Not just how many fish are caught

The title is a triple-play on words but the subject of the Marine Conservation Biology Institute's *Shifting Gears* is deadly serious. Expanding its earlier work documenting the sea-floor devastation caused by bottom trawling (see *Calypso Log*, October 2000), MCBI has produced a frightening analysis of collateral damage—habitat destruction and bycatch—caused by all the major kinds of fishing gear.

Over-fishing is a human tradition of long standing. People have decimated marine species for thousands of years, but modern technology has allowed exploitation to achieve new heights of voracity. Even the most die-hard advocate of the "it's just a natural fluctuation" school of thought is admitting that fisheries are in serious decline. Progress has produced instruments of such exquisite sensitivity that they can distinguish among species of fish and, at the same time, multiplied the brute strength and size of harvesting equipment to achieve ruthless efficiency. This machinery extends the ability to overkill beyond the capacity of fish stocks to reproduce. The result: the collapse of fisheries and the economies that depend upon them.

The same governments that subsidized the purchase of larger, more efficient gear now face the prospect of propping up the economies and the stocks at the same time. Fishing management is a financial, political and biological tug-of-war. If authorities are going to make the tough choices necessary to control fishing, they need all the scientifically defensible information they can get.

Most of the twentieth century was given over to calculations of catch limits for a succession of individual, commercially important species. Finally, in 1996, having exhausted the possibility of size and number limits to restore stocks, the US turned to a more holistic ecosystem-based approach to address factors beyond how many fish are landed. Legislation directed fisheries managers to incorporate two important new considerations: the reduction of bycatch and the preservation of essential fish habitat. The MCBI report provides a much-needed, scientifically sound tool used in addressing these two requirements.

Traps are not a threat to the submarine habitat, but they cannot select the animals caught.

> Fishing gear's role

Fishing equipment affects stocks both directly and indirectly (beyond the intended catch). Non-target species are trapped or killed, and then trashed because they are not valuable enough to be worth the space to store them, or because they do not meet regulatory standards for size or season. Less obvious is the scraping, flattening and crushing of fish habitats caused by the gigantic machines of commerce. Still more casualties can be ascribed to equipment "accidents": a ship runs into a large fish, propellers slash slow fish, lost nets entangle unwary fish.

The different kinds of gear vary widely in usage depending on the fishery. For example, midwater trawls dominate in the North Pacific (63 percent) but purse seine nets account for nearly half (48 percent) of mid-Pacific fishing, and pelagic longlines rule (63 percent) in the Western Pacific. The Gulf of Mexico and the Mid-Atlantic are heavily fished with purse seines (73 percent and 60 percent respectively), while New England and the South Atlantic are more evenly diversified among trawls, seines, pots and traps.

Obviously, different gears have different effects on habitat and bycatch. The heavy equipment that is lugged across the sea floor, like dredges and bottom trawls, does more physical damage, crushing and leveling rocky bottoms or stirring up sediment from soft bottoms that resettles and smothers the remaining organisms and plants. Gillnets and longlines, while they do not touch the ground, are non-selective and capture unwanted or unallowed creatures by entanglement, both when the gear is deployed in a fishery or when it is cut loose to drift.

It is not just the style of the gear but also the incredible size that alters the oceans. Dredges can be fifteen wide and weigh 2,400 pounds. Bottom gillnets can be strung together in a curtain 3,500 feet and more wide. Longlines can trail 12,000 hooks per dangling line. The doors of bottom trawls weigh a ton or more each and drag the ground with nets that are 40 by 200 feet. Dredges and trawls cover an area of sea floor that is twice the size of the contiguous US each year.

> Sorting the equipment

In order to compare such disparate equipment and usage, MCBI developed a "damage schedule" that integrates data and survey responses in order to rank the effects of all major commercial fishing gears. First, they sorted the equipment into ten groups: dredges, bottom gillnets, midwater and drift gillnets, hook and line, bottom longlines, pelagic longlines, pots and traps, purse seine nets, bottom trawls and midwater trawls.

Dredges are heavy metal frames with a leading "tickler chain" that chases scallops or clams out of the sea floor. The frame forms the mouth of a cage dragged behind to scoop up the shellfish as the contraption moves along. Bottom gillnets are huge sheets of netting hung down to the sea floor; fish swim into the netting and are trapped when the filament catches their gill covers. Midwater gillnets hang above the sea floor in the water column. Hook and line rigs use individual lines with baited hooks, sized and weighted according to the target species. Bottom longlines hang from buoys and dangle many shorter lines with baited hooks weighted to lie on or over the sea floor. Pelagic longlines float in the water column as deep as 1,200 feet.

Bottom trawls drag a large bag-shaped net, with heavy doors holding one end open, across the sea floor by a weighted groundline. Midwater trawls are lighter, and dragged through open water or just over the sea floor. Pots and traps made of wood or metal are baited and set on the sea floor. Purse seines are long panels of netting that are laid around schooling fish, then drawn up to close the bottom of the sack and hauled aboard ship.

When nets sort their catch

New kinds of nets are being introduced to make fishing more selective.

Using nets with bigger mesh can help limit the catch to adult fish. They allow smaller, juvenile fish to escape and grow to reproductive maturity. The color of the net, the addition of knots and the kind of netting can also be varied. For example, to protect dolphins, nets can be equipped with pingers that emit deterrent sounds, or made with barium sulfate that is easier for cetacean sonar to detect.

> Rating the damage

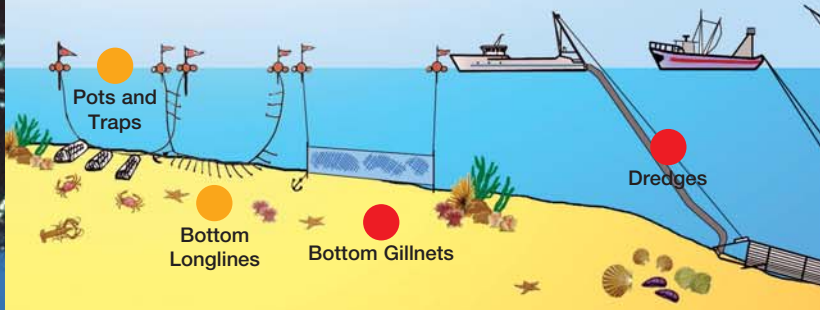
A workshop brought together experts in all aspects of fisheries: natural scientists, a social scientist, fishers, management officials and a conservationist. They reviewed each kind of gear and the damage it could cause: impact on physical structure, sea-floor plants and animals, shellfish and crabs, finfish, marine mammals, and seabirds and turtles. Then, the group assigned to each kind of equipment a rating for each kind of damage on a five-level scale, low to high. There was surprising consensus on which gear caused how much of what kind of damage, so MCBI proceeded to the next step.

A survey was sent out to hundreds of people involved with fisheries in every conceivable way (including the Cousteau Society) asking them to judge gear in paired comparisons, i.e. one set of impacts against another. All possible combinations were compared one-to-one. Again, there was a surprisingly consistent rating across the board. More than half the respondents rated habitat damage as more important than bycatch.

From the total returns, MCBI established an indexed ranking of the impact of different kinds of equipment, from bottom trawling at "most severe" to midwater gear at "least severe."

> Using the ranking

More than 90 percent of the 235,000 known marine species live in or on the sea floor; 283 of 380 marine fisheries live primarily in association with the sea floor. Fishing gear that comes into contact with the sea floor alters it and the organisms that live there. Bottom-dwelling creatures that are slow-growing are more sensitive to disturbance, and sea-floor habitats do not regenerate quickly or easily. Creating zones where certain gears are banned or limited can restrict damages as well as reduce bycatch. Shifting gears has been proved an effective approach to management. Changing from bottom trawls to traps in the California prawn fishery reduced both habitat damage and incidental catches of critically low rockfish populations. (See the article on page 14 for more about California's threatened rockfishes.)



Thanks to Lance E. Morgan and Ratana Chuenpadgdee of the Marine Conservation Biology Institute for their help.

Based on the ranking of impacts, the report recommends five policy options :

1. "Shifting gears," or substituting less damaging equipment for more damaging gear.
2. Offering incentives to change how the equipment is used.
3. Promoting new kinds of gear.
4. Limiting where equipment can be used.
5. Supporting further study of effects, including social and economic effects.

> Better management

Stock assessments are not defective, just deficient. Their limitations as a management tool mean that decision-makers need to look to other tools. Ecosystem-based management can address how removing predators, prey, competitors, parasites, hiding places, resting spots, and other structures result in unintended consequences for target species better than management based on single-species numbers.

Local knowledge is often over looked as a resource; skilled fishers can tell from experience where fish can be found or how equipment use affects marine life (and economic viability). Although such data may be considered "anecdotal" by a decision-maker reaching for the "best available science," they should not be ignored in shaping policies. In fact, incorporating input from local users of a resource not only improves the underlying knowledge base but can lead fishers to apply new measures with greater willingness, compliance and care.

Marine protected areas (MPAs) are another important management option for protecting threatened stocks. They are not necessarily no-take zones. MPAs can also be areas in which certain gear is limited, temporally, geographically or in intensity, so that critical habitat is protected from the highest impact gear. Besides limiting the kind and place of application, gear damage can be mitigated by requiring changes as simple as adding Japanese bird-scaring lines, lengths of brightly colored streamers that frighten sea birds away from baited hooks.

All of these approaches depend on understanding the damage that specific kinds of gear can do, and this is perhaps the greatest contribution of MCBI's ranking scheme. Managers now have a reliable measure for new initiatives and a scientifically based guide to what actions are most urgent. Shifting gears from single-species to ecosystem management, from sensitive to more tolerant habitats, from current to improved equipment—all these offer new hope for the development of truly sustainable fisheries.

Shifting Gears *by Lance E. Morgan and Ratana Chuenpagdee is published by Island Press, and available at www.islandpress.com. For more information about the Marine Conservation Biology Institute, see www.mcbi.org.*

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