

Compilation of coincident setline and trawl survey catch rates in the eastern Bering Sea

William G. Clark and Steven R. Hare

Abstract

For Area 4CDE, the coastwide stock assessment uses a predicted setline survey CPUE based on the annual NMFS trawl survey and the single setline survey of the eastern Bering Sea shelf carried out in 2006, which had an average CPUE of 18 lb/skate. It has been suspected that this value is somewhat low because the coastwide assessment estimates a biomass in Area 4CDE somewhat lower than the trawl survey swept-area estimate. For what they are worth, relative trawl and setline survey catch rates from other areas of overlap support the suspicion, but they are not worth much because the usable trawl survey data are so sparse and noisy.

Background

Every year the Commission carries out a setline survey of the entire shelf except for the eastern Bering Sea. Setline survey CPUE there is predicted from the annual NMFS trawl survey, scaled by the observed ratio of setline and trawl CPUE in 2006 when the only setline survey of the eastern Bering Sea was conducted. The coastwide stock assessment is then conducted using the predicted setline CPUE in the eastern Bering Sea and the observed setline CPUE in other areas. Likewise the survey apportionment of the coastwide total is done using predicted values for the eastern Bering Sea (Areas 4CDE) and real data elsewhere.

Before the adoption of the coastwide assessment, exploitable biomass in Area 4CDE was estimated by applying the fixed commercial setline selectivities to the mean of the most recent three swept-area estimates of total abundance at length from the trawl survey. (The trawl survey was taken as non-selective with a catchability of one for fish above 80 cm. The total estimates were reduced by 10% to account for the portion in Area 4A.) In 2004-2006 these estimates for Area 4CDE were all 50-55 M lb, whereas the 2006 coastwide assessment produced an estimate of 41 M lb (Clark and Hare 2007). It seemed unlikely that the trawl survey was overestimating the biomass, so it was stated at that time that the 2006 survey for whatever reason may have produced a low CPUE. Since then the 2007 trawl survey estimate came in at 34 M lb while the 2007 coastwide assessment produced an estimate of 36 M lb (Clark and Hare 2008), so there is at the moment less of a discrepancy. Still the three-year running average of the trawl survey estimates for Area 4CDE is 46 M lb.

The setline and trawl surveys have overlapped in some places over the years, and those data might shed some more light on the relationship between trawl and setline survey catch rates and therefore the question of whether the shelfwide 2006 data were somehow aberrant. This paper summarizes those other datasets and appraises their usefulness.

Available data

NMFS trawl survey stations are set on a 20 nmi grid covering the entire shelf from a depth of 10 to 100 fm. IPHC setline stations are set on a 10 nmi grid along the shelf edge covering depths from 75 to 275 fm. In addition Area 4C was surveyed in 1997, and in 2006 some regular

grid stations were added around St. Mathew (9 stations) and the Pribilofs (19 stations). There is therefore some overlap of the two surveys at present in every year at four station clusters: along the Area 4A edge (Fig.1), in Area 4C (Fig. 2), along the Area 4D edge (Fig. 3), and at St. Mathew (Fig.4).

To compile comparable setline and trawl datasets for each cluster/year, first all setline stations from a cluster/year in depths less than 100 fm were selected. Then all trawl stations lying within 10 nmi of any of the selected setline stations were identified. The resulting paired datasets are summarized in Table 1.

There are only three cases where there are more than 10 trawl stations in a dataset: the 2006 shelfwide survey, the 1997 Area 4C survey, and the 1997 Area 4D edge survey (just before the survey station pattern changed from triangles to a grid). Otherwise the number of comparable trawl stations is small and the number of legal-sized fish caught at those stations is also small and quite variable from tow to tow.

The setline CPUE shown in Table 1 is the usual measure: net weight of legal-sized fish per skate. To calculate a comparable measure for the trawl catch per hectare swept, the catch in weight at each length was multiplied by commercial setline selectivity at that length, so the trawl CPUE is reported in exploitable net pounds per hectare swept. This procedure matches what is done to calculate a total exploitable biomass from the swept-area estimates of total abundance at length.

The key value to be estimated from the paired datasets is the ratio of setline CPUE (lb/skate) to trawl CPUE (lb/ha), shown in the last column of Table 1. This ratio has the units ha/skate, meaning how many hectares have to be trawled to catch as much fish as a skate of setline gear. The median of this value over all datasets is 30 ha/skate, similar to what is seen in the Gulf of Alaska, so the value of 18 ha/skate observed in the 2006 survey does appear to be on the low side.

On the other hand most of the other numbers are based on very little data. There are more trawl stations in the shelfwide 2006 dataset (356) than in all the others combined (209). Another weakness of most of the paired datasets is that the included trawl and setline stations are not both uniformly distributed over the cluster (see e.g. Fig. 1).

Discussion

It is clear that the overlapping setline and trawl survey data apart from the 2006 shelfwide surveys are too sparse and too variable to provide any real improvement on the working value of 18 ha/skate based on the 2006 data. Nor can we expect much help from the few overlapping stations in future years. And yet it is still quite possible that the working value is low. If the estimate is in fact low, the end result is that we are acting in a precautionary manner as we refine our understanding of productivity in the Bering Sea.

One possible option would be to tweak the working value in order to bring the coastwide estimate for Area 4CDE up to the trawl survey estimate. A second option is to continue using the 2006 trawl data to scale the 4CDE biomass estimate until a second Bering Sea shelf setline survey is conducted. Plans to conduct such a survey in 2008 fell through due to a lack of viable survey bids. It is anticipated that a shelf wide survey will be conducted in the next year or two. Given all the other changes and questions surrounding the assessment, the apportionment and transition to a new lead assessment author (SRH), it is likely best to maintain current practice to facilitate understanding of 4CDE interannual changes. Therefore, we recommend this second option for the 2008 assessment.

References

Clark, W.G., and Hare, S.R. 2007. Assessment of the Pacific halibut stock at the end of 2006. Int. Pacific Halibut Comm. Report of Assessment and Research Activities 2006:97-128.

Clark, W.G., and Hare, S.R. 2008. Assessment of the Pacific halibut stock at the end of 2007. Int. Pacific Halibut Comm. Report of Assessment and Research Activities 2007:177-204.

Table 1. IPHC setline and NMFS trawl survey data from regions of overlap in the eastern Bering Sea. Setline CPUE is net pounds of legal sized fish per skate. Trawl CPUE is exploitable net pounds per hectare swept; the catch in weight at each length is scaled by commercial setline selectivity.

Cluster	Year	Setline stations	Legal fish	Setline CPUE (lb/sk)	Std. error	Trawl stations	Legal fish	Trawl CPUE (lb/ha)	Std. error	CPUE ratio (ha/sk)
Whole shelf	2006	82	300	18	4	356	167	1.0	0.2	18
4A edge	1997	34	1122	144	30	10	20	3.7	1.8	39
4A edge	1998	21	463	67	13	7	12	5.8	2.9	12
4A edge	2000	21	426	66	11	8	5	1.7	1.0	39
4A edge	2001	21	251	47	9	7	8	1.3	0.6	35
4A edge	2002	23	245	45	9	5	3	2.8	2.2	16
4A edge	2003	21	399	60	17	5	3	0.6	0.4	108
4A edge	2004	22	362	59	14	6	1	0.9	0.8	69
4A edge	2005	22	170	27	7	8	8	1.4	0.6	19
4A edge	2006	22	105	18	4	5	5	0.9	0.5	20
4A edge	2007	23	141	25	5	6	2	0.8	0.7	31
4C	1997	64	674	57	12	40	48	4.0	1.2	14
4C	2006	19	262	63	16	9	4	3.1	2.3	20
4C	2007	19	177	48	12	8	15	4.7	2.0	10
4D edge	1997	51	962	86	13	22	8	0.6	0.4	145
4D edge	2000	31	969	127	25	7	17	4.7	1.3	27
4D edge	2001	33	862	133	29	8	6	0.9	0.4	155
4D edge	2002	32	1172	205	41	7	12	4.1	1.4	50
4D edge	2003	29	1303	151	30	5	1	0.2	0.2	634
4D edge	2004	32	589	78	14	6	3	0.6	0.3	134
4D edge	2005	32	337	36	7	8	9	4.1	3.2	9
4D edge	2006	33	287	34	8	7	3	1.2	1.1	28
4D edge	2007	32	239	40	9	8	5	1.6	1.1	25
St. Mathew	2006	9	141	111	35	3	1	0.8	0.7	145
St. Mathew	2007	9	53	51	16	4	1	2.5	2.5	20

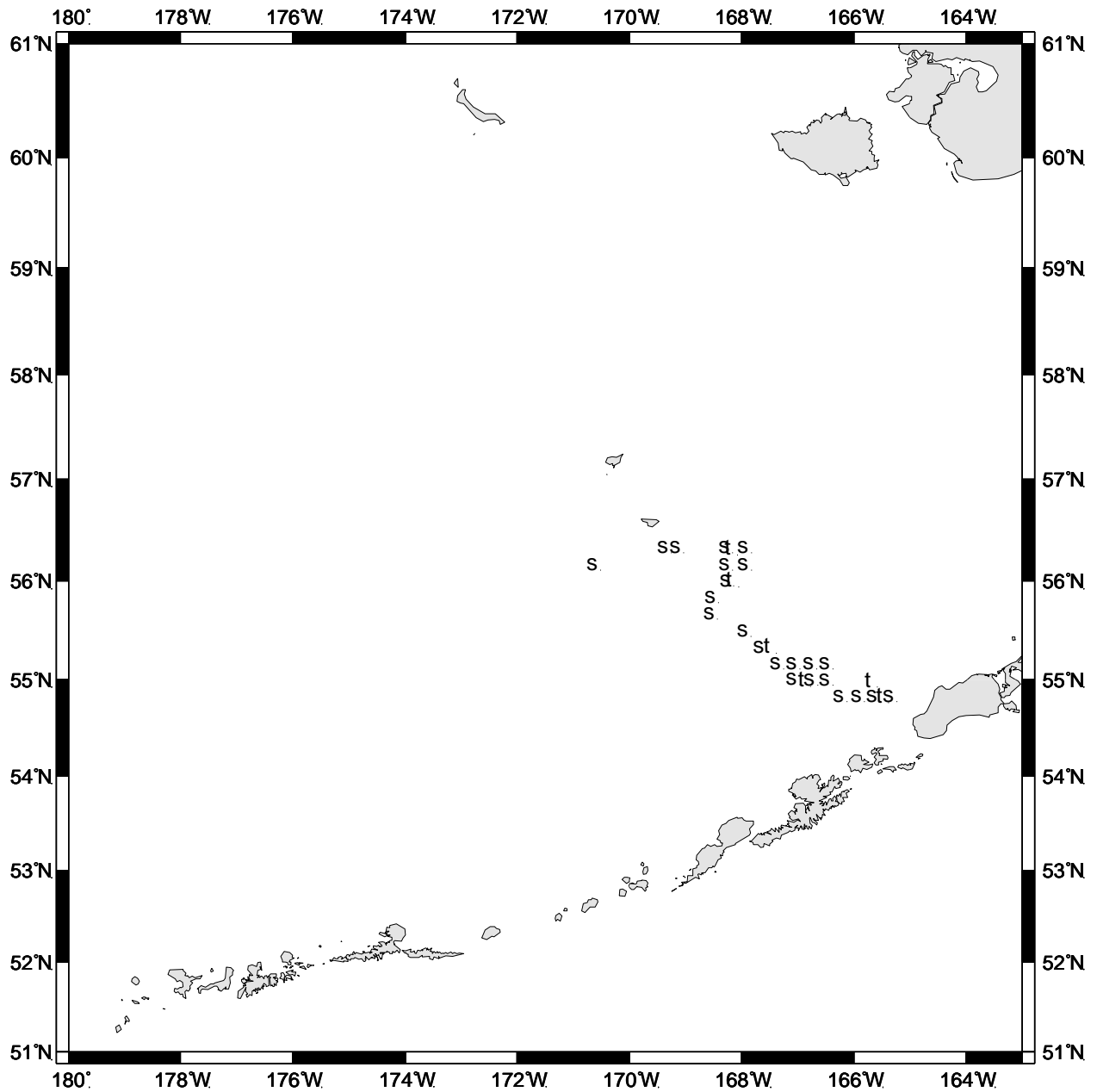


Figure 1. Setline and trawl survey stations along the Area 4A edge, 2007.

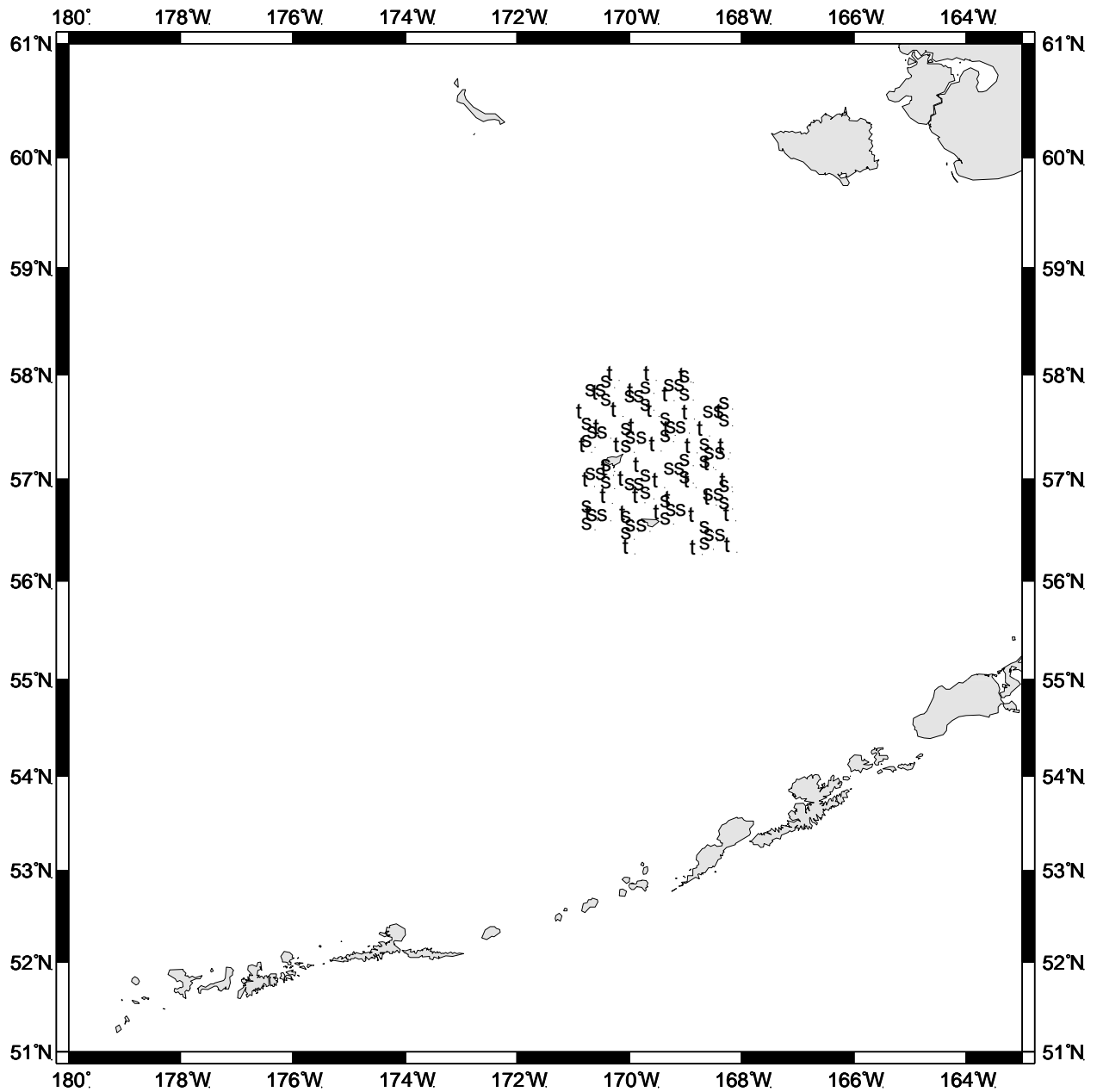


Figure 2a. Setline and trawl survey stations in Area 4C, 1997.

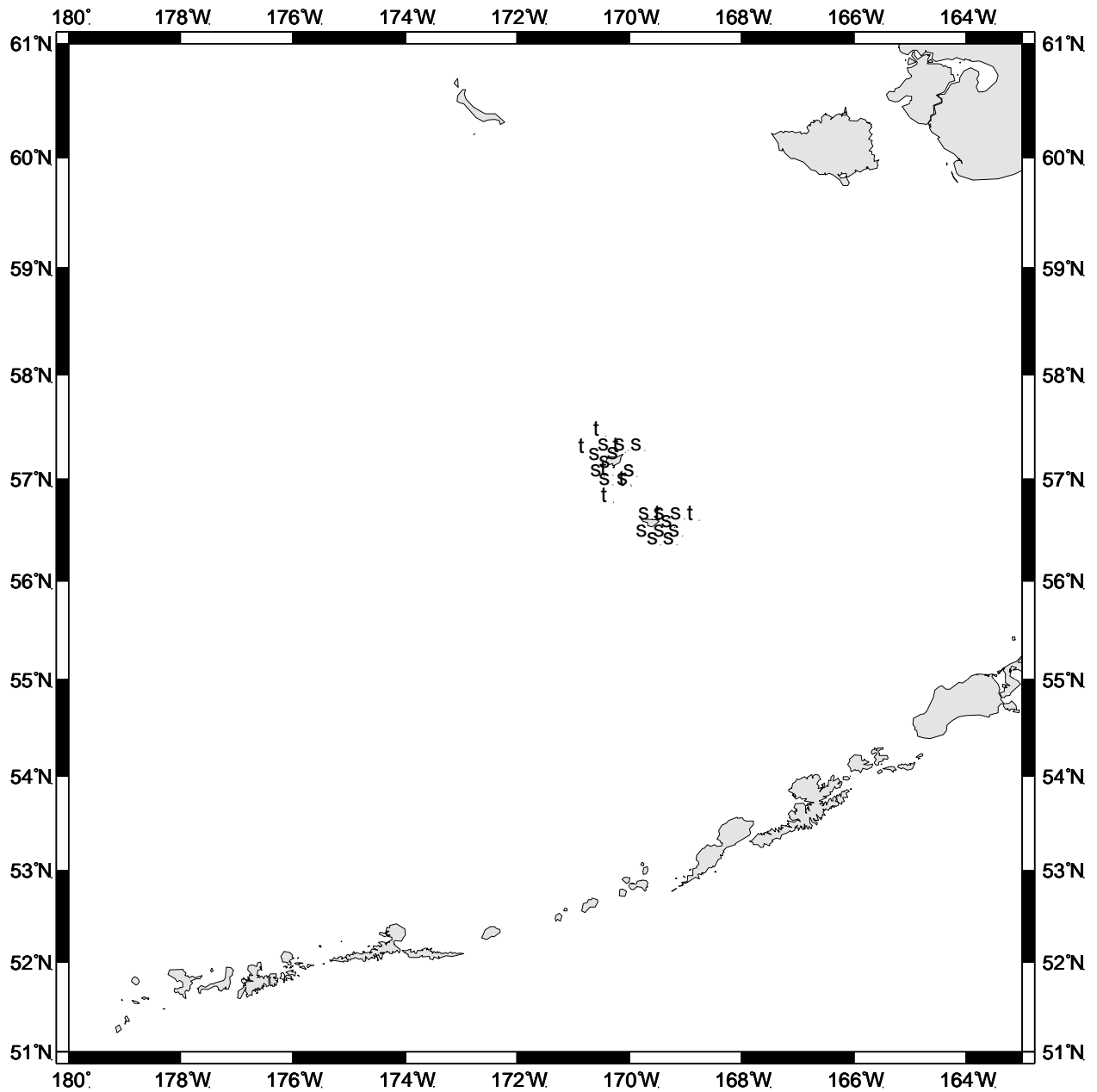


Figure 2b. Setline and trawl survey stations in Area 4C, 2007.

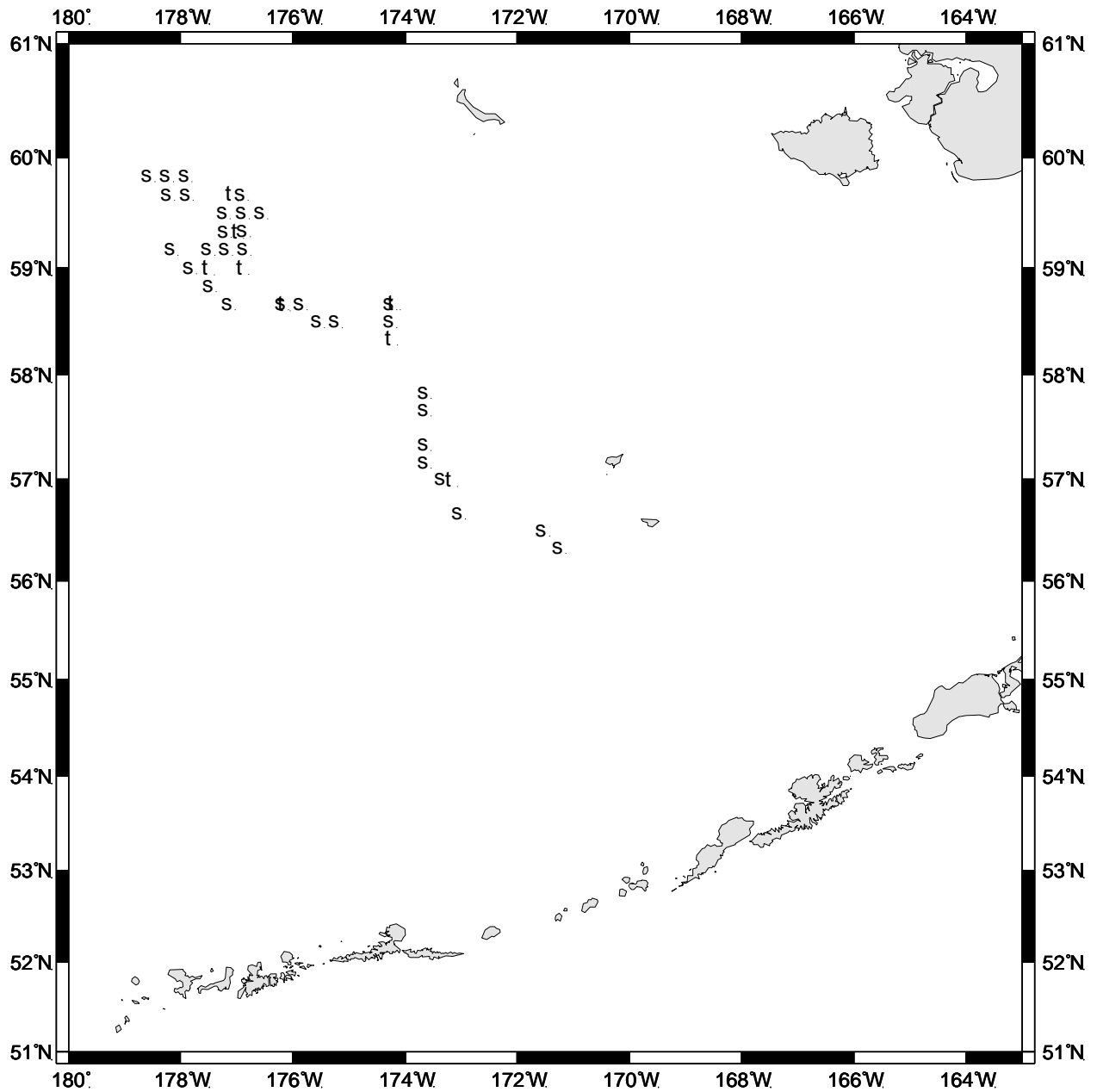


Figure 3. Setline and trawl survey stations along the Area 4D edge, 2007.

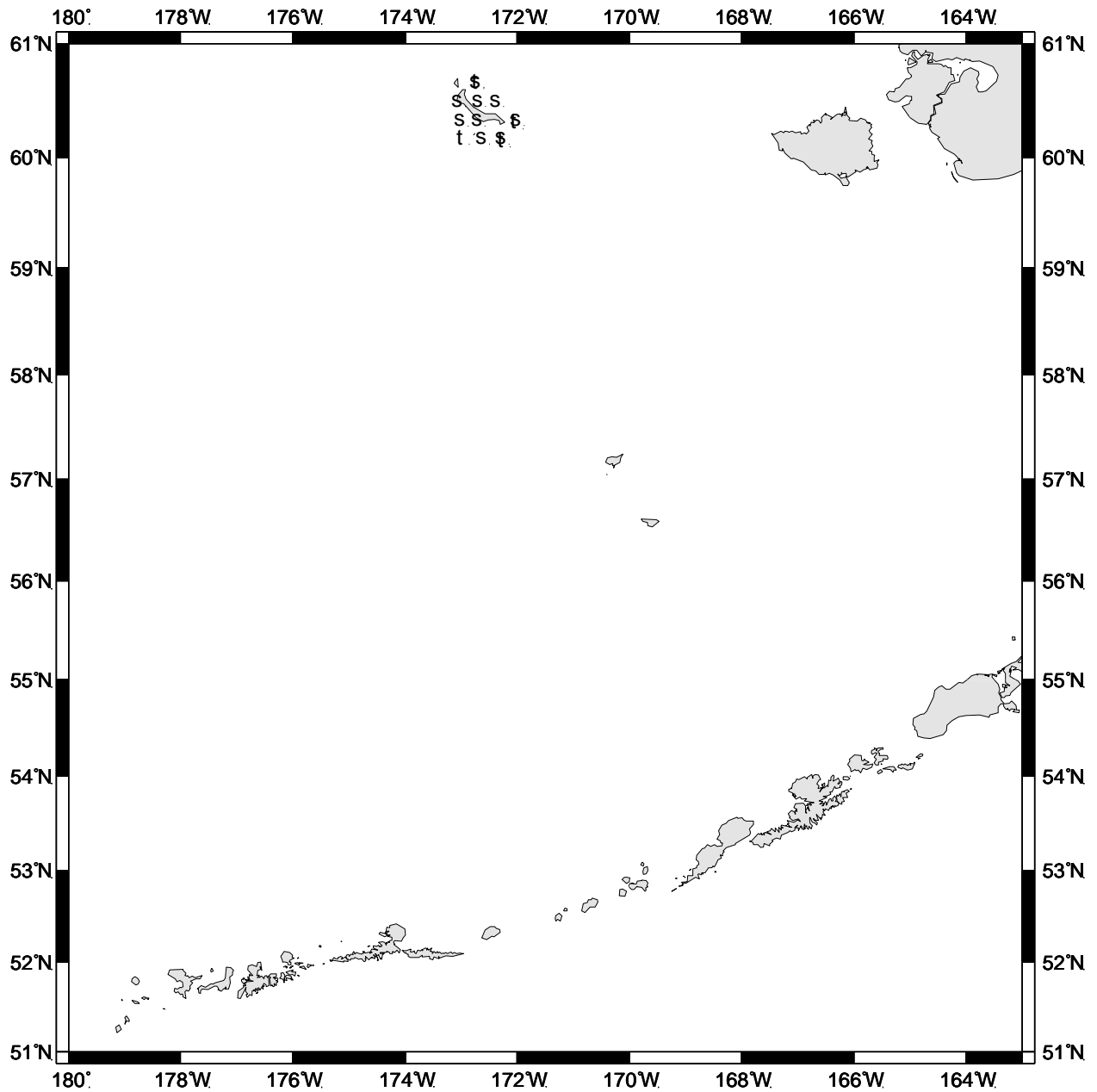


Figure 4. Setline and trawl survey stations at St. Mathew, 2007.