Fisheries and Oceans Canada | Pêches et Océans Canada
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Canadian Science Advisory Secretariat
Pacific Region **Science Response 2015/001**

SUMMARY OF PINK AND SPINY SCALLOP SURVEY RESULTS, 2000-2013 AND MOVING TOWARDS PRECAUTIONARY APPROACH REFERENCE POINTS

Context

The Scallop by Trawl fishery is a small fishery authorized under a non-transferable exploratory licence. The fishery is quota based and catch is monitored through hail and logbook programs.

Fisheries and Oceans (DFO) is currently reviewing the status of this exploratory fishery and will be consulting with stakeholders on future licence options for the fishery. As part of the Exploratory Fishery Guideline for Pink and Spiny Scallops by Trawl, a number of conditions were established for the fishery to transition from exploratory to a full commercial fishery, including developing a consultative process, conducting stock assessment surveys, and developing Precautionary Approach (PA) compliant reference points and harvest control rules.

In 2009, DFO began implementation of the Sustainable Fisheries Framework (SFF). The SFF is an established suite of policies that provide the foundation for an ecosystem-based and precautionary approach to fisheries management in Canada. The policies will promote environmentally sustainable fisheries and support economic prosperity in the industry and fishing communities. One policy under the SFF, "A Fishery Decision-Making Framework Incorporating the Precautionary Approach" (PA Framework) (DFO 2009), provides guidance for applying the PA in the management of Canadian fisheries.

Fisheries Management Branch has requested Science Branch provide a summary of Pacific Region Pink and Spiny scallop trawl survey results from 2000 to 2013, along with commentary on the utility of these surveys, for moving towards PA compliant reference points. Specifically, this Science Response is to address three objectives:

1. Provide summary of biomass estimates for each scallop bed surveyed and the uncertainty associated with the estimates from 2000 to 2013.
2. Present and comment on stock trends for each scallop bed surveyed from 2000 to 2013.
3. Provide commentary on the utility of the survey data collected to date for development of PA compliant reference points.

This Science Response Report results from the Science Response Process of October 2014 on the Review of Scallop by Trawl Experimental Fishery, 2000-2013.

Background

Pink and Spiny scallops (*Chlamys rubida* and *C. hastata*) were harvested commercially in British Columbia from 1982 until 1999. In 1999, the scallop trawl fishery was closed to due to concerns regarding the lack of management control rules, paucity of biological data on scallops, and very limited time series information on scallop stock trends (Lauzier et al., 2000). In 2000, the fishery was re-opened under scientific licence to allow for a small exploratory fishery. The objectives of the exploratory fishery were to collect data and conduct surveys to index stock biomass that would lead to development of a biologically-based assessment and management framework.

The exploratory fishery met the objective of collecting information needed for the development of an assessment and management framework (Lauzier et al. 2000, 2005). Under the exploratory fishery, industry-conducted surveys were initiated to index scallop biomass on known scallop beds in Pacific Fishery Management Areas (PFMA) 13 and 14, and also to collect biological data to estimate growth rates and natural mortality. The current assessment framework involves conducting industry-funded fishery-independent trawl surveys to estimate scallop biomass on each scallop bed being fished. A Total Allowable Catch (TAC) for each scallop bed is set based on the estimate of the total legal size scallop biomass and a recommended harvest rate of 4%. In addition, a minimum size limit of 48 mm is in effect for both Pink and Spiny scallops.

Description of the fishery

The commercial scallop fishery began in 1982 under a licence that allowed for harvest of both Pink and Spiny scallops by dive or trawl gear. In 1993, the dive and trawl fisheries were split. There was no limit to the number of licences issued annually in either fishery. Both fisheries were closed in 1999 due to concerns regarding the sustainability of these fisheries due to the lack of biologically-based management controls.

In 2000, an assessment and management framework for Pink and Spiny scallop fisheries off the west coast of Canada was presented to the Pacific Scientific Advice Review Committee (now the Centre for Science Advice Pacific) (Lauzier et al. 2000) and protocols for scallop dive and trawl surveys were developed based on this document. Lauzier et al. (2005) analysed data from 2000 – 2002 from the experimental scallop fisheries and provided preliminary estimates of natural mortality and growths rates of scallops, and made recommendations for appropriate harvest rates of both exploited and unexploited populations of scallops.

Since August 2007, pursuant to the DFO New Emerging Fisheries Policy (DFO 2008), DFO has licenced the scallop by trawl fishery using non-transferable exploratory fishing licences. Beginning in early 2009, DFO started consultations with all stakeholders to discuss the possibility of converting exploratory licences to commercial licences. Currently, a non-transferable scallop by trawl exploratory fishing licence is issued annually from August 1 to July 31 of the following year. In recent years, an average of five licences have been issued annually, with three licences actively fishing. Annual landings have ranged from a low of 10.1 t in 2002 to a high of 32.3 t in 2008.

As part of the exploratory fishery, surveys continue to be required for each fishing location. Surveys provide the only means of estimating scallop biomass upon which a biologically-based harvest quota can be established.

Assessment

Beginning in 2002, fishery-independent trawl surveys were conducted on 19 scallop beds in PFMAs 13 and 14. Since 2002, only 9 beds have been surveyed more than once, all in PFMA 13. Survey data from the 10 other beds are not included in this report because the exploratory surveys resulted in only a single data point each, such that commentary cannot be made on stock trend. Unless specified, the survey locations and survey protocols were conducted consistently between area and years. For each of the 9 beds, a summary of the biomass estimates (total biomass [Appendix A Table 1], total legal biomass [Appendix A Table 2], total legal Pink scallop biomass, and total legal Spiny scallop biomass), including measures of uncertainty, and a commentary on stock trends, is provided. The uncertainties in the biomass estimation of Pink and Spiny scallops are reported as 95% confidence intervals (CI).

Elk Point

Elk Point was surveyed in 2002, 2004, 2007, 2008, 2010, and 2012 (Figure 1), although in 2002, McMullen Point was included in the estimate. Note that the 2002 biomass estimates are reported as combined Pink and Spiny scallops over a combined area (Elk Point, Moriarty Point, and McMullen Point). Total scallop biomass and total legal biomass have been variable over the years surveyed from 2002 to 2012.

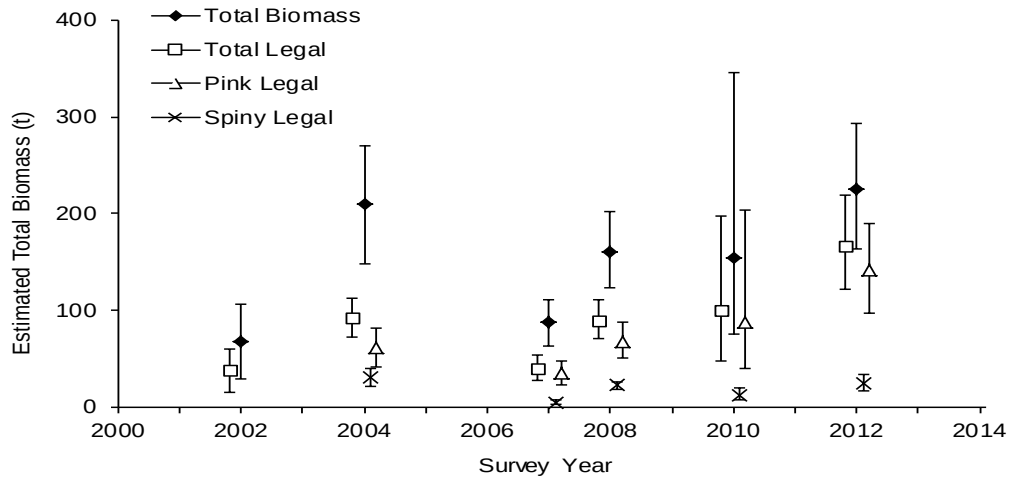

Figure 1. Total scallop, total legal scallop, legal Pink scallop (Chlamys rubida) and legal Spiny scallop (Chlamys hastata) mean biomass as determined from scallop trawl surveys, Elk Point, from 2004, 2007, 2008, 2010, and 2012. Note that biomass estimates for 2002 are combined from Elk Point, Moriarty Point and McMullen Point. Error bars represent 95% confidence intervals (CI).

Granite Point

Granite Point was surveyed in 2006, 2008, and 2013 (Figure 2). There was a very large increase in total legal scallop biomass from 22.0 t in 2008 to 389.0 t in 2013. There was also a large increase in total scallop biomass, which is attributed to a large increase in the legal scallop portion of Pink scallop biomass; although it is important to note that there are large gaps in years between surveys.

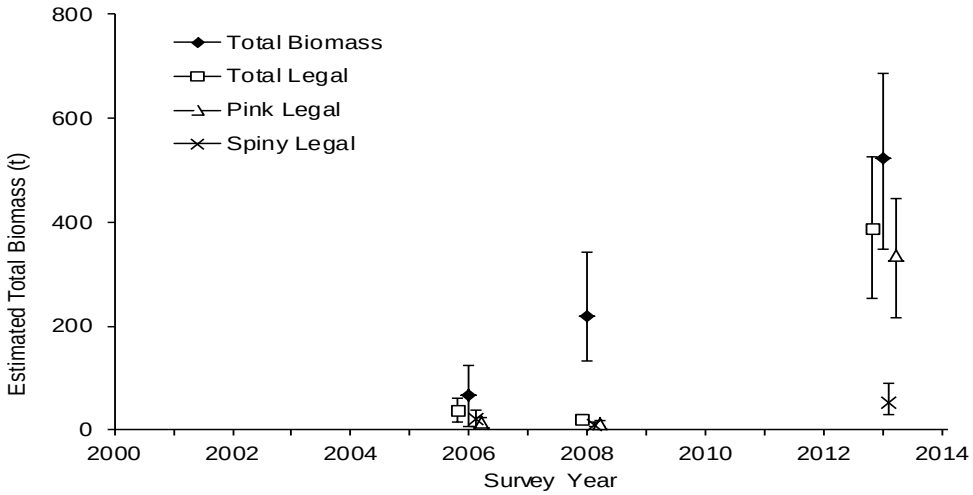

Figure 2. Total scallop, total legal scallop, legal Pink scallop (Chlamys rubida) and legal Spiny scallop (Chlamys hastata) biomass determined from scallop trawl surveys, Granite Point scallop bed, from 2006, 2008, and 2013. Error bars represent 95% confidence intervals (CI).

Hole in the Wall

Hole in the Wall was surveyed in 2000, 2002, 2004, 2006, 2009, 2011, and 2013 (Figure 3). Note that for 2009, the area estimate did not include the Florence Cove bed, which resulted in a reduced overall survey area. Since about 2000, there appears to be a decline in total scallop biomass and total legal biomass for both Pink and Spiny scallops.

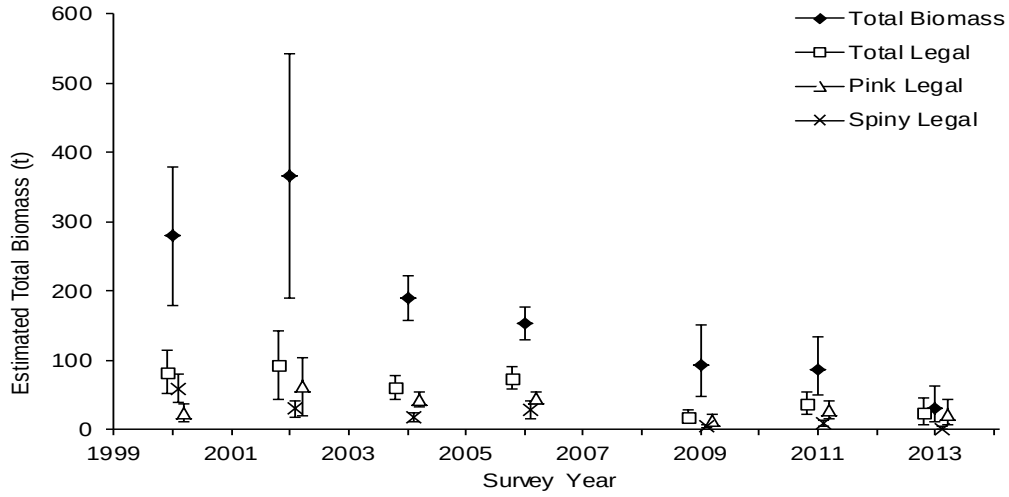

Figure 3. Total scallop, total legal scallop, legal Pink scallop (Chlamys rubida) and legal Spiny scallop (Chlamys hastata) mean biomass as determined from scallop trawl surveys at Hole in the Wall, in 2000, 2002, 2004, 2006, 2009, 2011, and 2013. Note for 2009, the area estimate did not include the Florence Cove bed which resulted in a reduced overall survey area. Error bars represent 95% confidence intervals (CI).

Moriarty Point

Moriarty Point was surveyed in years 2002, 2004, 2007, 2008, 2010, and 2012 (Figure 4) although in 2002, McMullen Point was included in the estimate. Also note that the 2002 biomass

estimates are reported as combined Pink and Spiny scallops over a combined area (Elk Point, Moriarty Point, and McMullen Point). From 2004, the estimates are broken down by species and by area. Since 2002, there appears to be an increase in total scallop biomass and total legal scallop biomass.

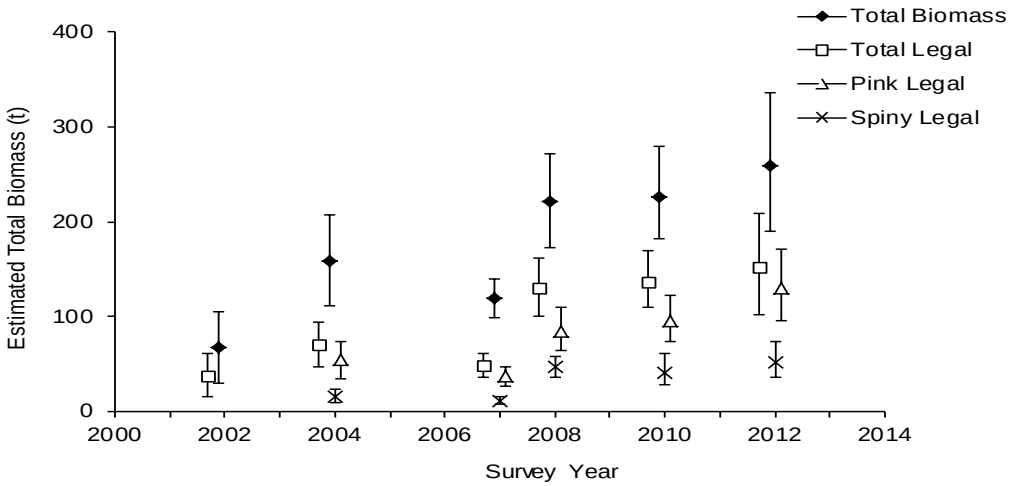

Figure 4. Total scallop, total legal scallop, legal Pink scallop (Chlamys rubida) and legal Spiny scallop (Chlamys hastata) mean biomass as determined from scallop trawl surveys, Moriarty Point, from 2004, 2007, 2008, 2010, and 2012. Note that biomass estimates for 2002 are combined from Elk Point, Moriarty Point and McMullen Point. Error bars represent 95% confidence intervals (CI).

Octopus Island

Octopus Island was surveyed in 2002 and 2008 (Figure 5). No trends in abundance could be detected due to the low number of surveys.

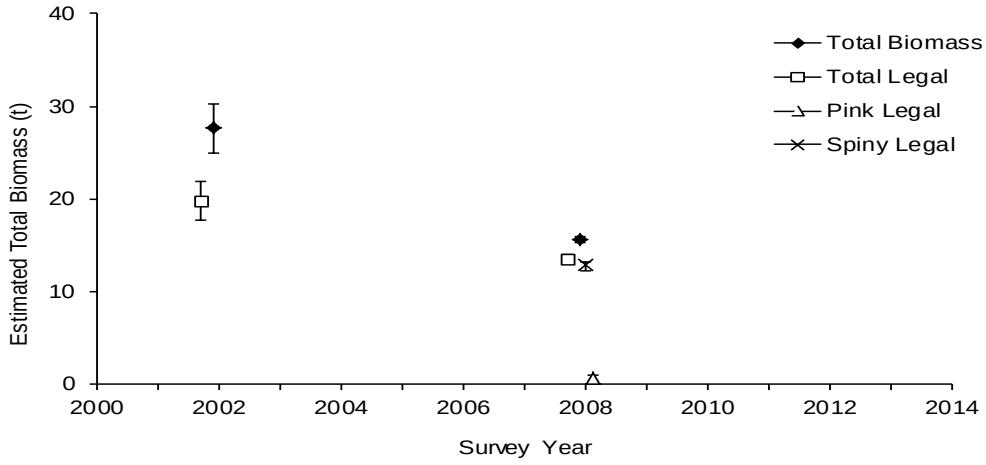

Figure 5. Total scallop, total legal scallop, legal Pink scallop (Chlamys rubida) and legal Spiny scallop (Chlamys hastata) biomass determined from scallop trawl surveys, Octopus Islands scallop bed in 2002 and 2008. Error bars represent 95% confidence intervals (CI).

Okisollo

Okisollo was surveyed in 2002, 2007, 2008, and 2013, but the 2002 data are not shown because two other beds in Okisollo (Venture Point and a mid-channel bed) were included in the estimate (Figure 6). The Venture Point bed is now occupied by a fish farm and the mid-channel bed is too deep to fish according to one of the fishers. The Okisollo scallop bed showed a similar trend in total scallop biomass as that observed at Granite Point scallop bed. There was a large increase in total legal scallop biomass of 118.8 t in 2013 from 21.0 t in 2008, although it's important to note that there are large gaps in years between surveys.

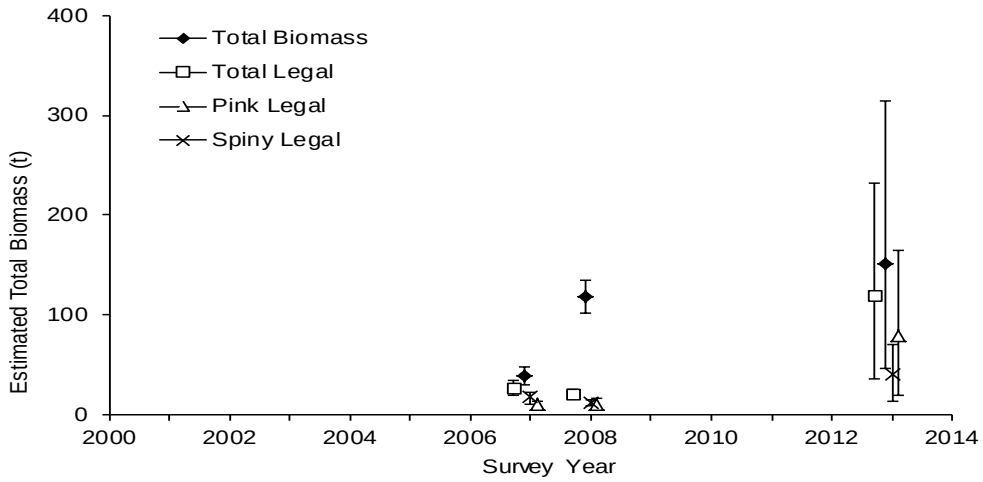

Figure 6. Total scallop, total legal scallop, legal Pink scallop (Chlamys rubida) and legal Spiny scallop (Chlamys hastata) biomass determined from scallop trawl surveys, Okisollo scallop bed, from 2007, 2008, and 2013. Note that 2002 is not shown because two other beds in Okisollo (Venture Pointt and a mid-channel bed) were included in the biomass estimate. Error bars represent 95% confidence intervals (CI).

SW Quadra (Red Can)

SW Quadra was surveyed in 2002, 2007, 2009, 2011, and 2012 (Figure 7). For the most recent survey years, total mean scallop biomass for SW Quadra in 2012 was 109.8 t, which was a large decrease from 230.9 t in 2011. Combined mean legal scallop biomass decreased from 77.0 t in 2012 from 175.7 t in 2011. There was a slight increase in legal Spiny scallop biomass from 43.3 t in 2011 from 44.3 t in 2012. There was a large decrease in legal Pink scallop biomass from 132.4 t in 2011 to 32.7 t in 2012. Scallop biomass has been variable over the surveys, although it is important to note that there are large gaps in years between 2002 and 2007, where no surveys were conducted.

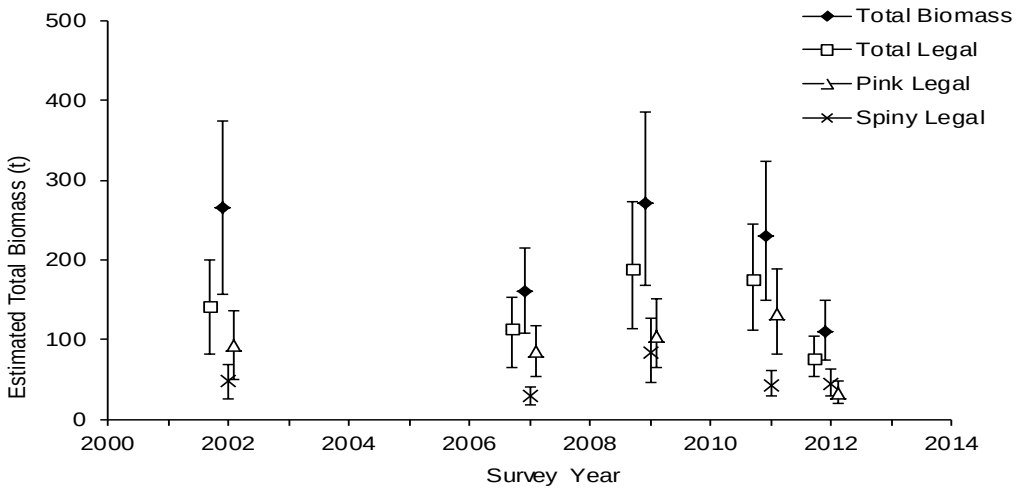

Figure 7. Total scallop, total legal scallop, legal Pink scallop (Chlamys rubida) and legal Spiny scallop (Chlamys hastata) mean biomass as determined from scallop trawl surveys at SW Quadra, in 2002, 2007, 2009, 2011, and 2012. Error bars represent 95% confidence intervals (CI).

Wilby Shoals (Green Can)

Wilby Shoals was surveyed in 2004, 2008, and 2011 (Figure 8). Total scallop biomass and total legal scallop biomass were relatively unchanged over the three years surveyed.

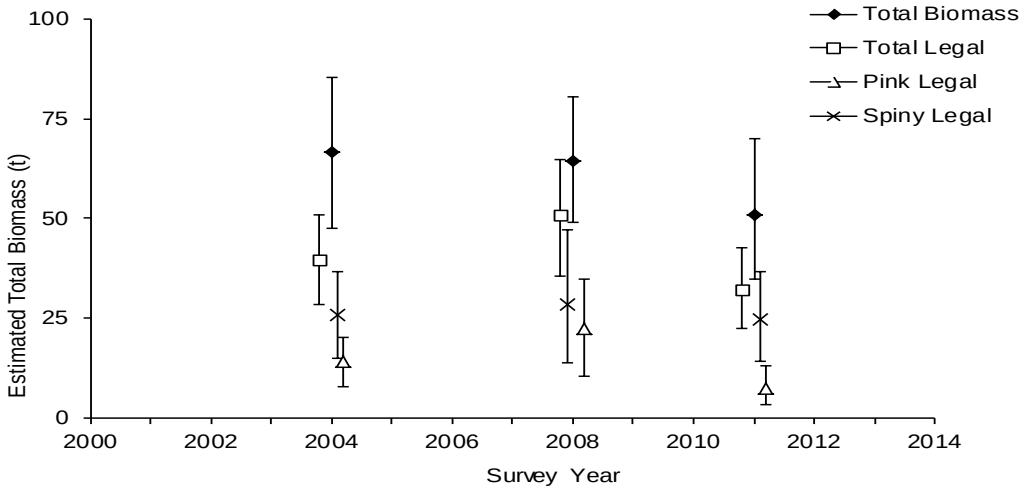

Figure 8. Total scallop, total legal scallop, legal Pink scallop (Chlamys rubida) and legal Spiny scallop (Chlamys hastata) mean biomass as determined from scallop trawl surveys at Wilby Shoals (Green Can), in 2004, 2008, and 2011. Error bars represent 95% confidence intervals (CI).

Willow Point

Willow Point was surveyed in 2002 and 2008 (Figure 9). No trends in abundance could be detected due to the low number of surveys.

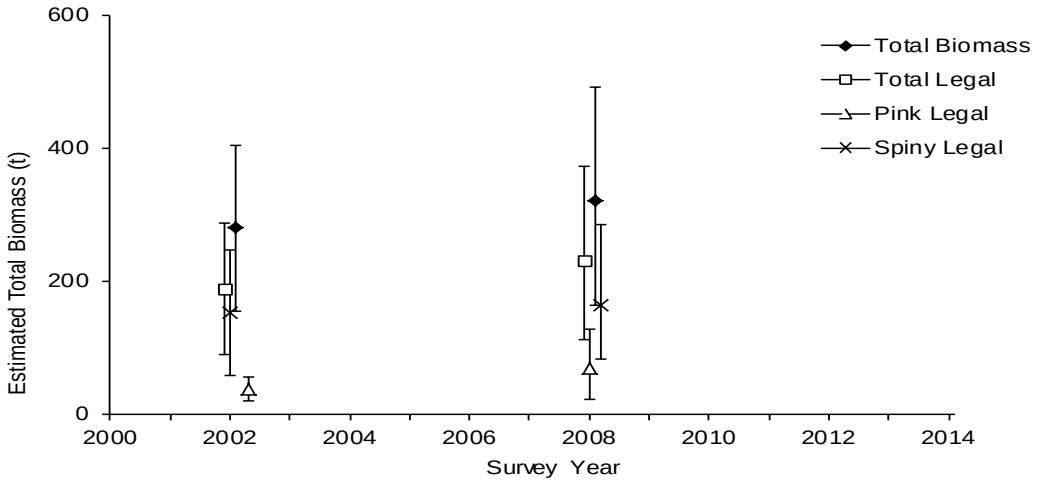

Figure 9. Total scallop, total legal scallop, legal Pink scallop (Chlamys rubida) and legal Spiny scallop (Chlamys hastata) mean biomass as determined from scallop trawl surveys at Willow Point, in 2002, 2007, 2009, 2011, and 2012. Error bars represent 95% confidence intervals (CI).

Summary

Stock trends varied by scallop bed with three scallop beds (Granite Point, Moriarty Point, and Wilby Shoals) showing an increasing trend and one scallop bed (Hole in the Wall) showing a downward trend. Three scallop beds (Elk Point, SW Quadra, and Wilby Shoals) show a variable trend. For two of the scallop beds (Octopus Islands and Willow Point) the survey data were insufficient to be able to comment on stock trends.

Conclusions

Sources of Uncertainty

The primary source of uncertainty in the assessment of Pink and Spiny scallop stocks is the paucity of biological and time series data. Lauzier et al. (2000) noted that each distinct aggregation of scallops must be assessed as a separate stock until sufficient data is obtained to delineate the degree of exchange or dispersal between scallop aggregations. Although assessment and management on a larger scale is desirable, due to the limited resources available for estimating biomass and administering TACs, there continues to be insufficient data to move forward on implementing a broader scale approach as recommended by Lauzier et al. (2005).

Precautionary Approach

The development of a harvest strategy compliant with the PA is desired for scallops. The minimum elements of the harvest strategy component of the PA policy include a removal reference for three stock zones delineated by a Limit Reference Point (LRP) and Upper Stock Reference (USR) (DFO 2006). A suggested approach in the DFO PA policy is to use Bmsy or a proxy as a base for delineating the PA stock status zones. Bmsy is defined as the biomass that can produce the maximum yield. The DFO PA policy specifies that the default LRP and USR are 0.4 and 0.8 of Bmsy respectively (DFO 2009). In the case of Pink and Spiny scallops, there is a paucity of data on which to estimate Bmsy; however, average biomass over a productive period could be used as a proxy for Bmsy. This approach has been used for Pink (*Pandalus*

spp.) and Sidestripe (*Pandalopsis dispar*) shrimp in the Pacific Region to establish provisional PA compliant reference points (Rutherford et al. 2009).

Unfortunately, for British Columbia Pink and Spiny scallop stocks, the survey data are sporadic and there currently are insufficient time series data on which to estimate a proxy for Bmsy. However, the current assessment framework, if implemented on an annual basis, will facilitate the development of PA compliant provisional reference points. Sufficient data and analysis have been completed to establish a removal reference when stocks are in the Healthy zone (Surry et al. 2011).

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Appendix A

Appendix A Table 1. Total scallop biomass (t) for each scallop bed area by year.

	Total Scallop Biomass (t)														
	Year														
Scallop bed	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Elk Point	-	-	67.2	-	209.3	-	-	87.2	159.7	-	155.0	-	225.7	-	-
Granite Point	-	-	-	-	-	-	66.3	-	219.4	-	-	-	-	521.8	-
Hole in the Wall	280.4	-	366.7	-	190.6	-	153.5	-	-	93.7[a]	-	87.7	-	31.9	-
Moriarty Point	-	-	67.2	-	158.9	-	-	119.0	221.1	-	226.8	-	259.5	-	-
Octopus Islands	-	-	27.6	-	-	-	-	-	15.7	-	-	-	-	-	-
Okisollo	-	-	-	-	-	-	-	39.1	118.6	-	-	-	-	150.7	-
SW Quadra (Red Can)	-	-	265.4	-	-	-	-	161.1	-	270.9	-	230.9	109.8	-	-
Wilby Shoals (Green Can)	-	-	-	-	66.5	-	-	-	64.2	-	-	50.7	-	-	-
Willow Point	-	-	278.9	-	-	-	-	-	363.3	-	-	-	-	-	-

[a]The area estimate did not include the Florence Cove bed which resulted in a reduced overall survey area.

Appendix A Table 2. Total legal scallop biomass (t) for each scallop bed area by year.

	Total Scallop Biomass (t)														
	Year														
Scallop bed	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Elk Point	-	-	37.8	-	92.8	-	-	40.6	90.0	-	100.0	-	167.1	-	-
Granite Point	-	-	-	-	-	-	38.5	-	22.0	-	-	-	-	389.0	-
Hole in the Wall	83.5	-	93.4	-	61.6	-	74.7	-	-	18.8[a]	-	37.2	-	24.3	-
Moriarty Point	-	-	37.8	-	70.5	-	-	48.4	130.9	-	136.1	-	152.1	-	-
Octopus Islands	-	-	19.7	-	-	-	-	-	13.6	-	-	-	-	-	-
Okisollo	-	-	-	-	-	-	-	27.3	21.0	-	-	-	-	118.8	-
SW Quadra (Red Can)	-	-	141.1	-	-	-	-	114.6	-	188.3	-	175.7	77.0	-	-
Wilby Shoals (Green Can)	-	-	-	-	39.7	-	-	-	50.7	-	-	32.1	-	-	-
Willow Point	-	-	188.6	-	-	-	-	-	230.7	-	-	-	-	-	-

[a]The area estimate did not include the Florence Cove bed which resulted in a reduced overall survey area.

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