APPENDIX B
Longfin smelt data analysis details

Appendix B. Deriving a catchability factor for longfin smelt.

References cited here are listed in the main document.

Newman (2008) fit a probability-of-capture model for delta smelt (*Hypomesus transpacificus*) from experimental data based on a midwater trawl with cod-end mesh size nominally identical to that used in the present data set. Here, the catchability curve derived by Newman is applied to longfin smelt, using CDFW Bay Study length frequency data for both trawls together for all years and months through 2008 (Figure A1 and Table A1). From Newman's Appendix A, Figure 5, a catchability quotient was estimated for each 5-mm size increment, assuming longfin smelt escape as delta smelt do. For fish > 90 mm FL (fork length), Q was taken as 1, based on Newman's empirical data The fraction of age-0 fish in each 5-mm increment was calculated from the longfin smelt length frequency data. Then a weighted catchability quotient, Q_0, was calculated from the sums of products of these fractions by their respective estimated Q's (Table A1). The resulting estimate is Q_0=0.38, i.e., 38% of longfin smelt are retained in the cod end of the trawl under these assumptions. That is, to estimate abundance from catch data, the catch rate should be multiplied by a factor of 2.6 to account for extrusion through the mesh of the net.

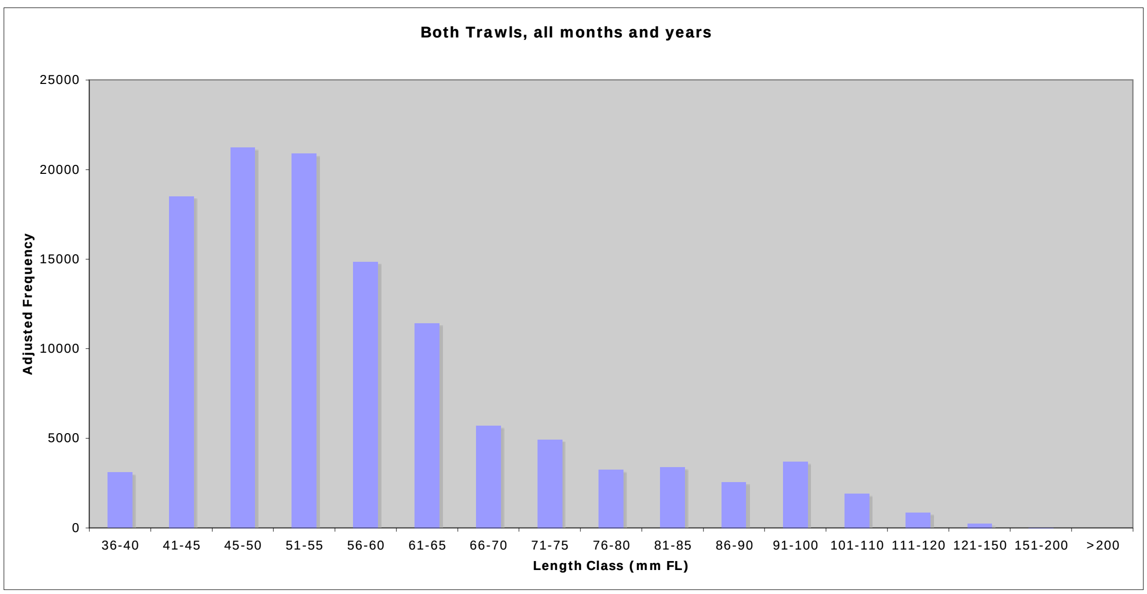

Figure A1. Combined length frequency plot for longfin smelt from otter trawl and midwater trawl, CDFW Bay Study, 1980-2008.

Table A1. Calculation of catchability quotient for longfin smelt due to extrusion

Length Class (mm)	Number of Fish	Fraction	Q*	FxQ
36-40	3094	0.027	0.15	0.004
41-45	18510	0.159	0.20	0.032
45-50	21235	0.182	0.25	0.046
51-55	20888	0.179	0.30	0.054
56-60	14847	0.127	0.35	0.045
61-65	11431	0.098	0.40	0.039
66-70	5719	0.049	0.50	0.025
71-75	4937	0.042	0.60	0.025
76-80	3247	0.028	0.65	0.018
81-85	3395	0.029	0.70	0.020
86-90	2555	0.022	0.80	0.018
91-100	3701	0.032	1.00	0.032
101-110	1930	0.017	1.00	0.017
111-120	858	0.007	1.00	0.007
121-150	247	0.002	1.00	0.002
151-200	15	0.000	1.00	0.000
>200	1	0.000	1.00	0.000
Total	**116610**		Q_0=	**0.383**

*Q=catchability from Newman (2008); values<1 based on his fitted curve in Appendix A, Fig 5; values=1 based on his empirical data.

Extrusion through the mesh of the net becomes less of a problem in the larger length categories (e.g., at lengths> 70 mm, 100% of smelt were retained according to Newman's observed data), but avoidance of the trawl may be a concern. There are no published data for net avoidance by longfin smelt. There is in fact surprisingly little quantitative data for any species, given that small otter trawls are common samplers in inshore habitats. DeMartini and Allen (1984) reported day-night differences in capture rates of queenfish (Seriphus politus), a small pelagic croaker. On the assumption that their trawl was 100% efficient at night, then the daytime efficiency for queenfish averged 24% at two depths where several hundred trawls were made. This would suggest a multiplier of about 4 for the larger fish, assuming longfin smelt to be capable of avoiding a small otter trawl to the same extent as do queenfish.

Finally, Figure A1 and Table A1 require further explanation. That is, longfin smelt <40 mm, though captured in the trawls, are not recorded (K. Hieb, personal communication: see also Orsi 1999). This means that the fish in the category reported here as 36-40 mm were all = 40mm FL, and that smaller fish, which may still be present in early summer (Orsi 1999) are not accounted for. For this reason, the multiplier of 2.6 based on the value of Q_0 developed above is not conservative for smaller fish, and of course does not cover avoidance by the less numerous, larger fish. It therefore seems prudent to use a multiplier >3, and conservative to use a value of 4 for all ages together in order to scale the trawl catch to an estimate of abundance for use in estimating encounter rates with the project.