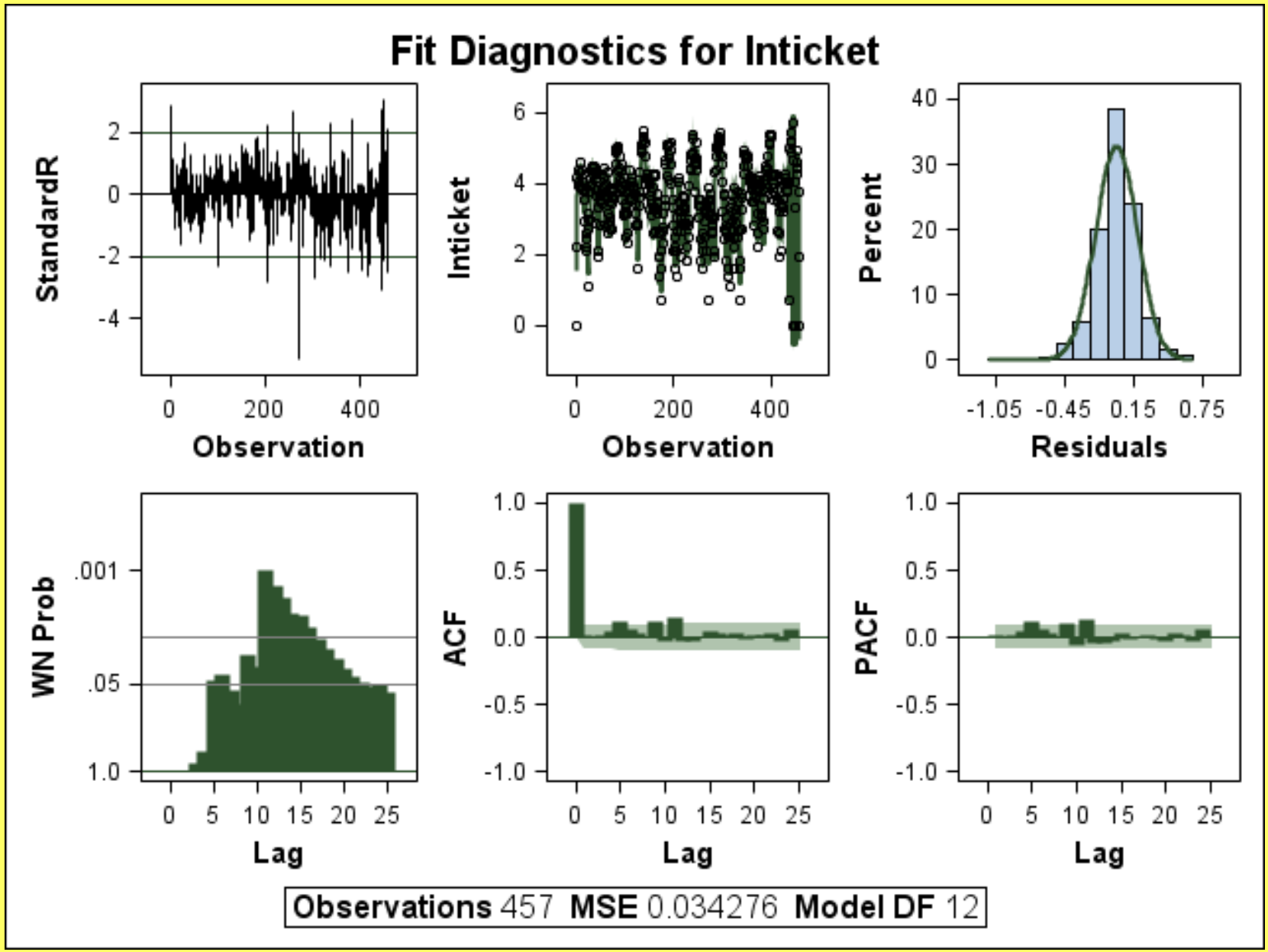
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