Chapter 15

Assessment of the Other Rockfish stock complex in the Bering Sea/Aleutian Islands

Paul D. Spencer and Chris N. Rooper

Executive Summary

Summary of Changes in Assessment Inputs

Changes in the input data

1) Catch and fishery lengths updated through October 2, 2010.
2) Biomass estimates from the 2010 AI trawl survey and 2010 EBS slope survey, and CPUE and lengths from the 2010 AI trawl survey, are presented in the assessment.

Changes in the assessment methodology

1) A weighted average of the three most recent surveys is used to compute average biomass.

Summary of Results

The harvest recommendations for the other rockfish assessment are obtained by applying an exploitation rate to the estimated biomass. The exploitation rate is based on the estimated natural mortality, which differs between shortspine thornyhead (SST) and the remaining stocks in the Other Rockfish complex. The summary for the SST portion of the complex is as follows:

	Last year		This year	
Quantity/Status	2010	2011	2011	2012
M (natural mortality)	0.03	0.03	0.03	0.03
Specified/recommended Tier	5	5	5	5
Biomass	35,803	35,803	44,939	44,939
F_{OFL} (F=M)	0.03	0.03	0.03	0.03
$maxF_{ABC}$ (maximum allowable = 0.75x F_{OFL})	0.0225	0.0225	0.0225	0.0225
Specified/recommended F_{ABC}	0.0225	0.0225	0.0225	0.0225
Specified/recommended OFL (t)	1074	1074	1,348	1,348
Specified/recommended AI ABC (t)	335	335	402	402
Specified/recommended EBS ABC (t)	470	470	609	609
Is the stock being subjected to overfishing?				
(for Tier 5 stocks, data are not available to determine whether the stock is in an overfished condition)				

The summary for the non-SST portion of the complex is as follows:

	Last year		This year	
Quantity/Status	2010	2011	2011	2012
M (natural mortality)	0.09	0.09	0.09	0.09
Specified/recommended Tier	5	5	5	5
Biomass	3,412	3,412	3,951	3,951
F_{OFL} (F=M)	0.09	0.09	0.09	0.09
$maxF_{ABC}$ (maximum allowable = 0.75x F_{OFL})	0.0675	0.0675	0.0675	0.0675
Specified/recommended F_{ABC}	0.0675	0.0675	0.0675	0.0675
Specified/recommended OFL (t)	307	307	356	356
Specified/recommended AI ABC (t)	219	219	164	164
Specified/recommended EBS ABC (t)	11	11	102	102
Is the stock being subjected to overfishing?				
(for Tier 5 stocks, data are not available to determine whether the stock is in an overfished condition)				

The total estimated biomass and recommended ABC and OFL for the Other Rockfish complex is as follows:

	Last year		This year	
Quantity/Status	2010	2011	2011	2012
M (natural mortality)				
Specified/recommended Tier	5	5	5	5
Biomass	39,215	39,215	48,890	48,890
F_{OFL} (F=M)				
$maxF_{ABC}$ (maximum allowable = 0.75x F_{OFL})				
Specified/recommended F_{ABC}				
Specified/recommended OFL (t)	1381	1381	1704	1704
Specified/recommended AI ABC (t)	555	555	566	566
Specified/recommended EBS ABC (t)	485	485	712	712
Is the stock being subjected to overfishing?	No	No	No	No
(for Tier 5 stocks, data are not available to determine whether the stock is in an overfished condition)				

The following table gives the recent biomass estimates, catch, and harvest specifications, and projected biomass, OFL and ABC for 2011-2012.

Year	Biomass	OFL	ABC	TAC	Catch
2009	39,215	1,380	1,040	1,040	597
2010	39,215	1,380	1,040	1,040	515[1]
2011	48,890	1,704	1,278		
2012	48,890	1,704	1,278		

[1] Catch as of October 2, 2010.

Responses to the comments of the Scientific and Statistical Committee

There were no comments or requests from the December 2008 or December 2009 SSC meetings pertaining to BSAI Other Rockfish.

Introduction

The BSAI Other Rockfish complex includes all species of *Sebastes* and *Sebastolobus*, other than Pacific ocean perch (POP, *Sebastes alutus*), northern rockfish (*Sebatses. polyspinis)* rougheye rockfish (*S. aleutianus*), and shortraker rockfish (*S. borealis*). Current definitions of the complex do not specifically exclude blackspotted rockfish (S. *melanostictus),* a recently recognized species (Orr and Hawkins 2008) that had historically been identified as rougheye rockfish in research surveys. However, blackspotted is currently not distinguished from rougheye rockfish in the fishery catches, and is thus currently managed under the BSAI blackspotted/rougheye complex.

Because the Other Rockfish complex is defined by what it excludes (i.e., POP, northern rockfish, rougheye rockfish, and shortraker rockfish) rather than by what it includes, an analysis was conducted in the 2001 Other Rockfish SAFE report to distinguish species expected to occur in the BSAI from rarely observed and potentially misidentified species. The criteria used for the analysis was occurrence in at least one haul of the BSAI surveys and/or occurrence in at least 1% of observed fishery hauls. Using data from 1999-2001, 7 species (shortspine thornyhead, dusky rockfish, redbanded rockfish, redstriped rockfish, yelloweye rockfish, harlequin rockfish, and sharpchin rockfish) were identified were identified as meeting these criteria (Table 1). Dark rockfish also met the criteria, but have since been removed from the Other Rockfish complex and is now managed by the State of Alaska.

The two most abundant species for Other Rockfish complex are dusky rockfish (*Sebastes variabilis*) and shortspine thornyheads (*Sebastolobus alascancus*). Shortspine thornyhead are a very long-lived fish with estimates of natural mortality ranging between 0.01 and 0.05. In the Aleutian Islands and eastern Bering Sea (EBS) slope, shortspine thornyheads occur between 200 m and 500 m (Reuter and Spencer 2001). In contrast, dusky rockfish are typically captured between 125 -200 m in the AI, and are rarely encountered in the EBS slope in either survey or fishery catches.

Fishery

Catches of Other Rockfish have been reported in a variety of species groups in the foreign and domestic catch records. Foreign catch records did not identify the various Other Rockfish by species, but reported catches in categories such as "other species" (1977-1979), and "other rockfish" (1980-1990), with the definitions of these groups changing between years. In the domestic fishery, the NOAA Fisheries Alaska Regional Office “Blend” catch database often reported the catches of Other Rockfish species in a single “other rockfish” category, although species-specific catch records have been available with the Catch Accounting System (CAS) database beginning in 2003. Reported ABCs, TACs, and catches of Other Rockfish from 1988-2010 are shown in Table 2. From 1991-2002, species catches were reconstructed by computing the harvest proportions within management groups from the North Pacific Foreign Observer Program database, and applying these proportions to the estimated total catch obtained from the NOAA Fisheries Alaska Regional Office “Blend” database. An identical procedure was used to reconstruct the estimates of catch by species from the 1977-1989 foreign and joint venture fisheries. Estimated domestic catches in 1990 were obtained from Guttormsen et al. 1992. Catches from the domestic fishery prior to the domestic observer program were obtained from PACFIN records. Catches of Other Rockfish since 1977 by area are shown in Table 3. Some relatively high catches occurred in the late 1970s – early 1980s; since 2001, catches have not exceeded 450 t in either the EBS or AI subareas. Both Tables 2 and 3 report only the catches of seven species identified above.

The catches of Other Rockfish are composed primarily of dusky rockfish and shortspine thornyhead; from 2004 -2010, these two species composed 89 % of the catch identified to species in the AI and in the 87% in the EBS (Tables 4 and 5). In the AI, the catches of dusky rockfish and SST total 1,093 t and 902 t, respectively, from 2004-2010. However, the proportion of SST in the EBS Other Rockfish catch was higher, as the catches of dusky rockfish and SST totaled 1,115 t and 160 t, respectively.

The catch of dusky rockfish and SST in various target fisheries and gear types from 2004-2010 are shown in Tables 6-9. In the EBS, dusky rockfish are primarily caught in the Pacific cod longline fishery, and trawl fisheries for Pollock, Pacific cod, rockfish, Atka mackerel and flathead sole (Table 6). Shortspine thornyhead catches in the EBS are obtained in the longline sablefish, turbot, and Pacific halibut fisheries, and trawl fisheries for arrowtooth flounder, pollock, rockfish, Pacific cod, flathead sole, and "other flatfish" fisheries (Table 7). Both species are caught primarily in areas 517, 519, and 521 along the EBS slope.

In the AI, dusky rockfish are caught primarily in the Atka mackerel trawl fishery, which accounted for 85% of the catch from 2004-2010 (Table 8). Catches of SST in the AI were obtained primarily in longline fisheries for sablefish, halibut, turbot, arrowtooth flounder, and Pacific cod, and trawl fisheries for rockfish and Atka mackerel (Table 9). Both species were caught primarily in the eastern and central AI, as the proportion of the AI catch in the western AI was 8% for dusky rockfish and 22% for SST.

A summary of the Other Rockfish catch retained and discarded from 2004-2010 are shown in Table 10. From 2004-2010 the percent of Other Rockfish discarded has ranged between 30% (2010) and 50% (2004) in the AI, and between 16% (2009-2010) and 37% (2008) in the EBS. Low discard rates are observed for SST, particularly if they are caught using fixed-gear which yields a higher quality product than trawl gear (Hiatt, Felthoven and Terry 2002

Data

Fishery data

In addition to the overall catch information discussed above, both SST and dusky rockfish have had increased sample sizes for lengths beginning in 2002. The fishery length frequencies for each species since 2002 show little change, with the bulk of the dusky rockfish being between approximately 28 and 48 cm (Figure 1), and the bulk of the SST lengths being between 30 and 60 cm (Figure 2).

Survey data

Several bottom trawl surveys provide biomass estimates for the EBS and AI regions. The 1979-85 cooperative U.S.-Japan trawl surveys in the EBS were conducted both on the continental shelf and slope, and cooperative surveys were also conducted in the AI from 1980-1986. U.S domestic trawl surveys were conducted in 1988, 1991, 2002, 2004, and 2008 on the eastern Bering Sea slope, and in 1991, 1994, 1997, 2000, 2002, 2004, 2006, and 2010 in the Aleutian Islands (Table 13.8). The 2008 Aleutian Islands survey was canceled due to lack of funding. The 2002 eastern Bering Sea slope survey represents the initiation of a new survey time series distinct from the previous surveys in 1988 and 1991. The EBS slope survey samples depths from 200 to ~1200 m, whereas the AI survey samples depths to 500 m. Thus, survey biomass estimates of deep-water species such as shortspine thornyhead are likely underestimated in the AI survey. The

cooperative U.S. – Japan AI trawl survey were conducted with different vessels, survey gear, and sampling design relative to the U.S. domestic trawls surveys that began in 1991.

From 1994-2006, the biomass estimates for Other Rockfish increased in both the AI and southern Bering Sea (SBS, the area from 165° W to 170° W) portions of the area covered by the AI trawl survey (Table 11). However, the 2010 survey biomass estimate in the AI and SBS areas decreased by 22% and 31%, respectively, from the 2006 estimates. Examination of species-specific survey biomass estimates reveals that the decrease between 2006 and 2010 is due to decreased estimate in dusky rockfish. Between 1997 and 2010, the dusky rockfish biomass estimate in the AI area has fluctuated between 515 t (2002) and 5957 t (2006), although the large 2006 estimates was driven by a small number of very large tows, leading to a large coefficient of variation (CV) of 0.89 (Table 12). Conversely, the biomass estimates of SST in the AI area have increased from 6,153 t in 1991 to 18,075 t in 2010 (Table 13). The estimates of SST for the SBS area between 1991 and 2010 have been lower and more variable, ranging between 187 t to 1,545 t with CVs between 0.41 and 0.73.

For dusky rockfish, the spatial distribution of biomass in the AI surveys show concentrations near Amchitka Island and the Delarof Islands (Figure 3). The spatial distribution of SST shows high densities primarily west of the Petral Bank (Figure 4).

The Other Rockfish species captured in the EBS slope survey from 2002-2010 were SST, dusky rockfish, and redbanded rockfish, although the estimated biomass for redbanded rockfish did not exceed 7 t for any year. The total for these three species increased from 16,975 t in 2002 to 29,453 in 2010, and in each survey year SST contributed more than 99% of estimated survey biomass of Other Rockfish (Tables 11, 13).

The lengths of dusky rockfish obtained in the 1997-2010 AI surveys (dusky was not identified by species prior to 1997) were generally between 35 and 45 cm, corresponding closely to the length distribution in the BSAI fishery (Figure 5). The lengths of SST obtained in the 1991-2010 AI surveys were generally between 15 cm and 50 cm, and were generally consistent between years with the exception of 1994 (Figure 6). Relative to the fishery length composition, the AI survey length composition has a higher percentage of SST between 10 and 20 cm, and a lower percentage greater than 50 cm. Assuming that larger SST in the AI inhabit deeper water, then this difference is likely related to the 500 m depth limit of the AI survey.

Very little age information exists for species in the Other Rockfish complex. The only available age data for dusky rockfish are from the 2002 AI survey (n = 108). Analysis of these data using a von Bertalanffy growth function result in an L_{inf} of 41.6 cm, K=0.32 and a t_o = 2.5 (Reuter and Spencer 2003). These results show a smaller length at age than that estimated for the GOA dusky rockfish (Clausen and Heifetz 2002). No age data exists for SST because an ageing technique has yet to be satisfactorily determined.

Analytical Approach

Other rockfish are currently assessed with the Tier 5 method, which requires estimates of natural mortality (M) and population size.

Estimates of natural mortality of SST have been variable due to the difficulty of ageing this species. In the GOA shortspine thornyhead assessment, Gaichas and Ianelli (2003), presented discussion of the natural mortality estimates from several studies. Several studies have calculated natural mortality differently due to the age of their oldest sample. Miller (1985) estimated natural

mortality to be 0.07 from a sample of SST in Southeast Alaska whose oldest age was 62 years old. A study using west coast SST estimated a natural mortality between 0.05-0.07 with the oldest age in the sample being 80 (Kline 1996). Pearson and Gunderson (2003) suggest that SST from Alaska have an $M = 0.013$, based on a study using the gonadosomatic index to estimate natural mortality. A natural mortality rate that low suggests that these fish reach maximum ages from 250-350 years, which would be very old even among rockfish species. One source of variability in these estimates is the variation in otoliths age reading techniques. Miller (1985) used surface ageing and the break and burn technique, and found that precision and comparability was low. Kline (1996) used a thin section technique that had better inter-reader ageing agreement, and radiometric verification supported this technique. Subsequent radiometric work by Kastelle et al. (2000) corroborated Kline's results. Thus, Kline's methodology and results are presumed to be the most accurate given the uncertainty of ageing SST.

Work is currently being done at the Alaska Fisheries Science Center to determine the best ageing technique to use for SST (personal communication Betty Goetz, Age and Growth group, REFM, AFSC). Historically, the value of *M* of 0.07 has been used to assess the other rockfish stock, which represents an approximation based on knowledge of rockfish life histories from other areas. This value is based on the estimate for shortspine thornyheads from Ianelli and Ito (1994), as this species comprises well over 90% of the other rockfish biomass (as calculated by survey data). In the 2003 GOA thornyhead assessment a value of M of 0.038 was used, which was obtained as an alternate value given in Pearson and Gunderson (2003). Because this value has been reviewed by the Plan Team and SSC, we recommend that a value of 0.03 be used for the SST portion of the BSAI Other Rockfish biomass in order to maintain consistency with GOA thornyheads.

The majority of the non-SST Other Rockfish biomass is composed of dusky rockfish. The *M* for dusky rockfish in the GOA is 0.09, and thus is currently the best estimate of *M* (Clausen and Heifetz 2002). For the 2010 assessment, we recommend using M of 0.09 for the remaining group of Other rockfish biomass.

Biomass for Other Rockfish were obtained by taking a weighted (4-6-9) biomass estimate of the most recent three surveys by area, with higher weights applied to more recent surveys. The EBS estimated biomass was obtained from summing the weighted average from the EBS slope survey with the weighted average from the SBS portion of the AI survey, whereas the biomass from only the AI portions of the AI surveys were used for the AI biomass estimate.

ABC and OFL recommendations

In recent years, BSAI other rockfish have been managed with a BSAI-wide OFL level and separate ABCs for the AI and EBS subareas. After calculating the average survey biomass as described above, the OFLs and area-specific ABCs are

Area	Species	M	Biomass	F_{abc}	ABC	F_{ofl}	OFL
BSAI	SST	0.03	44,939			0.03	1,348
BSAI	Non-SST	0.09	3,951			0.09	356
BSAI	Total		48,890				1,704
EBS	SST	0.03	27,083	0.0225	609		
EBS	Non-SST	0.09	1,518	0.0675	102		
EBS	Total		28,601		712		
AI	SST	0.03	17,856	0.0225	402		
AI	Non-SST	0.09	2,433	0.0675	164		
AI	Total		20,920		566		

Ecosystem Considerations

Ecosystem Effects on Stock
Little to no information is available to determine the diet of Other Rockfish species, important predators, or their trends over time.

Fishery Effects on the Ecosystem
The Other Rockfish complex is not a targeted fishery, therefore reference on the effects of the fishery on the ecosystem will be described in the SAFE chapters of the fisheries in which Other Rockfish is taken as bycatch.

Data gaps and research priorities

Validating aging techniques of shortspine thornyheads, and obtaining ages from archived samples, remains research priorities and are required for age-structured population modeling. Little is known regarding most aspects of the biology of the species in the Other Rockfish complex, including the reproductive biology and distribution, duration, and habitat requirements of various life-history stages. Given the relatively unusual reproductive biology of rockfish and its importance in establishing management reference points, data on reproductive capacity should be collected on a periodic basis.

References

Clausen, D. and J. Heifetz. 2001. Pelagic Shelf Rockfish In: Stock assessment and fishery evaluation report for the groundfish resources of the Gulf of Alaska as projected for 2002. Nov. 2001. North Pacific Fishery Management Council, P.O Box 103136, Anchorage, AK 99510.

Gaichas, S. and J. Ianelli. 2003. Thornyheads. In: Stock assessment and fishery evaluation report for the groundfish resources of the Gulf of Alaska as projected for 2000. Nov. 2003. North Pacific Fishery Management Council, P.O Box 103136, Anchorage, AK 99510.

Hiatt, T., R. Felthoven and J. Terry. 2002. Economic status of the groundfish fisheries off Alaska, 2001. In: Stock assessment and fishery evaluation report for the groundfish resources of the Gulf of Alaska and the Bering Sea/Aleutian Islands. Unpublished. North Pacific Fishery Management Council, P.O Box 103136, Anchorage, AK 99510.

Hood, G. M. 2004. PopTools version 2.6.2. Available on the internet. URL http://www.cse.csiro.au/poptools

Hinkley, S. 1999. Biophysical mechanisms underlying the recruitment process in walleye pollock. Univ. WA PhD. dissertation.

Ianelli, J.N., and S. Gaichas. 1999. Thornyheads. In: Stock assessment and fishery evaluation report for the groundfish resources of the Gulf of Alaska as projected for 2000. Nov. 1999. North Pacific Fishery Management Council, P.O Box 103136, Anchorage, AK 99510.

Ianelli, J.N., and D.H. Ito. 1994. Status of the thornyhead (*Sebastolobus* sp.) resource in 1994. In: Stock assessment and fishery evaluation report of the Gulf of Alaska as projected for 1995 (November 1994), 26 pp. North Pacific Fishery Management Council, P.O. Box 103136, Anchorage, AK 99510.

Kastelle, C.R., K.K. Kimura and S.R. Jay. 2000. Using $^{210}Pb/^{226}Ra$ disequilibrium to validate conventional ages in Scorpaenids (genera *Sebastes* and *Sebastolobus*). Fisheries Research 46 (2000) 299-312.

Kline, D.E. 1996. Radiochemical age verification for two deep-sea rockfishes *Sebastolobus altivelis* and *S. alascanus*. M.S. Thesis, San Jose State University, San Jose CA, 124 pp.

Miller, P.P. 1985. Life history study of the shortspine thornyhead, *Sebastolobus alascanus*, at Cape Ommaney, south-eastern Alaska. M.S. Thesis, Univ. Alaska, Fairbanks, AK, 61 p.

Orr, J.W. and S. Hawkins 2008. Species of the rougheye rockfish complex:resurrection of *Sebastes melanostictus* (Matsubara, 1934) and a redescription of *Sebastes aleutianus* (Jordan and Evermann, 1898) (Teleostei: Scorpaeniformes). Fish Bull. 106:111-134.

Polacheck, T., R. Hilborn, and A.E. Punt. 1993. Fitting surplus production models: comparing methods and measuring uncertainty. Can. J. Fish. Aquat. Sci. 50: 2597-2607.

Reuter, R.F., and P.D. Spencer 2001. Other Rockfish In: Stock assessment and fishery evaluation report for the groundfish resources of the Bering Sea and Aleutian Islands as projected

for 2003. Nov. 2001. North Pacific Fishery Management Council, P.O., Box 103136, Anchorage, AK 99510.

Reuter, R.F., and P.D. Spencer 2003. Other Rockfish In: Stock assessment and fishery evaluation report for the groundfish resources of the Bering Sea and Aleutian Islands as projected for 2004. Nov. 2001. North Pacific Fishery Management Council, P.O., Box 103136, Anchorage, AK 99510.

Reuter, R.F., and P.D. Spencer 2004. Other Rockfish In: Stock assessment and fishery evaluation report for the groundfish resources of the Bering Sea and Aleutian Islands as projected for 2005. Nov. 2001. North Pacific Fishery Management Council, P.O., Box 103136, Anchorage, AK 99510.

Spencer, P.D. and R.F. Reuter. 2003. Shortraker and Rougheye Rockfish. In: Stock assessment and fishery evaluation report for the groundfish resources of the Bering Sea and Aleutian Islands as projected for 2003. Nov. 2001. North Pacific Fishery Management Council, P.O., Box 103136, Anchorage, AK 99510.

Table 1. The percentage catch of "other rockfish" in AFSC research surveys (where at least one fish was observed) and in observed fisheries hauls (where fish were observed in >1% of hauls) from 1991-2001. Cases were no fish were observed are denoted with "~".

		EBS		**AI**	
Common name	Scientific name	**Survey**	**Fishery**	**Survey**	**Fishery**
Redbanded rockfish	*Sebastes babcocki*	~	~	1%	<1%
Dusky rockfish	*Sebastes variabilis*	18%	39%	22%	45%
Redstriped rockfish	*Sebastes proriger*	~	1%	~	1%
Yelloweye rockfish	*Sebastes ruberrimus*	~	1%	<1%	1%
Harlequin rockfish	*Sebastes variegatus*	~	1%	9%	5%
Sharpchin rockfish	*Sebastes zacentrus*	~	<1%	<1%	<1%
Shortspine thornyhead	*Sebastolobus alascanus*	62%	43%	61%	34%

Table 2. Total allowable catch (TAC), acceptable biological catch (ABC), and catch of seven Other Rockfish species (shortspine thornyhead, dusky rockfish, redbanded rockfish, redstriped rockfish, yelloweye rockfish, harlequin rockfish, and sharpchin rockfish) from 1988 to 2010.

Year	Area	ABC (t)	TAC (t)	Catch (t)
1988	BS	400	340	254
	AI	1,100	935	237
1989	BS	400	340	180
	AI	1,100	935	352
1990	BS	500	425	395
	AI	1,100	935	822
1991	BS	500	340	239
	AI	1,100	786	313
1992	BS	400	400	201
	AI	925	925	470
1993	BS	400	400	142
	AI	925	925	443
1994	BS	365	365	123
	AI	770	770	272
1995	BS	365	329	257
	AI	770	693	223
1996	BS	497	497	164
	AI	952	857	272
1997	BS	373	373	114
	AI	714	714	274
1998	BS	369	369	155
	AI	685	685	327
1999	BS	369	369	145
	AI	685	685	372
2000	BS	369	369	239
	AI	685	685	558
2001	BS	361	361	295
	AI	676	676	524
2002	BS	361	361	370
	AI	676	676	502
2003	BS	960	960	316
	AI	634	634	408
2004	BS	960	460	314
	AI	634	634	333
2005	BS	810	460	166
	AI	590	590	286
2006	BS	810	460	157
	AI	590	590	424
2007	BS	414	414	219
	AI	585	585	430
2008	BS	414	414	207
	AI	585	585	384
2009	BS	485	485	199
	AI	555	555	398
2010	BS	485	485	166
	AI	555	555	350

Table 3. Catch (t) of seven Other Rockfish species (shortspine thornyhead, dusky rockfish, redbanded rockfish, redstriped rockfish, yelloweye rockfish, harlequin rockfish, and sharpchin rockfish) from 1977 to 2010.

	Eastern Bering Sea				Aleutian Islands				BSAI
Year	Foreign	JV	Domestic	Total	Foreign	JV	Domestic	Total	Total
1977	52	0		52	537	0		537	589
1978	304	0		304	795	0		795	1,099
1979	281	0		281	2,053	0		2,053	2,334
1980	566	1		567	484	0		484	1,051
1981	337	0		337	236	0		236	574
1982	365	0		365	2,057	0		2,057	2,422
1983	208	1		210	717	4		721	931
1984	112	7		119	57	25		81	200
1985	35	1		36	1	14		15	51
1986	4	14	81	99	0	10	147	157	256
1987	3	4	535	542	0	5	138	143	684
1988	0	3	252	254	0	68	168	237	491
1989	0	9	171	180	0	0	352	352	533
1990			395	395			822	822	1,217
1991			239	239			313	313	552
1992			201	201			470	470	671
1993			142	142			443	443	584
1994			123	123			272	272	395
1995			257	257			223	223	479
1996			164	164			272	272	437
1997			114	114			274	274	388
1998			155	155			327	327	482
1999			145	145			372	372	517
2000			239	239			558	558	797
2001			295	295			524	524	819
2002			370	370			502	502	872
2003			316	316			408	408	724
2004			314	314			333	333	647
2005			166	166			286	286	452
2006			157	157			424	424	581
2007			219	219			430	430	648
2008			207	207			384	384	591
2009			199	199			398	398	597
2010*			166	166			350	350	515

*2010 catch data through Oct 2, 2010

Table 4. Catch (t) of Other Rockfish species in the Aleutian Islands from 2004-2010. Species total less than 1 ton of catch from 2004-2010 are not shown. Source: Catch Accounting System database

Species	2004	2005	2006	2007	2008	2009	2010*	Sum
dusky rockfish	129.45	134.16	161.43	231.28	179.82	141.97	114.51	1092.61
SST	97.38	113.18	156.92	128.96	113.79	142.48	148.93	901.64
unidentified other rockfish	51.73	18.96	76.13	27.16	50.82	90.90	53.18	368.88
harlequin rockfish	36.87	14.35	25.22	39.93	34.33	22.76	28.71	202.17
sharpchin	14.05	0.01	2.00		0.01		0.08	16.14
yelloweye rockfish	0.90	5.57	0.38	0.57	4.48	0.22	0.51	12.62
redbanded rockfish	0.17	0.17	0.13	1.42	0.93	0.39	3.59	6.80
redstriped rockfish	3.15	0.00	1.72	0.53	0.65	0.05	0.48	6.58
black rockfish	1.35		0.15	0.09	3.18	1.24	0.37	6.37
silvergray rockfish				3.01	0.02			3.03
unspecified slope rockfish	1.56							1.56
darkblotched rockfish	0.21		0.75		0.06	0.01		1.03
Sum	337.41	286.47	424.87	432.95	388.32	400.02	350.35	2620.38

*2010 catches through Oct 2, 2010.

Table 5. Catch (t) of Other Rockfish species in the eastern Bering Sea from 2004-2010. Species total less than 1 ton of catch from 2004-2010 are not shown. Source: Catch Accounting System database.

Species	2004	2005	2006	2007	2008	2009	2010*	Sum
SST	241.93	118.83	93.19	167.73	174.54	175.50	143.52	1115.23
dusky rockfish	31.86	36.22	46.60	44.95	15.40	10.27	10.48	159.63
unidentified other rockfish	29.73	12.67	15.10	4.48	15.89	11.67	10.33	99.87
other rockfish	14.89	1.47	6.94	1.77	8.73	2.52	4.26	40.58
redbanded rockfish	10.44	0.31	0.40	0.05	0.04	0.22	0.36	11.81
black rockfish	0.86	7.20	0.18	0.29	2.23	0.18	0.03	10.96
yelloweye rockfish	1.42	0.74	1.41	1.72	1.04	1.07	0.71	8.10
unspecified pelagic rockfish	1.43	1.63						3.07
Grand Total	318.16	178.08	156.97	219.42	209.48	199.29	165.83	1447.24

*2010 catches through Oct 2, 2010.

Table 6. Catch (t) of EBS dusky rockfish from 2004-2010 by target fishery and gear type.
Source: Catch Accounting System database.

Gear	Target	508	509	513	514	516	517	518	519	521	523	524	Grand Total
Longline	Pacific cod		0.05	2.64			7.14	0.02	4.10	52.42	0.07		66.44
Pelagic trawl	Pollock		3.70	0.23	0.00	0.01	21.11		10.20	2.80	0.77	0.23	39.04
Bottom Trawl	Pacific cod		2.94				3.80		16.52	8.63	0.12	0.07	32.07
Bottom Trawl	Rockfish	0.16					17.47	1.73					19.36
Bottom Trawl	Atka mackerel								12.94				12.94
Pelagic trawl	Pollock		0.57	0.03			1.78		2.25	4.40	0.05	0.02	9.08
Bottom Trawl	Flathead sole			0.29			0.07			8.17		0.28	8.81
Bottom Trawl	Arrowtooth						1.03	0.03	2.67				3.73
Bottom Trawl	Yellowfin sole		0.12	0.78			0.17			0.33			1.39
Bottom Trawl	Other flatfish						0.27		0.68				0.95
Bottom Trawl	Rock sole		0.59			0.03	0.04						0.67
Jig	Rockfish				0.58				0.09				0.66
Bottom Trawl	Pollock		0.15				0.17			0.00			0.33
Longline	Halibut							0.06				0.04	0.10
Bottom Trawl	Sablefish								0.08				0.08
Longline	Turbot									0.03	0.05		0.08
Longline	Sablefish							0.04					0.04
Pot	Pacific cod		0.00						0.00	0.00			0.01
Sum		0.16	8.13	3.96	0.58	0.04	53.04	1.89	49.52	76.77	1.06	0.63	195.78

Table 7. Catch (t) of EBS shortspine thornyhead from 2004-2010 by target fishery and gear type.
Source: Catch Accounting System database.

Gear	Target	508	509	513	514	517	518	519	521	523	524	530	Grand Total
Bottom trawl	Arrowtooth					220.21	5.03	63.40	0.38	0.01	0.07		289.11
Longline	Turbot					20.45	4.12	0.72	151.32	66.69	1.39		244.68
Pelagic Trawl	Pollock		0.47	0.21		79.03		38.61	0.21	0.02			118.54
Bottom trawl	Rockfish					49.88	0.24	48.79	1.27				100.17
Bottom trawl	Flathead sole			3.38		66.24		0.14	0.32				70.08
Longline	Sablefish	0.08			0.20	22.15	32.17	9.05	3.69	1.77		0.15	69.27
Bottom trawl	Other flatfish					39.00		10.56					49.56
Bottom trawl	Pacific cod					38.74		10.60	0.01				49.34
Longline	Halibut					4.17	22.59	3.44	2.47	1.20	0.03		33.90
Bottom trawl	Turbot					24.21	0.50	2.08					26.80
Bottom trawl	Atka mackerel					3.69		15.17					18.86
Longline	Pacific cod					2.05	0.44	0.31	8.31	0.71			11.81
Longline	Arrowtooth					1.53	0.06	0.10	0.50	5.36			7.55
Bottom trawl	Rock sole				0.06	6.81		0.54					7.40
Bottom trawl	Sablefish					0.14		4.66					4.79
Longline	Rockfish					0.14	1.75	1.47	0.46	0.63			4.45
Bottom trawl	Pollock					0.64		2.27	0.10				3.01
Pot	Sablefish					0.11	1.43	0.72					2.26
Pelagic Trawl	Pollock		0.00			1.97		0.07					2.04
Longline	Other species								0.54	0.12	0.02		0.69
Longline	(blank)					0.22		0.18					0.41
Bottom trawl	Yellowfin sole					0.27							0.27
Bottom trawl	Arrowtooth					0.14							0.14
Bottom trawl	Other flatfish					0.11							0.11
Jig	Halibut						0.01						0.01
Pot	Turbot								0.00				0.00
Bottom trawl	Flathead sole					0.00							0.00
Grand Total		0.08	0.47	3.59	0.26	581.88	68.33	212.89	169.57	76.52	1.51	0.15	1115.23

Table 8. Catch (t) of AI dusky rockfish from 2004-2010 by target fishery and gear type. Source: Catch Accounting System database.

Gear	Target	541	542	543	Sum
Bottom trawl	Atka mackerel	570.33	295.02	58.92	924.26
Longline	Pacific cod	43.86	25.49	13.44	82.78
Bottom trawl	Rockfish	18.70	21.54	15.88	56.12
Bottom trawl	Pacific cod	19.12	5.23	2.96	27.31
Bottom trawl	Arrowtooth	0.49			0.49
Pot	Pacific cod	0.03	0.41		0.44
Longline	Halibut	0.03	0.32		0.34
Longline	Turbot		0.31		0.31
Longline	Other species		0.02	0.15	0.18
Longline	Arrowtooth		0.17		0.17
Longline	Sablefish	0.08	0.06		0.14
Pelagic trawl	Pollock	0.06			0.06
Sum		652.69	348.57	91.35	1092.61

Table 9. Catches of AI shortspine thornyhead from 2004-2010 by target fishery and gear type. Source: Catch Accounting System database.

Gear	Target	541	542	543	Sum
Longline	Sablefish	232.37	170.13	8.96	411.46
Bottom trawl	Rockfish	3.24	34.32	123.85	161.41
Longline	Halibut	27.17	50.45	18.58	96.20
Longline	Turbot	2.25	71.39		73.64
Longline	Arrowtooth	7.34	51.01		58.35
Bottom trawl	Atka mackerel	0.33	6.32	34.90	41.55
Longline	Pacific cod	25.25	4.40	11.16	40.80
Longline	Rockfish	0.69	7.22	0.17	8.08
Bottom trawl	Arrowtooth	3.69			3.69
Longline	Other species	0.37	1.95		2.32
Pot	Sablefish	1.86	0.10		1.96
Bottom trawl	Turbot	1.33			1.33
Bottom trawl	Pacific cod	0.10		0.52	0.62
Longline	(blank)	0.18			0.18
Bottom trawl	Pollock	0.02			0.02
Pot	Rockfish	0.02			0.02
Pot	Pacific cod		0.01		0.01
Jig	Pacific cod	0.01			0.01
Grand Total		306.21	397.30	198.13	901.64

Table 10. Retained and discarded catch of seven Other Rockfish species (shortspine thornyhead, dusky rockfish, redbanded rockfish, redstriped rockfish, yelloweye rockfish, harlequin rockfish, and sharpchin rockfish) from 1977 to 2010.

Species Area	Catch (t) Year	Retained	Discard	Total	Percent Discarded
AI	2004	167	170	337	50.5%
	2005	186	100	286	35.0%
	2006	244	181	425	42.7%
	2007	209	224	433	51.6%
	2008	267	122	388	31.3%
	2009	256	144	400	36.1%
	2010	245	105	350	30.1%
EBS	2004	229	89	318	27.9%
	2005	144	34	178	19.0%
	2006	123	34	157	21.0%
	2007	143	76	219	34.7%
	2008	132	77	209	36.9%
	2009	167	32	199	16.1%
	2010	140	26	166	15.7%

Table 11. Survey biomass estimates and CVs (in parentheses) for Other Rockfish.

	AI survey			EBS Slope survey
Year	AI	S. Bering Sea	Total	
1979				3,251
1980	930 (0.18)	36 (0.73)	966 (0.18)	
1981				4,975
1982				4,381
1983	3971 (0.17)	802 (0.23)	4774 (0.15)	
1984				
1985				5,127
1986	6550 (0.19)	3253 (0.86)	9803 (0.31)	
1987				
1988				8,759
1989				
1990				
1991	6643 (0.22)	248 (0.48)	6891 (0.22)	4,529
1992				
1993				
1994	6452 (0.16)	1172 (0.48)	7624 (0.15)	
1995				
1996				
1997	9539 (0.17)	1683 (0.63)	11223 (0.18)	
1998				
1999				
2000	11924 (0.17)	1107 (0.45)	13031 (0.16)	
2001				
2002	14781 (0.20)	1111 (37)	15892 (0.18)	16,975 (0.12)
2003				
2004	18566 (0.18)	6473 (67)	25039 (0.22)	18,807 (0.09)
2005				
2006	23879 (0.24)	1706 (0.52)	25585 (0.23)	
2007				
2008				26,072 (0.12)
2009				
2010	18663 (0.15)	1172 (0.66)	19835 (0.15)	29,453 (0.12)

Table 12. Survey biomass estimates and CVs (in parentheses) for Dusky rockfish from 1997 - 2010.

	AI survey			EBS Slope survey
Year	AI	S. Bering Sea	Total	
1997	574 (0.76)	138 (0.46)	712 (0.62)	
1998				
1999				
2000	1250 (0.34)	55 (0.36)	1306 (0.33)	
2001				
2002	515 (0.32)	97 (0.36)	612 (0.27)	14 (0.57)
2003				
2004	730 (0.44)	1359 (0.91)	2089 (0.61)	7 (0.57)
2005				
2006	5956 (0.89)	731 (0.96)	6687 (0.80)	
2007				
2008				10 (1.00)
2009				
2010	560 (0.34)	120 (0.44)	680 (0.29)	102 (0.87)

Table 13. Survey biomass estimates and CVs (in parentheses) for shortspine thornyhead from 1997 - 2010.

	AI survey			EBS Slope survey
Year	AI	S. Bering Sea	Total	
1991	6153 (0.24)	187 (0.58)	6341 (0.23)	
1992				
1993				
1994	6240 (0.16)	1071 (0.52)	7311 (0.16)	
1995				
1996				
1997	8896 (0.18)	1545 (0.69)	10441 (0.18)	
1998				
1999				
2000	10649 (0.19)	1051 (0.48)	11700 (0.17)	
2001				
2002	14243 (0.20)	1012 (0.41)	15255 (0.19)	16950 (0.12)
2003				
2004	17335 (0.19)	945 (0.56)	18280 (0.18)	18793 (0.09)
2005				
2006	17876 (0.12)	968 (0.55)	18844 (0.12)	
2007				
2008				26055 (0.12)
2009				
2010	18075 (0.16)	1052 (0.73)	19127 (0.16)	29334 (0.12)

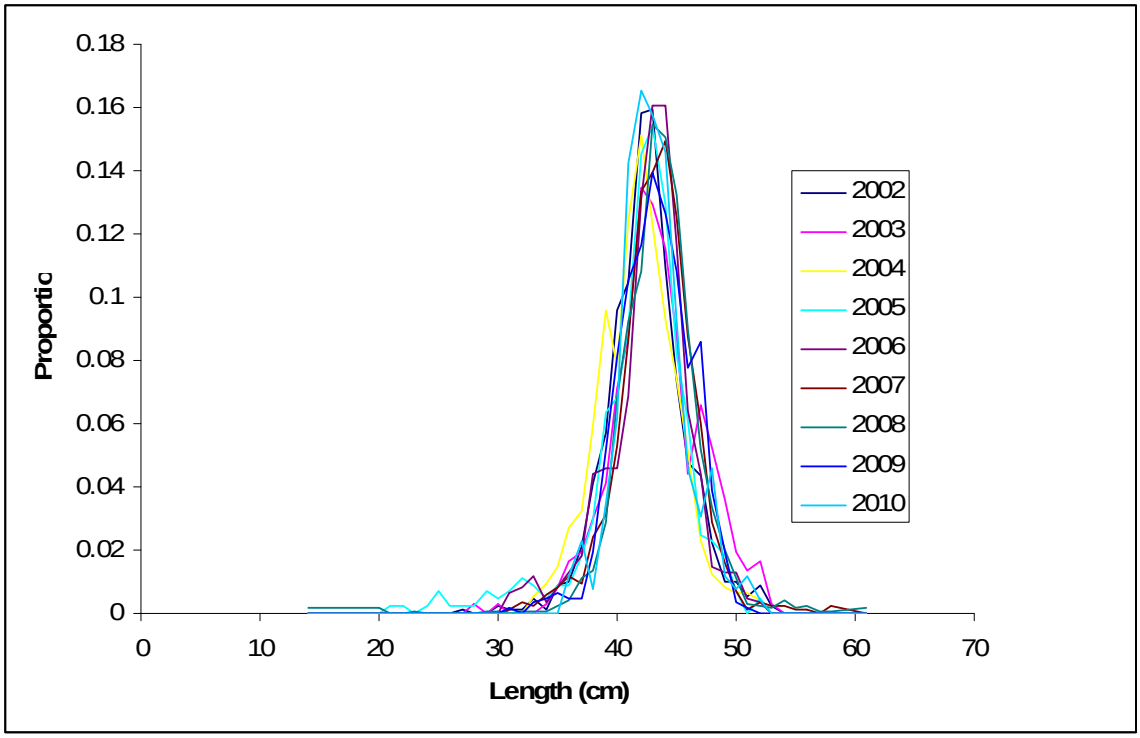

Figure 1. Dusky rockfish length frequencies from fishery observer sampling, 2002-2010.

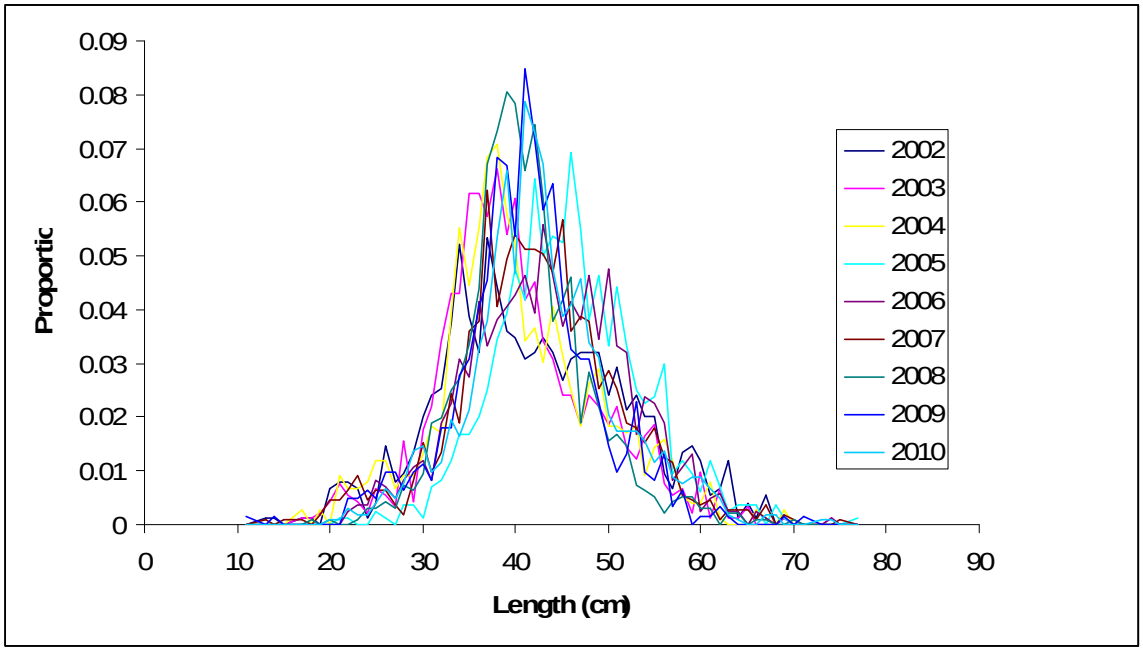

Figure 2. Shortspine rockfish length frequencies from fishery observer sampling, 2002-2010.

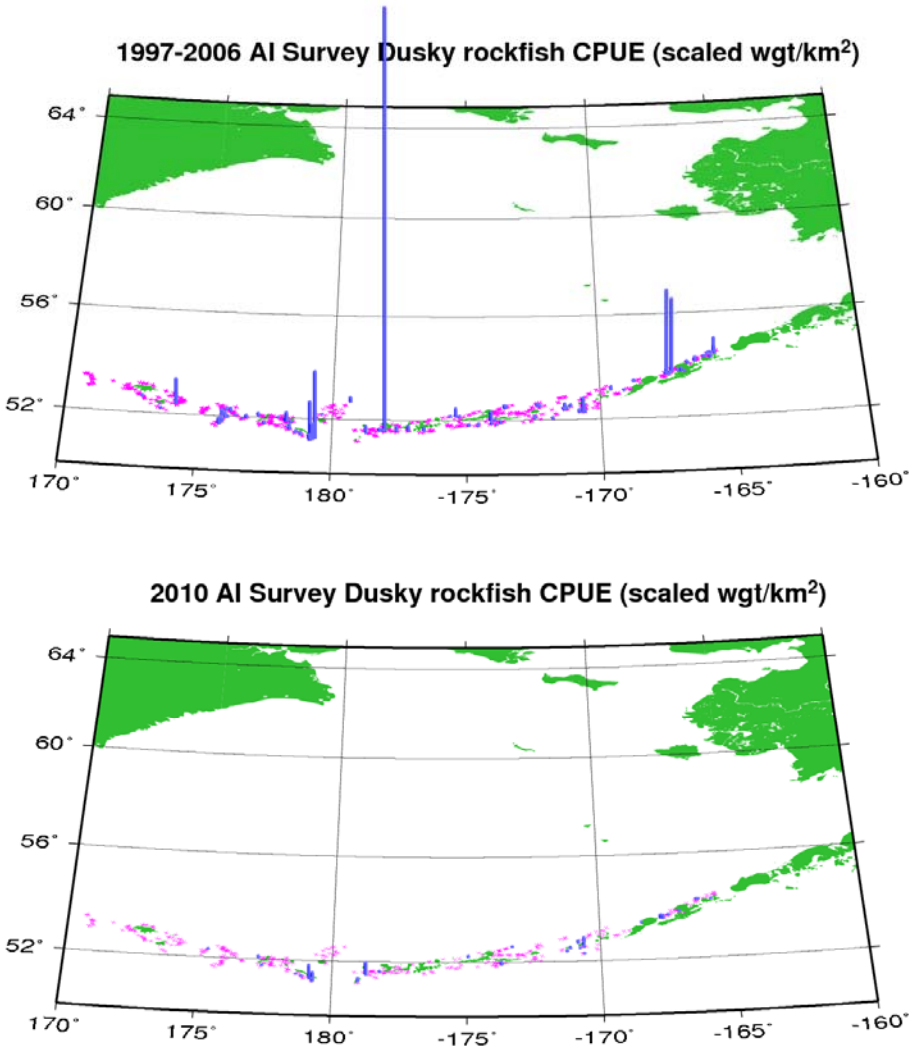

Figure 3. AI survey CPUE (scaled kg/km^2) of dusky rockfish from 1997 to 2010.

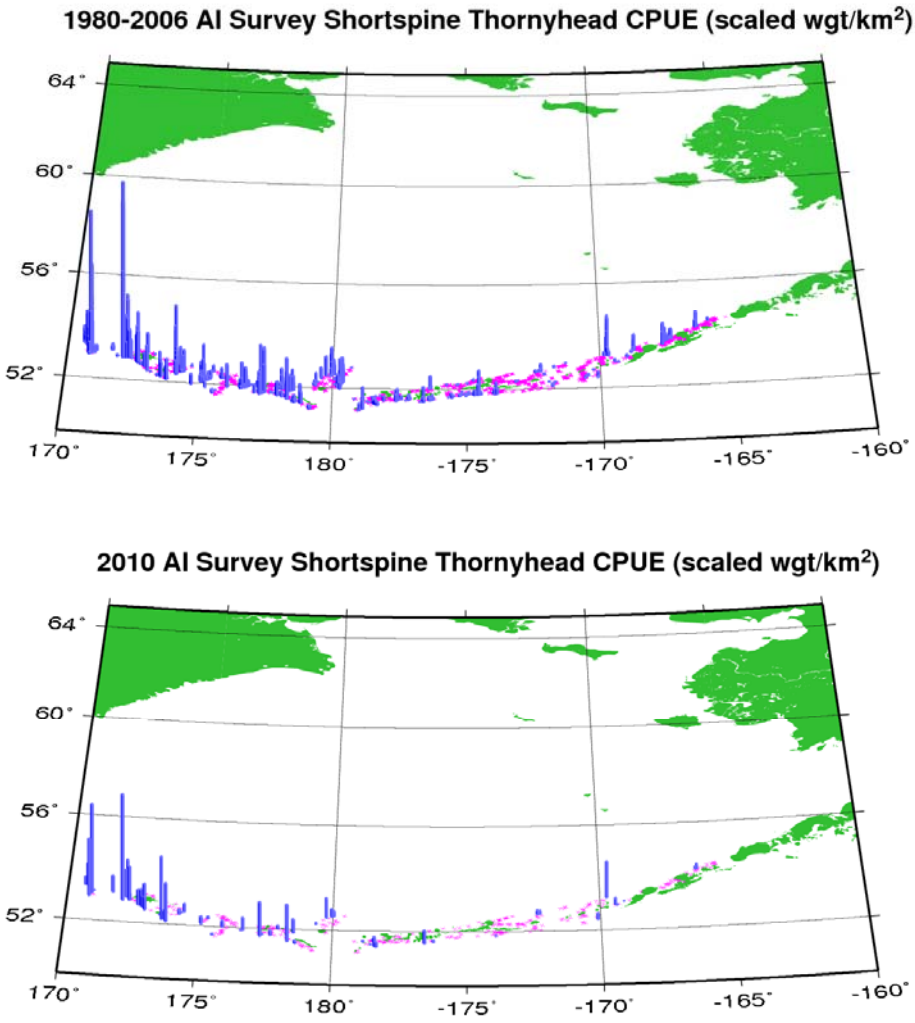

Figure 4. AI survey CPUE (scaled kg/km^2) of shortspine thornyhead from 1980 to 2010.

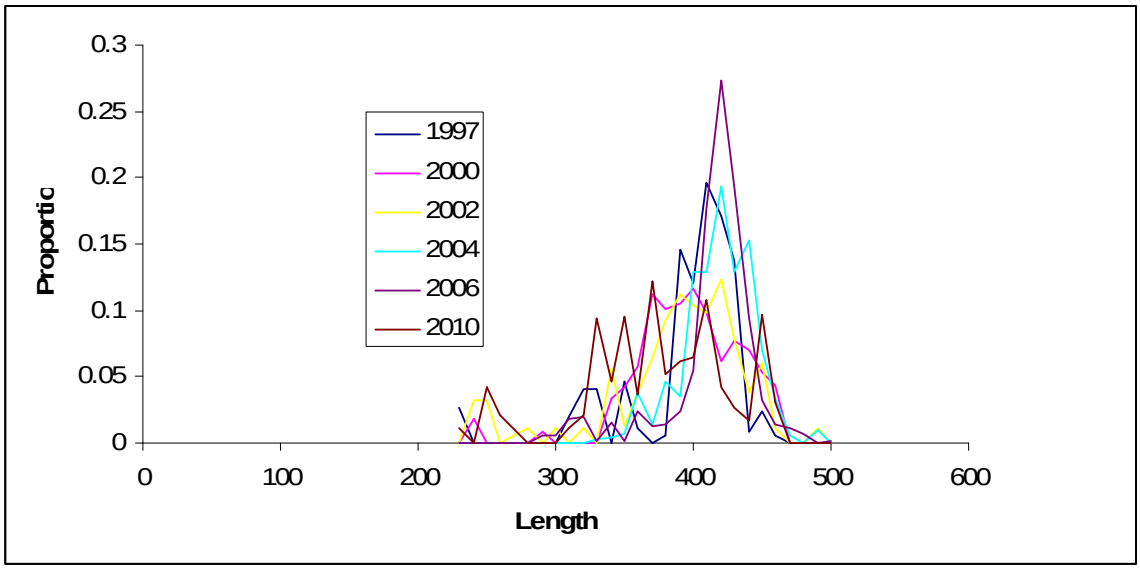

Figure 5. Dusky rockfish length frequencies from the Aleutian Island trawl survey, 1997-2010.

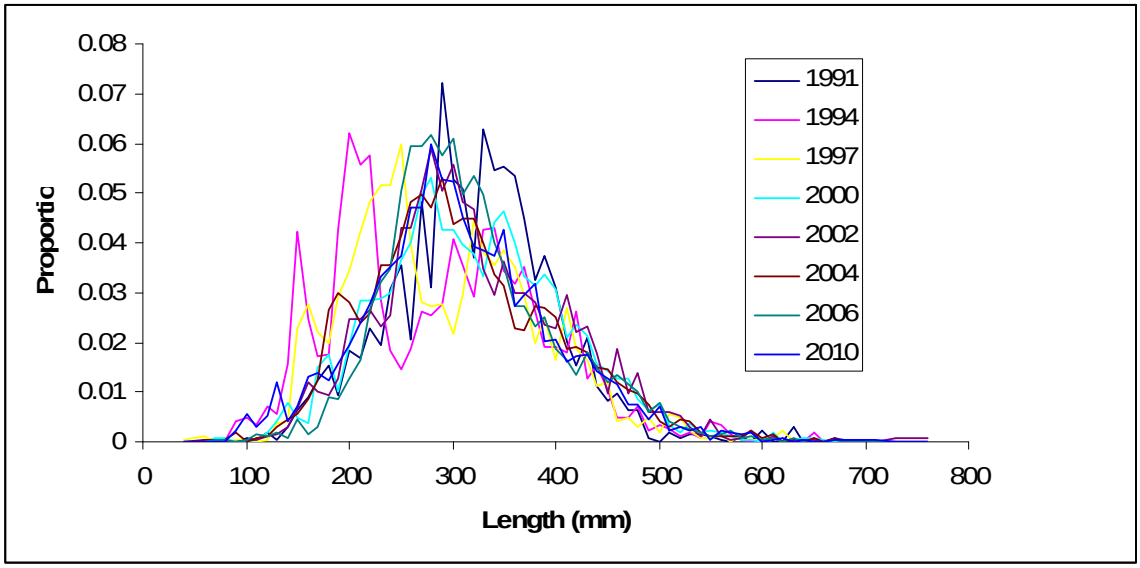

Figure 6. Shortspine thornyhead length frequencies from the Aleutian Island trawl survey, 1991-2010.