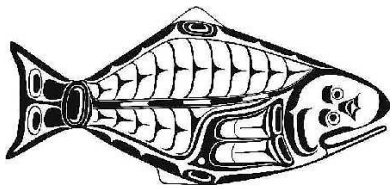


Effects of migration on impacts of U32* bycatch and wastage mortality of Pacific halibut

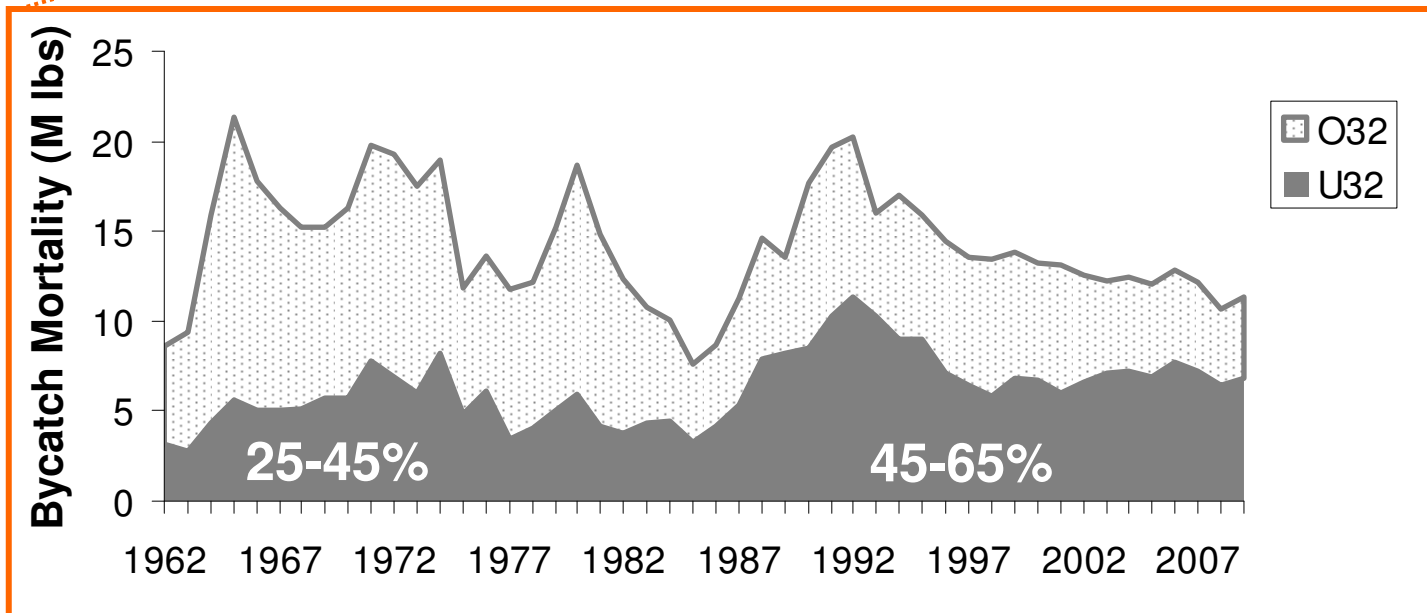
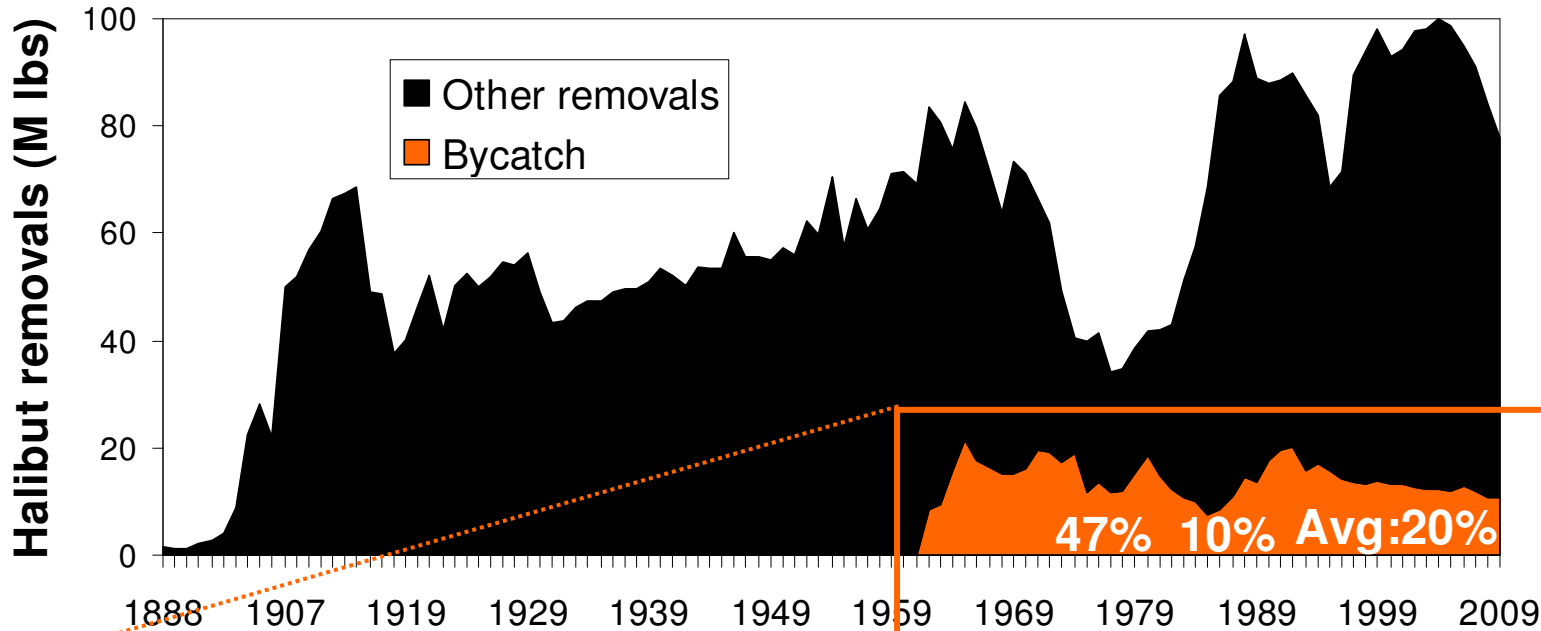
Juan L. Valero
Steven R. Hare



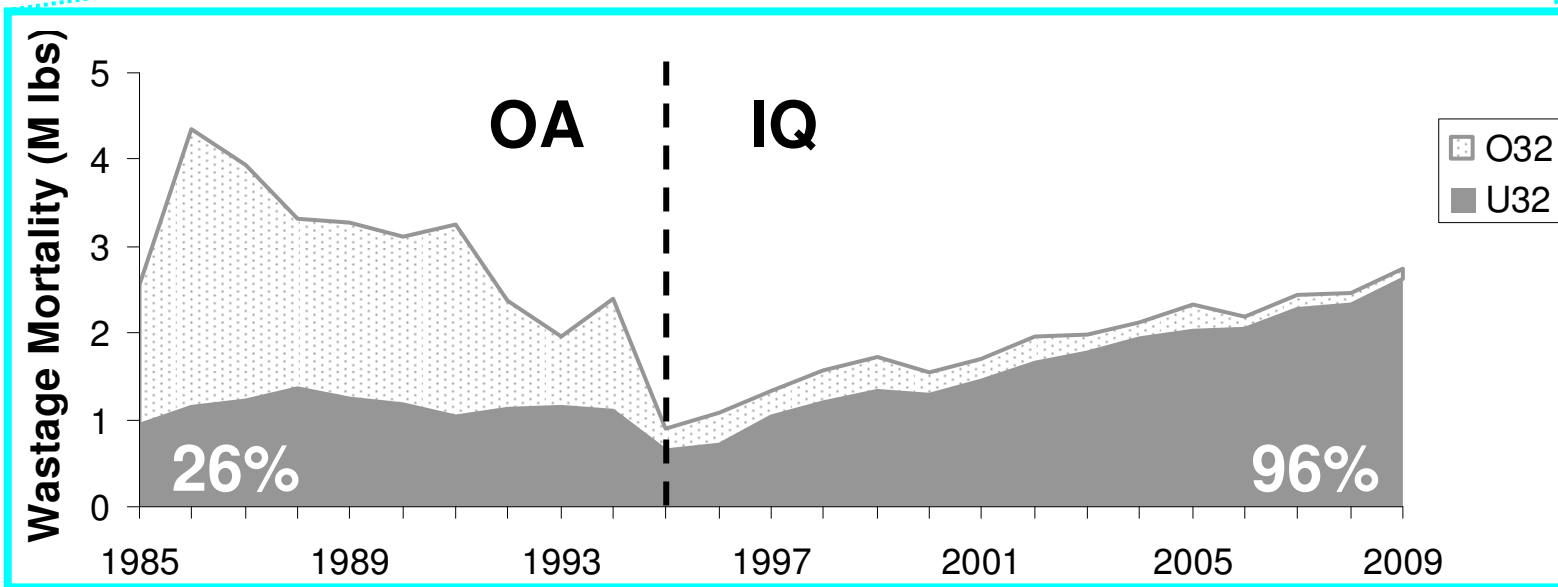
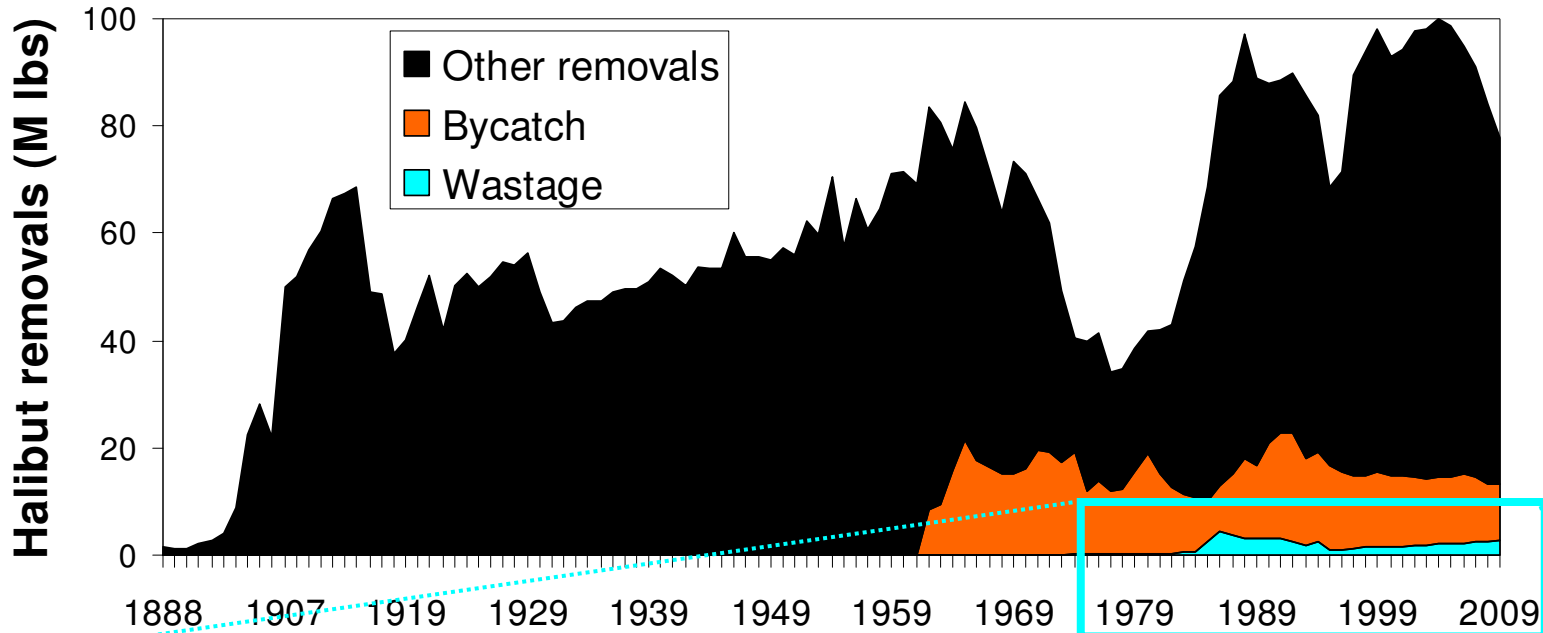
87th IPHC Annual Meeting, Victoria January 24-28, 2011

*U32: Under 32 inches

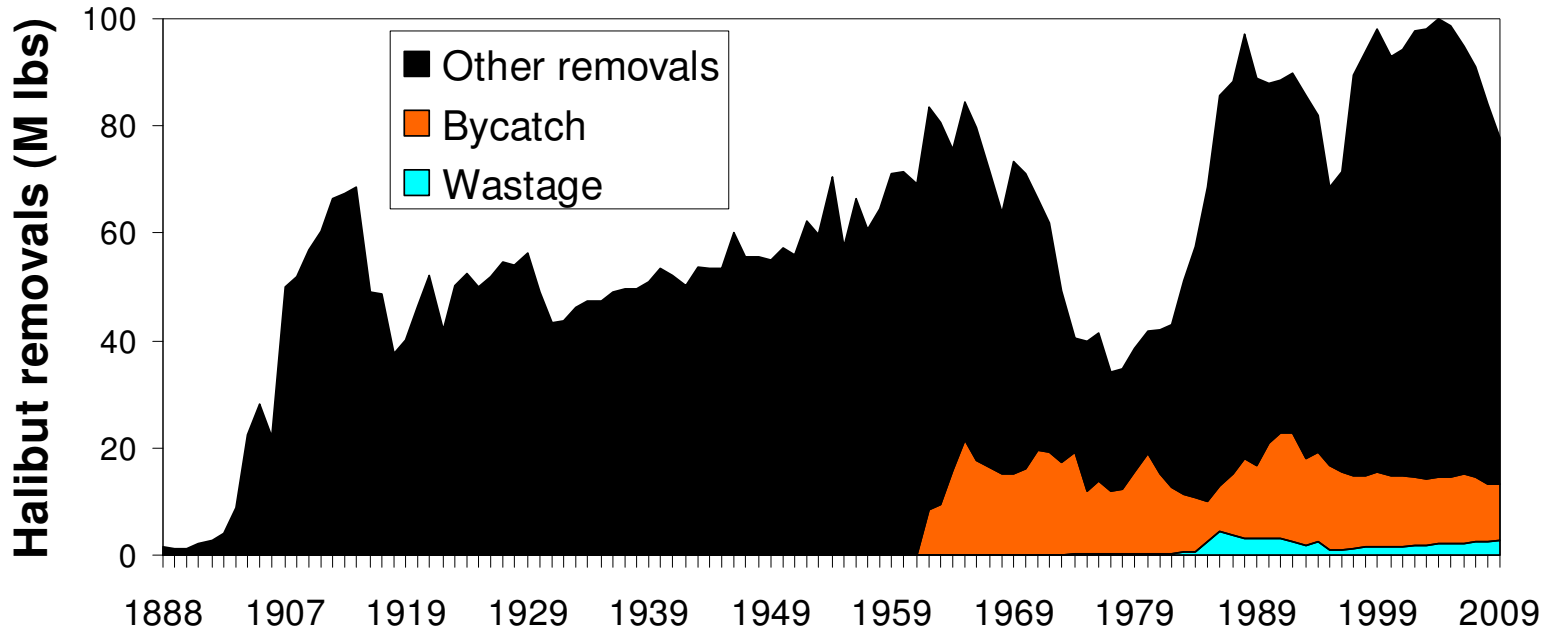
Halibut bycatch mortality history



Halibut wastage mortality history



Halibut bycatch and wastage management



Years	Focus	Approach
1980s	Lost yield	Calculate yield lost (1.4-1.58 lb) per lb of bycatch (all sizes) Reduce fishery yield in proportion to EBio distribution
1990s	Lost egg production	Replace egg loss (1 lb yield) per lb of bycatch (all sizes) Reduce fishery yield in proportion to EBio distribution
1996 2010	Harvest rate evaluation	Add O32 bycatch and O32 wastage to local removals U32 bycatch and U32 wastage into HR evaluation

Halibut bycatch and migration

Migration (Juveniles + adults)

~~Formerly assumed to be completed by age 8~~

PIT tags show ongoing migration of older halibut

Losses due to bycatch

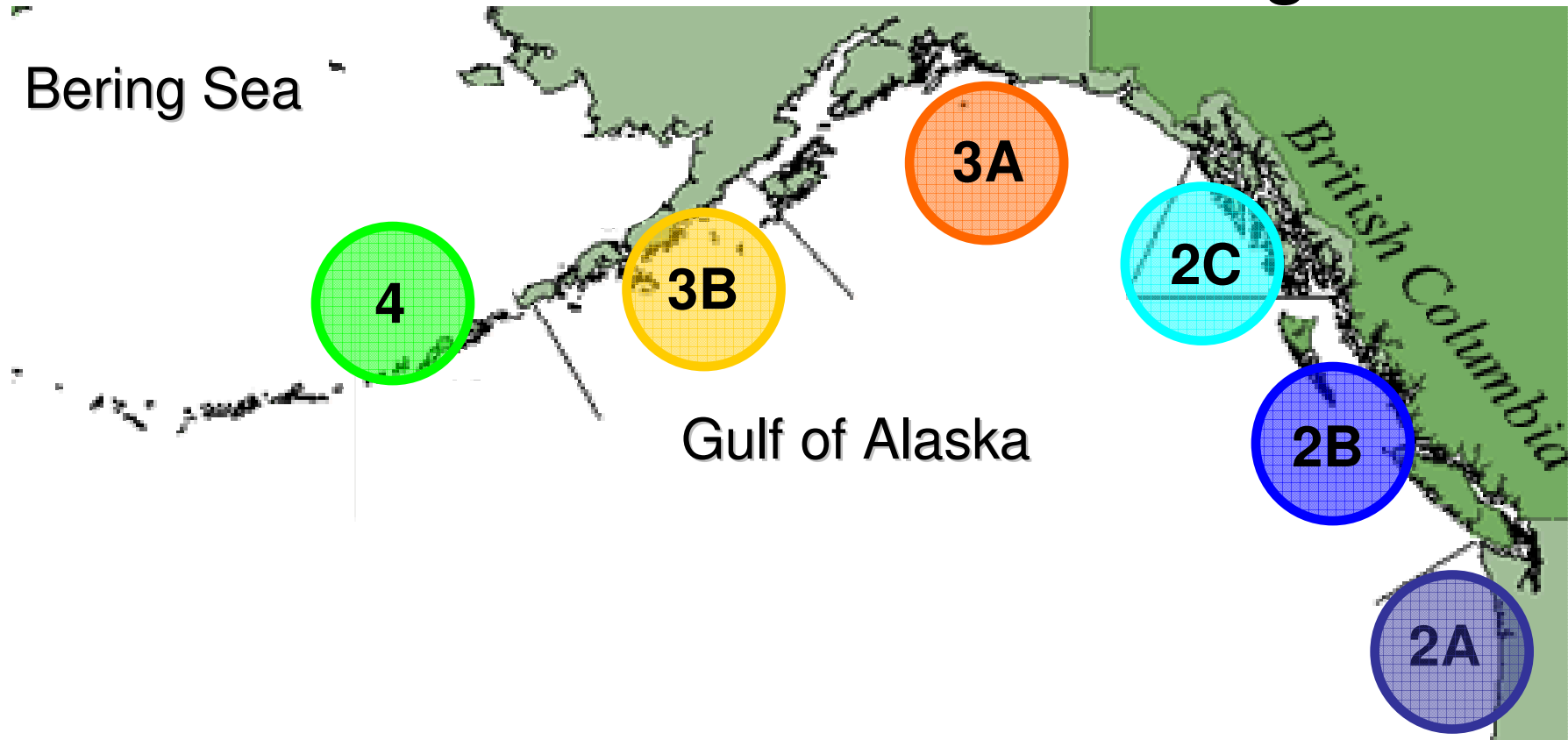
~~Mostly local~~

Out of area impacts

OBJECTIVES

- 1) Evaluate impacts of U32 halibut bycatch and wastage mortality on lost yield when taking into account migration
- 2) Evaluate impacts on 2011 lost yield of the last 8 years (as requested to staff)
- 3) Compare lost yield due to U32 bycatch to current yield and lost yield due to unbalanced harvest rates

Modeling structure



Areas 4A, 4B, 4C, 4D and 4E combined as Area 4

6 area model

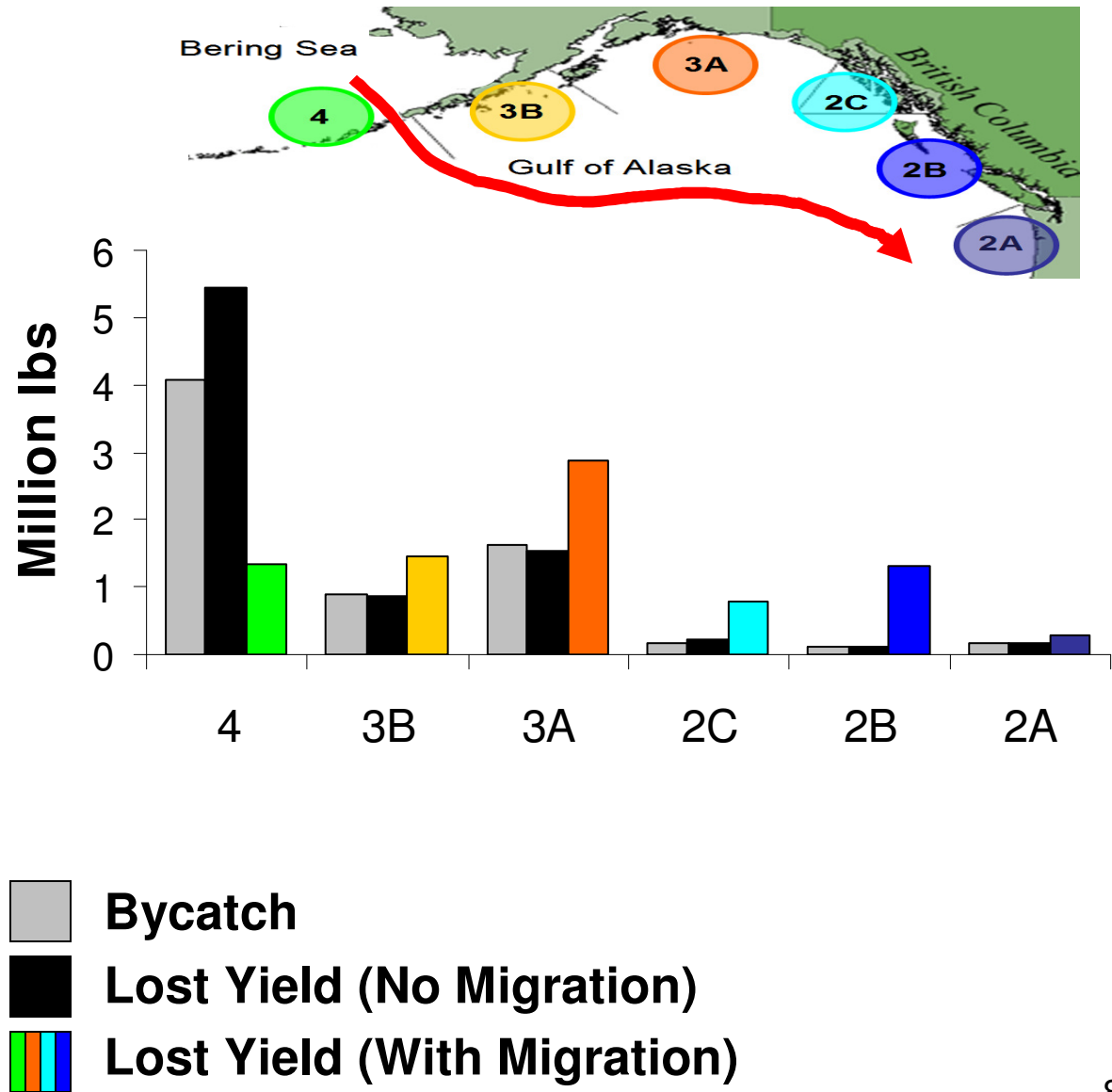
Area-specific size-at-age

Migratory age/size structured model

Modeling approach

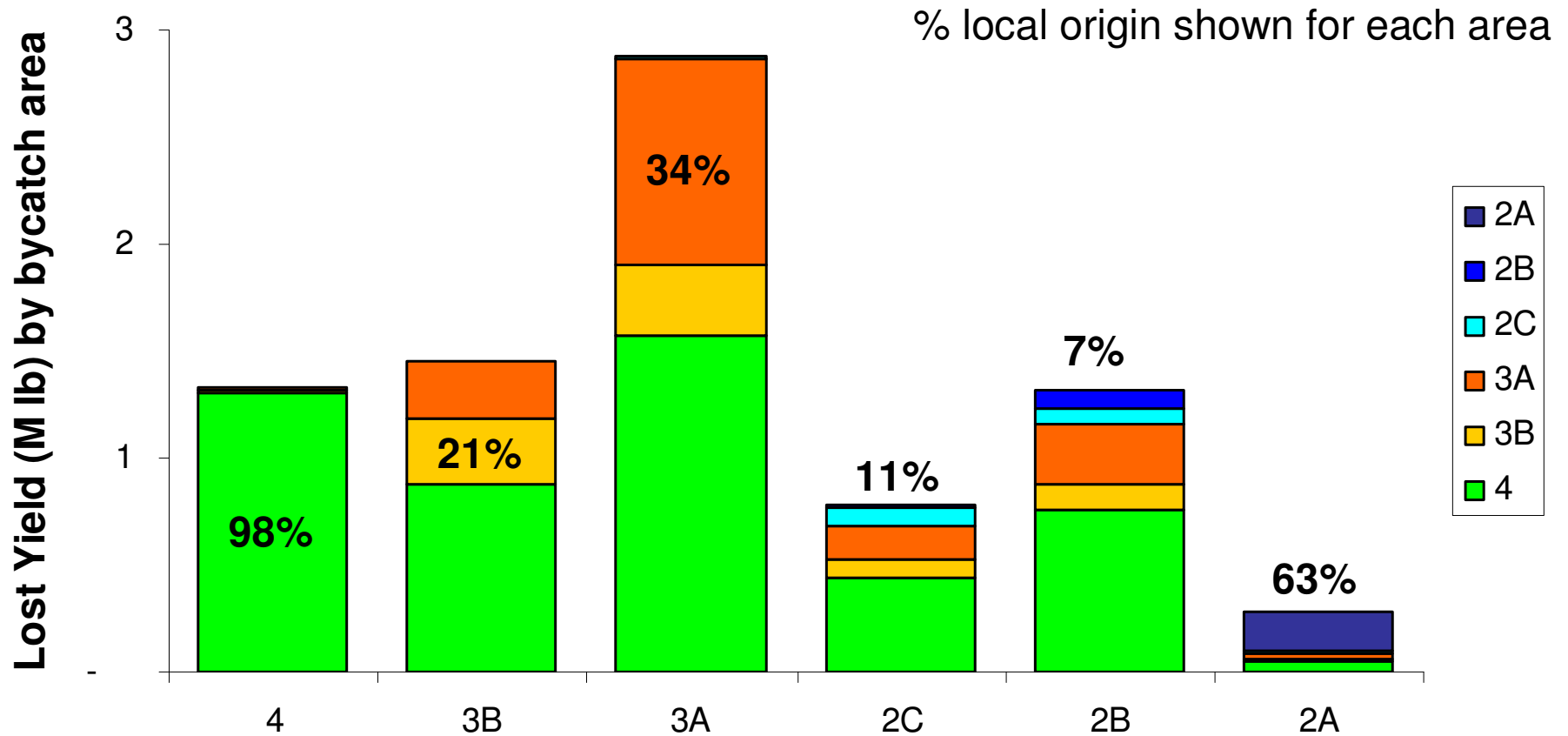
- **Start model with U32 fish killed as bycatch based on:**
 - Average between 1996-2008 (by area, sex, age)
 - Annual levels from 2003 and 2010 (by area, sex, age, year)
- **Keep track of where U32 fish, had they not been killed, would have migrated and contributed (either on average or for 2011) to the following metrics of interest:**
 - Lost Yield (LY)
 - Lost Spawning Biomass (SBio)
 - Egg Loss (EL)
- **Migrate fish according to fish size:**
 - < 65 cm movement based on tagging of juveniles
 - > 65 cm movement based on PIT tags
- **All runs use a constant harvest rate of ~20%**

U32 bycatch by area of capture and area where yield is lost



Source of U32 BYCATCH for each area where yield is lost **WITH Migration**

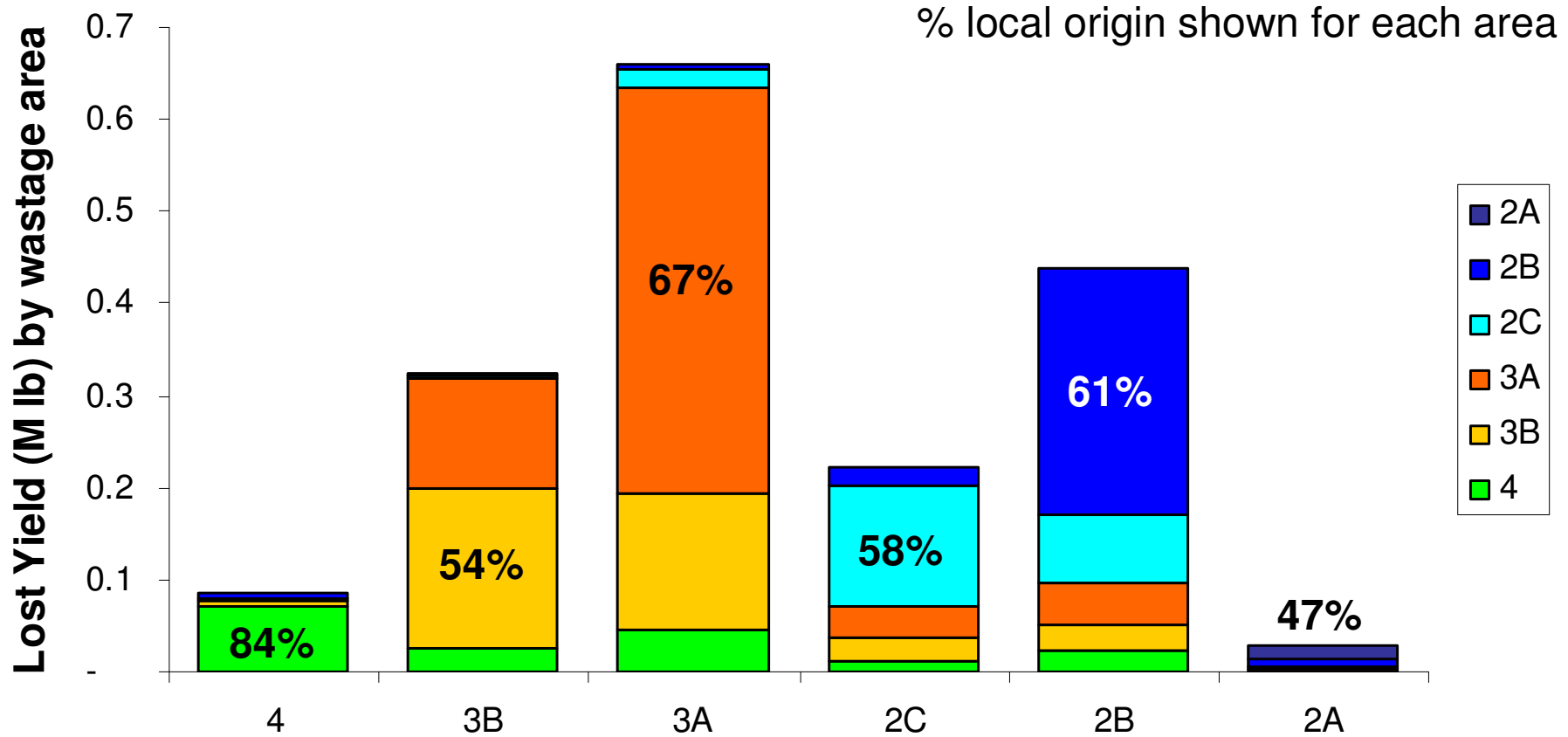
Impacts mostly from out of area bycatch



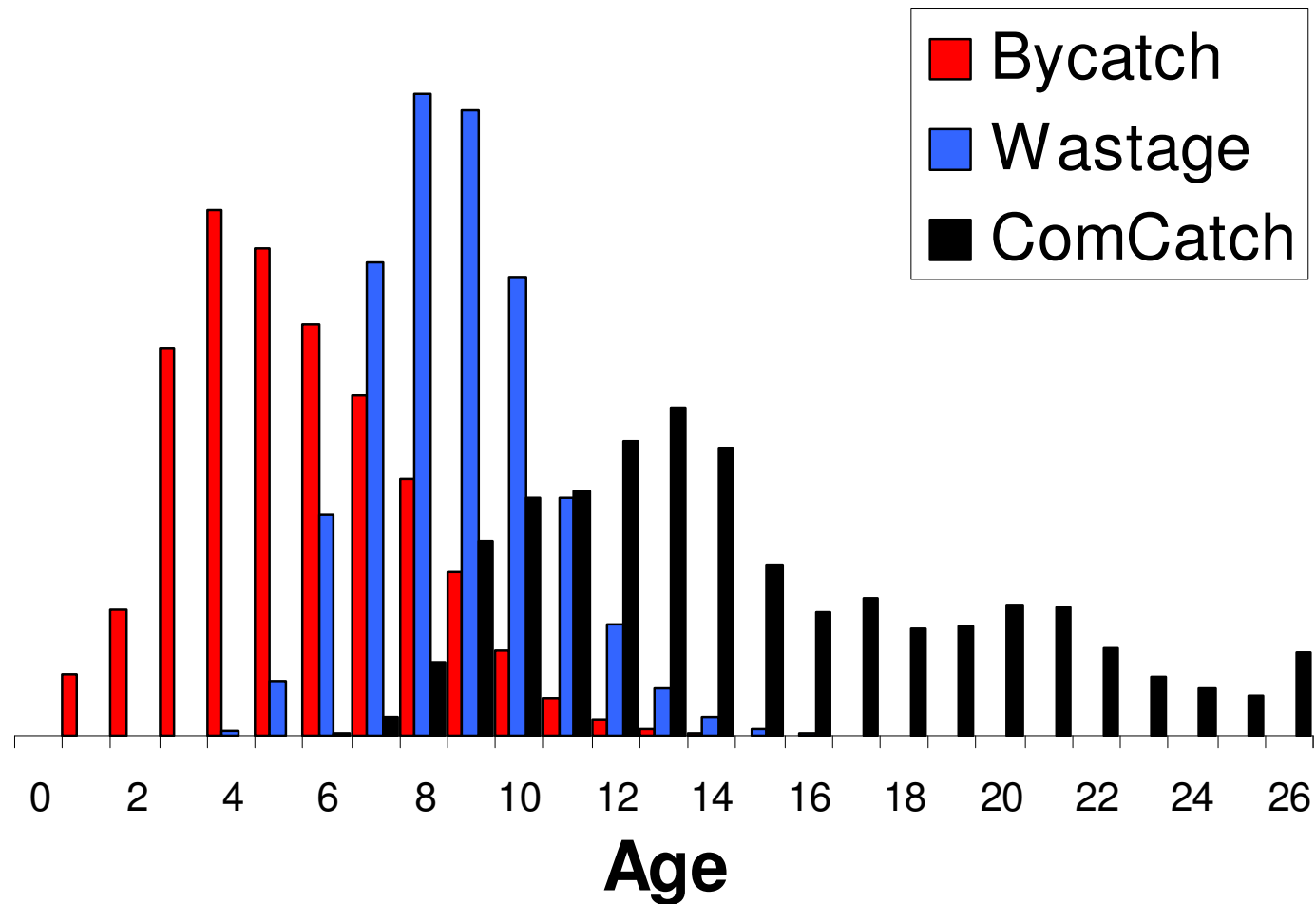
Source of U32 WASTAGE for each area where yield is lost

WITH Migration

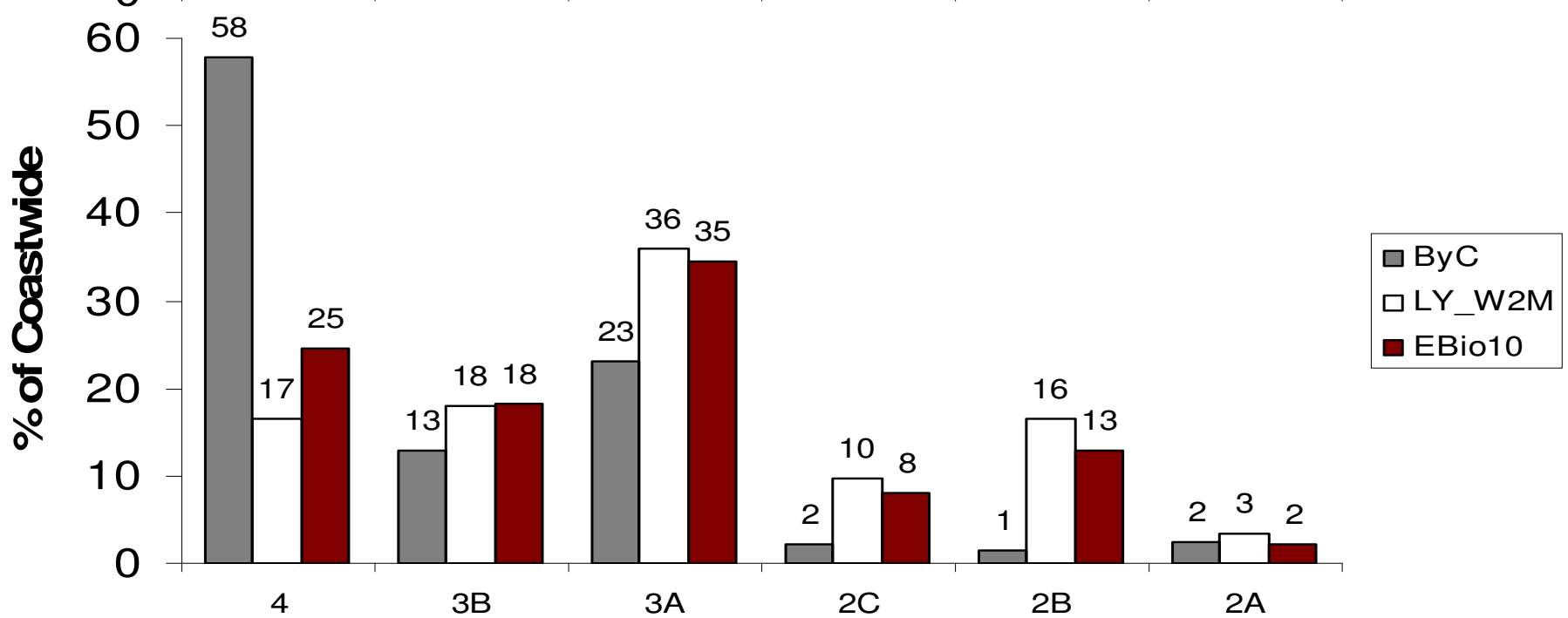
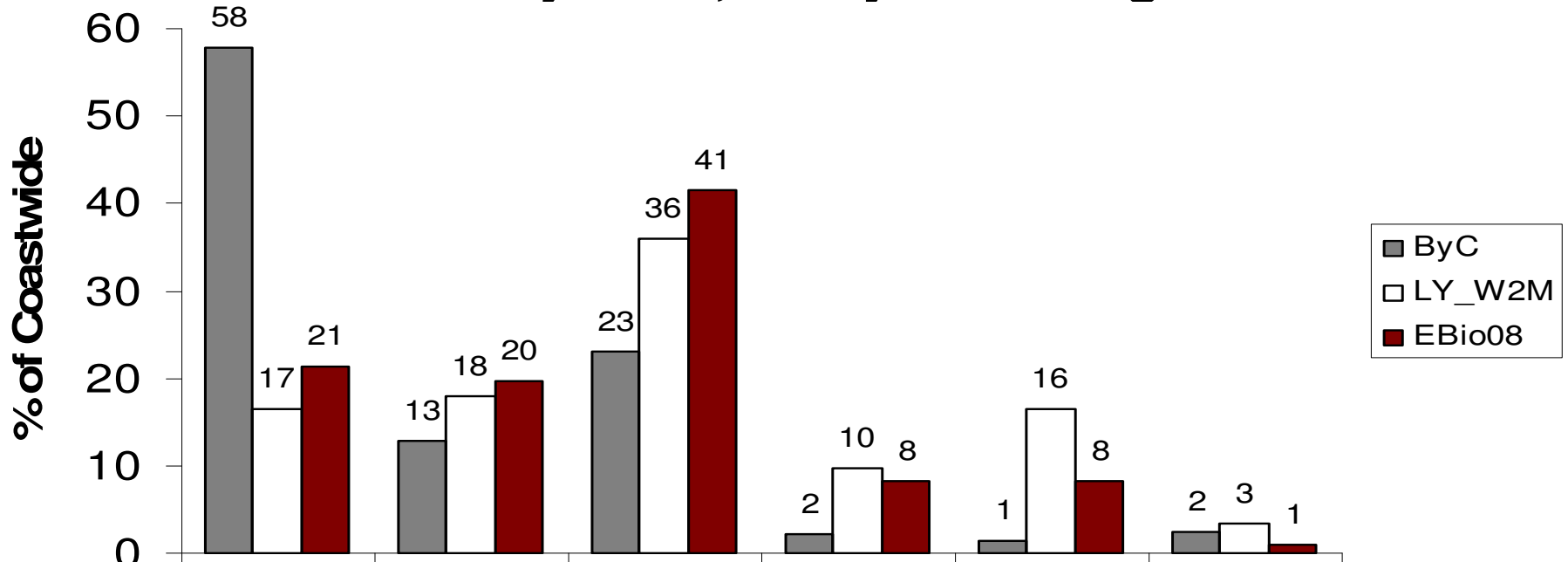
Impacts mostly from local wastage



Age distributions of U32 Bycatch, U32 Wastage and Comm. Catch



% Coastwide dist. of Bycatch, lost yield w/migration and EBio



Summary of effects of migration on U32 impacts on Lost Yield, Lost SBio and Egg Loss

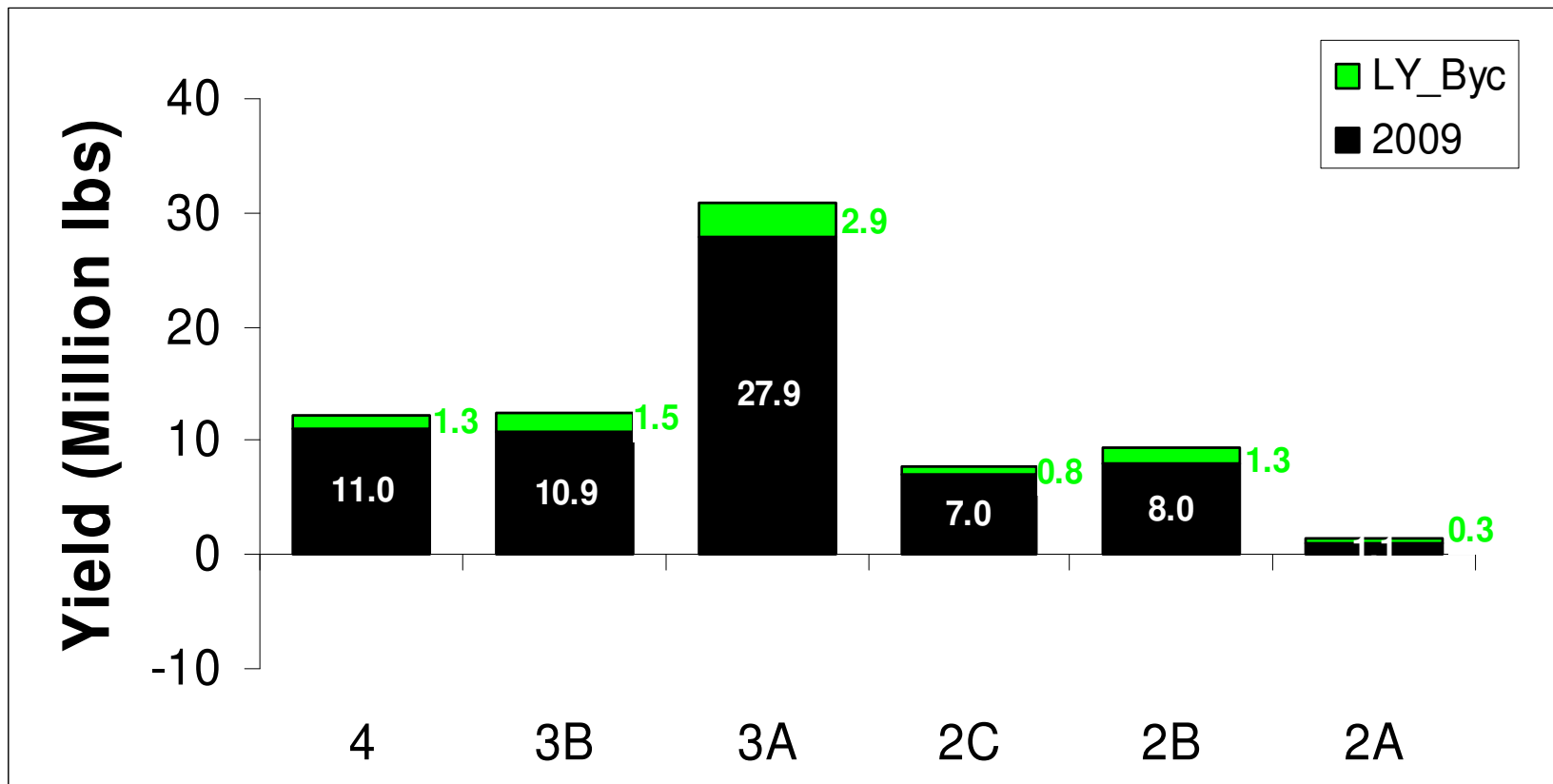
Impacts differ by area and type of U32 mortality when accounting for migration:

- Decreased U32 bycatch & wastage impacts on Area 4
- Increased impacts on other areas, particularly Area 2
- Most of U32 bycatch impacts from **out of area bycatch**
- Most of U32 wastage impacts from **local wastage**

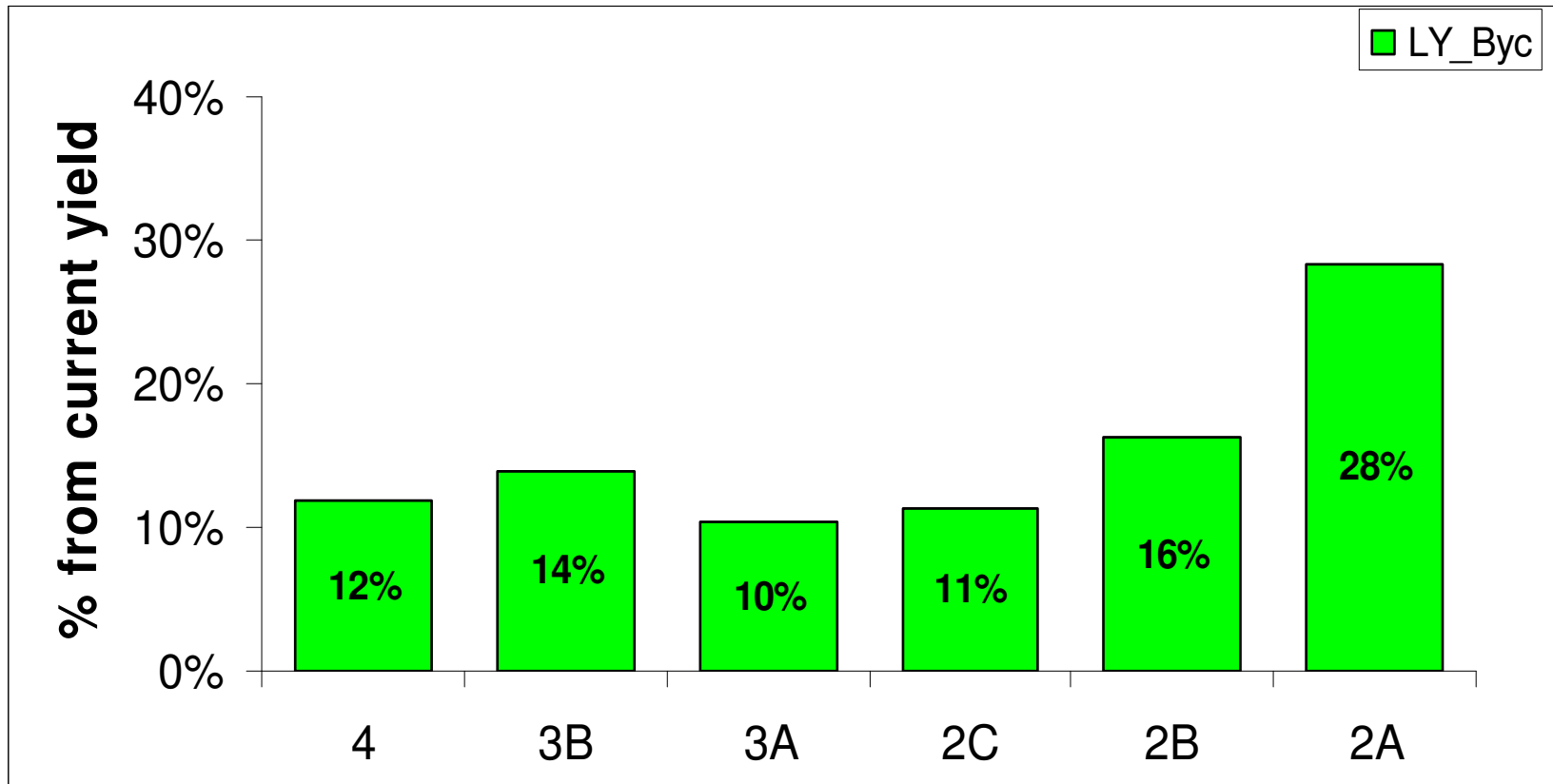
Last 8 years of U32 bycatch mortality results in less than 50% of yield loss

Lost yield due to U32 bycatch in perspective

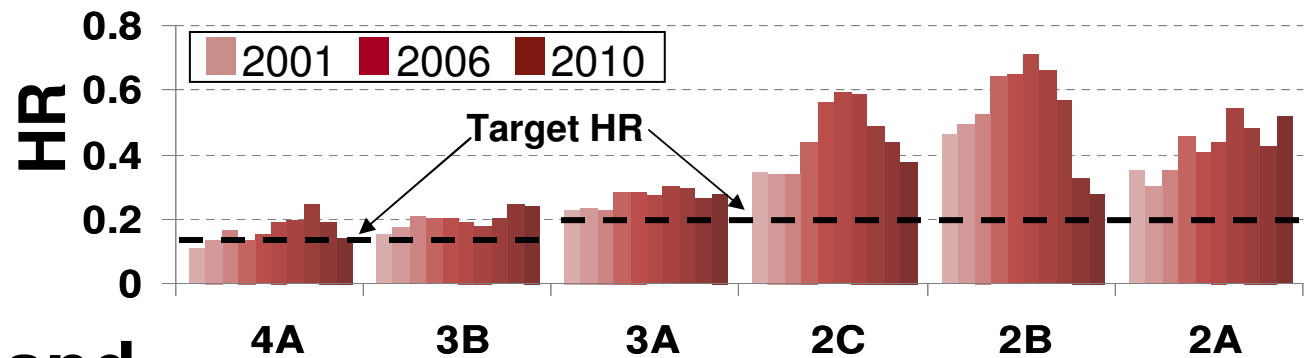
Lost yield (LY) due to U32 bycatch and 2009 removals



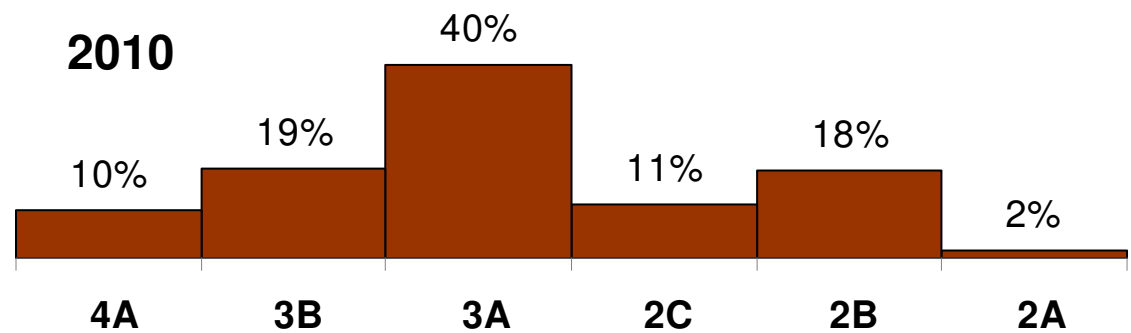
Lost yield (LY) due to U32 bycatch as % 2009 removals



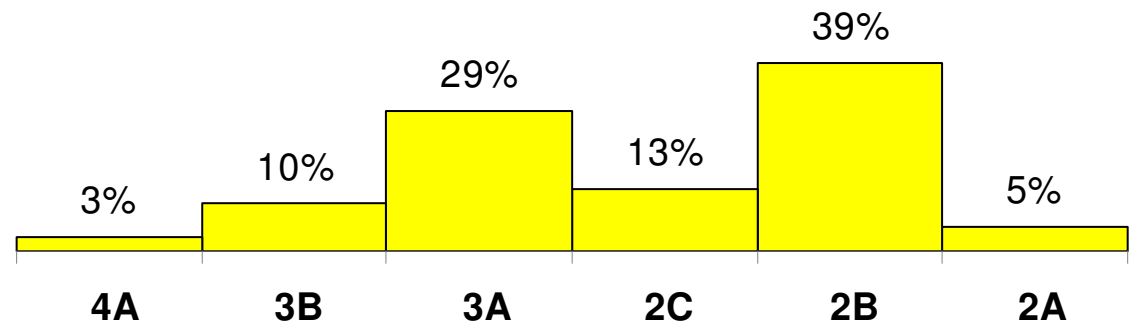
Unbalanced HR and halibut distribution



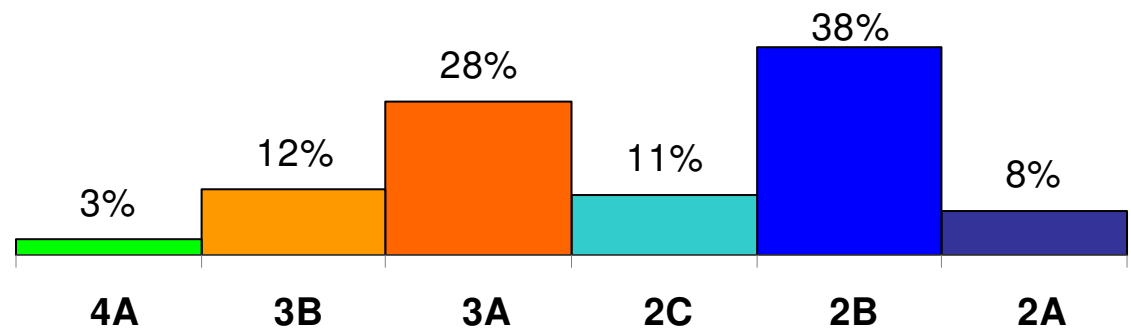
Survey CPUE



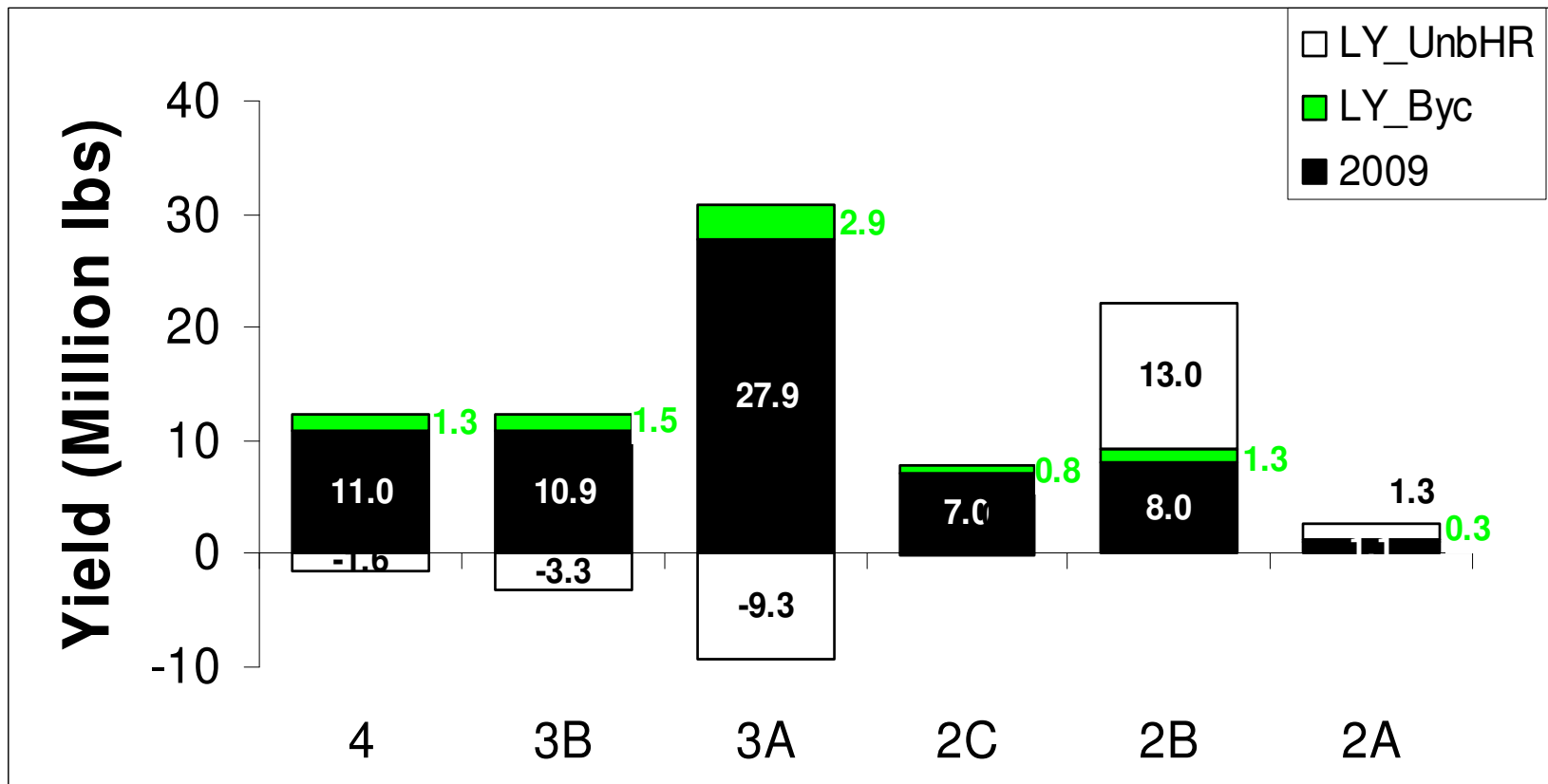
Earliest Historic CPUE



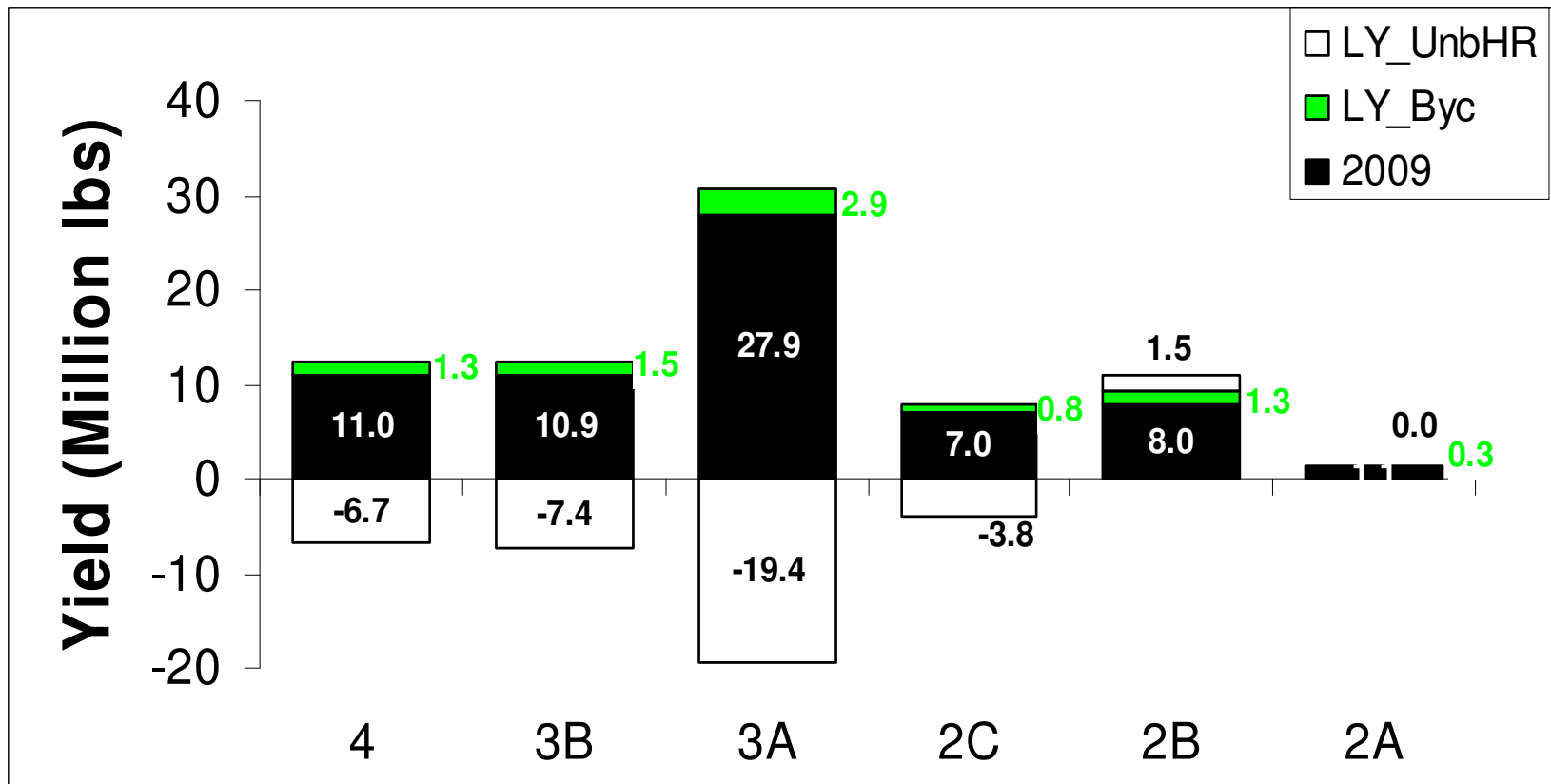
Simulation model HR: 0.2
used for bycatch modeling



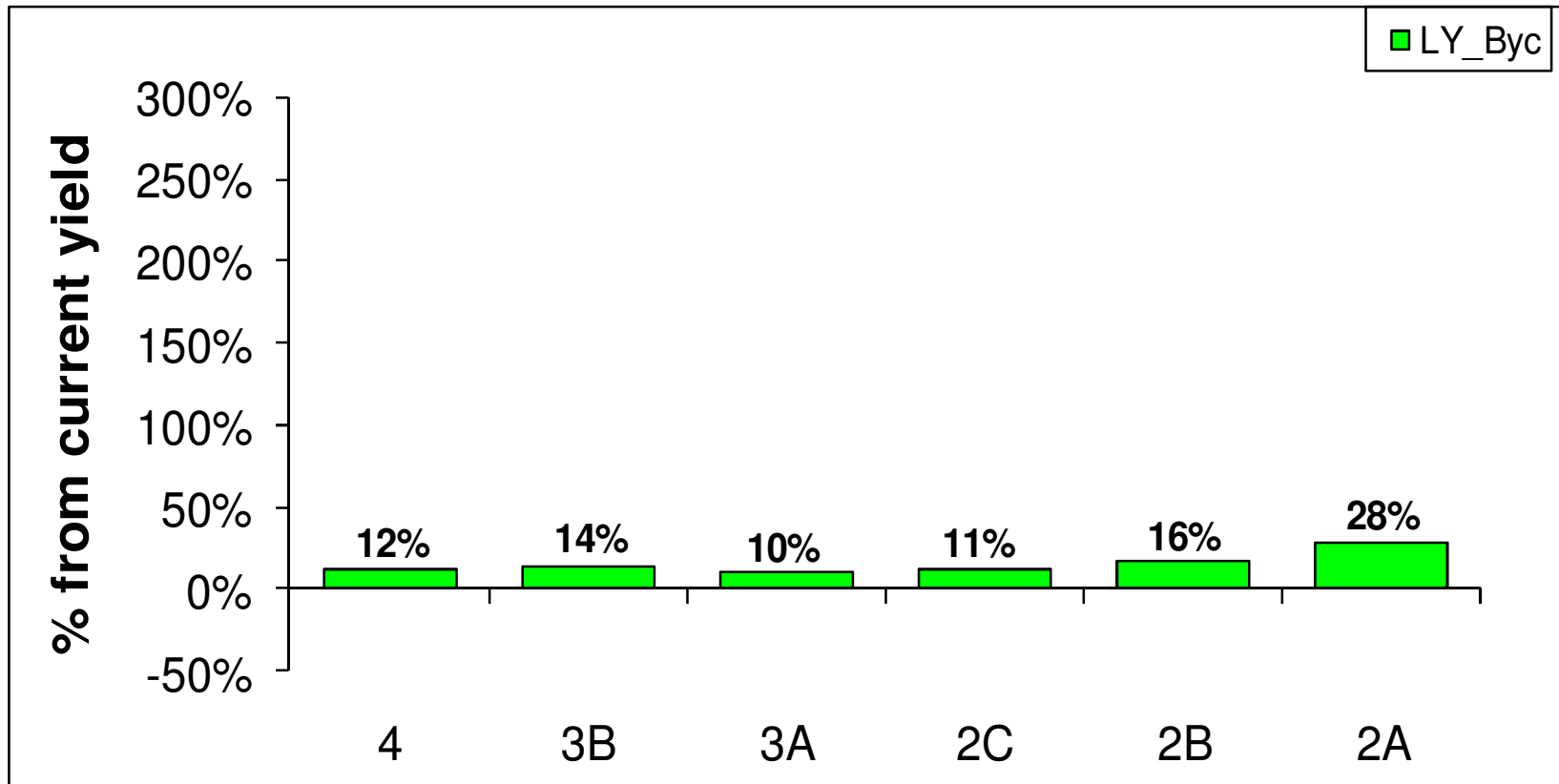
Lost yield due to current levels of U32 Bycatch and unbalanced HR at 2009 removals (65.8 M Ib)



Lost yield due to current levels of U32 Bycatch and unbalanced HR at low removals (30 M Ib)

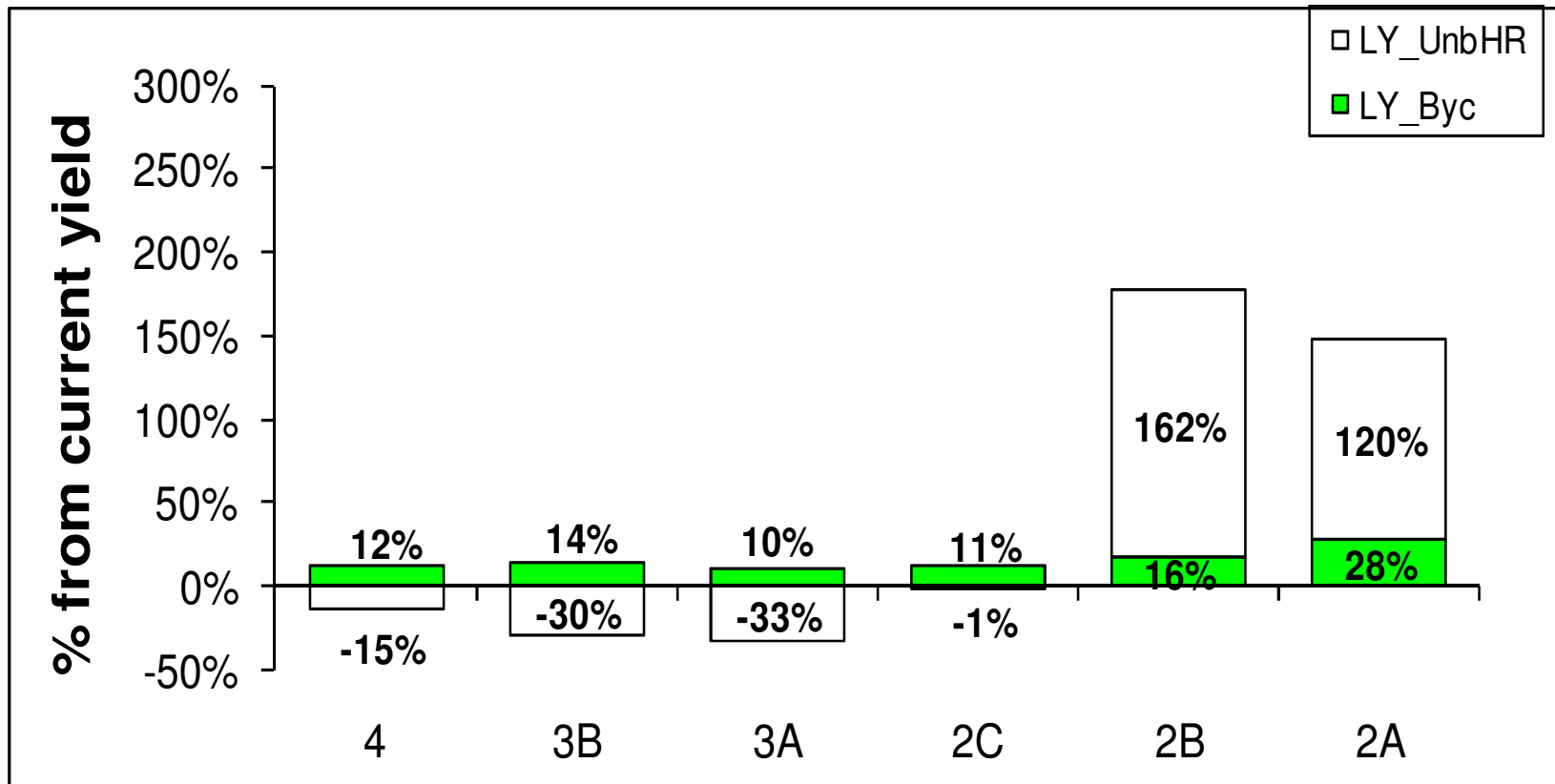


Lost yield due to U32 Bycatch as % of 2009 removals



Lost yield due to U32 Bycatch and unbalanced HR as % of 2009 removals

Assuming CW removals ~ 2009 = 65.8 M lbs



Lost yield due to U32 Bycatch and unbalanced HR as % of 2009 removals

Assuming CW removals = 30 M lbs

