

Effects of modifying the Area 2A setline survey

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Abstract

Consideration is being given to modifying the setline survey in Area 2A. This paper discusses some of the issues we would encounter by increasing station density in part of Area 2A, and outlines how an expansion into deeper and shallower waters, and into inside waters, could affect sample size and station configuration.

Introduction

This report follows up the analysis in Webster and Hare (2010) with an examination of the factors potentially affecting the expansion of the Area 2A survey. In the earlier report, we described how setline WPUE in Area 2A is estimated with much poorer relative precision than in other regulatory areas, with coefficients of variation (CV) averaging over 30% in recent years. The CV in all other areas has been consistently under 20% with the present survey design. The poor precision of the Area 2A estimate means that it is more likely to differ by a large amount from the true WPUE than is the case in other areas. While this is not important for the coastwide stock assessment, the use of WPUE as an abundance index for apportionment means there is valid concern that Area 2A's share of coastwide biomass could be quite different from that estimated using the survey data.

To lower the CV in Area 2A to 20% or less, we presented the option of using a 5 nm grid in statistical area 50 and estimating mean WPUE using the stratified sample mean, with statistical areas as strata. Area 50 has had consistently higher WPUE than all other statistical areas in Area 2A, but also has had high sample variance. We showed that bringing down the variance in this area by using a 5 nm grid was sufficient to achieve a CV of 20% or less for the entire regulatory area. In this paper, we discuss the implications of increasing survey intensity in Area 2A and other options for augmenting the current survey in this regulatory area.

Cost of additional stations

Figure 1 shows a 5 nm grid of survey stations in Area 50. A full 5 nm grid in area 50 would have 67 stations (including current stations), greater than the 52 recommended in Webster and Hare (2010). That number was four times the current 13 stations, which is what you would expect from changing a 10 nm grid to a 5 nm grid. However, some stations on the 10 nm grid in area 50 are not fished as part of the setline survey, mainly because of the dangers of shipping traffic off Cape Flattery. It is possible, perhaps likely, that some of the proposed stations will still not be fished for logistical reasons, and the number of new stations may end up being somewhat fewer than 54. Nevertheless, the increase is considerable relative to the current 84 stations in Area 2A.

WPUE in recent years has been very low in Area 2A, and catches have been insufficient to cover the financial costs of running the survey in this area. While statistical area 50 is the part of Area 2A with the highest WPUE, the possible quadrupling of the number of stations in Area 50 will come at considerable cost that is unlikely to be recovered by the sale of caught halibut. Further, there may be concerns that increasing the density of stations in the most productive part

of Area 2A would have a negative impact on the local halibut population. In 2009, survey catch on the standard 84 station grid in Area 2A accounted for 0.4% of all legal-sized 2A removals, and therefore it seems likely that an increase in survey density of the kind discussed in Webster and Hare (2010) will still lead to the survey having only a small cost in terms of halibut removals relative to the rest of the fishery.

Implications for the coastwide assessment

Data collected from Area 2A are an important, yet quite small, component of the inputs into the coastwide stock assessment modelling. Due to the sparseness of 2A survey data, survey age/sex compositions as well as mean length at age/sex for Area 2A are currently estimated using a combination of both 2A and 2B data. An expanded survey resulting in a larger dataset may allow 2A age, sex and length estimates to be computed solely from 2A fish. Sampling density within each statistical area will be used to weight the data components appropriately. Area 2A survey WPUE, used both for abundance weighting within the assessment as well as apportionment, would also take into account statistical area station density.

Yelloweye rockfish stations and rockfish bycatch

In 2006, 21 new stations were added to statistical area 50 on a 5 nm grid for the purpose of indexing yelloweye rockfish abundance. This included three stations that would also be part of a 10 nm grid if the current grid were expanded northwards towards the Strait of Juan de Fuca. Eight stations on a 5 nm grid were also surveyed from 2007-09, including seven of the 21 stations established in 2006, plus one new station (White et al., 2010). These rockfish stations are concentrated in the part of statistical area 50 that has had greatest survey WPUE in recent years, and therefore their inclusion in a survey WPUE calculation will lead to an estimate with positive bias. However, it is still helpful to perform the calculation to illustrate how increasing the number of stations in this statistical area can improve the CV for the entire regulatory area. Using a stratified estimator (Webster and Hare, 2010), CVs for 2006-09 including the 5 nm grid rockfish stations in statistical area 50 range from 19.7% (2006, 21 additional stations) to 25.6% (2007, 8 additional stations). This compares with CVs of 25-37% for 2006-09 based on the standard survey grid (Table 2).

The yelloweye rockfish stations were not fished in 2010 due to decreased limits of allowable yelloweye rockfish takes in the federal rebuilding plan, and IPHC increasing the number of skates fished at standard survey stations. Any effect the survey has on rockfish populations will only increase as the number of stations is increased, and it may be the case that the IPHC cannot fish additional stations because of restrictions on rockfish removals. To reduce their impact, IPHC rockfish stations used fewer skates per set than standard grid stations, 3 skates compared with 5-7 skates per station during 2006-09. If additional stations are permitted in rockfish areas, it also may be necessary to use fewer than the standard number of skates for these stations.

To get an idea of the effect of increasing station density on yelloweye catches, we estimated what catch would have been from 2006-09 based on observed data (Table 4). Our approach was to add the observed catch on the IPHC standard survey grid to the projected catch for a statistical area 50 surveyed with a 5 nm grid of 54 additional stations using three skates per set. We use only the 13 survey stations in Area 50 to project catch, because they are distributed throughout the area: including rockfish indexes stations would lead to biased estimates because of their

concentration in only a small part of Area 50. Thus, the projected catch with additional stations is given by:

$$C_{proj} = C_{SG} + \frac{(54 \times 3)C_{SG50}}{13 \times N_{SG}}$$

where the C is the catch in numbers of fish, and the subscripts refer to projected catch (proj), catch on the entire survey Area 2A survey grid (SG) and catch on the 13 survey grid stations in Area 50 (SG50). N_{SG} is the number of skates set on the survey stations in a given year.

Table 4 shows that had we done this study in 2006-09, we could have expected 30-80 additional yelloweye to be caught on the survey stations. However, in 2006-09 respectively, 14, 44, 13 and 29 yelloweye were caught on rockfish index stations that would also form part of the new 5 nm grid. Thus the actual increase above what was captured anyway would have been only about half of the values in Table 4. If some of the 5 nm stations are again used as rockfish index stations in 2011, it is unclear whether or not rockfish caught on these stations would count towards any yelloweye catch restrictions placed on the IPHC survey in Washington.

To put the projected increases in perspective, from 2006-08 it was estimated that total yelloweye catches in Area 2A ranged from 7.5 to 14.1 t (Stewart et al. 2009), or around 2500-4500 fish. Although we expect increases in catch due to the new stations to be small relative to total catch in Area 2A, we will still have to abide by any specific restrictions that are placed on IPHC yelloweye catch. At present, it is unclear exactly what these restrictions will be in 2011.

Expansion into other depths and inside waters

Currently, the IPHC setline survey in Area 2A has stations in the range of 20-275 fathoms (37-503 m), and no stations are located in inside waters (Salish Sea: Strait of Juan de Fuca, Puget Sound, Strait of Georgia, waters around the San Juan Islands). Increased commercial catches in other areas at greater depths, and ongoing commercial catches at shallower depths, have led the IPHC to consider expanding the depth range of the 10 nm survey grid. At present, staff are examining an expansion deeper to 400 fm (732 m), and shallower to 10 fm (18 m); see Hare et al. (2011) for a detailed discussion of issues associated with setline survey range expansion). Industry concerns about lack of survey data from inside waters in Area 2A are also leading staff to consider the feasibility of establishing survey stations in the Salish Sea.

The table below gives estimates of the number of potential new stations on an expanded 10 nm grid in Area 2A, and Figures 2 and 3 show maps of the 10 nm survey grid expanded into unsurveyed waters from 10-400 fm. Were all new stations to be fished, a total of 53 stations would be added to the 84 used at present. However, some stations on the current 10 nm grid are not fished as part of the setline survey, partly because of the dangers of shipping traffic which may also be a factor in inside waters. Improved communication with the US Coastguard may help ensure the safety of survey vessels while fishing these stations, and whether they can be safely fished or not will require further study. It is still possible, perhaps likely, that some of the proposed stations will not be fished for logistical reasons, and the number of new stations in an expanded survey may end up being somewhat fewer than 53.

Area	10-20 fm	20-275 fm	275-400 fm	Total
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Inside waters	3	14	0	17
Open waters	8	12	16	36
Total	11	26	16	53

Any expansion of the survey in Area 2A will lead to increased sample size, and, unless the distribution of halibut is unusually variable in the newly sampled regions, reduced CV for the estimate of WPUE. It is possible, therefore, that an expanded 10 nm grid in Area 2A will make it unnecessary to increase station density in statistical area 50 by the amount we have proposed, if at all.

References

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Table 1. Mean and range of coefficients of variation of mean CPUE for each regulatory area from 2001-09.

Area	Stations (2001-09)	Mean CV (2001-09)	CV range (2001-09)
2A	84	33%	27-40%
2B	169-170	8%	7-9%
2C	107-110	7%	6-8%
3A	366-374	5%	4-5%
3B	210-231	4%	4-5%
4A	107-114	12%	10-14%
4B	86-89	11%	9-13%
4D	48-58	17%	14-23%

Table 2. Comparison of current Area 2A station allocation among statistical areas to calculated optimal allocations for 2004-08.

Year	Statistical Area
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	8	9	10	20	30	40	50
<i>Current design</i>	3	9	15	17	14	13	13
2004	0	1	21	4	2	10	45
2005	0	3	6	8	3	5	59
2006	0	4	22	5	4	1	47
2007	0	3	10	3	1	6	62
2008	0	1	24	5	1	5	48
2009	1	8	25	4	1	4	42
Mean 2004-08	0	3	17	5	2	5	50

Table 3. Comparison of alternative methods for allocating sampling effort to statistical area in Area 2A.

Sample allocation method	Stratified SE and CV by year											
	2004		2005		2006		2007		2008		2009	
	SE	CV	SE	CV	SE	CV	SE	CV	SE	CV	SE	CV
1. Post-stratification with current allocation	7.27	27%	8.63	31%	4.61	28%	6.94	37%	5.49	30%	2.03	25%
2. Optimal allocation for each year	4.77	18%	4.73	17%	3.04	19%	3.66	20%	3.43	19%	1.37	17%
3. 2009 optimal allocation	5.24	19%	5.58	20%	3.24	20%	4.15	22%	3.60	19%	1.37	17%
4. Average of 2004-09 optimal allocations	4.95	18%	5.05	18%	3.15	19%	3.84	20%	3.51	19%	1.46	18%
5. #4 with minimum of 3 stations per stratum	5.02	19%	5.12	18%	3.17	20%	3.93	21%	3.58	19%	1.47	18%
6. #4 with no fewer stations per stratum than current allocation	4.48	17%	4.58	16%	2.88	18%	3.68	20%	3.34	18%	1.32	17%
7. Current allocation with four times the stations in Area 50	4.59	17%	4.53	16%	2.90	18%	3.65	19%	3.44	19%	1.37	17%

Table 4. Estimated increases in rockfish catches on Area 2A survey grid from addition of 54 stations on a 5 nm survey grid in Area 50, fished at 3 skates/set.

Year	IPHC survey skates/set	Observed catch (count)			Projected catch (count) with 54 new stations on 5 nm grid in Area 50	Increase on IPHC survey
		IPHC survey grid, Area 50	IPHC survey grid, other areas	Total		
2006	5	21	69	90	142	52
2007	5	32	103	135	215	80
2008	5	12	122	134	164	30
2009	7	32	59	91	148	57

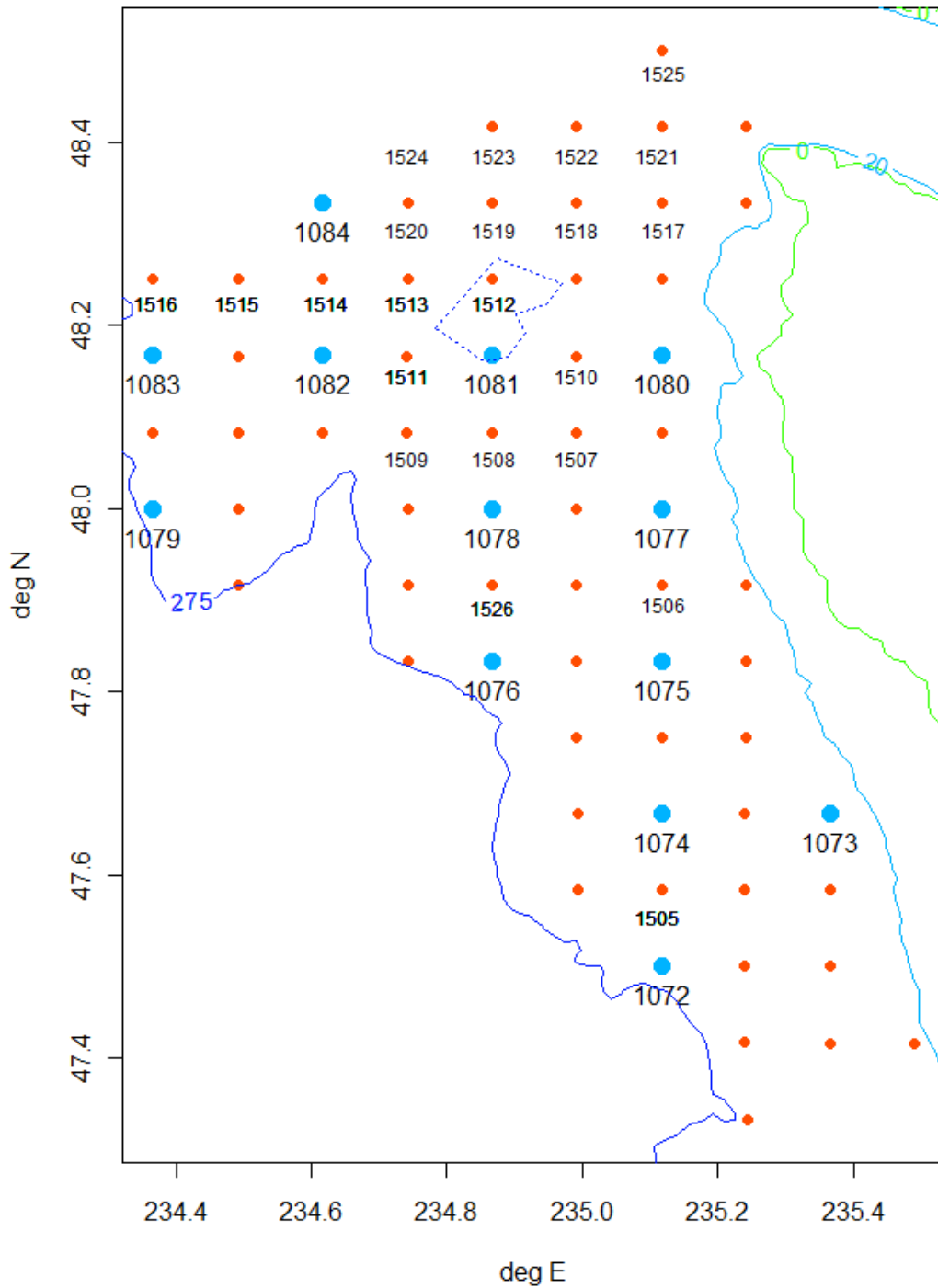


Figure 1. Proposed Area 50 station layout. Current survey stations are shown with large circles, and new stations with small circles. Where a station has been previously fished, its station number is given. The dashed polygon is a rockfish conservation area closed to commercial fishing.

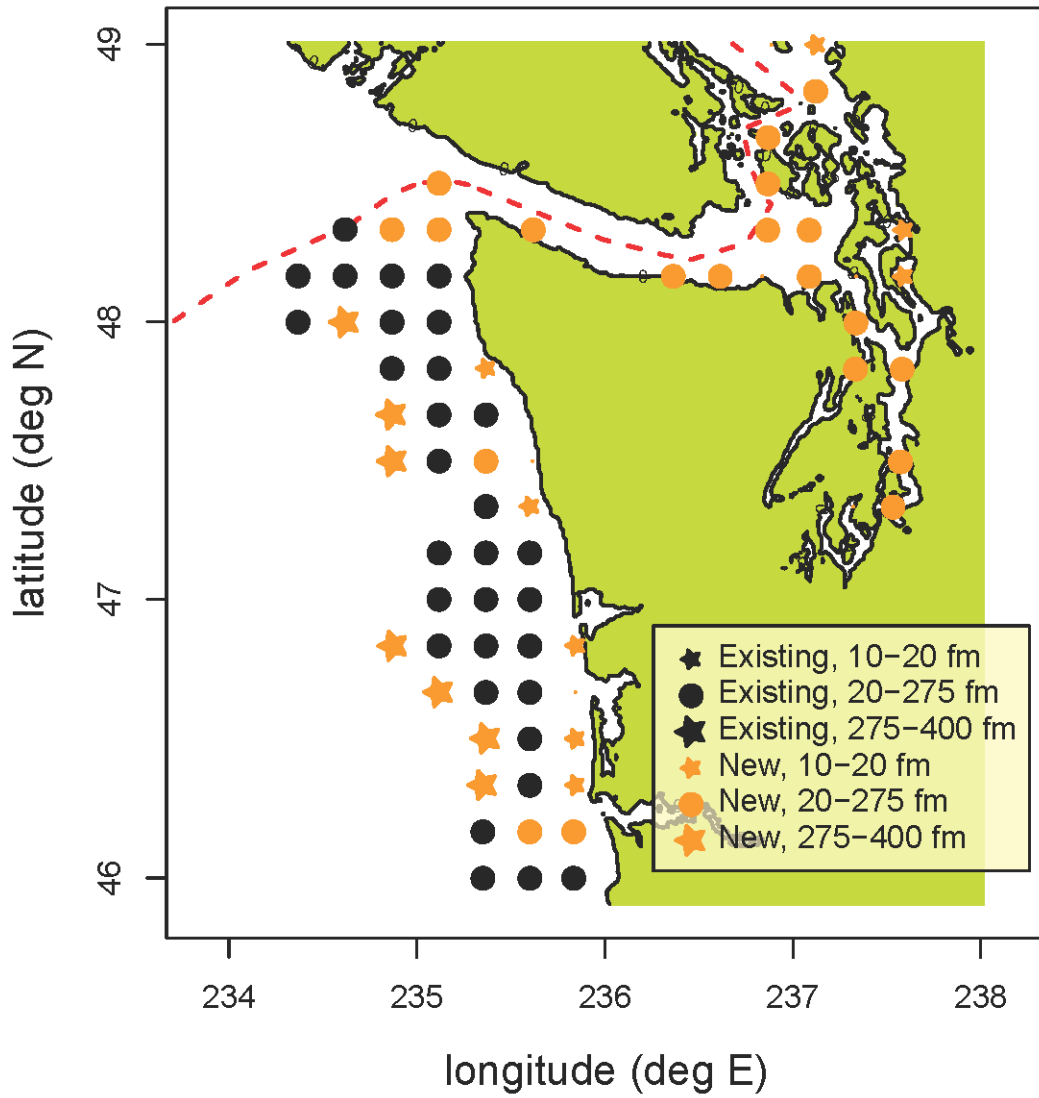


Figure 2 Expansion of current 10 nmile survey grid in the northern part of Area 2A into unsurveyed areas.

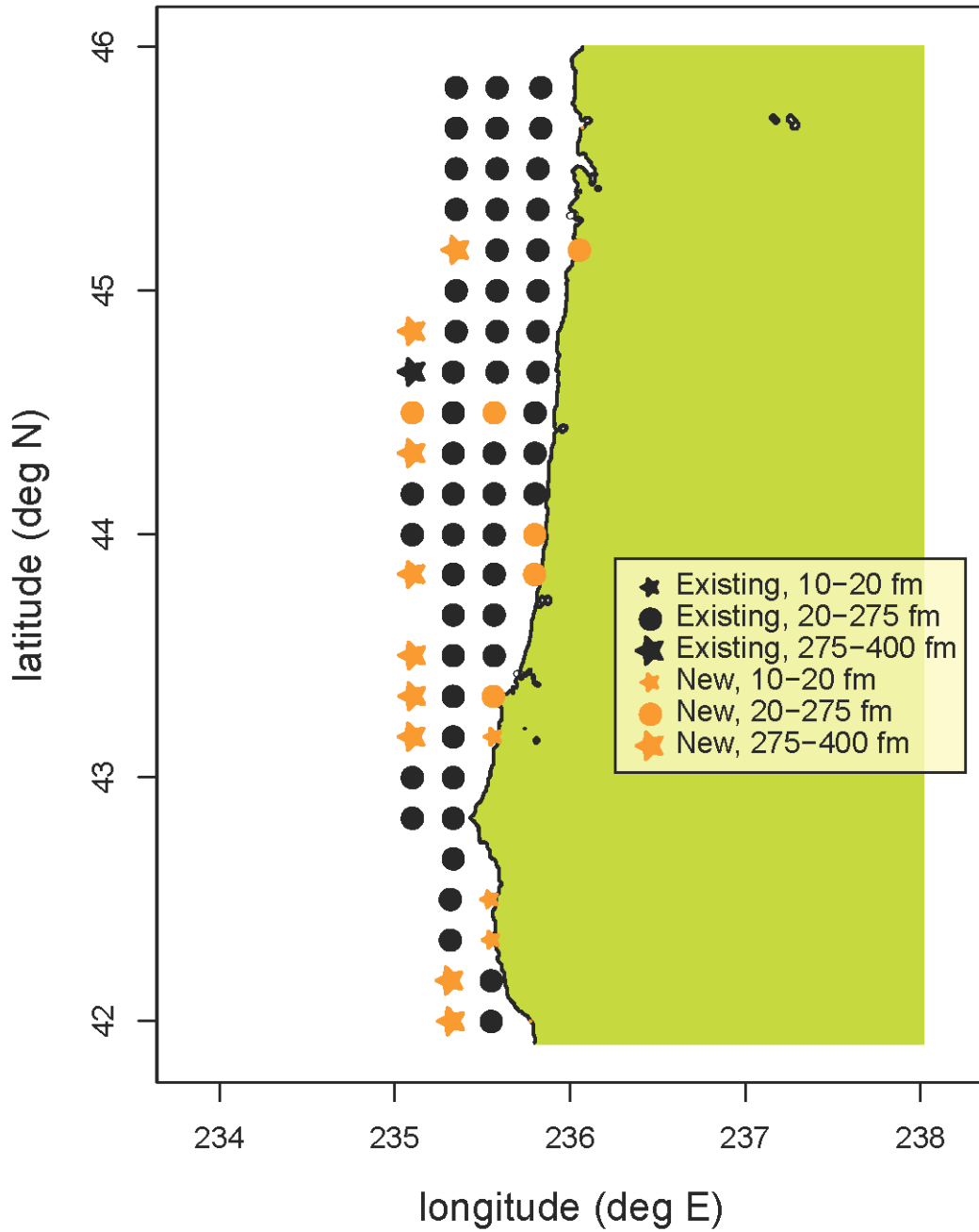


Figure 3 Expansion of current 10 nmile survey grid in the southern part of Area 2A into unsurveyed areas.