

Managing Virginia's Marine Fisheries



A Guide to the Process

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Editing & Design by Sally Mills

Contributing Writers: Bill DuPaul, Sally Mills, Chris Moore, Charlie Petrocci, Marla Trollan
Photos by Charlie Petrocci and VIMS

Line drawings © by Spike Knuth, © by Duane Raver, and VIMS

Cover Design by Susanna Musick / Artwork by Paula Leff and Gus Fitzgerald

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As active participants in bay and coast-wide management programs, Virginia fishery managers have a long history of stewarding marine fishes both at home and within the larger community sharing these resources. While fish stocks have always fluctuated over time, many popular bay and offshore fish species are currently showing signs of distress. Managers are more frequently faced with the task of imposing tighter regulations and downsizing quotas on annual landings. At the same time, our knowledge about the marine environment and interactions among fishes continues to grow, adding to the complexity of management responses.

Managing for sustainable fisheries requires the commitment of many people engaged in thoughtful public discourse over the use and conservation of ocean resources. A first step involves understanding how fisheries are managed in the Commonwealth—the structures in place and where and how you fit into them.

This publication is intended to help. If you are already well versed in fisheries management, please pass this guide along to someone else.

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A Primer on Fisheries Management in Virginia

By Sally Mills



In the United States, marine waters and associated flora

and fauna are considered common property resources and, as such, fall under the purview of federal and state governments to be managed for the benefit of all citizens. While coastal states are responsible for managing marine fishes in waters extending 3 miles from land, the National Marine Fisheries Service (NMFS) assumes primary management of marine fishes from 3 to 200 miles offshore. NMFS is an arm of NOAA (the National Oceanic & Atmospheric Administration), and the legislation that directs how this federal agency manages the nation's fisheries is the *Magnuson-Stevens Fishery Conservation and Management Act*, also known as the "Magnuson Act."

The Magnuson Act established a set of consistency standards

across the U.S. for managing the nation's marine fishes. The process of meeting these standards is undertaken through a shared management structure of eight regional councils, who report to the Secretary of Commerce and advise the NMFS about fishery conditions. The councils produce Fishery Management Plans (FMPs), which are the guiding force behind public stewardship of the nation's most popular—and therefore, most stressed—marine fishes. Fishery management plans represent the culmination of exhaustive research and input solicited from scientists, fishery managers, members of the seafood industry, and a host of interested citizens. Fishery manage-

ment plans, therefore, are key to understanding the basis upon which regulations are made.

In 1996, Congress amended the Magnuson Act by passing the Sustainable Fisheries Act (SFA). New language found in the SFA calls for increased attention to the reduction of bycatch and the protection of fisheries habitat. With these changes, the fisheries management paradigm shifted from one of a “species by species” approach to that of a more holistic, multi-species approach which recognizes the needs and services of all marine life sharing a common habitat.

At the same time, Atlantic coastal states came under control of the Atlantic States Marine Fisheries Commission (ASMFC) for migratory species moving through state waters. The decisions of the ASMFC now govern how Virginia manages many of its most cherished fishes – including striped bass, summer flounder, and grey trout.

Fishery management plans are, by all accounts, complex. They describe the nature and problems of a fishery and recommend actions needed to conserve it. At the federal level, FMPs are approved by the Secretary of Commerce, and the regulations that implement attendant management measures become federal law. Enforcement falls to the NMFS, the U.S. Coast Guard, and state enforcement agencies.

Fishery management plans

While it is beyond the scope of this publication to address the detailed dimensions of a fishery management plan, it is important to understand the key pieces upon which one is built. Components of a fishery management plan typically include:

- ▣ An overview of fishery parameters; measured by relative exploitation rates, assessment of long-term potential catch, economic importance, mortality rates, etc.;
- ▣ A biological profile of the species that identifies such things as the natural mortality rate,

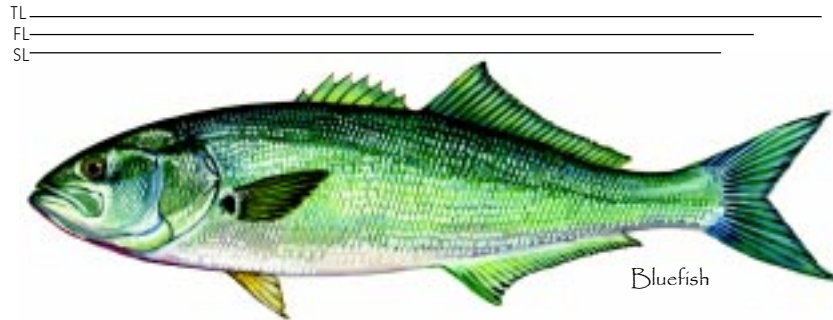
fecundity, various life stages such as spawning and larval development, young-of-year, sub-adults and adults;

- ▣ Habitat-specific requirements of the species and predator-prey relationships;
- ▣ A production profile of the fishery, including landings trends and gear use and efficiency;
- ▣ An economic profile of the fishery, including the value of landings, and ripple effects upon packers, distributors, and the local economy;
- ▣ A statement on the status of the resource. Also called the “stock assessment,” this is the crux of the scientific basis upon which management regulations move forward. It includes the best information available on current abundance, mortality, and exploitation, and uses that information to establish thresholds that must not be exceeded to ensure sustainability of the resource;
- ▣ Identified data and research needs (such as life history information);
- ▣ Existing regulations and management efforts; and
- ▣ Specific strategies proposed for action to put the fishery back on track. These might include limiting access, mandating gear changes, imposing more conservative size restrictions, establishing a marine protected area for the species, and most dramatically, placing a moratorium on harvesting.

While fishery management plans provide a road map for states to follow, those issued at the federal level stop short of dictating how Virginia, or any other coastal state, should get there. Instead, it is up to state resource managers to deliberate on those goals and respond with a plan of action that takes into account—and attempts to balance—the needs of various constituents with an interest in marine fisheries, while imposing regulations that sustain the overall health of the stocks.

Fish management is a dynamic process, of course. As time passes, fish stocks change and it is often necessary to amend, or update,

How Scientists Measure a Fish



Fork Length – The length of a fish as measured from the tip of its snout to the fork in the tail.

Standard Length – The length of a fish as measured from the tip of the snout to the hidden base of the tail fin rays.

Total Length – The length of a fish as measured from the tip of the snout to the tip of the tail.

a management plan. The amendment process is also an arduous one that may take a year or longer to complete. Virtually all Virginia marine fishes for which federal FMPs have been written are now being updated via amendments or other regulatory adjustments.

In Virginia waters (from the point of tidal influence to 3 miles offshore), the agency charged with managing marine fisheries is the Virginia Marine Resources Commission, as directed by the Code of Virginia. Revenue to do this is provided by the state's general fund and commercial and recreational fishing fees.

A Birds-eye Look at the VMRC

The Virginia Marine Resources Commission (VMRC) promulgates fisheries regulations through a 9-member board chaired by the commissioner. Board members are appointed by the governor, and the Commission often testifies directly to the state legislature. The agency's stated mission is to "balance the needs of a growing population for development, commerce, and recreation, with the goals of resource conservation and protection in the marine environment" – no small task indeed.

Access to commercial and recreational fishes is controlled through the issuance of licenses, and the use of approved harvesting gear by both groups is controlled by special permits. A suite of management tools is used (see page 12), based on information received from marine scientists and fishery managers who are regularly conducting biological sampling of fish and tracking landings and other industry-generated information. Analyses of fishing effort and overall stock conditions, as well as formulas designed to calculate threshold limits for maintaining sustainable stocks, are performed.

Restrictions on seasons, size, days at sea, and gear are imposed as needed to achieve management objectives. Depending on the particular fishery and point in time, such objectives might aim to relax or tighten up access to the resource.

Advisors in the process

As their mission has expanded to meet a growing coastal population placing various demands on the marine environment, the VMRC has enlisted the help of advisory committees comprised of scientists, commercial and rec-

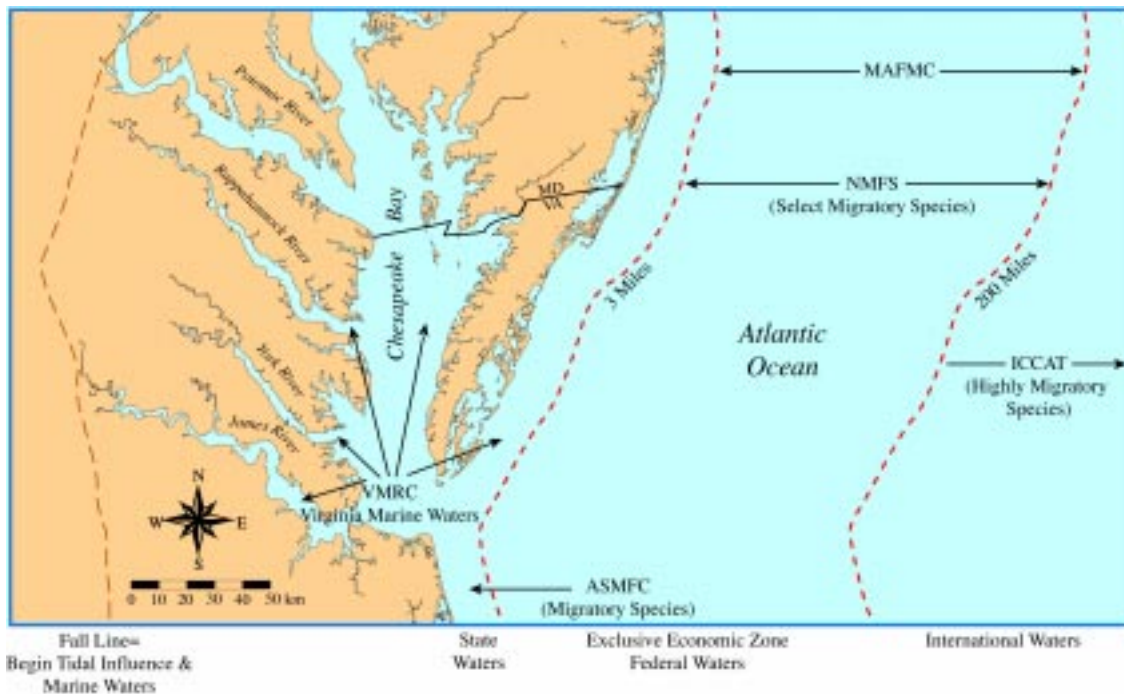
Who manages where?

All migratory fish moving through Virginia coastal waters are co-managed with the Atlantic States Marine Fisheries Commission (ASMFC). Through interstate fishery management plans, the ASMFC oversees 22 species of marine fish (including 7 species of shark) and promulgates regulations for those species that all Atlantic Coast states must follow. The ASMFC holds public meetings wherever needed according to the conditions posed by the particular fishery under review.

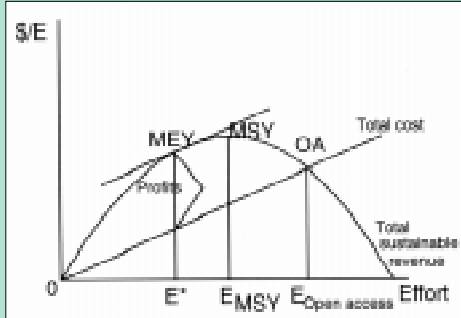
Fish that primarily inhabit offshore waters (more than 3 miles off the Virginia coast) are managed by the Mid-Atlantic Fishery Management Council (MAFMC), part of the National Marine Fisheries Service. Other states represented in the Mid-Atlantic region include North Carolina, Maryland, Delaware, Pennsylvania, New Jersey, and New

York. The MAFMC currently manages 13 offshore marine fish species, including Atlantic mackerel, butterfish, spiny dogfish, surf clam, tilefish, bluefish, summer flounder, and black sea bass. Highly migratory species, such as swordfish, are managed in federal waters directly by the National Marine Fisheries Service (NMFS).

Beyond the 200-mile limit, management of certain species of concern – all highly migratory in nature – is handled through an international body, the International Commission for the Conservation of Atlantic Tunas (ICCAT). Receiving special attention today are billfishes whose stocks have plummeted in recent decades. Scientists working with the ICCAT employ tracking devices to understand more about the habits of these fishes, and seek to engage countries around the globe in the protection of these predators at the top of the marine food chain.



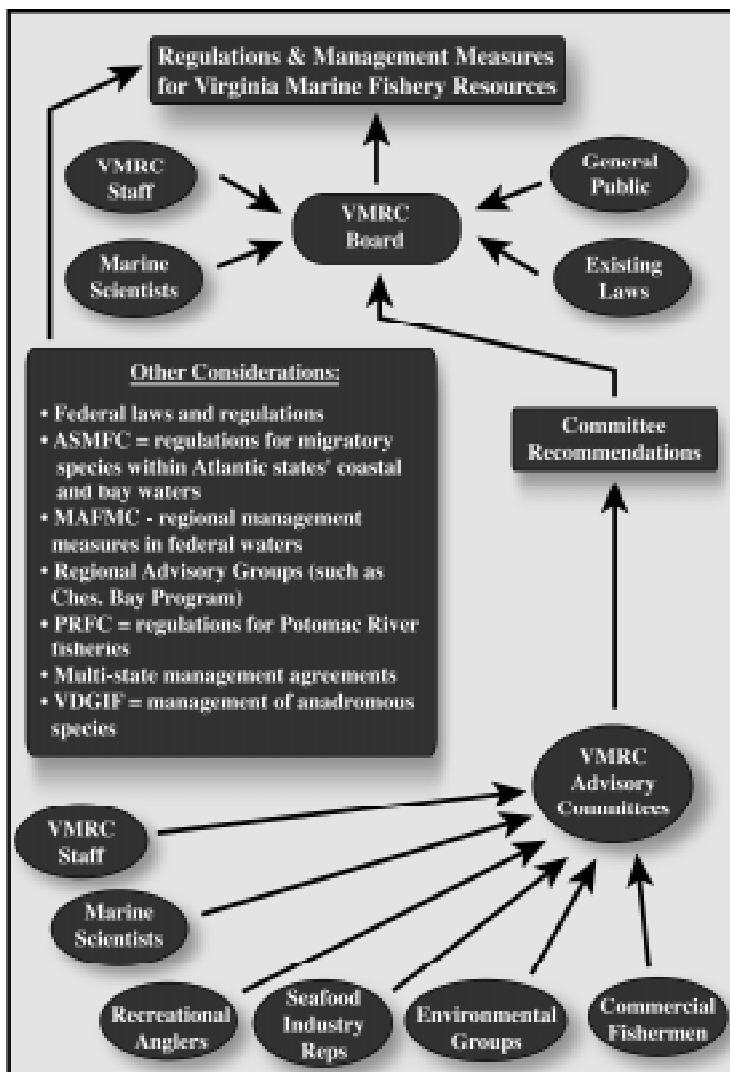
The graph shows a classic analysis of an open-access (unlimited) fishery. As fishing effort (E) increases, initially catches go up. At some point, however, the biological resource is no longer plentiful. If (E) continues at the same rate, catches (and revenues) will begin to go down. The concave curve represents the revenues that could be earned on a recurring basis at every level of fishing effort (E): the effort required to maximize economic yield, or to maximize sustainable yield, or to allow unlimited access and produce open-access yield. Fishery managers use the information from such models and factor in biological and socio-economic objectives when considering management strategies.



Maximum economic yield (MEY), maximum sustainable yield (MSY), and open-access yield (OA).

reational industry representatives, conservationists, and fishery managers. Committee members are appointed by the agency's director and are chosen for their technical expertise and constituent representation. They report to the board and make recommendations for action.

These advisory committees are the gears that make everything work. It is "where things happen." Commission staff, scientists, and industry members share their perspectives based on what they are seeing on the water and landed at Virginia docks. This information sets the stage for refining management tactics. In general, decisions factor in the biological health of the resource and socio-economic considerations of the fishing community. Admittedly, spirited debate often takes place among members, who at times represent opposing views on resource conservation and exploitation.



Common Marine Fishes of Virginia

SPECIES NAME	COMM/ REC'L	MGMT. AUTHORITY					HARVEST GEAR USED						
		VMRC	MAFMC	ASMFC	Other	Pot/ Trap	Hook/ Line	Pound Net	Gill Net	Trawl	Haul Seine	Long- line	
FINFISH:													
Amberjack	C/R	*			SAFMC		*						
American Eel	C	*		*		*	*	*					
American Shad	C/R	*		*			*	MORATORIUM					
Atlantic Croaker	C/R	*		*			*	*	*	*	*		
Atlantic Mackerel	C/R		*				*			*			
Black Drum	C/R	*			CBP		*						
Black Sea Bass	C/R	*	*	*		*	*						
Bluefish	C/R	*	*	*			*	*	*				
Butterfish	C	*	*				*	*			*		
Cobia	C/R	*			SAFMC		*	*			*		
Dolphin	C/R				NMFS		*						
Gray Trout (Weakfish)	C/R			*			*	*	*	*	*		
Mackerel, King	C/R				SAFMC		*	*	*				
Mackerel, Spanish	C/R			*	SAFMC		*	*	*				
Menhaden	C			*	VA Legislature				pound net and purse seine				
Monkfish	C		*						trawl and scallop dredge				
Northern Puffer	C/R	*				*	*					*	
Perch (White)	C/R	*					*	*	*				
Red Drum (Puppy Drum)	C/R	*		*			*	*	*				
River Herring (Blueback/Alewife)	C/R	*		*			*	*					
Scup (Porgy)	C/R	*	*	*		*	*	*	*	*			
Sharks (39 species, coastal)	C/R	*		*	NMFS		*		*			*	
Sheepshead	C/R	*					*						
Spadefish	R				SAFMC		*						
Spanish Mackerel	C/R	*		*	SAFMC		*		*				
Speckled Trout (Sp Seatrout)	C/R	*		*			*	*	*		*		
Spot	C/R	*		*			*	*	*	*	*		
Squid	C		*				*		trawl and jig rig				
Spiny Dogfish (Horndog)	C	*	*	*			*		*				
Striped Bass (Rockfish)	C/R	*		*	CBP		*	*	*	*	*		
Sturgeon	C/R	*		*				MORATORIUM					
Summer Flounder (Fluke)	C/R	*	*	*			*	*	*	*			
Tautog	C/R	*		*		*	*						
Tilefish	C		*				*						
Triggerfish	C/R				SAFMC		*						
Wahoo	C/R				SAFMC		*						
SHELLFISH:													
Blue Crab	C/R	*			CBP	*	dredge, dipnet, trotline, scrape, float, pen						
Clam, Hard (Quahog)	C/R	*	*				dredge, tong, hand						
Horseshoe Crab	C	*		*	CBP					*			
Oyster	C/R	*			CBP	dredge, tong, trays				*			
OFFSHORE:													
Bilfish (Sailfish/Swordfish/Marin)	R	*	*		NMFS/ICCAT		*					*	
Clam, Surf	C	*	*				dredge						
Conch: Channel Whelk	C	*					*						
Conch: Knobbed Whelk	C	*					dredge						
Sea Scallop	C		*		NEFMC		dredge						
Tuna (Bluefin/Yellowfin/others)	C/R				NMFS/ICCAT		*			*		*	

ASMFC = Atlantic States Marine Fisheries Commission
 CBP = Chesapeake Bay Program
 ICCAT = International Commission for the Conservation of Atlantic Tunas
 MAFMC = Mid-Atlantic Fishery Management Council
 NEFMC = New England Fishery Management Council
 NMFS = National Marine Fisheries Service (of NOAA)
 SAFMC = South Atlantic Fishery Management Council
 VMRC = Virginia Marine Resources Commission

Who gets the fish?

The process of allocating marine fishery resources – like other resource allocation decisions – is thorny, and sparks strong debate among identified user groups. Most notable are the disputes over quota shares assigned to recreational and commercial fishermen. In most cases, recreational anglers feel they are “discounted” in the decision process, coming up short on quotas.

Management of summer flounder, which represents a significant target species for both groups, provides a salient example of their gripe, according to many recreational anglers who belong to the Coastal Conservation Association, Virginia Chapter (CCA). When the VMRC moved trawl boats out of state waters in 1989 in response to plummeting flounder stocks, recreational landings were at historic lows while more efficient commercial gear were generating all-time large harvests for that sector. Using the prevailing numbers from that year to set the base allocation for the future – intended to rebuild stocks – meant that the VMRC allocation decision was viewed by sport fishermen as somewhat lopsided. They claim that millions of recreational flounder fishermen are currently allocated 40% of the total allowable catch (TAC), while a couple of thousand commercial fishermen are allocated 60% of the flounder harvest.

Realistically, committee participation involves a significant time commitment and learning curve. Pouring over data and trends and interpreting the results in order to make a management decision does not happen overnight. Like the writing of FMPs, it is often slow and arduous. Industry folks have a reputation for wanting action more quickly, while scientists and resource managers often call for more comprehensive data and information to make valid assessments. While Virginia does not write state-specific management plans, the rigorous evaluations performed during advisory committee meetings, along with existing multi-state agreements or federal FMPs, are together viewed as serving the same purpose.

Arguments like these prevail in other important fisheries—striped bass, grey trout, black sea bass, for example. But the historical treatment of commercial fishermen continues, because Virginia views the work of the commercial waterman to supercede other users sharing these resources. While it may be true that recreational anglers far outnumber commercial watermen as individuals, sport fishermen are engaged in a leisure past-time and taking their catch home cooler by cooler. Commercial watermen, on the other hand, make their living from the sea—feeding the masses in the process and offering seafood to consumers both near and far. This is the crux of the argument, and it is not expected to be resolved anytime soon.

Many CCA members give Commissioner Pruitt high marks for bringing them into the fold as advisors on key committees. At the same time, they point to the problems created by the structure of Virginia fisheries management. They suggest that because the VMRC is primarily funded by the taxpayers' general fund, the seafood industry has never paid its fair share for using fishery resources. The perspective is one that crops up across all segments of natural resource management and, admittedly, ingores the fact that fishery resources are managed for the benefit of all 7.1 million Virginians—including those who do not fish.

What comes out of these meetings – eventually – is tremendous compromise by all involved. It is through this “give and take” that fishery regulations are shaped. Such regulations must be believable by the seafood industry, while incorporating the most current knowledge and advice of experts from many fields.

According to Jack Travelstead, who heads up the Fisheries Management Division, “Advisory committees help design the regulations that will be supported by industry. This is key to the process. You must have buy-in from those who are being regulated.” Because there is never enough money for 100% enforcement, buy-in up front and education and outreach to those affected become ever more important.

Unfortunately, few members of the public engage in the fisheries management process in Virginia. While it is a commitment that involves taking the long view and following issues over time, it is likely that the more hours you invest the more successful you will be in conveying your point of view.

Recommended actions coming out of committee meetings are distributed to the Commission board and a public hearing date is set. During the hearing, additional public participation is encouraged and comments are taken. After hearing all public testimony, board members vote and new regulations become part of the Code of Virginia.

Other managing authorities

In addition to regulations imposed by the VMRC, fisheries management is also shared with other regulatory bodies. Marine fish moving through inland waters are jointly managed with the Virginia Department of Game and Inland Fisheries. Fish in the main stem of the Potomac River are managed in concert with the Potomac River Fisheries Commission. Similarly, many species of finfish are co-managed through the auspices of the Chesapeake Bay Program (CBP), a multi-jurisdictional body that has worked for more than 20 years under cooperative agreements intended to improve the health of the Chesapeake Bay ecosystem. Fish such as summer flounder, American eel, American croaker, and spot are examples of species for which guidance from CBP management plans exist.



Red Drum

BLACK SEA BASS

Black sea bass is jointly managed by both state and regional authorities, as well as the ASMFC due to its migratory behavior. It provides a good example of fishery management in a state of transition, due to recently enacted rules governing black sea bass commercial harvest. First, a little background: Management of black sea bass historically operated under a single, annual quota for all east coast states. Individual states implemented quarterly quotas based on trip limits. But the result, time and again, was that a tremendous burst of fishing activity – or “rodeo” – occurred. This resulted in early closures every quarter and trip limits lowered for the next quarter, in order to meet annual quota regulations. At some point, it became no longer economically feasible for a commercial fisherman to stay in the fishery due to the expense of traveling 40-50 miles offshore for a limited pay-out.

Under new regulations, which will run for the next two years, Virginia has begun using a new tool, individual fishery quota (or, IFQ) to manage the black sea bass fishery. Fewer commercial fishermen are allowed permits to harvest this species, and allocation is based on the percentage of harvest that an individual vessel has landed in the past five years. Importantly, it will be up to the permit holder to decide how he reaches his quota – whether all at once, or throughout the year – with no specified trip or season limits.

According to the VMRC, the approach looks promising and bodes well for Virginia fishermen, though not everyone is happy with the initial allocation decision. There should be room for adjustment and the opportunity for new entrants to the fishery in coming years.

Shellfish management

Management of Virginia's marine shellfish stocks mimics that of finfish; for bay species, emphasis is placed on coordination with Chesapeake Bay partner states. Management of the blue crab, for example, is conducted through the Chesapeake Bay Program. A Bi-State Blue Crab Advisory Committee was established in 1996 to assess the status of the fishery and the effectiveness of existing regulations. After two years of study, they recommended, among other actions, a reduction in fishing effort bay-wide.

That recommendation, now a formal part of the multi-state FMP, has translated into several new regulations for Virginia's blue crab fishermen. The regulations include a 15% reduction in fishing effort and a large sanctuary that is off-limits to harvesters during spawning season. While directives issued by advisory committees such as these are voluntary in nature, the VMRC views the partnership as a positive



one that has brought Maryland and Virginia managers to the table to discuss management of the blue crab in a complementary, if not parallel, manner.

Other shellfish, such as the oyster, are also managed under bay-wide management plans. What many of these Chesapeake Bay plans have in common are goals and objectives that factor in the historical distribution and harvests of the resource, while paying attention to its unique behavioral or life history attributes that call for a more customized, state-specific management approach.

Aquaculture production

With the challenges imposed by disease and loss of habitat, Virginia is producing more and more of its marine shellfish stocks through aquaculture and gardening efforts. Aquaculture is booming in both hard clams and oysters; yet in terms of management, it remains the "black box" of Virginia's seafood story. The Virginia Dept. of Agriculture and Consumer Services, assigned the lead role in following aquaculture activity in the state, conducts periodic surveys on production in order to make impact assessments for the state economy. The latest report of state-wide information was published in 1995. More general information can be gleaned from the U.S. Census of Agriculture, which was last updated in 1998.

While the VMRC has responsibility for managing all sub-aquaceous bottomlands in the state, it does not track aquaculture production—from clams and soft crabs, nor from the estimated 2,000 oyster gardeners in the state. At this point in time, the exact contributions of this growing sector of the seafood economy in Virginia remain unknown, in part because aquaculture is still judged to be a very thin slice of the overall "pie" in food production.

While estimates are regularly made about aquaculture and its economic impacts, getting a better handle on where and how much activ-

ity is currently underway appears to be called for. Issues have recently surfaced regarding incoming clam seed from other states (and with it, disease), forcing the VMRC to institute a tracking system on all importations. Closely associated is the fact that little is known about non-indigenous species with regard to their impacts on local ecosystems, their ability to introduce new diseases, and their ability to out-compete native species for survival. The VMRC is considering the introduction of an aquaculture permit, proposing that the funds generated could be targeted to disease research and other management concerns.

Also requiring increased management attention are the conflicts arising between opposing user groups of the shallow water environment. This is especially apparent on Virginia's Eastern Shore, where 90 percent of clam aquaculture takes place and where clam farming in bayside creeks and ocean embayments is increasingly in direct opposition to shoreline development and recreational activity.

Multi-species management

With the advent of multi-species management, more and more of the information acquired about marine ecosystems must be expressed at a theoretical level, through modeling. The Virginia Institute of Marine Science is currently involved in developing such models – one of which aims to help managers working at Chesapeake Bay-wide scale. Scientists at VIMS are busy creating a sampling platform from which to survey the mosaic of creatures that co-exist across the water column and estuary bottom. This data will form the underpinnings of the model's design. The benefit of such models is that they can incorporate the effects of technical progress (such as gear design) and biological interactions on population abundance. As such, it is believed that the information acquired and used to write multi-species fishery management plans will offer more realistic

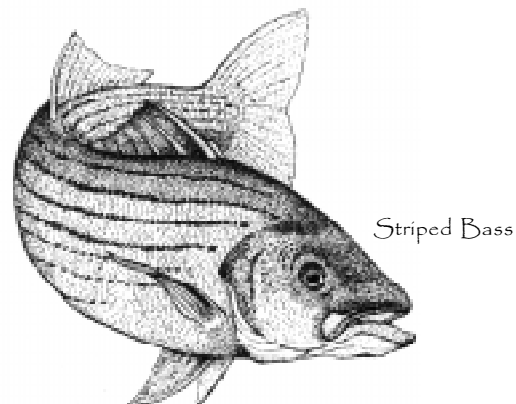
scenarios of what occurs in the water. Managers are quick to point out, however, that such models will augment, not take the place of, traditional, single species management plans.

With the advent of multi-species management, greater emphasis will be placed on identifying essential fish habitat and reducing wasteful fishing practices, which includes reducing bycatch. Similarly, concern continues to be raised over endangered animals living in our oceans, and laws and management strategies targeting their protection are on the rise. This leads to the unavoidable conclusions that more damaging harvest gears will be prohibited – which has implications for Virginia's dredging gear – and certain areas may become restricted from all fishing activity; for example, underwater grass beds that support the needs of juvenile fishes.

As more information about biological interactions is acquired and fed into ecosystem models, fishery management plans will require more frequent updates and refinements. The reality of this paradigm shift will no doubt translate into longer development time to write more complex plans governing the use and enjoyment of Virginia's marine fisheries.

■

Managing marine fisheries is a difficult task, and about to become even more challenging. For that reason, it is more important than ever that Virginians take an active role and make their voices heard in the ongoing dialogue.





Allocation – Distribution of the opportunity to fish among user groups or individuals. In Virginia, the share a user group gets is many times based on historical harvest amounts.

Bycatch Reduction Device – Devices that are installed in trawl nets to reduce the take of incidental catch.

Control Date – A calendar date after which new entrants to a fishery cannot be guaranteed future access to the fishery or in some cases cannot be guaranteed future use of a particular gear type in the fishery. Control dates are used to reduce the practice of obtaining fishing permits by speculators during the period that a fishery is under consideration for limited entry.

Control Rule – Describes a plan for pre-agreed management actions as a function of variables to the status of the stock. For example, a control rule can specify how fishing mortality or yield should vary with biomass.

Fishery-dependent Data – Data collected on a fish or fishery from commercial or sport fishermen and seafood dealers.

Fishery-independent Data – Data collected on a fish by scientists who catch the fish themselves, rather than depending on fishermen and seafood dealers.

Individual Transferable Quota (ITQ) – A form of limited entry that gives private property rights to fishermen by assigning a fixed share of the catch to each fisherman. Sometimes referred to as Individual Fishing Quota (IFQ).

Intercept Survey – An interview of anglers and examination of their catch upon completion of their fishing trip, or under certain circumstances, while they are still fishing.

Limited Entry – A program that changes a common property resource like fish into private property for individual fishermen. License limitation and the individual transferable quota (ITQ) are two forms of limited entry.

Marine Protected Areas (MPAs) – According to Executive Order 13158: any area of the marine environment reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein. See next entry.

Marine Reserves – Geographically defined space in the marine environment where special restrictions are applied to protect some aspect of the marine ecosystem including plants, animals, and natural habitats. See Marine Protected Areas, or MPAs.

Open Access Fishery – A fishery in which any person can participate at any time.

Possession Limit – The number and/or size of a species that a person can legally have at any one time. Refers to commercial and recreational fishermen. A possession limit generally does not apply to the wholesale market level and beyond.

Pulse Fishing – Harvesting a stock of fish, then moving on to other stocks or waiting until the original stock recovers.

Quota – The maximum number of fish that can be legally landed in a time period. It can apply to the total fishery or an individual fisherman’s share under an ITQ system. Could also include reference to size of fish.

Size Limit – The size of a species that a person can legally take in a day or trip.

Slot Limit – A limit on the size of fish that may be kept. Allows a harvester to keep fish that fall between a minimum and maximum size; or size limits that allow a harvester to keep fish under a minimum size and over a maxi-

imum size, but not those in between the minimum and maximum.

Total Allowable Catch (TAC) – The annual recommended catch for a species or species group. The regional council sets the TAC from the range of the acceptable biological catch.

Trip Interview Program (TIP) – A cooperative state-federal sampling activity of commercial fishery-dependent data conducted in various regions of NMFS. Data collected concentrate on size and age information for stock assessments of federal, interstate, and state managed species. TIP also collects information on the species composition, quantity, and price for market categories.

“Show Me the Data”

Critical to the wise management of marine fishes – like other natural resources – is sound and timely data on which to base decisions. While state and federal fishery resource managers have long recognized this need, in the past fisheries data have not been cooperatively shared or managed by coastal states in compatible formats. The Atlantic Coastal Cooperative Statistics Program was created to address this problem.

The Atlantic coast states are working hard to streamline the information collected about fisheries from commercial fishermen, recreational anglers, and charter and party boat

captains. Ultimately, one database will exist that will allow the user to query landings information for a species by specified time period, by gear type, by market price, and by other parameters of interest. Biological information gleaned from scientific sampling will eventually become part of the database, helping managers and the interested public keep pace with fisheries science.

The coordination of data collection and reporting signals a new day in fisheries management – one that will surely benefit all who are looking out for the long-term health and survival of marine fish stocks.

For more information about the program, contact the ACCSP at <www.accsp.org>.

Federal Management with Local Input

by William D. DuPaul, Ph.D.

The sea scallop (*Placopecten magellanus*) fishery is one of the most valuable fisheries along the east coast of the United States. Annual landings over the past two years have increased to record levels of over 45 million pounds valued at more than \$175 million, and the total economic impact of the fishery exceeds a half-billion dollars. Long-term averages are projected to be between 32-35 million pounds landed a year.

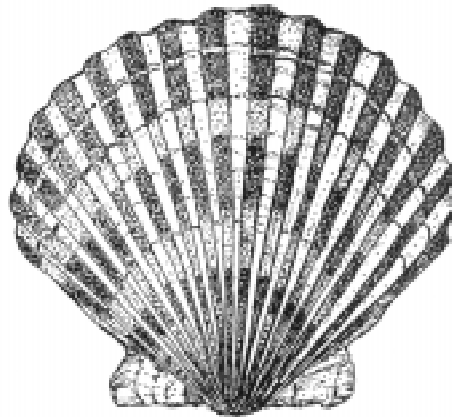
Commercial quantities of sea scallops are found from Virginia to Maine, with most of the resource in waters managed by federal regulations. The vessels that fish for scallops originate from North Carolina to Maine, and the largest ports landing sea scallops include Hampton Roads (Seaford, Hampton and Newport News, Virginia), Cape May, New Jersey and New Bedford, Massachusetts. There are 388 federal permits to harvest scallops but only about 300 vessels are presently active with about 200 classified as "full time." Most of the fleet is composed of vessels greater than 70' overall length and over 100 gross tonnage, and most vessels are capable of fishing from the waters off the coast of Virginia to the distant scallop

grounds on Georges Bank, off the Massachusetts coast, depending upon season and abundance.

Management of this complex fishery began in 1982 when the NMFS approved and implemented the New England Fishery Management Council's (NEFMC) *Atlantic Sea Scallop Fishery Management Plan*. The original plan regulated the fishery with an open access permit (no limit to the number of vessels) and a minimum meat count of no more than 32 meats per pound to prevent the harvest of small scallops. By 1993, it became evident that existing regulations were not effective in preventing excess fishing effort and fishing mortality; rather, catches were declining

and fishing effort was increasing.

In 1994, the NEFMC took bold actions to limit the number of vessels that could enter the fishery, started a day-at-sea reduction plan, limited vessel crew size and imposed new gear regulations to reduce the harvest of small scallops. These were some very difficult economic times in the scallop industry, with landings dropping to very low levels. But today, along with the additional special management areas



that are off limits to harvesting for a set period of time, fishing effort has been reduced by nearly half, fishing mortality has been reduced by over one-third, landings and revenues are at record levels, and the fishery has been declared to be operating at sustainable levels as defined by law.

This success story of responsible fisheries management has been accomplished by fishermen, scientists, and management agencies working together for a common goal. Of course, nature has been very kind in providing good recruitment over the past several years, making things a bit easier. As mentioned, the NEFMC has primary responsibility for developing the management plans for sea scallops, but because scallop distribution and the scallop fishing industry extends beyond New England, the Mid-Atlantic Fishery Management Council (MAFMC) has been enjoined to participate in the management process.

The fishery management councils are made up of individuals representing their respective state, management agencies, commercial and recreational fishing interests, environmental groups, and federal management and enforcement agencies. For this case in point, the NEFMC has a sea scallop committee with 2 representatives from the MAFMC from Virginia and North Carolina.

The scallop committee reviews input from the Sea Scallop Plan Development Team (PDT) and the Scallop Industry Advisory Committee. The PDT conducts analyses on scientific information pertaining to scallop population, gear research, and habitat and bycatch information, and projects possible outcomes of suggested management strategies. The PDT is made up of scientists from the NEFMC, NMFS, and academic research institutions including VIMS, and meets several times a year. The Scallop Industry Advisory Committee is an appointed committee of industry members from North

Carolina to Maine; three of the members are from Virginia. In turn, the Scallop Committee presents its recommendations to the full council for deliberation and decisions. When significant changes are proposed to the management plan, a series of public hearings are conducted.

Recently, a public hearing for Amendment 10 to the fishery management plan was held in Newport News and was well attended by vessel owners and captains. Amendment 10 addresses the formal use of an area management strategy that closes areas where there are large concentrations of juvenile scallops in order to maximize scallop yield down the road, and addresses concerns about bycatch and habitat.

Research to support the science behind management decisions is conducted by NMFS and various academic research institutions, including VIMS. In a novel approach to fund needed research, scallops that are allocated to industry to harvest are set aside to do so. Most of the research is conducted on board commercial scallop vessels, and the sale of a portion of the catch is returned to the research institution to cover associated expenses. The sea scallop industry has been extremely proactive in generating resources to support the research needed to properly manage the fishery.

Currently there are 61 limited access scallop vessels home-ported in Virginia and an additional dozen or so from other states using Virginia ports. Virginia's scallop industry employs nearly 2,000 people and generated landings in 2001 worth more than \$45 million. Clearly, Virginia has a vested interest in the future management and success of the sea scallop fishery.

A Case Study: Summer Flounder



By Christopher Moore, Ph.D.
and Marla Trollan, MPA

Every year, scientists, fisheries managers and administrators participate in a process that affects thousands of Virginians and millions of dollars. That process, which involves numerous meetings and hundreds of man-hours, results in a number of commercial and recreational management measures that impact the commercial and recreational harvest of marine fish in the waters off the coast of Virginia. One fish, summer flounder, has been at the forefront of management efforts over the past several years.

Summer flounder, commonly known as fluke, is one of the most important finfish to Virginia fishermen. In 2001, about 2.7 million pounds of summer flounder valued at 3 million dollars were landed in Virginia ports. In addition, Virginia anglers spent millions of dollars on bait, tackle, gas, food and lodging to use hook and line to pursue fluke from shore, piers, and boats in Virginia waters from Chincoteague to Onancock.

The abundance of summer flounder in waters off Virginia is a true success story and

directly relates to the positive impact that management measures have had on the stock. In 1988, the *Summer Flounder Fishery Management Plan* was implemented by the National Marine Fisheries Service (NMFS). Unfortunately, 1988 was also the year of a recruitment failure in the summer flounder stock. Because the fishery was highly dependent on incoming recruitment at that time, commercial and recreational landings dropped dramatically in 1989 and 1990. Survey values also indicated summer flounder abundance was at an all-time low.

The Mid-Atlantic Fishery Management Council (Council) and the Atlantic States Marine Fisheries Commission (Commission) responded to these declines by developing Amendment 2 to the Summer Flounder plan. That document, a comprehensive amendment first fully implemented in 1993, contained a number of management measures to regulate the commercial and recreational fisheries for summer flounder. These measures included a rebuilding schedule, commercial quotas, recreational harvest limits, size limits, gear restrictions, and permit and reporting requirements.

The plan also detailed a process that is followed each year to establish the regulations for the upcoming season. The process begins in June when the stock assessment is completed by scientists in a summer flounder working group. The group includes representatives from coastal states, including Virginia, and the Council, Commission, and NMFS. Commercial and recreational landings and discards by Virginia fishermen as well as Virginia trawl surveys of the summer flounder population are used together with fisheries-dependent and fisheries-independent information from other east coast states and the federal government to assess the current status of the stock.

Stock assessment results are utilized by the summer flounder monitoring committee to develop recommendations for consideration by the Council and the Commission's summer

flounder board. These two management bodies include representatives from Virginia. In August, the Council and Board develop management measures based on recommendations from the monitoring committee, industry advisors and the public. These management measures include a total allowable landing level (TAL), which is divided into a commercial quota (60%) and a recreational harvest limit (40%), minimum fish size regulations, and gear requirements. In 2003, the TAL was 23.3 million pounds with an associated commercial quota for the coast—state and federal waters combined—of 13.98 million pounds. The commercial quota is allocated to each state from Massachusetts to North Carolina; in 2003 Virginia was allocated 2.9 million pounds.

The Council and Board meet again in December to decide on recreational regulations for the following year. These management groups review the most current information on the recreational fishery and compare the performance of the fishery to the recreational harvest limit. Since 2001, the Council and Board have decided to use "conservation equivalency" to constrain the recreational harvest. As a result, each state, including Virginia, is allocated a portion of the harvest limit to develop state-specific regulations to achieve the limit. In 2003, the recreational limit for Virginia is 689,000 fish. The regulations put in place to achieve this limit include an 8-fish possession limit, 17.5-inch minimum fish size, and a closed season from January 1st to March 28th.

The summer flounder stock has responded dramatically to the management measures adopted by the Council and Commission since 1993, the first year that Amendment 2 was implemented. Fishing mortality rates have dropped significantly and spawning stock biomass has increased over 700 percent from 1989 to 2001. Projections of stock status for 2003 indicate that the stock is no longer overfished.

Virginia representatives have been active participants in the development, implementation, and administration of the summer flounder plan. They serve on the Council, the Commission, and technical working groups. Industry members from Virginia also deserve credit for serving as industry advisors and providing public comment during public hearings and Council meetings. The input and dedication of all these individuals has allowed the Council and Commission to develop a plan that balances the rebuilding of the summer flounder stock with the economic and social impacts to fishermen and their communities. It is doubtful that the Council and Commission could have made such remarkable strides to conserve and protect summer flounder without the hard work of all who contributed to this process.

Research Set-Aside Program

Managing fishery resources has been, and continues to be, a challenge owing to the uncertainty and lack of timely fishery data. This has made it difficult for managers to balance the needs of fishermen and conservation of the resource simultaneously.

A new research program is underway that integrates fishing industry activities with cooperating scientific partners to improve fishery management decisions. Known as the Research Set-Aside Program, a set-aside quota is removed from the annual quota allocation recommended by the Council for those species which it manages. This set-aside is then available for award to applicants who successfully meet research priorities and award conditions.

The successful applicant receives an individual sub-allocation of the quota to conduct the approved research experiment or project. Whatever funds are generated from this individual sub-allocation are available to use in conducting the research activities.

The Mid-Atlantic Fishery Management Council currently manages 13 species along the Mid-Atlantic coast:

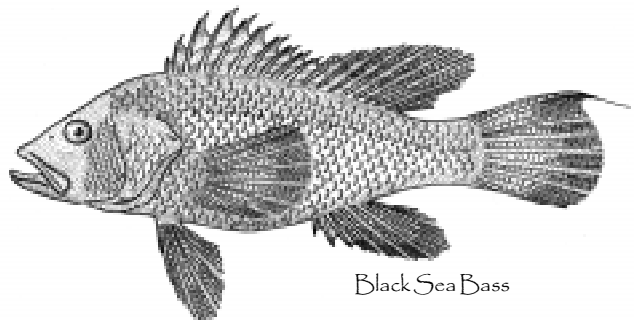
- Summer Flounder
- Scup
- Black Sea Bass
- Bluefish
- Spiny Dogfish
- Long-finned Squid
- Short-finned Squid
- Atlantic Mackerel
- Butterfish
- Surf Clams
- Ocean Quahog
- Tilefish
- Monkfish

Meetings are held every six weeks throughout the Mid-Atlantic region, and provide ample opportunity for public comment.

Contact the MAFMC at:

(302) 674-2331, or
www.mafmc.org

for additional information about upcoming meeting schedules.



Black Sea Bass

The authors work for the Mid-Atlantic Fishery Management Council. Chris Moore serves as deputy director and Marla Trollan serves as public affairs director.

Watermen Face More than the Wind

By Charlie Petrocci

REGULATIONS, ERRATIC HARVESTS, AND HIGH FUEL COSTS HAVE FISHERMEN UP AGAINST MORE THAN THE ELEMENTS, BUT THEY LOVE THEIR WORK

To say the commercial fisheries of Virginia have changed over the years is an understatement. But change is inevitable, no matter what business one is in. And watermen understand that.

Though times are tough and to a man they suggest the outlook is bleak, watermen still feel they have lived the past and don't want to miss the future. Nor would any change their lifestyle. Their love of working on the water, their independence, and the thrill of their catch draws them to the next day's sunrise. Most watermen would rather work 70 hours a week for themselves than 40 hours a week for someone else. Yet faced with undulating fish stocks, erratic markets,

bad weather, rising fuel prices, and high maintenance costs, the challenges seem constant.

This spring has been a test of endurance as high winds, endless rain, and stalled fish migrations have set some watermen back on their heels. But the Virginia commercial fishing industry remains resilient. Most believe there will always be a waterman as long as there

is something to harvest. And for the many waterfront towns of the Commonwealth that are economically bound to commercial fishing, the waterman's survival means the town's survival.



Weather or not

Robbie Lawson is no stranger to the water. For over 30 years he has worked the water in one way or another. With his 48-ft. deadrise, the *Captain Bob*, Lawson has sailed down the winding creeks leading out of Willis Wharf toward the distant inlet and the ocean. These days he spends the winter and spring months potting for whelk, known locally as conch, and through the summer potting hard crabs for a hungry local

market. Like all watermen, his job is demanding and often controlled by outside elements. And that includes weather.

"This has been a rough year so far," he says. "We've had a very cold winter and spring hasn't looked much better. Plus we've had a lot of wind. So with these cold water temperatures it's going to be a tough conch season

and maybe even a tougher crab season as well. Added to that we have some high bait and fuel prices these days, so that will compound things a bit," says Lawson. Lawson once was an active gill netter, but low prices on local species such as croaker have forced him into other fisheries.

He speaks standing in this small port town that once boasted a large surf clam fleet and several oyster and crab picking houses, now mostly all gone. Only a handful of watermen still fish gill nets, harvest oysters, or pot for crabs here. But Willis Wharf has witnessed a phoenix rise in its seafood industry in the form of clam farms and supporting hatcheries. Several large clam mariculture operations have developed here, in many cases employing local watermen who have seen better days on their own.

"I think clam culture here has saved a lot of watermen," says Lawson. "It's given a new chance for a lot of these guys." That fresh breath of air for a struggling industry may not be enough to excite the next generation, however.

"I don't see any young people coming behind me to work on the water. My own boy is 12 years old and my wife would kill me if I got him started working on the water. Though

I think some regulations are good, most are too restrictive, and with the economy right now I don't see a good future. So maybe it's best my son stays off the water."

Though times are tough in Willis Wharf, the town still tenaciously holds onto its heritage in the seafood industry. While clam farming may not be part of its traditional maritime roots, it may be a pathway to keeping the waterfront alive.

Three brothers

Ed, Greg, and Milton Stratton are three brothers who have decades between them of working the tide flats in and around the small seaside town of Wachapreague. These guys are opportunists, working the water as seasons, regulations and markets change. Ed, the oldest, has over 50 years on the water and his calloused hands reflect the hard labor.

"There was a time when I made good money oystering. I raised my family working the water and it's been good to me. But things have changed. Oysters are not as plentiful as they once were, and it's getting harder to make money today the way you could in the past. I try to keep up as best I can. But I love this job



and wouldn't want to do anything else," he says.

Wachapreague sits belly up to the marshes that extend to the inlet, which leads to the sea. It's one of those towns whose heart and soul is intricately tied to the water, and the daily tides are its life-blood. Though it once boasted oyster houses, active fish docks, and a large hotel that catered to the wealthy, its maritime soul is now anchored in sportfishing, with an active fleet of over two dozen charter boats.

"I work the winter and spring oystering, clamming, and crabbing, but come sportfishing season, my brother Milton and I cut fish for fishermen coming back to the docks. Tuna, dolphin, croaker, flounder, we fillet them all. It's good money," says Greg Stratton.

"We still work the water in our own boats during the summer, because most sport boats don't come in until late afternoon. It makes for a long day," adds brother Milton.

All three Stratton brothers are the sons of a son of a waterman. "Our father worked on the water as an oysterman," adds Ed. "We learned from him." Since his day, Wachapreague has changed. There were once four fish packing houses here and several oyster houses as well. Now local watermen like the Strattons have to drive to sell their catch.

"Regulations have hurt us. We can't catch horn dogs [spiny dogfish] anymore and that was a nice fishery for us in the spring. And the paperwork will kill you. All we do is fill out forms. I don't see much of a future unless things get better. Costs of things keep going up and fish prices are going down," says Ed.

The three Strattons represent only a handful of active Black watermen who still work



here. "At one time there were 30-40 Black watermen in Wachapreague, but no more. And I don't see any young men following behind. We may be the last," adds brother Greg.

A man on a mission

Ernie Bowden is a true-blood Chincoteager. On his boat, the *Barbara B*, he shifts his nets with the seasons. At 49 years old, he has spent almost 28 of them as a full-time waterman. "My father was a waterman and I actually started as a kid working with him sometimes. He was an offshore pound netter," says Ernie. In the past Ernie has tonged for oysters, worked the bottom for clams, and dredged crabs in the winter months. Today, 95% of his time is spent gill netting.

"I've seen an increase in some species and a decline in others. When I started, the main fish were spot and stripers and now it's croakers and sea trout. Historically fish move in cycles, which is good, and a good waterman will understand that," he says.

As president of the Eastern Shore Waterman's Association, Bowden speaks with authority and a love of his trade. "Regulations and allocations are always a challenge to

watermen. Some regs are good and needed, while I believe others have hurt us. Years ago there weren't enough regulations and maybe now we have too many. Minimum size regulations for example are good because we need spawners. But I feel season regulations cause discard mortality. Shad for example will become a trash fish if they close the season," Bowden speculates, referring to the ocean fishery.

Chincoteague once hosted over a dozen oyster shucking houses, clam houses, and several fish packing operations. Ernie remembers many of them growing up. Today almost all are gone, replaced by townhouses, motels, and restaurants. "I think we are over-managing individual species and not looking at all the species as a whole. You have predator and prey relations at work, and if we go after one species it will affect others. Same is true of watermen. If we close one species out, then

these guys have to shift and go after another to make a living. That puts a lot of pressure on those targeted species." There are over 3,200 license holders in the state of Virginia today. "I think about 1,400 of those are just card holders and not very active," he adds.

Like most watermen, Bowden sees a bleak future. He feels regulations and allocations are putting a lot of pressure on watermen in addition to other constraints like high fuel costs. "I think we would get a better understanding of our industry by those regulators – whether they are politicians or from the VMRC – if they would all spend some time out on the water with us to see what goes on. These people are responsible for making decisions about people's livelihoods and their futures, and they need to know the mechanics of the industry from the water up," says Bowden. He, like other Virginia watermen, knows he will always be faced with ever-changing regulations. They seem to move almost as much as the cycles of species these men depend on for the next catch of the day.



Pounding it out

Fred Jett at 50 years old is a pound netter. Like his father and his father before him, he works his copper-coated pound nets along the Potomac River and out in the Chesapeake Bay. "I'm working the same pound net sites my grandfather did decades ago," says Jett, obviously proud of his heritage. Asked about industry change since the fishing lineage started, he's quick to say that it's gotten more labor intensive.

"Sure things have changed over the years as far as species harvests, allocations, seasons, and licensing, but it's still a good business to be in. But I'd have to say it's gotten much more labor intensive. We're doing a lot more work now to make money than we had to do years ago," he adds.

Jett fishes mostly for the bait market, with bunker, mackerel, butterfish, and herring providing the bulk of his catch. "In the spring we also take rockfish, shad, and trout. Summer and fall, it's trout, bluefish, spot, croaker, rockfish, and more bunker. The bait goes to local crabbers and to crawfish trappers in Louisiana, while the food fish go to local and distant markets such as those in North Carolina," he says.

Jett runs a 3-man crew to work his pound nets. "I have three nets in the Potomac River and one out in the Chesapeake. So because of that, we fall under both Virginia state regulations and the Potomac River Fisheries Commission. Jett is impressed with the way the Potomac agency handles allocations and regulations.

"They seem to be easier to work with and are willing to work with pound netters on various concerns." One of those was the implementation of plastic cull panels for the corner pockets of pound nets. "They let out the small, juvenile fish such as trout and flounder, which is our future. Most of us realize that we need things like that along with realistic regulations to keep us alive. We need future fish stocks and any way we can help guarantee that, it's good for all of us. I think most commercial fishermen believe that." Jett is optimistic about his future and understands that fish move in cycles. His 82-year-old father, who still helps him occasionally on the water, no doubt has seen those cycles come and go over the years.

Though he is a commercial fisherman, Jett is quick to add that he is an avid sport fisherman as well. "I love to sport fish when I get a chance. And I think a lot of watermen do, but commercial fisheries are important; they supply food for the people."

At one time there were over 2,000 net licenses in the bay. Today that has dropped to about 200. "I think there are only about 150 active net licenses out there now, and the numbers are dropping. It's hard work and not many

people want to get into it. Since I have three daughters, I'm sure I'm the last in my family to carry on the tradition," he adds. The long lines of nets, like sentinels out in the Chesapeake, may be disappearing. Some may be grateful for their demise, while others will one day tell their tales with reverence when the last pole is pulled.

The end game

After the fish are caught, they have to go somewhere. Enter Wesley McDonald, better known as "Red." For the past 10 years he has owned Chincoteague Fisheries Company and, together with his wife Dee McDonald, has kept up the tradition of making Chincoteague an important landing site for just about every species caught in Virginia's waters. On any given day the old cement dock covered by a tin roof sees flounder, sharks, scallops, sea bass, porgies, shad, croaker, spot, and striped bass spill from boat to culling table.

"We pack it all. If they can catch it I can sell it," says Red. "The seafood market is hungry and buyers know we have good products. Most of my fish goes to New York, New Jersey, Philadelphia, Baltimore, and North Carolina, and everywhere in between," he says.

Some days the boats are lined up at his dock. Their sterns are their calling cards, with home ports from North Carolina, New Jersey, New England and points around tidewater Virginia.

"There are only two fish docks left on Chincoteague and we are the largest fish packer on the Eastern Shore of Virginia," Red asserts. "So we get boats from all over packing out here. I also buy from about 15 local Virginia gill netters here as well." With fish docks slowly disappearing, being replaced by motels and condos, fish packing houses are becoming a rare site these days.

McDonald sees his role as a fish packer as important to the community. "We're trying

to keep things alive in this business. These guys, including the local boats, need a place to sell their fish. We get a lot of tourists who come down the dock to take pictures. When they come over that bridge onto Chincoteague Island, it's the fishing boats lining the docks that first catch their eye. So I feel we are good both economically and socially for the island." For many tourists, he believes, seeing those boats gives them a sense of place and a strong connection to this maritime community.

Like most watermen in the region, Red McDonald voiced his opinion on the currently closed spiny dogfish season. "I think this has hurt a lot of watermen. It's not a big money maker for most, but it's a fishery that filled in the gaps. If we keep getting species like horn dogs closed out, then it's going to strangle some of these guys slowly. And I need watermen as much as they need me. We're all in this together." It may be that unwritten feeling of camaraderie that all in the seafood business share. Watermen may be independent, but they all need each other for the industry to survive.

A matter of trust

Commercial fishermen may be the most regulated user group in America – maybe in the world, for that matter. Most watermen know that regulations are needed, though they don't necessarily agree with all of them. For watermen, regulations are seen as the biggest threat to their livelihoods. And since regulations are often made in response to scientific assessments of changing species stocks, commercial fishermen believe regulations put unnecessary constraints on their ability to make a living off the water. Thus, there seems to prevail a general mistrust among watermen of the scientific community.

Commercial fishermen vent about the need for scientists to talk to them and listen

to their concerns. They feel their experience on the water gives them depth of knowledge about the species they target and the waters they fish. Many have acquired this knowledge not only as practitioners, but also from gathered information passed down from generations before them – fathers, uncles, and grandfathers who were also watermen. So quite often they believe they are not fairly heard by the scientific community who they believe are directly responsible for regulatory directives. This holds true at regulatory, public hearings as well, where many watermen believe the gatherings are just a formality and allocation decisions have already been made before the meeting takes place.

Importantly, many watermen feel they are also watching a way of life that has been part of their community for generations slowly slip through their fingers. Leaving the water for a 9-5 job is a life few—if any—of them would choose.

Ensuring a bright future

The importance of commercial fisheries to the Commonwealth can be traced to her earliest days. Fish and shellfish were primary sources of food and subsistence for the struggling colony. Development of fisheries into a viable trade and export business created economic stability for maritime villages small and large. Over the centuries, Virginia's seafood fed her citizens and created jobs from boat-building to commercial gear development, and caught the attention of international consumer markets.

As we look to the future of commercial fishing in Virginia, we cannot forget her past. Commercial fishing must not be abandoned, nor neglected. Only the concerted efforts and mutual respect of watermen, environmentalists, and seafood regulators working together to satisfy a demanding world seafood market can ensure that Virginia's commercial fishing future will be bright.

Glossary



Age Frequency or Age Structure – A breakdown of the different age groups of a kind of fish in a population or sample.

Anadromous – Fish that migrate from saltwater to fresh water to spawn.

Annual Mortality (A) – The percentage of fish dying in one year due to both fishing and natural causes.

Aquaculture – The farming of aquatic organisms in marine, brackish or fresh water. Farming implies private or corporate ownership of the organism and enhancement of production by stocking, feeding, providing protection from predators, or other management measures. Aquaculture production is reported as the weight and value of cultured organisms at their point of final sale.

Artisanal Fishery – Commercial fishing using traditional or small scale manually-operated gear and boats.

Benthic - Refers to animals and fish that live on or in the water bottom.

Biomass – The total weight or volume of a species in a given area.

Bycatch – The harvest of fish or shellfish other than the species for which the fishing gear was set. Examples are blue crabs caught in shrimp trawls or sharks caught on a tuna longline. Bycatch is also often called incidental catch. Some bycatch is kept for sale.

Catadromous - Fish that migrate from fresh water to saltwater to spawn.

Catch – The total number or poundage of fish captured from an area over some period of time. This

includes fish that are caught but released or discarded instead of being landed. The catch may take place in an area different from where the fish are landed. Note: Catch, harvest, and landings are different terms with different definitions.

Catch Per Unit of Effort (CPUE; C/E) – The number of fish caught by an amount of effort. Typically, effort is a combination of gear type, gear size, and length of time gear is used. Catch per unit of effort is often used as a measurement of relative abundance for a particular fish.

Charter Boat – A boat available for hire, normally by a group of people for a short period of time. A charter boat is usually hired by anglers.

Coastal Migratory Pelagic Fishes – Several species of fish that live in open waters near the coast, grouped together for management purposes.

Cohort – a group of fish spawned during a given period, usually within a year.

Commercial Fishery – A term related to the whole process of catching and marketing fish and shellfish for sale. *It refers to and includes fisheries resources, fishermen, and related businesses.

Crustacean - A group of freshwater and saltwater animals having no backbone, with jointed legs and a hard shell made of chitin. Includes shrimp, crabs, lobsters, and crayfish.

Demersal - Describes fish and animals that live near water bottoms. Examples are flounder and croaker.

Directed Fishery – Fishing that is directed at a certain species or group of species. This applies to both sport fishing and commercial fishing.

Effort – The amount of time and fishing power used to harvest fish. Fishing power includes gear size, boat size, and horsepower.

Elasmobranch - Describes a group of fish without a hard bony skeleton, including sharks, skates, and rays.

Environmental Impact Statement – An analysis of the expected impacts of a fisheries management plan (or some other proposed action) on the environment.

Essential Fish Habitat - Those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

Euryhaline – Fish that live in a wide range of salinities.

Ex-vessel – Refers to activities that occur when a commercial fishing boat lands or unloads a catch. For example, the price received by a captain for the catch is an ex-vessel price.

Fecundity – A measurement of the egg-producing ability of a fish. Fecundity may change with the age and size of the fish.

Fishery – All the activities involved in catching a species of fish or group of species.

Fishery Management Plan (FMP) – A plan to achieve specified management goals for a fishery. It includes data, analyses, and management measures for a fishery.

Fishing Mortality (F) – A measurement of the rate of removal of fish from a population by fishing. Fishing mortality can be reported as either annual or instantaneous. Annual mortality is the percentage of fish dying in one year. Instantaneous is that percentage of fish dying at any one time. The acceptable rates of fishing mortality may vary from species to species.

Generation Time – A measure of the time required for a female to produce a sexually mature female offspring.

Groundfish - A species or group of fish that lives most of its life on or near the sea bottom.

Growth – Usually an individual fish's increase in length or weight with time. Also may refer to the increase in numbers of fish in a population with time.

Harvest – The total number or poundage of fish caught and kept from an area over a period of time. Note that landings, catch, and harvest are different.

Head Boat – A fishing boat that takes recreational fishermen out for a fee per person. Different from a charter boat in that people on a head boat pay individual fees as opposed to renting the boat.

Juvenile – A young fish that has not reached sexual maturity.

Landings – The number or poundage of fish unloaded at a dock by commercial fishermen, or brought to shore by recreational fishermen for personal use. Landings are reported at the points at which fish are brought to shore and may be measured in terms of round (live) weight or dressed weight.

Length Frequency – A breakdown of the different lengths of a kind of fish in a population or sample.

Length-Weight Relationship – Mathematical formula for the weight of a fish in terms of its length. When only one is known, the scientist can use this formula to determine the other.

Mariculture – The raising of marine finfish or shellfish under some controls. Ponds, pens, tanks, or other containers may be used, and feed is often used. A hatchery is also mariculture but the fish are released before harvest size is reached.

Mark-Recapture – The tagging and releasing of fish to be recaptured later in their life cycles. These studies are used to study fish movement, migration, mortality, and growth, and to estimate population size.

Maximum Sustainable Yield (MSY) – The largest average catch that can be taken continuously (sustained) from a stock under average environmental conditions. This is often used as a management goal. Mean – another work for the average of a set of numbers. Simply add up the individual numbers and then divide by the number of items.

Model – In fisheries science, a description of something that cannot be directly observed. Often a set of equations and data used to make estimates.

Mollusk - A group of freshwater and saltwater animals with no skeleton and usually one or two hard shells made of calcium carbonate. Includes the oyster, clam, mussel, snail, conch, scallop, squid, and octopus.

Natural Mortality (M) – A measurement of the rate of removal of fish from a population from natural causes. Natural mortality can be reported as either annual or instantaneous. Annual mortality is the percentage of fish dying in one year. Instantaneous is the percentage of fish dying at any one time. The rates of natural mortality may vary from species to species.

Optimum Yield (OY) – The harvest level for a species that achieves the greatest overall benefits, including economic, social, and biological considerations. Optimum yield is different from maximum sustainable yield in that MSY considers only the biology of the species. The term includes both commercial and recreational yields.

Overfished – An overfished stock or stock complex is one “whose size is sufficiently small that a change in management practices is required in order to achieve an appropriate level and rate of rebuilding.” A stock or stock complex is considered overfished when its size falls below the MSST. A rebuilding plan is required for stocks that are overfished.

Overfishing – Harvesting at a rate equal to or greater than that which will meet the management goal, generally MSY.

Pelagic - Refers to fish and animals that live in the open sea, away from the sea bottom.

Population – Fish of the same species inhabiting a specified area.

Population Dynamics – The study of fish populations and how fishing mortality, growth, recruitment, and natural mortality affect them.

Predator-Prey Relationship – The interaction between a species (predator) that eats another species (prey). The stages of each species’ life cycle and the degree of interaction are important factors.

Recreational Fishery – Harvesting fish for personal use, fun and challenge. Recreational fishing does not include sale of catch. The term refers to and includes the fishery resources, anglers, and businesses providing needed goods and services.

Recruitment – A measure of the number of fish that enter a class during some time period, such as the spawning class or fishing-size class.

Relative Abundance – An index of fish population abundance used to compare fish populations from year to year. This does not measure the actual numbers of fish, but shows changes in the population over time.

Selectivity – The ability of a type of gear to catch a certain size or kind of fish, compared with its ability to catch other sizes or kinds.

Socioeconomics – A word used to identify the importance of factors other than biology in fishery management decisions. For example, how a surplus of income is distributed between small and large boats or part-time and full-time fishermen.

Spawner-Recruit Relationship – The concept that the number of young fish (recruits) entering a population is related to the number of parent fish (spawners).

Spawning Potential Ratio (SPR) - *The number of eggs that could be produced by an average recruit in a fished stock divided by the number of eggs that could be produced by an average recruit in an unfished stock. SPR can also be expressed as the spawning stock biomass per recruit (SSBR) of a fished stock divided by the SSBR of the stock before it was fished.

Spawning Stock Biomass – The total weight of the fish in a stock that is old enough to spawn.

Species – A group of similar fish that can freely interbreed.

Stock – A grouping of fish usually based on genetic relationship, geographic distribution, and movement patterns. Also a managed unit of fish.

Stock Assessment Group – A group of scientists, skilled in the study of fish population dynamics put together by a federal fishery management council to review the scientific data on the condition of a stock fish. The scientists generally come from universities and state and federal fisheries agencies.

Stock Assessment and Fishery Evaluation Report (SAFE) – A report that provides a summary of the most recent biological condition of a stock of fish and the economic and social condition of the recreational fishermen, commercial fishermen, and seafood processors who use the fish. The report provides information to the federal fishery management councils for determining harvest levels.

Stressed Area – An area in which there is special concern regarding harvest, perhaps because the fish are small or because harvesters are in conflict.

Surplus Production Model – A model that estimates the catch in a given year and the change in stock size. The stock size could increase or decrease depending on new recruits and natural mortality. A surplus production model estimates the natural increase in fish weight or the sustainable yield.

Survival Rate (s) – The number of fish alive after a specified time, divided by the number alive at the beginning of the period.

Target Reference Points – Benchmarks used to guide management objectives for achieving a desirable outcome (such as, optimum yield). Target reference points should not be exceeded on average.

Total Mortality (Z) – A measurement of the rate of removal of fish from a population by both fishing and natural causes. Total mortality can be reported as either annual or instantaneous. Annual mortality is the percentage of fish dying in one year. Instantaneous mortality is that percentage of fish dying at any one time. The rate of total mortality may vary from species to species.

Unit Stock – A population of fish grouped together for assessment purposes which may or may not include all the fish in a stock.

Virtual Population Analysis (VPA) – A type of analysis that uses the number of fish caught at various ages or lengths and an estimate of natural mortality to estimate fishing mortality in a cohort. It also provides an estimate of the number of fish in a cohort at various ages.

Year-Class – The fish spawned and hatched in a given year; a “generation” of fish.

Yield – The production from a fishery, stated in terms of numbers or weight.





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Virginia Marine Resources Commission
(757) 247-2200
www.mrc.state.va.us

Virginia Sea Grant, Marine Advisory Program
(804) 684-7170
www.vims.edu/adv/

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