A seasonal video-trawl survey to assess the population size of yellowtail flounder (*Pleuronectes ferruginea*) and windowpane (*Scophthalmus aquosus*) on Georges Bank.

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Sea Scallop Research Set-Aside 2024

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1.0 EXECUTIVE SUMMARY

Project Title: A seasonal video-trawl survey to assess the population size of yellowtail flounder (*Pleuronectes ferruginea*) and windowpane (*Scophthalmus aquosus*) on Georges Bank.

Year Awarded: 2024

RSA Priorities Addressed By This Research: Bycatch

Industry Partners: Nordic Inc, Daniel Eilertsen, FV Justice, Ronnie Borjeson, Robert Kohl, Tim Barrett, Andrew Earle, and Mike Matulitis

This project used SMAST's video-trawl survey technology to generate independent estimates of abundance, biomass, and spatial distribution for flatfish on Georges Bank, including two key bycatch species in the Atlantic sea scallop fishery. Stratified random surveys were conducted during fall 2024 and spring 2025, completing 76 total tows and collecting approximately 58 hours of video data.

Open codend tows allowed non-invasive enumeration of fish passing through the net, while closed codend tows provided biological samples for length-weight relationships and validation of video counts. Video-based counts were highly accurate, with approximately 97% agreement between observed and retained catch in validation tows. Species identification rates exceeded 75% for target species.

Survey results indicate that yellowtail flounder were concentrated in deeper waters (>50 m) on the southeastern portion of Georges Bank, while windowpane flounder were more broadly distributed but most abundant in shallower areas (<50 m). The 2025 average abundance was approximately 1.0 million yellowtail flounder and 3.38 million windowpane flounder, corresponding to biomasses of 573 MT and 476 MT, respectively.

This work demonstrates the effectiveness of the video-trawl methods for monitoring bycatch species and provides data to support stock assessments and management decisions. Additionally, high-resolution video collected during this project is being used to train deep learning algorithms to automate species identification and counting, which will improve efficiency for future surveys.

2.0 PRELIMINARY RESULTS AND DISCUSSION

Two seasonal surveys were completed on Georges Bank during fall 2024 and spring 2025 using a stratified random design, with 76 total tows and approximately 58 hours of video collected (Figure 1). For a portion of the survey, the chain sweep net was replaced with a rockhopper for strata that included more complex bottom. Closed codend validation of video counts showed 97% total accuracy and species identification rates ranged from 77–96%, with approximately 9% of individuals remaining unidentified due to sediment and image limitations.

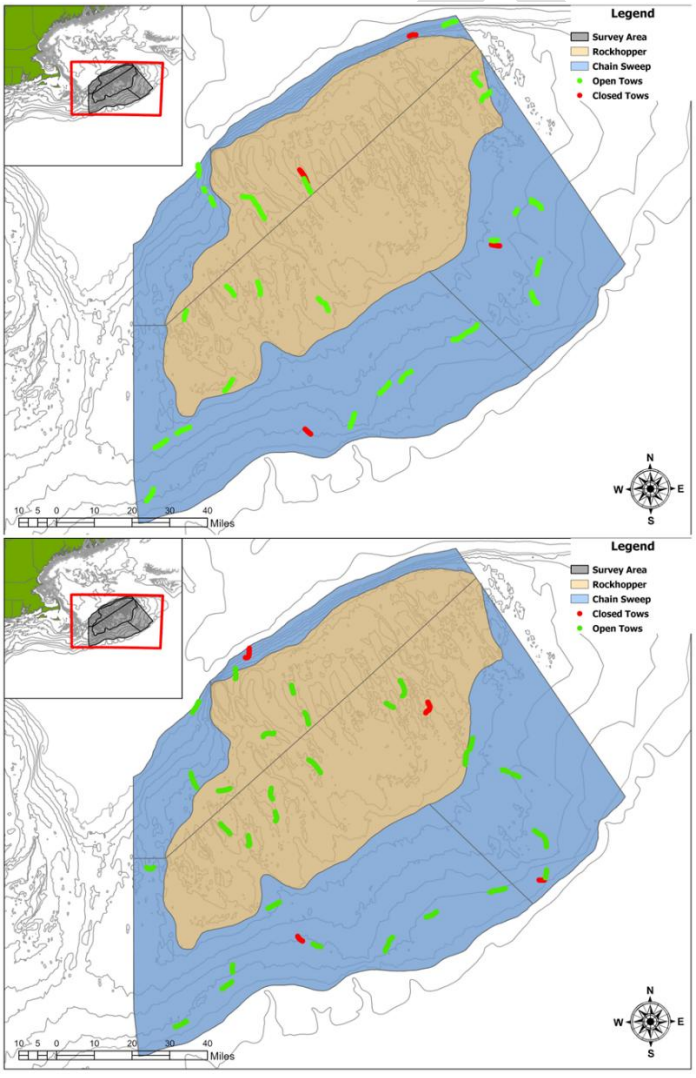

Figure 1. The survey areas (black outline) with the open codend (green) and closed codend (red) tow tracks from the fall 2024 (top) and spring 2025 (bottom) surveys. The chain sweep flat net was used in the blue strata, while the rockhopper net was used in the tan strata.

Yellowtail flounder were patchily distributed, with highest densities on the southeastern portion of Georges Bank at depths greater than 50 m. The mean 2025 abundance was 997,538 individuals with a biomass of 573 MT (Table 1; Figure 2). Windowpane flounder were more broadly distributed, with higher densities in shallower waters (<50 m), and an estimated abundance of 3,384,036 individuals and biomass of 476 MT (Table 1; Figure 2).

Fourspot flounder were the most common flatfish, occurring at high densities along the southern edge of Georges Bank (>60 m), with an estimated abundance of 33,066,991 individuals and biomass of 10,672 MT (Table 1; Figure 2). Winter flounder were moderately abundant, concentrated along the northern edge in the fall and more broadly distributed in spring, with 2,979,360 individuals and 2,159 MT biomass (Table 1; Figure 2). Summer flounder were primarily observed along the southern portion of the Bank, with 1,565,475 individuals and 1,760 MT biomass (Table 1; Figure 2).

Witch flounder and American plaice were only observed during the spring survey. Witch flounder were associated with deeper waters along the southern edge, with an abundance of 1,513,635 individuals and 445 MT biomass (Table 1; Figure 2), while American plaice occurred in low densities across the area, with an abundance of 63,926 individuals and 102 MT biomass (Table 1; Figure 2).

Flatfish distributions were strongly structured by depth and region, with the southern portion of Georges Bank supporting the highest overall densities, particularly for fourspot and summer flounder. High variability in tow-level densities resulted in large variance estimates, reflecting patchy distributions. Length-frequency and length-weight relationships were used to convert counts to biomass, and the upgraded stereoscopic camera system supported development of a deep learning algorithm , which is still ongoing (Figure 3).

Table 1. Biomass (MT) estimates with variance based on wingspread and varying efficiencies for the common flatfish species from both surveys and the 2025 average.

Species	Efficiency	Fall 2024		Spring 2025		2025 Average	
		Variance	Mean	Variance	Mean	Variance	Mean
Yellowtail Flounder	100%	132467	863	10871	283	68291	573
	75%	176622	1151	14494	378	91055	764
	50%	264934	1726	21741	566	136582	1146
	33%	401415	2615	32942	858	206943	1737
Windowpane Flounder	100%	1900	184	36374	767	20095	476
	75%	2533	246	48499	1022	26793	634
	50%	3800	369	72748	1534	40189	951
	33%	5758	559	110224	2324	60893	1441
Fourspot Flounder	100%	87558843	13920	4156916	7423	43541159	10672
	75%	116745124	18560	5542555	9897	58054879	14229
	50%	175117685	27841	8313833	14846	87082319	21343
	33%	265329826	42183	12596716	22494	131942907	32338
Winter Flounder	100%	3380492	3607	85273	711	1641349	2159
	75%	4507323	4809	113698	948	2188465	2879
	50%	6760984	7214	170547	1422	3282698	4318
	33%	10243915	10930	258404	2155	4973784	6542
Summer Flounder	100%	115994	1133	161084	2387	139791	1760
	75%	154658	1511	214779	3182	186389	2347
	50%	231988	2266.6	322168	4774	279583	3520
	33%	351496	3434.3	488133	7233	423610	5333
Witch Flounder	100%			8406	445	4436	445
	75%			11207	593	5915	593
	50%			16811	889	8872	889
	33%			25471	1347	13443	1347
American Plaice	100%			1813	102	957	102
	75%			2418	135	1276	135
	50%			3626	203	1914	203
	33%			5495	308	2900	308

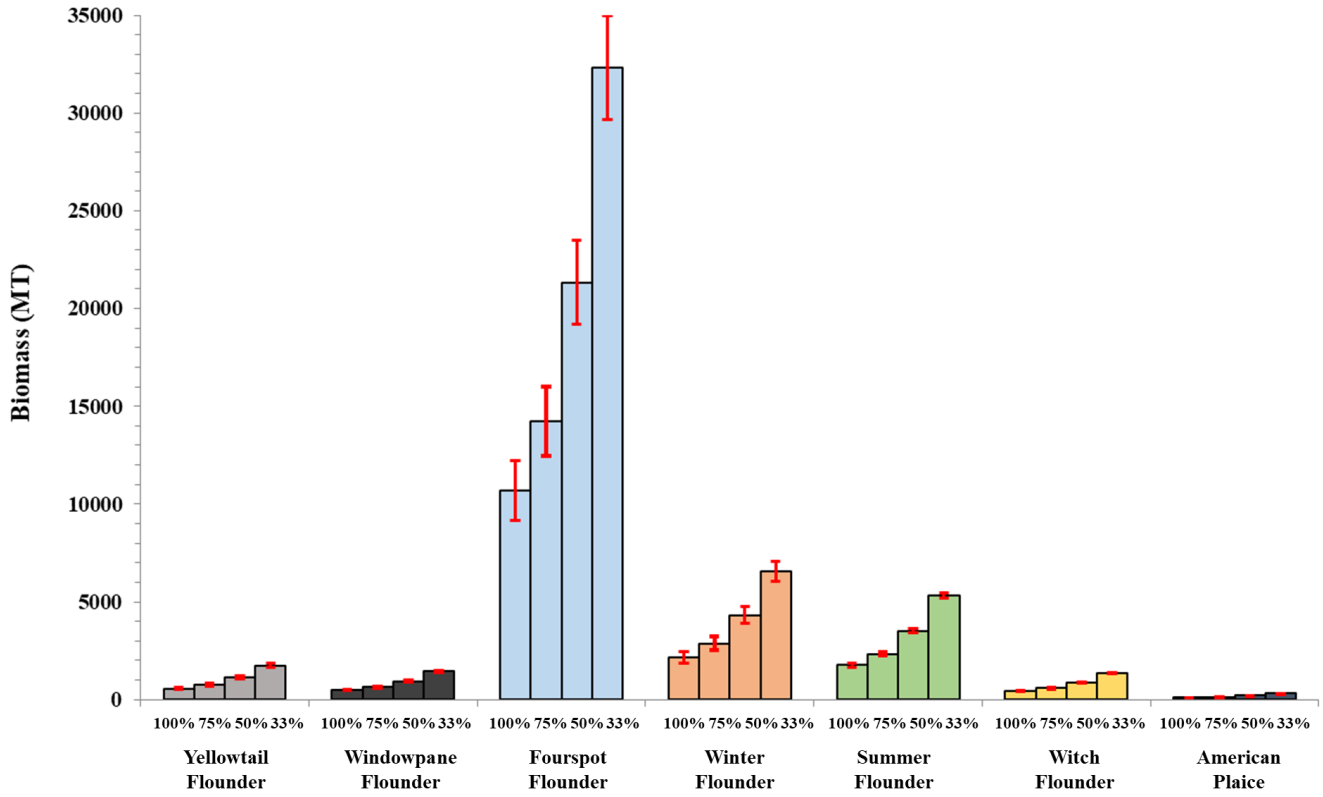

Figure 2. Flatfish biomass (MT) estimates using wingspread at varying efficiencies. Error bars indicate 95% confidence intervals.

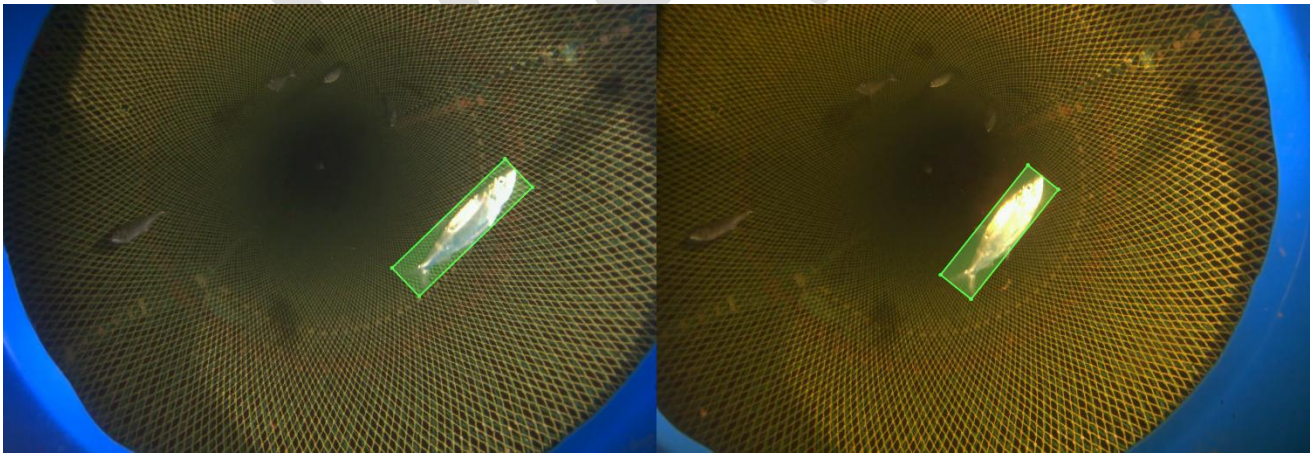

Figure 3. Example screenshot from the new stereoscopic video with algorithm-produced annotation

3.0 SPECIAL COMMENTS

This project successfully demonstrated that video-trawl survey methods provide a reliable, non-invasive approach for quantifying flatfish species on Georges Bank. The high agreement between video observations and retained catch (97%) confirms the accuracy of video counts. The ability to conduct open codend tows and enumerate fish without retention is particularly valuable for species of management concern. Integration with NEFSC survey strata ensures that results are directly comparable with existing datasets and useful for stock assessment applications.

Several limitations were identified that should be considered by managers. Survey capture efficiency remains uncertain and represents a key source of potential bias in absolute abundance estimates. Additionally, sediment resuspension and variable image quality led to a small proportion of unidentified fish, particularly in deeper or softer substrate habitats.

The upgraded high-frame-rate stereoscopic camera system can substantially improve image quality and enable development of a deep learning algorithm for automated fish detection, classification and measurement. However, continued investment in this technology is needed to improve processing efficiency and stereo based length estimation.