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Durable entitlements and resilience in fishery social ecological systems subject to environmental forcing

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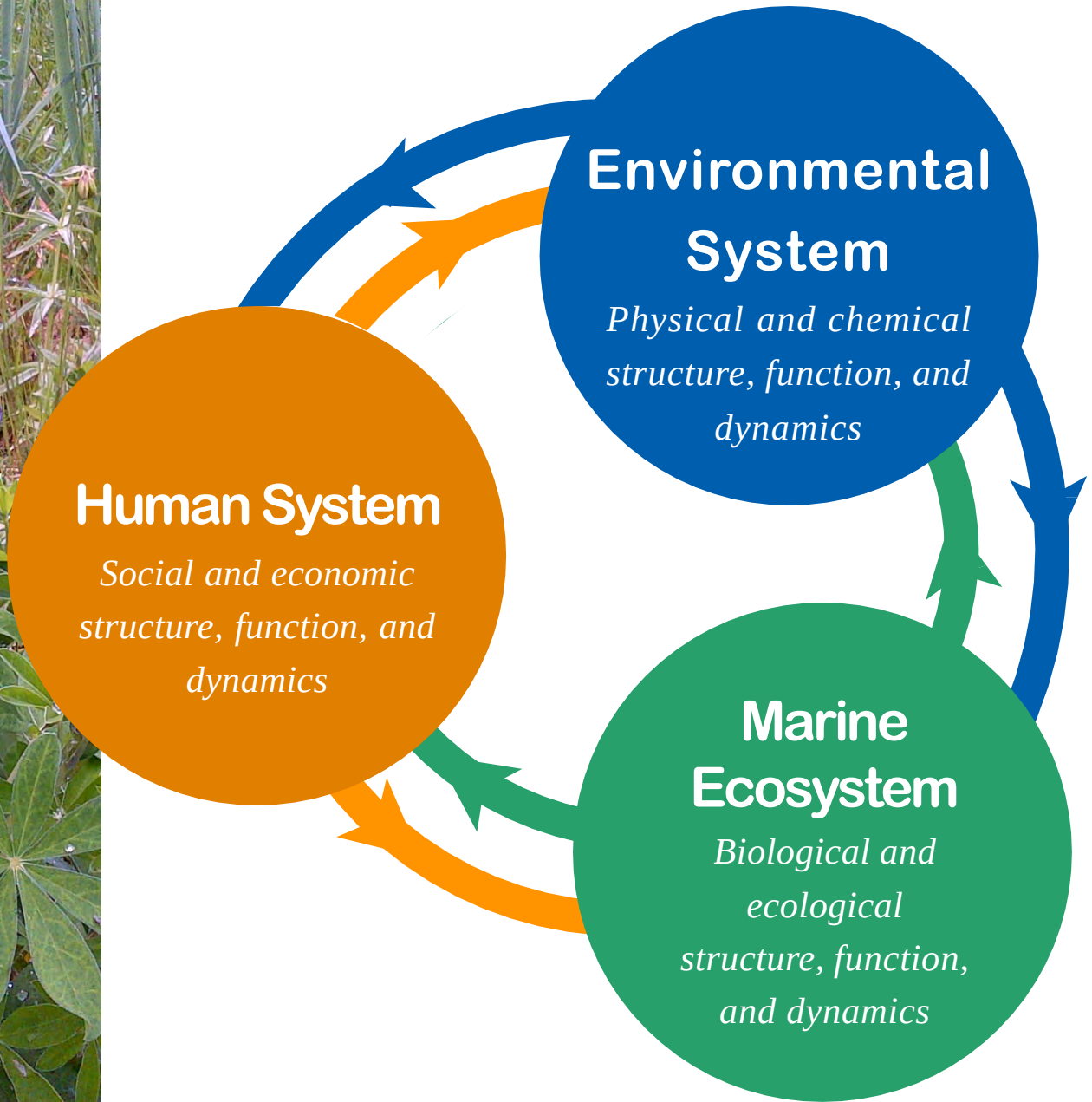
Marine Social-Ecological System



Durable Entitlements in Fisheries

Effort/Input Controls

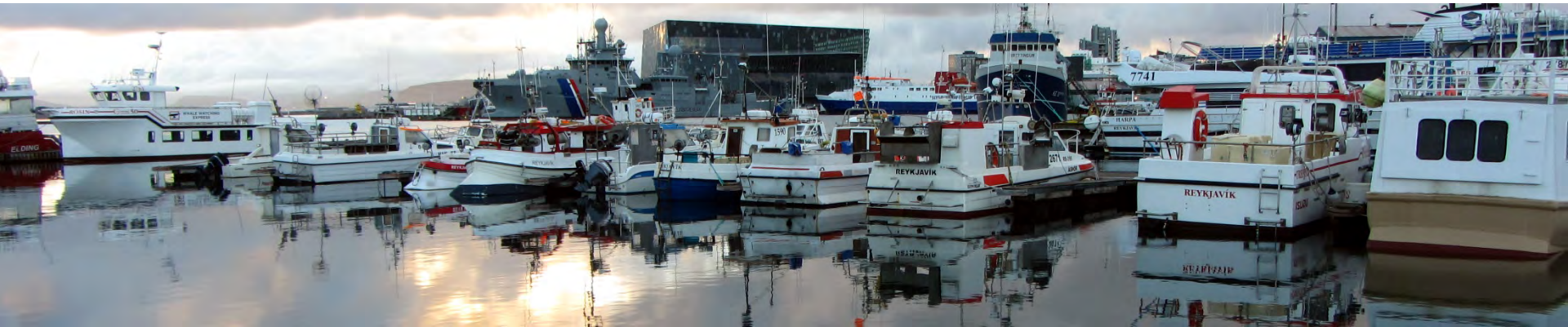
- License Limitation (LE, LLP)
- Pot quotas
- Days-at-Sea

Location Controls

- Spatially Rights (TURFs/SURFs)
- Superexclusive Registration

Output Controls

- Individual Quotas (IFQ, ITQ, IVQ)
- Community Allocations (CQ, CDQ)
- Fishing Cooperatives (Coops, Sectors, Enterprises)
- Corporations (Community, Private)
- Common Property
- Processing Quotas (PQ)



Durable Entitlements in Alaska Fisheries

Fishery	Start	Mgmt sys	% wt	% value
Salmon	1973	LLP	11	26
Herring	1973	LLP	1	1
Pollock+	1992, 1998	CDQ	*	*
Halibut	1995	IFQ	1	9
Sablefish	1995	IFQ	1	7
Pollock	1999/2000	Coops	54	20
Scallop	2000	LLP*	tr	tr
BSAI crab	2005	IFQ/IPQ	2	16
GOA Rockfish	2007	Coops	2	2
BSAI GF trawl	2008	Coops	19	12
BSAI GF LL	2010	Coops	8	6

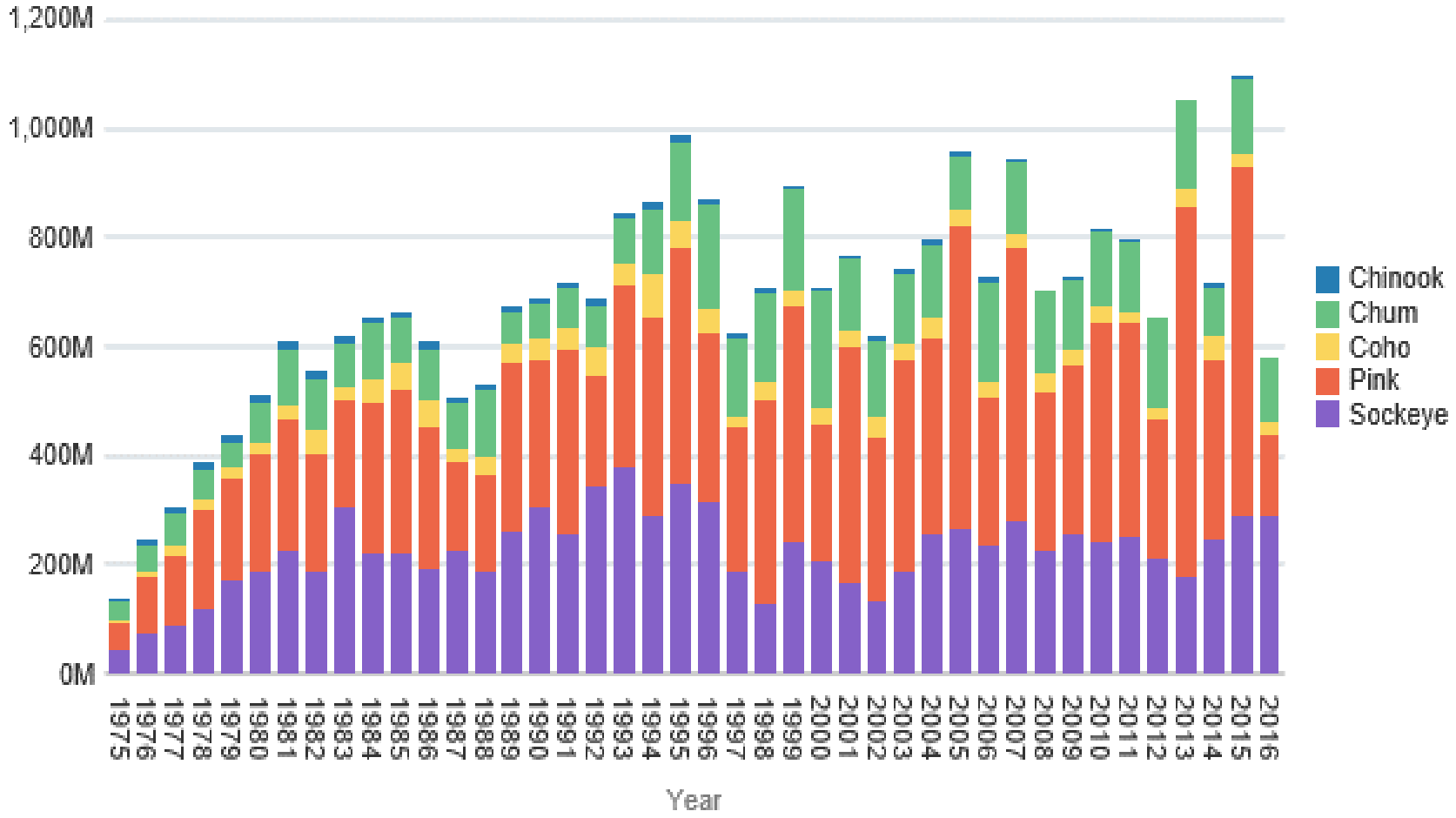
Alaska's Salmon Fisheries—A Successful Failure

Alaska's Salmon Fisheries

Following statehood in 1959, Alaska instituted effective escapement-based harvest limits and disrupted the monopsony power of the salmon canneries.

As fish stocks recovered, a rush of new entrants led to congestion on fishing grounds and made it difficult for managers to control catches.

Salmon Landings (lbs)



Alaska's Salmon Fisheries

To control the rush of entrants, Alaska passed the Limited Entry Act in 1972.

Limited entry capped the number of boats, but failed to prevent continued escalation of fishing power and associated pathologies of the race-for-fish.

Alaska's Salmon Fisheries

The race-for-fish resulted in individually sensible but collectively irrational excess investment in harvesting and processing capacity

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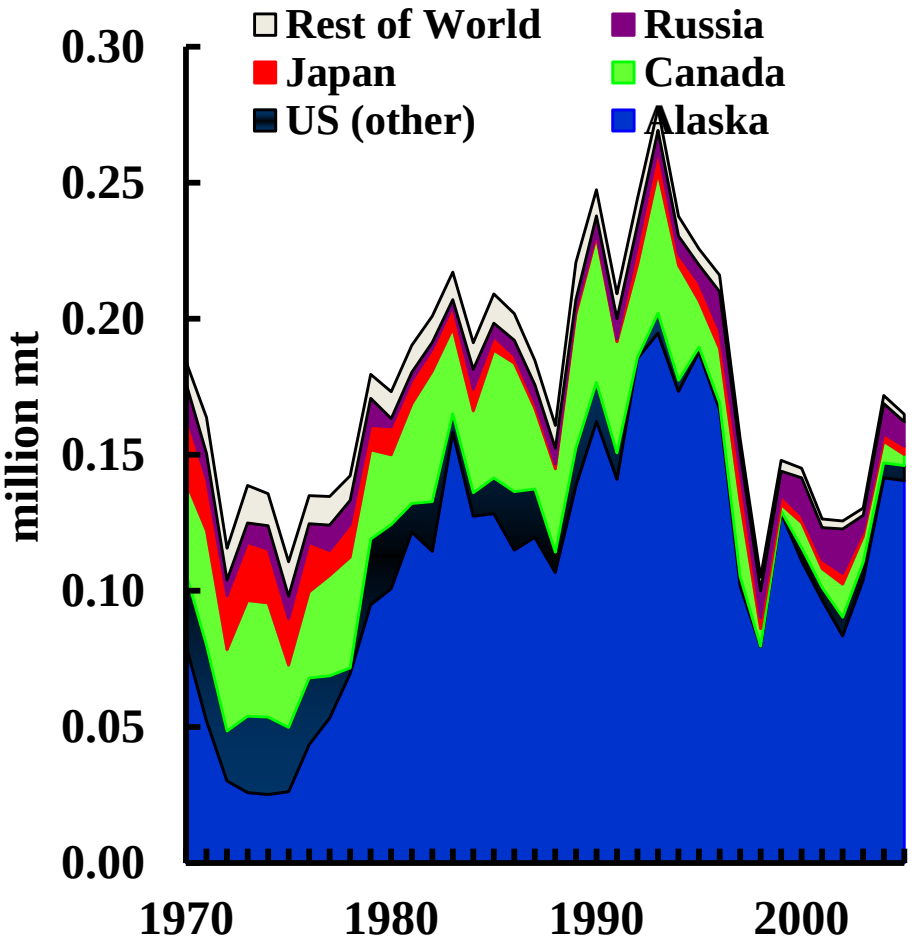
Alaska's Salmon Fisheries

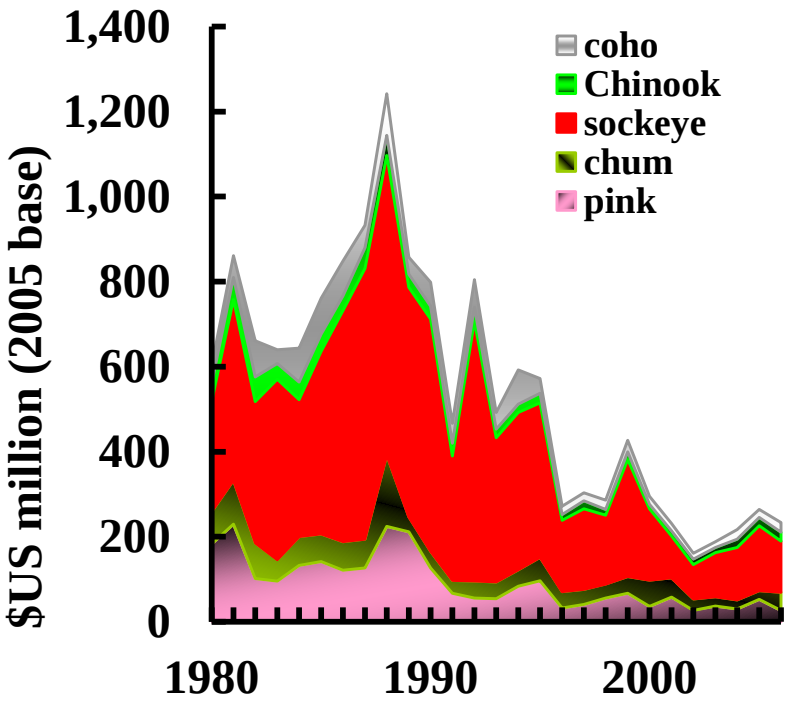
Buoyed by strong prices caused by declines in salmon production in other regions, Alaskan salmon fishery exvessel revenues and the price of limited entry permits soared through the mid-1980s.

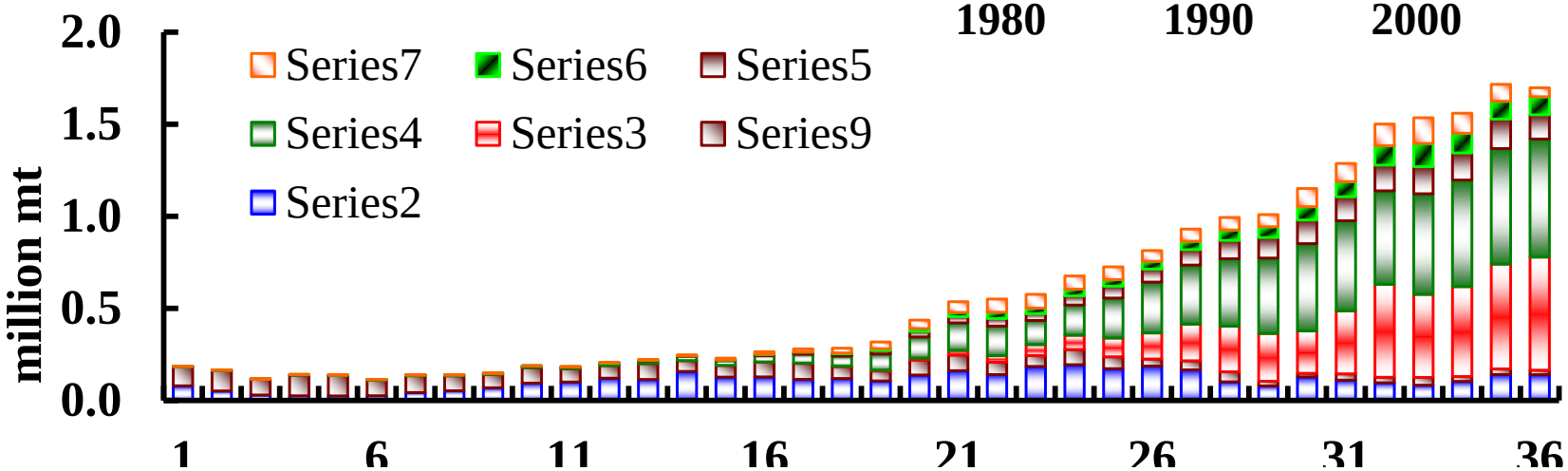


World catches of Chinook, coho, sockeye, and steelhead.

Alaska's Salmon Fisheries

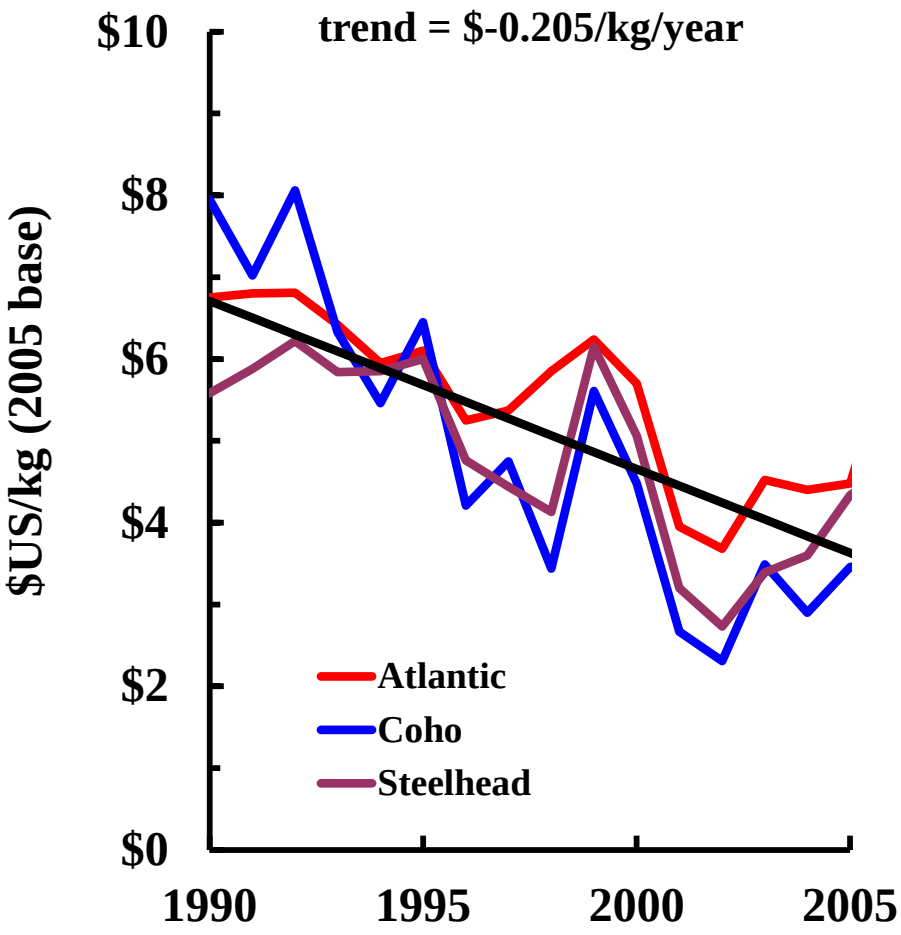
By the early 1990s, high volumes of salmon from Norway, Chile, the UK, and Canada began to depress Alaskan exvessel prices and revenues.





Alaska's Salmon Fisheries

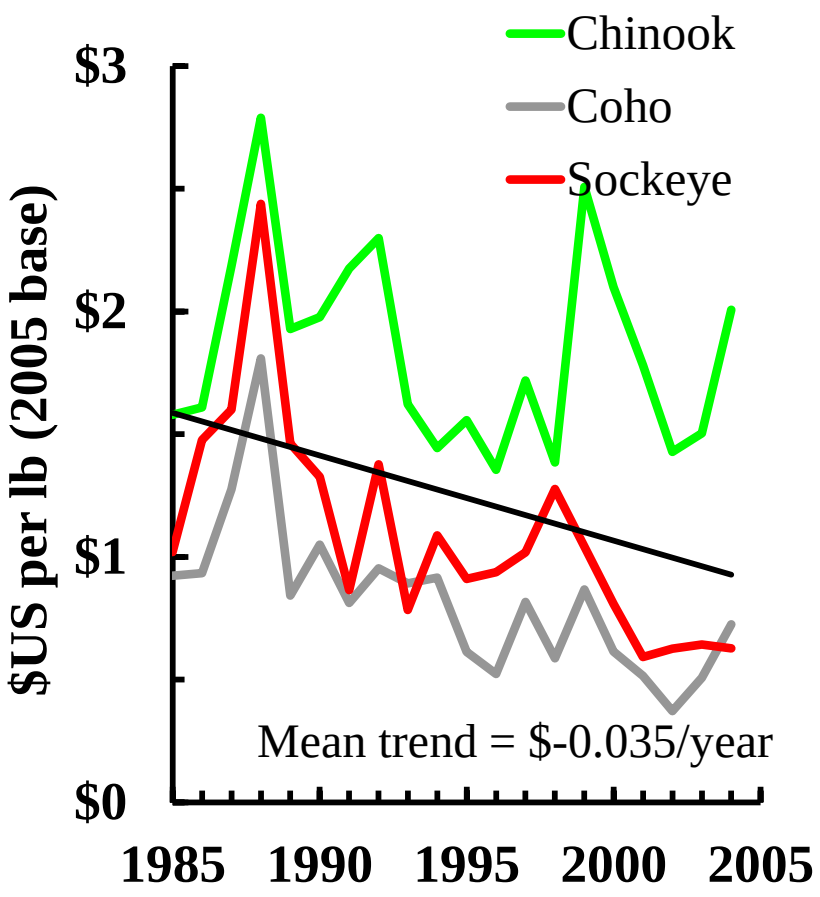
Aquaculture production increased because technological innovation caused production costs to decline more rapidly than the production-induced decreases in product prices.



FOB Chilean export prices.

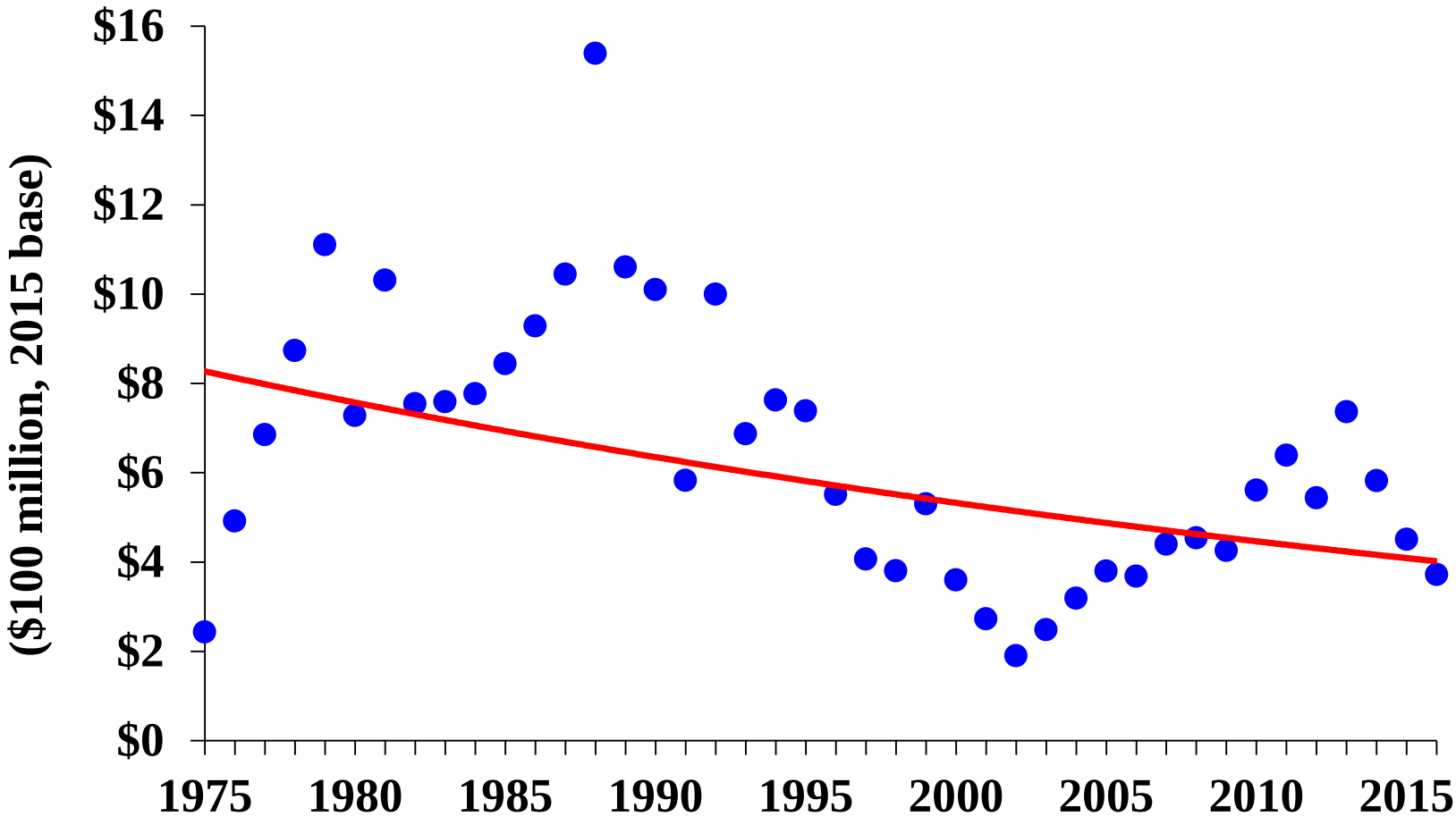
Alaska's Salmon Fisheries

Alaska exvessel prices fell because farmed salmon is a close substitute for Alaska salmon in all major markets

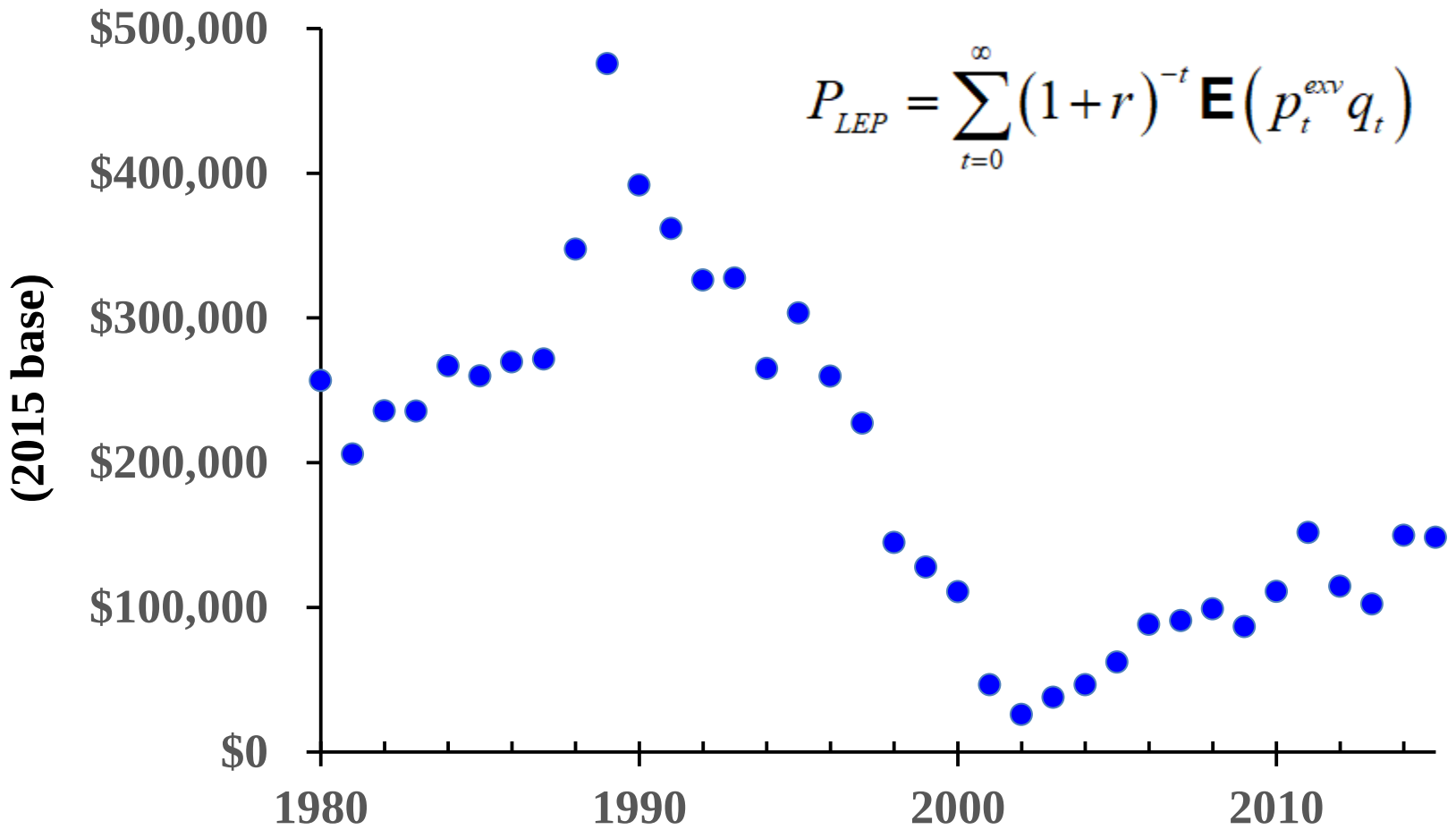


Alaska Exvessel Prices

Exvessel Revenue Alaska's Salmon



Bristol Bay Drift Gillnet Permit Value



Alaska's Salmon Fisheries

The collapse of exvessel prices created social and economic turmoil in salmon fishing communities because it reduced annual revenues by 80% **and** reduced the asset value of limited entry permits to well below outstanding loan balances, bankrupting many salmon fishermen.

Rural communities controlled 48% of the BB drift gillnet LEPs in the late 1970s but now control only 30%.

Salmon in Alaska

- Adoption of harvest and management strategies that foster a race-for-fish led to unsustainable investment in processing capacity and infrastructure in remote communities.
- Contraction of revenues resulted in closure of processing facilities in communities adjacent to small or highly variable runs, or runs of low-value species.
- The loss of wage income and tax receipts compromised the economic viability of these communities.
- While limited entry may have increased the resilience of ecological and governance systems, economic and social systems have not been resilient to external forcing.

Alaska's Salmon Fisheries—A Successful Failure

External forcing through competing goods in product market

Alaska's Halibut Fishery—Snatching Failure from the Jaws of Success

Alaska's Halibut Fishery

1880 Commercial fishery begins

1923 Halibut Commission formed

1976 MSFCMA enacted

1982 Authority to allocate catch delegated to NPFMC

1991 Canada implements IVQs

1995 Alaska implements IFQs

Alaska's Halibut IFQ Program

- Permanent allocation of shares of TAC to individual vessel owners
- Market-based transfer of quota shares between fishermen
- Limits on consolidation of quota shares
- Limits on transfer of quota shares between vessel classes
- Limits on leasing

Alaska's Halibut Fishery: Post-IFQ

- The fishery has reorganized to deliver high-quality fresh product throughout a protracted season.
- Average exvessel price (Alaska) increased $0.53/kg; about $11 million per year in exvessel revenue.
- Fishermen received ~92% of this increase.
- Processors received ~8% of this increase.
- The distribution of benefits from this program has influenced the structure of all subsequent programs in Alaska.

Alaska's Halibut Fishery: Post-IFQ

- Quota shares held by rural Alaskans increased from 14.6% in 1995 to 22.1% in 2006, but the growth has been concentrated in larger rural communities and masks losses in smaller communities.
- Pre-IFQ halibut processors lost market share and revenues as fishers bypassed traditional supply chains through contracts with niche processors and wholesalers.

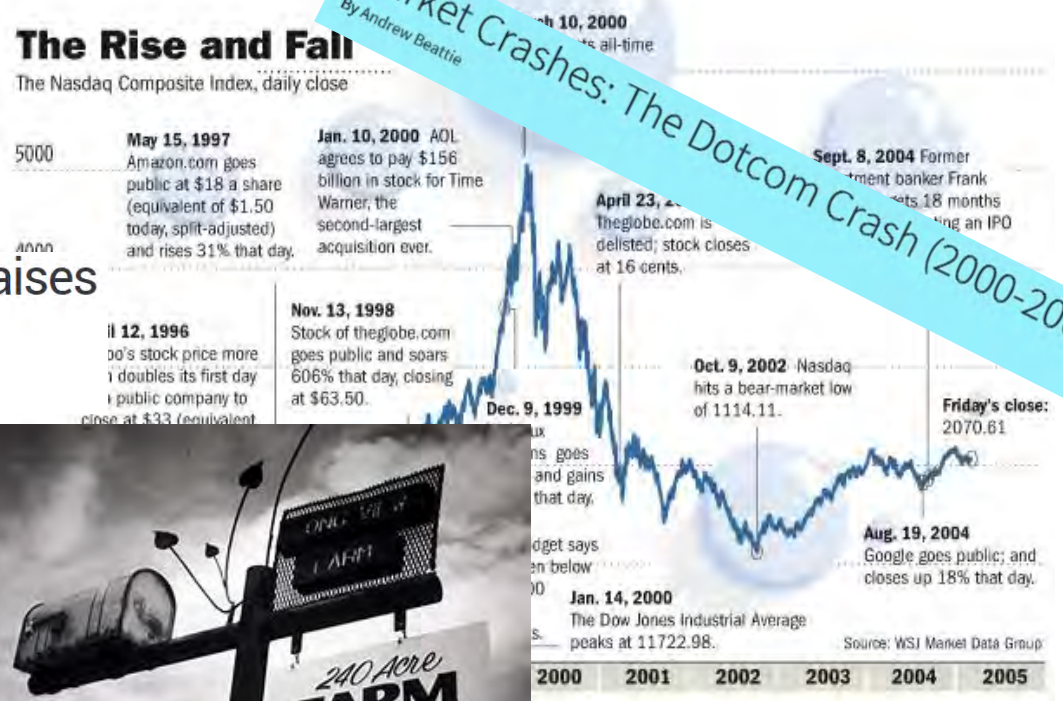
Alaska's Halibut Fishery: Post-IFQ

Some elements of this fishery became increasingly resilient under a market-based IFQ management strategy, while other historic participants lost due to market opportunities to cash in their halibut shares, and resilience has been reduced for some fishery-dependent communities.

Asset Price Bubbles

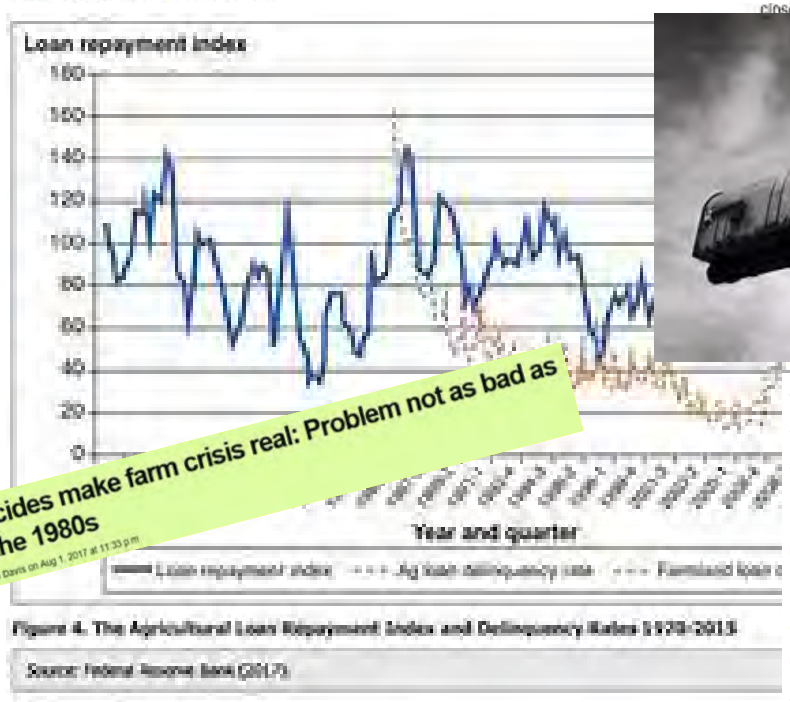
Tulip Mania

Market Crashes: The Dotcom Crash (2000-2002)



Farmland bubble? 10-year rise raises red flags

By William L. Watts
Published: Oct 21, 2013 11:23 a.m. ET



Suicides make farm crisis real: Problem not as bad as in the 1980s

By Don Davis on Aug 1, 2017 at 11:33 p.m.

Tulip Mania, also called **Tulip Craze,** Dutch **Tulpenwindhandel**, a speculative frenzy in 17th-century Holland over the sale of tulip bulbs. Tulips were introduced into Europe from Turkey shortly after 1550, and the delicately formed, vividly coloured flowers became a popular if costly item. The demand for differently coloured varieties of tulips soon exceeded the supply, and prices for individual bulbs of rare types began to rise to unwarranted heights in northern Europe. By about 1610 a single bulb of a new variety was acceptable as dowry for a bride, and a flourishing brewery in France was exchanged for one bulb of the variety Tulipe Brasserie. The craze reached its height in Holland during 1633–37. Before 1633 Holland's tulip trade had been restricted to professional growers and

Halibut IFQ Asset Price Bubble

$$IFQ_{it} = \frac{QS_i}{QSP} \times TAC_t$$

Time to Break-even

- QS price 3000lbs@$70/lb = $210,000
- IFQ@90% of QS = 2700lbs, IFQ@80% of QS = 2400lbs
- TAC_{2018}/ TAC_{1995} = 0.6
- Dock price $4.50/lb; Landed value = $12,150/yr

	Discount rate + Borrowing Cost							
	0%	1%	2%	3%	4%	5%	6%	7%
QS/QSP @90%	**28**	**33**	**42**	**61**	**>100**	**>100**	**>100**	**>100**
QS/QSP @80%	**32**	**38**	**50**	**98**	**>100**	**>100**	**>100**	**>100**

Halibut IFQ Asset Price Bubble

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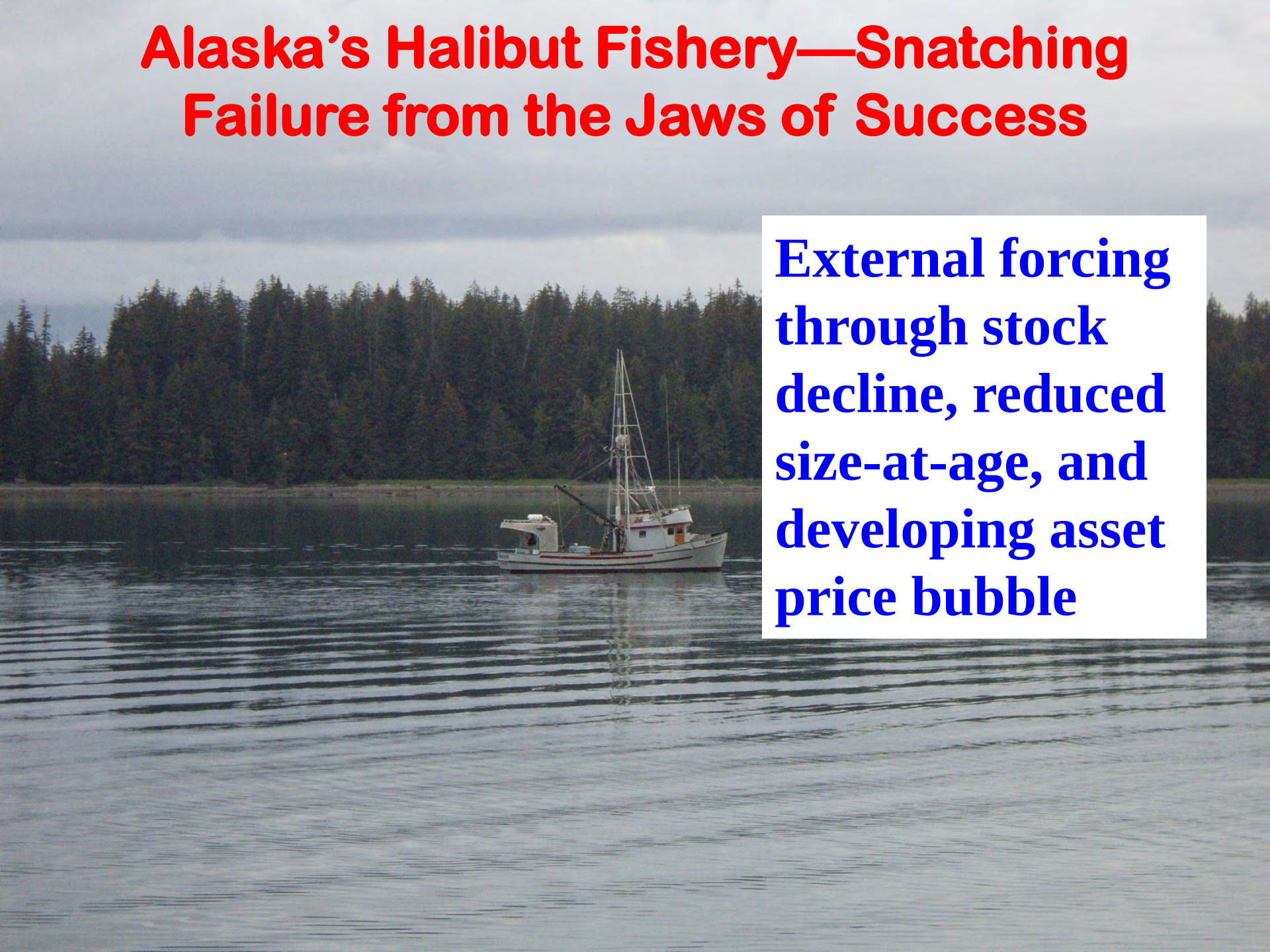
	Discount rate + Borrowing Cost							
	0%	1%	2%	3%	4%	5%	6%	7%
TAC_i/ TAC_{1995} @60%	**28**	**33**	**42**	**61**	**>100**	**>100**	**>100**	**>100**
QS/QSP @100%	**17**	**18**	**20**	**27**	**35**	**65**	**>100**	**>100**

Alaska's Halibut Fishery

- Before 1995, the management paradigm put biological sustainability at risk and incentivized unsustainable investment in harvesting capacity.
- Adoption of IFQs improved biological and economic sustainability in the commercial sector.
- Environmental change has led to reductions in the size at age of halibut, leading to reductions in allowed harvests.
- IFQ holders now face debt service costs for loans that reflected the present value of future catches that now appear improbably optimistic.

Alaska's Halibut Fishery—Snatching Failure from the Jaws of Success



External forcing through stock decline, reduced size-at-age, and developing asset price bubble

Ruminations

Durable entitlements have increased management precision, technical (production) efficiency, profits to fishing and processing sectors, and consumer surplus.

Ruminations

Fishery SES with durable entitlements are resilient to moderate and short-duration fluctuations in stock abundance associated with quasi-stationary ecosystems.

However, real ecosystems exhibit low-frequency (decadal-scale) dynamics and nonstationarities (fundamental alterations of underlying data-generating processes).

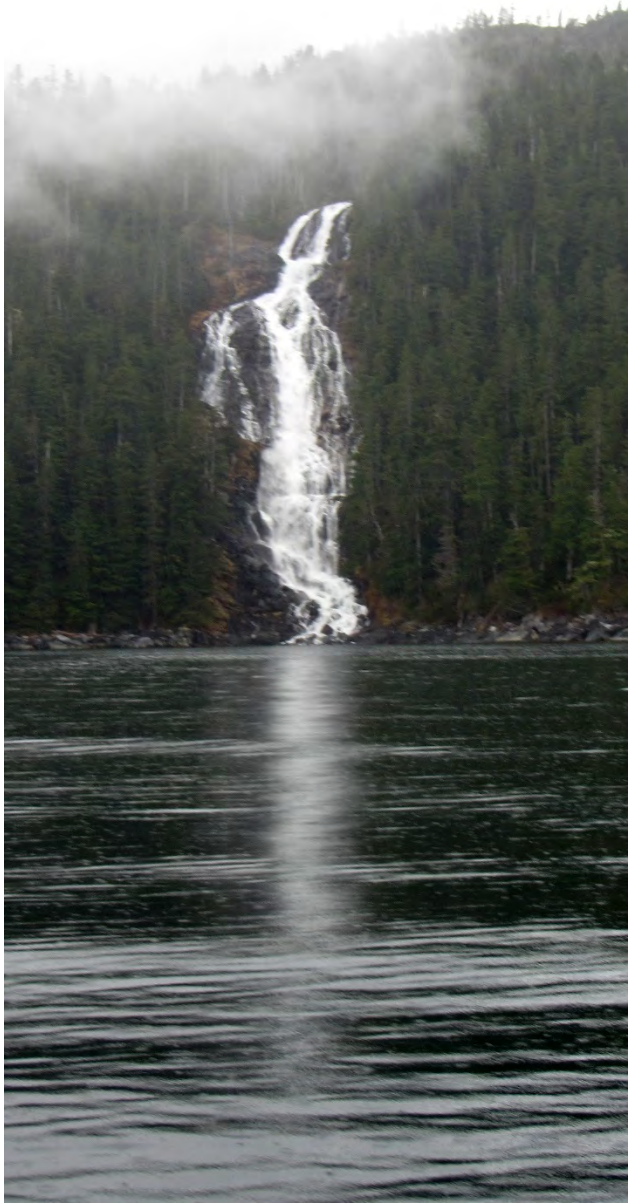
Ruminations

Durable entitlements to shares of the allowable catch increase profitability which helps buffer against modest adverse changes in stock abundance, exvessel prices, and input costs but can increase their fragility to larger perturbations.

Durable entitlement increase choice and resilience from the perspective of individuals but can decrease the resilience of fishery dependent communities.

Ruminations

While stock assessment systems and harvest control strategies may recognize and respond to ecosystem change, experience suggests that specialist fishery-social systems are ill-equipped to weather large or long-lasting changes in the abundance of target stocks of fish or shellfish.



Questions?

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