



MONTEREY BAY AQUARIUM®

Seafood WATCH

Eulachon

Thaleichthys pacificus



(©B. Guild Gillespie/www.chartingnature.com)

Pacific Canada, British Columbia
Net

December 14, 2012

Kelsey James, Consulting Researcher

Disclaimer

Seafood Watch® strives to ensure all our Seafood Reports and the recommendations contained therein are accurate and reflect the most up-to-date evidence available at time of publication. All our reports are peer-reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science or aquaculture. Scientific review, however, does not constitute an endorsement of the Seafood Watch program or its recommendations on the part of the reviewing scientists. Seafood Watch is solely responsible for the conclusions reached in this report. We always welcome additional or updated data that can be used for the next revision. Seafood Watch and Seafood Reports are made possible through a grant from the David and Lucile Packard Foundation.

Final Seafood Recommendation

Eulachon caught in the British Columbia, Canada net fisheries should be **Avoided**.

Stock	Fishery	Impacts on the Stock	Impacts on other Species	Management	Habitat and Ecosystem	Overall
		Rank (Score)	Lowest scoring species Rank*, Subscore, Score	Rank Score	Rank Score	Recommendation Score
Eulachon	Net	Red 1.53	No other main species caught Green, 5,5	Red 1	Green 3.46	AVOID 2.27

Scoring note – scores range from zero to five where zero indicates very poor performance and five indicates the fishing operations have no significant impact.

Table of Contents

Introduction	5
Analysis	8
<i>Criterion 1: Stock for which you want a recommendation</i>	8
<i>Criterion 2: Impacts on other retained and bycatch stocks</i>	11
<i>Criterion 3: Management effectiveness</i>	13
<i>Criterion 4: Impacts on the habitat and ecosystem</i>	17
Overall Recommendation	19
Acknowledgements.....	20
Appendix A: Review Schedule.....	22
About Seafood Watch®	23
Guiding Principles	24

Executive Summary

Eulachon (*Thaleichthys pacificus*) is an anadromous smelt that inhabits the Northeast Pacific. This analysis addresses the fishing of this species by net gear (seine and conical) in rivers along the British Columbian Coast, Canada.

Eulachon has low vulnerability, but in the Fraser River area the population is below estimated reference points. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has now listed two eulachon areas in British Columbia as endangered (Central and Fraser) and the third area (Nass/Skeena) is under reassessment. No commercial or recreational fisheries in freshwater occur for eulachon in British Columbia, only First Nation communities are allowed to fish and they determine in-season, if stock abundance is high enough that fishing can take place. Despite reduced fishing pressure, stocks are not recovering, but this may not be due to target fishing.

Fishing is conducted over a very short time period—only during the spawning run in early spring where eulachon aggregate and move up British Columbian rivers. First Nations fishing is highly selective using conical and seine nets set for only a few hours or for as long as overnight. Bycatch for this fishery is minimal due to gear utilized and short fishery duration. Salmon (fry) could be caught during fishing for eulachon, but there is no mention of salmon catch in eulachon fisheries in the COSEWIC reports, therefore, bycatch species are not assessed in this report.

Target fishing during the eulachon runs is highly restricted with no commercial or recreational fisheries (only First Nations fishing). The restrictions are enforced by the Department of Fisheries and Oceans (DFO). Eulachon fishing mortality from the freshwater target fisheries is not sufficiently managed through fishing regulations, and other threats besides target fishing mortality are likely prolonging or causing the depression of eulachon populations. Eulachon stocks are severely depleted from historic levels, and while recovery goals have been suggested to stop population depletion and to increase abundance, no timelines to implementation have been drafted. Scientific monitoring to evaluate specific river populations and to better quantify offshore biomass need to be developed and implemented, especially since substantial gaps in the knowledge of eulachon biology still exist. Overall, management of retained species is a high concern due to continued targeting of an endangered species. Eulachon effectively is the only species caught in this fishery therefore no bycatch management is necessary.

Net gear, seine and conical, has a low impact on the substrate. Eulachon fishing is highly regulated with very limited fishing opportunities in the Fraser River, therefore, there is strong mitigation in place. Eulachon are considered exceptional species due to their importance as a prey species for marine, freshwater and terrestrial animals. Current research is investigating the role eulachon plays in ecosystem processes, therefore ecosystem and food web considerations are a moderate concern.

Introduction

Scope of the analysis and ensuing recommendation

Eulachon (*Thaleichthys pacificus*) is an anadromous smelt that inhabits the Northeast Pacific. This analysis addresses the fishing of this species by net gear (seine and conical) in rivers along the British Columbian coast, Canada (Moody and Pitcher 2010).

Overview of the species and management bodies

Eulachon (*Thaleichthys pacificus*) is a small anadromous smelt that occurs only along the Northwest Pacific coast from northern California, USA to the southern Bering Sea (Moody and Pitcher 2010). Eulachon returns to about 38 British Columbian rivers in early spring to spawn (Hay and McCarter 2000, Moody and Pitcher 2010, COSEWIC 2011). It attains 25 cm fork length (FL) depending on the river and attains sexual maturity around 3 years in British Columbian waters (Pedersen et al. 1995, Clark et al. 2007). Eulachon is semelparous (DFO 2012). Between hatching and spawning, eulachon are found in near-benthic habitats on the offshore shelf around Dixon Entrance, Hecate Strait, Queen Charlotte Sound and the West Coast of Vancouver Island, generally between 80 and 200 m depth (COSEWIC 2011, DFO 2012).

Eulachon are most important to First Nations people of British Columbia, Canada, who have utilized this resource since before the 1800s (Moody and Pitcher 2010). Eulachon, also known as the candlefish, are used for food, smoked or “grease,” which is rendered from aged or rotted fish and is a staple in the diets of the First Nations people (Moody and Pitcher 2010).

Today, the people of First Nations are permitted to fish for eulachon (DFO 2012). There is a very minor recreational fishery in select tidal waters, but commercial fishing is not allowed (DFO 2012). The fishery is managed under the Integrated Fisheries Management Plan for the Fraser River and Fisheries and Oceans Canada throughout British Columbia (DFO 2012). The Integrated Fisheries Management Plan, despite managing only the Fraser River, has thorough background on eulachon fisheries throughout British Columbia, Canada (DFO 2012). Eulachon are mostly managed by individual First Nations, but are considered by COSEWIC in three areas: the Nass/Skeena, Central, and Fraser (Figure 1; COSEWIC 2011). Of the 38 British Columbian rivers in which the eulachon spawn, 3 are in the Nass/Skeena area, 34 in the Central area, and 1 in the Fraser area (COSEWIC 2011). Only 12 of the rivers have a consistent return of eulachon from year to year; 2 in Nass/Skeena, 5-9 in Central, and 1 in Fraser (Moody and Pitcher 2010; COSEWIC 2011). The genetic structure and the number of populations within each area is not well understood (COSEWIC 2011), therefore the three areas (Nass/Skeena, Central, and Fraser) will be used in this report.

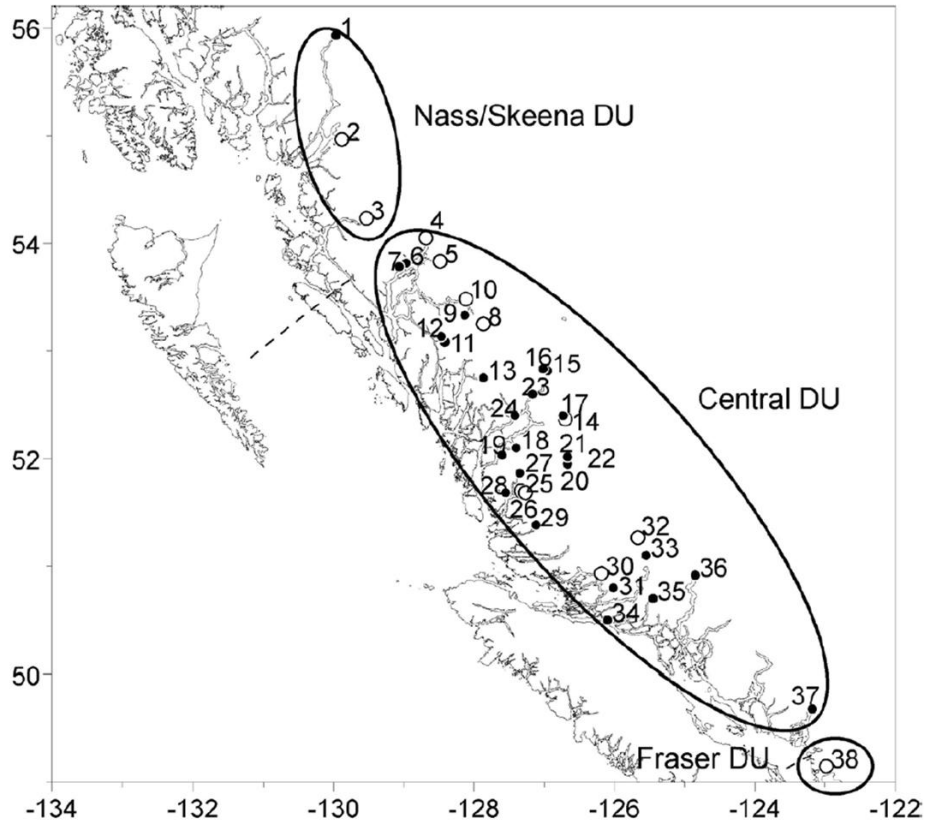


Figure 1. Suggested areas in British Columbia from COSEWIC (2011). DU stands for designatable unit, which is termed 'area' in this report. Open circles indicate rivers that are believed to have regular annual spawning runs and closed circles are rivers without annual spawning runs.

Commercial fisheries used to exist for the Nass River system until the 1940s and the Fraser River system until 1997 (DFO 2012). Catches are primarily recorded by individual First Nations communities therefore a composite record of catch over time is poorly known (Moody and Pitcher 2010). From patchy data the Nass River fishery had peak catches around 1900 and again around 1950 (Moody and Pitcher 2010). The Fraser River fishery had peak catches also around 1900 and around the 1950s and 1960s (Moody and Pitcher 2010). Eulachon populations, coast-wide, have generally experienced a sharp downward trend during the last 30-40 years due to a combination of habitat degradation, predation, bycatch and direct fishing (COSEWIC 2011).

Production statistics

Eulachon inhabits only coastal Northeast Pacific waters (Moody and Pitcher 2010) so all production originates from this region. British Columbian production was about 400 mt in 2005 and has decreased in more recent years (COSEWIC 2011). Production since 2004 is solely from First Nations fishing, which catch and consume most of the eulachon products (COSEWIC 2011).

US production has been less than 10 mt since 2005 (pers. comm. National Marine Fisheries Service, Fisheries Statistics Division, Silver Spring, MD 2012).

Importance to the US/North American market

There currently is no commercial fishery for eulachon in British Columbia, Canada (DFO 2012), so no imports to the United States occur. Eulachon spawning runs also occur in Alaskan, Washington, Oregon, and California rivers (Moody and Pitcher 2010) therefore, the US does not rely on British Columbia fisheries, and US fishing of eulachon is not covered in this report.

Common and market names

Common and market names are eulachon, candlefish, and salvation fish (Moody and Pitcher 2010). There are many variations on spelling such as: ooligan, eulachon, hooligan, olachen, olachon, oolachan, ollichan, and oulachan and First Nations communities have words for eulachon in their own languages as well (Moody 2008).

Primary product forms

Eulachon is eaten fresh, smoked, salted, and frozen whole (Moody and Pitcher 2010). The highest value product is the “grease,” which is produced from aged or rotted fish that are cooked until the oil has separated from the flesh (Moody and Pitcher 2010). Eulachon grease has important social and ceremonial purposes for First Nations people (Moody and Pitcher 2010).

Analysis

Scoring guide

- All scores result in a zero to five final score for the criterion and the overall final rank. A zero score indicates poor performance, while a score of five indicates high performance.
- The full Seafood Watch Fisheries Criteria that the following scores relate to are available on our website at www.seafoodwatch.org.

Criterion 1: Stock for which you want a recommendation

Guiding principles

- The stock is healthy and abundant. Abundance, size, sex, age and genetic structure should be maintained at levels that do not impair the long-term productivity of the stock or fulfillment of its role in the ecosystem and food web.
- Fishing mortality does not threaten populations or impede the ecological role of any marine life. Fishing mortality should be appropriate given current abundance and inherent resilience to fishing while accounting for scientific uncertainty, management uncertainty, and non-fishery impacts such as habitat degradation.

Summary

Stock	Fishery	Inherent Vulnerability Rank	Stock Status Rank (Score)	Fishing Mortality Rank (Score)	Criterion 1 Rank (Score)
Eulachon	Net	Low	Very High Concern (1)	Moderate Concern (2.33)	Red (1.53)

Eulachon has low vulnerability, but in the Fraser River area the population is below estimated reference points. The COSEWIC has now listed two eulachon areas in British Columbia as endangered (Central and Fraser) and the third area (Nass/Skeena) is under reassessment. No commercial or recreational fisheries in freshwater occur for eulachon in British Columbia; only First Nation communities are allowed to fish and they determine in-season, if stock abundance is high enough to allow fishing to take place. Despite reduced fishing pressure, stocks are not recovering, but this may not be due to target fishing.

Justification of Ranking

Eulachon

Factor 1.1 Inherent Vulnerability: Low

Key relevant information:

Fishbase vulnerability score is 33 (www.fishbase.org). For this reason, eulachon inherent vulnerability is deemed high.

Factor 1.2 Stock status: Very high concern

Key relevant information:

Eulachon is below limit reference points, which only exist for the Fraser River; a spawning stock biomass (SSB) of 500 tonnes (COSEWIC 2011; DFO 2012). Central and Fraser areas in British Columbia have been assessed by COSEWIC as endangered (COSEWIC 2011). The Nass/Skeena area is under reassessment by COSEWIC.

Detailed rationale:

Current spawning run size for the Nass/Skeena area are estimated to be less than 10% of what they were in the 1980s from catch data, which goes back to 1929 but is sporadic (COSEWIC 2011). The spawning biomass of the Nass/Skeena area is estimated at 400 t (10,000,000 mature individuals). Many rivers in the Central area reported virtually zero spawning biomass in 2009 (COSEWIC 2011). The largest spawning biomass in the Central area is in the Klinaklini River. It had 16 t (~375,000 mature individuals) of spawning biomass in 2009. This figure has been declining since at least the mid-1990s (COSEWIC 2011). The SSB of the Fraser River is ~ 25 t (600,000 individuals; COSEWIC 2011). It is estimated that the Fraser River population has declined 98% over the last 10 years, but declines in the runs have been observed by the First Nations in this area since 1952 (COSEWIC 2011). The reference point for the Fraser River was calculated from egg and larval surveys combined with river discharge rates and relative fecundity (COSEWIC 2011). Reference points are not available for other areas because they have not been calculated. Eulachon abundance has been estimated using the best available data in a variety of ways: fishery data within rivers, egg and larvae surveys, offshore trawl surveys, and historical information (COSEWIC 2011).

Factor 1.3 Fishing mortality: Moderate concern

Key relevant information:

Eulachon are assessed as endangered by COSEWIC (2011) for two of three areas, and severe limitations have been placed on fishing such that no commercial or recreational fishing is allowed in freshwater throughout British Columbia (DFO 2012). First Nations catch and historic commercial catch has varied among years and areas (Figure 2). Recent catches have been 0.2 mt in the Fraser River in 2011, 92 mt in the Kitimat River (Central area) in 2007, and 164 mt in the Nass/Skeena area in 2009 (COSEWIC 2011). Many of the rivers in the Central area have

recently had no catches (COSEWIC 2011). British Columbia eulachon are of special concern and there is fishery management in place (see Factor 3), however, recovery has not occurred since the last commercial fishery in 2004 (COSEWIC 2011). Fishing is an uncertain component in the continued depression of eulachon stocks, but is only one possibility of many that are potentially affecting the population (Levesque and Therriault 2011). Other possible threats to the eulachon population include predation (See Factor 4.3), environmental shifts, bycatch of eulachon in other fisheries (See Factor 3), pollution, river dredging, forest removal, and industrial development (Levesque and Therriault 2011). For this reason the fishing mortality on British Columbia eulachon is unknown.

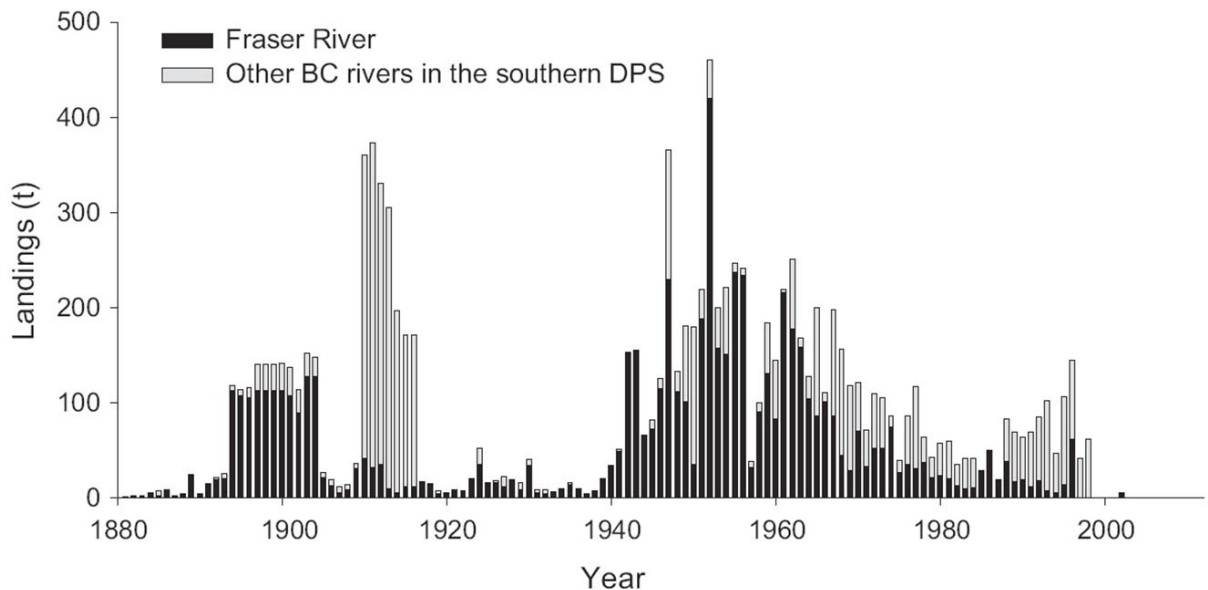


Figure 2. Available commercial and First Nations fisheries landings in British Columbia excluding the Nass/Skeena area. Light grey bars represent the Central area landings. Adapted from Gustafson et al. 2012.

Detailed rationale:

Recreational fishing is open in tidal waters of the North Coast (Nass/Skeena area) and inshore waters of Vancouver Island by gillnet and dip net with a daily limit of 20 kg and a possession limit of 40 kg (with a British Columbia sport fishing license; Levesque and Therriault 2011, DFO 2012). Recreational fishing is prohibited in tidal waters of Fraser River and the Central Coast (Levesque and Therriault 2011, DFO 2012). There is no catch reporting program for recreational fishing, but it is believed to be minor (DFO 2012).

Criterion 2: Impacts on other retained and bycatch stocks

Guiding principles

- The fishery minimizes bycatch. Seafood Watch® defines bycatch as all fisheries-related mortality or injury other than the retained catch. Examples include discards, endangered or threatened species catch, pre-catch mortality and ghost fishing. All discards, including those released alive, are considered bycatch unless there is valid scientific evidence of high post-release survival and there is no documented evidence of negative impacts at the population level.
- Fishing mortality does not threaten populations or impede the ecological role of any marine life. Fishing mortality should be appropriate given each impacted species' abundance and productivity, accounting for scientific uncertainty, management uncertainty and non-fishery impacts such as habitat degradation.

Summary

Stock	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore	Score (subscore*discard modifier)	Rank (based on subscore)
	Rank	Rank (Score)	Rank (Score)			
No other main species caught				5.00	5.00	Green

Justification of Ranking

The fishery is conducted over a very short time period—only during the spawning run in early spring where eulachon aggregates and moves up British Columbian rivers (Moody and Pitcher 2010). Fishing is further restricted to one day per year for each First Nations fishing license in the Fraser River (DFO 2012). Fishing is highly selective, using conical, gill and seine nets set for a few hours to overnight (Moody, pers. comm.). Bycatch for this fishery is minimal due to the gear types used, short fishery duration, and anything captured could easily be released due to the gear used (Moody, pers. comm.). Post-release mortality of potential bycatch is unknown, but bycatch is minimal despite potential effects. Salmon (fry) could be caught during eulachon fishing, but there is no mention of the salmon catch in the COSEWIC reports (2002; 2003a; 2003b; 2006), therefore, they are not assessed in this report.

Detailed Rationale:

Salmon exist throughout British Columbia, but there are only three endangered and one threatened population that could potentially be caught in seine and conical nets used for eulachon fishing. The fry of these salmon populations are moving towards the ocean during spring (COSEWIC 2002; 2003a; 2003b; 2006), which is when eulachon fishing occurs. The three endangered populations are coho salmon (*Oncorhynchus kisutch*) of the Interior Fraser population, and sockeye salmon (*Oncorhynchus nerka*) of the Sakinaw and Cultus population (COSEWIC 2002; 2003a; 2003b). The threatened population is Chinook salmon (*Oncorhynchus tshawytscha*) of the Okanagan population (COSEWIC 2006). All of these populations inhabit

specific river basins and are mainly threatened by habitat degradation and fishing mortality from mixed-stock salmon fisheries (COSEWIC 2002; 2003a; 2003b; 2006). There is no documentation of these populations being caught in eulachon fisheries and these populations are heavily studied (COSEWIC 2002; 2003a; 2003b; COSEWIC 2006), therefore, they are not assessed in this report.

Factor 2.4: Discard Rate: 0%–20%

Criterion 3: Management effectiveness

Guiding principle

The fishery is managed to sustain the long-term productivity of all impacted species. Management should be appropriate for the inherent resilience of affected marine life and should incorporate data sufficient to assess the affected species and manage fishing mortality to ensure little risk of depletion. Measures should be implemented and enforced to ensure that fishery mortality does not threaten the long-term productivity or ecological role of any species in the future.

Summary

Fishery	Management: Harvest Strategy Rank (Score)	Management: Bycatch Rank (Score)	Criterion 3 Rank (Score)
Net	Very High Concern (1)	All species retained (N/A)	Red (1)

Target fishing during the eulachon runs is highly restricted with no commercial or recreational fisheries (only First Nations fishing). The restrictions are enforced by the DFO. Eulachon fishing mortality from the freshwater target fisheries is not sufficiently managed through fishing regulations, and other threats besides target fishing mortality are likely prolonging or causing the depression of eulachon populations. Eulachon stocks are severely depleted from historic levels and although recovery goals have been suggested to stop population depletion and increase abundance, no timelines to implementation have been drafted. Scientific monitoring to evaluate specific river populations and better quantify offshore biomass need to be developed and implemented, especially since substantial gaps in the knowledge of eulachon biology still exist. Overall, management of retained species is a high concern due to the continued targeting of an endangered species. Eulachon effectively is the only species caught in this fishery, therefore, no bycatch management is necessary.

Justification of Ranking

Factor 3.1 Management of fishing impacts on retained species

Fishery	Critical?	Mgmt strategy and implement.	Recovery of stocks of concern	Scientific research and monitoring	Scientific advice	Enforce.	Track record	Stakeholder inclusion
Net	No	Ineffective	Ineffective	Moderately Effective	Highly Effective	Moderately Effective	Ineffective	Highly Effective

Key relevant information:

Fishing is highly restricted with no commercial or recreational fisheries, and these restrictions are enforced by DFO (DFO 2012). Directed fishing on an endangered species that does not show signs of recovery is a serious concern. Other threats besides directed fishing mortality are likely prolonging or causing the depression of eulachon populations (Levesque and Therriault 2011). Eulachon stocks are severely depleted from historic levels (DFO 2012) and while recovery goals to stop population depletion and increase abundance have been put forth, no timelines to implementation have been drafted (Levesque and Therriault 2011). Scientific monitoring to evaluate specific river populations and better quantify offshore biomass need to be developed and implemented, especially since substantial gaps in the knowledge of eulachon biology still exist (Levesque and Therriault 2011). The management strategy is insufficiently precautionary to protect populations therefore overall management of retained species is a very high concern.

Detailed rationale:*Management Strategy and Implementation*

Currently no commercial or recreational fishing is allowed throughout British Columbia, and only restricted First Nations fishing is allowed (COSEWIC 2011). Mitigation for identified threats to eulachon populations have been detailed for directed catch, bycatch, and river dredging (Levesque and Therriault 2011). Proposed mitigation must be tested for effectiveness to reduce threats on eulachon (Levesque and Therriault 2011). Existing mitigations include the integrated fisheries management plan by DFO for Fraser River that prohibits all commercial and recreational fishing. This plan has strong restrictions on First Nations, allowing only one harvest day per communal license (DFO 2012). The overall objective of the eulachon fishery management in the Fraser River area is to respond to conservation concerns with Fraser River stocks and to introduce measures that allow for stock rebuilding (Levesque and Therriault 2011). Other existing mitigation include limits on eulachon bycatch by the offshore shrimp trawl fisheries, and limits on in-river dredging that affect eulachon spawning habitat (Levesque and Therriault 2011). The bycatch of eulachon in offshore trawl fisheries is monitored at very low rates (0.5%–4%) therefore it is difficult to accurately determine the impacts on eulachon from this bycatch. DFO has been working specifically with the shrimp trawl fishery (the fishery with the most eulachon bycatch) to minimize this bycatch. Current management measures include mandatory bycatch reduction devices (BRDs) for all shrimp trawl nets and a bycatch limit of one percent of the offshore abundance index (DFO 2012). If this limit is exceeded, management actions could include: “closure of shrimp trawl fishery, closure of certain areas to shrimp trawling, or restricting trawling to beam trawlers, which have been found to have a lower impact on eulachon than otter trawlers” (DFO 2012). Management strategies are in place to address threats to the eulachon population, but the poor status of eulachon stocks shows that these strategies are not enough to ensure the prevention of the ongoing depression of the stock. As a result, the management strategy and implementation is deemed ineffective.

Recovery of stocks of concern

The selection of specific recovery targets is necessary for threatened and/or endangered stocks, and population targets should be developed for each of the three areas (Levesque and Therriault 2011). Immediate short-term and long-term recovery goals have been put forth but with no significant change to the likelihood of extinction or towards an improvement in population size to an eventual COSEWIC rating of “not at risk” (Levesque and Therriault 2011). No timelines have been put forth to project recovery since population growth rates are unknown (Levesque and Therriault 2011). No studies have documented that human intervention will promote eulachon productivity (Levesque and Therriault 2011). The rebuilding strategies put forth have an unknown probability for success. Despite the small size of the direct fishery it is contributing substantially to eulachon’s mortality, and until all fishing stops or is shown to be compatible with recovery, the recovery strategies are ineffective.

Scientific Research and Monitoring

Consistent abundance monitoring programs to evaluate populations do not exist for most rivers (Levesque and Therriault 2011). Annual larval assessment was one of the top three research recommendations from a 2007 workshop (Pickard and Marmorek 2007; Levesque and Therriault 2011). More research needs to be done to assess what will promote or what is preventing eulachon recovery. Substantial gaps exist in our knowledge of eulachon biology and ecology, including life history parameters, population size, population structure, genetics, habitat use, and requirements (Levesque and Therriault 2011). Data related to stock abundance is collected where possible, therefore, the scientific research and monitoring is moderately effective.

Scientific Advice

Scientific advice will support the development of specific recovery targets (Levesque and Therriault 2011). The drivers behind the coast-wide eulachon decline are unclear as are the reasons preventing their recovery, however, all the known or potential sources of mortality have been described (Levesque and Therriault 2011). In 2005, Therriault and McCarter (2005) recommended that no directed fishery for eulachon on Fraser River be allowed, including recreational, commercial, and First Nations. Neither recreational nor commercial fisheries have existed since, and First Nations fishing is restricted, especially in the Fraser River (DFO 2012). Management has consistently followed scientific advice, therefore, it is deemed highly effective.

Enforcement

Fishery officers (DFO Conservation and Protection) conduct directed and opportunistic patrols of the fishing area during open and closed seasons in the Fraser River (DFO 2012). First Nations are required to report their eulachon catches (DFO 2012), and generally, regulate the fishing of this resource individually. Regulation enforcement is lacking in the monitoring of eulachon bycatch in the offshore shrimp trawl fisheries (Levesque and Therriault 2011). Without informed estimates of fishing mortality due to bycatch, the enforcement is deemed moderately effective.

Track Record

Eulachon populations coast-wide have generally been experiencing a sharp downward trend with some rivers being severely depleted (DFO 2012). In 2005 each of the reference point indicators had signaled conservation concern for the Fraser River (Therriault and McCarter 2005) and no recreational or commercial fishery has occurred in British Columbian waters since (DFO 2012). Most in-river populations are low compared to historic levels (Levesque and Therriault 2011). The track record is ineffective since eulachon populations have yet to show signs of recovery over seven years of restricted fishing.

Stakeholder inclusion

Discussions of eulachon harvest management issues are conducted with an open and transparent consultation process and directly with First Nations, stakeholders and members of the public (DFO 2012). For this reason, the stakeholder inclusion is highly effective.

Factor 3.2 Management of fishing impacts on bycatch species

Fishery	All Species Retained?	Critical?	Mgmt strategy and implement	Scientific research and monitoring	Scientific advice	Enforce
Net	Yes					

Key relevant information:

N/A All species retained

Criterion 4: Impacts on the habitat and ecosystem

Guiding principles

- The fishery is conducted such that impacts on the seafloor are minimized and the ecological and functional roles of seafloor habitats are maintained.
- Fishing activities should not seriously reduce ecosystem services provided by any fished species or result in harmful changes such as trophic cascades, phase shifts or reduction of genetic diversity.

Summary

Fishery	Impact of gear on the substrate	Mitigation of gear impacts	EBFM	Criterion 4
	Rank (Score)	Rank (Score)	Rank (Score)	Rank (Score)
Net	Low Concern (3)	Strong mitigation (1)	Moderate Concern (3)	Green (3.46)

Net gear, seine and conical all have low impact on the substrate. Eulachon fishing is highly regulated with very limited fishing opportunities in the Fraser River; therefore, there is strong mitigation in place. Eulachon are considered 'exceptional species' due to their importance as a prey species for marine, freshwater, and terrestrial animals. Current research is investigating the role eulachon plays in ecosystem processes, therefore, ecosystem and food web considerations are a moderate concern.

Justification

Net

Factor 4.1 Impact of the fishing gear on the substrate: Low impact

Key relevant information:

Nets, seine and conical are operated by First Nations people fishing for eulachon in British Columbian rivers (Moody 2008). These nets have a low impact on the substrate because they contact the seafloor but are not mobile during fishing.

Detailed rationale:

Eulachon attach their eggs to sand or pebbles (DFO 2012) so the fishery occurs over soft sediment. Both seine nets and conical nets contact the bottom (Moody 2008). Gillnets and dip nets are used in the recreational fishery, but have a similar impact and the impact from the recreational fishery is considered minor (DFO 2012).

Factor 4.2 Modifying Factor: Mitigation of fishing gear impacts: Strong mitigation

Key relevant information:

Net fishing in British Columbian waters is highly regulated—one day per year per First Nations fishing license in the Fraser River (DFO 2012). First Nations eulachon fishing is highly regulated in other rivers as well by the First Nations themselves (Levesque and Therriault 2011). Eulachon spawning occurs for only a short period of time in early spring (Moody and Pitcher 2010). According to DFO (2012), “under normal operating circumstances, there is minimal to no environmental impact from gear types used in the eulachon fishery.” Due to the limited entry, short duration, and small fishing area of the fishery, there is strong mitigation of net impact.

Factor 4.3 Ecosystem and Food Web Considerations: Moderate concern

Key relevant information:

Eulachon are considered an ‘exceptional species,’ according to the Seafood Watch criteria, because they are an important prey species for marine and freshwater fish, mammals, and birds, providing a large amount of energy-rich food when food is otherwise scarce in the early spring (Moody and Pitcher 2010). Salmon and trout are reported to feed on eulachon eggs and larvae (DFO 2012). There is no current information available on the appropriate conservation limits for eulachon based on ecosystem considerations (DFO 2012). Current research is investigating the role eulachon plays in ecosystem processes (DFO 2012). For this reason, the ecosystem and food web considerations is deemed a moderate concern.

Detailed rationale (optional):

Marine predators include dogfish (*Squalus suckleyi*), Pacific cod (*Gadus macrocephalus*), hake, salmon, pollock, halibut, rockfish, marine mammals, and seabirds. Riverine predators include white sturgeon (*Acipenser transmontanus*), Stellar’s sea lions (*Eumetopias jubatus*), harbor seals (*Phoca vitulina*) and eagles (DFO 2012). A potentially serious side-effect of eulachon decline in Fraser River is a deleterious impact on the endangered white sturgeon, especially juveniles that scavenge on expired eulachon (Pickard and Marmorek 2007, COSEWIC 2011).

Overall Recommendation

Final Score = geometric mean of the four scores (Criterion 1, Criterion 2, Criterion 3, Criterion 4).

The overall recommendation is as follows:

- **Best Choice** = Final Score between 3.2 and 5, **and** no Red Criteria, **and** no Critical scores
- **Good Alternative** = Final score between 2.2 and 3.199, **and** Management is not Red, **and** no more than one Red Criterion other than Management, **and** no Critical scores
- **Avoid** = Final Score between 0 and 2.199, **or** Management is Red, **or** two or more Red Criteria, **or** one or more Critical scores.

Stock	Fishery	Impacts on the Stock	Impacts on other Species	Management	Habitat and Ecosystem	Overall
		Rank (Score)	Lowest scoring species Rank*, Subscore, Score	Rank Score	Rank Score	Recommendation Score
Eulachon	Net	Red 1.53	No other main species caught Green, 5,5	Red 1	Green 3.46	AVOID 2.27

Acknowledgements

Scientific review does not constitute an endorsement of the Seafood Watch® program, or its seafood recommendations, on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

Seafood Watch® would like to thank three anonymous reviewers for graciously reviewing this report for scientific accuracy.

References

- Clarke, A., A. Lewis, K. Telmer, and J. Shrimpton. 2007. Life history and age at maturity of an anadromous smelt, the eulachon *Thaleichthys pacificus*. *Journal of Fish Biology*. 71: 1-15.
- COSEWIC. 2011. COSEWIC Assessment and Status Report on the Eulachon, Nass/Skeena Rivers population, Central Pacific Coast population, and Fraser River population *Thaleichthys pacificus* in Canada. Committee on the Status of Endangered Wildlife in Canada. 88 p. Available at: www.sararegistry.gc.ca/status/status_e.cfm
- COSEWIC. 2006. COSEWIC Assessment and Status Report on the Chinook Salmon *Oncorhynchus tshawytscha*, Okanagan population in Canada. Committee on the Status of Endangered Wildlife in Canada. 41 pp. Available at: www.sararegistry.gc.ca/status_e/cfm.
- COSEWIC 2003a. COSEWIC Assessment and Status Report on the Sockeye Salmon *Oncorhynchus nerka* Sakinaw population in Canada. Committee on the Status of Endangered Wildlife in Canada. 35 pp.
- COSEWIC 2003b. COSEWIC Assessment and Status Report on the Sockeye Salmon *Oncorhynchus nerka*, Cultus population in Canada. 57 pp.
- COSEWIC 2002. COSEWIC Assessment and Status Report on the Coho Salmon *Oncorhynchus kisutch*, Interior Fraser population in Canada. Committee on the Status of Endangered Wildlife in Canada. 34 pp.
- DFO. 2012. Pacific Region Integrated Fisheries Management Plan Fraser River Eulachon. Fisheries and Oceans Canada. Available at: <http://www.pac.dfo-mpo.gc.ca/fm-gp/ifmp-eng.pdf>
- Gustafson, R.G., M.J. Ford, P.B. Adams, J.S. Drake, R.L. Emmett, K.L. Fresh, M. Rowse, E.A.K. Spangler, R.E. Spangler, D.J. Teel, and M.T. Wilson. 2012. Conservation status of eulachon in the California Current. *Fish and Fisheries*. 13: 121-138.
- Hay, D., and P.B. McCarter. 2000. Status of the eulachon *Thaleichthys pacificus* in Canada. Canadian Stock Assessment Secretariat. Research Document 2000/145. 92 p.
- Levesque, C.A., and T.W. Therriault. 2011. Information in support of a recovery potential assessment of eulachon (*Thaleichthys pacificus*) in Canada. Canadian Science Advisory Secretariat. Research Document 2011/101. 71 p.
- Moody, M.F. 2008. Eulachon past and present. Master's Thesis. University of British Columbia. 292 p.
- Moody, M.F., and T.J. Pitcher. 2010. Eulachon (*Thaleichthys pacificus*): Past and Present. Fisheries Centre Research Reports. 18(2): 195 p.
- Pedersen, R.V.K, U.N. Orr, and D.E. Hay. 1995. Distribution and preliminary stock assessment (1993) of the eulachon, *Thaleichthys pacificus*, in the lower Kitimat River, British Columbia. Canadian manuscript report of Fisheries and Aquatic Sciences no. 2330. Department of Fisheries and Oceans Canada, Prince Rupert, BC, North Coast Division and Habitat and Enhancement Branch, Pacific Biological Station. 23 p.
- Pickard, D., and D.R. Marmorek. 2007. A workshop to determine research priorities for eulachon, workshop report. Prepared by ESSA Technologies Ltd., Vancouver British Columbia for Fisheries and Oceans Canada, Nanaimo, British Columbia. 58 p.

Therriault, T.W., and P.B. McCarter 2005. Using an eulachon indicator framework to provide advice on Fraser River harvest opportunities for 2006. Canadian Science Advisory Secretariat. Research Document 2005/077. 15 p.

Appendix A: Review Schedule

Another Integrated Fisheries Management Plan (IFMP) for Fraser River will likely be drafted for 2014 and 2015. The current IFMP extends until December 31, 2013 (DFO 2012). COSEWIC just assessed eulachon as endangered (COSEWIC 2011) so a recovery plan is likely to follow within a few years to detail recovery strategies.

About Seafood Watch®

Monterey Bay Aquarium's Seafood Watch® program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch® defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. Seafood Watch® makes its science-based recommendations available to the public in the form of regional pocket guides that can be downloaded from www.seafoodwatch.org. The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Each sustainability recommendation on the regional pocket guides is supported by a Seafood Report. Each report synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's conservation ethic to arrive at a recommendation of "Best Choices," "Good Alternatives" or "Avoid." The detailed evaluation methodology is available upon request. In producing the Seafood Reports, Seafood Watch® seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and other scientific reviews of ecological sustainability. Seafood Watch® Research Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch®'s sustainability recommendations and the underlying Seafood Reports will be updated to reflect these changes.

Parties interested in capture fisheries, aquaculture practices and the sustainability of ocean ecosystems are welcome to use Seafood Reports in any way they find useful. For more information about Seafood Watch® and Seafood Reports, please contact the Seafood Watch® program at Monterey Bay Aquarium by calling 1-877-229-9990.

Disclaimer

Seafood Watch® strives to have all Seafood Reports reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science and aquaculture. Scientific review, however, does not constitute an endorsement of the Seafood Watch® program or its recommendations on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

Seafood Watch® and Seafood Reports are made possible through a grant from the David and Lucile Packard Foundation.

Guiding Principles

Seafood Watch™ defines sustainable seafood as originating from sources, whether fished¹ or farmed, that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

The following **guiding principles** illustrate the qualities that capture fisheries must possess to be considered sustainable by the Seafood Watch program:

- *Stocks are healthy and abundant.*
- *Fishing mortality does not threaten populations or impede the ecological role of any marine life.*
- *The fishery minimizes bycatch.*
- *The fishery is managed to sustain long-term productivity of all impacted species.*
- *The fishery is conducted such that impacts on the seafloor are minimized and the ecological and functional roles of seafloor habitats are maintained.*
- *Fishing activities should not seriously reduce ecosystem services provided by any fished species or result in harmful changes such as trophic cascades, phase shifts, or reduction of genetic diversity.*

Based on these guiding principles, Seafood Watch has developed a set of four sustainability **criteria** to evaluate capture fisheries for the purpose of developing a seafood recommendation for consumers and businesses. These criteria are:

1. Impacts on the species/stock for which you want a recommendation
2. Impacts on other species
3. Effectiveness of management
4. Habitat and ecosystem impacts

Each criterion includes:

- Factors to evaluate and rank
- Evaluation guidelines to synthesize these factors and to produce a numerical score
- A resulting numerical score and **rank** for that criterion

Once a score and rank has been assigned to each criterion, an overall seafood recommendation is developed on additional evaluation guidelines. Criteria ranks and the overall recommendation are color-coded to correspond to the categories on the Seafood Watch pocket guide:

¹ “Fish” is used throughout this document to refer to finfish, shellfish and other invertebrates.

Best Choices/Green: Are well managed and caught or farmed in environmentally friendly ways.

Good Alternatives/Yellow: Buy, but be aware there are concerns with how they're caught or farmed.

Avoid/Red: Take a pass on these. These items are overfished or caught or farmed in ways that harm other marine life or the environment.