



MONTEREY BAY AQUARIUM®

Seafood WATCH

Pacific Razor Clam

Siliqua patula



(Image courtesy of the Oregon Department of Fish and Game)

Pacific Northwest

Shovels and Clam Tubes

February 11, 2013

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Disclaimer

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Final Seafood Recommendation

Pacific razor clams (*Siliqua patula*) are ranked as a **Best Choice** for Washington, Oregon and the Quinault Nation.

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
Pacific razor clam	Washington	Yellow 2.64	No other main species caught Green, 5,5	Yellow 3	Yellow 3.12	BEST CHOICE 3.33
Pacific razor clam	Quinault Nation	Green 3.83	No other main species caught Green, 5,5	Green 5	Yellow 3.12	BEST CHOICE 4.16
Pacific razor clam	Oregon	Yellow 2.64	No other main species caught Green, 5,5	Yellow 3	Yellow 3.12	BEST CHOICE 3.33

Scoring note—scores range from zero to five where zero indicates very poor performance and five indicates the fishing operations have no significant impact. * Rank and color in the 'Impacts on other Species' column is defined based on the Subscore rather than the Score.

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Executive Summary

Pacific razor clams have a high inherent resilience to fishing pressure because they mature quickly. Stock assessments are not conducted on the commercial razor clam resource for the states of Washington and Oregon, however they are conducted on the nearby recreational razor clam resource, which is assumed to be part of the same population. The Pacific razor clam resource is not classified as overfished, but a quantitative stock assessment and reference points are lacking for Washington and Oregon.

The Quinault Indian Nation conducts biomass assessments of razor clams on their shorelines as well as a joint biomass assessment with Washington State on their usual and accustomed areas annually.¹ Quantitative stock assessments occur annually and the biomass is estimated to fluctuate around a sustainable level, however these target biomass reference points were not available for analysis. The total harvest rate for both the Washington State recreational fishery and the Quinault razor clam fisheries together is 30%. The Quinault Nation harvests half of this, 15%, per year. These harvest rates are believed to be sufficiently conservative to protect the razor clam resource. Biomass estimates have shown an increase in harvestable clams on the two, jointly managed beaches used for commercial harvest. Since the Quinault Indian Nation harvests half of the available razor clams, including harvest not related to the commercial fishery, the fishing mortality due to the commercial fishery is less than 15% of all legal size clams (3 inches or greater).

There are no substantial interactions with bycatch, nor are there impacts on non-target species, or discards. The hand harvest gears used to land razor clams evaluated in this report include clam tubes and shovels. Hand harvest methods are believed to result in negligible bycatch because hand harvesting allows fishermen to be very selective of the species they harvest.

There is a fixed commercial clamming season in Washington. To protect the razor clam resource, this season is believed to be significantly conservative. Managers conduct regular stock assessments in regions that can be applied to the commercial fishery (not on beaches where fishing occurs), and catch per unit effort (CPUE) and clam size landed is monitored. Although the fixed season for commercial razor clam digging has been set by permanent regulation (with no adjustments based on population changes), there is a mechanism to close the fishery in an emergency situation. Landings for the Pacific razor clam fishery in both states have increased in recent years, showing that management has been effective at maintaining stock abundance.

The total catch of all Quinault razor clam fisheries is set at 15% of the harvestable clams each year, and the catch of the commercial fishery is less than 15%. Rigorous stock assessments of the razor clam resource are performed annually, and the total allowable catch (TAC) is set based on the stock assessment. Landings in the Quinault Indian Nation's commercial razor clam fishery have been stable, indicating that management is effective at maintaining stock abundance.

¹ The Quinault Indian Nation and Washington State both conduct razor clam biomass assessments in the usual and accustomed areas to determine TAC for the year. TAC is 30% of legal-sized clams. Both the Quinault Indian Nation and Washington State get 50% of the TAC. The Quinault Indian Nation distributes their 50% between their commercial fishery, harvest for home use, and harvest for other purposes. Washington State distributes their 50% to the recreational fishery. In other words, each party is allowed to harvest 15% of the legal size clams available that year.

Shovels and clam tubes may cause habitat impacts on intertidal and subtidal habitats, depending upon how much disturbance the habitat is subject to from wave, tidal, or current action. Using shovels may also cause impacts to intertidal habitat, especially if the area harvested is not exposed to strong wave or tidal action, which would re-distribute disturbed sediment. However, these fisheries do not have significant bycatch, and they do not capture disproportionately important species to the ecosystem.

Introduction

Scope of the analysis and ensuing recommendation

This report contains an evaluation of the Pacific razor clam (*Siliqua patula*) in Washington and Oregon. Gears evaluated in this report include shovels and clam tubes. This report does not include the Washington State softshell clam fishery, due to lack of information on management. The Washington State softshell clam fishery is not managed by the state. Softshell clams are an invasive species in Washington and the fishery occurs entirely on private land, and thus out of the state's jurisdiction. Because the commercial softshell fishery is out of the state's jurisdiction, and very little is known about how the private sector manages the clams, Seafood Watch is unable to assess these clams in this report. Pacific razor clams (*Siliqua patula*) are distributed from Pismo Beach, California to the Aleutian Islands in Alaska. This report focuses on the Washington, Oregon, and Quinault Indian Nation commercial fisheries (Lassuy and Simons 1989; Figure 1; most commercial fishing in Oregon is on Clatsop Beach).

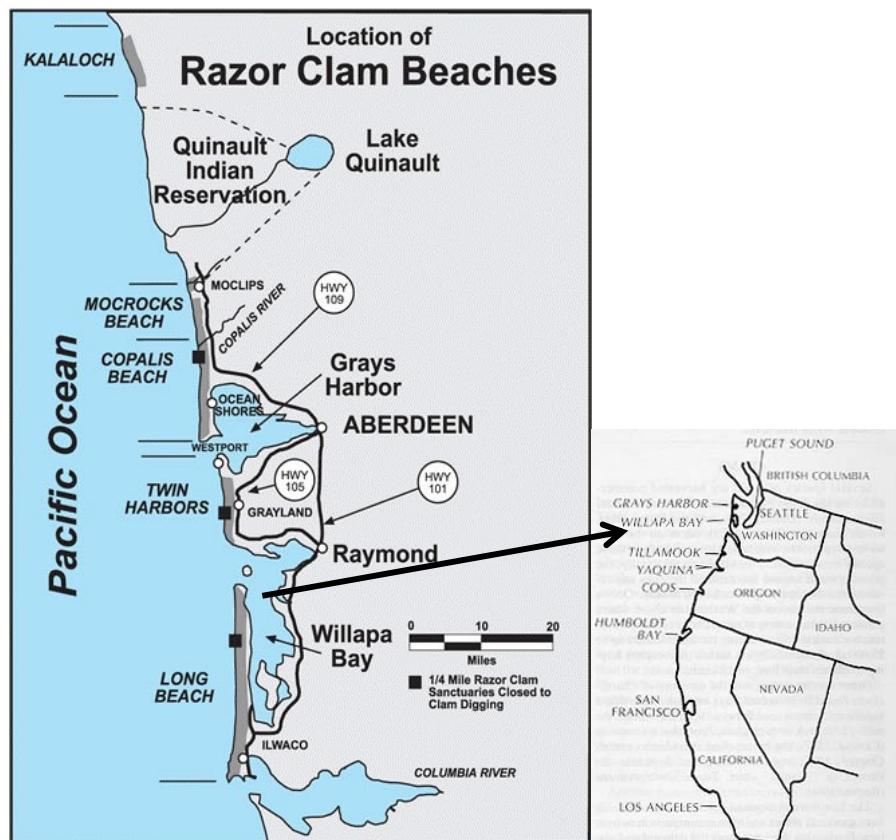


Figure 2. Major Washington State razor clam harvesting beaches. Figures from <http://wdfw.wa.gov/fishing/shellfish/razorclams/> and lib.noaa.gov

Species Overview: Pacific razor clam (*Siliqua patula*)

Along the US West Coast, the Pacific razor clam occurs in intertidal and subtidal exposed areas from Pismo Beach, California to the Aleutian Islands in Alaska (Lassuy and Simons 1989). Razor clams grow faster, but have shorter lifespans in southern latitudes (Lassuy and Simons 1989). Due to this tradeoff between shorter lifespans, and faster growth, Washington State was thought to have a razor clam stock that was ideal for heavy exploitation (Lassuy and Simons 1989). However, heavy exploitation and high stock losses to disease around 1980 led the Washington Department of Fish and Wildlife to reduce limits and seasons (Lassuy and Simons 1989). Pacific razor clams are managed by state and tribal governments because they occur in state waters and in areas subject to treaty rights. Razor clam landings peaked in 1951 at 1,249 metric tons, most of which was landed in Alaska.

From the 1950s through 1963, the state of Alaska produced the most Pacific razor clams of any state; however, razor clams in Alaska were overexploited. In 1964, Alaska experienced an earthquake, which raised high-quality razor clam habitat by 1.6 to 2 meters in elevation, and caused moderate mortality. The clam population did not return to previous numbers after the earthquake, and there have been no razor clam landings in Alaska since 1978 (Bishop and Powers 2003 and pers. comm., NMFS 2012). In the 1990s, Washington State's fishery was periodically closed due to domoic acid, which causes amnesic shellfish poisoning (Washington 2009). Pacific razor clam landings fluctuated around a low, constant point from 2000 to 2006, and began to increase from 2006 to 2010. Commercial Pacific razor clam landings in 2009 were 286,019 pounds (NMFS 2012 and Washington 2009). The Pacific razor clam fishery in Washington was worth \$431,519 in 2010. There is also a small commercial razor clam fishery on Clatsop Beach in Oregon (pers. comm. Matthew Hunter). Pacific razor clam fisheries in both states are managed on a beach by beach basis (Personal Communication, Bruce Kauffman and Matthew Hunter, 2012).

In Washington State, the Quinault Indian Nation signed a treaty in which they reserve the right to harvest all of the razor clams on their reservation, and half of the razor clam harvest in their usual and accustomed areas outside of reservation lands. The majority of commercial harvest in the Quinault Indian Nation Fishery takes place off reservation, and usual and accustomed areas off reservation are co-managed with Washington State. The beaches that are utilized for commercial harvest are Copalis and Morcrocks (Washington 2012C). Please see Figure 2 for razor clam landings from 2000 to 2010 (Washington 2009, NMFS 2012, and pers. comm., Scott Mazzone, 2012).

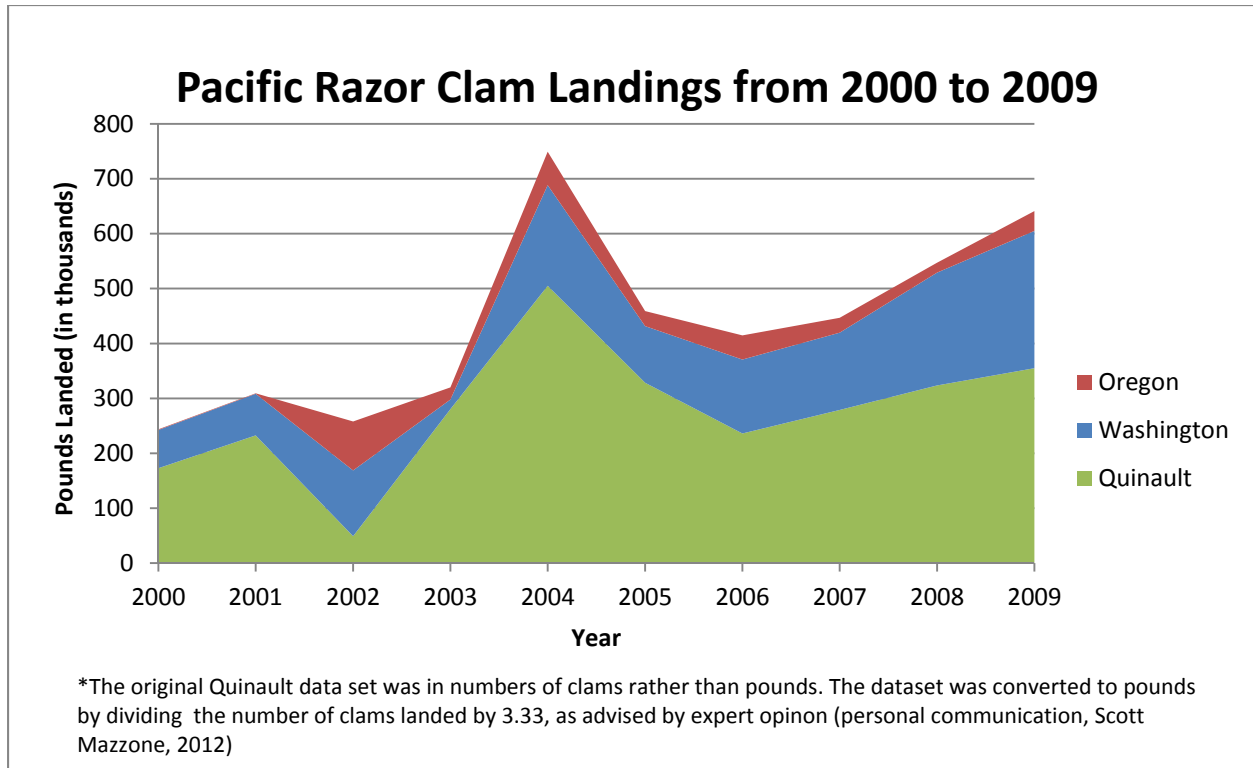


Figure 2: Razor Clam Landings (Washington 2009, NMFS 2012, and Personal Communication, S. Mazzone, 2012)

Additional common names for razor clams include Pacific razor clam, northern razor clam, and giant pod. There is also an Atlantic razor clam (*Ensis directus*) that is unrelated to the Pacific razor clam (*Siliqua patula*). Only the Pacific razor clam is covered in this report. Pacific razor clams are commonly fried, baked, used to make clam chowder, and sold as crab bait.

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.

Stock	Fishery	Inherent Vulnerability	Stock Status	Fishing Mortality	Criterion 1
		Rank	Rank (Score)	Rank (Score)	Rank Score
Pacific razor clam	Washington	Low	Moderate Concern (3)	Moderate Concern (2.33)	Yellow 2.64
Pacific razor clam	Quinalt Nation	Low	Low Concern (4)	Low Concern (3.67)	Green 3.83
Pacific razor clam	Oregon	Low	Moderate Concern (3)	Moderate Concern (2.33)	Yellow 2.64

Justification of Ranking

Factor 1.1 Inherent Vulnerability: Low

Key relevant information:

Pacific razor clams have an overall vulnerability score of 2.5 and are considered to have low vulnerability to fishing pressure.

Detailed rationale:

Inherent Vulnerability of Pacific razor clams

Factor	Pacific razor clam	Score	Source
Average Age of Maturity	2 years	3	Lassuy and Simons 1989
Average Maximum Age	7 years	3	Lassuy and Simons 1989
Reproductive Strategy	Broadcast Spawner	3	Nelson 1994
Density Dependence	Depensatory dynamics at low population sizes (Allee effects) demonstrated or likely	1	Bishop and Powers 2003, Lassuy and Simons 1989
Score (mean factor of scores):		2.5	

Factor 1.2 Stock status

Washington and Oregon: Moderate concern

Key relevant information:

The commercial fishery is not classified as overfished by the Department of Fish and Wildlife (pers. comm., Bruce Kauffman 2012), no stock assessment is done for the commercial razor clam fishery and reference points are not available to determine stock status (pers. comm., Bruce Kauffman). Razor Clam stocks in Washington State are managed on a beach-by-beach basis. The commercial razor clam fishery occurs on sandbars inside Willapa Bay, which are very dynamic, while the recreational fishery occurs on the nearby coastal beach. Since the area of the commercial fishery is so dynamic, the Washington State Department of Fish and Wildlife does not perform biomass surveys on the sandbars. However, the department performs biomass surveys on the coastal beaches, and the razor clams in both areas are assumed to be part of the same population (pers. comm., Bruce Kauffman 2012). Landings have been an increasing trend since the mid-2000s (Washington 2009).

Quinault Indian Nation: Low concern

Key relevant information:

There is a rigorous scientific biomass assessment conducted annually, the stock is not classified as overfished, and biomass is estimated to be fluctuating at an appropriate level; however, target and limit reference points are not currently available for analysis (pers. comm., Scott Mazzone, 2012; Figure 3). The Quinault Indian Nation conducts joint biomass assessments of razor clam populations with Washington State on usual and accustomed areas outside of reservation lands. Biomass data for harvestable clams on the two beaches used for commercial harvest in usual and accustomed areas are below (WDFW 2012B).

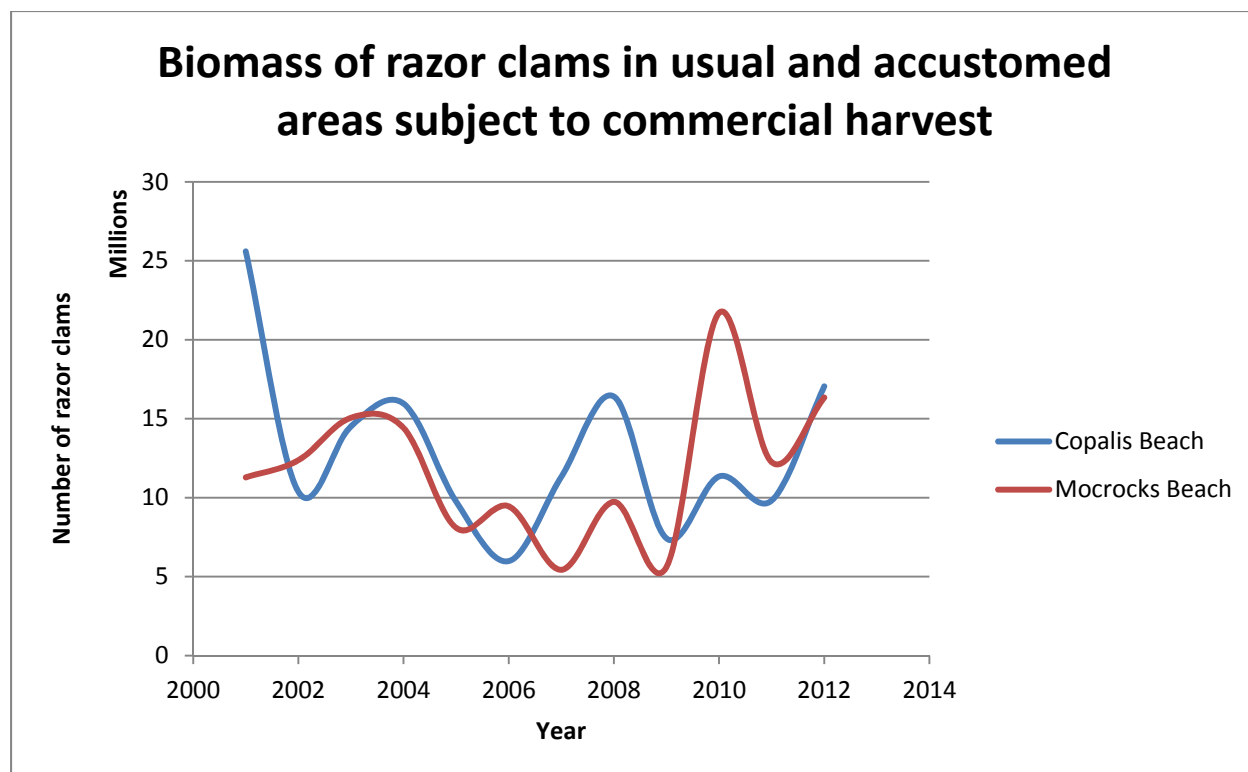


Figure 3: Biomass of Pacific razor clams in usual and accustomed areas subject to commercial harvest (WDFW 2012B)

Factor 1.3 Fishing mortality

Washington and Oregon: Moderate concern

Key relevant information:

Although catch-per-unit-effort is monitored for the Washington and Oregon commercial Pacific razor clam fishery, the fishing mortality is unknown. There are also no fishing mortality reference points with which to compare current fishing mortality.

Quinault Indian Nation: Low concern

Key relevant information:

In comparison, the Quinault Indian Nation and the Washington State Department of Fish and Wildlife have decided upon a catch rate of 30% for the razor clam fishery in usual and accustomed areas. Through treaty rights, the Quinault Indian Nation reserves the right to half of the total catch. Therefore all razor clam digging for the Quinault Indian Nation will cause a maximum of 15% fishing mortality. Commercial digging is conducted only on a portion of the available razor clam resource, therefore the Quinault Indian Nation's razor clam fishery creates fishing mortality of less than 15% (Personal Communication, Scott Mazzone 2012)². Therefore it is probable that fishing mortality is at or below a sustainable level that will allow the razor clam population to maintain current abundance.

² The Quinault Indian Nation and Washington State both conduct razor clam biomass assessments in the usual and accustomed areas to determine TAC for the year. TAC is 30% of legal sized clam biomass. Both the Quinault Indian Nation and Washington State get 50% each (or half) of the TAC. The Quinault Indian Nation distributes its half between its commercial fishery, its harvest for home use, and its harvest for other purposes. Washington State distributes its half to the recreational fishery. In summary, each party is allowed to harvest 15% of the legal size clams available that year.

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.

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

Justification of Ranking

Clam Tubes and Shovels

Pacific razor clams are harvested using only shovels or clam tubes, which are also known as 'clam guns' (see Figures 4 and 5). Clam guns consist of a tube with a handle and a small hole to allow air passage on top. The handle is used to drive the tube into the sand around a clam "show." The digger covers the air hole with a finger while using the handle to pull the tube of sand and the clam, up and onto the beach. The digger then removes the finger from the air hole and shakes the sand and the clam out of the tube (ODFW 2009A). Hand harvesting these clam species allows fishermen to be very selective about their catch, while returning unwanted species alive to their habitat, resulting in negligible bycatch (pers. comm., Bruce Kauffman).

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.

Fishery	Management: Harvest Strategy Rank (Score)	Management: Bycatch Rank (Score)	Criterion 3 Rank Score
Washington	Moderate Concern (3)	All species retained (N/A)	Yellow 3
Quinalt Nation	Very Low Concern (5)	All species retained (N/A)	Green 5
Oregon	Moderate Concern (3)	All species retained (N/A)	Yellow 3

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
Washington	No	Moderately Effective	N/A	Moderately Effective	Highly Effective	Highly Effective	Moderately Effective	Highly Effective
Quinalt Nation	No	Highly Effective	N/A	Highly Effective	Highly Effective	Highly Effective	Highly Effective	Highly Effective
Oregon	No	Moderately Effective	N/A	Highly Effective	Moderately Effective	Highly Effective	Highly Effective	Highly Effective

Overview by Region:

Washington: Pacific razor clams

The state manages Pacific razor clams on a beach-by beach basis, and conducts stock assessments of Pacific razor clams on the shoreline. However, the commercial Pacific razor clam fishery occurs on

sandbars inside Willapa Bay, and the razor clams in both areas are believed to be part of the same ecological population, so stock assessments on the shoreline are thought to be applicable to the clams on the sandbars (pers. comm., Bruce Kauffman 2012). Washington has a fixed eight-week commercial clam digging season with the belief that it is sufficiently conservative to protect the resource (pers. comm., Dan Ayres 2012). Landings have slowly increased since 2003; however, more time must pass before the successful long-term maintenance of stock abundance can be determined (Washington 2009).

Oregon: Pacific razor clams

Almost the entirety of the commercial Pacific razor clam fishery in Oregon occurs on Clastop Beach (pers. comm., Matthew Hunter 2012). Generally, there are about 45 participants in the fishery; of which 10-15 make consistent landings (pers. comm., Matthew Hunter 2012). Stock assessments are performed on Clastop Beach for informational purposes only (pers. comm., Matthew Hunter 2012). The clamming season is open, by permanent regulation, from October 1st through July 14th, meaning that managers cannot change the season length to respond to new scientific information. However, there are mechanisms to close the fishery if an emergency arises (pers. comm., Matthew Hunter 2012). Pacific razor clam landings in Oregon appear to be slowly increasing after a period of low landings in the late 1990s (Oregon 2008). Although landings have increased, more time must pass before the successful, long-term maintenance of stock abundance can be determined.

Quinault Indian Nation: Pacific razor clams

Most of the commercial fishery for Pacific razor clams in the Quinault Indian Nation occurs in usual and accustomed harvest areas; razor clam harvest on reservation beaches is used by non-commercial tribal fisheries (pers. comm., Scott Mazzone). These usual and accustomed areas are co-managed by the Quinault Indian Nation and the Washington State Department of Fish and Wildlife (pers. comm., Scott Mazzone, 2012). A joint biomass survey and stock assessment is performed annually, and TAC (30% of legal sized clams) is determined. Currently, 50% of the TAC goes to the Quinault Indian Nation (pers. comm., Scott Mazzone, 2012). In most cases, the other 50% of the razor clams go to the Washington State recreational fishery (pers. comm., Scott Mazzone, 2012). Pacific razor clam biomass in usual and accustomed areas has been stable over time.

Washington: Pacific razor clams

Management Strategy and Implementation: Moderately effective

The Pacific razor clam fishery has an appropriate strategy and goals, and recent landings increases suggest that it is being implemented successfully. In the 1980s a fixed season of eight weeks for commercial clamming was established in Washington State, under the assumption that this fixed season was conservative enough to prevent over-harvest and maintain the resource. During the season, CPUE is monitored as well as the length frequency of harvested clams (pers. comm., Bruce Kauffman 2012). Although the management strategy is appropriate and being implemented successfully, stock assessments are needed to ensure the long-term health of the fishery.

Recovery of Stocks of Concern: N/A

Pacific razor clams are not classified as overfished, and are not considered to be a stock of concern in Washington State (pers. comm., Bruce Kauffman 2012). However, clam landings decreased dramatically in Washington starting in 1980 and remained low until the year 2000. Since then, the Pacific razor clam stock has begun to increase and recover (NMFS 2012 and Washington 2009). Since no stocks of concern exist in this fishery, Seafood Watch deems the recovery of stocks of concern to be not applicable.

Scientific Research and Monitoring: Moderately effective

The management process in Washington State uses a scientific stock assessment each year to determine the population of Pacific razor clams on the ocean beaches. However, these stock assessments are conducted for the recreational Pacific razor clam fishery, which takes place on the beach, while the commercial fishery takes place on the sandbars in Willapa Bay (pers. comm., Bruce Kauffman 2012). The Pacific razor clams on the beach and sandbars are believed to be part of the same population, so the stock assessment done on the beach is considered applicable to the razor clams on the sandbars (pers. comm., Bruce Kauffman 2012). The sandbars where the commercial fishery takes place are very dynamic, making stock assessments on the sandbars themselves infeasible (pers. comm., Bruce Kauffman 2012).

Scientific Advice: Highly effective

Management nearly always follows scientific advice, the fishery was closed in 1988 due to low population levels, and prices for commercial clamming licenses were raised when it became evident that recreational clambers were buying commercial licenses to avoid recreational harvest limits (Washington 2009 and Washington 2012).

Enforcement: Highly effective

Regulations are enforced by the Washington Department of Fish and Wildlife. Enforcement occurs by monitoring CPUE, the size of clams landed, and the diggers (Washington 2012 and pers. comm., Bruce Kauffman 2012).

Track Record: Moderately effective

Measures enacted by management appear to be rebuilding stock abundance; however, not enough time has passed to determine if measures have maintained long-term stock abundance, therefore the track record is uncertain (Washington 2009).

Stakeholder Inclusion: Highly effective

The management process is transparent and includes stakeholder input in accordance with Washington State's Administrative Procedures Act (Washington 2012A).

Oregon: Pacific razor clams**Management Strategy and Implementation: Moderately effective**

Oregon's fishery is open by permanent regulation for a set period of time; however, the Oregon revised statutes give authority to the Oregon Department of Fish and Wildlife (ODFW) director to enact emergency closures when the need arises. The average number of participants in the fishery is 45 or fewer; of which 15 make consistent landings with hand harvest methods only. The number of people clamming and the method of take have caused fishing effort to be lower than it would be otherwise (pers. comm., Matthew Hunter 2012). Although the fishery is open by permanent regulation, if the need arises the fishery can be closed.

Recovery of Stocks of Concern: N/A

Pacific razor clams are not considered overfished in Oregon. There have been wide fluctuations in total razor clam landings in Oregon, but current trends show an increase in abundance when compared to the early 2000s (Oregon 2008). Since no stocks of concern exist in this fishery, Seafood Watch deems the recovery of stocks of concern to be not applicable.

Scientific Research and Monitoring: Highly effective

The Oregon Department of Fish and Wildlife conducts stock assessments on Clastop Beach, where nearly all of the commercial Pacific razor clams are landed. These surveys are for informational purposes only. Oregon also monitors CPUE, which has been closely tied to biomass abundance (pers. comm., Matthew Hunter 2012).

Scientific Advice: Moderately effective

Because the Pacific razor clam season is open by permanent regulation, management is unable to adjust the season to respond to lower biomass or other emerging scientific information (pers. comm., Matthew Hunter 2012).

Enforcement: Highly effective

Enforcement is done by the Oregon State Police Fish and Wildlife Division (ODFW 2009). Regulations are regularly enforced and independently verified through logbooks (ODFW 2012).

Track Record: Moderately effective

The Oregon Pacific razor clam stock has varied widely, but recent trends are showing an increase in landings (Oregon 2008).

Stakeholder Inclusion: Highly effective

The management process is transparent and includes stakeholder input (pers. comm., Matthew Hunter 2012).

Quinalt Indian Nation: Pacific razor clams**Management Strategy and Implementation: Highly effective**

Most of the Quinalt Indian Nation's commercial razor clam harvest occurs in their usual and accustomed areas, while the ceremonial and subsistence razor clam harvest occurs on reservation shorelines (pers. comm., Scott Mazzone 2012). The management strategy for the fishery is appropriate, and biomass surveys suggest that it is being implemented effectively. The Quinalt Indian Nation co-manages the razor clams in usual and accustomed areas with the Washington State Department of Fish and Wildlife (pers. comm., Scott Mazzone, 2012). The two governments perform annual biomass surveys together. Thirty percent of the available razor clams in usual and accustomed areas can be harvested, 15% for Washington State and 15% for the Quinalt Indian Nation. The biomass surveys allow the Quinalt Indian Nation and Washington State to determine how many pounds of clams make up 30%. There have not been any problems with stock depletion, indicating that current management is highly effective.

Recovery of Stocks of Concern: N/A

There are no stocks of concern in this fishery.

Scientific Research and Monitoring: Highly effective

The Quinalt Indian Nation and Washington State perform fishery-independent biomass surveys and a joint stock assessment each year in usual and accustomed areas to determine the number or pounds of clams that make up the TAC for the year (pers. comm., Scott Mazzone 2012).

Scientific Advice: Highly effective

The Shellfish Harvest Committee follows scientific advice; there is no debate about the scientific data or TAC. However, sometimes, due to logistics or other reasoning the Shellfish Harvest Committee chooses

to not follow management's proposed digging schedule (pers. comm., Scott Mazzone, 2012). As the Quinault Indian Nation nears their TAC on each beach, managers look at data from past years to estimate the amount of clams that will be harvested per dig. The number of digs are limited accordingly, and if TAC is met or exceeded, further digs are halted. TAC has very rarely been exceeded in the past, and the exceedence has been minimal (>1-5%).

Enforcement: Highly effective

Tribal fisheries enforcement officers are present at every commercial dig to enforce catch limits and other regulations. Commercial digs are scheduled at specific locations, and several fisheries enforcement officers are present each day at the specified locations (pers. comm., Scott Mazzone, 2012).

Track Record: Highly effective

Measures used by management have maintained long-term stock abundance (pers. comm., Scott Mazzone). The Quinault people have lived at the mouth of the Quinault River and harvested razor clams since time immemorial. In 1974, the Boldt decision gave the Quinault Indian Nation self-regulatory status. One of the prerequisites for self-regulatory status was a proven history of managing fisheries at a sustainable level. In 1997, the Quinault and WDFW began using the pumped area method to estimate Pacific razor clam biomass in order to determine TAC. Monitoring shows that the biomass has fluctuated at an abundant level over a long time period (see Figure 8).

Stakeholder Inclusion: Highly effective

The Quinault Indian Nation has a tribal fisheries policy spokesperson work with Washington State to determine how many clams are available for harvest each year. This spokesperson then works with tribal members to best represent their interests when working with Washington State. Tribal members are also able to participate in management with the harvest committee which determines how much of the Quinault Indian Nation's share of clams goes to each fishery. Although the opportunities for stakeholder inclusion are constrained by legal requirements and government-to-government negotiation, there are a number of opportunities for stakeholder participation in the management process.

Factor 3.2 Management of fishing impacts on bycatch species: N/A

Key relevant information:

There is no management of impacts on bycatch species because bycatch is minimal; using hydraulic clam dredges and hand harvest methods. For further discussion of bycatch in this report, please see Criterion 2.

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, nor should they result in harmful changes such as trophic cascades, phase shifts or reduction of genetic diversity.

Fishery	Impact of gear on the substrate	Mitigation of gear impacts	EBFM	Criterion 4
	Rank (Score)	Rank (Score)	Rank (Score)	Rank Score
Washington	Low Concern (3)	Minimal mitigation (0.25)	Moderate Concern (3)	Yellow 3.12
Quinault Nation	Low Concern (3)	Minimal mitigation (0.25)	Moderate Concern (3)	Yellow 3.12
Oregon	Low Concern (3)	Minimal mitigation (0.25)	Moderate Concern (3)	Yellow 3.12

Synthesis

Clam tubes and shovels may cause habitat impacts on intertidal and subtidal habitats, depending upon how much disturbance the habitat is subject to from wave, tidal, or current action (Brown and Wilson 1997; Figures 4 and 5). Intertidal areas in the United Kingdom where hand harvest gear is used have lower species richness, and there is potential for damage to undersized individuals of the fishery's target species (Kaiser et al 2001). Kaiser et al. (2001) found that raking impacts persisted in a habitat up to a year after the raking event. Using shovels may also cause impacts to intertidal habitat, especially if the area harvested is not exposed to strong wave or tidal action, which would re-distribute disturbed sediment. However, these fisheries do not have significant bycatch, and they do not impact the ecosystem through a disproportionate capture of important species. Overall, the impact to the benthic habitat by these gears is medium.



Figure 4. Clam shovel. Photo from Washington Department of Fish and Wildlife, located at: <http://wdfw.wa.gov/fishing/shellfish/razorclams/recipes.html>



Figure 5. Clam tube (gun). Photo from: <http://www.jackscountystore.co/stainlesssteelclamgun.aspx>

Justification of Ranking

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

Key relevant information:

Hand-gear (including tubes, rakes, hoes and shovels) can cause habitat impacts on the intertidal and subtidal habitats (Brown and Wilson 1997, Kaiser et al. 2001). A study on habitat impacts of raking mudflats in Maine found that commercial digging can have a negative impact on several intertidal species, although, these impacts are likely due to cumulative effects (Brown and Wilson 1997). When digging for clams, the pile of sediment left on the beach may damage many other types of intertidal species if the hole created is not refilled, and if the beach is not exposed to high-energy waves and tides (WDFW 2012).

Factor 4.2 Modifying factor: Mitigation of fishing gear impacts: Minimal mitigation

Key relevant information:

Washington (shovels, clam tubes): The commercial Pacific razor clam fishery is spatially restricted to the Willapa Spits (pers. comm., Bruce Kauffman 2012). A large portion of the Washington coast is dug for Pacific razor clams, and fishing effort is being controlled but not reduced.

Oregon (shovels, clam tubes): Oregon has only one beach, Clastop Beach, open to razor clam harvest for human consumption (pers. comm., Matthew Hunter 2012). All other beaches are protected from the commercial Pacific razor clam fishery's habitat impacts. Oregon, by way of its Department of Fish and Wildlife's website, also asks that clam diggers refill the holes they dig, although this request is not listed in the regulations for shellfishing (Oregon 2012). Fishing pressure is controlled but not reduced.

Quinault Indian Nation (shovels, clam tubes): Most of the Quinault Indian Nation's commercial razor clam digs occur in usual and accustomed areas off of the reservation beaches. Half of the TAC is taken by the Quinault Indian Nation and half is taken by the Washington State recreational Pacific razor clam fishery. A large portion of the Washington coast is dug for razor clams, and the Quinault commercial digging effort is controlled but not reduced.

Factor 4.3 Ecosystem and Food Web Considerations: Moderate concern

Key relevant information:

Species that are especially important to the ecosystem are not caught in the fisheries assessed in this report. The use of hand harvest to capture clams allows non-target species to be returned to the substrate alive, resulting in negligible bycatch of species that are important for ecosystem functioning. Still, there are no efforts to fully assess the ecological impacts in the fishery.

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 the following people for their diligent review of this report: Dan L. Ayres of the Washington State Department of Fish and Wildlife, and Scott Mazzone of the Quinault Indian Nation Division of Natural Resources.

Seafood Watch would also like to thank the following individuals for their guidance as the report was drafted: Matthew Hunter of the Oregon Department of Fish and Wildlife and Bruce Kauffman of the Washington State Department of Fish and Wildlife.

References

- Bishop, M.A. and Powers, S. 2003. *Restoration of Razor Clam (Siliqua Patula) Populations in Southeastern Prince William Sound Alaska: Integrating Science, Management & Traditional Knowledge in the Development of a Restoration Strategy*. Partners for Fish Wildlife Coastal Program, Alaska Regional Office, U.S. Fish and Wildlife Service. Available at: http://www.adfg.alaska.gov/static/fishing/PDFs/aquaticfarming/razor_clam_pws.pdf
- Brown, B and Wilson WH. 1997. "The role of commercial digging of mudflats as an agent for change of infaunal intertidal populations." *Journal of Experimental Marine Biology and Ecology*. 218:49-61.
- Eversole, A.G. 1987. *Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (South Atlantic)—Hard Clam*. U.S. Fish and Wildlife Service Biological Reports 82(11.75). U.S. Army Corps of Engineers, TR EL-82-4. 33pp. Available at: http://www.nwrc.usgs.gov/wdb/pub/species_profiles/82_11-075.pdf
- Global Invasive Species Database. 2012. *Mya arenaria (mollusc)*. Available at: <http://www.issg.org/database/species/ecology.asp?si=1159&fr=1&sts=&lang=EN>
- Hill, K. 2004. *Mercenaria mercenaria*. Smithsonian Marine Station at Fort Pierce. Available at: http://www.sms.si.edu/irlspec/mercen_mercen.htm
- Kaiser, MJ, Broad, G, and Hall, SJ. 2001. *Disturbance of intertidal soft-sediment benthic communities by cockle hand raking*. *Journal of Sea Research*. 45:119-130.
- Lassuy, D.R., and D Simons. 1989. *Species Profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Northwest)—Pacific razor clam*. U.S. Fish and Wildlife Service. Biol. Rep. 82(11.89). US Army Corps of Engineers, TR-EL-82-4. 16pp.
- Nelson, D. 1994. *Razor Clam*. Alaska Department of Fish & Game. Available at: http://www.adfg.alaska.gov/static/education/wns/razor_clam.pdf
- (New York 2012) *Hard Clam*. Department of Environmental Conservation. Available at: <http://www.dec.ny.gov/animals/6950.html>
- (NMFS 2012) National Marine Fisheries Service, Statistics Division. 2012. Annual Commercial Landings Statistics. Available at: http://www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html
- (NOAA Enforcement 2012) NOAA, Office of Law Enforcement. 2012. *About OLE—Office of Law Enforcement*. Available at: http://www.nmfs.noaa.gov/ole/ole_about.html
- (ODFW 2009) Oregon Department of Fish and Wildlife. 2009. *State Police Enforcement*. Available at: http://www.dfw.state.or.us/agency/budget/docs/09_11_ways_and_means/Tab%2025%20OSP.pdf
- (ODFW 2009A) Oregon Department of Fish and Wildlife. 2009. *Oregon: A Great Catch! How to Razor Clam*. Available at: <http://www.dfw.state.or.us/resources/fishing/docs/ClammingFlyer.pdf>
- (ODFW 2012) Oregon Department of Fish and Wildlife. 2012. *Commercial Shell Fishing*. Available at: http://www.dfw.state.or.us/MRP/shellfish/commercial/other_shellfish/index.asp
- (Oregon 2008) Oregon Department of Fish and Wildlife. 2008. *Table 3A: Commercial Fish and Shellfish Landings in Oregon 1999-2008*. Available at: http://www.dfw.state.or.us/fish/commercial/landing_stats/2008AnnRep/3A.pdf
- (Oregon 2012) Oregon Department of Fish and Wildlife. 2012. *Digging for Butter Clams*. Available at: http://www.dfw.state.or.us/MRP/shellfish/bayclams/dig_butter.asp

- (Washington 2009) Washington Department of Fish and Wildlife. 2009. *Washington Non-Treaty Commercial Razor Clam Fishery*. Available at:
http://wdfw.wa.gov/fishing/commercial/razorclams/historical_table09.pdf
- (Washington 2012) Washington Department of Fish and Wildlife. 2012. *History of the Commercial Razor Clam Fishery*. Available at: <http://wdfw.wa.gov/fishing/commercial/razorclams/history.html>
- (Washington 2012A) Washington State Governor’s Office of Regulator Assistance. 2012. *Washington’s Rulemaking Process*. Available at: <http://www.ora.wa.gov/regulatory/rulemaking.asp>
- (Washington 2012B) Washington Department of Fish and Wildlife. 2012. *Recreational Razor Clamming*. Available at: <http://wdfw.wa.gov/fishing/shellfish/razorclams/>
- (Washington 2012C) Washington Department of Fish and Wildlife. 2012. *How Recreational Razor Clam Seasons are Set*. Available at: http://wdfw.wa.gov/fishing/shellfish/razorclams/seasons_set.html
- Wellfleet. 2012. *Town of Wellfleet Shellfishing Policy and Regulations Last Amended 10/28/2008*. Available at:
http://www.wellfleetma.org/Public_Documents/WellfleetMA_Departments/shellfish_dept/shell_fish_regulations
- (WDFW 2012) “How to dig geoduck clams.” *Washington Department of Fish and Wildlife: Fishing and Shellfishing*. Available at: http://wdfw.wa.gov/fishing/shellfish/geoduck/howto_dig.html
- (WDFW 2012A) “Eastern Soft Shell” *Washington Department of Fish and Wildlife: Fishing and Shellfishing*. Available at: http://wdfw.wa.gov/fishing/shellfish/clams/eastern_softshell.html
- (WDFW 2012B) Washington Department of Fish and Wildlife. *Razor Clam Management: Setting the 2012-2013 Season*. Available at:
http://wdfw.wa.gov/fishing/shellfish/razorclams/2012_razor_clam_season_setting.pdf

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 fished³ 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:

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.

³ "Fish" is used throughout this document to refer to finfish, shellfish and other invertebrates.