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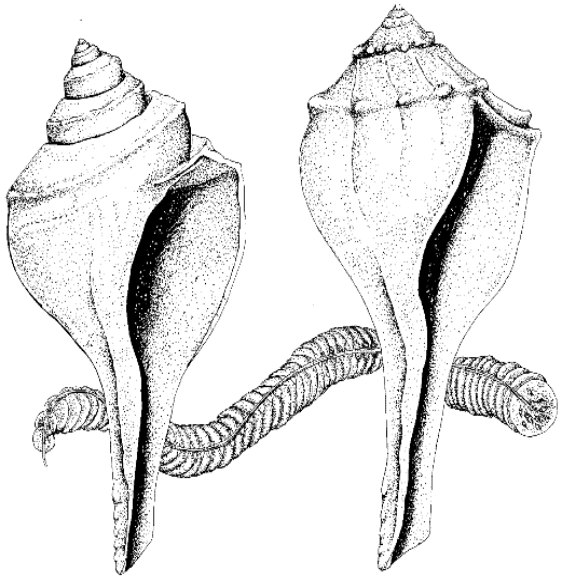
FishPath Workshop Report: Rhode Island Channeled Whelk



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WORKSHOP SUMMARY/OBJECTIVES

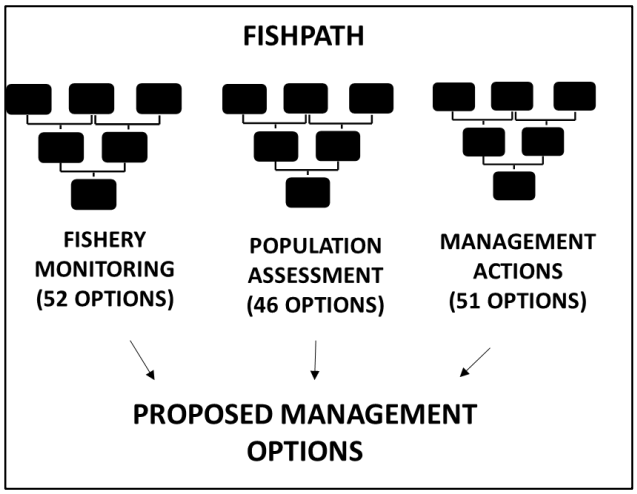
A two-day workshop was held at the University of Rhode Island's Bay Campus from September 6-7, 2017. The workshop was organized by The Nature Conservancy and the Rhode Island Department of Environmental Management, Division of Marine Fisheries (RIDEM, DMF), convening fisheries scientists, managers and representatives from Rhode Island, Massachusetts, and the Conservancy. Members of the whelk fishery were invited but were unable to attend. The goals of the workshop were to review the current context of the whelk fishery in RI and MA and explore management options suited to the RI fishery. RIDEM provided several presentations and facilitated discussion on the current management and characteristics of the fishery. The team led an engaged discussion, walking through the Conservancy-developed FishPath software tool to determine the pros and cons of current and alternative management options for the fishery. At the outset of the workshop, the participants decided to focus on the largest component of the fishery in RI, channeled whelks caught in pots. This report captures notes, preliminary FishPath outcomes, and next steps from the workshop.

FISHPATH

FishPath is a process, supported by an online tool, for guiding fisheries on a path towards sustainable management. The FishPath process is based on the principle that fisheries require a bottom-up, individually tailored approach to fisheries management that is identified through stakeholder engagement that builds capacity for local fishery managers. A key component of the FishPath process is a software application or tool that is a transparent, standardized, efficient, and comprehensive entry point into the larger approach to improving fisheries management. The FishPath software guides a stakeholder engagement process to identify context-appropriate fisheries management strategies, which includes a plan for data monitoring, stock assessment, and management rules for a particular fishery. Results of the FishPath process highlight the relevant caveats, assumptions, and challenges of implementing each identified approach so that the users can determine which approach is best for their fishery. The FishPath software identifies the most significant and limiting gaps in knowledge and capacity that preclude certain approaches from implementation, such that investments can be prioritized and key challenges can be addressed to improve management and conservation outcomes (Dowling et al., 2016).

The decision logic behind FishPath was developed through a Science for Nature and People Partnership Working Group (SNAPP 2016) which brought together 25 top fisheries scientists and practitioners from eight different countries. The Conservancy has further developed FishPath into a user-friendly software application through a collaboration with Australia's Commonwealth Scientific and Industrial Research Organization (CSIRO). The FishPath software contains 52 monitoring options, over 46 assessment options, and 51 types of management actions.

Figure 1: Illustration of the FishPath process to select a short list of fishery management options.



The FishPath process begins with a diagnostic questionnaire aimed at elucidating the key characteristics of the fishery including:

- the biology of the species
- the fishery operational characteristics
- the available data
- the social interactions and markets

- the relevant governance systems and policies affecting the fishery

The FishPath software then takes information gleaned from the fishery questionnaire and navigates through all options to identify monitoring, assessments, and management rules or actions that are appropriate for the fishery given its context (Fig. 1). Results of FishPath can be downloaded by stakeholders and used to guide the development of a fishery management plan.

Questionnaire

Workshop participants walked through the three sections of the FishPath questionnaire: monitoring, assessments, and management rules. Each FishPath question aims to collect information about the fishery, and then the FishPath software uses this information to compare that answer with the options within FishPath to see if there are any criteria or caveats that are associated with the answer. During the FishPath process, questions can be flagged if there is not consensus on the answer among workshop participants and answers can then be changed or adjusted after viewing results, if needed. During the workshop, all answers and notes associated with those answers were recorded and are provided in Appendix II of this report.

WHELK FISHERY DESCRIPTION

Overview

Biological

Channeled whelk (*Busycotypus canaliculatus*) and knobbed whelk (*Busycon carica*) are the main species in a data limited whelk fishery along the east coast of the United States. Knobbed whelks are the predominant species caught in the south, while channeled whelks comprise over 90% of landings in southern New England. Channeled whelks are predatory gastropods, that have relatively long lifespans, mature late, and exhibit sexually dimorphic growth. Females mature slower than males, reaching 50% maturity at 8.5 years of age (136.7 mm SL), while males reach 50% maturity at 7.4 years of age (116.4mm SL). Growth rates and size/age at maturity vary latitudinally along the coast. The Von Bertalanffy growth parameters have been estimated, but there is little information on the youngest and oldest (smallest and largest) individuals to anchor the specific parameters. Fertilization takes place internally and adults lay eggs in coils attached to the sediment that hatch as small, immature whelks. There is no pelagic larval stage and adults do not undergo any substantial migrations, limiting dispersal. Ripe eggs have been reported during most months of the year, however, in southern New England, spawning is believed to take place once a year, in mid-summer when water temperatures are highest (July-Aug). Catch rates drop significantly during this period. Channeled whelks generally live in sandy-muddy sediments or around shellfish beds. There are no known spawning or nursery locations and no mass aggregations. Densities vary throughout the Bay.

Operational Characteristics

The RI whelk fishery largely targets channeled whelk with pots. There is some opportunistic harvest when whelks are caught in trawl gear or bull rakes, but these are small components of the total catch. Knobbed whelks are not as abundant in RI waters and make up a small percentage of landings. Baited traps that are open on top and attached to a surface buoy(s) are the primary gear, either as a single pot or in strings of several attached pots. Traps are constructed from a variety of materials, though wooden traps are very common. A new wire mesh trap has been introduced that appears to catch smaller individuals. Bycatch and interactions with other species are little, and generally not considered a problem given the trap configurations and fishing method. The fishery is largely focused in the northern part of Narragansett Bay, including Mount Hope Bay, where the majority of whelk habitat

is located, but can also include portions of coastal Rhode Island Sound and the Sakonnet River. Whelks are generally landed live at known landing sites, and the majority are processed in facilities in Massachusetts for the Asian market.

Governance

Within Rhode Island waters, there are currently several regulations on the whelk fishery. In 2012, all fishermen with a quahog or softshell clam endorsement were provided a whelk endorsement. Now, a whelk endorsement requires a given fisher to be active in the quahog or softshell clam fishery. Some individuals who previously fished whelk have dropped their endorsement given the whelk fishery now requires reporting. In 2017, there were approximately 900 license holders, but only about 100 fishers active in the whelk fishery. Of those who fish whelk, about 80% of the landings are from roughly 20% of participants. The current size limit is set at 136.53 mm SL (5-3/8 in) or 76.20 mm SW (3 in), which is above the length at which 50% of individuals are mature (L50) for males, but at the L50 for females. The current trip limit per vessel is 35 bushels per day and there is a limit of 300 pots per license in the water at any one time. Pots cannot be hauled at night. There are separate regulations for recreational whelk fishing.

The season is open year-round; however, most of the catch occurs in the spring and fall. Whelks rarely enter traps when water temperatures are below 10°C. Some illegal, unreported and unregulated (IUU) fishing likely occurs, but it is not considered a major portion of the catch. Compliance to the regulations is generally considered good.

Data

Information about the whelk resource is derived from a number of sources. All landings are required to be reported and landings data goes back decades. The landings data from 1995-2005 are missing information due to a change in reporting requirements, but since 2006, effort and catch data have been well reported. Three fishery independent surveys exist, supplying information on relative abundance and biomass. The RIDEM conducts a monthly bottom trawl survey at 15 stations throughout Narragansett Bay. The survey initiated in 1990 to provide a better picture of the seasonal changes in the Bay compared to the longer running spring and fall survey originating in the late 1970s. The Graduate School of Oceanography/University of Rhode Island (GSO/URI) conducts weekly bottom trawls at two stations in Narragansett Bay that has been ongoing since 1959. The two trawl surveys employ scientific trawls with cod end liners to capture juveniles. The RIDEM also conducts a hydraulic dredge survey to assess shellfish in the Bay, largely focused on quahogs. The survey began in 1993 and modified its design in 2008. The two surveys with trawl gear are believed to provide reasonable estimates of whelks, but the time series of data from the shellfish survey is considered questionable. There have also been individual projects to gather length frequency, age and maturity data. A large study was conducted in 2012 and 2014 with some work continuingpresently. The landings and survey data cover the full range of whelks managed in Rhode Island.

A surplus production model is currently utilized to evaluate the status of the whelk resource. Current estimates indicate that the stock is at sustainable levels, but the harvest level is at or above the fishing reference point and will deplete the stock.

Socio-Economic

Whelks have been fished in southern New England for centuries, originally to reduce their predation on shellfish and then as a food item. As the local abundance of other commercial species has declined (e.g. American lobster) and the market has grown, the value of whelk has tripled over the last decade. Landings peaked in the early 1980s (> 400 mt) and currently vary between 250 and 300 mt. Few individuals fish solely for whelk and there is a considerable amount of latent effort in the fishery. Effort moves among the horseshoe crab bait fishery, the lobster fishery, and the quahog fishery as price, abundance and regulations shift.

Questionnaire

Workshop participants walked through the three sections of the FishPath questionnaire: monitoring, assessments, and management rules. Each FishPath question aims to collect information about the fishery, and then the FishPath software uses this information to compare that answer with the options within FishPath to see if there are any criteria or caveats that are associated with the answer. During the FishPath process, questions can be flagged if there is not consensus on the answer among workshop participants and answers can be them be changed or adjusted after viewing results, if needed. During the workshop, all answers and notes associated with those answers were recorded and are provided in Appendix II of this report.

FishPath Results

The FishPath process provided a list of potential options for monitoring, assessing the stock, and management rules, along with the potential pros and cons of each method. These results focused on the whelk pot fishery in Rhode Island, which is largely composed of channeled whelks.

Results discussed below represent only a subset of options with details around the caveats of each selected option. These options were highlighted during discussions at the workshop but are not intended to be a final list of options. FishPath results and questionnaire answers can be reviewed and edited on the FishPath website. To ensure confidentiality, the link has been supplied to RIDEM separately.

FishPath Section on Monitoring

There are a wide range of monitoring options available to fisheries, ranging from market surveys to logbooks and observer programs. FishPath covers this range of monitoring options identified in the software as 13 specific options. These monitoring options are subdivided according to the broad type of data that may be collected, as these influence the caveats and recommendations against each monitoring option. The four categories of data types are: 1) biology and life history information; 2) fishery operational characteristics; 3) data that yield broad sustainability trends; and 4) comprehensive time series of data that could inform stock status. All FishPath results for monitoring options are included below in Figure 1.

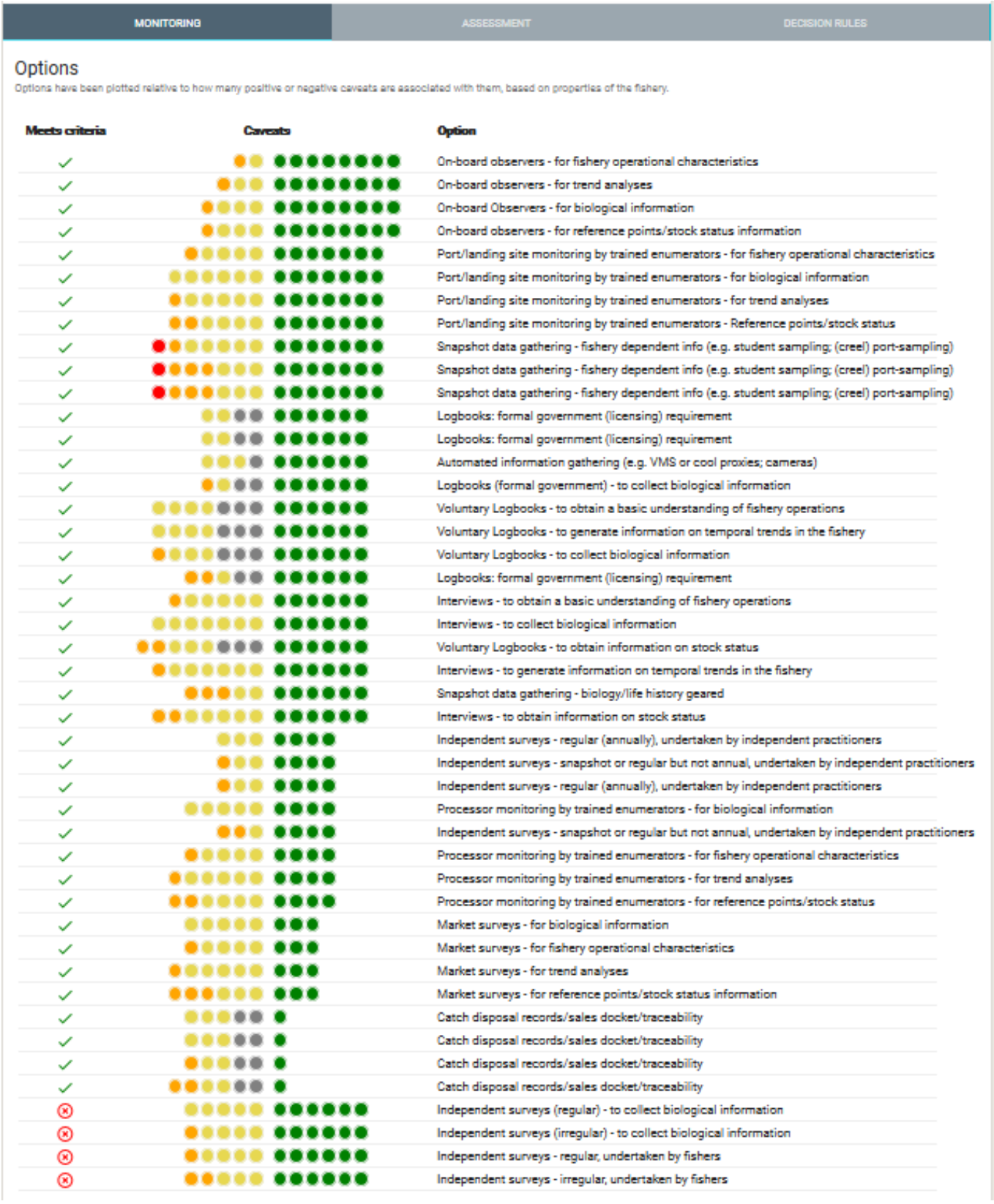


Fig 1: Monitoring results output from FishPath. This image displays all available monitoring options in FishPath with colored circles representing positive (green) caveats, cautionary (yellow, orange, red) caveats, and neutral (grey) caveats associated with the channeled whelk fishery.

While many biological aspects of channeled whelks have been estimated only recently, the Rhode Island fishery has a relatively robust monitoring program. Whelks benefit from a strong fisheries agency that has the regulations and infrastructure in place to collect a broad suite of data on the majority of fished species. Landings of almost all species are required to be reported and systems are therefore in place to record and manage the data. Whelk reporting is in place based on a preexisting system to monitor larger fisheries. There are also fisheries independent surveys designed to catch a broad spectrum of species that provide a relative index of abundance for whelk.

FishPath identified almost every monitoring option as possible in the fishery except for the fishery independent surveys conducted by fishers. The FishPath tool is still in development and simply did not have an option for state or federally run surveys. Fishery independent surveys are an excellent monitoring option that are currently being conducted by the State. Participants indicated, however, that a more focused whelk survey could be valuable and potentially could be run as a collaboration between the industry and RIDEM. In addition, specific studies could also benefit from broader engagement with the industry and potentially sampling with commercial boats.

While all options were possible, discussion during the questionnaire/results indicated that there were few new types of monitoring that would add a tremendous amount of value to the current data collection program. High investment options such as on-board observers or electronic monitoring were not considered necessary given the relatively low bycatch and good compliance with fishery regulations. Other options such as fish market surveys are generally considered initial data collection methods in extreme data limited cases, which was not the case for the whelk fishery.

Discussion did suggest that additional sampling or specific studies could be useful to better inform distribution and life history parameters. Currently, the von Bertalanffy growth parameters are poorly estimated because there are almost no samples at the smallest and largest size classes. Additional work to target collections of these size classes could improve parameter estimates that are in turn used in stock assessments. Additionally, there is little information on the finer scale distribution of whelks within Narragansett Bay or in relation to spawning and nursery areas. Certain management options are not possible (rotational closures, no-take zones) because of the lack of this information. A more focused whelk survey could improve this information.

There were several caveats that arose based on the answers to questions, but none were detrimental to the current monitoring program. The broad fishing patterns across the entire bay, varied nature of fishing operations and IUU fishing were all issues that indicate some of the challenges that would need to be overcome to get representative data. The current electronic reporting system in Rhode Island largely accounts for these factors to capture total catch. The lack of fishing associations also yielded a caveat because in many situations around the world, scientists and managers rely on strong fishing associations to develop data collection programs. While engaged, knowledgeable fishing participants can improve management, the strong governance present in most areas of the United States does not always require strong fishing associations for monitoring. The changing location of fishing activity, which was present largely in Massachusetts waters as opposed to Rhode Island is an important consideration and has implications for the distribution, productivity and status of the stock. Discussions revealed the under reporting of landings from 1995 – 2005 and the under reporting of invertebrates in general from the GSO/URI fish trawl survey in the 1960s. The strong governance, willingness of the industry to work with the agency and general compliance with regulations were all seen as positive caveats for the monitoring and management of the fishery.

FishPath Section on Assessments

Figure 2 displays all assessment options available in FishPath with information on whether minimum criteria have been met and the number of cautionary caveats for each option. Given the large amount of information on the RI whelk fishery there are a range of potential assessment options available and displayed in Figure 2. With the available data, potential categories of assessment techniques range from indicator-based frameworks, to proxy reference points, to stock status-based reference points, or a combination of a number of these. The specific

techniques utilized will depend on a thorough examination of the different types of data available, the caveats of the different methods, and the capacity RIDEM has to undertake these methods.

MONITORING | ASSESSMENT | DECISION RULES

Options

Options have been plotted relative to how many positive or negative caveats are associated with them, based on properties of the fishery.

Category	Option	Met Criteria?	Caveats
EMPIRICAL INDICATOR-BASED FRAMEWORKS	Sequential effort triggers	✓	●●●
	Size-based sequential trigger system	✓	●●●
	Sequential catch triggers	✓	●●●●
	Hierachical decision trees	✓	●●●●●
	Sequential trigger framework involving catch and/or effort, CPUE, size, sex ratio e...	✓	●●●●●
	CUSUM Control Charts	✓	●●●●●●
	RAPFISH (Multi-dimensional scaling)	✓	●●●●●●
	Traffic lights	✓	●●●●●●
NO REFERENCE POINTS	Corral/explore data via descriptive statistics	✓	●
	Discourse/expert judgement	✓	●
	Move directly to decision rules	✓	●
	PSA to estimate risk of overfishing	✓	●●
	Comprehensive assessment of risk to ecosystems (CARE)	✓	●●●
	Change in species composition ratios	✓	●●●●●●
	Change of dominant species	✓	●●●●●●
	Changes in gear type or manner of deployment	✓	●●●●●●
	Changes in spatial distribution of catch	✓	●●●●●●
	Ecosystem threshold analysis (coral reefs only)	⊗	●●
	Ecological Risk Assessment for the Effects of Fishing (ERAEF)	⊗	●●●
	Changes in spatial distribution of effort	⊗	●●●●●●
PROXY REFERENCE POINTS	Escapement: Samples of catch; ensure 30% have spawned (per squid fishery in C...	✓	●
	Changes in mean length/weight or length/weight percentiles	✓	●●●
	Size relative to size at maturity	✓	●●●
	Use of biomass surveys to inform spatial management	✓	●●●
	Catch by size indicators (per Froese 2004)	✓	●●●●●
	Depletion analysis	✓	●●●●●
	Linear regression to recent time series of CPUE	✓	●●●●●
	Standardised CPUE	✓	●●●●●
	Ratio of density inside:outside MPAs (per Babcock and MacCall; McGilliard et al.)	⊗	●●●
	Sustainability indicators (per Cope and Punt (2009) based on Froese's size-based...	⊗	●●●
	Size-specific catch rate indicators for fish sampled inside and outside of MPAs, a...	⊗	●●●●
	Fraction of Lifetime Egg Production (FLEP)	⊗	●●●●●●●●
STOCK-STATUS-BASED REFERENCE POINTS	Boosted Regression Tree (BRT) model for stock depletion using catch-data (Previ...	✓	●●●●
	Catch-MSY (Martel and Froese 2013)	✓	●●●●
	Depletion Corrected Average Catch (DCAC; MacCall)	✓	●●●●
	ORCS (Only Reliable Catch Series)	✓	●●●●
	SAFE (Zhou)	✓	●●●●
	Stochastic SRA (User Guide Lombardi and Walters)	✓	●●●●
	Stock synthesis using only a time series of catch SS-CO (Cope 2013)	✓	●●●●
	DB-SRA	✓	●●●●●
	Length-based SPR assessment	✓	●●●●●●
	Catch curves	✓	●●●●●●●
	Mortality estimates from length data in nonequilibrium situations (Gedamke and ...	⊗	●●●
	Feasible stock trajectories (Bentley and Langley 2012; Can J.)	⊗	●●●●
	Production model	⊗	●●●●●●●

Fig 2: Assessment option results from FishPath. This image displays all available assessment options in FishPath with circles representing caveats associated with the fishery and identifies if minimum criteria have been met in the fishery.

Assessments that use spatially explicit data were not recommended. Methods that compare inside and outside Marine Protected Areas were not possible because MPA's and detailed spatially explicit data do not exist. The other major method that was initially removed from consideration was a production model because the time series of data was not considered long enough. The staff at RIDEM understand the data, however, and have been able to fit a production model to the multiple time series and estimate stock biomass and status.

Within the FishPath software, two questions were identified as inciting the most caveats.

1. Has the selectivity pattern changed over time?

This question put a caveat on all methods that use length frequency data and many of the methods that utilize catch. Changes in selectivity impact the size and age of fish captured which can alter the perceived surviving fraction of different age groups (juveniles, spawners, old fish), mortality estimates, as well as estimates of productivity and proportion of the total population that is harvested.

2. Is there expert knowledge of suitable targets for indicators that could be used (directly or indirectly) to understand the status of the stock (or fishing pressure)?

Many methods rely on expert judgement to make some initial estimate of the current state of the stock or fishing pressure. Many depletion-based methods require an initial approximate estimate, making these estimates essential for many assessment options. RIDEM felt they had a good estimate of stock status, enabling many of these methods to be utilized.

One particular red caveat, indicating strong caution, was applicable for a number of options, "Have historical or recent changes occurred in how the fishery is operating (e.g. gear, distribution of effort, species composition, regulations)?" The participants indicated that changes have occurred and therefore must carefully examine how historical changes may impact data and the interpretation of results.

While many assessment options are possible, some are designed as initial approaches for a fishery with significantly less information available (e.g. change in dominant species, expert judgement). Other options are designed to evaluate the most critical needs in a region, such as which species in a coral reef or ground fish fishery should be prioritized (Productivity–Susceptibility Analysis, PSA). The participants had already focused the workshop on the Rhode Island channeled whelk fishery and therefore while working through the results, down weighted these assessments for use in this fishery. Standardized CPUE and other indicator-based methods are viable options, but other methods have the potential to provide more information on status and catch. Length-frequency data was available for certain years, but a consistent time series of lengths from the catch was not available. While length-frequency assessment methods are possible, their output would not reflect the status in the most recent years. The length frequency methods such as length-based SPR were down weighted. Incorporating length data along with other indicators was discussed. Given the long time-series of catch, catch-only methods were viewed as viable options that could produce estimates of sustainable annual yield. Catch-MSY and different stock reduction analysis (SRA) methods were all ranked highly. DCAC is a catch only method, but was not considered for the whelk fishery because the fishery has varied considerably over time instead of a single steady fish down, the natural mortality may be greater than $M=0.2\ yr^{-1}$, and an extension of DCAC, DB-SRA is available.

The other method that was ranked high by participants was fitting a production model. RIDEM already has a production model that estimates stock status and MSY. The FishPath process and discussion reaffirmed the method and encouraged continuation as well as possible comparisons with some of the catch only methods. The current production model utilizes the fisheries independent and dependent data sources and also linked total mortality to estimates of mortality from a catch curve analysis. This is a very strong approach utilizing the range of data available. One suggestion from participants was to potentially move this model into a larger framework such as Stock

Synthesis were all the components could be fit simultaneously and the errors could propagate. Regardless, the current production model appears to provide a good estimate of the status of the resource. See appendix for a full ranking of options.

FishPath Section on Management Rules

Figure 3 displays all management rule options available in FishPath with information on whether minimum criteria have been met and the number of caveats for each option.

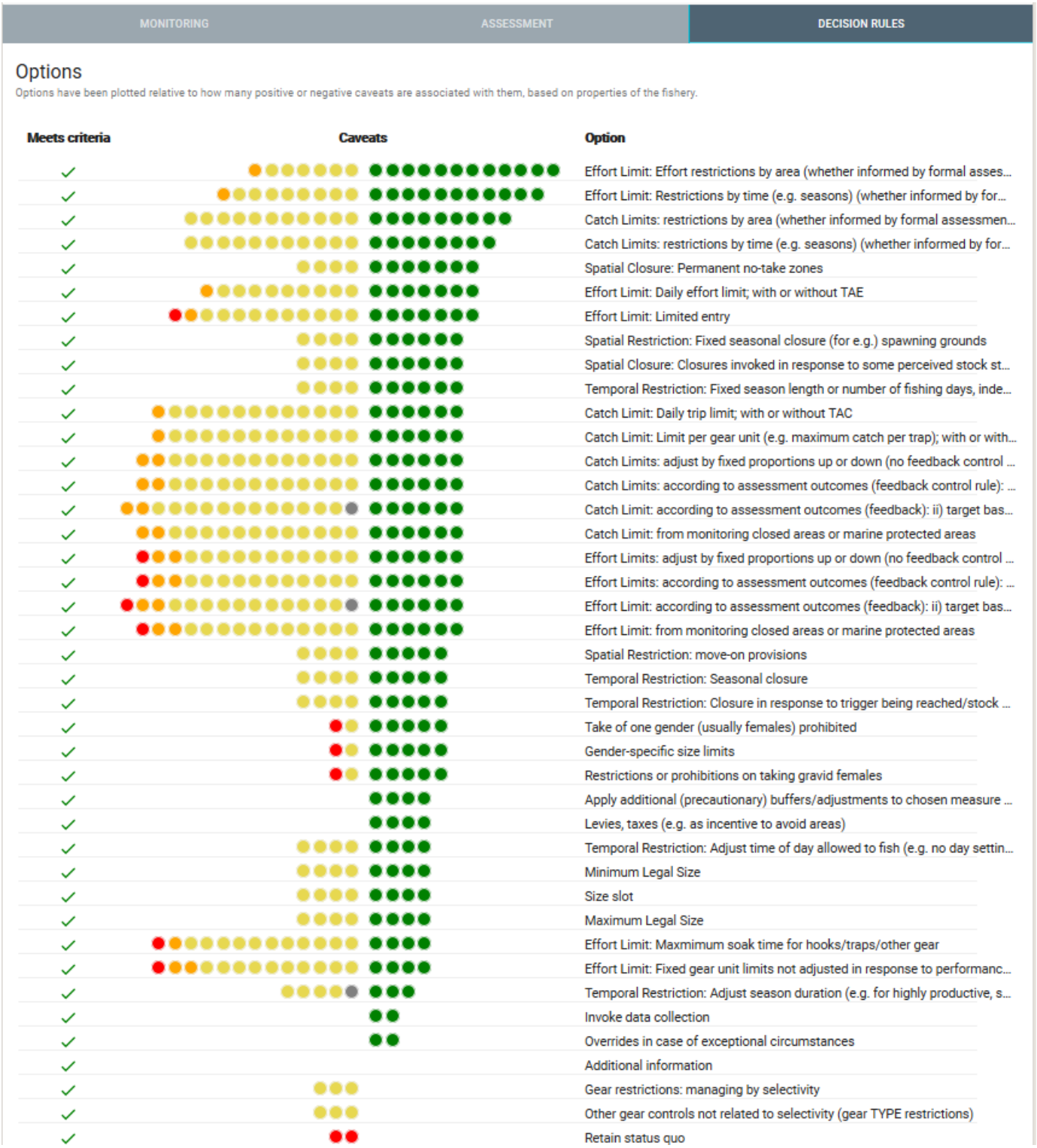


Fig 3: Decision rule option results from FishPath. This image displays all available decision rule options in FishPath with circles representing caveats associated with the channeled whelk fishery.

The RI whelk fishery has a wide range of available options for decision rules, with varying levels of caveats provided by FishPath. The most influential questions which produced these caveats are in Table 1. Major caveats in red highlighted a few important issues. Based on the current status determination, the stock was considered overexploited, thus retaining the status quo would lead to a decline. There was a significant amount of latent effort in the fishery due to the licensing system, so changes in regulations in multiple fisheries could shift effort among different managed species. Fisheries operations changed over time, suggesting that the system was dynamic. Effort creep also existed, indicating that input controls limiting effort should consider how current techniques would be altered.

Participants ranked the potential options to determine which decision rules would be most viable in Rhode Island. Long lived, late maturing, sedentary individuals with dimorphic growth and limited dispersal present serious challenges for fisheries management. Minimum size limits are typically needed in a fishery to ensure that immature individuals are not harvested; however, setting the size limit at the L50% of maturity for females results in the majority of the landings being composed of the larger females, which are the most valuable for sustaining the population. Slot limits are an option, but only if the fishing mortality levels are low enough that a proportion of individuals survive until they reach the upper size limit and are no longer subject to exploitation. Closed areas are commonly used where females grow larger than males to ensure the large females survive and are a source of eggs for the next generation. This strategy is most effective when eggs and/or larvae have a pelagic stage and can disperse outside the closed areas. This is not the case for whelk. Other common strategies include sex-based regulations where only the males of a certain size might be harvested, but this only works if sexes can be differentiated during harvest while the organism is still alive. This is not the case for whelks.

The options were divided into three general categories: viable and/or currently in place decision rules; decision rules that could potentially work; and nonviable decisions rules. The combination of whelk life history and whelk fishing impacts determined the nonviable decision rules and they were removed/down weighted. Potential decision rules were options that were not currently in use, but were potentially viable in Rhode Island. The majority of these tied an effort or catch limit to the status of whelk. These include a range of options, such as linking the number of allowable pots, length of the open season, daily catch limit, or seasonal catch limit to a measure of the stock such as CPUE, catch, or a model-based assessment. It was generally believed that the whelk industry would largely favor effort controls over annual catch controls. The FishPath process generally reaffirmed that the current decision rules in place were likely the most viable. These included a size limit, limited entry, an effort control in limiting the number of pots, a daily trip limit, and temporal restrictions (no hauling gear at night) (see table below). This package of regulations provides a reasonable management framework; however, the stock is currently experiencing overfishing. While the fishery is considered limited entry because participants need a license, as stated previously, there is a large amount of latent effort in the fishery. The size limit also allows immature females to be harvested. Maintaining the current situation, therefore could result in a serious decline in whelks and loss of future catch.

A few additional options were also identified that have previously not been considered. Rotational closures provide a means to manage sedentary species with limited dispersal. This type of framework would require a large enough distribution of the species that areas could be closed, but still allow fishing. Spatially explicit data throughout the Bay would be required to determine when to open and close areas, as well as a willingness for industry to move to different areas. Tiered licensing was also discussed as a possible option. This could reduce the latent effort by ensuring individuals who actively fish could have a given number of pots, daily trip limit, or an alternative control, while those moving into the fishery would only be allowed a smaller amount. One other option mentioned to reduce the mortality on older females was to move the season to a fall only fishery. The idea would be to close the fishery in the spring, allowing females on the edge of maturity to grow and breed in the summer before being caught

in the fall. This could lead to other supply and demand considerations and was simply an additional alternative option. See appendix for a full ranking of options.

Question	Answer
Does an assessment suggest that overfishing is probable, for any species harvested using the gear?	Yes
Is there latent effort in the fishery?	Yes
What is the extent of enforcement capability for this fishery?	Moderate
Is there a general societal sense that formal management is a good thing, in terms of complying with and supporting management measures?	Moderate
What is the level of fishery cooperation, in terms of complying with and supporting management measures?	Moderate
Is the nature of fishing operations (e.g. target species, gear types, fishing locations, markets) changing?	Moderate

Table 1: The most influential questions in the decision rules section.

The workshop provided a means to transparently examine the whelk fishery and objectively evaluate different options for developing an effective management plan that will lead to long term sustainability in the fishery. The workshop reaffirmed many of options for monitoring, assessments and decision rules and set the stage for real engagement with the whelk industry to co-develop a fishery management plan.

NEXT STEPS

1. TNC – Complete workshop report (this document) by February 2018
2. TNC – Provide RIDEM access to the FishPath software (completed at workshop)
3. RIDEM engage the whelk industry, potentially convening meetings or workshops to review the report and FishPath software. Fall 2018
4. RIDEM and the whelk Industry work together to develop a long-term whelk management plan.
5. Explore the possibility of developing a master's thesis at the University of Rhode Island to combine all the whelk data into a production model within the stock synthesis framework.
6. Consider the data needs presented within the report, and prospective funding opportunities to support programs that collect the critical data required.
7. TNC will assist with these activities as capacity enables.

FISHPATH MODIFICATIONS

The workshop participants provided critical feedback on the FishPath software and process. This feedback will be reviewed and considered in our next phase of enhancements to the software. There were two main components:

1. Participants found the lack of ability to sort/rearrange the results to seriously curtail an effective discussion about viable options. The ability to sort the results is currently being addressed.
2. It would be useful to add the ability to take notes on questions and results so that the discussion/rational for the answer can be retained. This is being planned for a future release of the software.

3. It would be very useful in the results section to see what criteria were met and thus why an option is available.
4. Some questions need to be reworded to clearly express their meaning and intent. These questions will be reviewed and edited, providing a glossary of terms used. Figures and examples will also be included in subsequent updates. This is currently occurring.
5. Add a question about whether sexes can be differentiated without killing the organisms. This change was completed in October 2017.

Dowling, N.A., Wilson, J.R., Rudd, M.B., Babcock, E.A., Caillaux, M., Cope, J., Dougherty, D., Fujita, R., Gedamke, T., Gleason, M., Gutierrez, N., Hordyk, A., Maina, G.W., Mous, P.J., Ovando, D., Parma, A.M., Prince, J., Revenga, C., Rude, J., Szuwalski, C., Valencia, S. and Victor, S., 2016. FishPath: A Decision Support System for Assessing and Managing Data- and Capacity-Limited Fisheries. In: T.J. Quinn, J.L. Armstrong, M.R. Baker, J. Heifetz and D. Witherell (Editors), Assessing and Managing Data-Limited Fish Stocks. Alaska Sea Grant, University of Alaska Fairbanks.

RI Whelk regulations

Prior to landing, all whelks must remain in their shells
No fishing at night
Whelk cannot be harvested with diving apparatus
The harvest or possession of whelks by non-residents is prohibited
Minimum size limit: 3 inches (76.2mm) shell width or 5 3/8 inches (136.5 mm) shell length
Commercial
All commercial harvesters must possess a shellfish license
Commercially licensed shellfisher can only sell to a licensed dealer
Possession limit, 35 bushels per vessel, per day
Pot limit, maximum of 300 whelk pots in the water, per license at any one time.
Recreational
One half bushel per resident per day; or if a vessel with more than one resident onboard is used, a maximum of one bushel per vessel per day
Pot limit, five whelk pots in the water at any one time

MEETINGS AND DISCUSSIONS WITH INDUSTRY

In the summer of 2018, RIDEM and TNC reached out to the whelk fishers about the FishPath workshop, to share information on the findings and get input on the current challenges, opportunities and limitations of the fishery itself. Tom Angell (RIDEM) contacted whelk fishers and asked if they would be interested in being contacted by Rich Bell (TNC). Rich Bell and TNC received no personal information except the names and phone numbers as provided by those fishers who agreed to be contacted. No names or contact information for individuals who did not agree to be contacted were provided to Rich Bell and no information on fishing activity (catch, licenses, time in the fishery, etc.) were provided to Rich Bell or TNC at any time for any fisher. Only those who agreed to meet were contacted. There were several in person meetings at the dock or coffee shops as well as phone calls and emails between Rich and industry members.

Results of discussions this summer

1. The fishers, in general, felt it was a boom and bust fishery so in some ways it was self-regulating. People are not going to fish if they are not making any money, and bait is expensive. When Rich asked how the increase in the value of whelks had changed the dynamic, most fishers said that as the value has risen, so has bait and gas prices.
2. Many of the fishers thought RIDEM had mismanaged parts of the larger RI fishery in the past. At some point in the past, many of the fisheries in the Bay became limited, or permits became challenging to get, and it was felt that the state was pushing people toward whelks to get some permit history, so they could then get a permit for other species. There was also a sense that the whelk fishers themselves had asked for some regulations and just as those were coming into effect, the state was pushing people into the fishery. The manner in which the size limits were implemented did not sit well with a number of the fishers interviewed.
3. It was suggested that RIDEM should develop an official gauge for measuring snails.
4. The need for a trap tag program was mentioned by most of the fishers. The whelk fishers had requested this previously and there was some aggravation that RIDEM had not been able to make it happen.
5. Several people mentioned that they would like to see more enforcement on the water, more RIDEM folks out on boats, and overall a larger enforcement presence. There was a sense that without enforcement, regulations were useless. They, of course, were not requesting boat boarding and checking every flare, but just neighborhood policing, come along side, say hello, measure a few snails and keep going, just to keep everyone honest.
6. A few people also mentioned CT regulations. It was suggested that CT has very few regulations and we should look and see if there were any lessons we could learn from them to either increase or decrease regulations.
7. There was concern about the impacts of warming water on the fisheries in the bay and particularly on the whelk fishery.

Following the one-on-one conversations over the summer, TNC and RIDEM hosted an informational exchange meeting for industry members at the URI Bay Campus on September 11, 2018. The meeting was designed as an opportunity to review the findings of the FishPath workshop with the whelk fishing industry, and to collaborate on and discuss the findings. It was an informational meeting with no management decisions being made at the meeting. The meeting, however, was planned to inform the RIDEM about the industry's opinions and thoughts on the findings of the workshop as well as potential ways to move forward on the science and management of the species.

During the meeting, the FishPath workshop was reviewed (e.g. the process, the types of questions, and some of the outputs.) The meeting was informal and encouraged discussion about the specifics of FishPath, as well as the whelk fishery in general. The intent of the meeting was to get ideas from the industry about how they would like to see the whelk fishery managed in the future, what they saw as the gaps and to encourage an open dialogue with DEM. Some of the different management outputs from the FishPath workshop were also presented for feedback.

Several important points came out of the meeting. Catch reporting has varied through time because of different regulations. There was a period in the 1990s when the rules on log books were changed resulting in not all whelk catch being recorded. In the early 2000s, there was a period when some whelks caught in RI waters were sold to Massachusetts and thus the RI whelks were counted as MA landings. The official RI totals indicate that channeled whelks make up over 95% of the total catch. Paper log books generally do not record knobbed whelk and some trips, and some periods could have as much as 25% knobbed whelk. The dealers generally sort by species so some of that information should be available. The participants indicated that the catch data since around 2012 were well documented (years when size limits were imposed) and should be used in evaluating the fishery, but there was not a clear consensus on what catch data to use in previous years.

The industry has observed changes in catch and recruitment over time. Currently, small whelks are much more prevalent then they have been in the past, which could suggest that the size limits are protecting smaller whelks until they recruit to the fishery. It was clear that width is a better measure than length for determining legal size, but there was no discussion around a standardized gauge. The need for a standardized gauge had only come up in conversations over the summer.

There was some discussion about research needs. A tagging study was of some interest as well as studies on the impacts of changes in water temperature in the bay. The movement patterns as well as mortality were discussed as potential aspects that could be derived from a tagging study. The idea of a dedicated survey did not garner much interest from the group. As was already clear, it would have been very useful to have industry members at the FishPath workshop. Though members of the whelk fishery were invited, none attended; however, their input would have been extremely helpful.

One of the largest discussion points concerned trap tags. A number of people mentioned that the industry had requested a trap tag program some years ago and voiced some frustration at the lack of response. The participants had little to say, positive or negative, about other potential management implementations such as rotational closures, tiered licensing system or changes in trap mesh size to reduce sorting time on deck. Instituting a trap tag program for whelk received strong support and it was suggested that DEM begin the initial stages of developing a program.

The participants had a lot to say and the meeting went roughly double the planned time. We would like to thank all the participants for their frank and honest ideas and opinions.