Future Seas Econ Report

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1 Introduction

This is a weekly report for the Economic group of the Future Seas Project. I downloaded landings data publicity available from PacFIN. The data has a panel data structure, where we observe commercial **west coast** species over *years*.

Changes from previous report:

- Time series for annual average prices for selected CPS species.
- PacFin data by state and port

2 Descriptive statistics

Table 1 shows descriptive statistics for each variable in the dataset:

Table 1: Descriptive statistics.

	Mean	Std.Dev	Min	Max
Landing_year	2001.89	11.65	1981.00	2021.00
Landings	293.30	2172.43	0.00	66890.30
N_dealers	20.38	13.00	0.75	68.00
N_vessels	42.10	31.41	0.75	182.00
Price	1.37	1.79	0.00	28.53
Revenue	347985.20	1835031.56	0.00	49987499.00

3 Graphical analysis

3.1 Revenue and landings: Historical averages.

Mean revenues by species are shown in Figure 1, while mean landings by species are shown in Figure 2.

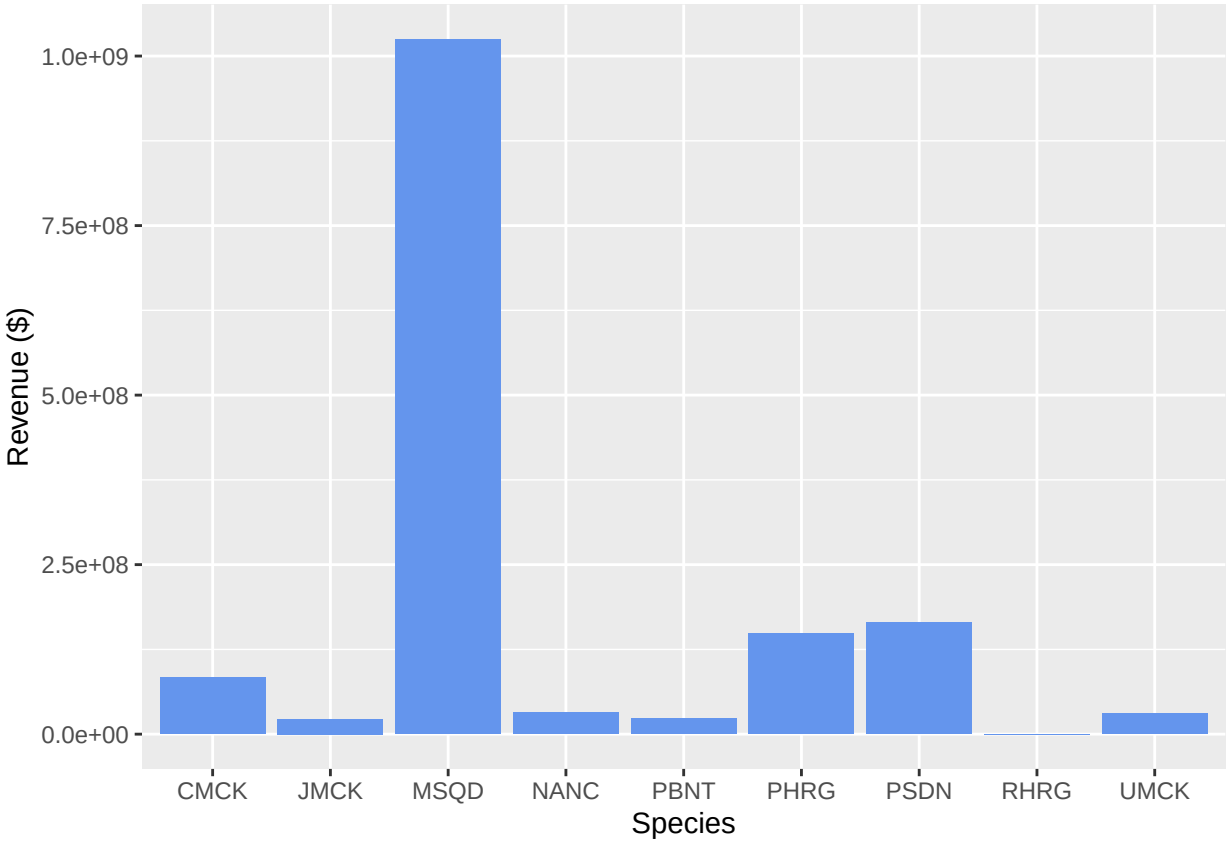

Figure 1: Annual mean revenue by CPS species. 1981-2021.

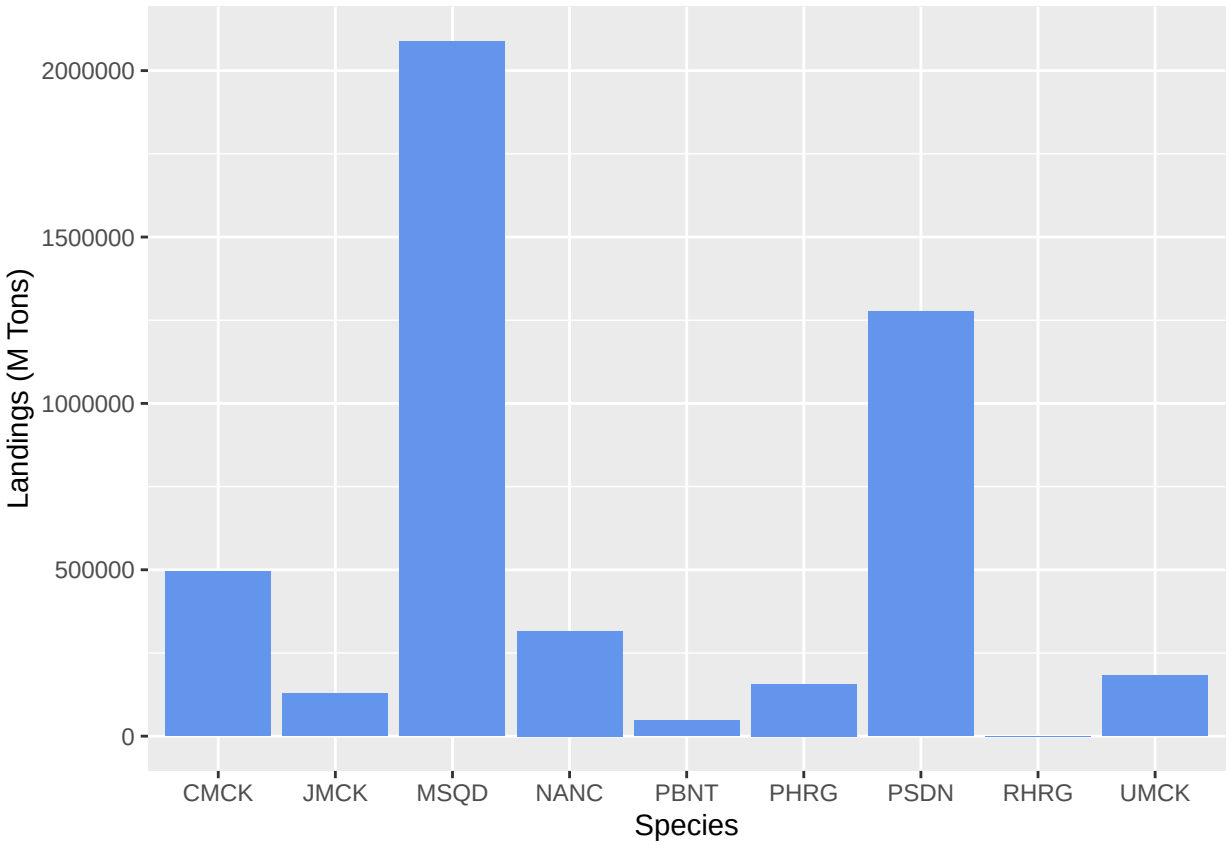

Figure 2: Annual mean landing by CPS species. 1981-2021.

3.2 Price and landings: Time series

Figure 3 shows landing over time by species, while Figure 4 shows landing and prices over time for selected CPS species.

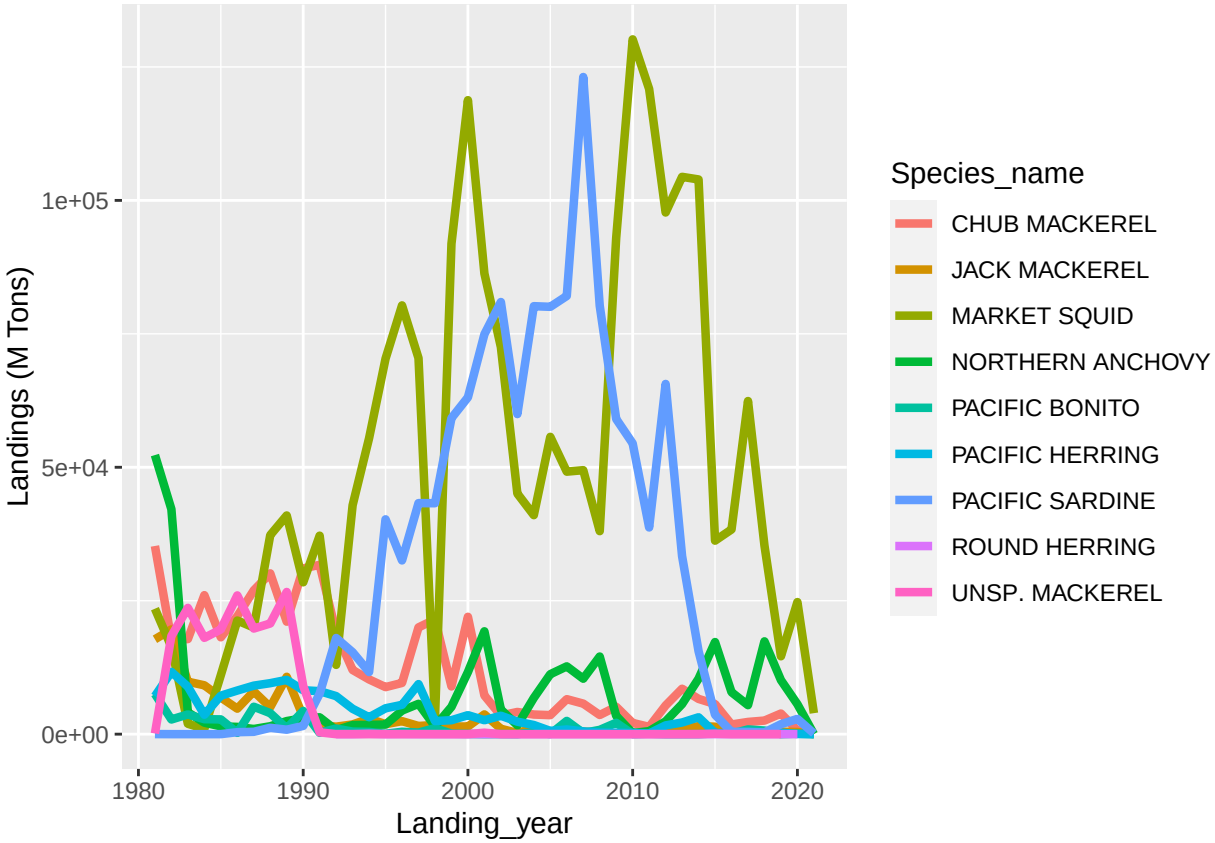

Figure 3: Total annual landing by CPS species.

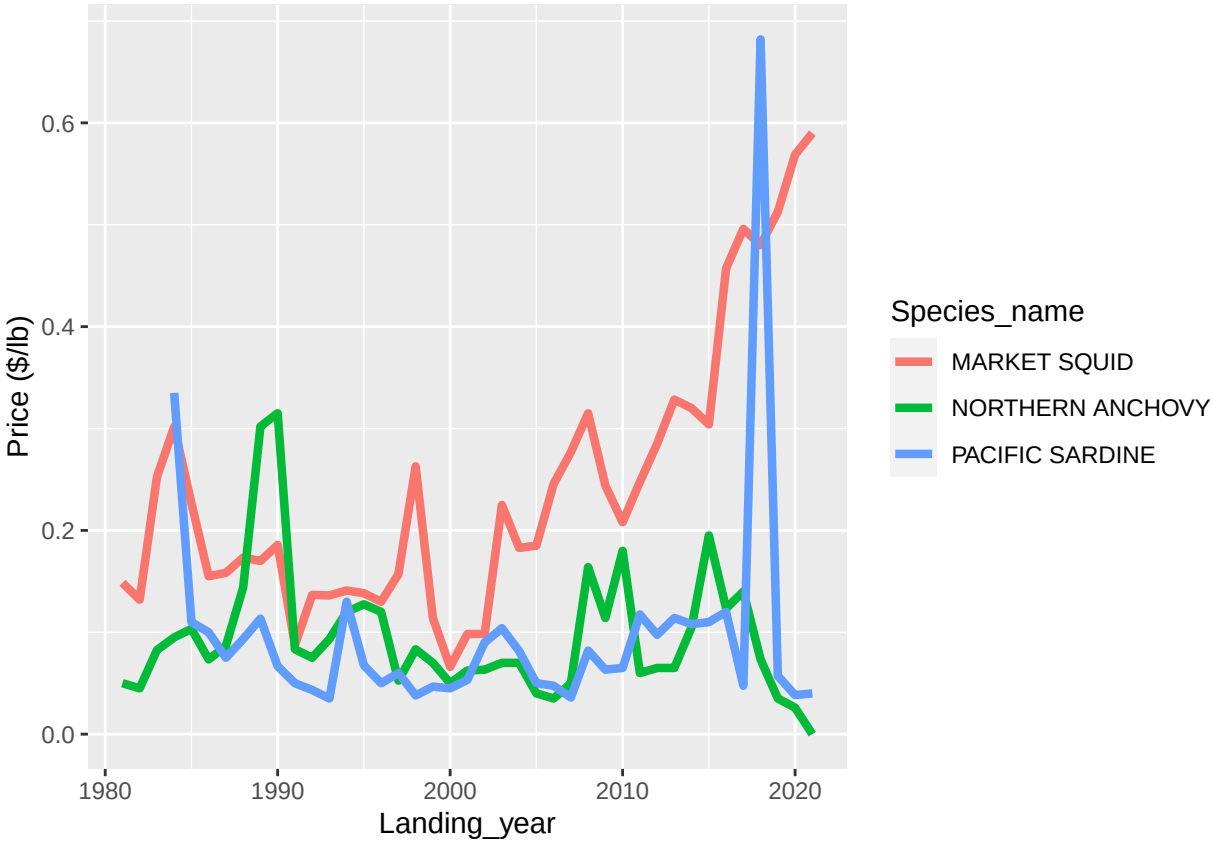

Figure 4: Annual averages of prices by CPS species.

3.2.1 Sardine

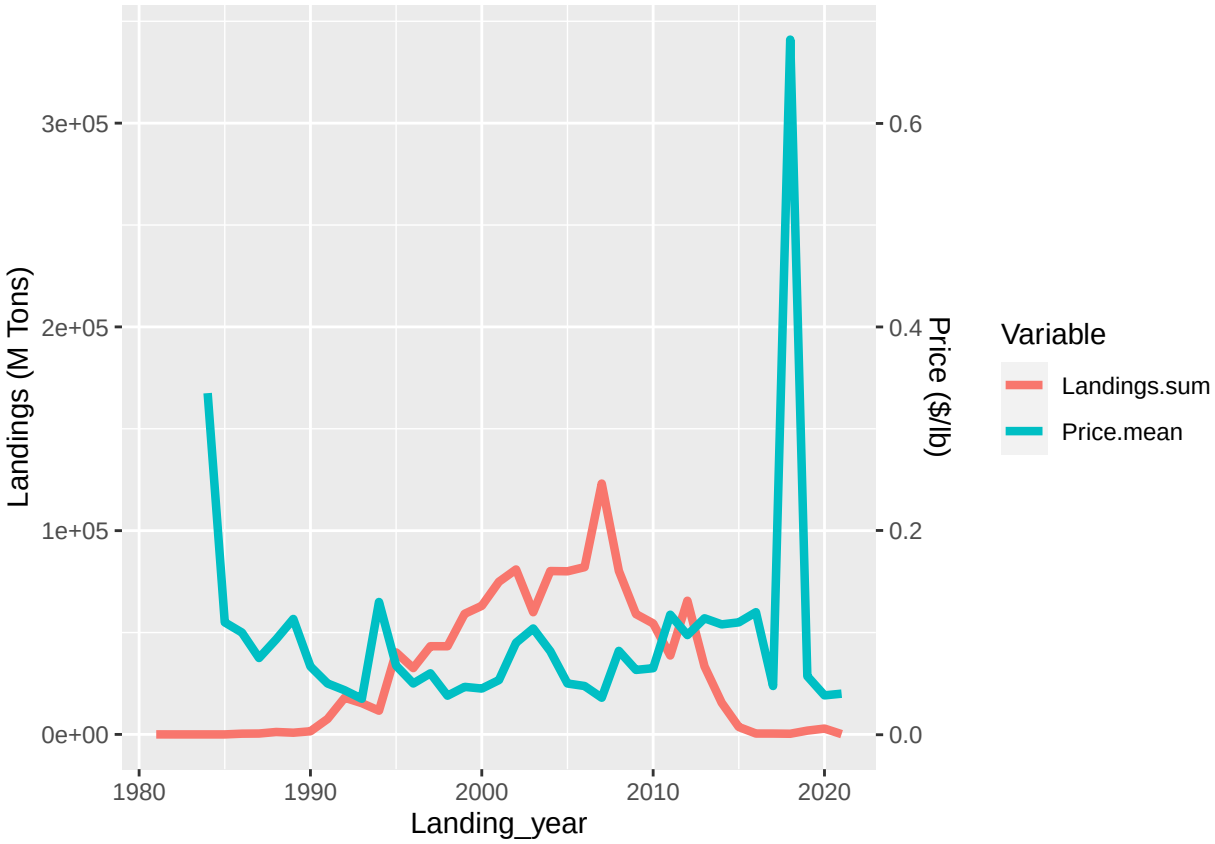

Figure 5: Landing v/s Prices. Pacific Sardine.

3.2.2 Anchovy

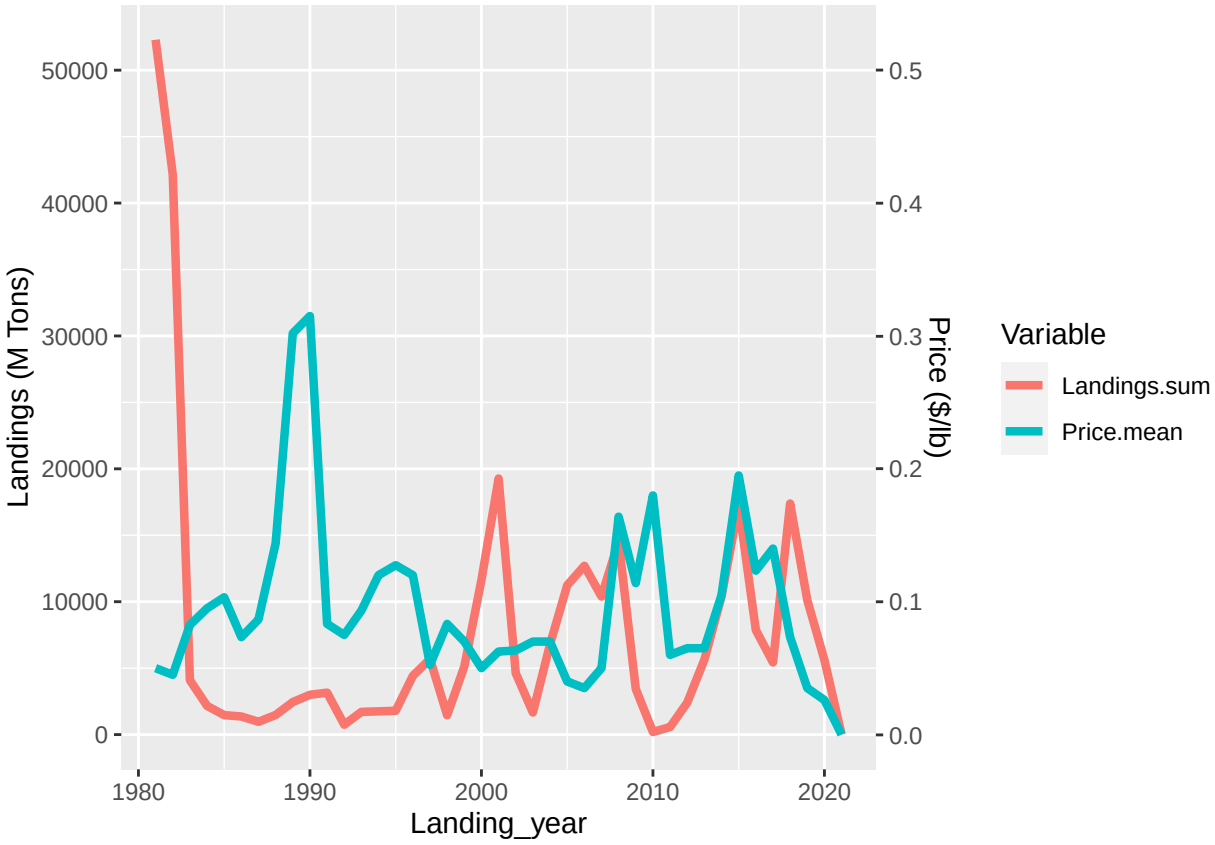

Figure 6: Landing v/s Prices. Northern Anchovy.

3.2.3 Market squid

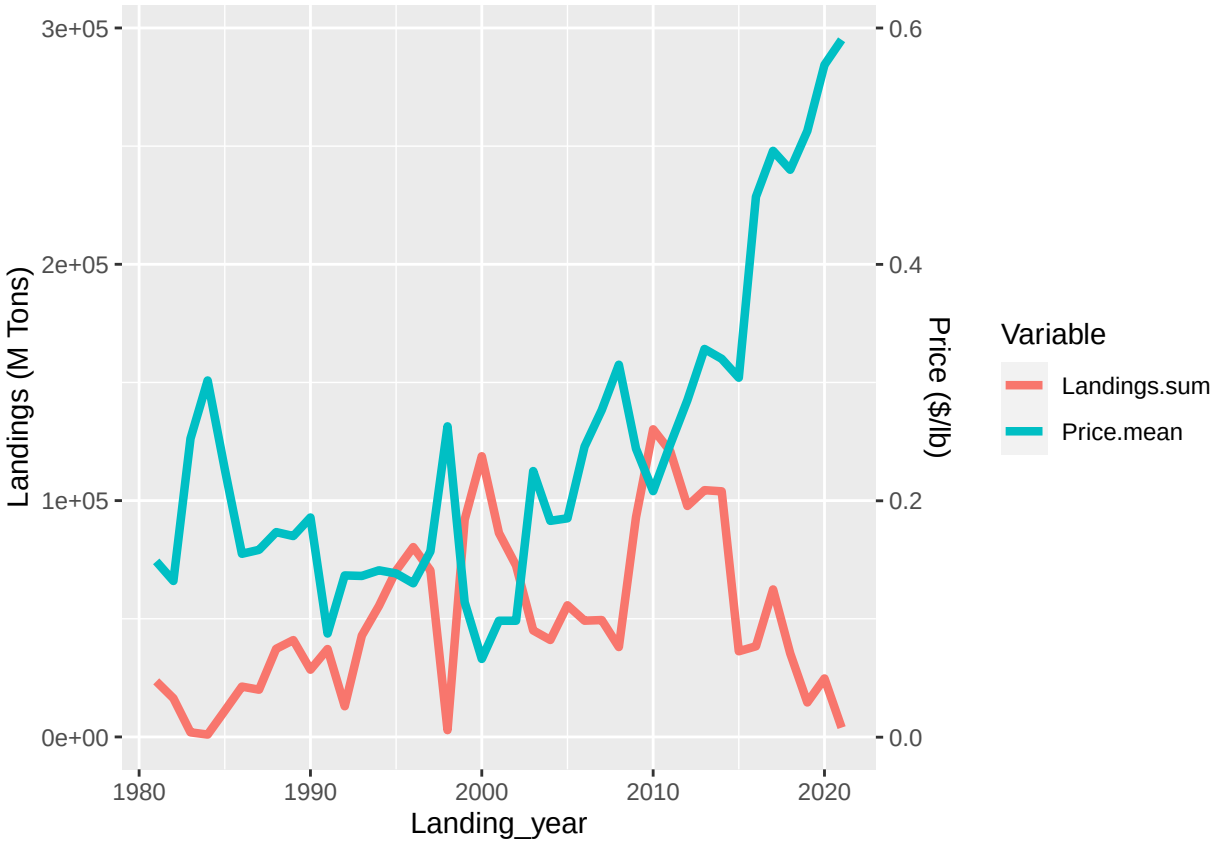

Figure 7: Landing v/s Prices. Market Squid.

3.3 Historical averages by state and port

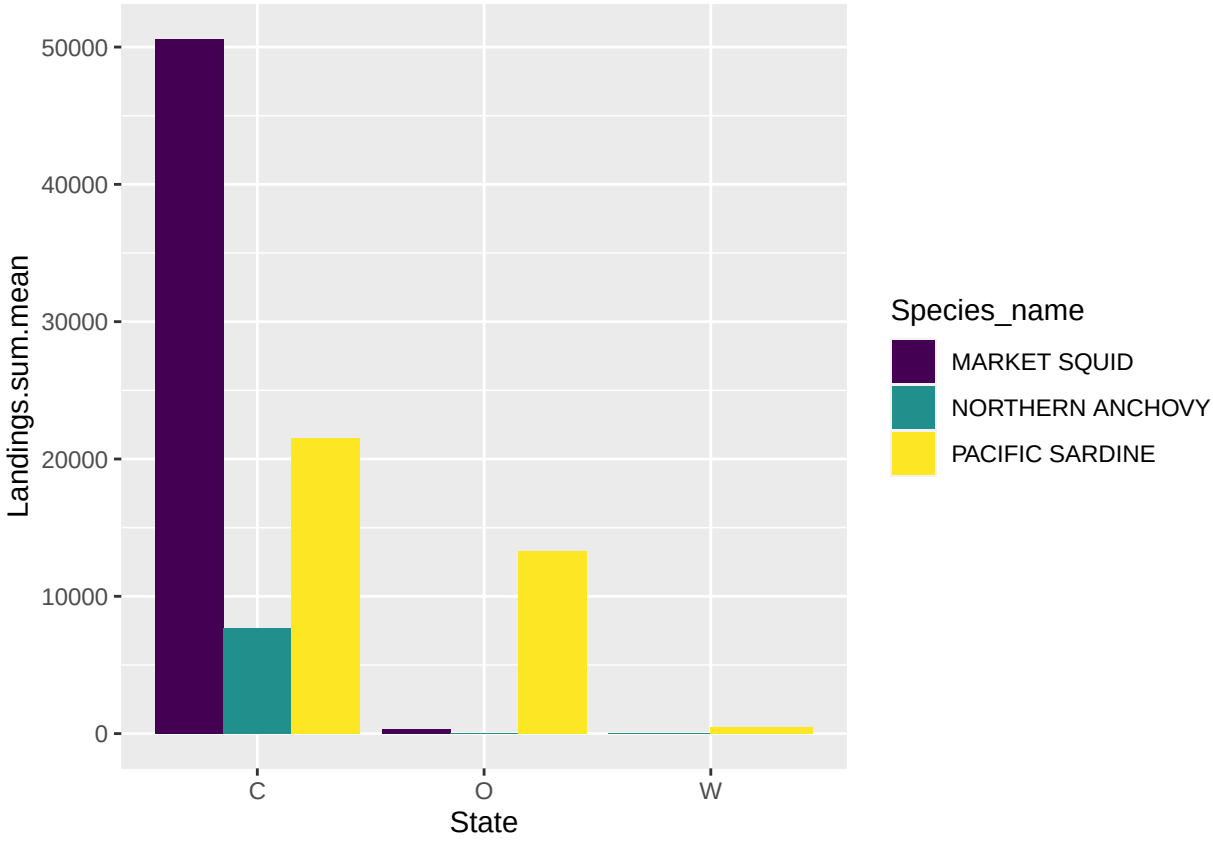

Figure 8: Landing by state.

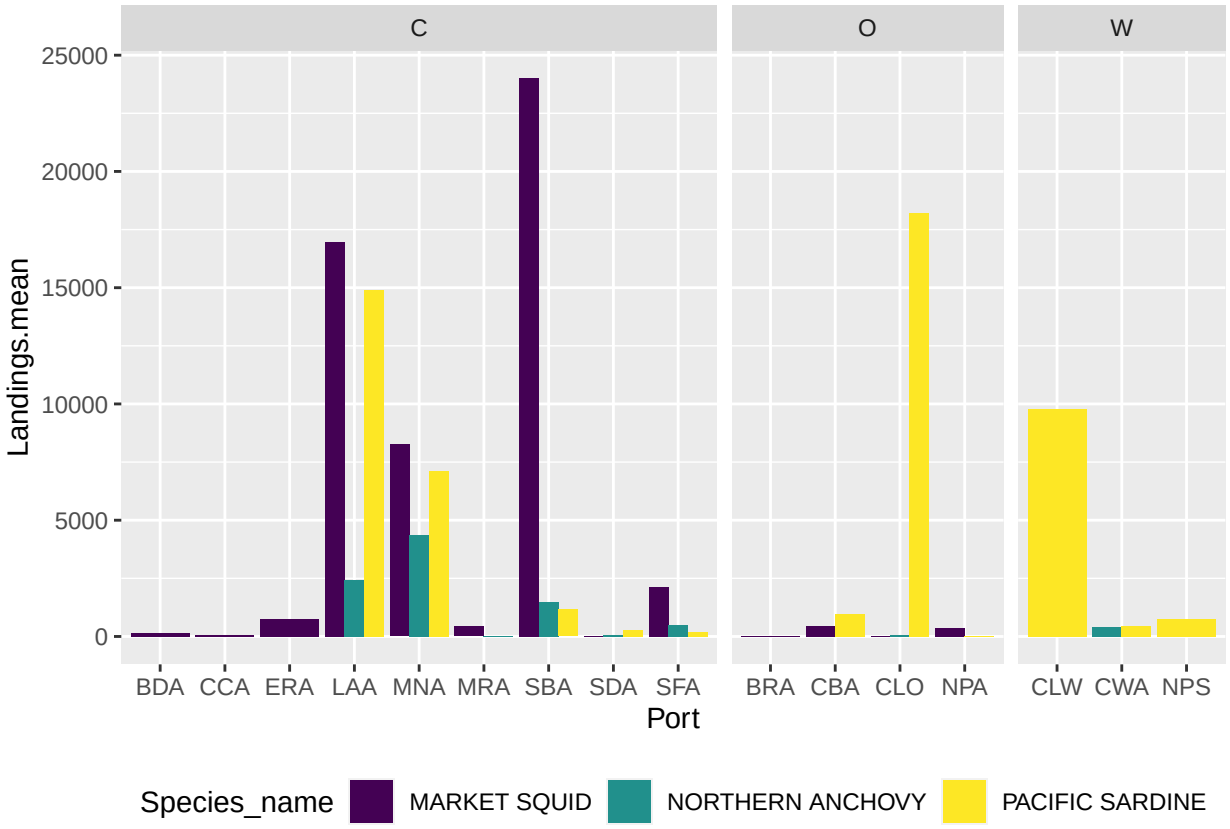

Figure 9: Landing by Port.

3.4 Time series by state and area ports

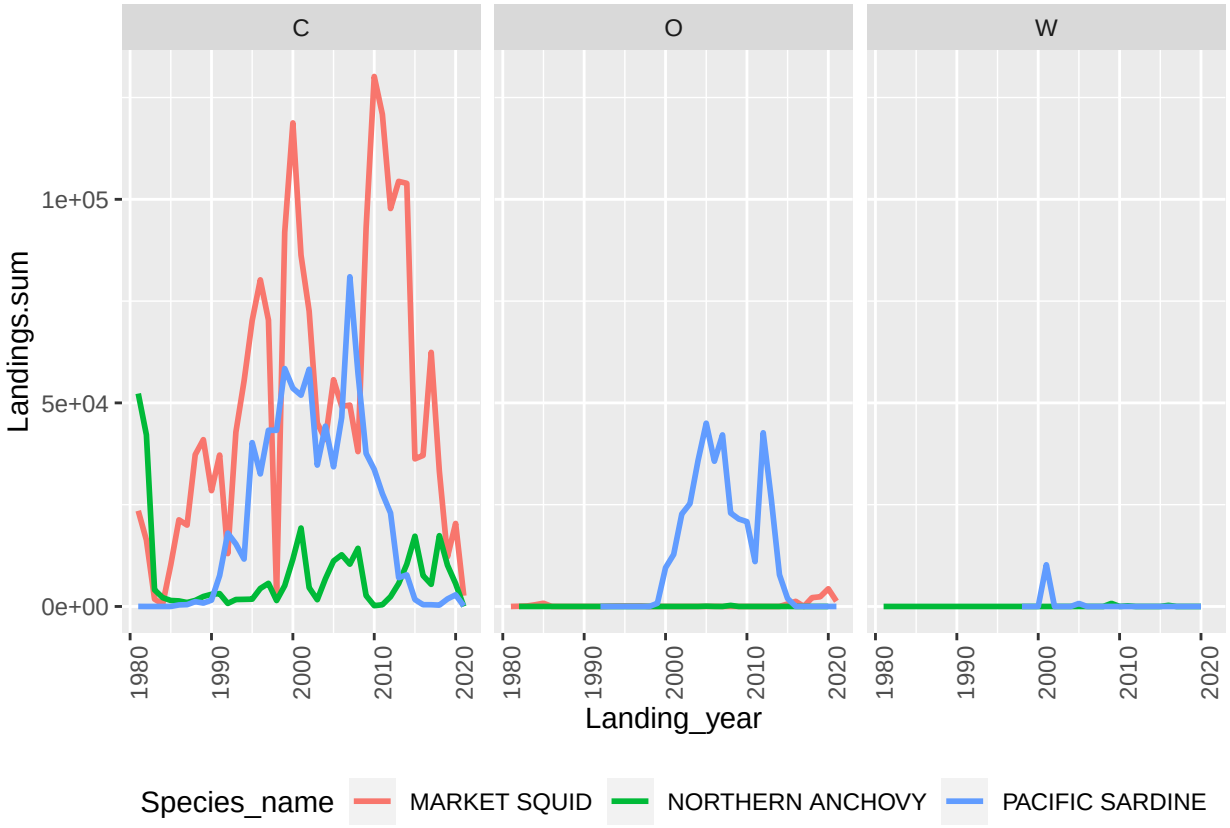

Figure 10: Annual average landing by state.

3.4.1 California ports

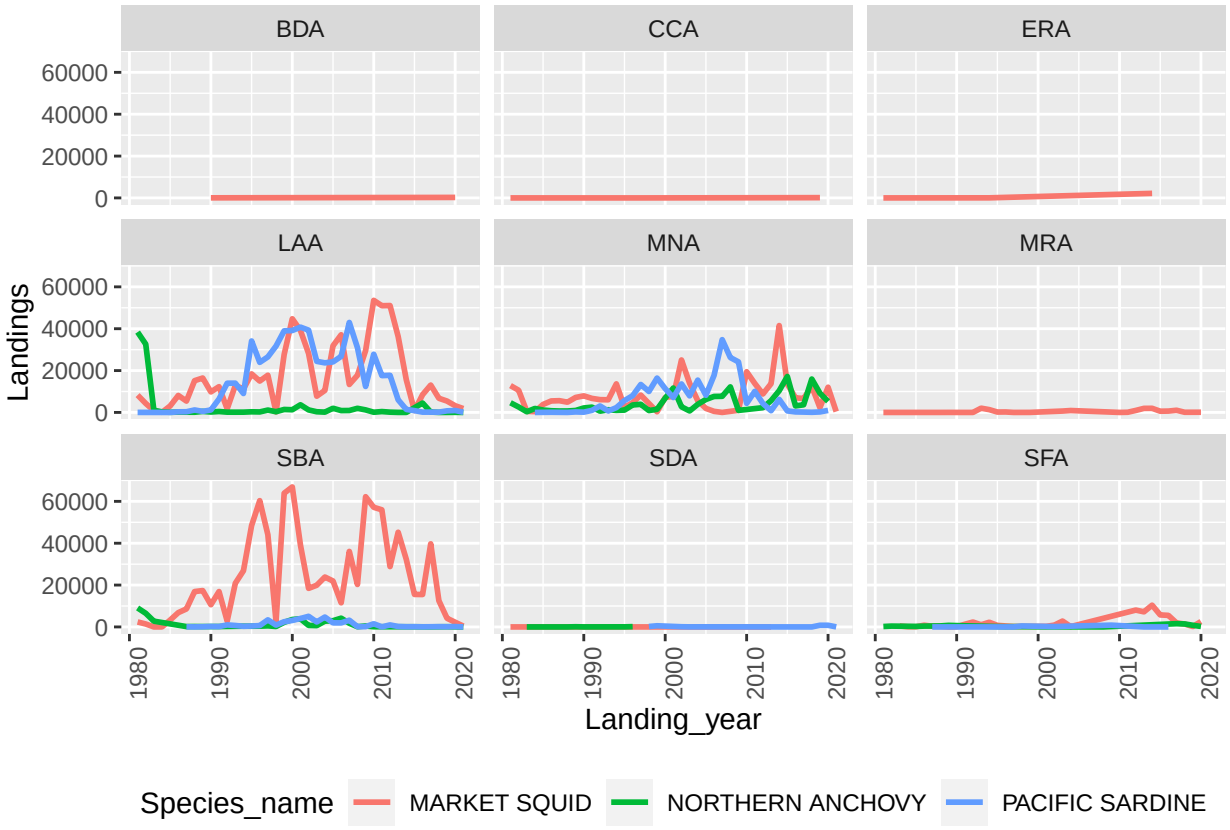

Figure 11: Annual average landing by area ports in California. *Notes:* BDA = Bodega Bay; CCA = Crescent City; ERA = Eureka; LAA = Los Angeles; MNA = Monterey; MRA = Morro Bay; SBA = Santa Barbara; SDA = San Diego; SFA = San Francisco.

3.4.2 Oregon ports

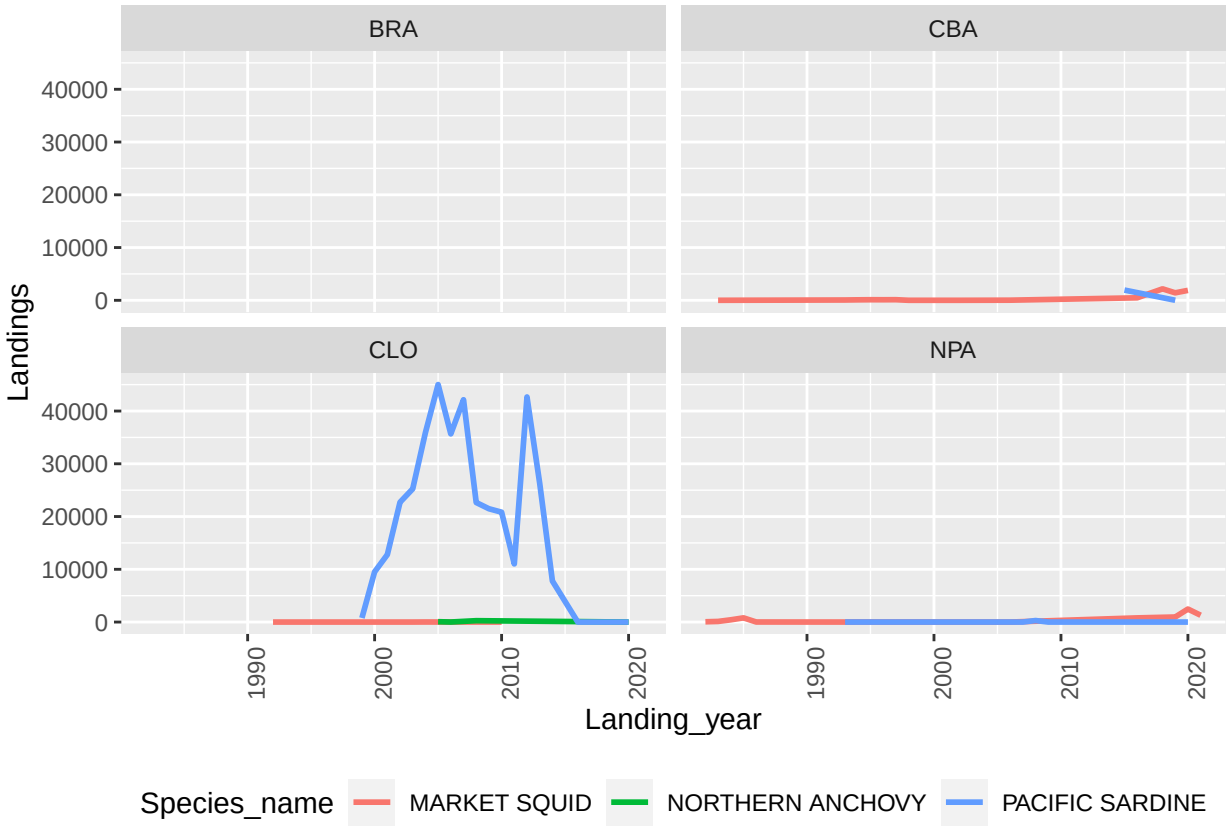

Figure 12: Annual average landing by area ports in Oregon. *Notes:* BRA = Brookings; CBA = Coos Bay; CLO = Columbia River (OR); NPA = Newport.

3.4.3 Washington ports

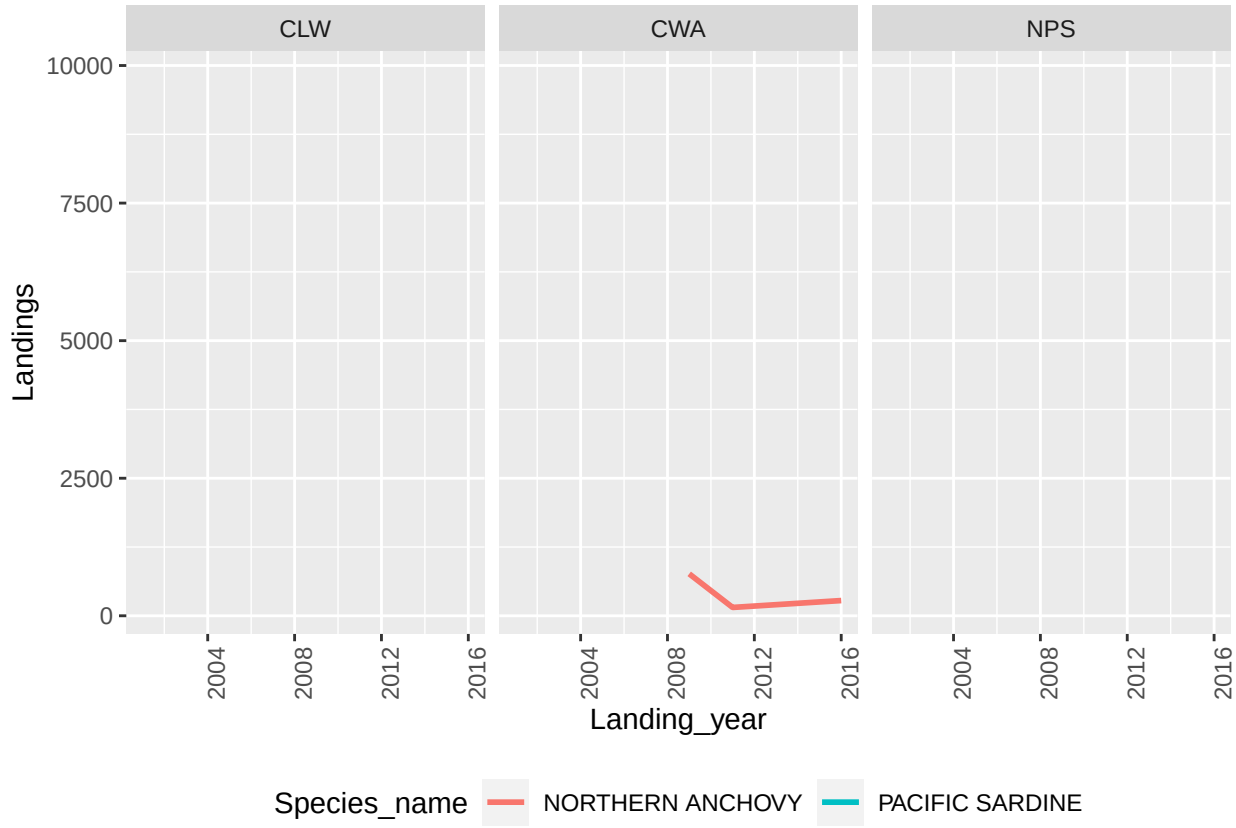

Figure 13: Annual average landing by area ports in Washington. *Notes:* CLW = Columbia River (WA) ; CWA = Washington Coastal; NPS = North Puget Sound.

3.4.4 All ports

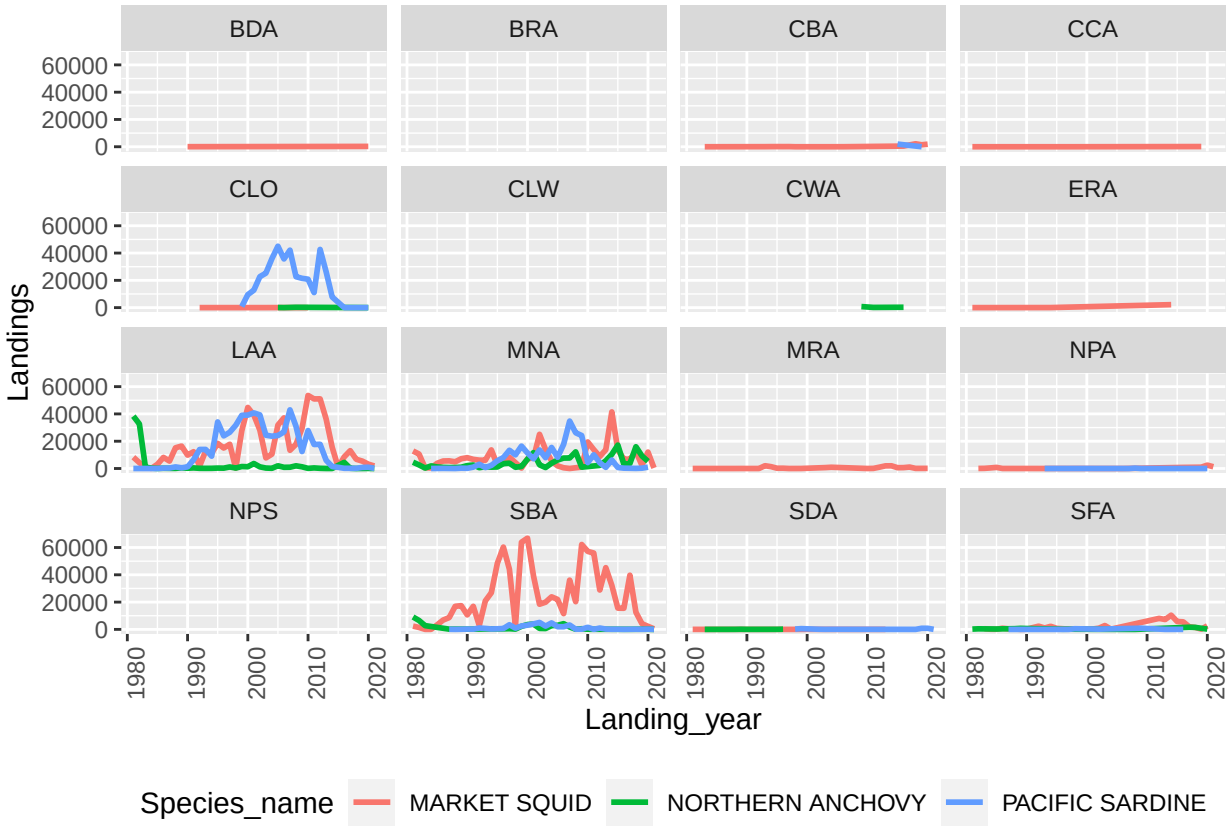

Figure 14: Annual average landing by area port. *Notes:* BDA = Bodega Bay; BRA = Brookings; CBA = Coos Bay; CCA = Crescent City; CLO = Columbia River (OR); CLW = Columbia River (WA) ; CWA = Washington Coastal; ERA = Eureka; LAA = Los Angeles; MNA = Monterey; MRA = Morro Bay; NPA = Newport; NPS = North Puget Sound; SBA = Santa Barbara; SDA = San Diego; SFA = San Francisco.

4 Preliminary estimations

4.1 Model fundametals

We want to estimate a model for landing in each port of Pacific Sardine. In general, landings are conditional to biological stocks, harvest cost, prices and regulations.

- Model: Production model. Bayesian models???
- Outcome variable:
  - Pacific sardine landings by port and year
- Explanatory variables
  - Stock abundance

- Harvest costs (e.g., distances and fuel cost)
- Own price
- Effort (number of vessels as a proxy?)
- Price of other substitutes?
- Regulations? (How we include them?)

Table 2 shows preliminary estimations for pacific sardine landing using a fixed-effect and random-effect models.

Table 2: Panel data models for Pacific Sardine landings.

	FE: Model 1	FE: Model 2	RE: Model 1	RE: Model 2
PSDN_Price	−23360.94	−19248.94	−25948.09	−19312.29
	(17277.08)	(17007.46)	(16943.19)	(17606.90)
PSDN_N_vessels	401.67***	408.80***	399.58***	397.56***
	(57.75)	(56.61)	(57.94)	(63.99)
MSQD_Price		−12127.68*		−12883.76*
		(5376.78)		(6152.54)
(Intercept)			−2854.89	−2116.85
			(5336.14)	(3660.02)
R^2	0.45	0.48	0.44	0.39
Adj. R^2	0.41	0.44	0.43	0.37
Num. obs.	100	100	100	100
s_idios			7881.11	7713.42
s_id			8608.51	1709.39

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

- Problems:
  - Endogeneity of prices
  - *N_vessel* by year and species, not by port.

4.2 Bayesian model

Let start thinking about the estimation of the Bayesian Hierarchical model for the Pacific Sardine.

- What to include:
  - Random effects by port and vessels. Each vessel may have different coefficients as well as ports.
  - Uncertainty from modeling the process (as well as from the imperfect observation of the process).
  - Solve for endogeneity of prices? IV bayesian model?

The Bayesian model can be described as follow:

$$\left[\beta, \sigma_p^2 | y_i\right] \propto \underbrace{\left[y_i | g\left(\beta, x_{i,t}\right), \sigma_p^2\right]}_{\text{process}} \underbrace{\left[\beta\right]\left[\sigma_p^2\right]}_{\text{parameters}} . \tag{1}$$

where y_i is the observed landings in port i, β are parameters to be estimated that describe the process of harvest, σ_p^2 is the stochasticity in the harvest process, and $x_{i,t}$ is the vector of variable that explain landing in port i during the landing year t.

If we assume that the parameters estimates for harvest varies for each port, we can rewrite the previous model as:

$$\left[\beta_i, \sigma_p^2, \sigma_\mu^2, \mu | y_i\right] \propto \left[y_i | g\left(\beta_i, x_{i,t}\right), \sigma_p^2\right] \underbrace{\left[\beta_i | \mu, \sigma_\mu^2\right]}_{\text{port paramter}} \left[\sigma_p^2\right] \left[\sigma_\mu^2\right] \left[\mu\right]. \tag{2}$$

where $g\left(\beta_i, x_{i,t}\right) = \sum_{k=1}^{K} \beta_i^k x_{it}^k$ and β_i are the port-specific parameters to be estimated. Using β_i and $x_{i,t}$ we can model landing for each port during a specific landing year.

- **Notes:**
  - *Do this by vessel?* In that case, we would predict landing by vessel. A secon model might be used to then allocate vessel landings to an specific port.
  - Different intercept by port/vessel explained by vessel/port characteristics