Report to Washington Department of Natural Resources – Results of 2011 Cherry Point Herring Acoustic/Trawl Survey

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Report by:
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Introduction

The Cherry Point herring stock has been assessed by the Washington Department of Fish and Wildlife (WDFW) since the early 1970's. Quantitative surveys have been conducted by WDFW and co-managers since 1973. The Cherry Point herring stock was considered to be the largest in Puget Sound for many years but has experienced a drastic decline in abundance since assessment surveys were initiated (Fig. 1). There is significant interest in the Cherry Point herring stock particularly due to its decline in abundance, the location of its spawning grounds, potential tribal and non-tribal harvest, and the establishment of the Cherry Point Aquatic Reserve.

Spawn deposition surveys have provided the annual estimate of herring spawning biomass for the Cherry Point stock. These surveys sample the stock's spawning grounds for spawn deposition and collected data are converted to an estimate of spawning escapement. Acoustic/Trawl (AT) Surveys are conducted on the prespawner holding areas early in, or prior to, the spawning season when prespawner abundance is peaking. AT surveys can provide additional information about the sampled stock, including age composition, annual survival rates, and recruitment. Herring spawn deposition surveys of the Cherry Point stock continue to be conducted annually by WDFW. However, WDFW funding for AT surveys was cut prior to 2010.

The Washington State Department of Natural Resources, Aquatic Resources Division (DNR) approached WDFW to conduct an AT survey in 2011 of the Cherry Point herring stock. This follows the establishment of the Cherry Point Aquatic Reserve in 2000 to conserve the site's aquatic habitats and species and the adoption in 2010 of a management plan containing goals to protect and help recover the fish and wildlife species of the Reserve, including the Cherry Point herring stock. The plan's actions include supporting partner agencies in monitoring of the Cherry Point Herring stock population and spawning events.

An interagency agreement was completed for DNR to fund WDFW to conduct one AT survey of the Cherry Point herring stock and provide DNR with a report detailing the results of the survey, which is the purpose of this report.

Methods

The acoustic/trawl (AT) survey was conducted the night of April 28-29, 2011 on previously documented prespawner holding areas of the Cherry Point herring stock. The survey date was selected based on previous years' spawning timing to sample prior to anticipated peak spawning. This method utilizes computer interfaced echosounding equipment that produces real-time estimates of total fish abundance, which are apportioned to herring biomass based on trawl catch data (Lemberg et al. 1990). The weighted data from all trawl samples for each stock are pooled and extrapolated to the final spawning biomass estimate from spawn deposition surveys. Analyses of the trawl caught samples provided the basis for the estimated age composition of the 2011 Cherry Point spawning biomass as described further in O'Toole (1993).

Spawn deposition surveys were conducted and results provided the final estimate for the spawning biomass for the Cherry Point stock. Marine vegetation on spawning grounds is sampled for location of spawn deposition and spawn density, and those data are converted to an estimate of spawning escapement (Stick 1994). These surveys are generally conducted weekly during a stock's spawning season to estimate cumulative spawn deposition and spawning escapement.

Results

Seven acoustic transects and three trawl tows were completed during the survey (Fig. 2). Trawl catches were sampled for species composition during the survey and selected mature prespawning herring (n=227) were later processed for length, weight, sex, maturity stage, and age.

The acoustic survey observed scattered concentrations of acoustic sign typical of herring and three trawl tows were set on the higher intensities of observed sign. Catches were primarily herring (range of 66 to 99% by weight by tow), but most were recovering/spent fish (81 to 98% by weight by tow) that are assumed to be a combination of winter spawning non-Cherry Point and post-spawning Cherry Point herring.

Table 1 summarizes survey results. The estimated spawning biomass from the acoustic-trawl survey was 335 tons (201 tons prespawner from AT survey results + 134 tons estimated spawning escapement prior to survey from spawn deposition surveys). This compares to the final estimated spawning biomass for the stock of 1,301 tons from spawn deposition surveys.

Sampled herring were mostly (86% by weight) age 2 or 3, with lesser numbers of age 4 and 5 fish (Fig. 3).

Discussion

The predominance of age 2 and 3 herring continues the trend of a higher proportion of younger fish in this stock compared to earlier years (Figure 3). At least two consecutive years' age composition data are needed to calculate stock indices such as recruitment and survival rate; age composition data were not calculated in 2009 (unsuccessful survey with no trawl catches) or 2010 (funding cut for surveys). However, the observed lack of older fish makes it likely that the estimated survival rate of adult fish would be low.

Agreement between AT and spawn deposition survey estimates has generally good in most years (Fig. 4). However, the sizable difference estimated in 2011 is concerning. Scattered concentrations of herring schools, low proportion of prespawning herring, relatively small stock size, a single acoustic-trawl survey estimate, and sampling errors/assumptions for both surveys methods are likely contributors to the difference in estimates. In previous years, when the Cherry Point stock was much larger, up to twelve AT surveys were conducted in one year, with peak abundance determined from more than a single survey, likely improving the accuracy of the AT estimate of prespawning abundance.

The Cherry Point herring stock continues to be at a critically low level of abundance, despite an increase from 2010 (Figure 1).

References

Lemberg, N. A., S. Burton, and W. Palsson. 1990. Hydroacoustic results for Puget Sound herring, whiting and Pacific cod surveys, 1988 and 1989. Wash. Dept. Fish. Prog. Rept. No. 281, 76p.

O'Toole, M. F. 1993. Characteristics of the 1993 Cherry Point herring spawning run and projection of run size for 1994. Wash. Dept. Fish Wildl. Brief. Rept., 22 p.

Stick, K. C. 1994. Summary of 1993 Pacific herring spawning ground surveys in Washington State waters. Wash. Dept. of Fish. Wild. Prog. Rept. no. 311, 49 p.

Table 1. Acoustic-trawl survey results for April 28, 2011 / Cherry Point stock.

			----- HYDROACOUSTIC / TRAWL SURVEY RESULTS -----								
		FILE NAME:	======>	11GG.xls				**TOTALS FOR ALL AREAS**			
		SURVEY AREA/STOCK:	======>	Gulf of Georgia				PELAGIC (shrtons)		2,699	
		SURVEY DATE:	======>	04/28/2011				TRGT SPP. (shrtons)		2,050	
		TARGET SPECIES:	======>	Herring				ADULTS (shrtons)		787	
		DATA COMMENTS:	======>					SPAWNERS (shrtons)		201	
				CV = +/-	15.94%						
SUBAREA:	**58.00**			APPLIED TOW NO'S:		1	2	0	0	0	
APPLIED TRAWL DATA				ACOUSTIC BIOMASS ESTIMATIONS				(metric tons)			(shrtons)
Herring	93.6%			PELAGIC (not TS corrected)				199.0			219.3
ADULTS	13.4%			TARGET SPP.				130.4			143.7
SPAWNERS	2.0%			ADULT TARGET SPP.				17.5			19.3
				SPAWNER TARGET SPP.				2.6			2.9
SUBAREA:	**56.50**			APPLIED TOW NO'S:		1	2	0	0	0	
APPLIED TRAWL DATA				ACOUSTIC BIOMASS ESTIMATIONS				(metric tons)			(shrtons)
Herring	93.6%			PELAGIC (not TS corrected)				230.4			254.0
ADULTS	13.4%			TARGET SPP.				151.0			166.4
SPAWNERS	2.0%			ADULT TARGET SPP.				20.2			22.3
				SPAWNER TARGET SPP.				3.1			3.4
SUBAREA:	**55.00**			APPLIED TOW NO'S:		1	2	0	0	0	
APPLIED TRAWL DATA				ACOUSTIC BIOMASS ESTIMATIONS				(metric tons)			(shrtons)
Herring	93.6%			PELAGIC (not TS corrected)				577.7			636.8
ADULTS	13.4%			TARGET SPP.				378.5			417.2
SPAWNERS	2.0%			ADULT TARGET SPP.				50.7			55.9
				SPAWNER TARGET SPP.				7.7			8.5
SUBAREA:	**53.50**			APPLIED TOW NO'S:		1	2	0	0	0	
APPLIED TRAWL DATA				ACOUSTIC BIOMASS ESTIMATIONS				(metric tons)			(shrtons)
Herring	93.6%			PELAGIC (not TS corrected)				367.7			405.3
ADULTS	13.4%			TARGET SPP.				240.9			265.6
SPAWNERS	2.0%			ADULT TARGET SPP.				32.3			35.6
				SPAWNER TARGET SPP.				4.9			5.4
SUBAREA:	**52.00**			APPLIED TOW NO'S:		3	0	0	0	0	
APPLIED TRAWL DATA				ACOUSTIC BIOMASS ESTIMATIONS				(metric tons)			(shrtons)
Herring	99.2%			PELAGIC (not TS corrected)				501.0			552.3
ADULTS	61.9%			TARGET SPP.				447.2			492.9
SPAWNERS	17.1%			ADULT TARGET SPP.				276.8			305.1
				SPAWNER TARGET SPP.				76.5			84.3
SUBAREA:	**50.50**			APPLIED TOW NO'S:		3	0	0	0	0	
APPLIED TRAWL DATA				ACOUSTIC BIOMASS ESTIMATIONS				(metric tons)			(shrtons)
Herring	99.2%			PELAGIC (not TS corrected)				366.8			404.4
ADULTS	61.9%			TARGET SPP.				327.4			360.9
SPAWNERS	17.1%			ADULT TARGET SPP.				202.7			223.4
				SPAWNER TARGET SPP.				56.0			61.7
SUBAREA:	**49.00**			APPLIED TOW NO'S:		3	0	0	0	0	
APPLIED TRAWL DATA				ACOUSTIC BIOMASS ESTIMATIONS				(metric tons)			(shrtons)
Herring	99.2%			PELAGIC (not TS corrected)				206.3			227.4
ADULTS	61.9%			TARGET SPP.				184.1			202.9
SPAWNERS	17.1%			ADULT TARGET SPP.				113.9			125.6
				SPAWNER TARGET SPP.				31.5			34.7

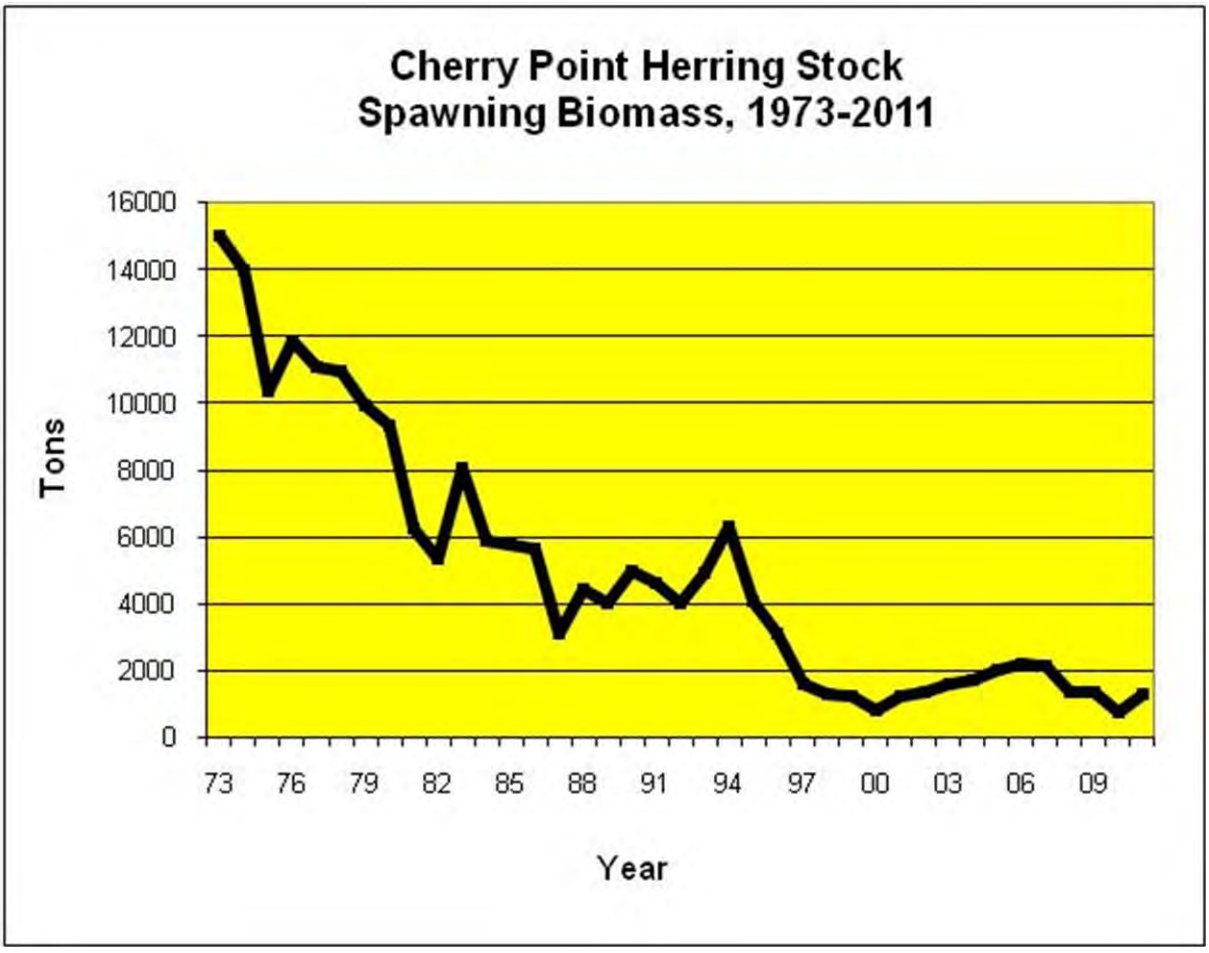

Figure 1. Estimated spawning biomass for the Cherry Point herring stock, 1973-2011.

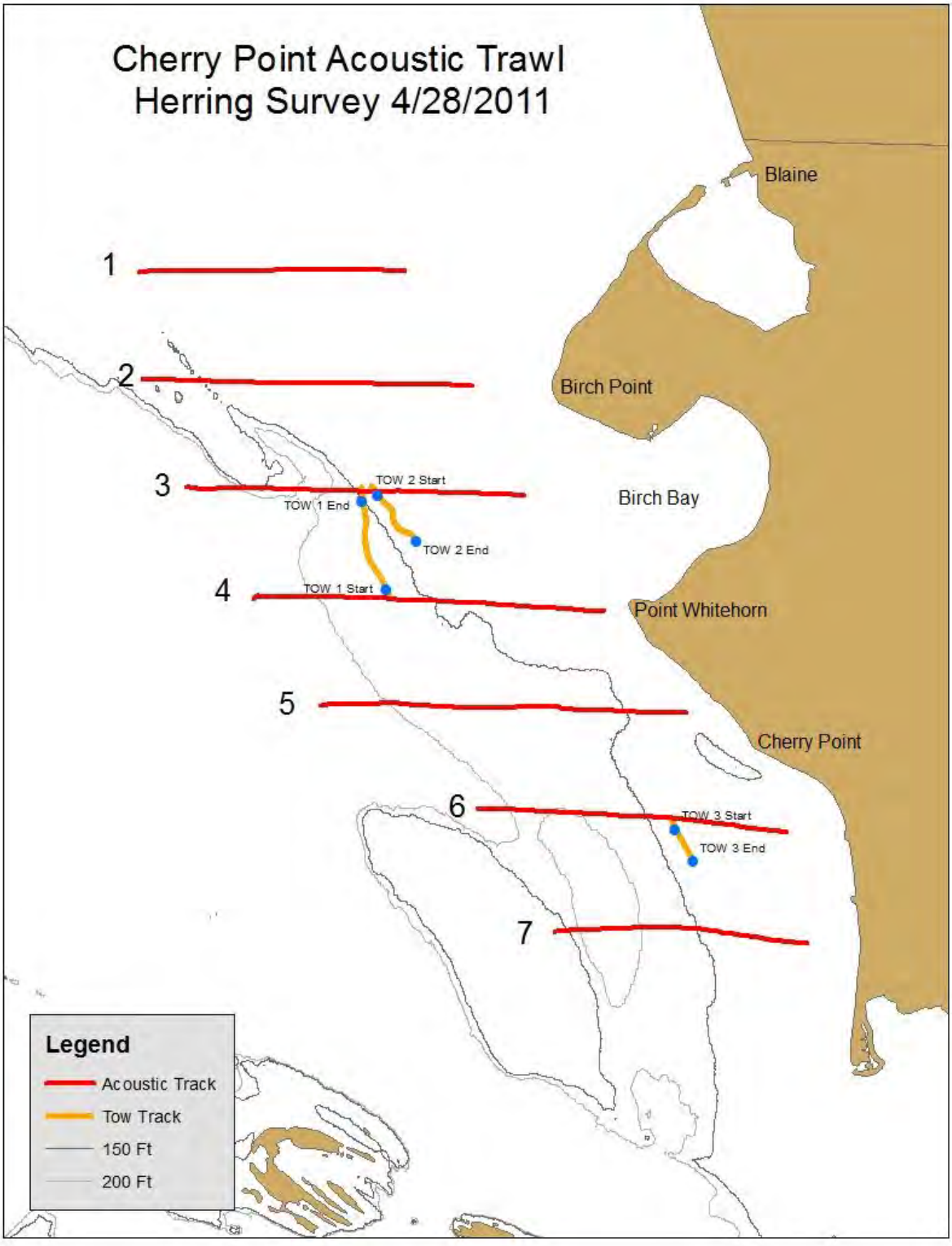

Figure 2. Acoustic transect and trawl tow locations for April 28, 2011 Cherry Point acoustic-trawl survey.

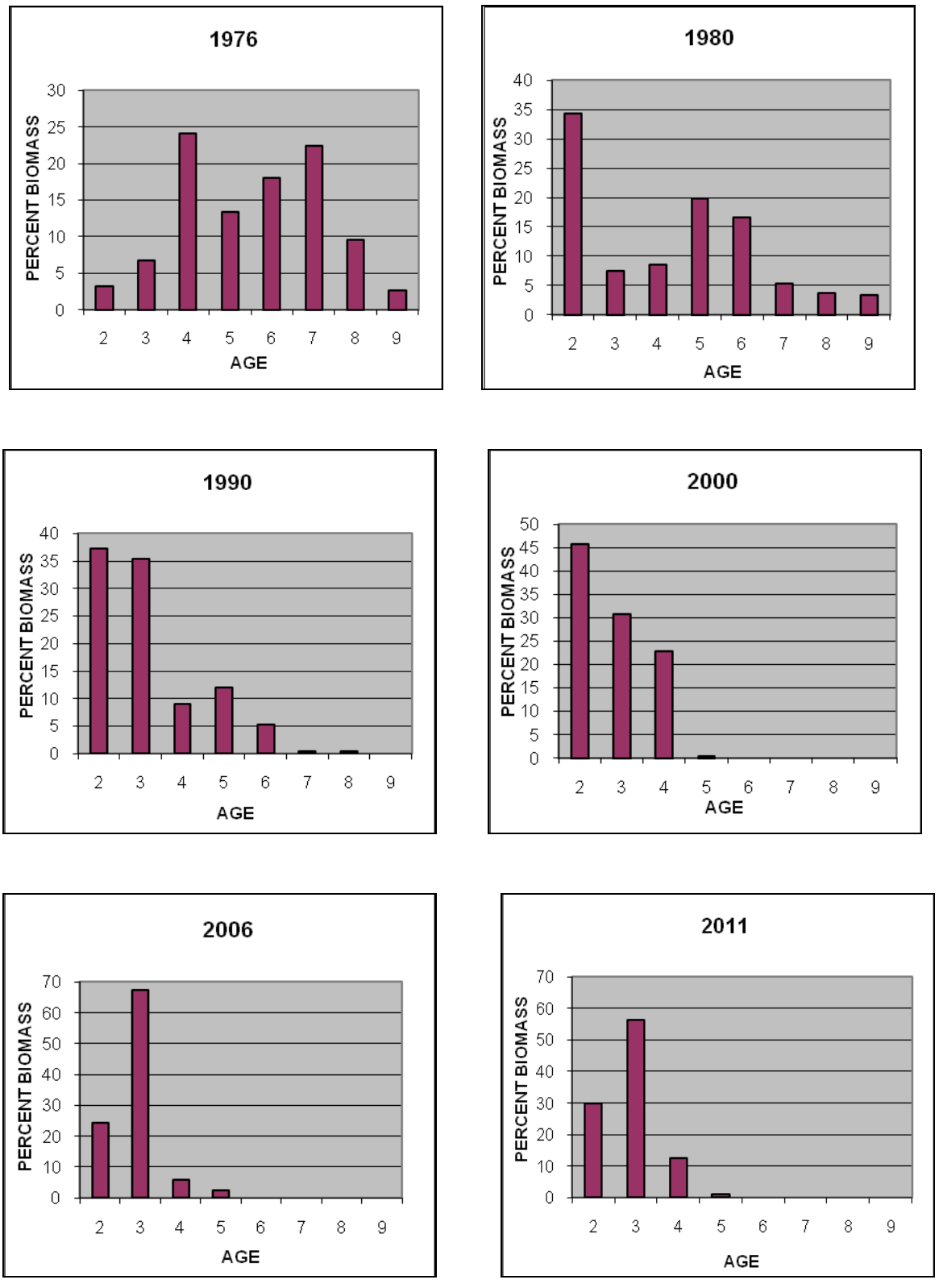

Figure 3. Age histograms by percent spawning biomass of selected years for Cherry Point herring stock.

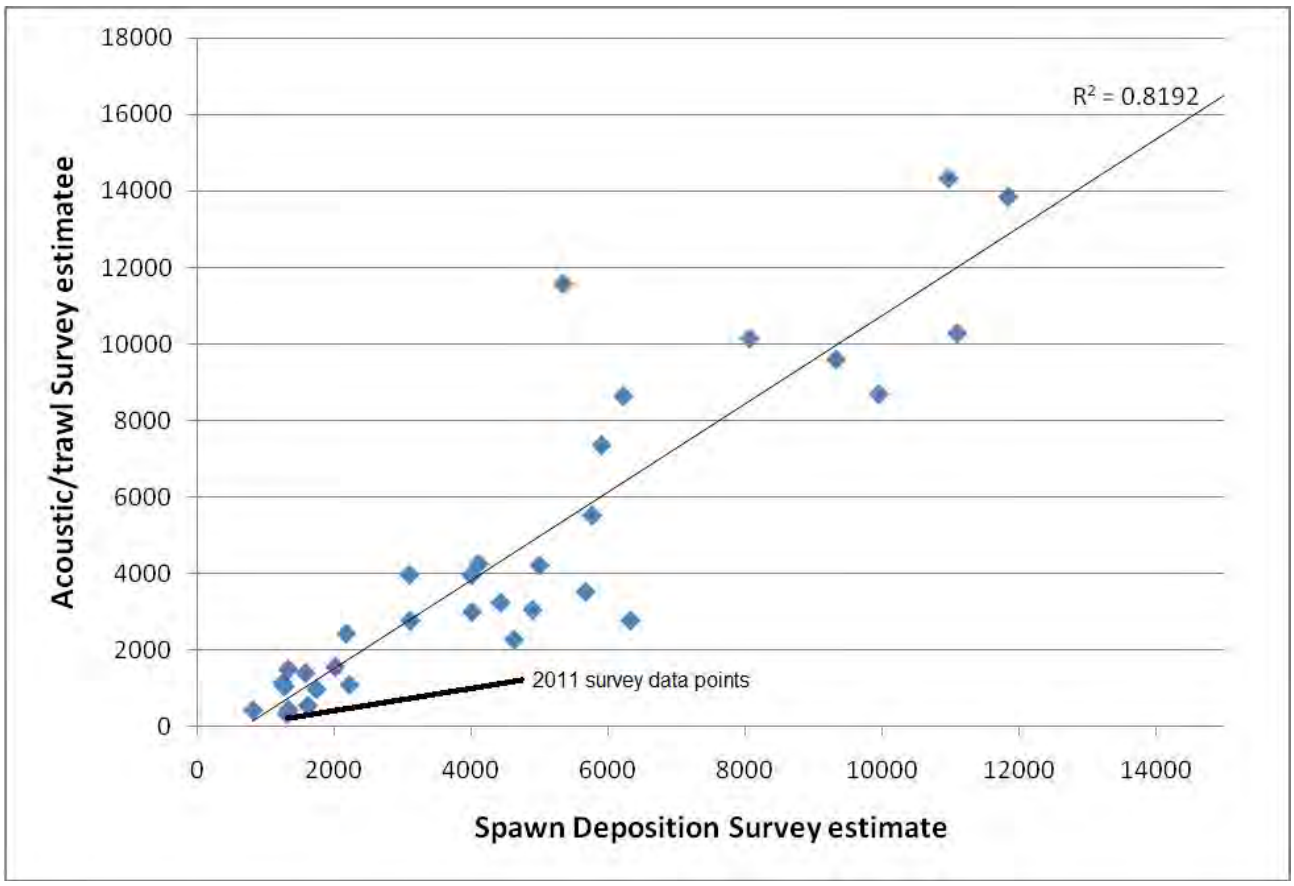

Figure 4. Acoustic/trawl survey estimates vs. spawn deposition survey estimate for Cherry Point stock (1976-2011).