

# Report on the Progress of Management Plan Implementation for the Olympia Oyster (*Ostrea lurida*) in Canada for the Period 2009 - 2015

## Olympia Oyster



2017

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## Preface

The federal, provincial, and territorial government signatories under the [Accord for the Protection of Species at Risk \(1996\)](#) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under Section 72 of the *Species at Risk Act* (S.C. 2002, c.29) (SARA) requires the competent minister to report on the implementation of the Management Plan for a species at risk, and on the progress towards meeting its objective within five years of the date when the Management Plan was placed on the Species at Risk Public Registry and in every subsequent five-year period, until its goal and objective has been achieved or the species' becomes threatened or endangered under SARA.

Reporting on the progress of management plan implementation requires reporting on the collective efforts of the competent minister(s), provincial organizations and all other parties involved in conducting activities that contribute towards the species' conservation. Management plans set goals and objectives for maintaining sustainable population levels of one or more species that are particularly sensitive to environmental factors, but, which are not in danger of becoming extinct. Some of the identified conservation measures are sequential to the progress or completion of others; and not all may be undertaken or show significant progress during the time frame of a Report on the Progress of Management Plan Implementation (Progress Report).

The Minister of Fisheries and Oceans and the Minister responsible for the Parks Canada Agency are the competent ministers under SARA for the Olympia Oyster. Fisheries and Oceans Canada has prepared this Progress Report with the support of the Parks Canada Agency.

As stated in the preamble to SARA, success in the conservation of species at risk depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in the management plan and will not be achieved by Fisheries and Oceans Canada, or any other jurisdiction alone. The cost of conserving species at risk is shared amongst different constituencies. All Canadians are invited to join in supporting and implementing the Management Plan for the Olympia Oyster for the benefit of the species and Canadian society as a whole.

## Acknowledgments

This Progress Report was prepared by Lily Stanton with input from Fisheries and Oceans Canada's (DFO) Marine Ecosystem and Aquaculture Division, Aquaculture Management Division and Aquatic Animal Health Section, and Environment Canada's Habitat Stewardship Program for Species at Risk. Fisheries and Oceans Canada would like to express its appreciation to all individuals and organizations who have contributed to the conservation of the Olympia Oyster.

## Executive Summary

The Olympia Oyster (*Ostrea lurida*) was listed as a species of Special Concern under the *Species at Risk Act* in 2003. The Management Plan for the Olympia Oyster (*Ostrea conchaphila*<sup>1</sup>) was finalized and published on the Species at Risk Public Registry in 2009.

The main threats identified for the Olympia Oyster include: human alteration of habitat, inadvertent introduction of non-native predators and parasites, vulnerability to human pollution (pulp mill effluents and possibly anti-fouling paints), and historic over harvesting.

The management goal for the Olympia Oyster is:

*Maintain stable populations of Olympia Oysters in British Columbia.*

The management objective for the Olympia Oyster is:

*Ensure maintenance of the relative abundance of Olympia Oysters at index sites from 2008-2013.*

This report documents the progress of Management Plan implementation for the Olympia Oyster in Canada for the period 2009-2015. It summarizes progress that Fisheries and Oceans Canada and the broader scientific community have made towards achieving the goal and objective set out in the Management Plan. During the time period reported by this Progress Report, achievements have been made in:

- The identification and establishment of Olympia Oyster index sites for continual monitoring of relative abundance of Olympia Oyster populations in different geographic zones in the Pacific Region;
- Development of survey protocols to make relative abundance and maximum density estimates at established index sites;
- Maintenance of the recreational harvest limit of zero and continuing the limitation of the commercial and recreational harvest of Olympia Oyster;
- Completion of baseline histopathological studies to determine the current health status and risk of disease to Olympia Oyster population in British Columbia;
- Implementation of mitigation measures for development projects to reduce negative impacts to Olympia Oyster habitat, by relocating dense populations of the species and constructing compensatory habitat; and
- Increased public awareness, community engagement, and outreach around communication of Olympia Oysters and their threats primarily through the efforts of

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<sup>1</sup> Since the original status report for Olympia Oyster (COSEWIC 2000), Polson *et al.* (2009) provided evidence that *Ostrea lurida* is the correct name for native oysters found on the Pacific coast of North America; the previously used name, *O. conchaphila*, refers instead to a separate species occurring further south (COSEWIC 2011).

stewardship groups such as the World Fisheries Trust and the Gorge Waterway Initiative in Victoria, British Columbia.

While there has been measurable progress towards meeting the management goal, objective, and performance measures presented in the Management Plan, continued monitoring of index sites, as well as increased management and mitigation measures, will be necessary to continue to maintain stable populations of Olympia Oysters in Canada.

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# 1 Introduction

This Progress Report outlines the progress made from 2009 to 2015 towards meeting the goal and objective listed in the Management Plan for Olympia Oyster, and should be considered as one in a series of documents for this species that are linked and should be taken into consideration together, including: the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status report (COSEWIC 2011); and Management Plan (DFO 2009).

Section 2 of the progress report summarizes key information on the threats to the species, the management goal and objective, and performance measures to assess and determine if the goal and objective are being met. For more detail, readers should refer back to the [Management Plan for the Olympia Oyster \(\*Ostrea lurida\*\) in Canada](#).

Section 3 reports the progress of activities identified in the Management Plan, to support achieving the management goal and objective. Section 4 summarizes the progress made and outcome of the conservation efforts.

## 2 Background

### 2.1 COSEWIC Assessment Summary

The Olympia Oyster was initially assessed and designated as Special Concern by COSEWIC in 2000 (COSEWIC 2000). The listing of Olympia Oyster in 2003 led to the development and publication of the Management Plan, based on the information provided in the COSEWIC Status Report (COSEWIC 2000). In 2011, COSEWIC reassessed and confirmed the status of the Olympia Oyster as a species of Special Concern (COSEWIC 2011).

#### Assessment Summary – May 2011

**Common Name:** Olympia Oyster

**Scientific Name:** *Ostrea lurida*

**Status:** Special Concern

**Reason for designation:**

This species is the only native oyster along the Pacific Coast of Canada. Although its population suffered large-scale historical declines associated with overharvest, it appears to have been stable in recent decades. However, recent introductions of exotic parasites, predatory snails, green crabs and fouling ascidians, as well as industrial and domestic pollution, pose significant threats to the oyster. Limited dispersal and vulnerability to low temperature extremes and sedimentation from floods and landslides may increase its vulnerability and ability to recover from adverse impacts.

**Occurrence:** British Columbia, Pacific Ocean

**Status History:** Designated Special Concern in November 2000 and in May 2011.

## 2.2 Threats to the Olympia Oyster

This section summarizes the information found in the Management Plan on threats to Olympia Oyster.

Table 1 summarizes the threats to the Olympia Oyster. Please refer to Section 1.5 of the Management Plan for more information on these threats.

**Table 1: Summary of the threats identified for the Olympia Oyster, based on the Management Plan.**

Threat	Level of Concern <sup>2</sup>	Description
<b>Human Alteration of Habitat</b>	High	Habitat loss and degradation of habitat through recreational and commercial harvesting practices, pollution and increased siltation due to foreshore development, forestry practices and land management practices (urbanization and industrialization).
<b>Introduction of Non-Native Predators and Parasites</b>	Medium	Inadvertent introductions through aquaculture and harvesting practices such as routine transfers of cultured or harvested wild species from one location to another.
<b>Pollution</b>	Medium	Pollution from pulp mills or anti-fouling paint releasing sulphite waste and tributyltin (TBT), respectively can cause deleterious effects such as reduced growth increased mortality and loss of reproductive success.
<b>Harvest (Historic)</b>	Low	Excessive and unsustainable commercial harvesting decimated natural Olympia Oyster beds along the Pacific Coast by 1930. Currently, there is no targeted commercial fishing of Olympia Oysters in British Columbia.

## 2.3 Management

This section summarizes the information found in the Management Plan on the management goal and objective necessary for the conservation of the Olympia Oyster, and on performance measures that provide a way to define and measure progress toward achieving that goal and objective.

### 2.3.1 Management Goal and Objective

Management Goal:

*Maintain stable populations of Olympia Oysters in British Columbia.*

<sup>2</sup> Level of Concern indicates whether managing the threat is an overall high, medium, or low level of concern for conservation of the species, taking into account the stress, extent, occurrence, frequency, casual certainty, and severity of the specific threat.

The management goal reflects the fact that British Columbia is likely at or near the northern end of the global distribution of Olympia Oysters and that the population appears to be stable at low levels relative to historic accounts.

In order to achieve this goal, the Management Plan identified a management objective:

*Ensure the maintenance of the relative abundance of Olympia Oysters at index sites from the period 2008-2013.*

### **2.3.2 Performance Measures**

Section 2.4 of the Management Plan includes the following performance measures to define and measure progress toward achieving the management goal and objective:

*Objective based performance measure:*

1. Has the relative abundance of Olympia Oysters at identified index sites changed over the period 2008-2013?

*Approach based performance measures:*

2. Have index sites been identified and protected?
3. Have anthropogenic threats been managed through existing management tools?
4. Have resource maps been created?
5. Have survey protocols been adopted?
6. Have tissue samples been collected from baseline analysis?
7. Have stakeholders been engaged in implementing management actions?

Some measures may not be complete within the time frame covered in this Progress Report. In such cases, the Department will continue to implement management measures and will report out on progress in the next Report on Progress of Management Plan Implementation for the Olympia Oyster.

Table 2 reports on the progress made against the performance measures as numbered above.

## **3 Progress towards Conservation**

The Management Plan for the Olympia Oyster divides the management effort into five conservation actions: 1) Protection, 2) Management, 3) Research, 4) Monitoring and Assessment, and 5) Outreach and Communication. Progress in carrying out these conservation actions is reported in Section 3.1. Section 3.2 reports on the progress on meeting the performance measures and other commitments identified in the Management Plan, and information obtained through implementation of the Management Plan.

### 3.1 Actions Supporting Conservation

Table 2 below provides information on the implementation of activities undertaken to address the conservation actions identified in the Management Plan. Each activity has been assigned one of four statuses:

- 1) *Completed*: the planned activity has been carried out and concluded;
- 2) *In progress*: the planned activity is underway and has not concluded;
- 3) *Not started*: the activity has been planned but has yet to start; or
- 4) *Cancelled*: the planned activity will not be started or completed.

#### Key to abbreviations used in Table 2:

BC MFLNRO	British Columbia Ministry of Forests, Lands & Natural Resource Operations
BCSGA	British Columbia Shellfish Growers Association
DFO	Fisheries and Oceans Canada
EC	Environment Canada
PC	Parks Canada
PSRF	Puget Sound Restoration Fund
ITC	Introductions and Transfers Committee
VIU	Vancouver Island University
WFT	World Fisheries Trust

In the participants column of the table, lead participant(s) is/are listed on top and in bold; other participants are listed alphabetically. Not all activities have specific participants identified.

**Table 2: Details of activities supporting the conservation of the Olympia Oyster from 2008 to 2015**

Activity	Timeline	Status	Details	Performance Measures	Participants
<b>Protection:</b>					
Protect index sites that are not already protected (e.g. within federal or provincial parks or provincial ecological reserves)	2008-2009	Cancelled	<ul style="list-style-type: none"> <li>Index sites were identified and established for long term monitoring (DFO 2010). However, no index sites are currently protected within federal or provincial parks or provincial ecological reserves. DFO has determined that Olympia Oyster index sites should represent the natural conditions found at non-protected sites in order to more accurately reflect detrimental impacts that pose a threat to Olympia Oyster populations (DFO 2010). Therefore, this conservation measure will not be started or completed.</li> </ul>	1	<b>DFO, PC</b> BC MFLNRO,
Undertake protection measures by identifying Olympia Oysters in coast wide mapping and land/marine-use planning processes	2008-2013+	Not Started	<ul style="list-style-type: none"> <li>Informing relevant authorities to take into account the presence of Olympia Oysters in land/marine use planning processes, such as the Quatsino Sound Coastal Plan, may offer some level of protection.</li> <li>To date, Olympia Oysters have not been identified in coast wide mapping land/marine-use planning processes, but the Department is committed to pursuing this conservation measure.</li> </ul>	1,2,3,4	<b>DFO</b>
<b>Management:</b>					
Mitigate potential impacts from commercial harvesting activities	2008-2013+	In Progress	<ul style="list-style-type: none"> <li>New aquaculture licenses are reviewed to determine if proposed tenure overlaps with habitat of species listed under SARA, including Olympia Oyster.</li> <li>If Olympia Oyster is thought to occur in a</li> </ul>	1, 3	<b>DFO</b>

Activity	Timeline	Status	Details	Performance Measures	Participants
			<p>proposed aquaculture site, conditions may be put in place to minimize potential impacts such as relocating or adjusting an aquaculture license, or in extreme cases a rejection of the proposal.</p>		
Maintain the recreational harvest limit of zero	2008-2013+	Completed	<ul style="list-style-type: none"> <li>The recreational harvest limit was reduced to zero in May 2007 and continues to be maintained under the federal <i>Fisheries Act</i> and the <i>British Columbia Sport Fishing Regulations</i>.</li> </ul>	1, 3	<b>DFO</b>
Limit recreation and commercial harvest	2008-2013+	Completed	<ul style="list-style-type: none"> <li>Under the federal <i>Fisheries Act</i> and the provincial <i>Fisheries Act</i>, recreational harvest was amended to a zero harvest bag limit.</li> <li>Commercial fishing for Olympia Oyster ceased in the 1930's and DFO has removed Olympia Oyster from shellfish aquaculture licenses.</li> </ul>	1, 3	<b>DFO</b>
Develop mitigation measures for non-native predators and parasites	2008-2013+	In Progress	<ul style="list-style-type: none"> <li>No new mitigation measures in key Olympia Oyster habitat were developed.</li> <li>The ITC were informed of the threat to Olympia Oysters in 2008, and determined existing practices would limit the likelihood of disease transferences (MacConnachie pers. comm. 2015).</li> <li>Currently, authorization is required by the ITC to release or transfer live fish, including shellfish and aquaculture species into fish habitat or fish rearing facilities. Under the provincial <i>Fisheries Act</i>, permission is required to plant or introduce oysters, oyster seed, shells and cultch outside the province and restricts movement of oysters, oyster culture, and harvesting equipment.</li> </ul>	1, 3	<b>DFO, ITC</b>

Activity	Timeline	Status	Details	Performance Measures	Participants
Regulate activities that may disrupt or alter habitat		In Progress	<ul style="list-style-type: none"> <li>In 2013, a relocation project was conducted by the WFT in the Gorge Waterway in Victoria. This project worked to reduce negative impacts to Olympia Oysters from the replacement of the Craigflower Bridge. Extensive studies were performed to identify the most suitable sites for Olympia Oyster relocation and are monitored annually for survival (WFT 2014).</li> </ul>	1, 3	WFT, EC
<b>Research:</b>					
Identify beaches where intertidal clam harvesting co-occurs with Olympia Oysters	2009	Cancelled	<ul style="list-style-type: none"> <li>Beaches where intertidal clam harvesting occurs with Olympia Oysters have not been identified. DFO has determined that intertidal clam harvesting does not occur with Olympia Oyster populations. Therefore, this conservation measure will not be started or completed.</li> </ul>	1,7	DFO, BCSGA
Review the success of restoration efforts in Washington, Oregon and California	As appropriate	In Progress	<ul style="list-style-type: none"> <li>DFO scientists attended several conferences to better understand restoration efforts in American jurisdictions. DFO scientists also acted as reviewers for <i>A Guide to Olympia Oyster Restoration and Conservation</i> funded by the National Estuarine Research Reserve Science Collaborative in the United States (Norgard pers. comm. 2015).</li> </ul>	2	DFO, PSRF
Collate information on the distribution of non-native predators and parasites (Provide information to ITC)	2008 - 2015+	In Progress	<ul style="list-style-type: none"> <li>The ITC were informed of the threat to Olympia Oysters in 2008, and determined existing practices would limit the likelihood of disease transferences (MacConnachie pers. comm. 2015).</li> <li>A report on the distribution of non-native species in British Columbia is currently in</li> </ul>	1, 3	DFO, PC, ITC

Activity	Timeline	Status	Details	Performance Measures	Participants
			progress and will be made available to the ITC once it is complete (Norgard pers. comm. 2015).		
<b>Monitoring and Assessment:</b>					
Establish & monitor index every five years	2009+	In Progress	<ul style="list-style-type: none"> <li>Thirteen index sites were identified by DFO (2010) to monitor changes in relative abundance spanning the majority of Olympia Oyster range in Canadian waters.</li> <li>All index sites were surveyed at least twice since 2010 and results of these surveys will be documented in a Canadian Technical Report of Fisheries and Aquatic Sciences (Norgard <i>et al.</i> 2015).</li> </ul>	1, 2	<b>DFO, PC, WFT, VIU, PSRF</b>
Develop survey protocols for index sites	2008-2013	Completed	<ul style="list-style-type: none"> <li>Extensive field surveys conducted in 2009 evaluated several different survey methods and developed quantitative protocols for estimating relative abundance of Olympia Oyster populations at index sites (Norgard <i>et al.</i> 2010).</li> </ul>	1,5	<b>DFO</b>
Undertake baseline histopathological examinations	2008-2013	Completed	<ul style="list-style-type: none"> <li>Baseline histopathological studies were completed in 2010 to determine the overall health status of Olympia Oysters from five locations in British Columbia (Meyers <i>et al.</i> 2010).</li> <li>Histological examinations continued throughout 2011 and 2012. No pathology or diseases of concern were detected in the majority of samples examined.</li> </ul>	6	<b>DFO, VIU</b>
<b>Outreach and Communication:</b>					
Communicate detrimental effects of	2008-2013+	In Progress	<ul style="list-style-type: none"> <li>The WFT informed the public about Olympia Oysters and the potential threats posed by</li> </ul>	7	<b>WFT, EC, DFO</b>

Activity	Timeline	Status	Details	Performance Measures	Participants
predator and parasite transfers			<p>introduction and spread of non-native species through public events, school programs, and interpretation activities at the Gorge Waterway Nature House.</p> <ul style="list-style-type: none"> <li>• Additional outreach and communication activities aimed at the aquaculture industry, the BCSGA, wild clam and oyster harvesters (commercial, recreational and First Nations), BC MFLNRO, and the ITC regarding the potential detrimental effects of predator and parasite transfers needs to be completed.</li> </ul>		

## 3.2 Summary of Progress towards Conservation

### 3.2.1 Status of Performance Measures

The following is a summary of the progress made towards the management of Olympia Oyster as outlined in the performance measures from the Management Plan.

#### *1. Has the relative abundance of Olympia Oysters at identified index sites changed over the period 2008-2013?*

A complete analysis determining any change in relative abundance of Olympia Oysters at identified index sites has not yet been performed.

Since the establishment of index sites by DFO in 2010, regular monitoring of the relative abundance of Olympia Oysters has occurred at each index site approximately every 2-3 years, and in some cases annually from 2010 to 2015 (Norgard pers. comm. 2015). Biological samples and measurements taken from survey sites provided insight into recruitment and age distribution of Olympia Oyster populations. Results of these surveys are currently being analysed for inclusion in a DFO Canadian Technical Report of Fisheries and Aquatic Sciences (Norgard *et al.* in prep.). Most surveys were completed in partnership with various stakeholders including PC, the Royal BC Museum, VIU, PSRF, and the WFT.

With support from the Habitat Stewardship Program for Species at Risk, the WFT has been involved in establishing three index sites for ongoing monitoring of Olympia Oyster populations along the Gorge Waterway in Victoria. Surveys at index sites were conducted on an annual basis providing vital baseline information for continued monitoring. To date, only observational data has been obtained comparing survey methodologies and density estimates. An analysis to determine a change in relative abundance was not performed. Future studies will aim to design surveys more conducive to obtaining density estimates (Bayus 2014).

#### *2. Have index sites been identified and protected?*

Index sites identified by DFO in 2010 are not currently protected through existing federal or provincial parks or ecological reserves, and no notations of interest or map reserves have been created to aid in protecting index sites since the completion of the Management Plan.

Existing federal and provincial marine protected areas, ecological reserves, provincial parks and national parks, such as the Pacific Rim National Park Reserve, as well as fisheries closures, provide some level of protection to Olympia Oysters at non-index sites (DFO 2009). DFO has determined that rather than protecting Olympia Oyster index sites, these index sites should be reflective of the impacts that affect the natural population (DFO 2010). This will allow the Department to evaluate impacts to the selected index sites and detect any changes in relative abundance (DFO 2010).

A review of index site selection methods was conducted by DFO in 2010. Olympia Oyster index sites were identified using a range of selection criteria from other assessment programs, which include:

- sites with previous data;

- sites known to be suitable habitat for Olympia Oyster;
- sites that were accessible and cost effective to survey;
- sites with third party interest to promote future collaborative work; or
- sites that were representative of potential impacts to the species.

Thirteen Olympia Oyster index sites were identified using a mixed approach incorporating these pre-determined criteria, in addition to randomly selected locations.

Extensive surveys conducted in 2009 assessed the distribution of Olympia Oysters and established protocols for surveying population abundance at various density levels (Norgard *et al.* 2010; Stanton *et al.* 2011). The existing range of Olympia Oysters in British Columbia was divided into four zones: North West Vancouver Island (NWVI), South West Vancouver Island (SWVI), Strait of Juan de Fuca (JDF), and Strait of Georgia (SOG). The Central Coast area is known to have populations of Olympia Oyster; however, due to absence of quantitative information and the high costs associated with surveying this area, the Central Coast was omitted from the index site selection process (DFO 2010). In all, thirteen index sites were recommended for surveying population abundance every five years, three in NWVI (Port Eliza, Klaskino Inlet, Amal Inlet), four in SWVI (Darr Island, Bacchante Bay, Hillier Island, Harris Point), two in JDF (Gorge Waterway Site #9, Ayum Creek), and four in SOG (Baker Bay, Jervis Inlet #1, Swy-a-lana Lagoon, Transfer Beach). The selected index sites provide a representative sample of Olympia Oyster populations in distinct geographic zones within the Pacific Region. These sites were selected in addition to five randomly selected sites to reduce bias and create a more statistically rigorous random survey design (DFO 2010).

Although index site selection took into consideration the potential for continued collaborative opportunities with the PSRF and WFT for continual surveying in Port Eliza and the Gorge Waterway, respectively, local and traditional knowledge was not obtained from First Nations, oyster harvesters, or aquaculturists.

### 3. *Have anthropogenic threats been managed through existing management tools?*

Several anthropogenic threats to Olympia Oysters including the introduction of non-native predators and parasites, and commercial and recreational harvest are managed through existing management tools.

The federal *Fisheries Act* and the provincial *Fisheries Act* reduced the recreational bag limit to zero in 2007, and DFO removed Olympia Oysters from shellfish aquaculture licences. In addition, the British Columbia Sport Fishing Guide recommends that recreational Pacific Oyster harvesters shuck their oysters directly on the beach that the oysters are harvested from, or to return empty shells to the same beach for disposal to avoid transfer of the non-native European Green Crab.

DFO's Aquaculture Resource Management Division places restrictions and limitations on new shellfish aquaculture licenses for other commercially harvested shellfish species in known Olympia Oyster habitat (Manning pers. comm. 2015).

Mitigation measures for the transfer of non-native predators and parasites are currently in progress and will require future work to develop management plans and direction for reducing the impact to native species, including the Olympia Oyster. The federal *Fisheries Act*, requires authorization from the ITC to release live fish, including aquaculture species such as shellfish

into any fish habitat or fish rearing facilities. The provincial *Fisheries Act* requires permission to be obtained to plant or introduce oysters, oyster seed, cultch or shells outside of the province and restricts the movement of oyster harvesting equipment in order to prevent the spread of non-native predators and parasites. The ITC was informed of the risk to Olympia Oyster in 2008, but determined that the existing practices would limit likelihood of disease transferences (MacConnachie pers. comm. 2015).

#### 4. *Have resource maps been created?*

Although index sites have been established (DFO 2010), no notations of interest or map reserves were created to aid in protecting index sites since the completion of the Management Plan. Protection measures have not been developed through identifying Olympia Oysters in coast wide mapping land/marine-use planning processes, but the Department will continue to pursue this conservation measure.

However, resource maps were created and are used by DFO Aquaculture Management when reviewing new aquaculture licenses, to determine if proposed leases overlap with known Olympia Oyster habitat (Manning pers. comm. 2015). The WFT have also developed resource maps outlining the distribution and relative abundance of Olympia Oyster populations along the Gorge Waterway in Victoria (Bayus 2014).

#### 5. *Have survey protocols been adopted?*

Index sites for long term monitoring were specifically established at sites that would allow for quantitative assessment. Survey protocols were adopted and are being used to monitor relative abundance at established index sites. These survey protocols, used to measure the relative abundance of Olympia Oysters along the Pacific coast of Canada, were reviewed and rigorously tested throughout the 2009 field season (Norgard *et al.* 2010). Recommendations on survey design were dependent on Olympia Oyster population structure, density, and habitat. The recommendations include:

- Quantitative surveys using either a two-stage or simple random sample design for abundant Olympia Oyster populations and relatively simple habitat.
- Qualitative survey methods for low density or cryptic Olympia Oyster populations to avoid disturbance to oyster habitat.
- A quadrat size of 0.25m<sup>2</sup> for quantitative surveys was adopted.
- Collection of additional biological and ecological information in conjunction with abundance surveys, such as size frequency data providing recruitment rates or voucher specimens to aid in reproductive studies, and histological or molecular analyses.

#### 6. *Have tissue samples been collected for baseline analysis?*

In 2008, tissue samples were collected from survey efforts and used to report on the health status of Olympia Oysters in British Columbia, after a number of parasite infections and diseases were reported in Olympia Oyster populations from Oregon and California (Meyers *et al.* 2010). The study was performed to determine if pathogens or parasites may be contributing to population decline or affecting the ability of Olympia Oyster to rebound after historic overexploitation, and to provide a baseline for future health assessments. Meyers *et al.* (2010) did not detect any pathogens or diseases of concern that would have a significant impact on the health of Olympia Oysters in British Columbia.

Additionally, general disease screening on tissue samples from Nanaimo, Ladysmith and Victoria, British Columbia were analysed in 2012 (Meyers pers. comm. 2015). Although most histological examinations did not detect any pathology or diseases of concern, a variant microcell species (*Mikrocytos* sp.) was detected in one sample from Nanaimo. Disseminated (haemocytic) neoplasia was detected in 26% of specimens from the Gorge Waterway in Victoria, indicating that this disease is likely contributing to mortality in those local populations (Meyers pers. comm. 2015).

*7. Have stakeholders been engaged in implementing management actions?*

With support from the Habitat Stewardship Program for Species at Risk, the WFT was involved in a number of projects working towards community engagement, communication, and outreach.

Since 2009, the WFT has been conducting research and monitoring the Gorge Ecosystem in Victoria. The WFT collaborated with the Capital Regional District of Victoria (CRD), and several other community stakeholder groups to re-locate and salvage a population of Olympia Oysters from the Craigflower Bridge Replacement Project site along the Gorge Waterway in Victoria.

The WFT undertook extensive dive surveys to select appropriate relocation sites within the Gorge Waterway, to mitigate and reduce any harmful impacts from the replacement of the Craigflower Bridge. These sites are monitored annually to evaluate the success of the project, and ensure that the site of the new bridge is conducive to recolonization by new oysters, to compensate for permanently lost habitat (WFT 2014). The Gorge Waterway Initiative works with the CRD to protect and ensure Olympia Oysters are considered in recreational and development activities. These organizations are all actively involved in environmental stewardship, community outreach and education, and environmental management of the Gorge Waterway, Portage Inlet and surrounding watersheds in Victoria.

## **4 Concluding Statement**

Through the implementation of conservation actions, progress has been made towards achieving the management goal and objective outlined in the Management Plan.

The development of survey protocols, and the identification and establishment of index sites for continual monitoring will allow for documentation of changes in relative abundance of Olympia Oyster in British Columbia. Surveys at index sites are conducted regularly, every 2-3 years, and in some cases annually. Once the survey results are analyzed, population trends and changes in relative abundance will be made available for evaluation.

Maintaining the recreational bag limit of zero and restricting the recreational and commercial harvest of Olympia Oyster helps reduce impacts to the population.

Collating all information available on the distribution of non-native predators and parasites has not yet been completed. Once complete, this information will aid in reducing negative impacts to native species in the Pacific region, including the Olympia Oyster.

Although development projects, such as the Craigflower Bridge Replacement Project, worked to reduce negative impacts to the species along the Gorge Waterway through a relocation program, additional conservation actions will be required to regulate future development projects that may disrupt or alter Olympia Oyster habitat. Mitigation measures will need to be further developed to manage current and future threats, to continue to protect Olympia Oysters and their habitat.

While measurable progress has been made towards meeting the goal, objective, and performance measures of the Management Plan, further work is necessary to increase knowledge and understanding of Olympia Oysters, to ensure continued conservation of the species.

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