

Fisheries Management Law & Economics

Applying Management in Alaska

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Asst Professor

University of Alaska Southeast



Fisheries Technology

Outline

Exam 2 Review

Recap – Emerging Management Techniques

Recap – Fisheries Management

Applying Management to Alaskan Fisheries

- PWS Salmon
- Bering Sea King Crab
- Southeast Sac Roe Herring

RECAP

Emerging Management Techniques

- Genetic stock management
- Digital Observer
- Cam Trawl
- HabCam
- Acoustics (Listening)
- Hydroacoustics (Sonar)
- AUV's
- Drones

Recap

- Fisheries Management..
- There is a need to manage these public resources due to Tragedy of the commons.
 - Many collapses to point to this
- Management Approaches
 - MSY
 - Quotas
 - Legislation
 - Closures
 - Gear Restrictions
- Fisheries Assessments

Recap

- Ecosystem Based Management
 - Reduce bycatch
 - Marine reserves
 - Monitoring of population characteristics
 - Catch share programs
 - Ecologically sustainable yield
 - Market Based Solutions

Applying Mgmt concepts to Alaskan Fisheries

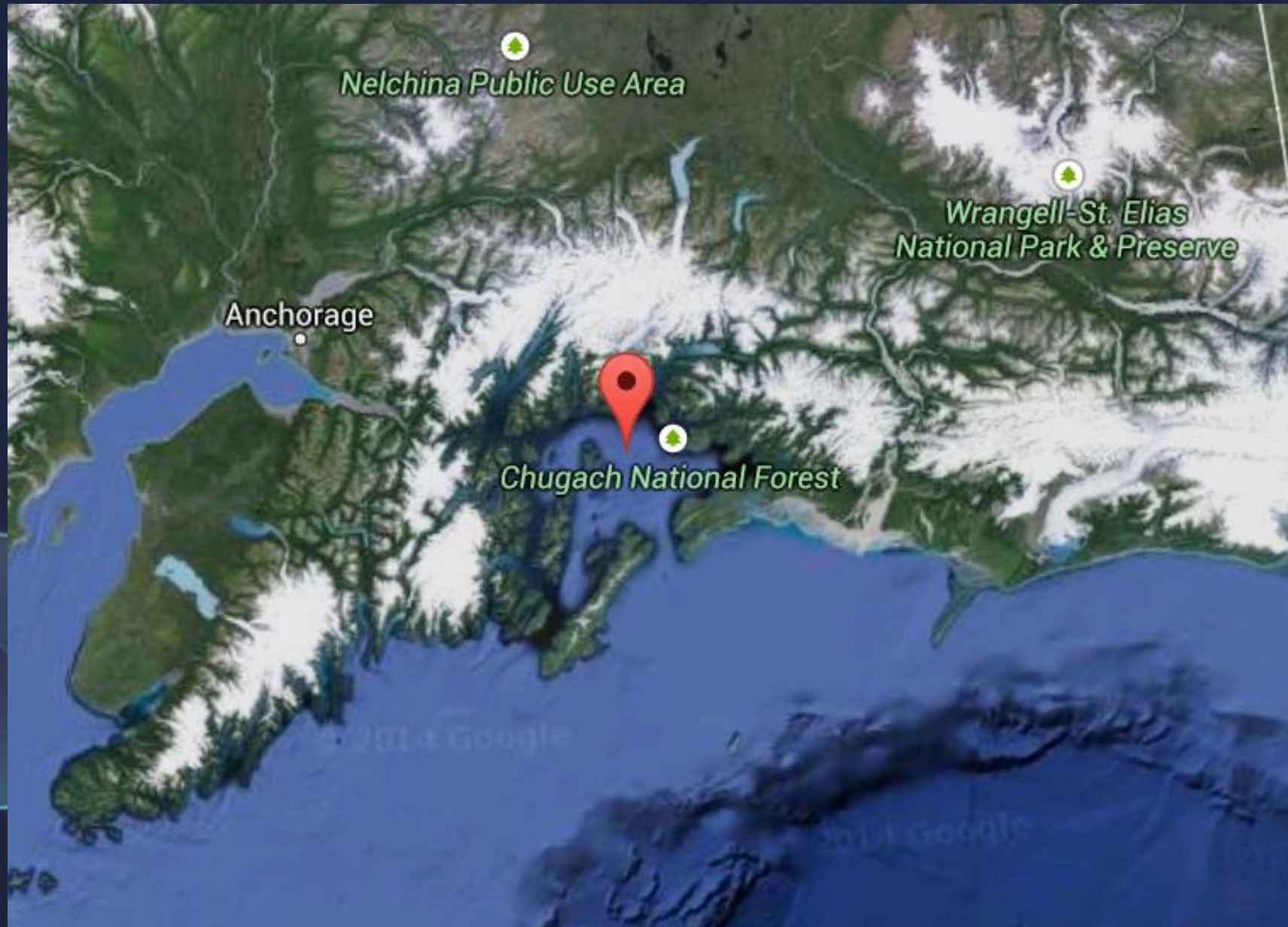
- PWS Salmon
- Bering Sea King Crab
- Southeast Sac Roe Herring

PWS Salmon Management

- Policy for the Management of Sustainable Salmon Fisheries (SSFP; 5AAC 39.222) , and....
- **Policy for Statewide Salmon Escapement Goals (5 AAC 39.223)**
- Both adopted to ensure salmon stocks are conserved, managed, and developed using the sustained yield principle



PWS



PWS Salon Management

- Central theme = “to achieve a constant level of **Escapement** regardless of run strength”
- As information improves, escapement goals improved/developed for increasing sustained harvest levels
- Professional and scientific approach req'd for establishing and changing goals

PWS Salon Management

- Establish BEGs and SEGs for actively managed stocks
- Establish sustainable escapement threshold (SET) if necessary
- Review goals every BOF cycle
- Escapement goal ranges should allow for uncertainty in...
 - Measurement techniques
 - Variability in assessments of stock size
 - Climate and oceanographic variability
 - Varying abundance of populations within stocks

Escapement Goals

- Biological Escapement Goal (BEG)
 - The escapement that provides the greatest potential for maximum sustained yield
 - Best Biological information & Scientifically defensible on the basis of available biological information
- Sustainable Escapement Goal (SEG)
 - A level of escapement, indicated by an index or an escapement estimate, that is known to provide for sustained yield over a 5 to 10 year period, used in situations where a BEG cannot be estimated due to the absence of a stock specific catch estimate

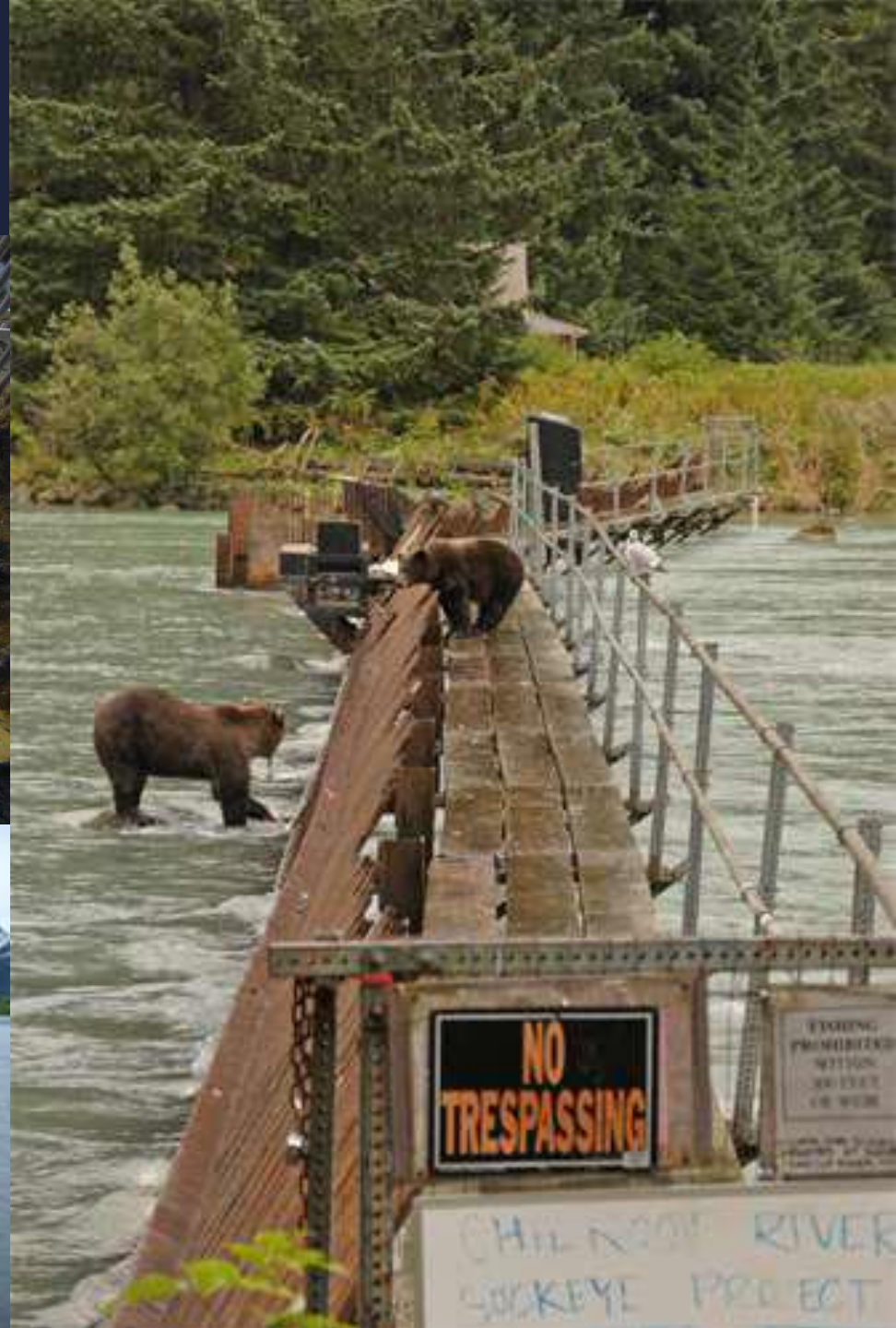
PWS Fisheries Assessment

- Stock Assessments
- Three components of stock assessments:
 - Estimation of escapement
 - Estimation of harvest (also called “catch”)
 - Estimation of age composition

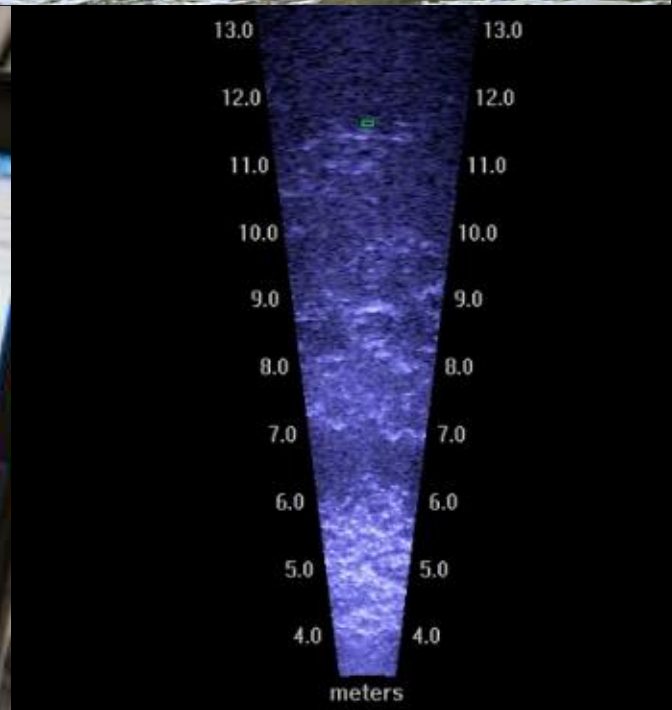
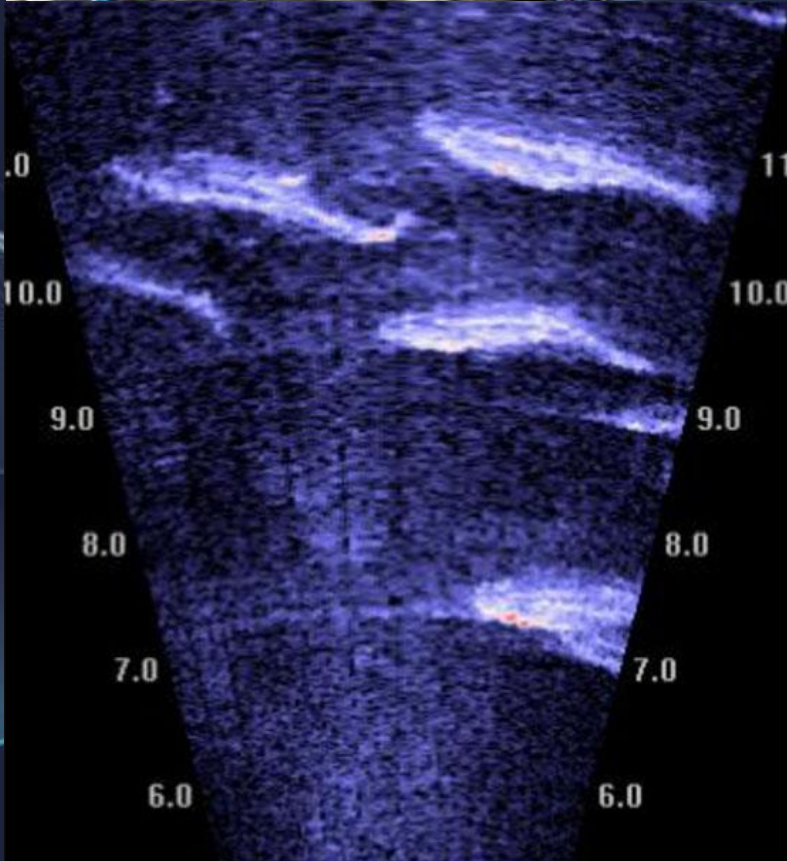
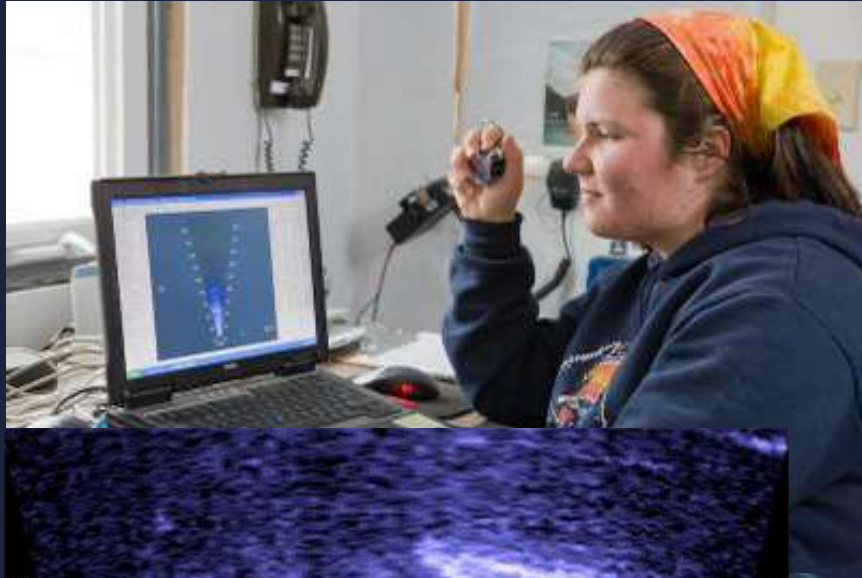
Escapement Estimate

- Best = weirs, towers
- Good = sonar, mark-recapture
- OK = aerial, foot, snorkel surveys

Weirs



Sonar



Aerial Surveys



Estimation of Harvest

- AK waters / species reported using e-Landings or paper fish ticket



ALASKA DEPARTMENT OF FISH & GAME
ELECTRONIC SALMON TICKET

DO NOT WRITE IN THIS SPACE
F09 155714

Statistical Area Worksheet

Stat. Area	%	Stat. Area	%
Report By/Checked:		Permitted:	

Vessel: PACIFIC POWER
ADFG ID: 00019
Name: 0158 54812W 08010 PAUL
DAY
P
 Mag Stripe Read

Owner: PA15 Elsie Inuvait
Custom Processor:

Deck Size: 4 Mgmt Pkg: LR
Chk Type: ESW Temperature: 32.0
Date Landed: 11/19/2008
Time of Landing: 18:10

Part of Landing or Offshore Operator Type: SIT 8338
Type of Gear Used: 15 Boxes gradey toall
 Dual Salmon Permit
 Partial Delivery
 Cook Delivery

SPECIES	STAT AREA	DEL COND	NUM	SCALE WEIGHT	DISP.	SIZE & GRADE	WGT WEIGHT	PRICE	AMOUNT
0158 01000	0158 01000	110	2,010	47,800		01 270g	330	4.95	1,635.00
						01 22-24	8,130	4.00	32,520.00
						01	35	3.24	113.40
						01 111	882	4.95	4,363.90
						01 001 100g	330	3.00	990.00
						01 001 115	330	4.95	1,635.00
0158 01000	0158 01000	110	47,800	47,800		01 270g	330	4.95	1,635.00
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						01 001 100g	330	3.00	990.00
						01 001 115	330	4.95	1,635.00
Net Salt - Reported for Ref. Personal Use									
0158 01000	0158 01000	110	2,010	47,800				2,943	117,713.44
Total: 2,943									117,713.44

I HEREBY ATTEST THAT THESE FISH WERE CAUGHT IN COMPLIANCE WITH ADFG REGULATIONS.

Permit Holder's Signature: _____ Date: _____

Fish Received by: _____

Landing Report ID: 273642 CFSR Aerial Station: 771982
Chitwah Count: 212 Chitwah 2nd Night: 3,272
Chitwah Count: 20 Chitwah 2nd Night: 115
Salmon Sub-Total: _____

Tax	Rate	Amount
Land Salmon Employment Tax		
Other		
Total		

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Other		
Total		

FISH - FAREWELL TO CHILDHOOD

Islington Assembly Hall, London

FRIDAY 29 APRIL 2016

Doors open 19.00

STANDING

£25.00 (Subject to booking fee)

This event is for over 14's only

53153462 LAWTON

www.seetickets.com

TICKETS ARE SOLD SUBJECT TO THE TERMS AND CONDITIONS OVERLEAF



#03232679

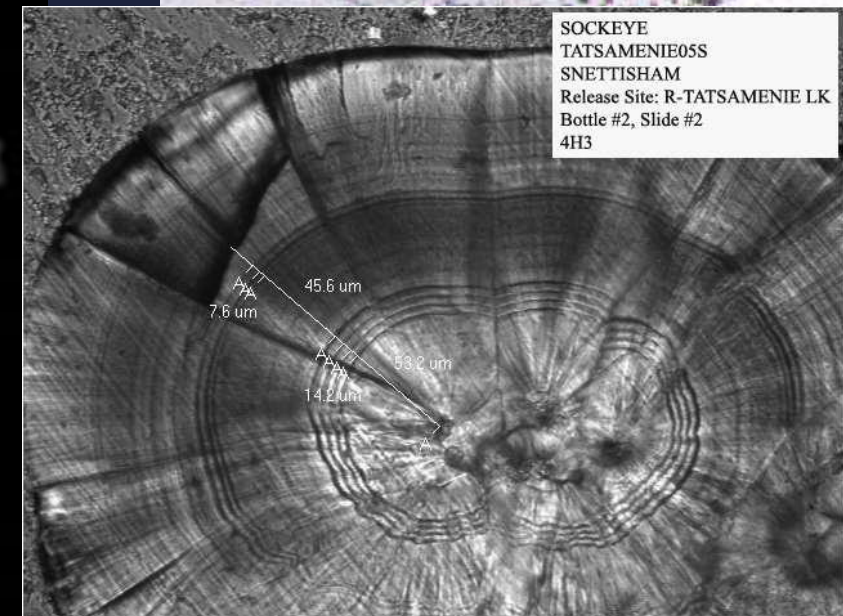
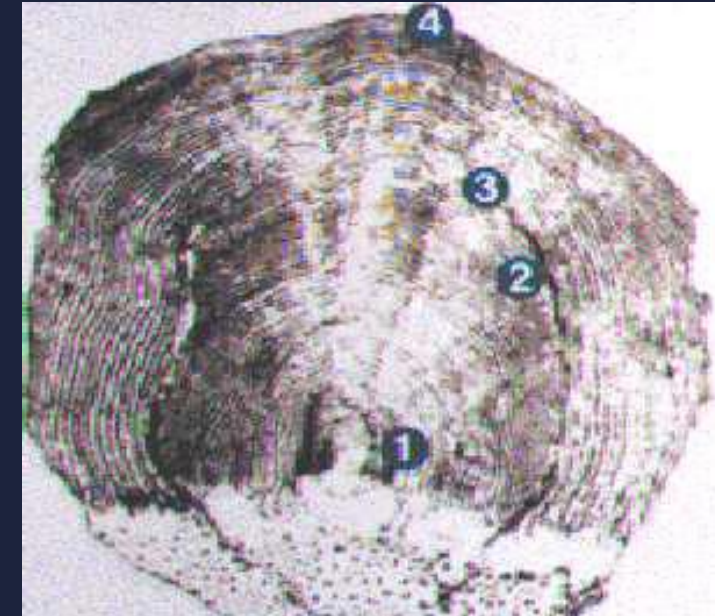
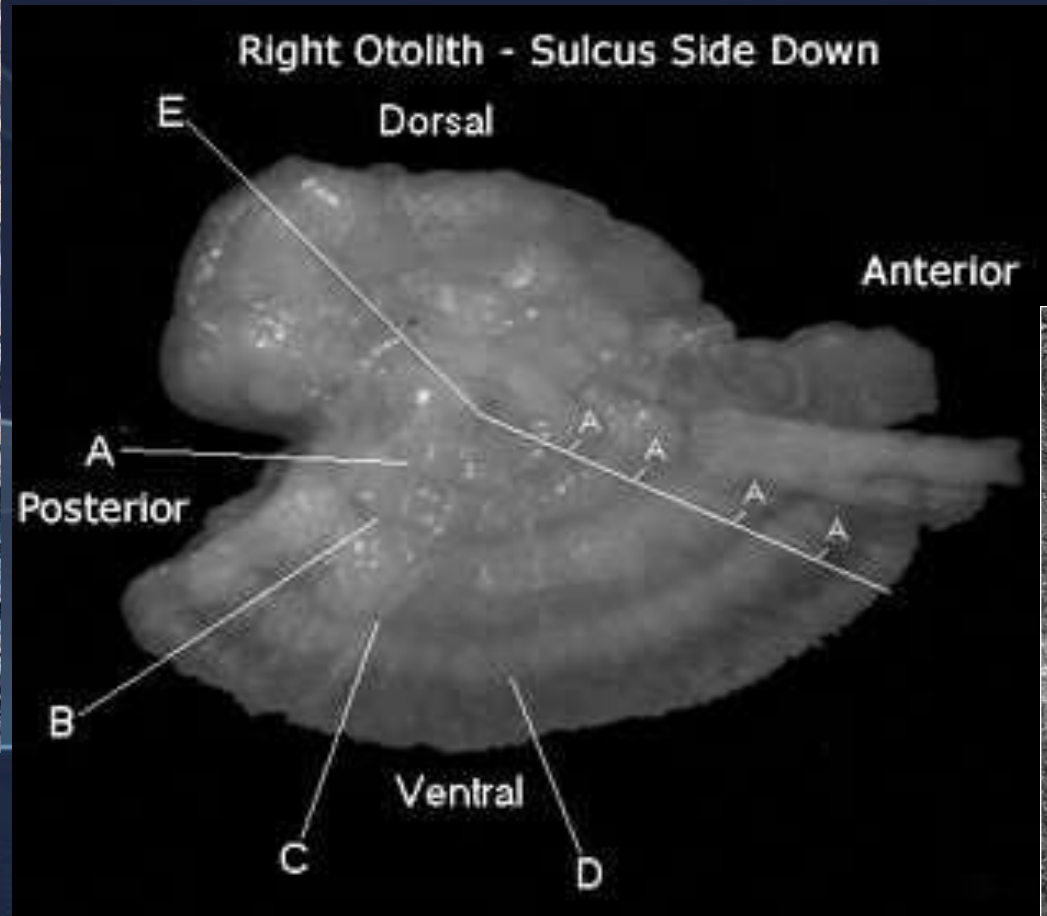
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See™

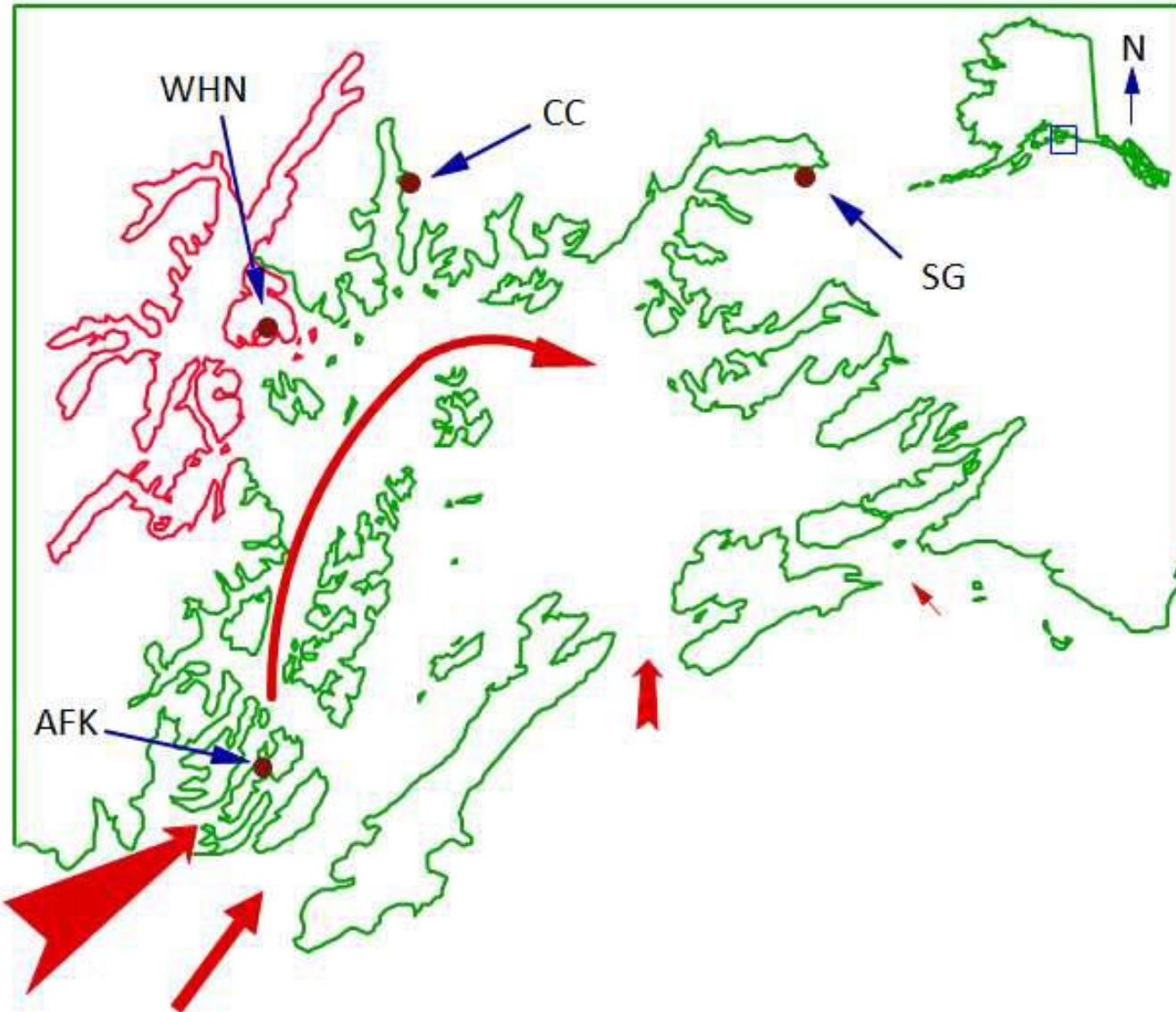
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Est. of age composition

- Scales and Otoliths
 - Thermal Marking / Stock Structure



Test Fishery



Hatchery locations and generalized salmon migration pathways.

Test Fishery

- Provides quantitative measure of run strength
- Provides sex ratios
- Allows management decisions based on stock composition



Assessment Data

- Estimate escapement, stock structure, and age composition
- Allows managers to set or fine tune Sustainable Escapement Goals (Usually Range)

Table 5.—Spawning escapement goals for Area E salmon stocks, 2014.

Species/stock	Goal		Long-term target ^a	Type ^b	Year implemented ^c	Evaluation method
	Lower	Upper				
Chinook salmon						
Copper River	24,000	and up	27,000	SEG ^d	2003	Mark-recapture
Coho salmon						
Bering River	13,000	– 33,000		SEG	2003	Aerial surveys
Copper River Delta	32,000	– 67,000		SEG	2003	Aerial surveys
Sockeye salmon						
Bering River	15,000	– 33,000		SEG	2012	Aerial surveys
Upper Copper River ^e	360,000	– 750,000	361,000	SEG	2012	Didson sonar
Copper River Delta ^f	55,000	– 130,000	84,500	SEG	2003	Aerial surveys
Coghill Lake	20,000	– 60,000		SEG	2012	Weir
Eshamy Lake	13,000	– 28,000		BEG	2009	Video

In season Management

- Emergency Orders

ALASKA DEPARTMENT OF FISH AND GAME DIVISION OF COMMERCIAL FISHERIES



NEWS RELEASE

*Sam Cotten, Commissioner
Scott Kelley, Director*



Contact:
Jeremy Botz, Gillnet Area Management Biologist
Charlie Russell, Seine Area Management Biologist
Steve Moffitt, Area Research Biologist
Stormy Haught, Asst. Area Management/Research Biologist
Phone: (907) 424-3212 Fax: (907) 424-3235

Prince William Sound Area Office
401 Railroad Avenue, PO Box 669
Cordova, AK 99574-0669
Date Issued: Wednesday, October 12, 2016
Time: 11:30 am

Prince William Sound Salmon Fishery News Release #64

COPPER RIVER DISTRICT: The commercial salmon fishing season in the Copper River District closed after the completion of the 36-hour fishing period beginning Monday, October 10. For the week ending October 15, the actual Copper River Delta coho salmon aerial survey count was 65,700 fish versus an anticipated range of 8,500 – 17,700 fish.

BERING RIVER DISTRICT: The commercial salmon fishing season in the Bering River District closed after the completion of the 36-hour fishing period beginning Monday, October 10. For the week ending October 8, the actual Bering River Delta coho salmon aerial survey count was 23,400 fish versus an anticipated range of 5,156 – 13,089 fish.

No additional scheduled salmon fisheries announcements are anticipated this season.



ALASKA DEPARTMENT OF FISH AND GAME
Sam Cotten, Commissioner

DIVISION OF SPORT FISH
Tom Brookover, Director

Contact:
[Mike Thalhauser](#)

Area Management Biologist
Phone: 907-267-2186

September 16, 2015

PRINCE WILLIAM SOUND SPORT, SUBSISTENCE, AND PERSONAL USE SHRIMP SEASONS CLOSED; PERMITS DUE BY OCTOBER 15

The 2015 Prince William Sound (PWS) sport, personal use, and subsistence shrimp seasons closed by regulation at 11:59 p.m., Tuesday, September 15, 2015. All PWS shrimp permits must be returned to the Alaska Department of Fish and Game no later than October 15.

Shrimp permits are self-addressed and can be folded, stamped and mailed, or personally delivered to department offices. Permits may also be scanned and emailed to dfg.pws.shrimp@alaska.gov. Permits must be returned even if the permit holder did not fish. The prompt return of all permits is necessary to manage this resource.

Please contact Mike Thalhauser in Anchorage at 267-2186 with any questions regarding the PWS sport shrimp fisheries, or Maria Wessel in Cordova at 424-3212 with any questions regards the PWS subsistence or personal use shrimp fisheries.

NEWS RELEASES

PWS Salmon Management

- Major tenets of the Policy for the Management of Sustainable Salmon Fisheries (SSFP; 5 AAC 39.222)
- Maintain salmon stocks and habitat
 - Regulatory closed waters
 - Anadromous stream closures
- Manage for escapement
- Establish and apply effective management
- Encourage public support and involvement
- Manage conservatively, acknowledge uncertainty

PWS Harvest 2016

- 19 million fish (only)
- \$58 million
 - 2015 - 104 m fish
 - \$117 million

2015 Alaska Commercial Salmon Harvests and Exvessel Values					
Species	Avg. Wt. (pounds)	Avg. Price per Pound	Number of Fish (thousands)	Lbs. of Fish (thousands)	Est. Value US\$ (thousands)
Chinook	16.42	\$5.65	24	388	\$2,189
Sockeye	5.35	\$2.01	3,210	17,183	\$34,593
Coho	7.43	\$0.66	198	1,469	\$966
Pink	3.38	\$0.22	98,254	332,085	\$71,913
Chum	5.38	\$0.61	2,544	13,679	\$8,331
Totals			104,229	364,802	\$117,990

2016 Alaska Commercial Salmon Harvests and Exvessel Values					
Species	Avg. Wt. (pounds)	Avg. Price per Pound	Number of Fish (thousands)	Lbs. of Fish (thousands)	Est. Value US\$ (thousands)
Prince William Sound					
Chinook	17.51	\$6.06	12	209	\$1,268
Sockeye	5.32	\$2.24	1,937	10,303	\$23,103
Coho	9.02	\$1.45	478	4,309	\$6,233
Pink	3.89	\$0.28	13,269	51,562	\$14,338
Chum	6.91	\$0.57	3,431	23,712	\$13,629
Totals			19,127	90,095	\$58,571

Recap PWS Salmon

- Fisheries Assessments
- Management Approaches
 - MSY
 - Quotas
 - Legislation
 - Closures
 - Gear Restrictions
- Ecosystem Based Management
 - Reduce bycatch
 - Marine reserves
 - Monitoring of population characteristics
 - Catch share programs
 - Ecologically sustainable yield

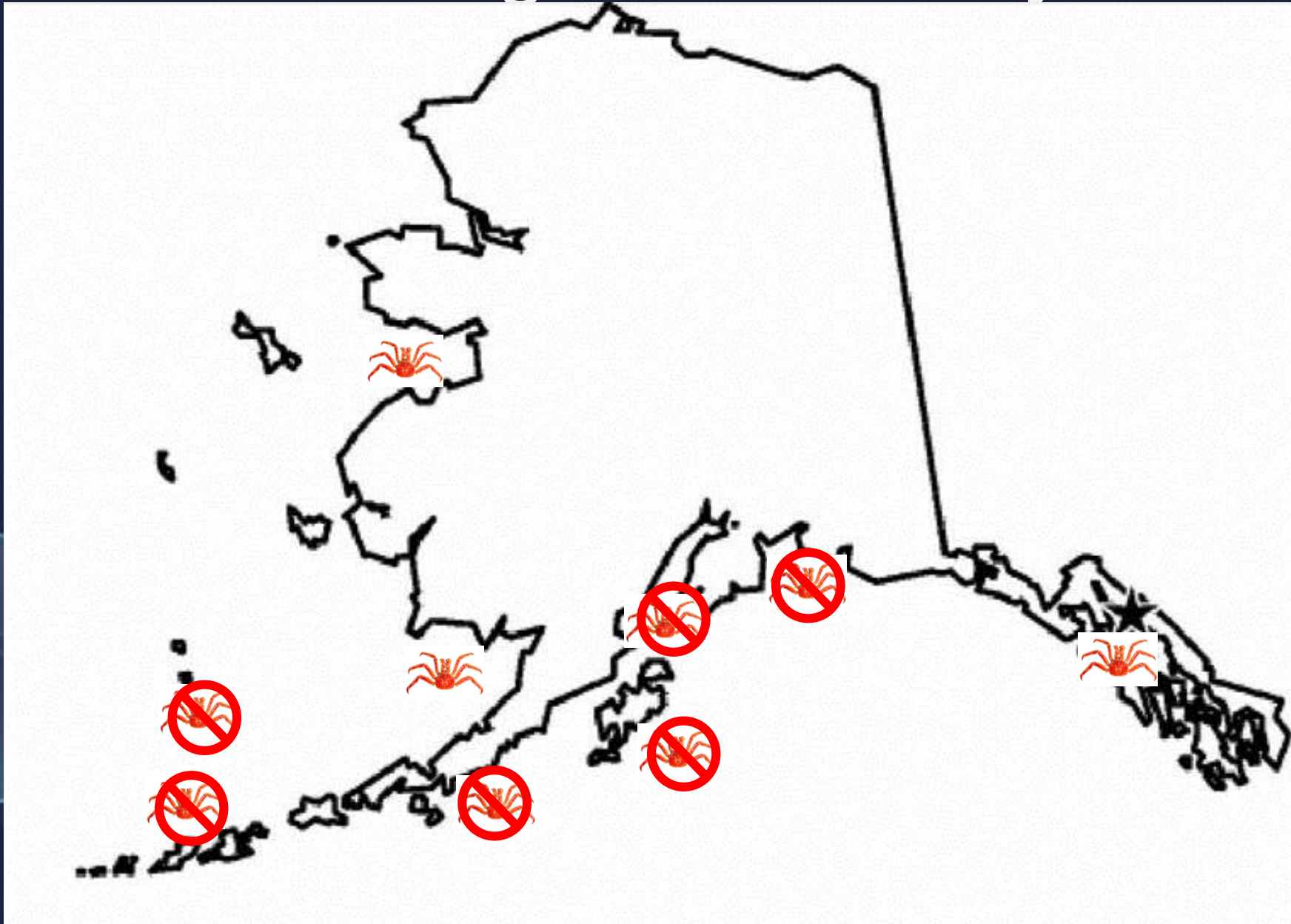
Self Check

- The escapement that provides the greatest potential for maximum sustained yield refers to
 - Biological Escapement Goal
 - Optimal Escapement Goal
 - Sustainable Escapement Goal
 - Inriver Goal
- In Season Management is achieved using
 - Fishery regulations
 - Emergency Orders
 - Fish & Wildlife Troopers
 - Test Fisheries

Bering Sea King Crab



Red King Crab Fishery



Bering Sea-Aleutian Island Crab Management

Cooperative management between federal and state agencies

- Federal
 - NPFMC: develops regulations, management plans
 - NMFS: surveys to estimate population abundance, fishery research
- State
 - BOF: makes allocative decisions, establishes policy for management
 - ADF&G: implements fishery regulations and harvest strategies

3 - S Harvest Strategy

Sex - Males only

- Protects eggs in population
- Males can mate with multiple females
- Males are bigger, longer legs

Size - One molt above maturity

- Ensures opportunity to mate at least once before entering fishery

Season – Avoid biologically sensitive periods

- Molting: vulnerable to handling (deadloss)
- Mating: disrupt fertilization
- Later harvests allows meat to “fill out”

} spring/summer

Other Mgmt Measures

- Legal Gear (pot dimensions, mesh sizes, escape holes)
- Permit Requirements
- Reporting Requirements
- Observer Requirements
- Limited Access
- Area Closures (protect habitat, bycatch, etc.)
- Pot Limits, gear modifications (Biodegradable)
- Bycatch Limits

Crab Fishery Management

- Reduced harvest rates provide for more conservation, increased stock productivity, less volatile catches, reduced probability of fishery closures, and increased market and price stability.
- Bycatch caps and area closures constrain negative impacts by trawl fleet on crab stocks and habitats.

Pre- 2005: Derby Style Fishery

“Race for crab” - catch crab as quickly as possible to maximize profits

- Led to short seasons (sometimes only days)
- Compromised vessel human and safety
- Forced processors to process crab as quickly as possible
 - Reduced product quality and increased deadloss
- Increased ghost fishing: lost gear
- Reduced ability to precisely monitor Total Allowable Catch (TAC)
 - The TAC was sometimes exceeded because in-season monitoring could not keep pace with harvests

Crab Rationalization Program

Share-based management program (Catch Share)

- Implemented in 2005
- Allocates harvest among users (harvesters, processors, communities)
- Quota shares (QS): captains + vessel owners
- Processor shares (PS): processors
- Community development quotas (CDQ): rural Alaska communities

Minimize negative social and economic impacts by promoting fishery involvement and economic development

Crab Rationalization Program

Individual allocation quota:

- percentage of the total catch *based on historic landings from specific periods* (depending on the fishery) Quota Share QS

Fisherman get IFQ (individual fishing quota)

- This varies from year to year
- Based on quota share and total harvest

$$QS \times TAC = IFQ$$

Effects of Crab Rationalization

- Reduction in fishing effort
 - Fewer vessels in fleet, fewer people with quota shares
 - Increased profits for remaining vessels
- Extended season: greater flexibility in selecting fishing time + location
 - Safer: reduced Coast Guard search and rescue cases
 - Less bycatch: longer soak times allow escapement of small crabs
- Less gear, decreased pot lifts, less ghost fishing
 - Better crab conservation

Effects of Rationalization

Fishermen form cooperatives: improves efficiency

- At end of season fisherman to consolidate remaining shares to single vessel
- Little un-harvested crab: maximizes TAC
- Efficient coordination with processors causes less down time between deliveries for processing crews
- More precise landings

Socioeconomic Impacts

- Reduction in fleet decreases available jobs in coastal communities
- Restricts ability for young people to enter fishery
- Questions about “fairness”
 - Does limited access privatize a public resource?
- Long-term social impacts
 - Loss of: identity, meaningful lifestyle, connection to the surrounding environment for some individuals

How do agencies make management decisions?

Stock Assessment Models:

- quantitative predictions about crab populations
- Length-based analysis: reduces uncertainty in annual abundance estimates

MSY: Maximum sustainable Yield

TAC: Total Allowable catch

OFL: Over Fishing Limits

Abundance Index

Life History Data

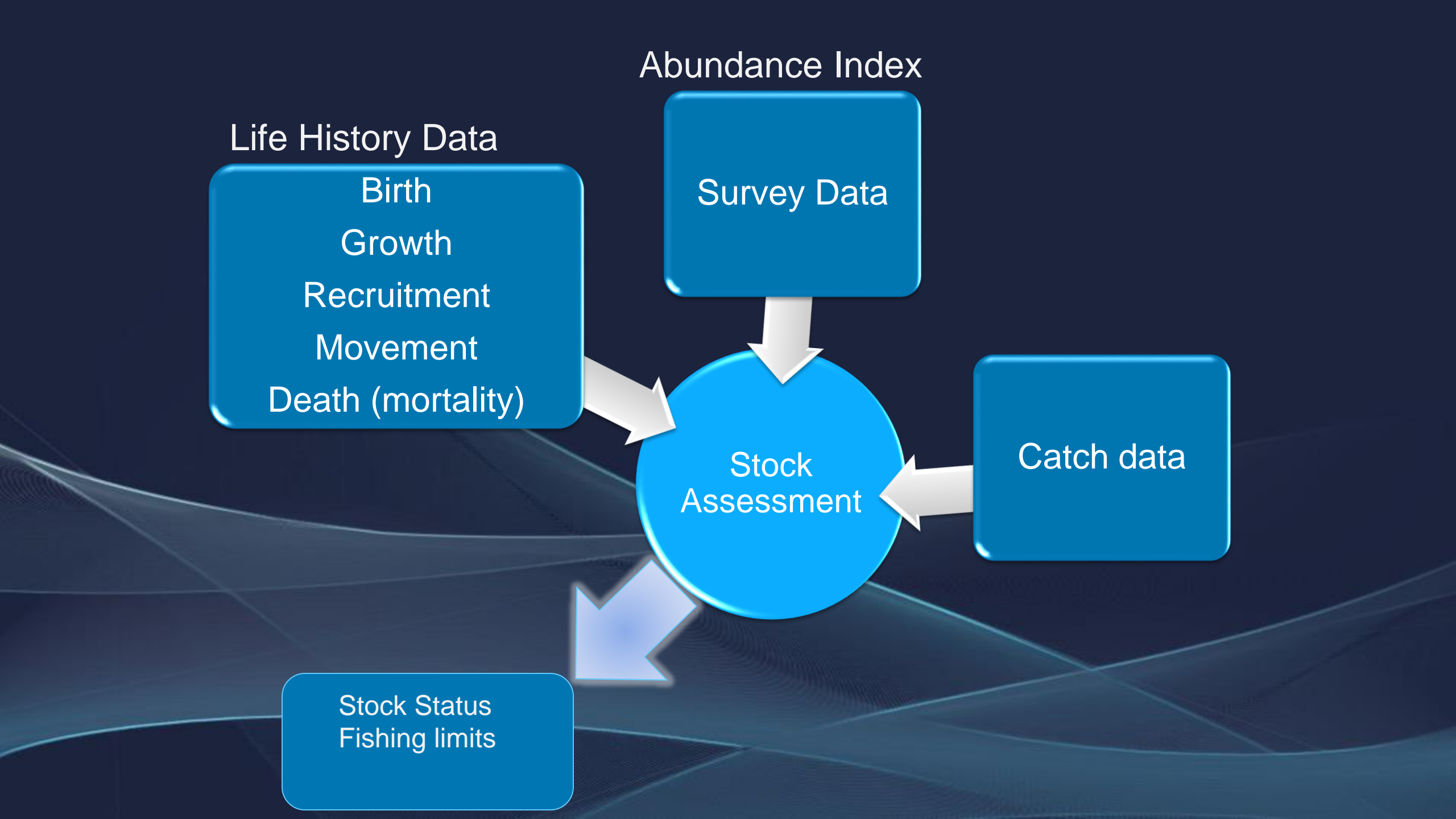
- Birth
- Growth
- Recruitment
- Movement
- Death (mortality)

Survey Data

Catch data

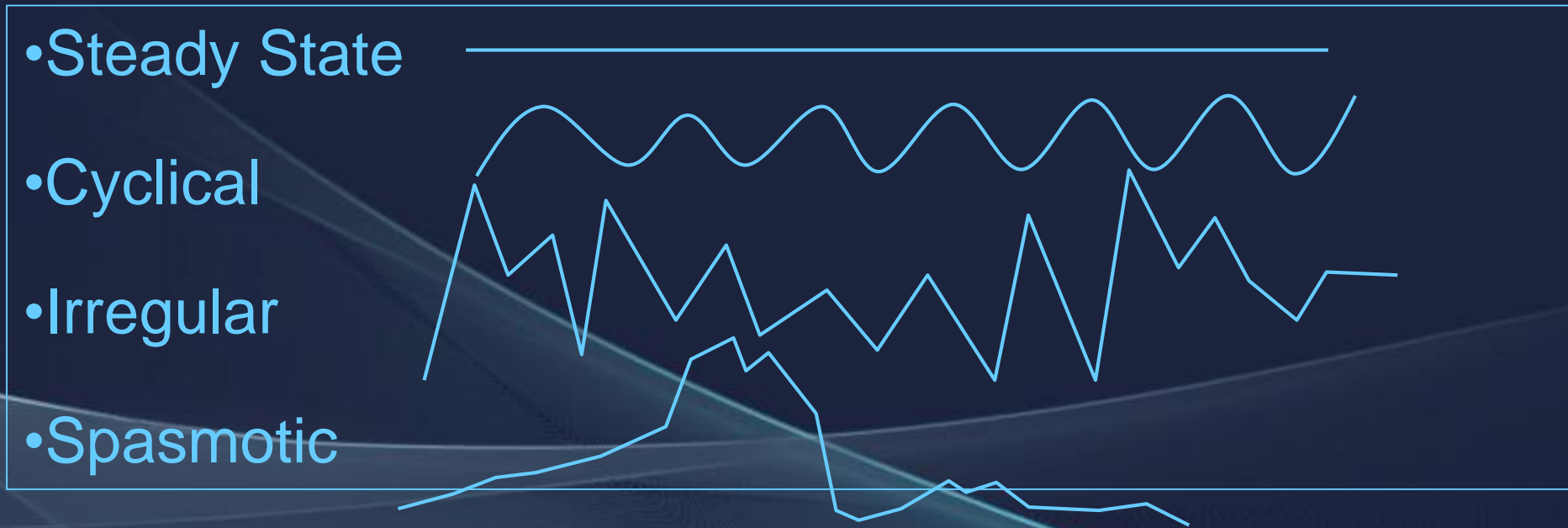
Stock Assessment

Stock Status
Fishing limits



Stock Assessment

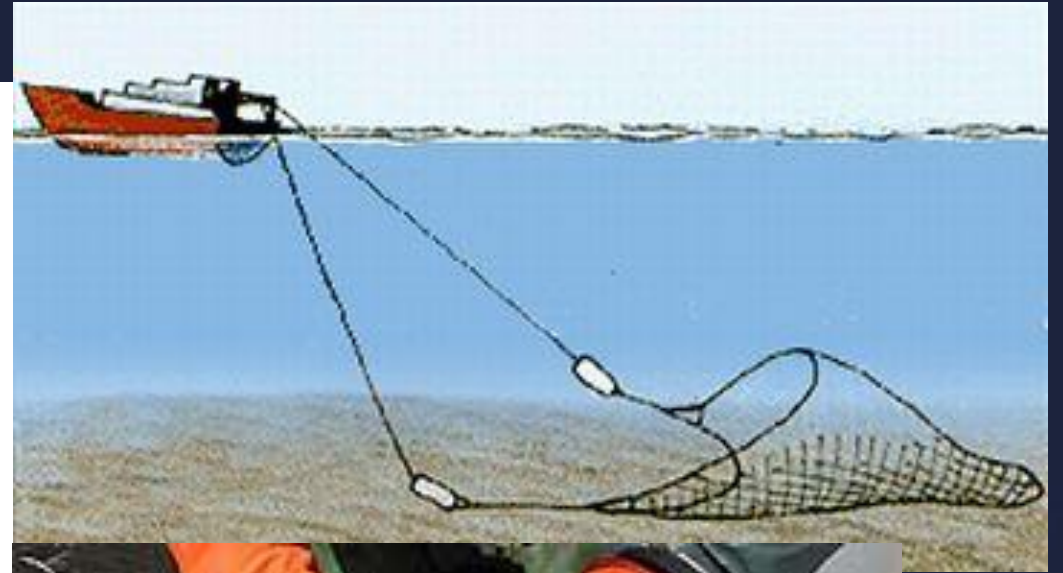
- Population trends over time



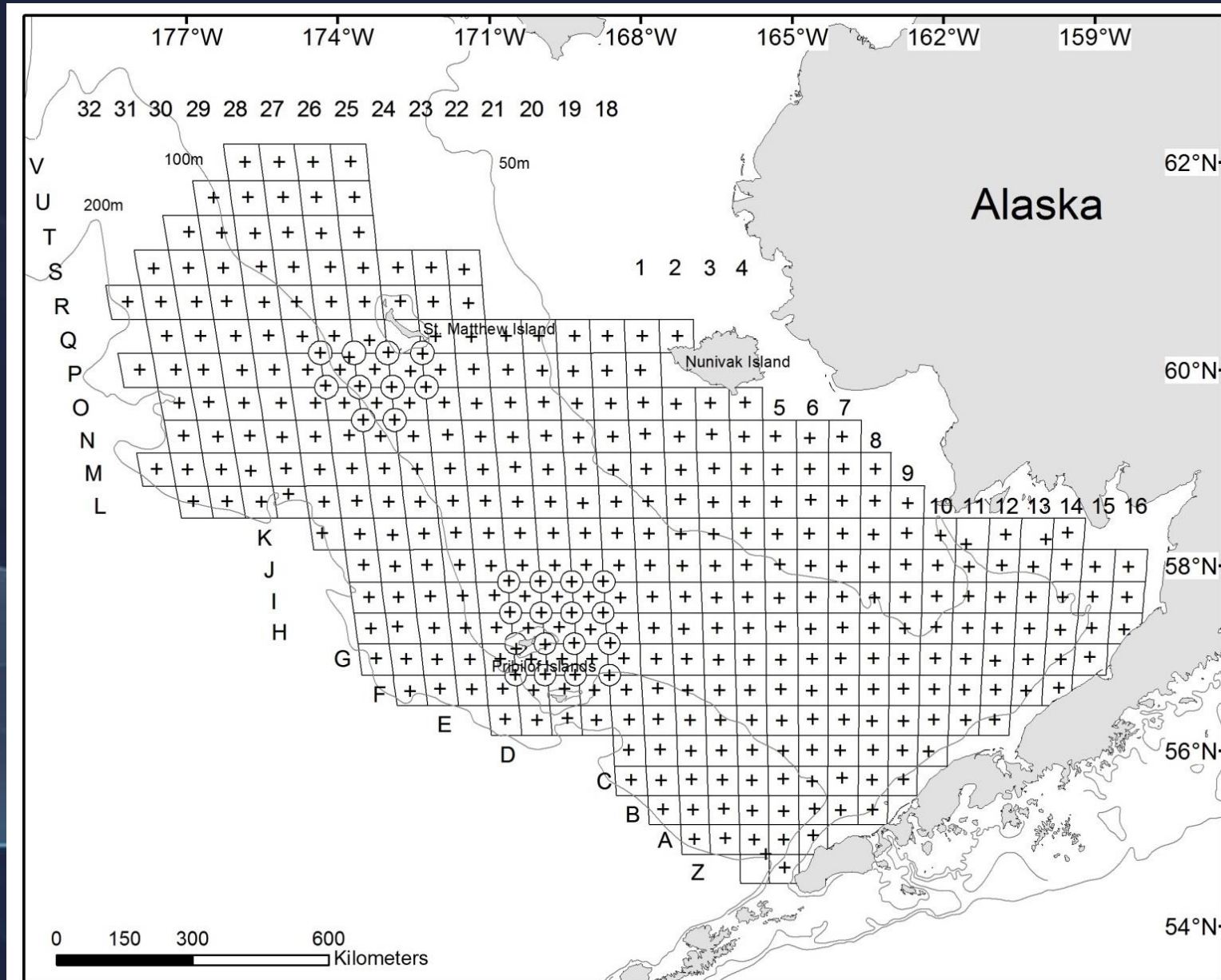
Bottom Trawl Surveys



The chartered fishing vessel *Vesteraalen*. (Photo by Jay Orr)



NMFS Crab Surveys

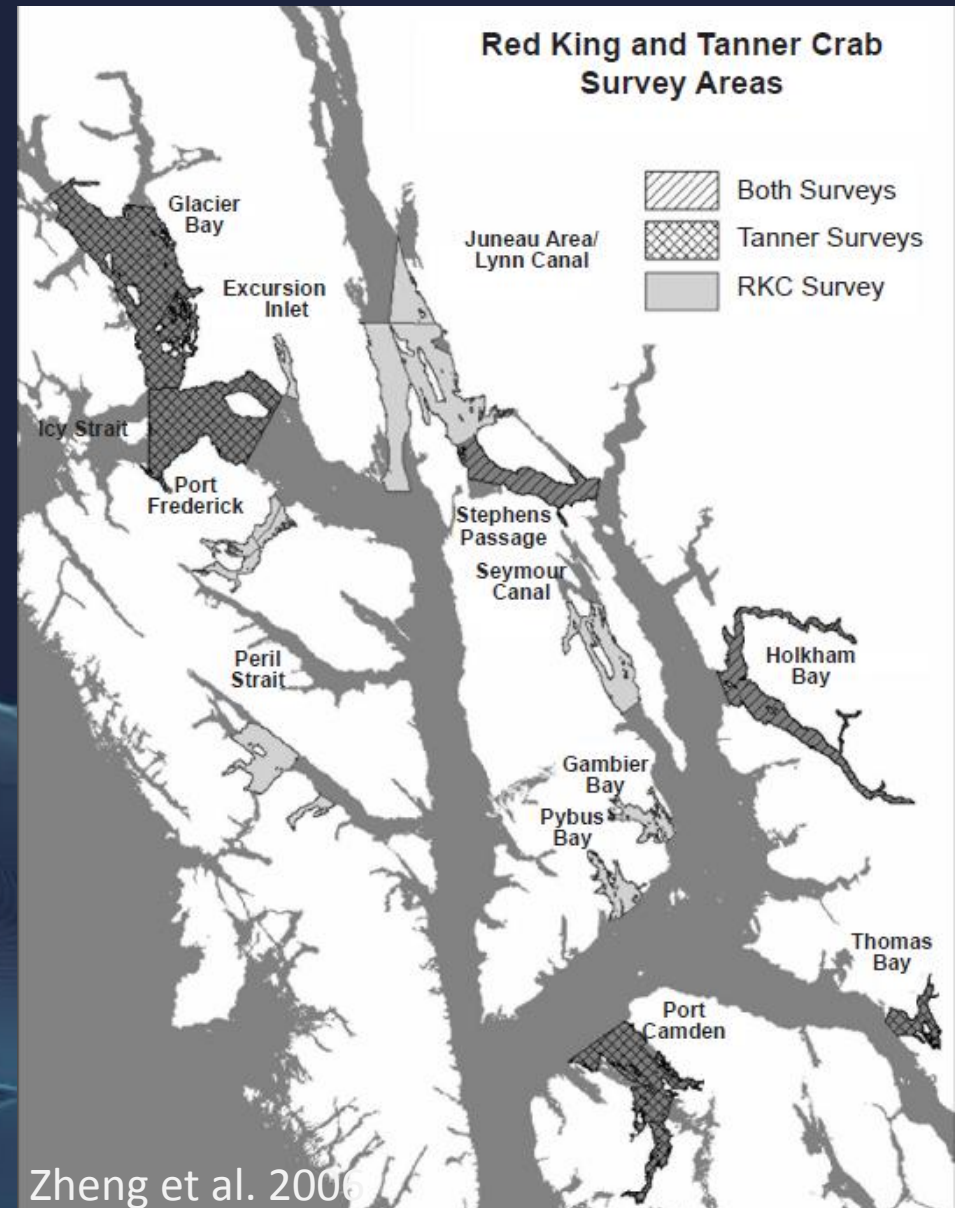






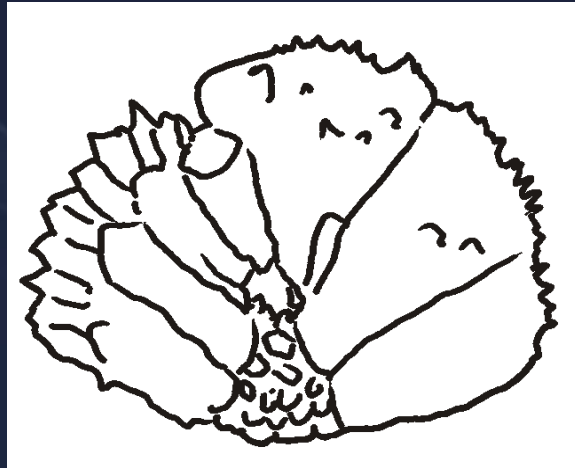


ADF&G Pot Surveys



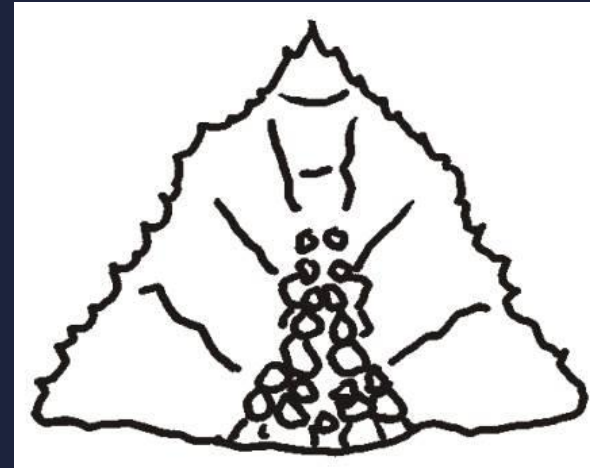
Biological Data Collection: Sex

Female

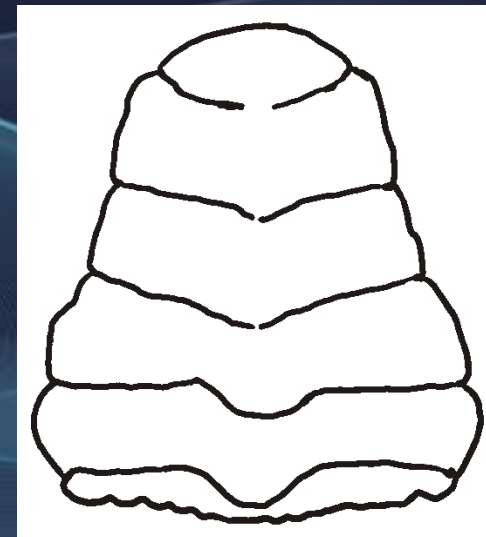
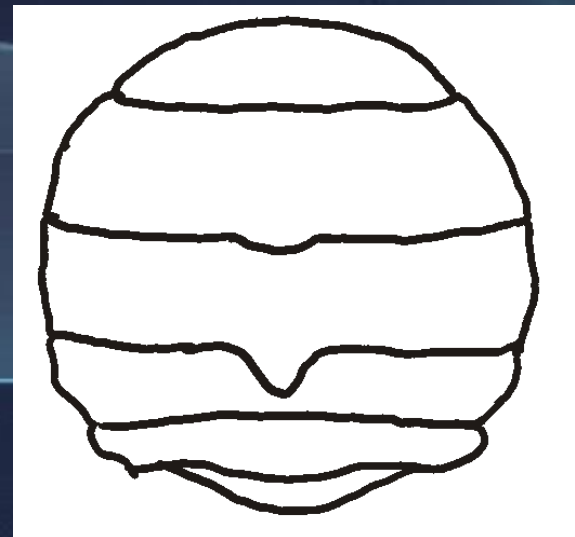


King

Male

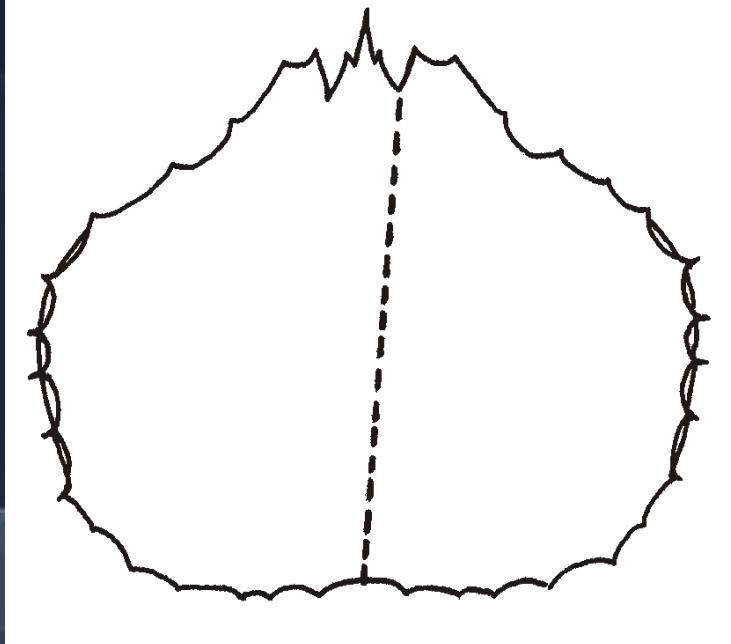


Snow
Tanner
Dung.



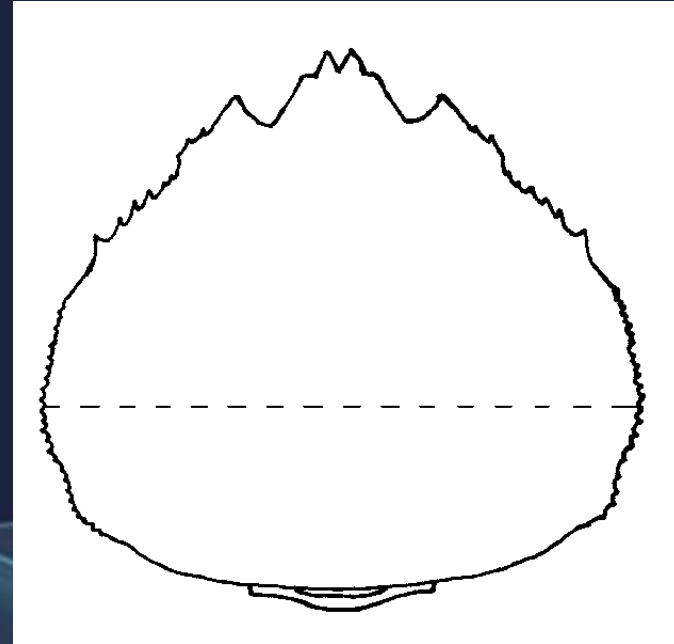
Biological Data: Size

Carapace length



King crabs

Carapace width

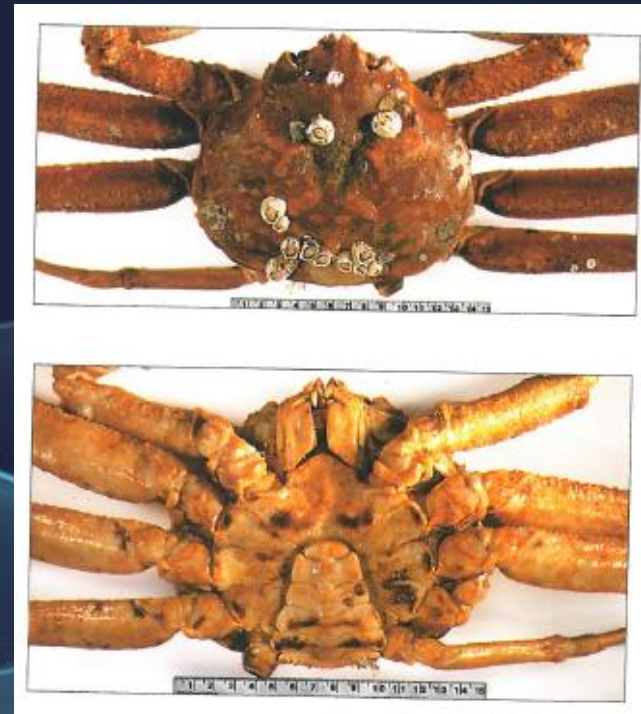


Snow, Tanner, Dungeness

Biological Data Collection

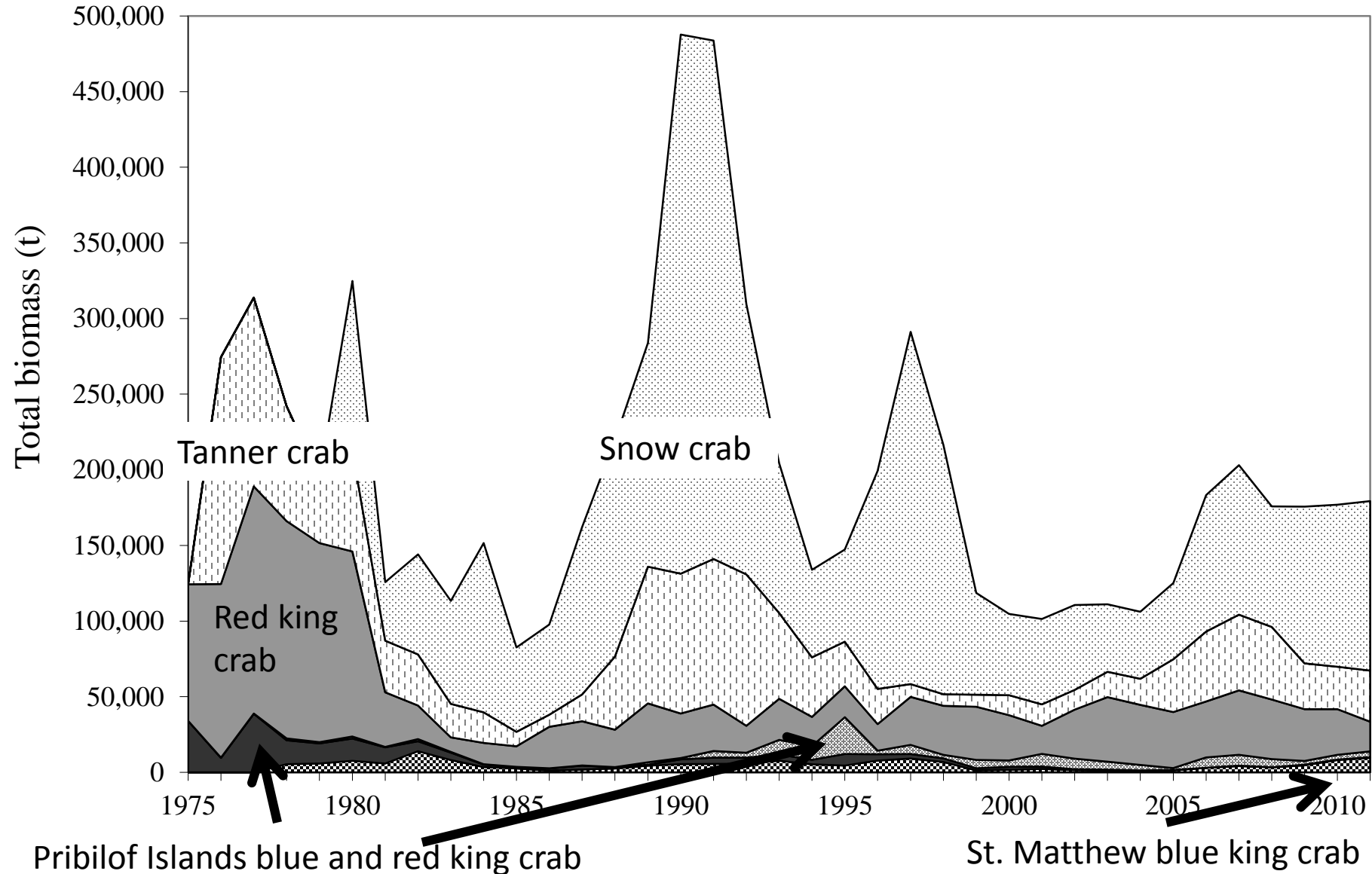
Shell condition: proxy for age

- 0 Molting
- 1 Soft
- 2 Hardshell (new, clean)
- 3 Oldshell (slightly worn)
- 4 Oldshell (worn)
- 5 Very Oldshell

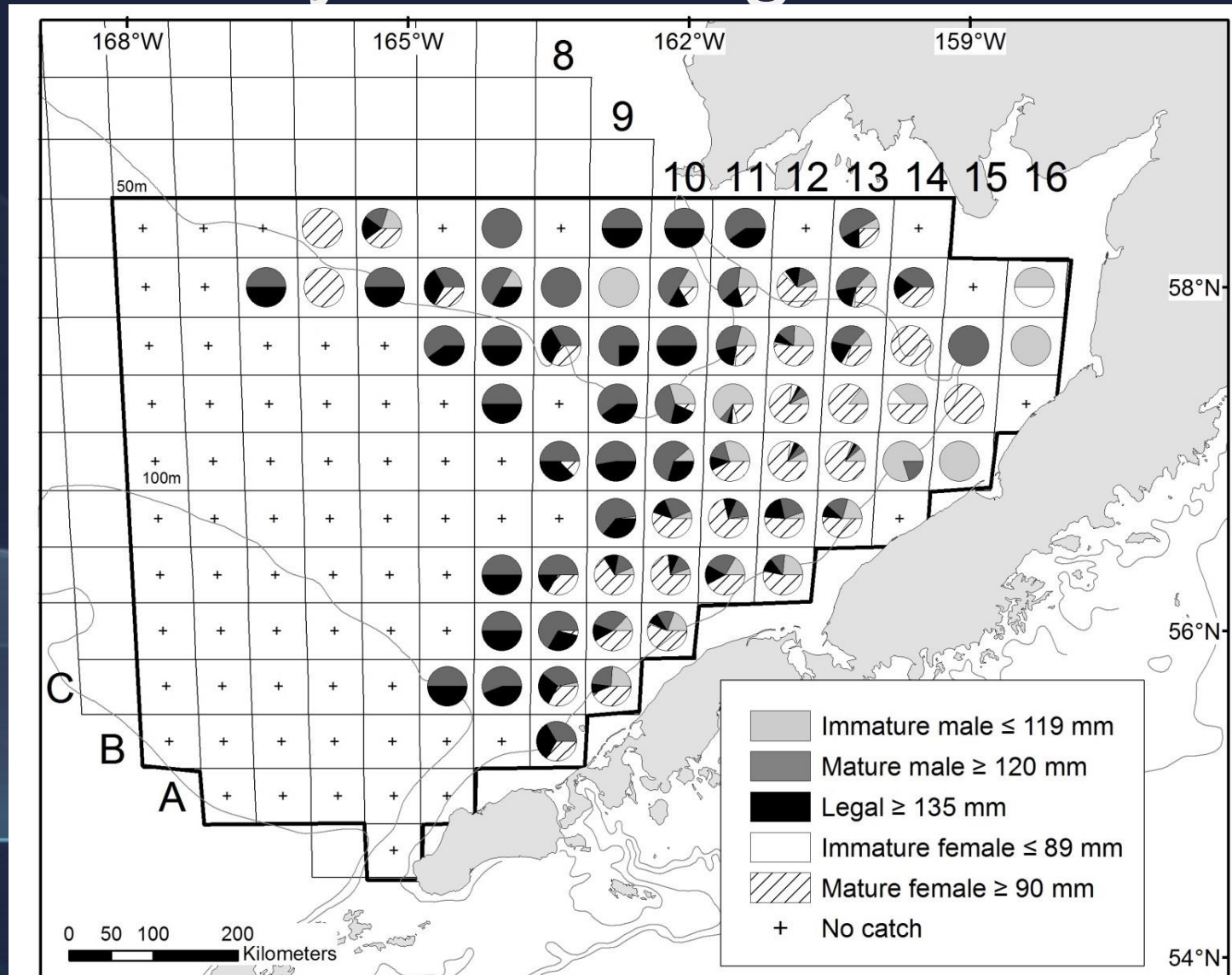


Eastern Bering Sea Crab Stocks

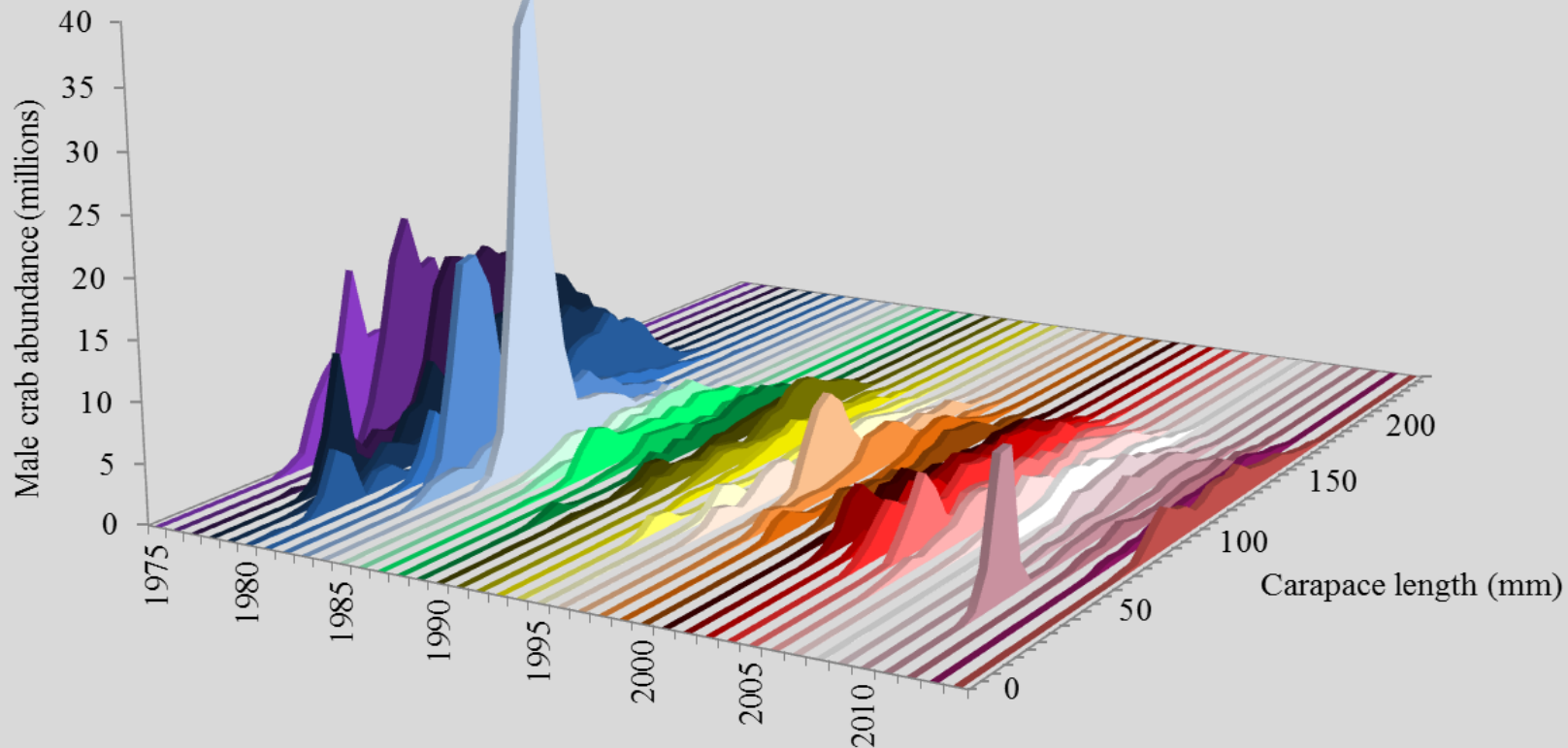
Mature Male Biomass



Spatial Distribution: e.g., Bristol Bay Red King Crab



Size Distribution: Bristol Bay Red King Crab



Abundance Index

Life History Data

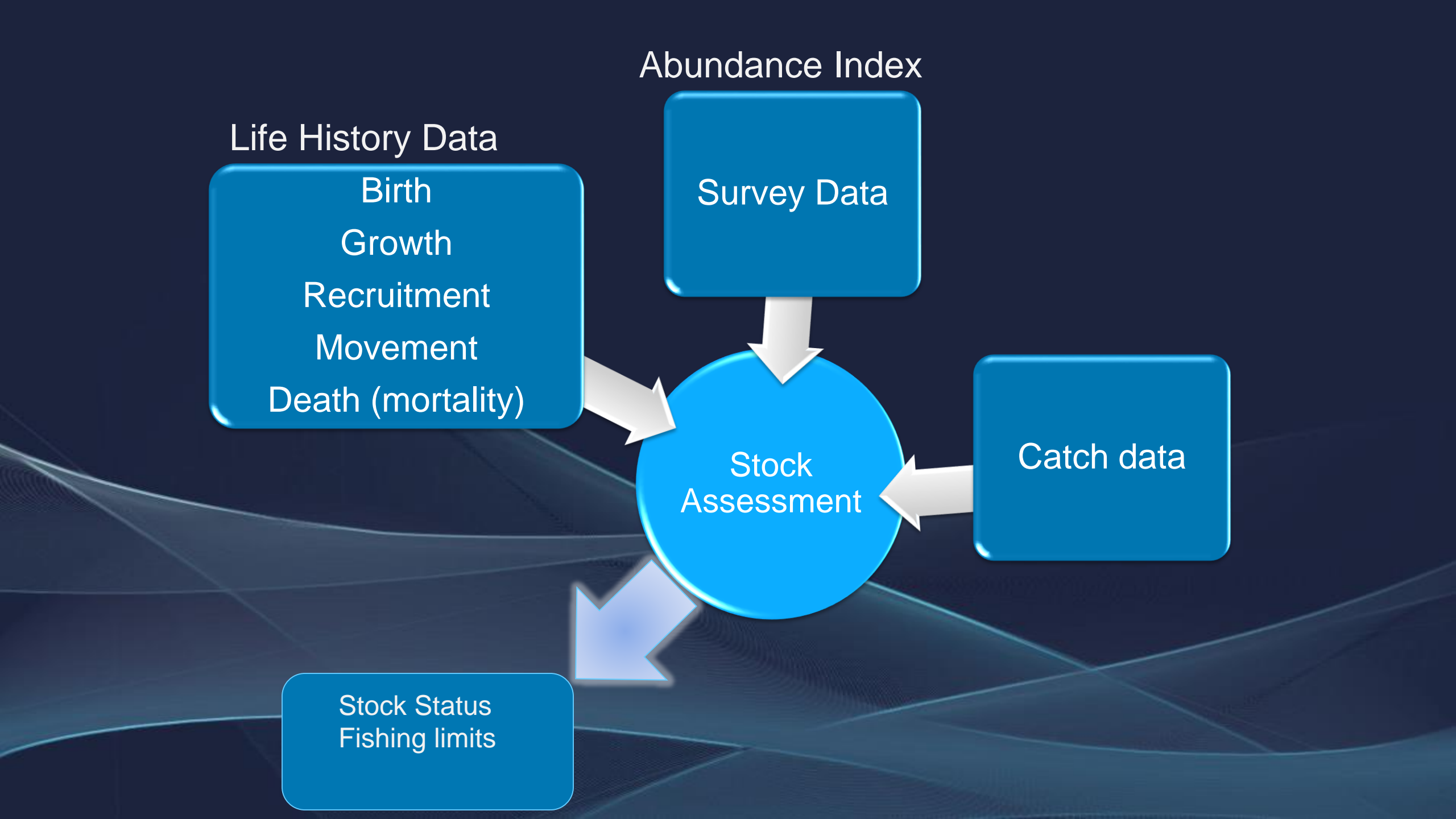
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- Recruitment
- Movement
- Death (mortality)

Survey Data

Catch data

Stock Assessment

Stock Status
Fishing limits



Survey Data

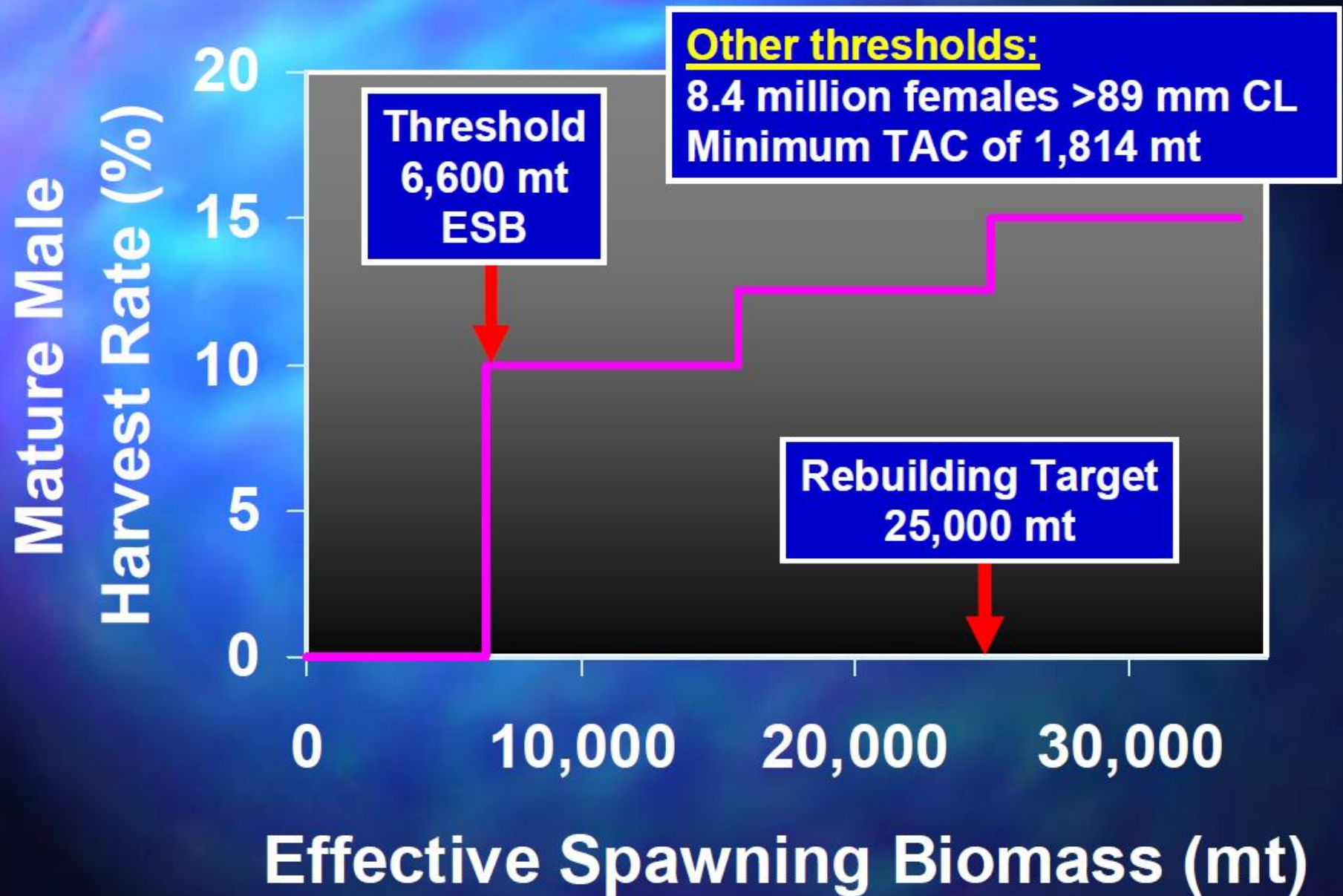
- Estimate abundance, biomass, and size distribution
- Population above critical thresholds?
 - Used as benchmark for harvesting a given stock
 - Exploitation rates then applied to estimate of population abundance to calculate TAC

Other Data for Stock Assessment Models

- Observer data: (e.g., size, sex)
- Dockside sampling (e.g., size, shell condition)
- Landings (# crabs, total weight)



Bristol Bay RKC Harvest Strategy



Recap Bearing Sea Crab

- Fisheries Assessments
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Self Check

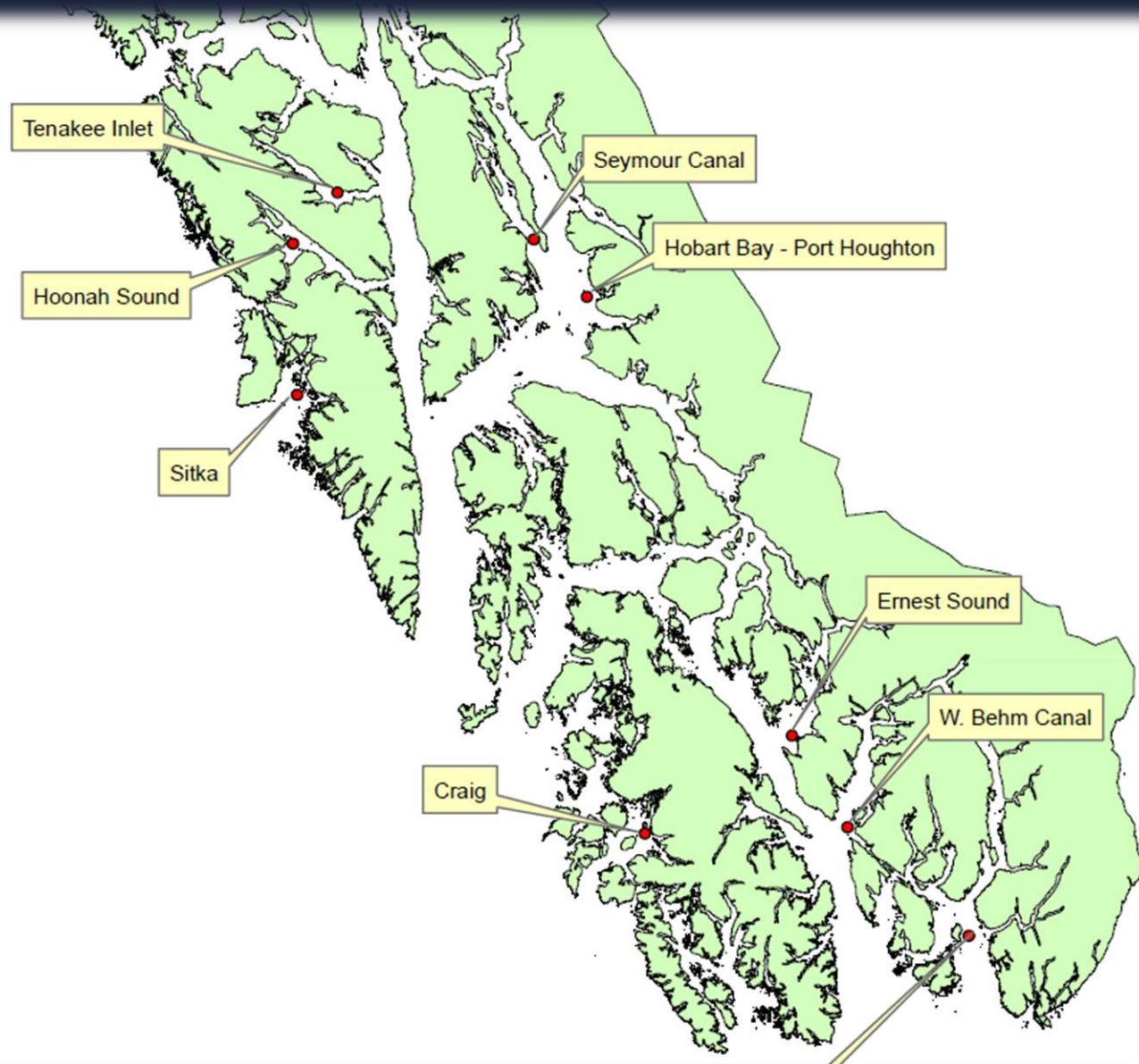
- There are currently 9 king crab fisheries in operation in Alaska
 - True
 - False
- The crab indicated on the picture below represents a
 - Male
 - Female



SE Sac Roe Herring



SE Herring Fisheries



Herring Assessments

- Aerial Survey of Spawn
- Spawn Deposition Dive Survey (Spawning biomass estimate)
- Samples for AWL
- Cast net samples
- Commercial fishery samples
- Winter test fishery samples
- Other – fecundity, juvenile sampling

Aerial Surveys



24. 4. 2006

Survey of Spawn

- Fly coastline and record miles of spawn

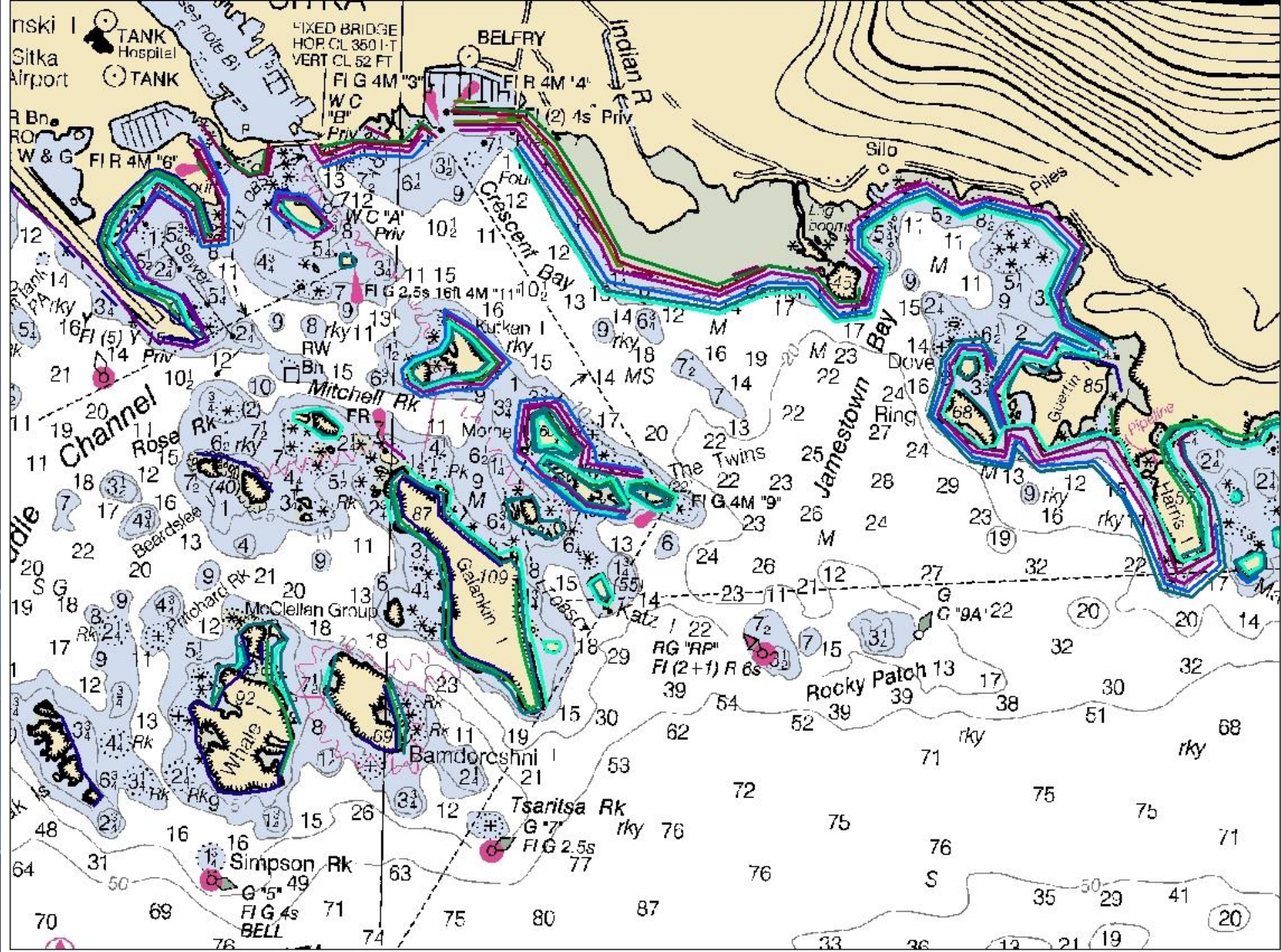


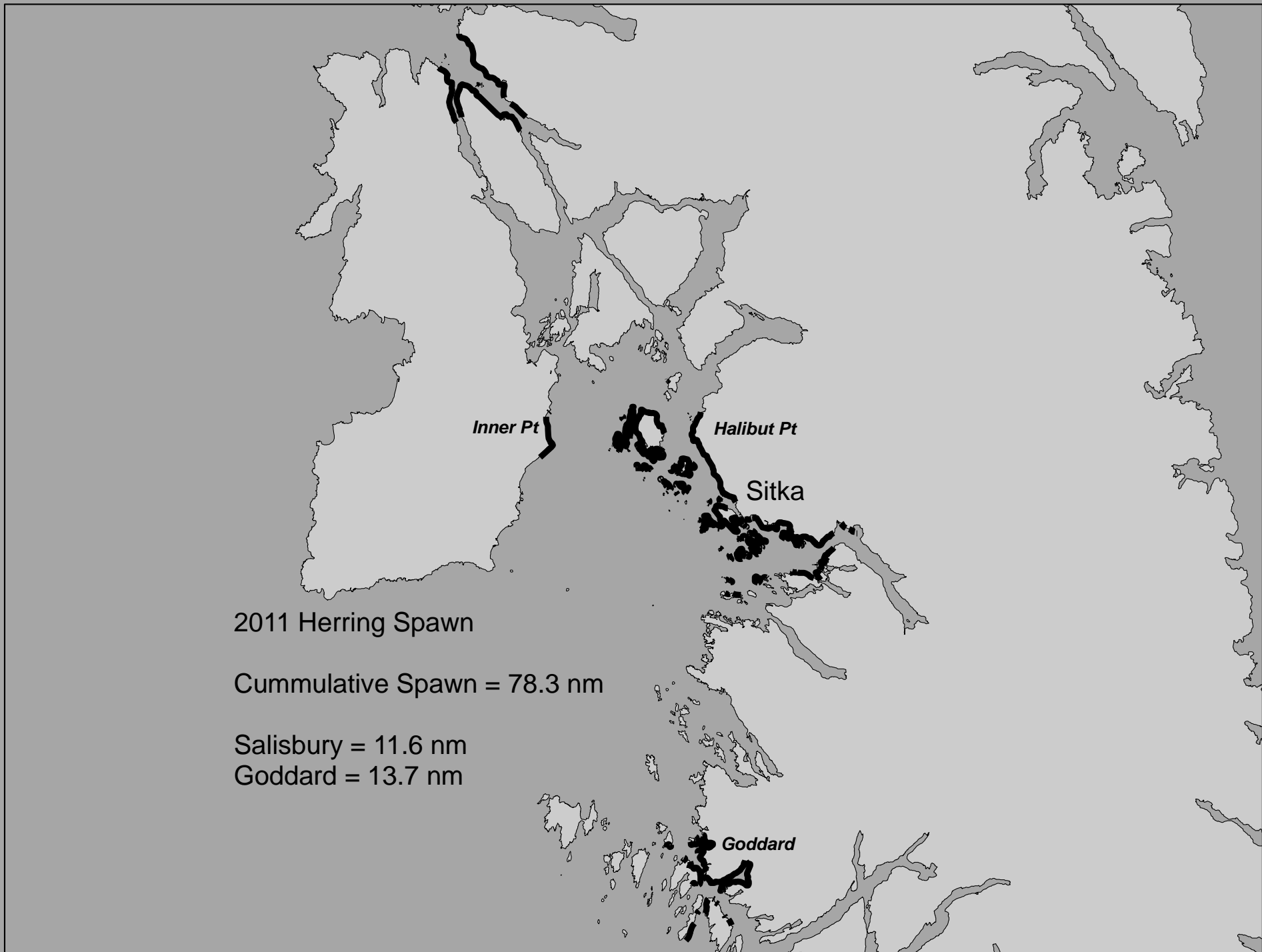
Herring Spawn

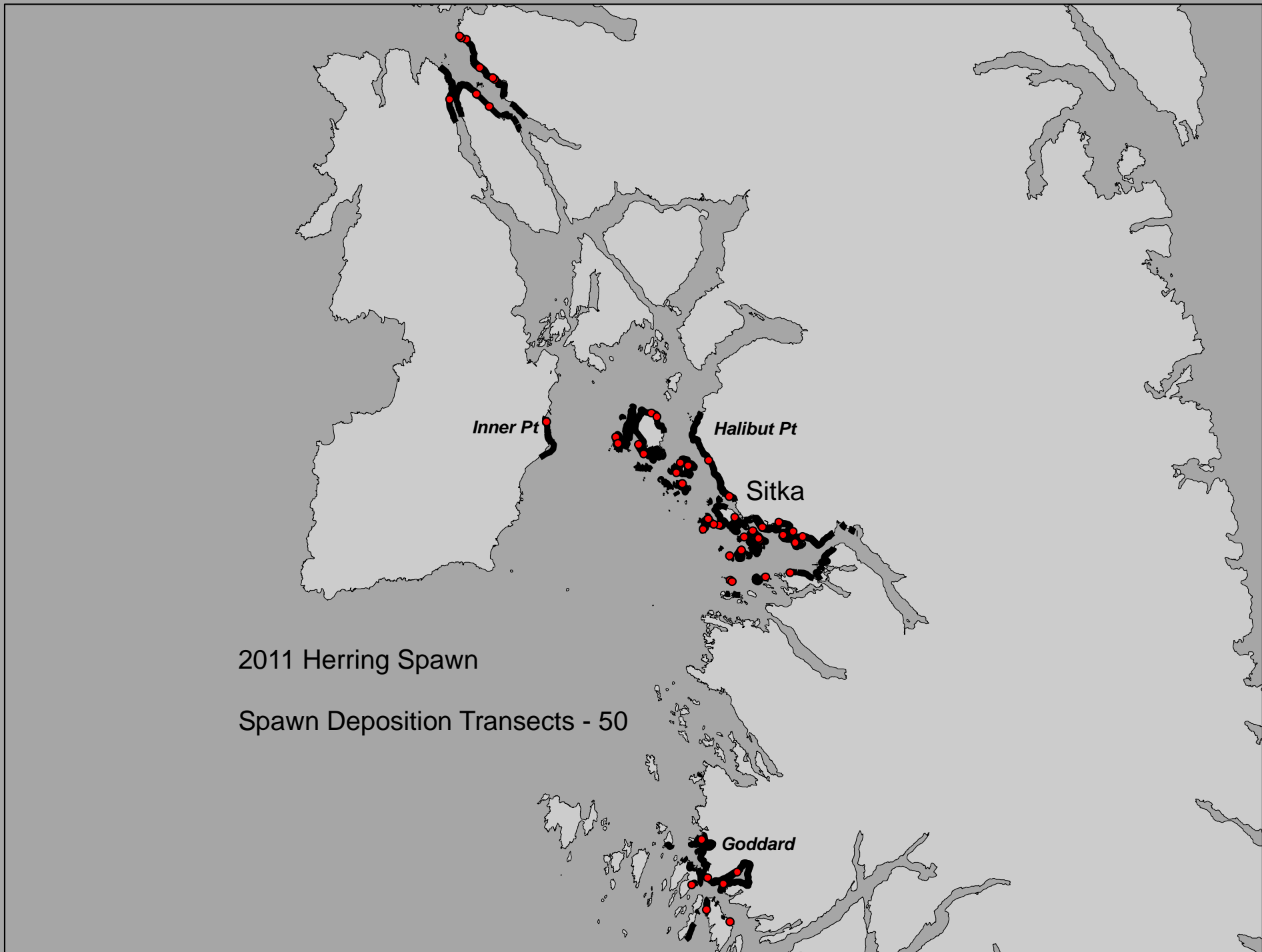












2011 Herring Spawn

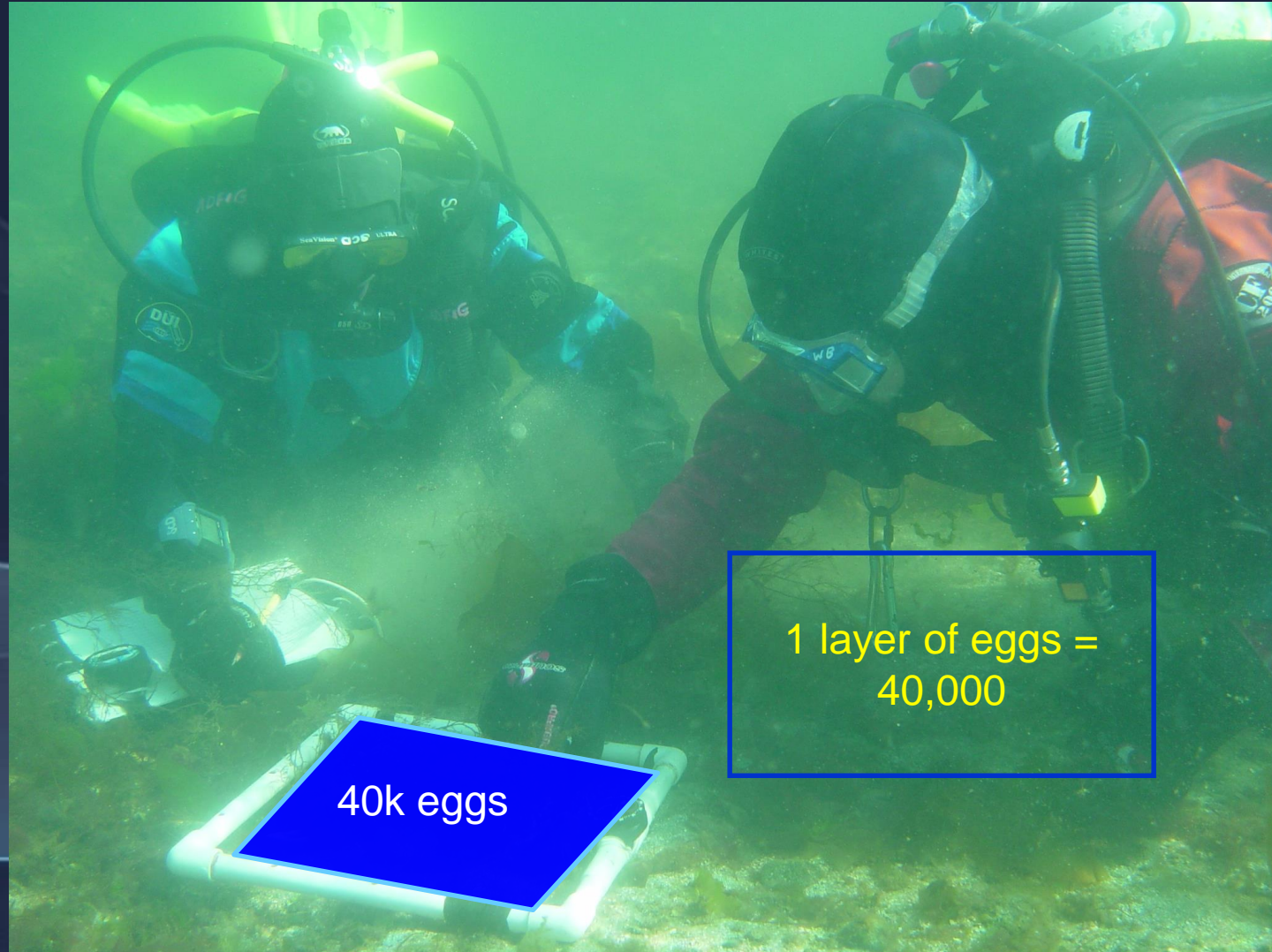
Spawn Deposition Transects - 50

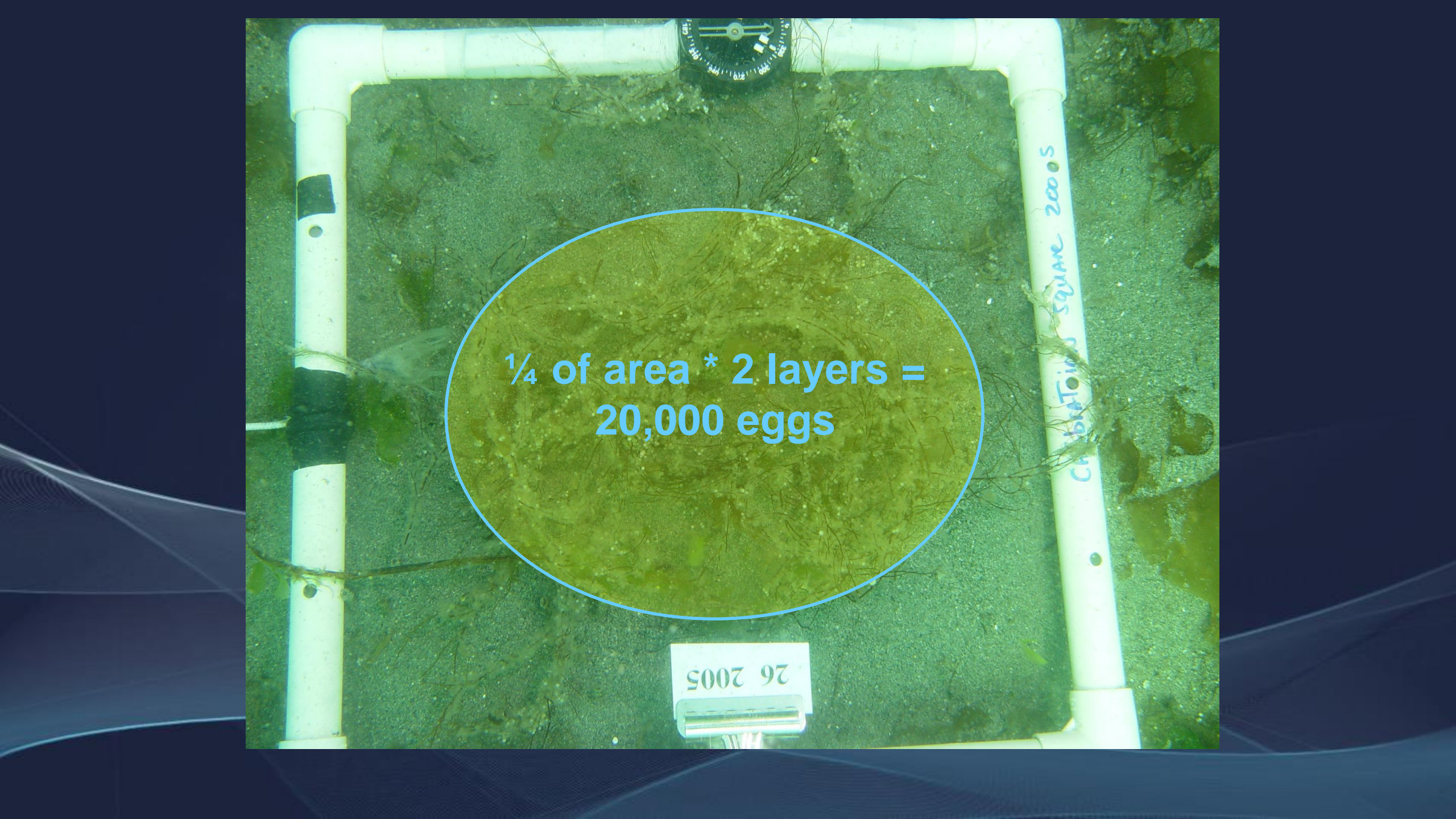


Intertidal Spawn Survey



Dive Team on Transect





$\frac{1}{4}$ of area * 2 layers =
20,000 eggs

26 2005

Herring Spawn

Eel grass



Hair kelp



Fucus (Popweed)



Macrocystis



Spawn Deposition

- Aerial survey mapping – length (m)
- Dive Survey –
 - Average width of spawn (m)
 - Average Density of eggs (eggs/m²)

Length (m) x width (m) x eggs (eggs/m²) = total eggs spawned

10% standard adjustment for egg loss due to predation, etc

Use fecundity-weight relationship to convert to number of herring.

Cast Net Samples

- Samples taken during active spawning over large area
 - Sample goal: 500 fish
- Provides estimate of spawning population age composition

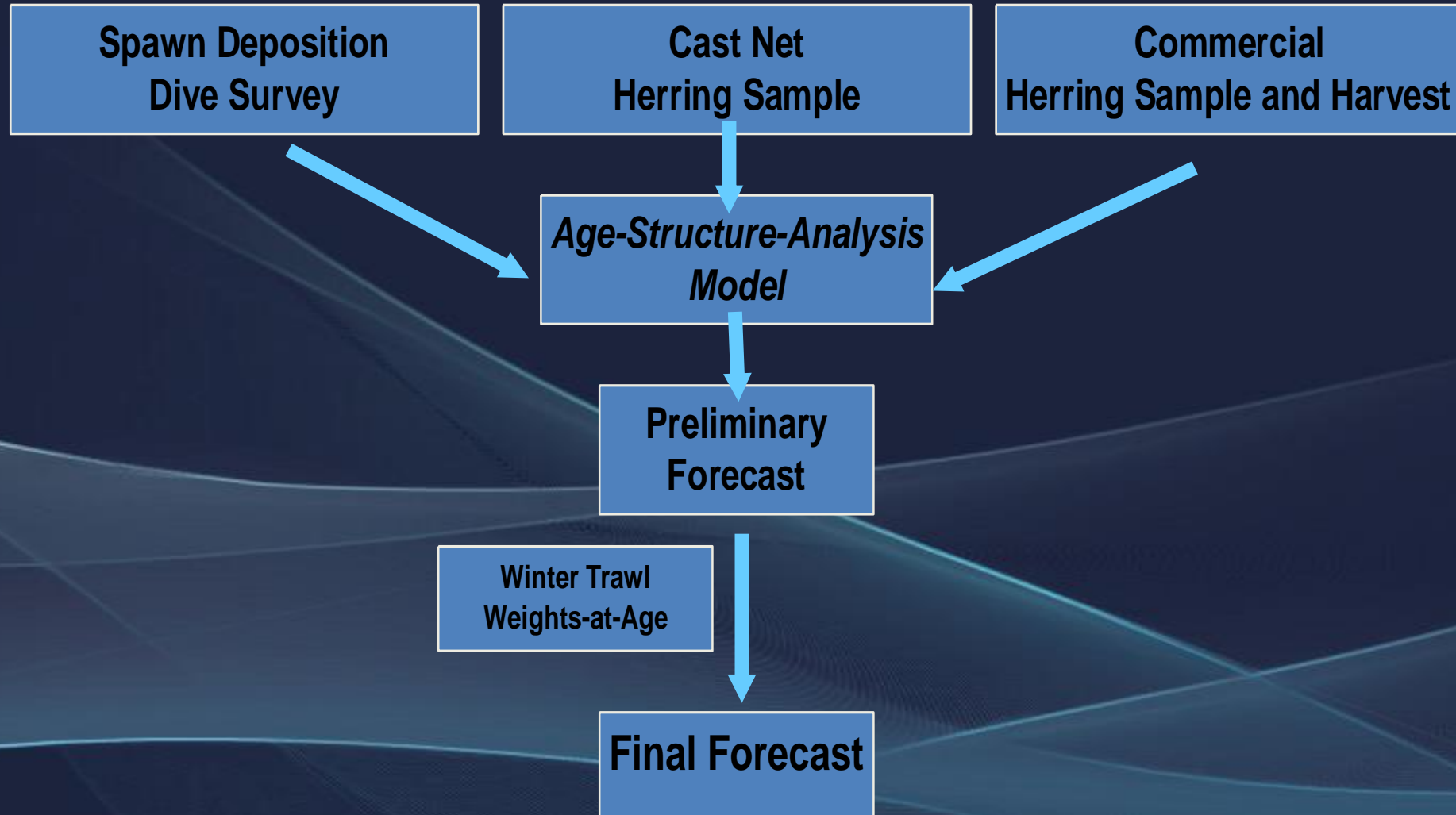


Commercial fishery samples



- Samples taken during commercial sac roe fishery from several boats from each opening
- Sample goal: 500 fish
- Estimates of
 - catch age composition
 - weight at age

Data Inputs ASA Herring Forecasting Model



Model Outputs



Number of herring in population at age in 2011

Survival rate = Proportion of herring that survive
year 1 to year 2

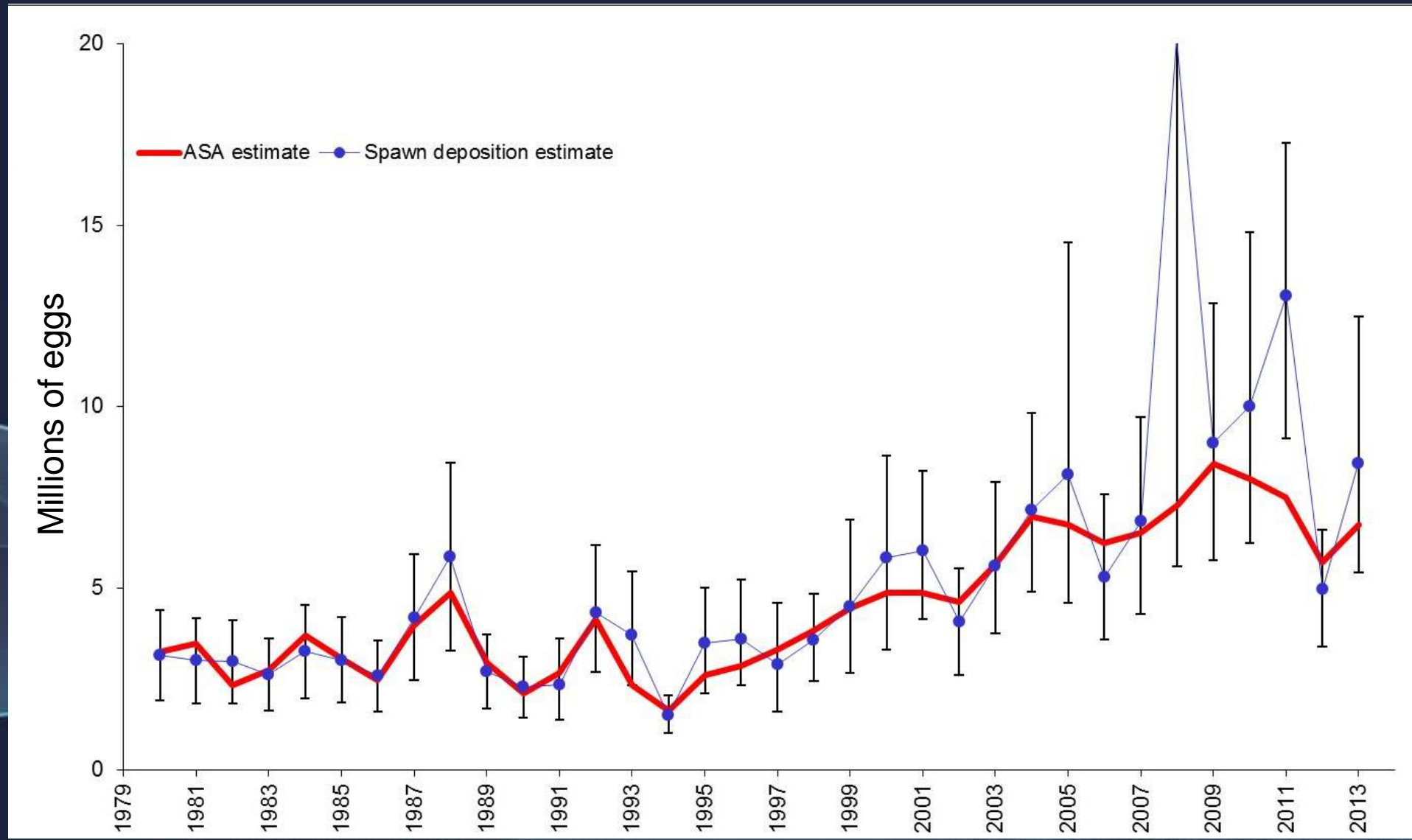
Age Specific Maturation rate

Recruitment



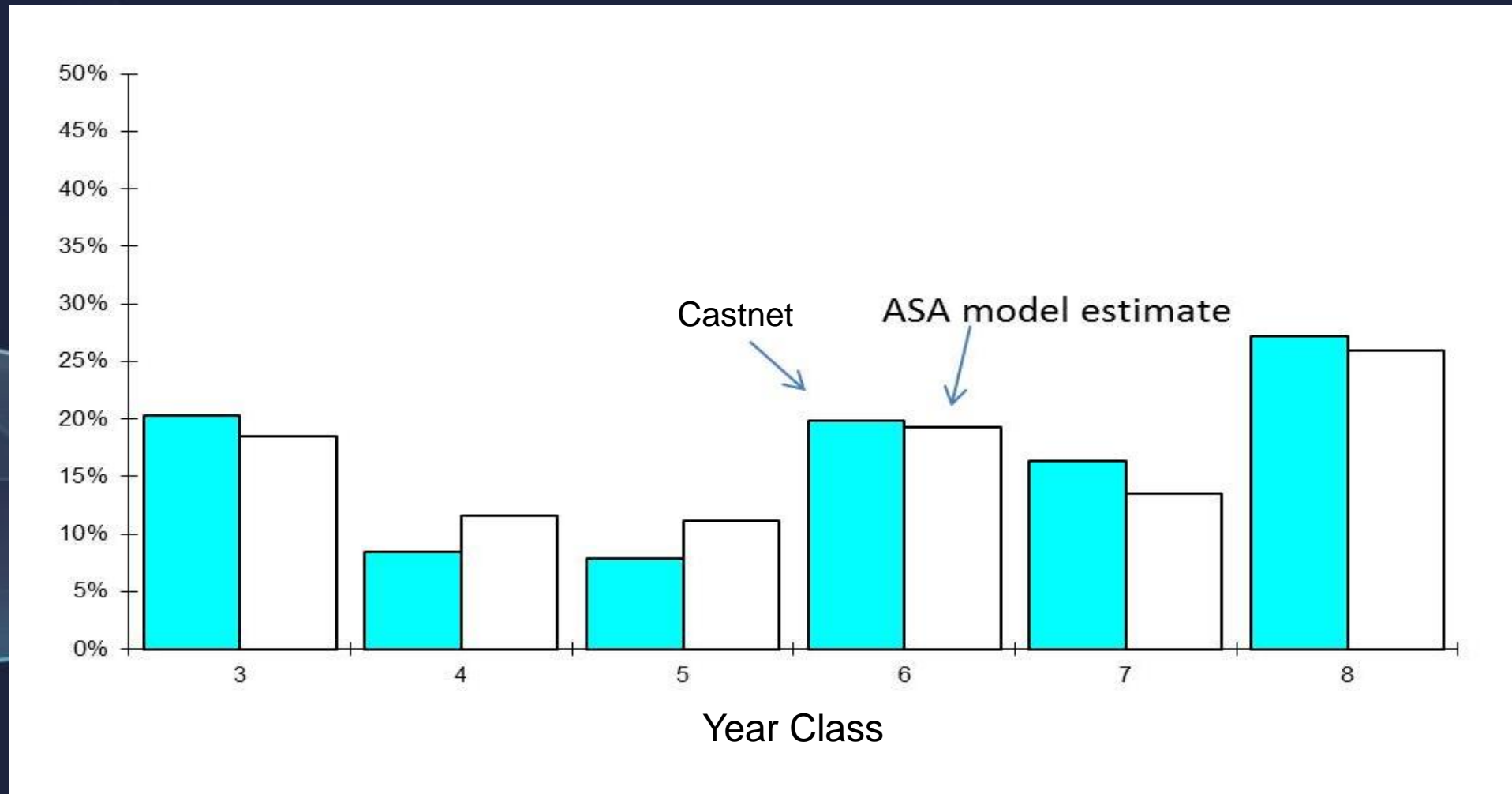
Forecast

Herring Egg Estimates



Model truthing

- Compare castnet age class to ASA Model





**Dip netting herring from
test set**

**Need three 10-kg
samples**



Industry roe technicians working up samples

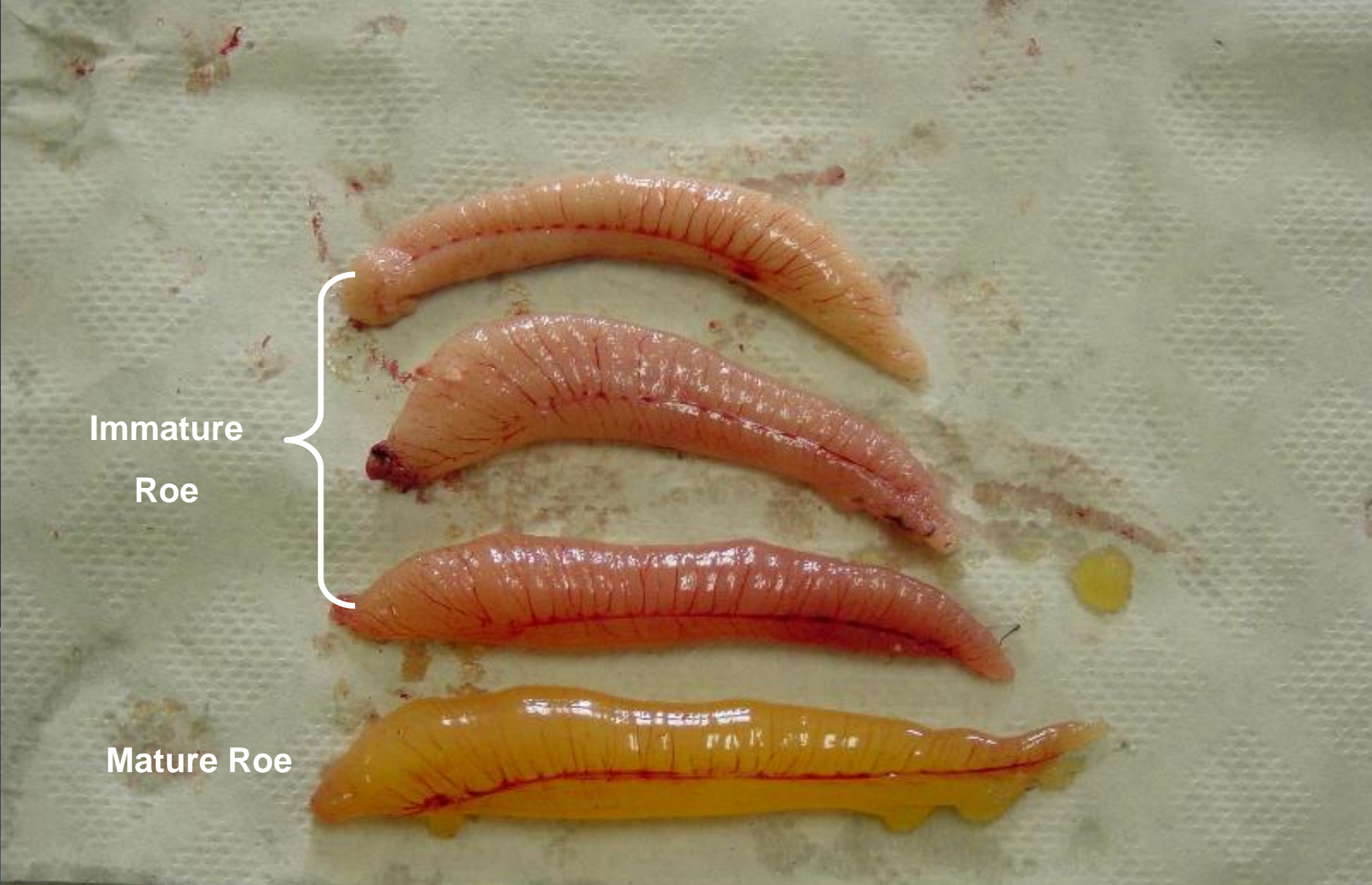


DANCE
25 05
Rocky Patch
28 30
150 T 4
1 02

Immature
Roe

Mature Roe

Progression of roe maturation



Regulatory Framework for Sitka Sound Herring

- Limited Entry – 48 Permits
- Gear – Purse Seine: 200 fms/1700 meshes
- Season and area– Emergency Order
- Sliding Harvest Rate 12-20% from 25,000-45,000 tons. No harvest below 25,000 tons.
- Manage for Sac Roe Recovery of at least 10%
- Mgt Plan for consideration of Subsistence

Recap SE Sac Roe Herring

- Fisheries Assessments
- Management Approaches
 - MSY
 - Quotas
 - Legislation
 - Closures
 - Gear Restrictions
- Ecosystem Based Management
 - Reduce bycatch
 - Marine reserves
 - Monitoring of population characteristics
 - Catch share programs
 - Ecologically sustainable yield

Self Check

- The abundance of herring are estimated using multiple survey techniques
 - True
 - False
- Which of the following is NOT used in modeling herring abundances
 - Spawn Deposition
 - Dive Surveys
 - Cast Net Surveys
 - Commercial Harvest Samples
 - Winter Test Fishery
 - All of the above are used in modeling herring abundance

Outline

Recap – Emerging Management Techniques

Applying Management to Alaskan Fisheries

- PWS Salmon
- Bering Sea King Crab
- Southeast Sac Roe Herring

Economics – In 32 Words

- Government's view of the economy could be summed up in a few short phrases: If it moves, tax it. If it keep moving, regulate it. And if it stops moving, subsidize it.
- Ronald Reagan