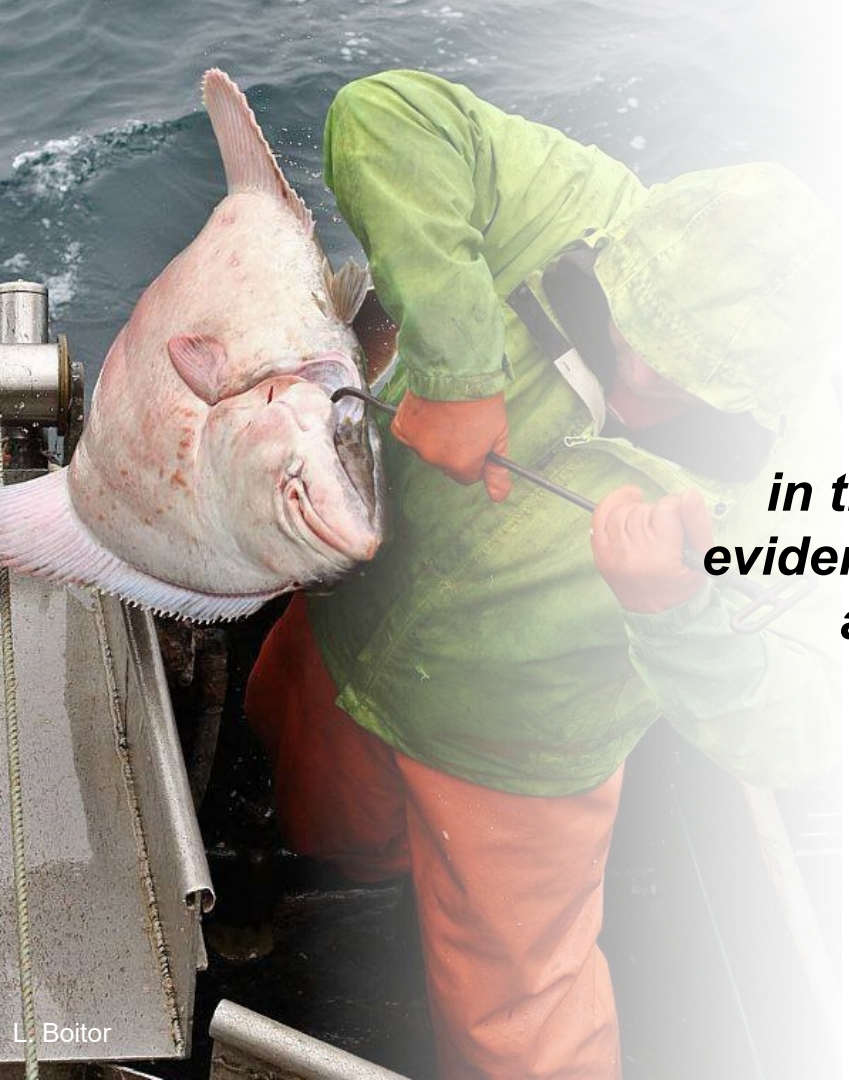

INTERNATIONAL PACIFIC HALIBUT COMMISSION

Movements of Pacific halibut *(Hippoglossus stenolepis)* *in the Bering Sea and Aleutian Islands: evidence of variance in relative connectivity and regional spawning dynamics*

Tim Loher

PISCES 2019: W2

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→ Noting that these concepts are intrinsically linked

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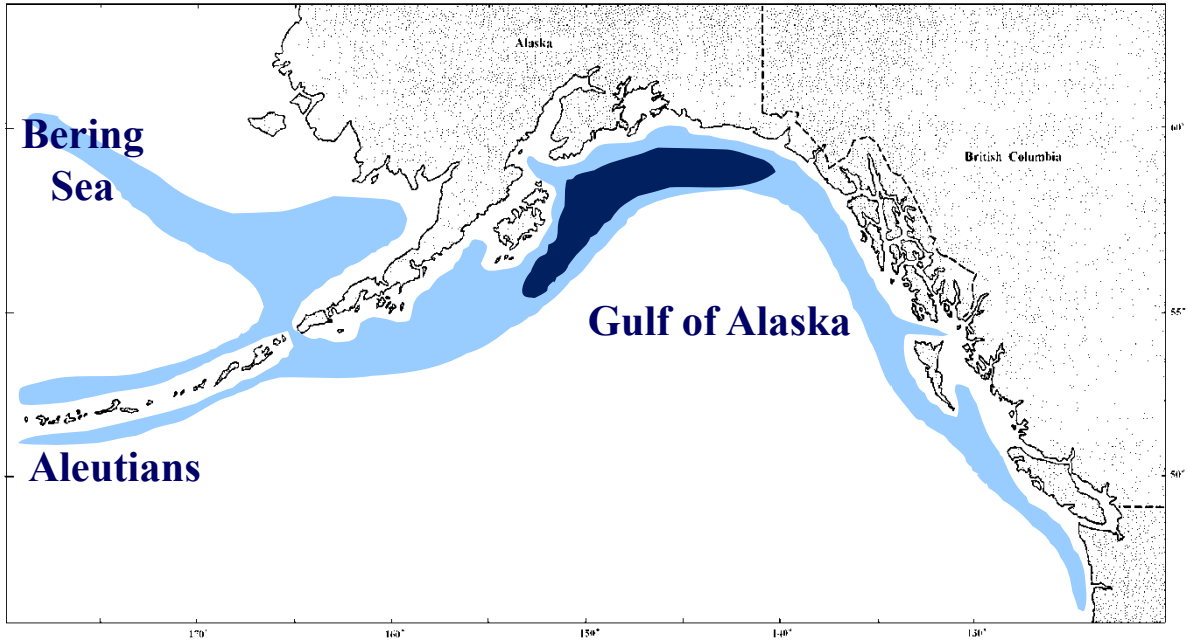

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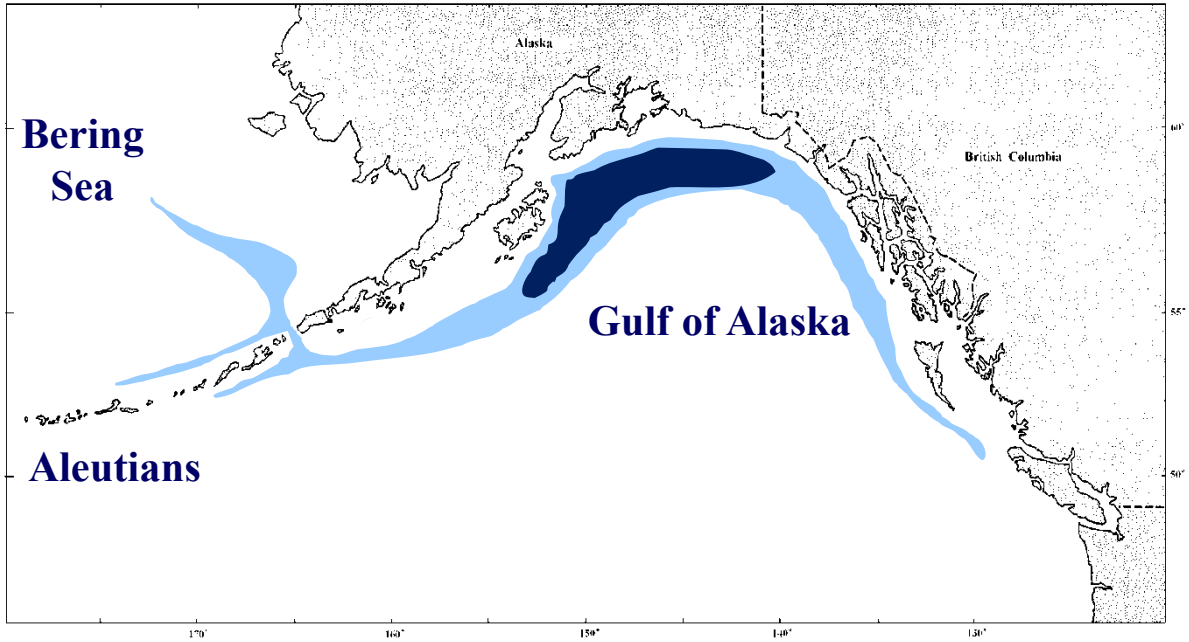

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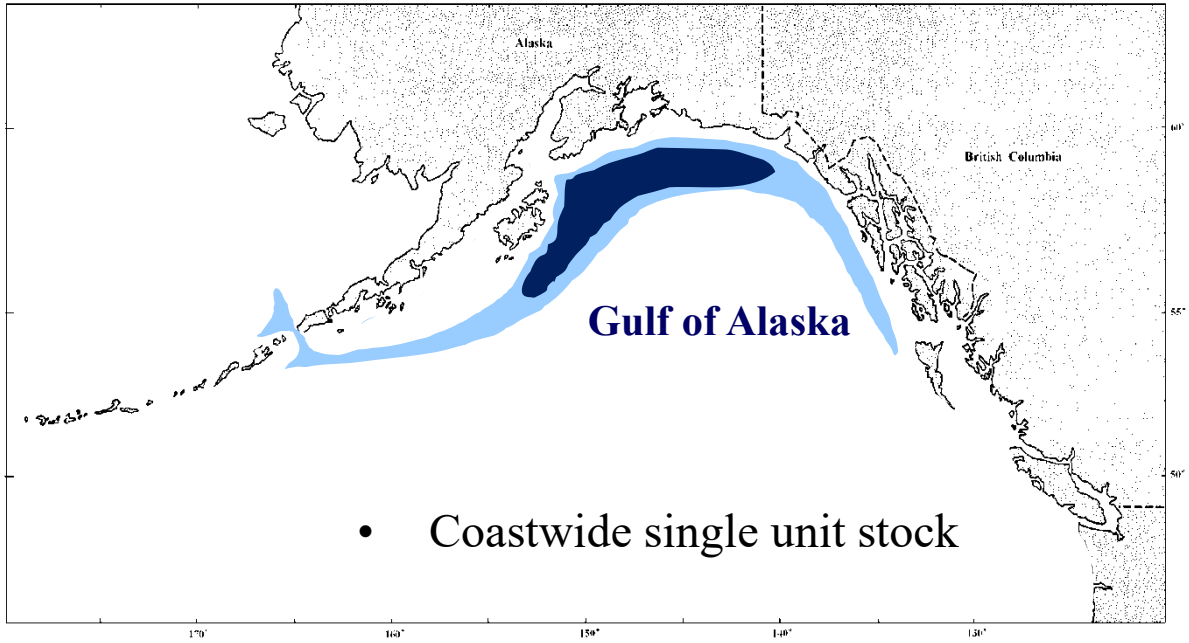

- Coastwide single unit stock

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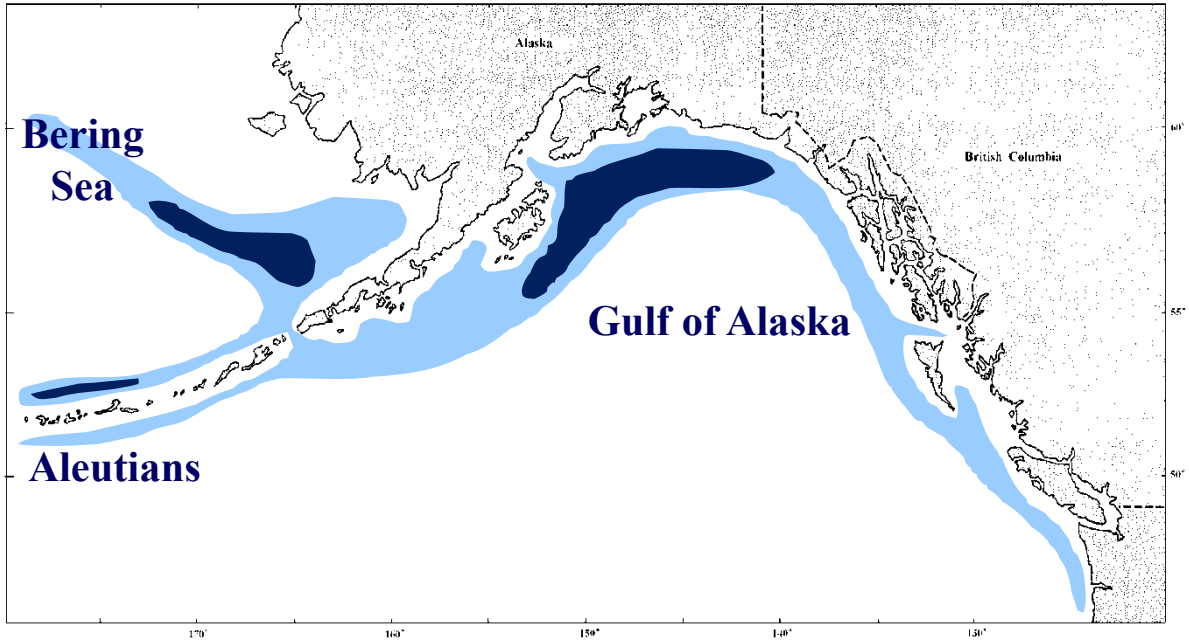

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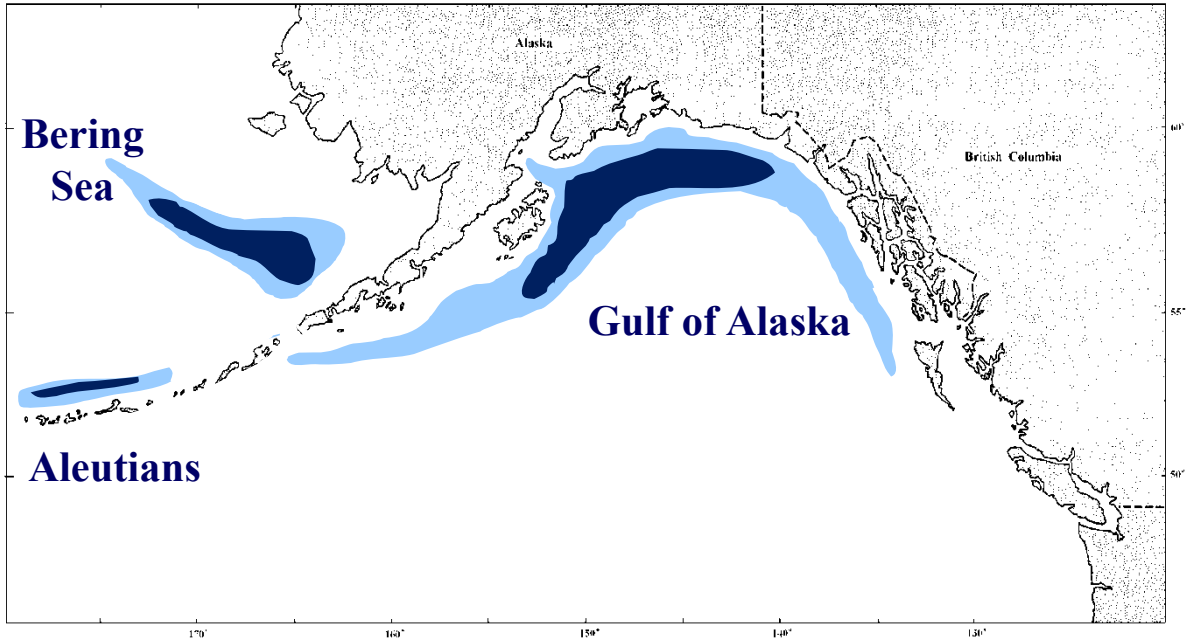

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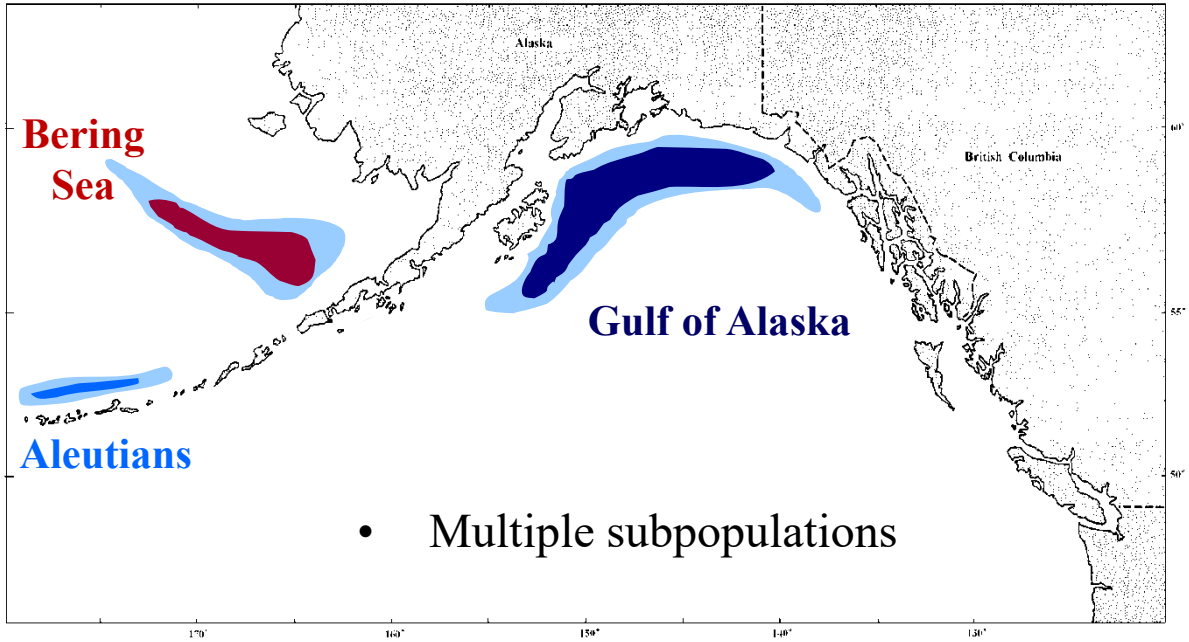

- Multiple subpopulations

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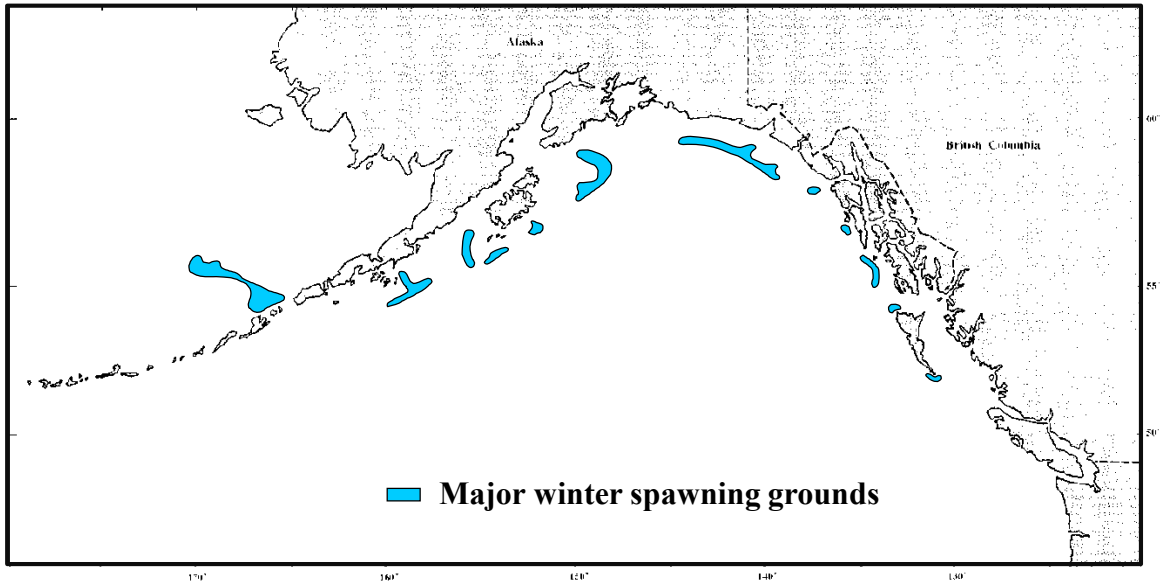
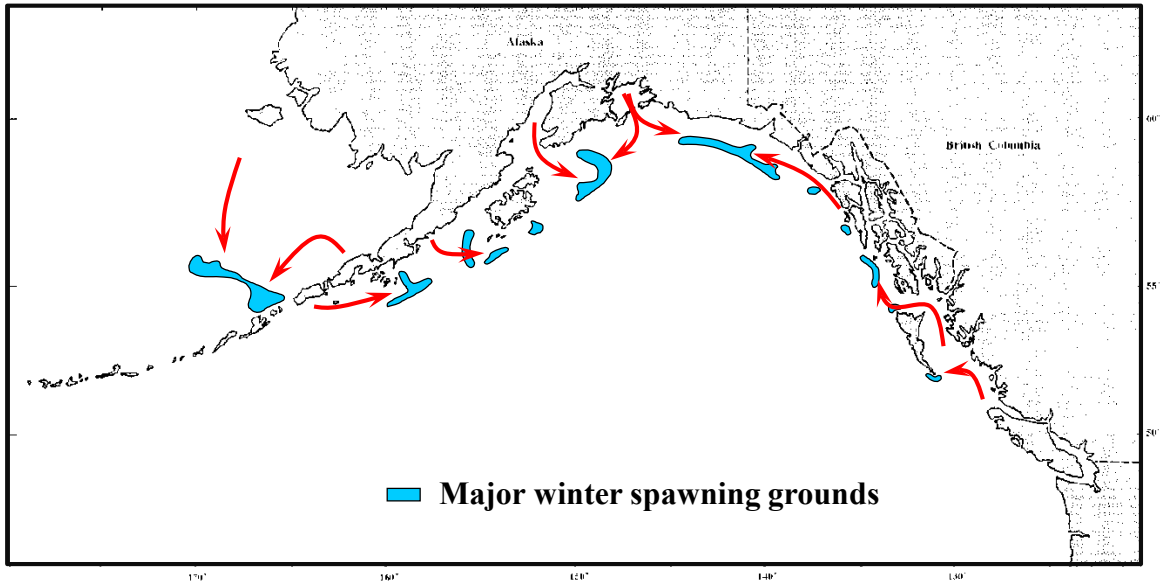


Why is dispersal important?

Seasonal migratory behavior

- Timing is everything



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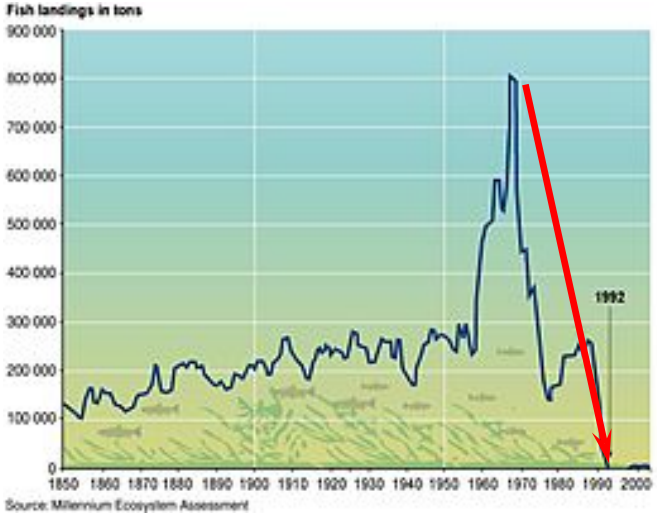

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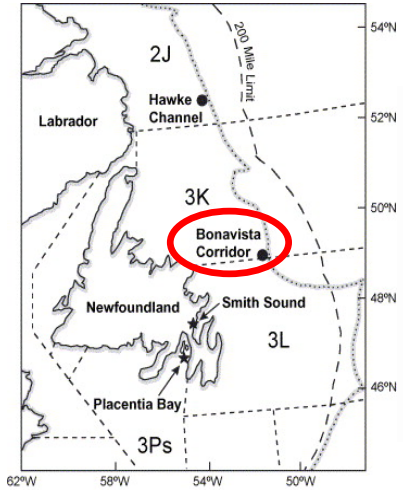
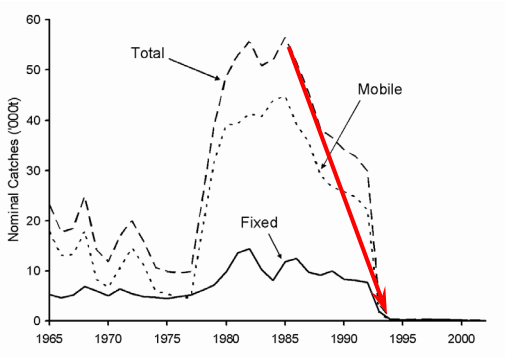


Sherwood and Rose, *Est Coast Shelf Sci* 63:537



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Seasonal migration: timing is everything

- Ecological considerations: regional and temporal variance

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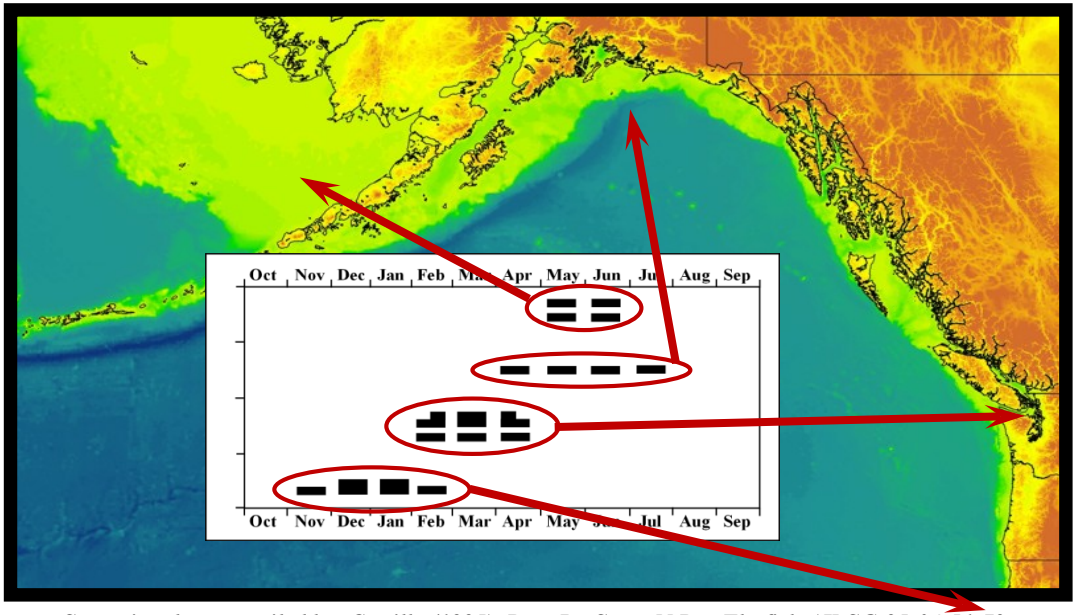
Here, starry flounder (Platichthys stellatus) :



Spawning data compiled by: Castillo (1995), Proc Int Symp N Pac Flatfish AK-SG-95-04:51-72

Study elements

Electronic archival tags: mark-report and so much more

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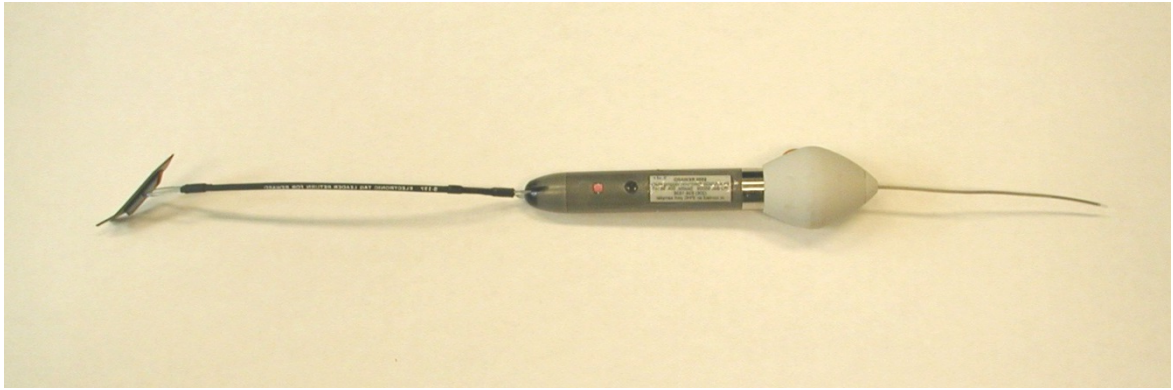

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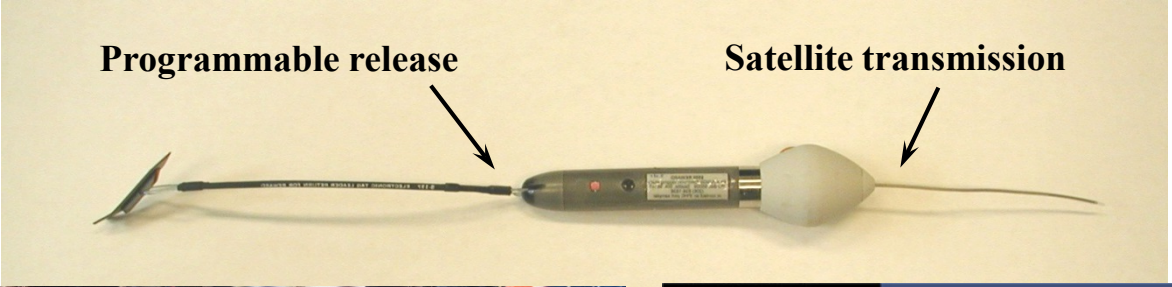
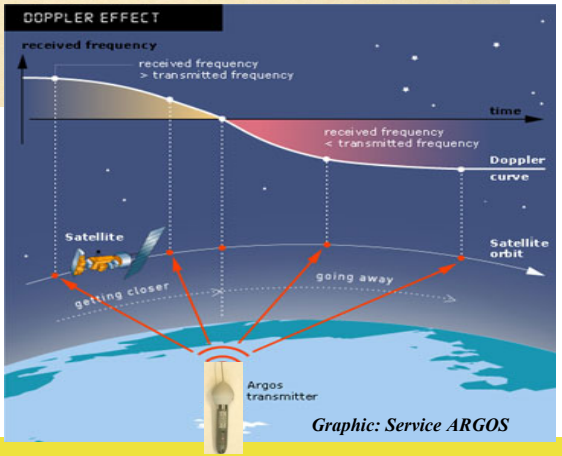
Electronic archival tags: *fishery independent* mark-report …





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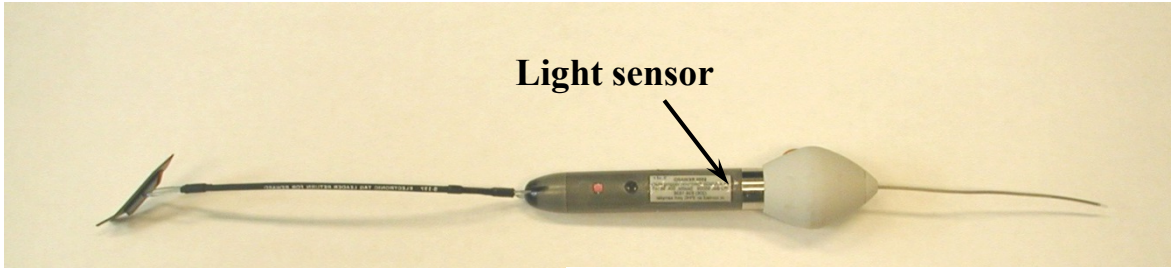
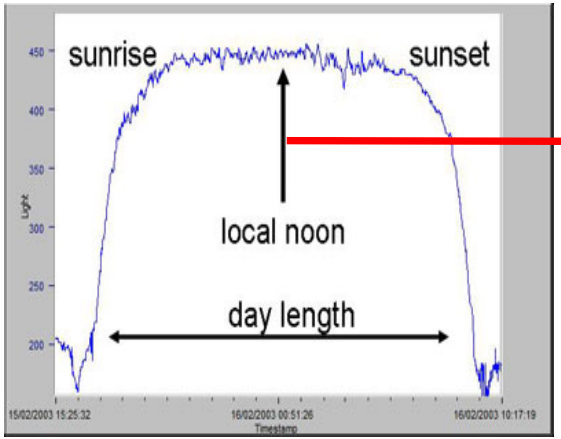
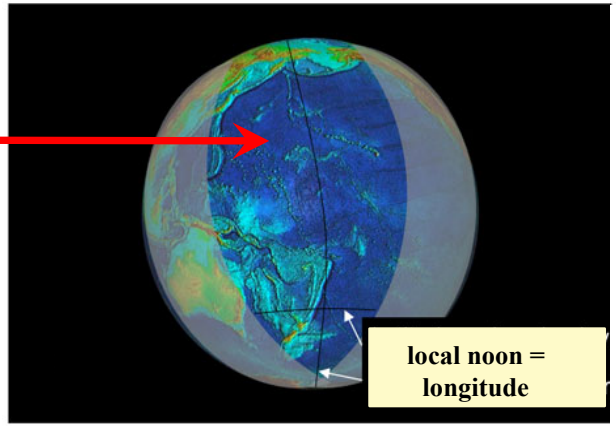
Electronic archival tags: mark-report and *at-liberty* positions







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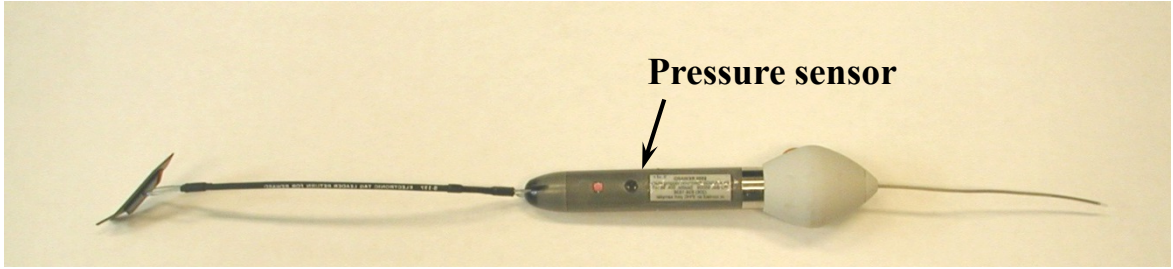
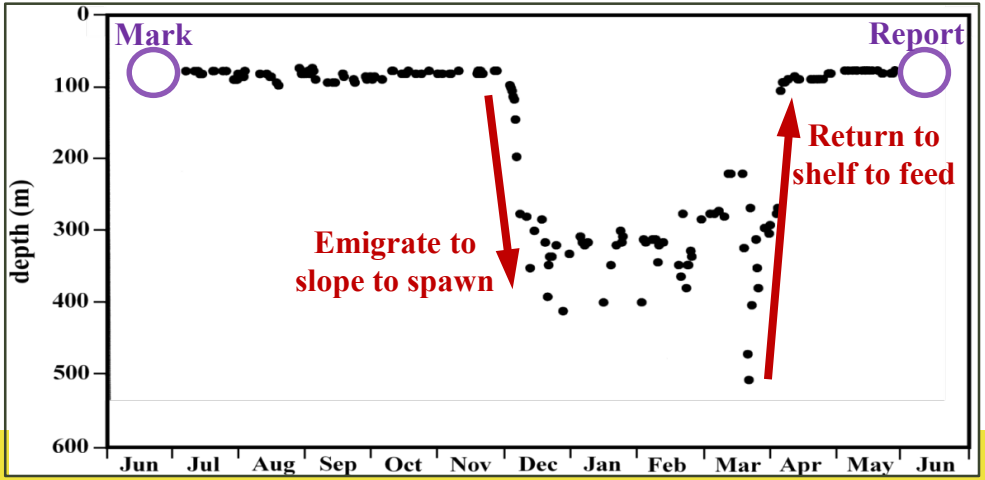
Electronic archival tags: mark-report, at-liberty positions, and *behavior*



The prototypical spawning migration:



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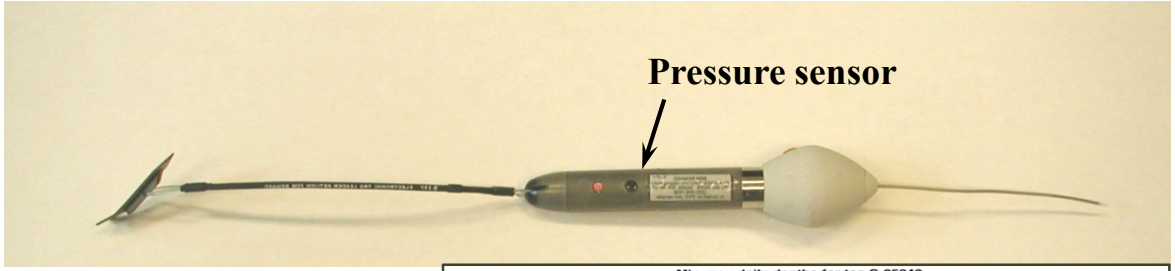
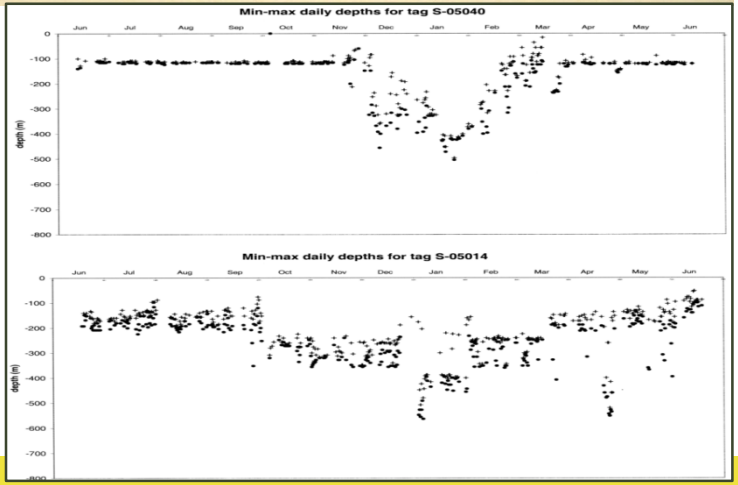


But, different fish do different things:



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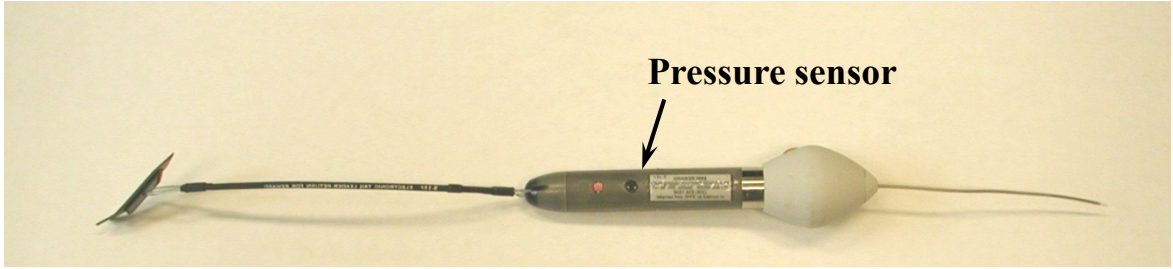
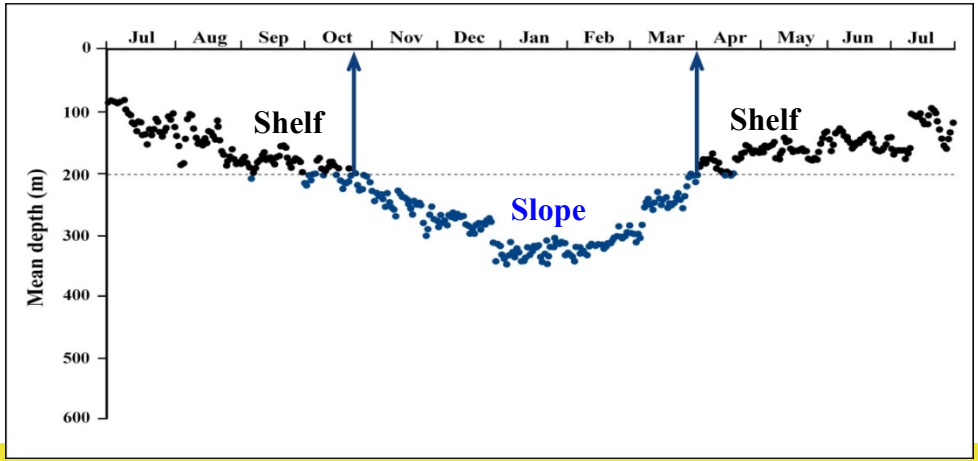


So, group-averaged data can be used to compare regions and demographics:



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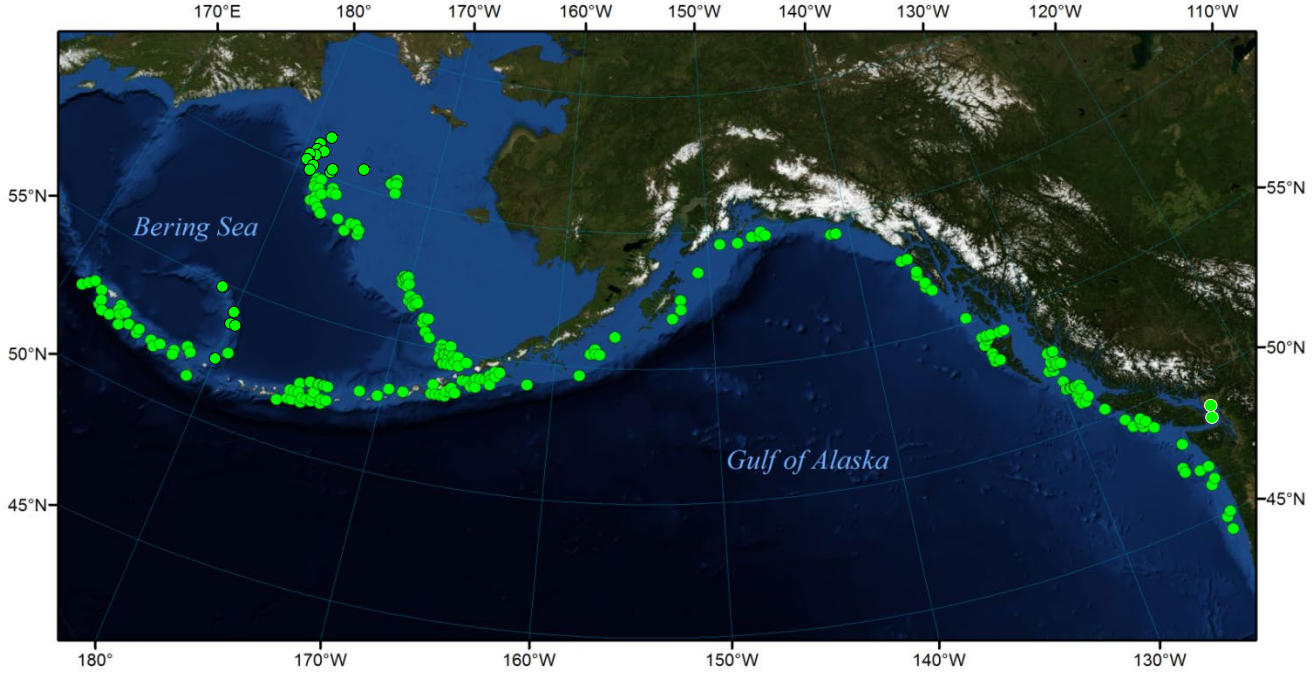

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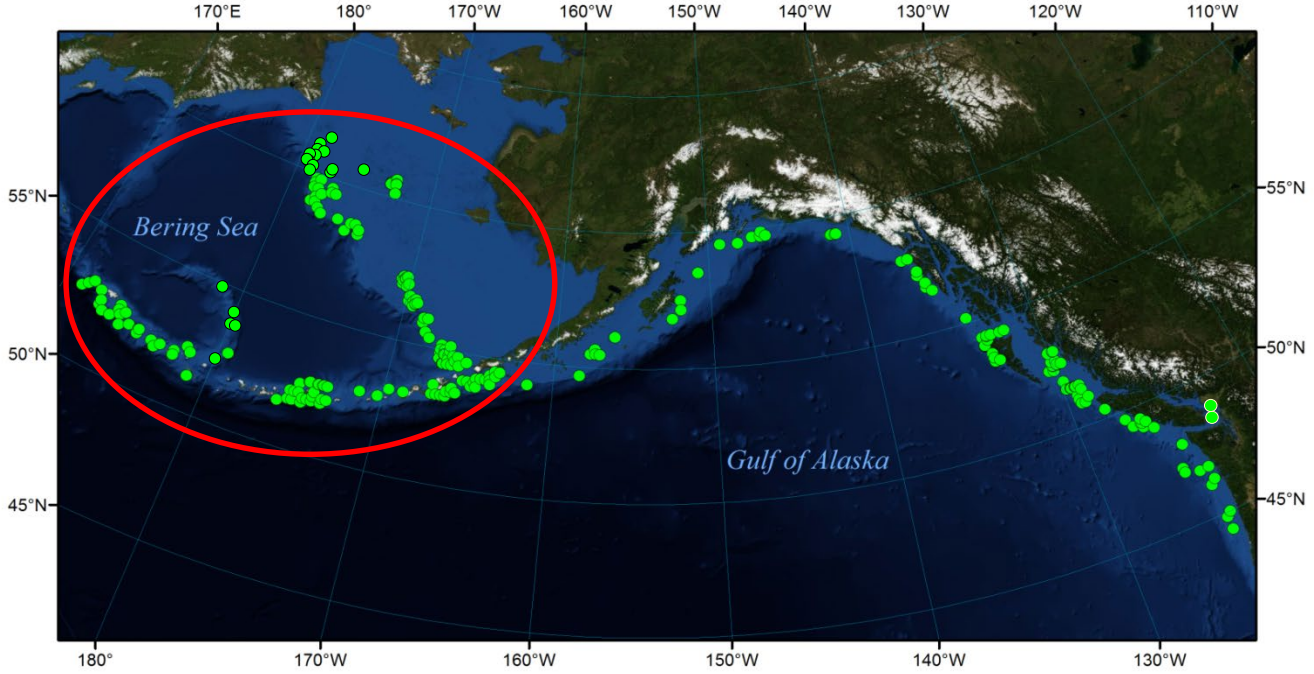
Today's focus will be **Bering Sea** deployments



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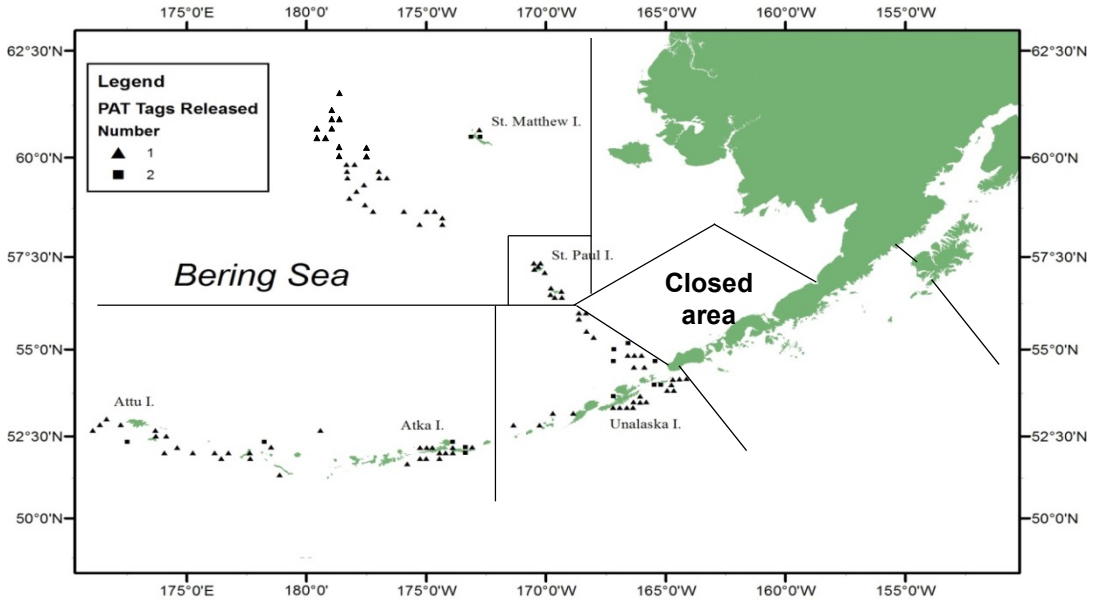
Specifically: (145) tags were deployed in 2008, 2009, and 2016



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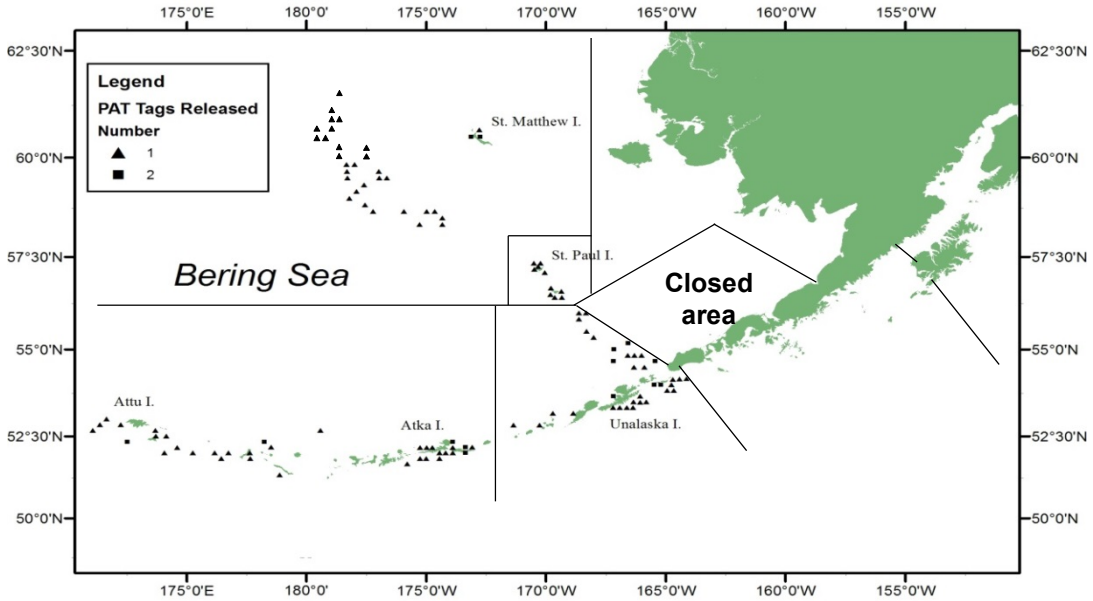
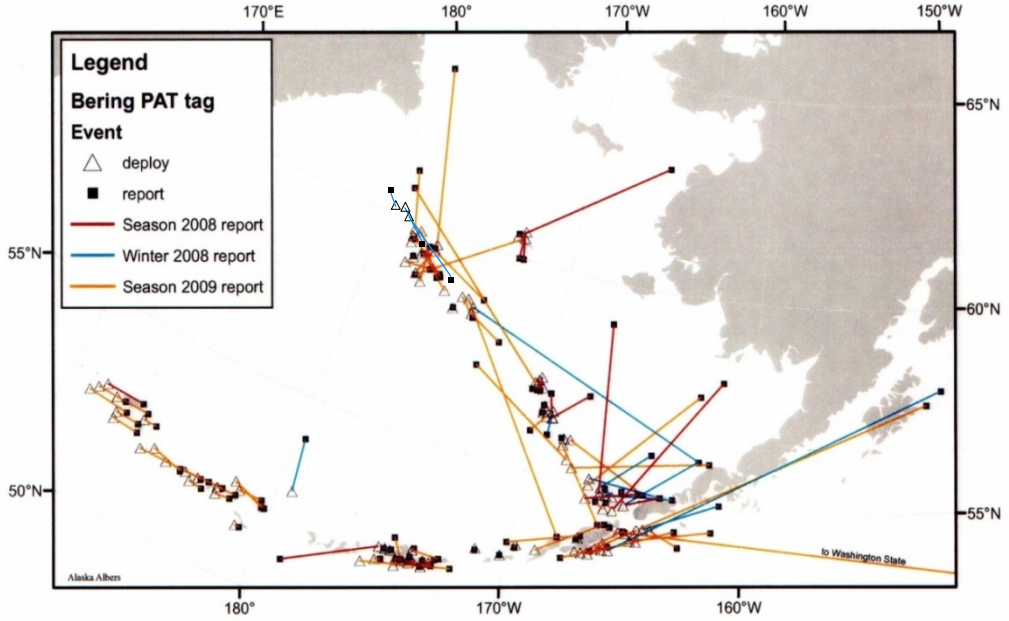
- Programmed for 365-day reporting, with “premature release detection”



Geographic dispersal: *endpoints*

(108) tags generated endpoints: (20) during winter (164-361 day); (71) at 365-days



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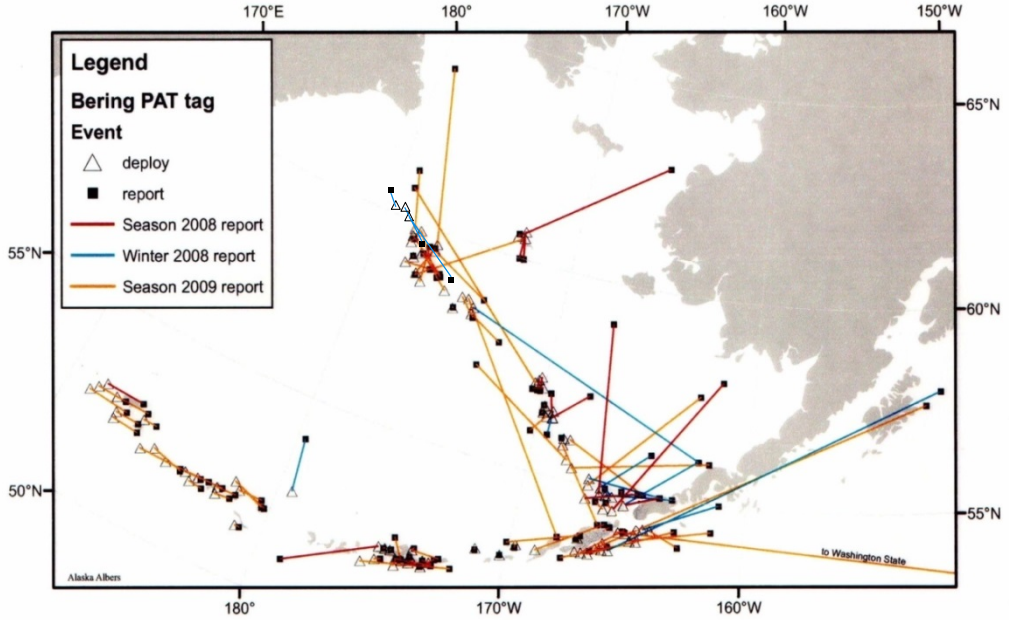

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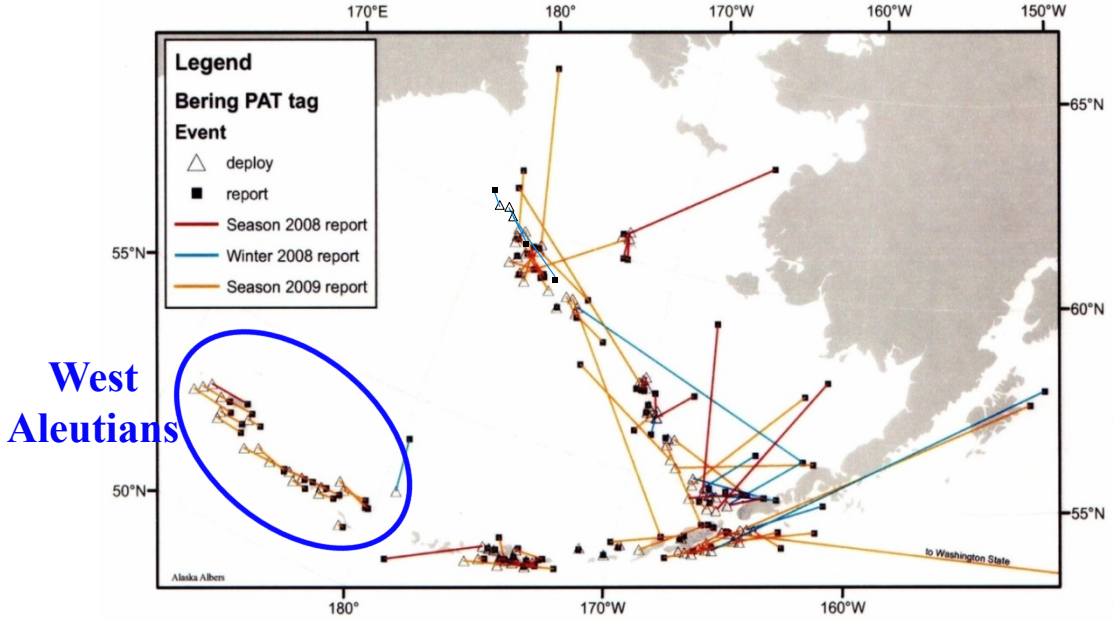

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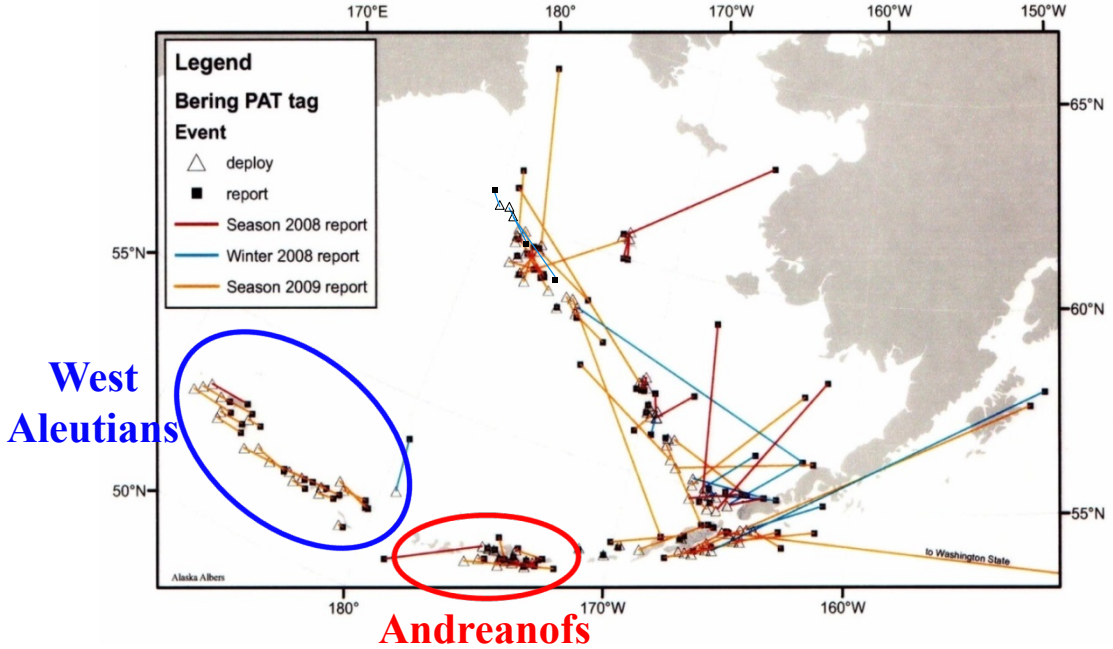

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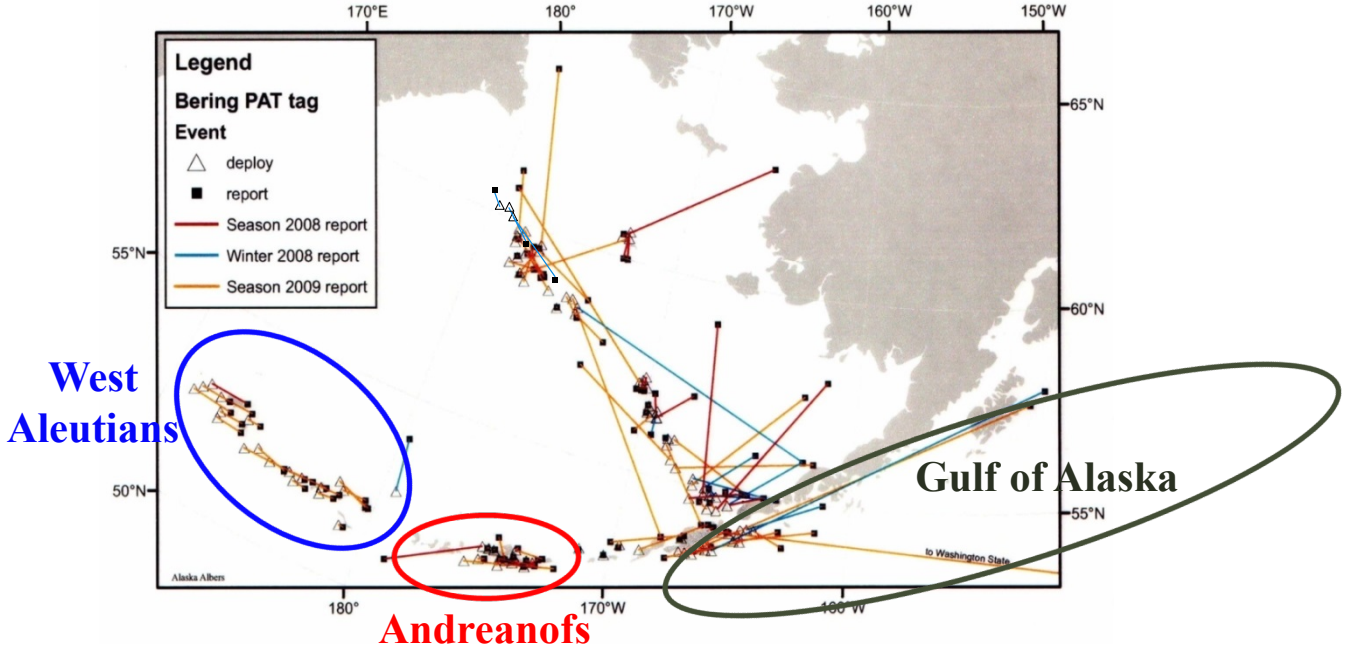

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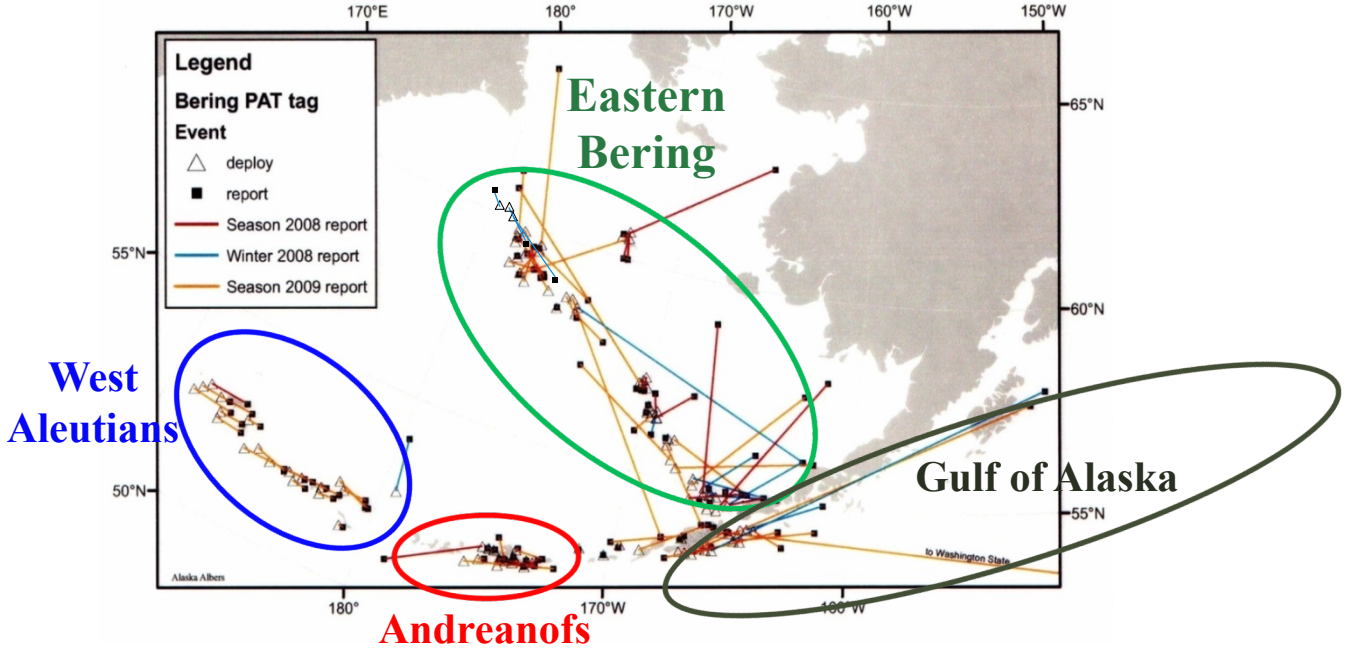

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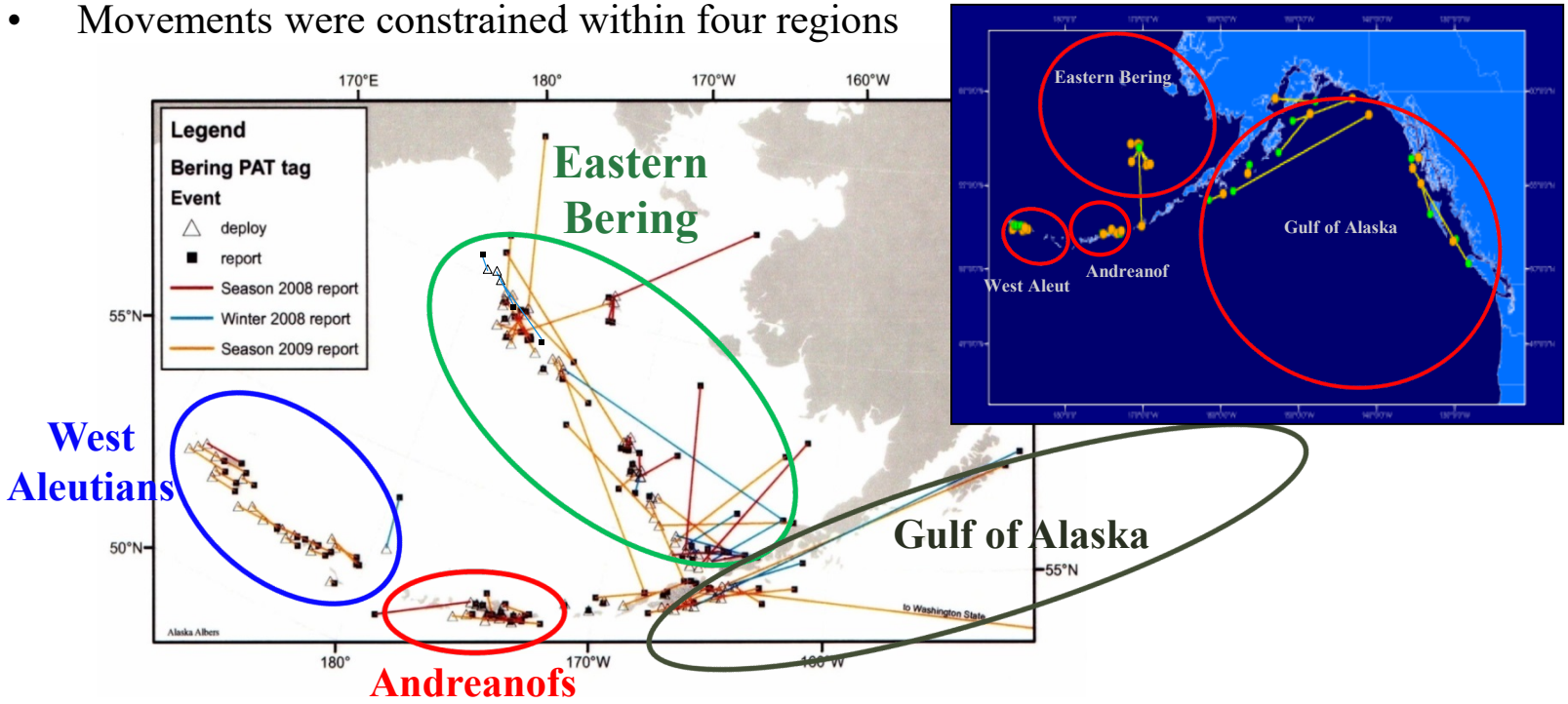

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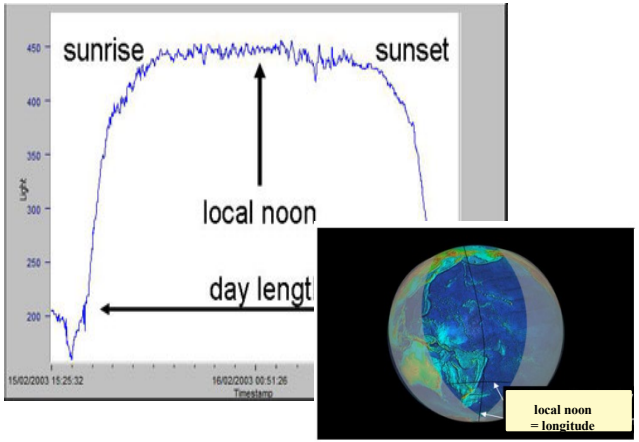
Curiously: (*110*) tags generated usable twilight data



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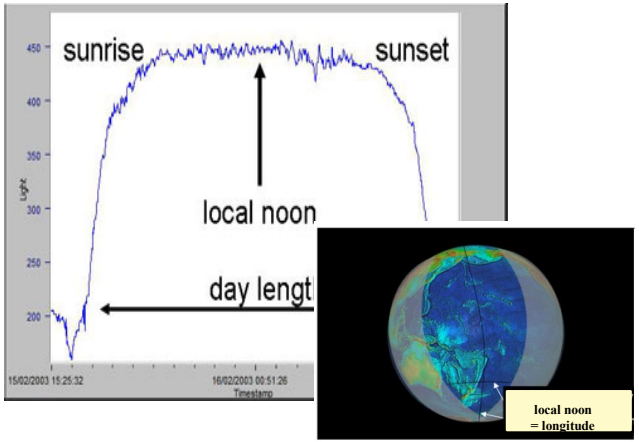

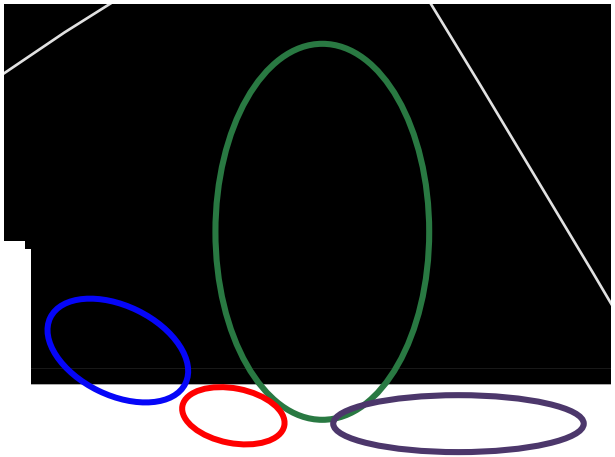

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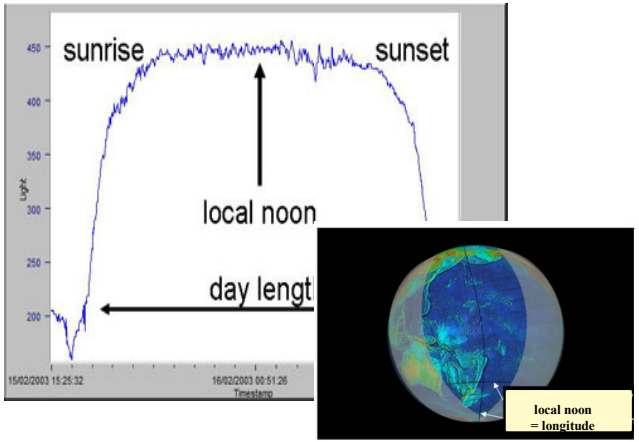

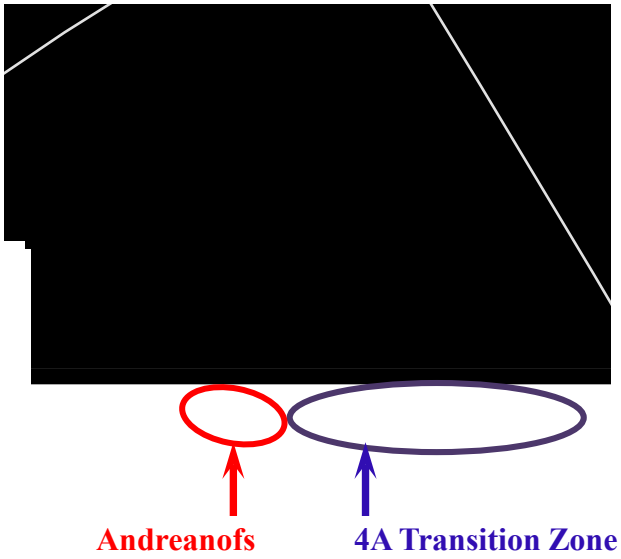

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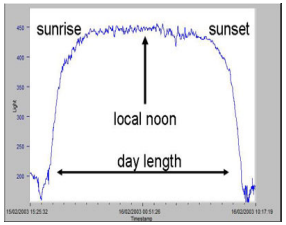
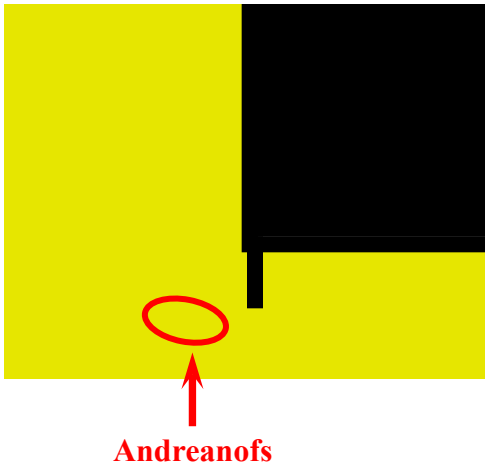
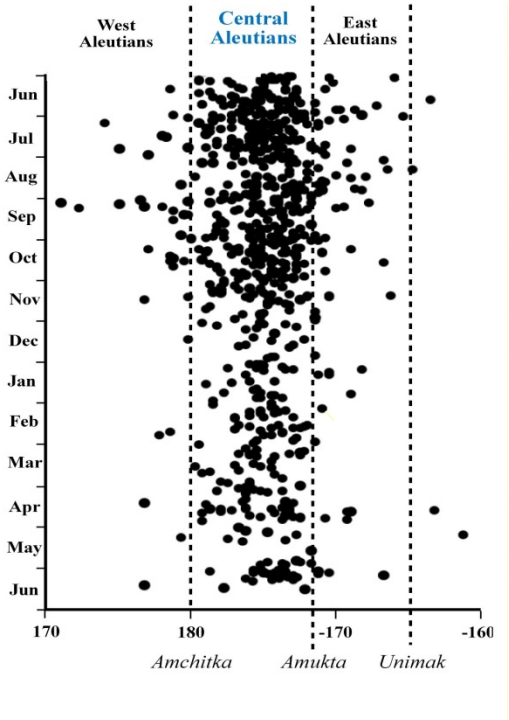




N = 16 fish; 751 positions



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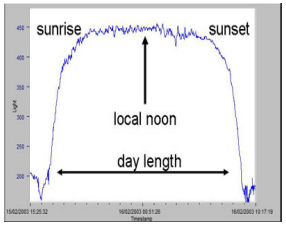
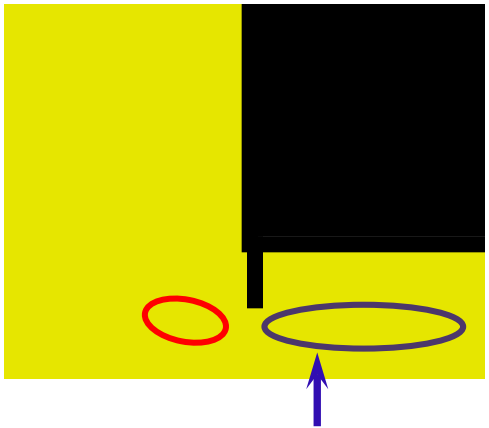
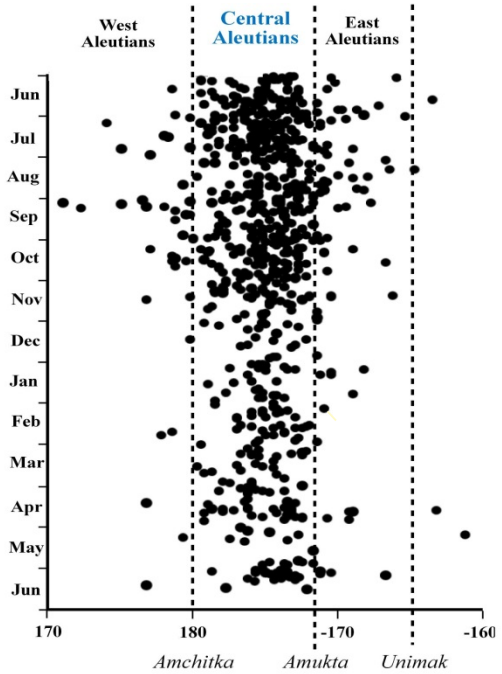
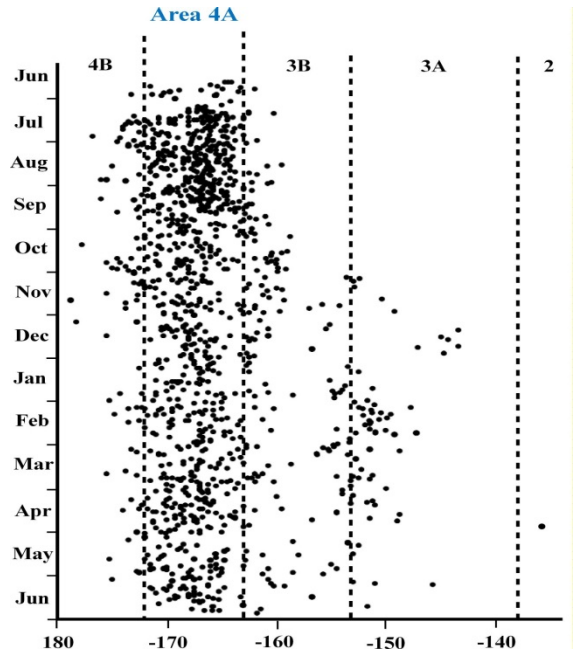




N = 16 fish; 751 positions

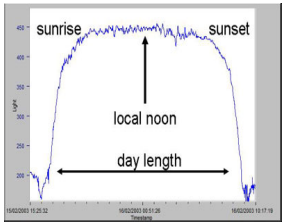


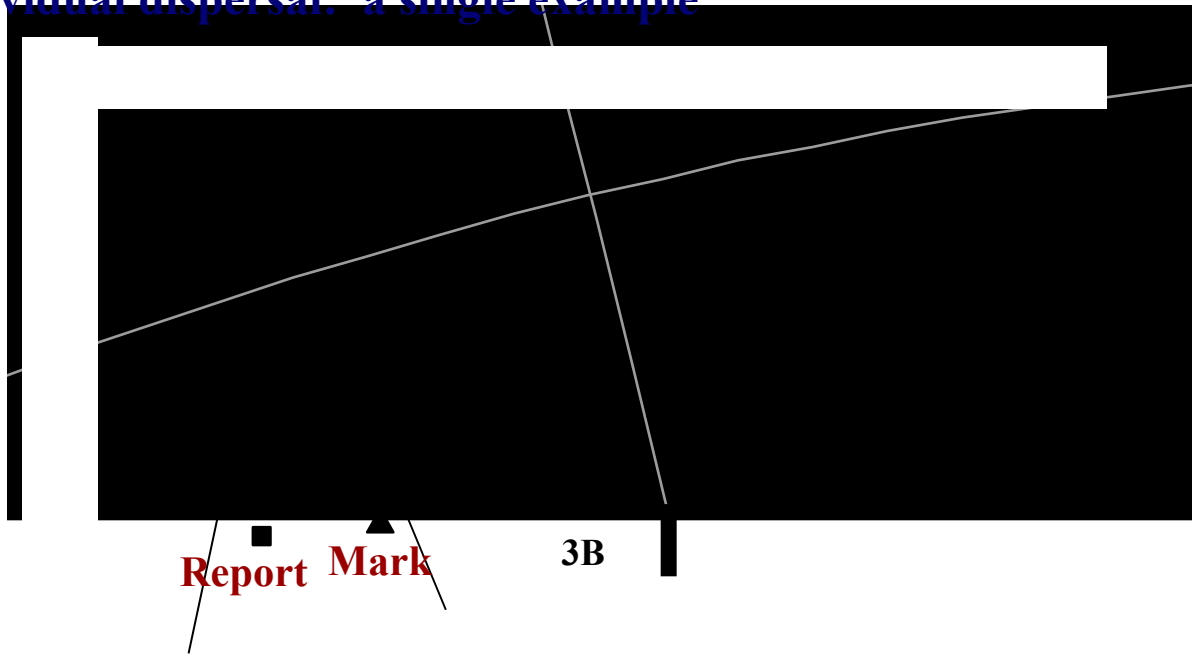
N = 23 fish; 1,189 positions



Geographic dispersal: *while at liberty*

Individual dispersal: a single example





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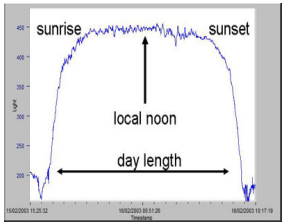

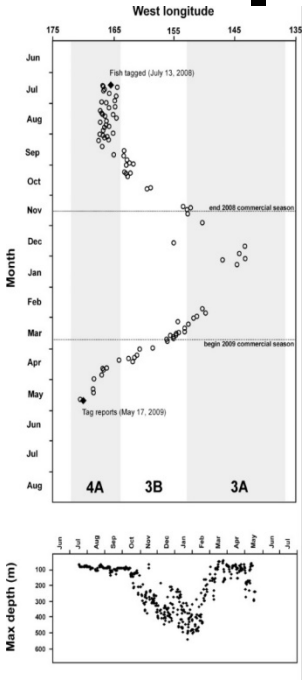

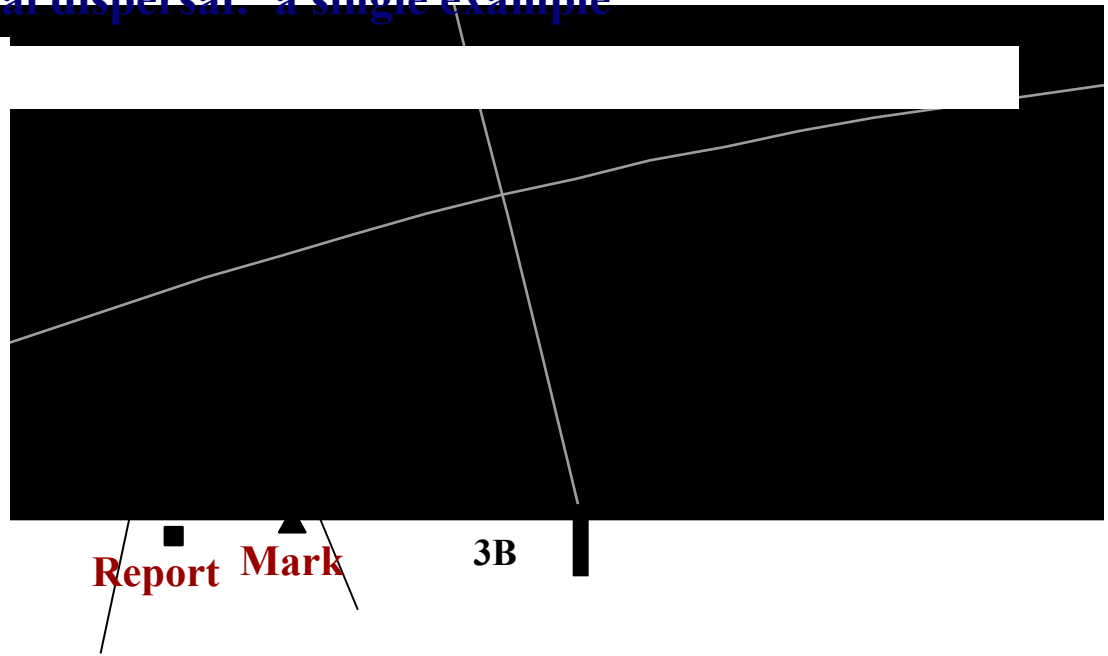

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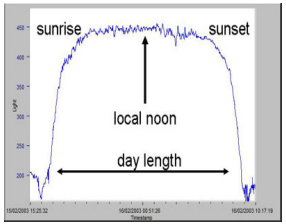
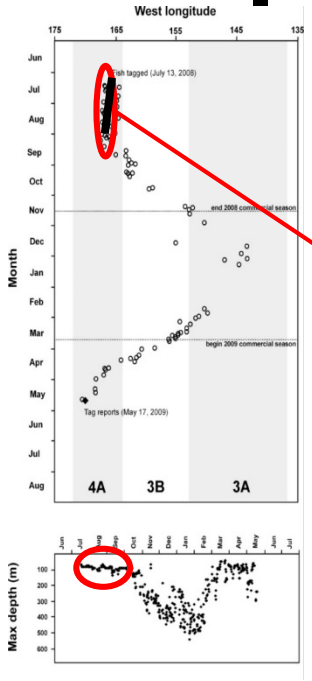
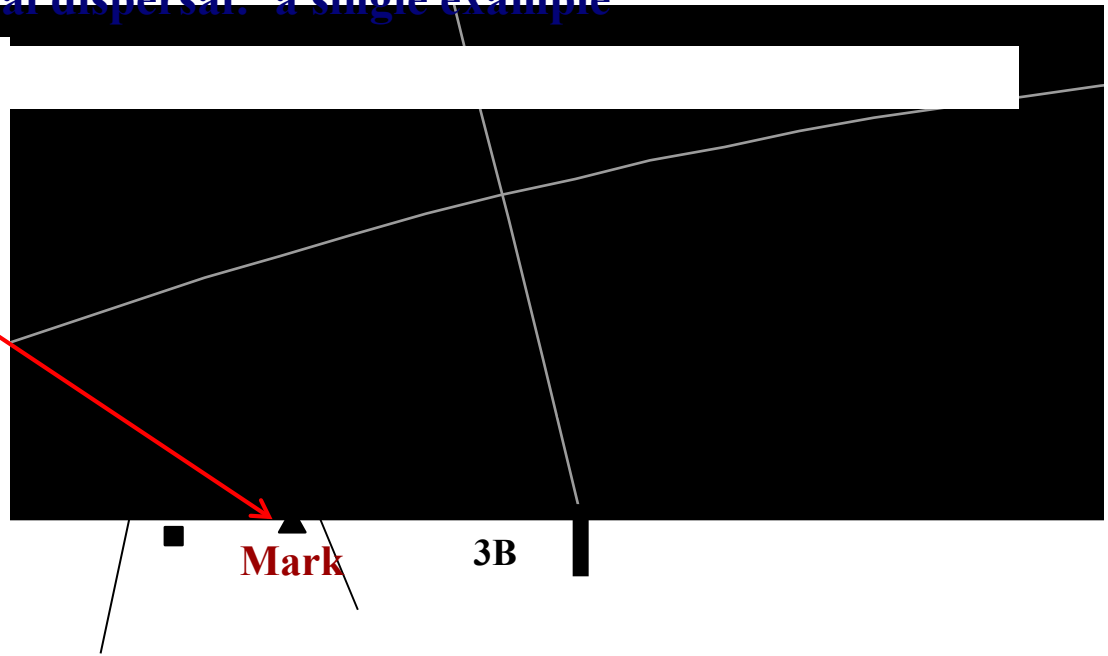


Light-based longitudes





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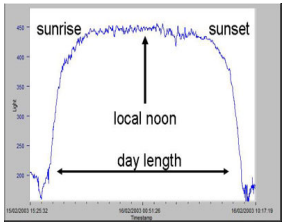

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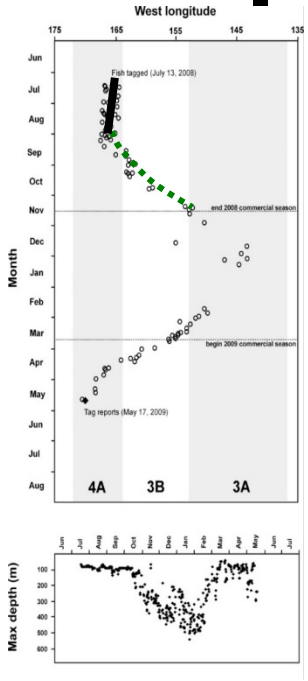

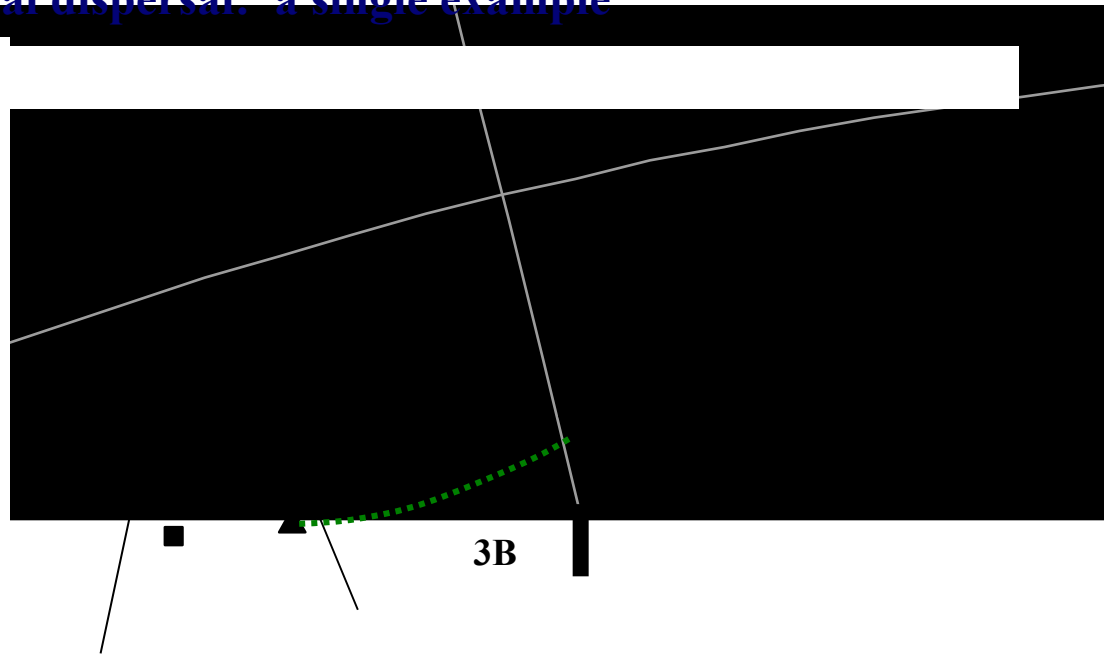

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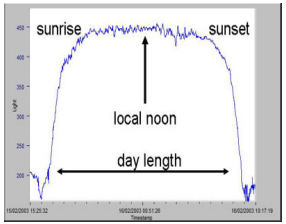

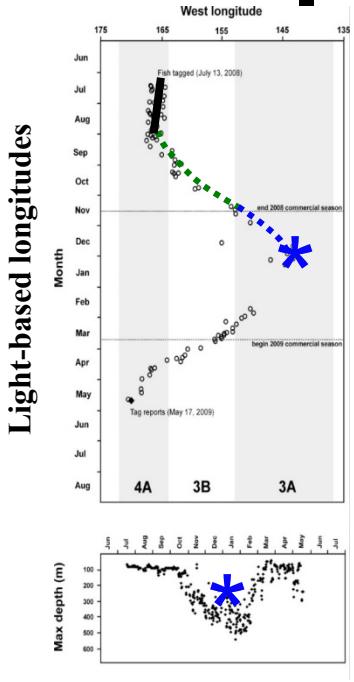

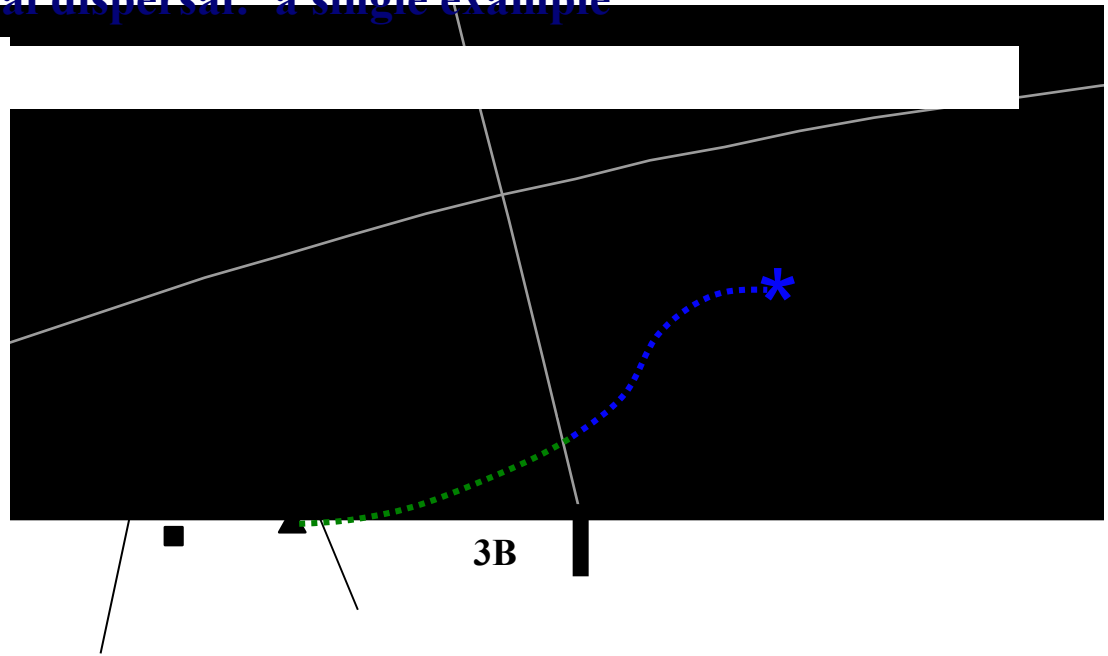

Geographic dispersal: *while at liberty*

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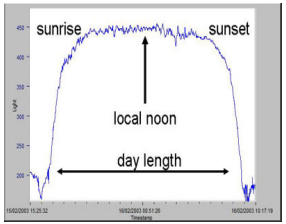

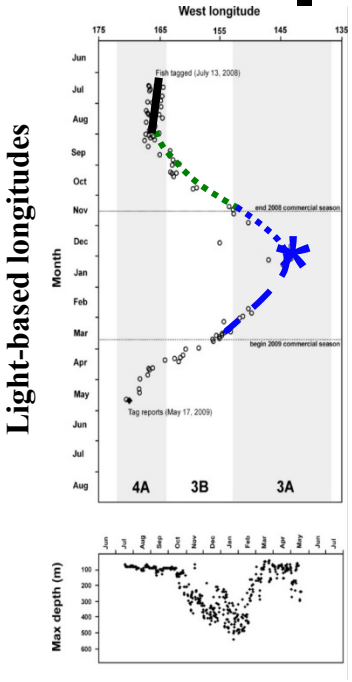

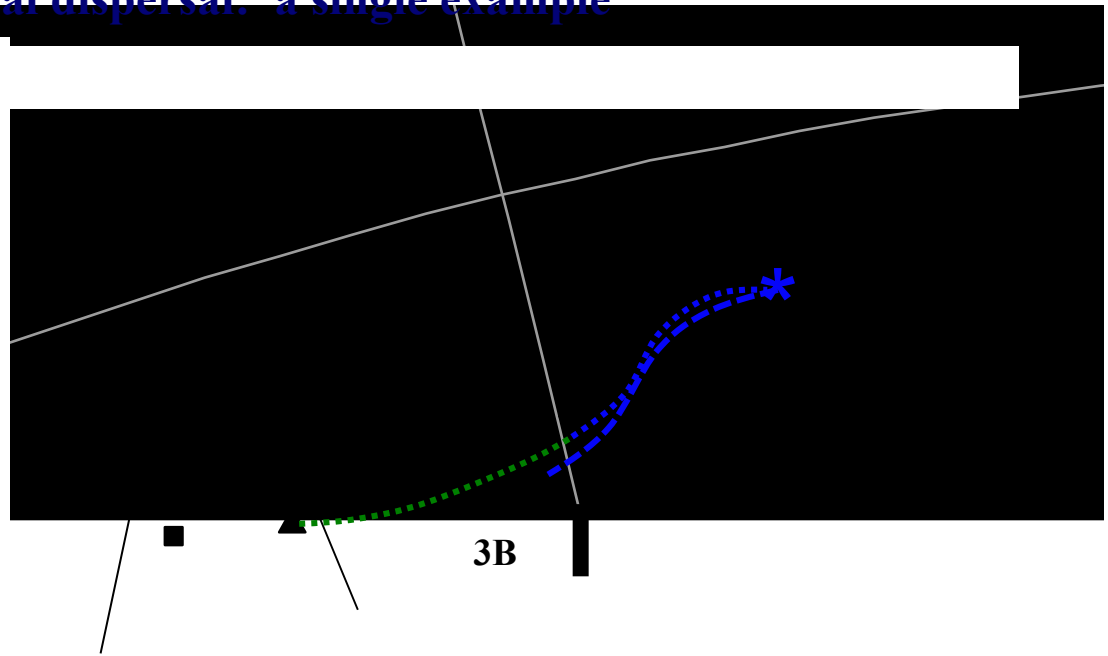

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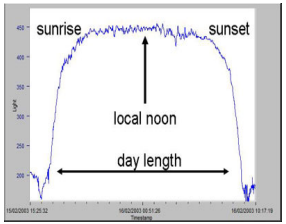
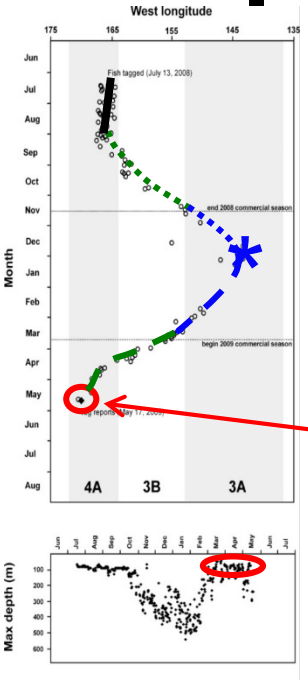
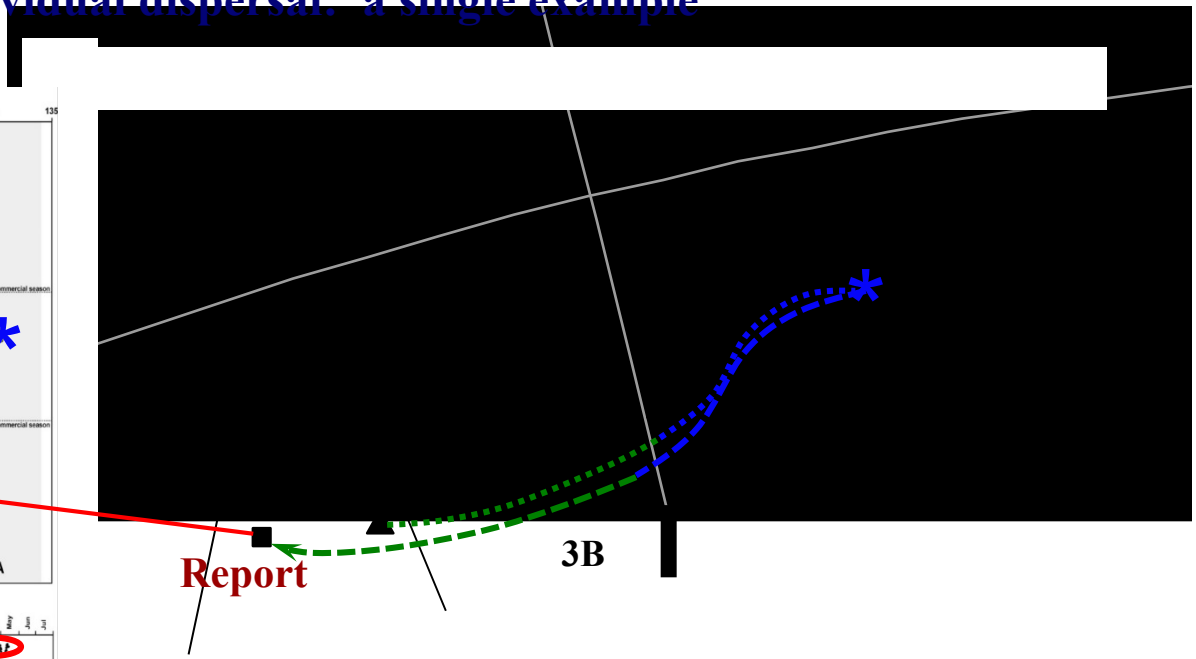


Light-based longitudes





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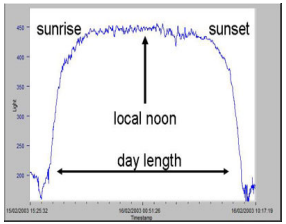

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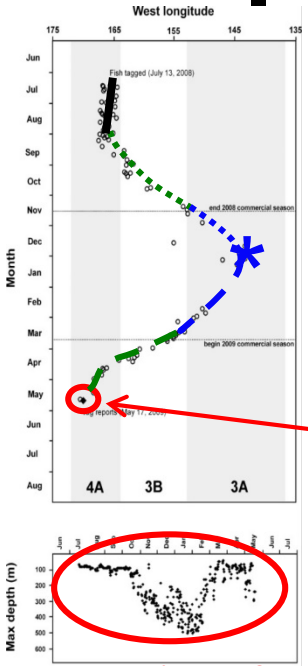
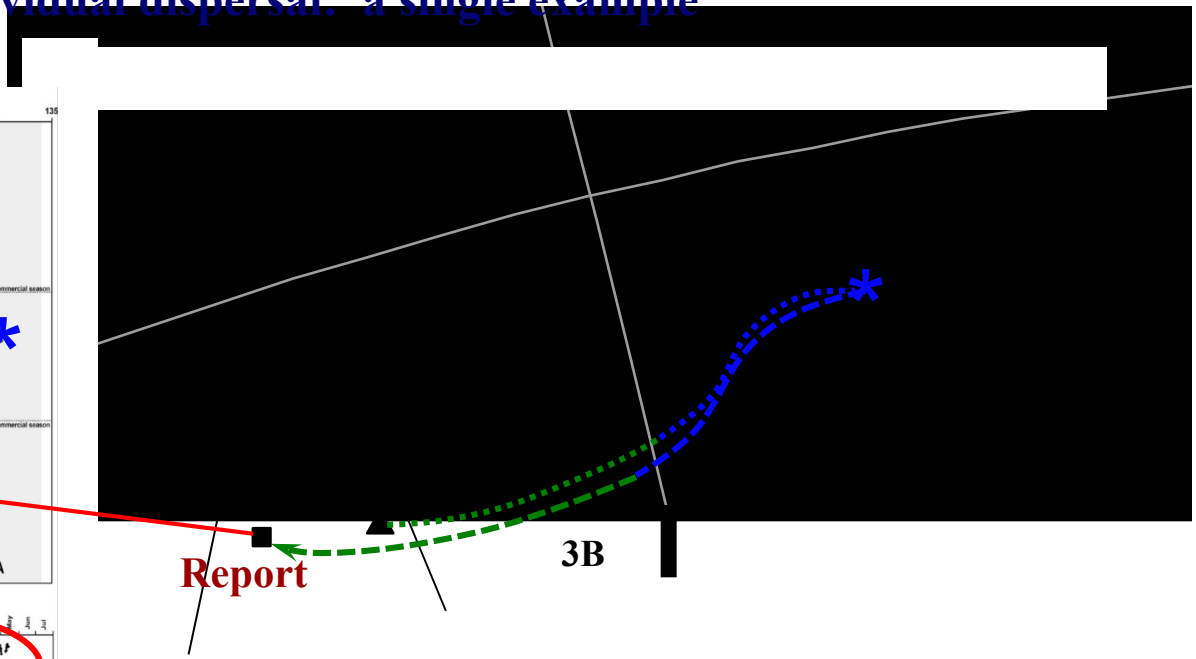
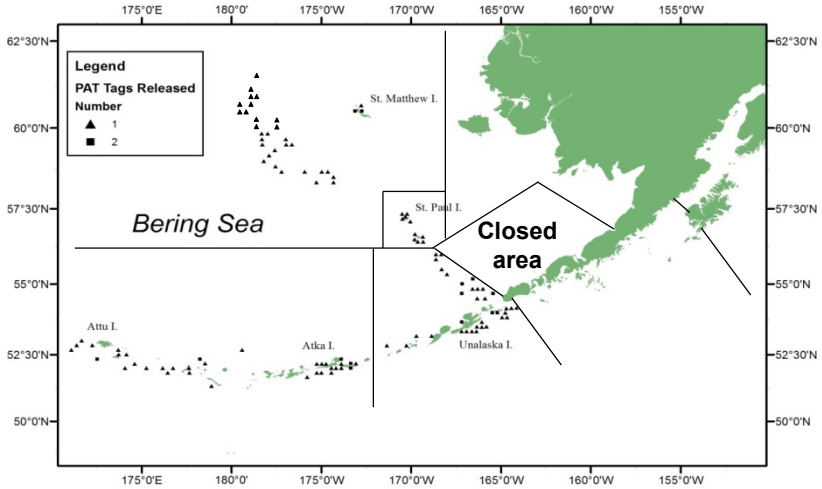




And speaking of depth …

Seasonal dispersal: *onshore-offshore movements*

(99) tags generated usable depth data



Seasonal dispersal: *onshore-offshore movements*

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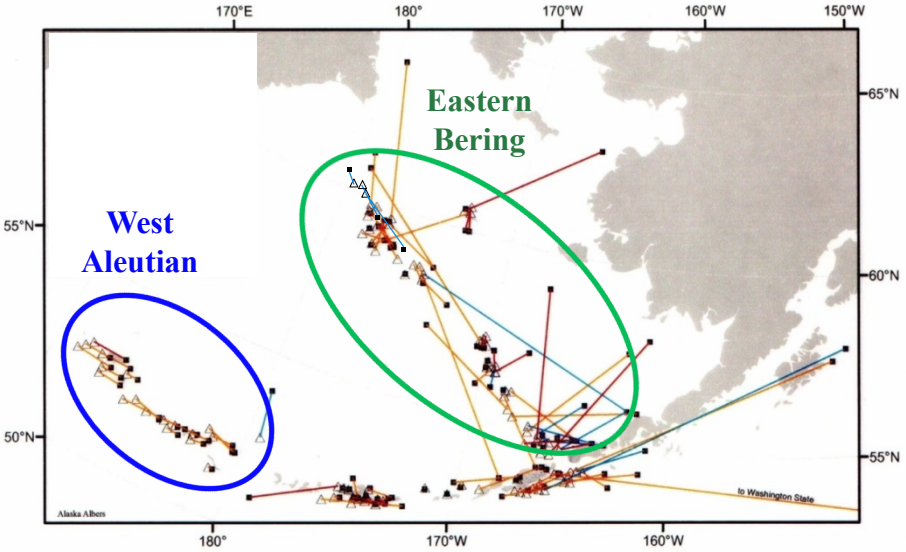
- Focusing on two regions ...



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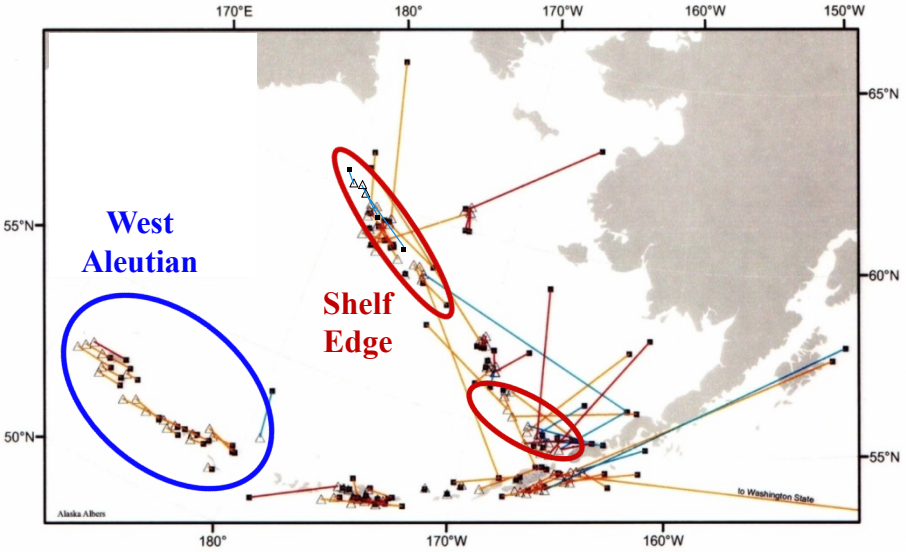

Seasonal dispersal: *onshore-offshore movements*

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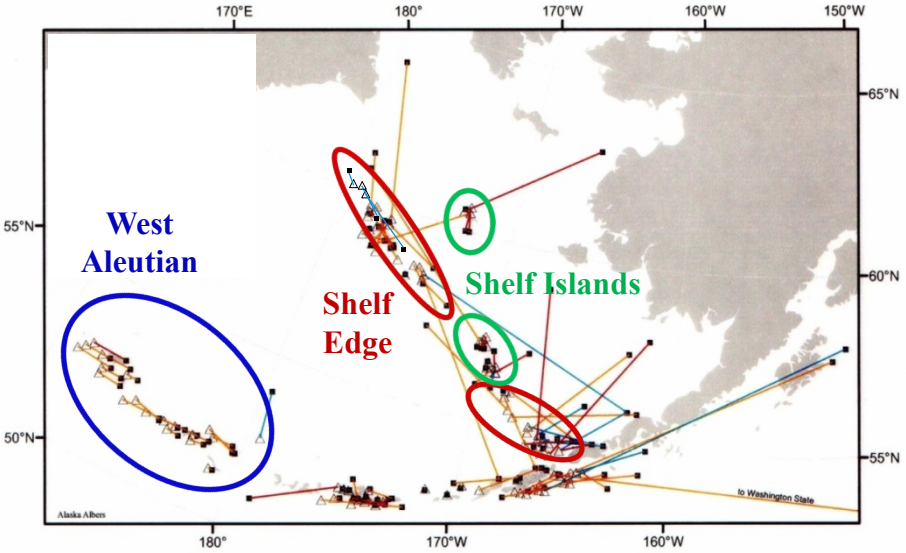
- Focusing on two regions … as <u>three</u> groups of fish



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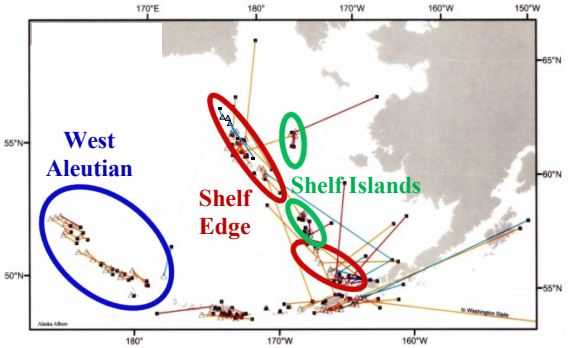
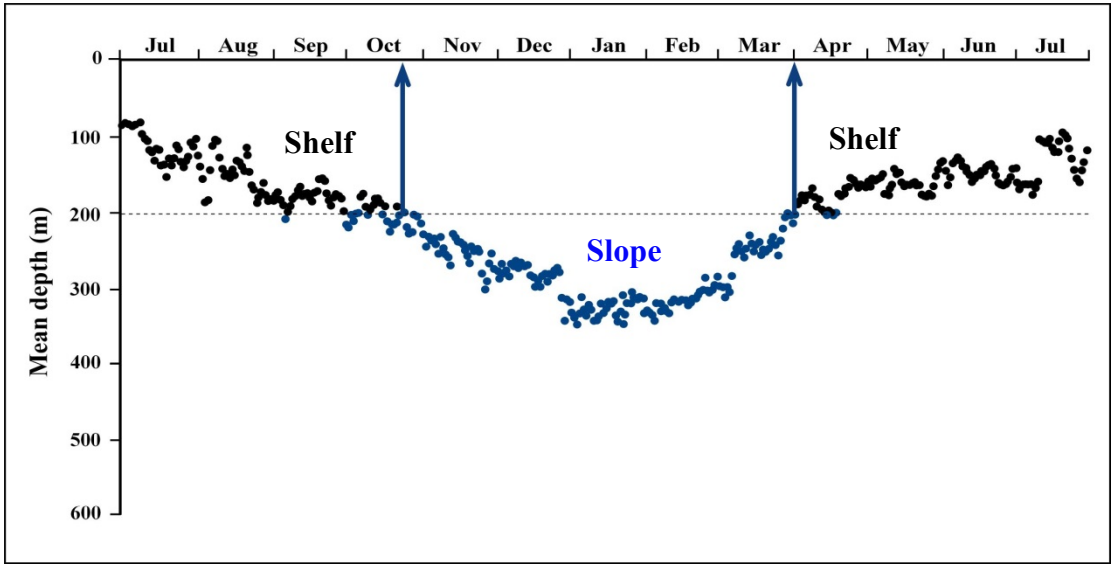


Group-averaged maximum depths



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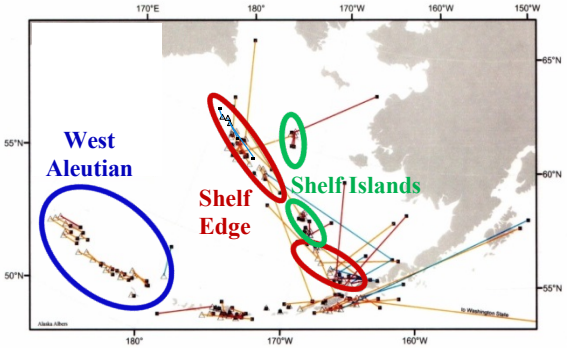

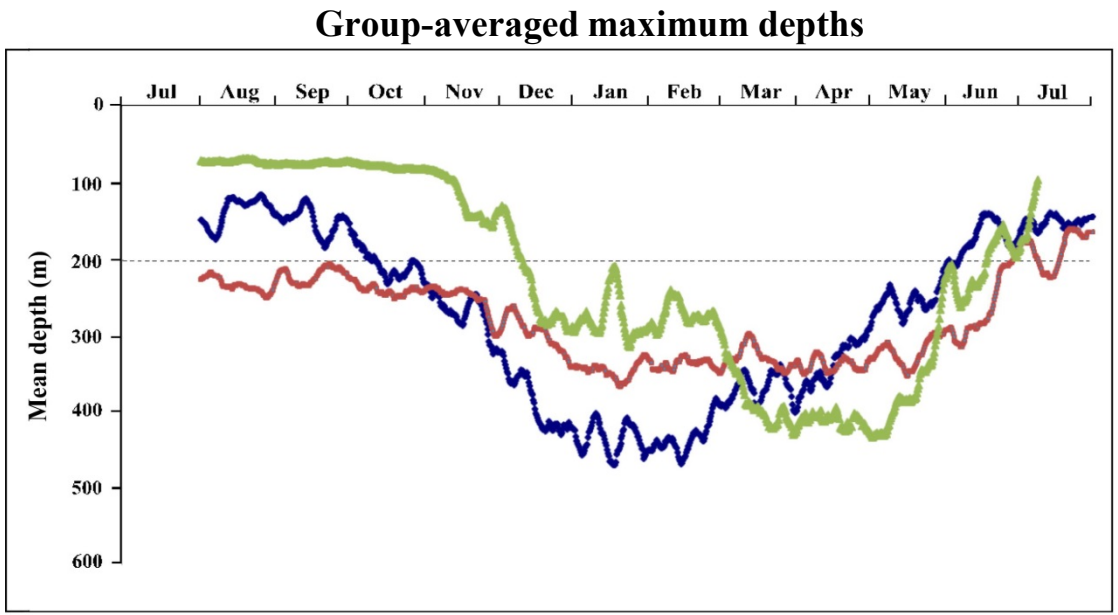

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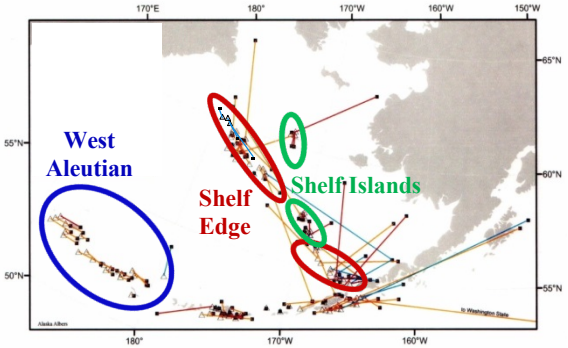

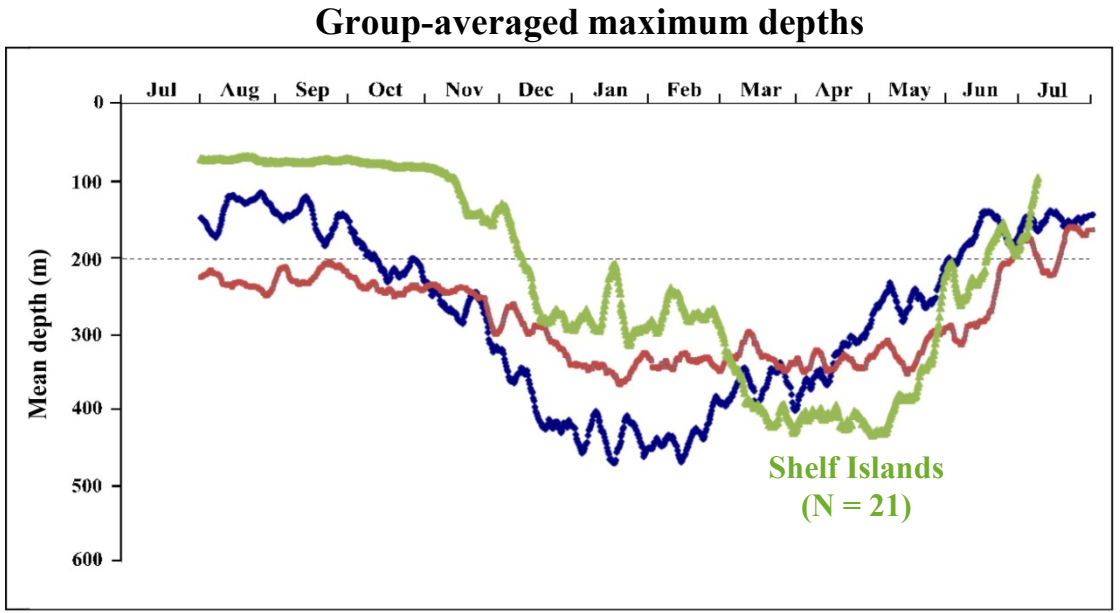

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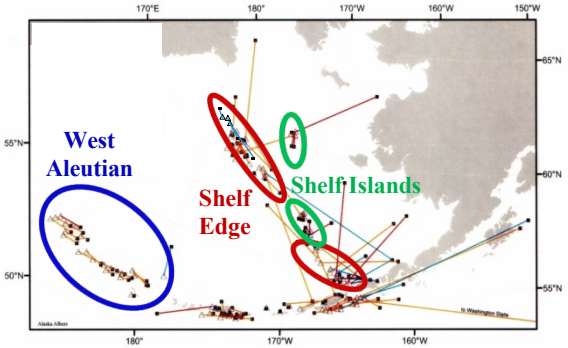

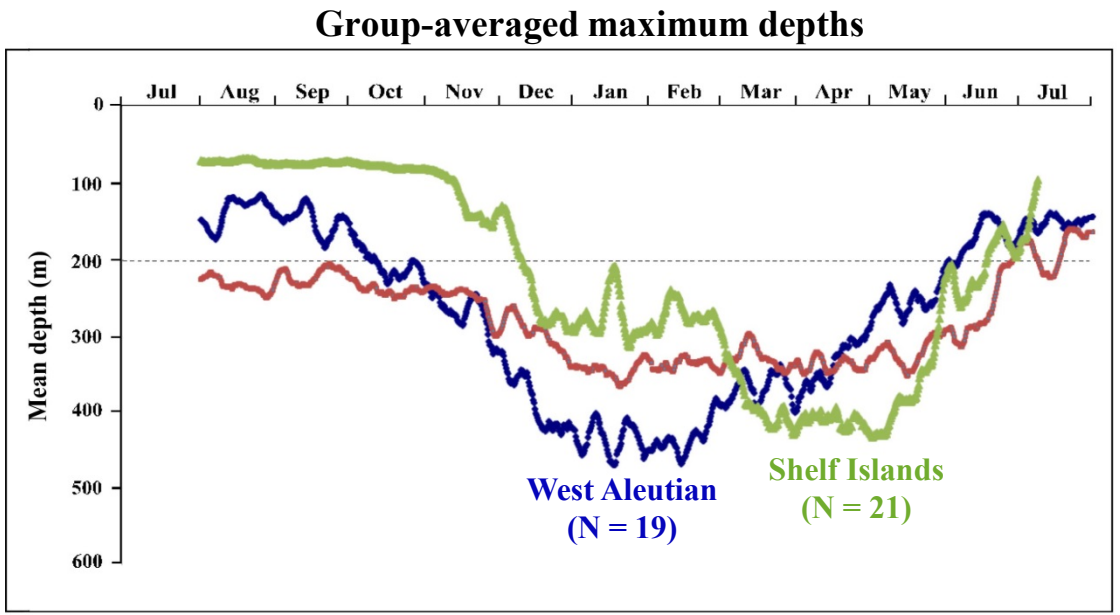

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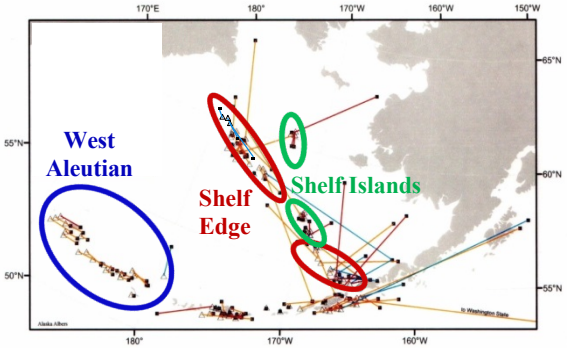

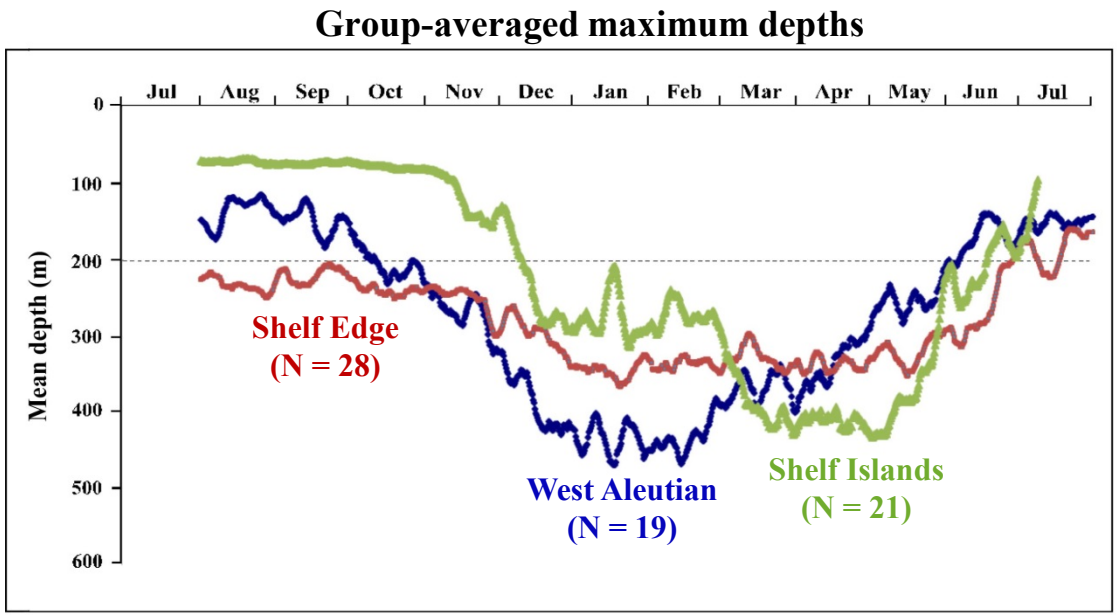

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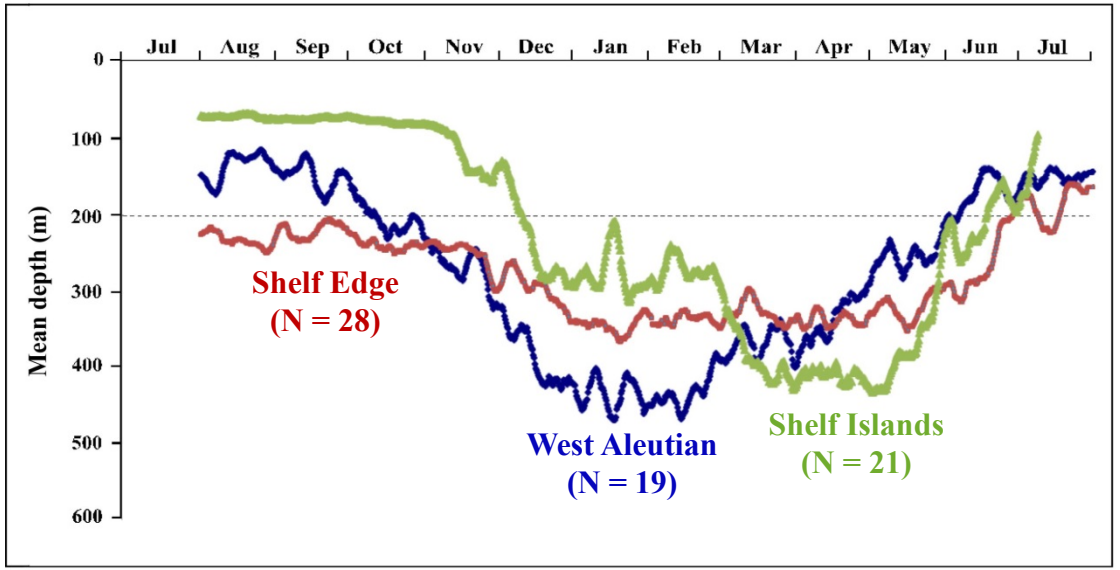
"Migratory contingents"



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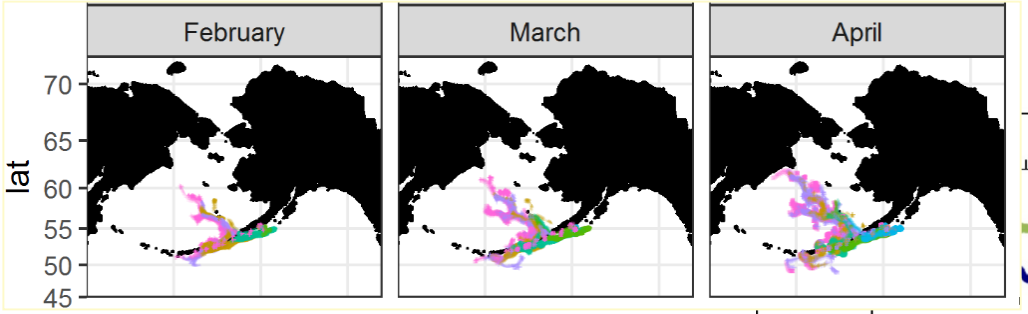
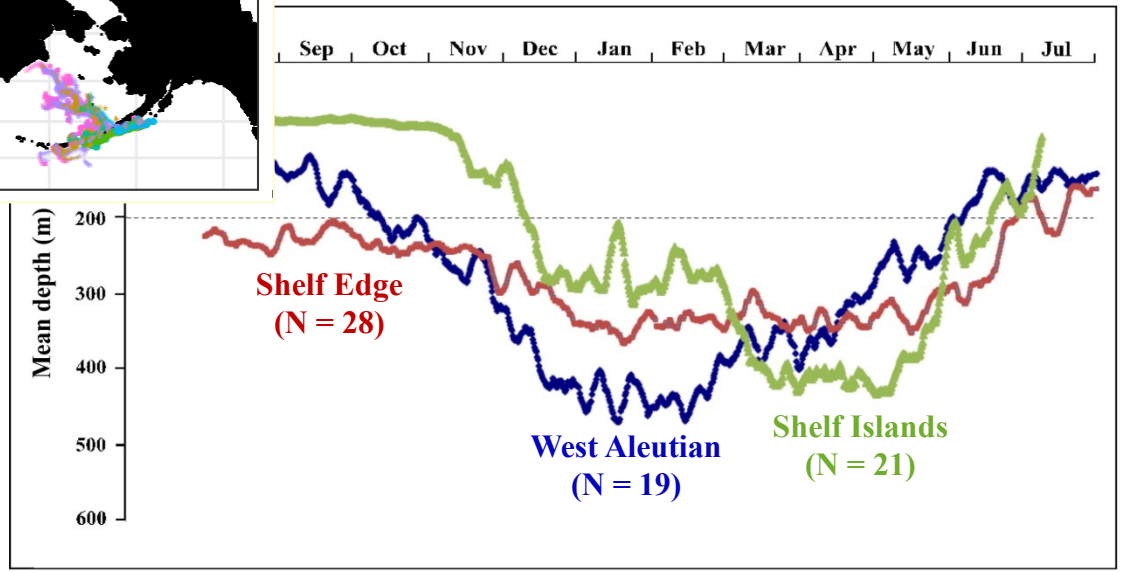


That likely deliver their larvae into substantially different conditions within each spawning season …

"Migratory contingents"



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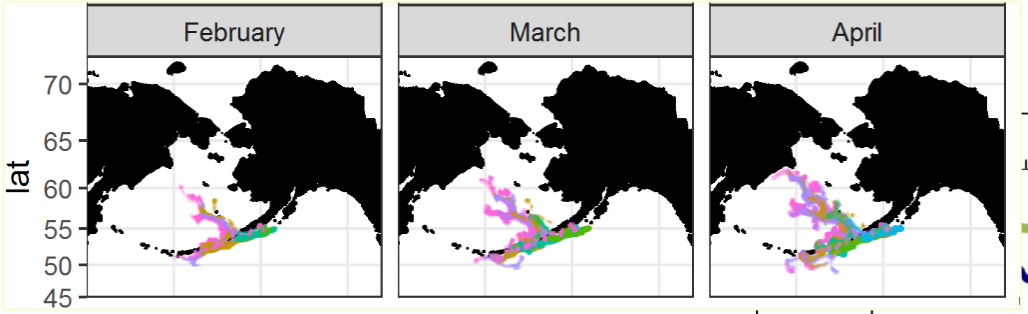
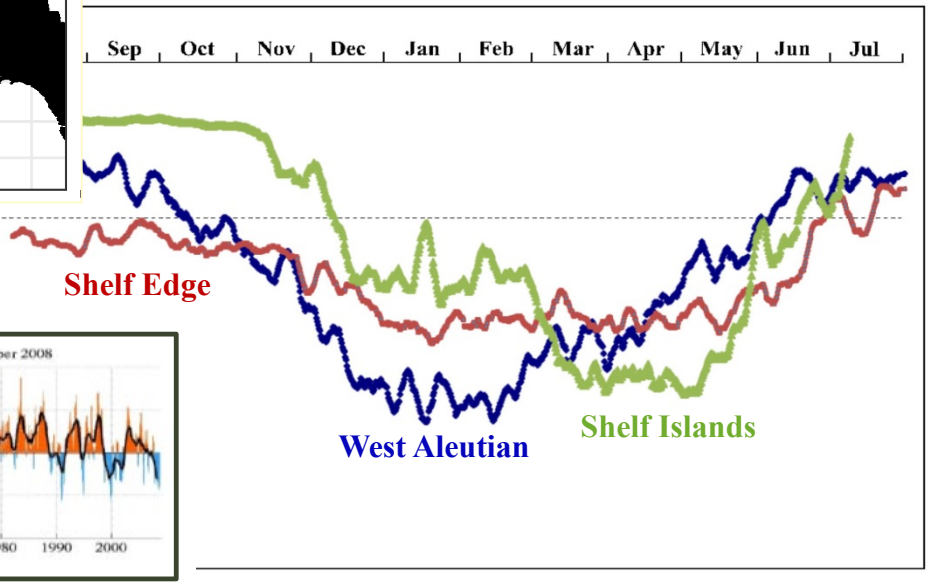
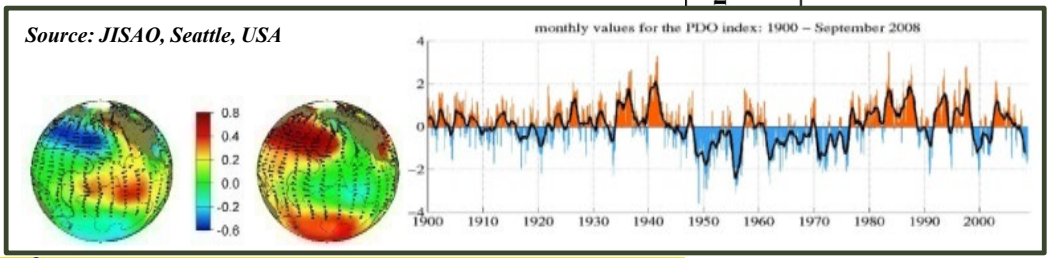


… allowing for population-level "environmental bet hedging"

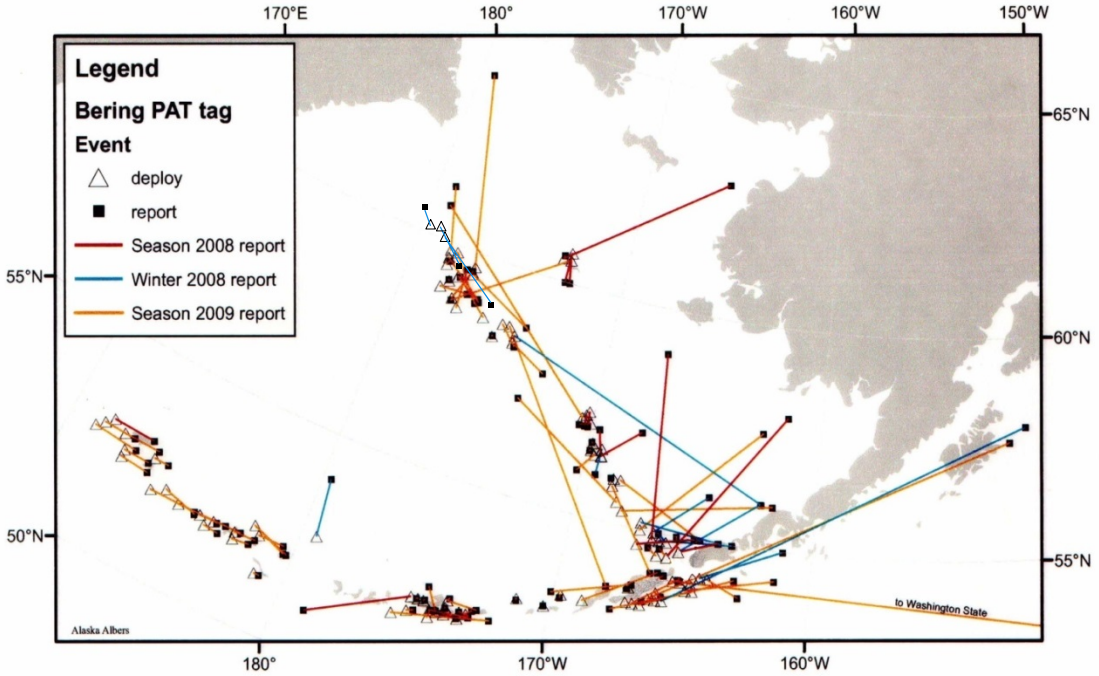
"Migratory contingents"





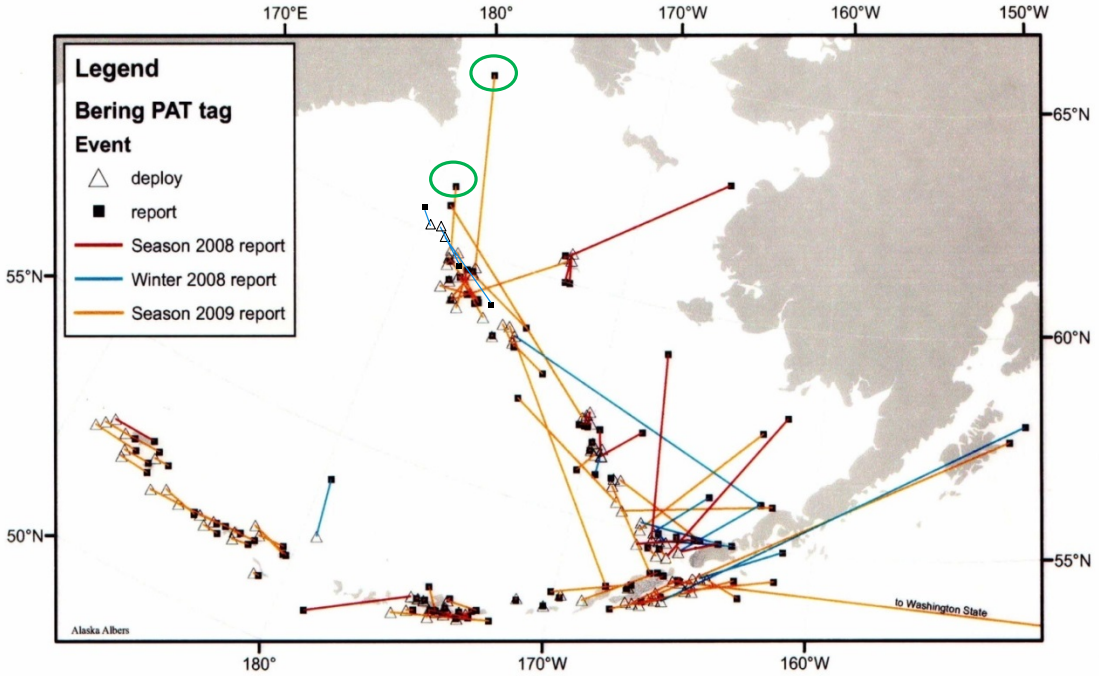
What else had you to learn?

Returning to geographic dispersal



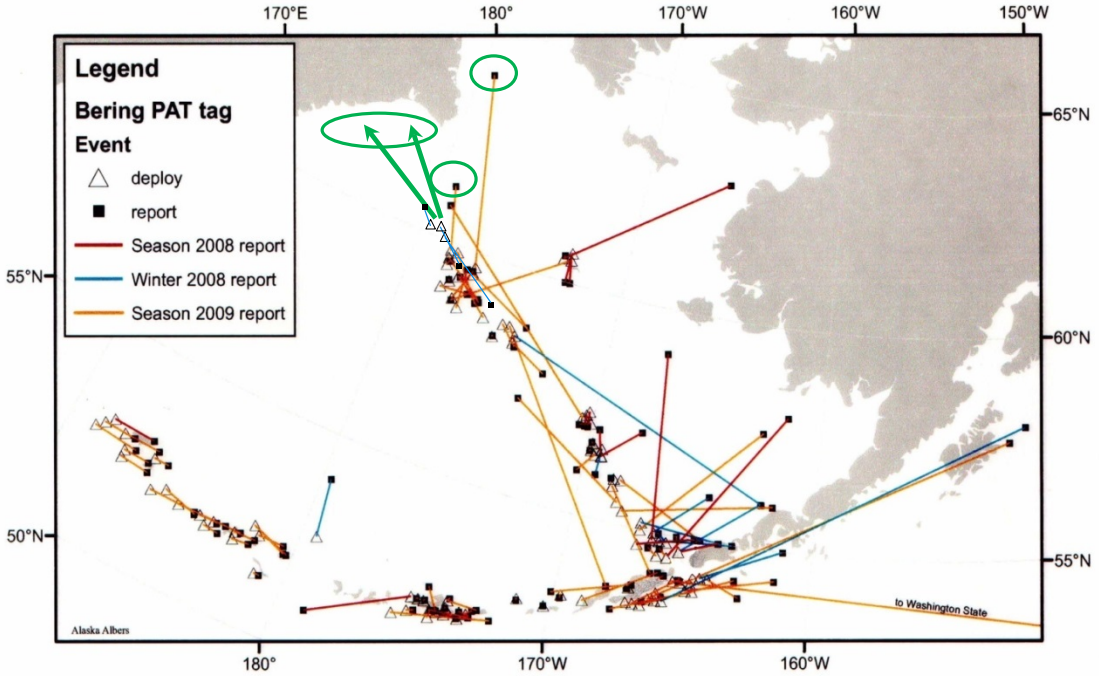
Returning to geographic dispersal

Two of the pop-ups were in Russian waters



Returning to geographic dispersal

Two of the pop-ups were in Russian waters; plus two fish recaptured



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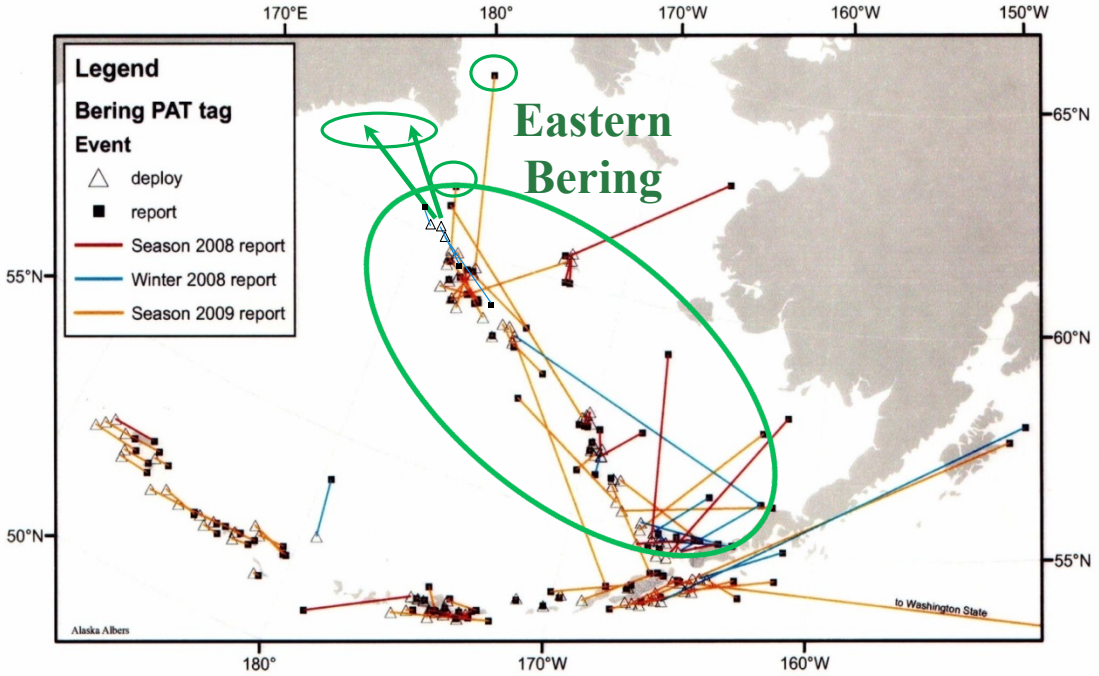

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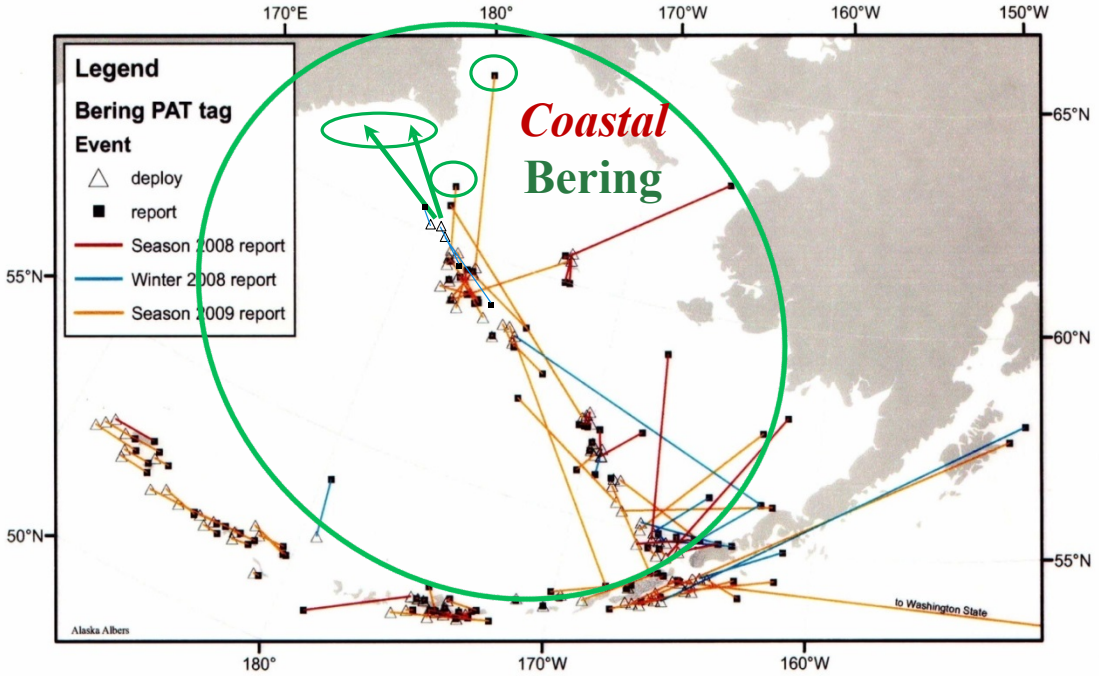
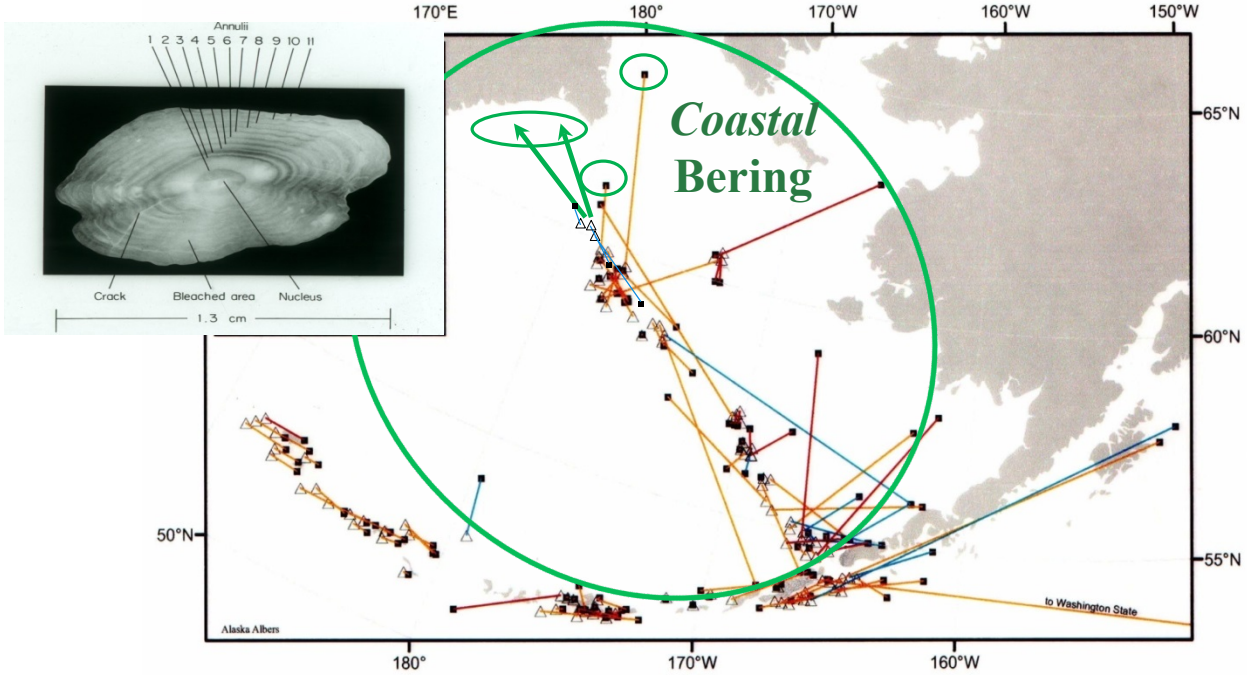


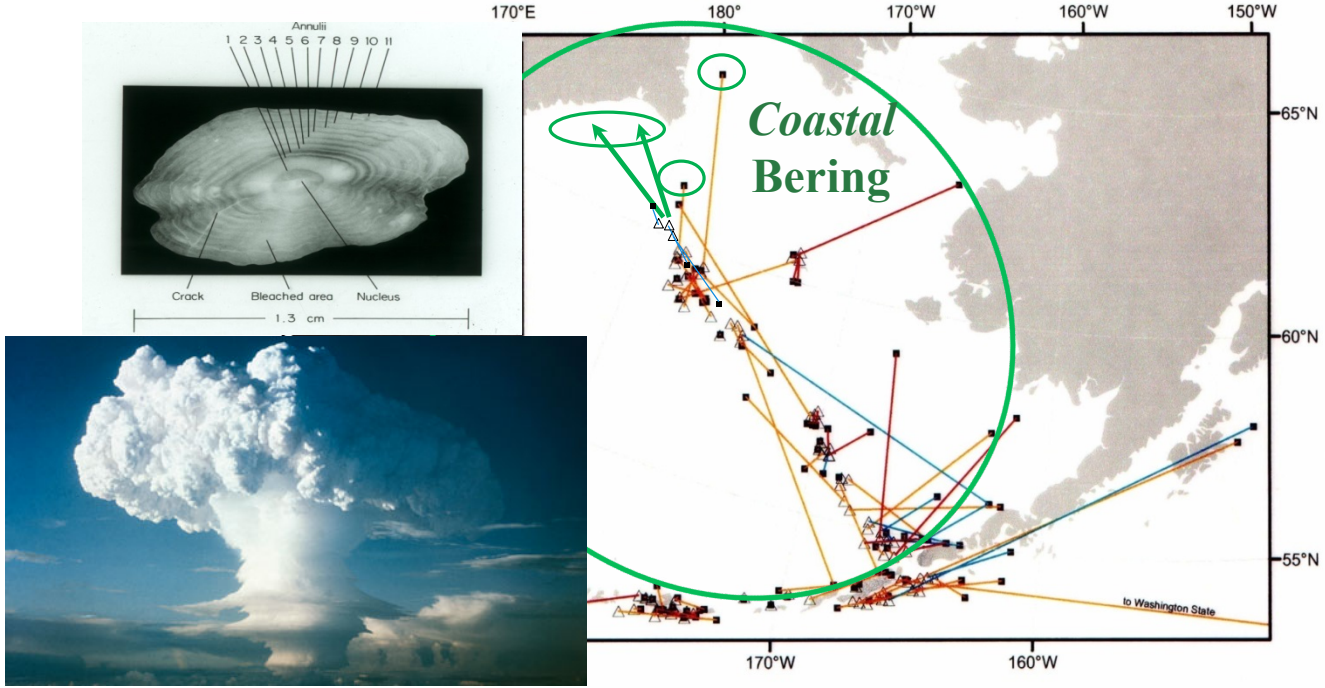
Curiouser and curiouser

The Otolith Connection:



Curiouser and curiouser

The Otolith Connection:



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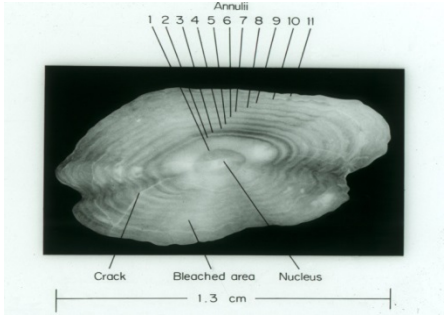

Pre- and post-bomb radiocarbon in fish otoliths

John M. Kalish

MAF Fisheries Greta Point, P.O. Box 297, Wellington, New Zealand

Received December 9, 1992; revision accepted January 4, 1993

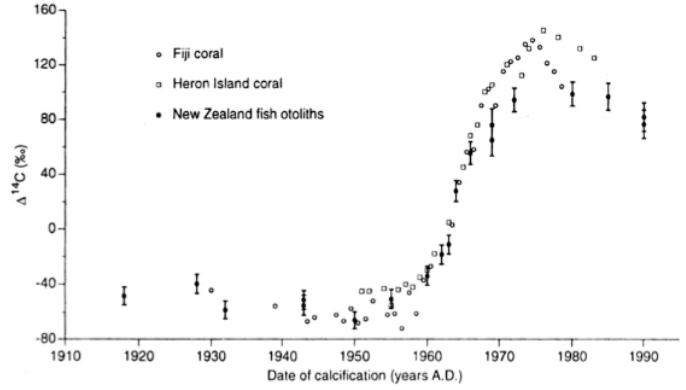

Fig. 1. $\Delta^{14}C$ (±1 sd) of *Pagrus auratus* otolith aragonite from New Zealand over the time period 1918 to 1990. $\Delta^{14}C$ measurements from hermatypic corals sampled in Fiji and Heron Island, Australia are presented for comparison [5,8].

Curiouser and curiouser

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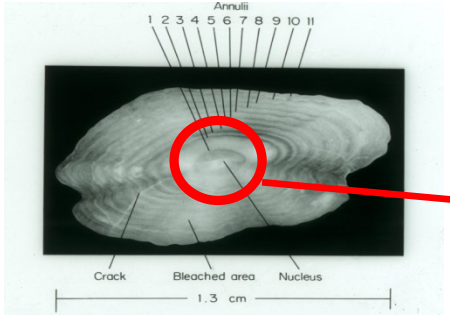

<Age-45

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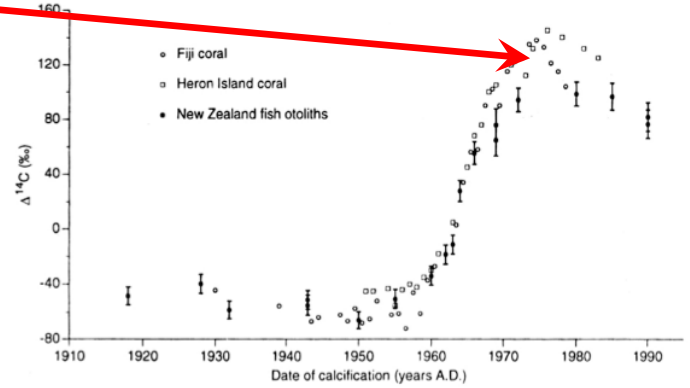

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Curiouser and curiouser

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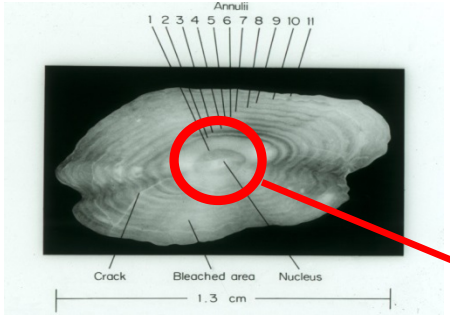

Age-60+

Pre- and post-bomb radiocarbon in fish otoliths

John M. Kalish
MAF Fisheries Greta Point, P.O. Box 297, Wellington, New Zealand
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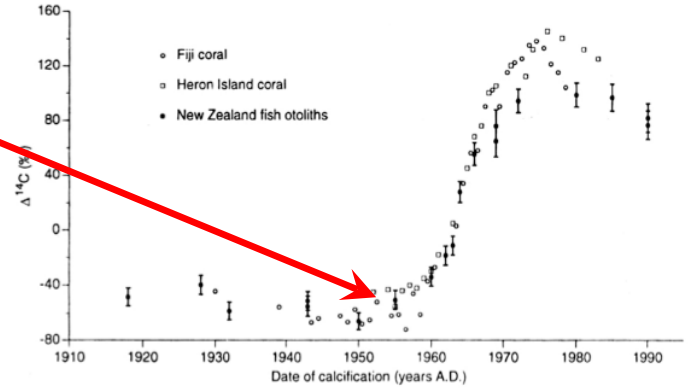

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Curiouser and curiouser

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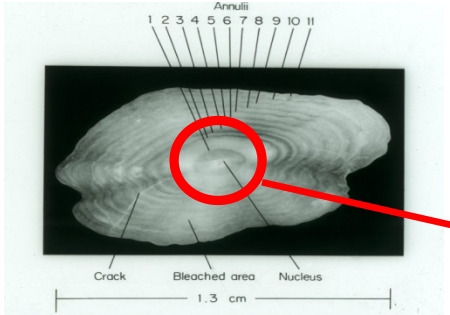

~Age 55

Pre- and post-bomb radiocarbon in fish otoliths

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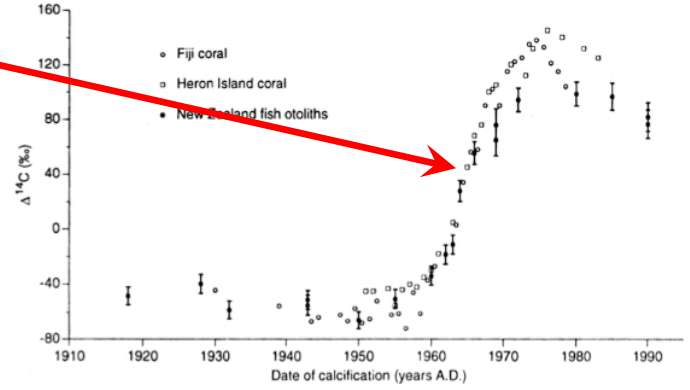

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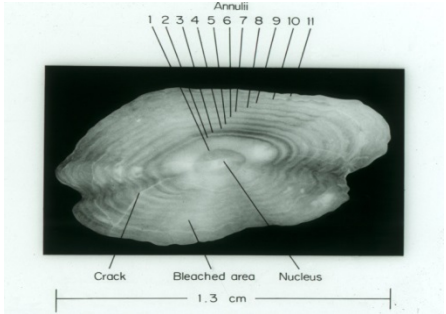

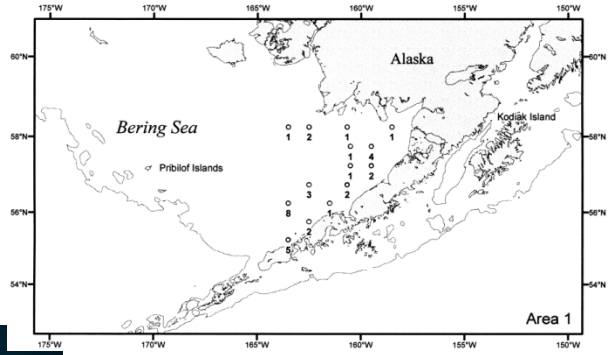

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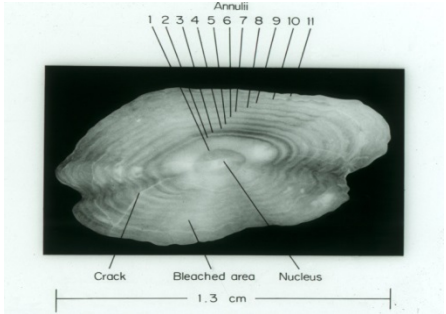

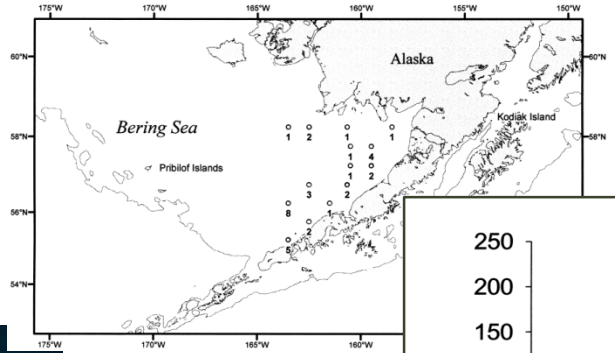

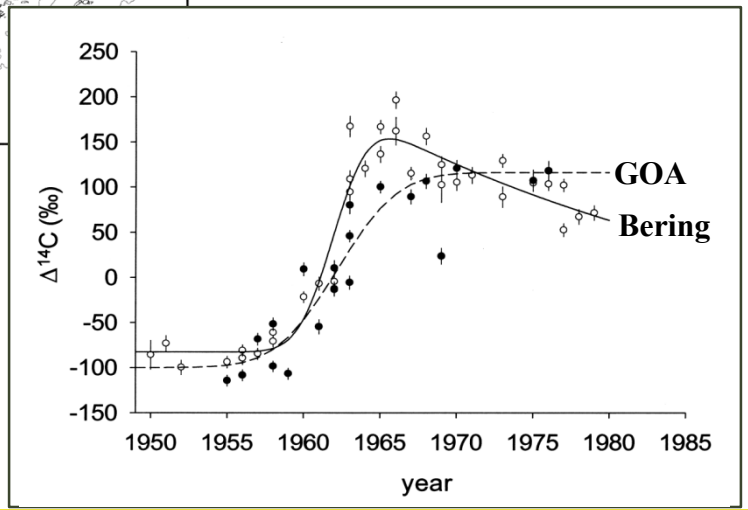

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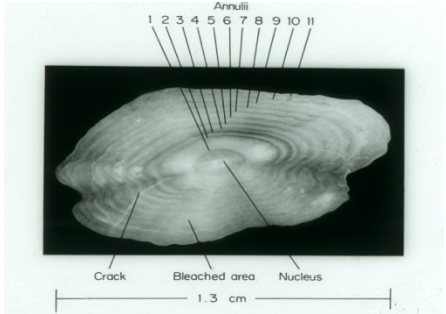
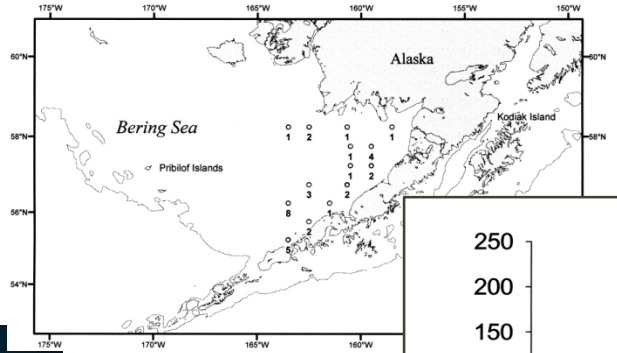
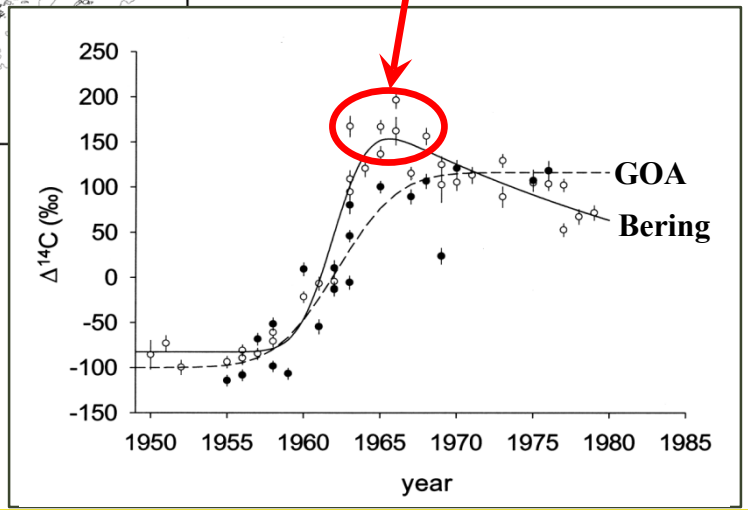




The Bristol Bay nursery showed a high-radiocarbon signature…



Curiouser and curiouser

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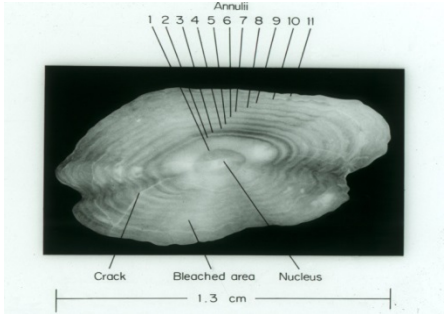
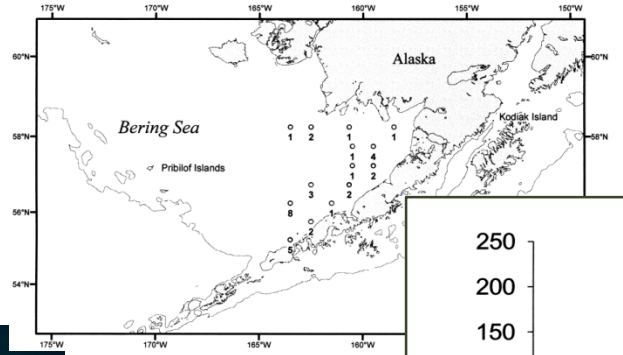
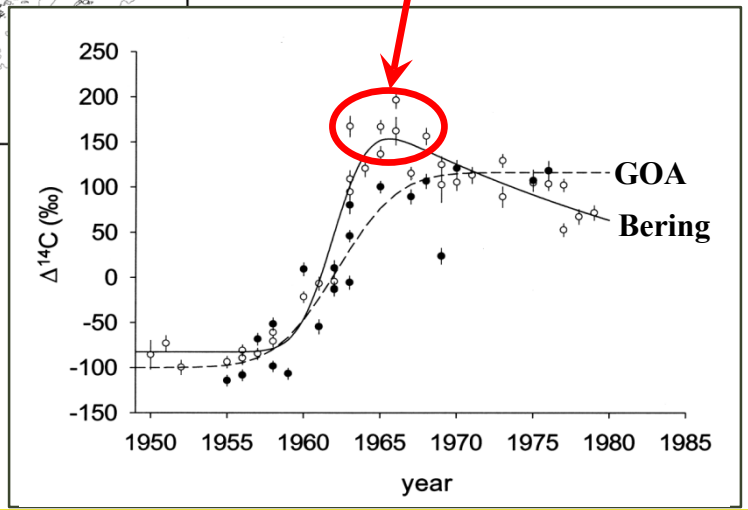




The Bristol Bay nursery showed a high-radiocarbon signature, that was absent in EBS adults



Curiouser and curiouser

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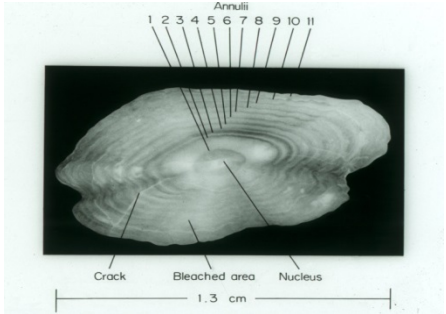
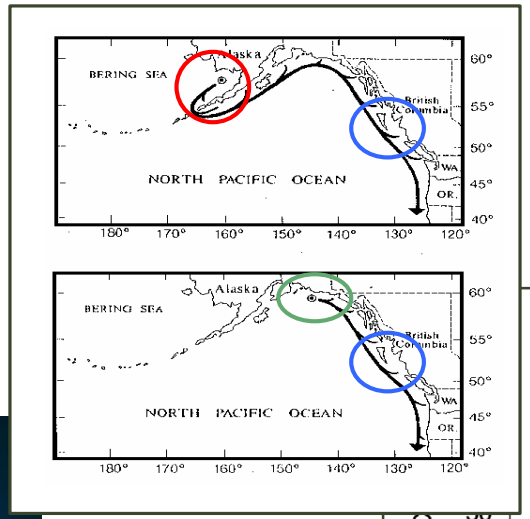
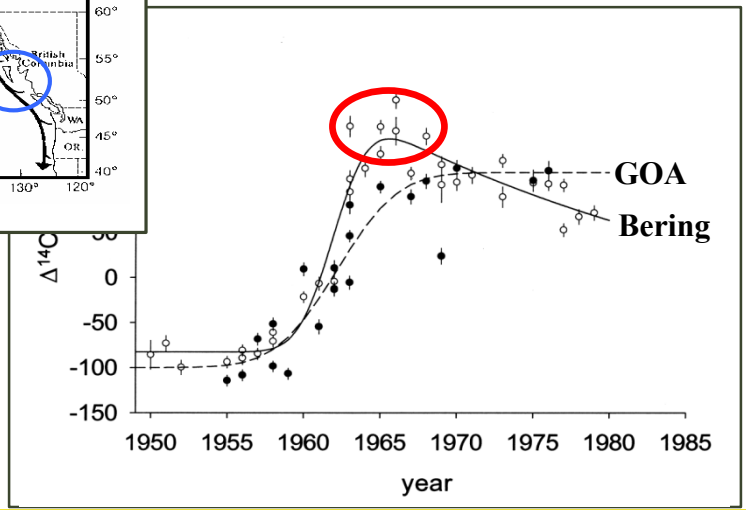


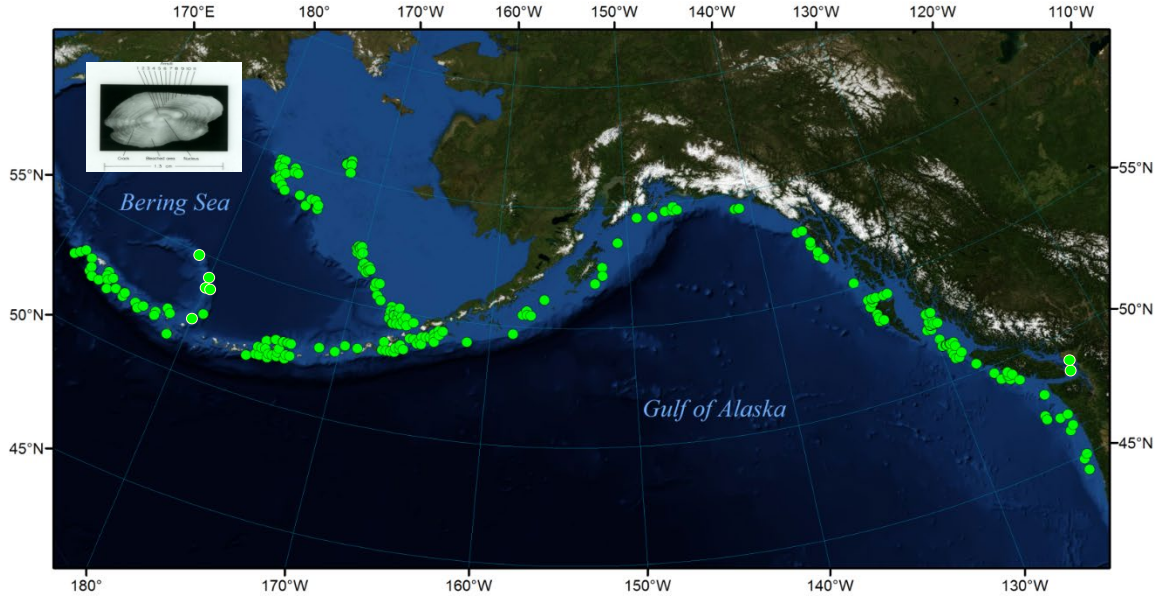


Is Bristol Bay predominantly contributing to Gulf of Alaska recruitment?



Curiouser and curiouser

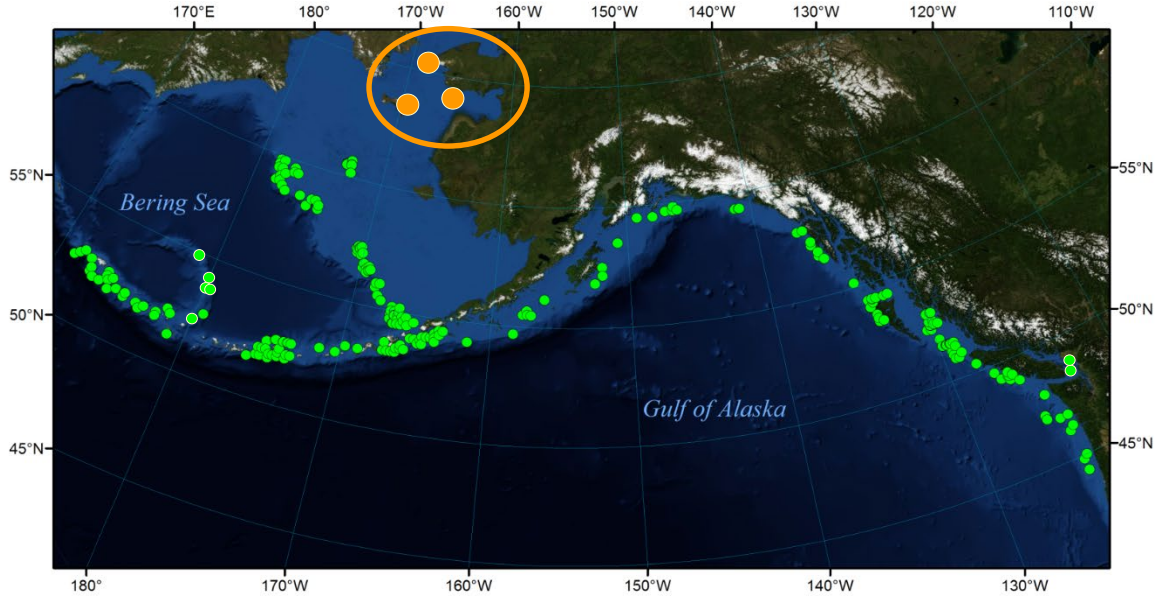
The Otolith Connection: does this imply a *western origin* for EBS Pacific halibut?



Curiouser and curiouser

The Otolith Connection: does this imply a *western origin* for EBS Pacific halibut?

- Ongoing tagging is focused on the Northern Bering Sea shelf



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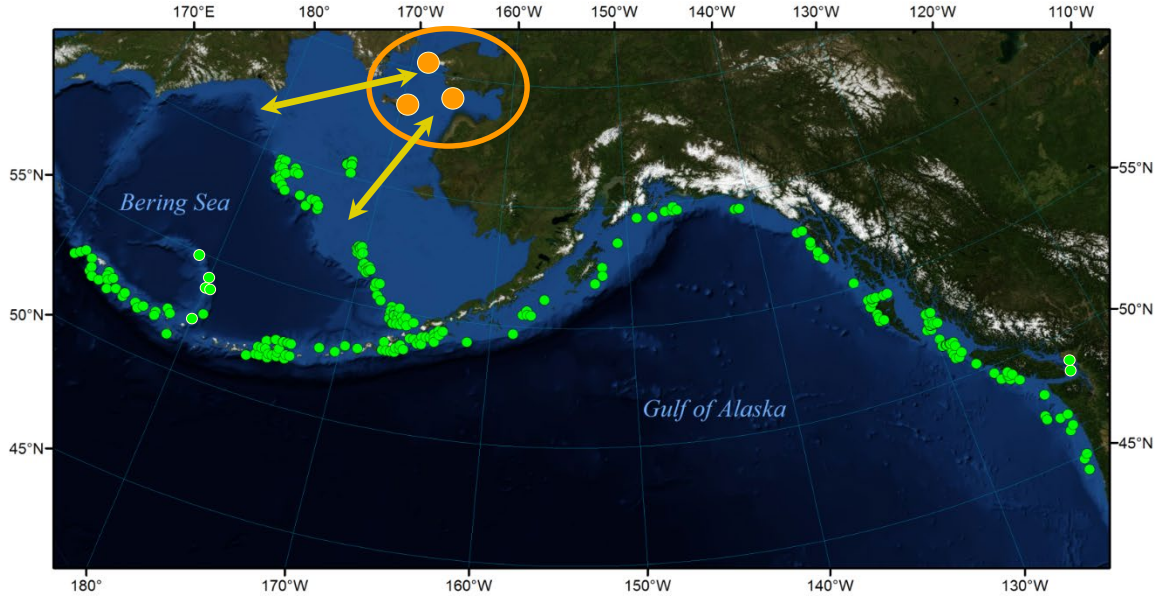
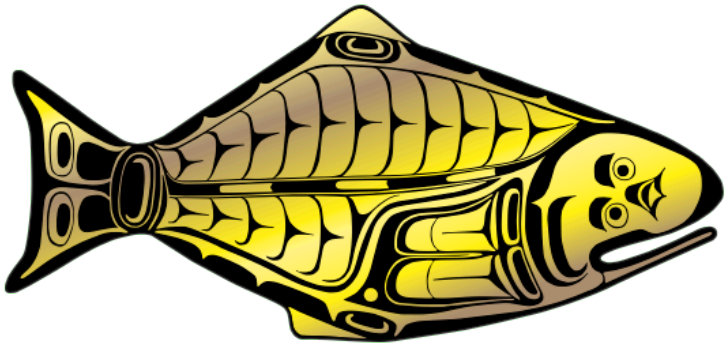


INTERNATIONAL PACIFIC



HALIBUT COMMISSION