



SECTION 2

Data Sources for Estimating Bycatch

Photo on previous page: A NMFS observer checks the dimensions of a net and its catch. Photo credit: NMFS AFSC, Marine Observer Program.

SECTION 2 Data Sources for Estimating Bycatch

2.1 Overview

Estimation of bycatch requires data from several sources. Fishery-dependent data, including bycatch data and the supplemental data used to estimate bycatch, are collected during fishing operations. Fishery observer programs are a good example of a source of fishery-dependent data. Observers are the only independent source for many types of information about fishing operations, including catch and bycatch composition, biological characteristics, and gear configuration. Information about bycatch may also be provided through self-reporting programs (i.e., data reported by fishermen or dealers/processors); these self-reporting programs are particularly important sources of supplemental data (e.g., effort and landings data). However, when bycatch information is submitted by the fishing industry, concerns regarding data quality must be addressed. These concerns may arise from the lack of training in data-collection methods and protocols, and potential underreporting by the industry; concerns may also be linked to the existence of incentives for misreporting.

Data on bycatch (species composition and quantity, specific information on marine mammal interactions, etc.) and retained catch are always required for bycatch estimation. Ancillary information (e.g., gear type, retained catch characteristics, observations on fishing operations, and environmental data) may also be necessary to the estimation process, depending on the estimation methods used. Verifiable sources of data, such as observers and vessel monitoring systems (VMS), are preferable, although certain kinds of industry-reported information may also be useful as supplemental data.

The choice of the method used for collecting bycatch data in a particular fishery is based on several factors, including:

- **Completeness**—do the data cover the entire range (temporal, spatial, depth, vessel attributes, etc.) of the fishery or fisheries that interact with the species of concern?
- **Cost**—is the method cost-effective?
- **Timeliness**—how quickly are the data available to fisheries scientists, managers, and fishermen?
- **Safety**—how safe is the data-collection method compared to other monitoring methods, and what safeguards are in place to ensure the safety of the data collectors?
- **Logistics**—how easily is the monitoring program implemented and maintained?
- **Planned use of data**—do management goals require a level of detail, quality, and timeliness that only certain data sources can provide?

This section focuses on fishery observer programs and commercial fishery logbook programs. These are the most common sources of data used in estimating fishery bycatch. Supplementary sources, such as landings reports completed by fishermen and/or dealers, port sampling reports, vessel monitoring systems, and stranding reports of protected species, will be discussed briefly. Costs and benefits associated with each data source must be considered with reference to the specific goals of the collection programs and the information requirements for bycatch estimation; these tradeoffs are discussed briefly toward the end of the section. This section is intended to provide a general overview of the data used to estimate bycatch and related issues; details about regional bycatch estimation methods and approaches are provided by region and fishery in Section 4.

2.2 Fishery Observer Programs

Fishery observers are trained biologists who collect data on fishing activities onboard commercial vessels (and at processing plants in some instances) to provide data in support of science and management programs. Each of the six NMFS regions is responsible for administering observer programs in its area. NMFS' authority to place observers aboard fishing vessels can be found in the MSA, the MMPA, and the ESA; in some cases state regulatory authority also exists. Observer programs are generally established to address one or more monitoring objectives, which may include bycatch (fish and protected species), catch, fishing operations, and regulatory compliance.

Observer program design and establishment of coverage levels will generally take into account specific management and science information needs. For example, an observer program designed to provide data for estimating protected species bycatch may require a high coverage level because fishery interactions with these species occur infrequently, while a program implemented to provide data for estimating total catch of target fish species may require lower levels of coverage. However, rare events may also be monitored at lower coverage levels, although this increases the level of uncertainty in the estimate. In some regulatory environments, for example when in-season management is supported by observer data, when bycatch limitations restrict target species harvest, or when monitoring for regulatory compliance is a priority, high (and in some cases 100%) observer coverage may be required.

Regardless of the primary reason for monitoring a fishery, observers are generally trained to collect quantity and composition information on catch and bycatch, as well as information on fish discard condition (e.g., released alive versus dead) and condition of protected species bycatch (e.g., location of entanglement and/or hooking, condition of animal upon release). Biological information collected by observers may include size composition of selected species, and

biological samples which can be used to determine age composition, maturity, feeding behavior, fecundity, stock characteristics, etc. Besides data on catch and bycatch, observers may also collect information on gear type and configuration, vessel type and power, fishing techniques, fishing effort, environmental conditions, and, in certain fisheries, economic information. Observers may also assist with fisheries research or tagging studies. Observer data are considered the most reliable source of information on bycatch, since the observers are independent and able to monitor bycatch directly.

In instances where the safety of observers is of particular concern or the logistics of placing observers aboard fishing vessels are unusually challenging, using small vessels to observe fishing operations may be an option. Government-owned or -leased “alternative platforms” have been employed in a few U.S. fisheries (e.g., the North Carolina small gillnet fisheries and the inshore Alaska salmon gillnet fisheries) to monitor bycatch. Sampling may target the fishery as a whole, or only those vessels that would otherwise be difficult to sample using an onboard observer.

Other approaches for collecting data at sea are under development. Use of video cameras to monitor fishing operations involves relatively new technologies (McElderry 2008) and has been used only in selected fisheries to date. Other sensors, such as global positioning systems (GPS) and hydraulic pressure monitors, may also be incorporated to provide accurate information regarding spatial and temporal characteristics of fishing. While electronic monitoring (EM) holds great promise for addressing certain objectives (e.g., compliance with discard prohibitions), it is not yet able to provide detailed information on catch and bycatch composition, or biological information.

Observer programs are expensive and logistically challenging. Detailed information on costs and logistics is provided in previous NMFS reports (e.g., NMFS 2004b). Logistical challenges and costs depend to a considerable degree on the size of the region being observed, the size of the fishing fleet, and the degree of difficulty associated with deploying observers. These aspects should be considered carefully prior to implementation of an observer program. Staff resources for training, debriefing, data management, etc. can also be substantial.

Even though observer programs provide the most reliable source of data, bias must be minimized and accounted for in the design of a program and in the use of any data collected. The sources of bias in observer programs fall into three broad categories: 1) incomplete sampling frame; 2) sampling bias caused by procedures for selecting vessels, problems with sample selection, or factors preventing the deployment of observers on all selected vessels; and 3) observer bias (i.e., measurement errors caused by changes in fishing behavior in the presence of observers). For some

programs, it has been possible to develop vessel selection strategies to minimize bias. A complete discussion of potential bias in observer programs is provided in Appendix D (see also Vølstad and Fogarty 2006).

2.3 Marine Mammal Data-Collection Programs

Under the MMPA, commercial fishers are required to report any injuries or mortalities of marine mammals that occur incidental to their fishing operations. Underreporting of injuries and mortalities is of considerable concern (Credle et al. 1994; National Marine Mammal Laboratory unpublished information). Thus, this information may be used to suggest a minimum number of marine mammals that are killed or seriously injured incidental to fishing operations, but the number is generally considered unreliable and these data are not utilized for bycatch estimation in this report.

A second source of information on marine mammal bycatch, and one that is used to estimate bycatch in this report, is stranding data. Stranding occurs when a marine mammal or sea turtle swims or floats to the shore and becomes beached (alive or dead) on land or stuck in shallow water, and also applies to dead animals floating at sea. The Marine Mammal Health and Strandings Response Program (MMHSRP) was established to facilitate reporting of stranding events, respond to stranding events, and to collect biological information on stranded animals. Volunteer stranding networks in all coastal states carry out these activities. Human-caused mortality documented by stranding networks (e.g., as evidenced by vessel strikes, gunshot wounds, or net or knife marks) is counted toward total annual human-caused mortality in marine mammal stock assessments. These estimates include strandings that demonstrate clear evidence of a fishery interaction, and are therefore classified as bycatch. However, it is not always possible to link each interaction to a specific fishery or type of fishing activity.

2.4 Logbooks

Logbooks provide a detailed record of a vessel’s fishing activity. They are completed onboard the vessel by the captain or a designated crew member (NMFS 2005). Reporting requirements for logbooks, which may also be called vessel trip reports (VTRs), catch reports, or trip tickets, are mandated and defined in Federal or state fishery management plans (FMPs) and differ by region and fishery. Typically, the information required includes gear type, date, time of day, location, weather conditions, deployment information (e.g., tow length and number of hooks set), and weight and species composition of catch (as well as total or retained catch, or product in some cases). Logbooks that require bycatch reporting are required under 39 FMPs (Table 2.1). Logbooks may also be a source of supplemental data, such

DATA SOURCES FOR ESTIMATING BYCATCH

Table 2.1
Requirements for bycatch reporting by FMP. Where an FMP is implemented across NMFS regions, it is listed under the lead NMFS region only.

Region	Fishery Management Plan (FMP)	Bycatch required to be reported
Northeast	Groundfish Multispecies	All discards, including protected species
	Atlantic Scallop	All discards, including protected species
	Monkfish	All discards, including protected species
	Summer Flounder, Scup and Black Sea Bass	All discards, including protected species
	Tilefish	All discards, including protected species
	Atlantic Bluefish	All discards, including protected species
	Atlantic Herring	All discards, including protected species
	Spiny Dogfish	All discards, including protected species
	Deep Sea Red Crab	All discards, including protected species
	Atlantic Mackerel, Squid and Butterfish	All discards, including protected species
	Northeastern Skate	All discards, including protected species
	Northern Shrimp	All discards, including protected species, when a vessel has a Federal permit
	Surfclam and Ocean Quahog	All discards, including protected species
	Atlantic Salmon ¹	ESA-listed species with no commercial harvest. FMP prohibits possession of Atlantic salmon ¹
Atlantic Lobster	All discards, including protected species, when a vessel has a Federal permit	
Southeast	Consolidated Highly Migratory Species	All discards, including protected species
	Snapper/Grouper/Wreckfish	All discards, including protected species
	Coastal Migratory Pelagics	All discards, including protected species
	Reef Fish	All discards, including protected species
	Golden Crab	All discards, including protected species
	Shallow Water Reef Fish	All discards, including protected species
	Headboat/Charterboat	None
	Dolphin and Wahoo	All discards, including protected species
	Shrimp	All discards, including protected species
	Spiny Lobster	All discards, including protected species
	Stone Crab	All discards, including protected species
	Coral, Coral Reefs, and Live/Hard Bottom Habitats of the South Atlantic Region	All discards, including protected species
	Pelagic Sargassum Habitat of the South Atlantic Region	All discards, including protected species
Alaska	Bering Sea/Aleutian Islands Groundfish	All fish, for vessels over 60 feet
	Gulf of Alaska Groundfish	All fish, for vessels over 60 feet
	Salmon ²	Discards of certain fish species (no Federal logbook requirement)
	King and Tanner Crab ³	Discards of certain fish species (no Federal logbook requirement)
	Alaska Scallop ⁴	Discards of certain fish species (no Federal logbook requirement)
Northwest	Pacific Coast Groundfish	All retained catch by limited-entry trawl fishery
	West Coast Salmon	Salmon (bycatch and mortalities)
Southwest	Coastal Pelagics	All discards, including protected species
	West Coast Fisheries for Highly Migratory Species	All discards, including protected species
Pacific Islands	Western Pacific Pelagics	All discards, including protected species
	Precious Corals	None
	Crustaceans	All fish
	Bottomfish and Seamount Groundfish	All fish
	Coral Reef Ecosystems	None

¹ FMP prohibits possession of Atlantic salmon and any directed or bycatch fishery for Atlantic salmon in Federal waters.

² Management delegated to the State of Alaska

³ Management of the Crab FMP is deferred to the State of Alaska, with Federal oversight.

⁴ The scallop fishery is jointly managed by the State of Alaska and NMFS.

as fishing effort and gear characteristics that are used in estimating bycatch.

Compared with observer programs, logbooks are considerably less expensive and present fewer logistical challenges. However, underreporting of bycatch species is a serious concern. Additionally, if there is inadequate compliance with logbook requirements, or reporting misrepresents actual fishing effort, the bycatch estimates derived from these data will be inaccurate. Where possible, analyses should be undertaken that compare self-reported bycatch data to observer data (e.g., Rago et al. 2005) so that biases in the data can be identified and addressed.

2.5. Production and Dealer Reports

Production and dealer reports typically do not provide bycatch data; in most cases they provide ancillary data that may be used in the bycatch estimation process. Production reports are completed on a daily or weekly basis, and provide information by species and reporting area. The NMFS requires this type of report for shoreside processors, factory motherships, catcher-processors, and floating processors that participate in the Alaska groundfish fisheries. Production reports contain information on species weights, types of each product produced, and discard that occurs during the reporting period. In other regions, dealers who purchase fish from commercial fishermen are required by regulation to complete reports indicating the species, weight, and value of fish purchased. These dealer reports provide important information about harvest levels, species composition, and economic value of the fishery. As with all industry-reported data it is generally not possible to verify the reported information.

2.6 Port Sampling and Dockside Monitoring

Port sampling utilizes trained biologists to collect fishery information and biological samples from fishermen and/or dealers at the dock. Port samplers collect information on biological characteristics of retained catch. Because bycatch is not observed by port samplers, they do not provide direct data on bycatch or discards. They may, however, provide ancillary information that is useful in bycatch estimation.

Dockside monitors are responsible for verifying species sorting and weighing at shoreside plants that receive deliveries from catcher vessels participating in the West Coast fishery for Pacific hake. Since discard at sea is severely restricted by regulation in this fishery, most of the catch is retained. However, retained catch composition and weight data may be useful ancillary information for bycatch estimation.

2.7 Vessel Monitoring Systems

Vessel monitoring systems (VMS) are required in many fisheries and have been installed on more than 5,000 fishing vessels in the U.S. These systems report vessel location information and can be used to track fishing operations. While VMS are implemented for compliance purposes, they can provide information that is useful in bycatch estimation. For example, VMS data on location, heading, and speed (derived from location information) may provide ancillary information for bycatch (or catch) estimation (Deng et al. 2005; Murawski et al. 2005; Mills et al. 2007).