The Oregon Pink (Ocean) Shrimp Trawl Fishery

Annual Surveillance Audit 1

Contract Number: 05-04 Oregon Ocean Shrimp
Version: 1

Date: February 25, 2009
Revision Date:

Client: Oregon Trawl Commission (OTC)

MSC reference standards:

MSC Accreditation Manual Issue 4,
MSC Fisheries Certification Methodology (FCM) Version 6,
MSC TAB Directives (All)
MSC Chain of Custody Certification Methodology (CoC CM) Version 6.

Approved Certification Body:
TAVEL Certification Inc.
99 Wyse Road, Suite 815
Dartmouth, Nova Scotia, Canada B3A 4S5

Original Assessment Team
Mr. Steven Devitt, B.Sc. TAVEL Certification Inc.
Mr. Donald Parsons, M.Sc.
Mr. Mark Pedersen, M.Sc. Margenex International Inc.
Dr. James Wilen, Ph.D., University of California, Davis

1.0 THE CERTIFIED FISHERY

1.1 The Client

The client and contact for the Oregon Pink Shrimp Fishery Certification is as follows:

Mr. Brad Pettinger, Executive Director
Oregon Trawl Commission
16289 Highway 101 S. Suite C
Brookings, Oregon 97415

Phone: 1(541) 469-7830
Fax: 1(541) 469-7863
Email: bpettinger@ortrawl.net

The client for the assessment is the Oregon Trawl Commission, an Oregon state government agency. The Oregon Trawl Commission (OTC) operates under the umbrella mandate of the Oregon Department of Agriculture Commodity Commissions Program. The commission was formed by a vote of the producers in 1962, and is funded entirely by fishermen from a percentage of their catch. OTC is made up of eight commissioners: five fishermen, one processor, one distributor and one public member. Commissioners are chosen from among the owners and captains of trawl vessels, processors and distributors by the director of the Oregon's Department of Agriculture.

1.2 The Fishery

The Oregon pink shrimp trawl fishery is managed by the State of Oregon (Oregon Department of Fish and Wildlife) through a limited entry program requiring harvesters have both a license for operating a commercial fishing vessel and a limited entry ocean shrimp harvesting permit.

The fishery targets ocean or pink shrimp *(Pandalus jordani)*. Ocean shrimp have been found from Unalaska to San Diego in waters from 37 to 460 meters in depth. Commercial concentrations are typically found between 90 and 180 meters depth. Shrimp congregate over green mud or mixed green mud - sand substrates called beds.

The specific scope of the full certification assessment was the commercial ocean shrimp fishery conducted by Oregon's permitted harvesters within the coastal and federal waters off the states of Washington, Oregon and California with the product landed in Oregon ports. Federal waters include waters beyond the three nautical mile state water limits out over the shelf and slope to the 200 nautical mile line.

1.3 Unit of Certification

The MSC certification methodology defines a candidate fishery unit of certification as follows "The fishery or fish stock (=biologically distinct unit) combined with the fishing method/gear and practice (=vessel(s) pursuing the fish of that stock) and management framework."

The certified fishery is defined as

Species:	Ocean Shrimp, Pink Shrimp (*Pandalus jordani*)
Geographic Area:	West Coast USA, Oregon, Washington, California (WOC)
Method of Capture:	Otter trawl
Fleet:	Oregon permitted vessels fishing in WOC and US EEZ waters, landing in Oregon ports.
Gear:	Otter trawl.
Stock:	This project evaluated and certified the west coast ocean shrimp stock which extends from south east Alaska to California waters. This assessment considers the health of the coast wide stock from Washington south to California and the effects of the Oregon permitted harvesters on that stock.
Management:	The fishery is managed by the Oregon Department of Fish and Wildlife.

2.0 THE SURVEILLANCE AUDIT

2.1 Surveillance Audit Details

TAVEL Lead Auditor: Steven Devitt (On-site) **Date:** November 24 - 25, 2008
Expert Assessors: Mark Pedersen (Review) **Start Time:** 09:30

Type of Audit: Surveillance
Duration: 2 Days

MSC Fishery Standard:	Version 2, November 2002
MSC Fishery Certification Methodology:	Version 6, September 2006
TAB Directives:	All

Scope of Audit: Oregon Pink Shrimp Trawl Fishery
PCR Issued: November 29, 2007
Certificate: TVI-F-07001
Certificate Expiry Date: December 5, 2012

Location of Audit: Oregon Dept of Fish and Wildlife
Hatfield Marine Science Center
2030 SE Marine Science Dr
Newport, OR 97365
Phone: 541 867 0300

2.2 Surveillance Audit Process

This report presents the findings and conclusions of the first surveillance audit conducted on the Oregon Pink Shrimp fishery. The surveillance audit was conducted in accordance with the Marine Stewardship Council (MSC) Fisheries Certification Methodology (FCM) Version 6, September 2006.

The surveillance audit was announced on the MSC website on October 30th, 2008 and stakeholders who had previously communicated with TAVEL during the certification process were notified by direct email. There were no requests from stakeholders to meet with the auditor during the scheduled surveillance audit times.

The surveillance audit consisted of three individual meetings between Steve Devitt of TAVEL and the Oregon Department of Fish and Wildlife (Dr. Bob Hannah, Mr. Steve Jones); the Oregon Trawl Commission (Mr. Brad Pettinger) and an independent consultant (Mr. James Golden), who was contracted to review the management program as required in one of the conditions identified during the initial fishery assessment.

The first meeting was conducted with ODFW personnel Dr. Bob Hannah and Mr. Steve Jones. The purpose of this meeting was to review the current status of the fishery, the target stock, on-going research as well as to discuss progress on conditions identified during the assessment.

The second meeting was conducted with the independent consultant contracted by the OTC to conduct an external management review.

The final meeting was conducted with the client to attain feedback on the conditions including current progress on each condition, status of remaining conditions. A general discussion about the fishery during the 2008 season and the impact of certification on the fishery and processing sector was also conducted.

3.0 RESULTS

This section provides general feedback on the status of the target stock, the fishery and the current status of the outstanding conditions. The initial certification assessment was completed in December 2007 and was based on the performance of the fishery completed in 2006 fishing year. This surveillance audit report will provide a review of stock status and fishery performance for the completed reporting cycle for the 2007 and 2008 fishing seasons (April – October, 2007, reported in the 19th Annual Pink Shrimp Review in February 2008 and April – October, 2008, reported in the 20th Annual Pink Shrimp Review in February 2009) as well as the preliminary stock status outlook indicators for the 2009 fishing season.

3.1 Fishery Results 2007 & 2008

The shrimp stock evaluation presently takes the form of in-season and annual analysis of CPUE data and biological samples collected from the Oregon fleet. CPUE, year-class strength, and geographic distribution of catch are compared to historical data and indicators of Biological Concern listed in the draft shrimp Fishery Management Plan (FMP). Table 1 presents fishery performance indicators for the 2007 and 2008 season.

Table 1: Fishery performance indicators for 2007 and 2008. Source: ODFW 20th Annual Pink Shrimp Review, 2009.

Fishery Performance Indicator	2007	2008
Commercial Landings (lbs)	20,080,482	25,508,839
Number of Landings	715	821
Number of Active Vessels	45	58
Fishing Effort (Single Rig Equivalents)	~35,000 Hrs	~39,000 Hrs
CPUE (lbs/ SRE hour)	~600	657
Dominant Age Class	1 year olds	2 yr olds
Count per pound (weighted average)	133	114
Average Ex-vessel price	$0.48	$0.55

Figure 1 presents the pink shrimp commercial landings in millions of pounds since 1957. This graph clearly demonstrates the cyclical nature of landings over the period of the fishery. Currently the landings are above the 15 year average of 19.6 million pounds.

Figure 2 displays fishing effort in thousands of hours trawled using the single rig equivalents (SRE). Fishing effort increased in 2008 to approximately 39,000 SRE hours.

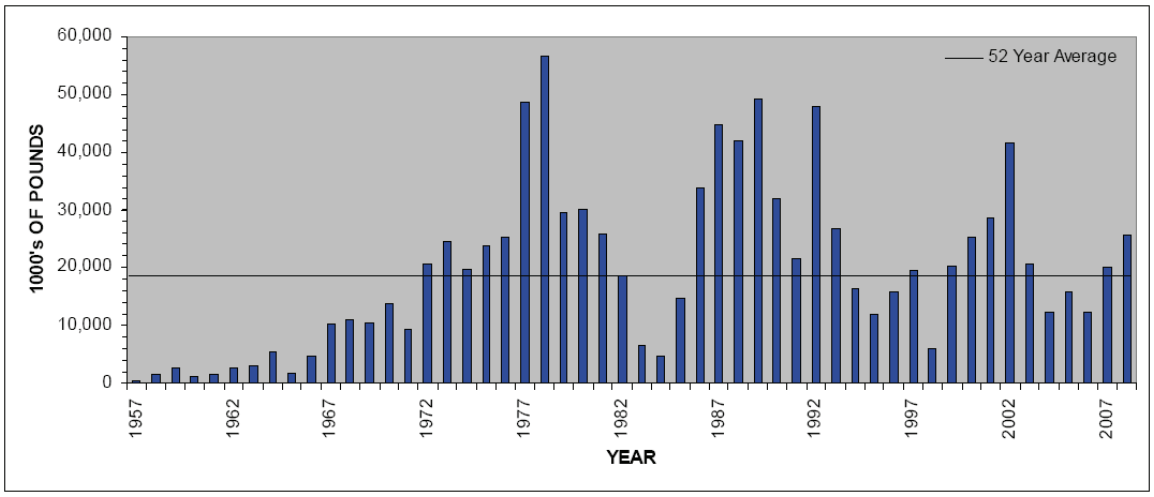

Figure 1: Oregon pink shrimp commercial landings (millions of pounds), 1957 – 2008.
Source: ODFW 20th Annual Pink Shrimp Review, 2009.

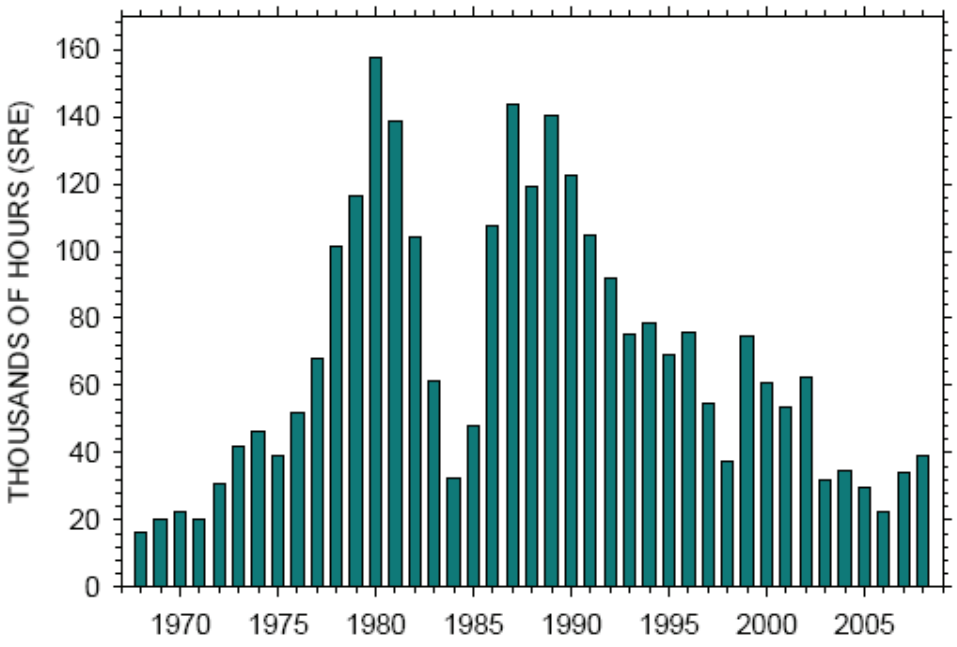

Figure 2: Fishing effort (1000's of single-rig equivalent hours: 1 SRE = 1 single-rig hour= 1 double-rig hours x 1.6) for pink shrimp landed in Oregon, 1968 – 2008. Source: ODFW 20th Annual Pink Shrimp Review, 2009.

Figure 3 displays catch per unit effort in pounds of shrimp caught per SRE hour from 1968 to 2008. The 2008 fishery recorded a CPUE of 657 pounds per hour, among the highest in the time series and the highest since 2002.

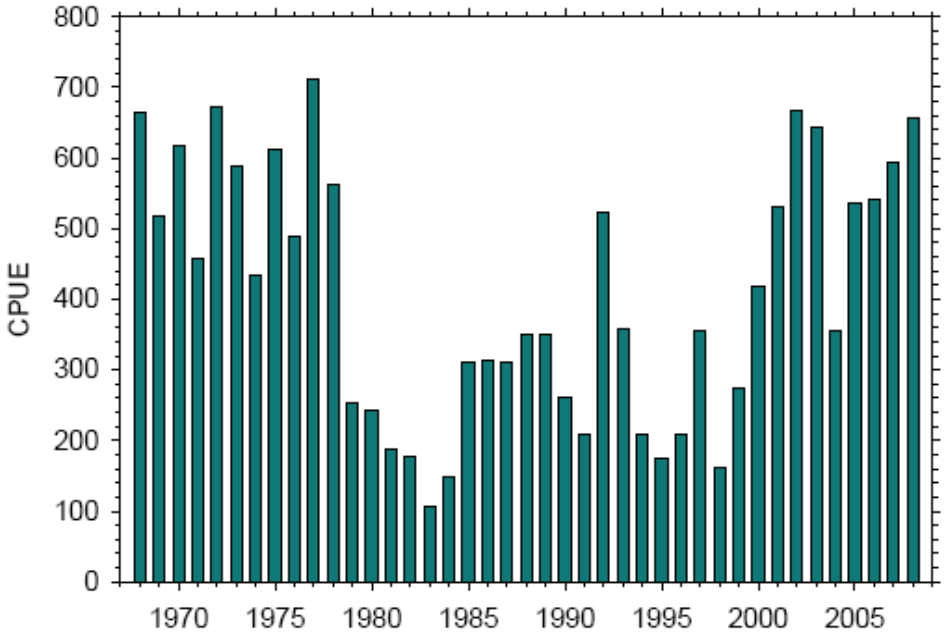

Figure 3: Catch per unit of effort (CPUE=lbs/SREhb) for vessels landing pink shrimp into Oregon, 1968-2008. Source: ODFW 20th Annual Pink Shrimp Review, 2009.

Pink shrimp have a maximum life span of four years, with shrimp ages 1 to 3 dominating the fishery. Figure 4 displays the percentage of age composition in the catch which indicates that age 2 shrimp dominated the 2008 catch.

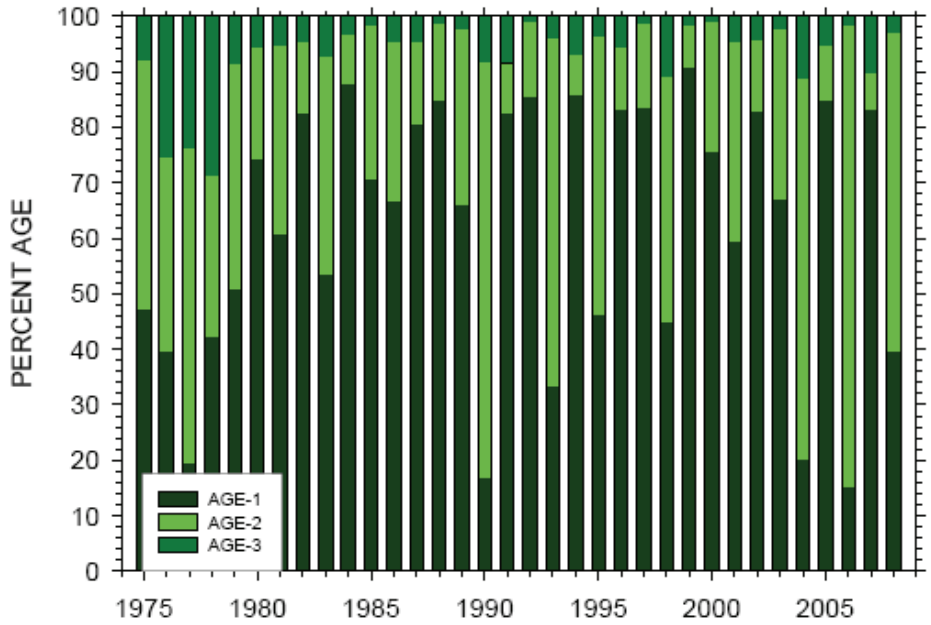

Figure 4: Annual percent age composition of pink shrimp (#'s of shrimp) landed in Oregon, 1975-2008. Source: ODFW 20th Annual Pink Shrimp Review, 2009.

3.2 Stock Status Outlook - 2009

The 20th Annual Pink Shrimp Review reports that prospects seem good for shrimp production during the 2009 season, with little reason to expect less than average shrimp abundance. Hold-over of shrimp from 2008 should be fairly good, especially in areas south of Cape Perpetua where age-1 shrimp were most abundant (ODFW, 2009).

The age-1 component of the late-season catch in 2008 was fairly high only in areas south of Cape Perpetua. Northern areas may have sharply less hold-over of age-1 shrimp (age-2 in '09). Hold-over survival to age-3 in 2009 is a big question (ODFW, 2009).

Recruitment strength and distribution of age-1 shrimp will be the major driver of shrimp abundance in 2009. The zero-age shrimp (zero's) component of market samples collected during fall 2008 showed a similar distribution pattern and slight increased abundance to that seen in fall 2007 (ODFW, 2009).

Adding to the mix of information, ODFW's recruitment model suggests that age-1 recruitment could be strong in 2009. The model is still being tested and has had variable predictive value in the past, but the 2008 season analysis indicates that the Oregon coast could experience one of the strongest recruitment events since the time series began in the mid 1980's. The model, which is based on the spring transition in coastal currents, uses April sea level to predict age-1 recruits the following year (Figure 5). Sea level during April 2008 was 6.8 feet, the lowest level in the time series, suggesting that recruitment could be well above average in 2009. The model doesn't indicate where along the coast the recruitment will occur though. ODFW's best guess is that most recruitment will occur south of Cape Perpetua, based on market sample information (ODFW, 2009).

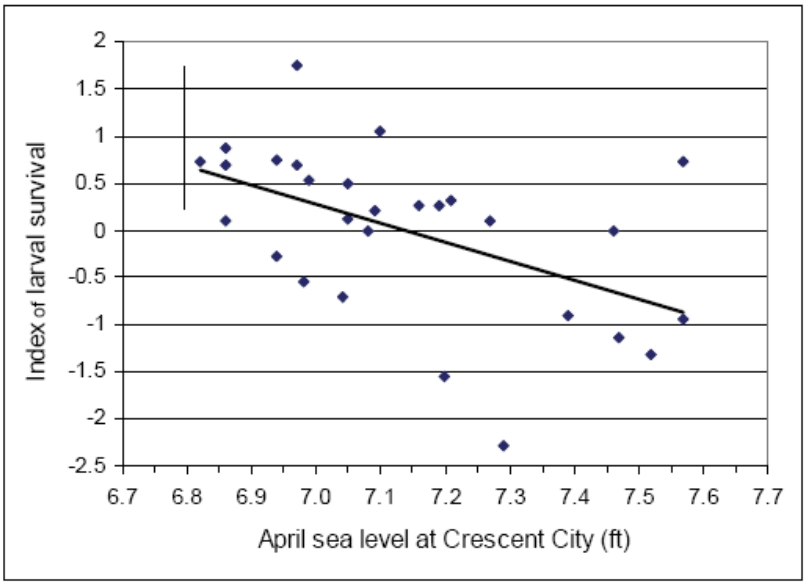

Figure 5: Index of larval survival vs. April sea level on year prior at Crescent City, CA. Points shown indicate year at age-1 catch. The vertical line shows the survival range that might be expected with a sea level of 6.8 feet. Source: ODFW 20th Annual Pink Shrimp Review.

3.3 Conditions

The fishery attained scores of 80 or more in 73 of the 77 performance indicators evaluated in the full certification assessment. The client agreed to improve the performance of the four indicators by undertaking the actions identified below each condition.

This surveillance audit reports on the client's progress of completing the corrective actions identified during the full assessment. For each condition, we provide the performance indicator, the 80 scoring guidepost and the client's action plan and the progress in completing the action plan. In order to close off a certification condition, the client must complete the defined action and prove performance at the 80 Scoring Guidepost.

3.3.1 Conditions, Action Plan and Client Progress

Condition 1

Performance Indictor 1.1.2.1	**80 Scoring Guidepost**
All fishing related mortality is recorded/ estimated. This includes landings, discards, and incidental mortality (adult and juvenile).	• Landings and discards are accurately recorded in log books as required by regulation. • Discards are well estimated for adult and juvenile shrimp.
Condition The client must meet the requirements of the 80 scoring guidepost prior to the first annual surveillance audit. Discards are to be accurately recording in log books. Discards are to be well estimated for adult and juvenile shrimp.	
Proposed Client Action Plan ODF&W agrees that having this information would be very valuable to their shrimp management program. Timing is also excellent in this corrective action (CA), as the department was planning on re-ordering shrimp logbooks this coming year and they will now modify the existing logbooks with a column that will catch the discard information. The OTC is also working with Pacific States Marine Fisheries Commission (PSMFC) on an electronic logbook for all west coast trawl fisheries and that feature will be incorporated as well.	
Activity Completed in Current Surveillance Cycle ODFW published and distributed new log books to the shrimp fleet in 2008 season. An example can be seen in Appendix 1. Compliance with completion of the new information requirements (discard and dumped tows) of the log was evaluated to be good. The 2008 log book results were evaluated, and as expected with a first time implementation, there were inconsistencies in the use of the new data fields on the revised log. ODFW provided detailed feedback to the fleet in the February 2009 Annual Pink Shrimp Review and committed to following up with harvesters to ensure that that data from the 2009 season is of higher quality. The logbooks show that about 1.4% of all Oregon shrimp tows in 2008 had at least one bag dumped. Also, only about 16.3% of all reported dumped catch was shrimp.	
Activity Evaluation (Milestone deliverables, timeline, results) Significant progress toward meeting the condition to satisfy SG 80 bullet one has been made by promulgation of the regulation and distribution of the new logbooks. The ODFW 2009 annual	

report, however, indicated 62% of the tows had an entry of discard information into the new logbooks. Bob Hannah of ODFW noted of the 38% of logs which were problematic, there was 23% which had blank fields in the discard information and the other 15% had a level of minimal catch (both shrimp and discard) recorded as zero, but was almost certainly not zero. He refers to this as a "hailing threshold", or harvesters' interpretation of the requirements.

While it is unreasonable to expect that the discard entry space will be filled in 100%, there is room for improvement. If this practice had been more specifically understood at the time the original condition was written, it would have been more practical to allow at least two years to implement the program.

Status of Condition

The surveillance audit concludes that the intent of the condition has been met but at the time of the audit, there was not an available estimate of total catch and discards. The discard analysis is currently being completed by ODFW. As such, the assessment team concludes that the fishery does not currently meet the 80 scoring guidepost and has reworded the initial condition as follows:

"The client can meet the requirements of the 80 scoring guidepost if 60% of logbook compliance related to discards is observed prior the first annual surveillance audit; and significant improvement in that percentage shown by the second and third annual surveillance audit. Results of estimations of target species discard and by-catch will be provided within seven months of the annual end of season."

The next surveillance audit will confirm whether log book data completion and data accuracy has improved. The performance indicator will be rescored either once estimates of discards are provide or, at the latest, after the next surveillance audit.

Condition 2

Performance Indictor 2.1.1.4	**80 Scoring Guidepost**
Information exists on the ability of the ecosystem to recover from fishery related impacts.	• The main elements of the ecosystem affected by the fishery have been documented and are understood, and this provides a convincing scenario of how the ecosystem would recover from fishery related impacts.

Condition

Within one year, the client must document the main elements of the ecosystem affected by the fishery. Within two years the client must have completed a study (including a report) that will

provide inferences into understanding of the type and magnitude of effects that shrimp trawling has on the main ecosystem elements. Based on the results of the research, a report should provide a convincing scenario of how the ecosystem would likely recover if there are significant fishery related impacts.

[As a suggestion, the team thinks that two actions are required: firstly conduct a literature search that focuses on characterizing the effects of sediment plumes and physical contact on representative marine communities, and then prepare a report that infers likely effects (and significance) to key infauna species on shrimp grounds; and secondly, analyze any existing data, if available, to compare areas of heavy trawling vs light (or no) trawling to develop inferences related to ecosystem recovery. The study would include a semiquantitative analysis of differences in the physical character of the seabed, the abundance of seapens, shrimp, tube worms, corals and other key infaunal communities between the various treatments.

If results do not allow for development of a convincing scenario of how the ecosystem would recover from fishery related impacts, then within 5 years, design and implement, as funding becomes available, a controlled experiment to characterize ecosystem recovery. The approach would be to establish at least two control (non-trawled) and two shrimp trawled sites; then through underwater video or other acceptable means, perform at least a semiquantitative analysis of differences in seabed character and the abundance of key infaunal communities between the two treatments.]

Proposed Client Action Plan

This corrective action is in two parts, 1) a literature search and 2) the design and application of a controlled experiment. The OTC will fund the literature search and ODF&W has already started an ROV study on benthic impacts this last month. It is important to point out that this study was already on the drawing board before the Assessment Team began discussing it as a possible CA. The proactive approach of the shrimp program, continually trying to better understand the fishery and it's impacts, is why the Oregon pink shrimp fishery has scored as well as it has.

<u>Literature Search</u>

The OTC will hire a qualified contractor to conduct a literature search that will focus on characterizing the effects of sediment plumes and other effects on representative marine communities and to prepare a report that infers likely effects (and significance) to key fauna species on the shrimp grounds that will satisfy the CA requirements. This work will be completed within the 12 month time frame.

<u>Fishing Effects on Ecosystem Comparison Study</u>

ODF&W has recently completed 20 hours of ROV generated video tape of the sea floor in four areas around the Nehalem Bank. Two sites were selected inside and outside of an area newly closed to bottom trawling off of the northern Oregon Coast (see attached chart). The 20 hours of film footage taken with the ROV will require a tremendous amount of time to review, analyze

and evaluate and those efforts will begin this winter and could take up to two years. Additional studies relative to this issue are part of a long term line of investigation (5-10 years). The department is directed by the Governor (through designees) and the legislature (through budgets) and the staff has a limited ability to truly commit to do future projects. However, I believe that the shrimp program has an outstanding track record of following through on their plans. As Director of the OTC, I am also on the external budget committee for ODF&W and am able to help explain the value of this project to the fishery and the coastal communities if funding turns into an issue (Brad Pettinger, OTC Executive Director, 2007).

Activity Completed in Current Surveillance Cycle

Literature Search

As required, a literature search of the effects of sediment plumes and other effects on representative marine communities was completed. The client's contactor also prepared a report that infers likely effects (and significance) to key fauna species on the shrimp grounds. The full report can be found in Appendix 2, the summary of findings is below.

The published literature on bottom trawl effects is growing and the quality of research has improved from advocacy papers relating trawling to "clear-cutting" and massive destruction of fish and habitat. The scientific community has documented the cases of destructive fishing which is evident in many poorly regulated areas where trawling has destroyed significant fishery structures and associated habitat. In shrimp fisheries the level of impact is complicated by the depth fished and if the fishery is sub-tropical or arcto-temporal. For mid to outer shelf fisheries like Oregon pink shrimp the effects of shrimp trawling appear to relate to disturbance of the epifauna and production of mud plumes and potential impacts on productivity.

The literature on trawl resuspension is very small, but the results to date indicate that resuspension plumes are short-lived and effects are highly localized. The worst biological effects have been noted in trawl sediments silting in shallow near-shore shellfish beds. The study by Pusceddu et al. (2005) suggest that trawling increases productivity at the lower trophic levels which suggests increased productivity at higher trophic levels, but it would be very difficult to detect this at current levels of fishing in the shrimp fishery off Oregon.

The only potential negative impact that might be occurring from shrimp trawl fisheries in fine sediment mud where near bottom permanent suspension layer could occur as reported by Pilskaln et al. 1998. This is not likely occurring off Oregon due to strong seasonal changes in water mass movements along and across shelf. The absence of reports of these conditions from ROV and near bottom camera observations also indicates that this condition is not present off Oregon.

As shown in this review there are only a few quantitative observations of bottom resuspension by trawling and most indicate effects are short term and little evidence of significant lasting effects. There could be localized effects, but since trawling is repeated in the same locales and trawl locations are a minor percentage of the available habitat the effects, if any are expected to be very minor, and possibility impossible to measure. Lastly, it should be noted that modern shrimp trawling methods do not dig into the substrate as traditional gear. All of the gear is

lighter than used in the past, tickler chains have been abandoned and foot ropes are being shielded with PVC pipe that rides over the bottom easier and reduces trawl drag (Pettinger, OTC; Pers. Comm,.). All of these factors reduce trawl impacts from historic levels.

There is unquestionably a need for further field work to measure specific effects of trawl resuspension plumes on general productivity and community structure; however, the associated level of work may be great in order to separate natural from anthropomorphic change. As Churchill (2005) points out any study on the effects of trawling is best done with input and cooperation of the fishing community and without a priori assumptions as to whether bottom fishing is harmful or beneficial to the marine environment.

Fishing Effects on Ecosystem Comparison Study

In June 2007, ODFW staff conducted a baseline video survey of the sea floor within and adjacent to the Nehalem Bank Essential Fish habitat (EFH) no-trawl zone (Figure 6). Analysis of the survey is complete and a report has been submitted to The Journal of Experimental Marine Biology and Ecology. In the paper, the authors compare the occurrence and relative abundance of the macro-biota (invertebrates and fish) and topographical features between the four areas sampled. The authors conclude that shrimp trawling has had a moderate level of impact on the seafloor biota, warranting further research into how shrimp trawls impact benthic invertebrates. The paper should be accepted and printed in 2009.

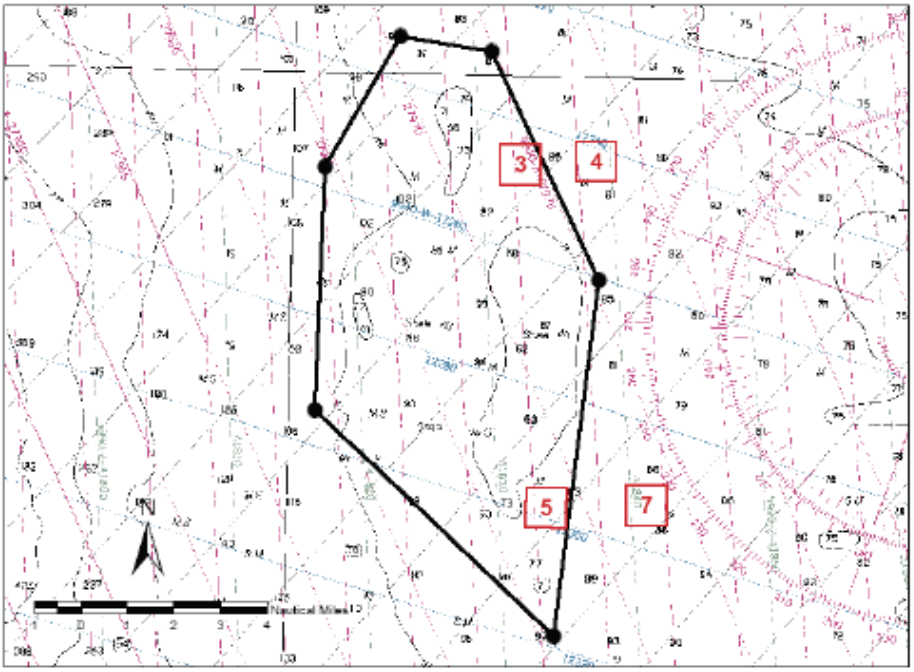

Figure 6: A chart of the Nehalem Bank/Shalepile area showing the EFH no-trawl zone boundaries established in June 2006. The squares labeled #'s 3, 4, 5 and 7 are the areas surveyed during the June 2007 video survey. Source: ODFW 20th Annual Pink Shrimp Review.

Activity Evaluation (Milestone deliverables, timeline, results)
The literature search and video survey has been completed and will provide a basis for identification of the main elements of the ecosystem which might possible. The results of the first phase of the in-situ study are completed and the client is on schedule to complete the second phase of their action plan.
Status of Condition The first surveillance audit requirement has been completed and objective attained. The concluding activity of the condition is underway. The performance indicator will be rescored after the next surveillance audit.

Condition 3

Performance Indictor 3.1.3	**80 Scoring Guidepost**
The management system incorporates and applies an adaptive and responsible exploitation strategy.	A responsible management strategy is followed, including: • explicit long-term management objectives seek to maintain stocks at high levels of productivity. • an explicit harvest strategy which accounts for uncertainty. • the management system estimates all commercial catches, landings and by-catch and annually assesses the status of target stocks.
Condition Prior to the first annual surveillance audit, the client must prove that the management system estimates all commercial catches, landings and by-catch and annually assesses the status of the stock. [Condition Intent: The deficiencies that reduce the score below 80 relate to shortcomings of total catch and estimates of discards (see 1.1.2.1 for elaboration). Periodic observer coverage exists that records discards of undersized shrimp, but there are no estimates of total catches	

compared with total landings data.]
Proposed Client Action Plan As stated earlier, the timing is excellent in this CA, as the department was planning on re-ordering shrimp logbooks this coming year and they will now modify the existing logbooks with a column that will catch the discard information. The OTC is also working with the PSMFC on an electronic logbook for all west coast trawl fisheries and that feature will be incorporated as well.
Activity Completed in Current Surveillance Cycle New fishing log books were designed, ordered and distributed to the fleet, see Condition 1 above.
Activity Evaluation (Milestone deliverables, timeline, results) The requirement to collect information and generate estimates of discards has been completed.
Status of Condition The surveillance audit concludes that the requirements of the condition have been met. The client met the intent of the condition and achieved everything stated in their Proposed Client Action Plan statements. The condition is certain to be satisfied when information on total catch and by-catch is provided after a reasonable amount of time is afforded to do so. The performance indicator will be rescored once an estimate of discard and bycatch is provided to TAVEL. This is expected in the following 2 – 3 months.

Condition 4

Performance Indictor 3.6.1	**80 Scoring Guidepost**
The management system measures and records and evaluates all aspects of the fishery to provide a basis for assessments of stocks and management performance.	• There is a monitoring program that covers all indicators of stock health and management performance. • The monitoring program has been subjected to independent outside review to identify gaps
Condition Within one year, the client shall subject the fishery monitoring program to an independent outside review to identify gaps. The review shall verify that the monitoring program covers all	

indicators of stock health and management performance.

The review must be undertaken by a credible management expert.

Proposed Client Action Plan

The OTC will to hire a credible management expert to review the performance of the management system. Within 6 months of the certificate award the OTC will provide:

- The proposed reviewers(s) curriculum vita
- The terms of reference and scope for the management Review.

Prior to the First Annual Surveillance Audit, the OTC will provide:

- The report of results of the Management Review
- Identify Gaps from review process
- Proposed corrective action for identified gaps
- Propose timeline for corrective action plan
- Propose period and rationale for subsequent management review

Activity Completed in Current Surveillance Cycle

Scope of Work and Proposed Reviewer

TAVEL was provided with and accepted the proposed reviewer for the independent review, Mr. James Golden. His CV can be found in Appendix 3.

A proposed scope of work for the review was provided as follows.

Scope and Terms of Reference for the Management Review

Scope

The management review covers the Oregon pink shrimp trawl fishery over the period November 2007 through October 31, 2008. The review consisted of checking documents and data sources used by the State to manage the pink shrimp fishery and by contacting Oregon Department of Fish and Wildlife and Oregon State Police staff, Brad Pettinger, Executive Director of the Oregon Trawl Commission, the National Marine Fisheries Service, and fishermen.

Corrective Action Plan

The reviewer evaluated the client and fisheries performance in meeting conditions attached to the MSC certification for the Oregon Pink Shrimp Fishery. The evaluation of each condition is found under the heading *Evaluation of Management Performance.*

Overall Management Review

The overall management performance was a condition placed on the fishery. The review was broken into five components:

Fishery Monitoring – The Oregon Department of Fish and Wildlife monitor the fishery through a logbook and port sampling program. The reviewer evaluated 2008 sampling programs by comparing them with performance criteria established for the fishery by ODFW.

Enforcement Compliance – The Oregon State Police enforces commercial fisheries rules and regulations for the shrimp fishery. OSP was interviewed to obtain statistics on compliance rates for the period November 2007-October 31, 2008.

Research – Ongoing and planned research are important components of the overall management program for pink shrimp. More information is needed (as evidenced by the MSC conditions placed on the fishery) to evaluate impacts on habitat, to ensure bycatch reduction efforts are effective, and to evaluate the need for and kinds of precautionary management measures that might necessary. The reviewer evaluated ongoing and future research plans for performance and consistency with needs.

Stock Assessment – The reviewer evaluated sampling and monitoring programs along with in-season stock assessments. The reviewer also interviewed the Senior Shrimp Biologist regarding ODFW's plans to update annual environmental models.

Organizational Integrity/Viability – The primary organization responsible for managing the Oregon pink shrimp fishery is the Oregon Department of Fish and Wildlife. Continued certification is dependent on continued performance of the management program as described by the previous four activities. The reviewer evaluated the prospects for continued financial support and agency priority for maintenance of the shrimp management program.

Management Review Report

The report of the independent management review was provided to TAVEL as required. The full content can be found in Appendix 3 below. The findings of that process are below.

Fishery Monitoring

Central and Southern Oregon grounds continued to provide the mainstay of the fishery which was dominated by Oregon landings coastwide. The trend in increased catch continued in 2008 and Oregon landings were up by about 21% over the previous season. Likewise effort, as measured by the number of trips, also increased 15%. ODFW's sampling program continues to be as robust as it has been in the past. Other than a few trips with high count per pound shrimp at the beginning of the season, there were no other indicators of Biological Concern – count per pound remained low, the fishery depended on two year old shrimp, and CPUE was higher than in 2008 and the long-term average.

Bycatch is thought to be quite low since the implementation of mandatory BRDs or excluders in the shrimp fishery, yet actual data on bycatch and discard is not available at this time. ODFW will provide estimates and evaluate a new logbook designed to collect such information.

Enforcement Compliance

From November 1, 2007 through October 31, 2008, OSP worked 108.25 hours towards Pink Shrimp enforcement (Samuals 2008). During those hours OSP officers made 106 contacts resulting in 8 NIC (not in compliance) being either a warning or citation. This would have resulted in a voluntary compliance rate of pink shrimp rules at about 92.5%. Details of the types of warnings or citations were not available within the timeframe of the data request, but are present within OSP database.

Research

ODFW continues to make strides in research directed at bycatch reduction, and to evaluate potential impacts of shrimp trawl gear on macrobethos. Plans for additional modeling work are only preliminary as is evaluation of potential precautionary measures that might be employed if fishery effects are found.

Stock Assessment

ODFW and staff have collected catch, effort, and biological data and are in the process of evaluating it for their annual review. Sampling continues to be robust in comparison to previously established statistical standards. No alarming trends were seen in the data collected during the 2008 season when evaluated against the draft FMP's list of Biological Concerns. Effort may continue to increase. Evaluation of the environmental model is pending.

Identified Gaps

The primary gap appears to be in acquiring estimates of discard mortality of shrimp and fish. Evaluation of the new logbook system is forthcoming which may provide estimates. Lags in independent observer data may make evaluation difficult.

A minor gap concerns the lack of formal top-down review by upper levels of management. Much responsibility is placed at middle and lower management levels within Marine Resources Program for management and management review of the pink shrimp fishery. Upper managers must rely on the initiative of the Senior Shrimp Biologist and MRP Manager to inform upper levels of management regarding stock status and fishery concerns. Performance of mid and lower level managers has historically been excellent however.

Proposed Corrective Action

1. The client and ODFW will encourage NMFS to provide coverage and data necessary and in a timely fashion to evaluate the new logbook program.
2. Continued gear research on bycatch reduction is recommended.
3. In years past, formal MRP program reviews were conducted to evaluate project strengths and weaknesses and to apprise the Harvest Manager of emerging fishery issues. ODFW may want to consider an annual or biannual program review.

Timeline for Proposed Corrective Action

The clients suggests that the timeline be 2 or 3 years, consistent with the proposed management review cycle below, in order to evaluate the new logbook or conduct an experiment to do the same, complete evaluation of bycatch reduction devices, and continue to update the model and evaluate literature for

other potential precautionary approaches to managing shrimp.

Proposed Period and Rationale for Future Management Reviews

The client proposes a 2 to 3 year cycle for management reviews. Much of the information needed to evaluate management and research performance takes more than a year to acquire. For example, logbook and sample data, and data on bycatch and discard may not be available for 3 months to 6 months or more beyond the end of the fishing season. Research results may require even more time. The fishery and management have been stable for decades and resource risk both historically and now especially at current levels of abundance and effort seems to be low.

Activity Evaluation (Milestone deliverables, timeline, results)

Deliverable timelines for the scope of work and the management review were met.

The TAVEL Auditor and reviewer have reviewed the results of the review and determined that the identified gaps are reasonable as is the proposed actions to improve performance in this area.

TAVEL will confirm during the second surveillance that the management/ scientific agencies have committed to conducting the proposed corrective actions. Assuming that there is commitment to conduct these corrective actions, TAVEL will close the required corrective action for the certification and audit the occurrence the proposed management review. Should the agency not commit to conducting the proposed action, the client will be found in non-conformance of the condition.

Status of Condition

The required actions identified in the certification report have been completed. TAVEL will audit the status of the proposed actions identified in the management review in the second surveillance audit.

The assessment team has reviewed the information and has determined that the performance indicator can now score 80.

4.0 CONCLUSIONS AND RECOMMENDATIONS

TAVEL Certification concludes that the Oregon Pink Shrimp fishery continues to meet the intent and requirements of the MSC Principles and Criteria of Sustainable Fishing. This is demonstrated by the ongoing commitment of the harvesters and ODFW staff to conduct the fishery in a sustainable manner and to evaluate the impact of the fishery on the target stock and non-target species and habitat.

Corrective actions were conducted to the best of the abilities of the client and agency in accordance with the defined timeline and deliverables identified in the certification award contract.

To bring the surveillance audit into line with the fishery assessment cycle which concludes in February of each year, TAVEL will request a variation from the MSC Fisheries Certification Methodology so that surveillance activities can be conducted when assessment results are finalized each year.

Fishery Improvements

Noteworthy in the 2008 season is that the industry and ODFW continue to improve the bycatch reduction device technology.

The average bar spacing of rigid-grates BRDs decreased in 2008 to 1.18 inches, with more vessels using rigid-grates with one-inch bar spacing or less than ever before (Figure 7). In the 2008 logbooks, shrimpers reported using a bar spacing of one inch or less on 22 vessels (37.9% of vessels) at least some of the time during the season. ODFW staff estimated that about 27% of all tows by vessels landing shrimp in Oregon during 2008 were made using rigid-grates with one-inch spacing or less. The apparent shift to narrower bar spacing was probably in response to the large numbers of "mini" hake in the 2008 season. The shift undoubtedly helped reduce the catch of other small fish as well, including juvenile rockfish and smelt (ODFW, 2009).

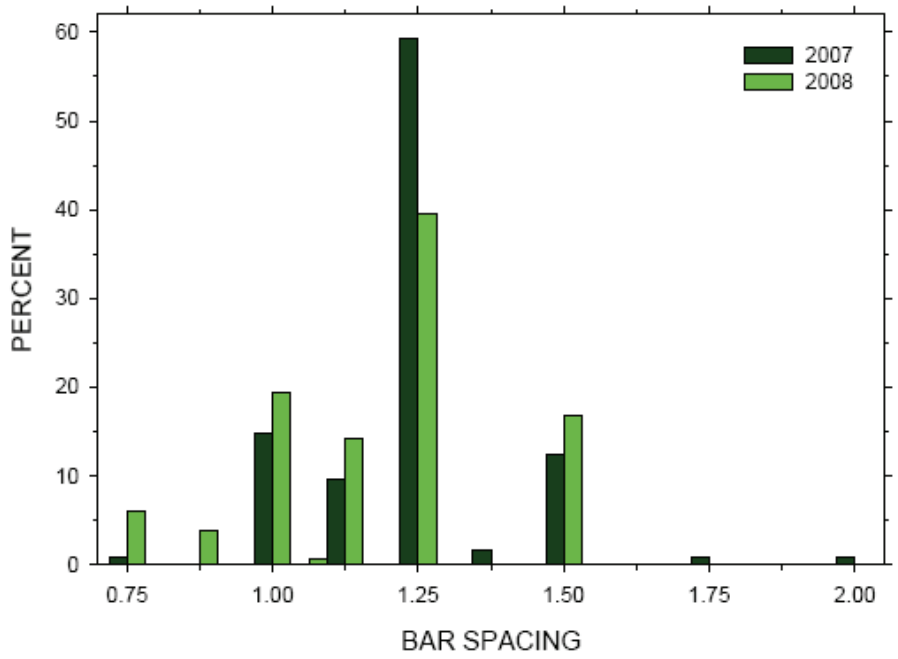

Figure 7: The percentage of shrimp trips versus the rigid grate bar spacing (inches) used on the trips during 2007 and 2008. Source: ODFW 20th Annual Pink Shrimp Review.

Shrimp project research for the next few years will probably focus on ways to further reduce bycatch in the shrimp fishery, either through rigid-grate BRD modifications or fishing-line/footrope

changes. ODFW plans to conduct a full test of a refined rigid-grate with 0.75" bar spacing this year to confirm initial results from 2005 (see Figure 8) and to further demonstrate its utility to the fleet.

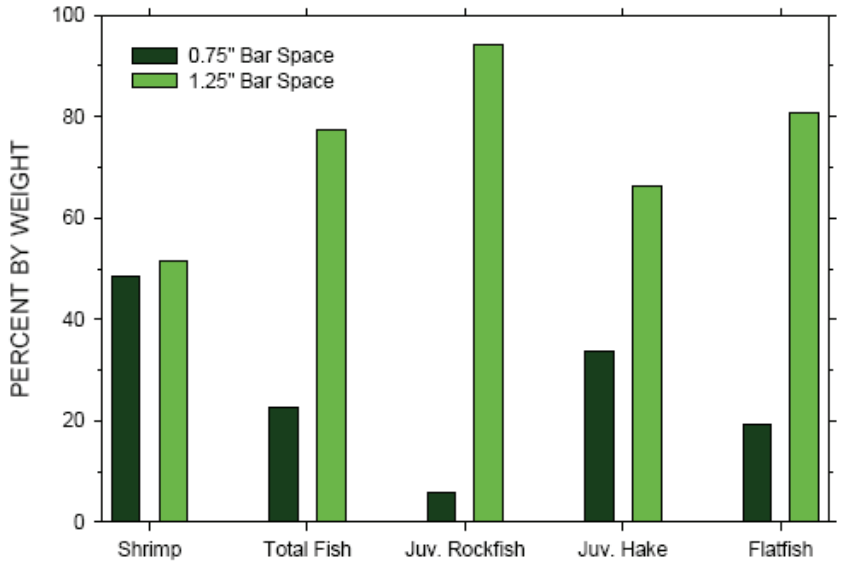

Figure 18. The percentage of total catch (pounds) of selected catch categories caught during a charter experiment using a 0.75" bar-spaced rigid-grate and a 1.25" rigid grate in 2005.

Appendix 1: 2008 Shrimp Fishing Log Example.

Appendix 2

Literature Search and Report Effects of Trawl Sediment Plumes on Representative Marine Communities

Author: **Dr. Vidar Wespestad**

Date: **November 24, 2008**

The effects of trawling has long been a subject of controversy since trawling first began when beam trawling was introduced in Europe in the 14th century. (Jones 1992). In the intervening time there have been several investigations and commissions to study the effects of trawling, but it is only within the past 2 decades that a combination of public pressure and advances in observational gear have resulted in quantitative studies of the impacts of fishing on marine habitat. Jones (1992) provides a historical review of the effects of trawling up until the early 1990s. His review concluded direct effects include scraping and ploughing of the substrate, sediment resuspension, destruction of benthos, and dumping of processing waste. Indirect effects include post-fishing mortality and long-term trawl-induced changes to the benthos. He noted that there are few conclusive studies since it is difficult to isolate the cause; but, research has established that the degree of environmental perturbation from bottom trawling activities is related to the weight of the gear on the seabed, the towing speed, the nature of the bottom sediments, and the strength of the tides and currents. Further that there is an association with depth and bottom trawling in very deeper water (> 1000 m) where the fauna is less adapted to changes in sediment regimes and disturbance from storm events, the effects of gear take longer to disappear.

Collie et al. (2001) published "A quantitative analysis of fishing impacts on shelf-sea benthos" which examined 39 published fishery impact studies. The results of this review indicated that inter-tidal dredging and scallop dredging have the greatest initial effects on benthic biota, while trawling has less effect. The analysis of all the studies support the general view of how fisheries inpact benthic communities,. Fauna in stable gravel, mud and biogenic habitats are more adversely affected than those in less consolidated coarse sediments. They further concluded that areas that are fished in excess of three times per year (as occurs in parts of the North Sea and Georges Bank) are likely to be maintained in a permanently altered state. They also note that there are substantial gaps

in the available data, in particular, data on impacts and recovery of epifaunal structure-forming benthic communities.

Off the west coast of the United States there have been few published studies of fishery impacts. Several have been conducted off Alaska looking at bottom trawl effects, comparisions in the Bering Sea and in the Gulf of Alaska show some effects but relatively minor differences between trawled and untrawled areas (McConnaughey et al. 2000) Stone, R. P., and M. M. Masuda. (2003). These studies found little difference between trawled and untrawled areas, but noted that there was some change in epibethic biota. Schwinghamer et al. (1998) reported similar results from the Grand Banks off Newfoundland, CA. where in an experimental series of trawls found the physical effects of otter trawling observed were moderate and that recovery occurs in about a year.

Friedlander et al. (1999) reported on numbers and orientation of trawl marks was quantified over an extensive portion of the outer shelf and slope off Eureka, California observed with high-resolution sidescan-sonar. They found trawl marks are commonly oriented parallel to bathymetric contours and there was a significant positive correlation between the number of trawl marks observed on the sidescan images and the number of annual trawl hours logged within reporting areas. Fishing logbook data indicate that the entire reporting area was trawled about one and a half times on an average annual basis and that some areas were trawled over three times annually. The study also noted that the portion of the total area trawled was about 15%. Similar trawled/untrawled ratios of 15-20% are reported from other areas Jones (1992).

Shrimp trawling effects

There have been several studies of shrimp trawl interactions with bottom sediments. Most of these studies have been in tropical shrimp fisheries, primarily in Australia and the Southeast U.S. Some studies have been conducted in Europe and eastern Canada.

Simpson and Les Watling (2006) observed the cumulative impacts of seasonal commercial shrimp trawling on habitat and macrofaunal community structure for two mud-bottom fishing grounds and adjacent untrawled areas in the Gulf of Maine. The results suggest that seasonal shrimp trawling produced at least short-term changes (<3 months) in macrofaunal community structure, but did not appear to result in long-term cumulative changes. Resilience to trawling disturbance may be due in part to high levels of biological disturbance generated by benthic megafauna, such as lobsters and

fish. By burrowing, pit-digging, and possibly foraging, these animals rework sediments to a depth of 16–17 cm, creating a natural level of disturbance that appears to maintain macrofaunal communities in a perpetually low successional state, so potentially minimizing trawling impacts. Moreover, sediment resuspension associated with shrimp trawling did not appear to result in net loss of deposited material on fishing grounds, but there is evidence that trawling may alter sediment mixing regimes.

In another paper on effects of shrimp trawling off the Northeast U.S. Sparks-McConkey and Les Watling (2001) report results of experimental trawling in an area closed to shrimp trawling for 20 years that did not exhibit scouring of sediments by storm events or tidal flow. Untrawled and trawl stations were monitored before trawling and changes in infauna and geochemical parameters were measured post-treatment for 6 months. Numbers and species composition changed in the trawled area and differences between trawled and untrawled area were apparent 6 months after trawling. They alos found that there was little change to bottom topography, but that chlorophyll *a* content of the trawled surface sediments was significantly elevated

Dellapenna et al. (2006) report shrimp trawl effects from the Gulf of Mexico, both direct effects and sedimentation effects; however, this study, and most of the tropical shrimp studies are in estuaries, or near shore areas. In sub-tropical shrimp fisheries, fished at similar depth and substrates as off Oregon, the effects of shrimp trawling are expressed as smoothed bottom with a reduction of epibenthic “fuzz” of bryozoans and other small sessile plants and animals. (Collie et al. 2000).

In summary the primary physical effects of shrimp trawls is a removal of all or a portion of the epibenthic organisms in the areas trawled. One trend evident in trawl fishing gear is lighter gear with reduced bottom contact than traditional heavy gear used in European fisheries. Stone and Masuda. (2003) remark on this factor as a possible reason for no apparent significant trawl impacts between trawled and untrawled areas in the Gulf of Alaska.

Shrimp trawl substrate plumes and resuspension effects.

While there have been many studies of the effects of general trawling and shrimp trawling there have been few studies of silt suspension from trawls. The NRC (2002) found that fishing gear that

disturbs the sediment surface can change sediment grain size distribution or characteristics, suspended load, and the magnitude of sediment transport processes. Bottom trawling and dredging can both resuspend and bury biologically recyclable organic material, changing the flow of nutrients through the food web (Mayer et al., 1991).

Some of the most detailed studies have been conducted in the northeast; U.S. Churchill (2001) reviews most of the work related to understanding the dynamics and effects of trawl gear plumes. Based solely on the decline in sediment resuspension frequency with increasing depth off the shelf (Figure 2), one would expect a mean transport of sediment from the outer shelf to the slope. This occurs because some portion of the sediment resuspended over the outer shelf will eventually settle out on the slope where resuspension events are rare (Csanady et al. 1988). A result is permanent (or at least quasi-permanent) removal of contaminants and organic carbon from the shelf environment (Churchill 1989).

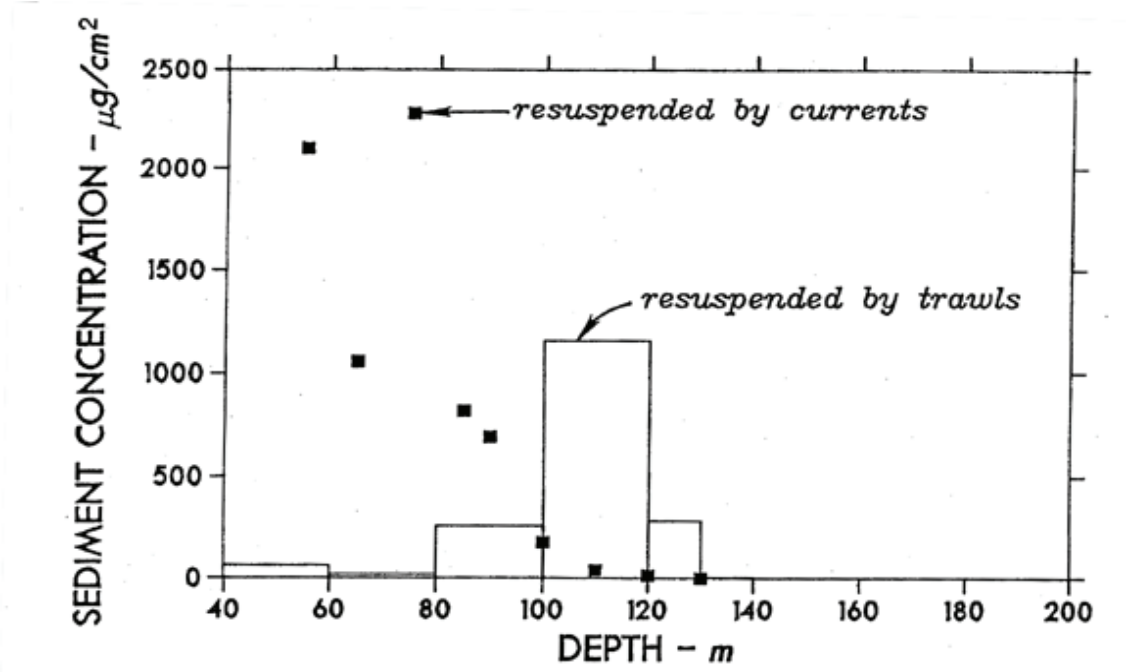

FIGURE 2. **Comparison of model predictions of the averaged mass of suspended sediment put into suspension by currents (squares) and trawling (histogram) as a function of bottom depth. Both sets of values are for sediment resuspended over the "Mud Patch" (shown in Figure 1) over the January through March time period (see Churchill 1989 for further details).**

The above figure2 from Churchill (2001) indicates that the Oregon trawl fishery which generally fishes between 80 and 200 m. is in the range of suspended sediments from trawling is negligible

relative to current driven resuspension to depths where trawl resuspension is the primary mechanism.

Pilskaln et al. 1998 report that the benthic environment of the Gulf of Maine is characterized by a thick and basin-wide nepheloid layer, classically defined as a near-bottom region of permanent sediment resuspension. They believe fishing may strongly affect measured resuspension fluxes and contribute to the maintenance of the nepheloid layer based on seasonal variation in sediment resuspension based collection of large, benthic infaunal worms and resuspended bottom sediment, in a sediment trap that appeared associated with intensive bottom trawling in this area. Conversely they found few worms and less sediment during no fishing periods.

Durrieu et al.(2005) conducted a trawling experiment at three sites in the northwest Mediterranean to assess resuspension of particulate and dissolved solids released from muddy sediments using small bobbins and rockhopper gear. Plumes of resuspended sediment from trawling were measured using acoustic backscattered intensity, from a towed Acoustic Doppler Current Profiler. The trawls produced significant resuspension with clouds several hundreds meters behind the trawl with observed widths of 70-200 m and heights of 3–6 m high.

The average suspended sediment concentrations in the plumes measured by Durrieu et al. reached 50 mg l^{-1}. Resuspended sediment flux along the path of the trawls range from 190 g m^{-2} s^{-1}, for the coarsest sediment (clayey silt), to 800 g m^{-2} s^{-1} for the finest sediment (silty clay). They concluded that only the top 1 mm of the bottom was effected indicating that a very small fraction of the sediment churned by the trawl and doors is resuspended. Further they noted that the plumes rapidly decayed within the first hour, but some (10-15% of the sediment, mostly fine particles remained due to the near-bottom turbulence; and, that currents strongly effected the distribution of plumes

Dellapenna et al. (2006) examined shrimp trawling on seabed resuspension and bottom characteristics in shallow estuaries through a series of disturbance and monitoring experiments were conducted at a bay bottom mud site (2.5 m depth) in Galveston Bay, Texas. Based on pre and post-trawl sediment profiles of ^{7}Be; pore water dissolved oxygen and sulfide concentration; and bulk sediment properties, it was estimated that the trawl rig, including the net, trawl doors, and “tickler chain,” excavate the seabed to a maximum depth of approximately 1.5 cm, with most areas

displaying considerably less disturbance. Water column profile data in the turbid plume left by the trawl in these under-consolidated muds (85–90% porosity; <0.25 kPa undrained shear strength) demonstrate that suspended sediment inventories of up to 85–90 mg/cm^2 are produced immediately behind the trawl net; an order of magnitude higher than pre-trawl inventories and comparable to those observed during a 9–10 m/s wind event at the study site. Plume settling and dispersion caused suspended sediment inventories to return to pre-trawl values about 14 min after trawl passage in two separate experiments, indicating particles re-settle primarily as flocs before they can be widely dispersed by local currents. As a result of the passage of the trawl rig across the seabed, shear strength of the sediment surface showed no significant increase, suggesting that bed armoring is not taking place and the trawled areas will not show an increase in critical shear stress.

In a related study by Warnken et al. it was found that the effects of shrimp trawling are largely dependent on the prevailing sediment redox conditions due to the shallow penetration depth of both oxygen and the trawl gear. They concluded that it is unlikely that trawling activities adversely affect the overall health of Galveston Bay. However, repeated trawling with removal of the upper oxic sediment layers could trend surface sediments towards anoxia and ultimately lead to changes in benthic-pelagic coupling.

Regarding disruption to productivity from resuspension of bottom material a mesocosm study by Pusceddu et al. (2005) of effects on bacteria sediment resuspension resulted in a general decrease of all benthic microbia; however, this reduction was short term (i.e., 36 h). The disruption then had a stimulatory effect on activities of surviving bacterial cells, which, in turn, resulted in increased sediment organic C turnover rates which may enhance nutrient availability in the trophic state of coastal marine ecosystems.

At higher tropic levels sediment resuspended did improve the food value of the suspended material available to filter feeders, and if expressed as protein per unit weight of sediment filtered, actually decreased the food value since filter feeders had to filter more material to obtain nutrients. (Anderson & Meyer ,1986) reported in Churchill 2001).

Summary

The published literature on bottom trawl effects is growing and the quality of research has improved from advocacy papers relating trawling to “clear-cutting” and massive destruction of fish

and habitat. The scientific community has documented the cases of destructive fishing which is evident in many poorly regulated areas where trawling has destroyed significant fishery structures and associated habitat. In shrimp fisheries the level of impact is complicated by the depth fished and if the fishery is sub-tropical or arcto-temporal. For mid to outer shelf fisheries like Oregon pink shrimp the effects of shrimp trawling appear to relate to disturbance of the epifauna and production of mud plumes and potential impacts on productivity.

The literature on trawl resuspension is very small, but the results to date indicate that resuspension plumes are short-lived and effects are highly localized. The worse biological effects have been noted in trawl sediments silting in shallow near-shore shellfish beds. The study by Pusceddu et al. (2005) suggest that trawling increases productivity at the lower trophic levels which suggests increased productivity at higher trophic levels, but it would be very difficult to detect this at current levels of fishing in the shrimp fishery off Oregon.

The only potential negative impact that might be occurring from shrimp trawl fisheries in fine sediment mud where near bottom permanent suspension layer could occur as reported by Pilskaln et al. 1998. This is not likely occurring off Oregon due to strong seasonal changes in water mass movements along and across shelf. The absence of reports of these conditions from ROV and near bottom camera observations indicates also indicates that this condition is not present off Oregon.

As shown in this review there are only a few quantitative observations of bottom resuspension by trawling and most indicate effects are short term and little evidence of significant lasting effects. There could be localized effects, but since trawling is repeated in the same locales and trawl locations are a minor percentage of the available habitat the effects, if any are expected to be very minor, and possibility impossible to measure. Lastly, it should be noted that modern shrimp trawling methods do not dig into the substrate as traditional gear. All of the gear is lighter than used in the past, tickler chains have been abandoned and foot ropes are being shielded with PVC pipe that rides over the bottom easier and reduces trawl drag Pettinger, OTC Pers. Comm,.). All of these factors reduce trawl impacts from historic levels.

There is unquestionably a need for further field work to measure specific effects of trawl resuspension plumes on general productivity and community structure; however, the associate level of work may be great in order to separate natural from anthropomorphic change. As Churchill

(2005) points out any study on the effects of trawling is best done with input and cooperation of the fishing community and without a priori assumptions as to whether bottom fishing is harmful or beneficial to the marine environment.

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Appendix 3: Independent Management System Review.