An Overview of Fisheries Economics and Management

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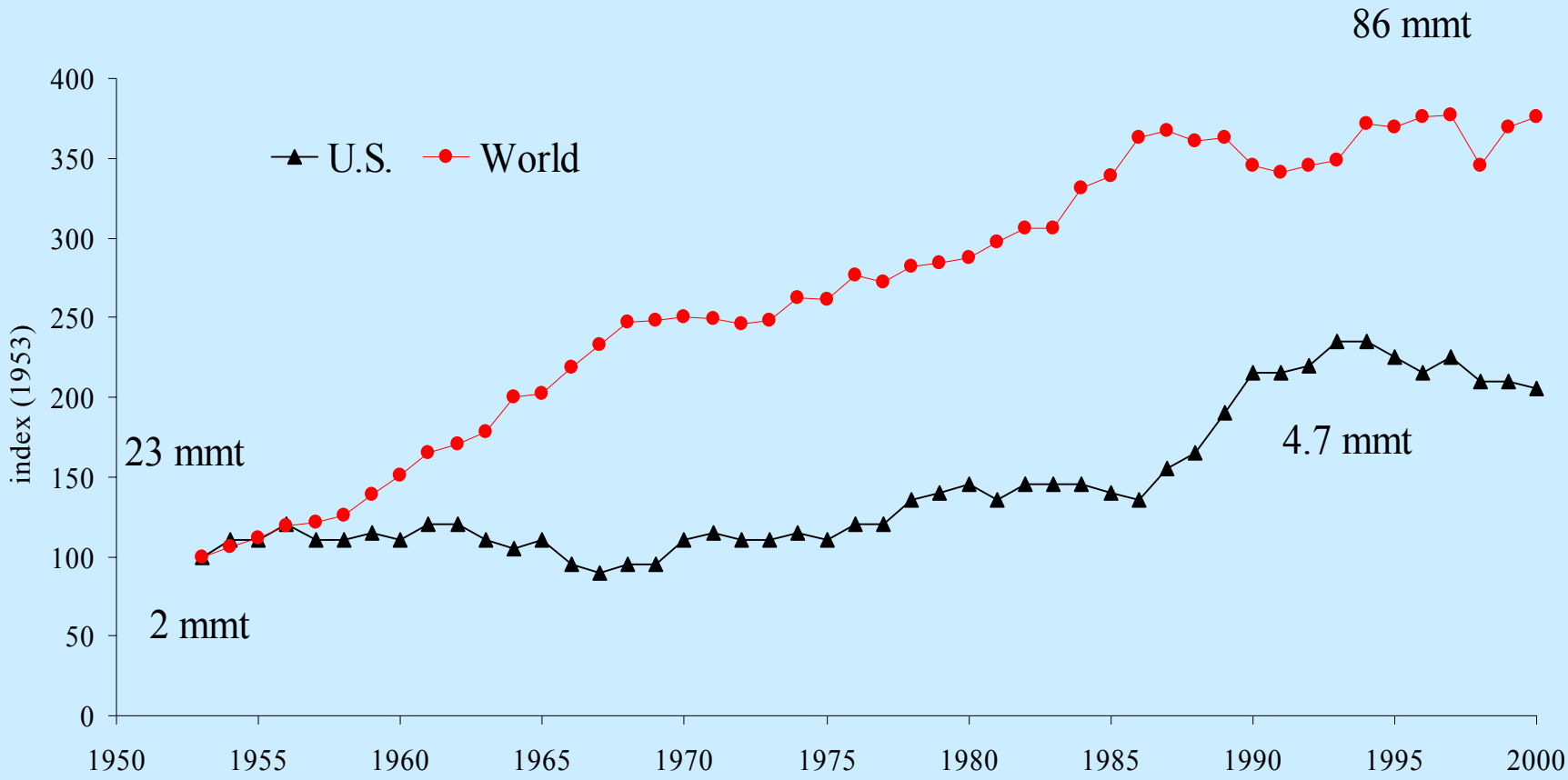
Fisheries Management

- Overall trends
- Policy problem
- (Bio)economic insight
- Alternative courses of action
- Importance of property rights

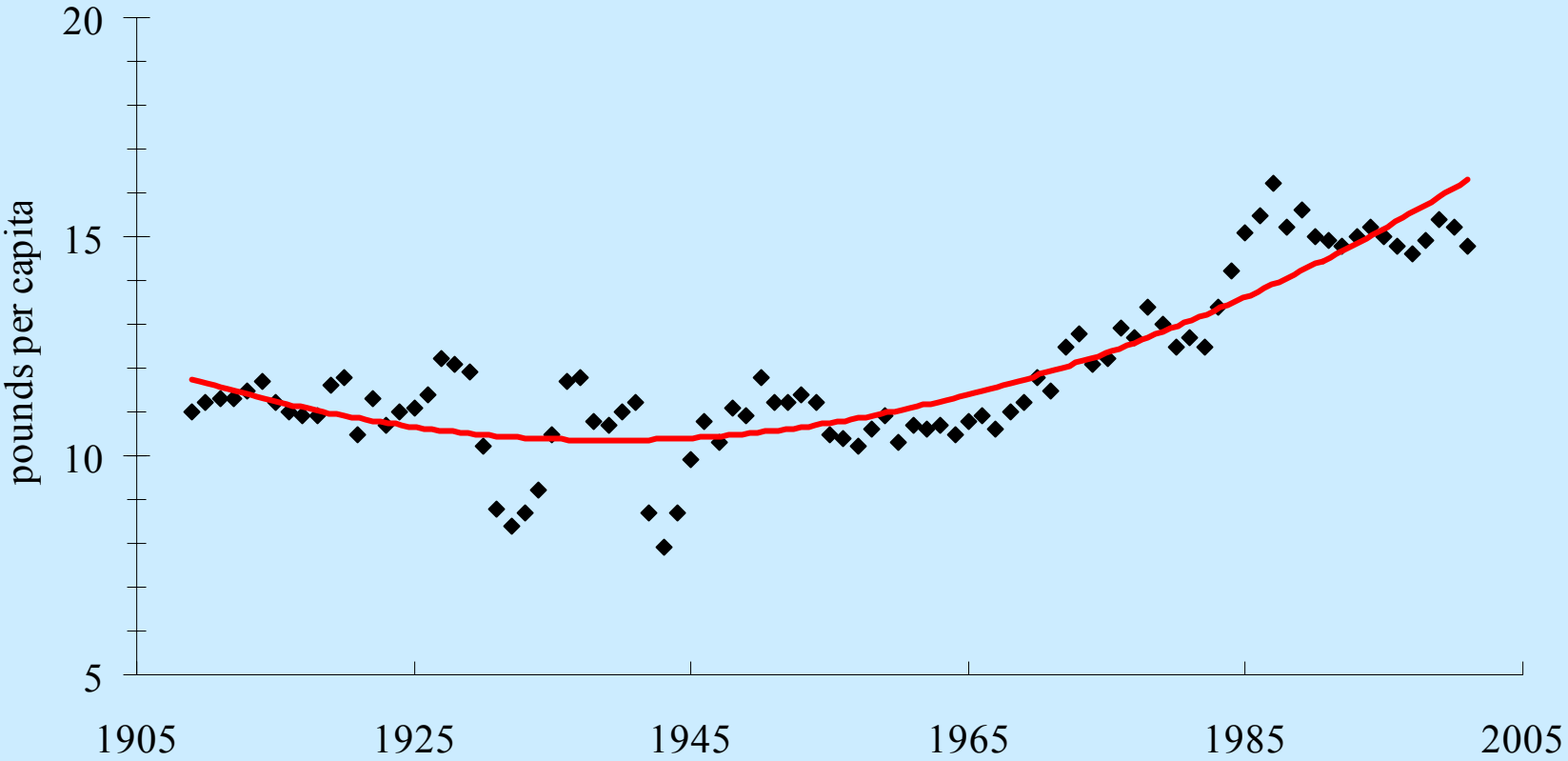
World and U.S. Marine Fish Landings (1953-2000)



Major US Domestic Species Landed in 1998
(landings and value)

Species	Lbs m	Species	$m
Pollock	2.72	Shrimp	516
Menhaden	1.71	Crabs	473
Salmon	0.64	Lobsters	278
Cod	0.58	Salmon	257
Crabs	0.55	Pollock	190
Hakes	0.54	Clams	135
Flounders	0.39	Cod	113
Shrimp	0.38	Menhaden	104
Herring	0.27	Flounders	97
Clams	0.11	Tuna	94

US Seafood Consumption: 1909-2001

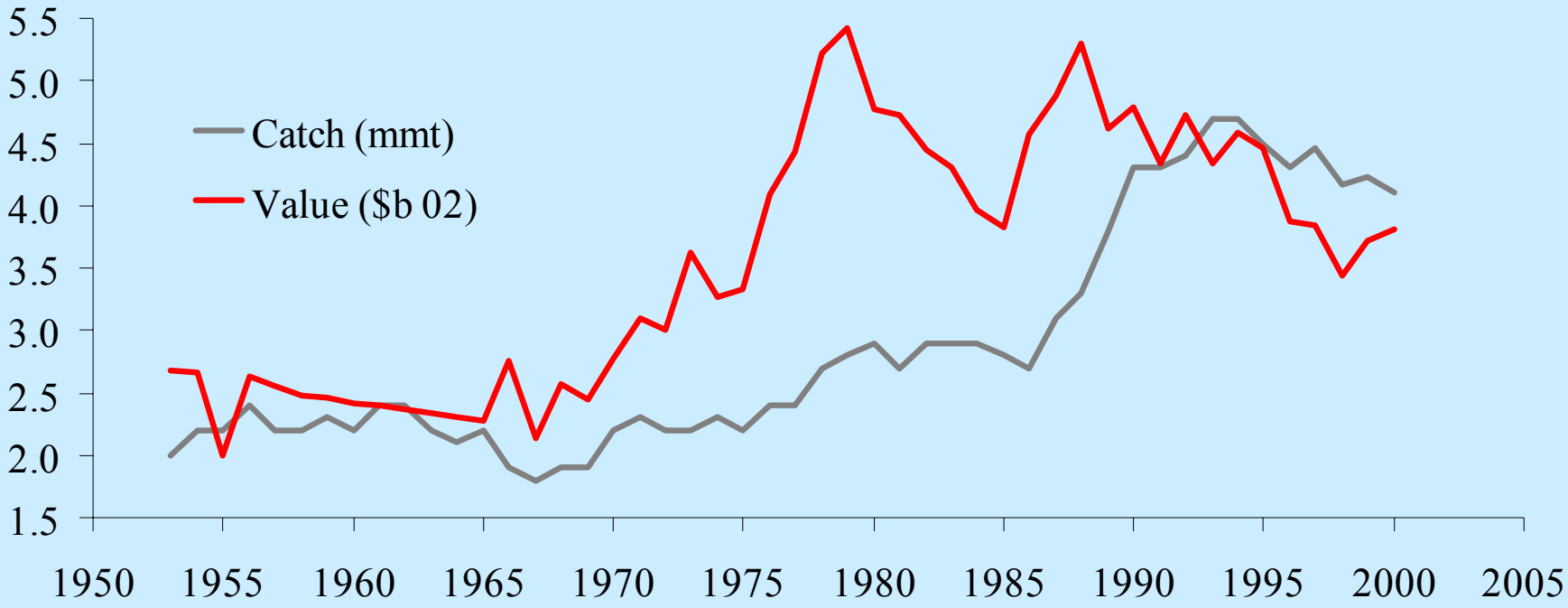


Problem

- Bycatch (Alverson *et al.* 1994)
- Fishing down food webs (Pauly *et al.* 1998)
- Habitat impacts (Auster and Langton 1999)
- Fishing deeper (Moore 1999)
- Coastal ecosystem collapse (Jackson *et al.* 2001)
- Rapid recovery failure (Hutchings 2000)
- **OVERFISHING!**

U.S. Commercial Catch and Exvessel Value

($b 2002)

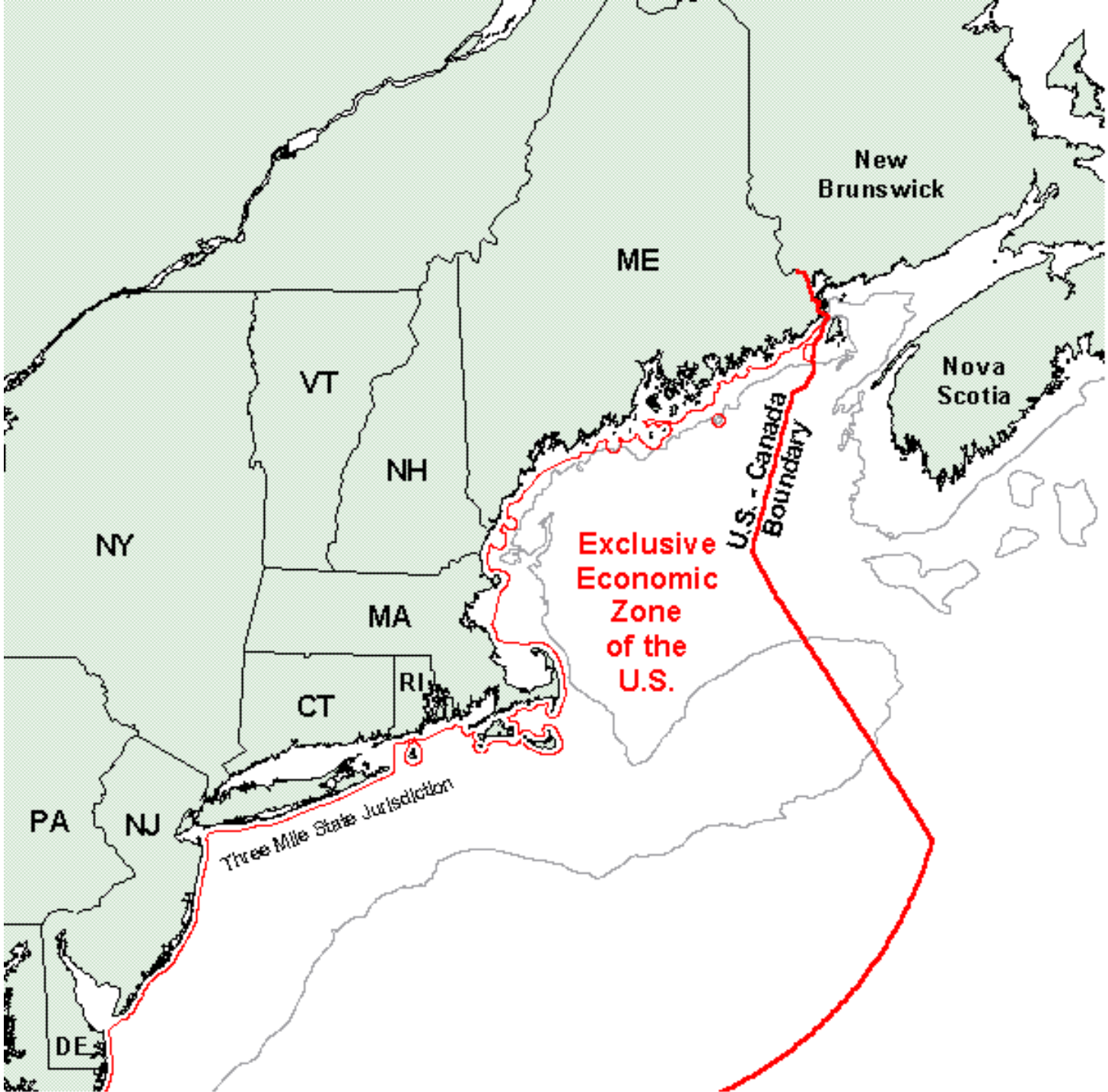


Magnuson-Stevens Act

- Enacted 1976
- 200 nmi fishery conservation zone (EEZ)
- Fishery management councils
- National Standards
- Fishery management plans
- [Regional coastal councils]

Potentially Conflicting Goals

- Prevent overfishing
- Achieve optimum yield
- Fair allocation
- Economic efficiency
- Minimize bycatch
- Rebuild overfished stocks
- Consider community impacts
- Protect essential fish habitat
- Conserve protected species


New Brunswick
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PA
NJ
DE
Nova Scotia
U.S. - Canada Boundary
Exclusive Economic Zone of the U.S.
Three Mile State Jurisdiction

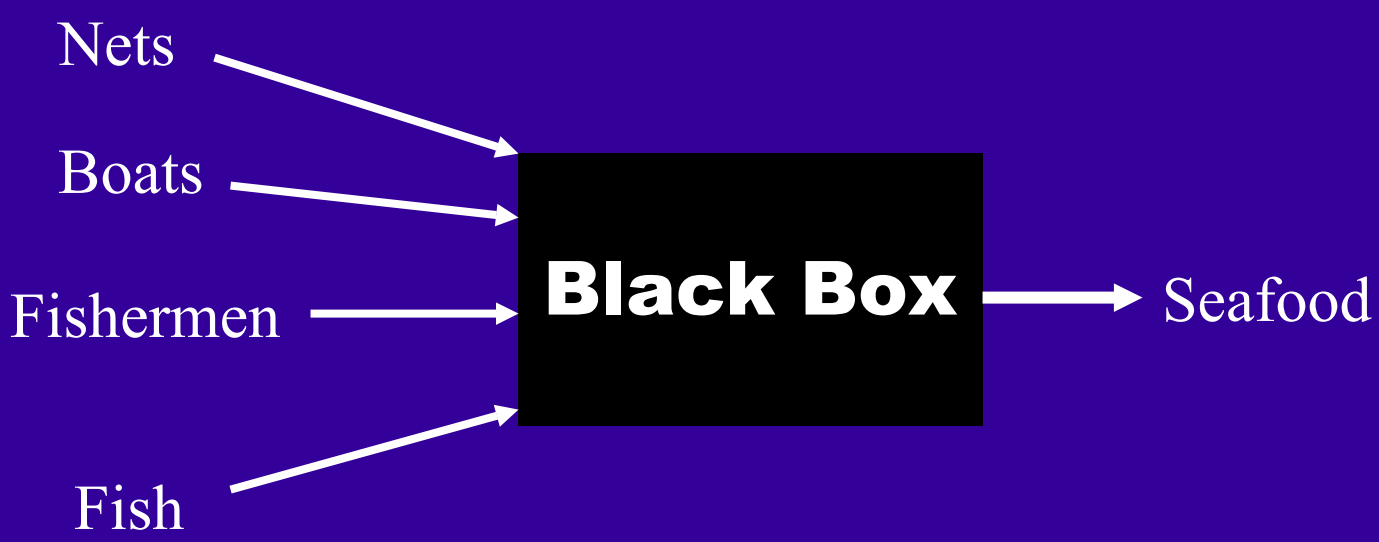
US Fisheries

- 959 fish stocks (295 are “major”)
- 81 overfished (44 are major)
- 3 approaching overfished (major)
- 163 not overfished
- 712 status unknown (82% are “minor”)
- 39 fishery management plans (FMPs)
- 5 FMPs under development
- ~$4b in exvessel value
- ~71,000 employed

Some Overexploited, Depleted Fisheries
(NMFS 1999)

Fishery	Region	RAY	LTPY	L-R
Haddock	Northeast	3,800	52,000	48,200
Bluefish	Mid-Atlantic	11,200	42,700	31,500
Yellowtail flounder	Northeast	2,900	31,900	29,000
Atlantic Cod	Northeast	15,200	40,000	24,800
Summer flounder	Northeast	9,700	24,500	14,800
Red snapper	Gulf	3,815	15,000	11,185
Winter flounder	Northeast	5,500	12,900	7,400
King mackerel	Gulf	3,307	9,750	6,443
Bluefin tuna	Northeast	2,300	5,250	2,950
American plaice	Northeast	4,300	7,200	2,900
Red drum	Gulf	5,031	7,900	2,869
Sea scallop	Northeast	7,100	9,310	2,210
Windowpane flounder	Northeast	800	1,900	1,100
Witch flounder	Northeast	2,000	2,900	900

INPUTS → TECHNOLOGY → OUTPUT



STOCK $\dot{x} = f(x, G, M, F, \varepsilon)$

LOGISTIC GROWTH $\dot{x} = G(x) = rx\left(1 - \frac{x}{K}\right)$

TECHNOLOGY $h = qxE$

EQUILIBRIUM ($\dot{x} = 0$) $h(x, E) = G(x)$

$qxE = rx - \left(\frac{r}{K}\right)x^2$

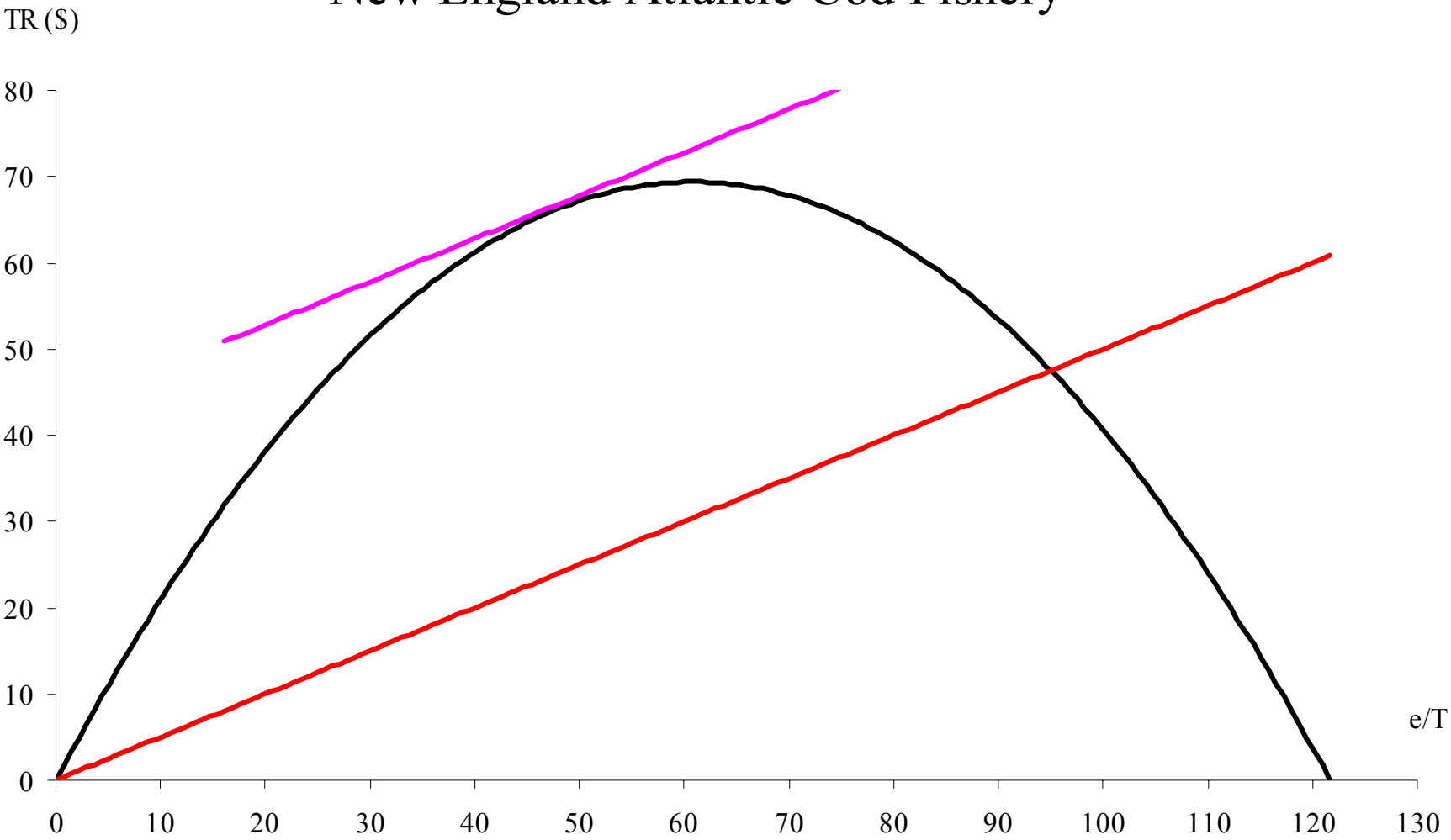
STOCK-EFFORT RELATION $x = K - \left(\frac{Kq}{r}\right)E$

SUSTAINABLE YIELD $h(E(x)) = qKE - \left(\frac{q^2K}{r}\right)E^2$

SUSTAINABLE REVENUE $TR(E(x)) = ph(E(x))$

TOTAL COST $TC(E(x)) = cE(x)$

New England Atlantic Cod Fishery



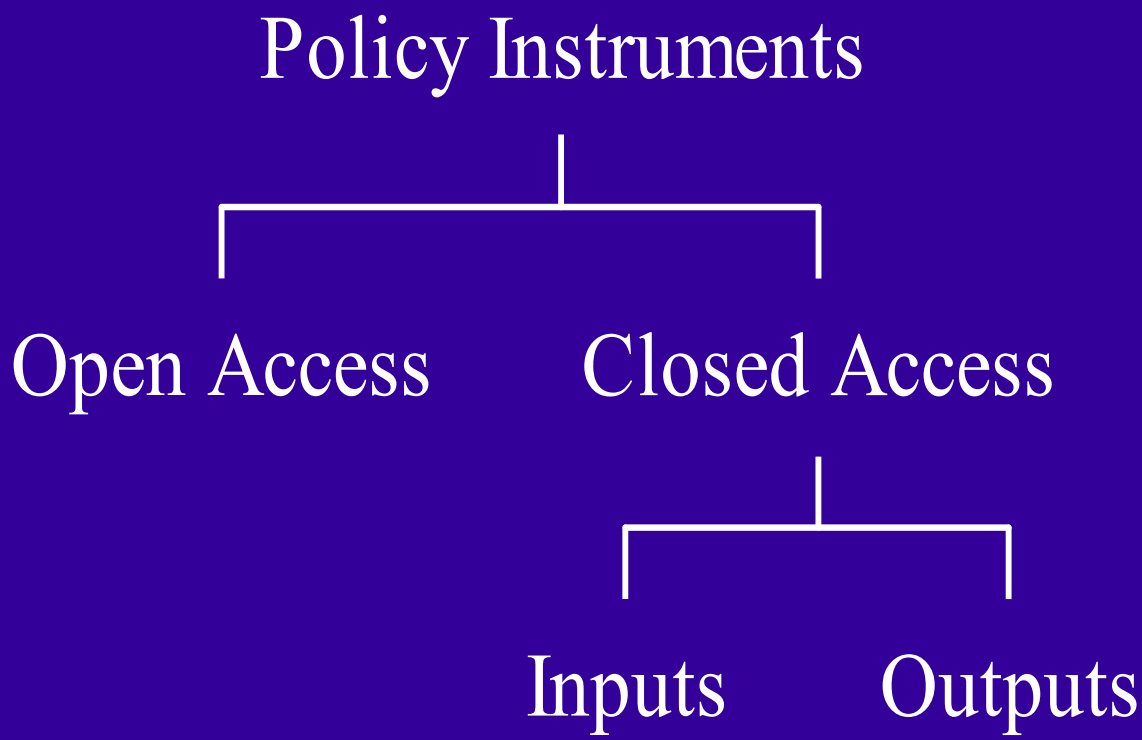
Annual Potential Net Economic Value for Selected US Fisheries

Species	Location	Year	REV	APNEV	REV '00	APNEV '00	APNEV/REV
Gulf Shrimp	Gulf of Mexico	1996	401	190	436	207	47%
Groundfish (other)	New England	1989	82	52	113	69	61%
American lobster	New England/Mid-Atlantic	1998	225	56	236	59	25%
Sea scallop	New England/Mid-Atlantic	1996	99	37	108	40	37%
Atlantic cod	New England	1989	48	29	66	40	61%
Haddock	New England	1989	5	22	6	30	485%
Yellowtail flounder	New England	1989	14	22	19	30	158%
Yellowfin tuna	Eastern Tropical Pacific	1987	97	18	146	26	18%
Menhaden	Mid-Atlantic	1986	43	6	67	9	13%
Groundfish	Pacific	1984	27	4	44	7	16%
Pink Shrimp	Pacific	1984	20	3	33	5	16%
Pacific whiting	Pacific	1984	19	3	31	5	16%
Silver hake	New England/Mid-Atlantic	1994	14	4	16	4	26%
Hawaiian lobster	Hawaii	1989	5	2	8	3	40%
Red Snapper	Gulf of Mexico	1996	8	3	9	3	36%
Dungeness crab	Pacific	1984	8	1	13	2	16%
TOTAL		**--**	**1,114**	**452**	**1,351**	**540**	
AVERAGE							**67%**
MEDIAN							**31%**

Management Concepts

- Essential fish habitat
- Ecosystem management
- Adaptive management
- Conservation of biological diversity
- Precautionary approach

Conservation and Management Measures

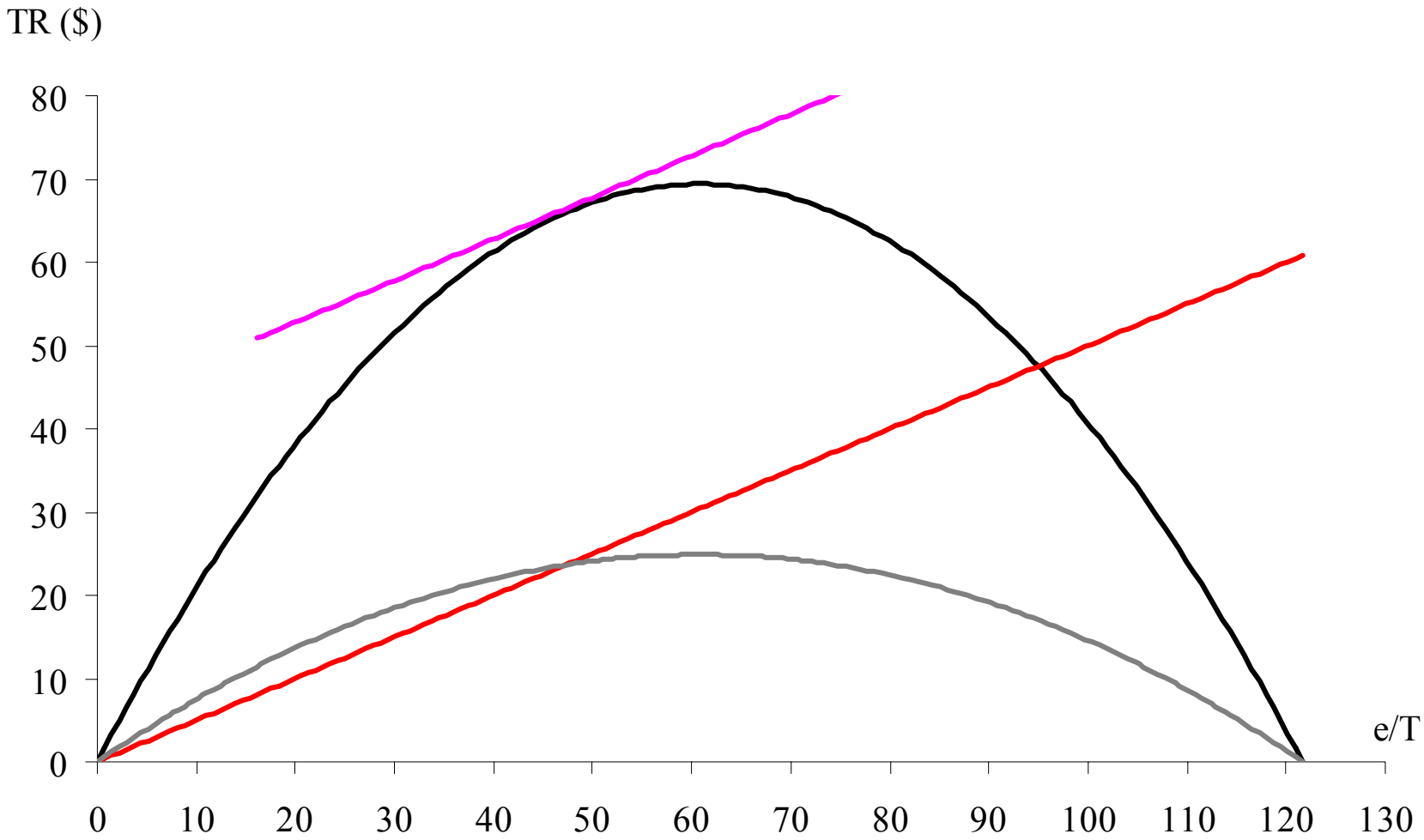


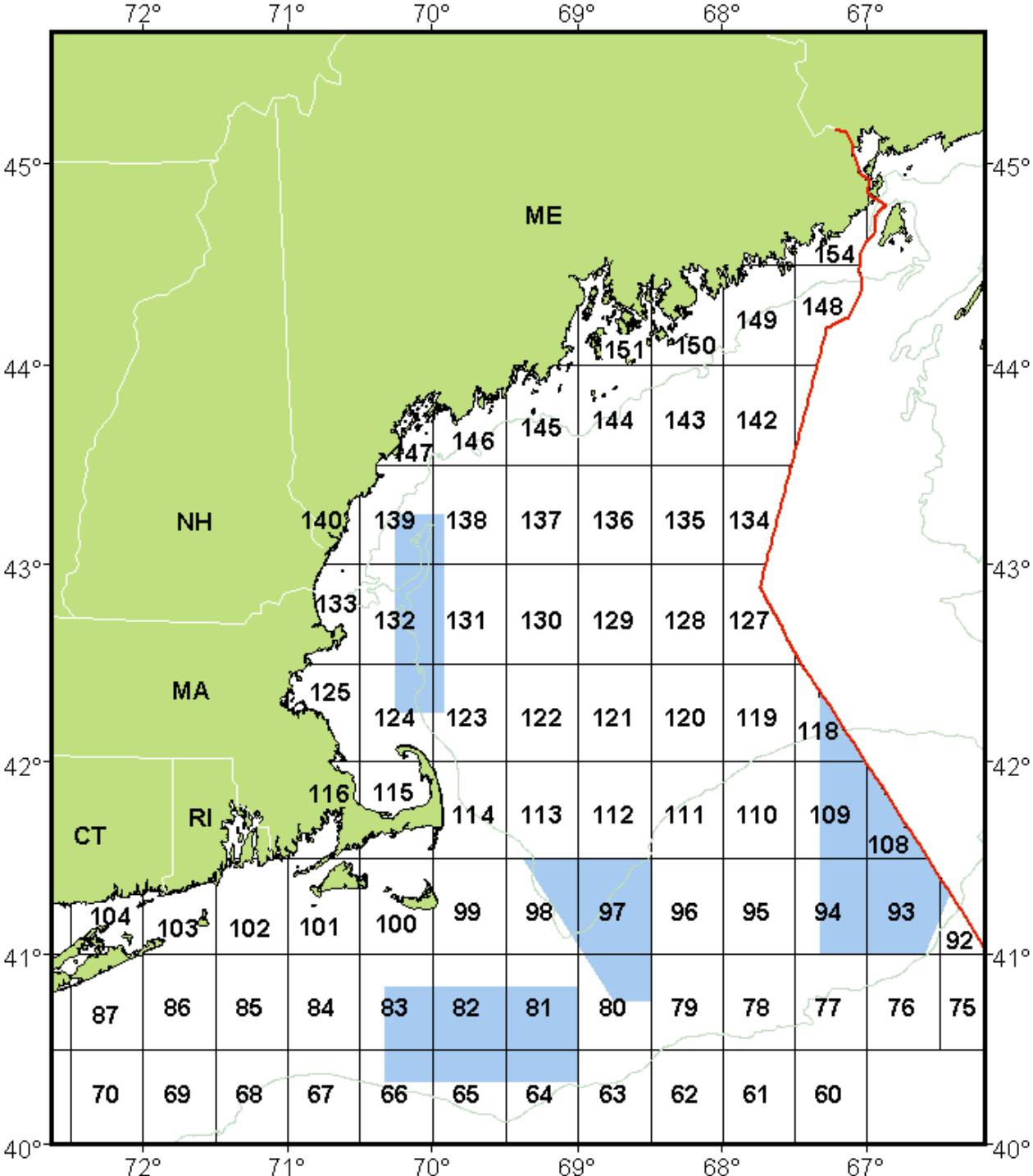
Open-Access Measures

- Tax on Landings*
- Tax on Fishing Effort*
- Boat License Fee
- Total Allowable Catch (Quota)
- Marine Reserves (Time, Space)
- Gear Restrictions
- Fish Size Limits

New England Atlantic Cod Fishery

revenue reduction measures

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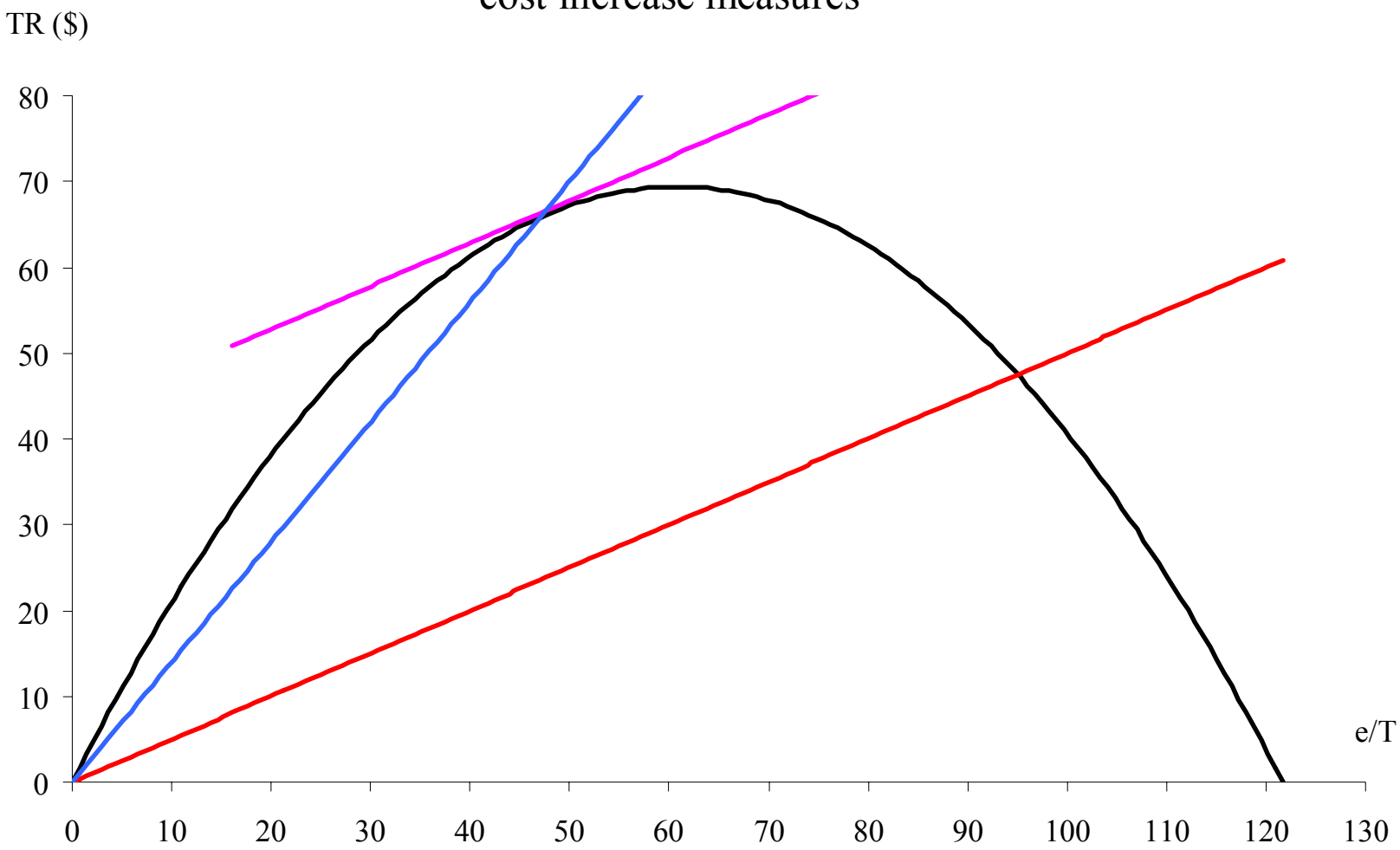
New England Atlantic Cod Fishery

cost increase measures



Controlled Access (Inputs)

- Entry Moratorium
- Days at Sea
- Buyout
- Effort Limits

Controlled Access (Outputs)

- Individual Transferable Quotas (ITQs)
  - Annual TAC set
  - Shares of quota allocated
  - Shares are legal right to % of annual TAC
  - Shares can be bought, sold
  - Binding constraint on fishing mortality
  - Quota ends up with efficient fishermen

ITQs: some pros and cons

Advantages	Disadvantages
↑ Profits	Potential high-grading
↑economic stability	Underreporting of catch
↑ product quality	Data degradation
↑ safety	Enforcement costs, problems
↑ investment climate	Elimination of little guy
Compensation for leaving	Reduced employment
↓ gear conflicts	Industrial resistance
↓ gear losses	Perceived inequities
↓ waste	
Mitigation of market gluts	