Preliminary* Data for 2022 Fishing season and acoustic surveys

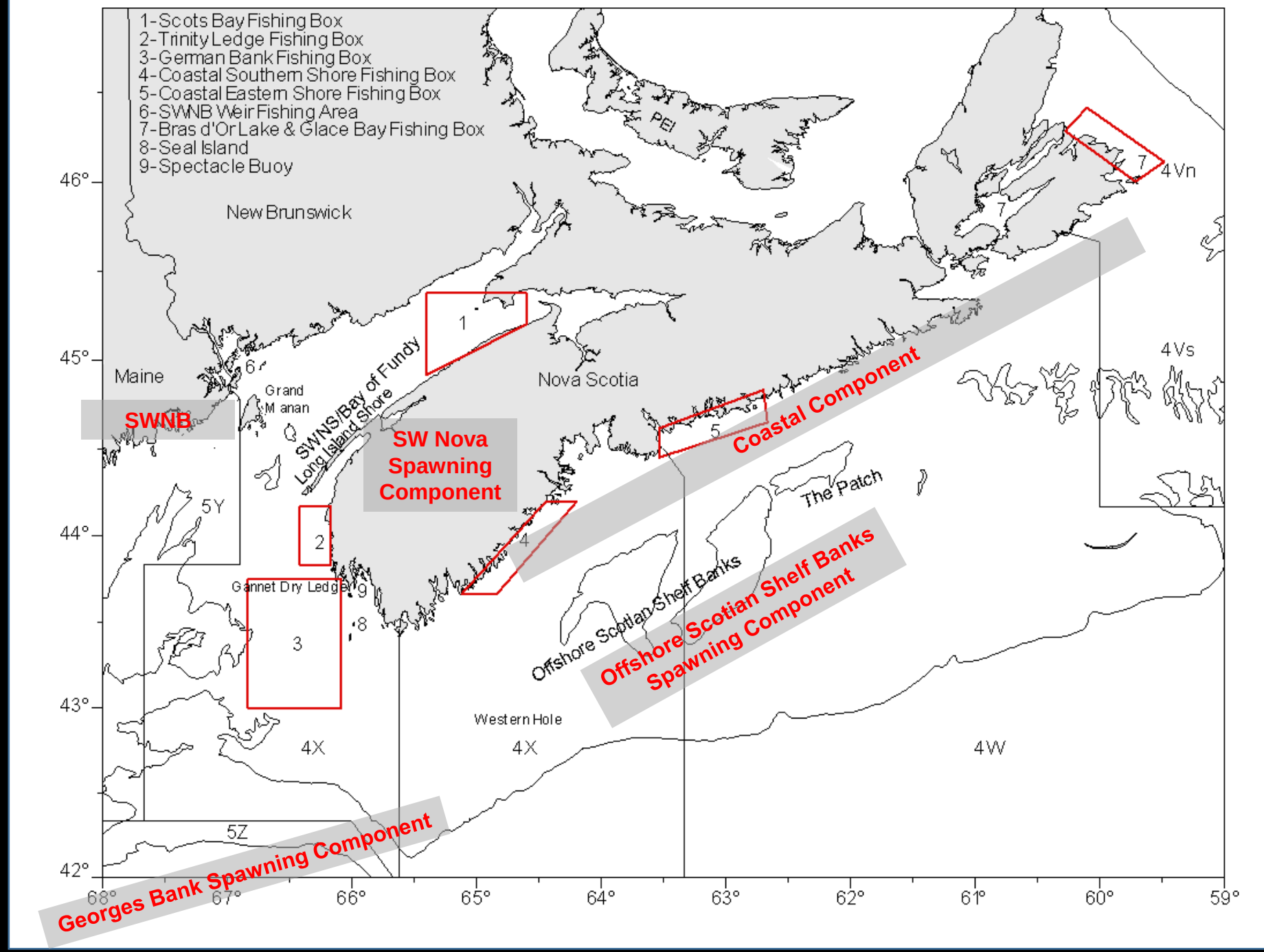
*DFO Science CSAS Peer-Review process scheduled March 27-ish.

Outline

- Acoustic Survey Results
- MSE-based advice – Stability MP.
- MSE-based advice – Requests from RM for DFO Science Advice.

4XVW Spawning Components

- Coastal (South Shore, Eastern Shore and Cape Breton) Nova Scotia
- Southwest Nova Scotia/Bay of Fundy (SWNS/BoF)
- Offshore Scotian Shelf Banks
- New Brunswick migrant juveniles


1-Scots Bay Fishing Box
2-Trinity Ledge Fishing Box
3-German Bank Fishing Box
4-Coastal Southern Shore Fishing Box
5-Coastal Eastern Shore Fishing Box
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7-Bras d'Or Lake & Glace Bay Fishing Box
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New Brunswick
PEI
Nova Scotia
Maine
Grand Manan
SWNS/Bay of Fundy
Long Island Shore
SWNB
SW Nova Spawning Component
Coastal Component
Offshore Scotian Shelf Banks Spawning Component
Georges Bank Spawning Component
Gannet Dry Ledge
Offshore Scotian Shelf Banks
The Patch
Western Hole
4Vn
4Vs
4W
4X
5Y
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Landings 4VWX

Table 1. Reported landings (rounded to thousands of tonnes) and total allowable catch for the 4VWX Herring management unit by component from 2010 to 2022 with decadal averages from 1970 to 2019.

Year	Avg. 1970–79	Avg. 1980–89	Avg. 1990–99	Avg. 2000–09	Avg. 2010–19	2015	2016	2017	2018	2019*	2020	2021	2022
4WX SWNS/BoF TAC[1]	106	106	112	69	48	50	50	42.5	42.5	35	35	35	23.45
4WX SWNS/BoF[1]	131	131	96	66	45	49	50	39	40	35	34	33	23
4VWX Coastal NS[2]	< 1	< 1	4	7	7	5	8	8	10	13	18	12	12
Offshore Scotian Shelf[2]	38	<0.1	13	6	4	2	1	4	3	6	< 0.1	< 0.9	2.5
SW New Brunswick[2]	26	24	24	15	5	< 0.2	4	2	12	5	6	4	3.3
Total Landings	172	155	137	93	60	56	63	53	65	53	56	48	48

1 - Quota year from October 15th of the preceding year to October 14th, 2019. *An interim catch is reported from October 15th 2019 to December 31st 2019 because in 2020 Quota year was changed to match calendar year (January 1st to December 31st).
2 - Calendar year from January 1st to December 31st.

Acoustic Surveys

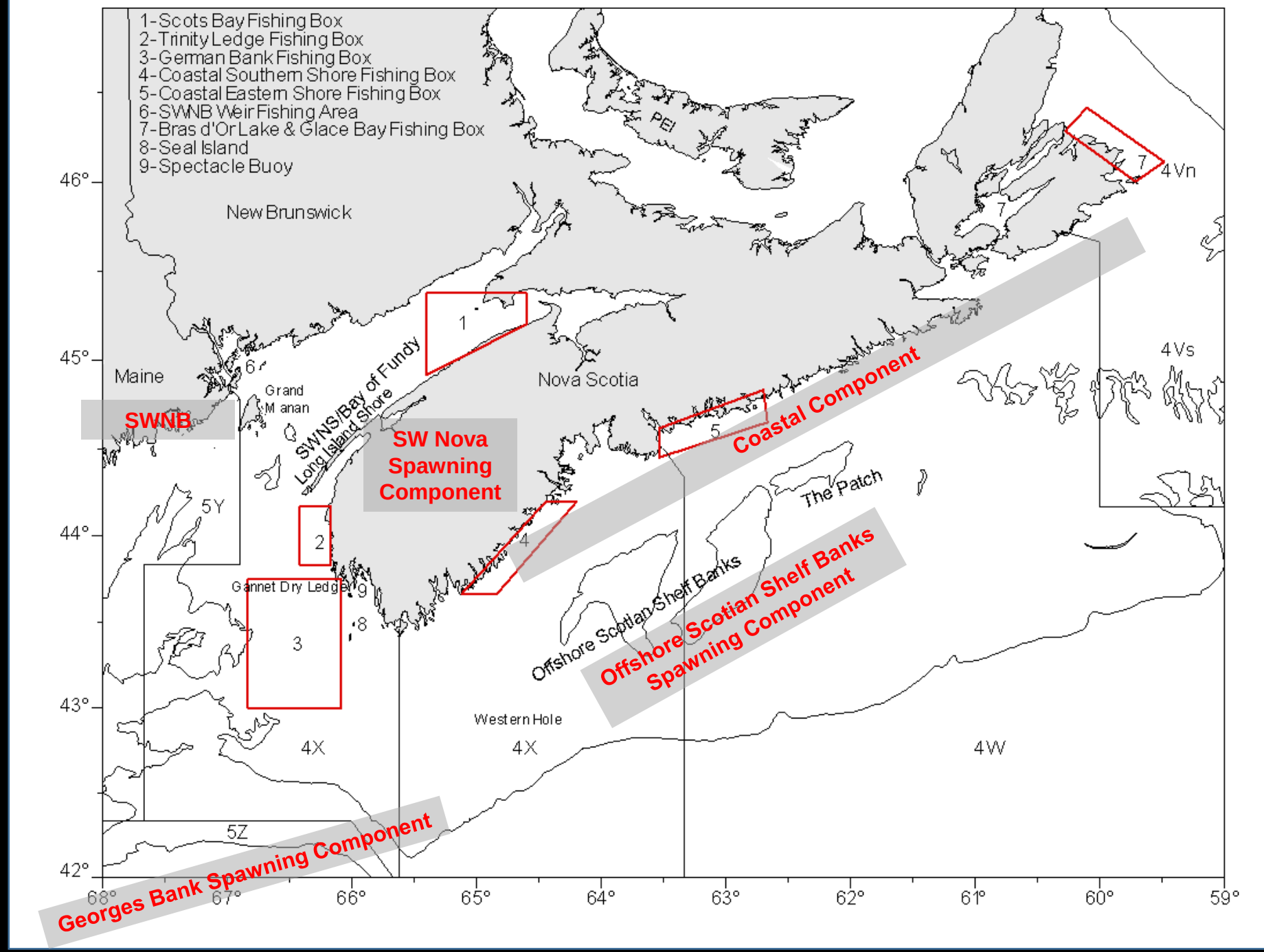
Spawning Grounds	Number of Surveys
	2022
Offshore Banks	0
Scots Bay	10
German Bank	6
Seal Island	6
Spectacle Buoy	5
Trinity Ledge	5
Little Hope	5 (-1*)
Eastern Shore	10 (3 used)
Glace Bay	0
Total Counted	39

*Vessel acoustics weren't calibrated, can't be counted.

Coastal Nova Scotia

Coastal Nova Scotia

- Three fall spawning fisheries considered
  1) Port Mouton/Little Hope
  2) Halifax/Eastern Shore
  3) Glace Bay
- Acoustic surveys, catches and samples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4Vn
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5Y
5Z
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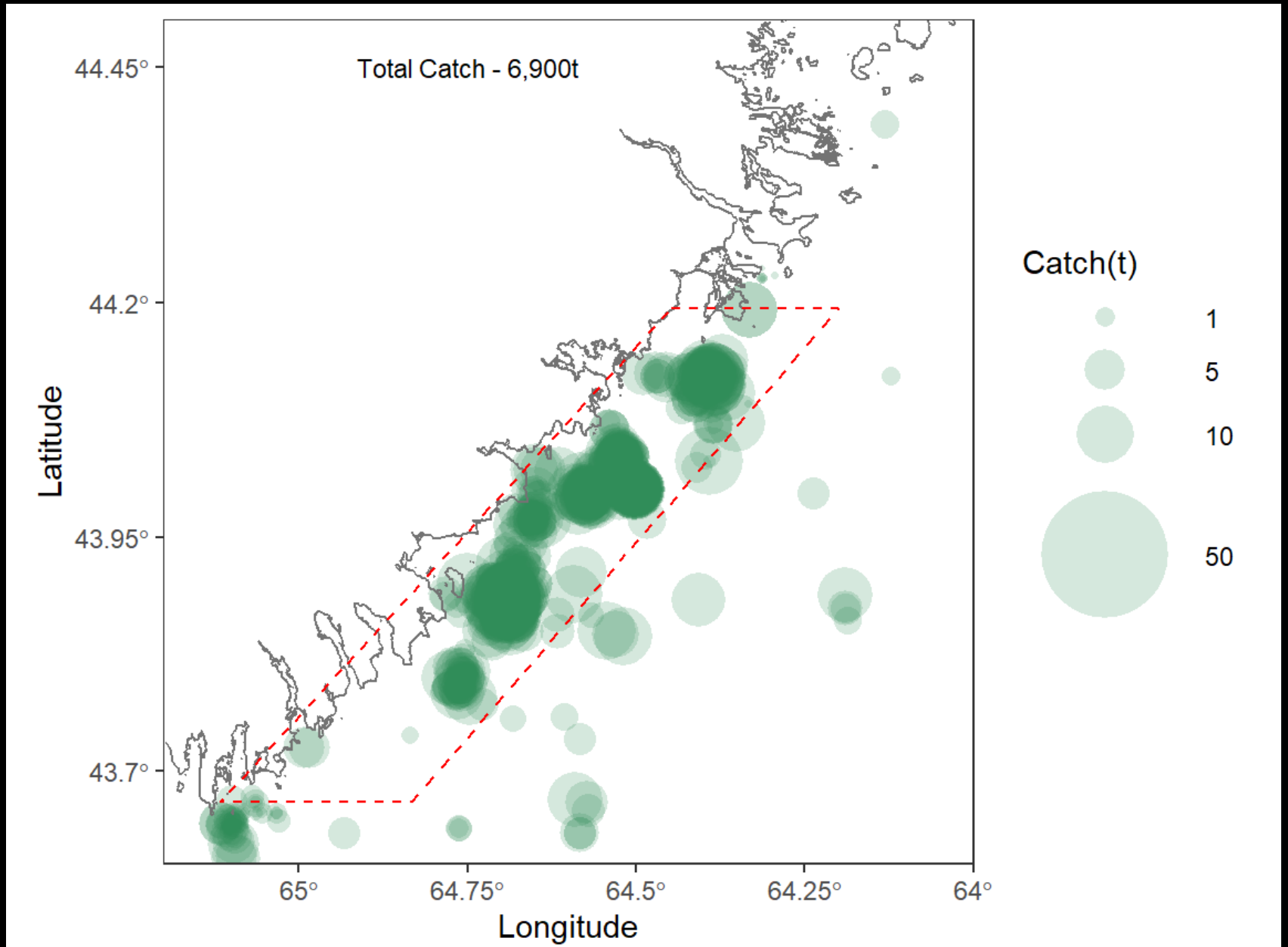
Little Hope

Little Hope


Total Catch - 6,900t
44.45°
44.2°
43.95°
43.7°
Latitude
65°
64.75°
64.5°
64.25°
64°
Longitude
Catch(t)
1
5
10
50

Little Hope – Samples 2022

DATE	TS for 38 kHz	Length Frequency Sample Size (N)	No. Measured Length Frequency	Mean Length (mm)	Detailed Sample Size (n)	Mean Weight (kg)
9/7/2022	-34.84	1	101	274	30	0.148
9/19/2022	-34.82	1	100	272	28	0.145
9/30/2022	-34.87	1	100	272	28	0.147
10/11/2022	-34.63	1	103	270	29	0.137
10/22/2022	-34.72	1	102	270	28	0.140

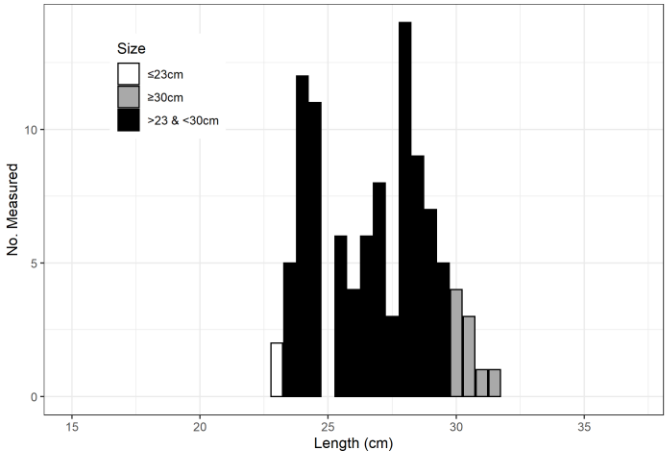
*Standard Target strength used. Length-frequency or detailed sample not available. Reporting target strength for 38 kHz, for 50, 75, and 120 kHz, add -0.10727, -0.26575, and -0.44946, respectively.

Calibrations for Little Hope

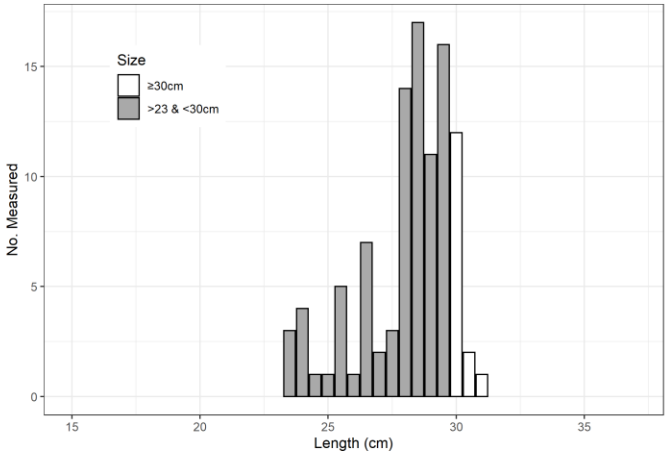
Only used acoustic data from:

- Atlantic Star
- Saltwater Hunter

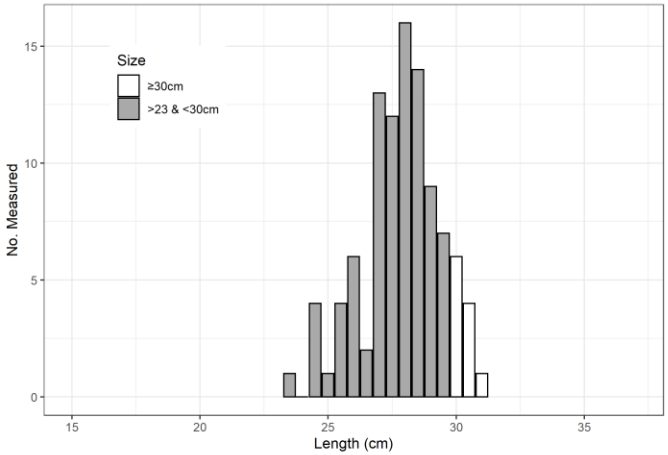
Fishery Samples used for survey on 2022-09-07



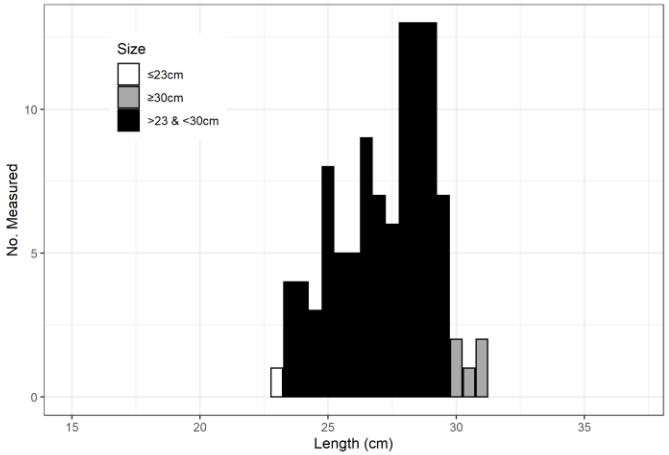
Fishery Samples used for survey on 2022-09-19



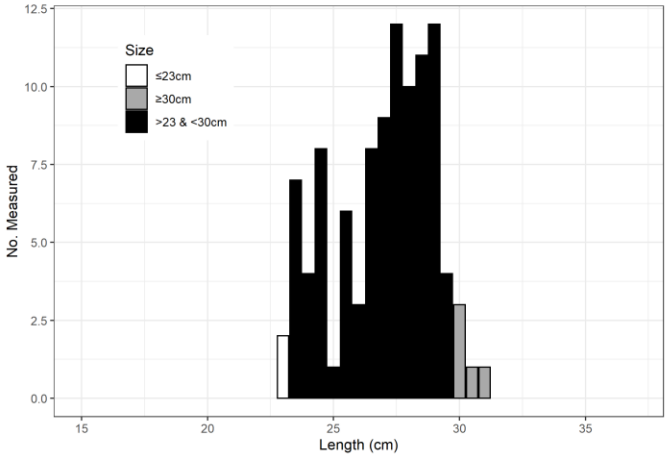
Fishery Samples used for survey on 2022-09-30

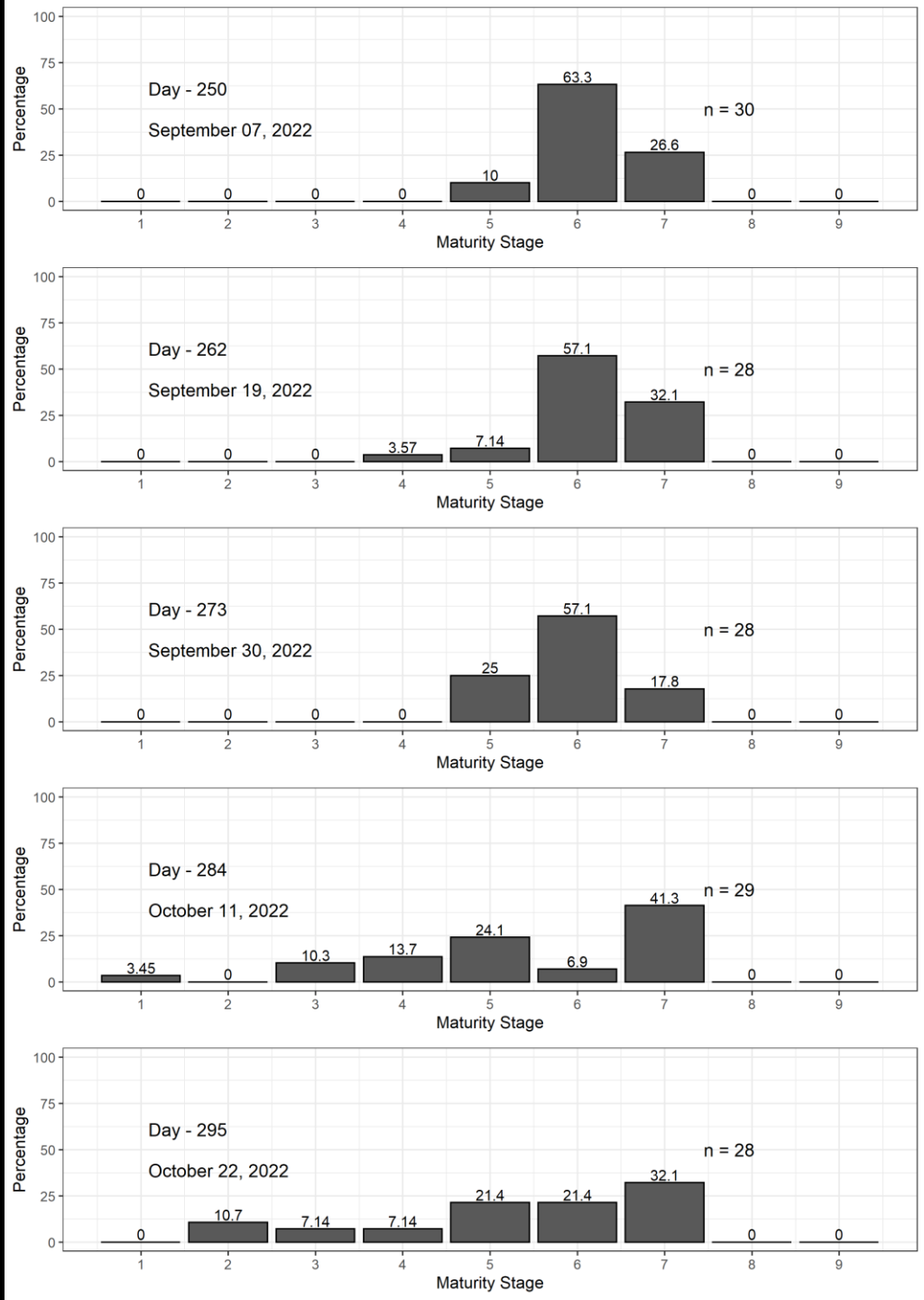


Fishery Samples used for survey on 2022-10-11



Fishery Samples used for survey on 2022-10-22





Maturation Stages

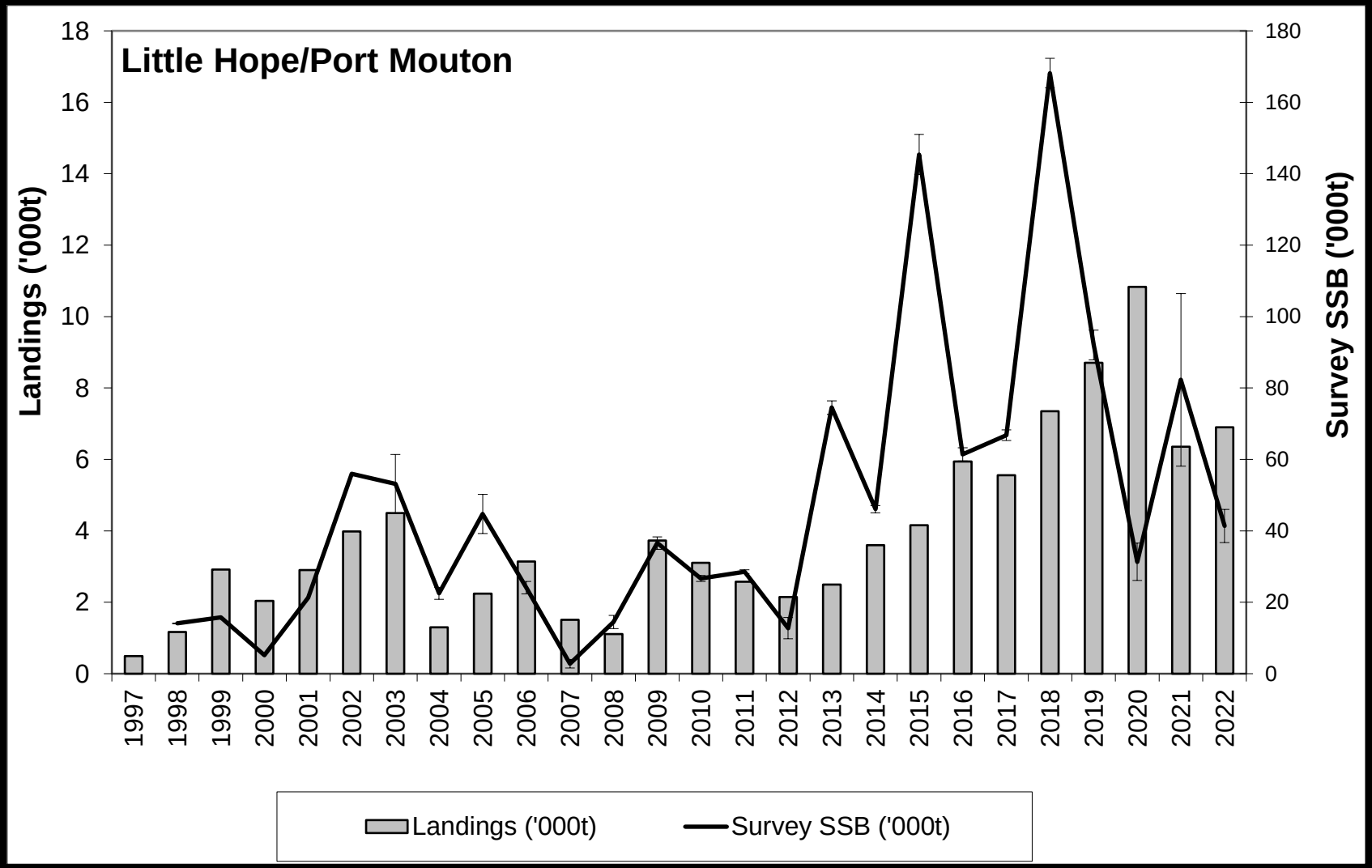
1 - Immature 1
2 – Immature 2
3 – Ripening 1
4 – Ripening 2
5 - Ripe
6 – Spawning
7 - Spent
8 - Recovering
9 – Recovering 2

Little Hope Summary - 2022

Location	Date	Target Strength* (dB/kg)	Area (km^2)	mean Sa (dB/m^2)	Biomass (t)	Standard Error (t)	SE %
Little Hope #1	9/6/2022	-35.29	80.3	-34.81	20,263	905	4%
Little Hope #2	9/18/2022	-35.27	9.4	-38.98	1,760	400	23%
Little Hope #3	9/29/2022	-35.32	12.6	-25.22	18,933	521	3%
Little Hope #4	10/21/2022	-35.17	99.8	-58.85	427	121	28%
Summary			**202.16**	**-39.46**	**41,383**	**12,662**	31%

*Target Strength presented here is for herring targets detected using a 120 kHz transducer.

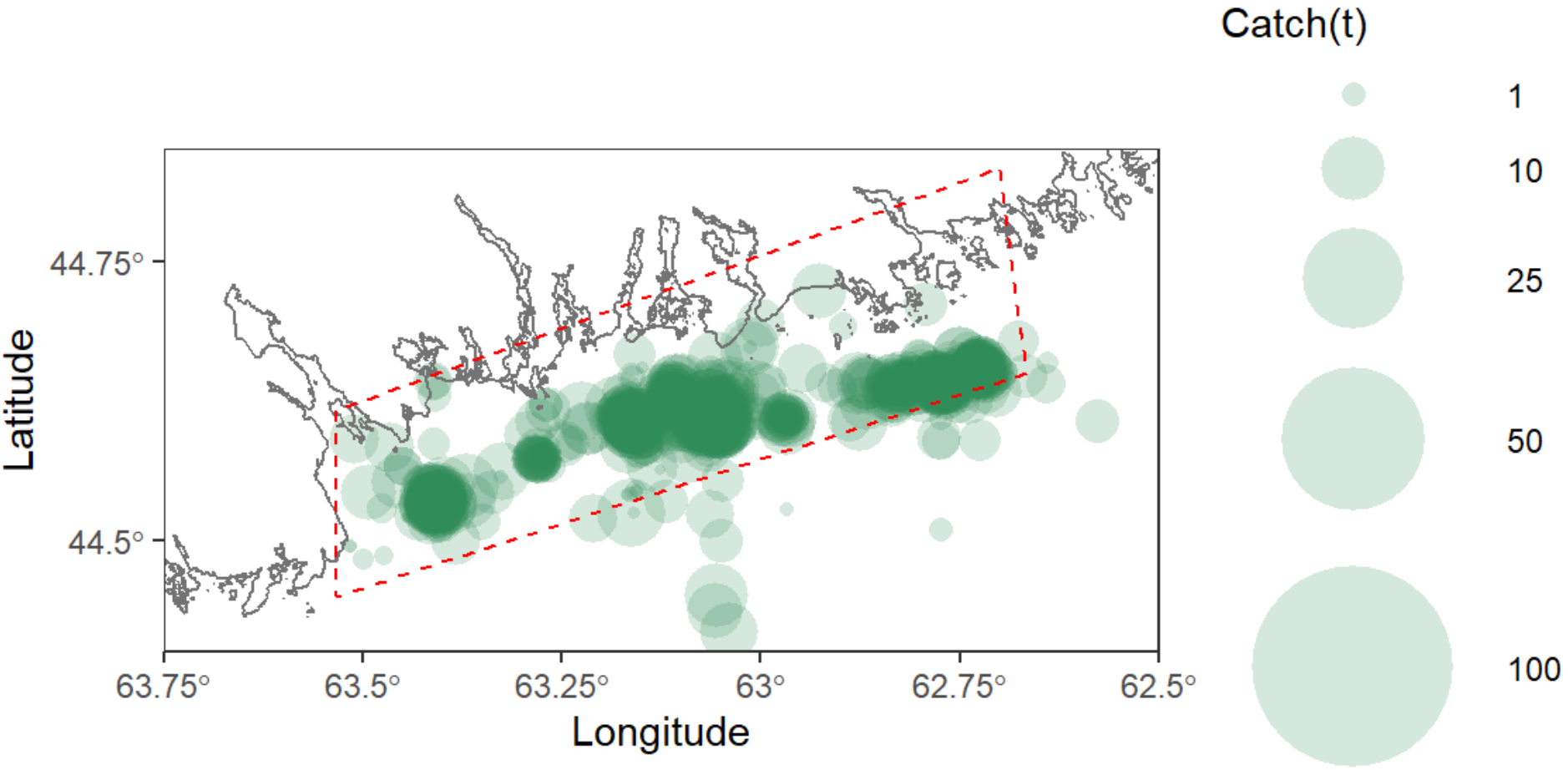
Little Hope Summary



Halifax/Eastern shore

*Standard Target strength used. Length-frequency or detailed sample not available.
Reporting target strength for 38 kHz, for 50, 75, and 120 kHz, add -0.10727, -0.26575, and -0.44946, respectively.

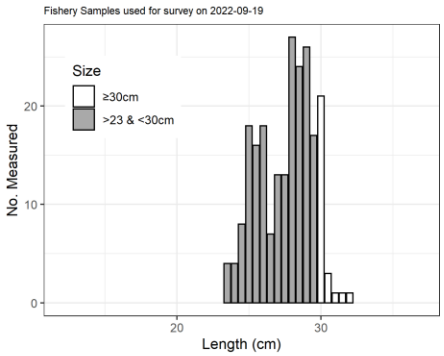
Total Catch = 5,495 mt

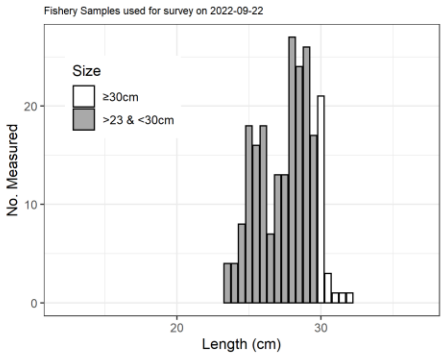


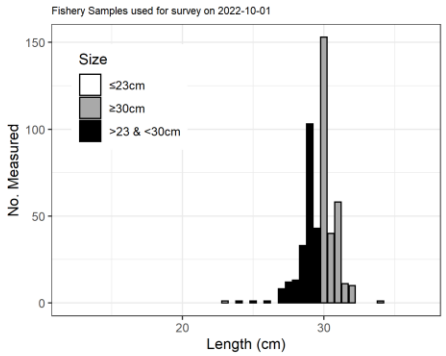
Eastern Shore – 2022 Samples

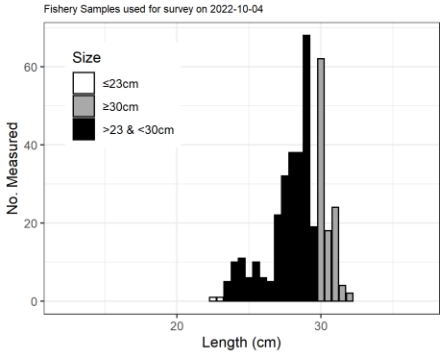
DATE	TS for 38 kHz	Length Frequency Sample Size (N)	No. Measured Length Frequency	Mean Length (mm)	Detailed Sample Size (n)	Mean Weight (kg)
9/19/2022	-35.17	1	222	278	31	0.169
9/22/2022	-35.17	1	222	278	31	0.169
10/1/2022	-35.49	4	489	285	39	0.176
10/4/2022	-35.05	3	382	272	63	0.169
10/8/2022	-35.05	3	382	272	63	0.169
10/13/2022	-35.35	1	307	280	36	0.173
10/17/2022	-35.35	1	307	280	36	0.173
10/18/2022	-35.35	1	307	280	36	0.173
10/23/2022	-35.07	1	193	273	34	0.169
10/25/2022	-35.07	1	193	273	34	0.169

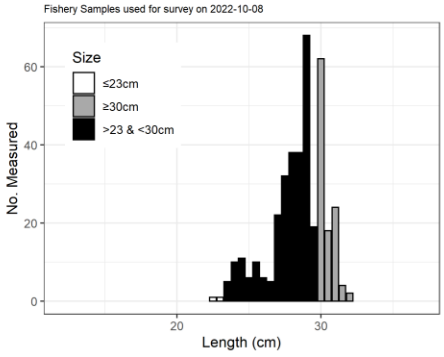
*Standard Target strength used. Length-frequency or detailed sample not available. Reporting target strength for 38 kHz, for 50, 75, and 120 kHz, add -0.10727, -0.26575, and -0.44946, respectively.

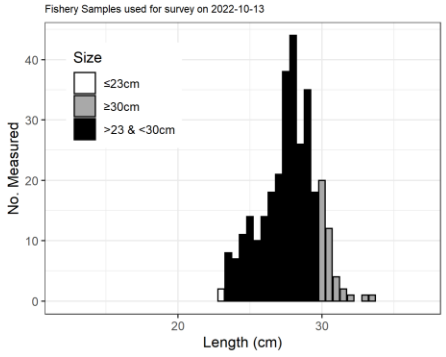

Fishery Samples used for survey on 2022-09-19
Size
≥30cm
>23 & <30cm
No. Measured
Length (cm)

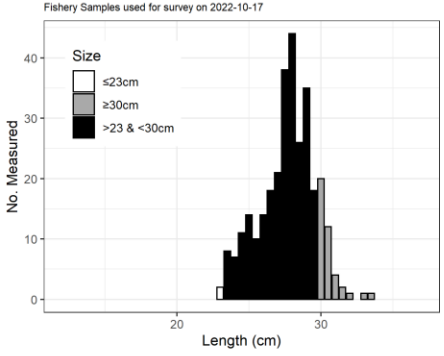

Fishery Samples used for survey on 2022-09-22
Size
≥30cm
>23 & <30cm
No. Measured
Length (cm)

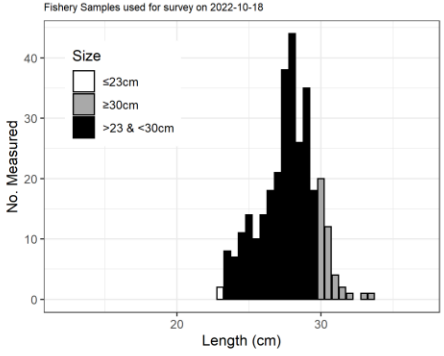

Fishery Samples used for survey on 2022-10-01
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)

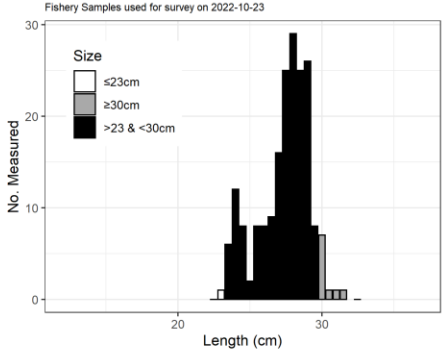

Fishery Samples used for survey on 2022-10-04
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)

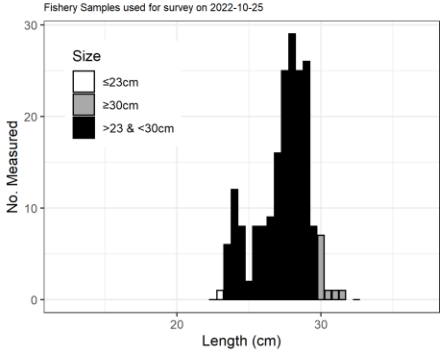

Fishery Samples used for survey on 2022-10-08
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)

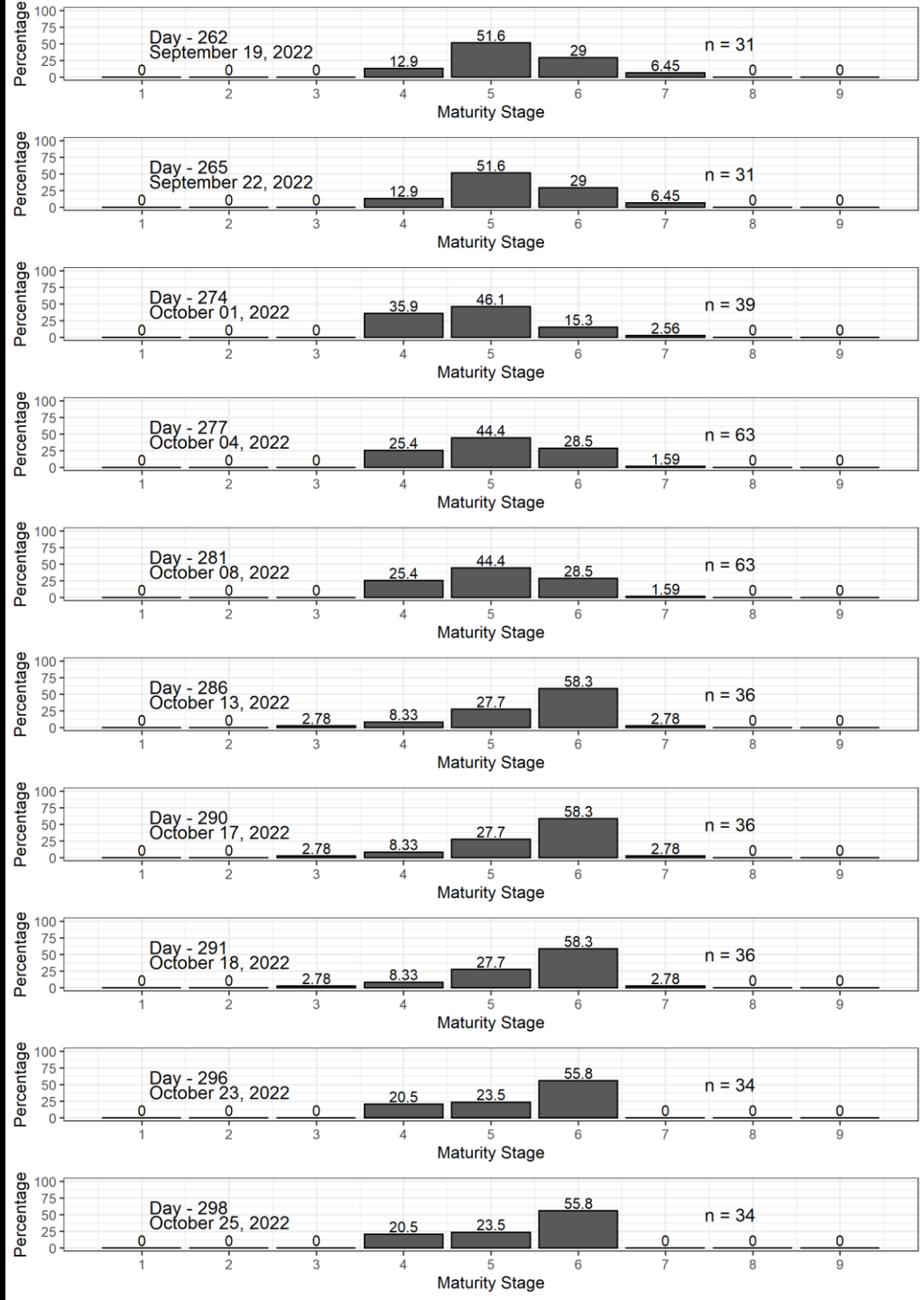

Fishery Samples used for survey on 2022-10-13
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)


Fishery Samples used for survey on 2022-10-17
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)


Fishery Samples used for survey on 2022-10-18
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)


Fishery Samples used for survey on 2022-10-23
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)


Fishery Samples used for survey on 2022-10-25
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)



Maturation Stages

1 - Immature 1
2 – Immature 2
3 – Ripening 1
4 – Ripening 2
5 - Ripe
6 – Spawning
7 - Spent
8 - Recovering
9 – Recovering 2

Eastern Shore Summary – without removals

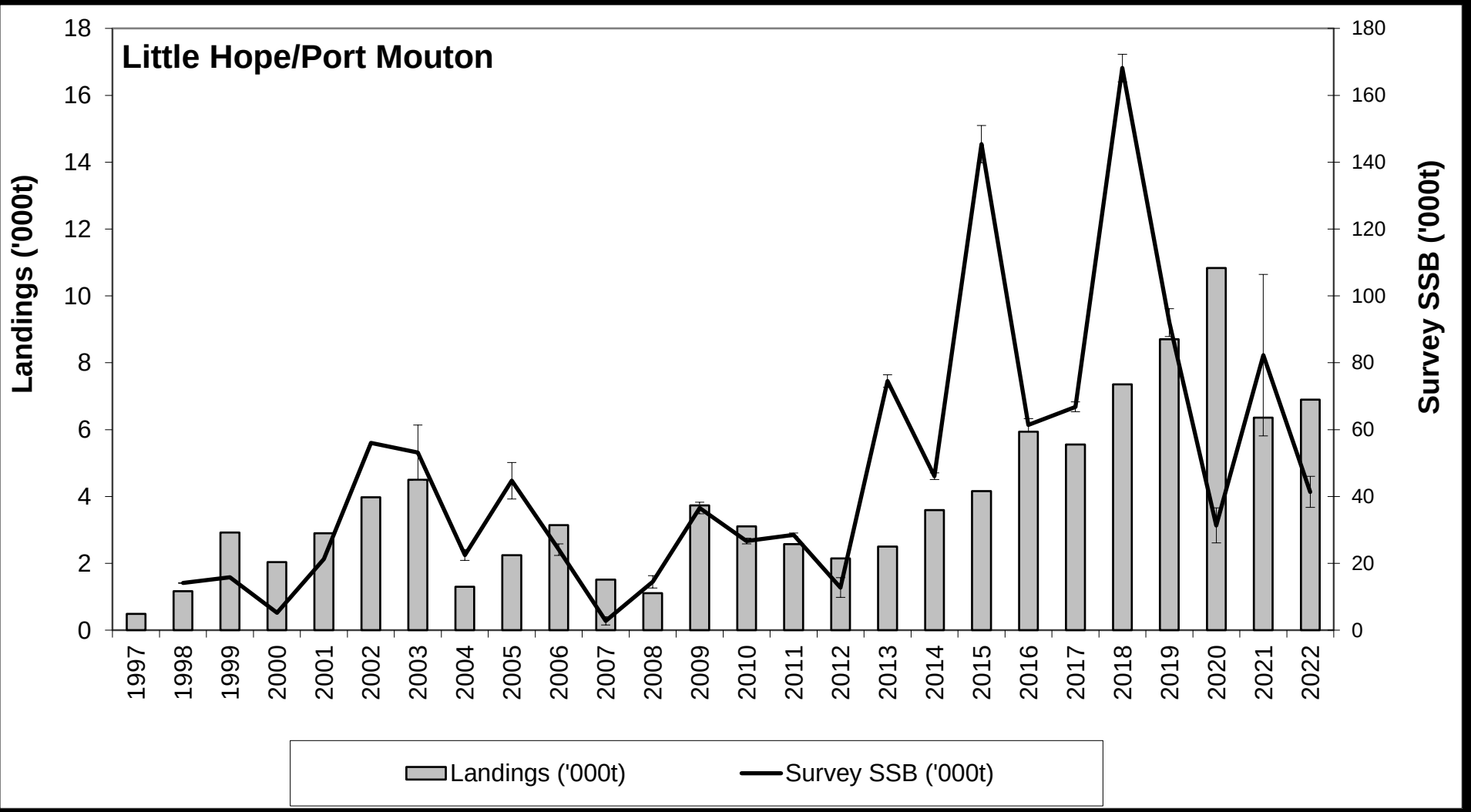
Location	Date	Target Strength* (dB/kg)	Area (km^2)	mean Sa (dB/m^2)	Biomass (t)	Standard Error (t)	SE %
Eastern Shore #1	9/19/2022	-35.62	2.3	-38.80	1,093	341	31%
Eastern Shore #2	9/22/2022	-35.62	10.7	-31.12	**4,423**	135	26%
Eastern Shore #3	10/1/2022	-35.94	0.2	-33.07	428	223	52%
Eastern Shore #4	10/4/2022	-35.50	21.2	-29.64	**15,057**	104	23%
Eastern Shore #5	10/8/2022	-35.50	0.5	-43.99	69	20	29%
Eastern Shore #6	10/13/2022	-35.95	3.9	-43.02	768	172	22%
Eastern Shore #7	10/17/2022	-35.80	3.7	-36.34	**833**	80	31%
Eastern Shore #8	10/18/2022	-35.80	0.7	-35.95	702	212	30%
Eastern Shore #9	10/23/2022	-35.52	0.3	-43.30	56	45	80%
Eastern Shore #10	10/25/2022	-35.52	1.4	-45.31	148	97	66%
Summary			**45.0**	**-38.06**	**23577.2**	**2,466**	**10%**

Eastern Shore Summary

Location	Date	Target Strength* (dB/kg)	Area (km^2)	mean Sa (dB/m^2)	Biomass (t)	Standard Error (t)	SE %
Eastern Shore #1	9/22/2022	-35.62	10.7	-31.12	4,423	135	26%
Eastern Shore #3	10/4/2022	-35.50	21.2	-29.64	15,057	104	23%
Eastern Shore #4	10/17/2022	-35.80	3.7	-36.34	833	80	31%
Summary			**35.613**	**-32.37**	**20,313**	**2,413**	12%

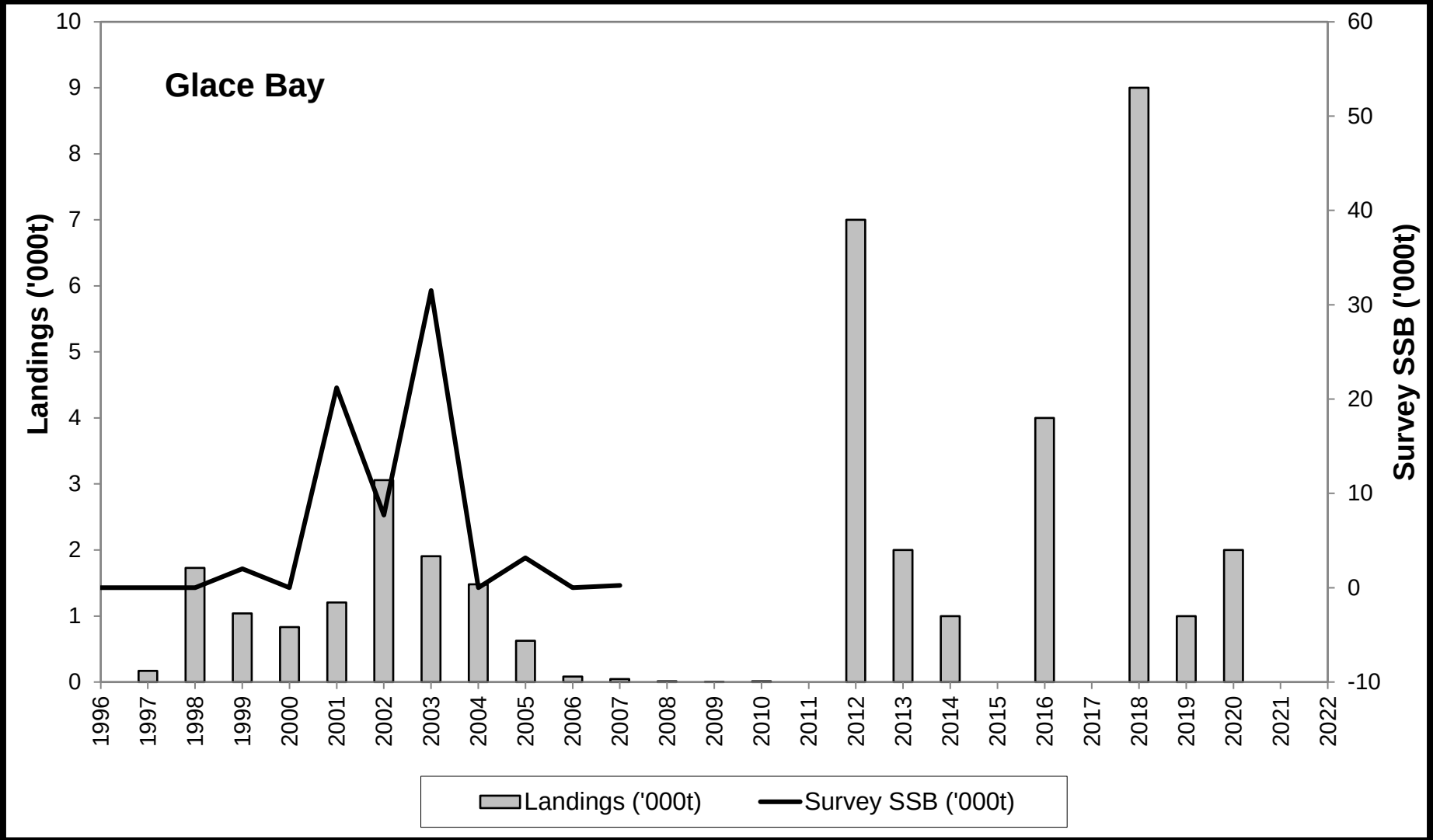
*Target Strength presented here is for herring targets detected using a 120 kHz transducer.

Eastern Shore Summary



Glace Bay

Glace Bay Summary



Coastal Nova Scotia
Landings summary

Table 6. Recorded landings and allocations (tonnes) of Herring from major gillnet fisheries on the Coastal Nova Scotia spawning component average for 1998 to 2012 and biomass for 2013–2022. Landings reported are from the MARFIS database and include Herring landed outside of the allocation season.

Landings and Allocations (t)		Avg. 98–12	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Little Hope/Port Mouton	Catch	2,558	2,499	3,596	4,160	5,943	5,557	7,353	8,707	10,747	6,355	6,900
	Allocation	2,487	2,387	3,577	3,772	6,151	6,803	7,884	9,757	10,676	8,622	8,595
Halifax/Eastern Shore	Catch	2,596	1,390	1,163	1,001	1,837	2,259	2,553	4,544	6,871	5,635	5,495
	Allocation	3,359	2,427	1,959	1,066	1,884	2,856	3,960	4,671	7,303	6,649	5,699
Glace Bay	Catch	1	2	1	0	4	0	9	1	2	0	0
Bras d'Or Lakes	Catch	0	0	0	0	0	0	0	0	0	0	0

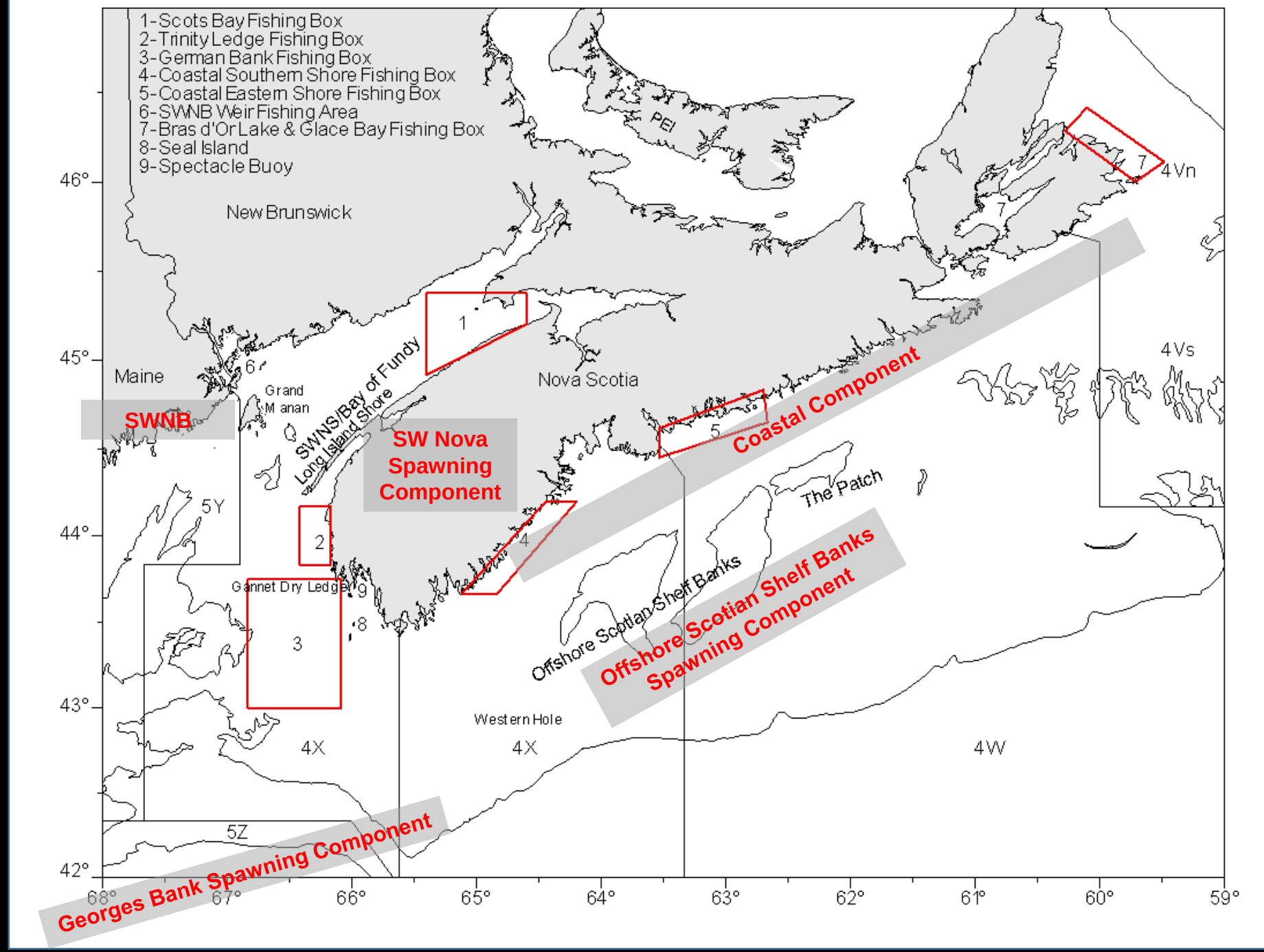
Coastal Nova Scotia
Acoustic summary

Table 7. Estimated Herring acoustic spawning stock biomass (SSB) (tonnes) average for 1998-2011, biomass for 2013 to 2022 and recent 5-year average for the Coastal Nova Scotia spawning component areas.

Acoustic index of SSB (t)	Avg. 98–12	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Avg. last 5 years
Little Hope (SSB)	25,244	73,992	46,077	145,395	61,408	66,815	168,164	92,019	31,344	71,421	41,383	80,866
Allocation	2,487	2,421	3,577	3,772	6,151	6,803	7,884	9,757	10,676	8,622	8,595	
Halifax (SSB)	29,994	6,870	9,586	68,562	54,312	58,681	42,416	141,198	26,205	16,425	20,313	49,311
Allocation	3,359	2,630	2,240	1,066	1,884	2,856	3,960	4,671	7,303	6649	5,699	
Glace Bay	7380	-	50	-	-	-	-	-	-	-	-	-
Bras d'Or Lakes	300	-	-	-	-	-	-	-	-	-	-	-

"-" = no survey

Southwest New Brunswick migrant juvenile fishery component.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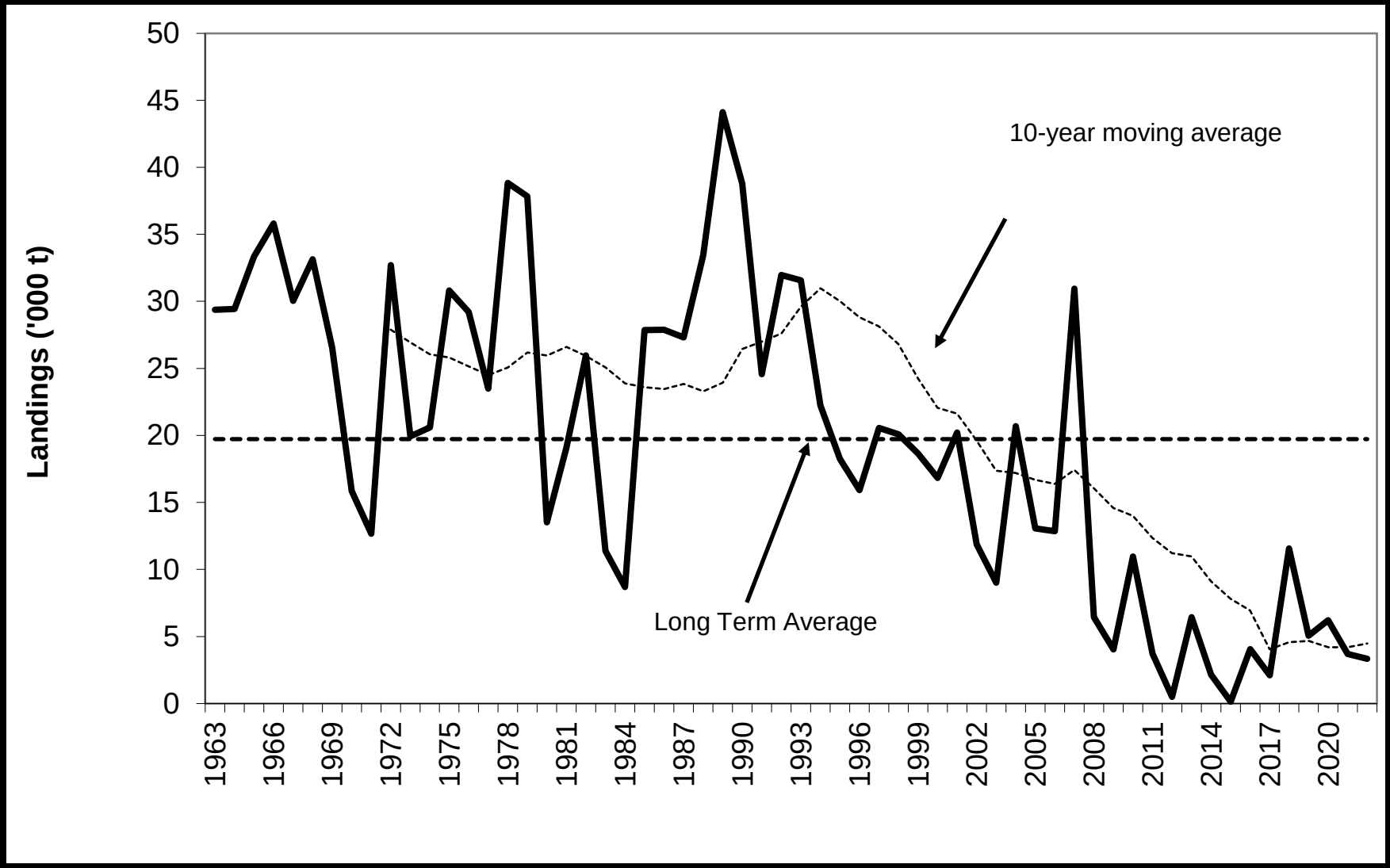
60°
59°



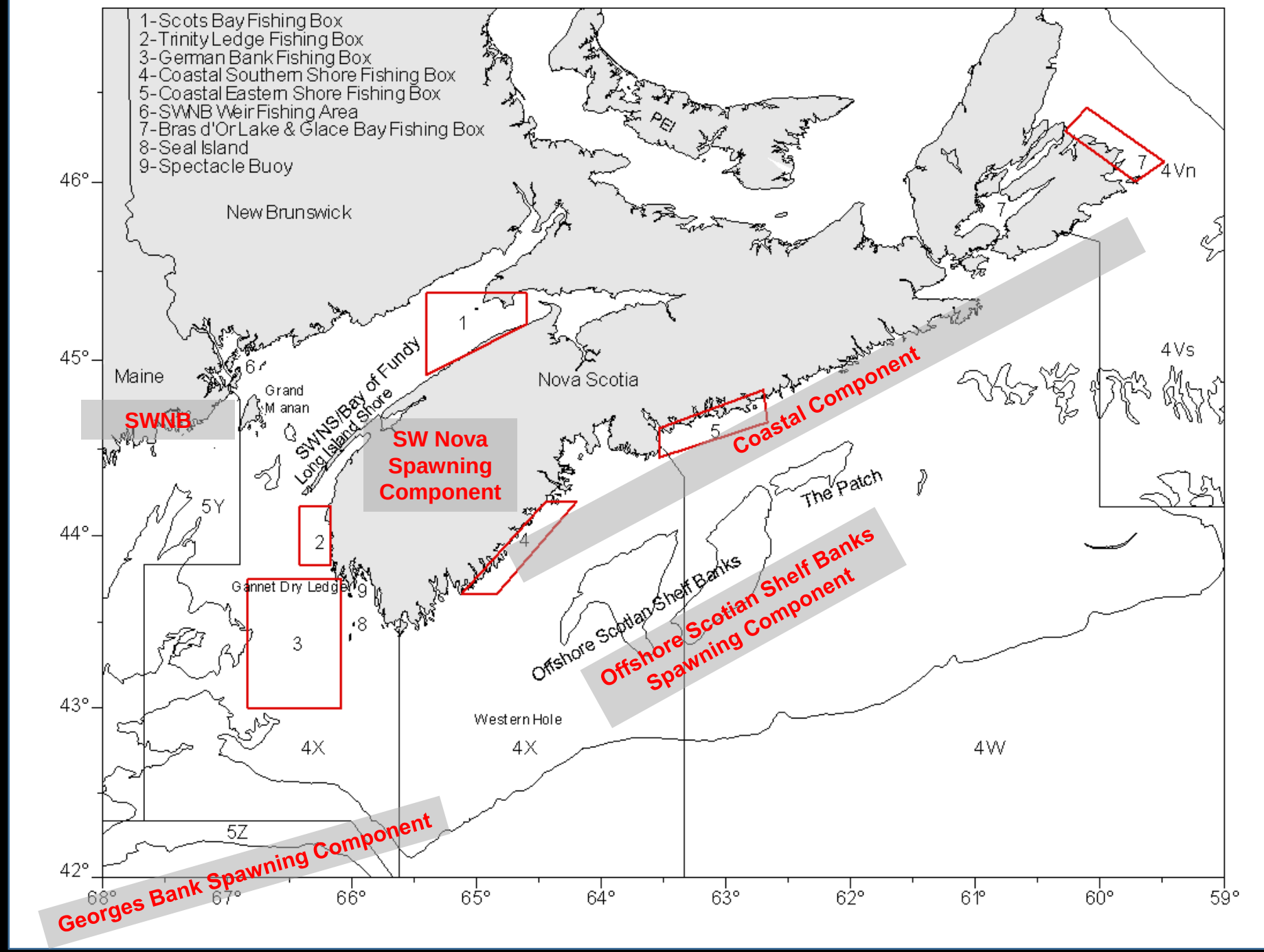
Herring landings from the New Brunswick weir and shutoff fishery for 1963-2022.

Total Removals for 2022 = 3341 mt

NB Weir Summary

- Total Removals 3341 mt.
- Near the lowest landings observed since 1963.
- The landings time series for this fishery may not be indicative of abundance because catches are extremely susceptible to many factors in addition to abundance, including effort.

Offshore Fishery Component


1-Scots Bay Fishing Box
2-Trinity Ledge Fishing Box
3-German Bank Fishing Box
4-Coastal Southern Shore Fishing Box
5-Coastal Eastern Shore Fishing Box
6-SWNB Weir Fishing Area
7-Bras d'Or Lake & Glace Bay Fishing Box
8-Seal Island
9-Spectacle Buoy
New Brunswick
PEI
Nova Scotia
Maine
Grand Manan
SWNS/Bay of Fundy
Long Island Shore
SWNB
SW Nova Spawning Component
Coastal Component
Offshore Scotian Shelf Banks Spawning Component
Georges Bank Spawning Component
Gannet Dry Ledge
Offshore Scotian Shelf Banks
The Patch
Western Hole
4Vn
4Vs
4W
4X
5Y
5Z
1
2
3
4
5
6
7
8
9
46°
45°
44°
43°
42°
68°
67°
66°
65°
64°
63°
62°
61°
60°
59°

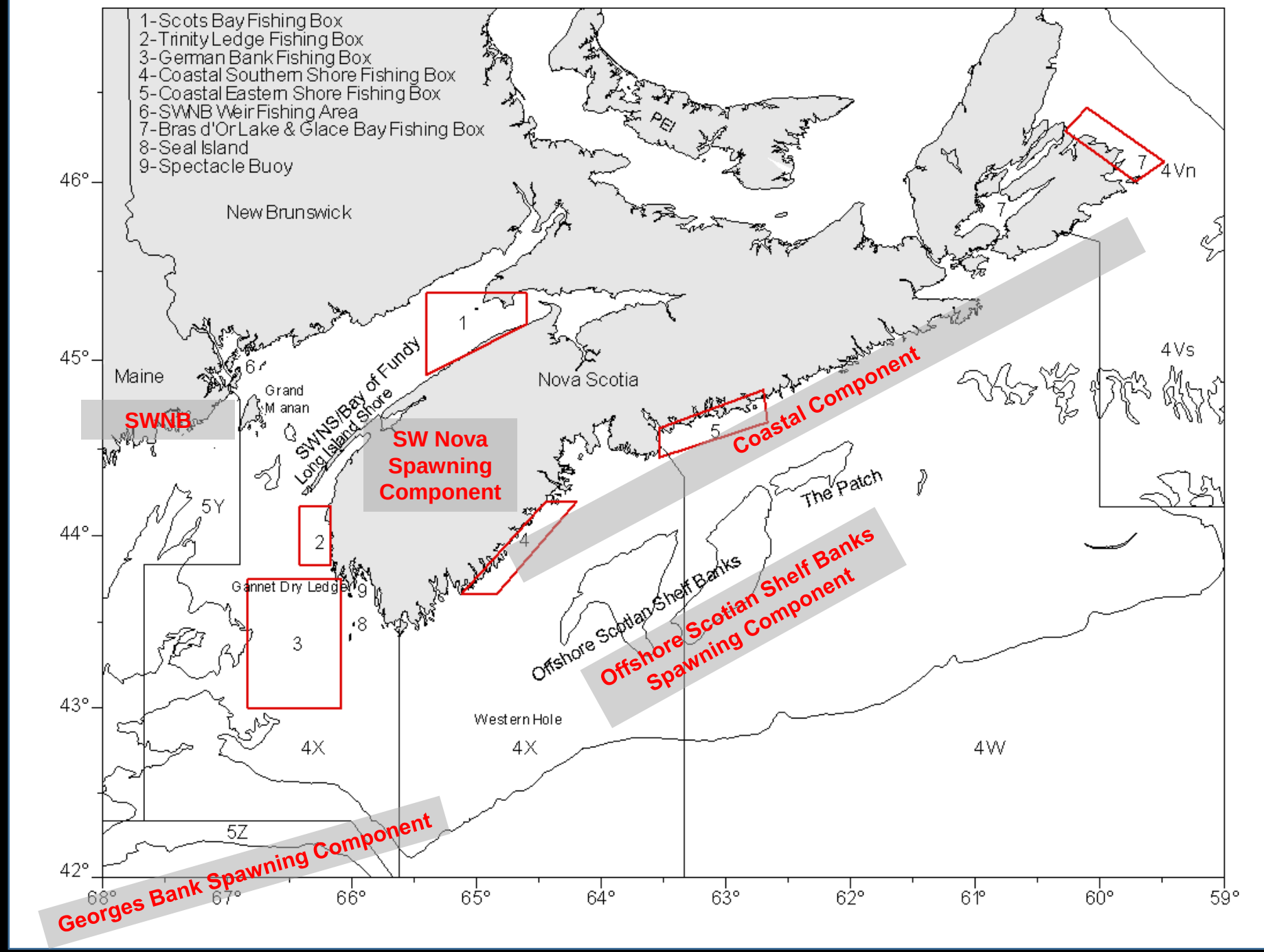
Offshore Component

- Total Removals 2,548 mt.
- Allocation lowered to 8,000 mt.
- In the absence of recent information about stock status, there is no basis for evaluating the current catch allocation.
- Structured acoustic surveys required to provide inference on stock status in the offshore area.

SWNS/BoF Spawning Component

SWNS/BoF Spawning Component

- Southwest Nova Scotia/Bay of Fundy
  - 3 major spawning areas
    - Scots Bay
    - German Bank
    - Trinity Ledge
  - Minor spawning areas
    - Seal Island
    - Browns Bank*
    - Gannet Dry Ledge*
    - Spectacle Buoy


1-Scots Bay Fishing Box
2-Trinity Ledge Fishing Box
3-German Bank Fishing Box
4-Coastal Southern Shore Fishing Box
5-Coastal Eastern Shore Fishing Box
6-SWNB Weir Fishing Area
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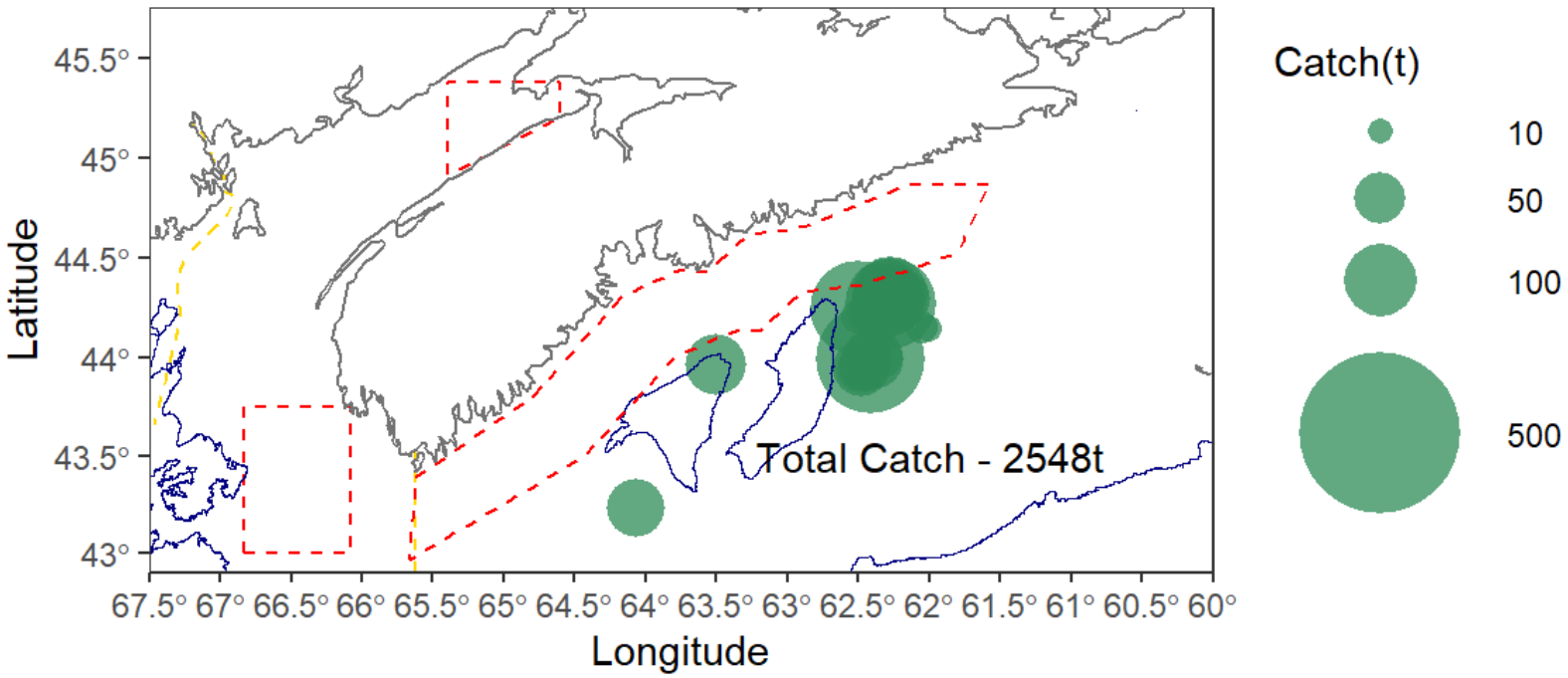
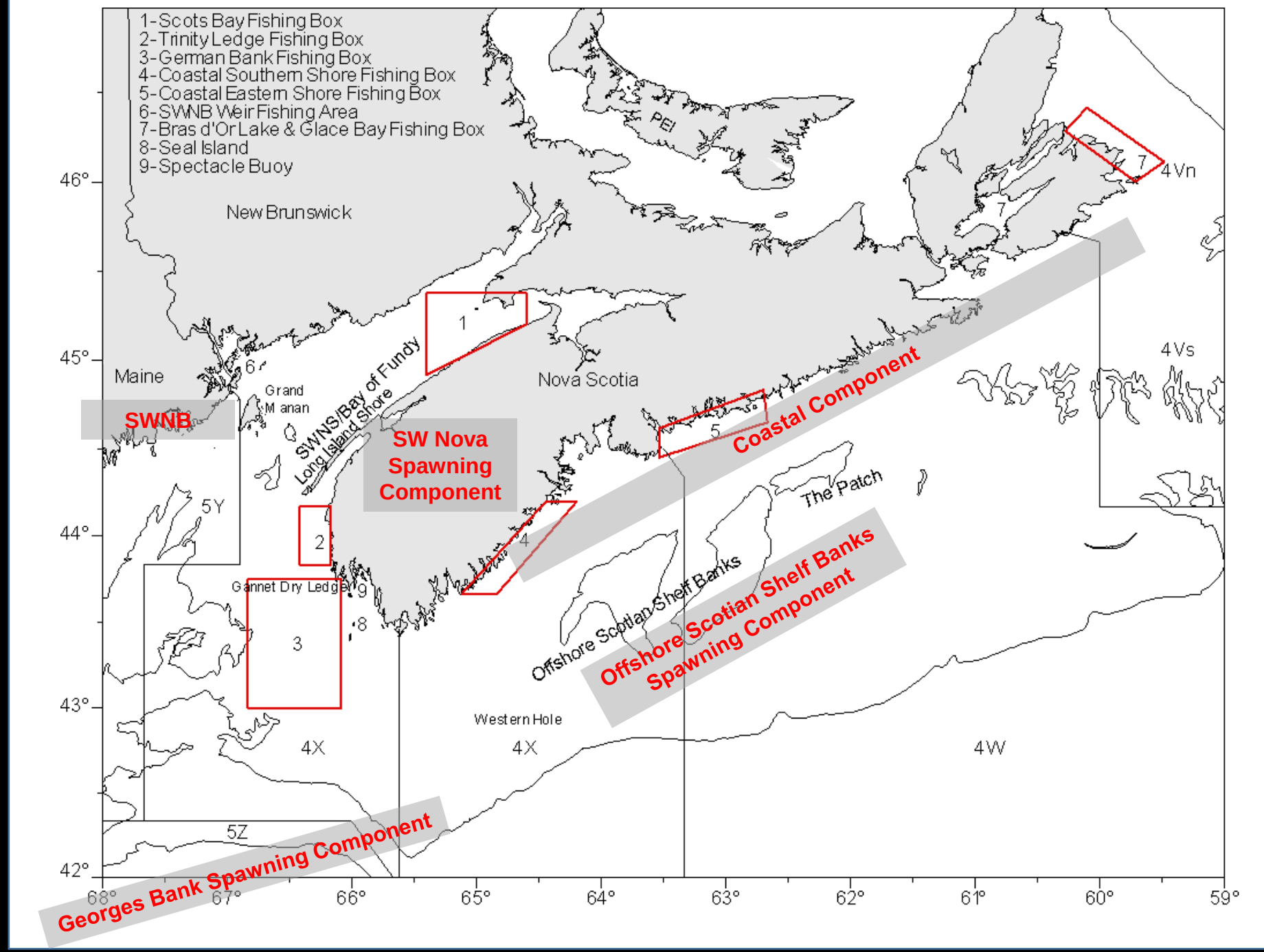
New Brunswick
PEI
Nova Scotia
Maine
Grand Manan
SWNS/Bay of Fundy
Long Island Shore
SWNB
SW Nova Spawning Component
Coastal Component
Offshore Scotian Shelf Banks Spawning Component
Georges Bank Spawning Component
Gannet Dry Ledge
Offshore Scotian Shelf Banks
The Patch
Western Hole
4Vn
4Vs
4W
4X
5Y
5Z
1
2
3
4
5
6
7
8
9
46°
45°
44°
43°
42°
68°
67°
66°
65°
64°
63°
62°
61°
60°
59°

Purse Seine


Latitude
45.5°
45°
44.5°
44°
43.5°
43°
67.5° 67° 66.5° 66° 65.5° 65° 64.5° 64° 63.5° 63° 62.5° 62° 61.5° 61° 60.5° 60°
Longitude
Total Catch - 2548t
Catch(t)
10
50
100
500


1-Scots Bay Fishing Box
2-Trinity Ledge Fishing Box
3-German Bank Fishing Box
4-Coastal Southern Shore Fishing Box
5-Coastal Eastern Shore Fishing Box
6-SWNB Weir Fishing Area
7-Bras d'Or Lake & Glace Bay Fishing Box
8-Seal Island
9-Spectacle Buoy
New Brunswick
PEI
Nova Scotia
Maine
Grand Manan
SWNS/Bay of Fundy
Long Island Shore
SWNB
SW Nova Spawning Component
Coastal Component
Offshore Scotian Shelf Banks Spawning Component
Georges Bank Spawning Component
Gannet Dry Ledge
Offshore Scotian Shelf Banks
The Patch
Western Hole
4Vn
4Vs
4W
4X
5Y
5Z
1
2
3
4
5
6
7
8
9
46°
45°
44°
43°
42°
68°
67°
66°
65°
64°
63°
62°
61°
60°
59°

CATCH – FY 2022

Gear	May	June	July	Aug	Sept	Oct	Nov	Total
GILL NET	0	0	29	11	2,067	150	4	2,261
PURSE SEINE	188	5,751	2,942	5,238	4,783	2,090	0	20,992
Total	188	5,751	2,971	5,249	6,850	2,240	4	23,253

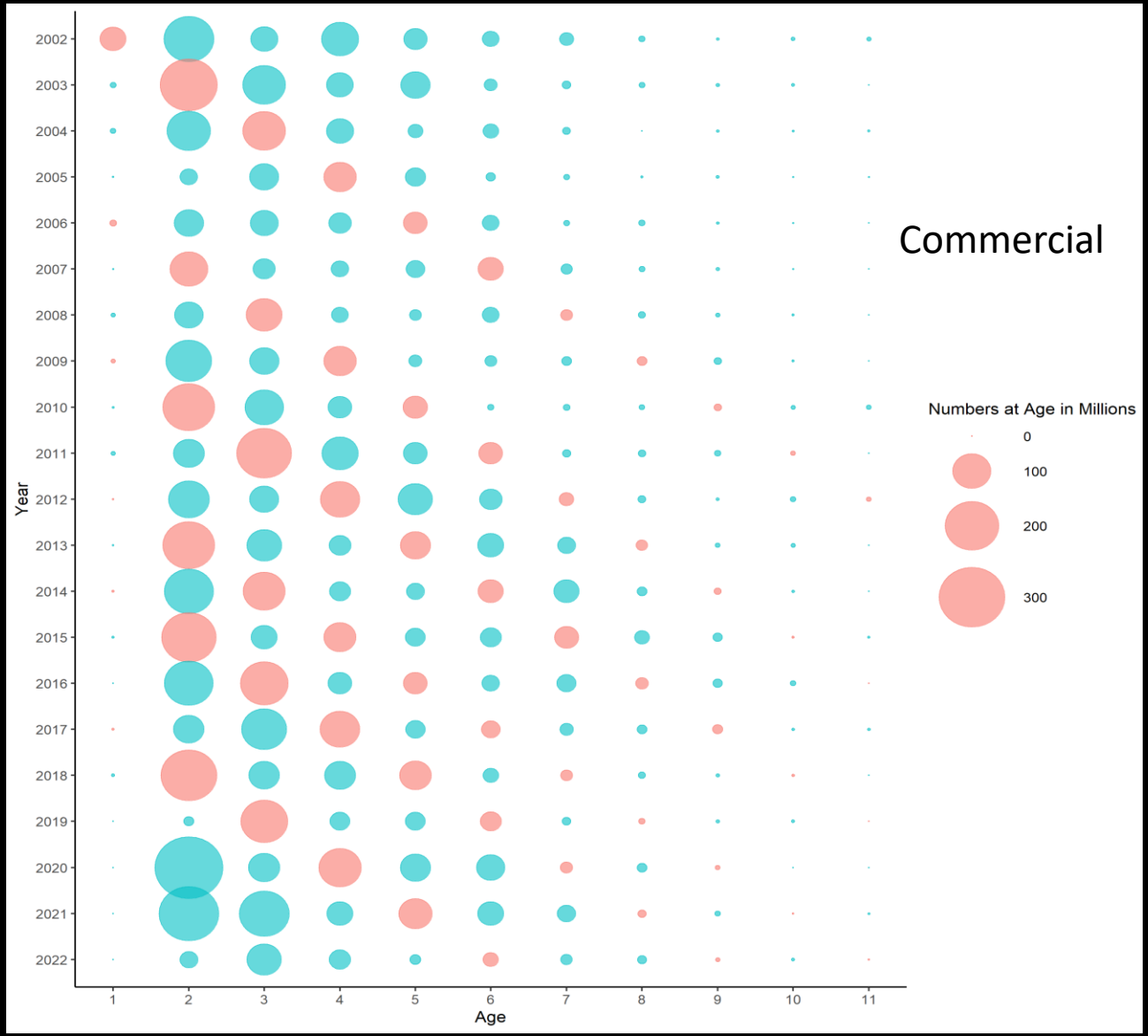


Figure. Numbers-at-age in the commercial landings for Southwest Nova Scotia/Bay of Fundy spawning component from 2002–2022 by quota year from purse seine and gillnet gear. The size of the bubble is proportional to the numbers by age. Selected cohort-classes from 1998, 2005, 2007, 2011, 2013, and 2016 are shown in red.

Figure. *Acoustic survey relative numbers at age (denoted by circle size) for the Scots Bay and German Bank SWNS/BoF spawning component from purse seine gear. The size of the bubble is proportional to the numbers by age. Selected year-classes 1998, 2005, 2007, 2011, 2013 are shown in red.*

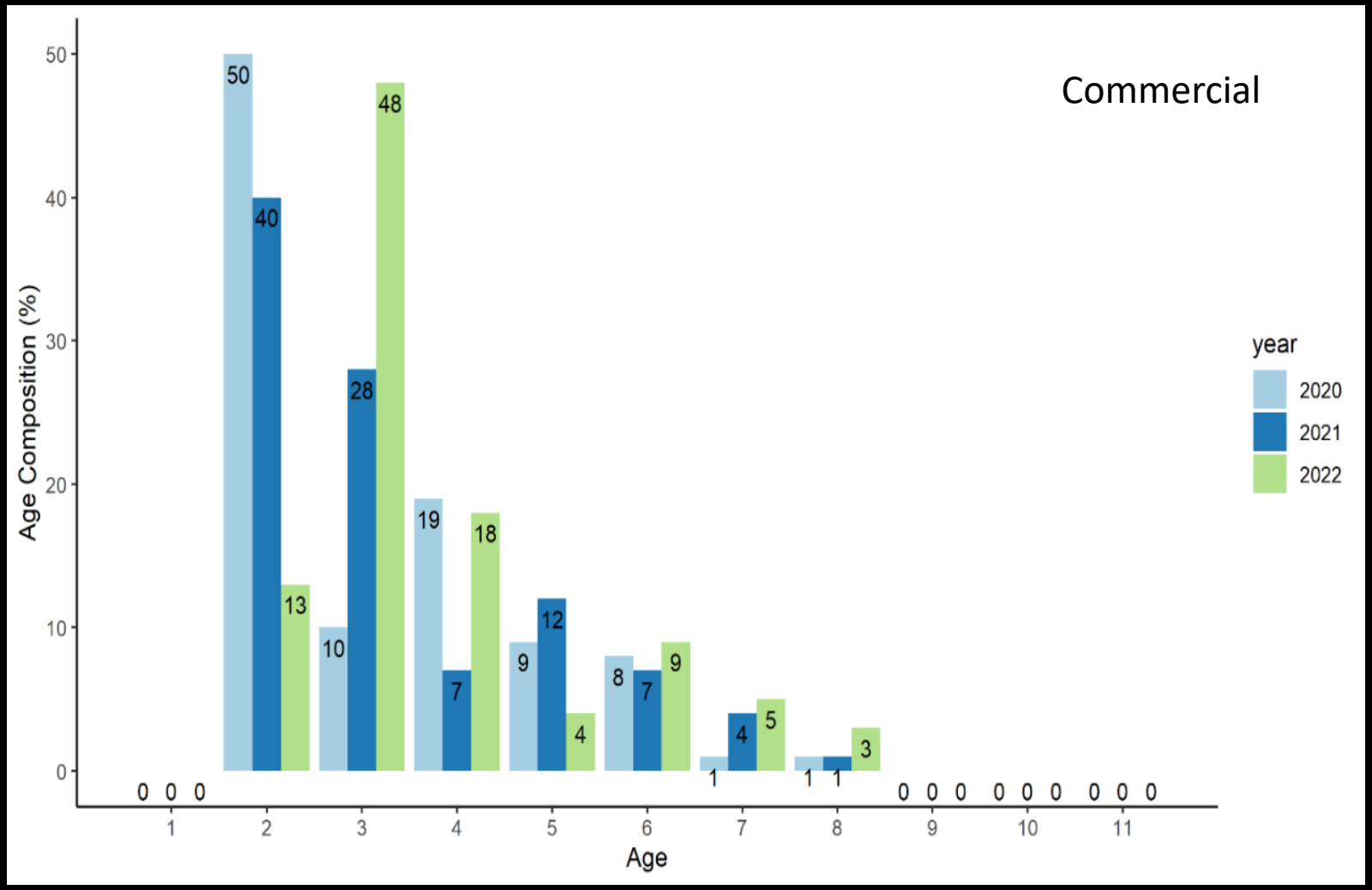


Figure. Commercial catch age composition (% catch by number) for Southwest Nova Scotia/Bay of Fundy spawning component for calendar years 2020, 2021 and 2022 from purse seine and gillnet gear

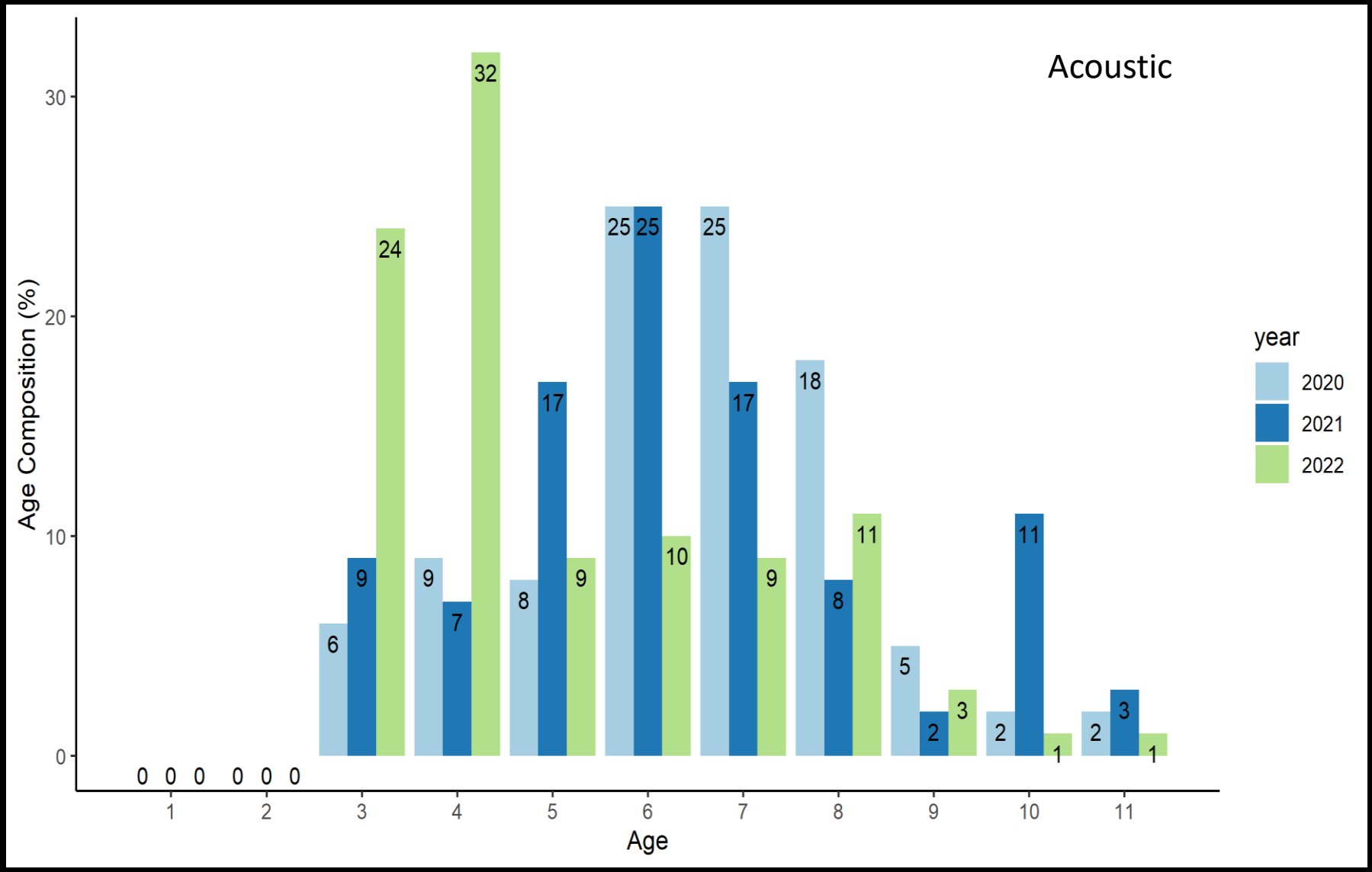


Figure. *Acoustic survey age composition (% by number) for Southwest Nova Scotia/Bay of Fundy spawning component for Scots Bay and German Bank for calendar years (2020, 2021, and 2022) from purse seine gear*

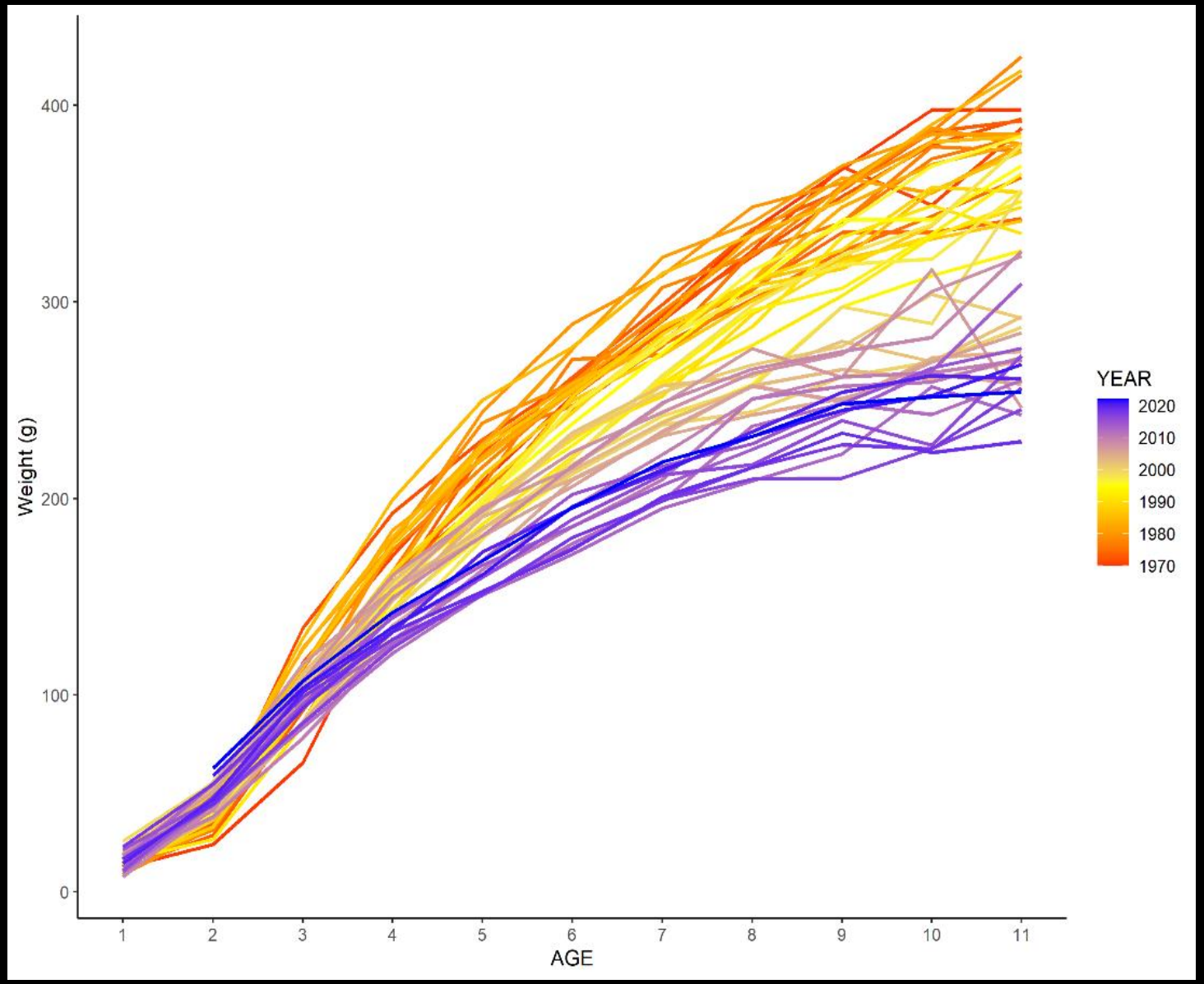


Figure. Fishery mean weights-at-age for the SWNS/BoF component from 1970 to 2022. Red lines indicate earlier in the time series and purple to blue lines are later in the time series.

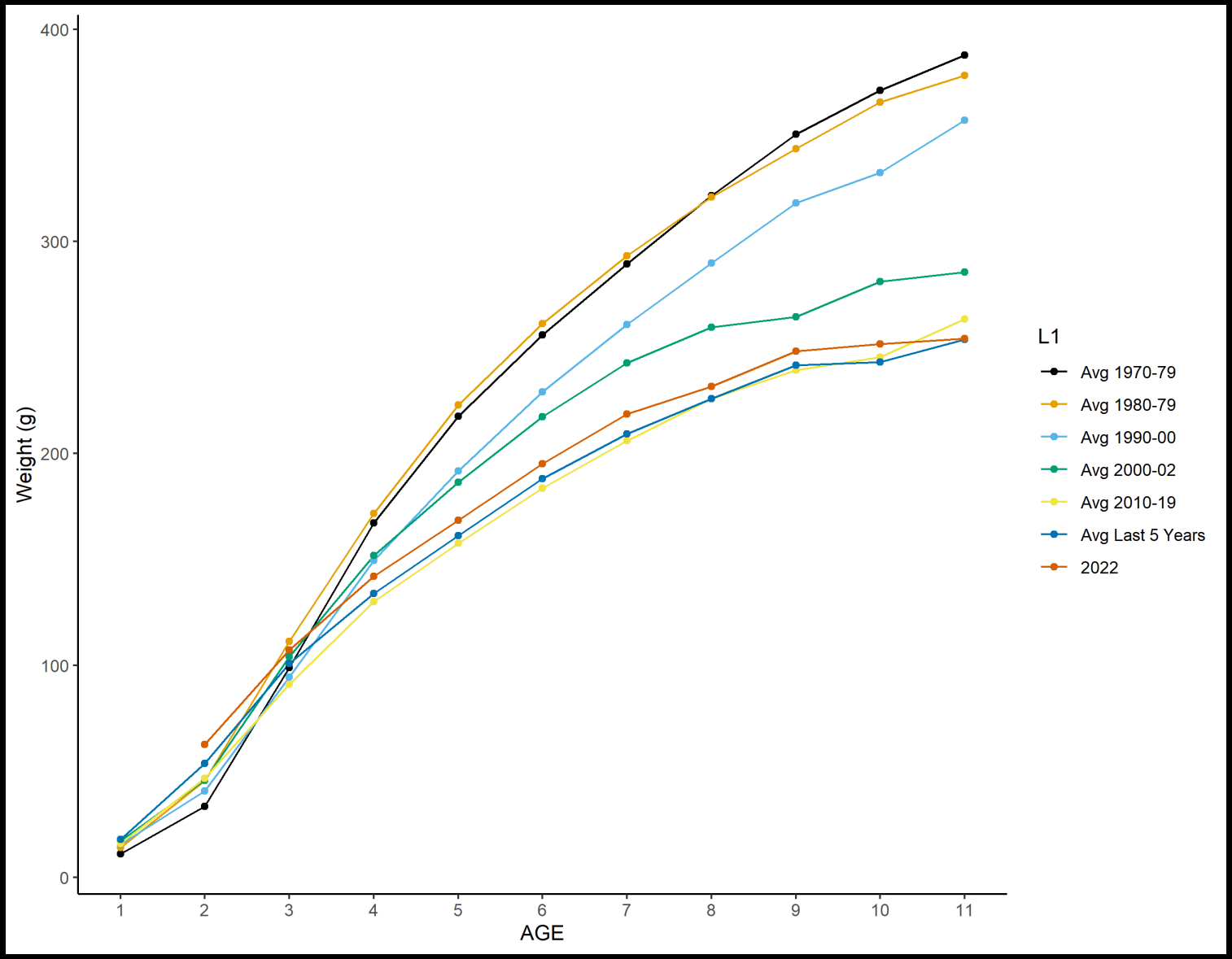
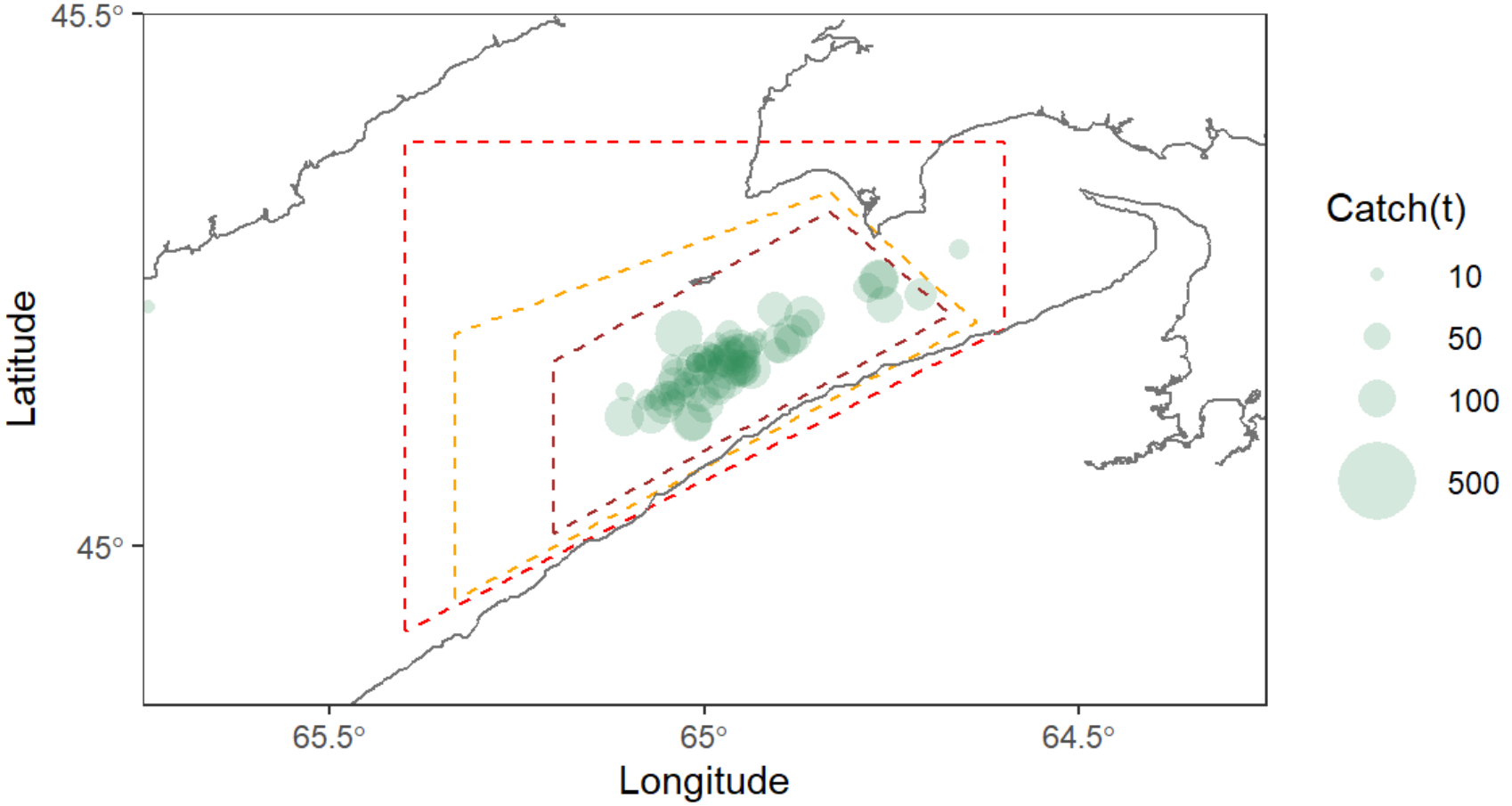


Figure. Fishery decadal mean weights-at-age for the SWNS/BoF component from 1970 to 2022, including average for last 5 years, and average weight-at-age for last fishing season.

Comparison of Scots Bay to German Bank?

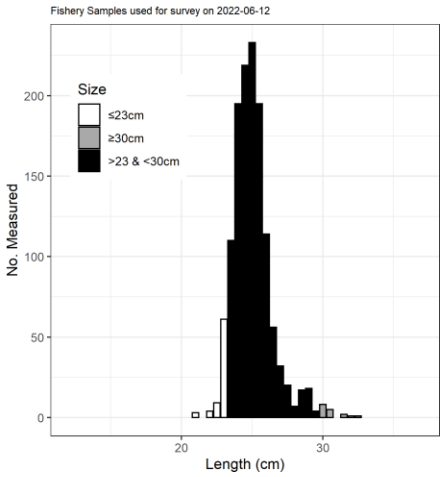
Total Catch = 5377 mt

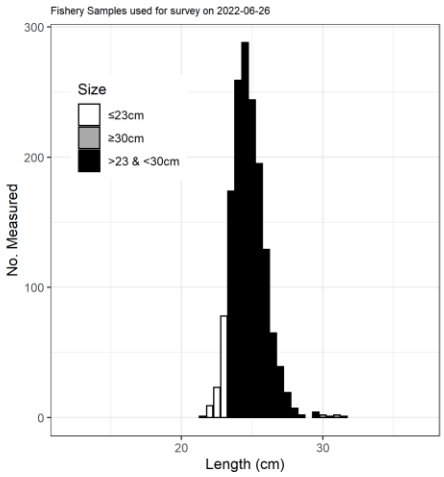


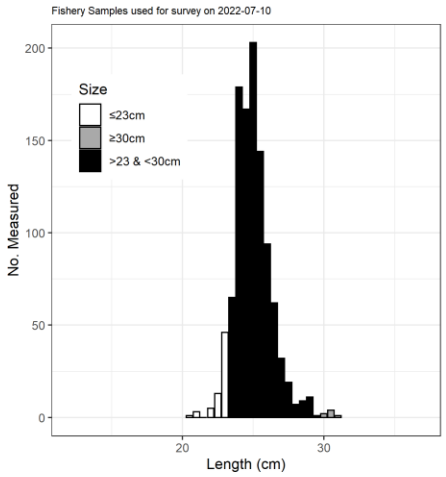
Scots Bay survey Samples

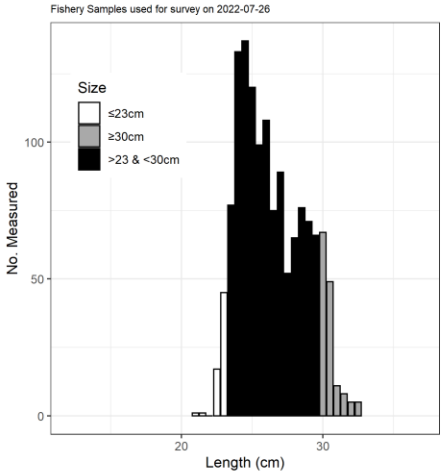
DATE	TS for 38 kHz	Length Frequency Sample Size (N)	No. Measured Length Frequency	Mean Length (mm)	Detailed Sample Size (n)	Mean Weight (kg)
5/29/2022	-35.50	NA	NA	280*	NA	0.180*
6/12/2022	-35.15	7	1314	268	36	0.152
6/26/2022	-35.01	8	1542	264	33	0.143
7/10/2022	-35.09	6	1068	258	35	0.139
7/26/2022	-35.21	7	1377	268	53	0.154
8/7/2022	-35.30	16	3141	265	154	0.154
8/21/2022	-35.43	8	1615	276	117	0.172
9/5/2022	-35.30	10	1978	265	54	0.154
9/18/2022	-35.13	4	602	250	28	0.131
10/2/2022	-35.50	NA	NA	280*	NA	0.180*

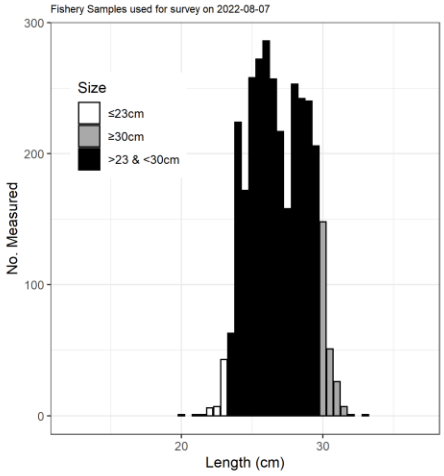
*Standard Target strength used. Length-frequency or detailed sample not available. Reporting target strength for 38 kHz, for 50, 75, and 120 kHz, add -0.10727, -0.26575, and -0.44946, respectively.

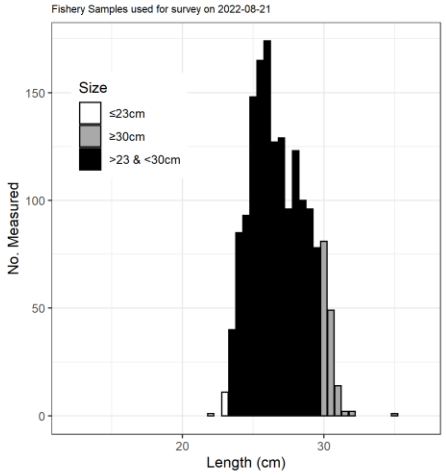

Fishery Samples used for survey on 2022-06-12
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)

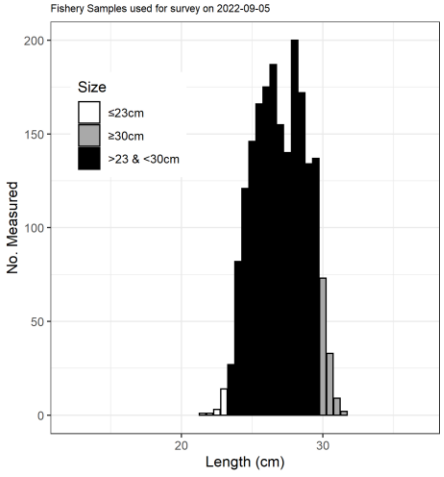

Fishery Samples used for survey on 2022-06-26
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)

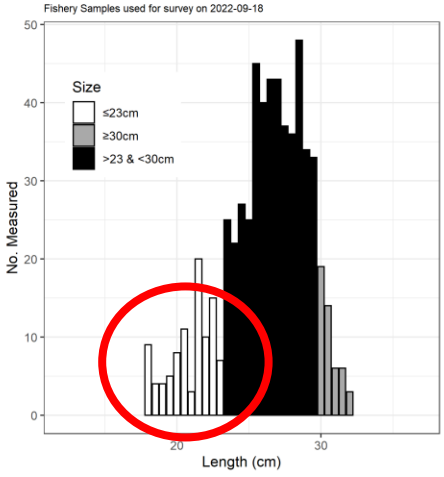

Fishery Samples used for survey on 2022-07-10
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)

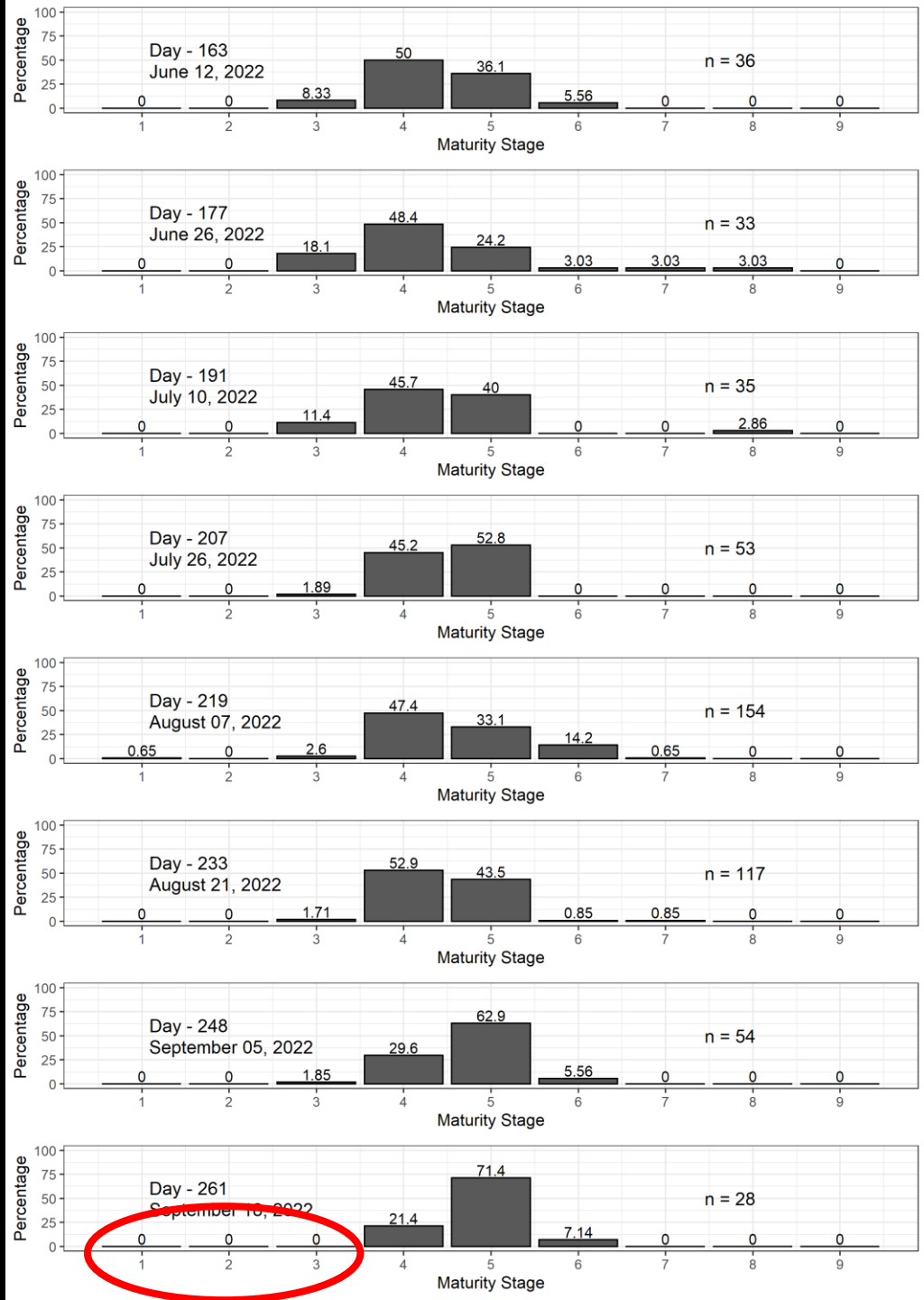

Fishery Samples used for survey on 2022-07-26
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)


Fishery Samples used for survey on 2022-08-07
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)


Fishery Samples used for survey on 2022-08-21
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)


Fishery Samples used for survey on 2022-09-05
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)


Fishery Samples used for survey on 2022-09-18
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)



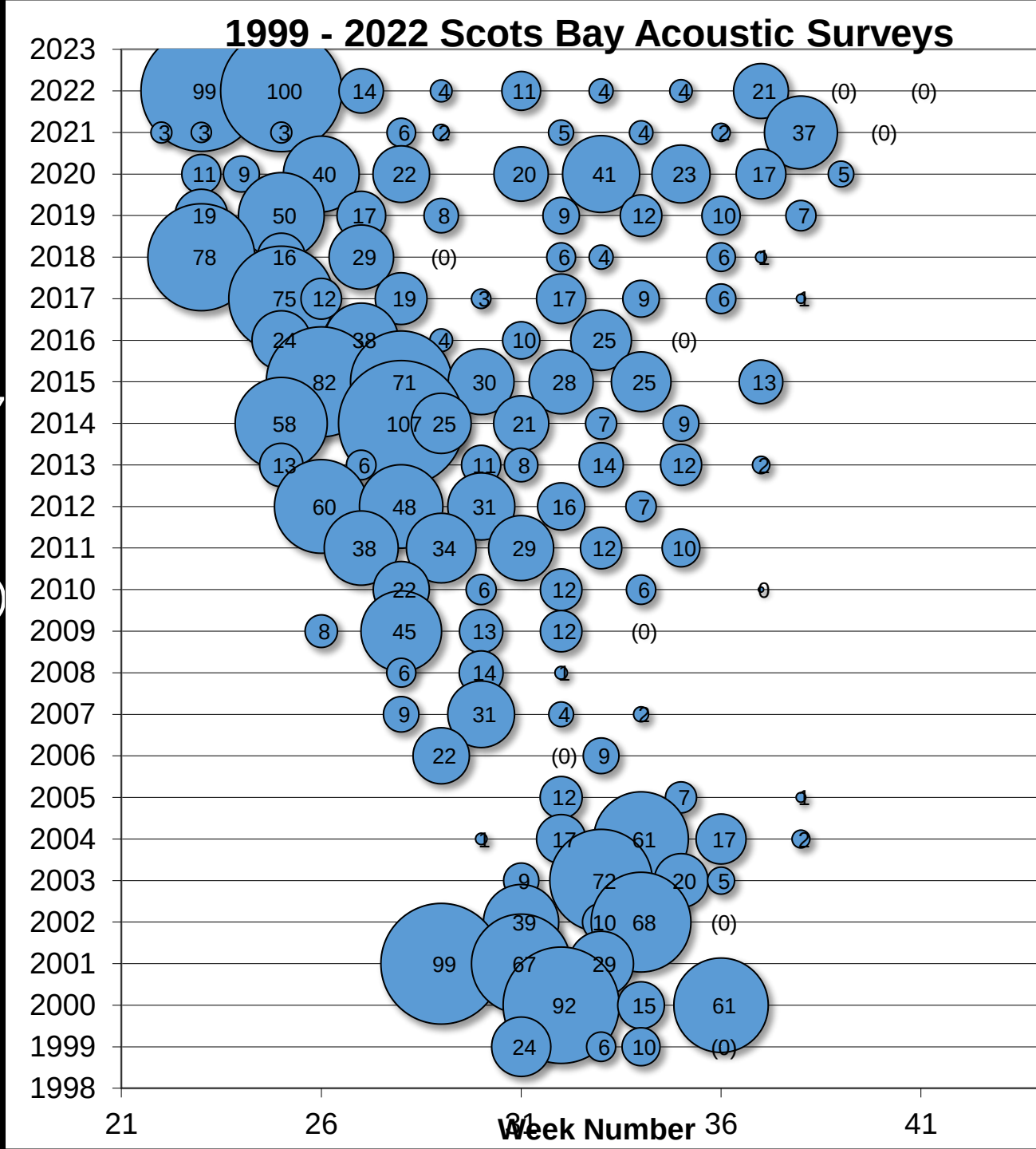
Maturation Stages

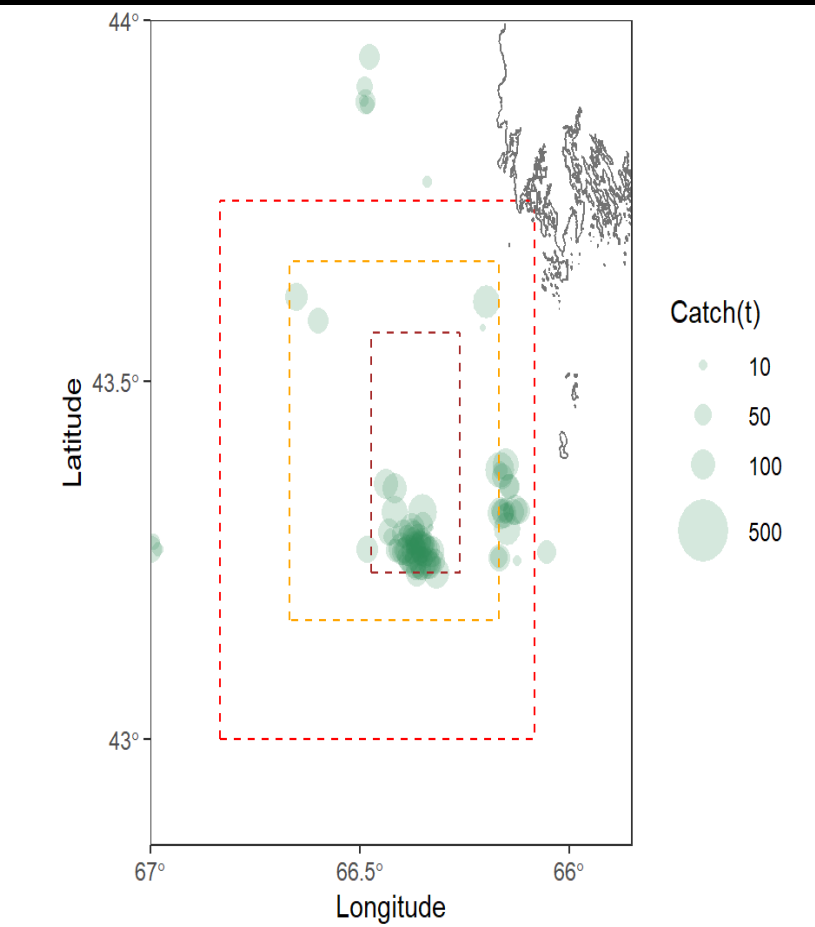
1 - Immature 1
2 – Immature 2
3 – Ripening 1
4 – Ripening 2
5 - Ripe
6 – Spawning
7 - Spent
8 - Recovering
9 – Recovering 2

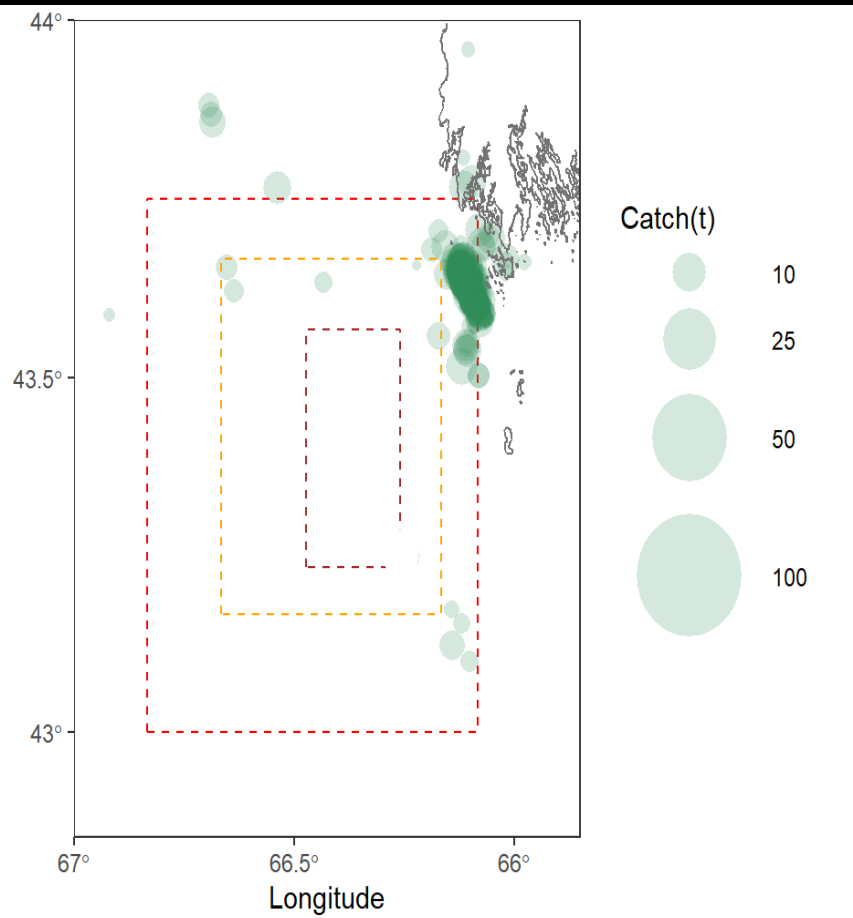
Scots Bay 1999-2022

Surveys:

- June 27 – Sept. 8 (2015)
- June 18 – Aug. 27(2016)
- June 21 – Sept. 23 (2017
- June 9 – Sept. 15 (2018)
- June 8 – Sept. 15 (2019)
- June 2 – Sept. 20 (2020)
- May 25 – Sept. 26 (2021)
- May 29 – Oct. 3 (2022)







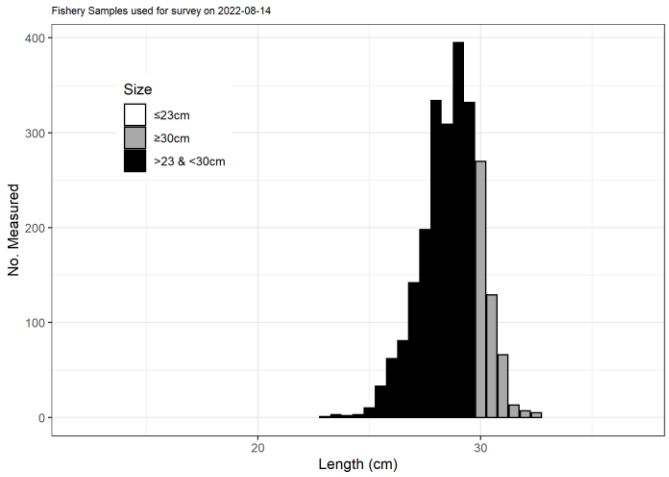
Total Catch
4542 mt

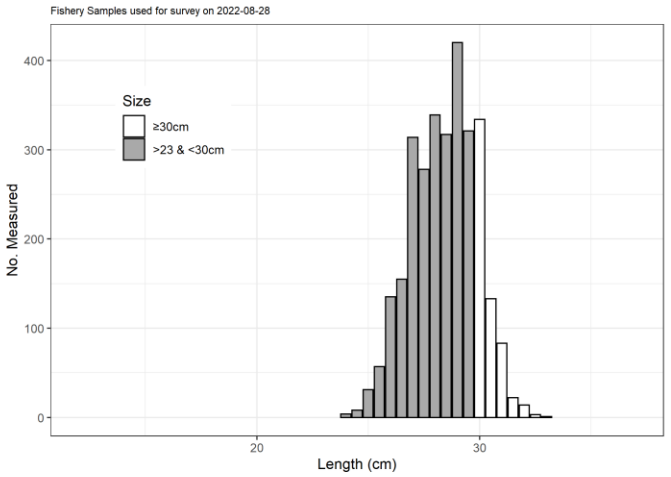
German Bank survey Samples

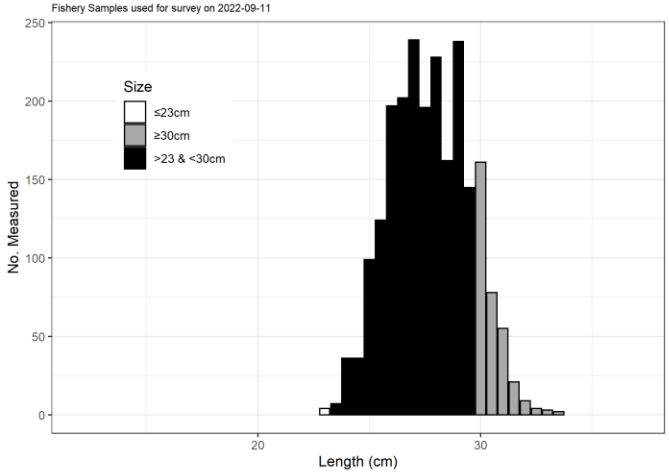
DATE	TS for 38 kHz	Length Frequency Sample Size (N)	No. Measured Length Frequency	Mean Length (mm)	Detailed Sample Size (n)	Mean Weight (kg)
8/14/2022	-35.4614	12	2395	278	69	0.175479
8/28/2022	-35.4513	15	2969	285	151	0.184002
9/11/2022	-35.3879	11	2246	282	81	0.177535
9/25/2022	-35.2652	5	967	278	24	0.167731
10/10/2022	-34.9192	7	1299	280	28	0.157123
10/23/2022	-35.5	NA	NA	NA	NA	NA

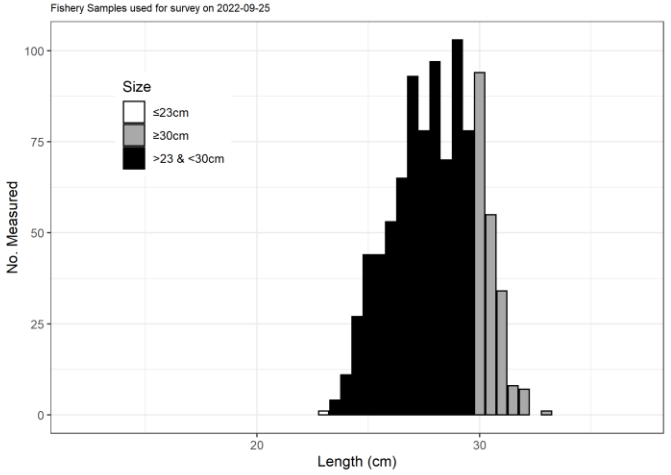
*Standard Target strength used. Length-frequency or detailed sample not available.

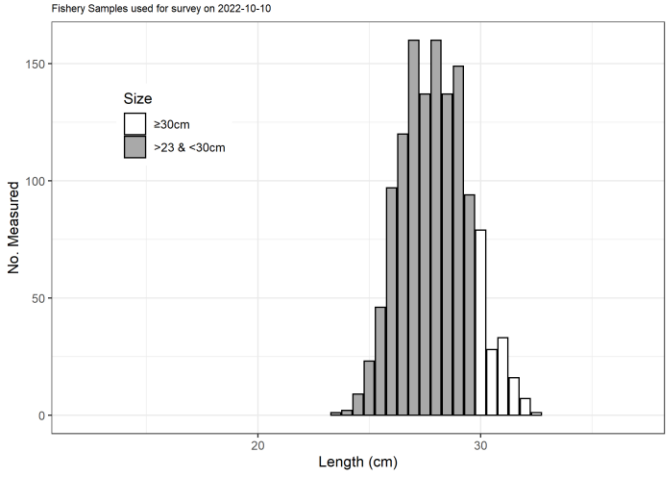
Reporting target strength for 38 kHz, for 50, 75, and 120 kHz, add -0.10727, -0.26575, and -0.44946, respectively.

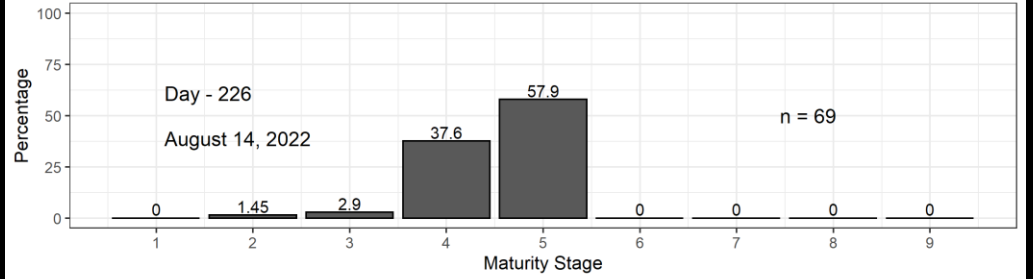

Fishery Samples used for survey on 2022-08-14
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)

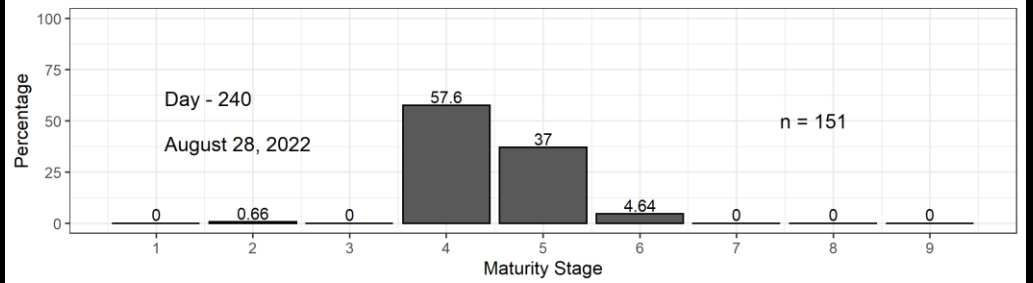

Fishery Samples used for survey on 2022-08-28
Size
≥30cm
>23 & <30cm
No. Measured
Length (cm)

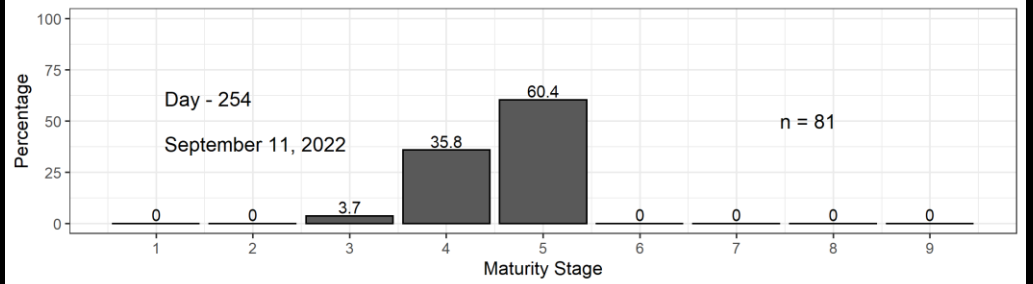

Fishery Samples used for survey on 2022-09-11
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)

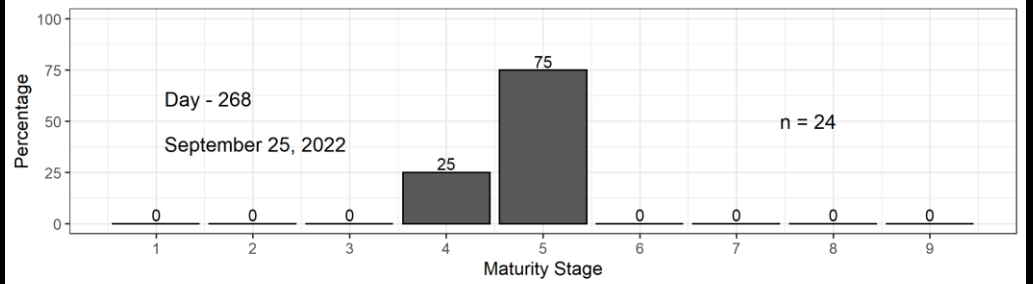

Fishery Samples used for survey on 2022-09-25
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)

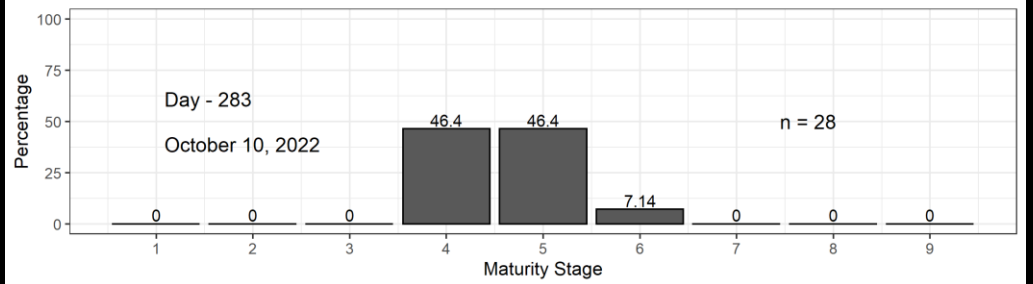

Fishery Samples used for survey on 2022-10-10
Size
≥30cm
>23 & <30cm
No. Measured
Length (cm)











Maturation Stages

1 - Immature 1
2 – Immature 2
3 – Ripening 1
4 – Ripening 2
5 - Ripe
6 – Spawning
7 - Spent
8 - Recovering
9 – Recovering 2

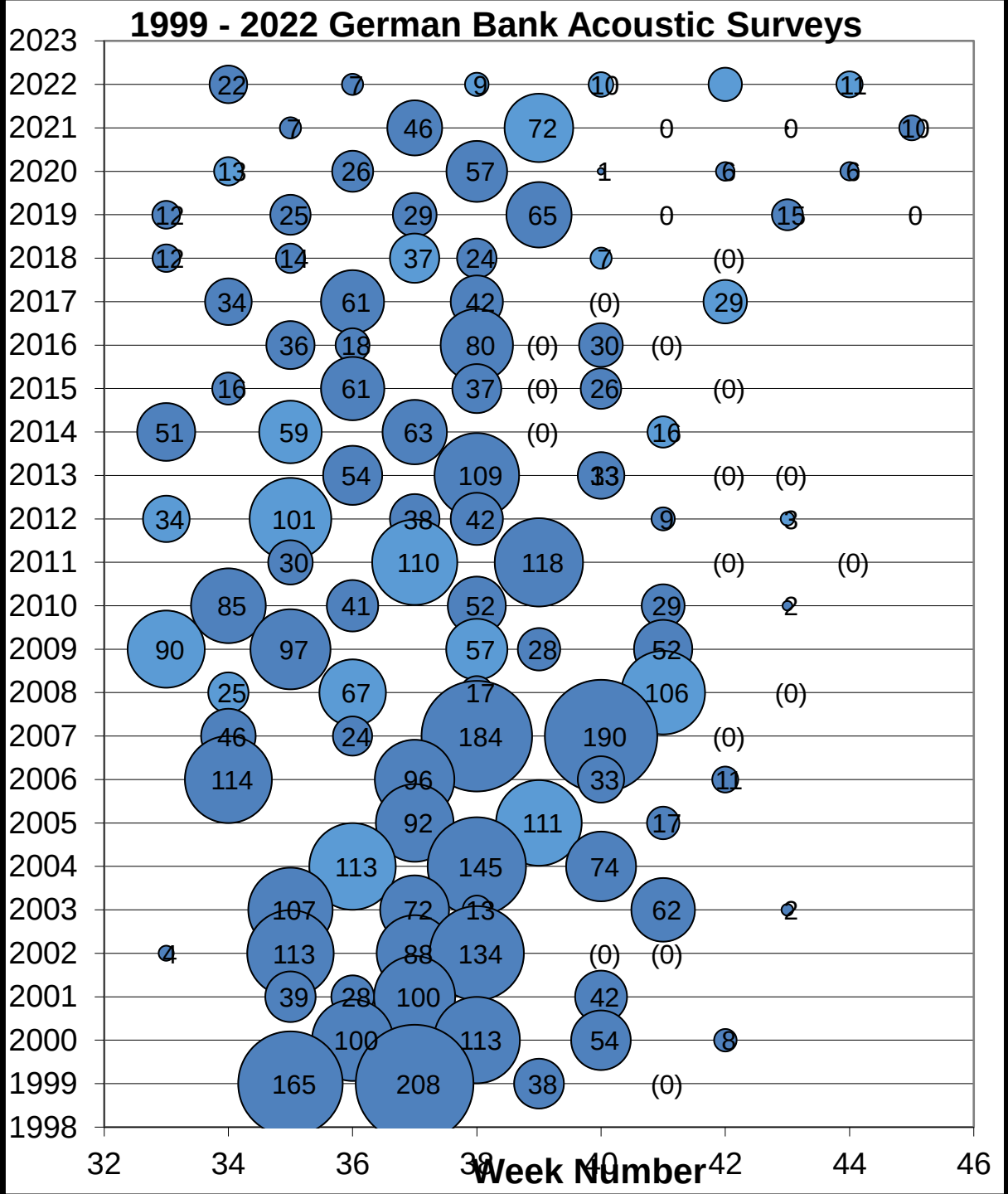
German Bank Summary

Location	Date	Target Strength* (dB/kg)	Area (km²)	mean Sa (dB/m²)	Unadjusted Biomass (t)	Standard Error (t)	SE %	Adjusted Biomass (t)
German Bank #1	8/14/2022	-35.46	800.6	-51.06	22,081	6,030	27%	22,081
German Bank #2	8/28/2022	-35.45	789.0	-53.74	11,699	3,825	33%	7,393
German Bank #3	9/11/2022	-35.39	795.0	-53.64	11,902	2,006	17%	8,826
German Bank #4	9/25/2022	-35.27	811.4	-53.39	12,503	3,015	24%	9,761
German Bank #5	10/10/2022	-34.92	814.8	-50.97	20,247	5,850	29%	17,675
German Bank #6	10/23/2022	-35.50	821.6	-52.73	15,565	6,276	40%	10,823
Summary			**4832.4**	**-52.59**	**93,996**	**11,735**	**12%**	**76,559**

German Bank 1999-2021

Survey date ranges:

- Aug. 17 – Oct. 12 (2015)
- Aug. 21 – Oct. 7 (2016)
- Aug. 17 – Oct. 18 (2017)
- Aug. 12 – Oct. 22 (2018)
- Aug. 11 – Nov. 3 (2019)
- Aug. 16 – Oct. 25 (2020)
- Aug. 23 – Nov. 3 (2021)
- Aug. 14 – Oct. 23 (2022)

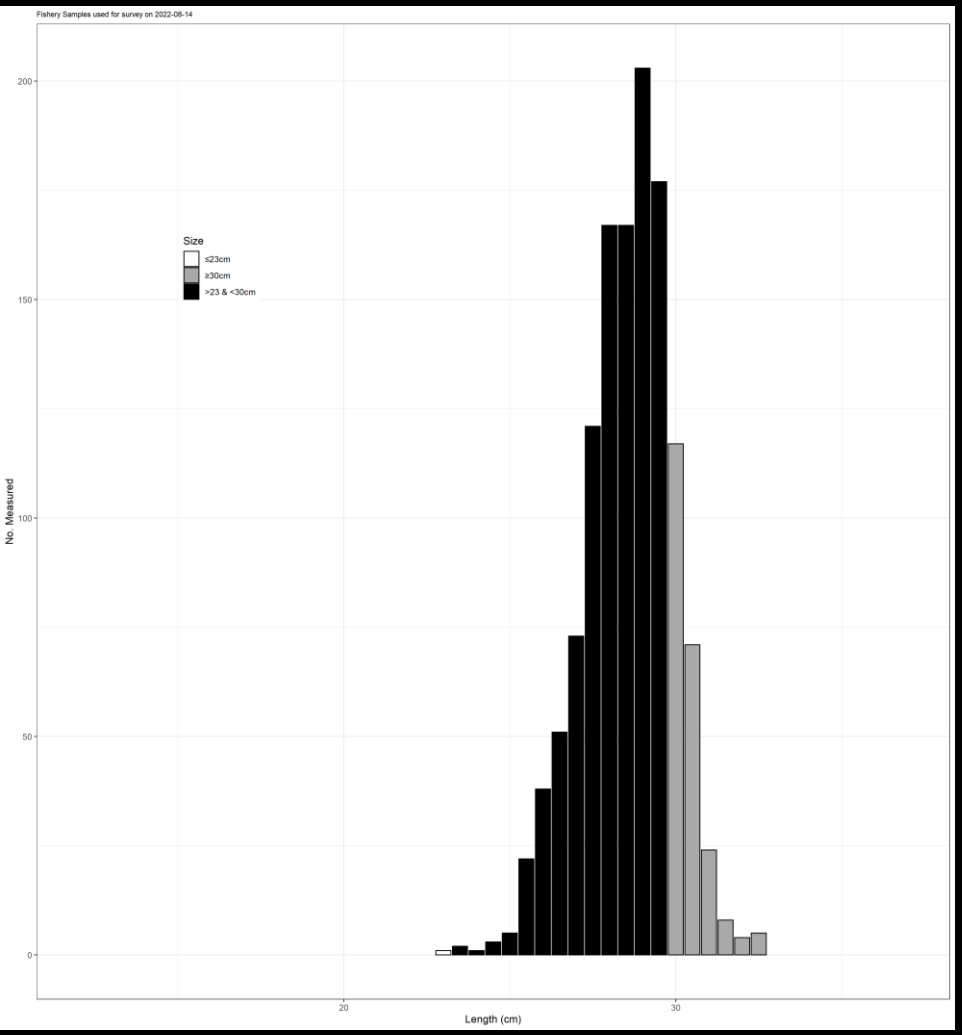


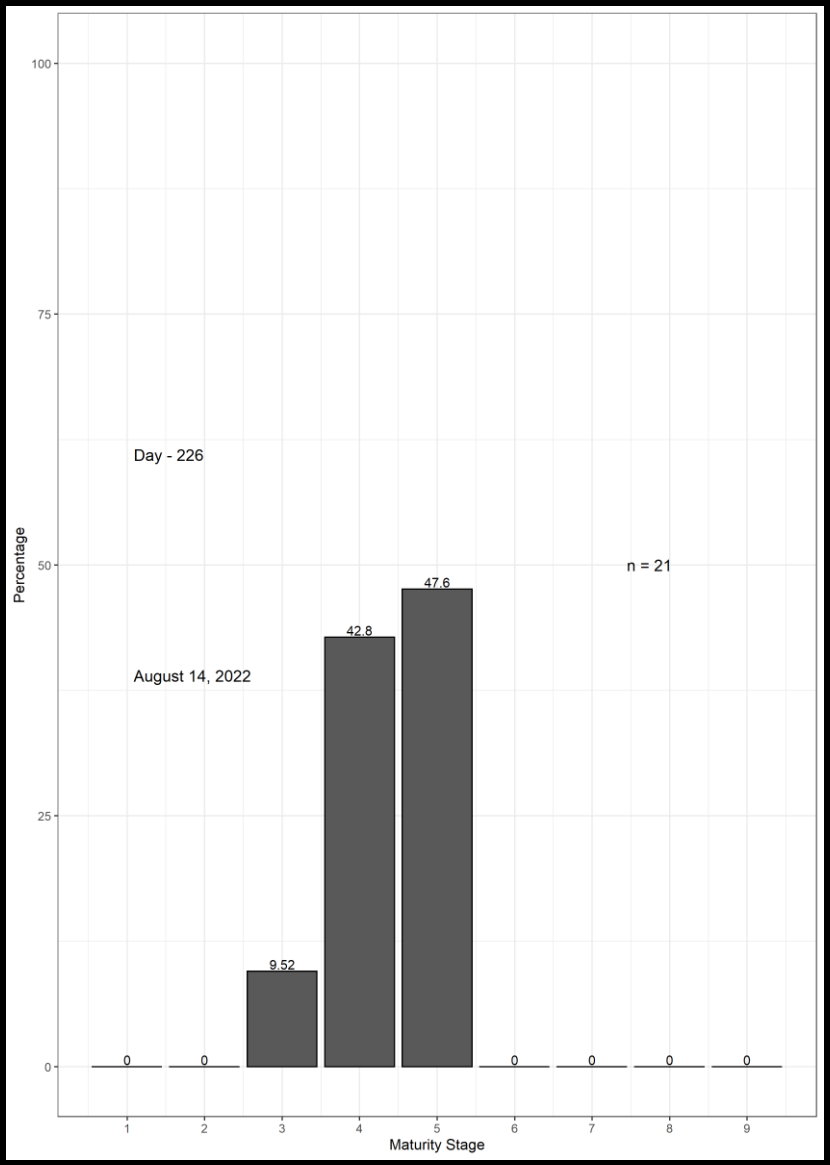
Seal Island

Total Catch = 1498 mt

Seal Island survey Samples

DATE	TS for 38 kHz	Length Frequency Sample Size (N)	No. Measured Length Frequency	Mean Length (mm)	Detailed Sample Size (n)	Mean Weight (kg)
8/14/2022	-35.33	6	1260	278	21	0.170
8/28/2022	-35.5	NA	NA	280*	NA	0.180*
9/11/2022	-35.5	NA	NA	280*	NA	0.180*
9/25/2022	-35.5	NA	NA	280*	NA	0.180*
10/10/2022	-35.5	NA	NA	280*	NA	0.180*
10/23/2022	-35.5	NA	NA	280*	NA	0.180*


Fishery Samples used for survey on 2022-08-14
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)
0
50
100
150
200
20
30


Day - 226
August 14, 2022
n = 21
Percentage
Maturity Stage
0
25
50
75
100
1
2
3
4
5
6
7
8
9
0
0
9.52
42.8
47.6
0
0
0
0

Seal Island Summary

Location	Date	Target Strength* (dB/kg)	Area (km^2)	mean Sa (dB/m^2)	Biomass (t)	Standard Error (t)	SE %
Seal Island #1	8/15/2022	-35.33	268.6	-56.47	2,086	760	36%
Seal Island #2	8/29/2022	-35.50	270.5	-62.26	570	144	25%
Seal Island #3	9/12/2022	-35.50	267.2	-51.71	6,392	1,241	19%
Seal Island #4	9/26/2022	-35.50	272.3	-54.13	3,732	507	14%
Seal Island #5	10/11/2022	-35.50	251.6	-52.02	5,604	2,084	37%
Seal Island #6	10/24/2022	-35.50	284.8	-54.91	3,260	1,123	34%
Summary			**1615.1**	**-55.25**	**21,643**	**2,828**	**13%**

Trinity Ledge

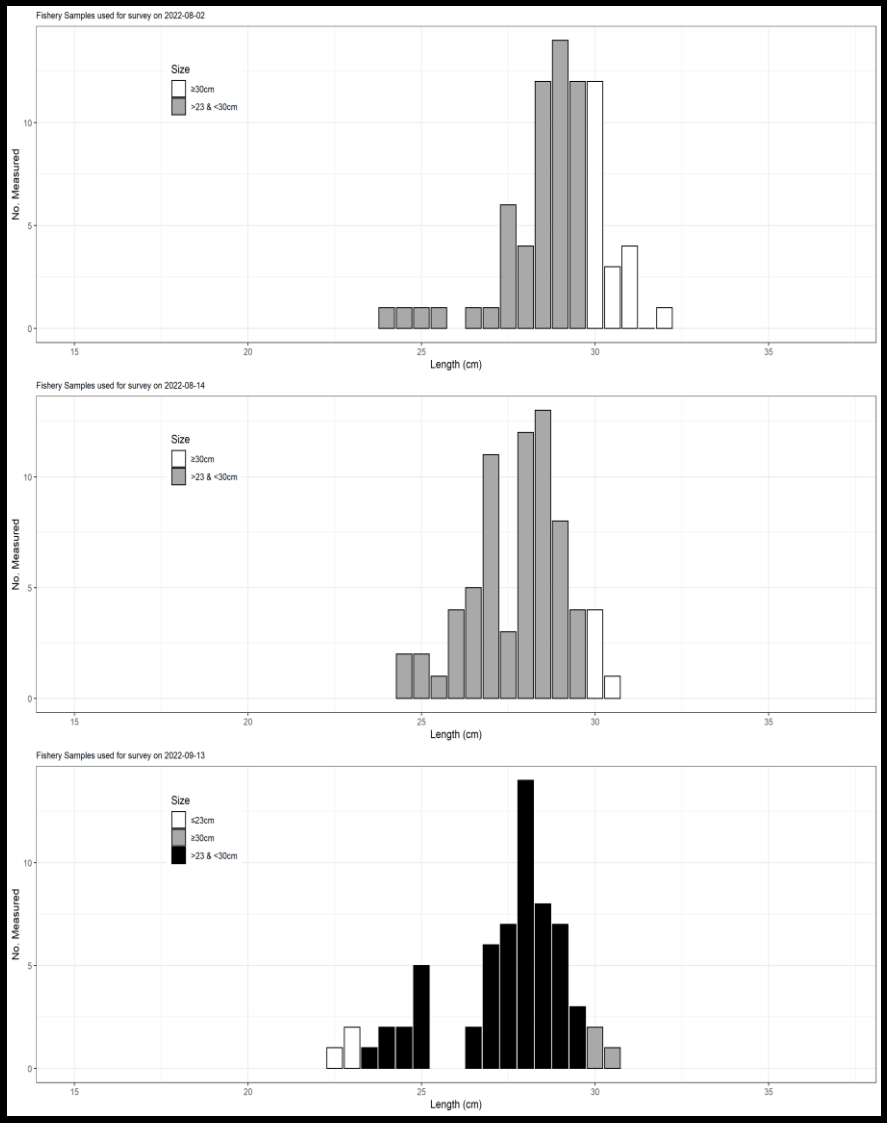
Total Catch = 483 mt

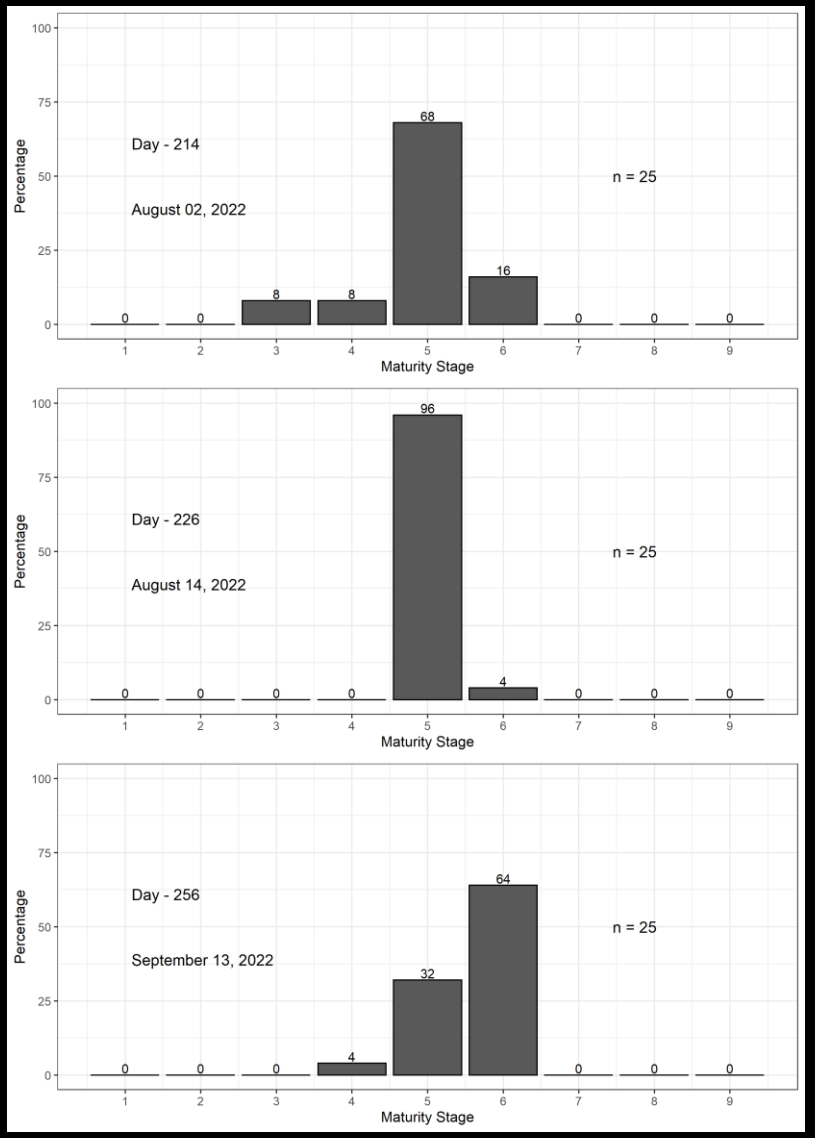
Trinity Ledge survey Samples

DATE	TS for 38 kHz	Length Frequency Sample Size (N)	No. Measured Length Frequency	Mean Length (mm)	Detailed Sample Size (n)	Mean Weight (kg)
8/2/2022	-35.54	1	74	281	25	0.182
8/14/2022	-35.64	1	70	275	25	0.179
8/24/2022	-35.5	NA	NA	280*	NA	0.180*
9/3/2022	-35.5	NA	NA	280*	NA	0.180*
9/13/2022	-35.35	1	63	266	25	0.157

*Standard Target strength used. Length-frequency or detailed sample not available.

Reporting target strength for 38 kHz, for 50, 75, and 120 kHz, add -0.10727, -0.26575, and -0.44946, respectively.


Fishery Samples used for survey on 2022-08-02
Size
≥30cm
>23 & <30cm
No. Measured
Length (cm)
Fishery Samples used for survey on 2022-08-14
Size
≥30cm
>23 & <30cm
No. Measured
Length (cm)
Fishery Samples used for survey on 2022-09-13
Size
≤23cm
≥30cm
>23 & <30cm
No. Measured
Length (cm)


Day - 214
August 02, 2022
n = 25
Percentage
Maturity Stage
0 0 8 8 68 16 0 0 0
Day - 226
August 14, 2022
n = 25
Percentage
Maturity Stage
0 0 0 0 96 4 0 0 0
Day - 256
September 13, 2022
n = 25
Percentage
Maturity Stage
0 0 0 4 32 64 0 0 0

Trinity Ledge Summary

Location	Date	Target Strength* (dB/kg)	Area (km^2)	mean Sa (dB/m^2)	Biomass (t)	Standard Error (t)	SE %
Trinity #1	8/2/2022	-35.99	14.8	-52.74	313	405	129%
Trinity #2	8/14/2022	-36.09	10.0	-40.05	4,009	1,863	46%
Trinity #3	8/24/2022	-35.95	13.5	-43.31	2,471	1,635	66%
Trinity #4	9/3/2022	-35.95	10.1	-43.12	1,934	1,150	59%
Trinity #5	9/13/2022	-35.80	13.7	-31.62	8,749	2,034	55%
Summary			**62.1**	**-42.17**	**17,475**	**5,178**	**30%**

*Target Strength presented here, based on most common frequency used during survey

Spectacle Buoy Survey Samples

DATE	TS for 38 kHz	Length Frequency Sample Size (N)	No. Measured Length Frequency	Mean Length (mm)	Detailed Sample Size (n)	Mean Weight (kg)
8/3/2022	-35.5	NA	NA	280*	NA	0.180*
8/15/2022	-35.5	NA	NA	280*	NA	0.180*
8/25/2022	-35.45	2	123	270	41	0.165
9/4/2022	-35.34	2	124	265	50	0.155
9/14/2022	-35.5	NA	NA	280*	NA	0.180*

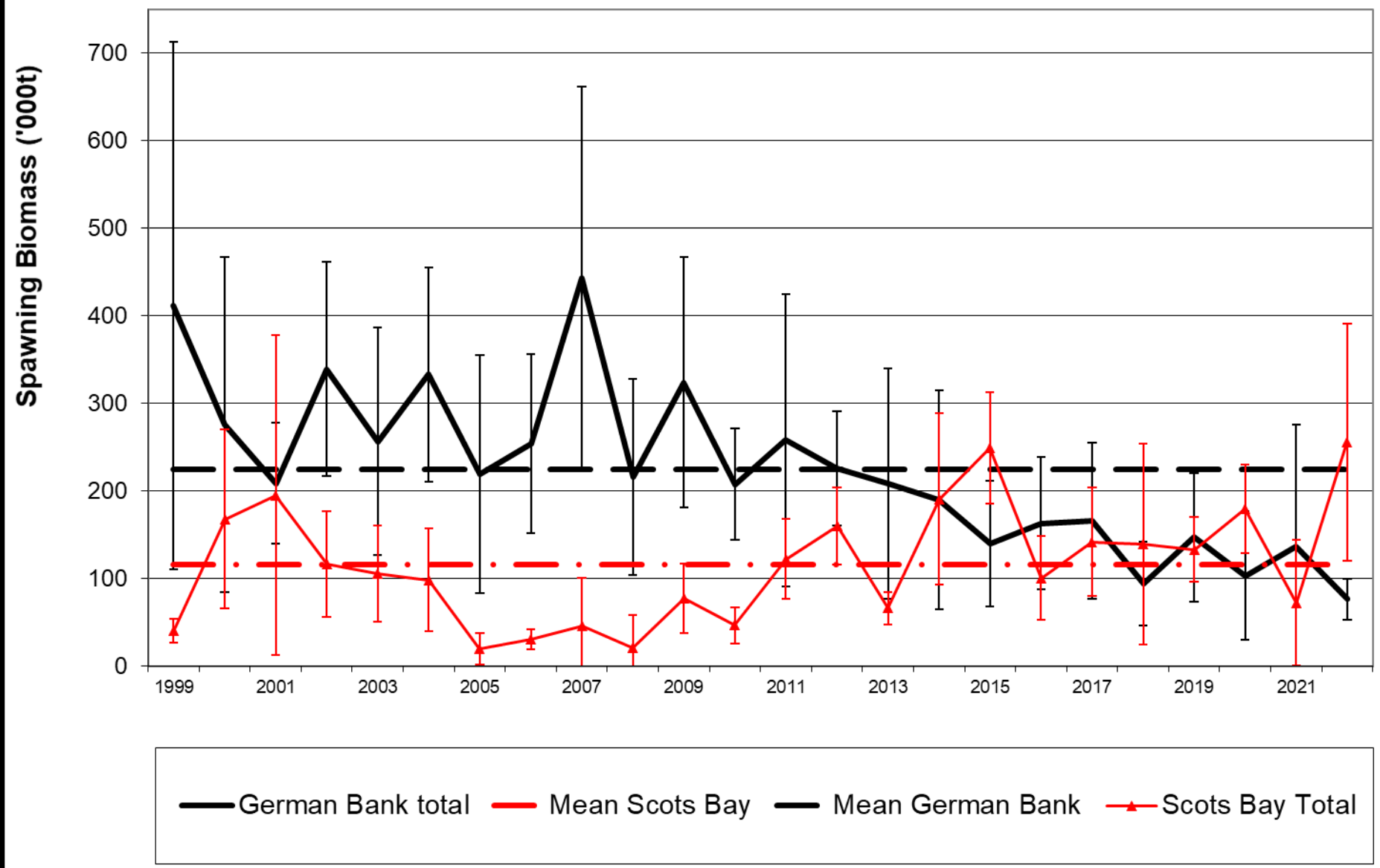
*Standard Target strength used. Length-frequency or detailed sample not available.

Reporting target strength for 38 kHz, for 50, 75, and 120 kHz, add -0.10727, -0.26575, and -0.44946, respectively.

Landings of interest for 2022

GROUND	CATCH
Baccaro Box	494
Gannet Dry Ledge	2,052
Grand Manan	3,336
Grand Manan Banks	4,487
Long Island	948
Lurcher	31
Scots Bay	5,377
Seal Island	1,498
Trinity	483

Summary Information for Bay of Fundy/ Southwest Nova Scotia


Spawning Biomass ('000t)
700
600
500
400
300
200
100
0
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
German Bank total
Mean Scots Bay
Mean German Bank
Scots Bay Total

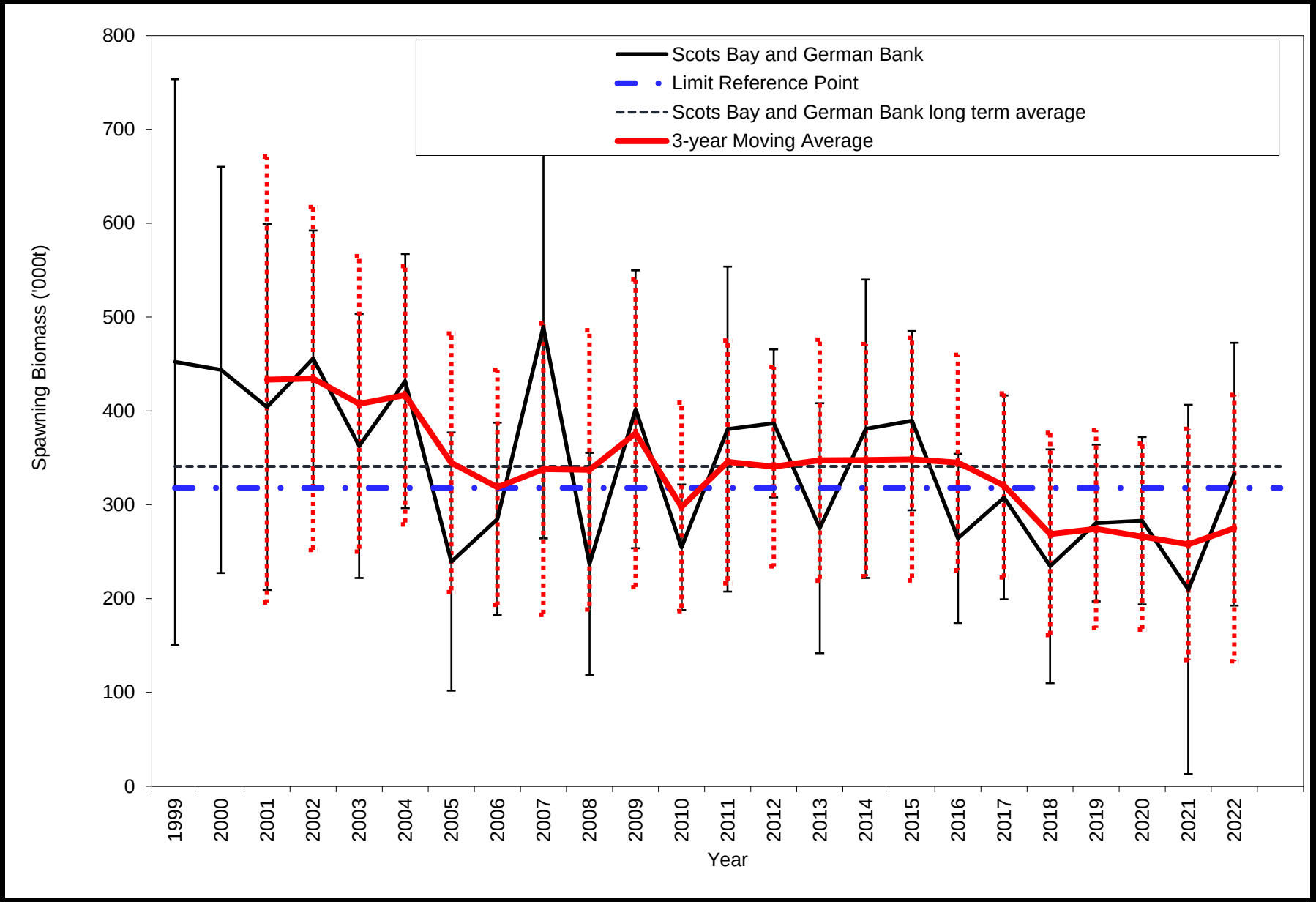
Overall SSB for SWNS/BOF Stock Area

Table 2. Acoustic surveys spawning biomass index for Southwest Nova Scotia/Bay of Fundy spawning component average for 1999–2009 and biomass for 2010 to 2022 (rounded to thousands of tonnes).

Location	Avg. 1999–2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020§	2021§	2022	Avg. 2005–2010	Avg. 1999–2022
Scots Bay (inbox)	79	91	123	59	187	228	98	133	129	80	165	66	182	38	104
Scots Bay (outbox)	1	32	38	8	4	21	3	9	10	53	15	6	74	3	12
Scots Bay total	84	123	161	66	191	249	101	142	140	133	180	72	256	40	116
German Bank (inbox)	289	249	219	200	188	140	163	166	95	147	103	137	77	273	223
German Bank (outbox)	6	9	7	9	2	-	-	-	-	-	-	-	-	6	6
German Bank total	291	258	226	209	190	140	163	166	95	147	103	137	77	278	225
German + Scots	371	381	387	275	381	390	264	308	235	280	283	209	333	318	341
Trinity Ledge	7	7	3	1	5	1	1	14	7	20	14	4	17	6	7
Spec Buoy (spring)	1	0	-	-	-	-	-	-	-	-	-	-	-	1	1
Spec Buoy (fall)	44	-	-	-	-	-	-	9	10	23	13	23	16	-	22
Overall Stock Area	386	388	390	276	386	390	265	330	251	323	310	237	366	324	356
Seal Island	7	1	-	-	-	-	-	-	21	30	4	9	22	10	11
Browns Bank	26	-	-	-	-	-	-	-	-	-	-			8	26
Total All Areas	393	390	390	276	386	390	265	330	272	353	313	246	387	327	363

** Note: Average 2005–2010 = Limit Reference Point (German Bank and Scots Bay total only). Numbers for Scots Bay and German Bank are adjusted for turnover.*

ACOUSTIC SURVEYS 1999 – 2022



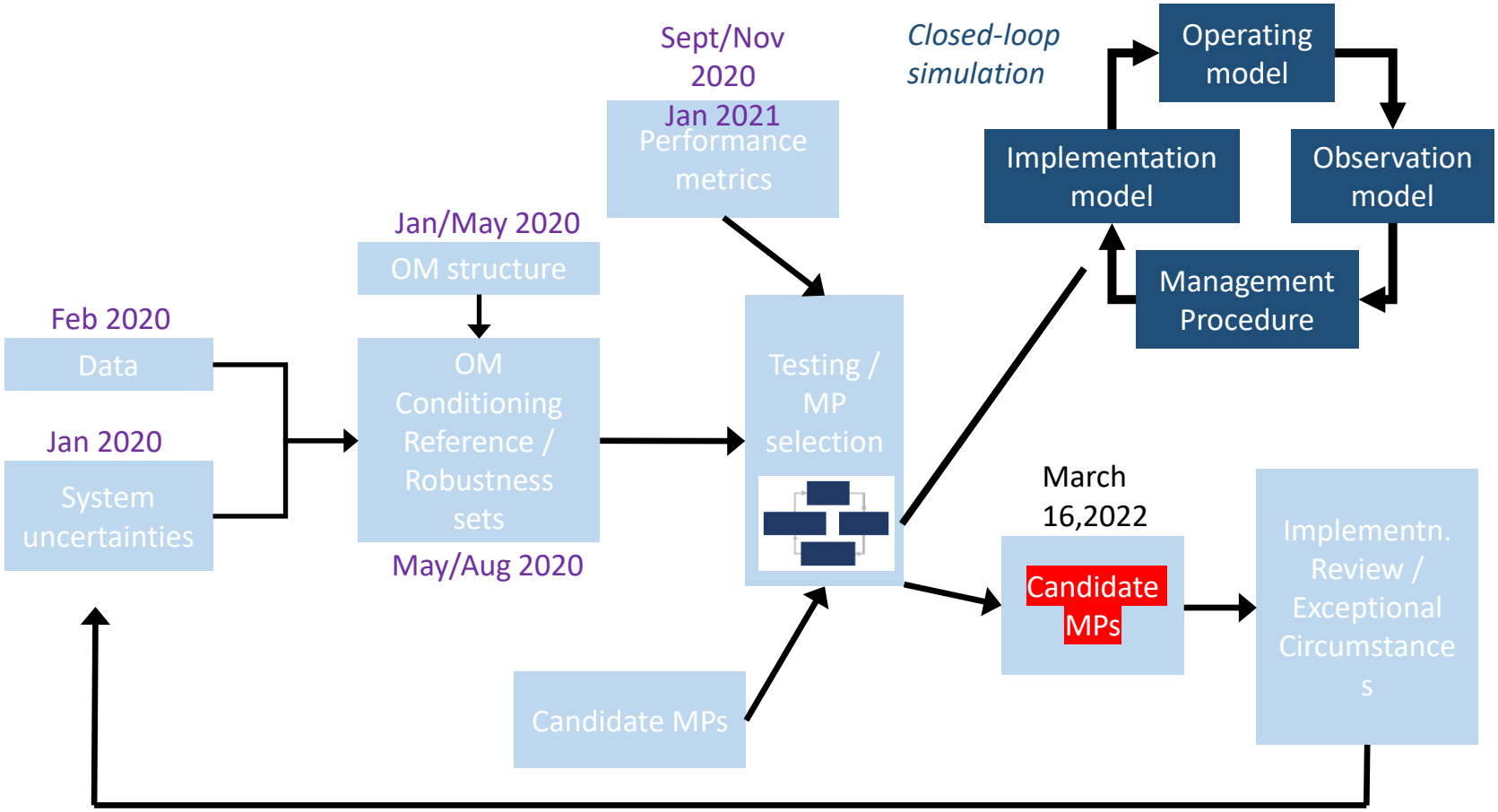
Evaluation of SWNS/BoF

- The 3-year average is below the LRP. Therefore, the stock is considered in the Critical zone.
- German Bank biomass lowest, and Scots Bay highest since surveys began. Yet, stock advice is based on the whole component.
- Need two more years of similar acoustic survey results to provide evidence of rebuilding.

MSE-based Science Advice Updates

Background - MSE

- Management strategy evaluation (MSE) considers multiple working hypotheses of the population dynamics of a fishery stock (Operating models) to test whether potential harvest strategies (Management Procedures) can achieve management objectives.
- Analytical modeling framework using MSE developed from 2019-2022.
- The analytical framework passed peer-review in Feb 16-17 2022 meeting.


Sept/Nov 2020
Jan 2021
Performance metrics
Closed-loop simulation
Operating model
Implementation model
Observation model
Management Procedure
Jan/May 2020
OM structure
Feb 2020
Data
Jan 2020
System uncertainties
OM Conditioning Reference / Robustness sets
May/Aug 2020
Testing / MP selection
March 16,2022
Candidate MPs
Implementn. Review / Exceptional Circumstance s
Candidate MPs

Background - MSE

- Selection of a subset of candidate Management Procedures presented in this Science meeting was not agreed at a meeting of the SFHAC on March 16, 2022.
- DFO Peer-Review Science Assessment occurred March 30, 2022.
- Following assessment there was little attempt to nominate a formal MP.
- Options for candidate MPs were further investigated by DFO Science as options to present to DFO RM.
- The decision was made to decrease TAC by 33%.

DFO Resource Management Objective 1

Objective	Performance Threshold	Timeframe	Acceptable Probability
Maintain SSB above LRP	P(model estimated SSB > model estimated SSB2005-2010)	Year 10 to Year 15	75%

The stock must maintain above the LRP with at least 75% probability in each year in years 10-15 of the projection period.

MPs that do not meet this objective will not be further considered.

Stability MP

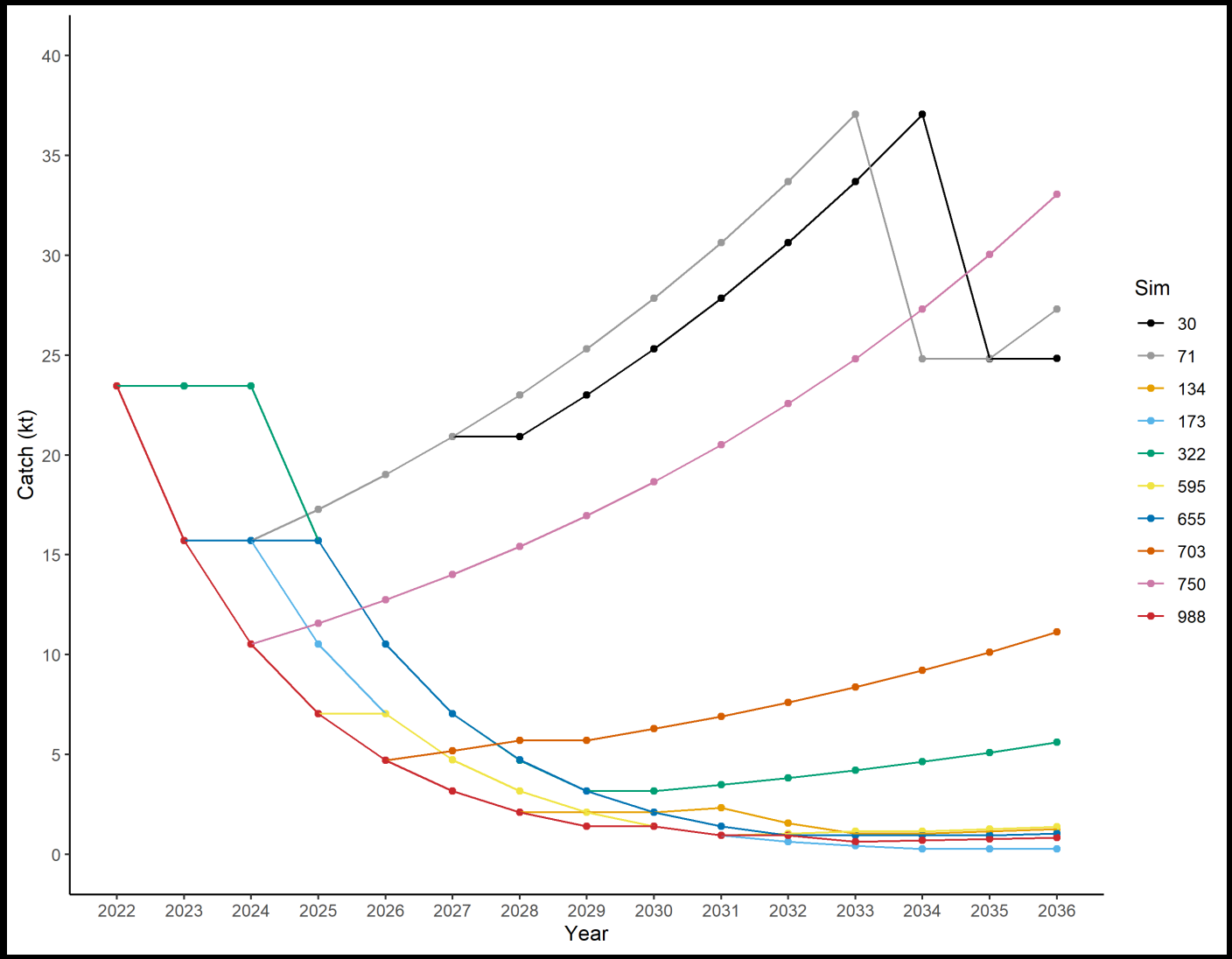
What is this MP, where did it come from and why DFO science added it to the suite of MPs to consider to RM.

STAB_35_33_10_400

$$TAC_{y+1} = \begin{cases} 0.67TAC_y & if\ I_y < 318 \\ TAC_y & 318 \leq I_y < 400 \\ 1.1TAC_y & if\ I_{-1} \geq 400 \end{cases}$$

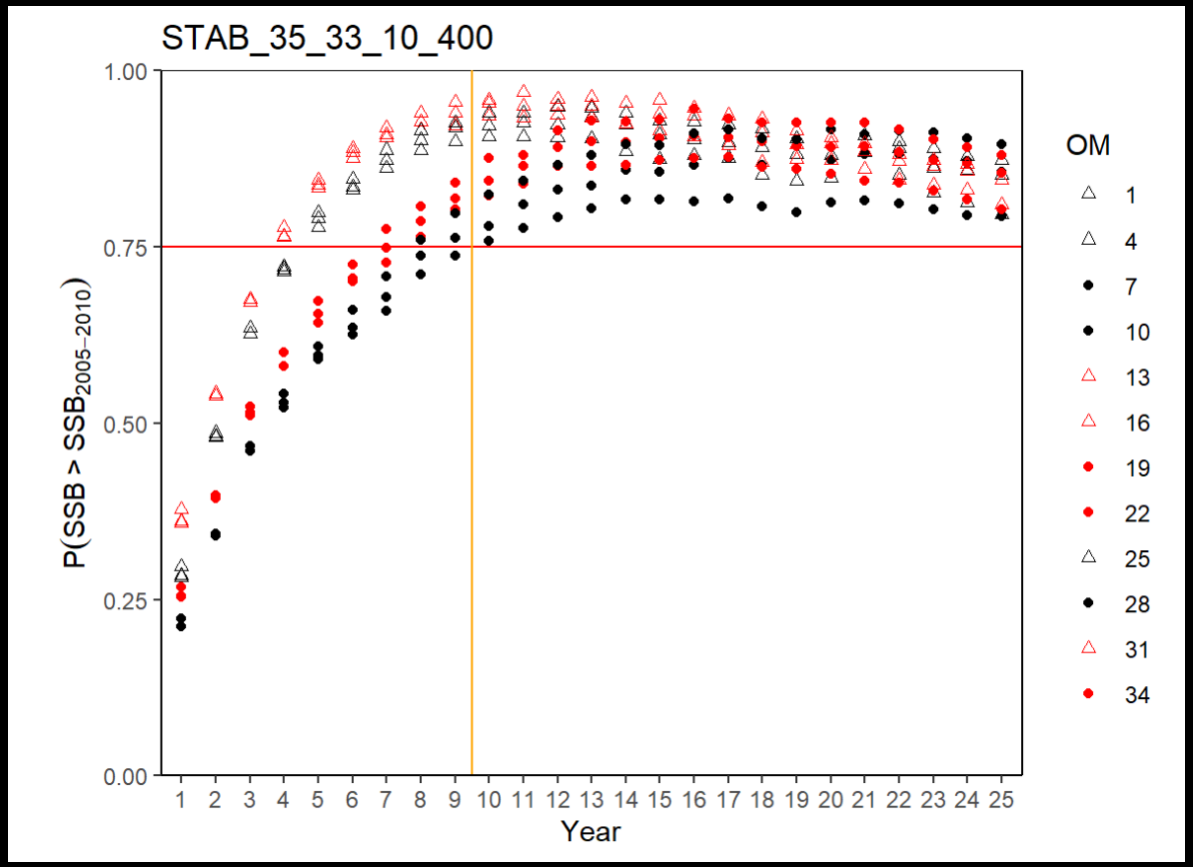
a. If annual index is below the LRP of 318 kt, then reduce this year's TAC by 33% based on the TAC the year prior.
b. If the annual index is between 318-400 kt, then maintain TAC to be the same as last years TAC. (Preliminary results from the acoustic surveys suggests we between 318-400 kt for this year.)
c. If the annual index is greater than 400 kt, then increase the TAC by 10% based on the TAC the year prior.

What catches does STAB generate?



Did it pass Objective 1 of the MSE?

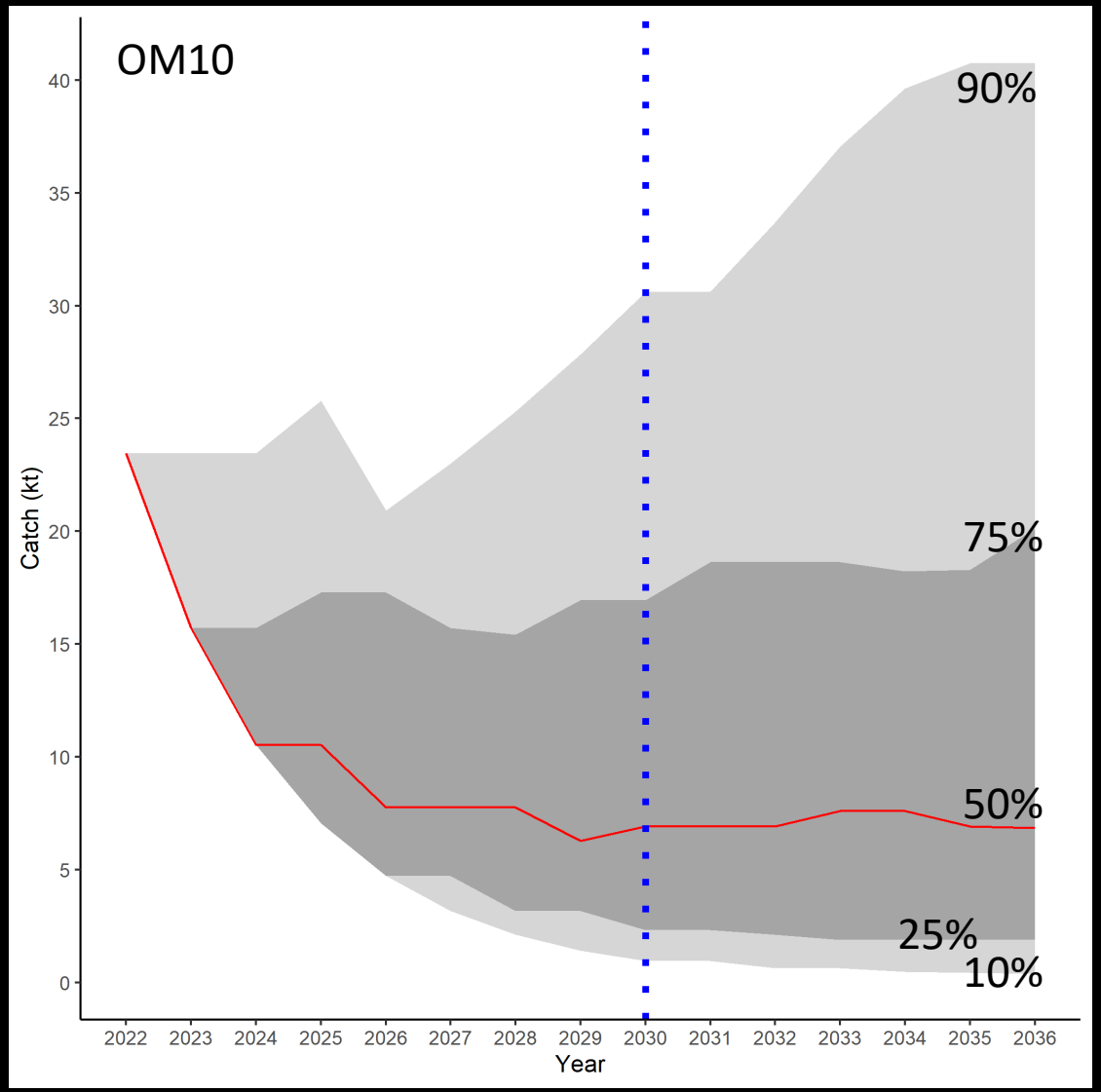
Maintaining a 75% probability of the model SSB in year 10-15 projective above model mean $SSB_{2005\text{-}2010}$ across all OMs.



Yes.

If MP was formerly implanted last year would have resulted in 33% TAC reduction

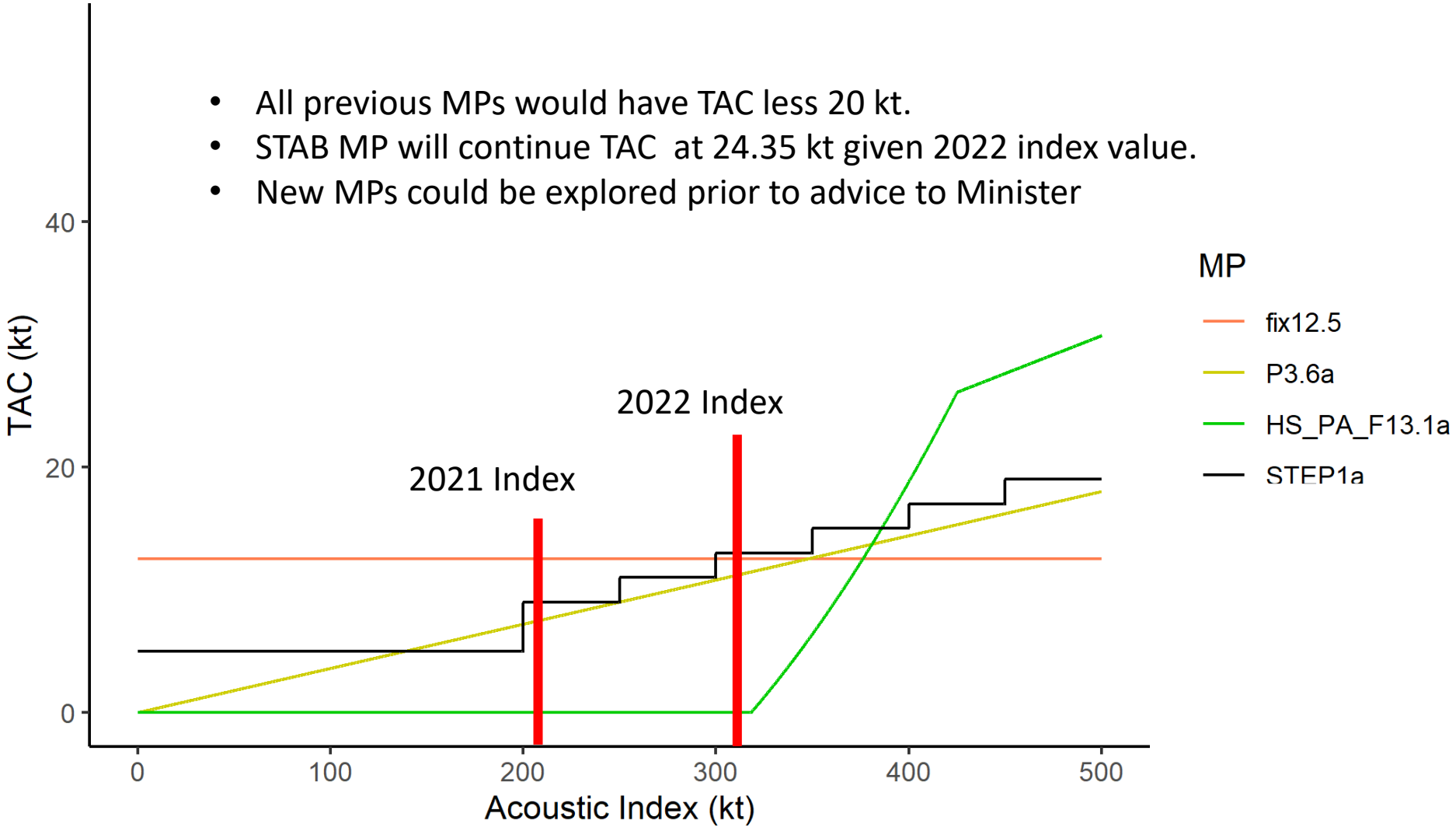
Possible trajectories with STAB



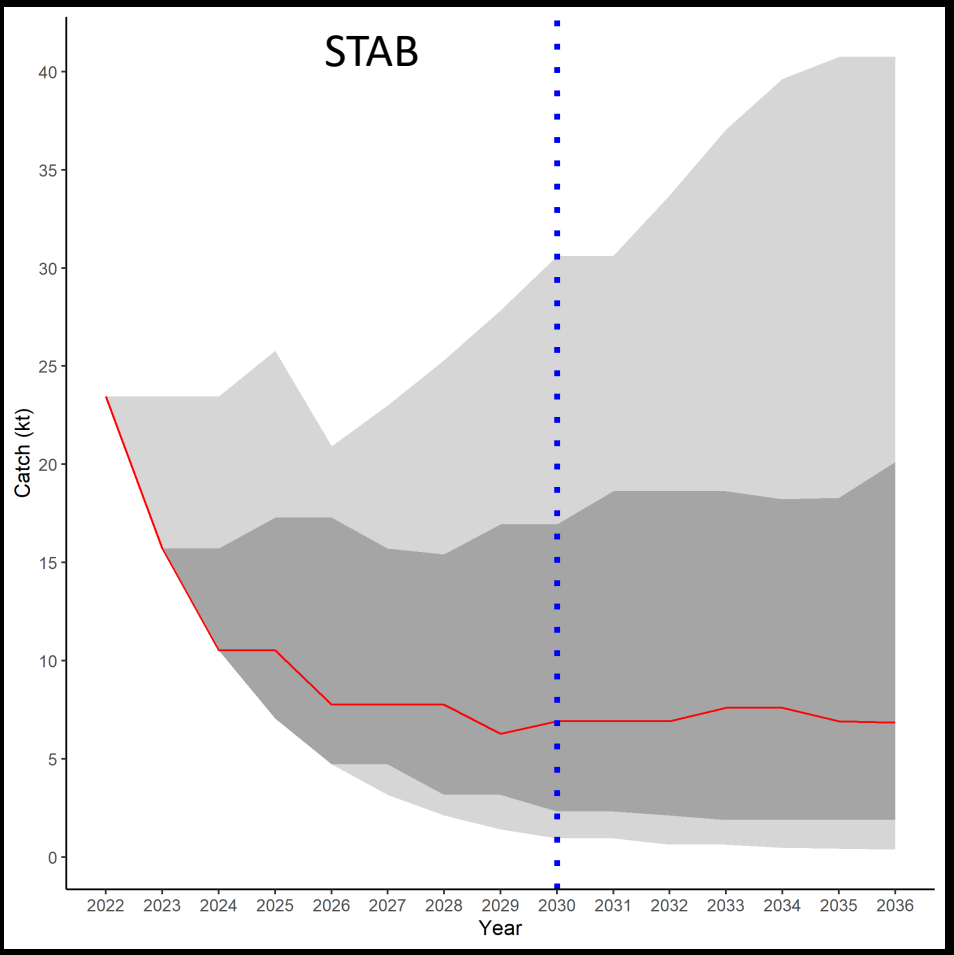
Risk of decreasing Catch, but Short-term Yield could be high.

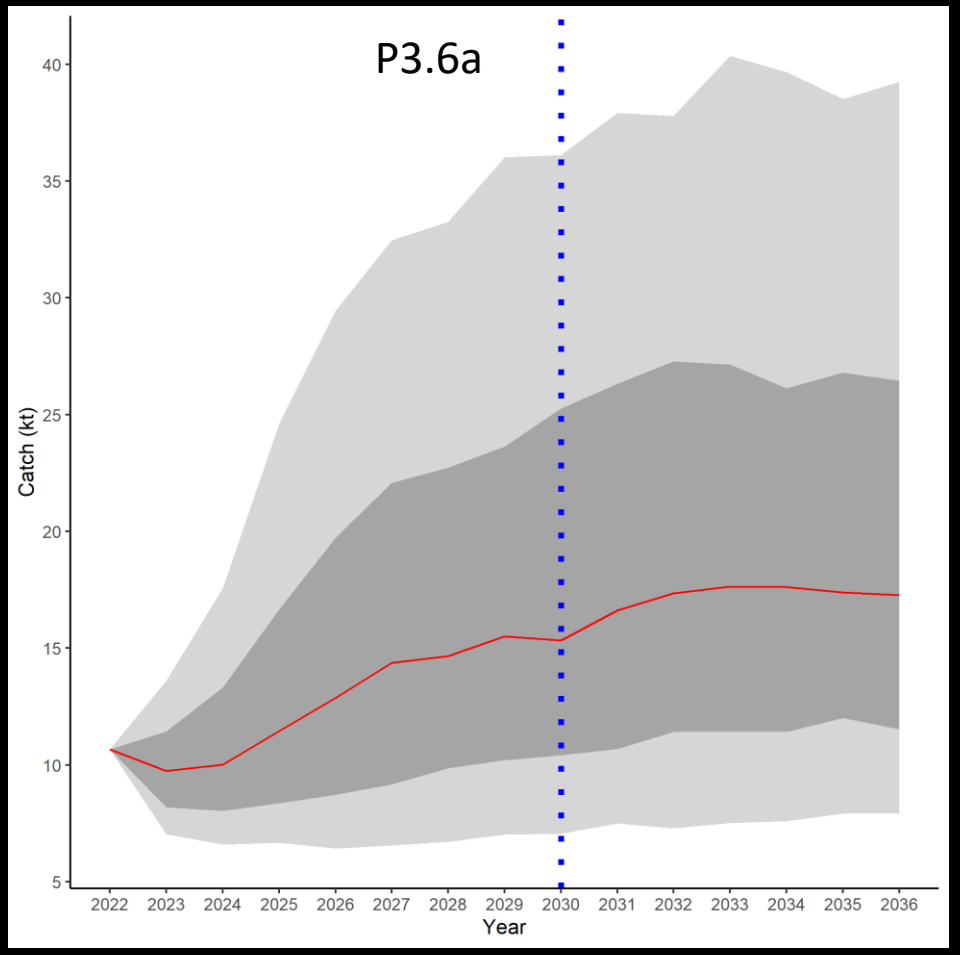
Shape of previous candidate MPs

- All previous MPs would have TAC less 20 kt.
- STAB MP will continue TAC at 24.35 kt given 2022 index value.
- New MPs could be explored prior to advice to Minister

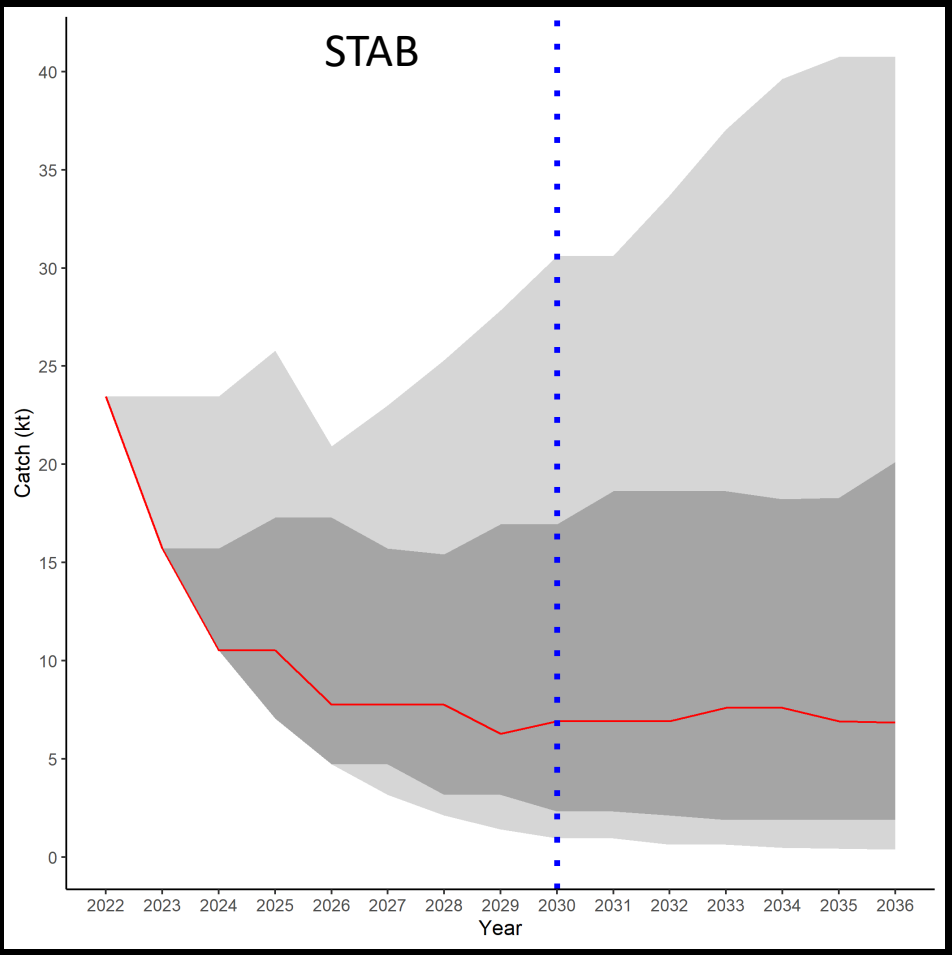


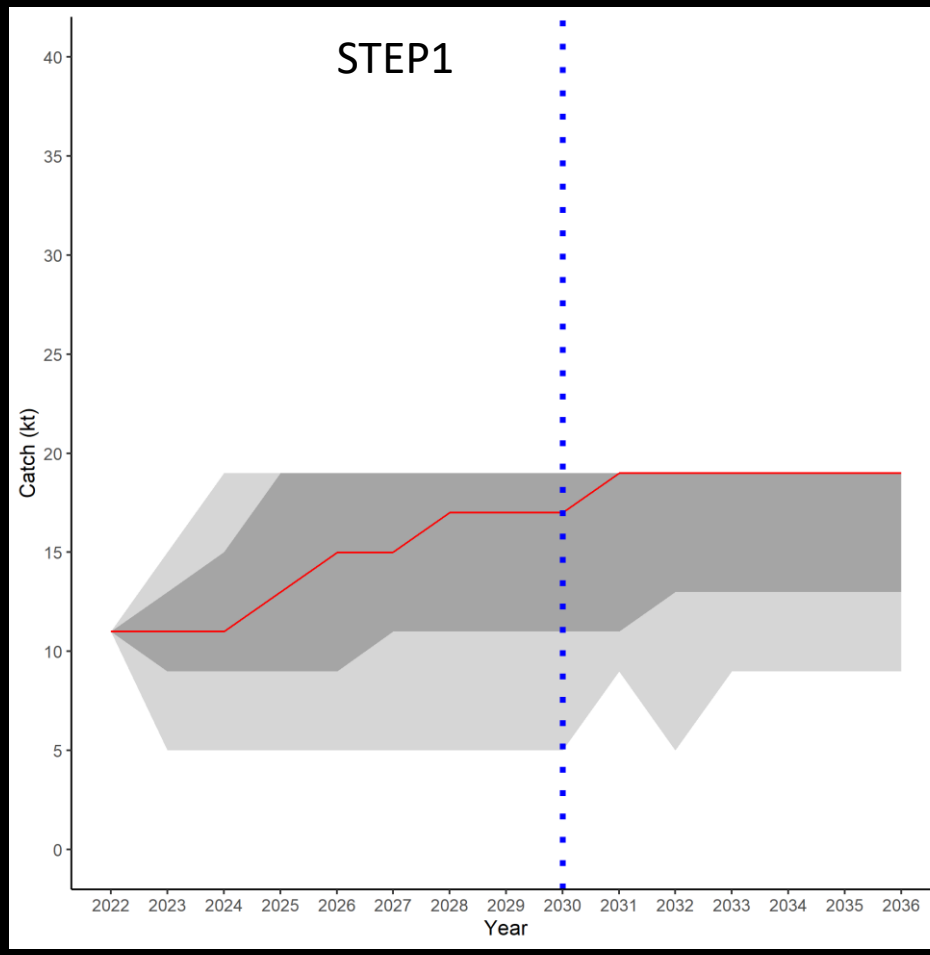
Trade offs


STAB
Catch (kt)
Year
0
5
10
15
20
25
30
35
40
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036


P3.6a
Catch (kt)
Year
5
10
15
20
25
30
35
40
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036

Trade offs


STAB
Catch (kt)
0
5
10
15
20
25
30
35
40
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
Year


STEP1
Catch (kt)
0
5
10
15
20
25
30
35
40
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
Year

DFO Resource Management requests for Science Advice in 2023.

Updating Existing MSE Analytics

- CSAS update using existing analytics (Mar 27).
- Operating Models are conditioned to 2020.
- Update projections using exact removals from 2021 and 2022 fishing seasons and the 2022 index.
- Inform tradeoffs among candidate MPs.
- Modify candidate MPs to pass Objective 1, by maintaining model SSB in year 10 to 15 projective above model mean $SSB_{2005\text{-}2010}$ across all OMs.

What does this mean for next year?

Acoustic Index for 2022 was 332.570 kt.

Subset candidate MPs being considered*:

MP	Recommended TAC from MP for 2023
STAB_35_33_10_400	Status Quo – 23.45 kt
P3.6a	11.972 kt
STEP1	13 kt
Fix 12.5	12.5 kt

*Other new candidate MPs could be explored prior to March 27th.

What isn't occurring for the DFO Science Update:

- Selection and Implementation of a candidate MP, as DFO RM will decide what action to make in this regard.

End