Fisheries and Oceans Canada | Pêches et Océans Canada
Science | Sciences
Pacific Region
Canadian Science Advisory Secretariat
Science Advisory Report 2009/053

RATIONALE FOR INDEX SITE SELECTION FOR OLYMPIA OYSTERS (*OSTREA LURIDA* CARPENTER, 1864) IN BRITISH COLUMBIA

Figure 1. Olympia Oysters (Ostrea lurida). Source: Royal BC Museum

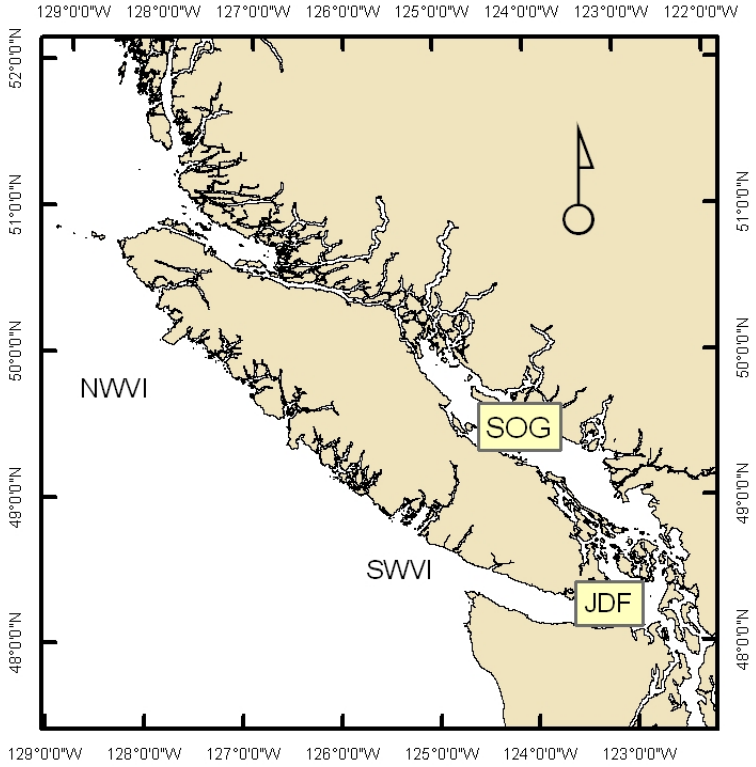

Figure 2. Delineation of strata used in index site selection

Context :

Olympia oysters (Ostrea lurida Carpenter, 1864) were listed under the Species At Risk Act (SARA) as species of Special Concern in 2003. A SARA Management Plan was posted by Fisheries & Oceans Canada (DFO) in 2009. The objective of the Management Plan is to ensure maintenance of the relative abundance of Olympia oysters at index sites over the next six years (2008-2013). One of the identified management actions to reach this objective is to monitor relative abundance levels at index sites at least once every five years. This Science Advisory Report reviews the methodology used to identify index sites for Olympia oyster monitoring and recommend sites for future monitoring.

SUMMARY

- Olympia oysters are managed as a species of Special Concern under the *Species at Risk Act*.
- One of the objectives of the management plan is to conduct relative abundance surveys at index sites.

- To reach this objective relative abundance levels are monitored at index sites at least once every five years using previously reviewed and accepted methodology.
- A review of index site selection methods used in other assessment programs was undertaken. A range of criteria were identified. These criteria were used in the selection of index sites for the Olympia oyster survey program.
- Thirteen Olympia oyster index sites have been identified based on a mix of pre-determined criteria and randomly selected locations.

INTRODUCTION

The Olympia oyster, *Ostrea lurida* Carpenter, 1864 (= *Ostrea conchaphila* Carpenter, 1857 [*partim*]) is one of four species of oysters established in British Columbia (BC), Canada, and the only naturally occurring oyster (Bourne 1997; Gillespie 1999, 2009). Olympia oysters were listed as a species of special concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2000, and under the Species at Risk Act (SARA) in 2003 (COSEWIC 2000; SARA 2003). A management plan for Olympia oysters was completed in 2009 (DFO 2009). One of the required actions in the management plan is the identification of index sites to monitor changes in population abundances. Given the species' sessile nature and generation time, existing threats, funding levels and duration of the management plan, a five-year survey cycle has been established to track changes in population abundances. A previous CSAS peer review process identified appropriate survey methodologies for index sites (Norgard et al 2009).

Index sites are areas that are surveyed regularly using standardized protocols. The assumption behind using an index sites approach is that the area being surveyed is representative of the larger population. By using an index, temporal and spatial variability are controlled. Given that the monitoring program for Olympia oysters is in its infancy, the approach used to identify index sites was assessed.

ASSESSMENT

In reviewing index site selection from other assessment programs a number of common principles were identified. Although not specifically referenced the approaches can be binned into the following categories:

- Site has previous data
- Site is known to be suitable habitat for the species in question
- Site is accessible and cost effective to survey
- Site has interest from third parties to allow for future collaborative work
- Sites were representative of the potential impacts that the species may face.

The identification of index sites as a proxy for measuring population dynamics has been used in a wide variety of assessment programs in DFO. Seven different programs that employ index sites were reviewed (Table 1). Details on approaches used for index site selection are listed in the Sources of Information section. The most commonly used criteria for index site selection has either been to choose sites where the species in question was previously known to reside or to select sites that are convenient and accessible. These approaches may introduce bias into the sampling and may not accurately reflect the true state of the population. Conversely, those sites that are chosen because of pre-existing conditions may already have data that can be added to in future studies. Also, choosing sites that are both convenient and accessible greatly increases the probability of the survey continuing in the future. To provide a balance between statistically rigorous random survey design with the constraints of field sampling and limited budgets, a mixed approach to index site selection is being proposed.

Table 1. Summary of index programs reviewed and principles applied in index site selection.

Program	Applied principles in site selection
Northern abalone (*Haliotis kamtchatkana)* (Hankewich and Lessard 2008)	• Site has previous data
Manila clam (*Venerupis philippinarum*) (Gillespie et al. 2001)	• Site has previous data • Site has interest from third parties to allow for future collaborative work
Giant red sea cucumber (*Parastichopus californicus*) (DFO 1999, N. Duprey, pers. comm.)	• Site has previous data • Site has interest from third parties to allow for future collaborative work
Lingcod (*Ophidon elongatus*) – Juvenile trawl (Workman et al. 1992)	• Site is known to be suitable habitat for the species in question • Site is accessible and cost effective to survey
Lingcod (*Ophidon elongatus*) – Eggmass surveys (King and Beaith 2001, King and Winchell 2002)	• Site is known to be suitable habitat for the species in question
Pacific salmon (Sockeye, Chinook, Coho, Pink & Chum) (C. Parken, pers. comm).	• Site is known to be suitable habitat for the species in question • Site is accessible and cost effective to survey
Atlantic salmon – Miramichi river (Claytor et al. 1991).	• Sites were representative of the potential impacts that the species may face.
Soil quality in Alberta (Cannon 2002)	• Sites were representative of the potential impacts that the species may face.

Index site selection methodology for Olympia oysters.

In the summer of 2009, extensive surveys were undertaken to assess the distribution of Olympia oysters and test different protocols for surveying population abundances at different densities (Norgard et al. 2009). Olympia oysters were present on 74 of 98 beaches visited. Each beach was subsequently categorized as high abundance (H), low abundance (L), visual survey only (V) or not survey-able (N). The V and N categories are beaches where Olympia oysters are present but because of very low densities or location of oysters (on vertical surfaces, under-hangs, etc.) it would be inappropriate to survey them using quantitative methods without detrimental impact to the animals and their habitats. These rankings are subjectively based on observations of field staff.

Olympia oysters have a short pelagic larval phase (2-3 weeks). Ocean and tidal currents prevent the rapid dispersion of juveniles around coastal waters. Threats to the Olympia oyster vary by location (DFO 2009). In the Strait of Georgia habitat disturbance, previous over harvesting and pollution are the greatest concern. On the west coast of Vancouver Island inter-species competition and the introduction of an invasive species (Green crab) pose the greatest threat. With this is mind, it was deemed appropriate to divide the existing range of Olympia oysters into four zones: North West Vancouver Island (NWVI), South West Vancouver Island, (SWVI), Strait of Juan de Fuca (JDF) and Strait of Georgia (SOG). Although populations are known to occur in the Central Coast area of BC, because of lack of quantitative information about these sites and the high cost of surveying in this area, a decision was made not to include them in index site selection.

Partnerships, collaboration and community engagement are important factors to consider when establishing a long-term survey program. Prior to the writing of the Olympia oyster management plan and the development of goals and objectives, oysters have been actively studied by various groups for a variety of reasons. To build on the work done by others, two pre-determined index sites per geographic area were chosen because of existing data or future collaborative opportunities for continual surveying. The majority of these locations have a high density population level. The risk with this approach is that a bias may be introduced that may not accurately reflect the true status of population levels. To address this potential bias two more beaches in NWVI, SOG and one more in SWVI were chosen at random using a random number generator. In JDF there are not sufficient beaches to warrant further surveys, so only the two pre-determined sites were chosen (Table 2, Figure 1).

Table 2. Proposed Olympia oyster index sites in British Columbia. Pre-determined sites met one or more of the commonly used criteria for index site selection. The randomly chosen sites were selected from beaches surveyed in 2009 that had either a "H" or a "L" designation.

Index Site	Pre-determined	Random	Previous data	Suitable habitat	Accessible & cost effective	Third party interest	Representative of potential threats
Northwest Vancouver Is. (NWVI)							
Port Eliza #2 (H)	X		X	X		X	X
Klaskino Inlet (L)	X		X	X			X
Amai Inlet (L)		X		X			X
Southwest Vancouver Is. (SWVI)							
Darr Island (L)	X		X	X			X
Bacchante Bay (L)		X		X			X
Hillier Island (H)		X		X	X		X
Harris Point (H)	X		X	X	X		X
Juan de Fuca Strait (JDF)							
Gorge Waterway Site #9 (H)	X		X	X	X	X	X
Ayum Creek (L)	X			X		X	X
Strait of Georgia (SOG)							
Baker Bay (H)	X		X	X			X
Jervis Inlet #1 (H)		X		X			X
Swy-a-lana Lagoon (L)	X		X	X	X		X
Transfer Beach (L)		X		X	X		X

High abundance (H), low abundance (L)

Site Summary

The following provides a brief summary of each selected site. For a more detailed description please contact the author.

Port Eliza #2
This site was selected was because there had been previous surveys on these beaches and they have been part of a collaborative project with the Puget Sound Restoration Fund. These beaches were originally selected for the collaborative project because it was felt they represented minimally impacted Olympia oyster populations (Norgard et al. 2009).

Klaskino Inlet - This site was selected because previous survey information existed and the population was of sufficient size, albeit relative low abundance, present in distinct beds and therefore surveyable.

Amai Inlet - This site was a randomly selected site.

Darr Island – this site was selected because previous survey information existed.

Bacchante Bay - This site was a randomly selected site.

Hillier Island – This site was a randomly selected site.

Harris Point – This site was selected because previous survey information existed.

Gorge Waterway Site #9 – This site was selected because previous survey information existed, it was easily accessible by land and there is considerable interest in collaborative monitoring with a local stewardship group.

Ayum Creek – This site was selected because a local First Nation indicated the population was surveyable and expressed interest in collaborative monitoring. Adequate population size and suitable habitat for subsequent surveys was confirmed by site visit and survey.

Baker Bay – This site had been selected because previous survey information existed.

Swy-a-lana Lagoon – This site was selected because previous survey information existed and is easily accessible by land.

Jervis Inlet - This site was a randomly selected site.

Transfer Beach - This site was a randomly selected site.

CONCLUSIONS AND ADVICE

Thirteen index sites are recommended to serve as index sites to monitor changes in relative abundance spanning the majority of the Olympia oyster range in Canadian waters (Table 2, Figure 3). The methods for choosing these index sites were a mix of opportunistic sites that have been examined or surveyed previously, supplemented with randomly selected sites that were confirmed to have sufficient populations of varying densities and suitable habitat that would allow subsequent surveys without detrimental impact to the animals or their habitat. Therefore, it is believed that this approach will provide a representative sample of Olympia oyster populations in different geographic zones in the Pacific region.

The definitive northern edge of the Olympia oyster range is unknown. Quantitative, opportunistic surveys are recommended for the Central Coast area.

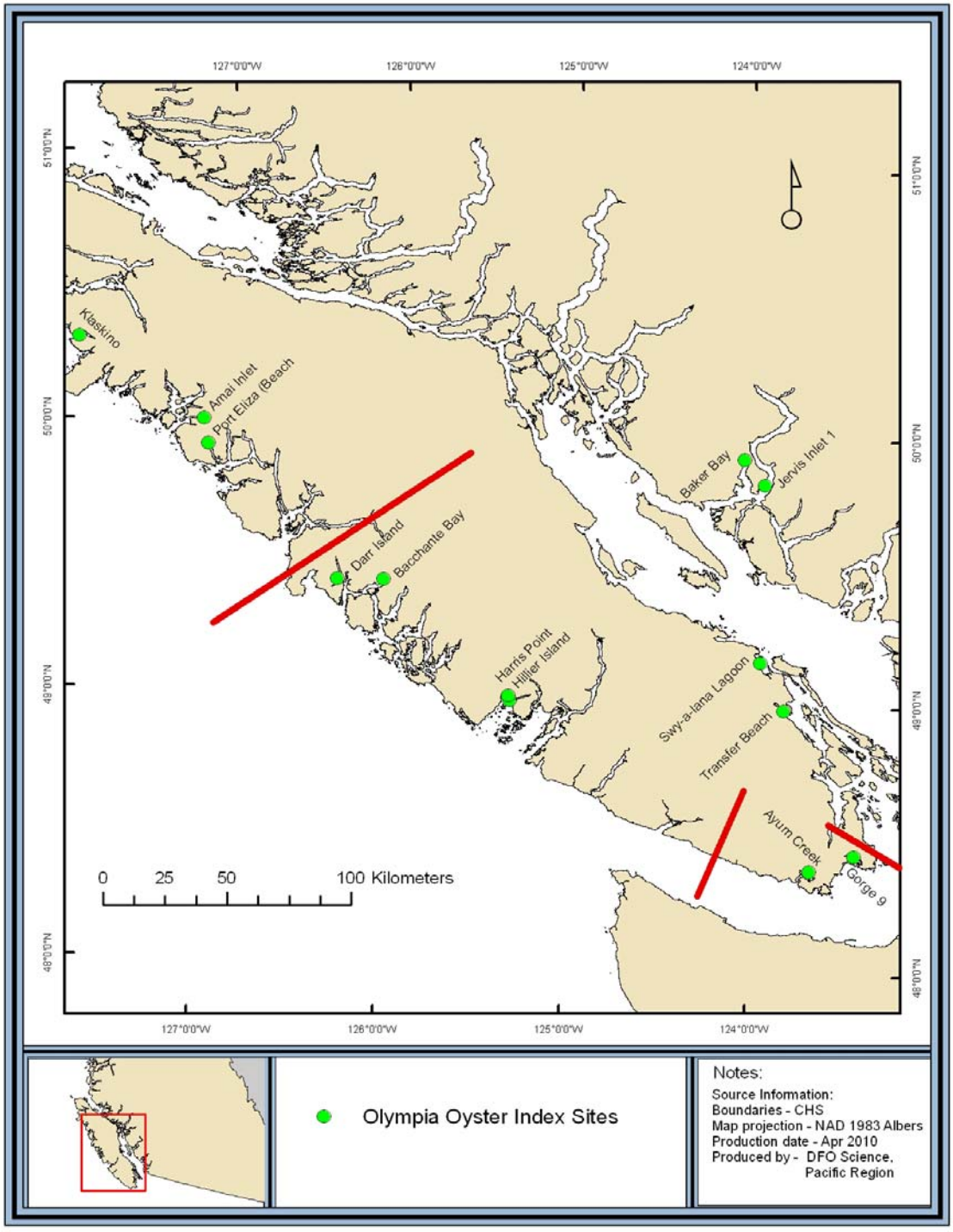

Figure 3. Olympia oyster index sites.

SOURCES OF INFORMATION

Bourne, N. 1997. Molluscan fisheries of British Columbia. NOAA Technical Report NMFS 128:115-130.

Cannon, K.R. 2002. Alberta benchmark site selection and sampling protocols. AESA Soil Quality Resource Monitoring Program. 47p

Claytor, R.R., Chadwick, E.M.P., Nielsen, G.A., Chaput, G.J., Cairns, D.K., Courtenay, S.C., and Dupuis, H.M.C. 1991. Index programs: their value in southern Gulf of St. Lawrence fish stock assessments. ICES C.M. D:1

Connor, D.W., Breen, J., Champion, A., Gilliland, P.M., Huggett, D., Johnston, C., Laffoley, D. d'A., Lieberknecht, L., Lumb, C., Ramsay, K., and Shardlow, M. 2002. Rationale and criteria for the identification of nationally important marine nature conservation features and areas in the UK. Version 02.11. Peterborough, Joint Nature Conservation Committee (on behalf of the statutory nature conservation agencies and Wildlife and Countryside Link) for the Defra Working Group on the Review of Marine Nature Conservation. 23p.

COSEWIC. 2000. Status report on the Olympia Oyster, *Ostrea conchaphila*, in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa. 30p.

DFO. 1999. Giant Red Sea Cucumber. DFO Science Stock Status Report C6-10 (1999). 5p

DFO. 2009. Management Plan for the Olympia oyster (*Ostrea conchaphila*) in Canada. Species at Risk Act Management Plan Series. Fisheries and Oceans Canada, Ottawa. v + 31 p.

Duprey, Nick. Personal communication. Sea cucumber biologist. Pacific Biological Station. Fisheries and Oceans Canada. Nanaimo BC.

Gillespie, G.E. 1999. Status of the Olympia oyster, *Ostrea conchaphila*, in Canada. DFO Canadian Stock Assessment Secretariat Research Document 99/150. 36 p.

Gillespie, G.E. 2009. Status of the Olympia oyster, *Ostrea lurida* Carpenter, 1864, in British Columbia, Canada. Journal of Shellfish Research 28(1):59-68.

Gillespie, G.E., Norgard, T.C., and Scurrah, F.E. 2001. Status of Manila clam (*Venerupis philippinarum*) stocks in Area 7, British Columbia, with a proposal for active management of a data-limited fishery. Canadian Science Advisory Secretariat Research Document 2001/089. 59 p. Available from www.dfo-mpo.gc.ca/csas-sccs.

Hankewich, S., and Lessard, J. 2008. Resurvey of northern abalone, *Haliotis kamtschatkana,* populations along the central coast of British Columbia, May 2006. Can. Manuscr. Rep. Fish. Aquat. Sci.2838: vi + 41 p.

Krause, J.C., Boedeker, D., Backhausen, I., Heinicke, K., Grob, A., and von Nordheim, H. 2006. Rationale behind site selection for the NATURA 2000 network in the German EEZ. German Federal Agency for Nature Conservation, branch office: Isle of Vilm. *In:* Progress in Marine Conservation in Europe. Springer Berlin Heidelberg

King, J.R. and Beaith, B.W. 2001. Lingcod (*Ophiodon elongatus*) nest density SCUBA survey in the Strait of Georgia, January 16-April 26, 2001. Can. Tech. Rep. Fish. Aquat. Sci. 2374: 21 p.

King, J.R., and Winchell, P.M. 2002. Lingcod (*Ophiodon elongatus*) egg mass density SCUBA survey in the Strait of Georgia, January 15-March13,2002. Can. Tech. Rep. Fish. Aquat. Sci. 2437: 16 p.

Norgard, T.C., Davies, S, Stanton, L.M., and Gillespie, G.E. 2009. Evaluation of survey methodologies for monitoring Olympia Oyster (*Ostrea lurida* Carpenter, 1864) populations in British Columbia, DFO Can. Sci. Advis. Sec. Res. Doc 2010/006. iv + 56p. Available from www.dfo-mpo.gc.ca/csas-sccs.

Parken, Chuck. Personal communication. Acting Section Head Salmon Assessment. Pacific Biological Station. Fisheries and Oceans Canada. Nanaimo BC.

SARA 2003. Species at Risk Act. http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=645

Workman, G.D., Yamanaka, K.L., and Richards, L.J. 1992. Bottom Trawl Survey of Young-of-the-Year Lingcod (*Ophiodon elongtus*) in the Strait of Georgia by the R/V CALIGUS, June 15- August 3, 1991. Can. Manuscr. Rep. Fish. Aquat. Sci. 2167: 35 p.

FOR MORE INFORMATION

Contact: Sean MacConnachie
Pacific Biological Station
3190 Hammond Bay Rd
Nanaimo BC
V9T 6N7
Tel: 250-756-7223
Fax: 250-756-7138
E-Mail: Sean.MacConnachie@dfo-mpo.gc.ca

This report is available from the:

Centre for Science Advice (CSA)
Pacific Region
Fisheries and Oceans Canada
Pacific Biological Station
3190 Hammond Bay Road
Nanaimo, B.C. V9T 6N7

Telephone: 250-756-7208
Fax: 250-756-7209
E-Mail: csap@dfo-mpo.gc.ca

Internet address: www.dfo-mpo.gc.ca/csas-sccs

ISSN 1919-5079 (Print)
ISSN 1919-5087 (Online)

La version française est disponible à l'adresse ci-dessus.

CORRECT CITATION FOR THIS PUBLICATION

DFO. 2010. Rationale for index site selection for Olympia Oysters (*Ostrea luridea* Carpenter 1864) in British Columbia. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2010/053.