



Recovery of the Bristol Bay Stock of Red King Crabs Under a Rebuilding Plan

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Outline of Presentation

- **Red king crab biology and life history**
- **Fishery overview**
- **Stock and fishery management history**
- **Ingredients of stock rebuilding plan**
- **Stock response after implementation**
- **Conclusions**

Red King Crab Biology

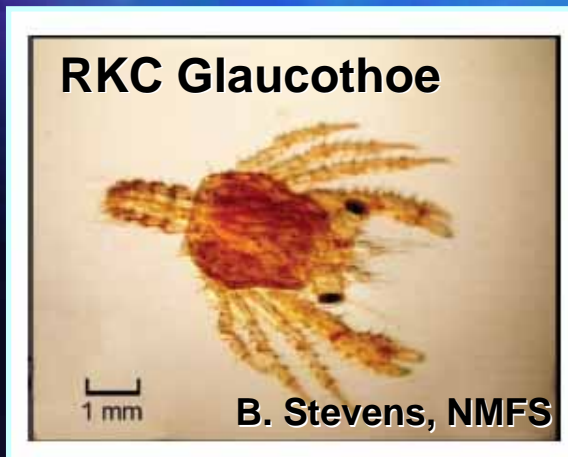
- Anomurans (not *true* crabs)
- Mating
 - Tied to female annual molting
 - ♂'s must be present at fertilization
- Females carry up to 500,000 embryos ~11 mo.



Early Life History of Red King Crab



- Embryos hatch in February – March off Kodiak Island and April to June in Bristol Bay
- Larvae pass through four zoeal stages
- Then they transform to glaucothoe while searching for suitable nursery habitat.
- With the next molt, they become benthic juveniles.



Red King Life History

- Distributed from intertidal zone to >200 m from British Columbia to Hokkaido, Japan
- Young-of-the-year live <50 m in high-relief habitat
- Juveniles form aggregations (pods)



Photo: L. Barr, Auke Bay, AK

- Young molt several times per year through age 3
- After age 3, molting is annual, until maturity
- After maturity, “skip molting” occurs in males with increasing probability
- Longevity > 20 years

THE BERING SEA



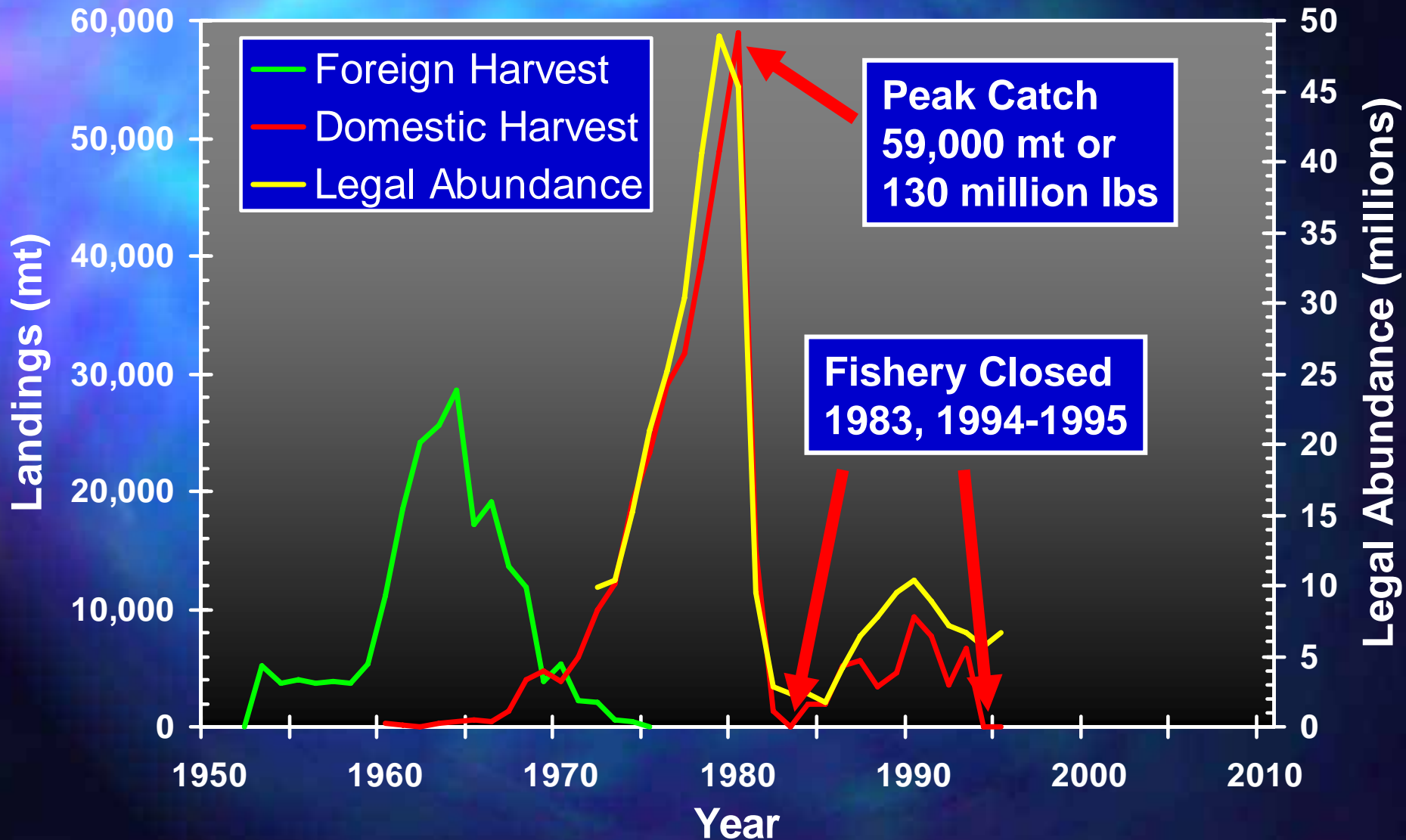
Red King Crab Fishery



Fishery Management through 1995

- 3-S (Size-Sex-Season) Management
 - Sex – Only males are legal for harvest
 - Size – Males ≥ 165 mm CW (≥ 135 mm CL). Legal size defined as one molt increment above size of maturity
 - Season – no fishing during spring molting & mating periods. Current opening Oct. 15th
- Pot limits
- Target harvest rate:
 - Pre-1990: 20-60% of legal males, depending on population size, pre-recruit abundance and relative abundance of post-recruits
 - Post-1990: 20% of mature males, with maximum 60% legal male harvest rate

Historical Abundance & Landings



Concerns in mid 1990s

Conservation Concerns

- Stock declines
- Harvest rates – too high?
- Too much fishing effort
- Handling mortality
- Bycatch in other fisheries
- Trawling/dredging effects on crab habitats

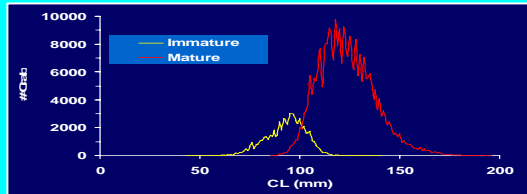


Socio-economic Concerns

- High variability in catches
- Loss of employment and default on bank loans
- High rates of crew injury and mortality

Development of Rebuilding Plan

Length-based Analysis



Handling
Mortality
Studies

Analysis of Crab Bycatch
from Observer Data



Mgt. Strategy Evaluation:
1. Long-term harvest strategy
2. Stock rebuilding strategy

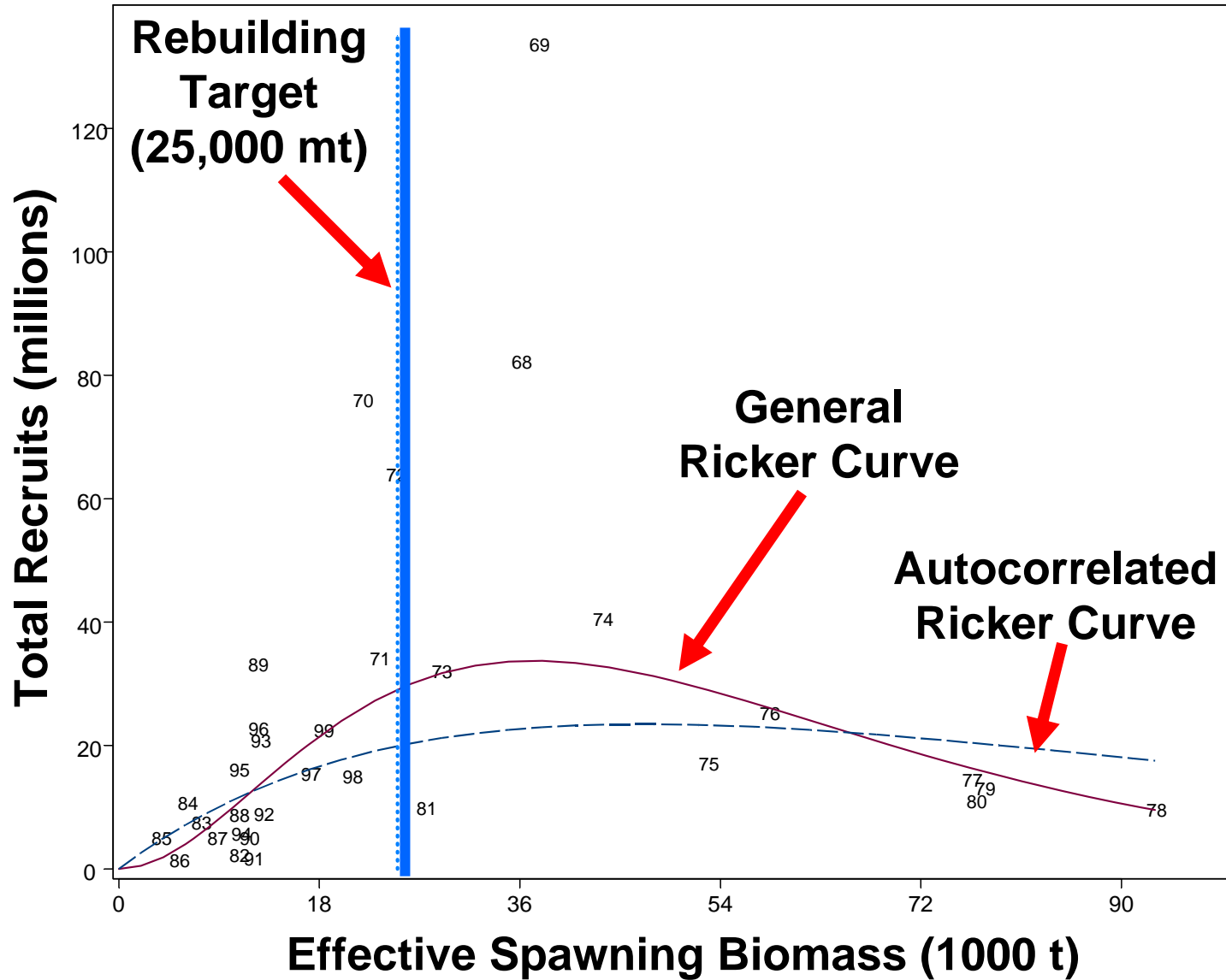
Area Closures and Crab
Bycatch Caps in Trawl
Fishery



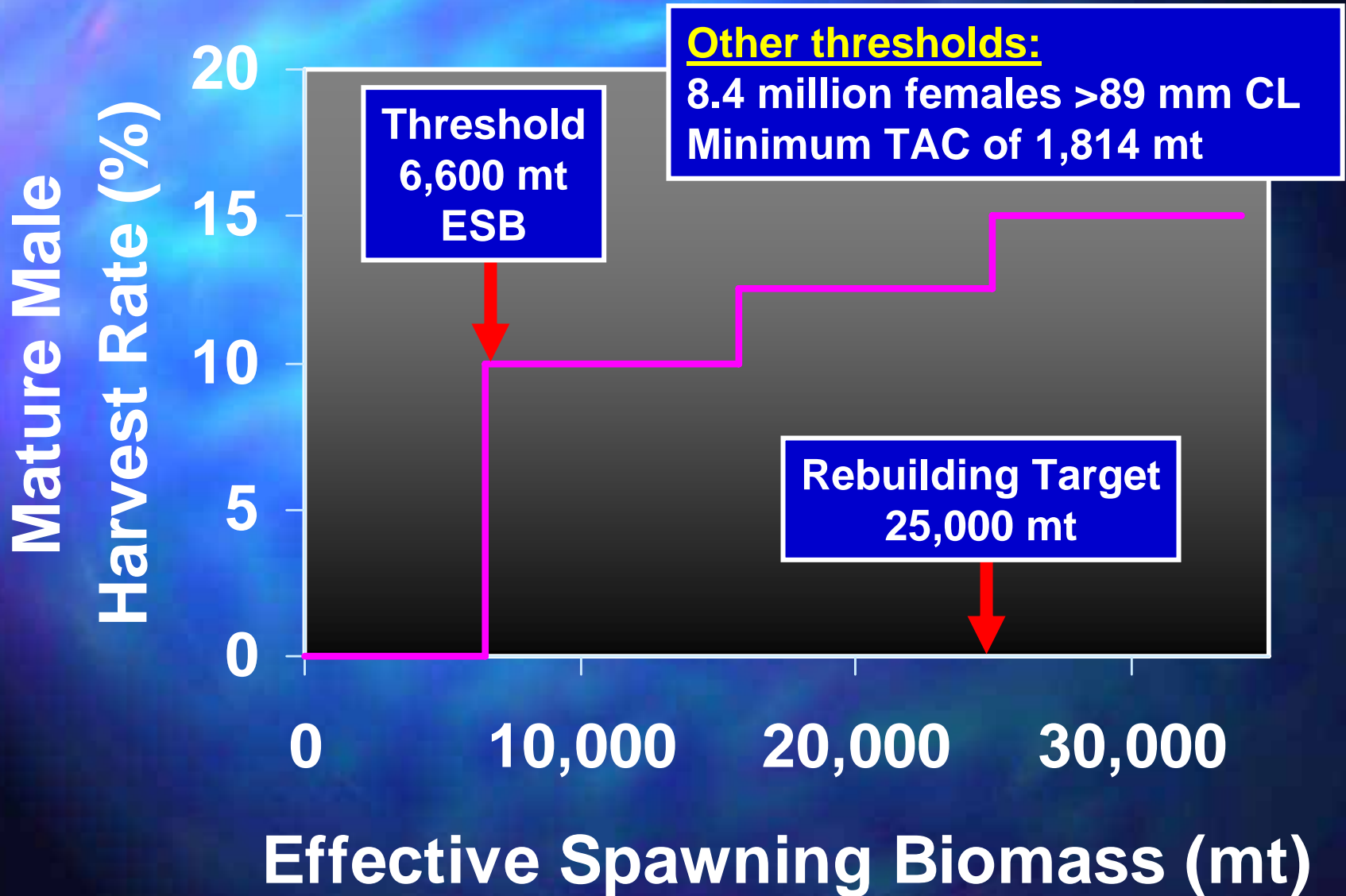
Crab TACs



Stock-recruit & Rebuilding Target

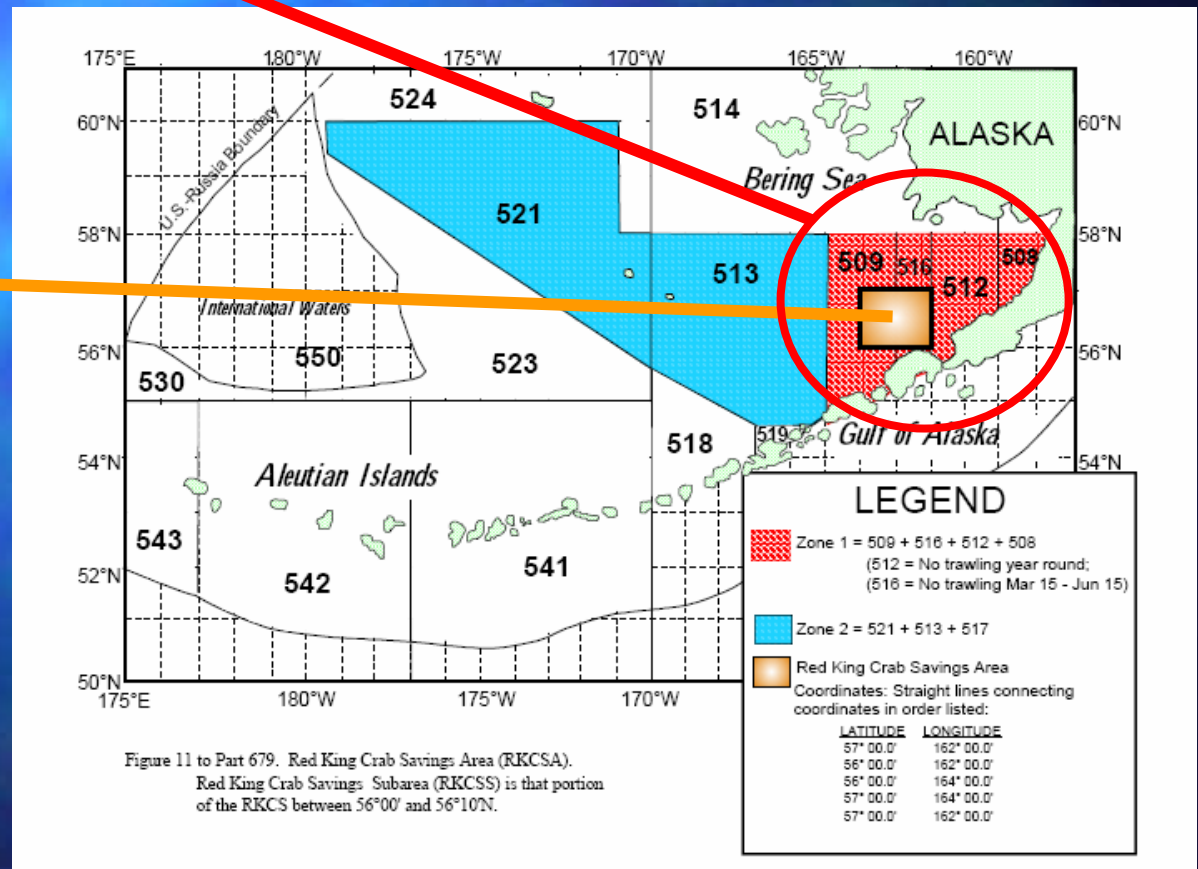


Bristol Bay RKC Harvest Strategy



Trawl Bycatch Controls and Area Closures

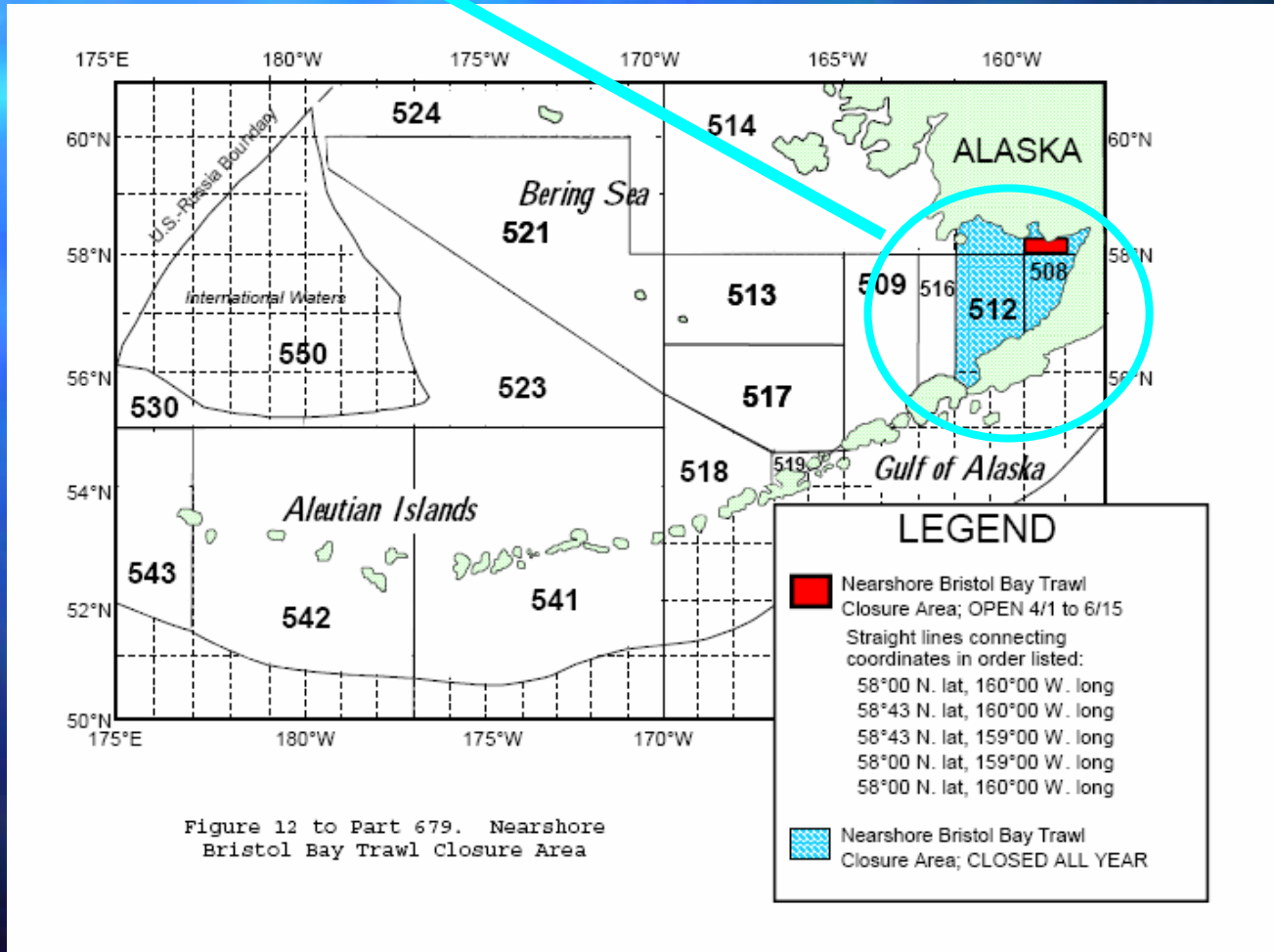
- **Zone 1** – Prohibited species caps (PSCs) of 35,000, 100,000, or 200,000 red king crab depending on crab abundance
- Closure of **Red King Crab Savings Area** protects adult male red king crab



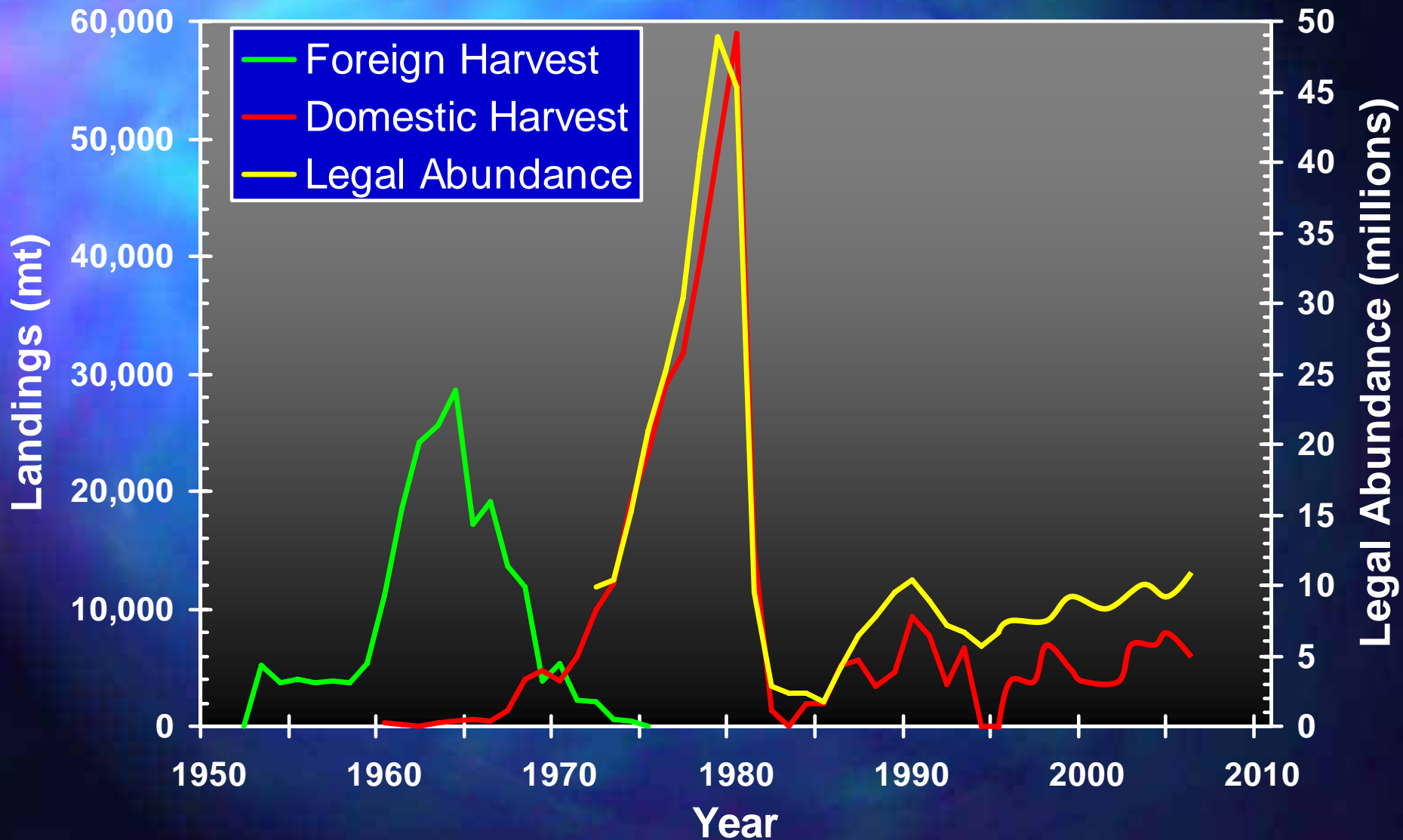
Nearshore Trawl Closure Area



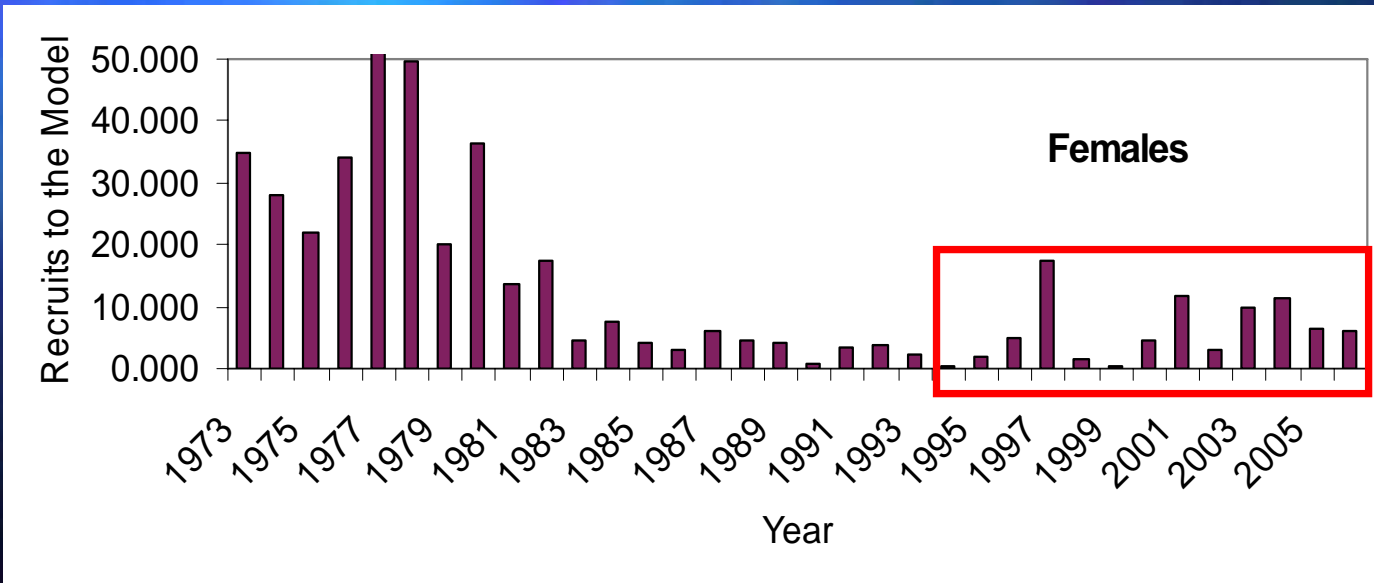
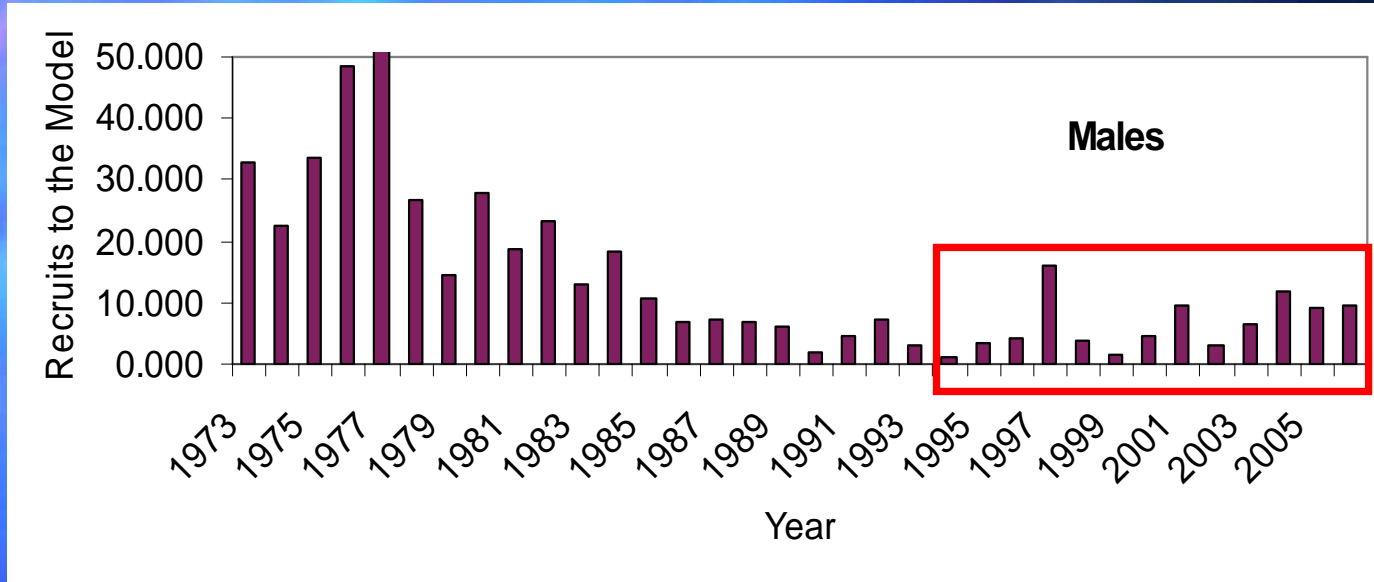
- Nearshore Bristol Bay Closure – Protects juvenile red king crab habitat



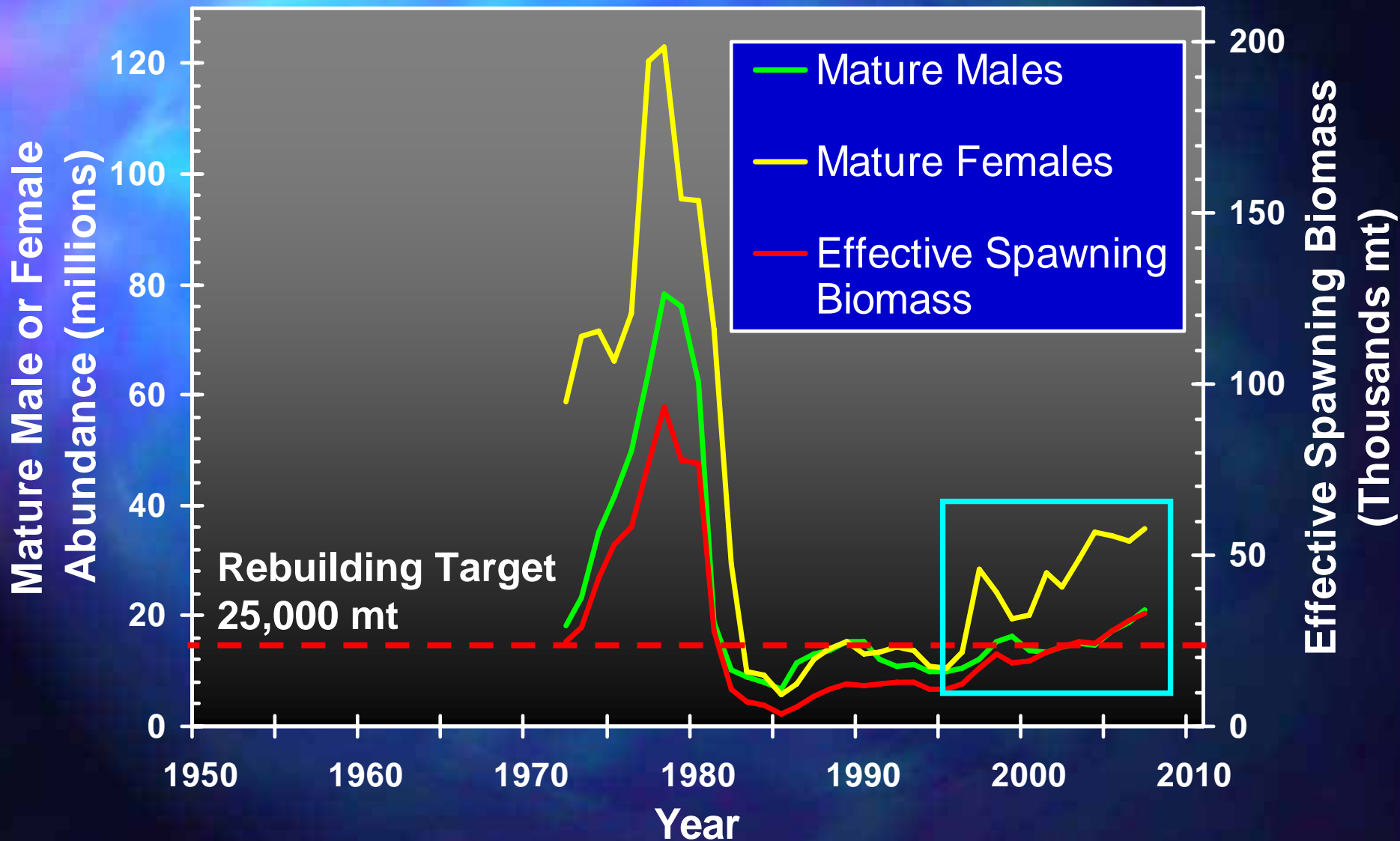
Historical Abundance & Landings



Some Stock Improvement since 1990s



Historical Abundance & Landings



Crab Rationalization Program (2002)

- Allocates BSAI crab resources among harvesters, processors, and coastal communities.
- Addresses problems with previous derby fishery by reducing bycatch and increasing vessel safety.

Created entitlements:

Quota share (QS) – a long-term privilege to harvest a percentage of the crab harvest.

Individual fishing quota (IFQ) – $QS \times TAC$.

Processor Quota Share (PQS) – long-term privilege to receive a percentage of crab harvest in a fishery.

Individual Processor Quota (IPQ) – $PQS \times TAC$.

Benefits of Rebuilding Plan

- Length-based analysis provides annual estimates of abundance
- Reduced harvest rates and threshold provide for more conservative harvest strategy
- Bycatch caps and area closures constrain crab bycatch and habitat impacts
- Decline from 302 vessels in 1991 to 81 vessels in 2006 reduced overcapitalization
- Stock recovery seems attributable to ecosystem-based management approach including reduced fishing mortality, lower bycatch, habitat protection, and reduced fishing effort.

A photograph of a seabed covered with a dense population of small crabs. The crabs are mostly brown and orange in color, with some appearing lighter. They are scattered across the dark, textured seabed. In the bottom left corner, there is a large, dark, rounded object, possibly a rock or a piece of coral. The overall scene is dimly lit, with some light reflecting off the crabs and the seabed.

Questions?